GE
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Pittsfield, MA 01201
USA

Transmitted via Overnight Courier

July 11, 2007

Ms. Susan Svirsky
U.S. Environmental Protection Agency
c/o Weston Solutions, Inc.
10 Lyman Street
Pittsfield, MA 01201

Re: GE-Pittsfield/Housatonic River Site
Rest of River (GECD850)
Corrective Measures Study Proposal – Treatability Study Work Plan

Dear Ms. Svirsky:

As you know, the General Electric Company (GE) submitted its Corrective Measures Study Proposal (CMS Proposal) for the Rest of River to the U.S. Environmental Protection Agency (EPA) in February 2007 pursuant to the Reissued RCRA Permit issued by EPA to GE. In a letter to GE dated April 13, 2007, EPA "conditionally approved" the CMS Proposal, subject to a number of conditions and directives; and it directed GE to submit, for EPA review and approval, a Supplement to the CMS Proposal addressing a number of those conditions and directives. In addition to those directives, EPA's letter requested (in General Comment 30) that GE conduct a treatability study on chemical extraction using sediment/soil of varying PCB concentrations from the Housatonic River and floodplain, and that GE include a work plan for that study in the CMS Proposal Supplement. In the CMS Proposal Supplement, which was submitted to EPA on May 11, 2007, GE explained that the steps required to design a treatability study and develop a work plan were underway, but that additional time was necessary to complete those steps, and that the requested treatability study work plan would be provided separately at a later date. This letter and its attachments constitute GE's Treatability Study Work Plan.

Following receipt of EPA's April 13, 2007 letter, GE conducted an in-depth literature review (including review of available EPA technology databases) and phone interviews with numerous potential vendors to compile available information on chemical extraction technologies. It then provided a Request for Proposal (RFP) to six potential vendors and received proposals from four of them. GE then reviewed those proposals in detail to determine the process and vendor most likely to have a technology potentially applicable to the Housatonic River sediments and floodplain soils. Based on this review, GE has selected BioGenesis Enterprises, Inc. to perform a bench-scale treatability study of chemical extraction. This study, along with associated plans and schedule, are described in the following attachments to this letter:

Attachment A: Materials Collection/Management Plan for Bench-Scale Treatability Study

Attachment B: Bench-Scale Treatability Study Work Plan (prepared by BioGenesis)

Attachment C: Bench-Scale Treatability Study Testing Schedule

Attachment A describes the locations proposed for collection of test material for this study (namely, sediment locations just downstream of the Confluence of the East and West Branches and within Woods Pond and a floodplain location south of New Lenox Road). It also describes the procedures that will be used for sampling, collection, and analysis of the test material; the procedures for transport of such material from the collection locations to the location where the bench-scale testing will be conducted (Building 12 at the GE facility in Pittsfield) and for the management of such material at that location; and associated water treatment procedures.

Attachment B provides a work plan for the performance of the bench-scale study. As detailed in Attachment B, the proposed bench-scale testing will be conducted using the BioGenesis^{SM} Soil and Sediment Washing Process. This process uses surfactant and a high-pressure wash to remove PCBs from the sediment and soil particles. The PCB-containing aqueous waste is then treated to destroy PCBs using a cavitation/oxidation process. Resulting waste water is treated using conventional water treatment before appropriate disposal.

As noted above, the bench-scale testing will be conducted by BioGenesis in Building 12 at the GE Pittsfield facility (EPA ID #MAD002084093). Oversight will be provided by ARCADIS BBL and GE. The attached BioGenesis Work Plan describes its extraction process, the sampling and analysis that will be conducted to evaluate the bench-scale test results, and the data and mass balance information that will be provided in the Treatability Study Report.

Attachment C provides a detailed project schedule for the bench-scale study. The estimated duration of this work is approximately 20 weeks. Following approval of this Work Plan by EPA, preliminary sampling will be conducted by ARCADIS BBL (as described in Attachment A) to confirm or adjust the material collection locations. After this step, test material will be collected, transported to the GE facility, sampled for PCBs, TOC and grain size, and then used for bench-scale testing by BioGenesis. Testing will be conducted in two phases: (1) a testing and optimization phase; and (2) a series of replicate validation runs for each of the test materials. These phases are described in the BioGenesis Work Plan (Attachment B).

Following receipt of laboratory data, a detailed Treatability Study Report documenting the results from the study will be prepared. That report will be included in the CMS Report and the information and findings from this study will be incorporated, as appropriate, into the evaluations presented in the CMS Report.

Please let me know if you have any questions about this Treatability Study Work Plan or would like to discuss any issues.

Very truly yours,

Andrew T. Silfer

Andrew T. Silfer, P.E.
GE Project Coordinator

ATS/csc
Attachments

cc: Dean Tagliaferro, EPA
Timothy Conway, EPA
Holly Inglis, EPA
Rose Howell, EPA (cover letter and CD)
Richard McGrath, Sleeman Hanley & DiNitto
Scott Campbell, Weston Solutions (3 copies)
Susan Steenstrup, MDEP (2 copies)
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Susan Peterson, CDEP
Michael Carroll, GE
Roderic McLaren, GE
Kevin Mooney, GE
Stuart Messur, ARCADIS BBL
James Rhea, QEA
James Bieke, Goodwin Procter
Samuel Gutter, Sidley Austin
Public Information Repositories
GE Internal Repository

Attachments

ARCADIS BBL

Attachment A

Materials Collection/
Management Plan for
Bench-Scale Treatability Study

ARCADIS BBL

Attachment A
Materials Collection/Management Plan for Bench-Scale Treatability Study

This attachment describes: (1) the locations proposed for the collection of test materials for the Housatonic River Bench-Scale Chemical Treatability Study; (2) the procedures to be used for collection and sampling and analysis of such materials; (3) the procedures for transport of such materials from the collection locations to the bench-scale test location and management of those materials at the test location; and (4) associated water treatment procedures.

1. Materials Collection Locations

Sediment and floodplain soil from three locations will be collected for the Housatonic River Chemical Treatability Study. The three locations were selected by reviewing available sediment and floodplain soil data, and identifying locations which: (a) contain average PCB concentrations at or above 50 milligrams per kilogram (mg/kg); (b) cover a range of representative material types, including those primarily consisting of silts and clays and those composed mostly of sand; and (c) are relatively easy to access and collect using hand-operated equipment. The selected locations consist of two sediment sample locations (one sample with coarse material representative of high-energy areas and one sample with fine material representative of more depositional areas) and one floodplain sample location.

Materials collection locations are shown on Figure A-1. A description of the selected locations, the anticipated characteristics of the material present at each location, and the proposed depth for material collection at each location is provided below. Detailed analytical data from previous sampling at these locations are provided in Table A-1.

Reach 5A Sediments (TS-SED-1)

Relatively coarse sediments will be collected from an area in Reach 5A just downstream of the confluence of the East and West Branches of the Housatonic River, where the grain size distribution is predominantly sand and gravel (>0.075 mm in diameter). Specifically, it is anticipated that sediments will be collected from EPA sediment sample location SE000335, which is located on the inside curve of an oxbow approximately 1800 feet downstream of the confluence (Figure A-1). Samples from this location were collected and analyzed in 6-inch intervals to a depth of 3.5 feet on May 5, 1999. The resulting data are summarized in Table A-1. These data indicate that the material within the upper 3.5 feet at this location is composed of approximately 75% to 96% sand, with an average of over 90% sand, and that total PCB concentrations in this material ranged from 6.5 to 350 mg/kg, with

an average of 92 mg/kg. Based on review of these data and the criteria identified above, a treatability study sample labeled TS-SED-1 will be collected from the top 3.5 feet at this location (subject to adjustment based on preliminary additional sampling, as discussed below) to represent relatively coarse sediment material.

Woods Pond Sediments (TS-SED-2)

Fine grained sediments will be collected from within Woods Pond, where the river is more depositional in character and grain size distribution is predominantly clay and silt (<0.075 mm in diameter). Specifically, it is anticipated that sediments will be collected from EPA sediment sample location SD136703, which is near the eastern shore of the headwaters of Woods Pond (Figure A-1). Samples from this location were collected and analyzed at 6-inch intervals to a depth of 2.5-feet on August 5, 1999. The resulting data are also summarized in Table A-1. These data indicate that the material within the top 2 feet at this location had the higher concentrations of PCBs, ranging from 53 to 240 mg/kg, with an average of 150 mg/kg. The material in the upper 2 feet is composed of 74% to 84% silt. Based on review of these data and the criteria identified above, a treatability study sample labeled TS-SED-2 will be collected from the top 2 feet at this location (subject to adjustment based on preliminary additional sampling, as discussed below) to represent fine sediment material.

Floodplain Soils (TS-SO-1)

Land owned by the General Electric Company (GE) south of New Lenox Road has been selected as the sample location for the floodplain soils. Specifically, it is anticipated that soils will be collected from EPA floodplain soil sample location F0953002, which is east of the Housatonic River and south of New Lenox Road (Figure A-1). Samples from this location were collected at 6-inch intervals to a depth of 2.5-feet on December 17, 1998. PCB analyses were performed only on samples from the 0- to 0.5-foot, 1- to 1.5-foot, and 2- to 2.5-foot depth intervals, and grain size information is available only for the 2- to 2.5-foot depth interval. These data are summarized in Table A-1. They indicate that PCB concentrations ranged from 21 mg/kg (estimated) to 200 mg/kg, with an average of 93 mg/kg, and that the material in the 2- to 2.5-foot depth interval was primarily composed of sands and silts. Based on review of these data and the criteria identified above, a treatability study sample labeled TS-SO-1 will be collected from the top 2.5 feet of soil at location F0953002 to represent floodplain soil material, subject to adjustment based on additional preliminary sampling (discussed below) to ensure that the material collected has PCB concentrations within the range of the prior data and that the material type and grain size are generally similar to those found in the 2- to 2.5-foot depth interval.

