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Via Electronic Mail

December 20, 2024

Mr. Richard Fisher
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region I
5 Post Office Square - Suite 100
Boston, MA 02109-3912

Re: GE-Pittsfield/Housatonic River Site
Rest of River (GECD850)
Proposed Dewatering and Water Treatment Systems for Upland Disposal Facility Area: Addenda to Upland Disposal Facility Revised Final Design Plan and Upland Disposal Facility Revised Operation, Monitoring, and Maintenance Plan

Dear Mr. Fisher:

GE is today submitting separately the *Upland Disposal Facility Revised Final Design Plan* and the *Upland Disposal Facility Revised Operation, Monitoring, and Maintenance Plan*. Enclosed herewith for EPA's review and approval are three addenda to those plans that address the dewatering and water treatment systems proposed for use at the Upland Disposal Facility (UDF) area. Those addenda are the *Conceptual Sediment Dewatering and Water Treatment Evaluation* and the *Dewatering/Water Treatment Treatability Study Work Plan* (which are addenda to the Revised UDF Final Design Plan) and the *Sediment Dewatering and Water Treatment Systems Conceptual Operations, Monitoring, and Maintenance Plan* (which is an addendum to the Revised UDF Operation, Monitoring, and Maintenance Plan). Complete hard copies of these addenda will also be sent to you.

Please let me know if you have any questions about these addenda.

Very truly yours,

Matthew Calacone
Senior Project Manager
GE Aerospace

Enclosures

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General Electric Company

Conceptual Sediment Dewatering and Water Treatment Evaluation

Addendum to the Upland Disposal Facility Revised Final Design Plan

Housatonic River – Rest of River
Pittsfield, Massachusetts

December 2024

Conceptual Sediment Dewatering and Water Treatment Evaluation

Addendum to the Upland Disposal Facility Revised Final Design Plan

Housatonic River – Rest of River
Pittsfield, Massachusetts

December 2024

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Abbreviations

µg/L	micrograms per liter
%	percent
ARAR	applicable or relevant and appropriate requirement
CMR	Code of Massachusetts Regulation
COC	constituent of concern
Dewatering/Treatment Treatability Plan	*Dewatering/Water Treatment Treatability Study Work Plan*
EBCT	empty bed contact time
EPA	United States Environmental Protection Agency
GAC	granular-activated carbon
GE	General Electric Company
gpm	gallons per minute
HDPE	high-density polyethylene
MassDEP	Massachusetts Department of Environmental Protection
NPDES	National Pollutant Discharge Elimination System
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
Reach 6 Conceptual Work Plan	*Conceptual Remedial Design/Remedial Action Work Plan for Reach 6*
Reach 6 PDI Summary Report	*Pre-Design Investigation Summary Report for Reach 6*
Revised Final Permit	*Revised Final Resource Conservation and Recovery Act Permit Modification*
Revised UDF Final Design Plan	*Upland Disposal Facility Revised Final Design Plan*
Revised UDF OMM Plan	*Upland Disposal Facility Revised Operation, Monitoring, and Maintenance Plan*
ROR	Rest of River
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbon
TSS	total suspended solids
UDF	Upland Disposal Facility
UDF Final Design Plan	*Upland Disposal Facility Final Design Plan*
UDF OMM Plan	*Upland Disposal Facility Operation, Monitoring, and Maintenance Plan*
VOC	volatile organic compound

1 Introduction and Background

On December 16, 2020, pursuant to the 2000 Consent Decree (CD) for the GE Pittsfield/Housatonic River Site (the Site) (EPA and GE 2000), the U.S. Environmental Protection Agency (EPA) issued to the General Electric Company (GE) a final revised modification of GE's Resource Conservation and Recovery Act Corrective Action Permit (Revised Final Permit; EPA 2020) for the Housatonic Rest of River (ROR), which set forth a Remedial Action selected by EPA to address polychlorinated biphenyls (PCBs) in the ROR. The ROR is that portion of the Housatonic River and its backwaters and floodplain (excluding certain residential lawn area) located downstream of the confluence of the East and West Branches of the Housatonic River in Pittsfield, Massachusetts. The ROR has been segmented into six separate remediation units (RUs) to manage workflow and schedule for the ROR Remedial Action. The ROR Remedial Action also includes the construction and operation of an on-site Upland Disposal Facility (UDF) for the disposal of a portion of the sediments and soils removed from the ROR area.

Reach 5A was the first RU to be addressed because it is the most upstream reach in the ROR. The *Conceptual Remedial Design/Remedial Action Work Plan for Reach 5A* (Anchor QEA et al. 2023) was submitted to EPA on September 28, 2023, and conditionally approved by EPA on December 3, 2024. Reach 6, which includes Woods Pond, is the second RU to be addressed; and the *Conceptual Remedial Design/Remedial Action Work Plan for Reach 6* (Reach 6 Conceptual Work Plan; Anchor QEA et al. 2024) was submitted to EPA on October 31, 2024, and is currently under EPA review. As described in the Reach 6 Conceptual Work Plan, the remediation for Reach 6 will include removal of sediments from Woods Pond and other aquatic portions of Reach 6 and disposal of such removed sediments at the UDF or at an off-site disposal facility, consistent with the requirements specified in Attachment E to the Revised Final Permit. As further described in that plan, GE plans to implement hydraulic dredging and pumping for the sediments in Reach 6, including on-site transport from Reach 6 to the UDF.

In February 2024, GE submitted an *Upland Disposal Facility Final Design Plan* (UDF Final Design Plan; Arcadis 2024a) and an *Upland Disposal Facility Operation, Monitoring, and Maintenance Plan* (UDF OMM Plan; Arcadis 2024b), which were both conditionally approved by EPA in letters dated September 12, 2024. Those letters required GE to submit revised versions of those plans. They also required GE to provide information regarding the design, location, and operation, monitoring, and maintenance (OMM) of the on-site dewatering and water treatment facilities to be constructed at the UDF area to manage the sediments that are hydraulically dredged and transported there. In response, GE has prepared and is submitting on December 20, 2024 a Revised UDF Final Design Plan (Arcadis 2024c) and a Revised UDF OMM Plan (Arcadis 2024d). With specific respect to the on-site dewatering and water treatment facilities, GE has prepared and is submitting this *Conceptual Sediment Dewatering and Water Treatment Evaluation* as an addendum to the Revised UDF Final Design Plan to provide information regarding the conceptual design and location of the on-site dewatering and water treatment facilities at the UDF area. This submittal is also accompanied by a *Dewatering/Water Treatment Treatability Study Work Plan* (Dewatering/Treatment Treatability Plan; Arcadis 2024e), which is another addendum to the Revised UDF Final Design Plan and presents a proposal for testing required to satisfy data needs required to further the design of dewatering and water treatment facilities proposed for use at the UDF area. Finally, the Revised UDF OMM Plan is accompanied by an addendum, entitled *Sediment Dewatering and Water Treatment Systems Conceptual Operations, Monitoring, and Maintenance Plan* (Arcadis 2024f), which presents a conceptual implementation schedule and describes OMM activities for the dewatering and water treatment facilities at the UDF area.

The on-site dewatering and water treatment facilities at the UDF will manage sediments and water generated during remediation of multiple RUs that will involve hydraulic dredging and pumping of removed sediments to the UDF. These RUs are, in order, Reaches 6, 5C, 7B, and 7C. Since Reach 6 will be the first of these RUs to be remediated, the dewatering and water treatment systems at the UDF will be constructed and operational before remediation activities in Reach 6 begin. Because pre-design investigations have not yet been conducted at other RUs expected to use these systems (i.e., Reaches 5C, 7B, and 7C), the conceptual design presented herein relies primarily on the information collected during investigations conducted in Reach 6. Those investigations were described in the *Pre-Design Investigation Summary Report for Reach 6* (Reach 6 PDI Summary Report; Anchor QEA 2024), which includes a summary of the sediment characteristics and existing sediment data that have been considered in the evaluation presented herein. In general, significant variability was observed in the dry bulk density, moisture content, and grain size distribution of the sediment samples collected from Reach 6. The variability in geotechnical index parameter results reflects the heterogenous nature of the sediment at various depth intervals and locations in Reach 6. The Reach 6 Conceptual Work Plan outlines the conceptual hydraulic dredging and transport activities planned for Reach 6, including on-site transport from Reach 6 to the sediment dewatering system at the UDF. Figure 1-1 illustrates the site plan for the UDF operational area and includes the conceptual location for the sediment dewatering and water treatment systems, as well as the conceptual pipeline route and outfall for the treated water.

Following completion of the studies described in the Dewatering/Treatment Treatability Plan, the final design of the sediment dewatering and water treatment systems at the UDF will be provided in a separate final design report on those systems, which will be another, later addendum to the Revised UDF Final Design Plan.

2 Conceptual Sediment Dredging and Transport Approach

As discussed in the Reach 6 Conceptual Work Plan, the removal volume for Reach 6 includes sediments in Woods Pond itself plus those in the outlet channel from Woods Pond and in Valley Mill Pond (located on the eastern side of the river south of Woods Pond Dam and hydraulically connected to Reach 6). As presented there, approximately 493,300 cubic yards (cy) of sediment are estimated for removal from those areas, including approximately 484,700 cy for disposal in the UDF and approximately 8,600 cy for disposal at an off-site facility.[1] Based on these estimated removal volumes for Reach 6, and as stated in the Conceptual Work Plan, average dredge production rates between 625 and 830 cubic yards per day (cy/day) would be needed to complete the Reach 6 dredging within the target schedule of three to four years.

Based on the hydraulic dredging production rate presented the GE's Revised Corrective Measures Study Report (Arcadis et al. 2010) for Alternative SED 9 (which was similar to the subsequently selected ROR remedy), two dredge plants would need to operate for 10 to 12 hours per day or one dredge plant would need to operate for 20 to 24 hours per day (two 10-hour or 12-hour shifts) to achieve these average production rates. The final production rate and schedule will be determined during the final remedial design for Reach 6 based on a variety of factors, including the ability to receive and dewater dredged sediments at the UDF. Further evaluation of potential dredging production rates will be presented in the Final RD/RA Work Plan for Reach 6 based on the final design of the on-site dewatering facility at the UDF and the final sediment removal volumes. The production rates considered for this conceptual sediment dewatering and water treatment evaluation are summarized in Table 2-1. It is anticipated a system designed for this volume would be able to accommodate material to be directly hydraulically transported to the UDF from other RUs.

Table 2-1. Assumed Reach 6 Production Rates Considered in Evaluation

Design Parameter	Conceptual Assumption
Active Dredge Crews	2 crews
Daily Operation Time	10 to 12 hours
Hydraulic Dredging Production Rate	625 and 830 cy/day

It is anticipated that sediments designated for off-site disposal, which are estimated to consist of sediments from Valley Mill Pond, will be removed separately from the sediments designated for disposal in the UDF. Under the conceptual design, these sediments would be hydraulically dredged and then pumped to and segregated at the UDF. However, additional evaluation of the sediment dredging and transport approach for Valley Mill Pond will be conducted after supplemental data are collected on the sediments in that pond. In any case, large debris and/or dense aquatic vegetation may require removal by mechanical means separately from and prior to initiating hydraulic dredging.

Dredged sediment from Reach 6 will be transported to the UDF sediment dewatering area via the sediment slurry conveyance system (i.e., transport pipeline) described in Appendix E to the Reach 6 Conceptual Work Plan. Water generated during sediment dewatering will be conveyed to the treatment system via a separate conveyance system, which will be designed once a dewatering technology is selected.

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[1] As described in the Rach 6 Conceptual Work Plan, the design presented in that Work Plan does not include remediation of the headwaters of Woods Pond (i.e., the portion of Reach 6 between the downstream end of Reach 5C and Woods Pond proper), which will be addressed in a later addendum to the Final RD/RA Work Plan for Reach 6.

3 Sediment Dewatering Evaluation

This section provides an evaluation of the following applicable technologies for sediment dewatering and disposal in the UDF:

- Geotextile tubes, placed within the UDF consolidation area; and
- Mechanical dewatering system adjacent to the UDF.

Geotextile tubes, placed within the UDF and filled with slurry pumped directly from the Reach 6 shoreline facility, are a simple and effective means for dewatering sediment within the UDF where it will remain, thus minimizing handling. A mechanical dewatering system (i.e., filter presses) adjacent to the UDF is a more aggressive approach to dewatering sediment slurry that is used in applications where geotextile tubes are not sufficient to meet project requirements such as dredge production rates, schedule, and available space.

As discussed above, the Reach 6 Conceptual Work Plan describes the conceptual hydraulic dredging and transport activities planned for Reach 6, including on-site transport from Reach 6 to the UDF. As presented there, it is anticipated that dredged sediment from Reach 6 will be conveyed to a shoreline support facility on the southern shoreline of Woods Pond, which will contain a pump station. From there, material will be hydraulically conveyed to the UDF for dewatering and further processing, as needed, for eventual disposal. The details related to the shoreline support facility and how hydraulically dredged sediment will be transported from the shoreline support facility to the UDF property are described in Appendix E to the Reach 6 Conceptual Work Plan, entitled Hydraulic Transport Evaluation for Reach 6.

As an alternative, for small quantities, such as mechanically dredged material that will be disposed of off site, passive dewatering may be performed on the shoreline adjacent to dredging operations. Passive dewatering is achieved via gravity in a container or on a mixing pad with an impermeable liner and a sump for water collection. Gravity dewatering allows water to freely drain from the sediment; the amount of water that is separated depends on the sediment composition, duration, and weather. A drying agent may be mixed into the dredged material to further decrease the water content of the dredged material by solidifying, absorbing, or reacting with the water. The objective of the drying agent is to decrease the water content and improve the dredged material characteristics as needed to meet transport and disposal or placement requirements. Gravity dewatering and drying agent evaluation will be performed as discussed in Section 3.2. Similar to water generated through other dewatering technologies, decant water that drains passively from the sediment would be treated using an on-site water treatment plant prior to discharge. Passive dewatering has limited applicability for large dredging projects, especially where space for shoreline facilities is limited, but may be utilized for small-scale operations for a limited amount of dredged material.

The remainder of this section provides a screening evaluation of the applicable technologies for sediment dewatering and data needs identified to further the design.

3.1 Dewatering Technology Screening

Technology evaluations for the use of geotextile tube and mechanical dewatering methods are presented in this section. As discussed above, this technology screening has been conducted using data available for Reach 6 sediment that will be hydraulically dredged and pumped to the UDF for disposal, as presented in the Reach 6 PDI Summary Report. The information presented herein is conceptual; selection of the appropriate dewatering technology will be based on information gathered during forthcoming treatability testing, as proposed in the Dewatering/Treatment Treatability Plan. The final determination regarding the dewatering technology to be used will be made during the final design of the dewatering and water treatment systems and presented in a final design report on those systems, which will be another addendum to the Revised UDF Final Design Plan.

3.1.1 Geotextile Tubes

Geotextile tubes are made of high-strength, permeable geotextile fabric. They retain sediment while allowing water to drain from the small openings in the geotextile tubes. Typical geotextile tube sizes have a circumference of 30 to 90 feet, but those with a circumference of 60 to 75 feet are ideal. Lengths can be up to 200 feet and are adjusted as needed during construction to provide an efficient layout. Geotextile tube dewatering has been successfully applied on sediment remediation projects and can be combined with hydraulic dredging. Geotextile tube dewatering is a simple process that is advantageous when dredge material is transported by slurry, sufficient space is available, and there is minimal need for rapid material dewatering (e.g., dewatered material being dewatered at its final disposition location) and/or minimal use of additional, complex pieces of equipment.

3.1.1.1 System Location

Geotextile tubes require a large amount of relatively flat space; however, to maximize the efficient use of space and to expedite dewatering with compression loading, the tubes are typically stacked. If selected for dewatering for ROR sediment pumped to the UDF, geotextile tubes will be positioned within the UDF in the consolidation area, possibly necessitating that both cells designed within the consolidation area remain active throughout the duration of active use of the UDF. Geotextile tube layout and stacking will be carefully planned and executed to maximize efficient use of space. Berms may be placed between and around the tubes for stability and to prevent rolling. In the UDF, sediment from mechanical dewatering operations or mechanically dredged and stabilized sediment can be used to create the berms and fill around the tubes.

As noted above, it is anticipated that sediments designated for off-site disposal, which are estimated to consist of sediments from Valley Mill Pond, will be hydraulically removed separately from the sediments designated for disposal in the UDF and will then be pumped to and segregated at the UDF. The location for the dredged materials for off-site disposal will be managed in a separate bermed area within the consolidation area. Once the material is sufficiently dewatered, the geotextile tubes will be opened and the dewatered material removed and loaded for off-site disposal (see Section 3.1.1.2).

3.1.1.2 Dewatering Process

Geotextile tube dewatering can be combined with hydraulic dredging by pumping the sediment slurry directly into geotextile tubes and directly feeding any required polymer into the pipeline without additional material handling steps. Polymers are often added to enhance dewatering by flocculating fine-grained materials. During filling, several inlet ports in the tube may be used to maximize efficiency. Inlet piping is manifolded with flow control valves to allow even filling of the tubes. Filling of geotextile tubes is alternated with draining time until the geotextile tube is filled with sediment. Due to this, at least two tubes are typically in operation at any given time so that operators can alternate filling and draining times between tubes to minimize downtime. New geotextile tubes and manifold connections are set up as the active draining tubes are filled and dewatering to allow for transitions safely and efficiently without halting dredging operations. Additional standby tubes are prepared for overflow or unforeseen circumstances to minimize project downtime. Geotextile dewatering testing and polymer bench testing are required to evaluate the fill/drain schedule and further the design (see Section 3.2).

After a given geotextile tube is completely filled, the sediment is allowed to dewater within the tube over a period of time, generally on the order of weeks to months, but timing can vary depending on sediment properties (e.g., sand will dewater more quickly than non-plastic, fine-grained material, which typically takes the longest to dewater) and final disposition requirements. Settlement is greatest in the beginning, just after filling, and becomes asymptotic over time. If the geotextile tubes are placed and filled at the location where the sediment is ultimately to be disposed of (in this case, for material designated for disposal in the UDF), no additional handling of the material within the tubes or preparation of the material is required prior to closure of the UDF. If the material within the geotextile tubes requires disposal at an off-site location, once the sediment in a tube has adequately dewatered, the tube would be opened and the material would be loaded into containers for transport to the selected off-site facility(ies) or to a rail loading facility for subsequent transport to the selected off-site facility(ies).

Filtrate production from geotextile tubes typically takes longer than with traditional mechanically dewatered and stabilized sediments. While a significant portion of the water is generated during the filling phase for each geotextile tube, the geotextile tubes will continue to release filtrate as the material in the tube continues to dewater through passive dewatering and/or as the sediment within the tube consolidates due to presence of other tubes stacked on top of it or other fill placed over the tube.

Filtrate leaving the geotextile tubes will be captured in a designated containment area/sump, separate from the general leachate collection system designed for the UDF.[2] Water generated from the designated containment area/sump designated for geotextile tube dewatering and water generated from the general leachate collection system designated for the UDF will be pumped to an on-site water treatment plant and treated prior to discharge (see Section 4). It is anticipated that the UDF will receive dewatered material from downstream RUs (i.e., Reaches 7E, 7G, and 8) for years after the last geotextile tube is filled (from Reach 7C), so the extended time for geotextile tube dewatering within the UDF consolidation area is not expected to impact the schedule for final closure of the UDF.

3.1.1.3 Screening and Desanding

Screening and desanding may result in more efficient use of the geotextile tubes, primarily for the finer sediment fraction, resulting in fewer tubes overall and more active operational area available within the UDF for additional throughput from Reach 6 and/or other RUs. However, there is a significant effort and expense to mobilize the necessary large equipment, set up the system, and operate screening and desanding systems. Consideration of the removal of coarse material will be further evaluated during the final design of the dewatering system to be used at the UDF.

To incorporate screening and desanding into a process using geotextile tubes, the slurry would first be pumped into a screening and desanding unit, such as a separation system, using vibrating screens and hydrocyclones. Hydrocyclone technology has been used effectively with dredging activities, primarily for the separation of materials of different density or weight within a dredge slurry mixture. If desired, beneficial use of coarse materials could be further evaluated based on waste characterization testing.

The screening and desanding unit will remove oversize material, with the cutoff sizes for the screen and hydrocyclone dependent on the ideal composition of the remaining solids for dewatering in the geotextile tubes. For example, a system may utilize a screen to remove solids greater than 0.125 inch, followed by a coarse sand

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[2] Although the current UDF design includes infrastructure for leachate collection and conveyance of leachate generated during UDF operation (see Design Drawing 6 [Leachate Collection Plan] in the Revised Final UDF Design Plan), the expected water flow rate for water generated by initial geotextile tube dewatering is significantly higher than what would be expected during long-term UDF operation. Therefore, a separate collection and conveyance system sized to accommodate the expected geotextile tube dewatering flow rate will be designed if geotextile tube dewatering is selected and included in the final design report for the dewatering and water treatment systems.

hydrocyclone and then a fine sand hydrocyclone. The effluent overflow can then be treated with polymer and pumped to geotextile tubes.

Removal of the coarse and sand material from the slurry stream would result in fewer geotextile tubes being required due to the removal of volume as well as focusing the dewatering on the fraction of material that may be more amendable to consolidation (i.e., fine-grained sediment). High sand content can result in the need for more inlet ports due to mounding within the tube. However, removal of the sand fraction from the sediment slurry can increase the dewatering time needed if a specific moisture content is required to be met. In cases where the geotextile tube is to remain in place as part of on-site disposal operations, such as the UDF, the longer dewatering time is not a significant drawback. If fact, the separated sand may be beneficial for use within the UDF for grading within the disposal cell and leveling between layers of geotextile tubes if additional fill is needed.

