MaineDOT

Highway Program

Brad Foley, Program Manager
Rich Crawford & Heath Cowan, Assistant Program Managers
Phone: 624-3480 Fax: 624-3481

Memorandum

To: Jonathan French
From: Karen Gross
Date: 3/28/2011
Subject: Final Geotechnical Information
Eddington, PIN 17259.00
Soils Report No. 2011-108

The preliminary subsurface investigations have been completed for the Eddington project. This work consisted of four solid stem auger borings to identify subsurface materials, and four rod soundings to identify depth to bedrock. The boring and sounding locations were selected based on design plans and the presence of underground and overhead utility conflicts at this intersection.

A summary of the investigations are presented in the following table:

Boring No.	Station (ft)	Offset (ft)	Exploration Depth (ft)	Depth to water (ft)	Pavement Thickness		Subgrade Type (approx @ 30 inch depth)	Refusal Depth (ft)	Comments
					HMA (in)	Subbase (in)			
HB-EDD-101	13+90	10.5 L	10.5	- - -	10.8	19.2	SAND, gravel	10.5	sandy SILT below sand and gravel
HB-EDD-102	14+90	10.0 L	13.3	- - -	9.6	20.4	SAND, gravel	13.3	sandy SILT below sand and gravel
HB-EDD-103	16+00	10.0 L	9.2	- - -	9.6	20.4	SAND, gravel	9.2	sandy SILT below sand and gravel
HB-EDD-104	17+00	10.0 L	11.4	- - -	9.6	20.4	SAND, gravel	11.4	sandy SILT below sand and gravel
Rod Sounding	16+75	28.0 R	5.7	- - -				5.7	
Rod Sounding	17+10	29.0 R	5.6	- - -				5.6	
Rod Sounding	39+75	34.0 L	3.1	- - -				3.1	
Rod Sounding	40+25	34.0 L	6.9	- - -				6.9	

As you can see from this information, bedrock is fairly shallow on the Fickett and Commonsense Housing properties, so bedrock excavation will probably be necessary in the cut sections on the northbound side of Route 9, and the westbound side of Route 178.

Bedrock is also relatively close to the surface beneath the roadway between Stations 13+00 to 17+00. There should be no deep seated stability issues with the proposed added fills on the slope located between the river and the roadway. The x-sections also show that a thin sliver fill is proposed on this slope between Stations 13+50 and 14+50. These thin fills can be prone to sliding on the underlying materials, prone to erosion until re-vegetated, and difficult to compact. I recommend shifting the alignment slightly to the right to avoid any work on this slope if safety allows.

The Surficial Geology map for the Veazie Quadrangle indicates that the surficial soils in this area are predominately Presumpscot Formation, which is a marine sediment consisting of a mix of silt, clay, and

sand. The sandy SILT encountered in the borings is consistent with the information on the geology maps. Drainage improvements are recommended with this soil type since it tends to be moderately frost susceptible, has poor drainage properties, and will have a reduction in strength when saturated.

I will be submitting the samples we collected for lab testing sometime next week. This lab testing information will give us the gradation of the existing subbase and other properties we may need to determine the subgrade resilient modulus for the pavement design. I'll also visit the site to make sure my assumptions are correct in regards to the slope between the river and roadway.

Let me know if you have any questions.

MaineDOT

Highway Program

Brad Foley, Program Manager
Rich Crawford & Heath Cowan, Assistant Program Managers
Phone: 624-3480 Fax: 624-3481

Memorandum

To: Jonathan French
From: Karen Gross
Date: December 1, 2010
Subject: Lab Test Results, Eddington
PIN 17259.00

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I have received the lab test results for the Eddington project. Four samples were collected from the roadway borings located along the proposed slope widening on Route 9. As noted on the boring logs, the subbase and subgrade were similar in all borings. Therefore, 1 subbase and 1 subgrade sample were tested and represent the subbase and subgrade soils throughout this entire section.

The subbase sample is described as sandy gravel, with a USCS classification of GW-GM and an AASHTO classification of A-1-b. The subbase has a water content of 2.4% and is considered non-frost susceptible.

The subgrade sample is described as sand with some silt, with a USCS classification of SM and an AASHTO classification of A-2-4. The subgrade has a water content of 12.9% and is considered moderately frost susceptible.

As I mentioned previously, I recommend benching the existing slope when placing the new fill for widening. Benching should be done in accordance with Standard Specification 203.09, and as per Chapter 14 in the Highway Design Guide. I would avoid showing the actual benching on the plans and cross sections. The benching dimensions (rise/run) should be determined during construction and be based on the actual soil conditions. I recommend showing the limits, requirements (as per), and I would include “as directed by the resident”.

