GE
159 Plastics Avenue
Pittsfield, MA 01201
USA

Transmitted Via Overnight Delivery

May 5, 2006

Ms. Sharon Hayes
United States Environmental Protection Agency
EPA New England
One Congress Street, Suite 1100
Boston, MA 02114-2023

Re: GE-Pittsfield/Housatonic River Site
Hill 78 and Building 71 On-Plant Consolidation Areas (GECD210 & GECD220)
2006 Consolidation and Phase II Final Cover Construction

Dear Ms. Hayes:

This letter summarizes the 2006 consolidation and final cover construction activities to be conducted by the General Electric Company (GE) at the Building 71 and Hill 78 On-Plant Consolidation Areas (OPCAs). Specifically, this letter provides a summary of the anticipated consolidation of materials to be generated by remediation and demolition activities performed in 2006, as well as the technical design and construction activities related to installing a final cover over portions of the Building 71 and Hill 78 OPCAs (collectively referred to as Phase II final cover).

In general, the construction activities described in this letter and its attachments will involve materials and practices similar to those used over the last six years during material consolidation in the OPCAs and during installation of a final cover on a portion of the Building 71 OPCA in 2005 (Phase I final cover). The consolidation and Phase II final cover construction activities will be conducted in accordance with the following documents:

- June 1999 *Detailed Work Plan for On-Plant Consolidation Areas* (1999 Detailed Work Plan);
- August 1999 *Addendum to June 1999 Detailed Work Plan*;
- GE's June 13, 2000 *Response to April 27, 2000 EPA Comments*;
- Letter from the United States Environmental Protection Agency (EPA) dated January 30, 2001, providing final conditional approval of GE's 1999 Detailed Work Plan, as modified by the August 1999 Addendum and June 2000 response to comments;
- GE's March 9, 2001 letter response to *EPA Conditions for Approval of OPCA Work Plan*; and
- April 2006 *Addendum to OPCA Work Plan* (approved by EPA on April 17, 2006).

In addition, construction activities will be performed consistent with applicable requirements included in the June 2003 *Project Operations Plan* and any subsequent revisions (e.g., air monitoring, quality assurance testing, etc.).

Consistent with the approach outlined in GE's March 9, 2001 response letter, the technical information related to the Building 71 and Hill 78 final cover construction (i.e., technical drawings, specifications, and engineering calculations) is provided for EPA review and approval. The Building 71 and Hill 78 OPCA consolidation information presented in this letter is provided to EPA for informational purposes only.

The remainder of this letter presents an overview of the anticipated 2006 consolidation and final cover activities planned for each OPCA, and the anticipated implementation schedule for both the consolidation and construction activities.

I. Material Consolidation Activities

In 2006, GE anticipates that approximately 30,000 cubic yards of material will be consolidated at the Building 71 OPCA and the Hill 78 OPCA. These materials are anticipated to consist of the following: (a) soils excavated by GE during remediation activities at the Phase 4 Floodplain Properties (adjacent to the 1½ Mile Reach of the river), Former Oxbow Areas A and C, Former Oxbow Areas J and K, and the Lyman Street Area, as well as any soils generated during the remaining remediation activities at Newell Street Area I and Newell Street Area II; (b) soils and sediments excavated by EPA during the 1½-Mile Reach Removal Action activities; and (c) building demolition debris associated with Brownfields-related activities at certain areas of the GE Plant. Materials that are generated by these activities and meet the criteria in the Consent Decree (CD) and *Statement of Work for Removal Actions Outside the River* (SOW) for consolidation at the Hill 78 or Building 71 OPCA will be placed within the appropriate OPCAs consistent with the technical drawings and specifications presented in the 1999 Detailed Work Plan and subsequent correspondence (including the April 2006 *Addendum to OPCA Work Plan).*

II. Final Cover Construction Activities

The portion of the Building 71 OPCA that has not previously been capped and a portion of the Hill 78 OPCA are anticipated to reach their design capacity in 2006. Once the final consolidation grades are achieved in these areas, final cover installation activities will be initiated. The Building 71 area anticipated to be covered in 2006 is approximately 2.7 acres in size (see Figure 1 in Attachment 1); the Hill 78 area anticipated to be covered in 2006 is approximately 1.9 acres in size (see Figure 1 in Attachment 1). Please note that the final cover areas indicated for these OPCAs are conceptual only; the actual constructed final cover acreages may vary based on the quality and quantity of material available for consolidation at each OPCA and the anticipated time frame for cover construction in consideration of establishing vegetation.

Based on discussions with EPA, to limit disturbance of the OPCA surface and minimize potential dust generation, earthwork activities associated with the final cover installation (exclusive of ongoing consolidation activities and geosynthetics installation) will be limited to approximately one acre in size at any given time – i.e., only one acre of subgrade or final cover soils will be disturbed at one time (at either of the OPCAs) and that acre of cover will be completed before proceeding to the next acre.

As described in the 1999 Detailed Work Plan, as amended by the August 1999 Addendum, the final cover system for both the Building 71 and Hill 78 OPCAs will contain the following components (from bottom to top):

- a minimum of 6 inches of suitable consolidated soil material (i.e., material that has a maximum particle size of 3 inches or less);
- a geocomposite clay liner (on the plateau area only – i.e. surfaces with a slope of less than 10%);
- a 60-mil-thick (minimum average roll value) textured high density polyethylene (HDPE) flexible membrane liner;
- a geosynthetic drainage composite (GDC);
- an 18-inch thick (minimum) layer of general soil fill material; and
- a 6-inch thick (minimum) layer of topsoil with vegetative cover.

The minimum and maximum slopes of the final cover are 4% and 33%, respectively. A portion of the stormwater runoff from the Building 71 and Hill 78 Phase II final cover area will be collected by mid-slope swales constructed along the final cover side-slopes and conveyed to either of the two stormwater basins located adjacent to the OPCAs. Drainage ditches positioned around the perimeter of the Building 71 and Hill 78 OPCAs will also convey runoff to the OPCA stormwater basins and an existing drainage ditch located south of the Hill 78 OPCA. Precipitation that infiltrates the cover soils will be intercepted by the GDC and collected by a perforated drainage pipe (collection pipe) installed within the final cover system anchor trench. The collection pipe will outlet at several locations including the stormwater basins, the perimeter drainage ditches, and the existing stormwater ditch located south of the Hill 78 OPCA.

Construction details related to the final cover components and stormwater management features are provided in Attachment 1. Attachment 2 includes the project technical specifications, which provide specific requirements for material installation, earthwork activities, erosion control, and site restoration.

III. Final Cover Design Calculations

Engineering calculations for the following construction activities were previously submitted to and conditionally approved by the EPA:

- northern stormwater basin, submitted on June 2, 2000 and conditionally approved on June 26, 2000;
- southern stormwater basin and Building 71 OPCA perimeter ditch, submitted on June 13, 2000 and conditionally approved on June 26, 2000;
- Building 71 OPCA perimeter ditch (design summary) and the Merrill Road culvert evaluation, submitted on March 27, 2002 and conditionally approved on May 28, 2002; and
- Building 71 OPCA mid-slope drainage swales, Building 71 OPCA final cover system GDC and collection pipe, veneer stability of the final cover system, and the embankment drainage ditch, submitted on July 15, 2005 and conditionally approved on August 25, 2005.

Additional engineering calculations prepared to support the remaining final cover construction activities are included in Attachment 3. These additional calculations include sizing for the Hill 78 mid-slope drainage swale, perimeter drainage ditch, GDC, and collection pipe.

IV. Anticipated Schedule

Consolidation activities were initiated on April 24, 2006 and will be performed throughout the year, with the frequency and duration of the events contingent upon the amount of materials generated that will be consolidated at the OPCAs. However, regardless of the number of placement periods, the consolidation activities planned for 2006 are expected to be completed by end of this year, unless weather conditions allow extended consolidation activities through the winter months at the beginning of 2007. Phase II final cover construction activities are anticipated to commence during the summer months and be completed by the end of 2006. However, this schedule is tentative and may vary based on the progress of consolidation material placement in the Building 71 and Hill 78 OPCAs.

Sincerely,

John F. Novotny, P.E.
Manager, Facilities and Brownfields Programs

RLP/cmb
Attachments

cc: Dean Tagliaferro, EPA
Tim Conway, EPA
John Kilborn, EPA
Holly Inglis, EPA
Rose Howell, EPA*
K.C. Mitkevicius, USACE
Susan Steenstrup, MDEP (2 copies)
Anna Symington, MDEP*
Jane Rothchild, MDEP*
Linda Palmieri, Weston (2 copies)
Nancy E. Harper, MA AG*
Dale Young, MA EOEA*
Tom Hickey, Director, PEDA
Mayor James Ruberto, City of Pittsfield
Pittsfield Department of Health
Jeffrey Bernstein, Bernstein, Cushner & Kimmell
Teresa Bowers, Gradient
Michael Carroll, GE*
Andrew Silfer, GE
Roderic McLaren, GE*
James Nuss, BBL
James Bieke, Goodwin Procter
Larry Kirsch, Goodwin Procter
Public Information Repositories
GE Internal Repository

**cover letter only*

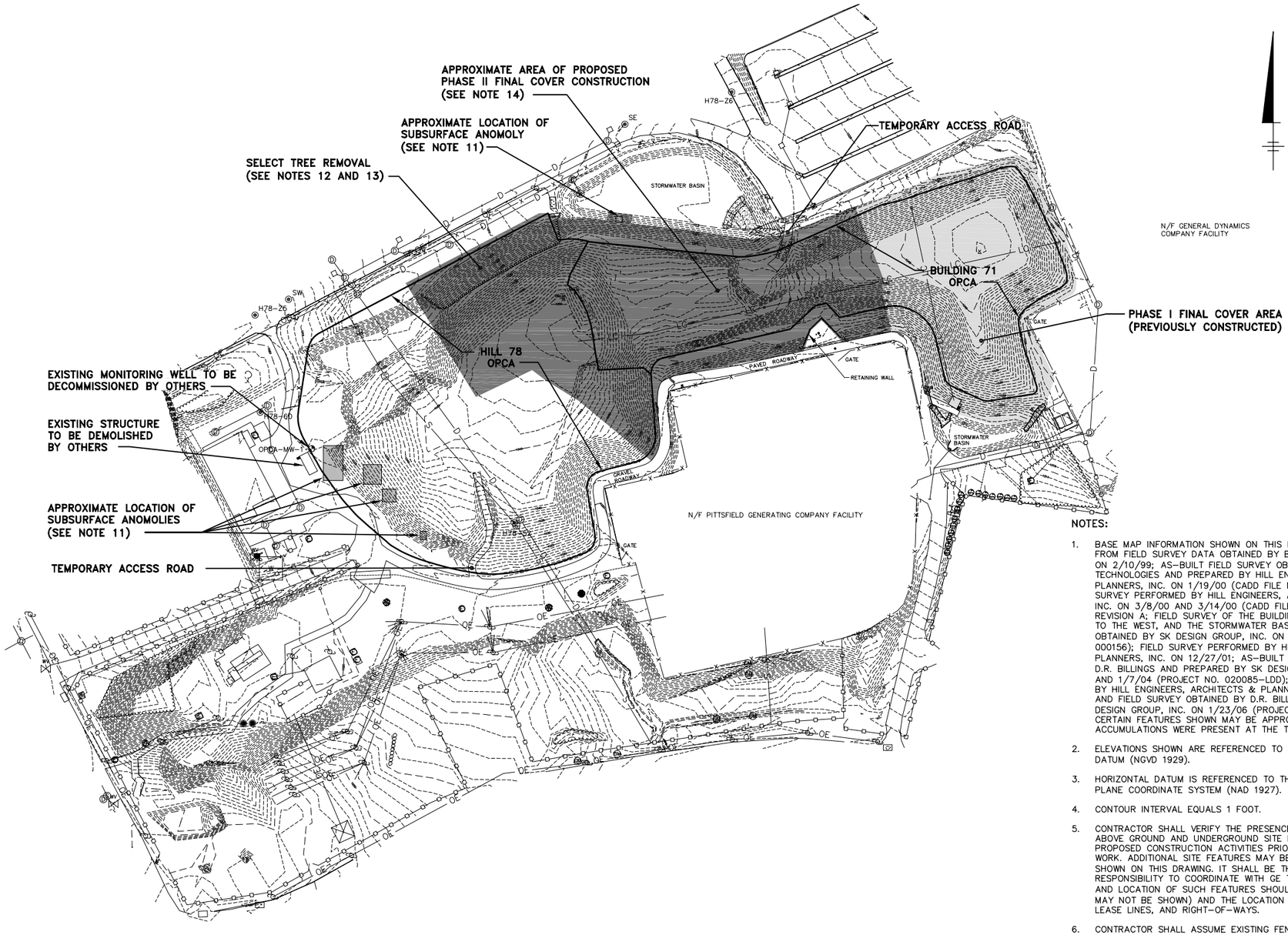
Attachments

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Attachment 1

Technical Drawings

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists



LEGEND:

SW	SURVEY BENCHMARK		RIPRAP
GM	GAS MARKER		CENTERLINE DITCH
	GUY ANCHOR		ABOVE GROUND STEAM PIPE
	MONITORING WELL	D	DRAINAGE LINES
	WATER SUPPLY WELL		OVERHEAD UTILITY
S	SANITARY MANHOLE	X	CHAIN LINK FENCE (SEE NOTE 6)
	CATCH BASIN		WOOD STOCKADE FENCE
D	DRAIN MANHOLE	1000	INDEX CONTOUR LINE
	WATER METER PIT		INTERMEDIATE CONTOUR LINE
E	ELECTRIC MANHOLE		VEGETATION
	UTILITY POLE	LC	LEACHATE COLLECTION FORCEMAIN
WV	WATER VALVE	E	UNDERGROUND ELECTRIC LINES
	FIRE HYDRANT	S	SEWER
	BOLLARD		
	WELL		
	TREE		

NOTES:

1. BASE MAP INFORMATION SHOWN ON THIS DRAWING WAS DEVELOPED FROM FIELD SURVEY DATA OBTAINED BY BLASLAND, BOUCK & LEE, INC. ON 2/10/99; AS-BUILT FIELD SURVEY OBTAINED BY MAXYMILLIAN TECHNOLOGIES AND PREPARED BY HILL ENGINEERS, ARCHITECTS, & PLANNERS, INC. ON 1/19/00 (CADD FILE NO. MX-36-2.DWG); FIELD SURVEY PERFORMED BY HILL ENGINEERS, ARCHITECTS, & PLANNERS, INC. ON 3/8/00 AND 3/14/00 (CADD FILE NO. SRV-4541.DWG) REVISION A; FIELD SURVEY OF THE BUILDING 71 OPCA, ADJACENT AREA TO THE WEST, AND THE STORMWATER BASIN TO THE NORTHWEST OBTAINED BY SK DESIGN GROUP, INC. ON 12/8/00 (PROJECT NO. 000156); FIELD SURVEY PERFORMED BY HILL ENGINEERS, ARCHITECTS, & PLANNERS, INC. ON 12/27/01; AS-BUILT FIELD SURVEY OBTAINED BY D.R. BILLINGS AND PREPARED BY SK DESIGN GROUP, INC. ON 11/25/03 AND 1/7/04 (PROJECT NO. 020085-LDD); FIELD SURVEY PERFORMED BY HILL ENGINEERS, ARCHITECTS & PLANNERS, INC. IN JANUARY 2005, AND FIELD SURVEY OBTAINED BY D.R. BILLLINGS AND PREPARED BY SK DESIGN GROUP, INC. ON 1/23/06 (PROJECT NO. 020085-AB-1-23-06). CERTAIN FEATURES SHOWN MAY BE APPROXIMATE SINCE SNOW AND ICE ACCUMULATIONS WERE PRESENT AT THE TIME OF CERTAIN SURVEYS.
2. ELEVATIONS SHOWN ARE REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD 1929).
3. HORIZONTAL DATUM IS REFERENCED TO THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM (NAD 1927).
4. CONTOUR INTERVAL EQUALS 1 FOOT.
5. CONTRACTOR SHALL VERIFY THE PRESENCE AND LOCATION OF ALL ABOVE GROUND AND UNDERGROUND SITE FEATURES IN THE VICINITY OF PROPOSED CONSTRUCTION ACTIVITIES PRIOR TO COMMENCEMENT OF SITE WORK. ADDITIONAL SITE FEATURES MAY BE PRESENT WHICH ARE NOT SHOWN ON THIS DRAWING. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH GE TO DETERMINE THE PRESENCE AND LOCATION OF SUCH FEATURES SHOULD THEY EXIST (AND WHICH MAY NOT BE SHOWN) AND THE LOCATION OF ON-SITE EASEMENTS, LEASE LINES, AND RIGHT-OF-WAYS.
6. CONTRACTOR SHALL ASSUME EXISTING FENCING AT PERIMETER OF SITE IS GE'S PROPERTY LINE. NO WORK SHALL BE PERFORMED OUTSIDE THE PROPERTY LINE WITHOUT GE'S PRIOR APPROVAL.
7. CONTRACTOR SHALL FURNISH AND PLACE PROPER GUARDS TO MINIMIZE POTENTIAL FOR ACCIDENTS.
8. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PROCEDURES AND PROGRAMS. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS FOR THE SAFETY OF, AND SHALL PROVIDE THE NECESSARY MEASURES TO PREVENT DAMAGE, INJURY, OR LOSS TO ALL EMPLOYEES ON THE WORK SITE AND ANY OTHER PERSONS WHO MAY BE AFFECTED THEREBY.
9. EXISTING SURFACES OR FEATURES NOT SPECIFIED FOR MODIFICATION THAT ARE DAMAGED OR DESTROYED AS A RESULT OF WORK SHALL BE RESTORED BY THE CONTRACTOR TO THEIR PRECONSTRUCTION CONDITION AT THE CONTRACTOR'S EXPENSE AND TO THE SATISFACTION OF GE, IN A TIMELY MANNER.
10. ALL CONTRACTOR-RELATED ACTIVITIES SHALL BE PERFORMED IN A MANNER WHICH ALLOWS FOR ALL NECESSARY OPERATING ACTIVITIES ASSOCIATED WITH THE PITTSFIELD GENERATING COMPANY AND GENERAL DYNAMICS COMPANY FACILITIES. ANY WORK DEEMED NECESSARY WHICH MAY AFFECT THOSE FACILITIES SHALL BE BROUGHT TO THE ATTENTION OF GE PRIOR TO COMMENCEMENT OF SUCH WORK. GE SHALL PROVIDE THE CONTRACTOR WITH AUTHORIZATION TO PROCEED PROVIDED GE AND THE AFFECTED PARTY(IES) DEEM THE ACTION NECESSARY AND ACCEPTABLE.
11. SUBSURFACE ANOMOLIES IDENTIFIED AS A PART OF THE GEOPHYSICAL SURVEYS PERFORMED BY GEOPHYSICAL APPLICATIONS, INC. IN 2001 AND 2002 SHALL BE INCLUDED WITHIN THE LIMITS OF FINAL COVER AS SHOWN ON THE FOLLOWING DRAWINGS.
12. SELECT TREES SHALL BE REMOVED AS NEEDED TO FACILITATE CONSOLIDATION GRADING AND FINAL COVER CONSTRUCTION. CONTRACTOR TO COORDINATE WITH GE ON TREE SELECTION PRIOR TO COMMENCEMENT OF TREE REMOVAL ACTIVITIES. TREES NOT IDENTIFIED FOR REMOVAL SHALL BE PROTECTED AS NECESSARY TO AVOID BEING DAMAGED. TREES NOT IDENTIFIED FOR REMOVAL WHICH ARE DAMAGED SHALL BE REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO GE. THE CONTRACTOR SHALL TAKE EVERY PRECAUTION FEASIBLE TO AVOID DAMAGING TREES NOT SELECTED FOR REMOVAL.
13. TREES SELECTED FOR REMOVAL SHALL EITHER BE CUT AND CHIPPED WITHIN THE OPCA CONSOLIDATION LIMITS OR TRANSPLANTED AT A LOCATION SPECIFIED BY GE. CONTRACTOR TO COORDINATE WITH GE ON SPECIFIC REQUIREMENTS.
14. THE FINAL COVER AREA IS CONCEPTUAL ONLY; THE ACTUAL FINAL COVER AREA MAY VARY BASED ON THE QUALITY AND QUANTITY OF MATERIAL AVAILABLE FOR CONSOLIDATION AT EACH OPCA AND THE ANTICIPATED TIME FRAME FOR COVER CONSTRUCTION IN CONSIDERATION OF ESTABLISHING VEGETATION.

X: 20405X00.DWG, 20405X01.DWG
L: ON=*, OFF=*REF, |X01 RIPRAP*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD TJR LAF
N/20405001/OPCA/20405G01.DWG

Graphic Scale
100' 0 100' 200'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name: James M. Nuss
Professional Engineer's No.: 38000
State: MASS. Date Signed:
Project Mgr.: PHB Designed by: CAA Drawn by: LAF

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

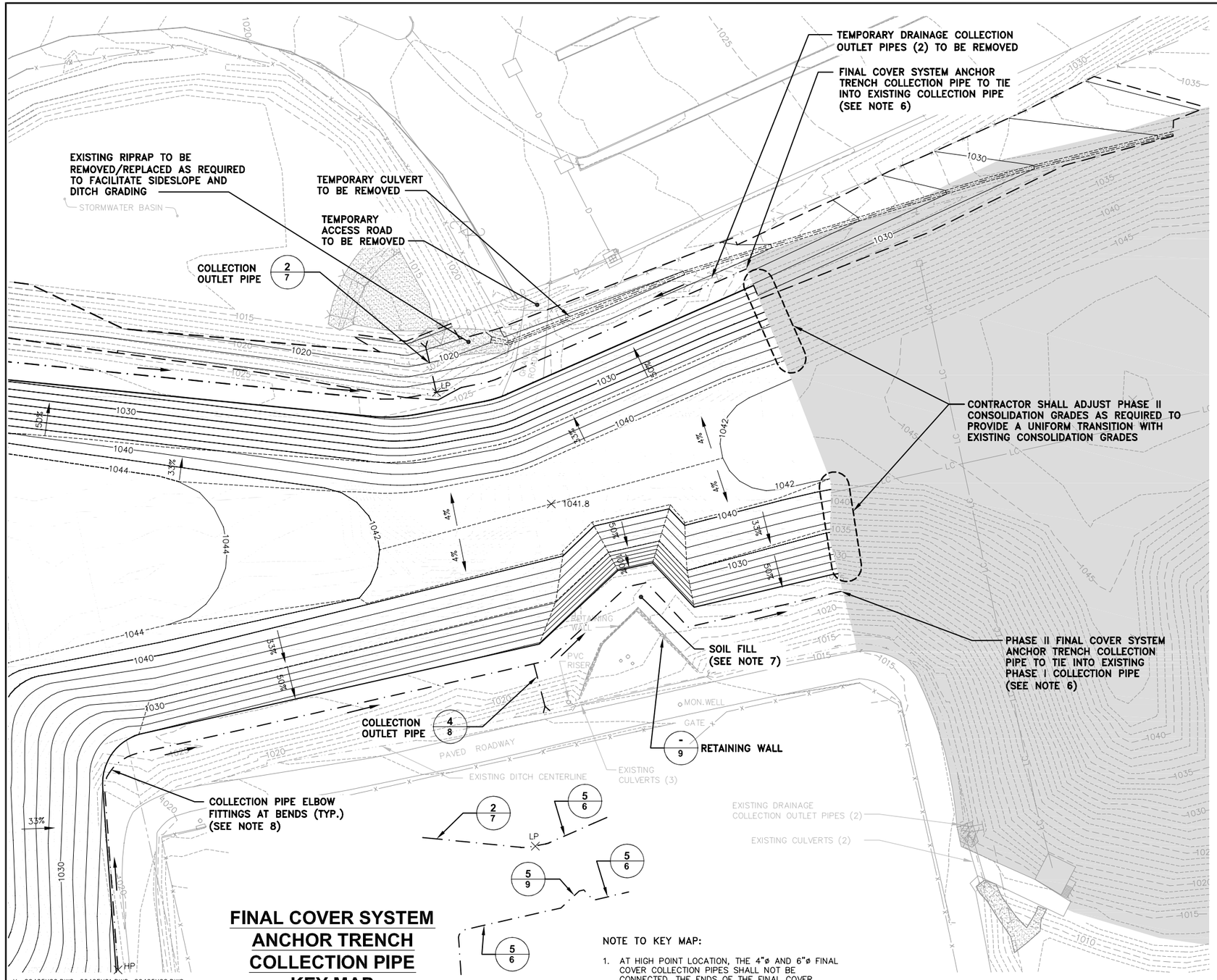
EXISTING SITE PLAN

GENERAL

BBL Project No. 204.05
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

1



FINAL COVER SYSTEM ANCHOR TRENCH COLLECTION PIPE KEY MAP

NOT TO SCALE

NOTE TO KEY MAP:

1. AT HIGH POINT LOCATION, THE 4"ø AND 6"ø FINAL COVER COLLECTION PIPES SHALL NOT BE CONNECTED. THE ENDS OF THE FINAL COVER COLLECTION PIPES SHALL BE COVERED WITH HDPE ENDCAPS AT THE HIGH POINT.

X: 20405X00.DWG, 20405X01.DWG, 20405X02.DWG
L: ON=*, OFF=*REF, X02|TEXT_40*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD TJR LAF
N/20405001/OPCA/20405G02.DWG

LEGEND:

- HP — PROPOSED HIGH POINT
- LP — PROPOSED LOW POINT
- 1030 — PROPOSED INDEX CONTOUR LINE
- PROPOSED INTERMEDIATE CONTOUR LINE
- 1041.8 — PROPOSED SPOT ELEVATION
- 3/8 — DETAIL REFERENCE NUMBER / DRAWING REFERENCE NUMBER
- 1 — SURVEY CONSTRUCTION CONTROL POINT (SEE TABLE ON THIS DRAWING)
- PROPOSED GRADE BREAK
- FINAL COVER SYSTEM ANCHOR TRENCH COLLECTION PIPE AND FLOW DIRECTION 5/6 3/7
- LIMIT OF CONSOLIDATION MATERIAL PLACEMENT
- APPROXIMATE LIMIT OF GRADING
- PHASE I FINAL COVER (PREVIOUSLY CONSTRUCTED)
- PROPOSED DITCH CENTERLINE

SURVEY CONTROL INFORMATION CONSTRUCTION POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	AS-BUILT ELEV.*	DESCRIPTION
		TO BE PROVIDED TO CONTRACTOR AT TIME OF CONSTRUCTION			

* AS-BUILT INFORMATION TO BE COMPLETED BY CONTRACTOR AND INCLUDED WITH RECORD DRAWINGS.

NOTES:

1. SEE DRAWING 1 FOR ADDITIONAL BASEMAP INFORMATION.
2. PROPOSED GRADES/ELEVATIONS SHOWN REPRESENT THE TOP OF FINAL CONSOLIDATED SOIL MATERIAL (I.E., BOTTOM OF FINAL COVER GEOSYNTHETICS).
3. SURVEY TOLERANCE IS ±0.05' UNLESS OTHERWISE APPROVED BY GE OR GE'S REPRESENTATIVE.
4. CONTRACTOR SHALL NOTE THAT ALTHOUGH A PRE-CONSTRUCTION SURVEY HAS BEEN PERFORMED BY OTHERS, ANY NOTED DISCREPANCIES SHALL BE BROUGHT TO GE'S ATTENTION AND ADDRESSED ACCORDINGLY.
5. SEE DRAWING 4 FOR PERIMETER GRADING AND STORMWATER MANAGEMENT FEATURES.
6. EXISTING AND NEW COLLECTION PIPES SHALL BE CONNECTED USING COMPATIBLE FITTINGS AS SPECIFIED BY THE PIPE MANUFACTURER.
7. CONTRACTOR TO CONTINUE CONSTRUCTION OF RETAINING WALL AND PLACEMENT OF ADJACENT SOIL FILL AS REQUIRED TO MAINTAIN IN-PLACE STABILITY OF CONSOLIDATION MATERIAL. CONSOLIDATION MATERIAL AND SOIL FILL TO BE PLACED IN A MANNER THAT AVOIDS DISCHARGE OF STORMWATER RUNOFF BEYOND THE LIMIT OF CONSOLIDATION.
8. ELBOW FITTINGS (45 OR 90 DEGREE) TO BE INSTALLED WHERE NECESSARY TO PROVIDE A SMOOTH FLOW TRANSITION. COLLECTION PIPE SHALL NOT BE BENT IN A MANNER WHICH COULD CAUSE KINKING OR BULKING OF THE INSTALLED PIPE.

Graphic Scale
30' 0 30' 60'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss
Professional Engineer's No.	38000
State	MASS.
Date Signed	
Project Mgr.	PHB
Designed by	CAA
Drawn by	LAF

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

CONSOLIDATION GRADING PLAN BUILDING 71

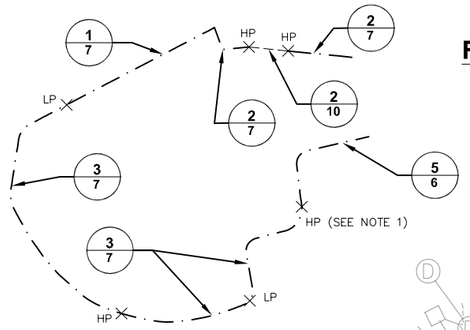
GENERAL

BBL Project No. 204.05
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

FINAL COVER SYSTEM ANCHOR TRENCH COLLECTION PIPE KEY MAP

NOT TO SCALE



NOTE TO KEY MAP:

1. AT HIGH POINT LOCATION, THE 4"ø AND 6"ø FINAL COVER COLLECTION PIPES SHALL NOT BE CONNECTED. THE ENDS OF THE FINAL COVER COLLECTION PIPES SHALL BE COVERED WITH HDPE ENDCAPS AT THE HIGH POINT.

LEGEND:

- HP — PROPOSED HIGH POINT
- LP — PROPOSED LOW POINT
- 1030 — PROPOSED INDEX CONTOUR LINE
- PROPOSED INTERMEDIATE CONTOUR LINE
- 1048.0 — PROPOSED SPOT ELEVATION
- 4/7 — DETAIL REFERENCE NUMBER / DRAWING REFERENCE NUMBER
- 1 — SURVEY CONSTRUCTION CONTROL POINT (SEE TABLE ON THIS DRAWING)
- PROPOSED GRADE BREAK
- FINAL COVER SYSTEM ANCHOR TRENCH COLLECTION PIPE (SEE FINAL COVER SYSTEM COLLECTION PIPE KEY MAP)
- LIMIT OF CONSOLIDATION MATERIAL PLACEMENT
- APPROXIMATE LIMIT OF GRADING
- PROPOSED RIPRAP

SURVEY CONTROL INFORMATION CONSTRUCTION POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	AS-BUILT ELEV.*	DESCRIPTION
		TO BE PROVIDED TO CONTRACTOR AT TIME OF CONSTRUCTION			

* AS-BUILT INFORMATION TO BE COMPLETED BY CONTRACTOR AND INCLUDED WITH RECORD DRAWINGS.

NOTES:

1. SEE DRAWING 1 FOR ADDITIONAL BASEMAP INFORMATION.
2. PROPOSED GRADES/ELEVATIONS SHOWN REPRESENT THE TOP OF FINAL CONSOLIDATED SOIL MATERIAL (I.E., BOTTOM OF FINAL COVER GEOSYNTHETICS).
3. SURVEY TOLERANCE IS ±0.05' UNLESS OTHERWISE APPROVED BY GE OR GE'S REPRESENTATIVE.
4. CONTRACTOR SHALL NOTE THAT ALTHOUGH A PRE-CONSTRUCTION SURVEY HAS BEEN PERFORMED BY OTHERS, ANY DISCREPANCIES NOTED BY THE CONTRACTOR EITHER PRIOR TO OR DURING PERFORMANCE OF THE PROJECT WORK SHALL BE BROUGHT TO GE'S ATTENTION AND ADDRESSED ACCORDINGLY.
5. SEE DRAWING 5 FOR PERIMETER GRADING AND STORMWATER MANAGEMENT FEATURES.
6. FINAL COVER TO EXTEND OVER ANOMOLY AS SHOWN ON DRAWING 10, DETAIL 2.

X: 20405X00.DWG, 20405X01.DWG, 20405X02.DWG
L: ON=*, OFF=*REF, X02|*PIECE, |TEXT_3D*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD TJR LAF
N/20405001/OPCA/20405G03.DWG

Graphic Scale
40' 0 40' 80'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	Designed by	Drawn by
PHB	CAA	LAF

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

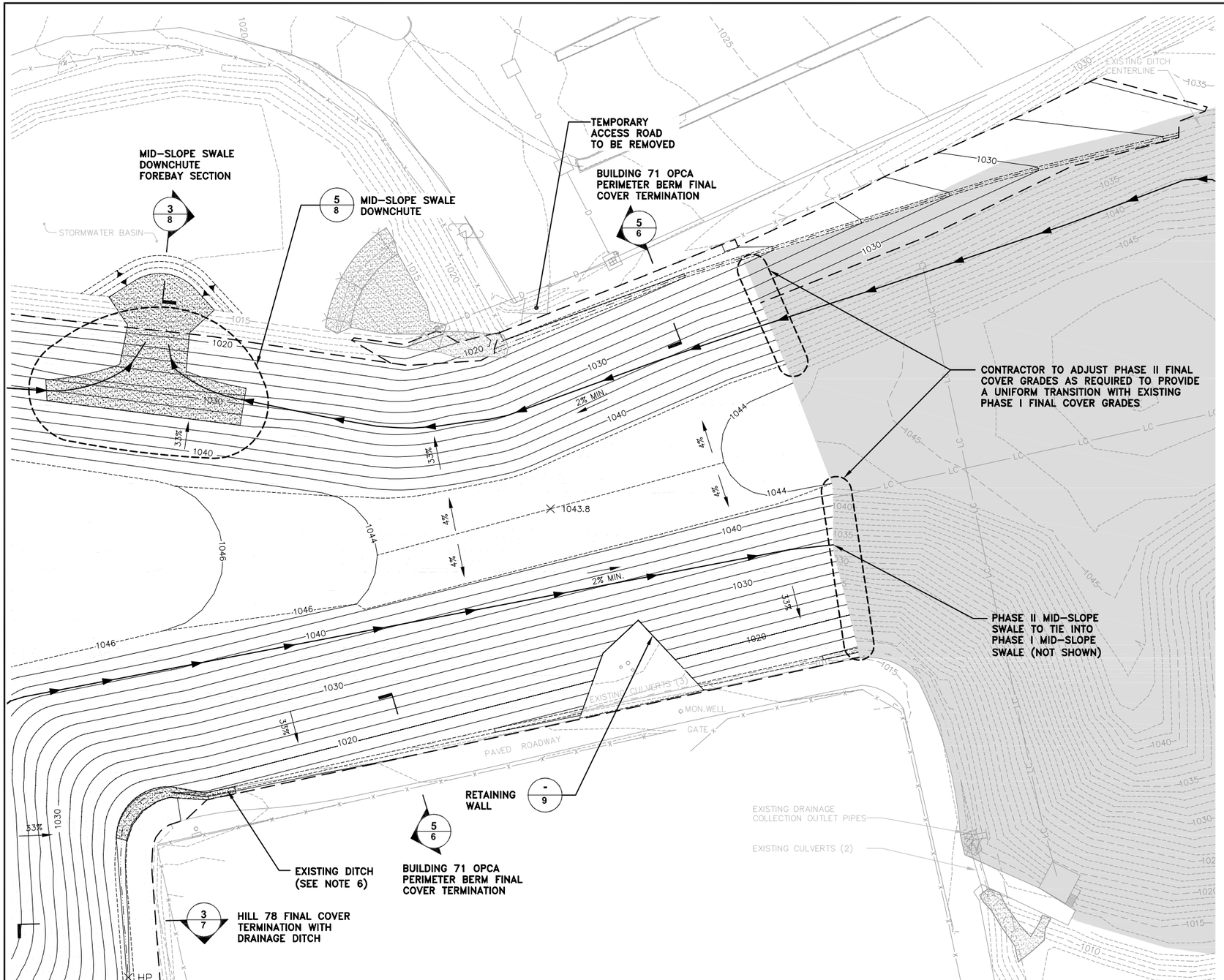
CONSOLIDATION GRADING PLAN
HILL 78

GENERAL

BBL Project No. 204.05
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

3



X: 20405X00.DWG, 20405X01.DWG, 20405X03.DWG
L: ON=*, OFF=*REF, X03|TEXT_40*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD TJR LAF
N/20405001/OPCA/20405G04.DWG

LEGEND:

- HP — PROPOSED HIGH POINT
- LP — PROPOSED LOW POINT
- 1030 — PROPOSED INDEX CONTOUR LINE
- PROPOSED INTERMEDIATE CONTOUR LINE
- 1043.8 — PROPOSED SPOT ELEVATION
- 3/8 — DETAIL REFERENCE NUMBER / DRAWING REFERENCE NUMBER
- SURVEY CONSTRUCTION CONTROL POINT (SEE TABLE ON THIS DRAWING)
- PROPOSED GRADE BREAK
- PROPOSED DITCH CENTERLINE
- APPROXIMATE LIMIT OF GRADING
- PROPOSED MID-SLOPE SWALE — 1/8
- PROPOSED RIPRAP
- PHASE I FINAL COVER (PREVIOUSLY CONSTRUCTED)

SURVEY CONTROL INFORMATION CONSTRUCTION POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	AS-BUILT ELEV.*	DESCRIPTION

TO BE PROVIDED TO CONTRACTOR AT TIME OF CONSTRUCTION

* AS-BUILT INFORMATION TO BE COMPLETED BY CONTRACTOR AND INCLUDED WITH RECORD DRAWINGS.

