Geotechnical Engineering Evaluation Report

Waban Hill Reservoir Dam
NID # MA 01111
Newton, Massachusetts

Prepared for:
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Sign-off Sheet

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The main text of this report is posted separately on the Newton CPC website.

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SYMBOLS AND TERMS USED ON BOREHOLD AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of visible and invisible fragments of decayed organic matter
Till	unstratified glacial deposit which may range from clay to boulders
Fill	material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	3 inches in thickness
Seam	1/16 inch to 3 inches in thickness
Parting	< 1/16 inch in thickness

Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classified System (USCS) (ASTM D 2487 or D 2488). The classification excludes particles larger than 3 inches. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 3 inches, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	>20%

Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes relative density, as determined by the Standard Penetration Test N-Value. A relationship between compactness condition and N-Value is shown in the following table.

Relative Density	**SPT N-Value**
Very Loose	<4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests.

Consistency	**Undrained Shear Strength**
	Kips/sq.ft.
Very Soft	<0.25
Soft	<0.25 – 0.5
Firm	0.5 – 1.0
Stiff	1.0 – 2.0
Very Stiff	2.0 – 4.0
Hard	>4.0

ROCK DESCRIPTION

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

Rock quality classification is based on a modified core recovery percentage (RQD) in which all pieces of sound core over 4 inches long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on NW core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from *in situ* fractures. The terminology describing rock mass quality based on RQD is subjective and is underlain by the presumption that sound strong rock is of higher engineering value than fractured weak rock.

Terminology describing rock mass:

Spacing (inches)	Joint Classification	Bedding, Laminations, Bands
>240	Extremely Wide	-
80-240	Very Wide	Very Thick
24-80	Wide	Thick
8-24	Moderate	Medium
2½-8	Close	Thin
¾-2½	Very Close	Very Thin
<¾	Extremely Close	Laminated
<¼		Thinly Laminated

Terminology describing rock strength:

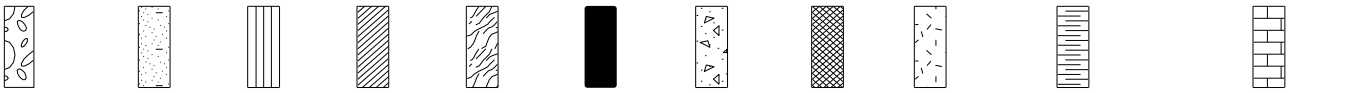
Strength Classification	Unconfined Compressive Strength (Kips/sq.ft.)
Extremely Weak	<20
Very Weak	20-100
Weak	100-520
Medium Strong	520-1040
Strong	1040-2090
Very Strong	2090-5200
Extremely Strong	>5200

Terminology describing rock weathering:

Term	Description
Fresh	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly Weathered	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately Weathered	Less than half the rock is decomposed and/or disintegrated into soil.
Highly Weathered	More than half the rock is decomposed and/or disintegrated into soil.
Completely Weathered	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders, Cobbles, Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Metamorphic Bedrock | Sedimentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

Measured in standpipe, piezometer or well

Inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound hammer falling 30 inches, required to drive a 2 inch O.D. split spoon sampler one foot into the soil. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the number of blows are reported over sampler penetration in inches (e.g. 50/3). Some design methods make use of N value corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
y	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_U	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals I_p (50) in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test ` of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

BOREHOLE LOG

B-1/MW-1

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/15/2014 to 1/15/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-1/MW-1**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	270.1	Grass			in.			
0		Topsoil	SS	1A	6	16 32	43	
	269.1							
		Dense, brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)	SS	1B	6	11 8		
	268.1							
		Dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)	SS	2	10	16 19 21 27	40	
	266.1							
		No Recovery	SS	3	0	26 25 22 23	47	
5	264.1							
		Dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)	SS	4	6	37 23 15 19	38	
	262.1	- Coarse gravel in tip -						
		Medium dense, light brown coarse to fine SILTY SAND, little fine gravel, moist (FILL)	SS	5	12	20 16 10 11	26	
10								
	255.1							
15		Dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)	SS	6	6	27 19 16 11	35	
		- Coarse gravel in tip -						
	250.1							
20		Dense, light brown coarse to fine SAND, little silt, little medium to fine gravel, wet (SM-ML)	SS	7	10	16 16 19 30	35	
		- Coarse gravel in tip -						
	245.1							
25								

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

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BOREHOLE LOG

B-1/MW-1

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/15/2014 to 1/15/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-1/MW-1**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
							in.			
25	243.6	Very dense, light brown coarse to fine SAND, little silt, little medium to fine gravel, wet (SM-ML) - Coarse gravel in tip -			SS	8	10	36 95 100/4"	195	
		Exploration terminated at 26.5 feet BGS								
30										
35										
40										
45										
50										

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

>>●

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

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BOREHOLE LOG

B-2/MW-2

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/15/2014 to 1/16/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-2/MW-2**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	270.1	Grass					in.			
0	269.6	Topsoil			SS	1A	2	9	27	
		Medium dense, brown coarse to fine SAND, some coarse gravel, little silt, moist (FILL)			SS	1B	6	13 14 11		
	268.1	Dense, brown coarse to fine SAND, some coarse gravel, little silt, moist (FILL)			SS	2	12	8 10 21 19	31	
	266.1	Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, moist (FILL)			SS	3	10	12 11 9 23	18	
5	264.1	Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, moist (FILL)			SS	4	12	53 16 9 8	25	
	262.1	- Course gravel in tip -								
		Medium dense, brown/light brown coarse to fine SILTY SAND, trace medium to fine embedded gravel, wet (FILL)			SS	5	12	17 11 12 16	23	
10		- Coarse gravel in tip -								
	255.1	Medium dense, gray coarse to fine SILTY SAND, trace medium embedded gravel, wet (FILL)			SS	6	16	19 12 15 21	27	
15										
	250.1	No Recovery			SS	7	0	13 22 22 17	44	
20										
25	245.1									

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

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BOREHOLE LOG

B-2/MW-2

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/15/2014 to 1/16/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-2/MW-2**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (in.)	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
25		Very dense, brown coarse to fine SILTY SAND, some coarse to fine gravel, wet (SM-ML)			SS	8	18	35 85 22 68	167	
		- 3" Gray coarse gravel layer from 26' to 26.25' -								
30	240.1	Very dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			SS	9	14	47 41 50 52	91	
35	235.1	Very dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			SS	10	2	100/3"	100	
		- Coarse gravel in tip -								
40	230.1	Very dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			SS	11	10	35 102 100/2"	202	
	228.1	Exploration terminated at 42 feet BGS								
45										
50										

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

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BOREHOLE LOG

B-3/MW-3

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/16/2014 to 1/16/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-3/MW-3**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	248.3	Grass					in.			
0	247.8	Topsoil			SS	1A	2	3	7	
		Loose, brown coarse to fine SILTY SAND, trace embedded fine gravel, trace organics, moist (SM-ML)			SS	1B	6	3 4 4		
	246.3 245.8				SS	2A	3	4	48	
		Loose, brown coarse to fine SILTY SAND, trace embedded fine gravel, trace organics, moist (SM-ML)			SS	2B	8	17 31 51		
	244.3	Dense, brown coarse SAND, little coarse to fine gravel, little silt, moist (SM-ML)			SS	3	16	35 47 49 41	96	
5	242.3	Very dense, brown coarse to fine SAND, little coarse to fine gravel, little silt, moist (SM-ML)			SS	4A	10	37 48	99	
	241.3	Very dense, brown coarse to fine SAND, little coarse to fine gravel, little silt, moist (SM-ML)			SS	4B	10	51 55		
	240.3	Very dense, light brown medium to fine SILTY SAND, little embedded coarse to fine gravel, moist (SM-ML)			SS	5	8	20 26 36 46	62	
10		Very dense, light brown medium to fine SILTY SAND, trace embedded coarse to fine gravel, moist (SM-ML)								
	233.3									
15		Very dense, brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			SS	6	6	81 100/2"	100	
		- 3" Gray coarse gravel layer from 26' to 26.25' -								
	228.3									
20	227.8	Very dense, brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			SS	7	5	100/5"	100	
		Exploration terminated at 20.5 feet BGS								
25										

Undrained Shear Strength - tsf: 1 2 3 4

Water Content & Atterberg Limits: W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test
□ Field Vane Test ■ Remolded
✖ Pocket Penetrometer / Torvane

STN13-GEO-I-VOC 191711340_WABANRESERVOIR_NEWTONMA.GPJ JW NHP.GDT 3/20/14

BOREHOLE LOG

B-4

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/14/2014 to 1/14/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-4**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	270.6	Grass					in.			
0	270.1	Topsoil			SS	1A	2	8	32	
		Dense, gray-brown coarse to fine SAND, little medium to fine gravel, trace silt, dry (FILL)			SS	1B	4	17 15 16		
	268.6									
		Medium dense, brown medium to fine SILTY SAND, moist (FILL)			SS	2	8	15 9 8 9	17	
	266.6									
5		Dense, brown medium to fine SILTY SAND, trace embedded fine gravel, moist (FILL)			SS	3	10	19 20 22 26	42	
	264.6									
		No Recovery			SS	4	0	27 19 20 15	39	
	262.6									
		Dense, gray-brown coarse to fine SILTY SAND, trace embedded coarse to fine gravel, wet (FILL)			SS	5	14	17 19 24 20	43	
10										
15	255.6									
		Medium dense, light gray coarse to fine SILTY SAND, trace embedded coarse to fine gravel, wet (FILL)			SS	6	16	15 16 14 13	30	
20	250.6									
		Medium dense, light brown coarse to fine SILTY SAND, little clay, trace embedded coarse to fine gravel, wet (SM)			SS	7	12	13 9 11 20	20	
25	245.6									

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

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BOREHOLE LOG

B-4

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/14/2014 to 1/14/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-4**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES SPT blows / 6"	SAMPLES SPT N-Value	PID Reading (PPM)
							in.			
25		Very dense, light brown coarse to fine SILTY SAND, trace embedded coarse to fine gravel, wet (SM-ML)			SS	8	20	26 27 36 32	63	
30	240.6	No Recovery			SS	9	0	100/5"	100	
35	235.6	Very dense, light brown coarse to fine SILTY SAND, trace embedded coarse to fine gravel, wet (SM-ML)			SS	10	4	100/4"	100	
40	230.6 230.1	Very dense, brown coarse to fine SILTY SAND, little embedded coarse to fine gravel, wet (SM) Exploration terminated at 40.5 feet BGS			SS	11	5	100/5"	100	
45										
50										

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test
□ Field Vane Test ■ Remolded
✖ Pocket Penetrometer / Torvane