As noted above, further evaluation and a decision regarding use of a screening and desanding system as part of the use of geotextile tubes (if selected for dewatering) will be included in final design report/addendum on the dewatering and water treatment systems to be used at the UDF.

3.1.2 Mechanical Dewatering

Mechanical dewatering is a much more complex and aggressive method of dewatering than use of geotextile tubes and passive dewatering. Hydraulically dredged slurry must be conditioned prior to dewatering with filter presses. The conditioning process includes screening, sand removal, gravity thickening, and polymer addition during multiple steps. Figure 3-1 presents a process flow diagram of a typical mechanical dewatering operation. Many of these processes require the use of treated water from the water treatment plant, which further increases the size and complexity of the sediment management process, including the need for additional water treatment and treated water storage capacity. Mechanical dewatering is attractive when there is a need to process dredged material quickly, when the processing facility and disposal site are not co-located, and when there is a greater need to reduce the water content (and therefore weight) of the dewatered material.

A conceptual design for a mechanical dewatering system has been developed using average, steady-state values, based on data available for Reach 6 sediment that will be hydraulically dredged and pumped to the UDF for disposal, as presented in the Reach 6 PDI Summary Report. Variability in dredged sediment over time will be evaluated further during the Reach 6 design process if mechanical dewatering is selected for use at the UDF, based on information gathered during the forthcoming treatability testing. Mechanical dewatering, if selected, will occur at the production rates discussed in Section 2. Design requirements for the major mechanical dewatering equipment are summarized in Table 3-3.

Table 3-1. Mechanical Dewatering Major Equipment

Equipment	Quantity	Size
Scalping Screens	2	Redundant screens with a minimum capacity of 1,500 gpm
Slurry Holding Tanks	5	20,000-gallon mobile tanks
Hydrocyclone Skid	2	Redundant hydrocyclones with a minimum capacity of 1,500 gpm
Gravity Thickener	2	25-foot approximate diameter
Filter Press Feed Tanks	5	20,000-gallon mobile tanks
Filter Presses	3	Two presses with 10-ton-per-hour capacity, and one redundant press
Polymer Skids	2	Polymer thickening and filter presses

3.1.2.1 System Location

Based on the size of the equipment included in the UDF design, there is sufficient space adjacent to the UDF to install a mechanical dewatering system if one is needed. The mechanical dewatering system, if needed, can fit within the operations area immediately to the south of the UDF (Figure 1-1). A final location will be selected if mechanical dewatering will be used.

3.1.2.2 Dewatering Process

Screening, as discussed in Section 3.1.1.3, is typically the first step to mechanical dewatering, to remove material too large to be processed through the dewatering unit. The gravel and small debris removed through screening would be loaded into containers for temporary storage and passive dewatering. Free liquid collected from the containers would be collected and pumped back to the head of the screen.

Sands and fines that flow through the screen may be subject to the desanding process. Desanding, as discussed in Section 3.1.1.3, removes sand from the slurry. In a mechanical dewatering process, desanding may be conducted to reduce abrasive wear of sludge pumps, filter press media, and other sediment dewatering equipment. It also reduces the total volume of solids that the remainder of the system needs to process. While the presence of granular material, such as sand, would generally produce a drier filter cake, the use of sand after a certain threshold would interfere with the effectiveness of the polymer and decrease dewatering efficiency.

After desanding, the slurry would flow to a residue tank, which feeds the gravity thickening process. Polymer may be added to the slurry to facilitate thickening. Settled sludge would be pumped from the bottom of the thickeners into a holding tank and the supernatant (i.e., overbearing water) would be pumped to the water treatment plant for treatment.

From the holding tank, the thickened slurry would be pumped to a filter press(es) where pressure is applied to separate water from the sediment, resulting in a filter cake and filtrate water. Filter presses that can be used include belt presses, plate and frame filter presses, and membrane filter presses. Membrane filter presses are generally the most efficient, meaning they often have higher throughput capacity, can produce filter cakes with the least amount of residual moisture, and can achieve a solids content similar to that achieved using geotextile tube dewatering. Filter cake solids would be stockpiled along with the coarse-grained material from the screening and desanding process, and then loaded into trucks for placement into the UDF.

A mechanical dewatering system can be designed with a high throughput, allowing it to adapt to a range of dredging scenarios. However, mechanical dewatering requires significant energy input to run the multiple components in the mechanical dewatering treatment train, and the many components can result in a noisy operation. Additionally, mechanical dewatering has potential constructability and operations issues due to the number of system components and general complexity of operation. Complex operations may increase the potential for downtime and delays and may require multiple trained operators at the site to operate the system. In addition, there are multiple material handling steps to move the sediment efficiently from the initial screening process to place the material in the UDF.

3.2 Data Needs

Treatability bench-scale testing is needed to evaluate dewatering methods to select feasible and practicable methods for dewatering sediments at the UDF area to meet placement and/or disposal requirements. Specifically, additional data are needed to evaluate sediment dewatering by geotextile tubes and mechanical methods, including an evaluation of appropriate flocculants to improve the dewatering processes. The following testing is needed to further the design of the dewatering operations:

- **Sediment Stabilization Evaluation:** To support the design for dewatering of sediments that are mechanically dredged, testing will be conducted to evaluate passive (gravity) dewatering and sediment stabilization techniques to meet transport and disposal requirements. This testing will include a gravity drainage study, drying agent testing, and shake/vibration testing.
- **Geotextile Tube Dewatering Evaluation:** Geotextile dewatering bench-scale testing will be conducted to replicate field conditions and evaluate the dewatering performance (e.g., rate and extent of dewatering) of one or more commercially available geotextile fabrics. Before starting geotextile tube bench-scale tests, polymer jar testing will be performed to evaluate appropriate dosing for flocculation of fine-grained materials and to determine the appropriate polymer to use in the geotextile tube bench-scale testing.
- **Mechanical Dewatering Evaluation:** Sequential testing will be conducted to simulate and evaluate the multiple operations of mechanical dewatering. Bench-scale testing will include the following steps, in order:
  - **Oversized Material Removal and Desanding:** Screening and desanding testing will be performed to verify the cutoff sizes and optimize the efficiency of each process.
  - **Polymer Jar Testing and Thickening:** Testing will be conducted to evaluate various polymers and doses, as well as the hydraulic loading rate, thickened slurry geotechnical and chemistry parameters, and water parameters.
  - **Mechanical Filter Press Testing:** Filter presses and polymers will be tested to optimize the solids content of the filter cake and minimize solids carryover to the water treatment plant. Design parameters such as pressure, cycle time, and cloth type will be varied to identify the optimal configuration. In addition, the filter cakes will undergo geotechnical analysis to evaluate composition for disposal.

These proposed tests are described in detail in Sections 4 through 6 of the Dewatering/Treatment Treatability Plan. Filtrate water from the sediment dewatering evaluations will be collected and analyzed for water chemistry parameters to support the design of the water treatment system (see Section 4).

4 Water Treatment System

Water generated from sediment dewatering and the UDF leachate will require treatment before it can be discharged back to the Housatonic River. This section presents proposed water quality criteria for discharge of treated water to the Housatonic River and an evaluation of the possible water treatment processes required to reduce constituents of concern (COCs) below those water quality criteria.

For the purposes of developing a conceptual design for the water treatment system, it is assumed that sediment dewatering will be performed using geotextile tubes within the UDF consolidation area.

4.1 System Location

The proposed site for the water treatment system is in the UDF’s southeastern operations area, as shown on Figure 4-1. The proposed discharge route and outfall from that system are shown on Figure 1-1. If required, additional space is available in the UDF’s southern operations area.

The majority of the proposed water treatment system components will be contained within a building, which will likely be approximately 15,000 to 20,000 square feet in size to fit the required equipment; and some equipment (e.g., equalization tank, water transfer pump, clarifier, and sludge transfer pump) will be installed outdoors. As described below, the clarifier and sludge transfer pump are required equipment in case dissolved-phase metals treatment is required; if the results of treatability bench-scale testing, discussed in Section 4.5, indicate that treatment of dissolved-phase metals is not required, the overall water treatment system footprint may be reduced.

4.2 Influent Water Quality and Treatment Goals

This section describes the expected water quality characteristics, based on available data, and the treatment objectives (including proposed water quality criteria) for discharging water back to the Housatonic River.

4.2.1 Water Treatment System Influent Chemical Characteristics

The influent to the water treatment system will be a mixture of porewater and overlying surface water removed from dredged sediment. Sediment and water from different RUs are expected to have varying chemical compositions; however, analytical data for Reach 6 dredged materials can be used as a baseline for design of the water treatment system. In addition, porewater analytical data collected in support of similar dredging and dewatering activities in the 1.5-Mile Reach at this Site (U.S. Army Corps of Engineers 2001), which are presented in Table 4-1, can be used as a baseline for understanding potential porewater concentrations in the absence of similar samples from the ROR.

PCBs are the primary COC for the ROR water treatment system at the UDF. Dissolved-phase PCB concentrations are expected to range from 0.04 micrograms per liter (µg/L) to 150 µg/L in the untreated generated water (i.e., water treatment system influent) based on concentrations observed in the 1.5-Mile Reach treatment system influent. PCBs existing as free product are not expected to be present in the water treatment system influent. Additionally, low-level concentrations of volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and other semi-volatile organic compounds (SVOCs) are expected to be present in the water treatment system influent based on porewater data from the 1.5-Mile Reach and surface water data collected from the Housatonic River upstream from Reach 6.

Data from the 1.5-Mile Reach treatment system indicate that metals (particularly zinc) detected in the influent were primarily in an insoluble form and removed by filtration/settling. Provisional infrastructure to address dissolved-phase metals has thus been retained for the water treatment system until bench-scale data are obtained for the ROR (see Section 4.5).

The water treatment system at the UDF is downstream of sediment dewatering processes that will remove the bulk of the suspended solids from the dredged slurry. Therefore, low to moderate levels of total suspended solids (TSS) are expected in the water treatment system influent. TSS loading will be assessed during future bench-scale evaluations of sediment dewatering methods (see Section 4.5).

Water generated by sediment dewatering activities is expected to have circumneutral pH (6 to 8 standard units) and contain negligible amounts of oil and grease.

4.2.2 Water Treatment System Flow Rates

The water treatment system will be designed to accommodate flows ranging from 500 to 1,500 gpm, which is the expected flow of water to be generated by sediment dewatering activities based on the production rates presented in Table 2-1. Dredging crews may not work 24 hours per day; therefore, flow to the water treatment system could be intermittent.

4.2.3 Treatment System Goals and Proposed Effluent Discharge Criteria

The water treatment system is anticipated to discharge to the Housatonic River. As stated in Table 6-1 of the Reach 6 Conceptual Work Plan, such discharge will meet the substantive requirements of EPA’s National Pollutant Discharge Elimination System (NPDES) regulations by meeting the criteria established by the EPA On-Scene Coordinator in accordance with 40 CFR 122.3(d). Proposed discharge criteria for the water treatment system at the UDF are presented in Table 4-2. Parameters included are PCBs, VOCs, PAHs, other SVOCs, total petroleum hydrocarbons (TPH), and metals. The proposed criteria are based on the discharge criteria established by EPA for the 1.5-Mile Reach Removal Action water treatment system. The proposed criterion for PCBs, 0.5 parts per billion, is also the federal and Massachusetts drinking water standard for PCBs. If bench-scale testing indicates that treatment of dissolved-phase metals is not required, metals will be removed from the list of water quality parameters for which to test and evaluate before discharge.

The water treatment system will be designed based on expected influent characteristics and to meet the EPA-approved discharge criteria.

4.3 Conceptual Technology Selection

This section describes the proposed water treatment processes, based on available data. A water treatment process flow diagram is presented as Figure 4-2.

4.3.1 Granular-Activated Carbon

Granular-activated carbon (GAC) has been selected as a treatment technology based on the media’s ability to effectively treat a wide variety of COCs, including PCBs, VOCs, PAHs, other SVOCs, and TPH. In vessels configured for downflow, influent water is introduced at the top of the vessel, COCs are removed by adsorption onto GAC media, and treated water exits the vessel at the bottom through an underdrain system. The area over which COCs are adsorbed within each vessel (mass transfer zone) moves downwards towards the vessel effluent as system operation continues over time. The migration of the mass transfer zone eventually results in COC breakthrough at the vessel effluent; therefore, GAC vessels are typically installed in a series configuration to mitigate the risk of permit exceedances in the treatment system effluent. Additionally, sufficient empty bed contact time (EBCT) between the COCs and GAC is required for effective removal. Typical EBCTs range from 6 to 10 minutes for VOCs, PAHs, other SVOCs, and TPH and 7 to 8 minutes for PCBs.

It is anticipated the water treatment system will be designed with three parallel trains of three GAC vessels in series to accommodate the expected treatment system flow rate (see Section 4.2.2) while maintaining a minimum 20-minute EBCT per treatment train. The basis for design for the water treatment system and preliminary approximate equipment sizing is presented in Table 4-3.

4.3.2 Filtration

Multimedia filters and bag filters will be used to remove TSS from the influent water and reduce fouling of the GAC media. Additional bag filters will be placed downstream of the GAC vessels to remove any PCBs adsorbed onto carbon fines prior to discharge. These filtration steps will also remove metals present in insoluble forms in the process water. Solids will be removed from the multimedia filters via backwash and transferred to the sediment dewatering system. If treatment for dissolved-phase metals is required, precipitation and clarification steps would be added to the treatment system, as outlined in Section 4.3.3.

4.3.3 Dissolved-Phase Metals Precipitation and Clarification (Provisional)

Precipitation via pH adjustment, flocculation, and clarification were selected as provisional technologies to address potential dissolved-phase metals in the water treatment system influent. In general, dissolved-phase metals can be precipitated as metal-hydroxides by dosing the process water with sodium hydroxide to increase the pH. The pH required to induce precipitation varies by metal and may exceed permitted discharge limits; therefore, acid may be required to lower the pH of the process water prior to discharge. Flocculation of precipitated solids would be aided by a polymer flocculant and the solids would be separated from the process water via a clarifier. Sludge would be removed periodically from the clarifier and transferred to the sediment dewatering system. Treatment of dissolved-phase metals is provisional pending the results from forthcoming bench-scale testing (see Section 4.5).

4.4 Conceptual Water Treatment System Design

Figure 4-2 illustrates the conceptual water treatment system process flow diagram. As shown there, water generated by sediment dewatering activities will first be conveyed to an equalization tank, which will buffer variations in influent flow to the water treatment system. Water from the equalization tank will be pumped to the dissolved-phase metals treatment unit operations, including two parallel trains of pH-adjusted vessels, if the requirement for such provisional treatment is retained based on results from forthcoming bench-scale testing (insoluble metals will be removed through filtration unit operations).

Process water will be pumped to a clarifier to remove solids aided by a polymer flocculant. Clarified water will be conveyed to a media tank for final pH adjustment (if required) and then pumped through multimedia filters, bag filters, and GAC vessels for removal of TSS, PCBs, VOCs, PAHs, other SVOCs, and TPH. The GAC vessels are configured in three parallel trains of three vessels in series. A final set of bag filters will be present downstream of the GAC vessels to remove any residual carbon fines that may contain PCBs prior to discharge to the Housatonic

River. Treated water can be recycled back to the equalization tank at the system headworks on an as-needed basis.

The water treatment system will also contain infrastructure to support backwashing of the multimedia filters and GAC vessels. Treated water will be diverted from the system discharge to a storage tank and used as source water for backwashing. Backwash flow will be pumped to a holding tank to allow for initial solids separation. Water will be decanted from the tank and pumped back to the equalization tank at the system headworks.

Solids will be pumped periodically from the backwash holding tank and provisional clarifier and transferred to the sediment dewatering system.

4.5 Data Needs

Additional sampling and treatability bench-scale testing are needed to confirm the design for the water treatment system to be operated at the UDF. The needed sampling and testing are as follows:

- **Water Filtrate Sampling:** Filtrate from the geotextile dewatering testing will be submitted for the analyses of standard COCs, oil and grease, pH, TSS, hardness, alkalinity, and total organic carbon. The analytical results will serve as representative baseline samples of the likely water treatment system influent.
- **Metals Precipitation Evaluation:** If comparison of the baseline sampling results on the filtrate (discussed above) to the proposed water quality discharge limits for dissolved metals (listed in Table 4-2) indicates that dissolved-phase metals treatment is required during the water treatment process,), chemical-physical testing (jar testing) will be conducted to evaluate polymers for removal or treatment of the dissolved metals. Sludge/solids generated from the precipitation and flocculation processes will also be tested to evaluate waste characteristics.
- **GAC Evaluation:** Rapid small-scale column tests of various GAC media will be conducted to support the evaluation of GAC usage rates for treatment of PCBs and other COCs.

These proposed sampling activities and tests are described in detail in Section 7 of the Dewatering/Treatment Treatability Plan.

5 Treated Water Pipeline Routing and Design

Appendix E to the Reach 6 Conceptual Work plan describes the conceptual pipeline routing and design for conveying the dredged sediment from the shoreline support facility to the UDF. It is anticipated that the pipeline for conveying the treated water from the water treatment system will run parallel to the sediment transport pipeline. This section describes the facilities necessary to carry the treated water from the treatment facility to the Housatonic River and the assessments required for design purposes. Further information will be presented in the final design report/addendum on the dewatering and water treatment systems to be used at the UDF.

5.1 Ancillary Facilities

To provide for safe and efficient operations of the treated water pipeline, air and vacuum relief valves may be required to vent entrained air and prevent vacuum conditions. Vacuum relief valves will be placed as necessary to allow air into the pipeline when negative pressure conditions occur, such as during draining or sudden flow stoppage, preventing pipe collapse or deformation. Placement of these valves will be identified based on the hydraulic analysis performed as the pipeline route is refined during the final design of the treatment facility. Should portions of the pipeline be installed below grade, manholes may be necessary to provide access to the pipeline for system flushing in the event of an emergency. Manholes, if needed, will be strategically placed in the system to promote the dissipation of positive or negative pressures.

5.2 Design Capacity

Design capacity will be determined based on the maximum treatment facility output. The treated water pipeline is anticipated to be a gravity main (i.e., no hydraulic pumps are anticipated along the pipeline).

5.3 Pipe Material Specification

It will be crucial to select pipe material that will provide a minimal amount of friction head loss within the system. The pipeline will be installed above grade unless noted otherwise; for this reason, above-ground pipe supports designed to guide pipeline movement during normal pumping operations will be necessary. Multiple options are available for use, including high-density polyethylene (HDPE) and ductile iron. HDPE piping provides flexibility, strong abrasion resistance, and low friction head loss and is currently the preferred material. Further evaluation of fluid properties and verification of typical flow operation will be necessary to determine the appropriate pipe class(s).

Excessive abrasion is not anticipated for the treated water pipeline. Properties of pipe material may result in significant thermal expansion across the pipeline. The pipeline will be designed to withstand year-round weather conditions regardless of typical operations. Several expansion loops will be required to prevent stress to the pipeline from thermal expansion and contraction. These properties will be considered in more detail during the final design.

5.4 Winterizing Requirements

The system will be winterized prior to the occurrence of freezing temperatures in each construction season.

5.5 Treated Water Outfall

A treated water outfall will be designed where the treated water will discharge back into the Housatonic River. Armoring (e.g., riprap outfall with a geofabric base) will be necessary to prevent erosion of the shoreline at the discharge location.

6 Schedule and Reporting

As described in the Dewatering/Treatment Treatability Plan, the treatability studies described therein are anticipated to be conducted in 2025, with the results reported in a Treatability Studies Summary Report, which will be submitted prior to the Final RD/RA Work Plan for Reach 6 and prior to the final design of the sediment dewatering and water treatment systems intended for operation at the UDF. The final design of the latter will be provided in a separate design report on those systems, which will be another addendum to the Revised USF Final Design Plan. The dewatering and water treatment systems at the UDF will be constructed and operational before remediation activities in Reach 6 begin.

7 References

Anchor QEA. 2024. *Pre-Design Investigation Summary Report for Reach 6*. Prepared for General Electric Company, Pittsfield, Massachusetts. October 31.

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Tables

Table 4-1
1.5-Mile Reach Porewater Data and Anticipated Influent Chemistry
Conceptual Sediment Dewatering and Water Treatment Evaluation
Housatonic River – Rest of River
Pittsfield, Massachusetts

Compound	Unit	Porewater (Influent) Quality
Inorganics		
Arsenic	µg/L	ND (4.6)
Barium	µg/L	55.9
Beryllium	µg/L	0.56
Chromium (total)	µg/L	ND (2.2)
Cobalt	µg/L	ND (3)
Copper	µg/L	5.8 J
Lead	µg/L	ND (3.7)
Nickel	µg/L	ND (2.9)
Thallium	µg/L	**ND (3.9)**
Tin	µg/L	ND (3.8 J)
Vanadium	µg/L	ND (2.9)
Zinc	µg/L	**656**
Organics		
1,2,4,5-Tetrachlorobenzene	µg/L	ND (11)
1,2,4-Trichlorobenzene	µg/L	ND (11), 0.78 J
1,2-Dichlorobenzene	µg/L	ND (11)
1,3-Dichlorobenzene	µg/L	ND (11)
1,4-Dichlorobenzene	µg/L	ND (11)
2-Butanone	µg/L	2.5 R
Acetone	µg/L	21 J
Benzene	µg/L	3.9 J
Bis(2-Ethylhexyl) Phthalate	µg/L	ND (11)
Chlorobenzene	µg/L	1.6
Chloroform	µg/L	ND (0.5)
Diethyl Phthalate	µg/L	ND (11)
Ethylbenzene	µg/L	ND (0.5)
Polychlorinated Biphenyls (total)	µg/L	**2.4**
Polynuclear Aromatic Hydrocarbons	µg/L	1 J, ND (11)
Pentachlorobenzene	µg/L	ND (11)
Phenol	µg/L	ND (11)
Toluene	µg/L	ND (0.5)
Trichloroethylene	µg/L	ND (0.5)
Xylene(s)	µg/L	ND (0.5)

Notes:

1. Pore water quality data is as reported in Final Design Specifications 1.5-Mile Removal Action – First Phase (U.S. Army Corps of Engineers. November, 2001).

