Special Remediation Branch

GUIDELINES FOR ADDRESSING PRE-REGULATORY LANDFILLS AND DUMPS

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Department of Environmental Quality
Division of Waste Management
Superfund Section
Special Remediation Branch
Pre-Regulatory Landfill Unit

217 West Jones Street
1646 Mail Service Center
Raleigh, North Carolina 27699-1646
Telephone: (919) 707-8200

Pre-Regulatory Landfill Program:
https://deq.nc.gov/about/divisions/waste-management/superfund-section/pre-regulatory-landfill-program

Updates from March 2022 Version:

1. Web links and reference information page.
2. NC DEQ EDD required for all laboratory data.
3. Laboratory data loaded to EQuIS production database.
4. RI phase – PFAS added as potential contaminate of concern.
5. Laboratory data quality validation procedures.
6. Background sample collection and evaluation procedures.
7. Sensitive environment survey radius increased from 500 feet to 1,000 feet.
8. Vicinity Map – increased radius from 500 feet to 1,000 feet.
9. Surface water sampling must represent the potential or known area of impact from the WDA.
10. Evaluation of existing soil covers – added confirmation sampling for excavation, grid spacing, sample locations, and iterative truncation process.
11. Groundwater investigation procedures.
12. Potable well sampling procedures.
13. Landfill & soil gas evaluation.
14. TCE indoor air immediate action levels.
15. RI summary review with Unit PM and Unit Supervisor.
16. Conceptual site model summary chart.
17. Notice plat recordation procedures.
18. Field procedures and sample collection techniques.
19. Laboratory Analytical Parameters.
20. Borrow soil location and sampling procedures.
21. Engineered waste disposal area cover system procedures.

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DEFINITIONS

The following definitions apply to this guidance:

1. **Contamination**: a contaminant released into an environmental medium that has resulted in or has the potential to result in an increase in the concentration of the contaminant in the environmental medium in excess of unrestricted use standards.

2. **Disposal**: the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste into or on any land or water so that the solid waste or any constituent part of the solid waste may enter the environment or be emitted into the air or discharged into any waters, including groundwaters (Ref. North Carolina General Statue (NCGS) 130A-290(a) (6)).

3. **Hazardous waste**: a solid waste, or combination of solid wastes, which because of its quantity, concentration or physical, chemical, or infectious characteristics may:
    a. Cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or
    b. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed (Ref. NCGS 130A-290(a) (8)).

4. **Inactive Hazardous Substance or Waste Disposal Site or Site**: any facility as defined in CERCLA/SARA which includes any site or area where a hazardous substance has been deposited, stored, disposed of, or placed or otherwise come to be located. The site includes the waste disposal area and any area containing media impacted by the waste disposal area.

5. **Industrial solid waste**: solid waste generated by manufacturing or industrial processes that is not hazardous waste (Ref. NCGS 130A-290(a) (13b)).

6. **Municipal solid waste**: any solid waste resulting from the operation of residential, commercial, industrial, governmental, or institutional establishments that would normally be collected, processed, and disposed of through a public or private solid waste management service. Municipal solid waste does not include hazardous waste, sludge, industrial waste managed in a solid waste management facility owned and operated by the generator of the industrial waste for management of that waste, or solid waste from mining or agricultural operations (Ref. NCGS 130A-290(a) (18a)).

7. **Pre-1983 landfill:** any land area, whether publicly or privately owned, on which municipal solid waste disposal occurred prior to 1 January 1983 but not thereafter but does not include any landfill used primarily for the disposal of industrial solid waste (Ref. NCGS 130A-290(a) (22a)).

8. **Property/Properties:** the parcel(s) that include the site/waste disposal area and anywhere contamination from the pre-1983 landfill has come to be located.

9. **Waste disposal area:** the estimated or actual waste disposal footprint derived from investigation activities regardless of the number of properties on which it is located.

RELATED LINKS & REFERENCE INFORMATION

Pre-Regulatory Landfill Unit Information
Pre-Regulatory Landfill Unit | NC DEQ

Division of Waste Management Resources
DEQ Risk-Based Remediation | NC DEQ
DWM Vapor Intrusion Guidance | NC DEQ
DWM Site Locator Tool | NC DEQ GIS Data (arcgis.com)
DWM Online Documents and Environmental Data | NC DEQ
Contaminated Property: Issues and Liabilities Brochure | NC DEQ

Division of Water Resources
Groundwater Standards | NC DEQ
Surface Water Standards | NC DEQ
NC Surface Water Classifications map | NC DEQ

United States Environmental Protection Agency (always consult the most current versions)
Quality System and Technical Procedures for LSASD Field Branches | US EPA
Region 4 Human Health Risk Assessment Supplemental Guidance, January 2014 Draft Final | US EPA
Laboratory Data Review for the Non-Chemist | US EPA
Risk Assessment Guidance for Superfund Volume I, Human Health Evaluation Manual (Part A) | US EPA
Superfund Residential Lead Sites Handbook | US EPA

PFAS Resources (always consult the sources for the most current PFAS Resources)
PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024 | US EPA
USEPA Designation of PFOA and PFOS as Hazardous Substances - May 2024
ITRC PFAS Sampling and Analysis - September 2023
ITRC Sampling Precautions and Laboratory Analytical Methods for PFAS - July 2022
USEPA Multi-Industry PFAS Study - September 2021

INTRODUCTION

The Pre-Regulatory Landfill Unit (Unit) was established in 2007 to address pre-1983 non-industrial landfills and dumps (landfills and dumps that ceased accepting waste prior to January 1, 1983). These landfills and dumps are unlined waste disposal areas (WDA) that are not subject to the North Carolina Department of Environmental Quality (DEQ) Solid Waste Management post-closure regulations administered by the Solid Waste Section (Title 15A North Carolina Administrative Code (NCAC) 13B). The legislation passed in 2007 established funding for remedial investigations (RI) and risk based remedial action plans (RAP) at these sites. The RI and risk-based RAP work activities are completed by Professional Engineering firms (Contractors) under contract with DEQ.

The Unit also manages a Local Government Reimbursement Program for certain eligible activities. Local governments may conduct RI activities in accordance with this guidance document including subsequent amendments and editions and request reimbursement of assessment expenses if the activities and costs are pre-approved by the Unit and comply with statutory requirements. *Guidelines for the Local Government Reimbursement Program* are outlined in Attachment 1.

The RI phase for each pre-1983 landfill is initiated by obtaining property access permission for DEQ staff, Contractor staff and U.S. Army Corp of Engineers (USACE) staff. Once property access permission has been obtained, an initial site visit is performed by the Unit PM, the Contractor PM, and Contractor staff personnel who will be performing field work.

Typical RI activities include collecting receptor information, identifying all potential sensitive environments, performing a geophysical survey to delineate the edge of the WDA, soil borings and/or test pits to confirm the extent of waste, and media sampling (groundwater, surface water, soil, sediment, surface vapor screening and subsurface landfill and soil gas) to identify and delineate the extent of contaminants of concern. These RI activities are planned based on historical information available in the Unit's records, risks posed by current site conditions, and any pending redevelopment plans. If needed, access permission will be obtained from the North Carolina Department of Transportation (NCDOT) to install borings in the NCDOT right-of-way.

The Contractor PM must submit a work plan, cost estimate and proposed schedule for review and approval by the Unit PM prior to implementation. Additional information regarding general task order management protocol is available in the *Pre-Regulatory Landfill Program Contract Task Management Guidance*, which can be found in Attachment 2.

After the RI is complete, the next step is the remedial design (RD) phase. The Contractor PM will prepare a draft RAP based on the contaminants of concern, topography, and sensitive environments for review by the Unit. The draft RAP will be made available for public comment prior to final approval and implementation. If significant public interest exists, a public meeting and/or informational session may be held. Contractors may need to provide technical and administrative support for public meetings and informational sessions.

Note: Due to the wide range of conditions encountered at pre-1983 landfill sites, these guidelines will not address every conceivable situation.

DOCUMENT FORMATTING AND SUBMITTAL REQUIREMENTS

All documents should be submitted electronically in PDF format unless otherwise specified by the Unit PM. Laboratory data must be submitted in PDF format with each report and electronically according to the DEQ Electronic Data Deliverable (EDD) template for upload to the EQuIS Database. All laboratory data must be uploaded to the EQuIS production database by the Contractor PM. The associated cover letters, appendices, and signed and notarized certifications should be included with the document as one PDF. Company logos may be used on the report cover page, but company logos and file names cannot be in the text of the report including headers/footers and figures. Documents may be e-mailed, but if they are large then a file-sharing system may be used. Electronic documents should not be protected or encrypted with passwords. Any paper submissions to the Unit should be double-sided (except for figures, tables, and color photographs).

The Contractor PM shall perform a complete review of all draft reports to identify all errors and omissions prior to submitting to the Unit PM for review and is expected to make requested revisions. The Contractor PM should not make report revisions that are not requested by the Unit PM unless the Contractor identifies a reporting error.

All reports should be submitted in accordance with the following:

1. Summarize methods and results and do not include conclusions or recommendations.
2. Sequentially numbered sections that reflect each task in the task order.
3. Letter size paper (8.5 x 11 inch) and ledger (11x17) if approved by Unit PM.
4. Font size 9 or greater for all text in documents, tables, and figures.
5. Font size must remain 9 or greater after conversion to PDF.
6. Submittal date.
7. Name of the pre-1983 landfill.
8. Identification number of the pre-1983 landfill.
9. Approved task order identification number.
10. Summary of any required variances from the approved work plan (Contractor must seek Unit pre-approval).
11. Copies of all Contractor field notes and waste manifests.

Field notes include but are not limited to, soil boring logs, equipment calibration logs, and water sample collection field sheets. All abbreviations and symbols used for field notes must correspond to the requirements as outlined in the *Pre-Regulatory Landfill Program Contract Task Management Guidance*, which can be found in Attachment 2.

Report appendices should not include correspondence with the Unit relative to contracting and task orders, but may include the following:

1. Photographs.
2. GPS coordinates.
3. Site survey plat.
4. Soil boring and well construction logs (digital and in diagram form).
5. Field notes.
6. Geophysical survey.
7. Laboratory analytical reports.

All site reports are stored with other site records electronically in an online document management system (Laserfiche). Instructions for accessing the Laserfiche system are provided in a link at the front of this document.

REPORT CERTIFICATION REQUIREMENTS

The following certification statement with the notarized signature of the Contractor PM, must be included on each RI report and RAP report: "I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete."

Additional certification by relevant professionals is required if applicable. Any work that would constitute the "practice of engineering" as defined by NCGS 89C shall be performed under the responsible charge of, and signed and sealed by, a professional engineer licensed in the state of North Carolina. Any work that would constitute the "public practice of geology" as defined by NCGS 89E shall be performed under the responsible charge of, and signed and sealed by, a geologist licensed in the state of North Carolina.

SURVEY CERTIFICATION REQUIREMENTS

All surveys must comply with and be signed and sealed by a surveyor licensed in the state of North Carolina in accordance with NCGS 47-30 (plats and subdivisions; mapping requirements). In addition to NCGS 47-30, Appendix A, *Instructions for Preparing a Notice Plat for Recordation*, outlines the requirements for preparing a pre-1983 landfill Notice Plat and the associated recordation process.

REMEDIAL INVESTIGATION PHASE

The lateral and vertical extent of contamination must be delineated to unrestricted use or natural background concentrations in each area of concern for all contaminated media (soil, groundwater, sediment, surface water, and vapor) during the RI. The DEQ Risk Calculator may also be used to calculate cumulative risk for residential/unrestricted use at the perimeter soil sampling locations to satisfy delineation of soil contamination. However, at some sites, natural background concentrations (metals only) and anthropogenic background concentrations (PFAS, PAHs, PCB and/or Dioxins) or sample reporting limits may serve as delineation endpoints, provided that the laboratory's reporting limits are not elevated more than ten times the laboratory's MDLs, and/or published average MDLs for the method/analyte.

Subsequent delineation work phases must include all CERCLA hazardous substances detected (including those with qualified estimated concentrations), unless the contaminant concentration is proven through sampling to be the result of a naturally occurring condition, area wide anthropogenic background, or the contaminant is a common laboratory contaminant detected in concentrations below that detected in the method blank.

Per-and polyfluoroalkyl substances (PFAS) are now designated as hazardous substances by the United States Environmental Protection Agency (USEPA), so these compounds should be considered as potential contaminants of concern at a site when conducting a RI. PFAS are a complex group of chemicals found in the environment worldwide due to their widespread use in in, but not limited to, aerospace, automotive, construction, textile and waterproof fabrics, paper and packaging, metal plating and etching, semi-conductor and electronic industries, food packaging, and non-stick coatings, and in firefighting foams. Sampling and analytical methods, fate and transport properties and toxicity data are evolving rapidly. The RI of sites with known or potential PFAS should aim for a comprehensive characterization of ***all known and potential*** PFAS sources and analytes. The lack of documentation of PFAS use is not sufficient to rule out a site from further investigation, because PFAS chemicals are generally not listed on Safety Data Sheets or other product inserts. See the Interstate Technology & Regulatory Council (ITRC) PFAS sampling and analytical methods fact sheet and supplemental information on PFAS assessment from USEPA that can be accessed using the links provided at the front of this document.

Note: *Contaminants* such as 1,4-Dioxane and several short-chained PFAS are highly water soluble and tend to travel with minimal degradation in groundwater. Concentrations of these chemicals, time since the release, groundwater flow velocity, local topography, preferential groundwater flow pathways (such as geologic fractures and foliations or subsurface utilities) and likelihood of aerial deposition (e.g., previous presence of a smokestack or fume hood at facility) should be considered when determining the distance from the property that may impact receptors.

Remediation to below the practical quantitation limits or site-specific natural background concentrations (for metals only) is not required. Final remediation goals should be based on acceptable risk and can be determined using the DEQ Risk Calculator and Risk Calculator User Guide (provided in a link at the front of this document).

At any time during the remedial investigation, the Unit must be notified within 24 hours of discovery, or as soon as feasible, of the following:

1. **Contamination that has migrated beyond the source property**
2. **Imminent Hazards**
   a. **Uncontrolled access by children to the contaminated media**
   b. **Detections in water supply wells, or**
   c. **Site contaminant vapors detected within occupiable structures**
3. **Threat to sensitive environment**

The notification can be by phone or email and any notification delays should be shown to be unavoidable.

The Contractor PM will submit a work plan, cost estimate, and proposed schedule to perform RI phase activities for assigned sites. Each work plan should describe the plans for gathering data to build the conceptual site model (CSM). The Unit PM will review the submitted packet and will request edits to the packet or will provide approval of the proposed RI phase work activities. Requested edits to work plans and cost estimates (identifying personnel and materials) addressing the scope of work are typically delivered to the Unit PM within ten business days of receipt. The work plan and cost estimate must be based on information gathered during the initial site visit. Prior to conducting RI activities, the proposed work plan and cost estimate must be pre-approved by the Unit PM. Assign a task order number that increases sequentially for each specific activity, and each task order should be authorized, completed, and invoiced separately.

Generally, the pre-1983 landfills included in the Unit inventory have location-receptor summary reports on file, Contractor PMs should ensure completed work is not duplicated.

Required field procedures and sample collection techniques are outlined in Appendix B, *Field Procedures and Sample Collection Techniques*.

Information pertaining to asbestos containing materials, required handling protocols and notification procedures are provided in Appendix C, *Asbestos Containing Material*.

All soil and water samples must be submitted to either a laboratory certified under 15A NCAC Subchapter 02H .0800 or a laboratory currently part of the USEPA Contract Laboratory Program and analyzed in accordance with the requirements outlined in Appendix D, *Laboratory Analytical Parameters*. Laboratories analyzing vapor samples should have NELAP certification.

The Unit prefers that investigation-derived waste (IDW) be disposed of off-site at appropriate disposal or recycling facilities. In residential and public use areas, IDW will require off-property management unless it meets unrestricted use levels and disposal permission has been granted by the property owner. IDW cannot be transferred and discharged to another area of the property.

With Unit concurrence drill cuttings, fluids, muds, soils, and sampling purge water may be discharged or stored in the area of contamination from which it was derived and are not subject to RCRA permitting as long as the material:

1. Stays on site and remains in the contaminated area.

2. Is secured.
3. Does not increase the spread of contamination or concentrations in a particular medium.
4. Does not cause mobilization of contaminants.
5. Does not introduce contamination to uncontaminated soil or groundwater.
6. Does not cause an increase in contaminant concentrations.

The completion of the RI phase should establish the following:

1. The lateral and vertical extent of contamination in each area of concern for all contaminated media (soil, groundwater, sediment, surface water and vapor) delineated to unrestricted use standards.
2. Identify potential exposure pathways and receptors that may currently be, or may become, exposed to contamination.
3. Collect sufficient sampling data to support inclusion or elimination of chemicals at concentrations within naturally occurring or anthropogenic background levels, and to determine a cleanup level.
4. Characterize site conditions to address data gaps and refine the CSM to support the proposed remedy for each contaminated medium.

Once the Unit PM and the Contractor PM are satisfied that the RI phase is complete, the Contractor PM will request a meeting with the Unit PM and Unit Supervisor to review the site and ensure the criteria listed are complete. After the meeting, if all the criteria are complete, the Contractor PM will receive a request to submit a RI summary report using the template in Appendix E, *Remedial Investigation Summary Report Template*.

LABORATORY DATA QUALITY VALIDATION

A thorough review of each laboratory report should be conducted by the Contractor PM to ensure quality control standards have been met. Standard Operating Procedures (SOPs) should be requested from each laboratory so the process of analysis, quantitation limits (QLs), and quality control procedures are clear. Additionally, the Contractor PM must be familiar with each analytical method to understand the method requirements and identify if the laboratory meets those requirements.

VALIDATION STATEMENT

1. The Contractor PM must confirm the following items are included in each laboratory report before submitting to the Unit PM and provide a statement that the sample results are valid for the intended purpose.

CHAIN OF CUSTODY (COC)

1. Compare the date and time of sample collection with the date and time of analysis to ensure the samples were analyzed within the specified holding time.

2. The COC form must be completed and signed. Notes concerning what happened to the sample from the time of collection to the time the sample was received at the laboratory should be included in the COC.

LABORATORY CERTIFICATION

1. Laboratory certification should be in accordance with 15A NCAC 2H, USEPA contract laboratory, or NELAP certification for vapor samples. The laboratory certification numbers must be included in the laboratory report.

CASE NARRATIVE

1. A case narrative must always be included in a laboratory report, even if the laboratory did not encounter any issues. Any significant receipt, analysis, or quality assurance/quality control (QA/QC) problems should be documented in this section, and specifically:
    a. Whether the holding times were met or exceeded.
    b. Whether samples were received in good condition and at the required temperature/preservation.
    c. Discussion of possible reasons for any quality control criteria outside acceptance limits.
    d. Justification for any deviation from the methods, additional sample preparation, sample dilution, and analytical problems not rectified.
    e. Observations regarding any occurrences that may affect sample integrity or data quality.

QUALIFIERS

1. Qualifiers are laboratory codes that provide comments on the data. Since each laboratory has its own qualifier nomenclature, the laboratory report should provide a description of the qualifiers used.

2. Careful attention should be given to low-biased analytical results, which indicate the results of a specific analyte are likely to be underestimated. Low-biased data may be used to show an exceedance of a regulatory standard or acceptable risk value. However, low-biased data may not be used to show that a regulatory standard or acceptable risk value **has not** been exceeded. In these cases, resampling may be necessary. In general, high-biased data are acceptable for use.

METHOD BLANK (MB) ANALYSIS

1. The MB should indicate there is no detection for any analytes. An analyte detection suggests potential cross-contamination. If the detected analyte in the MB is also detected in the sample, a more in-depth review may be needed.

2. Review surrogate analytes associated with the MB to ensure they are within the established control limits.

LAB CONTROL SAMPLE (LCS)

1. A LCS consists of ultra-pure water spiked with known concentrations of target analytes. The LCS tests whether the method can reliably measure the concentration of a target analyte when that analyte is spiked into an interference-free medium. To verify calculations are done correctly, perform a spot check using the equation below; where the spike concentration is the "true value" and the LCS result is the "actual value".

   (Actual Value ÷ True value) x 100 = % Recovery

2. Compare the LCS % recovery values to the established % recovery limits. Highlight any analyte that exceeds this range and compare it with the sample. If there is a low-biased qualifier for a detected analyte, resampling may be necessary.

3. Review surrogate compounds associated with the LCS to ensure the calculations are done correctly and the % recovery is within the established reporting limits.

MATRIX SPIKE (MS)/MATRIX SPIKE DUPLICATE (MSD)

1. A MS sample is an environmental sample that has been spiked with known concentrations of target analytes. A matrix spike duplicate (MSD) is a split sample of the MS and is used to assess the precision of a method in that sample matrix. Since the MS/MSD analyses are performed on batches of samples, the sample selected to spike may be one on which a HRE is performed, one on which an HRE is not performed but within the same project, or outside the project. A MS/MSD performed on a sample evaluated in the HRE has the most relevance, within the same project may have some relevance, and outside the project may have little to no relevance.

2. To verify calculations are done correctly, perform a spot check using the equation below, where the spike concentration is the "true value" and the MS/MSD result is the "actual value".

   (Actual Value ÷ True value) x 100 = % Recovery

If an analyte was detected in the MS/MSD sample, the pre-spike concentration must be subtracted from the MS and MSD results to calculate the actual value before calculating the % recovery of each. *Note: Use the absolute value of the difference.*

Example: Analyte in sample = 1.3 µg/L, MS Spike Conc. = 40 µg/L; MS Result = 55.9 µg/L, thus:

MS % Recovery = [(55.9 – 1.3) ÷ 40] x 100 = 137%

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 4310609 4310610

Parameter	Units	92714708012 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
1,1,1-Trichloroethane	ug/L	ND	20	20	30.9	28.7	154	143	60-140	7	M1
1,1,2,2-Tetrachloroethane	ug/L	ND	20	20	26.9	24.9	135	124	60-140	8	
1,1,2-Trichloroethane	ug/L	ND	20	20	29.0	26.0	145	130	60-140	11	M1
1,1-Dichloroethane	ug/L	ND	20	20	29.8	27.9	149	140	60-140	7	M1
1,1-Dichloroethene	ug/L	ND	20	20	30.2	28.5	151	142	60-140	6	M1
1,2,4-Trichlorobenzene	ug/L	ND	20	20	25.7	25.6	128	128	60-140	0	
1,2-Dibromo-3-chloropropane	ug/L	ND	20	20	29.2	27.0	146	135	60-140	8	M1
1,2-Dibromoethane (EDB)	ug/L	ND	20	20	29.8	27.2	149	136	60-140	9	M1
1,2-Dichlorobenzene	ug/L	ND	20	20	27.8	27.4	139	137	60-140	1	
1,2-Dichloroethane	ug/L	ND	20	20	29.3	27.1	146	136	60-140	8	M1
1,2-Dichloropropane	ug/L	ND	20	20	30.0	27.2	150	136	60-140	10	M1
1,3-Dichlorobenzene	ug/L	ND	20	20	27.3	27.0	136	135	60-140	1	
1,4-Dichlorobenzene	ug/L	ND	20	20	26.9	26.3	134	132	60-140	2	
2-Butanone (MEK)	ug/L	1.3J	40	40	55.9	49.2	137	120	60-140	13	
2-Hexanone	ug/L	ND	40	40	63.2	55.5	158	139	60-140	13	M1
4-Methyl-2-pentanone (MIBK)	ug/L	ND	40	40	58.5	51.0	146	127	60-140	14	M1

3. Compare the MS % recovery and MSD % recovery values to their respective established % recovery limits. Highlight any analyte that exceeds this range to compare it with the sample.

