TENORM REUSE WORK PLAN

and Variance Request
for

310 Ship Canal
NYSDEC SITE No. C915322

310 Ship Canal Parkway, Buffalo, NY, 14218

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Executive Summary

This TENORM Reuse Work Plan (TRWP) was prepared on behalf of Laborers Way 1, LLC ("Laborers Way") as part of required documentation for requesting a variance from the authorized disposal methods described in 6 NYCRR Part 380-4.1 for excavation spoils containing Technically Enhanced Naturally Occurring Radioactive Materials (TENORM) with radium-226 concentration less than 15 pCi/g in accordance with New York State Department of Environmental Conservation (NYSDEC) requirements. The stockpiled TENORM spoils will be reused as fill in designated portions of the NYSDEC Brownfield Cleanup Program (BCP) Site No. C915322, located at 310 Ship Canal Parkway, Buffalo, New York (Site). The variance request is being made to alleviate the unanticipated economic burden and financial hardship to Site developers imposed by the authorized disposal methods described in 6 NYCRR Part 380-4.1 and requiring off-site disposal of the TENORM excavation spoils. Estimated off-site disposal costs are summarized in Attachment G.

The Site is currently vacant land that is undergoing redevelopment for commercial or industrial use. Previous site characterization efforts identified historic fill (primarily iron/steel slag with various mixtures of slag, sands, silts, clay) with observed thicknesses ranging up to 15 to 16 feet below grade. Portions of this fill material contains TENORM. Laboratory analytical results indicated that the naturally occurring radioactive materials (NORM) in the slag had been technically enhanced resulting in concentrations of radium-226 approximately seven (7) times (6.7 pCi/g) the background concentration of 0.63 pCi/g on average, while thorium-232 progeny (radium-228) were at or near typical background levels of 0.8 pCi/g ranging from 0.783 to 1.635 pCi/g. Analytical results for stockpiled materials are provided in Attachment D.

During the ongoing site redevelopment activities, excavated materials were subject to the requirements of a NYSDEC approved TENORM Management Plan (TMP). The TMP and Preliminary Site Development Plan (PSDP) are provided in Attachment C. The TMP identifies provisions for proper screening, storage, handling, and on-site management of excavated materials. As required by the TMP, materials identified as TENROM were segregated and stockpiled on-site for off-site disposal or as fill materials pending approval of a variance from the authorized disposal methods described in 6 NYCRR 380-4.1 by NYSDEC. This TRWP provides the requirements under which the stockpiled TENORM may be properly managed on-site under an approved variance request. For stockpiled materials to qualify for reuse under an approved variance, Ra-226 concentrations of the materials must be below 15 pCi/g on average (see Table 4), and the on-site reuse must be shown to meet applicable dose limits.

Following approval of the variance request by NYSDEC, the stockpiled materials that have met the reuse criteria will be reused as fill in designated fill location(s). The material will be placed in six-inch, un-

compacted lifts to a maximum thickness of approximately three (3) feet. Materials not meeting reuse criteria as identified through sampling or scans, will be removed, and staged for out-of- state disposal or resampling. During reuse, additional field scans will be performed to ensure that the radiological concentrations are within the anticipated range. Intermediate sampling and scans performed during stockpile accumulation have provided assurance that the materials are sufficiently characterized by the analytical results to conclude that the concentrations reported are representative. Scan data of stockpiled materials and background locations, used to establish the range of representative count rates and the investigation level, are provided in Attachment E.

To demonstrate that the reuse of stockpiled materials in the designated reuse location(s) will meet dose criteria and have no significant impacts on public or worker health, an assessment of potential radiation exposure to near-term on-site workers, future commercial and residential occupants, and inadvertent intruders was performed using the RESidual RADioactive (RESRAD) Material Model developed at Argonne National Laboratory. The dose assessment scenarios, model parameters, and results are described in Section 1.5.1 and RESRAD results are provided in Attachment F. The estimated exposures calculated were compared to the public dose limit prescribed by New York State and Federal regulatory agencies of 100 mrem/year for scenarios with no controls in place and an Applicable or Relevant and Appropriate Requirement (ARAR) identified in Section 1.5.2 as United States Environmental Protection Agency (EPA) 10 CFR 40 Appendix A, I, Criterion 6(6) equivalent to 12 mrem/year with institutional and engineering controls in place i.e., environmental easement (EE), soil cover, site deed restrictions etc. RESRAD results for site use scenarios with controls in-place and the all-controls-fail/residential farmer scenario were below required and applicable dose standards as shown in Table 3 below. RESRAD modeling reports are provided in Attachment F.

The reuse of the stockpiled TENORM spoils accumulated from excavations required for site development will be performed in strict compliance with this document, the NYSDEC BCP requirements for Site No. C915322, and all other provisions outlined by NYSDEC in approving this variance request and including those described in the New York State Environmental Conservation Laws and 6 NYCRR Part 380. In addition, as part of the NYSDEC-approved remediation for the Site, an EE will be prepared and registered for the property.

1.0 Introduction

This work plan presents the necessary testing and relocation requirements for the reuse of excavation spoils containing Technically Enhanced Naturally Occurring Radioactive Materials (TENORM) slag with concentrations of radium-226 (Ra-226) below 15 picocuries per gram (pCi/g) in designated portions of subplot 4, located at 310 Ship Canal Parkway Buffalo, New York. This TENORM Reuse Work Plan (TRWP) has been prepared on behalf of Laborers Way 1, LLC (“Laborers Way”), the site owner, who has included Subplot 4 in

the Buffalo Lakeside Commerce Park development. The parcel (Site) is approximately 5.11 acres in size and is included in the New York State (NYS) Brownfield Cleanup Program ("BCP") and designated Site No. C915322. Preparation of a TRWP is a requirement outlined by the New York State Department of Environmental Conservation (NYSDEC) for requesting a variance from the authorized disposal methods described in 6 NYCRR 380-4.1.

As required by NYSDEC, C&S has prepared and is submitting a 6 NYCRR Part 380 Variance Request (Variance Request) to NYSDEC together with this TRWP and as discussed in the Variance Request and this TRWP, there are locations at the Site that fill placement will be required to bring the Site to design grade. As a result, and to alleviate significant financial hardship (see Appendix G) without adding any significant environmental or public health and safety risk, Laborers Way would like to use low-level TENORM material stockpile at the Site with concentrations less than 15 picocuries per gram (pCi/g) Ra-226 as fill.

The reuse of the stockpiled TENORM spoils accumulated from excavations required for site development will be performed in strict compliance with the NYSDEC Brownfield Cleanup Program (BCP) requirements for Site No. C915322 and all other provisions outlined by NYSDEC in approving this variance request and including those described in the New York State Environmental Conservation Laws and 6 NYCRR Part 380. In addition, as part of the NYSDEC-approved remediation for the Site, an environmental easement (EE) will be prepared and registered for the property. The easement will include requirements for preparation of a Site Management Plan (SMP) detailing the use of periodic monitoring and oversight for any invasive work performed at the property. The SMP will include provisions for the screening, handling, characterization, and final interment of all soils, including potential TENORM. The SMP will be reviewed and approved by the NYSDEC prior to the issuance of the Certificate of Completion.

1.1 Site Description

The Site address is 310 Ship Canal Parkway Buffalo, NY and includes 5.11 acres of vacant land. The parcel (Parcel #4) is part of a larger 10.84-acre parcel identified as SBL # 132.15-2-1. The Site is bounded to the west by a vacant lot (70 Laborers Way), to the north by a wetland area, the Ship Canal Parkway to the east and beyond which Sonwil Distribution is located, and to the south by the vacant BCP parcel identified as 24 Laborers Way (Site No. C915385). The property is located within a commercial area being utilized and developed for industrial and commercial purposes. The Site location is shown on Figure 1.

The Site is currently vacant land, which is in the process of being redeveloped for commercial use and has been stripped of vegetation, received limited excavation for utility access and building footers, and has been

partially filled and graded using with clean stone. The Site redevelopment includes an approximately 136,000-square foot two store grow house manufacturing and processing building, one 7,000-square foot office building, parking areas, and landscaped grass areas. Drainage features on Site include a drainage ditch along the western property limit used to divert Site stormwater in a southerly direction towards the Ship Canal and Lake Erie.

1.2 Site Use History

The Site is currently located within the Buffalo Lakeside Commerce Park (BLCP) Development and includes approximately 5.11 acres of vacant land which is underdeveloped property located in the City of Buffalo. BLCP occupies over 200 acres, which was originally a lake margin swamp. In the early 1900s, the BLCP area was purchased by Buffalo Union Steel Corporation for the purpose of manufacturing pig iron, with construction blast furnaces completed by 1915. By 1929, the properties were purchased by National Steel Company, and the new corporate entity became known as Hanna Furnace Corporation.

The Site area was historically used for slag dumping and for rail line coordination. Slag and other industrial fill materials used as rail ballasts were noted to be present throughout the properties. Additionally, historical reports also noted possible dumping or landfill activities from at least the 1960s through 2005.