2. Material Collection and Sampling Procedures

This section describes the preliminary sampling to be conducted to confirm that the PCB concentrations and grain size of the material to be collected at the selected locations are within the target range. It also describes the procedures for collection and subsequent additional sampling and analysis of the test material to be used in the bench-scale tests. The amount of PCB-containing material to be treated annually will not exceed 70 cubic feet of non-liquid PCBs and will not have PCB concentrations exceeding 10,000 mg/kg

Preliminary Sampling

Preliminary sampling at the three locations described in Section 1 will be conducted to confirm that the PCB concentrations are within the expected range based on prior results and, if not, to find areas with similar target PCB concentrations. This sampling will be performed using Lexan tubes for sediment and augers or shovels for the floodplain soils to collect representative samples in the areas proposed for materials collection. At each location, specified in Section 1, a composite sample will be prepared using 3 to 5 grab samples. Each composite sample will be analyzed for PCBs to confirm that the PCB concentrations are generally within the expected range. In addition, visual observations will be made to confirm that the materials are generally consistent with the previous information. Based on these preliminary sampling results and visual observations, the locations selected for materials collection may be adjusted; and if necessary, additional preliminary sampling and observations may be performed at additional locations to identify materials with the target PCB concentrations and grain size.

Material Collection and Additional Sampling

Following completion of the preliminary sampling, sediment from the locations shown on Figure A-1 (or adjusted based on preliminary sampling results) will be collected for the treatability study. At each sample location, a Lexan tube or other suitable device (e.g., shovel or Ponar dredge) will be driven to the depth shown on Table A-2 or refusal (whichever is less). Material collection activities will be performed until a total composite volume of approximately 55 gallons has been obtained at each location.

Floodplain soils will be collected from the location shown on Figure A-1 (or adjusted based on preliminary sampling results). At this sample location, a shovel will be used to collect a sample to a depth of 2.5 feet. Additional soil will be collected as needed until a total composite volume of approximately 55 gallons has been obtained. The excavation at this location will be backfilled with clean soil.

Collected materials will be then transported in 55-gallon drums to Building 12 at the GE Pittsfield facility, where the bench-scale testing will be performed. (Transport and management procedures for these materials to and at Building 12 are described in Section 3 below.) At Building 12, the material from each collection location will be homogenized by placing it on a polyethylene liner (within the bermed area in Building 12) and mixing it using a shovel. Following homogenization, the materials will be sampled for PCBs, total organic carbon (TOC), and grain size, as shown on Table A-2. These samples will be prepared by compositing a minimum of 5 grab samples from each 55-gallon drum. The resulting data will be provided to the bench-scale testing contractor for its use in optimizing the treatment process prior to the testing to be conducted as part of the bench-scale study. This initial sampling will not include additional samples for quality assurance/quality control (QA/QC) purposes, because the individual untreated test materials will be sampled again as part of each bench test, with appropriate QA/QC samples, for use in calculating mass balance and other evaluations in the bench-scale process (see the Bench-Scale Treatability Study Work Plan).

Analytical Procedures

The preliminary samples and the samples of the collected test material will be analyzed in accordance with procedures in the project *Field Sampling Plan/Quality Assurance Project Plan* (FSAP/QAPP) (ARCADIS BBL, 2007). Analyses for PCBs and TOC will be performed by Northeast Analytical, Inc. (NEA), using EPA Method 8082 for PCBs and the Lloyd Kahn Method for TOC. Analyses for grain size will be conducted by Geotechnics, Inc. with sieve and hydrometer, using ASTM Method D422.

3. Material Transport and Management Procedures

Transport Procedures

The test material collected from the three locations described in Section 1 will be transported to Building 12 at the GE Pittsfield facility for bench-scale testing, as discussed in the Bench-Scale Treatability Study Work Plan. Transportation routes are shown on Figure A-2. Such transport will be considered to occur “on-site” within the meaning of Paragraph 9.a of the Consent Decree (CD) for the GE-Pittsfield/Housatonic River Site, and thus will be subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) on-site permitting exemption referenced in Paragraph 9.a of the CD. In these circumstances, while manifests under the Toxic Substances Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA) will not be necessary, site-specific transportation procedures have been developed for the transport of such material. These procedures will include the following:

- The material will be handled by qualified personnel trained per U.S. Department of Transportation (DOT) requirements for handling and transporting hazardous materials, with such training to include general safety, emergency response, exposure protection, accident prevention, preparation of shipping papers, and securing loads.

- Transport will be via truck using a driver that has received appropriate DOT training.

- Materials will be packaged in DOT-approved containers for PCB-containing materials (55-gallon steel drums), those drums will be loaded into and secured in the transportation truck, and applicable DOT labeling and placarding requirements will be followed.

- A Hazardous Materials Bill of Lading (BOL) will be prepared and signed by the truck driver.

- The trucks will leave the collection locations and proceed to Building 12 utilizing the routes shown on Figure A-2.

Test Material Management Procedures at Building 12

Upon arrival at Building 12, the drums containing the test material will be unloaded and placed within the interior of Building 12. Building 12 is a covered and enclosed building which has a cement floor and 6-inch concrete berms to prevent potential runoff, and which meets the TSCA PCB storage requirements set forth in 40 CFR 761.65(b). As discussed above, the materials from each collection location will then be homogenized by placing them on a polyethylene liner within the bermed area and mixing them using a shovel. Materials will be placed back in the individual drums and stored for use in the treatability study.

Treatability Testing

The bench-scale treatability testing will be conducted at Building 12 in accordance with the Bench-Scale Treatability Study Work Plan. This testing will be considered to occur “on-site” within the meaning of Paragraph 9.a of the CD and thus will be considered to be subject to the above-mentioned on-site permit exemption under CERCLA and the CD.

Disposition of Test Material

At the conclusion of the bench-scale tests, the treated material and any remaining untreated material, as well as any miscellaneous PCB-containing materials used in or resulting from the study, will be containerized and disposed of appropriately in accordance with EPA's TSCA regulations, based on the PCB concentrations of the material prior to treatment.

4. Water Treatment

Water generated from materials collection activities, including water decanted during homogenization and water from decontamination activities, will be containerized and transported to the Building 64G Groundwater Treatment Facility (GWTF) at the GE facility for treatment and discharge under GE's NPDES Permit. GE requests approval from EPA for treatment and discharge of such water generated during bench-scale testing in at the Building 64G GWTF. In addition, water is one of the major waste streams resulting from the treatment process as discussed in the Bench-Scale Treatability Study Work Plan. If possible and if approved, this water will also be treated and discharged at the Building 64G GWTF. If such water cannot be appropriately treated and discharged, it will be containerized for characterization and off-site treatment/disposal at an approved facility.