   Results of the MS/MSD are used to measure precision in the analysis by calculating a relative percent difference (RPD). Ideally, RPD values are below 30%; however, factors such as sample heterogeneity or samples with high contaminant concentrations can affect these results. Further evaluation is necessary if RDP values are greater than 30%. To verify RPD calculations are done correctly, perform a spot check for the RPD using the equation below. *Note: Use the absolute value of the difference.*

   [(MS – MSD) ÷ Mean of MS and MSD] x 100 = RPD

   Example: MS = 29 µg/L and MSD = 26 µg/L; RPD = ((29-26) ÷ [(29+26)/2)]) x 100 = 11%

4. Review surrogate compounds associated with the MS/MSD to ensure the % recoveries are within the established reporting limits and the calculations for the RPD are correct.

DILUTIONS

1. Make sure dilutions have the appropriate qualifier and the reporting limit has been adjusted. Sometimes a diluted analyte may be reported as “non-detect”. The reporting limit will be much higher than expected, and data may be of limited use.

ANALYTICAL RESULTS

1. After the QC data has been reviewed, the analytical results for the samples are evaluated. Surrogate results should be within the established reporting limits for each sample.

2. Compare the sample results to the QC data. MB, LCS, and MS/MSD results affecting detected chemicals should be qualified on the analytical result pages and mentioned in the Case Narrative. If the qualifiers do not pertain to the analyte(s) detected in the sample, the analytical results may be used. If there are qualifiers associated with detected chemicals, those data should be evaluated for useability.

LABORATORY DATA QUALITY VALIDATION INFORMATION

For further information regarding laboratory data review and data evaluation, the following documents may be used:

1. Laboratory Data Review for the Non-Chemist, United States Environmental Protection Agency, October 2014 (provided in a link at the front of this document).

2. 2) Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A, Chapter 5, Data Evaluation), United States Environmental Protection Agency, December 1989 (provided in a link at the front of this document).

GENERAL REQUIREMENTS FOR REMEDIAL INVESTIGATION AND REMEDIAL ACTION PLAN WORK PLANS AND REPORTS

The following items may need to be included in RI and RAP work plans and reports.

1. All work proposals must include a description of:
    a. Equipment and personnel decontamination procedures.
    b. Measures that assure the health and safety of nearby residential and business communities by demonstrating that they will not be adversely affected by activities.

2. All work proposals, cost estimates, reports and other relevant correspondence submitted to the Unit PM must include the following:
    a. Name of the pre-1983 landfill.
    b. Pre-1983 landfill identification number.
    c. Task order number.
    d. Date(s) samples collected.

3. Before task activities begin, current site conditions must be photographed. The photographic record must include areas or objects that may be disturbed or affected. Restoration efforts and noteworthy items encountered during RI and RAP task activities must be documented. After RI and RAP task activities are complete, a photograph is required to document restoration. If pre-disturbed conditions are not documented to support complete restoration, the Contractor will be held responsible for all associated restoration expenses. Photographs must be submitted with a point of reference description in the report for the task. Unit PMs may identify specific photographs to include in reports.

4. The Contractor PM must ensure all personnel, including subcontractor personnel, engaged in intrusive field activities at the site comply with OSHA required health and safety training for hazardous waste sites and site health and safety plans. The Contractor PM must also ensure that personnel in the field are qualified to identify contaminated material and landfill waste.

5. All GPS coordinates must be submitted in the following format:
    a. Latitude/longitude.
    b. Decimal degrees to the fifth order.
    c. Differentially corrected.
    d. WGS84 format.
    e. Sample ID (i.e. monitoring well, soil gas probe, and etc.).
    f. Tabulated as an appendix in the RI Summary Report.

6. All supporting figures and maps should be drawn to scale and include, at a minimum, the following:
    a. Bar scale (in feet and miles).
    b. Legend with an explanation of all symbols.
    c. North arrow.
    d. Background topographic contours (light grey shading).

Note: Multiple maps or figures may be required to adequately display information.

7. All professional work (reports) must be signed and sealed by the appropriate State licensed professionals (geologist and engineers). A single document may require the signature and seal of more than one professional.

DEVELOPING THE CONCEPTUAL SITE MODEL

Evaluating current and potential future site related risk requires the development of a CSM where the exposure pathways and receptors are known. The level of detail in the CSM should match the complexity of the site and receptor impact (risk) from contaminated media. A detailed and complete CSM is the basis for selecting an appropriate and effective remedy for a site. The following RI activities include elements of a CSM that demonstrate site conditions are well understood, and a risk-based remedy will be protective of all current and potential future receptors.

Contamination extent, fate and transport, should be well understood to predict the ultimate extent of contamination. A risk-based remedy relies on the placement of institutional controls on all properties affected by the contamination. Adequately predicting the maximum extent of a groundwater contaminant plume and demonstrating a groundwater contaminant plume is predictable, stable or shrinking over time along with delineating hazardous/explosive vapors to unrestricted use standards is critical for proper placement of institutional controls.

The CSM flow chart displayed in Appendix F, *Conceptual Site Model*, must be complete and reflective of the site. Submit the CSM flow chart with each report showing completed activities and the completed CSM must be included in the RI summary report. The same figure should be updated and included in all subsequent report submittals to show the final CSM for the site.

REMEDIAL INVESTIGATION ACTIVITIES

Data for each tasked item must be submitted to the Unit in a report.

REMEDIAL INVESTIGATION HISTORICAL USE RESEARCH

8. Provide a summary of historical operations including, but not limited to:
    a. A chronological listing of owners and operators.
    b. Written documentation and interviews with individuals who have historical knowledge to provide verification of time operated.
    c. Types of waste received.
    d. Other relevant information about disposal operations.
    e. Current site use.
    f. Surrounding property use.
    g. Street address of site.
    h. Records, if available, indicating large quantities of industrial waste (more than expected at a municipal solid waste landfill for the time of operation).
    i. Known or suspected areas of hazardous substance disposal (hot spots).

Important: If research indicates that paragraph 9(h) or 9(i) may be of concern at the WDA, contact the Unit. Waste characterization of exposed wastes or hot spots may be required prior to any other investigation activities.

9. Provide aerial photography and Sanborn Fire Insurance maps, if available, showing:
    a. WDA conditions from pristine land.
    b. WDA during the time of active operation.
    c. WDA present conditions.

10. Provide copies of all non-financial encumbrances (easements and rights-of-way) and leases for the site.

REMEDIAL INVESTIGATION SITE LOCATION

11. Collect geographic coordinates (GPS) for the following:
    a. WDA entrance.
    b. Site entrance.
    c. Points delineating the suspected perimeter of the WDA.

REMEDIAL INVESTIGATION REPORT INFORMATION

12. Provide a figure titled, “USGS Topographic Location Map,” using the current published United States Geological Survey topographic map for the subject area that includes the following:
    a. WDA estimated perimeter.
    b. 500-foot radius from the estimated WDA perimeter.
    c. 1,000-foot radius from the estimated WDA perimeter.
    d. Maximum scale: 1” = 1,000’.

13. Provide a figure, titled "Vicinity Map," that includes the following:
    a. Property owner name, zoning classification, and property boundaries of property/properties containing the WDA.
    b. WDA estimated perimeter.
    c. Property owner name, zoning classification, and property boundaries of adjacent properties within 1,000 feet of the WDA perimeter.
    d. Roadways.
    e. Easements.

14. Provide a figure, titled "Surface Water Map," that includes the following information pertaining to surface water bodies within 1,000 feet of the estimated WDA perimeter:
    a. WDA estimated perimeter.
    b. Locations of surface water bodies:
        i. Streams (ephemeral, intermittent, and perennial).
        ii. Division of Water Resources Index number.
        iii. Lakes.
        iv. Storm ditches.
    c. Name and class of each water feature.
    d. Flow direction of each water feature.

15. Provide a figure, titled "Water Supply Map," that includes the following water supply sources within 1,000 feet of the estimated WDA perimeter:
    a. WDA estimated perimeter.
    b. Water supply wells.
    c. Water supply springs.
    d. Surface water intakes.
    e. Distance in feet to the WDA perimeter.

16. Provide a table, titled "Water Supply Table," that includes the following information cross referenced to the "Water Supply Map":
    a. Current water source owner.
    b. Current water source user (if other than water source owner).
    c. Address and Parcel Identification Number (PIN) of water source.

Note: water sources should be identified using available maps, online resources, local utility offices and by visual inspection.

17. Provide a figure, titled "Site Map," (multiple maps may be used) that includes the following:
    a. WDA estimated perimeter.
    b. Accessibility issues.
    c. Existing monitoring wells.
    d. Paved areas.
    e. Landscaped areas.
    f. Type and extent of ground cover.
    g. General surface conditions.
    h. On-site structures.

i. Sumps.
j. Septic systems.
k. Storm water conduits.
l. Above ground and underground utilities (electric, water, and sewer).
m. Non-financial encumbrances (easements and rights-of-way).
n. Leases.
o. Surface or exposed waste.

18. Provide a summary of a sensitive environment survey of the WDA and areas located within 1,000 feet of the estimated WDA perimeter. For each sensitive environment (as listed in Appendix G, *Sensitive Environment Survey*) identified, the following is required:
    a. Provide a summary of potential effects to sensitive environments identified for RAP options.
    b. Tabulate results to include the following:
        i. Contacts.
        ii. Responses.
        iii. Dates and types of communication.

19. Provide a figure, titled "Sensitive Environment Map," that includes the delineated boundary of all sensitive environments across all properties containing, all or a portion of, the WDA and any additional property within 1,000 feet of the estimated WDA perimeter. The map should be prepared using the contacts provided in Appendix G.

20. Conduct and provide a summary of a geophysical survey delineating the horizontal extent of the WDA, including a 25-foot buffer beyond the estimated WDA perimeter using single frequency methods on a 100-foot grid. Describe any on-site features that may cause interference with the survey (i.e. railroad, electric fence, etc.).

21. Provide a figure, titled "Geophysical Survey Results Map" that includes the following:
    a. WDA perimeter determined visually and by the geophysical survey.
    b. 25-foot buffer beyond the estimated WDA perimeter.
    c. Point locations where survey grade GPS data delineating the WDA boundary were collected.

22. Provide a description of local/regional geologic and hydrogeologic conditions.

CONTAMINANT DELINEATION REMEDIAL INVESTIGATION ACTIVITIES

Prior to initiating invasive field work activities, the Contractor PM must contact the North Carolina One-Call Center (NC811) to request the identification of all publicly owned underground utilities. The Contractor PM must also ensure that publicly and privately-owned utilities are not damaged during invasive field work activities.

The clearing of vegetative material to enable access to proposed sampling points should be minimized. Hand tools must be used for clearing unless justification for use of heavy equipment is provided to and approved by the Unit PM.

All contaminant delineation work plans and reports must provide a summary of the planned and actual handling of investigation-derived wastes.

BACKGROUND SAMPLE COLLECTION

Naturally occurring or anthropogenic substances can be present in the environment and not associated with site conditions, actions, or activities. In North Carolina, several naturally occurring metals are prevalent in soil, sediment, groundwater and surface water. In addition, anthropogenic (human-made) background contaminants can include PFAS, dioxins, polycyclic aromatic hydrocarbons (PAHs), and/or polychlorinated biphenyls (PCBs). Indoor air may have non-site-related contaminants detected indoors or in outdoor ambient air, so establishing background conditions is important for all media.

Remediation of contaminants below naturally occurring or anthropogenic background concentrations is not required, even if the background levels are higher than State or Federal standards. However, the Unit does not allow comparison with published regional background values alone.

Sufficient sampling near the site should take place to quantify these potential contributions to the site in a legally defensible manner. Statistics play a major role in establishing background concentration levels, and methods vary widely in their degree of complexity, but in all cases, sample concentrations that are obvious outliers should not be used to establish background concentrations.

The *USEPA Region IV January 2014 Draft Final Human Health Risk Assessment Supplemental Guidance* (provided in a link at the front of this document) has recommended that two times the average site-specific background concentration can be used to eliminate contaminants of concern.

In vapor-intrusion investigations, identifying background contamination is especially complicated, for several reasons:

1. Some background contaminants are present in most structures.
2. Background concentrations can vary by orders of magnitude over the course of a day.
3. Some commercial/industrial facilities may have Permissible Exposure Limits under OSHA that may be much higher than vapor-intrusion limits, making indoor sources potentially huge in occupational settings.

For these reasons, the list of analytes during indoor sampling should be restricted to those measured in soil gas, including their daughter products. Care should be taken to rule out indoor air contaminants that may not be attributed to the site. An occupant survey and site walkover should identify known and potential indoor sources. Lab, container and ambient air contaminants should be ruled out. Sub slab soil gas samples should be collected concurrently with indoor air samples to identify inconsistent attenuation ratios.

When determining background levels for any media, the methodology used to eliminate background compounds or determine cleanup levels for site contaminants that are also present as background should be well-documented in reports submitted to the Unit. The risk of the background chemicals contributing to the site should be included in the initial risk calculation, and an unacceptable risk due to the contribution from background levels should be reported to the Unit for awareness.

Site-specific soil, sediment, surface water, and groundwater samples must be collected and analyzed in accordance with Appendix B, *Field Procedures and Sample Collection Techniques* and Appendix D, *Laboratory Analytical Parameters* to establish natural metals concentrations and area-wide anthropogenic background. Because natural metals concentrations are highly variable, the Unit recommends a minimum of 12 background soil samples for each site.

The laboratory PQL is a scientific standard pursuant to G.S. 150B-2(8a)(h). Substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the PQL. For contaminants with an existing standard that is less than the laboratory's PQL, the PQL is the State standard per 15A NCAC 02L .0202(b1) when the analytical methods specified in Appendix B are used. In these cases, the laboratory's PQL cannot be elevated more than 10 times the Method Detection Limit (MDL) or published MDL for a contaminant.

NATURAL SOIL METALS CONCENTRATIONS

23. Collect a minimum of 12 site-specific background soil samples at locations that are not impacted by the landfill and away from roadways, railways, parking areas and other potential sources of contamination. Background soil samples should be collected from 0 to 12 inches below ground surface.

AREA-WIDE SOIL ANTHROPOGENIC BACKGROUND DUE TO AIRBORN RELEASES

24. Background soil samples should also be collected at any site having known or suspected PFAS, Dioxin, PAH, and/or PCB contamination to establish area-wide anthropogenic background levels. These samples should be collected at various distances from the site. If the results indicate over a large area, no increase in concentration toward the site and after any obvious outliers are removed, the upper end of the range of concentrations detected (or preferably the 95% UCL) can be used as the anthropogenic level.

NATURAL GROUNDWATER METALS CONCENTRATION

25. Install permanent groundwater monitoring well(s) to establish natural background concentrations of metals. The monitoring well(s) should be installed upgradient of the WDA and sampled a minimum of four times to generate an average concentration for each analyte.

    Arsenic and 1,2-dichloropropane are sometimes found in groundwater due to normal application of pesticides. Other pesticides, if applied properly, are not as commonly found in groundwater due to their lower solubility. Many former agricultural properties, however, will have levels of pesticides or nitrates remaining in soil due to routine application. Federal and state laws generally exempt concentrations associated with normal application of agricultural chemicals. Overuse and improper use do not qualify for that exemption. If the presence of agricultural chemicals can be shown to be due to normal application, their remediation is not required by the Inactive Hazardous Sites Response Act (IHSRA) and by most state and federal remediation law.

SURFACE WATER AND SEDIMENT BACKGROUND CONCENTRATION

26. Collect surface water and sediment samples upstream of the WDA to establish natural or anthropogenic background concentrations. If contamination is found upstream of the site in concentrations greater than the downstream concentrations, downstream delineation may not be necessary.

BACKGROUND SAMPLE RESULTS

27. Provide a figure(s), titled "Background Sample Results Map" that depicts the location of all background samples.

28. Provide a table, titled "Background Sample Results Table," that summarizes the results of collected background soil, sediment, groundwater, and surface water samples. Show the average concentration and 2x the average concentration for each analyte. The results are not compared to any standards, but instead are used to establish natural background concentrations at the site and to assist with establishing remediation goals.

WASTE DISPOSAL AREA DELINEATION/THICKNESS AND SURFACE WASTE CHARACTERIZATION

29. Determine the perimeter and thickness of the WDA by completing the following:
    a. Advance hollow stem auger (HSA) borings or other methods (test pits) around the perimeter of the WDA as depicted by the geophysical survey and/or historical information. The distance between borings is site specific considering property boundaries, utilities, steep slopes, and other items where a more accurately characterized Site boundary will enable a more effective remedial action plan.
    b. If waste is not encountered in the initial boring, offset additional borings in the direction of the estimated WDA until waste is encountered.
    c. If waste is encountered in the initial boring, offset additional borings in the direction away from the estimated WDA until no waste is encountered.
    d. Extend borings a minimum of ten feet below ground surface (bgs) unless waste is encountered (delineation of boundary).
    e. Extend borings along at least two perpendicular transects through the WDA to determine the thickness of the WDA. The size and shape of the WDA should be considered when determining the total number of borings needed to provide a general waste volume.
    f. Collect GPS coordinates for the center of the delineated WDA.

30. Provide a figure, titled "WDA Delineation," that includes the following:
    a. Unique identifier for each boring.
    b. Locations of all borings.
    c. Perimeter of WDA based on borings or other method.
    d. Location and approximate volume of surface waste.
    e. Location and approximate volume of buried waste.
    f. Parcels and PIN containing waste and/or contaminated media.
    g. Acres of waste determined by the delineated boundary.

h. Acres for all parcels containing waste and/or contaminated media.

31. Provide a table, titled "WDA Delineation," that includes the following:
    a. Unique identifier for each boring.
    b. Total depth of each boring.
    c. Depth to waste from the surface.
    d. Waste type (if applicable).
    e. Lithologic description based on Unified Soil Classification System.

32. Characterize surface waste by completing the following:
    a. Identify and describe the location, volume and type of surface waste related to each parcel containing the WDA.
    b. List tires and white goods separately.
    c. Identify and describe the types of physical hazards found at the WDA.
    d. Describe the potential mobility of surface waste related to erosional features, stormwater channels, streams, flooding etc.

33. Provide a figure, titled "Location of Surface Waste," that includes the location of surface waste on each parcel containing the WDA.

ABOVE GROUND VAPOR SURVEY

For larger sites with consistent terrain and no known hot spots, a larger grid spacing could be used.

34. Evaluate the potential for above ground vapors by collecting landfill gas readings across the WDA on a 50-foot grid using field instrumentation. Reference the geophysical survey or the WDA delineation maps for the location and extent of the WDA. At each sampling point, collect measurements in accordance with the following:
    a. Instruments must run for at least 30 seconds or as specified in the manufacturer's instructions before recording the measurement.
    b. Collect measurements no more than six inches above the ground surface.
    c. Do not perform the above ground vapor evaluation on rainy or windy days or during a period of changing barometric pressure.
    d. Record background measurements upwind of, but in close proximity to the WDA.
    e. Collect the following parameters at each sampling point and report each parameter in the units as outlined in Appendix B:
        i. Methane.
        ii. Oxygen.
        iii. Carbon dioxide.
        iv. Hydrogen sulfide.
        v. Total volatile organic compounds.
    f. Collect the following parameters hourly during the above ground vapor evaluation and report each parameter in the units as outlined in Appendix B:
        i. Barometric pressure.
        ii. Ambient temperature.
        iii. Humidity.

g. Place temporary flagging (i.e. wooden stakes) at all grid points with detectable concentrations of any of the contaminants listed in paragraph 34e.
h. Recheck each of the grid points with detectable concentrations of any landfill gas before leaving the WDA.
i. Collect GPS coordinate data for all sampling points.
j. If any contaminants are detected, a second confirmation survey may need to be conducted on a later day.

35. Provide a figure, titled "Above Ground Vapor Survey," that includes the following:
    a. Unique identifier for each sampling node.
    b. Locations of all above ground vapor sampling points.
    c. Locations of background sampling points.
    d. Highlight, or otherwise designate, where contaminants of concern were detected.

36. Provide a table, titled "Above Ground Vapor Survey," that includes the following:
    a. Unique identifier for each sampling node.
    b. Field measurement results for all survey events as outlined in paragraph 34.

EVALUATION OF WDA EXISTING SOIL COVER AS THE PERMANENT SOIL COVER SYSTEM & CONFIRMATION SAMPLING FOR AREAS WHERE WASTE HAS BEEN REMOVED

Soil cover evaluation may be applicable for sites that meet specific criteria. If a site currently does not have trees covering the WDA, the thickness and quality of the existing soil cover could be considered. If grubbing activities are needed, the existing soil cover thickness and quality may not be evaluated due to potentially contaminating the soil during grubbing.

For an existing soil cover to qualify as the permanent soil cover, the existing soil cover must be a minimum of 12 inches thick, be free of any waste material, and meet unrestricted use standards.

37. Establish a 100-foot by 100-foot grid (roughly ¼ acre sectors) across the delineated WDA, subject property if the WDA has not been delineated, or excavation area where waste was removed. Do not extend the grids beyond the delineated WDA, subject property boundary, or excavation. Depending on the size of the excavation, the grid spacing may be reduced. Submit a figure to the Unit PM showing proposed sample locations and 25-foot grid lines in each grid as depicted in Figure 1 (Soil Cover/Confirmation Sampling Locations) for approval prior to initiating sample collection.

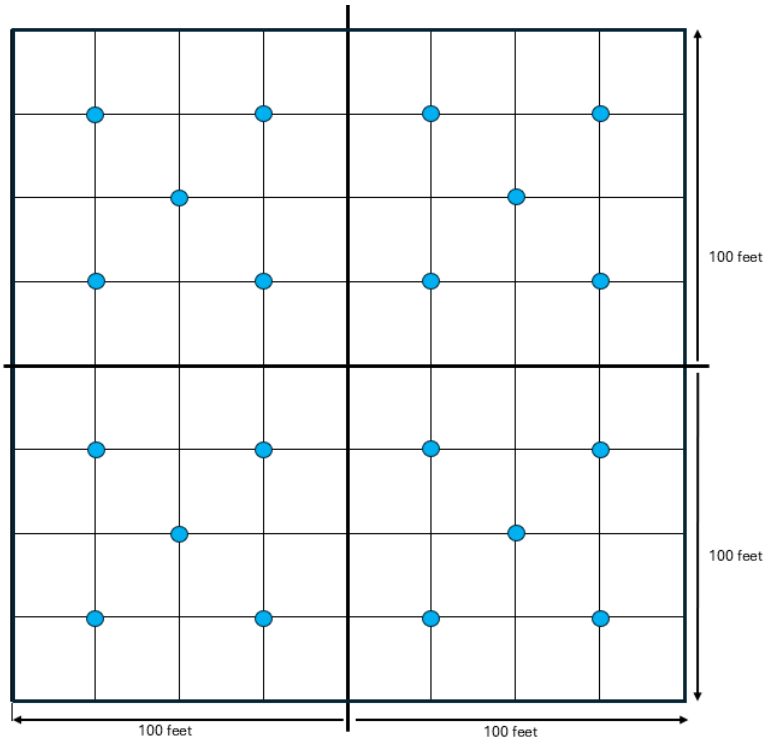

Figure 1: Soil Cover/Confirmation Sampling Locations.