Bold = indicates result exceeded discharge criteria for the 1.5-Mile Reach

µg/L = micrograms per liter

J = Concentration stated represents an estimated value.

ND = Compound was not detected. Value in parentheses represents the reporting limit.

R = Result was rejected during data validation.

Table 4-2

Proposed Effluent Discharge Criteria
Conceptual Sediment Dewatering and Water Treatment Evaluation
Housatonic River – Rest of River
Pittsfield, Massachusetts

Parameter	Proposed Discharge Criteria (ppb)[(1)]
VOCs	
1,2-dichlorobenzene	75
1,3-dichlorobenzene	100
1,4-dichorobenzene	100
2-Butanone	100
Acetone	100
Benzene	5 (2)
Chlorobenzene	100
Chloroform	100
Cis-1,2-Dichloroethene	70
Ethylbenzene	(2)
Methyl tert-butyl ether	70
Toluene	(2)
Trichloroethylene	5
Xylene(s), Total	(2)
SVOCs	
1,2,4,5-Tetrachlorobenzene	100
1,2,4-Trichlorobenzene	70
Bis(2-ethylhexyl) phthalate	100
Diethyl phthalate	100
Pentachlorobenzene	100
Phenol	100
PAHs	
Fluoranthene	100
Fluorene	100
Indeno[1,2,3-cd]pyrene	100
Naphthalene	100
Phenanthrene	100
Pyrene	100
Metals	
Arsenic	50
Barium	100
Beryllium	4
Chromium	100
Cobalt	100
Copper	100
Lead	50
Nickel	100
Thallium	2
Tin	100
Vanadium	100
Zinc	100

Table 4-2
Proposed Effluent Discharge Criteria
Conceptual Sediment Dewatering and Water Treatment Evaluation
Housatonic River – Rest of River
Pittsfield, Massachusetts

Parameter	Proposed Discharge Criteria (ppb)[1]
PCBs	
Total PCBs	0.5 [3]
General	
Total Petroleum Hydrocarbons	5,000

Notes:

1 Proposed discharge criteria are generally based on those used by EPA for a similar water treatment system discharging to the Housatonic River as part of the 1.5-Mile Reach Removal Action.
2 Total BTEX not to exceed 100 ppb. Benzene not to exceed 5 ppb.
3 This is also the federal and Massachusetts drinking water standard for PCBs.

Abbreviations:

BTEX = benzene, toluene, ethylbenzene, and xylenes
TBD = no prior standard; to be determined based on forthcoming treatability study testing
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
ppb = parts per billion; equivalent to microgram per liter
SVOC = semi-volatile organic compounds
VOC = volatile organic compounds

Table 4-3
Water Treatment System Basis of Design
Conceptual Sediment Dewatering and Water Treatment Evaluation
Housatonic River – Rest of River
Pittsfield, Massachusetts

Item	Description	Notes
Operating Period	Intermittent	Based on 10 to 12 hours per day sediment processing operation
Hydraulic Capacity		
Treatment System Design Flowrate	500 to 1,500 gpm	
Filtrate Equalization		
Hydraulic Residence Time	29 to 70 minutes	Corresponding to anticipated range of flowrates
Tank Volume	35,000 gallons	
Provisional Metals Treatment - pH Adjustment		
Reaction Tank Trains	2 parallel trains	2 vessels per train
Hydraulic Residence Time	16 to 40 minutes	Corresponding to anticipated range of flowrates
Reaction Tank Volume (per tank)	10,000 gallons	
Base Type	Sodium Hydroxide	
Base Feed Rate	TBD ppm	Dependent on influent chemistry and metals concentrations
Acid Type	Sulfuric Acid	
Acid Feed Rate	TBD ppm	Dependent on influent chemistry and pH after metals treatment
Provisional Metals Treatment - Clarifier Feed Equalization		
Hydraulic Residence Time	6 to 15 minutes	Corresponding to anticipated range of flowrates
Clarifier Feed Tank Volume	7,500 gallons	
Provisional Metals Treatment - Clarifier		
Clarifier Loading Rate	0.5 gpm/ft^2	
Clarifier Required Surface Area	1,000 to 2,400 ft^2	
Polymer Type	MagnaFlocc 155 or equivalent	
Polymer Feed Rate	50 ppm	Dependent on influent chemistry and total suspended solids characteristics
Media Feed Equalization		
Hydraulic Residence Time	6 to 15 minutes	Corresponding to anticipated range of flowrates
Media Feed Tank Volume	7,500 gallons	
Multimedia Filters		
Loading Rate	6 gpm/ft^2	
Total Required Surface Area	83 - 200 ft^2	Corresponding to anticipated range of flowrates
Bag Filters		
Bag Material	Polypropylene	
Nominal Pore Size	5 µm	

Table 4-3
Water Treatment System Basis of Design
Conceptual Sediment Dewatering and Water Treatment Evaluation
Housatonic River – Rest of River
Pittsfield, Massachusetts

Item	Description	Notes
GAC System		
GAC Trains	3 parallel trains, 3 vessels per train	Number of trains run concurrently will depend on influent flowrate
Vessel Configuration	lead/mid/lag	
Empty Bed Contact Time (per train)	20 minutes	
Vessel Size (Diameter)	10 ft	
Vessel Size (GAC Mass)	20,000 lbs	
Treated Water Storage Tank		
Backwash Volume (per GAC vessel)	17,500 gallons	GAC backwash volume higher than MMF backwash volume
Tank Volume	25,000 gallons	
Decant Water Storage Tank		
Tank Volume	25,000 gallons	Holding tank for backwash effluent

Notes:

cy = cubic yards
ft^2 = square feet
GAC = granular-activated carbon
gpm = gallons per minute
lbs = pounds
µm = micrometers

Figures

EXISTING FEATURES LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- ELEVATION CONTOUR (25-FOOT INTERVAL)
- ELEVATION CONTOUR (5-FOOT INTERVAL)
- EDGE OF ROAD
- OH OVERHEAD WIRES
- FEMA 100-YEAR-DESIGNATED FLOOD BOUNDARY (APPROXIMATE)
- WET AREA

DESIGN FEATURES LEGEND

- APPROXIMATE LIMIT OF UDF GRADING
- APPROXIMATE LIMIT OF UDF CONSOLIDATION AREA
- CONCEPTUAL TREATED WATER PIPELINE ROUTE

NOTES:

1. AERIAL IMAGERY FROM BING MAPS © 2023 MICROSOFT CORPORATION © 2023 MAXAR © CNES (2023) DISTRIBUTION AIRBUS DS.
2. UDF = UPLAND DISPOSAL FACILITY

0 250' 500'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
CONCEPTUAL SEDIMENT DEWATERING AND WATER TREATMENT EVALUATION

UDF OPERATIONAL AREA CONCEPTUAL SITE PLAN

ARCADIS

FIGURE
1-1

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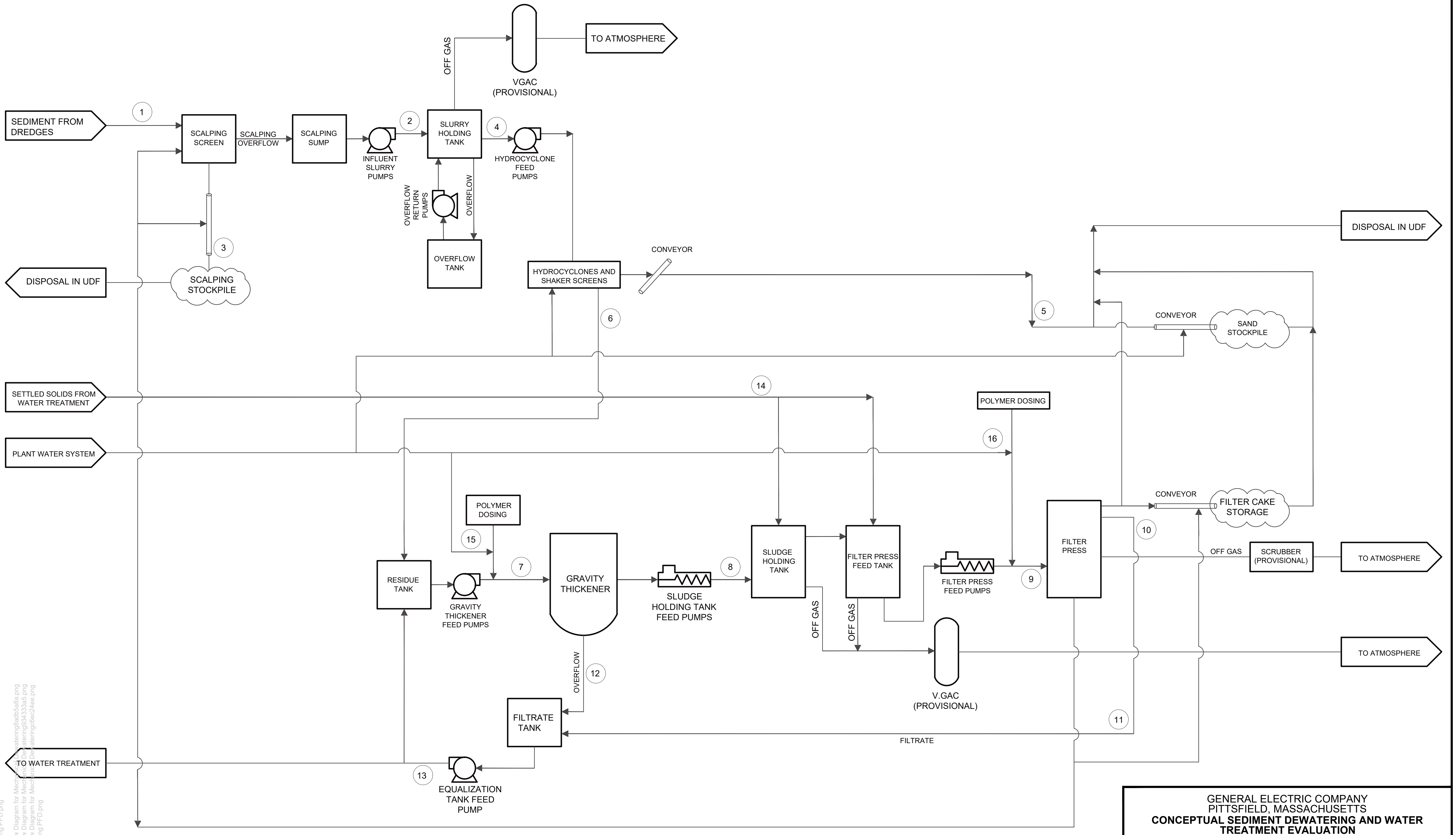

STREAM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DESCRIPTION	INFLUENT SLURRY	SCALPING SCREEN SLURRY EFFLUENT	GRAVEL AND SMALL DEBRIS	HYDROCYCLONE INFLUENT	HYDROCYCLONE SAND TO CONVEYOR	HYDROCYCLONE OVERFLOW	GRAVITY THICKENER INFLUENT	GRAVITY THICKENER UNDERFLOW	FILTER PRESS INFLUENT	FILTER CAKE	FILTRATE WATER (FILTER PRESS)	GRAVITY THICKENER OVERFLOW	FILTRATE WATER TO WTP	SETTLED SOLIDS FROM WATER TREATMENT	POLYMER ADDITION BEFORE THICKENER	POLYMER ADDITION AFTER THICKENER

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
CONCEPTUAL SEDIMENT DEWATERING AND WATER TREATMENT EVALUATION

CONCEPTUAL MECHANICAL DEWATERING PROCESS FLOW DIAGRAM

ARCADIS

FIGURE
3-1

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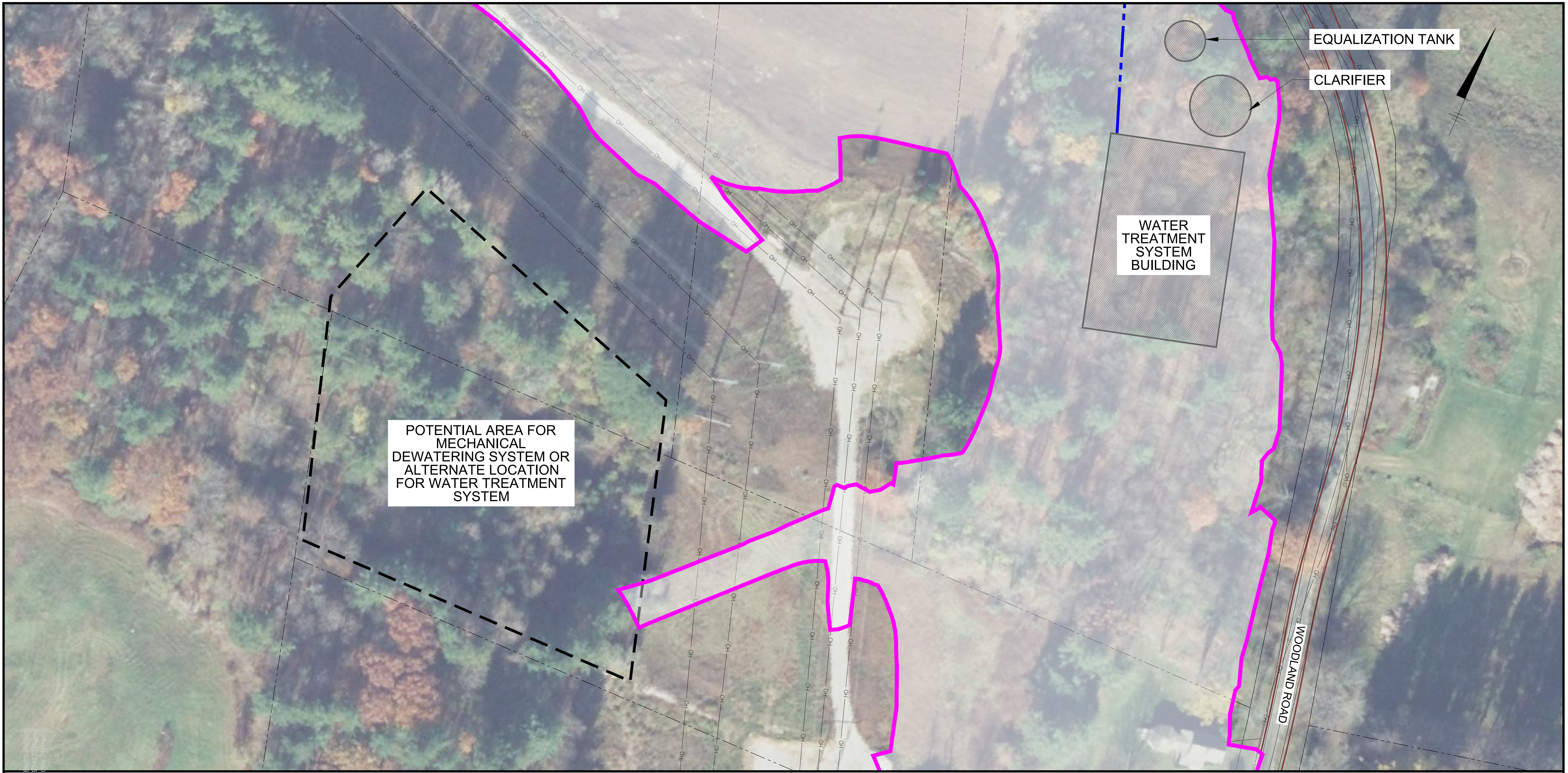
Figure - Process Flow Diagram for Mechanical Dewatering634333a5.png
Figure - Process Flow Diagram for Mechanical Dewatering6ec24ee.png
Mechanical Dewatering PFD.png
Arcadis Logo.PNG



EXISTING FEATURES LEGEND

— - - —	APPROXIMATE PROPERTY BOUNDARY
——	EDGE OF ROAD
— OH —	OVERHEAD WIRES

DESIGN FEATURES LEGEND

——	APPROXIMATE LIMIT OF UDF GRADING
— - —	CONCEPTUAL TREATED WATER PIPELINE ROUTE

NOTES:

1. AERIAL IMAGERY FROM BING MAPS © 2023 MICROSOFT CORPORATION © 2023 MAXAR © CNES (2023) DISTRIBUTION AIRBUS DS.
2. UDF = UPLAND DISPOSAL FACILITY

0 80' 160'

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
CONCEPTUAL SEDIMENT DEWATERING AND WATER TREATMENT EVALUATION

UDF WATER TREATMENT SYSTEM CONCEPTUAL LAYOUT PLAN

ARCADIS

FIGURE
4-1

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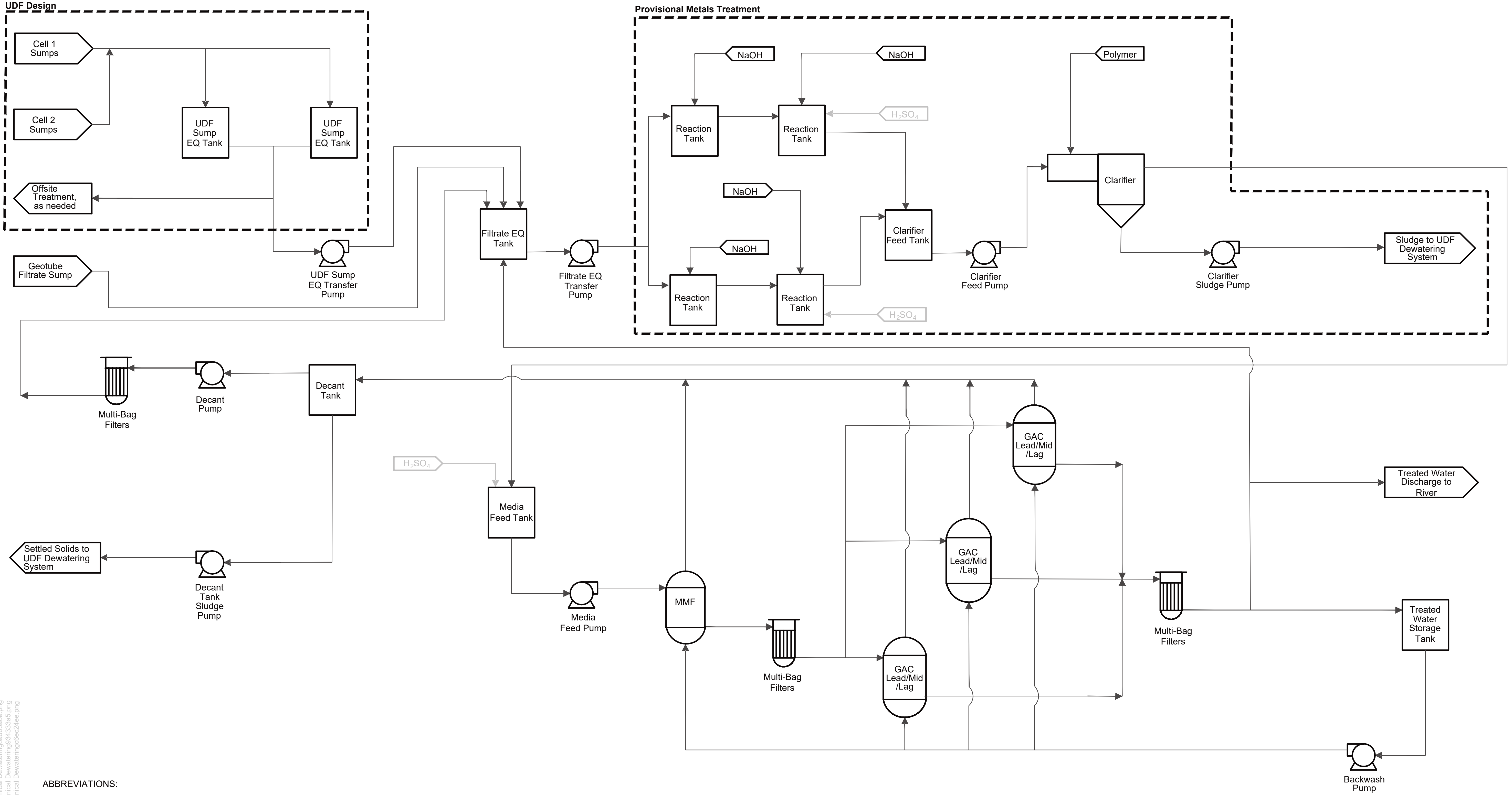

ABBREVIATIONS:

EQ	EQUALIZATION
GAC	GRANULAR ACTIVATED CARBON
H2SO4	SULFURIC ACID
MMF	MULTIMEDIA FILTER
NAOH	SODIUM HYDROXIDE
UDF	UPLAND DISPOSAL FACILITY