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BOREHOLE LOG

B-5

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/17/2014 to 1/17/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-5**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	250.9	Grass					in.			
0		Topsoil			SS	1A	2	3 4	9	
	249.9									
		Loose, brown medium to fine SILTY SAND, trace roots, trace embedded fine gravel, wet			SS	1B	2	5 6		
	248.9	No Recovery			SS	2	0	5 6 13 5	19	
	246.9	Medium dense, brown SILTY fine SAND, trace roots (SM)			SS	3	4	4 5 5 7	10	
5	244.9	Loose dark brown SILTY fine SAND, trace roots, possible original ground (SM)			SS	4	2	2 2 2 2	4	
	242.9									
	242.4	Organics			SS	5A	4	7		
		Very dense, brown coarse to fine SILTY SAND, trace embedded medium to fine gravel, moist (SM-ML)			SS	5B	10	23 100/5"	123	
10	240.9	Very dense, brown coarse to fine SILTY SAND, trace embedded medium to fine gravel, moist (SM-ML)			SS	6	18	75 52 34 28	86	
	235.9									
15		Very dense, brown coarse to fine SILTY SAND, trace embedded medium to fine gravel, moist (SM-ML)			SS	7	16	73 100/5"	100	
	230.9									
20		Very dense, brown coarse to fine SILTY SAND, trace embedded medium to fine gravel, moist (SM-ML)			SS	8	18	81 77 100/4"	177	
	229.4	Exploration terminated at 21.5 feet BGS								
25										

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

STN13-GEO-I-VOC 191711340_WABANRESERVOIR_NEWTONMA.GPJ JW NHP.GDT 3/20/14

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BOREHOLE LOG

B-6

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/17/2014 to 1/17/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-6**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	246.7	Grass					in.			
0		Topsoil			SS	1A	2	4 24	52	
	245.7	Very dense, brown medium to fine SILTY SAND, little rock chips. moist (SM-ML)			SS	1B	2	28 22		
	244.7	Medium dense, brown medium to fine SILTY SAND, trace medium gravel, moist (SM-ML)			SS	2	4	5 10 12 9	22	
	242.7	Medium dense, brown medium to fine SILTY SAND, trace medium gravel, moist (SM-ML)			SS	3A	6	10 19	86	
5	241.7	Very dense, light brown medium to fine SILTY SAND, little coarse to fine, trace rock chips, moist (SM-ML)			SS	3B	6	67 93		
	240.7	Very dense, light brown medium to fine SILTY SAND, trace medium to fine gravel, moist (SM-ML)			SS	4	14	32 52 67 48	119	
	238.7	Very dense, light brown medium to fine SILTY SAND, trace medium to fine gravel, moist (SM-ML)			SS	5	10	27 28 100/5"	128	
10	235.7	Cobble from 11.0' to 12.0'			RC					
	234.7									
	233.7	Very dense, brown coarse to fine SILTY SAND, some gravel, wet (SM-ML)			SS	6	1	75 100/4"	100	
15	231.7	No Recovery			SS	7	0	68 72 100/3"	172	
	226.7	Very dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, wet (SM-ML)			SS	8	2	100/2"	100	
20										
25	221.7									

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

Continued Next Page

BOREHOLE LOG

B-6

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/17/2014 to 1/17/2014**

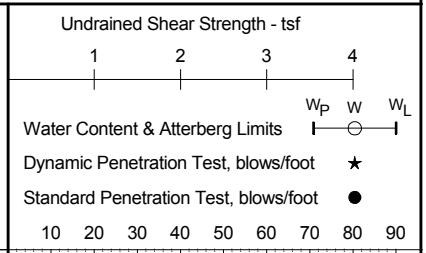
WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-6**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
							in.			
25		Very dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, wet (SM-ML)			SS	9	18	42 59 92 82	151	
30	216.7	Very dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, wet (SM-ML)			SS	10	22	38 34 54 63	88	
	214.7	Exploration terminated at 32 feet BGS								
35										
40										
45										
50										



Driller: NH Boring (Roger); Supervisor: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test
□ Field Vane Test ■ Remolded
✖ Pocket Penetrometer / Torvane

STN13-GEO-I-VOC 191711340_WABANRESERVOIR_NEWTONMA.GPJ JW NHP.GDT 3/20/14

Stantec

BOREHOLE LOG

B-7

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/14/2014 to 1/14/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-7**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SPT blows / 6"	SPT N-Value	PID Reading (PPM)
	270.2	Grass					in.			
0	269.7	Topsoil			SS	1A	4	7	19	
		Medium dense, gray-brown coarse to fine SILTY SAND, some coarse to fine gravel, moist (FILL)			SS	1B	8	8 11 6		
	268.2	Medium dense, brown coarse to fine SILTY SAND, little embedded coarse gravel, moist (FILL)			SS	2	8	4 10 11 7	21	
	266.2	No Recovery			SS	3	0	11 13 18 20	31	
5	264.2	No Recovery			SS	4	0	19 6 10 13	16	
	262.2	Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, wet (FILL)			SS	5	8	10 10 11 13	21	
10										
15	255.2	Dense, gray coarse to fine SILTY SAND, trace embedded fine gravel, wet (FILL)			SS	6	4	9 11 21 20	32	
20	250.2	No Recovery			SS	7	0	13 17 19 22	36	
25	245.2									

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

Continued Next Page

BOREHOLE LOG

B-7

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/14/2014 to 1/14/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-7**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES SPT blows / 6"	SAMPLES SPT N-Value	PID Reading (PPM)
							in.			
25	243.2	Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, wet (SM-ML)			SS	8	6	7 4 11 21	15	
		Exploration terminated at 27 feet BGS								
30										
35										
40										
45										
50										

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

Driller: NH Boring (Roger); Supervisor: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test
□ Field Vane Test ■ Remolded
✖ Pocket Penetrometer / Torvane

Stantec

BOREHOLE LOG

B-8

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

EXPLORATION DATE **1/17/2014 to 1/17/2014**

WATER LEVEL

PROJECT No. **191711341**

EXPLORATION No. **B-8**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	MATERIAL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES SPT blows / 6"	SAMPLES SPT N-Value	PID Reading (PPM)
	250.4	Grass					in.			
0										
5		Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, moist (SM-ML)			SS	1	16	1 7 3 8	10	
	244.4									
		Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, wet (SM-ML)			SS	2	22	17 34 87 100/4"	121	
	242.4									
		Exploration terminated at 8 feet BGS								
10										
15										
20										
25										

Undrained Shear Strength - tsf

1 2 3 4

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/foot ★

Standard Penetration Test, blows/foot ●

10 20 30 40 50 60 70 80 90

>>

Driller: NH Boring (Roger); Supervisor: Sam Burke

ATV Rig

Hammer Type: 140# safety (2" SS), free falling 30 inches

△ Unconfined Compression Test

□ Field Vane Test ■ Remolded

✖ Pocket Penetrometer / Torvane

STN13-GEO-I-VOC 191711340_WABANRESERVOIR_NEWTONMA.GPJ JW NHP.GDT 3/20/14

MONITORING WELL LOG

B-1/MW-1

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

DATES: BORING **1/15/2014 to 1/15/2014** WATER LEVEL

PROJECT No. **191711341**

BOREHOLE No. **B-1/MW-1**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	270.10	Grass						in.		
0		Topsoil			Flush mounted roadway box	SS	1A	6	43	
	269.1	Dense, brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)			2 inch PVC riser in drill cuttings	SS	1B	6		
	268.1	Dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)				SS	2	10	40	
	266.1	No Recovery				SS	3	0	47	
5	264.1	Dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)				SS	4	6	38	
	262.1	- Coarse gravel in tip -								
		Medium dense, light brown coarse to fine SILTY SAND, little fine gravel, moist (FILL)				SS	5	12	26	
10					2 inch PVC riser in bentonite					
					2 inch PVC riser in filter sand					
15	255.1	Dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, moist (FILL)			Top of screen at 16 feet	SS	6	6	35	
		- Coarse gravel in tip -								
20	250.1	Dense, light brown coarse to fine SAND, little silt, little medium to fine gravel, wet (SM-ML)			2 inch PVC in filter sand	SS	7	10	35	
		- Coarse gravel in tip -								
25	245.1									

Driller: NH Boring (Roger); Stantec Field Representative: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

Continued Next Page

Stantec

MONITORING WELL LOG

B-1/MW-1

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

DATES: BORING **1/15/2014 to 1/15/2014** WATER LEVEL

PROJECT No. **191711341**

BOREHOLE No. **B-1/MW-1**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
								in.		
25	243.6	Very dense, light brown coarse to fine SAND, little silt, little medium to fine gravel, wet (SM-ML) - Coarse gravel in tip -			Bottom of screen at 26 feet	SS	8	10	195	
		Exploration terminated at 26.5 feet BGS								
30										
35										
40										
45										
50										

Driller: NH Boring (Roger); Stantec Field Representative: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

Stantec

MONITORING WELL LOG

B-2/MW-2

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

DATES: BORING **1/15/2014 to 1/16/2014** WATER LEVEL

PROJECT No. **191711341**

BOREHOLE No. **B-2/MW-2**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	270.12	Grass						in.		
0	269.6	Topsoil			Flush mounted roadway box	SS	1A	2	27	
		Medium dense, brown coarse to fine SAND, some coarse gravel, little silt, moist (FILL)			2 inch PVC riser in drill cuttings	SS	1B	6		
	268.1	Dense, brown coarse to fine SAND, some coarse gravel, little silt, moist (FILL)				SS	2	12	31	
	266.1	Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, moist (FILL)				SS	3	10	18	
5	264.1	Medium dense, brown coarse to fine SILTY SAND, trace embedded fine gravel, moist (FILL)			2 inch PVC riser in bentonite	SS	4	12	25	
	262.1	- Course gravel in tip -			2 inch PVC riser in filter sand					
		Medium dense, brown/light brown coarse to fine SILTY SAND, trace medium to fine embedded gravel, wet (FILL)				SS	5	12	23	
10		- Coarse gravel in tip -								
	255.1	Medium dense, gray coarse to fine SILTY SAND, trace medium embedded gravel, wet (FILL)				SS	6	16	27	
15										
	250.1	No Recovery				SS	7	0	44	
20					2 inch PVC riser in bentonite					
	245.1				2 inch PVC riser in filter sand					
25										

Driller: NH Boring (Roger); Stantec Field Representative: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