The sample locations in each grid should be 25 feet in both directions from the grid intersection and one sample location in the center of the grid. If this is not possible, adjustments may be made in consultation with the Unit PM. Grids that are less than 10,000 square feet will need to include the same number of sample locations as a full grid and multiple contiguous grids may be combined to reach the maximum area of 10,000 square feet.

The composite soil sample should include five aliquots, one sample from each circle icon as shown in Figure 1. The discrete soil sample should be collected from the center circle icon of each 100-foot by 100-foot grid.

38. Collect soil cover or confirmation samples for laboratory analysis according to the following:
    a. The top 12 inches of soil should be sampled to determine if the existing soil cover can be used as a permanent soil cover over the WDA or if the excavated area is sufficient to meet unrestricted use standards. Each aliquot for the composite sample and each discrete sample should be collected from 0 inches to 12 inches bgs.
    b. The thickness of the existing soil cover over the WDA must be recorded at each sample location (composite and discrete) as depicted in Figure 1.
    c. If there is no existing soil cover over the WDA at the designated sample location, document the absence of an existing soil cover and collect a sample from the location for compositing or the discrete sample.
    d. In each grid, collect five aliquots, one from each circle icon as depicted in Figure 1 to create one composite sample per grid for analysis of metals (antimony, arsenic, barium, beryllium, cadmium, trivalent and hexavalent chromium, cobalt, copper, lead,

manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc), semi-volatile organic compounds, 1,4-Dioxane, ammonia, sulfate, nitrates, and nitrites, .

e. In each grid, collect one discrete sample from the center circle icon for analysis of volatile organic compounds.
f. Soil cover and confirmation samples must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*.
g. Soil cover and confirmation analysis must be conducted in accordance with Appendix D, *Laboratory Analytical Parameters*.

39. Evaluate soil cover or confirmation sample analytical results by applying the following iterative truncation procedure:
    a. Compile an Excel table that includes all sample results to be used in the risk evaluation. The sample locations should be in rows, chemicals in columns. All sample results should be included, along with detection limits for non-detects. Screen the maximum concentration of all contaminants against the Environmental Protection Agency Regional Screening Level (EPA RSL) at the lower of 1) the incremental cancer risk (ICR) of 1.0E-06, and 2) a hazard quotient (HQ) 0.1. Only contaminants with maximum concentrations exceeding these levels will be entered into the risk calculator. In addition, if the PRLF program collected site-specific or regional background data (sampling area and total number of samples for regional background data sets will be determined by the PRLF program based on the area of interest), contaminates with a maximum concentration greater than 2 times the average site-specific or regional background concentration will be entered into the risk calculator. The maximum concentration vs. RSL and site-specific background comparison must be documented in the above-mentioned excel table. Below are examples of applications of this screening process.

Example 1: Background Calculation Example for Inorganics

Chemical	Area	Concentration (mg/kg)
Antimony	1	<0.142
	2	<0.111
	3	<0.104
	4	<0.131
2x average bkgd		0.244

If there are no detections, the background is calculated based on the detection limit.

Example 2: Background Calculation Examples for Inorganics

Chemical	Area	Concentration (mg/kg)
Antimony	1	<0.142
	2	1.3
	3	0.704 J
	4	<0.131
2x average bkgd		1.14

If there is a combination of detects and nondetects, the detection limit is used as a proxy concentration for the nondetects. J qualified samples are used at their full value.

Example 3: Screening using background and RSLs

Chemical	Maximum Concentration	2x average bkgd	RSL (Lower of CR= 10^{-6} and HI= 0.1)	Enter in Calculator?
Antimony	0.9	1.14	3.1	No (max < bkgd, RSL)
Arsenic	0.5	0.3	0.68	No (max < RSL)
Cadmium	1.1	1.4	0.71	No (max < bkgd)
Nickel	160	70	140	Yes
Acetone	1,700	NA	7,300	No (max < RSL)
Benzene	7	NA	1.2	Yes

b. Areas with lead contamination exceeding the PSRG (for residential, either 200 mg/kg or 100 mg/kg if additional sources of lead are identified) should be removed from the risk evaluation and placed in the "potential remediation" category. The PSRG will be determined by completing the Residential Lead Screening Level Checklist and submitting it to DEQ with the recommended screening level.
c. Only contaminants with maximum concentrations exceeding the RSLs (ICR = 1.0E-06, HI = 0.1) and 2 times the average site-specific or regional background concentrations should be entered into the DEQ Risk Calculator. The location of the concentrations entered must appear on the data input sheet.

40. To determine which areas exceed allowable risk limits, systematically remove areas from the original risk calculator (above). For each area removed, use a separate calculator, and each calculator should be saved. The calculator used for the first removal will be the original risk calculator. The calculator used for the second removal will be the calculator modified for the first removal, and so on. Only one location removal may be conducted per calculator.
    a. If the Cumulative Calculated Carcinogenic Risk > 1.0E-04, replace the concentration of the chemical contributing the highest risk with the second highest concentration for that chemical. Repeat this process for all other chemicals associated with this location. Record the location(s) of the new maximum concentration(s)in the data input sheet.
    b. Repeat Step 1 until the Cumulative Calculated Carcinogenic Risk < 1.0E-04.
    c. If any individual chemical Cumulative Calculated Non-Carcinogenic Hazard Quotient > 1.0, repeat step 1 until no individual chemical HQ > 1.0. The last calculator you modified for the carcinogenic risk will be the first calculator you use to start this process.
    d. **Stop when no individual Calculated Non-Carcinogenic Hazard Quotients > 1.0.** Load the risk results into the Critical Effects Evaluation Tool (CEET). Submit the completed Request for Review of Critical Effects Evaluation form along with items 1, 3, 4, and 5 from the submittals list below.
    e. After reviewing the critical effects evaluation, DEQ will either:
        i. Ask for additional runs of the risk calculator, or
        ii. Confirm the results of the critical effects evaluation.

41. Iterative Truncation Submittals:
    a. Excel table that includes all sample results to be used in the risk evaluation (number 1 from the beginning of this guidance).
    b. Map(s) depicting all sample locations.
    c. Pdf of the calculator data output sheets for each location removal. The associated excel spreadsheets will be requested if necessary.
    d. The excel version of the risk calculator for the last run.
    e. The excel version of the DEQ critical effects evaluation.
    f. Each area removed using the above procedure will require a separate risk evaluation. For example, if you removed Area 1 from the evaluation because of a risk exceedance, you would run a separate risk calculation for all the chemicals detected in Area 1 that exceeded the initial screen (RSL greater than 1.0E-06 or HI greater than 0.1 *and 2 times the average site-specific background concentration*). The data output sheets can be submitted as a pdf, the associated excel spreadsheets will be requested if necessary.
    g. If a risk evaluation is needed in an area where a duplicate sample was collected, the original and duplicate sample results should be combined. If, for a specific chemical, one sample was non-detect and the other a detection, enter the higher of the detected concentration or ½ the detection limit. If a chemical was detected in both the original and duplicate sample and relative percent difference is less than 50% for soil, enter the average concentration. If the RPD is greater than 50%, enter the higher concentration.

42. Provide the following figures for the evaluation of WDA existing soil cover as the permanent soil cover system or confirmation sampling process that includes the following:
    a. Site map with actual soil sample collection locations (based on GPS data) in each grid to include grid numbering and the WDA or property boundary.
    b. Existing soil cover thickness results over the WDA or subject property in three-inch increments, 3, 6, 9, and 12 inches to include grid numbering. The soil thickness data can be displayed by grid using average thickness for the samples collected in each grid.
    c. Lead concentrations per grid using transparent red for concentrations exceeding 200 mg/kg.
    d. Other contaminants of concern per grid using transparent purple for concentrations exceeding applicable risk thresholds based on the data reduction and critical effects evaluation process.
    e. Areas of existing soil cover less than 12 inches in thickness using black line cross hatching per grid.
    f. Comprehensive site map showing each grid with grid numbering, lead concentrations exceeding 200 mg/kg, other contaminants of concern exceeding unrestricted use standards, and existing soil cover less than 12 inches and/or existing soil cover containing waste material. This figure is intended to show the grids that need to be addressed for a risk-based remedial action plan.

43. Provide tables for the evaluation of WDA existing soil cover as the permanent soil cover system or confirmation sampling that includes the following:
    a. Unique identifier for each soil cover sample.
    b. PID results.
    c. Analytical results from all cover soil sampling events.

d. Identify concentrations used for DEQ risk calculator.
e. Identify concentrations exceeding background sample results.

SURFACE WATER/SEDIMENT/SEEP INVESTIGATION

If contamination is detected in any downstream sample above upstream conditions, additional surface water/sediment assessment will be needed. The downstream extent of contamination must be delineated to concentrations less than or equal to the 15A NCAC 02B standards for surface water or upstream concentrations whichever is higher.

There is no risk-based alternative for surface waters, so applicable 15A NCAC 02B standards must always be met for perennial and intermittent streams.

Remediation goals for sediment should be based on the same procedures used to establish remedial goals for soil. The sediment remedial goals should be based on the residential health-based soil remediation goals (or the upstream "background" concentrations if higher) and should be based on concentrations that ensure contaminated sediment will not cause exceedance of the remediation goals for groundwater or surface water.

44. Collect surface water and sediment samples according to the following:
    a. Samples must be collected in a downstream to upstream progression and must represent the potential area of impact from the WDA.
    b. Surface water and sediment samples must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*.
    c. Surface water and sediment sample analysis must be in accordance with Appendix D, *Laboratory Analytical Parameters*.

45. Collect one set of sediment and water samples from each seep location observed on-site.

46. Provide a figure, titled "Surface Water/Sediment/Seep Investigation," that includes the following:
    a. Unique identifier for each surface water/sediment/seep sample.
    b. Location of surface water samples.
    c. Location of sediment samples.
    d. Location of seep samples.
    e. Location of samples exceeding 15A NCAC 02B standards, upstream background concentrations, and unrestricted use standards for soils.

47. Provide a table, titled "Surface Water/Sediment/Seep Investigation," that includes the following:
    a. Unique identifier for each surface water/sediment/seep sample.
    b. Analytical results compared to 15A NCAC 02B and upstream background for surface water.
    c. Identify concentrations used for DEQ risk calculator.
    d. Identify concentrations exceeding background sample results.

If hazardous substances are present in groundwater, the lateral and vertical extent of all contaminant plumes must be delineated to develop a conceptual site model. Development of the conceptual site model may include complex hydrogeology such as fractured bedrock aquifers, complex contaminant behavior, and dense non-aqueous phase liquids. The lateral and vertical extent of the groundwater contaminant plumes must be defined to the 15A NCAC 02L standards.

Temporary monitoring wells are not permitted. Permanent monitoring wells should be used at all sites and well installation and abandonment must comply with the current codified edition of 15A NCAC 02C well construction standards. Permanent monitoring wells are necessary to support multiple sampling events for site characterization and completion of the remedial investigation. Contractor PM must submit a GW-1 Well Construction Form to DEQ and obtain approval from the applicable regional office prior to installation of all monitoring wells.

Subsequent monitoring well installation and sampling work phases must include all CERCLA hazardous substances detected (including those with qualified estimated concentrations) and degradation products, unless the contaminant concentration is proven through sampling to be the result of a naturally occurring condition, area wide anthropogenic background or the contaminant is a common laboratory contaminant detected in concentrations below that detected in the method blank.

For a monitoring well to be considered a delineation end point, it must have a minimum of four sampling events that meets unrestricted use standards unless the contaminant concentration is proven through sampling to be the result of a naturally occurring condition, area wide anthropogenic background or the contaminant is a common laboratory contaminant detected in concentrations below that detected in the method blank.

48. Permanent groundwater monitoring wells must be installed according to the following:
    a. Advance soil borings outside of the delineated WDA to groundwater.
    b. Install a permanent groundwater monitoring well in each boring.
    c. Various drilling methods such as hollow stem auger, air rotary, sonic…, may be used depending on the depth to groundwater.
    d. Flush mount versus stick up well covers will be determined based on property usage.

49. In-waste permanent groundwater monitoring wells (used when there is a suspected hot spot) must be installed according to the following:
    a. Advance soil borings within the WDA.
    b. Install a permanent Type III groundwater monitoring well in each boring, double case the well to the waste-soil interface.
    c. Various drilling methods such as hollow stem auger, air rotary, sonic…, may be used depending on the depth to groundwater.
    d. Flush mount versus stick up well covers will be determined based on property usage.

50. Bedrock surface permanent groundwater monitoring wells must be installed according to the following:
    a. Advance soil borings outside of the delineated WDA to the top of bedrock.
    b. Install a 2-inch diameter permanent groundwater monitoring well in each boring.
    c. Install ten feet of screen.

Important: All borings must be logged in the field.

51. Provide the following for each permanent monitoring well:
    a. Boring log information must include but is not limited to:
        i. Top of ground elevation.
        ii. Detailed soil description and lithology at depths.
        iii. Depth of groundwater observed during drilling.
        iv. Notable reaction of drill rig during advancement.
        v. Depth of competent rock encountered.
        vi. Detailed notes/remarks.
    b. A well construction diagram.
    c. GW-1 well construction form.
    d. Ground water elevation for each well.
    e. Details of well development.
    f. Details of well abandonment.
    g. Water level measurements for all available groundwater wells.
    h. One groundwater sample from each well must be collected in accordance with Appendix B, *Field Procedures and Sample Collection Techniques*, and the groundwater sample analysis must be in accordance with Appendix D, *Laboratory Analytical Parameters*.
    i. Well construction details in a table and including the following:
        i. Installation date.
        ii. Top of casing elevation.
        iii. Ground surface elevation.
        iv. Total well depth.
        v. Well screen interval.
        vi. Depth to groundwater.
        vii. Groundwater elevation.

52. Provide a figure(s), titled "Groundwater Investigation," that includes the following for each sampling event:
    a. Unique identifier for each monitoring well.
    b. Location of permanent monitoring wells.
    c. Groundwater potentiometric surface and flow direction map to include land surface topography and surface water features.
    d. Location of samples exceeding 15A NCAC 02L standards
    e. Area representing the 15A NCAC 02L standard exceedance (contaminant plume) displayed on the figure.
    f. Notes section on the figure with the following information:
        Risk values shown in **bold** (red text) exceed the DEQ risk calculator acceptable limits of 1.0E-04 for carcinogenic risk and 1.0 for the Hazard Index.

g. Groundwater to Indoor Air risk calculator results for each monitoring well with a call out box including the following information and the abbreviations shown in parentheses may be used:
    i. Residential carcinogenic risk (RES CR).
    ii. Residential hazard index (RES HI).
    iii. Non-residential carcinogenic risk (NON-RES CR).
    iv. Non-residential hazard index (NON-RES HI).

Example of monitoring well call out box.

MW-001	Date
RES CR:	7.3E-07
RES HI:	**1.6E+01**
NON-RES CR:	4.7E-06
NON-RES HI:	**1.3E+00**

53. Provide a table, titled "Groundwater Investigation," that includes the following:
    a. Unique identifier for each monitoring well.
    b. Identify concentrations exceeding natural background sample results.
    c. Analytical results compared to 15A NCAC 02L and upgradient natural background concentrations for groundwater.
    d. Identify concentrations used for DEQ risk calculator.

54. Monitoring well construction and abandonment documentation must be submitted to the NC Division of Water Resources and to the County Health Department responsible for the county in which the monitoring well is located and included in the report to the Unit.

POTABLE WATER SUPPLY WELL SAMPLING

55. Collect a potable water supply sample from each potable water supply well that is within 1,000 feet of the delineated WDA boundary according to the procedure outlined in Appendix B, Section 8.

If the remedial investigation is complete, only analyze contaminants of concern detected in groundwater and their degradation products identified during the groundwater investigation. If the remedial investigation is not complete, only analyze for VOCs to include all US EPA Target Compound List analytes.

The Contractor PM will be responsible for completing the laboratory data quality validation procedure, as outlined in this document, and submitting the laboratory data along with the validation statement to the Unit PM within 24 hours of receipt.

The Unit PM will request a health risk evaluation (HRE) from the DWM toxicologist for any detected analytes in the potable water supply well laboratory report. Attach the appropriate cover letter to the HRE and mail/email to the potable water supply well owner. If the HRE states the potable water is not safe for consumption, bottled water must be delivered to the potable

water supply well owner. The Unit PM will contact the Contractor PM to coordinate delivery of bottled water and contact the potable water supply well owner to inform them of the results and pending delivery of bottled water.

56. Provide a figure, titled "Potable Water Supply Well Sampling," that includes the following:
    a. Unique identifier for each potable water supply well.
    b. Location of each potable water supply well.
    c. Analytical results detected above applicable Federal Maximum Contaminant Levels (MCL), 15A NCAC 02L standards or Interim Maximum Allowable Concentrations (IMAC) if final standards are not available.

57. Provide a table, titled "Potable Water Supply Well Sampling," that includes the following:
    a. Unique identifier for each potable water supply well.
    b. Analytical results compared to MCL, 15A NCAC 02L standards or IMAC if final standards are not available.

LANDFILL & SOIL GAS PROBE INSTALLATION AND MONITORING

The DEQ Risk Calculator can calculate cumulative risk to indoor air using groundwater, soil gas or indoor air data as the vapor intrusion evaluation progresses. Where a property is vacant or no structures exist to evaluate indoor air, soil gas data will be used to determine whether indoor air must be evaluated in future structures.

TCE INDOOR AIR IMMEDIATE ACTION LEVELS

The DWM implemented Trichloroethylene (TCE) vapor intrusion indoor air action levels in 2019. The TCE-sensitive population at risk is women of child-bearing age (defined as age 15 to 50 years), and the action level for each scenario is as follows:
• Residential setting action level = **2.1 micrograms per cubic meter of air (µg/m3)**.
• Non-residential setting action level = **8.8 µg/m3**.

Based upon information from the USEPA and other scientific studies, the DWM has determined that when the inhalation action level concentration has been exceeded and the TCE-sensitive population may be exposed, immediate actions must be taken to report the concentrations to the DWM, notify the exposed population, and take response actions to reduce the exposure to below the action level concentration as quickly as possible (within 72-hours or less for women in their first trimester of pregnancy).

If unacceptable TCE levels are reported in indoor air, procedures for notifying the Branch, implementing mitigation response actions, and communicating with building occupants must be followed. Fact sheets are available to communicate information to the public for both the residential and workplace scenarios. More information on procedures and resources can be accessed using the link to the *DWM Vapor Intrusion Guidance* webpage provided at the front of this document.

Indoor air levels that do not meet acceptable risk for the property's use will require active mitigation with engineered controls. If the building is occupied and VOC indoor air levels exceed acceptable risk, temporary air purification units should be installed immediately with concurrent and ongoing monitoring until a permanent vapor intrusion mitigation system (VIMS) can be installed and tested for effectiveness. Plans for a permanent system should be provided in a sitewide or interim RAP and include the recordation of PRLF-approved LURs that specify the monitoring and maintenance requirements of the VIMS.

58. Landfill Gas Probe (LFGP) & Soil Gas Probe (SGP) Installation:

LFGPs must be installed with a minimum spacing of one probe every two acres across the delineated WDA. If the WDA is less than two (2) acres in size, install at least one probe. If the WDA is greater than 20 acres in size, the total number of probes may be adjusted based on site conditions.

a. Install LFGPs within the delineated WDA according to the minimum requirements outlined in Appendix B.
b. Install SGPs or LFGPs outside the delineated WDA according to the minimum requirements outlined in Appendix B.
c. If gas probes cannot be constructed according to the approved work plan and minimum requirements as outlined in Appendix B, contact the Unit PM, and document any variances.

59. Gas Sample Collection:
Landfill & Soil Gas Sampling should be conducted in accordance with the NCDEQ DWM Vapor Intrusion Guidance (provided in a link at the front of this document).

Gas sample collection should also be conducted in accordance with Appendix B (*Field Procedures and Sample Collection Techniques*) and Appendix D (*Laboratory Analytical Parameters).*

The following sampling methods and parameters are used to establish landfill and soil gas conditions.

a. Field Instrument Measurements
    i. Methane
    ii. Hydrogen sulfide
    iii. Oxygen
    iv. Carbon dioxide
    v. Ambient barometric pressure
    vi. VOCs
    vii. Ambient temperature at time of screening
    viii. Relative humidity
b. Summa Canister Sample Collection
    i. VOCs and methane

c. Tedlar Bag Sample Collection
    i. Hydrogen sulfide
d. SiloCan Sample Collection
    i. VOCs
    ii. Methane
    iii. Hydrogen sulfide
e. Sorbent Tube Sample Collection
    i. Mercury
    ii. Other contaminants of concern
f. Flux Chamber Installation and Sample Collection
    i. VOCs
g. Passive Soil Gas Sample Collection
    i. VOCs
h. Gas Probe Inspection
i. Gas Probe Gauging (only if blockage or water intrusion suspected)
j. Gas Probe Static and Differential Pressure Measurements
k. A representative picture of the setup for each type (summa cans, sorbent tubes, etc.) of gas sampling (one per event).

60. Provide a figure, titled "Gas Probe Results," that includes the following:
a. Unique identifier for each gas probe.
b. Location of gas probes.
c. Notes section on the figure with the following information:
    Risk values shown in **bold** (red text) exceed the DEQ risk calculator acceptable limits of 1.0E-04 for carcinogenic risk, 1.0 for the Hazard Index, or the Lower Explosive Limit for methane of 5% by volume.
d. Soil Gas to Indoor Air risk calculator results for each gas probe plus percent by volume of methane. Each gas probe should have a call out box with the following information and the abbreviations shown in parentheses may be used:
    i. Residential carcinogenic risk (RES CR).
    ii. Residential hazard index (RES HI).
    iii. Non-residential carcinogenic risk (NON-RES CR).
    iv. Non-residential hazard index (NON-RES HI).
    v. Percent by volume of methane.

    Example of gas probe call out box.

LFGP/SGP-001	Date
RES CR:	7.3E-07
RES HI:	**1.6E+01**
NON-RES CR:	4.7E-06
NON-RES HI:	**1.3E+00**
Methane by Volume:	**45%**

e. Identify the gas probes with detections using field instruments in accordance with Appendix B, (*Field Instrument Parameters and Equipment Requirements*).

61. Provide a table, titled "Gas Probe Results," that includes the following:
    a. Unique identifier for each gas probe.
    b. Field measurement results as outlined in Section 58.
    c. Contaminant concentrations for all detected compounds in summa canister samples.
    d. Identify concentrations used for DEQ risk calculator.
    e. Risk calculator results for each sample location.