NOTE:

1. GRAY FONT INDICATES THAT SULFURIC ACID WILL BE ADDED TO ADJUST pH AS NEEDED.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
CONCEPTUAL SEDIMENT DEWATERING AND WATER TREATMENT EVALUATION

CONCEPTUAL WATER TREATMENT PROCESS FLOW DIAGRAM

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FIGURE
4-2

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XREFS: IMAGES:
X-REACH 6 SMDE Figure - Process Flow Diagram for Mechanical Dewatering8adb5a8a.png
X-XSECS Figure - Process Flow Diagram for Mechanical Dewatering934333a5.png
Figure - Process Flow Diagram for Mechanical Dewateringc6ec24ee.png
Mechanical Dewatering PFD.png

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General Electric Company

Dewatering/Water Treatment Treatability Study Work Plan

Addendum to the Upland Disposal Facility Revised Final Design Plan

Housatonic River – Rest of River
Pittsfield, Massachusetts

December 2024

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Tables

Figures

Attachments

Abbreviations

ASTM	ASTM International
Dewatering/Treatment Design Addendum	*Conceptual Sediment Dewatering and Water Treatment Evaluation*
Dewatering/Treatment Treatability Plan	*Dewatering/Water Treatment Treatability Study Work Plan*
DQO	data quality objective
EBCT	Empty Bed Contact Time
EPA	United States Environmental Protection Agency
FSP/QAPP	Field Sampling Plan/Quality Assurance Project Plan
GAC	granular activated carbon
GE	General Electric Company
MassDEP	Massachusetts Department of Environmental Protection
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	Pre-Design Investigation
Reach 5A Conceptual Work Plan	*Conceptual Remedial Design/Remedial Action Work Plan for Reach 5A*
Reach 6 Conceptual Work Plan	*Conceptual Remedial Design/Remedial Action Work Plan for Reach 6*
Reach 6 SDC Work Plan	*Supplemental Data Collection Work Plan for Reach 6*
Revised Final Permit	*Revised Final Resource Conservation and Recovery Act Permit Modification*
Revised UDF Final Design Plan	*Upland Disposal Facility Revised Final Design Plan*
Revised UDF OMM Plan	*Upland Disposal Facility Revised Operation, Monitoring, and Maintenance Plan*
ROR	Rest of River
RSSCT	Rapid Small-Scale Column Test
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbon
TOC	total organic carbon
TSS	total suspended solids
UDF	Upland Disposal Facility
UDF Final Design Plan	*Upland Disposal Facility Final Design Plan*
UDF OMM Plan	*Upland Disposal Facility Operation, Monitoring, and Maintenance Plan*
VOC	volatile organic compound

1 Introduction

On December 16, 2020, pursuant to the 2000 Consent Decree (CD) for the GE Pittsfield/Housatonic River Site (the Site) (EPA and GE 2000), the U.S. Environmental Protection Agency (EPA) issued to the General Electric Company (GE) a final revised modification of GE's Resource Conservation and Recovery Act Corrective Action Permit (Revised Final Permit; EPA 2020) for the Housatonic Rest of River (ROR), which set forth a Remedial Action selected by EPA to address polychlorinated biphenyls (PCBs) in the ROR. The ROR is that portion of the Housatonic River and its backwaters and floodplain (excluding certain residential lawn areas) located downstream of the confluence of the East and West Branches of the Housatonic River, in Pittsfield, Massachusetts. The ROR has been segmented into six separate remediation units (RUs) to manage workflow and schedule for the ROR Remedial Action. The ROR Remedial Action also includes the construction and operation of an on-site Upland Disposal Facility (UDF) for the disposal of a portion of the sediments and soils removed from the ROR area.

Reach 5A was the first RU to be addressed because it is the most upstream reach in the ROR. The *Conceptual Remedial Design/Remedial Action Work Plan for Reach 5A* (Reach 5A Conceptual Work Plan; Anchor QEA et al. 2023) was submitted to EPA on September 28, 2023, and conditionally approved by EPA on December 3, 2024. Reach 6, which includes Woods Pond, is the second RU to be addressed; and the *Conceptual Remedial Design/Remedial Action Work Plan for Reach 6* (Reach 6 Conceptual Work Plan; Anchor QEA et al. 2024) was submitted to EPA on October 31, 2024, and is currently under EPA review. As described in the Reach 6 Conceptual Work Plan, the remediation for Reach 6 will include removal of sediments from Woods Pond and other aquatic portions of Reach 6 and disposal of such removed sediments at the UDF or at an off-site disposal facility, consistent with the requirements specified in Attachment E to the Revised Final Permit. As further described in that plan, GE plans to implement hydraulic dredging and pumping for the sediments in Reach 6,

In February 2024, GE submitted an *Upland Disposal Facility Final Design Plan* (UDF Final Design Plan; Arcadis 2024a) and an *Upland Disposal Facility Operation, Monitoring, and Maintenance Plan* (UDF OMM Plan; Arcadis 2024b), which were both conditionally approved by EPA in letters dated September 12, 2024. Those letters required GE to submit revised versions of those plans. They also required GE to provide information regarding the design, location, and operation, monitoring, and maintenance (OMM) of the on-site dewatering and water treatment facilities to be constructed at the UDF area to manage the sediments that are hydraulically dredged and transported there. In response, GE has prepared and is submitting on December 20, 2024 a Revised UDF Final Design Plan (Arcadis 2024c) and a Revised UDF OMM Plan (Arcadis 2024d). With specific respect to the on-site dewatering and water treatment, GE has prepared and is submitting two addenda to the Revised UDF Final Design Plan:

- The *Conceptual Sediment Dewatering and Water Treatment Evaluation* (Dewatering/Treatment Design Addendum; Arcadis 2024e), which provides information regarding the conceptual design and location of the on-site dewatering and water treatment facilities at the UDF; and
- This *Dewatering/Water Treatment Treatability Study Work Plan* (Dewatering/Treatment Treatability Plan), which presents a proposal for testing required to satisfy identified data needs to further the design of dewatering and water treatment facilities proposed for use at the UDF.

In addition, the Revised UDF OMM Plan is accompanied by an addendum, entitled *Sediment Dewatering and Water Treatment Systems Conceptual Operations, Monitoring, and Maintenance Plan* (Arcadis 2024f), which presents a conceptual implementation schedule and describes OMM activities for the dewatering and water treatment facilities at the UDF area.

The on-site dewatering and water treatment facilities at the UDF will manage sediments and water generated during remediation of multiple RUs that will involve hydraulic dredging and pumping of removed sediments to the UDF. These RUs are, in order, Reaches 6, 5C, 7B, and 7C. Since Reach 6 will be the first of these RUs to be remediated, the dewatering and water treatment systems at the UDF will be constructed and operational before remediation activities in Reach 6 begin. Because pre-design investigations have not yet been conducted at other RUs for which these systems will be used (i.e., Reaches 5C, 7B, and 7C), the conceptual design presented in the Dewatering/Treatment Design Addendum and the basis for design of the treatability studies presented herein rely primarily on the information collected during investigations conducted in Reach 6. Those investigations were described in the *Pre-Design Investigation Summary Report for Reach 6* (Reach 6 PDI Summary Report; Anchor QEA 2024), which includes a summary of the sediment characteristics and existing sediment data that have been considered in developing the treatability studies described herein. The prior investigations included collection of PCB analytical data and limited geotechnical data (e.g., moisture content, grain size analysis, Atterberg limits, density, and specific gravity). Additional data collection to support evaluation of sediment removal and sediment transport designs is proposed in the *Supplemental Data Collection Work Plan for Reach 6* (Reach 6 SDC Work Plan), which is Appendix F to the Reach 6 Conceptual Work Plan. The treatability study testing presented herein will build on the data collected previously and the data collections proposed in the Reach 6 SDC Work Plan. It is anticipated that the information collected and to be collected for Reach 6 will be sufficient to support design of the dewatering and water treatment systems at the UDF without the need for additional investigations in the other RUs for which these systems will be used.

2 Data Quality Objectives

This work plan describes the treatability studies proposed to provide data that will support the final design and evaluation of sediment dewatering and water treatment systems at the UDF area.

As described in the Reach 6 Conceptual Work Plan and the Dewatering/Treatment Design Addendum, it is anticipated that sediments from Reach 6 will be hydraulically dredged and transported to a sediment dewatering facility at the UDF area, and that water from those dewatering activities will be treated at a water treatment facility constructed at the UDF area. The purpose of each treatability study presented herein is to obtain information to support the selection of the dewatering and water treatment technologies that will be included in the final design. The data collected may also be used by the selected Remediation Contractor(s) to support determination of the means and methods for sediment processing and dewatering.

As identified in the Dewatering/Treatment Design Addendum, dewatering technologies to be evaluated include geotextile tubes and mechanical dewatering (e.g., continuous filter press) and, to a limited degree, passive dewatering. The treatability studies included herein will evaluate physical properties of the dredged material for handling and dewatering and evaluate pumping and flocculation of the slurried material using the dewatering technologies. The Dewatering/Treatment Design Addendum also proposes water quality criteria for discharge of treated water to the Housatonic River and includes a proposed water treatment processes required to reduce constituents of concern (COCs) below those water quality criteria. The bench-scale treatability study testing proposed herein will provide data on the potential concentrations within the filtrate to evaluate potential water treatment and discharge requirements for the final design.

To achieve these overall objectives, the data quality objectives (DQOs) for the treatability studies presented herein are as follows:

DQO 1. Evaluate the effectiveness of dewatering technologies in handling sediment to be hydraulically conveyed to the UDF.

DQO 2. Evaluate the effect of de-sanding the sediment slurry before initiating the dewatering operations.

DQO 3. Evaluate potential PCB, dewatering polymer, toxicity, and other chemical concentrations within the water generated during sediment dewatering and leachate generation at the UDF.

If alternate methods are identified as the primary means for sediment dewatering and/or water treatment during final design, proposed by the selected Remediation Contractor, or identified during an adaptive management process during construction, additional treatability study testing may be proposed. Additional treatability study testing may also be proposed by the selected Remediation Contractor to refine or confirm the contractor’s proposed implementation methods.

3 Field Sampling Plan and Summary of Sample Use

This section describes the field sampling activities that will be performed to collect representative samples from various locations throughout Reach 6 to be used for treatability study testing described in Sections 4 through 8. The field sampling activities will be conducted in accordance with this work plan and GE's most recent Field Sampling Plan/Quality Assurance Project Plan (FSP/QAPP; Arcadis 2023), which was conditionally approved by EPA on March 21, 2024. This section also provides an overview of how the samples collected will be used for the treatability study testing described in Sections 4 through 8.

3.1 Field Sampling Activities

To support the treatability study testing, sediment samples will be collected to provide representative spatial coverage across Reach 6 and to represent a range of sediment types and PCB concentrations. In addition, surface water samples will be collected.

Bulk sediment samples will be collected from five locations within Woods Pond and one area in Valley Mill Pond, as shown on Figure 3-1. These locations were selected in an attempt to provide different sediment types (i.e., both fine and coarse material) and a range of PCB concentrations (based on the PDI sediment data) and to be spatially distributed throughout Reach 6. These locations are co-located with a subset of the locations proposed in the Reach 6 SDC Work Plan for sediment waste characterization sampling. Surface water samples will also be collected at some of the sample locations for use in blending with sediments for the testing.

Table 3-1 summarizes the proposed sediment samples to be collected for the treatability study testing.

Table 3-1: Bulk Sediment Sample Summary

Treatability Study Sample ID	Reach 6 SDC WP Sample ID [a]	Sediment Sample Volume (gallons)	Surface Water Sample Volume (gallons)
TS6-WP-S1	WC-574-00-C	10	55
TS6-WP-S2	WC-E-F-3-4	10	55
TS6-WP-S3	WC-G-5	10	55
TS6-WP-S4	WC-I-4	10	55
TS6-WP-S5	WC-J-K-9-10	10	55
TS6-WP-S6	WC-K-L-7-8	10	15
Total for Woods Pond:		**60**	**290**
TS6-VMP-S1	WC-Q/R-5/6	15	90
TS6-VMP-S2	WC-W/X-4/5	15	55
Total for Valley Mill Pond:		**30**	**145**

Note:

[a] The sediment samples will be collected in the vicinity of the referenced Reach 6 SDC Work Plan sampling location by compositing material collected from core(s) advanced to depths up to 6 feet below the sediment surface.

At each of the sample locations, sediment samples will be collected, composited, and containerized in sealable buckets or drums. Sediment collection will be achieved through manual core collection in accordance with the methodology outlined in Appendix C2 of the FSP/QAPP (Standard Operating Procedure for Sediment Probing, Coring, and Sample Collection) until the buckets are full. In addition, surface water will be collected using grab sampling methods to facilitate generation of sediment/water mixes needed during the testing.

The sample volumes listed in Table 3-1 are approximate and may be subject to revision. Those sample volumes are based on the estimated quantity of sediment and water for the estimated number of tests, as discussed in Section 3.2 and summarized in Table 3-2. Final quantities needed for the testing will be determined based on consultation with the selected laboratories.

3.2 Summary of Sample Use

Subsamples of sediment from each of the eight composited sample will initially be submitted for the following analyses:

- PCBs as Aroclors using EPA Method 8082;
- Moisture content (by ASTM International [ASTM] D2216);
- Particle size (by ASTM D6913/D7928);
- Atterberg (liquid and plastic) limits (by ASTM D4318);
- Dry density (by ASTM D2937);
- Organic content (by ASTM D2974);
- Unconfined compressive strength (by ASTM D2166); and
- Presence of free liquids (by the paint filter test, EPA Method 9095B).

Samples sent to the analytical laboratory will be submitted under chain-of-custody protocol and will be processed for a standard turnaround time. Following these initial analyses and/or the results from the Reach 6 SDC Work Plan, the sediment samples will be used, with the collected surface water samples described in Section 3.1, for treatability study testing, as summarized below and described in Sections 4 through 8. Based on review of the results from the initial analysis, sediment sample material will be grouped into one to three sample groups with similar characteristics for further treatability testing. Sample volumes in Table 3-1 assume that material from Valley Mill Pond will be handled, and therefore tested, separately from material from Woods Pond; however, material from each pond may be combined, as appropriate, based on review of results from the initial testing. The number of tests and quantities required for each sample group of similar characteristics are summarized in Table 3-2. Figure 3-2 provides a process flow diagram for the sequencing anticipated for the various tests for each sample group and associated sample volume. Final quantities needed for the testing will be determined based on consultation with the selected laboratory(ies).

Table 3-2: Treatability Study Testing Sample Requirements for Each Sample Group

Treatability Study	Number of Tests (Guidance)	Quantity of Sediment Required	Quantity of Water Required	Sample Description
Passive Dewatering and Sediment Stabilization				
Gravity Drainage Study	1 (SOP: Gravity Drainage Test)	0.3 gallon (1 liter)	NA	Site sediment (bulk)
Shake/Vibration Testing	1 (SOP: Shake / Vibration Test)	0.3 gallon	NA	Dewatered sediment from gravity drainage study

Treatability Study	Number of Tests (Guidance)	Quantity of Sediment Required	Quantity of Water Required	Sample Description
Drying Agent Testing	1 (SOP: Stabilization Amendment Test)	0.3 gallon	NA	Site sediment (bulk)
Shake/Vibration Testing	Up to 8 (SOP: Shake / Vibration Test)	Up to 2.4 gallons total (0.3 gallon per test)	NA	Site sediment dewatered based on drying agent testing results
Geotextile Tube Dewatering				
Dewatering Polymer Jar Testing	1 (ASTM D2035)	1 gallon	9 gallons	10 gallons (at least 10 gallons per test) of slurry prepared from site sediment (bulk) and surface water
Geotextile Dewatering Test	1 (SOP: Geotextile Dewatering Bench-Scale Testing)	5 gallons	At least 45 gallons	At least 50 gallons total (50 gallons per test) of slurry prepared from site sediment (bulk) and surface water
Mechanical Dewatering[b]				
Oversized Material Removal	1 (SOP: Oversized Material Removal)	10 gallons (assumes 5% volume loss during test)	NA	Site sediment (bulk)
Desanding	1 (SOP: Oversized Material Removal and Desanding)	9.3 gallons	NA	Use material retained after oversized material removal (assumes 5% volume loss during oversized material removal)
Polymer Testing and Thickening	5 (SOP: Polymer Testing and Thickening)	1.5 gallons total (1 liter [0.3 gallon] per test)	NA	Use material retained after desanding
Filter Press	Minimum 3 (SOP: Mechanical Filter Press)	7.5 gallons (2.5 gallons per test)	NA	Use material retained after desanding and dosed with the polymer mixture selected in polymer testing
Water Treatment System Evaluation				
Water Filtrate Sampling	2 (for multiple analytes)	NA	4 gallons total (2 gallons per test)	Use liquid generated during geotextile tube and mechanical dewatering testing
Metals Precipitation[b]	2 to 3 (SOP: Precipitant Treatment, ASTM D2035)	NA	10 to 15 gallons total (5 gallons per test)	Use liquid generated during geotextile tube dewatering testing

Treatability Study	Number of Tests (Guidance)	Quantity of Sediment Required	Quantity of Water Required	Sample Description
GAC Testing	2 (ASTM D6586)	NA	75 gallons total (37.5 gallons per test)	Use liquid generated during geotextile tube dewatering testing; if metals precipitation is performed, first dose with optimal dose determined during metals precipitation testing

Notes:

[a] If sediments from Valley Mill Pond and Woods Pond are handled separately, the mechanical testing test will be performed on material from Valley Mill Pond. However, if appropriate, an additional test may be added for sediment from Woods Pond.

[b] If needed, based on metals concentrations in water filtrate samples generated from geotextile tube dewatering testing.

GAC = granular activated carbon; NA = not applicable; SOP = standard operating procedure.

4 Passive Dewatering and Sediment Stabilization Evaluation

This section summarizes the proposed testing to support the design for passive dewatering of sediment that is mechanically dredged. Testing will be performed in a manner similar to the treatability study testing proposed for Reach 5A, as described in the Treatability Study Work Plan for Reach 5A, which was Appendix H to the Reach 5A Conceptual Work Plan (and to which GE will submit an addendum per EPA's December 3, 2024 conditional approval letter). The studies described in this section will be performed using sediment homogenized from the bulk sediment samples collected as discussed in Section 3. Liquid that may have separated from the sample during transportation will be mixed back into the sample before testing.

4.1 Gravity Drainage Study

A drainage study will be performed to evaluate the ability of mechanically dredged sediment to passively dewater via gravity drainage and to evaluate whether the dredged material will need additional treatment to meet transportation requirements (e.g., satisfy the paint filter test) and/or disposal facility requirements. The drainage study will involve placing sediment on a screen and allowing the sample to drain by gravity over time, as described in Treatability Study Work Plan for Reach 5A. Samples will be collected at multiple time intervals throughout the drainage study for moisture content and paint filter testing. The drainage study will be conducted in general accordance with the Standard Operating Procedure (SOP) provided in Attachment A (or an SOP from the testing contractor), including geotechnical analysis for evaluation of disposal characteristics and measurement. In addition, filtrate (i.e., liquid) that drains from the sediment during the drainage study will be collected and measured for quantity and turbidity. If sufficient volume of filtrate is available, filtrate will be sampled and submitted for analysis of total suspended solids (TSS), PCBs, metals, and total petroleum hydrocarbons (TPH). Samples sent to the analytical laboratory will be submitted under chain-of-custody protocol and will be processed for a standard turnaround time.

4.2 Drying Agent Testing

Stabilization of sediment will be investigated using a variety of commercially available amendments at various dosages with the goal of determining effective amendments/doses needed to meet transportation requirements (e.g., satisfy the paint filter test) and and/or disposal facility requirements (e.g., structural strength). The stabilization testing will be performed regardless of the results of the drainage study and will be performed as described in Treatability Study Work Plan for Reach 5A and in general accordance with the SOP provided in Attachment B (or an SOP from the testing contractor), including geotechnical analysis for evaluation of disposal characteristics. The four following drying agents will initially be evaluated at mix ratios of 2.5%, 5.0%, and 7.5% by weight during testing:

- Type I Portland cement;
- Cement kiln dust;
- Calciment®; and
- Lime/lime kiln dust.

Mix ratios will be evaluated through paint filter testing, percent solids analysis, moisture content, and visual observations of physical characteristics at various cure periods. A pocket penetrometer will also be used to evaluate the initial strength of the amended sediment. Mix ratios will also be monitored for weight change. If adequate testing results are not obtained using the initial mix ratios, additional mix ratios may be evaluated.

After amendments, mix ratios, and cure times are established through testing, geotechnical testing will be performed on selected treated sediment samples, as described in the SOP in Attachment B. Vendor-provided specification sheets for each drying agent evaluated will be included in the report summarizing the results of this testing.

4.3 Shake/Vibration Testing

Shake/vibration testing will be performed on the sediment samples to evaluate whether free liquids could be liberated from the processed materials as a result of handling and transportation. The purpose of this testing is to simulate motion similar to that which might occur during transport of untreated (if possible) or stabilized sediments to a disposal destination. The transport-simulated samples will then be examined and tested for free water.

The test will use sediment samples that have not received any stabilization treatment and stabilized sediment samples that have cured for a period of time. The samples will be placed into large tubes and set upright in laboratory shaker equipment. The shaker will operate for a selected period of time to simulate the expected transit period. Upon completion of the test, any stratification or liquid accumulation on the surface or the bottom will be noted, and the samples will undergo a paint filter test. The shake/vibration test will be performed as described in Treatability Study Work Plan for Reach 5A and in general accordance with the SOP provided in Attachment C (or an SOP from the testing contractor).