A byproduct of the production of iron and steel is slag. Blast furnace slag (i.e., iron slag) is generally comprised of the non-metallic components separated from mined iron ore during smelting in a blast furnace. Steel furnace slag is the product that is developed simultaneously with steel, where lime and oxygen are added to remove impurities. It consists of calcium silicates and combined oxides of iron, calcium and other metals. The slag material present in the subsurface at 310 Ship Canal likely originated from both processes and is the source of the low activity TENORM. Radium (chemical symbol Ra) is a naturally-occurring radioactive metal and occurs naturally as the isotopes of Radium-224, Radium-226, and Radium-228 and is present in low levels in virtually all rock, soil, water, plants, and animals. The primary isotope of concern in TENORM is Radium-226.

1.3 Site Geology and Hydrology

The following geologic information is based on observations made during the 2018 Site Characterization Report completed by GES and the 2022 investigation activities completed by C&S and previously reported in the Remedial Investigation / Alternatives Analysis / Remedial Work Plan (RI/AA/RAWP) prepared for the Site by C&S Engineers in July 2022 (Reference 1). The NYSDEC approved the RI/AA/RAWP on December 12, 2022.

The Site is generally flat, with the surface covered by slag and soil with limited vegetation. Site topography is crowned across the middle and northern portions and generally slopes downward to the west and southwest, towards a drainage ditch along the western property limit. The drainage ditch generally flows southerly with discharge to the nearby Ship Canal and ultimately Lake Erie. The Site contains historic fill (primarily iron/steel slag with various mixtures of slag, sands, silts, clay) with observed thicknesses ranging up to 15 to 16 feet below grade. Native soil encountered beneath the fill consisted of black peat material atop brown and gray silts and clays. Bedrock was not encountered at the Site; however, previous geotechnical reporting indicates the bedrock present at the site is part of the Levanna Shale Member of the Middle Devonian Age Skaneateles Formation.

Measurements collected from six monitoring wells on the Site in the July 2022 investigation found groundwater on the Site from 9 to approximately 13.5 feet below the top of riser (section 4.1.2 ref.1) indicating that groundwater flow is generally to the west towards Lake Erie. However, on the northern half of the Site, groundwater appears to flow to the northwest towards the nearby wetland; while on the southern half of the Site, groundwater flows south to southwest towards the Ship Canal.

In association with the NYSDEC's approval of the RI/AA/RAWP on December 12, 2022, the Department issued a Decision Document for the Site. The decision document prescribes the following remedy for the Site:

1. Remedial Design: A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31.

2. Cover system: A site cover will be required to allow for commercial use of the site. The cover will consist either of the structures such as buildings, pavement, sidewalks comprising the site development or a soil cover in areas where the upper one foot of exposed surface soil will exceed the applicable soil cleanup objectives (SCOs). Where the soil cover is required it will be a minimum of one foot of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for commercial use. The soil cover will be placed over a demarcation layer, with the upper six inches of the soil of sufficient quality to maintain a vegetation layer. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6 NYCRR Part 375- 6.7(d).

3. Vapor Mitigation: The site will install an active sub-slab depressurization system (SSDS) in any future buildings onsite to adequately mitigate the migration of radon vapors from the slag which will

remain onsite.

4. Environmental Easement: The remedy will achieve a Track 4 commercial cleanup at a minimum and will include an environmental easement and site management plan as described below.
    - Institutional Control: Imposition of an institutional control in the form of an environmental easement for the controlled property which will:
        - require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
        - allow the use and development of the controlled property for, commercial or industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
        - restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or County DOH; and
        - require compliance with the Department approved Site Management Plan.

5. Site Management Plan (SMP): A Site Management Plan is required, which includes the following:
    - An Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
        - Institutional Controls: The environmental easement discussed in remedial element 4 above.
        - Engineering Controls: the site cover discussed in remedial element 2 above, and the SSDS discussed in remedial element 3 above.

The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

The December 12, 2022 decision document contains additional details on the remedy.

1.4 Site Radiological Characterization

In response to identification of underlying slag materials that containing TENORM, a gamma radiation walk-over survey of the parcel was performed by Advanced Construction Services, Inc. (ACS) during May 2022. After evaluation of the gamma walkover data, Austin Master Services (AMS) concluded that there is a

relatively consistent layer of near surface (0-18 inches) radiologically impacted material over much of the site. However, test pits and borings installed under direction of C&S during July 2022, confirmed that slag materials extend to much deeper depths across the site. Appendix A contains the AMS' letter report of findings from the gamma walkover survey data. Following the gamma walk-over survey, four slag samples were collected from test pits excavated at biased locations reflecting the range of gamma count rates observed during the walkover survey. Laboratory analytical results indicated that the naturally occurring radioactive materials (NORM) in the slag had been technically enhanced resulting in concentrations of radium-226 ranging from 13.376 to 17.221 pCi/g while thorium-232 progeny (radium-228) were at or near typical background levels ranging from 0.783 to 1.635 pCi/g. The AMS investigation report indicated that the samples were collected from depths varying from 0–2 ft bgs at locations with significantly different scan readings and slag volumes ranging from 20% and 50% with scan results not correlated or representative of slag content. Because the sample descriptions and associated scan data were significantly different despite the slag content, these initial sample results were determined to be unreliable and additional sampling of excavated slag was conducted at excavation locations during Site development. Appendix B contains the initial Pace Analytical laboratory sample results and the ACS sampling and data assessment report.

To establish background levels of radioactivity for near-site and on-site soils, three (3) samples were collected from the upper 1.5 feet of surface soils in three locations: Two samples were collected from off-site adjacent areas: one approximately 50 feet east of the site and a second approximately 1000 feet southeast. Both locations had similar ground cover and soil as was identified on-site. An on-site background location in an area outside site activity impacts was identified in the roadway median between the site access road and Ship Canal Parkway (Figure 2). Analytical results for the background soil are shown in Table 1 below and in Appendix D. All sample results will be prepared and submitted to the EQuIS database in accordance with the RI/AA/RAWP.

Table 1: 310 Ship Canal Background Sample Results (pCi/g) **

SAMPLE I.D.	310 BkgOn1- 4.11.23			310 BkgOff1- 8.24.22 S			310 BkgOff2- 4.12.23		
Radionuclide	Result	Uncert	Qual*	Result	Uncert	Qual*	Result	Uncert	Qual
Actinium-228	0.836	0.285		0.570	0.208		0.425	0.163	
Bismuth-212	0.429	0.688	U*	0.683	0.460		0.806	0.521	
Bismuth-214	0.827	0.135		0.363	0.127		0.604	0.109	
Lead-210	-1.12	2.57	U	-10.2	7.95	U	1.44	3.54	U
Lead-212	0.949	0.0929		0.492	0.0829		0.425	0.0645	
Lead-214	1.13	0.141		0.705	0.115		0.550	0.104	
Radium-226	1.13	0.141		0.705	0.115		0.550	0.104	
Potassium-40	15.8	1.25		11.7	1.15		11.4	1.05	
Radium-228	0.836	0.285		0.570	0.208		0.425	0.163	
Thallium-208	0.216	0.0501		0.109	0.0476		0.117	0.0538	
Thorium-230	1.13	0.141		0.705	0.115		0.550	0.104	
Thorium-232	0.836	0.285		0.570	0.208		0.425	0.163	
Thorium-234	1.67	1.57		0.000	2.82	U	0.228	1.37	U
Uranium-234	1.13	0.141		0.705	0.115		0.550	0.104	
Uranium-235	0.0667	0.125	U	-0.0164	0.122	U	0.0485	0.160	U
Uranium-238	1.67	1.57		0.000	2.82	U	0.228	1.37	U

* "U" laboratory qualifier indicated analyte was not detected above MDA
** Analytical results from GEL laboratories using gamma spectroscopy method DOE HASL 300, 4.5.2.3/Ga-01-R
*** Average offsite background radium-226 = 0.6275 pCi/g

At each background location, five (5) 1-minute gamma counts were collected using both a shielded and an unshielded Ludlum 44-10, 2x2 NaI detector coupled to a Ludlum 2241 ratemeter. The average count rate for shield and unshielded readings at each of the background locations were: 2633/7541 cpm for location BkgOn1; 2556/7523 cpm at location BkgOff1, 2488/7474 cpm at location BkgOff2, respectively. On-site material segregation scan rates were set at 1.5x the daily instrument background levels for shielded detector readings collected at background location C. However, scan readings above 1200 cpm were generally representative of 1.5x daily instrument background levels and were approximately equal to1.5x the average background readings from all three locations.

1.5 Site Development Approach

In general, the subsurface conditions at the Site and areas proposed for reuse of the TENORM impacted spoils is underlain with fill characterized by slag, miscellaneous fill materials, gravel and/or soil. Excavated TENORM materials brought to the surface during site redevelopment activities were subject to the requirements of the NYSDEC approved TENORM Management Plan (TMP), submitted as part of the

Preliminary Site Development Plan, dated November 7, 2022 (Appendix C). The TMP and Preliminary Site Development Plan (PSDP) were approved and added as an appendix of the December 1, 2022 RI/AA/RAWP. During redevelopment activities, various materials (topsoil, soil/fill, and slag) have been generated and managed in accordance with the RI/AA/RAWP (Ref. 1) and TMP, which identifies provisions for proper storage, handling, and on-site management of excavated materials and clean fill. The TMP was prepared in part to address the requirements for the on-site management and disposition of excavated TENORM materials including off-site disposal. This TRWP will address TENORM reuse requirements following NYSDEC approval of a variance request from the authorized disposal methods described in 6 NYCRR Part 380-4.1 for which this TRWP will support. Additionally, as a requirement of the Variance, an SMP will be prepared using the NYSDEC template to include provisions for the reuse and maintenance of TENORM impacted spoils and cover systems.

During site development, soil and fill materials generated from excavation activities were field screened (see Appendix E and Figure 3) as they were being removed in the excavator bucket using a Ludlum Model 2241-2 Ratemeter/Scaler with a Ludlum 44-10 sodium iodide scintillator (2x2 meter) to detect gamma radiation in counts per minute (cpm). For purposes of gamma-screening, a radiological activity threshold also referred to as the investigation level (IL), of one and a half (1.5) times the daily measured background was established to identify TENORM impacted materials. Materials excavated and screened at levels below the 1.5 times the daily background threshold were deemed reusable by NYSDEC as backfill at the Site and were not segregated or stockpiled. This material was placed under a cover as a requirement of the Decision Document.

Material was also segregated based upon the visual characteristics of slag since the iron and steel slag materials were identified as the primary source of TENORM identified in soils at the site. Materials excavated and identified as slag and/or based on radiological screening measurements exceeding the IL were identified as TENORM and subsequently stockpiled in the TENORM staging area located in the northeastern portion of the Site. The volume of stockpiled spoils after utility and foundation excavations were completed is approximately 1640 cubic yards (CY). This volume is stored on-site in four (4) separate stockpiles. The soil volumes in each stockpile are: 420, 490, 500, and 230 CY of segregated TENORM impacted materials. Additional materials are expected to be generated during future intrusive work at the Site. This material and subsequent TENORM spoils anticipated to be generated during on-going redevelopment activities at the site is the subject to this TRWP. The TENORM material is proposed to be placed under the cover system as a requirement of the DD.

1.5.1 Exposure Impacts from Reuse Materials as Fill

As part of the variance request for reuse of impacted materials, NYSDEC requires that a dose assessment be

performed to quantify the potential radiation dose to site use individuals that may occur due to the material reuse under likely site use scenarios. In compliance with this requirement, an exposure assessment has been performed using the RESidual RADioactive (RESRAD) Material Model developed at Argonne National Laboratory to analyze potential radiation exposures to site use individuals from the residual radiological content of the reuse materials. RESRAD uses a pathway analysis method in which the relationship between radionuclide concentrations in soil and the dose to a member of a critical population group is expressed as the sum of the products of "pathway factors." Pathways are determined by the specified exposure scenarios. RESRAD can evaluate nine (9) of the principal radiation exposure pathways used to determine potential radiation dose from on-site radiation sources. The nine exposure pathways include: External gamma; Inhalation (without radon); Plant Ingestion; Meat Ingestion; Milk Ingestion; Aquatic Foods; Drinking Water; Soil Ingestion; and Radon.

However, because plausible or likely current and future use scenarios at the Site and/or in the reuse placement area do not involve groundwater or agricultural uses, not all nine of the potential exposure pathways are applicable or relevant. At this site, plant, milk, meat, and aquatic food ingestion, and groundwater use as a drinking water or irrigation source are not plausible and were not used by RESRAD in determining dose to an on-site individual.

Reuse materials will be placed to a design depth of 2.5-ft (see Figure 2) and a maximum depth of 3-ft with 1-ft of soil/hard cover materials placed over the compacted fill. The one-foot thickness is the minimum soil cover requirement for commercial/industrial site development required by the Brownfield Cleanup Program (BCP), 6 NYCRR Part 375. The proposed area to place TENORM under the cover system is a 0.4-acre area that will be developed into a parking lot.

The radionuclide concentrations used to evaluate potential exposures from the TENORM impacted fill are the maximum laboratory analytical concentrations identified in composite samples collected from each 500 CY of reuse materials before placement. The RESRAD radionuclide and maximum concentration values used are shown in Table 2 below and in Appendix D. Laboratory analytical reports are provided in Appendix C for all reuse samples collected. As shown in the sample results, the primary enhanced NORM isotope identified is Radium-226 whereas the concentrations of Th-232, Ra-228 and other decay progeny co-located with the Ra-226 are at or near concentrations typically observed in background soils (see Table 1 in section 1.4 above).

RESRAD was used to evaluate the following five (5) potential exposure scenarios:

1. Industrial Worker – No Building Occupancy. Assumes a site worker would spend an hour between lunch breaks and traversing on the 0.4-acre parking lot for 250 days/year or 250 hr/year.

2. Groundskeeper: This person would be present maintaining outside facilities on the 0.4-acre site for eight hours per week, 8-months of the year or 300 hours per year with an additional 44 hours/yr for snow removal resulting in a total of 344 hrs./yr. On the 0.4-acre fill area
3. Recreational User: Assumes a neighbor spends 6 hrs/wk for 26 weeks of the year playing in the 0.4-acre parking lot area for a total of 156 hrs/yr.
4. Future Industrial Worker – Assumes a building constructed on the TENORM reuse area with the 1-ft of cover/hardcover removed is occupied by the receptor (worker) for 7 hrs./day for 250 days/yr. and with 1-hr spent on-site outside the building. The building is a slab-on-grade structure covering 500 sq ft of the 0.4-acre reuse area.

5. Future Construction Worker & Inadvertent Intruder: Both scenarios are evaluated by assuming either a construction worker or inadvertent intruder removes the soil cover for foundation construction or subgrade work and are directly exposed to the TENORM fill. The estimated duration required to construct a foundation and building was estimated to be 500 hours (about 3 weeks) i.e., 8 hours/day for 63 days (about 2 months), during which time the individual would be exposed to the uncovered TENORM materials.

In each exposure scenario, individual radiation dose is evaluated for the on-site receptor while in the reuse placement area i.e., 0.4-acre parking lot shown in Figure 2. For exposure scenarios 1, 2 and 3, the primary exposure pathway is direct exposure from the radiological material in the ground and for scenarios 4 and 5 the cap is assumed to have been removed. Although radon and inhalation of resuspended particulate also contribute dose primarily during future use scenarios following cover removal, the direct exposure pathway is the principal source of radiation (approximately 98% of dose) to on-site receptors at the site in all the scenarios evaluated. Table 3 below identifies the maximum potential dose estimated by RESRAD and the year the dose was determined to occur.

Table 2: Maximum Sample Concentrations for Stockpile Composite Samples Used in RESRAD Modelling

Isotope*	Concentration (pCi/g)**	Sample I.D. 310-500.5.032223
U-238	5.87	Dup result
U-234	6.74	
Ra-226	6.74	
Ra-228	0.902	301-100.Y2. S.031723

*- RESRAD assumes ingrowth and equilibrium for progeny unless progeny concentrations at time zero indicated otherwise.
**- Results shown are the maximum concentrations reported for stockpile composite sample results.

Table 3: Summary of RESRAD Receptor Dose for Site Specific Scenarios

Scenario	Maximum Annual Dose (mrem/yr)	Maximum Dose Year	Critical Pathway
Industrial Worker	0.72	304	External
Groundskeeper	0.86	304	External
Recreational User	0.45	304	External
Future Industrial Worker (30 yr)*	10.40	30	External
Future Construction Worker/Intruder (30 yr)**	0.14	30	External
Resident Farmer All-Controls-Fail	67.33	1000	Water

* Maximum dose of 13.4 mrem/yr in first year assumes no cover immediately following placement which is not plausible under EE and cover requirements. With no cover after year 30 dose is 10.4 mrem/yr.
** Maximum dose of 4.54 mrem/yr with no cover during first year and after year 30 dose drops to 0.14 mrem/yr.

Wherever appropriate, RESRAD default values were used to perform the site-specific dose assessments. However, to adjust default parameters for site specific and scenario specific conditions, default parameters were revised as described below:

- Time (indoors/outdoors on-site): RESRAD default values are 0.25 and 0.50 of a year, which correspond to 2,191.5 hours (about 3 months) and 4,383 hours (about 6 months) respectively. The number of hours used for the site-specific scenarios are described in section 1.5.1 above and were used to calculate the fractional yearly time duration spent indoors and outdoors on-site. For example, the 500 hours estimated for the on-site receptor in scenario 5 becomes 500 divided by the number of hours in a year i.e., 8766 equaling 0.057 or 5.7% of a year.
- Contamination layer thickness: RESRAD uses a default layer thickness of 2.0 meter whereas for the scenarios evaluated a sit-specific thickness layer of 0.73 meters (2.5-ft) was used.
- Contamination Area: RESRAD default is 10,000 square meters. For all the site-specific scenarios, the contaminated zone or area is identified as being 1673 ft^2 (0.4 acres) in a rectangular shape 65-ft x 270-ft long.
- Soil Density: RESRAD default for soils is 1.5 grams/cc however, because the materials being reused are made up of primarily slag materials, a density of 2.2 g/cc was used.
- Cover Depth: RESRAD assumes that the contaminated layer is not covered. In the scenarios evaluated and as required by NYSDEC, a soil cover depth of 1-ft or 0.3048 meters is used.
- Building Air Exchange Rate: A RESRAD default for this parameter is 0.5 and assumes residential structures. In future use scenarios where a building on the site is used, the building is assumed to be a commercial garage, utility, or pole building and because the exposure occurs during and after construction and these buildings are typically less insulated or tight, an air turnover rate of 4 was used.

- Foundation Radon Coefficient: The RESRAD default for this parameter is 3E-07 m^2/s. However, as suggested by NUREG 0706, a default value of 6E-9 m^2/s was used and a contaminated zone radon coefficient of 3E-07 m^2/s. The RESRAD default value for the radon coefficient is based on sandy or loamy soils which are much more porous than slag materials and the default value is 2E-06 m2/s.
- Foundation Depth: The RESRAD default value is 1-meter bgs whereas the building construction scenarios used estimated a foundation depth of 0.5 meters (1.64-ft) to reflect the type of building being constructed.

Appendix F shows the RESRAD input parameters and exposure results for each scenario and a graph showing radionuclide ingrowth and year of maximum dose.

1.5.1.1 Residential Farmer Exposure Assessment

In response to a request by the NYSDEC, an additional scenario is evaluated below.
RESRAD was used to evaluate the potential exposure received by a residential farmer residing in a slab-on-grade home built over the backfill reuse area (1626 m^2) using likely and potential exposures pathways resulted in a maximum potential dose of 54.02 mrem/year. Due to institutional controls (i.e., deed restrictions, public water source, etc.) and planned future uses (30-100 years), drinking water and the radon pathways are assumed to be mitigated. The remaining pathways: meat and milk ingestion, and aquatic foods, would also not be viable due to the planned site use and controls. Based on these assumptions the exposure to an on-site resident farmer in the near-term i.e., <100 years, with institutional controls (IC) in place, using the maximum radionuclide concentrations observed in the reuse slag/soil, and the site-specific parameters shown in the table below, receptor dose was determined for years 30, 100, and, should IC and currently planned future use continue, the dose for years 300 and 1000 are also calculated.

Contaminated Zone Dimensions	Initial Soil Concentrations (pCi/g)
Area: 1626 square meters	Ra-226: 6.740E+00
Thickness: 0.76 meters	Ra-228: 9.000E-1
Cover Depth: 0.31 meters	Th-228: 7.100E-1
	U-238: 5.870E+00

RESRAD Site Specific parameters and Soil Concentrations used for the Resident Farmer Scenario (see Attachment F)

The maximum total dose to the on-site residential farmer was determined by RESRAD as occurring in year 70.1 with a dose of 54.02 mrem/yr. Alternatively, if all pathways are "on" with the exception of radon, the

maximum total dose estimate for the resident farmer scenario using the same site-specific and RESRAD default parameters is 67.33 mrem/yr, determined to occur in year 1000 (Attachment F). The additional 13.3 mrem/yr estimated using all exposure pathways is largely due to Radium-226 in the water dependent pathways of drinking water and plant/fish consumption during the time period following year 450 when cover erosion and radionuclide (primarily Ra-226) fractionation and migration occurs through the soil column. Soil pH, water column fluctuation, clay, and mineral content i.e., calcium, manganese (FeMn) are the primary factors affecting the chemical fractionation of Ra-226 in the soil column. Soil study data show that a majority of the soil Ra-226 is mobile (45-99%) under normal environmental conditions (*Chemical fractionation of radium-226 in NORM contaminated soil from oil fields*. J Environ Radioact. 2016 Dec.).

In either case, i.e., likely or all pathways excluding radon, the RESRAD estimated maximum dose is conservatively estimated to be well below the recommended 100 mrem/yr dose limit identified by NRC, NYSDEC and DOH for radiation exposure to the general public.

1.5.2 Comparative Dose Criteria

Two (2) applicable comparative criteria were identified and used to compare the results of the RESRAD models:

- United State Nuclear Regulatory Commission (NRC) 10 CFR 20.1402- Radiological Criteria for Unrestricted Use of Formally Utilized Sites.
- United States Environmental Protection Agency (EPA) 10 CFR 40 Appendix A, I, Criterion 6(6) as implemented per Directive No. 9200.4-35P April, 2000.

The NRC 10 CFR Part 20 is the Standard for Protection Against Radiation. Part 20.1402 is the Radiological Criteria for Unrestricted Use, which states that a formally utilized site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group[4] that does not exceed 25 millirem (mrem) per year, including that from groundwater sources of drinking water, and that the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). The 25 mrem per year could be considered as an applicable or relevant and appropriate requirement (ARAR).

10 CFR 40 Appendix A, I, Criterion 6(6) requires that if a dose assessment is conducted at a site with contaminates of concern that include: Ra-226, Ra-228, Th-230, Th-232, U-234 and/or U-238 in soils, then 12 millirem per year (mrem/yr) effective dose equivalent should be the maximum dose limit for the maximally exposed individual (MEI) using exposure parameters consistent with the selected land use for the site.

Compliance with Criterion 6(6) rule achieves an equivalent remediation risk level to that determined for soil concentration of 5 pCi/g for Ra-226 in soil which was recommended as a maximum concentration for surface soils in 40 CFR Part 192. Therefore, the use of the 6(6) criterion is more conservative as the dose from other radionuclides present is also considered. Compliance with the rule is considered protective and equivalent to the exposure limit in other governmental actions, particularly regulations and guidance developed by EPA.

Both criteria can be considered ARARs (Applicable or Relevant and Appropriate Requirement) and "to-be-considered" comparative value (TBC) for evaluation of the RESRAD model outputs in the absence of TENORM regulatory criteria or guidance in New York State.

Based on the RESRAD models, the maximum potential dose to on-site receptors occurs for future use scenarios that assume loss of the required cover material i.e., soil/hard cover, and that occur no sooner than 30 years following completion of site redevelopment. The conservative dose estimate determined for the hypothetical future use site receptors range from 0.14 mrem/yr (Future Recreational User) to 0.14 mrem/yr (Future Industrial Worker). However, a dose to a site receptor with controls in-place and under plausible near-term scenarios is below 1 mrem/yr from materials placed in the reuse area. The dose assessment conducted for the five (5) scenarios indicate that the proposed use of the low-level radiological material as fill material are below the most restrictive 12 mrem/yr (EPA) standard that has been identified as TBC/ARAR. In the case of the residential farmer when all-controls-fail, the maximum allowable dose limit identified by NRC, NYSDOH and NYSDEC of 100 mrem/year, excluding radon pathway, for members of the public is used as the maximum permissible dose. The results of the RESRAD assessment for the residential farmer with all pathways on excluding radon, were 67.33 mrem/yr, well below the 100 mrem/year limit. RESRAD modeling assessment reports for all scenarios are provided in Attachment F.

Therefore, re-use the low-level TENORM material as backfill on the site would not present any significant adverse impact to the public health and safety or the environment as has been demonstrated by the results of the conservative site use scenarios modeled. Specifically, low-level TENORM with concentrations less than 15 pCi/g as fill in the specified locations of the Site (see Figure3), which will be placed under a minimum of 1-foot of approved cover system and/or hardscape (i.e., asphalt or other) will not result in exposures exceeding those recommended by regulatory agencies (applicable ARARs) under plausible or likely current or future site use.

2.0 Reuse Approach for TENORM Materials

TENORM slag materials that have met the reuse criteria as described in the TENORM Management Plan (TMP) (Appendix C) prepared for the Site and approved by NYSDEC will be relocated on-site to the proposed reuse fill areas (Figure 3) and placed in 6-inch un-compacted lifts. The TENORM material will be placed under the cover system as a requirement of the Decision Document.

As described in the TMP and section 7.2 of the RI/AA/RWP (Ref. 1), visual confirmation of slag and field gamma scans during excavation were used to initially segregated materials that contained TENORM from materials that could be immediately reinterned on Site. When scan count rates exceeded 1.5 times the daily background and/or slag was visually identified, the excavated materials were stockpiled pending additional scans and sampling to determine whether materials would qualify for reuse under an approved variance request or alternatively, would require out-of-state disposal at a licensed facility. Final disposition of materials exceeding reuse criteria i.e., 15 pCi/g Ra-226 will not be determined until the volume and concentrations of the materials are known. This information is required to determine compliance with waste acceptance criteria for any disposal facility being considered and to identify the most cost-effective disposal alternative. However, under current State regulations related to acceptance of TENORM materials, Michigan's municipal solid waste landfills are one option.

Michigan's current TENORM disposal guidelines are currently being reevaluated under Senate Bill 503 which is anticipated to continue current practices with some additional regulation provide that the disposal of Radium-226 contaminated materials, from any source, containing a concentration not exceeding 50 pCi/g can be accepted without regard to radioactivity in a Type I (hazardous waste) or Type II (municipal solid waste) landfill. Michigan's TENORM regulations were assessed by the Argonne National Laboratory in a study funded by the U.S. Department of Energy and American Petroleum Institute in 1999. The Argonne study concluded that the Michigan disposal guidelines of 50 pCi/g of Radium-226 would not adversely impact human health or the environment, provided the TENORM wastes were placed deeper than approximately 10 feet below the landfill cap.