METHANE ASSESSMENT

62. Methane assessment must be completed if methane is greater than 1.25% by volume (12,500 ppm of methane in air equals 1.25% by volume or 25% of the LEL) in any landfill or soil gas probe and if existing or future structures are located on or within 1,000 feet of the delineated WDA boundary. Delineate methane until the percent by volume is less than 1.25% in soil gas (or no more than global background). Static and differential pressure readings should be collected during methane assessments.

STRUCTURAL VAPOR INTRUSION

Once the groundwater investigation and WDA landfill/soil gas probe sampling is complete, a structural vapor intrusion investigation will be necessary if contaminants exceed the target risk in the DEQ risk calculator. Samples should only be analyzed for COCs previously detected and their degradation products. The structural vapor intrusion investigation should evaluate current and future structures on or within 500 feet of the WDA perimeter and within 100 feet of the perimeter of groundwater volatile organic contaminant plumes. Refer to DWM Vapor Intrusion Guidance Document.

If methane is detected above 5% by volume in soil gas within 100 feet of an occupied structure, methane alarms should be installed, and additional evaluation and/or mitigation should be conducted.

Important: Contact the Unit PM immediately upon receipt of any indoor air samples that exceed the DEQ risk calculator target risk or if methane is detected above 1.25% by volume.

63. Collect soil gas samples using batch-certified Summa canisters for VOC analysis in accordance with Appendix D, *Laboratory Analytical Parameters*. Sample collection must comply with the DWM Vapor Intrusion Guidance (in particular, collection protocols and Appendix B within the DWM Vapor Intrusion guidance).

64. Provide a map(s), titled "Soil Gas Results," that includes the following:
    a. Unique identifier for each soil gas probe.
    b. Location of soil gas probes.
    c. Notes section on the figure with the following information:
        Risk values shown in **bold** (red text) exceed the DEQ risk calculator acceptable limits of 1.0E-04 for carcinogenic risk, 1.0 for the Hazard Index, or the Lower Explosive Limit for methane of 5% by volume.

d. Soil Gas to Indoor Air risk calculator results for each gas probe plus percent by volume of methane. Each gas probe should have a call out box with the following information and the abbreviations shown in parentheses may be used:
    i. Residential carcinogenic risk (RES CR).
    ii. Residential hazard index (RES HI).
    iii. Non-residential carcinogenic risk (NON-RES CR).
    iv. Non-residential hazard index (NON-RES HI).
    v. Percent by volume of methane.

Example of gas probe call out box.

LFGP/SGP-001	Date
RES CR:	7.3E-07
RES HI:	**1.6E+01**
NON-RES CR:	4.7E-06
NON-RES HI:	**1.3E+00**
Methane by Volume:	**45%**

65. Provide a table(s), titled "Soil Gas Probe Results," that includes the following:
    a. Sample date(s).
    b. Sample probe depth (if applicable).
    c. Contaminant concentrations for all detected compounds in summa canister or passive sampler analytical results.
    d. Concentrations used for DEQ risk calculator.
    e. Risk calculator results for each sample location

66. Evaluate laboratory analysis data using the DEQ risk calculator and submit the results to the Unit PM.

67. Collect crawlspace gas samples for laboratory analysis from buildings in accordance with the following:
    a. Samples must comply with the DWM Vapor Intrusion Guidance (in particular, collection protocols and Appendix B within the DWM Vapor Intrusion guidance).
    b. Survey the crawlspace for background sources.
    c. If present, remove background sources 24 to 72 hours prior to sample collection.
    d. Document background sources that cannot be removed and collect photos.
    e. Screen for the following using field instrumentation to locate points of vapor entry and background sources to assist in determining sample locations, and report each parameter in the units as outlined in Appendix B:
        i. Methane.
        ii. Oxygen.
        iii. Carbon dioxide.
        iv. Barometric pressure.
        v. Hydrogen sulfide.
        vi. Volatile organic compounds (VOCs).
        vii. Temperature.

viii. Humidity.

f. Confirm that exhaust fans, clothes dryers, fireplaces, and other items that may induce short term pressure changes are inoperable during the sampling event.
g. Collect samples using batch-certified Summa canisters or passive samplers and analyze for only contaminants detected at the site and their degradation products.
h. Collect an exterior upwind background air sample initiated one hour prior to the collection of the crawlspace samples.
i. Continuous supervision of the equipment by the consultant performing the test or secured access is required.
j. Before moving to indoor air sampling, evaluate laboratory analysis data using the DEQ risk calculator and submit the results to the Unit PM.
k. Notes section on the figure with the following information:
   Risk values shown in **bold** (red text) exceed the DEQ risk calculator acceptable limits of 1.0E-04 for carcinogenic risk, 1.0 for the Hazard Index, or the Lower Explosive Limit for methane of 5% by volume.
l. Indoor Air risk calculator results for crawl space sample plus percent by volume of methane. Each crawl space sample should have a call out box with the following information and the abbreviations shown in parentheses may be used:
   i. Residential carcinogenic risk (RES CR).
   ii. Residential hazard index (RES HI).
   iii. Non-residential carcinogenic risk (NON-RES CR).
   iv. Non-residential hazard index (NON-RES HI).
   v. Percent by volume of methane.

Example of indoor air call out box.

LFGP/SGP-001	Date
RES CR:	7.3E-07
RES HI:	**1.6E+01**
NON-RES CR:	4.7E-06
NON-RES HI:	**1.3E+00**
Methane by Volume:	**45%**

68. Collect indoor air samples for laboratory analysis for buildings and locations in accordance with the following:
    a. Samples must comply with the DWM Vapor Intrusion Guidance (in particular, collection protocols and Appendix B within the DWM Vapor Intrusion guidance).
    b. Survey the interior of the structure for background sources.
    c. If present, remove background sources 24 to 72 hours prior to sample collection.
    d. Document background sources that cannot be removed and collect photos.
    e. Screen for the following using field instrumentation to locate points of vapor entry and background sources to assist in determining sample locations, and report each parameter in the units as outlined in Appendix B:
       i. Methane.
       ii. Oxygen.
       iii. Carbon dioxide.

iv. Barometric pressure.
v. Hydrogen sulfide.
vi. Volatile organic compounds (VOCs);
vii. Temperature.
viii. Humidity.

f. Confirm that exhaust fans, clothes dryers, fireplaces, and other items that may induce short term pressure changes are inoperable during the sampling event.
g. Collect samples using individually certified Summa canisters or passive samplers and analyze for only contaminants detected at the site and their degradation products.
h. Collect an exterior (ambient air) upwind background sample in accordance with DWM Vapor Intrusion Guidance (provided in a link at the front of this document).
i. Continuous supervision of the equipment by the consultant performing the test or secured access is required.
j. Notes section on the figure with the following information:
   Risk values shown in **bold** (red text) exceed the DEQ risk calculator acceptable limits of 1.0E-04 for carcinogenic risk, 1.0 for the Hazard Index, or the Lower Explosive Limit for methane of 5% by volume.
k. Indoor Air risk calculator results for each indoor air sample plus percent by volume of methane. Each indoor air sample should have a call out box with the following information and the abbreviations shown in parentheses may be used:
   i. Residential carcinogenic risk (RES CR).
   ii. Residential hazard index (RES HI).
   iii. Non-residential carcinogenic risk (NON-RES CR).
   iv. Non-residential hazard index (NON-RES HI).
   v. Percent by volume of methane.

Example of indoor air call out box.

LFGP/SGP-001	Date
RES CR:	7.3E-07
RES HI:	**1.6E+01**
NON-RES CR:	4.7E-06
NON-RES HI:	**1.3E+00**
Methane by Volume:	**45%**

69. Provide a table, titled “Structural Vapor Intrusion,” that includes the following:
    a. Unique identifier for structures screened for vapor intrusion.
    b. Risk calculator results for each sample location.

CONTAMINANT SOURCES AND IMPACTED RECEPTORS

70. Identify contaminant sources that may be contributing to the potential and/or documented contamination at the pre-1983 landfill.

71. Provide a map, titled “Contaminant Sources and Impacted Receptors,” that includes the following:

a. Unique identifier for points of contamination and impacted receptors.
b. Location of each impacted receptor.
c. Contaminants with associated concentrations impacting each receptor.
d. Iso-concentrations for each contaminant.

72. Provide a table, titled "Contaminant Sources and Impacted Receptors," that includes the following:
    a. Unique identifier for points of contamination and impacted receptors.
    b. Contaminants (including degradation products) in concentrations by media type.

WASTE CHARACTERIZATION FOR HOT SPOT ASSESSMENT

In addition to characterizing the waste, an estimated volume reported in cubic yards, will be required. After waste removal, native soils below removed waste must be sampled and evaluated according to the confirmation sampling for areas where waste has been removed section of this guidance document.

73. Characterize buried waste at the WDA by completing the following:
    a. Advance borings into the WDA.
    b. Continuously log each boring and characterize (describe) the waste/soil encountered.
    c. Provide boring logs with the following information:
        i. Ground elevation.
        ii. Soil cover thickness.
        iii. Waste description and soil lithology based on Unified Soil Classification System.
        iv. Soil contamination ranges.
        v. Top of waste elevation.
        vi. Thickness of waste.
    d. Collect solid media samples from each boring from intervals below ground surface.
    e. Collect solid media samples from the highest readings recorded, using a PID instrument, for analysis and identify the sampled interval(s).
    f. Collect one sample from native soil 1-2 feet beneath waste.
    g. Provide a description of the buried waste.
    h. Provide an estimated volume of buried waste and impacted soil in cubic yards to be removed to restore the area to unrestricted use.
    i. Laboratory analysis of waste sample should comply with permitted receiving facility requirements.

74. Provide a map(s), titled "Waste Characterization Borings," that includes the following:
    a. Unique identifier for each waste characterization boring.
    b. Locations of all waste characterization borings.
    c. Soil cover iso-thickness contours.
    d. Waste iso-thickness contours.
    e. Hazards requiring special management during removal (asbestos, high methane, high VOCs…)

75. Provide a table, titled “Waste Characterization Borings,” that includes the following:
    a. Unique identifier for each waste characterization boring.
    b. Thickness of waste (reported in feet) in each waste characterization boring.
    c. Depth (reported in feet) to native soil below waste.
    d. PID field screening results for each waste characterization boring.
    e. Waste characterization analytical results compared to permitted receiving facility requirements.

REMEDIAL INVESTIGATION SUMMARY REPORT

Once the Unit PM and the Contractor PM are satisfied that the RI phase is complete, the Contractor PM will request a meeting with the Unit PM and Unit Supervisor to review the site and ensure the criteria listed are complete. After the meeting, if all the criteria are complete, the Contractor PM will receive a request to submit a RI summary report using the template in Appendix E, *Remedial Investigation Summary Report Template*.

REMEDIAL ACTION PLAN DESIGN

Upon completion of the investigation, the Contractor PM will schedule a meeting with the Unit PM and Unit Supervisor to present a generalized remedial action plan based on the risk from the WDA and contaminated media (i.e. groundwater, surface water, sediment, vapor or exposed contaminated soils) to determine the appropriate risk-based remedial activities for the site. Draft RAPs must address the risk identified at each site but should not include activities such as waste relocation and/or removal unless the WDA is impacting a receptor, or a known hotspot is contributing to groundwater contamination. The investigation establishes the site and identifies the risk for a particular PRLF, and the RI summary should be the foundation for the risk-based RAP. The Unit PM will authorize the RAP design phase after the review meeting. The Contractor PM is responsible for acquiring all applicable permits and approvals during the RAP design phase to ensure there is not a delay implementing the RAP.

> This is not an exhaustive list of RAP criteria, and the Unit may request additional items for consideration during the RAP design phase to address site specific conditions.

At a minimum, the RAP should be based on site specific conditions and risk and include the following:

1. A discussion of the RI results and CSM, including media contaminated, contaminants of concern and the areal and vertical extent of contamination.

2. A brief statement of objectives for the remedial action.

3. Discussion of the following, if applicable, but final remedy elements are determined by site specific conditions, risk, and cost:
    a. Management of exposed waste and/or surface debris.
    b. Relocation or removal of waste "hotspots" impacting receptors or contributing to groundwater contamination.
    c. Management of landfill leachate.
    d. Slope stabilization.

4. A brief evaluation of risk-based remedial alternatives addressing site specific risk (soil cover with geotextile, soil cover with geoweb, combination of geotextile and geoweb, or use of existing soil cover, if applicable) using the following feasibility study criteria:
    a. Protection of human health and the environment, including attainment of cleanup levels.
    b. Compliance with applicable federal, state and local regulations.
    c. Long-term effectiveness and permanence.
    d. Reduction of toxicity, mobility and volume.
    e. Short-term effectiveness (i.e., effectiveness at minimizing the impact of the site remedial action on the environment and the local community).
    f. Implementability (i.e., technical and logistical feasibility, including an estimate of time required for completion).
    g. Cost.
    h. Community acceptance.

5. A detailed description and conceptual design of the proposed remedy, for each contaminated medium including an evaluation of the potential for the remedy to affect sensitive environments identified.

6. A Description of procedures to install an engineered WDA cover system.

7. A sampling plan for monitoring and evaluating a groundwater remedy's performance and any changes to the extent of the contaminant and associated risk to receptors and sensitive environments.

8. A description of any proposed treatability studies, interim steps, and additional site characterization needed to support the final design.

9. A description of well installation and abandonment, stormwater management and management of investigation and remedial action derived wastes (i.e. purge water and drill cuttings).

10. A list of required permits and verification of regulatory agency approval.

11. Mitigation measures pertaining to Waters of the United States (404/401 permits, buffer permitting and pre-construction notifications).

12. Planned erosion and sediment control (E&SC) measures must be designed to satisfy the regulatory requirements of the Division of Energy, Mineral & Land Resources (DEMLR).

13. A description of procedures and a schedule for construction, implementation, operation and maintenance, system monitoring and performance evaluation, and progress reporting. The construction schedule must include the total time needed to complete the remedy plus the average number of adverse weather days for the proposed time of year. The number of proposed adverse weather days per month is determined using 24-hour rain event volumes, averaged for the past three calendar years, and the impact of that volume to the on-site soil type. One-quarter inch of rain in 24 hours may be enough to impact a clay rich site, while one-inch of rain may be needed to impact a site consisting of mostly sand. The expectation is to develop a realistic construction schedule to include the average number of adverse weather days.

<u>Important</u>: The National Oceanic and Atmospheric Administration (NOAA) should be used to establish the number of proposed adverse weather days per month using the following website: https://www.ncdc.noaa.gov/cdo-web/datatools/lcd. **Select the county corresponding to the location of the pre-1983 landfill and add the county station to the cart. Once added to the cart, select the file format, daily output and the date range for the requested report.**

14. A description of the criteria used for remedial action completion, including procedures for post-remediation confirmation sampling.

15. Identification of off-site borrow material that will be used for the engineered WDA cover system. Fill must be evaluated pursuant to the guidance outlined in Appendix H, *Borrow Soil Location and Sampling Procedure*.

16. An evaluation of the off-site borrow material analytical results using the DEQ risk calculator and critical effects tool, if applicable, to ensure the material is acceptable for unrestricted use in the engineered WDA cover system. The risk calculator results must be submitted to the Unit PM for review before any material is transported to the site.

17. An evaluation of surface preparation techniques and engineered WDA cover systems according to the guidance outlined in Appendix H, *Engineered Cover Systems*.

18. A description of procedures for establishing a vegetative cover as a component of the engineered WDA cover system.

19. A health and safety plan that assures that the health and safety of nearby residential and business communities (erecting physical barriers and/or signs, controlling foot and vehicular traffic, suppressing dust, etc.) will not be adversely affected by exposure to site contaminants and activities related to the remedial action. The plan should conform to all local, state, and federal regulations for health and safety.

20. Equipment and personnel decontamination procedures.

21. A description of the land use restrictions if institutional controls serve as, or are part of, the remedial action plan. The description must identify all parcels requiring institutional controls.

22. All professional work must be signed and sealed by the appropriate professionals, if necessary (e.g., licensed geologist, registered professional engineer, etc.). A single document may require the signature and seal of more than one professional.

PUBLIC COMMENT

1. All draft RAPs must be publicly noticed prior to implementation by publishing weekly for a period of three consecutive weeks in a newspaper having general circulation in the county or counties where the site is located and by mail to persons that have requested to be on the mailing list for the site in accordance with NCGS 130A-310.4(c)(2).

2. Copies of the draft RAP must be sent to the following when the public comment period begins:
    a. impacted property owners (parcels containing the WDA and adjoining parcels);
    b. local government officials (city/town manager or county manager depending on the location of the pre-1983 landfill);
    c. the county health director; and
    d. the public library closest to the site location.

3. The public comment period must remain open for 45 days after the three-week publication to allow for receipt of written comments before the RAP is approved.

4. All public comments will be evaluated and considered before finalizing the draft RAP.

5. The Unit will conduct a hearing if there is significant public interest at the site:
    a. the hearing date and time will be posted 30 calendar days in advance of the scheduled hearing; and
    b. the public comment period will extend to 20 calendar days after the date of the scheduled hearing.

REMEDIAL ACTION PHASE

After the public comment period has ended, the Unit must review and respond to all submitted comments and conduct a public hearing, if applicable. Recordation of the land use restrictions and notice plat must be complete prior to subcontractor solicitation.

RECORDATION OF NOTICE PLATS

1. Notice Plats, approved by the Unit, may be recorded upon completion of the remedial investigation. A Notice may be recorded for all properties contaminated with physical waste and impacted by migrating contaminated groundwater and/or landfill gas.

2. A Notice Plat will not be required for a property where the remedial action plan will be to restore the property to unrestricted use standards.

3. Instructions for preparing a Notice Plat and recordation instructions are outlined in Appendix A, *Instructions for Preparing a Notice Plat for Recordation*.

RECORDATION OF LAND USE RESTRICTIONS

1. Land use restrictions, approved by the Unit, and the Notice of Environmental Contamination must be recorded prior to the Unit authorizing the Contractor PM to initiate the subcontractor solicitation for RAP implementation.

2. Land use restrictions will not be required for a property where the remedial action plan is to restore the property to unrestricted use standards if confirmation sampling supports the intended use.

The RA phase is the implementation of the final RAP. The Contractor PM must submit a final RAP to the Unit based on applicable public comments, prior to commencement of RAP activities and include an updated implementation timeline.

WDA REMEDY

1. The Contractor PM will prepare a request for proposal (RFP) for advertisement, in accordance with NCGS Chapter 143, Articles 3D and 8, to select a sub-contractor to implement the construction components of the RAP.

2. A pre-bid meeting will be held for all interested parties at the WDA.

3. The RFP advertisement must be published for 15 calendar days and include the following:
    a. WDA name and location;
    b. location of bidding documents drafted by the Contractor (Contractor website);
    c. contractor PM contact information (name, phone number and email); and
    d. day, time and location when the sealed bids will be opened.

SOIL, GROUNDWATER AND WASTE HOT SPOT REMEDIATION

4. Active soil and/or groundwater remediation will most often precede WDA remediation unless incorporated in the waste.

REMEDIAL ACTION PROGRESS REPORTS

Daily remedial action progress reports must be submitted to the Unit PM.

5. The daily progress report must include the following:
    a. pre-1983 landfill name and identification number;
    b. location;
    c. date;
    d. temperature (ºF);
    e. weather;
    f. name, company affiliation and title for all personnel on-site;
    g. equipment:
        i. description;
        ii. number on-site; and
        iii. number in-use;

h. narrative outlining all activities for the day listed by applicable time the action occurred;
i. Operation and maintenance results, if needed;
j. Discussion of major problems, if encountered;
k. Attestation that a request for a cost adjustment is or is not required at this time;
l. signature of on-site Contractor representative; and
m. photographs documenting the daily activities.

6. The progress report must include the following:
    a. operation and maintenance results; and
    b. discussion of major problems encountered.

REMEDIAL ACTION COMPLETION REPORT

Remedial action completion reports must be submitted to the Unit within 30 calendar days of the Division of Energy, Mineral and Land Resources (DEMLR) closing the erosion and sedimentation control permit for the site.

7. The RA completion report must include the following:
    a. results of the remedy;
    b. final drawings (as-built plans and specifications);
    c. summary of variances from the final design plans (approved work variances and change orders);
    d. summary of any problems encountered during construction;
    e. Proof that each monitoring well has been properly abandoned;
    f. Disposal facility approvals, and disposal manifests for an excavation/offsite disposal;
    g. post remedy confirmation sampling;
    h. monitoring requirements;
    i. appropriate certification statements or forms;
    j. verification DEMLR closed the erosion and sedimentation control permit and all erosion control measures have been removed from the site;
    k. photographic record of completed RAP;
    l. summary of remedial action operating experience and effectiveness in meeting design specifications; and
    m. discussion of criteria for remedial action completion.

8. For remedial action completion the following certification language must also be included in the report:

    “I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete.”

APPENDIX A: INSTRUCTIONS FOR PREPARING A NOTICE PLAT FOR RECORDATION

The following is a list of instructions to assist in the preparation and recordation of a survey plat (Notice Plat) that serves as a notice of environmental contamination or an institutional control as a site remedy per 130A-310.8. Plat nomenclature has been updated according to Session Law 2021-158 (SB 389), effective 9/16/21. The Notice Plat may be recorded with a companion Declaration of Perpetual Land Use Restriction (DPLUR) document that specifies the land-use restriction and annual inspection and reporting requirements, or it may stand alone.

NOTICE PLAT CONTENT REQUIREMENTS

The Notice Plat of the subject property must be prepared and certified by a professional land surveyor registered in North Carolina. Every plat should be based on a new or existing survey of the entire property unless the property is extremely large or otherwise problematic to resurvey. The modification of an existing survey prepared by another surveyor is allowed if approved by the Unit PM. Where a site is located on more than one parcel or tract of land, a composite map or plat showing all parcels or tracts may be recorded.

The Notice Plat must meet the requirements of NCGS § 47-30 [§ 130A-310.8(a)] for maps and plats (some, but not all are specified below) and any requirements of the Register of Deeds in the county where the site is located. It's best to contact them early to understand their requirements. All plats must be reviewed and approved by the North Carolina Geodetic Survey (Gary Thompson) prior to recordation. Unit PMs should email a PDF copy of the plat to the North Carolina Geodetic Survey for approval prior to printing mylars and requesting signatures from property owners. The plat must include the following:

1. A title block located at one of the plat perimeters with the following:
    a. Notice of Environmental Contamination.
    b. The name of the PRLF site and the PRLF identification number (precede with the phrase "A portion of the Site:" if the property is but one part of the overall contaminated site).
    c. The names of the current owner(s) exactly as they appear on the existing property deed.
    d. The property township, county and state, the date(s) of the survey, a scale, and name and address of surveyor or firm preparing the plat.

2. Property lines with bearings and distances, a north arrow (specifying whether true or magnetic), datum used (NAD 83 or NAD 27) or references to previously recorded deed or plat bearings (if based on magnetic north or referenced to previously recorded deed or plat bearings, must include the date and source the index was originally determined).

