FUSS & O'NEILL
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November 10, 2009

Betsey Wingfield
Bureau Chief, Bureau of Water Protection and Land Reuse
Connecticut Department of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

RE: Crystal Pond Dam – Eastford
Emergency Repairs Construction Report

Dear Ms. Wingfield:

In response to the identified need for immediate repairs to Crystal Pond Dam in Eastford, Connecticut, and pursuant to the subsequent Dam Construction Emergency Authorization (DS-2009-02EA) issued by your office, Crystal Pond Association has completed dam repairs under the direction of Fuss & O'Neill, Inc. Construction took place on October 12 and 13, 2009.

The purpose of the dam construction was to repair leakage and piping erosion that had been discovered, originating approximately six inches below the pond's normal water surface elevation on the dam's upstream face and emerging at the downstream toe. In addition the end of a wooden log had been observed embedded in the dam embankment near the leakage entry point.

In the weeks prior to construction, the Association increased their normal winter drawdown by gradually lowering the pond to about 5 feet below the normal pool water surface elevation. Fuss & O'Neill used a soil auger to take several samples of the existing embankment soil and performed a gradation analysis. Eastern Construction of Eastford, Connecticut, the contractor selected by the Association to perform the repairs, identified and stockpiled a suitable soil for use in embankment reconstruction. This soil was also analyzed and found by a Fuss & O'Neill geotechnical engineer to be sufficiently impervious and a good match to the existing embankment material. The contractor also installed erosion controls along the up- and downstream toe of the dam in the area that was to be excavated.

A Fuss & O'Neill engineer was on hand during construction to observe the exploratory excavation and embankment reconstruction. The contractor began by carefully exposing the wooden log embedded in the upstream side of the dam. The log was found to be only two feet in length and was easily removed. Subsequently the contractor followed the leakage path through the embankment, stopping frequently to clear the spoils by hand and

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back as practicable without threatening the integrity of the downstream portion of the embankment. Several pieces of wood planking were removed from the bottom of the excavation, apparently the remnant of a fence impounded within and parallel to the base of the dam. A margin of approximately 2 feet was excavated around the leakage path exit point and the slopes were laid back to facilitate good contact between old and new embankment materials. Loose soil and stone were removed and the surfaces lightly scarified.

The completed excavation, with a depth of approximately 5 feet, was surrounded on 3 ½ sides by intact embankment. This facilitated placement and compaction of fill. The contractor lined the downstream face and bottom of the excavation with a permeable filter fabric, covering the leakage path exit point. New embankment fill was placed in 8-inch lifts and compacted using a plate vibrator and jumping jack. When the embankment had been reconstructed in this manner a 4-inch lift of topsoil was placed over the excavation site, and topsoil was also used to fill ruts left by the machinery along the dam crest. These areas were seeded and covered by straw matting to prevent erosion. Riprap was re-installed along the upstream face of the dam at the location of the excavation.

The association will now monitor the embankment for signs of leakage or movement as the water level is returned to normal level and throughout the next year.

It is our opinion that the immediate need of repairing piping erosion at the Crystal Pond Dam has been satisfied at this time. Please refer to the attached sequence of construction, sketches, photographs of construction activities, and soil gradation analyses.

Sincerely,

David W. Hammond

David Hammond, EIT, CFM
Project Engineer

Philip W. Moreschi, P.E., CFM
Vice President

c: Carroll Stearns, Crystal Pond Association
Peter Spangenberg, P.E., CT DEP

Attachments: Sequence of Construction
Location Map (Figure 1)
Construction As-built Sketches (Figures 2-6)
Photo Log
Soil Gradation Analyses

Emergency Repairs
Sequence of Construction

10/12/2009:

1. Dewatered impoundment and installed soil and erosions controls on up- and downstream sides of dam at project location.

2. Carefully exposed full extent of wood/log located within embankment. Log was only 2 feet long and was easily removed.

3. Completed excavation to expose leakage path, leaving embankment intact on downstream side and along most of upstream side.