Continued Next Page

Stantec

MONITORING WELL LOG

B-2/MW-2

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

DATES: BORING **1/15/2014 to 1/16/2014** WATER LEVEL

PROJECT No. **191711341**

BOREHOLE No. **B-2/MW-2**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
								in.		
25		Very dense, brown coarse to fine SILTY SAND, some coarse to fine gravel, wet (SM-ML)			Top of screen at 26 feet	SS	8	18	167	
		- 3" Gray coarse gravel layer from 26' to 26.25' -								
30	240.1	Very dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			2 inch PVC in filter sand	SS	9	14	91	
35	235.1	Very dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)			Bottom of screen at 36 feet	SS	10	2	100	
		- Coarse gravel in tip -								
40	230.1	Very dense, light brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)				SS	11	10	202	
	228.1	Exploration terminated at 42 feet BGS								
45										
50										

Driller: NH Boring (Roger); Stantec Field Representative: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

STN13-MON-I 191711340_WABANRESERVOIR_NEWTONMA.GPJ JW NHP.GDT 3/20/14

Stantec

MONITORING WELL LOG

B-3/MW-3

CLIENT **Waban Hill Reservoir**

LOCATION **Manet Road, Newton, Massachusetts**

DATES: BORING **1/16/2014 to 1/16/2014** WATER LEVEL

PROJECT No. **191711341**

BOREHOLE No. **B-3/MW-3**

DATUM **Boston City Base**

DEPTH (ft)	ELEVATION (ft)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	248.25	Grass						in.		
0	247.8	Topsoil			Flush mounted roadway box	SS	1A	2	7	
		Loose, brown coarse to fine SILTY SAND, trace embedded fine gravel, trace organics, moist (SM-ML)			2 inch PVC riser in drill cuttings	SS	1B	6		
	246.3									
	245.8	Loose, brown coarse to fine SILTY SAND, trace embedded fine gravel, trace organics, moist (SM-ML)				SS	2A	3	48	
						SS	2B	8		
	244.3	Dense, brown coarse SAND, little coarse to fine gravel, little silt, moist (SM-ML)								
5		Very dense, brown coarse to fine SAND, little coarse to fine gravel, little silt, moist (SM-ML)			2 inch PVC riser in bentonite	SS	3	16	96	
	242.3									
		Very dense, brown coarse to fine SAND, little coarse to fine gravel, little silt, moist (SM-ML)			2 inch PVC riser in filter sand	SS	4A	10	99	
	241.3									
	240.3	Very dense, light brown medium to fine SILTY SAND, little embedded coarse to fine gravel, moist (SM-ML)				SS	4B	10		
		Very dense, light brown medium to fine SILTY SAND, trace embedded coarse to fine gravel, moist (SM-ML)			Top of screen at 8 feet	SS	5	8	62	
10										
					2 inch PVC in filter sand					
	233.3									
15		Very dense, brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)				SS	6	6	100	
		- 3" Gray coarse gravel layer from 26' to 26.25' -								
					Bottom of screen at 18 feet					
	228.3									
20	227.8	Very dense, brown coarse to fine SILTY SAND, little coarse to fine gravel, wet (SM-ML)				SS	7	5	100	
		Exploration terminated at 20.5 feet BGS								
25										

Driller: NH Boring (Roger); Stantec Field Representative: Sam Burke
ATV Rig
Hammer Type: 140# safety (2" SS), free falling 30 inches

STN13-MON-I 191711340_WABANRESERVOIR_NEWTONMA.GPJ JW NHP.GDT 3/20/14

Appendix B BORING LOGS 1983

Boring Logs WH-1 through WH-3

DATE
STARTED 4/6/83
FINISHED 4/7/83
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC — SUBSURFACE LOG

HOLE NO. WH-1
SURF. ELEV. 270.0
G. W DEPTH

PROJECT Subsurface Investigation
MDC-Water Division

LOCATION Waban Hill Reservoir
Newton, Mass.

DEPTH FEET	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	4	6	10		FILL: Dark brown SILT, Some fine Sand, trace fine gravel	Note #1: At completion of boring, porous plastic tip piezometers with 3/4" Sch 80 PVC riser pipe were installed as specified to depths of 40.0' and 20.0'. Three inch roadway box installed at ground surface.
5		2	20	16	12	28		-grades brown SILT, Some fine Sand, Some fine Gravel; (Moist-Loose to Firm)	
10		3	14	23	23	46		FILL: Brown fine SAND & SILT, trace fine gravel	
15		4	33	30	24	54		-grades Some fine Gravel	
20		5	17	17	30	47		-No Recovery	
		6	50	60	80	140		(Moist-Compact to Very Compact)	
25		7	20	20	50	70			
30		8	100/.3					-grades brown SILT & fine SAND, Some embedded coarse Sand & fine Gravel	
		9	60	100/.4					
35		10	100/.4					(Wet to Moist-Very Compact)	
40								End of Boring @ 40.0'	

N = No blows to drive 2 " spoon 12 " with 140 lb pin wt falling 30 "per blow
C = No blows to drive _____ " casing _____ " with _____ lb weight falling _____ "per blow

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION 4" Flush Joint Casing (NW)

DATE STARTED 4/6/83
FINISHED 4/6/83
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC — SUBSURFACE LOG

HOLE NO. WH-2
SURF ELEV 249.2
G. W DEPTH

PROJECT Subsurface Investigation
MDC-Water Division

LOCATION Waban Hill Reservoir
Newton, Mass.

DEPTH FT	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION
0		1	1	2	2	4		FILL: Dark brown SILT, little fine sand (Moist, Loose)
5		2	5	7	8	15		Brown fine SAND & SILT, Some fine GRAVEL (Moist-Firm)
10		3	8	10	16	26		FILL: Brown SILT, Some fine Sand, little fine gravel (Wet-Firm)
15		5	12	23	49	89		Brown fine SAND & SILT, Some embedded coarse Sand & fine Gravel
20		4	39	41	48	72		
25		6	39	51	73	124		
30		7	42	51	55	104		(Moist-Very Compact)
								End of Boring @ 30.0'

NOTES

Note #1:
At completion of boring, a porous plastic tip observation well with 3/4" Sch 80 PVC riser pipe was installed as specified to a depth of 23.0'. Three inch roadway box installed at ground surface.

N = No blows to drive 2 " spoon 12 " with 140 lb pin wt falling 30 "per blow

C = No blows to drive _____ " casing _____ " with _____ lb. weight falling _____ "per blow

METHOD OF INVESTIGATION 2 3/8" Flush Joint Casing (BW)

CLASSIFICATION Visual by Geologist

DATE
STARTED 4/6/83
FINISHED 4/7/83
SHEET 1 OF 2

EMPIRE SOILS INVESTIGATIONS INC — SUBSURFACE LOG

HOLE NO WH-3
SURF. ELEV. 270.2
C. W. DEPTH

PROJECT Subsurface Investigation
MDC-Water Division

LOCATION Waban Hill Reservoir
Newton, Mass.

DEPTH FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0									Note #1: At completion of boring, porous plastic tip piezometers with 3/4" Sch 80 PVC riser pipe were installed as specified to depths of 39.0' and 20.5'. Three inch roadway box installed at ground surface.
		1	2	2	5	7		FILL: Brown fine SAND & SILT, Some fine to coarse Gravel (Moist-Loose)	
5		2	11	6	5	16		Brown SILT & fine SAND, little embedded coarse sand & fine gravel	
								-grades Some fine Gravel	
10		3	8	11	11	22		(Wet-Firm)	
15		4	10	13	14	27		Brown fine SAND & SILT, Some fine Gravel	
20		5	18	20	23	43			
25		6	33	42	59	101		(Wet-Firm to Very Compact)	
30		7	15	14	13	27		Brown fine to coarse SAND, Some Silt, Some fine Gravel (Wet-Firm)	
35		8	29	100/.4				Brown fine SAND & SILT, Some embedded coarse Sand & fine Gravel	
40		9	18	21	25	46		-No Recovery	

N = No blows to drive 2 " spoon 12 " with 140 lb pin wt. falling 30 "per blow

C = No blows to drive _____ " casing _____ " with _____ lb weight falling _____ "per blow

CLASSIFICATION Visual by Geologist

METHOD OF INVESTIGATION 3" Flush Joint Casing (NW)

DATE
STARTED 4/6/83
FINISHED 4/7/83
SHEET 2 OF 2

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO WH-3
SURF. ELEV.
G. W. DEPTH

PROJECT Subsurface Investigation
MDC-Water Division

LOCATION Waban Hill Reservoir
Newton, Mass.

DEPTH IN FEET	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS IN CASING	SOIL OR ROCK CLASSIFICATION	NOTES
40									
		10	41	47				(Moist-Very Compact)	
								End of Boring @ 41.5'	
45									

N = No blows to drive 2 " spoon 12 " with 140 lb pin wt falling 30 "per blow

C = No blows to drive _____ " casing _____ " with _____ lb weight falling _____ "per blow