3. Identification of all adjacent property owners.

4. A vicinity map.

5. Unique site features.

6. On-property structures.

7. A notes section including the following information or specific language. In all cases, Notes a. - e. are required. Notes f. - j. should be selected based on the specific situations explained in **bold**.
    a. A list (or type) of regulated contaminants known to be present (today) in each environmental medium (soil, groundwater, surface water, and sediment). § 130A-310.8(a)(2).
    b. The quantity of each contaminant disposed on the property (if known). § 130A-310.8(a)(2).
    c. The phrase: "The contaminant information identified on this Notice Plat is based on the best available information at the time of filing."
    d. The phrase: this Notice Plat supersedes any previous Notice recorded for this parcel pursuant to NCGS 130A-310.8.
    e. The following instructional language (exactly as written in the box below): § 130A-310.8(e).

> When this property or any part of it is sold, leased, conveyed or transferred, North Carolina law requires that the following language be placed in the description section of the deed or other instrument of transfer in no smaller type than that used in the body of the deed:
>
> Hazardous substances are present in environmental media at this property. [<Add, if Notice is part of a RAP>, and the property has been remediated by use of land use controls with Department approval.] A Notice of Environmental Contamination is recorded at the [*fill in*] County Register of Deed's office in Map Book [*fill in*], Page [*fill in*].

When the Notice Plat is being recorded in conjunction with a Declaration of Perpetual Land Use Restrictions document (DPLUR), add:

    f. The phrase: "A Land Use Restrictions document entitled "[*enter the appropriate title, e.g., Declaration of Perpetual Land-Use Restrictions*]" limiting the uses of this property, is being recorded concurrently with this Notice Plat."

Or, when no Land Use Restriction document is being recorded concurrently with the Notice Plat, the property's groundwater is currently contaminated above 15A NCAC .02L standards, and the Department allows reliance on other State or local land-use controls, include Notes a. through e., AND the water supply well installation restriction specified in 15A NCAC 02C (aka 2C Rule) below: § 130A-310.8(a)(3)

    g. "Pursuant to 15A North Carolina Administrative Code 02C .0107 (b)(1), the source of water for any water supply well shall not be from a water bearing zone or aquifer that is contaminated. Therefore, state law prohibits construction of a water supply well on this property after groundwater contamination is known to exist on the property. After

the date of recordation of this Notice, pre-existing wells should not be used without contaminant testing and appropriate treatment. Further, pursuant to North Carolina General Statute 87-88(c) and 15A North Carolina Administrative Code 02C .0112(a), no well may be constructed or maintained in a manner whereby it could be a source or channel of contamination of the groundwater supply or any aquifer."

h. Add references to any local ordinances relating to groundwater use (e.g., water line connection requirements, well-installation prohibitions or groundwater-use restrictions).

Where a Notice Plat only is being recorded on an uncontaminated, non-source property because a future water supply well installed on the property could draw contaminants onto the property at levels that exceed the 15A NCAC .02L standards, include the 2C Rule and the following:

i. The phrase: "Based on the best available information at the time of filing, this property does not contain hazardous substances in groundwater. However, a future water supply well installed on the property could influence groundwater migration from a neighboring property that contains hazardous substances in groundwater."

Where a Notice of Residual Petroleum is already recorded on the deed and the restrictions specified therein are not in conflict with the intended property use, add the following: § 130A-310.8(a)(3)

j. The phrase: "The land-use restrictions specified in the Notice of Residual Petroleum, previously recorded pursuant to N.C. Gen. Stat. § 143B-279.9(b) and N.C. Gen. Stat. § 143B-279.11(g) in the _____ County Register of Deeds, Book _____, Page _____ on _<date>_, remain in full force and effect, and are incorporated herein."

8. The location and dimensions of distinct areas where hazardous substances are known to have been disposed (landfills, trenches, and open impoundments/pits) with respect to a surveyed corner of the affected property. This requirement is not necessary for spills or indistinct releases § 130A-310.8(a)(1).

9. The location of on-site wells with respect to a surveyed corner of the affected property (potable, production, monitoring and any other type) where hazardous substances have been detected in groundwater, unless each hazardous substance detected has an associated 15A NCAC 2L groundwater standard and the concentration is below such standard § 130A-310.8(a)(1 and 2).

10. The surveyor's certification and seal (using a permanent ink stamp) which includes, but is not limited to, specification of the source of information for the plat, the ratio of precision, and the type of survey pursuant to NCGS 47-30 (f)(11).

11. The location of the delineated waste disposal area.

12. The following language positioned in the upper left corner of the plat:

Approved for the purposes of NCGS § 130A-310.8.

_____

William F. Hunneke
Chief, Superfund Section
Division of Waste Management

NORTH CAROLINA
WAKE COUNTY

I,_____, a Notary Public of said County and State, do hereby certify that_____did personally appear and sign before me this the_____day of_____, _____.

_____

Notary Public (signature)

My commission expires_____,_____. (official seal)

13. Owner acknowledgement consisting of the printed name(s), title(s) and properly notarized (using a permanent ink stamp) signature(s) (signature(s) made in indelible ink) of individual(s) with authority to legally bind the property owner(s), with the following language:

This certifies that the undersigned is (are) the owner(s) of the property shown on this map.

_____

[*Owner or Owner's Representative signature*]

_____

[*Owner or Owner's Representative Name*]

_____

[*Owner or Owner's Representative Title and Organization*]

[*State*]
[*County*]

I,_____, a Notary Public of said County and State, do hereby certify that_____did personally appear and sign before me this the_____day of_____, _____.

_____

Notary Public (signature)
My commission expires_____,_____. (official seal)

INSTRUCTIONS FOR DIVISION APPROVAL

14. The draft Notice Plat (and companion DPLUR, if any) must be delivered directly to the Unit PM for review. The Unit PM will send the Notice Plat to the State surveyor for their additional review and comment (North Carolina Geodetic Survey). All instructions must be followed, and all comments must be addressed to receive approval.

15. After receiving approval from the Unit PM, the Contractor PM may order the final Notice Plat and coordinate with the property owner to obtain signature.

16. Once the Contractor PM has obtained the property owners signature, the signed Notice Plat must be delivered to the Unit PM at one of the addresses below (Do Not Fold Document):

    Via Overnight Courier or Hand Delivery
    NC Division of Waste Management
    Pre-Regulatory Landfill Unit
    DEQ Office Building
    217 W. Jones Street
    Raleigh, NC 27699

    Or

    Via US Mail
    NC Division of Waste Management
    Pre-Regulatory Landfill Unit
    1646 Mail Service Center
    Raleigh, NC 27699-1646

RECORDATION OF DOCUMENT(S)

17. After the Unit PM obtains the Section Chief's signature, the Notice Plat must be sent back to the Contractor PM for recordation. Recordation must be completed within 15 days of receiving the completed Notice Plat:
    a. File a certified copy of the Notice Plat in the site's county Register of Deeds' office.
    b. Send the Unit PM, (1) an electronic version of the Notice Plat affixed with the seal of the Register of Deeds and reflecting the book and page number where recorded, and (2) an electronic copy of the page in the grantor index where the Notice Plat is referenced.

Important: If the Notice Plat is being recorded concurrently with a DPLUR document, these documents must be recorded as follows: The Notice Plat must be recorded first and assigned book and page numbers. The book and page numbers where the Notice Plat is recorded must be handwritten in the designated blanks on the DPLUR document prior to the DPLUR document being recorded.

**** Always check with the specific County's Register of Deeds office early on for their requirements on paper type (mylar or paper) and other requirements they may have.****

APPENDIX B: FIELD PROCEDURES AND SAMPLE COLLECTION TECHNIQUES

Sample collection and analyses must be performed by persons who are qualified by education, training, and experience and under the supervision of a licensed professional. Field procedures relating to sample collection techniques, sample containers, sample preservation, sample holding times equipment decontamination and field measurement procedures, should comply with the most current version of the USEPA Region IV Science And Ecosystem Support Division (SESD) *Field Branches Quality System and Technical Procedures* (provided in a link at the front of this document).

Due to the extensive use of PFAS and their presence at trace levels in most environmental media, aspects of sampling and analysis require a unique protocol and high level of care to avoid cross-contamination with everyday packaging, body lotions, and biasing sampling equipment. Please follow the links provided at the front of this document for PFAS sampling protocols.

In addition to the standard protocols outlined in the USEPA technical procedures referenced above, the following should be considered to ensure defensible quality data is submitted to the Unit.

1. Collect GPS coordinates of all sample locations (soil, sediment, borings, gas probes, and monitoring wells) and if needed, stake and flag until the remedial investigation is complete.

2. Survey grade data is required for monitoring well(s) top of casing.

3. Field QC samples are required for each sampling event (field day) and each laboratory if different laboratories are utilized for the same sampling event. Include the following for each sampling event unless additional QA/QC testing is specified by the Unit PM:
    a. One duplicate sample (for multi-point soil or monitoring well sampling events only):
        i. Per medium.
        ii. Per container type.
    b. One equipment rinsate blank collected prior to sample collection.
    c. Trip blank.

4. Portable field instrumentation must be capable of detecting the following parameters:
    a. Methane instruments must have an infrared sensor capable of detecting methane at least 0.5% by volume of air. Methane should be reported in the following formats:
        i. Percent of lower explosive limit (% LEL).
        ii. Percent by volume in air (% bv).
    b. Oxygen as percent by volume in air (% bv).
    c. Carbon dioxide as percent by volume in air (% bv).
    d. Barometric pressure (inches Hg).
    e. Hydrogen sulfide as parts per million (ppm).
    f. Volatile organic compounds (VOCs by PID) as parts per million (ppm).
    g. Temperature as degrees Fahrenheit.
    h. Relative humidity as percent (%).
    i. Mercury as $\mu g/m^3$, minimum detection limit of 25 $\mu g/m^3$.

5. Field Instrument Calibration Data, Quality Assurance Data and Reporting Requirements. Include all of the following in the landfill gas evaluation report:
    a. Instrument manufacturer.
    b. Model number.
    c. Serial number.
    d. Date of factory calibration (annual) and maintenance parameters.
    e. Instrument detection limits (upper and lower).
    f. Field calibration data:
        i. Date and time of field calibration (must be same day as screening).
        ii. Bump test(s) to verify proper calibration and instrument accuracy is maintained before, during and after evaluation.
        iii. Type(s) of calibration gas and expiration dates.
        iv. Additional field calibration if specified by the manufacturer due to changing weather conditions (such as barometric pressure, temperature, etc.).
    g. Field conditions:
        i. Name(s) of person conducting the evaluation.
        ii. Brief description of weather conditions and other possible impacts on data: windy, nearby exhaust from vehicles etc.
        iii. Date and time begin/end of field screening.
        iv. Ambient temperature, humidity and barometric pressure readings (collected at least hourly during field sampling).

6. Field instrument landfill gas survey results should be submitted on a table that includes the following:
    a. Sample location.
    b. Instrument readings.
    c. Observations that may affect the results like a water trap, filters, increasing barometer pressure, significant change in the temperature, etc.
    d. At least two (2) readings must be recorded and reported anywhere there is equal to or greater than 2% change in the reading.
    e. Two readings must be recorded for the background locations and two other randomly selected monitoring points for all direct read instruments.

Note: Manufacturer calibration is not the same as field calibration.

7. Sampling must be planned so that required holding times for analytical methods are met.

8. Potable water supply well sampling must comply with the following:

If the remedial investigation is complete, only analyze for contaminants detected in groundwater and their degradation products identified during the groundwater investigation. If the remedial investigation is not complete, only analyze for VOCs to include all US EPA Target Compound List analytes.

    a. Record the location of each water supply well using a handheld GPS unit in accordance with the spatial data requirements outlined in this document.

b. Photograph each water supply well to document the following:
    i. Well location related to the residence (view from driveway if both residence and well can be captured in the same frame showing house number).
    ii. Current condition of the wellhead.
    iii. Sampling location (valve at wellhead or hose bib on residence).
c. Record the sampling location and document if the sample is collected downstream of pressure tanks, filtration systems, or other devices (i.e. valve at wellhead or hose bib outside the house).
d. Do not remove or alter insulation, heat tape or other site-specific items that the homeowner has installed on their wellhead (document the current condition and sample the well as close to the wellhead as possible).
e. Record site specific conditions that might impact the well (debris surrounding the well or industrial operations).
f. Water supply well sampling steps:
    i. Collect the initial turbidity reading.
    ii. Purge tap for 15 minutes.
    iii. Collect additional turbidity, conductivity and pH (at least 3 sets) readings during purging.
    iv. Collect additional sample if the post-purge turbidity is lower than the pre-purge turbidity reading and discard the pre-purge sample.
    v. If post-purge turbidity reading has increased, purge an additional 15 minutes and recheck turbidity.
    vi. If turbidity is lower, follow the procedure in Section 8(f)(iv).
    vii. If turbidity is higher, collect and filter sample and analyze with initial unfiltered (pre-purge) sample at the site.
g. Record the amount of time the well was purged in minutes.
h. Document the total volume of water purged.
i. Prepare trip blanks for each sampling event (if more than one laboratory is used, each laboratory must have a trip blank for analysis).
j. For sites with a completed remedial investigation, include only contaminants identified including TICs (library search) if retained as contaminants of concern and the degradation product of the contaminants.
k. Samples collected for Volatile Organic Analysis (VOA) should be collected directly into sample containers without mixing. Composite samples are not permitted.

9. The following should be considered when collecting groundwater samples:

Temporary monitoring wells are not permitted. Permanent monitoring wells should be used at all sites and well installation and abandonment must comply with the current codified edition of 15A NCAC 02C well construction standards. Permanent monitoring wells are necessary to support multiple sampling events for site characterization (CSM development) and completion of the remedial investigation.

a. Filtration of samples for metals analysis before acid digestion is not permitted (See exception for hexavalent chromium in water in Appendix D).
b. If turbidity is a problem:

i. Collect samples using low-flow purging and sampling techniques.
ii. Passive bag samplers.

c. Additional well development may be necessary.
d. Rapid analysis is recommended to reduce contact time with the acid preservative.

10. The following must be considered when collecting surface water samples:
    a. Shallow surface waters (less than six inches deep) or highly turbid, samples may be collected in a separate collection container and then decanted into the sample container.
    b. Samples for VOA must be decanted into the sample container immediately.
    c. Samples for metals analysis may be allowed to settle for a few minutes prior to decanting.
    d. All collection containers must be made of the same materials, be pre-cleaned and handled in the same manner as the sample container.

11. All soil, sediment and waste samples for VOA should be collected directly into sample containers without mixing.

12. Landfill Gas Probe Installation (LFGPs are typically installed within the delineated WDA):
    a. LFGP construction is similar to monitoring well construction standards, using one-inch PVC with flush mount completion.
    b. LFGPs should be sealed at least five feet below ground surface (shallower depths may draw air from the surface) and the screened interval must be at least two feet above seasonal high-water table (if encountered).
    c. The minimum screen length is two feet; but five feet of screen is optimal.
    d. An additional screen can be used where waste thicknesses extend beyond 10 feet below ground surface to get better coverage of the waste area.
    e. An air-tight cap/seal and sampling port should be installed at the surface termination of the PVC casing and can consist of a slip-cap, stopper, or threaded fittings.
    f. PVC glues, caulking or other substances with the potential to off-gas VOCs should not be used during LFGP construction.
    g. A dedicated two-way valve and tubing should be installed to the cap/seal to allow for sampling and the valve should remain in the closed position until sample tubing and instrumentation is connected.
    h. LFGPs are not required to have a protective lockable casing unless in areas accessible to the public.
    i. Where applicable, a permanently affixed identification plate should be included with the date of probe completion, total probe depth, screen length, and probe ID number.
    j. LFGPs should be allowed 48 hours to equilibrate before sampling.

13. Soil Gas Probe Installation (SGPs are typically used outside of the delineated WDA):
    a. SGP construction consists of a 6-inch implant attached to Teflon tubing with flush mount completion.
    b. SGPs implants should be sealed at least five feet below ground surface.
    c. A two-way valve should be installed to the tubing to allow for sampling and the valve should remain in the closed position until sample tubing and instrumentation is connected.
    d. SGPs should be allowed 48 hours to equilibrate before sampling.

14. Gas probe inspections should be conducted each time a gas probe is sampled. If the integrity of a probe is in question during the inspection, the Unit PM should be notified to determine if sampling/analysis should proceed at that probe. Deficiencies should be noted in the field notes and documented with a photo as needed. The inspection should include the following:
    a. Visually inspect the integrity of the probe including: the annular seal, cap/seal, valve, tubing, and fittings.
    b. Confirm that a seal is established on the probe (cap/seal intact and two-way valve in the closed position).
    c. Document any deficiencies such as cracked concrete, damaged/missing valves or fittings, missing or stripped bolts, missing locks, or evidence of water intrusion or damage to the probe.

15. Gas probe static and differential pressure measurements may be used to assess whether and to what extent pressure gradients might influence soil gas flow. General considerations for gas probe static pressure measurements:
    a. Pressure readings should be collected prior to opening the gas probe valve. If a probe has not been properly sealed (valve closed or cap/seal is not installed), pressure readings should not be collected until at least 24-hours after the seal on the probe has been re-established.
    b. A Landtec GEM 5000+ or digital manometer should be used. The type of manometer should be included in reporting with the static pressure reading (inches H2O), date, time, ambient barometric pressure, and temperature.
    c. If Field Instrument Measurements are requested by the Unit PM in conjunction with Static Pressure Readings, the measurements should be collected consecutively.
    d. The sequence for static pressure readings should include the following:
        i. Visually inspect the integrity of the cap/seal/tubing and confirm the two-way valve has been in the closed position for at least 24-hours.
        ii. With the two-way valve in the closed position, connect the GEM 5000+ (or manometer) to the probe tubing.
        iii. Zero the manometer.
        iv. Open the valve and record the stabilized reading (in inches H2O).
        v. Close the valve and then remove the gauge from the tubing.
        vi. Proceed with other sample collection methods.

16. Gas probe sampling should be conducted in accordance with the NCDEQ DWM Vapor Intrusion Guidance including subsequent amendments and editions (provided in a link at the front of this document). If repairs, adjustments or alterations are made to the probe, the probe must be purged before sampling. If gas probe static pressure measurements are being collected, the probe must equilibrate for at least 24-hours after a seal has been re-established. Valves and fittings should be used and placed in closed positions when connecting/disconnecting sampling instrumentation to maintain a gas seal and minimize the potential for ambient air to enter the probe/sample train.

17. Field instrument measurements should be collected for screening purposes from each gas probe for all sampling events. The following are the units of measurement to be reported:
    a. Landfill Gas Analyzer:

i. Methane.
ii. Hydrogen sulfide.
iii. Oxygen.
iv. Carbon dioxide.
v. Ambient barometric pressure.

b. Photoionization Detector (PID)
vi. VOCs.

c. Thermometer/Hygrometer
vii. Ambient temperature at time of screening (or within 1 hour).
viii. Relative humidity.

Sampling equipment should be included in the approved work plan. Equipment and reporting must be in accordance with the *Field Instrument Parameters and Equipment Requirements* (Section 4 - Appendix B) and *Field Instrument Calibration Data, Quality Assurance Data and Reporting Requirements* (Section 5 - Appendix B).

18. Flux chambers may be used at sites where geologic conditions prevent construction of gas probes (results from flux chambers are qualitative and not quantitative). The following should be considered when utilizing flux chambers:
    a. Recess the flux chamber into the ground surface and seal with grout or hydrated bentonite.
    b. Attach to the chamber air-tight fittings that allow connections to either field instruments and/or summa canisters.
    c. Use water trap filters in the sample line when moisture or liquid is found in the flux chamber.
    d. Record the length of time a calibrated field instrument is connected to the flux chamber when taking a reading so the procedure may be duplicated if re-testing is needed.

19. Passive gas sample collection should consider the following:
    a. Understand the limitations of the sampler and ensure that proper detection limits can be obtained since there are different reporting limits for different sampling times.
    b. Soil gas samples using passive samplers should only be utilized for screening purposes such as understanding spatial distribution or source identification. Passive sampler soil gas results should not be used to evaluate potential risk (risk calculations).
    c. Passive samplers can be used for crawlspace and indoor air samples to evaluate potential risk (risk calculations).
    d. Samplers should be appropriate for the chemicals of concern being investigated since some compounds are less reliably detected with passive samplers due to unknown uptake rates.

20. A leak test should be performed directly before sample collection. The following methods can be used:
    a. Introducing helium as a tracer compound through a shroud over the probe and sampling train.
    b. Introducing helium through a shroud over the sample probe and a shut-in pressure test of the entire sampling train.

If a shroud is not feasible based on probe construction, a shut-in test of the sampling train should be performed. The method used must be documented and if the leak test fails, the gas probe should not be sampled. A leak test can also be conducted on the laboratory supplied cannister and regulator prior to mobilizing to the field.

21. Sorbent tube screening may be utilized to test for the presence of landfill gas contaminants (e.g. mercury). Sorbent Tubes shall be used in accordance with the manufacturers' guidance and reporting limits must be adequately low.

22. Landfill gas probe gauging can be completed by using a decontaminated water level meter to evaluate if there is water, sediment, debris, or other blockages in the probe. If water or debris is encountered in the probe, a gas sample should not be collected.

APPENDIX C: ASBESTOS CONTAINING MATERIAL

1. The presence of asbestos containing materials (ACM) must be determined if waste material will be disturbed as part of the remedy (consolidation or removal). If any suspected ACM is observed (demolition debris would be considered suspect) during the site investigation phase, collect samples from the suspect materials for analysis to determine percent asbestos. Select five soil sample locations so that each location represents approximately 20% of the area to be disturbed. (Note: 5 samples may not be enough to determine if suspect asbestos is present) At each location determine the depth of waste and collect a composite sample that represents the thickness of waste in that area. Collect soil and any suspect ACMs identified in the cuttings. Analyze samples by EPA Method 600/R-93/116 or equivalent. No additional activities should take place in the suspect area until the presence and concentration of ACM is known. Any identified ACMs must be categorized as friable or non-friable.

2. Sites Containing Friable ACMs
   Friable ACMs can be crumbled with hand pressure. Fibrous fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered friable as they readily release airborne fibers if disturbed. Also, concrete ACM is a non-friable ACM that can release fibers if broken. If encountered, a determination must be made if the material can be removed without breaking, or the material must be treated as a friable ACM. The following must be completed when friable ACMs will be disturbed:
   a. All friable ACMs must be removed and disposed of at a permitted facility.
   b. State and federal asbestos regulations must be reviewed and followed.
   c. The RAP must contain an asbestos remediation plan. This plan must be sent to the NC DHHS Health Hazards Control Unit for review at least 45 days before the start of any land disturbing activities.
   d. Air monitoring must be conducted by an asbestos accredited air monitor during disturbance and removal.
   e. An accredited asbestos supervisor will be on site during ACM disturbance.

