ENERGYSOLUTIONS

CS-313111-004

Final Status Survey Report
Breckenridge Disposal Site

Madison Road
St. Louis, Bethany Township, Michigan

Project No. 313111 **Revision 1**

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ABBREVIATIONS and ACRONYMS

Ac	Actinium
AEC	Atomic Energy Commission
AF	area factor
ALARA	as low as reasonably achievable
ANI	American Nuclear Insurers
BDS	Breckenridge Disposal Site
bgs	below grade surface
Bi	Bismuth
cpm	counts per minute
CHP	Certified Health Physicist
CWA	confirmed waste area
DCGL	derived concentration guideline level
EMC	elevated measurement comparison
ERG	Environmental Recycling Group
FSS	Final Status Survey
FSSR	Final Status Survey Report
GPS	global positioning system
m^2	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual (NUREG-1575)
MDA	minimum detectable activity
MDC	minimum detectable concentration
Pb	Lead
PHP	project health physicist
PM	project manager
PWA	potential waste area
QA	quality assurance
QC	quality control
Ra	Radium
RA	remediation area
RE	radiological engineer
RPD	relative percent difference
SHSO	site health and safety officer
SOF	sum of fractions
SU	survey unit

Th	Thorium
TEDE	Total Effective Dose Equivalent
U	Uranium
VSP	Visual Sample Plan

1.0 INTRODUCTION

This Final Status Survey Report (FSSR) provides a complete and concise record of the radiological status of the Breckenridge Disposal Site (BDS) upon completion of all site remediation activities prior to site backfill, re-grading and hydro-seeding. The Final Status Survey (FSS) incorporated a variety of on-site radiological surveys and measurement techniques using the guidance as provided in Reference 10.1, NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) as well as off-site laboratory analysis of soil samples for quality control purposes.

1.1 Site Description and History

The Breckenridge Disposal Site is located on Madison Road about 4 miles east of downtown St. Louis, Bethany Township, Michigan. The Breckenridge property is a narrow triangular-shaped parcel of land that is mostly flat and grassy with scattered large trees. The Site, bounded by Madison Road on the north, by Bush Creek on the east, and by farmland on the west, is about 5,100 m^2 in size. The nearest residence is located approximately 0.2 kilometers to the east across Bush Creek. A six-foot high chain-link fence controls access to the Site. Figure 1-1 shows the Site location.

Between 1967 and 1970, the Site was used for the disposal of process wastes from an yttrium recovery operation managed by Michigan Chemical Corporation. These disposal activities were authorized under U.S. Atomic Energy Commission (AEC) License Number SMB-0833 and were performed in accordance with 10CFR20.304, "Disposal by Burial in Soil." The buried waste material was a solid waste byproduct known as filter-cake, which originated from a rare-earth metal (yttrium) extraction process. Disposal records reported that the filter-cake was typically a dense, clay-like material containing elevated levels of naturally occurring uranium and thorium. After site operations ceased, AEC License Number SMB-0833 was terminated.

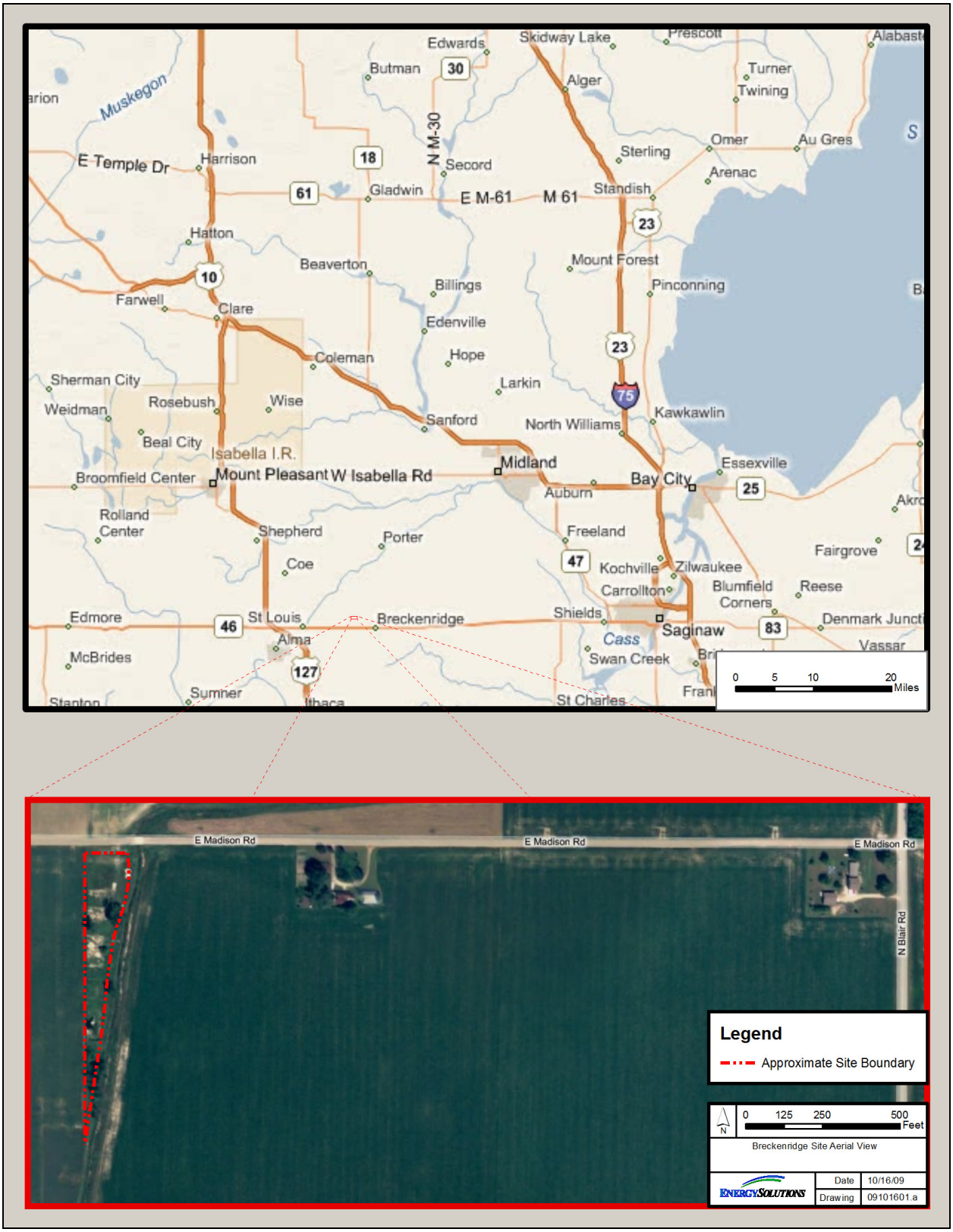


Figure 1-1 Breckenridge Disposal Site Location

1.2 Site Characterization

Since elevated levels of surface radioactivity remained on Site, the U.S. Nuclear Regulatory Commission (NRC) requested that the radiological conditions at the Site be re-evaluated. Characterization studies were performed at the BDS by several contractors between 1982 and 2007. These efforts included site surveys and sampling using a variety of methods including geophysical surveys such as electromagnetics and magnetometry, subsurface sampling using Geoprobe® push samples and investigative trenching. These provided an estimate on the overall extent of radioactive materials remaining on site in terms of area, volume, and average concentrations of the contaminants of concern (i.e., ^{232}Th and ^{238}U).

Based upon the characterization data, waste inventory estimates were developed and subsequently revised. Initial waste volume estimates performed in 2002 were derived using two different methods. The first estimate was derived based upon the Confirmed Waste Area (CWA) and Potential Waste Area (PWA) footprints and some basic assumptions as identified during the 2001 site characterization activities. The CWAs were identified by the geophysical surveys and verified using core bore sampling (Geoprobe®) while the PWAs were identified as possible disposal areas using the geophysical survey data; however they were not confirmed by sampling. The locations of these CWAs and PWAs as determined in 2002 are outlined in Figure 1-2. The second waste inventory estimate used a filter-cake volume based on the average densities of waste-material samples that were collected during the characterization and the historical estimate of 151 wet tons of total waste deposited at the Site. Based upon these assumptions, the waste volume was estimated to approximately 120 cubic yards of buried filter cake.

Subsequent characterization efforts between 2004 and 2007 including additional site surveys and core samples supplemented the 2002 characterization data and identified several Remediation Areas (RAs) also identified in Figure 1-2 including areas of surface contamination. Based upon the revised estimates, waste volumes were estimated to be approximately 1,524 cubic yards of surface soils, buried filter-cake and surrounding soils requiring removal and disposal.

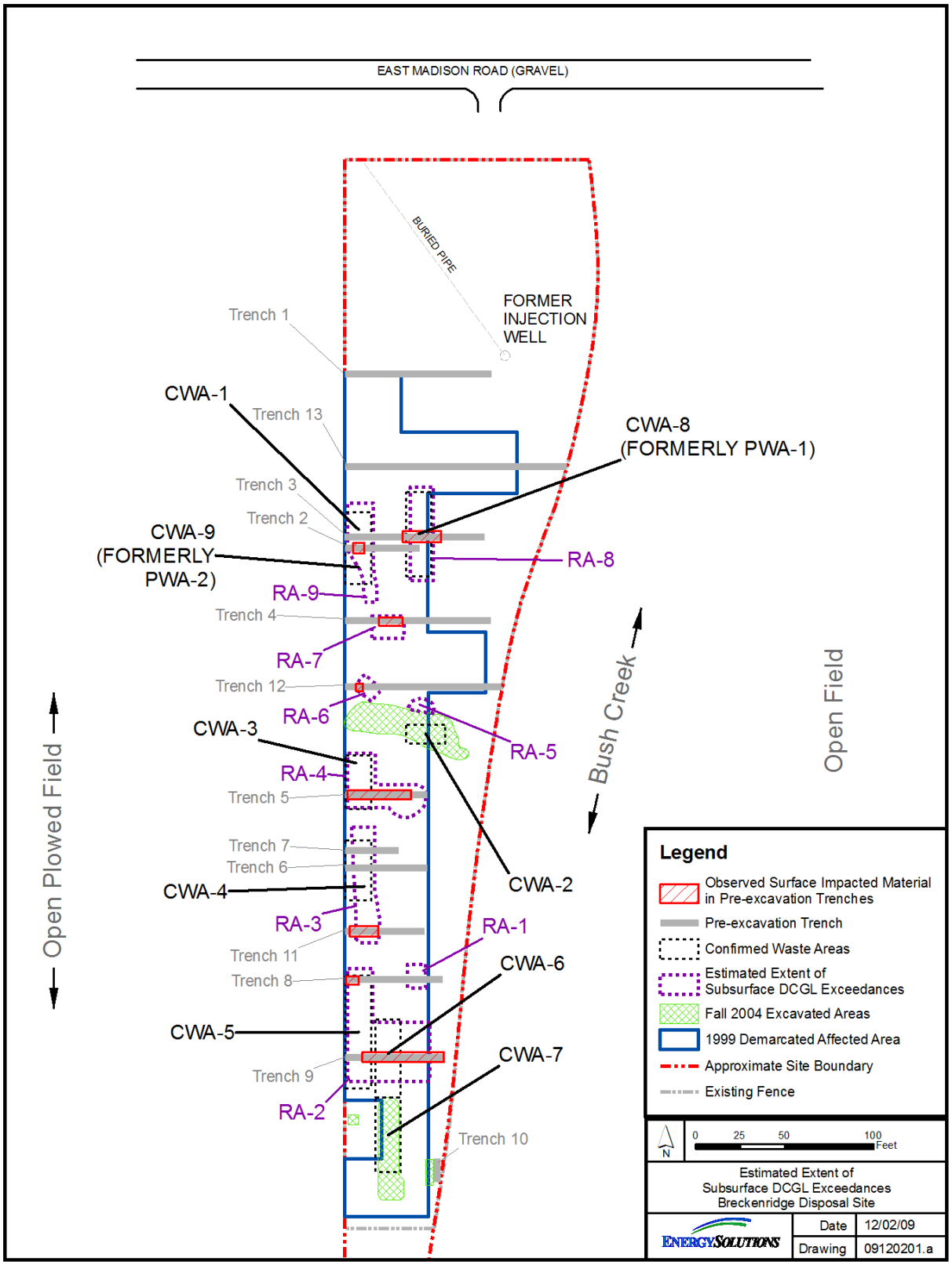


Figure 1-2 Breckenridge Disposal Site – CWAs and RAs

2.0 ORGANIZATION AND RESPONSIBILITIES

The project organizational chart for the BDS remediation is provided as Figure 2-1. The on-site staffing included the Project Manger (PM), Project Health Physicist (PHP), Certified Waste Broker, Senior Health Physics Technicians, Equipment Operators and Laborers. A summary of the individual responsibilities is provided as follows.

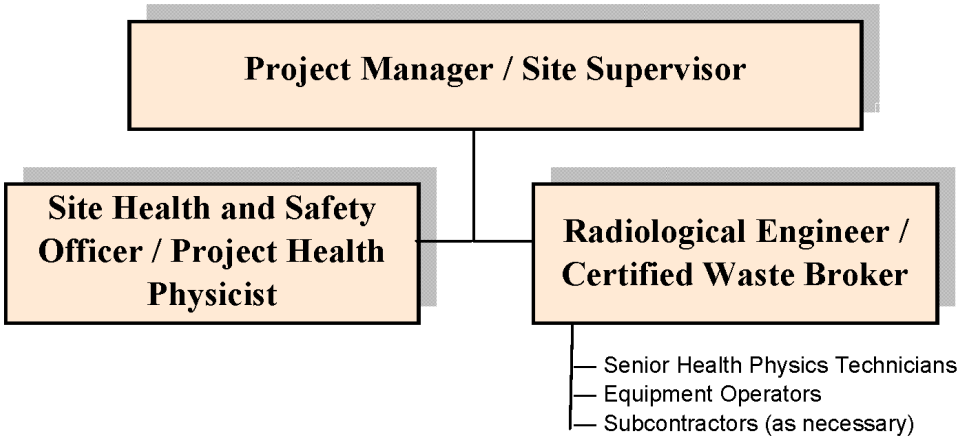


Figure 2-1 BDS Project Organizational Chart

2.1 Project Manager

The PM had the overall responsibility for the project and coordinated the day-to-day field activities with the help of the Project Health Physicist (PHP). The PM oversaw all subcontract personnel and services and was the primary point of contact at the project site for all regulatory personnel and visitors. Based upon the size and complexity of the project, the PM also served as the site supervisor ensuring that the appropriate areas were being excavated with the assistance of the PHP to support remediation efforts and unrestricted site release.

2.2 Project Health Physicist

The PHP was a Certified Health Physicist (CHP) and served as the on-site radiation safety officer and the site health and safety officer (SHSO) as needed and provided the necessary site specific training of all project personnel. The PHP was responsible for the day-to-day activities of the on-site analytical laboratory and worked in conjunction with the PM to coordinate the Health Physics activities in support of site remediation and Final Status Surveys. He was specifically responsible for the implementation of the Radiation Protection Plan (RPP), guiding the excavation of contaminated materials and specifically tasked to ensure the quality of the Final Status Surveys and sampling results.

2.3 Site Health and Safety Officer

A separate SHSO was mobilized to the site upon finding hazardous and unknown materials within the trenches. The SHSO was responsible for the day-to-day

inspection of the excavation and non-permit required confined spaces. They were specifically responsible for ensuring the proper sloping of the trenches, air sampling for hazardous constituents using a photo-ionization detector (PID) and overseeing the sampling of any hazardous materials.

2.4 Radioactive Materials Broker

A certified waste broker was assigned to manifest and coordinate waste shipments to the Clive, Utah licensed disposal facility. They were responsible for ensuring regulatory compliance as well as overseeing package loading, waste manifesting, shipment inspections, ensuring the waste met the approved waste profile(s) on record and overseeing the actual waste transfers to the rail spur.

2.5 Health Physics Technicians

The Health Physics Technicians reported to the PHP and PM and were specifically responsible for job coverage, waste shipping surveys, ensuring project personnel followed the proper radiation protection procedures, performance of remediation surveys, free release surveys and the performance of the Final Status Surveys and sampling.

2.6 Equipment Operators and Labor Staff

The equipment operators and labor staff were the core staff that operated the site equipment and performed the actual site remediation activities under the guidance of project management and the Health Physics staff.

3.0 SITE REMEDIATION ACTIVITIES SUMMARY

Upon approval of the project Remedial Work Plan, Reference 10.3, by the NRC and the State, Energy*Solutions* mobilized to the BDS on May 5th, 2010. Once the site trailer and services had been established, all site training was performed including site specific training to the project Work Plans, radiation worker training, site specific hazards and the use of the soft sided super-sacks including their proper loading and handling. Following training, the site was then grubbed and trees removed to prepare it for baseline surveys and breaking ground. Ground was broken and the excavation began May 15th, 2010 starting at the southern end of the site working north.

The excavation proceeded in 6-inch lifts. Each lift was first surveyed by performing a 100% walkover scan using a sodium iodide detector coupled with a GPS. The data was then plotted and samples collected throughout the area based upon the measured readings by navigating back to specific locations using the GPS. Samples were collected and analyzed at a variety of field reading levels. Figure 3-1 provides an example of a lift survey and sampling effort.

The contaminated areas were then identified using marking paint based upon the field readings and sampling results. Contaminated soils were then removed and loaded directly into the super-sacks and sealed, moved to the north end of the site, surveyed and staged for shipment to the Clive disposal facility in Clive, Utah as radioactive waste.

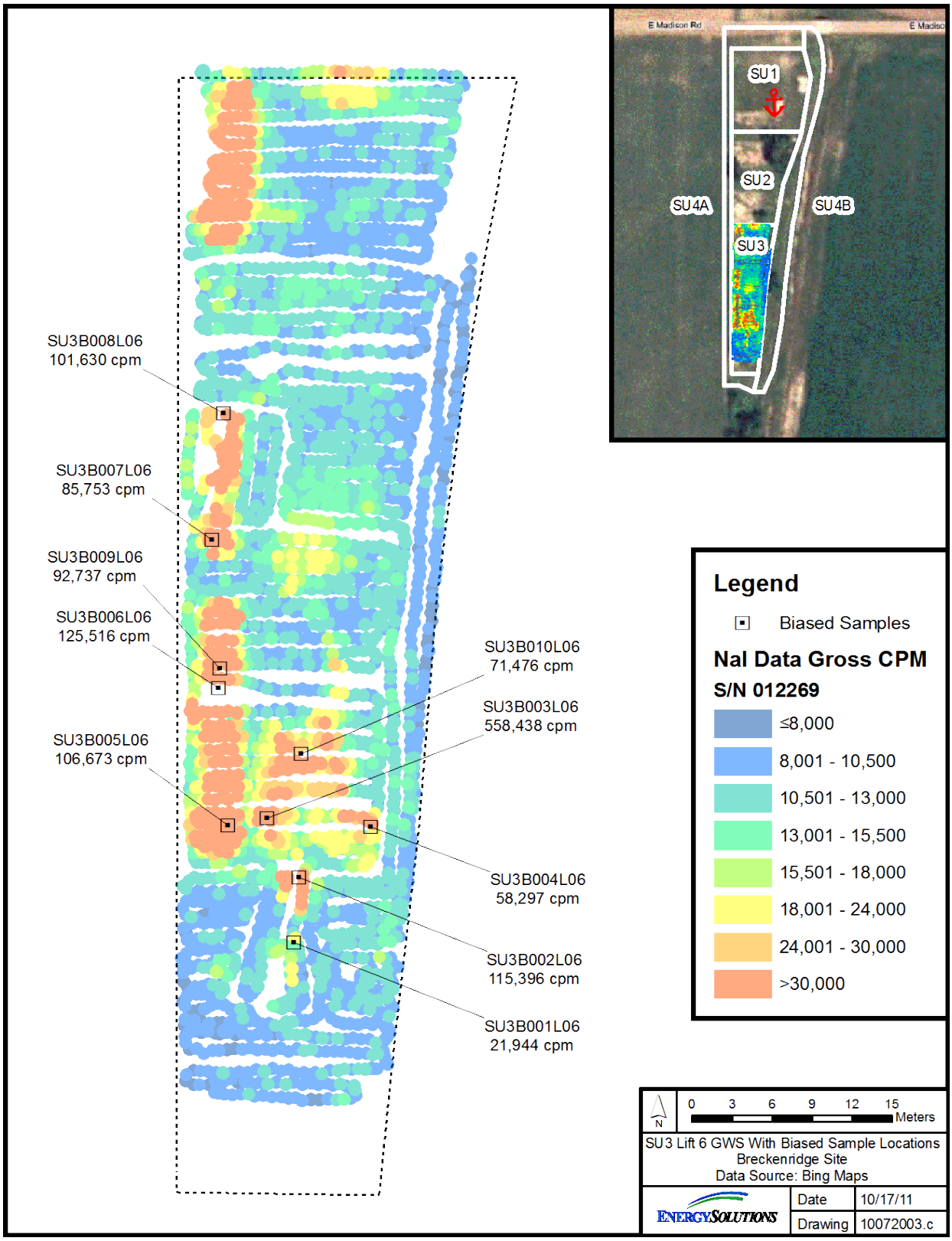


Figure 3-1 SU3 Lift 6 - Remedial Action Survey and Sampling

As each lift was removed, the survey and sampling data was reviewed and the action levels for identifying contaminated soils were revised based upon the field readings and sample results. This method proceeded through 6 lifts, or 3 feet bgs, at which time the excavation was modified to 1-foot lifts until 5-feet bgs was reached where the tops of the trenches or CWAs were expected to be unearthed.

In order to fully expose the tops of the CWAs and to aid in the trench excavation, surrounding "clean" soils were removed as necessary. These on-site clean soils were stockpiled along the west fence at the northern end of the site. As the "clean" soils were stockpiled, the soils were re-surveyed and systematically sampled to ensure no contaminated soils were inadvertently stockpiled.

The tops of the trenches within Survey Unit 3 (SU3) or the southern third of the site were exposed on or about July 28th, 2010. The CWAs were encountered approximately at 5-feet bgs as anticipated.

The excavation of the CWAs began on or about August 1st, 2010 starting with CWA-5 at the south fence working north. The radioactive waste (filter-cake) and the surrounding contaminated soils were removed and stockpiled prior to loading. On August 5th, 2010, drums of acid were encountered and compromised within CWA-5 spilling the contents within the excavated trench. The area was immediately vacated and the proper notifications were made including Energy*Solutions* management, the NRC and the State of Michigan. The project was placed in temporary shutdown until the proper path forward was identified.

An addendum was prepared and approved to the Remedial Work Plan, Reference 10.4, and site remediation re-started on September 20th, 2010. All project personnel received 40-hour HazWoper training as necessary and were trained to the Remedial Work Plan Addendum and the new controls moving forward.

As the CWA excavation progressed, several more drums were encountered and notifications made. Attempts were made to recover the drums and drum liners; however, the conditions of the drums had deteriorated such that recovery was difficult. Samples were taken as necessary and shipped for off-site analysis to assess the materials to ensure proper disposal. Over the course of excavation, 4 drums and drum liners were recovered and over-packed for shipment and disposal as mixed waste.

Trench excavation proceeded to November 2nd, 2010 when three unknown trenches, Trenches A, B and C, were identified within Survey Unit 2 (SU2) and found to contain laboratory chemicals and containers. Upon discovery, notifications were again made to Energy*Solutions* management, NRC and the State. Environmental Recycling Group (ERG) was contracted by the Trustee to help oversee the excavation of these three trenches and to sort, characterize and temporarily package the chemicals and containers for future disposition and disposal by the EPA.

Site excavation was completed December 4th, 2010 and the project temporality demobilized mid December until January 4th, 2011 at which time the remaining radioactive and mixed wastes were shipped off-site for disposal. All waste shipments were completed January 13th, 2011. A total of 4,107 cubic yards of radioactive waste was shipped. Over the course of site excavation and remediation, the extent of surface contamination was much more than anticipated as well as the number and size of the CWAs resulting in the increased waste volumes. Twenty-eight bags were left on-site as potential backfill.

The site remobilized July 5th, 2011 to complete the site FSS. Site surveys and sampling were completed and the site backfilled using the bags that were left on-site, the on-site clean soils and off-site soils from a borrow area. Site backfill was completed on September 1st, 2011 at which time the BDS was re-graded and hydro-seeded. Full site demobilization was completed by September 21st, 2011.

4.0 SITE RELEASE CRITERIA

The detailed development of the site release criteria or derived concentration guideline levels (DCGLs) as used for the BDS is documented in Reference 10.2, Energy*Solutions* document CS-313111-001*, Re-Evaluation of the Breckenridge DCGLs, Gamma Scan Sensitivity, Gamma Scan Action Levels and Development of Area Factors*. Initial release criteria had previously been developed and approved by the NRC in 2006; however, based upon additional site specific information upon mobilization, subsequent remediation surveys and sampling, and the identification of elevated ^{230}Th, these values were re-assessed and approved by the NRC as presented in the above reference. A summary of the release criteria as applied at the BDS is provided as follows.

4.1 Derived Concentration Guideline Levels

With the identification of elevated ^{230}Th as compared to ^{238}U and ^{232}Th through off-site alpha spec analysis, the 2006 DCGLs as previously developed were no longer adequate for demonstrating compliance to the total effective dose equivalent (TEDE) limit of 25 millirem per year (mrem/yr). These DCGLs were re-evaluated using RESRAD models that independently determined the DCGLs for each radionuclide, or decay chain, corresponding to 25 mrem/yr for the conditions as found at the remediation site. As summarized in Reference 10.2, since ^{230}Th was identified not to be in equilibrium as originally assumed, DCGLs were developed for the following decay chains to most closely model the conditions at the Breckenridge Site.

$$^{232}Th + C,\ ^{238}U + D,\ ^{234}U,\ ^{230}Th, \text{ and } ^{226}Ra + C$$

Table 4-1, below, provides the re-evaluated DCGLs as used with the unity rule for demonstrating site compliance with the dose based release criteria.

Table 4-1 Re-Evaluated DCGLs

Radionuclide	DCGL (pCi/g)	
	Surface	Subsurface
^{232}Th + C	5.0	65.9
^{238}U + D	442.4	8,658
^{234}U	2,729	6,113
^{230}Th	276.9	97.9
^{226}Ra + C	6.2	51.2

4.2 Unity Rule

The unity rule, or sum of fractions (SOF), was used to demonstrate compliance to the DCGLs for mixtures of radionuclides using the following equation. Note that ^{238}U is used as a surrogate for ^{234}U with a demonstrated 1:1 ratio based upon off-site alpha spec analyses (i.e., secular equilibrium).

$$SOF = \frac{C_{^{232}Th}}{DCGL_{^{232}Th+C}} + \frac{C_{^{238}U}}{DCGL_{^{238}U+D}} + \frac{C_{^{238}U}}{DCGL_{^{234}U}} + \frac{C_{^{230}Th}}{DCGL_{^{230}Th}} + \frac{C_{^{226}Ra}}{DCGL_{^{226}Ra+C}}$$

When measured by alpha spec analysis, the actual ^{230}Th activity was used in the unity equation; otherwise, the concentration of ^{232}Th was used as a surrogate for ^{230}Th using the ratio of 9.8:1 for ^{230}Th to ^{232}Th activity as documented in Reference 10.2. This activity ratio is based upon a statistical evaluation of off-site alpha spec analytical data. For simplicity, instead of modifying the ^{232}Th+ C DCGL, the ^{230}Th to ^{232}Th ratio and ^{232}Th concentration will be inserted into the ^{230}Th term above. The revised ^{230}Th term used in the unity equation is illustrated below.

$$\frac{C_{^{230}Th}}{DCGL_{^{230}Th}} = \frac{9.8 \cdot C_{^{232}Th}}{DCGL_{^{230}Th}}$$

4.3 Area Factors

Sections 2.5.1.1 and 5.5.2.4 of MARSSIM addresses the concern of small areas of elevated activity in the survey unit. A simple comparison to an investigation level ($DCGL_{EMC}$) was used to assess the impact of potential elevated areas. The $DCGL_{EMC}$ is the DCGL modified by an area factor (AF) to account for the dose from the small area of the elevated activity. The AFs for the radionuclides of concern are provided in Table 4-2.

4.4 Elevated Measurement Comparison

In the event that a survey unit has elevated areas exceeding the DCGLs, the survey unit may still pass the release criteria as established by MARSSIM. This is demonstrated by ensuring the each individual elevated area is shown to have an SOF less than unity using MARSSIM Equation I-18 as follows based upon the size of the elevated area and the appropriate Area Factors as determined from Table 4-2 using logarithmic interpolation.

$$\sum_{i=1}^{x} \frac{\overline{C}_i}{(AF_i)(DCGLw_i)} \leq 1$$

In addition, it must also be demonstrated that the survey unit has an SOF of less than unity on a collective basis taking into account the systematic survey results and any contribution from each elevated area as identified using MARSSIM Equation 8-2 as follows where δ_i is the average contaminant concentration for the survey unit.

$$\sum_{i=1}^{x}\frac{\delta_i}{DCGLw_i}+\sum_{j=1}^{y}\sum_{i=1}^{x}\frac{\overline{C}_{i,j}-\delta_i}{(AF_{i,j})(DCGLw_i)}\leq 1$$

Provided both EMC results above are demonstrated, the survey unit meets the requirements for release as established by MARSSIM as long as the appropriate statistical testing criterion is met.

Table 4-2 Area Factors

Radionuclide	Contaminated Zone Area (m^2)									
	3,800	3,000	1,000	600	300	100	30	10	3	1
Surface										
^{232}Th + C	1.0	1.0	1.0	--	1.2	1.3	1.7	2.5	5.3	12.4
^{238}U + D	1.0	1.0	1.1	--	1.2	1.4	1.8	2.6	5.4	12.4
^{234}U	1.0	1.1	1.2	--	3.8	9.8	23.6	44.0	82.7	130
^{230}Th	1.0	1.0	1.1	--	1.3	1.6	2.2	3.5	7.4	17.0
^{226}Ra + C	1.0	1.0	1.0	--	1.3	1.5	1.9	2.8	6.0	14.1
Subsurface										
^{232}Th + C	--	--	--	1.0	1.9	4.5	8.7	12.9	27.3	54.9
^{238}U + D	--	--	--	1.0	2.0	5.7	16.3	36.0	38.8	38.8
^{234}U	--	--	--	1.0	2.0	5.9	18.6	49.0	143	367
^{230}Th	--	--	--	1.0	2.0	5.6	15.5	32.9	81.6	179
^{226}Ra + C	--	--	--	1.0	2.0	5.6	15.6	33.1	82.1	181

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

Project quality was ensured through the implementation of several Energy*Solutions* programs and practices. These included the proper selection and training of personnel, working to approved work plans and procedures, selection of appropriate instrumentation, implementation of an instrument program, sample control, sample analysis and records review and management. This ensured that all quality items associated with the project met certain standards, specifically the reproducibility and reliability of the FSS data as presented in this Report for the release of the Breckenridge Disposal Site.

5.1 Personnel Selection and Training

The selection of project staff was based upon their experience on similar projects and their familiarity with the types of equipment being utilized, soil remediation logistics and survey protocols. The project staff had experience with other soil excavation projects, use of the specific waste containers and the implementation of MARSSIM.

In addition, all project staff received site specific training to the approved Work Plans and procedures. Additional training was provided commensurate with the type of

work each individual performed. This included training on the use of the waste packaging, general radiation worker training, personnel protective equipment and the FSS protocols and sampling requirements.

5.2 Approved Work Plans and Procedures

Prior to mobilization and performing any on-site work, the Remedial Work Plan and associated documents were prepared by Energy*Solutions*. These included:

- Remedial Project Work Plan (NRC approved)
- Health and Safety Plan,
- Soil Erosion and Sedimentation Control Plan, and
- Radiation Protect Program Procedures

These Work Plans and procedures specified the project operating requirements and quality controls. Any changes to the Work Plans or deviations were prepared and submitted for approval as appropriate prior to being implemented. Approved changes included the re-evaluation of the site release criteria based upon site specific information and dose models and the Remedial Project Work Plan Addendum, Reference 10.4, to address the increased safety controls upon discovery of hazardous constituents on-site.

5.3 Instrumentation

In order to ensure the quality of project survey records and the FSS data as presented in this report, the Energy*Solutions* instrument program was implemented. This included the proper instrument selection and the establishment of specific instrument performance standards as follows:

5.3.1 Instrument Selection

Survey instruments were selected to ensure the detection of the radionuclides of concern as present at the BDS. A list of instruments and their uses is provided in Table 5-1.

Typical gross alpha and beta counters were selected for the direct measurement of alpha and beta contamination associated with the radionuclides of concern for equipment and materials release and shipping surveys; however for the detection of quantification in soil, the Ludlum Models 2350-1 was used with the Model 44-10 detector for open land surveys and the Genie 2K HPGe gamma spectroscopy system for the analysis of samples.

The Model 44-10 is a 2x2 NaI(Tl) gamma scintillator and was selected for the detection of ^{228}Ac (^{232}Th surrogate), ^{226}Ra and ^{238}U in soils for open land surveys and has adequate sensitivity for the required detection levels. This is demonstrated in Reference 10.2 and as summarized in Section 6.4. This instrument was coupled with the Trimble GPS to allow for accurate mapping of the scan results and the post processing of the data to aid in the selection of soil sample locations as needed.

The Genie 2K gamma spectroscopy system is a High Purity Germanium (HPGe) detection system selected for the identification and quantification of gamma emitters in samples.

Table 5-1 Survey Instrumentation

Instrument	Detector	Radiation Detected	Calibration	Use
Ludlum Model 2221	Model 44-10 gamma scint	gamma	^{137}Cs (γ)	Open Land Surveys
Ludlum Model 2350-1	Model 44-10 gamma scint	gamma	^{137}Cs (γ)	Open Land Surveys
Trimble GPS	NA	NA	NA	Open Land Surveys
Eberline Model E-520	HP-270 GM probe	gamma	^{137}Cs (γ)	Waste and shipment surveys
Genie 2K Gamma Spec	HPGe	gamma	Mixed gamma	Isotopic Analysis
Ludlum Model 3030	Model 43-10-1	Alpha Beta	^{230}Th ^{99}Tc	Smear Counting and Air Samples
Ludlum Model 3	GM pancake	Alpha + Beta	^{99}Tc	Personnel Frisking and Direct Surveys
Ludlum Model 12	Model 43-5	Alpha	^{230}Th	Personnel Frisking and Direct Surveys

5.3.2 Instrument Calibration

All project instrumentation was calibrated in accordance with Energy*Solutions* approved procedures using NIST traceable sources. Instrument calibrations were documented with calibration certificates and/or forms and maintained in the field. Calibration labels were also attached to all portable instruments showing the calibration and calibration due dates.

5.3.3 Instrument Response Tests

Prior to use on-site, all project instrumentation calibrations were verified and initial response test data collected. These initial measurements were used to establish instrument control charts and performance standards (response ranges) in which the instruments were tested against on a daily basis prior to use. The daily response tests were compared to these performance standards to ensure the instruments were functioning properly. When an instrument failed a response test, the results were investigated to determine the cause of failure. In the event that an instrument was not functioning properly, the instrument was removed from service for repair and re-calibration.

5.3.4 Sources

All sources used for calibration and response testing were selected to be representative of the instruments response to the radionuclides of concern. All sources used for calibration were NIST traceable. Those sources located on-site

were controlled by project personnel and were securely locked when not in use or attended.

5.4 Sample Analysis

One of the most important aspects of Quality Assurance and Quality Control at the BDS was to ensure the validity and reliability of the sample analyses from the on-site gamma spectroscopy system. The following sections discuss the key elements for the QA/QC of the gamma spec system.

5.4.1 Sample Collection and Preparation

Soil samples were collected following a soil sampling procedure. Samples were assigned unique sample IDs and collected in zip lock bags and submitted to the on-site lab for processing and analysis.

Samples were processed by drying and sifting through a ¼-inch sieve to remove larger stones and debris. The samples were then packaged and sealed in sample containers for analysis in the same geometry as the system was calibrated. This was to ensure uniformity in the samples and to most closely match the system calibration. Additionally, sample spoils (i.e., stones and debris) were periodically monitored to ensure no activity was discarded.

5.4.2 Sample Splits and Duplicates

To ensure data reproducibility of the on-site counting system, both sample splits and duplicates were analyzed. This was performed to ensure the system would report similar results within specified acceptance criteria. Split samples consisted of splitting a composite sample into two separate samples while duplicates consisted of the re-analysis of the same sample. The results of the on-site QA/QC analyses are provided in Section 8.2 along with a summary of the acceptance criteria.

5.4.3 Off-Site Lab Analyses

As an added control for the on-site counting system, selected samples were shipped to an off-site lab on the Energy*Solutions* approved vendors list. The off-site sample results were then compared to the on-site results using the same methods for the on-site sample splits and duplicates. The results of the off-site QA/QC analyses are provided in Section 8.3.

5.4.4 Sample Chain-of-Custody

Samples shipped off-site were accompanied by a COC record tracking their possession and location. Copies of these records were maintained through the life cycle of the samples through sample disposal. These records identified the specific sample IDs, Fed-Ex tracking numbers and the required sample analyses to be performed. Upon review of the off-site sample analyses and acceptance of the data, the samples were disposed by the off-site lab.

5.5 Records Management

Copies of quality records were maintained on-site through the duration of the project. All quality records were reviewed including the on-site and off-site analysis results, air sample records, site surveys and free release surveys. All FSS results were either reviewed by a CHP and/or the Project Health Physicist.

Upon demobilization, all records will be maintained and archived in accordance with the American Nuclear Insurers (ANI). Copies of specific records will be provided upon request.

6.0 FINAL STATUS SURVEY DESIGN

The FSS design was based upon the survey protocols as outlined in Reference 10.3, Energy*Solutions* document CS-OP-PN-042, *Remedial Work Plan, Waste Excavation and Site Restoration for the Breckenridge Disposal Site* in accordance with the regulatory guidance as provided in Reference 10.1, NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). A summary of the survey protocols as applied to the BDS is provided in the following sections:

6.1 Survey Units and Classification

Based upon the size and configuration of the site, the site was delineated into 5 separate survey units, SU1, SU2, SU3, SU4 and the "Clean" overburden or on-site clean soils that were removed to aid in the excavation of the Confirmed Waste Areas or CWAs. Figure 6-1 provides a pictorial of the survey units as established for the FSS along with several site features as defined in the figure.