CLASSIFICATION Visual by Geologist

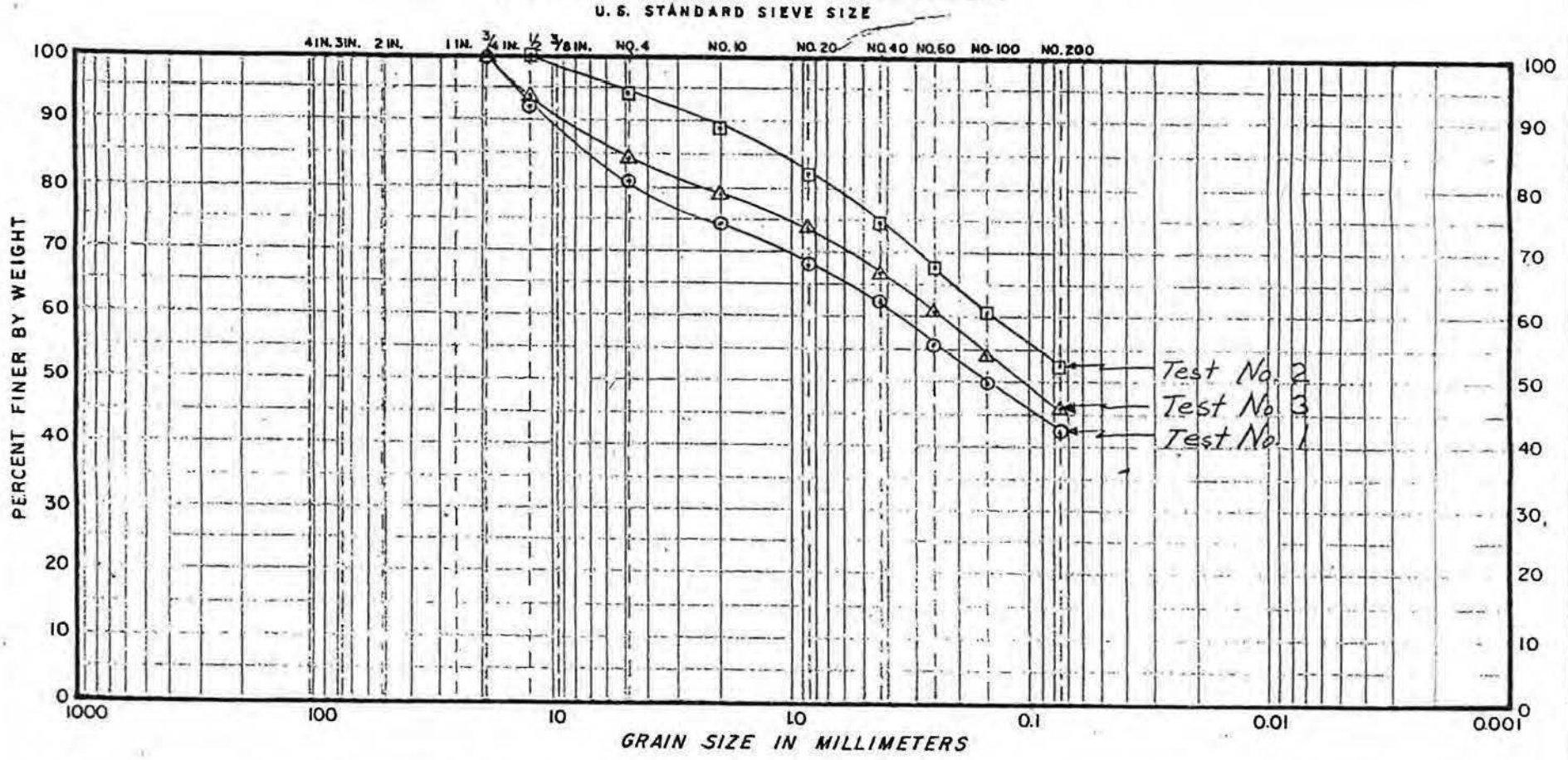
METHOD OF INVESTIGATION 3" Flush Joint Casing (NW)

Appendix C Laboratory Test Results

WH Series Borings – Gradation Analyses

HALEY & ALDRICH, INC.

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM, CORPS OF ENGINEERS, U.S. ARMY

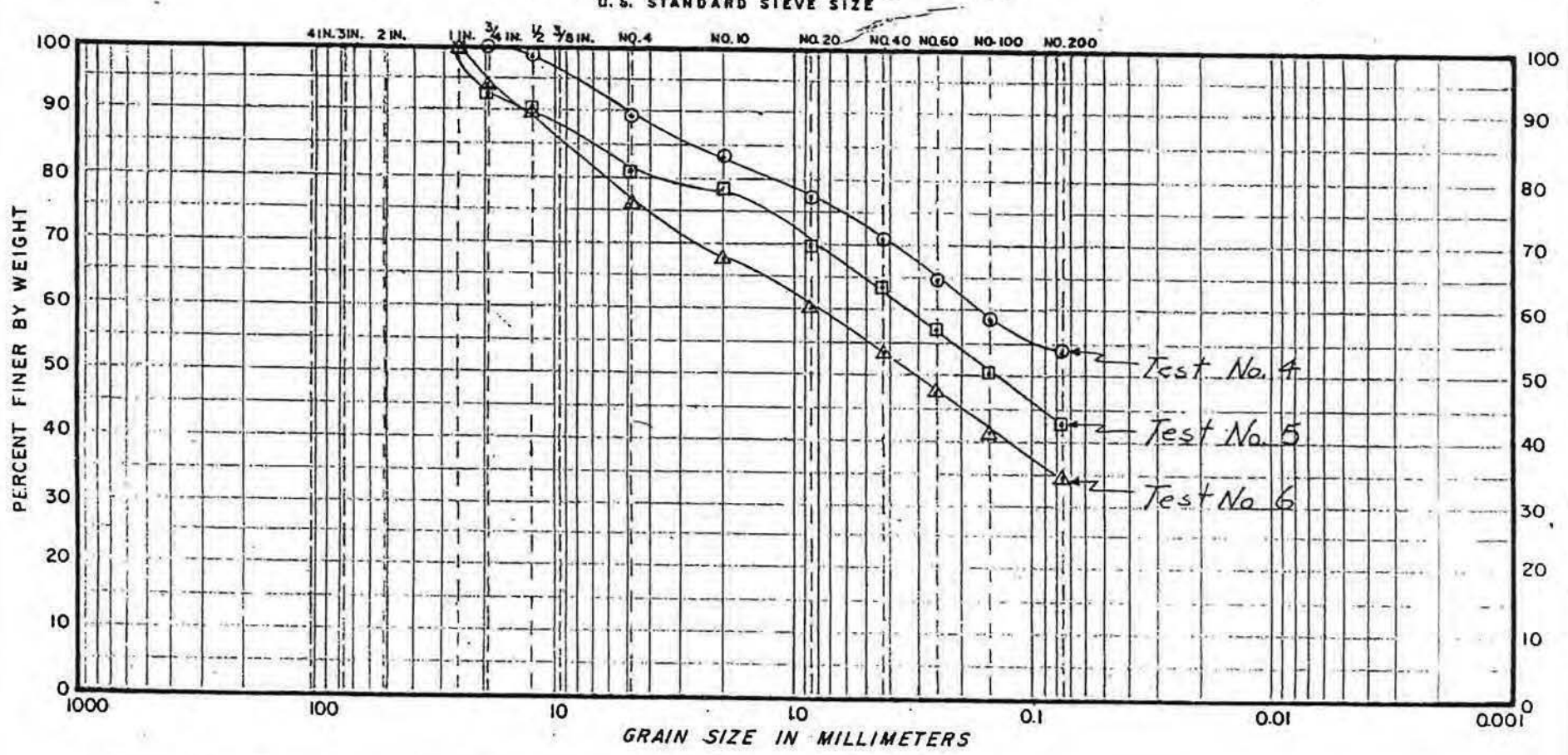
TEST NO.	BORING	SAMPLE	DEPTH (ft.)	DESCRIPTION
1	WH1	S4	15 - 16.5	Sandy SILT, little gravel.
2	WH2	S9	33 - 33.9	Sandy SILT, trace gravel.
3	WH2	S3	8.5 - 10	Sandy SILT, little gravel.

PROJECT MDC WABAN HILL RESERVOIR EMBANKMENT DAM

FILE NO. 487601 DATE July 1983

HALEY & ALDRICH, INC.

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

UNIFIED SOIL CLASSIFICATION SYSTEM, CORPS OF ENGINEERS, U.S. ARMY

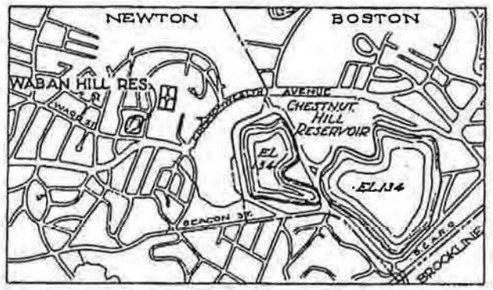
TEST NO.	BORING	SAMPLE	DEPTH (ft.)	DESCRIPTION
4	WH2	S6	23.5 - 25	Sandy SILT, little gravel.
5	WH3	S3	8.5 - 10	Sandy SILT, little gravel.
6	WH3	S4	13.5 - 15	Silty coarse to fine SAND, some gravel.

PROJECT MDC WABAN HILL RESERVOIR EMBANKMENT DAM

FILE NO. 487601 DATE July 1983

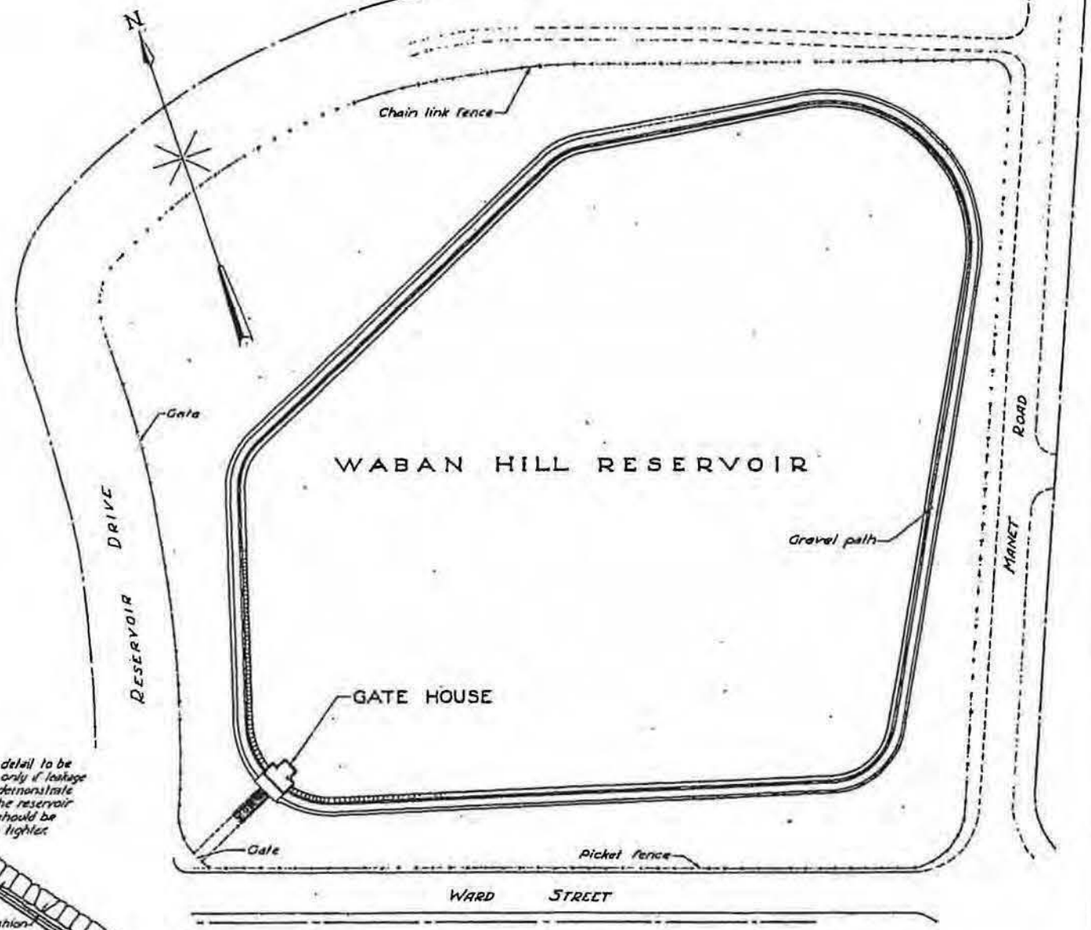
Appendix D Historic Design Drawing

Waban Hill Reservoir - Plan and Details (Proposed Raising of Flow Line) May 31, 1944



KEY MAP

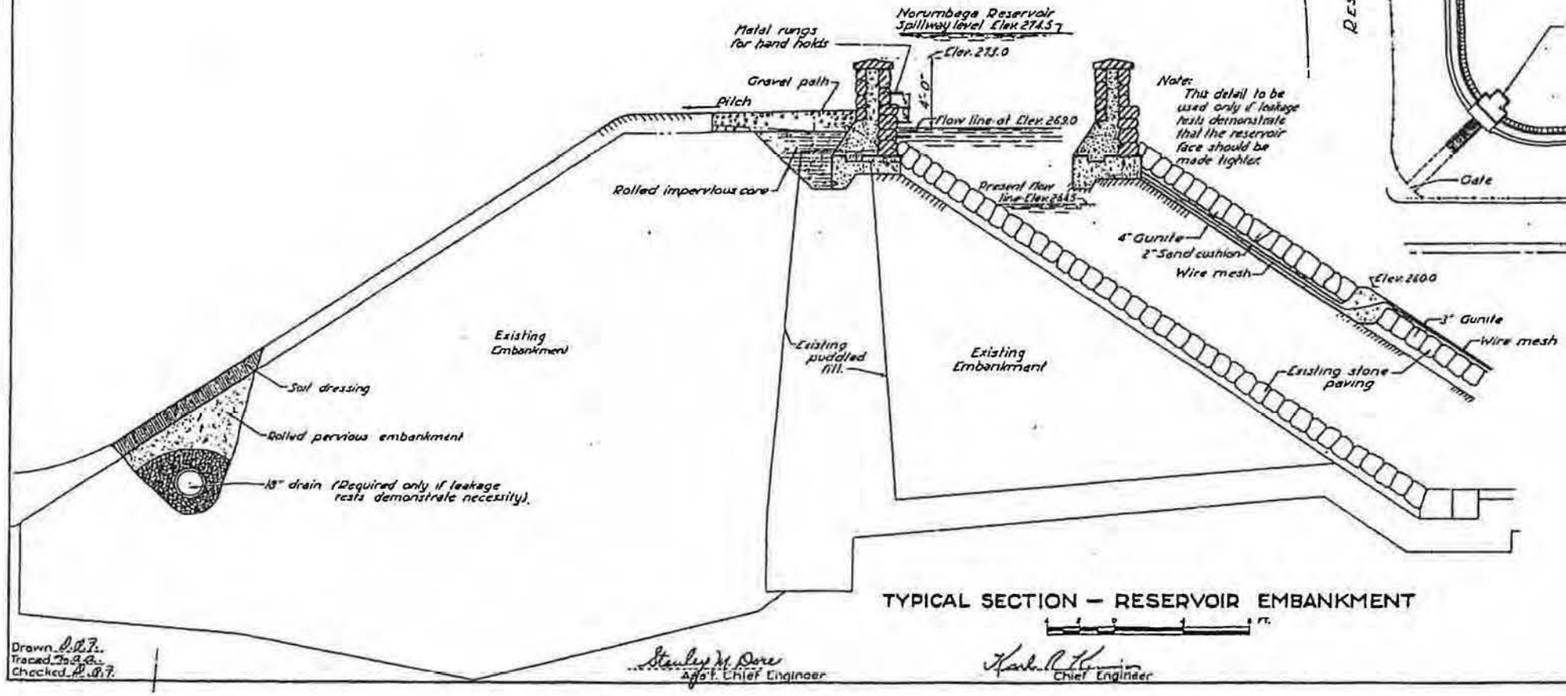
1000 500 0 1000 2000 FT.



PLAN

40 20 0 40 80 FT.

Notes
Elevations, Boston City Base



TYPICAL SECTION — RESERVOIR EMBANKMENT

1 0 1 2 FT.

COMMONWEALTH OF MASSACHUSETTS
METR. DISTR. WATER SUPPLY COMMISSION
POST WAR PUBLIC WORKS PROJECTS

WABAN HILL RESERVOIR

PLAN AND DETAILS
(PROPOSED RAISING OF FLOW LINE)

Scales as Shown

MAY 31, 1944

Drawn D.B.T.
Traced J.A.G.
Checked D.B.T.

