Mt. Kisco WWTP Radiological Characterization Work Plan

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Prepared for:

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1. INTRODUCTION

1.1. PURPOSE

The purpose of this document is to specify procedures to characterize and determine the extent of any radioactive contamination at the former Mt Kisco Waste Water Treatment Plant in Mt. Kisco, NY. The work is being conducted in response to a concern regarding potential radiological impacts from the former Canadian Radium & Uranium (CRU) processing facility which was located within the Village of Mt. Kisco. It is believed that CRU discharged wastewater contaminated with radium into the sewer system between 1943 and February of 1958.

1.2. OVERVIEW

This Site Characterization Work Plan is designed as a MARSSIM-compliant characterization survey plan. The survey will be conducted in two phases:

- Phase 1: delineation of the areal extent of surface soil contamination
- Phase 2: measurement of the depth of contamination

Phase 1, outlined in this document, utilizes an overland, GPS-based gamma scan of the site as the main method of delineating the areal extent of radium soil contamination. Soil sampling with subsequent radioanalysis will also be used to quantify the magnitude of radium concentrations existing in surface soils.

Phase 2 will assess the depth of contamination via downhole gamma logging and soil core sampling with subsequent laboratory analysis.

Also see the "Initial Site Visit Work Plan for Radiological Impacts" for additional information regarding site preparation to be performed before this Plan is implemented. Such preparation will include brush cutting of the undeveloped parcels, fence installation, and scoping surveys of the access road and "dogleg" portion of the property. These preliminary tasks are necessary to facilitate the site characterization survey and to prevent public access to potentially contaminated areas.

1.3. REFERENCES

1. "Initial Site Visit Work Plan (ISV) For Site Investigation for Radiological Impacts Former Mt. Kisco Wastewater Treatment Site Morgan Drive, Mt. Kisco, Westchester County, NY", July 31, 2018. (includes Appendix A - Procedure for Conducting a Scoping Survey of the 2 Morgan Drive Extension ("Dogleg"), Access Road, and Fence Line; Appendix B - Contamination Monitoring and Decontamination Procedure; Appendix C - Groundwater Well Sampling Procedure; and

Appendix D - Field Forms

2. "Health and Safety Plan For Site Investigation for Radiological Impacts Former Mt. Kisco Wastewater Treatment Site Morgan Drive, Mt. Kisco, Westchester County, NY", July 24, 2018.

3. 6 NYCRR Part 380, "Prevention and Control of Environmental Pollution by Radioactive Materials", New York State Department of Environmental Conservation, May 10, 2018.

4. 10 CRR-NY Part 16, "State Sanitary Code Part 16 – Ionizing Radiation", New York State Department of Health, April 18, 2001.

2. SCOPE AND DESCRIPTION OF CHARACTERIZATION

2.1. GENERAL AREA DESCRIPTION

The former Waste Water Treatment Plant (WWTP) is located on Morgan Dr. in Mt. Kisco, NY. Its area is approximately 21 acres comprised of the following five (5) deeded parcels (NYSDEC, 2018);

Tax Map/Parcel No.: 80.55-1-2.1/1
1 Morgan Drive, Mt. Kisco, NY
Owner: Rolling Frito-Lay Sales, LLP

Tax Map/Parcel No.: 80.55-1 -2.1/2
3 Morgan Drive, Mt. Kisco, NY
Owner: United States Postal Service

Tax Map/Parcel No.: 80 .55-1 -2.1/3
6 Morgan Drive
Owner: Creme de la Creme

Tax Map/Parcel No.: 80.55-1-2.1/4
2 Morgan Drive
Owner: Radio City Ventures, LLC

Tax Map/Parcel No.: 80.55-1-2.2
Portion of 1 Lexington Ave., including Access Road
Owner: Village of Mt. Kisco

Two parcels, 2 and 6 Morgan Drive are currently undeveloped. The 2 Morgan Drive parcel had numerous WWTP structures including filters beds, sludge drying beds, sprinkling filter beds, primary and secondary clarifiers, and storage building. Many of the structures are still present and in a state of disrepair. The 6 Morgan Drive parcel also contained numerous structures

including filter beds, chlorination building, and chlorine contact tank/pump house. No structures appear to remain on the 6 Morgan Drive parcel. Two parcels are developed (Frito-Lay and the US Post Office). Only the exterior land areas of these two parcels will be surveyed. Also, interior portions of the former structures located on the 2 Morgan Drive parcel will not be surveyed due to safety considerations.