3. Sites Containing Non-friable ACMs
   Materials such as vinyl-asbestos floor tile or roofing felt are considered non-friable if intact and generally do not emit airborne fibers unless subjected to sanding, sawing and other aggressive operations. The following must be completed when non-friable ACMs will be disturbed:
   a. All non-friable ACMs must be removed and disposed of at a permitted facility.
   b. State and federal asbestos regulations must be reviewed and followed.
   c. The RAP must contain an asbestos remediation plan. This plan must be sent to the NC DHHS Health Hazards Control Unit for review at least 45 days before the start of any land disturbing activities.
   d. The RAP must include an alternative plan that addresses the discovery of friable asbestos or exposures above the Permissible exposure limit (PEL). These discoveries should not result in work delays.
   e. During non-friable asbestos waste disturbance, a trained or an accredited asbestos supervisor must be on site.
   f. Air monitoring must be conducted by an asbestos accredited air monitor during disturbance.

g. If air monitoring shows a result above the PEL, then all ACMs in the identified area will be handled as friable ACMs.
h. If the content of the disturbed area is shown to be relatively homogeneous, and 5 days of air monitoring has not identified any exceedances of the PEL, air monitoring may be discontinued.

4. If ACMs were not identified within areas of planned disturbance, on-site personnel must still include an accredited asbestos inspector during waste removal or consolidation activities. An ACM contingency plan should also be prepared to address ACMs if identified.

5. Code of Federal Regulations:
   a. 29 CFR - 1926.1101(c) - Permissible exposure limit (PEL): The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air as an eight (8) hour time-weighted average (TWA); and
   b. 29 CFR - 1926.1101 App H: C. The potential for an asbestos-containing product to release breathable fibers depends largely on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felt are considered non-friable if intact and generally do not emit airborne fibers unless subjected to sanding, sawing and other aggressive operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken.

6. For additional information regarding asbestos regulation and guidance please contact:
   Jeff Dellinger, Health Hazards Control Unit, North Carolina Department of Health and Human Services.
   Telephone number: (919) 707-5972 or email jeff.dellinger@dhhs.nc.gov
   Web site: https://epi.dph.ncdhhs.gov/asbestos/healthaz.html

   Ms. Hollis Yelverton, Occupational Safety and Health Program, North Carolina Department of Labor
   Telephone number: (919) 807-7865.
   Web site: https://www.labor.nc.gov/safety-and-health/occupational-safety-and-health/occupational-safety-and-health-topic-pages/asbestos

APPENDIX D: LABORATORY ANALYTICAL PARAMETERS

GENERAL INSTRUCTION

All samples must be submitted to a certified laboratory under 15A NCAC Subchapter 02H .0800 or be a contract laboratory under the USEPA Contract Laboratory Program. The Contractor PM must provide a copy of Appendix D to the laboratory to ensure appropriate analyte lists are used in the analysis of samples.

The comprehensive list of parameters below must be included in the remedial investigation phase of testing each contaminated medium. Each sample should be analyzed for the following unless there is documentation indicating that a specific analysis is not necessary:

1. **Metals**: Hazardous substance list metals (totals analysis) which include antimony, arsenic, barium, beryllium, cadmium, trivalent and hexavalent chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc.

   Iron is only analyzed when conducting background soil sampling and borrow source soil sampling.

   > Analysis of chromium in soil should be speciated into trivalent and hexavalent chromium, since hexavalent chromium is more toxic than trivalent chromium. For groundwater, hexavalent chromium analyses is not needed because the 15A NCAC 02L groundwater standard for total chromium accounts for the toxicity of hexavalent chromium.

   If coal ash is known or suspected to have been discharged at the site, the following additional toxic, non-hazardous substance metals should be included in the testing of groundwater: boron, molybdenum, and strontium.

   Total metals analysis should be used for groundwater samples. However, analysis of surface water for toxicity testing and hardness dependent metals (e.g., cadmium, chromium, copper, lead, nickel, silver, and zinc) requires analysis of dissolved metals according to DWR.

2. **Ammonia, Nitrates, Nitrites,** and **Sulfate**: In addition to all investigation samples, included when evaluating existing soil covers.

3. **VOCs/SVOCs**: Volatile and semi-volatile organic compounds listed on the most current USEPA Contract Laboratory Program Target Compound List using analytical methods specified in Tables 1, 2, and 3 with a library search (using the National Institute of Standards and Technology mass spectral library) to produce a list of tentatively identified compounds (TICs). The library search should identify TICs for the largest ten peaks in each analytical fraction of VOCs and SVOCs that have reasonable agreement with reference spectra (i.e. relative intensities of major ions agree within ± 20%). The list of identified TICs should not include laboratory control sample compounds, surrogates, matrix spike compounds, internal standards, system monitoring compounds or target compounds. The library search for TICs during the remedial investigation phase should be done on samples from the location with the highest contamination in each area of concern or if the "worst case" location is not known, then on a representative number of samples across the area.

Any TICs that are hazardous substances, that have reasonable agreement with reference spectra and are detected in more than one sample in an area of concern should be included in all subsequent analytical work unless the compound is a laboratory contaminant, documented to be naturally occurring or from an anthropogenic background. Check with the laboratory on possible procedures to quantify the TICs so that cleanup levels can be determined. A summary of the nature of any TICs eliminated from future analysis and reporting should be provided in the RI report, including reasons for eliminating the constituent.

4. **Methane**, **Hydrogen Sulfide**, and **Mercury:** Dissolved methane in groundwater may be a concern at sites with methane migration. Concentrations greater than 28 mg/l could potentially cause flammable or explosive levels in confined spaces like crawl spaces, well houses or pipes.

5. **1,4-Dioxane:** If chlorinated solvents, including 1,1,1-trichloroethane (TCA) or trichloroethylene (TCE), are present, or if it is a suspected contaminant of concern. It is often associated with certain chlorinated solvents because of its widespread use as a stabilizer, but other uses are documented such as printing inks and paints, flame retardant production, rubber and plastics, deicing and antifreeze, among others. It is also a by-product present in many goods, including personal care products and herbicides (i.e., Round-up, and other herbicides) and is used as a purifying agent in the manufacture of pharmaceuticals.

6. **PFAS:** If suspected to have been discharged at the property with other contaminants, through aerial deposition (such as from a smokestack) or associated with a process that commonly involves PFAS. Information regarding the list of USEPA-industry sectors likely to have used PFAS and how to comprehensively characterize sites affected by PFAS can be found in the links available at the front of this document. Note that in May 2024, the USEPA designated PFOA and PFOS, including their salts and structural isomers, as CERCLA hazardous substances.

7. **Other Potential Contaminants**: Pesticides, PCBs, dioxins, cyanide, formaldehyde, phosphorous and any other CERCLA hazardous substance or pollutants not mentioned here if suspected to have been discharged at the site.

    a. If cyanide is a known or suspected contaminant of concern, cyanide should be analyzed using total cyanide methods.

    b. If PCBs are a known or suspected contaminant of concern in soils, samples should be collected in the area of highest concentration and analyzed using both total PCB analysis and congener-specific analysis. The congener analysis should specify the dioxin-like PCB congeners for comparison with their PSRGs. The sum of the dioxin-like PCB congener concentrations should be subtracted from the Total PCB analytical result. The resulting concentration are then compared to allowable concentrations for non-dioxin-like PCBs, which are the PSRGs for “Polychlorinated Biphenyls (high risk)”. If concentrations detected are less than soil remedial goals for both the individual dioxin-like congeners and for the total non-dioxin like congeners, no additional PCB sampling is required. If concentrations exceed applicable remedial goals, more gross delineation can be performed using total PCB analyses and then the perimeter of the extent of contamination samples run for the dioxin-like congeners found at the site. In areas where

PCBs are detected, soil samples should also be collected and analyzed for VOCs because they are commonly present as carriers for PCBs. Final confirmation samples must also be analyzed using congener specific analyses. Aroclor analyses should not be used unless trying to fingerprint a manufacturer of PCB fluid.

If soil in a fairly large area contains PCBs above the PSRGs, an evaluation of anthropogenic background concentrations may be warranted. If a protection of groundwater PSRG is exceeded, a groundwater samples should be collected at that location and analyzed for *Total* PCBs and the results compared to the current IMAC of 0.09 ugL.

If laboratory sample dilutions were performed on initial samples, subsequent phase samples must be analyzed for the entire analytical fraction previously diluted. Sample dilutions raise analytical detection limits and can mask the presence of other constituents at lower concentrations.

If a compound that is not a common laboratory contaminant is detected in both the blank and a sample, another phase of sampling is necessary to demonstrate the absence or presence of the contaminant.

After completing the first round of sampling in source areas, subsequent samples must include all CERCLA hazardous substances detected (including those with qualified estimated concentrations), unless the contaminant concentration is proven through sampling to be the result of a naturally occurring condition, area wide anthropogenic background or the contaminant is a common laboratory contaminant detected in concentrations below that detected in the method blank. Subsequent sampling events would also need to include potential degradation compounds (which are also CERCLA hazardous substances) of those CERCLA hazardous substances detected at the site.

ANALYTICAL METHODS

The analytical methods used should be the most recent versions of the analytical methods tabulated below. For hazardous and solid waste test methods (SW-846 Method), the latest edition of SW-846, including any subsequent updates which have been incorporated into the edition, must be used. Sampling must be planned so that required holding times for analytical methods are met. The laboratory's reporting limits should be at or below remedial goals.

Table 1: Soil, Sediment and Waste Analytical Methods.

Volatile Organic Compounds[1]	SW-846 Method 8260
1,4-Dioxane[2]	SW-846 Method 8270
Semi-volatile Organic Compounds[1]	SW-846 Method 8270
Metals[3] (excluding hexavalent chromium) Pesticides, Herbicides, PCB congeners, Dioxins, Cyanide, Phosphorous, Formaldehyde and any other analytes not covered by above methods	USEPA method or method published in *Standard Methods for the Examination of Water and Wastewater* having detection limits below unrestricted use remedial goals or having the lowest detection limit. For PCB congeners use USEPA Method 1668.
Hexavalent chromium	SW-846 Method 3060A[4] alkaline digestion coupled with a USEPA method or method published in *Standard Methods for the Examination of Water and Wastewater* having detection limits below unrestricted use remedial goals or otherwise having the lowest detection limit.
PFAS compounds[8]	USEPA Method 1633 ASTM D7968-17a
Ammonia	USEPA Method 350.1
Nitrate & Sulfate	USEPA Method 300.0 or 353.2

Table 2: Water Analytical Methods Including Groundwater, Surface Water and TCLP/SPLP Leachate.

Volatile Organic Compounds[1]	SW 846 Method 8260
1,4-Dioxane [2]	SW 846 Method 8270 SIM using d8 isotope analysis
Semi-volatile Organic Compounds[1]	SW-846 Method 8270
Metals[3, 5], Pesticides, Herbicides, PCBs, Dioxins, Cyanide, Phosphorous, Formaldehyde and any other analytes not covered by above methods	USEPA method or method published in *Standard Methods for the Examination of Water and Wastewater* having the lowest detection limits or having detection limits below the 15A NCAC 02L standards or IMACs.
Hexavalent chromium (if total chromium exceeds 2 times the site-specific natural background concentrations and the applicable remedial goal for hexavalent chromium and chromium is a known or suspected contaminant at the site)[6, 7]	USEPA Method 218.7 or Method 218.6 as modified by USEPA Region IV.
Ammonia	USEPA Method 350.1

Nitrate & Sulfate	USEPA Method 300.0 or 353.2
Dissolved methane	Method RSK 175
PFAS compounds[8]	USEPA Method 1633 USEPA Method 537.1 Modified for drinking water.

Table 3: Gas Analytical Methods.

Volatile Organic Compounds using batch-certified or individually certified (indoor air only) Summa canisters	Method TO-15 or TO-15 SIM (indoor air or crawlspace only)
Methane	USEPA Method 3C or ASTM D1946/D1945
Hydrogen Sulfide	USEPA Method 15
Mercury	NIOSH 6009

References for Tables 1, 2 and 3:

1. *Analyses must include the USEPA Target Compound List plus a library search in certain cases as described in Appendix D.*

2. *1, 4-Dioxane samples should not be collected with passive or diffusive bag samplers. Also, avoid use of Alconox and Liquinox for precleaning of sampling equipment and containers. Methods 8260 and 8260 SIM is not recommended due to interference issues between 1,4-Dioxance and some chlorinated solvents, particularly TCE and 1,2-DCE.*

3. *SW-846 Method 6010 does not have detection limits below the unrestricted use standards/15A NCAC 02L standards for all of the hazardous substance list metals. Therefore, ICP-MS should be used instead of ICP when conducting metals scans. For metals, ICP-MS has lower quantitation limits than ICP. However, ICP should be used for certain metals where interference issues exist.*

4. *SW-846 Method 3060A extraction for soil and sediment samples allows for a 30-day holding time prior to extraction.*

5. *Rapid analyses of samples are recommended to lessen the contact time with the acid preservative. Filtration of groundwater and surface water samples before digestion is not permitted. Highly turbid water samples for metals analysis should be collected when turbidity is less than 10 NTUs. Highly turbid samples may be collected in a separate collection container and then decanted into the sample container.*

6. *Hexavalent chromium analysis is not needed for groundwater samples as the 15A NCAC 02L standard for total chromium is based on the more toxic hexavalent chromium species. The listed methods can be used for surface water and for ecological assessment purposes.*

7. *Samples collected for hexavalent chromium analyses must be field filtered within 15 minutes of collection. Each sample must be collected in a separate pre-preserved container from those for other metals analyses. Method 218.7 or Method 218.6 as modified by USEPA Region IV should be used. Method 218.7 requires low turbidity and allows for a 14-day holding time. USEPA*

Region IV has developed a modification to Method 218.6 that allows for a 28-day holding time. Bottles must be pre-preserved as specified in the modification to the Method. Laboratories should contact the USEPA in Region IV for the methodology modification. Otherwise, any USEPA Method or Standard Method may be used. However, other methods have a 24-hour holding time. Selection of methods and pre-preservation of bottles should be discussed with the laboratory prior to sample collection.

8. *Analysis of a comprehensive list of PFAS analytes with a reporting limit of 4 ppt or less for PFOA and PFOS is required.*

The recommended analytical methods for PFAS are referred to as targeted methods because they provide concentrations of known and commonly detected PFAS. Additional analytical methods are available to characterize the total PFAS that may be present at a site. The total oxidizable precursor (TOP) method can identify PFAS precursors (or parent compounds) that degrade to PFOS and PFOA over time. Conversely the TOP assay can indicate which sites do not have such precursors present, so future occurrence of PFOS and PFOA as degradation products can be ruled out. Consult with DEQ chemists for more information on the uses and limitations of total PFAS methods such as TOP, Non-targeted Analysis, and total organic fluorine methods.

LABORATORY DATA REPORTING

The Unit will not approve payment for samples analyzed out of holding time or if the Contractor fails to comply with this guidance document including subsequent amendments and editions.

Laboratory reports submitted to the Unit must include the items listed below:

1. The laboratory report must state the name and address of the laboratory and that the laboratory is either certified for applicable parameters under 15A NCAC Subchapter 02H .0800 and provide its certification number, or that it is a contract laboratory under the US EPA's Contract Laboratory Program (CLP). Full US EPA CLP documentation packages are not required.

2. A signed statement from the laboratory that the samples were received in good condition, at the required temperature and that analysis of the samples complied with all procedures outlined in the analytical method used, unless otherwise specified in a narrative.

3. A report of the remaining vacuum of each Summa canister received. Summa canisters shall be identified as either being batch certified or individually certified as cleaned by the laboratory.

4. A case narrative justifying any deviations from the methods, additional sample preparation, sample dilution, and unrectified analytical problems, including details of any known conditions or findings which may affect the validity of analytical data, including but not limited to equipment blank, trip blank, method blank, surrogate, spiked sample, or other QC data.

The laboratory must provide a written explanation for any sample having sample quantitation limits that exceed 10 times the laboratory or published MDLs.

5. Names of the individuals performing each analysis, the quality assurance officer reviewing the data and the laboratory manager.

6. Laboratory report of analytical results with consecutive page numbers, including:
    a. Date and time of sampling.
    b. Sample matrix description and identification number(s).
    c. Date samples were received, extracted and analyzed by the laboratory.
    d. Sample preparation and analytical method name(s) and number(s), including filtration or preservation procedures used.
    e. Dilution factors and the sample PQL of each reported analyte based upon analytical conditions. Any PQL exceeding 10 times the published analytical MDL must be justified with supporting information.
    f. Reports of detected and estimated constituents even if they were not definitively quantified. All estimated concentrations and constituents not meeting method QA/QC requirements which have data qualifiers must be reported.
    g. The results of any library searches performed for TICs.
    h. Units reported as mass per unit volume for air, soil gas, vapor, and aqueous samples. Units reported as mass per unit mass for solid samples.
    i. Laboratory sheets for the laboratory QC samples, including results for bias and precision, continued calibration and control limits used. The following minimum laboratory quality control sample reporting information must be provided, and samples that exceed control limits/acceptance criteria must be flagged: i. At least one matrix spike and one matrix spike duplicate per sample delivery group or 14-day period, whichever is more frequent (control limits must be specified):
        i. At least one matrix spike and one matrix spike duplicate per sample delivery group or 14-day period, whichever is more frequent (control limits must be specified).
        ii. At least one method blank per sample delivery group or 12-hour period, whichever is less.
        iii. System monitoring compounds, surrogate recovery required by the method and laboratory control sample analysis (acceptance criteria must be specified).

Any quality control concerns, data qualifiers or flags should be evaluated and discussed in the associated report.

    j. Completed chain-of-custody documentation with associated air bill (if applicable) attached.

7. Laboratory sheets for all analytical results, including sample identification, sampling dates, date samples were received by laboratory, extraction dates, analysis dates, analytical methods used, dilution factors, and sample quantitation limits.

8. All constituents detected must be reported even if they were not definitively quantified. All estimated concentrations with data qualifiers must be reported.

9. The results of any library search performed for “tentatively identified compounds.”

10. Data quality should be reviewed and validated by both the Contractor PM and the laboratory. Any quality control concerns, data qualifiers or flags should be evaluated and discussed in the associated report.

APPENDIX E: REMEDIAL INVESTIGATION SUMMARY REPORT TEMPLATE

The following template must be used to draft a RI summary report. Populate/modify the text within the brackets [ ] to reflect site specific information.

REMEDIAL INVESTIGATION SUMMARY REPORT
[SITE NAME]
[SITE CITY], [SITE COUNTY], North Carolina
Site ID No. [SITE ID]
State Contract No. [N1####S]
Task Order [TASK ORDER NUMBER]

Prepared By:

_____
[Name]
[Title]
[NC License #]

_____
[Name]
[Title]
[NC License #]

[Company Logo]

Submitted To:

North Carolina Department of Environmental Quality
Division of Waste Management
Superfund Section
Special Remediation Branch
Pre-Regulatory Landfill Unit
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Prepared By:
[Company Name]
[Address]
[Phone #]

[Date]

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1.0 INTRODUCTION

All RI summary reports should include the following introductory text:

Pre-regulatory landfills include any land area that was used for municipal solid waste disposal prior to January 1, 1983. These waste disposal areas were unlined and unregulated receiving facilities and could contain hazardous waste, medical waste, and/or asbestos-containing materials. Exposure to contaminated soils, hazardous materials, contaminated groundwater, hazardous, and/or explosive vapors are typical risks associated with PRLFs.

Environmental and human health risks posed by PRLFs are mitigated using a risk-based approach for assessment and remediation. There are three goals for the remedial investigation. One goal is to establish the lateral and vertical extent of contamination in each area of concern for all contaminated media, such as soil, groundwater, sediment, surface water, and vapor. The second goal is to determine if hazardous exposure risks are present within the Site. However, it is technically infeasible and cost prohibitive to identify all contaminants and the highest contaminant concentrations present within PRLF sites; therefore, the investigation may include limited waste characterization data. The third goal is to establish potential exposure pathways and receptors that are impacted or may become exposed to contamination. The investigation should also include the geologic conditions and site conditions to support a feasibility study of remedial alternatives. The typical risk-based remedial alternative for a PRLF includes an engineered WDA cover system installed over the delineated footprint of the waste disposal area and recordation of land use restrictions and a notice of environmental contamination.

Provide the information required in the RI Activities section of this guidance document.

2.0 SENSITIVE ENVIRONMENTS

Provide the information required in the RI Activities section of this guidance document. Provide a narrative summarizing all activities that took place during the on-site investigation and the results of those field activities. Provide the information returned from contacted agencies from Appendix G.

If sensitive environments were not identified, state “No sensitive environments were identified in the site vicinity.”

3.0 GEOPHYSICAL SURVEY

Provide the information required in the RI Activities section of this guidance document.

4.0 GEOLOGY AND HYDROGEOLOGY

Provide the information required in the RI Activities section of this guidance document.

5.0 NATURAL AND ANTHROPOGENIC BACKGROUND

Provide the information required in the Background Sample Collection section of this guidance document.

6.0 WASTE DISPOSAL AREA

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.0 MEDIA CHARACTERIZATION

7.1 Above Ground Vapor Survey

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

If above ground vapors were not detected during the above ground vapor survey, state "No above ground vapors were detected at the ground surface."

7.2 Evaluation of Existing Soil Cover for use as the Permanent Cover System

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.3 Surface Water/Sediment/Seep Investigation

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.4 Groundwater Investigation

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.5 Potable Water Supply Well Sampling

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.6 Landfill Gas Probe Installation and Monitoring

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.7 Methane Assessment

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.8 Structural Vapor Intrusion

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.9 Contaminant Sources and Impacted Receptors

Provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

7.10 Waste Characterization (Consolidation, Total Removal or Hot Spot Assessment)

If the Unit PM requested waste characterization, provide the information required in the Contaminant Delineation RI Activities section of this guidance document.

8.0 CONCEPTUAL SITE MODEL

Discuss the CSM and include the completed flow chart from Appendix F.

9.0 RISK EVALUATION

9.1 Physical Risks

Discuss physical risks associated with the waste disposal area including slip, trip, and fall hazards, voids created by USTs or vehicles, sharps, oxygen displacement by hydrogen sulfide, and explosion/fire hazards associated with methane.

9.2 Chemical Risks

For each investigated media type, the data must be entered into the DEQ risk calculator, and the following statement must be included in the RI summary report with the risk calculator results: "The DEQ risk calculator was utilized to evaluate the risks of contaminants of concern identified in (*select each investigated media type*) and the results are outlined below." Provide an explanation if a media type was not investigated.

Summarize the risk calculator results for each investigated media type for all receptors and pathways provided in the risk calculator.