MaineDOT

Highway Program

Brad Foley, Program Manager
Rich Crawford & Heath Cowan, Assistant Program Managers
Phone: 624-3480 Fax: 624-3481

Memorandum

To: Jonathan French
From: Karen Gross
Date: January 19, 2011
Subject: Resilient Modulus, Eddington
PIN 17259.00

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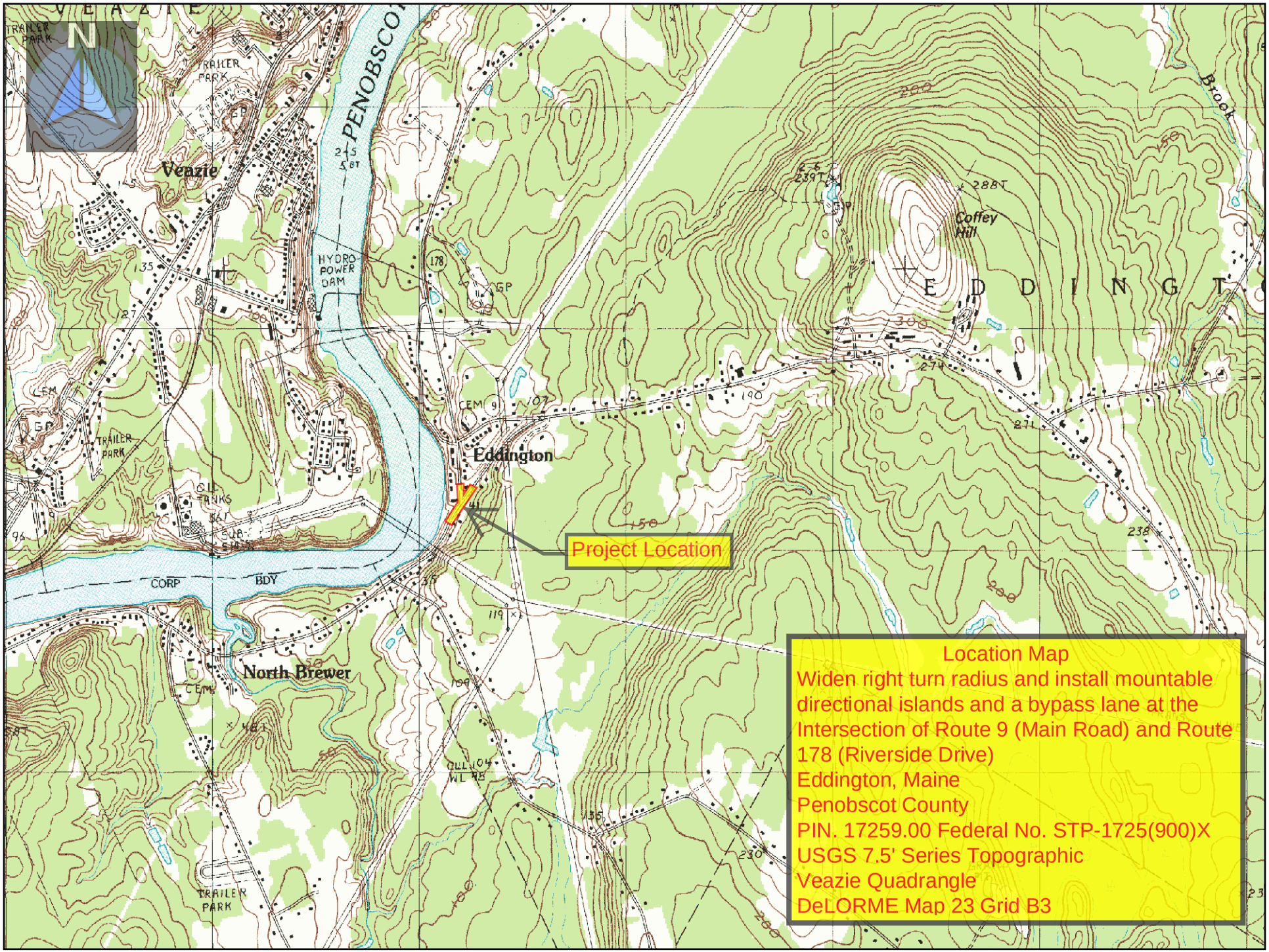
The recommended resilient modulus (Mr) to use for the pavement design is 4500 psi. The value is based on the existing subgrade soils correlated to MaineDOT Soil Support Value charts.