TABLE A-1
SUMMARY OF EPA SAMPLE ANALYTICAL RESULTS

HOUSATONIC RIVER CMS CHEMICAL TREATABILITY STUDY
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Sample ID: / Sample Depth(Feet): / Date Collected:	Units	SE000335 0 - 0.5 05/05/99	SE000335 0.5 - 1 05/05/99	SE000335 1 - 1.5 05/05/99	SE000335 1.5 - 2 05/05/99	SE000335 2 - 2.5 05/05/99	SE000335 2.5 - 3 05/05/99	SE000335 3 - 3.5 05/05/99	SD136703 0 - 0.5 08/05/99	SD136703 0.5 - 1 08/05/99	SD136703 1 - 1.5 08/05/99	SD136703 1.5 - 2 08/05/99	SD136703 2 - 2.5 08/05/99
Grain Size													
SIZE (01) 075.0 MM	%FINER	100	100	100	100	100	100	100	100	100	100	100	100
SIZE (02) 050.0 MM	%FINER	100	100	100	100	100	100	100	100	100	100	100	100
SIZE (03) 037.5 MM	%FINER	100	100	100	100	100	100	100	100	100	100	100	100
SIZE (04) 025.0 MM	%FINER	100	100	100	100	100	100	100	100	100	100	100	100
SIZE (05) 019.0 MM	%FINER	100	100	100	100	100	100	100	100	100	100	100	100
SIZE (06) 012.7 MM	%FINER	100	100	100	100	100	100	100	100	100	100	100	100
SIZE (07) 009.5 MM	%FINER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SIZE (08) 004.75 MM	%FINER	100	100	100	100	100	99.4	100	100	100	100	100	100
SIZE (09) 002.0 MM	%FINER	100	100	100	100	100	99.3	99.9	100	100	100	100	100
SIZE (10) 850.0 UM	%FINER	99.9	99.7	99.9	99.9	99.7	98.6	99.4	100	100	100	100	100
SIZE (11) 425.0 UM	%FINER	96	84.3	96.8	91.8	67.1	91.8	97.4	100	99.8	100	100	99.9
SIZE (12) 250.0 UM	%FINER	64.9	31.9	64.4	53.5	25.4	55.3	87.6	100	99.7	100	100	99.9
SIZE (13) 180.0 UM	%FINER	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SIZE (14) 150.0 UM	%FINER	23.6	9.6	21.7	13	7.7	19.8	47.7	100	99.1	100	100	99.8
SIZE (15) 075.0 UM	%FINER	9.4	4.5	9.8	5	4	10	25.3	100	95.2	100	100	98.3
SIZE HYDRO (16) ~49.0 UM	%FINER	6.1	3	5.2	5	2.6	4.2	12.9	62.6	95.2	66.3	61.6	50.8
SIZE HYDRO (17) ~37.0 UM	%FINER	4.8	2.6	4.8	3.2	2.2	3.7	12.4	50.3	58.4	55.5	61.6	50.8
SIZE HYDRO (18) ~23.0 UM	%FINER	4.4	2.6	3.9	2.7	2.2	3.3	8.6	39.1	46.9	44.6	46.2	31.1
SIZE HYDRO (19) ~18.0 UM	%FINER	4	2.1	3.5	2.3	2.2	3.3	7.6	39.1	35.5	37	36.9	24.9
SIZE HYDRO (20) ~13.0 UM	%FINER	3.2	1.7	3	1.8	1.7	2.9	6.5	22.4	28.2	37	30.8	17.6
SIZE HYDRO (21) ~09.0 UM	%FINER	2.8	1.7	3	0.5	0	1.7	4.9	15.6	20.9	25	23.6	12.4
SIZE HYDRO (22) ~07.0 UM	%FINER	2.4	1.3	2.6	0	0	0.8	3.2	15.6	20.9	18.5	17.4	12.4
SIZE HYDRO (23) ~04.0 UM	%FINER	1.2	0	0	0	0	0	1.6	6.7	10.4	14.1	11.3	12.4
SIZE HYDRO (24) ~03.0 UM	%FINER	1.2	0	0	0	0	0	1.6	6.7	10.4	14.1	11.3	12.4
SIZE HYDRO (25) ~01.4 UM	%FINER	0.4	0	0	0	0	0	0	2.2	3.1	5.4	4.1	0
Grain Size Class													
D-50 Calculation	MM	0.2139	0.3104	0.2163	0.2414	0.3532	0.2351	0.1558	0.0366	0.0268	0.0299	0.0265	0.0364
Clay	%	2.4	1.3	2.6	0	0	0.8	3.2	15.6	20.9	18.5	17.4	12.4
Gravel	%	0	0	0	0	0	0.6	0	0	0	0	0	0
Sand	%	90.6	95.5	90.2	95	96	89.4	74.7	0	4.8	0	0	1.7
Silt	%	7	3.2	7.2	5	4	9.2	22.1	84.4	74.3	81.5	82.6	85.9
PCBs													
Aroclor-1254	mg/kg	0.58 U	2.9 U	2.8 U	0.50 U	2.5 U	2.9 U	13 U	3.4 U	11 U	10 U	4.6 U	0.81 U
Aroclor-1260	mg/kg	9.5	65	33	6.5	82	95	350	53	240	220	76 J	31 J
Total PCBs	mg/kg	9.5	65	33	6.5	82	95	350	53	240	220	76 J	31 J
Miscellaneous													
Percent Solids	%	NA	NA	NA	NA	NA	NA	NA	36.3	37.6	39.3	36.1	41.2
TOC	mg/kg	13,024	9,269	13,769	6,801	4,234	18,700	29,236	115,195	276,649 [265,679]	89,966	206,338	190,954

Notes:

J - Indicates an estimated value.
U - The compound was analyzed for but not detected. The assocaited value is the compound quantitation limit.
NA -Not Analyzed

TABLE A-1
SUMMARY OF EPA SAMPLE ANALYTICAL RESULTS

HOUSATONIC RIVER CMS CHEMICAL TREATABILITY STUDY
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Sample ID: Sample Depth(Feet): Date Collected:	Units	F0953002 0 - 0.5 12/17/98	F0953002 1 - 1.5 12/17/98	F0953002 2 - 2.5 12/17/98
Grain Size				
D-50 Calculation	MM	NA	NA	0.063
SIZE (01) 075.0 MM	%FINER	NA	NA	100
SIZE (02) 050.0 MM	%FINER	NA	NA	100
SIZE (03) 037.5 MM	%FINER	NA	NA	100
SIZE (04) 025.0 MM	%FINER	NA	NA	100
SIZE (05) 019.0 MM	%FINER	NA	NA	100
SIZE (07) 009.5 MM	%FINER	NA	NA	100
SIZE (08) 004.75 MM	%FINER	NA	NA	100
SIZE (09) 002.0 MM	%FINER	NA	NA	100
SIZE (10) 850.0 UM	%FINER	NA	NA	98.8
SIZE (11) 425.0 UM	%FINER	NA	NA	96.7
SIZE (12) 250.0 UM	%FINER	NA	NA	94.1
SIZE (13) 180.0 UM	%FINER	NA	NA	89.2
SIZE (14) 150.0 UM	%FINER	NA	NA	83.9
SIZE (15) 075.0 UM	%FINER	NA	NA	63.4
SIZE HYDRO (17) ~37.0 UM	%FINER	NA	NA	21
SIZE HYDRO (18) ~23.0 UM	%FINER	NA	NA	15.8
SIZE HYDRO (20) ~13.0 UM	%FINER	NA	NA	11.8
SIZE HYDRO (21) ~09.0 UM	%FINER	NA	NA	7.9
SIZE HYDRO (22) ~07.0 UM	%FINER	NA	NA	5.3
SIZE HYDRO (24) ~03.0 UM	%FINER	NA	NA	2.6
SIZE HYDRO (25) ~01.4 UM	%FINER	NA	NA	0.7
Grain Size Class				
Clay	%	NA	NA	5.3
Gravel	%	NA	NA	0
Sand	%	NA	NA	36.6
Silt	%	NA	NA	58.1
PCBs				
Aroclor-1254	mg/kg	0.51 UJ	12 U	9.0
Aroclor-1260	mg/kg	21 J	200	50
Total PCBs	mg/kg	21 J	200	59 J
Miscellaneous				
TOC	mg/kg	NA	NA	58,400

Notes:

J - Indicates an estimated value.
U - The compound was analyzed for but not detected. The assocaited value is the compound quantitation limit.
NA - Not analyzed

TABLE A-2

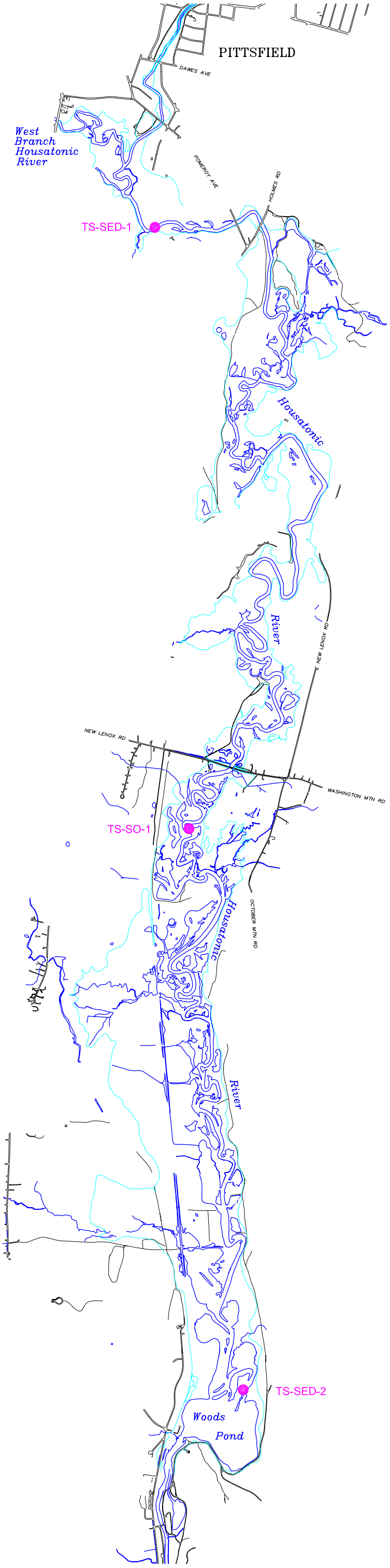
BENCH-SCALE TEST MATERIAL SAMPLING AND ANALYSIS

HOUSATONIC RIVER CMS CHEMICAL TREATABILITY STUDY
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

Sample Location	Matrix	Depth Interval (bgs)	Analysis		
			PCBs (8082)	TOC (Lloyd Kahn)	Grain Size (ASTM D-422)
TS-SED-1	Sediment	0 - 3.5'	X	X	X
TS-SED-2	Sediment	0 - 2'	X	X	X
TS-SO-1	Soil	0 - 2.5'	X	X	X

Since individual samples of untreated material will be collected and tested again before each bench run, with appropriate QA/QC samples, no additional field QA/QC samples will be collected for the samples listed above.