See the "Initial Site Safety Work Plan for Site Investigation" for a more in-depth description of the parcels and these businesses.

2.2. PREVIOUS INVESTIGATIONS

In 2017, Great Lakes Environmental and Safety Consultants, Inc. (GLESC) conducted a radiological walkover survey and sampling of 2 Morgan Drive parcel. A report titled "Radiological Survey & Sampling Results Morgan Drive Lot 3, Mt. Kisco, NY" was issued in October 2017.

GLESC conducted a gamma walkover survey of former Sludge Drying Bed #1, Sludge Drying Bed #2 and Sprinkling Bed.

Also, 14 surficial soil samples were collected from the following locations:

- Sludge Drying Bed #1- four (4) samples of filter media
- Pond #1 - one (1) sediment sample from bottom of pond
- Pond #2 - two (2) sediment samples obtained from bottom of pond
- Sludge Drying Bed #2 - four (4) samples of filter media
- Hot spots - three (3) samples of three (3) hotspots identified during the gamma walkover

Three (3) hot spot samples exhibited elevated levels of Radium-226 ranging from 25.53 pCi/g to 65.04 pCi/g. A total of six (6) of the 11 other soil samples analyzed exhibited elevated levels of Radium-226 ranging from 13.24 pCi/g to 21.05 pCi/g.

Two (2) water samples were collected from the following areas in which water accumulated:

- Pond #1 - one (1) composite aqueous sample from the pond
- Pond #2 - one (1) composite aqueous sample from the pond

Primary Tank #2 and Primary Tank #1 were inaccessible due to safety concerns and not sampled.

Gross alpha counts from the Pond #1 sample (P1-W1) were detected at 317 pCi/L and Radium-226 at 11.3 pCi/L.

The Pond #2 sample (P2-W1) did not exceed the established drinking water limits of 15 pCi/L gross alpha and 3 pCi/L Ra-226.

Gamma walkovers of remaining structural components of the WWTP or other accessible land

areas were not significantly greater than background levels. Significantly elevated activity levels were observed, however, in three hotspots taken from areas between the Primary Tank and Sprinkling Filter Bed (HS-1), an area on the northwestern edge of Pond #2 (HS-2) and an area along the northwestern boundary of the site between Pond #1 and Pond #2 (HS-3). Biased samples obtained from these three hotspots confirmed significantly greater activity than background, specifically Radium-226.

GLESC recommended a remedial action plan be developed to address the removal and disposal of soil in areas identified with elevated radioactivity. On December 20, 2017, the NYSDEC conducted a limited survey to confirm the results of the Great Lakes survey at 2 Morgan Drive and a limited gamma walkover of accessible areas on the adjacent property, 6 Morgan Drive to assess for impacts. The Great Lakes results were confirmed for 2 Morgan Drive and readings elevated above background were detected on 6 Morgan Drive property.

On April 9, 2018, both NYSDEC and Great Lakes collected groundwater samples from 4 existing wells located on the 6 Morgan Drive property. The May 9, 2018 Groundwater Sampling report from Great Lakes indicates that their sample results were below the NYS groundwater standard of 3 pCi/L for Ra-226. Also on April 9th, NYSDEC performed a limited gamma walkover survey of areas of interest on an around the Morgan Drive properties. Additional readings above background were detected to the north of the access road between the 6 Morgan Drive property and the Kisco River. Elevated readings were also detected on 2 Morgan Drive near the edge of Morgan Drive.

Figure 1. Survey Area and Underlaying Parcels

3. DATA QUALITY OBJECTIVES

The following data quality objectives are based on MARSSIM principles as applicable to this site:

3.1. STATE THE PROBLEM

- The location, extent, identity and concentration of radiological contaminants must be determined to allow planning of future decommissioning and waste disposal efforts.

3.2. IDENTIFY THE DECISION

- Determine if existing data, process knowledge, and newly performed measurements can adequately specify the locations, type, and extent of contamination for decommissioning planning and waste characterization.

