FINAL

RADIOLOGICAL CHARACTERIZATION SURVEY REPORT

Forest Glen Annex and Gillette Building

Silver Spring, MD and Rockville, MD

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LIST OF ACRONYMS AND ABBREVIATIONS

α	alpha radiation of Type I
β	beta radiation of Type II
AEC	U.S. Atomic Energy Commission
AF	activity factor
AFIP	Armed Forces Institute of Pathology
ALARA	as low as reasonably achievable
^{241}Am	americium-241
AMC	Army Materiel Command
ARA	Army Radiation Authorization
ARL	Army Research Laboratory
ARO	Army Reactor Office
BRAC	Base Realignment and Closure
^{14}C	carbon-14
CABRERA	Cabrera Services, Inc.
CENAB	USACE, Baltimore District
CFR	Code of Federal Regulations
cm^2	square centimeters
COC	chain of custody
^{57}Co	cobalt-57
^{60}Co	cobalt-60
cpm	counts per minute
^{51}Cr	chromium-51
^{137}Cs	cesium-137
CSM	conceptual site model
DCGL	Derived Concentration Guideline Level
DOE	U.S. Department of Energy
DORF	Diamond Ordnance Radiation Facility
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
DQCR	Daily Quality Control Report
DQO	data quality objective
DU	depleted uranium
FOL	Field Operations Lead
FSS	Final Status Survey
FSSR	Final Status Survey Report
^{153}Gd	gadolinium-153
^{3}H	hydrogen-3/tritium
^{203}Hg	mercury-203
HDL	Harry Diamond Laboratories
HPO	Health Physics Office
HSA	Historical Site Assessment
^{192}Ir	iridium-192
^{125}I	iodine-125
^{129}I	iodine-129
^{131}I	iodine-131
LTR	License Termination Rule
Ludlum	Ludlum Measurements, Inc.
μR/hr	microR per hour
m^2	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
mCi	milliCurie
μCi	microCurie
MD	Maryland
MDC	minimum detectable concentration
MeV	mega-electron volts
^{99}Mo	molybdenum-99
mrem/yr	millirem per year
^{63}Ni	nickel-63
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NUREG	NRC Regulation
^{32}P	phosphorus-32
^{33}P	phosphorus-33
pCi/g	picoCuries per gram
PPE	personal protective equipment
^{234m}Pa	protactinium-234m
^{239}Pu	plutnonium-239
QA	Quality Assurance
QC	Quality Control
RAM	radioactive materials
RCOC	radiological contaminant of concern

RCOPC	radiological contaminant of potential concern
^{35}S	sulfur-35
SAP	Sampling and Analysis Plan
SCWP	Site Characterization Work Plan
SHSP	Site Health and Safety Plan
SN	serial number
SOP	standard operating procedure
SOR	sum-of-ratios
SSV	soil screening value
^{90}Sr	strontium-90
SU	survey unit
^{99}Tc	technitium-99
^{99m}Tc	technitium-99m
TEDE	total effective dose equivalent
Th	thorium
^{230}Th	thorium-230
^{231}Th	thorium-231
^{232}Th	thorium-232
^{234}Th	thorium-234
U	uranium
^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
U.S.	United States
USACE	U. S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USAIDR	U.S. Army Institute of Dental Research
WRAIR	Walter Reed Army Institute of Research
WRAMC	Walter Reed Army Medical Center
^{133}Xe	xenon-133

EXECUTIVE SUMMARY

Walter Reed Army Medical Center (WRAMC) Main Post in Washington, DC has been slated for closure no later than 15 September 2011 as part of Base Realignment and Closure (BRAC) 2005 (Public Law 101-510 as amended). BRAC is the process by which the nation reshapes its military installations to become more efficient and effective in supporting its forces. The Forest Glen Annex of WRAMC will remain operational and command and control of the Annex was transferred to Fort Detrick in Frederick, Maryland (MD) on 1 October 2009. Activities at Forest Glen Annex and leased locations currently operate under WRAMC's NRC license, which will be terminated as a result of the closure of WRAMC. Therefore, WRAMC must ensure that all locations on the current NRC license are released for unrestricted use or transferred to a new permit/license. WRAMC, through the U.S. Army Corps of Engineers (USACE), contracted Cabrera Services, Inc. (CABRERA) to evaluate the Forest Glen Annex and the leased Gillette Building in Rockville, MD and determine if the facilities are suitable for release or reuse with respect to radiological conditions.

The purpose of this survey effort was to specifically address facilities and areas identified during the Historical Site Assessment (HSA) (CABRERA, 2009a) as being impacted by current or former operations involving radioactive materials regulated via U.S. Nuclear Regulatory Commission (NRC) licensing or Department of the Army Radiation Authorizations (ARA).

A radiological characterization survey of Buildings 511, 512, (at the Forest Glen Annex) and the Gillette Building in Rockville, MD was performed by Cabrera Services, Inc. (CABRERA) on November 16th through 19th, 2009 in accordance with the approved Site Characterization Work Plan (SCWP), Vol. I: Sampling and Analysis Plan (SAP) and Vol. II: Site Health and Safety Plan (SHSP) (CABRERA, 2009b). This characterization survey included scans and static measurements taken on floors and walls for fixed and removable contamination, collection of smears for removable contamination on surfaces, and collection of smears for tritium analysis by liquid scintillation. All surveys were designed and completed according to guidance in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NRC, 2000) and Army Materiel Command (AMC) guidance, "*Guidance on Radiological Decommissioning Survey for*

Areas where U.S. Nuclear Regulatory Commission Licensed Commodities Were Used" (AMC, 2004).

Results of the characterization surveys indicate that no areas of the Forest Glen Annex or Gillette Building exceed residual radioactivity screening levels as defined in the SCWP. It is expected that the data collected during this effort will be acceptable for Final Status Survey (FSS). A Final Status Survey Report will be submitted under separate cover. Therefore, no further radiological study is necessary.

1.0 INTRODUCTION

1.1 Purpose and Scope

This Characterization Report summarizes the survey details and analytical results, and this report will be followed by a Final Status Survey Report (FSSR) that will present some of the same information in greater detail to be used to support the facilities' NRC license removal. This radiological characterization survey report is based on requirements set forth in the project SCWP, specifically in Volume I, the SAP. It has been prepared by Cabrera Services, Inc. (CABRERA) in support of Base Realignment and Closure (BRAC) 2005 at the former Walter Reed Army Medical Center (WRAMC)-controlled Forest Glen Annex and leased facilities in Rockville, MD. As of 1 October 2009, command of the Forest Glen Annex was transferred from WRAMC to Fort Detrick, MD.

The U.S. Army Corps of Engineers (USACE) is responsible for evaluating whether Buildings 511 and 512 of the Forest Glen Annex and the leased Gillette Building in Rockville, MD are suitable for unrestricted release with respect to radiological conditions. This work is being performed under contract to the U.S. Army Corps of Engineers (USACE) Baltimore District (CENAB), Contract No. W912-DQ-08-D-0003 - Delivery Order 02.

In accordance with contract direction, this characterization effort was designed using the approach outlined in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (United States [U.S.] Nuclear Regulatory Commission [NRC], 2000) as incorporated into the Department of the Army, Army Materiel Command guidance (AMC, 2004). Army Materiel Command, "*Guidance on Radiological Decommissioning Survey for Areas where U.S. Nuclear Regulatory Commission Licensed Commodities Were Used*", AMCPE-SG-G (11-9h), April 2004 (AMC 2004). AMC 2004 is applicable to, "all sites where NRC-licensed radioactive Army commodities or Army radium containing commodities were stored (long term) repaired, or potentially involved in cannibalization, demilitarization or burial operations. AMC guidance was incorporated into this survey design not because a large amount of commodities were used at Forest Glen rather CABRERA incorporated AMC guidance because certain aspects are more conservative than MARSSIM. For instance, AMC Guidance (AMC,

2004) requires 30 static measurements and wipe samples per survey unit, MARSSIM would only require 14. Implementation of AMC guidance resulted in additional sampling and ultimately a more rigorous survey than if MARSSIM were used exclusively. AMC requirements parallel requirements for the Simplified Procedure for Certain Users of Sealed Sources, Short Half-life Materials, and Small Quantities as indicated in MARSSIM Appendix B. In other cases MARSSIM guidance is more stringent, for example AMC 2004 does not require scanning for alpha/gamma emitting isotopes or wipe testing in ventilation systems and/or drains. Both scanning and biased sampling in drains/ducts were performed as part of the Forest Glen Survey.

Additionally AMC Guidance provides six conditions under which areas where former RAM use occurred can be considered non-impacted. These conditions are:

a) Area was used for short term storage only,
b) Area where individual item activity did not require posting as “Radioactive Material” area per 10CFR20.1902,
c) Areas where generally licensed items such as smoke detectors and exit signs were present,
d) Areas where a specific NRC License condition relieved the “Radioactive Material” posting requirement for bulk storage (example less than 100 tritium compasses)
e) Where armored vehicles with intact DU shielding were present, and
f) Where sealed NRC licensed commodity items were present and leak testing indicated no source leakage.

CABRERA thoroughly evaluated the Historical Site Assessment (HSA) (CABRERA, 2009a) and developed a Site Characterization Work Plan (SCWP) (CABRERA, 2009b). The SCWP detailed a survey approach to be in compliance with MARSSIM. The intent of this survey was to evaluate the radiological status of these facilities.

The field team closely followed the protocol presented in the SCWP and completed field activities in November 2009.

1.2 Site History and Summary of Historical Site Assessment

1.2.1 Site History

The Forest Glen Annex is located near the suburban community of Forest Glen in Montgomery County, Maryland, approximately 3.5 miles northwest of the WRAMC Main Post. The Forest Glen Annex is bounded by the Capital Beltway to the north, Brookeville Road to the east and Rock Creek Park to the west. The Gillette Building is located in the 270 Research Center at 1413 Research Blvd, Rockville, MD 20850 (across from Interstate-270) approximately 14 miles northwest of the WRAMC Main Post. The area is depicted in Figure 1 and Figure 2.

The WRAMC has been operational for 97 years. In ten decades, the WRAMC has grown to a vast medical complex, teaching medical professionals, medical research programs, and treating hundreds of thousands of patients.

The Main Post was established by Congressional Legislation in 1905 as Walter Reed General Hospital. Construction was completed in 1909 and the first patients were admitted. The Hospital started as a small 80 bed facility and from this modest beginning has emerged the present day Walter Reed General Hospital which is world acclaimed as one of the finest military medical facilities. The tenant activities associated with WRAMC include but are not limited to the following: Armed Forces Institute of Pathology (AFIP), Armed Forces Pest Management Board, Tri-Service Medical Information Systems, U.S. Army Area Dental Laboratory, U.S. Army Information Systems Command, U.S. Army Institute of Dental Research (USAIDR), and Walter Reed Army Institute of Research (WRAIR). (USACHPPM, 1997)

The Forest Glen Annex of WRAMC was purchased for use as a convalescent center near the beginning of the United States' involvement in World War II, and it was officially established as a military reservation in 1942. It was activated for use as a convalescent center for the Main Post and received its first patients in January 1943. In addition to clinics and wards, it had separate messing and billeting facilities for duty personnel and patients. The real estate on which the Forest Glen Section is situated was formerly the National Park Seminary, a private women's junior college. The buildings and grounds were acquired in 1942 at a cost of $1,000,000. The peak patient-load during World War II reached approximately 500. After 1946, the need for convalescent beds abated and space was made available for other activities. In addition to the

Convalescent Hospital activities, the WRAMC has maintained its Audiology and Speech Center, as well as psychiatry and some orthopedic patients at Forest Glen. Minimal housing and recreation facilities have also been provided.

From 1961 through 1977, Harry Diamond Laboratories operated the Diamond Ordnance Radiation Facility (DORF) out of Building 516 at the Forest Glen Annex. A logistics warehouse, community center complex, automotive maintenance shop motor pool, facilities engineering shop, and post laundry were built during the 1970s. During the 1980s, the AFIP Repository and Research Services Facility, a child development center, and a temporary residence facility, the Fisher House, were completed.

Since the closure of Building 40 on the Main Post in 1997, the main WRAIR administrative buildings and research laboratories have been located on the Forest Glen Annex. The area currently serves as an auxiliary service, support, and research area for the WRAMC Main Post, and current activities conducted at Forest Glen include motor vehicle maintenance, research laboratories, and a post exchange. The post is no longer used for convalescent care (USACHPPM, 2000).

During the HSA, documents gathered from various sources were reviewed and evaluated to extract information on the possession and use of RAM. These documents included licenses, permits, authorizations, inventory records, surveys, historical drawings, and floor plans. In addition, the HSA included a visual inspection of all buildings and areas where RAM was used or stored. The use of RAM at WRAMC was historically, and is currently conducted in accordance with NRC licenses and Department of the Army Radiation Authorizations.

Based on HSA findings, 17 buildings were identified as areas where RAM was used or stored, and 6 of those buildings were classified as Impacted by RAM (Only 3 Impacted buildings were addressed by this effort). These buildings are shown in Figure 3 and Figure 4.

1.2.2 Licenses and Army Radiation Authorizations Applicable to Forest Glen Annex

Radioactive materials use at the Forest Glen Annex has been conducted under NRC Licenses, and Department of the Army Radioactive Authorizations (ARA) issued to WRAMC. The following is a list of active and terminated licenses and permits issued to WRAMC:

- NRC License No. 08-01738-02, Expiration Date 30 April 2015 (original Atomic Energy Commission License dates to 1957) – Operations are conducted at the Main Post in the District of Columbia, the Forest Glen Annex in Maryland, and at the leased facilities in Rockville, Maryland. License 08-01738-02 allows possession and use of any byproduct radionuclide with mass number between 1 and 83 up to 400 mCi each, plus nuclide-specific possession and use limits pertaining to nuclear medicine and bio-medical research activities, such as tritium (^{3}H), phosphorus-32 (^{32}P), strontium-90 (^{90}Sr), molybdenum-99 (^{99}Mo), technitium-99m (^{99m}Tc), iodine-131 (^{131}I), xenon-133 (^{133}Xe), cesium-137 (^{137}Cs), gadolinium-153 (^{153}Gd), iridium-192 (^{192}Ir), americium-241 (^{241}Am), plutonium-239 (^{239}Pu), and cobalt-60 (^{60}Co).
- Terminated NRC License No. 08-01738-03, terminated on 17 August 2004 – NRC License 08-01738-03 allowed for possession and use of gamma cell irradiators. Upon termination of the license, gamma cell irradiator possession was transferred to NRC License No. 08-01738-02.
- ARA No. 08-01-15, Expiration Date 30 November 2015. This ARA allows for the use of radium in medical treatment and research; previous iterations of this authorization predate the original 1957 AEC License and other multiple ARAs through the years. This ARA represents a renewal of the former ARA 08-01-97.
- U.S. Army Reactor Office Reactor Permit No. DORF-1-97, issued to Director, U.S. Army Research Laboratory (ARL), for the Diamond Ordnance Radiation Facility (DORF), Building 516, Forest Glen Annex, WRAMC. DORF is being addressed under another contract under a separate action.

The Army, through the USACE and their contractor(s), will evaluate the type and locations of potential hazards at these facilities and the surrounding environment in support of an overall effort to ensure that all facilities and areas can be released for unrestricted use as part of the BRAC process. Such release will be sought from NRC as appropriate for all radioactive materials (RAM) license(s).

The overall project intent is to plan, perform, and document radiological decommissioning efforts to allow “unrestricted release” of the facilities. This phase and previous phases include the (1) identification of known sources/areas of radioactive contamination; (2) identification of impacted areas; (3) identification of data gaps in impacted areas; (4) assessment of the likelihood of contaminant migration; (5) identification of areas that need further action; and (6) production of information useful for designing subsequent radiological characterization surveys.

1.3 Summary of Impacted Areas at Forest Glen Annex

Based on currently available information as analyzed in the HSA, the Sampling and Analysis Plan (SAP) directed the survey team to focus on three buildings 511, 512 and Gillette.

It is common to find that buildings being surveyed for BRAC have undergone some degree of renovation; that was the case at all three buildings considered in the scope of this survey. Renovations included removal/replacement of flooring (new tile, carpet and/or epoxy) wall removal or addition to create new rooms or expand existing areas, painting of surfaces, removal/replacement of legacy laboratory hoods, ventilation and plumbing renovation, and removal/replacement of cabinetry. When renovation had taken place and in some cases buildings turned over to a lessee or tenant, the survey team used professional judgment and took a graded approach to the survey methodology. A sufficient number of measurement locations were investigated at buildings 511, 512 and Gillette to meet MARSSIM requirements.

1.3.1 Buildings 511 (SU01) and 512 (SU02)

Buildings 511, 512 were research laboratories that had strict RAM usage procedures. In 1974 WRAMC enacted Regulation 40-10 that instituted requirements for periodic (weekly/monthly) surveys of areas/rooms using RAM and immediate decontamination of said areas found to exceed 200 dpm/100cm^2. Therefore, it is highly unlikely that new building materials were installed over contaminated surfaces or that the industry practice of painting or waxing surfaces to “seal” contamination would have taken place Forest Glen under Regulation 40-10. A December 1997 letter to the NRC indicates that RAM would no longer be used in Buildings 511 and 512, but no formal close-out documentation was discovered. Field observations and interviews conducted with site personnel indicate office furniture and laboratory hoods in both buildings were installed after RAM usage had ceased. Radioactive controls and/or restrictions no longer exist in buildings 511 and 512.

Building 511 was renovated in 1992; the primary current mission is animal research. In some cases animals have been involved with costly long term projects; building management indicated that the survey must not interfere with animal well being. Intrusive sampling would have impacted these projects. Using a graded approach when a measurement location was not available for survey, another random location was selected in its place:

1) Building 511 underwent extensive renovation in 1992 including removal of old flooring and replacement with new epoxy flooring. Wall/room addition and/or removal, paint, cabinetry and plumbing.
2) Documentation and interviews with site personnel indicated that there were procedures/protocols in place dating back to 1974 that required periodic surveys and immediate decontamination of areas found to be in excess of 200 dpm/100cm^2 removable activity. Therefore, it is highly unlikely that new building materials were installed over contaminated surfaces or that the industry practice of painting or waxing surfaces to "seal" contamination ever took place at Forest Glen.
3) Laboratory procedures/protocols used for RAM control and disposal were in place and followed.
4) This survey focused on impacted areas and items which were accessible but would satisfy the MARSSIM Class 3 survey requirements. Also the survey team investigated potentially suspect areas such as drains, sinks, and ventilation which is consistent with guidance provided in section 4.8.4.1 of MARSSIM Rev. 1, 2001.
5) There is no reason to believe that formerly impacted surfaces still exist and were not surveyed due to accessibility issues. The existing building surfaces were surveyed as a conservative measure.

Building 512 was renovated in 1995 and again at some point within the last 8 years. When determining the level of effort required to survey difficult to access areas in building 512 a graded approach was followed:

1) Building 512 underwent extensive renovation in 1995 and even more recently including new tile, carpet, wall/room addition and/or removal, paint, cabinetry, roof material and plumbing.
2) Field observations and interviews with site personnel indicated that there were procedures/protocols in place dating back to 1974 that required periodic surveys and immediate decontamination of areas found to be in excess of 200 dpm/100cm^2 removable activity.
3) A review of previous scoping and/or routine surveys performed by WRAMC HPO indicated no elevated activity.
4) Laboratory procedures/protocols used for RAM control and disposal were in place and followed.

5) The team surveyed on top of carpet/tile and then using a graded approach (and with management approval) removed sections of floor coverings throughout Building 512. When a measurement location was not available for survey, another random location was selected in its place.

1.3.2 Gillette Building (SU03)

WRAIR medical research laboratories having historical RAM usage have existed here. Close-out documentation exists for the entire north wing of the Gillette Building, but historical records show RAM usage in several other rooms, not within the north wing. Considering the strict contamination control requirements of WRAMC Regulation 40-10, building history (detailed below), and existing survey results, the HSA recommendation to survey the entire building as one Class 3 survey unit (SU) was considered appropriate. As of 1997, the only rooms in the Gillette Building actively using RAM were 1066, 1082, and 2143 with the only active isotopes being ^{51}Cr, ^{99m}Tc, ^{125}I, (all very short-lived). According to the most recent WRAMC HPO inventory (provided in July 2008), the Gillette Building had no rooms where RAM was actively being used, and had not since at least 2006 or earlier. According to HPO Authorization 680 (applicable to Gillette building RAM users), the last rooms with authorized RAM usage were 1071, 1110, 1086, and 1097 (however, room close-out surveys exist for these rooms). HPO Authorization 680 was terminated entirely as of February 2007. Although several room final surveys exist, a full building close-out survey record was not discovered. RAM is not currently used in any rooms/areas at Gillette. No radioactive controls or restrictions exist.

A brief timeline of Gillette Building activities is presented below:

1) WRAMC held an NRC license which allowed its tenants to use RAM;
2) The Armed Forces Institute of Pathology (AFIP) leased rooms/labs in the Gillette Building where RAM was used under the NRC license held by WRAMC, but as far as the license is concerned, only the building is listed;
3) The WRAMC health physics office maintained internal authorizations for who could use RAM under their NRC license on a per user per room basis – when a user or room was no longer in need of authorization, an internal room close-out occurred;
4) Because RAM use by AFIP still was possible in Gillette, the building was never taken off the NRC license, only the internal WRAMC authorization was terminated for the room and/or user;

Once BRAC occurred, the Gillette building as a whole is required to undergo Final Status Survey in order to be removed from the license.

When determining the level of effort required to survey difficult to access areas in the Gillette Building a graded approach was followed:

1) The Gillette Building has undergone extensive renovation including new tile, carpet, wall/room addition and/or removal, paint, cabinetry, roof material and plumbing. This building is currently leased.
2) Field observations and interviews with site personnel indicated that there were procedures/protocols in place that required periodic surveys and immediate decontamination of areas found to be in excess of 200 dpm/100cm^2 removable activity. Therefore, it is highly unlikely that new building materials were installed over contaminated surfaces or that the industry practice of painting or waxing surfaces to "seal" contamination ever took place at Forest Glen.
3) A review of previous scoping, routine and/or building close-out surveys performed by WRAMC HPO indicated no elevated activity. The close-out surveys were thorough and consisted of direct and removable contamination readings conducted in random and bias locations.
4) Laboratory procedures/protocols used for RAM control and disposal were in place and followed.
5) There is no reason to believe that formerly impacted surfaces still exist and were not surveyed due to accessibility issues. The existing building surfaces were surveyed as a conservative measure.

1.3.3 Summary of Non-Surveyed Areas at Forest Glen Annex

Buildings 101, 149A, 188, 500, 501, 506, 508 and the landfill were considered in the course of the HSA but no further actions were deemed necessary during this survey effort. See table 1-1 for status of these buildings.

When considering building classification the Cabrera team reviewed the HSA that detailed operations, history of accidents, incidents, and leak tests; routine and release surveys were also considered. Additionally, AMC 2004 Guidance section 1 lists (6) conditions that allow a building or area to be considered non-impacted; they are:

a) Area was used for short term storage only,

b) Area where individual item activity did not require posting as "Radioactive Material" area per 10CFR20.1902,

c) Areas where generally licensed items such as smoke detectors and exit signs were present,

d) Areas where a specific NRC License condition relieved the "Radioactive Material" posting requirement for bulk storage (example less than 100 tritium compasses)

e) Where armored vehicles with intact DU shielding were present, and

f) Where sealed NRC licensed commodity items were present and leak testing indicated no source leakage.

No close-out documentation exists for Building 101, but during the site visit, it was discovered that the building has already been released to Montgomery County (along with many buildings on the property to the north of the Forest Glen Annex, formerly the National Seminary Park property). No radioactive controls or restrictions exist in this building or on any of the property that has been transferred to Montgomery County. Physical documentation of the transfer to Montgomery County was not available.

AMC Guidance was used to remove Building 101 from the survey. The only commodities used in building 101 were a portable lead paint analyzer containing a sealed Cd-109 source and a chromatography unit that contained a sealed H-3 source. In accordance with Army Materiel Command (AMC) Guidance (AMC, 2004) section 6 - 1(a, b and c) this area can be considered non--impacted.

Buildings/areas showing complete close-out and clear NRC concurrence in writing –

- 500,
- 149A (already transferred to Montgomery County)
- 506

Since release, strict protocols were in place in accordance with Army Regulation 10-40 to prohibit reintroduction of RAM to these buildings, therefore there is no reason to believe these areas could have been re-impacted.

Buildings/areas showing complete close-out, but no NRC concurrence –

- 508,
- 188 (already transferred to Montgomery County)

The survey protocol used by WRAMC HPO included a historical review to determine if there were any "spills or unusual occurrences" gridding of floors and lower walls (3' grids), selection and use of proper survey equipment, direct surveys for alpha, beta and gamma radiation, and swipe surveys of each grid that were counted for alpha, beta and low energy beta. These surveys, although pre-dating MARSSIM publication, were reviewed and found to be comparable with MARSSIM Final Status Survey protocol, and thus serve as acceptable documentation as to the buildings' release. Information packages documenting appropriateness for radiological release and/or prior acceptance by NRC are included as Appendix F. Since release, strict protocols were in place in accordance with Army Regulation 10-40 to prohibit reintroduction of RAM and there is no reason to believe these areas could have been re-impacted.

No close-out documentation could be found, but this building has been extensively renovated, and a "clean" medical room now exists where the room containing RAM previously existed, with no radioactive controls or restrictions in place. The only isotopes used in this building all have half-lives of less than 120 days (^{32}P, ^{33}P, and ^{35}S), and no RAM has been used in this building for over 18 years. These short lived radionuclides were eliminated in accordance with the temporal boundaries sections of the DQOs contained in this document (section 7.3.4.3).. These radionuclides were eliminated as RCOPCs and were the only radionuclides used in building 501. Therefore Building 501 is considered non-impacted.

1.3.4 Building 503

Building 503, although impacted, is slated for continued use for laboratory research after BRAC. Appropriate radiological permits/licenses are set to be transferred to the Navy. Findings presented in the HSA, with regards to specific radionuclides and rooms where used, were meant to serve as a snapshot of the RAM usage as of the publication date of the HSA. At some point in time during the license transfer as part of BRAC, the new holder may deem surveys necessary, although surveys will not occur as part of this current effort.

The former Buildings 504 and 509 would have been considered impacted, but they were demolished when the new WRAIR Building (503) was built; however, no documentation of close-out prior to demolition was discovered. Since Building 503 (also considered impacted) was built over the footprints of these Buildings 504 and 509, they can be disregarded at this time. While it is unclear where building debris from the former buildings 504 and 509 was disposed of; WRAMC procedures/protocols were in place to ensure that any RAM went to a properly permitted facility for disposal. Interviews with former WRAMC RSO Col William Johnson (U.S Army Ret) and document review did not reveal any information that indicated onsite burial of building 504 and 509 construction debris.

1.3.5 Taft Building

Similar to Building 503, the Taft Building in Rockville, MD, although impacted, is slated for continued use for laboratory research after BRAC. Appropriate radiological permits/licenses are set to be transferred to the Navy. Findings presented in the HSA, with regards to specific radionuclides and rooms where used, are meant to serve as a snapshot of the RAM usage as of the publication date of the HSA. Currently, only Rooms 15 and 20 are known to be impacted. At some point in time during the license transfer as part of BRAC, the new holder may deem surveys necessary, although they will not be completed as part of this current effort.

1.3.6 Building 516 (DORF)

Building 516 (DORF), Building 513, supporting USTs and the surrounding grounds are undergoing full decommissioning under a separate effort than the rest of the Forest Glen Annex and leased facilities in Rockville, MD. This complex is not intended to be addressed under this action and will not be discussed in detail in this report.

1.3.7 The Landfill

While there is no evidence that onsite burial of radioactive material ever occurred at Forest Glen, it should be noted that the Army has initiated action to perform radiological and chemical surveys of the landfill area.

Table 1-1: Summary of Areas Investigated

Building	Original Structure Name	Department(s) / RAM Use(s)	Current Tenant and Conditions	Impacted or Non-Impacted	Rationale
101	Former Dormitory for National Seminary Park	Chromatograph with sealed H-3 source, Portable Lead Paint Analyzer Cd-109 sealed source	Abandoned, building/land turned over to Montgomery County	Non-Impacted	Use of a lead paint analyzer and chromatograph containing a sealed H-3 source were the only evidence of RAM usage. Thereby, per AMC Guidance section 6, 1(a, b and c) this area can be considered non--impacted. This building has already been turned over to Montgomery County and is no longer part of Forest Glen
149A	Bunker	Health Physics Office Storage	Abandoned, building/land turned over to Montgomery County	Impacted but released via WRAMC HPO surveys.	Radiological Close-out Survey as of 6/23/1997, see data package/building fact sheet in Appendix F
188	WRAMC, Health Physics Office	Former use by Health Physics Office	Abandoned, building/land turned over to Montgomery County	Impacted but released via WRAMC HPO surveys.	Radiological Close-out Survey as of 6/23/1997, see data package/building fact sheet in Appendix F
500	WRAIR	WRAIR Research Labs	WRAIR Administration	Impacted but released via WRAMC HPO surveys.	Radiological Close-out Survey as of 7/12/2000, see data package/building fact sheet in Appendix F

Building	Original Structure Name	Department(s) / RAM Use(s)	Current Tenant and Conditions	Impacted or Non-Impacted	Rationale
501	WRAIR	WRAIR Research Labs	WRAIR Pilot Bioproduction Facility	Impacted with short lived isotopes.	Only short-lived radionuclides ever present. In accordance with the temporal boundaries for this survey isotopes with less than a 120 day half life were eliminated
503[1]	WRAIR	WRAIR Research Labs	WRAIR Research Labs	Impacted – Class 1	RAM still being used
504[2]	Unknown	Unknown	None, Demolished	Impacted but demolished with new building in footprint	In footprint of Building 503
506	WRAIR	WRAIR Research Labs	Abandoned	Impacted but released via WRAMC HPO surveys.	Radiological Close-out Survey as of 6/8/1999, see data package/building fact sheet in Appendix F
508	WRAIR	WRAIR Research Labs	Viral Con Projects	Impacted but released via WRAMC HPO surveys.	Radiological Close-out Survey as of 3/5/1998, see data package/building fact sheet in Appendix F

Building	Original Structure Name	Department(s) / RAM Use(s)	Current Tenant and Conditions	Impacted or Non-Impacted	Rationale
509[2]	WRAMC, Health Physics Office	Health Physics Office Waste Storage	None, Demolished	Impacted but demolished with new building in footprint	In footprint of Building 503
511	**WRAIR**	**Animal Medical Research Facility**	**Animal Research**	**Impacted – Class 3**	**No Radiological Close-out Survey**
512	**WRAIR**	**Veterinary Quarantine, Medical Research Facility**	**Hospital, Allergen Extract Lab, Pharmacy**	**Impacted – Class 3**	**No Radiological Close-out Survey**
513	WRAMC, Health Physics Office	Source range for calibration of instruments at DORF	General non-radiological storage, used by WRAMC HPO	Formally impacted but released via WRAMC HPO surveys.	Radiological Close-out Survey as of 7/7/1997, see data package/building fact sheet in Appendix F
516	DORF	Radiation Experiments	Used by WRAMC HPO as a temporary radioactive waste decay and storage facility	Impacted – Class 1	Still in use as storage facility, will be addressed under a separate decommissioning action.
516 (outside)	Water Retention Tanks	Holdup Tanks for Water from DORF Pool and Wash Sink	WRAMC HPO Decay and Storage Facility	Formally impacted but released via WRAMC HPO surveys.	This area was addressed under a separate decommissioning action.

Building	Original Structure Name	Department(s) / RAM Use(s)	Current Tenant and Conditions	Impacted or Non-Impacted	Rationale
Taft[1]	Taft Court	WRAIR Medical Research Labs	WRAIR Medical Research Labs	Impacted – Class 1	RAM still being used
Landfill	Landfill	Burial of onsite waste	Ballfield	Non-Impacted	Although the HSA found no evidence that burial of RAM ever occurred at Forest Glen the USACE has initiated an action to survey this area for radiological and chemical constituants
Gillette	**Gillette Building**	**WRAIR Medical Research Labs**	**WRAIR Medical Research Labs**	**Impacted – Class 3**	No Radiological Close-out Survey exists for the south wing, however close out documentation does exist for the north wing. A class 3 survey was performed to fill in data gaps and tie together the entire Gillette Building close out effort into one document.

Notes

1 Building 503 and the Taft Building, although impacted, are slated to continue using RAM under new license/licensee.

2 Buildings 504 and 509 would be considered Impacted, but since they were demolished, and Building 503 (an impacted building) has been built within their footprints, they essentially have now become part of the footprint for Building 503, and any future investigations should treat them as such.

1.4 Radiological Contaminants of Potential Concern

The use of RAM in affected buildings can be summarized as follows:

- Health physics support using sealed sources in microCurie (μCi) quantities (e.g., calibration sources).
- Clinical and biomedical research using unsealed μCi and mCi quantities. Of the various unsealed isotopes used in research, only long-lived radioisotopes, i.e. half-lives greater than 120 days, present any potential for residual contamination. This is the main historical usage of RAM in the laboratories at the Forest Glen Annex and leased facilities in Rockville, MD.

A detailed inventory of radioactive materials and their respective locations is included in the HSA. The radionuclides that are considered radiological contaminants of potential concern (RCOPCs) based on HSA findings were carried over for this characterization effort as summarized on a per-building basis in Table 1-2. Further information regarding how this table was developed is presented in the sections to follow.

Table 1-2: Historically-Used Radionuclides in Impacted Buildings (RCOPCs)/Survey Design Rationale

Building	Historically-Used (RCOPCs)[a]	Radionuclides Retained as (RCOPCs)[b]	Half-Life	Principal Emissions (mega-electron volts [MeV])	Analysis Performed to Detect	(DCGL) (dpm/100cm^2)
511 (SU01)	^{14}C, ^{57}Co, ^{3}H, ^{203}Hg, ^{125}I, ^{131}I, ^{32}P, ^{35}S	^{14}C	**5.7E+03 years**	**0.156 (beta$_{max}$)**	liquid scintillation	3.7E+05
		^{57}Co	**271.8 days**	**0.122 (gamma$_{max}$)**	gamma spectroscopy	7.05E+03 (fixed) 7.05E+02 (removable)
		^{3}H	**12.3 years**	**0.0186 (beta$_{max}$)**	liquid scintillation	1.2E+07
512 (SU02)	^{14}C, ^{3}H	^{14}C	**5.7E+03 years**	**0.156 (beta$_{max}$)**	liquid scintillation	3.7E+05
		^{3}H	**12.3 years**	**0.0186 (beta$_{max}$)**	liquid scintillation	1.2E+07
Gillette (SU03) ^{57}Co, ^{60}Co, ^{51}Cr, ^{137}Cs, ^{3}H, ^{125}I, ^{129}I, ^{63}Ni, ^{99m}Tc		^{3}H	**12.3 years**	**0.0186 (beta$_{max}$)**	liquid scintillation	1.2E+07
		^{60}Co	**5.3 years**	**0.314 (beta$_{max}$)**	**gross beta**	7.05E+03 (fixed) 7.05E+02 (removable)
		^{137}Cs	**30.2 years**	**1.176 (beta$_{max}$)**	**gross beta**	7.05E+03 (fixed) 7.05E+02 (removable)
		^{129}I	**1.6E+07 years**	**0.150 (beta$_{max}$)**	**liquid scintillation**	3.5E+03
		^{63}Ni	**100 years**	**0.066 (beta$_{max}$)**	**liquid scintillation**	1.8E+05
		^{57}Co	**271.8 days**	**0.122 (gamma$_{max}$)**	**gamma spectroscopy**	7.05E+03 (fixed) 7.05E+02 (removable)
(ALL SU's)	DU	uranium-238 (^{238}U) – 99.8%	**4.5E+09 years**	**4.260 (alpha)**	**gross alpha**	**101 (fixed)** **10.1 (removable)**
		uranium-235 (^{235}U) – 0.02%	**7.0E+08 years**	**4.470 (alpha)**	**gross alpha**	**101 (fixed)** **10.1 (removable)**
		uranium-234 (^{234}U) - 0.0007%	**2.5E+05 years**	**trace**	**gross alpha**	**101 (fixed)** **10.1 (removable)**

a – Based on HSA Findings
b – Only radionuclides with half-lives greater than 120 days were retained as RCOPCs (such that 7-10 half-lives would have passed, indicating decay to negligible levels)
c – DU DCGL was derived as described in following sections

The list of radionuclides shown in Table 1-2 is based on radionuclides known to have been used or to be present at Buildings 511, 512, and Gillette. ***This list only represents radionuclides used in Impacted buildings included in this phase of the investigation (radionuclides for Buildings 503 and Taft are not included here, but they are included in the HSA). It is not intended to be a comprehensive list of all radionuclides used at the Forest Glen Annex and leased facilities in Rockville, MD***. Although Table 1-2 presents the list of RCOPCs on a per building basis, the conservative approach taken during the survey was to address all RCOPCs at all buildings.

Of the radionuclides known to have been used at former WRAMC-controlled facilities, only those radionuclides with half-lives greater than 120 days were retained as RCOPCs, as they have the greatest potential to be remaining post-closure of the facility. Using 120 days as a half-life cut-off for which radionuclides were considered RCOPCs is conservative in that at least 7 half lives would have passed since active RAM usage, ensuring the radionuclide would be decayed to negligible levels and not pose a concern. The elimination of short lived isotopes is in accordance with temporal boundaries detailed in section 7.3.4.3 of this document.

Note that the greater-than-120-day half-life cutoff represents a revision to information presented in the Final HSA. Using 120 days as the cutoff for RCOPC inclusion is a more conservative approach and is preferred by NRC. For Buildings 511, 512, and Gillette, this revision resulted in the addition of ^{57}Co to the RCOPC list. Co-60 (with limits of 7.1E+03 dpm/100cm^2 total; 7.1E+02 dpm/100cm^2 removable; and 3.8E+00 pCi/g volumetric) is considered the most restrictive beta RCOPC for non-DORF buildings, and thus, the values for ^{60}Co were to be used in determining instrumentation needs and criteria for free release for beta.

1.5 Applicable Regulatory Criteria Applicable to DCGL Development

The following table is based on screening levels from NRC NUREG-1757, Volume 2 Tables B.1 and B.2, and from` NUREG/CR-5512, Volume 3, Table 5.19, utilizing screening values for P_{crit} at 0.90. The screening guideline levels and the transferable radioactivity goal for each RCOPC are presented in Table 1-3.

On June 21, 1997, the NRC published the final rule on "Radiological Criteria for License Termination", the License Termination Rule (LTR), as Subpart E to 10 Code of Federal

Regulations (CFR) Part 20. The criteria for termination with unrestricted release is residual radioactivity, which is undistinguishable from background, and results in a total effective dose equivalent (TEDE) to an average member of the critical group that does not exceed 25 millirem per year (mrem/yr), including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from excavation and waste disposal activities. For the decommissioning of WRAMC facilities, a dose objective of 25 mrem/yr above background will be applicable and is therefore used as the basis for conducting the site radiological surveys. For the purposes of this survey, it is appropriate and conservative approach to include the contribution from background in all results (presented in Appendix A).

Supplemental information regarding the implementation of the LTR, including screening criteria for building surfaces and soil, was published by NRC in the Federal Register Volume 63, Number 222, November 18, 1998; the Federal Register Volume 64, Number 234, December 7, 1999; and also the Federal Register Volume 65, Number 114, June 13, 2000. Soil screening criteria used for RCOPCs not presented in the preceding Federal Register documents have been referenced from Table 5.19 of NRC Regulation (NUREG)/CR-5512, Volume 3, October 1999, where possible. These screening criteria will be used as guideline activity limits and to establish instrument/analysis sensitivity requirements for RCOPCs during the performance of radiological surveys.