SYR-85-RLP LJP LAYER: ON=*, OFF=*REF*
G:\CAD\GE-CAD\GE_ACTIVE\N\20858003\SAMPWP\20858B02.DWG SAVED: 7/11/2007 12:30 PM LAYOUT: A-1 PAGESETUP: ---- PENTABLE: PLTFULL.CTB SAVED: 7/11/2007 12:30 PM PRINTED: 7/11/2007 12:30 PM BY: BPITTSLEY
PROJECTNAME: ----
XREFS: IMAGES:
20858X01



LEGEND:

- LIMIT OF APPROXIMATE 10-YEAR FLOODPLAIN
- EDGE OF WATER
- ROADWAY OR TRAIL

NOTE:

1. MAPPING BASED ON APRIL 1990 AERIAL PHOTOGRAPHY.

0 1200' 2400'
GRAPHIC SCALE

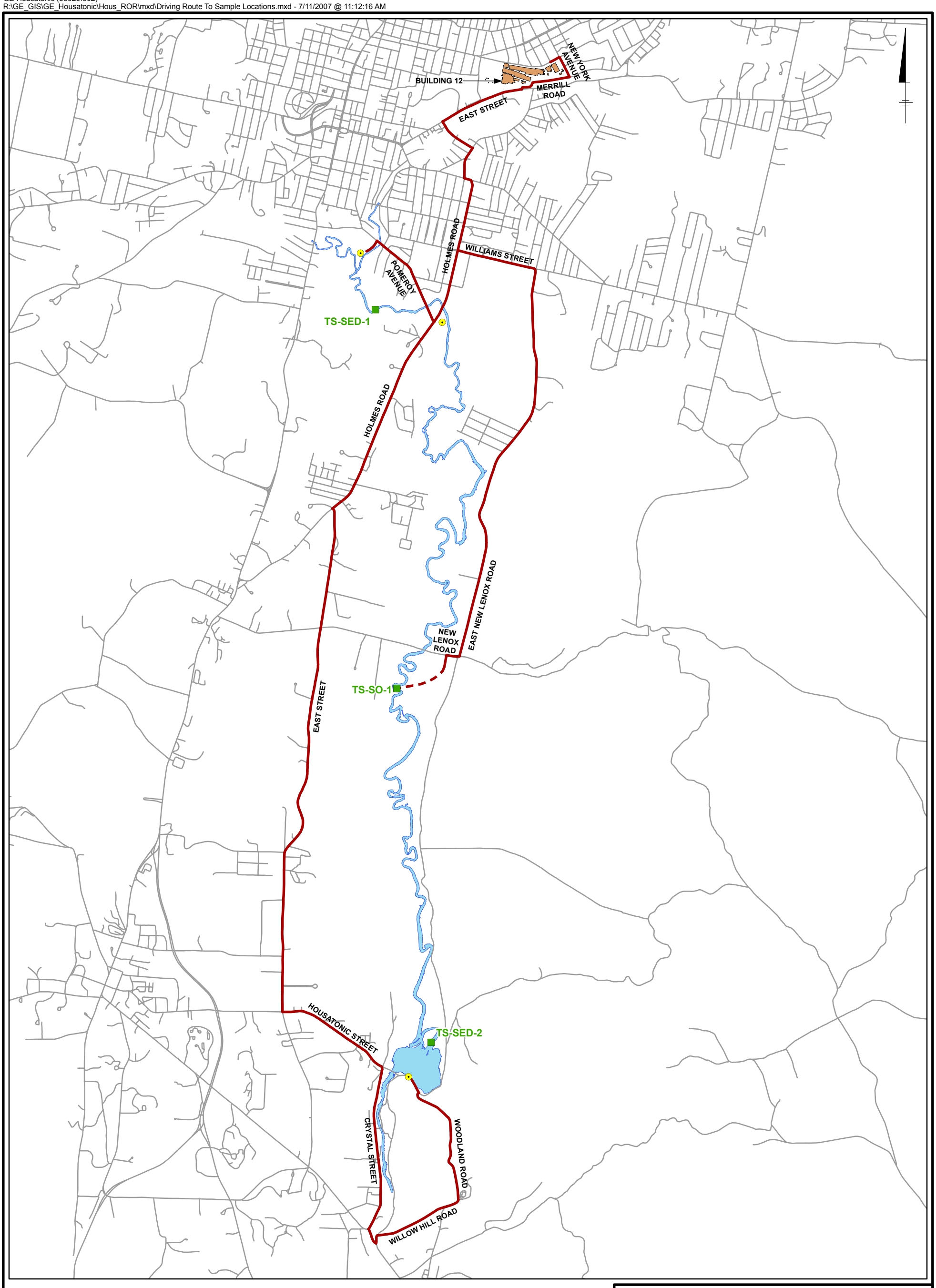
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
HOUSATONIC RIVER REST OF RIVER CMS

SAMPLING LOCATIONS FOR CHEMICAL TREATABILITY STUDY

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
A-1

SYR-85 MTK
GE Housatonic (30929.002)
R:\GE_GIS\GE_Housatonic\Hous_ROR\mxd\Driving Route To Sample Locations.mxd - 7/11/2007 @ 11:12:16 AM



LEGEND:

- RIVER ACCESS POINT
- SEDIMENT SAMPLE LOCATION
- DRIVING ROUTE TO SEDIMENT SAMPLE LOCATION
- STREET/ROAD
- HOUSATONIC RIVER
- ESA II NORTH BUILDING

NOTE:

1. BASEMAPPING PROVIDED BY MASS GIS.

0 3,500 7,000 Feet
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
HOUSATONIC RIVER REST OF RIVER CMS

ROUTES FOR TRANSPORT OF TREATABILITY STUDY MATERIAL

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
A-2

ARCADIS BBL

Attachment B

Bench-Scale Treatability Study Work Plan (Prepared by BioGenesis)

BIOGENESIS^{SM} SEDIMENT WASHING TECHNOLOGY

Bench-Scale Treatability Study Work Plan
Housatonic River – Rest of River

11 July 2007

Prepared for:

General Electric Company

ARCADIS of New York, Inc.
Syracuse, New York

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1 INTRODUCTION

This Bench-Scale Treatability Study Work Plan (Work Plan) describes the methods to be used to perform bench-scale treatability testing of the BioGenesis[SM] Soil/Sediment Washing Technology on soil and sediment samples from the Housatonic River – Rest of River site in the northeastern United States. This Work Plan has been prepared by BioGenesis Enterprises, Inc. (BioGenesis), for the General Electric Company (GE) and ARCADIS of New York, Inc. (ARCADIS BBL), for the treatability study work.

1.1 Background

The Housatonic River is located in the northeastern United States. Numerous sampling and investigative activities conducted over the past 25 to 30 years have identified the presence of polychlorinated biphenyls (PCBs) and other chemical constituents, at varying concentrations, in the Housatonic River (River) downstream of the GE facility in Pittsfield, Massachusetts. These activities have included investigations of the portion of the River known as the Rest of River area, which begins at the confluence of the East and West Branches of the River (the Confluence) (about two miles downstream of the GE facility) and flows through western Massachusetts and Connecticut. GE previously developed a *RCRA Facility Investigation Report* (RFI Report) for the Rest of River area to document the nature, extent, fate, and transport of PCBs, as well as certain other chemical constituents, that have potentially migrated from the GE facility in Pittsfield into the surface water, sediments, floodplain soils, and biota of the Rest of River area. GE is currently performing a Corrective Measures Study (CMS) to evaluate potential corrective measures (remedial actions) to address PCBs within the Rest of River area.

As part of the CMS, GE has determined that it would be appropriate to conduct a bench-scale treatability study of a potential chemical extraction technology for sediment and soils of various types that may be removed from the River and/or floodplain in the Rest of River area. Such testing will be conducted to support the evaluation of potential corrective measures for the management of such sediments and soils from portions of the Rest of River. BioGenesis has prepared this Work Plan for the performance of bench-scale treatability tests of the BioGenesis[SM]

Soil/Sediment Washing Technology on two sediment samples and one floodplain soil sample containing PCBs from the Rest of River area.

1.2 Objectives

The objectives of this bench-scale treatability study are to:

1. Evaluate the extent to which the BioGenesis^{SM} Soil/Sediment Washing Technology can reduce PCB concentrations in soil and sediment from the Rest of River area.

2. Provide an understanding of the disposition of PCBs through the various stages of the BioGenesis^{SM} Soil/Sediment Washing Process and of the process relationships and dependencies with other project factors (e.g., percent solids, storage capacity, and water treatment), so as to assist in evaluating this technology.

3. Provide sufficient information on the BioGenesis^{SM} Soil/Sediment Washing Technology to support the evaluation of the technology for full-scale implementation, including operational uptime, equipment needs and availability for the full-scale system, effectiveness and implementability of the technology at full-scale, and health and safety considerations, and to provide a basis for developing full-scale implementation costs.

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2 Technology Description

Presented below is a description of the BioGenesis[SM] Soil/Sediment Washing Technology and the application of this technology at full-scale. Details on the bench-scale treatability testing are included in Section 3 of this work plan.

2.1 BioGenesis[SM] Soil/Sediment Washing Technology

The BioGenesis[SM] Soil/Sediment Washing Technology is a patented low temperature decontamination process, which uses impact forces and propriety chemicals to remove organic and inorganic contamination from soil and sediment particles. The technology, which was patented by BioGenesis in December 2001, is designed to decontaminate both coarse-grained (sand-sized) and fine-grained (silt- and clay-sized) particles, by isolating individual particles and removing contaminants and naturally occurring organic material adsorbed to the particles. The result of the BioGenesis[SM] process is a treated soil/sediment that can potentially be used, depending on the results achieved and on obtaining any necessary regulatory approvals, as a fill material or as a raw material in the production of topsoil or other construction grade products.

The BioGenesis[SM] Soil/Sediment Washing Technology involves three core processes, Preprocessing, Application of Collision Impact Forces, and Cavitation/Oxidation, as well as four additional material handling and separation steps. A schematic of the overall BioGenesis[SM] Soil/Sediment Washing Process is illustrated in Figure 2-1. The following is a description of the individual processing steps:

1. **Soil/Sediment Preparation** – The first materials handling step involves the preparation of the soil/sediment. This includes offloading, screening, storage, and the addition of the proprietary washing chemicals. The soil/sediment is screened to remove any rocks and debris greater than ¼ inch using a wet screener. The oversized material is rinsed on top of the screen and can be sorted and recycled and/or disposed of. The screened material is then stored prior to processing.

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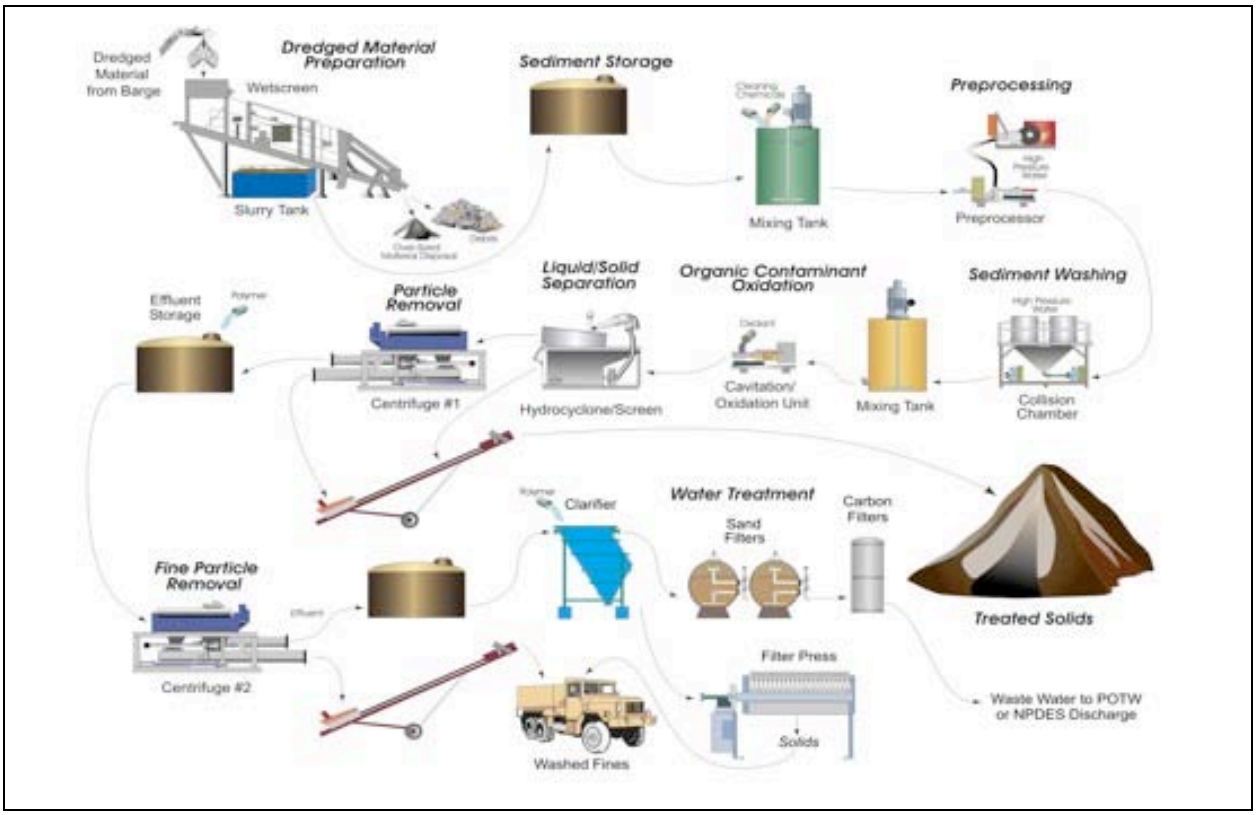

Figure 2-1 BioGenesis^{SM} Soil/Sediment Washing Technology

2. **Preprocessing** – The first core processing step of the BioGenesis^{SM} Soil/Sediment Washing Process is the preprocessing step. The screened soil/sediment is pumped from the storage system to the treatment facility where it is mixed with proprietary specialty chemicals such as surfactants, chelating agents, and defoamers. The specialty chemicals are added at this stage to prepare the soil/sediment for decontamination by decreasing the affinity among contaminants, soil/sediment solids, and naturally occurring organic material.

   The soil/sediment particles are then pumped to the BioGenesis preprocessor unit, which uses physical forces through high-pressure water (up to 10,000 psi) to disaggregate the sediment particles from each other and from the loosely associated naturally occurring organic material. The result is that clumped particles are disaggregated into the sediment

slurry and the naturally occurring organic material is fractionated and transferred to the water phase.

3. **Application of Collision Impact Forces** – The second core-processing step of the BioGenesis[SM] Soil/Sediment Washing Process is the application of collision impact forces. The soil/sediment slurry from step 2 is pumped to the BioGenesis Collision Chamber where high-pressure water is used to create impact forces to strip the biofilm layer and adsorbed contaminants from the individual solid/sediment particles. The result is that the fractionated biofilm and contaminants are transferred to the water phase. After the BioGenesis collision chamber, contamination that was adsorbed to the individual solid particles, as well as the naturally occurring organic material and biofilm, have been transferred to the aqueous phase.

4. **Cavitation/Oxidation** – The third core-processing step of the BioGenesis[SM] Soil/Sediment Washing Process involves destruction of organic contaminants using enhanced oxidation. The destruction is accomplished through cavitation and oxidation. Hydrogen peroxide, a strong oxidizing agent, is added to the sediment slurry upstream of the cavitation system. Cavitation, created within the BioGenesis cavitation unit, occurs when air bubbles created in the slurry implode. The implosion of the air bubbles enhances the ability of hydrogen peroxide to oxidize organic molecules.

   Immediately after the cavitation/oxidation step, the slurry consists of:

   - washed solid particles,
   - residual organic materials in the aqueous phase that may still contain some organic and inorganic contaminants,
   - inorganic contaminants in the water phase, and

- water that contains the majority of contaminants (primarily inorganic constituents) desorbed from the soil/sediment solids and organic material.

5. **Solid/Liquid Separation** – At this stage, the slurry is ready for liquid/solid separation, which results in a decontaminated solid fraction and a liquid fraction that contains inorganic contaminants, residual un-oxidized organic contaminants, naturally occurring organic material, and residual fine-grained soil/sediment particles. Unless liquid/solid separation is performed shortly after Step 4, the contaminant partitioning process will reinitiate between the cleaned solids and the contaminant-enriched liquid. This means that any inorganic contaminants and un-oxidized organic contaminants, which are suspended in the liquid fraction, are candidates to be readsorbed/scavenged onto the cleaned solid particles. Thus, the cleaning process is partially reversible, with the reversal being caused by the particle-reactive characteristics of these contaminants.

   The solid/liquid separation step includes (a) a primary settling device, a hydrocyclone in combination with wet screens, followed by (b) a secondary settling device, a centrifuge, and potentially (c) a third settling device, a filter press. The treated soil/sediment solids separated from the aqueous phase are then stockpiled prior to disposal or reuse, if appropriate.

6. **Wastewater Treatment** – The wastewater from the solid/liquids separation step contains inorganic and organic contaminants, naturally occurring organic material, and residual fine-grained soil/sediment particles. Standard wastewater treatment processes can be used to remove the contaminants from the wastewater prior to discharge to a local publicly owned treatment works or to a surface water body, if allowed under an applicable NPDES permit or other appropriate authorization. Alternatively, this wastewater could be containerized and transported for treatment and/or disposal at an appropriate off-site facility.

7. **Disposition of Treated Solids** – The end result of the process consists of the treated

solids that were separated from the slurry in the Solid/Liquid Separation step. Depending on the concentrations of contaminants in those solids and obtaining necessary regulatory approvals, these materials may be suitable for re-use (e.g., as fill materials or as raw materials to be blended with a variety of other raw materials to produce a reusable product), or would be subject to other appropriate disposition. (Disposition of the treated material resulting from this bench-scale study is discussed in Section 3.4 below.)

2.2 Full-Scale System Residuals

Throughout the BioGenesis[SM] Soil/Sediment Washing Process, water and proprietary chemicals are added to the soil/sediment slurry to aid in the physical process of removing naturally occurring organic materials and contaminants from the soil/sediment particles. In addition to the treated sediment from the full-scale process, there are a limited number of output streams that require additional treatment and/or disposal. These are:

- oversized materials removed in the screening operation that can be segregated and recycled and/or disposed of (as appropriate, depending on their chemical concentrations and regulatory requirements);

- wastewater from the water treatment process (discussed above); and

- wastewater treatment sludge from the water treatment process, the quantity and quality of which are dependent on the grain size distribution in the soil/sediment and the level of metal contaminants in the untreated soil/sediment.

The BioGenesis[SM] Soil/Sediment Washing Process is a water-based decontamination process that is operated at ambient temperatures. There are no air emissions from the system because it is a closed system.

2.3 Scale-up of Bench-Scale Work

The full-scale BioGenesis[SM] Soil/Sediment Washing equipment has been designed to be modular to provide a variety of full-scale processing rates. The base-processing rate for each module is 40 cubic yards (cyds) per hour at the plant inlet for a nominal annual soil/sediment decontamination rate of 250,000 cyds per year.

The core process equipment of the BioGenesis[SM] Soil/Sediment Washing Technology has been replicated at bench-scale (1/12 scale) so that the results of the bench-scale testing can be representative of full-scale operations. The equipment is operated in a semi-flow-through mode to emulate full-scale operations.