NOTES:

1. SEE DRAWING 1 FOR BASEMAP INFORMATION.
2. SEE DRAWING 2 FOR ADDITIONAL DESIGN INFORMATION.
3. SURVEY TOLERANCE IS ±0.05' UNLESS OTHERWISE APPROVED BY GE OR GE'S REPRESENTATIVE.
4. PROPOSED GRADES/ELEVATIONS SHOWN REPRESENT TOP OF FINAL COVER SYSTEM.
5. BASED ON PREVIOUS DISCUSSIONS WITH THE EPA, EARTHWORK ACTIVITIES ASSOCIATED WITH FINAL COVER SUBBASE GRADING WILL BE LIMITED TO APPROXIMATELY ONE ACRE IN SIZE AT ANY GIVEN TIME. FURTHER SUBBASE GRADING WILL CONTINUE ONCE A PORTION OF THE ONE ACRE AREA IS COMPLETED WITH EITHER 6 INCHES OF CLEAN SOIL FILL OR LINER MATERIAL.
6. EXISTING AND PROPOSED DITCH TIE-IN TO BE GRADED TO PROVIDE A UNIFORM AND SMOOTH FLOW TRANSITION.

Graphic Scale
30' 0 30' 60'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	Designed by	Drawn by
PHB	CAA	LAF

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

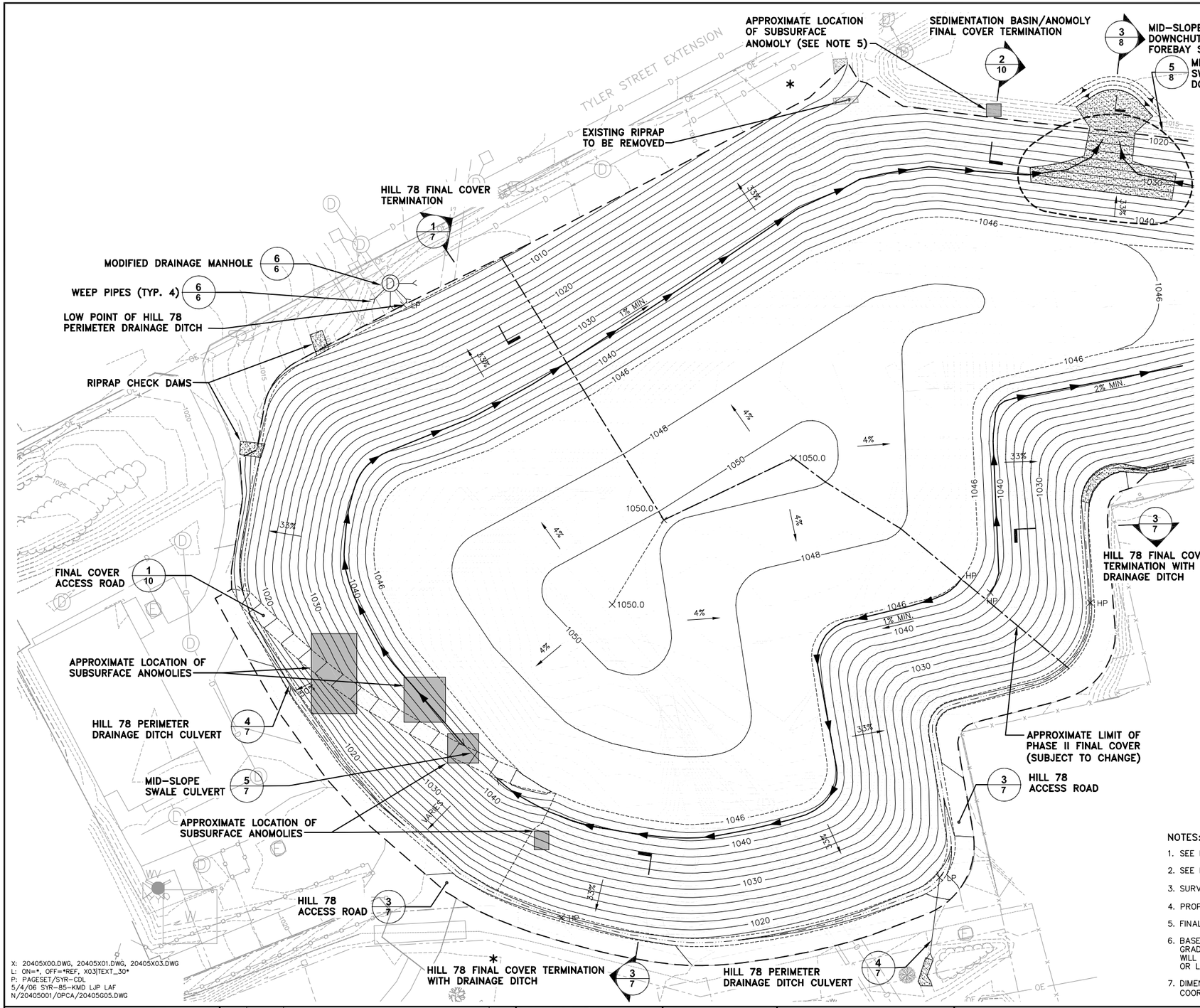
FINAL COVER GRADING PLAN BUILDING 71

GENERAL

BBL Project No. 204.05
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

4



X: 20405X00.DWG, 20405X01.DWG, 20405X03.DWG
L: ON=*, OFF=*REF, X03|TEXT_30*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD LJP LAF
N/20405001/OPCA/20405G05.DWG

LEGEND:

- HP — PROPOSED HIGH POINT
- LP — PROPOSED LOW POINT
- 1030 — PROPOSED INDEX CONTOUR LINE
- PROPOSED INTERMEDIATE CONTOUR LINE
- 1050.0 — PROPOSED SPOT ELEVATION
- 3/8 — DETAIL REFERENCE NUMBER / DRAWING REFERENCE NUMBER
- 1 — SURVEY CONSTRUCTION CONTROL POINT (SEE TABLE ON THIS DRAWING)
- PROPOSED GRADE BREAK
- HILL 78 PERIMETER DRAINAGE DITCH 4/8
- APPROXIMATE LIMIT OF GRADING
- PROPOSED MID-SLOPE SWALE 1/8
- PROPOSED RIPRAP
- * BLUEBIRD HOUSE 3/10

SURVEY CONTROL INFORMATION CONSTRUCTION POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	AS-BUILT ELEV.*	DESCRIPTION

TO BE PROVIDED TO CONTRACTOR AT TIME OF CONSTRUCTION

* AS-BUILT INFORMATION TO BE COMPLETED BY CONTRACTOR AND INCLUDED WITH RECORD DRAWINGS.

NOTES:

1. SEE DRAWING 1 FOR BASEMAP INFORMATION.
2. SEE DRAWING 3 FOR ADDITIONAL DESIGN INFORMATION.
3. SURVEY TOLERANCE IS ±0.05' UNLESS OTHERWISE APPROVED BY GE OR GE'S REPRESENTATIVE.
4. PROPOSED GRADES/ELEVATIONS SHOWN REPRESENT TOP OF FINAL COVER SYSTEM.
5. FINAL COVER TO EXTEND OVER ANOMOLY AS SHOWN ON DRAWING 10, DETAIL 2.
6. BASED ON PREVIOUS DISCUSSIONS WITH THE EPA, EARTHWORK ACTIVITIES ASSOCIATED WITH FINAL COVER SUBBASE GRADING WILL BE LIMITED TO APPROXIMATELY ONE ACRE IN SIZE AT ANY GIVEN TIME. FURTHER SUBBASE GRADING WILL CONTINUE ONCE A PORTION OF THE ONE ACRE AREA IS COMPLETED WITH EITHER 6 INCHES OF CLEAN SOIL FILL OR LINER MATERIAL.
7. DIMENSIONS OF RIPRAP CHECK DAMS TO BE DETERMINED IN THE FIELD AT TIME OF CONSTRUCTION AND IN COORDINATION WITH GE OR GE'S REPRESENTATIVE.

Graphic Scale: 40' 0 40' 80'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss
Professional Engineer's No.	38000
State	MASS.
Date Signed	
Project Mgr.	PHB
Designed by	CAA
Drawn by	LAF

BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS

HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

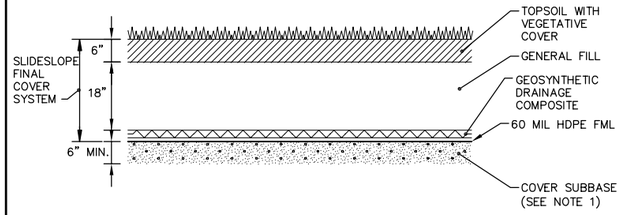
FINAL COVER GRADING PLAN
HILL 78

GENERAL

BBL Project No. 204.05

Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

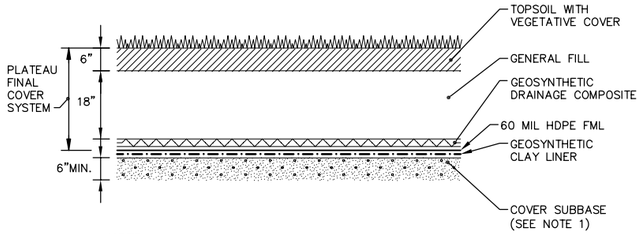


NOTE:

1. COVER SUBBASE SHALL CONSIST OF SUITABLE CONSOLIDATED SOIL MATERIAL HAVING A MAXIMUM PARTICLE SIZE OF 3 INCHES OR LESS.

SIDESLOPE FINAL COVER SYSTEM (1)

NOT TO SCALE

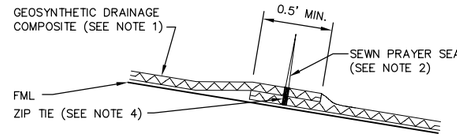


NOTE:

1. COVER SUBBASE SHALL CONSIST OF SUITABLE CONSOLIDATED SOIL MATERIAL HAVING A MAXIMUM PARTICLE SIZE OF 3 INCHES OR LESS.

PLATEAU FINAL COVER SYSTEM (2)

NOT TO SCALE

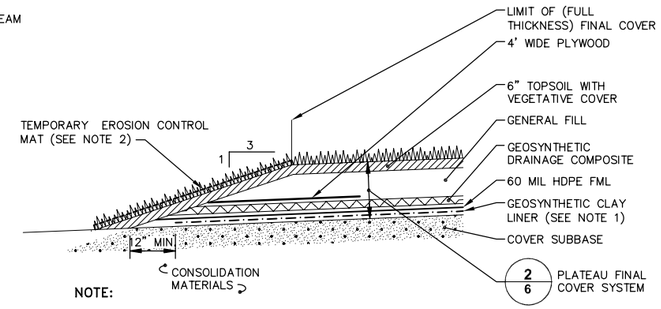


NOTES:

1. ALL GEOSYNTHETIC DRAINAGE COMPOSITE SHALL SHINGLE DOWNSLOPE AS SHOWN.
2. THE TOP GEOTEXTILE LAYER OF THE GEOSYNTHETIC DRAINAGE COMPOSITE IS TO BE PEELED BACK SO THAT A PRAYER SEAM MAY BE SEWN ABOVE THE GEOCOMPOSITE OVERLAP.
3. IF GEOTEXTILE IS UNABLE TO BE PEELED BACK WITHOUT CAUSING DAMAGE, A PATCH OF GEOTEXTILE SHALL BE HEAT BONDED TO THE TOP GEOTEXTILE LAYER OF THE GEOCOMPOSITES OVER THE SEAM.
4. ZIP TIES SHALL BE PLACED EVERY 5' ALONG ADJACENT PANELS AND EVERY 6" ALONG BUTT SEAMS AND IN ANCHOR TRENCHES.

TYPICAL GEOSYNTHETIC DRAINAGE COMPOSITE SEAM (3)

NOT TO SCALE

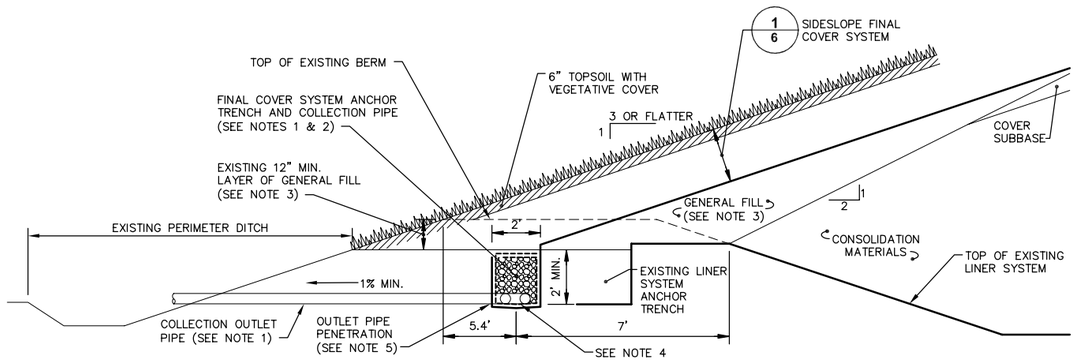


NOTE:

1. GEOSYNTHETIC CLAY LINER IS PRESENT ONLY IN THE PLATEAU FINAL COVER SYSTEM.
2. TEMPORARY EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN S150 OR EQUAL.

TEMPORARY FINAL COVER TERMINATION (4)

NOT TO SCALE

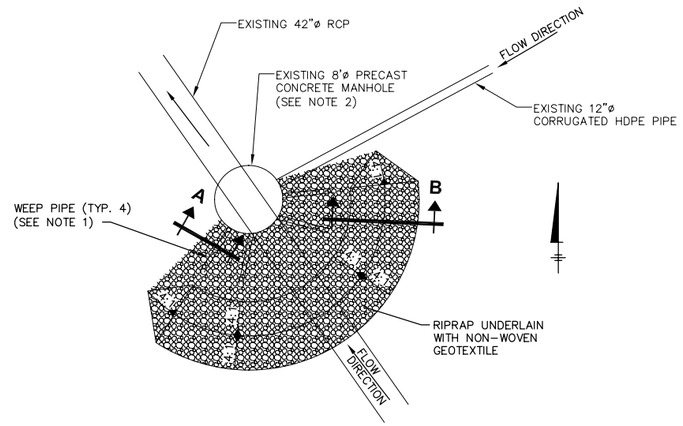


NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 4"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3. OUTLET PIPES SHALL BE TWO 4"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%. OUTLET PIPES SHALL TEE INTO THE FINAL COVER COLLECTION PIPE.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. EXISTING LAYER OF SOIL ON PERIMETER BERM TO BE REMOVED/REGRADED AS NECESSARY TO FACILITATE FINAL COVER CONSTRUCTION. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM GEOSYNTHETICS.
4. THE INSIDE AND OUTSIDE FINAL COVER COLLECTION PIPES TO BE OUTLETTED SEPARATELY USING 90° ELBOW FITTINGS.
5. CONTRACTOR TO CONSTRUCT WATER TIGHT SEAL AT OUTLET PIPE/FLEXIBLE MEMBRANE LINER PENETRATION. CONTRACTOR TO SUBMIT TECHNICAL INFORMATION AND CONSTRUCTION METHODOLOGY TO GE'S REPRESENTATIVE FOR REVIEW AND ACCEPTANCE PRIOR TO INSTALLATION.

BUILDING 71 OPCA PERIMETER BERM FINAL COVER TERMINATION (5)

NOT TO SCALE

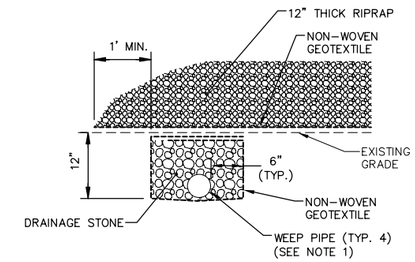


NOTES:

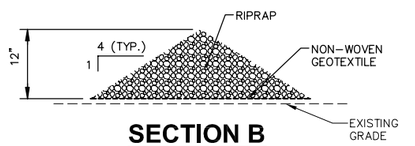
1. WEEP PIPES SHALL BE RIGID 6"ø PERFORATED CORRUGATED HDPE PIPES.
2. THE EXISTING PRECAST CONCRETE MANHOLE SHALL BE BORED WITH CARE TO ALLOW FOR INSTALLATION OF WEEP PIPES. ANY DAMAGE TO THE MANHOLE SHALL BE REPAIRED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE.

MODIFIED DRAINAGE MANHOLE (6)

NOT TO SCALE



SECTION A



SECTION B

GENERAL NOTES:

1. GEOSYNTHETICS ARE SHOWN AT AN EXAGERATED SCALE FOR CLARITY.

X: 20405X00.DWG
L: ON=*, OFF=*REF*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD LJP LAF
N/20405001/OPCA/20405006.DWG

Graphic Scale: SCALE AS NOTED

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	Designed by	Drawn by
PHB	CAA	KMD

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS

HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

FINAL COVER DETAILS

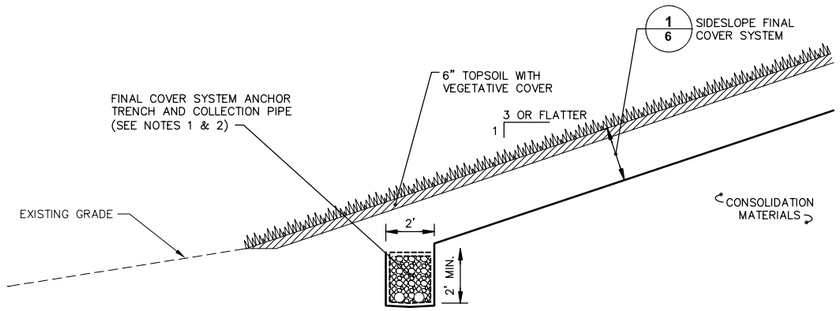
GENERAL

BBL Project No. 204.05

Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

6



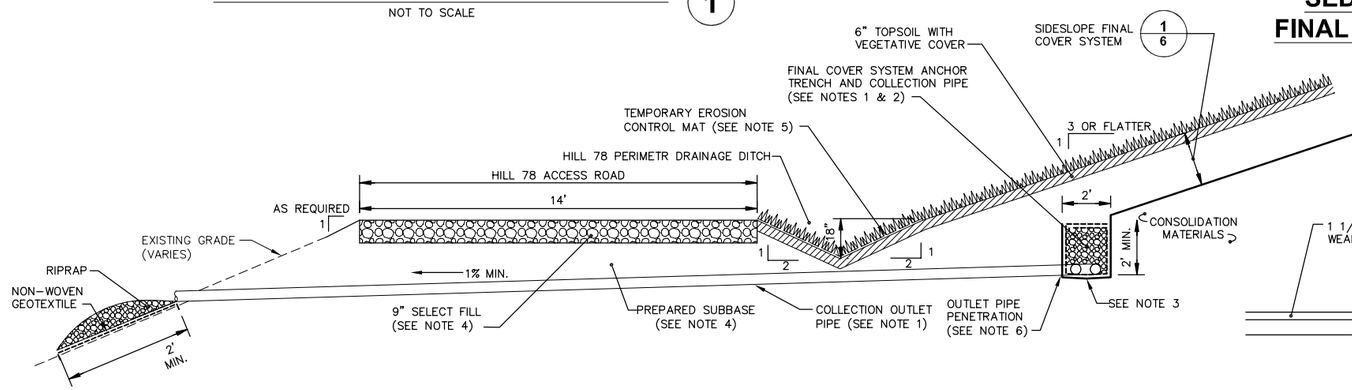
NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 6"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 4 AND 5.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.

HILL 78 FINAL COVER TERMINATION

NOT TO SCALE

1



HILL 78 FINAL COVER TERMINATION WITH DRAINAGE DITCH

NOT TO SCALE

3

NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 6"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3. OUTLET PIPES SHALL BE TWO 6"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%. OUTLET PIPES SHALL TEE INTO THE FINAL COVER COLLECTION PIPE.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. THE INSIDE FINAL COVER COLLECTION PIPE WILL BE CONNECTED TO THE OUTER FINAL COVER COLLECTION PIPE USING A TEE CONNECTION AND APPROPRIATE FITTINGS AS SPECIFIED BY THE PIPE MANUFACTURER AT THE COLLECTION OUTLET PIPE LOCATION.
4. THE EXISTING GRAVEL ROAD MATERIAL MAY BE SUITABLE FOR USE AS THE PREPARED SUBBASE AND SELECT FILL FOR THE CONSTRUCTION OF THE ACCESS ROAD. THIS SHALL BE DETERMINED AT THE TIME OF CONSTRUCTION WITH GE'S APPROVAL. THE THICKNESS OF THE SELECT FILL MAY VARY BASED ON THE SUITABILITY OF THE EXISTING GRAVEL ROAD MATERIAL.
5. TEMPORARY EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN S150 OR EQUAL.
6. CONTRACTOR TO CONSTRUCT WATER TIGHT SEAL AT OUTLET PIPE/FLEXIBLE MEMBRANE LINER PENETRATION. CONTRACTOR TO SUBMIT TECHNICAL INFORMATION AND CONSTRUCTION METHODOLOGY TO GE'S REPRESENTATIVE FOR REVIEW AND ACCEPTANCE PRIOR TO INSTALLATION.

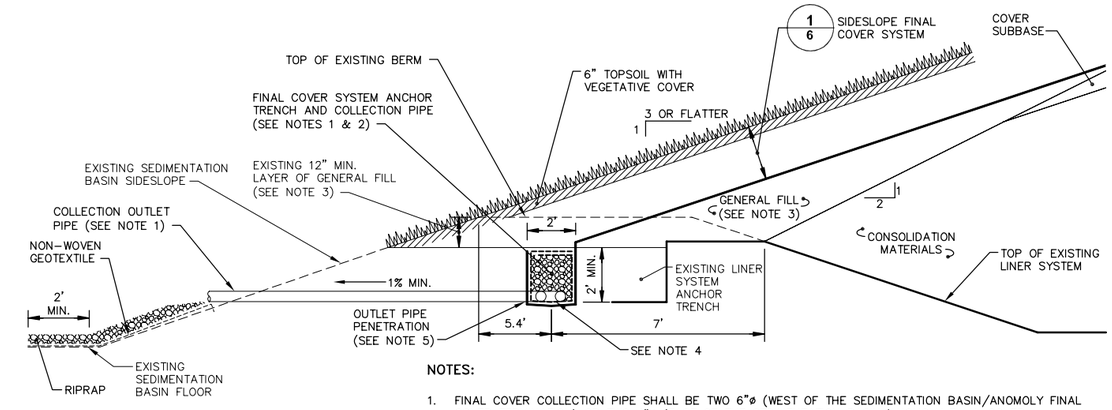
GENERAL NOTES:

1. GEOSYNTHETICS ARE SHOWN AT AN EXAGERATED SCALE FOR CLARITY.

SEDIMENTATION BASIN FINAL COVER TERMINATION

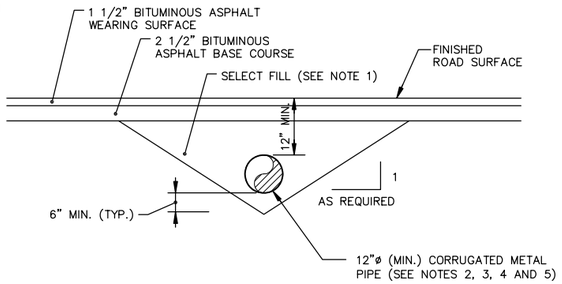
NOT TO SCALE

2



NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 6"ø (WEST OF THE SEDIMENTATION BASIN/ANOMOLY FINAL COVER TERMINATION) OR TWO 4"ø (EAST OF THE SEDIMENTATION BASIN/ANOMOLY FINAL COVER TERMINATION) PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWING 2. OUTLET PIPES SHALL BE TWO 4"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%. OUTLET PIPES SHALL TEE INTO THE FINAL COVER COLLECTION PIPE.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. EXISTING LAYER OF SOIL ON PERIMETER BERM TO BE REMOVED/REGRADED AS NECESSARY TO FACILITATE FINAL COVER CONSTRUCTION. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM GEOSYNTHETICS.
4. THE INSIDE FINAL COVER COLLECTION PIPE WILL BE CONNECTED TO THE OUTER FINAL COVER COLLECTION PIPE USING A TEE AND APPROPRIATE FITTINGS AS SPECIFIED BY THE PIPE MANUFACTURER AT THE COLLECTION OUTLET PIPE LOCATION.
5. CONTRACTOR TO CONSTRUCT WATER TIGHT SEAL AT OUTLET PIPE/FLEXIBLE MEMBRANE LINER PENETRATION. CONTRACTOR TO SUBMIT TECHNICAL INFORMATION AND CONSTRUCTION METHODOLOGY TO GE'S REPRESENTATIVE FOR REVIEW AND ACCEPTANCE PRIOR TO INSTALLATION.



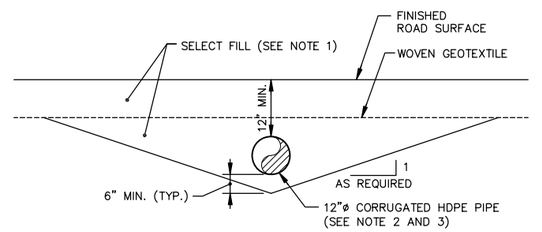
NOTES:

1. SELECT FILL SHALL BE COMPACTED DENSE GRADE CRUSHED STONE M2.01.7 OR EQUAL.
2. PIPE SHALL HAVE A MINIMUM SLOPE OF 1%.
3. THE INVERTS OF THE PIPE INSTALLED BENEATH THE FINAL COVER ACCESS ROAD SHALL MATCH THE INVERT OF THE HILL 78 PERIMETER DRAINAGE DITCH AT THE INLET AND OUTLET ENDS.
4. THE UPSTREAM INVERT OF THE PIPE INSTALLED AT THE LOW POINT OF THE HILL 78 PERIMETER DRAINAGE DITCH SHALL MATCH THE INVERT OF THE HILL 78 PERIMETER DRAINAGE DITCH AT THE INLET.
5. CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

HILL 78 PERIMETER DRAINAGE DITCH CULVERT

NOT TO SCALE

4



NOTES:

1. SELECT FILL SHALL BE COMPACTED DENSE GRADE CRUSHED STONE M2.01.7 OR EQUAL.
2. CORRUGATED HDPE PIPE SHALL BE ADS N-12 OR EQUIVALENT. CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3. THE INVERT OF THE PIPE SHALL MATCH THE INVERT OF THE MID-SLOPE SWALE AT INLET AND OUTLET ENDS.
4. CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

MID-SLOPE SWALE CULVERT

NOT TO SCALE

5

X: 20405X00.DWG
L: ON=*, OFF=*REF*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD LJP LAF
N/20405001/OPCA/20405G07.DWG

Graphic Scale

SCALE AS NOTED

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name: James M. Nuss
Professional Engineer's No.: 38000
State: MASS. Date Signed:
Project Mgr.: PHB Designed by: CAA Drawn by: KMD

BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

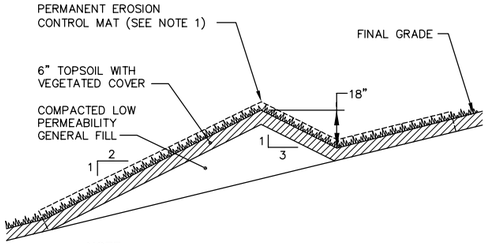
MISCELLANEOUS DETAILS

GENERAL

BBL Project No. 204.05
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

7



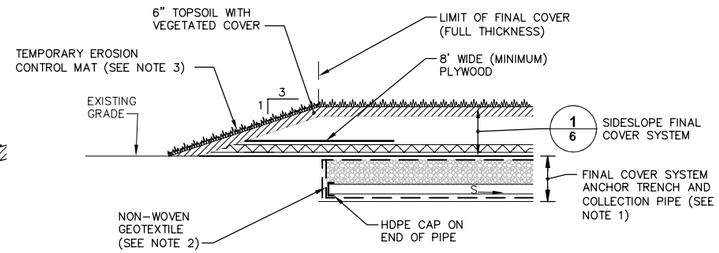
NOTE:

1. PERMANENT EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN P300 OR EQUAL.
2. MID-SLOPE SWALE TO BE CONSTRUCTED WITH A MINIMUM 1% INVERT SLOPE ON THE HILL 78 OPCA FINAL COVER AND A MINIMUM 2% INVERT SLOPE ON THE BUILDING 71 OPCA FINAL COVER.

MID-SLOPE SWALE

NOT TO SCALE

1



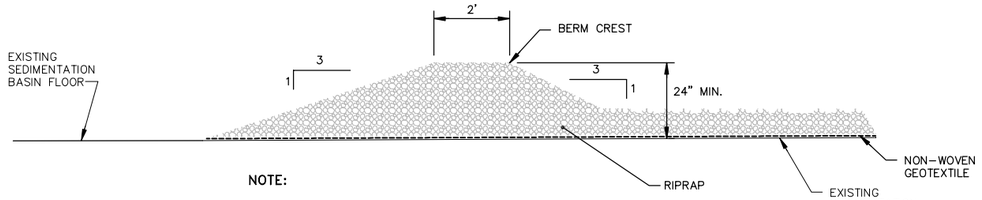
NOTES:

1. REFER TO DRAWINGS 4 AND 5 FOR ADDITIONAL INFORMATION PERTAINING TO THE FINAL COVER SYSTEM ANCHOR TRENCH AND COLLECTION PIPE.
2. GEOTEXTILE AT THE END OF THE ANCHOR TRENCH TO BE OVERLAPPED AS SHOWN.
3. TEMPORARY EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN S150 OR EQUAL.

TEMPORARY ANCHOR TRENCH COLLECTION PIPE TERMINATION

NOT TO SCALE

2



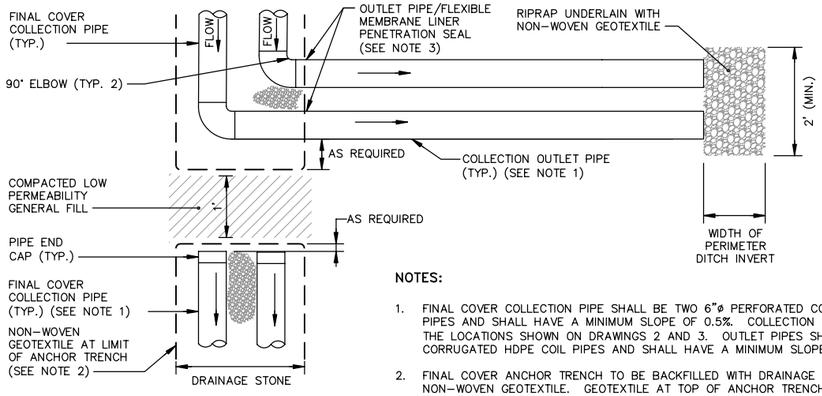
NOTE:

1. EXISTING TOPSOIL AND VEGETATION SHALL BE REMOVED PRIOR TO INSTALLATION OF NON-WOVEN GEOTEXTILE AND RIPRAP.

MID-SLOPE SWALE DOWNCHUTE FOREBAY SECTION

NOT TO SCALE

3



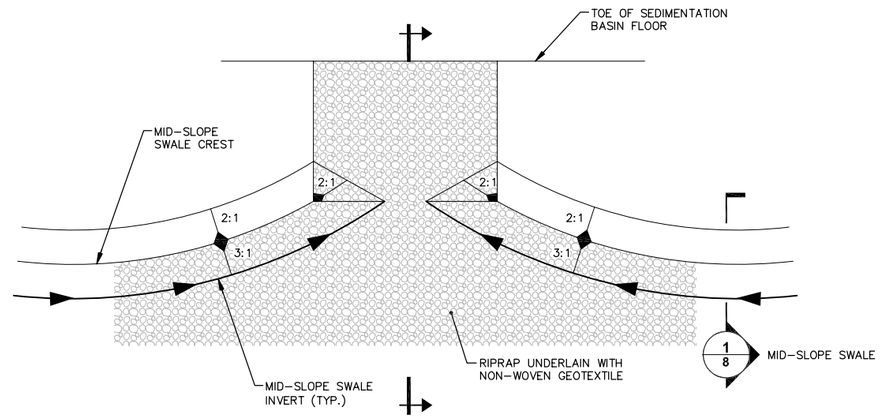
NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 6"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3. OUTLET PIPES SHALL BE TWO 6"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH.
3. CONTRACTOR TO CONSTRUCT WATER TIGHT SEAL AT OUTLET PIPE/FLEXIBLE MEMBRANE LINER PENETRATION. CONTRACTOR TO SUBMIT TECHNICAL INFORMATION AND CONSTRUCTION METHODOLOGY TO GE'S REPRESENTATIVE FOR REVIEW AND ACCEPTANCE PRIOR TO INSTALLATION.