10.0 SOLE USE STATEMENT AND CERTIFICATION

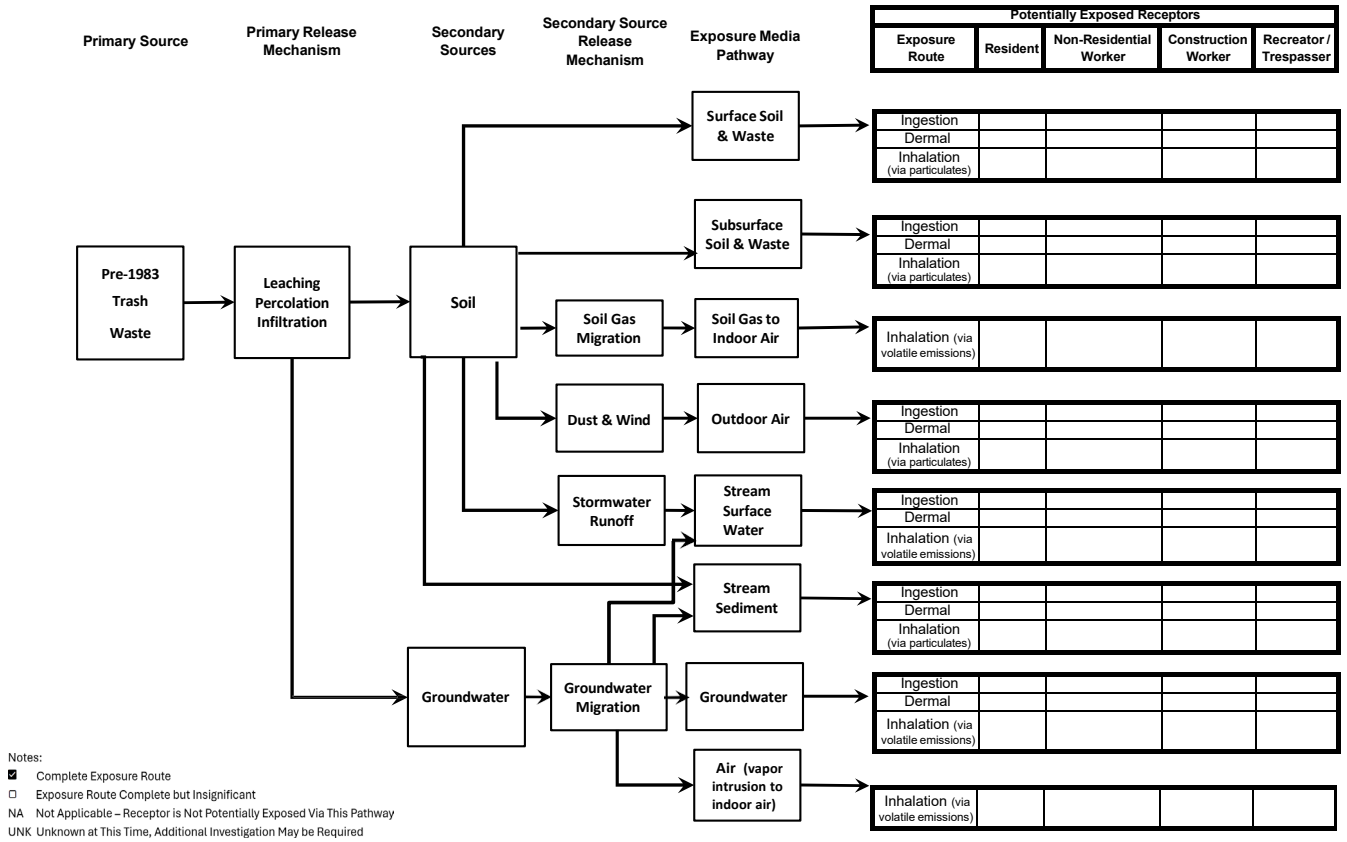
Suggested language: The report was prepared solely for the intended use of NCDEQ Special Remediation Branch, Pre-Regulatory Landfill Unit performed in the scope of work for Task Order [_____]. Use of this document for other purposes is at the sole risk of the user.

Report Certification

11.0 REFERENCES

APPENDIX F: CONCEPTUAL SITE MODEL

Conceptual Site Model
Site Name (Site ID number)



Potentially Exposed Receptors				
Exposure Route	Resident	Non-Residential Worker	Construction Worker	Recreator / Trespasser
Ingestion				
Dermal				
Inhalation (via particulates)				
Ingestion				
Dermal				
Inhalation (via particulates)				
Inhalation (via volatile emissions)				
Ingestion				
Dermal				
Inhalation (via particulates)				
Ingestion				
Dermal				
Inhalation (via volatile emissions)				
Ingestion				
Dermal				
Inhalation (via particulates)				
Ingestion				
Dermal				
Inhalation (via volatile emissions)				
Inhalation (via volatile emissions)				

Notes:
☑ Complete Exposure Route
☐ Exposure Route Complete but Insignificant
NA Not Applicable – Receptor is Not Potentially Exposed Via This Pathway
UNK Unknown at This Time, Additional Investigation May be Required

APPENDIX G: SENSITIVE ENVIRONMENT SURVEY

1. Sensitive environment surveys must include the WDA and all areas within 1,000 feet of the delineated WDA perimeter.

2. The survey must also identify areas that likely serve as natural areas attractive to terrestrial ecological receptors and for the existence of stressed vegetation or stressed wildlife.

3. Establishing the presence of sensitive environments is necessary to determine if special sampling (such as aquatic toxicity testing) is required and if remediation activities would result in more harm than good (for example, excavation and destruction of a wetland versus leaving in place residual contamination which may not significantly impact the wetland environment).

4. Refer to the *Sensitive Environment Contact List* for agency information. These individuals must be contacted in order to identify specific sensitive environments.

5. Sensitive environments include the following:
    a. State Parks;
    b. Areas Important to Maintenance of Unique Natural Communities;
    c. Sensitive Areas Identified Under the National Estuary Program;
    d. Designated State Natural Areas;
    e. State Seashore, Lakeshore and River Recreational Areas;
    f. Rare Species (state and federal Threatened and Endangered);
    g. Sensitive Aquatic Habitat;
    h. State Wild and Scenic Rivers;
    i. National Seashore, Lakeshore and River Recreational Areas;
    j. National Parks or Monuments;
    k. Federal Designated Scenic or Wild Rivers;
    l. Designated and Proposed Federal Wilderness and Natural Areas;
    m. National Preserves and Forests;
    n. Federal Land designated for the protection of Natural Ecosystems;
    o. State-Designated Areas for Protection or Maintenance of Aquatic Life;
    p. State Preserves and Forests;
    q. Terrestrial Areas Utilized for Breeding by Large or Dense Aggregations of Animals;
    r. National or State Wildlife Refuges;
    s. Marine Sanctuaries;
    t. National and State Historical Sites;
    u. Areas Identified Under Coastal Protection Legislation;
    v. Coastal Barriers or Units of a Coastal Barrier Resources System;
    w. Spawning Areas Critical for the Maintenance of Fish/Shellfish Species within River, Lake or Coastal Tidal Waters;
    x. Migratory Pathways and Feeding Areas Critical for Maintenance of Anadromous Fish Species within River Reaches or Areas in Lakes or Coastal Tidal Waters in which such Fish Spend Extended Periods of Time;
    y. State Lands Designated for Wildlife or Game Management; and
    z. Wetlands.

Sensitive Environment Contact List

CONTACT	NAME & CONTACT INFORMATION	SENSITIVE ENVIRONMENT
NC Division of Conservation, Planning, and Community Affairs – Natural Heritage Program	Visit the Natural Heritage Program's interactive maps of Natural Heritage resources to search for records within 2 miles of your project area or the database search tool for record summaries by county and USGS 7.5-minute topo map. You can also download GIS shapefiles of our data; see the "GIS Download" page for details. Email inquiries to: natural.heritage@ncdenr.gov	State Parks Areas Important to Maintenance of Unique Natural Communities Sensitive Areas Identified Under the National Estuary Program Designated State Natural Areas State Seashore, Lakeshore and River Recreational Areas Rare species (state and federal Threatened and Endangered) Sensitive Aquatic Habitat State Wild & Scenic Rivers
National Park Service - Public Affairs Office	Anita Barnett Anita_Barnett@nps.gov (404) 507-5706 http://www.nps.gov/rivers	National Seashore, Lakeshore and River Recreational Areas National Parks or Monuments Federal Designated Wild & Scenic Rivers
US Forest Service	Heather Luczak, Forest NEPA Coordinator Heather.luczak@usda.gov (828) 257- 4817	Designated and Proposed Federal Wilderness and Natural Areas National Preserves and Forests Federal Land Designated for the Protection of Natural Ecosystems
NC Division of Water Resources	Nora Dreamer, Basin Planner nora.deamer@ncdenr.gov (919) 707-9119 Ian McMillan, Branch Supervisor Ian.Mcmillan@ncdenr.gov (919) 707-9026 Ask for Clean Water Act 305b report	State-Designated Areas for Protection or Maintenance of Aquatic Life

NC Forest Service	Michael Foushee, Director, Safety, Planning & Analysis michael.foushee@ncagr.gov (919) 857-4820	State Preserves and Forests
US Fish & Wildlife Service	Pete Benjamin, Field Supervisor Pete_benjamin@fws.gov (919) 856-4520 x 11	Endangered Species
NC Department of Natural and Cultural Resources	Renee Gledhill-Earley, Environmental Review Coordinator (919) 814-6579 Renee.gledhill-earley@ncdcr.gov	National and State Historical Sites
NC Division of Coastal Management	Mike Lopazanski, Deputy Director mike.lopazanski@ncdenr.gov (252) 808-2808 ext. 223 http://dcm2.enr.state.nc.us	Areas Identified Under Coastal Protection Legislation Coastal Barriers or Units of a Coastal Barrier Resources System.
NC Wildlife Resources Commission	David Cox, Technical Guidance Supervisor David.Cox@ncwildlife.org (919) 707-0366	National or State Wildlife Refuges State lands designated for wildlife or game management Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or lakes or coastal tidal waters. Spawning Areas Critical for the Maintenance of Fish/Shellfish Species within River, Lake or Coastal Tidal Waters.
US Army Corps of Engineers	Asheville Regulatory Field Office Dina Supple: (828) 271-7980 AshevilleNCREG@usace.army.mil Charlotte Regulatory Field Office Lisa Hreha: (704) 510-1441 CharlotteNCREG1@usace.army.mil Raleigh Regulatory Field Office Josephine Schaffer: (919) 554-4884 RaleighNCREG@usace.army.mil Washington Regulatory Field Office Nikki Dameron: (252) 975-1399 WashingtonNCREG@usace.army.mil Wilmington Regulatory Field Office Kasey Jones: (910) 251-4811 WilmingtonNCREG@usace.army.mil	Wetlands

APPENDIX H: BORROW SOIL LOCATION AND SAMPLING PROCEDURES

The Unit must approve the import of fill material that originates from an off-site source. Imported fill material must meet the acceptable risk for unrestricted property use. If metals exceed levels suitable for unrestricted use, according to the DEQ risk calculator, a critical effects evaluation (CEE) must be performed. The CEE should be submitted to the Unit PM for review and the DEQ toxicologist must approve of the CEE prior to the Unit approving the fill material for import. The receiving site's naturally occurring background levels should be considered prior to importing fill material to ensure the imported fill material has metal concentrations similar to the receiving site.

Any party accepting or importing contaminated soil that exceeds levels suitable for unrestricted use may make themselves a responsible party under CERCLA.

Off-site borrow sources may be in-situ sources or stockpiled sources. If a stockpile is utilized, the owner of the stockpiled fill material will be required to sign an affidavit, attesting that the stockpiled fill material originated from one source location and not from multiple sources and the owner of the stockpile must provide documentation for the origin of the fill material. The stockpiled fill material that is sampled and tested must be the same fill material that is purchased and imported for use at the site.

OFF-SITE BORROW SOURCES

Preferred borrow sources for fill material are those that were previously undeveloped or used solely for agricultural or residential purposes. The following list of borrow sources are considered undesirable as soil fill material and shall not be utilized:

1. Locations on or within 1,000 feet of a site that the Division of Waste Management (DWM) manages, permits, or has inventoried.
2. Dredged material from a marine environment (unless it has dried to meet the moisture content of the receiving site).
3. Soils from below the groundwater table (unless it has dried to meet the moisture content of the receiving site).
4. Soils containing construction, demolition debris, and/or reclaimed asphalt pavement or concrete.
5. Soils from recycling operations that collect, sort, reprocess, or manufacture products.
6. Soils from transfer stations that collect, consolidate, temporarily store, sort, or recover refuse or used materials from off site.
7. Soils from a contaminant cleanup or removal.
8. Commercial or industrial sites where hazardous materials were used, handled, or stored.
9. Soils containing coal and wood ash.

Collect samples from the fill material source according to the type of fill (in-situ or stockpile). Sampling methodologies must be in accordance with USEPA Region IV *Field Branches Quality System and Technical Procedures* for soil sampling and these guidelines.

The history and location of the proposed borrow source must be established and documented. If the proposed borrow source meets the criteria listed above, the following procedure shall be used for verification sampling and testing.

Borrow Soil Collection Procedure (in-situ and stockpiles):

1. Discrete samples at different depth horizons according to the following:
    a) Up to 1,000 cubic yards – collect one sample per 250 cubic yards.
    b) 1,000 cubic yards to 5,000 cubic yards - collect four samples for the first 1,000 cubic yards plus one sample per each additional 500 cubic yards.
    c) Greater than 5,000 cubic yards – collect 12 samples for the first 5,000 cubic yards plus one sample per each additional 1,000 cubic yards.

2. Generate a table with the following:
    a. Sample ID with depth horizon.
    b. Individual sample results.
    c. Average borrow soil concentration per analyte.
    d. Add 2x average background soil (site specific or regional data set) concentration per analyte according to background soil collection procedures (see below).
    e. Add EPA Regional Screening Levels (RSLs) for residential soil at the lessor of cancer risk = 1.0E-06 and HQ = 0.1.

Background Soil Collection Procedure:

1. Discrete samples collected from top 12 inches of soil outside the delineated waste disposal area.

2. Collect a minimum of 12 discrete samples for site specific background and a minimum of 50 discrete samples for regional background (sampling area and total number of samples for regional background data sets will be determined by the PRLF program based on the area of interest).

3. Generate a table with the following:
    a. Sample ID.
    b. Individual sample results.
    c. Average background soil concentration per analyte.
    d. Add 2x average background soil (site specific or regional data set) concentration per analyte.
    e. Add EPA RSLs for residential soil at the lessor of cancer risk = 1.0E-06 and HQ = 0.1.

Borrow Soil Evaluation Process:

1. Screen average borrow soil concentrations per analyte against the greater of 2x average background (site specific or regional) soil concentration per analyte and EPA RSLs at the lower of 1) the incremental cancer risk (ICR) of 1.0E-06, and 2) a hazard quotient (HQ) 0.1.

2. Only contaminants exceeding these levels will be entered into the risk calculator.

3. If the average borrow soil concentration has a cumulative carcinogenic risk > 1.0E-04, go to step 5. If not, proceed to step 4.

4. If
    a. The average borrow soil concentration has a cumulative carcinogenic risk < 1.0E-04,
    b. Each analyte has a calculated non-carcinogenic hazard quotient (HQ) of 1.0 or less, and

c. The cumulative HQ is greater than 1.0, you can stop and perform a critical effects evaluation.

5. If the average borrow soil concentration of one or more analyte has a cumulative carcinogenic risk of > 1.0E-04 or a calculated non-carcinogenic HQ greater than 1.0, that sample location (soil boring) with the highest concentration should be removed from the data set and a new average calculated.

6. Enter the new average for the analyte into the DEQ risk calculator and continue this process until both the cumulative carcinogenic risk is less than 1.0E-04 and the calculated non-carcinogenic HQ for each analyte is 1.0 or less.

7. Submit the excel version of the DEQ risk calculator for the last run, the excel version of the DEQ critical effects evaluation, along with data tables to DEQ toxicologist for review of the risk calculator and critical effects evaluation output.

8. DEQ toxicologist will provide a borrow source memo stating the soil is suitable for unrestricted use and can be used as beneficial fill or request another run of the DEQ risk calculator.

APPENDIX I: ENGINEERED WDA COVER SYSTEMS

Engineered cover systems may be used at pre-1983 landfills to prevent dermal exposure to physical or chemical hazards created by the WDA or to prevent infiltration of precipitation at a site with groundwater contamination. The engineered WDA cover systems can include a soil cover with geotextile demarcation fabric, a matrix of soil filled high-density polyethylene (HDPE) expandable cells or a combination of both.

All engineered WDA cover systems must include manufacturing recommendations for products incorporated into the design and site-specific conditions to ensure the implementation and success of a risk-based remediation. The engineered WDA cover system must be a minimum of 12 inches of clean soil, aggregate, or a soil/aggregate mixture suitable for unrestricted use and must support vegetative growth regardless of the type of engineered WDA cover system selected. The vegetative cover must consist of grasses appropriate for the physiographic province where the Site is located.

Installation of an engineered WDA cover system would not be necessary for sites that are void of trees and have an existing soil cover that is a minimum of 12 inches thick and meets unrestricted use. In these situations, the existing soil cover would be utilized as the permanent WDA cover system without incorporating a geotextile demarcation fabric or HDPE expandable cells.

SOIL COVERS WITH GEOTEXTILE DEMARCATION FABRIC

Information pertaining to the NC Department of Transportation (NCDOT) approved geotextiles (1056-4) is available at the following website: https://apps.ncdot.gov/vendor/approvedproducts/. Geotextile demarcation fabric (or equivalent) that may be used is listed in the following table.

Company Name	Product Name	Model Number	Description
TenCate Geosynthetics	Mirafi 140NL/O	Orange	Nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. The product is inert to biological degradation and resists naturally encountered chemicals.

SOIL COVER WITH HIGH-DENSITY POLYETHYLENE EXPANDABLE CELLS

Information pertaining to the approved NCDOT geocells (1056-6) is available at the following website: https://apps.ncdot.gov/vendor/approvedproducts/. Geocells (or equivalent) that may be used are listed in the following table.

Company Name	Product Name	Model Number	Description
Presto Geosystems	Presto Geoweb	GW20V4, GW30V4, and GW40V4	Cell length ranges from 8.8 to 18.7 inches. Cellular confinement system for soil stabilization and slope protection.
Hanes Geo Components	TerraCell	140	Cellular confinement system for soil stabilization and slope protection.

Strata Systems, Inc.	Strataweb (4 inch height)	Styles 356 & 445	High performance three-dimensional cellular confinement system manufactured from extruded strips of HDPE, precision welded to form multiple cell heights and sizes. When filled with granular material, provides superior confinement and reinforcement.
Geo Products	EnviroGrid	EGA20 4 inch	Cellular confinement.

Research these products and be familiar with their characteristics (strength, flexibility, installation procedures, accessories, tools required for installation and etc.) and Site-specific conditions (environmental, logistical and engineering challenges) before selecting a product for the cover system. Follow the manufacturer's recommendations when installing and anchoring the product to the ground surface. Anchors may include product specific anchors, cut rebar stakes, polyethylene strips, and/or installation of an anchor trench.

WDA SURFACE PREPARATION

1. After grubbing activities are complete (if applicable) and the WDA has been graded for positive storm water runoff (if applicable), the WDA is covered with a geotextile demarcation fabric and/or the HDPE expandable cell system and filled with soil, aggregate, or a soil/aggregate mixture suitable for unrestricted use.

2. Refer to manufacturer installation recommendations and guidelines pertaining to the use of a geotextile between waste and the base of the cellular confinement system.

3. All daylighting tires and white goods must be removed prior to installation of the cellular confinement system and large individual pieces of daylighting waste that would result in a surface variation greater than 3 inches must be removed.

4. The top of the cellular confinement system should be covered with a minimum thickness of 2 inches of fill material. If the chosen fill material varies significantly from the WDA surface material, and sufficient surface compaction cannot be achieved, a non-woven geotextile may be required to maintain separation of the WDA surface and fill materials.

ATTACHMENT 1: GUIDELINES FOR THE LOCAL GOVERNMENT REIMBURSEMENT PROGRAM

The following guidelines pertain to local governments requesting approval to conduct RI activities at pre-1983 landfills and participate in the reimbursement program.

INTRODUCTION

1. Local governments may conduct RI phase activities in accordance with the current published edition of the *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* guidance document including subsequent amendments and editions and seek reimbursement of assessment expenses if the activities were approved by the Unit.

2. Questions regarding the local government reimbursement program may be emailed to the PRLF Unit Supervisor, or by telephone at (919) 707-8333. PRLF Unit contact information may be found at the following website: PRLF Unit.

3. NCGS 130A-310.6 (f) establishes the local government reimbursement program and outlines the four criteria necessary to qualify for reimbursement.

A unit of local government that voluntarily undertakes assessment or remediation of a pre-1983 landfill may request that the Department reimburse the costs of assessment of the pre-1983 landfill and implementation of measures necessary to remediate the site to eliminate an imminent hazard. The Department shall provide reimbursement under this subsection if the Department finds all of the following:

(1) The unit of local government undertakes assessment and remediation under a plan approved by the Department.
(2) The unit of local government provides a certified accounting of costs incurred for assessment and remediation.
(3) Each contract for assessment and remediation complies with the requirements of Articles 3D and 8 of Chapter 143 of the NCGS.
(4) Remedial action is limited to measures necessary to abate the imminent hazard.

LETTER OF INTEREST/REIMBURSEMENT ELIGIBILITY

4. To establish eligibility, the local government must submit a "Letter of Interest" to the North Carolina Division of Waste Management PRLF Unit stating the desire to voluntarily conduct an environmental assessment of a qualified pre-1983 landfill. The "Letter of Interest" should include the pre-1983 Landfill ID#, Landfill Name, and Landfill street address (including the City and County). Mail the "Letters of Interest" to:

PRLF Unit Supervisor
Local Government Reimbursement Program
Pre-Regulatory Landfill Unit
1646 Mail Service Center
Raleigh, NC 27699-1646

5. Prior to submittal of the initial work plan, the local government must provide a signed statement to the Unit confirming that the local government's consultant contract complies with Articles 3D (Procurement of Architectural, Engineering, and Surveying Services) and 8 (Public Contracts) of Chapter 143 of the NCGS to be eligible for reimbursement. A *Certification of Contracting Procedures Form* is provided in this document and must be completed to meet this requirement. The local government is required to provide, on official letterhead, its vendor and federal identification number to establish a reimbursement account with the Unit.

6. Once the completed *Certification of Contracting Procedures Form* has been received, the Unit will contact the local government to arrange a meeting with the local government to provide guidance on the work plan.

7. The local government's contractor must provide a work plan, cost proposal, and schedule for implementation once approved by the Unit.

8. Assessment work plans, cost proposals, and schedules require review and approval by the Unit. Reimbursement is subject to availability of funds and the Units review of the local government certified accounting of costs to ensure they are consistent with standard assessment costs. To ensure reimbursement, the local government should closely monitor costs and confirm the consultant complies with NCGS 130A-310.6 (f).

WORK PLAN/COST PROPOSAL PREPARATION

WORK PLAN

9. Work plans should include: an in-depth description of the proposed scope of work and methodologies that will be utilized and a proposed schedule for completing the scope of work.

10. The local government's contractor must comply with the current published edition of the *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* guidance document including subsequent amendments and editions to develop and complete all work activities. Procedures outlined in work plans must also comply with the current published version of the US Environmental Protection Agency Region IV Science and Ecosystem Support Division "Field Branches Quality System and Technical Procedures."

11. Due to the wide range of conditions encountered at pre-1983 landfills, the guidance document will not address every conceivable situation. The local government's contractor may need to consider proposing additional analyses and sample collection based on existing site-specific conditions and future land use.

COST PROPOSAL

12. A cost proposal outlining the costs for completing the scope of work presented in the work plan, must be attached to each work plan for review and approval by the Unit. Cost proposals must be submitted to the Unit in accordance with the *Cost Proposal and Invoice Format Sheets* which an

example can be found in Attachment 4. **Costs not approved by the Unit are not eligible for reimbursement**.