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3 Bench-Scale Testing

3.1 Delivery of Untreated Soil/Sediment Samples

Three samples of untreated soil/sediment from the Rest of River area will be collected as described in GE's *Materials Collection/Management Plan for Bench-Scale Treatability Study*. Material will be collected to be representative of the range of physical characteristics typical of the Rest of River sediments and floodplain soils and to be representative of higher concentration PCBs (i.e., greater than 50 mg/kg). Material will include one of each of the following:

- coarse-grained sediment (as collected, not dewatered);
- fine-grained sediment (as collected, not dewatered); and
- floodplain soil.

Test material will be collected in 55-gallon drums (one for each sample), transported to Building 12 at the GE Pittsfield Facility, homogenized and sampled for PCBs, TOC and grain size to provide a preliminary indication of the material characteristics. Results will be provided to BioGenesis prior to the start of testing to assist with optimization of the process prior to the more formal testing described below.

Bench-scale testing will be conducted by BioGenesis at Building 12 at the GE Pittsfield Facility, which is described in GE's *Materials Collection/Management Plan for Bench-Scale Treatability Study*. Materials will be further sampled and tested during each test run as described below.

3.2 Bench-Scale Testing Procedures

The bench-scale testing will be conducted using a systematic approach to ensure the success and repeatability of the testing. Testing will be conducted in three stages:

- preliminary examination and chemical formulation (jar testing);

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- optimization testing (laboratory testing to be performed by BioGenesis); and

- validation testing (laboratory testing to be performed by independent laboratories on behalf of GE).

The following is step-by-step description of the bench-scale testing procedures.

3.2.1 Preliminary Examination and Chemical Formulation

The initial step of the bench-scale treatability study will be to perform jar tests using sub-samples from each soil/sediment source. These tests will be performed to provide a qualitative evaluation of the interaction of the soil or sediment with cleaning chemicals. This evaluation will determine the soil/sediment characteristics important to the operation of the liquid-solid separation process, and will also provide an insight into the compatibility of cleaning chemicals with the mineralogy of the soil/sediment.

The jar testing will be performed by mixing the BioGenesis washing chemicals and soil or sediment in a beaker with a mechanical mixer, de-watering the soil/sediment, chemically extracting treated and untreated material, and qualitatively comparing the extractions to determine relative removal efficiency of the organic components. No analytical sampling or analyses will be conducted during this step.

3.2.2 Equipment Setup

Following the preliminary examination jar testing, the bench-scale testing equipment will be set up and checked for proper operation. The bench-scale equipment will include:

- processing tanks,
- feed pumps,
- 680 bar water blaster,
- pre-processor,
- collision chamber,

- cavitation/oxidation unit,
- aeration/liquid-solid separation equipment,
- shaker screen,
- centrifuge,
- air compressor, and
- filter press.

Select photographs of the bench-scale equipment are contained in Appendix 1. A typical process flow for bench-scale testing is depicted in Figure 3-1. Depending on the characteristics of the soil or sediment being treated, the equipment configuration may be adjusted. In certain cases where the settling characteristics of the treated soil/sediment are good, certain equipment may be by-passed completely.

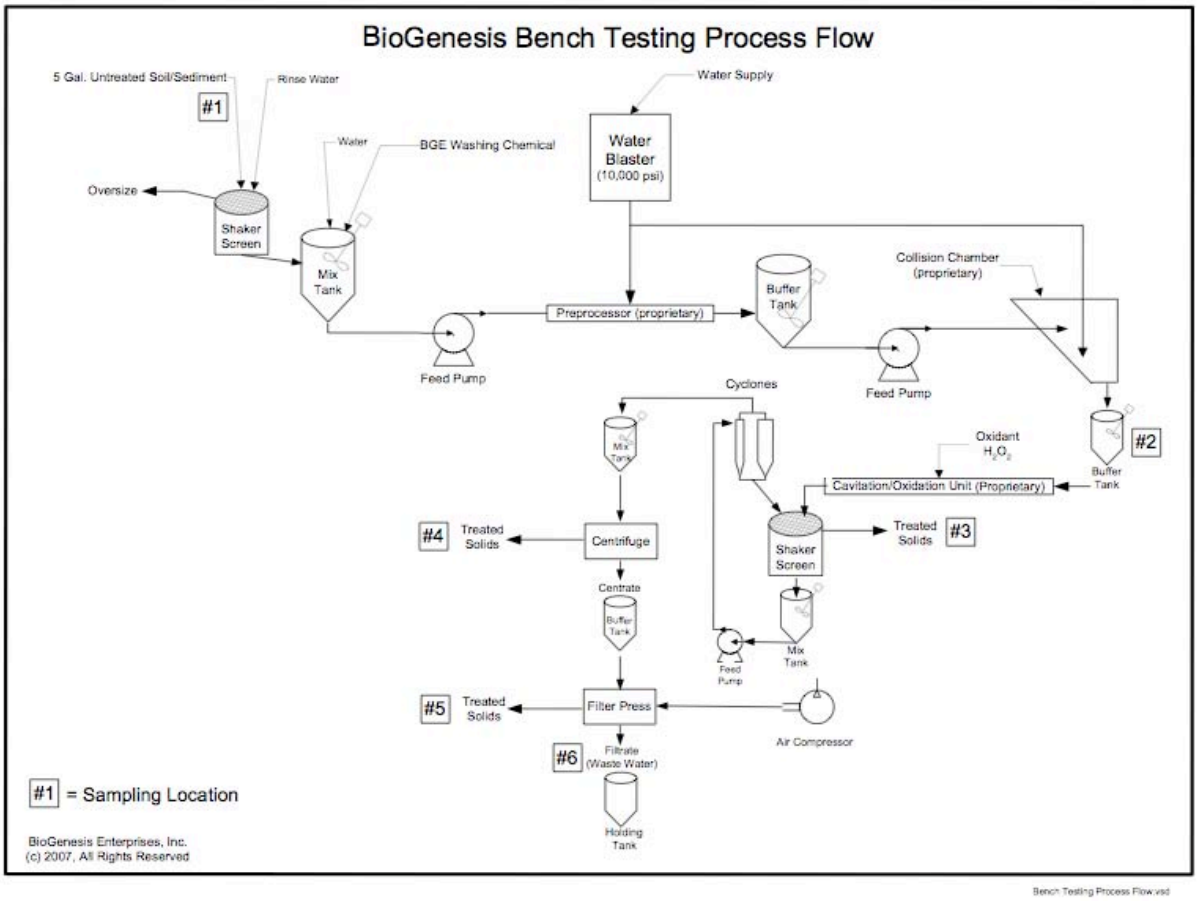

Figure 3-1 BioGenesis Bench-Scale Testing Process Flow Diagram

3.2.3 Process Optimization

When the equipment setup is complete, one to as many as four optimization runs will be conducted to test the selected chemical formulation(s) in the bench-scale equipment on each soil/sediment source. Each run will be conducted on approximately 5 gallons of soil/sediment test material and will use approximately 15 to 20 gallons of water and 10 to 30 ounces of washing chemicals. BioGenesis will collect and analyze samples of the treated soil/sediment solids and wastewater for PCB Aroclors and other relevant parameters (e.g., grain size, TOC). Based on these results, adjustments to the washing chemicals and equipment setup to remove, add, or modify equipment and/or their operating parameters will be made and additional preliminary test runs may be conducted.

Note that the optimization runs will be used by BioGenesis to optimize its process in anticipation of reproducible validation runs discussed in the following subsection. GE and its representatives will observe the process and may collect split samples at various stages of testing to evaluate laboratory comparability. No other testing will be performed by GE, and the data collected during the optimization runs will not be used to evaluate the effectiveness of the BioGenesis^{SM} process. Only data from the validation runs (see below) will be used to evaluate the effectiveness of the process.

3.2.4 Validation Test Runs, Sample Collection and Analyses

When the sample results are received from the optimization testing discussed above, the results will be evaluated by BioGenesis to determine the chemical doses and equipment settings to be used for validation test runs. The validation runs will be used to provide the data used to evaluate the effectiveness of the BioGenesis^{SM} Soil/Sediment Washing Technology. The primary purposes of the validation runs are to further fine-tune the chemical formulations and equipment operating conditions as well as to perform reproducible and comparable test runs to produce treated material for chemical analysis by GE's independent laboratories.

The test material from each soil/sediment collection location in the Rest of River area will be

processed in a minimum of three validation test runs. Each run will be conducted on approximately 5 gallons of soil/sediment test material and will use approximately 15 to 20 gallons of water and 10 to 30 ounces of washing chemicals. Before and after each validation test run, samples will be collected by GE representatives, identified, packaged, and shipped by overnight delivery to the laboratories for testing.

To provide data for the evaluation process, samples will be collected at the following stages of each test run (see Figure 3-1 for sample locations):

- untreated feed material (soil/sediment) [Sample Location 1]
- collision chamber outlet (slurry to be separated into solid and aqueous portion using a centrifuge) [Sample Location 2]
    - solids
    - unfiltered aqueous
    - filtered aqueous
- treated solids – hydrocyclones [Sample Location 3]
- treated solids – centrifuge [Sample Location 4]
- treated solids – filter press [Sample Location 5]
- wastewater [Sample Location 6]
    - unfiltered aqueous
    - filtered aqueous

As mentioned earlier, a minimum of three validation runs will be conducted for the material from each soil/sediment collection location. Samples will be collected from each run at each of the six test locations described above, for a total of 27 samples for each soil/sediment test material. Table 3-1 provides additional details regarding the numbers, locations, and analytes for these samples. Samples will be collected and packaged in accordance with the project *Field Sampling Plan/Quality Assurance Project Plan* (FSP/QAPP) (ARCADIS BBL, 2007), and will be sent to GE's independent laboratories for analyses. The samples will be analyzed by the laboratories using the methods listed below in accordance with the FSP/QAPP.

Table 3-1 Validation Testing Run Sampling and Analysis

					Solids Analyses			Aqueous Analyses			
Soil/ Sediment Source	**Validation Run**	**Sample Location**	**Sample ID**	**Matrix**	**PCB Aroclors SW846 Method 8082**	**Grain Size Distribution ASTM Method D422**	**TOC Lloyd Kahn**	**PCB Aroclors SW846 Method 8082**	**TOC SW846 Method 9060**	**TSS EPA Method 160.1**	**TDS EPA Method 160.2**
1 - Coarse-grained sediment	**1**	Untreated Soil/Sediment	B-S1-R1-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S1-R1-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S1-R1-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S1-R1-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S1-R1-L3-S	S	X	X	X				
		Treated Sediment - Hydrocyclone Outlet	B-S1-R1-L3-2	QC - DUP	X	X	X				
		Treated Sediment - Hydrocyclone Outlet	B-S1-R1-L3-S MS/MSD	QC - MS/MSD	X		X				
		Treated Sediment - Centrifuge Outlet	B-S1-R1-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S1-R1-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S1-R1-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S1-R1-L6-AF	A				X	X	X	X
	2	Untreated Soil/Sediment	B-S1-R2-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S1-R2-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S1-R2-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S1-R2-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S1-R2-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S1-R2-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S1-R2-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S1-R2-L6-A	A				X	X	X	X
		Wastewater - Aqueous	B-S1-R2-L6-2	QC - DUP				X	X		
		Wastewater - Aqueous	B-S1-R2-L6-A MS/MSD	QC - MS/MSD				X	X		
		Wastewater - Aqueous (filtered)	B-S1-R2-L6-AF	A				X	X	X	X
	3	Untreated Soil/Sediment	B-S1-R3-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S1-R3-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S1-R3-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S1-R3-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S1-R3-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S1-R3-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S1-R3-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S1-R3-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S1-R3-L6-AF	A				X	X	X	X

Table 3-1 Validation Testing Run Sampling and Analysis

					Solids Analyses			Aqueous Analyses			
Soil/ Sediment Source	**Validation Run**	**Sample Location**	**Sample ID**	**Matrix**	**PCB Aroclors SW846 Method 8082**	**Grain Size Distribution ASTM Method D422**	**TOC Lloyd Kahn**	**PCB Aroclors SW846 Method 8082**	**TOC SW846 Method 9060**	**TSS EPA Method 160.1**	**TDS EPA Method 160.2**
2 - Fine-grained sediment	**1**	Untreated Soil/Sediment	B-S2-R1-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S2-R1-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S2-R1-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S2-R1-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S2-R1-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S2-R1-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S2-R1-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S2-R1-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S2-R1-L6-AF	A				X	X	X	X
	2	Untreated Soil/Sediment	B-S2-R2-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S2-R2-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S2-R2-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S2-R2-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S2-R2-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S2-R2-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S2-R2-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S2-R2-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S2-R2-L6-AF	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S2-R2-L6-2	QC - DUP				X	X		
		Wastewater - Aqueous (filtered)	B-S2-R2-L6-AF MS/MSD	QC - MS/MSD				X	X		
	3	Untreated Soil/Sediment	B-S2-R3-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S2-R3-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S2-R3-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S2-R3-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S2-R3-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S2-R3-L4-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S2-R3-L4-2	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S2-R3-L4-S MS/MSD	S	X		X				
		Treated Sediment - Filter Press Outlet	B-S2-R3-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S2-R3-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S2-R3-L6-AF	A				X	X	X	X

Table 3-1 Validation Testing Run Sampling and Analysis

					Solids Analyses			Aqueous Analyses			
Soil/ Sediment Source	**Validation Run**	**Sample Location**	**Sample ID**	**Matrix**	**PCB Aroclors SW846 Method 8082**	**Grain Size Distribution ASTM Method D422**	**TOC Lloyd Kahn**	**PCB Aroclors SW846 Method 8082**	**TOC SW846 Method 9060**	**TSS EPA Method 160.1**	**TDS EPA Method 160.2**
3 - Floodplain soil	**1**	Untreated Soil/Sediment	B-S3-R1-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S3-R1-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S3-R1-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S3-R1-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S3-R1-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S3-R1-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S3-R1-L5-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S3-R1-L5-2	QC - DUP	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S3-R1-L5-S MS/MSD	QC - MS/MSD	X		X				
		Wastewater - Aqueous	B-S3-R1-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S3-R1-L6-AF	A				X	X	X	X
	2	Untreated Soil/Sediment	B-S3-R2-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S3-R2-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S3-R2-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S3-R2-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S3-R2-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S3-R2-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S3-R2-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S3-R2-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S3-R2-L6-AF	A				X	X	X	X
	3	Untreated Soil/Sediment	B-S3-R3-L1-S	S	X	X	X				
		Collision Chamber Outlet - Solid Fraction	B-S3-R3-L2-S	S	X	X	X				
		Collision Chamber Outlet - Aqueous Fraction	B-S3-R3-L2-A	A				X	X	X	X
		Collision Chamber Outlet - Aqueous Fraction (filtered)	B-S3-R3-L2-AF	A				X	X	X	X
		Treated Sediment - Hydrocyclone Outlet	B-S3-R3-L3-S	S	X	X	X				
		Treated Sediment - Centrifuge Outlet	B-S3-R3-L4-S	S	X	X	X				
		Treated Sediment - Filter Press Outlet	B-S3-R3-L5-S	S	X	X	X				
		Wastewater - Aqueous	B-S3-R3-L6-A	A				X	X	X	X
		Wastewater - Aqueous (filtered)	B-S3-R3-L6-AF	A				X	X	X	X
Total Number of Samples					**45**	**45**	**45**	**36**	**36**	**36**	**36**
Total Number of QC Sample Sets (Field Duplicates and MS/MSD pairs)					**3**	**3**	**3**	**2**	**2**	**2**	**2**

Notes:
1. Matrix: S = Solid, A = Aqueous
2. PCB and TOC for solids will be reported with percent solids and on a dry weight basis.
3. One bottle blank will be collected for solids PCBs and TOC and one bottle blank will be collected for aqueous PCBs and TOC.
4. NEA will perform chemical analyses; Geotechnics will perform grain size analysis using sieve and hydrometer.

Solid samples will be analyzed for the following:

- PCB Aroclors – by EPA SW846 Method 8082 (reported with percent solids on a dry weight basis)

- Grain Size Distribution – by ASTM Method D422

- Total Organic Carbon (TOC) – by the Lloyd Kahn Method (reported with percent solids on a dry weight basis)

Aqueous samples (filtered and unfiltered) will be analyzed for:

- PCB Aroclors – by EPA SW846 Method 8082
- Total Suspended Solids (TSS) – by EPA Method 160.1
- Total Dissolved Solids (TDS) – by EPA Method 160.2
- TOC – by EPA SW846 Method 9060

Chemical testing on behalf of GE will be performed by Northeast Analytical, Inc. (NEA), and analyses for grain size will be conducted by Geotechnics, Inc. with sieve and hydrometer.

3.2.5 QA/QC Procedures

To provide measures of the quality of the data from the validation test runs, Quality Control samples will be collected and the results will be evaluated in terms of precision, accuracy, representativeness, completeness, and comparability. Laboratory quality control procedures will be implemented in accordance with the project FSP/QAPP and will include reagent blanks, matrix spike and duplicate samples, instrument calibrations, internal and surrogate spiking solutions. Table 3-1 includes a listing of the field duplicate and MS/MSD QC samples.

The data resulting from the validation test runs will be validated and evaluated for usability in accordance with EPA Region I guidelines as defined in the FSP/QAPP. This will include Tier I

validation on 100% of the data with additional Tier II validation on 25% of the data.

3.3 Equipment Decontamination

In between each test run, the bench-scale equipment will be cleaned to ensure that no cross-contamination occurs between test materials and test runs. Visible liquids and solids will be removed from the process equipment, and the equipment will be flushed with BioGenesis' proprietary washing chemicals and water.

Following the completion of the bench-scale treatability tests, the non-disposable equipment will be decontaminated prior to demobilization by flushing with BioGenesis' proprietary washing chemicals and water. After decontamination, the equipment will be tested by collecting 1 to 3 wipe samples from each piece of equipment, based on the size of the equipment. Samples will be analyzed for PCBs by GE's independent laboratory. If results indicate that surface concentrations of PCBs are 10 μg/100 cm^2 or less, the equipment will be considered adequately decontaminated for transportation off-site. If that criterion is not achieved, the washing and testing process will be repeated until that criterion is achieved.

3.4 Residual Disposal

Solids generated during the bench-scale treatability study, including untreated soil/sediment, treated soil/sediment, oversized material removed during screening, and other miscellaneous PCB-containing materials used in or resulting from the study, will be disposed of in accordance with EPA's regulations under TSCA based on pre-treatment PCB concentrations.

GE plans to treat all water generated during the bench-scale testing in the Building 64G Groundwater Treatment Facility (GWTF) at the GE facility and discharge under GE's NPDES Permit. In addition, wastewater and wash water generated during the bench-scale treatability test will be containerized and transported to the Building 64G GWTF for treatment and discharge. If such water cannot be appropriately treated and discharged, it will be containerized for characterization and off-site treatment/disposal at an approved facility.