5 Geotextile Tube Dewatering Evaluation

This section describes the proposed treatability study testing, including testing methods and type of analyses, to be performed to support evaluation of geotextile tube dewatering at the UDF. If substantial updates to the procedures described in this section are needed (e.g., based on field conditions, material characteristics, volume size), updated procedures will be provided to EPA for review and approval before initiating testing.

The sediment samples and surface water collected as discussed in Section 3 will be transported to a qualified laboratory for treatability study testing. Testing will include jar testing with various polymers and bench-scale geotextile tube dewatering evaluations as described in Sections 5.2 and 5.3, respectively.

5.1 Sand Separation Evaluation

Review of data presented in the Reach 6 PDI Summary Report indicates that, in general, the sand fraction is less than 50%. Potential benefits of sand separation prior to geotextile tube dewatering could include use of the coarse material (sand) generated to build the geotextile tube infrastructure (i.e., slopes for drainage, berms to contain tubes, and roads for access to the tube fields), reduction in the number of tubes required, and in some cases, reuse of the non-contaminated coarse fraction of the sediment material. For this project, however, there will already be sufficient surplus of sand and gravel material from UDF construction for geotextile tube infrastructure needs, there is no space limitation for the tube field, and reuse of the non-contaminated coarse fraction is not an option. As such, there is no significant benefit to sand separation prior to geotextile tube dewatering. Further, not separating sand (and leaving it in the tubes) will likely provide for faster consolidation from increased drainage and strength in stacking the tubes. By contrast, for mechanical dewatering, sand separation is required as part of the sediment processing steps and will be further evaluated as part of the mechanical dewatering evaluation (described in Section 6.1).

5.2 Dewatering Polymer Jar Testing

Polymers, specifically those that are polyacrylamide-based, are a critical part of the dewatering process in geotextile tubes. Polymers act as flocculants, improving dewatering characteristics, increasing the dewatering rate and particle retention, and reducing the risk of clogging. Polymer testing will be performed to determine the optimal polymer type and dose to optimize the dewatering efficiency of the hydraulically dredged sediment. The polymers to be tested may include cationic, anionic, and non-ionic polymers with consideration of polymers on the Massachusetts Department of Environmental Protection (MassDEP) approved list (MassDEP 2024). The specific polymers to be tested will be determined by the selected treatability testing laboratory.

For testing, sediment samples will be mixed with river water samples to achieve a 10 percent solids slurry. Jar testing will be conducted at multiple polymer doses for each polymer to observe changes in flocculate formation, settling rate, and the clarity of the supernatant. A series of jars for each polymer will be labeled with the polymer name, type, and dose. Equal volumes of slurry and the specified polymer dose, prepared per the polymer specifications, will be added to each jar and testing will be performed in accordance with ASTM D2035 (Standard Practice for Coagulation-Flocculation Jar Test of Water). The mass and volume of settled solids, and the turbidity of the supernatant will be measured. The polymer that is most effective at the lowest dose will be used in the geotextile dewatering bench-scale testing (Section 5.3).

5.3 Geotextile Dewatering Bench-Scale Testing

The geotextile dewatering bench-scale testing will be performed to approximate field conditions by combining bulk sediment and surface water from the site in a conical bottom tank to achieve the target solids content of 10 percent. Contents of the tank will be sufficiently agitated using a propeller to create a homogenous slurry of fine and coarse grain material before adding polymer based on jar testing results (Section 5.2) and filling the geotextile tube. The volume of filtrate released from the geotextile tube will be collected and measured to determine the rate and extent of water generation. There is a limited number of manufacturers of geotextile tubes; tubes from one of these manufacturers will be used in the testing, based on laboratory preference and availability. An example of the testing system setup is shown in Figure 5-1.

The geotextile dewatering bench-scale test will be conducted in general accordance with the SOP provided in Attachment D (or an SOP from the testing contractor).

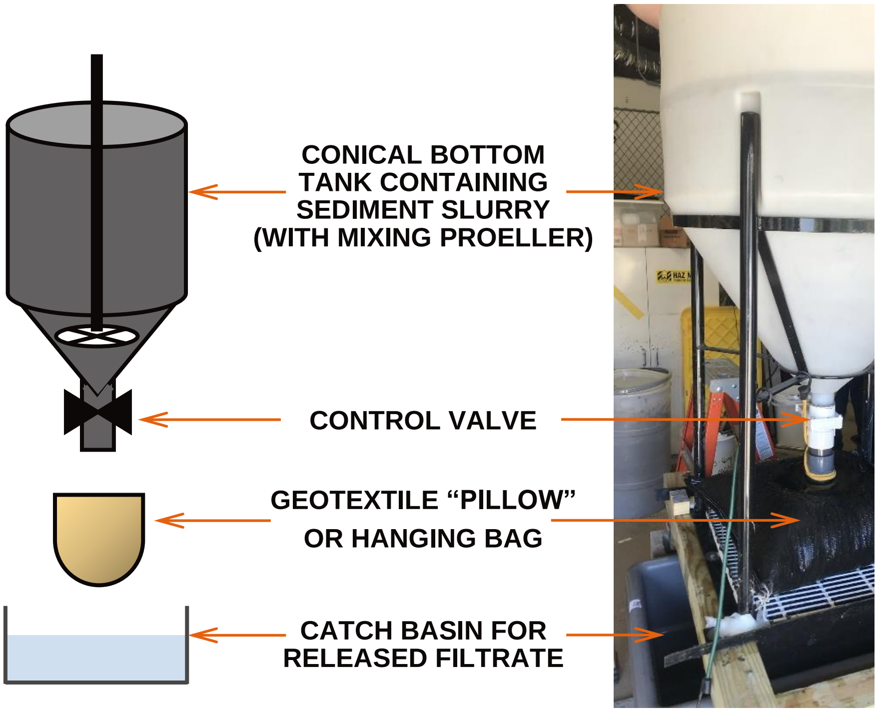

Figure 5-1. Example Geotextile Dewatering Bench-Scale Testing Setup

One test will be performed on each of the representative sediment groups to capture the range of potential dewatering conditions anticipated during full-scale dredge operations (e.g., fine vs coarse grained material), all at 10 percent solids.

Replicates may be modified based on sediment conditions encountered in the field. The volume and turbidity of filtrate released from the geotextile container will be measured during the filling phase and at regular periods after filling is complete during the dewatering phase. The filled geotextile container will be allowed to continue draining for 14 days or until no more liquid is released from geotextile container, whichever occurs first. A curve documenting the rate of filtrate draining from the geotextile container per unit of time will be developed. Filtrate water will be containerized for water treatment testing described in Section 7.1.

During the dewatering phase, samples of the material within the geotextile container may be collected through the fill port to evaluate the moisture content of the material. At the end of the bench-scale scale dewatering phase (i.e., 14 days or once geotextile container stops releasing liquid, whichever occurs first), the geotextile container will be cut open and the material inside photographed. Samples of the dewatered material will be tested for the geotechnical parameters listed in the SOP in Attachment D to determine the physical properties of the dewatered sediment for evaluation of disposal characteristics.

Geotextile tube dewatering testing is expected to take approximately six to eight weeks following completion of field sampling.

6 Mechanical Dewatering Evaluation

This section describes the proposed bench-scale testing to address mechanical dewatering of hydraulically dredged sediments. Mechanical dewatering with a filter press is an alternative to dewatering with geotextile tubes. Results of this testing will be compared with the geotextile tube dewatering bench-scale testing to determine the most efficient and effective technology. Figure 6-1 shows the proposed process flow for mechanical dewatering.

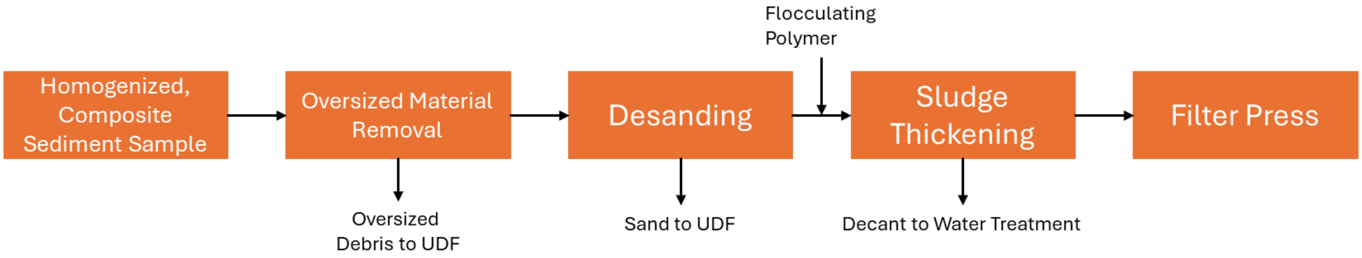

Figure 6-1: Mechanical Dewatering Block Flow Diagram

The sediment samples and surface water collected as discussed in Section 3 will be used in the evaluations described in the remainder of this section.

6.1 Oversized Material Removal and Desanding

Sediment will be prepared for mechanical dewatering bench-scale testing by removing oversized material and sand. Sediment composites will be thoroughly mixed and passed through a sieve No. 7 (2.8 mm) to remove oversized material. River water will be used to wash the sediments through the sieves and slurry will be collected in a five-gallon bucket underneath the sieve.

In addition to removing oversized material, the sediment composite will be desanded to produce a slurry consistent with expected full-scale operations. The slurry produced during the previous step (with particle sizes greater than 2.8 mm removed) will be mixed for approximately 5 to 10 minutes, or more if needed to achieve a homogeneous and thoroughly mixed slurry. The mixed slurry will then be allowed to settle for 60 seconds and then decanted. The slurry produced from the decant will consist of fine and organics. If the lower portion of the bucket contains significant amounts of fines, that sand fraction will be rinsed with river water over a No. 200 sieve (75 micrometers) to collect additional fines and organics to add to the decanted fraction.

The oversized material removal and desanding evaluation will be conducted in general accordance with the SOP provided in Attachment E (or an SOP from the testing contractor).

6.2 Polymer Testing and Thickening

Desanded slurry will be used to complete a polymer bench-scale test. Results from the dewatering polymer jar testing will be used to select two to three polymer mixtures to be applied on a larger scale needed to generate the quantity of thickened sludge needed for filter press testing. Polymer mixtures will be mixed at the same ratio selected from the jar testing with desanded slurry to create a slurry with approximately 10 percent solids. The polymer-dosed slurry will be thoroughly mixed and a small aliquot from each mixture will be removed to perform a settling test. The settling test will record the amount of time needed to release 25 to 75 percent of the water from the flocculated sediment. The falling liquid-solid interface will be observed and recorded relative to time lapse. The plot of this data will create a zone settling rate or velocity which can be used in full-scale design of thickeners.

The remaining polymer-dosed slurries will be allowed to settle for up to one week. This extended settling time will simulate sludge thickening in the full-scale operation. Thickening of the slurry is necessary to achieve a high enough solids content for efficient filter press operation. Samples of the thickened slurry will be tested for moisture content (by ASTM D2216) and relative density (by ASTM D5057). The polymer testing on the thickened slurry will be conducted in general accordance with ASTM D2035 and the procedures outlined in Section 5.2 (or an SOP from the testing contractor).

6.3 Mechanical Filter Press Testing

The final process step in mechanical dewatering bench-scale testing is use of a filter press. Bench-scale scale units on the order of 100 to 500 millimeters are available for testing from many vendors and laboratories. This allows various filter cloths and membranes to be tested, various sludge amendments to be tested if needed (i.e. pH adjustment or amendments such as diatamaeceous earth), and a filter cake to be produced for characterization. The filter cake quantity can be used to size elements of the UDF and to compare with sludge produced during geotextile tube treatability study testing.

For the bench-scale test unit, a feed pump will pull slurry from thickened sludge and will feed into the filter plates or membranes. A hydraulic or mechanical motor will compress the plates, containing filter cake within the unit, and allowing filtrate to be collected as it is squeezed out. Time and pressure applied will be recorded throughout the test. Filtrate flowrate and filter cake moisture content will be measured following completion of each test to determine which micrometer cloth (or other variable) complete dewatering in as short a time as possible.

The mechanical filter process bench-scale test will be conducted in general accordance with the SOP provided in Attachment F (or an SOP from the testing contractor), including geotechnical analysis for evaluation of disposal characteristics.

7 Water Treatment System Evaluation

This section describes the proposed treatability study testing to support evaluation of the water treatment system to be operated at the UDF area, including testing methods and types of analyses. If substantial updates to the procedures described in this section are needed (e.g., based on field conditions, material characteristics, volume size), updated procedures will be provided to EPA for review and approval before initiating testing.

The water filtrate collected from the geotextile tube and mechanical dewatering evaluations will be used for this evaluation. The testing described herein has been developed for each of the one to three sample groups created as described in Section 3.2. However, if the results of initial water filtrate sampling indicate similar characteristics in the filtrate from each sample group, filtrate from each group may be combined, as appropriate, based on review of the results from the initial water filtrate sampling described in Section 7.1.

7.1 Water Filtrate Sampling

Filtrate from the dewatering testing, as available, will be submitted for the analyses of the following:

- PCBs using EPA Method 608.3;
- Volatile organic compounds (VOCs) using EPA Method 624.1;[1]
- Polycyclic aromatic hydrocarbons (PAHs) using EPA Method 625.1;
- Other semi-volatile organic compounds (SVOCs) using EPA Method 625.1/420.1/420.4;
- TPHs (C6 to C25) using EPA Method 8015D;
- Total and dissolved metals using EPA Method 200.7/200.8 (arsenic, barium, beryllium, chromium, cobalt, copper, iron, manganese, lead, nickel, thallium, tin, vanadium, and zinc);[2]
- Oil and grease using EPA Method SW-846 1664B;
- pH using EPA Method 150.1;
- TSS using SM 2540D;
- Alkalinity using SM 2320B;
- Hardness using SM 2340C; and
- Total organic carbon (TOC) using SM 5310C.

Samples sent to the analytical laboratory will be submitted under chain-of-custody protocol and will be processed for a standard turnaround time. The analytical results will serve as representative baseline samples of the water treatment system influent. This sampling plan assumes that sufficient filtrate volume (approximately 100 gallons) will be produced from the selected polymer dose and geotextile dewatering bench-scale testing to accommodate the water treatment system influent baseline sample analysis listed above and treatability bench-scale tests described in the remainder of this section. If sufficient filtrate volume is not produced from the selected polymer

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[1] VOC samples will be collected and preserved within the first 24 hours of filtrate generation to minimize losses due to volatilization.

[2] For dissolved metals samples, the sample will be filtered with a 0.45-micrometer filter prior to transfer to the sample container.

dose and geotextile dewatering bench-scale testing, additional sediment will be dewatered with geotextile tubes and the filtrate will be used for the water treatability bench testing.

The results from these baseline analyses will be compared to the water quality criteria proposed for discharge of treated water to the Housatonic River in the Dewatering/Treatment Design Addendum. If that comparison indicates that dissolved metals precipitation is required during the water treatment process, further bench-scale testing will be performed, as outlined in Section 7.2, prior to creation of the GAC column test source water. However, if review of the baseline metals analytical sampling data indicates that dissolved metals precipitation is not required during the water treatment process, 75 gallons (minimum) of raw geotextile filtrate will be filtered for use as source water for GAC column testing, as outlined in Section 7.3. Procedurally, this can be accomplished by pumping the raw geotextile filtrate through a five-micrometer bag filter.

7.2 Metals Precipitation Evaluation

If the comparison of filtrate analytical results to the proposed water quality discharge criteria, as described in Section 7.1, indicates that dissolved metals precipitation is required during the water treatment process, metals precipitation bench-scale testing will be performed as described in this section.

The metals precipitation laboratory bench-scale testing has been developed based on the anticipated need to reduce concentrations of total and dissolved metals to levels below proposed water quality criteria for discharge of treated water to the Housatonic River. The treatability study preliminarily includes the following:

1. Chemical-physical treatment – use of caustic to precipitate target metals and polymer to facilitate flocculation prior to settling; and
2. Sludge generation and analysis – development of generated sludge volume estimates and toxicity characteristic leaching procedure (TCLP) testing, if possible, to evaluate the potential waste characteristics.

These tests will involve jar testing, to be performed in accordance with ASTM D2035, to evaluate chemical-physical treatment and to generate solids for the sludge generation and analysis evaluation, as described in the following subsections. Should results of the water filtrate sampling analysis described in Section 7.1 indicate the need for additional treatment processes or removal of proposed treatment process steps, additional tests will be incorporated or tests will be removed, as needed, to ensure adequate and efficient treatment of the filtrate. In general, the treatment process steps will be completed in series. Water from the previous test will be used as influent to the next process step to simulate the treatment train. For example, upon completion of the caustic addition, the pH-adjusted water will be used to conduct the flocculation test. This will allow for the development of a comprehensive, sequential approach to treat the filtrate.

7.2.1 Precipitant Treatment

Precipitant treatment jar testing will be completed on raw filtrate water to evaluate the most effective dosage rate. During jar testing, visual observations will be recorded regarding floc formation and solids accumulation during settling. The pH of each jar test will be adjusted using a sodium hydroxide (caustic) solution. Additionally, each jar will be continuously mixed using a magnetic stir plate (or similar) until the target pH is achieved. Specific metals requiring precipitation will be identified by evaluating baseline sample results as outlined above. Target pH values for each jar test will be determined based on the minimum solubility of the metal-hydroxide precipitates. The initial volume of raw filtrate water, the initial and final solution pH, the volume of caustic required to achieve the target pH, and the caustic concentration of the solution used for pH adjustment will be recorded.

Following treatment with caustic, mixing will stop and the water will be allowed to settle. Samples of the supernatant will be analyzed for the total and dissolved target metal parameters identified in raw filtrate baseline analysis (Section 7.1). For the precipitant treatment study, dissolved metals samples will be passed through a 0.45-micrometer filter at the analytical laboratory prior to analysis. Samples sent to the analytical laboratory will be submitted under chain-of-custody protocol and will be processed for a standard turnaround time.

The precipitant treatment jar test will be conducted in accordance with the SOP provided in Attachment G (or an SOP from the testing contractor).

7.2.2 Coagulation and Flocculation

To start, flocculants that have proven successful with similar water chemistries will be tested on filtrate water, following the precipitation step. Visual observations will be recorded, and conditions documented using digital photography. TSS and turbidity measurements will be used to quantitatively evaluate settled supernatant of samples treated with effective water treatment chemicals. Jar testing will follow procedures similar to those outlined in Section 5.2 above and in accordance with ASTM D2035.

Should products with past successful track records be inadequate, polymer suppliers will be consulted in a screening process to select a technically appropriate regime of water treatment chemicals intended to expedite solids flocculation and enhance settling velocity. The water treatment chemical will be documented using visual observations and digital photography along with TSS and turbidity measurements made on settled supernatant. Quality and settling characteristics of the floc generated with the water treatment chemical regime will be considered when making the selection. Following selection of the most desirable combination of water treatment chemicals, the project team will confirm and document the dosage calculations.

Once the most effective flocculant additive is selected, jar testing will be conducted by diluting the additives to three dosage rates to evaluate the most effective dosage rate. During jar testing, visual observations will be recorded related to floc formation and solids accumulation during settling.

Following flocculant treatment, the water will be allowed to settle and analytical samples for total target metal parameters identified in raw filtrate analysis will be collected. Samples sent to the analytical laboratory will be submitted under chain-of-custody protocol and will be processed for a standard turnaround time. Analytical results along with qualitative and quantitative field analysis will be utilized to select the optimal flocculant based on settling efficiency and target parameter results.

The selected metals precipitation parameters will be utilized to treat 75 gallons (minimum) of filtrate, which will then be pumped through five-micrometer bag filters for use as GAC column testing source water, as described in Section 7.3. The pH of the filtrate water will be evaluated following metals precipitation treatment and adjusted using sulfuric acid as needed to meet anticipated discharge requirements (6.5 – 8.3 standard units [SU]). If final pH adjustment is required, the initial and final sample pH values, initial sample volume, concentration of sulfuric acid used, and volume of sulfuric acid used will be recorded.

Sludge/solids will be generated from the precipitation and flocculation processes. Solids will be assessed from each process, including sludge volume generated, and solids content will be recorded. The sludge/solids from the selected chemical and dosage test run will be analyzed for moisture content (by ASTM D2216) and relative density (by ASTM D5057) if sufficient material is generated.

7.3 Granular Activated Carbon Evaluation

GAC is the proposed treatment technology for anticipated PCB removal. GAC allows for effective removal of a variety of contaminants from water through physical and chemical adsorption mechanisms. To evaluate treatment efficacy, rapid small-scale column tests (RSSCT) will be performed on the two different GAC media identified below.

1. Reactivated GAC (Calgon DSR-C); and
2. Bituminous GAC (Calgon F400).

RSSCT for GAC requires the grinding of GAC media into a smaller size before putting it into the testing column. This step allows for proportional reduction of empty bed contact time (EBCT) as the vessel size decreases. A key feature of RSSCTs is that the GAC grains utilized in the mini-column are considerably smaller than full-scale grains. As determined by Crittenden et al. (1991), mini-columns containing finely ground GAC can accurately simulate full-scale GAC breakthrough profiles in a fraction of the time required for full-scale adsorption systems. The RSSCT test stand will be built based on the specific conditions of interest (e.g., flow rate, EBCT, etc.) so that activated carbon performance and utilization rate for the target compound(s) can be determined. Figure 8-1 below shows an example RSSCT apparatus. Only one test column is proposed for each test discussed herein. All tests will be performed in accordance with ASTM D6586 (Standard Practice for the Prediction of Contaminant Adsorption on GAC in Aqueous Systems Using RSSCTs).