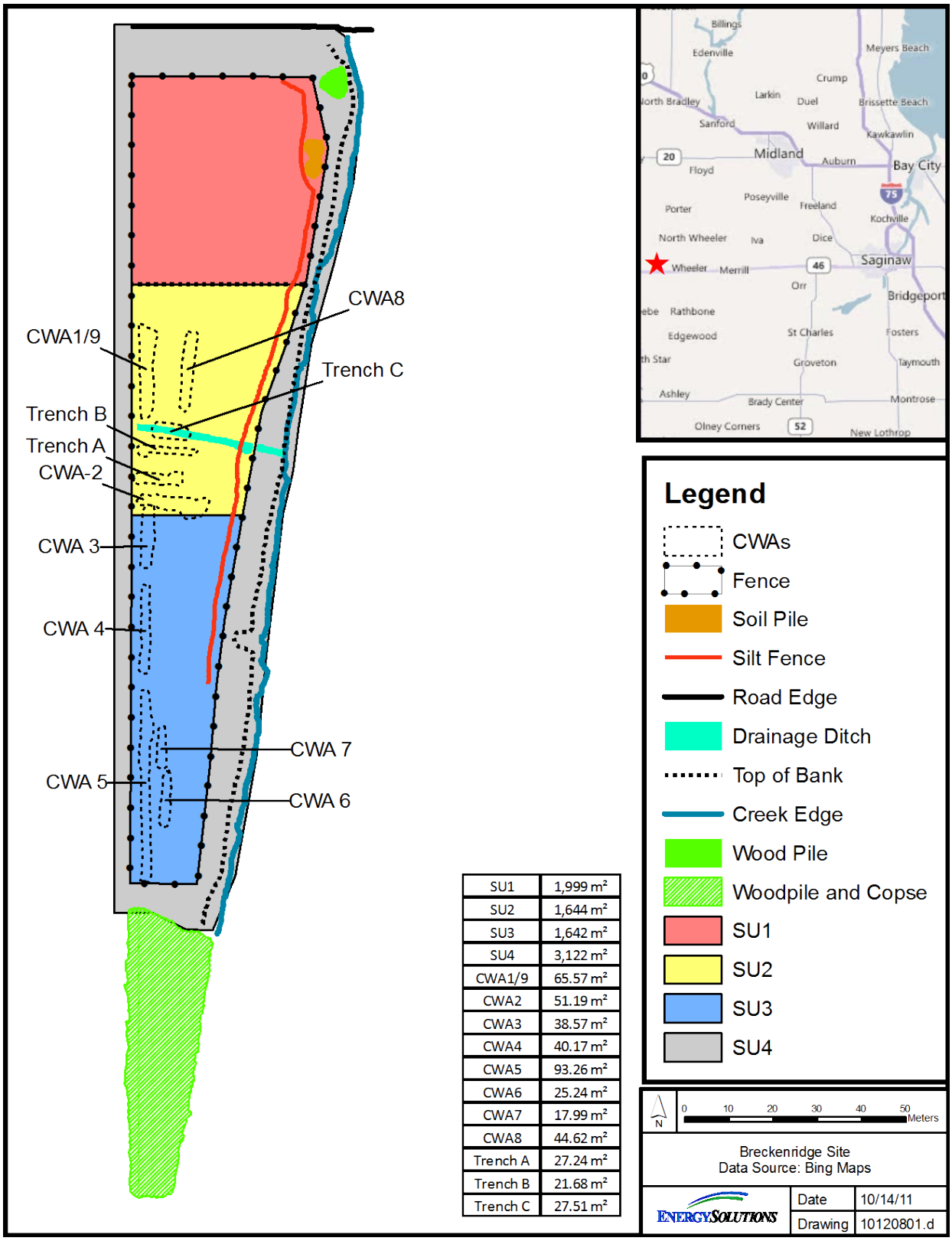
SU1 is located at the north end of the site starting at the northern edge of SU2 extending to north fence. The survey unit is 1,999 square meters in size and was considered Class 1 even though it did not encompass any waste trenches. This area was primarily used to stage packaged waste prior to shipment and to stockpile the on-site clean soils for use as backfill as it was removed during the remediation of Survey Units 2 and 3.

SU2 was considered Class 1 as waste trenches were found in the area. SU2 is located at the center of the site starting at the northern edge of SU3 extending slightly north of CWAs 1 and 8 and the central grouping of trees. The survey unit is 1,644 square meters in size and encompasses CWA-1, CWA-2, the northern tip of CWA-3, CWA-8, CWA-A, CWA-B and CWA-C.

SU3 was considered Class 1 as waste trenches were also found in the area. SU3 is located at the south end of the site from the south fence extending just south of CWA-2. The survey unit is 1,642 square meters in size and encompasses CWA-4, CWA-5, CWA-6, CWA-7 and most of CWA-3.

SU4 was considered Class 3 and is located outside the controlled fence encompassing SU1, SU2 and SU3. The survey unit consists of a buffer zone extending outward approximately 5 meters from the fenceline to the north, west and south and extending to Bush Creek on the eastern side. This area was not expected to be contaminated.

The on-site clean soils removed during the remediation of SU2 and SU3 were also considered Class 1. These soils were removed from Class 1 areas to be used as backfill. As the soils were removed during excavation, they were stockpiled within SU1 until the remediation was complete.



SU1	1,999 m²
SU2	1,644 m²
SU3	1,642 m²
SU4	3,122 m²
CWA1/9	65.57 m²
CWA2	51.19 m²
CWA3	38.57 m²
CWA4	40.17 m²
CWA5	93.26 m²
CWA6	25.24 m²
CWA7	17.99 m²
CWA8	44.62 m²
Trench A	27.24 m²
Trench B	21.68 m²
Trench C	27.51 m²

Figure 6-1 Breckenridge Survey Units

6.2 Gamma Scans

All Class 1 areas received a 100% walkover gamma scan as part of the FSS. This was performed to provide complete coverage of the survey units to ensure the areas were remediated as required. A 100% walkover gamma scan was also performed outside the fence in SU4 to the maximum extent practical due to topography.

6.3 Gamma Scan Action Levels

During site remediation of SU2 and SU3, walkover scans were performed prior to each lift removal. The initial action levels that were implemented to guide the excavation were 3,000 and 23,000 net cpm above background for surface (< 1.5 m bgs) and subsurface soils (> 1.5 m bgs), respectively, as developed empirically and as documented in Reference 10.2. Using an average background of 8,000 cpm, the surface and subsurface action levels were 11,000 and 31,000 gross cpm respectively. All areas exceeding these action levels were removed, packaged and shipped as radioactive waste. All other areas below the action levels were removed and treated as clean overburden and stockpiled within SU1 prior to use as backfill.

Over the course of site remediation following subsequent gamma scans and soil sampling from each lift as it was removed, these action levels were revised and finalized at 18,000 and 31,000 gross cpm for surface and subsurface soils respectively. This re-evaluation is documented in Reference 10.2.

The final action levels as stated above were developed empirically using statistical analysis of the site specific survey and sampling data and through dose modeling using the guidance as provided in NUREG-1507 to account for the presence of elevated ^{230}Th in the radionuclide mix.

6.4 Gamma Scan Sensitivity

To ensure adequate scanning sensitivities for the instrument utilized, it can be shown that the minimum detectable concentrations (MDCs) for open land scanning as provided in NUREG-1507 Table 6.4 are adequately sensitive for every radionuclide listed in Table 4-1 except for ^{230}Th. To account for this lack of scan sensitivity for ^{230}Th, ^{232}Th was again used as a surrogate for ^{230}Th as discussed above. In order to account for the ^{230}Th activity, a modified ^{232}Th DCGL was calculated using Equation I-14 of MARSSIM (NUREG-1575) as follows:

$$DCGL_{^{232}Th_{Mod}} = \frac{1}{\frac{1}{DCGL_{^{232}Th}} + \frac{R_{^{230}Th\,:\,^{232}Th}}{DCGL_{^{230}Th}}}$$

Using the established 9.8:1 activity ratio between ^{230}Th and ^{232}Th, the modified ^{232}Th DCGL was calculated to be 4.2 pCi/g and 8.7 pCi/g for Surface and Subsurface soils, respectively. The ^{232}Th scan MDC of 1.8 pCi/g is less than both modified DCGLs as determined; therefore, adequate scan sensitivity has been demonstrated using the re-evaluated DCGLs with ^{232}Th accounting for the dose from ^{230}Th.

In addition, it has also been demonstrated through dose modeling, following the guidance of NUREG-1507 and as presented in Energy*Solutions* document CS-313111-001, *Re-Evaluation of Breckenridge DCGLs, Gamma Scan Sensitivity, Gamma Scan Action Levels and Development of Area Factors*., that the scanning sensitivity was also adequate for the survey and sampling design to ensure that the area meets the release criteria and that no areas of elevated activity would be missed.

6.5 Systematic Sampling

Systematic sampling and measurement locations were located in a systematic pattern or grid with a triangular grid spacing, *L*, determined using the Equation below (form of MARSSIM Equation 5-5) for all Class 1 areas based upon the survey unit size and the minimum number of sampling or measurement locations as determined necessary to adequately assess the survey units based upon the final walkover survey results.

$$L = \sqrt{\frac{A}{0.866 \times n}}$$

where: A = Area of the survey unit, and

n = Number of sampling and measurement locations.

For each survey unit, a total of 12 systematic sampling locations were determined to be sufficient based upon the surface scan statistics. The starting point for each survey unit was then randomly selected and a triangular sampling grid generated using the grid spacing as determined using Visual Sample Plan (VSP) v5.9.

SU4, or the buffer zone around the fenced property, was treated as a Class 3 area. This survey unit was split into two separate sampling zones, SU4A and SU4B, due to specific sampling requirements along Bush Creek. In accordance with the Project Work Plan, 30 samples were to be taken along Bush Creek between the creek and the BDS. Sample locations were selected randomly using VSP v5.9.

The on-site clean soils were systematically sampled as the soils were removed and stockpiled for use as backfill. One composite sample was collected for every 20 cubic yards of soils removed and stockpiled. Additionally, all off-site soils used as backfill once site remediation was complete were also systematically sampled as it was brought on site. One composite sample was collected for every 100 cubic yards of soil.

6.6 Biased Sampling

Biased samples were collected at elevated areas as identified during the walk-over gamma scans and as selected following an evaluation of the walkover results once the data was plotted. This was performed to investigate any areas of potential concern. Elevated areas were identified by the surveyor as the walkover gamma scans were performed and upon plotting of the gamma scan data. By plotting the survey results, the post processed data could be reviewed to identify additional areas for sampling that may have been missed by the surveyor.

6.7 Subsurface Sampling

Geoprobe® sampling was performed at each final status survey location to a depth of 10 to 12 feet bgs (original grade) or until refusal (i.e., impediment or inability to drive the sample to full depth) whichever was reached first. This included both systematic and biased sampling locations depending upon the final excavation depth, available access within the open excavation and depending upon the safety of using the equipment as a result of the excavation topography.

The purpose of Geoprobe® sampling was to provide additional assurance that no further subsurface contamination exists and to demonstrate that any residual contamination does not exceed 2 feet thick per the dose models.

6.8 Sign Test

For ease of application and evaluating the FSS design, the Sign test was used to assess the number of sampling and measurement locations as determined from Table 5-5 of MARSSIM for planning purposes. This was only applied to the systematic measurements as taken within each survey unit and does not include any biased measurements. This included both the systematic samples taken on the triangular grid and the trench samples taken every 10 linear feet alone the trench centerline.

As there were multiple radionuclides of concern, the individual sample SOF was subtracted from unity. All positive differences, i.e., sample SOF below 1, were summed and used as the test statistic S+. Provided the test statistic exceeded the critical value in the Table I.3 of MARSSIM for the assumed decision error, an adequate number of samples were taken and the null hypothesis, i.e., that the survey unit exceeds the release criterion, was rejected.

7.0 FSS RESULTS SUMMARY

A summary of the FSS results for the BDS is provided in the following sections for each survey unit. This includes a descriptive narrative of the surveys performed as well as any gamma scan surveys and soil sampling results.

7.1 Background Study

Although the Sign test was being used to demonstrate compliance with the release criteria to document the unconditional release of the site as described in Section 6.8, a background study was still conducted for informational purposes presented as follows. This study was performed on a plot of land located just NE of the Breckenridge Disposal Site along Bush Creek as presented in Figure 7-1. This area was selected to be representative of the background in the area because of its similarities to the BDS. As with the BDS, the background area is an uncultivated plot of land directly adjacent to Bush Creek located in the same general vicinity.

As part of the background study, a total of 20 surface soil samples were collected and 1 minute static readings taken at each sampling location using the same instrumentation as used during the Gamma Walkover Surveys (GWS) for FSS. The results of the background study are provided in Table 7-1.

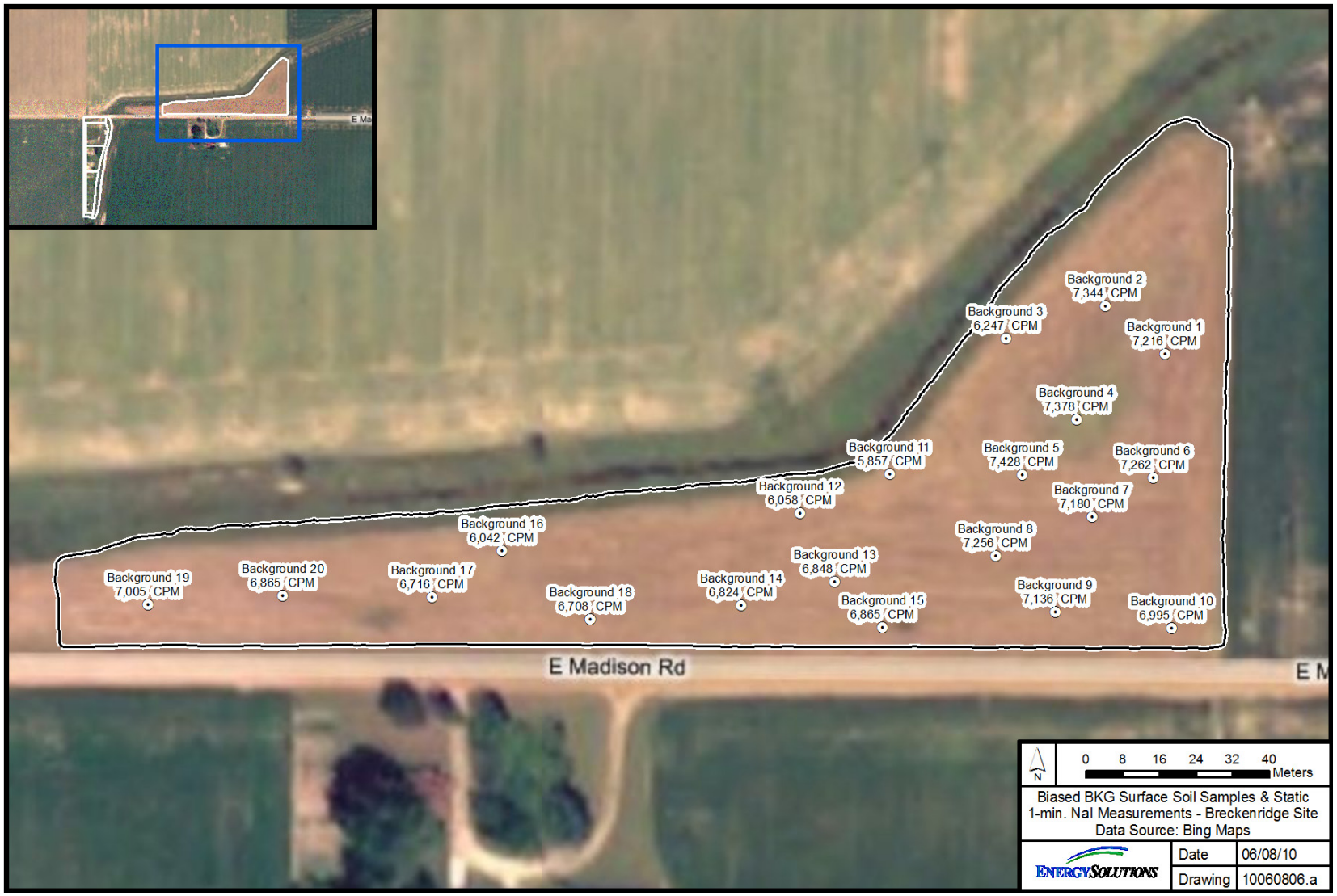


Figure 7-1 Background Study Sampling Locations

Table 7-1 Background Study Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
BKGD01	**71**	0	7,216	*4.32E-01*	8.53E-01	5.98E-01	**6.23E-01**	1.21E-01	**5.98E-01**	2.51E-01	0.22
BKGD02	**71**	0	7,344	**5.35E-01**	5.18E-01	5.24E-01	**6.54E-01**	1.23E-01	**5.24E-01**	2.75E-01	0.21
BKGD03	**71**	0	6,247	**5.75E-01**	4.97E-01	4.27E-01	**4.84E-01**	1.97E-01	**4.27E-01**	2.66E-01	0.17
BKGD04	**71**	0	7,378	*3.19E-01*	7.94E-01	7.00E-01	**6.33E-01**	1.00E-01	**7.00E-01**	2.62E-01	0.25
BKGD05	**71**	0	7,428	*6.23E-01*	8.17E-01	5.71E-01	**6.35E-01**	1.16E-01	**5.71E-01**	1.82E-01	0.22
BKGD06	**71**	0	7,262	*5.77E-01*	8.65E-01	4.95E-01	**5.54E-01**	1.02E-01	**4.95E-01**	2.30E-01	0.19
BKGD07	**71**	0	7,180	*3.02E-01*	8.44E-01	6.93E-01	**5.68E-01**	1.21E-01	**6.93E-01**	2.15E-01	0.23
BKGD08	**71**	0	7,256	*5.83E-01*	8.23E-01	5.75E-01	**5.64E-01**	9.30E-02	**5.75E-01**	1.94E-01	0.21
BKGD09	**72**	0	7,136	*2.30E-01*	8.70E-01	6.75E-01	**6.10E-01**	1.25E-01	**6.75E-01**	2.00E-01	0.24
BKGD10	**72**	0	6,995	*6.85E-01*	8.28E-01	6.79E-01	**4.92E-01**	9.89E-02	**6.79E-01**	1.80E-01	0.22
BKGD11	**72**	0	5,857	*3.62E-01*	6.85E-01	3.33E-01	**4.45E-01**	1.98E-01	**3.33E-01**	2.08E-01	0.14
BKGD12	**72**	0	6,058	*6.87E-01*	7.37E-01	4.59E-01	*5.92E-01*	9.48E-01	**4.59E-01**	1.99E-01	0.19
BKGD13	**72**	0	6,848	*5.64E-01*	6.31E-01	6.49E-01	**5.78E-01**	1.14E-01	**6.49E-01**	2.64E-01	0.23
BKGD14	**72**	0	6,824	**7.93E-01**	7.85E-01	6.28E-01	**5.30E-01**	1.02E-01	**6.28E-01**	1.83E-01	0.22
BKGD15	**73**	0	6,865	**9.64E-01**	7.99E-01	5.81E-01	**5.50E-01**	1.02E-01	**5.81E-01**	1.62E-01	0.21
BKGD16	**73**	0	6,042	*3.48E-02*	7.17E-01	4.87E-01	**5.38E-01**	9.20E-02	**4.87E-01**	2.17E-01	0.19
BKGD17	**73**	0	6,716	*4.82E-01*	5.15E-01	4.34E-01	**6.01E-01**	9.53E-02	**4.34E-01**	2.10E-01	0.19
BKGD18	**73**	0	6,708	*2.57E-01*	8.15E-01	6.05E-01	**5.86E-01**	1.13E-01	**6.05E-01**	1.80E-01	0.22
BKGD19	**73**	0	6,865	*4.45E-01*	5.54E-01	5.98E-01	**6.24E-01**	1.27E-01	**5.98E-01**	2.03E-01	0.22
BKGD20	**73**	0	6,708	*6.00E-01*	8.60E-01	6.23E-01	**6.18E-01**	1.10E-01	**6.23E-01**	4.15E-01	0.23
		Average:	6,847	5.02E-01		5.67E-01	**5.74E-01**		**5.67E-01**		0.21
		Std Dev.:	472	2.13E-01		1.00E-01	**5.56E-02**		**1.00E-01**		0.03
		UCL 95%:	7,622	8.54E-01		7.32E-01	**6.65E-01**		**7.32E-01**		0.25
		Maximum:	7,428	9.64E-01		7.00E-01	**6.54E-01**		**7.00E-01**		0.25

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b ^{230}Th is assumed to be in equilibrium with ^{232}Th with a 1:1 ratio as expected in natural background.

7.2 Trench Backfill Soils – Bagged Material

During the initial site remediation in 6-inch lifts, the gamma scan action levels for the surface soils were modified as site specific data was collected through soil sampling and gamma scan surveys. This progression and re-evaluation of the action levels is provided in Section 6.3. As a result, some of the bags loaded during earlier site remediation contained soils that met the subsurface DCGLs and could be used as backfill within the CWA trenches once site remediation was complete.

Over the course of shipping waste off-site in 2010, a total of 28 bags were segregated for use as potential backfill in the trenches below 1.5 meters bgs. The bag surveys upon loading were used as a basis to segregate these bags as potential backfill.

Upon re-mobilization in July of 2011, these 28 bags were dumped on the ground within SU1 in groups of 4 or 6 bags, spread to a depth not exceeding 1-foot. The bagged material was then scanned and sampled to ensure the material could be utilized as backfill in the trenches. One soil sample was collected for each bag within the group with 2 samples selected in a biased manner following each surface scan.

One of the 28 bags, upon opening, was immediately segregated and repackaged for shipment off site as waste based upon a visual inspection of the material and subsequent gamma scans. The other 27 bags were used as backfill within CWA-1, 2, 3, 4, 8 and Trench C. This material was placed in the specified trenches not exceeding 2 feet in depth prior to any site backfill.

The gamma walkover scans for each set of bags are provided in Figure 7-2 with the soil sample results provided in Table 7-2. There was one small area, approximately 5 square meters that exceeded the subsurface DCGLs as noted in the referenced Figure and Table. This area was identified after it had been piled for use as backfill and was likely blended with the other soils during movement; however, in the event it was placed in the trenches as one contiguous area, any dose contribution to either SU2 or SU3 as a result of placing these soils back in the trenches is addressed as part of the EMC testing as applicable based upon the footprint of the area as identified.

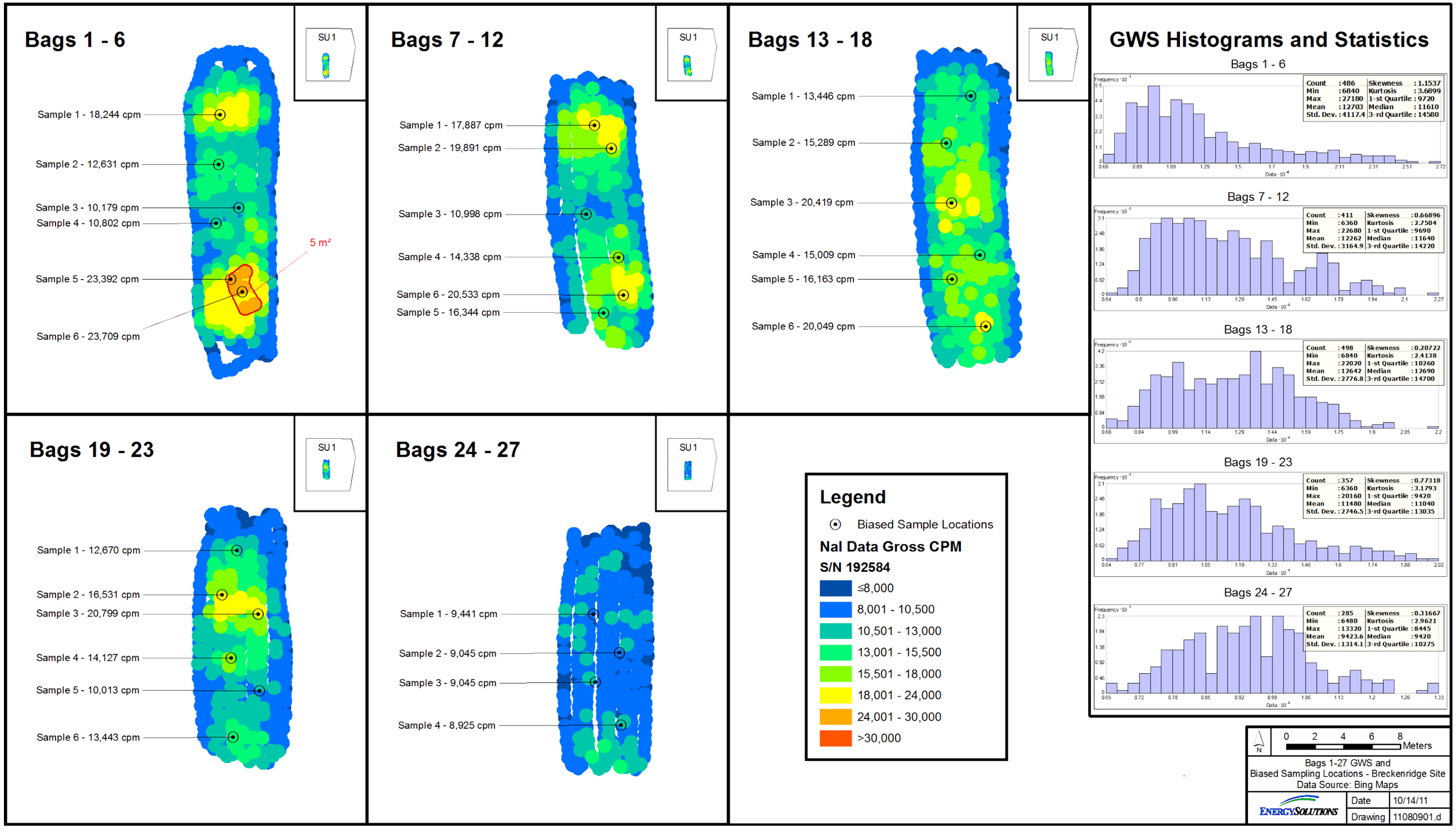


Figure 7-2 Trench Backfill – Walkover Scans (27 Bags)

Table 7-2 Trench Backfill Sampling Results (Bagged Material)

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
BGS0106001	0	6.825	18,244	*5.33E-01*	3.07E+00	4.76E+01	**3.05E+00**	2.70E+00	**4.86E+00**	6.46E-01	0.62
BGS0106002	0	6.825	12,631	**3.81E+00**	2.69E+00	2.13E+01	*-1.11E+00*	2.02E+00	**2.17E+00**	5.14E-01	0.23
BGS0106003	0	6.825	10,179	*1.10E+00*	2.10E+00	1.80E+01	*1.87E+00*	1.92E+00	**1.84E+00**	5.06E-01	0.25
BGS0106004	0	6.825	10,802	*1.70E+00*	2.79E+00	1.45E+01	*1.20E+00*	2.21E+00	**1.48E+00**	3.73E-01	0.19
BGS0106005 QC	0	6.825	23,392	**7.10E+00**	4.06E+00	1.06E+02	*3.33E+00*	5.33E+00	**9.85E+00**	8.44E-01	**1.30**
BGS0106006	0	6.825	23,709	**5.48E+00**	3.63E+00	8.75E+01	*4.14E+00*	4.18E+00	**8.93E+00**	9.03E-01	**1.11**
BGS0712001	0	6.825	17,887	*4.22E+00*	4.99E+00	6.55E+01	**2.41E+00**	2.32E+00	**6.69E+00**	7.99E-01	0.82
BGS0712002	0	6.825	19,891	*7.63E-01*	2.67E+00	3.82E+01	**3.26E+00**	2.92E+00	**3.89E+00**	6.10E-01	0.51
BGS0712003	0	6.825	10,998	*2.80E+00*	2.86E+00	1.26E+01	*-4.17E-01*	1.88E+00	**1.28E+00**	5.24E-01	0.14
BGS0712004	0	6.825	14,338	*3.69E-01*	2.97E+00	3.65E+01	**2.94E+00**	2.71E+00	**3.73E+00**	6.16E-01	0.49
BGS0712005	0	6.825	16,344	**3.70E+00**	3.08E+00	4.52E+01	*-1.19E-01*	3.53E+00	**4.62E+00**	6.05E-01	0.53
BGS0712006	0	6.825	20,533	**5.91E+00**	3.31E+00	4.17E+01	*-1.26E+00*	2.64E+00	**4.25E+00**	7.81E-01	0.47
BGS1318001	0	6.825	13,446	**4.55E+00**	3.72E+00	3.03E+01	*9.94E-02*	2.19E+00	**3.09E+00**	5.59E-01	0.36
BGS1318002	0	6.825	15,289	**4.03E+00**	3.91E+00	3.61E+01	*5.27E-01*	1.95E+00	**3.68E+00**	6.11E-01	0.44
BGS1318003	0	6.825	20,419	**5.87E+00**	2.55E+00	2.65E+01	*-2.10E+00*	2.24E+00	**2.71E+00**	5.81E-01	0.27
BGS1318004	0	6.825	15,009	*3.06E+00*	3.51E+00	2.77E+01	*2.96E-01*	2.03E+00	**2.83E+00**	3.73E-01	0.33
BGS1318005 QC	0	6.825	16,163	**5.70E+00**	2.84E+00	3.38E+01	*2.08E-01*	3.03E+00	**3.45E+00**	5.43E-01	0.40
BGS1318006	0	6.825	20,049	*1.25E+00*	3.92E+00	3.50E+01	**5.35E+00**	3.83E+00	**7.20E+00**	6.28E-01	0.57
BGS1923001	0	6.825	12,670	*2.25E+00*	3.18E+00	2.23E+01	*6.33E-01*	2.11E+00	**2.28E+00**	5.62E-01	0.28
BGS1923002	0	6.825	16,531	*1.72E+00*	3.63E+00	3.18E+01	**3.80E+00**	3.67E+00	**3.24E+00**	4.99E-01	0.45
BGS1923003 QC	0	6.825	20,799	*2.65E+00*	3.54E+00	5.98E+01	**3.37E+00**	2.97E+00	**6.10E+00**	7.20E-01	0.77
BGS1923004	0	6.825	14,127	*2.16E+00*	4.01E+00	3.60E+01	*1.45E+00*	2.18E+00	**3.68E+00**	5.09E-01	0.45
BGS1923005	0	6.825	10,013	*1.33E+00*	2.39E+00	1.66E+01	*5.92E-01*	2.32E+00	**1.70E+00**	1.12E+00	0.21
BGS1923006	0	6.825	13,442	*1.02E+00*	3.14E+00	2.22E+01	*1.89E+00*	2.52E+00	**2.27E+00**	5.62E-01	0.30

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
BGS2427001	0	6.825	9,441	*3.14E+00*	3.24E+00	1.77E+01	*-9.13E-01*	2.27E+00	**1.80E+00**	6.53E-01	0.19
BGS2427002	0	6.825	9,045	*1.64E+00*	1.97E+00	1.34E+01	*2.46E+00*	2.91E+00	**1.36E+00**	1.06E+00	0.21
BGS2427003	0	6.825	9,045	*1.23E+00*	2.66E+00	1.53E+01	**3.43E+00**	2.85E+00	**1.56E+00**	9.42E-01	0.25
BGS2427004	0	6.825	8,925	*2.62E-01*	2.48E+00	9.36E+00	**1.88E+00**	1.88E+00	**9.55E-01**	8.39E-01	0.15
		Average:		2.57E+00		2.98E+01	1.34E+00		**3.18E+00**		0.38
		Std Dev.:		1.72E+00		1.44E+01	1.83E+00		**1.68E+00**		0.18
		UCL 95%:		5.40E+00		5.35E+01	4.35E+00		**5.95E+00**		0.68
		Maximum:		5.91E+00		6.55E+01	5.35E+00		**7.20E+00**		0.82

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.

c Bold "red" values are samples from an elevated area. The data from these samples has been excluded from the survey unit statistics. These values were included in the EMC evaluations.

d Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.3 On-Site Clean Soils – Overburden

To aid in site remediation, soils below the gamma scan action level for surface soils were removed as necessary down to 1.5 meters bgs (i.e., 4.875 feet) to allow for the safe excavation of the contaminated subsurface soils and CWAs. These on-site clean soils or overburden were removed and stockpiled within SU1 and staged for use as backfill upon the completion of SU2 and SU3 remediation. Once stockpiled, the soils were re-scanned to ensure no contaminated soils were inadvertently placed in the stockpile.

Following the remediation of both SU2 and SU3 and placing the soils from the 27 Bags back into the trenches, the on-site clean soils were used to backfill the remaining portions of the site that were excavated below 1.5 meters in depth.

Because the overburden that was removed was part of each lift survey during remediation, it was difficult to document and present the surface scans. The contaminated portions removed and packaged as waste was part of each lift survey. As a result and as agreed upon by the NRC, the surface scans of the soils were documented once they were used as backfill and placed back into the excavation. The result of this gamma walkover scan is presented in Figure 7-3. Included within this figure is a histogram and data set statistics for the entire walkover scan for the on-site clean soils as it was placed back in the excavation.

In addition to the gamma walkover scans, one composite sample was collected for every 20 yards of overburden as it was removed and stockpiled in accordance with the project Remedial Work Plan, CS-OP-PN-042, Reference 10.3. A summary of the sample results for the on-site clean soils is presented in Table 7-3. All soil samples were well below the surface DCGLs and were very close to background levels as documented in Table 7-1.