The existing subgrade soil consists of silty sand throughout the project limits. Based on the percentage of material passing the # 200 sieve (32 %), the charts indicate that the soil support values fall in the lower range of the soil support values typical of that material type. Silty sands typically have soil support values ranging from 4 to 5. For this project, the soil support values most probably range from 4 to 4.2. These values further correlate to resilient modulus values of 4300 psi to 4700 psi. The recommended value of 4500 psi is simply the average. If you prefer to be more conservative, and Mr of 4300 psi would still be considered appropriate.

I have attached the charts and lab test data used to determine soil type for your reference. Please let me know if you have any questions.



Map Scale 1:24000

PRELIMINARY GEOTECHNICAL INVESTIGATIONS SUMMARY

Eddington, Rt. 9 and Rt. 178 PIN #17259.00

Boring No.	Station (ft)	Offset (ft)	Exploration Depth (ft)	Depth to water (ft)	Pavement Thickness		Subgrade Type (approx @ 30 inch depth)	Refusal Depth (ft)	Comments
					HMA (in)	Subbase (in)			
HB-EDD-101	13+90	10.5 L	10.5	- - -	10.8	19.2	SAND, gravel	10.5	sandy SILT below sand and gravel
HB-EDD-102	14+90	10.0 L	13.3	- - -	9.6	20.4	SAND, gravel	13.3	sandy SILT below sand and gravel
HB-EDD-103	16+00	10.0 L	9.2	- - -	9.6	20.4	SAND, gravel	9.2	sandy SILT below sand and gravel
HB-EDD-104	17+00	10.0 L	11.4	- - -	9.6	20.4	SAND, gravel	11.4	sandy SILT below sand and gravel
Rod Sounding	16+75	28.0 R	5.7	- - -				5.7	
Rod Sounding	17+10	29.0 R	5.6	- - -				5.6	
Rod Sounding	39+75	34.0 L	3.1	- - -				3.1	
Rod Sounding	40+25	34.0 L	6.9	- - -				6.9	

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Intersection Improvements Routes 9/178

Location: Eddington, Maine

Boring No.: HB-EDD-101

PIN: 17259.00

Driller:	MaineDOT	**Elevation (ft.)**		**Auger ID/OD:**	5" Dia.
Operator:	Giguere/Giles/Daggett	**Datum:**	NAVD 88	**Sampler:**	Off Flights
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	10/26/10-10/26/10	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	13+90, 10.5 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	S1		0.90 - 3.40			SSA	-0.90		PAVEMENT.	
							0.90		Brown, dry, fine to coarse SAND, some gravel, trace silt.	
	S2		3.40 - 10.50				-3.40		Grey-brown, damp, fine sandy SILT, oil odor.	
5										
10							-10.50		**Bottom of Exploration at 10.50 feet below ground surface.** REFUSAL	
15										
20										
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Intersection Improvements Routes 9/178

Location: Eddington, Maine

Boring No.: HB-EDD-102

PIN: 17259.00

Driller:	MaineDOT	**Elevation (ft.)**		**Auger ID/OD:**	5" Dia.
Operator:	Giguere/Giles/Daggett	**Datum:**	NAVD 88	**Sampler:**	Off Flights
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	10/26/10-10/26/10	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	14+90, 10.0 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	S3		0.80 - 4.10			SSA	-0.80		PAVEMENT.	
									0.80 Brown, sandy GRAVEL, trace silt.	A-1-a, GW-GM WC=2.4%
							-4.10		4.10	
5	S4		4.10 - 13.30						Grey-brown, damp, SAND, some silt, trace gravel.	A-2-4, SM WC=12.9%
10										
							-13.30		13.30 **Bottom of Exploration at 13.30 feet below ground surface.** REFUSAL	
15										
20										
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Intersection Improvements Routes 9/178

Location: Eddington, Maine

Boring No.: HB-EDD-103

PIN: 17259.00

Driller:	MaineDOT	**Elevation (ft.)**		**Auger ID/OD:**	5" Dia.
Operator:	Giguere/Giles/Daggett	**Datum:**	NAVD 88	**Sampler:**	Off Flights
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	10/26/10-10/26/10	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	16+00, 10.0 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA	-0.80		PAVEMENT.	
									0.80 Brown, fine to coarse SAND, some gravel, trace silt. ≅S3	
5							-5.00		5.00 Grey-brown, damp, fine sandy SILT. ≅S4	
							-9.20		9.20 **Bottom of Exploration at 9.20 feet below ground surface.** REFUSAL	
10										
15										
20										
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Intersection Improvements Routes 9/178

Location: Eddington, Maine

Boring No.: HB-EDD-104

PIN: 17259.00

Driller:	MaineDOT	**Elevation (ft.)**		**Auger ID/OD:**	5" Dia.
Operator:	Giguere/Giles/Daggett	**Datum:**	NAVD 88	**Sampler:**	Off Flights
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	N/A
Date Start/Finish:	10/26/10-10/26/10	**Drilling Method:**	Solid Stem Auger	**Core Barrel:**	N/A
Boring Location:	17+00, 10.0 ft Lt.	**Casing ID/OD:**	N/A	**Water Level*:**	None Observed

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods WOC = weight of casing

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA	-0.80		PAVEMENT.	
									0.80	
									Brown, fine to coarse SAND, some gravel, trace silt. ≅S3	
							-4.70		4.70	
5									Grey-brown, damp, fine sandy SILT. ≅S4	
10							-11.40		11.40	
									Bottom of Exploration at 11.40 feet below ground surface.	
									REFUSAL	
15										
20										
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

State of Maine - Department of Transportation

Rod Sounding Summary Sheet

Town(s): Eddington Project Number: 17259.00

Boring	Station (Feet)	Offset (Feet)	Refusal (Feet)	No Refusal (Feet)	Water (X) = Yes	Comments 10/26/2010
Route 9						
	16+75	28.0 Rt.	5.7			
	17+10	29.0 Rt.	5.6			
Route 178						
	39+75	34.0 Lt.	3.1			
	40+25	34.0 Lt.	6.9			

State of Maine - Department of Transportation

Laboratory Testing Summary Sheet

Town(s): Eddington Project Number: 17259.00

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C. %	L.L.	P.I.	Classification		
									Unified	AASHTO	Frost
HB-EDD-102, S3	14+90	10.0 Lt.	0.8-4.1	240056	1	2.4			GW-GM	A-1-a	0
HB-EDD-102, S4	14+90	10.0 Lt.	4.1-13.3	240057	1	12.9			SM	A-2-4	II

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MaineDOT and Corps of Engineers Classification Systems.

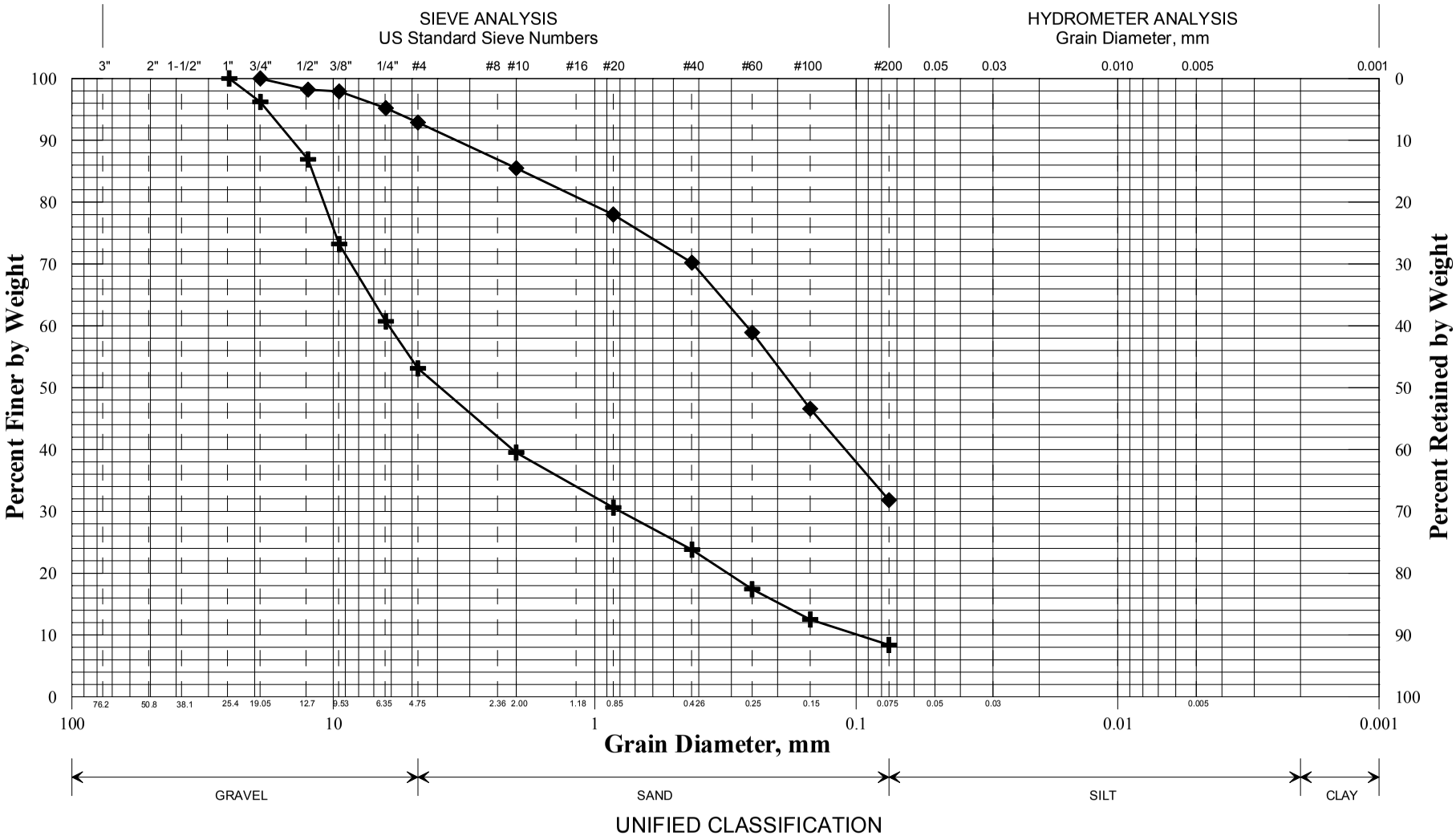
GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

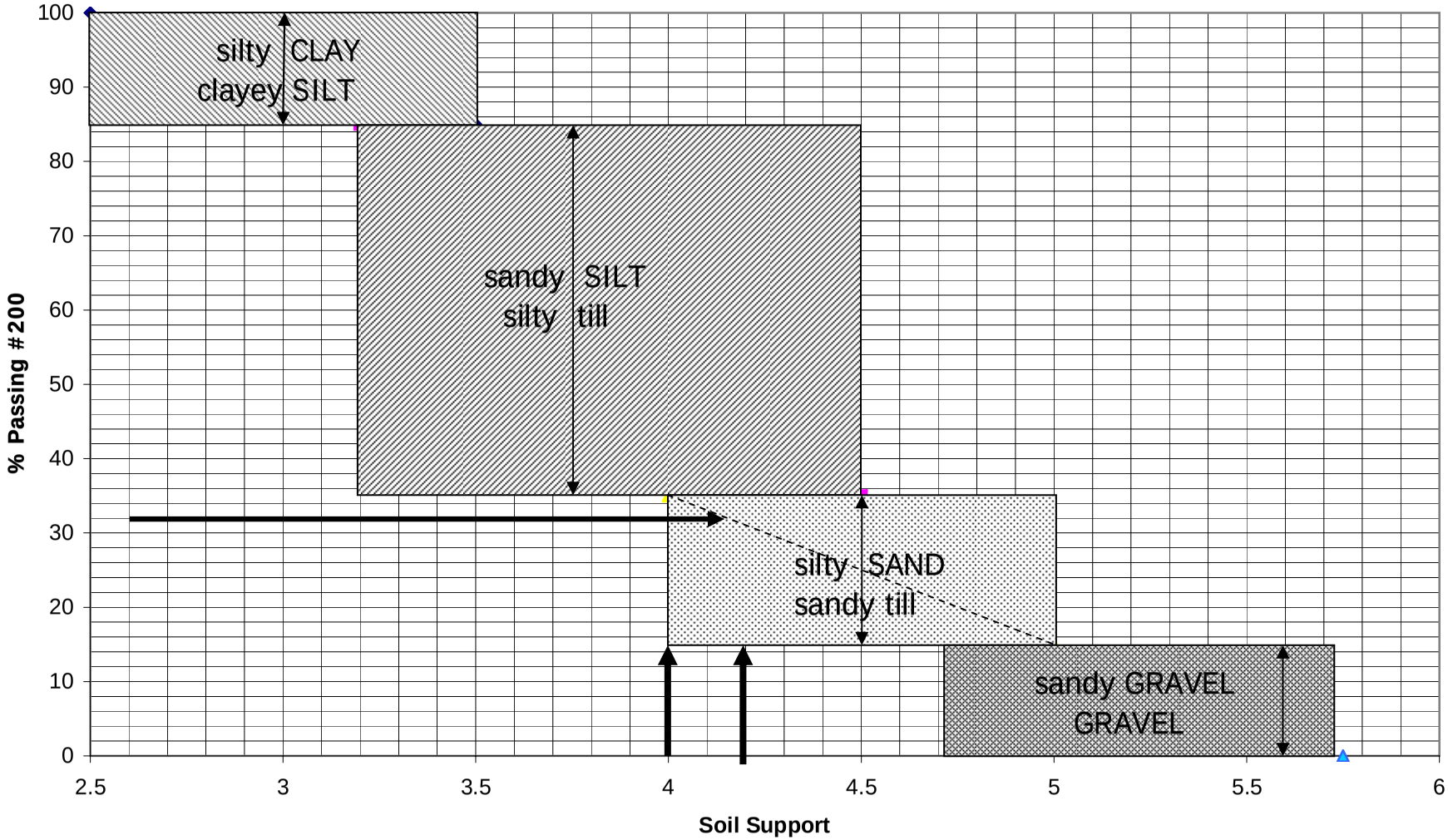
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE

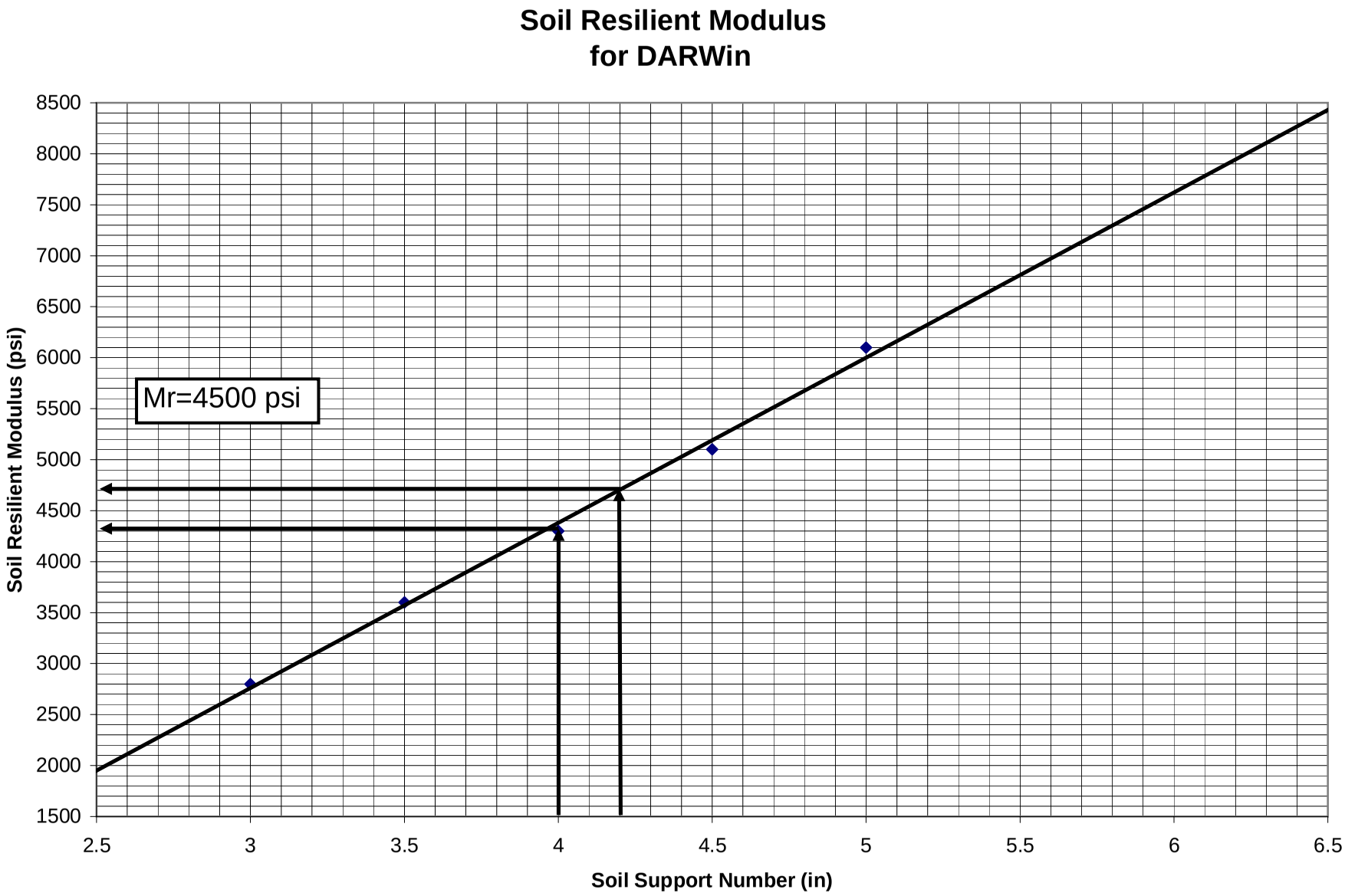


	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	HB-EDD-102/S3	14+90	10.0 LT	0.8-4.1	Sandy GRAVEL, trace silt.	2.4			
◆	HB-EDD-102/S4	14+90	10.0 LT	4.1-13.3	SAND, some silt, trace gravel.	12.9			
■									
●									
▲									
✕									