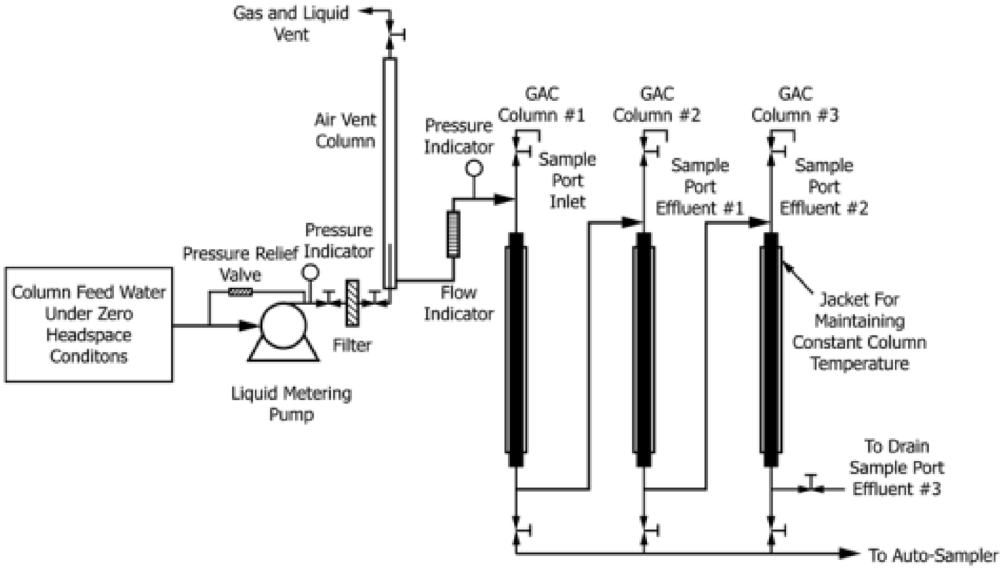

Figure 7-1 Flow Diagram for Three-Column RSSCT Apparatus (courtesy of ASTM D6586)

The liquid generated during dewatering testing will be used; if the metals precipitation evaluation indicates that metals precipitation will be required in the water treatment system treatment train, the liquid will first be dosed with the most effective pH adjustment and coagulation/flocculation additives determined during the metals precipitation testing (described in Section 7.2). The GAC column testing source water will then be pumped through a five-micrometer bag filter to simulate the expected filtration in the water treatment system. The GAC column testing source water (after pH adjustment and coagulation/flocculation and filtration) will be analyzed for the following:

- PCBs using EPA Method 608.3;
- VOCs using EPA Method 624.1;

- PAHs using EPA Method 625.1;
- Other SVOCs using EPA Method 625.1/420.1/420.4;
- TPHs (C6 to C25) using EPA Method 8015D;
- Total and dissolved metals using EPA Method 200.7/200.8;
- TSS using SM 2540D; and
- TOC using SM 5310C.

If metals precipitation is not required, the results from water filtrate sampling discussed in Section 7.1 will be sufficient to characterize the influent for GAC column testing for most analytes. However, GAC column testing source water will be pumped through a five-micrometer bag filter and re-analyzed for the following:

- PCBs using EPA Method 608.3;
- Total metals using EPA Method 200.7/200.8; and
- TSS using SM 2540D.

Samples sent to the analytical laboratory will be submitted under chain-of-custody protocol and will be processed for a standard turnaround time. Target analytes and frequency may be adjusted based on preliminary filtrate and/or post metals precipitation treatment sampling analysis.

To evaluate GAC, this task includes the following:

- Two RSSCT will be completed to breakthrough:
  - One column of Reactivated GAC simulating a full-scale 10-minute EBCT; and
  - One column of Bituminous GAC simulating a full-scale 10-minute EBCT.
- During the testing, analysis will include approximately 30 TOC and 30 PCB samples analyzed per RSSCT. Each test will collect the following samples at the designated frequencies:
  - TOC sampled:
    - Every 100 bed volumes until 500 bed volumes,
    - Then every 250 bed volumes until 2,000 bed volumes,
    - Then every 500 bed volumes until 5,000 bed volumes,
    - Then every 1,000 bed volumes until TOC breakthrough.
  - PCBs sampled:
    - Every 1,000 bed volumes until 5,000 bed volumes,
    - Then every 2,500 bed volumes until 10,000 bed volumes,
    - Then every 5,000 bed volumes until breakthrough of the target analyte.
  - The addition of VOCs, PAHs other SVOCs, and TPH to the RSSCT sample list and the required sampling frequency will be based on review of the GAC column testing source water analytical results.

RSSCT results will be evaluated to determine time to breakthrough for each GAC and to select the most efficient and effective medium based on treatment needs.

8 Data Evaluation, Schedule, and Reporting

After EPA approval of this Dewatering/Treatment Treatability Plan, GE will initiate the treatability study activities, starting with field sampling. It is anticipated that the field sampling will be conducted in 2025 concurrently with field activities to support the supplemental data collection activities described in the Reach 6 SDC Work Plan, after the necessary EPA approvals and subject to weather constraints. It is anticipated that the treatability study activities associated with the sediment dewatering evaluations discussed in Sections 4 through 6 can be completed within five to eight months after sample collection. Testing associated with water treatment evaluations discussed in Section 7 are anticipated to be completed within four months after that.

The treatability study testing data will be evaluated and incorporated into the remedial design for the dewatering and water treatment systems. Analytical chemistry data will undergo data validation in accordance with the FSP/QAPP. The data and information generated during the treatability study testing will be reviewed, evaluated, and interpreted in light of the DQOs identified in Section 2. The treatability study testing results will be used to evaluate and refine the design of the sediment dewatering/processing and water treatment systems at the UDF. In addition, the data will be used to support the preparation of the design specifications to be provided with the final design of those systems.

The results of the treatability study will be summarized in a Treatability Studies Summary Report, which will be submitted prior to the Final RD/RA Work Plan for Reach 6 and prior to the final design of the sediment dewatering and water treatment systems intended for operation at the UDF. The final design of the latter will then be provided in a separate final design report on those systems, which will be another, later addendum to the Revised UDF Final Design Plan, as described in the Dewatering/Treatment Design Addendum. The dewatering and water treatment systems at the UDF will be constructed and operational before remediation activities in Reach 6 begin.

9 References

Anchor QEA. 2024. *Pre-Design Investigation Summary Report for Reach 6*. Prepared for General Electric Company, Pittsfield, Massachusetts. October 31.

Anchor QEA, AECOM, and Arcadis (Arcadis U.S., Inc). 2023. *Conceptual Remedial Design/Remedial Action Work Plan for Reach 5A*. Prepared for General Electric Company, Pittsfield, Massachusetts. September 28.

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Arcadis. 2024a. *Upland Disposal Facility Final Design Plan*. Prepared for General Electric Company, Pittsfield, Massachusetts. February 28.

Arcadis. 2024b. *Upland Disposal Facility Operation, Monitoring, and Maintenance Plan*. Prepared for General Electric Company, Pittsfield, Massachusetts. February 28.

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Arcadis. 2024d. *Upland Disposal Facility Revised Operation, Monitoring, and Maintenance Plan*. Prepared for General Electric Company, Pittsfield, Massachusetts. December 20.

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Arcadis, Anchor QEA, and AECOM. 2010. *Revised Corrective Measures Study Report. Housatonic River – Rest of River*. Prepared for General Electric Company, Pittsfield, Massachusetts. October.

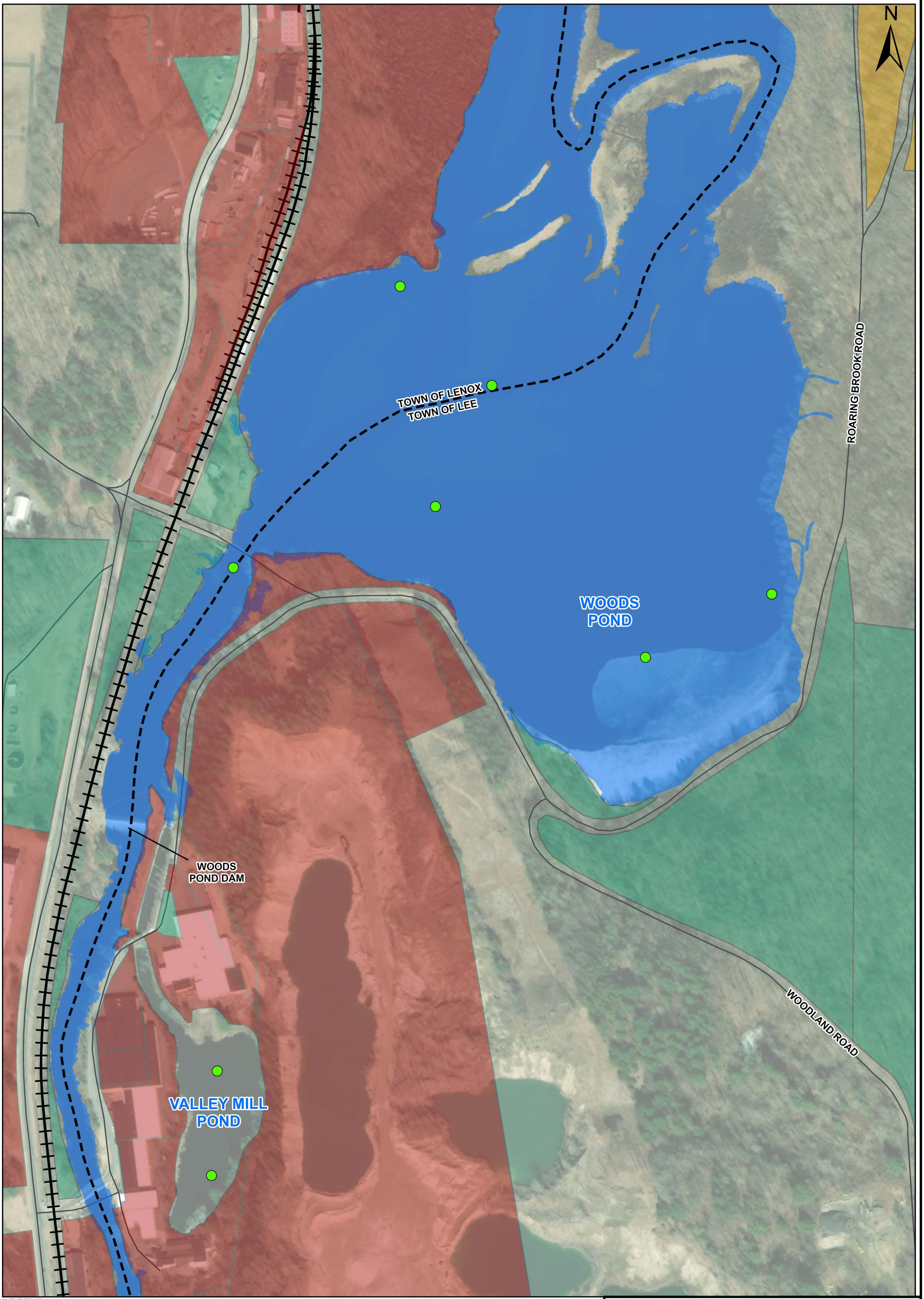
Crittenden et al. (1991), Crittenden JC, Reddy PJ, Arora H, Trynoski J, Hand DW, Perram DL, Summers RS. Predicting GAC performance with rapid small-scale column tests. J AWWA 1991; 83:1:77-87.

EPA (U.S. Environmental Protection Agency). 2020. *Revised Final Permit Modification to the 2016 Reissued RCRA Permit and Selection of CERCLA Remedial Action and Operation & Maintenance for Rest of River*. December.

MassDEP (Massachusetts Department of Environmental Protection). 2024. List of Approved Technologies for Use In Massachusetts --310 CMR 22.04(8). Updated: November 1, 2024. Available online at: https://www.mass.gov/doc/list-of-massdep-approved-new-drinking-water-technologies/download. Last accessed November 15.

Figures

Path: T:_ENV\GE\GE_Housatonic\ArcPro Projects\Treatability Study WP\Treatability Study WP.aprx\Fig3-1 Proposed Sample Locs Last Saved By: ksinsabaugh 11/19/2024



LEGEND

- ● SAMPLE LOCATION
- TOWNSHIP BOUNDARY
- ROAD
- RAILROAD
- 🟦 HOUSATONIC RIVER

PARCELS WITHIN 500 FEET OF RIVER

- 🟩 RESIDENTIAL
- 🟨 COMMERCIAL
- 🟥 INDUSTRIAL

NOTES:

1. COORDINATE SYSTEM: NAD83 STATE PLANE MASSACHUSETTS MAINLAND FIPS 2001
2. BASEMAP SOURCE: VIVID IMAGERY PROVIDED BY MAXAR, ACCESSED 11/19/2024

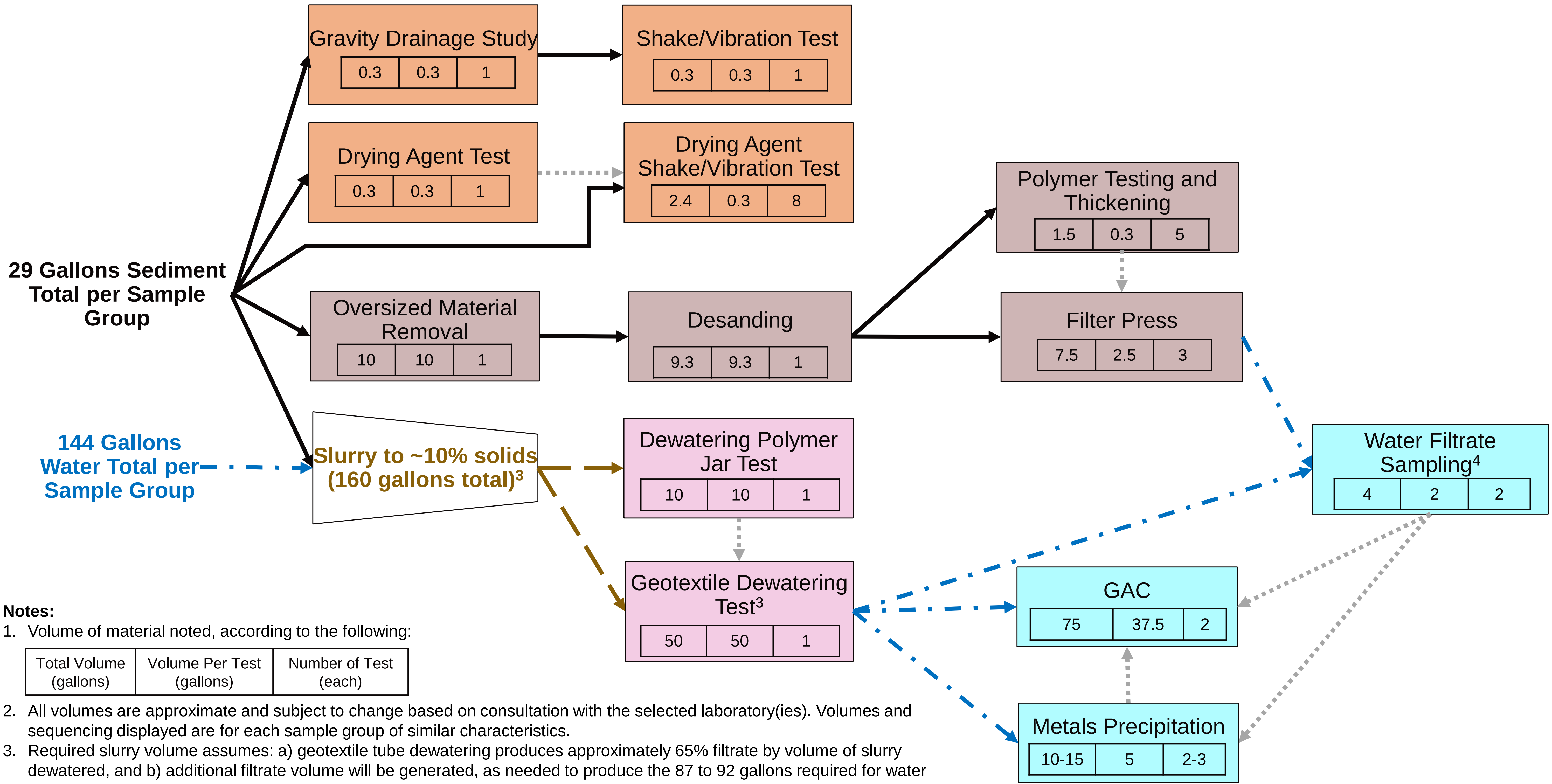
0 300 600
GRAPHIC SCALE IN FEET

GENERAL ELECTRIC COMPANY
HOUSATONIC RIVER - REST OF RIVER
TREATABILITY STUDY WORK PLAN

PROPOSED SAMPLE LOCATIONS

ARCADIS

FIGURE
3-1



Notes:

1. Volume of material noted, according to the following:

Total Volume (gallons)	Volume Per Test (gallons)	Number of Test (each)

2. All volumes are approximate and subject to change based on consultation with the selected laboratory(ies). Volumes and sequencing displayed are for each sample group of similar characteristics.
3. Required slurry volume assumes: a) geotextile tube dewatering produces approximately 65% filtrate by volume of slurry dewatered, and b) additional filtrate volume will be generated, as needed to produce the 87 to 92 gallons required for water treatment system testing, by dewatering using geotextile tubes in parallel to the geotextile dewatering test.
4. Approximately two gallons per test, one test per treatment train (e.g., one for passive dewatering, one for geotextile tube dewatering, and one for mechanical dewatering).

Legend:

→ Sediment material processed in sequence
-·→ Water material processed in sequence
--→ Slurry material processed in sequence
····→ Results used to inform subsequent tests

Process Evaluated:

🟧 Passive dewatering and sediment stabilization
▭ Geotextile tube dewatering
▭ Mechanical dewatering
▭ Water treatment system

GENERAL ELECTRIC COMPANY
HOUSATONIC RIVER – REST OF RIVER
TREATABILITY STUDY WORK PLAN

TREATABILITY STUDY TESTING SEQUENCE FOR EACH SAMPLE GROUP

ARCADIS

FIGURE
3-2

https://arcadiso365.sharepoint.com/teams/GE_Housatonic_ROR/General_Reach6/Reach6_RDRA_WP_Conceptual/Appx_5.09_SedMgtEval/Figures
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Attachment A

Standard Operating Procedure: Gravity Drainage Test

Standard Operating Procedure: Gravity Drainage Test

Rev: 0 | Rev Date: December 2024

Scope and Application

This standard operating procedure (SOP) describes procedures for conducting a bench-scale Drainage Study as part of the treatability study program. The purpose of this study is to estimate the water content of a composite sample after gravity draining for a period of time.

Equipment List

The following materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- Analytical balance
- No. 200 standard sieve
- Conical paint filters (60 × 60 mesh or 60 × 48 standard mesh)
- Sampling spoon
- Laboratory stands
- Funnels
- Graduated cylinders
- Graduated beaker
- Digital camera
- Laboratory notebook

Drainage Study Procedure

In this test, samples representative of sediment proposed for removal are placed atop a screen and allowed to gravity drain for 72 hours. For each bulk sediment sample, the procedures are as follows:

1. Don appropriate PPE.
2. Homogenize the bulk sediment sample (ensure that water content is representative of anticipated site conditions).
3. Collect pre-test subsamples for determination of total solids and for testing in accordance with the Paint Filter Liquids Test (SW846 Test Method 9095B).
4. Collect 1 liter of sediment from each sample.
5. Place the sediment material in a conical configuration in the center of a No. 200 standard sieve.
6. Set up the apparatus to collect any water that drains from the sample during the testing in a graduated beaker.
7. Place each screen and sample in a non-drafty location or place a non-airtight cover over the sieve.
8. Photograph the testing apparatus.
9. After drainage durations of 6, 24, 48, and 72 hours, remove a 25-gram sample from the center of the cone and determine the total solids content. Measure the amount of water that drains from the sample at each time interval. Conduct paint filter testing on the sample at each time interval. Homogenize the remaining material between each test duration and repeat for the 72 hour duration; submit a sample of for testing for strength and physical properties at a geotechnical laboratory as follows:
    a. Moisture Content (by ASTM International [ASTM] D2216);
    b. Grain Size Distribution (by ASTM D6913/D7928);

    c. Atterberg (Liquid and Plastic) Limits (by ASTM D4318);
    d. Hydraulic Conductivity (by ASTM D5856, D2434, or D5084);
    e. Standard Proctor (by ASTM D698);
    f. Dry Density (by ASTM D2937);
    g. Unconfined Compressive Strength (by ASTM D2166);
    h. Undrained Shear Strength (by ASTM D2573, D4648, and D2850);
    i. Triaxial Undrained Shear Strength (by ASTM 4746); and
    j. Presence of Free Liquids (by the Paint Filter Test, EPA Method 9095B.
10. For each sample, plot the solids concentration vs. time.
11. After test completion, conduct further testing on the homogenized remaining material (from Step 9) in accordance with the Shake/Vibration Test procedures (see separate SOP), as applicable.

References

EPA (U.S. Environmental Protection Agency), 2004. SW-846 Method 9095B – Paint Filter Liquids Test. Revised November 2004.