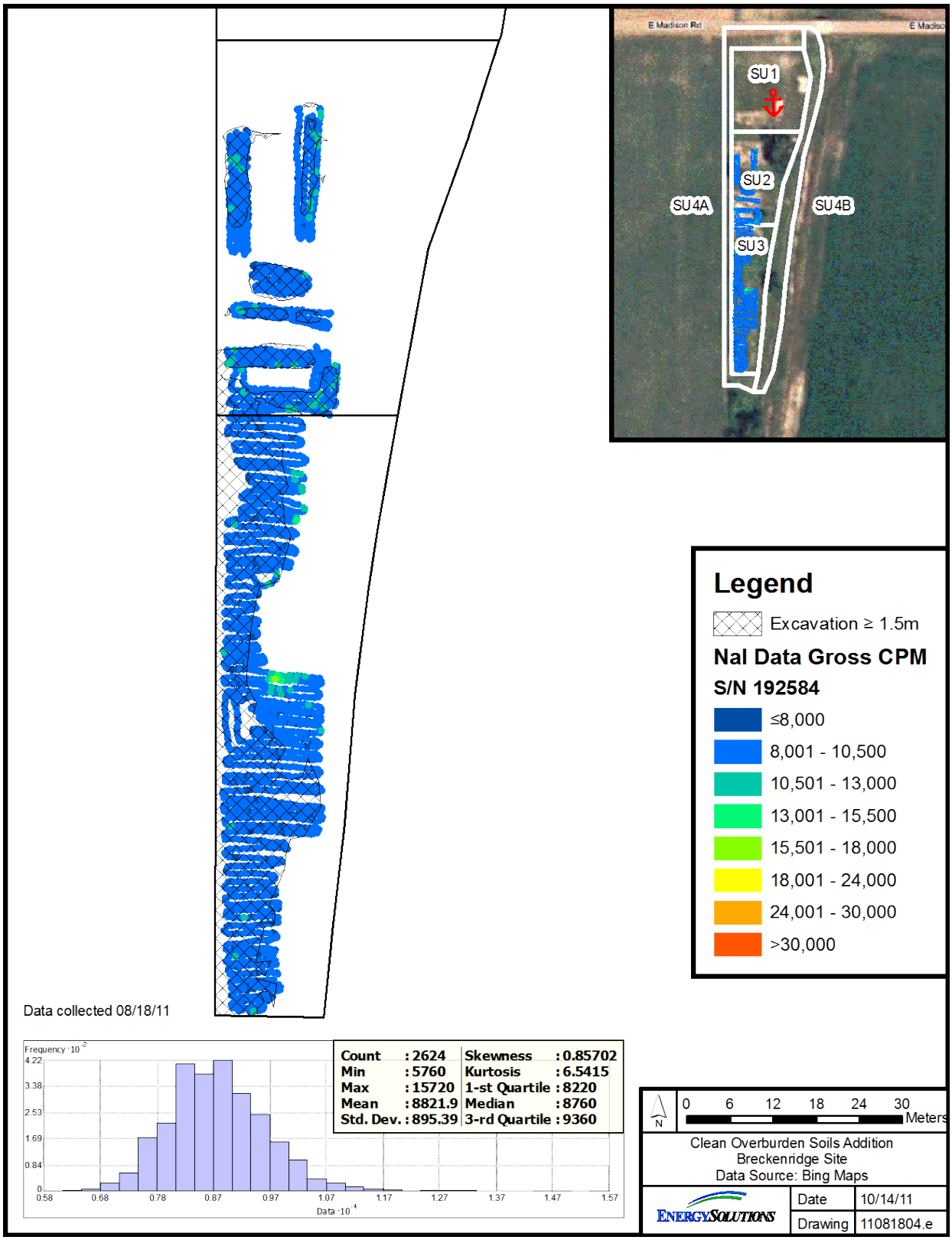


Figure 7-3 On-Site Clean Soils – Walkover Scan

Table 7-3 On-Site Clean Soils Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU3OB001	**85**	0.000		*6.88E-01*	7.04E-01	5.42E+00	**5.12E-01**	8.22E-02	**5.53E-01**	1.87E-01	0.21
SU3OB002	**85**	0.000		*3.11E-01*	6.09E-01	6.96E+00	**5.56E-01**	1.06E-01	**7.10E-01**	1.60E-01	0.26
SU3OB003	**85**	0.000		*3.27E-01*	8.41E-01	7.77E+00	**5.96E-01**	1.10E-01	**7.93E-01**	1.70E-01	0.28
SU3OB004	**85**	0.000		*5.21E-01*	6.10E-01	9.82E+00	**7.70E-01**	1.15E-01	**1.00E+00**	2.64E-01	0.36
SU3OB005	**85**	0.000		*2.54E-01*	5.69E-01	6.42E+00	**5.84E-01**	9.52E-02	**6.55E-01**	1.42E-01	0.25
SU3OB006	**85**	0.000		*4.19E-01*	8.20E-01	7.36E+00	**5.31E-01**	1.14E-01	**7.51E-01**	2.05E-01	0.26
SU3OB007	**85**	0.000		*5.74E-01*	5.92E-01	7.35E+00	**6.51E-01**	1.27E-01	**7.50E-01**	2.70E-01	0.28
SU3OB008	**85**	0.000		*3.18E-01*	8.26E-01	5.56E+00	**5.54E-01**	1.15E-01	**5.67E-01**	1.91E-01	0.22
SU3OB009	**86**	0.000		*6.70E-01*	7.92E-01	1.28E+01	**7.33E-01**	1.29E-01	**1.31E+00**	3.33E-01	0.43
SU3OB010	**82**	0.000		*1.36E-01*	7.90E-01	6.10E+00	**5.46E-01**	1.04E-01	**6.23E-01**	1.41E-01	0.23
SU3OB011 [QC]	**82**	0.000		*4.82E-01*	6.27E-01	1.12E+01	**7.41E-01**	1.23E-01	**1.14E+00**	1.93E-01	0.39
SU3OB012	**82**	0.000		*6.98E-01*	9.08E-01	8.35E+00	**6.55E-01**	1.07E-01	**8.52E-01**	2.17E-01	0.31
SU3OB013	**82**	0.000		**1.31E+00**	8.50E-01	7.60E+00	**6.19E-01**	1.14E-01	**7.76E-01**	4.41E-01	0.29
SU3OB014	**82**	0.000		**5.74E-01**	5.07E-01	4.70E+00	**4.48E-01**	9.16E-02	**4.80E-01**	1.35E-01	0.19
SU3OB015	**82**	0.000		*4.91E-01*	7.25E-01	6.54E+00	**5.13E-01**	1.62E-01	**6.67E-01**	3.44E-01	0.24
SU3OB016	**84**	0.000		*5.36E-01*	8.19E-01	5.97E+00	**5.82E-01**	1.13E-01	**6.09E-01**	2.48E-01	0.24
SU3OB017	**84**	0.000		*6.09E-01*	6.28E-01	6.09E+00	**6.26E-01**	1.08E-01	**6.22E-01**	2.79E-01	0.25
SU3OB018	**83**	0.000		*4.42E-01*	5.28E-01	5.74E+00	**5.90E-01**	1.13E-01	**5.85E-01**	2.33E-01	0.23
SU3OB019	**83**	0.000		*1.58E-01*	8.54E-01	7.85E+00	**6.21E-01**	1.07E-01	**8.01E-01**	1.97E-01	0.29
SU3OB020	**83**	0.000		*6.55E-01*	6.80E-01	8.30E+00	*5.69E-01*	9.99E-01	**8.47E-01**	2.46E-01	0.29
SU2OB021	0	0.000		*2.26E-01*	7.35E-01	5.49E+00	**9.65E-01**	7.84E-01	**5.60E-01**	1.82E-01	0.29
SU2OB022	0	0.000		*5.92E-01*	6.43E-01	7.53E+00	*8.00E-01*	8.47E-01	**7.68E-01**	1.73E-01	0.31
SU2OB023	0	0.000		**1.47E+00**	1.02E+00	1.16E+01	*6.24E-01*	1.02E+00	**1.19E+00**	2.17E-01	0.38
SU2OB024 [QC]	0	0.000		**1.39E+00**	7.65E-01	1.55E+01	**1.27E+00**	1.23E+00	**1.77E+00**	1.91E-01	0.62
SU2OB025	0	0.000		*7.28E-01*	9.33E-01	1.02E+01	*9.11E-01*	9.16E-01	**1.04E+00**	2.01E-01	0.39
SU2OB026	0	0.000		**7.93E-01**	6.95E-01	8.88E+00	*8.12E-01*	1.07E+00	**9.06E-01**	2.36E-01	0.35
SU2OB027 [QC]	0	0.000		**1.54E+00**	7.88E-01	6.18E+00	**1.52E+00**	1.33E+00	**1.68E+00**	3.08E-01	0.61
SU2OB028	0	0.000		**9.33E-01**	6.91E-01	1.16E+01	**1.47E+00**	1.31E+00	**1.19E+00**	2.63E-01	0.52

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU2OB029	0	0.000		*6.18E-01*	7.13E-01	1.05E+01	**1.09E+00**	9.45E-01	**1.07E+00**	1.12E-01	0.43
SU2OB030	0	0.000		*4.22E-01*	6.00E-01	7.90E+00	**1.45E+00**	1.09E+00	**8.06E-01**	2.44E-01	0.43
SU2OB031	0	0.000		*2.71E-01*	5.37E-01	6.54E+00	*3.01E-01*	8.45E-01	**6.68E-01**	1.75E-01	0.21
SU2OB032	0	0.000		*5.78E-01*	8.45E-01	6.28E+00	*6.10E-01*	7.37E-01	**6.40E-01**	2.06E-01	0.25
SU2OB033	0	0.000		*4.81E-01*	5.04E-01	5.56E+00	*7.50E-01*	1.28E+00	**5.67E-01**	1.52E-01	0.26
SU2OB034	0	0.000		*7.47E-01*	7.70E-01	5.30E+00	*2.02E-01*	8.53E-01	**5.41E-01**	2.32E-01	0.16
SU2OB035	0	0.000		*5.14E-01*	5.29E-01	3.72E+00	*7.04E-01*	8.55E-01	**3.80E-01**	2.36E-01	0.20
SU2OB036	0	0.000		*5.36E-01*	5.49E-01	6.71E+00	**1.30E+00**	1.02E+00	**6.84E-01**	2.21E-01	0.37
SU2OB037	0	0.000		*2.14E-01*	7.59E-01	4.62E+00	*2.37E-01*	7.14E-01	**4.71E-01**	2.37E-01	0.15
SU2OB038 [QC]	0	0.000		**9.91E-01**	8.19E-01	5.65E+00	*5.94E-01*	1.03E+00	**5.77E-01**	2.46E-01	0.23
SU2OB039	2	0.000		*7.67E-01*	8.62E-01	5.39E+00	*8.34E-01*	9.27E-01	**5.50E-01**	2.81E-01	0.27
SU2OB040	0	0.000		**9.55E-01**	8.13E-01	4.34E+00	*4.40E-01*	1.01E+00	**4.43E-01**	2.79E-01	0.18
SU2OB041	2	0.000		**6.73E-01**	5.77E-01	5.31E+00	*2.28E-01*	7.73E-01	**5.41E-01**	2.21E-01	0.17
SU2OB042	2	0.000		*1.11E-01*	9.03E-01	6.10E+00	**1.22E+00**	8.57E-01	**6.22E-01**	2.36E-01	0.34
SU2OB043	2	0.000		**6.24E-01**	5.44E-01	5.62E+00	**1.09E+00**	7.94E-01	**5.74E-01**	1.97E-01	0.31
SU2OB044	2	0.000		*4.24E-01*	8.52E-01	6.21E+00	*7.20E-01*	8.49E-01	**6.33E-01**	2.88E-01	0.27
SU2OB045	2	0.000		*5.54E-01*	5.66E-01	5.94E+00	*4.16E-01*	8.38E-01	**6.07E-01**	1.67E-01	0.21
SU2OB046	1	0.000		*1.80E-01*	7.86E-01	5.65E+00	**1.20E+00**	1.01E+00	**5.76E-01**	2.40E-01	0.33
SU2OB047	2	0.000		**1.04E+00**	8.06E-01	7.01E+00	*3.60E-01*	9.36E-01	**7.15E-01**	2.72E-01	0.23
SU2OB048	0	0.000		*3.21E-01*	5.35E-01	4.77E+00	*2.98E-01*	9.26E-01	**4.86E-01**	2.49E-01	0.16
SU2OB049	0	0.000		*8.32E-01*	9.01E-01	7.52E+00	**1.43E+00**	1.18E+00	**7.67E-01**	2.49E-01	0.41
SU2OB050	0	0.000		*4.65E-01*	7.74E-01	5.96E+00	**1.17E+00**	9.35E-01	**6.08E-01**	2.30E-01	0.33
SU2OB051 [QC]	0	0.000		**7.46E-01**	6.40E-01	7.02E+00	*5.45E-01*	8.07E-01	**7.16E-01**	2.49E-01	0.26
SU2OB052	0	0.000		**6.87E-01**	5.86E-01	6.64E+00	*3.56E-01*	7.95E-01	**6.78E-01**	2.40E-01	0.22
SU2OB053	0	0.000		**8.30E-01**	5.45E-01	7.19E+00	*1.01E+00*	1.08E+00	**7.34E-01**	2.47E-01	0.34
SU2OB054	1	0.000		*3.40E-01*	8.52E-01	7.56E+00	*6.95E-01*	8.90E-01	**7.71E-01**	1.15E-01	0.29
SU2OB055 [QC]	1	0.000		**8.24E-01**	6.01E-01	1.72E+00	**1.02E+00**	8.83E-01	**6.87E-01**	2.49E-01	0.31
SU2OB056	0	0.000		*4.35E-01*	8.98E-01	9.05E+00	**1.26E+00**	8.86E-01	**9.23E-01**	2.31E-01	0.42
SU2OB057	0	0.000		*5.10E-01*	7.25E-01	5.42E+00	**1.05E+00**	8.62E-01	**5.53E-01**	1.81E-01	0.30
SU2OB058	0	0.000		*6.45E-01*	8.50E-01	6.61E+00	*4.81E-01*	8.17E-01	**6.75E-01**	2.39E-01	0.24

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU2OB059	0	0.000		*4.96E-01*	7.78E-01	6.32E+00	*7.05E-01*	8.80E-01	**6.45E-01**	2.33E-01	0.27
SU2OB060	1	0.000		*7.01E-01*	8.60E-01	6.12E+00	*1.86E-01*	8.43E-01	**6.25E-01**	2.33E-01	0.18
SU2OB061	1	0.000		*4.72E-01*	9.91E-01	7.27E+00	**1.08E+00**	9.92E-01	**7.42E-01**	2.83E-01	0.35
SU2OB062	1	0.000		*4.95E-01*	8.13E-01	5.84E+00	*9.52E-01*	9.67E-01	**5.96E-01**	2.27E-01	0.30
SU2OB063	1	0.000		*4.46E-01*	8.72E-01	7.29E+00	**1.48E+00**	9.91E-01	**7.44E-01**	2.25E-01	0.41
SU2OB064	1	0.000		*3.99E-01*	6.22E-01	6.65E+00	**1.03E+00**	9.14E-01	**6.79E-01**	1.54E-01	0.33
SU2OB065	1	0.000		**4.98E-01**	4.59E-01	5.53E+00	**8.70E-01**	7.94E-01	**5.65E-01**	2.28E-01	0.27
SU2OB066	1	0.000		*3.01E-01*	8.12E-01	6.49E+00	*6.40E-01*	8.19E-01	**6.62E-01**	2.12E-01	0.26
SU2OB067 [QC]	1	0.000		*2.66E-01*	4.70E-01	6.20E+00	**8.78E-01**	7.52E-01	**6.32E-01**	1.49E-01	0.29
SU2OB068	2	0.000		*4.19E-01*	5.42E-01	5.65E+00	*1.13E+00*	1.13E+00	**5.77E-01**	2.24E-01	0.32
SU2OB069	2	0.000		*1.35E-01*	5.10E-01	6.87E+00	*7.88E-01*	8.20E-01	**7.01E-01**	1.94E-01	0.29
SU2OB070	2	0.000		**9.57E-01**	5.36E-01	6.54E+00	*9.76E-01*	9.81E-01	**6.67E-01**	2.30E-01	0.32
SU2OB071 [QC]	0	0.000		**9.03E-01**	6.37E-01	1.52E+00	*8.93E-01*	1.42E+00	**1.04E+00**	2.29E-01	0.36
SU2OB072	0	0.000		**7.02E-01**	6.60E-01	5.92E+00	*7.81E-01*	1.12E+00	**6.04E-01**	2.22E-01	0.27
SU2OB073	0	0.000		*7.29E-01*	9.02E-01	6.17E+00	*3.25E-01*	8.33E-01	**6.30E-01**	1.68E-01	0.20
SU2OB074	0	0.000		**1.32E+00**	9.24E-01	5.61E+00	*4.53E-02*	1.09E+00	**5.72E-01**	2.03E-01	0.15
SU2OB075	0	0.000		*3.68E-01*	9.66E-01	6.27E+00	**9.80E-01**	9.06E-01	**6.39E-01**	1.69E-01	0.31
SU2OB076	0	0.000		*5.14E-01*	7.45E-01	6.74E+00	*5.67E-01*	8.47E-01	**6.88E-01**	1.64E-01	0.25
SU2OB077	0	0.000		*5.49E-01*	6.42E-01	5.45E+00	*9.04E-01*	1.02E+00	**5.56E-01**	2.20E-01	0.28
SU2OB078	0	0.000		**6.54E-01**	5.76E-01	6.64E+00	*2.62E-01*	9.97E-01	**6.78E-01**	1.75E-01	0.20
SU2OB079	0	0.000		*8.56E-01*	8.86E-01	6.01E+00	*8.24E-01*	8.50E-01	**6.13E-01**	2.82E-01	0.28
SU2OB080 [QC]	0	0.000		*5.26E-01*	6.90E-01	5.50E+00	*7.42E-01*	8.47E-01	**5.61E-01**	2.34E-01	0.25
SU2OB081	0	0.000		**7.78E-01**	6.00E-01	5.60E+00	*5.73E-01*	9.93E-01	**5.71E-01**	2.31E-01	0.23
		Average:		6.01E-01		6.75E+00	7.54E-01		**7.22E-01**		0.29
		Std Dev.:		2.99E-01		2.11E+00	3.35E-01		**2.38E-01**		0.09
		UCL 95%:		1.09E+00		1.02E+01	1.30E+00		**1.11E+00**		0.44
		Maximum:		1.54E+00		1.55E+01	1.52E+00		**1.77E+00**		0.62

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.
c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.3.1 Elevated Measurement Comparison

No elevated areas exceeding the surface DCGLs were identified.

7.3.2 Deviations from the FSSP

There were no deviations from the FSSP for the on-site clean soils.

7.3.3 Sign Test

A total of 81 systematic measurements were taken as the soil was removed and stockpiled. According to MARSSIM Table I.3, the critical value based upon 81 measurement location with a 5% decision error is forty-seven (47). After subtracting the individual measurement SOFs from unity, there were a total of 81 positive values which exceeds the critical value. As a result, the of-site clean soils passed the sign test thereby rejecting the null hypothesis.

7.3.4 Conclusions

Based upon the survey and sample results as presented for the on-site clean soils, the survey unit meets the sign test and is suitable for unconditional release based upon the intent of MARSSIM. The average SOF for on-site clean soils as demonstrated in Table 7-3 is 0.29 for a total residual dose of approximately 7.25 mrem to an average member of the critical group.

It should be noted that this is based upon gross activities and does not take into affect any contribution from background. As a result, any reported residual dose is conservative.

7.4 Survey Unit 1 (SU1)

A summary of the FSS Results for Survey Unit 1 are provided as follows:

7.4.1 SU1 Walkover Survey

Upon the removal of all packaged waste and the on-site clean soils from the area, a final walkover gamma scan was performed and the data plotted. The scan results are provided in Figure 7-4. A 100% scan was performed to the maximum extent practical; however, due to GPS plotting capabilities, survey unit topography, survey references and the scan methodology (poling measurements every second), small void areas as depicted by the color white will be present in the figure. No areas exceeded the surface soil action level of 18,000 cpm. Included within this figure is a histogram and data set statistics for the entire walkover scan of SU1.

7.4.2 Surface Soil Sampling and Results

Following the final walkover scan of the area, the survey unit was sampled and all samples analyzed on site. Surface soil samples (0-6") were collected throughout the area in accordance with the FSS Protocols. Systematic samples were collected on a triangular grid with a random starting point. Based upon the evaluation of the walkover survey and the VSP design, it was determined that 12 systematic sampling locations were adequate.

In addition to the systematic sampling locations, 3 biased samples were taken at areas based upon the final walkover scan survey and the surface topography. No surface samples were collected at biased sample locations 2 and 3 as these locations were only selected to investigate subsurface soils under the concrete slab and a surface depression located in the area to ensure there was no underlying trench. Geoprobe® samples were taken at these two locations for investigation purposes only.

Figure 7-5 provides a summary of all the soil sampling locations as collected for SU1 with the sample analysis results presented in Table 7-4 for the surface soil samples.

7.4.3 Subsurface Soil Sampling and Results

Following the analysis of all surface soil samples, subsurface samples were collected at each sample location as depicted in Figure 7-5. Geoprobe® samples were taken at each sampling location down to an approximate depth of 12 feet bgs or until refusal. The samples were then divided and analyzed in 2-foot composites.

All sample results for the subsurface soils are provided in Table 7-5. All results were well below the applicable DCGLs and an SOF of unity.

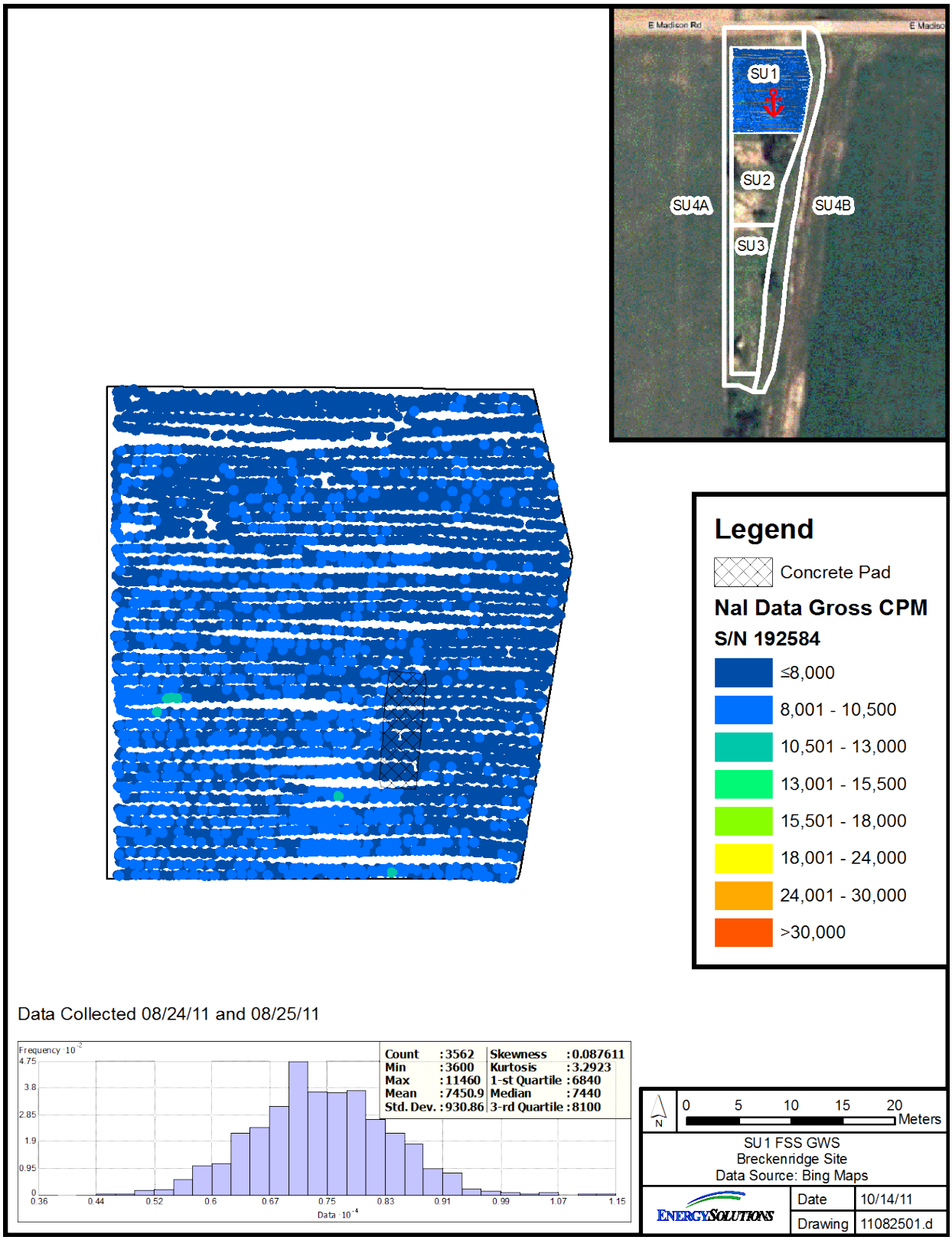


Figure 7-4 SU1 Final Status Survey – Walkover Scan

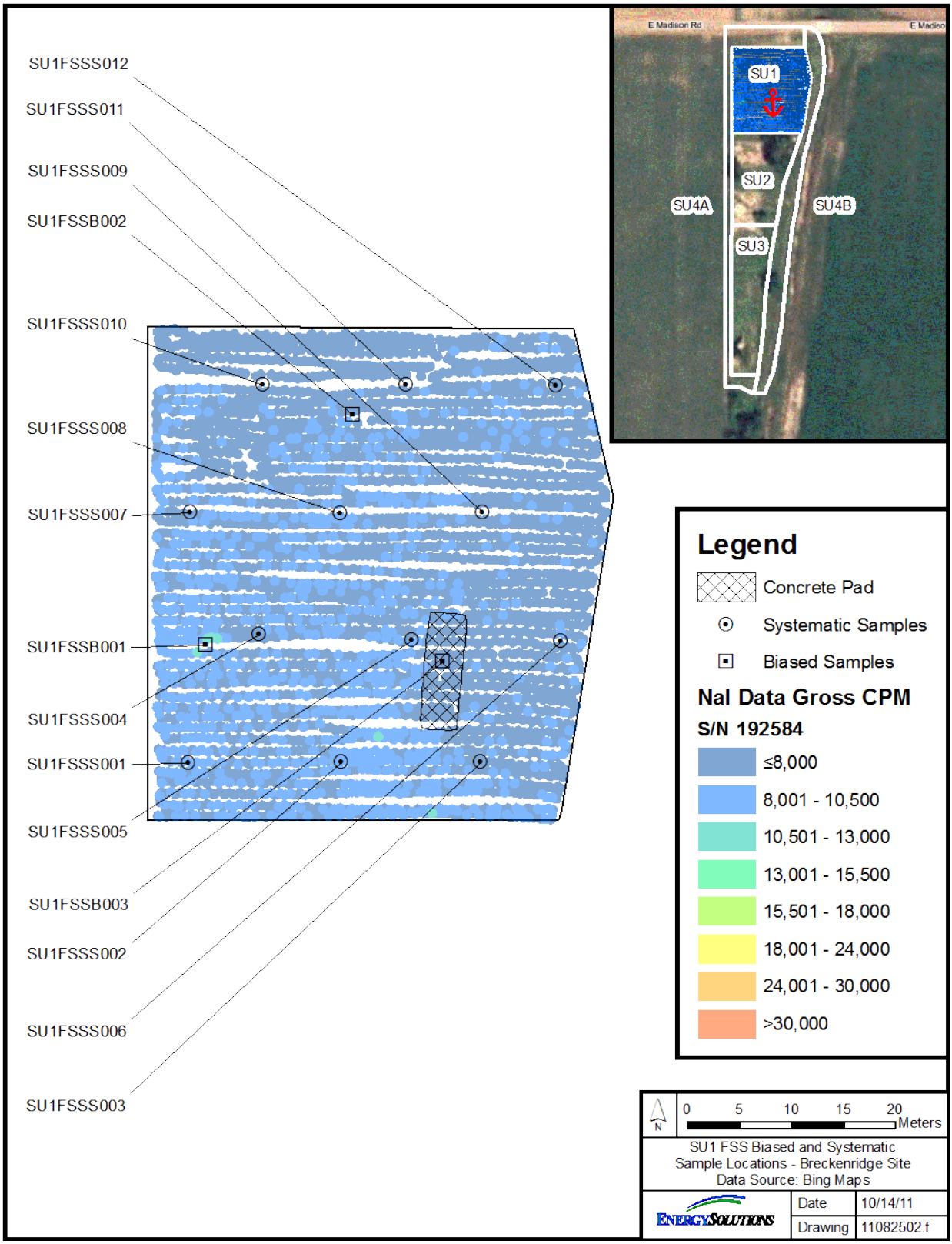


Figure 7-5 SU1 Final Status Survey - Sampling Map

Table 7-4 SU1 Systematic and Biased Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU1FSSS001	0	0.000	8,211	*9.80E-01*	1.22E+00	6.16E+00	*8.32E-01*	9.44E-01	**6.28E-01**	2.41E-01	0.28
SU1FSSS002	1	0.000	8,922	*9.32E-01*	1.08E+00	8.70E+00	*5.28E-01*	1.02E+00	**8.88E-01**	2.25E-01	0.30
SU1FSSS003	0	0.000	7,428	*2.76E-01*	1.04E+00	4.14E+00	*4.83E-01*	1.12E+00	**4.23E-01**	1.15E-01	0.18
SU1FSSS004	0	0.000	7,479	*1.36E-01*	8.17E-01	5.39E+00	*5.98E-01*	1.06E+00	**5.50E-01**	2.48E-01	0.23
SU1FSSS005	5	0.000	7,947	*5.85E-01*	1.30E+00	7.21E+00	*6.30E-01*	9.95E-01	**7.36E-01**	1.45E-01	0.28
SU1FSSS006	5	0.000	7,177	*7.74E-01*	1.25E+00	5.14E+00	*3.82E-01*	1.20E+00	**5.24E-01**	1.43E-01	0.19
SU1FSSS007	0	0.000	8,135	*2.70E-01*	9.69E-01	6.81E+00	*7.64E-01*	9.37E-01	**6.95E-01**	2.51E-01	0.29
SU1FSSS008	0	0.000	7,634	*3.85E-01*	1.19E+00	4.79E+00	*5.38E-01*	9.18E-01	**4.89E-01**	1.74E-01	0.20
SU1FSSS009 [QC]	0	0.000	6,984	*4.75E-01*	7.86E-01	4.80E+00	*6.55E-01*	1.31E+00	**4.90E-01**	1.75E-01	0.22
SU1FSSS010	5	0.000	6,212	*5.42E-01*	1.35E+00	4.53E+00	*4.10E-01*	9.47E-01	**4.62E-01**	2.23E-01	0.18
SU1FSSS011	1	0.000	7,082	*3.86E-01*	1.26E+00	4.69E+00	*6.05E-01*	1.09E+00	**4.78E-01**	2.28E-01	0.21
SU1FSSS012	1	0.000	7,095	*4.69E-01*	1.24E+00	4.62E+00	*8.93E-01*	9.46E-01	**4.72E-01**	2.36E-01	0.26
SU1FSSB001 [QC]	0	0.000	9,842	*1.08E+00*	1.71E+00	3.28E+00	*1.99E+00*	2.18E+00	**1.28E+00**	2.77E-01	0.59
		Average:	7,704	5.60E-01		5.40E+00	7.16E-01		**6.25E-01**		0.26
		Std Dev.:	934	2.96E-01		1.46E+00	4.12E-01		**2.39E-01**		0.11
		UCL 95%:	9,240	1.05E+00		7.80E+00	1.39E+00		**1.02E+00**		0.44
		Maximum:	9,842	1.08E+00		8.70E+00	1.99E+00		**1.28E+00**		0.59

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.
c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

Table 7-5 SU1 Subsurface Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU1FSSS001A [QC]	1	0.000	NA	*5.89E-01*	1.13E+00	4.79E+00	**1.16E+00**	1.11E+00	**4.89E-01**	1.74E-01	0.30
SU1FSSS001B	0	2.000	NA	*5.48E-01*	1.93E+00	7.22E+00	*5.32E-01*	1.60E+00	**7.37E-01**	6.43E-01	0.26
SU1FSSS001C	0	4.000	NA	*1.26E+00*	1.90E+00	7.81E+00	*1.58E-01*	1.50E+00	**7.97E-01**	6.09E-01	0.22
SU1FSSS001D	0	6.000	NA	*2.07E-01*	1.99E+00	5.86E+00	*7.90E-01*	2.18E+00	*5.98E-01*	7.07E-01	0.08
SU1FSSS001E	0	8.000	NA	*4.81E-01*	1.97E+00	6.72E+00	*7.40E-01*	1.74E+00	**6.86E-01**	6.20E-01	0.09
SU1FSSS001F	1	10.000	NA	*7.49E-01*	1.02E+00	3.87E+00	*-9.48E-02*	7.33E-01	**3.95E-01**	1.98E-01	0.04
SU1FSSS002A	0	0.000	NA	*8.30E-01*	2.09E+00	4.15E+00	*2.48E-01*	1.41E+00	*4.24E-01*	7.25E-01	0.14
SU1FSSS002B	0	2.000	NA	*9.65E-01*	2.01E+00	7.31E+00	*2.61E-01*	1.19E+00	**7.46E-01**	6.87E-01	0.22
SU1FSSS002C [QC]	0	4.000	NA	*1.13E+00*	2.09E+00	7.90E-01	*1.38E+00*	2.30E+00	*6.50E-01*	7.21E-01	0.36
SU1FSSS002D	0	6.000	NA	*1.11E+00*	2.03E+00	4.73E+00	*1.21E+00*	2.24E+00	*4.83E-01*	6.64E-01	0.08
SU1FSSS002E	0	8.000	NA	*8.81E-01*	2.02E+00	7.95E+00	*6.01E-01*	1.45E+00	**8.11E-01**	7.28E-01	0.11
SU1FSSS002F	0	10.000	NA	*6.41E-01*	2.12E+00	6.55E+00	*7.25E-01*	1.58E+00	*6.68E-01*	7.65E-01	0.09
SU1FSSS003A	0	0.000	NA	*1.51E-01*	2.02E+00	5.76E+00	*5.34E-01*	2.19E+00	*5.88E-01*	7.30E-01	0.22
SU1FSSS003B	0	2.000	NA	*3.07E-01*	1.50E+00	5.41E+00	*1.32E+00*	1.63E+00	*5.52E-01*	7.04E-01	0.34
SU1FSSS003C [QC]	8	4.000	NA	*1.08E+00*	2.05E+00	5.06E+00	*9.08E-01*	1.46E+00	*5.17E-01*	7.27E-01	0.27
SU1FSSS003D	1	6.000	NA	*6.88E-01*	2.14E+00	8.20E+00	*5.74E-01*	2.38E+00	**8.36E-01**	7.41E-01	0.11
SU1FSSS003E	0	8.000	NA	*1.26E+00*	2.39E+00	8.91E+00	*3.62E-01*	1.86E+00	**9.09E-01**	7.46E-01	0.11
SU1FSSS003F	1	10.000	NA	*1.23E+00*	2.07E+00	6.40E+00	*6.43E-01*	1.78E+00	*6.53E-01*	7.10E-01	0.09
SU1FSSS004A	7	0.000	NA	*1.96E+00*	2.19E+00	8.19E+00	*1.01E+00*	1.69E+00	**8.35E-01**	7.40E-01	0.36
SU1FSSS004B	1	2.000	NA	*4.30E-01*	2.31E+00	8.40E+00	*7.36E-01*	1.54E+00	**8.57E-01**	7.21E-01	0.32
SU1FSSS004C	1	4.000	NA	*2.20E+00*	2.33E+00	6.42E+00	*6.43E-01*	2.64E+00	*6.55E-01*	6.92E-01	0.26
SU1FSSS004D	1	6.000	NA	*1.18E+00*	2.14E+00	7.31E+00	*1.45E+00*	2.29E+00	*7.46E-01*	7.97E-01	0.11
SU1FSSS004E	1	8.000	NA	*1.25E+00*	1.95E+00	6.21E+00	*0.00E+00*	2.23E+00	*6.34E-01*	6.55E-01	0.07
SU1FSSS004F	0	10.000	NA	*5.99E-01*	2.11E+00	4.89E+00	*1.20E+00*	2.36E+00	*4.99E-01*	7.32E-01	0.08

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU1FSSS005A	0	0.000	NA	*1.16E+00*	2.46E+00	1.02E+01	*8.06E-01*	1.74E+00	**1.04E+00**	8.28E-01	0.38
SU1FSSS005B	6	2.000	NA	*1.09E+00*	2.29E+00	1.17E+01	*8.38E-01*	2.48E+00	**1.19E+00**	8.16E-01	0.42
SU1FSSS005C	6	4.000	NA	*5.70E-01*	1.86E+00	6.12E+00	*4.12E-01*	2.12E+00	*6.25E-01*	6.37E-01	0.21
SU1FSSS005D	6	6.000	NA	*7.36E-01*	2.13E+00	3.29E+00	*5.15E-01*	1.68E+00	*3.36E-01*	6.52E-01	0.05
SU1FSSS005E	6	8.000	NA	*6.68E-01*	1.81E+00	6.77E+00	*1.78E+00*	2.08E+00	**6.91E-01**	5.79E-01	0.11
SU1FSSS005F	6	10.000	NA	*1.01E+00*	2.15E+00	8.16E+00	*1.08E-01*	1.50E+00	**8.33E-01**	7.53E-01	0.10
SU1FSSS006A	1	0.000	NA	*1.77E-01*	1.98E+00	4.72E+00	*1.83E+00*	2.16E+00	*4.82E-01*	6.51E-01	0.41
SU1FSSS006B	1	2.000	NA	*9.24E-01*	2.14E+00	4.94E+00	*1.39E+00*	2.25E+00	*5.04E-01*	7.27E-01	0.35
SU1FSSS006C	1	4.000	NA	*7.34E-01*	2.07E+00	1.11E+01	*4.86E-01*	1.37E+00	**1.14E+00**	6.50E-01	0.35
SU1FSSS006D	1	6.000	NA	*6.61E-01*	1.95E+00	6.04E+00	*1.42E+00*	1.44E+00	*6.17E-01*	6.64E-01	0.10
SU1FSSS006E	2	8.000	NA	*3.66E-01*	1.16E+00	5.36E+00	*1.55E+00*	1.58E+00	*5.47E-01*	5.53E-01	0.09
SU1FSSS006F	1	10.000	NA	*9.65E-01*	1.94E+00	5.92E+00	*1.74E+00*	2.21E+00	*6.04E-01*	6.18E-01	0.10
SU1FSSS007A	1	0.000	NA	*1.77E+00*	2.21E+00	8.87E+00	*2.84E-01*	1.32E+00	**9.05E-01**	7.80E-01	0.26
SU1FSSS007B [QC]	1	2.000	NA	*1.11E+00*	1.94E+00	7.80E-01	*5.54E-01*	1.53E+00	**7.21E-01**	4.86E-01	0.24
SU1FSSS007C	0	4.000	NA	*7.96E-01*	2.15E+00	3.27E+00	*1.24E+00*	2.33E+00	*3.34E-01*	7.03E-01	0.28
SU1FSSS007D	0	6.000	NA	*1.64E+00*	1.87E+00	7.68E+00	*1.70E+00*	1.99E+00	**7.83E-01**	6.31E-01	0.12
SU1FSSS007E	1	8.000	NA	*9.78E-01*	1.69E+00	4.53E+00	*5.06E-01*	1.46E+00	**4.62E-01**	3.43E-01	0.06
SU1FSSS007F	1	10.000	NA	*3.93E-01*	1.55E+00	7.48E+00	*7.39E-01*	1.24E+00	**7.63E-01**	5.31E-01	0.10
SU1FSSS008A [QC]	3	0.000	NA	*2.06E-01*	1.28E+00	7.93E+00	*1.42E+00*	1.59E+00	**8.10E-01**	6.38E-01	0.42
SU1FSSS008B	1	2.000	NA	*5.72E-02*	1.10E+00	7.77E+00	**1.96E+00**	1.48E+00	**7.93E-01**	5.94E-01	0.50
SU1FSSS008C	1	4.000	NA	*5.11E-01*	1.65E+00	1.91E+00	*0.00E+00*	1.75E+00	*1.95E-01*	5.92E-01	0.05
SU1FSSS008D	1	6.000	NA	*5.45E-01*	1.69E+00	6.17E+00	*8.48E-01*	1.31E+00	**6.29E-01**	5.65E-01	0.09
SU1FSSS008E	1	8.000	NA	*5.48E-01*	1.66E+00	5.97E+00	**1.40E+00**	1.29E+00	**6.09E-01**	5.93E-01	0.10
SU1FSSS008F	1	10.000	NA	*1.32E-01*	1.61E+00	4.58E+00	*7.69E-01*	1.23E+00	*4.67E-01*	5.41E-01	0.07