13. Cost proposals are required to be prepared on a time and materials basis and should be broken out per task as outlined in the associated work plan. Labor costs per personnel level unit rates, subcontractor costs (i.e. driller, analytical, etc.), and expense details (i.e. mileage, instruments, etc.) should be provided for each task. Use the Personnel Qualifications and Task Descriptions reference sheet, which can be found in Attachment 3, to determine the labor costs for various personnel.

REIMBURSEMENT

14. The local government must pay the consultant in accordance with their contract and then submit a certified accounting of costs with the consultant invoice(s) to the Unit for reimbursement.

15. All invoices must be submitted to the Unit in accordance with the *Cost Proposal and Invoice Format Sheets* which can be found in Attachment 4. Invoices must be submitted in the same format as the cost proposal for reconciliation and each invoice submittal must include a completed *PRLF Invoice Check List Form* which can be provided by the Unit (example in Attachment 5).

16. Submit a cover letter on official local government letterhead to request reimbursement and include the following:
    a. vendor/Federal ID number;
    b. current mailing address;
    c. invoice(s) from contractor in the same format as the proposal cost sheet;
    d. copies of the check(s) used to pay the contractor;
    e. dollar amount you are requesting for reimbursement; and
    f. a statement verifying that certified accounting in accordance with NCGS 130A-310.6(f)(2) was conducted.

17. The invoice packet will be reviewed by the Unit and compared to the work plan and cost proposal. After the invoice review is complete, the invoice packet will be submitted to accounting for processing, or the Local Government representative will receive a response requesting additional invoicing details.

<u>Important</u>: To avoid delay in reimbursement and multiple requests for additional supporting documentation, the Local Government representative must submit invoices in the same format as the cost proposal with the completed *PRLF Invoicing Check List Form* (Attachment 5) and all receipts organized and numbered to reflect the order outlined in the approved work plan.

CERTIFICATION OF CONTRACTING PROCEDURES FORM

Complete the Certification of Contracting Procedures Form by populating/modifying the italicized text within the brackets [ ] to reflect site specific information.

[name of unit of local government], hereby affirms that it complied with the requirements of Articles 3D and 8 of Chapter 143 of the North Carolina General Statutes in all contracts entered into to date for the assessment and/or remediation of the *[name of landfill]* Landfill *[landfill ID number]* located at *[street address, city, county]* for which it is seeking reimbursement of expenses from the North Carolina Division of Waste Management.

IN WITNESS WHEREOF, *[name of unit of local government]* has caused these presents to be executed in its name by *[name of authorized agent]*, its *[title]*, on this the *[date]* day of *[month]*, *[year]* .

[name of unit of local government]

By: *[signature of authorized agent]*

Signatory's name typed or printed: *[name of authorized agent]*

STATE OF NORTH CAROLINA
COUNTY OF *[county]*

I, *[name]*, a Notary Public, do hereby certify that *[name of authorized agent]* personally appeared before me on this day, produced proper identification in the form of _____, was duly sworn and or affirmed, and declared that he or she holds the title of *[title]* of *[name of unit of local government]*, and declared that, to the best of his or her knowledge and belief, that the information contained in the above Certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this *[date]* day of *[month]*, *[year]*.

[name]
Notary Public

My commission expires *[date]*.

REQUEST FOR PROPOSAL (RFP) TEMPLATE

The following template may be used to draft a request for proposal (RFP). Populate/modify the italicized text within the brackets [ ] to reflect site specific information.

Request for Proposals (RFP): Pre-Regulatory Landfill Assessment

[North Carolina Local Government Name] is exploring the potential for re-use of a tract of land known as the [*Pre-Regulatory Landfill Site Name]*. In order to determine the feasibility of the re-use of this property, a detailed assessment of this closed landfill is needed. The landfill is located in [*City*], [*County*], North Carolina.

[North Carolina Local Government Name] is interested in contracting the services of an approved environmental consultant to perform and certify assessment services for this landfill in full cooperation of and under the guidance of the North Carolina Department of Environmental Quality (NC DEQ) Division of Waste Management, Special Remediation Branch, Pre-Regulatory Landfill Unit (Unit).

All environmental consultants interested in responding to this RFP should refer to the current published edition of the Unit's *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* guidance document including subsequent amendments and editions when responding in order to adequately prepare for the effort required in work plan preparation, cost proposals and report submittal. All services proposed must be approved by the Unit following these guidelines and other regulations as determined by the Unit.

[North Carolina Local Government Name] is voluntarily undertaking the assessment of this pre-1983 landfill as defined in NCGS130A-290(a) (21a). The approved environmental consultant must be qualified to perform and will be responsible for compliance of all phases of this voluntary remedial investigation as directed by the Unit.

[North Carolina Local Government Name] will not be responsible for any activities, services or other costs associated with this RFP or subsequent contract work that is not pre-approved by the Unit. All work must comply with the requirements of NCGS 130A-310.6 (f) and designated by NC DEQ as reimbursable to the *[North Carolina Local Government Name]* under this statute. It is the sole responsibility of the approved environmental consultant to assure that all work performed as a result of this RFP is reimbursable to the *[North Carolina Local Government Name]* under this program administered by the Unit.

The property is known to the Unit and listed on the *Old Landfill Inventory* as: [*SITE NAME*], [*IDENTIFITACTATION NUMBER*]. The landfill is located on a portion of [*County*] Parcel, PIN: [*number*]. Only the landfill and areas that may have been impacted by past landfill activities as outlined in the *Guidelines for Addressing Pre-Regulatory Landfills and Dumps* is to be considered for this RFP.

ATTACHMENT 2: PRE-REGULATORY LANDFILL PROGRAM CONTRACT TASK MANAGEMENT GUIDANCE

The following guidelines pertain to Professional Engineering firms (Contractors) awarded a contract to complete RI and risk based remedial action plans with the North Carolina Department of Environmental Quality's (NC DEQ) Pre-Regulatory Landfill Unit (Unit).

INTRODUCTION

Executed contracts are in accordance with Articles 3D and 8 of Chapter 143 of the North Carolina General Statutes. The statutory references can be found at the following websites, respectively: https://www.ncleg.net/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_143/Article_3D.html and https://www.ncleg.net/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_143/Article_8.html

The Contractor shall ensure that all documents and work plans comply with the Contractor's executed contract with the NC DEQ and the Inactive Hazardous Sites Response Act. All work activities shall be conducted in compliance with the current published editions of the following guidance documents including subsequent amendments and editions:

1. Guidelines for Addressing Pre-Regulatory Landfills and Dumps; and
2. Division of Waste Management: Vapor Intrusion Guidance.

The Contractor must assign a PM who will manage all RI and RA activities for the pre-1983 landfill. The Contractor PM is critical for maintaining communication and efficiently completing RI and RA activities. During the preparation of a remedial action plan (RAP), the Contractor PM may transition to an engineer PM due to engineering design components.

TASK ORDERS

All work activities must be performed on a task order not to exceed basis as outlined in the executed contract.

The Contractor PM will develop work plans, cost proposals, schedules and reports for Unit review. Task orders should contain all activities that will be completed at approximately the same time. If beneficial, subtasks can be used in a task order to separate events. Deadline extensions may be requested in writing on Contractor company letterhead only when unforeseen circumstances arise, otherwise all work is expected by the requested deadline.

Once the Unit PM confirms the work plan, cost proposal and schedule satisfy the requested task order, an approval authorization will be sent to the Contractor PM via e-mail. The Contractor PM must receive the task order approval authorization prior to commencement of any work activities.

Important: Work activities completed without prior authorization from the Unit will not be reimbursed.

Once the Unit PM confirms the work activities outlined in the approved task order are complete, the Contractor PM may submit an invoice to the Unit.

WORK PLANS, COST PROPOSALS AND SCHEDULES

Work plans, cost proposals and schedules must include a cover letter addressed to the attention of the assigned Unit PM and submitted via email. Include the pre-1983 landfill identification number and name along with the task order number exactly as listed in the task order request.

Include a proposed schedule with all work plans that includes the task(s)/subtask(s) to be performed each day (field activities) and the Contractor personnel that will be on site based on the Personnel Qualifications and Task Descriptions as outlined in Attachment 3 (i.e. Staff Geologist, Technician, sub-contractor).

Figure 1 is an example of a field activities schedule outlining the number of weeks, the day of the week, associated task order/subtask number and quantity and classification of contractor personnel and sub-contractor personnel for each day.

Week 1 – Day 1	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 2	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 3	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 4	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 5	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 6	Subtask #(s)	Quantity of Staff	Personnel Classification
Week 1 – Day 7	Subtask #(s)	Quantity of Staff	Personnel Classification

Figure 1: Field Activities Schedule

The week is the week that field work begins for the associated task(s)/subtask(s). Day 1 is the first day that field work begins, regardless of the day of the week. The task/subtask number(s) are the task/subtask(s) that will be performed on the listed day(s). The number of personnel for each day represents the number of staff in the field for that day.

Contractor field personnel must receive a copy of the approved work plan for reference during field activities.

If revisions to work plans, cost proposals and/or reports are required, provide the Unit PM, via email, a complete document with revisions including a new revision date. The work plan should not be modified without approval of the Unit.

Cost proposals must have numbered pages and conform to the formatting as shown in the *Cost Proposal and Invoice Format Sheets* which can be found in Attachment 4.

Unit rates must match with the corresponding Personnel Level description based on the type of work activity such as remedial investigation/design and active remedial oversight as outlined in the Fee Schedule of each executed contract.

Costs associated with the preparation of health and safety plans are part of the Contractor's responsibility to ensure the safety of field staff. When special site conditions exist that affect public safety, i.e. exclusion zones to protect the public, then costs associated with the health and safety plan may be included.

Activities exceeding $10,000 require quotes to document the competitive bidding process. The Contractor must comply with paragraph K as outlined in the Scope of Work in each executed contract.

COST ADJUSTMENTS AND WORK VARIANCES

When the approved work plan, cost proposal or schedule will not be maintained or cannot be completed as planned, the Contractor PM must notify the respective Unit PM and explain the pending issues. The Contractor PM must request a cost adjustment (change order) when a specific activity will exceed the approved task order dollar amount or a work variance if there are significant changes to the approved work plan impacting itemized costs or the approved schedule.

In accordance with the terms of the executed contract, the Contractor PM must immediately contact the Unit PM and provide the details, cost proposal, and schedule for the requested change order. The Unit PM may provide verbal approval of the cost adjustment. If verbal approval is granted, the Contractor PM must submit a written request along with the itemized costs within 48 hours of the verbal approval. If the Unit PM does not receive the written request within 48 hours, the Contractor may not be paid for the work activities.

Note: Work activities completed without approval from the Unit will not be paid.

A variance from the approved work plan must also be requested when there are significant changes to work plan activities that will affect individual line-item costs (unit rates) but will not exceed the total approved cost of the task order. The Contractor PM must immediately contact the Unit PM when issues arise that will result in work not being completed in accordance with the work plan. Discuss the details, cost, and schedule for the work plan variances with the Unit PM. The Unit PM may provide verbal approval of the variance. If verbal approval is granted, the Contractor PM must submit a written request along with the new itemized costs within 48 hours of the verbal approval. If the Unit PM does not receive the written request within 48 hours, the Contractor may not be paid for the work activities.

INVOICES

After the Contractor PM provides notification that all work activities associated with a particular task order is complete and the Unit PM is satisfied with the deliverable, the Contractor PM shall submit invoices.

Upon completion of each task order, including submittal of all approved related documents (including but not limited to written reports on technical progress, identification of problems, delays and cost updates) and the associated certifications, the Contractor PM may submit an invoice for payment that complies with the authorized costs outlined for each task order.

The Contractor PM should submit invoices as soon as possible once task order(s) activities are complete but must submit the invoice and all associated verification documents within 30 days from the date when the Unit PM issued the task order completion letter.

All invoices must be submitted in the same format as the approved cost proposal with all costs identified and a completed *PRLF Invoice Check List Form* which can be found in Attachment 5. Each invoice packet must include numbering to identify the costs associated with quotes and supporting documentation. The numbering will assist both the Contractor PM and Unit PM with review and

verification of all required documentation. The Contractor PM must initial and date all invoices submitted to the attention of the Unit PM assigned to the project.

Include approved cost adjustments and approved work variances with all invoice submittals. Identify the approved changes on the invoice checklist for review by the Unit PM.

CONTRACTOR INTERACTION WITH UNIT PM AND PROPERTY OWNERS

The Contractor PM will be the primary point of contact with the property owner(s). Whether at meetings on site or via telephone, the Contractor PM will provide the property owner(s) with information associated with all activities.

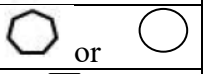
If a property owner becomes uncooperative or if the Contractor PM or their staff must leave a site due to safety concerns, immediately report the situation to the Unit PM. The Unit will work to resolve any property access concerns or safety issues with the Contractor PM, property owner(s) and any other impacted parties.

The Contractor PM must communicate with the Unit PM on a frequency established by the Unit and based on the type of field activities and work phase. There may be the need for daily communication via telephone, email and/or written reports. Communication between the Contractor PM and Unit PM is critical for maintaining a transparent record of completed RI and RA phase work activities.

REPORT SYMBOLS AND ABBREVIATIONS

Display symbols and abbreviations on all figures and maps according to the following:

Note: Use the last four digits of the site identification number before the sample abbreviation.
Example: 0730-TW-1

Description	Abbreviation		Symbol
Monitoring Well	MW-#		
Water Supply Well	PW-House number		
Waste Characterization	WC-#		
Boring (no soil sample collected)	B-#		
Soil Boring (soil sample collected)	SB-#		
Surface Water/Sediment Sample	SW/SD-#		
Landfill Gas Probe	LFGP-#		
Soil Gas Probe	SGP-#		

ATTACHMENT 3: PERSONNEL QUALIFICATIONS AND TASK DESCRIPTIONS

PERSONNEL AND QUALIFICATIONS	TASK DESCRIPTIONS
Principal Engineer/Geologist/Hydrogeologist/Scientist Administrative and/or professional head of the organization or primary contract. Responsible for conceiving and executing business functions of the organization. Directs the professional staff. Normally has a financial interest in the company as partial owner, major investor or stockholder, or officer. Charges an extremely limited number of hours per site as the Principal. This position should never bill field or field supervision hours.	- Expert testimony - Legal strategies - Depositions - Contract oversight (limited)
Senior Engineer/Geologist/Hydrogeologist/Scientist Typically requires professional registration when applicable to task, 8 years of experience in technical or managerial roles, and regulatory compliance. Serves as senior technical leader, provides contract oversight for environmental remediation projects of medium to large scope and /or complexity and has developed substantial expertise in their field of practice. Generally, supervises Project Managers and oversees several projects. Duties typically include reviewing reports, developing strategies, and attending client and/or associated project meetings. Responsible for approving designs, reports, plans, and specifications before submittal to the Pre-Regulatory Landfill Unit. If significantly involved in a highly technical project, should have substantial technical expertise directly related to the project. Ensures compliance of field service operations with OSHA safety standards. Addresses public health concerns.	- Expert testimony - Site strategy and planning - Contract oversight - Reviews technical reports - Reviews corrective action plans - Reviews engineering/remedial system design - Health and safety coordinator - Reviews site safety plans
Project Engineer/Geologist/Hydrogeologist/Scientist Typically possesses at a minimum, a bachelor of science degree in engineering, geology, hydrogeology, or a directly related field. Serves as manager for entire project and has at least 5 years of experience in the environmental field. Duties typically include preparing proposals, reviewing reports, developing strategies, and attending client and/or associated project meetings. Under general supervision, prepares environmental design and plan specifications for site remedial activities. Leads and supervises teams of staff and technician level personnel, but would have a limited number of hours charged to each site, and only a small percentage of total field hours. Serves as site technical expert or supervisor for hydrogeological site characterizations and remediation activities and tests, and assembly of reports, plans, and specifications.	- Project management - Site strategy and planning - Develop site health and safety plans - Engineering/remedial system design - Data review and analysis - Report review - Site meetings and reconnaissance - On-site supervision (periodic) - Work plan preparation/review - Site investigation planning/review - Field work planning/review - Site inspection (periodic)
Staff Engineer/Geologist/Hydrogeologist/Scientist Requires at a minimum, a bachelor's degree in engineering, geology, hydrogeology, or related science and l to 5 years of experience in the environmental field. Works under supervision of the project manager to perform routine tasks related to environmental investigation and remediation projects. Is the primary person responsible for gathering field data and is competent at data analysis. Must be able to conduct investigation and remedial activities including directing drilling and monitoring well installation, sampling, conducting site and geologic mapping, documenting field activities, and compiling data. Must have knowledge of QA/QC procedures and protocol. This position will normally be highest in the number of hours billed for on-site work. However, technicians (see below) would conduct routine or on-going monitoring.	- Report preparation - Field work preparation/planning - Supervises site investigation and remediation activities - Site reconnaissance and mapping - Engineering/remedial system design and installation - Limited data review and analysis - On-site health and safety supervisor
Technician Typically requires a high school diploma, certified or licensed trades-person, or an associate's degree at a minimum. Responsible for general supervision of the installation, maintenance, and repair of on- site equipment. Conducting routine monitoring, collecting samples, and preparing equipment maintenance/operating logs.	- Field work preparation - Operation and maintenance of equipment - Well developing and sampling - Soil sampling - Handling of investigation and remediation derived wastes - Remedial system installation, operation, and maintenance - Monitoring activities
Draftsperson/CAD Typically requires a high school diploma. Requires 2 to 8 years of experience or 2 years of related college and more than 1 year of experience. Generally requires a Technical Drawing Certificate, and advanced drafting skills such as Computer Aided Drafting (CAD) & Design (CADD) operations.	- Drafting - CAD/CADD work - Cartography - Plotting of GPS and standard survey data
Word Processor/Clerical Operates computer for work processing, spreadsheets, and statistical typing, correspondence report generation, general office work, typing, and filing.	- Spreadsheets - Report generation - Word processing - Typing - Filing - General secretarial - Document reproduction

ATTACHMENT 4: COST PROPOSAL AND INVOICE FORMAT SHEETS

The following formats must be used by both Contractors and Local Governments for developing cost proposals and invoice submittals.

COST PROPOSAL FORMAT SHEET

Cost Proposal

Site ID #: Task Order #: Work Phase Description: RI Delineation
State Contract #: Site Name:

Task Order # & Task Description (Work Plan and Field Services):

Subtask A - Subtask Description (Work Plan and Estimate):

Labor

Personnel Level	Unit Rate ($)	# Units	Total Cost
Project	$0	0	$0
Staff	$0	0	$0
Word Processor/Clerical	$0	0	$0
		Subtotal Subtask A	$0

Subtask B – Cover Soil Sampling:

Labor

Personnel Level	Unit Rate ($)	# Units	Total Cost
Staff	$0	0	$0
Technician	$0	0	$0

Expendables and Reimbursable:

GPS Unit	$0	0	$0
PID	$0	0	$0
Subcontractor drilling	$0	0	$0
Per diem	$0	0	$0
Mileage	$0	0	$0
		Subtotal Subtask B	$0
		Cost Proposal Task Total	$0

INVOICE FORMAT SHEET

Invoice

Site ID #: Task Order #: Work Phase Description: RI Delineation
State Contract #: Site Name:

Task Order # & Task Description (Work Plan and Field Services):

Subtask A - Subtask Description (Work Plan and Estimate):

Labor

Personnel Level	Unit Rate ($)	# Units	Total Cost
Project	$0	0	$0
Staff	$0	0	$0
Word Processor/Clerical	$0	0	$0
		Subtotal Subtask A	$0

Subtask B – Cover Soil Sampling:

Labor

Personnel Level	Unit Rate ($)	# Units	Total Cost
Staff	$0	0	$0
Technician	$0	0	$0

Expendables and Reimbursable:

GPS Unit	$0	0	$0
PID	$0	0	$0
Subcontractor drilling	$0	0	$0
Per diem	$0	0	$0
Mileage	$0	0	$0
		Subtotal Subtask B	$0
		Invoice Task Total	$0

(*Contractor PM Signature*)

_____

Name: Invoice # (Company Invoice #):

Title: Remit To: (Company Name)
(Company Address)

Company Name:

ATTACHMENT 5: PRLF INVOICING CHECK LIST FORM

PRLF INVOICING CHECK LIST

Contractor PM Initial: Task Order ID: PRLF PM Initial:
Date Invoice Submitted to PRLF: Date to PRLF Peer:

EXAMPLE ONLY

Contractor PM	Local Gov't PM	PRLF PM	PRLF PEER	
				Contractor Invoice
				Is the approved cost proposal included at the end of the invoice package?
				Was a work plan variance submitted that affected costs? (If so, explain in notes below)
				Is the site name and ID # correct on the invoice and cost proposal?
				Is the invoice date representative of the latest invoice submittal date?
				Does the format of the invoice match the format of the cost proposal, including breakout of subtasks?
				Are all line items from the cost proposal included in the invoice?
				Is an explanation provided in the notes for **all** items that vary from the cost proposal to the invoice? Such as:
				Invoiced line items not included in the cost proposal?
				Equipment unit rates invoiced higher than proposed?
				Large variances in proposed personnel hours and invoiced hours? (Reasonable variances are accepted)
				Are the unit costs correct per the contract fee schedule?
				Is tax for rented equipment and purchased supplies listed as a separate line item?
				Are shipping costs listed as a separate line item?
				Is an explanation provided in the notes if the invoice includes project or senior level hours for field work?
				Is the math correct?
				Subcontractor Invoice(s)
				Are all subcontractor invoices provided, and in the order they appear on the contractor's invoice?
				Are all subcontractor bids provided with the cost proposal in the order they appear in the cost proposal?
				Do the subcontractor's total costs match the consultant's invoice line items?
				Is an explanation provided in the notes for sub line items not included in the cost proposal bid?
				Is an explanation provided in the notes for sub rates invoiced higher than in the cost proposal bid?
				If the sub invoice covers multiple tasks and/or cost adjustments, are the totals clearly broken out for each?
				If a sub's proposed line items/unit hours were reduced, are the consultant's associated line items reduced?
				Do all sub invoices and bids show a breakdown of costs in separate line items (no lump sum costs)?
				Is the math correct on the subcontractor invoices?
				Additional Items for Remedy Invoices
				Is the cost spreadsheet from the consultant/subcontractor contract included?
				Are the line items relevant to this invoice highlighted on the contractor/subcontractor cost spreadsheet?
				Does the invoice contain validation of units for invoiced subcontractor items?
				Such as: weight tickets, surveyor statements of volumes (SF, acres, etc.) field measurements collected by contractor, cut/fill reports, field observation reports documenting days, activities, etc.
				If a sub hires a sub to complete a line item (i.e. surveyor, driller, etc) is there proof of services rendered?
				Such as: surveyor report, driller well abandonment records, field observation reports, etc.
				To be Completed by PRLF Staff Only
				Is the invoice and approved cost proposal separately secured (if more than 1 page each)?
				Is the task order on the database?
				Does the total cost of the cost proposal match the database?

Notes: