Geocres No:
31E-234

FOUNDATION INVESTIGATION
AND DESIGN REPORT
EMBANKMENTS ALONG HIGHWAY 11 - STA.13+260 TO STA.14+600
ROBINS ROAD/BLACK CREEK ROAD I/C UNDERPASS STRUCTURE
APPROACH EMBANKMENTS AND ACCESS RAMPS
HIGHWAY 11, BURK'S FALLS TO SOUTH RIVER
ONTARIO

G.W.P. 742-93-00, WP 757-93-01, SITE 44-421

Geocres Number: 31E-234

Report to

Marshall Macklin Monaghan

VOLUME 2/3

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
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July 6, 2005
File: 19-1423-24
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THURBER

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THURBER

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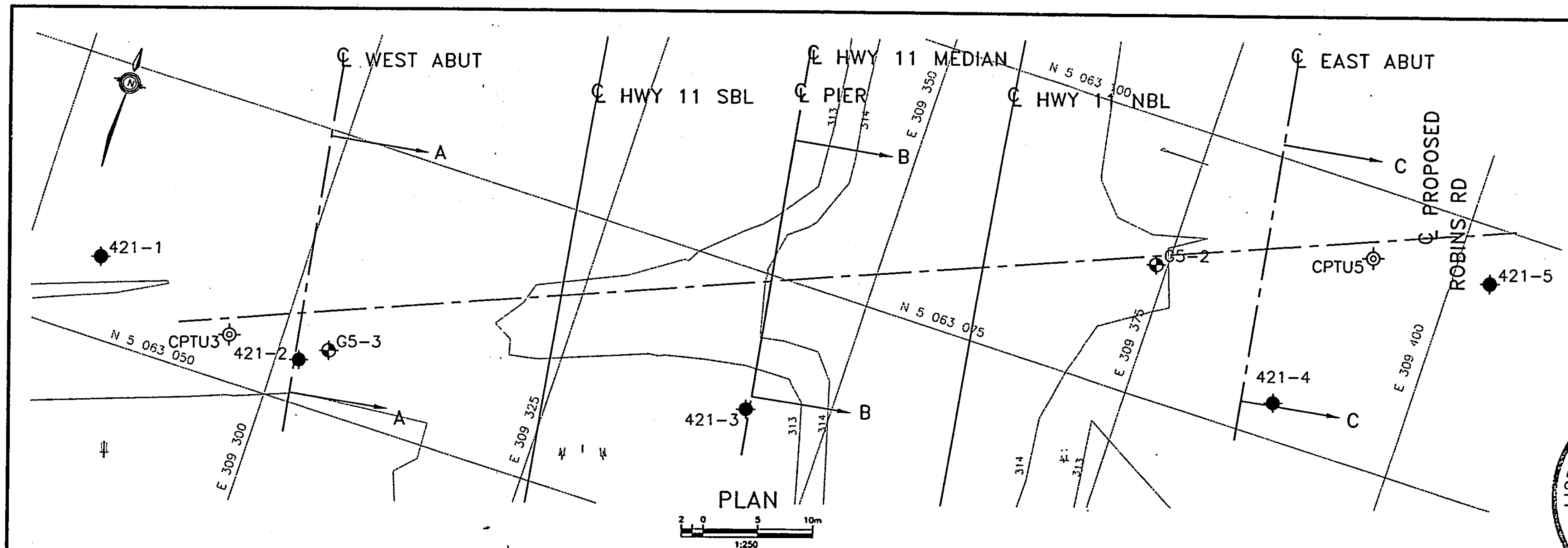

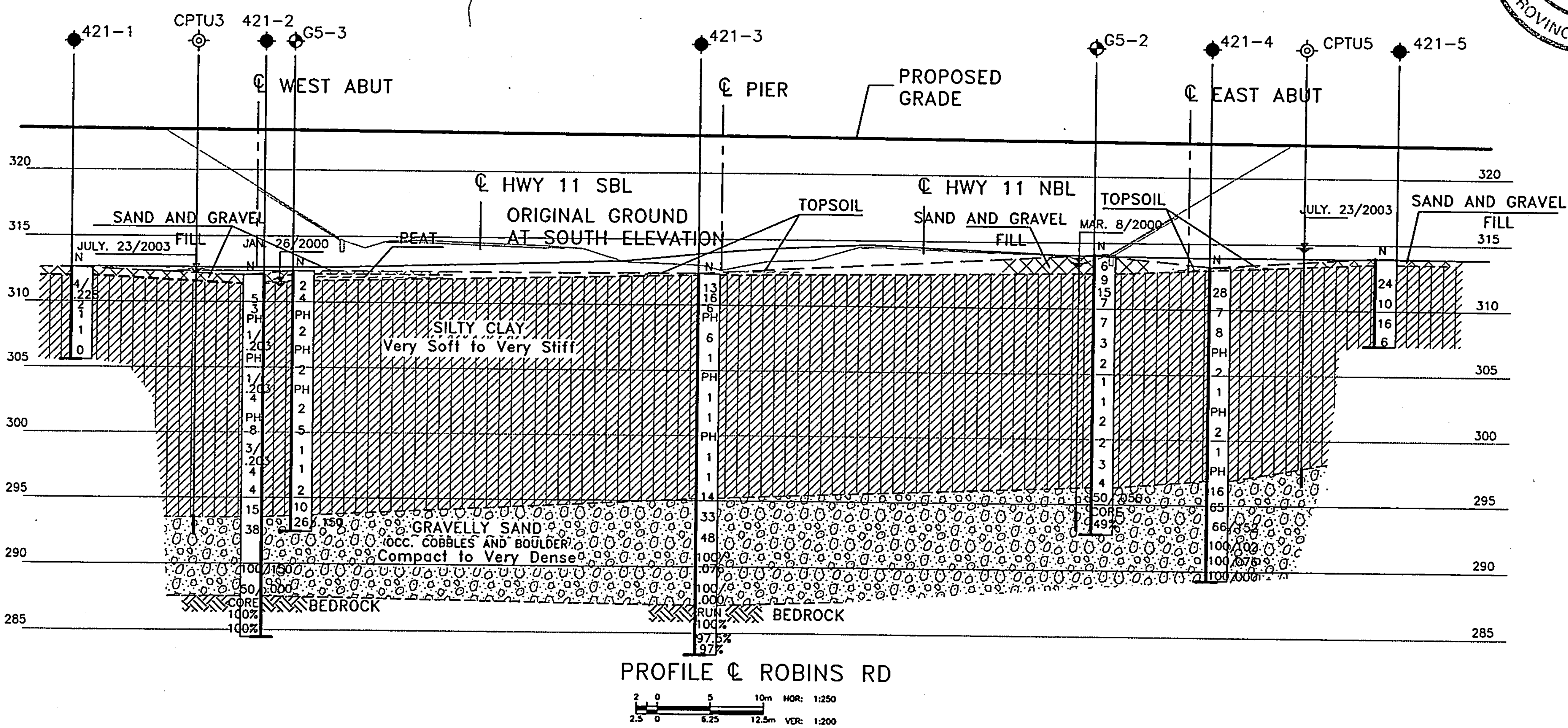

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No

WP No 757-93-01

ROBINS RD/BLACK CREEK RD I/C UNDERPASS

BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Marshall Macklin Monaghan

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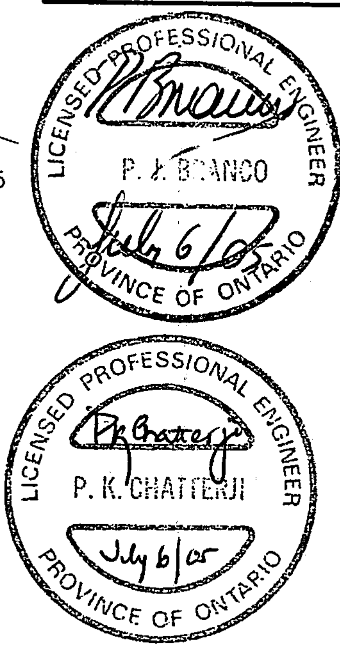

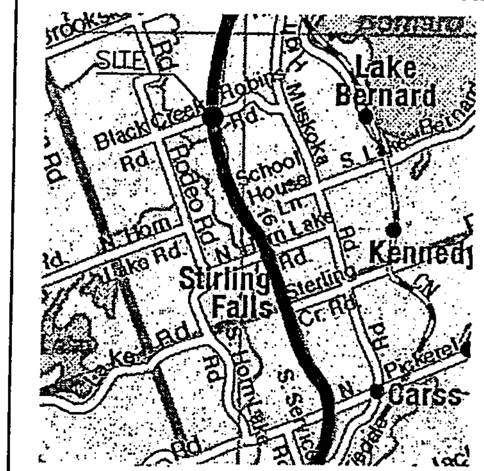

KEYPLAN

LEGEND

●	BoreHole by THURBER
⊕	Dynamic Cone Penetration Test (cone)
◆	BoreHole by GOLDER
◎	Piezocone by Conetec
N	Blows /0.3m (std pen Test,475J/blow)
CONE	Blows /0.3m (60° Cone ,475J/blow)
PH	Pressure, Hydraulic
▼	WL
	Head Artesion Water
	Piezometer
90%	Rock Quality Designation (RQD)

NO	ELEVATION	NORTHING	EASTING
BH 421-1	312.6	5 063 057.3	309 281.8
BH 421-2	312.0	5 063 054.0	309 302.1
BH 421-3	312.4	5 063 062.6	309 342.6
BH 421-4	313.2	5 063 078.3	309 388.1
BH 421-5	314.0	5 063 094.9	309 403.4
BH G5-2	314.1	5 063 087.0	309 374.0
BH G5-3	312.4	5 063 055.7	309 304.5
CPTU3	312.6	5 063 054.2	309 295.3
CPTU5	314.0	5 063 093.8	309 392.5

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

BENCH MARK

NOTE:

Sections A–A, B–B, C–C, are shown on Drawing No.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PKC	CODE CHBDC	LOAD	DATE	
DRAWN SS	CHK PJB	SITE 44-421	STRUCT	SCHEME	DWG (2)

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No
WP No 757-93-01

ROBINS RD/BLACK CREEK RD
I/C UNDERPASS
SOIL STRATA

SHEET

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THURBER
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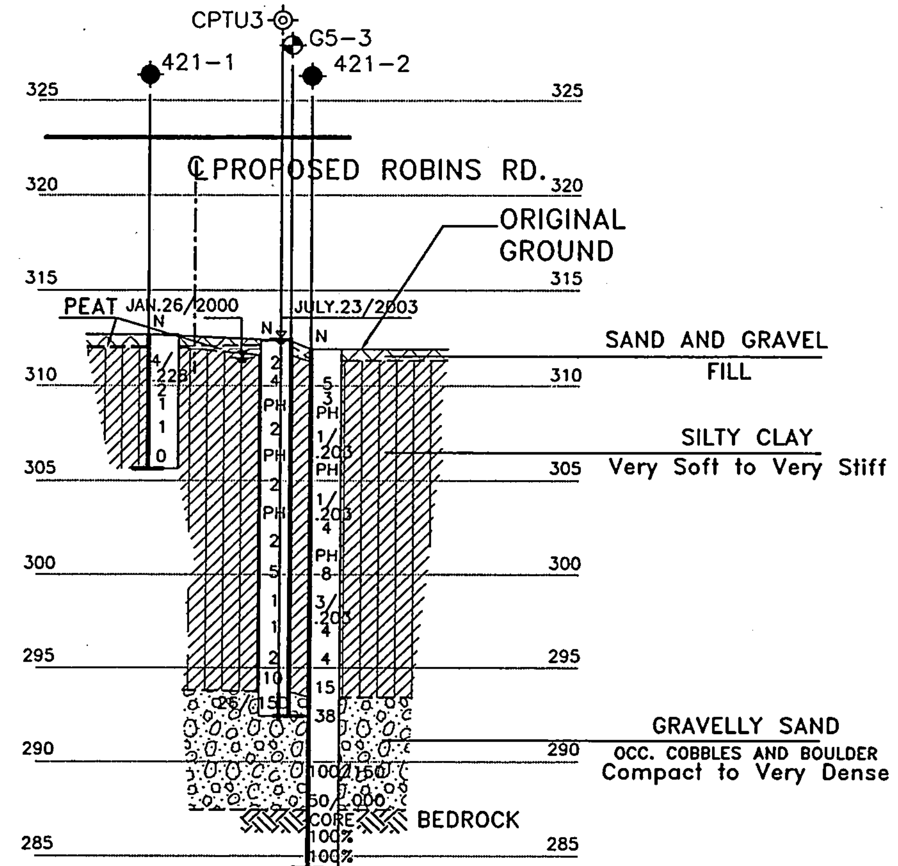

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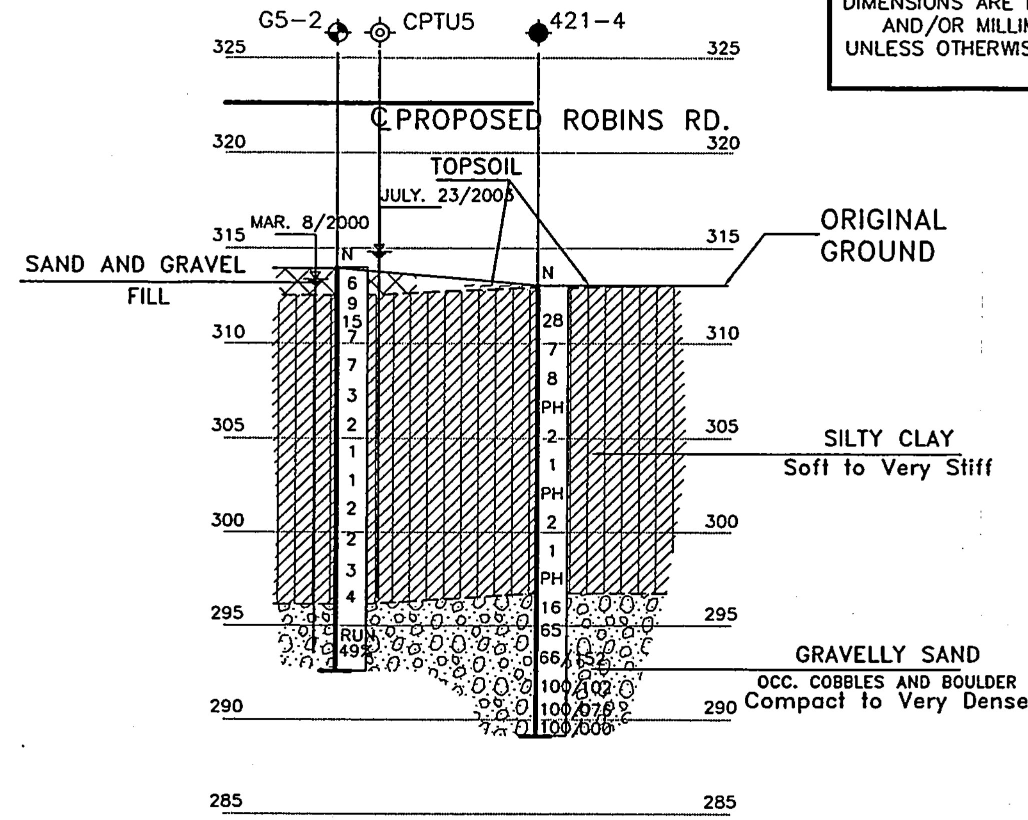
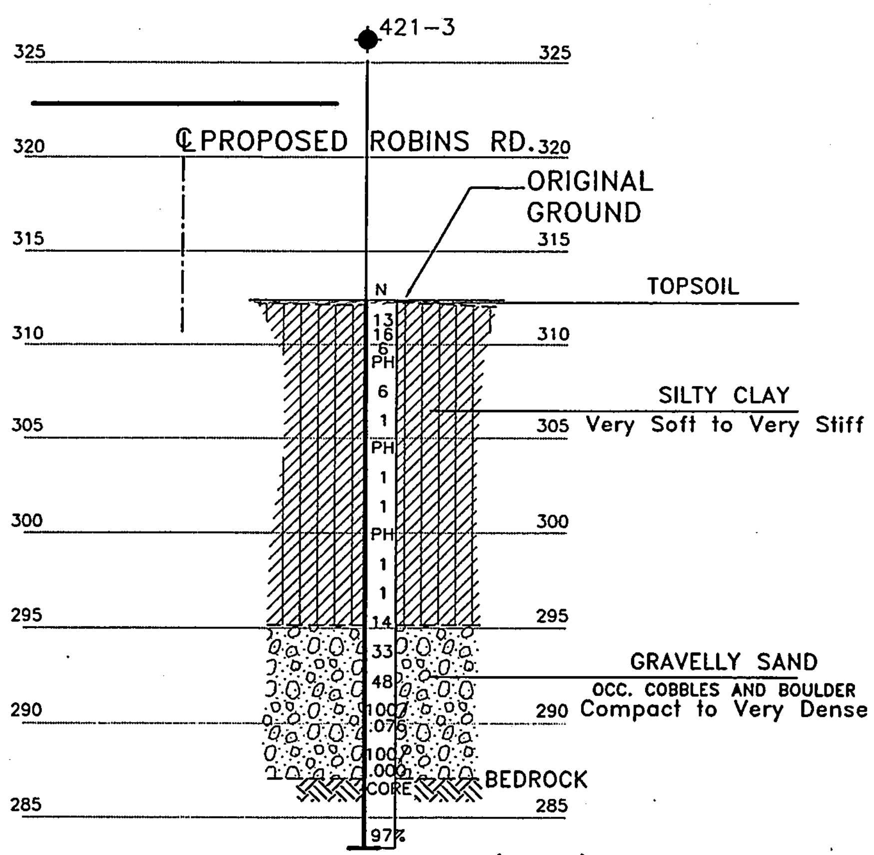
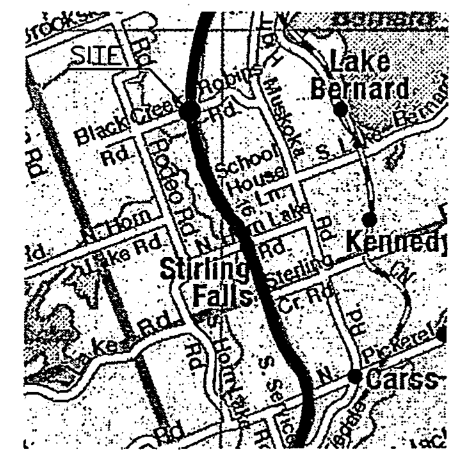


SECTION C–C (EAST ABUTMENT)



SECTION B–B (PIER)



KEYPLAN

NOTE:
Refer to drawing "BOREHOLE LOCATIONS AND SOIL STRATA" for location of sections.

LICENSED PROFESSIONAL ENGINEER
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July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
July 6/05
PROVINCE OF ONTARIO

LEGEND

⯁	BoreHole by THURBER
⊕	Dynamic Cone Penetration Test (cone)
⯁	BoreHole by GOLDER
⊕	Piezocone by Conetec
N	Blows /0.3m (std pen Test,475J/blow)
CONE	Blows /0.3m (60° Cone ,475J/blow)
PH	Pressure, Hydraulic
▼	WL
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)

NO	ELEVATION	NORTHING	EASTING
BH 421–1	312.6	5 063 057.3	309 281.8
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— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

BENCH MARK

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION		
DESIGN PJB	CHK PKC	CODE CHBDC	LOAD	DATE	
DRAWN SS	CHK PJG	SITE 44–421	STRUCT	SCHEME	DWG (2)

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 13+400 to 14+000
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

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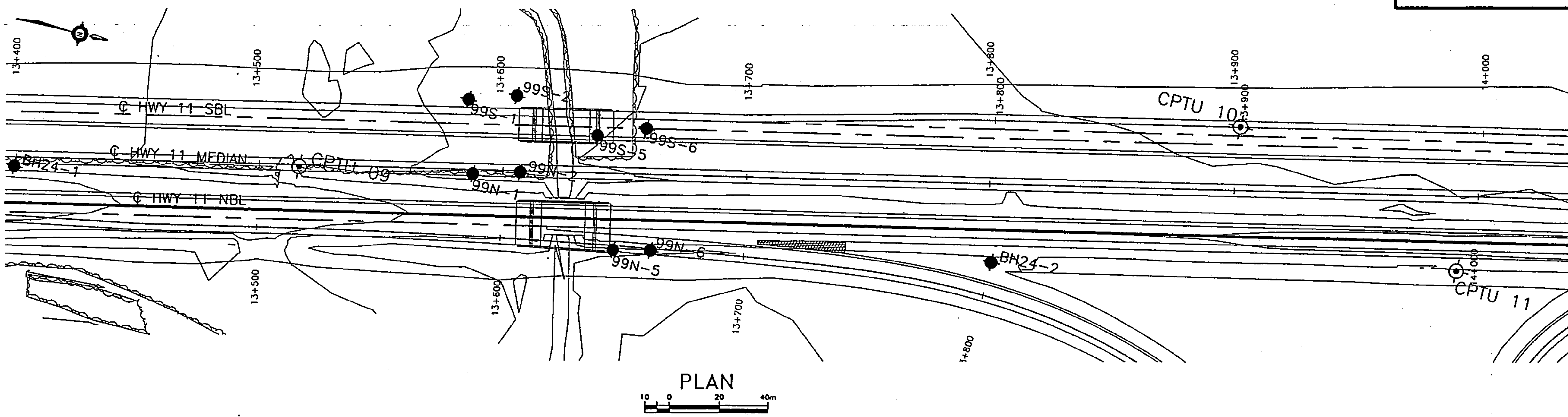
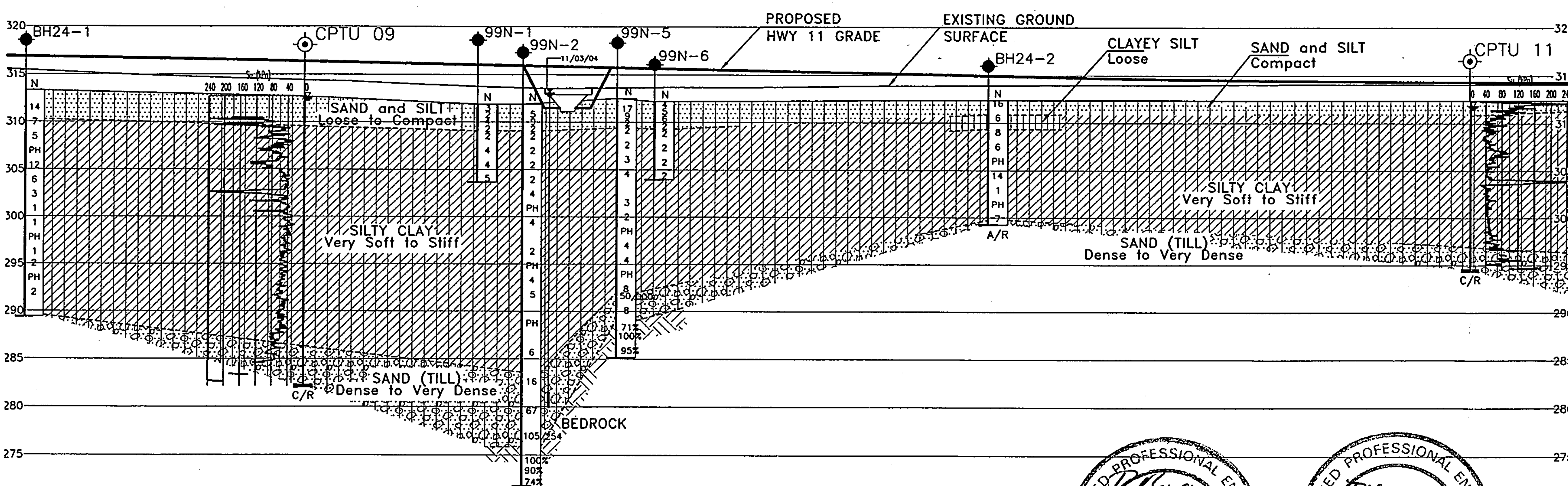
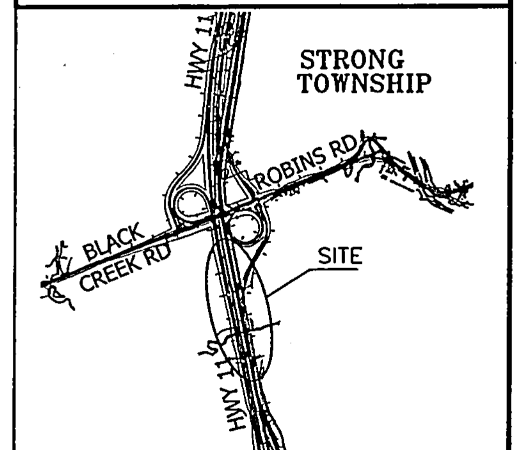


PLAN



PROFILE OF HWY 11 NBL



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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P. K. CHATTERJI
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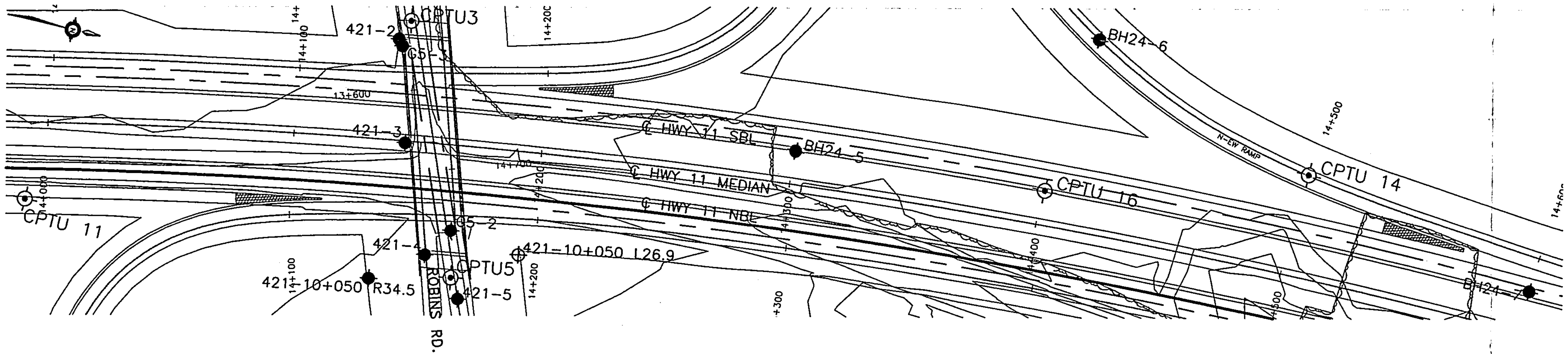
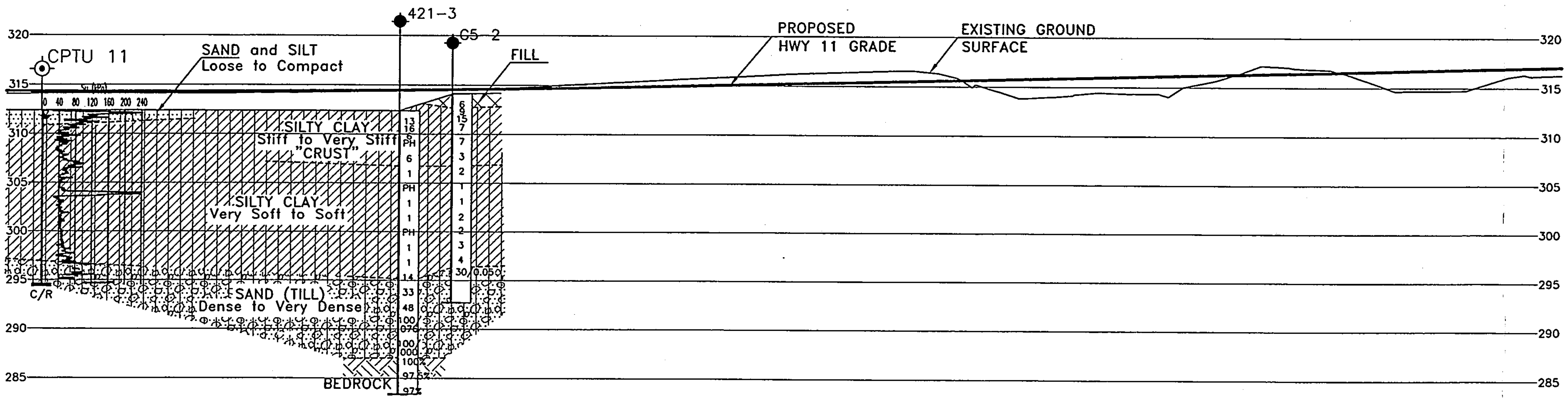
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



PLAN



PROFILE OF HWY 11 NBL

HOR: 10 0 20 40m
VERT: 2.5 0 2.5 10m

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 14+000 to 14+600
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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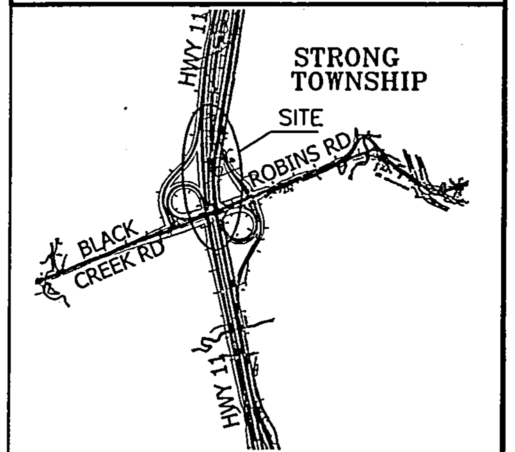

KEYPLAN

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

LICENSED PROFESSIONAL ENGINEER
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PROVINCE OF ONTARIO

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100 mm ON ORIGINAL DRAWING

REVISIONS		
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME DWG

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 13+400 to 14+000
SBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

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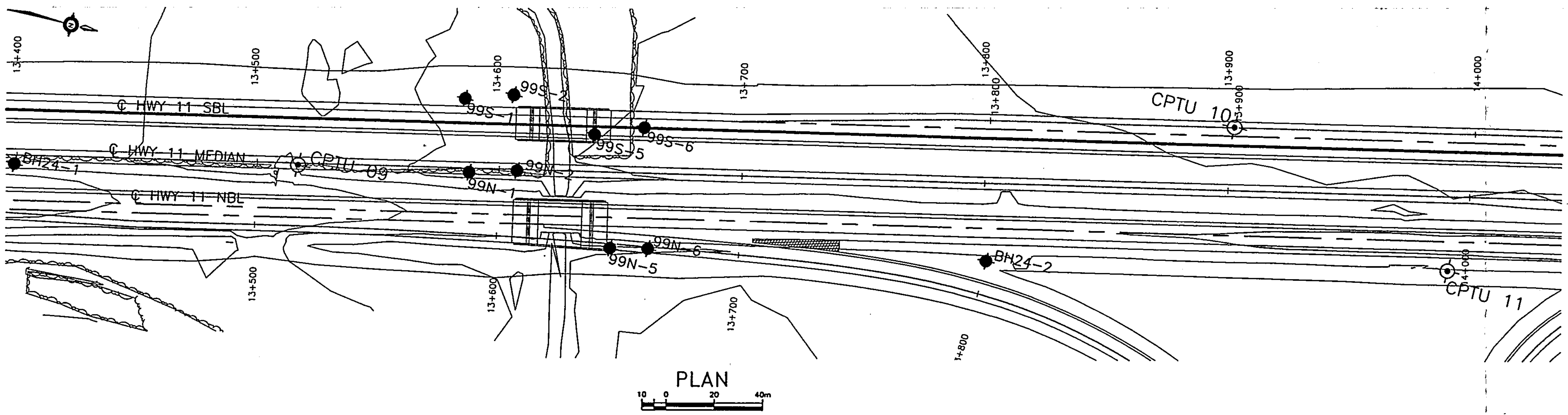

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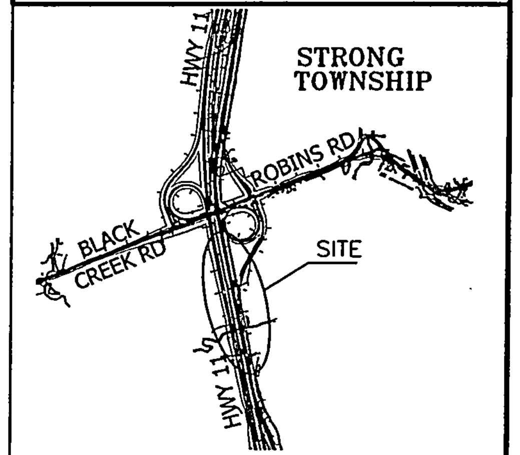

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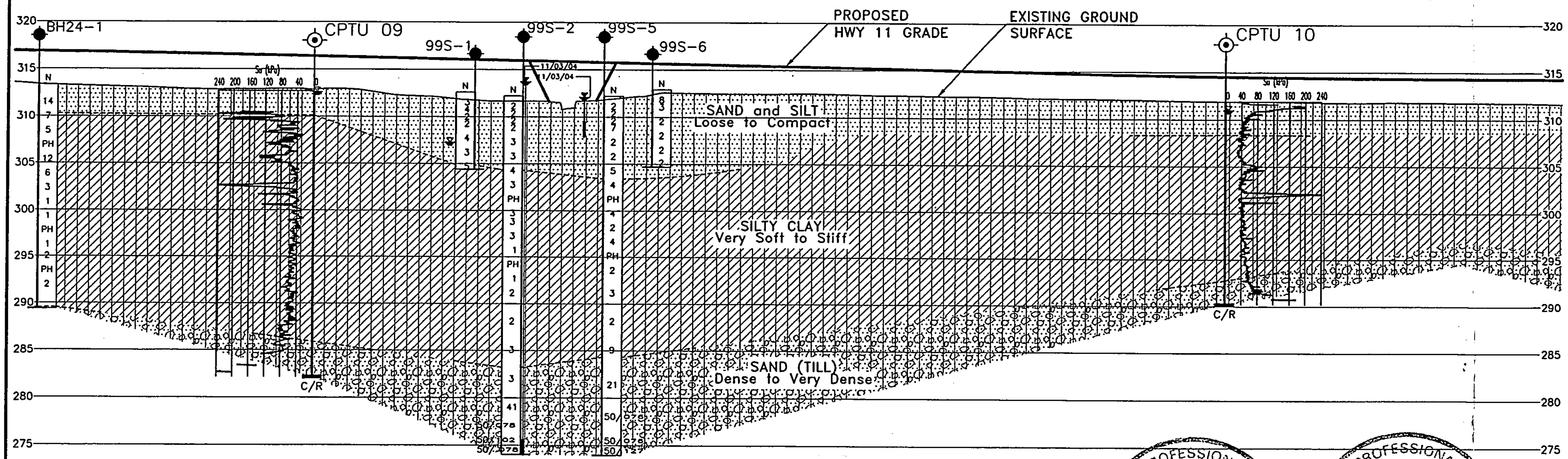

PROFILE OF HWY 11 SBL

HOR: 10 0 20 40m
VERT: 2.5 0 2.5 10m

LEGEND

Symbol	Description
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

LICENSED PROFESSIONAL ENGINEER
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PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO
July 6/05

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DEC 04	BY		ISSUED AS DRAFT FOR REVIEW
DATE	BY		DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
STATION 14+000 to 14+600
SBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
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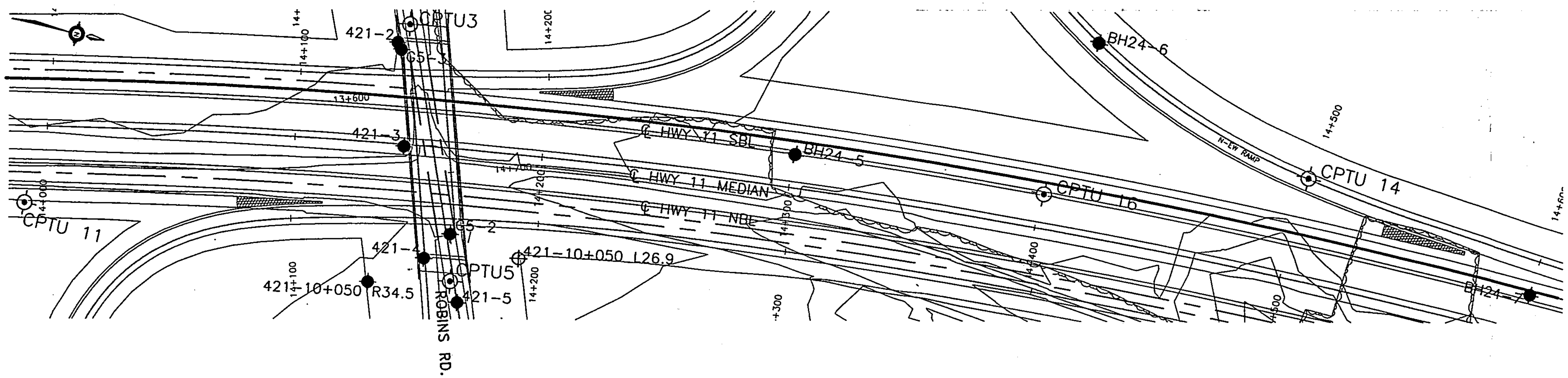

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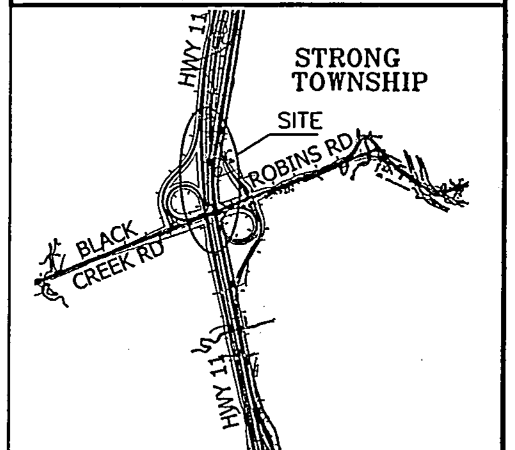

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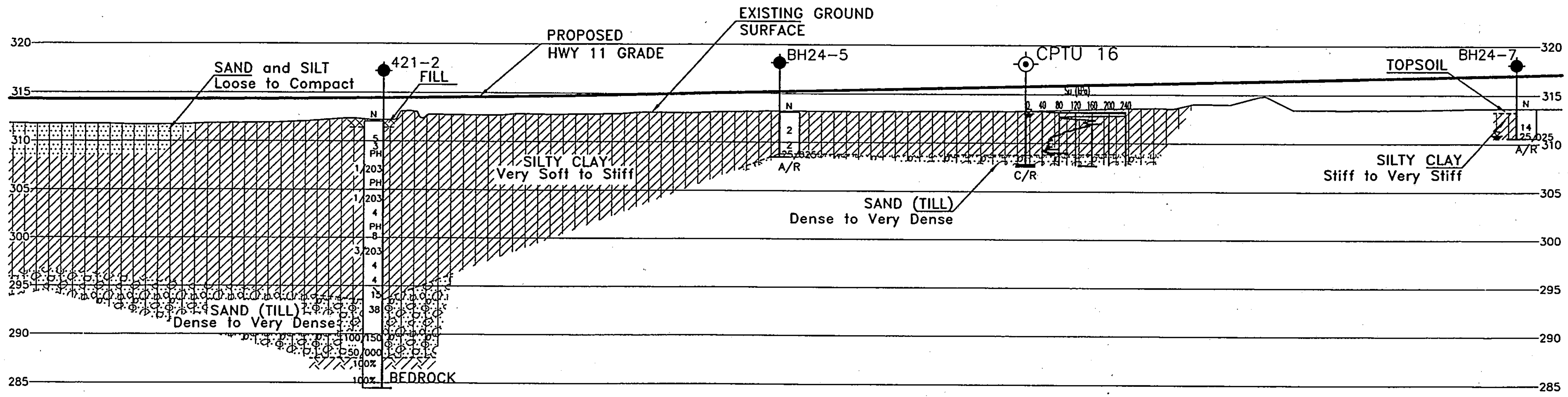

PROFILE OF HWY 11 SBL

HOR: 10 0 20 40m
VERT: 2.5 0 2.5 10m

	LEGEND
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
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	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —

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P. ...
July 6/05
PROVINCE OF ONTARIO

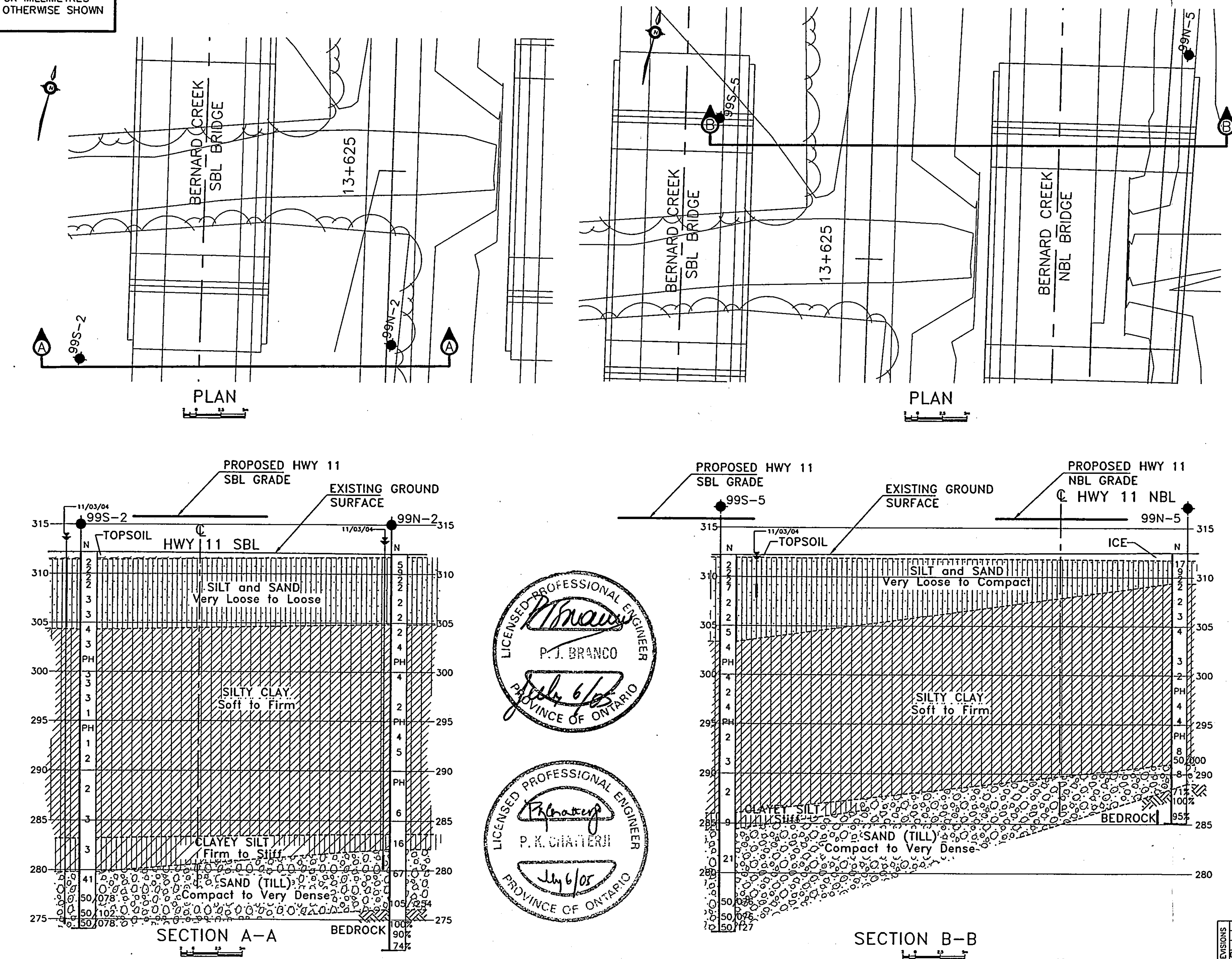
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
	DEC 04	BY	ISSUED AS DRAFT FOR REVIEW

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



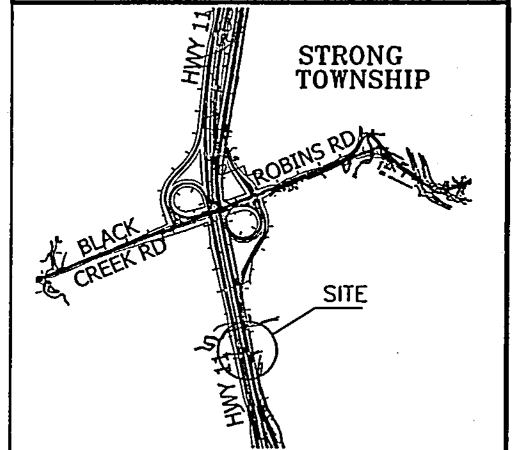
HWY 11
CONT No
WP No 742-93-00

SHEET

HIGHWAY 11 MAINLINE
STRONG TOWNSHIP
BERNARD CREEK BRIDGE
CROSS SECTIONS
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
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C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

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REVISIONS		
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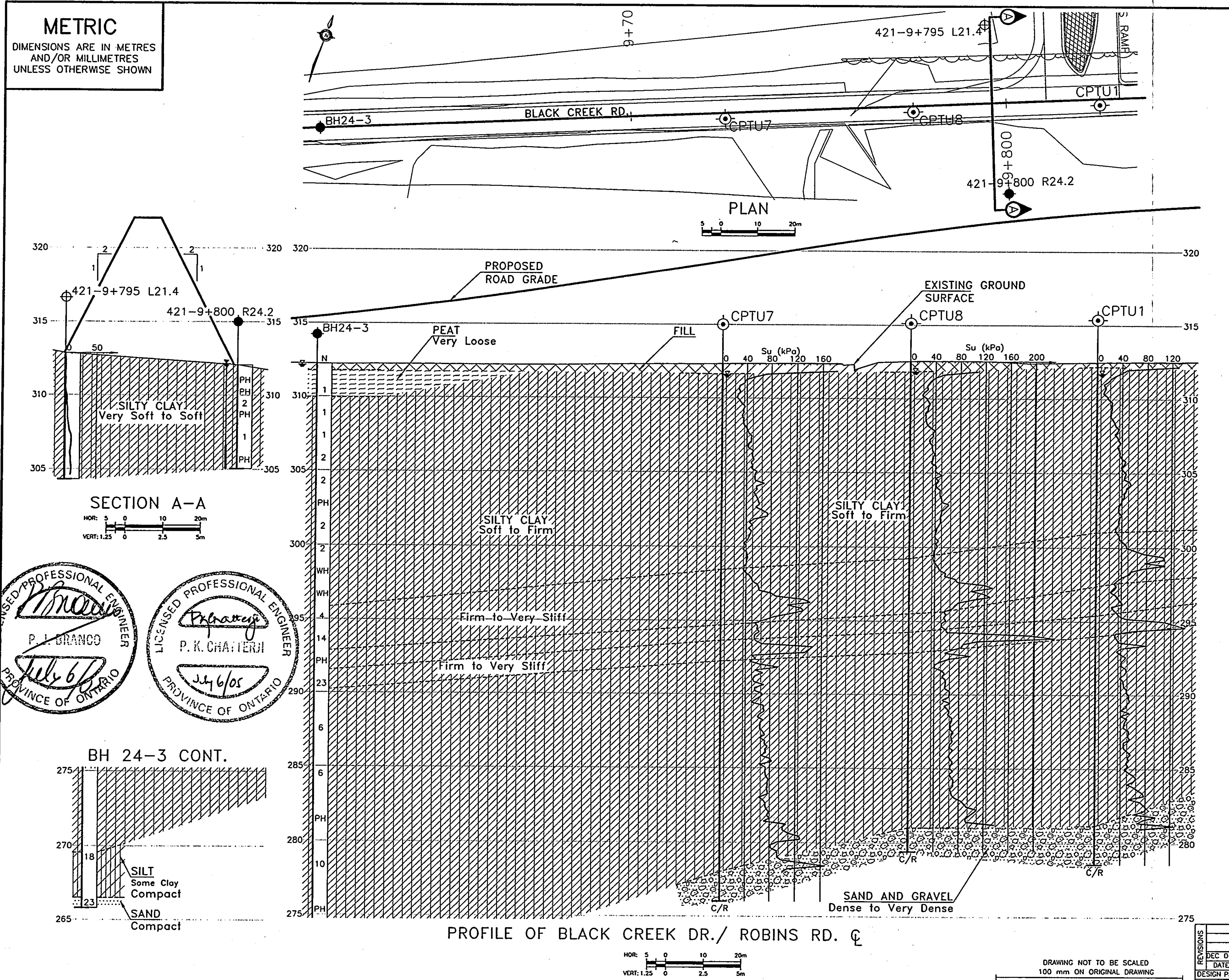
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



HWY 11
CONT No
WP No 742-93-00

SHEET

HWY 11 BURK'S FALLS – SOUTH RIVER
STRONG TOWNSHIP
BLACK CREEK ROAD CENTRELINE
STATION 9+600 TO 9+830
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

STRONG TOWNSHIP
HWY 11
ROBINS RD
BLACK CREEK RD
SITE

KEYPLAN

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
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A/R	Auger Refusal
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NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

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REVISIONS		
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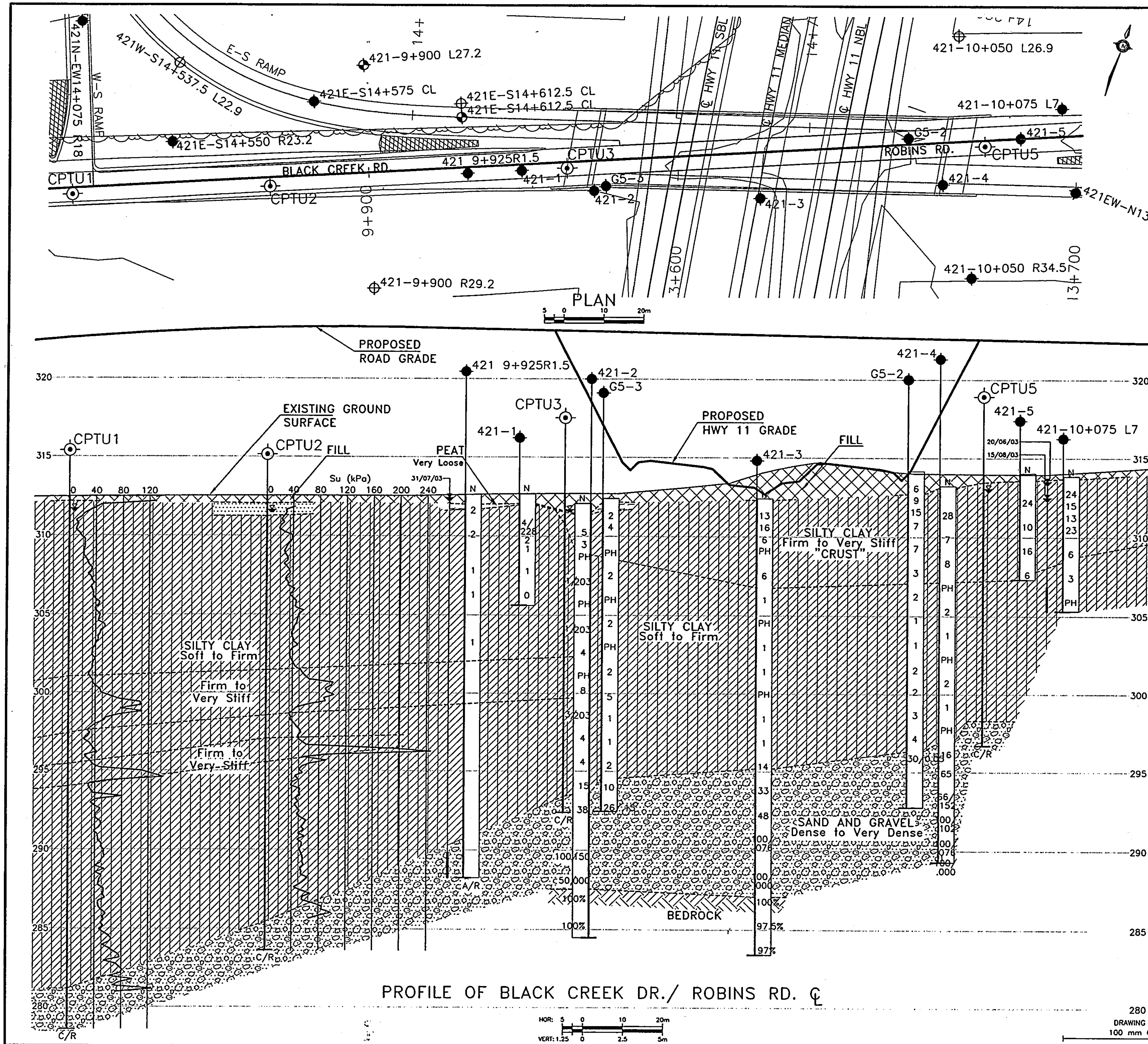
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

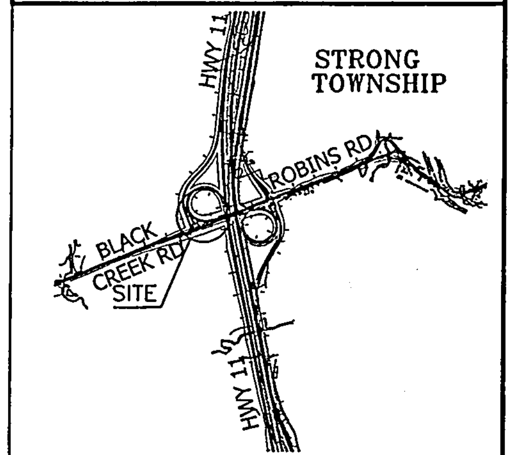
HWY 11
CONT No
WP No 742–93–00

SHEET

HWY 11 BURK'S FALLS – SOUTH RIVER
STRONG TOWNSHIP
BLACK CREEK. RD./ROBINS RD. CL.
STATION 9+830 TO 10+080
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LICENSED PROFESSIONAL ENGINEER
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July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LEGEND

Symbol	Description
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
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A/R	Auger Refusal
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NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

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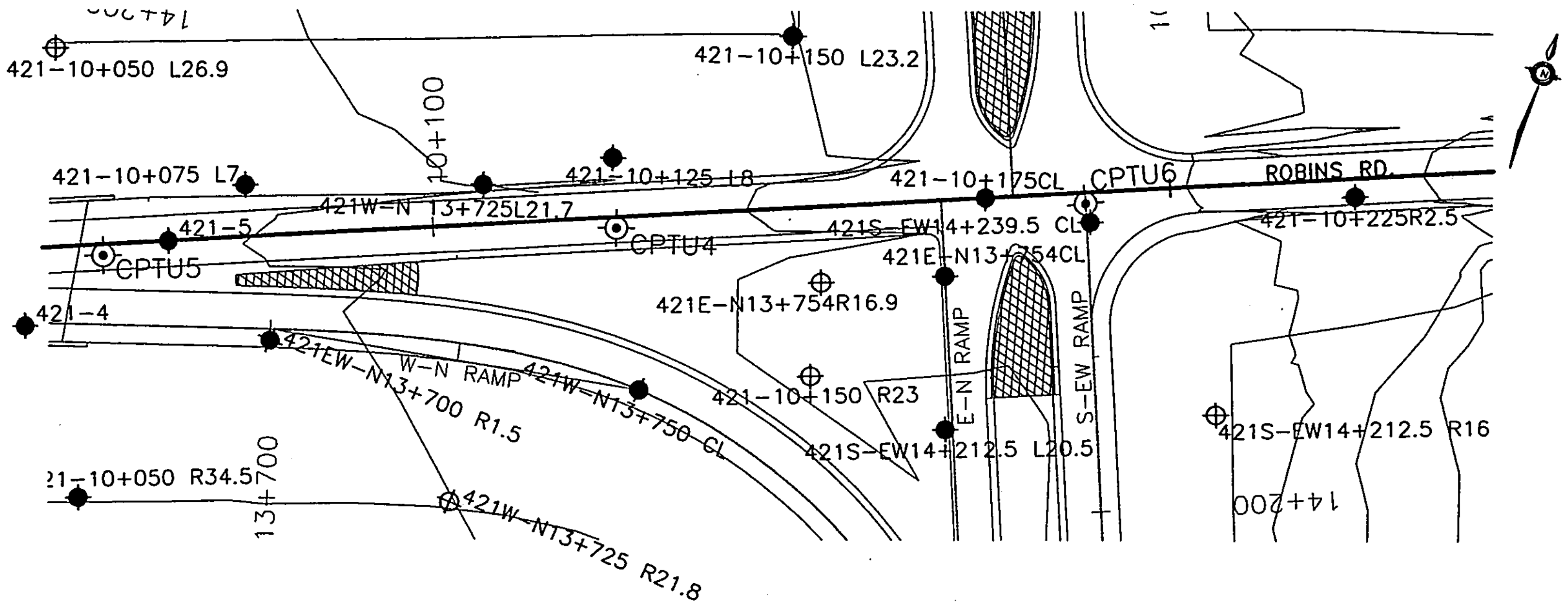
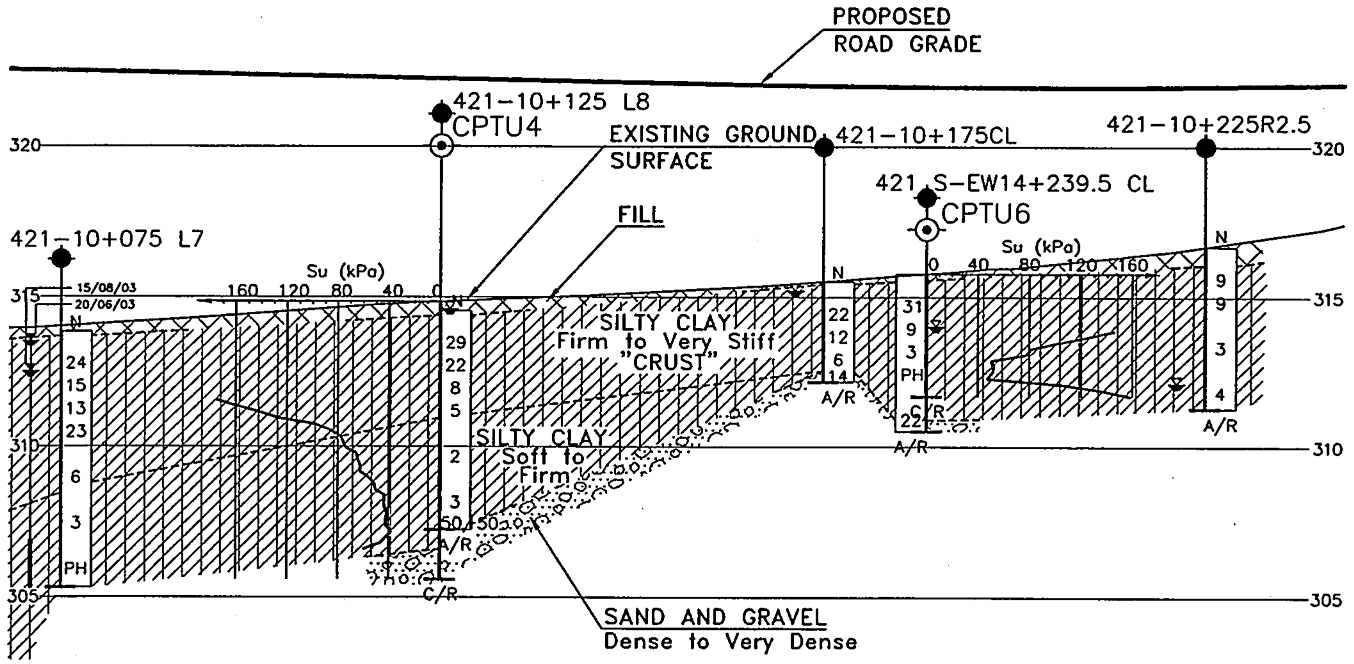
REVISIONS			
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC–04	
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



PLAN



PROFILE OF ROBINS RD. ℄

HOR: 5 0 10 20m
VERT: 1:25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

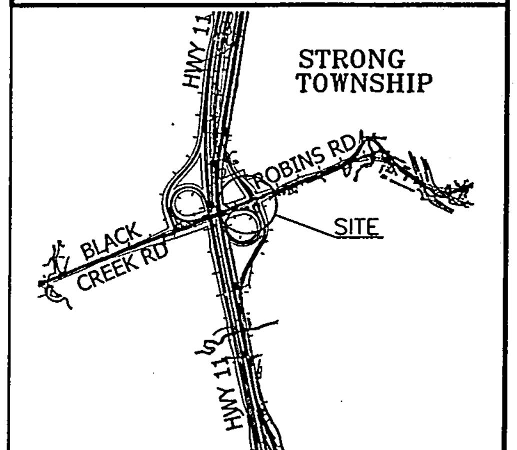
HWY 11
CONT No
WP No 742-93-00

SHEET

HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
ROBINS ROAD CENTRELINE
STATION 10+080 TO 10+220
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

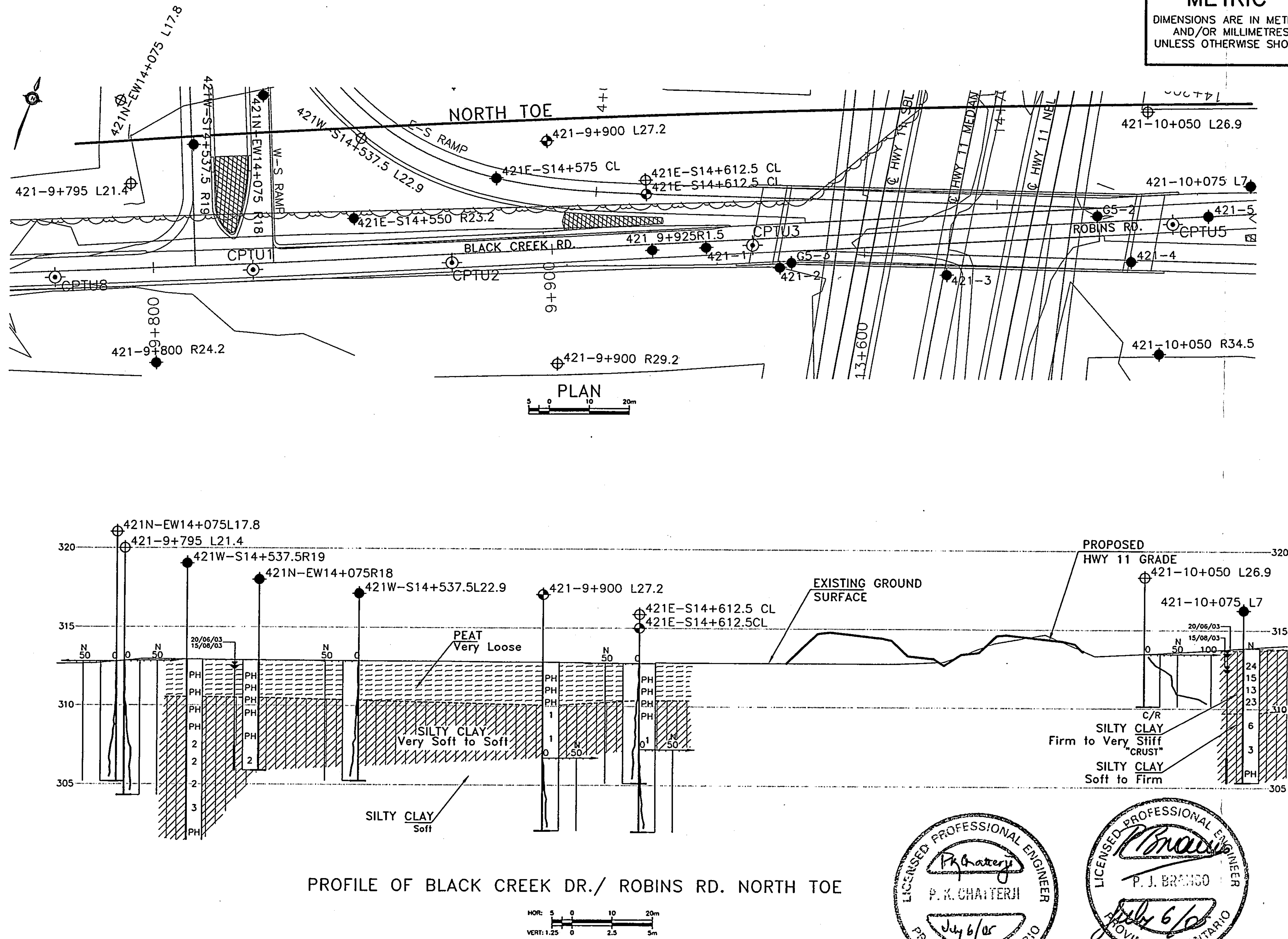
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS			
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04	
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



PROFILE OF BLACK CREEK DR./ ROBINS RD. NORTH TOE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

HWY 11 BURK'S FALLS – SOUTH RIVER
STRONG TOWNSHIP
BLACK CREEK RD./ROBINS RD. N. TOE
STATION 9+790 TO 10+100
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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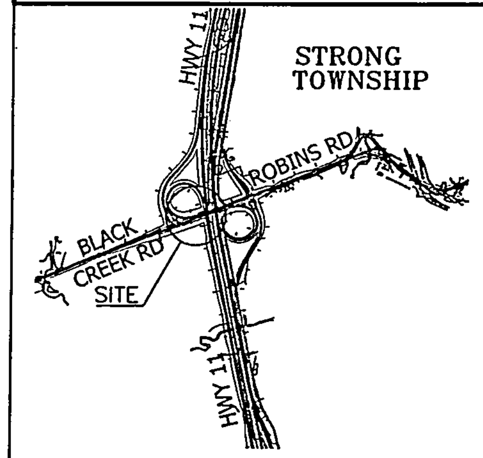
THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

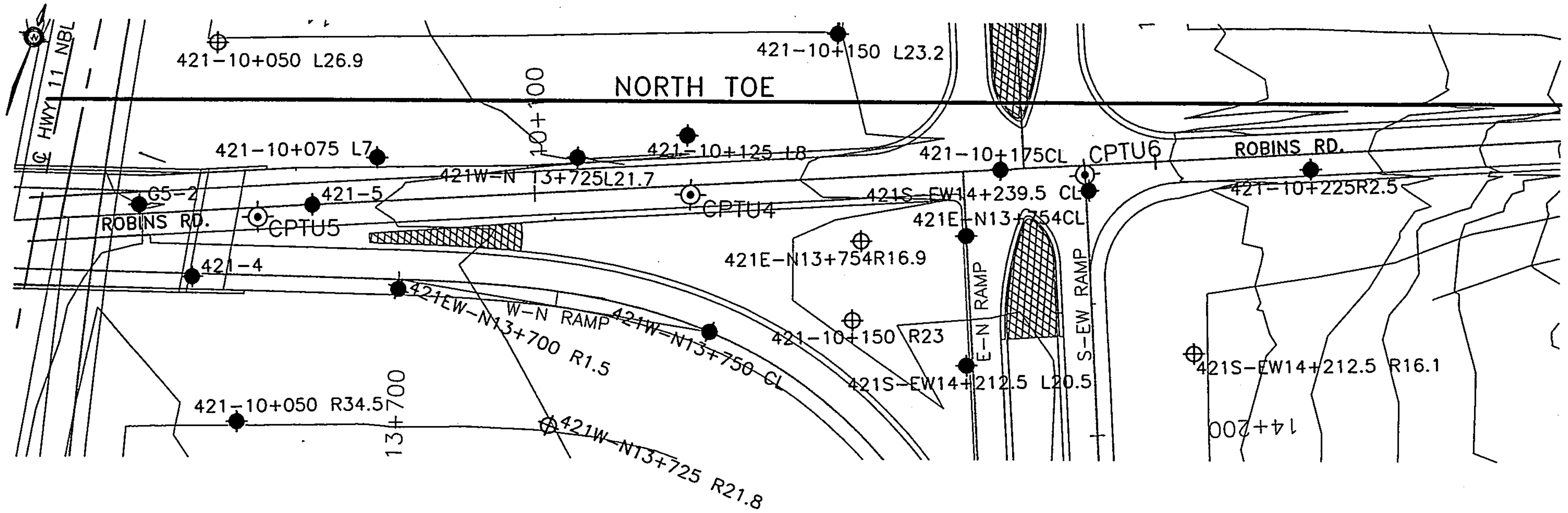
LICENSED PROFESSIONAL ENGINEER P. K. CHATTERJI PROVINCE OF ONTARIO July 6/05

LICENSED PROFESSIONAL ENGINEER P. J. BRANSO PROVINCE OF ONTARIO July 6/05

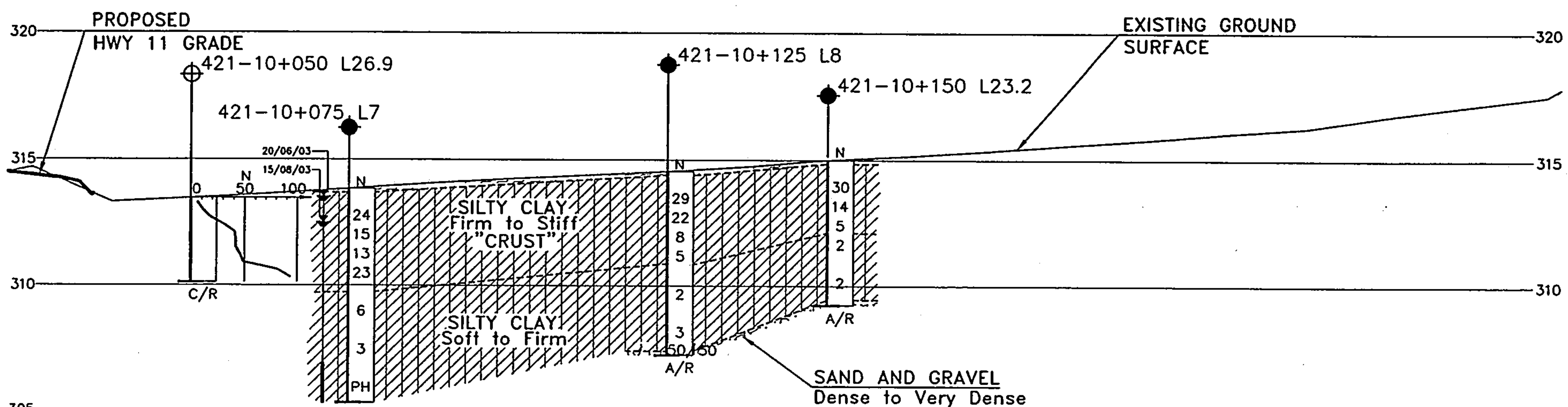
— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DEC 04	BY		ISSUED AS DRAFT FOR REVIEW
DATE	BY		DESCRIPTION
DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



PLAN



PROFILE OF BLACK CREEK DR./ ROBINS RD. NORTH TOE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANDO
July 6/05
PROVINCE OF ONTARIO

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

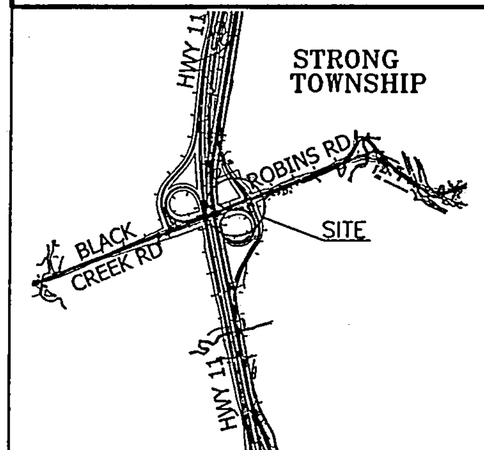
HWY 11
CONT No
WP No 742-93-00

SHEET

HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
ROBINS ROAD NORTH TOE
STATION 10+100 TO 10+260
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU - Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS			
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	

DESIGN PJB | CHK PJB | CODE | LOAD | DATE DEC-04
DRAWN WRW | CHK | SITE | STRUCT | SCHEME | DWG

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

HWY 11 BURK'S FALLS – SOUTH RIVER
STRONG TOWNSHIP
BLACK CREEK RD./ROBINS RD. S. TOE
STATION 9+800 TO 10+080
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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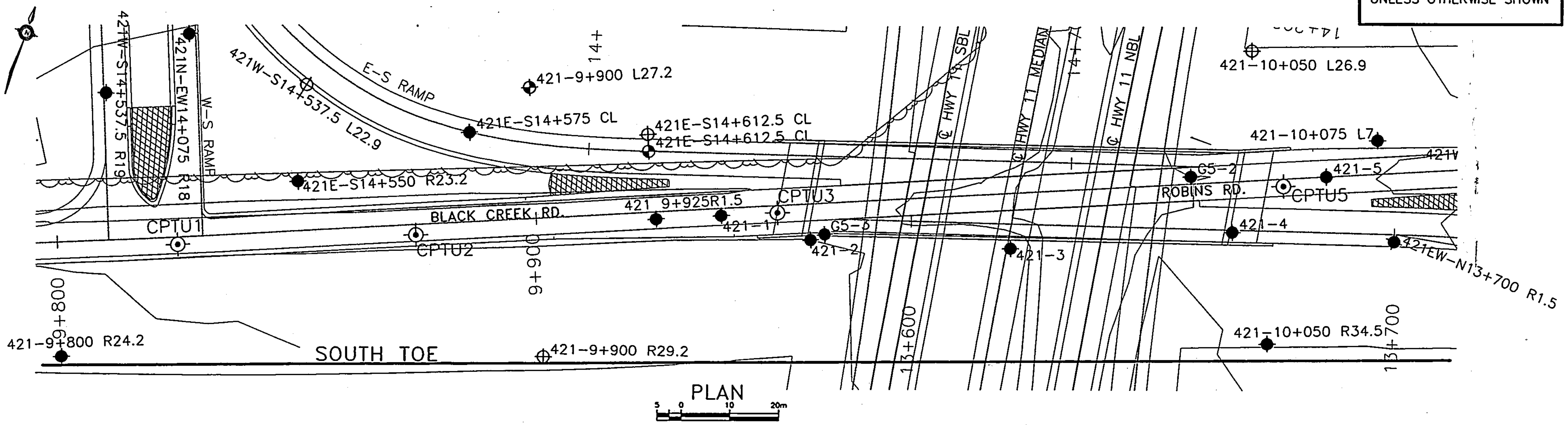
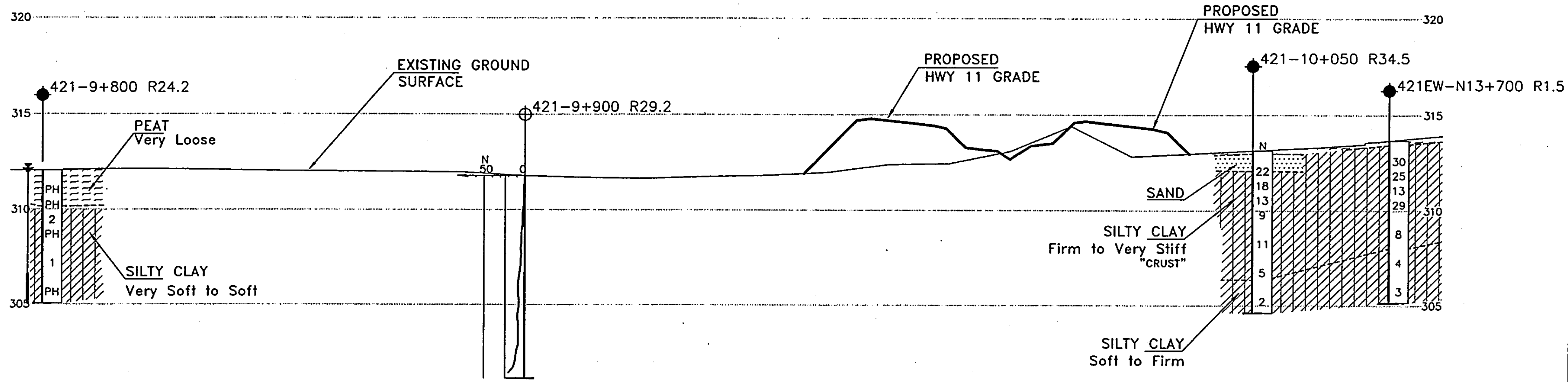
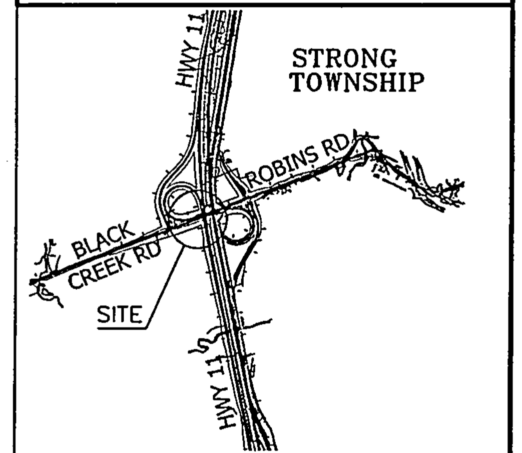


PLAN



PROFILE OF BLACK CREEK DR./ ROBINS RD. SOUTH TOE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m



KEYPLAN

LEGEND	
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
July 6/05
PROVINCE OF ONTARIO

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
ROBINS RD. SOUTH TOE
STATION 10+030 TO 10+200
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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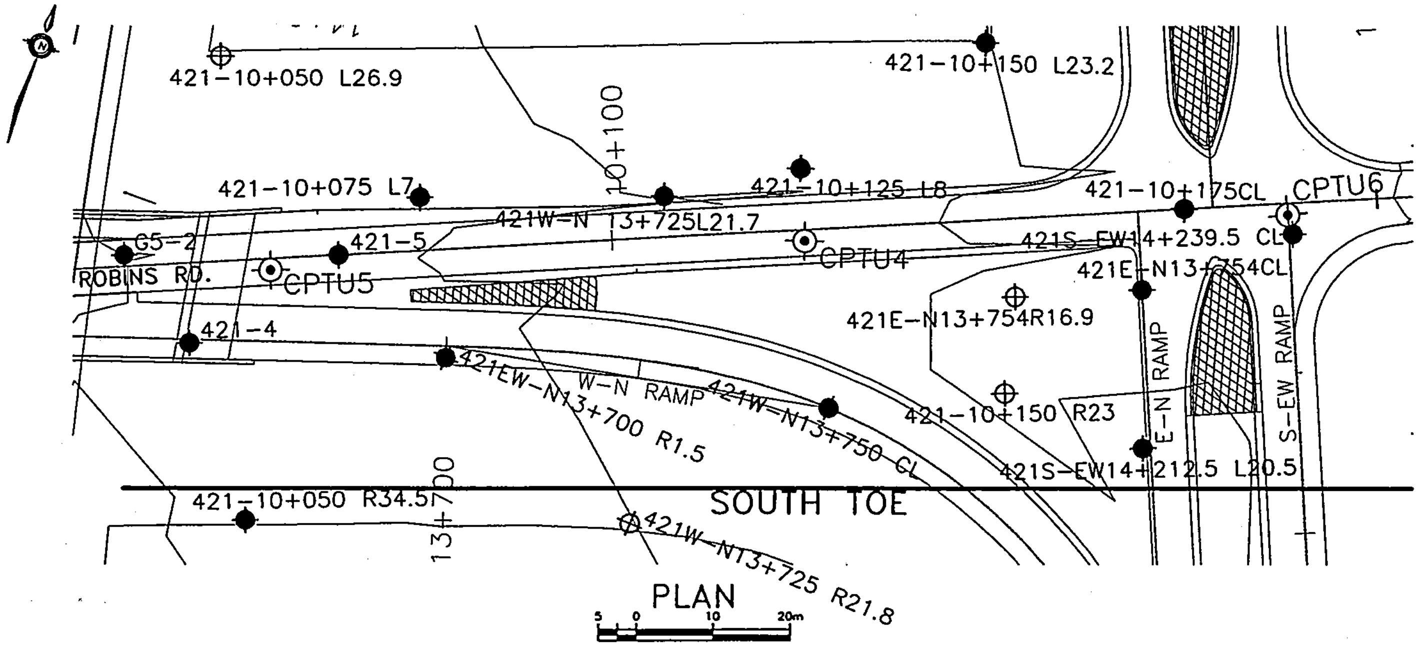
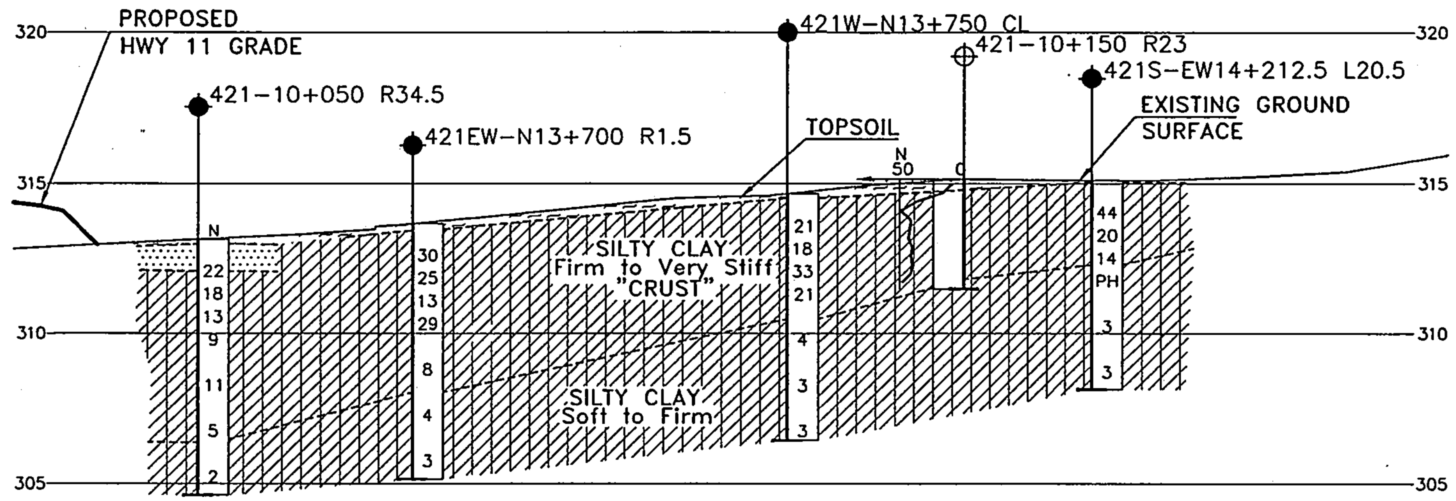
THURBER ENGINEERING LTD.