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU1FSSS009A	1	0.000	NA	*3.73E-01*	1.75E+00	5.14E+00	*5.50E-01*	1.42E+00	*5.25E-01*	5.49E-01	0.21
SU1FSSS009B	1	2.000	NA	*7.93E-01*	1.90E+00	8.08E+00	*2.35E-01*	1.39E+00	**8.24E-01**	6.41E-01	0.23
SU1FSSS009C	1	4.000	NA	*1.82E-01*	1.29E+00	4.65E+00	*0.00E+00*	1.90E+00	*4.74E-01*	5.75E-01	0.11
SU1FSSS009D	1	6.000	NA	*6.65E-01*	1.58E+00	9.06E+00	*3.17E-01*	1.30E+00	**9.24E-01**	5.52E-01	0.11
SU1FSSS009E	1	8.000	NA	*6.23E-01*	1.62E+00	2.31E+00	*1.49E+00*	1.84E+00	*2.36E-01*	5.21E-01	0.06
SU1FSSS009F	1	10.000	NA	*6.78E-01*	1.39E+00	4.91E+00	*2.33E-01*	1.02E+00	**5.01E-01**	4.55E-01	0.06
SU1FSSS010A	1	0.000	NA	*5.36E-01*	1.68E+00	4.16E+00	*1.06E+00*	1.49E+00	*4.24E-01*	5.30E-01	0.27
SU1FSSS010B [QC]	1	2.000	NA	*1.05E+00*	1.77E+00	7.10E-01	*5.49E-01*	1.37E+00	**6.82E-01**	3.65E-01	0.23
SU1FSSS010C	1	4.000	NA	*1.46E+00*	1.54E+00	5.06E+00	*2.72E-01*	1.12E+00	**5.16E-01**	2.98E-01	0.17
SU1FSSS010D	1	6.000	NA	*6.56E-01*	1.67E+00	7.05E+00	*9.93E-01*	1.14E+00	**7.20E-01**	5.82E-01	0.10
SU1FSSS010E	1	8.000	NA	*1.22E+00*	1.57E+00	3.14E+00	*5.54E-01*	1.36E+00	*3.21E-01*	5.30E-01	0.05
SU1FSSS010F	1	10.000	NA	*3.99E-01*	1.57E+00	4.42E+00	*7.59E-01*	1.32E+00	*4.52E-01*	5.11E-01	0.07
SU1FSSS011A	2	0.000	NA	*2.33E-01*	1.49E+00	7.64E+00	*1.33E+00*	1.39E+00	**7.79E-01**	5.94E-01	0.40
SU1FSSS011B	2	2.000	NA	*1.39E+00*	1.80E+00	1.25E+01	*5.79E-01*	1.27E+00	**1.28E+00**	6.36E-01	0.40
SU1FSSS011C	2	4.000	NA	*4.78E-01*	1.33E+00	8.94E+00	*6.72E-01*	1.44E+00	**9.12E-01**	5.90E-01	0.32
SU1FSSS011D	2	6.000	NA	*7.18E-01*	1.62E+00	3.46E+00	*6.83E-01*	1.31E+00	*3.53E-01*	5.27E-01	0.05
SU1FSSS011E	2	8.000	NA	*1.09E+00*	1.70E+00	5.74E+00	*4.66E-01*	1.52E+00	*5.85E-01*	5.94E-01	0.08
SU1FSSS011F	3	10.000	NA	*2.91E-01*	1.50E+00	4.59E+00	*1.48E+00*	1.63E+00	**4.68E-01**	4.63E-01	0.08
SU1FSSS012A	3	0.000	NA	*9.42E-01*	1.70E+00	6.48E+00	*8.15E-01*	1.33E+00	**6.61E-01**	5.63E-01	0.29
SU1FSSS012B	3	2.000	NA	*2.57E-01*	1.68E+00	7.90E+00	*4.00E-01*	1.94E+00	**8.06E-01**	6.29E-01	0.25
SU1FSSS012C	3	4.000	NA	*7.63E-01*	1.67E+00	3.79E+00	*1.29E+00*	1.41E+00	*3.87E-01*	5.36E-01	0.30
SU1FSSS012D	2	6.000	NA	*8.93E-01*	1.65E+00	9.35E+00	*2.72E-01*	1.36E+00	**9.54E-01**	5.27E-01	0.12
SU1FSSS012E	2	8.000	NA	*1.14E+00*	1.54E+00	7.57E+00	*7.48E-01*	1.43E+00	**7.73E-01**	4.83E-01	0.10
SU1FSSS012F	2	10.000	NA	*4.69E-01*	1.64E+00	6.99E+00	**1.82E+00**	1.70E+00	**7.13E-01**	5.03E-01	0.12

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU1FSSB001A [QC]	3	0.000	NA	*7.82E-01*	1.73E+00	6.30E-01	*9.49E-01*	1.55E+00	**7.01E-01**	3.02E-01	0.30
SU1FSSB001B	3	2.000	NA	*7.17E-01*	1.78E+00	7.98E+00	*5.82E-01*	1.30E+00	**8.15E-01**	3.39E-01	0.29
SU1FSSB001C	3	4.000	NA	*3.18E-01*	1.30E+00	4.66E+00	*1.13E+00*	1.20E+00	**4.75E-01**	2.71E-01	0.30
SU1FSSB001D	3	6.000	NA	*9.17E-01*	1.75E+00	4.80E+00	*3.18E-01*	1.21E+00	*4.90E-01*	5.14E-01	0.06
SU1FSSB001E	4	8.000	NA	*7.46E-01*	1.18E+00	9.40E+00	*3.53E-01*	1.76E+00	**9.59E-01**	6.17E-01	0.12
SU1FSSB001F	3	10.000	NA	*4.06E-01*	1.65E+00	4.27E+00	*5.69E-01*	1.75E+00	*4.36E-01*	5.55E-01	0.06
SU1FSSB002A	3	0.000	NA	*1.12E+00*	1.73E+00	8.09E+00	*6.45E-01*	1.61E+00	**8.26E-01**	5.81E-01	0.30
SU1FSSB002B	3	2.000	NA	*3.27E-01*	1.15E+00	6.15E+00	*5.08E-01*	1.09E+00	**6.27E-01**	5.81E-01	0.23
SU1FSSB002C	4	4.000	NA	*1.22E+00*	1.60E+00	5.57E+00	*3.16E-01*	1.26E+00	**5.68E-01**	5.62E-01	0.19
SU1FSSB002D	2	6.000	NA	*5.32E-01*	1.56E+00	4.15E+00	**1.44E+00**	1.43E+00	*4.23E-01*	5.38E-01	0.08
SU1FSSB002E	2	8.000	NA	*3.08E-01*	1.53E+00	4.44E+00	*9.82E-01*	1.18E+00	*4.53E-01*	5.37E-01	0.07
SU1FSSB002F	3	10.000	NA	*6.76E-01*	1.51E+00	4.05E+00	*8.02E-01*	1.70E+00	*4.14E-01*	4.95E-01	0.06
SU1FSSB003A	1	0.000	NA	*4.47E-01*	1.18E+00	6.04E+00	*1.48E+00*	1.56E+00	**6.16E-01**	3.99E-01	0.38
SU1FSSB003B	3	2.000	NA	*4.97E-01*	1.36E+00	5.36E+00	*1.64E+00*	1.90E+00	**5.47E-01**	3.14E-01	0.40
SU1FSSB003C [QC]	1	4.000	NA	*3.89E-01*	1.12E+00	5.30E+00	**8.87E-01**	8.85E-01	**5.41E-01**	1.77E-01	0.27
SU1FSSB003D	1	6.000	NA	*6.02E-01*	1.11E+00	4.82E+00	*1.60E-01*	7.75E-01	**4.91E-01**	3.90E-01	0.06
SU1FSSB003E	1	8.000	NA	*9.83E-01*	1.16E+00	3.87E+00	*-5.52E-02*	8.25E-01	**3.95E-01**	3.54E-01	0.04
		Average:		7.61E-01		5.99E+00	8.05E-01		**6.39E-01**		0.19
		Std Dev.:		4.16E-01		2.33E+00	5.07E-01		**2.07E-01**		0.12
		UCL 95%:		1.45E+00		9.83E+00	1.64E+00		**9.80E-01**		0.39
		Maximum:		2.20E+00		1.25E+01	1.96E+00		**1.28E+00**		0.50

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.

c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.4.4 Elevated Measurement Comparison

No elevated areas exceeding the DCGLs were identified.

7.4.5 Deviations from the FSSP

There were no deviations from the FSSP for the survey of SU1.

7.4.6 Sign Test

A total of 12 systematic measurements were taken on a triangular grid throughout the area. According to MARSSIM Table I.3, the critical value based upon 12 measurement location with a 5% decision error is nine (9). After subtracting the individual measurement SOFs from unity, there were a total of 12 positive values which exceeds the critical value. As a result, SU1 passed the sign test thereby rejecting the null hypothesis.

7.4.7 Conclusions

Based upon the survey and sample results as presented for SU1, the survey unit meets the sign test and is suitable for unconditional release based upon the intent of MARSSIM. The average SOF for SU1 as demonstrated in Table 7-4 is 0.26 for a total residual dose of approximately 6.5 mrem to an average member of the critical group.

It should be noted that this is based upon gross activities and does not take into affect any contribution from background. As a result, any reported residual dose is conservative.

7.5 Survey Unit 2 (SU2)

A summary of the FSS Results for Survey Unit 2 are provided as follows:

7.5.1 SU2 Walkover Survey

Upon completion of excavation within the Survey Unit, a final gamma walkover scan was performed and the data plotted. The scan results are provided in Figure 7-6 along with a histogram and data set statistics for the walkover survey. A 100% scan was performed to the maximum extent practical; however, due to GPS plotting capabilities, survey unit topography, survey references and the scan methodology (poling measurements every second), small void areas as depicted by the color white will be present in the figure. As noted in Figure 7-6, there are also some areas, as shown, where the scan data was not recorded as part of the GPS plots due to obstructions and poor satellite reception. These areas were in fact scanned with no indication of elevated readings based upon the audible response during the surveys. The areas where the clean overburden and waste bags were staged had been surveyed multiple times prior to staging any materials with no indication of elevated readings during the walkover surveys. The other areas, i.e., the trees, tanker and excavator, were surveyed as part of the final scan; however, the satellite signal was lost due to obstructions interfering with the satellite signals. Although the data for these areas are not shown, all indications from the audible response during the survey showed no evidence of any areas of elevated activity or response. Additionally, these areas were re-surveyed as part of the final site walkover as presented in Figure 7-16.

It should be noted that the gamma scan action level is different for soils greater than 1.5 m bgs as specified in Section 6.2. To help in reviewing the data and selecting areas to be samples, the data was plotted by only showing data that exceeded 13,000 cpm and showing the locations of the trenches and areas that were excavated greater than 1.5 m bgs as presented in Figure 7-7.

7.5.2 Surface Soil Sampling and Results

Following the final walkover scan of the area, the survey unit was sampled and all samples analyzed on site. Surface soil samples (0-6") were collected throughout the area in accordance with the FSS protocols. Systematic samples were collected on a triangular grid with a random starting point. Based upon the evaluation of the walkover survey and the VSP design, it was determined that 12 systematic sampling locations were adequate. Systematic samples were also collected every 10 linear feet along the centerline of each trench.

In addition to the systematic sampling locations, 3 biased samples were taken at elevated areas based upon the final walkover survey as show in Figure 7-7 and as noted during the walkover. Biased sample 3 was collected after additional remediation of the area to ensure the area had been remediated. No biased samples were taken within the trenches as the systemic sampling provided adequate coverage of all elevated areas within the trenches.

Figure 7-7 provides a summary of all the soil sampling locations with the sample analysis results presented in Table 7-6 for the systematic/biased samples and Table 7-7 for the trench samples.

Based upon these sample results, 2 elevated areas were identified with an SOF above unity. These 2 areas are addressed in Section 7.5.4 along with the area as identified in the bagged material used to backfill the trenches.

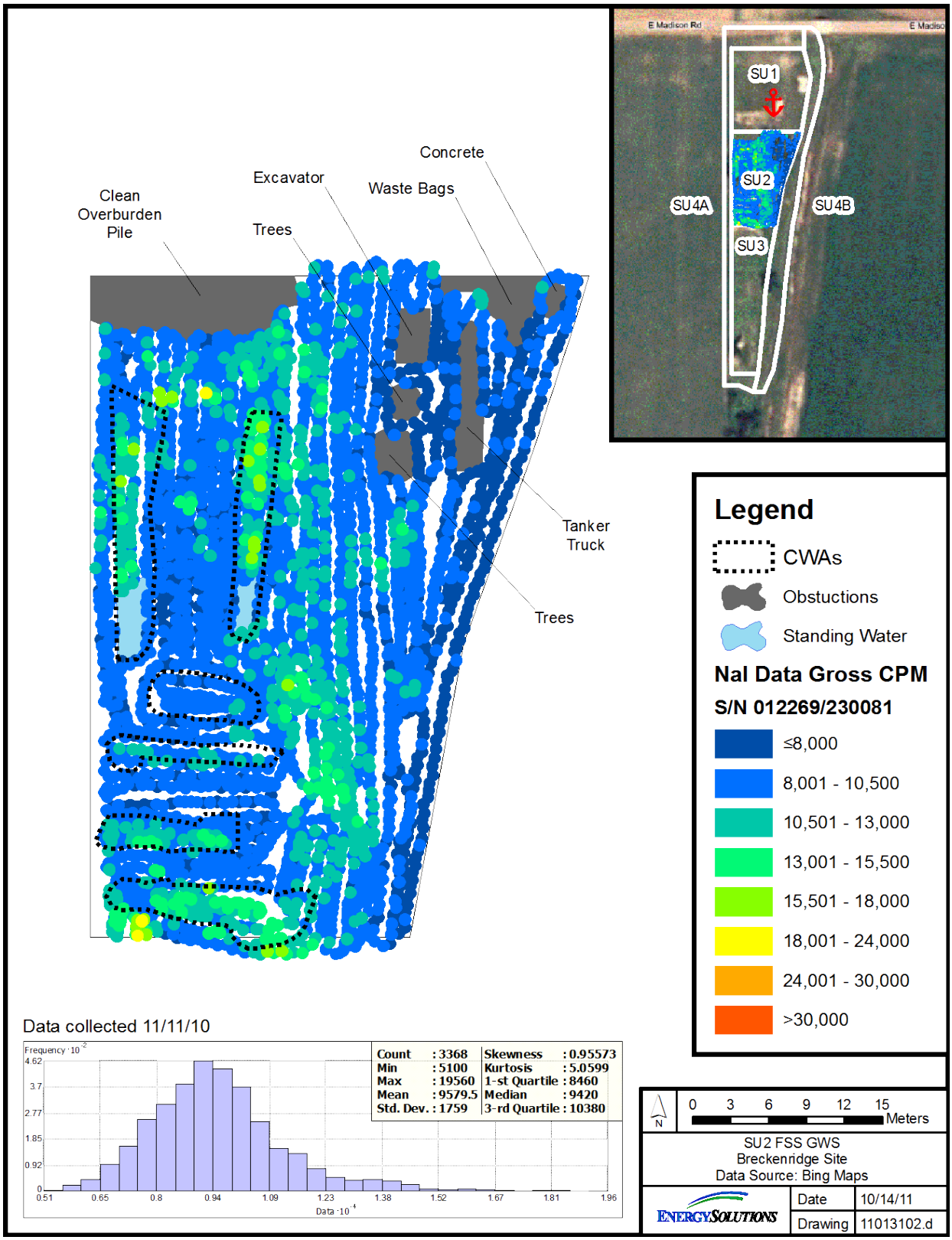


Figure 7-6 SU2 Final Status Survey – Walkover Scan

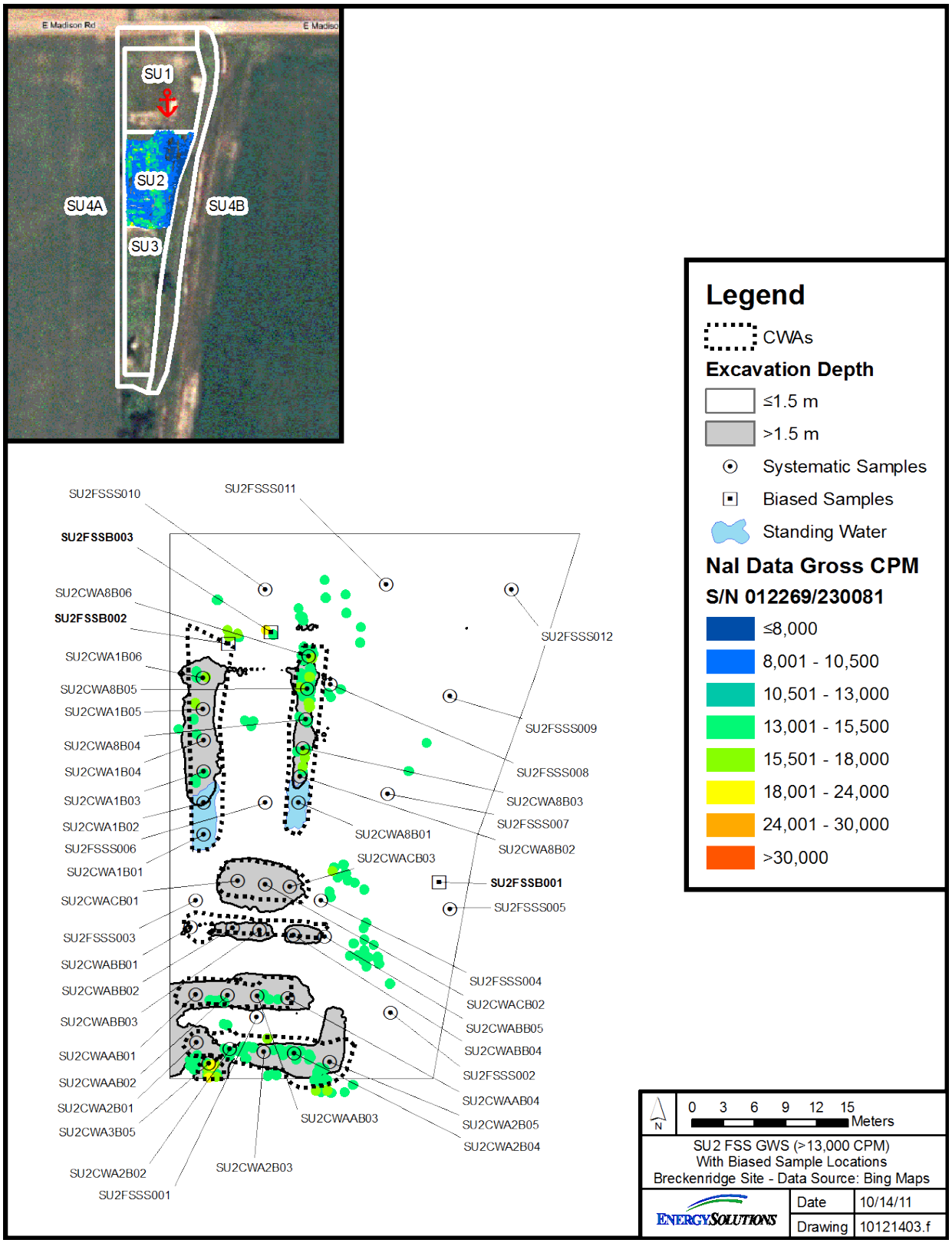


Figure 7-7 SU2 Final Status Survey - Sampling Map

Table 7-6 SU2 Systematic and Biased Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2FSSS001	0	2.925	7,849	*3.84E-01*	4.25E-01	4.55E+00	*5.58E-01*	6.69E-01	**4.65E-01**	2.20E-01	0.20
SU2FSSS002	0	1.105	11,253	*3.52E-01*	8.82E-01	1.52E+01	**2.01E+00**	9.27E-01	**1.55E+00**	2.34E-01	0.69
SU2FSSS003	0	3.023	8,198	*4.85E-01*	7.50E-01	4.84E+00	*5.54E-01*	1.13E+00	**4.94E-01**	1.75E-01	0.21
SU2FSSS004	0	3.218	11,371	**8.67E-01**	5.41E-01	5.01E+00	**1.30E+00**	1.04E+00	**5.12E-01**	1.98E-01	0.33
SU2FSSS005	0	0.000	7,084	*6.51E-01*	7.82E-01	5.23E+00	*4.27E-01*	8.27E-01	**5.33E-01**	1.54E-01	0.20
SU2FSSS006	0	2.990	7,982	*6.07E-01*	7.35E-01	5.59E+00	**9.19E-01**	8.51E-01	**5.70E-01**	1.78E-01	0.28
SU2FSSS007	0	0.000	9,097	**8.92E-01**	6.41E-01	1.09E+01	**1.40E+00**	9.39E-01	**1.11E+00**	2.42E-01	0.49
SU2FSSS008	0	3.478	10,496	*9.39E-01*	1.04E+00	6.29E+00	*5.67E-01*	9.62E-01	**6.42E-01**	1.54E-01	0.25
SU2FSSS009	0	0.000	6,563	*5.63E-01*	5.81E-01	6.88E+00	**9.80E-01**	8.70E-01	**7.02E-01**	1.99E-01	0.32
SU2FSSS010	0	2.145	9,300	**9.58E-01**	6.38E-01	5.68E+00	*7.07E-01*	1.04E+00	**5.80E-01**	2.72E-01	0.25
SU2FSSS011	0	0.000	9,556	**1.16E+00**	6.19E-01	8.70E+00	*8.36E-01*	1.04E+00	**8.88E-01**	2.40E-01	0.35
SU2FSSS012	0	0.000	9,782	*7.19E-01*	1.12E+00	1.49E+01	**1.34E+00**	1.20E+00	**1.52E+00**	1.89E-01	0.58
SU2FSSB001 [QC]	22	0.000	11,621	**1.35E+00**	7.14E-01	7.20E+00	**1.83E+00**	1.20E+00	**8.27E-01**	2.57E-01	0.49
SU2FSSB002 [QC]	21	3.510	13,892	**7.77E+00**	1.14E+00	5.32E+01	**4.93E+00**	1.91E+00	**5.62E+00**	3.88E-01	**2.13**
SU2FSSB003 [QC]	21	2.925	16,248	**1.19E+01**	1.42E+00	6.22E+01	**7.62E+00**	2.28E+00	**6.96E+00**	4.73E-01	**2.88**
		Average:	9,242	7.63E-01		7.77E+00	1.03E+00		**8.00E-01**		0.36
		Std Dev.:	1,650	2.98E-01		3.68E+00	5.08E-01		**3.75E-01**		0.16
		UCL 95%:	11,957	1.25E+00		1.38E+01	1.87E+00		**1.42E+00**		0.62
		Maximum:	11,621	1.35E+00		1.52E+01	2.01E+00		**1.55E+00**		0.69

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.

c Bold "red" values are samples from an elevated area. The data from these samples has been excluded from the survey unit statistics. These values were included in the EMC evaluations.

d Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

Table 7-7 SU2 Trench (Confirmed Waste Area) Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2CWA1B01 QC	0	8.580	10,922	**5.04E+00**	1.03E+00	4.78E+00	**1.57E+00**	1.40E+00	**9.22E-01**	3.63E-01	0.09
SU2CWA1B02 QC	0	8.580	13,502	**2.60E+00**	1.07E+00	1.19E+01	*1.15E+00*	1.44E+00	**1.21E+00**	4.08E-01	0.16
SU2CWA1B03	0	8.580	11,753	**1.23E+00**	1.09E+00	7.61E+00	*1.31E+00*	1.31E+00	**7.77E-01**	3.71E-01	0.12
SU2CWA1B04	0	7.443	10,922	**5.87E+00**	1.34E+00	6.06E+00	**2.14E+00**	1.56E+00	**6.18E-01**	4.01E-01	0.11
SU2CWA1B05	0	6.728	10,806	**1.58E+00**	9.06E-01	5.31E+00	*1.03E+00*	1.19E+00	*5.41E-01*	6.35E-01	0.08
SU2CWA1B06 QC	0	7.020	12,381	**2.78E+00**	9.68E-01	2.57E+01	**2.32E+00**	1.70E+00	**1.86E+00**	4.10E-01	0.34
SU2CWA2B01	0	5.330	9,826	*5.36E-01*	7.20E-01	7.77E+00	**2.10E+00**	1.72E+00	**7.93E-01**	3.82E-01	0.13
SU2CWA2B02	0	4.908	11,326	**3.00E+00**	1.14E+00	1.08E+01	*1.45E+00*	1.81E+00	**1.10E+00**	5.98E-01	0.16
SU2CWA2B03 QC	1	6.013	12,029	**1.07E+01**	2.67E+00	4.60E+01	**5.27E+00**	3.58E+00	**1.43E+01**	7.52E-01	0.79
SU2CWA2B04	1	6.078	13,699	**2.93E+00**	1.35E+00	5.15E+00	*1.32E+00*	1.82E+00	**5.26E-01**	3.53E-01	0.09
SU2CWA2B05	1	5.785	11,298	**1.21E+00**	9.55E-01	1.01E+01	*6.68E-01*	1.22E+00	**1.03E+00**	3.43E-01	0.13
SU2CWA3B05 QC	1	7.800	19,939	**3.30E+00**	2.38E+00	2.24E+00	**1.00E+01**	3.10E+00	**8.74E+00**	8.71E-01	0.35
SU2CWA8B01	0	5.428	10,969	**1.65E+00**	1.01E+00	6.25E+00	*1.35E+00*	1.47E+00	**6.38E-01**	2.94E-01	0.10
SU2CWA8B02	1	5.428	12,180	*5.27E-01*	1.78E+00	8.42E+00	*8.76E-01*	1.41E+00	**8.60E-01**	6.81E-01	0.12
SU2CWA8B03 QC	1	5.460	13,838	**3.24E+00**	1.50E+00	1.32E+01	*2.38E+00*	2.41E+00	**2.44E+00**	5.18E-01	0.22
SU2CWA8B04	0	5.168	11,643	*5.67E-01*	1.18E+00	5.47E+00	*1.55E+00*	1.63E+00	*5.58E-01*	5.85E-01	0.09
SU2CWA8B05	0	5.948	16,842	**2.39E+00**	1.47E+00	1.13E+01	*8.46E-01*	1.66E+00	**1.15E+00**	2.73E-01	0.15
SU2CWA8B06 QC	0	4.778	16,438	**4.21E+00**	1.08E+00	3.62E+00	**2.52E+00**	1.61E+00	**8.47E-01**	3.04E-01	0.60
SU2CWAAB01	0	6.435	10,189	**1.15E+00**	9.08E-01	9.20E+00	**1.47E+00**	1.24E+00	**9.39E-01**	3.60E-01	0.14
SU2CWAAB02	0	6.695	10,778	**1.27E+00**	1.10E+00	1.12E+01	**1.39E+00**	1.35E+00	**1.14E+00**	3.86E-01	0.16
SU2CWAAB03	0	6.988	11,388	*9.41E-01*	1.27E+00	5.82E+00	*1.05E-01*	1.00E+00	*5.94E-01*	6.00E-01	0.07
SU2CWAAB04	0	6.435	9,388	*9.97E-01*	1.33E+00	8.04E+00	*5.57E-01*	1.14E+00	**8.21E-01**	2.59E-01	0.11

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU2CWABB01	0	4.778	9,733	*6.72E-01*	8.56E-01	6.36E+00	*1.12E+00*	1.63E+00	**6.49E-01**	3.49E-01	0.34
SU2CWABB02	0	4.940	8,942	**1.13E+00**	1.12E+00	5.50E+00	*9.82E-01*	1.52E+00	*5.61E-01*	5.62E-01	0.08
SU2CWABB03	0	5.200	11,101	**2.43E+00**	1.05E+00	7.79E+00	*1.06E+00*	1.59E+00	**7.95E-01**	2.95E-01	0.11
SU2CWABB04	0	5.428	9,767	**1.05E+00**	9.87E-01	5.72E+00	*1.26E+00*	1.42E+00	**5.84E-01**	2.94E-01	0.09
SU2CWABB05	0	4.290	9,361	*8.04E-01*	1.16E+00	7.27E+00	*6.57E-01*	1.08E+00	**7.42E-01**	6.52E-01	0.28
SU2CWACB01	0	9.588	8,772	*7.48E-01*	8.38E-01	3.49E+00	*6.70E-01*	8.44E-01	*3.56E-01*	4.25E-01	0.05
SU2CWACB02	0	10.758	9,780	*3.97E-01*	1.07E+00	4.47E+00	*5.17E-01*	1.05E+00	**4.57E-01**	2.96E-01	0.06
SU2CWACB03	0	7.085	9,752	*8.55E-01*	1.15E+00	5.78E+00	*8.04E-01*	1.15E+00	**5.89E-01**	5.64E-01	0.08
		Average:	11,643	2.19E+00		9.07E+00	1.68E+00		**1.57E+00**		0.18
		Std Dev.:	2,500	2.13E+00		8.20E+00	1.83E+00		**2.83E+00**		0.16
		UCL 95%:	15,755	5.69E+00		2.26E+01	4.70E+00		**6.22E+00**		0.45
		Maximum:	19,939	1.07E+01		4.40E+01	1.00E+01		**1.43E+01**		0.79

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.
c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.5.3 Subsurface Soil Sampling and Results

Following the analysis of all surface soil samples, subsurface samples were collected throughout the area. Geoprobe® samples were taken at each systematic sampling location down to an approximate depth of 10 feet bgs or until refusal. The samples were then analyzed in 2-foot composites.

Geoprobe® sampling was not performed within CWA-3 and Trench C due to their depth and for safety reasons. Because of the overall depth of these two trenches, it was determined that it was not safe to access the trenches with the Geoprobe® equipment nor was it necessary based upon the trench sample results and excavation depth. Additionally, Geoprobe® samples were not collected at sample locations 1 and 2 within CWA-1 due to standing water nor at each of the 3 biased sample locations due to the weather (frozen ground and snow)

Upon review of the sample analysis results, the only two locations that exceeded an SOF were biased sample locations 2 and 3. Based upon the surrounding subsurface sample results throughout the area and a visual inspection of these two areas, it was determined that subsurface sampling was not necessary. Subsequent investigation (i.e., field surveys) of the subsurface soils showed no indication of additional contamination.

Figure 7-8 shows the sub-surface soil sampling locations as collected with the sample analysis results provided in Table 7-8. All subsurface soil samples were well below an SOF of unity. Based upon the surveys and subsurface sampling results it was determined that no further subsurface sampling was required.

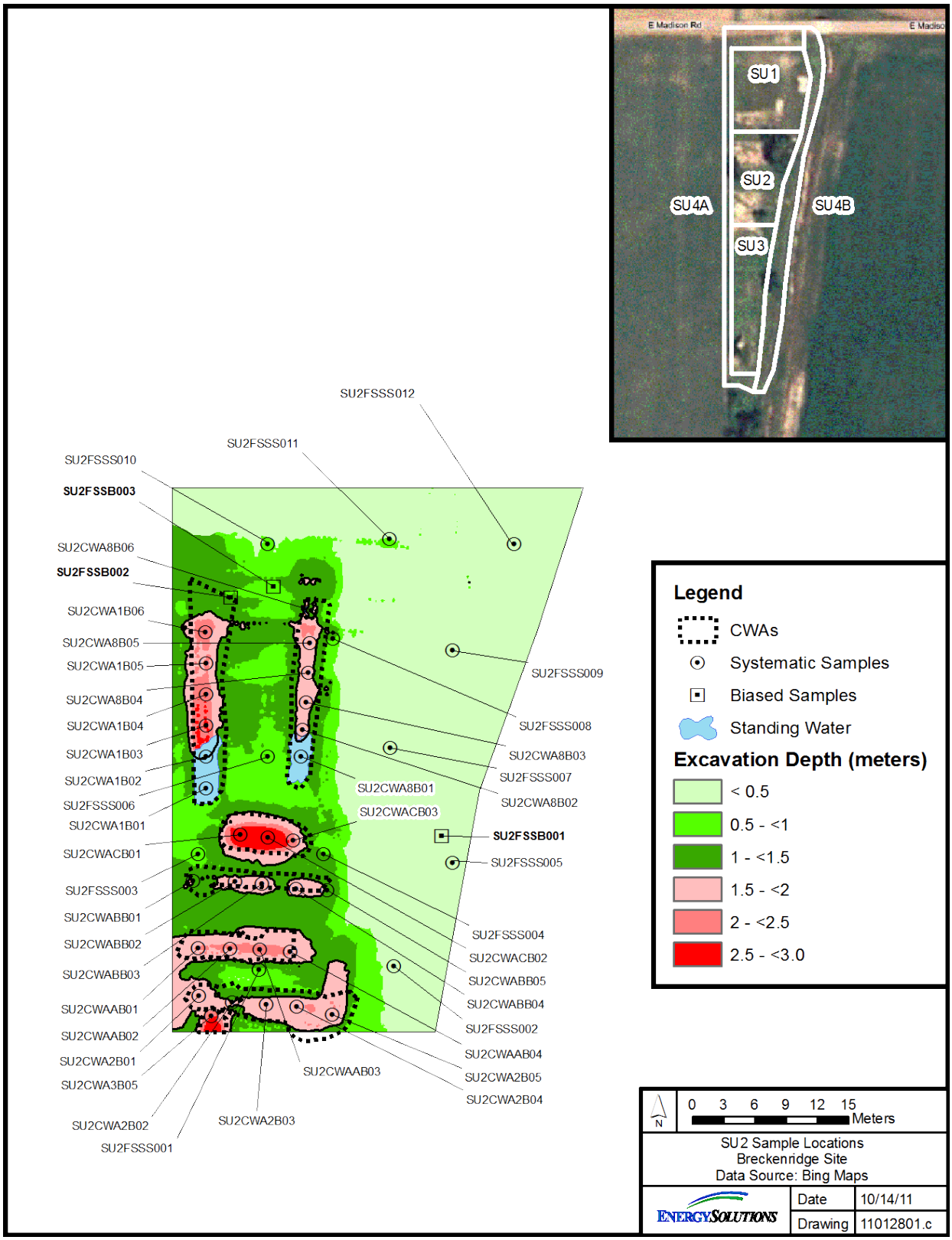


Figure 7-8 SU2 Final Status Survey - Sub-surface Sampling Map

Table 7-8 SU2 Subsurface Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2CWA1B03A	28	8.580	N/A	**1.68E+00**	1.35E+00	7.87E+00	*3.64E-01*	1.18E+00	**8.03E-01**	6.89E-01	0.10
SU2CWA1B03B	28	10.580	N/A	*8.52E-01*	1.09E+00	4.34E+00	*1.69E-01*	1.35E+00	*4.42E-01*	5.17E-01	0.05
SU2CWA1B03C	28	12.580	N/A	*4.77E-01*	1.16E+00	8.30E+00	*8.72E-01*	9.85E-01	**8.47E-01**	6.54E-01	0.11
SU2CWA1B03D	28	14.580	N/A	*4.41E-01*	5.49E-01	4.21E+00	*3.97E-01*	8.52E-01	*4.30E-01*	5.07E-01	0.06
SU2CWA1B04A [QC]	27	7.443	N/A	**3.12E+00**	1.25E+00	7.80E-01	*1.45E+00*	1.63E+00	**1.03E+00**	6.77E-01	0.05
SU2CWA1B04B	27	9.443	N/A	*8.68E-01*	1.16E+00	5.51E+00	**2.13E+00**	1.64E+00	*5.62E-01*	5.85E-01	0.11
SU2CWA1B04C	27	11.443	N/A	*3.77E-01*	1.15E+00	5.38E+00	*1.21E+00*	1.22E+00	**5.49E-01**	2.97E-01	0.09
SU2CWA1B04D	27	13.443	N/A	*8.19E-01*	1.10E+00	5.08E+00	*5.85E-01*	1.02E+00	**5.18E-01**	2.94E-01	0.07
SU2CWA1B05A	27	6.728	N/A	*1.11E+00*	1.15E+00	4.59E+00	*1.34E+00*	1.64E+00	**4.69E-01**	3.91E-01	0.08
SU2CWA1B05B	27	8.728	N/A	**1.14E+00**	1.13E+00	4.59E+00	*4.55E-01*	9.62E-01	*4.69E-01*	6.61E-01	0.06
SU2CWA1B05C	27	10.728	N/A	*9.22E-01*	1.04E+00	5.06E+00	*2.80E-01*	9.54E-01	*5.17E-01*	5.76E-01	0.07
SU2CWA1B05D	27	12.728	N/A	*9.26E-01*	1.17E+00	3.30E+00	*1.38E-01*	7.84E-01	*3.37E-01*	6.39E-01	0.04
SU2CWA1B06A	27	7.020	N/A	*7.48E-01*	1.14E+00	5.79E+00	*3.78E-01*	1.27E+00	**5.91E-01**	2.64E-01	0.08
SU2CWA1B06B	27	9.020	N/A	*5.13E-01*	1.20E+00	5.86E+00	*5.95E-01*	1.05E+00	*5.98E-01*	6.16E-01	0.08
SU2CWA1B06C	27	11.020	N/A	**1.31E+00**	1.09E+00	5.21E+00	**1.82E+00**	1.53E+00	**5.31E-01**	2.99E-01	0.10
SU2CWA1B06D	27	13.020	N/A	*1.01E+00*	1.07E+00	4.66E+00	*4.88E-01*	1.04E+00	*4.76E-01*	5.81E-01	0.06
SU2CWA2B01A	0	5.330	N/A	*6.50E-01*	6.63E-01	6.60E+00	*5.36E-01*	1.63E+00	**6.73E-01**	2.23E-01	0.09
SU2CWA2B01B	0	7.330	N/A	*2.35E-01*	1.16E+00	7.07E+00	*1.01E+00*	1.12E+00	**7.21E-01**	3.57E-01	0.10
SU2CWA2B01C	0	9.330	N/A	*7.91E-01*	1.08E+00	5.61E+00	*5.76E-01*	1.04E+00	**5.73E-01**	1.99E-01	0.08
SU2CWA2B01D	1	11.330	N/A	*6.79E-01*	1.01E+00	4.51E+00	*2.54E-01*	1.48E+00	*4.60E-01*	5.26E-01	0.06

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2CWA2B02A	0	4.908	N/A	*5.61E-01*	9.87E-01	6.67E+00	*6.88E-01*	9.07E-01	**6.81E-01**	5.64E-01	0.09
SU2CWA2B02B	2	6.908	N/A	*9.63E-01*	1.02E+00	5.36E+00	*7.28E-01*	1.42E+00	**5.46E-01**	5.27E-01	0.08
SU2CWA2B02C	2	8.908	N/A	*8.36E-01*	1.07E+00	6.01E+00	*3.50E-01*	1.04E+00	**6.13E-01**	6.07E-01	0.08
SU2CWA2B02D	2	10.908	N/A	*5.47E-01*	1.10E+00	7.30E+00	*3.42E-01*	1.25E+00	**7.45E-01**	6.04E-01	0.09
SU2CWA2B03A	2	6.013	N/A	*9.44E-01*	1.04E+00	5.15E+00	*6.25E-01*	1.42E+00	**5.26E-01**	5.06E-01	0.07
SU2CWA2B03B [QC]	2	8.013	N/A	*5.83E-01*	1.06E+00	1.25E+01	*7.27E-01*	1.10E+00	**1.28E+00**	3.28E-01	0.16
SU2CWA2B03C	2	10.013	N/A	*5.29E-01*	8.23E-01	5.16E+00	**1.97E+00**	1.65E+00	**5.27E-01**	3.42E-01	0.10
SU2CWA2B03D	26	12.013	N/A	*6.59E-01*	9.32E-01	7.80E+00	*7.53E-01*	1.66E+00	**7.96E-01**	6.10E-01	0.11
SU2CWA2B04A	0	6.078	N/A	*6.00E-01*	1.46E+00	7.37E+00	*8.45E-01*	1.08E+00	**7.52E-01**	5.51E-01	0.10
SU2CWA2B04B	0	8.078	N/A	*8.97E-01*	9.78E-01	5.38E+00	*1.61E-01*	7.85E-01	**5.49E-01**	4.24E-01	0.07
SU2CWA2B04C	0	10.078	N/A	**1.42E+00**	8.31E-01	4.81E+00	*2.01E-01*	1.27E+00	**4.91E-01**	2.98E-01	0.06
SU2CWA2B04D	0	12.078	N/A	*9.28E-01*	1.15E+00	2.69E+00	*5.88E-01*	1.09E+00	*2.75E-01*	6.37E-01	0.04
SU2CWA2B05A	0	5.785	N/A	*6.07E-01*	9.68E-01	2.83E+00	*4.26E-01*	8.75E-01	**2.88E-01**	1.58E-01	0.04
SU2CWA2B05B	0	7.785	N/A	*8.16E-01*	1.11E+00	5.87E+00	*6.72E-01*	1.12E+00	**5.99E-01**	5.63E-01	0.08
SU2CWA2B05C	0	9.785	N/A	*9.58E-01*	1.21E+00	5.35E+00	*2.38E-01*	1.06E+00	*5.46E-01*	6.21E-01	0.07
SU2CWA2B05D	0	11.785	N/A	*5.19E-01*	9.51E-01	4.31E+00	*3.83E-01*	9.95E-01	*4.39E-01*	5.26E-01	0.06
SU2CWA8B01A	26	5.428	N/A	**1.17E+00**	1.14E+00	6.06E+00	*8.35E-01*	1.65E+00	**6.18E-01**	3.31E-01	0.09
SU2CWA8B01B	26	7.428	N/A	*5.05E-01*	8.84E-01	3.40E+00	*2.21E-02*	8.27E-01	*3.47E-01*	4.19E-01	0.04
SU2CWA8B01C	26	9.428	N/A	*9.02E-01*	1.03E+00	3.45E+00	*1.13E-01*	8.28E-01	*3.52E-01*	5.90E-01	0.04
SU2CWA8B01D	26	11.428	N/A	*9.68E-01*	1.13E+00	7.31E+00	*1.66E-01*	9.37E-01	**7.45E-01**	6.18E-01	0.09
SU2CWA8B02A	27	5.428	N/A	*7.90E-01*	8.06E-01	5.14E+00	*6.89E-01*	1.59E+00	**5.25E-01**	2.49E-01	0.07
SU2CWA8B02B	27	7.428	N/A	*6.07E-01*	9.52E-01	4.01E+00	*0.00E+00*	1.36E+00	*4.10E-01*	5.10E-01	0.05
SU2CWA8B02C	27	9.428	N/A	*4.68E-01*	9.69E-01	5.94E+00	*5.31E-01*	1.05E+00	**6.06E-01**	5.03E-01	0.08
SU2CWA8B02D	27	11.428	N/A	*9.77E-01*	1.16E+00	8.52E+00	*2.53E-01*	1.10E+00	**8.69E-01**	6.19E-01	0.11

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2CWA8B03A [QC]	27	5.460	N/A	*5.87E-01*	1.24E+00	4.87E+00	*4.94E-01*	1.13E+00	*4.97E-01*	5.98E-01	0.07
SU2CWA8B03B	27	7.460	N/A	*4.47E-01*	7.07E-01	3.56E+00	*5.68E-01*	9.70E-01	**3.63E-01**	3.41E-01	0.05
SU2CWA8B03C	27	9.460	N/A	**1.29E+00**	1.26E+00	3.95E+00	*2.79E-01*	1.21E+00	*4.03E-01*	5.43E-01	0.05
SU2CWA8B03D	27	11.460	N/A	*4.73E-01*	1.00E+00	3.09E+00	*7.71E-01*	1.03E+00	**3.15E-01**	2.96E-01	0.05
SU2CWA8B04A	25	5.168	N/A	*6.10E-01*	1.24E+00	8.33E+00	*1.13E+00*	1.59E+00	**8.50E-01**	5.69E-01	0.12
SU2CWA8B04B	25	7.168	N/A	**9.48E-01**	9.03E-01	4.81E+00	*8.24E-02*	9.36E-01	*4.91E-01*	5.05E-01	0.06
SU2CWA8B04C	25	9.168	N/A	*7.82E-01*	1.11E+00	4.07E+00	*4.98E-01*	9.68E-01	**4.15E-01**	3.20E-01	0.06
SU2CWA8B04D	25	11.168	N/A	*6.89E-01*	9.91E-01	2.16E+00	*4.43E-01*	9.32E-01	*2.20E-01*	5.34E-01	0.03
SU2CWA8B05A	25	5.948	N/A	*1.09E+00*	1.19E+00	5.79E+00	*4.98E-01*	9.73E-01	**5.91E-01**	3.10E-01	0.08
SU2CWA8B05B	25	7.948	N/A	*5.85E-01*	1.10E+00	7.03E+00	*6.97E-01*	1.24E+00	**7.17E-01**	6.03E-01	0.10
SU2CWA8B05C	25	9.948	N/A	*5.30E-01*	8.91E-01	4.70E+00	*4.02E-01*	8.74E-01	*4.80E-01*	4.85E-01	0.06
SU2CWA8B05D	25	11.948	N/A	*8.59E-01*	1.11E+00	5.02E+00	*4.47E-01*	1.03E+00	**5.12E-01**	2.65E-01	0.07
SU2CWA8B06A	25	4.778	N/A	*4.26E-01*	1.08E+00	5.62E+00	*6.81E-01*	1.55E+00	*5.74E-01*	5.98E-01	0.25
SU2CWA8B06B	25	6.778	N/A	*5.97E-01*	1.12E+00	4.98E+00	*1.03E+00*	1.54E+00	**5.08E-01**	3.01E-01	0.08
SU2CWA8B06C	25	8.778	N/A	*5.16E-01*	1.15E+00	5.63E+00	*8.47E-01*	1.02E+00	**5.75E-01**	2.67E-01	0.08
SU2CWA8B06D	25	10.778	N/A	*4.54E-01*	9.02E-01	6.13E+00	*2.02E-01*	1.31E+00	**6.25E-01**	4.84E-01	0.08
SU2CWAAB01A	0	6.435	N/A	*9.90E-01*	1.21E+00	8.37E+00	*5.47E-01*	1.38E+00	**8.54E-01**	6.13E-01	0.11
SU2CWAAB01B	0	8.435	N/A	*6.64E-01*	7.71E-01	6.06E+00	*4.75E-01*	1.49E+00	**6.18E-01**	5.91E-01	0.08
SU2CWAAB01C	0	10.435	N/A	*6.97E-01*	6.98E-01	4.82E+00	*3.96E-01*	1.14E+00	*4.92E-01*	6.02E-01	0.06
SU2CWAAB01D	0	12.435	N/A	*3.31E-01*	1.10E+00	4.82E+00	**9.70E-01**	9.09E-01	*4.92E-01*	5.85E-01	0.08
SU2CWAAB02A	1	6.695	N/A	*8.13E-01*	1.08E+00	5.34E+00	*1.36E+00*	1.56E+00	*5.45E-01*	6.22E-01	0.09
SU2CWAAB02B	1	8.695	N/A	*4.42E-01*	1.02E+00	5.47E+00	*1.05E+00*	1.39E+00	**5.58E-01**	5.21E-01	0.09
SU2CWAAB02C	1	10.695	N/A	*4.91E-01*	5.99E-01	5.22E+00	*3.44E-01*	8.79E-01	*5.32E-01*	5.38E-01	0.07
SU2CWAAB02D	1	12.695	N/A	*8.60E-01*	1.12E+00	6.38E+00	*0.00E+00*	1.53E+00	**6.51E-01**	5.55E-01	0.08

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2CWAAB03A [QC]	**32**	6.988	N/A	*4.37E-01*	1.11E+00	5.21E+00	**5.54E-01**	1.32E-01	**5.32E-01**	2.84E-01	0.07
SU2CWAAB03B	0	8.988	N/A	*1.27E+00*	1.30E+00	6.51E+00	*7.04E-01*	1.40E+00	**6.64E-01**	6.41E-01	0.09
SU2CWAAB03C	0	10.988	N/A	**1.35E+00**	1.13E+00	4.31E+00	**1.65E+00**	1.62E+00	**4.39E-01**	2.61E-01	0.08
SU2CWAAB03D	0	12.988	N/A	*6.43E-01*	8.21E-01	4.36E+00	*2.09E-01*	1.05E+00	**4.45E-01**	3.20E-01	0.06
SU2CWAAB04A	0	6.435	N/A	**1.05E+00**	1.05E+00	4.77E+00	**1.72E+00**	1.57E+00	**4.87E-01**	1.98E-01	0.09
SU2CWAAB04B	0	8.435	N/A	*6.87E-01*	8.04E-01	6.89E+00	*1.10E+00*	1.27E+00	**7.03E-01**	6.72E-01	0.10
SU2CWAAB04C	0	10.435	N/A	*4.35E-01*	1.28E+00	5.09E+00	**1.63E+00**	1.16E+00	*5.19E-01*	5.80E-01	0.09
SU2CWAAB04D	0	12.435	N/A	*3.74E-01*	1.00E+00	6.58E+00	*3.34E-01*	1.06E+00	**6.72E-01**	5.31E-01	0.08
SU2CWABB01A	22	4.778	N/A	*4.69E-01*	6.33E-01	9.86E+00	*3.19E-01*	9.29E-01	**1.01E+00**	6.73E-01	0.29
SU2CWABB01B	23	6.778	N/A	*7.69E-01*	9.25E-01	4.33E+00	*2.52E-01*	9.75E-01	**4.42E-01**	1.88E-01	0.06
SU2CWABB01C	23	8.778	N/A	*9.17E-01*	1.15E+00	6.93E+00	*7.10E-01*	9.76E-01	**7.07E-01**	6.19E-01	0.10
SU2CWABB01D	23	10.778	N/A	*6.04E-01*	1.14E+00	9.11E+00	*5.21E-01*	1.15E+00	**9.30E-01**	6.64E-01	0.12
SU2CWABB02A	22	4.940	N/A	**9.41E-01**	7.45E-01	4.79E+00	*3.13E-01*	1.54E+00	**4.88E-01**	3.48E-01	0.06
SU2CWABB02B	22	6.940	N/A	*9.31E-02*	9.56E-01	4.10E+00	*5.26E-01*	8.45E-01	*4.18E-01*	4.73E-01	0.06
SU2CWABB02C	22	8.940	N/A	**7.56E-01**	6.00E-01	3.49E+00	*8.50E-01*	1.10E+00	**3.56E-01**	1.48E-01	0.06
SU2CWABB02D	22	10.940	N/A	*2.09E-01*	8.31E-01	1.63E+00	*8.87E-01*	1.20E+00	*1.66E-01*	4.06E-01	0.04
SU2CWABB03A	23	5.200	N/A	*6.83E-01*	1.31E+00	7.83E+00	*7.90E-01*	1.26E+00	**7.99E-01**	6.58E-01	0.11
SU2CWABB03B	23	7.200	N/A	*7.89E-01*	1.10E+00	4.66E+00	*8.85E-01*	1.24E+00	*4.75E-01*	5.70E-01	0.07
SU2CWABB03C	23	9.200	N/A	**1.27E+00**	1.20E+00	5.01E+00	*4.51E-01*	1.03E+00	*5.12E-01*	5.68E-01	0.07
SU2CWABB03D	23	11.200	N/A	*1.06E+00*	1.12E+00	7.04E+00	*4.15E-01*	9.46E-01	**7.18E-01**	6.22E-01	0.09
SU2CWABB04A [QC]	28	5.428	N/A	*1.00E+00*	1.17E+00	1.04E+01	*5.56E-01*	1.29E+00	**1.06E+00**	6.10E-01	0.13
SU2CWABB04B	23	7.428	N/A	**1.23E+00**	1.13E+00	6.75E+00	*-2.46E-01*	1.01E+00	**6.89E-01**	4.80E-01	0.07
SU2CWABB04C	23	9.428	N/A	*7.97E-01*	1.08E+00	2.33E+00	*1.23E+00*	1.41E+00	*2.38E-01*	5.59E-01	0.05
SU2CWABB04D	23	11.428	N/A	*2.47E-01*	1.00E+00	4.91E+00	*8.97E-01*	9.37E-01	**5.01E-01**	2.34E-01	0.08

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2CWABB05A	22	4.290	N/A	*3.51E-01*	1.10E+00	5.55E+00	*7.63E-01*	9.26E-01	*5.66E-01*	6.01E-01	0.26
SU2CWABB05B	22	6.290	N/A	*1.15E+00*	1.15E+00	4.05E+00	*4.63E-01*	1.20E+00	*4.14E-01*	5.96E-01	0.06
SU2CWABB05C	22	8.290	N/A	*3.30E-01*	1.00E+00	3.84E+00	*7.32E-01*	1.06E+00	*3.92E-01*	4.72E-01	0.06
SU2CWABB05D	22	10.290	N/A	*7.37E-01*	1.02E+00	5.53E+00	*4.31E-01*	1.50E+00	**5.64E-01**	5.34E-01	0.07
SU2FSSS001A	2	2.925	N/A	*7.35E-01*	1.13E+00	6.03E+00	*4.65E-01*	1.29E+00	**6.15E-01**	5.75E-01	0.22
SU2FSSS001B	2	4.925	N/A	**1.15E+00**	9.84E-01	6.83E+00	*6.79E-02*	1.36E+00	**6.97E-01**	5.39E-01	0.08
SU2FSSS001C	2	6.925	N/A	*1.01E+00*	1.10E+00	4.98E+00	*5.41E-01*	9.26E-01	**5.09E-01**	2.34E-01	0.07
SU2FSSS001D	2	8.925	N/A	*8.06E-01*	1.09E+00	5.50E+00	*2.15E-02*	1.18E+00	**5.61E-01**	3.74E-01	0.07
SU2FSSS002A [QC]	2	1.105	N/A	*7.43E-01*	1.18E+00	8.60E+00	*5.37E-01*	1.35E+00	**8.77E-01**	3.73E-01	0.30
SU2FSSS002B	2	3.105	N/A	*7.89E-01*	1.09E+00	6.10E+00	*4.07E-01*	1.12E+00	*6.23E-01*	6.47E-01	0.21
SU2FSSS002C	2	5.105	N/A	*8.45E-01*	1.21E+00	6.51E+00	*1.20E+00*	1.64E+00	**6.64E-01**	3.05E-01	0.10
SU2FSSS002D	2	7.105	N/A	*4.41E-01*	1.05E+00	4.02E+00	*6.68E-01*	9.36E-01	**4.10E-01**	3.16E-01	0.06
SU2FSSS003A	4	3.023	N/A	**9.07E-01**	6.72E-01	4.52E+00	*6.95E-01*	1.15E+00	**4.61E-01**	2.93E-01	0.22
SU2FSSS003B	4	5.023	N/A	*5.47E-01*	1.10E+00	6.16E+00	**1.18E+00**	1.11E+00	**6.28E-01**	3.79E-01	0.10
SU2FSSS003C	4	7.023	N/A	*4.55E-01*	6.90E-01	3.98E+00	**1.70E+00**	1.43E+00	**4.06E-01**	2.46E-01	0.08
SU2FSSS003D	4	9.023	N/A	*3.60E-01*	9.77E-01	5.73E+00	**1.33E+00**	8.99E-01	**5.84E-01**	5.30E-01	0.09
SU2FSSS004A	4	3.218	N/A	*1.06E+00*	1.12E+00	6.06E+00	*3.51E-01*	1.16E+00	*6.18E-01*	6.24E-01	0.20
SU2FSSS004B	4	5.218	N/A	*9.68E-01*	1.15E+00	6.49E+00	*1.44E+00*	1.48E+00	**6.62E-01**	3.37E-01	0.10
SU2FSSS004C	4	7.218	N/A	*5.87E-01*	9.23E-01	5.47E+00	*7.34E-01*	1.14E+00	**5.58E-01**	5.14E-01	0.08
SU2FSSS004D	4	9.218	N/A	*1.77E-01*	9.20E-01	5.68E+00	*7.19E-01*	8.98E-01	**5.80E-01**	5.02E-01	0.08
SU2FSSS005A	4	0.000	N/A	*4.83E-01*	7.30E-01	4.58E+00	*1.16E+00*	1.63E+00	**4.67E-01**	3.16E-01	0.30
SU2FSSS005B	4	2.000	N/A	*8.96E-01*	1.10E+00	4.61E+00	*7.50E-01*	1.24E+00	**4.71E-01**	3.46E-01	0.23
SU2FSSS005C	5	4.000	N/A	*5.18E-01*	7.79E-01	6.29E+00	*1.29E+00*	1.47E+00	**6.42E-01**	2.87E-01	0.36
SU2FSSS005D	5	6.000	N/A	**1.13E+00**	7.80E-01	5.35E+00	*1.65E-01*	1.09E+00	*5.46E-01*	6.09E-01	0.07

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU2FSSS006A	4	2.990	N/A	*5.74E-01*	7.33E-01	6.83E+00	*6.10E-01*	8.48E-01	**6.97E-01**	5.90E-01	0.26
SU2FSSS006B	4	4.990	N/A	*6.40E-01*	7.74E-01	3.56E+00	*4.25E-01*	1.06E+00	**3.63E-01**	3.19E-01	0.05
SU2FSSS006C	4	6.990	N/A	*1.09E+00*	1.11E+00	5.45E+00	*-1.32E-01*	1.11E+00	**5.57E-01**	3.23E-01	0.06
SU2FSSS006D	4	8.990	N/A	*4.16E-01*	5.66E-01	4.12E+00	*3.38E-01*	8.31E-01	**4.20E-01**	4.16E-01	0.06
SU2FSSS007A	4	0.000	N/A	*6.53E-01*	1.07E+00	4.98E+00	**1.21E+00**	1.15E+00	**5.08E-01**	2.80E-01	0.32
SU2FSSS007B	4	2.000	N/A	**1.29E+00**	1.18E+00	7.16E+00	*2.73E-01*	9.24E-01	**7.30E-01**	2.92E-01	0.22
SU2FSSS007C	4	4.000	N/A	**1.16E+00**	1.08E+00	8.18E+00	*8.18E-03*	1.05E+00	**8.35E-01**	5.77E-01	0.20
SU2FSSS007D	4	6.000	N/A	*3.59E-01*	6.33E-01	5.20E+00	**1.94E+00**	1.53E+00	*5.31E-01*	5.93E-01	0.10
SU2FSSS008A	4	3.478	N/A	*1.23E+00*	1.27E+00	6.75E+00	*5.63E-01*	1.20E+00	**6.89E-01**	3.44E-01	0.26
SU2FSSS008B	4	5.478	N/A	*7.01E-01*	1.12E+00	5.86E+00	*7.68E-01*	1.53E+00	**5.98E-01**	3.30E-01	0.08
SU2FSSS008C	4	7.478	N/A	*6.78E-01*	7.22E-01	4.92E+00	*3.57E-01*	8.58E-01	**5.02E-01**	3.39E-01	0.07
SU2FSSS008D	4	9.478	N/A	*1.08E+00*	1.13E+00	5.71E+00	*1.51E-01*	1.36E+00	**5.82E-01**	2.33E-01	0.07
SU2FSSS009A	26	0.000	N/A	**9.21E-01**	8.90E-01	5.07E+00	*4.72E-01*	1.25E+00	*5.17E-01*	6.66E-01	0.20
SU2FSSS009B	26	2.000	N/A	*9.70E-01*	1.23E+00	5.90E+00	*1.71E+00*	1.77E+00	**6.02E-01**	2.96E-01	0.42
SU2FSSS009C	26	4.000	N/A	*6.69E-01*	1.15E+00	6.49E+00	*6.29E-01*	1.13E+00	**6.62E-01**	3.35E-01	0.26
SU2FSSS009D	26	6.000	N/A	*7.89E-01*	1.14E+00	5.42E+00	*1.76E-01*	1.22E+00	*5.53E-01*	6.71E-01	0.07
SU2FSSS010A	26	2.145	N/A	*3.69E-01*	1.16E+00	4.66E+00	*5.80E-01*	1.53E+00	*4.76E-01*	6.25E-01	0.21
SU2FSSS010B	26	4.145	N/A	*8.84E-01*	1.30E+00	6.30E+00	*7.49E-01*	1.25E+00	*6.43E-01*	6.46E-01	0.27
SU2FSSS010C	26	6.145	N/A	*4.30E-01*	1.16E+00	5.97E+00	*1.02E+00*	1.12E+00	*6.09E-01*	6.31E-01	0.09
SU2FSSS010D	26	8.145	N/A	*9.50E-01*	1.23E+00	9.88E+00	*4.96E-01*	1.10E+00	**1.01E+00**	6.64E-01	0.13
SU2FSSS011A [QC]	27	0.000	N/A	*5.92E-01*	8.29E-01	6.73E+00	*4.00E-01*	1.13E+00	**6.87E-01**	3.36E-01	0.23
SU2FSSS011B	26	2.000	N/A	*4.98E-01*	1.04E+00	4.56E+00	*1.01E+00*	1.53E+00	*4.65E-01*	5.30E-01	0.27
SU2FSSS011C	26	4.000	N/A	*6.81E-01*	1.25E+00	8.38E+00	**1.94E+00**	1.71E+00	**8.55E-01**	6.27E-01	0.52
SU2FSSS011D	27	6.000	N/A	*3.92E-01*	1.22E+00	6.24E+00	*1.44E+00*	1.69E+00	**6.37E-01**	3.78E-01	0.10

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU2FSSS012A	27	0.000	N/A	**1.33E+00**	1.30E+00	5.83E+00	*3.82E-01*	1.25E+00	*5.95E-01*	7.46E-01	0.21
SU2FSSS012B	27	2.000	N/A	*5.94E-01*	1.05E+00	8.23E+00	*1.05E+00*	1.48E+00	**8.39E-01**	5.55E-01	0.37
SU2FSSS012C	27	4.000	N/A	*1.12E+00*	1.16E+00	7.43E+00	*2.83E-01*	1.30E+00	**7.58E-01**	5.95E-01	0.23
SU2FSSS012D	27	6.000	N/A	*3.97E-01*	1.16E+00	7.64E+00	*8.13E-01*	1.10E+00	**7.79E-01**	2.73E-01	0.11
		Average:		7.66E-01		5.64E+00	6.69E-01		**5.82E-01**		0.11
		Std Dev.:		3.54E-01		1.69E+00	4.70E-01		**1.71E-01**		0.08
		UCL 95%:		1.35E+00		8.41E+00	1.44E+00		**8.64E-01**		0.25
		Maximum:		3.12E+00		1.25E+01	2.13E+00		**1.28E+00**		0.52

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.
c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.5.4 Elevated Measurement Comparison

Two elevated areas of concern were identified based upon the walkover scans and soil sampling results which were further evaluated using the EMC test in accordance with Section 4.4. These 2 areas are shown in Figure 7-9 and the approximate size of each area provided. In addition, there was one area identified as part of the bagged meterial used as backfill as shown in Figure 7-2. Based upon the Area Factors (AFs) as developed in CS-313111-001*, Re-Evaluation of Breckenridge DCGLs, Gamma Scan Sensitivity, Gamma Scan Action Levels and Development of Area Factors* and presented in Section 4.3, the applicable AF for each area was determined using logarithmic interpolation. As presented in Table 7-9 through Table 7-11, the EMC result for each individual area is shown to be below an SOF of unity.

Table 7-9 SU2 Area 1 EMC Results (1.0 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	12.4	5.0	5.62	0.091
^{238}U + D	12.4	442.4	7.77	0.001
^{234}U	130.0	2,729	7.77	0.000
^{230}Th	17.0	276.9	53.2	0.011
^{226}Ra + C	14.1	6.2	4.93	0.056
EMC < 1.5 m bgs; therefore surface DCGLs apply.			Σ SOF_1	**0.160**

Table 7-10 SU2 Area 2 EMC Results (1.0 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	12.4	5.0	6.96	0.112
^{238}U + D	12.4	442.4	11.9	0.002
^{234}U	130.0	2,729	11.9	0.000
^{230}Th	17.0	276.9	62.2	0.013
^{226}Ra + C	14.1	6.2	7.62	0.087
EMC < 1.5 m bgs; therefore surface DCGLs apply.			Σ SOF_2	**0.214**

Table 7-11 SU2 Area 3 EMC Results – Backfill (5 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	16.4	65.9	9.39	0.009
^{238}U + D	36.7	8,658	6.29	0.000
^{234}U	72.2	6,113	6.29	0.000
^{230}Th	44.9	97.9	96.8	0.022
^{226}Ra + C	45.2	51.2	3.74	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF_3	**0.032**

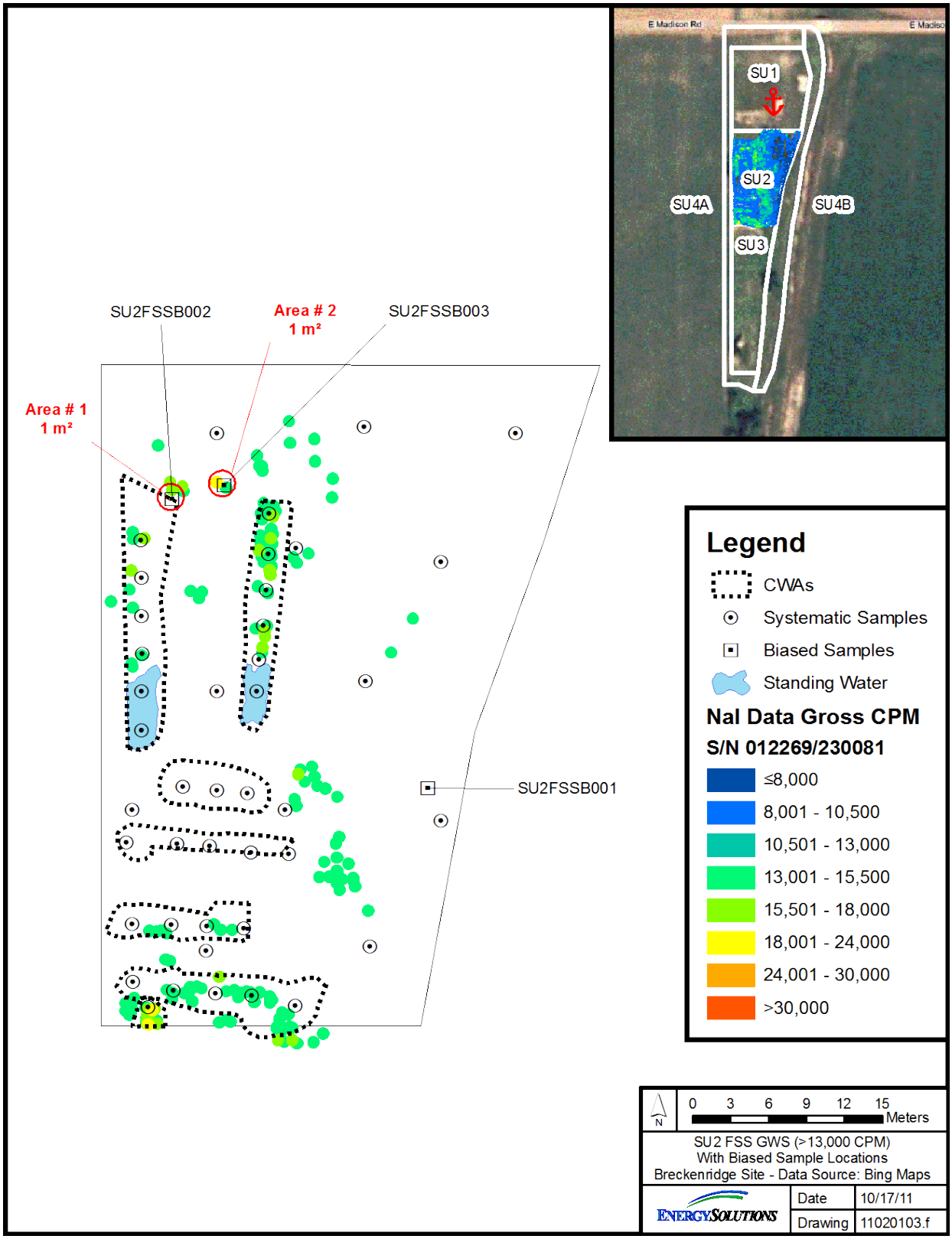


Figure 7-9 SU2 Elevated Areas

Although it has been demonstrated that each individual elevated area meets the EMC test, it must be demonstrated that SU2 also meets the EMC test as a collective unit. In order to determine this, the survey unit was split into two distinct areas, the trenches and the balance of the survey unit. The average concentrations for each contaminant and area, δ_i, were determined separately and the resulting SOFs weighted by the applicable fraction, *f*, based upon the survey unit footprint. The total area of SU2 is 1,644 m^2 with a trench footprint of 242 m^2 or 14.8%. The SOF contribution for each of these two areas is summarized below in Table 7-12 and Table 7-13.

Table 7-12 SU2 Trench SOF Summary

	δ_i	$DCGL_{w,i}$	*f*	SOF_i
^{232}Th + C	2.32	65.9	0.148	0.005
^{238}U + D	2.37	8,658	0.148	0.000
^{234}U	2.37	6,113	0.148	0.000
^{230}Th	18.7	97.9	0.148	0.028
^{226}Ra + C	1.52	51.2	0.148	0.004
Trenches were > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF	**0.038**

Table 7-13 SU2 Systematic SOF Summary

	δ_i	$DCGL_{w,i}$	*f*	SOF_i
^{232}Th + C	0.80	5.0	0.852	0.136
^{238}U + D	0.76	442.4	0.852	0.001
^{234}U	0.76	2,729	0.852	0.000
^{230}Th	7.77	276.9	0.852	0.024
^{226}Ra + C	1.03	6.2	0.852	0.142
SU2 general area < 1.5 m bgs; therefore surface DCGLs apply.			Σ SOF	**0.303**

The average contaminant concentrations for the trenches were determined using the soil samples from the bagged material and the systematic sampling within the trenches excluding the samples from any elevated areas. The average contaminant concentrations for the balance of the survey unit were calculated using the systematic and biased samples taken in the survey unit, also excluding any samples taken from elevated areas.

To complete the EMC evaluation, the SOF contribution to the survey unit from the 3 elevated areas was calculated using the equation from Section 4.4. The SOF contribution to SU2 from each of these areas is summarized in Table 7-14 through Table 7-16.

Table 7-14 SU2 Area 1 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	12.4	5.0	5.62	0.80	0.078
^{238}U + D	12.4	442.4	7.77	0.76	0.001
^{234}U	130.0	2,729	7.77	0.76	0.000
^{230}Th	17.0	276.9	53.2	7.77	0.010
^{226}Ra + C	14.1	6.2	4.93	1.03	0.045
EMC < 1.5 m bgs; therefore surface DCGLs apply.				ΣSOF_1	**0.133**

Table 7-15 SU2 Area 2 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	12.4	5.0	6.96	0.80	0.099
^{238}U + D	12.4	442.4	11.9	0.76	0.002
^{234}U	130.0	2,729	11.9	0.76	0.000
^{230}Th	17.0	276.9	62.2	7.77	0.012
^{226}Ra + C	14.1	6.2	7.62	1.03	0.075
EMC < 1.5 m bgs; therefore surface DCGLs apply.				ΣSOF_2	**0.188**

Table 7-16 SU2 Area 3 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	16.4	65.9	9.39	2.32	0.007
^{238}U + D	36.7	8,658	6.29	2.37	0.000
^{234}U	72.2	6,113	6.29	2.37	0.000
^{230}Th	44.9	97.9	96.8	18.7	0.018
^{226}Ra + C	45.2	51.2	3.74	1.52	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.				ΣSOF_3	**0.025**

The collective SOF for SU2 is summarized in Table 7-17. The total SOF for SU2 including the contribution from all elevated areas was 0.688, well below unity.

Table 7-17 SU2 Elevated Measurement Comparison SOF Results

Survey Unit Component	SOF_{SU2} Contribution
SU2 – Systematic	0.303
SU2 – Trenches	0.038
Area 1	0.133
Area 2	0.188
Area 3	0.025
Σ SOF_{SU2}	**0.688**

7.5.5 Deviations from the FSSP

It should be noted that the FSS protocols were deviated in a couple of instances within SU2 as follows, specifically for geoprobing the centerline of CWA-3 and Trench C. This was done based upon safety considerations. Additionally, Geoprobe® samples were not collected at locations 1 and 2 within CWA-1 due to standing water.

A second deviation from the FSS protocols was for the Geoprobe® sample analyses themselves. The top 6 inches were not sampled as the surface soils were already sampled during systematic sampling. Additionally, the full length of each Geoprobe® was analyzed in 2-foot composites rather than scanning the tubes and analyzing the highest 1-foot composite.

The last deviation was during Geoprobe® sampling at the biased sampling location outside the trenches. Due to weather at the time, Geoprobe® samples were not collected at the 3 biased sample locations. Based upon the surrounding subsurface sampling and subsequent field investigation, it was demonstrated that no further subsurface contamination was present.

7.5.6 Sign Test

A total of 12 systematic measurements were taken on a triangular grid throughout the area and 30 along the centerline of the trenches. According to MARSSIM Table I.3, the critical value based upon 42 measurement locations with a 5% decision error is twenty-six (26). After subtracting the individual measurement SOFs from unity, there were a total of 42 positive values which exceeds the critical value.

7.5.7 Conclusions

Based upon the survey and sample results as presented for SU2, the survey unit meets both the sign and EMC tests and is suitable for unconditional release based upon the intent of MARSSIM. The total SOF for SU2 as demonstrated is 0.688 for a total residual dose of approximately 17.2 mrem to an average member of the critical group.

It should be noted that this is based upon gross activities and does not take into affect any contribution from background. As a result, any reported residual dose is conservative.

7.6 Survey Unit 3 (SU3)

A summary of the FSS for Survey Unit 3 are provided as follows:

7.6.1 SU3 Walkover Survey

Upon completion of excavation within the Survey Unit, a final gamma walkover scan was performed and the data plotted. The scan results are provided in Figure 7-10 along with a histogram and data set statistics for the walkover survey. A 100% scan was performed to the maximum extent practical; however, due to GPS plotting capabilities, survey unit topography, survey references and the scan methodology (poling measurements every second), small void areas as depicted by the color white will be present in the figure. To aid in the data evaluation of the scan results, the walkover survey was also plotted and all areas exceeding 13,000 gross cpm documented to aid in biased sampling of the area and the release of the site. This final walkover scan illustrating all areas greater than 13,000 cpm is provided as Figure 7-11.

It should be noted that the action level is different for soils greater than 1.5 meters bgs. Based upon the GPS data from the walkover survey, a depth profile of the final excavation was developed and all areas greater than 1.5 meters in depth area provided as part of the walkover scans and as depicted on the maps.

7.6.2 Surface Soil Sampling and Results

Following the final walkover scan of the area, the survey unit was sampled and all samples analyzed on site. Surface soil samples (0-6") were collected throughout the area in accordance with the FSS protocols. Systematic samples were collected on a triangular grid with a random starting point. Based upon the evaluation of the walkover survey and the VSP design, it was determined that 12 systematic sampling locations were adequate. Systematic samples were also collected every 10 linear feet along the centerline of each trench.

In addition to the systematic sampling locations, 6 biased samples were taken at elevated areas based upon the final walkover scan survey as show in Figure 7-11. No biased sampling was taken within the trenches as the systemic sampling provided adequate coverage of all elevated areas within the trenches.

Figure 7-11 provides a summary of all surface soil sample locations with the sample analysis results presented in Table 7-18 for the systematic/biased samples and Table 7-19 for the trench samples.

Based upon the soil sample results, 3 elevated areas were identified with an SOF above unity. These 3 areas are addressed in Section 7.6.4 along with the area as identified in the bagged material used to backfill the trenches.

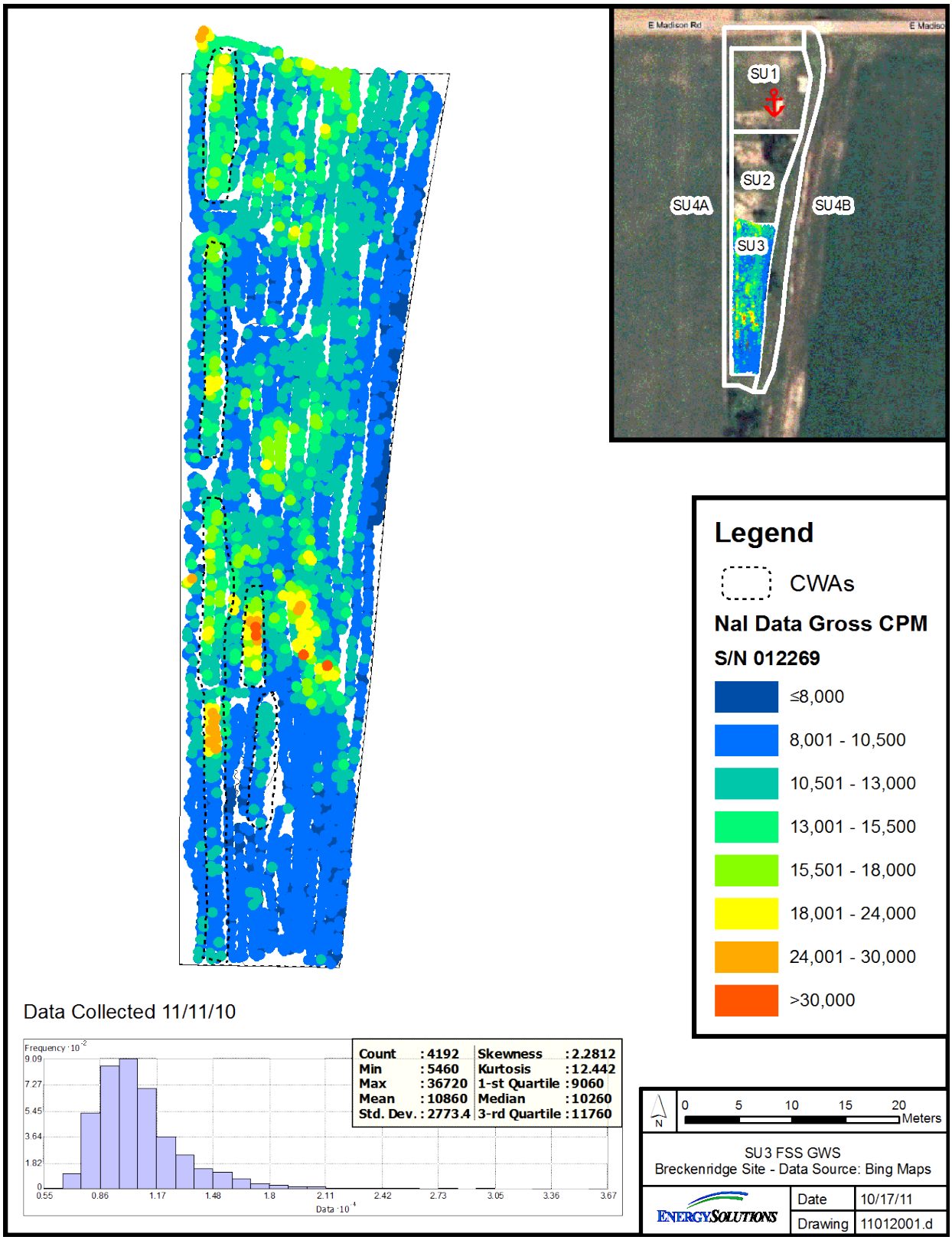


Figure 7-10 SU3 Final Status Survey Map – Walkover Scan

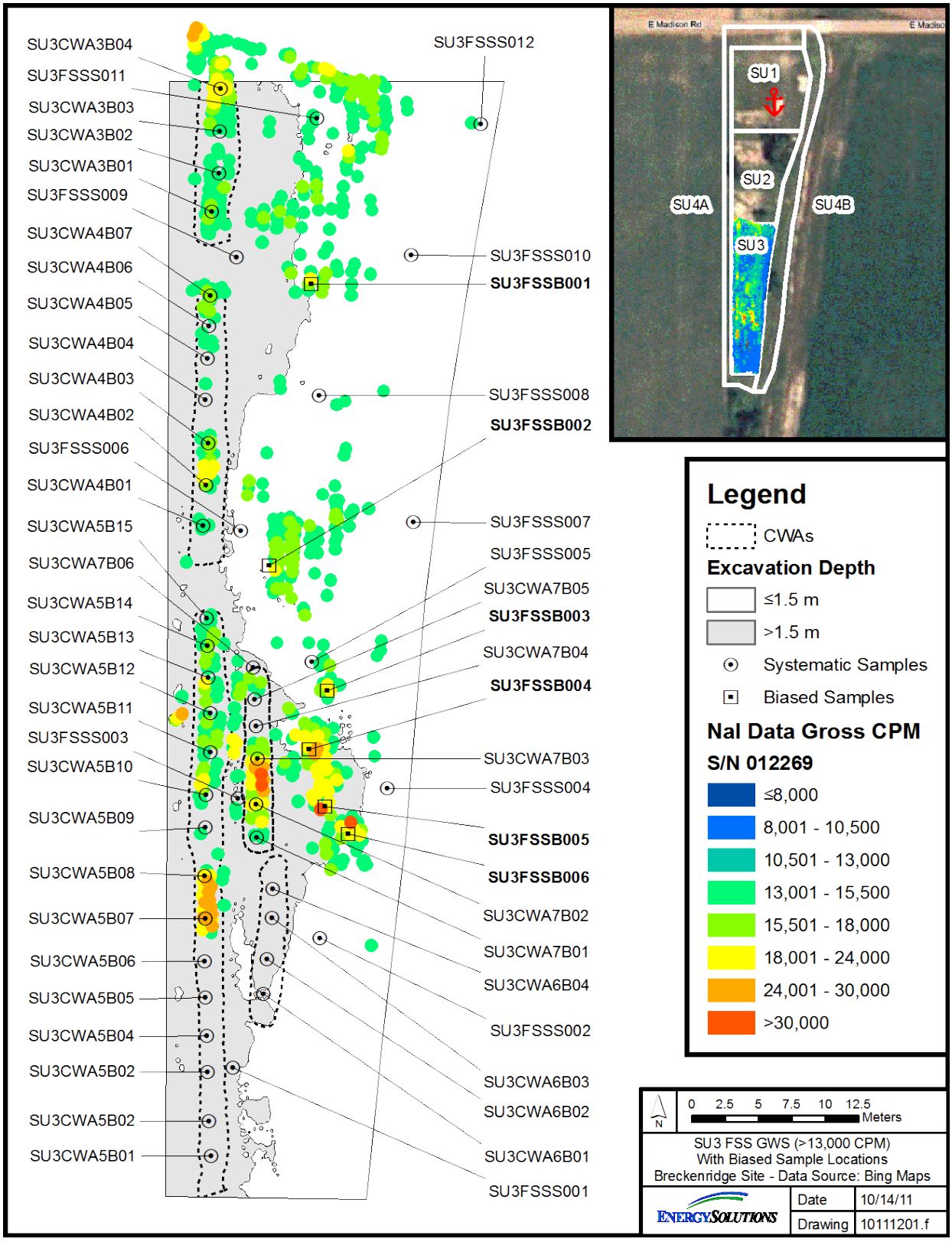


Figure 7-11 SU3 Final Status Survey - Sampling Map

Table 7-18 SU3 Systematic and Biased Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU3FSSS001	0	6.877	9,294	*4.47E-01*	6.64E-01	4.28E+00	*2.49E-01*	6.53E-01	**4.36E-01**	1.23E-01	0.06
SU3FSSS002	0	2.657	9,066	**6.31E-01**	5.82E-01	7.35E+00	**1.43E+00**	1.02E+00	**7.50E-01**	1.79E-01	0.41
SU3FSSS003	2	7.610	10,179	**2.42E+00**	9.05E-01	2.80E+01	**2.50E+00**	1.73E+00	**2.86E+00**	2.92E-01	0.38
SU3FSSS004	0	0.000	12,328	**1.08E+00**	6.48E-01	1.24E+01	*2.57E-01*	1.11E+00	**1.26E+00**	2.17E-01	0.34
SU3FSSS005	0	4.901	10,216	**1.08E+00**	8.24E-01	8.21E+00	*8.43E-01*	1.08E+00	**8.37E-01**	1.54E-01	0.11
SU3FSSS006	0	5.257	8,967	*5.44E-01*	6.10E-01	7.23E+00	*9.15E-01*	1.01E+00	**7.38E-01**	2.15E-01	0.10
SU3FSSS007	0	0.000	9,496	*7.69E-01*	8.59E-01	7.57E+00	**9.34E-01**	8.69E-01	**7.72E-01**	2.08E-01	0.33
SU3FSSS008	2	3.979	11,019	*3.22E-01*	7.04E-01	6.55E+00	*9.16E-01*	9.19E-01	**6.69E-01**	2.13E-01	0.31
SU3FSSS009	2	6.655	10,056	*6.76E-01*	9.01E-01	9.77E+00	**1.37E+00**	1.22E+00	**9.97E-01**	2.53E-01	0.14
SU3FSSS010	2	4.191	10,143	*5.02E-01*	5.83E-01	6.46E+00	*1.00E+00*	1.30E+00	**6.59E-01**	2.02E-01	0.32
SU3FSSS011 [QC]	2	4.931	13,019	**9.27E-01**	7.89E-01	1.40E+01	**1.80E+00**	1.32E+00	**1.43E+00**	3.29E-01	0.20
SU3FSSS012	2	0.000	9,294	*4.46E-01*	8.44E-01	5.42E+00	*4.60E-01*	9.08E-01	**5.53E-01**	1.72E-01	0.21
SU3FSSB001 [QC]	0	4.875	15,447	**4.73E+00**	1.94E+00	6.10E+01	**2.94E+00**	2.78E+00	**6.20E+00**	7.18E-01	0.78
SU3FSSB002	0	4.875	18,954	*7.66E-01*	2.67E+00	5.13E+01	*2.02E+00*	3.03E+00	**3.60E+00**	9.33E-01	0.62
SU3FSSB003	0	4.875	18,583	**5.55E+00**	1.52E+00	5.41E+01	*2.03E+00*	2.18E+00	**3.73E+00**	5.91E-01	0.65
SU3FSSB004	0	5.257	18,092	**3.05E+00**	1.09E+00	4.14E+00	*7.95E-01*	1.27E+00	**8.21E-01**	4.09E-01	0.07
SU3FSSB005	0	5.257	31,578	**3.94E+00**	1.20E+00	1.77E+01	*1.29E+00*	1.79E+00	**1.87E+00**	4.52E-01	0.24
SU3FSSB006 [QC]	0	5.257	22,532	**6.14E+00**	1.80E+00	8.00E+01	**2.91E+00**	2.30E+00	**6.38E+00**	5.48E-01	0.97
		Average:	13,792	1.89E+00		2.14E+01	1.37E+00		**1.92E+00**		0.35
		Std Dev.:	6,096	1.93E+00		2.34E+01	8.35E-01		**1.88E+00**		0.26
		UCL 95%:	23,819	5.07E+00		6.00E+01	2.74E+00		**5.02E+00**		0.77
		Maximum:	31,578	6.14E+00		8.00E+01	2.94E+00		**6.38E+00**		0.97

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.
c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

Table 7-19 SU3 Trench (Confirmed Waste Area) Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU3CWA3B01	0	11.050	14,679	*5.37E-01*	1.19E+00	5.96E+00	**1.78E+00**	1.50E+00	**6.08E-01**	3.21E-01	0.11
SU3CWA3B02	1	12.025	11,847	*5.03E-01*	1.33E+00	9.90E+00	*8.61E-01*	1.56E+00	**1.01E+00**	3.04E-01	0.13
SU3CWA3B03	1	12.350	12,114	*4.55E-01*	1.19E+00	4.30E+00	**2.43E+00**	1.73E+00	**4.39E-01**	4.10E-01	0.10
SU3CWA3B04	1	11.700	20,201	*1.40E+00*	1.79E+00	2.80E+00	**2.88E+00**	2.40E+00	**4.32E+00**	5.42E-01	0.15
SU3CWA4B01	0	8.668	11,606	**1.17E+00**	1.07E+00	9.73E+00	*7.54E-01*	1.58E+00	**9.93E-01**	3.49E-01	0.13
SU3CWA4B02	0	8.544	13,050	*9.13E-01*	1.22E+00	7.75E+00	*1.02E+00*	1.63E+00	**7.91E-01**	3.57E-01	0.11
SU3CWA4B03 QC	0	9.692	27,490	**9.28E+00**	2.63E+00	2.22E+01	**6.45E+00**	3.32E+00	**1.43E+01**	7.71E-01	0.57
SU3CWA4B04	0	9.828	11,482	**1.74E+00**	1.24E+00	2.59E+00	*1.32E+00*	1.63E+00	**8.39E-01**	4.05E-01	0.07
SU3CWA4B05	0	9.573	11,918	*1.05E+00*	1.24E+00	5.52E+00	*1.12E+00*	1.27E+00	**5.63E-01**	3.19E-01	0.09
SU3CWA4B06	0	9.643	12,857	*1.04E+00*	1.26E+00	8.47E+00	*5.21E-01*	1.12E+00	**8.64E-01**	6.82E-01	0.11
SU3CWA4B07 QC	0	8.872	16,567	**1.23E+01**	1.98E+00	1.48E+02	**4.43E+00**	2.85E+00	**1.20E+01**	6.59E-01	**1.78**
SU3CWA5B01	1	7.070	9,374	*6.70E-01*	7.43E-01	9.14E+00	*5.87E-01*	1.19E+00	**9.32E-01**	5.94E-01	0.12
SU3CWA5B02	1	8.096	9,383	*1.85E-01*	1.23E+00	5.52E+00	*8.13E-01*	1.66E+00	**5.63E-01**	2.02E-01	0.08
SU3CWA5B03	1	8.569	9,862	**1.64E+00**	1.54E+00	5.67E+00	*5.50E-01*	1.85E+00	*5.79E-01*	6.86E-01	0.08
SU3CWA5B04	0	9.473	9,530	*6.86E-01*	1.28E+00	5.97E+00	*4.86E-01*	1.03E+00	**6.09E-01**	3.76E-01	0.08
SU3CWA5B05	0	8.520	9,138	*5.22E-01*	1.31E+00	7.75E+00	*1.64E+00*	1.69E+00	**7.90E-01**	3.16E-01	0.12
SU3CWA5B06	0	9.153	9,738	*7.32E-01*	1.31E+00	6.00E+00	*1.13E+00*	1.67E+00	**6.12E-01**	2.97E-01	0.09
SU3CWA5B07 QC	0	9.467	26,693	**4.49E+00**	1.34E+00	8.24E+00	*8.02E-01*	1.82E+00	**8.41E-01**	3.77E-01	0.11
SU3CWA5B08 QC	0	8.144	26,453	**1.30E+01**	2.75E+00	1.26E+02	**4.99E+00**	3.50E+00	**1.72E+01**	8.12E-01	**1.65**
SU3CWA5B09	0	10.672	11,366	*1.07E+00*	1.16E+00	6.02E+00	*9.84E-01*	1.52E+00	**6.14E-01**	3.64E-01	0.09
SU3CWA5B10	0	11.282	11,749	*4.51E-01*	1.16E+00	5.87E+00	*8.12E-01*	1.02E+00	*5.99E-01*	6.01E-01	0.09
SU3CWA5B11	0	9.850	14,145	**2.70E+00**	1.08E+00	1.75E+01	*9.98E-01*	1.42E+00	**1.78E+00**	4.34E-01	0.23
SU3CWA5B12	0	10.281	13,186	**1.34E+00**	1.05E+00	8.62E+00	*1.44E+00*	1.83E+00	**8.79E-01**	3.42E-01	0.13
SU3CWA5B13	0	9.511	13,916	*7.39E-01*	1.24E+00	4.68E+00	*4.56E-01*	1.31E+00	*4.78E-01*	5.76E-01	0.06
SU3CWA5B14	0	9.548	14,945	**2.41E+00**	1.29E+00	3.03E+01	**1.93E+00**	1.85E+00	**2.52E+00**	5.29E-01	0.39

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU3CWA5B15	0	7.737	11,299	**1.21E+00**	8.05E-01	4.75E+00	**1.97E+00**	1.88E+00	**6.56E-01**	6.09E-01	0.10
SU3CWA6B01	0	3.152	9,805	*1.12E+00*	1.33E+00	6.26E+00	*7.96E-01*	1.48E+00	*6.38E-01*	6.57E-01	0.28
SU3CWA6B02	0	3.974	10,017	*1.49E+00*	1.65E+00	7.70E+00	*1.31E+00*	1.35E+00	**1.22E+00**	4.05E-01	0.49
SU3CWA6B03	0	4.751	10,425	**1.90E+00**	1.50E+00	7.05E+00	*1.53E-01*	1.33E+00	**7.19E-01**	7.15E-01	0.20
SU3CWA6B04	0	5.745	11,190	**1.47E+00**	1.04E+00	9.59E+00	*1.51E+00*	1.73E+00	**9.79E-01**	3.45E-01	0.14
SU3CWA7B01	0	9.747	13,137	**1.14E+00**	9.59E-01	8.79E+00	*5.37E-01*	1.03E+00	**8.97E-01**	3.05E-01	0.11
SU3CWA7B02 [QC]	0	8.486	17,485	**8.48E+00**	1.83E+00	1.31E+02	**3.75E+00**	2.72E+00	**8.03E+00**	5.67E-01	**1.54**
SU3CWA7B03 [QC]	0	8.619	18,959	**3.47E+00**	9.59E-01	4.62E+00	*1.19E+00*	1.42E+00	**9.74E-01**	3.21E-01	0.09
SU3CWA7B04	0	7.332	10,275	*1.79E-01*	1.21E+00	9.17E+00	*4.16E-01*	1.74E+00	**9.35E-01**	3.28E-01	0.12
SU3CWA7B05	0	6.581	10,589	**1.96E+00**	9.16E-01	6.90E+00	*3.35E-01*	1.32E+00	**1.30E+00**	3.27E-01	0.10
SU3CWA7B06	0	6.160	11,554	*4.01E-01*	1.33E+00	1.13E+01	*1.22E+00*	1.23E+00	**1.16E+00**	3.29E-01	0.16
		Average:	13,556	1.52E+00		8.38E+00	1.25E+00		**1.39E+00**		0.15
		Std Dev.:	4,867	1.67E+00		5.46E+00	1.12E+00		**2.43E+00**		0.12
		UCL 95%:	21,562	4.27E+00		1.74E+01	3.09E+00		**5.39E+00**		0.35
		Maximum:	27,490	9.28E+00		3.03E+01	6.45E+00		**1.43E+01**		0.57

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.

c Bold "red" values are samples from an elevated area. The data from these samples has been excluded from the survey unit statistics. These values were included in the EMC evaluations.

d Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.6.3 Subsurface Soil Sampling and Results

Following the analysis of all surface soil samples, subsurface samples were collected throughout the area. Geoprobe® samples were taken at each systematic sampling location down to an approximate depth of 10 feet bgs or until refusal. The samples were then divided and analyzed in 2-foot composites.

Geoprobe® sampling was not performed within the trenches as originally planned due to their depth and for safety reasons. Because of the overall depth of the trenches and the narrow width, it was determined that it was not safe to try and access the trenches with the Geoprobe® unit. Additionally, based upon the soil type encountered at the bottoms of the trenches, compacted virgin clay, it would not be effective to attempt to Geoprobe® the trenches within SU3. As an alternative, subsurface samples were collected at sampling locations with elevated activity using a pick ax to sample approximately 6-inches below the surface.

Figure 7-12 provides a summary of all locations where subsurface soil samples were collected. All subsurface sampling results are provided in Table 7-20 and were well below an SOF of unity. Based upon the subsurface sampling results, the soil type and the surveys performed it was determined that no further subsurface sampling was required.

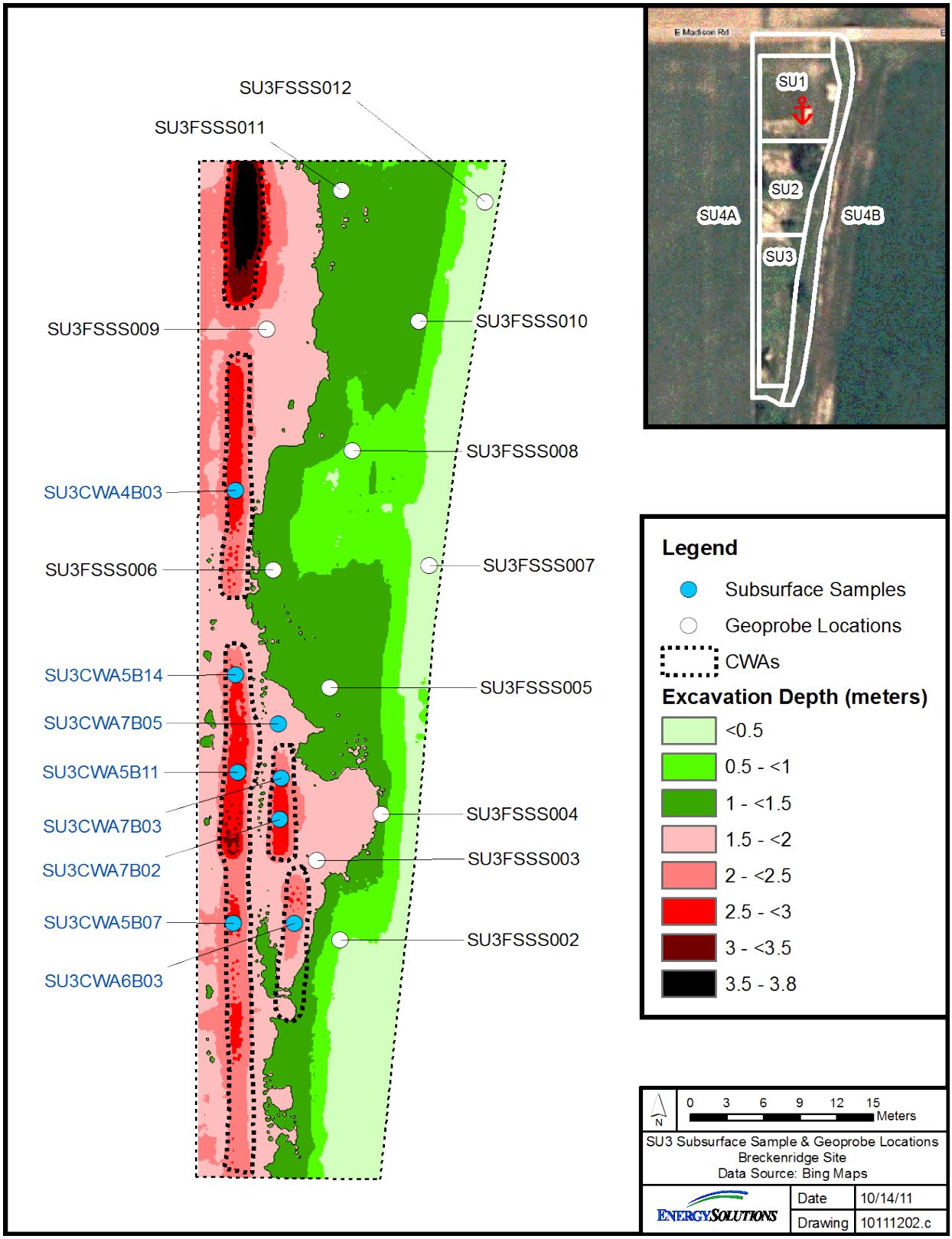


Figure 7-12 SU3 Final Status Survey - Sub-surface Sampling Map

Table 7-20 SU3 Subsurface Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU3FSSS002A	0	2.657	N/A	**1.06E+00**	8.14E-01	5.73E+00	*3.37E-01*	1.09E+00	*5.85E-01*	6.59E-01	0.19
SU3FSSS002B	1	4.657	N/A	*1.05E+00*	1.14E+00	4.41E+00	*3.21E-01*	1.07E+00	**4.50E-01**	3.37E-01	0.16
SU3FSSS002C	0	6.657	N/A	*4.71E-01*	1.08E+00	5.49E+00	*6.44E-01*	1.03E+00	**5.60E-01**	2.04E-01	0.08
SU3FSSS002D	1	8.657	N/A	*6.93E-01*	1.14E+00	5.75E+00	*3.49E-01*	1.60E+00	**5.87E-01**	3.52E-01	0.07
SU3FSSS003A	1	7.610	N/A	*9.73E-01*	1.05E+00	5.40E+00	*2.41E-01*	7.51E-01	**5.51E-01**	3.05E-01	0.07
SU3FSSS003B	0	9.610	N/A	*1.61E-01*	1.17E+00	5.08E+00	*9.57E-01*	1.11E+00	*5.18E-01*	6.51E-01	0.08
SU3FSSS003C [QC]	0	11.610	N/A	*5.77E-01*	1.14E+00	3.75E+00	*5.01E-01*	1.55E+00	*3.82E-01*	5.91E-01	0.05
SU3FSSS004A	1	0.000	N/A	*6.33E-01*	1.19E+00	7.39E+00	*8.49E-01*	1.67E+00	**7.54E-01**	2.84E-01	0.32
SU3FSSS004B	1	2.000	N/A	*4.84E-01*	1.16E+00	4.13E+00	*5.23E-01*	1.64E+00	*4.22E-01*	6.55E-01	0.18
SU3FSSS004C	0	4.000	N/A	*9.64E-01*	1.10E+00	6.55E+00	*9.22E-01*	1.15E+00	**6.69E-01**	5.49E-01	0.31
SU3FSSS005A	0	4.901	N/A	*9.64E-01*	1.09E+00	3.83E+00	*5.91E-01*	1.22E+00	**3.91E-01**	2.33E-01	0.06
SU3FSSS005B	0	6.901	N/A	*5.04E-01*	1.08E+00	4.39E+00	*2.69E-01*	1.06E+00	*4.48E-01*	5.88E-01	0.06
SU3FSSS005C	0	8.901	N/A	*5.17E-01*	7.42E-01	5.26E+00	*5.67E-01*	8.78E-01	**5.36E-01**	3.06E-01	0.07
SU3FSSS006A	1	5.257	N/A	*6.08E-01*	1.10E+00	4.62E+00	*3.46E-01*	9.73E-01	*4.72E-01*	5.70E-01	0.06
SU3FSSS006B	1	7.257	N/A	*5.23E-01*	1.26E+00	5.13E+00	*1.35E+00*	1.59E+00	**5.24E-01**	2.45E-01	0.09
SU3FSSS006C	1	9.257	N/A	*1.03E+00*	1.20E+00	6.06E+00	*3.58E-01*	1.55E+00	*6.19E-01*	6.44E-01	0.08
SU3FSSS006D	1	11.257	N/A	*9.09E-01*	1.20E+00	5.71E+00	*4.46E-01*	1.07E+00	**5.83E-01**	5.81E-01	0.08
SU3FSSS007A	1	0.000	N/A	*6.73E-01*	1.28E+00	4.55E+00	*6.41E-01*	1.10E+00	*4.64E-01*	6.35E-01	0.21
SU3FSSS007B	0	2.000	N/A	*7.43E-01*	1.24E+00	2.71E+00	*7.96E-01*	1.35E+00	*2.77E-01*	5.61E-01	0.20
SU3FSSS007C	0	4.000	N/A	*5.40E-01*	1.21E+00	7.27E+00	*7.21E-01*	9.76E-01	**7.41E-01**	2.83E-01	0.29
SU3FSSS007D	0	6.000	N/A	*8.05E-01*	1.08E+00	5.20E+00	*4.33E-01*	1.50E+00	*5.31E-01*	5.45E-01	0.07
SU3FSSS007E	0	8.000	N/A	*6.48E-01*	1.12E+00	8.29E+00	*1.07E+00*	1.69E+00	**8.46E-01**	6.43E-01	0.12

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU3FSSS008A [QC]	0	3.979	N/A	*8.47E-01*	1.27E+00	9.11E+00	*1.23E+00*	1.84E+00	**9.30E-01**	3.37E-01	0.42
SU3FSSS008B	0	5.979	N/A	*2.42E-01*	1.08E+00	4.45E+00	**1.20E+00**	1.09E+00	*4.54E-01*	5.71E-01	0.08
SU3FSSS009A	0	6.655	N/A	*8.82E-01*	1.15E+00	4.29E+00	*5.32E-01*	1.08E+00	**4.38E-01**	3.20E-01	0.06
SU3FSSS009B	1	8.655	N/A	*4.54E-01*	1.07E+00	4.55E+00	*3.01E-01*	1.06E+00	*4.64E-01*	7.12E-01	0.06
SU3FSSS009C	1	10.655	N/A	*6.63E-01*	1.24E+00	4.98E+00	*1.11E+00*	1.27E+00	**5.08E-01**	3.63E-01	0.08
SU3FSSS009D	1	12.655	N/A	*8.64E-01*	1.11E+00	7.47E+00	**1.35E+00**	1.22E+00	**7.62E-01**	5.80E-01	0.11
SU3FSSS010A	1	4.191	N/A	*5.31E-01*	1.19E+00	6.76E+00	*8.95E-01*	1.35E+00	**6.90E-01**	3.66E-01	0.31
SU3FSSS010B	1	6.191	N/A	*5.81E-01*	1.20E+00	3.36E+00	*4.18E-01*	1.57E+00	*3.43E-01*	5.93E-01	0.05
SU3FSSS010C	1	8.191	N/A	*3.72E-01*	1.29E+00	7.64E+00	*8.96E-01*	1.12E+00	**7.80E-01**	6.63E-01	0.11
SU3FSSS011A [QC]	61	4.931	N/A	*5.72E-01*	7.62E-01	4.48E+00	**5.34E-01**	1.33E-01	**4.57E-01**	3.28E-01	0.06
SU3FSSS011B	0	6.931	N/A	*7.54E-01*	1.11E+00	7.58E+00	**1.55E+00**	1.47E+00	**7.74E-01**	4.01E-01	0.12
SU3FSSS011C	0	8.931	N/A	*8.69E-01*	1.04E+00	5.22E+00	*4.25E-01*	1.06E+00	*5.33E-01*	5.86E-01	0.07
SU3FSSS011D	0	10.931	N/A	*5.83E-01*	6.89E-01	4.66E+00	*1.30E+00*	1.46E+00	**4.75E-01**	2.37E-01	0.08
SU3FSSS012A	0	0.000	N/A	*4.75E-01*	1.31E+00	4.40E+00	*6.53E-01*	1.27E+00	**4.49E-01**	2.99E-01	0.21
SU3FSSS012B	0	2.000	N/A	*1.19E+00*	1.22E+00	7.27E+00	*3.71E-01*	1.64E+00	**7.42E-01**	6.63E-01	0.24
SU3FSSS012C	0	4.000	N/A	*9.60E-01*	1.11E+00	5.16E+00	*1.47E-01*	1.06E+00	*5.27E-01*	6.29E-01	0.15
SU3FSSS012D	0	6.000	N/A	*1.02E+00*	1.13E+00	4.25E+00	*5.00E-01*	1.14E+00	*4.34E-01*	6.08E-01	0.06
SU3FSSS012E	0	8.000	N/A	*6.79E-01*	1.28E+00	4.36E+00	*1.22E+00*	1.75E+00	*4.44E-01*	6.65E-01	0.08
SU3CWA4B03A	0	10.192	N/A	**1.19E+00**	7.68E-01	6.59E+00	*6.61E-01*	1.16E+00	*6.72E-01*	6.73E-01	0.09
SU3CWA5B07A	0	9.967	N/A	**3.14E+00**	1.80E+00	2.26E+01	*1.69E+00*	1.96E+00	**4.62E+00**	5.05E-01	0.34
SU3CWA5B11A	0	10.350	N/A	**3.12E+00**	1.83E+00	1.53E+01	*1.64E+00*	1.97E+00	**2.24E+00**	5.44E-01	0.22
SU3CWA5B14A	0	10.048	N/A	*1.14E+00*	1.29E+00	6.42E+00	*5.87E-01*	1.32E+00	**6.56E-01**	3.16E-01	0.09

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU3CWA6B03A	0	5.251	N/A	*6.57E-01*	8.42E-01	9.30E+00	*1.03E+00*	1.21E+00	**9.49E-01**	6.62E-01	0.13
SU3CWA7B02A	0	8.986	N/A	**1.89E+00**	1.10E+00	1.49E+01	**1.78E+00**	1.66E+00	**1.52E+00**	3.58E-01	0.21
SU3CWA7B03A	0	9.119	N/A	**2.12E+00**	1.02E+00	9.28E+00	*1.26E-01*	1.27E+00	**9.47E-01**	3.28E-01	0.11
SU3CWA7B05A	0	7.081	N/A	*8.01E-01*	8.65E-01	5.71E+00	*7.41E-01*	7.51E-01	*5.82E-01*	6.22E-01	0.08
		Average:		8.78E-01		6.39E+00	7.52E-01		**7.15E-01**		0.14
		Std Dev.:		5.90E-01		3.42E+00	4.30E-01		**6.57E-01**		0.09
		UCL 95%:		1.85E+00		1.20E+01	1.46E+00		**1.80E+00**		0.29
		Maximum:		3.14E+00		2.26E+01	1.78E+00		**4.62E+00**		0.42

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis; all other values were determined via surrogate to ^{232}Th as specified in Section 4.2.

c Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.6.4 Elevated Measurement Comparison

Three elevated areas of concern were identified based upon the walkover scans and soil sampling results which were further evaluated using the EMC test in accordance with Section 4.4. These 3 areas are provided in Figure 7-13 and the approximate size of each area provided. In addition, there was one area identified as part of the bagged material used as backfill as shown in Figure 7-2. Based upon the Area Factors (AFs) as developed in CS-313111-001*, Re-Evaluation of Breckenridge DCGLs, Gamma Scan Sensitivity, Gamma Scan Action Levels and Development of Area Factors* and presented in Section 4.3, the applicable AF for each area was determined using logarithmic interpolation. As presented in Table 7-21 through Table 7-24, the EMC result for each individual area is shown to be below an SOF of unity. For conservatism, the average contaminant activity for each elevated area was assumed to be equal to the maximum measured concentration for that area.

Elevated area 3 was identified through sample analysis and identified for further investigation by the Radiological Engineer while performing the walkover scans. There was a fourth location identified in CWA-4 near sample location 3; however, upon subsequent sample analysis via alpha spec by the off-site laboratory, it was determined that Th-230 was not an issue at this location and the SOF was below unity and was not considered as an elevated area of concern.

Table 7-21 SU3 Area 1 EMC Results (10.6 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	26.9	65.9	8.03	0.005
^{238}U + D	38.7	8,658	8.48	0.000
^{234}U	140.2	6,113	8.48	0.000
^{230}Th	80.1	97.9	131.0	0.017
^{226}Ra + C	80.6	51.2	3.75	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF_1	**0.022**

Table 7-22 SU3 Area 2 EMC Results (10.1 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	27.2	65.9	17.2	0.010
^{238}U + D	38.8	8,658	13.0	0.000
^{234}U	142.5	6,113	13.0	0.000
^{230}Th	81.4	97.9	126.0	0.016
^{226}Ra + C	81.9	51.2	4.99	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF_2	**0.027**

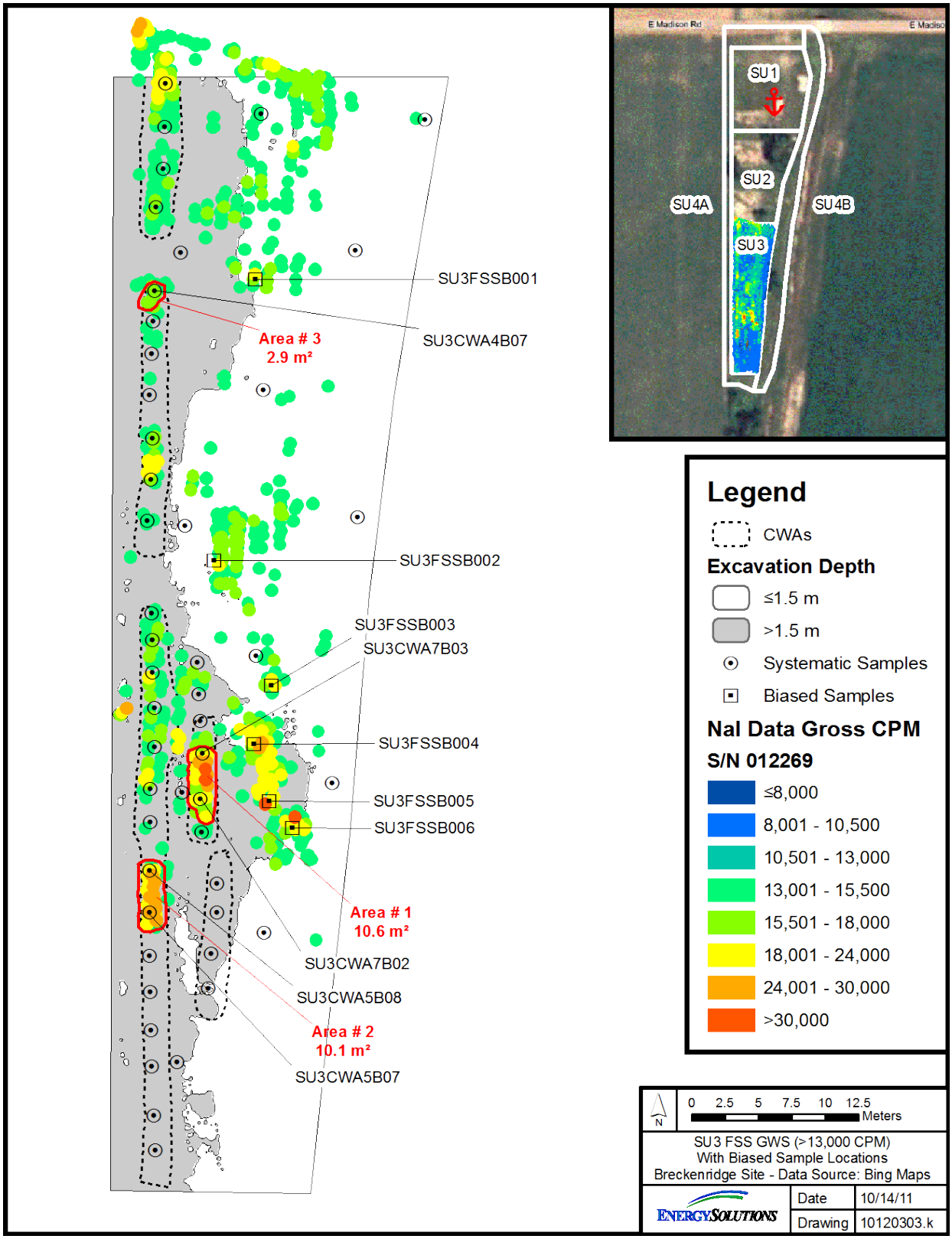


Figure 7-13 SU3 Elevated Areas

Table 7-23 SU3 Area 3 EMC Results (2.9 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	28.7	65.9	12.0	0.006
^{238}U + D	38.8	8,658	12.3	0.000
^{234}U	154.2	6,113	12.3	0.000
^{230}Th	87.5	97.9	148	0.017
^{226}Ra + C	87.0	51.2	4.43	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF_3	**0.025**

Table 7-24 SU3 Area 4 EMC Results – Backfill (5 m^2)

	AF_i	$DCGL_{w,i}$	C_i	SOF_i
^{232}Th + C	16.4	65.9	9.39	0.009
^{238}U + D	36.7	8,658	6.29	0.000
^{234}U	72.2	6,113	6.29	0.000
^{230}Th	44.9	97.9	96.8	0.022
^{226}Ra + C	45.2	51.2	3.74	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF_4	**0.032**

Although it has been demonstrated that each individual elevated area meets the EMC test, it must be demonstrated that SU3 also meets the EMC test as a collective unit. As with SU2, the survey unit was split into two distinct areas, the trenches and the balance of the survey unit. The average concentrations for each contaminant and area, δ_i, were determined separately and the resulting SOFs weighted by the applicable fraction, *f*, based upon the survey unit footprint. The total area of SU3 is 1,642 m^2 with a trench footprint of 286 m^2 or 17.4%. The SOF contribution for each of these two areas is summarized below in Table 7-25 and Table 7-26.