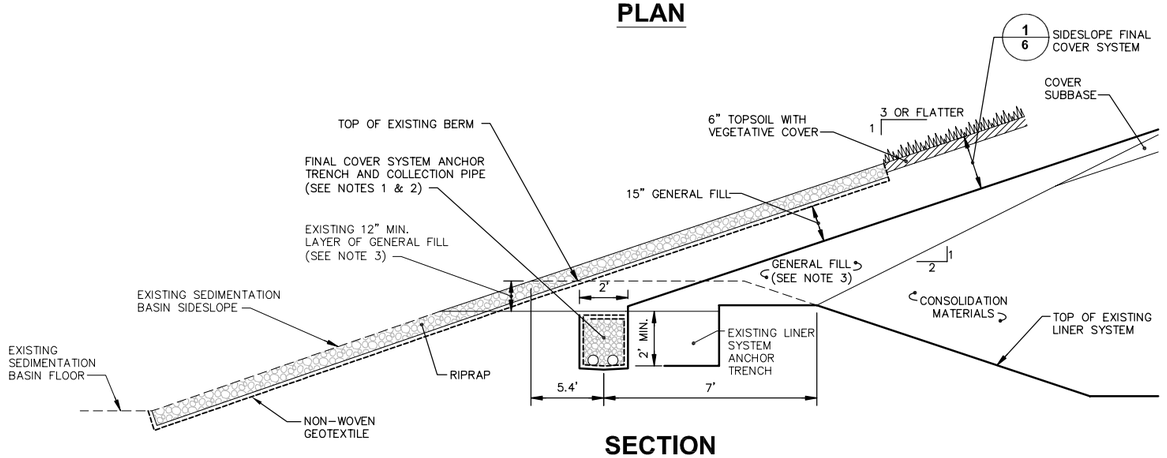
COLLECTION OUTLET PIPE

NOT TO SCALE

4



PLAN



SECTION

NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 4"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. EXISTING LAYER OF SOIL ON PERIMETER BERM TO BE REMOVED/REGRADED AS NECESSARY TO FACILITATE FINAL COVER CONSTRUCTION. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM GEOSYNTHETICS.

MID-SLOPE SWALE DOWNCHUTE

NOT TO SCALE

5

GENERAL NOTES:

1. GEOSYNTHETICS ARE SHOWN AT AN EXAGERATED SCALE FOR CLARITY.

X: 20405X00.DWG
L: ON=*, OFF=REF
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD KMD LAF
N/20405001/OPCA/20405G08.DWG

Graphic Scale

SCALE AS NOTED

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	Designed by	Drawn by
PHB	CAA	KMD

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS

HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

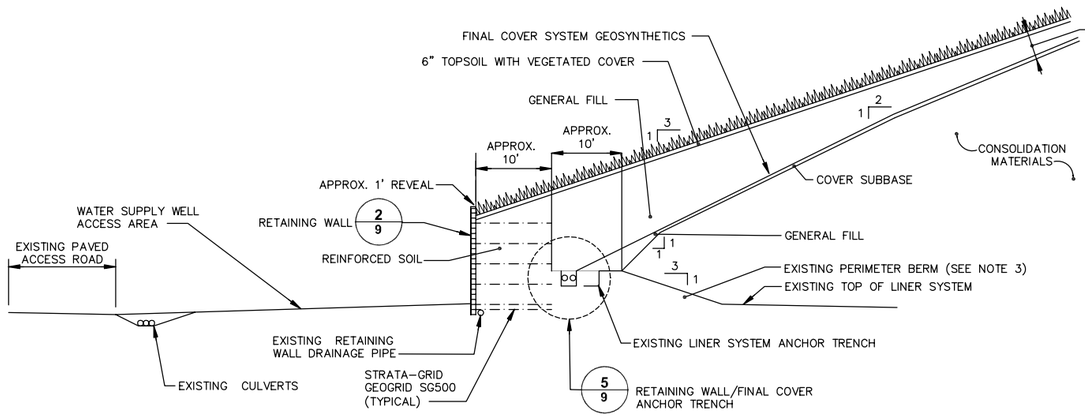
MISCELLANEOUS DETAILS

GENERAL

BBL Project No. 204.05

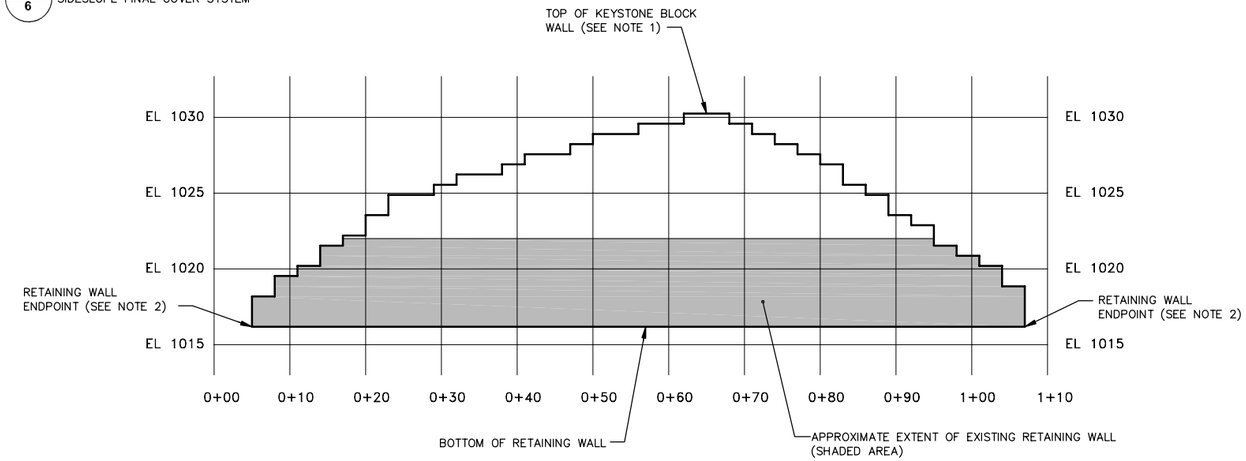
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120



RETAINING WALL FINAL COVER TERMINATION 1

NOT TO SCALE



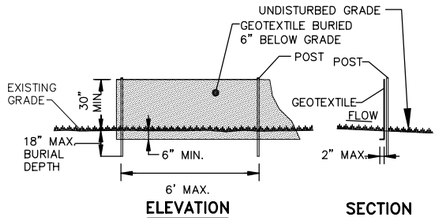
NOTES:

1. ACTUAL ELEVATION OF KEYSTONE BLOCK WALL AND NUMBER OF KEYSTONE BLOCKS AT A GIVEN LOCATION MAY VARY BASED ON FIELD CONDITIONS.
2. ACTUAL ENDPOINT OF KEYSTONE BLOCK WALL TO BE BASED ON EXISTING AS-BUILT CONDITIONS.

RETAINING WALL PROFILE 2

HORIZONTAL GRAPHIC SCALE 0 10' 20'

VERTICAL GRAPHIC SCALE 0 5' 10'



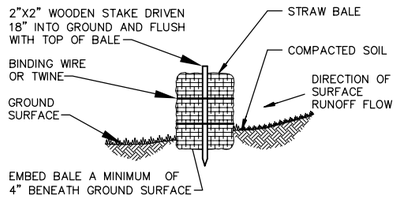
ELEVATION SECTION

NOTES:

1. SEDIMENT DEPOSITS SHALL BE REMOVED AS NECESSARY TO PREVENT DAMAGE TO THE SILT FENCE.
2. THE SILT FENCE WILL REMAIN IN-PLACE UNTIL GRADED AREAS ARE SUFFICIENTLY STABILIZED WITH VEGETATION.
3. THE SILT FENCE SHALL BE PLACED AT THE TOE OF ALL SLOPES AND IN OTHER AREAS AS REQUIRED TO MINIMIZE EROSION POTENTIAL.

SILT FENCE 3

NOT TO SCALE

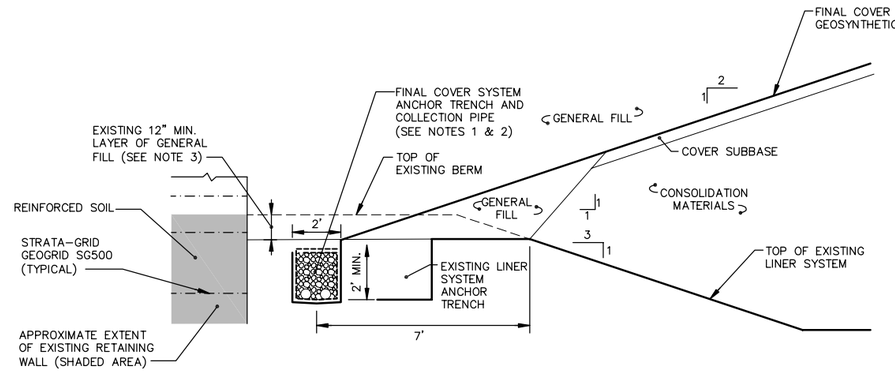


NOTES:

1. SEDIMENT DEPOSITS SHALL BE REMOVED AS NECESSARY TO PREVENT DAMAGE TO THE STRAW BALE.
2. THE STRAW BALE WILL REMAIN IN-PLACE UNTIL GRADED AREAS ARE SUFFICIENTLY STABILIZED WITH VEGETATION.

STRAW BALE 4

NOT TO SCALE



NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 4"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. EXISTING LAYER OF SOIL ON PERIMETER BERM TO BE REMOVED/REGRADED AS NECESSARY TO FACILITATE FINAL COVER CONSTRUCTION. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM GEOSYNTHETICS.

RETAINING WALL/FINAL COVER ANCHOR TRENCH 5

NOT TO SCALE

X: 20405X00.DWG
L: ON=*, OFF=REF
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD KMD LAF
N/20405001/OPCA/20405G09.DWG

Graphic Scale

SCALE AS NOTED

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	Designed by	Drawn by
PHB	CAA	KMD

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS

HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

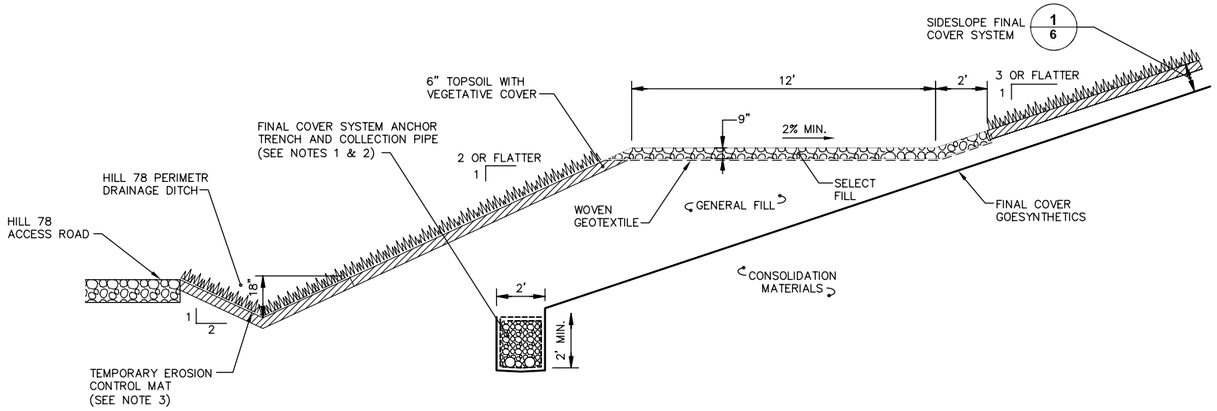
MISCELLANEOUS DETAILS

GENERAL

BBL Project No. 204.05

Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120



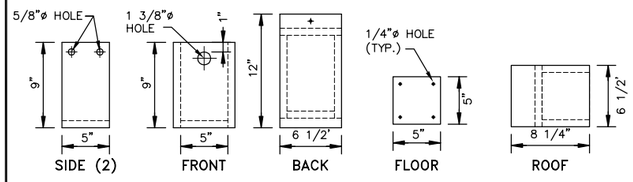
NOTES:

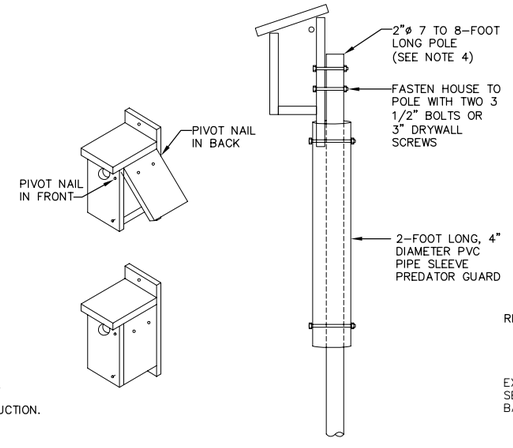
1. FINAL COVER COLLECTION PIPE SHALL BE TWO 6"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3. OUTLET PIPES SHALL BE TWO 6"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%. OUTLET PIPES SHALL TEE INTO THE FINAL COVER COLLECTION PIPE.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. TEMPORARY EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN S150 OR EQUAL.

FINAL COVER ACCESS ROAD

NOT TO SCALE

1





NOTES:

1. USE ONE NAIL OR SCREW AT BOTTOM TO CLOSE SIDE. NAIL OR SCREW SIDE CLOSED.
2. TWO "PIVOT" NAILS ALLOW SIDE TO SWING OUT FOR CLEANING.
3. BLUEBIRD HOUSE POSTS ARE TO BE INSTALLED AT LOCATIONS SHOWN ON DRAWING 5.
4. MATERIAL TO BE USED FOR THE POLE WILL BE SPECIFIED BY GE AT TIME OF CONSTRUCTION.
5. THE BLUEBIRD HOUSE SHALL BE CONSTRUCTED OF CEDAR.

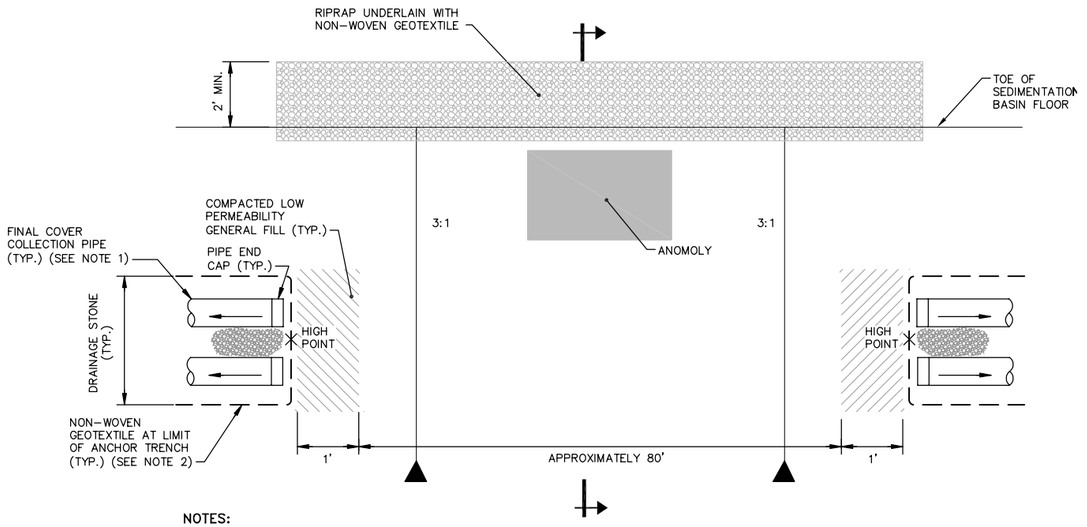
BLUEBIRD HOUSE

NOT TO SCALE

3

GENERAL NOTES:

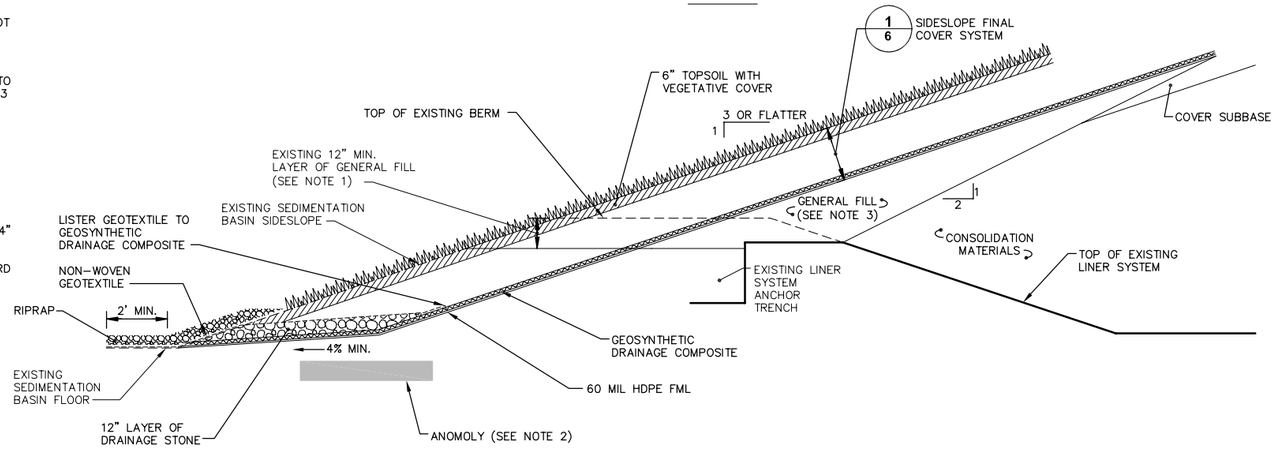
1. GEOSYNTHETICS ARE SHOWN AT AN EXAGERATED SCALE FOR CLARITY.



NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 6"ø (WEST OF THE ANOMOLY) OR 4"ø (EAST OF THE ANOMOLY) PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWINGS 2 AND 3. OUTLET PIPES SHALL BE TWO 6"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH.
3. HIGH POINTS REPRESENT CONDITION DEPICTED ON DRAWING 3.

PLAN



NOTES:

1. EXISTING LAYER OF SOIL ON PERIMETER BERM TO BE REMOVED/REGRADED AS NECESSARY TO FACILITATE FINAL COVER CONSTRUCTION. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM GEOSYNTHETICS.
2. LOCATION OF ANOMOLY SHOWN IS APPROXIMATE AND IS BASED ON THE PLANIMETRIC LOCATION OF THE ANOMOLY DEPICTED ON DRAWINGS 1, 3, AND 5.

SECTION
SEDIMENTATION BASIN/ANOMOLY FINAL COVER TERMINATION

NOT TO SCALE

2

X: 20405X00.DWG
L: ON=*, OFF=*REF*
P: PAGESET/SYR-CDL
5/4/06 SYR-85-KMD LJP LAF
N/20405001/OPCA/20405G10.DWG

Graphic Scale: SCALE AS NOTED		Professional Engineer's Name: James M. Nuss	GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN **MISCELLANEOUS DETAILS** GENERAL	BBL Project No. 204.05
THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. **USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.**		Professional Engineer's No.: 38000 State: MASS. Date Signed: Project Mgr.: PHB Designed by: CAA Drawn by: KMD		Date: APRIL 2006 Blasland, Bouck & Lee, Inc. Corporate Headquarters 6723 Towpath Road Syracuse, NY 13214 315-446-9120
No. Date Revisions Init				10

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

Attachment 2

Specifications

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

MATERIALS & PERFORMANCE SPECIFICATIONS

Section 01160 - Survey Control

Section 02200 - Earthwork

Section 02207 - Restoration of Surfaces

Section 02212 - Topsoil, Seeding and Mulch

Section 02219 - Geosynthetic Drainage Composite

Section 02222 - Soil Fill Materials

Section 02232 - Geotextile Fabric

Section 02233 - Silt Fencing

Section 02234 - Flexible Membrane Liner

Section 02271 - Riprap

Section 02413 - Geosynthetic Clay Liner

April 2006 *Addendum to OPCA Work Plan*

MATERIALS AND PERFORMANCE - SECTION 01160

SURVEY CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Survey control for construction purposes is provided on the Technical Drawings. The Contractor shall safeguard all survey points and bench marks. Should any of these points be destroyed, the replacement cost shall be borne by the Contractor. The Contractor shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established survey points and bench marks.

B. The Contractor shall be responsible for the layout of any additional survey controls, grid coordinate locations, lines, grades, and elevations necessary for the proper construction and testing of the work called for by the Technical Drawings and Specifications, at no additional cost to GE. Survey activities shall include, but not be limited to: maintaining appropriate slopes and specified layer thicknesses.

C. Vertical survey tolerance to be maintained during construction is 0.05 feet unless otherwise approved by GE or GE's Representative.

D. The Contractor shall employ a Massachusetts licensed surveyor to provide the surveying functions necessary for the proper construction and documentation of the work.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. All labor, materials, services, and equipment necessary to complete the earthwork activities called for by the Technical Drawings and specifications or as requested by GE or GE's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02207 - Restoration of Surfaces
B. Section MP-02222 - Soil Fill Materials

1.03 SUBMITTALS

A. Contractor's proposed method(s) of compaction and equipment.

1.04 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

A. American Society for Testing and Materials (ASTM)

1.05 DEFINITION

A. Earthwork is defined to include, but is not limited to, clearing, pavement removal, rough grading, excavation for subgrades, trenching, handling and disposal of surplus materials, maintenance of excavations, removal of water, backfilling operations, embankments and fills, and compaction.

PART 2 - PRODUCTS

Specified elsewhere.

PART 3 - EXECUTION

3.01 UNAUTHORIZED EXCAVATION

A. The Contractor shall not be entitled to any compensation for excavations carried beyond or below the lines and subgrades prescribed on the Technical Drawings. The Contractor shall refill such unauthorized excavations at its own expense and in conformance with the provisions of this specification.

B. Should the Contractor, through negligence or for reasons of its own, carry its excavation below the designated subgrade, appropriate materials specified in MP Section 02222 - Soil Fill Materials shall be furnished and placed as backfill in sufficient quantities to re-establish the required subgrade surface. Soil fill materials used for backfilling shall be spread and compacted in conformance with the requirements of the specification. The cost of any tests required as a result of this refilling operation shall be borne by the Contractor.

C. All material which slides, falls, or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense, and no extra compensation will be paid to the Contractor for any materials ordered for refilling the void areas left by the slide, fall, or cave-in.

3.02 BACKFILL MATERIALS

A. Soil fill material shall be used as specified for backfill, and when excavated material cannot be used as backfill. Requirements for off-site soil fill materials are specified in MP Section 02222 - Soil Fill Materials.

B. If the excavated material on-site is approved in advance by GE or GE's Representative for reuse and as being suitable for filling or backfilling purposes, it shall be used as general fill material.

C. On-site material is designated as "native fill" or "existing soil" material.

D. When on-site material is used, the Contractor shall remove all frozen material, boulders (over 6-inch diameter), trash, and debris, from such material prior to placement.

E. If it so elects, the Contractor may, at its own expense, substitute other types of material specified elsewhere in place of native fill material, provided such substitution is approved in advance by GE or GE's Representative.

3.03 GENERAL BACKFILLING REQUIREMENTS

A. Backfilling shall be started at the lowest section of the area to be backfilled so that fill is placed in an upslope direction only.

B. Drainage controls for the areas being backfilled shall be maintained at all times.

C. Areas to be backfilled shall be inspected prior to backfilling operations. All unsuitable materials and debris shall be removed.

D. Backfill material shall be inspected prior to placement and all roots, vegetation, organic matter, or other foreign debris shall be removed.

E. Stones larger than 6 inches in any dimension shall be removed or broken.

F. Stones shall not be allowed to form clusters with voids.

G. Backfill material shall not be placed when moisture content is too high to allow proper compaction.

H. When material is too dry for adequate compaction, water shall be added to the extent necessary.

I. No backfill material shall be placed on frozen ground nor shall the material itself be frozen or contain frozen soil fragments when placed.

J. No calcium chloride or other chemicals shall be added to prevent freezing.

K. Material incorporated in the backfilling operation that is not in satisfactory condition shall be subject to rejection, removal, and disposal at the Contractor's expense.

L. If the Contractor fails to stockpile and protect on-site excavated material acceptable for reuse as backfill, then the Contractor shall provide an equal quantity of acceptable off-site material at no expense to GE.

M. A minimum soil cushion layer of 12 inches (measured following compaction) shall be maintained between tracked construction equipment and geosynthetics.

N. With the exception of backfill placed directly over geosynthetics, the maximum lift thickness is 12 inches (measured following compaction).

O. Extreme care shall be taken to avoid damaging geosynthetic materials during placement of soil material above the geosynthetics.

3.04 METHOD OF COMPACTION

A. General

1. The Contractor shall adopt compaction methods that produce the degree of compaction specified herein, prevent subsequent settlement, and provide adequate support.

2. Methods used shall avoid disturbance to underlying soils and to subsurface utilities.

3. Prior to filling or backfilling activities, the Contractor shall submit an Operations Plan that describes the equipment and method proposed for compaction.

4. Hydraulic compaction by ponding or jetting is not permitted.

5. Backfill material shall not be left in an uncompacted state at the close of a day's construction.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

6. Prior to terminating work, the final layer of compacted fill, after compaction, shall be rolled with a smooth-drum roller, if necessary, to eliminate ridges of soil left by tractors, trucks, or other construction related equipment.

7. As backfill progresses, the surface shall be graded such that no ponding of water shall occur on the surface of the fill.

8. Fill shall not be placed on snow, ice, or soil that was permitted to freeze prior to compaction.

9. Unsatisfactory materials shall be removed prior to fill placement.

B. Equipment

1. Generally, equipment used for compaction shall be the largest type in consideration of space limitations of the work areas and the need to protect adjacent facilities and underlying materials.

2. Compaction of fill material in confined areas shall be accomplished by means of a drum-type, power driven, hand-guided vibratory compactor, or by hand-guided vibratory plate tampers.

3. If the proposed method does not give the degree of compaction required, an alternate method shall be adopted until the required compaction is achieved.

C. Minimum Compaction Requirements

1. Unless specified otherwise on the Technical Drawings or in these specifications, subbase of the final cover (i.e. suitable consolidated materials) and general fill within the final cover shall be compacted by proof rolling.

2. Proof-rolling shall be performed and deemed acceptable by GE's Representative prior to placing subsequent materials over the prepared surface.

3. When proof-rolling, the prepared surface shall be acceptable when deformations caused by site equipment (e.g., roller, dump truck) are no deeper than one-inch. Any soft or wet materials that deform more than one-inch shall be removed and replaced with suitable material. Replaced material shall be compacted and retested in accordance with this specification.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

3.05 BACKFILL FOR ANCHOR TRENCHES

A. General

1. Anchor trench backfill shall be placed in 8-inch-thick loose lifts and thoroughly compacted by approved mechanical methods to achieve a firm and uniform density.

2. Anchor trench backfilling and compaction to be performed in a manner that avoids damaging geosynthetics.

3.06 BACKFILLING EMBANKMENTS AND EXCAVATIONS

A. General

1. Embankment areas shall be cleared and grubbed prior to initiating fill operations.

2. Embankments and excavations shall be formed or backfilled with satisfactory materials placed in successive layers, approximately horizontal, of not more than 12-inches in loose depth for the full width of the embankment or excavation.

3. All materials placed in constructing the embankment shall be free of organic matter, leaves, grass, roots, and other objectionable material.

4. At all times the Contractor shall slope the embankment to provide for surface drainage away from the placement area.

5. Materials placed in layers shall be of the proper moisture content to obtain the prescribed compaction.

6. Wetting or drying the material to achieve an acceptable and uniform moisture content throughout the layer may be required.

B. Compaction

1. Any areas inaccessible to roller compaction equipment shall be compacted by mechanical tampers.

2. In the construction of embankments, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, layers shall be constructed approximately horizontal, maintaining surface drainage away from the placement area and keying layers into adjoining slopes.

3. The compaction equipment shall be of such design, weight, and quantity as to obtain the required density.

4. Contractor to ensure adequate bonding between successive layers is achieved.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

3.07 GRADING

A. After completing all fill and backfill operations, the Contractor shall grade the site to the lines, grades, and elevations shown on the Technical Drawings, taking into account any subsequent site restoration requirements.

3.08 EXISTING FACILITIES

A. General

1. Existing subsurface facilities may be encountered during performance of the construction work, or located in close proximity to the construction work.

2. These facilities may include, but are not necessarily limited to, sewers, drains, water mains, conduits and their appurtenances. These facilities may not be shown on the Technical Drawings. However, the sizes, locations, and heights or depths (if indicated on the Technical Drawings) are approximate only, and the Contractor shall conduct its operations with caution and satisfy itself as to the accuracy of the information given. The Contractor shall not claim nor shall it be entitled to receive compensation for damages sustained by reason of the inaccuracy of the information given or by reason of its failure to properly maintain, and/or support such structures.

3. The Contractor shall be aware that other subsurface facilities may be present on or in the vicinity of the site, the existence and/or location of which are not known. Such subsurface facilities may include, but not be limited to individual water and gas services, electrical conduits, storm drains, etc. The Contractor shall consult with GE or GE's Representatives regarding such facilities and, if possible, determine, prior to construction, the location and depth of any such facilities that may exist in and around areas to be excavated.

4. If subsurface facilities are known to exist in an area but their location is uncertain, the Contractor shall exercise reasonable care in its excavation technique to avoid damage to the subsurface facilities.

5. The Contractor shall notify Massachusetts DIGSAFE prior to the start of site work. The Contractor is responsible for determining the appropriate amount of time needed to contact DIGSAFE in advance of performing excavation activities and for reviewing/protecting facilities identified by DIGSAFE.

B. Notification and Protection Procedures

1. Except where superseded by state or local regulations, or in the absence of any applicable regulations, the Contractor shall, as a minimum, include the following procedures in its operations:

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

a. Prior to Excavating

1. Determine correct field location of all nearby underground facilities to arrange for Representatives of the utilities to locate them.

2. Notify owners of nearby underground facilities when excavating is to take place, allowing them reasonable time to institute precautionary procedures or preventive measures that they deem necessary to protect their facilities.

3. In cooperation with owners of nearby facilities, provide temporary support and protection of those underground facilities that may be at all vulnerable to damage by virtue of their physical condition or location, or those that could create hazardous conditions if damaged.

b. Immediately notify any utility owner of any damage to its underground facilities resulting from the Contractor's operations, and arrange for repairs to be made as soon as possible.

c. In case of an electrical short, or escape of gas or hazardous fluids (resulting from damage to an underground facility), immediately notify GE and all persons who might be endangered and assist in evacuation of people from the area.

3.09 OTHER REQUIREMENTS

A. Unfinished work

1. When, for any reason, the work is to be left unfinished, all excavations shall be filled and all roadways and watercourses left unobstructed with their surfaces in a safe and satisfactory condition.

B. Hauling Material on Public Roadways

1. When hauling material over the public roadways, the Contractor shall provide suitable tight vehicles so as to prevent material deposits on pavement roads. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets, and pavements clean and free from dirt, mud, stone, and other hauled material. Related activities shall be coordinated with GE or GE’s representative.

2. When hauling materials that contain PCBs or other hazardous constituents, the Contractor shall abide by all applicable federal, state, and local codes, including, but not limited to, manifesting and placarding (if necessary). Related activities shall be coordinated with GE or GE’s representative.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

C. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of its operations to such a degree that it will not endanger the safety and welfare of the general public. Related activities shall be performed in accordance with applicable Occupational Safety and Health Administration (OSHA), Project Operations Plan (POP), and the April 2006 Addendum to OPCA Work Plan.

2. During consolidation and final cover construction activities, dust shall be controlled by the use of water spraying (e.g., piped sprinkler system), calcium chloride, and temporary silt fencing (as wind barriers). Additionally, exposed soil areas shall be covered when not active, vehicle speeds reduced, and work activities minimized during windy, dry days. Daily and interim covers shall be used throughout the fill progression activities to reduce dust generation.

3. In the event that dust is observed emanating from materials at the OPCAs during either operating or non-operating periods, the contractor shall implement dust suppression measures. The specific types of dust suppression measures that may be implemented include (but are not limited to) additional water spraying (e.g., piped sprinkler system), hydroseeding (with mulch and tackifier), spraying of vapor suppression foam, and/or placement of additional wind barriers (i.e., silt fencing).

4. In addition, the Contractor shall perform the following activities:

   a. Use tarps covering consolidation materials (i.e., excavated soils and sediments and building demolition debris) or clean backfill/cover materials during transport to the OPCAs; retain tarp covers on the transport vehicles until immediately before offloading of materials at the OPCAs; and re-tarp empty transport vehicles before leaving the OPCA area;

   b. Use water spray (e.g., piped sprinkler system) during the unloading of every truck transporting consolidation materials (i.e., excavated soils and sediments and building demolition debris) or clean backfill/cover materials to the OPCAs;

   c. Increase the frequency of street sweeping along the GE-owned Tyler Street Extension and the General Dynamics parking lot;

   d. Shut-down OPCA consolidation operations during sustained high wind conditions (i.e., sustained winds greater than 20 mph); and

   e. Limit the maximum number of trucks offloading to the OPCAs to no more than 75 per day at the Building 71 OPCA and no more than 100 per day at the Hill 78 OPCA, unless EPA grants prior approval for a greater number.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

E. Disposal

1. All materials (e.g., soil, stone, debris, vegetation, etc.) encountered during earthwork activities that are identified as waste material or material deemed unsuitable for use or reuse, shall be disposed of as specified in the Contractor's operational plan or as requested by GE or GE's Representative.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02207

RESTORATION OF SURFACES

PART 1 - GENERAL

1.01 DESCRIPTION

A. All types of surfaces disturbed, damaged, or destroyed while performing the work under or as a result of the operations of the Contract, shall be restored and maintained, as specified herein or as directed by GE or GE's Representative.

B. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to or better than the condition of each prior to being damaged. All proposed and completed work shall be approved by GE or GE's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02200 - Earthwork
B. Section MP-02212 - Topsoil, Seeding and Mulch
C. Section MP-02222 - Soil Fill Materials

1.03 SUBMITTALS

A. A schedule of restoration operations shall be submitted by the Contractor to GE or GE's Representative for review.

1.04 SCHEDULE OF RESTORATION

A. After an accepted schedule has been agreed upon, it shall be adhered to unless otherwise revised with the approval of GE or GE's Representative.

B. The replacement of surfaces at any time, as scheduled or as requested, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

PART 2 - PRODUCTS

Specified elsewhere.

PART 3 - EXECUTION

3.01 STONE OR GRAVEL PAVEMENT

A. All pavement and other areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.

1. The depth of the asphalt or gravel shall be at least equal to the existing condition.

2. After compaction, the surface shall conform to the slope and grade of the area being replaced.

MATERIALS AND PERFORMANCE - SECTION 02207

RESTORATION OF SURFACES

3.02 LAWNS AND IMPROVED AREAS

A. The area to receive topsoil shall be graded to a depth of not less than 6 inches or as specified, below the proposed finish surface.

1. If the depth of existing topsoil prior to construction was greater than 6 inches, topsoil shall be replaced to that depth.

B. The furnishing and placing of topsoil, seed and mulch shall be as directed by GE or GE's Representative.

C. When required to obtain germination, the seeded areas shall be watered in such a manner as to prevent washing out of the seed.

D. Any washout or damage that occurs shall be regraded and reseeded until a good sod is established.

E. The Contractor shall maintain the newly seeded areas in good condition, including regrading, reseeding, watering, and mowing.

3.03 OTHER TYPES OF RESTORATION

A. Trees, shrubs, and landscape items inadvertently damaged or destroyed as a result of the construction operations shall be replaced in like species and size.

1. All planting and care thereof, shall meet the standards of the American Association of Nurserymen.

B. Drainage structures, including culverts, manholes, catch basins, and piping, that are destroyed or removed as a result of the construction operations shall be replaced in like size and material, and shall be replaced at the original location and grade unless otherwise shown on the Technical Drawings. When there is minor damage to a culvert and with the consent of GE or GE's Representative, a repair may be undertaken, if satisfactory results can be obtained.

C. Fences destroyed or removed as a result of the construction operations shall be replaced in like size and material, and shall be replaced at the original location unless otherwise noted.

3.04 MAINTENANCE

A. The finished products of restoration shall be maintained in an acceptable condition for and during a period of one year following the date of Substantial Completion or other such date as set forth elsewhere in the Contract Documents.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this section consists of furnishing and placement of topsoil, fertilizer, seed, and mulch, and maintenance of seeded areas until final acceptance by GE.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02200 - Earthwork
B. Section MP-02207 - Restoration of Surfaces

1.03 SUBMITTALS

A. Analysis of the seed (to demonstrate compliance with the seed mix identified in Section 2.01 of this specification) and fertilizer (to identify chemical composition), and proposed application rates (to demonstrate compliance with the fertilizer application rate identified in Section 3.01B of this specification).

B. Should hydroseed be used, the Contractor shall submit all data including material and application rates.

C. Location of source, and pH and organic content testing of off-site topsoil (if required).

D. Sample of topsoil to be tested by GE for chemical contaminants.

E. The name, location, and quantity of each source and type of soil fill material proposed by the Contractor including a sample of each source and soil fill type to be analyzed for PCBs, volatile organic compounds (VOCs), Semi-VOCs, and metals. The results of the analyses will be compared to the appropriate regulatory levels. If such analyses indicate unacceptable chemical characteristics, GE will reject the use of fill materials from the proposed source(s), and the Contractor must identify and submit a sample(s) from another fill source. If a fill source is rejected by GE, analytical testing for one additional fill source will be performed at the expense of GE. If additional fill sources (more than two sources per fill material) are rejected, additional testing will be at the expense of the Contractor.

Soil sampling results previously submitted to, and approved by GE (within the last calendar year), for the proposed sources can be submitted to GE in lieu of additional testing. However, GE reserves the right to request additional verification testing prior to source approval.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

PART 2 - PRODUCTS

2.01 MATERIALS

A. Any off-site topsoil shall be unfrozen, friable, natural loam and shall be free of clay lumps, brush needs, litter, stumps, stones, and other extraneous matter. The topsoil shall have an organic content between 5% and 20%, and a pH between 5.5 and 7.5.

B. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 16% nitrogen, 6% phosphoric acid and 8% potash.

1. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

C. Seed mixtures shall be of commercial stock of the current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.

1. All seed shall meet state standards of germination and purity.

D. 1. Seed mix for all site areas other than the Hill 78 OPCA final cover:

65%	Kentucky Blue Grass
20%	Perennial Rye Grass
15%	Fescue

2. Seed mix to be used for the Hill 78 OPCA final cover shall be a mixture of native warm-season grass and wildflower species, such as big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), indian grass (*Scorghastrum nutans*), wild blue lupine (*Lupinus perennis*), Canada wild-rye (*Elymus canadensis*), Canada goldenrod (*Solidago Canadensis*), common milkweed (*Asclepias syriaca*), beard tongue (*Pestamon digitalis*), grass-leaved goldenrod (*Euthamia graminifolia*), blue verain showy tick-trefoil (*Desmodium canadense*), roundhead blush clover (*Lespidesa capitata*), and wild bergamont (*Monarada fistulosa*). The seed mixture shall include a minimum of four grasses and a minimum of four forbs (from those listed above) of equal percentages by weight. To ensure surface soil stability and prevent erosion, a nurse crop of annual rye-grass (*Lolium temulentum*) will be added to the seed mixture. The seed mixture will be applied at a rate of 25 pounds per acre.

E. The seed mix used on the interim cover shall be a quick-germinating rye grass.

F. Mulch shall be stalks of oats, wheat, rye, or other approved crops free from noxious weeds and coarse materials.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

PART 3 - EXECUTION

3.01 INSTALLATION

A. The topsoil shall be applied in a single loose lift of not less than six-inches. No compaction is required or allowed other than that which occurs as a result of placement and grading.

1. Following placement of topsoil and prior to fertilizer application, all stones greater than 1-inch in diameter, sticks, and other deleterious material shall be removed.

B. The fertilizer shall be applied to the surface uniformly at the rate of 20 pounds per 1,000 square feet.

1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a depth of at least 2 inches with a disk or other suitable method traveling across the slope if possible.

C. After the soil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader at a rate specified by the seed manufacturer or as specified in Part 2.01 of this Section.

1. The seed shall be raked lightly into the surface.

2. Seeding and mulching shall not be done during windy weather.

D. The mulch shall be hand or machine spread to form a continuous blanket over the seed bed, approximately 2 inches in uniform thickness at loose measurement with a minimum of 90% surface coverage. Excessive amounts or bunching of mulch shall not be permitted.

1. Unless otherwise specified, mulch shall be left in place and allowed to decompose.

2. Any mulch that has not disintegrated at time of first mowing shall be removed.

3. The mulch shall be placed with a tackifier.

E. Seeded areas shall be watered as often as required to obtain germination, and to obtain and maintain a satisfactory sod growth. Watering shall be performed in such a manner as to prevent washing out of seed and mulch.

F. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed, and mulch. The Contractor must submit all data regarding hydroseed materials and application rates to GE or GE's Representative for review.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

3.02 MAINTENANCE

A. All erosion rills or gullies within the topsoil layer shall be filled with approved topsoil and graded smooth, and reseeded and mulched.

B. The Contractor shall also be responsible for repairs to all erosion of the seeded areas until all new grass is firmly established and reaches a height of not less than 4 inches. All bare or poorly vegetated areas must be reseeded and mulched.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide all labor, materials, tools, and equipment necessary to furnish and install geosynthetic drainage composite where specified in the Technical Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02232 - Geotextile Fabric
B. Section MP-02234 - Flexible Membrane Liner
C. The Construction Quality Assurance Plan – On-Plant Consolidation Areas (CQAP)

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM);

1.	D1505-98	Specific Gravity
2.	D1238-01	Melt Flow Index
3.	D1603-01	Carbon Black Content
4.	D5199	Thickness
5.	D4716-01	Constant Head Transmissivity
6.	D5261	Weight
7.	D1777-96	Thickness
8.	D4632-91	Grab Tensile and Grab Elongation
9.	D4833-00	Puncture
10.	D4751-99a	A.O.S.
11.	D4533-98	Trapezoidal Tear
12.	D4491-99a	Water Flow Rate
13.	GRI GC7	Ply Adhesion

1.04 SUBMITTALS

A. Operational Submittals

1. Manufacturer’s data for the geosynthetic drainage composite including physical properties and roll size.

2. Geosynthetic drainage composite material sample.

3. Manufacturer's quality assurance/quality control program.

4. Certified results of all quality control testing.

5. Contractor's proposed transportation, handling, and storage techniques.

6. Shop drawings, and proposed installation techniques.

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Skaps Industries; or
B. Approved equal.

2.02 MATERIALS

A. The geosynthetic drainage composite shall be comprised of a high-density polyethylene (HDPE) drainage net composited with two, 6 oz/yd^2 non-woven geotextiles. The geotextiles shall be heat bonded to both sides of the drainage net.

1. The drainage net to be used in the composite shall be a profiled mesh made by extruding two sets of high density strands together to form a diamond shaped, three-dimensional net to provide planar fluid flow. The drainage net shall be made of HDPE containing carbon black, anti-oxidants, and heat stabilizers that shall be manufactured from resin provided from one resin supplier.

2. The geotextile shall be a non-woven, needle punched polymeric material.

B. The geosynthetic drainage composite shall meet the following specifications:

1. Drainage Net

Property	Test Method	Required Value
Specific Gravity (g/cm^3)	ASTM D1505	0.94 minimum
Melt Flow Index (g/10 min)	ASTM D1238 – Condition 190/2.16	1.0 maximum
Carbon Black Content (%)	ASTM D4218	2.0 minimum
Thickness (mil)	ASTM D5199	300 $\pm$ 30 minimum

2. Geotextile

Property	Test Method	Required Value (MARV)
Fabric Weight (oz/yd^2)	ASTM D5261	6.0
Grab Strength (lbs.)	ASTM D4632	150
Puncture Resistance (lbs.)	ASTM D4833	95
A.O.S. (U.S. Sieve)	ASTM D4751	70
Water Flow Rate (gal/min/ft^2)	ASTM D4491	125

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

3. Composited Materials

Property	Area of GDC Installation	Test Method	Minimum Test Value
Transmissivity (m^2/s)	Hill 78 OPCA	ASTM D4716*	3.77×10^{-3} at a hydraulic gradient equal to 0.1
			4.03×10^{-4} at a hydraulic gradient equal to 0.33
	Building 71 OPCA		17.32×10^{-4} at a hydraulic gradient equal to 0.1
			3.73×10^{-4} at a hydraulic gradient equal to 0.33
Ply Adhesion		GRI GC7	1.0

* Test methods to be performed with the following modifications:

Substrate Material:	60-Mil HDPE geomembrane
Superstrate Material:	Neoprene or 6 inches of representative soil
Applied Normal Compressive Load:	2,500 lbs/sq.ft.
Seating Time:	100 hours (minimum)

2.03 DELIVERY, STORAGE AND HANDLING

A. The geosynthetic drainage composite shall be packaged and shipped by appropriate means so as to prevent damage. Materials shall be delivered only after the required submittals have been received and reviewed by GE or GE's Representative.

B. The geosynthetic drainage composite shall be furnished in rolls, marked or tagged with the following information:

1. Manufacturer's Name
2. Product Identification
3. Lot/Batch Number
4. Roll Number
5. Roll Dimensions

C. The geosynthetic drainage composite shall be stored in an area approved by GE or GE's Representative that prevents damage to the product or packaging.

D. The geosynthetic drainage composite shall be kept clean and free from dirt, dust, mud, and any other debris.

E. Any geosynthetic drainage composite found to be damaged shall be replaced with new material at the Contractor's expense.

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

2.04 CONFORMANCE TESTING

A. Conformance testing shall be the responsibility of GE. Geocomposite will be sampled by GE at the specified frequency and forwarded to an independent testing laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed properties.

B. At a minimum, tests to determine the following characteristics will be performed on the geocomposite:

1. Transmissivity, ASTM D4716*
2. Ply Adhesion, GRIGC7

* Conformance test methods to be performed with the modifications specified in Section 2.02 B of this specification.

C. Geocomposite samples will be taken across the entire width of the roll. Unless otherwise stated or specified by GE's Representative, samples will be 3-feet long by roll width

D. Unless otherwise specified, geocomposite samples will be taken at a rate of one per lot or one per 100,000 ft^2 of geocomposite.

E. Conformance testing of alternative materials shall be at the Contractor's expense.

F. Conformance test results, if required, will be reviewed by GE or GE's Representative. The material shall either be accepted or rejected by GE or GE's Representative based on the results of the conformance testing. Deployment of the geocomposite shall not commence until GE or GE's Representative has determined that the material is acceptable. If the Contractor has reason to believe that failing tests may be the result of the CQA Laboratory incorrectly conducting the tests, the Contractor may request that the sample in question be retested by the CQA Laboratory with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Contractor. Alternatively, the Contractor may have the sample retested at two different approved CQA Laboratories at the expense of the Contractor. If both laboratories produce passing results, the material may be accepted at the discretion of GE or GE's Representative. If both laboratories do not produce passing results, then the original CQA Laboratory's test results will stand. The use of these procedures for dealing with failed test results is subject to the approval of GE or GE's Representative.

If a test result is not in conformance with a required MARV, all material from the lot represented by the failing test shall be considered out of specification and rejected. Alternatively, at the option of GE or GE's Representative, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to

the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) will be rejected. If one or both of the additional tests fail, then the entire lot will be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot. The additional conformance test samples will be collected by GE or GE's Representative and submitted to the same CQA laboratory that was used for the original conformance testing. The costs associated with the additional conformance testing will be borne by the Contractor.

2.05 QUALITY ASSURANCE

A. Field delivered material shall meet the specification values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered material meets the manufacturer's specifications. The Contractor shall submit to GE or GE's Representative certified quality control test results conducted by the manufacturer during the manufacturing of the geosynthetic drainage composite delivered to the project site. The results must identify the sections of field delivered geosynthetic drainage composite they represent. The Contractor shall also provide the lot and roll number for the material delivered to the site.

B. The manufacturer shall have developed and shall adhere to their quality assurance program in the manufacture of the geosynthetic drainage composite.

C. The installer shall verify in writing prior to installation that the geosynthetic drainage composite has not been damaged due to improper transportation, handling, or storage.

D. Each of the installer's personnel shall have recorded 500,000 sf of successful material installation.

E. The Contractor shall provide shop drawings for indicating panel layouts and installation sequence.

PART 3 - EXECUTION

3.01 PREPARATION

A. The areas designated for placement of geosynthetic drainage composite shall be free from any deleterious material.

B. If the geosynthetic drainage composite is not clean before installation, it shall be washed by the Contractor until accepted by GE or GE's Representative.

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

3.02 INSTALLATION

A. Geosynthetic drainage composite shall be installed at locations shown on the Technical Drawings.

B. Adjacent rolls shall be installed so that the geonet component will have a minimum overlap of 4 inches.

C. The geonet shall be tied with plastic fasteners every 5 feet along the slope, every 6 inches on butt seams, and every 6 inches in the anchor trench.

D. The geotextiles shall be continuously sewn using a polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile.

E. In the corners of the side slopes, where overlaps between rolls of nets are staggered, an extra layer of geosynthetic drainage composite shall be installed from the top to the bottom of the slope.

F. The geosynthetic drainage composite shall be unrolled downslope, keeping the net in slight tension to minimize wrinkles and folds.

G. If a tri-planar material is used, it must be installed in the appropriate flow direction.

H. Adequate loading shall be placed to prevent uplift by wind.

I. Holes or tears in the geosynthetic drainage composite shall be repaired in accordance with the manufacturer's recommendations/specifications.

3.03 QUALITY CONTROL

A. The Contractor shall provide as-built drawings identifying panel layout, locations or imperfections, and repairs and any other appropriate observations.

- END OF SECTION –

MATERIALS AND PERFORMANCE - SECTION 02222

SOIL FILL MATERIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Work under this section shall include, but not necessarily be limited to, supplying all labor and materials, excavating, transporting, dumping, spreading, and compacting Soil Fill Materials in the locations and to the depth shown on the Technical Drawings and/or as requested by GE or GE's Representative.

B. Applicable Standards and Specifications

1. American Society for Testing Materials (ASTM).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02212 – Topsoil, Seeding and Mulch.
B. Section MP-02200 - Earthwork

1.03 SUBMITTALS

A. The name, location, and quantity of each source and type of soil fill material proposed by the Contractor including a sample of each source and soil fill type to be sampled for PCBs, volatile organic compounds (VOCs), Semi-VOCs, and metals. The results of the analyses will be compared to the appropriate regulatory levels. If such analyses indicate unacceptable chemical characteristics, GE will reject the use of fill materials from the proposed source(s), and the Contractor must identify and submit a sample(s) from another fill source. If a fill source is rejected by GE, analytical testing for one additional fill source will be performed at the expense of GE. If additional fill sources (more than two sources per fill material) are rejected, additional testing will be at the expense of the Contractor.

Soil sampling results previously submitted to, and approved by GE (within the last calendar year), for the proposed sources can be submitted to GE in lieu of additional testing. However, GE reserves the right to request additional verification testing prior to source approval.

B. Contractors shall provide a grain size analysis (ASTM D422) for each source and type of soil fill material.

MATERIALS AND PERFORMANCE - SECTION 02222

SOIL FILL MATERIALS

PART 2 - PRODUCTS

2.01 MATERIALS

A. Select fill shall be the types listed below:

Drainage Stone

1. Material placed in the anchor trench shall be washed, rounded run-of-bank gravel, with a d_{max} of 1 ½-inches and a d_{min} of 3/4-inches.

Access Road Material

1. Material used for final cover access road shall be compacted dense grade crushed stone M2.01.7 or equal.

B. General Fill shall be the type listed below:

1. Material shall be free of large (greater than 3-inches) objects, sticks, roots, or any other deleterious materials. Materials must provide a compacted, smooth, uniform surface free from any protruding objects that could damage the overlying or underlying FML.

PART 3 - EXECUTION

3.01 PLACEMENT

A. The entire surface to be covered with General Fill material shall be stripped of all grass, vegetation, topsoil, rubbish, or other unsuitable materials before backfilling.

B. In general, soil fill material shall be placed and compacted in horizontal layers no less than 3 inches and not exceeding those thicknesses indicated in Section MP-02200. The subgrade for placement of soil fill material shall be approved by GE or GE's Representative. Soil fill material shall not be placed on ground that shall not support the weight of construction equipment.

C. Trucks or other heavy equipment shall not be operated over the fill layer until the minimum thickness of soil fill has been placed and properly compacted by tampers or other approved method.

D. When placing soil fill above geosynthetics, soil shall be placed in a manner which prevents damage to the underlying geosynthetics.

E. At the end of a day, the Contractor shall track the slope with a bulldozer perpendicular to the slope to help minimize erosion.

MATERIALS AND PERFORMANCE - SECTION 02222

SOIL FILL MATERIALS

3.02 CRITERIA AND TOLERANCES

A. Soil fill materials shall be constructed to such heights as to allow for post-construction settlement. Any settlements that occur before final acceptance of the Contract shall be corrected to make the backfill conform to the established lines and grades.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall supply all labor, materials, tools, and equipment required to furnish and install geotextile fabric as specified herein and as shown on the Technical Drawings or as indicated by GE or GE's Representative.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D4491 Permittivity
2. D4632-91 Grab Tensile and Grab Elongation
3. D3786 Mullen Burst
4. D4833-00 Puncture
5. D4533-91 Trapezoidal Tear
6. D4355-99 Ultraviolet Resistance

1.03 SUBMITTALS

A. Manufacturer's data for geotextile including, at a minimum, physical properties, packaging, and installation techniques.

B. Manufacturer's quality assurance/quality control program.

C. Certified results of all quality control testing.

D. Contractor's proposed on-site transportation, handling, storage, and installation techniques.

E. Manufacturer's standard warranty provided for the geotextiles.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Skaps Industries;
B. Propex Fabrics; or
C. Approved equal.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

2.02 MATERIALS

A. For these specifications and the Technical Drawings, the terms "geotextile" and "geotextile fabric" shall be considered synonymous.

B. Geotextile fabric to be used within the anchor final cover system shall be non-woven geotextile. Geotextile fabric to be used beneath the final cover access road shall be woven geotextile.

C. The non-woven geotextile shall be of needle-punched construction and consist of long-chain polymeric fibers or filaments composed of polypropylene, shall be free of any chemical treatment that reduces permeability, and shall be inert to chemicals commonly found in soil.

D. The geotextiles indicated on the Technical Drawings shall have the minimum physical properties listed below:

Woven Geotextile:

Property	Unit of Measure	Test Method	Test Value
Grab Tensile	lbs.	ASTM D4632	315 min.
Grab Elongation	%	ASTM D4632	50 max.
Mullen Burst	psi	ASTM D3786	508 min.
Puncture	lbs	ASTM D4833	113 min.
Trapezoidal Tear	lbs	ASTM D4533	113 min.
UV Resistance	% Retained @ 500 hrs.	ASTM D4355	70 min.
Permittivity	sec^{-1}	ASTM D4491	0.05 min.

Non-Woven Geotextile:

Property	Unit of Measure	Test Method	Minimum Test Value
Grab Tensile	lbs.	ASTM D4632	158
Grab Elongation	%	ASTM D4632	50
Mullen Burst	psi	ASTM D3786	189
Puncture	lbs	ASTM D4833	56
Trapezoidal Tear	lbs	ASTM D4533	56

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

Property	Unit of Measure	Test Method	Minimum Test Value
UV Resistance	% Retained @ 500 hrs.	ASTM D4355	70
Permittivity	sec^{-1}	ASTM D4491	0.05

2.03 DELIVERY, STORAGE AND HANDLING

A. The geotextile shall be furnished in a protective wrapping that shall be labeled with the following information: manufacturer's name, product identification, lot #, roll #, and dimensions.

B. The geotextile shall be protected from ultraviolet light, precipitation, mud, soil, excessive dust, puncture, cutting, and/or other damaging conditions prior to and during delivery and on-site storage. The geotextile shall be stored on-site at a location approved by GE or GE's Representative.

2.04 QUALITY ASSURANCE

A. The field-delivered fabric shall meet the specification values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered material meets the manufacturer's specifications. The Contractor shall provide the quality control test results conducted by the manufacturer during the manufacturing of the geotextile fabric delivered to the project site. The results shall identify the sections/panels of field-delivered fabric they represent. The Contractor shall also provide the lot and roll number for the fabric delivered to the site.

B. The manufacturer shall have developed and shall adhere to its own quality assurance program in the manufacture of the geotextile.

C. The installer shall verify, in writing and prior to installation, that the geotextile fabric has not been damaged due to improper transportation, handling, or storage.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installing the geotextile, placement surfaces shall be leveled and uniformly compacted, as necessary, to provide a stable interface for the geotextile that is as smooth as possible.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

3.02 GEOTEXTILE INSTALLATION

The following procedures and requirements will be followed during the geotextile installation.

A. Placement

1. Placement of the geotextile shall not be conducted during adverse weather conditions. The geotextile shall be kept dry during storage and up to the time of deployment. During windy conditions, all geotextiles shall be secured with sandbags or an equivalent approved anchoring system. Removal of the sandbags or equal shall only occur upon placement of an overlying soil layer.

2. Proper cutting tools shall be used to cut and size the geotextile materials. Extreme care shall be taken while cutting geotextiles.

3. During the placement of geotextiles, all dirt, dust, sand, and mud shall be kept off to prevent clogging. If excessive containment materials are present on the geotextile, it shall be cleaned or replaced as requested by GE or GE's Representative.

4. The non-woven geotextile shall be covered within the time period recommended by the manufacturer, and in no case later than two weeks after its placement.

5. In all cases, seams on sideslopes shall be parallel to the line of slope. No horizontal seams shall be allowed on side slopes.

B. Seaming and Repairing

1. Geotextiles shall be continuously sewn using a polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile.

2. Repair of tears or holes in the geotextile shall require the following procedures:

a. On slopes: A patch made from the same geotextile shall be double seamed into place; with each seam 1/4-inch to 3/4-inch apart and no closer than 1 inch from any edge. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.

b. Non-slopes: A patch made from the same geotextile shall be spot-seamed in place with a minimum 24-inch overlap in all directions.

3.03 POST-CONSTRUCTION

A. Upon completing the installation, the Contractor shall submit to GE or GE's Representative:

1. All quality control documentation.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

3.04 WARRANTY

A. The Contractor shall obtain from the manufacturer and submit to GE or GE's Representative, a standard warranty provided for the geotextiles.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02233

SILT FENCING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall supply all labor, materials, tools, and equipment required to furnish and install silt fencing as specified herein and as shown on the Technical Drawings, or as requested by GE or GE's Representative.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D4632 Grab Tensile and Grab Elongation
2. D3786 Mullen Burst
3. D4833 Puncture
4. D4355-99 Ultraviolet Resistance
5. D4751 Apparent Opening Size

1.03 SUBMITTALS

A. Manufacturer's data for geotextile including, at a minimum, physical properties, and packaging.

B. Manufacturer's quality assurance/quality control program.

C. Certified results of all quality control testing.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Skaps Industries;
B. Propex Fabrics; or
C. Equal.

2.02 MATERIALS

A. The silt fencing shall consist of long-chain polymeric fibers or filaments composed of polypropylene.

B. The silt fencing shall be free of any chemical treatment that reduces permeability and shall be inert to chemicals commonly found in soil.

C. The silt fencing indicated on the Technical Drawings shall have the minimum physical properties listed below:

MATERIALS AND PERFORMANCE - SECTION 02233

SILT FENCING

Property	Unit of Measure	Test Method	Value
Grab Tensile	lbs.	ASTM D4632	80
Grab Elongation	%	ASTM D4632	15
Mullen Burst	Psi	ASTM D3786	250
Puncture	Lbs	ASTM D4833	30
Apparent Opening Size	US Sieve Number	ASTM D4751	#10 Sieve
UV Resistance	%	ASTM D4355	70 @ 500 hrs

2.03 DELIVERY, STORAGE AND HANDLING

A. The silt fencing shall be furnished in a protective wrapping that shall be labeled with the following information: manufacturer's name, product identification, lot #, roll #, and dimensions.

2.04 QUALITY ASSURANCE

A. The field-delivered fabric shall meet the specification values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered fabric meets the manufacturer's specifications. The Contractor shall provide the quality control test results conducted by the manufacturer during the manufacturing of the silt fencing delivered to the project site. The results shall identify the sections/panels of field-delivered fabric they represent. The Contractor shall also provide the lot and roll number for the material delivered to the site.

B. The manufacturer shall have developed and shall adhere to its own quality assurance program in the manufacture of the silt fencing.

C. The installer shall verify in writing prior to installation that the silt fencing has not been damaged due to improper transportation, handling, or storage.

PART 3 - EXECUTION

3.01 SILT FENCING INSTALLATION

A. The silt fencing shall be installed as depicted on the Technical Drawings and in conformance with the manufacturer's recommendations.

3.02 WARRANTY

A. The Contractor shall obtain from the manufacturer and submit to GE or GE’s Representative, a standard warranty provided for the geotextiles.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Under this section, the Contractor shall furnish and install 60-mil thick, textured high-density polyethylene (HDPE) Flexible Membrane Liner (FML) material as shown on the Technical Drawings and as specified herein.

2. The Contractor shall be responsible for all Quality Assurance/Quality Control (QA/QC) testing specified herein and as indicated on the Technical Drawings. All QA/QC testing, with the exception of non-destructive tests, shall be conducted by an independent laboratory at the Contractor's expense.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02219 - Geosynthetic Drainage Composite
B. Section MP-02232 - Geotextile Fabric

1.03 APPLICABLE CODES, STANDARDS, SPECIFICATIONS, AND PUBLICATIONS

A. American Society for Testing and Materials (ASTM)

1.	D6693	Tensile Properties of Plastics
2.	D1505/792	Specific Gravity and Density of Plastics by Displacement
3.	D1004-94a	Initial Tear Resistance of Plastic Film and Sheeting
4.	D1505-98	Density of Plastics by the Density Gradient Technique
5.	D1603-01	Carbon Black in Olefin Plastics
6.	D5397-99	Environmental Stress-Cracking of Ethylene Plastics
7.	D5994-98	Core Thickness of Textured Geomembrane
8.	D5596-94	Microscopical Examination of Pigment Dispersion in Plastic Compounds
9.	D4833-97	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
10.	D1603	Carbon Black Content

B. Geosynthetic Research Institute (GRI)

GRI Test Method GM 13	Test Properties, Testing Frequencies and Recommended Warrant for High-Density Polyethylene (HDPE) Smooth and Textured Geomembranes

C. Where reference is made to one of the above codes, standards, specifications, or publications the revisions in effect at the time of bid shall apply.

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

1.04 QUALIFICATIONS

A. FML Manufacturer

1. The Contractor shall submit to GE or GE's Representative for approval the following information regarding the FML Manufacturer:

a. Corporate background and information.

b. Manufacturing capabilities including:

- Quality control procedures for manufacturing; and
- List of material properties including certified test results, to which FML samples are attached.

c. A list of at least 10 completed facilities, totaling a minimum of 10,000,000 ft^2, for which the Manufacturer has manufactured FMLs. For each facility, the following information shall be provided:

- Name and purpose of facility, its location, and date of installation;
- Name of Owner, Project Manager, Designer, Fabricator (if any), and Installer; and
- Thickness of FML, surface area of FML manufactured.

d. Origin (resin supplier's name, resin production plant) and identification (brand name, number) of the resin.

B. Installer

1. The Installer must be trained and approved and/or licensed by the FML Manufacturer for the installation of FML.

2. The Contractor shall submit to GE or GE's Representative for approval the following written information, relative to the Installer:

a. Copy of Installer's letter of approval or license by the Manufacturer.

b. Resume of the "master seamer" to be assigned to this project, including dates and duration of employment.

3. All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests. At least one seamer shall have experience seaming a minimum of 1,000,000 ft^2 of FML at the type for this project, using the same type of seaming apparatus in use at the site.

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. PolyFlex; or
B. Approved equal.

2.02 MATERIALS

A. HDPE Lining Material Specifications

1. HDPE FML material shall meet the following minimum specification values listed below and as listed in GRI GM13.

Property	Test Method	Specification Limit (MARV)
		60 mil Textured
HDPE FML Resin		
Specific Gravity (min.)	ASTM D1505/D792	0.940
Carbon Black Content	ASTM D1603/D4218	2.0 - 3.0%
Carbon Black Dispersion	ASTM D5596	1, 2 or 3 category All 10 views
HDPE FML Rolls		
Thickness (nominal)	ASTM D5994	60 mil
Thickness (min. avg.)		57 mil
lowest individual 8 of 10 values		54 mil
lowest individual of 10 values		51 mil
Density (min.)	ASTM D1505/D792	.940

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

Property	Test Method	Specification Limit (MARV)
		60 mil Textured
Tensile Properties		
Tensile Strength at Break (min.)	ASTM D6693	90 ppi
Tensile Strength at Yield (min.)		126 ppi
Elongation at Break (min.)		100%
Elongation at Yield (min.)		12%
Tear Resistance (min.)	ASTM D1004	42 lbs
Puncture Resistance (min.)	ASTM D4833	90 lbs
Stress Crack Resistance	ASTM D5397	200 Hour

B. Welding Material

1. The resin used in the welding material must be identical to the liner material.

2. All welding materials shall be of a type recommended and supplied by the manufacturer and shall be delivered in the original sealed containers, each with an indelible label bearing the brand name, manufacturer's mark number, and complete directions as to proper storage.

C. Labeling FML Rolls

1. Labels on each roll or factory panel shall identify the following:

- Thickness of the material;
- Length and width of the roll or factory panel;
- Manufacturer;
- Directions to unroll the material;
- Product identification;
- Lot number; and
- Roll or field panel number.

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

2.03 DELIVERY, HANDLING, AND STORAGE

A. The Contractor shall be liable for all damages to the materials incurred prior to and during transportation to the site.

B. Handling, storage, and care of the FML prior to and following installation at the site are the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by GE or GE's Representative.

C. The Contractor shall notify GE or GE's Representative of the anticipated delivery time.

2.04 CONFORMANCE TESTING

A. Conformance testing shall be the responsibility of GE. The FML will be sampled by GE at the specified frequency and forwarded to an independent testing laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed properties.

B. At a minimum, tests to determine the following characteristics will be performed on the FML:

1. Density, ASTM D1505
2. Carbon black content, ASTM D1603
3. Carbon black dispersion, ASTM D5596
4. Thickness, ASTM D5199
5. Tensile characteristics, ASTM D638

B. FML samples will be taken across the entire width of the roll. Unless otherwise specified or permitted by GE's Representative, samples will be 3-feet long by the roll width.

C. Unless otherwise specified, FML samples will be taken at a rate of one per lot or one per 100,000 ft^2 of FML.

D. Conformance testing of alternative materials shall be at the Contractor's expense.

E. Conformance test results, if required, will be reviewed by GE or GE's Representative. The material shall either be accepted or rejected by GE or GE's Representative based on the results of the conformance testing. Deployment of the FML shall not commence until GE or GE's Representative has determined that the material is acceptable. If the Contractor has reason to believe that failing tests may be the result of the CQA Laboratory incorrectly conducting the tests, the Contractor may request that the sample in question be retested by the CQA Laboratory with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Contractor. Alternatively, the Contractor may have the sample retested at two different approved CQA Laboratories at the expense of the Contractor. If both laboratories produce passing results, the material may be

accepted at the discretion of GE or GE's Representative. If both laboratories do not produce passing results, then the original CQA Laboratory's test results will stand. The use of these procedures for dealing with failed test results is subject to the approval of GE or GE's Representative.

If a test result is not in conformance with a required MARV, all material from the lot represented by the failing test shall be considered out of specification and rejected. Alternatively, at the option of GE or GE's Representative, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) will be rejected. If one or both of the additional tests fail, then the entire lot will be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot. The additional conformance test samples will be collected by GE or GE's Representative and submitted to the same CQA laboratory that was used for the original conformance testing. The costs associated with the additional conformance testing will be borne by the Contractor.

2.05 ADDITIONAL SUBMITTALS

A. The Contractor shall submit the following items for approval at least one week prior to installation:

1. Shop drawings that shall include:

a. Layout plan;

b. Quality control program manuals covering all phases of manufacturing and installation; and

c. Complete and detailed written instructions for the storage, handling, installation, seaming, inspection plan fail criteria for liner inspections, and QA/QC testing procedures of the liner in compliance with these specifications and the condition of its warranty.

PART 3 - EXECUTION

3.01 FML INSTALLATION

A. Related Earthwork

1. The Contractor shall ensure that all related earthwork requirements under this section are complied with:

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

a. The FML installations shall be performed on a firm, smooth, soil or geotextile-covered surface free from stones or protruding objects.

b. No FML shall be placed onto an area that has become softened by precipitation. Appropriate methods of moisture control are the responsibility of the Contractor.

c. No FML shall be placed on frozen soil material. Such material shall be removed and replaced with new soil fill as specified in the Section MP-02222 - Soil Fill Materials.

d. The FML Installer shall certify in writing that the final surface on which the FML is to be installed is acceptable.

e. All surfaces on which the FML is to be installed shall be acceptable to GE or GE's Representative prior to FML installation.

f. Free edges of FML shall be secured so as to prevent uplift by wind or the intrusion of water under the liner. Edge protection shall include sandbags, polyethylene sheeting, or other methods as deemed necessary by the Contractor and approved by GE or GE's Representative.

g. The FML shall be anchored within an anchor trench constructed to the dimensions shown on the Technical Drawings. Care shall be taken while backfilling the trenches to prevent damage to the FML.

B. FML Deployment

1. FML shall be deployed according to the following procedures:

a. Placement of the FML panels shall be according to the approved location and position plan provided by the Installer. Placement shall follow all instructions on the boxes or wrapping containing the FML materials that describe the proper methods of unrolling panels.

b. The method of placement must ensure that:

- Deployed FML must be visually inspected for uniformity, tears, punctures, blisters, or other damage or imperfections. Any such imperfections shall be immediately repaired and reinspected.
- No equipment used shall damage the FML by handling, trafficking, leakage of hydrocarbons, or other means.
- No personnel working on the FML shall smoke, wear damaging shoes, or engage in other activities that could damage the FML.

- The prepared surface underlying the FML must not be allowed to deteriorate after acceptance, and must remain acceptable up to the time of FML placement and until completion of the project.
- Adequate temporary loading and/or anchoring (e.g., sand bags), not likely to damage the FML, shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).
- Direct contact with the FML shall be minimized (i.e., the FML in excessively high-traffic areas shall be protected by geotextiles, extra FML, or other suitable materials).

c. Any damage to the FML panels or portions of the panels as a result of placement must be replaced or repaired at no cost to GE. The decision to replace or repair any panel or portions of panels shall be made by GE or GE's Representative.

d. The Installer shall assign an "identification number" to each FML panel placed. The number system used shall be simple, logical, and shall identify the relative location in the field.

C. Seaming

1. The seaming procedures below shall be implemented, where applicable, during installation of the FML. The seaming procedures are as follows:

a. Generally, all seams whether field or factory, shall be oriented parallel to the line of slope, not across slope. At liner penetrations and corners, the number of seams shall be minimized.

b. The area of the FML to be seamed shall be cleaned and prepared according to the procedures specified by the material manufacturer. Any abrading of the FML shall not extend more than one-half inch on either side of the weld. Care shall be taken to eliminate or minimize the number of wrinkles and "fishmouths" resulting from seam orientation.

c. Field seaming is prohibited when either the air or sheet temperature is below 32ºF, or when the sheet temperature exceeds 122ºF, or when the air temperature is above 104ºF. At air or sheet temperatures between 32ºF and 40ºF, seaming shall be conducted directly behind a preheating device. In addition, seaming shall not be conducted when FML material is wet from precipitation, dew, fog, etc., or when winds are in excess of 20 miles per hour.

d. Seaming shall not be performed on frozen or excessively wet underlying soil surfaces.

e. Seams shall have an overlap beyond the weld large enough to perform destructive peel tests, but shall not exceed 5 inches.

f. The Contractor shall perform trial seams on excess FML material. A 1-foot by 3-foot seamed liner sample shall be fabricated with the seam running down the 3-foot length in the center of the sample. Such trial seaming shall be conducted prior to the start of each seaming succession for each seaming crew, change in machine or every 4 hours, after any significant change in weather conditions or FML temperature, or after any change in seaming equipment. From each trial seam, four field test specimens shall be taken. The test specimens shall be 1-inch by 12-inch strips cut perpendicular to the trial seam. Two of these specimens shall be shear tested and two shall be peel tested using a field tensiometer, and recorded as pass (failure of liner material) or fail (failure of seam). Upon initial failure, a second trial seam shall be made; if both trial seams fail, then the seaming device and its operator shall not perform any seaming operations until the deficiencies are corrected and two successive passing trial seams are produced. Completed trial seam samples cannot be used as portions of a second sample and must be discarded.

g. Where fishmouths occur, the material shall be cut, overlapped, and an overlap weld shall be applied. Where necessary, patching using the same liner material shall be welded to the FML sheet.

h. Acceptable seaming methods for FML are:

- Extrusion welding using extrudate with identical physical, chemical, and environmental properties; and
- Hot wedge welding using a proven fusion welder and master seamer.

i. Seaming device shall not have any sharp edges that might damage the FML. Where self-propelled seaming devices are used, it shall be necessary to prevent "bulldozing" of the device into the underlying soil.

D. Seam Testing

1. The Contractor shall perform nondestructive seam testing on 100 percent of field seams. The following test method and procedures may be used:

a. Air pressure testing may be used if double-track hot-wedge welding has been used to seam the HDPE FML. Using approved pressure testing equipment, the following procedures will be followed:

- Seal both ends of the air channel separating the double-track hot-wedge welds;
- Insert pressure needle into air channel and pressurize the air channel to 27 psi;
- Monitor pressure gauge for 3 minutes and determine whether pressure is maintained without a loss of more than 2 psi; and
- If the pressure test fails, then localize the leak and mark the area for repair.

Air pressure testing will be conducted under the direct observation of GE or GE's Representative.

b. Vacuum testing will be used on all seams not tested using air pressure testing. Using an approved vacuum box, the following procedures will be followed:

- Apply a soapy water mixture over the seam;
- Place vacuum box over soapy seam and form a tight seal;
- Create a vacuum by reducing the vacuum box pressure to 5 psi for 10 seconds;
- Observe through the vacuum box window any bubbles;
- Where bubbles are observed, mark seam for repair;
- Move vacuum box further down seam overlapping tested seam by 3 inches; and
- Where hot-wedge seaming has been performed, the overlap must be cut back to the weld.

All vacuum testing will be conducted under the direct observation of GE or GE's Representative.

2. In addition to nondestructive seam testing, the Contractor will perform destructive testing. The destructive testing procedures are as follows:

a. Test samples will be prepared by the Installer every 500 feet of seam length, a minimum of one test for each seaming machine per day, or more frequently at the discretion of GE or GE's Representative. Sample location and size will be selected by GE or GE's Representative. The sample size (12 x 56 inches) will be large enough to produce three sets of test specimens for the following tests:

- Seam Shear Strength, ASTM D6392; and
- Peel Adhesion, ASTM D6392.

b. Ten specimens will compose a set. Five of these will be tested for peel and the other five for shear strength. Each specimen will be 1-inch wide and 12-inches long with the field seam at the center of the specimen. The 56-inch sample length will first be cut at the ends to produce two field peel test specimens. The remaining 54 inches will be divided up into thirds and one-

third submitted to the Contractor, one-third submitted by GE to the independent testing laboratory, and one-third to GE or GE's Representative for storage and future reference.

c. Test specimens will be considered passing if the minimum values below are met or exceeded for four of the five test specimens tested by the independent laboratory. All acceptable seams will lie between two locations where samples have passed.

d. The cost of destructive testing will be borne by the Contractor.

e. Seams will meet the following minimum specification values listed below and as listed in GRI Test Method GM19:

Seam Properties	Specification Limit	Test Method
Shear Strength at Yield (lb/in width)	120 ppi	ASTM D6392
Peel Adhesion – Fusion	91 ppi and Film tear bond	ASTM D6392
Peel Adhesion - Extrusion	78 ppi and Film tear bond	ASTM D6392

3. If a sample fails destructive testing, the Contractor shall ensure that: the seam is reconstructed in each direction between the location of the sample that failed and the location of the next acceptable sample; or the welding path is retraced to an intermediate location at least 10 feet in each direction from the location of the sample that failed the test, and a second sample is taken for an additional field test. If this second test sample passes, the seam must be then reconstructed between the location of the second test and the original sampled location. If the second sample fails, the process must be repeated.

   All costs for work performed to achieve passing tests along with costs for retesting will be borne by the Contractor.

4. If double-track hot-wedge welding is used, GE or GE's Representative and the Installer must agree on the track weld that will be used in the destructive testing. The weld chosen inside or outside must be consistently tested, and must pass according to the criteria above.

5. All holes created by cutting out destructive samples will be patched by the Contractor immediately with an oval patch of the same material welded to the membrane using extrusion welding. The patch seams will be tested using a vacuum box and using the procedures described above. Work will not proceed with materials covering the FML until passing results of destructive testing have been achieved.

6. At the ends of each field seam, two field test specimens will be taken and field tested with a field tensiometer. Both specimens must pass prior to placing the membrane in the anchor trench or continuing with additional seams. Failure of these specimens will require correcting the seaming device and repair of the preceding seam according to the failure testing and procedures described above.

E. Liner Repair

1. All imperfections, flaws, construction damage, and destructive and nondestructive seam failures shall be repaired by the Installer of the FML. The appropriate methods of repair are listed below:

- Patching, used to repair holes, tears, undispersed raw materials, and contamination by foreign matter;
- Grinding and rewelding, used to repair small sections of extruded seams;
- Spot welding or seaming used to repair pinholes or other minor, localized flaws;
- Capping, used to repair large lengths of failed seams;
- Topping, used to repair areas of inadequate seams which have an exposed edge; and
- Removing bad seams and replacing with a strip of new material welded into placed, used with large lengths of fusion seams.

F. Construction Material Placement and Penetrations

1. Wrinkles that develop from normal placement procedures must be controlled such that the underlying FML does not fold over. Small wrinkles, defined as having their height less than or equal to one-half their base width, may be trapped and pushed down by the overlying soil. Any wrinkle that becomes too large and uncontrollable or that folds the FML over must be brought to the attention of GE or GE's Representative. If necessary, the FML shall be uncovered, cut, laid flat, seamed by extrusion welding, and non-destructively tested.

3.02 POST-CONSTRUCTION

A. The Installer of the FML materials shall prepare and the Contractor shall submit to GE or GE's Representative, record drawings illustrating the following information:

- Dimensions of all FML field panels;
- Panel locations referenced to the Technical Drawings;
- All field seams and panels with the appropriate number or code; and
- Location of all patches, repairs, and destructive testing samples.

MATERIALS AND PERFORMANCE - SECTION 02234

FLEXIBLE MEMBRANE LINER

3.03 WARRANTY

A. The Contractor shall obtain and submit to GE or GE's Representative from the Manufacturer a standard warranty provided for the FML.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02271

RIPRAP

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Under this section, the Contractor shall furnish all labor, equipment, and materials, and shall perform all work necessary to place a protective covering of erosion-resistant riprap at locations shown on the Technical Drawings or as requested by GE or GE's Representative. The work shall be done in accordance with these specifications and in conformity with the lines and grades shown on the Technical Drawings.

1.02 SUBMITTALS

A. Particle size distribution of all proposed riprap types.

B. Proposed sources of riprap and amount of available material at each source.

PART 2 - PRODUCTS

2.01 RIPRAP

A. Stone used for riprap shall be hard; durable; angular in shape; resistant to weathering and to water action; free from overburden, spoil, shale and organic material; and shall meet the gradation requirements for the type specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone or boulders shall not be accepted unless authorized by GE or GE's Representative. Shale and stone with shale seams are not acceptable.

B. The sources from which the stone shall be obtained shall be selected by the Contractor for approval by GE or GE's Representative well in advance of the time the stone shall be required in the work. The acceptability of the stone shall be determined by service records and/or by suitable tests, as required by GE or GE's Representative. If testing is required, suitable samples of stone shall be taken in the presence of GE or GE's Representative prior to mobilization to the site. The approval of some rock fragments from a particular quarry site shall not be construed as constituting the approval of all rock fragments taken from that quarry.

C. The sizes of riprap to be provided shall be the following:

Type	Maximum Stone Size (dmax)	d50
1	6"	4"

Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified.

MATERIALS AND PERFORMANCE - SECTION 02271

RIPRAP

D. In addition to meeting the gradation requirements set forth in this section for the type of riprap indicated, riprap shall consist of stones shaped as nearly as practicable in the form of right rectangular prisms.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Slopes or ditches to be protected by riprap shall be free of brush, topsoil, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. All soft or spongy material shall be removed as requested by GE or GE's Representative and replaced with approved material and compacted as specified.

B. Stone for riprap shall be placed on the prepared slopes and surfaces in a manner that shall produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids. The entire mass of stone shall be placed so as to be in conformance with the lines, grades, and thicknesses shown on the Technical Drawings. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing of riprap in layers, or by dumping into chutes, or by similar methods likely to cause segregation shall not be permitted.

C. The larger stones shall be well distributed. All material going into riprap protection shall be so placed and distributed such that there are no large accumulations of either the larger or smaller sizes of stone.

D. Hand placing or rearranging of individual stones by mechanical equipment may be required to the extent necessary to secure the results specified.

E. Unless otherwise authorized by GE or GE's Representative, the riprap protection shall be placed in continuous progression with the construction of the embankment. The Contractor shall maintain the riprap protection until accepted, and any material displaced by any cause shall be replaced to the lines and grades shown on the Technical Drawings at no additional cost to GE.

F. Riprap shall be placed so that the dimension approximately equal to the layer thickness is perpendicular to the slope surface, and so that the weight of the stone is carried by the underlying material and not by the adjacent stones. On slopes, the largest stones shall be placed at the bottom of the slope. The riprap shall be properly aligned and placed so as to minimize void spaces between adjacent stones. The spaces between the stones shall be filled with spalls of suitable size.

G. All sediment deposited within the riprap following installation shall be promptly removed by the Contractor.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the installation of geosynthetic clay liner (GCL) where shown on the Technical Drawings.

B. GCL will be installed as part of the final cover system construction. The following technical specifications present requirements for the manufacturing, testing, transport, storage and installation of the GCL.

1.03 REFERENCES

A. American society for Testing Materials (ASTM)

1. ASTM D4354 Standard Practice for Sampling of Geosynthetics for Testing.

2. ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

3. ASTM D4873 Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.

4. ASTM D5887 Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.

5. ASTM D5888 Standard Guide for Storage and Handling of Geosynthetic Clay Liners.

6. ASTM D5889 Standard Practice for Quality Control of Geosynthetic Clay Liners.

7. ASTM D4643 Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

8. ASTM D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

9. ASTM D5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

10. ASTM D5891 Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

11. ASTM D5993 Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners.

12. ASTM D 6495 Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners.

Note: The most current version of the specified test method should be followed by the Manufacturer, Contractor or authorized testing laboratory.

1.04 SUBMITTALS

A. The Contractor shall submit to GE's Representative the following items:

1. Prior to Delivery to the Site:

a. A project reference list demonstrating the Contractor's experience on a minimum of 5 significant projects of installed GCL, or as approved by GE.

b. A list of all GCL installation crew personnel and resumes of the Supervisor and QC Manager including prior experience installing GCL. This information shall be submitted at least 30 days prior to the commencement of GCL installation. If the exact crew who will be performing the installation is not known 30 days in advance of the start date, the Contractor shall submit a list of several potential crew members. This information shall be supplied in a timely manner for approval in order to avoid delay of any construction activities. GCL crew staff will be subject to approval by GE.

c. A copy of the Manufacturer's Manufacturing Quality Assurance/ Manufacturing Quality Control (MQA/MQC) Plan for testing GCL.

d. A statement of the GCL Manufacturer's experience in manufacturing GCL, including the manufacturing and supplying company's name, address, and employee contact.

e. A certification from the GCL Manufacturer attesting that the proposed GCL meets the physical, mechanical and manufacturing requirements specified in Part 2 of this Section.

f. Copies of the Manufacturing Quality Control (MQC) certificates for the material to be delivered to the site. The reports shall include the quality control test results of samples obtained during the manufacturing of the material to be delivered to the site. The GCL will be rejected if it does not meet the specified requirements of Part 2 of this Section or if it is

found to have defects, rips, holes, flaws, deterioration or other damage deemed unacceptable by GE or GE's Representative.

g. Summary report including results of MQC testing required by this Section for GCL material to be delivered to the site. The report must clearly demonstrate that the GCL material to be delivered to the site meets the requirements of Part 2 of this Section.

h. Proposed method of GCL panel seaming including overlap distance at sides and end of panels and use of additional material to complete the seal (if any).

i. Internal and interface shear strength test results as required in Section 2.01.

2. Prior to Installation:

a. A schedule of operations including means and methods of installation.

b. The proposed method of deploying material and placement of panels.

c. Proposed method or process by which adjacent panels will be joined to provide a continuous hydraulic barrier.

d. The Installer shall certify in writing that the final surface on which the GCL is to be installed is acceptable.

e. Shop drawings including details panel layout diagrams, of all overlapping attachments and anchoring.

f. Proposed method of protecting installed GCL panels from rain, ponding water or other elements that could over hydrate or damage the GCL.

3. During Installation Submitted Daily:

a. Daily construction progress reports clearly showing GCL panels and GCL roll numbers placed by date.

4. Upon Completion:

a. Record Panel Layout Diagram.

b. Summary and log of all field quality control work completed by the Contractor.

c. Certification that GCL installation is complete and in accordance with these specifications.

d. Statement of material and installation warranties.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall be responsible for the protection of the GCL against damage during transportation to the site, during storage and installation at the site, and prior to placement of subsequent construction materials.

B. GCL labeling, shipment, and storage shall follow ASTM D4873 and D5888, as modified according to this Section.

C. Product labels shall clearly show the manufacturer or supplier name, style name, roll number and roll dimensions.

D. If any special handling is required, it shall be so marked on the outside surface of the wrapping, (i.e., “Do not stack more than three rolls high”).

E. The GCL shall be supplied dry (unhydrated, 30% or less moisture content) and be delivered to the site undamaged.

F. Each GCL roll shall be wrapped with a material that will protect the bentonite from moisture and the GCL from damage due to shipment, water, sunlight and contaminants.

G. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the packaging shall be immediately repaired and/or roll tarped to prevent potential additional hydration. The roll shall be set aside and marked for closer inspection upon deployment. Sections of the roll may be rejected if the moisture content of the bentonite has become excessively high as determined by GE’s Representative.

H. Storage area should be relatively flat and well drained. During storage, the GCL rolls shall be elevated off the ground utilizing a method which will not damage the GCL. Material that is damaged as a result of the method of storage or handling shall be rejected and replaced at no additional cost to GE. The GCL rolls shall be adequately covered to protect them from the following:

1. Site construction damage;
2. Precipitation and ponded water;
3. Chemicals that are strong acids or bases;
4. Flames or sparks, temperatures in excess of 49°C (120°F); and
5. Any environmental condition that might damage the GCL.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

I. The Contractor shall protect the work described in this Section before, during and after installation. Only non-damaged, sufficiently dry material (as determined by GE's Representative) shall be included within the construction.

J. Roll numbers on partially used rolls shall be maintained such that each GCL roll number can be readily identified just prior to GCL deployment.

K. If GE's Representative determines that the GCL is damaged or excessively hydrated, the Contractor shall make all repairs and replacements in a timely manner to prevent delays in the progress of work. Any material damaged by the Contractor, or damaged by others due to improper delivery, installation and/or storage, as determined by GE's Representative, shall be replaced by the Contractor at no cost to GE.

1.06 QUALITY ASSURANCE SAMPLING, TESTING AND ACCEPTANCE

A. The Contractor shall, at no additional cost to GE, provide whatever reasonable assistance GE's Representative may require in obtaining the samples for conformance testing.

B. The Contractor shall provide quality control data issued by the manufacturer prior to site delivery of the GCL. In the event the material is delivered prior to receipt of the manufacturer's quality control certificates, the GCL without quality control certificates will be stored separate from GCL with quality control certificates. GCL rolls with unacceptable quality control data shall be segregated from approved material and marked for rejection.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. CETCO (Bentomat® DN); or
B. Approved equal.

2.02 MATERIALS

A. The GCL shall consist of a low permeability sodium bentonite encapsulated between two non-woven geotextiles. The bentonite and finished product requirements are described in the following Parts and include the minimum quality control testing.

B. The Contractor shall obtain a certificate from the GCL manufacturer for MQC testing described in this Part.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

2.03 BENTONITE

A. The bentonite used for the production of the GCL shall be low permeability sodium bentonite.

B. The bentonite portion of the GCL shall be granular bentonite.

C. The supplier and/or source of the bentonite shall be included on the MQA results for the bentonite.

2.04 GEOSYNTHETIC CLAY LINER

A. The following table represents the minimum required QC testing that must be conducted by the Manufacturer on the GCL. The GCL shall be tested in accordance with ASTM D5889 as modified by the following table. Testing shall be conducted at the frequencies listed in the manufacturers QA/QC procedures must meet the required values provided:

GEOSYNTHETIC CLAY LINER		
Property	**Method**	**Value**
Hydraulic Conductivity	ASTM D5887	5 x 10^{-9} cm/sec max.
Mass Per Unit Area		
1. Bentonite Content	ASTM D5993	0.75 lb/ft^2 dry weight MARV*
2. Geotextile Upper Layer	ASTM D5261	6.0 oz/yd^2 MARV*
3. Geotextile Lower Layer	ASTM D5261	6.0 oz/yd^2 MARV*
Bentonite Moisture Content	ASTM D4643	30% max.
Index Flux [1]	ASTM D5887	1 x 10^{-8} m^3/m^2/sec max.
Grab Tensile Strength[2]	ASTM D4632	90 lbs MARV*

* Minimum Average Roll Value.

1. Test according to manufacturer's recommendations and in compliance with the specified ASTM standard.

2. Tensile testing to be performed in the machine and cross directions.

2.05 CONFORMANCE TESTING

A. Conformance testing shall be the responsibility of GE. The GCL will be sampled by GE at the specified frequency and forwarded to an independent testing laboratory for testing to ensure the conformance to both the design specifications and the list of guaranteed properties.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

B. Conformance testing shall be conducted in accordance with ASTM D6495 and at a minimum shall determine the following characteristics on the GCL:

1. Hydraulic Conductivity (ASTM D5887).
2. Mass per Unit Area of Bentonite (ASTM D5993).
3. Mass per Unit Area Upper and Lower Layer Geotextile (ASTM D5261).
4. Bentonite Moisture Content (ASTM D4643).
5. Index Flux of GCL (ASTM D5887).
6. Grab Tensile Strength of GCL (ASTM D4632).

C. GCL samples will be taken across the entire width of the roll. Unless otherwise specified or permitted by GE's Representative, samples shall be three feet long by the roll width.

D. Unless otherwise specified, samples shall be taken at a frequency of one per 25,000 ft^2 of material delivered to the site.

E. Conformance testing of alternative materials shall be at the Contractor's expense.

F. Conformance test results, if required, will be reviewed by GE or GE's Representative. The material shall either be accepted or rejected by GE or GE's Representative based on the results of the conformance testing. Deployment of the GCL shall not commence until GE or GE's Representative has determined that the material is acceptable. If the Contractor has reason to believe that failing tests may be the result of the CQA Laboratory incorrectly conducting the tests, the Contractor may request that the sample in question be retested by the CQA Laboratory with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Contractor. Alternatively, the Contractor may have the sample retested at two different approved CQA Laboratories at the expense of the Contractor. If both laboratories produce passing results, the material may be accepted at the discretion of GE or GE's Representative. If both laboratories do not produce passing results, then the original CQA Laboratory's test results will stand. The use of these procedures for dealing with failed test results is subject to the approval of GE or GE's Representative.

If a test result is not in conformance with a required MARV, all material from the lot represented by the failing test shall be considered out of specification and rejected. Alternatively, at the option of GE or GE's Representative, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out-of-specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) will be rejected. If one or both of the additional tests fail, then the entire lot will be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot. The additional conformance test samples will be

collected by GE or GE's Representative and submitted to the same CQA laboratory that was used for the original conformance testing. The costs associated with the additional conformance testing will be borne by the Contractor.

PART 3 – EXECUTION

3.01 SITE PREPARATION

A. The surface to be covered by the GCL shall be cleared of sharp objects, boulders, sticks, or any materials that may puncture, shear, or tear the GCL. The GCL subgrade shall have a smooth, finished surface, free from pockets, holes, ruts and depressions that could cause bridging and overstress the material in the opinion of GE's Representative.

B. The Contractor shall inspect the subgrade for unsuitable areas or soft spots before the GCL is placed. Additional surface preparation will be required to eliminate any unsuitable areas as determined by GE's Representative.

C. The subgrade/geosynthetic surface below the GCL shall:

1. Be prepared in accordance with the Technical Drawings and Specifications.

2. For GCL deployment over soil surfaces, the prepared soil surface shall have no stones or other protrusions that may be damaging to the GCL as determined by GE's Representative.

3. Be approved, accepted and certified by GE's Representative and Contractor's quality assurance inspector.

3.02 INSTALLATION

A. GCL shall not be deployed during periods of excessive rain or winds, which could prevent an acceptable installation as determined by GE's Representative.

B. All GCL materials shall be installed according to the grades and locations presented in the Technical Drawings and in accordance with manufacturer's recommendations.

C. The Contractor shall furnish the roll number and panel number to GE's Representative prior to the installation of each panel.

D. The Contractor shall maintain the GCL in an "as received" condition up to and including the time that the overlying layer of the Final Cover System is documented by GE's Representative. While the GCL will begin to hydrate immediately upon deployment, it is essential that the GCL not become excessively hydrated prior to loading, as placement of material over hydrated bentonite may destabilize a given area. The GCL must have a minimum of 1 foot of general fill in place prior to full hydration. Additional restrictions and guidance with regard to hydrated or wet GCL are as follows:

1. GCL shall not be placed on wet subgrade, as determined by GE's Representative.

2. GCL becoming partially hydrated prior to covering with general fill shall be evaluated by GE's Representative to ascertain the condition of the material and to determine if removal and replacement is necessary.

3. In the event that excessive hydration occurs prior to placement of the overlying materials described above, the GCL material shall be evaluated by GE's Representative to ascertain the condition of the material and to determine if removal is necessary.

E. The Contractor is required to place cover materials as quickly as possible after deployment of GCL. The GCL and overlying geomembrane shall be deployed on the same day to avoid exposure of the GCL to precipitation.

F. Contractor personnel shall not be allowed to wear shoes that can damage the GCL during deployment or placement of subsequent geosynthetic materials.

G. GCL Panels shall be deployed in a direction from the highest elevation to the lowest elevation within the area to be lined. Whenever possible, GCL panels shall be staggered such that cross seams between panels are not continuous throughout the lined area. GCL panels shall be installed free of tension.

H. GCL seams shall be overlapped a minimum of 6 in. on edge seams and minimum of 12 in. on end seams after shrinkage and before placing cover.

I. The GCL rolls shall be handled in a manner that minimizes loss of bentonite along edges during deployment.

J. The Contractor shall be responsible for protection of the GCL during installation. Unless otherwise approved by GE's Representative, no rubber tire ATV's, tracked vehicles or any other equipment which may pose a risk of puncturing, tearing or otherwise damaging the GCL shall be permitted for use directly over the GCL.

K. The GCL shall not be covered until inspected and approved by GE's Representative.

3.03 REPAIRS

A. Repairs are to be made as soon as possible following deployment of GCL panels.

B. Damage to the GCL shall be repaired in the following manner, unless alternate procedures are proposed by the Contractor and approved by GE's Representative.

1. The damaged area shall be cleared of dirt and debris.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

2. A patch of GCL shall be cut to extend a minimum of 12 in. beyond the damaged area in all directions.

3. Granular bentonite shall be placed around the perimeter of the damaged area at a rate of 0.25 pounds per linear foot.

4. The patch shall be placed over the damaged area and may be secured with an adhesive to keep the patch in position during backfilling or other activities over the GCL. The adhesive shall be approved by the Manufacturer and GE's Representative.

PART 4 – QUALITY CONTROL

4.01 GENERAL

A. The Contractor, before installation begins, shall appoint an experienced individual who will be on-site at all times during the installation, to represent the Contractor in all matters to this work. This appointment shall be subject to approval by GE.

B. All of the forms specified and required must be submitted in a timely fashion.

C. Any changes in the proposed method of work, subcontractors to be utilized, GCL or manufacturing must be approved in advance by GE. The Contractor assumes all responsibility relevant to providing an acceptable product.

4.02 QUALITY CONTROL DURING MANUFACTURING

A. The Contractor shall be solely responsible for the quality of the material provided. Should any tests performed on the material yield unsatisfactory results, the Contractor will be responsible for replacing the material with materials that meet project specifications without delay to the project and at no additional cost to GE.

4.03 QUALITY CONTROL DURING INSTALLATION

A. GE's Representative and the Contractor shall visually inspect all material to be included in the work for damage incurred during transportation and for uniformity, and compare roll identification numbers with those on the certification provided by the manufacturer to assure delivery of the appropriate material.

B. GE's Representative and Contractor shall also visually inspect the material for any damage incurred as a result of handling or on-site storage.

C. Damage to GCL during installation shall be repaired according to this Section. If GE's Representative determines that the damage is considered un-repairable, the damaged material will be replaced at no additional cost to GE.

- END OF SECTION -

GE
159 Plastics Avenue
Pittsfield, MA 01201
USA

Transmitted Via Overnight Delivery

April 13, 2006

Ms. Sharon M. Hayes
GE Facility Project Manager
United States Environmental Protection Agency
One Congress Street, Suite 1100
Boston, MA 02114-2023

Re: GE-Pittsfield/Housatonic River Site
Building 71 and Hill 78 On-Plant Consolidation Areas (GECD200)
2006 Addendum to OPCA Work Plan

Dear Ms. Hayes:

This letter documents several modifications recently implemented, or to be implemented, by the General Electric Company (GE) at the Building 71 and Hill 78 On-Plant Consolidation Areas (OPCAs) located within the GE Plant Area in Pittsfield, Massachusetts. Most of these modifications relate to operational aspects of the OPCAs, such as air monitoring, dust control, traffic flow, and other maintenance items, and have been incorporated into the day-to-day operations of the OPCAs, with the concurrence of the U.S. Environmental Protection Agency (EPA). However, the modifications described herein also include a proposed modification to the configuration of the Hill 78 OPCA.

The design, construction, operation, closure, and post-closure monitoring of the OPCAs were described in a June 1999 document titled *Detailed Work Plan for On-Plant Consolidation Areas* (1999 Detailed Work Plan), which was conditionally approved by EPA in a letter dated July 9, 1999, and is included in an attachment to the Consent Decree (CD) for the GE-Pittsfield/Housatonic River Site. That work plan was subsequently amended by an August 12, 1999 Addendum to the June 1999 Work Plan (also included in an attachment to the CD), and further modified by GE's June 13, 2000 Response to EPA's April 27, 2000 Comments on that Addendum. The June 1999 Detailed Work Plan, as so amended and modified (referred to collectively as the "OPCA Work Plan"), was conditionally approved by EPA in a letter dated January 30, 2001. On March 9, 2001, GE provided a response to EPA's conditions in that letter.

Since that time, GE has periodically provided OPCA-related technical submittals and other status updates to EPA. These have included technical design documents corresponding to the phased construction and use of the OPCAs, as well as regular updates on OPCA operations in GE's monthly status reports under the CD. In addition, GE and EPA routinely discuss operation of the OPCAs, including the status of the OPCAs in terms of receiving materials stemming from EPA's ongoing remediation activities associated with the 1½ Mile Reach of the Housatonic River.

Most recently, beginning in the fall of 2005, GE and EPA have had several discussions regarding various aspects of the OPCA operations. Based on those discussions, GE prepared and submitted to the EPA a list of 12 enhancements to the existing practices and activities (Attachment A). This letter expands upon that list of enhancements and serves as an Addendum to the OPCA Work Plan. The OPCA modifications and enhancements recently implemented by GE (with EPA concurrence), or to be implemented, are discussed in more detail below.

AIR MONITORING

In accordance with the OPCA Work Plan, as well as GE's *Ambient Air Monitoring Plan* (part of its *Project Operations Plan* currently under revision), the EPA-approved air monitoring program for the OPCAs has included daily monitoring for airborne particulates and monthly monitoring for airborne PCBs during periods of active consolidation. (This monitoring program is in addition to other monitoring performed by on-site contractors as part of their project-specific health and safety monitoring program.) The monitoring program for particulates and PCBs has included monitoring/sampling at five locations situated around the OPCAs during OPCA-related activities that could potentially produce dust. The results of these monitoring efforts are provided to EPA.

The air monitoring program has included notification and action levels approved by EPA. For particulate matter, the notification level is a 10-hour average concentration of 120 $\mu g/m^3$ for particulates with a diameter less than 10 micrometers (PM_{10}), and the action level is a 10-hour average PM_{10} concentration of 150 $\mu g/m^3$ (which is the level of the national ambient air quality standard for PM_{10}). For PCBs, the notification and action levels have been 24-hour average concentrations of 0.05 $\mu g/m^3$ and 0.1 $\mu g/m^3$, respectively. This program required GE to: (a) report any exceedances of these levels to EPA; (b) in the event of an exceedance of a notification level, discuss with EPA appropriate response measures; and (c) in the event of an exceedance of an action level, discuss with EPA appropriate immediate response actions (including temporary stoppage of work) and propose corrective action (e.g., use of water spray, modification of work practices, and/or suspension of work pending further evaluation).

As part of the modified OPCA monitoring efforts, GE has implemented or will implement the following operational changes:

- The former southeast monitoring location has been moved to a position directly between the OPCAs and the Allendale School property located north of the Hill 78 OPCA. The specific location of this relocated monitor (as well as two new monitors installed by EPA at the Allendale School property) are depicted on Figure 1.

- Since 1999, PCB air monitoring has been conducted on a monthly basis during periods of active consolidation at the OPCAs. However, from November 1, 2005 through December 21, 2005, GE performed PCB air monitoring on a weekly basis, regardless of whether consolidation activities were occurring. A summary of all PCB air monitoring results from 1999 through 2005 is provided in Attachment B. Starting in 2006, unless otherwise agreed between GE and EPA, GE will conduct PCB air monitoring weekly during active consolidation activities and during any activities that could potentially disturb the consolidated waste material, and monthly during all other periods (i.e., when consolidation activities are not occurring). EPA will advise GE as to which day during a given week or month (as applicable) such monitoring will be conducted.

- As GE has discussed with EPA on several occasions, high humidity levels may affect the ability of the particulate monitoring equipment to accurately measure ambient particulate levels. High relative humidity has lead in some cases to apparent instrument particulate readings that are elevated, primarily due to moisture interference on the sensor. To minimize the potential impact that high humidity may have on the particulate data, GE has modified the current instruments with additional inlet controls to minimize moisture interference on the sensor, and it is currently evaluating the use of alternative instruments that effectively account for atmospheric relative humidity.

- A GE representative will conduct periodic checks of the particulate air monitors on each day of monitoring (once at approximately 9:00 a.m. and once again prior to 12:00 noon) to (a) confirm that the monitors are functioning properly; and (b) confirm that the particulate notification level of 120 $\mu g/m^3$ has not been reached. The particulate notification level is based on a daily time-weighted average. When periodic checks are conducted, an evaluation will be made based on the time-weighted average as of that time. If it is observed that the average particulate concentration is above the notification level at that time, GE will notify EPA as soon as practicable, will take appropriate steps aimed at preventing an exceedance of the action level, and will discuss with EPA the need for and type of additional response measures. However, there is no exceedance of the notification or action level unless the daily time-weighted average measured at the end of the 10-hour daily monitoring period is above that level.

- As noted above, the EPA-approved notification and action levels for PCBs have historically been 24-hour average concentrations of 0.05 $\mu g/m^3$ and 0.1 $\mu g/m^3$, respectively. However, GE has agreed that, going forward, for the OPCA air monitoring program only (and not for any other area at the GE-Pittsfield/Housatonic River Site), the action level for PCBs will be reduced to 0.05 $\mu g/m^3$, so that it is equivalent to the notification level.

- In the event of an exceedance of the particulate action level of 150 $\mu g/m^3$ (based on the daily time-weighted average) or the new PCB action level of 0.05 $\mu g/m^3$ for the OPCAs, GE will report such exceedance to EPA immediately upon receipt of the data showing the exceedance, temporarily cease ongoing consolidation activities, and discuss with EPA the need for and type of immediate or short-term response actions to address the exceedance. In addition, GE will evaluate the cause of the exceedance and the need for additional engineering controls, discuss that evaluation with EPA, and propose to EPA appropriate engineering controls or other corrective actions. Consolidation activities will not be resumed until EPA has approved appropriate response actions, including engineering controls if proposed.

DUST CONTROL

In accordance with the OPCA Work Plan, the potential for dust generation at the OPCAs is controlled using a variety of measures, both temporary and permanent. During consolidation activities, dust is controlled by the use of water, calcium chloride, and temporary silt fencing (as wind barriers). Additionally, exposed soil areas are covered when not active, vehicle speeds are reduced, and work activities are minimized during windy, dry days. Daily and interim covers are also used throughout the fill progression activities to reduce dust generation.

To further address the potential for dust generation, in the event that visible dust is observed emanating from materials at the OPCAs during either operating or non-operating periods, GE will implement dust suppression measures. The specific types of dust suppression activities that may be performed include

(but are not limited to) additional water spraying, hydroseeding (with mulch and tackifier), spraying of vapor suppression foam, and/or placement of additional wind barriers (i.e., silt fencing).

In addition, GE has implemented and will continue to perform the following activities:

- Use of tarps covering consolidation materials (i.e., excavated soils and sediments and building demolition debris) or clean backfill/cover materials during transport to the OPCAs; retention of the tarps on the vehicles until immediately before offloading of materials at the OPCAs; and re-tarping of empty transport vehicles before they leave the OPCA area;

- Use of water spray during the unloading of every truck transporting materials to the OPCAs (including waste materials and clean backfill/cover materials);

- Increasing the frequency of street sweeping along the GE-owned Tyler Street Extension and the General Dynamics parking lot;

- Shut-down of OPCA consolidation operations during sustained high wind conditions (defined as sustained winds greater than 20 mph); and

- Limiting the maximum number of trucks offloading to the OPCAs to no more than 75 per day at the Building 71 OPCA and no more than 100 per day at the Hill 78 OPCA, unless EPA grants prior approval for a greater number.

VEHICLE ACCESS

The typical transportation route for hauling materials to the OPCAs previously accessed the consolidation areas using Tyler Street Extension, which is located between the OPCAs and the Allendale School property. The OPCA trucking route has been modified so that, beginning in 2006, transport vehicles will access the Hill 78 OPCA using Tyler Street or Merrill Road, New York Avenue, and Gate 25 located southwest of the Hill 78 OPCA. When accessing the Building 71 OPCA, access will be via Merrill Road, the General Dynamics parking lot, and the gate located on the north side of the Building 71 OPCA. This modified trucking route will result in only leachate tanker trucks traveling to or from the OPCAs along Tyler Street Extension between the OPCAs and Allendale School. The new transportation routes to and from both OPCAs are shown on Figure 2.

In addition, the modified route shown for transport to and from the Hill 78 OPCA will also be used for the transport of remediation-related waste materials from the GE-Pittsfield/Housatonic River Site (as defined in the CD) to GE's RCRA Part B-permitted hazardous waste storage facility at Building 78. These include, for example, such materials as non-aqueous-phase liquid (NAPL) (including both light and dense NAPL), filter cake from the Building 64G water treatment facility, solid materials from Removal Actions that constitute hazardous waste, oil from the oil recovery systems, and water recovered from the ground in connection with the groundwater monitoring programs and destined for off-site disposal. Similarly, the modified route shown for transport to and from the Building 71 OPCA leachate transfer facility will be used for the transport of leachate from that OPCA to the Building 64G treatment facility.

Shipments of such waste materials to or from the OPCAs or the Building 78 storage facility via the routes shown on Figure 2 will be considered to occur "onsite" within the meaning of Paragraph 9.a of the CD and thus will be subject to the onsite permitting exemption set forth in Section 121(e) of the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and referenced in Paragraph 9.a of the CD. In these circumstances, such shipments will be carried out in accordance with the site-specific transportation procedures listed in Attachment C.

HOURS OF OPERATION

GE has implemented the following modifications to the hours of OPCA operations, regardless of season:

- There will be no equipment start-up before 7:00 a.m., and no transport vehicles will enter the OPCA areas after 4:00 p.m. However, certain end-of-day activities (e.g., placement of daily cover, site cleanup, leachate hauling, etc.) may extend beyond 4:00 p.m.

- During the above-specified OPCA hours of operation, GE will limit placement of consolidation materials to one OPCA at a time (i.e., either the Hill 78 OPCA or the Building 71 OPCA, but not both simultaneously).

- Leachate collection at the Building 71 OPCA and associated trucking to and from GE's 64G treatment facility will continue as needed (i.e., day or night, including weekends), with transport via the modified transportation route shown on Figure 2.

In addition to the above changes, starting in 2006, GE will provide a representative at the OPCAs on a full-time basis during active consolidation activities and other activities that could potentially disturb the consolidated waste material.

Further, GE will, as a precautionary measure, shut down consolidation operations at the OPCAs during periods of both high ambient temperature and high humidity, or when visible ground fog or mist is present. High temperature/high humidity conditions will be defined as conditions when the ambient temperature is greater than 75°F and relative humidity is greater than 80%. The temperature and relative humidity will be monitored at the Pittsfield Municipal Airport weather station at approximately 9:00 a.m. and again prior to 12:00 noon; and if the above levels are exceeded, the OPCA consolidation activities will be suspended for the remainder of that day. This shut-down procedure will be terminated in the event that GE can demonstrate, and EPA concurs, that the use of alternative or modified particulate monitoring equipment can produce reliable particulate readings on hot, humid days without moisture/humidity interference.

DAILY COVER

In accordance with the OPCA Work Plan, a daily cover is installed over the active portions of the OPCAs at the end of each working day to minimize the potential for precipitation to enter the underlying consolidation materials and the potential for migration of PCBs and other constituents via airborne dust. In general, the cover consists of polyethylene sheeting. When polyethylene sheeting is used, sandbags, tires, or other heavy objects are installed along the perimeter of the sheeting to secure the sheeting. However, on some days, wood chips have been used as a daily cover when available. In those instances, a 3- to 6-inch-thick layer of wood chips is spread over exposed consolidation materials. Although the use of wood chips as a daily cover was not originally identified in the OPCA Work Plan, EPA previously approved GE's request to use wood chips, and they have effectively served as daily cover at the OPCAs throughout the consolidation activities. Going forward, a 3- to 6-inch layer of wood chips may be used as

a daily cover at the Hill 78 OPCA (when available), but not at the Building 71 OPCA. Polyethylene sheeting will be used for daily cover at the Building 71 OPCA.

SITE MODIFICATIONS

In the fall of 2005, GE planted nine additional trees to the north of the Hill 78 and Building 71 OPCAs (between the OPCAs and the Allendale School property). These trees were planted to enhance the visual barrier between the OPCAs and the Allendale School property. GE plans to continue this effort with the planting of 10 additional trees between the OPCAs and Allendale School property in 2006.

In addition, at EPA's request, GE has developed a plan to modify the approved OPCA layout, specifically the footprint of the Hill 78 OPCA. In order to preserve as many of the existing trees on the northern boundary of the Hill 78 OPCA as possible and thus to maintain the natural partition between the OPCAs and the Allendale School property, GE plans (with EPA approval) to slightly reconfigure the Hill 78 OPCA footprint. Specifically, GE is proposing to reduce the consolidation limits on the north side of the OPCA by approximately 0.24 acre, an area estimated to have the capacity to contain a volume of approximately 14,000 cubic yards (cy) of material. In addition, on the southeast side of that OPCA, GE plans to eliminate another approximate 0.16-acre portion of the footprint (estimated to have the capacity to contain approximately 5,000 cy) in order to maintain a suitable area for continued operation of the existing perimeter access road. To compensate for the capacity lost in this footprint revision (approximately 19,000 cy), an additional consolidation area of approximately 0.8 acre (with an estimated capacity of 19,000 cy) will be added to the south/southwest side of the Hill 78 OPCA. The planned revisions to the OPCA footprint are shown on Figure 3, and it is anticipated that these revisions will be included in a forthcoming Fourth Modification of the CD.

While the lateral extent of the Hill 78 OPCA will thus be increased by this modification by approximately 0.4 acre (i.e., from 5.6 to 6.0 acres), there will be no change in height or net volume at this OPCA. It should be noted that, as these modifications do not affect the Building 71 OPCA, there will be no change in the height or lateral extent (4.4 acres) of the Building 71 OPCA.

FINAL COVER DESIGN PLANS

In 2005, GE initiated the installation of approximately 2.5 acres of final cover at the Building 71 OPCA, with only the installation of certain drainage features and hydroseeding remaining to be finished by late spring 2006. GE is currently preparing the engineering design for installing the final cover over the remainder of the Building 71 OPCA and the entire Hill 78 OPCA. Once completed, the design (including technical drawings, specifications, and calculations) will be provided to the EPA for its review and approval. The submittal with the design drawings will include proposed operational procedures to limit the disturbance of the consolidated waste material, and minimize potential dust generation and airborne emissions.

At this time, GE anticipates that the design will be submitted to EPA in April 2006 and that final cover construction activities can begin in early summer. However, this schedule for final cover installation is tentative and may vary based on the progress of consolidation material placement in the OPCAs.

We trust that this Addendum sufficiently documents the recently implemented and proposed additional modifications at the OPCAs, and we request EPA approval of this Addendum, including the proposal for modification of the Hill 78 OPCA layout. If you have any comments or questions, please feel free to contact me.

Sincerely,

John F. Novotny

John F. Novotny, P.E.
Manager, Facilities and Brownfields Programs

GDR/cmb
Attachments

cc: Dean Tagliaferro, EPA
Tim Conway, EPA
John Kilborn, EPA
Holly Inglis, EPA
Rose Howell, EPA*
K.C. Mitkevicius, USACE
Susan Steenstrup, MDEP (2 copies)
Anna Symington, MDEP*
Jane Rothchild, MDEP*
Thomas Angus, MDEP*
Linda Palmieri, Weston (2 copies)
Nancy E. Harper, MA AG*
Dale Young, MA EOEA
Tom Hickey, Director, PEDA
Mayor James Ruberto, City of Pittsfield
Pittsfield Department of Health
Jeffrey Bernstein, Bernstein, Cushner & Kimmell
Teresa Bowers, Gradient
Michael Carroll, GE*
Andrew Silfer, GE
Roderic McLaren, GE*
James Nuss, BBL
James Bieke, Goodwin Procter
Larry Kirsch, Goodwin Procter
Public Information Repositories
GE Internal Repository

**cover letter only*

Attachment A

OPCA Operations Enhancements/ Additional Requirements

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Attachment A

OPCA Operations – Enhancements/Additional Requirements

1. PCB air monitoring weekly instead of monthly / continue daily particulate monitoring (both during active OPCA operations). PCB air monitoring monthly during shutdown periods.
2. Moved an air monitor directly between OPCAs and school (also upgraded select particulate monitors so they are less sensitive to humidity conditions).
3. Increased dust suppression measures at OPCAs (additional water spray during unloading).
4. Increased frequency of street sweeping along GE-Owned Tyler Street Extension and parking lot.
5. Modified OPCA trucking route with EPA's approval to reduce traffic by 50% along Tyler Street Extension (treated as a one-way road for trucks into the OPCAs).
6. Limited hours of OPCA operations as follows: no equipment start-up before 7 am; last truck into the OPCA at 4 pm; other end of day activities may extend beyond 4 p.m. regarding placement of daily cover systems (regardless of season). OPCA leachate collection and associated trucking will continue as needed (day or night, including weekends).
7. Shut down of OPCA operations due to:
   - High wind conditions (e.g. 20+ mph)
   - High humidity conditions
8. Temporary shutdown of OPCAs if PCB air notification level exceeded (0.05 ug/m^3).
9. Limited the daily maximum truckloads to OPCA 71 cell (75 trucks), without additional approval by EPA.
10. Limited OPCA operations to one cell at a time (71 or 78 but not both).
11. Develop plan to modify approved Hill 78 footprint (in order to keep the trees on the northern boundary).
12. Planting of 10 additional trees between OPCAs and school in 2006 (in addition to 9 trees planted in Fall 2005).

Attachment B

Summary of 1999 – 2005 PCB Ambient Air Sampling Results

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

ATTACHMENT B

SUMMARY OF 1999 - 2005 PCB AMBIENT AIR SAMPLING RESULTS

ON-PLANT CONSOLIDATION AREAS (OPCAs)
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(all results are ug/m^3)

Date	Northwest of OPCAs	Northwest of OPCAs colocated	Southwest of OPCAs	Southwest of OPCAs colocated	West of OPCAs	North of OPCAs	Southeast of OPCAs	Pittsfield Generating (CG)	Background Sample Location		
									West of 40's Bldgs.	Inside GE Gate 31[11]	East of Building 9B[16]
1999											
08/08/99 - 08/09/99[1]	----------	----------	0.0021	NA[2]	0.0009	NA[3]	0.0022	0.0011	----------	----------	----------
08/13/99 - 08/14/99[4]	----------	----------	0.0027	0.0046[5]	0.0048	0.0062	0.0019	0.0024	----------	----------	----------
09/21/99 - 09/22/99	----------	----------	0.0011	0.0017	0.0010	0.0010	0.0010	0.0011	----------	----------	----------
10/19/99 - 10/20/99	----------	----------	0.0010	0.0007	0.0013	0.0010	0.0009	0.0010	----------	----------	----------
11/17/99 - 11/18/99	----------	----------	0.0010	0.0010	0.0007	0.0007	0.0007	0.0017[6]	----------	----------	----------
2000											
05/17/00 - 05/18/00	----------	----------	0.0018	0.0017	0.0011	----------	----------	0.0010[7]	----------	----------	----------
07/20/00 - 07/21/00	----------	----------	0.0045	0.0040	0.0013	0.0018	0.0014	0.0030	0.0046	----------	----------
08/24/00 - 08/25/00	----------	----------	0.0043	0.0042	0.0333	0.0334[8]	0.0015	0.0110[9]	0.0135	----------	----------
09/07/00 - 09/08/00	----------	----------	0.0028	0.0031	0.0016	0.0022	0.0018	0.0125	0.0039	----------	----------
10/06/00 - 10/07/00	----------	----------	0.0008	0.0008	0.0006	0.0004	0.0004	0.0015	0.0055	----------	----------
2001											
06/06/01 - 06/07/01	----------	----------	0.0012	0.0010	ND	ND	ND	0.0009	0.0019	----------	----------
06/13/01 - 06/14/01	----------	----------	0.0023	0.0031	0.0026	ND	ND	0.002	0.0047	----------	----------
07/12/01 - 07/13/01	----------	----------	0.0019	0.0017	0.0009	0.0005	0.0028	0.0016	0.0014	----------	----------
12/06/01 - 12/07/01	----------	----------	0.0008	0.0005	ND	0.0008	0.0012	0.0011	0.0008	----------	----------
2002											
06/02/02 - 06/03/02	----------	----------	0.0017[10]	0.0019[10]	0.0006[10]	0.0005[10]	0.0071[10]	0.0007[10]	----------	0.0004[10]	----------
06/07/02 - 06/08/02	----------	----------	0.0013	0.0009	ND	ND	ND	0.0005	----------	ND	----------
07/18/02 - 07/19/02	----------	----------	0.0038	0.0027	0.0014	0.0008	0.0023	0.0025	----------	0.002	----------
09/18/02 - 09/19/02	----------	----------	0.0127[10]	0.0015[10]	0.0012[10]	0.0006[10]	0.0059[10]	0.0030[10]	----------	0.0021[10]	----------
12/18/02- 12/19/02	----------	----------	ND	0.0009	ND	ND	ND	ND	----------	0.0012	----------
2003											
05/20/03 - 05/21/03	----------	----------	0.0025[12]	0.0099[12]	0.0037[12]	0.0033[12]	0.0007[12]	0.0015[12]	----------	0.0065[12]	----------
06/18/03 - 06/19/03	----------	----------	0.0013	0.0011	0.0015	0.0009	0.0007	0.0017	----------	0.0028	----------
08/05/03 - 08/06/03	----------	----------	0.0020	0.0031	0.0060	0.0019	0.0019	0.0017	----------	0.0090	----------
09/15/03 - 09/16/03	----------	----------	0.0020	NA[13]	0.0028	ND	0.0004	0.0011	----------	0.0037	----------
09/29/03 - 09/30/03	----------	----------	0.0015	0.0015	0.0008	0.0003	0.0004	0.0005	----------	0.0010	----------
10/13/03 - 10/14/03	----------	----------	0.0011	0.0005	0.0003	NA[14]	0.0004	0.0003	----------	0.0010	----------

(See Notes on Page 3 of 3)

ATTACHMENT B

SUMMARY OF 1999 - 2005 PCB AMBIENT AIR SAMPLING RESULTS

ON-PLANT CONSOLIDATION AREAS (OPCAs)
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(all results are ug/m^3)

Date	Northwest of OPCAs	Northwest of OPCAs colocated	Southwest of OPCAs	Southwest of OPCAs colocated	West of OPCAs	North of OPCAs	Southeast of OPCAs	Pittsfield Generating (CG)	Background Sample Location		
									West of 40's Bldgs.	Inside GE Gate 31[11]	East of Building 9B[16]
2004											
05/14/04 - 05/15/04	----------	----------	0.0019	0.0013	0.0065	0.0017	0.0013	0.0040	----------	0.0038	----------
06/17/04 - 06/18/04	----------	----------	0.0032	0.0023	0.0026	0.0030	0.0065	0.0152	----------	0.0026	----------
09/13/04 - 09/14/04	----------	----------	0.0023	0.0025	0.0009	0.0006	0.0010	0.0033	----------	0.0019	----------
09/14/04 - 09/15/04	----------	----------	ND	0.0017	0.0020	ND	0.0006	0.0015	----------	0.0031	----------
10/11/04 - 10/12/04	----------	----------	0.0010	0.0011	0.0004	0.0004	0.0011	0.0007	----------	0.0004	----------
11/02/04 - 11/03/04	----------	----------	ND	ND	ND	0.0009	0.0004	0.0005	----------	0.0010	----------
12/14/04 - 12/15/04	----------	----------	NA[15]	NA[15]	ND	ND	0.0009	ND	----------	ND	----------
2005											
05/05/05 - 05/06/05	----------	----------	0.0009	0.0008	0.0009	0.0008	0.0009	0.0030	----------	0.0014	----------
06/01/05 - 06/02/05	----------	----------	0.0016	0.0015	0.0023	0.0012	NA[17]	0.0014	----------	0.0024	----------
06/29/05 - 06/30/05	----------	----------	0.0048	0.0028	0.0042	0.0020	0.0045	0.0085	----------	0.0080	----------
08/02/05 - 08/03/05	----------	----------	0.0037	0.0030	0.0029	0.0010	0.0097	0.0050[18]	----------	----------	0.0012
09/01/05 - 09/02/05	----------	----------	0.0220	0.0269	0.0025	0.0015	0.0372	0.0309	----------	----------	0.0010
10/06/05 - 10/07/05	----------	----------	0.0035	0.0035	0.0039	0.0183	0.0042	0.0384	----------	----------	0.0025
10/27/05 - 10/28/05	----------	----------	0.0008	0.0010	0.0021	0.0011	0.0137[19]	0.0061	----------	----------	0.0019
11/01/05 - 11/02/05	----------	----------	0.0013	0.0019	0.0016	0.0111	0.0026	0.0090	----------	----------	ND
11/08/05 - 11/09/05	----------	----------	0.0015	0.0012	0.0012	0.0011	0.0034	0.0103	----------	----------	0.0007
11/17/05 - 11/18/05	----------	----------	ND	ND	0.0008	ND	0.0014	0.0040	----------	----------	ND
11/22/05 - 11/23/05	0.0009[20]	0.0008[20]	----------	----------	ND	0.0003	0.0009	0.0031	----------	----------	ND
12/01/05 - 12/02/05	0.0024	0.0014	----------	----------	0.0010	0.0019	0.0011	0.0040	----------	----------	0.0015
12/06/05 - 12/07/05	ND	ND	----------	----------	ND	ND	ND	ND	----------	----------	ND
12/15/05 - 12/16/05	0.0011	0.0008	----------	----------	0.0012	0.0015	0.0005	0.0007	----------	----------	0.0005
12/20/05 - 12/21/05	ND	ND	----------	----------	0.0006	ND	0.0005	0.0012			ND
Exceedances of Notification Level (0.05 µg/m^3)	None	None	None	None	None	None	None	None	None	None	None

(See Notes on Page 3 of 3)

ATTACHMENT B

SUMMARY OF 1999 - 2005 PCB AMBIENT AIR SAMPLING RESULTS

ON-PLANT CONSOLIDATION AREAS (OPCAs)
GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
(all results are ug/m^3)

Notes:

All sampling and analytical activities performed and/or coordinated by Berkshire Environmental Consultants, Inc.
NA - Not Available
ND - Non Detect (<0.0003)

[1] Background (prior to site activity) sampling event conducted from 7 a.m. Sunday to 7 a.m. Monday. No soil was moved during this sampling event.
[2] Co-located sampler was not in place for the first (background prior to site activity) sampling event.
[3] Sample was not analyzed. Due to loss of power, the sampling period was shortened to approximately 6 hours.
[4] Sampling was conducted from 7 p.m. on August 13, 1999 to 7 p.m. on August 14, 1999.
[5] Sample was collected using a PUF and filter from a separate lab shipment. These samples were not used in precision calculations.
[6] PCB monitor was relocated to the northeast corner of this site on November 2, 1999.
[7] This sample was collected at the alternative location for the Cogeneration facility.
[8] Sample does not meet criteria for validity. Value is estimated and may be biased high. Sampling was interrupted due to temporary loss of power to the air samplers after on-site soil handling activities had been completed for the day. Total volume sampled was 206.3 m^3.
[9] Sample does not meet criteria for validity. Value is estimated and may be biased high. Sampling was interrupted due to temporary loss of power to the air samplers after on-site soil handling activities had been completed for the day. Total volume sampled was 273.2 m^3.
[10] Result is believed to be biased high due to the presence of PCB on the field blank.
[11] Background PCB monitoring location was permanently relocated from west of the 40's building complex in February 2002 to inside GE Gate 31 on the corner of Woodlawn Avenue and Tyler Street due to demolition activity at Building 31.
[12] Result is biased high due to contamination of the laboratory method blank.
[13] Sample was not collected at this site during this event. PCB sampling on this day at OPCAS was run concurrently with another PCB sampling event at Building 25. A co-located sample was collected at that site.
[14] Sample did not meet validity requirements and was not analyzed. Sampler air flow was restricted.
[15] Sample did not meet the QA/QC criteria of 24 hours ± 30 minutes due to a power supply interruption and is therefore not reported.
[16] Background PCB monitoring location was permanently relocated from inside GE Gate 31 on the corner of Woodlawn Avenue and Tyler Street in July 2005 to East of Building 9B, between Building 9B and New York Avenue, to provide more representative background data.
[17] Not available - sample voided due to condensing tube tip breakage during analysis at the laboratory. Re-extraction was not possible.
[18] The PCB results from the OPCA CG site failed a laboratory QA/QC criteria. The sample failed both surrogate spike recoveries. One spike recovery failed very high at 540% (acceptable range 50-150%) and one failed very low at 1.4% (acceptable range 27-132%).
[19] The PCB results from the OPCA SE site failed a laboratory QA/QC criteria. The sample failed both surrogate spike recoveries. One spike recovery failed very high at 1400% (acceptable range 50-150%) and one failed very high at 414% (acceptable range 27-132%)
[20] Data are reported for informational purposes only. Sample did not meet the QA/QC critieria of 24 hours ± 30 minutes due to a power supply interruption from the generator.

Attachment C

Transportation Procedures

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

ATTACHMENT C

TRANSPORTATION PROCEDURES

Transportation of remediation-related waste materials generated at the GE-Pittsfield/Housatonic River Site subject to the Consent Decree to or from GE's On-Plant Consolidation Areas (OPCAs) or the Building 78 hazardous waste storage facility at the GE Plant via the transportation routes shown on Figure 2 of this OPCA Work Plan Addendum will be conducted in accordance with the following procedures:

- The contractor conducting the shipments will be required to:
    - Employ qualified personnel trained per U.S. Department of Transportation (DOT) requirements for handling and shipping the types of materials to be transported (e.g., hazardous materials or hazardous waste), with such training to include general safety, emergency response, exposure protection, accident prevention, preparation of shipping papers, and securing loads;
    - Employ drivers that have a Commercial Driver's License with an appropriate endorsement for the type of waste to be transported;
    - Utilize trucks that are DOT-inspected;
    - Include in its Health and Safety Plan, Operations Plan, and Contingency Plan, detailed provisions for responding to transportation emergencies such as spills, releases, or other incidents;
    - Maintain records of the number of loads of materials sent to the OPCAs or Building 78 storage facility on a daily basis; and
    - Confirm that the materials are suitable for transport.
- For the transport of consolidation materials (i.e., building demolition debris and excavated soil and sediment), after a safety check of the truck, the truck bed will be lined with polyethylene, the materials will be placed in the truck, and the load will be covered with tarps. The load will not be uncovered until the trucks are within the OPCA footprint and are ready to dump. Empty transport vehicles will also be tarped before they leave the OPCA area. Similar to transport vehicles hauling building demolition debris and excavated soil and sediment, transport vehicles hauling clean backfill or cover materials will also be tarped when traveling to the OPCAs, and empty transport vehicles will be re-tarped before leaving the OPCA area.
- A Bill of Lading (BOL) will be prepared and signed by the truck driver. However, since the transport will occur entirely "onsite" (as discussed in the text of this Addendum), a manifest is not required.
- After another safety check of the vehicle and placarding, the truck will leave the site and proceed to the appropriate OPCA or Building 78 storage facility utilizing the applicable route shown on Figure 2 of this OPCA Work Plan Addendum. Vehicles transporting consolidation materials to the Building 71 OPCA will be placarded with a Class 9 UN 3432 placard in accordance with 49 CFR 172.504 (see attached figure), and a PCB ML Marker in accordance with 40 CFR 761.40.

- Upon arrival of the transport vehicle at the appropriate OPCA or the Building 78 hazardous waste storage facility, the OPCA or storage facility contractor (as appropriate) will document receipt of the load and the material will be off-loaded and placed by that contractor.

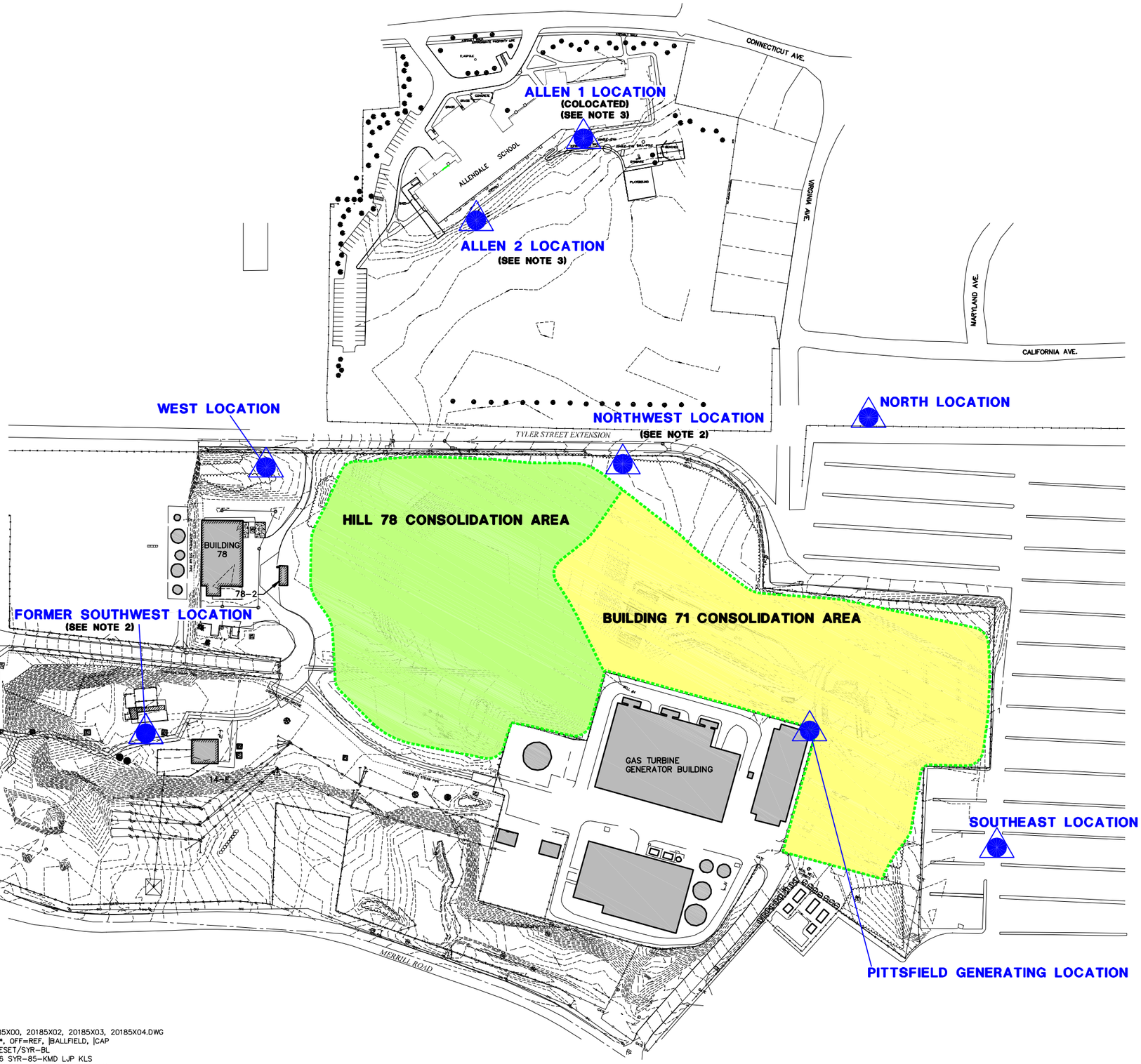
- Prior to leaving either OPCA, a visual inspection of each transport vehicle will be performed. Accumulations of soil or sediment on the vehicle tires or other exterior surfaces will be removed manually or, if necessary, by using a high pressure water spray.

CLASS 9 UN 3432 PLACARD

03/30/06 SYR-D85-DJH
20405001/20405g01.cdr

Figures

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists



LEGEND:

- EXISTING BUILDING OR STRUCTURE
- EXISTING ROADS
- EXISTING FENCE
- APPROXIMATE LOCATION OF PCB AIR MONITORING STATIONS
- APPROXIMATE LIMIT OF ANTICIPATED FUTURE CONSOLIDATION AREA FOOTPRINT

NOTE:

1. NOT ALL PHYSICAL FEATURES ARE SHOWN.
2. THE SOUTHWEST PCB AIR MONITORING STATION WAS MOVED TO THE NORTHWEST LOCATION ON NOVEMBER 21, 2005.
3. THE PCB AIR MONITORING STATIONS ADJACENT TO THE ALLENDALE SCHOOL WERE INSTALLED ON DECEMBER 5, 2005.

0 200' 400'

GRAPHIC SCALE

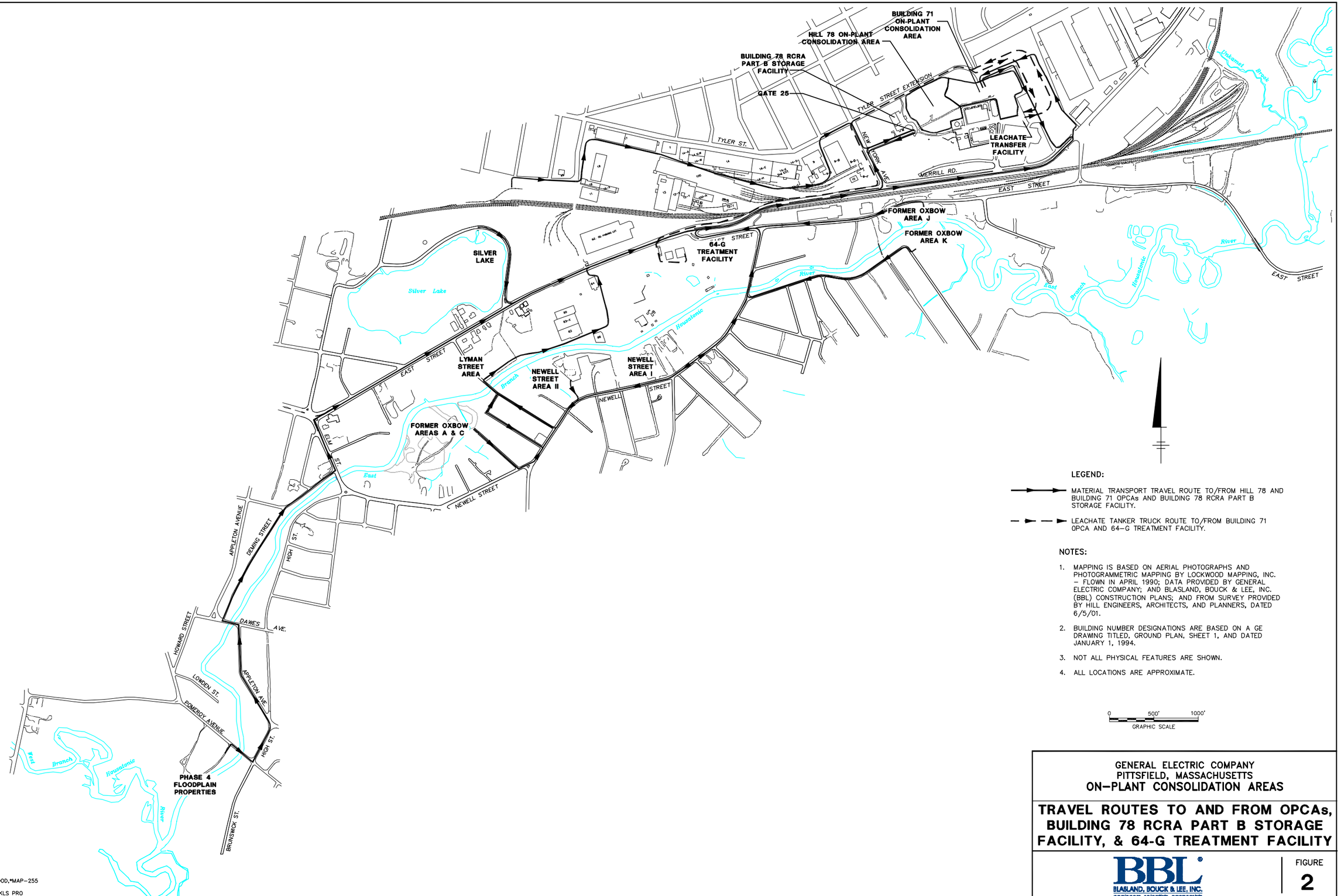
X: 20185X00, 20185X02, 20185X03, 20185X04.DWG
L: ON=*, OFF=REF, |BALLFIELD, |CAP
P: PAGESET/SYR-BL
4/13/06 SYR-85-KMD LJP KLS
N/20185003/REPORT/20185G18.DWG

GENERAL ELECTRIC COMPANY,
PITTSFIELD MASSACHUSSETTS
BUILDING 71 AND HILL 78 ON-PLANT CONSOLIDATION AREAS

APPROXIMATE LOCATION OF PCB AIR MONITORING STATIONS

BBL BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
1



LEGEND:

- MATERIAL TRANSPORT TRAVEL ROUTE TO/FROM HILL 78 AND BUILDING 71 OPCAs AND BUILDING 78 RCRA PART B STORAGE FACILITY.
- LEACHATE TANKER TRUCK ROUTE TO/FROM BUILDING 71 OPCA AND 64-G TREATMENT FACILITY.

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. – FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY; AND BLASLAND, BOUCK & LEE, INC. (BBL) CONSTRUCTION PLANS; AND FROM SURVEY PROVIDED BY HILL ENGINEERS, ARCHITECTS, AND PLANNERS, DATED 6/5/01.
2. BUILDING NUMBER DESIGNATIONS ARE BASED ON A GE DRAWING TITLED, GROUND PLAN, SHEET 1, AND DATED JANUARY 1, 1994.
3. NOT ALL PHYSICAL FEATURES ARE SHOWN.
4. ALL LOCATIONS ARE APPROXIMATE.

0 500' 1000'
GRAPHIC SCALE

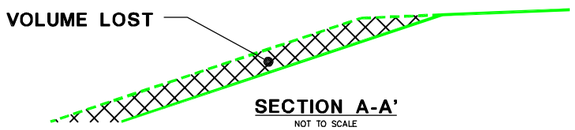
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
ON-PLANT CONSOLIDATION AREAS

TRAVEL ROUTES TO AND FROM OPCAs, BUILDING 78 RCRA PART B STORAGE FACILITY, & 64-G TREATMENT FACILITY

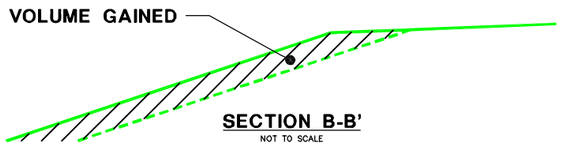
BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE 2

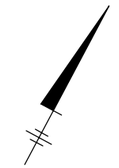
X: 20405X01.DWG
L: ON=*,OFF=*REF,*FLOOD,*MAP-255
P: PAGESET-DL2B1
4/7/06 SYR-85-PRO KLS PRO
N/20405001/OPCA/20405P03.DWG



SECTION A-A'
NOT TO SCALE



SECTION B-B'
NOT TO SCALE



LEGEND:

- EXISTING BUILDING OR STRUCTURE
- EXISTING ROADS
- NON–TSCA/NON–RCRA AREA
- TSCA/RCRA AND NON–TSCA/NON–RCRA AREA
- APPROXIMATE LIMIT OF APPROVED CONSOLIDATION AREA FOOTPRINT
- APPROXIMATE LIMIT OF REVISED CONSOLIDATION AREA FOOTPRINT
- EXISTING SECURITY FENCE

NOTES:

1. MAPPING IS BASED ON AERIAL PHOTOGRAPHS AND PHOTOGRAMMETRIC MAPPING BY LOCKWOOD MAPPING, INC. –FLOWN IN APRIL 1990; DATA PROVIDED BY GENERAL ELECTRIC COMPANY; AND BLASLAND, BOUCK & LEE, INC. (BBL) CONSTRUCTION PLANS, AND ON OBSERVATIONS DURING A SITE VISIT BY BBL PERSONNEL ON DECEMBER 3, 1997.
2. SITE BOUNDARIES ARE APPROXIMATE.
3. NOT ALL PHYSICAL FEATURES SHOWN.

0 100' 200'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
ON–PLANT CONSOLIDATION AREAS

REVISED ON-PLANT CONSOLIDATION AREA FOOTPRINT

BBL BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
3

X: 20405X04.DWG
L: ON=*, OFF=*REF
P: PAGESET/PLT-DL
4/13/06 SYR-85-LJP DJP KLS
N/20405001/OPCA/REPORT/20405G01.DWG

Attachment 3

Final Cover Design Calculations

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Mid-Slope Swale Design

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

CLIENT: General Electric Company **PROJECT:** Pittsfield, Massachusetts **Prepared By:** RLP **Date:** April 2006
TITLE: Hill 78 and Building 71 OPCA Final Cover Design Calculations **Checked By:** CAA **Date:** April 2006
SUBJECT: Mid-Slope Swale Design **Reviewed By:** PHB **Date:** April 2006

TASK:

Demonstrate that the proposed geometry for the mid-slope swale provides adequate hydraulic capacity to convey the estimated peak discharge resulting from a 25-year, 24-hour storm event. Demonstrate that stable hydraulic conditions exist within the swale during the design storm event for newly graded conditions and after vegetation is established.

REFERENCES:

1. Hill 78 and Building 71 OPCAs Final Cover Design Drawing No. 4 entitled "Final Cover Grading Plan, Building 71," Blasland, Bouck & Lee, Inc. (BBL), April 2006.

2. Hill 78 and Building 71 OPCAs Final Cover Design Drawing No. 5 entitled "Final Cover Grading Plan, Hill 78," BBL, April 2006.

3. Hill 78 and Building 71 OPCAs Final Cover Design Drawing No. 8 entitled "Miscellaneous Details," BBL, April 2006.

4. *Technical Release 55 – Urban Hydrology for Small Watersheds*, p. 2-5, Soil Conservation Service, June 1986 (attached).

5. PondPack for Windows, Version 7.5, hydrology modeling program, Haestad Methods, Inc.

6. North American Green Erosion Control Materials Design Software v. 4.3.

7. "Stormwater Technical Handbook," MA Department of Environmental Protection, and MA Office of Coastal Zone Management, March 1997.

8. Attachment 3 entitled OPCA Final Cover Design Calculation "Mid-Slope Swale Design" to the July 15, 2005 letter to the U.S. Environmental Protection Agency regarding the 2005 Final Cover Construction.

ASSUMPTIONS:

1. The design storm is the 25-year, 24-hour event, which produces 5.3 inches of rainfall, based on Reference 4.

2. The watershed areas for the swales are based on References 1 and 2. The largest watershed area associated with the mid-slope swale will occur following final cover construction of the entire Hill 78 On-Plant Consolidation Area (OPCA). Therefore, the design for the mid-slope swale is based on the final buildout condition for the Hill 78 OPCA presented on Reference 2. The approximate watershed boundary used for the mid-slope swale design is shown on the attached watershed area map.

3. As shown on References 1 and 2, three mid-slope swales will be constructed. Two mid-slope swales will be constructed on the northern and southern sideslopes of the Building 71 final cover and one will be constructed along the sideslope of the Hill 78 final cover. The swales constructed along the northern sideslope of the Building 71 final cover and the sideslope of the Hill 78 final cover will terminate at the existing northern stormwater basin. The swale constructed along the southern sideslope of the Building 71 final cover will tie into the mid-slope swale designed as part of the Phase I final cover.

4. The mid-slope swales constructed on the Building 71 OPCA were previously evaluated (Reference 8), based on the largest contributing watershed area associated with the Building 71 OPCA final cover. Therefore, the mid-slope swale constructed on the Hill 78 OCPA is analyzed for the maximum estimated peak flow condition presented in this calculation. The maximum peak flow condition is calculated for both the newly graded and vegetated conditions.

5. Runoff curve numbers are determined from Reference 4. The runoff curve numbers for the newly graded and vegetated conditions are based on hydrologic soil group C and the following cover types:

   - Newly Graded Condition: newly graded areas, CN = 91; and
   - Vegetated Condition: open space, fair condition, CN = 79.

   Affects on the hydraulic calculations associated with the final cover access road surface are considered negligible and therefore, are not included.

6. The mid-slope swale constructed along the sideslopes of the Hill 78 final cover will have a minimum invert slope of 1%, while the mid-slope swales constructed along the Building 71 final cover will have a minimum invert slope of 2%.

7. A permanent erosion control mat will line the interior surfaces of the mid-slope swales to minimize erosion of the channel.

8. Based on Reference 3, the proposed mid-slope swales consist of a built-up berm which creates a v-notch channel against the final cover surface. The mid-slope swales will have an interior sideslope of 3:1 (H:V), and an invert depth of 1.5 feet.

9. The Manning "n" value and the critical and permissible shear stress values are calculated by Reference 6 based on the channel lining and the estimated hydraulic conditions of the mid-slope swale.

10. Reference 7 recommends that the channel design be based on the peak discharge from the 10-year, 24-hour storm. In contrast, the mid-slope swale design is based on the peak discharge from the 25-year, 24-hour storm and is therefore, considered more conservative.

CALCULATIONS:

1. Estimated Peak Discharges

The largest watershed area contributing to a mid-slope swale on the Hill 78 OPCA is approximately 3.06 acres. The curve number for the tributary watershed is determined based on cover type and condition for each area as described in Assumption 5. The estimated peak discharge for the largest contributing watershed is calculated by Reference 5. The following table summarizes the resulting estimated peak discharges:

Condition (Newly Graded or Vegetated)	Curve Number	Time of Concentration [hrs]	Estimated Peak Discharge [cfs]
Newly Graded	91	0.13	12.22
Vegetated	79	0.61	5.60

Supporting output from Reference 5 is included as an attachment to this calculation.

2. Estimated Hydraulic Conditions

The resulting hydraulic conditions are based on the proposed geometry of the mid-slope swale and the above-calculated peak discharges immediately following mid-slope swale construction and during conditions where vegetation is established. The following table summarizes the resulting estimated hydraulic conditions:

Condition (Newly Graded or Vegetated)	Estimated Peak Discharge [cfs]	Manning "n" [1]	Flow Depth [ft]	Flow Velocity [ft/sec]	Shear Stress[1] [psf]	Permissible Shear Stress[1] [psf]	Factor of Safety[2]
Newly Graded	12.22	0.028	1.10	3.38	0.68	3.00	4.38
Vegetated[3]	5.60	0.105	1.34	1.04	0.83	8.00	9.60

Notes:
1- The Manning "n", shear stress, and permissible shear stress values are calculated by Reference 5 based on the channel lining and the estimated hydraulic conditions of the channel.
2- The factor of safety is based on a comparison between the permissible shear stress and calculated shear stress.
3- The shear stress and permissible shear stress values are presented for vegetation or soil conditions, depending on which material's properties result in the lowest factor of safety.

Because the flow depths for the newly graded and vegetated conditions are less than the depth of the mid-slope swale (1.5 feet), the proposed swale configuration provides adequate hydraulic capacity. Additionally, because the critical shear stress is less than the permissible shear stress for both conditions, the mid-slope swale lining is considered hydraulically stable. The hydraulic analysis and output from Reference 6 is included as an attachment to this calculation.

SUMMARY:

The mid-slope swale configuration shown on Reference 3 provides adequate hydraulic capacity to convey the 25-year, 24-hour estimated peak discharges. Stable hydraulic conditions exist in the swales for both newly graded and vegetated conditions during the design storm event.

Supporting Output

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Newly Graded Watershed Condition

Table of Contents

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 MSS REV.PPW

::

TIME OF CONCENTRATION CALCULATOR

::

Segment #1: Tc: Length & Vel.

Hydraulic Length 1287.64 ft
Avg.Velocity 3.38 ft/sec

Segment #1 Time: .1058 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 5.00 ft
Slope .330000 ft/ft
Unpaved

Avg.Velocity 9.27 ft/sec

Segment #2 Time: .0001 hrs

Segment #3: Tc: TR-55 Sheet

Mannings n .0110
Hydraulic Length 150.00 ft
2yr, 24hr P 2.8000 in
Slope .040000 ft/ft

Avg.Velocity 1.84 ft/sec

Segment #3 Time: .0226 hrs

==========
Total Tc: .1286 hrs
==========

Type.... Tc Calcs
Name.... SCS UH 10

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 MSS REV.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== User Defined Length & Velocity ==========

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 yr year storm
Duration = 24.0000 hrs Rain Depth = 5.3000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\
HYG File - ID = 2006 MSS.HYG - SCS UH 10 25yr24
Tc = .1286 hrs
Drainage Area = 3.060 acres Runoff CN= 91

==========
Computational Time Increment = .01715 hrs
Computed Peak Time = 12.1057 hrs
Computed Peak Flow = 12.22 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 12.17 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 91
Area = 3.060 acres
S = .9890 in
0.2S = .1978 in

Cumulative Runoff

4.2738 in
1.090 ac-ft

HYG Volume... 1.090 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .12860 hrs (ID: SCS UH 10)
Computational Incr, Tm = .01715 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 26.96 cfs
Unit peak time Tp = .08573 hrs
Unit receding limb, Tr = .34294 hrs
Total unit time, Tb = .42867 hrs

MID-SLOPE SWALE
NEWLY GRADED WATERSHED CONDITION

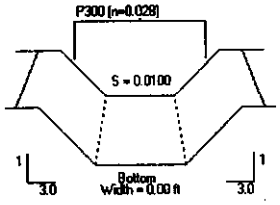
Channel Design (Input)	
Flow Capacity (cfs)	12.22
Channel Depth (ft) (minimum)	1.50
Channel Base Width (ft)	0.00
Left Side Slope (x:1)	3.00
Right Side Slope (x:1)	3.00
Channel Width at Top (ft)	9.00
Channel Bed Slope	0.010
Manning "n"	0.028

Flow Conditions (Output)	
Flowrate from Manning Equation (cfs)	12.22
Required Flow Depth (ft)	1.10
Resulting Flow Velocity (ft/s)	3.38
Resulting Flow Width at Top (ft)	6.58
Resulting Flow Area (ft^2)	3.61
Resulting Wetted Perimeter (ft)	6.94
Resulting Hydraulic Radius (ft)	0.52
Permissible Shear Stress (psf)	3.00
Calculated Shear Stress (psf)	0.68
Channel Conditions	
Resulting Freeboard Depth (ft)	0.40
Shear Stress Factor of Safety	4.38

North American Green - ECMDS Version 4.3		3/15/2006 11:28 AM	COMPUTED BY: RLP
PROJECT NAME: OPCA Final Cover Design Calculations		PROJECT NO.: 20405	
FROM STATION/REACH:	TO STATION/REACH:	DRAINAGE AREA: 3.06	DESIGN FREQUENCY: 25-year

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
12.2	1.0	3.38	3.61	0.52	1.10



Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	P300	Unvegetated	1				3.00	0.68	4.38	STABLE
	Staple E									

Vegetated Watershed Condition

Table of Contents

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 MSS REV.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: Length & Vel.

Hydraulic Length 1287.64 ft
Avg.Velocity 1.04 ft/sec

Segment #1 Time: .3439 hrs

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 5.00 ft
Slope .330000 ft/ft
Unpaved

Avg.Velocity 9.27 ft/sec

Segment #2 Time: .0001 hrs

Segment #3: Tc: TR-55 Sheet

Mannings n .2400
Hydraulic Length 150.00 ft
2yr, 24hr P 2.8000 in
Slope .040000 ft/ft

Avg.Velocity .16 ft/sec

Segment #3 Time: .2665 hrs

==========
Total Tc: .6106 hrs
==========

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 MSS REV.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== User Defined Length & Velocity ==========

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 yr year storm
Duration = 24.0000 hrs Rain Depth = 5.3000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\
HYG File - ID = 2006 MSS.HYG - SCS UH 20 25yr24
Tc = .6106 hrs
Drainage Area = 3.060 acres Runoff CN= 79

==========
Computational Time Increment = .08141 hrs
Computed Peak Time = 12.4561 hrs
Computed Peak Flow = 5.60 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.4500 hrs
Peak Flow, Interpolated Output = 5.60 cfs
==========

DRAINAGE AREA

ID:None Selected
CN = 79
Area = 3.060 acres
S = 2.6582 in
0.2S = .5316 in

Cumulative Runoff

3.0616 in
.781 ac-ft

HYG Volume... .781 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .61060 hrs (ID: SCS UH 20)
Computational Incr, Tm = .08141 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 5.68 cfs
Unit peak time Tp = .40706 hrs
Unit receding limb, Tr = 1.62825 hrs
Total unit time, Tb = 2.03532 hrs

MID-SLOPE SWALE
VEGETATED WATERSHED CONDITION

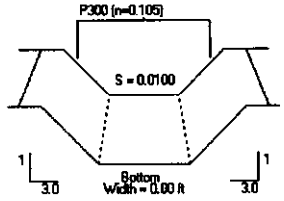
Channel Design (Input)	
Flow Capacity (cfs)	5.60
Channel Depth (ft) (minimum)	1.50
Channel Base Width (ft)	0.00
Left Side Slope (x:1) (maximum)	3.00
Right Side Slope (x:1) (maximum)	3.00
Channel Width at Top (ft)	9.00
Channel Bed Slope	0.010
Manning "n"	0.105

Flow Conditions (Output)	
Flowrate from Manning Equation (cfs)	5.60
Required Flow Depth (ft)	1.34
Resulting Flow Velocity (ft/s)	1.04
Resulting Flow Width at Top (ft)	8.01
Resulting Flow Area (ft^2)	5.35
Resulting Wetted Perimeter (ft)	8.45
Resulting Hydraulic Radius (ft)	0.63
Permissible Shear Stress (psf)	8.00
Calculated Shear Stress (psf)	0.83
Channel Conditions	
Resulting Freeboard Depth (ft)	0.16
Shear Stress Factory of Safety	9.60

North American Green - ECMDS Version 4.3	3/15/2006 11:23 AM	COMPUTED BY: RLP
PROJECT NAME: OPCA Final Cover Design Calculations	PROJECT NO.: 20405	
FROM STATION/REACH:	TO STATION/REACH:	DRAINAGE AREA: 3.06	DESIGN FREQUENCY: 25-year,

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
5.6	1.0	1.04	5.35	0.63	1.34



Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	P300	Vegetation	3	C	Mix	75-95%	8.00	0.83	9.60	STABLE
	Staple E	Soil	Loam				2.000	0.013	154.17	STABLE

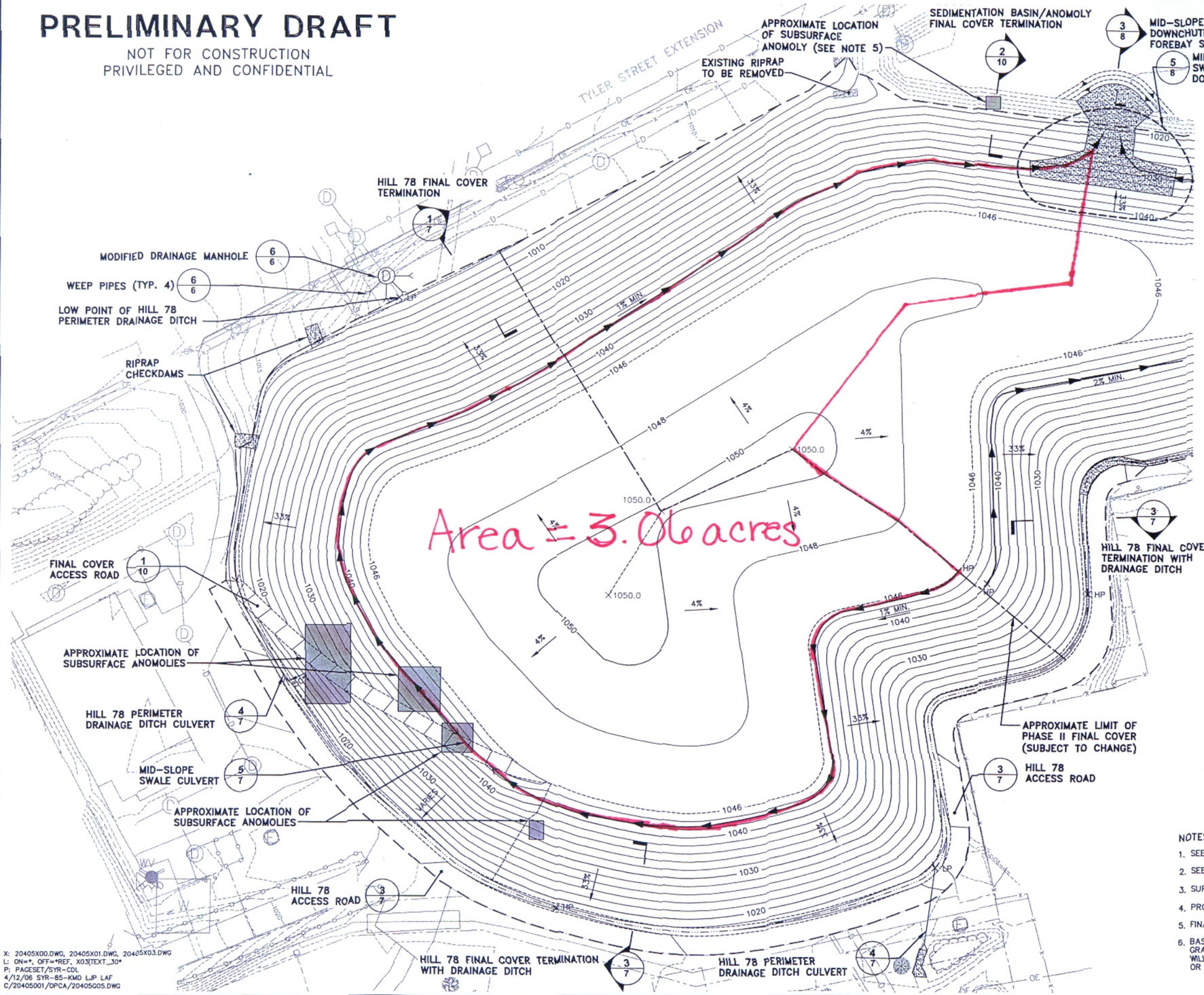
[redacted]

Watershed Map

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

PRELIMINARY DRAFT

NOT FOR CONSTRUCTION
PRIVILEGED AND CONFIDENTIAL



X: 20405X00.DWG, 20405X01.DWG, 20405X03.DWG
L: ON=*, OFF=*REF, X03|TEXT_30*
P: PAGESET/SYR-CDL
4/12/06 SYR-85-KMD LJP LAF
C/20405001/OPCA/20405G05.DWG

LEGEND:

- HP — PROPOSED HIGH POINT
- LP — PROPOSED LOW POINT
- 1030 — PROPOSED INDEX CONTOUR LINE
- PROPOSED INTERMEDIATE CONTOUR LINE
- 1050.0 — PROPOSED SPOT ELEVATION
- 3/8 — DETAIL REFERENCE NUMBER / DRAWING REFERENCE NUMBER
- SURVEY CONSTRUCTION CONTROL POINT (SEE TABLE ON THIS DRAWING)
- PROPOSED GRADE BREAK
- HILL 78 PERIMETER DRAINAGE DITCH 4/8
- APPROXIMATE LIMIT OF GRADING
- PROPOSED MID-SLOPE SWALE 1/8
- PROPOSED RIPRAP

SURVEY CONTROL INFORMATION CONSTRUCTION POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	AS-BUILT ELEV.*	DESCRIPTION

* AS-BUILT INFORMATION TO BE COMPLETED BY CONTRACTOR AND INCLUDED WITH RECORD DRAWINGS.

NOTES:

1. SEE DRAWING 1 FOR BASEMAP INFORMATION.
2. SEE DRAWING 3 FOR ADDITIONAL DESIGN INFORMATION.
3. SURVEY TOLERANCE IS ±0.05' UNLESS OTHERWISE APPROVED BY GE OR GE'S REPRESENTATIVE.
4. PROPOSED GRADES/ELEVATIONS SHOWN REPRESENT TOP OF FINAL COVER SYSTEM.
5. FINAL COVER TO EXTEND OVER ANOMOLY AS SHOWN ON DRAWING 10, DETAIL 2.
6. BASED ON PREVIOUS DISCUSSIONS WITH THE EPA, EARTHWORK ACTIVITIES ASSOCIATED WITH FINAL COVER SUBBASE GRADING WILL BE LIMITED TO APPROXIMATELY ONE ACRE IN SIZE AT ANY GIVEN TIME. FURTHER SUBBASE GRADING WILL CONTINUE ONCE A PORTION OF THE ONE ACRE AREA IS COMPLETED WITH EITHER 6 INCHES OF CLEAN SOIL FILL OR LINER MATERIAL.

Graphic Scale
40' 0 40' 80'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	PHB	Designed by: CAA / Drawn by: LAF

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

FINAL COVER GRADING PLAN
HILL 78

GENERAL

BBL Project No. 204.05
Date APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

5

References

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Hill 78 Perimeter Ditch Design

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

CLIENT: General Electric Company PROJECT: Pittsfield, Massachusetts **Prepared By: GNG/RLP Date: April 2006**
TITLE: Hill 78 and Building 71 OPCA Final Cover Design Calculations **Checked By: CAA Date: April 2006**
SUBJECT: Hill 78 Perimeter Ditch Design **Reviewed By: PHB Date: April 2006**

OBJECTIVE:

Demonstrate that the proposed geometry for the Hill 78 perimeter ditch provides adequate hydraulic capacity to convey the estimated peak discharge from the 25-year, 24-hour storm event. Demonstrate that stable hydraulic conditions exist in the Hill 78 perimeter ditch during the design storm event.

REFERENCES:

1. Hill 78 and Building 71 OPCAs Final Cover Design Drawing No. 5 entitled "Final Cover Grading Plan – Hill 78," Blasland, Bouck & Lee, Inc. (BBL), April 2006.

2. Hill 78 and Building 71 OPCAs Final Cover Design Drawing No. 7 entitled "Miscellaneous Details," BBL, April 2006.

3. *Technical Release 55 – Urban Hydrology for Small Watersheds*, p. 2-5, Soil Conservation Service, June 1986 (attached).

4. PondPack for Windows, Version 9, hydrology modeling program, Haestad Methods, Inc.

5. North American Green Erosion Control Materials Design Software v. 4.3, 2003.

6. "Stormwater Technical Handbook," MA Department of Environmental Protection, and MA Office of Coastal Zone Management, March 1997.

ASSUMPTIONS:

1. As shown on Reference 1, the Hill 78 perimeter ditch will be constructed around the west, south, and east of Hill 78.

2. The Hill 78 perimeter ditch will have a minimum invert slope of 1%.

3. As shown on Reference 2, the Hill 78 perimeter ditch will be v-notch, having sideslopes of 2:1 (H:V), and a depth of 1.5 feet.

4. The design storm is the 25-year, 24-hour event, which produces 5.3 inches of rainfall, based on Reference 3.

5. The watershed area for the Hill 78 perimeter ditch is based on Reference 1. The largest watershed area associated with the Hill 78 perimeter ditch will occur following final cover construction of the entire Hill 78 On-Plant Consolidation Area (OPCA). Therefore, the design for the Hill 78 perimeter ditch is based on the final buildout condition for the Hill 78 OPCA presented on Reference 1. The approximate watershed boundary used for the Hill 78 perimeter ditch design is shown on the attached watershed area map.

6. A temporary erosion control mat will line the interior surfaces of the Hill 78 perimeter ditch to minimize erosion of the unvegetated channel lining. The temporary erosion control mat will degrade over time and is intended to protect the topsoil until vegetation is established.

7. Runoff curve numbers are determined from Reference 3. The runoff curve numbers are based on hydraulic soil group C and the following cover types:

   - Newly Graded Cover: newly graded areas, CN = 91
     paved road areas, CN = 98; and
   - Vegetated Cover: open space, fair condition, CN = 79
     paved road areas, CN = 98.

   Since the contributing watershed area includes a portion of the Hill 78 access road, a composite curve number is calculated for both newly graded and vegetated conditions. It should be noted that although the Hill 78 access road will be constructed of gravel, a paved roadaszx is assumed for conservatism and in the event the access road is paved in the future.

8. Reference 6 recommends that the channel design be based on the peak discharge from the 10-year, 24-hour storm. In contrast, the Hill 78 perimeter ditch design is based on the peak discharge from the 25-year, 24-hour storm and is therefore, considered more conservative.

9. The Manning "n" value and the critical and permissible shear stress values are calculated by Reference 5 based on the channel lining and the estimated hydraulic conditions of the Hill 78 perimeter ditch.

10. The Hill 78 perimeter ditch is analyzed for the maximum estimated peak flow condition resulting from the largest contributing watershed area. The maximum peak flow condition is calculated for both the newly graded and vegetated conditions.

CALCULATIONS:

1. Estimated Peak Discharge

The watershed area contributing to the Hill 78 perimeter ditch is approximately 1.12 acres. The composite curve number for the tributary watershed is determined by Reference 4 based on cover type and condition as described in Assumption 7. The estimated peak discharge for the contributing watershed area is calculated by Reference 4. The following table summarizes the resulting estimated peak discharges:

Condition (Newly Graded or Vegetated)	Composite Curve Number	Time of Concentration [hrs]	Estimated Peak Discharge [cfs]
Newly Graded	92	0.09	4.69
Vegetated	81	0.26	3.08

Supporting output from Reference 4 is included as an attachment to this calculation.

2. Estimated Hydraulic Conditions

The resulting hydraulic condition is based on the proposed geometry of the Hill 78 perimeter ditch (Assumption 3) and the above-calculated peak discharges immediately following perimeter ditch construction and during conditions where vegetation is established.

The following table summarizes the resulting estimated hydraulic conditions:

Condition (Newly Graded or Vegetated)	Estimated Peak Discharge [cfs]	Manning "n" [1]	Flow Depth [ft]	Flow Velocity [ft/sec]	Shear Stress[1] [psf]	Permissible Shear Stress[1] [psf]	Factor of Safety[2]
Newly Graded	4.69	0.042	1.05	2.12	0.66	1.75	2.67
Vegetated[3]	3.08	0.117	1.32	0.89	0.82	4.20	5.11

Notes:
1- The Manning "n", shear stress, and permissible shear stress values are calculated by Reference 5 based on the channel lining and the estimated hydraulic conditions of the channel.
2- The factor of safety is based on a comparison between the permissible shear stress and calculated shear stress.
3- The shear stress and permissible shear stress values are presented for vegetation or soil conditions, depending on which material's properties result in the lowest factor of safety.

Because the flow depths for both conditions are less than the depth of the Hill 78 perimeter ditch (1.5 feet), the proposed ditch configuration provides adequate hydraulic capacity. Additionally, because the critical shear stress is less than the permissible shear stress for both conditions, the ditch lining is considered hydraulically stable.

The hydraulic analysis and output from Reference 5 is included as an attachment to this calculation.

SUMMARY:

The proposed Hill 78 perimeter ditch configuration provides adequate hydraulic capacity to convey the 25-year, 24-hour estimated peak discharges. Stable hydraulic conditions exist in the Hill 78 perimeter ditch for both newly graded and vegetated conditions during the design storm event.

Supporting Output

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Newly Graded Watershed Condition

Table of Contents

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 PERM DITCH REVISED.PPW

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: Length & Vel.

Hydraulic Length	614.00 ft
Avg.Velocity	2.12 ft/sec

Segment #1 Time: .0805 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.0110
Hydraulic Length	72.00 ft
2yr, 24hr P	2.8000 in
Slope	.330000 ft/ft
Avg.Velocity	3.70 ft/sec

Segment #2 Time: .0054 hrs

Total Tc: .0859 hrs

Type.... Tc Calcs
Name.... SCS UH 10

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 PERM DITCH REVISED.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== User Defined Length & Velocity ==========

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

Type.... Runoff CN-Area
Name.... SCS UH 10

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 PERM DITCH REVISED.PPW
Title... Newly Graded

RUNOFF CURVE NUMBER DATA

Newly Graded

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Newly Graded	91	.990			91.00
Paved Road	98	.130			98.00
COMPOSITE AREA & WEIGHTED CN --->		1.120			91.81 (92)

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 yr year storm
Duration = 24.0000 hrs Rain Depth = 5.3000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\
HYG File - ID = 2006 Per.HYG - SCS UH 10 25yr24
Tc = .0859 hrs
Drainage Area = 1.120 acres Runoff CN= 92

==========
Computational Time Increment = .01145 hrs
Computed Peak Time = 12.1005 hrs
Computed Peak Flow = 4.69 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.1000 hrs
Peak Flow, Interpolated Output = 4.69 cfs
==========

DRAINAGE AREA

ID:SCS UH 10
CN = 92
Area = 1.120 acres
S = .8696 in
0.2S = .1739 in

Cumulative Runoff

4.3826 in
.409 ac-ft

HYG Volume... .409 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .08586 hrs (ID: SCS UH 10)
Computational Incr, Tm = .01145 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 14.78 cfs
Unit peak time Tp = .05724 hrs
Unit receding limb, Tr = .22896 hrs
Total unit time, Tb = .28620 hrs

Project: OPCA Final Cover Design Calculations **Prepared by: GNG**
Project No.: 204.05 **Date: April 2006**
Subject: Hill 78 Perimeter Ditch Design

PERIMETER DITCH
NEWLY GRADED WATERSHED CONDITION

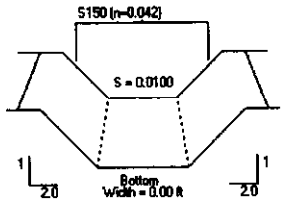
Channel Design (Input)	
Flow Capacity (cfs)	4.69
Channel Depth (ft) (minimum)	1.50
Channel Base Width (ft)	0.00
Left Side Slope (x:1)	2.00
Right Side Slope (x:1)	2.00
Channel Width at Top (ft)	6.00
Channel Bed Slope	0.010
Manning "n"	0.042

Flow Conditions (Output)	
Flowrate from Manning Equation (cfs)	4.69
Required Flow Depth (ft)	1.05
Resulting Flow Velocity (ft/s)	2.12
Resulting Flow Width at Top (ft)	4.22
Resulting Flow Area (ft^2)	2.22
Resulting Wetted Perimeter (ft)	4.71
Resulting Hydraulic Radius (ft)	0.47
Permissible Shear Stress (psf)	1.75
Calculated Shear Stress (psf)	0.66
Channel Conditions	
Resulting Freeboard Depth (ft)	0.45
Sheer Stress Factor of Safety	2.67

North American Green - ECMDS Version 4.3		3/15/2006 04:19 PM	COMPUTED BY: RLP
PROJECT NAME: OPCA Final Cover Design Calculations		PROJECT NO.: 29405	
FROM STATION/REACH:	TO STATION/REACH:	DRAINAGE AREA:	DESIGN FREQUENCY: 25-year

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
4.7	1.0	2.12	2.22	0.47	1.05



Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	S150	Unvegetated					1.75	0.66	2.67	STABLE
	Staple D									

Vegetated Watershed Condition

Table of Contents

Type.... Tc Calcs
Name.... SCS UH 20

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 PERM DITCH REVISED.PPW

TIME OF CONCENTRATION CALCULATOR

Segment #1: Tc: Length & Vel.

Hydraulic Length	614.00 ft
Avg.Velocity	.89 ft/sec

Segment #1 Time: .1916 hrs

Segment #2: Tc: TR-55 Sheet

Mannings n	.2400
Hydraulic Length	72.00 ft
2yr, 24hr P	2.8000 in
Slope	.330000 ft/ft
Avg.Velocity	.31 ft/sec

Segment #2 Time: .0637 hrs

Total Tc: .2553 hrs

Type.... Tc Calcs
Name.... SCS UH 20

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 PERM DITCH REVISED.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== User Defined Length & Velocity ==========

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

Type.... Runoff CN-Area
Name.... SCS UH 20

File.... V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\2006 PERM DITCH REVISED.PPW
Title... Newly Graded

RUNOFF CURVE NUMBER DATA

Newly Graded

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Vegetated	79	.990			79.00
Paved Road	98	.130			98.00
COMPOSITE AREA & WEIGHTED CN --->		1.120			81.21 (81)

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 yr year storm
Duration = 24.0000 hrs Rain Depth = 5.3000 in
Rain Dir = C:\HAESTAD\PPKW\RAINFALL\
Rain File -ID = SCSTYPES.RNF - TypeIII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = V:\GE_PITTSFIELD_CD_OPCAS_CONFIDENTIAL\NOTES AND DATA\DESIGN\
HYG File - ID = 2006 Per.HYG - SCS UH 20 25yr24
Tc = .2553 hrs
Drainage Area = 1.120 acres Runoff CN= 81

==========
Computational Time Increment = .03404 hrs
Computed Peak Time = 12.1881 hrs
Computed Peak Flow = 3.08 cfs

Time Increment for HYG File = .0500 hrs
Peak Time, Interpolated Output = 12.2000 hrs
Peak Flow, Interpolated Output = 3.05 cfs
==========

DRAINAGE AREA

ID:SCS UH 20
CN = 81
Area = 1.120 acres
S = 2.3457 in
0.2S = .4691 in

Cumulative Runoff

3.2519 in
.304 ac-ft

HYG Volume... .303 ac-ft (area under HYG curve)

***** UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = .25534 hrs (ID: SCS UH 20)
Computational Incr, Tm = .03404 hrs = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 4.97 cfs
Unit peak time Tp = .17022 hrs
Unit receding limb, Tr = .68090 hrs
Total unit time, Tb = .85112 hrs

Project: OPCA Final Cover Design Calculations **Prepared by: GNG**
Project No.: 204.05 **Date: April 2006**
Subject: Hill 78 Perimeter Ditch Design

PERIMETER DITCH
VEGETATED WATERSHED CONDITION

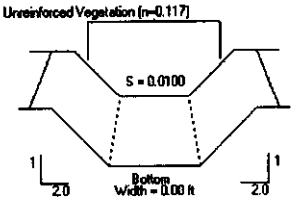
Channel Design (Input)	
Flow Capacity (cfs)	3.08
Channel Depth (ft) (minimum)	1.50
Channel Base Width (ft)	0.00
Left Side Slope (x:1)	2.00
Right Side Slope (x:1)	2.00
Channel Width at Top (ft)	6.00
Channel Bed Slope	0.010
Manning "n"	0.117

Flow Conditions (Output)	
Flowrate from Manning Equation (cfs)	3.08
Required Flow Depth (ft)	1.32
Resulting Flow Velocity (ft/s)	0.89
Resulting Flow Width at Top (ft)	5.30
Resulting Flow Area (ft^2)	3.47
Resulting Wetted Perimeter (ft)	5.93
Resulting Hydraulic Radius (ft)	0.59
Permissible Shear Stress (psf)	4.20
Calculated Shear Stress (psf)	0.82
Channel Conditions	
Resulting Freeboard Depth (ft)	0.18
Sheer Stress Factor of Safety	5.11

North American Green - ECMDS Version 4.3		3/15/2006 04:31 PM	COMPUTED BY: RLP
PROJECT NAME: OPCA Final Cover Design Calculations		PROJECT NO.: 20405	
FROM STATION/REACH:	TO STATION/REACH:	DRAINAGE AREA:	DESIGN FREQUENCY: 25-year

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
3.1	1.0	0.89	3.47	0.59	1.32



Not to Scale

LINER RESULTS

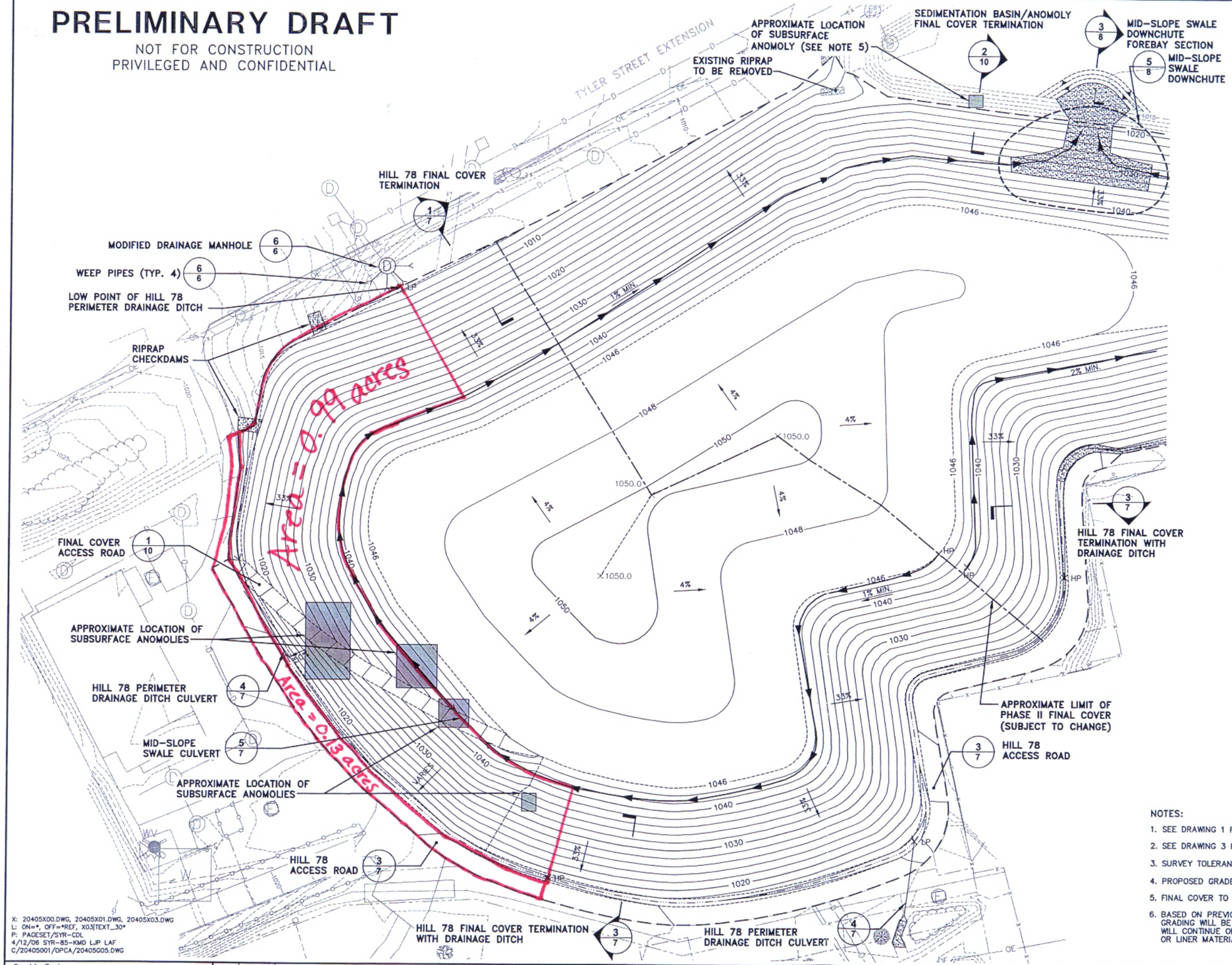
Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	Unreinforced	Vegetation		C	Mix	75-95%	4.20	0.82	5.11	STABLE
		Soil	Loam				0.035	0.004	9.67	STABLE

Watershed Area Map

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

PRELIMINARY DRAFT

NOT FOR CONSTRUCTION
PRIVILEGED AND CONFIDENTIAL



LEGEND:

X HP	PROPOSED HIGH POINT
X LP	PROPOSED LOW POINT
1030	PROPOSED INDEX CONTOUR LINE
	PROPOSED INTERMEDIATE CONTOUR LINE
X 1050.0	PROPOSED SPOT ELEVATION
3/8	DETAIL REFERENCE NUMBER / DRAWING REFERENCE NUMBER
1	SURVEY CONSTRUCTION CONTROL POINT (SEE TABLE ON THIS DRAWING)
	PROPOSED GRADE BREAK
	HILL 78 PERIMETER DRAINAGE DITCH 4/8
	APPROXIMATE LIMIT OF GRADING
	PROPOSED MID-SLOPE SWALE 1/8
	PROPOSED RIPRAP

SURVEY CONTROL INFORMATION CONSTRUCTION POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	AS-BUILT ELEV.*	DESCRIPTION

* AS-BUILT INFORMATION TO BE COMPLETED BY CONTRACTOR AND INCLUDED WITH RECORD DRAWINGS.

NOTES:

1. SEE DRAWING 1 FOR BASEMAP INFORMATION.
2. SEE DRAWING 3 FOR ADDITIONAL DESIGN INFORMATION.
3. SURVEY TOLERANCE IS ±0.05' UNLESS OTHERWISE APPROVED BY GE OR GE'S REPRESENTATIVE.
4. PROPOSED GRADES/ELEVATIONS SHOWN REPRESENT TOP OF FINAL COVER SYSTEM.
5. FINAL COVER TO EXTEND OVER ANOMOLY AS SHOWN ON DRAWING 10, DETAIL 2.
6. BASED ON PREVIOUS DISCUSSIONS WITH THE EPA, EARTHWORK ACTIVITIES ASSOCIATED WITH FINAL COVER SUBBASE GRADING WILL BE LIMITED TO APPROXIMATELY ONE ACRE IN SIZE AT ANY GIVEN TIME. FURTHER SUBBASE GRADING WILL CONTINUE ONCE A PORTION OF THE ONE ACRE AREA IS COMPLETED WITH EITHER 6 INCHES OF CLEAN SOIL FILL OR LINER MATERIAL.

X: 20405X00.DWG, 20405X01.DWG, 20405X03.DWG
L: ON=*, OFF=*REF, X03|TEXT_30*
P: PAGESET/SYR-CDL
4/12/06 SYR-85-KMD LJP LAF
C/20405001/OPCA/20405G05.DWG

Graphic Scale
40' 0 40' 80'

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED. USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.

No.	Date	Revisions	Init

Professional Engineer's Name	James M. Nuss	
Professional Engineer's No.	38000	
State	MASS.	Date Signed
Project Mgr.	Designed by	Drawn by
PHB	CAA	LAF

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
HILL 78 AND BUILDING 71 OPCAs PHASE II FINAL COVER DESIGN

FINAL COVER GRADING PLAN
HILL 78

GENERAL

BBL Project No.	204.05
Date	APRIL 2006

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

5

References

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Final Cover System Geosynthetic Drainage Composite and Collection Pipe Design3

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Final Cover System Geosynthetic Drainage Composite and Collection Pipe Design

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

CLIENT: General Electric Company **PROJECT:** Pittsfield, Massachusetts **Prepared By:** RLP **Date:** April 2006
TITLE: Hill 78 and Building 71 OPCA Final Cover Design Calculation **Checked By:** CAA **Date:** April 2006
SUBJECT: Final Cover System Geosynthetic Drainage Composite and Collection Pipe Design **Reviewed By:** PHB **Date:** April 2006

OBJECTIVE:

Determine the minimum required transmissivity for the geosynthetic drainage composite (GDC) for the On-Plant Consolidation Area (OPCA) final cover system. Determine the required diameter for the final cover collection pipe within the final cover system anchor trench.

REFERENCES:

1. Hill 78 and Building 71 OPCA Final Cover Design Drawing No. 4 entitled "Final Cover Grading Plan – Building 71," Blasland, Bouck & Lee, Inc. (BBL), April 2006.

2. Hill 78 and Building 71 OPCA Final Cover Design Drawing No. 5 entitled "Final Cover Grading Plan – Hill 78," BBL, April 2006.

3. Hill 78 and Building 71 OPCA Final Cover Design Drawing No. 6 entitled "Final Cover Details," BBL, April 2006.

4. Hill 78 and Building 71 OPCA Final Cover Design Drawing Nos. 7 and 8 entitled "Miscellaneous Details," BBL, April 2006.

5. Advanced Geotech Systems website entitled "landfilldesign.com."

6. Visual HELP v2.2.0.1 (Windows-based implementation of HELP model v. 3), Waterloo Hydrogeologic, Inc.

7. "Hydraulic Design of Geosynthetic and Granular Liquid Collection Layers Comprising Two Different Slopes," Giroud, J.P., Zornberg, J.G., and Beech, J.F., technical paper presented in Geosynthetics International - Special Issue on Liquid Collection Systems, 2000.

8. *Engineer-in-Training Reference Manual*, 8th Edition, Lindeburg, Michael R., P.E., p. A-47, 1992 (attached).

9. Attachment 3 entitled OPCA Final Cover Design Calculation "Final Cover (Veneer) Stability," to the July 15, 2005 letter to the U.S. Environmental Protection Agency regarding the 2005 Final Cover Construction.

10. *Technical Release 55 – Urban Hydrology for Small Watersheds*, p. 2-5, Soil Conservation Service, June 1986 (attached).

11. Hill 78 and Building 71 OPCA Final Cover Design Drawing No. 2 entitled "Consolidation Grading Plan – Building 71," BBL, April 2006.

12. Hill 78 and Building 71 OPCA Final Cover Design Drawing No. 3 entitled "Consolidation Grading Plan – Hill 78," BBL, April 2006.

13. Attachment 3 entitled OPCA Final Cover Design Calculation "Final Cover System Geosynthetic Drainage Composite and Collection Pipe Design" to the July 15, 2005 letter to the U.S. Environmental Protection Agency regarding the 2005 Final Cover Construction

ASSUMPTIONS:

1. The minimum required transmissivity for the final cover GDC is governed by the longest undrained length and flattest gradient. The minimum required transmissivity for the final cover on the Building 71 OPCA was evaluated in Reference 13, based the longest undrained length and flattest gradient of the Building 71 OPCA. Therefore, the minimum required transmissivity for the final cover GDC on the Hill 78 OCPA is analyzed in this calculation. Based on References 1 and 2, the governing conditions were determined to extend from the peak of the Hill 78 OPCA plateau down to the final cover system anchor trench. This final cover length consists of a compound slope having an upper segment on the plateau area of approximately 150 feet at 4% and a lower segment along the sideslope of approximately 116 feet at 33%. As shown on Reference 4, the GDC will terminate in the final cover anchor trench. A collection pipe located within the final cover system anchor trench will collect drainage from the GDC.

2. The minimum required transmissivity for each slope segment is based on Giroud's equation (presented in Reference 5) and the following parameters:

    - Maximum allowable head in the GDC is limited to the thickness of the drainage layer (i.e., the thickness of the GDC core which is 0.76 cm);
    - Impingement rate (i.e., rate at which precipitation infiltrates to GDC layer) is calculated using Reference 6 and the following parameters:
        - Maximum leaf area index = 3.5 (approximately the middle of the range for a good stand of grass based on guidance values presented in the User's Guide for HELP Model v.3);
        - Evaporative zone depth = 24 inches (assumed to be the thickness of the final cover system and is within the range of guidance values for silty/clayey soil presented in the User's Guide for HELP model v.3);
        - The hydraulic conductivity for the vegetated cover soil is 3.7×10^{-4} cm/s which is the default value for loam (topsoil), based on Reference 6.
        - The hydraulic conductivity for the general soil fill in the final cover is 5.2×10^{-4} cm/s which is the default value for fine sandy loam, based on Reference 6.

3. Typical factors of safety are from Reference 5 (see attached calculations for specific values).

4. When determining the impingement rate, the initial moisture contents for the various layers are calculated by Reference 6 under nearly steady-state conditions (i.e., they are not user-specified).

5. The runoff curve number is 79 and is based on a hydraulic soil group C for open space, fair vegetation condition (Reference 10).

6. For the purposes of calculating the applied loading on the GDC, the final cover is assumed to have a unit weight of 125 lb/ft^3 (Reference 9).

7. The hydraulic capacity of the final cover collection pipe must equal or exceed the estimated flowrate from the GDC draining to it. The hydraulic capacity of the GDC is based on the design transmissivity value (determined in this calculation sheet), the slope of the GDC upgradient of the pipe, and the longest undrained length of pipe. Based on References 11 and 12, the longest undrained length of pipe is approximately 625 feet. The minimum slope of the collection pipe is 0.5%. Discharge points for the collection pipe are shown on References 11 and 12.

CALCULATIONS:

1. Minimum Required Transmissivity

The minimum required transmissivity for the final cover GDC is based on Giroud's equation:

$$\Phi = \frac{TSF q_h L}{\sin\beta + \frac{t_{LCL}/L}{TSF}\cos^2\beta}$$

where,

Φ = minimum required transmissivity
TSF = total serviceability factor (a combination of reduction and overall design safety factors)
q_h = impingement rate (rate at which water infiltrates through the cover soils into the GDC)
L = maximum drainage length
β = slope angle of drainage layer
t_{LCL} = thickness of geonet core of GDC

Because the composite slope consists of two distinct slope lengths and gradients, separate required transmissivities are determined for the 4% and 33% slope segments (Reference 7).

The required transmissivity for the 4% slope segment is based on the following parameters:

TSF = 4.72 (see attached calculations for individual factors of safety)
q_h = 2.37 in/day = 7.0 x 10^{-5} cm/s (calculated using Reference 6 based on Assumptions 1,2,4 and 5)
L = 150 feet (Assumption 1)
β = 2.29^o (4%, Assumption 1)
t_{LCL} = 0.76 cm (Assumption 2)

$\therefore$ Φ = 37.74 cm^2/s = 3.77 x 10^{-3} m^2/s = Minimum Required Transmissivity for the 4% Slope

The required transmissivity for the 33% slope segment is based on the following parameters:

TSF = 4.72 (see attached calculations for individual factors of safety)
q_h = 1.13 in/day = 3.3 x 10^{-5} cm/s (calculated using Reference 6 based on Assumptions 1,2,4 and 5)
L = 266 feet (150 feet at 4%, and 116 feet at 33 %, Assumption 1)
β = 18.26^o (33%, Assumption 1)
t_{LCL} = 0.76 cm (Assumption 2)

$\therefore$ Φ = 4.03 cm^2/s = 4.03x 10^{-4} m^2/s = Minimum Required Transmissivity for the 33% Slope

2. Maximum Applied Load on the GDC

Because the in-place transmissivity of the GDC is partly a function of the applied loading, it is necessary to estimate the maximum load that will be applied to the GDC. Due to its proximity to the top of the final cover (2 feet below the top of the vegetated topsoil), the final cover GDC will likely experience about 250 psf due to soil weight (2 feet x 125 pcf = 250 psf). The operation of construction equipment over the GDC during final cover construction is expected to result in another 1,000 psf (based on the use of low ground pressure equipment exerting about 7 psi). Combining these two loadings and multiplying by a factor of safety of 2.0 yields a design loading of 2,500 psf.

3. Required Collection Pipe Diameter

The required collection pipe diameter is determined using the Hazen-Williams equation and the design transmissivity from the GDC that drains to the collection pipe (i.e., GDC at a 33% slope). The maximum flowrate from the GDC is determined using Darcy's law, the definition of transmissivity, and the design transmissivity value for the 33% slope calculated above:

$$Q = kiA$$
$$k = \Phi/t$$
$$A = Lt$$
$$\therefore Q = L\Phi i$$

where,

L = length of collection pipe = 625 ft (Assumption 7)
Φ = design transmissivity of GDC = 4.03cm^2/s = .004 ft^2/s
i = hydraulic gradient of the GDC upgradient of the collection pipe = 33% (Assumption 1)

Thus,

$$Q = (625 \text{ ft})\ (0.004 \text{ ft}^2/\text{s})\ (0.33) = 0.8 \text{ cfs}$$

The Hazen-Williams equation is:

$$Q = 1.318 A C_h R^{0.63} S^{0.54}$$

where,

Q = maximum flowrate from the GDC (from above)
A = cross sectional area of pipe flowing full = $\pi\ (D^2/4)$
C_h = Hazen-Williams friction coefficient for corrugated plastic pipe = 100
R = hydraulic radius = A/P = D/4
P = wetted perimeter of pipe flowing full = πD

S = longitudinal slope of pipe = 0.5% (Assumption 7)

Thus,

$$0.8 = 1.318 * \left(\pi \frac{D^2}{4} \right) * (100) * \left(\frac{D}{4} \right)^{0.63} * (0.005)^{0.54}$$

Solving for D,

D = 0.65 feet = 7.8 inches

In order to provide the required flow capacity to achieve this diameter, two 6-inch diameter pipes will be used for the collection pipe. It should be noted that two 6-inch diameter pipes are based on the design transmissivity and longest undrained length of pipe for the Hill 78 OPCA (Assumption 7).

A 6-inch diameter corrugated HDPE pipe has an inside diameter of 6 inches (0.5 feet). The pipe-full capacity for one 6-inch diameter pipes is determined using the Hazen-Williams equation:

$$Q = 1.318 * \left(\pi \frac{0.5^2}{4} \right) * (100) * \left(\frac{0.5}{4} \right)^{0.63} * (0.005)^{0.54} = 0.4 \text{ cfs}$$

Consequently, two 6-inch diameter collection pipes will provide a pipe-full capacity of 0.8 cfs (0.4 cfs * 2).

The actual flow depth in the collection pipes for the design flowrate (0.8 cfs for two pipes, 0.4 cfs in each 6-inch diameter pipe) can be calculated using the ratio of the design flowrate to the pipe-full flowrate of one 6-inch diameter pipe:

Q/Q_o = 0.4 cfs/0.4 cfs = 1.0

Based on Reference 8, this flowrate ratio corresponds to a ratio of depth to pipe diameter of about 1.0. Therefore, the flow depth in each 6-inch pipe is about 0.5 feet or 6 inches (1.0*0.5 feet = 0.5 feet).

Summary:

The final cover GDC on the Hill 78 OPCA (Assumption 1) must provide the following minimum transmissivities:

Φ = 37.74 cm^2/s with a hydraulic gradient = 0.10 (representative of a 4% slope); and
Φ = 4.03 cm^2/s with a hydraulic gradient = 0.33 (representative of a 33% slope).

It should be noted, for completeness, that the final cover GDC on the Building 71 OPCA per Reference 13 must provide the following minimum transmissivities:

Φ = 17.32 cm^2/s with a hydraulic gradient = 0.10 (representative of a 4% slope); and
Φ = 3.73 cm^2/s with a hydraulic gradient = 0.33 (representative of a 33% slope).

The final cover GDC material must provide these transmissivities at the specified slopes under an applied loading of 2,500 psf.

Although a GDC with a 275-mil thick geonet core is assumed for these calculations, any thickness of geonet core is acceptable for the final cover GDC assuming it meets or exceeds the above transmissivities with the loading and gradients presented above.

Based on a hydraulic analysis of conditions anticipated for the final cover system, two 6-inch diameter corrugated HDPE pipes will provide sufficient capacity for the final cover collection pipe to convey the flowrate from the final cover GDC on the Hill 78 OPCA. The final cover collection pipe for the Building 71 OPCA will be two 4-inch diameter corrugated HDPE pipes as calculated in Reference 13.

HELP Model Output

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

4 % Slope

```
**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07 (1 November 1997)         **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************
```

```
PRECIPITATION DATA FILE:    C:\WHI\UNSAT22\data\P954.VHP\_weather1.dat
TEMPERATURE DATA FILE:      C:\WHI\UNSAT22\data\P954.VHP\_weather2.dat
SOLAR RADIATION DATA FILE:  C:\WHI\UNSAT22\data\P954.VHP\_weather3.dat
EVAPOTRANSPIRATION DATA:    C:\WHI\UNSAT22\data\P954.VHP\_weather4.dat
SOIL AND DESIGN DATA FILE:  C:\WHI\UNSAT22\data\P954.VHP\I_386480.inp
OUTPUT DATA FILE:           C:\WHI\UNSAT22\data\P954.VHP\O_386480.prt
```

```
TIME:  10:27     DATE:   3/6/2006
```

```
**********************************************************************

TITLE:  4% Slope

**********************************************************************
```

```
NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
         COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.
```

```
                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   8
      THICKNESS                   =     15.24   CM
      POROSITY                    =      0.4630 VOL/VOL
      FIELD CAPACITY              =      0.2320 VOL/VOL
      WILTING POINT               =      0.1160 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.4647 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.370000000000E-03 CM/SEC
    NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 7

THICKNESS	=	45.72	CM
POROSITY	=	0.4730	VOL/VOL
FIELD CAPACITY	=	0.2220	VOL/VOL
WILTING POINT	=	0.1040	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3020	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.5200000000000E-03	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.60	CM
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	45.7	METERS

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.10	CM
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.2000000000000E-12	CM/SEC
FML PINHOLE DENSITY	=	2.00	HOLES/HECTARE
FML INSTALLATION DEFECTS	=	2.00	HOLES/HECTARE
FML PLACEMENT QUALITY	=	3 - GOOD	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	79.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	0.4047	HECTARES
EVAPORATIVE ZONE DEPTH	=	61.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	20.888	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	28.682	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	6.523	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	20.894	CM
TOTAL INITIAL WATER	=	20.894	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ALBANY, NY

STATION LATITUDE	=	42.67	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	123	
END OF GROWING SEASON (JULIAN DATE)	=	282	
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.90	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY, NY

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.39	2.26	3.01	2.94	3.31	3.29
3.00	3.34	3.23	2.93	3.04	3.00

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY, NY

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY, NY AND STATION LATITUDE = 42.45 DEGREES

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	3.20	11615.74682	2620015
RUNOFF	2.567	9318.94680	690003
DRAINAGE COLLECTED FROM LAYER 3	2.37004	8603.04417	950025
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.012076	43.83638	950025
AVERAGE HEAD ON TOP OF LAYER 4	0.550		
MAXIMUM HEAD ON TOP OF LAYER 4	0.218		
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	2.0 FEET		
SNOW WATER	6.59	23929.2545	690020

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4155
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1070

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

33 % Slope

```
**********************************************************************************
**********************************************************************************
**                                                                              **
**                                                                              **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                  **
**                 HELP MODEL VERSION 3.07 (1 November 1997)                    **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                      **
**                     USAE WATERWAYS EXPERIMENT STATION                        **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                **
**                                                                              **
**                                                                              **
**********************************************************************************
**********************************************************************************


PRECIPITATION DATA FILE:    C:\WHI\UNSAT22\data\P954.VHP\_weather1.dat
TEMPERATURE DATA FILE:      C:\WHI\UNSAT22\data\P954.VHP\_weather2.dat
SOLAR RADIATION DATA FILE:  C:\WHI\UNSAT22\data\P954.VHP\_weather3.dat
EVAPOTRANSPIRATION DATA:    C:\WHI\UNSAT22\data\P954.VHP\_weather4.dat
SOIL AND DESIGN DATA FILE:  C:\WHI\UNSAT22\data\P954.VHP\I_386607.inp
OUTPUT DATA FILE:           C:\WHI\UNSAT22\data\P954.VHP\O_386607.prt


TIME:  10:42     DATE:   3/6/2006


**********************************************************************************

TITLE:  33% Slope

**********************************************************************************


NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
         COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   8
      THICKNESS                    =     15.24   CM
      POROSITY                     =      0.4630 VOL/VOL
      FIELD CAPACITY               =      0.2320 VOL/VOL
      WILTING POINT                =      0.1160 VOL/VOL
      INITIAL SOIL WATER CONTENT   =      0.4647 VOL/VOL
      EFFECTIVE SAT. HYD. COND.    =  0.370000000000E-03 CM/SEC
    NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
             FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 7

THICKNESS	=	45.72	CM
POROSITY	=	0.4730	VOL/VOL
FIELD CAPACITY	=	0.2220	VOL/VOL
WILTING POINT	=	0.1040	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1893	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.5200000000000E-03	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.60	CM
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	35.4	METERS

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.10	CM
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.2000000000000E-12	CM/SEC
FML PINHOLE DENSITY	=	2.00	HOLES/HECTARE
FML INSTALLATION DEFECTS	=	2.00	HOLES/HECTARE
FML PLACEMENT QUALITY	=	3 - GOOD	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	79.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	0.4047	HECTARES
EVAPORATIVE ZONE DEPTH	=	61.0	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	15.737	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	28.682	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	6.523	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	15.743	CM
TOTAL INITIAL WATER	=	15.743	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
ALBANY, NY

STATION LATITUDE	=	42.67	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	123	
END OF GROWING SEASON (JULIAN DATE)	=	282	
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.90	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	68.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY, NY

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.39	2.26	3.01	2.94	3.31	3.29
3.00	3.34	3.23	2.93	3.04	3.00

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY, NY

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
21.10	23.40	33.80	46.60	57.50	66.70
71.40	69.20	61.20	50.50	39.30	26.50

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR ALBANY, NY AND STATION LATITUDE = 42.45 DEGREES

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	3.20	11615.74682	2620015
RUNOFF	2.449	8888.46754	690003
DRAINAGE COLLECTED FROM LAYER 3	1.12506	4083.86947	2640008
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000662	2.40479	1570007
AVERAGE HEAD ON TOP OF LAYER 4	0.004		
MAXIMUM HEAD ON TOP OF LAYER 4	0.005		
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET		
SNOW WATER	6.59	23929.2545	690020

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3564
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1070

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

Required Transmissivity Calculations

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

4 % Slope

General Electrical Company
Pittsfield, Massachusetts
OPCA Final Cover
Giroud's Equation for Minimum Required Geocomposite Transmissivity

4% Slope

Input

Drainage Length [m]:	45.7
Drainage Layer Thickness [cm]:	0.76
Slope of Drainage Layer:	0.04
Impingement Rate, q_h, [cm/s][1]:	7.0E-05

Factor of Safety		Typical Range for Factor of Safety		
		Surface Water	Leachate Collection	Leachate Detection
Intrusion Reduction Factor, RF_{in}	1.1	1.0-1.2	1.0-1.2	1.0-1.2
Creep Reduction Factor, RF_{cr}:	1.2	1.1-1.4	1.4-2.0	1.4-2.0
Chemical Clogging Reduction Factor, RF_{cc}:	1.1	1.0-1.2	1.5-2.0	1.5-2.0
Biological Clogging Reduction Factor, RF_{bc}:	1.3	1.2-1.5	1.5-2.0	1.5-2.0
Overall FS for Drainage, FS_d:	2.5	2.0-3.0	2.0-3.0	2.0-3.0

Output

Total Serviceability Factor	4.72

Required Transmissivity [cm^2/s]:	**37.74**

Notes:

1. Impingement rate is equal to the peak daily value for lateral drainage collected by the geocomposite layer as calculated using Visual HELP. The amount of lateral drainage (in cm) is converted from the daily average infiltration rate to the geocomposite.

33 % Slope

General Electric Company
Pittsfield, Massachusetts
OPCA Final Cover
Giroud's Equation for Minimum Required Geocomposite Transmissivity

33% Slope

Input

Drainage Length [m]:	81.1
Drainage Layer Thickness [cm]:	0.76
Slope of Drainage Layer:	0.33
Impingement Rate, q_h, [cm/s][1]:	3.3E-05

Factor of Safety		Typical Range for Factor of Safety		
		Surface Water	Leachate Collection	Leachate Detection
Intrusion Reduction Factor, RF_{in}	1.1	1.0-1.2	1.0-1.2	1.0-1.2
Creep Reduction Factor, RF_{cr}:	1.2	1.1-1.4	1.4-2.0	1.4-2.0
Chemical Clogging Reduction Factor, RF_{cc}:	1.1	1.0-1.2	1.5-2.0	1.5-2.0
Biological Clogging Reduction Factor, RF_{bc}:	1.3	1.2-1.5	1.5-2.0	1.5-2.0
Overall FS for Drainage, FS_d:	2.5	2.0-3.0	2.0-3.0	2.0-3.0

Output

Total Serviceability Factor	4.72

Required Transmissivity [cm^2/s]:	**4.03**

Notes:

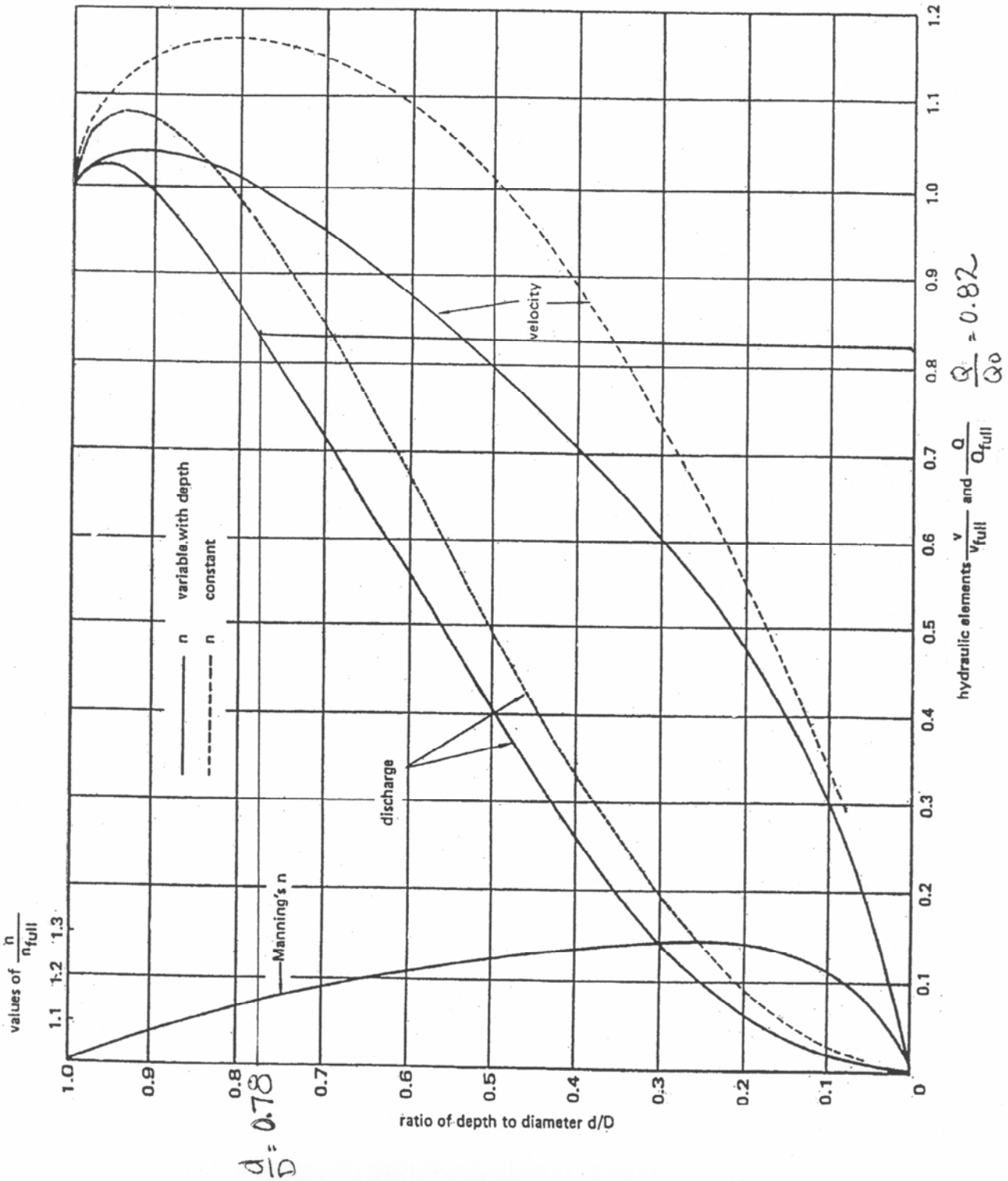
1. Impingement rate is equal to the peak daily value for lateral drainage collected by the geocomposite layer as calculated using Visual HELP. The amount of lateral drainage (in cm) is converted from the daily average infiltration rate to the geocomposite.

References

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

APPENDIX 19.C
Circular Channel Ratios

Experiments have shown that n varies slightly with depth. This figure gives velocity and flow rate ratios for varying n (solid line) and constant n (broken line) assumptions.



0.78

d/D

$\frac{Q}{Q_0} = 0.82$

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.