Stanley M. Dore
Asst. Chief Engineer

Hark A. Hanin
Chief Engineer

File 70X

Acc. 27719

Appendix E Slope Stability Results

E.1 SUBSURFACE PROFILE A-A – SOUTHEAST SLOPE

E.1.1 Upstream Slope

E.1.2 Downstream Slope

E.2 SUBSURFACE PROFILE B-B – NORTHWEST SLOPE

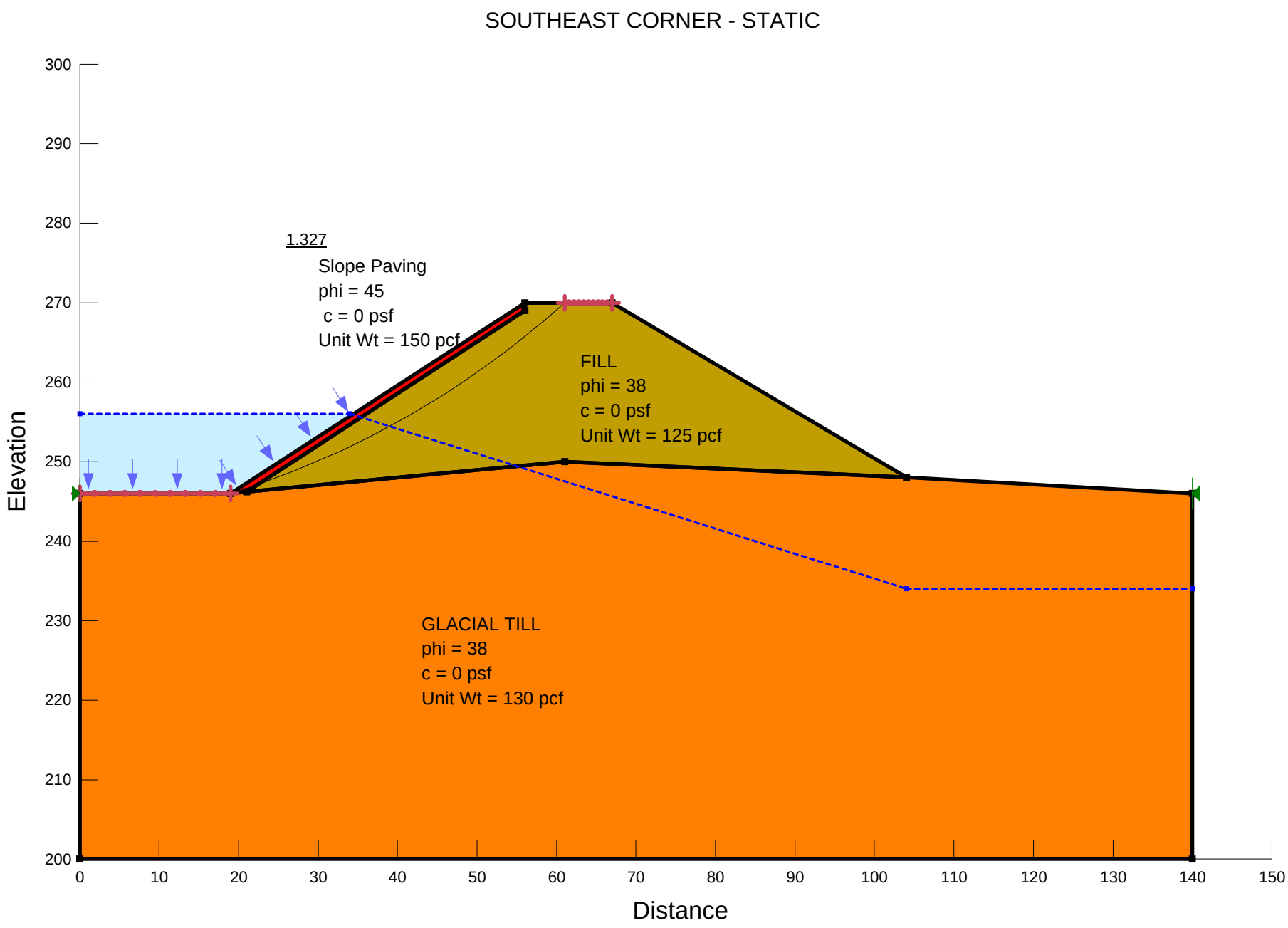
E.2.1 Upstream Slope

E.2.2 Downstream Slope

E.3 UPSTREAM SLOPE – SUDDEN DRAWDOWN CONDITION

E.1 SUBSURFACE PROFILE A-A – SOUTHEAST SLOPE

E.1.1 Upstream Slope


SOUTHEAST CORNER - STATIC
1.327
Slope Paving
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
10
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100
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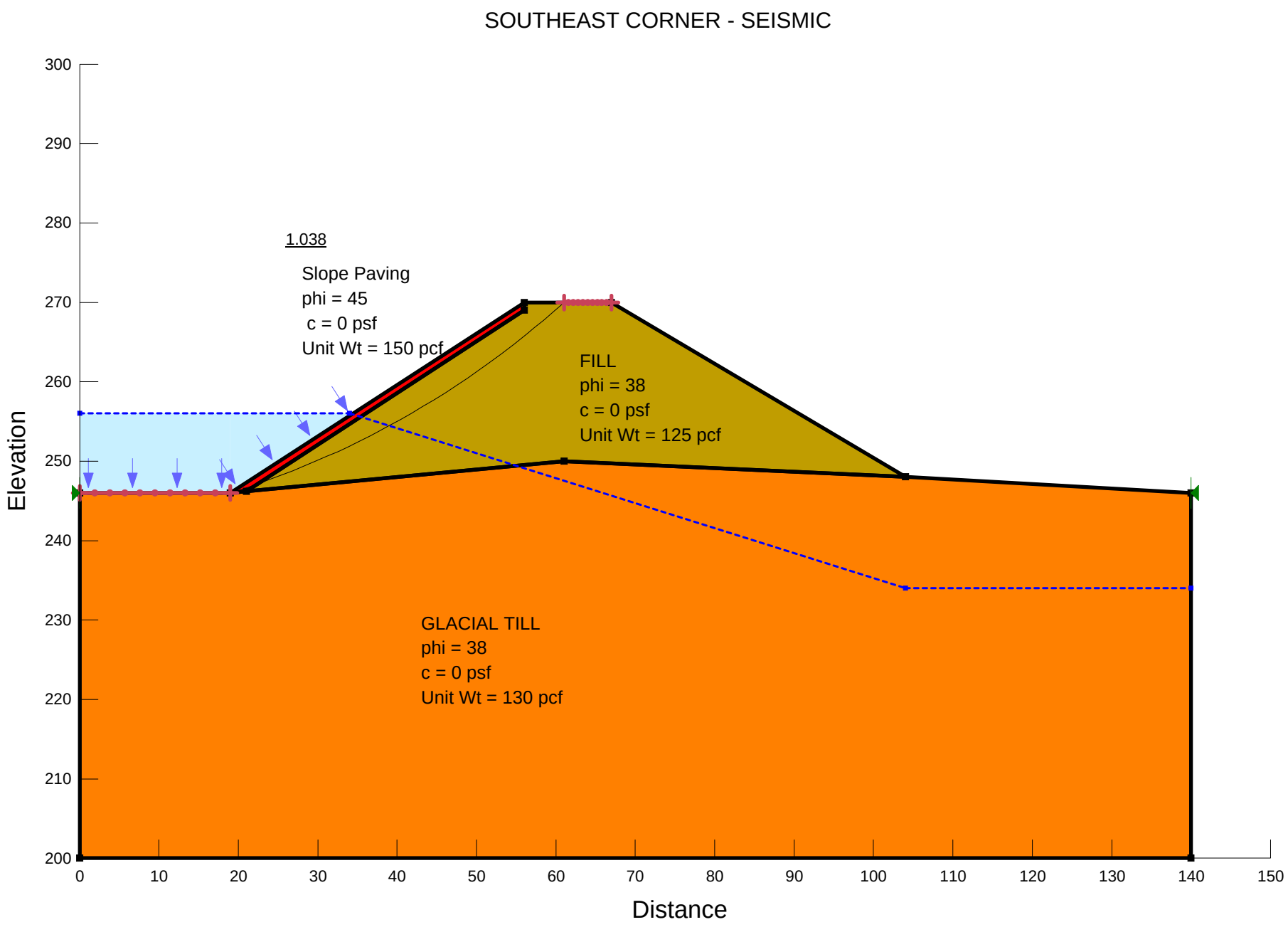
120
130
140
150


SOUTHEAST CORNER - SEISMIC
1.038
Slope Paving
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
10
20
30
40
50
60
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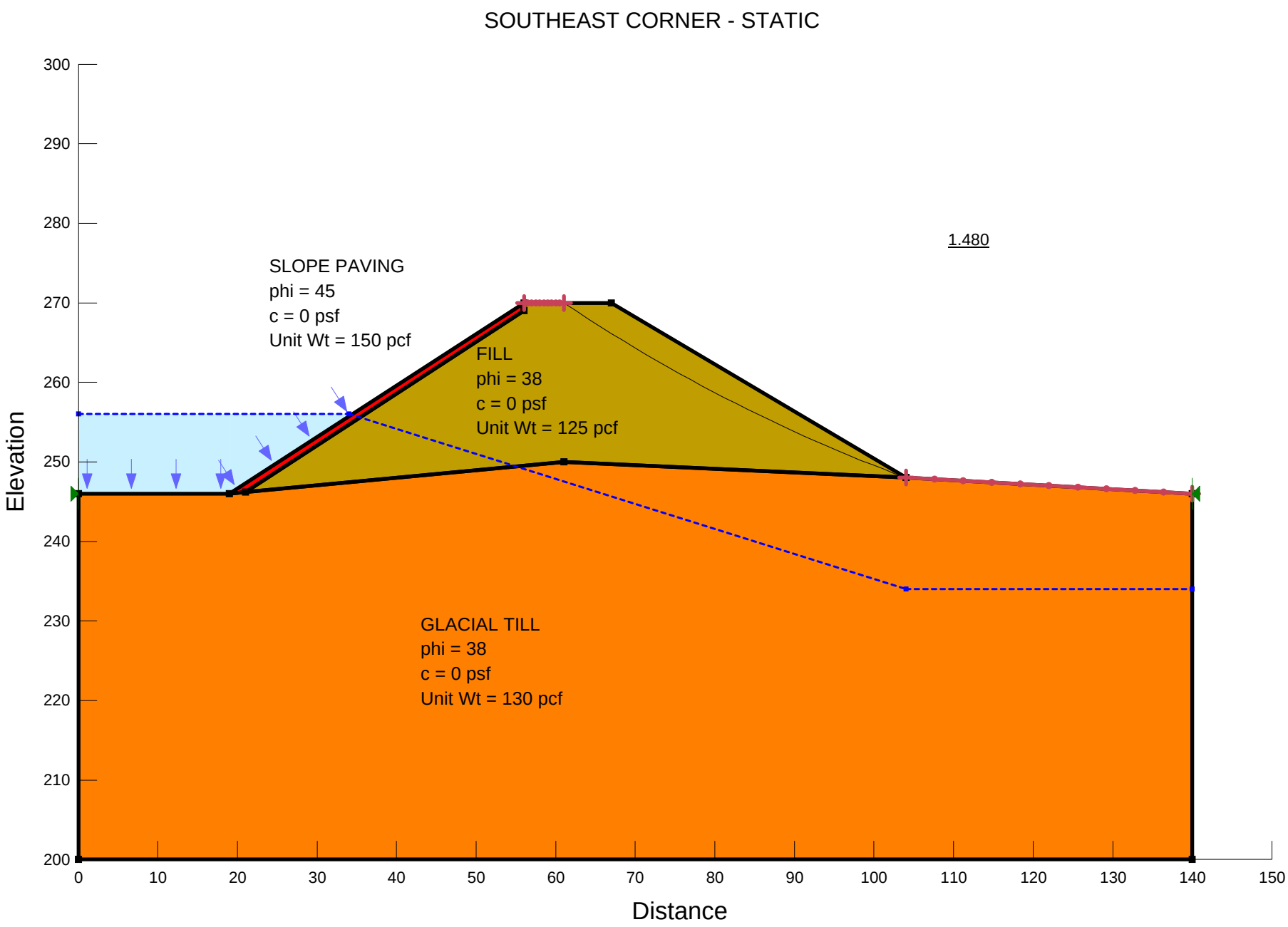
80
90
100
110
120
130
140
150

E.1.2 Downstream Slope


SOUTHEAST CORNER - STATIC
1.480
SLOPE PAVING
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
10
20
30
40
50
60
70
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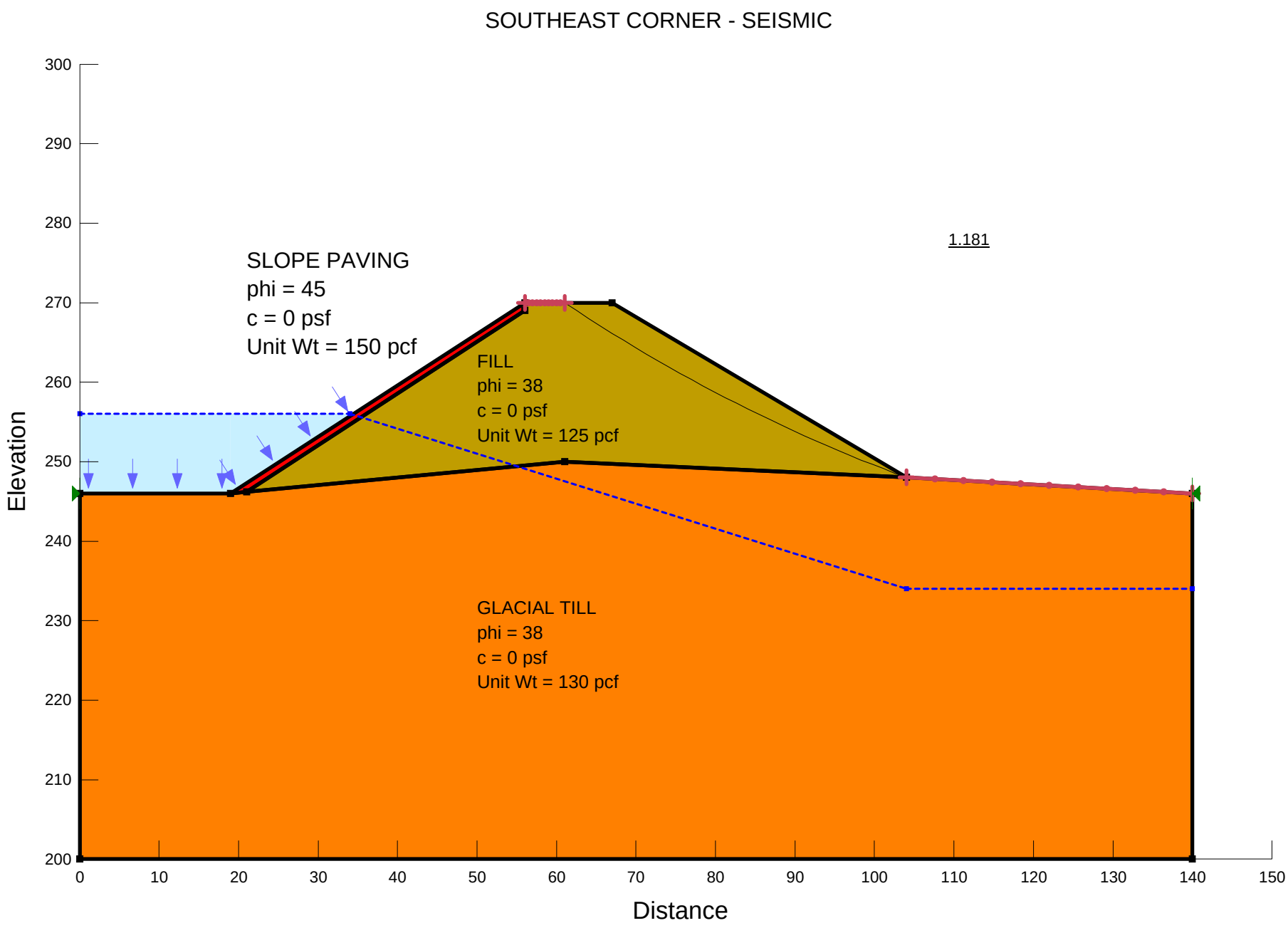
90
100
110
120
130
140
150


SOUTHEAST CORNER - SEISMIC
1.181
SLOPE PAVING
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
10
20
30
40
50
60
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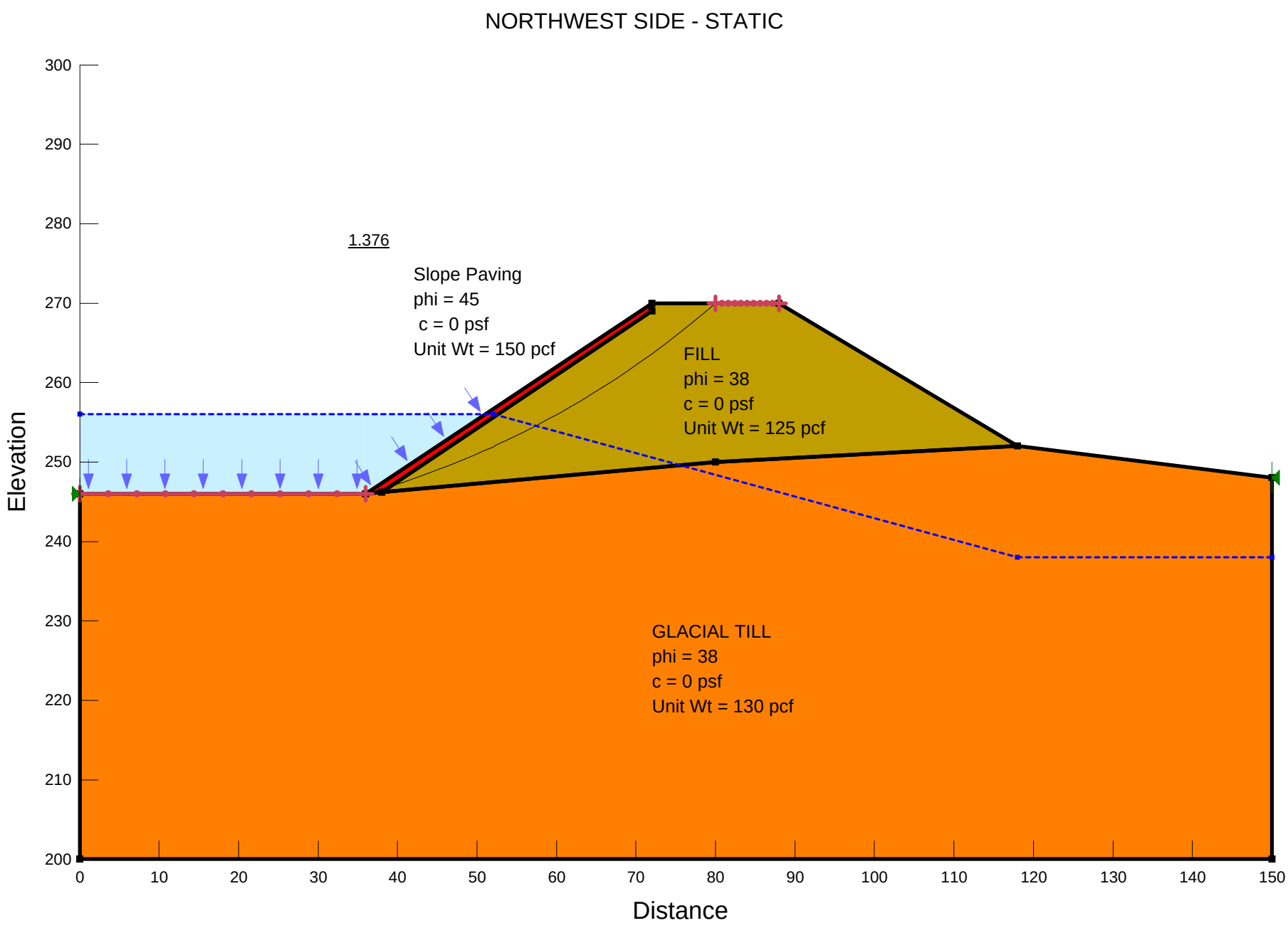
140
150

E.2 SUBSURFACE PROFILE B-B – NORTHWEST SLOPE

E.2.1 Upstream Slope


NORTHWEST SIDE - STATIC
1.376
Slope Paving
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
10
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60
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120
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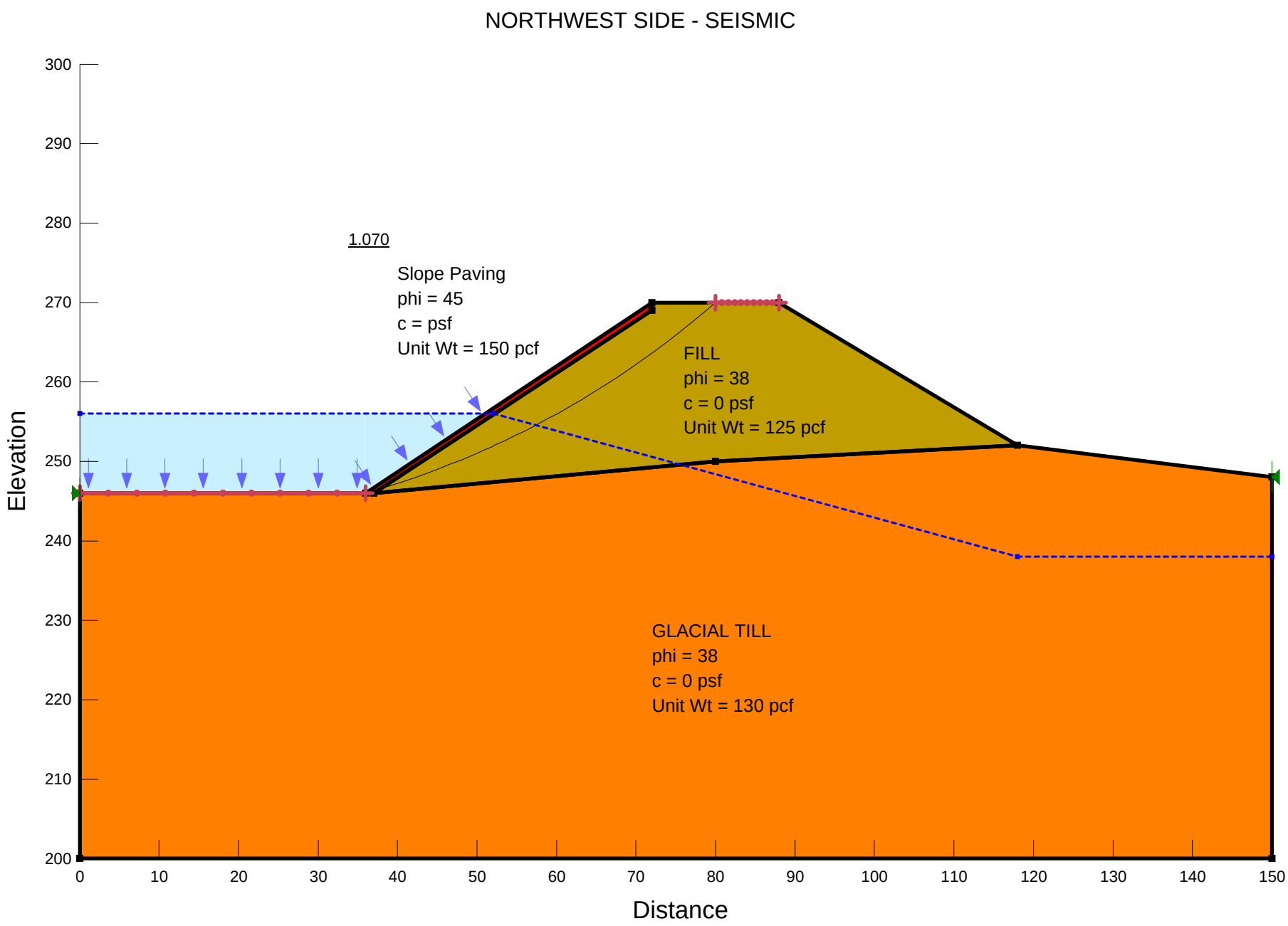
140
150


NORTHWEST SIDE - SEISMIC
1.070
Slope Paving
phi = 45
c = psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
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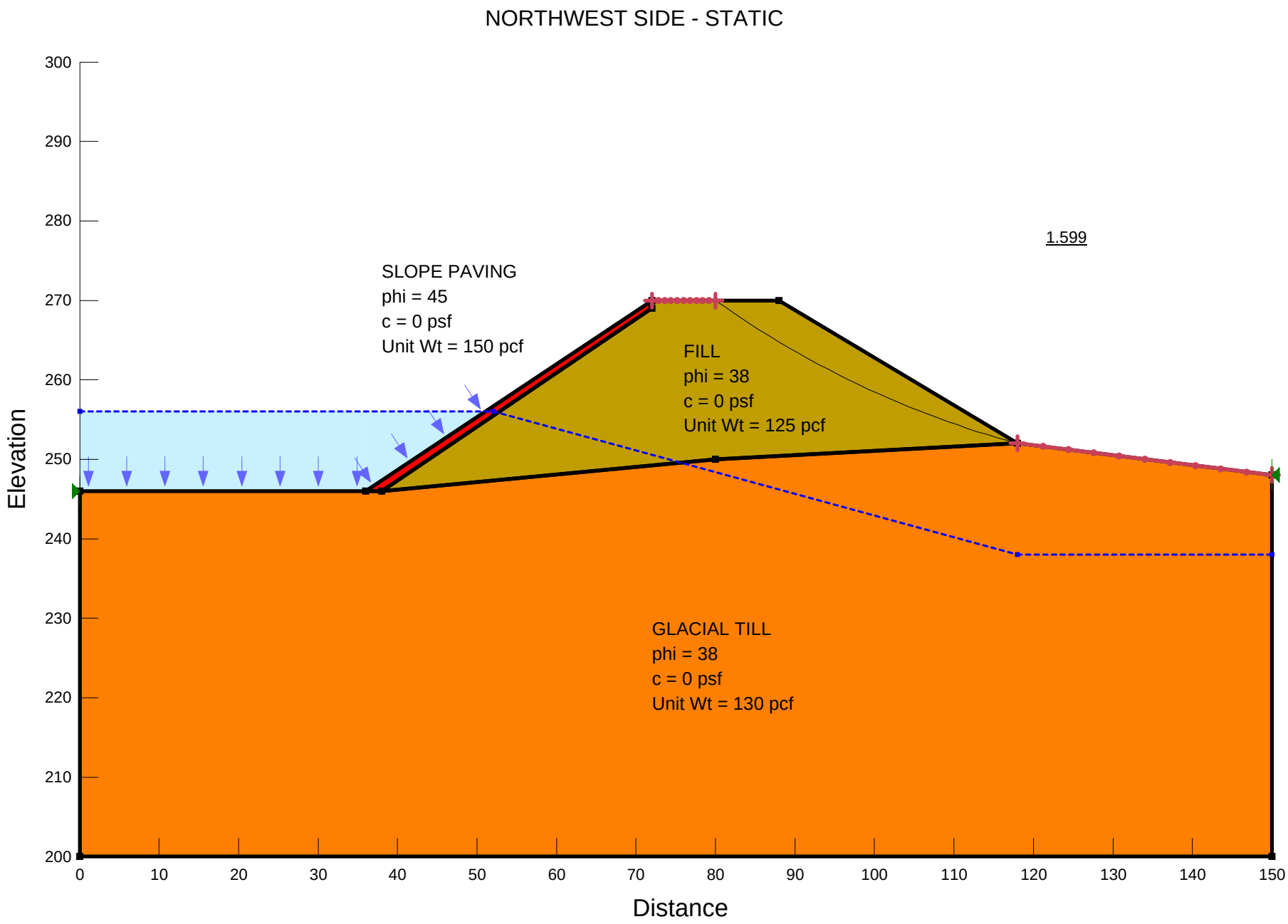
E.2.2 Downstream Slope