4. Excavated further to provide a 2-foot margin on all sides of exit hole on downstream face of excavation.

5. Removed loose soils and stone from excavation and lightly scarified surface.

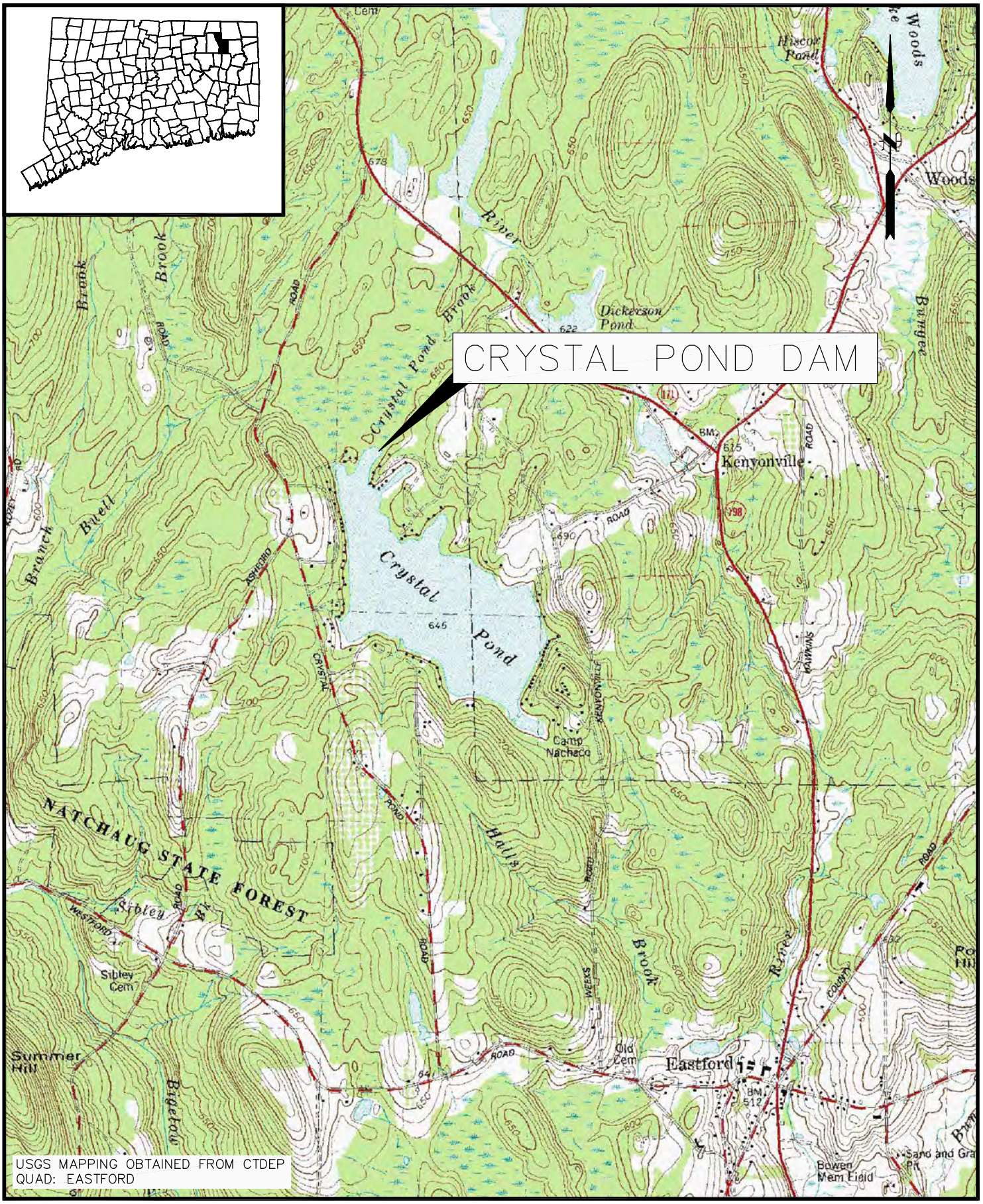
6. Placed permeable filter fabric against downstream face of excavation, including exit site of leakage path.

7. Placed new embankment soil in 8-inch lifts and compacted using plate vibrator and jumping jack.

10/13/2009:

8. Placed 4 inches of topsoil over excavation site, as well as to cover ruts along crest from machinery.

9. Seeded topsoil and staked hay mats for erosion protection.



SCALE:	
HORZ.:	1" = 2000'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	NGVD29 (FEET)