PIN
017259.00
Town
Eddington
Reported by/Date
WHITE, TERRY A 11/29/2010

Guidelines for Selection
of Soil Support Values for Pavement Design




Soil Resilient Modulus
for DARWin
Soil Resilient Modulus (psi)
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
Mr=4500 psi
2.5
3
3.5
4
4.5
5
5.5
6
6.5
Soil Support Number (in)

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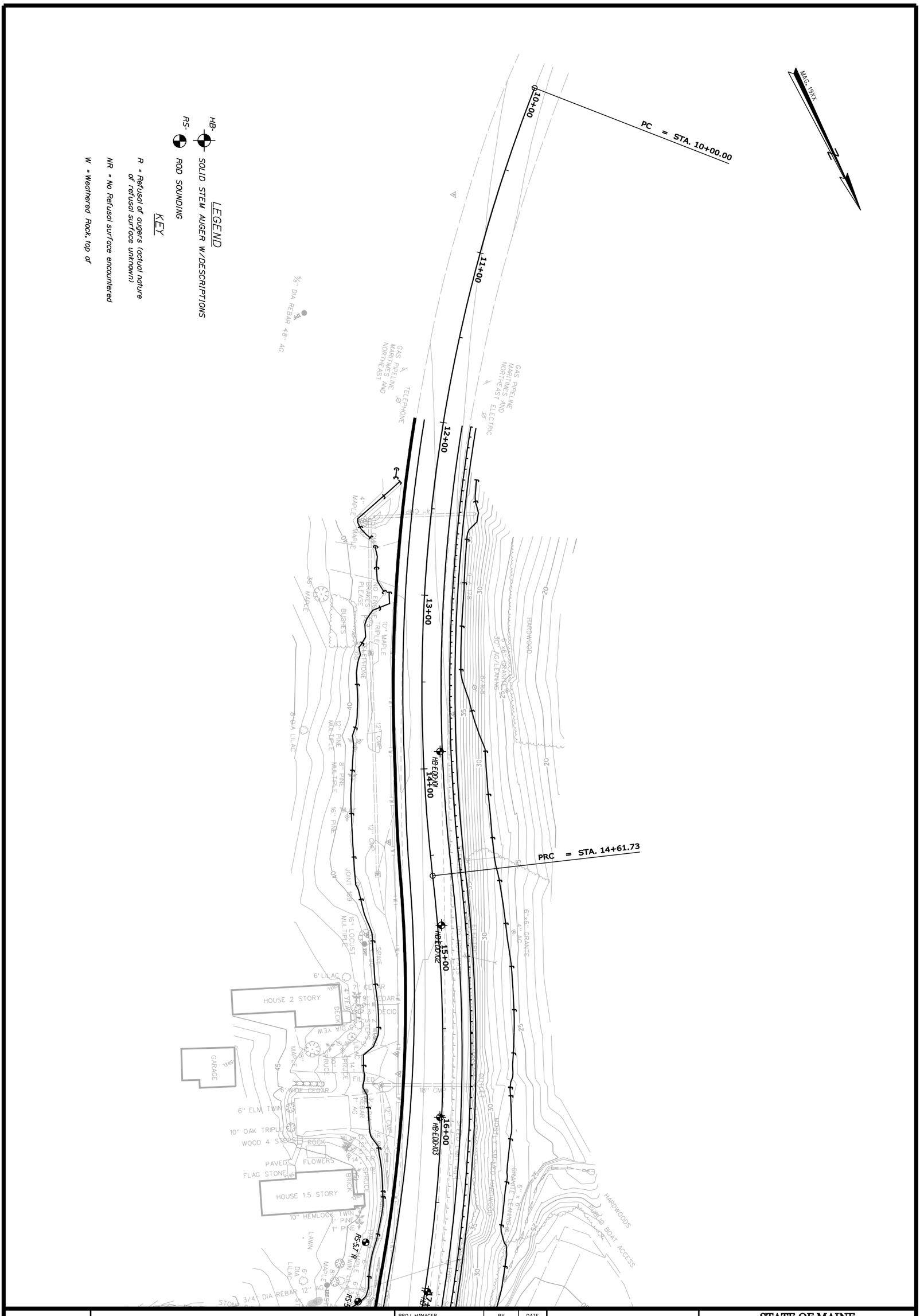

PROJ. MANAGER		BY	DATE
DESIGN-DETAILED	K.GROSS	T.WHITE	NOV 2010
CHECKED-REVIEWED			
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

SHEET NUMBER 1 OF 2

EDDINGTON
INTERSECTION ROUTE 9/178

GEOPLANS

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1725(900)X

PIN 17259.00

HIGHWAY PLANS

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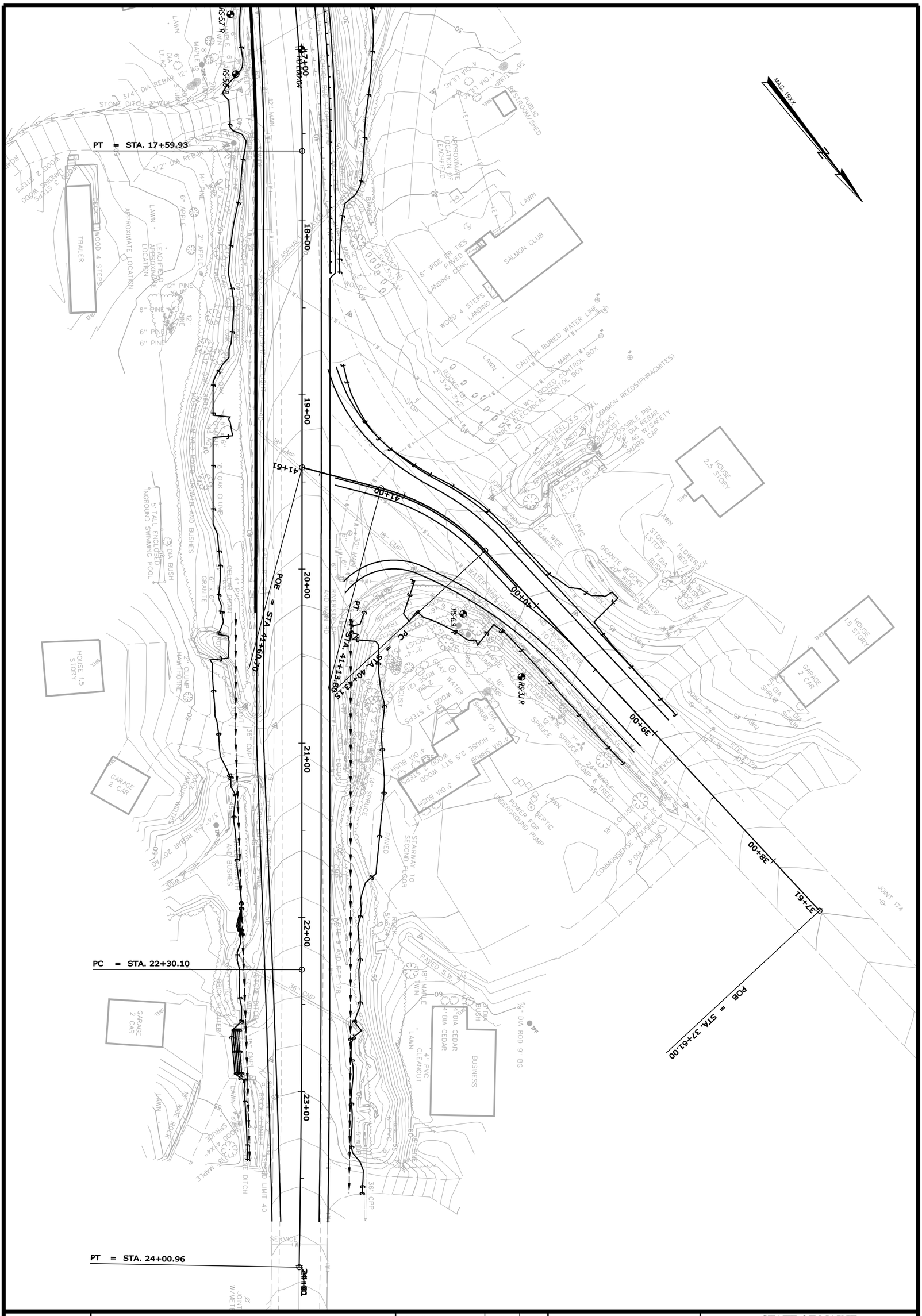

SHEET NUMBER 2 OF 2	EDDINGTON INTERSECTION ROUTE 9/178	PROJ. MANAGER	BY / DATE
	GEOPLANS	DESIGN-DETAILED: K.GROSS	T.WHITE / NOV 2010
		CHECKED-REVIEWED	SIGNATURE
		DESIGN2-DETAILED2	
		DESIGN3-DETAILED3	P.E. NUMBER
		REVISIONS 1	
		REVISIONS 2	
		REVISIONS 3	DATE
		REVISIONS 4	
		FIELD CHANGES	

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

STP-1725(900)X

PIN 17259.00 HIGHWAY PLANS