Attachment B

Standard Operating Procedure: Stabilization/Solidification Amendment Test

Standard Operating Procedure: Stabilization/Solidification Amendment Test

Rev: 0 | Rev Date: December 2024

Scope and Application

This standard operating procedure (SOP) describes procedures for conducting bench-scale Stabilization/Solidification (S/S) Amendment Tests. These tests will determine the effectiveness of different amendment types and doses to meet transportation and disposal facility requirements for excavated sediment.

Equipment List

The following materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- Stainless steel mixing bowl
- Soil mixing apparatus
- Sample containers
- Analytical balance
- Digital camera
- Paint Filter testing equipment described in the Paint Filter Liquids Test method (SW846 Test Method 9095B)
- Laboratory notebook

Test Procedure for Stabilization/Solidification

The S/S test method described below will be conducted in a laboratory bench-scale setup using sediment collected from target removal locations. Samples used in the test will be approximately 1 kilogram in weight. The tests will be conducted under three different S/S amendment percentages for each amendment type. The following stabilization amendments will be tested, unless stated otherwise in the project work plan: Type I Portland cement; cement kiln dust, Calciment, and lime. The treatability testing will be performed using these commercially available amendments at mix ratios of 2.5%, 5%, and 7.5% by weight. If adequate testing results are not obtained using the initial ratios, additional mix ratios will be evaluated.

Upon receipt of the bulk sediment samples, the S/S bench-scale testing will be conducted using the following laboratory procedure:

1. Don appropriate PPE.
2. Homogenize the bulk sediment sample (ensure that water content is representative of anticipated site conditions).
3. Determine the initial percent moisture, percent solids, and weight for each sample and record the data in a notebook along with a description of the sample material based on visual observations.
4. Divide each composite sample into subsamples.
5. Photograph the samples.
6. Label each of the subsamples with the sediment sample location nomenclature and the following to indicate the amendment type and dose:
    a. Three subsamples subject to the addition of Portland cement (PC) are to be labeled with the suffixes "-PC (2.5%)", "-PC (5%)", and "-PC (7.5%)."
    b. Three subsamples subject to the addition of Cement Kiln Dust (CKD) are to be labeled with the suffixes "-CKD (2.5%)", "-CKD (5%)", and "-CKD (7.5%)."

   c. Three subsamples subject to the addition of Calciment (Calc) are to be labeled with the suffixes "-Calc (2.5%)", "-Calc (5%)", and "-Calc (7.5%)."
   d. Three subsamples subject to the addition of lime (CaO) are to be labeled with the suffixes "-CaO (2.5%)", "-CaO (5%)", and "-CaO (7.5%)."
7. Add the stabilization amendment (by weight relative to the total subsample weight) listed in Step 6 to correspond to the sample labels. Thoroughly mix the stabilization amendment into the sample. For example, add 5% PC by weight to the sample with the suffix "-PC (5%)." Weigh each sample before and after amendment application. Document the results in the project notebook along with the date, time, and laboratory air temperature. Photograph the samples.
8. Let the samples cure for a period of 12 hours, weigh each sample and then analyze each of the subsamples for percent solids (Standard Method 2540G), moisture content (ASTM D2216), paint-filter test (EPA Method 9095B), and strength using a pocket penetrometer. Weigh the sample again after this testing. Document the results in the project notebook along with the date, time, and laboratory air temperature. Photograph the samples after each cure period.
9. Repeat the procedure listed in Step 8 after letting the samples cure for 24, 48 and 72 hours.
10. Document the optimal amendment type, mix ratio (dosage), and cure time based on the testing.
11. Prepare a single sample using the selected amendment and mixing ratio, and allow to cure the optimal cure time. Submit resulting material for the following geotechnical tests to determine the strength and physical properties of the amended material:
    a. Moisture Content (by ASTM International [ASTM] D2216);
    b. Grain Size Distribution (by ASTM D6913/D7928);
    c. Atterberg (Liquid and Plastic) Limits (by ASTM D4318);
    d. Hydraulic Conductivity (by ASTM D5856, D2434, or D5084);
    e. Standard Proctor (by ASTM D698);
    f. Dry Density (by ASTM D2937);
    g. Unconfined Compressive Strength (by ASTM D2166);
    h. Undrained Shear Strength (by ASTM D2573, D4648, and D2850);
    i. Triaxial Undrained Shear Strength (by ASTM 4746); and
    j. Presence of Free Liquids (by the Paint Filter Test, EPA Method 9095B.

    Test methods used will be appropriate for the material tested (i.e., cohesive soils versus non-cohesive soils).
12. After test completion, conduct further testing on amended sediment samples in accordance with the Shake/Vibration Test procedures (see separate SOP), as applicable.

References

EPA (U.S. Environmental Protection Agency), 2004. SW-846 Method 9095B – Paint Filter Liquids Test. Revised November 2004.

Attachment C

Standard Operating Procedure: Shake/Vibration Test

Standard Operating Procedure: Shake/Vibration Test

Rev: 0 | Rev Date: December 2024

Scope and Application

This standard operating procedure (SOP) describes procedures for the shake/vibration test for untreated and stabilized/solidified sediments. The purpose of this study is to simulate motion similar to that which might be imparted during transport of untreated (if possible) or stabilized/solidified sediments to a disposal destination. The transport-simulated samples will then be examined and tested for free water.

Equipment List

The following materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- Lexan tubing (3-inch inside diameter by 24 inches)
- Laboratory shaker with variable control
- Digital camera
- Paint Filter testing equipment described in the Paint Filter Liquids Test method (SW846 Test Method 9095B)
- Laboratory notebook

Procedure for Shake/Vibration Testing

1. Don appropriate PPE.
2. Select the following sediment samples for shake/vibration testing:
    a. One control sediment sample from each field sample location using bulk sediment that has not been subject to gravity drainage testing or amendment testing. Homogenize the bulk sediment sample before control sample collection (ensure that water content is representative of anticipated site conditions).
    b. One sediment sample from each field sample location that was subject to gravity drainage testing (see separate SOP).
    c. One sediment sample from each field sample location that was subject to stabilization/solidification testing after curing for at least 72 hours (see separate SOP). Samples for shake/vibration testing will be selected from the optimal amendment type and dose for each sample location.
3. Prepare 24-inch sections of Lexan tubing by sealing one end. Place approximately 1 kilogram of each sample into the Lexan tubing by filling to a depth of approximately 10 inches. Tap lightly, then mark and record the sediment depth in each tube. Seal the upper end of the tube to prevent desiccation.
4. Bundle the tubes and place them upright in the shaker. Secure the bundle to the shaker. Photograph the samples.
5. Set the shaker to a rotation speed of 60 revolutions per minute. Continue slow shaking for a duration of five days.
6. After the simulated transit period, remove the tubes from the shaker. Allow the tubes to stand undisturbed for 2 to 4 hours. After that time, observe and photograph the sediment surface of each tube. Mark and measure the sediment surface in each tube. Note and measure any stratification or liquid accumulation on the surface or the bottom. Submit samples for Paint Filter testing (EPA Method 9095B).

References

EPA (U.S. Environmental Protection Agency), 2004. SW-846 Method 9095B – Paint Filter Liquids Test. Revised November 2004.

Attachment D

Standard Operating Procedure: Geotextile Dewatering Bench-Scale Test

Standard Operating Procedure: Geotextile Dewatering Bench-Scale Test

Rev: 0 | Rev Date: December 2024

Scope and Application

This standard operating procedure (SOP) describes the geotextile dewatering bench testing performed to demonstrate dewatering of sediment slurry using a geotextile “pillow” or “hanging bag.” The purpose of this testing is to visualize the dewatering process, evaluate the efficiency of the selected dewatering polymer and geotextile material, evaluate the clarity of the effluent, and predict dewatering durations and achievable percent solids.

Equipment List

The following equipment and materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- Laboratory stand(s)
- 50-gallon conical bottom tank equipped with control valve
- Variable speed electric drill with mixing propeller attachment
- For each test run:
    - Geotextile “pillow” or hanging bag (e.g., TenCate GDT unit or equivalent)
    - Stand-pipe with 2” male thread adapter
    - Drainage stand/rack
    - Catch basin/container
- Digital camera
- Stopwatch
- Analytical balance / scale
- Glassware for measuring liquid volumes (e.g., beakers, graduated cylinders)
- Laboratory notebook and/or applicable forms
- Paint Filter testing equipment described in the Paint Filter Liquids Test method (SW846 Test Method 9095B)
- Sample containers

Procedure

The tests described below will be conducted in a laboratory bench-scale setup using slurry prepared from sediment collected from target removal locations and surface water collected from the targeted work area. Sediment slurry used in the test will be approximately 40 to 50 gallons. Unless stated otherwise in the project work plans, the tests will be conducted on representative subset of slurry samples as follows: coarser material at 10% solids, finer material at 10% solids, mixed material at 10% solids. For each prepared slurry sample to be tested, the procedures are as follows:

1. Don appropriate PPE.
2. Prepare geotextile container inlet connection/standpipe in preparation for connection to testing apparatus. Record the empty weight of the prepared geotextile container.
3. Assemble the testing apparatus as shown in Figure 1. Set up the apparatus to collect any water that drains from the geotextile container during the testing.

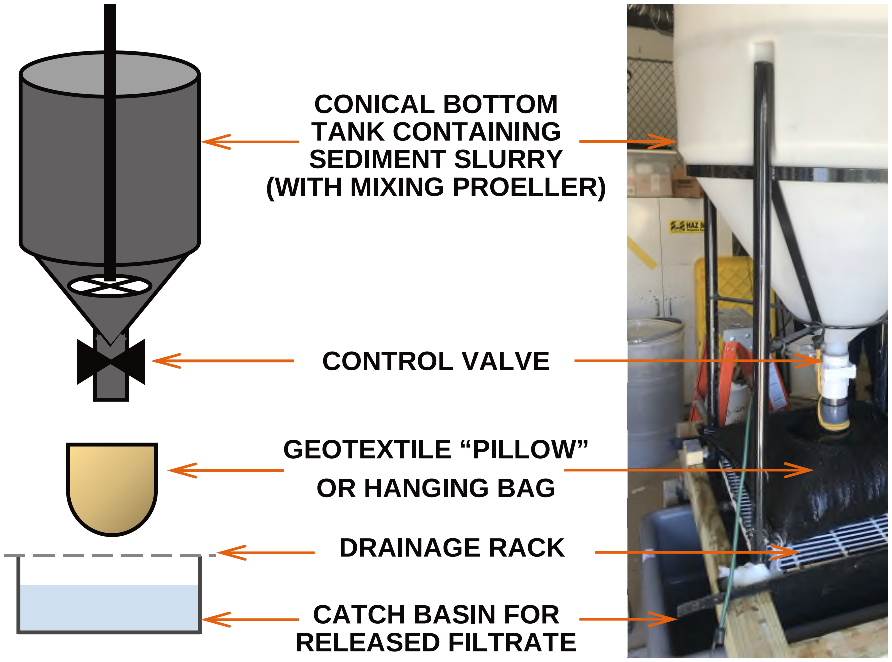

Figure 1 - Testing Apparatus Setup

4. Combine bulk sediment sample and surface water in tank (control valve closed) to achieve the target slurry solids content. Record the quantity of sediment and surface water used to create the slurry sample.
5. Polymer type and dosage will have been determined from polymer jar testing (see ASTM D2035 or applicable project SOP). Record polymer name and dosage. Mix the polymer into the slurry sample using the variable speed electric drill with mixing propeller attachment until floc is formed. Record quantity of polymer added, mixing speed, and mixing duration.
6. Collect pre-test sample of sediment slurry and analyze for percent solids (Standard Method 2540G) and moisture content (ASTM D2216). The sediment slurry should be gently stirred prior to collecting the percent solids and moisture content sample. Gentle stirring can be achieved using the variable speed drill with mixing propeller if the delivered mixing energy does not risk destroying flocculant structure. If flocculant structure is at risk when using the drill/mixing propeller, a handheld paddle can be substituted.
7. While continuing to gently mix the flocculated sediment slurry, open control valve to begin filling of geotextile container. Record date, time, and laboratory air temperature to document the start of filling operations. Continue to agitate contents to maintain solids in suspension during filling of container.
8. During filling of container, monitor filtrate generation by performing the following approximately every 5 minutes:
    a. Collect a filtrate sample from the corner of the container, examine for clarity and test for turbidity.
    b. Measure quantity of filtrate generated by volume using applicable glassware or by weight using a scale.
    c. Containerize filtrate generated from each test for further sampling and testing as identified in the project work plans.
9. Once filling of the geotextile container is complete, record the following:
    a. Date and time
    b. Duration of filling
    c. Quantity of slurry remaining in conical bottom tank, if any.

10. Continue to monitor filtrate generation, as described in Step 8, until the end of the dewatering period at the frequency identified below. For each test, plot the filtrate generated vs. time. Unless otherwise indicated in the project work plans, the dewatering period will be for 14 days or until no more liquid is released from the geotextile container, whichever occurs first
    a. Every 15 to 30 minutes for the first 4 hours of testing
    b. At least twice per day for the first three days
    c. Once every 2 to 3 days through the end of testing.
11. After drainage durations of approximately 4, 24, 48, 72, 120, 168, 216, and 244 hours, remove a 25-gram sample from the center of the geotextile container (access through inlet port) and determine the percent solids (Standard Method 2540G) of the sample. Record the date, time, and weight of sediment removed from the container. For each test, dewatered sediment percent solids vs time.
12. After dewatering test completion:
    a. Record the final weight of the filled container (with inlet/pipe, if included in empty weight from Step 2)
    b. Cut open the top of the geotextile container and photograph the undisturbed material inside.
    c. Cut through the sediment and photograph a cross-section of the dewatered sediment.
13. Collect sub-samples of the dewatered material and perform paint filter liquids testing (SW846 Test Method 9095B).
14. Test samples of the dewatered material for the following geotechnical parameters to determine the physical properties of the dewatered sediment for disposal characterization:
    a. Moisture content (by ASTM D2216)
    b. Grain size distribution (by ASTM D6913/D7928)
    c. Liquid limit, plastic limit, and plasticity index (Atterberg Limits) (by ASTM D4318)
    d. Hydraulic conductivity (by ASTM D5856, D2434, or D5084)
    e. Standard proctor (by ASTM D698)
    f. Dry Density (by ASTM D2937);
    g. Unconfined compressive strength (by ASTM D2166);
    h. Undrained shear strength (by ASTM D2573, D4648, and D2850); and
    i. Triaxial undrained shear strength (by ASTM 4746).
15. If required by the project work plans, conduct further sampling and testing of dewatered sediment per applicable SOPs.

References

Standard Methods Committee of the American Public Health Association, American Water Works Association, and Water Environment Federation. 2540 Solids. In: Standard Methods For the Examination of Water and Wastewater, 24th Edition, ed. Lipps WC, Baxter TE, Braun-Howland E. Washington DC: APHA Press.

U.S. Environmental Protection Agency. 2004. SW-846 Method 9095B – Paint Filter Liquids Test. Revised November 2004.

Attachment E

Standard Operating Procedure: Oversized Material Removal and Desanding Bench Testing

Oversized Material Removal and Desanding Bench Testing Procedure

Rev: 0 | Rev Date: December 2024

Scope and Application

This procedure describes the oversized material removal and desanding bench testing performed to demonstrate preparation of sediment slurry for mechanical dewatering. The purpose of this testing is to verify material balance assumptions upstream of mechanical dewatering, prepare samples and evaluate potential material handling steps required for mechanical dewatering bench testing.

Hydraulically transported sediments may be treated for preliminary removal of coarse (>0.075 mm) particulates. Removal of coarse/dense materials relieves loading of solids to dewatering facilities.

Equipment List

The following equipment and materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- Materials and equipment as required for Sieve analysis (ASTM D422).
- For slurry quantities greater than 5 gallons, an AOD pump with hoses and other accessories
- 5-gallon buckets
- Variable speed electric drill with mixing propeller attachment
- Analytical balance / scale
- Laboratory notebook and/or applicable forms
- Sample containers

Procedure

The tests described below will be conducted in a laboratory bench-scale setup using slurry prepared from sediment collected from target removal locations and surface water collected from the targeted work area. Sediment slurry used in the test will be approximately 40 to 50 gallons.

1. Don appropriate PPE.
2. Combine bulk sediment sample and surface water in bucket/barrel to achieve the target slurry solids content. Record the quantity of sediment and surface water used to create the slurry sample.
3. Thoroughly mix slurry using an electric dual paddle mixer or an AOD pump with the suction and discharge hoses both inside the barrel.
4. Place slurry on a No. 7 (2.8 mm) sieve and collect the passing slurry in a 5-gallon (or greater) vessel. Use additional river water to wash the sediments through the sieve. Record amount of additional river water used.
5. Weigh the material collected on the sieve to permit a mass balance. The material collected on the sieve shall be stored for disposal with an aliquot reserved for potential analytical testing.
6. Repeat steps 3, 4, and 5 for desanding with a different mesh size sieve.
    a. Desanded slurry will be developed by passing the required quantity of simulated dredge slurry across a #200 screen with 0.075 millimeter openings. This mesh size may be adjusted, based on results of this process.
7. Aliquots of sand material and slurry containing fines will be retained for potential analysis. The weight of sand material will also be measured, permitting a mass balance.
8. If required by the project work plans, conduct further sampling and testing of slurry per applicable SOPs.

Attachment F

Standard Operating Procedure: Mechanical Membrane Filtration Bench-Scale Test

Standard Operating Procedure: Mechanical Membrane Filtration Bench-Scale Test

Rev: 0 | Rev Date: December 2024

Scope and Application

This procedure describes the membrane dewatering bench testing performed to demonstrate dewatering of sediment slurry using a filter press. The purpose of this testing is to simulate the dewatering process, evaluate the efficiency of the selected dewatering polymer and filter press, evaluate the clarity of the effluent, and the achievable percent solids.

Equipment List

The following equipment and materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- 470-mm Membrane filter press with feed pump specific to the press that will be included in the design
- Calibrated bucket
- Digital camera
- Timer / Stopwatch
- Analytical balance / scale
- Glassware for measuring liquid volumes (e.g., beakers, graduated cylinders)
- Laboratory notebook and/or applicable forms
- Paint Filter testing equipment described in the Paint Filter Liquids Test method (SW846 Test Method 9095B)
- Sample containers

Procedure

The tests described below will be conducted in a laboratory bench-scale setup using slurry prepared from sediment collected from target removal locations and surface water collected from the targeted work area. Unless stated otherwise in the project work plans, the tests will be conducted on representative subsets of slurry samples as follows: coarser material at 10 percent solids, finer material at 10 percent solids, mixed material at 10 percent solids. For each prepared slurry sample that will be tested, the procedures are as follows:

1. Don appropriate PPE.
2. Calibrate the equipment and instruments as required by manufacturer’s instructions.
3. Install the selected cloth on the filter plates and put the plates in the filter press frame then close the press and pressurize the hydraulic cylinder to the proper pressure.
4. Close the press record the closing hydraulic pressure. Set the valves to the correct positions for testing.
5. Prepare the slurry as required, including any additives such as polymer.
6. Start the feed pump(s) and record the time required to fill the press.
7. After the press has filled and filtrate begins coming out of the press start timing the filter press cycle.
8. Note the filtrate volume collected at regular time intervals and compare it to anticipated values.
9. Continue the run until the press reaches the maximum pressure and terminal flow rate for the press.
10. Perform an air blow and/or cake washing if specified for the test. Follow the manufacturer’s instructions and use durations and other instructions for each specific test.

11. Depending on testing specifications, open the press immediately or allow the cake to remain in the press for the required amount of time.
12. After opening the press, record the elapsed filter press cycle time.
13. While removing the cake, observe the cake release and describe the drop based on the following possible descriptions:
    a. Cake dropped unassisted from the cloth.
    b. Cake dropped from the cloth with assistance.
    c. Scraping was required to remove the cake from the cloth.
14. Record other noteworthy cake observations, for example:
    a. Uneven distribution of the filter cake solids inside the press.
    b. Evidence of excessive solids or polymer carryover into the filtrate.
    c. Excessive fouling or solids bypass.
15. Collect samples of the dewatered material and perform paint filter liquids testing (SW846 Test Method 9095B).
16. Place the filter cake into sample containers for geotechnical analyses. The following geotechnical tests will be performed:
    a. Moisture Content (by ASTM International [ASTM] D2216);
    b. Grain Size Distribution (by ASTM D6913/D7928);
    c. Atterberg (Liquid and Plastic) Limits (by ASTM D4318);
    d. Hydraulic Conductivity (by ASTM D5856, D2434, or D5084);
    e. Standard Proctor (by ASTM D698);
    f. Dry Density (by ASTM D2937);
    g. Unconfined Compressive Strength (by ASTM D2166);
    h. Undrained Shear Strength (by ASTM D2573, D4648, and D2850);
    i. Triaxial Undrained Shear Strength (by ASTM 4746); and
17. Store the samples on ice in a cooler and submit to the analytical laboratory using standard chain-of-custody procedures.

References

Universal Filtration & Pumping Solutions, Inc. 2024. Filter Press Testing. https://automaticfilterpress.com/filter-press-testing. Accessed November 2024.

U.S. Environmental Protection Agency. 1986. EPA 600/M-86/017. Design Information Report Recessed Plate Filter Presses. June 1986.

U.S. Environmental Protection Agency. 2000. EPA 832-F-00-058. Biosolids Technology Fact Sheet Recessed-Plate Filter Press. September 2000.