For stockpiled materials to qualify for reuse under an approved variance, analytical results for composite samples collected from every 500 cubic yards (CY) of stockpiled materials are required to have Ra-226 concentrations below 15 pCi/g. When stockpiled materials meet reuse criteria, they are placed in the designated on-site fill reuse areas shown in Figure 3 to a maximum thickness of approximately 3 feet. Materials not meeting reuse criteria i.e., sample analytical results exceeding 15 pCi/g, will be removed, and staged for out-of- state disposal.

Materials currently stockpiled were sampled intermittently from each excavation location as they were accumulated and composite samples were prepared for every 500 CYs of material stockpiled as required by the TMP. The 500 CY capacity, planned for each stockpile, was estimated during construction activities by accounting for the number of 20 CY truck loads placed in the stockpile location. Once the 500 CY capacity was reached, a composite sample of the material was collected. Analytical results from intermediate and required composite samples i.e., 100CY and 500 CY respectively, show concentrations of Ra-226 well below the reuse criteria of 15 pCi/g (see Table 4 below). As a result, approximately 1640 CY of material has been accumulated in the three stockpiles that have been characterized by 500 CY composite samples and, is candidate for reuse pending NYSDEC approval of a variance request. During reuse, additional field scans will be performed to ensure that there are no significant deviations in reuse materials although intermediate sampling and scans have provided assurance that the materials are sufficiently characterized by the analytical results to conclude that the concentrations reported are representative. Laboratory analytical results from the TENORM samples are provided in Appendix D and the Ra-226 results are summarized in Table 4 below along with concentrations reported from the background reference area. Composite samples from stockpile four (4) are still pending analysis.

TABLE 4: Stockpile Soil Composite Sample Ra-226 Results

Sample No.	Description	Ra-226 Results (pCi/g)[1]		
		Result	Uncert	MDL/MDC
310-100.5.022823	Composite sample 100CY, stockpile 1	3.38	0.252	0.123
310.250.5.030223	Composite sample 250CY, stockpile 1	3.41	0.244	0.127
310-450.5.031723	Composite sample 450CY, stockpile 1	3.48	0.255	0.14
310-100.Y2.5.031723	Composite sample 100CY, stockpile 2	5.44	0.349	0.151
310-500.5.032223	Composite sample 500CY, stockpile 2	6.74	0.31	0.145
310-500.Y3.5.033123	Composite sample 500CY, stockpile 3	2.81	0.287	0.146
310-bkgoff1-8.24.22-5	Initial Offsite background	0.705	0.115	0.0617
310-bkgoff2-4.12.23-5	2nd Off-site background	0.55	0.104	0.799

1 All samples were identified as "soil" and analyzed using gamma spectroscopy method DOE HASL300/Ga-01-R with results reported for dry weight.

After the placement and when designated grades are achieved in the proposed reuse areas, a demarcation layer will be placed over the top of the TENORM, and the areas will be covered with a minimum of 1- foot of acceptable soil/fill or covered with suitable hardscape as required under the BCP. The TENORM material

will be placed under the cover system as a requirement of the Decision Document.

Any future subsurface activities at the Site would be subject to limitations imposed by an Environmental Easement (EE) and restrictions identified and summarized in the Site Management Plan (SMP) to be prepared.

3.0 Purpose and Scope

This TRWP presents the scope of work and planned approach for the TENORM reuse which includes the placement methods, field screening methods, analytical sampling, and installation of a cover systems. As part of the NYSDEC-approved remediation for the Site, an EE will be placed on the entire 5.11-acre property. The EE will include requirements for periodic monitoring and the use of an SMP for any invasive work at the property. The SMP will include provisions for the screening, handling, characterization, and final interment of all soils, including potential TENORM, and will be reviewed and approved by the NYSDEC prior to the issuance of the Certificate of Completion.

The scope of the TRWP activities includes:

- Providing drawings for the Site that will show the proposed location(s) of the TENORM reuse areas, thicknesses, and cover system information.
- Cover system placement.
- Establish and provide components of an Environmental Easement for the Site.

4.0 Project Organization and Responsibilities

MJW Corporation will provide radiological oversight and field screening of work areas and equipment during TENORM reuse activities. Both C&S Companies (C&S) and MJW will maintain field notes and documentation of the TENORM reuse locations and activities and C&S will prepare an SMP describing relevant inspections and documentation following completion of the EE and site redevelopment The site construction contractor RP Oakhill under the supervision and direction of C&S project manager will be responsible for TENORM relocation, placement, compaction, and cover system while the site developer Zephyr Partners, and subcontractor C&S will be responsible for survey controls for determining reuse placement locations and for verifying lift thicknesses. Zephyr Partners and subcontractors C&S and MJW will be responsible for arranging off-site disposal of TENORM with concentrations above 15 pCi/g at an approved out-of-state facility.

Zephyr Partners environmental representatives will be responsible for providing NYSDEC with the

information needed for preparation of an EE and for filing the signed document with Erie County. It is anticipated that MJW will monitor the TENORM reuse actions to verify that the work is performed in accordance with the approved TRWP and the approved 6 NYCRR Part 380 Variance. The NYSDEC DER and Division of Materials Management (DMM) will be kept aware of all TENORM reuse actions in weekly reports.

5.0 TENORM Reuse and Placement

Four (4) TENORM stockpiles, three of which contain approximately 500 CY of reuse materials and are completed and a fourth pile, currently open to accept additional excavation spoils as site redevelopment activities continue, are present at the Site. The current volume estimate for pile 4 is approximately 230 CY and because the majority of utility and footer excavations have been completed, the volume is not anticipated to increase significantly. All four piles are located in the northeastern corner of the Site (see Figure 3). The estimated volume of material in each TENORM stockpile is based on continuous logging of material transported during construction by the on-site contractors. As discussed in section 1.2 above, TENORM is present in the slag at the Site which was used as fill and is as a byproduct of the former production of iron and/or steel. As the Site redevelopment activities were occurring (building foundation and utility excavations) both slag and other subsurface soil/fill were excavated simultaneously as subsurface conditions were not uniform. However, as identified during initial site characterization, the TENORM slag materials are the primary subsurface constituent at the site and are present from near surface to approximately 16-ft bgs and as such, represent the majority of the stockpiled soil volume.

There is one (1) proposed TENORM reuse area at the Site, as shown in Figure 2. The area is located in the southwestern quadrant on the site and covers approximately 17424 square feet (ft^2). The reuse area is offset from the property line by approximately 30-ft and design specifications require a minimum 1-foot-deep cap graded to a 3:1 slope extending thirty (30) feet towards the parcel's western boundary. The depth of the TENORM fill required to bring the reuse area to 1-ft below design grade (allowing for 1-ft clean cap cover) is estimated to be approximately 2.5ft which results in an estimated fill volume of approximately 1500 – 1800 CY that would be approximately equal to the total volume of material currently accumulated in the four on-site TENORM reuse stockpiles.

As a contingency, C&S would also like to evaluate the site development plan and determine if there are other areas of the Site that may be suitable for TENORM reuse. These location(s) would be identified and discussed with NYSDEC prior to any material being placed at the locations.

Prior to the placement of TENORM, a demarcation layer (i.e., orange mesh or equivalent) will be placed across the area. TENORM will be placed on top of this demarcation layer, and will also be covered by a second demarcation layer once filling is complete, prior to the placement of the clean cover.

Fill placement is not anticipated to exceed 2.5-ft in depth and the maximum reuse placement thickness used in the RESRAD model was 2.5-ft to ensure that potential receptor exposures are conservatively determined. As noted above, the placement thickness of the TENORM fill will be 1-foot less than the required final design grade requirement to allow for installation of a minimum 1-foot depth of acceptable cover material or hardscape cover system with associated subbase. Once the required TENORM placement elevation is reached, the demarcation layer (i.e., orange mesh or equivalent) will be placed prior to the cover system installation. The TENORM material will be placed under the cover system as a requirement of the Decision Document.

6.0 TENORM Reuse Construction Overview

6.1 Project Coordination/Kickoff Construction Meeting

A project coordination/kickoff meeting will be held with key representatives of the Project Team before the reuse activities begin. Attendees at the meeting will include a representative from C&S, Zephyr Partners, construction contractor(s) and MJW. The NYSDEC Project Manager will be notified of the meeting date and time and requested to invite those individuals from the Department they would like have present at the meeting or via teleconference. Agenda items will include:

- Project schedule
- Work sequencing
- Designation of responsibilities, contact personnel, and phone numbers.
- TENORM Reuse Work Plan review.
- Project documentation requirements
- Import Materials/Cover System Installation
- Health and safety requirements
- Temporary controls (dust suppression, storm water management) as described in the site-specific Stormwater Pollution Prevention Plan (SWPP, Ref.2) and in sections 7.9 and 7.10 of the site Remedial Investigation / Alternatives Analysis / Remedial Work Plan (RI/AA/RAWP).

The C&S project manager will prepare meeting minutes for distribution to attendees following the meeting. Progress meetings or calls will be conducted, as necessary, throughout the TENORM reuse and cover system

installation construction period to clarify or status TENORM reuse work practices and progress.