0 1000 2000
GRAPHIC SCALE

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CRYSTAL POND ASSOCIATION

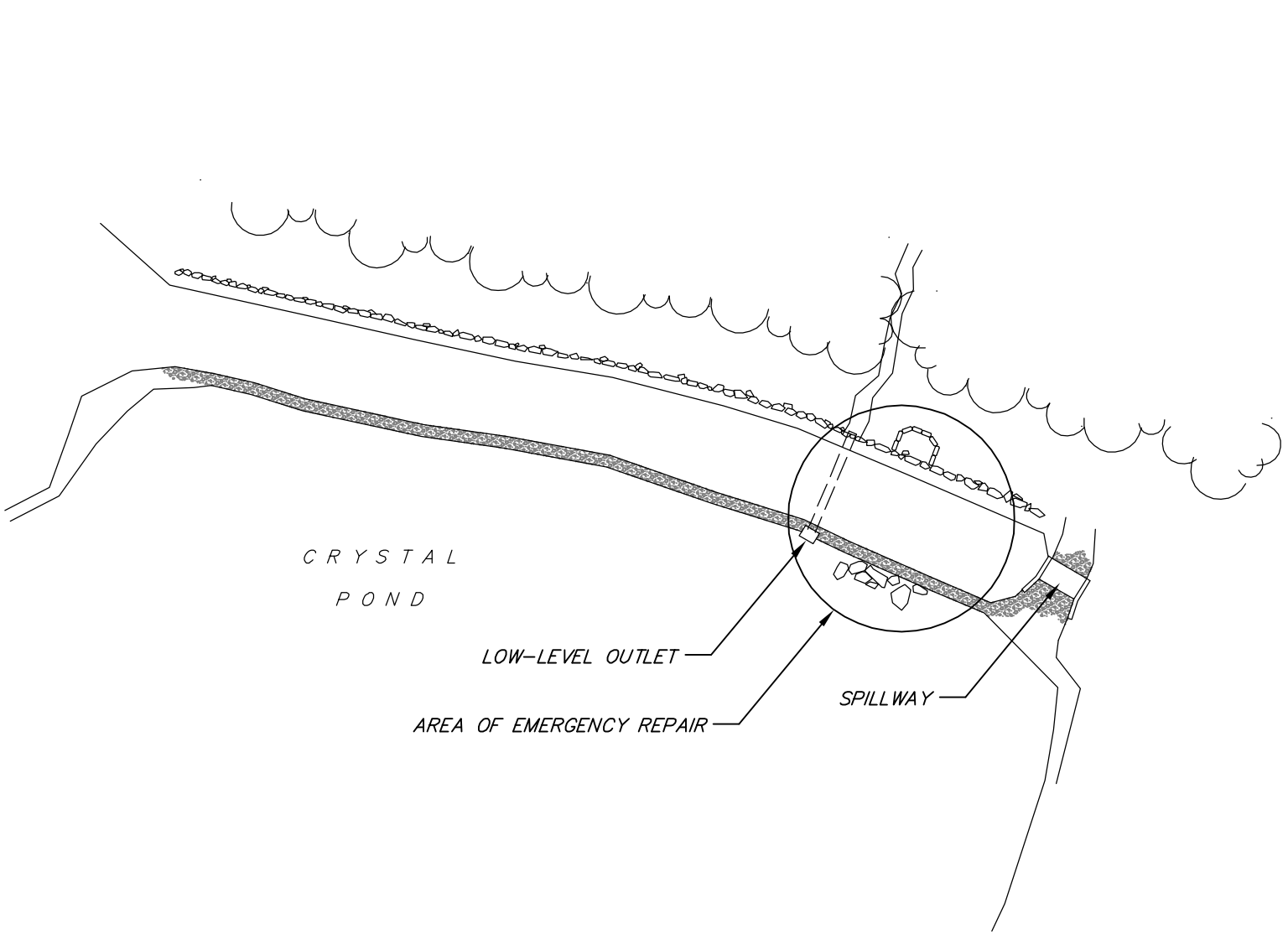
LOCATION MAP

CRYSTAL POND DAM EMERGENCY REPAIRS

EASTFORD CONNECTICUT

PROJ. No.: 20050682.B30
DATE: OCTOBER 12, 2009

FIG 1



SCALE:	
HORZ.:	1" = 40'
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 20 40
GRAPHIC SCALE

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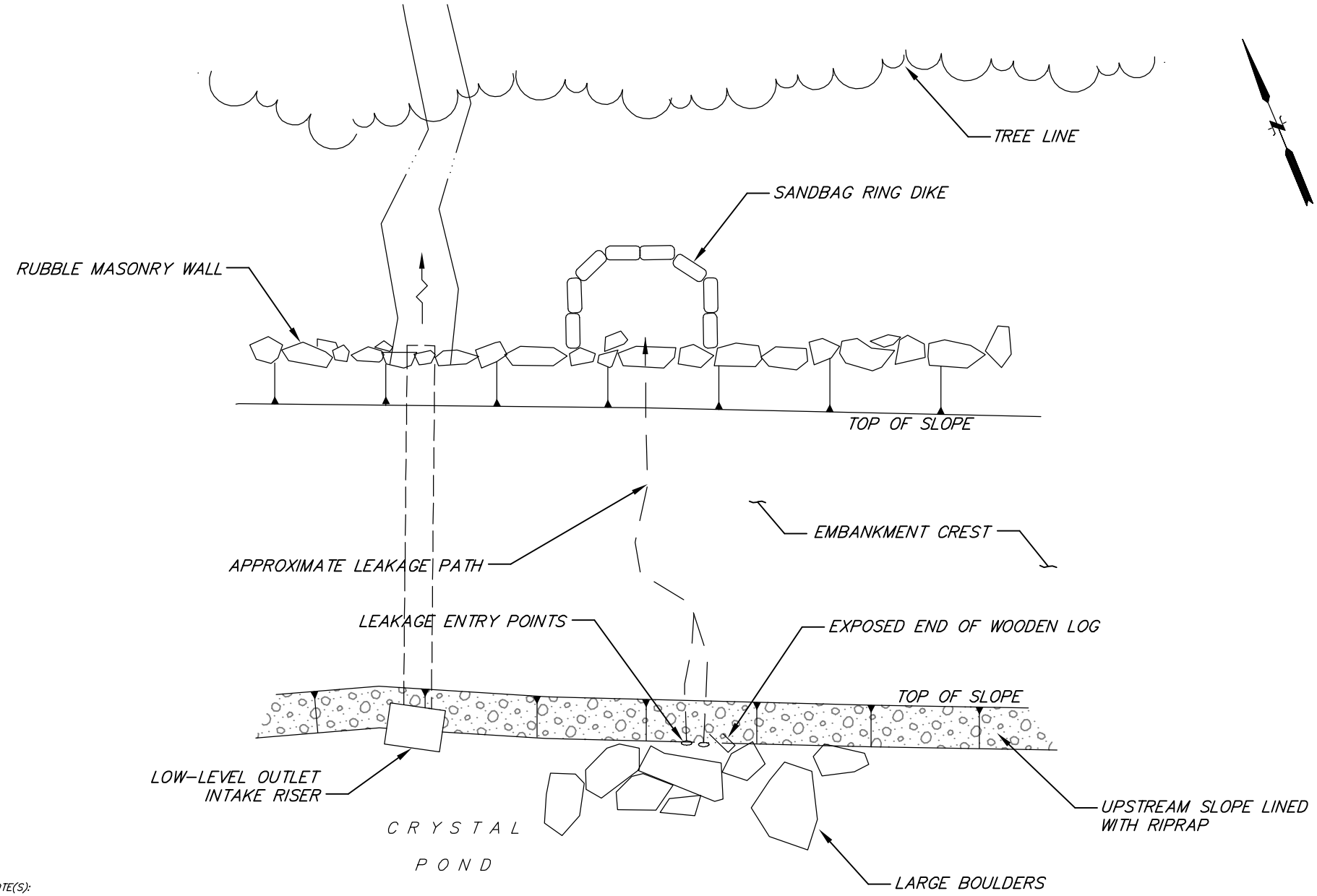
CRYSTAL POND ASSOCIATION
AREA OF EMERGENCY REPAIR
CRYSTAL LAKE DAM EMERGENCY REPAIRS
EASTFORD CONNECTICUT

PROJ. No.: 20050682.B30
DATE: OCTOBER 12, 2009

FIG 2



NOTE(S):

1. DIMENSIONS BASED UPON APPROXIMATE MEASUREMENTS WITH TAPE MEASURE

SCALE:
HORZ.: 1" = 10'
VERT.:
DATUM:
HORZ.:
VERT.:
0 5 10
GRAPHIC SCALE

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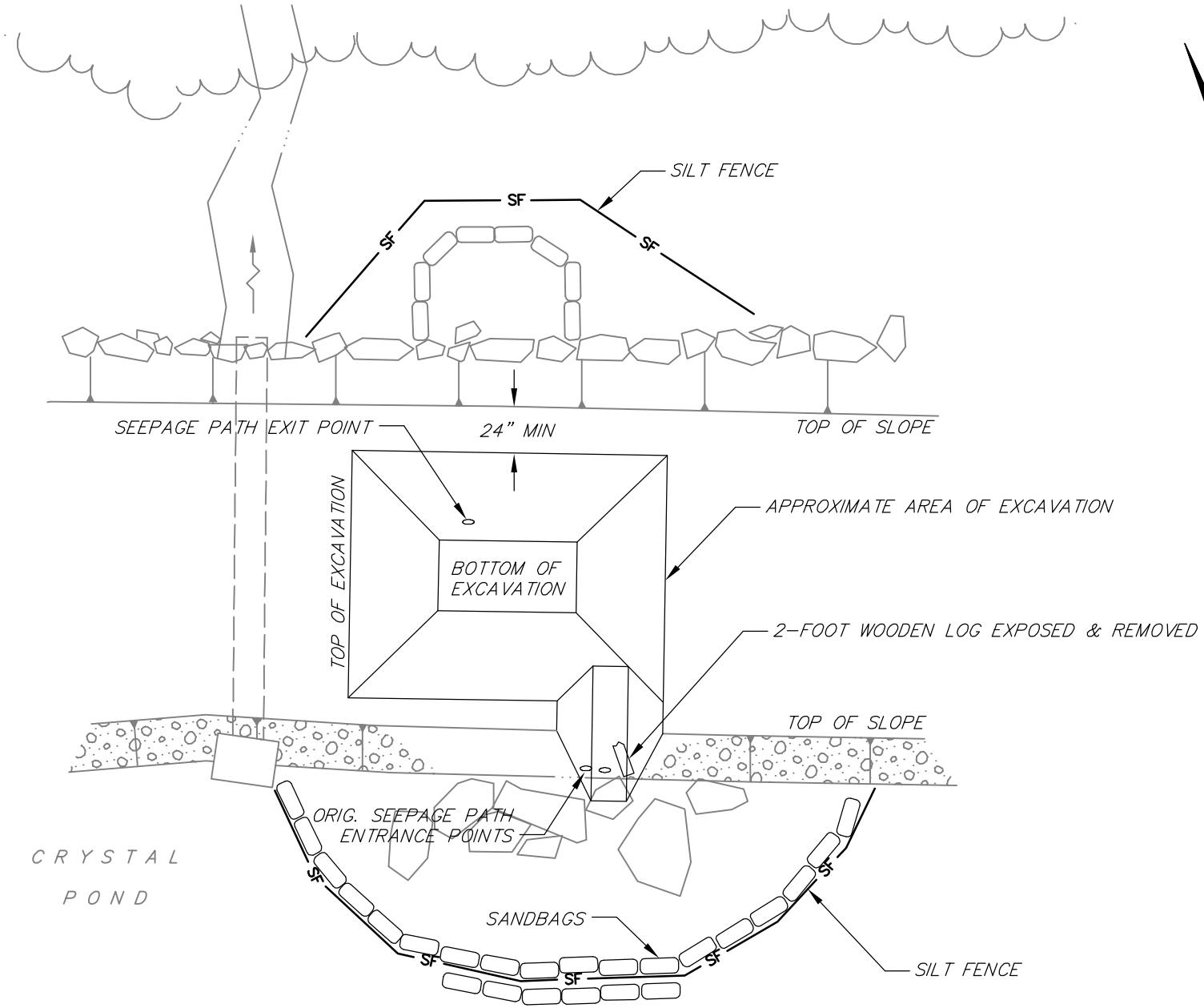
CRYSTAL POND ASSOCIATION
PREEXISTING CONDITIONS
CRYSTAL LAKE DAM EMERGENCY REPAIRS
EASTFORD CONNECTICUT

PROJ. No.: 20050682.B30
DATE: OCTOBER 12, 2009

FIG 3

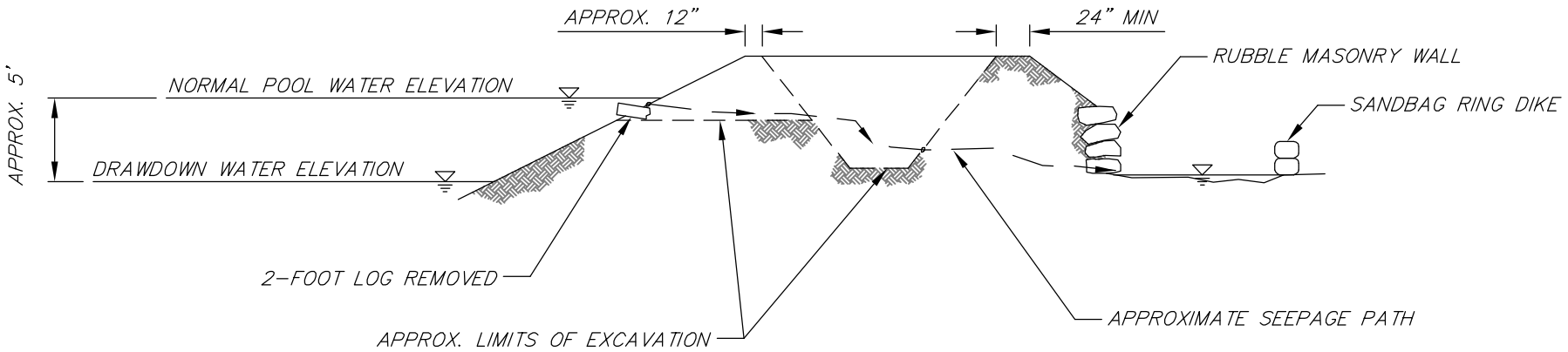


NOTE(S):