3.3. IDENTIFY INPUTS TO THE DECISION

- Existing characterization data obtained during prior surveys.
- Facility and process knowledge germane to the construction, operation, and history of the site.
- New survey and analysis information collected in selected areas to determine the presence or indicate the absence of radiological contaminants.
- New York State Department of Environmental Conservation (NYSDEC) regulatory guidance
- New York State Department of Health (NYSDOH) radiological health and safety guidance

3.4. DEFINE BOUNDARIES OF THE STUDY

The survey area consists of portions of the following parcels:

Tax Map/Parcel No.: 80.55-1-2.1/1
1 Morgan Drive, Mt. Kisco, NY (exterior land areas only)
Owner: Rolling Frito-Lay Sales, LLP

Tax Map/Parcel No.: 80.55-1 -2.1/2
3 Morgan Drive, Mt. Kisco, NY (exterior land areas only)
Owner: United States Postal Service

Tax Map/Parcel No.: 80 .55-1 -2.1/3
6 Morgan Drive
Owner: Creme de la Creme

Tax Map/Parcel No.: 80.55-1-2.1/4
2 Morgan Drive
Owner: Radio City Ventures, LLC

Tax Map/Parcel No.: 80.55-1-2.2
Portion of 1 Lexington Ave., including Access Road
Owner: Village of Mt. Kisco

The survey area is specified by the NYSDEC in the Consent Order as the gray area in Figure 1 above.

3.5. STATE THE DECISION RULES

- The effectiveness of the characterization survey in localizing and quantifying contamination depends on two general considerations:
    - the quantity and placement of sampling/measurement locations must be sufficient to spatially characterize the area
    - the quantity and types of measurements and analyses performed must be sufficient to radiologically characterize the contaminants

3.6. LIMITS ON DECISION ERRORS

- Constraints on decision errors are not applicable to this survey because subjective rather than statistical techniques are used, i.e., this is a characterization survey not a final status survey.

3.7. OPTIMIZATION OF THE SURVEY DESIGN FOR COLLECTING DATA

There are a few alternatives for determining contaminant concentrations in soil. The options are summarized as follows:

- **Delineating areas of soil contamination on the surface:** In the past, the main method of performing a characterization survey of a land area was to overlay a grid over the area and manually record readings within each grid square. However, with the advent of GPS-based radiation data collection systems, the entire survey area can now be walked-over along transects with count rates and GPS coordinates being recorded approximately every 1-second. In this way, thousands of data points can be collected within a reasonable period of time allowing 2-dimensional plots of gamma activity to be created.
- **Obtaining contaminant data from soil:** After areas of elevated surface gamma activity have been mapped using the GPS-based system, surface soil sampling

with subsequent laboratory analysis will be performed to determine the type and concentrations of radionuclides present at those spots. The radionuclide concentration data will be useful for comparison to regulatory limits, for worker health / safety considerations, and for survey considerations which a correlation between gamma count rate and radium concentration may be calculated. As part of a later phase of assessment, core sampling and *in situ* measurement (i.e., gamma-logging) could be performed to estimate the depth of contamination.

- **Analysis of surface soil samples:** Options include a wide range of radioanalytical and chemical analysis techniques with a wide range of associated costs. For this survey, analysis of the Bi-214 gamma emission after at least 21 days of in-growth will provide the most accurate and cost-effect analysis of radium in soil. This will be performed by a NYS-approved ELAP laboratory.

4. METHODS

4.1. GAMMA SCAN PROCEDURE

4.1.1. Introduction

This procedure provides guidance for recording gamma radiation levels emitted by surface soils while walking over the targeted area with a global positioning system (GPS)-based gamma radiation detection system.