Table 1-3: Acceptable License Termination Screening Values for Building Surface Contamination and System Surface Contamination

RCOPC	Radioactivity Type	NUREG/CR-5512 Volume 3 Table 5.19 P_{crit} 0.90 (dpm/100 cm^2) - fixed	NUREG/CR-5512 Volume 3 Table 5.19 P_{crit} 0.90 (dpm/100 cm^2) - removable	NUREG-1757 Volume 1 Table B.1 (dpm/100 cm^2) - fixed	NUREG-1757 Volume 1 Table B.1 (dpm/100 cm^2) - removable	NUREG-1757 Volume 1 Table B.2 (pCi/g)
^{3}H	low-energy beta	1.24E+08	1.24E+07	1.2E+08	1.2E+07	1.1E+02
^{14}C	low-energy beta	3.67E+06	3.67E+05	3.7E+06	3.7E+05	1.2E+01

RCOPC	Radioactivity Type	NUREG/CR-5512 Volume 3 Table 5.19 P_{crit} 0.90 (dpm/100 cm^2) - fixed	NUREG/CR-5512 Volume 3 Table 5.19 P_{crit} 0.90 (dpm/100 cm^2) - removable	NUREG-1757 Volume 1 Table B.1 (dpm/100 cm^2) - fixed	NUREG-1757 Volume 1 Table B.1 (dpm/100 cm^2) - removable	NUREG-1757 Volume 1 Table B.2 (pCi/g)
^{129}I	low-energy beta	3.47E+04	3.47E+03	3.5E+04	3.5E+03	5.0E-01
^{57}Co	gamma	2.11E+05	2.11E+04	unlisted	unlisted	1.5E+02
^{60}Co	Beta/gamma	7.05E+03	7.05E+02	7.1E+03	7.1E+02	3.8E+00
^{63}Ni	low-energy beta	1.82E+06	1.82E+05	1.8 E+06	1.8 E+05	2.1 E+03
^{137}Cs	beta	2.80 E+04	2.80 E+03	2.8 E+04	2.8 E+03	1.1 E+01

The most restrictive screening value for each type of radioactivity is shown in **bold**. These radionuclides represent the RCOPCs for this characterization survey. These restrictive values were chosen as derived concentration guideline limits (DCGLs) for this characterization survey.
Isotopes of uranium and thorium were considered for inclusion based on their presence on License No. SUB-603. This license allowed for possession of source material for the purposes of training, shielding and research. Despite the authority to possess up to 200 pounds of U or Th, no evidence (current or historical RAM Authorizations or Protocols) was found to support active use of these metals (and their respective radioisotopes) at either the Main Post or the Forest Glen Annex. It is suspected that SUB-603 (source material license) was exclusive to Building 40 on the Main Post but no definitive proof could be found to adequately discount the NRC concern. Therefore, an evaluation of U and Th was performed using a graded approach, where the potential for use, associated risk, and cost of inclusion were all considered for future investigations at the Forest Glen Annex.

After careful consideration, it was determined that only depleted uranium (DU) be added to the RCOC list at Forest Glen. This decision was based on the following points:

- No specifics are given on the license to determine physical, chemical, or isotopic make-up of these metals. Given the historical mission at Forest Glen and the lack of evidence to the contrary, it was determined that DU was the most likely form of source material that would be present.

- Given the very low potential DCGLs based on Building Surface Screening Values SSVs) found in NUREG/CR-5512 (6 - 7 dpm/100cm^2 for ^{232}Th and 19.5 - 101 dpm/100cm^2 for ^{238}U), the technical approach required to ensure adequate detection of these nuclides at these levels could have a profound impact on future survey performance and its resulting cost. The values at the low end of the range above assume that the nuclide listed is in full equilibrium with its decay progeny. The latter are for the nuclide itself.
- The potential DCGL values for ^{232}Th (the most abundant nuclide in natural thorium) are prohibitively low given the use of the NRC surface screening values (SSVs). Without further evidence of the use of ^{232}Th at Forest Glen, implementation of surveys with the capability of detecting 6-7 dpm/100 cm^2 alpha could not be justified.
- A composite alpha DCGL for Depleted Uranium (DU) of 101 dpm/100cm^2 could be readily implemented at Forest Glen without substantial cost implications. The use of the nuclide-only SSV is based on the underlying assumption that DU (circa 1950's vintage) would not be expected to have decay progeny in-growth beyond U-234 due to inadequate decay time. Therefore, there is no need to include additional conservatism to the applied SSV values. Also, standard health physics instrumentation could detect DU at these levels without additional scaling factors or the need for application of surrogate nuclides.

For the reasons stated above, DU was added to the RCOPC list for Forest Glen with alpha surveys performed in all areas considered to be impacted by use of RAM.

The alpha DCGL based on DU was developed as per the following table:

Table 1-4: Determination of Gross Alpha Activity Specific DCGL for Depleted Uranium

Analyte	Activity Fraction (AF)	# of Alpha particles	AF for Alpha	Isotopic DCGL (dpm/100 cm^2)	Activity Specific DCGL Alpha (dpm/100 cm^2)
^{234}U	0.000007	1	0.000	9.06E+01	0
^{235}U	0.002	1	0.003	9.76E+01	0
^{238}U	0.998	1	0.997	1.01E+02	101
			Total	**Gross DCGL**	**101**

The following methodologies were utilized during the derivation of gross alpha DCGL.

- Determination of Activity Fraction (AF): Based on U.S. Department of Energy (DOE) *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities* (DOE, 2000), depleted uranium is the sum of 99.8% of ^{238}U, 0.0007% of ^{234}U and 0.2% of ^{235}U with respect to percentages by weight. Those values are used as the activity fraction for DU.
- Number of Alpha and Beta Particles: ^{238}U has one alpha and two beta emitters (^{234}Th and ^{234m}Pa), ^{235}U has one alpha and one beta (^{231}Th), and ^{234}U has one alpha and no beta particles. Each of those alpha and beta emitters is assumed to be in secular equilibrium with their uranium parent.
- Individual DCGL: The soil screening criteria referenced from Table 5.19 of NUREG/CR-5512, Volume 3, October 1999, were utilized as the individual DCGL for each uranium isotopes.
- Determination of Gross Alpha DCGL and Gross Beta DCGL: By multiplying the percentage of activity fraction and individual DCGL, the activity-specific DCGL were calculated for each uranium isotope. The activity-specific DCGL for each isotope were summed to determine the gross DCGL for the Site.

The Building Surface DCGL values shown in Table 1-3 were also broken down into alpha and beta emitting RCOPCs for application to specific survey instrumentation. The choices of gross alpha and beta DCGL values for the Site characterization surveys are provided in Table 1-5.

Table 1-5: DCGL Values for Forest Glen Characterization Survey

	Alpha (based on DU) dpm/100 cm^2		Beta (based on ^{60}Co) dpm/100 cm^2		Low-energy Beta (^{3}H) dpm/100 cm^2	Low-energy Beta (^{14}C) dpm/100 cm^2	Low-energy Beta (^{63}Ni) dpm/100 cm^2	Low-energy Beta (^{129}I) dpm/100 cm^2
	Total	Removable	Total	Removable	Removable	Removable	Removable	Removable
DCGL	101	10.1	7050	705	1.2E+07	3.7E+05	1.8E+05	3.5E+03

Note: Removable DCGLs are 10% of total.

2.0 CHARACTERIZATION SURVEYS OF FOREST GLEN ANNEX BUILDINGS AND THE GILLETTE BUILDING

Field activities at the Site were performed by the CABRERA team on November 16-18, 2009. The field activities included radiological characterization surveys. The characterization survey efforts consisted of static (fixed) and smear (removable) radiological contamination surveys. Additionally, floor and wall scanning occurred, and exposure rate surveys were conducted.

2.1 Scope and Rationale for Surveys

The characterization surveys were designed in accordance with MARSSIM guidance (NRC 2000) Details of survey design can be found in the SCWP, (CABRERA, 2009b). Field changes to the SCWP implemented during the course of field work are outlined in Section 2.3.3 – "*Field Changes to the Work Plan*".

2.2 Work Plan Implementation

2.2.1 Scope of Surveys

Areas were designated as impacted based on the potential presence of contamination, as determined during the HSA process (CABRERA, 2009a). In order to confirm the extent of radiological impacts to these areas, the following field tasks were implemented in accordance with the approved SCWP (CABRERA, 2009b).

- Direct surface alpha radioactivity measurements were performed within buildings/indoor areas
- Direct surface beta radioactivity measurements were performed within buildings/indoor areas
- Scanning surveys of at least 2% of floors and lower walls
- Gamma readings were taken throughout the buildings/indoor areas
- Smear samples were collected and analyzed for gross alpha and beta radioactivity within buildings/indoor areas
- Smear samples were collected and analyzed for low-energy beta RCOPCs by liquid scintillation within buildings/indoor areas
- Smear samples were collected, bundled into a composite, and analyzed by gamma spectroscopy to determine if any elevated energy peaks existed that would indicate presence of gamma emitting isotopes.

Radiological survey activities consisted of low-impact methods. After performing the survey, arrangements were made with building contacts such that disturbed areas would be returned to pre-survey condition. See the field photographs presented in Appendix D. Biased samples were taken in areas where indications of past RAM use would likely have accumulated if present such as floor/sink drains and ventilation.

2.2.2 Characterization Survey Instrumentation

Survey and stationary instrumentation utilized during the characterization survey is presented in Table 2-1.

Table 2-1: Survey Meters and Detector Probes used for Characterization Survey

Ratemeter / Probe	Detector Type	Radiation Sensitivity	Ratemeter / Probe Serial Numbers	Calibration Due Date	Instrument Detection Sensitivity, alpha/beta (dpm/100 cm^2)
Ludlum Model 2360 / 43-68	Gas Proportional	Alpha, Beta (Direct)	184906 / 116721	9/17/2010	51/442
Ludlum Model 2360 / 43-68	Gas Proportional	Alpha, Beta (Direct)	225241 / 160790	9/17/2010	51/442
Ludlum Model 2360 / 43-37	Gas Proportional	Alpha, Beta (Direct)	145474 / 066273	9/17/2010	20/210
Ludlum Model 2929 / 43-10-1	Smear Counter	Alpha, Beta (Removable)	152275 / 155350	9/17/2010	9.5/151
Ludlum Model 19	Exposure Rate	Gamma	167164	9/17/2010	N/A

2.2.3 Field Changes to Work Plan

To account for observed field conditions, several onsite field changes to the SCWP were implemented during execution of the Characterization Survey:

Building 511

Despite a diligent attempt to gain access to a locked office that contained a planned survey location for SU 01-06, the survey point was moved 5 feet away to an accessible area. The new location was outside the office door on the hallway floor. Figures 5 through 14 accurately represent sample locations as they were taken in the field.

The location for SU01-14 had to be moved approximately 5 feet from its planned location due to being located within a locked utility room, after a diligent attempt had been to gain access. The new location was outside the utility room door on the hallway floor. Figures 5 through 14 accurately represent sample locations as they were taken in the field.

Building 511 houses an animal research facility. The facility has specific health and safety requirements, as well as room-specific personal protective equipment (PPE). Prior to the survey, the field team members who were to enter Building 511 received all appropriate health and safety clearance. During the survey, the Building 511 escort was able to provide all room-specific PPE to the field team members. An example of this PPE is shown in the field photographs in Appendix D (Figure D-4). Due to the current mission in this building, intrusive activity that would lead to destruction of building surfaces was not desirable and engineering controls to ensure the animals were not harmed or exposed to any type of contaminate would have been required. Therefore, underlying surfaces were not surveyed; rather the team took biased measurements/samples in areas where indications of past RAM use would likely have accumulated if present (such as floor/sink drains and ventilation) in lieu of actually performing intrusive sampling beneath surfaces

Building 512

This building had undergone renovation since RAM usage and removal of tile and carpet did not negatively impact building operations. Although the probability of finding contamination under tile and carpeting was remote, the level of effort required to remove/replace floor surfaces was also relatively small. It was determined field that a prudent approach to a more thorough characterization effort would be to collect static measurements and smears from both the tile surface and the sub-floor surface at each location where a tile was to be pulled up. Tile surface and sub-floor measurements and smears were collected at all locations, except SU02-32, where bare floor only existed. Smears for low-energy beta were only collected on the sub-floor.

Gillette Building

The location for SU03-70 had to be moved approximately 5 feet from its planned location due to being located within a locked utility room, after a diligent attempt had been to gain access. The new location was in the ladies' bathroom on the ceramic tile floor. Figures 20 through 29 accurately represent sample locations as they were taken in the field.

The location for SU03-75 had to be moved approximately 5 feet from its planned location due to being located within a locked utility room, after a diligent attempt had been to gain access. The new location was in the hallway as close to the planned location as possible. Figures 20 through 29 accurately represent sample locations as they were taken in the field.

The locations for SU03-79, 80, and 84 had to be moved from their planned locations due to being located on the roof (the section of the roof that covers the first floor of the building, but is level with the second floor of the building), where no radiological materials usage would have ever occurred, in addition to posing a possible safety hazard to the survey team. The new locations were in the walkway leading out to the roof. Figures 20 through 29 accurately represent sample locations as they were taken in the field. Building management did not approve access to the roof due to concerns for roof damage. Internal ventilation ducting was investigated and found to a small fraction of the DCGL; therefore potential fall-out of roof surfaces was remote. Additionally, records and interviews suggest that the roof had been replaced adding to the unlikelihood that contamination would be found.

The HSA determined that rooms 1066, 1082, 2143, 1205, 1205, 1206, and 1207 should be investigated. Renovation had occurred in this area and several of the rooms were consolidated and renamed. The entire area around rooms 1066, 1082 was scanned, to ensure the formerly impacted areas were covered. Floor and wall scans occurred in Room 2143 (the most recently terminated former RAM-using room) and the survey team took additional bias measurements in this area.

Rooms 1205, 1206, and 1207 were not identified on the floor plans, and were unable to be located in the field. Those rooms were taken off the WRAMC Health Physics Office Authorization 650 as of 1999, and it was determined that the room numbering scheme changed between 1999 and the time the characterization survey occurred. Those rooms were historically authorized for ^{125}I and ^{3}H (^{125}I was eliminated from the RCOPC list during the HSA phase as it has a half life of <120 days). Floor scan coverage was increased to increase the probability of detecting the presence of elevated activity indicating that contamination may be present. Floor scans of the first floor of the Gillette Building resulted in approximately 6.5% coverage, and the floor scan of the second floor of the Gillette Building resulted in approximately 5% coverage.

General

Per Appendix B of the SAP (Volume I of the SCWP), it was determined that the required minimum detectable concentration (MDC) for the Ludlum 43-68 could be met with a sample count time of 1 minute and background count time of 1 minute. For renovated areas where new tile covered original surfaces, to account for attenuation associated with mastic, these times were increased to a 2 minute sample count time/2 minute background count time for the 43-68.

Cobalt-57 (a pure gamma emitter) was included as a RCOPC for this survey effort. The DCGL for ^{57}Co (presented in Table 1-4 and based on the value found in NUREG/CR-5512 Table 5.19) was 2.11E+04 dpm/100cm^2. Gamma spectroscopy analysis for this RCOPC required nearly a kilogram of material. The survey team did not find enough mass to be useful for volumetric sample analysis. It was determined that after the smears were counted for removable alpha and beta, they would be bundled into a single composite sample that encompassed all survey units. The composite sample would then be analyzed via gamma spectroscopy. Because this is a non-destructive process, if elevated values were found for ^{57}Co, the laboratory could break down the composite sample into sub-composite smear bundles (per survey unit) to determine the cause of the elevated activity. If any elevated values were found for ^{57}Co on any of these sub-composite smear bundles, the laboratory could break down the bundle into individual smears. Due to the nature of gamma spectroscopy analysis, additional gamma emitting isotopes would be identified although the value for ^{57}Co would be the radionuclide of interest. If any other radionuclide exhibited abnormally high values, the sample would be further investigated. The analytical laboratory was able to achieve an MDC of 2.6 pCi/composite sample for Co^{57}, which converts to 5.72 dpm/ composite sample (1 pCi = 2.2dpm). During the field effort, 149 smears (covering 100 cm^2 each) were collected and composited, thus the total area covered by the composite smear was 14900 cm^2. However, to avoid potential issues of dilution, a more conservative approach was taken. The total activity of the composite sample was applied to the surface area covered by a single smear. Applying this extremely conservative approach resulted equated to 5.72 dpm/100 cm^2.

Sampling Apparatus and Field Instrumentation

The purpose of this section is to describe survey instruments and methodologies that were used for surveys implemented during site radiological investigations. Specific measurement/sampling frequencies and approaches are discussed in the SCWP.

For enclosed and unenclosed structures, scanning and integrated direct measurements and surface smears were performed to measure surface radioactivity concentrations of site RCOPCs. These measurements were based on alpha or beta emissions, depending upon the RCOPC of interest.

2.3 Direct Radiation Measurements

Building and indoor surfaces were measured for alpha and beta radioactivity using direct scan survey and integrated direct measurement techniques. These components of radiological characterization surveys were performed in accordance with CABRERA standard operating procedures (SOP) OP-020 "*Operation of Contamination Survey Meters*," Rev 0 (CABRERA, 2000a) and OP-021 "*Alpha-Beta Counting Instrumentation*," Rev 0 (CABRERA, 2000b), and CABRERA standard radiation instrumentation templates "*Alpha/Beta Counting and Smear Worksheet*", Rev 4.

Alpha and beta radioactivity direct scan surveys and integrated direct measurements were performed over at least 1-2% floors and lower walls (per a MARSSIM Class 3 survey) using a Ludlum Model 43-37 gas flow proportional detector floor monitor (active area of 582 square centimeters [cm^2]). In certain instances where accessibility was an issue, such as in small rooms, the floor monitor was replaced with a Ludlum 43-68 (active area of 126 cm^2) handheld alpha/beta radioactivity gas flow proportional detector. Both the 43-37 and 43-68 detectors were coupled to a Ludlum 2360 Alpha-Beta Data Logger. The 43-37 and the 43-68 were calibrated to measure both alpha and beta surface activity (i.e., dual channel analysis). Alpha and beta measurement results were recorded separately. These detectors are not sensitive to relatively low-energy alpha/beta radioactivity due to the presence of their Mylar® entrance windows. Beta emitters with maximum energies less than approximately 40 keV cannot be effectively detected. Per calculations in Appendix B of the SAP (Volume I of the SCWP), this instrumentation setup was capable of detecting all alpha and beta emitters ≥40keV and thereby appropriate for this characterization effort. It should be noted that direct readings using the 43-68 and43-37 probes are not technically feasible for H-3 and other low energy betas, therefore analysis for these isotopes was accomplished via liquid scintillation counting of swipe samples only.

Measurement locations were located using a tape measure or equivalent method in facilities.

2.4 Integrated Direct Radioactivity Measurements

As discussed in Section 2.3.3 (Field Changes to Work Plan), actual count times used in the field for integrated alpha/beta measurements are expressed as Table 3-1:

Table 2-2: Count Times for Integrated Alpha/Beta

Alpha/beta limiting integrated (all areas)	**2 min**
Alpha/beta limiting background (all areas)	**2 min**

Additional bias measurements were performed at locations determined in the field throughout the performance of the random location survey. Bias measurements were performed at the following locations:

- Floor drains in Building 511, Building 512, and the Gillette Building
- Sink drains in Building 512 and the Gillette Building
- Horizontal structures with surfaces where airborne contamination may have settled (e.g., counter tops, bench tops, exhaust fans, etc.) in Room 114 of Building 511
- Room 2143 in the Gillette Building
- Ventilation ducts in 511, 512 and Gillem

In cases where contamination is suspected, it is appropriate to subtract out the material-specific reference area background measurement. This value would be compared to the DCGL to ensure that what is being observed is truly contamination, as opposed to just a higher end of background contribution. In the case of Forest Glen, little to no actual contamination was expected, and all gross results were lower than the DCGL, even with the inclusion of background. To demonstrate a more conservative approach, all data as presented in this report includes the contribution of background.

2.4.1 General Area Gamma Exposure Rate Measurements

General area gamma exposure rate measurements were qualitatively performed during the survey activities to ensure worker health and safety and to identify unusual exposure rate conditions. Measurements were performed using a Ludlum Model 19 tissue-equivalent scintillation detector, in accordance with CABRERA operational procedure OP-023, "*Operation of micro-R Meters*", Rev 0 (CABRERA, 2000c). Measurements were performed using the "slow" response time constant setting. The detector was positioned over the area of interest and allowed to stabilize prior to recording the measurement. The technician used their judgment to determine when the instrument has stabilized. Such measurements were performed at 1 meter from and/or on contact with the surface being evaluated.

2.5 Smear Sample Collection and Analysis

Smear samples were collected at specific locations, as to quantify transferable surface alpha and beta radioactivity. Smear samples were collected over approximately 100 cm^2. Smear samples were analyzed for alpha and beta radioactivity using a Ludlum Measurements, Inc. (Ludlum) 2929 alpha/beta scintillation counter in accordance with CABRERA operational procedure OP-021 *"Alpha-Beta Counting Instrumentation,"* (CABRERA, 2000b). Count times are shown in Table 3-2. Note that these count times represent a field change to the SCWP (as discussed in Section 2.3.3)

Table 2-3: Count Times for Removable Alpha/Beta

	Ludlum 2929
Alpha limiting integrated (all areas)	**2 min**
Beta limiting integrated (all areas)	**2 min**
Alpha limiting background (all areas)	**5 min**
Beta limiting background (all areas)	**5 min**

Additional smear samples were collected to be analyzed for low energy beta (via ^{3}H, ^{63}Ni, ^{129}I, and ^{14}C) an analytical laboratory (ALS-Paragon). All raw data, as well as data summary tables, can be found in Appendix C. Low energy beta analysis was performed using 2 channel liquid scintillation counting. The lower energy channel was used to report H^{3} concentrations directly. The upper analysis window was open between 20-175 keV and results were reported in gross counts per minute. An isotope specific efficiency was established for each of the other low energy RCOPCs. Results in this window were reported in gross CPM and then divided by the efficiency of each isotope found within the window.

Table 2-4: Isotope Specific LSC Efficiencies

Isotope	LSC Efficiency
C^{14}	0.49 counts/disintegration
I^{129}	0.44 counts/disintegration
Ni^{63}	0.102 counts/disintegration

After counting smears for gross alpha/beta, the smears were bundled into a composite sample to be analyzed via gamma spectroscopy (to account for ^{57}Co) by the analytical laboratory. All raw data, as well as data summary tables, can be found in Appendix C.

2.6 Volumetric Sample Collection and Analysis

The survey team did not find enough mass in drains, ducts, sinks etc to be useful for volumetric sample analysis. Therefore, volumetric samples were not collected. However, analysis of the composite smear for gamma spectroscopy is intended to be a surrogate for any volumetric sample collection and analysis. Given the *mission* at Forest Glen, there was no expectation of any volumetric contamination that would not be removable at the surface, thus, this was an appropriate approach.

3.0 SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

3.1 Field Log

Project data was recorded in a field data logbook and subsequently transferred to an electronic format (presented in Appendix B). Field data logbook records are sufficient to allow data transactions to be reconstructed if *necessary*. The Project Manager was responsible to ensure logbook(s) entries were completed appropriately.

The following information, at a minimum, was recorded:

- Instrument (e.g., meter/detector) serial numbers
- Names of field survey personnel
- Identification of area surveyed
- Description of large obstacles or geographic features that limit accessibility to the areas to be surveyed
- Notes regarding equipment performance (e.g., loss of satellite signal, technical malfunction, etc.)
- Notes regarding any issue related to the survey and requiring documentation

The field data logbooks are permanently bound and the pages are numbered. Pages were not removed from logbooks under any circumstances. All entries were made in blue or black ink. Entries are legible, factual, detailed, and complete and shall be signed and dated by the individual(s) making the entries. If a mistake was made, the error was denoted by placing a single line through the erroneous entry and initialing the deletion. Under no circumstances was any previously entered information completely obliterated. Use of whiteout in data logbooks was not permitted for any reason.

3.1.1 Project Logbook

All significant events that occurred during this radiological characterization survey were documented and retained for future reference. While many types of project events have specific forms on which they are documented, many events occur on a routine basis during survey field activities that were documented as they occurred. Additionally, project data transactions were also to be recorded as they occurred.

Significant project events were recorded in the Project Logbook. The Project Manager/Field Operations Lead (FOL) was responsible for maintaining the Project Logbook and reviewed the Project Logbook at least daily to report significant issues.

The Project Logbook is considered a legal record and remains permanently bound. The pages were numbered and were not removed from the logbook under any circumstances. Entries are legible, factual, detailed, and complete. If a mistake was made, the individual making the entry placed a single line through the erroneous entry and initialed and dated the deletion. Under no circumstances was any previously entered information completely obliterated. Use of whiteout in the Project Logbook was not permitted for any reason. Only one Project Logbook was maintained. The Project Logbook is presented in electronic format in Appendix B.

3.2 Sample Documentation

This section describes procedures for maintaining sample control through proper sample documentation. When samples are collected for radiological analyses, documentation is shown through sample labels, chain-of-custody (COC) forms, and field logbooks. This information enables the maintenance of sample integrity from the time of the sample collection through transport to the laboratory. All documentation was completed with indelible ink.

3.2.1 Sample Labels and/or Tags

Sample labels were printed directly onto the sample containers in indelible ink, and they included the following items:

- Client name
- Project name
- Sample location
- Date/time
- Sample collector
- Sample identification
- Preservation
- Analyses requested

The sample labels and COC were generated using an electronic database management system to more accurately and precisely manage the sample identification numbers, labeling, and chain-of-custody.

3.2.2 Chain-of-Custody Records

A COC form was completed and accompanied each sample shipment. The following information was provided on the chain-of-custody:

- Site name
- Laboratory name and contact.
- Turnaround time-only if site-specific conditions require non-standard turnaround time.
- Sample ID, matrix, sample date, and collection time.
- Parameters, analytical methods, bottle type, bottle volume, sample type, and preservative.
- Signed release on bottom of chain-of-custody.

The COC were generated using an electronic database management system to more accurately and precisely manage the sample identification numbers, labeling, and chain-of-custody.

3.2.3 Receipt for Sample Forms

The analytical services laboratory analyzed the condition of the samples upon receipt. This information was recorded on a form. The form included the date, client's name, cooler number, temperature of samples, etc. The laboratory sample custodian or manager signed and dated the form. The form was returned by email within 24 hours of receiving the samples. Receipts received by the analytical laboratory are presented in Appendix C.

3.3 Field Records

Field analytical records are presented in Appendix B. Such records included the following field data forms for recording the results/measurements and quality assurance/quality control (QA/QC) checks for field surveys:

- Radiological instrument QC checks
- Instrument calibration records
- Daily Quality Control Reports (DQCR)

3.4 Corrections to Documentation

Corrections to documentation consisted of placing a single line through an incorrect entry, noting corrected information, and initializing and dating the changes.

4.0 SAMPLE PACKAGING AND SHIPPING

The procedures for packaging and shipping samples collected during the performance of the characterization survey are outlined below.

4.1 Sample Handling

The designee of the Project Manager/FOL arranged for delivery of all coolers, labels, and sample containers prior to conducting field activities. Sample containers were labeled using indelible ink directly on the sample container. The labels included the project name and number, unique sample identifier, sample date and time of collection, sample procedure (i.e., wipe), preservative used, analysis requested, and sampler's initials.

4.2 Sample Transport

Sample labels, field notebook information, and chain-of-custody forms were checked for accuracy in sample identification and to verify that all the required information had been supplied. As soon as the sampling team was ready to transport samples from the field to the laboratory, the laboratory point-of-contact was notified of the shipment, along with the estimated time of arrival. Samples were shipped to the laboratory via overnight carrier.

5.0 RESULTS AND EVALUATION OF DATA QUALITY OBJECTIVES

5.1 Characterization Survey Results

The results of the characterization survey measurements and sample analyses are summarized in the sections to follow. Characterization Survey worksheets for each building are also provided in Appendix A. Each of these worksheets contains results of direct and removable contamination measurements.

5.1.1 Static Measurement/Scan Results

A total of 140 static (integrated direct contamination) measurements were collected during the field effort at randomly generated locations. The 140 static measurements were comprised of 30 random and 15 biased measurements in Survey Unit (SU)-01 (Building 511), 29 random measurements on the surface of the tile, 30 measurements on the bare floor, and 3 biased measurements in SU-02 (Building 512), and 30 random and 3 biased measurements in SU-03 (Gillette Building).

A summary of the results are presented in Table 6-1 and Table 6-2, and raw data is also presented in Appendix A. As seen in Table 6-1 and Table 6-2, no results exceed the DCGLs as previously presented in Table 2-3.

Surface scan surveys were performed in all accessible areas of the buildings. A minimum of 1-2% of floor areas were surveyed in Class 3 areas (see coverage as highlighted in Figure 9, Figure 14, Figure 19, Figure 24, and Figure 29); however, due to ease of use of the instrument, as well as the need for a conservative approach, this guideline was exceeded as follows:

- The floor scan of the first floor of the Building 511 resulted in approximately 7% coverage, and the floor scan of the second floor of the Building 511 resulted in approximately 5% coverage, for a total of 6% coverage.
- The floor scan of Building 512 (with only one floor) resulted in approximately 10% coverage.
- The floor scan of the first floor of the Gillette Building resulted in approximately 6.5% coverage, and the floor scan of the second floor of the Gillette Building resulted in approximately 5% coverage, for a total of 5.75.5% coverage.

NUREG-1507 provides a rigorous derivation of the calculational expression for instrument sensitivity, typically stated as the minimum detectable concentration (MDC). The MDC equations and example values for both static and scan measurements are presented in this section.

For static measurements, background and indicator measurements are both typically one minute in duration. The following equation for the MDC from NUREG-1507, Equation 3-10, as modified, applies:

$$StaticMDC = \frac{3 + 4.65\sqrt{C_b}}{(\varepsilon_s)(\varepsilon_i)\left(\frac{a}{100cm^2}\right)}$$

where:

C_b = Background count in one minute
ε_i = Intrinsic instrument efficiency
ε_s = Surface efficiency
a = probe area in cm^2

Table 5-1: Observed Static Alpha MDC

Observed Field MDC Calculations - Static Readings (Alpha)						
Instrument	**S/N**	**R_B**	**T_{S+B}**	**T_B**	**K**	**MDC**
43-68	PR160790	0.50	2	2	0.230	13.11
43-68	PR116721	0.40	2	2	0.260	11.00
43-37	PR066273	2.20	2	2	0.290	19.83

Table 5-2: Observed Static Beta MDC

Observed Field MDC Calculations - Static Readings (Beta)						
Instrument	**S/N**	**R_B**	**T_{S+B}**	**T_B**	**K**	**MDC**
43-68	PR160790	130.20	2	2	0.260	147.39
43-68	PR116721	121.10	2	2	0.260	142.25
43-37	PR066273	140.60	2	2	0.270	147.49

For scanning, the time interval over an area is typically one second. The following equation is developed from reference NUREG-1507.

$$ScanMDC = \frac{1.38 * 60\sqrt{\frac{R_B}{60}}}{\sqrt{0.5}(\varepsilon_s)(\varepsilon_i)\left(\frac{a}{100cm^2}\right)}$$

where:

1.38 = a desired performance proportions level of 0.95 for true positive results and a level 0.6 false positives;
R_B = Background rate in cpm; and
0.5 = MARSSIM determined level of performance for the surveyor.

Thin window gas-flow proportional counters are typically used for performing alpha surveys and these were selected for this project. Alpha radiation has a very limited range and is significantly affected by surface conditions. For this reason, alpha scans are generally performed on relatively smooth, impermeable surfaces (*e. g.*, concrete, metal, drywall) and not on porous material (*e. g.*, wood) or for volumetric contamination (*e. g.*, soil, water). Instrumentation is kept as close to the surface as practical while scanning for alpha radiation, typically less than 1 centimeter (0.4 inches). In most cases, porous and volumetric contamination cannot be detected by scanning for alpha activity and meet the objectives of the survey because of high detection sensitivities.

The alpha scanning process was performed in two stages: continuous monitoring and stationary sampling (pausing). During the continuous monitoring, the surveyor listened to the number of clicks or counts. Because the instrument background for alpha is low (<3 cpm), a single count gave the surveyor cause to stop and investigate further by pausing for an additional few seconds. The scan MDC for alpha contamination was based on the continuous monitoring stage.

<u>MARSSIM has formulas and probability concepts for scanning alpha contamination when the background is less than 3 cpm.</u> Abelquist [Reference 10.13] has developed scan MDCs on structure surfaces for alpha radiation by use of Poisson summation statistics. Appendix J in MARSSIM provides a complete derivation of the formula used to determine the probability of observing a single count:

$$P(n \geq 1) = 1 - e^{-\left(\frac{G\varepsilon t}{60}\right)}$$

Where:

$P(n \geq 1)$ is the probability of observing a single count;
G is the elevated area activity (αpm);

ε is the detector efficiency (4π); and
t is the residence time of the detector over the activity.

The scan process was performed in two stages: continuous monitoring and stationary sampling (pausing). During the continuous monitoring, the surveyor listened to the number of clicks or counts. Because the instrument background is low (<3 cpm), a single count gives the surveyor cause to stop and investigate further by pausing for an additional number of seconds. The scan MDC for alpha contamination is based on the continuous monitoring stage which is illustrated as follows.

Per Abelquist's example pages 193-197 [Reference 10.13], setting the P(n ≥ 1) at the 90% level and solving for G which is now defined as the alpha scan MDC.

$$scanMDC_{alpha} = \frac{[-\ln(1-P(n \geq 1))]60}{\varepsilon_i \varepsilon_s t}$$

where:

ε_i = Intrinsic instrument efficiency
ε_s = Surface efficiency
t = residence time (sec), calculated from scan rate

The scan rate selected for alpha was very slow at a 4 second interval; additional time does not reduce the MDC appreciably. The scan MDC for alpha was calculated to be 60 dpm/100 cm^2. With increases in alpha background rates, the scan MDCs would be higher and a conservative decision was made to use 60 dpm/100 cm^2 for all materials.

Use of the formula used for beta scanning shown above when alpha background rates are >3 is more correct. Investigation of every count for a high background material is not feasible and DQOs regarding the counts to be investigated were established. In this case, a rate of 4 to 5 counts/sec indicated radiation levels exceeding the MDC and detecting the presence of residual radioactivity.

Thin window gas-flow proportional counters are also normally used when surveying for beta emitters and were selected for this project. High-energy beta radiation is easier to measure than alpha radiation because the beta particles are smaller and have less charge, which increases the range. Similar to scanning for alpha radiation, the beta detector is held as close to the surface as practical (approximately 1 centimeter) and moved at a rate such that the desired IL can be detected. The beta scanning process was performed in two stages: continuous monitoring and stationary sampling (pausing). During the continuous monitoring, the surveyor listened to the number of clicks or counts. Because the instrument background for beta is higher than the instrument background for alpha, the surveyor listened for an increased count rate relative to instrument background. An increased count rate was cause to stop and investigate further by pausing for an additional few seconds. The scan MDC for beta contamination was based on the continuous monitoring stage and was calculated to be 212 dpm/100cm2.

5.1.2 Results of Removable (Smear) Contamination Measurements

A total of 140 smears (1 at each static measurement location) were collected for alpha and beta removable contamination. A summary of the results is presented in Table 6-2 with all raw data presented in Appendix A. As seen in Table 6-3 and Table 6-4, no results exceed the DCGLs. The removable contamination DCGLs represent 10% of the "Total" contamination DCGLs for surfaces, as presented in Table 2-3.

In addition to the onsite alpha-beta screening, the 140 smears were bundled into a composite sample (after analysis on the 2929 was complete) for analysis by gamma spectroscopy. The result of this analysis is presented in Table 6-9, with raw data presented (and summarized) in Appendix C. Gamma spectroscopy results were presented in the units of pCi/sample and then converted to dpm/100cm^2 for comparison and analysis (via conversion factor of 2.2 dpm/pCi and the fact that each smear covered 100 cm^2). Note that the raw data for the gamma spectroscopy analysis includes results for other radionuclides as well. These radionuclides are present in the gamma spectrum, but the gamma RCOPC for this field effort is ^{57}Co (and thus the value within the data set to be used for comparison is the value for ^{57}Co). If any suspiciously high values had shown up in the raw data for any other radionuclides, they would have been investigated further, but this was not the case for the analysis performed.

A total of 95 smears were also collected and analyzed for low-energy beta, with no results found to exceed the DCGL. These 95 smears were comprised of 30 random smears and 1 biased smear in SU-01 (Building 511), 30 random smears and 1 biased smear in SU-02 (Building 512), and 30 random smears and 3 biased smears in SU-03 (Gillette Building). Results were reported in units of picoCuries per sample and converted to units of dpm/100cm^2 for analysis and comparison against the project DCGL.

A summary of smear results is presented in Tables 5-3 through 5-5, with the laboratory data summarized in Appendix C (full electronic data deliverables are also available in Appendix C).

Table 5-3: Static Survey Summary by Building (Alpha)

Building	Number of readings (n)	Minimum Value (dpm/100 cm^2)	Maximum Value (dpm/100 cm^2)	Mean Value (dpm/100 cm^2)	Standard Deviation (dpm/100 cm^2)	Surfaces > DCGL? DCGL = 101 dpm/100 cm^2 (alpha, DU)	Percent of DCGL
511	45	-1.85	14.77	1.6	3.1	No	2%
512	62	-3.5	15.7	1.8	4.2	No	2%
Gillette	33	-3.5	20	1.1	4.9	No	1%

Table 5-4: Static Survey Summary by Building (Beta)

Building	Number of readings	Minimum Value (dpm/100 cm^2)	Maximum Value (dpm/100 cm^2)	Mean Value (dpm/100 cm^2)	Standard Deviation (dpm/100 cm^2)	Surfaces > DCGL? DCGL = 7050 dpm/100 cm^2 (beta, ^{60}Co)	Percent of DCGL
511	45	-64	430	64	92	No	1%
512	62	-3.8	456	177	98	No	3%
Gillette	33	-20	973	141	177	No	2%

Table 5-5: Smear Survey Summary by Building (Alpha)

Building	Number of smears (n)	Minimum Value (dpm/100 cm^2)	Maximum Value (dpm/100 cm^2)	Mean Value (dpm/100 cm^2)	Standard Deviation (dpm/100 cm^2)	Surfaces > DCGL? DCGL = 10.1 dpm/100 cm^2 (alpha, DU)	MDC (dpm/100 cm^2)
511	45	-0.5	1.2	-0.3	0.4	No	9.5
512	62	-0.5	2	-0.1	0.6	No	9.5
Gillette	33	-0.5	2	-0.3	0.6	No	9.5

Table 5-6: Smear Survey Summary by Building (Beta)

Building	Number of smears (n)	Minimum Value (dpm/100 cm^2)	Maximum Value (dpm/100 cm^2)	Mean Value (dpm/100 cm^2)	Standard Deviation (dpm/100 cm^2)	Surfaces > DCGL? DCGL =705 dpm/100 cm^2 (beta, ^{60}Co)	MDC (dpm/100 cm^2)
511	62	-4.8	66	23	17	No	151
512	45	-18.5	64	24	17	No	151
Gillette	33	3.8	72	36	16	No	151

Table 5-7: Smear Survey Summary by Building (Low Energy Beta, Tritium,C-14, I-129, Ni-63)

Building	isotope	Number of samples (N)	Min Value	Max Value	Value	Standard Deviation	MDC	DCGL dpm/100cm2	% DCGL
511	H-3	31	-8.6	2.4	-1.9	2.3	20	1.20E+07	2.00E-09
512	H-3	31	-7.7	17.5	0.7	4.9	20	1.20E+07	1.46E-08
Gillette	H-3	31	-6.2	4.2	-0.7	2.7	20	1.20E+07	3.50E-09
511	C-14	31	19.2	21.7	17.5	2.3	24.8	3.75E+05	5.79E-07
512	C-14	31	21.7	40	35.9	4.9	24.8	3.75E+05	1.07E-06
Gillette	C-14	31	17.5	35.9	28	2.7	24.8	3.75E+05	9.57E-07
511	I-129	31	20.7	40.5	29.5	4.6	26.1	3.50E+05	1.16E-06
512	I-129	31	23.4	43.2	31.8	5.2	26.1	3.50E+05	1.23E-06
Gillette	I-129	31	18.9	38.7	30.3	4.3	26.1	3.50E+05	1.11E-06
511	Ni-63	31	47.1	92	67.1	4.9	80.6	1.80E+05	5.11E-06
512	Ni-63	31	53.2	98.2	72.3	5.6	80.6	1.80E+05	5.46E-06
Gillette	Ni-63	31	43	88	68.8	4.7	80.6	1.80E+05	4.89E-06

Table 5-8: Composite Smear Analysis Summary (Gamma Spectroscopy)

Building	Result (dpm/100 cm^2)	Surfaces > DCGL? DCGL = 2.11E+04 dpm/100 cm^2 (^{57}Co)	MDC (dpm/100 cm^2)
ALL	-1.11	No	2.6

Table 5-9: Sum of Ratios (Direct Beta/Direct Alpha/Low energy beta)

Building	Direct Beta Percentage of DCGL	Direct Alpha Percentage of DCGL	Low Energy Beta Percentage of DCGL*	Sum of Ratios
511	1%	2%	6.8E-06%	3%
512	3%	2%	7.8E-06%	5%
Gillette	2%	1%	7.0E-06%	3%

* As a conservative measure the maximum low energy beta values were used in the SOR calculations

5.1.3 Results of Exposure Rate Surveys

Exposure rate surveys with a Ludlum Model 19 meter were taken in general areas of each building. All exposure rate measurements were shown to be consistent with ambient background levels in each building or area. The results of the surveys are provided in the Survey Forms in Appendix A and shown on Figures 9, 14, 19, 24, and 29.

Table 5-10: Summary of Gamma Dose Rates per Building

Instrument		S/N
Ludlum Model 19		167164
Building	**Survey Unit**	**Exposure Rate Range**
511	1	5-8 uR/hr
512	2	4 - 7 uR/hr
Gillette	3	3 - 8 uR/hr

6.0 DATA QUALITY ASSESSMENT

A quality assessment of the data collected during the characterization surveys at Forest Glen Annex was performed. The assessment included the following aspects of the data set:

- The completeness of the data set with respect to the requirements outlined in the SCWP.
- Basic (i.e. minimum, maximum, mean) Statistical Analysis of the data set
- QA/QC records for instrumentation

6.1 Data Completeness

All data that was specified in the SCWP was collected and analyzed successfully.

6.1.1 Statistical Analysis

Basic statistical analysis was performed on the characterization data that was collected during the performance of the sampling requirements of the SCWP. The analysis included quantities such as the minimum, maximum, and mean of static and smear sampling, as well as minimum, maximum, and mean of low energy beta analysis results. The values for this analysis are presented in the summary tables in section 6. The statistical analysis is intended for comparison purposes only, as rigorous statistical analysis will be performed during development of the FSSR.

6.1.2 Instrument Quality Assurance / Quality Control

During the execution of characterization survey work, *qualitative* and *quantitative* instrumentation was used to collect measurements. *Qualitative* instruments (e.g., Ludlum Model 19) provide results that show that a parameter (e.g. radioactive contamination) is present or is not present with a lesser degree confidence in determining "how much" is present. Conversely, *quantitative* instruments [Alpha/beta detectors (e.g., Ludlum Models 43-68 and 43-37) and a smear counter (Ludlum Model 2929)] are used to determine if a parameter is present and to estimate "how much" is present with a known degree of confidence. The QA/QC elements for these two instrument classes are similar, with the quantitative class being more rigorous. There are three QA/QC checks that are accomplished for each class:

General Instrument Conditions

During daily QA/QC checks, both classes of instruments were inspected for physical damage, battery voltage levels, current calibration, and erroneous readings, in accordance with CABRERA's standard operating procedures (SOPs)

Instrument Response Checks

Instruments used for qualitative measurements were response checked daily by comparing response to designated cesium-137 (^{137}Cs) National Institute of Standards and Technology (NIST) traceable source and to ambient background. The acceptance criteria for these instrument response checks are +/- 20% of the mean response generated using ten initial source checks and ten measurements of ambient background

Instruments used for quantitative measurements were response checked daily by comparing response to designated ^{230}Th and ^{99}Tc NIST-traceable sources and to ambient background. The acceptance criteria for these instrument response checks was two and three-sigma of the mean response generated using ten initial source checks and ten measurements of ambient background.

Background Checks

Background checks were performed daily for each qualitative instrument. These checks were performed to monitor fluctuations in ambient gamma background that could impact the interpretation of the measurements, not to monitor the performance of the instruments. The results of the background measurements were recorded and presented on a control chart. Background measurements were performed in an identical fashion for a 10-minute count, with no source. The acceptance criteria for these instrument response checks will be two and three-sigma of the mean. The results of the background measurements were recorded

A response check outside the two-sigma range, but within the three-sigma range is considered cause for a recount prior to further evaluation. A response check outside the two-sigma range on the second count or three-sigma range on the initial count is considered cause for further evaluation prior to continued use. A response check outside these limits is cause for an evaluation of conditions (e.g., instrument operation, source/detector geometry) prior to further counts and/or removal of the instrument from service. Instruments must pass a response check prior to field use.

There were no QA/QC issues identified during the field activities at Forest Glen Annex. The QA/QC data for this field effort is presented in Appendix B.

6.2 Off-Site Laboratory Sample Analysis

Gamma spectroscopy analysis of the composited swipe samples was performed by the off-site laboratory ALS-Paragon (Paragon) in Fort Collins, Colorado using the U.S. Environmental Protection Agency (USEPA) 901.1 method. Low energy beta (specifically, ^{3}H, ^{14}C, ^{129}I, and ^{63}Ni) analysis, where applicable, was performed via Liquid Scintillation (USEPA 900 method). Analysis of the composite smear was performed via gamma spectroscopy.

Paragon calibrates gamma spectrometers using NIST-traceable mixed radionuclide standards in a soil matrix. The calibration geometry is identical to the counting geometry for the sample. The efficiency calibrations are performed annually, when routine checks indicate a calibration problem, or following repairs to a system component. Energy calibrations are performed at least once per quarter, or when performance checks or system maintenance dictate the need for recalibration.

In December 2009, the laboratory analyzed 95 wipes for ^{3}H in 8 analytical batches (reported over 6 laboratory reports), as well as 1 composite smear via gamma spectroscopy (reported in 1 laboratory report).

As analytical QC, in December 2009, the laboratory analyzed 9 field duplicate samples, 8 internal laboratory duplicate samples, 9 method blanks (MBs), 9 laboratory control samples (LCS), and 9 laboratory control sample duplicates (LCSD) for ^{3}H.

The laboratory performed internal validation of all sample results and assigned qualifiers. The laboratory validation addressed sample chain of custody, instrument performance, ability to meet required detection limits, the results of the QC samples, and other factors that might affect data quality. The results of the validation are summarized in a case narrative provided for each shipment of samples received by the laboratory. As a part of its analytical data review, CABRERA reviewed the case narratives and the results of the quality control samples. The following sections provide a summary of those reviews. All off-site laboratory Electronic Data Deliverables (EDD) are included in Appendix C.

6.2.1 Chain of Custody

Chain of custody (COC) forms were maintained for all samples collected and analyzed during the project. No custody deficiencies were identified during the course of the project. Copies of the signed COC forms are maintained in the project files. No results needed to be qualified due of COC deficiencies. Completed copies of all COC forms are provided as part of the lab report Electronic Data Deliverables (EDD) in Appendix C.

6.2.2 Data Qualifiers

Paragon uses the "U" qualifier to denote that the reported result is less than the sample-specific MDC. The "LT" qualifier is used to denote that the reported result is less than the requested MDC, but greater than the sample-specific MDC.

6.2.3 Instrument Response

To monitor instrument performance, Paragon makes a series of daily measurements for both the gamma spectrometers. These checks included peak energy, peak resolution, efficiency and background. The results of these checks were recorded and compared against warning and action limits. Exceedance of a warning limit does not require operator response, but may be used by laboratory quality personnel to identify potential instrument problems. If an action limit is exceeded, the action must be taken and the instrument cannot be used until the problem is corrected and the checks are in control. The results of the routine instrument checks were reviewed as a part of the data validation process. No results were qualified because of any instrument performance problems.

6.2.4 Field Duplicate Evaluation

Duplicate samples were collected and sent offsite to Paragon for gamma spectroscopy analysis in order to evaluate the sample collection procedures of CABRERA personnel. Duplicate samples were required for 10% of the total samples collected (3 per SU). Duplicate measurements of radioactivity concentration were compared to the initial analytical results by determining a z-score and comparing it against the performance criteria as follows.

The z-score for each data set was calculated using the following equation:

$$\text{Z - score} = \frac{|\text{Sample - Duplicate}|}{\sqrt{\sigma^2_{\text{Sample}} + \sigma^2_{\text{Duplicate}}}}$$

Where:

Sample	= Original sample value,
Duplicate	= Duplicate sample value,
σ_{Sample}	= 2σ counting uncertainty of the sample, and,
$\sigma_{\text{Duplicate}}$	= 2σ counting uncertainty of the duplicate.

The calculated z-score results were compared to a performance criterion of less than or equal to 1.96, which represents the 95% confidence interval to the mean in a normal population. Calculated z-scores less than 1.96 would be considered acceptable, and values greater than 1.96 would be investigated for possible discrepancies in analytical precision, or for sources of disagreement with the assumption that the sample result and duplicate sample result are of the same normally distributed population. The standard deviations, σ_{Sample} and $\sigma_{\text{Duplicate}}$, represented the true standard deviation of the measured population.

A total of 9 field duplicate samples were collected, representing 9.5% of the 95 study samples obtained. All but two duplicate samples, i.e. 78% of the total, met the performance criteria of less than or equal to 1.96 for ^{3}H analysis. The two duplicate samples that did not meet z-score performance criteria were taken at SU02-46 and SU03-86, with SU02-46 demonstrating a z-score of -2.05 and SU03-86 demonstrating a z-score of 2.24. These values represent only slight differences from the 1.96 performance criterion, and can be primarily attributed to how close data values were determined to be to each other, SU02-46 had a result of -0.9 with uncertainty of 2.70 and its field duplicate had a result of 3.1 with uncertainty of 2.70, and SU02-86 had a result of 1.9 with uncertainty of 2.70 and its field duplicate had a result of -2.3 with uncertainty of 2.50.

Based on these results, it is expected that the original and duplicate results were part of the same population at the required confidence level (95%).

Therefore, it is concluded that these laboratory sample results meet the evaluation of precision without qualification. Z-score worksheets are presented in Appendix B, and detailed QC duplicate results are shown in Appendix C.

6.2.5 Laboratory Duplicate Evaluation

Duplicate analyses of samples were performed by Paragon to evaluate the precision of their results. Duplicate analyses were required for 10% of the total samples analyzed from all SUs. The duplicate results were compared to the initial sample results by calculating a z-score and comparing it against the performance criteria as follows. The z-score for each sample-duplicate pair was calculated using the equation in Section 6.2.4.

The calculated z-score results were compared to a performance criterion of less than or equal to 1.96, which represents the 95% confidence interval to the mean in a normal population. Calculated z-scores less than 1.96 would be considered acceptable, and values greater than 1.96 would be investigated for possible discrepancies in analytical precision, or for sources of disagreement with the assumption that the sample result and duplicate sample result are of the same normally distributed population.

A total of 8 laboratory duplicate samples were analyzed for ^{3}H, representing 8.4% of the 95 study samples obtained. Based on these results, it is expected that the original and duplicate results were part of the same population at the required confidence interval (95%). Therefore, it is concluded that these laboratory sample results meet the evaluation of precision without the need for qualification. Detailed QC duplicate results are shown in Appendix C.

6.2.6 Method Blank

A MB is a sample, typically reagent grade water that is known to be free of the analytes of interest. The MB is analyzed along with samples of an associated analytical batch and receives the same reagents, in the same quantities, and is carried through the same sample preparation (e.g., digestion/extraction) and analysis steps as all other samples. The MB provides assurances that an analyte of interest is not inadvertently added to the samples through a reagent or analytical operation. Paragon analyzed one MB with each analytical batch of 20 or fewer samples, for a total of 9 MBs in December 2009 and 1 MBs in April 2010. When an analyte of interest is found in the MB, there is the possibility that the sample results will be biased high. Results are qualified as estimated (J) for all associated samples that have activity concentrations above the detection limit and less than 10 times the blank value. When results are qualified as estimated, it is the responsibility of the data user to determine whether the data are acceptable for use. None of the samples were qualified because of MB activity.

6.2.7 Laboratory Control Sample / Laboratory Control Sample Duplicate

When sample volume was insufficient to allow preparation of a duplicate, laboratory control samples (LCS) and laboratory control sample duplicates (LCSD) are prepared in lieu of a field duplicate sample. A LCS is a sample that is prepared by adding a known aliquot of the analyte of interest, or a surrogate analyte to a volume of laboratory certified reagent grade water. The LCS is analyzed with the associated sample batch using the same analytical procedures and instruments. The LCS results are used as a measure of the accuracy of the analytical methods. Paragon analyzed one LCS with each batch of 20 or fewer samples, for a total of 9 LCS (with 9 LCSD). If the LCS results are unacceptable, samples in the analytical batch are typically reanalyzed. In cases where the samples are not reanalyzed, the results may be rejected (R-qualifier) or qualified as estimated (J-qualifier) during the data validation or review process. No radiochemical sample results were rejected or qualified as estimated on the basis of LCS results.

6.2.8 Detection Limits

MDC requirements are typically established during the development of project data quality objectives and represent the sensitivity required for the analytical procedures. The MDC is a statistical parameter that represents the uncertainty associated with the measured concentration of an analyte near background concentrations. When practical, MDCs are set well below project-specific action criteria such as regulatory limits or clean-up goals. The MDCs are set sufficiently low to provide assurances that the concentrations of analytes that are "undetectable" will not exceed action limits. For the FSS, the MDCs were set at 10% of the project $DCGL_W$ defined in the SCWP. The laboratory met the MDCs for the RCOPCs for all samples. No data were qualified because of a failure to meet the MDCs.

6.2.9 Method Performance and Summary Assessment

Overall, the performance of the laboratory analyses was excellent. The samples were analyzed for all of the analytes as required by the contracts with the laboratories as part of the FSS. The data were subjected to data review and validation by Paragon personnel and appropriate qualifiers applied to the data. In addition, CABRERA independently reviewed the data for the QC samples: duplicate samples, LCS, and MBs. The results of the QC samples were all acceptable and did not indicate any data quality problems. None of the data were rejected during the data validation and review process.

6.3 Evaluation of Data Quality Objectives

Data Quality Objectives (DQOs) for this Characterization Survey effort were defined in Section 3.3 of the SAP (Volume I of the SCWP). The results of this characterization survey were evaluated against the DQOs to ensure that the intent of the SCWP has been fulfilled. Evaluation of the DQOs for final release of each area will be performed in the FSSR, to be provided under separate cover. The following outlines the DQOs for this phase of radiological investigation.

6.3.1 Step 1: State the Problem

6.3.1.1 Problem Description

RAM has been used in existing and former hospital facilities and research laboratories at the Forest Glen Annex and leased facilities in Rockville, MD over the course of its operating history. A characterization survey was conducted in impacted areas as defined in the HSA to provide a more comprehensive picture of what areas have been truly impacted by this RAM usage.

6.3.1.2 Results

A characterization survey was conducted in accordance with the SCWP and a comprehensive view of the radiological status of impacted areas has been developed.

6.3.2 Step 2: Identify the Decision

6.3.2.1 Principal Study Question

Do RCOPC concentrations within Impacted areas exceed background levels by more than the chosen applicable levels for unrestricted release; and if so, what is the nature and extent of the contamination?

6.3.2.2 Decision Statements

The following statements assume that RCOPC concentrations inside buildings exceed release levels. If RCOPC concentrations inside Impacted areas do not exceed the DCGLs, the condition of the area would satisfy the release criterion.

- Determine whether RCOPC concentrations on interior building surfaces exceed the applicable DCGLs.
- Determine locations where RCOPC transferable contamination values exceed ten percent of acceptable DCGLs, based on smear surveys.

- If survey unit RCOPC concentrations inside buildings exceed the applicable release criteria, then affected areas must undergo further investigation and or remediation to levels satisfying the release criteria.
- Determine and apply Sum of Ratios (SOR) in areas where multiple radioisotopes exist, if necessary.

6.3.2.3 Results

– RCOPC concentrations on interior building surfaces did not exceed DCGLs.

– No sample locations exceeded transferable contamination values.

– No further investigation or remediation is necessary.

– SOR is not necessary.

6.3.3 Step 3: Identify Inputs to the Decision

6.3.3.1 Information Inputs

Data collection and evaluation should be performed using guidance found in the MARSSIM, and include:

- Interior scan surveys for alpha, beta, and gamma RCOPCs;
- Fixed-point measurements at designated random and judgmental locations;
- Smear surveys for removable contamination at designated random and judgmental locations;
- Exposure rate surveys within the confines of each survey area; and

6.3.3.2 Results

Several deviations from the SCWP were necessary based on detailed field evaluations. Detailed discussions of the work plan changes are presented in Section 2.3.3.

6.3.4 Step 4: Define the Study Boundaries

6.3.4.1 Data Population

The population of interest should be the concentrations of RCOPCs on interior building surfaces and in building systems in the Impacted buildings. This population was further subdivided into survey units (SUs) during the characterization survey.

6.3.4.2 Results

Surveys were conducted per SU within building structures

6.3.4.3 Spatial and Temporal Boundaries

Spatial boundaries for this investigation are horizontally and vertically limited to interior building surfaces of impacted rooms.

Temporal boundaries for this characterization effort were established for radionuclides with half lives less than 120 days. Isotopes with half lives less than 120 days were eliminated as RCOPCs. This protocol is consistent with NUREG-1757, Vol. 1 regarding decommissioning group 1.

Data collection and analysis was performed in a timely manner to support the Forest Glen Annex BRAC milestones.

6.3.4.4 Constraints on Data Collection

Although there were management concerns about access to certain areas; Cabrera used a graded approach per MARSSIM Class 3 survey requirements resulting in a 95% confidence level required for this survey. When a random point was not able to be surveyed, the survey point was moved to a different random location.

6.3.4.5 Results

All data collection activities were performed in accordance with requirements of the SCWP. At Forest Glen Annex and Gillette Building, no constraints existed on data collection.

6.3.5 Step 5: State the Decision Rules

6.3.5.1 Surface Scan Surveys

If areas of elevated radioactivity were identified during alpha and beta surface scan surveys above chosen DCGL levels, identified areas would have been marked for additional follow-up characterization activities or decontamination, as appropriate. Additional surveys would then include static and smear samples for removable activity. The source and radionuclide mix at that location would also be determined, if feasible.

6.3.5.2 Exposure Rate Measurements

Exposure rate surveys were to be evaluated directly against nominal background levels in non-Impacted areas of the Forest Glen Annex and Gillette Building.

6.3.5.3 Systems Surveys

Due to the current mission of the buildings surveyed in this effort, volumetric sampling was not practical. However, the survey team paid particular attention to drains and other likely sources of potential contamination and took several bias samples in these areas.

6.3.5.4 Results

All surveys were completed as required by the SCWP with any field deviations documented in Section 2.3.3. Volumetric samples could not be collected; however, gamma spectroscopy analysis of a composite smear was performed as a surrogate activity, and no elevated radioactivity was discovered.

6.3.6 Step 6: Define Acceptable Decision Errors

Constraints on decision error are not needed, because a statistical sampling plan is not required at the characterization survey phase of the project. The numbers of samples selected will be acceptable for a final status survey (FSS); however, no statistical evaluation is performed at this phase. Areas surveyed will be deemed impacted or non-impacted based on historical information, characterization survey results, and professional judgment.

6.3.6.1 Results

Surveys were conducted with a rigor that will be acceptable for a final status survey.

6.3.6.2 Step 7: Optimize the Design

The variability of data may have an effect on the sampling design. If necessary, the sample frequency and the analytical procedures would undergo changes to optimize the design. Changes would then occur concurrently for several steps with the DQO process. The design options, such as sample collection design, sample size, and analytical procedures would be evaluated based on cost and the ability to meet the DQOs.

6.3.6.3 Results

The surveys were optimized in the SCWP and subsequent field changes to allow the data to be used in a FSS context.

6.4 Data Quality Assessment in Support of the Conceptual Site Model

The radiological Conceptual Site Model (CSM), originally developed as part of the HSA, used available information to provide potential contaminant pathways to support the determination of methods to assess the nature and extent of contamination, the determination of areas and media to be sampled, and the development of strategies for data collection. The preliminary Forest Glen CSM is presented in the project Historical Site Assessment (CABRERA, 2009a) and a summary of how the characterization survey was designed based on the CSM is summarized in Table 7-1 and the following sections. The information presented in Table 7-1 was originally presented in the SCWP; however, here it has been revised to reflect how the characterization survey was actually conducted.

Table 6-1: Radiological Survey Summary

Building Number	Direct Radioactivity Scan Survey		Integrated Direct Radioactivity Measurements		Smear Samples	
	Radioactivity Type	Percent Coverage	Radioactivity Type	Quantity	Radioactivity Type	Quantity
511 (SU01)	alpha, beta, gamma	**12%**	alpha, beta	**45** (30 random, 15 bias)	alpha, beta, low energy beta (^3H)	**45**[a] **31** (30 random, 1 bias)
512 (SU02)	alpha, beta, gamma	**10%**	alpha, beta	**62** (29 random-surface, 30 random-subsurface 3 bias)	alpha, beta, low energy beta (^3H),	**62**[a] **31** (30 random, 1 bias)
Gillette (SU03)	alpha, beta, gamma	**11.5%**	alpha, beta	**33** (30 random, 3 bias)	alpha, beta, low energy beta (^3H)	**33**[a] **33** (30 random, 3 bias)

[a] Random/bias in the same proportions as the integrated measurements.

[b] 11 different building surface types were encountered, and 5 measurements were taken with each instrument (2 instruments).

Possible contaminant pathway scenarios:

Scenario 1 – Leaks and/or spills: For the former laboratories located in Buildings 511 and 512 and the Gillette Building, this possibility could result from sealed sources or storage containers that have been compromised, laboratory accidents, or the transfer of contamination from unsealed radiological commodities.

Scenario 2 – Storage/disposal activities: materials that had been used and/or stored in Buildings 511 and 512 and the Gillette Building, or any materials disposed of down laboratory sinks could then contaminate areas apart from where they were in active use.

Building 511

The building was surveyed as MARSSIM Class 3 with a focus on original surfaces, as possible. A scan survey of 12% on floors, bench tops, and lower wall surfaces was performed (over the required 1-2%), along with 45 static measurements/smears (over the required 30) and a general area exposure rate measurement. Performance of the required surveys/analyses did not reveal any radioactive contamination that would require reclassification.

Building 512

The building was surveyed as MARSSIM Class 3 with a focus on original surfaces, as possible. A scan survey of at 10% on floors, bench tops, and lower wall surfaces was performed (over the required 1-2%), along with 62 static measurements/smears (over the required 30) and a general area exposure rate measurement. Given the extensive renovation of this building, the chance of finding any original surfaces was thought to be low, so the survey effort required pulling up tiles to access original surfaces. Performance of the required surveys/analyses did not reveal any radioactive contamination that would require reclassification.

Gillette Building

The building was surveyed as MARSSIM Class 3 with a focus on original surfaces, as possible. A scan survey of at least 11.5% on floors, bench tops, and lower wall surfaces was performed (over the required 1-2%), along with 33 static measurements/smears (over the required 30) and a general area exposure rate measurement. Performance of the required surveys/analyses did not reveal any radioactive contamination that would require reclassification.

Based on the data collected from the characterization survey effort the CSM is valid, and accurate. The initial MARSSIM building classifications are appropriate based on the data analysis. The data that was used to support this conclusion also shows that no radioactivity exists above the prescribed limits (and thus, no contamination exists); therefore, no further study of areas within the scope of this project is warranted.

7.0 CONCLUSIONS

A radiological characterization survey of three buildings (Buildings 511, 512, and Gillette) at the Forest Glen Annex and leased facilities in Rockville, MD was performed by CABRERA during November 2009. This characterization survey included general area scans of over 1-2% of floor/wall surfaces (12% for Building 511, 10% for Building 512, and 11.5% for Gillette Building), general area exposure rates, 140 integrated static alpha/beta measurements, collection of 140 smears for removable alpha and beta contamination on surfaces (which were bundled into a composite to be analyzed for gamma spectroscopy as well), and collection/analysis of 95 smears for low energy beta contamination (via liquid scintillation analysis).

For this survey, gross alpha/beta (fixed and removable) was represented by DCGLs based on values for depleted uranium (DU) and ^{60}Co (cobalt-60). These RCOPCs presented the most restrictive screening values for the specific radioactivity type. Gross alpha/beta was measured via direct integrated measurement for fixed radioactivity and smear analysis for removable radioactivity. The DCGL for gross alpha was 101 dpm/100cm^2 (fixed) and 10.1 dpm/100cm^2 (removable). The DCGL for gross beta was 7.05E+03 dpm/100cm^2 (fixed) and 7.05E+02 dpm/100cm^2 (removable).

Low-energy beta was represented by the DCGLs for ^{3}H (tritium), ^{63}Ni, ^{14}C, and ^{129}I. Low-energy beta was measured via smears collected for 3-channel liquid scintillation analysis performed by an off-site laboratory. The DCGL for ^{3}H was 1.2E+07 dpm/100cm^2. The DCGL for ^{63}Ni was 3.5E+03 dpm/100cm^2. The DCGL for ^{14}C was 3.7E+05 dpm/100cm^2. The DCGL for ^{129}I was 1.8E+05 dpm/100cm^2.

Gamma was represented by the DCGL for ^{57}Co (cobalt-57), the only gamma-emitting RCOPC at the Forest Glen Annex. ^{57}Co was measured via composite smear collected for gamma spectroscopy analysis performed by an off-site laboratory. The DCGL for ^{57}Co was 2.11E+04 dpm/100cm^2.

Floor scans and general exposure rate surveys were also performed as part of the survey and meant to be qualitative in nature.

The results of the characterization survey, as presented in Section 6, and supported by data in Appendix A (field survey data) and Appendix C (laboratory summary/data), indicate that no surveyed areas of the Site exceed the appropriate DCGLs as presented in the SCWP.

Data collected during this survey is acceptable for a FSS; however, no statistical evaluations have been performed during this phase. A presentation of the FSS results, in the form of a Final Status Survey Report (FSSR), in accordance with the MARSSIM guidance, will be provided under separate cover.

8.0 REFERENCES

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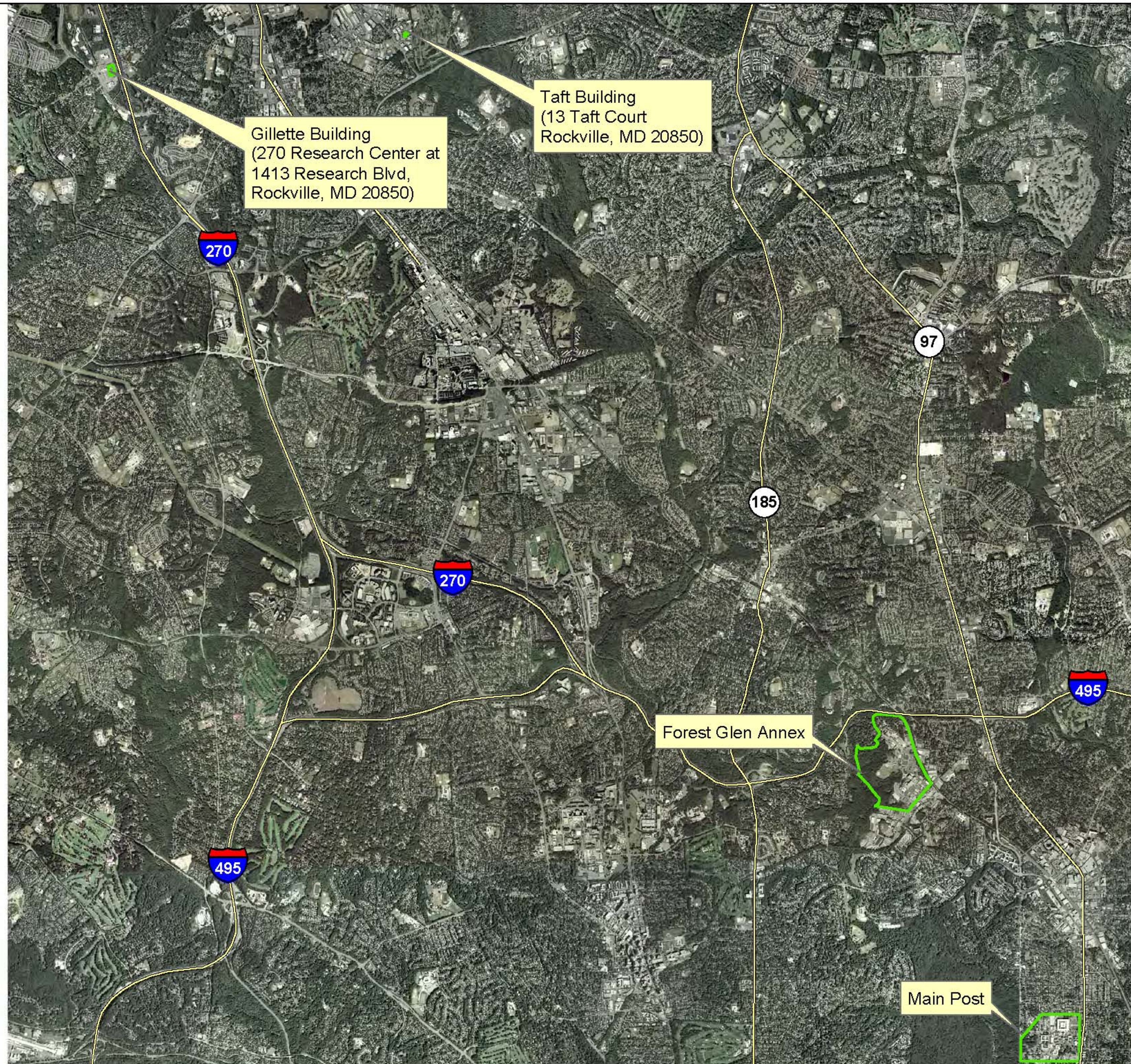
FIGURES



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CORPS OF ENGINEERS
BALTIMORE, MARLYAND

PREPARED BY: KJ

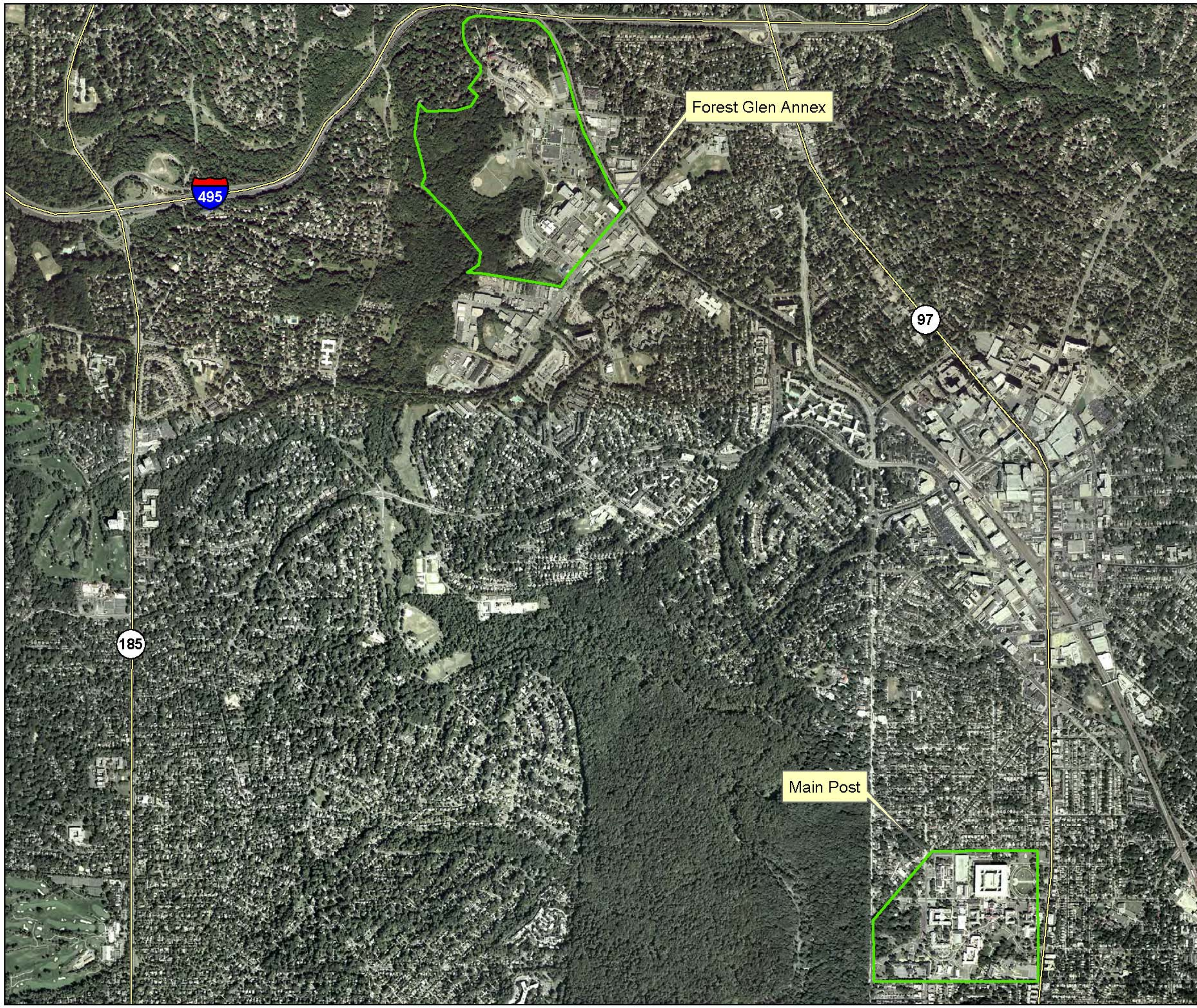
REVIEWED BY: MB

FOREST GLEN ANNEX SILVER SPRING MARYLAND

AREA OVERVIEW MAP

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 1**

SCALE: 0 0.15 0.3 0.6 0.9 Miles | DATE: 12/01/2009



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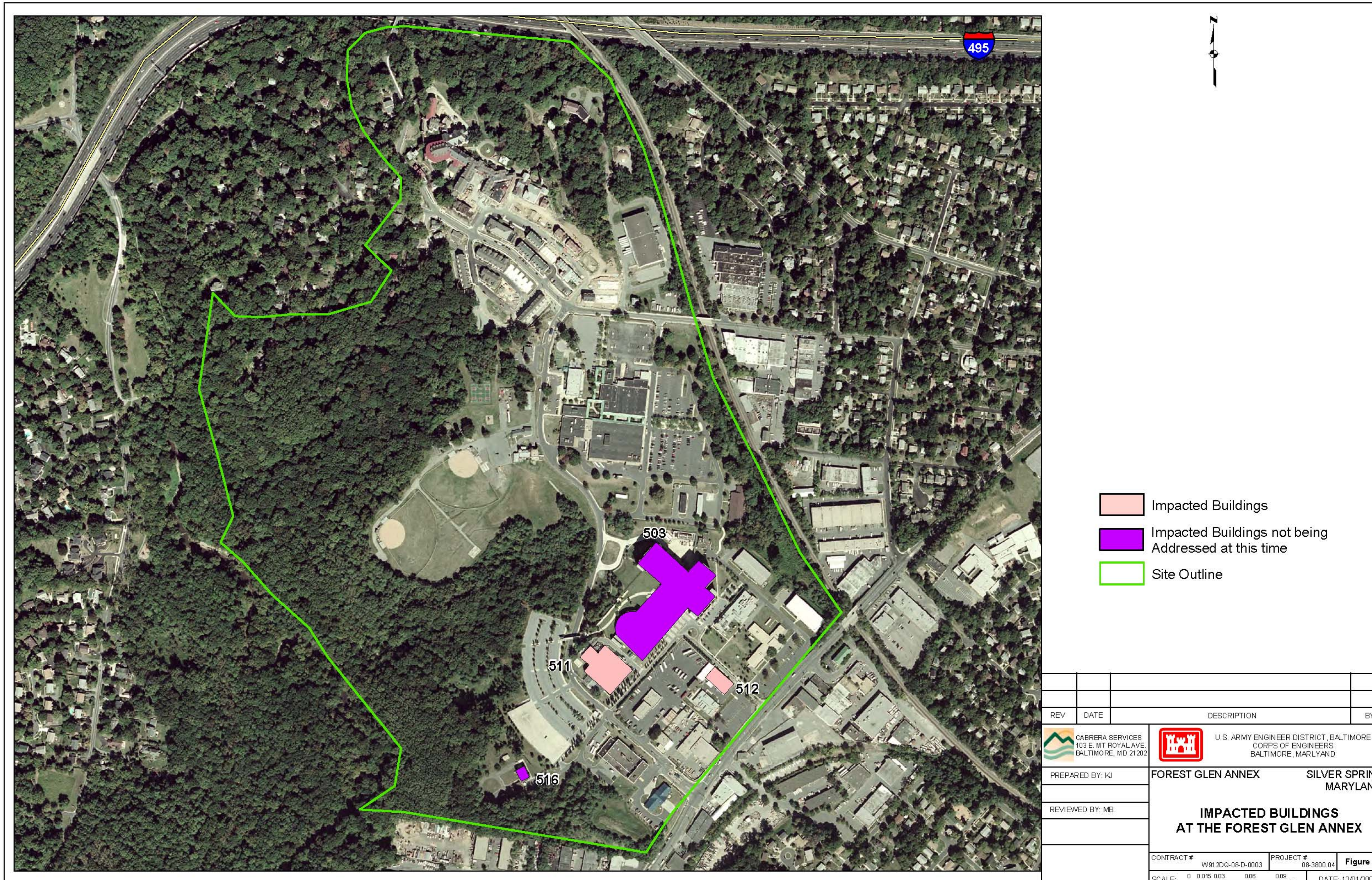
REVIEWED BY: MB

FOREST GLEN ANNEX — SILVER SPRING MARYLAND

MAIN POST IN RELATION TO FOREST GLEN ANNEX

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 2**

SCALE: 0 0.045 0.09 0.18 0.27 Miles | DATE: 12/01/2009


495
N
503
511
512
516
Impacted Buildings
Impacted Buildings not being Addressed at this time
Site Outline
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
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BALTIMORE, MARLYAND
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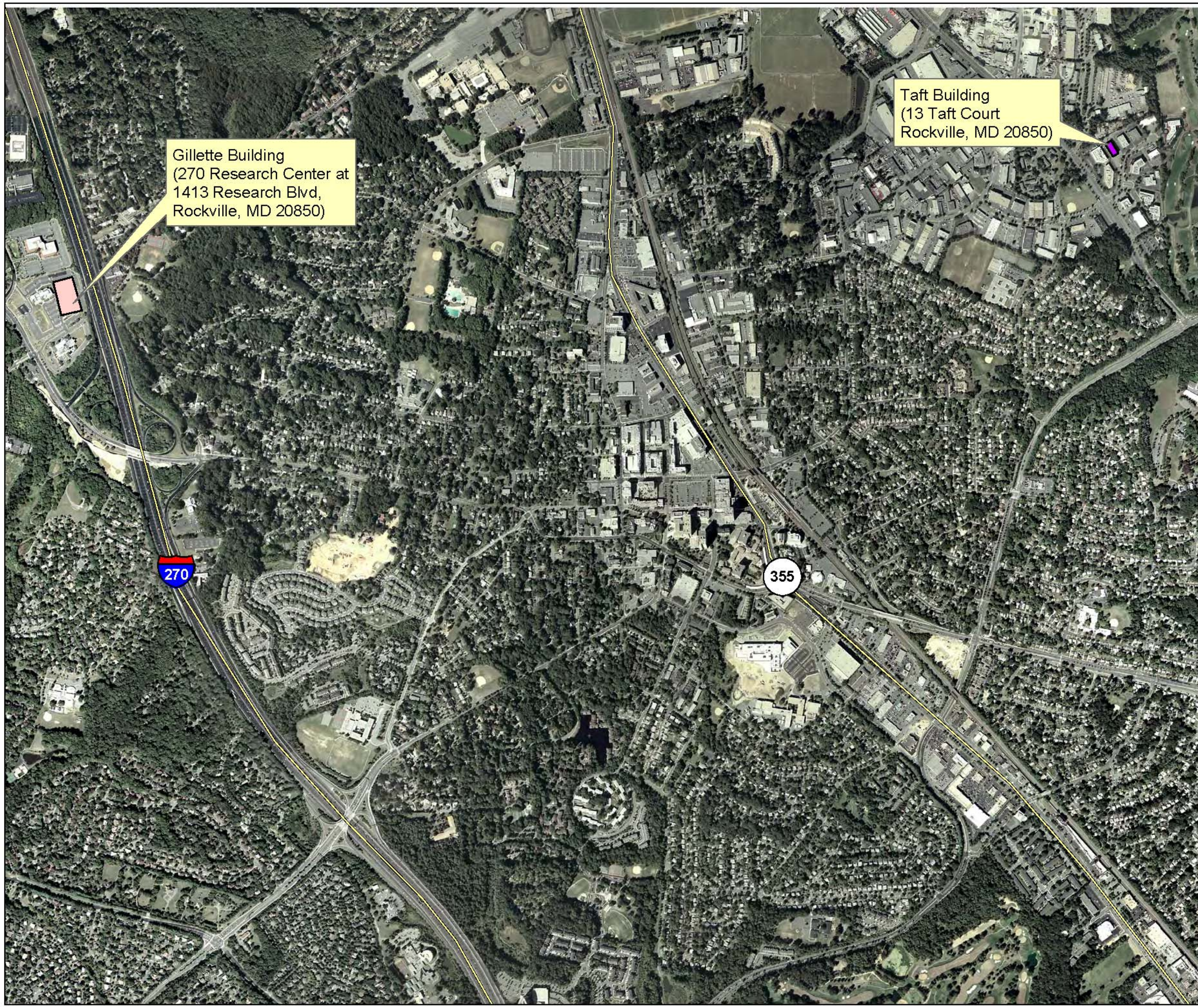
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
IMPACTED BUILDINGS
AT THE FOREST GLEN ANNEX
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 3
SCALE: 0 0.015 0.03 0.06 0.09 Miles
DATE: 12/01/2009

FINAL



N

Impacted Buildings

Impacted Buildings not being Addressed at this time

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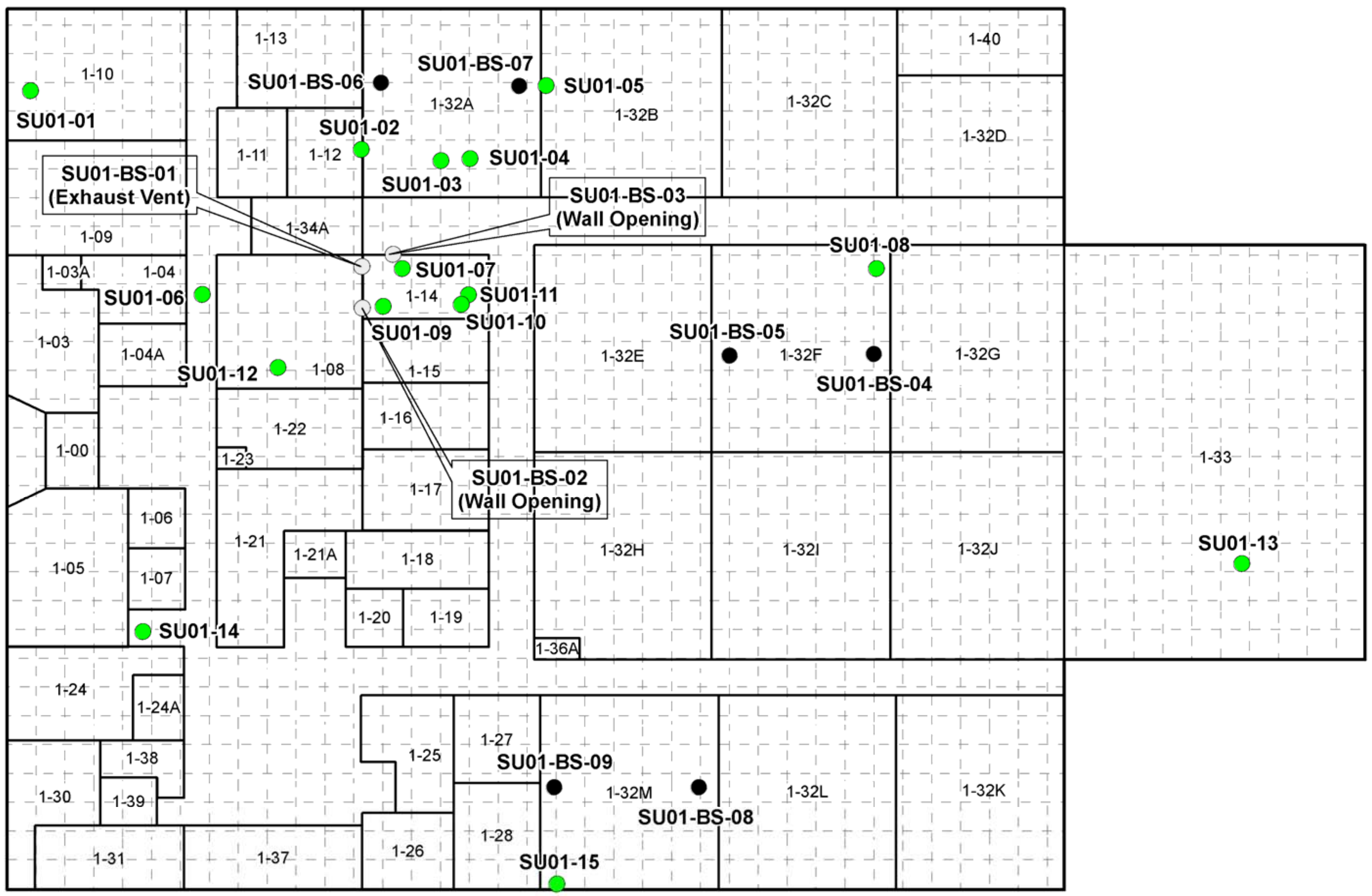
GILLETTE BUILDING — ROCKVILLE MARYLAND

IMPACTED BUILDINGS AT THE LEASED FACILITIES IN ROCKVILLE, MARYLAND

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 4**

SCALE: 0 0.045 0.09 0.18 0.27 Miles | DATE: 12/01/2009



ID	X Coordinate	Y Coordinate
SU01-01	1296940.4495	487213.2556
SU01-02	1296904.3224	487258.8253
SU01-03	1296895.2745	487269.3806
SU01-04	1296891.2983	487272.4822
SU01-05	1296873.0350	487271.6995
SU01-06	1296941.5758	487259.4506
SU01-07	1296912.7073	487279.0418
SU01-08	1296851.2747	487333.3967
SU01-09	1296919.5268	487281.7300
SU01-10	1296909.1591	487290.4355
SU01-11	1296907.1597	487290.0016
SU01-12	1296940.1676	487277.6175
SU01-13	1296837.8436	487413.6775
SU01-14	1296988.0819	487296.4652
SU01-15	1296963.4961	487376.7654
SU01-BS-01	1296917.6992	487274.1616
SU01-BS-02	1296922.4238	487279.5658
SU01-BS-03	1296912.2861	487276.1030
SU01-BS-04	1296861.4176	487344.1887
SU01-BS-05	1296880.3105	487327.8285
SU01-BS-06	1296894.1528	487252.3972
SU01-BS-07	1296876.5848	487268.6501
SU01-BS-08	1296933.9706	487380.4558
SU01-BS-09	1296952.6874	487363.8965

Legend

- Biased Sample Locations
- Biased Sample Locations (Drain)
- Random Sample Locations

Note: Due to lack of accessibility, points SU01-06 and SU01-14 were moved in the field - the locations shown on this figure accurately represent the location of the sample/measurement as taken in the field

REV	DATE	DESCRIPTION	BY

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BALTIMORE, MARLYAND

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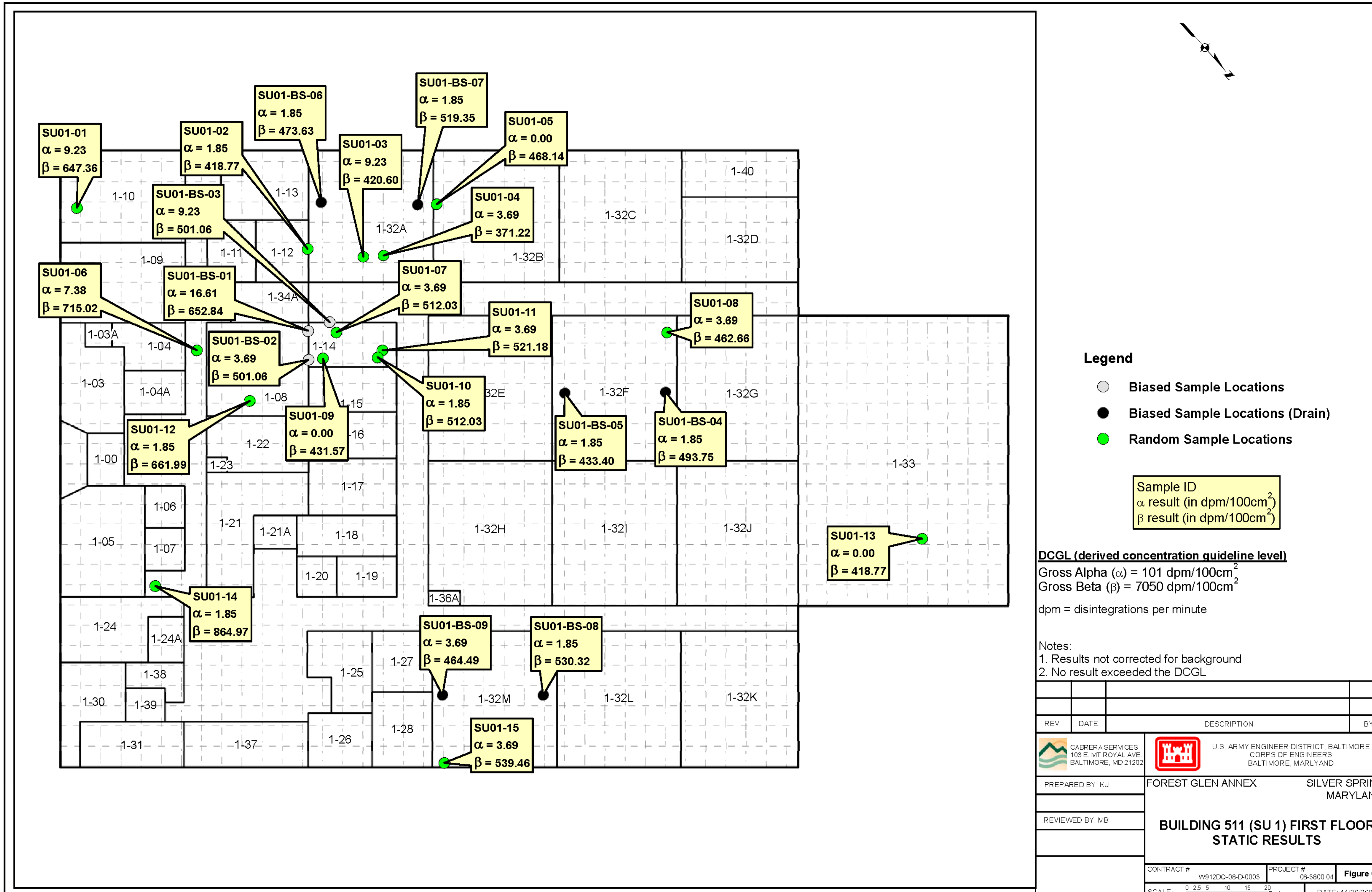
FOREST GLEN ANNEX — SILVER SPRING MARYLAND

BUILDING 511 (SU 1) FIRST FLOOR RANDOM AND BIASED SAMPLE LOCATIONS

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 5

SCALE: 0 2.5 5 10 15 20 Feet | DATE: 11/25/2009


SU01-01 α = 9.23 β = 647.36
SU01-02 α = 1.85 β = 418.77
SU01-BS-06 α = 1.85 β = 473.63
SU01-03 α = 9.23 β = 420.60
SU01-BS-07 α = 1.85 β = 519.35
SU01-05 α = 0.00 β = 468.14
SU01-BS-03 α = 9.23 β = 501.06
SU01-04 α = 3.69 β = 371.22
SU01-06 α = 7.38 β = 715.02
SU01-BS-01 α = 16.61 β = 652.84
SU01-07 α = 3.69 β = 512.03
SU01-11 α = 3.69 β = 521.18
SU01-08 α = 3.69 β = 462.66
SU01-BS-02 α = 3.69 β = 501.06
SU01-10 α = 1.85 β = 512.03
SU01-09 α = 0.00 β = 431.57
SU01-12 α = 1.85 β = 661.99
SU01-BS-05 α = 1.85 β = 433.40
SU01-BS-04 α = 1.85 β = 493.75
SU01-13 α = 0.00 β = 418.77
SU01-14 α = 1.85 β = 864.97
SU01-BS-09 α = 3.69 β = 464.49
SU01-BS-08 α = 1.85 β = 530.32
SU01-15 α = 3.69 β = 539.46
1-10
1-13
1-32A
1-32C
1-40
1-32D
1-09
1-11
1-12
1-32B
1-34A
1-03A
1-04
1-14
1-03
1-04A
1-08
1-15
32E
1-32F
1-32G
1-16
1-22
1-00
1-23
1-17
1-33
1-06
1-21
1-21A
1-18
1-32H
1-32I
1-32J
1-05
1-07
1-20
1-19
1-36A
1-24
1-24A
1-27
1-25
1-38
1-30
1-39
1-32M
1-32L
1-32K
1-28
1-26
1-31
1-37
N
Legend
Biased Sample Locations
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
α result (in dpm/100cm^2)
β result (in dpm/100cm^2)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 101 dpm/100cm^2
Gross Beta (β) = 7050 dpm/100cm^2
dpm = disintegrations per minute
Notes:
1. Results not corrected for background
2. No result exceeded the DCGL
REV
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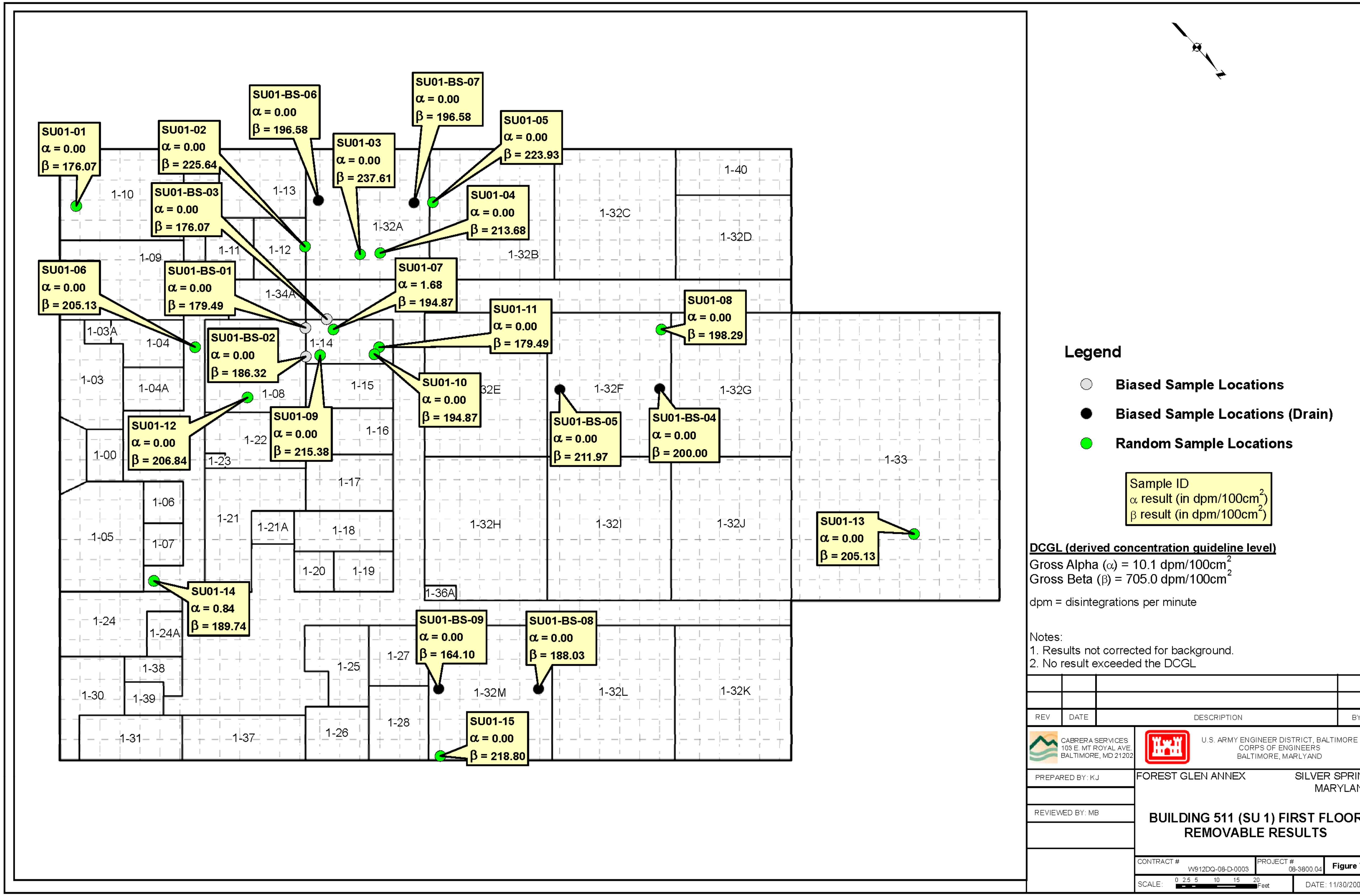
SILVER SPRING
MARYLAND
REVIEWED BY: MB
BUILDING 511 (SU 1) FIRST FLOOR
STATIC RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3600.04
Figure 6
SCALE:
0 2.5 5 10 15 20
Feet
DATE: 11/30/2009


SU01-01
α = 0.00
β = 176.07
SU01-02
α = 0.00
β = 225.64
SU01-BS-06
α = 0.00
β = 196.58
SU01-03
α = 0.00
β = 237.61
SU01-BS-07
α = 0.00
β = 196.58
SU01-05
α = 0.00
β = 223.93
SU01-BS-03
α = 0.00
β = 176.07
SU01-04
α = 0.00
β = 213.68
SU01-06
α = 0.00
β = 205.13
SU01-BS-01
α = 0.00
β = 179.49
SU01-07
α = 1.68
β = 194.87
SU01-11
α = 0.00
β = 179.49
SU01-08
α = 0.00
β = 198.29
SU01-BS-02
α = 0.00
β = 186.32
SU01-10
α = 0.00
β = 194.87
SU01-BS-05
α = 0.00
β = 211.97
SU01-BS-04
α = 0.00
β = 200.00
SU01-12
α = 0.00
β = 206.84
SU01-09
α = 0.00
β = 215.38
SU01-13
α = 0.00
β = 205.13
SU01-14
α = 0.84
β = 189.74
SU01-BS-09
α = 0.00
β = 164.10
SU01-BS-08
α = 0.00
β = 188.03
SU01-15
α = 0.00
β = 218.80
1-10
1-13
1-32A
1-32B
1-32C
1-40
1-32D
1-09
1-11
1-12
1-34A
1-03A
1-04
1-14
1-03
1-04A
1-08
1-15
32E
1-32F
1-32G
1-22
1-16
1-00
1-23
1-17
1-33
1-06
1-21
1-21A
1-18
1-32H
1-32I
1-32J
1-05
1-07
1-20
1-19
1-36A
1-24
1-24A
1-25
1-27
1-38
1-30
1-39
1-32M
1-32L
1-32K
1-31
1-37
1-26
1-28
Legend
Biased Sample Locations
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 10.1 dpm/100cm²
Gross Beta (β) = 705.0 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL
REV
DATE
DESCRIPTION
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BALTIMORE, MD 21202
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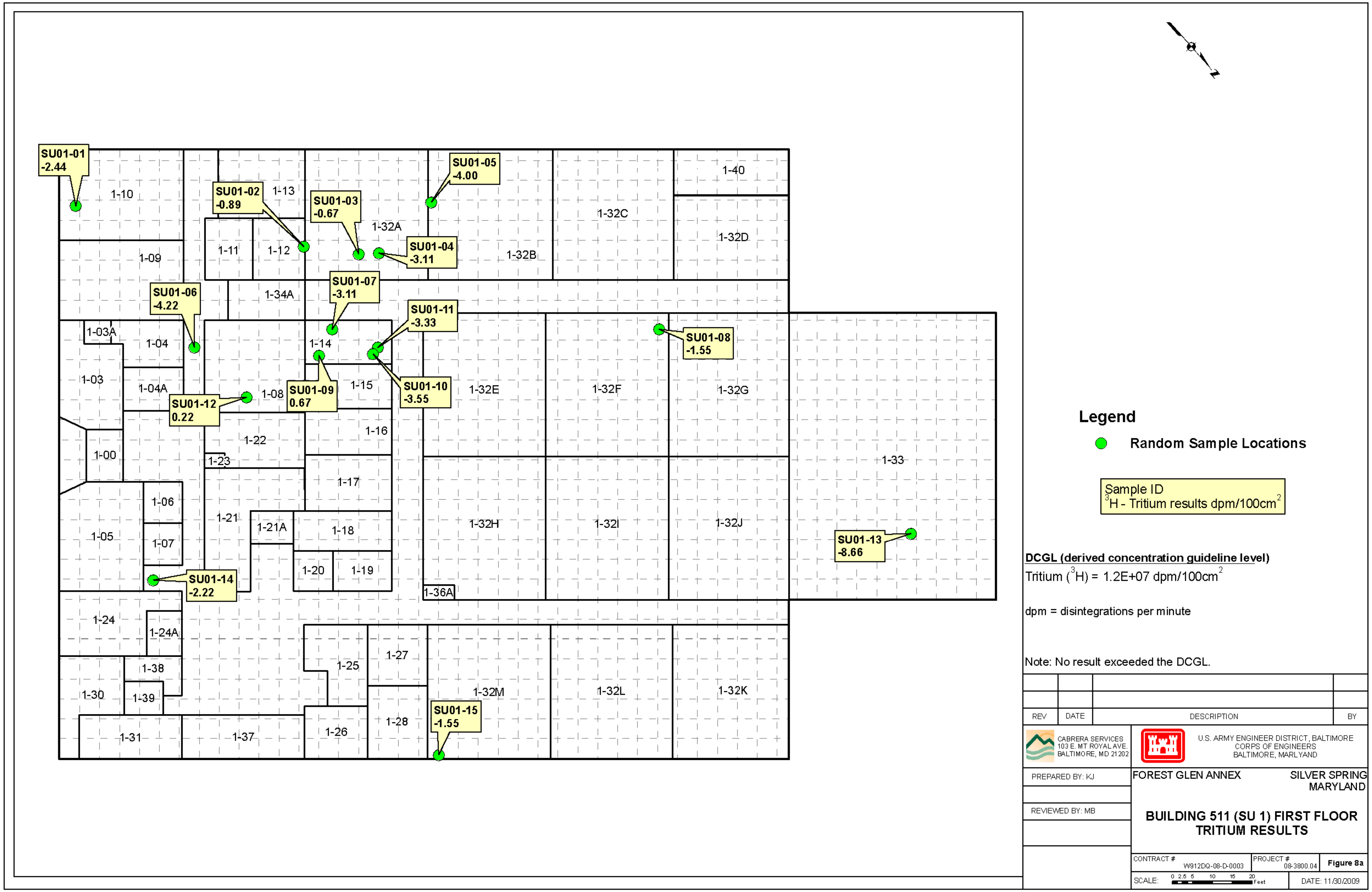
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) FIRST FLOOR
REMOVABLE RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 7
SCALE:
Feet
DATE: 11/30/2009

FINAL


SU01-01
-2.44
SU01-02
-0.89
SU01-03
-0.67
SU01-04
-3.11
SU01-05
-4.00
SU01-06
-4.22
SU01-07
-3.11
SU01-08
-1.55
SU01-09
0.67
SU01-10
-3.55
SU01-11
-3.33
SU01-12
0.22
SU01-13
-8.66
SU01-14
-2.22
SU01-15
-1.55
1-00
1-03
1-03A
1-04
1-04A
1-05
1-06
1-07
1-08
1-09
1-10
1-11
1-12
1-13
1-14
1-15
1-16
1-17
1-18
1-19
1-20
1-21
1-21A
1-22
1-23
1-24
1-24A
1-25
1-26
1-27
1-28
1-30
1-31
1-32A
1-32B
1-32C
1-32D
1-32E
1-32F
1-32G
1-32H
1-32I
1-32J
1-32K
1-32L
1-32M
1-33
1-34A
1-36A
1-37
1-38
1-39
1-40
Legend
Random Sample Locations
Sample ID
^{3}H - Tritium results dpm/100cm^2
DCGL (derived concentration guideline level)
Tritium (^{3}H) = 1.2E+07 dpm/100cm^2
dpm = disintegrations per minute
Note: No result exceeded the DCGL.
REV
DATE
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BY
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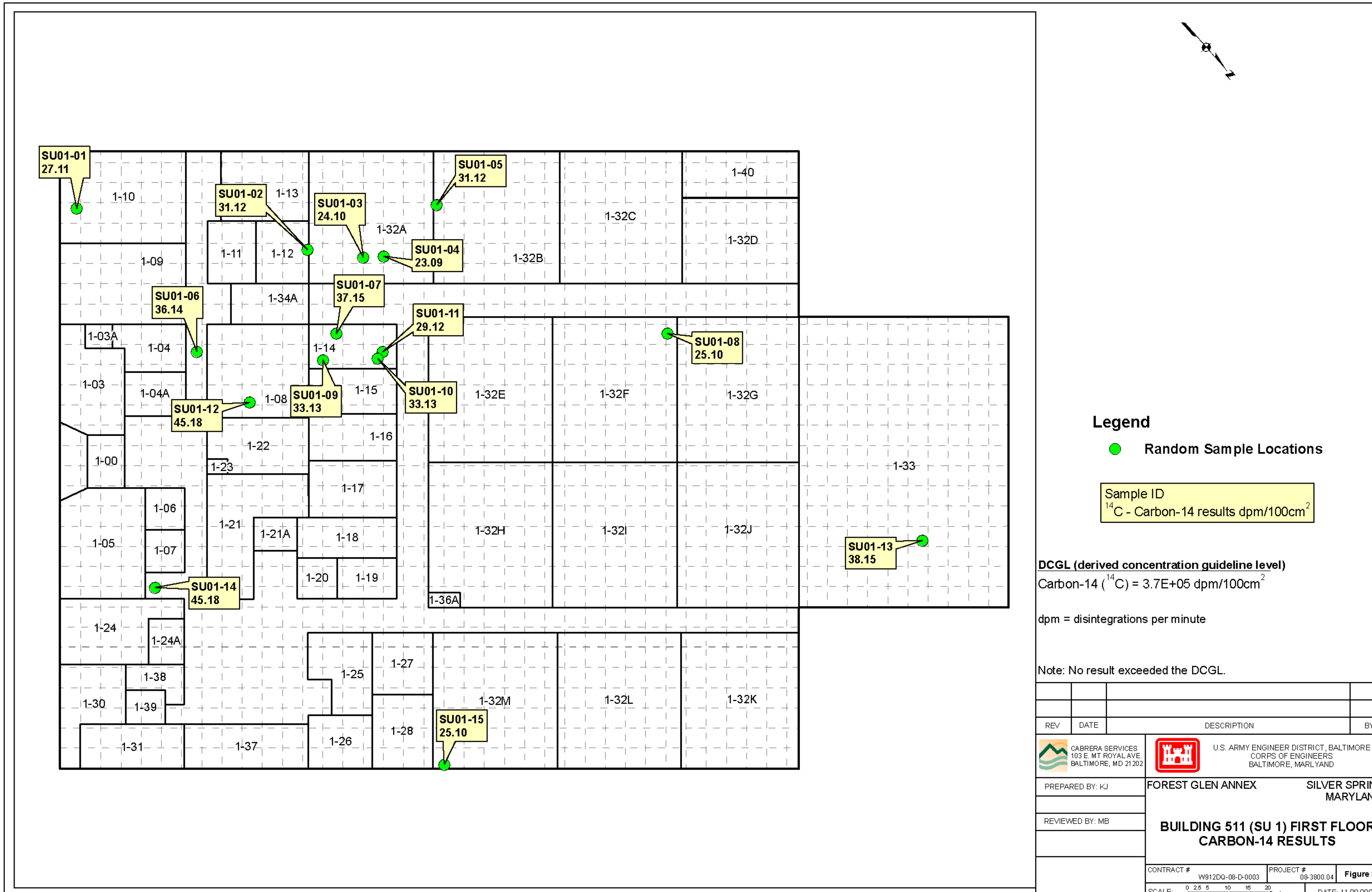
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) FIRST FLOOR
TRITIUM RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 8a
SCALE:
Feet
DATE: 11/30/2009


SU01-01
27.11
SU01-02
31.12
SU01-03
24.10
SU01-04
23.09
SU01-05
31.12
SU01-06
36.14
SU01-07
37.15
SU01-08
25.10
SU01-09
33.13
SU01-10
33.13
SU01-11
29.12
SU01-12
45.18
SU01-13
38.15
SU01-14
45.18
SU01-15
25.10
1-10
1-13
1-32A
1-32B
1-32C
1-40
1-32D
1-09
1-11
1-12
1-34A
1-03A
1-04
1-14
1-03
1-04A
1-08
1-15
1-32E
1-32F
1-32G
1-33
1-22
1-16
1-00
1-23
1-17
1-06
1-21
1-21A
1-18
1-32H
1-32I
1-32J
1-05
1-07
1-20
1-19
1-36A
1-24
1-24A
1-27
1-25
1-38
1-32M
1-32L
1-32K
1-30
1-39
1-28
1-26
1-31
1-37
N
Legend
Random Sample Locations
Sample ID
^{14}C - Carbon-14 results dpm/100cm^2
DCGL (derived concentration guideline level)
Carbon-14 (^{14}C) = 3.7E+05 dpm/100cm^2
dpm = disintegrations per minute
Note: No result exceeded the DCGL.
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DATE
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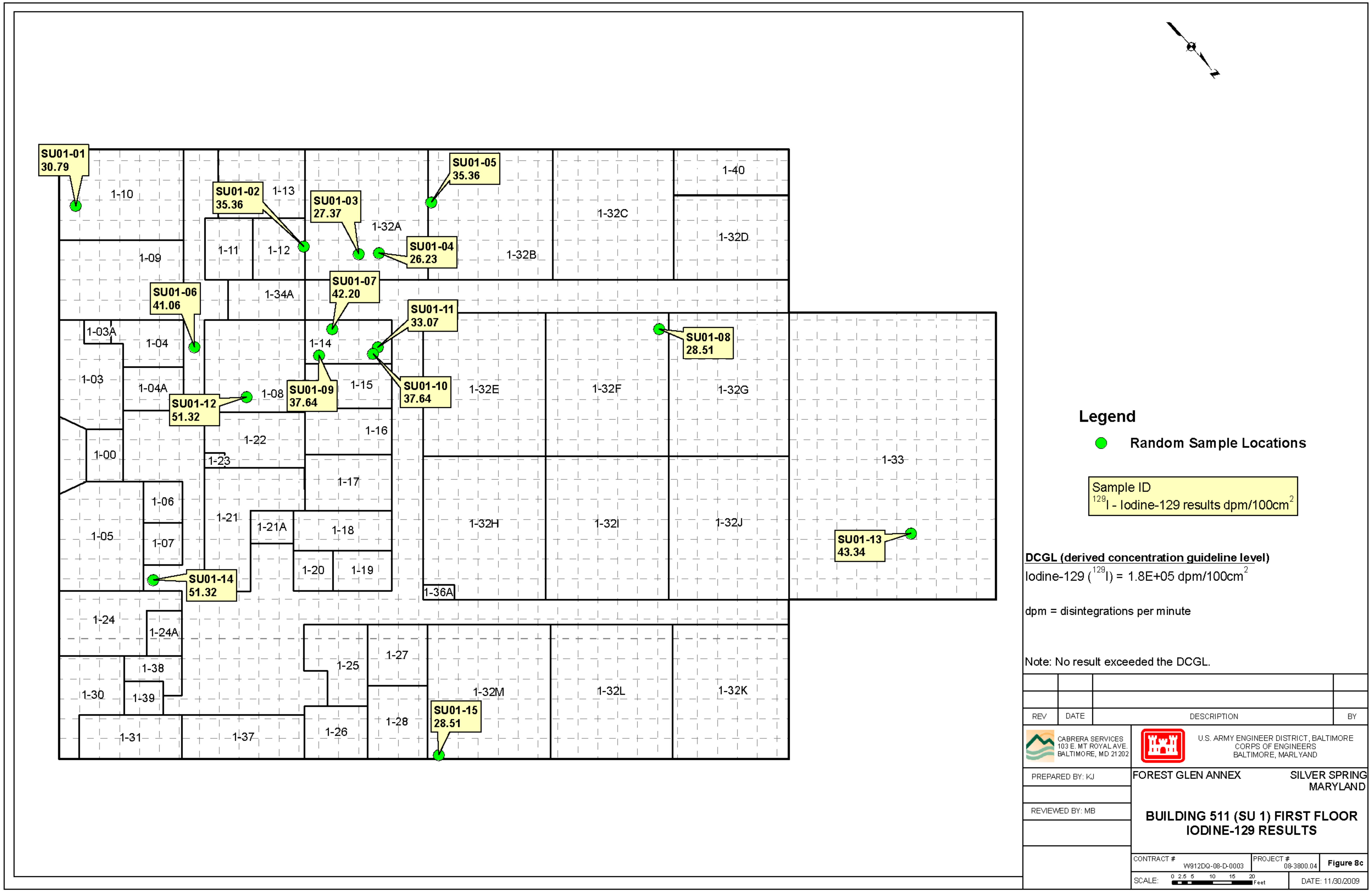
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) FIRST FLOOR
CARBON-14 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 8b
SCALE:
0 2.5 5 10 15 20
Feet
DATE: 11/30/2009


SU01-01
30.79
SU01-02
35.36
SU01-03
27.37
SU01-04
26.23
SU01-05
35.36
SU01-06
41.06
SU01-07
42.20
SU01-08
28.51
SU01-09
37.64
SU01-10
37.64
SU01-11
33.07
SU01-12
51.32
SU01-13
43.34
SU01-14
51.32
SU01-15
28.51
1-10
1-13
1-09
1-11
1-12
1-32A
1-32B
1-32C
1-32D
1-40
1-34A
1-03A
1-04
1-03
1-04A
1-14
1-08
1-15
1-16
1-22
1-23
1-00
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1-18
1-20
1-19
1-32E
1-32F
1-32G
1-32H
1-32I
1-32J
1-33
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1-24
1-24A
1-38
1-30
1-39
1-31
1-37
1-25
1-27
1-26
1-28
1-32M
1-32L
1-32K
Legend
Random Sample Locations
Sample ID
^{129}I - Iodine-129 results dpm/100cm^2
DCGL (derived concentration guideline level)
Iodine-129 (^{129}I) = 1.8E+05 dpm/100cm^2
dpm = disintegrations per minute
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
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BALTIMORE, MD 21202
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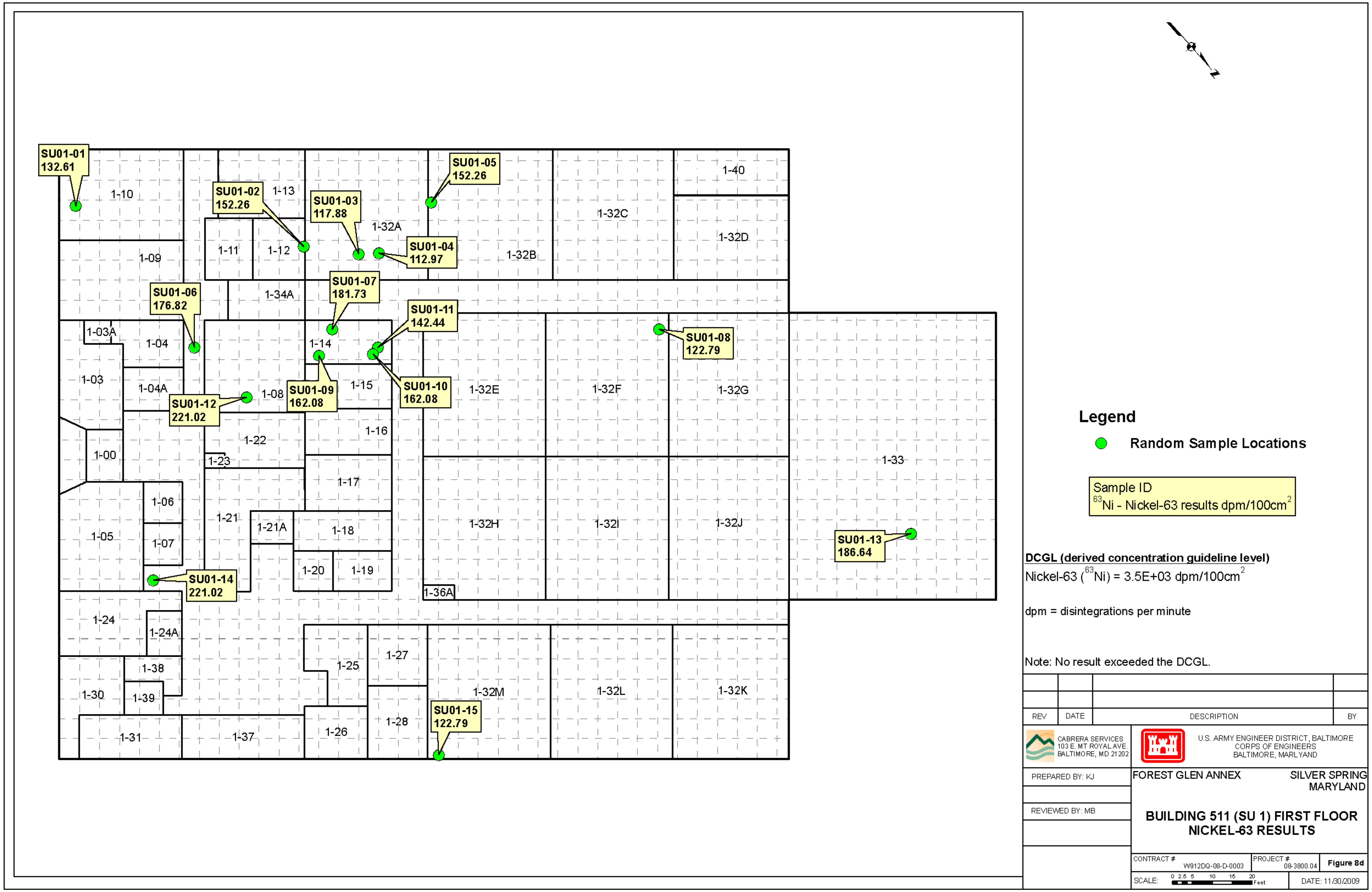
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) FIRST FLOOR
IODINE-129 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 8c
SCALE:
0 2.5 5 10 15 20
Feet
DATE: 11/30/2009


SU01-01
132.61
SU01-02
152.26
SU01-03
117.88
SU01-04
112.97
SU01-05
152.26
SU01-06
176.82
SU01-07
181.73
SU01-08
122.79
SU01-09
162.08
SU01-10
162.08
SU01-11
142.44
SU01-12
221.02
SU01-13
186.64
SU01-14
221.02
SU01-15
122.79
1-00
1-03
1-03A
1-04
1-04A
1-05
1-06
1-07
1-08
1-09
1-10
1-11
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1-15
1-16
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1-18
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1-20
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1-21A
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1-32J
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1-34A
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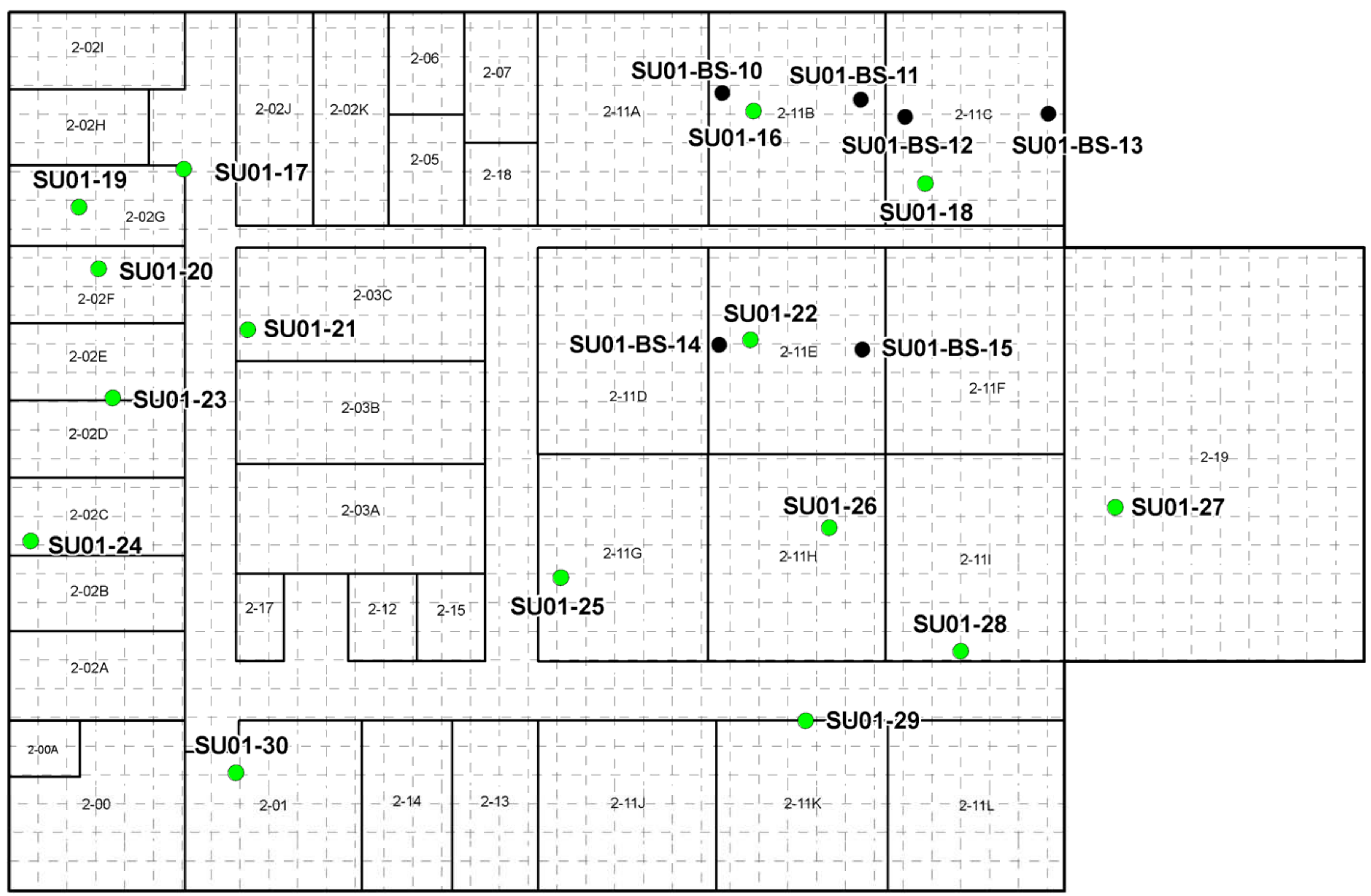
1-37
1-38
1-39
1-40
Legend
Random Sample Locations
Sample ID
^{63}Ni - Nickel-63 results dpm/100cm^2
DCGL (derived concentration guideline level)
Nickel-63 (^{63}Ni) = 3.5E+03 dpm/100cm^2
dpm = disintegrations per minute
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) FIRST FLOOR
NICKEL-63 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 8d
SCALE:
DATE: 11/30/2009


α = 0 - 2
β = 250 - 320
1-10
1-13
1-32A
1-32B
1-32C
1-40
1-32D
1-11
1-12
1-09
1-34A
1-03A
1-04
1-14
1-03
1-04A
1-08
1-15
1-32E
1-32F
1-32G
α = 0
β = 350 - 450
1-16
α = 0 - 5
β = 200 - 300
α = 0
β = 150 - 250
1-22
1-00
1-23
1-17
1-33
1-06
1-21
1-21A
1-18
1-32H
1-32I
1-32J
1-05
1-07
1-20
1-19
α = 0
β = 280 - 320
1-36A
1-24
1-24A
1-27
1-25
1-38
1-30
1-39
1-32M
1-32L
1-32K
1-28
1-31
1-37
1-26
α = 0
β = 250 - 300
Legend
Exposure Rate
(μR/hr)
Floor Scan Coverage
(counts per minute)
α = alpha
β = beta
μR/hr = microR per hour
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
REVIEWED BY: MB
BUILDING 511 (SU 1) FIRST FLOOR
FLOOR SCAN AND EXPOSURE RATE
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3600.04
Figure 9
SCALE:
Feet
DATE: 11/25/2009



ID	X Coordinate	Y Coordinate
SU01-16	1296927.6584	487337.0153
SU01-17	1296884.1647	487392.5457
SU01-18	1296965.1206	487262.1254
SU01-19	1296875.5989	487327.8316
SU01-20	1296848.7980	487298.3163
SU01-21	1296847.4902	487391.5722
SU01-22	1296887.0255	487361.3413
SU01-23	1296912.3293	487383.8225
SU01-24	1296992.3491	487325.1411
SU01-25	1296929.5045	487240.4613
SU01-26	1296952.0689	487243.6876
SU01-27	1296834.8439	487327.5278
SU01-28	1296992.2146	487271.3400
SU01-29	1296947.4846	487233.3789
SU01-30	1296939.7238	487268.7808
SU01-BS-10	1296850.8024	487292.3975
SU01-BS-11	1296833.5607	487309.1248
SU01-BS-12	1296829.7869	487316.5147
SU01-BS-13	1296810.8288	487332.5508
SU01-BS-14	1296880.2759	487324.8787
SU01-BS-15	1296862.2317	487341.9477

Legend

- ● Biased Sample Locations (Drain)
- ● Random Sample Locations

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

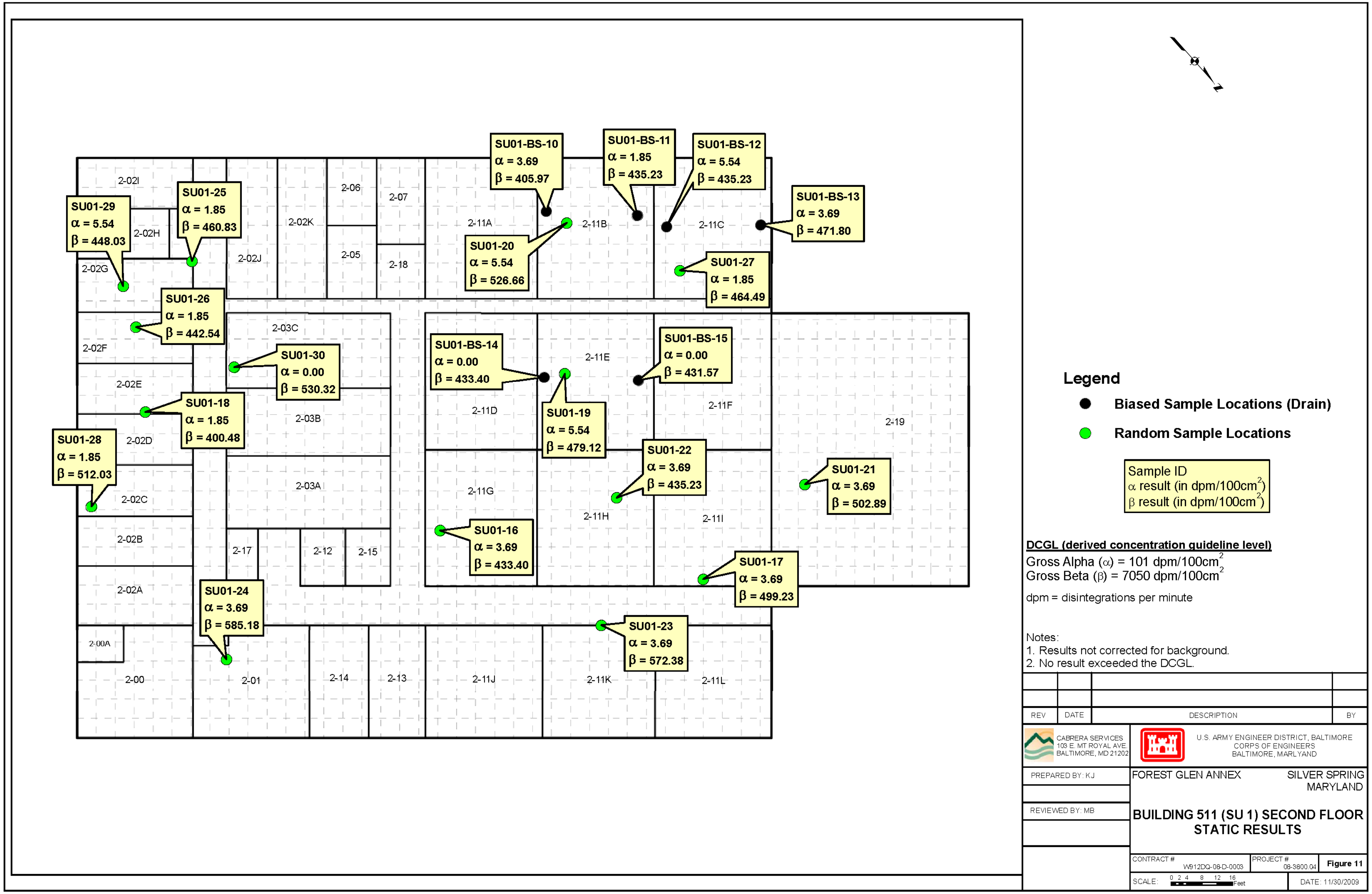
REVIEWED BY: MB

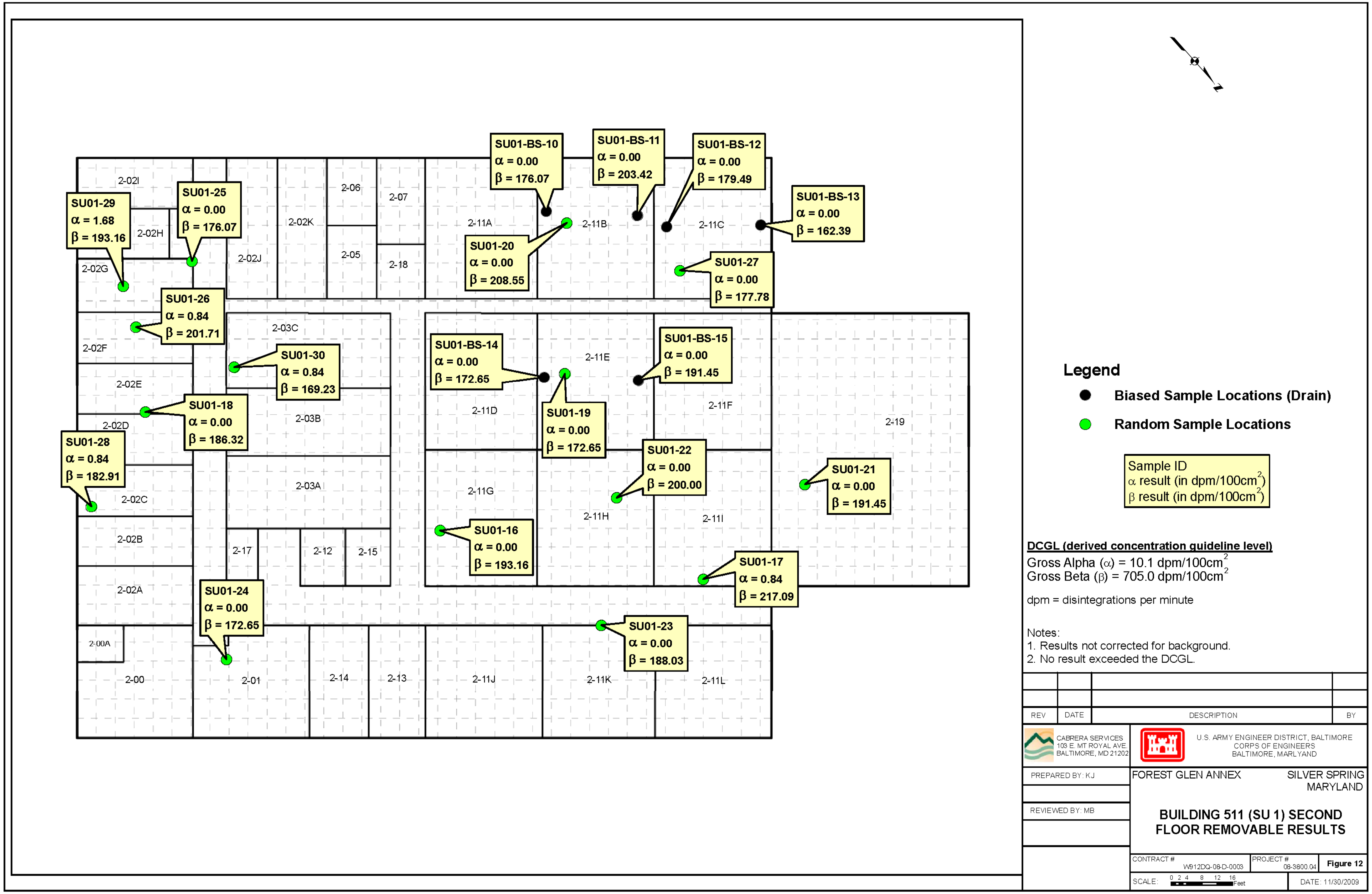
FOREST GLEN ANNEX — SILVER SPRING MARYLAND

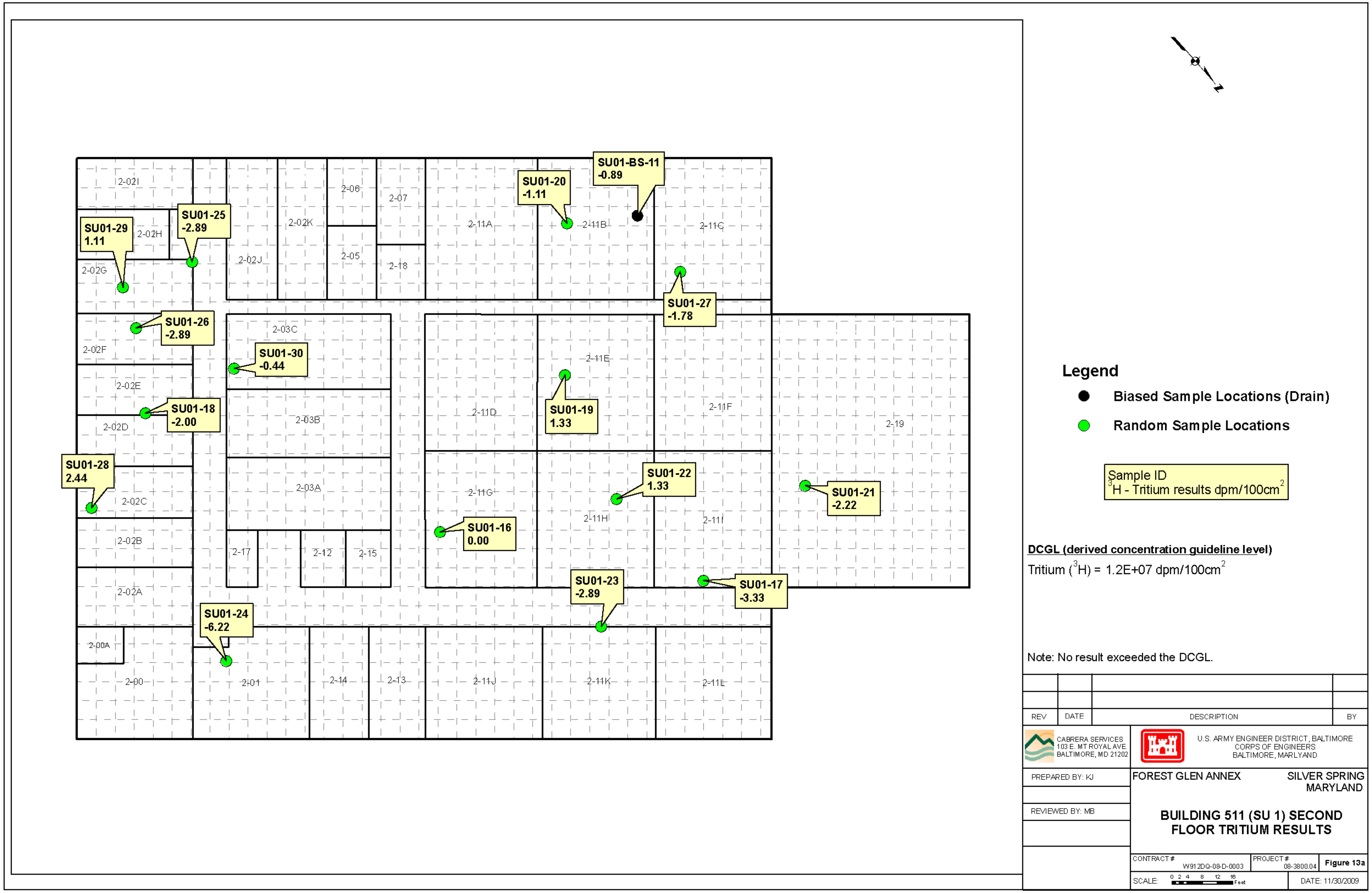
BUILDING 511 (SU 1) SECOND FLOOR RANDOM AND BIASED SAMPLE LOCATIONS

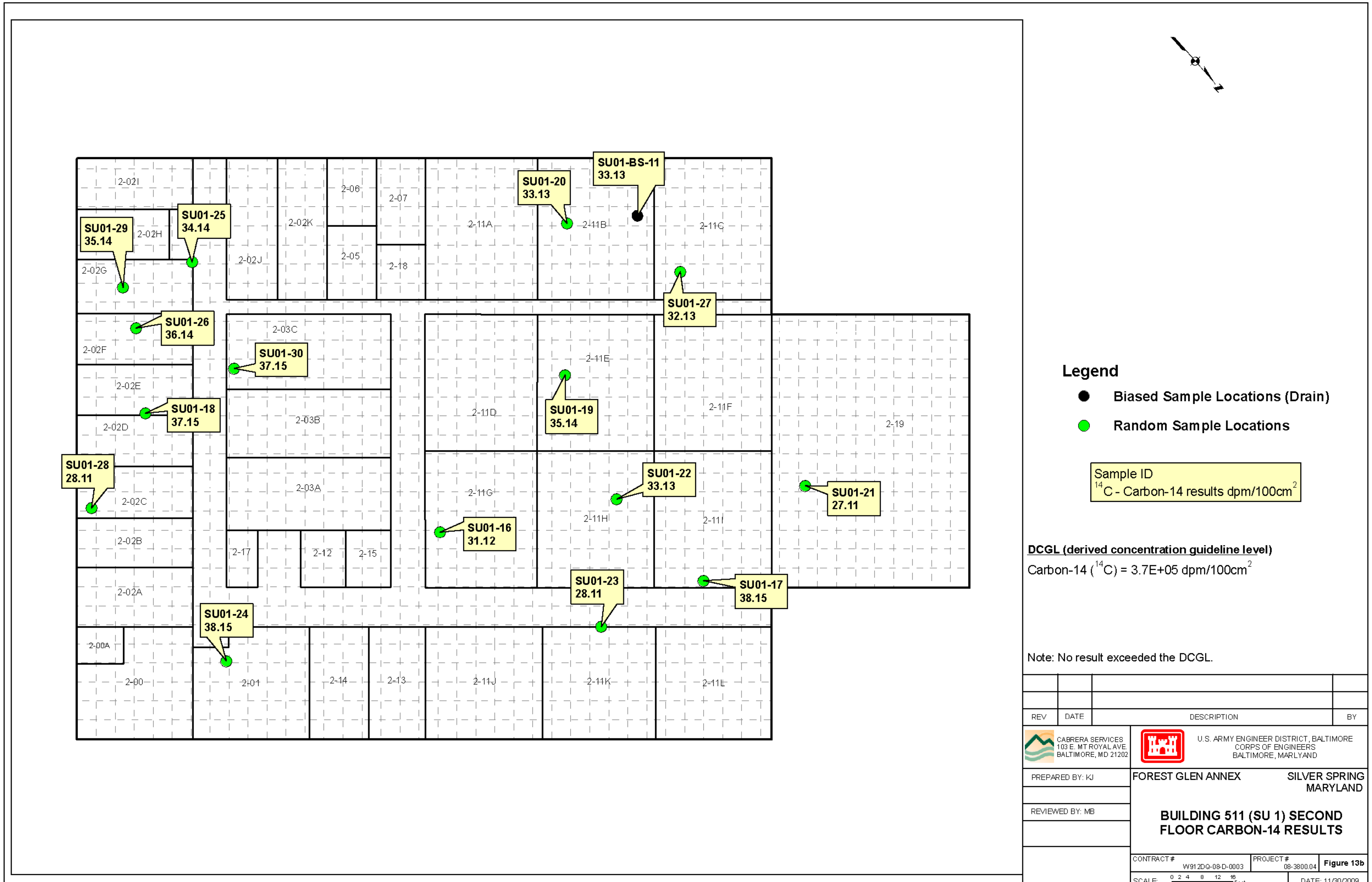
CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 10**

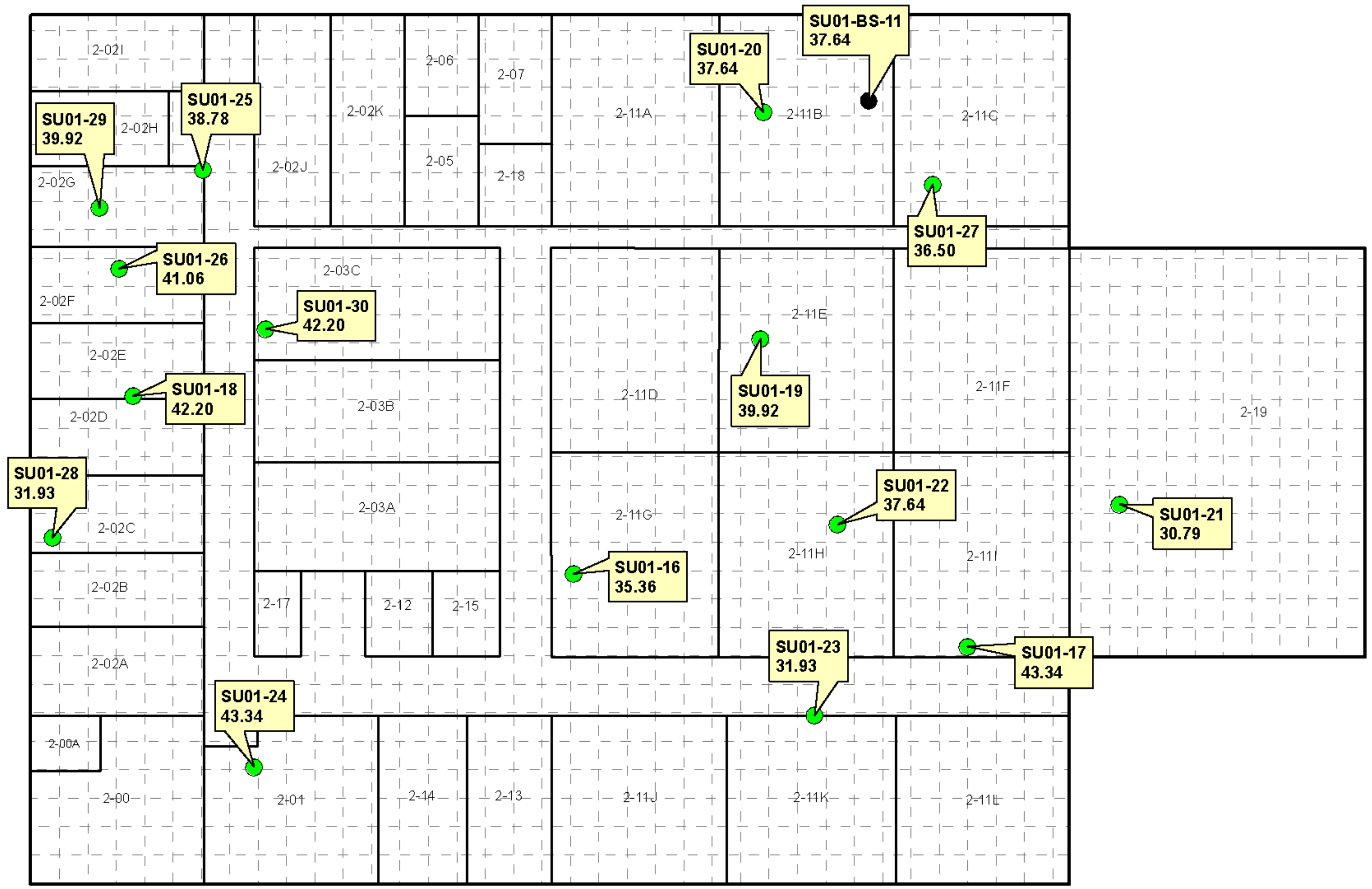
SCALE: 0 2 4 8 12 16 Feet | DATE: 11/30/2009


SU01-BS-10 α = 3.69 β = 405.97
SU01-BS-11 α = 1.85 β = 435.23
SU01-BS-12 α = 5.54 β = 435.23
SU01-BS-13 α = 3.69 β = 471.80
SU01-25 α = 1.85 β = 460.83
SU01-29 α = 5.54 β = 448.03
SU01-20 α = 5.54 β = 526.66
SU01-27 α = 1.85 β = 464.49
SU01-26 α = 1.85 β = 442.54
SU01-30 α = 0.00 β = 530.32
SU01-BS-14 α = 0.00 β = 433.40
SU01-BS-15 α = 0.00 β = 431.57
SU01-18 α = 1.85 β = 400.48
SU01-19 α = 5.54 β = 479.12
SU01-28 α = 1.85 β = 512.03
SU01-22 α = 3.69 β = 435.23
SU01-21 α = 3.69 β = 502.89
SU01-16 α = 3.69 β = 433.40
SU01-17 α = 3.69 β = 499.23
SU01-24 α = 3.69 β = 585.18
SU01-23 α = 3.69 β = 572.38
2-02I
2-02H
2-02G
2-02F
2-02E
2-02D
2-02C
2-02B
2-02A
2-00A
2-00
2-01
2-02J
2-02K
2-06
2-07
2-05
2-18
2-03C
2-03B
2-03A
2-17
2-12
2-15
2-14
2-13
2-11A
2-11B
2-11C
2-11D
2-11E
2-11F
2-11G
2-11H
2-11I
2-11J
2-11K
2-11L
2-19
N
Legend
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 101 dpm/100cm²
Gross Beta (β) = 7050 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) SECOND FLOOR
STATIC RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 11
SCALE:
0 2 4 8 12 16
Feet
DATE: 11/30/2009


SU01-BS-10 α = 0.00 β = 176.07
SU01-BS-11 α = 0.00 β = 203.42
SU01-BS-12 α = 0.00 β = 179.49
SU01-BS-13 α = 0.00 β = 162.39
SU01-BS-14 α = 0.00 β = 172.65
SU01-BS-15 α = 0.00 β = 191.45
SU01-16 α = 0.00 β = 193.16
SU01-17 α = 0.84 β = 217.09
SU01-18 α = 0.00 β = 186.32
SU01-19 α = 0.00 β = 172.65
SU01-20 α = 0.00 β = 208.55
SU01-21 α = 0.00 β = 191.45
SU01-22 α = 0.00 β = 200.00
SU01-23 α = 0.00 β = 188.03
SU01-24 α = 0.00 β = 172.65
SU01-25 α = 0.00 β = 176.07
SU01-26 α = 0.84 β = 201.71
SU01-27 α = 0.00 β = 177.78
SU01-28 α = 0.84 β = 182.91
SU01-29 α = 1.68 β = 193.16
SU01-30 α = 0.84 β = 169.23
2-02I 2-02H 2-02G 2-02F 2-02E 2-02D 2-02C 2-02B 2-02A 2-00A 2-00 2-01 2-02J 2-02K 2-03C 2-03B 2-03A 2-17 2-12 2-15 2-06 2-05 2-07 2-18 2-14 2-13
2-11A 2-11B 2-11C 2-11D 2-11E 2-11F 2-11G 2-11H 2-11I 2-11J 2-11K 2-11L 2-19
Legend
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 10.1 dpm/100cm²
Gross Beta (β) = 705.0 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV DATE DESCRIPTION BY
CABRERA SERVICES 103 E. MT ROYAL AVE BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE CORPS OF ENGINEERS BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 511 (SU 1) SECOND FLOOR REMOVABLE RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 09-3800.04
Figure 12
SCALE: 0 2 4 8 12 16 Feet
DATE: 11/30/2009


SU01-BS-11
-0.89
SU01-20
-1.11
SU01-25
-2.89
SU01-29
1.11
SU01-27
-1.78
SU01-26
-2.89
SU01-30
-0.44
SU01-19
1.33
SU01-18
-2.00
SU01-28
2.44
SU01-22
1.33
SU01-21
-2.22
SU01-16
0.00
SU01-23
-2.89
SU01-17
-3.33
SU01-24
-6.22
2-02I
2-02H
2-02G
2-02K
2-02J
2-06
2-05
2-07
2-18
2-11A
2-11B
2-11C
2-02F
2-03C
2-02E
2-03B
2-11D
2-11E
2-11F
2-19
2-02D
2-03A
2-02C
2-11G
2-11H
2-11I
2-02B
2-17
2-12
2-15
2-02A
2-00A
2-00
2-01
2-14
2-13
2-11J
2-11K
2-11L
Legend
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
3H - Tritium results dpm/100cm2
DCGL (derived concentration guideline level)
Tritium (3H) = 1.2E+07 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) SECOND
FLOOR TRITIUM RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 13a
SCALE:
DATE: 11/30/2009


SU01-BS-11
33.13
SU01-20
33.13
SU01-25
34.14
SU01-29
35.14
SU01-27
32.13
SU01-26
36.14
SU01-30
37.15
SU01-19
35.14
SU01-18
37.15
SU01-28
28.11
SU01-22
33.13
SU01-21
27.11
SU01-16
31.12
SU01-23
28.11
SU01-17
38.15
SU01-24
38.15
2-02I
2-02H
2-02G
2-02J
2-02K
2-06
2-05
2-07
2-18
2-11A
2-11B
2-11C
2-02F
2-02E
2-02D
2-02C
2-02B
2-02A
2-00A
2-00
2-01
2-03C
2-03B
2-03A
2-17
2-12
2-15
2-14
2-13
2-11D
2-11E
2-11F
2-11G
2-11H
2-11I
2-11J
2-11K
2-11L
2-19
Legend
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
^{14}C - Carbon-14 results dpm/100cm^2
DCGL (derived concentration guideline level)
Carbon-14 (^{14}C) = 3.7E+05 dpm/100cm^2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) SECOND
FLOOR CARBON-14 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 13b
SCALE:
0 2 4 8 12 16
Feet
DATE: 11/30/2009



Legend

- Biased Sample Locations (Drain)
- Random Sample Locations

Sample ID
^{129}I - Iodine-129 results dpm/100cm^2

DCGL (derived concentration guideline level)

Iodine-129 (^{129}I) = 1.8E+05 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

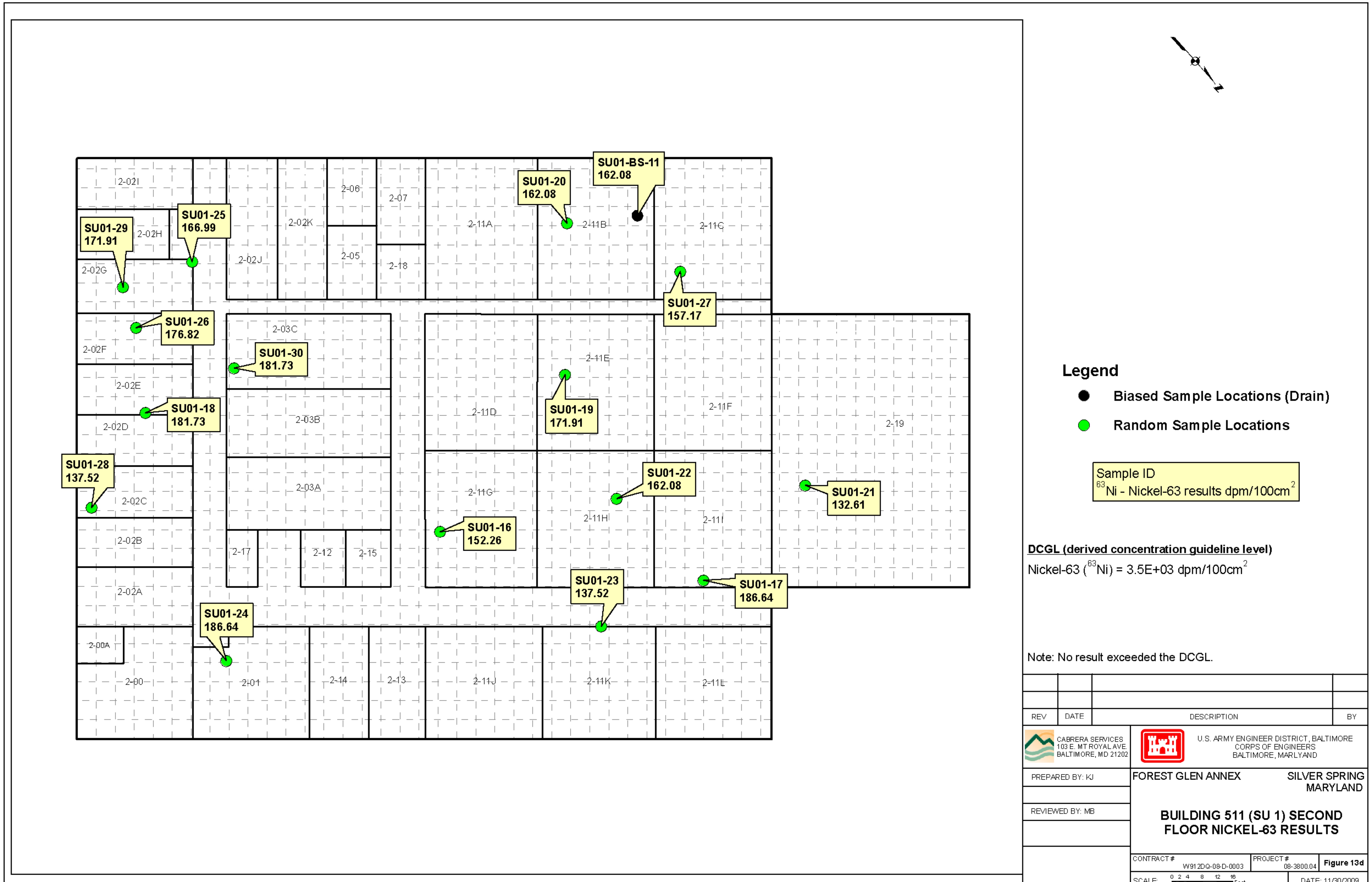
REVIEWED BY: MB

FOREST GLEN ANNEX SILVER SPRING MARYLAND

BUILDING 511 (SU 1) SECOND FLOOR IODINE-129 RESULTS

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 13c**

SCALE: 0 2 4 8 12 16 Feet | DATE: 11/30/2009


SU01-BS-11 162.08
SU01-20 162.08
SU01-25 166.99
SU01-29 171.91
SU01-27 157.17
SU01-26 176.82
SU01-30 181.73
SU01-19 171.91
SU01-18 181.73
SU01-28 137.52
SU01-22 162.08
SU01-21 132.61
SU01-16 152.26
SU01-23 137.52
SU01-17 186.64
SU01-24 186.64
2-02I
2-02H
2-02G
2-02F
2-02E
2-02D
2-02C
2-02B
2-02A
2-00A
2-00
2-01
2-02J
2-02K
2-06
2-05
2-07
2-18
2-03C
2-03B
2-03A
2-17
2-12
2-15
2-14
2-13
2-11A
2-11B
2-11C
2-11D
2-11E
2-11F
2-11G
2-11H
2-11I
2-11J
2-11K
2-11L
2-19
Legend
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
63Ni - Nickel-63 results dpm/100cm2
DCGL (derived concentration guideline level)
Nickel-63 (63Ni) = 3.5E+03 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 511 (SU 1) SECOND
FLOOR NICKEL-63 RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 13d
SCALE: 0 2 4 8 12 16 Feet
DATE: 11/30/2009

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

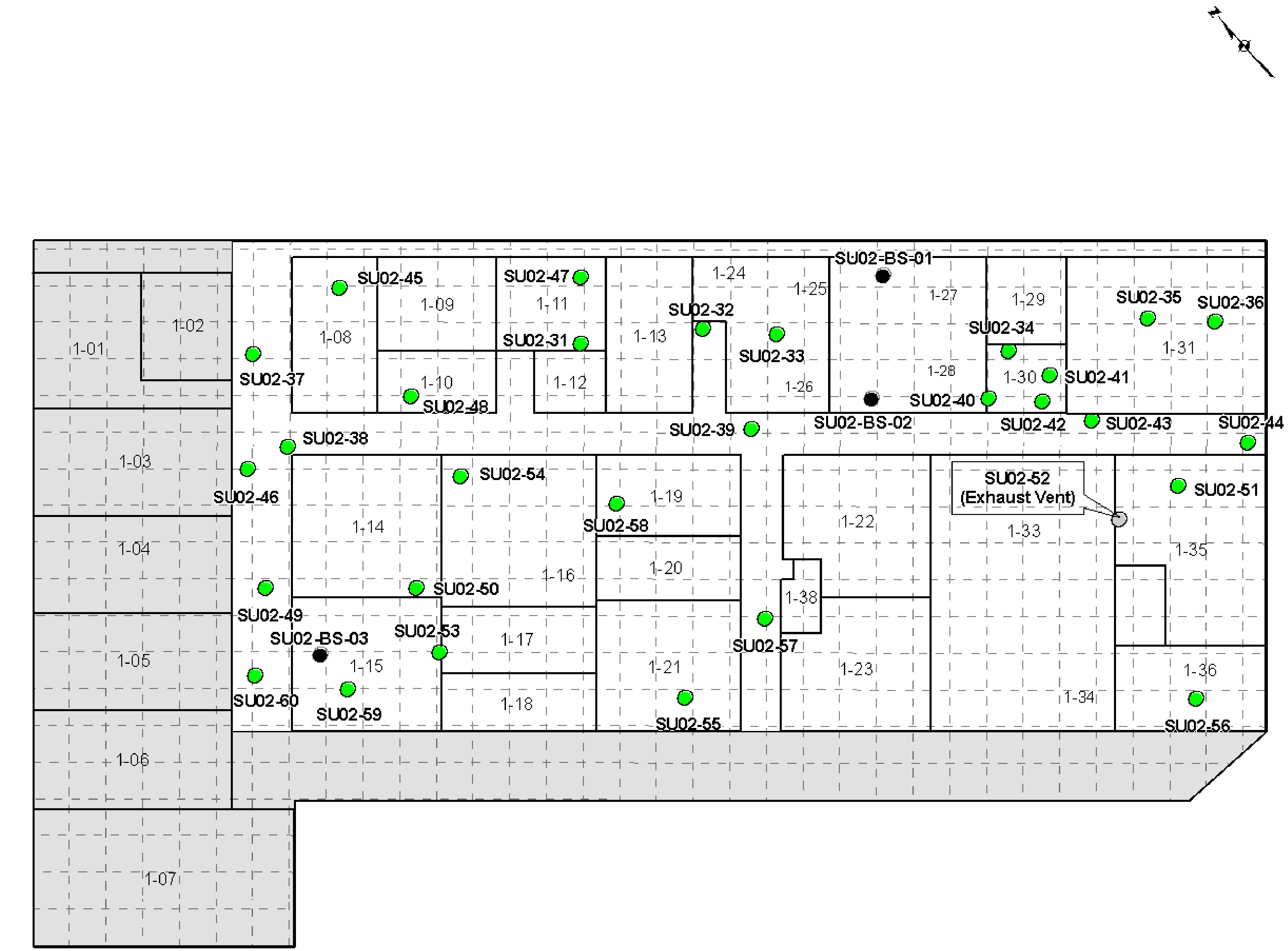
PREPARED BY: KJ
REVIEWED BY: MB

FOREST GLEN ANNEX — SILVER SPRING MARYLAND

BUILDING 511 (SU 1) SECOND FLOOR FLOOR SCAN AND EXPOSURE RATE

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 14**

SCALE: 0 2 4 8 12 16 Feet | DATE: 11/30/2009



ID	X Coordinate	Y Coordinate
SU02-31	1297486.925	487305.946
SU02-32	1297500.652	487296.465
SU02-33	1297507.765	487289.146
SU02-34	1297529.866	487266.486
SU02-35	1297547.029	487257.330
SU02-36	1297553.561	487250.947
SU02-37	1297452.461	487334.490
SU02-38	1297447.591	487321.834
SU02-39	1297496.554	487281.755
SU02-40	1297523.523	487263.479
SU02-41	1297531.869	487260.380
SU02-42	1297528.742	487258.260
SU02-43	1297532.047	487251.954
SU02-44	1297545.951	487235.548
SU02-45	1297467.273	487333.346
SU02-46	1297441.593	487323.186
SU02-47	1297492.813	487312.653
SU02-48	1297464.830	487315.901
SU02-49	1297432.561	487309.383
SU02-50	1297448.059	487295.805
SU02-51	1297535.030	487237.413
SU02-52	1297525.970	487239.242
SU02-53	1297444.601	487287.170
SU02-54	1297462.644	487303.219
SU02-55	1297465.568	487260.322
SU02-56	1297517.517	487214.110
SU02-57	1297480.857	487261.113
SU02-58	1297476.014	487286.402
SU02-59	1297431.869	487291.752
SU02-60	1297423.688	487301.488
SU02-BS-01	1297523.926	487285.630
SU02-BS-02	1297511.646	487274.009
SU02-BS-03	1297432.247	487297.785

Legend

Biased Sample Locations

Biased Sample Locations (Drain)

Random Sample Locations

New addition per
1997 - 2000 renovation

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND

PREPARED BY: KJ

REVIEWED BY: MB

FOREST GLEN ANNEX

SILVER SPRING
MARYLAND

BUILDING 512 (SU 2)
RANDOM AND BIASED
SAMPLE LOCATIONS

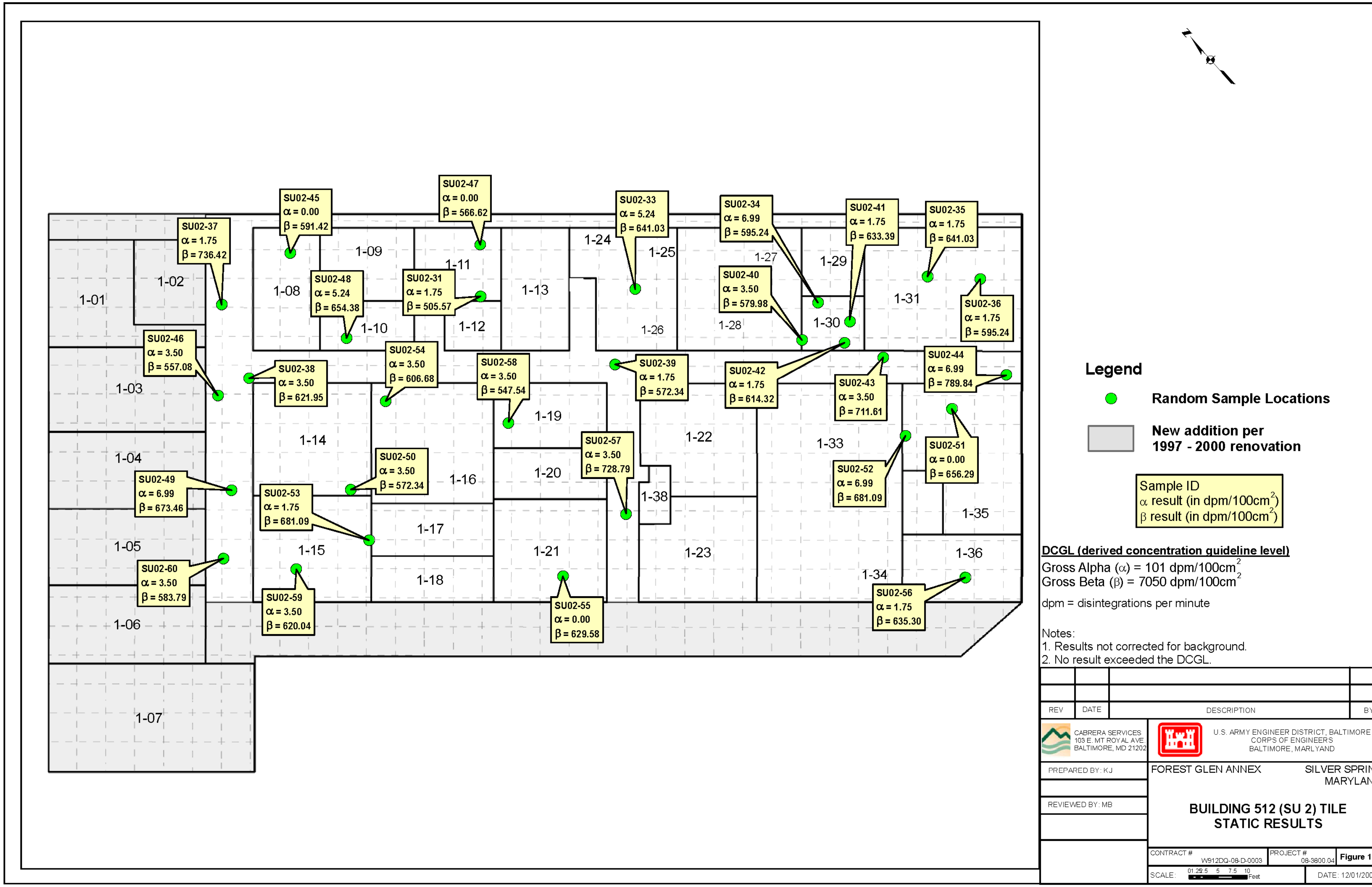
CONTRACT # W912DQ-08-D-0003

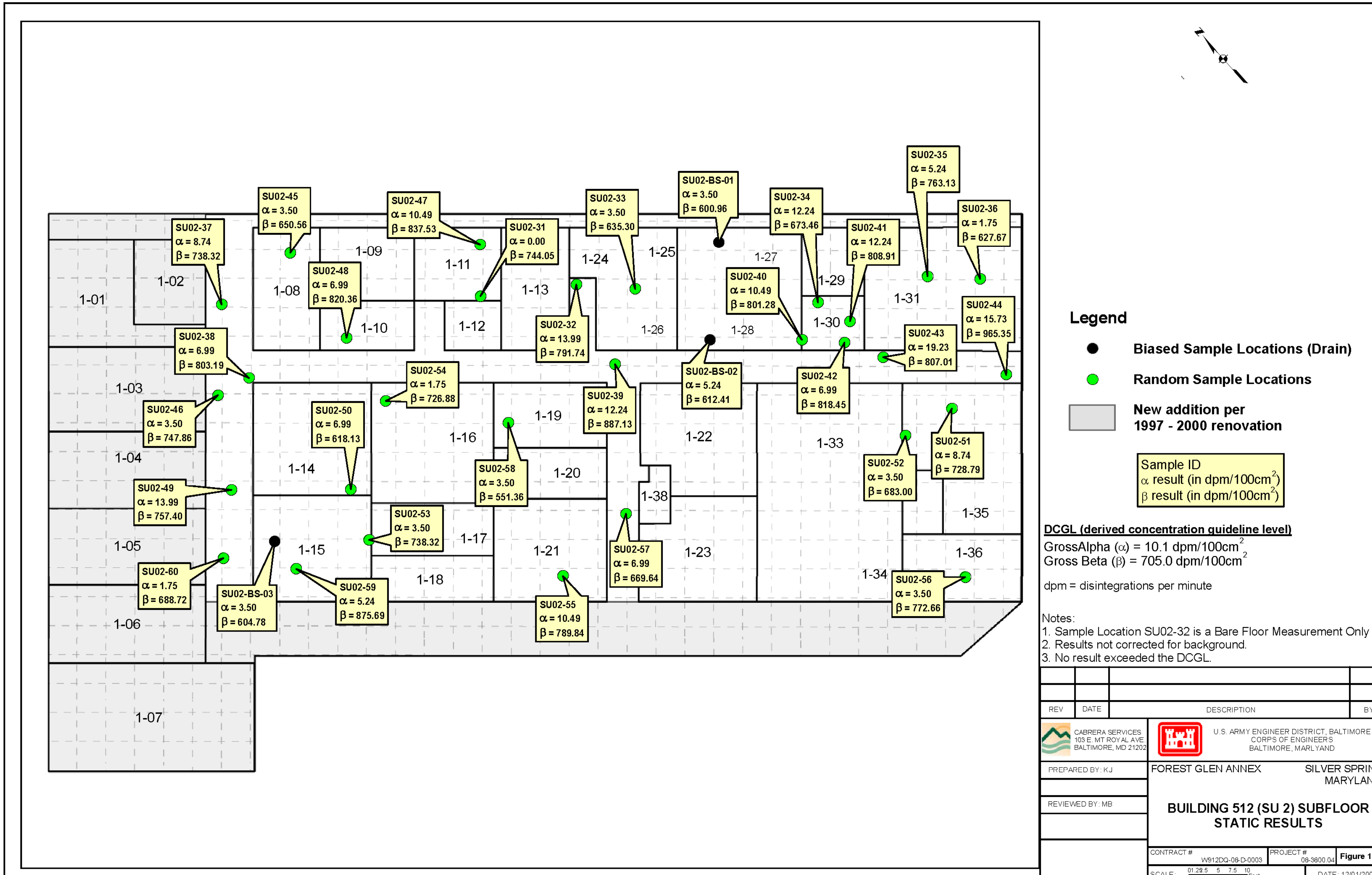
PROJECT # 08-3800.04

Figure 15

SCALE: 0 1.25 2.5 5 7.5 10 Feet

DATE: 12/01/2009


1-01
1-02
1-03
1-04
1-05
1-06
1-07
1-08
1-09
1-10
1-11
1-12
1-13
1-14
1-15
1-16
1-17
1-18
1-19
1-20
1-21
1-22
1-23
1-24
1-25
1-26
1-27
1-28
1-29
1-30
1-31
1-33
1-34
1-35
1-36
1-38
SU02-45 α = 0.00 β = 591.42
SU02-47 α = 0.00 β = 566.62
SU02-33 α = 5.24 β = 641.03
SU02-34 α = 6.99 β = 595.24
SU02-41 α = 1.75 β = 633.39
SU02-35 α = 1.75 β = 641.03
SU02-37 α = 1.75 β = 736.42
SU02-48 α = 5.24 β = 654.38
SU02-31 α = 1.75 β = 505.57
SU02-40 α = 3.50 β = 579.98
SU02-36 α = 1.75 β = 595.24
SU02-46 α = 3.50 β = 557.08
SU02-38 α = 3.50 β = 621.95
SU02-54 α = 3.50 β = 606.68
SU02-58 α = 3.50 β = 547.54
SU02-39 α = 1.75 β = 572.34
SU02-42 α = 1.75 β = 614.32
SU02-43 α = 3.50 β = 711.61
SU02-44 α = 6.99 β = 789.84
SU02-57 α = 3.50 β = 728.79
SU02-50 α = 3.50 β = 572.34
SU02-49 α = 6.99 β = 673.46
SU02-53 α = 1.75 β = 681.09
SU02-52 α = 6.99 β = 681.09
SU02-51 α = 0.00 β = 656.29
SU02-60 α = 3.50 β = 583.79
SU02-59 α = 3.50 β = 620.04
SU02-55 α = 0.00 β = 629.58
SU02-56 α = 1.75 β = 635.30
Legend
Random Sample Locations
New addition per 1997 - 2000 renovation
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 101 dpm/100cm²
Gross Beta (β) = 7050 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
REVIEWED BY: MB
BUILDING 512 (SU 2) TILE
STATIC RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 16a
SCALE: 0 1.25 2.5 5 7.5 10 Feet
DATE: 12/01/2009


SU02-37 α = 8.74 β = 738.32
SU02-45 α = 3.50 β = 650.56
SU02-47 α = 10.49 β = 837.53
SU02-31 α = 0.00 β = 744.05
SU02-33 α = 3.50 β = 635.30
SU02-BS-01 α = 3.50 β = 600.96
SU02-34 α = 12.24 β = 673.46
SU02-41 α = 12.24 β = 808.91
SU02-35 α = 5.24 β = 763.13
SU02-36 α = 1.75 β = 627.67
SU02-48 α = 6.99 β = 820.36
SU02-40 α = 10.49 β = 801.28
SU02-32 α = 13.99 β = 791.74
SU02-44 α = 15.73 β = 965.35
SU02-43 α = 19.23 β = 807.01
SU02-38 α = 6.99 β = 803.19
SU02-54 α = 1.75 β = 726.88
SU02-BS-02 α = 5.24 β = 612.41
SU02-42 α = 6.99 β = 818.45
SU02-39 α = 12.24 β = 887.13
SU02-46 α = 3.50 β = 747.86
SU02-50 α = 6.99 β = 618.13
SU02-58 α = 3.50 β = 551.36
SU02-51 α = 8.74 β = 728.79
SU02-52 α = 3.50 β = 683.00
SU02-49 α = 13.99 β = 757.40
SU02-53 α = 3.50 β = 738.32
SU02-57 α = 6.99 β = 669.64
SU02-60 α = 1.75 β = 688.72
SU02-BS-03 α = 3.50 β = 604.78
SU02-59 α = 5.24 β = 875.69
SU02-55 α = 10.49 β = 789.84
SU02-56 α = 3.50 β = 772.66
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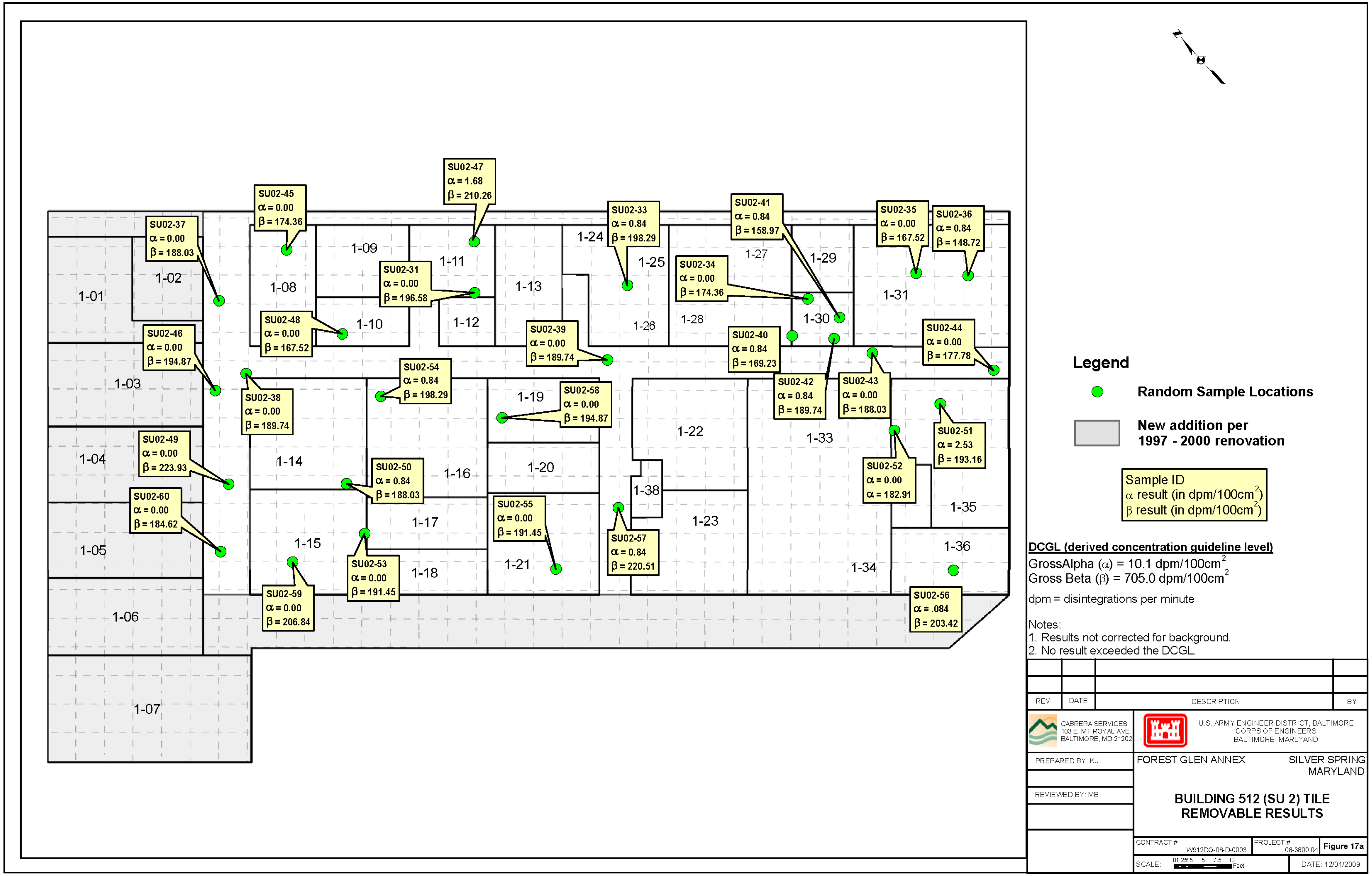
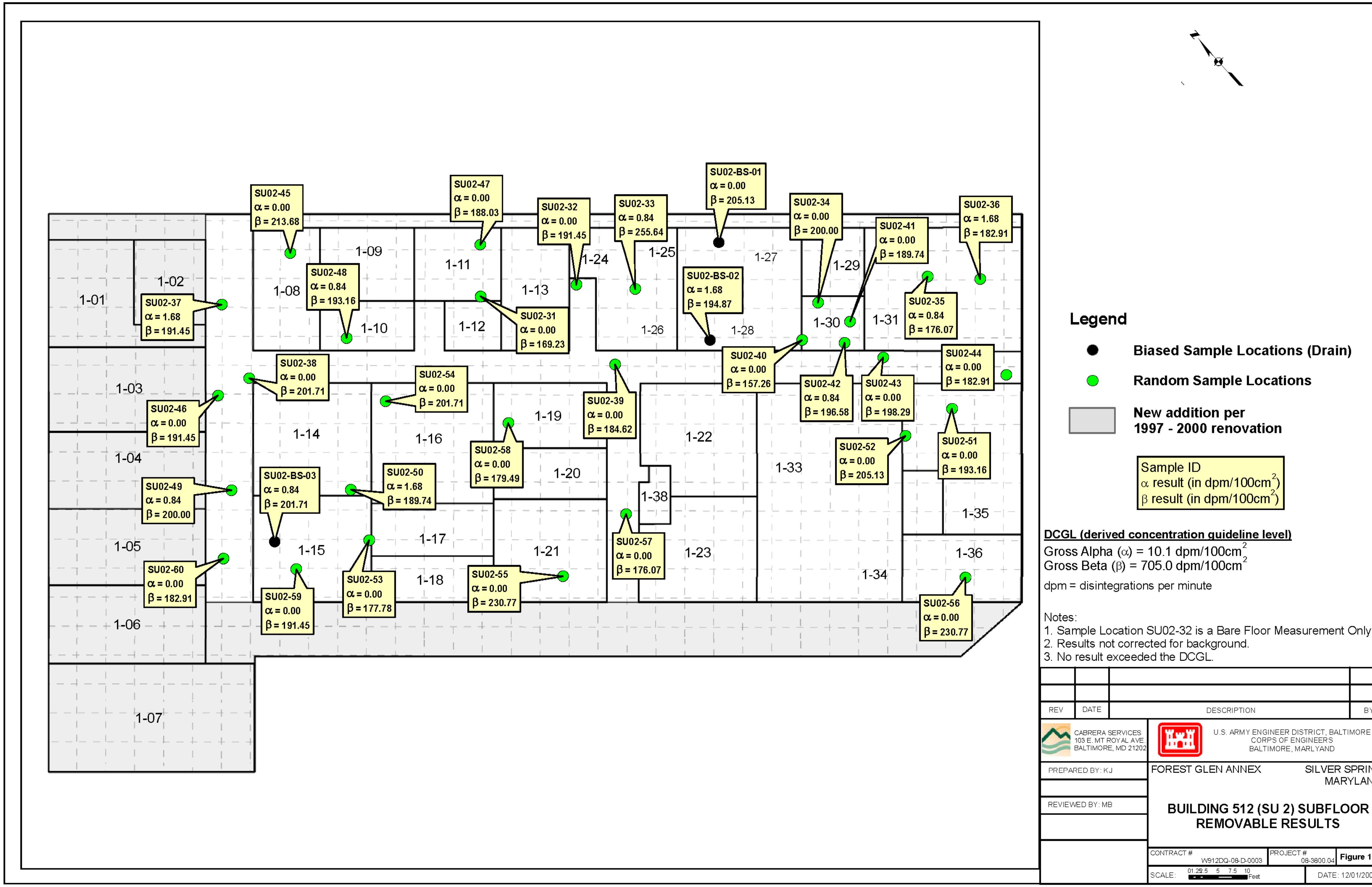
1-36
1-38
Legend
Biased Sample Locations (Drain)
Random Sample Locations
New addition per 1997 - 2000 renovation
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
GrossAlpha (α) = 10.1 dpm/100cm²
Gross Beta (β) = 705.0 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Sample Location SU02-32 is a Bare Floor Measurement Only
2. Results not corrected for background.
3. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 512 (SU 2) SUBFLOOR STATIC RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3600.04
Figure 16b
SCALE:
Feet
DATE: 12/01/2009


SU02-37 α = 0.00 β = 188.03
SU02-45 α = 0.00 β = 174.36
SU02-47 α = 1.68 β = 210.26
SU02-33 α = 0.84 β = 198.29
SU02-41 α = 0.84 β = 158.97
SU02-35 α = 0.00 β = 167.52
SU02-36 α = 0.84 β = 148.72
SU02-31 α = 0.00 β = 196.58
SU02-34 α = 0.00 β = 174.36
SU02-48 α = 0.00 β = 167.52
SU02-46 α = 0.00 β = 194.87
SU02-39 α = 0.00 β = 189.74
SU02-40 α = 0.84 β = 169.23
SU02-44 α = 0.00 β = 177.78
SU02-54 α = 0.84 β = 198.29
SU02-38 α = 0.00 β = 189.74
SU02-58 α = 0.00 β = 194.87
SU02-42 α = 0.84 β = 189.74
SU02-43 α = 0.00 β = 188.03
SU02-49 α = 0.00 β = 223.93
SU02-50 α = 0.84 β = 188.03
SU02-51 α = 2.53 β = 193.16
SU02-52 α = 0.00 α = 182.91
SU02-60 α = 0.00 β = 184.62
SU02-55 α = 0.00 β = 191.45
SU02-57 α = 0.84 β = 220.51
SU02-53 α = 0.00 β = 191.45
SU02-59 α = 0.00 β = 206.84
SU02-56 α = .084 β = 203.42
1-01 1-02 1-03 1-04 1-05 1-06 1-07 1-08 1-09 1-10 1-11 1-12 1-13 1-14 1-15 1-16 1-17 1-18 1-19 1-20 1-21 1-22 1-23 1-24 1-25 1-26 1-27 1-28 1-29 1-30 1-31 1-33 1-34 1-35 1-36 1-38
Legend
Random Sample Locations
New addition per 1997 - 2000 renovation
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
GrossAlpha (α) = 10.1 dpm/100cm²
Gross Beta (β) = 705.0 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES 103 E. MT ROYAL AVE. BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE CORPS OF ENGINEERS BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 512 (SU 2) TILE REMOVABLE RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3600.04
Figure 17a
SCALE:
Feet
DATE: 12/01/2009


1-01
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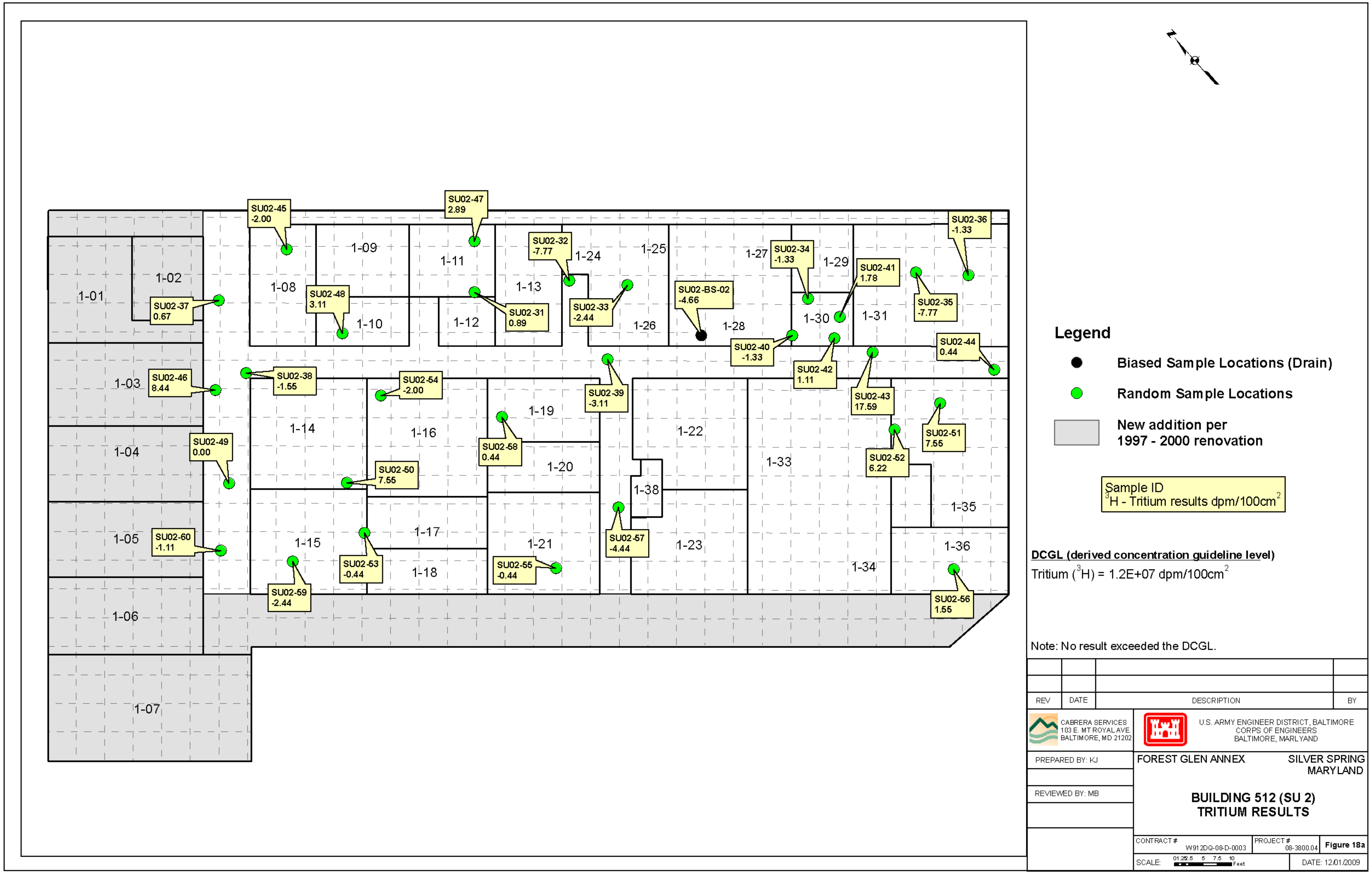
SU02-45 α = 0.00 β = 213.68
SU02-47 α = 0.00 β = 188.03
SU02-32 α = 0.00 β = 191.45
SU02-33 α = 0.84 β = 255.64
SU02-BS-01 α = 0.00 β = 205.13
SU02-34 α = 0.00 β = 200.00
SU02-41 α = 0.00 β = 189.74
SU02-36 α = 1.68 β = 182.91
SU02-48 α = 0.84 β = 193.16
SU02-BS-02 α = 1.68 β = 194.87
SU02-35 α = 0.84 β = 176.07
SU02-37 α = 1.68 β = 191.45
SU02-31 α = 0.00 β = 169.23
SU02-38 α = 0.00 β = 201.71
SU02-54 α = 0.00 β = 201.71
SU02-40 α = 0.00 β = 157.26
SU02-44 α = 0.00 β = 182.91
SU02-39 α = 0.00 β = 184.62
SU02-42 α = 0.84 β = 196.58
SU02-43 α = 0.00 β = 198.29
SU02-46 α = 0.00 β = 191.45
SU02-58 α = 0.00 β = 179.49
SU02-52 α = 0.00 β = 205.13
SU02-51 α = 0.00 β = 193.16
SU02-BS-03 α = 0.84 β = 201.71
SU02-50 α = 1.68 β = 189.74
SU02-49 α = 0.84 β = 200.00
SU02-57 α = 0.00 β = 176.07
SU02-60 α = 0.00 β = 182.91
SU02-59 α = 0.00 β = 191.45
SU02-53 α = 0.00 β = 177.78
SU02-55 α = 0.00 β = 230.77
SU02-56 α = 0.00 β = 230.77
Legend
Biased Sample Locations (Drain)
Random Sample Locations
New addition per 1997 - 2000 renovation
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 10.1 dpm/100cm²
Gross Beta (β) = 705.0 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Sample Location SU02-32 is a Bare Floor Measurement Only
2. Results not corrected for background.
3. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 512 (SU 2) SUBFLOOR REMOVABLE RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 17b
SCALE:
Feet
DATE: 12/01/2009



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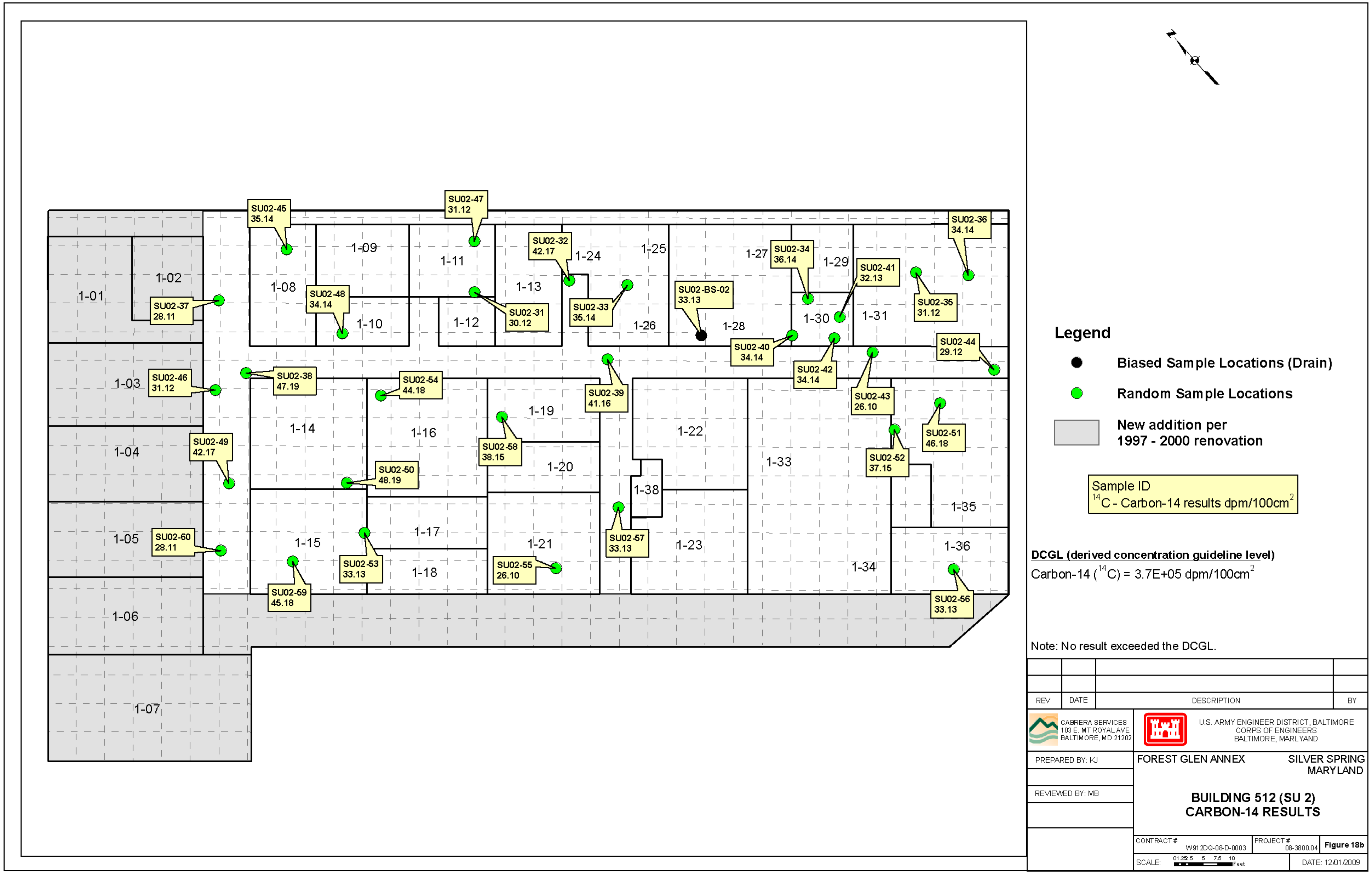
SU02-45 -2.00
SU02-47 2.89
SU02-32 -7.77
SU02-36 -1.33
SU02-34 -1.33
SU02-41 1.78
SU02-48 3.11
SU02-37 0.67
SU02-31 0.89
SU02-33 -2.44
SU02-BS-02 -4.66
SU02-35 -7.77
SU02-40 -1.33
SU02-44 0.44
SU02-42 1.11
SU02-38 -1.55
SU02-54 -2.00
SU02-46 8.44
SU02-39 -3.11
SU02-43 17.59
SU02-49 0.00
SU02-58 0.44
SU02-51 7.55
SU02-52 6.22
SU02-50 7.55
SU02-60 -1.11
SU02-57 -4.44
SU02-53 -0.44
SU02-55 -0.44
SU02-59 -2.44
SU02-56 1.55
Legend
Biased Sample Locations (Drain)
Random Sample Locations
New addition per 1997 - 2000 renovation
Sample ID
3H - Tritium results dpm/100cm2
DCGL (derived concentration guideline level)
Tritium (3H) = 1.2E+07 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 512 (SU 2)
TRITIUM RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 18a
SCALE:
Feet
DATE: 12/01/2009


1-01
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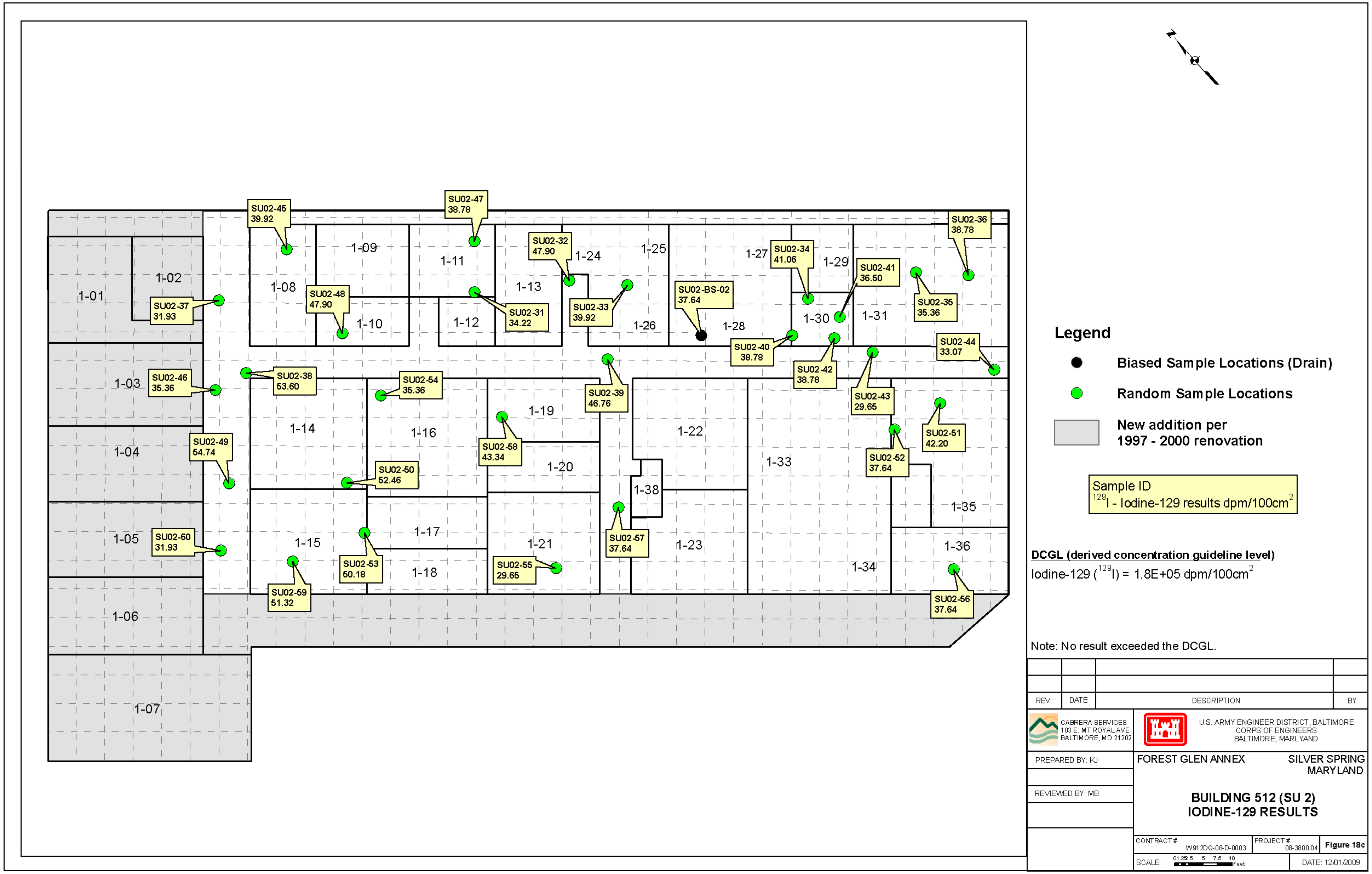
SU02-45 35.14
SU02-47 31.12
SU02-32 42.17
SU02-36 34.14
SU02-34 36.14
SU02-41 32.13
SU02-37 28.11
SU02-48 34.14
SU02-31 30.12
SU02-33 35.14
SU02-BS-02 33.13
SU02-35 31.12
SU02-40 34.14
SU02-44 29.12
SU02-42 34.14
SU02-46 31.12
SU02-38 47.19
SU02-54 44.18
SU02-39 41.16
SU02-43 26.10
SU02-51 46.18
SU02-49 42.17
SU02-58 38.15
SU02-50 48.19
SU02-52 37.15
SU02-60 28.11
SU02-57 33.13
SU02-53 33.13
SU02-55 26.10
SU02-59 45.18
SU02-56 33.13
Legend
Biased Sample Locations (Drain)
Random Sample Locations
New addition per
1997 - 2000 renovation
Sample ID
14C - Carbon-14 results dpm/100cm2
DCGL (derived concentration guideline level)
Carbon-14 (14C) = 3.7E+05 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 512 (SU 2)
CARBON-14 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 18b
SCALE:
Feet
DATE: 12/01/2009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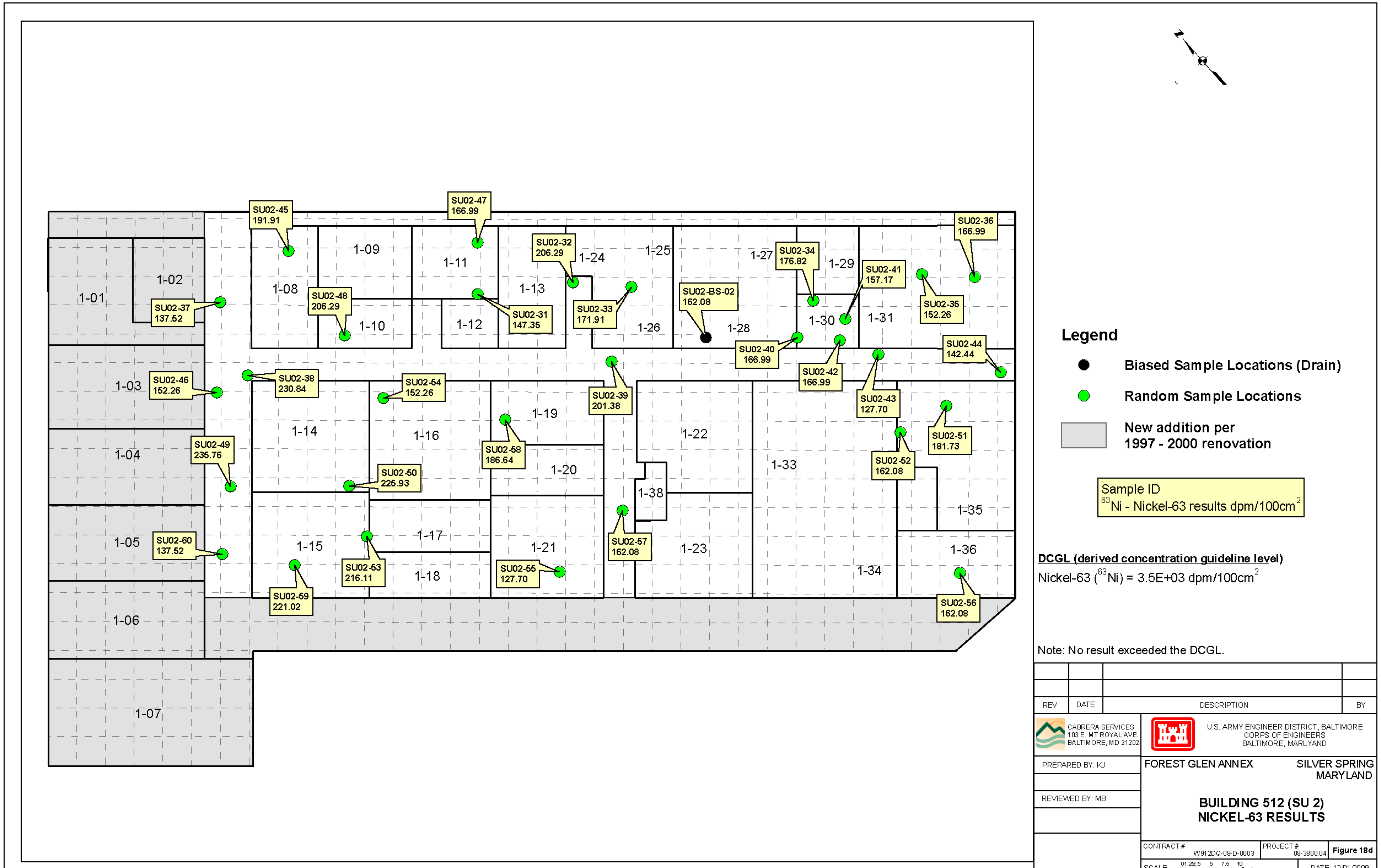
SU02-45 39.92
SU02-47 38.78
SU02-32 47.90
SU02-36 38.78
SU02-34 41.06
SU02-41 36.50
SU02-37 31.93
SU02-48 47.90
SU02-31 34.22
SU02-33 39.92
SU02-BS-02 37.64
SU02-35 35.36
SU02-40 38.78
SU02-44 33.07
SU02-42 38.78
SU02-46 35.36
SU02-38 53.60
SU02-54 35.36
SU02-39 46.76
SU02-43 29.65
SU02-51 42.20
SU02-49 54.74
SU02-58 43.34
SU02-50 52.46
SU02-52 37.64
SU02-60 31.93
SU02-57 37.64
SU02-53 50.18
SU02-55 29.65
SU02-59 51.32
SU02-56 37.64
Legend
Biased Sample Locations (Drain)
Random Sample Locations
New addition per 1997 - 2000 renovation
Sample ID
129I - Iodine-129 results dpm/100cm2
DCGL (derived concentration guideline level)
Iodine-129 (129I) = 1.8E+05 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 512 (SU 2)
IODINE-129 RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 18c
SCALE:
Feet
DATE: 12/01/2009


SU02-45
191.91
SU02-47
166.99
SU02-32
206.29
SU02-36
166.99
SU02-34
176.82
SU02-41
157.17
SU02-BS-02
162.08
SU02-37
137.52
SU02-48
206.29
SU02-31
147.35
SU02-33
171.91
SU02-35
152.26
SU02-44
142.44
SU02-40
166.99
SU02-42
166.99
SU02-46
152.26
SU02-38
230.84
SU02-54
152.26
SU02-39
201.38
SU02-43
127.70
SU02-51
181.73
SU02-49
235.76
SU02-58
186.64
SU02-50
225.93
SU02-52
162.08
SU02-60
137.52
SU02-53
216.11
SU02-55
127.70
SU02-57
162.08
SU02-59
221.02
SU02-56
162.08
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Legend
Biased Sample Locations (Drain)
Random Sample Locations
New addition per
1997 - 2000 renovation
Sample ID
63Ni - Nickel-63 results dpm/100cm2
DCGL (derived concentration guideline level)
Nickel-63 (63Ni) = 3.5E+03 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING
MARYLAND
BUILDING 512 (SU 2)
NICKEL-63 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 18d
SCALE:
Feet
DATE: 12/01/2009


1-01
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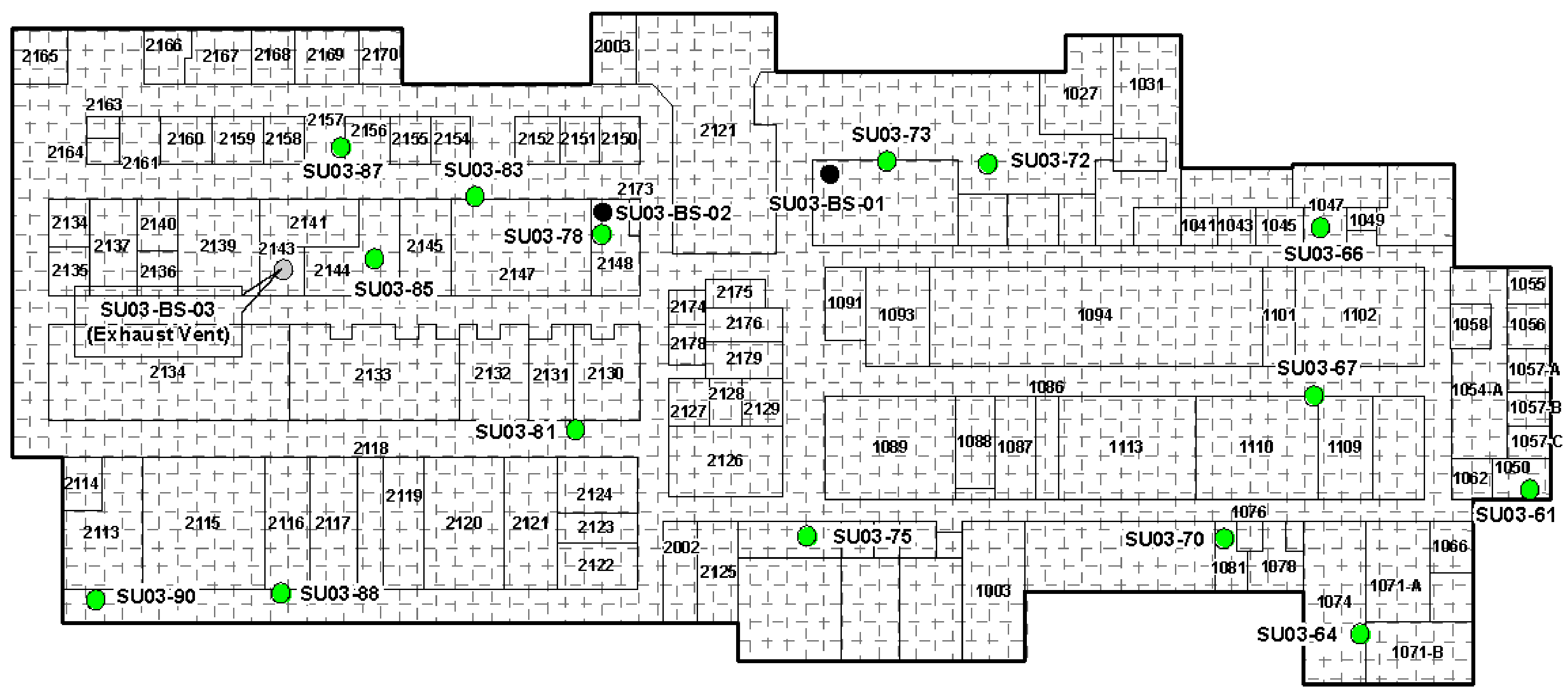
1-36
1-38
4 - 7
Floor Scan Ranges
Vinyl Tile
α and β = 275 - 375
Concrete
α and β = 325 - 475
Wall
α and β = 275 - 375
Legend
4 - 7
Exposure Rate Range (µR/hr)
Floor Scan Coverage (counts per minute)
New addition per 1997 - 2000 renovation
α = alpha
β = beta
µR/hr = microR per hour
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
FOREST GLEN ANNEX
SILVER SPRING MARYLAND
BUILDING 512 (SU 2)
FLOOR SCAN AND EXPOSURE RATE
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3600.04
Figure 19
SCALE:
Feet
DATE: 12/01/2009



ID	X Coordinate	Y Coordinate
SU03-61	1262279.357	519016.313
SU03-64	1262328.912	518981.877
SU03-66	1262225.085	518943.447
SU03-67	1262269.581	518953.331
SU03-70	1262313.010	518939.696
SU03-72	1262231.213	518851.916
SU03-73	1262237.505	518825.165
SU03-75	1262341.210	518830.226
SU03-78	1262276.220	518755.831
SU03-80	1262329.136	518762.333
SU03-83	1262275.029	518719.993
SU03-85	1262298.124	518697.877
SU03-87	1262271.343	518681.497
SU03-88	1262392.398	518696.409
SU03-90	1262406.717	518648.154
SU03-BS-01	1262244.693	518811.208
SU03-BS-02	1262270.409	518754.262
SU03-BS-03	1262307.185	518674.547

Legend

- Biased Sample Locations
- Biased Sample Locations (Drain)
- Random Sample Locations

Note: Due to lack of accessibility, points SU03-70 and SU03-75 were moved in the field - the locations shown on this figure accurately represent the location of the sample/measurement as taken in the field.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

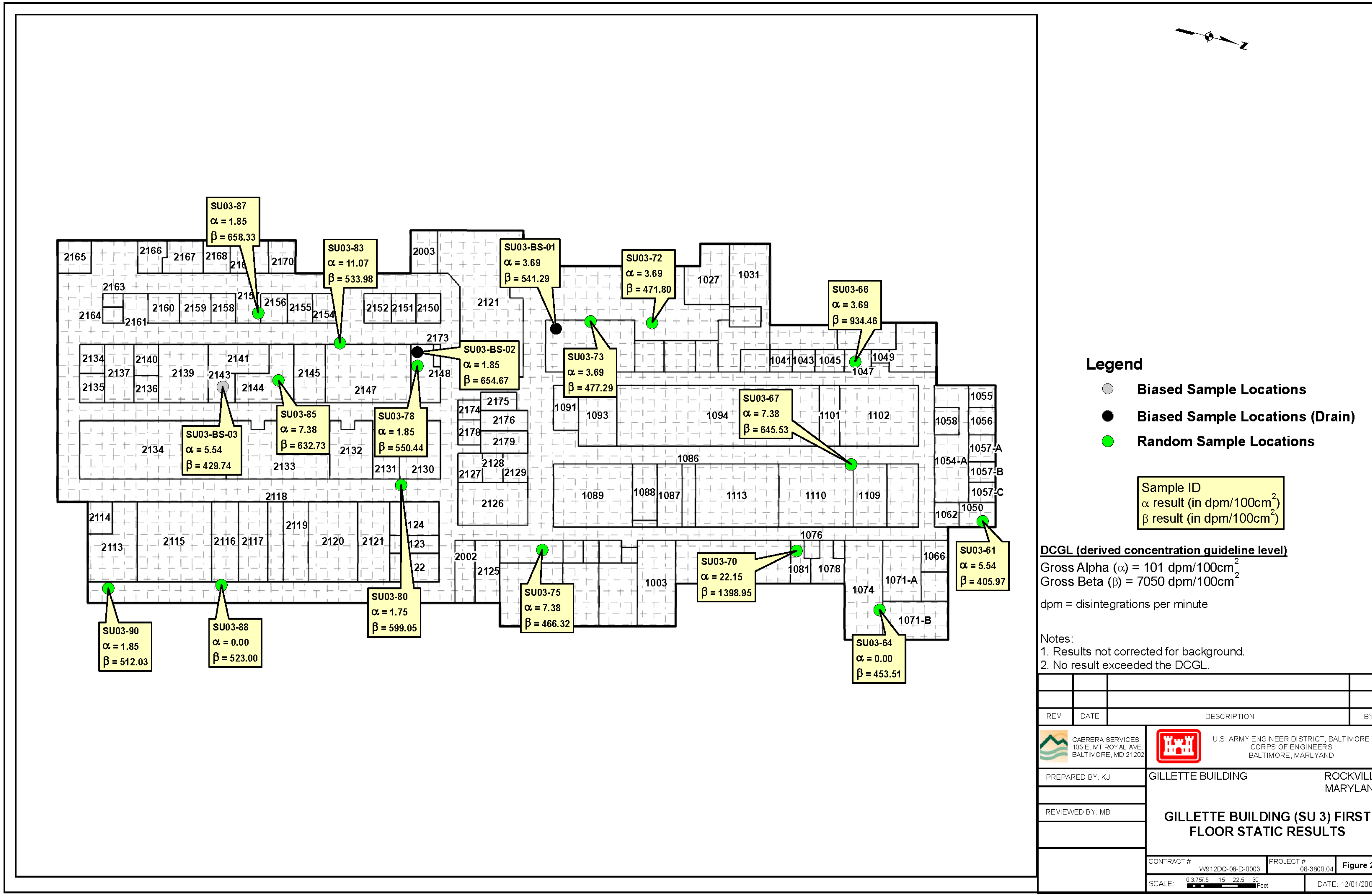
REVIEWED BY: MB

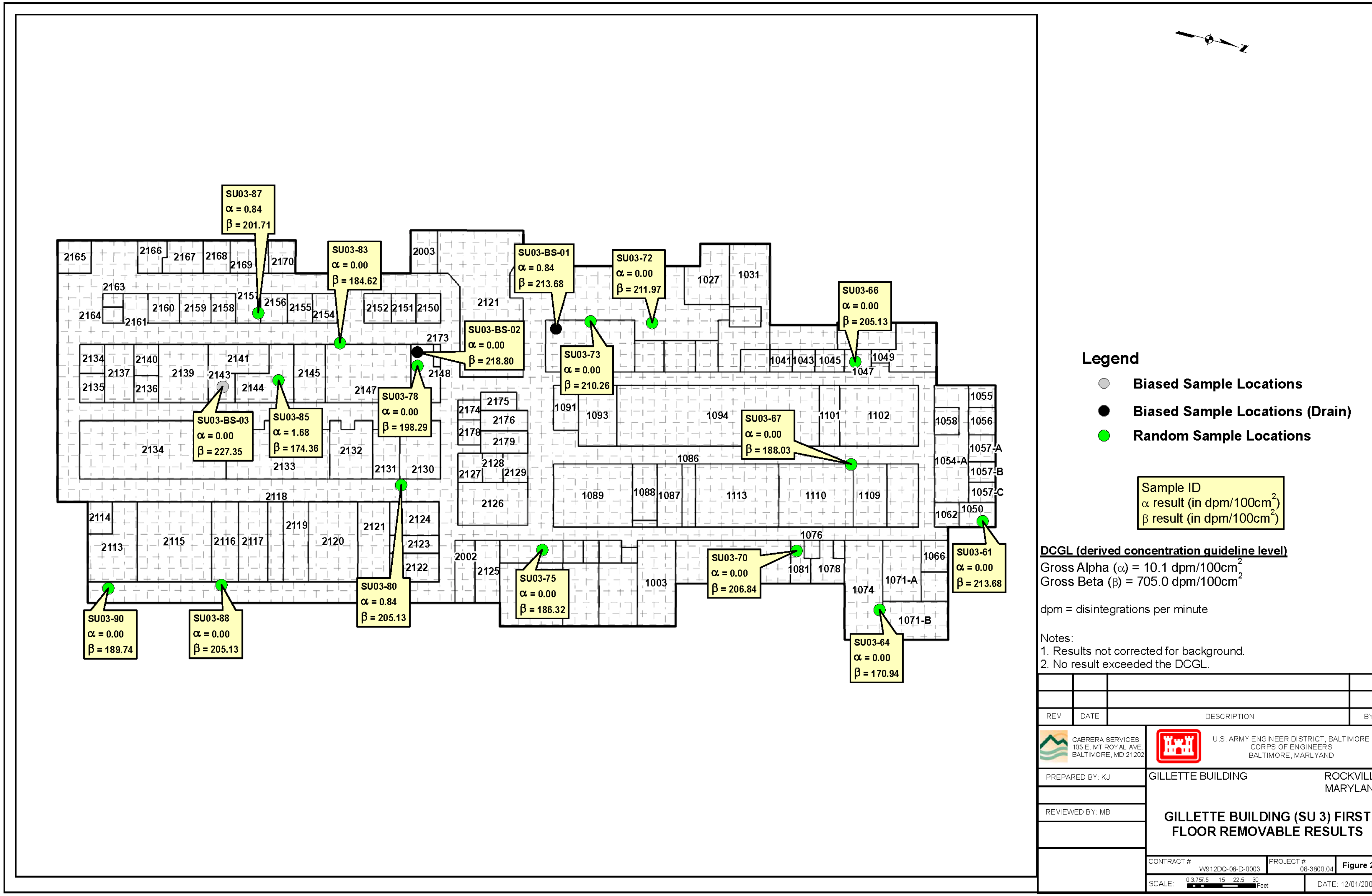
GILLETTE BUILDING — ROCKVILLE MARYLAND

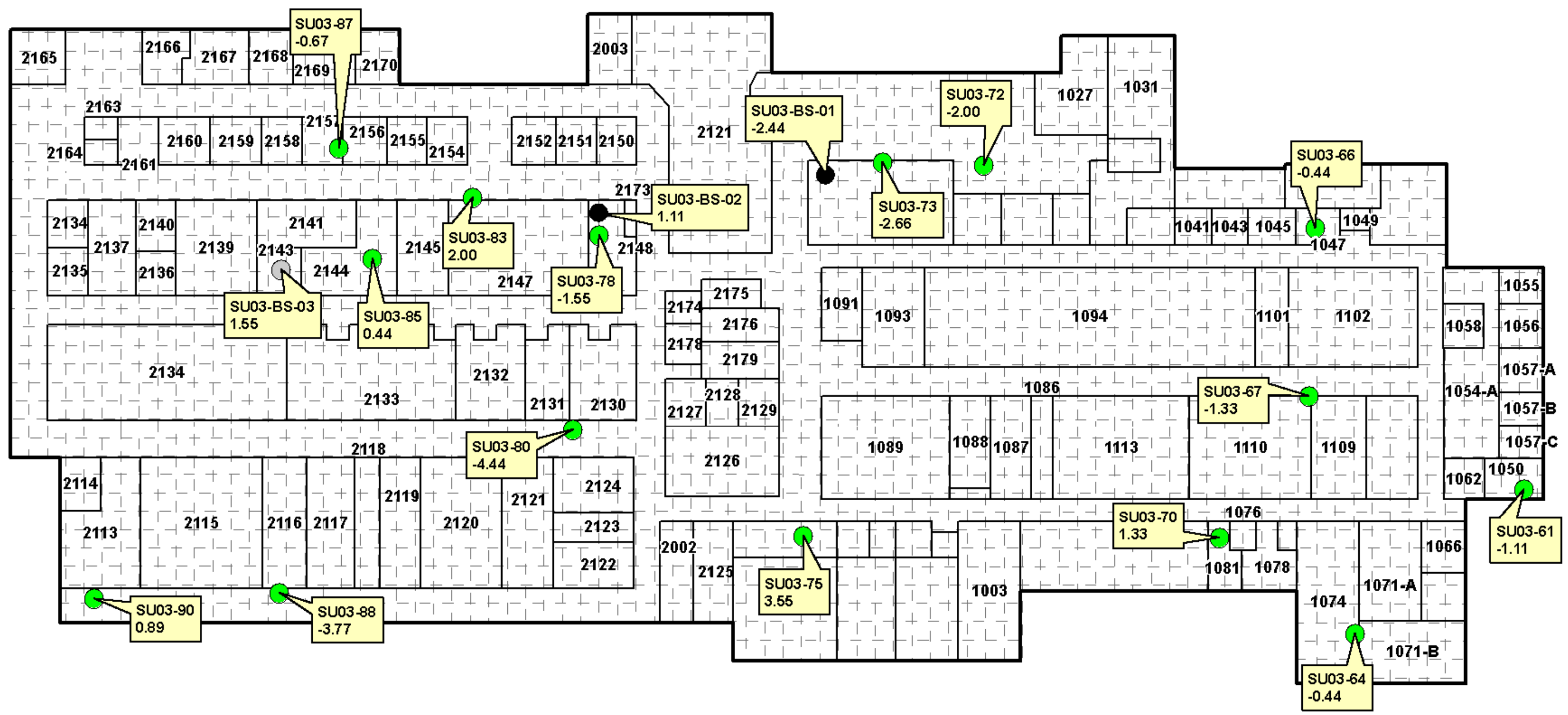
GILLETTE BUILDING (SU 3) FIRST FLOOR RANDOM AND BIASED SAMPLE LOCATIONS

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 20

SCALE 0 3.75 7.5 15 22.5 30 Feet | DATE: 12/01/2009


SU03-87
α = 1.85
β = 658.33
SU03-83
α = 11.07
β = 533.98
SU03-BS-01
α = 3.69
β = 541.29
SU03-72
α = 3.69
β = 471.80
SU03-66
α = 3.69
β = 934.46
SU03-BS-02
α = 1.85
β = 654.67
SU03-73
α = 3.69
β = 477.29
SU03-85
α = 7.38
β = 632.73
SU03-78
α = 1.85
β = 550.44
SU03-BS-03
α = 5.54
β = 429.74
SU03-67
α = 7.38
β = 645.53
SU03-61
α = 5.54
β = 405.97
SU03-70
α = 22.15
β = 1398.95
SU03-75
α = 7.38
β = 466.32
SU03-80
α = 1.75
β = 599.05
SU03-90
α = 1.85
β = 512.03
SU03-88
α = 0.00
β = 523.00
SU03-64
α = 0.00
β = 453.51
Legend
Biased Sample Locations
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
α result (in dpm/100cm2)
β result (in dpm/100cm2)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 101 dpm/100cm2
Gross Beta (β) = 7050 dpm/100cm2
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND
PREPARED BY: KJ
REVIEWED BY: MB
GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3) FIRST
FLOOR STATIC RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3600.04
Figure 21
SCALE:
Feet
DATE: 12/01/2009


SU03-87
α = 0.84
β = 201.71
SU03-83
α = 0.00
β = 184.62
SU03-BS-01
α = 0.84
β = 213.68
SU03-72
α = 0.00
β = 211.97
SU03-66
α = 0.00
β = 205.13
SU03-BS-02
α = 0.00
β = 218.80
SU03-73
α = 0.00
β = 210.26
SU03-78
α = 0.00
β = 198.29
SU03-BS-03
α = 0.00
β = 227.35
SU03-85
α = 1.68
β = 174.36
SU03-67
α = 0.00
β = 188.03
SU03-61
α = 0.00
β = 213.68
SU03-70
α = 0.00
β = 206.84
SU03-75
α = 0.00
β = 186.32
SU03-80
α = 0.84
β = 205.13
SU03-90
α = 0.00
β = 189.74
SU03-88
α = 0.00
β = 205.13
SU03-64
α = 0.00
β = 170.94
Legend
Biased Sample Locations
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
α result (in dpm/100cm2)
β result (in dpm/100cm2)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 10.1 dpm/100cm2
Gross Beta (β) = 705.0 dpm/100cm2
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND
PREPARED BY: KJ
REVIEWED BY: MB
GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3) FIRST
FLOOR REMOVABLE RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 22
SCALE:
Feet
DATE: 12/01/2009



Legend

- Biased Sample Locations
- Biased Sample Locations (Drain)
- Random Sample Locations

Sample ID
^3H - Tritium results dpm/100cm^2

DCGL (derived concentration guideline level)
Tritium (^3H) = 1.2E+07 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

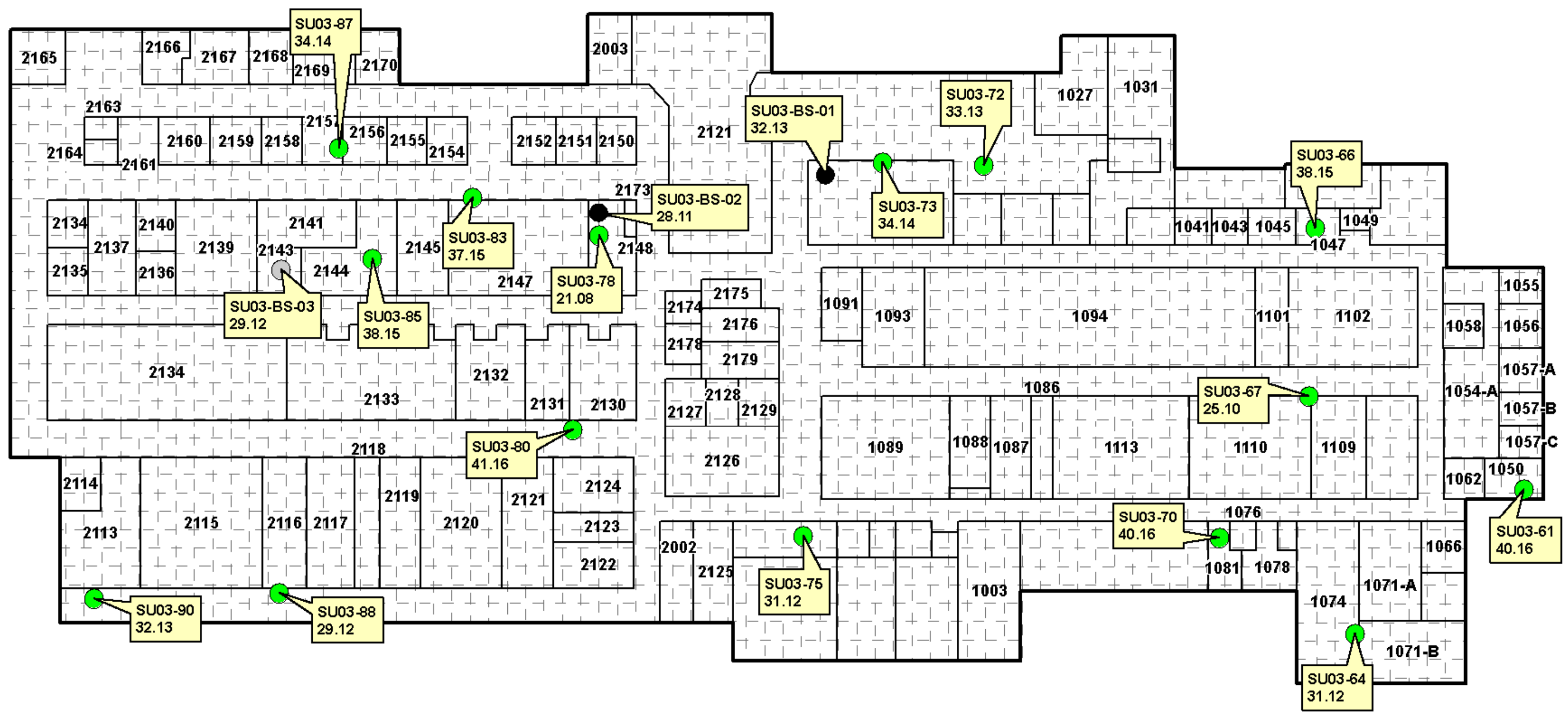
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ
REVIEWED BY: MB

GILLETTE BUILDING ROCKVILLE MARYLAND

**GILLETTE BUILDING (SU 3)
FIRST FLOOR TRITIUM RESULTS**

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 23a
SCALE: 0 3.75 7.5 15 22.5 30 Feet | DATE: 12/01/2009



Legend

- Biased Sample Locations
- Biased Sample Locations (Drain)
- Random Sample Locations

Sample ID
^{14}C - Carbon-14 results dpm/100cm^2

DCGL (derived concentration guideline level)
Carbon-14 (^{14}C) = 3.7E+05 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

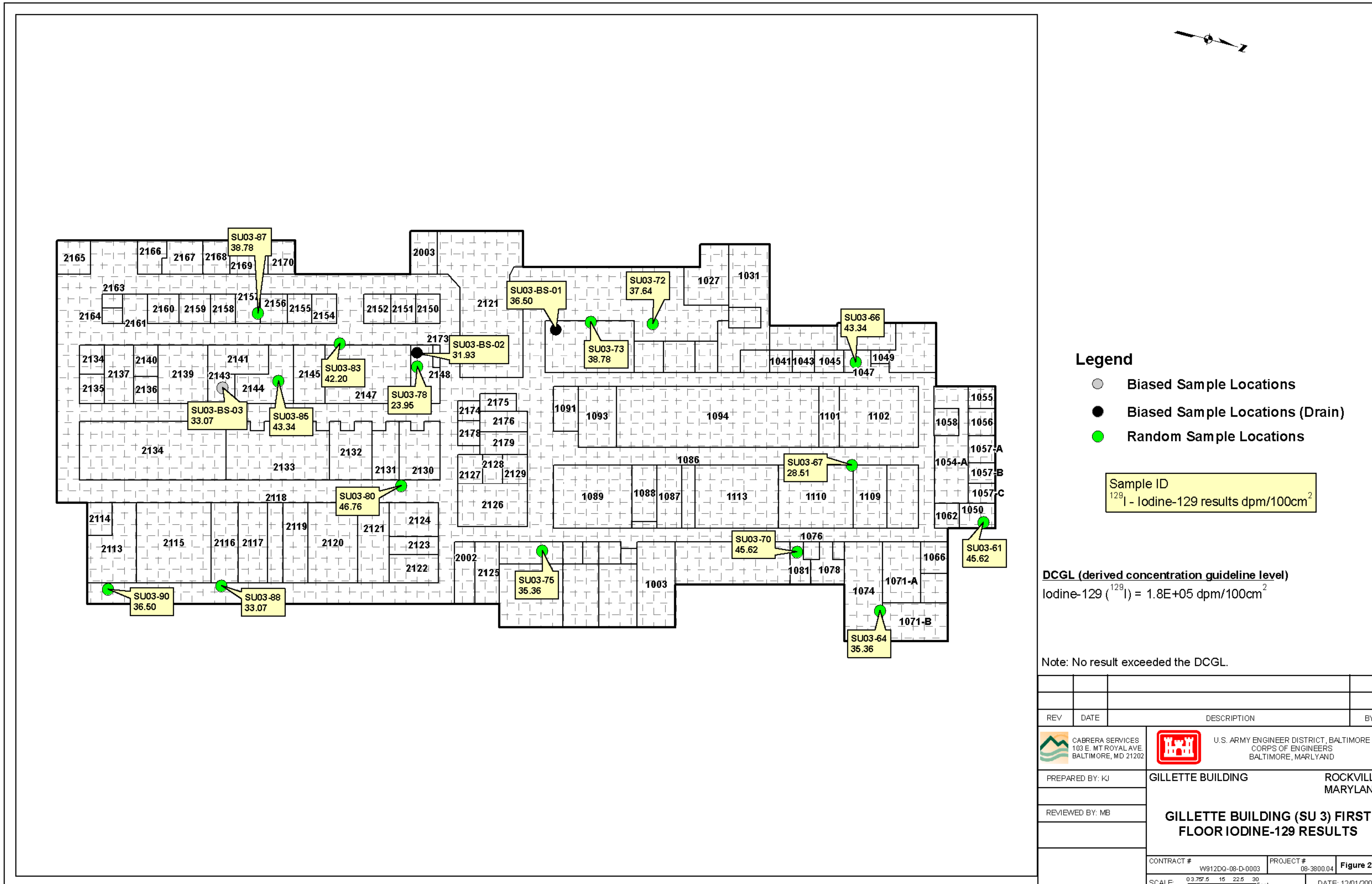
REVIEWED BY: MB

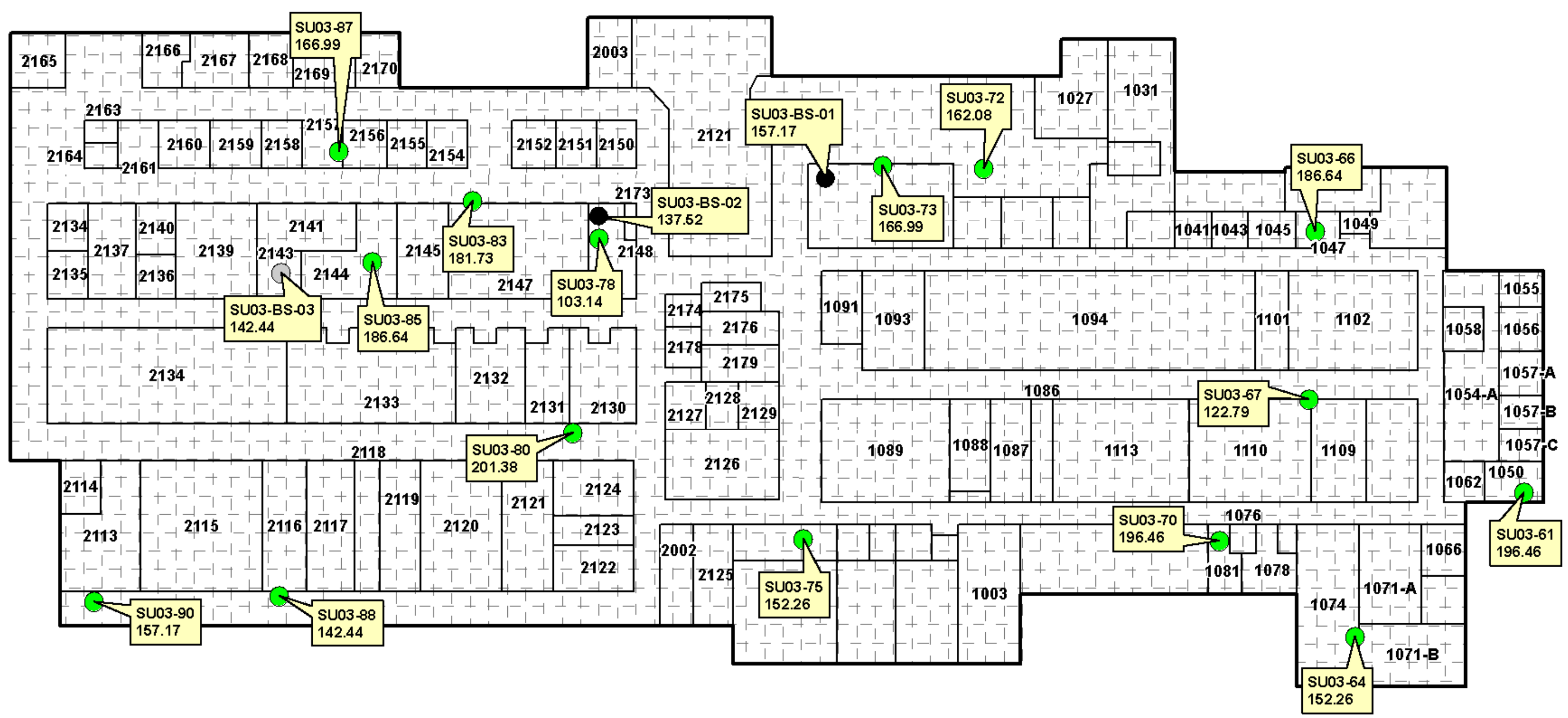
GILLETTE BUILDING — ROCKVILLE MARYLAND

GILLETTE BUILDING (SU 3) FIRST FLOOR CARBON-14 RESULTS

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 23b

SCALE: 0 3.75 7.5 15 22.5 30 Feet | DATE: 12/01/2009


SU03-87
38.78
SU03-BS-01
36.50
SU03-72
37.64
SU03-66
43.34
SU03-73
38.78
SU03-BS-02
31.93
SU03-83
42.20
SU03-78
23.95
SU03-BS-03
33.07
SU03-85
43.34
SU03-67
28.51
SU03-80
46.76
SU03-70
45.62
SU03-61
45.62
SU03-75
35.36
SU03-90
36.50
SU03-88
33.07
SU03-64
35.36
Legend
Biased Sample Locations
Biased Sample Locations (Drain)
Random Sample Locations
Sample ID
129I - Iodine-129 results dpm/100cm2
DCGL (derived concentration guideline level)
Iodine-129 (129I) = 1.8E+05 dpm/100cm2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND
PREPARED BY: KJ
REVIEWED BY: MB
GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3) FIRST
FLOOR IODINE-129 RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3800.04
Figure 23c
SCALE:
DATE: 12/01/2009



Legend

- Biased Sample Locations
- Biased Sample Locations (Drain)
- Random Sample Locations

Sample ID
^{63}Ni - Nickel-63 results dpm/100cm^2

DCGL (derived concentration guideline level)
Nickle-63 (^{63}Ni) = 3.5E+03 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND

PREPARED BY: KJ

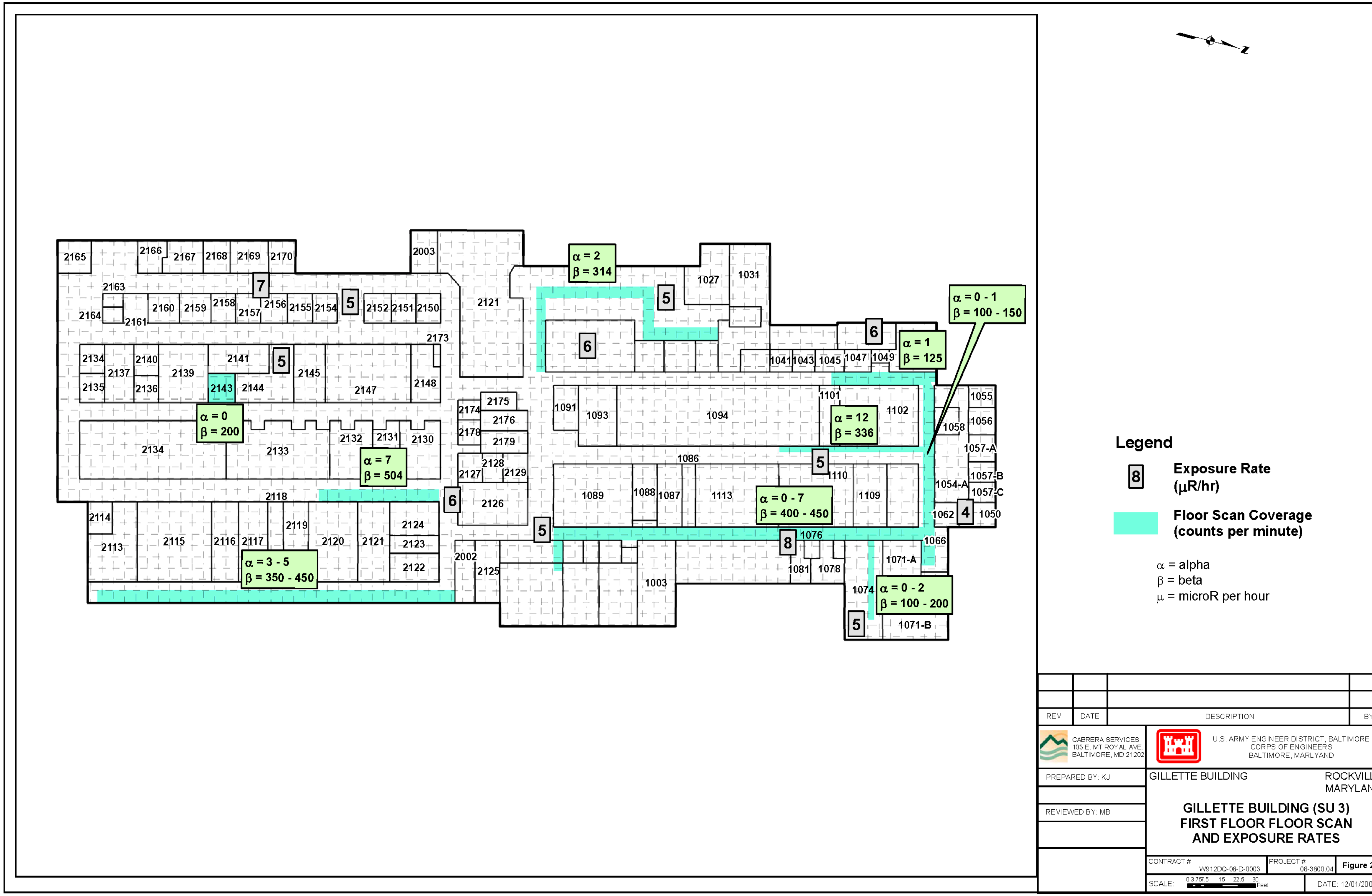
REVIEWED BY: MB

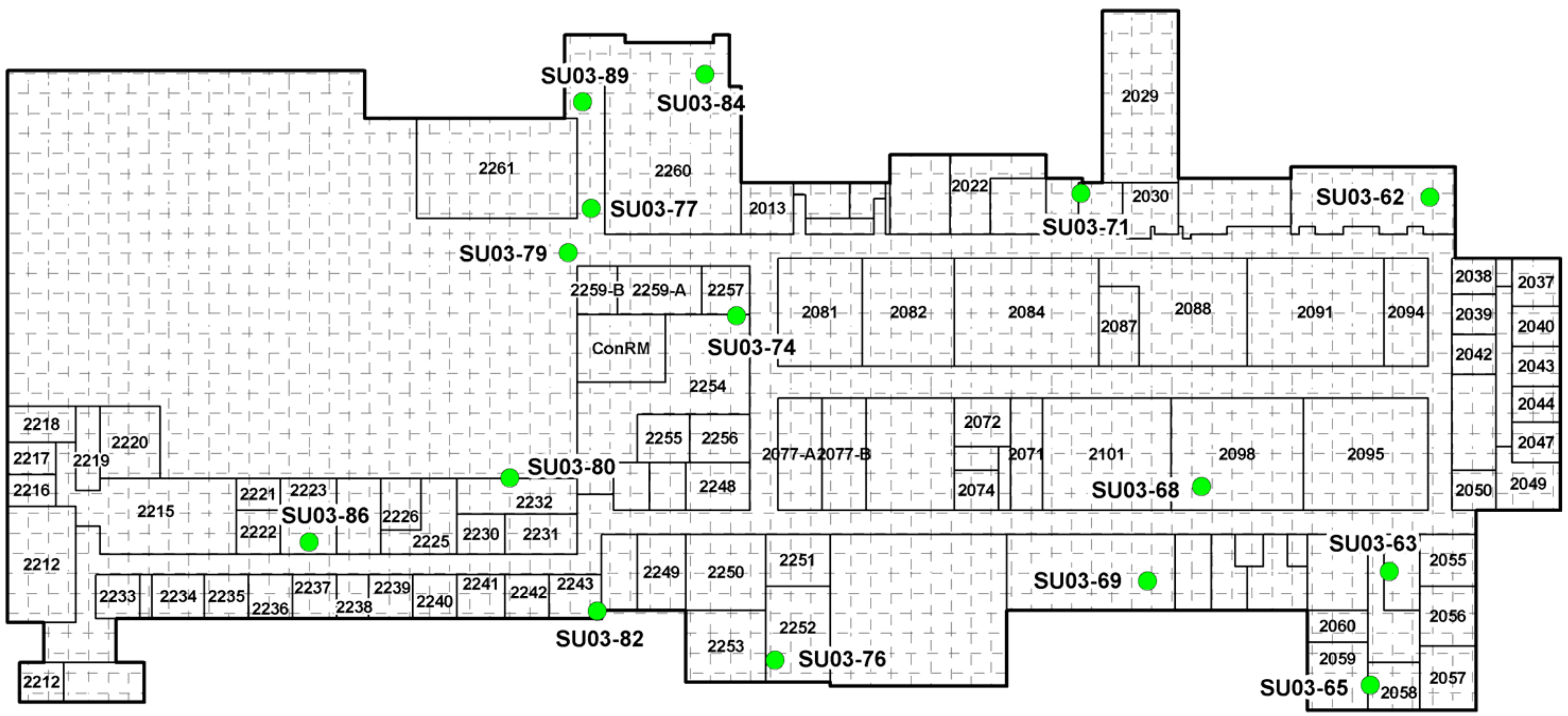
GILLETTE BUILDING — ROCKVILLE MARYLAND

GILLETTE BUILDING (SU 3) FIRST FLOOR NICKEL-63 RESULTS

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 23d

SCALE: 0 3.75 7.5 15 22.5 30 Feet | DATE: 12/01/2009


α = 2
β = 314
α = 0 - 1
β = 100 - 150
α = 1
β = 125
α = 0
β = 200
α = 12
β = 336
α = 7
β = 504
α = 0 - 7
β = 400 - 450
α = 3 - 5
β = 350 - 450
α = 0 - 2
β = 100 - 200
Legend
Exposure Rate
(μR/hr)
Floor Scan Coverage
(counts per minute)
α = alpha
β = beta
μ = microR per hour
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND
PREPARED BY: KJ
REVIEWED BY: MB
GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3)
FIRST FLOOR FLOOR SCAN
AND EXPOSURE RATES
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3600.04
Figure 24
SCALE:
Feet
DATE: 12/01/2009



ID	X Coordinate	Y Coordinate
SU03-62	1262213.0264	518970.9123
SU03-63	1262306.1210	518984.8984
SU03-65	1262334.7980	518987.4463
SU03-68	1262297.4220	518934.2028
SU03-69	1262323.6329	518927.1748
SU03-71	1262234.0985	518886.5240
SU03-74	1262285.5514	518811.2452
SU03-76	1262366.4191	518842.4281
SU03-77	1262268.7862	518769.4224
SU03-79	1262280.8966	518766.7402
SU03-81	1262339.0551	518766.9316
SU03-82	1262365.7068	518796.4698
SU03-84	1262229.0961	518788.2981
SU03-86	1262367.3532	518722.5867
SU03-89	1262243.5072	518760.5916

Legend

● Random Sample Locations

Note: Due to lack of accessibility, points SU03-79, SU03-80 and SU03-84 were moved in the field - the locations shown on this figure accurately represent the location of the sample/measurement as taken in the field

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

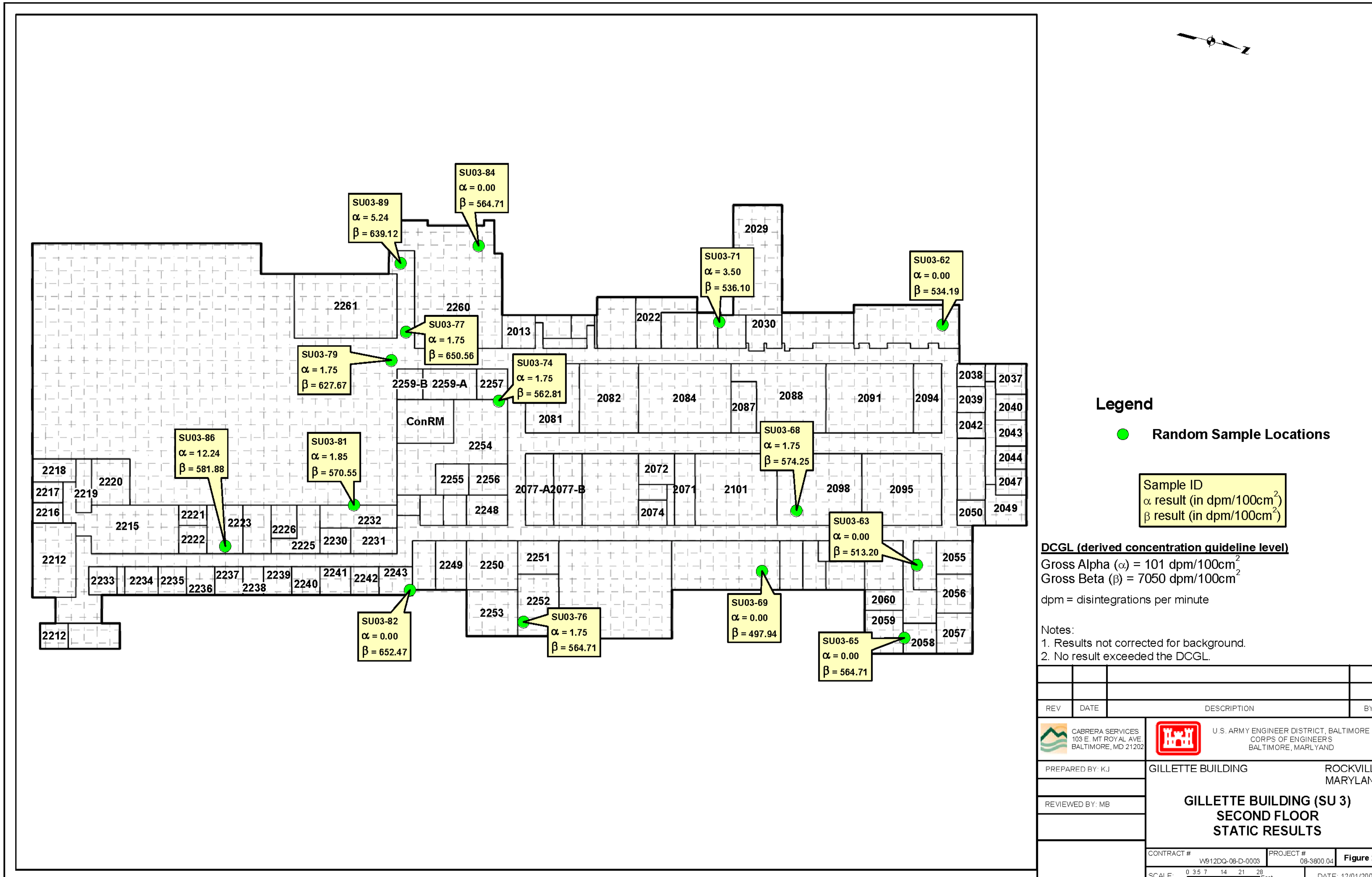
REVIEWED BY: MB

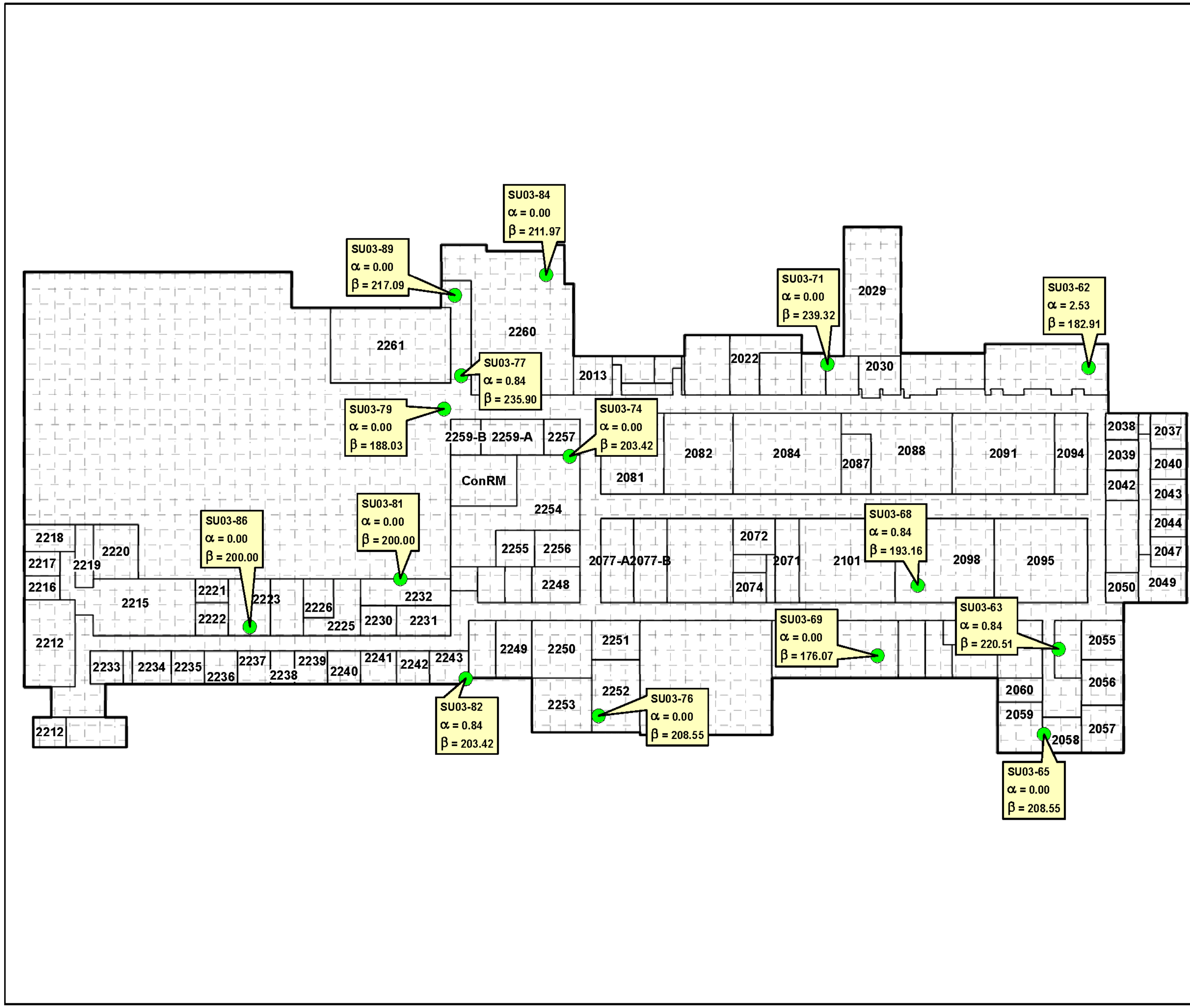
GILLETTE BUILDING — ROCKVILLE MARYLAND

GILLETTE BUILDING (SU 3)
SECOND FLOOR
SAMPLE LOCATIONS

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 25

SCALE: 0 3.5 7 14 21 28 Feet | DATE: 12/01/2009


SU03-84
α = 0.00
β = 564.71
SU03-89
α = 5.24
β = 639.12
SU03-71
α = 3.50
β = 536.10
SU03-62
α = 0.00
β = 534.19
SU03-77
α = 1.75
β = 650.56
SU03-79
α = 1.75
β = 627.67
SU03-74
α = 1.75
β = 562.81
SU03-68
α = 1.75
β = 574.25
SU03-86
α = 12.24
β = 581.88
SU03-81
α = 1.85
β = 570.55
SU03-63
α = 0.00
β = 513.20
SU03-82
α = 0.00
β = 652.47
SU03-76
α = 1.75
β = 564.71
SU03-69
α = 0.00
β = 497.94
SU03-65
α = 0.00
β = 564.71
2261
2260
2013
2022
2029
2030
2259-B
2259-A
2257
ConRM
2254
2081
2082
2084
2087
2088
2091
2094
2038
2037
2039
2040
2042
2043
2044
2047
2049
2050
2218
2217
2219
2220
2216
2215
2221
2222
2223
2226
2225
2230
2231
2232
2255
2256
2248
2077-A
2077-B
2072
2074
2071
2101
2098
2095
2212
2233
2234
2235
2236
2237
2238
2239
2240
2241
2242
2243
2249
2250
2251
2252
2253
2055
2056
2057
2058
2059
2060
Legend
Random Sample Locations
Sample ID
α result (in dpm/100cm²)
β result (in dpm/100cm²)
DCGL (derived concentration guideline level)
Gross Alpha (α) = 101 dpm/100cm²
Gross Beta (β) = 7050 dpm/100cm²
dpm = disintegrations per minute
Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3)
SECOND FLOOR
STATIC RESULTS
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3600.04
Figure 26
SCALE:
Feet
DATE: 12/01/2009



Legend

● Random Sample Locations

Sample ID
α result (in dpm/100cm^2)
β result (in dpm/100cm^2)

DCGL (derived concentration guideline level)
Gross Alpha (α) = 10.1 dpm/100cm^2
Gross Beta (β) = 705.0 dpm/100cm^2

dpm = disintegrations per minute

Notes:
1. Results not corrected for background.
2. No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARLYAND

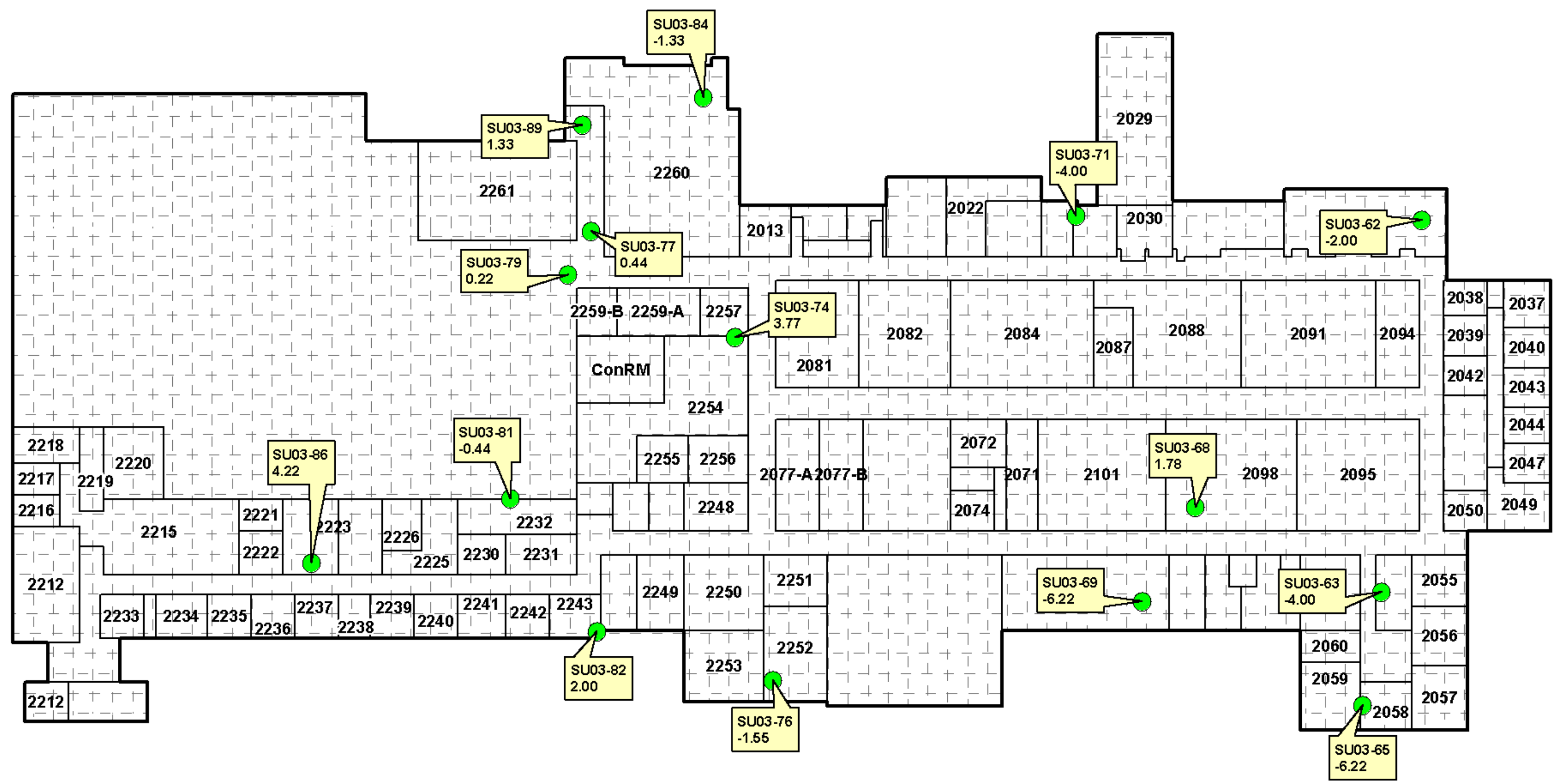
PREPARED BY: KJ
REVIEWED BY: MB

GILLETTE BUILDING — ROCKVILLE MARYLAND

**GILLETTE BUILDING (SU 3)
SECOND FLOOR
REMOVABLE RESULTS**

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 27**

SCALE: 0 3.5 7 14 21 28 Feet | DATE: 12/01/2009



Legend

● Random Sample Locations

Sample ID
^3H - Tritium results dpm/100cm^2

DCGL (derived concentration guideline level)

Tritium (^3H) = 1.2E+07 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

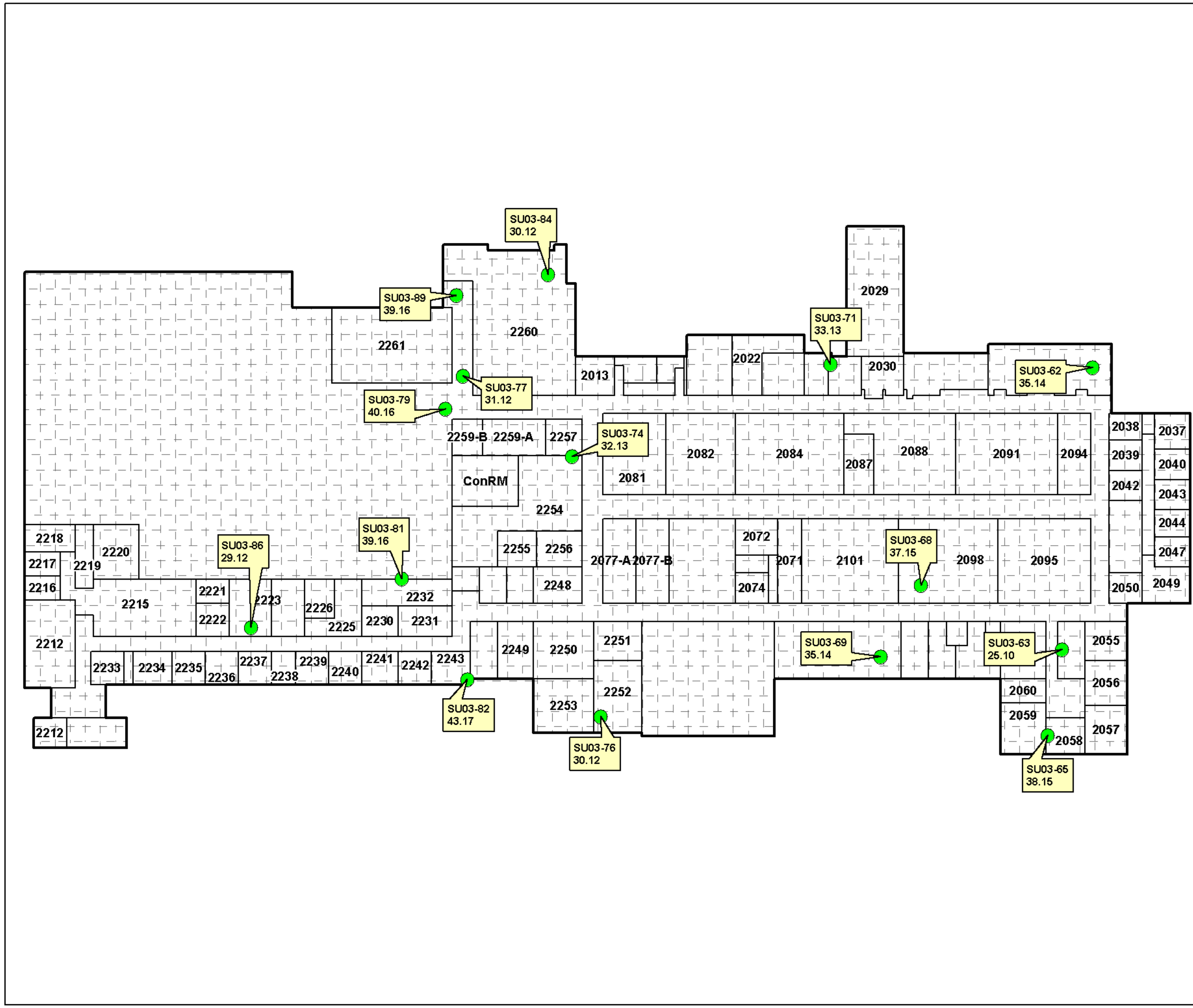
REVIEWED BY: MB

GILLETTE BUILDING — ROCKVILLE MARYLAND

**GILLETTE BUILDING (SU 3)
SECOND FLOOR
TRITIUM RESULTS**

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 28a

SCALE: 0 3.5 7 14 21 28 Feet | DATE: 12/01/2009



Legend

Random Sample Locations

Sample ID
^{14}C - Carbon-14 results dpm/100cm^2

DCGL (derived concentration guideline level)

Carbon-14 (^{14}C) = 3.5E+05 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

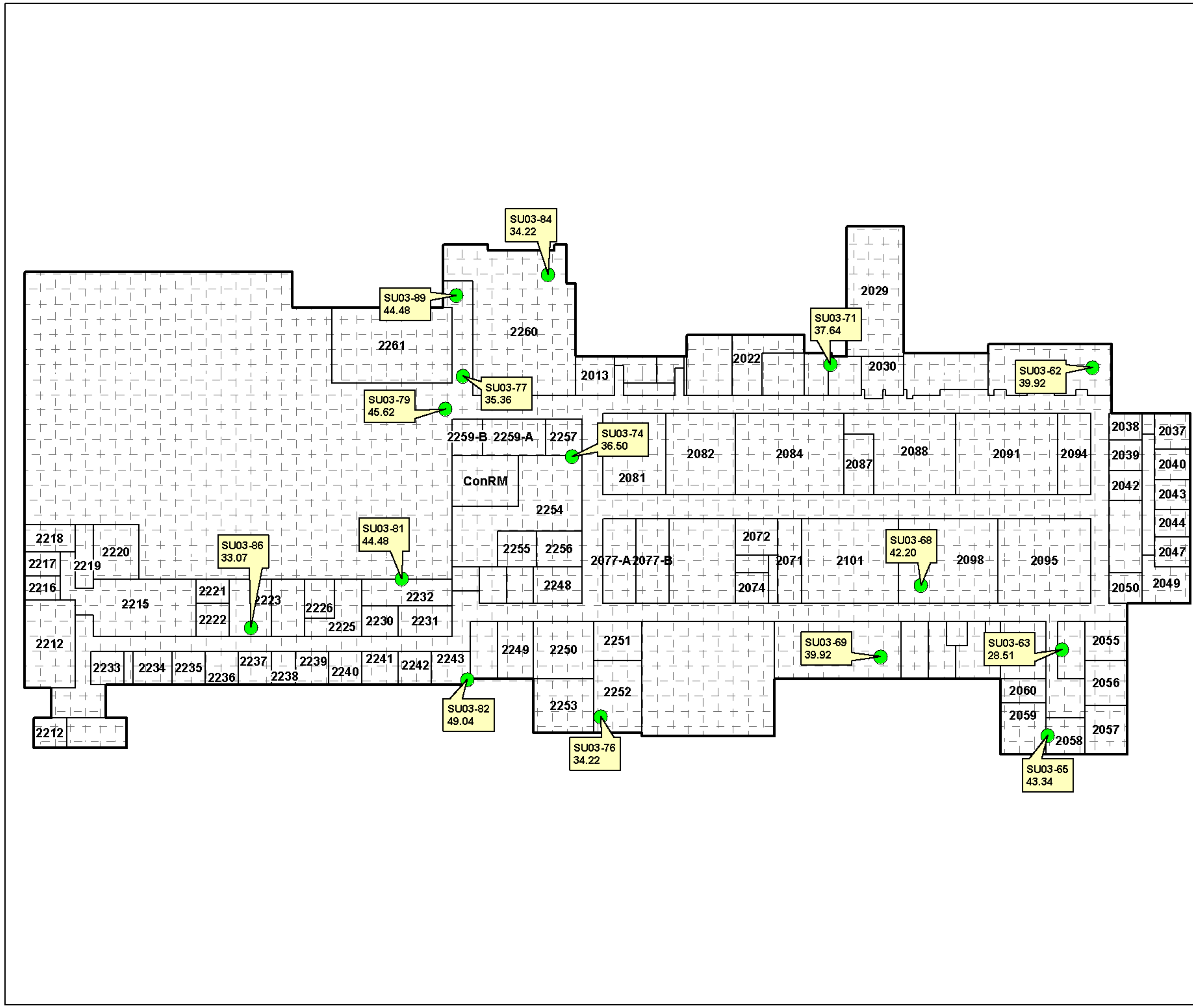
REVIEWED BY: MB

GILLETTE BUILDING — ROCKVILLE MARYLAND

**GILLETTE BUILDING (SU 3)
SECOND FLOOR
CARBON-14 RESULTS**

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | **Figure 28b**

SCALE: 0 3.5 7 14 21 28 Feet | DATE: 12/01/2009



Legend

Random Sample Locations

Sample ID
^{129}I - Iodine-129 results dpm/100cm^2

DCGL (derived concentration guideline level)
Iodine-129 (^{129}I) = 1.8E+05 dpm/100cm^2

Note: No result exceeded the DCGL.

REV	DATE	DESCRIPTION	BY

CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202

U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND

PREPARED BY: KJ

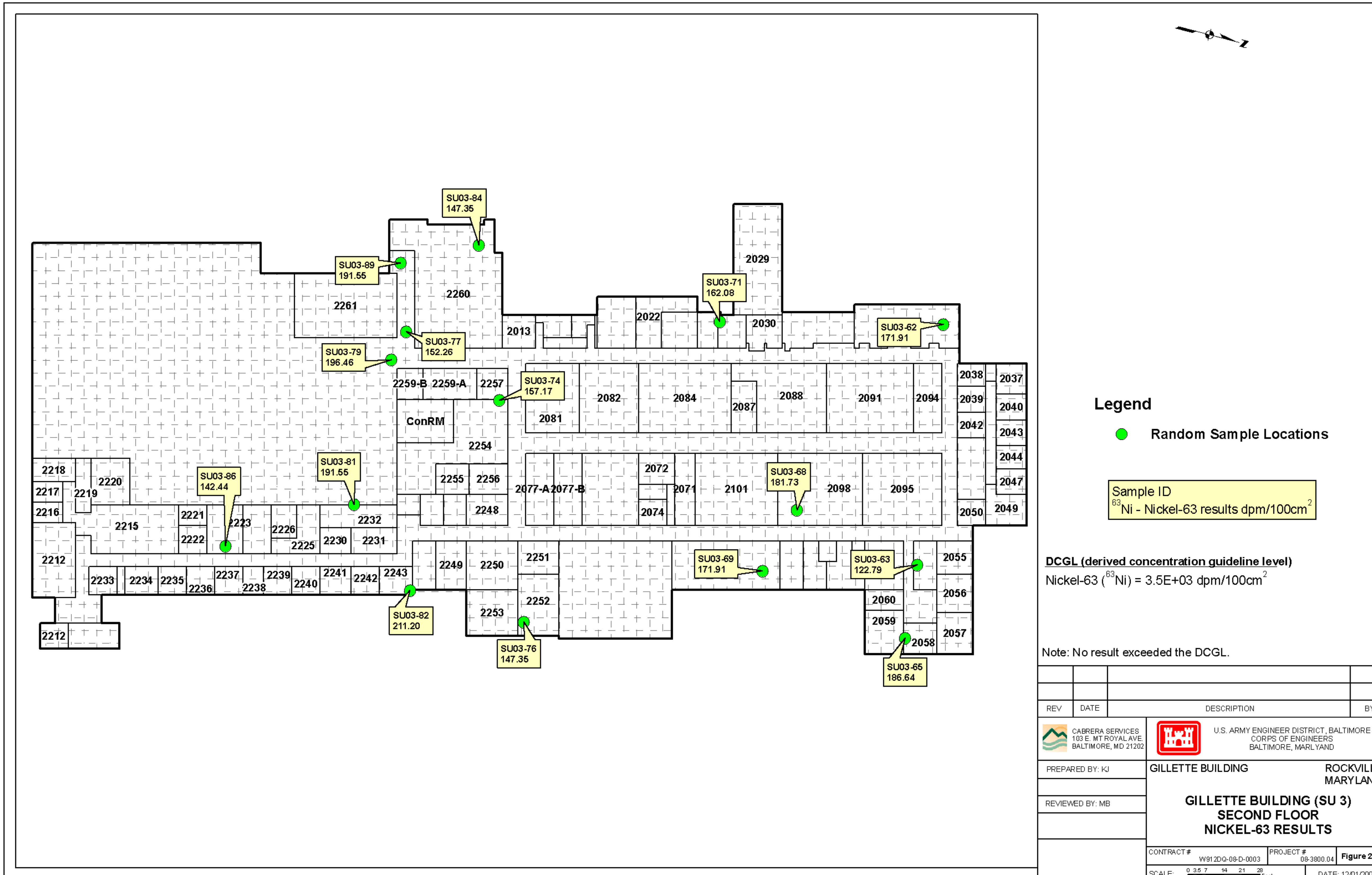
REVIEWED BY: MB

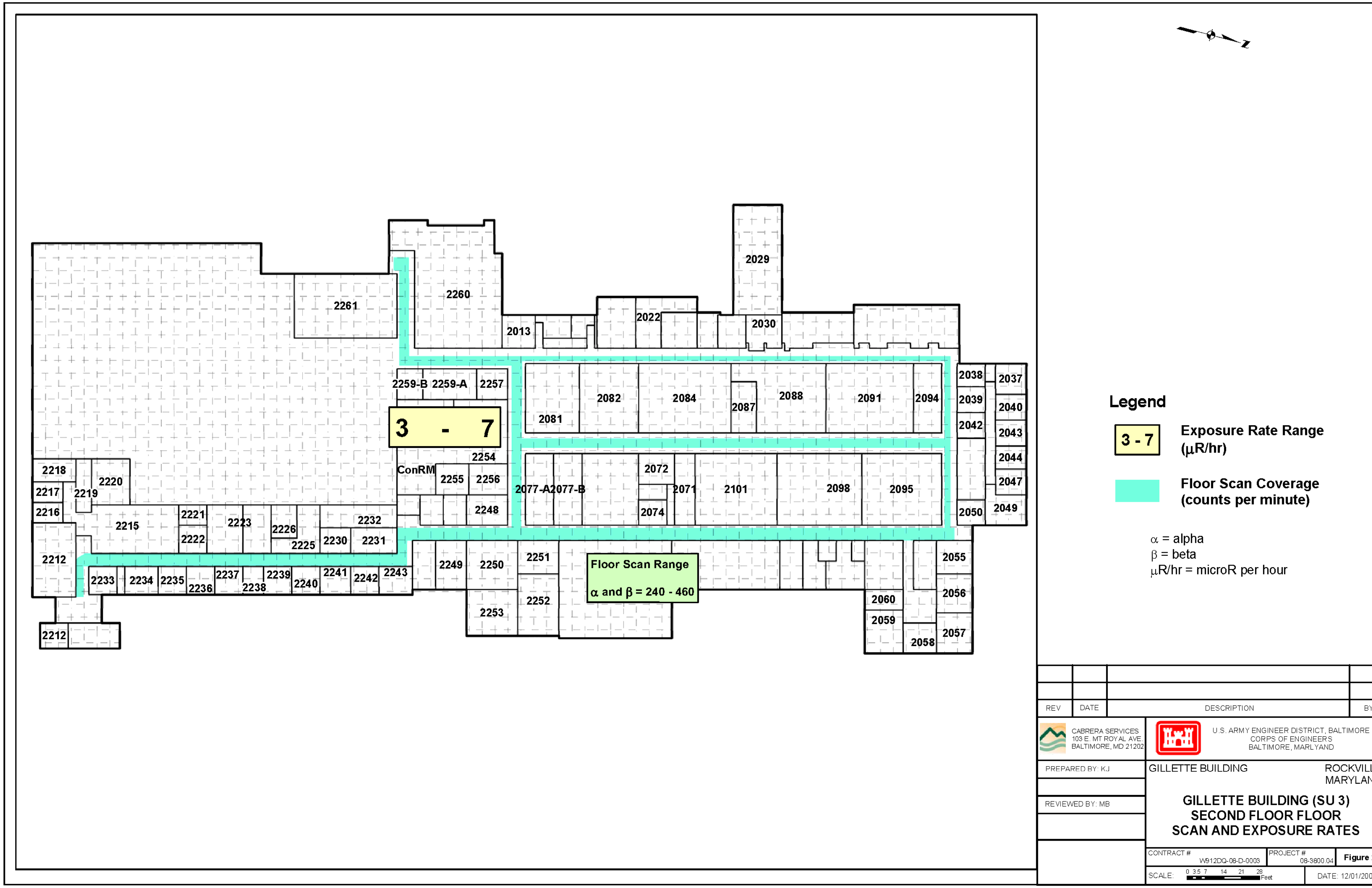
GILLETTE BUILDING — ROCKVILLE MARYLAND

**GILLETTE BUILDING (SU 3)
SECOND FLOOR
IODINE-129 RESULTS**

CONTRACT # W912DQ-08-D-0003 | PROJECT # 08-3800.04 | Figure 28c

SCALE: 0 3.5 7 14 21 28 Feet | DATE: 12/01/2009


SU03-84
147.35
SU03-89
191.55
SU03-77
152.26
SU03-79
196.46
SU03-74
157.17
SU03-71
162.08
SU03-62
171.91
SU03-81
191.55
SU03-86
142.44
SU03-68
181.73
SU03-69
171.91
SU03-63
122.79
SU03-82
211.20
SU03-76
147.35
SU03-65
186.64
Legend
Random Sample Locations
Sample ID
^{63}Ni - Nickel-63 results dpm/100cm^2
DCGL (derived concentration guideline level)
Nickel-63 (^{63}Ni) = 3.5E+03 dpm/100cm^2
Note: No result exceeded the DCGL.
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
103 E. MT ROYAL AVE.
BALTIMORE, MD 21202
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
BALTIMORE, MARYLAND
PREPARED BY: KJ
REVIEWED BY: MB
GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3)
SECOND FLOOR
NICKEL-63 RESULTS
CONTRACT # W912DQ-08-D-0003
PROJECT # 08-3800.04
Figure 28d
SCALE:
DATE: 12/01/2009


2261
2260
2029
2013
2022
2030
2259-B
2259-A
2257
3 - 7
2254
ConRM
2255
2256
2248
2081
2082
2084
2087
2088
2091
2094
2038
2037
2039
2040
2042
2043
2044
2047
2050
2049
2072
2077-A
2077-B
2071
2101
2098
2095
2074
2218
2217
2219
2220
2216
2215
2221
2222
2223
2226
2225
2232
2230
2231
2212
2233
2234
2235
2236
2237
2238
2239
2240
2241
2242
2243
2249
2250
2251
2252
2253
Floor Scan Range
α and β = 240 - 460
2055
2056
2060
2059
2058
2057
2212
Legend
3 - 7
Exposure Rate Range
(μR/hr)
Floor Scan Coverage
(counts per minute)
α = alpha
β = beta
μR/hr = microR per hour
REV
DATE
DESCRIPTION
BY
CABRERA SERVICES
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GILLETTE BUILDING
ROCKVILLE
MARYLAND
GILLETTE BUILDING (SU 3)
SECOND FLOOR FLOOR
SCAN AND EXPOSURE RATES
CONTRACT #
W912DQ-08-D-0003
PROJECT #
08-3600.04
Figure 29
SCALE:
Feet
DATE: 12/01/2009

APPENDICES

APPENDIX A

Survey Packages

APPENDIX B

Quality Assurance / Quality Control

APPENDIX C

Laboratory Sample Analysis Summary

(and Electronic Data Deliverables)

APPENDIX D

Field Photographs

Figure D-1: Building 511 (Animal Cage) – Floor Scan
Figure D-2: Building 511 (Animal Cage)
Figure D-3: Building 511 (Drain)
Figure D-4: Building 511 (PPE)
Figure D-5: Building 512
Figure D-6: Building 512
Figure D-7: Building 512
Figure D-8: Building 512
Figure D-9: Building 512
Figure D-10: Building 512
Figure D-11: Building 512
Figure D-12: Building 512
Figure D-13: Building 512
Figure D-14: Building 512
Figure D-15: Building 512

APPENDIX E

Final Site Characterization Work Plan, Vol. I: Sampling and Analysis Plan and

Vol. II: Site Health and Safety Plan

(Provided in attached electronic format)

APPENDIX F

Review Packages of Previous Building Close-out Survey Documentation

(Provided in attached electronic format)

APPENDIX G

Final Historical Site Assessment Report

(Provided in attached electronic format)