7.0 Health and Safety Plan

Appendix C, *TENORM Monitoring and Safety Plan (TMSP)* of the NYSDEC approved *Preliminary Site Development Plan*, dated 11/7/2022 and prepared for the Site will be used for the TENORM Reuse activities described herein. The TMSP addresses health and safety with respect to radiological safety and monitoring and provides guidance to workers performing intrusive activities where exposure to contaminated soil and/or fill material is possible. Section 7.0 Remedial Work Plan of the RI/AA/RAWP prepared for the site contains construction and general health and safety consideration for site development activities and includes filling and grading activities. Collectively these two documents constitute the HASP for TENORM reuse activities.

Site contractor and subcontractor employees involved with the TENORM Reuse project are required to attend a Site health and safety orientation and Site-Specific Radiation Awareness Training (provided by MJW) if they had not already received the training. Site access control is maintained by the site development contractor and C&S, the Site is currently controlled through fencing when personnel are not actively working. Due to the limited area of disturbance anticipated air monitoring beyond what is currently required under section 7.9 of the RI/AA/RAWP will not be performed.

8.0 Site Preparation and TENORM Fill Placement

The field equipment necessary for the implementation of this project is currently present at the Site.

8.1 Storm Water Management

A Notice of Intent (NOI) was submitted for the redevelopment project on October 26, 2022 by Laborers Way 1, LLC. A stormwater pollution prevention plan (SWPPP) was also prepared for the Site. The NOI was deemed accurate and complete, and the SWPPP was identified to be in substantive conformance with the requirements in the SPDES General Permit for Stormwater discharges from MS4 in a letter from NYSDEC to Laborers Way 1, LLC., dated June 30, 2022. The permit issued for the Site is NYR 11J951.

Due to the permeable nature of the soil/fill material at the Site and its relatively flat topography, storm water ponding/runoff is not expected to pose a significant concern. Silt fencing has been previously installed around the perimeter of the Site and will be maintained in accordance with the SWPPP, in addition to the required inspections. Therefore, storm water ponding/runoff is not expected to pose a significant soil particulate or contaminant transport pathway during TENORM reuse activities. Therefore, the existing

construction storm water controls identified in the SWPP will remain in effect during the TENORM reuse project.

8.2 TENORM Stockpile Loadout & Placement

Material present in the stockpiles will be loaded and placed into dump trucks for transportation to the reuse area located in the southwestern quadrant of the site. As mentioned above, the reuse area covers approximately 17,424 square foot (ft^2) and is expected to require fill to a depth of approximately 2.5 ft to reach a grade 1-ft below finished design grade. The materials will be placed in the designated reuse area and spread out in 6-inch un-compacted lifts using a bulldozer. During the TENORM placement, site survey controls will be used to verify and document the lift thickness. Once the uncompact lift thickness is verified, it will be field screened by an on-site radiological control technician to ensure gamma radiation readings are within the range of readings previously observed as piles were accumulated and to ensure that no elevated measurement locations are present. Appendix E identifies the gamma scan readings collected from material in excavator buckets during site redevelopment. As shown in Appendix E, scan readings are generally above the IL (54 of the 64 scan readings) and the materials consist of a significant percentage of slag materials. Appendix E also demonstrates the variety of base samples from which excavation composite samples were formed that MJW staff retrieved. The corresponding locations of these samples are shown in Figure 3. Because analytical results from the scanned and stockpiled materials are relatively consistent with Ra-226 concentrations well below the 15 pCi/g upper limit for reuse, a screening level of twice background (2x) will be applied for scans performed during load out and placement of the reuse materials to identify elevated materials requiring additional investigation.

If scan or static measurements for placed material are found to be greater than two (2) times the daily background, it will be further evaluated, and staged for reassessment and out-of-state disposal if concentration data are above 15 pCi/g.

In general, the majority of the TENORM reuse placement area will be covered with a 6-inch uncompact lift which will allow field screening to occur prior to placement of subsequent lifts. Once scanned, the material will be compacted at thickness intervals required to ensure that engineered compaction specifications are achieved. After the compaction is complete, the elevation of the top of the compacted material will be measured and as required, the next 6-inch un-compacted lift will be placed. This process will continue until the required TENORM grades are achieved and allowing for a minimum of 1 foot of acceptable cover material or hardscape cover to be placed.

8.2.1 Confirmation Field Screening

As noted above, to verify that the TENORM impacted fill materials are consistent with the characterization results identified for the stockpiled reuse materials, gamma scan readings in the range of those observed during stockpile accumulation i.e., 1.5 to 2 times instrument background readings, will be used as screening levels during material placement. If scan count rates are at or below twice the background count rate, it will be assumed that the TENORM concentration of the placed reuse material are below the radium-226 concentration limit of 15 pCi/g and consistent with the analytical results obtained from composite samples collected during materials characterization.

To perform the field screening, each 6-inch lifts of uncompact material will be field screened at randomly selected locations during lift placement by a radiological control technician (RCT) using the same instrumentation used to screen and segregate excavation materials during site development (Ludlum Model 2221 Ratemeter/Scaler coupled to a Ludlum 44-10 sodium iodide detector).

Field screening will consist of scan measurements from accessible locations within the lift placement area at intervals consistent with maintaining construction progress. When scan measurements outside the range of those anticipated i.e., twice the daily instrument background readings are observed, the RCT will investigate the area by collecting static 1-minute count measurements at the location. If count rate data confirm readings above twice the daily background count rate, the elevated measurement location will be delineated by the RCT based on additional scan and static count rate measurements and the placed fill material from the 6-inch lift in the delineated area will be removed and returned to a separate stockpile pending additional characterization or off-site disposal. If removed soil concentrations are determined to be greater than the maximum concentrations used during initial dose assessments performed to qualify the materials for reuse under a variance request, the evaluations will be rerun using the higher concentrations, and submitted to NYSDEC for approval. Material with laboratory results for Ra-226 greater than 15 pCi/g will be disposed of off-site and additional dose assessments will not be required.

8.3 Cover System Installation

After the TENORM has been deemed acceptable, compacted, and achieved the required Site design grades, the demarcation layer and cover system will be installed in accordance with the Decision Document. As noted in the design drawing for the designated backfill area (Figure 2), the reuse area is offset from the western site boundary at a sufficient distance to ensure that the minimum 1-ft depth of cover can be maintained and graded on a 3:1 slope extending outward from the backfill area.

9.0 Engineering & Institutional Controls

The future use of the TENORM placement area(s) has not been finalized, therefore the final cover system is unknown. However, based on current plans, the reuse area will have a minimum of 1-foot-deep clean soil/fill cover graded outward from the reuse area at a 3:1 slope. Although future development plans may also require a hardscape cover that will be approved by NYSDEC, the minimum 1-ft cover requirement will be maintained, and the cover design documented in the SMP to be completed for the Site. The EE and SMP will document cover engineering and institutional controls required to install and maintain the cover.

9.1 Engineering Controls

A demarcation layer will be placed across the excavated area in which the TENORM will be interred. A second demarcation layer will be placed above the TENORM after the design grades have been achieved in the placement areas of the Site and prior to placement of cover system material. Demarcation will be placed to easily identify the underlying TENORM sub-grade fill from the cover system material and prevent the potential for inadvertent removal of TENORM during potential future Site work. The demarcation material will be comprised of an orange plastic industrial netting or equivalent material with distinguishing color or characteristics that will be rolled across the TENORM and overlapped by approximately 1 foot at the seams.

9.1.1 Sub-slab Depressurization System

An additional control system will be a sub-slab depressurization system (SSDS), as required in the December 12, 2022 Decision Document. The SSDS will provide a conduit for venting any radon vapors generated by the TENORM before it enters the site structures, thereby protecting workers. The NYSDEC-approved December 1, 2022 RI/AA/RAWP contains detailed design of the SSDS.

9.1.2 Cover System

If a soil/fill cover system is to be utilized over the TENORM, it will consist of a minimum of 1 foot of acceptable material meeting the criteria described in section 7.8 of the RI/AA/RAWP and following completion of Site remedial activities and redevelopment, further described in the SMP.

If the cover system is a hardscape (i.e., asphalt cover for parking lot) it will be composed of the materials required to properly construct the hardscape for its end-use (i.e., asphalt parking lot with required sub-base for proper construction). Cover system material(s) brought onto the Site, will be done in accordance with the requirements of the RI/AA/RAWP and the materials will be documented in the Construction Completion Report and SMP. If excavation activities are required after construction of the cover system, they will be completed in accordance with the controls described in the SMP and EE.

9.1.3 Cover and Off-site Fill Import Criteria

All materials proposed for import onto the Site must be approved by C&S and the NYSDEC. The criteria under which off-site material may be used as cover or backfill are presented in the RI/AA/RAWP.

9.1.4 Quality Assurance Requirements

Based on current Site requirements, the Site will have a 1-foot soil cover or equivalent hardcover system as part of the final cover system design. As a requirement, all imported soil sources, including general backfill soil and topsoil, will be subject to third-party testing to verify that they meet the quality assurance requirements specified in the RI/AA/RAWP. The required specified number of samples will be submitted to an independent, NYSDOH ELAP-certified laboratory for analysis. C&S Engineering will be notified of the sampling and provided an opportunity to observe the sample collection work. An Import Request which may include analytical testing will be submitted to the NYSDEC and approved prior to delivery of any imported material onsite.