1. DIMENSIONS ARE APPROXIMATE.

SCALE: HORZ.: 1" = 10' VERT.: DATUM: HORZ.: VERT.: 0 5 10 GRAPHIC SCALE	WWW.FandO.COM FUSS & O'NEILL *Disciplines to Deliver* 146 HARTFORD RD MANCHESTER, CT 06040 860.646.2469	CRYSTAL POND ASSOCIATION EMERGENCY REPAIRS PLAN CRYSTAL LAKE DAM EMERGENCY REPAIRS EASTFORD CONNECTICUT	PROJ. No.: 20050682.B30 DATE: OCTOBER 12, 2009 FIG 4

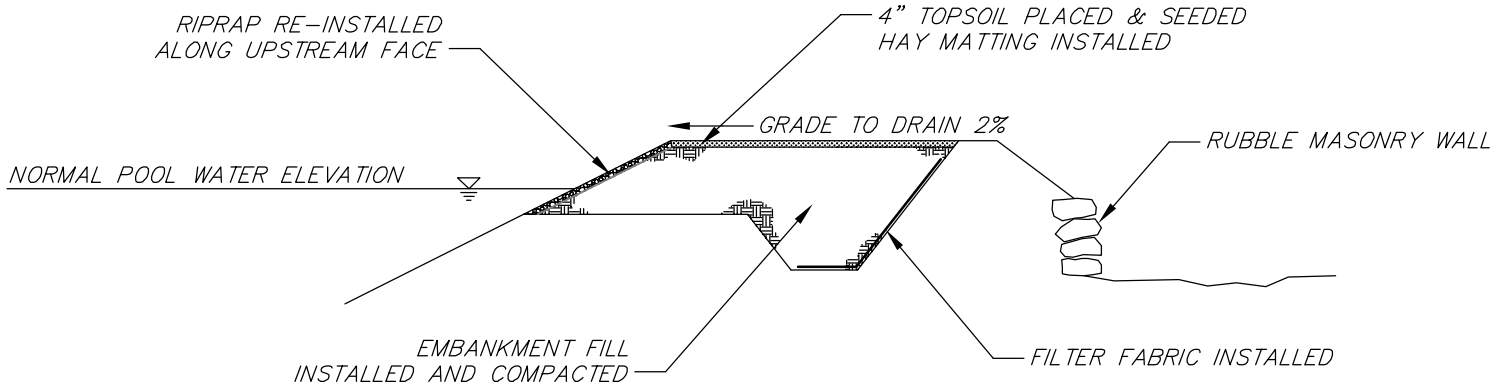
UCS: ROTATED | MS VIEW: | LMAN: | CTB:



NOTE(S):

1. DIMENSIONS ARE APPROXIMATE

SCALE: HORZ.: 1" = 10' VERT.: 1" = 10' DATUM: HORZ.: VERT.: 0 5 10 GRAPHIC SCALE	WWW.FandO.COM FUSS & O'NEILL *Disciplines to Deliver* 146 HARTFORD RD MANCHESTER, CT 06040 860.646.2469	CRYSTAL POND ASSOCIATION EMERGENCY REPAIRS SECTION CRYSTAL LAKE DAM EMERGENCY REPAIRS EASTFORD CONNECTICUT	PROJ. No.: 20050682.B30 DATE: OCTOBER 12, 2009 FIG 5



NOTE(S):

1. DIMENSIONS ARE APPROXIMATE.
2. EXCAVATION FACES WERE LIGHTLY SCARIFIED PRIOR TO PLACING FILL.
3. FILL WAS PLACED IN 8" LOOSE LIFTS, THEN MECHANICALLY COMPACTED.
4. EMBANKMENT FILL SELECTED BASED ON SOIL GRADATION TESTING OF EXISTING EMBANKMENT.

SCALE:	
HORZ.: 1" = 10'	
VERT.: 1" = 10'	
DATUM:	
HORZ.:	
VERT.:	
0 5 10	
GRAPHIC SCALE	

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CRYSTAL POND ASSOCIATION

FINISHED CONDITIONS

CRYSTAL LAKE DAM EMERGENCY REPAIRS

EASTFORD CONNECTICUT

PROJ. No.: 20050682.B30	
DATE: OCTOBER 12, 2009	

FIG 6

Photo 1: Overview of Crystal Pond from Dam. Pond is drawn down approx. 5 feet.

Photo 2: Overview of construction location on dam, right of low-level outlet intake riser.

Photo 3: Start of excavation

Photo 4: Embedded log was found to be only 2 feet in length and was easily removed.

Photo 5: Excavation followed the seepage path. At this point it opened up to nearly the size of a basketball.

Photo 6: The completed excavation retained intact embankment on the downstream side and along much of the upstream side.

Photo 7: Location of seepage path exit point on downstream face of excavation

Photo 8: Permeable filter fabric installed, lining the downstream face of the excavation.

Photo 9: Embankment fill placed and compacted in 8-inch lifts (1 of 4)

Photo 10: Embankment fill placed and compacted in 8-inch lifts (2 of 4)

Photo 11: Embankment fill placed and compacted in 8-inch lifts (3 of 4)

Photo 12: Embankment fill placed and compacted in 8-inch lifts (4 of 4)

Photo 13: Riprap re-installed along the dam's upstream face for erosion protection

Photo 14: 4-inch layer of topsoil placed and seeded over excavation site and to fill ruts from machinery.

Photo 15: Hay matting placed and staked for erosion protection.

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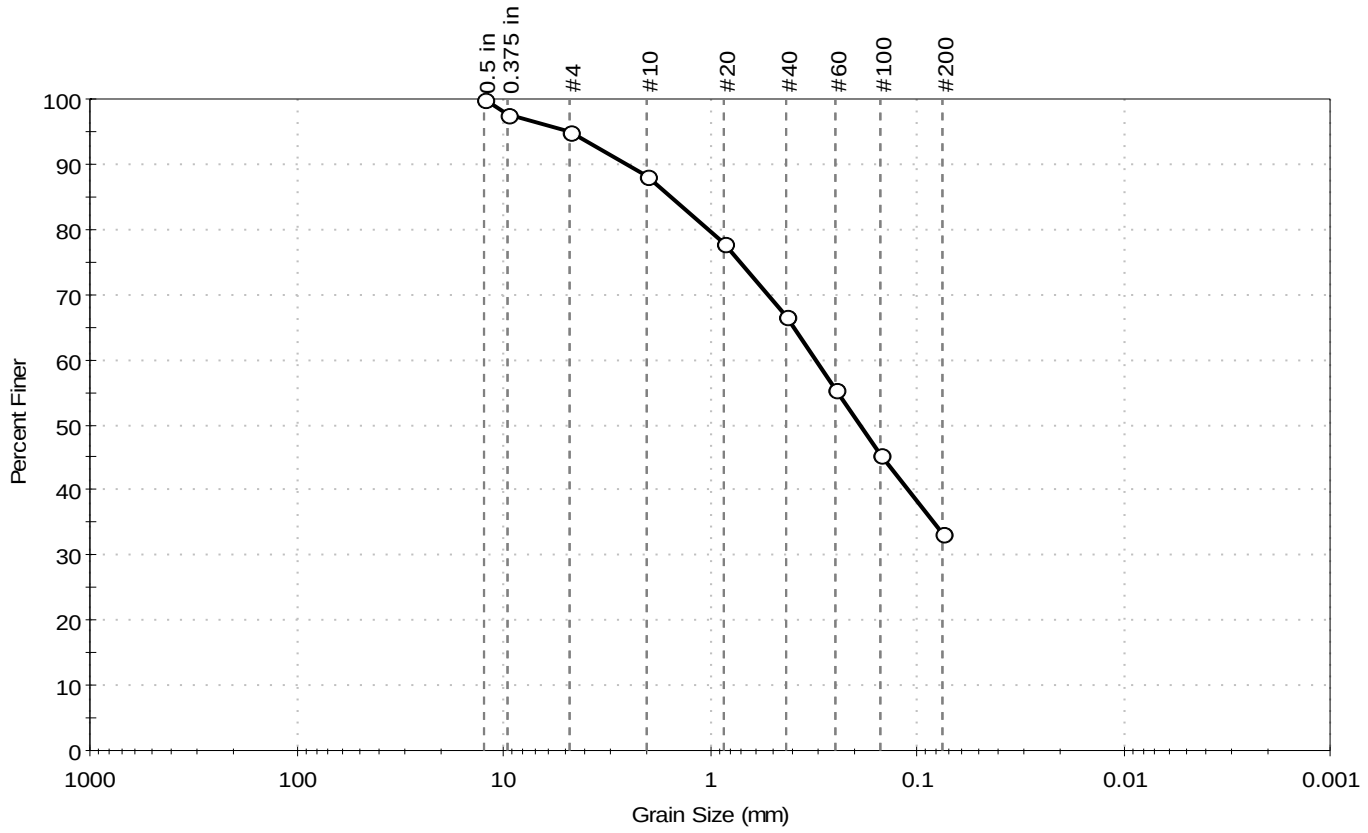
Client:	Fuss & ONeill, Inc				
Project:	Crystal Pond Dam Emergency Repairs				
Location:	Eastford, CT			Project No:	GTX-9343
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-6	Test Date:	09/24/09	Checked By:	jdt
Depth :	---	Test Id:	164536		

Test Comment: ---
Sample Description: Moist, dark olive brown silty sand
Sample Comment: Organics noted in sample

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	5.1	61.7	33.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	98		
#4	4.75	95		
#10	2.00	88		
#20	0.85	78		
#40	0.42	67		
#60	0.25	56		
#100	0.15	46		
#200	0.075	33		

Coefficients

D_{85} = 1.5478 mm D_{30} = N/A
D_{60} = 0.3099 mm D_{15} = N/A
D_{50} = 0.1884 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Existing dam embankment soil (Sample 1 of 2)

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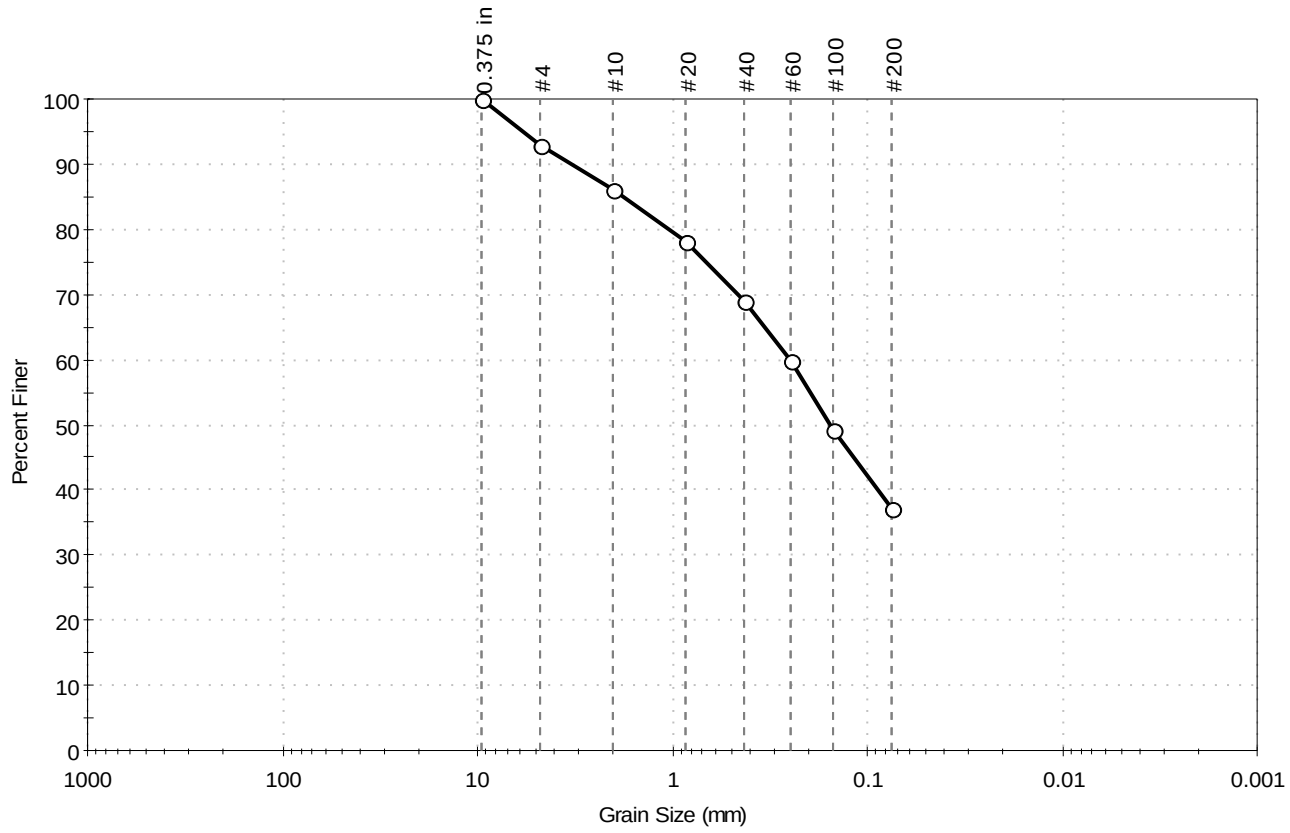
Client:	Fuss & ONeill, Inc				
Project:	Crystal Pond Dam Emergency Repairs				
Location:	Eastford, CT			Project No:	GTX-9343
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-7	Test Date:	09/24/09	Checked By:	jdt
Depth :	---	Test Id:	164537		

Test Comment: ---
Sample Description: Moist, light brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	7.1	55.7	37.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	93		
#10	2.00	86		
#20	0.85	78		
#40	0.42	69		
#60	0.25	60		
#100	0.15	49		
#200	0.075	37		

Coefficients

D_{85} = 1.7723 mm D_{30} = N/A
D_{60} = 0.2520 mm D_{15} = N/A
D_{50} = 0.1547 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Existing dam embankment soil (Sample 2 of 2)

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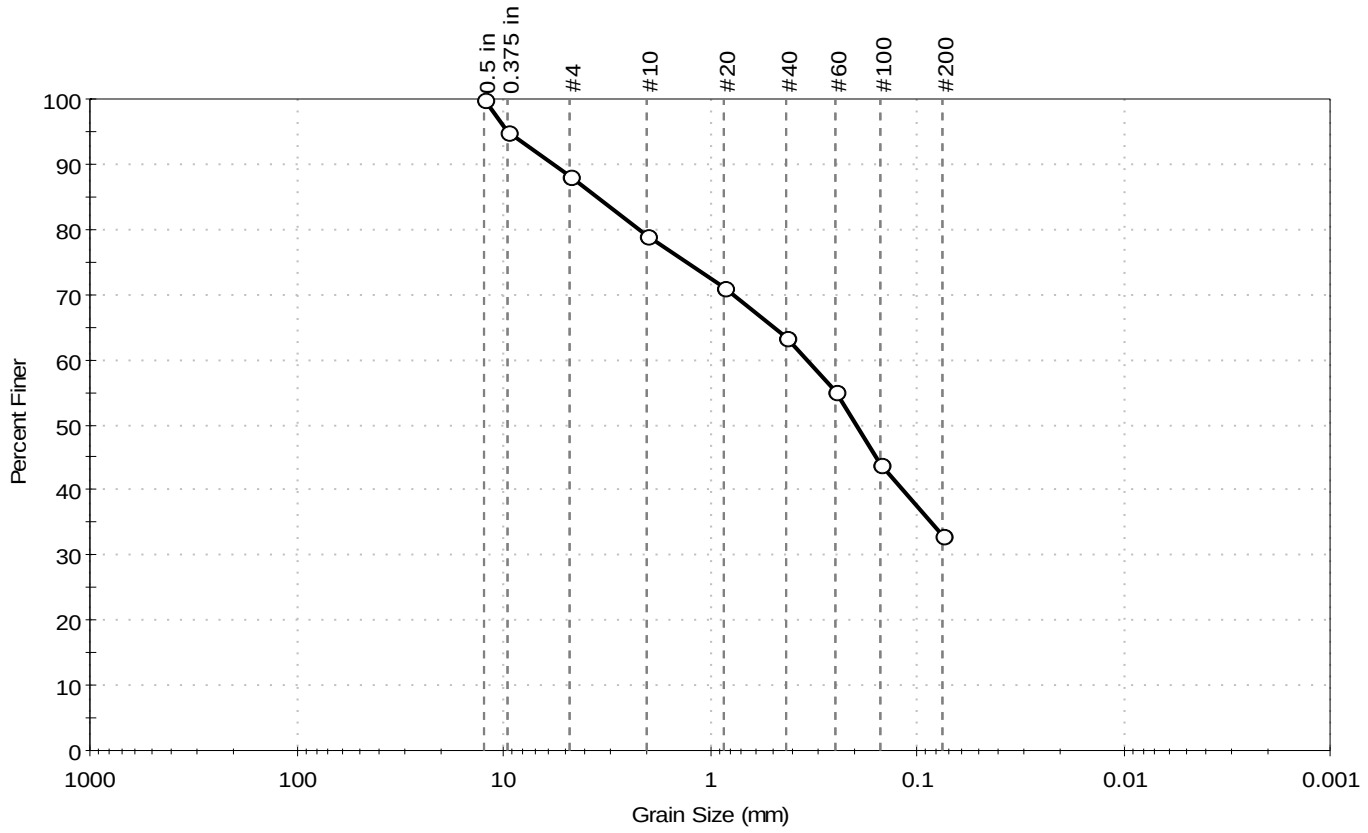
Client:	Fuss & ONeill, Inc				
Project:	Crystal Pond Dam Emergency Repairs				
Location:	Eastford, CT			Project No:	GTX-9343
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	EC-A	Test Date:	10/05/09	Checked By:	jdt
Depth :	---	Test Id:	165449		