NORTHWEST SIDE - STATIC
1.599
SLOPE PAVING
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
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200
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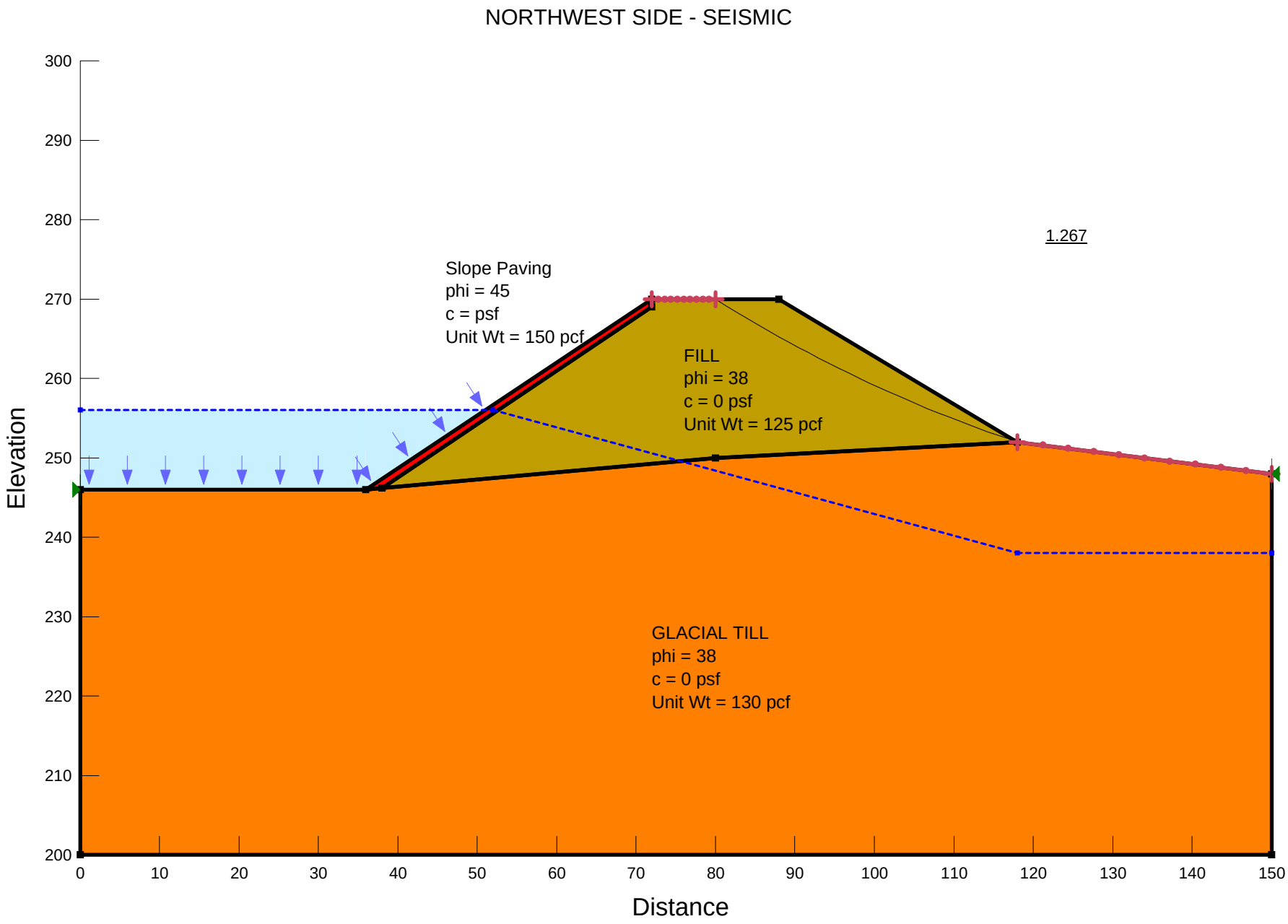
NORTHWEST SIDE - SEISMIC
1.267
Slope Paving
phi = 45
c = psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
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220
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200
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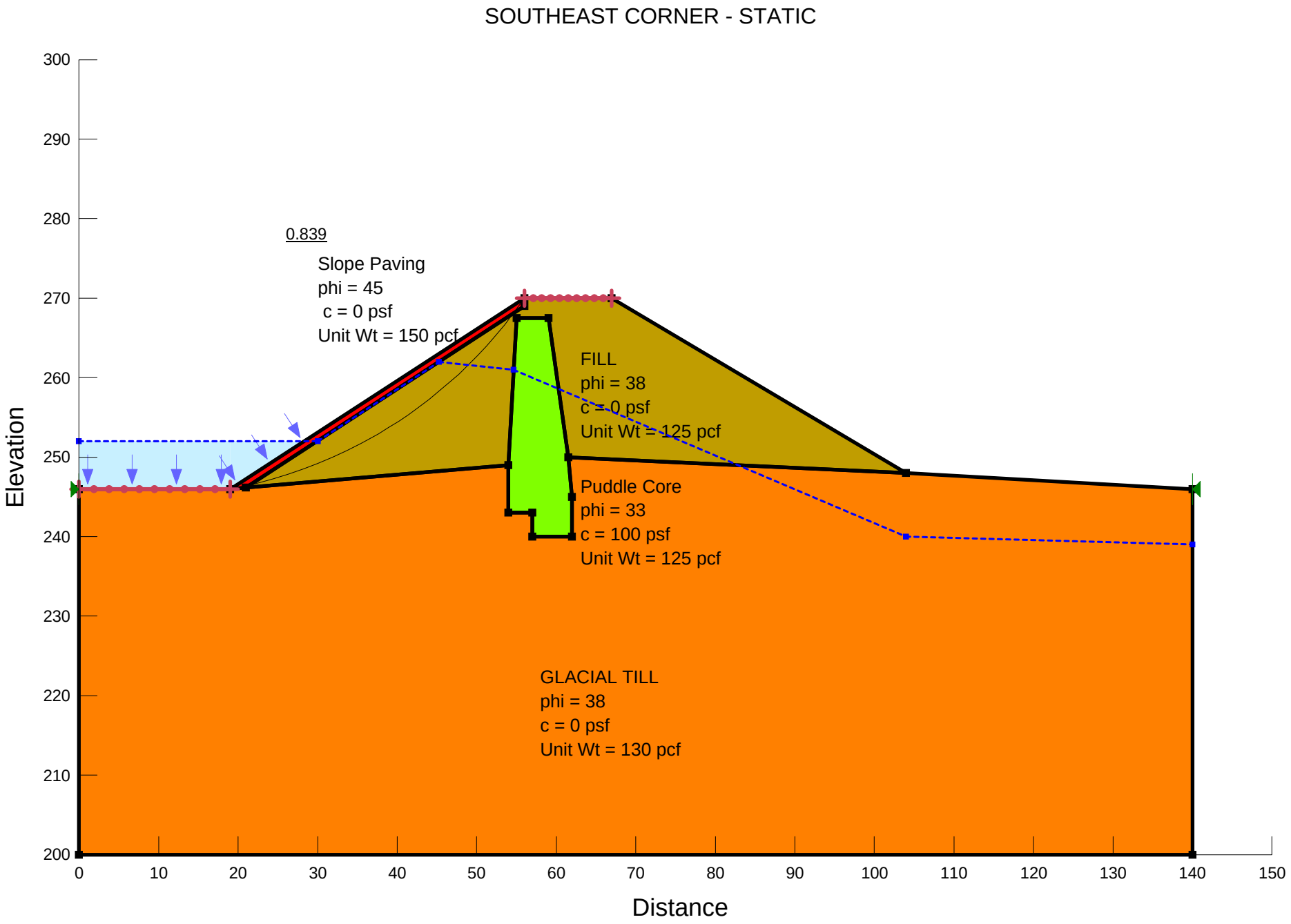
E.3 UPSTREAM SLOPE – SUDDEN DRAWDOWN CONDITION


SOUTHEAST CORNER - STATIC
0.839
Slope Paving
phi = 45
c = 0 psf
Unit Wt = 150 pcf
FILL
phi = 38
c = 0 psf
Unit Wt = 125 pcf
Puddle Core
phi = 33
c = 100 psf
Unit Wt = 125 pcf
GLACIAL TILL
phi = 38
c = 0 psf
Unit Wt = 130 pcf
Elevation
Distance
300
290
280
270
260
250
240
230
220
210
200
0
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120
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150

Appendix F REFERENCES

F.1 Previous Reports/Documents Referenced

The following is a list of reviewed documents that provided background information for this report:

1. "Waban Hill Reservoir Dam Phase I Inspection/Evaluation Report'" Pare Corporation, date of inspection September 7, 2012.

2. "Waban Hill Reservoir Dam Phase I Inspection/Evaluation Report'" GZA GeoEnvironmental, date of inspection August 24, 2010.

3. "Report on Phase II Investigation, Waban Hill Reservoir Dam, Newton, Massachusetts" Haley & Aldrich, Inc. date of report October 27, 1983.

4. "Waban Hill Reservoir Dam, Phase I Inspection Report, National Dam Inspection Program, Department of the Army, New England Division, Corps of Engineers" O'Brien & Gere Engineers, Inc. date of inspection October 23, 1979; date of report March 24, 1980.

5. Commonwealth of Massachusetts Metro Distr. Water Supply Commission, Post War Public Works Projects, Waban Hill Reservoir, Plan and Details (Proposed Raising of Flow Line) dated May 31, 1944.