Attachment G

Standard Operating Procedure: Metals Precipitation Bench Testing

Standard Operating Procedure: Metals Precipitation Bench Testing

Rev: 0 | Rev Date: December 2024

Scope and Application

This standard operating procedure describes the bench testing performed to evaluate removal of dissolved metals from the water treatment system influent by precipitation. The purpose of this testing is to identify a target pH and estimate the associated sodium hydroxide (caustic) demand expected for the full-scale system design.

Equipment List

The following equipment and materials, as required, will be available during this procedure:

- Personal protective equipment (PPE)
- Laboratory stand(s)
- Laboratory glassware (e.g., beakers, burettes, graduated cylinders)
- pH probe with continuous measurement functionality and display
- Mixing apparatus (e.g., magnetic stir plate and stir bar)
- 25% (weight percent) sodium hydroxide solution
- Sample collection equipment (e.g., peristaltic pump and tubing)
- 0.45-micron filters
- Digital camera
- Stopwatch
- Laboratory notebook and/or applicable forms
- Sample containers with appropriate preservative

Procedure

The tests described below will be conducted in a laboratory bench-scale setup using filtrate from the optimal geotextile and polymer configuration determined in the preceding geotextile dewatering bench-scale test. The range of pH values tested for metals precipitation will be determined after reviewing the geotextile filtrate baseline sampling analytical results. Target pH values for metals precipitation testing will be based on the minimum solubility of the applicable metal-hydroxide precipitates.

For each target pH tested, the procedures are as follows:

1. Don appropriate PPE.
2. Calibrate equipment and instruments based on manufacturer’s guidelines.
3. Transfer 1L of geotextile filtrate to 1.5L beaker.
4. Place a beaker on magnetic stir plate and place magnetic stir bar in the beaker.
5. Secure pH probe to a test stand and place probe in beaker.
6. Assemble the burette apparatus and ensure the burette discharge valve is closed.
7. Fill the burette with sodium hydroxide solution.
8. Place the burette over the beaker.
9. Turn on the pH probe and record initial reading.
10. Open the burette discharge valve slightly and begin titrating to the target pH. Record the solution pH and volume of sodium hydroxide added until the titration is complete.

11. Once the target pH is achieved, close the burette discharge valve and discontinue mixing. Allow the solution to settle for 15 minutes.
12. Collect samples for total and dissolved metals from the supernatant.
13. For dissolved metals samples, filter the sample with a 0.45-micron filter prior to transferring to the sample container.
14. Store the samples on ice in a cooler and submit to the analytical laboratory using standard chain-of-custody procedures.
15. Analysis for total and dissolved metals will be completed using US EPA method 200.7/200.8. The metals to be analyzed for will be determined after reviewing the geotextile filtrate baseline sampling analytical results.

References

U.S. Environmental Protection Agency. 1994. “Method 200.7: Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry,” Revision 4.4. Cincinnati, OH.

U.S. Environmental Protection Agency. 1994. “Method 200.8: Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry,” Revision 5.4. Cincinnati, OH.

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General Electric Company

Sediment Dewatering and Water Treatment Systems Conceptual Operations, Monitoring, and Maintenance Plan

Addendum to the Upland Disposal Facility Revised Operations, Monitoring, and Maintenance Plan

Housatonic River – Rest of River
Pittsfield, Massachusetts

December 2024

Sediment Dewatering and Water Treatment Systems Conceptual Operations, Monitoring, and Maintenance Plan

Addendum to the Upland Disposal Facility Revised Operations, Monitoring, and Maintenance Plan

Housatonic River – Rest of River
Pittsfield, Massachusetts

December 2024

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Table of Contents

Table

Abbreviations

Dewatering/Treatment Design Addendum	*Conceptual Sediment Dewatering and Water Treatment Evaluation*
Dewatering/Treatment Treatability Plan	*Dewatering/Water Treatment Treatability Study Work Plan*
EPA	United States Environmental Protection Agency
FSP/QAPP	Field Sampling Plan/Quality Assurance Project Plan
GAC	granular-activated carbon
GE	General Electric Company
HASP	Health and Safety Plan
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
Revised UDF Final Design Plan	*Upland Disposal Facility Revised Final Design Plan*
Revised UDF OMM Plan	*Upland Disposal Facility Revised Operation, Monitoring, and Maintenance Plan*
ROR	Rest of River
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbon
UDF	Upland Disposal Facility
UDF Final Design Plan	*Upland Disposal Facility Final Design Plan*
UDF OMM Plan	*Upland Disposal Facility Operation, Monitoring, and Maintenance Plan*
VOC	volatile organic compound

1 Introduction

On December 16, 2020, pursuant to the 2000 Consent Decree (CD) for the GE Pittsfield/Housatonic River Site (the Site) (EPA and GE 2000), the U.S. Environmental Protection Agency (EPA) issued to the General Electric Company (GE) a final revised modification of GE's Resource Conservation and Recovery Act Corrective Action Permit (Revised Final Permit; EPA 2020) for the Housatonic Rest of River (ROR), which set forth a Remedial Action selected by EPA to address polychlorinated biphenyls (PCBs) in the ROR. The ROR is that portion of the Housatonic River and its backwaters and floodplain (excluding certain residential lawn areas) located downstream of the confluence of the East and West Branches of the Housatonic River in Pittsfield, Massachusetts. The ROR has been segmented into six separate remediation units (RUs) to manage workflow and schedule for the ROR Remedial Action. The ROR Remedial Action also includes the construction and operation of an on-site Upland Disposal Facility (UDF) for the disposal of a portion of the sediments and soils removed from the ROR area.

In February 2024, GE submitted an *Upland Disposal Facility Final Design Plan* (UDF Final Design Plan; Arcadis 2024a) and an *Upland Disposal Facility Operation, Monitoring, and Maintenance Plan* (UDF OMM Plan; Arcadis 2024b), which were both conditionally approved by EPA in letters dated September 12, 2024. Those letters required GE to submit revised versions of those plans. They also required GE to provide information regarding the design, location, and operation, monitoring, and maintenance (OMM) of the on-site dewatering and water treatment facilities to be constructed at the UDF area. In response, GE has prepared and is submitting on December 20, 2024 a Revised UDF Final Design Plan (Arcadis 2024c) and a Revised UDF OMM Plan (Arcadis 2024d). With specific respect to the design of the on-site dewatering and water treatment facilities, GE has prepared and is submitting two addenda to the Revised UDF Final Design Plan:

- The *Conceptual Sediment Dewatering and Water Treatment Evaluation* (Dewatering/Treatment Design Addendum; Arcadis 2024e), which provides information regarding the conceptual design and location of the on-site dewatering and water treatment facilities at the UDF; and
- The *Dewatering/Water Treatment Treatability Study Work Plan* (Dewatering/Treatment Treatability Plan; Arcadis 2024f), which contains a proposal for testing to satisfy data needs required to further the design of those facilities.

In addition, GE has prepared and is submitting as an addendum to the Revised UDF OMM Plan this *Sediment Dewatering and Water Treatment Systems Conceptual Operations, Monitoring, and Maintenance Plan*, which presents a conceptual implementation schedule and describes OMM activities for the dewatering and water treatment facilities at the UDF area.

The on-site dewatering and water treatment facilities at the UDF will manage sediments and water generated during remediation of multiple RUs that will involve hydraulic dredging and pumping of removed sediments to the UDF. These RUs are, in order, Reaches 6, 5C, 7B, and 7C. Since Reach 6 will be the first of these RUs to be remediated,[1] the on-site dewatering and water treatment facilities will be constructed and operational before remediation activities begin for Reach 6. The OMM activities described herein are conceptual and based on the preliminary designs included in the Dewatering/Treatment Design Addendum. The final design of the sediment dewatering and water treatment systems will be determined based on the results of the treatability studies

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[1] The conceptual hydraulic dredging and transport activities planned for Reach 6, including on-site transport from Reach 6 to the UDF, are described in the *Conceptual Remedial Design/Remedial Action Work Plan for Reach 6* (Anchor QEA et al. 2024), which was submitted to EPA on October 31, 2024, and is currently under EPA review.

described in the Dewatering/Treatment Treatability Plan. The final OMM plan for the sediment dewatering and water treatment systems intended for operation at the UDF area will be provided in a separate report, which will be another addendum to the Revised UDF OMM Plan.

2 General Conceptual Operations, Monitoring, and Maintenance Activities

General OMM activities for the UDF area in which the sediment dewatering and water treatment systems will be located (e.g., oversight, site controls, environmental monitoring, roads and traffic) are described in the Revised UDF OMM Plan. Reporting requirements for those general OMM activities will also be in accordance with the Revised UDF OMM Plan. In addition, during operation of the sediment dewatering and water treatment systems, information on performance will be routinely communicated by the operator to GE to demonstrate that the systems are functioning properly to meet specified performance criteria. Such information will include reports showing field and analytical tests and associated adjustments made, if any, to the system to meet specified performance criteria. As appropriate, GE will submit certain information (e.g., water treatment system effluent discharge sample results) to EPA. At a minimum, GE will notify EPA of exceedances of the EPA-approved effluent discharge criteria for the water treatment system.

In addition, during OMM activities for the sediment dewatering and water treatment systems, work will be performed in accordance with the following documents:

- Sampling and analysis and other data collection activities will be performed in accordance with GE’s Field Sampling Plan/Quality Assurance Project Plan (FSP/QAPP). The most recent FSP/QAPP was submitted to EPA in December 2023 (Arcadis 2023a) and was conditionally approved by EPA on March 21, 2024.
- The minimum health and safety requirements and procedures for response actions will be in accordance with GE’s Site Health and Safety Plan (HASP). The most recent revised Site HASP was submitted to EPA in July 2023 (Arcadis 2023b) for review and informational purposes.
- Contingency and emergency procedures, including spill prevention and response, will be in accordance with GE’s Contingency and Emergency Procedures Plan, which is Attachment F to GE’s revised updated Project Operations Plan (POP). The most recent revised POP was submitted to EPA in November 2024 (Arcadis 2024g) and is currently under EPA review.

These plans are available on the EPA website for the Site (EPA 2024), as will be any addenda or future revisions of those plans.

3 Sediment Dewatering System Conceptual Operations, Monitoring, and Maintenance Plan

This section summarizes the preliminary OMM requirements for the sediment dewatering system to be operated at the UDF area. As stated above, the OMM activities described herein are conceptual and based on the preliminary design included in the Dewatering/Treatment Design Addendum, which includes both geotextile tube and mechanical dewatering systems. The selection and final design of the sediment dewatering system will be determined based on the results of the treatability studies described in the Dewatering/Treatment Treatability Plan, and this OMM plan will be revised as appropriate based on that final design. The final OMM plan for the sediment dewatering system will include information for the final designed system(s) such as:

- Overview of equipment;
- Process and operations description for each piece of equipment;
- Instrumentation and controls description for applicable equipment;
- Equipment inspection and maintenance schedule; and
- Contingency plan for maintenance / replacement of critical equipment.

3.1 Geotextile Tube Dewatering System

This section presents the conceptual OMM requirements for the sediment dewatering system assuming use of geotextile tubes for sediment dewatering.

Prior to dewatering operations, the geotextile tubes will be deployed in accordance with the design tube layout and the manufacturer’s recommendations. When stacking is to be performed, only the first layer of tubes will be deployed and will include overlapping adjacent tubes to reduce the gap between layers. The discharge line from the hydraulic conveyance pipe will be fitted with a valve or manifold system that will connect to the fill ports on the geotextile tubes during operation, which will allow the operator to control the filling of the geotextile tube. The valve or manifold system will be fitted with a sampling port installed close to the first point of connection to the first geotextile tube container to allow for necessary sampling to ensure the proper flocculation. During operation, there will be three main steps for using geotextile tubes for dewatering of dredged slurry, as described below; these steps will be performed cyclically until the manufacturer’s maximum fill height is reached.

The first step in the cycle is to fill the geotextile tube with polymer conditioned slurry material. To perform filling, the valve/manifold system from the dredges will be connected to the fill ports in the geotextile tube. The fill ports not being used for filling will be closed in accordance with the manufacturer’s recommendations to prevent loss of material during filling operations. The geotextile tubes will be filled as evenly as possible by pumping material (via dredge and/or booster pump) into the different fill ports until the manufacturer’s recommended fill height has been achieved. During filling operations, samples of the polymer conditioned slurry will be routinely collected (e.g., at least once daily) from the sampling port in the valve/manifold system for visual inspection.

The second step in the cycle is dewatering. Once a tube reaches the manufacturer’s recommended fill height, the flow of slurry will be directed towards other tube(s) and the original tube will be allowed to dewater. The geotextile tube will be constructed of a material that retains sediment while water passes through. With the solids still contained in the geotextile tube, the water will be collected and treated as discussed in Section 4.

The third step in the cycle is consolidating the solids that remain in the tube after most of the water has seeped through the geotextile fabric. Vibratory rollers, or similar, may be used to aid in consolidation of the material within the geotextile tubes in accordance with the manufacturer’s recommendations. Once the material in the geotextile tube is sufficiently consolidated (based on visual observation of the tube height), the tube will be reconnected to the valve/manifold system and the cycle will restart by filling the tube to the manufacturers’ recommended fill height. This cycle will be repeated until the geotextile tube is completely filled as determined based on manufacturer’s recommendations. Upon completion of filling a tube, the fill ports will be closed in accordance with the manufacturer’s recommendations.

When stacking is performed, the gap between adjacent tubes of the lower layer will be filled with a smooth drainable material (e.g., hay bales, sand) before deploying the next layer of geotextile tube(s). Deploying and filling of the upper layer of geotextile tubes will be performed in a similar manner to that for the first layer except that a lower initial fill height will be used until it is observed that there is no movement of either the lower-level tubes or the tube being filled during filling activities. If material within geotextile tube(s) requires disposal at an off-site location, those geotextile tubes will be located and filled separately from the geotextile tubes that are to remain at the UDF. Material within the geotextile tubes can be monitored for dewatering progress by sampling through the geotextile tubes fill port. Once that material is sufficiently dewatered to meet transport and disposal facility requirements, the geotextile tube will be cut open and the materials loaded into trucks using excavation equipment.

3.2 Mechanical Dewatering System

This section presents the conceptual OMM requirements for the sediment dewatering system assuming use of filter presses for sediment dewatering. The OMM activities described herein are based on the conceptual mechanical dewatering process flow diagram provided as Figure 3-1 to the Dewatering/Treatment Design Addendum.

The mechanical sediment dewatering process will begin by removing oversized material using scalping screens and desanding using hydrocyclones and shaker screens. The coarse solids and sand material removed from both process units will be routed directly for disposal in the UDF. The slurry material passing through the screens and hydrocyclones will proceed to gravity thickening. Sludge generated from thickening will undergo mechanical dewatering by filter press. Overflow and filtrate from the gravity thickener and filter press will be returned to the water treatment plant (Section 4). Flocculating polymer will be added upstream of the gravity thickener and dewatering polymer will be added upstream of the filter press. Break tanks and overflow tanks will be used to achieve design hydraulic loading rates. Provisional air treatment in the form of granular activated carbon (GAC) will be used as well.

Flow management, process monitoring, and equipment operation will be continuously monitored to achieve proper routine operation of the mechanical dewatering process. Flow management will consist of monitoring and adjusting slurry flowrates based on sediment loading. In addition, overloading to the desander and dewatering units will be controlled by maintaining consistent flow through the units. Process monitoring will consist of regularly checking parameters such as turbidity, solids concentration, pH, and chemical dosing (if applicable). Sludge dryness and filtrate quality will also be regularly monitored. Equipment operation will consist of routine start-up and shut down operation as well as daily operation of pumps, filter presses, and other systems. If chemical handling is required, proper storage and dosing of coagulants and/or flocculants will be monitored as well as regular calibration of dosing pumps.

Maintenance activities will include routine, preventative, and corrective maintenance. Routine maintenance will include daily checks of mechanical systems (e.g., pumps, screens, and conveyors) and visual inspections of tanks, pipelines, and connections for leaks or wear. Routine cleaning will include removing accumulated sediment from desanding and dewatering units as well as cleaning filter screens, hydrocyclones, and other equipment to prevent clogging. Preventative maintenance will include manufacturer-recommended equipment service schedules such as lubrication of bearings, pumps, and moving parts, as well as replacement of worn parts such as impellers, filter plates, and membranes. Regular calibration of sensors (e.g., flowmeters, turbidity sensors) will be included with other preventative maintenance activities. Corrective maintenance will include troubleshooting and repair of mechanical, electrical, or control system failures, as well as replacement of damaged or malfunctioning components.

Waste management activities will be conducted on an as-needed basis and will include sludge management and monitoring of water treatment system discharge effluent water quality (see Section 4). Dewatered sludge will be removed and stored appropriately prior to disposal either in the UDF or at an off-site facility depending on the material being dewatered and associated disposal criteria.

4 Water Treatment System Conceptual Operations, Monitoring, and Maintenance Plan

This section presents the conceptual OMM requirements for the water treatment system to be operated at the UDF area. As stated above, the OMM activities described herein are conceptual and based on the preliminary design included in the Dewatering/Treatment Design Addendum. The final design of the water treatment system will be determined based on the results of the treatability studies described in the Dewatering/Treatment Treatability Plan, and the plans described herein will be revised as appropriate based on that final design. The final OMM plan for the water treatment system will include information for the final designed system(s) such as:

- Overview of equipment;
- Process and operations description for each piece of equipment;
- Instrumentation and controls description for applicable equipment; and
- Equipment inspection and maintenance schedule.

The OMM activities described herein are based on the conceptual water treatment process flow diagram provided as Figure 4-2 of the Dewatering/Treatment Design Addendum.

The UDF water treatment system will receive filtrate water from the dewatering process discussed in Section 3 in an equalization tank. The filtrate water will be treated first for metals via pH adjustment precipitation and clarifier settling. Decant from the metals precipitation treatment (if included in the final design) will then be sent through a multimedia filter and bag filters for solids treatment. Following solids treatment, GAC will be used to treat the effluent for PCBs, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), other semi-volatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPH) in the process water prior to discharge to the Housatonic River. When necessary, treated water will be diverted to a storage tank and used to backwash GAC vessels and multimedia filters. Backwash water will be directed to a holding tank to allow for initial solids settling, and then water from the holding tank will be decanted and returned to the equalization tank for further treatment. Solids from the holding tank will be transferred to the sediment dewatering system operated at the UDF.

Efficient operation of a water treatment system requires a systematic approach encompassing a spectrum of OMM activities. Influent filtrate conditions may vary greatly depending on pumping rate and the RU being remediated. Sudden and/or gradual changes in influent water conditions can lead to clarifier upsets and/or different chemical dosing needs. To accommodate unanticipated changes in the influent and respond rapidly to such changes, visual performance indicators and jar tests will be used during operation if the provisional clarifier and associated coagulation/flocculation chemical dosing are applied in the treatment train. Jar testing allows the operator/engineer to determine alternate mixing rates and chemical dosages that will result in proper settling for solids removal. Analytical samples will also be taken mid-process to confirm treatment results. Bag filtration pressures will be monitored to inform filter changeout. GAC pressures will be monitored to inform backwash needs and performance sampling will be conducted in conjunction with backwash frequency assessment to determine when media should be changed out.

The OMM activities summarized in Table 4-1 will help facilitate proper evaluation of system operation, identify causes for any issues, and maintain proper operation.

Table 4-1. Water Treatment System Operation, Monitoring, and Maintenance Activities and Schedule

Task	Frequency / Schedule for Task Completion		
	Two to Three Times per Week	Weekly	As Needed[a]
Assessment of key performance indicators such as pH and turbidity tests	X		
Measurement and recording of system flow rates and pressures, including calculation of total discharge volume	X		
Visual inspection of equipment and piping	X		
Performing clarifier inspection and maintenance to assess solids settling, optimize sludge transfer operations, and ensure proper operation of mechanical components		X	
Checking and refilling chemical feed tanks (sodium hydroxide, sulfuric acid, flocculant, and coagulant)		X	
Cleaning and calibrating pH monitoring instrumentation		X	
Collect analytical system performance samples and field screening data to assess GAC breakthrough and the performance of select unit operations		X	
Changing bag filters		X	
Backwashing multi-media filters		X	
Perform equipment and instrumentation maintenance		X	
Conducting sludge settling jar tests to assess system performance and chemical dosing			X
Backwashing GAC vessels			X
Collect mid-process performance samples			X
Change out GAC media			X
Conduct annual function testing of level switches, critical control system interlocks, and emergency stop buttons			X
Winterization activities including inspecting heat trace systems, piping/equipment insulation, and building heaters			X

Note:

[a] As-needed tasks will likely be conducted monthly, quarterly, or annually.

Compliance samples to monitor the water quality of the treatment system discharge effluent will be collected every other day during the first week of operation, weekly for the rest of the first month, and once every other week for the balance of the water treatment system operation, unless, based on proven system performance, a reduced frequency is proposed by GE and approved by EPA. Samples will be collected and analyzed in accordance with GE’s FSP/QAPP and compared to the criteria presented in the Dewatering/Treatment Design

Addendum or superseding values (if any) included in the EPA-approved final design for the water treatment system.

In addition, waste management activities for spent media (e.g., GAC, bag filters) will be conducted on an as-needed basis, with such media to be disposed of in the UDF or off-site based on waste characterization sampling (as appropriate). Any such spent media to be disposed of in the UDF will meet the criteria in Attachment E of the Revised Final Permit for disposal in the UDF. Spent GAC may also be considered for reactivation rather than disposal.

5 References

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