All analyses will be in accordance with USEPA SW-846 methodology and the required laboratory data package level (Level A or as otherwise requested) will be made available to the NYSDEC on request. Target import criteria are the Commercial Soil Cleanup Objectives (CSCOs) in accordance with Appendix 5; Allowable Constituent Levels for Imported Fill or Soil Subdivision 5.4(e) in DER-10.

9.2 Institutional Controls

Institutional Control(s) will be imposed in the form of an Environmental Easement (EE) described and required by the NYSDEC and recorded with the Erie County Clerk for the Site. The EE will require compliance with the SMP, the IC/ECs placed on the Site, identify use restrictions (e.g., commercial and/or industrial) and restrict the use of groundwater as a source of potable and/or process water without New York State Department of Health approval.

10.0 Air Monitoring

Section 7.9 of the RI/AA/RAWP identifies the circumstances requiring air monitoring and provides provisions for Community Air and Fugitive Dust monitoring. C&S Engineers and MJW will implement air or dust monitoring when Site conditions or circumstance are required and as prescribed in the RI/AA/RAWP.

11.0 Radiation Safety Monitoring

Radiation safety monitoring will be performed by MJW during all TENORM reuse activities including activities involving excavation, grading, field screening, and cover system installation. Personnel and equipment will be monitoring during any activities performed in and around exposed TENORM materials

as described in the *TENORM Monitoring and Safety Plan, (TMSP)* previously prepared for Site development activities and presented in Appendix E, of the NYSDEC approved *Preliminary Site Development Plan*, dated 11/7/2022.

11.1 Personnel Monitoring

The dose rates and total dose from exposure to radiation and radioactive materials will be significantly less than 1 milli-Sievert (100 mrem). As a result, no individual personnel monitoring (either external or internal) will be required. Personnel monitoring is required under NYCRR Code 16 when radiation doses are expected to exceed 500 mrem. As further justification, external dose rates measured in the vicinity of stockpiled TENORM materials were less than 20 microrem/hour.

11.2 Personal Protection Equipment

No specific personal protection equipment (PPE) will be required for radiological protection as part of this TENORM reuse project. PPE for construction safety purposes will be worn in accordance with the Site HASPs.

11.3 Equipment Monitoring

As described in the TMP surface measurements will be collected from construction equipment and personnel during the day to ensure TENORM levels are acceptable. Surface measurements from equipment used in handling TENORM impacted materials that will require decontamination are as follows (listed in Appendix A of NYSDOH Code 16):

- Alpha 20 dpm/100 cm2 removable
- Alpha 500/100 cm2 total
- Beta 1000 dpm/100 cm2 removable
- Beta 5000 dpm/100 cm2 total

12.0 Documentation and Reporting

C&S and MJW will document TENORM reuse activities at the Site. Documentation will include reports of

construction activities, results from any required air or dust monitoring, gamma radiation measurements, equipment and personnel surveys, decontamination activities, and photographs and sketches, as necessary.

12.1 Construction Monitoring

C&S Engineers will implement standard reporting procedures for Site activities that will include preparation of a field activity report and, when appropriate, problem identification and corrective measures reports. Information that may be included on the field activity report form includes:

- Activities and locations of construction work under way.
- Equipment and personnel working in the area, including subcontractors.
- A description of subsurface soil/fill encountered, verification of fill placement coordinates, monitoring results, types, and placement of cover materials, including verification (certification) documentation.

The NYSDEC will be notified of problems requiring modifications to this TRWP or completion of construction requirements or specifications. Problem identification and corrective measures reports will be provided to NYSDEC whenever major field problems are encountered. Discussions regarding appropriate and recommended corrective measures for major issues or problems will be related to NYSDEC for agreement and will be included as part of the Construction Completion Report (CCR). Changes or additions to this TRWP will also be noted in the CCR.

Photographic documentation of TENORM reuse activities will be prepared by either C&S or MJW throughout the duration of the project to convey work activities progress and significant changes in conditions or circumstances that may arise. Photographs will be provided in digital format.

12.2 Progress Reports

C&S Engineering will prepare and submit to NYSDEC monthly progress reports that include:

- Activities performed during reporting period.
- Results of tests or other pertinent data.
- Work scheduled for the upcoming reporting period.
- Percentage of completion, delays encountered or anticipated that may affect the schedule, and a description of efforts made to mitigate those delays or anticipated delays.
- Other actions/information pertinent to the project.

Weekly progress reports will also be prepared and submitted to the NYSDEC detailing activities performed on-site.

12.3 Construction Completion Report

A Construction Completion Report (CCR) will be prepared and submitted to the NYSDEC for documenting the TENORM reuse activities. The report will be submitted within 60 days of completion of the work and will also be required to be submitted with the Periodic Review Report (PRR) which documents Site activities under for the BCP for the corresponding time period. The CCR will document activities were completed in accordance with the TRWP and are consistent with the requirements of Section 5.8 of DER-10 that include:

- Text describing the TENORM placement, field screening, confirmation sampling, and cover system installation activities performed.
- A description of any problems encountered, deviations from the TRWP, and associated corrective measures taken; and other pertinent information necessary to document that the Site activities were carried out in accordance with this TRWP.
- A Site map showing the extent of TENORM reuse activities, lift placement thicknesses, and type of cover system installed.
- Field Screening and laboratory analytical data.
- Copies of field activity reports and, if applicable, problem identification and corrective measure reports.
- A certification by a licensed NYS Professional Engineer in accordance with Section 1.5 of DER-10.

13.0 Site Management Plan

A Site Management Plan (SMP) will be prepared for the Site following completion of the remedial actions described in the RI/AA/RAWP. It will be developed using the most recent NYSDEC SMP template (August 2015) to provide protocols and procedures to address soil/fill that may be excavated at the Site during future redevelopment and the maintenance of the cover system. The SMP will be in effect until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36.

14.0 Corrective Measures Plan

If any component of the remedy are found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Plan will be submitted to the NYSDEC for approval. This Plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Plan until it is approved by the NYSDEC.

15.0 Project Schedule

TENORM reuse activities at the Site are expected to begin in early September 2023, following NYSDEC approval of this TRWP and the Variance request. The equipment and labor force to implement the TRWP is already on-site. The NYSDEC Project Manager will be notified seven (7) days in advance of the start of field activities related to the TENORM placement activities.

FIGURES

Figure 1
Site Location

Location of 310 Ship Canal Parcel
In Comparison to South Buffalo Area

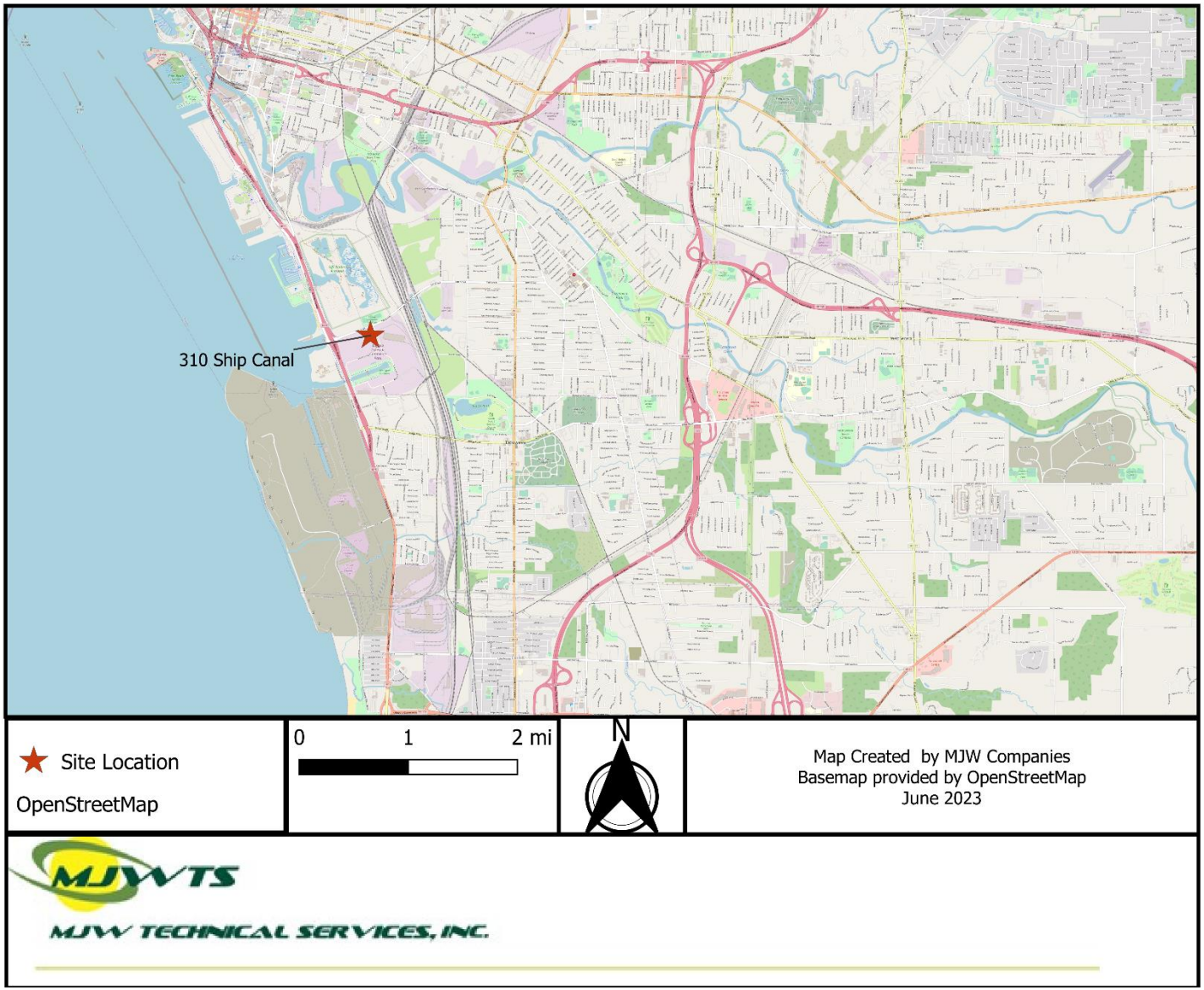

Figure 2:

Location of 310 Ship Canal Background Samples
Relative to South Buffalo Area

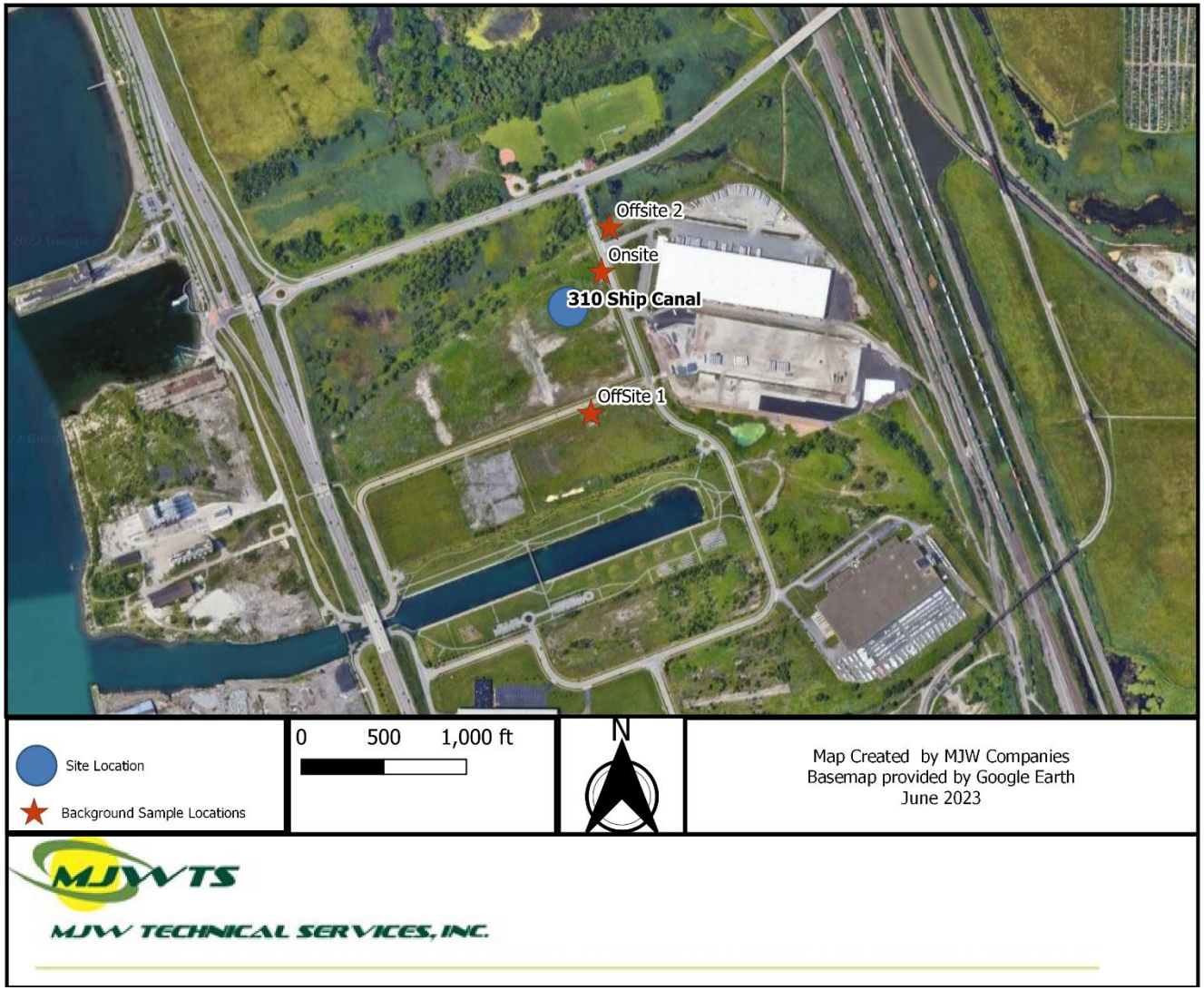

Figure 3:

TENORM Reuse Location

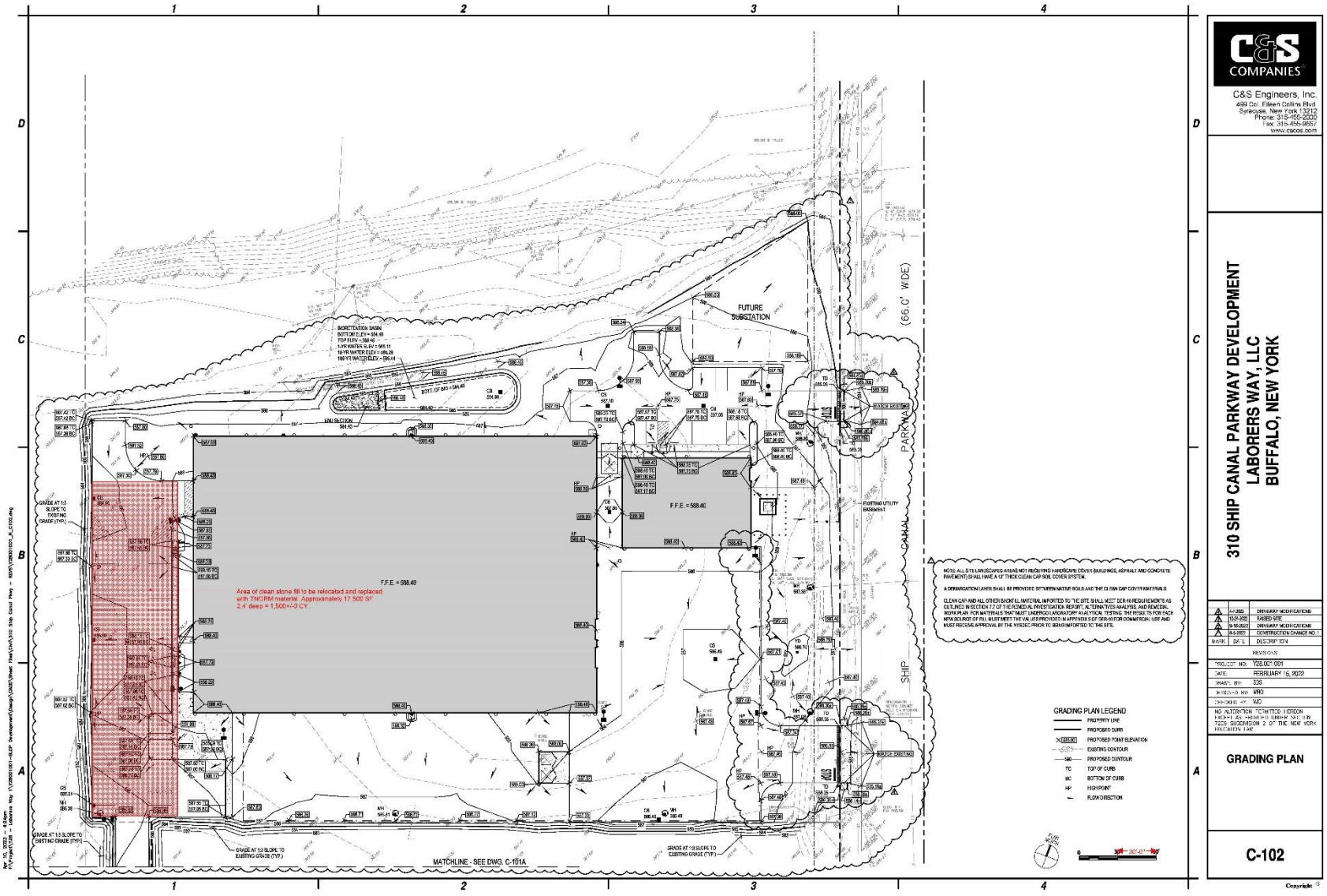

Figure 4:

Current TENORM Stockpile and Sample Locations