4.1.2. Equipment and Supplies

1. Global Positioning System (GPS) unit (Trimble Model Pro6H or R2)
2. Ludlum Model 44-10 gamma scintillation probe and Model 2221 or 3000 ratemeter or equivalent.
3. Tablet computer running Trimble Terrasync software
4. Flags or stakes and tape measure.
5. Field maps of site and target locations.
6. Personal Protective Equipment (PPE) – including disposable gloves and safety glasses. Refer to the "Health and Safety Plan for Site Characterization" for specific requirements .
7. Miscellaneous supplies – Paper towels, field logbooks, writing instrument, and digital camera or phone

4.1.3. Background Area

A background area will be chosen in the Mt. Kisco vicinity. A GPS-based gamma scan must be conducted of the background area before conducting the survey of the main site. This is to establish the average background reading for real time comparison to site readings. Conduct the background scan using the same procedure as the site scan for at least 15 minutes (approximately

900 readings). After background scan, calculate the mean and standard deviation of the background readings. The investigation level for the site survey will be 1.5 times the background mean.

To establish background radionuclide concentration data, eight (8) soil samples will be collected from the background area at the depths expected to be collected during the actual survey (i.e., 0 to 6" deep). These samples will be sent for analysis along with samples collected from the main site.

4.1.4. Procedure for GPS-based Gamma Scan in Open Area

1. Review the site map and observe the terrain. Using marking flags and tape measure, layout 10-foot wide transects parallel to one side of the property. Plan to walk back and forth in straight lines along the transects. However, deviation from the transect lines are acceptable if obstacles are present or hotspots are detected in between transect that should be more closely delineated.

2. Perform and record a daily instrument check by visually inspecting the unit and noting that the calibration date is within 1-year of use; perform source and background counts to ensure that gamma detection is properly operating; allow the GPS antenna to acquire satellites for a few minutes and ensure that the positional and count rate data are being received by the Terrasync computer. Don the system using a backpack, shoulder straps, etc.

3. Maneuver to the starting point of the first transect. Confirm the location by examining the site map and landmarks. Open a new survey file in the GPS unit; this process begins data acquisition starting with the present coordinates.

4. Perform the survey by walking in a straight line parallel to the fence line or any adjacent survey transects at a rate of approximately 0.5 meters per second. Transect passes are to be approximately 10 feet apart.

5. The scintillation probe is to be held steady at a consistent elevation from the ground surface (approximately 1 to 3 inches).

6. Data are sent automatically into the GPS from the ratemeter at a rate of one count period per second although there could be an occasional skipped second due to non-syncing of the GPS and ratemeter. Use the audible feedback from the ratemeter and computer to ensure proper system operation and to reveal hotspots that should be more closely delineated.

7. If elevated readings greater than 1.5 x background are encountered, walk over and around the hotspot to better investigate the area.

8. After completion of the survey, close the survey file. Ensure that the data file is uploaded to a desktop computer for processing at the end of the day.

4.1.5. Procedure for Manual Gamma Scan in Wooded Area

Since some areas of the site may have substantive tree cover, thus limiting the number of available satellites "seen" by the GPS, manual data collection may have to be performed.

1. In the wooded area, set up 30' x 30' squares parallel to adjacent GPS transect lines. The goal is to set up 30' x 30' grid squares to be added onto the GPS-scanned areas. Use flags or stakes to mark the squares. (Leave flagging in place for potential future surveying by a land surveyor.)

2. Scan each grid square noting the approximate average count rate and the maximum. Mark any significant hotspots exceeding 1.5 x background. If an area is found exhibiting elevated count rates (> 1.5 x bkg), draw the outline of the elevated area on the site map.

The resultant manually-collected data will be added to the GPS-collected gamma map during data processing after the survey is complete.

4.2. SURFACE SOIL SAMPLING

Procedure for the Manual Collection and Processing of Soil Samples

After the gamma map is produced, soil samples will be collected from areas exhibiting gamma emission greater than 1.5 times background. A closely spaced cluster of hotspots may be considered to be a single elevated area per the discretion of the survey manager.

4.2.1. Introduction

This procedure describes the equipment and methods to manually collect a soil sample with a hand auger or shovel.

4.2.2. Equipment and Supplies

1. Hand auger and cross handle or shovel.
2. Sample containers, cooler (no ice is necessary for radiological samples)
3. Global Positioning System (GPS) unit
4. Personnel protective equipment (PPE) - including disposable gloves and safety glasses. Refer to the Health and Safety Plan for PPE requirements.

5. Miscellaneous Supplies: Decontaminated sampling equipment, field books, writing instrument, and digital camera or phone, 4- or 6-mil plastic sheeting.

4.2.3. Soil Collection with Hand Auger or Shovel

Note that for holes dug on this site, excess investigation-derived soil will be placed back in the hole.

1. Data from soil collection will be recorded in the field logbook at the time of collection. All recorded data will be transcribed into an electronic spreadsheet at the end of the sampling program.
2. Using a GPS, maneuver to the target coordinates for each sample location, assuming that sufficient satellite signal is available. Confirm the location by examining the site map, landmarks and the radiation reading. Record and save actual coordinates in the GPS unit. (If satellite signal is not available, maneuver to target sample location using site features and a measuring tape. Record all radiation and localization measurements in the field logbook.)
3. Position the clean (decontaminated) hand auger on the soil surface (perpendicular to the ground). Turn the cross handle for about three revolutions, or until the auger head is full (collecting a sample from 0" to 6" deep. Or, use a shovel and collect a 0" to 6" deep sample. Place the collected material on polyethylene plastic (use a decontaminated spoon if necessary to assist in removal).
4. If a deeper sample is warranted (not prescribed for this phase of the characterization survey), repeat step #3 until the borehole reaches the targeted depth or hits refusal (which is defined as the depth at which no additional penetration can be achieved in a one-minute period). All soil cuttings will be placed on plastic sheeting in the order of excavation.

4.2.4. Soil Processing

1. Check the collected soil with a GM beta-gamma probe. Note the reading in the logbook.

2. Transfer the collected soil to a decontaminated bowl or pan using a decontaminated spoon.

3. Thoroughly homogenize the sample using the following steps:
    a. Scrape soil from the sides, corner, and bottom of the pan into the center and mix.
    b. Separate the sample into quarters and push to separate parts of the pan.
    c. Mix each quarter thoroughly and return to the center of the pan.
    d. Thoroughly mix the quarters together.

4. Place homogenized material into a labeled sample jar. Label the jar with the Sample ID number, date and time of collection, the name of the collector, and site name.

5. Decontaminate equipment with soap and water prior to moving to the next sampling location.

4.2.5. Sample Analyses

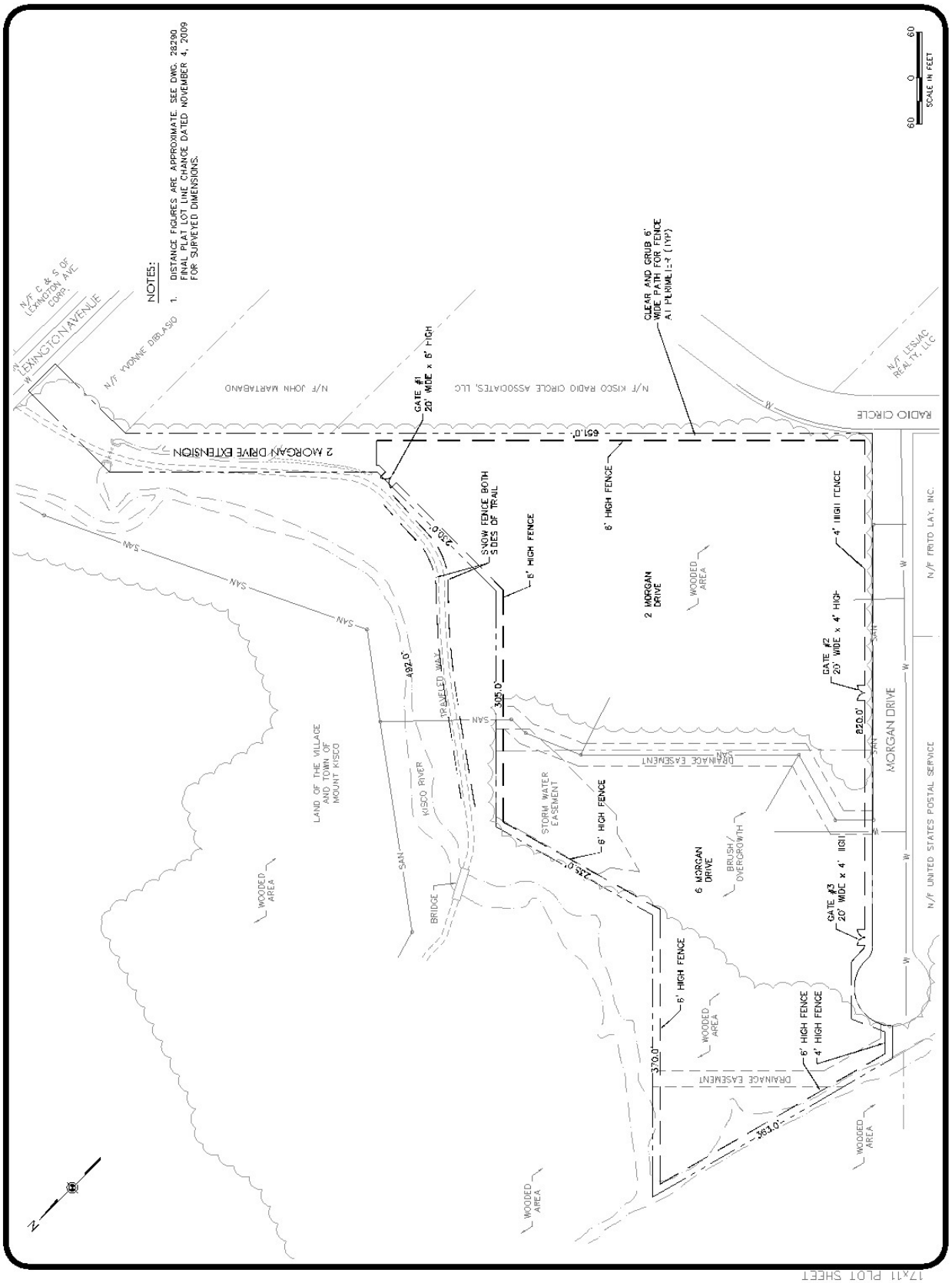
The site and background area samples will be sent to a NYSDEC-approved ELAP-certified laboratory. The analysis shall be gamma spectroscopy with at least 21-day radon ingrowth for specific radium-226 quantitation.

5. PHASE 2 SAMPLING PLAN AND REPORTING

Data from the Phase 1 Characterization Survey will be utilized to develop a sampling plan for Phase 2. The sampling plan will be shared with NYSDEC prior to implementation and will include recommendations for the locations of depth profile contamination measurements.

A Site Characterization Report summarizing the results of both Phase 1 and Phase 2 will be issued within 60 days of receipt of all analytical results. The report will include the gamma map generated from the surface gamma scan, a sample location map, laboratory analytical reports with the results summarized in tabular form, and recommendations for next steps.

Attachment A – Site Map


NOTES:
1. DISTANCE FIGURES ARE APPROXIMATE. SEE DWG. 28290 FINAL PLAT LOT LINE CHANGE DATED NOVEMBER 4, 2009 FOR SURVEYED DIMENSIONS.
N/F C & S OF LEXINGTON AVE. CORP.
LEXINGTON AVENUE
N/F YVONNE DIBLASIO
N/F JOHN MARTABANO
N/F KISCO RADIO CIRCLE ASSOCIATES, LLC
N/F LESMAC REALTY, LLC
RADIO CIRCLE
GATE #1 20' WIDE x 6' HIGH
CLEAR AND GRUB 6' WIDE PATH FOR FENCE AT PLUMBERS (TYP)
651.0'
2 MORGAN DRIVE EXTENSION
SNOW FENCE BOTH SIDES OF TRAIL
6' HIGH FENCE
4' HIGH FENCE
2 MORGAN DRIVE
WOODED AREA
GATE #2 20' WIDE x 4' HIGH
820.0'
MORGAN DRIVE
N/F FRITO LAY, INC.
N/F UNITED STATES POSTAL SERVICE
492.0'
305.0'
TRAVELED WAY
DRAINAGE EASEMENT
STORM WATER EASEMENT
LAND OF THE VILLAGE AND TOWN OF MOUNT KISCO
KISCO RIVER
BRIDGE
BRUSH / OVERGROWTH
6 MORGAN DRIVE
GATE #3 20' WIDE x 4' HIGH
235.0'
370.0'
363.0'
SAN
W
0
60
SCALE IN FEET
17x11 PLOT SHEET