Test Comment: ---
Sample Description: Moist, yellowish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	11.8	55.1	33.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.5 in	12.50	100		
0.375 in	9.50	95		
#4	4.75	88		
#10	2.00	79		
#20	0.85	71		
#40	0.42	63		
#60	0.25	55		
#100	0.15	44		
#200	0.075	33		

Coefficients

D_{85} = 3.5174 mm D_{30} = N/A
D_{60} = 0.3414 mm D_{15} = N/A
D_{50} = 0.1979 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Soil used for embankment reconstruction (Sample 1 of 2)

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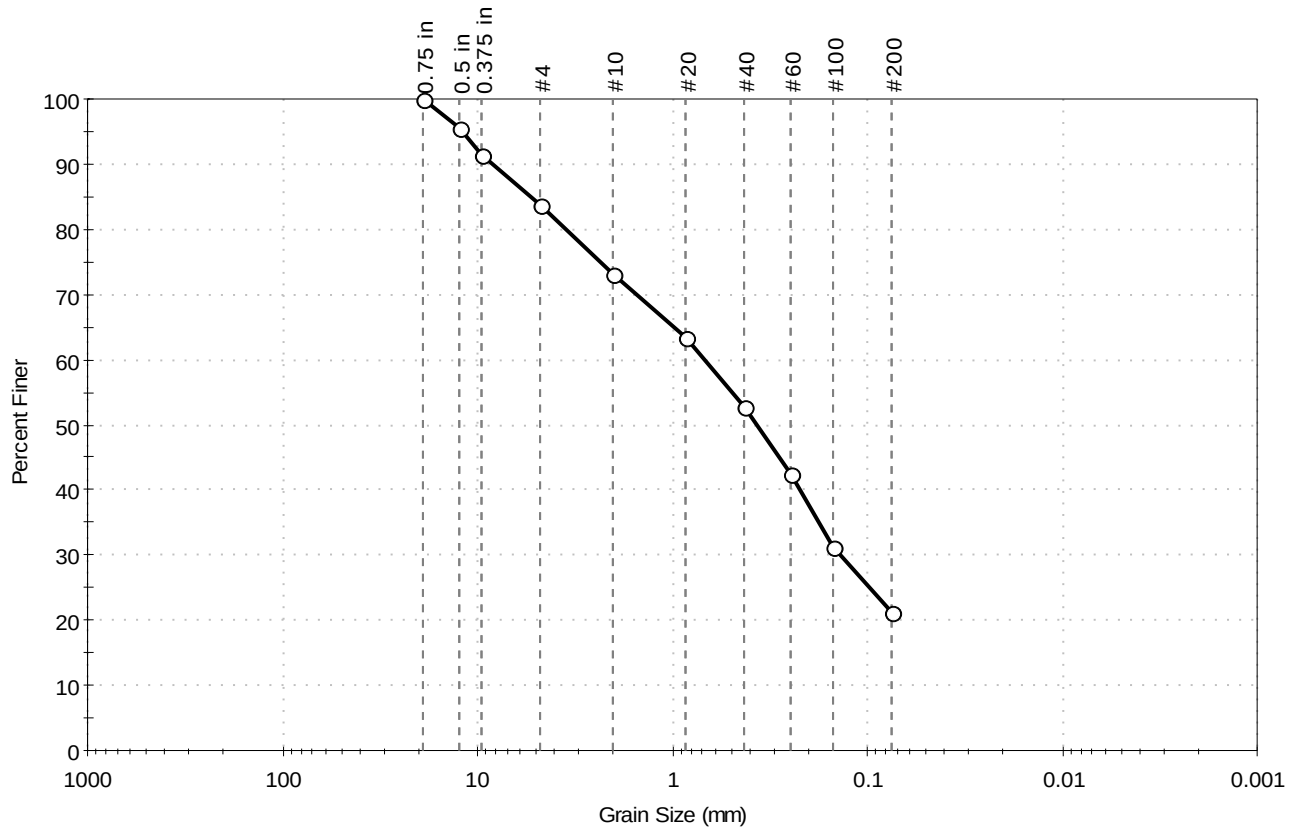
Client:	Fuss & ONeill, Inc				
Project:	Crystal Pond Dam Emergency Repairs				
Location:	Eastford, CT			Project No:	GTX-9343
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	EC-B	Test Date:	10/05/09	Checked By:	jdt
Depth :	---	Test Id:	165450		

Test Comment: ---
Sample Description: Moist, light yellowish brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



%Cobble	%Gravel	%Sand	%Silt & Clay Size
---	16.3	62.5	21.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	96		
0.375 in	9.50	91		
#4	4.75	84		
#10	2.00	73		
#20	0.85	64		
#40	0.42	53		
#60	0.25	42		
#100	0.15	31		
#200	0.075	21		

Coefficients

D_{85} = 5.3348 mm D_{30} = 0.1373 mm
D_{60} = 0.6771 mm D_{15} = N/A
D_{50} = 0.3701 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Soil used for embankment reconstruction (Sample 2 of 2)

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