Table 7-25 SU3 Trench SOF Summary

	δ_i	$DCGL_{w,i}$	*f*	SOF_i
^{232}Th + C	2.18	65.9	0.174	0.006
^{238}U + D	1.98	8,658	0.174	0.000
^{234}U	1.98	6,113	0.174	0.000
^{230}Th	17.8	97.9	0.174	0.032
^{226}Ra + C	1.29	51.2	0.174	0.004
Trenches were > 1.5 m bgs; therefore subsurface DCGLs apply.			Σ SOF	**0.042**

Table 7-26 SU3 Systematic SOF Summary

	δ_i	$DCGL_{w,i}$	*f*	SOF_i
^{232}Th + C	1.92	5.0	0.826	0.317
^{238}U + D	1.89	442.4	0.826	0.004
^{234}U	1.89	2,729	0.826	0.001
^{230}Th	21.4	276.9	0.826	0.064
^{226}Ra + C	1.37	6.2	0.826	0.183
SU3 general area < 1.5 m bgs; therefore surface DCGLs apply.			Σ SOF	**0.568**

The average contaminant concentrations for the trenches were determined using the soil samples from the bagged material and the systematic sampling within the trenches excluding the samples from any elevated areas. The average contaminant concentrations for the balance of the survey unit were calculated using the systematic and biased samples taken in the survey unit, also excluding any samples taken from elevated areas.

To complete the EMC evaluation, the SOF contribution to the survey unit from the 4 elevated areas was calculated using the equation from Section 4.4. The SOF contribution to SU3 from each of these areas is summarized in Table 7-27 through Table 7-30.

Table 7-27 SU3 Area 1 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	26.9	65.9	8.03	2.18	0.003
^{238}U + D	38.7	8,658	8.48	1.98	0.000
^{234}U	140.2	6,113	8.48	1.98	0.000
^{230}Th	80.1	97.9	131.0	17.8	0.014
^{226}Ra + C	80.6	51.2	3.75	1.29	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.				ΣSOF_1	**0.018**

Table 7-28 SU3 Area 2 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	27.2	65.9	17.2	2.18	0.008
^{238}U + D	38.8	8,658	13.0	1.98	0.000
^{234}U	142.5	6,113	13.0	1.98	0.000
^{230}Th	81.4	97.9	126.0	17.8	0.014
^{226}Ra + C	81.9	51.2	4.99	1.29	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.				ΣSOF_2	**0.023**

Table 7-29 SU3 Area 3 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	28.7	65.9	12.0	2.18	0.005
^{238}U + D	38.8	8,658	12.3	1.98	0.000
^{234}U	154.2	6,113	12.3	1.98	0.000
^{230}Th	87.5	97.9	148	17.8	0.015
^{226}Ra + C	87.0	51.2	4.43	1.29	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.				ΣSOF_3	**0.021**

Table 7-30 SU3 Area 4 SOF Summary

	AF_i	$DCGL_{w,i}$	C_i	δ_i	SOF_i
^{232}Th + C	16.4	65.9	9.39	2.18	0.007
^{238}U + D	36.7	8,658	6.29	1.98	0.000
^{234}U	72.2	6,113	6.29	1.98	0.000
^{230}Th	44.9	97.9	96.8	17.8	0.018
^{226}Ra + C	45.2	51.2	3.74	1.29	0.001
EMC > 1.5 m bgs; therefore subsurface DCGLs apply.				ΣSOF_4	**0.026**

The collective SOF for SU3 is summarized in Table 7-31. The total SOF for SU3 including the contribution from all elevated areas was 0.698, well below unity.

Table 7-31 SU3 Elevated Measurement Comparison SOF Results

Survey Unit Component	SOF_{SU2} Contribution
SU2 – Systematic	0.568
SU2 – Trenches	0.042
Area 1	0.018
Area 2	0.023
Area 3	0.021
Area 4	0.026
ΣSOF_{SU3}	**0.698**

7.6.5 Deviations from the FSSP

It should be noted that the FSS protocols were deviated in a couple of instances within SU3 as follows, specifically for geoprobing the centerline of the trenches. This was done based upon safety considerations. Due to the depth of many of the sample locations, greater than 10 feet bgs, it was not necessary to Geoprobe®; however at those location that were less than 10 feet bgs within the trenches, they could not be safely accessed using the Geoprobe®.

The bottoms of the trenches consisted of very hard virgin clay that was difficult to excavate or Geoprobe®. There was a very clear visual and physical delineation once the bottoms of the trenches were reached. Additionally, most of the samples along the centerline of the trenches were well below the SOF of unity for site release. As an alternative, sample locations that did show some activity, specifically those at or near an SOF of unity were sampled below the surface by hand, using a pick ax, to obtain the sample.

A second deviation from the FSS protocols was for the Geoprobe® sample analyses themselves. The top 6 inches were not sampled as the surface soils were already sampled. Additionally, the full length of each Geoprobe® was analyzed in 2-foot composites rather than scanning the tubes and analyzing the highest 1 foot composite.

The last deviation was for Geoprobe® sampling at each biased sample location outside the trenches. Based upon the biased sample results, no elevated activity was identified with the exception of one area encompassing biased samples 4 through 6. This area was investigated in the field and 6 to 8 inches removed using the excavator at several locations. At each location, the subsurface soils were scanned using the NaI(tl) detector and it was confirmed that the surface scans were consistent with background.

7.6.6 Sign Test

A total of 12 systematic measurements were taken on a triangular grid throughout the area and 36 along the centerline of the trenches. According to MARSSIM Table I.3, the critical value based upon 48 measurement locations with a 5% decision error is thirty (30). After subtracting the individual measurement SOFs from unity, there were a total of 45 positive values which exceeds the critical value.

7.6.7 Conclusions

Based upon the survey and sample results as presented for SU3, the survey unit meets both the sign and EMC tests and is suitable for unconditional release based upon the intent of MARSSIM. The total SOF for SU3 as demonstrated is 0.698 for a total residual dose of approximately 17.5 mrem to an average member of the critical group.

It should be noted that this is based upon gross activities and does not take into affect any contribution from background. As a result, any reported residual dose is conservative.

7.7 Survey Unit 4 (SU4)

A summary of the FSS Results for Survey Unit 4 are provided as follows:

7.7.1 SU1 Walkover Survey

Upon mobilization, the areas outside the fence, SU4, were surveyed. The scan results are provided in Figure 7-14. A 100% scan was performed to the maximum extent practical; however, due to GPS plotting capabilities, survey unit topography, survey references and the scan methodology (poling measurements every second), small void areas as depicted by the color white will be present in the figure. No areas of concern were identified. Included within this figure is a histogram and data set statistics for the entire walkover scan of SU4.

7.7.2 Surface Soil Sampling and Results

Following the final walkover scan of the area, the survey unit was sampled and all samples analyzed on site. Surface soil samples (0-6") were collected throughout the area in accordance with the Final Status Survey Protocols. Random samples were collected throughout SU4 with 20 taken between Bush Creek and the BDS and 11 samples around the remaining perimeter. One biased sample was collected at the drain outfall from the drain which transects the site across SU2. In accordance with the Project Work Plan, all samples taken between the BDS and Bush Creek were shipped off-site for alpha spec analysis.

Figure 7-15 provides a summary of all the soil sampling locations as collected for SU4 with the sample analysis results presented in Table 7-32. All sample results from SU4 are consistent with background as presented in Table 7-1.

7.7.3 Subsurface Soil Sampling and Results

No subsurface samples were collected. SU4 is located outside the controlled fence and was considered Class 3.

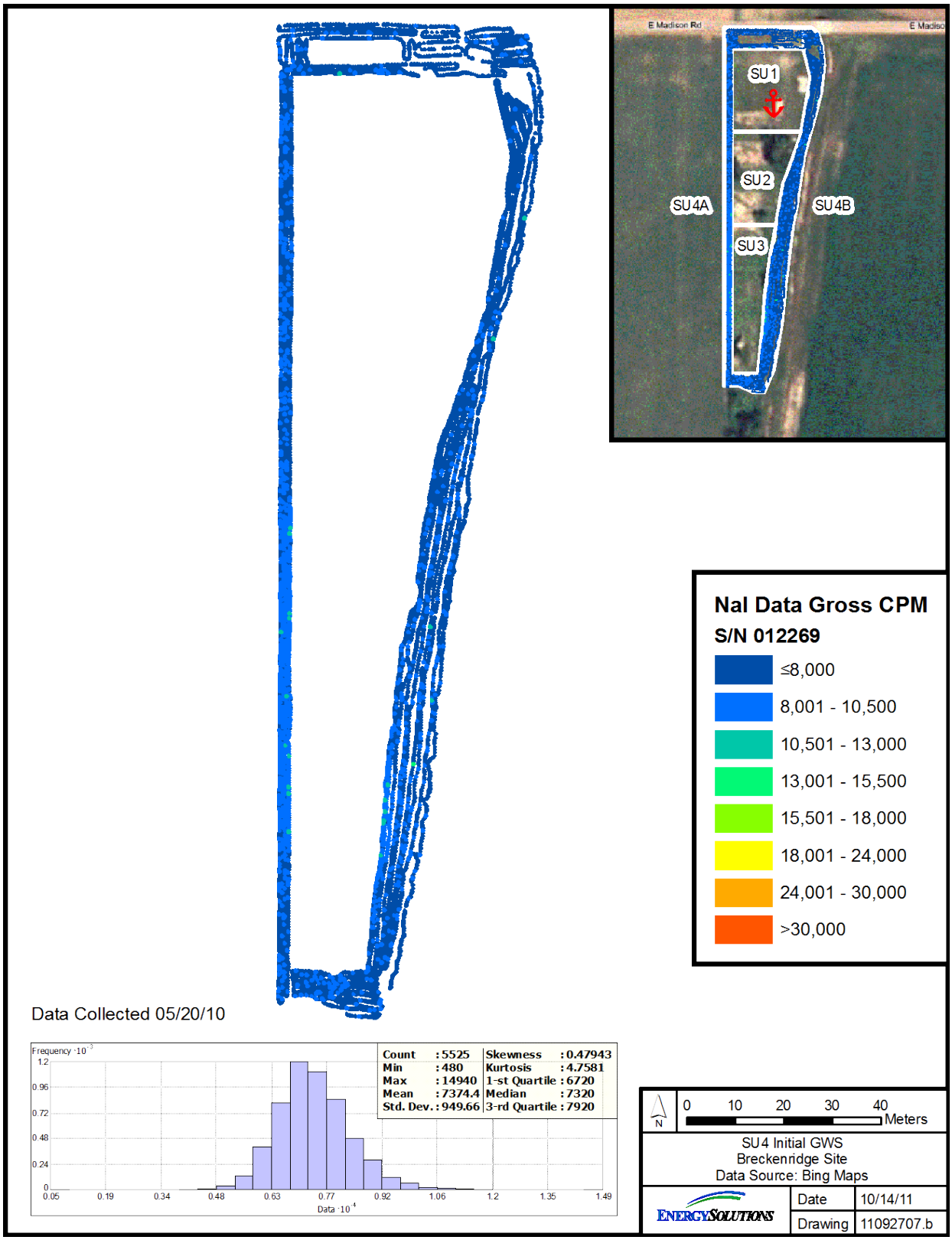


Figure 7-14 SU4 Final Status Survey – Walkover Scan

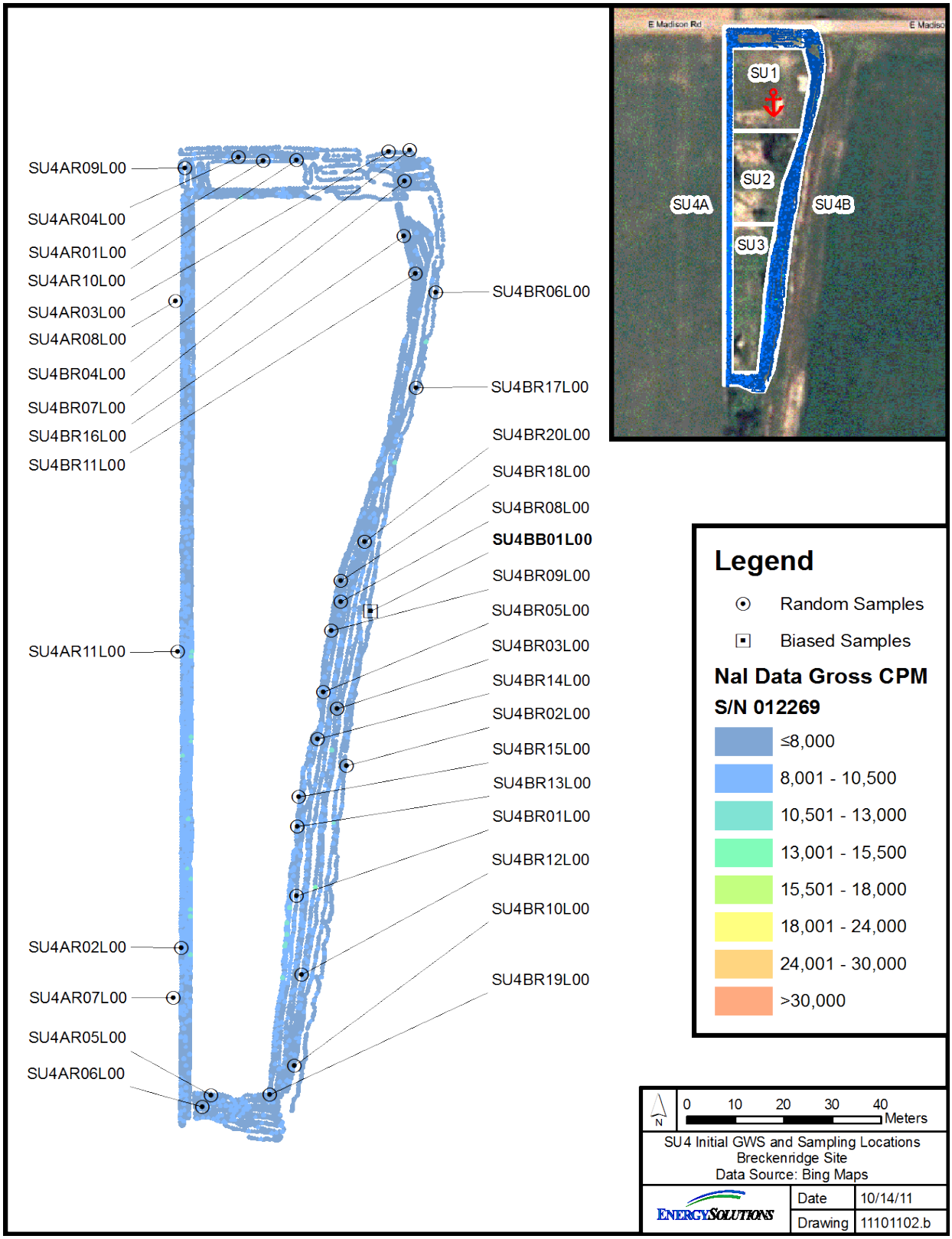


Figure 7-15 SU4 Final Status Survey – Sampling Map

Table 7-32 SU4 Soil Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
SU4AR01L00	**82**	0.000	7,913	*4.72E-01*	6.28E-01	4.29E-01	**5.27E-01**	2.30E-01	**4.29E-01**	1.62E-01	0.17
SU4AR02L00	**82**	0.000	8,467	*4.20E-01*	5.48E-01	5.22E-01	**6.90E-01**	1.01E-01	**5.22E-01**	2.20E-01	0.22
SU4AR03L00	**82**	0.000	6,335	*3.70E-01*	7.03E-01	4.91E-01	**4.73E-01**	2.03E-01	**4.91E-01**	1.11E-01	0.18
SU4AR04L00	**82**	0.000	8,102	*3.62E-01*	7.68E-01	5.48E-01	**4.23E-01**	1.15E-01	**5.48E-01**	2.40E-01	0.18
SU4AR05L00	**82**	0.000	7,674	*1.23E-01*	8.05E-01	5.33E-01	**5.43E-01**	1.14E-01	**5.33E-01**	2.71E-01	0.20
SU4AR06L00	**82**	0.000	7,340	*7.60E-01*	8.57E-01	4.61E-01	**4.33E-01**	1.10E-01	**4.61E-01**	2.18E-01	0.17
SU4AR07L00	**82**	0.000	7,763	**7.94E-01**	5.29E-01	3.77E-01	**4.76E-01**	9.84E-02	**3.77E-01**	2.69E-01	0.16
SU4AR08L00	**82**	0.000	8,032	*6.76E-01*	7.93E-01	5.97E-01	**6.15E-01**	1.04E-01	**5.97E-01**	1.97E-01	0.22
SU4AR09L00 [QC]	**82**	0.000	7,294	*3.39E-01*	7.26E-01	4.02E-01	**5.30E-01**	9.69E-02	**4.02E-01**	3.52E-01	0.17
SU4AR10L00	**83**	0.000	6,904	*3.70E-01*	6.24E-01	7.87E-01	*5.38E-01*	6.75E-01	**7.87E-01**	5.02E-01	0.25
SU4AR11L00	**83**	0.000	8,441	**8.36E-01**	5.10E-01	5.31E-01	**6.34E-01**	1.09E-01	**5.31E-01**	1.44E-01	0.21
SU4BR01L00	5	0.000	7,687	**5.30E-01**	1.00E-01	6.00E-01	*1.12E-01*	1.41E+00	**5.90E-01**	6.00E-02	0.14
SU4BR02L00	5	0.000	6,747	**5.00E-01**	5.00E-02	4.60E-01	*3.41E-01*	1.09E+00	**6.00E-01**	4.00E-02	0.18
SU4BR03L00	5	0.000	7,624	**5.00E-01**	4.00E-02	6.10E-01	**1.70E+00**	1.56E+00	**5.00E-01**	6.00E-02	0.38
SU4BR04L00	5	0.000	6,370	**4.10E-01**	7.00E-02	5.00E-01	*4.56E-01*	1.24E+00	**4.60E-01**	3.00E-02	0.17
SU4BR05L00	5	0.000	7,629	**5.20E-01**	7.00E-02	5.10E-01	*8.85E-01*	1.73E+00	**5.10E-01**	4.00E-02	0.25
SU4BR06L00	5	0.000	6,858	**5.00E-01**	6.00E-02	7.20E-01	*8.02E-01*	1.16E+00	**5.50E-01**	5.00E-02	0.24
SU4BR07L00	5	0.000	6,741	**5.00E-01**	6.00E-02	6.40E-01	*1.59E+00*	1.66E+00	**6.70E-01**	5.00E-02	0.39
SU4BR08L00	5	0.000	7,597	**4.90E-01**	9.00E-02	1.24E+00	*9.60E-01*	1.27E+00	**7.20E-01**	1.70E-01	0.30
SU4BR09L00	5	0.000	7,060	**4.10E-01**	6.00E-02	6.90E-01	*1.05E+00*	1.73E+00	**6.30E-01**	5.00E-02	0.30
SU4BR10L00	6	0.000	7,201	**4.00E-01**	9.00E-02	6.90E-01	*6.68E-01*	1.05E+00	**5.20E-01**	3.00E-02	0.22
SU4BR11L00	6	0.000	7,000	**4.60E-01**	1.00E-01	6.20E-01	*2.10E-01*	1.04E+00	**5.20E-01**	4.00E-02	0.14
SU4BR12L00	6	0.000	7,478	**4.80E-01**	5.00E-02	7.10E-01	*4.75E-01*	1.15E+00	**6.00E-01**	6.00E-02	0.20
SU4BR13L00	6	0.000	7,746	**4.70E-01**	1.00E-01	6.30E-01	*1.14E+00*	1.73E+00	**5.90E-01**	5.00E-02	0.31
SU4BR14L00 [QC]	6	0.000	7,962	**5.60E-01**	7.00E-02	6.30E-01	*5.63E-01*	1.17E+00	**6.30E-01**	3.00E-02	0.22
SU4BR15L00	6	0.000	7,677	**4.80E-01**	7.00E-02	7.50E-01	*6.22E-01*	1.22E+00	**5.80E-01**	4.00E-02	0.22
SU4BR16L00	6	0.000	6,660	**3.70E-01**	1.00E-01	5.50E-01	*3.03E-01*	1.11E+00	**4.40E-01**	5.00E-02	0.14

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
SU4BR17L00	6	0.000	6,980	**5.10E-01**	8.00E-02	7.70E-01	*1.08E+00*	1.28E+00	**4.80E-01**	1.10E-01	0.27
SU4BR18L00	6	0.000	6,950	**4.00E-01**	6.00E-02	5.90E-01	*8.01E-01*	1.71E+00	**4.40E-01**	3.00E-02	0.22
SU4BR19L00	7	0.000	7,449	**3.90E-01**	8.00E-02	6.60E-01	*9.38E-01*	1.50E+00	**6.30E-01**	1.00E-02	0.28
SU4BR20L00	7	0.000	7,541	**4.80E-01**	9.00E-02	6.70E-01	*4.25E-01*	1.25E+00	**5.10E-01**	3.00E-02	0.17
SU4BB01L00	**83**	0.000	7,541	*3.14E-01*	5.48E-01	3.78E-01	**4.20E-01**	1.03E-01	**3.78E-01**	1.84E-01	0.15
		Average:		**4.75E-01**		**6.03E-01**	6.69E-01		**5.38E-01**		0.22
		Std Dev.:		**1.41E-01**		**1.61E-01**	3.56E-01		**9.50E-02**		0.07
		UCL 95%:		**7.07E-01**		**8.69E-01**	1.25E+00		**6.95E-01**		0.33
		Maximum:		**8.36E-01**		**1.24E+00**	1.70E+00		**7.87E-01**		0.39

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b ^{230}Th is assumed to be in equilibrium with ^{232}Th with a 1:1 ratio as expected in natural background.

c Highlighted values (i.e., yellow) were obtained via off-site alpha spec analysis.

d Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.7.4 Elevated Measurement Comparison

No elevated areas exceeding the DCGLs were identified.

7.7.5 Deviations from the FSSP

There were no deviations from the FSSP for the survey of SU4.

7.7.6 Sign Test

A total of 32 random measurements were taken throughout the area. According to MARSSIM Table I.3, the critical value based upon 32 measurement locations with a 5% decision error is twenty-one (21). After subtracting the individual measurement SOFs from unity, there were a total of 32 positive values which exceeds the critical value.

7.7.7 Conclusions

Based upon the survey and sample results as presented for SU4, the survey unit meets the sign test and is suitable for unconditional release based upon the intent of MARSSIM. The total SOF for SU4 as demonstrated in Table 7-32 is 0.22 for a total residual dose of approximately 5.5 mrem to an average member of the critical group.

It should be noted that this is based upon gross activities and does not take into affect any contribution from background. As a result, any reported residual dose is conservative.

7.8 Off-Site Backfill

Once site remediation had been complete and all the on-site soils placed back in the excavation, off-site soils were trucked in to backfill the site. These soils were screened in advance to ensure they did not contain any hazardous constituents prior to introducing them to the site. Additionally, one composite sample was collected for every 100 yards as it was brought on site in accordance with the project Remedial Work Plan, CS-OP-PN-042, Reference 10.3. A summary of the sample results for the off-site backfill is presented in Table 7-33. All soil samples were well below the surface DCGLs and were consistent with background levels as documented in Table 7-1.

Table 7-33 Off-Site Backfill Sampling Results

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
BF001 QC	0	0.000	NA	*4.77E-01*	8.00E-01	5.70E-01	*4.75E-01*	8.00E-01	**3.19E-01**	2.19E-01	0.14
BF002	0	0.000	NA	*3.51E-01*	1.04E+00	3.10E-01	*4.15E-01*	8.33E-01	**3.10E-01**	1.54E-01	0.13
BF003	3	0.000	NA	*3.64E-01*	1.06E+00	4.03E-01	*1.81E-01*	7.10E-01	**4.03E-01**	1.87E-01	0.11
BF004	1	0.000	NA	*1.56E-01*	9.60E-01	3.98E-01	*6.88E-01*	7.75E-01	**3.98E-01**	3.57E-01	0.19
BF005	3	0.000	NA	*6.19E-01*	1.12E+00	5.91E-01	*7.94E-01*	8.13E-01	**5.91E-01**	3.63E-01	0.25
BF006	0	0.000	NA	*5.74E-01*	9.95E-01	3.37E-01	*1.38E-01*	7.32E-01	*3.37E-01*	3.37E-01	0.09
BF007	2	0.000	NA	*2.75E-01*	1.01E+00	3.22E-01	*6.26E-01*	1.14E+00	**3.22E-01**	1.84E-01	0.17
BF008	0	0.000	NA	*4.70E-01*	1.07E+00	4.60E-01	*5.25E-01*	8.34E-01	**4.60E-01**	3.32E-01	0.18
BF009	0	0.000	NA	*6.19E-01*	1.03E+00	4.23E-01	**7.98E-01**	7.51E-01	**4.23E-01**	3.36E-01	0.22
BF010 QC	0	0.000	NA	*6.36E-01*	1.07E+00	3.54E-01	*8.68E-01*	1.16E+00	**3.54E-01**	1.88E-01	0.21
BF011	2	0.000	NA	*5.92E-01*	1.03E+00	2.27E-01	*2.78E-01*	1.08E+00	*2.27E-01*	3.20E-01	0.09
BF012	2	0.000	NA	*8.73E-01*	9.54E-01	2.45E-01	**1.10E+00**	1.08E+00	**2.45E-01**	1.76E-01	0.23
BF013	2	0.000	NA	*8.73E-02*	1.10E+00	1.91E-01	*6.19E-01*	7.31E-01	*1.91E-01*	2.20E-01	0.14
BF014	0	0.000	NA	*5.64E-01*	1.03E+00	3.46E-01	*4.54E-01*	7.77E-01	**3.46E-01**	3.40E-01	0.15
BF015	0	0.000	NA	*4.19E-01*	1.06E+00	4.23E-01	*8.50E-01*	8.67E-01	**4.23E-01**	2.16E-01	0.22
BF016	0	0.000	NA	*3.87E-01*	1.06E+00	4.10E-01	*4.93E-01*	7.98E-01	**4.10E-01**	1.98E-01	0.16
BF017	0	0.000	NA	*2.00E-01*	9.42E-01	2.72E-01	*7.79E-01*	8.42E-01	**2.72E-01**	1.54E-01	0.18
BF018	1	0.000	NA	*5.53E-01*	1.13E+00	6.59E-01	*4.40E-01*	7.10E-01	**6.59E-01**	3.85E-01	0.21
BF019	0	0.000	NA	*2.99E-01*	1.00E+00	3.51E-01	*7.26E-01*	8.86E-01	**3.51E-01**	3.48E-01	0.19
BF020	0	0.000	NA	*5.82E-01*	1.03E+00	4.66E-01	*1.02E-01*	6.97E-01	**4.66E-01**	1.87E-01	0.11
BF021	0	0.000	NA	*4.66E-01*	1.01E+00	4.78E-01	*3.09E-01*	7.75E-01	**4.78E-01**	3.60E-01	0.15
BF022	0	0.000	NA	*2.81E-01*	1.03E+00	1.41E-01	*4.64E-01*	1.16E+00	*1.41E-01*	3.17E-01	0.10
BF023 QC	0	0.000	NA	*4.45E-01*	1.10E+00	2.68E-01	*3.65E-01*	8.66E-01	**2.68E-01**	2.34E-01	0.11
BF024	0	0.000	NA	*3.31E-01*	7.26E-01	4.04E-01	*3.19E-01*	8.26E-01	**4.04E-01**	1.82E-01	0.13
BF025	0	0.000	NA	*3.24E-01*	1.04E+00	3.72E-01	*5.31E-01*	8.07E-01	**3.72E-01**	1.39E-01	0.16
BF026	0	0.000	NA	*5.88E-01*	1.13E+00	3.35E-01	*2.75E-01*	7.40E-01	**3.35E-01**	3.35E-01	0.11
BF027	0	0.000	NA	*8.21E-02*	1.00E+00	5.26E-01	*9.12E-01*	1.04E+00	**5.26E-01**	3.29E-01	0.25

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U Activity (pCi/g)	^{238}U MDA (pCi/g)	^{230}Th Activity (pCi/g)	^{226}Ra Activity (pCi/g)	^{226}Ra MDA (pCi/g)	^{232}Th Activity (pCi/g)	^{232}Th MDA (pCi/g)	SOF
BF028	0	0.000	NA	*6.32E-01*	1.08E+00	4.72E-01	*-1.90E-02*	9.02E-01	**4.72E-01**	3.63E-01	0.09
BF029	0	0.000	NA	*2.10E-01*	6.74E-01	2.32E-01	*5.76E-01*	7.92E-01	**2.32E-01**	1.91E-01	0.14
BF030	0	0.000	NA	*6.90E-01*	9.91E-01	2.75E-01	*-6.51E-02*	6.95E-01	**2.75E-01**	1.85E-01	0.05
BF031	0	0.000	NA	*2.11E-01*	7.36E-01	3.12E-01	*5.65E-01*	8.45E-01	*3.12E-01*	3.57E-01	0.16
BF032	0	0.000	NA	*7.91E-01*	1.05E+00	3.92E-01	*1.17E-01*	9.08E-01	**3.92E-01**	2.28E-01	0.10
BF033	0	0.000	NA	*3.78E-01*	1.09E+00	3.13E-01	*5.67E-01*	7.24E-01	*3.13E-01*	3.63E-01	0.16
BF034	0	0.000	NA	*7.27E-01*	1.08E+00	4.27E-01	*1.96E-01*	6.38E-01	**4.27E-01**	1.63E-01	0.12
BF035	0	0.000	NA	*3.15E-01*	7.10E-01	4.30E-01	**1.05E+00**	8.83E-01	**4.30E-01**	3.31E-01	0.26
BF036	0	0.000	NA	*9.32E-01*	1.09E+00	4.21E-01	*1.07E+00*	1.14E+00	**4.21E-01**	3.19E-01	0.26
BF037	0	0.000	NA	*4.24E-01*	1.01E+00	2.12E-01	*3.32E-01*	7.09E-01	*2.12E-01*	3.38E-01	0.10
BF038	0	0.000	NA	*5.79E-02*	7.33E-01	6.72E-01	*6.57E-01*	6.74E-01	**6.72E-01**	3.56E-01	0.24
BF039 [QC]	0	0.000	NA	*5.77E-01*	1.07E+00	4.70E-01	*4.77E-01*	9.48E-01	*3.10E-01*	3.41E-01	0.14
BF040	0	0.000	NA	*3.14E-01*	1.01E+00	3.69E-01	*6.20E-01*	8.56E-01	**3.69E-01**	3.29E-01	0.18
BF041 [QC]	0	0.000	NA	*1.50E-01*	8.96E-01	3.01E-01	*7.90E-01*	8.72E-01	**3.01E-01**	1.99E-01	0.19
BF042	1	0.000	NA	*1.31E-01*	6.95E-01	3.88E-01	*7.34E-01*	7.45E-01	**3.88E-01**	1.96E-01	0.20
		Average:		4.32E-01		3.80E-01	5.28E-01		**3.70E-01**		0.16
		Std Dev.:		2.18E-01		1.18E-01	2.88E-01		**1.14E-01**		0.05
		UCL 95%:		7.90E-01		5.74E-01	1.00E+00		**5.57E-01**		0.25
		Maximum:		8.73E-01		5.91E-01	1.10E+00		**5.91E-01**		0.25

Notes:

a Bold values are values greater than MDA; italics are less than MDA.

b ^{230}Th is assumed to be in equilibrium with ^{232}Th with a 1:1 ratio as expected in natural background.

c Highlighted ^{230}Th values (i.e., yellow) were obtained via off-site alpha spec analysis.

d Samples denoted with a QC were included in the on-site and/or off-site QC analyses. QC results are presented in Section 8.0.

7.9 Final Site Survey

Following the complete backfill of the site and upon re-grading, the site received a final survey in accordance with the Remedial Work Plan as follows:

7.9.1 BDS Walkover Survey

A 100% walkover survey was performed inside the fence along with some of the surrounding areas to close out the project. This was performed to document the as left condition of the site and to ensure nothing was overlooked during site remediation. The scan results for this final walkover are provided in Figure 7-16. Included within this figure is a histogram and data set statistics for the entire walkover scan.

7.9.2 Surface Soil Sampling and Results

Four surface samples were collected following the final site walkover survey. These samples were collected for due diligence to investigate the couple of slightly elevated areas as identified in the scan; however, it should be noted that these areas were well below the action levels for surface soils. Figure 7-17 shows the locations where these samples were collected and the results provided in Table 7-34. Sample 1 was collected within SU1 in the vicinity where the one waste bag was repackaged for shipment as waste. Samples 2 through 4 were collected along the east boundary of SU3. All samples were below the release criteria and consistent with the sample activities as presented earlier for each survey unit.

7.9.3 Subsurface Soil Sampling and Results

No subsurface samples were required or collected.

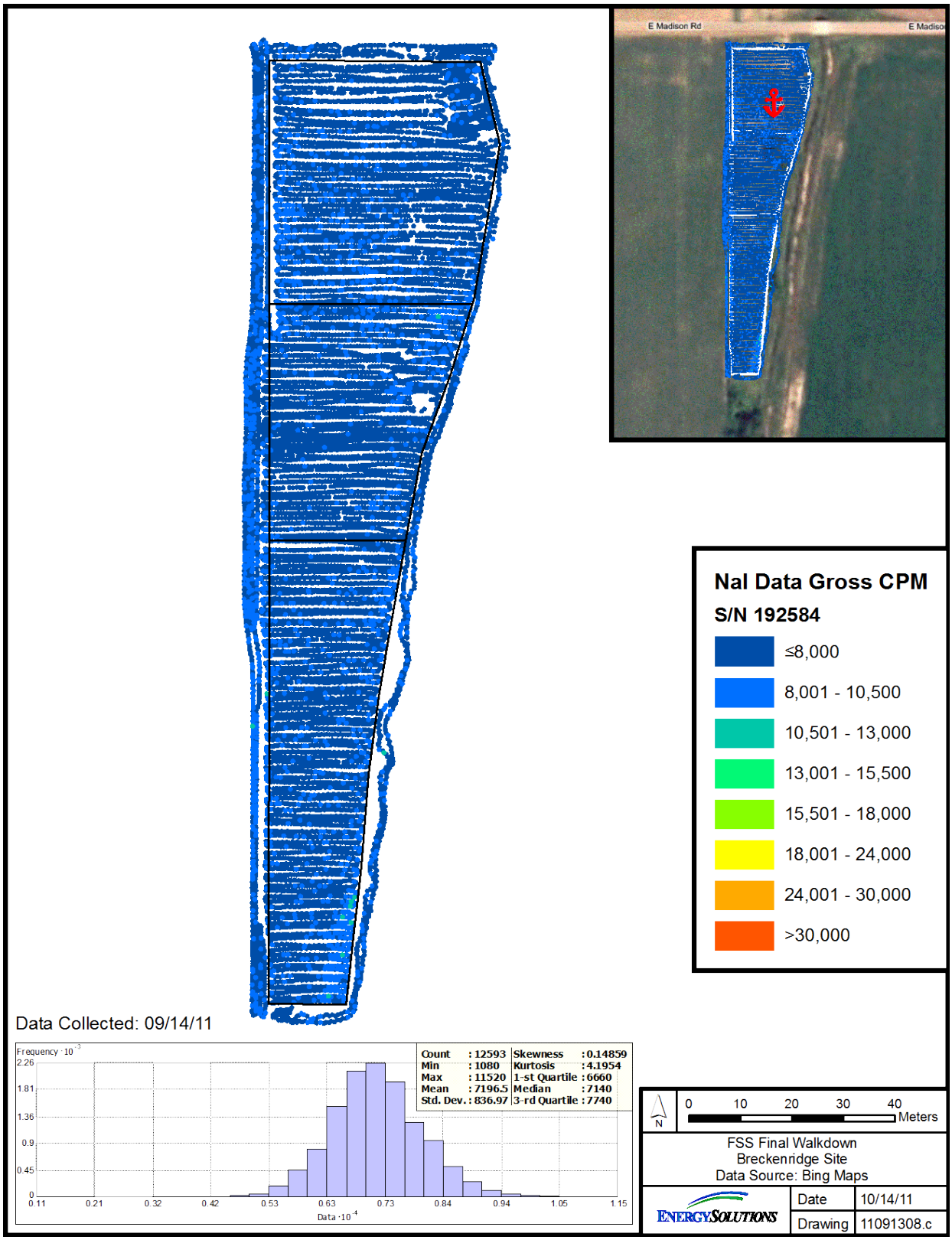


Figure 7-16 BDS Final Status Survey – Walkover Scan

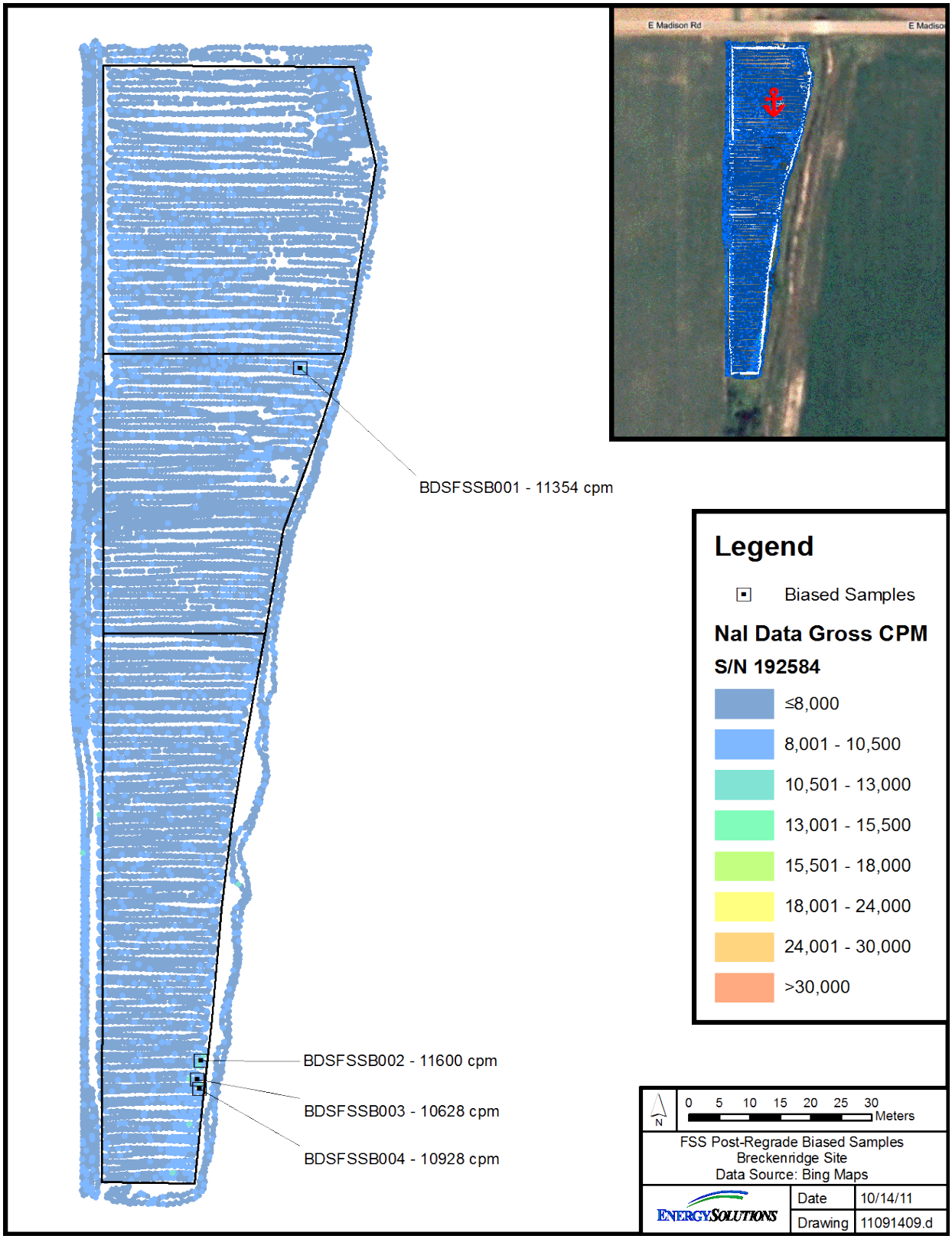


Figure 7-17 BDS Final Status Survey - Sampling Map

Table 7-34 BDS Final Grade Sampling Results - Biased

Sample ID	In-growth (days)	Depth (feet)	In- Situ Count Rate (cpm)	^{238}U		^{230}Th	^{226}Ra		^{232}Th		SOF
				Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	Activity (pCi/g)	MDA (pCi/g)	
BDSFSSB001	0	0.000	11,354	*5.50E-01*	1.34E+00	2.05E+01	*1.00E+00*	2.02E+00	**2.09E+00**	3.25E-01	0.66
BDSFSSB002	0	0.000	11,600	**2.15E+00**	1.46E+00	2.32E+01	*1.35E+00*	1.73E+00	**2.36E+00**	3.66E-01	0.78
BDSFSSB003	0	0.000	10,628	*1.19E+00*	1.38E+00	1.45E+01	*3.18E-03*	1.28E+00	**1.48E+00**	2.66E-01	0.35
BDSFSSB004	0	0.000	10,928	**1.98E+00**	1.16E+00	1.54E+01	*1.02E+00*	1.30E+00	**1.57E+00**	3.21E-01	0.54

Notes:
a Bold values are values greater than MDA; italics are less than MDA.
b ^{232}Th was calculated via surrogate as specified in Section 4.2.

8.0 QA/QC RESULTS

8.1 QA/QC Testing Criteria

To ensure data quality, sample splits and duplicates were analyzed on-site and samples shipped for off-site analysis. As a minimum, 5% of all FSS samples had sample splits and/or duplicates analyzed on-site as well as 5% sent for off-site analysis. There were a total of 600 FSS samples collected and analyzed including the Geoprobe® composite samples. A total of 39 on-site splits and/or duplicates were analyzed and 29 shipped for off-site gamma spec analysis and 62 for isotopic thorium via alpha spec. All QA samples were evaluated using the Relative Percent Difference (RPD) method as applicable with a goal of an RPD of less than or equal to 50% for samples with activity less than 5 times the MDA and 30% for those samples with higher activity. Samples analyzed using different analytical techniques, i.e. gamma spec versus alpha spec, were not compared using the RPD due to the inherent differences. The off-site alpha spec analyses were reviewed for ^{232}Th activity to ensure they were consistent with the on-site gamma spec results as quantified using ^{228}Ac.

The RPD was calculated using the equation below.

$$\%RPD = \frac{|S_1 - S_2|}{\overline{S}} \times 100$$

Where: S_1 = the value for the off-site sample result (pCi/g), and
S_2 = the value for the on-site sample result (pCi/g).

In order to properly utilize the RPD method, care must be taken in interpreting the results depending upon the analysis routines performed. Differences in the analytical routines such as the way the peaks are analyzed can amplify these differences. Additionally, additional error may be introduced if the samples are re-processed or different geometries and volumes are used. Summaries of the QA/QC results for the gamma spec analyses are provided as follows.

8.2 On-Site QC

The on-site QC results are provided in Table 8-1. Three analytes were reviewed per sample analysis, ^{238}U via ^{234}Th, ^{232}Th via ^{228}Ac, and ^{226}Ra. There were a total of 10 failures out of 117 total comparisons, under 10%, using the RPD method; however, it should be noted that 9 of these 10 failures resulted when trying to compare two values, each of which were below the MDA. None of the ^{232}Th results failed, with ^{232}Th being the most limiting radionuclide at the BDS and the easiest to detect using the gamma spec analysis with the least interference. All samples with measureable activity greater than MDA passed with the exception of one. This sample failed for ^{226}Ra with and RPD of 59%, slightly above the test criteria of 50%. It should also be noted that ^{226}Ra is the most difficult to quantify in the field using gamma spec analysis due to interference from ^{235}U, especially when not allowing for daughter in-growth by sealing the sample for 30 days prior to analysis.

Table 8-1 On-Site QA Samples

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
BKGD09	*2.30E-01*	8.70E-01	**6.10E-01**	1.25E-01	**6.75E-01**	2.00E-01
BKGD09D	*4.01E-01*	5.90E-01	**5.67E-01**	9.75E-02	**6.28E-01**	2.77E-01
RPD	54.1%		7.4%		7.1%	
Pass / Fail	**Fail**		Pass		Pass	
BGS0106005	**7.10E+00**	4.06E+00	*3.33E+00*	5.33E+00	**9.85E+00**	8.44E-01
BGS0106005S	**8.04E+00**	4.10E+00	*1.50E+00*	3.59E+00	**9.65E+00**	7.05E-01
RPD	12.4%		75.8%		2.1%	
Pass / Fail	Pass		**Fail**		Pass	
BGS1923003	*2.67E+00*	3.54E+00	**3.35E+00**	2.97E+00	**6.10E+00**	7.20E-01
BGS1923003D	*1.63E+00*	3.76E+00	**4.28E+00**	3.59E+00	**5.77E+00**	7.05E-01
RPD	48.2%		24.2%		5.4%	
Pass / Fail	Pass		Pass		Pass	
SU3OB011	*4.82E-01*	6.27E-01	**7.41E-01**	1.23E-01	**1.14E+00**	1.93E-01
SU3OB011D	**6.84E-01**	5.77E-01	**7.69E-01**	1.23E-01	**9.99E-01**	2.73E-01
RPD	34.7%		3.6%		13.5%	
Pass / Fail	Pass		Pass		Pass	
SU2OB024	**1.39E+00**	7.65E-01	**1.27E+00**	1.23E+00	**1.77E+00**	1.91E-01
SU2OB024S	**1.64E+00**	7.79E-01	*9.36E-01*	1.56E+00	**1.87E+00**	2.51E-01
RPD	16.3%		30.6%		5.8%	
Pass / Fail	Pass		Pass		Pass	
SU2OB027	**1.54E+00**	7.88E-01	**1.52E+00**	1.33E+00	**1.68E+00**	3.08E-01
SU2OB027D	**9.37E-01**	8.04E-01	**8.19E-01**	1.39E-01	**1.64E+00**	2.75E-01
RPD	48.9%		59.8%		2.5%	
Pass / Fail	Pass		**Fail**		Pass	
SU2OB038	**9.91E-01**	8.19E-01	*5.94E-01*	1.03E+00	**5.77E-01**	2.46E-01
SU2OB038D	*6.72E-01*	8.40E-01	*4.34E-01*	8.47E-01	**5.63E-01**	2.20E-01
RPD	38.4%		31.2%		2.4%	
Pass / Fail	Pass		Pass		Pass	
SU2OB051	**7.46E-01**	6.40E-01	*5.45E-01*	8.07E-01	**7.16E-01**	2.49E-01
SU2OB051S	*5.85E-01*	6.10E-01	**5.61E-01**	1.11E-01	**8.50E-01**	1.94E-01
RPD	24.2%		2.9%		17.1%	
Pass / Fail	Pass		Pass		Pass	
SU2OB067	*2.66E-01*	4.70E-01	**8.78E-01**	7.52E-01	**6.32E-01**	1.49E-01
SU2OB067S	*4.80E-01*	8.18E-01	**5.52E-01**	1.04E-01	**5.73E-01**	1.55E-01
RPD	57.3%		45.5%		9.8%	
Pass / Fail	**Fail**		Pass		Pass	
SU2OB080	*5.26E-01*	6.90E-01	*7.42E-01*	8.47E-01	**5.61E-01**	2.34E-01
SU2OB080S	*5.63E-01*	6.27E-01	**7.05E-01**	9.45E-02	**6.96E-01**	2.40E-01
RPD	6.9%		5.0%		21.5%	
Pass / Fail	Pass		Pass		Pass	

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
SU1FSSS009	**9.50E-01**	7.86E-01	*3.08E-01*	2.18E+00	**4.90E-01**	2.77E-01
SU1FSSS009D	*9.84E-01*	1.20E+00	*3.02E-01*	9.56E-01	**4.77E-01**	2.45E-01
RPD	3.6%		1.9%		2.6%	
Pass / Fail	Pass		Pass		Pass	
SU1FSSS001A	*5.89E-01*	1.13E+00	**1.16E+00**	1.11E+00	**4.89E-01**	1.74E-01
SU1FSSS001AD	*7.40E-01*	1.00E+00	*7.47E-01*	9.39E-01	**5.50E-01**	1.82E-01
RPD	22.7%		43.5%		11.7%	
Pass / Fail	Pass		Pass		Pass	
SU1FSSS003C	*1.08E+00*	2.05E+00	*9.08E-01*	1.46E+00	*5.17E-01*	7.27E-01
SU1FSSS003CS	*1.07E+00*	1.77E+00	*1.41E+00*	1.95E+00	*5.22E-01*	5.37E-01
RPD	1.1%		43.7%		1.1%	
Pass / Fail	Pass		Pass		Pass	
SU1FSSS008A	*2.06E-01*	1.28E+00	*1.42E+00*	1.59E+00	**8.10E-01**	6.38E-01
SU1FSSS008AS	*6.27E-01*	1.95E+00	**1.46E+00**	1.43E+00	*5.20E-01*	5.37E-01
RPD	101.1%		2.9%		43.5%	
Pass / Fail	**Fail**		Pass		Pass	
SU1FSSB003C	*3.89E-01*	1.12E+00	**8.87E-01**	8.85E-01	**5.41E-01**	1.77E-01
SU1FSSB003CD	*1.63E-01*	8.17E-01	*6.95E-01*	9.98E-01	**4.79E-01**	1.87E-01
RPD	81.9%		24.2%		12.1%	
Pass / Fail	**Fail**		Pass		Pass	
SU2FSSB001	**1.35E+00**	7.14E-01	**1.83E+00**	1.20E+00	**8.27E-01**	2.57E-01
SU2FSSB001S	**1.54E+00**	7.14E-01	**1.66E+00**	1.20E+00	**1.31E+00**	2.57E-01
RPD	13.2%		10.1%		45.3%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA1B02	**2.60E+00**	1.07E+00	*1.15E+00*	1.44E+00	**1.21E+00**	4.08E-01
SU2CWA1B02S	**2.80E+00**	1.06E+00	*1.43E+00*	1.46E+00	**1.11E+00**	3.18E-01
RPD	7.3%		21.4%		9.3%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA2B03	**1.07E+01**	2.67E+00	**5.27E+00**	3.58E+00	**1.43E+01**	7.52E-01
SU2CWA2B03S	**9.36E+00**	2.48E+00	**4.69E+00**	2.97E+00	**1.14E+01**	7.40E-01
RPD	13.2%		11.7%		22.6%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA3B05	**3.30E+00**	2.38E+00	**1.00E+01**	3.10E+00	**8.74E+00**	8.71E-01
SU2CWA3B05S	**2.83E+00**	1.79E+00	**1.04E+01**	3.18E+00	**6.87E+00**	6.70E-01
RPD	15.2%		3.5%		24.0%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA1B04A	**3.12E+00**	1.25E+00	*1.45E+00*	1.63E+00	**1.03E+00**	6.77E-01
SU2CWA1B04AS	**3.28E+00**	1.07E+00	*1.39E+00*	1.44E+00	**1.12E+00**	3.38E-01
RPD	4.9%		3.9%		8.0%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA2B03B	*5.83E-01*	1.06E+00	*7.27E-01*	1.10E+00	**1.28E+00**	3.28E-01
SU2CWA2B03BD	*8.25E-01*	1.35E+00	*4.49E-01*	1.11E+00	**9.56E-01**	3.12E-01
RPD	34.4%		47.3%		28.7%	
Pass / Fail	Pass		Pass		Pass	

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
SU2CWA8B03A	*5.87E-01*	1.24E+00	*4.94E-01*	1.13E+00	*4.97E-01*	5.98E-01
SU2CWA8B03AS	*5.07E-01*	1.28E+00	*4.66E-01*	8.90E-01	**5.69E-01**	2.80E-01
RPD	14.6%		5.8%		13.5%	
Pass / Fail	Pass		Pass		Pass	
SU2CWAAB03A	*4.37E-01*	1.11E+00	**5.54E-01**	1.32E-01	**5.32E-01**	2.84E-01
SU2CWAAB03AS	*6.33E-01*	6.48E-01	*7.59E-01*	9.12E-01	*5.57E-01*	6.41E-01
RPD	36.5%		31.3%		4.6%	
Pass / Fail	Pass		Pass		Pass	
SU2CWABB04A	*1.00E+00*	1.17E+00	*5.56E-01*	1.29E+00	**1.06E+00**	6.10E-01
SU2CWABB04AS	*6.86E-01*	8.18E-01	*5.92E-01*	1.16E+00	**6.42E-01**	3.36E-01
RPD	37.7%		6.3%		49.2%	
Pass / Fail	Pass		Pass		Pass	
SU2FSSS002A	*7.43E-01*	1.18E+00	*5.37E-01*	1.35E+00	**8.77E-01**	3.73E-01
SU2FSSS002AS	*8.16E-01*	8.37E-01	*3.82E-01*	1.19E+00	**9.03E-01**	4.21E-01
RPD	9.3%		33.6%		2.8%	
Pass / Fail	Pass		Pass		Pass	
SU2FSSS011A	*5.92E-01*	8.29E-01	*4.00E-01*	1.13E+00	**6.87E-01**	3.36E-01
SU2FSSS011AS	*8.23E-01*	1.23E+00	*5.12E-01*	9.37E-01	**6.71E-01**	3.41E-01
RPD	32.7%		24.5%		2.3%	
Pass / Fail	Pass		Pass		Pass	
SU3FSSS011	**9.27E-01**	7.89E-01	**1.80E+00**	1.32E+00	**1.43E+00**	3.29E-01
SU3FSSS011S	*5.98E-01*	6.77E-01	**1.33E+00**	1.06E+00	**1.38E+00**	3.01E-01
RPD	43.1%		30.2%		3.5%	
Pass / Fail	Pass		Pass		Pass	
SU3FSSB006	**6.14E+00**	1.80E+00	**2.91E+00**	2.30E+00	**6.38E+00**	5.48E-01
SU3FSSB006S	**5.53E+00**	1.90E+00	*2.18E+00*	2.34E+00	**6.85E+00**	4.32E-01
RPD	10.3%		28.8%		7.2%	
Pass / Fail	Pass		Pass		Pass	
SU3CWA4B03	**9.28E+00**	2.63E+00	**6.45E+00**	3.32E+00	**1.43E+01**	7.71E-01
SU3CWA4B03S	**9.67E+00**	2.31E+00	**6.08E+00**	3.69E+00	**1.38E+01**	7.15E-01
RPD	4.2%		6.0%		3.4%	
Pass / Fail	Pass		Pass		Pass	
SU3CWA5B07	**4.49E+00**	1.34E+00	*8.02E-01*	1.82E+00	**8.41E-01**	3.77E-01
SU3CWA5B07S	**4.40E+00**	1.36E+00	*1.40E+00*	1.49E+00	**7.89E-01**	3.95E-01
RPD	2.1%		54.4%		6.4%	
Pass / Fail	Pass		**Fail**		Pass	
SU3CWA7B03	**3.47E+00**	9.59E-01	*1.19E+00*	1.42E+00	**9.74E-01**	3.21E-01
SU3CWA7B03S	**3.31E+00**	9.33E-01	*1.27E+00*	1.54E+00	**9.36E-01**	4.19E-01
RPD	4.8%		6.8%		4.0%	
Pass / Fail	Pass		Pass		Pass	
SU3FSSS003C	*5.77E-01*	1.14E+00	*5.01E-01*	1.55E+00	*3.82E-01*	5.91E-01
SU3FSSS003CS	*8.94E-01*	1.10E+00	*8.65E-01*	1.18E+00	*3.06E-01*	6.05E-01
RPD	43.1%		53.3%		22.1%	
Pass / Fail	Pass		**Fail**		Pass	

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
SU3FSSS008A	*8.47E-01*	1.27E+00	*1.23E+00*	1.84E+00	**9.30E-01**	3.37E-01
SU3FSSS008AS	**9.15E-01**	8.12E-01	**1.10E+00**	1.04E+00	**8.17E-01**	3.57E-01
RPD	7.7%		11.4%		12.9%	
Pass / Fail	Pass		Pass		Pass	
SU3FSSS011A	*5.72E-01*	7.62E-01	**5.34E-01**	1.33E-01	**4.57E-01**	3.28E-01
SU3FSSS011AS	*5.85E-01*	1.12E+00	**4.94E-01**	3.00E-01	**6.28E-01**	3.37E-01
RPD	2.4%		7.8%		31.5%	
Pass / Fail	Pass		Pass		Pass	
SU4BR14L00	*4.21E-01*	1.16E+00	*5.63E-01*	1.17E+00	*5.85E-01*	6.03E-01
SU4BR14L00S	*4.98E-01*	8.72E-01	**4.92E-01**	1.65E-01	**6.66E-01**	2.25E-01
RPD	16.7%		13.5%		12.9%	
Pass / Fail	Pass		Pass		Pass	
SU4AR09L00	*3.39E-01*	1.19E+00	*5.30E-01*	1.73E+00	*4.02E-01*	5.88E-01
SU4AR09L00D	*3.53E-01*	5.89E-01	**5.25E-01**	1.06E-01	**5.18E-01**	1.35E-01
RPD	3.8%		0.8%		25.3%	
Pass / Fail	Pass		Pass		Pass	
BF010	*6.36E-01*	1.07E+00	*8.68E-01*	1.16E+00	**3.54E-01**	1.88E-01
BF010S	*7.47E-01*	1.09E+00	*5.69E-01*	6.60E-01	**4.00E-01**	1.57E-01
RPD	16.1%		41.6%		12.2%	
Pass / Fail	Pass		Pass		Pass	
BF023	*4.45E-01*	1.10E+00	*3.65E-01*	8.66E-01	**2.68E-01**	2.34E-01
BF023S	*4.69E-01*	1.11E+00	*6.92E-01*	1.03E+00	**3.58E-01**	2.21E-01
RPD	5.3%		61.9%		28.7%	
Pass / Fail	Pass		**Fail**		Pass	
BF041	*1.50E-01*	8.96E-01	*7.90E-01*	8.72E-01	**3.01E-01**	1.99E-01
BF041D	*4.51E-01*	1.08E+00	**9.33E-01**	8.51E-01	**3.15E-01**	2.20E-01
RPD	100.2%		16.6%		4.6%	
Pass / Fail	**Fail**		Pass		Pass	

Notes:
a Bold values are values greater than MDA; italics are less than MDA

8.3 Off-Site QC

A summary of the off-site QC results is provided in Table 8-2. As with the on-site analyses, three analytes were reviewed per sample, ^{238}U via ^{234}Th, ^{232}Th via ^{228}Ac, and ^{226}Ra. There were a total of 20 failures out of 87 total comparisons, just under 25%, using the RPD method; however, it should be noted as stated earlier, that caution must be taken when using the RPD method when interpreting the results. Upon discussion with the off-site laboratory, there were inherent differenced that may have introduced additional error affecting the RPD results. The off-site laboratory reprocessed the samples using a smaller volume than used on-site and there were other differences in the way the data was processed. These are discussed as follows as they pertain to each analyte.

Of the 29 samples shipped for off-site QC analysis, there were 11 that failed the RPD test for ^{238}U as quantified from ^{234}Th. Four of the 11 failures resulted when trying to compare values where either one or both values were below the MDA. Additionally, based upon discussion with the off-site laboratory, the ^{234}Th activity as reported is biased high due to the ^{228}Ac contribution to the 93 keV peak for ^{234}Th as they did not deconvolute the peak. In the presence of elevated ^{232}Th activity, the 93 keV peak of ^{234}Th will result in higher reported values for ^{234}Th due to interference from ^{228}Ac [1]. As part of the on-site laboratory analyses, these peaks were deconvoluted to remove any ^{228}Ac contribution to more accurately report the ^{234}Th activity. As part of the investigation, the off-site laboratory ALS Laboratory Group was asked to perform a deconvolution calculation on sample SU3FSSB006 from SU3. The deconvoluted activity was 7.0 pCi/g rather than the 8.9 pci/g as reported. This resulted in an approximate overestimation of the activity by approximately 27%. Taking this into account and assuming the percent error is consistent, only one sample would fail the RPD test with a result of 56% slightly higher than the 50% criteria. Additionally, in order to bound the impact between the laboratory discrepancies for ^{238}U, assuming an increase in the on-site ^{238}U values of up to 100%, (i.e., doubling of the reported ^{238}U results), there would be no impact to the overall dose as the primary drivers of dose at the site are ^{232}Th and ^{226}Ra.

Of the 29 samples, there were 7 that failed the RPD test for ^{226}Ra. It should be noted that the off-site laboratory allowed for the in-growth of the ^{226}Ra daughters by holding the "sealed" samples approximately 30 days prior to sample analysis by gamma spec and quantified the ^{226}Ra activity from the ^{214}Pb and ^{214}Bi peaks which provide much more accurate results. Alternatively, the on-site samples were analyzed within a few days of collection and could not be quantified from its daughter products because they were not in equilibrium. The ^{226}Ra activity was quantified by deconvoluting the 186 keV peak and will typically be overestimated due to the presence ^{235}U. Although the amount of ^{235}U is low, the high 186 keV yield (approximately 54%), will result in an overestimation of ^{226}Ra, especially, when there is any significant amount of Uranium present. Upon review of the on-site results which were analyzed close to complete ingrowth, the reported ^{214}Pb and ^{214}Bi activities were well within an RPD

[1] E-mail correspondence between Lance Steere (ALS Global) and Michael Carr (Energy*Solutions*); Subject: FW: Gamma Spec Analysis, questions from Energy*Solutions*; January 25th 2011.

of 50%. Because the on-site analyses for ^{226}Ra were based off the 186 keV peak, it should be noted that the ^{226}Ra values as reported in this report were generally biased high. This would result in a conservative estimate of any dose as contributed to a member of the critical group due to any residual ^{226}Ra activity on site.

Lastly, of the 29 samples, there were 2 that failed the RPD test for ^{232}Th as quantified from ^{228}Ac. Both of these failures resulted when trying to compare values where either one or both values were below the MDA.

Table 8-2 Off-Site QA Samples

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
BGS0106005	**7.10E+00**	4.06E+00	*3.33E+00*	5.33E+00	**9.85E+00**	8.44E-01
BGS0106005OS	**8.60E+00**	6.60E+00	**2.87E+00**	7.70E-01	**1.18E+01**	1.10E+00
RPD	19.1%		14.9%		18.0%	
Pass / Fail	Pass		Pass		Pass	
BGS1318006	*1.25E+00*	3.92E+00	**5.35E+00**	3.83E+00	**7.20E+00**	6.28E-01
BGS1318006OS	*4.10E+00*	5.10E+00	**2.53E+00**	5.60E-01	**7.20E+00**	8.00E-01
RPD	106.4%		71.6%		0.0%	
Pass / Fail	**Fail**		**Fail**		Pass	
SU2OB024	**1.39E+00**	7.65E-01	**1.27E+00**	1.23E+00	**1.77E+00**	1.91E-01
SU2OB024OS	*2.50E+00*	4.90E+00	**1.38E+00**	5.60E-01	**1.53E+00**	9.70E-01
RPD	57.0%		7.9%		14.4%	
Pass / Fail	**Fail**		Pass		Pass	
SU2OB027	**1.54E+00**	7.88E-01	**1.52E+00**	1.33E+00	**1.68E+00**	3.08E-01
SU2OB027OS	*1.20E+00*	3.40E+00	**1.21E+00**	4.20E-01	**1.72E+00**	7.20E-01
RPD	25.1%		22.6%		2.1%	
Pass / Fail	Pass		Pass		Pass	
SU2OB055	**8.24E-01**	6.01E-01	**1.02E+00**	8.83E-01	**6.87E-01**	2.49E-01
SU2OB055OS	*1.20E+00*	2.60E+00	**9.10E-01**	6.00E-01	**1.06E+00**	9.70E-01
RPD	37.1%		11.3%		42.7%	
Pass / Fail	Pass		Pass		Pass	
SU2OB071	**9.03E-01**	6.37E-01	*8.93E-01*	1.42E+00	**1.04E+00**	2.29E-01
SU2OB071OS	*2.00E-01*	2.30E+00	**1.03E+00**	5.90E-01	**1.35E+00**	8.60E-01
RPD	127.5%		14.2%		26.1%	
Pass / Fail	**Fail**		Pass		Pass	
SU1FSSB001	*1.20E+00*	1.71E+00	**2.61E+00**	2.18E+00	**1.23E+00**	2.77E-01
SU1FSSB001OS	*-1.20E+00*	3.40E+00	**2.45E+00**	5.20E-01	**1.50E+00**	1.00E+00
RPD	149396.2%		6.3%		20.0%	
Pass / Fail	Pass		Pass		Pass	
SU1FSSS002C	*1.13E+00*	2.09E+00	*1.38E+00*	2.30E+00	*6.50E-01*	7.21E-01
SU1FSSS002COS	*1.00E+00*	2.50E+00	**9.10E-01**	4.40E-01	*2.40E-01*	8.00E-01
RPD	11.9%		40.9%		92.1%	
Pass / Fail	Pass		Pass		**Fail**	
SU1FSSS007B	*1.11E+00*	1.94E+00	*5.54E-01*	1.53E+00	**7.21E-01**	4.86E-01
SU1FSSS007BOS	*1.50E+00*	3.20E+00	**1.03E+00**	3.50E-01	**1.04E+00**	4.60E-01
RPD	30.0%		60.1%		36.3%	
Pass / Fail	Pass		**Fail**		Pass	
SU1FSSS010B	*1.05E+00*	1.77E+00	*5.49E-01*	1.37E+00	**6.82E-01**	3.65E-01
SU1FSSS010BOS	*1.00E-01*	2.70E+00	**8.10E-01**	4.20E-01	**6.20E-01**	4.60E-01
RPD	165.2%		38.4%		9.5%	
Pass / Fail	**Fail**		Pass		Pass	

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
SU1FSSB001A	*7.82E-01*	1.73E+00	*9.49E-01*	1.55E+00	**7.01E-01**	3.02E-01
SU1FSSB001AOS	*1.00E+00*	2.50E+00	**9.10E-01**	4.40E-01	*5.00E-01*	6.40E-01
RPD	24.5%		4.2%		33.5%	
Pass / Fail	Pass		Pass		Pass	
SU2FSSB001	**1.35E+00**	7.14E-01	**1.83E+00**	1.20E+00	**8.27E-01**	2.57E-01
SU2FSSB001OS	*1.00E+00*	2.80E+00	**1.84E+00**	5.20E-01	**9.00E-01**	7.40E-01
RPD	29.7%		0.4%		8.5%	
Pass / Fail	Pass		Pass		Pass	
SU2FSSB002	**7.77E+00**	1.14E+00	**4.93E+00**	1.91E+00	**5.62E+00**	3.88E-01
SU2FSSB002OS	**1.24E+01**	6.20E+00	**2.45E+00**	6.50E-01	**5.30E+00**	1.30E+00
RPD	45.9%		67.2%		5.8%	
Pass / Fail	**Fail**		**Fail**		Pass	
SU2FSSB003	**1.19E+01**	1.42E+00	**7.62E+00**	2.28E+00	**6.96E+00**	4.73E-01
SU2FSSB003OS	**1.44E+01**	4.10E+00	**3.47E+00**	5.20E-01	**6.59E+00**	8.00E-01
RPD	19.3%		74.8%		5.5%	
Pass / Fail	Pass		**Fail**		Pass	
SU2CWA1B01	**5.04E+00**	1.03E+00	**1.57E+00**	1.40E+00	**9.22E-01**	3.63E-01
SU2CWA1B01OS	**6.20E+00**	3.50E+00	**1.06E+00**	4.10E-01	**8.90E-01**	6.70E-01
RPD	20.7%		38.6%		3.6%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA1B06	**2.78E+00**	9.68E-01	**2.32E+00**	1.70E+00	**1.86E+00**	4.10E-01
SU2CWA1B06OS	**2.40E+00**	2.20E+00	**9.40E-01**	4.70E-01	**1.72E+00**	8.40E-01
RPD	14.7%		84.8%		7.7%	
Pass / Fail	Pass		**Fail**		Pass	
SU2CWA2B03	**1.07E+01**	2.67E+00	**5.27E+00**	3.58E+00	**1.43E+01**	7.52E-01
SU2CWA2B03OS	**2.32E+01**	7.10E+00	**3.88E+00**	8.20E-01	**1.40E+01**	1.40E+00
RPD	73.8%		30.4%		1.9%	
Pass / Fail	**Fail**		Pass		Pass	
SU2CWA3B05	**3.30E+00**	2.38E+00	**1.00E+01**	3.10E+00	**8.74E+00**	8.71E-01
SU2CWA3B05OS	**6.60E+00**	6.00E+00	**1.15E+01**	7.00E-01	**6.70E+00**	1.20E+00
RPD	66.8%		13.7%		26.5%	
Pass / Fail	**Fail**		Pass		Pass	
SU2CWA8B03	**3.24E+00**	1.50E+00	*2.38E+00*	2.41E+00	**2.44E+00**	5.18E-01
SU2CWA8B03OS	**3.30E+00**	3.10E+00	**1.59E+00**	4.30E-01	**1.78E+00**	6.90E-01
RPD	1.8%		39.8%		31.5%	
Pass / Fail	Pass		Pass		Pass	
SU2CWA8B06	**4.21E+00**	1.08E+00	**2.52E+00**	1.61E+00	**8.47E-01**	3.04E-01
SU2CWA8B06OS	**4.90E+00**	3.10E+00	**1.03E+00**	3.80E-01	**6.50E-01**	5.30E-01
RPD	15.2%		83.9%		26.3%	
Pass / Fail	Pass		**Fail**		Pass	
SU2CWA1B04A	**3.12E+00**	1.25E+00	*1.45E+00*	1.63E+00	**1.03E+00**	6.77E-01
SU2CWA1B04AOS	**3.40E+00**	3.00E+00	**7.60E-01**	5.30E-01	*6.10E-01*	8.20E-01
RPD	8.6%		62.3%		51.4%	
Pass / Fail	Pass		**Fail**		**Fail**	

	Processed					
Sample	**^{238}U (pCi/g)**	**MDA (pCi/g)**	**^{226}Ra (pCi/g)**	**MDA (pCi/g)**	**^{232}Th (pCi/g)**	**MDA (pCi/g)**
SU3FSSB001	**4.73E+00**	1.94E+00	**2.94E+00**	2.78E+00	**6.20E+00**	7.18E-01
SU3FSSB001OS	**8.10E+00**	3.10E+00	**2.46E+00**	4.00E-01	**6.45E+00**	4.80E-01
RPD	52.6%		17.8%		3.9%	
Pass / Fail	**Fail**		Pass		Pass	
SU3FSSB006	**6.14E+00**	1.80E+00	**2.91E+00**	2.30E+00	**6.38E+00**	5.48E-01
SU3FSSB006OS	**8.90E+00**	2.20E+00	**2.57E+00**	4.10E-01	**5.99E+00**	7.00E-01
RPD	36.7%		12.3%		6.3%	
Pass / Fail	Pass		Pass		Pass	
SU3CWA4B03	**9.28E+00**	2.63E+00	**6.45E+00**	3.32E+00	**1.43E+01**	7.71E-01
SU3CWA4B03OS	**2.27E+01**	3.90E+00	**4.30E+00**	4.80E-01	**1.62E+01**	7.00E-01
RPD	84.0%		40.0%		12.4%	
Pass / Fail	**Fail**		Pass		Pass	
SU3CWA4B07	**1.23E+01**	1.98E+00	**4.43E+00**	2.85E+00	**1.20E+01**	6.59E-01
SU3CWA4B07OS	**2.11E+01**	4.10E+00	**3.25E+00**	5.50E-01	**1.27E+01**	8.00E-01
RPD	52.4%		30.7%		5.6%	
Pass / Fail	**Fail**		Pass		Pass	
SU3CWA5B08	**1.30E+01**	2.75E+00	**4.99E+00**	3.50E+00	**1.72E+01**	8.12E-01
SU3CWA5B08OS	**1.87E+01**	4.20E+00	**4.24E+00**	5.10E-01	**1.73E+01**	7.00E-01
RPD	35.8%		16.2%		0.7%	
Pass / Fail	Pass		Pass		Pass	
SU3CWA7B02	**8.48E+00**	1.83E+00	**3.75E+00**	2.72E+00	**8.03E+00**	5.67E-01
SU3CWA7B02OS	**1.46E+01**	2.80E+00	**2.66E+00**	4.90E-01	**8.50E+00**	7.00E-01
RPD	53.0%		33.9%		5.7%	
Pass / Fail	**Fail**		Pass		Pass	
BF001	*4.77E-01*	8.00E-01	*4.75E-01*	8.00E-01	**3.19E-01**	2.19E-01
BF001OS	*3.00E-01*	2.40E+00	**5.10E-01**	3.70E-01	*2.80E-01*	4.70E-01
RPD	45.5%		7.1%		13.1%	
Pass / Fail	Pass		Pass		Pass	
BF039	*5.77E-01*	1.07E+00	*4.77E-01*	9.48E-01	*3.10E-01*	3.41E-01
BF039OS	*9.00E-01*	2.50E+00	**4.40E-01**	3.80E-01	*4.80E-01*	5.50E-01
RPD	43.8%		8.0%		43.0%	
Pass / Fail	Pass		Pass		Pass	

Notes:
a Bold values are values greater than MDA; italics are less than MDA

9.0 CONCLUSIONS

Based upon the FSS results as summarized in this Report, the Breckenridge Disposal Site meets the requirements for free release in accordance with the guidance as provided in MARSSIM and the Remedial Work Plan. It has been demonstrated through the evaluation of all soil samples as collected and analyzed, including any elevated areas as identified, that the average member of the critical group will not receive a dose in excess of 25 mrem per year in accordance with 10CFR20.1402, *Energy – Standards for Protection Against Radiation - Radiological Criteria for Unrestricted Use*. The maximum residual dose that may be received is 17.5 mrem as demonstrated for Survey Unit 3. Additionally, it should be noted that the residual doses as presented in this Report are conservative. All results are based upon gross activities without taking background into account providing further assurance that the release criteria has been met. Lastly, based upon the results as presented in this report and the remediation as performed, any residual doses that may be received by an individual member of the public is considered to be as low as reasonably achievable or ALARA.

10.0 REFERENCES

10.1 US NRC, NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Revision 1, August 2000.

10.2 Energy*Solutions*, CS-313111-001, *Re-Evaluation of the Breckenridge DCGLs, Gamma Scan Sensitivity, Gamma Scan Action Levels and Development of Area Factors*, Revision 1, January 19, 2011.

10.3 Energy*Solutions*, CS-OP-PN-042, *Remedial Work Plan – Waste Excavation and Site Restoration for the Breckenridge Disposal Site*, Revision 0, January 27, 2010.

10.4 Energy*Solutions*, CS-OP-PN-042 Addendum, *Remedial Work Plan – Waste Excavation and Site Restoration for the Breckenridge Disposal Site*, Revision 0, September 14, 2010.

10.5 US NRC, 10CFR20, *Title 10 Code of Federal Regulation Part 20, Standards for the Protection Against Radiation*.