3.5 Reporting

Following receipt of the analytical data, BioGenesis will prepare a report that will describe the bench-scale testing procedure, present the data developed during testing, and interpret the results. The report will provide a detailed discussion of how well the BioGenesis[SM] Soil/Sediment Washing Process achieved the stated objectives, provide a discussion of the strengths, limitations and applicability of the process for the Rest of River area, and include any recommendations for additional testing. The report will include detailed tables showing the mass balance and fate of PCBs in each treatment residual waste stream. The report will also include a detailed discussion of costs for full-scale implementation. The information from this report will be incorporated, as appropriate, into the CMS Report.

3.6 Health and Safety

The bench-scale treatability tests will be conducted under the BioGenesis field Health and Safety Plan (HSP) with any additional requirements identified by GE, if necessary, for conducting work at the GE Pittsfield facility. The HSP will be available to EPA upon request.

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APPENDIX 1

BENCH-SCALE EQUIPMENT PHOTOS

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Photo 1 – Overview of BioGenesis bench-scale testing equipment

Photo 2 – Feed pump, preprocessor, and collision chamber

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Photo 3 – Water blaster pump

Photo 4 – Shaker screen and feed tank

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Photo 5 – Shaker screen

Photo 6 – Hydrocyclones over shaker screen

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Photo 7 – Filter press setup

Photo 8 – Loading filter press

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Photo 9 – Centrifuge solids

Photo 10 – Wet, treated sediment dewatered in filter press

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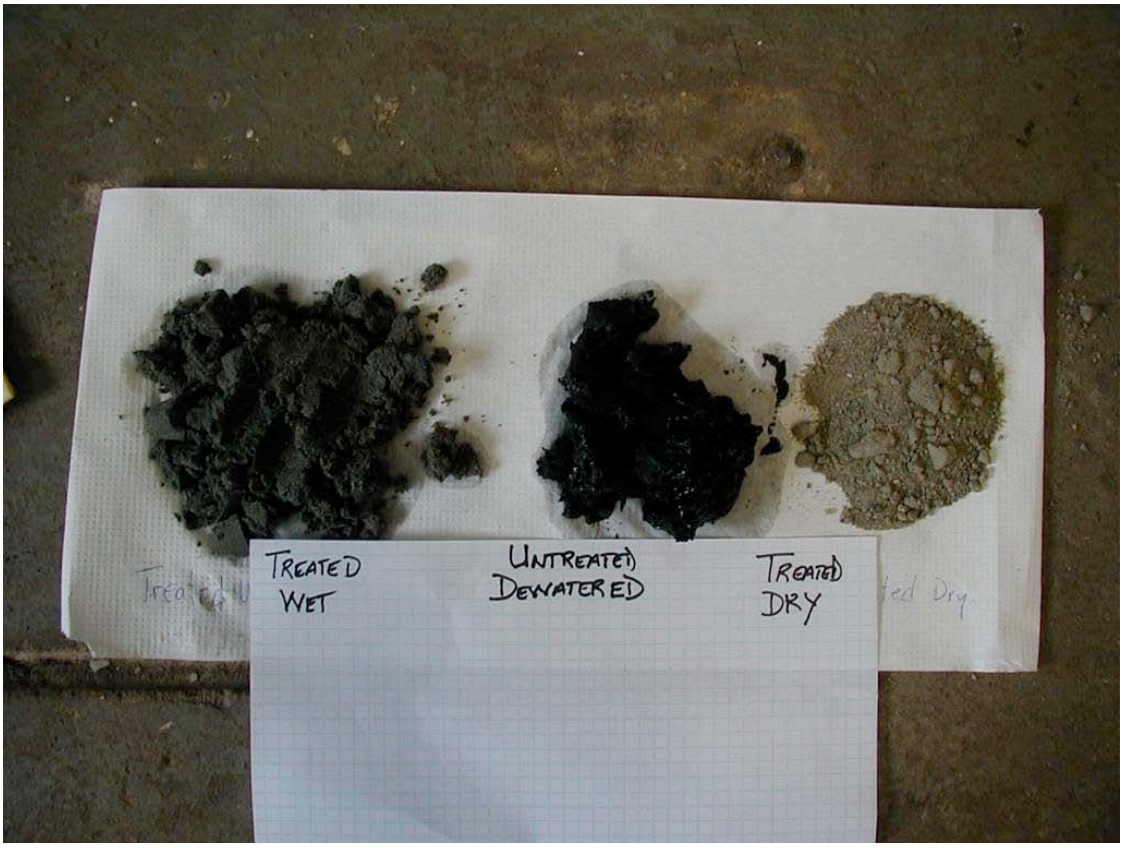

Photo 11 – Comparison of untreated, wet treated, and dry treated sediment

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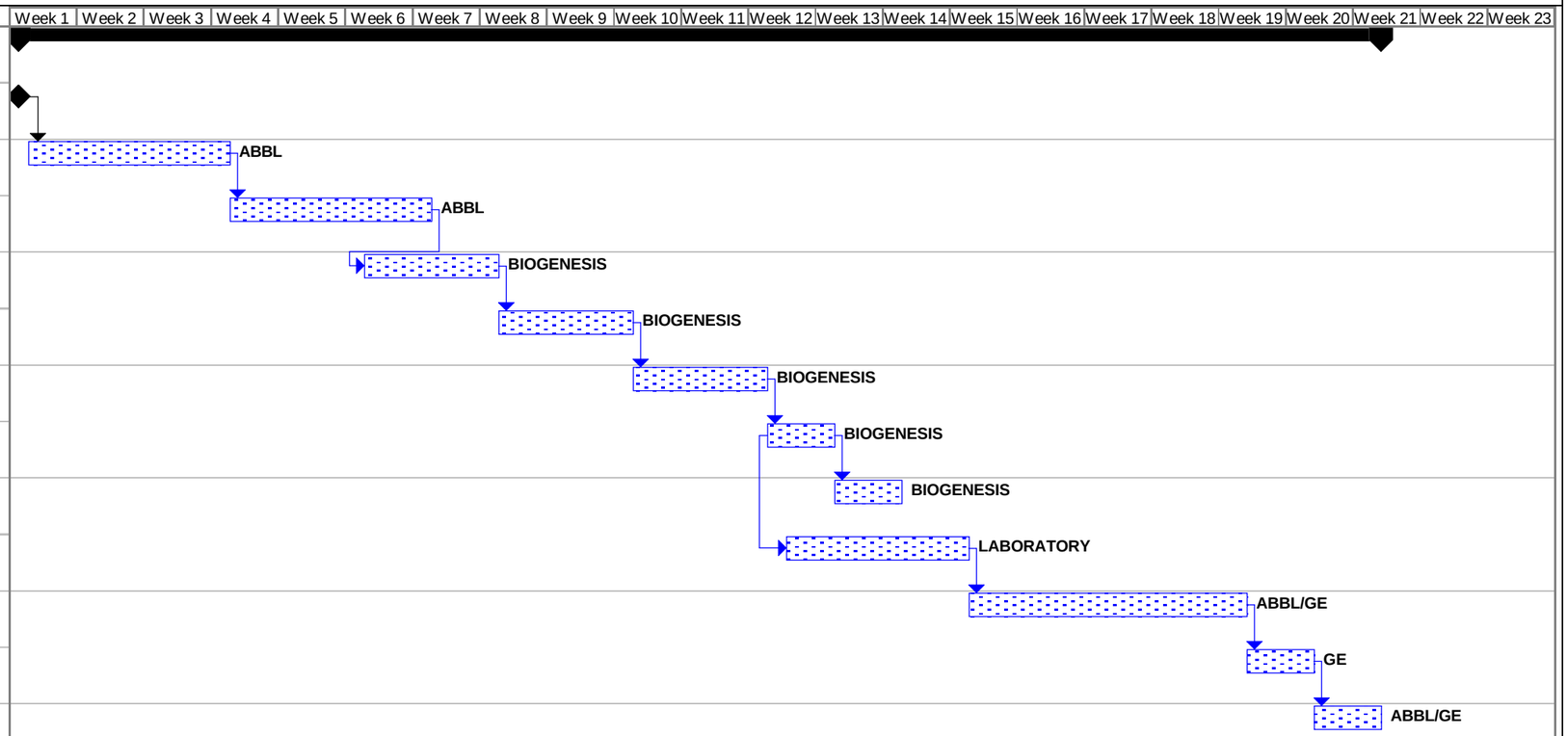
Attachment C

Bench-Scale Treatability Study
Testing Schedule

ATTACHMENT C
BENCH-SCALE TREATABILITY STUDY TESTING SCHEDULE
GENERAL ELECTRIC COMPANY - HOUSATONIC RIVER-REST OF RIVER

ID	Task Name	Duration
1	**Treatability Studies - Chemical Extraction**	**20.2 wks**
2	EPA Approval of Work Plan	1 day
3	Collect and analyze preliminary samples to verify collection locations*	3 wks
4	Collect, transport, sample and analyze test material	3 wks
5	BioGenesis mobilization to Pittsfield	2 wks
6	Preliminary materials examination and chemical formulation (jar tests)	2 wks
7	Equipment setup and process optimization with rapid turnaround lab analysis	2 wks
8	Validation runs	1 wk
9	BioGenesis decontamination and demobilization	1 wk
10	Laboratory analysis	2.6 wks
11	Results evaluation, data validation and report preparation	4 wks
12	GE review/comment on report	1 wk
13	Finalize draft report	1 wk



Notes:
* Assumes only one round of preliminary sample collection.

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