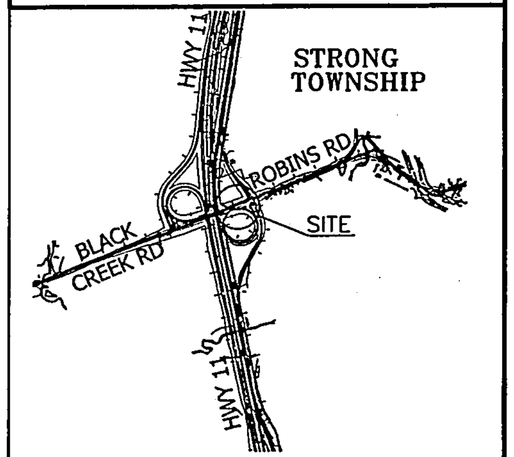


PROFILE OF BLACK CREEK DR./ ROBINS RD. SOUTH TOE

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
July 6/05
PROVINCE OF ONTARIO



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU - Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

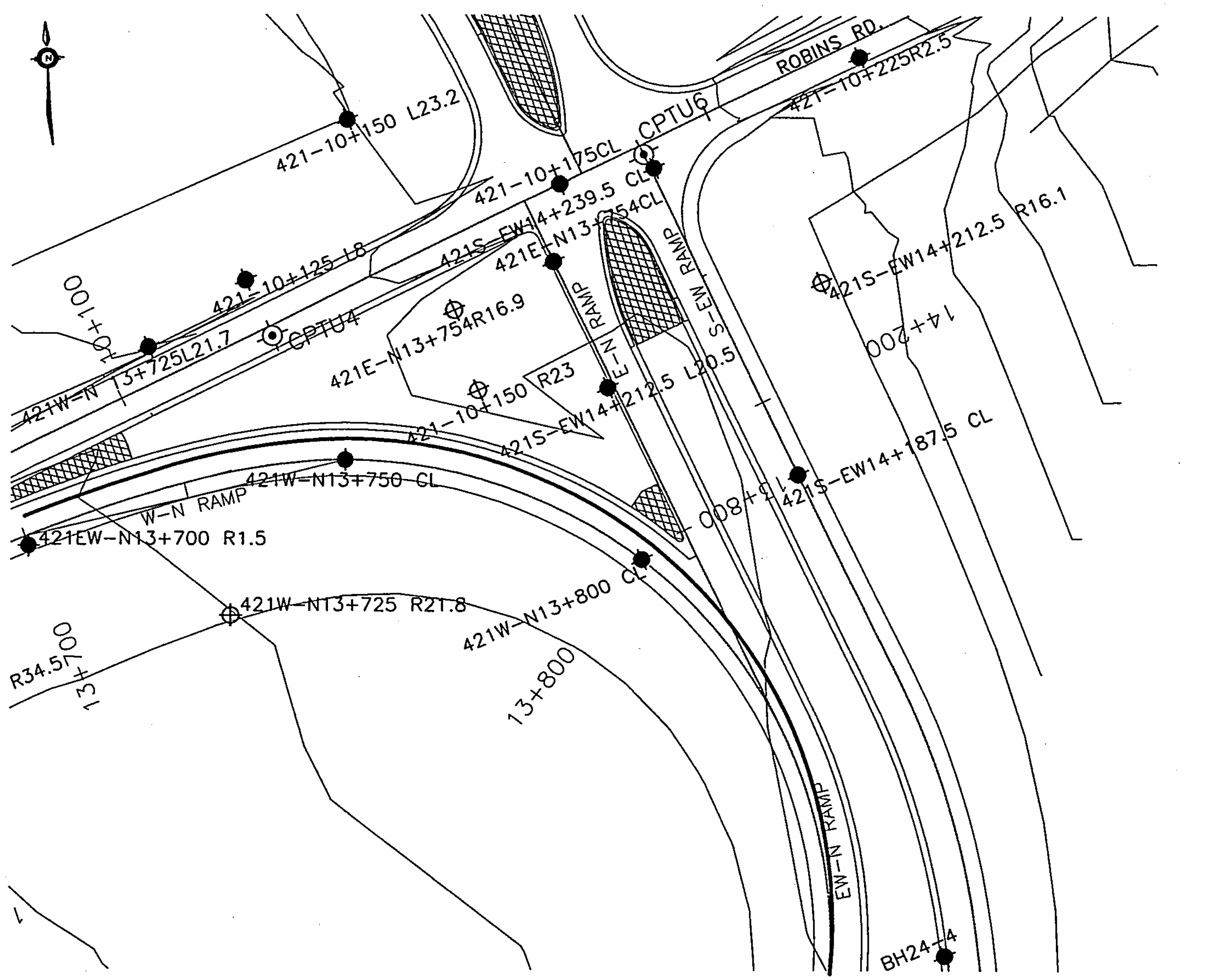
— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

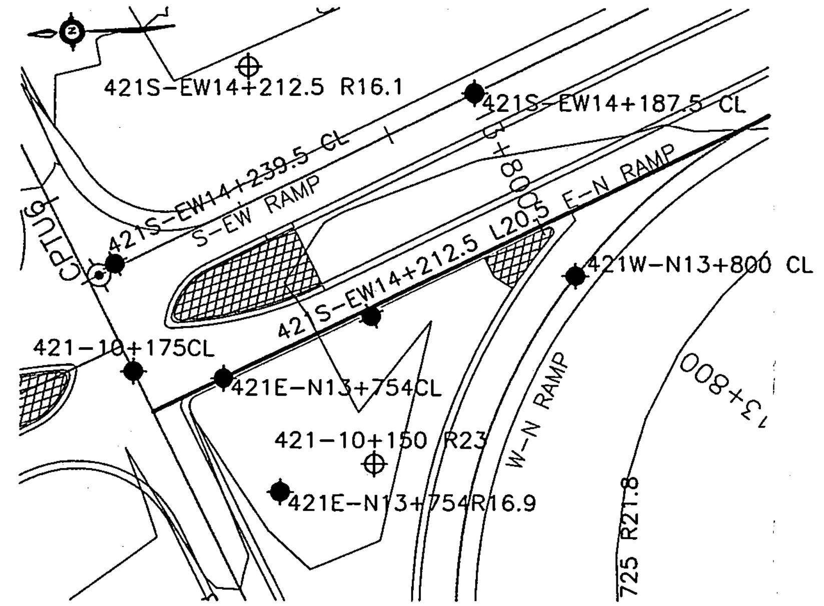
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

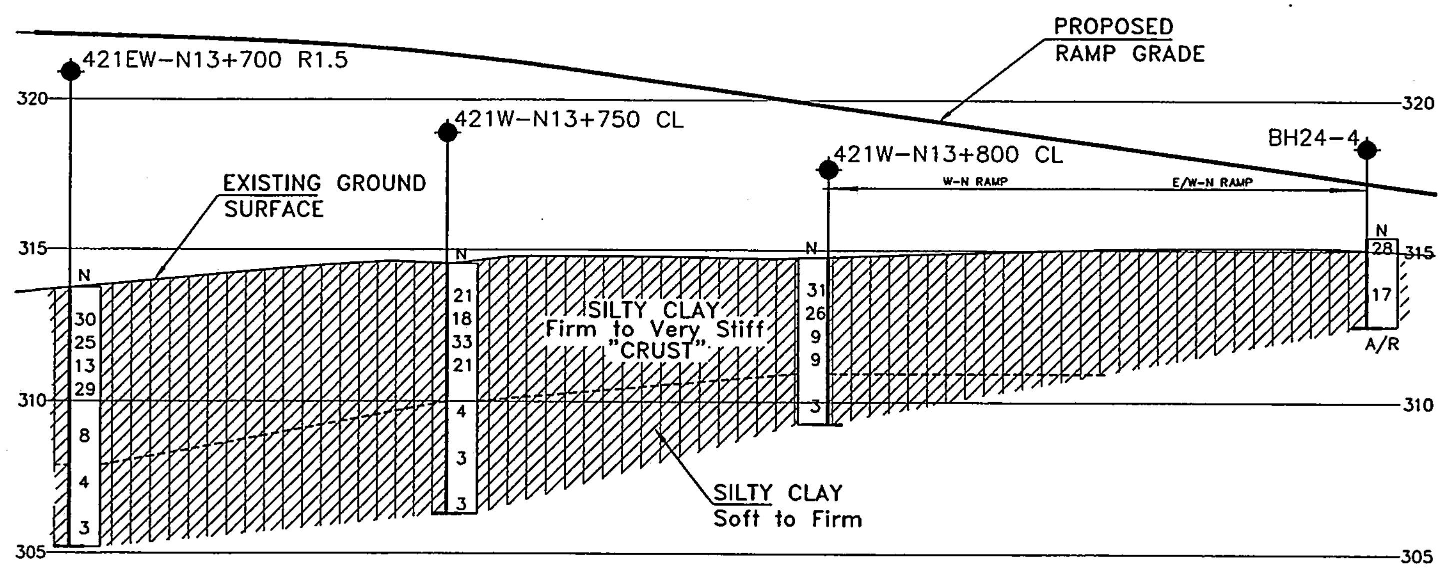
REVISIONS		
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

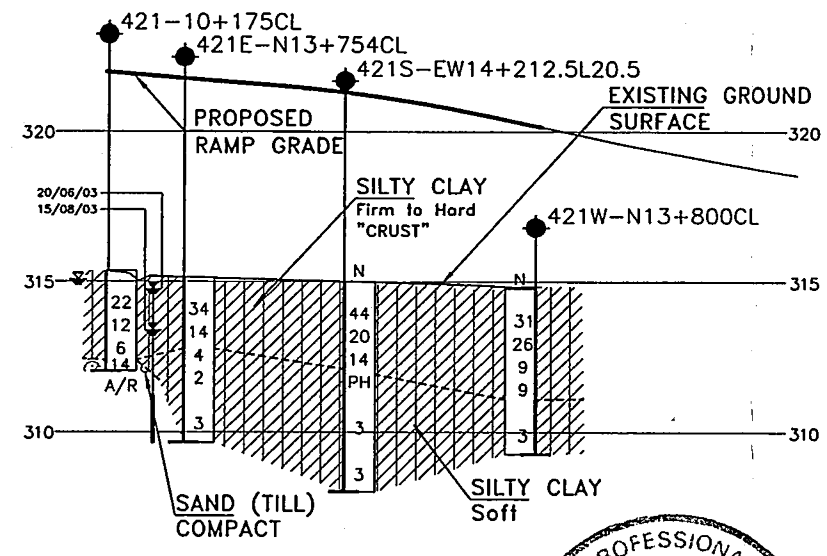


PLAN





PROFILE OF EW-N RAMP



PROFILE OF E-N RAMP

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
July 6/05
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

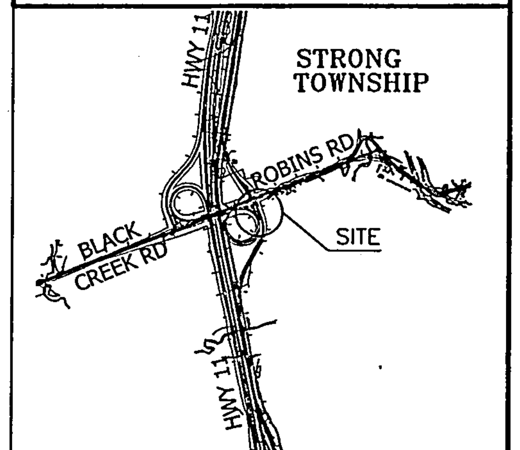
HWY 11
CONT No
WP No 742-93-00

SHEET

HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
EW-N AND E-N RAMPS CENTRELINE
STATION 13+750 TO 13+830
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

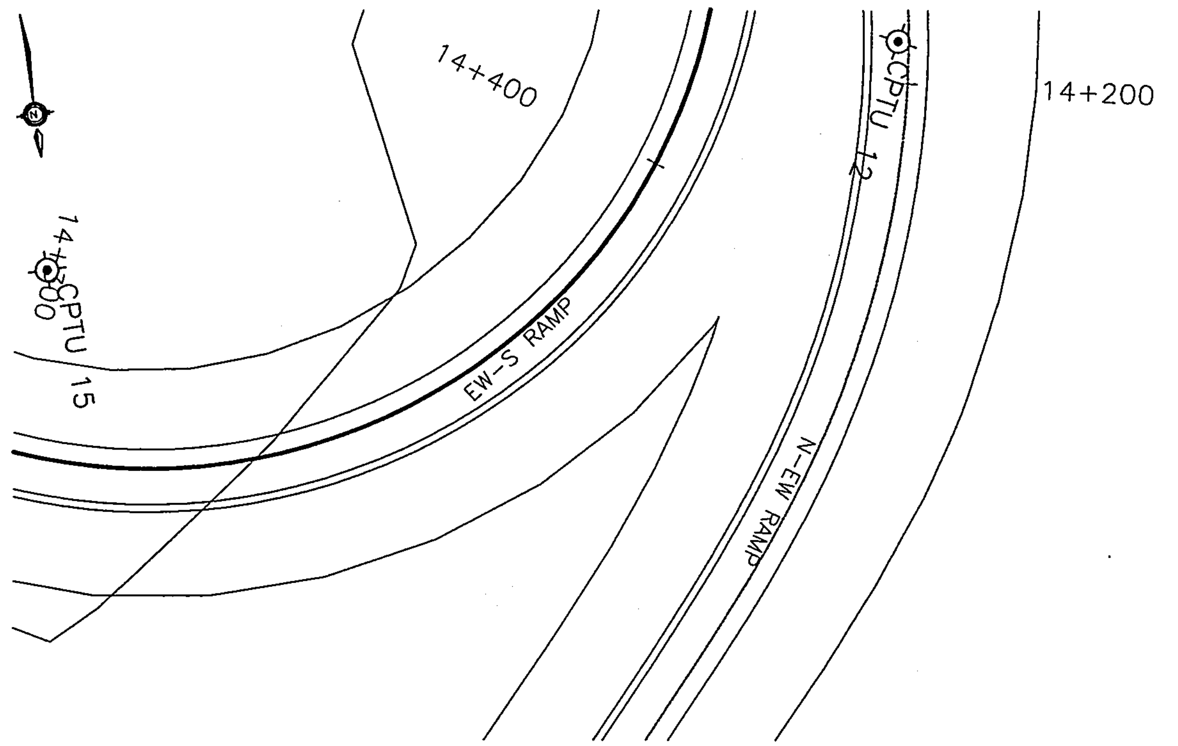
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU - Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

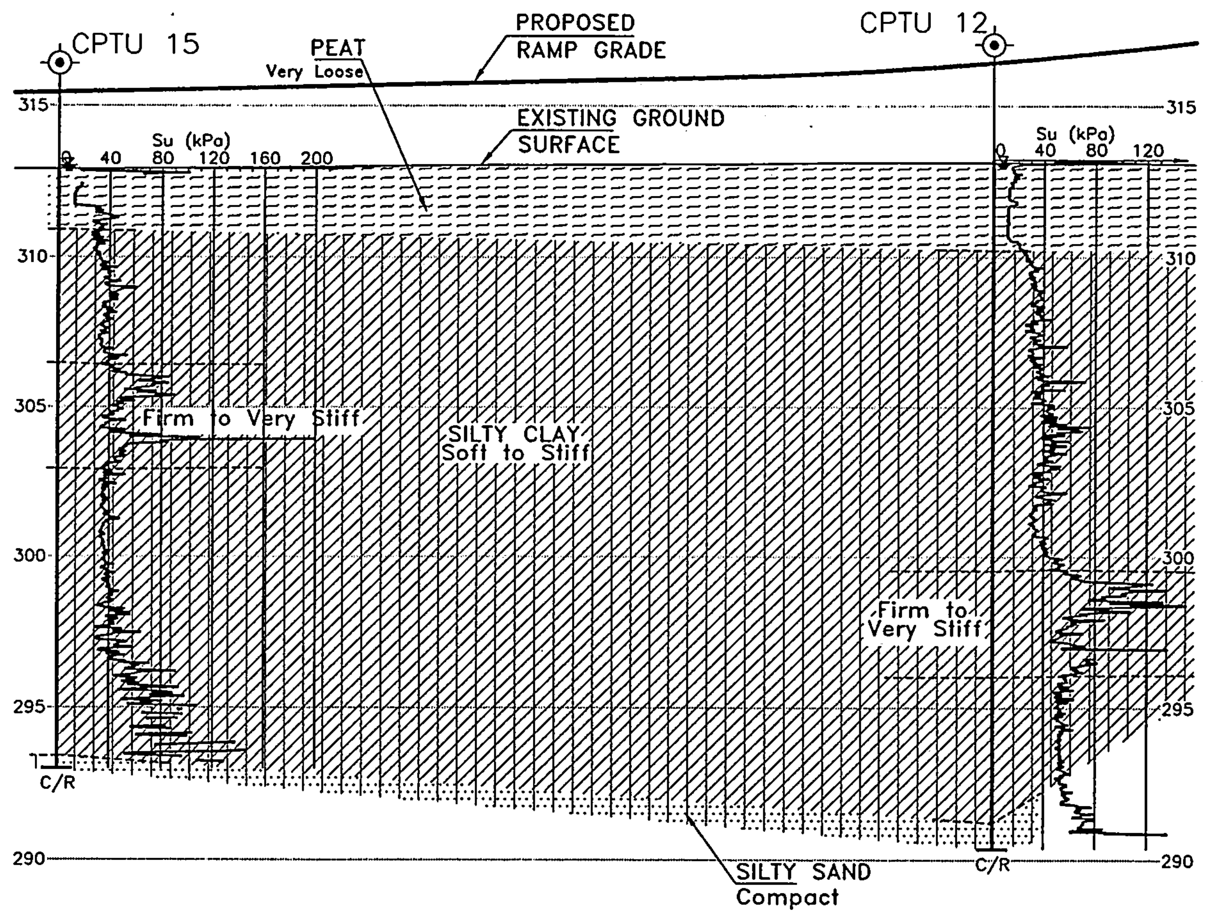
— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS			
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04	
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



PLAN



PROFILE OF EW–S RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRAUN
July 6/05
PROVINCE OF ONTARIO

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742–93–00

HWY 11 BURK'S FALLS – SOUTH RIVER
STRONG TOWNSHIP
EW–S RAMP CENTRELINE
STATION 14+300 TO 14+430
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Marshall
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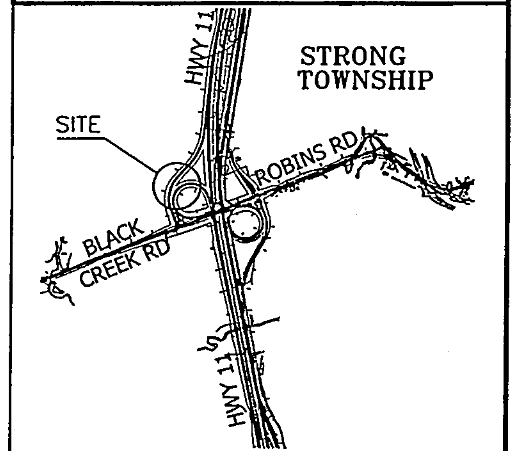
THURBER



KEYPLAN

LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —
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REVISIONS		
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC–04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

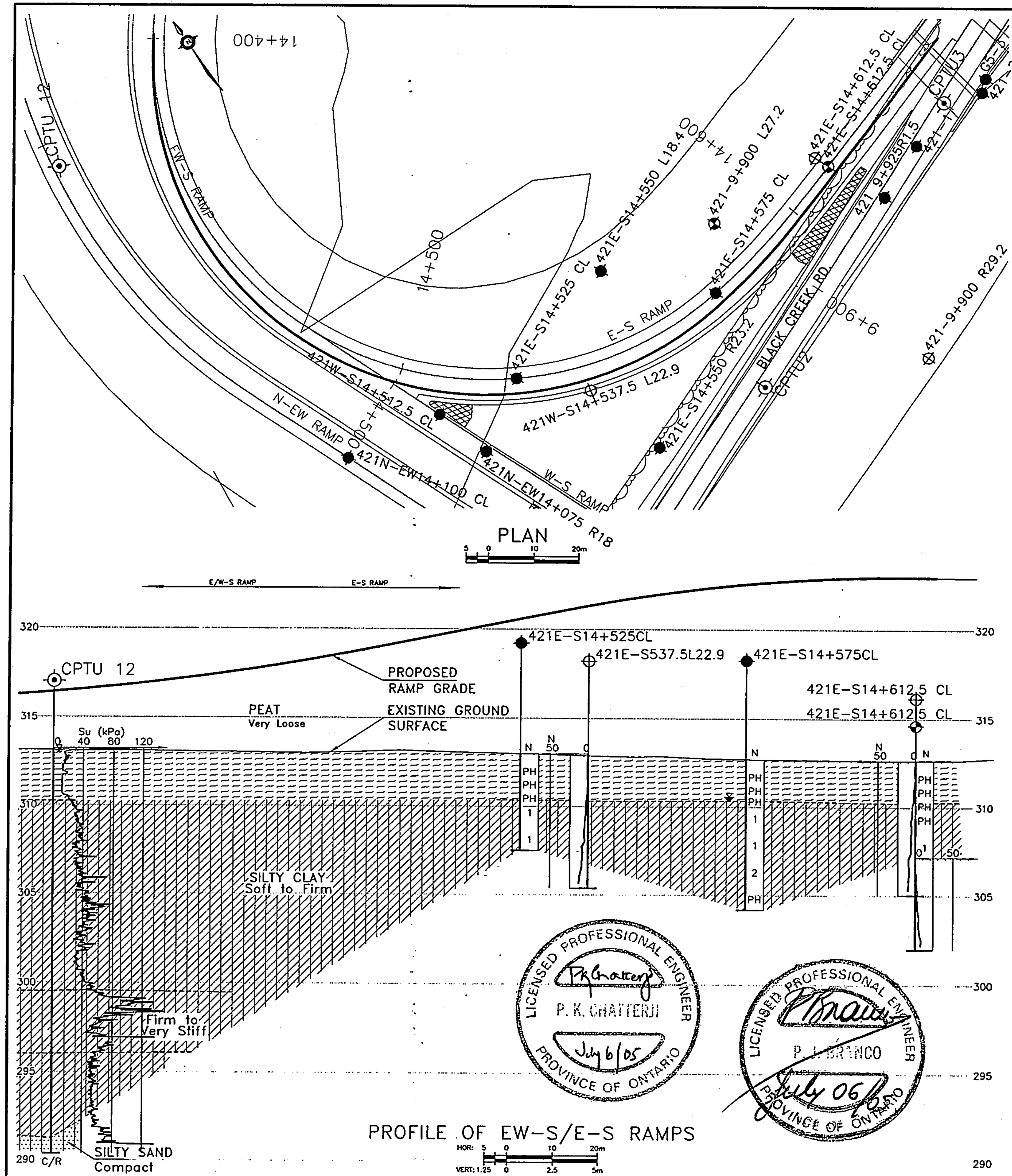
HWY 11
CONT No
WP No 742-93-00

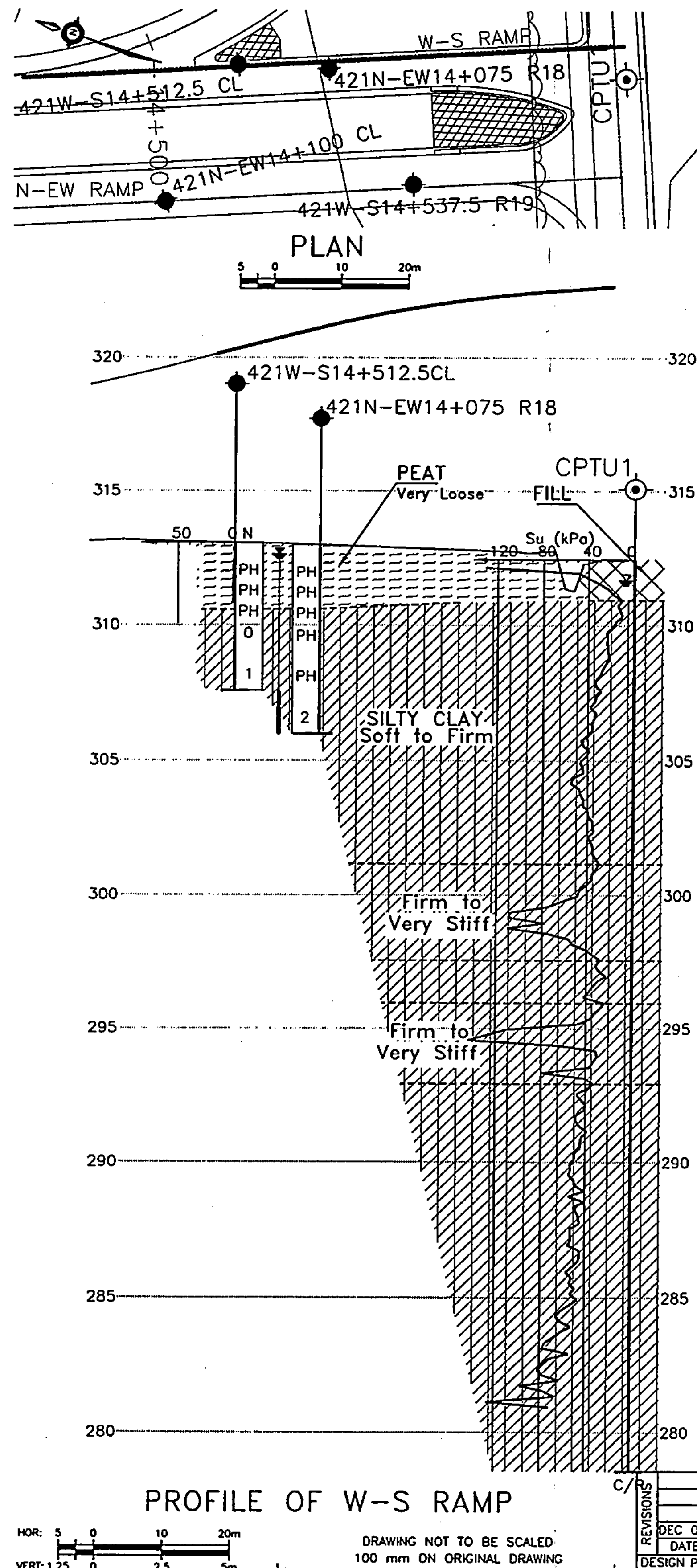
SHEET

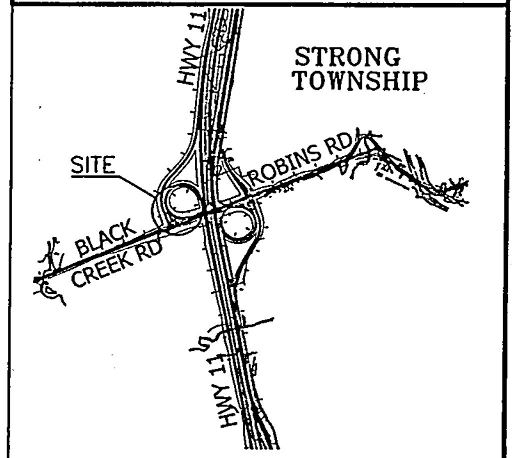
HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
EW-S AND W-S RAMPS CENTRELINE
STATION 14+430 TO 14+650
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.







KEYPLAN

LEGEND

Symbol	Description
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU - Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90% -	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

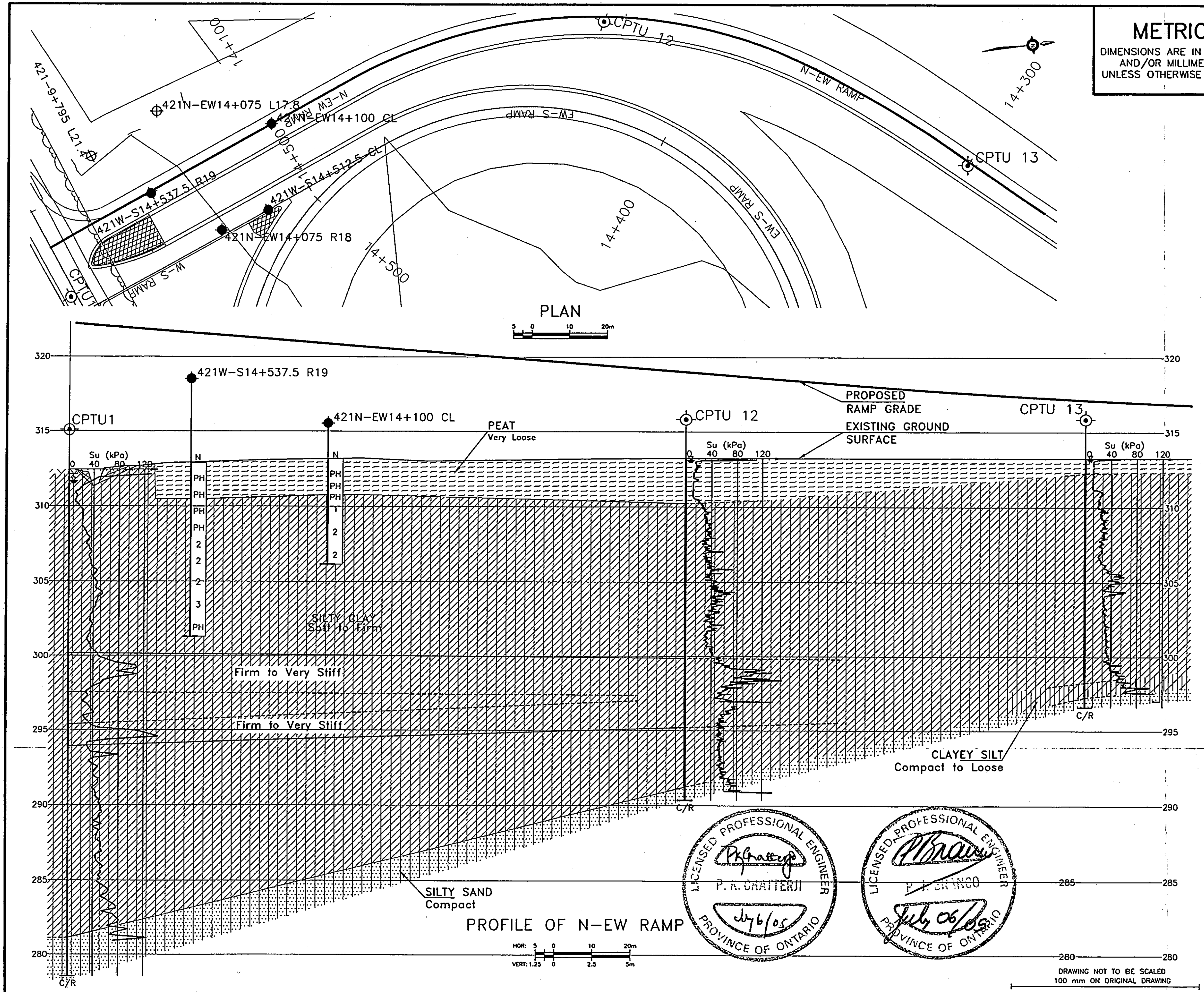
NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

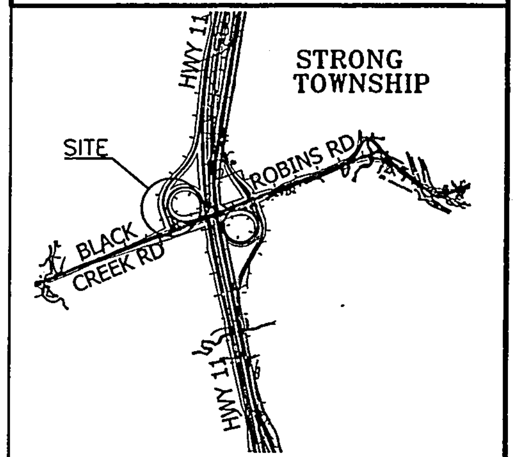
HWY 11
CONT No
WP No 742-93-00

SHEET

HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
N-EW RAMP CENTRELINE
STATION 14+030 TO 14+300
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
	DEC 04		ISSUED AS DRAFT FOR REVIEW

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

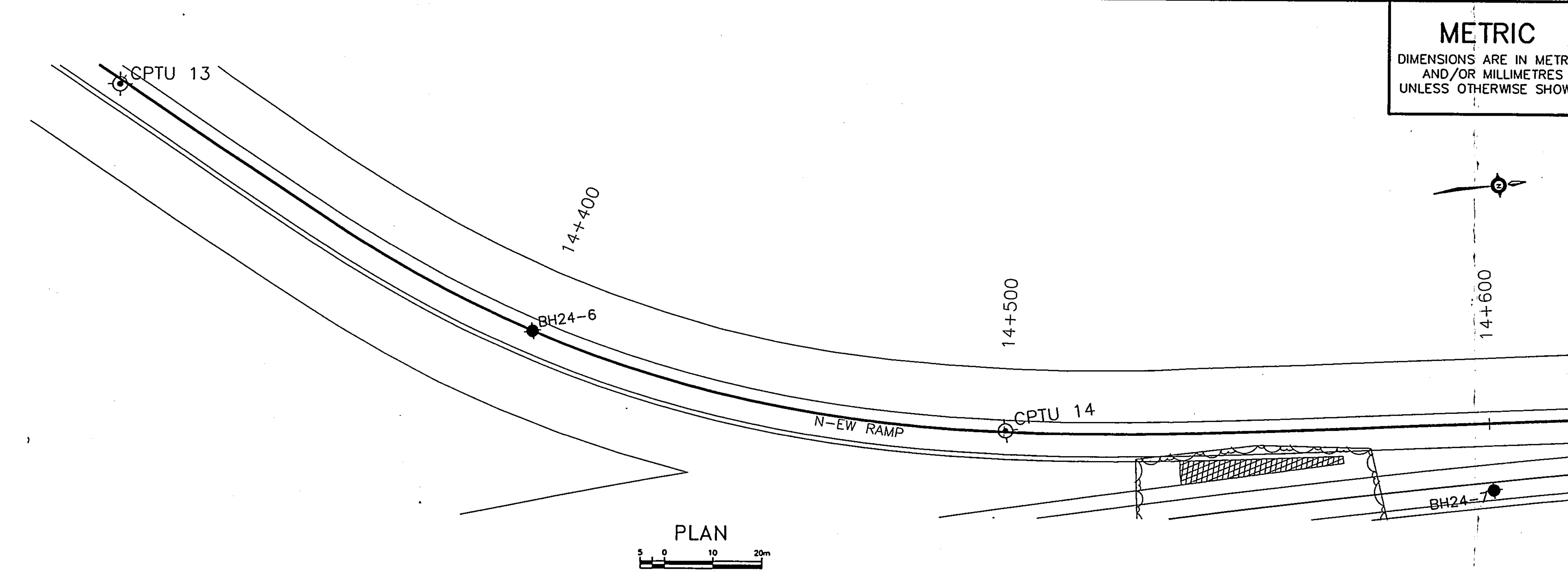
HWY 11
CONT No
WP No 742-93-00

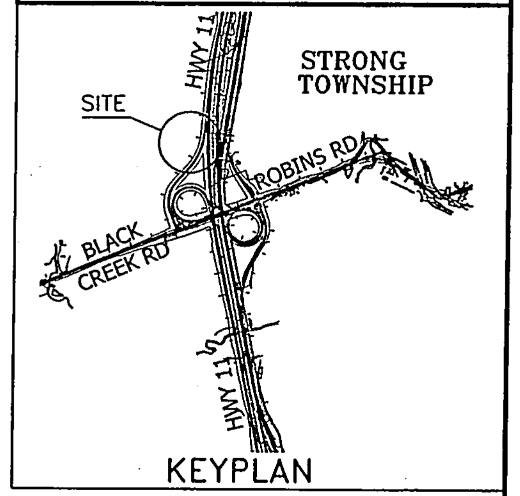
SHEET

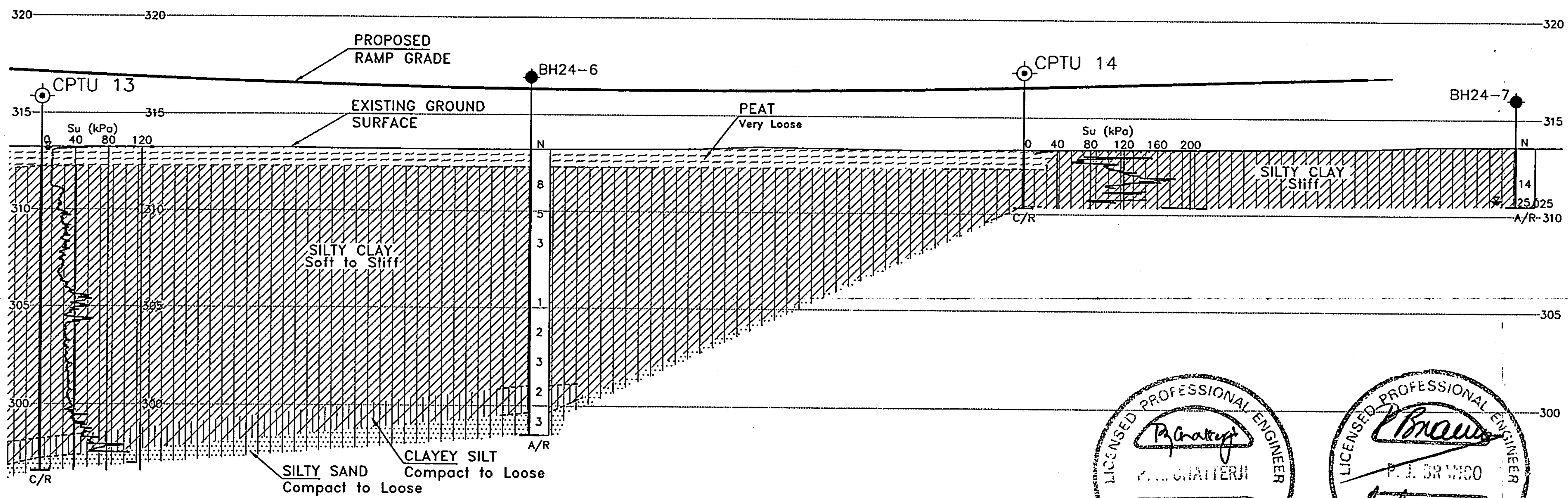
HWY 11 BURK'S FALLS – SOUTH RIVER
STRONG TOWNSHIP
N-EW RAMP CENTRELINE
STATION 14+300 TO 14+600
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.







PROFILE OF N-EW RAMP

HOR: 5 0 10 20m
VERT: 1.25 0 2.5 5m

LICENSED PROFESSIONAL ENGINEER
P. J. CHATTERJI
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
July 06/05
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

LEGEND

●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU – Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

– NOTE –

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS			
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	

DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04	
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

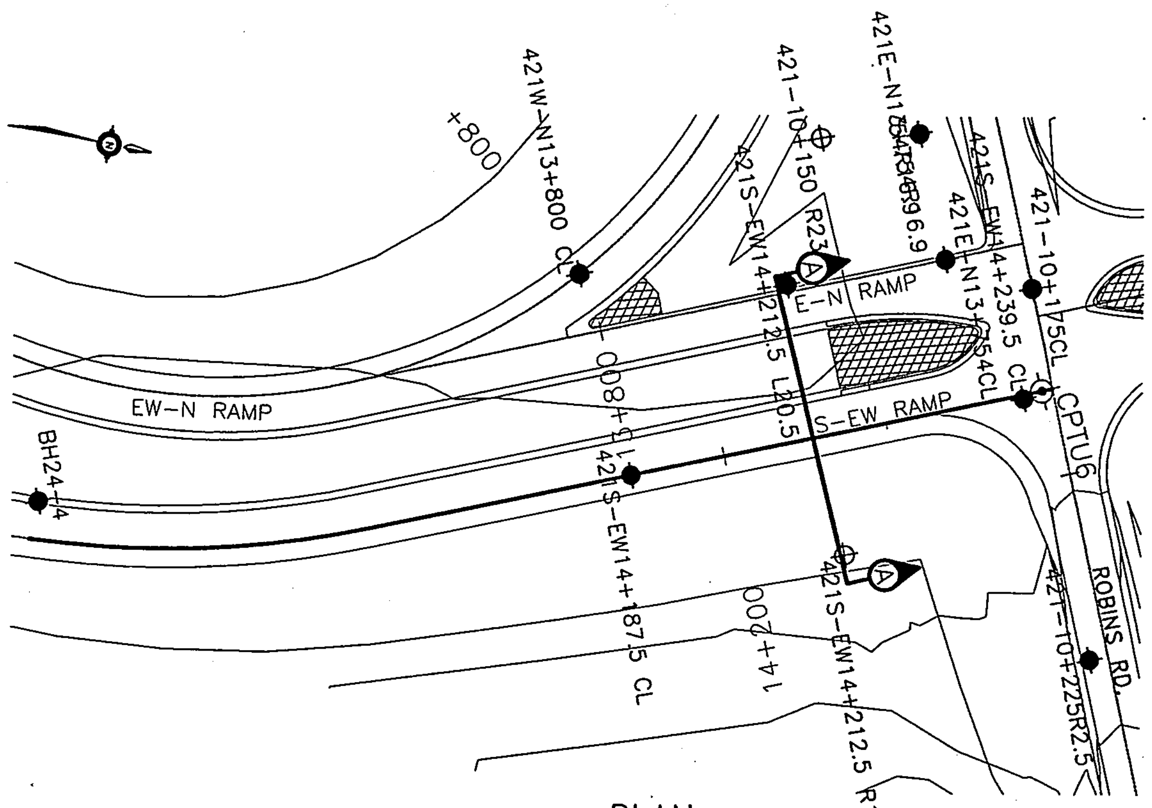
HWY 11
CONT No
WP No 742-93-00

SHEET

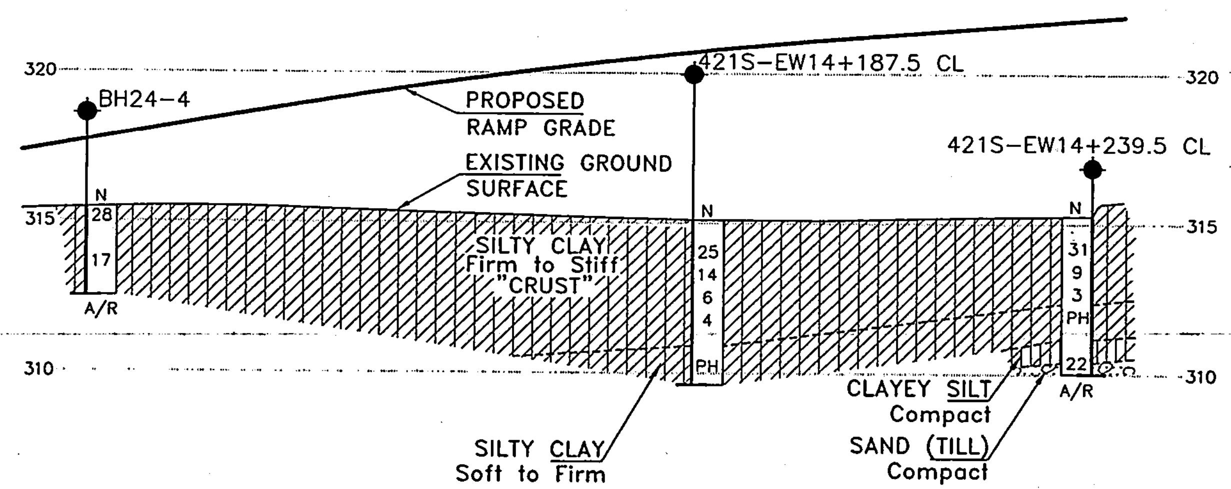
HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
S-EW RAMP CENTRELINE
STATION 14+100 TO 14+250
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

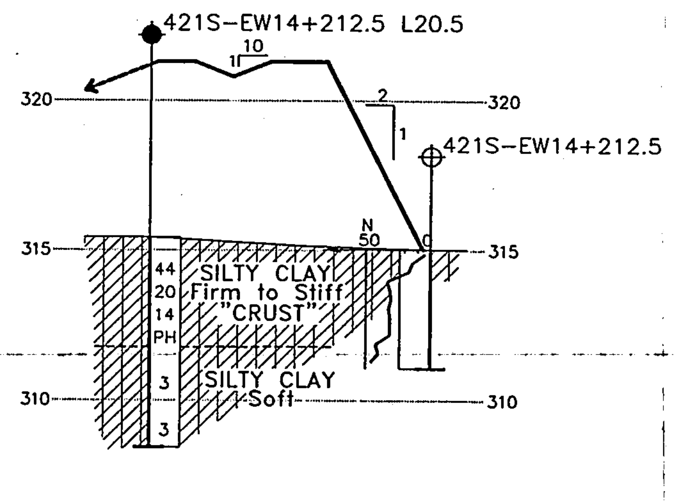
THURBER ENGINEERING LTD.



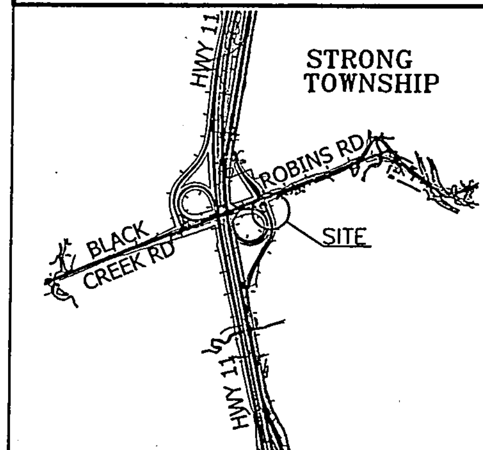
PLAN



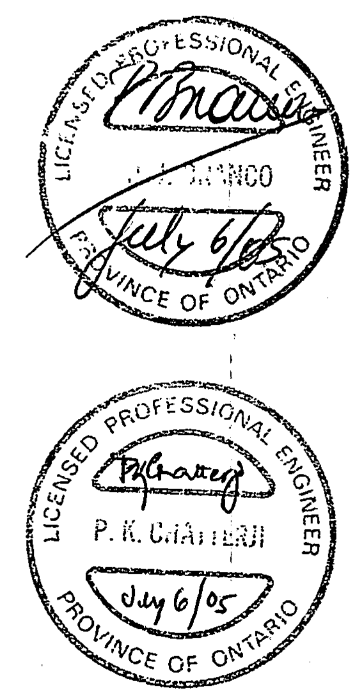
PROFILE OF S-EW RAMP



SECTION A-A



KEYPLAN



LEGEND

	Bore Hole
	Dynamic Cone Penetration Test (cone)
	Bore Hole & Cone
	CPTU - Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	WL in Piezometer at Time of Investigation (Date)
	Head Artesian Water
	Piezometer
	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

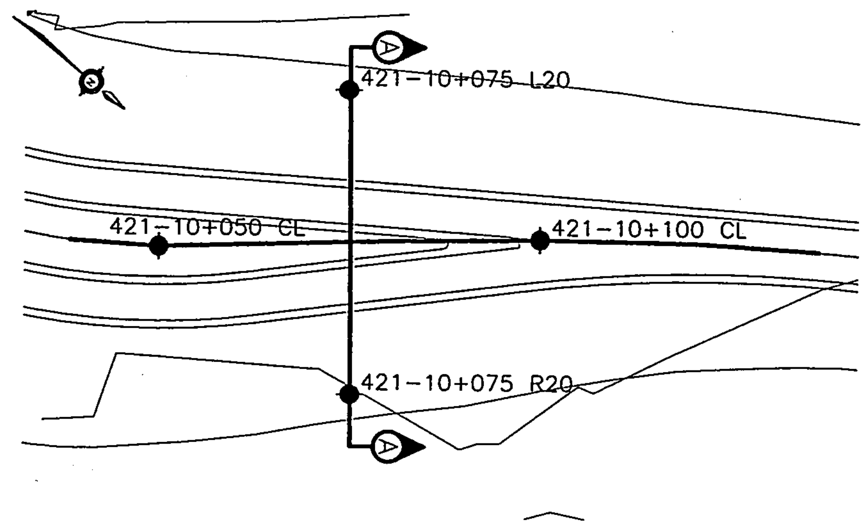
NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

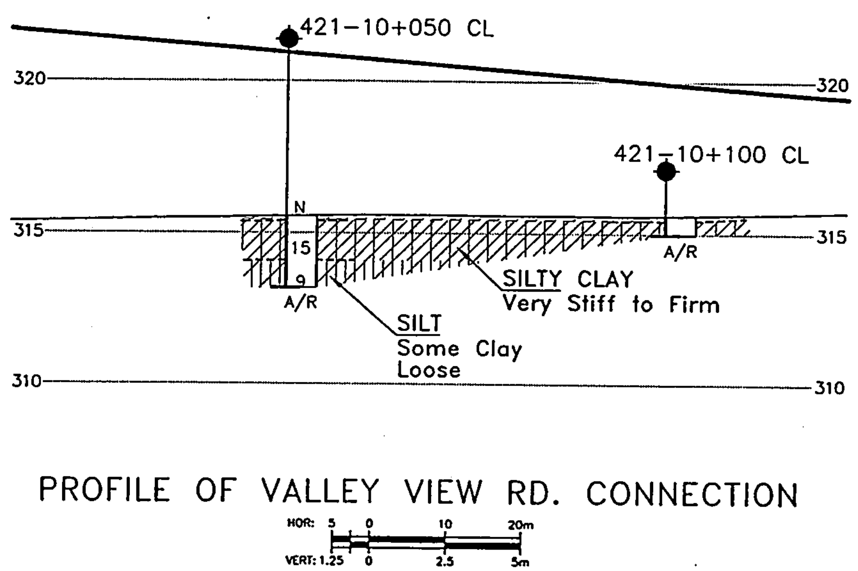
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		
DEC 04	BY	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION

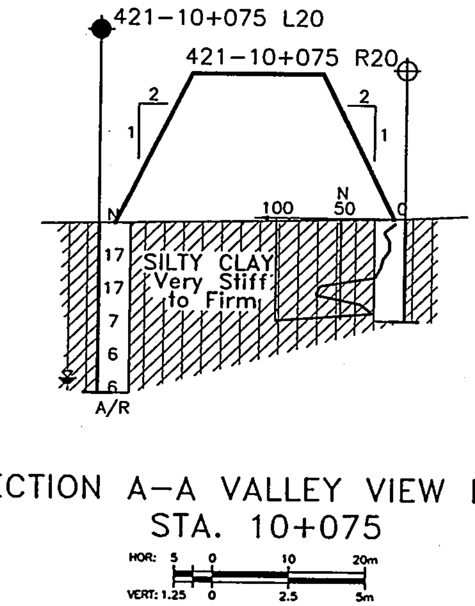
DESIGN PJB	CHK PJB	CODE	LOAD	DATE DEC-04	
DRAWN WRW	CHK	SITE	STRUCT	SCHEME	DWG



PLAN



PROFILE OF VALLEY VIEW RD. CONNECTION



CROSS SECTION A-A VALLEY VIEW RD. CONNECTION
STA. 10+075

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 742-93-00

SHEET

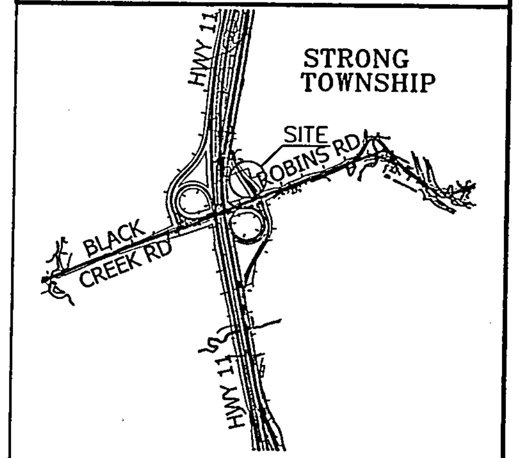
HWY 11 BURK'S FALLS - SOUTH RIVER
STRONG TOWNSHIP
VALLEY VIEW ROAD CONNECTION
STATION 10+025 TO 10+125
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
P. BRAUN
July 6/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
July 6/05
PROVINCE OF ONTARIO



KEYPLAN

	LEGEND
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone)
⊕	Bore Hole & Cone
⊙	CPTU - Piezocone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▼	WL in Piezometer at Time of Investigation (Date)
↑	Head Artesian Water
	Piezometer
▼	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	ELEVATION	STATION	OFFSET FROM MEDIAN CL

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
	DEC 04	BY	ISSUED AS DRAFT FOR REVIEW

DESIGN PJB | CHK PJB | CODE | LOAD | DATE DEC-04
DRAWN WRW | CHK | SITE | STRUCT | SCHEME | DWG

APPENDIX A

BOREHOLE LOGS

SYMBOLS

UNIFIED SOILS CLASSIFICATION SYSTEM

EXPLANATION OF ROCK LOGGIN TERMS

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT[1] 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

1) Laboratory Triaxial Testing
2) Field Insitu Vane Testing
3) Laboratory Vane Testing
4) SPT value
5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE

SS Split Spoon Sample
WS Wash Sample
AS Auger (Grab) Sample
TW Thin Wall Shelby Tube Sample
TP Thin Wall Piston Sample
PH Sampler Advanced by Hydraulic Pressure
PM Sampler Advanced by Manual Pressure
WH Sampler Advanced by Self Static Weight
RC Rock Core
SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

▽ Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

(1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.

(2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

SYMBOLS

CLAYSTONE

SILTSTONE

SANDSTONE

GRANITIC GNEISS

BENTONITE

DISCONTINUITY SPACING

Bedding	**Bedding Plane Spacing**
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

STRENGTH CLASSIFICATION

Rock Strength	**Approximate Uniaxial Compressive Strength** (MPa)	(psi)	**Field Estimation of Hardness***
Extremely Strong	Greater than 200	Greater than 29,200	Requires many blows of geological hammer to break.
Very Strong	100-200	14,600 to 29,200	Requires a few blows of geological hammer to break.
Strong	50-100	7,300 to 14,600	Breaks under single blow of geological hammer.
Moderately Strong	12.5 to 50.0	1,825 to 7,300	¼" indentations with sharp end of geological pick.
Moderately Weak	5.0 to 12.5	730 to 1,825	Too hard to cut by hand into triaxial specimen.
Weak	1.25 to 5.0	182 to 730	Crumbles under firm blows of geological pick.
Very Weak (Rock)	0.60 to 1.25	85 to 182	May be broken in the hand with difficulty.

THURBER

ROBINS ROAD/BERNARD CREEK BRIDGE AND APPROACHES

(ALL BOREHOLES EXCEPT BH24-3)

Ministry of Transportation Ontario

RECORD OF BOREHOLE No BH 421-1

METRIC

G.W.P. 742-93-00	LOCATION N 5 063 057.3 E 309 281.8 (Robins Road)	ORIGINATED BY DP
HWY 11	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY SS
DATUM Geodetic	DATE 25.03.03 - 25.03.03	CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	GR	SA	SI	CL
312.6 / 0.0	**SAND and GRAVEL** Brown (FILL)										
312.0 / 0.6	**PEAT**				312		225				
311.9 / 0.7	Silty **CLAY**, trace fine sand, trace organics Very Soft to Firm Grey										
		1	SS	4/ .228	311						
		2	SS	2	310			0	0	67	33
	occasional laminations	3	SS	1	309	+3					
		4	SS	1	308						
		5	SS	0	307 / 306	+3					
305.6 / 7.1	END OF BOREHOLE AT 7.06 m.										

+3, ×3: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-2

METRIC

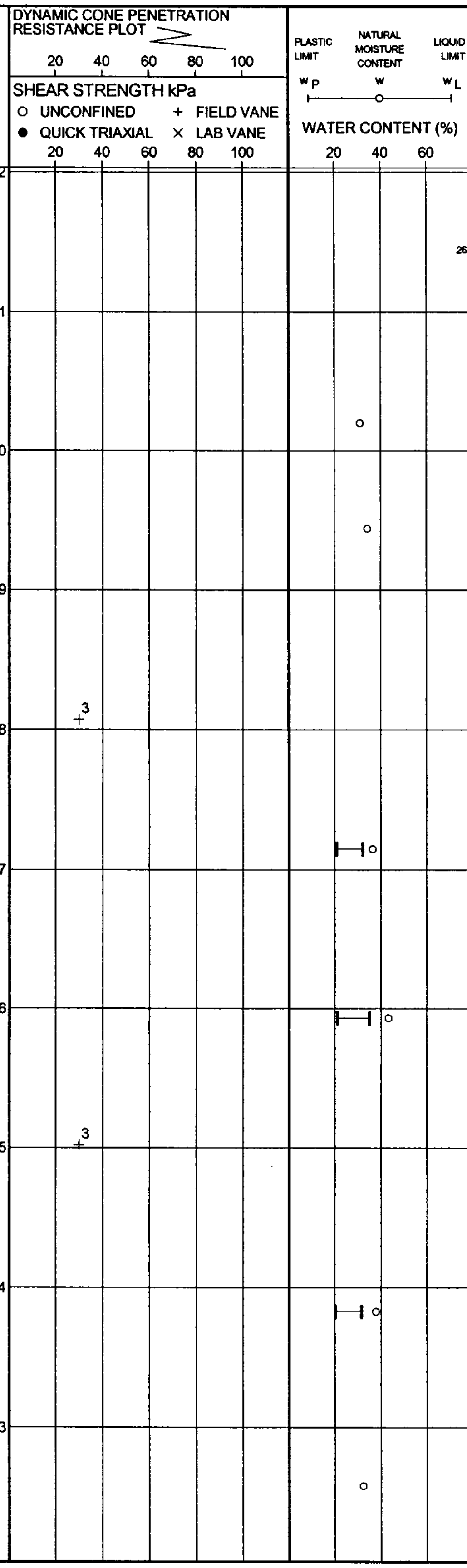
W.P. 742-93-00	LOCATION N 5 063 054.0 E 309 302.1 (Robins Road)		ORIGINATED BY DP
HWY 11	BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary /NQ Core Barrel		COMPILED BY SS
DATUM Geodetic	DATE 26.03.03 - 27.03.03		CHECKED BY JL

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
312.0 / 0.0	**SAND and GRAVEL** Brown (FILL)
311.4 / 0.6	**PEAT**
311.3 / 0.7	Silty **CLAY**, trace fine sand, trace organics Very Soft to Firm Grey
302.0	

SAMPLES

NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	5		
2	SS	3		0 4 64 31
1	TW	PH		
3	SS	1/ .203		
				0 0 68 32
2	TW	PH	17.7	oedometer test: e0=1.179, P'=120KPa, Cc=0.38, Cr=0.06, G=2.75
4	SS	1/ .203		0 3 60 37
5	SS	4		



Continued Next Page

+ ³, × ³ : Numbers refer to Sensitivity

20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 11/02/05 s

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BH 421-2

METRIC

G.W.P.	742-93-00	LOCATION	N 5 063 054.0 E 309 302.1 (Robins Road)	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers/Tri-cone Mud Rotary /NQ Core Barrel	COMPILED BY	SS
DATUM	Geodetic	DATE	26.03.03 - 27.03.03	CHECKED BY	JL

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	GR	SA	SI	CL
10.0	Silty **CLAY** to clayey **SILT**, trace fine sand Firm Grey				302						
		3	TW	PH	301		Wp–WL plotted	0	2	68	30
						+ 3 (field vane)					
		6	SS	8	300		Wp–w	0	1	77	23
299.4 / 12.7	Varved Soft to Firm from 12.7m to 17.2m depth				299						
		7	SS	3/ .203			o				
					298						
		8	SS	4	297		o				
					296						
		9	SS	4			o				
294.8 / 17.2	Stiff to Very Stiff				295						
		10	SS	15	294		o				
293.5 / 18.5	Gravelly **SAND**, medium to coarse grained, occ. cobbles and boulders Dense to Very Dense Brown Wet				293		o				
		1	GS				o				
		11	SS	38			o				

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

+ ³, × ³ : Numbers refer to Sensitivity

15 ⊕ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-2

METRIC

G.W.P.	742-93-00	LOCATION	N 5 063 054.0 E 309 302.1 (Robins Road)	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers/Tri-cone Mud Rotary /NQ Core Barrel	COMPILED BY	SS
DATUM	Geodetic	DATE	26.03.03 - 27.03.03	CHECKED BY	JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%)
	Cobble from 20.6m to 20.8m				292		
					291		
	Cobble from 21.9m to 22.1m				290		
		12	SS	100/ .150		o (~20)	
					289		
	Boulder from 24m to 24.3m	13	SS	50/ .000	288		
287.5	Boulder from 24.3m to 24.5m	1	RUN				
24.5	**BEDROCK** Fresh, white and black, strong to very strong GRANITIC GNEISS				287		
	TCR=100%, SCR=100%, RQD=100%, FI=0 Unconfined Compressive Strength: MIN: 109MPa, MAX: 146MPa, AVERAGE: 121MPa	2	RUN		286		
	TCR=100%, SCR=100%, RQD=100%, FI=0 Unconfined Compressive Strength: MIN: 84MPa, MAX: 162MPa, AVERAGE: 111MPa	3	RUN		285		
284.5							
27.6	END OF BORE HOLE AT 27.58m. LOST CIRCULATION DURING DRILLING BELOW 18.5m DEPTH.						

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+3, ×3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BH 421-3

METRIC

G.W.P. 742-93-00 LOCATION N 5 063 062.6 E 309 342.6 (Robins Road) ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary /NQ Core Barrel COMPILED BY SS

DATUM Geodetic DATE 27.03.03 - 29.03.03 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	GR	SA	SI	CL
312.4											
312.3 / 0.0	**TOPSOIL**										
0.1	Silty **CLAY**, trace fine sand Firm to stiff Grey				312						
		1	SS	13			o				
					311						
		2	SS	16			o	0	2	74	24
					310						
		3	SS	6			├o (wP–w)				
		1	TW	PH	309						
						+ 7 (field vane)					
					308						
		4	SS	6			o				
					307						
306.7 5.6	Light varving from 5.6m to 14.8m depth Very Soft to Firm Wet										
		5	SS	1	306		o	0	0	51	49
					305						
		2	TW	PH							
					304	NA					
		6	SS	1	303		o				

Continued Next Page

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-3

METRIC

G.W.P. 742-93-00 | LOCATION N 5 063 062.6 E 309 342.6 (Robins Road) | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary /NQ Core Barrel | COMPILED BY SS

DATUM Geodetic | DATE 27.03.03 - 29.03.03 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
					302			
		7	SS	1			~47	0 0 51 49
					301			
		3	TW	PH	300			
						+ 2.6 (~64, field vane)		
					299			
		8	SS	1			~39	
					298			
		9	SS	1	297		~35	
296.1 / 16.3	some fine to very fine sand Stiff				296			
		10	SS	14			~36	
295.2 / 17.2	Gravelly **SAND** , fine to coarse grained, occ. cobbles and boulders Dense to Very Dense Brown Wet				295		~9	
					294			
		11	SS	33			~14	
					293			

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-3

METRIC

G.W.P. 742-93-00 | LOCATION N 5 063 062.6 E 309 342.6 (Robins Road) | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary /NQ Core Barrel | COMPILED BY SS

DATUM Geodetic | DATE 27.03.03 - 29.03.03 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)
		12	SS	48	292	o (~15)
					291	
	Boulder from 21.6m to 22.5m	13	SS	100/ .076		o (~12)
					290	
		1	GS		289	
		14	SS	100/ .000	288	
287.1 / 25.3	**BEDROCK** Slightly weathered, white and black, very strong GRANITIC GNEISS TCR=100%, SCR=100%, RQD=100%, FI=0	1	RUN		287	
	TCR=98%, SCR=97.5%, RQD=97.5%, FI=1 Unconfined Compressive Strength: MIN: 116MPa, MAX: 188MPa, AVERAGE: 153MPa	2	RUN		286, 285	
283.4 / 29.0	TCR=100%, SCR=100%, RQD=97%, FI=1 Unconfined Compressive Strength: MIN: 143MPa, MAX: 175MPa, AVERAGE: 154MPa	3	RUN		284	
	END OF BOREHOLE AT 29.0m.					

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ◆ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No BH 421-4

METRIC

G.W.P. 742-93-00 | LOCATION N 5 063 078.3 E 309 388.1 (Robins Road) | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary | COMPILED BY SS

DATUM Geodetic | DATE 20.03.03 - 25.03.03 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
313.2								
313.0 / 0.1	**TOPSOIL**				313			
	Brown Silty **CLAY**, trace sand Very Stiff to Frim Brown (CL)				312			
	Frozen	1	SS	28				0 3 77 20
					311			
		2	SS	7	310			0 2 65 33
309.1 / 4.1	Grey				309			
		3	SS	8	308			0 1 74 26
	Soft to Stiff				307			
		1	TW	PH			17.7	0 1 53 46
					306			oedometer test: e0=1.107, P'=120KPa, Cc=0.30, Cr=0.055, G=2.75
		4	SS	2	305			
		5	SS	1	304			0 0 42 58

Field vane plot value near elev. 306: 2.75

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity | 20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-4

METRIC

G.W.P. 742-93-00 LOCATION N 5 063 078.3 E 309 388.1 (Robins Road) ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary COMPILED BY SS

DATUM Geodetic DATE 20.03.03 - 25.03.03 CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
					303		
		2	TW	PH			0 0 66 34
					302		
					301		
		6	SS	2			
					300		
	some fine sand						
		7	SS	1			
					299		
					298		
		3	TW	PH			
296.9					297		
16.3	Gravelly **SAND**, fine to coarse grained, occ. cobbles and boulders Compact to very dense Brown Wet (SP)						
		8	SS	16			4 88
					296		
		9	SS	65	295		
	Boulder from 18.4m to 19.1m						
					294		
		1	GS				
	Cobble from 19.3m to 19.4m	2	GS				
		10	SS	66/ .152			

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100 — shear strength value 2 plotted near 301.7

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity   20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-4

METRIC

G.W.P. 742-93-00 | LOCATION N 5 063 078.3 E 309 388.1 (Robins Road) | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers/Tri-cone Mud Rotary | COMPILED BY SS

DATUM Geodetic | DATE 20.03.03 - 25.03.03 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
					293
		3	GS		
	Boulder from 21.1m to 21.6m	11	SS	100/ .102	292
		4	GS		
					291
		12	SS	100/ .076	
					290
		5	GS		
289.3		~~13~~	~~SS~~	~~100/~~ .000	
23.9	END OF BOREHOLE AT 23.93m.				

SOIL PROFILE; SAMPLES; STRAT PLOT; GROUND WATER CONDITIONS; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+ ³, × ³: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No BH 421-5

METRIC

G.W.P. 742-93-00 | LOCATION N 5 063 094.9 E 309 403.4 (Robins Road) | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 25.03.03 - 25.03.03 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa (field vane, sensitivity)	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
314.0							314				
0.0	**SAND and GRAVEL** Brown (FILL)										
313.5 / 0.5	Silty **CLAY**, trace fine sand Very Stiff to Stiff Grey						313				
			1	SS	24		312		o		
			2	SS	10		311		o		
							310	+ 2.5			
			3	SS	16		309		o		
								+ 3.5			
308.4 / 5.6	trace to some fine sand Firm						308				
			4	SS	6				o		
307.3 / 6.7	END OF BOREHOLE AT 6.71 m.										

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 9+795 L21.4

METRIC

G.W.P. 742-93-00 LOCATION 421 Black Creek Rd, ST. 9+795, O/S 21.4L & 421 N-EW ST. 14+052, O/S 4R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 20.11.02 - 20.11.02 CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	DCPT from surface.										
8.5	END OF DCPT AT 8.53m.										

+³, ×³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 9+800 R24.2

METRIC

G.W.P. 742-93-00 LOCATION 421 Black Creek Road, ST. 9+800, O/S 24.2R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 22.11.02 - 22.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	NOTES
0.0	**TOPSOIL** with organics				
0.2	**PEAT**, fibrous, some organics and rootlets Dark Brown to Black Wet	1	TW	PH	Unit weight: 19
		2	TW	PH	Unit weight: 26
1.9	Silty **CLAY**, trace sand Firm Grey Wet	1	SS	2	
		3	TW	PH	
					Field vane, sensitivity 0
		2	SS	1	
					Field vane, sensitivity 0
		4	TW	PH	
7.0	END OF BOREHOLE AT 7.01m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 20/06/03 -0.09 15/08/03 -0.10				

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 9+900 L27.2

METRIC

W.P. 742-93-00 LOCATION 421 Black Creek Road, ST. 9+900, O/S 27.2L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 21.11.02 - 21.11.02 CHECKED BY JL

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	NATURAL MOISTURE CONTENT (%)	SHEAR STRENGTH (kPa)	GR	SA	SI	CL
0.0	**PEAT**, fibrous, some organics Dark Brown to Black Wet									
		1	TW	PH	674					
		2	TW	PH	199					
		3	TW	PH	194					
2.7	Silty **CLAY**, trace sand, laminated Soft Grey						0	0	67	33
		1	SS	1						
						+ 0				
		2	SS	1			0	0	64	36
						+ 0				
6.1	END OF SAMPLING AT 6.1 m. DCPT started at 6.1 m.									

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 9+900 L27.2

METRIC

G.W.P. 742-93-00 LOCATION 421 Black Creek Road, ST. 9+900, O/S 27.2L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 21.11.02 - 21.11.02 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
10.7	END OF DCPT AT 10.67 m. BOREHOLE OPEN ON TO 10.67 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 9+900 R29.2

METRIC

G.W.P.	742-93-00	LOCATION	421 Black Creek Road, ST. 9+900, O/S 29.2R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	SS
DATUM	Geodetic	DATE	22.11.02 - 22.11.02	CHECKED BY	JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 9+900 R29.2 METRIC

G.W.P. 742-93-00 LOCATION 421 Black Creek Road, ST. 9+900, O/S 29.2R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 22.11.02 - 22.11.02 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
10.7	END OF DCPT AT 10.67m.										

+ ³, × ³: Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 9+925 R1.5 — 1 OF 3 — METRIC

W.P. 742-93-00 | LOCATION 421 Black Creek Road, ST. 9+925, O/S 1.5R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 25.07.03 - 25.07.03 | CHECKED BY JL

ELEV / DEPTH (m)	DESCRIPTION
312.6 / 0.0	**SAND and GRAVEL** (FILL)
312.0 / 0.6	**PEAT**, fibrous, some wood; Dark Brown to Black; Moist
311.7 / 0.9	Silty **CLAY**, trace sand; Soft; Grey; Wet

SAMPLE NUMBER	TYPE	"N" VALUES
1	GS	
1	SS	2
2	SS	2
3	SS	1
4	SS	1
5	SS	1

Shear strength plot values (field vane, sensitivity): 4.7, 4.8, 2.9, 1.8, 2.27

Water content: 124 (sample 1 GS)

REMARKS & GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
Sample 3	0	2	64	34
Sample 5	0	2	70	28

Column headings: SOIL PROFILE; SAMPLES (NUMBER, TYPE, "N" VALUES); STRAT PLOT; GROUND WATER CONDITIONS; ELEVATION SCALE (312–303); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60); UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 9+925 R1.5

METRIC

G.W.P. 742-93-00 LOCATION 421 Black Creek Road, ST. 9+925, O/S 1.5R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 25.07.03 - 25.07.03 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
302.5 10.1	END OF SAMPLING AT 10.1 m.							+ 1.72			
							302				
							301				
							300				
							299				
							298				
							297				
							296				
							295				
							294				
							293				

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 9+925 R1.5

METRIC

G.W.P.	742-93-00	LOCATION	421 Black Creek Road, ST. 9+925, O/S 1.5R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	25.07.03 - 25.07.03	CHECKED BY	JL

SOIL PROFILE: ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
							292				
							291				
							290				
							289				
288.2 24.4	END OF BOREHOLE AT 24.36 m. AUGER REFUSAL AT 24.36 m ON PROBABLE BEDROCK OR BOULDER. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 07/31/2003 0.2										

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

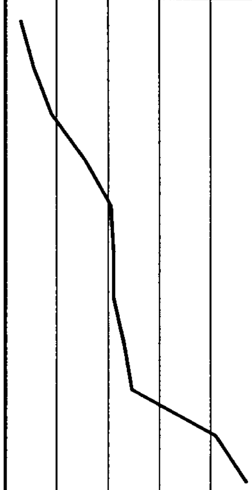
RECORD OF BOREHOLE No 421 10+050 L26.9

METRIC

G.W.P. 742-93-00 | LOCATION 421 Robins Road, ST. 10+050, O/S 26.9L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY SS

DATUM Geodetic | DATE 15.11.02 - 15.11.02 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	DCPT from surface.										
3.4	END OF DCPT AT 3.35m. CONE REFUSAL AT 3.35 m.										

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 10+050 R34.5

METRIC

G.W.P. 742-93-00 | LOCATION 421 Robins Road, ST. 10+050, O/S 34.5R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 14.11.02 - 14.11.02 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL**					
0.2	**SAND**, some silt Compact Brown Moist	1	SS	22		
1.1	Silty **CLAY**, occasional iron oxide staining, laminated Very Stiff to Firm Grey	2	SS	18		0 2 70 29
		3	SS	13		
		4	SS	9		
		5	SS	11		0 1 72 26
		6	SS	5		
		7	SS	2		
8.5	END OF BOREHOLE AT 8.53 m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100

Field vane readings: 3.7, 4

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m^3

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 10+075 L7

METRIC

G.W.P.	742-93-00	LOCATION	421 Robins Road, ST. 10+075, O/S 7L	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	18.11.02 - 18.11.02	CHECKED BY	JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa	WATER CONTENT (%)	GR	SA	SI	CL
0.0	**TOPSOIL** with organics and rootlets									
0.2	Silty **CLAY**, trace sand Very Stiff to Stiff Brown	1	SS	24			0	2	69	29
1.5	Silt and clay laminations	2	SS	15						
		3	SS	13						
		4	SS	23						
4.1	Very Stiff to Firm Grey	5	SS	6			0	1	55	45
					+ 7.33					
		6	SS	3						
					+ 8.5					
		1	TW	PH						
					+ 3					
8.5	END OF BOREHOLE AT 8.53 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 20/06/03 0.32 15/08/03 1.34									

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 10+125 L8

METRIC

G.W.P. 742-93-00	LOCATION 421 Robins Road, ST. 10+125, O/S 8L	ORIGINATED BY DP
HWY 11	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY SS
DATUM Geodetic	DATE 18.11.02 - 18.11.02	CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	SHEAR STRENGTH kPa (FIELD VANE)	WATER CONTENT (%)	GR	SA	SI	CL
0.0	**TOPSOIL** with organics										
0.2	Silty **CLAY** Very Stiff Brown										
		1	SS	29							
		2	SS	22				0	1	74	25
2.2	Silty **CLAY**, trace sand, occasional silt and clay lamination Stiff to Firm Brown	3	SS	8							
		4	SS	5							
						+ 9					
		5	SS	2				0	0	52	47
						+ 9					
		6	SS	3							
					∇	+					
7.2	Gravelly **SAND**, trace silt	7	SS	50/ .150							
7.3	END OF BOREHOLE AT 7.32 m. AUGER REFUSAL AT 7.32 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 7.01 m AND WATER LEVEL AT 7.01 m UPON COMPLETION.. WATER LEVEL AT 7.01m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+³, ×³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 10+150 L23.2 1 OF 1 METRIC

G.W.P. 742-93-00 LOCATION 421 Robins Road, ST. 10+150, O/S 23.2L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 15.11.02 - 15.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa (FIELD VANE, sensitivity)	WATER CONTENT (%)	GR	SA	SI	CL
0.0	TOPSOIL with organics									
0.2	Silty CLAY Very Stiff to Firm Brown to Grey									
		1	SS	30						
		2	SS	14			0	1	50	49
		3	SS	5						
		4	SS	2			0	1	53	46
					+ 5					
		5	SS	2						
					+ 3.5					
5.6	SAND AND GRAVEL	1	GS							
5.8	END OF BOREHOLE AT 5.79 m. AUGER REFUSAL AT 5.79 m ON PROBABLE BEDROCK OR BOULDER.									

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

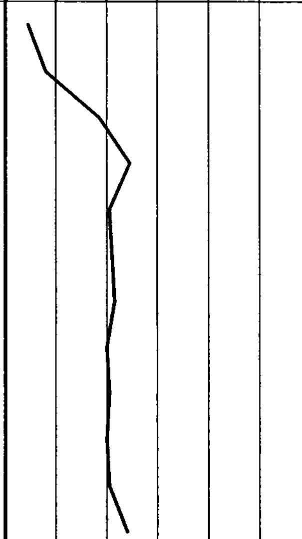
Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 10+150 R23

METRIC

G.W.P.	742-93-00	LOCATION	421 Robins Road, ST. 10+150, O/S 23R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test	COMPILED BY	SS
DATUM	Geodetic	DATE	13.11.02 - 13.11.02	CHECKED BY	JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
3.7	END OF DCPT AT 3.66m.										

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4 421ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 10+175 CL

METRIC

G.W.P. 742-93-00 | LOCATION 421 Robins Road, ST. 10+175, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 19.11.02 - 19.11.02 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	WATER CONTENT (%)	GR	SA	SI	CL
0.0	TOPSOIL with organics									
0.1	Silty CLAY, Very Stiff to Stiff, Brown	1	GS		∇					
		1	SS	22		~25				
		2	SS	12		~32				
2.2	Clayey SILT, trace sand, trace organics, Firm, Brown	3	SS	6		~22	0	6	72	21
3.0	GRAVEL	4	SS	14		~18				
3.4	END OF BOREHOLE AT 3.35 m. AUGER REFUSAL AT 3.35 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.30 m AND WATER LEVEL AT 0.30 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.									

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4 421 ROBINS & BLACK CREEK.GPJ 30/01/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 10+225 R2.5 — 1 OF 1 — METRIC

W.P. 742-93-00 | LOCATION 421 Robins Road, ST. 10+225, O/S 2.5R | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 23.07.03 - 23.07.03 | CHECKED BY JL

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa (FIELD VANE +)	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
317.2 / 0.0	**SAND and GRAVEL** (FILL)						317							
316.6 / 0.6	Silty **CLAY**, trace sand, varved Stiff Grey		1	SS	9		316							
			2	SS	9		315							
			3	SS	3		314				0	1	83	16
							313	5.4 +; 3.4 +						
			4	SS	4	∇	312				0	2	81	17
311.8 / 5.4	END OF BOREHOLE AT 5.41 m. AUGER REFUSAL AT 5.41 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.18 m AND WATER LEVEL AT 4.57 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60); REMARKS & GRAIN SIZE DISTRIBUTION (%)

+ 3, × 3: Numbers refer to Sensitivity — 20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 11/02/05 s

BOREHOLES 24-1 THROUGH 24-7

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-1

METRIC

W.P.	742-93-00	LOCATION	N 5 062 328.15 E 309 470.89	ORIGINATED BY	JL
HWY	11	BOREHOLE TYPE	Hollow Stem Augers / NW Casing	COMPILED BY	WM
DATUM	Geodetic	DATE	01.10.04 - 02.10.04	CHECKED BY	PJB

SOIL PROFILE

ELEV DEPTH	DESCRIPTION
314.8	
0.0	**TOPSOIL**
0.2	**SAND**, medium grained, trace silt Brown Wet
312.9 1.8	**SILT**, trace to some sand, trace to some clay Compact Grey Wet
311.7 3.0	Silty **CLAY**, trace sand, occasional silt layers, occasional sand seams Firm Grey occasional sand seams

SAMPLES

NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	14		
2	SS	7		
3	SS	5		
1	TW	PH	18.7	Oedometer test: e_0 = 0.916 p' = 75 KPa C_c = 0.21 C_R = 0.045 G = 2.74
4	SS	12		
5	SS	6		

Column headings: GROUND WATER CONDITIONS; ELEVATION SCALE (314, 313, 312, 311, 310, 309, 308, 307, 306, 305); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60)

Plot annotation: 3.3

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-1

METRIC

W.P. 742-93-00	LOCATION N 5 062 328.15 E 309 470.89		ORIGINATED BY JL
HWY 11	BOREHOLE TYPE Hollow Stem Augers / NW Casing		COMPILED BY WM
DATUM Geodetic	DATE 01.10.04 - 02.10.04		CHECKED BY PJB

SOIL PROFILE: ELEV DEPTH | DESCRIPTION | STRAT PLOT
SAMPLES: NUMBER | TYPE | "N" VALUES
GROUND WATER CONDITIONS
ELEVATION SCALE
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 20 40 60
UNIT WEIGHT γ kN/m³
REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Elevation Scale	Number	Type	"N" Values	Field Vane (Sensitivity)	Unit Weight (kN/m³)	Remarks & Grain Size Distribution (%) GR SA SI CL
				3		
304	6	SS	3			0 0 57 43
				2.3		
303	7	SS	1			
302				2		
301	8	SS	1			
				3.1		
300	2	TW	PH		16.6	Oedometer test: e_0 = 1.5302, p' = 140 KPa, C_R = 0.05, C_c = 0.68, G = 2.76
299						Vane sank 75 mm
298	9	SS	1			
				2.8		
297	10	SS	2			
296				+		Vane sank 50 mm
295	3	TW	PH			

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+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-1

METRIC

W.P.	742-93-00	LOCATION	N 5 062 328.15 E 309 470.89	ORIGINATED BY	JL
HWY	11	BOREHOLE TYPE	Hollow Stem Augers / NW Casing	COMPILED BY	WM
DATUM	Geodetic	DATE	01.10.04 - 02.10.04	CHECKED BY	PJB

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa (FIELD VANE)	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
						2.4						
					294							
		11	SS	2					0	0	68	32
					293	2.9						
					292							
291.0												
290.8 / 23.9	Silty SAND, fine to medium grained Grey Wet				291							
	END OF BOREHOLE AT 23.93 m. CASING REFUSAL AT 23.93 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE GROUTED TO SURFACE.											

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60); UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL; STRAT PLOT.

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-2

METRIC

W.P.	742-93-00	LOCATION	N 5 062 732.96 E 309 439.82
HWY	11	BOREHOLE TYPE	Hollow Stem Augers
DATUM	Geodetic	DATE	03.10.04 - 03.10.04

ORIGINATED BY JL
COMPILED BY WM
CHECKED BY PJB

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
312.3	
0.0	**TOPSOIL**
0.2	Silty **SAND**, medium grained Compact Brown Moist
310.8 1.5	Clayey **SILT**, trace sand, occasional sand seams Firm Grey
309.3 3.0	Silty **CLAY**, trace sand, occasional silt layers Stiff to Firm Grey

SAMPLES

NUMBER	TYPE	"N" VALUES	Approx. Elevation	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	UNIT WEIGHT γ kN/m³
1	SS	16	312		
2	SS	6	310.5		
3	SS	8	309	0 2 71 26	
4	SS	6	307.5		
1	TW	PH	306	Oedometer test: e_0 = 0.972 p' = 50 KPa C_c = 0.17 C_R = 0.04 G = 2.75	18.5
5	SS	14	304.5		
6	SS	1	303		

GROUND WATER CONDITIONS

ELEVATION SCALE: 312, 311, 310, 309, 308, 307, 306, 305, 304, 303

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE: 20 40 60 80 100

Field vane at approx. elevation 304: 2.6

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

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$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 2324.GPJ 09/02/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 24-2

METRIC

W.P. 742-93-00 | LOCATION N 5 062 732.96 E 309 439.82 | ORIGINATED BY JL

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 03.10.04 - 03.10.04 | CHECKED BY PJB

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
								+3			
							302				
			2	TW	PH					17.2	Oedometer test: e_0 = 1.324, p' = 100 KPa, C_R = 0.03, C_c = 0.45, G = 2.76
							301	+3.5			
300.1 / 12.2	Clayey **SILT**, to some clay, trace to some sand, Firm, Grey		7	SS	7		300				
299.7 / 12.6	Silty **SAND**, trace gravel, trace clay, Grey, Wet										
299.1 / 13.2	END OF BOREHOLE AT 13.16 m. AUGER REFUSAL AT 13.16 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE GROUTED TO SURFACE.										

ONTMT4S 2324.GPJ 09/02/05

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 24-3

METRIC

W.P. 742-93-00 | LOCATION N 5 062 933.01 E 308 985.29 | ORIGINATED BY WRW

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 28.09.04 - 30.09.04 | CHECKED BY PJB

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	FIELD VANE SHEAR STRENGTH kPa (Sensitivity)	WATER CONTENT	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
312.2									
0.0	**ROAD FILL**				312				
311.7 / 0.5	**PEAT**				311				
		1	SS	1					No recovery in SS#1
309.9 / 2.3	Silty **CLAY**, with frequent silt layers Soft to Firm Grey				310				
		2	SS	1	309		○		
					308	+ (10.5)			
		3	SS	1			├┤ ○		0 0 68 32
					307	+ (6.2)			
		4	SS	2	306		○		
					305	+ (4.5)			
		5	SS	2			○		
					304	+ (4.7)			
		1	TW	PH	303		├┤ ○	17.3	Oedometer test: e_0 = 1.28 p' = 80 KPa C_c = 0.37 C_R = 0.02 G = 2.75

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+³, ×³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 2324.GPJ 09/02/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 24-3

METRIC

W.P. 742-93-00 LOCATION N 5 062 933.01 E 308 985.29 ORIGINATED BY WRW

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 28.09.04 - 30.09.04 CHECKED BY PJB

SOIL PROFILE: ELEV DEPTH | DESCRIPTION | STRAT PLOT

SAMPLES: NUMBER | TYPE | "N" VALUES

GROUND WATER CONDITIONS | ELEVATION SCALE

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Elevation	Description	Sample No.	Type	"N" Value	Field Vane (kPa) / Sensitivity	Remarks / Grain Size (GR SA SI CL)
~302					+ 3.9	
~301.3		6	SS	2		
~300.5					+ 9.7	
~299.8		7	SS	2		
299					+	Vane sank
~298.3		8	SS	WH		
~297.5					+ 5.2	
~296.8		9	SS	WH		0 0 61 39
~296					+ 4.2	
~295.2		10	SS	4		
~294.4						Vane did not break
~293.7	Becoming Stiff	11	SS	14		

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$+^3, \times^3$: Numbers refer to Sensitivity; 20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 24-3

METRIC

W.P. 742-93-00	LOCATION N 5 062 933.01 E 308 985.29	ORIGINATED BY WRW
HWY 11	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY WM
DATUM Geodetic	DATE 28.09.04 - 30.09.04	CHECKED BY PJB

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
		2	TW	PH	292			18.3	Oedometer test: e_o = 1.063, p' = 82 KPa, C_R = 0.05, C_c = 0.23, G = 2.78
						+ 3.9			
	Becoming Very Stiff	12	SS	23	291				No recovery in SS#12
					290				
					289				
	Becoming Firm	13	SS	6	288				
					287				
					286				
		14	SS	6	285				
					284				
					283				

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$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-3

METRIC

W.P. 742-93-00 | LOCATION N 5 062 933.01 E 308 985.29 | ORIGINATED BY WRW

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY WM

DATUM Geodetic | DATE 28.09.04 - 30.09.04 | CHECKED BY PJB

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH / WATER CONTENT	UNIT WEIGHT γ kN/m3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
					282			
		3	TW	PH			16.4	Oedometer test: e_o = 1.62, p' = 260 KPa, C_R = 0.03, C_c = 0.94, G = 2.78
					281	>>3.4		
					280			
					279			
		15	SS	10				
					278			Vane did not break
					277			
					276			No sample recovered
		4	TW	PH				
					275			
					274			
					273			
		16	SS					0 1 78 21

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$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 2324.GPJ 09/02/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 24-3

METRIC

W.P. 742-93-00 LOCATION N 5 062 933.01 E 308 985.29 ORIGINATED BY WRW

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 28.09.04 - 30.09.04 CHECKED BY PJB

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
						272						
						271						
						270						
269.5 / 42.7	**SILT**, some clay, trace sand Compact Grey Moist	17	SS	18			o		0	5	82	13
						269						
						268						
						267						
266.5 / 45.7	**SAND**, fine grained, trace silt Compact Brown Wet	18	SS	23		266	o					
265.9 / 46.3	END OF BOREHOLE AT 46.33 m. BOREHOLE OPEN TO 12.19 m AND WATER LEVEL AT 0.91 m UPON COMPLETION.											

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60); REMARKS & GRAIN SIZE DISTRIBUTION (%).

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 24-4

METRIC

W.P. 742-93-00 LOCATION N 5 063 016.98 E 309 554.31 ORIGINATED BY JL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM

DATUM Geodetic DATE 02.10.04 - 02.10.04 CHECKED BY PJB

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
315.3													
0.0	**TOPSOIL**												
0.1	Silty **CLAY**, trace sand, occasional iron oxide staining Very Stiff Brown		1	SS	28		315						
			2	SS	17		314			0	0	67	33
312.4							313						
2.9	END OF BOREHOLE AT 2.95 m. AUGER REFUSAL AT 2.95 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.												

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

REMARKS & GRAIN SIZE DISTRIBUTION (%)

$+^3, \times^3$: Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-5

METRIC

W.P. 742-93-00	LOCATION N 5 063 216.97 E 309 310.81	ORIGINATED BY WRW
HWY 11	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY WM
DATUM Geodetic	DATE 28.09.04 - 28.09.04	CHECKED BY PJB

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
314.4						
0.0	**TOPSOIL**					
0.1	Silty **CLAY**, occasional silt layers Soft Grey	1	SS	2	wP–w ~20–38; w ~57	0 0 48 51
		2	SS	2	w ~45	
	(Field vane at ~310.4: 4.0)					
310.2 4.3	**SAND**, fine grained, trace silt Very Dense Grey Wet boulders encountered	3	SS	25/ .025	w ~15	
309.8 4.6	END OF BOREHOLE AT 4.60 m. AUGER REFUSAL AT 4.60 m ON PROBABLE BEDROCK OR BOULDER.					

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE (314, 313, 312, 311, 310); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60); UNIT WEIGHT γ kN/m³.

ONTMT4S 2324.GPJ 09/02/05

+³, ×³: Numbers refer to Sensitivity

20 / 15 – 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 24-6

METRIC

W.P.	742-93-00	LOCATION	N 5 063 325.02 E 309 239.51	ORIGINATED BY	WRW
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	24.09.04 - 27.09.04	CHECKED BY	PJB

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH (kPa) / SENSITIVITY	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
313.1						
0.0	**PEAT**, fibrous, some rootlets Black					
312.2 0.9	Silty **CLAY**, with frequent silt layers, trace sand Stiff Grey					
		1	SS	8		
					3.0	
		2	SS	5		
					5.5	
		3	SS	3		0 3 72 25
					2.6	
305.5 7.6	Silty **CLAY** Soft to Firm Grey					
		4	SS	1		
						Vane sank 75 mm
		5	SS	2		0 0 55 45

Elevation scale: 313, 312, 311, 310, 309, 308, 307, 306, 305, 304

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE: 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%): 20 40 60; 408 (near 312.3)

UNIT WEIGHT γ kN/m^3

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 2324.GPJ 09/02/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24-6

METRIC

W.P. 742-93-00	LOCATION N 5 063 325.02 E 309 239.51	ORIGINATED BY WRW	
HWY 11	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY WM	
DATUM Geodetic	DATE 24.09.04 - 27.09.04	CHECKED BY PJB	

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa (FIELD VANE)	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
					303	+		Vane sank on remould
		6	SS	3	302		o	
						2.9		
300.9 / 12.2	Clayey **SILT**, some sand Soft Grey	7	SS	2	301		H o	0 4 80 16
					300	7.7		
299.5 / 13.6	**SAND**, medium to coarse grained, trace silt Loose Brown Wet	8	SS	3	299		o	
298.4 / 14.7	END OF BOREHOLE AT 14.71 m. AUGER REFUSAL AT 14.71 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 1.22 m AND WATER LEVEL AT 0.91 m UPON COMPLETION.							

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; UNIT WEIGHT γ kN/m³

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 24-7

METRIC

W.P.	742-93-00	LOCATION	N 5 063 517.03 E 309 298.96	ORIGINATED BY	WRW
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	24.09.04 - 24.09.04	CHECKED BY	PJB

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
313.5									
0.0	**TOPSOIL**, some rootlets								
313.1 / 0.4	Silty **CLAY**, some sand Stiff Grey					313	124		
						312			
		1	SS	14					0 15 58 27
						311			
310.4 / 3.1	END OF BOREHOLE AT 3.07 m. AUGER REFUSAL AT 3.07 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 3.07 m AND WATER LEVEL AT 2.74 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.	2	SS	25/ .025					Spoon bouncing

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

+ ³, × ³: Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

BERNARD CREEK SBL AND NBL BRIDGES

THURBER

Ministry of Transportation
Ontario

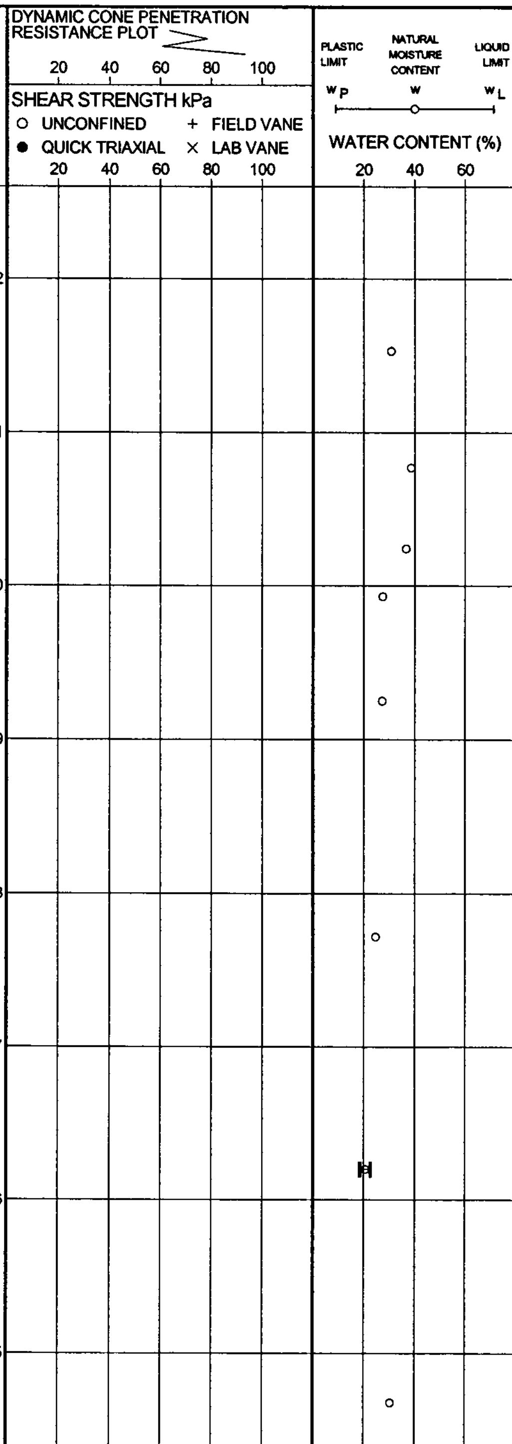
THURBER

RECORD OF BOREHOLE No 99S-1

METRIC

W.P.	756-93-01	LOCATION	N 5 062 507.3 E 309 419.1 (Bernard Creek Bridge SBL)	ORIGINATED BY	SL
HWY	11	BOREHOLE TYPE	Hollow Stem Augers, HQ Coring	COMPILED BY	SS
DATUM	Geodetic	DATE	10.01.04 - 10.01.04	CHECKED BY	AEG

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
312.6						
0.0 / 312.4	**TOPSOIL** (250mm)					
0.3	**SILT and SAND,** trace organics near top of layer Very Loose to Loose Brown Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)				312	
		1	SS	3		
		2	SS	4	311	
		3	SS	2	310	
		4	SS	2		0 44 56 (SI+CL)
					309	
		5	SS	4	308	
					307	
		6	SS	3	306	0 4 72 24
					305	
304.4		7	SS	5		
8.2	END OF BOREHOLE AT 8.23m. WATER LEVEL IN OPEN BOREHOLE AT 5.33m DEPTH UPON COMPLETION.					



UNIT WEIGHT γ kN/m³

$+^3, \times^3$: Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99S-2

METRIC

W.P.	756-93-01	LOCATION	N 5 062 526.2 E 309 414.7 (Bernard Creek Bridge SBL)	ORIGINATED BY	SL
HWY	11	BOREHOLE TYPE	Hollow Stem Augers, HW Casing	COMPILED BY	SS
DATUM	Geodetic	DATE	11.01.04 - 12.01.04	CHECKED BY	AEG

SOIL PROFILE: ELEV / DEPTH, DESCRIPTION, STRAT PLOT. SAMPLES: NUMBER, TYPE, "N" VALUES. GROUND WATER CONDITIONS. ELEVATION SCALE. DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100). SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100). PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60). UNIT WEIGHT γ kN/m³. REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL.

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE (GR SA SI CL)
312.2 / 0.0	**TOPSOIL** (750mm)				ground water at 1.45m above ground surface
311.4 / 0.8	**SILT and SAND**, trace organics near top of layer Very Loose to Loose Brown Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)	1	SS	2	
		2	SS	2	
		3	SS	2	
		4	SS	2	
		5	SS	3	0 26 60 14
		6	SS	3	
304.3 / 7.9	Silty **CLAY**, trace sand Soft to Firm Grey Wet	7	SS	4	0 93 7 (SI+CL)
	occasional silt layers, thin sand seams Soft	8	SS	3	

Elevation scale: 312, 311, 310, 309, 308, 307, 306, 305, 304, 303

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99S-2

METRIC

W.P. 756-93-01 LOCATION N 5 062 526.2 E 309 414.7 (Bernard Creek Bridge SBL) ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers, HW Casing COMPILED BY SS

DATUM Geodetic DATE 11.01.04 - 12.01.04 CHECKED BY AEG

SOIL PROFILE: ELEV DEPTH	DESCRIPTION	SAMPLES: NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
					302				
	occasional silt layers, thin sand seams	1	TW	PH					
					301				
						+ 2.2			
					300				
		9	SS	3					0 2 66 32
					299				
		10	SS	3					
					298				
		11	SS	3					
					297				
						+ 4.8			
					296				
		12	SS	1					
					295				
		2	TW	PH					
					294				
						+ 4.3			
	becoming soft								
					293				
		13	SS	1					

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+3, ×3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 99S-2

METRIC

W.P. 756-93-01 | LOCATION N 5 062 526.2 E 309 414.7 (Bernard Creek Bridge SBL) | ORIGINATED BY SL

HWY 11 | BOREHOLE TYPE Hollow Stem Augers, HW Casing | COMPILED BY SS

DATUM Geodetic | DATE 11.01.04 - 12.01.04 | CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa (FIELD VANE)	NATURAL MOISTURE CONTENT / LIMITS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		14	SS	2	291	+ (sensitivity 1.3)	Wp–w, WL	0 0 35 65
		15	SS	2	288	+ (sensitivity 3.5)	w	
		16	SS	3	285		w	
283.2 29.0	Clayey **SILT**, with thin clay seams Firm to Stiff Grey Wet							

Elevation scale: 292, 291, 290, 289, 288, 287, 286, 285, 284, 283

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+ 3, × 3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99S-2 — METRIC

W.P. 756-93-01 | LOCATION N 5 062 526.2 E 309 414.7 (Bernard Creek Bridge SBL) | ORIGINATED BY SL

HWY 11 | BOREHOLE TYPE Hollow Stem Augers, HW Casing | COMPILED BY SS

DATUM Geodetic | DATE 11.01.04 - 12.01.04 | CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		17	SS	3	282	~27	0 0 84 15
					281		
279.8					280		
32.4	**SAND**, fine grained, with occasional cobbles and boulders Very Dense Grey Wet	18	SS	41	279	~25	
278.3							
33.9	**BOULDER**	1	RUN		278		Tricone from 33.91m to 34.44m
277.5							
34.7	**SAND**, fine grained, with occasional cobbles and boulders Very Dense Grey Wet (TILL)	19	SS	50/ .078	277		HQ casing to 35.05m 0.5m of sand in HQ casing cleaned out with tricone
					276		
		20	SS	50/ .102			
	cobbles from 37.13m to 37.36m				275		
	boulder from 37.36m to 38m	2	RUN				NQ barrel from 37.13m to 38m broke through boulders
274.0		21	SS	50/ .078			No sample in spoon
38.2	END OF BOREHOLE AT 38.18m. STANDPIPE PLACED IN HOLE. BOREHOLE CAVED TO 10.06m BEFORE SEALING THE STANDPIPE TIP. DATE DEPTH(m) Mar. 4/ 2004 1.5 above ground surface Mar. 11/ 2004 1.45 above ground surface						

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+³, ×³: Numbers refer to Sensitivity — 20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99SBERNARDBAK.GPJ 09/02/05 s

RECORD OF BOREHOLE No 99S-5

METRIC

W.P. 756-93-01 | LOCATION N 5 062 564.3 E 309 429.0 (Bernard Creek Bridge SBL) | ORIGINATED BY SL
HWY 11 | BOREHOLE TYPE Hollow Stem Augers, HW Casing | COMPILED BY SS
DATUM Geodetic | DATE 08.01.04 - 08.01.04 | CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
312.2							
0.0 / 312.0	**TOPSOIL**				312		
0.3	**SILT and SAND**, trace organics near top of layer Very Loose to Loose Grey Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)	1	SS	2	311		
		2	SS	2	310		
		3	SS	2			
		4	SS	7	309		0 46 42 12
					308		
		5	SS	2	307		
		6	SS	2	306		0 2 83 16
					305		
		7	SS	5	304		
303.4 / 8.8	**Silty CLAY**, trace sand Soft to Firm Grey				303		
		8	SS	4			

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL.

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$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99SBERNARD.GPJ 24/02/05 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99S-5

METRIC

W.P.	756-93-01	LOCATION	N 5 062 564.3 E 309 429.0 (Bernard Creek Bridge SBL)	ORIGINATED BY	SL
HWY	11	BOREHOLE TYPE	Hollow Stem Augers, HW Casing	COMPILED BY	SS
DATUM	Geodetic	DATE	08.01.04 - 08.01.04	CHECKED BY	AEG

SOIL PROFILE: ELEV / DEPTH; DESCRIPTION; STRAT PLOT
SAMPLES: NUMBER; TYPE; "N" VALUES
GROUND WATER CONDITIONS
ELEVATION SCALE
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT w_P; NATURAL MOISTURE CONTENT w; LIQUID LIMIT w_L
WATER CONTENT (%): 20 40 60
UNIT WEIGHT γ kN/m³
REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Description: Soft

Elevation scale: 302, 301, 300, 299, 298, 297, 296, 295, 294, 293

NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
1	TW	PH				
9	SS	4				
10	SS	2				
11	SS	4	0	2	52	46
2	TW	PH				
12	SS	2				

Field vane sensitivity values: 3 (approx. El. 302.2), 2.9 (approx. El. 299.1), 2.7 (approx. El. 296.0), 2.7 (approx. El. 293.0)

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99SBERNARD.GPJ 24/02/05 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99S-5

METRIC

W.P. 756-93-01 | LOCATION N 5 062 564.3 E 309 429.0 (Bernard Creek Bridge SBL) | ORIGINATED BY SL

HWY 11 | BOREHOLE TYPE Hollow Stem Augers, HW Casing | COMPILED BY SS

DATUM Geodetic | DATE 08.01.04 - 08.01.04 | CHECKED BY AEG

ELEV / DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	FIELD VANE (sensitivity)	WATER CONTENT (%)	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
					292			
		13	SS	3			o	
					291	+ 3		
					290			
					289			
		14	SS	2			wP–wL, o	0 0 51 49
					288	+ 2.8		
					287			
286.0 / 26.2	Clayey **SILT**, with thin clay seams Firm to Stiff Grey Wet				286			
		15	SS	9	285		o	
						+ 3.8		
284.3 / 27.9	Boulder							
284.1 / 28.1	**SAND**, trace silt, trace gravel, occasional cobbles Compact to Very Dense Brown Moist (TILL)	1	RUN		284			
		2	RUN		283		o	

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 99S-5

 METRIC

W.P. 756-93-01 LOCATION N 5 062 564.3 E 309 429.0 (Bernard Creek Bridge SBL) ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers, HW Casing COMPILED BY SS

DATUM Geodetic DATE 08.01.04 - 08.01.04 CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	REMARKS
					282	
		16	SS	21		
					281	
					280	
		3	RUN			
					279	Sand heaving into NQ casing to 30.48m
		4	RUN		278	
		17	SS	50/ .076	277	Sand coming into NQ casing to 32.92m Tricone method to get SPT values at 35.06m
					276	
		18	SS	50/ .076		No sand found inside HW casing at 36.58m
					275	
274.0		19	SS	50/ .127	274	
38.2	END OF BOREHOLE AT 38.23m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) Mar. 4/ 2004 0.1 Mar. 11/ 2004 0.12					

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity   15-20-5-10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99S-6

METRIC

W.P. 756-93-01 LOCATION N 5 062 582.6 E 309 418.3 (Bernard Creek Bridge SBL) ORIGINATED BY SL

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 09.01.04 - 09.01.04 CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
312.9						
312.7 / 0.0	**TOPSOIL**					
0.2	**SILT and SAND**, trace organics near top of layer Very Loose to Loose Brown Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)					
					312	
		1	SS	8		
		2	SS	3	311	0 8 72 20
		3	SS			
					310	
		4	SS	2		
					309	
		5	SS	2	308	0 22 63 15
					307	
		6	SS	2		
					306	
		7	SS	2	305	
304.7 / 8.2	END OF BOREHOLE AT 8.23m. WATER LEVEL IN OPEN BOREHOLE AT 3.48m DEPTH UPON COMPLETION. BOREHOLE CAVED TO 5.56m.					

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³

Field vane reading at approx. elev. 307.5: 2.5

+3, ×3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99N-1

1 OF 1

METRIC

W.P.	755-93-01	LOCATION	N 5 062 517.2 E 309 452.6 (Bernard Creek Bridge NBL)	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	10.03.04 - 10.03.04	CHECKED BY	AEG

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 | SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60 | UNIT WEIGHT γ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	REMARKS GR SA SI CL
312.2						
0.0	TOPSOIL					
0.1	**SILT and SAND**, trace organics near top of layer, Very Loose to Loose, Brown, Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)	1	SS	3	312	
		2	SS	2	311	
		3	SS	4	310	
309.4		4	SS	2		
2.8	Silty **CLAY**, occasional sand, Firm, Grey, Wet (CL)	5	SS	2	309	0 4 75 21
					308	
		6	SS	4	307	
		7	SS	4	306	
					305	
304.0		8	SS	5		
8.2	END OF BOREHOLE AT 8.23m. WATER LEVEL IN OPEN BOREHOLE AT 0.76m DEPTH UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.					

ONTMT4S 99NBERNARD-I.GPJ 09/02/05

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99N-2

METRIC

W.P. 755-93-01	LOCATION N 5 062 536.0 E 309 447.4 (Bernard Creek Bridge NBL)	ORIGINATED BY GA
HWY 11	BOREHOLE TYPE Hollow Stem Augers, Tricone	COMPILED BY SS
DATUM Geodetic	DATE 04.03.04 - 05.03.04	CHECKED BY AEG

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100) | SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100) | PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60) | UNIT WEIGHT γ kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

ELEV / DEPTH	DESCRIPTION
311.7	
0.0	**SILT and SAND**, trace organics near top of layer Very Loose to Loose Dark Brown to Brown Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.) occasional gravel Brown to Grey
309.2 2.5	Silty **CLAY**, trace sand Soft to Firm Grey Wet

NUMBER	TYPE	"N" VALUES	REMARKS / GRAIN SIZE (GR SA SI CL)
1	SS	5	
2	SS	9	
3	SS	2	5 82 13 (SI+CL)
4	SS	2	
5	SS	2	
6	SS	2	0 1 81 18
7	SS	2	0 4 66 30
8	SS	4	

Remarks: ground water at 1.2m above ground surface

Elevation scale: 311, 310, 309, 308, 307, 306, 305, 304, 303, 302

Field vane sensitivity values: 3.3 (approx. elev. 303.5), 3.3 (approx. elev. 302.0)

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99NBERNARD-I.GPJ 24/02/05

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 99N-2

METRIC

W.P.	755-93-01	LOCATION	N 5 062 536.0 E 309 447.4 (Bernard Creek Bridge NBL)	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers, Tricone	COMPILED BY	SS
DATUM	Geodetic	DATE	04.03.04 - 05.03.04	CHECKED BY	AEG

Column headings: SOIL PROFILE (ELEV / DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) (20, 40, 60); UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) (GR, SA, SI, CL)

Samples:

NUMBER	TYPE	"N" VALUES
1	TW	PH
9	SS	4
10	SS	2
2	TW	PH
11	SS	4
12	SS	5

Elevation scale: 301, 300, 299, 298, 297, 296, 295, 294, 293, 292

Field vane sensitivity labels: 3.3, 2.9, 3.1, 3, 3.5, 3

Grain size distribution (GR SA SI CL):

GR	SA	SI	CL
0	5	56	39
0	1	39	60

becoming firm

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

15 ⊕ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99N-2

METRIC

W.P. 755-93-01 LOCATION N 5 062 536.0 E 309 447.4 (Bernard Creek Bridge NBL) ORIGINATED BY GA

HWY 11 BOREHOLE TYPE Hollow Stem Augers, Tricone COMPILED BY SS

DATUM Geodetic DATE 04.03.04 - 05.03.04 CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / Sensitivity	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%)
						+ 2.8 (field vane, ~55 kPa)		
					291			
					290			
		3	TW	PH	289			
						+ 3 (field vane, ~75 kPa)		
					288			
					287			
		13	SS	6	286		~48	
						+ 2.1 (field vane, ~75 kPa)		
					285			
					284			
283.7 28.0	Clayey **SILT**, occasional gravel Very Stiff Grey Wet							
		14	SS	16	283		~20	
281.9					282			Mud rotary from

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99NBERNARD-I.GPJ 24/02/05

THURBER

RECORD OF BOREHOLE No 99N-2

METRIC

W.P. 755-93-01	LOCATION N 5 062 536.0 E 309 447.4 (Bernard Creek Bridge NBL)	ORIGINATED BY GA
HWY 11	BOREHOLE TYPE Hollow Stem Augers, Tricone	COMPILED BY SS
DATUM Geodetic	DATE 04.03.04 - 05.03.04	CHECKED BY AEG

SOIL PROFILE: ELEV / DEPTH; DESCRIPTION; STRAT PLOT. SAMPLES: NUMBER; TYPE; "N" VALUES. GROUND WATER CONDITIONS. ELEVATION SCALE. DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100). SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100). PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60). UNIT WEIGHT γ kN/m³. REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	REMARKS
289.8	**BOULDER**					29.87m
30.2	**SAND**, trace to some gravel, occasional silt, occasional cobbles or boulders Very Dense Brown Wet (SP)				281	Tricone casing from 30.48m to 32m
		15	SS	67	280	
					279	
					278	
		16	SS	105/ .254	277	
276.1 35.7	**BEDROCK** Slightly weathered **GRANITIC GNEISS**, laminated to thinly banded, pale pink with sub-vertical dark banding, rough sub-planar joints, some clay infilling, strong to very strong				276	
					275	
		1	RUN			RUN 1# TCR=100%, SCR=100%, RQD=100%, UCS=135.4MPa
		2	RUN		274	RUN 2# TCR=100%, SCR=100%, RQD=90%, UCS=117.2MPa
		3	RUN		273	RUN 3# TCR=100%, SCR=100%, RQD=74%, UCS=141.2MPa
271.9 39.9	END OF BOREHOLE AT 39.85m				272	

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

15-20-5-10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 99N-2

METRIC

W.P. 755-93-01	LOCATION N 5 062 536.0 E 309 447.4 (Bernard Creek Bridge NBL)	ORIGINATED BY GA
HWY 11	BOREHOLE TYPE Hollow Stem Augers, Tricone	COMPILED BY SS
DATUM Geodetic	DATE 04.03.04 - 05.03.04	CHECKED BY AEG

SOIL PROFILE			SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE				
	Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) Mar. 10/ 2004 1.2 above ground surface Mar. 11/ 2004 1.2 above ground surface										

ONTMT4S 99NBERNARD-I.GPJ 24/02/05

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 99N-5

METRIC

W.P.	755-93-01	LOCATION	N 5 062 580.6 E 309 470.0 (Bernard Creek Bridge NBL)	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers, NW Casing	COMPILED BY	SS
DATUM	Geodetic	DATE	17.02.04 - 18.02.04	CHECKED BY	AEG

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	WATER CONTENT (%) / REMARKS	GR	SA	SI	CL
311.7 / 0.0	**SILT and SAND**, trace organics near top of layer; Very Loose to Loose; Brown; Wet; (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)	1	SS	17						
		2	SS	9	311					
		3	SS	2	310					
309.4 / 2.3	Silty **CLAY**, occasional sand seams; Soft; Grey; Wet	4	SS	2	309		0	1	61	39
		5	SS	2	308					
		6	SS	3	307 / 306					
		7	SS	4	305					
					304 / 303	Field vane +3.6				
					302					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m^3

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ◆ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99N-5

METRIC

W.P. 755-93-01	LOCATION N 5 062 580.6 E 309 470.0 (Bernard Creek Bridge NBL)	ORIGINATED BY GA
HWY 11	BOREHOLE TYPE Hollow Stem Augers, NW Casing	COMPILED BY SS
DATUM Geodetic	DATE 17.02.04 - 18.02.04	CHECKED BY AEG

SOIL PROFILE

ELEV DEPTH	DESCRIPTION
	Silty **CLAY**, occasional sand seams Soft Grey Wet
292.0 19.7	**SAND**, some gravel or cobbles

SAMPLES

NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
8	SS	3	
9	SS	2	0 5 78 17
1	TW	PH	
10	SS	4	
11	SS	4	
2	TW	PH	
12	SS	8	

ELEVATION SCALE: 301, 300, 299, 298, 297, 296, 295, 294, 293, 292

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE — 20 40 60 80 100

Field vane sensitivities plotted: 3, 3.6, 3.6

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99NBERNARD-I.GPJ 24/02/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99N-5

METRIC

W.P.	755-93-01	LOCATION	N 5 062 580.6 E 309 470.0 (Bernard Creek Bridge NBL)	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers, NW Casing	COMPILED BY	SS
DATUM	Geodetic	DATE	17.02.04 - 18.02.04	CHECKED BY	AEG

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Loose Brown Wet (TILL) boulder from 19.75m to 20.06m		13	SS	50/ .000			+ 2.6			
							291				
			14	SS	8						
							290				
289.0			1	GS							
22.7	**BEDROCK** Slightly weathered **GRANITIC GNEISS**, laminated to thinly banded, pale pink with sub-vertical dark banding, rough sub-planar joints, some clay infilling, strong to very strong						289				
			1	RUN							RUN 1# TCR=71%, SCR=71%, RQD=71%, UCS=124.3MPa
							288				
			2	RUN							RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=115.24MPa
							287				
			3	RUN			286				RUN 3# TCR=100%, SCR=100%, RQD=95%, UCS=117.13MPa
285.1 26.6	END OF BOREHOLE AT 26.62m. WATER LEVEL IN OPEN BOREHOLE AT 0.5m ABOVE THE GROUND SURFACE. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. BOREHOLE BACKFILLED AS FOLLOWS: 0 - 19.8m Grout 19.8m - 22.9m Holeplug WATER LEVEL READINGS: DATE DEPTH (m) 26/02/04 2.2 04/03/04 0.9 above ground surface 11/03/04 1.1 above ground surface										

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

+ 3, × 3: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

ONTMT4S 99NBERNARD-I.GPJ 24/02/05

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 99N-6

METRIC

W.P. 755-93-01 | LOCATION N 5 062 595.7 E 309 466.7 (Bernard Creek Bridge NBL) | ORIGINATED BY GA

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 18.02.04 - 18.02.04 | CHECKED BY AEG

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
312.2								
0.0	**SILT and SAND**, trace organics near top of layer Very Loose to Loose Brown to Grey Wet (Glacial lake deposit characterized by interbedding of silt and sand and intermittent clay seams. Partially reworked at surface by present stream.)		1	SS	4		312	
			2	SS	5		311	
			3	SS	6		310	
309.3			4	SS	2			
2.9	Silty **CLAY**, occasional sand seams Very Soft Grey Wet		5	SS	2		309	0 13 71 16
			6	SS	2		308 / 307	
			7	SS	2		306 / 305	
304.0			8	SS	2			0 3 71 26
8.2	END OF BOREHOLE AT 8.23 m. WATER LEVEL IN OPEN BOREHOLE AT 0.1 m ABOVE SURFACE. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.							

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

+³, ×³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 99NBERNARD-I.GPJ 09/02/05

RAMPS EAST OF HWY11

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 S-EW 14+187.5 CL 1 OF 1 — METRIC

W.P. 742-93-00 | LOCATION 421 S-EW Ramp, ST. 14+187.5, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 13.11.02 - 13.11.02 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
0.0	TOPSOIL with organics												
0.1	Silty **CLAY**, layered, trace sand; Very Stiff to Firm; Brown												
		1	SS	25									
		2	SS	14									
		3	SS	6						0	1	43	57
		4	SS	4									
	Becoming Grey												
		1	TW	PH			8.5						
5.5	END OF BOREHOLE AT 5.49 m. BOREHOLE OPEN TO 5.49 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.												

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60
REMARKS & GRAIN SIZE DISTRIBUTION (%)

+ ³, × ³: Numbers refer to Sensitivity | 20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 S-EW 14+212.5 L20.5 1 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 S-EW Ramp, ST. 14+212.5, O/S 20.5L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 14.11.02 - 14.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL** with organics							
0.1	Silty **CLAY**, laminated Very Stiff to Firm Brown and Grey	1	GS					
		1	SS	44				
		2	SS	20				
		3	SS	14				
		1	TW	PH				0 0 53 46
							8	
		4	SS	3				
							8	
		5	SS	3				
							12.5	
7.0	END OF BOREHOLE AT 7.01 m. BOREHOLE OPEN TO 7.01 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.							

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

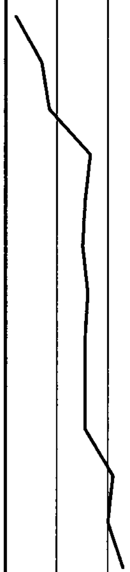
UNIT WEIGHT γ kN/m³

+³, ×³: Numbers refer to Sensitivity 20 15 5 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

RECORD OF BOREHOLE No 421 S-EW 14+212.5 R16.1 1 OF 1 METRIC

W.P. 742-93-00	LOCATION 421 S-EW Ramp, ST. 14+212.5, O/S 16.1R		ORIGINATED BY DP
HWY 11	BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT)		COMPILED BY SS
DATUM Geodetic	DATE 13.11.02 - 13.11.02		CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
4.0	END OF DCPT AT 3.96 m.										

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 S-EW 14+239.5 CL 1 OF 1 METRIC

W.P. 742-93-00 | LOCATION 421 S-EW Ramp, ST. 14+239.5, CL & 421 E-N Ramp, ST. 13+754, O/S 19.8L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 13.11.02 - 13.11.02 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL** with organics				
0.1	Silty **CLAY**, mottled, layered Hard to Soft Brown, Grey Dry to Wet	1	SS	31	
		2	SS	9	0 0 61 39
		3	SS	3	
		1	TW	PH	
4.1	Clayey **SILT**, trace sand Very Stiff Grey Wet	4	SS	22	
4.9	**SAND AND GRAVEL**				
5.3	END OF BOREHOLE AT 5.26 m. AUGER REFUSAL AT 5.26 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.26 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.				

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3

Field vane sensitivity: 5

+ 3 , × 3 : Numbers refer to Sensitivity   15-5 / 20-10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 E-N 13+754 CL

METRIC

W.P. 742-93-00
LOCATION 421 E-N Ramp, ST. 13+754, CL
ORIGINATED BY DP

HWY 11
BOREHOLE TYPE Hollow Stem Augers
COMPILED BY SS

DATUM Geodetic
DATE 14.11.02 - 14.11.02
CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH (FIELD VANE) kPa	WATER CONTENT (%)	GR	SA	SI	CL
0.0	**TOPSOIL** with organics									
0.1	Silty **CLAY**, layered with grey silt and brown clay Hard to Firm Grey and Brown Wet	1	SS	34						
		2	SS	14						
		3	SS	4			0	1	76	23
		4	SS	2			0	0	57	43
					+ 5					
		5	SS	3						
					+ 7					
5.5	END OF BOREHOLE AT 5.49 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.61m slotted screen.									

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

WATER LEVEL READINGS:

DATE	DEPTH (m)
20/06/03	0.80
15/08/03	1.77

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

Ministry of Transportation
Ontario

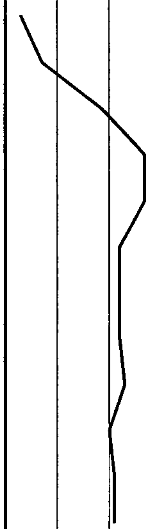
THURBER

RECORD OF BOREHOLE No 421 E-N 13+754 R16.9 METRIC

W.P. 742-93-00 LOCATION 421 E-N Ramp, ST. 13+754, O/S 16.9R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 14.11.02 - 14.11.02 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
3.7	END OF DCPT AT 3.66m.										

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

+ ³, × ³: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 W-N 13+700 R1.5 1 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 W-N Ramp, ST. 13+700, O/S 1.5R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 14.11.02 - 14.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	SHEAR STRENGTH kPa	GR	SA	SI	CL
0.0	**TOPSOIL** with organics									
0.2	Silty **CLAY**, laminated, trace sand Very Stiff to Firm Brown Dry to Wet									
		1	SS	30	~21					
		2	SS	25	~22					
		3	SS	13	~25		0	1	62	37
		4	SS	29	~21					
		5	SS	8	~28					
5.6	layers of silty brown clay									
		6	SS	4	~33					
						+ 7 (field vane, ~70)				
		7	SS	3	~37		0	0	44	56
						+ 5 (field vane, ~50)				
8.5	END OF BOREHOLE AT 8.53 m. BOREHOLE OPEN TO 8.53 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.									

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60); UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity   15-⊕-5 (20 / 10) (%) STRAIN AT FAILURE

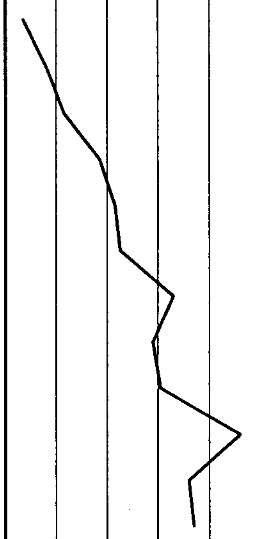
ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 W-N 13+725 L21.7 1 OF 1 METRIC

W.P.	742-93-00	LOCATION	421 W-N Ramp, ST. 13+725, O/S 21.7L	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	SS
DATUM	Geodetic	DATE	15.11.02 - 15.11.02	CHECKED BY	JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
3.7	END OF DCPT AT 3.66m.										

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⌖ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 W-N 13+725 R21.8 1 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 W-N Ramp, ST. 13+725, O/S 21.8R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 14.11.02 - 14.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	TOPSOIL with organics					
0.2	Silty CLAY, laminated Very Stiff to Firm Brown Dry to Wet					
		1	SS	24		
		2	SS	21		0 2 62 36
		3	SS	16		
		4	SS	32		
4.1	Becoming Grey at 4.1 m					
		5	SS	6		
		1	TW	PH		
		6	SS	2		0 0 40 60
8.5	END OF BOREHOLE AT 8.53 m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.					

Field vane sensitivity values plotted: 4, 4, 2.67

+ ³, × ³: Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 W-N 13+750 CL

METRIC

W.P. 742-93-00	LOCATION 421 W-N Ramp, ST. 13+750, CL		ORIGINATED BY DP
HWY 11	BOREHOLE TYPE Hollow Stem Augers		COMPILED BY SS
DATUM Geodetic	DATE 13.11.02 - 13.11.02		CHECKED BY JL

ELEV DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m3	GR	SA	SI	CL
0.0	**TOPSOIL** with organics													
0.2	Silty **CLAY** Hard to Firm Brown to Grey		1	GS										
			1	SS	21									
			2	SS	18									
			3	SS	33									
			4	SS	21									
			5	SS	4									
			6	SS	3						0	0	46	54
			7	SS	3									
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE OPEN TO 8.23 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

Dynamic cone penetration resistance plot scale: 20 40 60 80 100

Shear strength kPa: O UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60

REMARKS & GRAIN SIZE DISTRIBUTION (%)

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 09/02/05 s

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 W-N 13+800 CL

METRIC

W.P. 742-93-00	LOCATION 421 W-N Ramp, ST. 13+800, CL	ORIGINATED BY DP	
HWY 11	BOREHOLE TYPE Hollow Stem Augers	COMPILED BY SS	
DATUM Geodetic	DATE 13.11.02 - 13.11.02	CHECKED BY JL	

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**TOPSOIL** with organics						
0.1	Silty **CLAY**, occasional very thin brown clay lamination; Hard to Very Stiff; Grey; Moist to Wet	1	SS	31			
		2	SS	26			0 0 58 42
2.2	Silty **CLAY**, silt and clay lamination; Stiff to Firm; Grey/ Brown; Wet	3	SS	9			
		4	SS	9			
					+ 6		
		5	SS	3			0 0 51 49
					+ 2.25		
5.5	END OF BOREHOLE AT 5.49 m. BOREHOLE OPEN TO 5.49 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.						

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL.

$+^3, \times^3$: Numbers refer to Sensitivity

15 20 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 VV 10+050 CL

METRIC

W.P. 742-93-00 | LOCATION Valley View Road Connection, ST. 10+050, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 01.10.03 - 01.10.03 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Clayey **TOPSOIL** with organics										
0.2	Silty **CLAY**, some sand Stiff Brown Moist to Wet		1	SS	15				o		
1.5	**SILT**, some clay, some sand, trace gravel Loose Brown Moist to Wet		2	SS	9				o		
2.4	END OF BOREHOLE AT 2.36 m. AUGER REFUSAL AT 2.36 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 2.36 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

Legend: O UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × LAB VANE. Scales: 20 40 60 80 100. Water content: PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; 20 40 60.

$+^3, \times^3$: Numbers refer to Sensitivity

15 ⊕ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 VV 10+075 L20

METRIC

W.P. 742-93-00
LOCATION Valley View Road Connection, ST. 10+075, O/S 20L
ORIGINATED BY DP

HWY 11
BOREHOLE TYPE Hollow Stem Augers
COMPILED BY SS

DATUM Geodetic
DATE 01.10.03 - 01.10.03
CHECKED BY JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	SHEAR STRENGTH kPa	WATER CONTENT (%)	GR	SA	SI	CL
0.0	Clayey **TOPSOIL** with organics										
0.2	Silty **CLAY**, trace sand Very Stiff to Firm Brown to Grey Moist to Wet										
		1	SS	17							
	becoming grey	2	SS	17				0	3	73	24
	occasional silt pocket lenses	3	SS	7							
		4	SS	6				0	1	78	21
						+ 3.44 (field vane)					
		5	SS	6	∇						
5.6	END OF BOREHOLE AT 5.64 m. AUGER REFUSAL AT 5.64 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.64 m AND WATER LEVEL AT 5.18 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND BENTONITE SEAL TO SURFACE.										

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, "N" VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) (20 40 60); UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) (GR SA SI CL)

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

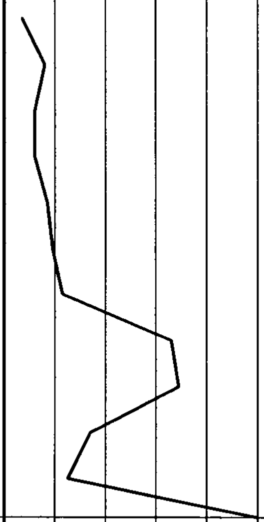
ONTMT4S VALLEY VIEW RD.GPJ 09/02/05 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 VV 10+075 R20 1 OF 1 METRIC

W.P.	742-93-00	LOCATION	Valley View Road Connection, ST. 10+075, O/S 20R	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	SS
DATUM	Geodetic	DATE	01.10.03 - 01.10.03	CHECKED BY	JL

SOIL PROFILE: ELEV DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	DCPT from surface.										
3.4	END OF DCPT AT 3.4 m. CONE REFUSAL AND BOUNCING AT 3.4 m. PROBABLE BEDROCK OR BOULDER.										

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 VV 10+100 CL

METRIC

W.P. 742-93-00 | LOCATION Valley View Road Connection, ST. 10+100, CL | ORIGINATED BY DP
HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS
DATUM Geodetic | DATE 01.10.03 - 01.10.03 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Clayey **TOPSOIL** with organics										
0.2	Silty **CLAY**, trace sand Brown Moist		1	GS					~20		
0.6	END OF BOREHOLE AT 0.61m. AUGER REFUSAL AT 0.61 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.61 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

Shear strength legend: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE. Plastic limit w_P, natural moisture content w, liquid limit w_L.

$+^3, \times^3$: Numbers refer to Sensitivity

15-20-5-10 (%) STRAIN AT FAILURE

RAMPS WEST OF HWY11

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 N-EW 14+075 R18 1 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 N-EW Ramp, ST. 14+075, O/S 18R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 20.11.02 - 20.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	PEAT WITH ORGANICS, fibrous Dark Brown to Black Wet				
		1	TW	PH	
		2	TW	PH	
2.4	Silty CLAY, laminated, partially organic Soft Grey Wet	3	TW	PH	0 0 67 33
2.8	Silty CLAY, laminated Soft Grey Wet	4	TW	PH	No Recovery in TW#4
		5	TW	PH	
		1	SS	2	
7.0	END OF BOREHOLE AT 7.01 m. BOREHOLE OPEN TO 7.01 m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.				

Plot annotations: water content values 279, 806, 219 (peat samples); shear strength (field vane) values 0, 0, 0.

WATER LEVEL READINGS:

DATE	DEPTH (m)
20/06/03	0.35
15/08/03	0.36

Column headings: SOIL PROFILE; SAMPLES; STRAT PLOT; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 N-EW 14+075 L17.81 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 N-EW Ramp, ST. 14+075, O/S 17.8L ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 21.11.02 - 21.11.02 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
7.6	END OF DCPT AT 7.62m.										

+ ³, × ³ : Numbers refer to Sensitivity

15-⊕-5 (20 above, 10 below) (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 N-EW 14+100 CL

METRIC

W.P. 742-93-00 LOCATION 421 N-EW Ramp, ST. 14+100, CL ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 21.11.02 - 21.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa (field vane, sensitivity)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT WITH ORGANICS**, fibrous Dark Brown to Black Wet					
		1	TW	PH		No Recovery in TW#1
		2	TW	PH		
2.4	Silty **CLAY**, laminated Soft to Firm Grey Wet	3	TW	PH		0 0 60 40
		1	SS	1		
					+ 5	
		2	SS	2		0 0 66 34
					+ 0	
		3	SS	2		
					+ 5	
7.0	END OF BOREHOLE AT 7.01 m. BOREHOLE OPEN TO 7.01 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.					

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; STRAT PLOT.

Water content plot annotation: 133

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 W-S 14+512.5 CL 1 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 W-S Ramp, ST. 14+512.5, CL ORIGINATED BY DP
HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY SS
DATUM Geodetic DATE 20.11.02 - 20.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, trace to some organics Dark Brown to Black Wet										
			1	TW	PH						No Recovery in TW#1
			2	TW	PH				375		
									151		
2.5	Silty **CLAY**, laminated Soft Grey Wet		3	TW	PH						
			1	SS	0						0 0 61 39
								0			
			2	SS	1						
								4			
5.5	END OF BOREHOLE AT 5.49 m. BOREHOLE OPEN TO 5.49 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS. DCPT FOR PEAT LAYER CARRIED OUT ADJACENT TO BOREHOLE.										

Legend: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L

$+^3, \times^3$: Numbers refer to Sensitivity   20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 W-S 14+537.5 R19 1 OF 2 METRIC

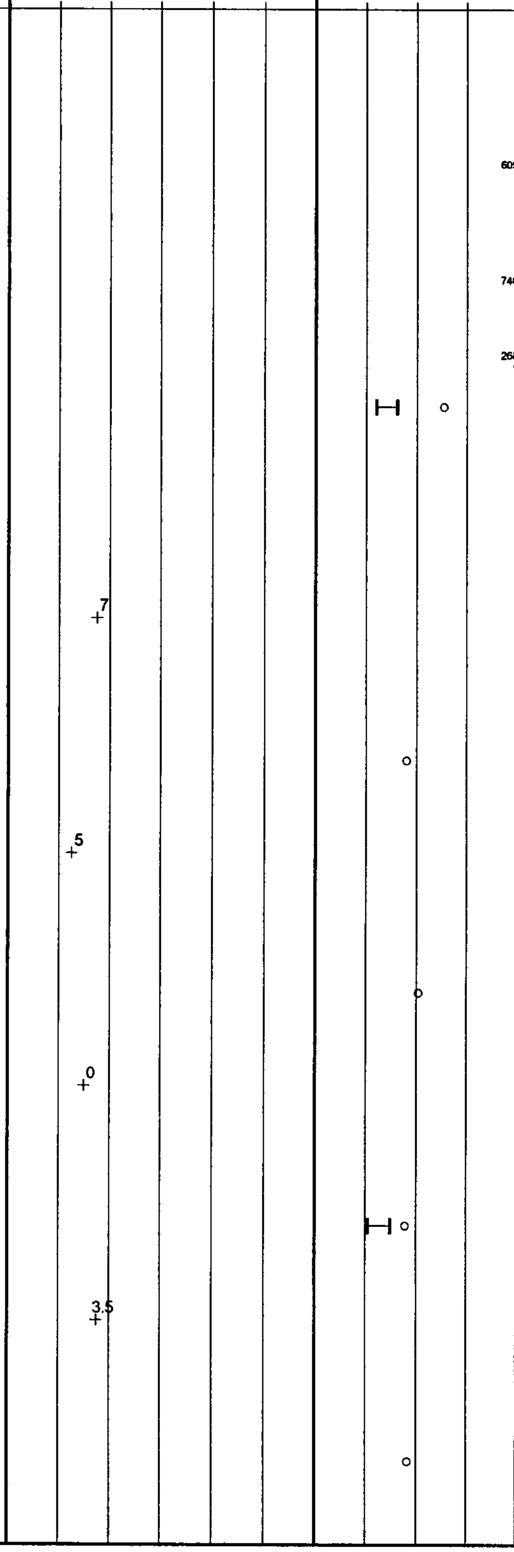
W.P. 742-93-00 LOCATION 421 W-S Ramp, ST. 14+537.5, 19R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 20.11.02 - 20.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, fibrous, trace some organics Dark Brown to Black Wet	1	TW	PH	
		2	TW	PH	
2.4	Silty **CLAY**, partially organics, laminated Soft Grey Wet	3	TW	PH	0 0 59 41
2.8	Silty **CLAY**, laminated Soft to Firm Grey Wet	4	TW	PH	
		1	SS	2	
		2	SS	2	
		3	SS	2	0 0 66 33
		4	SS	3	

Column headings: SOIL PROFILE; SAMPLES; STRAT PLOT; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³



Continued Next Page

+ ³, × ³ : Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 W-S 14+537.5 R19 METRIC

W.P. 742-93-00	LOCATION 421 W-S Ramp, ST. 14+537.5, 19R		ORIGINATED BY DP
HWY 11	BOREHOLE TYPE Hollow Stem Augers		COMPILED BY SS
DATUM Geodetic	DATE 20.11.02 - 20.11.02		CHECKED BY JL

SOIL PROFILE: ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
								+1			
			5	TW	PH						
								+2			
11.6	END OF BOREHOLE AT 11.58 m. BOREHOLE OPEN TO 11.58 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 421 W-S 14+537.5 L22.91 OF 1 METRIC

W.P. 742-93-00
LOCATION 421 W-S Ramp, ST. 14+537.5, 22.9L
ORIGINATED BY DP

HWY 11
BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT)
COMPILED BY SS

DATUM Geodetic
DATE 19.11.02 - 19.11.02
CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20, 40, 60, 80, 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20, 40, 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
7.6	END OF DCPT AT 7.62m.										

+ 3, × 3: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421 ROBINS & BLACK CREEK.GPJ 10/02/05 s

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Ontario

THURBER

RECORD OF BOREHOLE No 421 E-S 14+525 CL

METRIC

W.P. 742-93-00 | LOCATION 421 E-S Ramp, ST. 14+525, CL | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Hollow Stem Augers | COMPILED BY SS

DATUM Geodetic | DATE 20.11.02 - 20.11.02 | CHECKED BY JL

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	PEAT, some to trace organics Dark Brown to Black Wet				
		1	TW	PH	No Recovery in TW#1
		2	TW	PH	No Recovery in TW#2
		3	TW	PH	
2.6	Silty **CLAY**, trace sand, laminated Soft Grey Wet				
		1	SS	1	0 0 65 35
		2	SS	1	
5.5	END OF BOREHOLE AT 5.49 m. BOREHOLE OPEN TO 5.49 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.				

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3

Plotted values: 145, 94 (water content, peat); field vane 10, 5 (clay).

$+^3, \times^3$: Numbers refer to Sensitivity   20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

RECORD OF BOREHOLE No 421 E-S 14+550 R23.2 1 OF 1 METRIC

W.P. 742-93-00 LOCATION 421 E-S Ramp, ST. 14+550, O/S 23.2R ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SS

DATUM Geodetic DATE 19.11.02 - 19.11.02 CHECKED BY JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	FIELD VANE (kPa) / sensitivity	WATER CONTENT	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**PEAT**, with grass and small tree vegetation						
0.3	**PEAT**, fibrous Dark Brown to Black Wet	1	TW	PH			No Recovery in TW#1
		2	TW	PH		319, 200	
2.4	Silty **CLAY**, laminated, partially organic Soft Grey	3	TW	PH			0 0 61 39
		1	SS	2			
3.7	Silty **CLAY**, laminated Soft to Firm Grey Wet				+0		
		2	SS	1			0 0 68 32
					+7		
		3	SS	2			
					4.5		
7.0	END OF BOREHOLE AT 7.01 m. BOREHOLE CAVED TO SURFACE. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.						

+ 3, × 3: Numbers refer to Sensitivity

20 15 5 10 (%) STRAIN AT FAILURE

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Ontario

THURBER

RECORD OF BOREHOLE No 421 E-S 14+550 L18.4 1 OF 1 METRIC

W.P. 742-93-00 | LOCATION 421 E-S Ramp, ST. 14+550, O/S 18.4L | ORIGINATED BY DP

HWY 11 | BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) | COMPILED BY SS

DATUM Geodetic | DATE 19.11.02 - 19.11.02 | CHECKED BY JL

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
0.0	DCPT from surface.										
7.6	END OF DCPT AT 7.62m.										

+ ³, × ³ : Numbers refer to Sensitivity

15, 20, 5, 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

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Ontario

THURBER

RECORD OF BOREHOLE No 421 E-S 14+575 CL

METRIC

W.P.	742-93-00	LOCATION	421 E-S Ramp, ST. 14+575, CL	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	SS
DATUM	Geodetic	DATE	19.11.02 - 19.11.02	CHECKED BY	JL

SOIL PROFILE

ELEV DEPTH	DESCRIPTION
0.0	**PEAT**, fibrous, some rootlets Dark Brown to Black Wet
2.4	Silty **CLAY**, trace sand Soft to Firm Grey
8.5	END OF BOREHOLE AT 8.53 m. BOREHOLE OPEN TO 8.53 m AND WATER LEVEL AT 2.13 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.

SAMPLES

NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	TW	PH	473	
2	TW	PH	378	
3	TW	PH		0 0 63 37
1	SS	1		
2	SS	1		0 0 63 36
3	SS	2		
4	TW	PH		

Column headings: GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L, WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3.

Field vane sensitivity values plotted: 0, 0, 3; 1.67

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

15 ⌖ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No 421 E-S 14+612.5 CL

METRIC

W.P.	742-93-00	LOCATION	421 E-S Ramp, ST. 14+612.5, CL	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT)	COMPILED BY	SS
DATUM	Geodetic	DATE	21.11.02 - 21.11.02	CHECKED BY	JL

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	WATER CONTENT (%)	GR	SA	SI	CL
0.0	**PEAT**, fibrous, trace to some organics Dark Brown to Black Wet								
		1	TW	PH	365				
		2	TW	PH	96				
2.4	Silty **CLAY**, laminated Soft Grey Wet	3	TW	PH		0	0	66	34
		4	TW	PH					
		1	SS	1					
5.5	END OF SAMPLING AT 5.49 m. AUGERED TO 6.10 m AND DCPT STARTED AT 6.10 m.								

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 421 E-S 14+612.5 CL 2 OF 2 METRIC

W.P. 742-93-00 LOCATION 421 E-S Ramp, ST. 14+612.5, CL ORIGINATED BY DP

HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY SS

DATUM Geodetic DATE 21.11.02 - 21.11.02 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
10.7	END OF DCPT AT 10.67m. BOREHOLE OPEN TO 10.67 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS SURFACE.										

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

$+^3, \times^3$: Numbers refer to Sensitivity

15-⌖-5 (20 above, 10 below) (%) STRAIN AT FAILURE

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Ontario

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RECORD OF BOREHOLE No 421 E-S 14+612.5 CL (CONE) 1 OF 1 METRIC

W.P.	742-93-00	LOCATION	421 E-S Ramp, ST. 14+612.5, CL	ORIGINATED BY	DP
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	SS
DATUM	Geodetic	DATE	21.11.02 - 21.11.02	CHECKED BY	JL

SOIL PROFILE: ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	DCPT from surface.										
7.6	END OF DCPT AT 7.62m.										

+ ³, × ³: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 421ROBINS & BLACK CREEK.GPJ 10/02/05 s

FOUNDATION INVESTIGATION REPORT

EMBANKMENTS ALONG HIGHWAY 11 - STA.13+260 TO STA.14+600

ROBINS ROAD/BLACK CREEK ROAD I/C UNDERPASS STRUCTURE

APPROACH EMBANKMENTS AND ACCESS RAMPS

HIGHWAY 11, BURK'S FALLS TO SOUTH RIVER

ONTARIO

G.W.P. 742-93-00, WP 757-93-01, SITE 44-421

Geocres Number: 31E-234

Report to

Marshall Macklin Monaghan

Volume 3/3

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
Phone: (905) 829 8666
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July 6, 2005
File: 19-1423-24
C:\Thurber Files\19\MMM\1423-12-Hwy11-Burk's Falls\1423-24 Hwy11-Robins Road-Supplementary\Report\1423-12 Robins Suppl-FNDN FACTUAL-PJB-Final-July-2005.doc

THURBER

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APPENDIX B

LABORATORY TEST RESULTS

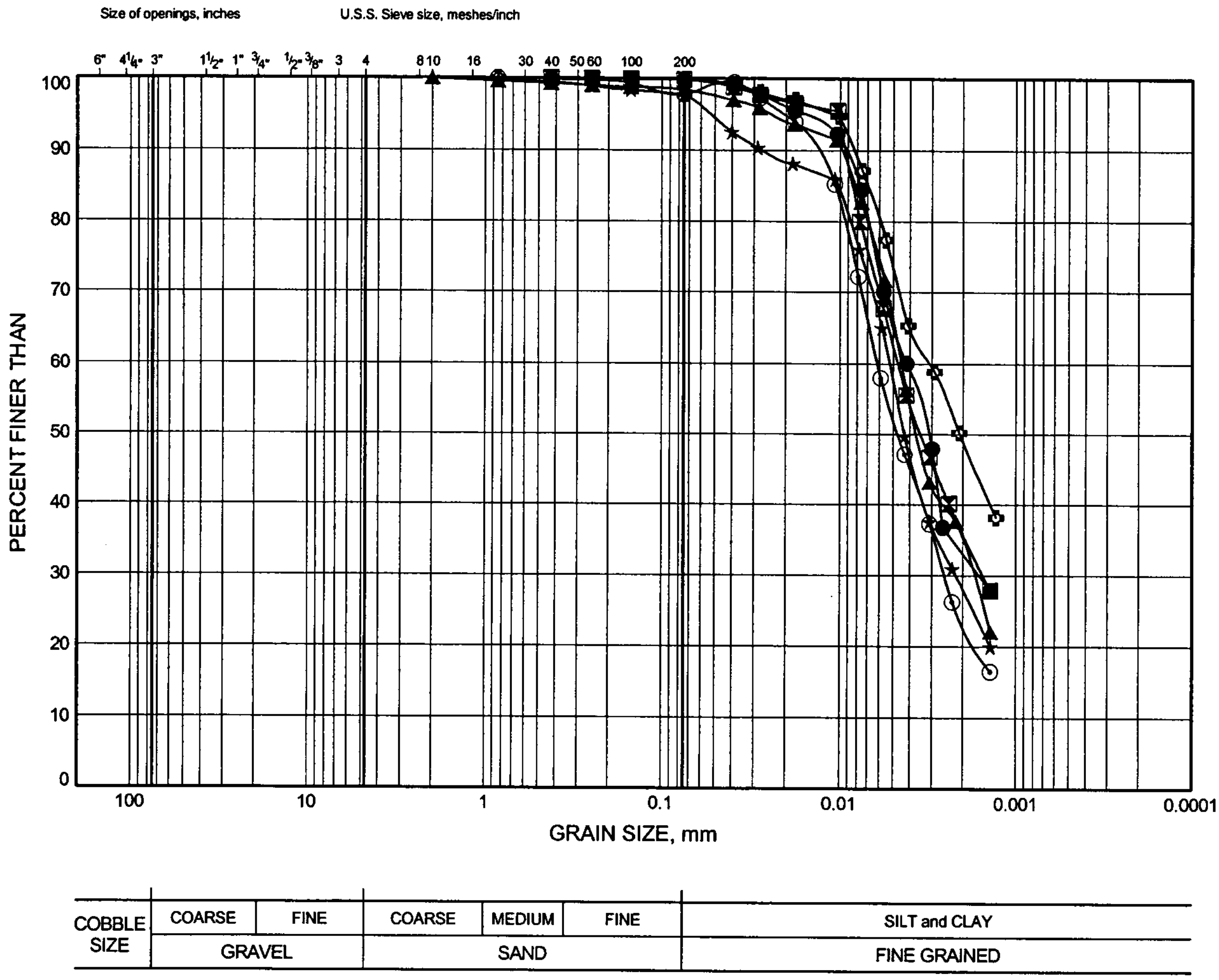
BLACK CREEK ROAD

BLACK CREEK RD.

GRAIN SIZE DISTRIBUTION

FIGURE B1

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 9+900 L27.2	2.75	
⧗	421 9+900 L27.2	4.88	
▲	421 9+925 R1.5	4.88	307.72
★	421 9+925 R1.5	9.45	303.15
⊙	BH 421-3	1.83	310.54
✪	BH 421-3	6.40	305.97

Date February 2005

Project 742-93-00

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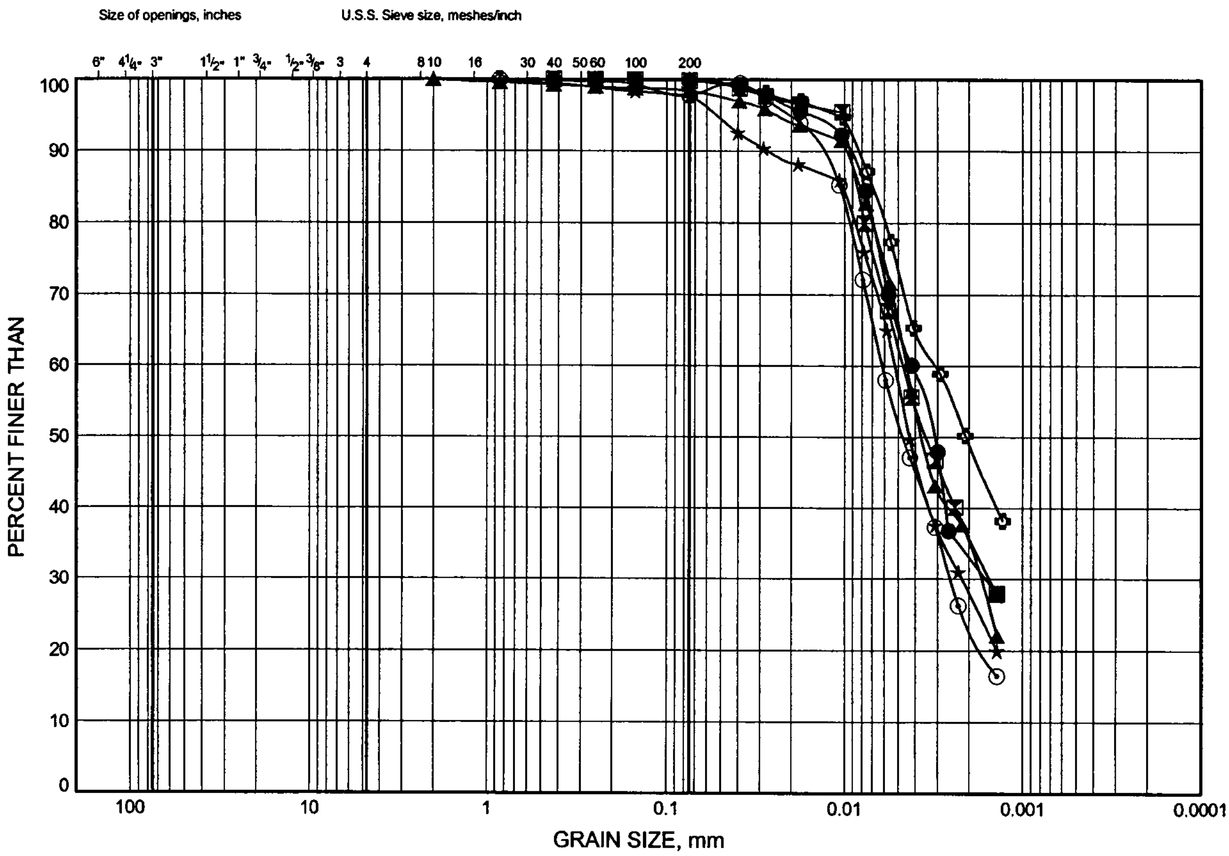
THURBGSD APPENDIX B(BLACK CREEK).GPJ 10/02/05

BLACK CREEK RD.

GRAIN SIZE DISTRIBUTION

FIGURE B1

SILTY CLAY



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 9+900 L27.2	2.59	
⊠	421 9+900 L27.2	4.88	
▲	421 9+925 R1.5	4.88	307.72
★	421 9+925 R1.5	9.45	303.15
⊙	BH 421-3	1.83	310.54
✪	BH 421-3	6.40	305.97

Date February 2005

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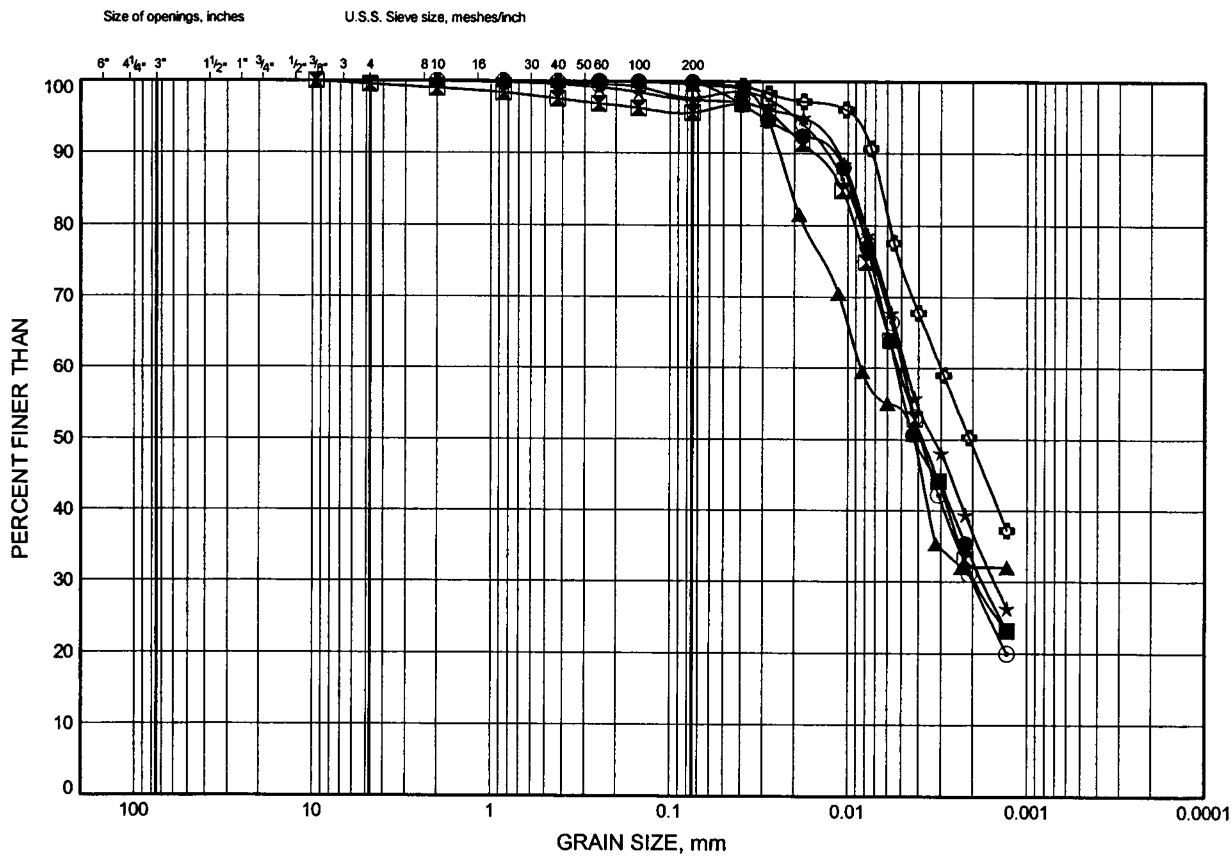
BLACK CREEK RD.

GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY



COBBLE SIZE	GRAVEL		SAND			SILT and CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH 421-1	2.59	310.04
⧗	BH 421-2	2.59	309.44
▲	BH 421-2	6.10	305.93
★	BH 421-2	8.20	303.83
⊙	BH 421-2	10.92	301.11
✿	BH 421-3	10.97	301.40

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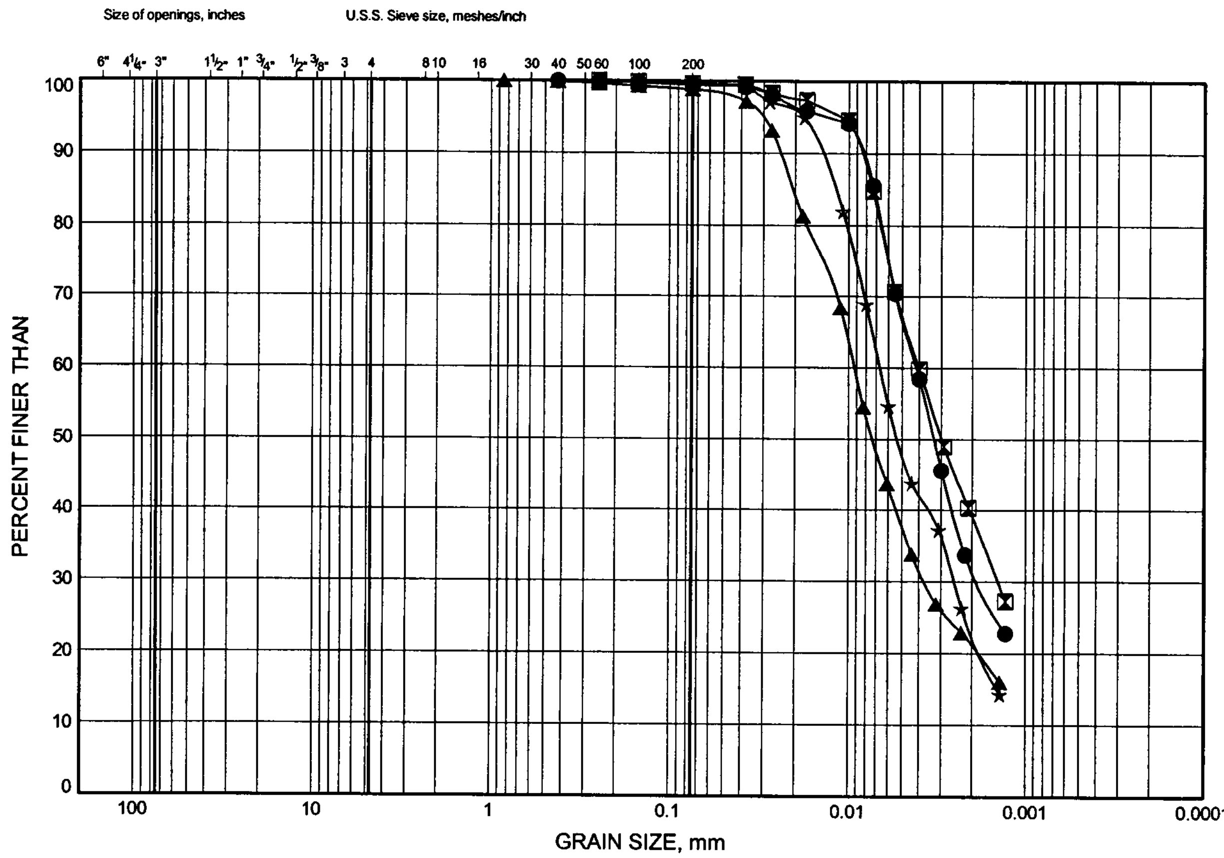
BLACK CREEK RD.

GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY CLAY



<table>
<tr><td rowspan="2">COBBLE SIZE</td><td>COARSE</td><td>FINE</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td><td>SILT and CLAY</td></tr>
<tr><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td>FINE GRAINED</td></tr>
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SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-3	4.88	307.30
⊠	24-3	15.54	296.64
▲	24-3	39.93	272.25
★	BH 421-2	11.89	300.14

THURBGSD APPENDIX B(BLACK CREEK).GPJ 10/02/05

Date February 2005

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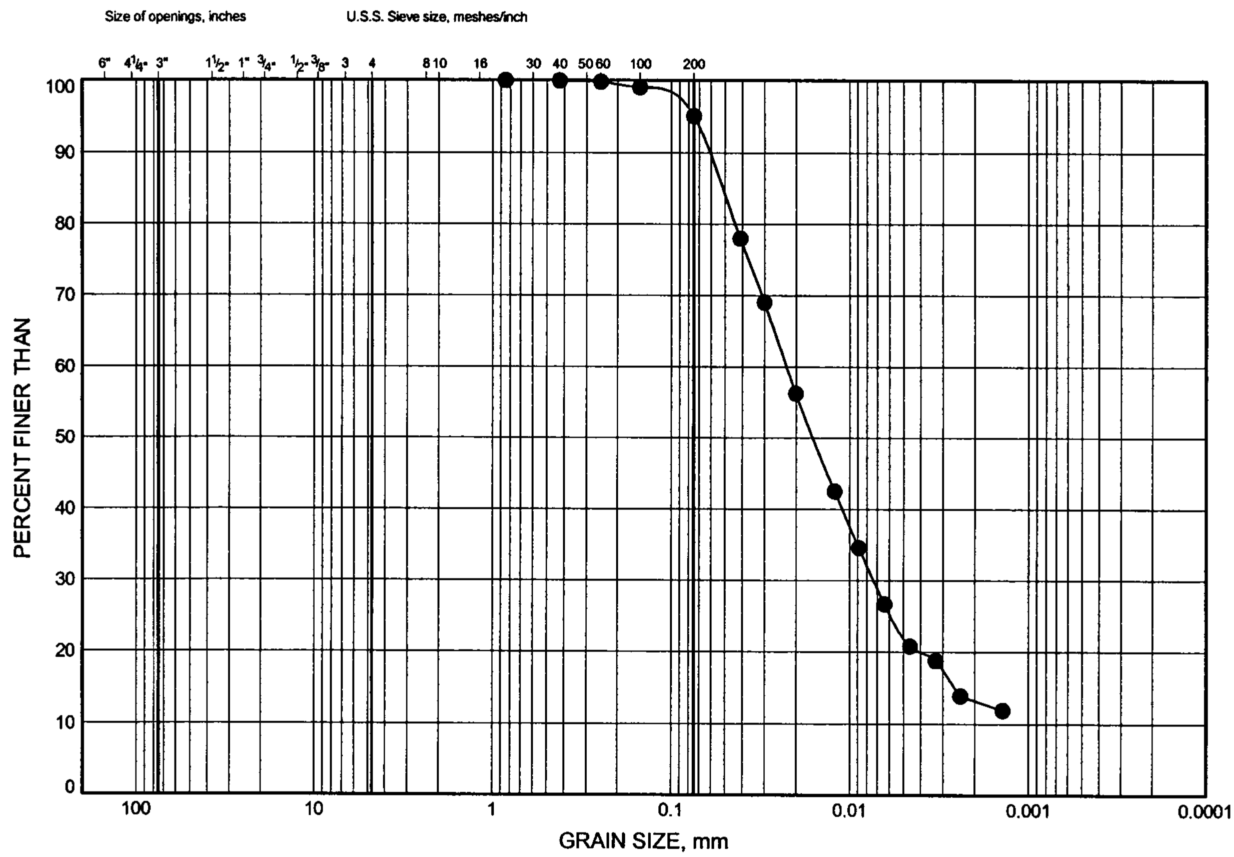
BLACK CREEK RD.

GRAIN SIZE DISTRIBUTION

FIGURE B4

SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-3	42.98	269.20

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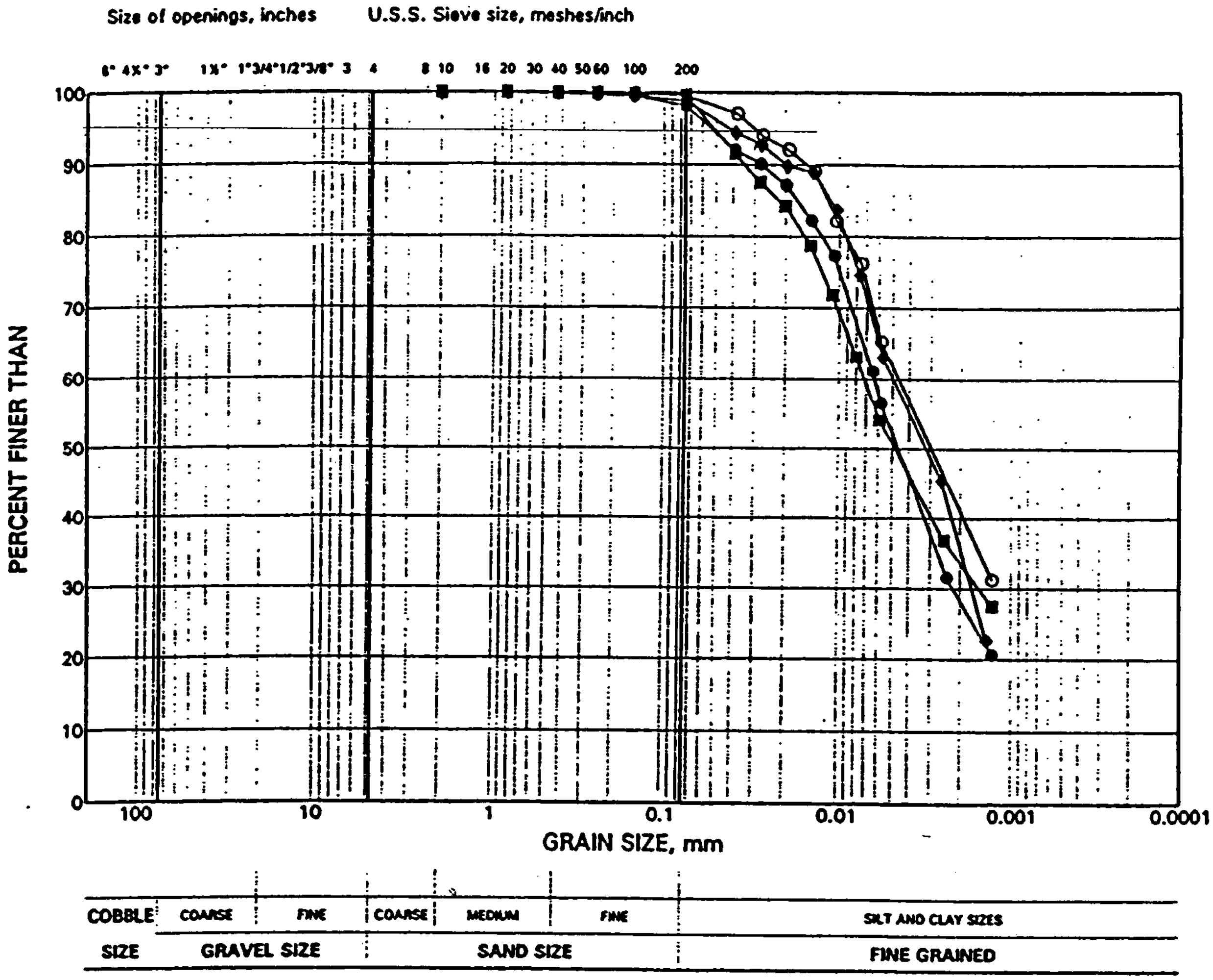
GRAIN SIZE DISTRIBUTION

Silty Clay, trace sand

FIGURE B5



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)	
●	5-2	3	311.2	Black Creek
■	5-2	12	298.3	
◆	5-3	4	307.4	
○	5-3	12	295.0	

Project 991-1193

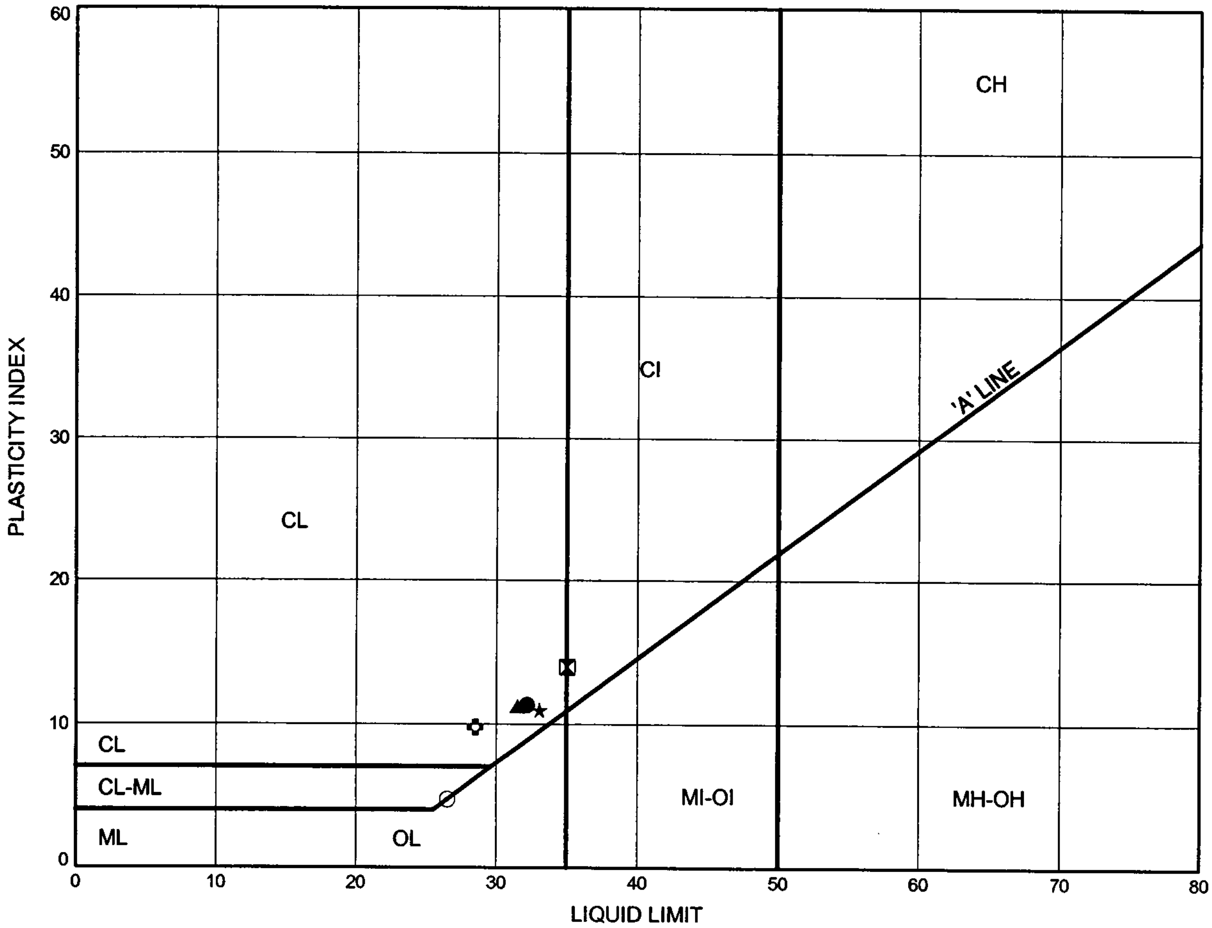
Golder Associates

BLACK CREEK RD.

ATTERBERG LIMITS TEST RESULTS

FIGURE B6

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH 421-2	1.49	93.62
⊠	BH 421-2	1.86	93.25
▲	BH 421-2	2.50	92.61
★	BH 421-2	3.33	91.78
⊙	BH 421-2	3.62	91.48
✪	BH 421-3	0.79	94.42

Date February 2005

Project 742-93-00

THURBER

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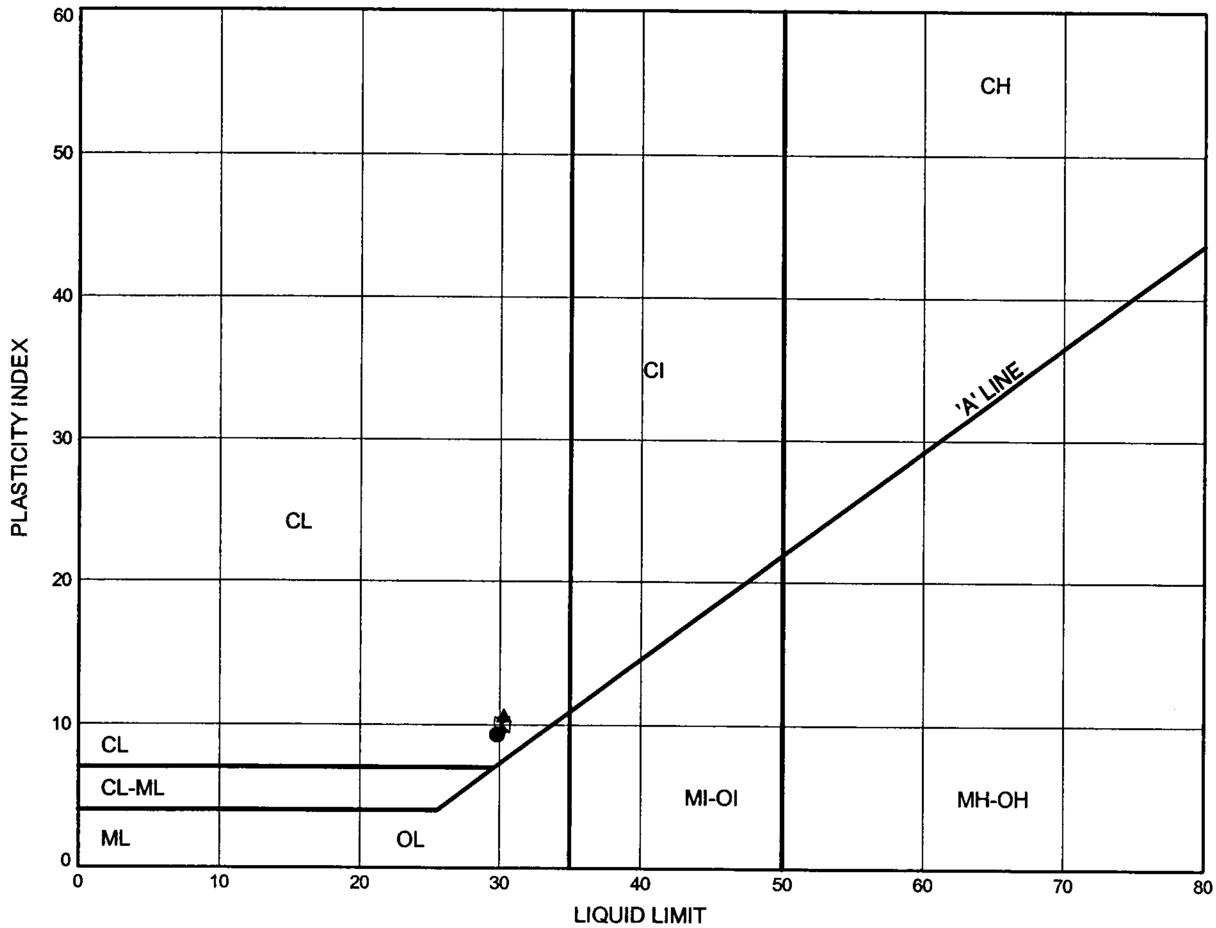
THURBALT APPENDIX B(BLACK CREEK).GPJ 10/02/05

BLACK CREEK RD.

ATTERBERG LIMITS TEST RESULTS

FIGURE B7

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 9+900 L27.2	4.88	
⊠	421 9+925 R1.5	9.45	303.15
▲	BH 421-1	3.35	309.28

Date February 2005

Project 742-93-00

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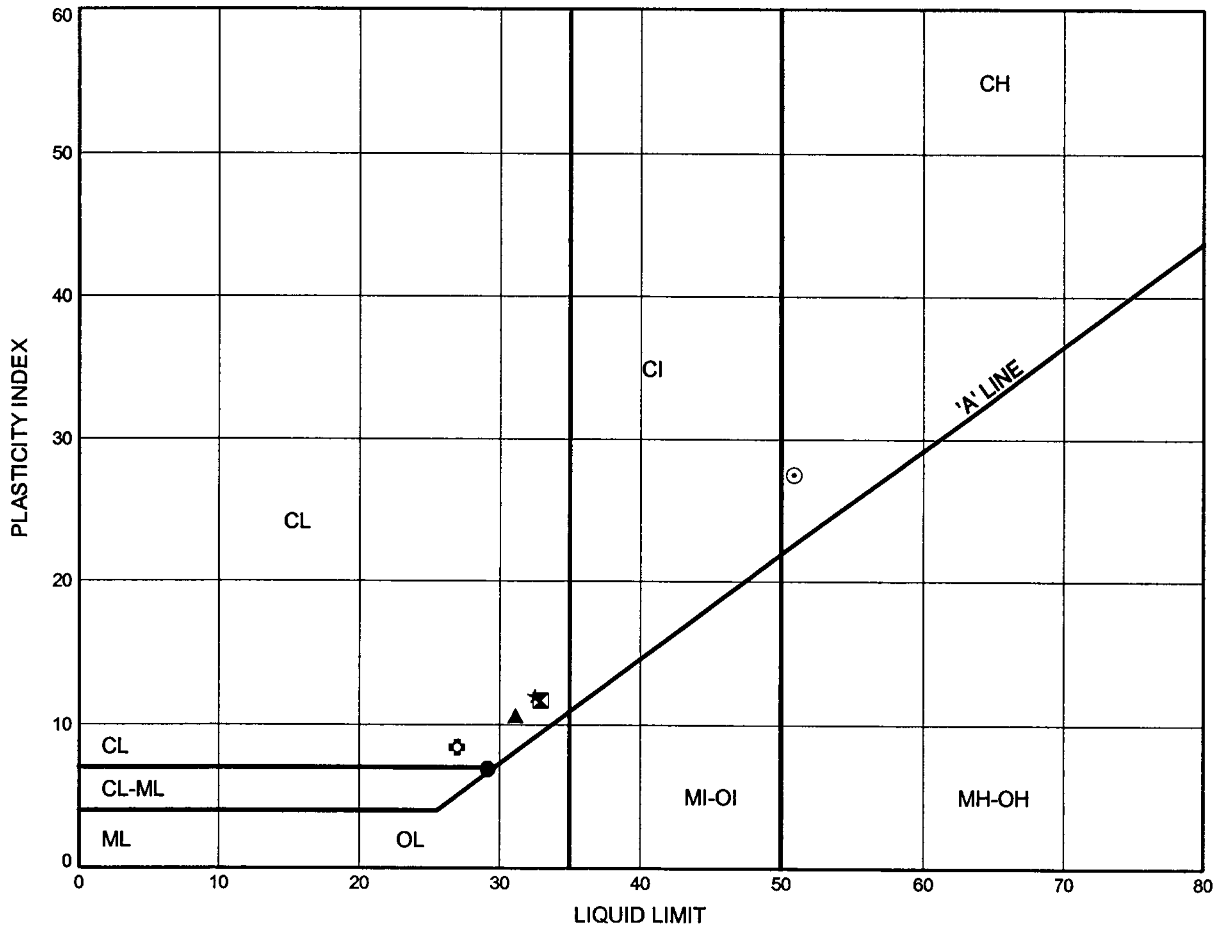
THURBALT APPENDIX B(BLACK CREEK).GPJ 10/02/05

BLACK CREEK RD.

ATTERBERG LIMITS TEST RESULTS

FIGURE B8

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-3	4.88	307.30
⊠	24-3	9.45	302.73
▲	24-3	15.54	296.64
★	24-3	20.12	292.06
⊙	24-3	30.78	281.40
✿	24-3	39.93	272.25

Date February 2005

Project 742-93-00

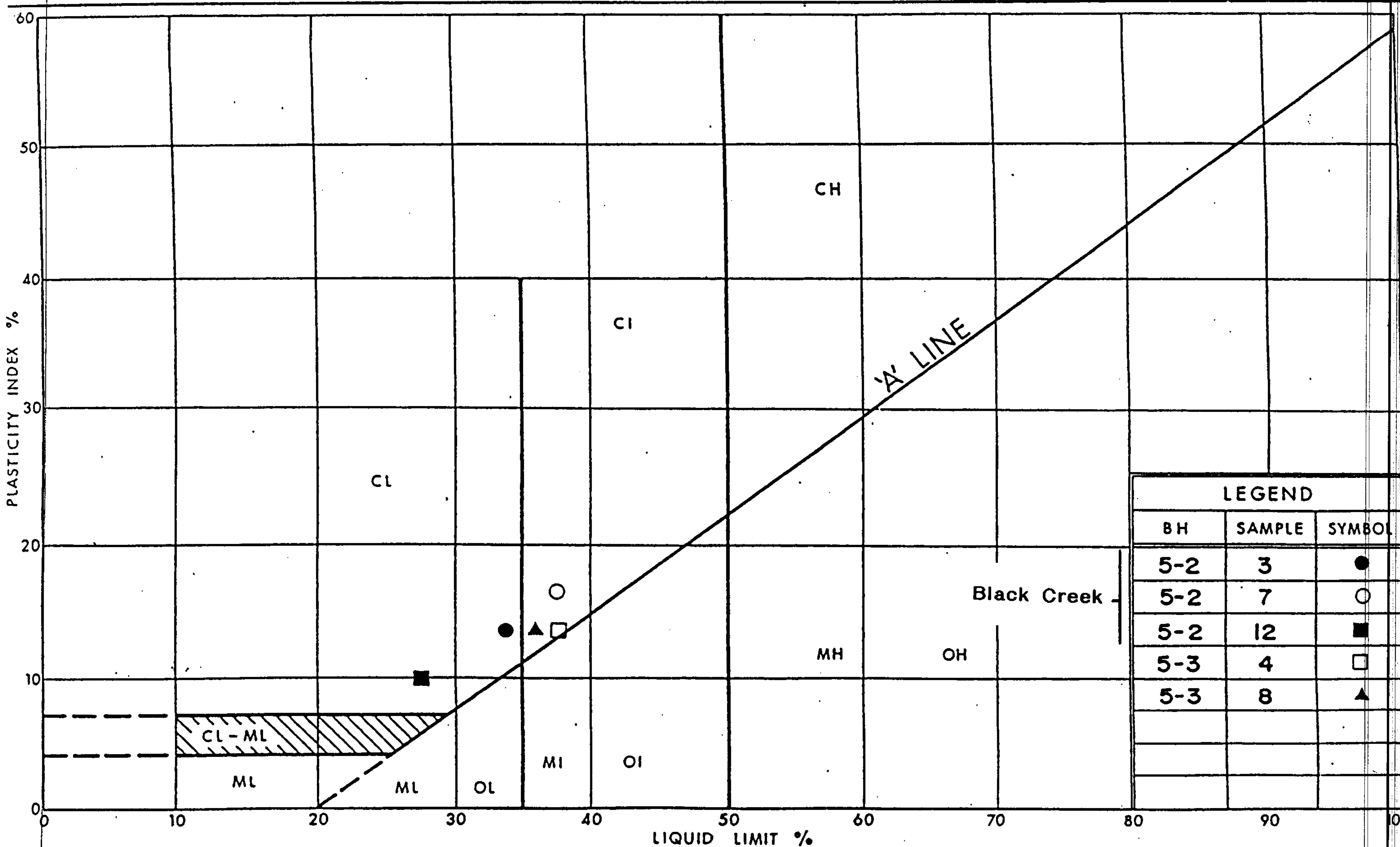
THURBER

Prep'd HS

Chkd. PJB

THURBALT APPENDIX B(BLACK CREEK).GPJ 10/02/05

Oct 75, FF-S-21



Ministry of Transportation Ontario

PLASTICITY CHART
SILTY CLAY

FIG No. 6

W P 335-98-00

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	TW#1
Borehole Number	24-3	Sample Depth, m	9.1-9.8

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	6		
Date Started	10/08/2004		
Date Completed	10/21/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	17.33
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	11.83
Area, cm^2	31.67	Specific Gravity, measured	2.75
Volume, cm^3	60.17	Solids Height, cm	0.833
Water Content, %	46.54	Volume of Solids, cm^3	26.39
Wet Mass, g	106.33	Volume of Voids, cm^3	33.79
Dry Mass, g	72.56	Degree of Saturation, %	100.0

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.280	1.900				
4.69	1.897	1.277	1.899	240	3.18E-03	3.37E-04	1.05E-07
9.53	1.890	1.268	1.894	108	7.04E-03	7.61E-04	5.25E-07
19.25	1.880	1.256	1.885	53	1.42E-02	5.41E-04	7.54E-07
38.68	1.862	1.235	1.871	53	1.40E-02	4.88E-04	6.69E-07
77.38	1.832	1.199	1.847	49	1.48E-02	4.08E-04	5.90E-07
154.68	1.758	1.110	1.795	80	8.54E-03	5.04E-04	4.22E-07
309.21	1.666	1.000	1.712	103	6.03E-03	3.13E-04	1.85E-07
618.78	1.587	0.905	1.627	53	1.06E-02	1.34E-04	1.39E-07
1237.37	1.513	0.816	1.550	40	1.27E-02	6.30E-05	7.86E-08
2473.23	1.438	0.726	1.476	60	7.69E-03	3.19E-05	2.41E-08
1237.37	1.451	0.742	1.445				
309.21	1.473	0.768	1.462				
77.38	1.504	0.805	1.489				
19.25	1.544	0.853	1.524				
4.69	1.571	0.886	1.558				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.57	Unit Weight, kN/m^3	18.98
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	14.30
Area, cm^2	31.67	Specific Gravity, measured	2.75
Volume, cm^3	49.75	Solids Height, cm	0.833
Water Content, %	32.73	Volume of Solids, cm^3	26.39
Wet Mass, g	96.31	Volume of Voids, cm^3	23.37
Dry Mass, g	72.56		

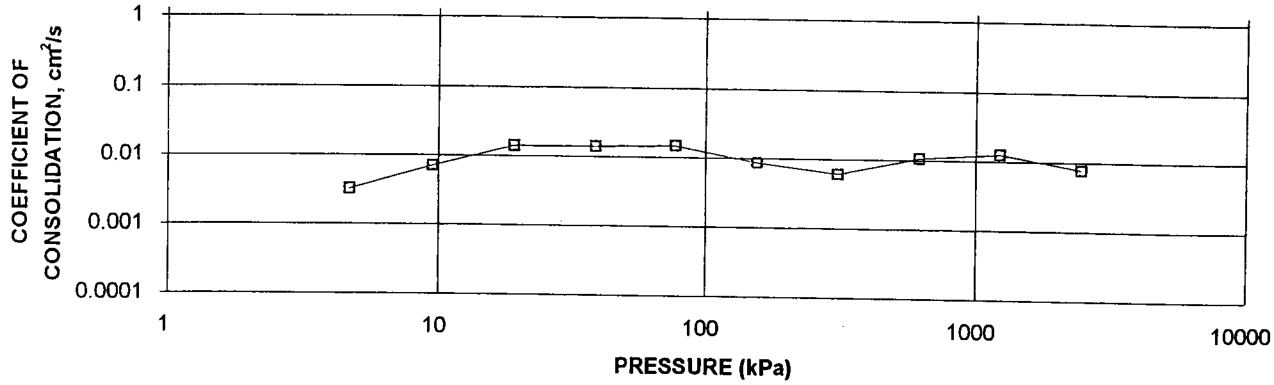
Prepared By: LFG

Golder Associates

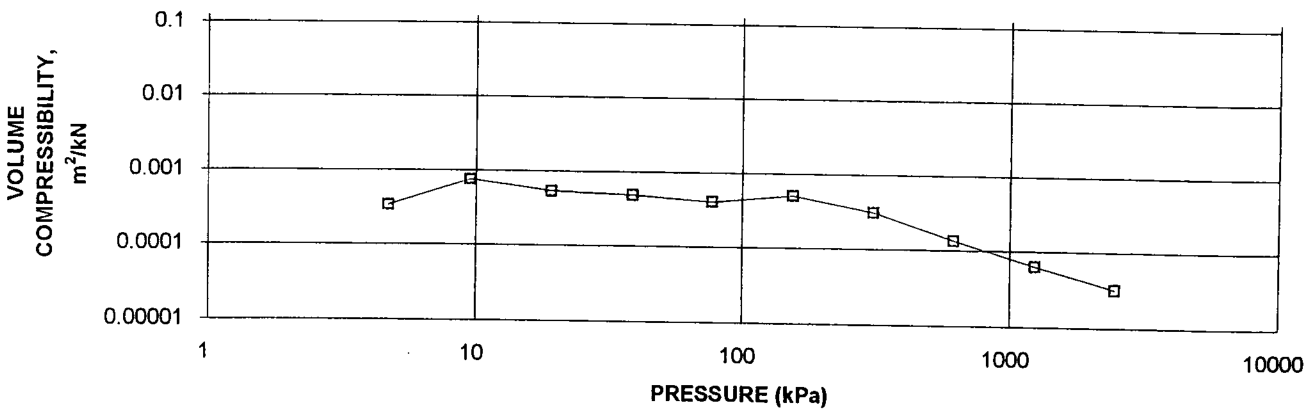
Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY

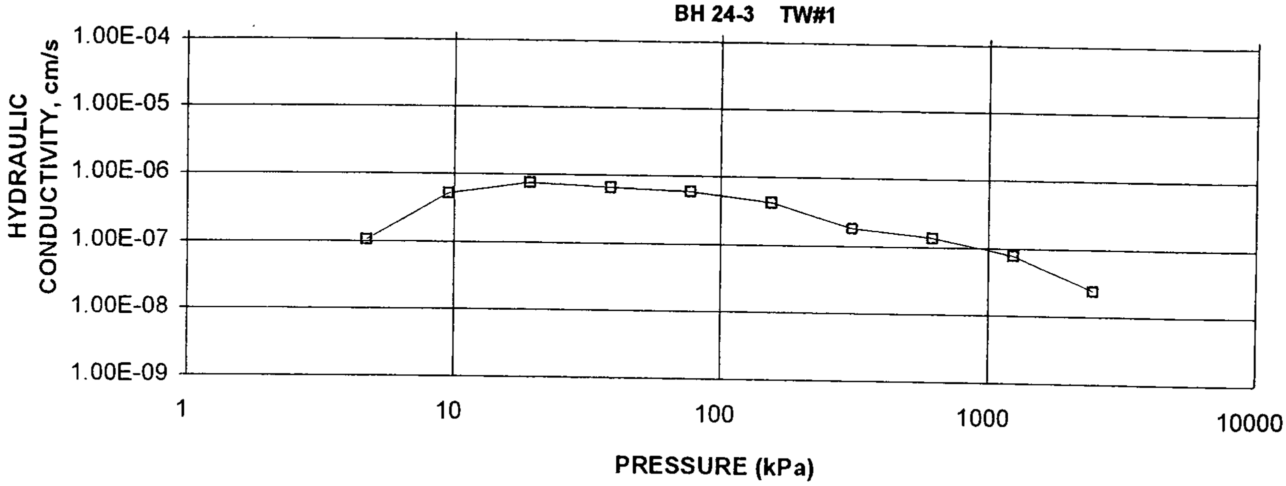
CONSOLIDATION TEST
CV cm²/s VS PRESSURE (kPa)
BH 24-3 TW#1



CONSOLIDATION TEST
MV m²/kN vs PRESSURE (kPa)
BH 24-3 TW#1



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH 24-3 TW#1



Project No. 04-1116-100
Prepared By: LFG

Golder Associates

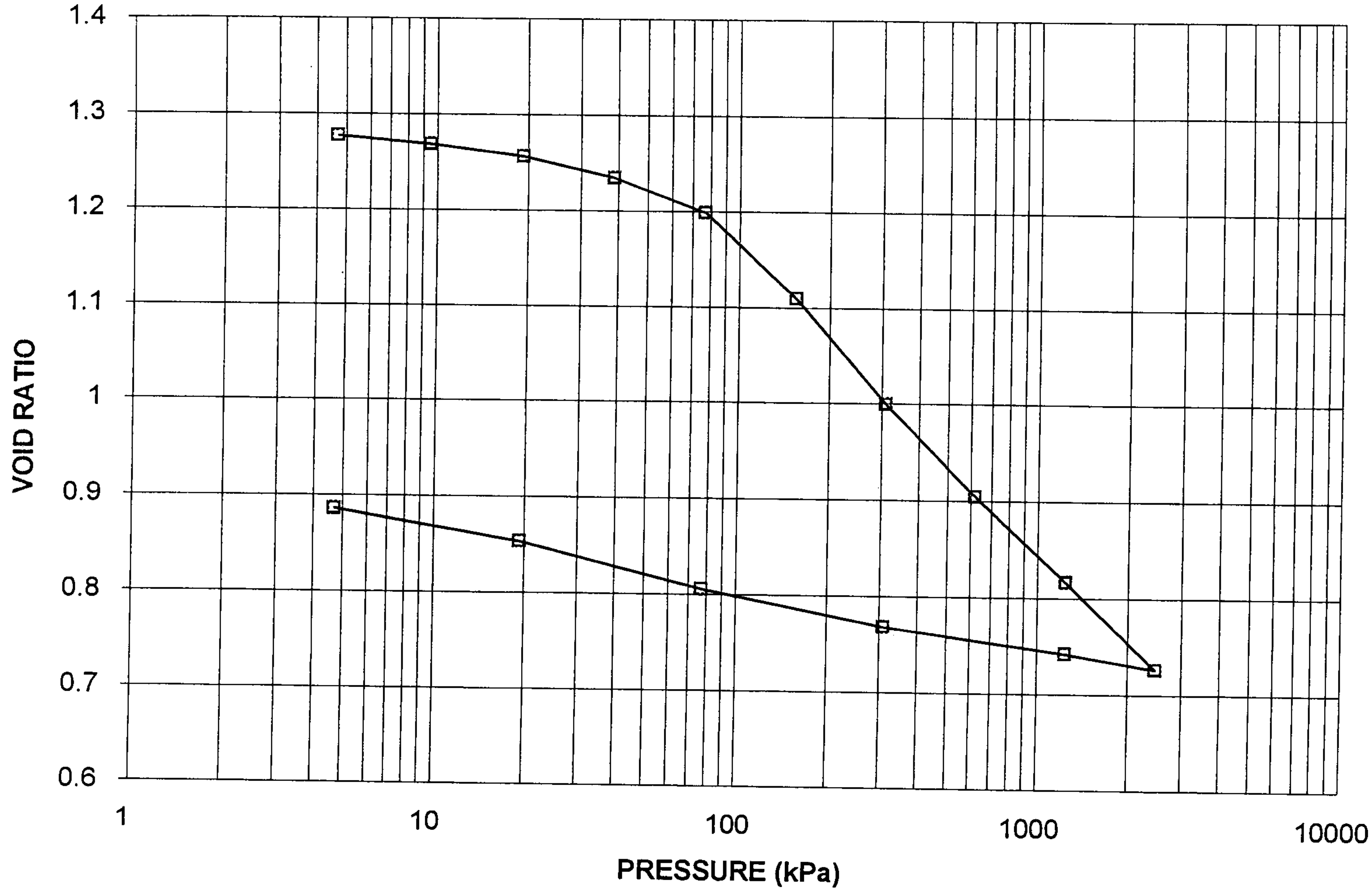
Checkey By: MM

Project No. 04-1116-100
Prepared By: LFG

Golder Associates

Checked By: MM

CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH 24-3 TW#1

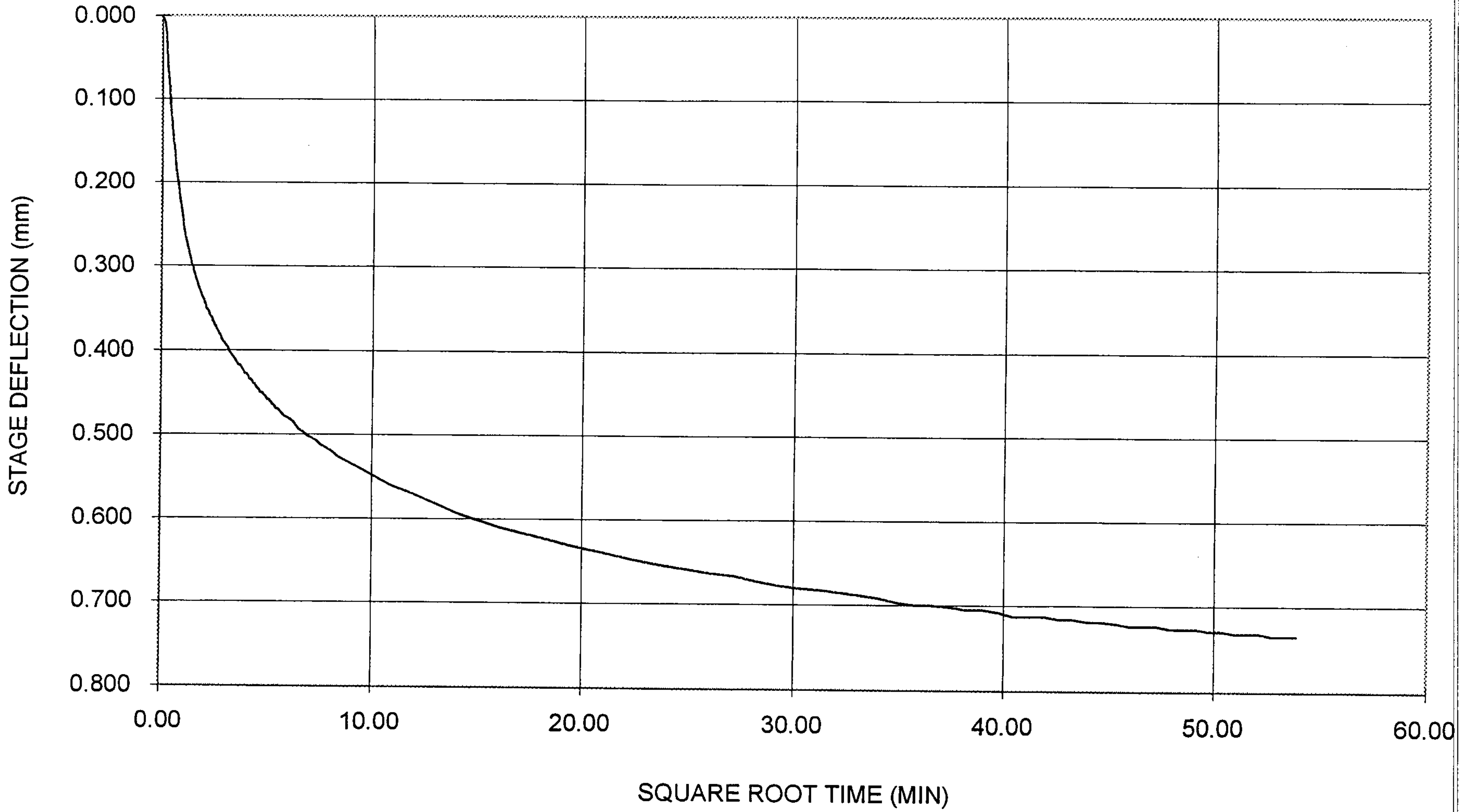


CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE

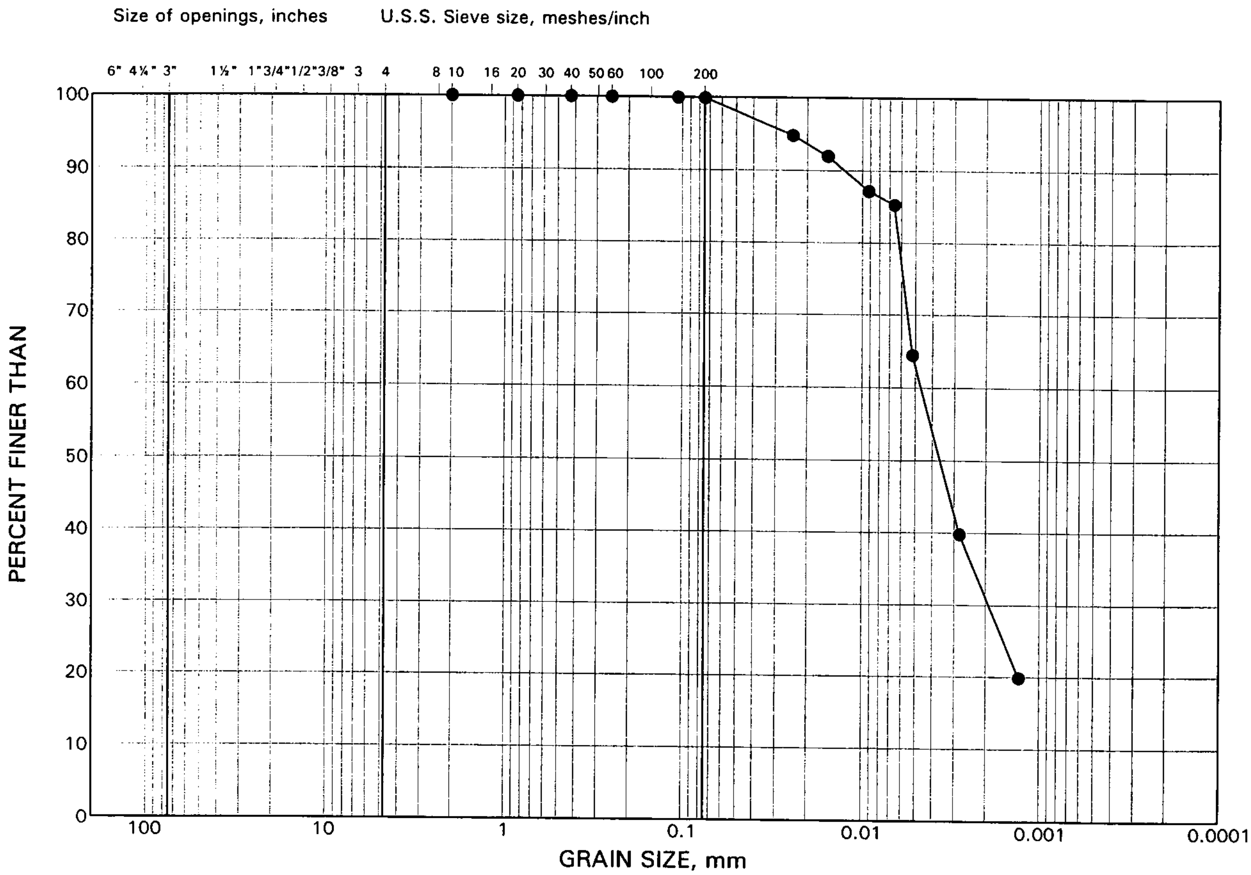
BOREHOLE 24-3 SAMPLE NUMBER TW#1

APPLIED PRESSURE = 154.7 kPa



GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-3	TW#1	9.1-9.8

Date 10/26/2004

Project 04-1116-100

Golder Associates

Prepared by LG

Checked by

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	TW#2
Borehole Number	24-3	Sample Depth, m	19.8-20.4

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	9		
Date Started	10/09/2004		
Date Completed	10/21/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.92	Unit Weight, kN/m^3	18.26
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	13.22
Area, cm^2	31.52	Specific Gravity, measured	2.78
Volume, cm^3	60.36	Solids Height, cm	0.928
Water Content, %	38.20	Volume of Solids, cm^3	29.26
Wet Mass, g	112.41	Volume of Voids, cm^3	31.10
Dry Mass, g	81.34	Degree of Saturation, %	99.9

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.915	1.063	1.915				
4.87	1.887	1.033	1.901	454	1.69E-03	3.00E-03	4.97E-07
9.55	1.878	1.023	1.883	113	6.65E-03	1.00E-03	6.54E-07
19.50	1.861	1.005	1.870	94	7.88E-03	8.92E-04	6.89E-07
39.07	1.840	0.982	1.851	103	7.05E-03	5.60E-04	3.87E-07
77.88	1.812	0.952	1.826	89	7.94E-03	3.77E-04	2.93E-07
155.52	1.778	0.915	1.795	60	1.14E-02	2.29E-04	2.55E-07
310.65	1.726	0.859	1.752	43	1.51E-02	1.75E-04	2.60E-07
621.13	1.666	0.795	1.696	40	1.52E-02	1.01E-04	1.51E-07
1245.45	1.606	0.730	1.636	34	1.67E-02	5.02E-05	8.21E-08
2487.60	1.545	0.664	1.576	43	1.22E-02	2.56E-05	3.08E-08
1245.45	1.555	0.675	1.550				
310.65	1.581	0.703	1.568				
77.88	1.611	0.735	1.596				
19.50	1.639	0.766	1.625				
4.87	1.668	0.797	1.654				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.67	Unit Weight, kN/m^3	19.65
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	15.17
Area, cm^2	31.52	Specific Gravity, measured	2.78
Volume, cm^3	52.57	Solids Height, cm	0.928
Water Content, %	29.51	Volume of Solids, cm^3	29.26
Wet Mass, g	105.34	Volume of Voids, cm^3	23.32
Dry Mass, g	81.34		

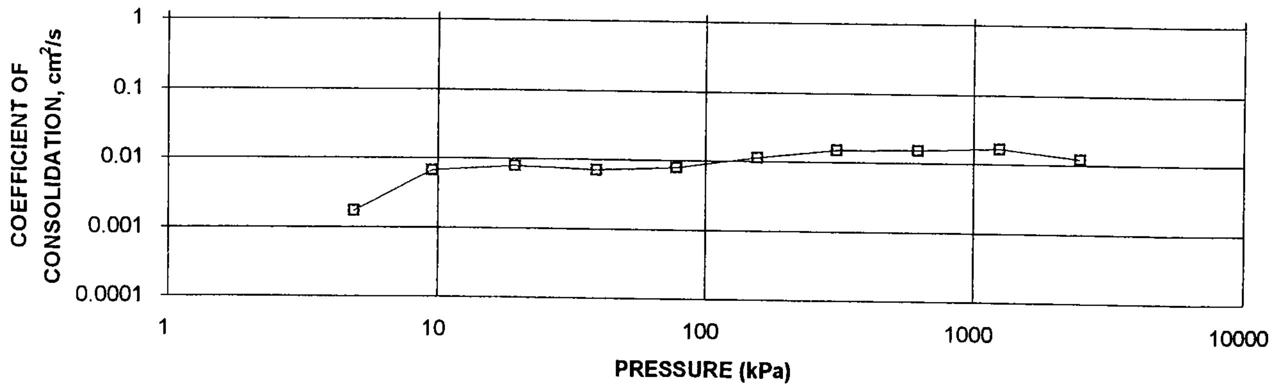
Prepared By: LFG

Golder Associates

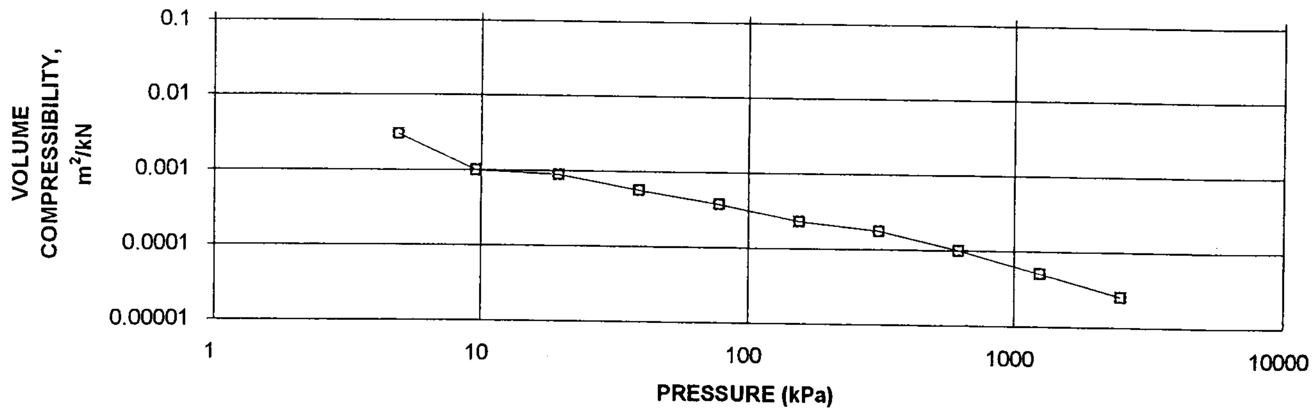
Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY

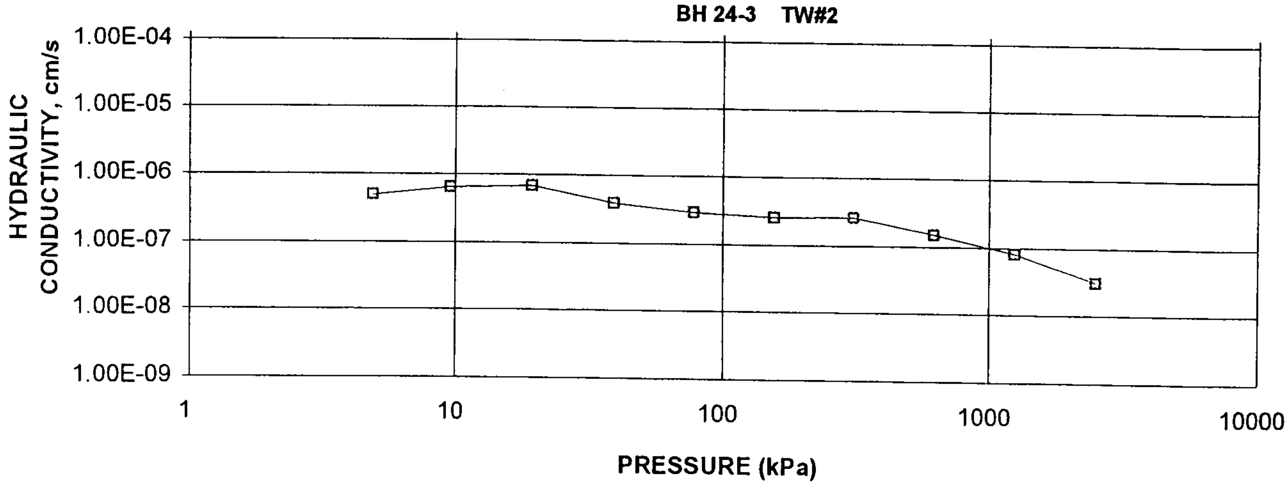
CONSOLIDATION TEST
CV cm^2/s VS PRESSURE (kPa)
BH 24-3 TW#2



CONSOLIDATION TEST
MV m^2/kN vs PRESSURE (kPa)
BH 24-3 TW#2



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH 24-3 TW#2



Project No. 04-1116-100
Prepared By: LFG

Golder Associates

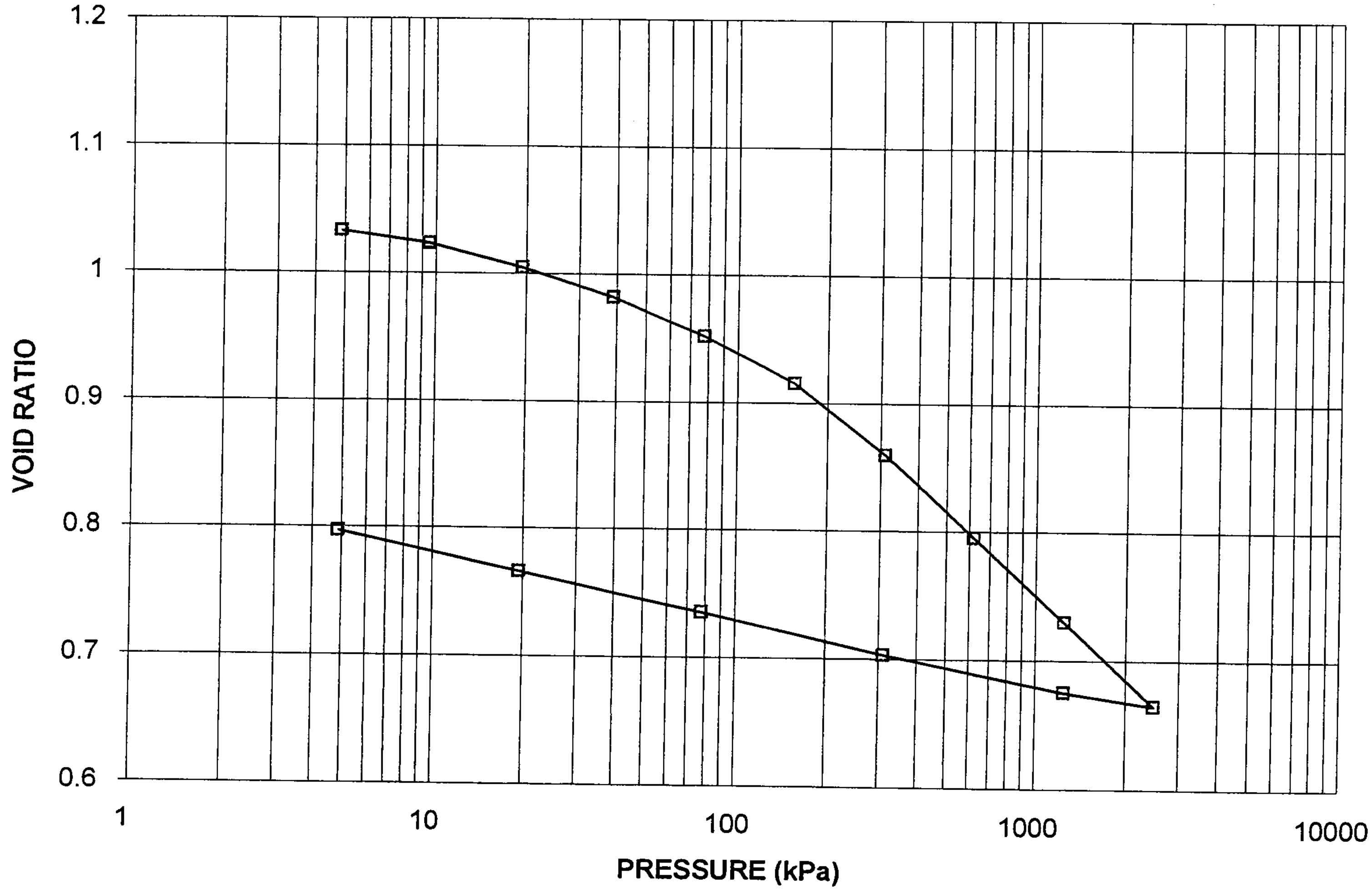
Checkey By: MM

Project No. 04-1116-100
Prepared By: LFG

Golder Associates

Checked By: MM

CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH 24-3 TW#2

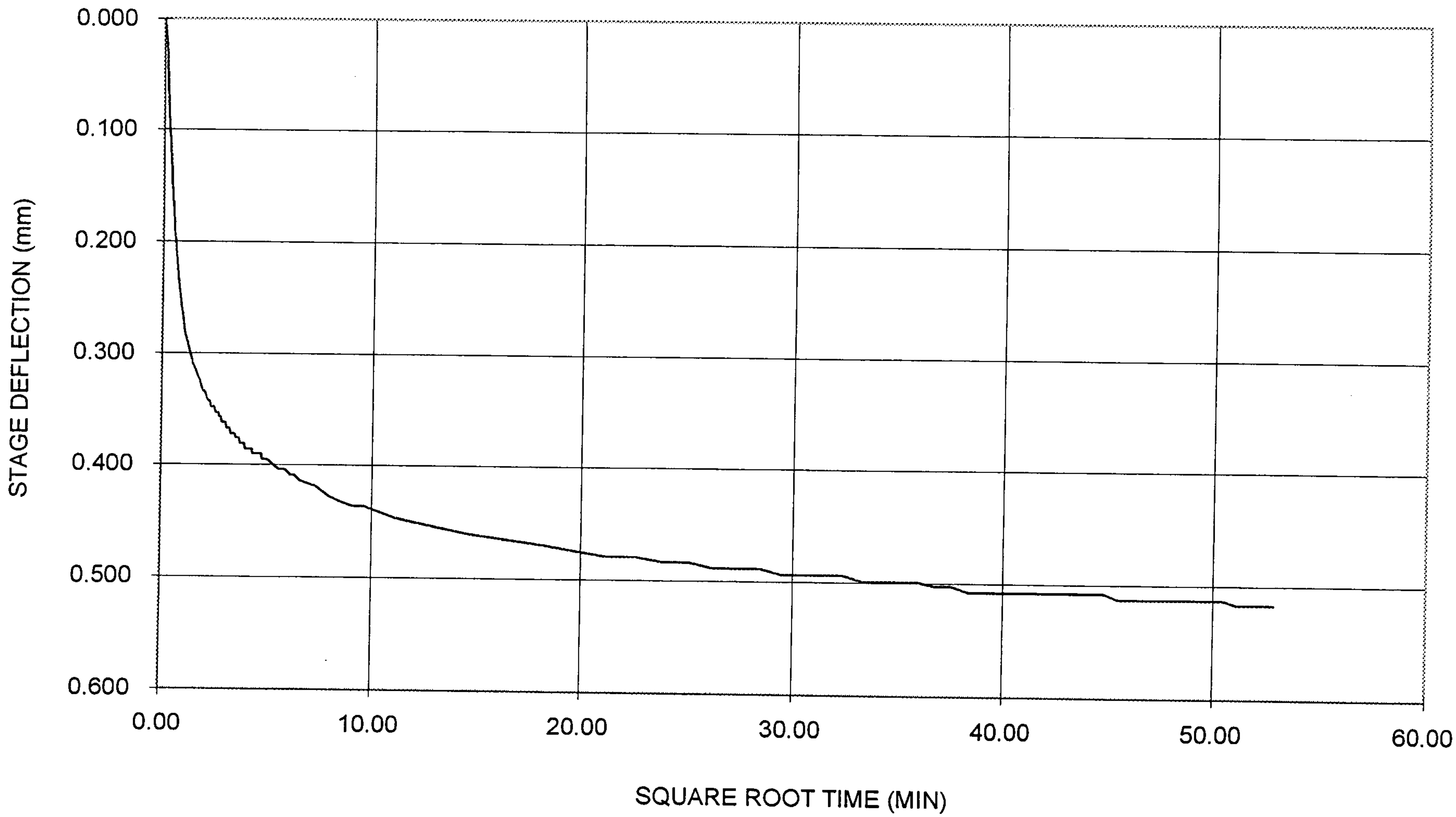


CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE

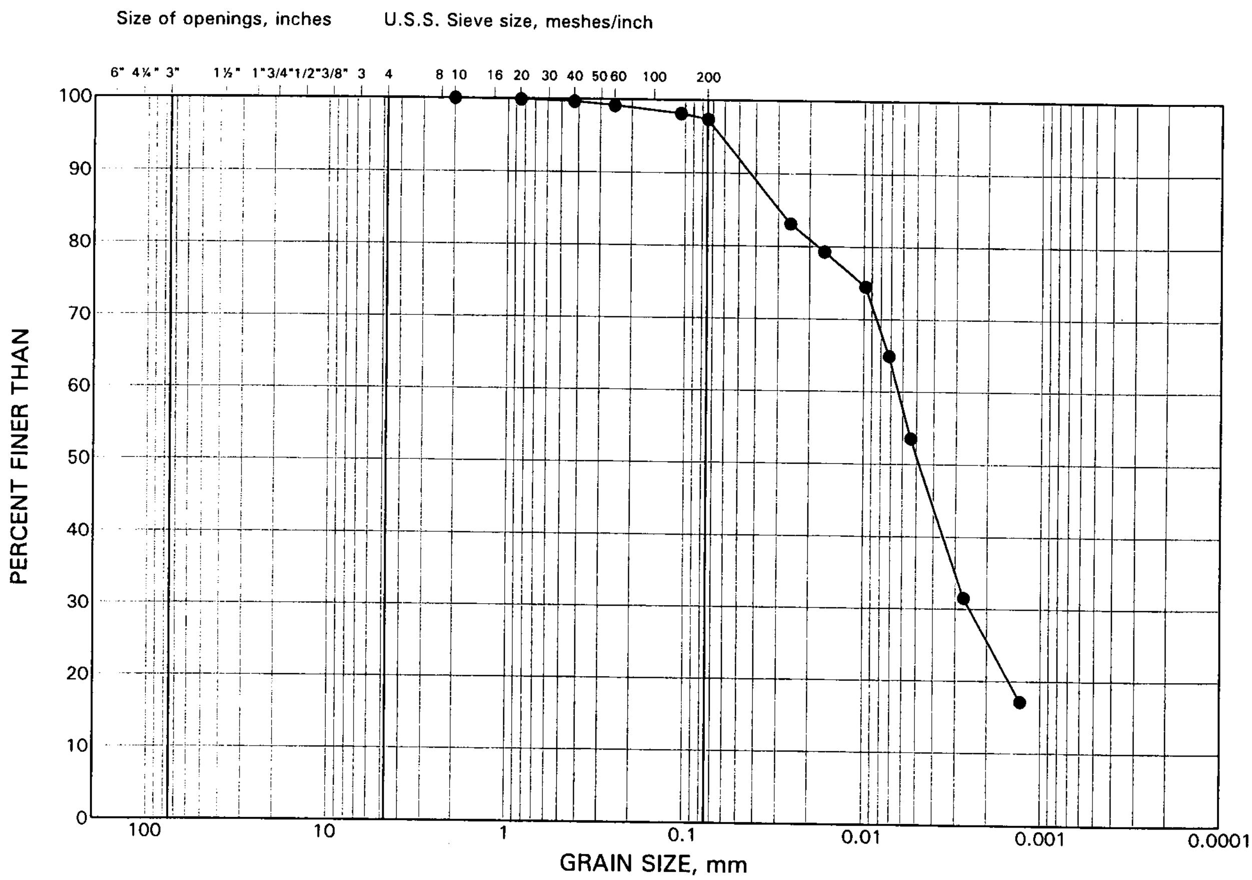
BOREHOLE 24-3 SAMPLE NUMBER TW#2

APPLIED PRESSURE = 310.7 kPa



GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-3	TW#2	19.8-20.4

Date 10/26/2004

Project 04-1116-100

Golder Associates

Prepared by LG

Checked by

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	TW#3
Borehole Number	24-3	Sample Depth, m	30.5-31.1

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	7		
Date Started	10/08/2004		
Date Completed	10/21/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	16.35
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	10.40
Area, cm^2	31.65	Specific Gravity, measured	2.78
Volume, cm^3	60.13	Solids Height, cm	0.725
Water Content, %	57.15	Volume of Solids, cm^3	22.95
Wet Mass, g	100.26	Volume of Voids, cm^3	37.18
Dry Mass, g	63.80	Degree of Saturation, %	98.1

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.620	1.900				
4.83	1.895	1.613	1.898	68	1.12E-02	5.45E-04	5.99E-07
9.46	1.890	1.606	1.893	28	2.71E-02	5.68E-04	1.51E-06
19.51	1.883	1.597	1.887	49	1.54E-02	3.67E-04	5.53E-07
38.91	1.874	1.584	1.879	40	1.87E-02	2.44E-04	4.48E-07
77.57	1.861	1.566	1.868	23	3.21E-02	1.77E-04	5.58E-07
154.88	1.841	1.539	1.851	23	3.16E-02	1.36E-04	4.21E-07
309.37	1.771	1.442	1.806	28	2.47E-02	2.38E-04	5.77E-07
619.29	1.558	1.149	1.665	540	1.09E-03	3.62E-04	3.86E-08
1238.54	1.422	0.961	1.490	197	2.39E-03	1.16E-04	2.71E-08
2476.15	1.319	0.819	1.371	135	2.95E-03	4.38E-05	1.27E-08
1238.54	1.336	0.842	1.328				
309.37	1.381	0.905	1.359				
77.57	1.437	0.982	1.409				
19.51	1.482	1.044	1.460				
4.83	1.529	1.109	1.506				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

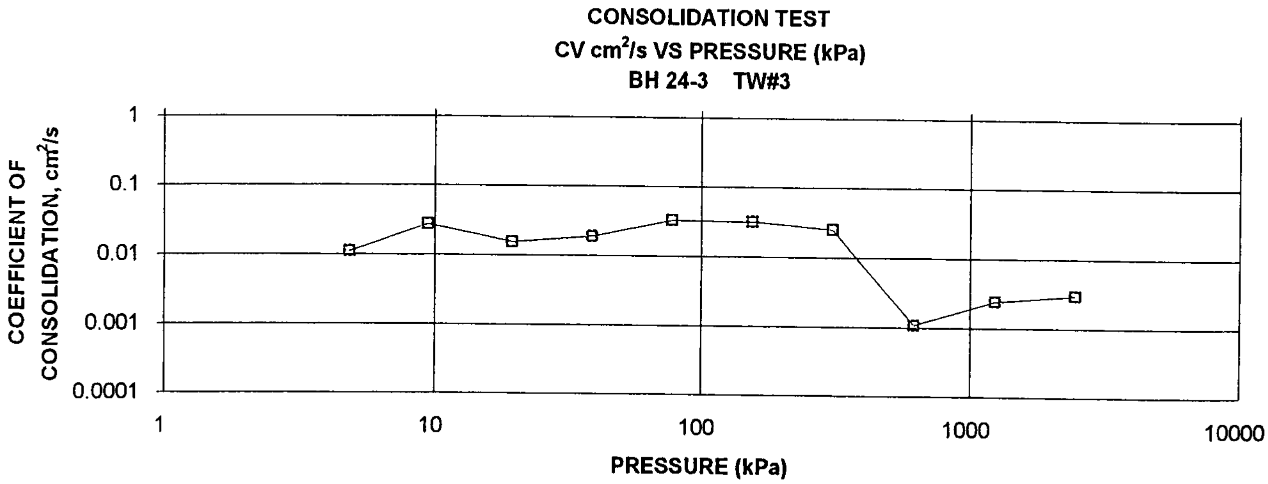
Sample Height, cm	1.53	Unit Weight, kN/m^3	18.31
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	12.93
Area, cm^2	31.65	Specific Gravity, measured	2.78
Volume, cm^3	48.39	Solids Height, cm	0.725
Water Content, %	41.58	Volume of Solids, cm^3	22.95
Wet Mass, g	90.33	Volume of Voids, cm^3	25.44
Dry Mass, g	63.80		

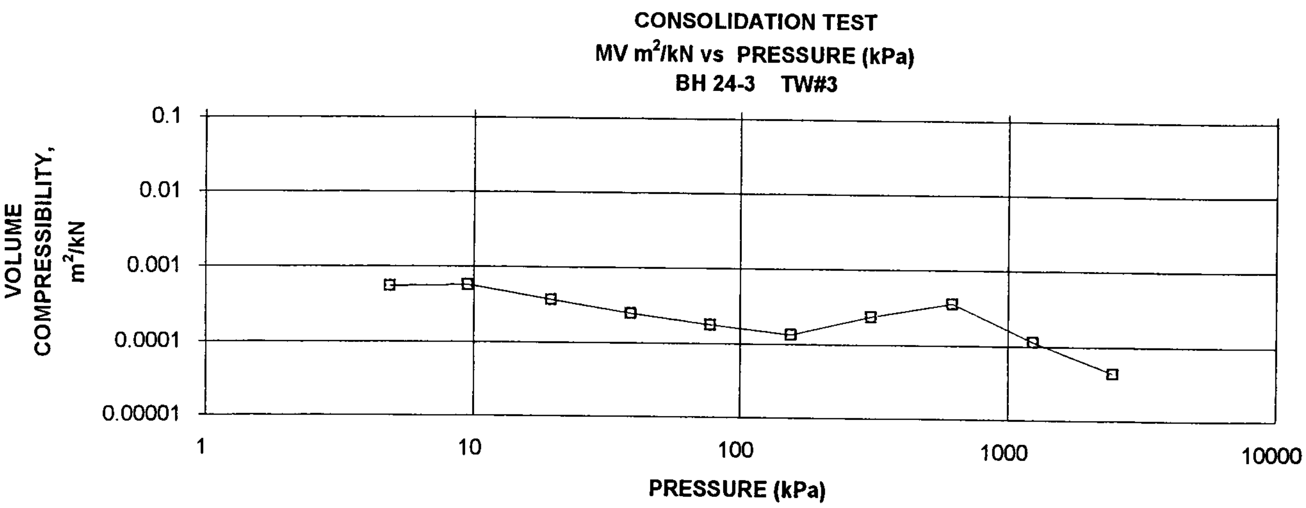
Prepared By: LFG

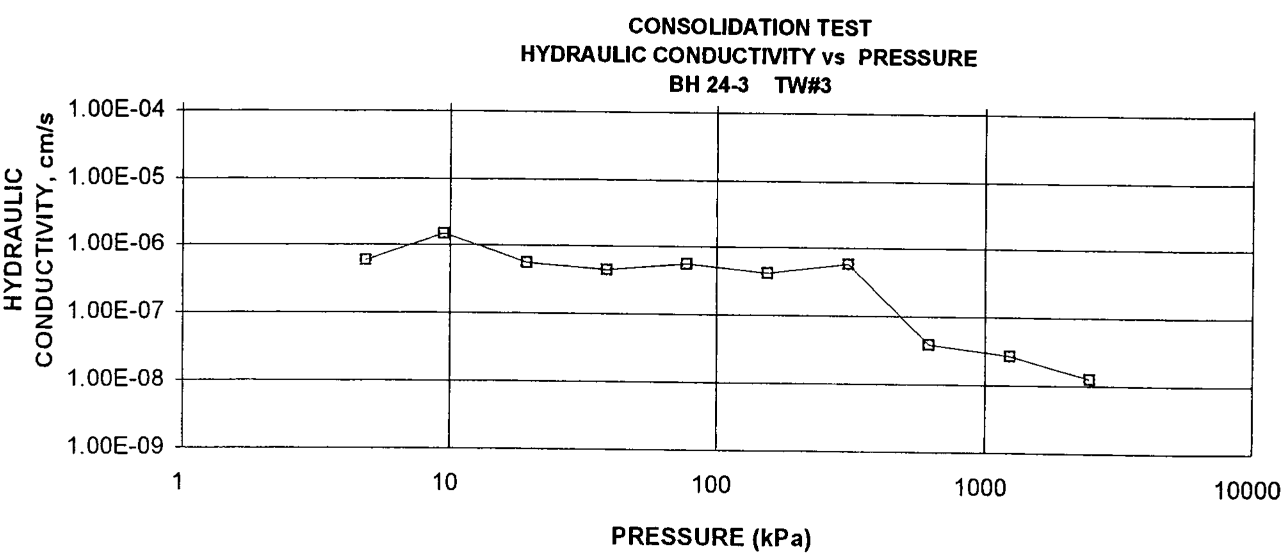
Golder Associates

Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY







Project No. 04-1116-100
Prepared By: LFG

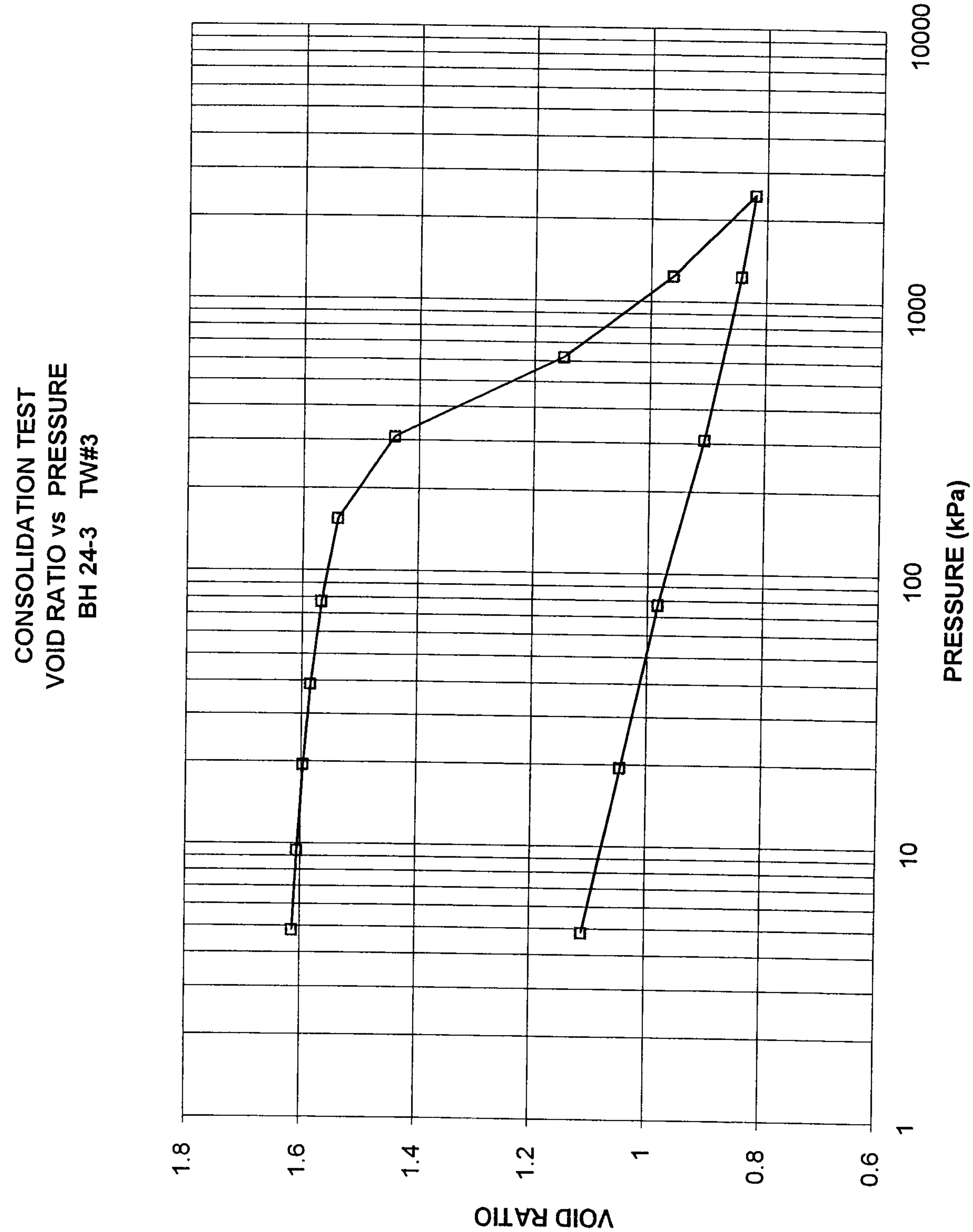
Golder Associates

Checkey By: MM

CONSOLIDATION TEST

VOID RATIO VS. LOG PRESSURE

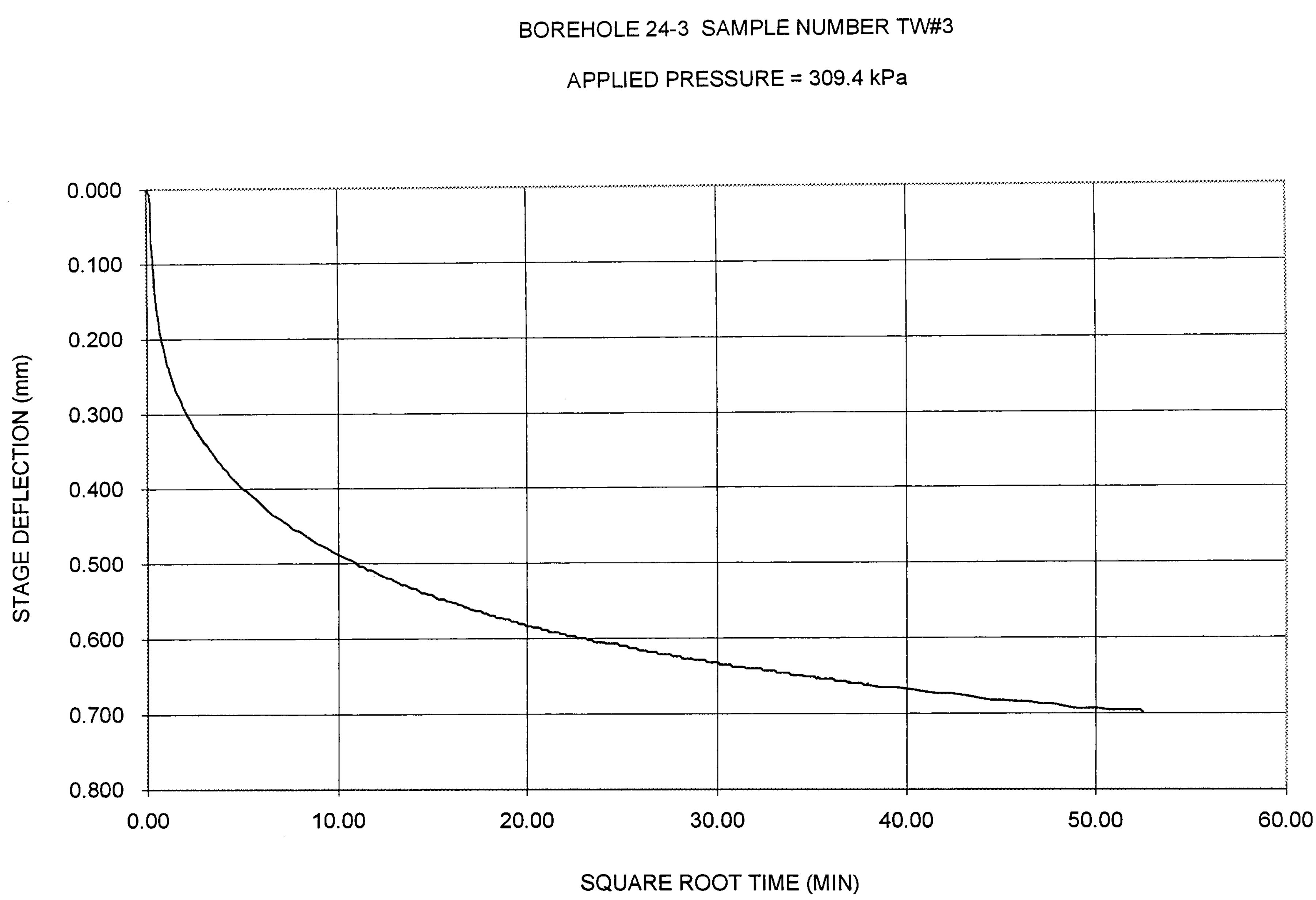
FIGURE



Project No. 04-1116-100
Prepared By: LFG

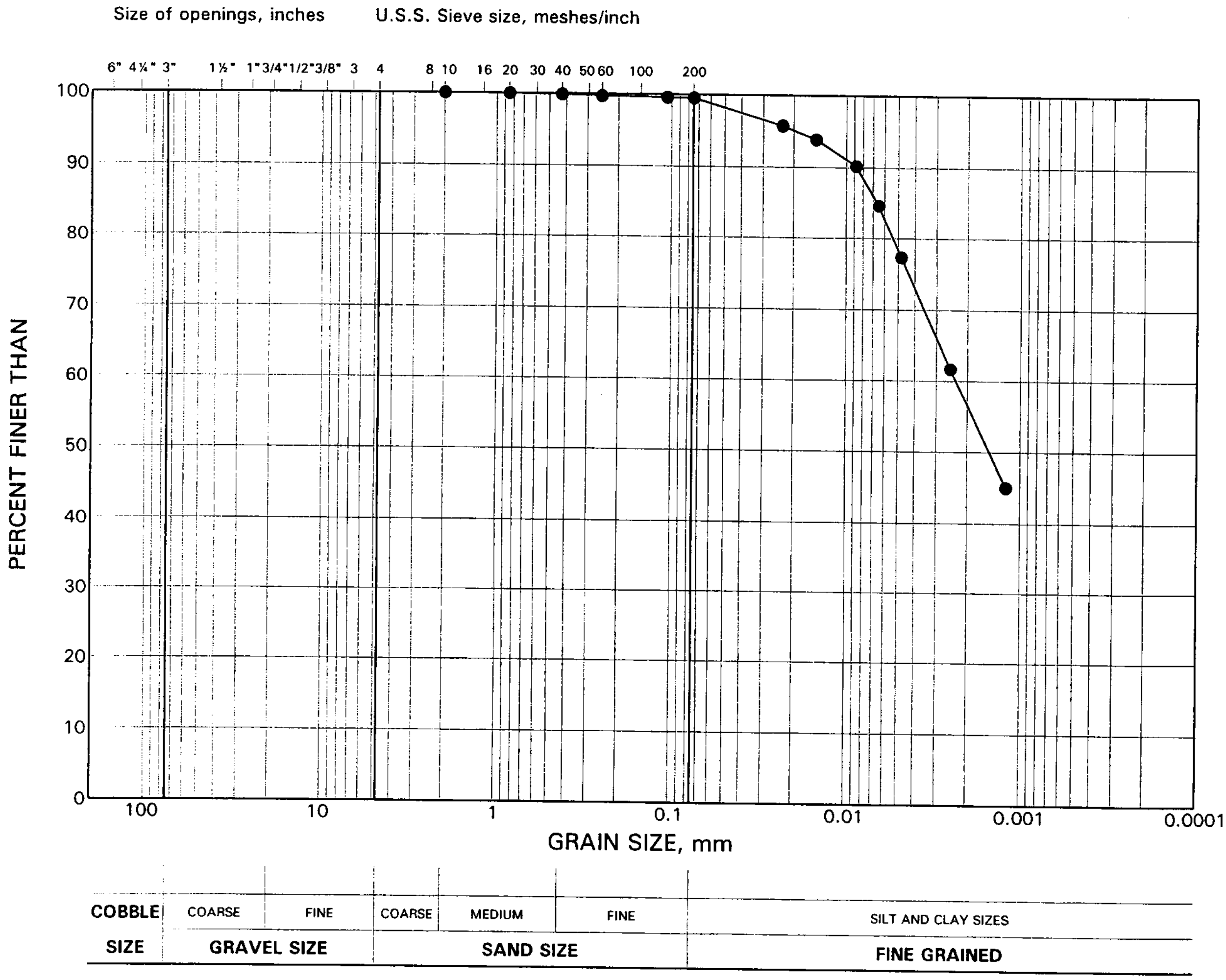
Golder Associates

Checked By: MM


BOREHOLE 24-3 SAMPLE NUMBER TW#3
APPLIED PRESSURE = 309.4 kPa
STAGE DEFLECTION (mm)
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.00
10.00
20.00
30.00
40.00
50.00
60.00
SQUARE ROOT TIME (MIN)

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-3	TW#3	30.5-31.1

Date 10/26/2004
Project 04-1116-100

Golder Associates

Prepared by LG
Checked by

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER	04-1116-100
PROJECT NAME	Thurber / Lab Testing / 19-1423-24
DATE TESTED	October, 2004

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI	
24-3	TW#1	30.0-32.0	9.14-9.75	46.6%	LL=32.9, PL=21.2, PI=11.7	
24-3	TW#2	65.0-67.0	19.81-20.42	38.2%	LL=32.5, PL=20.5, PI=12.0	**Black Creek Rd.**
24-3	TW#3	100.0-102.0	30.48-31.09	57.2%	LL=50.9, PL=23.4, PI=27.5	
24-2	ST#1	20.0-22.0	6.10-6.71	35.3%	LL=34.0, PL=22.1, PI=11.9	
24-1	ST#2	50.0-52.0	15.24-15.85	55.4%	LL=56.4, PL=23.9, PI=32.5	**Hwy 11**
24-1	ST#1	20.0-22.0	6.10-6.71	36.7%	LL=33.1, PL=22.1, PI=11.0	
24-2	ST#2	35.0-37.0	10.67-11.28	47.8%	LL=32.9, PL=22.0, PI=10.9	

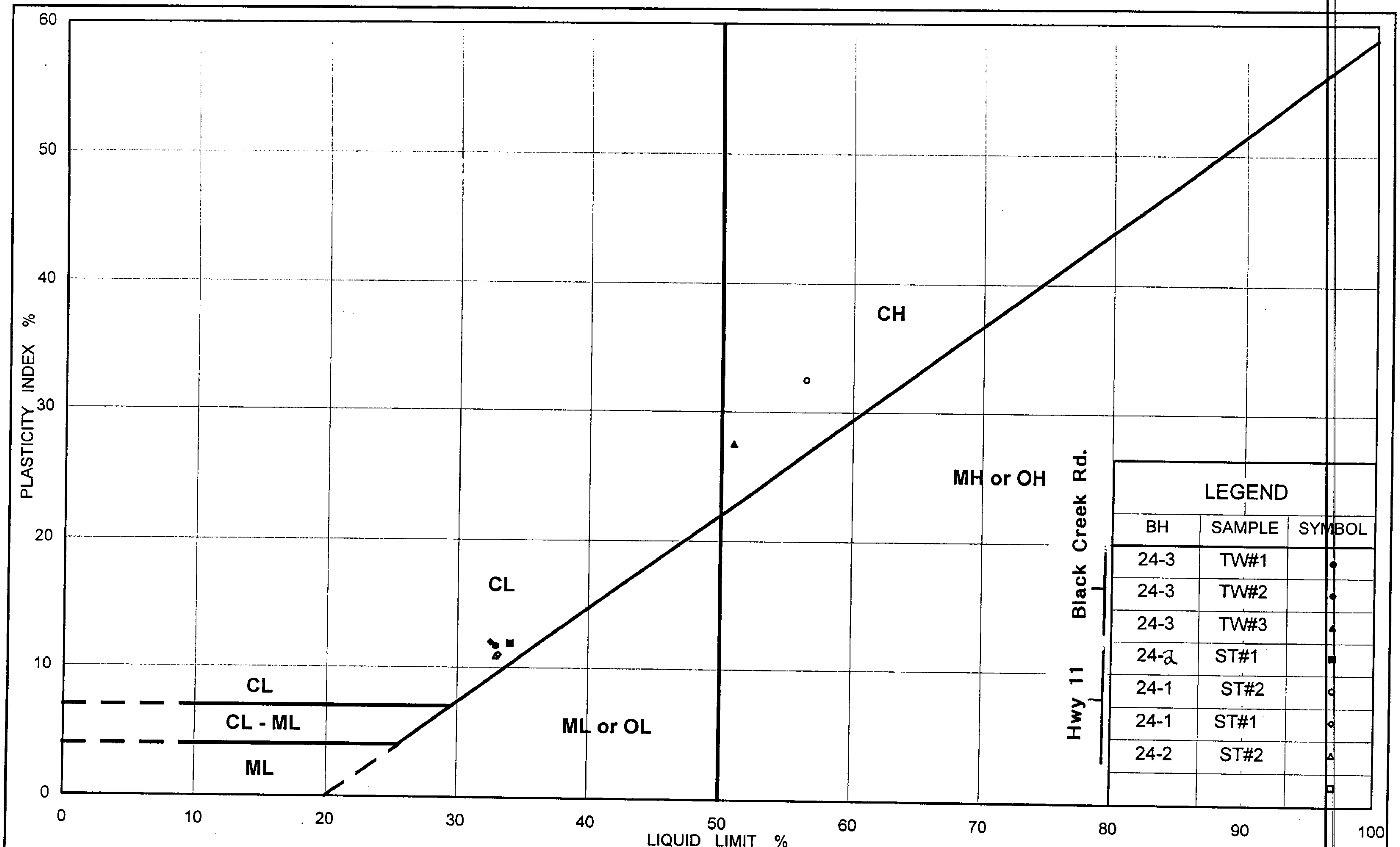
SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-00 TEST METHOD A

PROJECT NUMBER	04-1116-100
PROJECT NAME	Thurber / Lab Testing / 19-1423-24
DATE TESTED	October, 2004

Borehole No.	Sample No.	Specific Gravity	
24-3	TW#1	2.75	Black Creek Rd.
24-3	TW#2	2.78	
24-3	TW#3	2.78	
24-2	ST#1	2.75	Hwy 11
24-1	ST#2	2.76	
24-1	ST#1	2.74	
24-2	ST#2	2.76	

Note: Test carried out on soil particles <4.75mm using distilled water.



Golder Associates

PLASTICITY CHART

FIG No.

Project No. 04-1116-100

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	031-116011	Sample Number	2
Borehole Number	421-2	Sample Depth, m	6.1-6.6

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	7		
Date Started	03-05-26		
Date Completed	03-06-07		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m³	17.73
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m³	12.38
Area, cm²	31.57	Specific Gravity, measured	2.75
Volume, cm³	59.98	Solids Height, cm	0.872
Water Content, %	43.26	Volume of Solids, cm³	27.53
Wet Mass, g	108.46	Volume of Voids, cm³	32.45
Dry Mass, g	75.71	Degree of Saturation, %	100.9

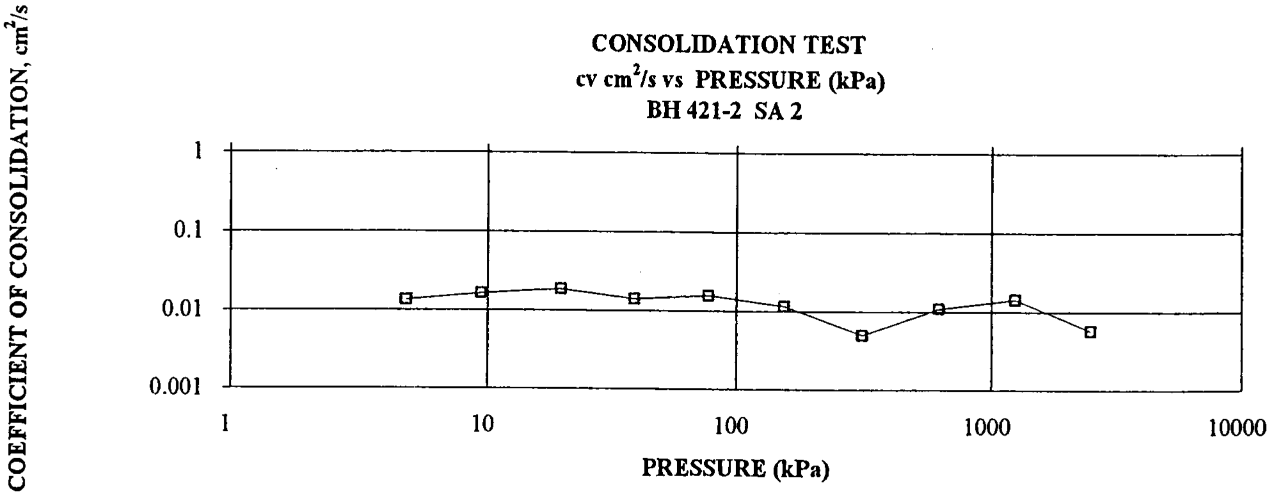
TEST COMPUTATIONS

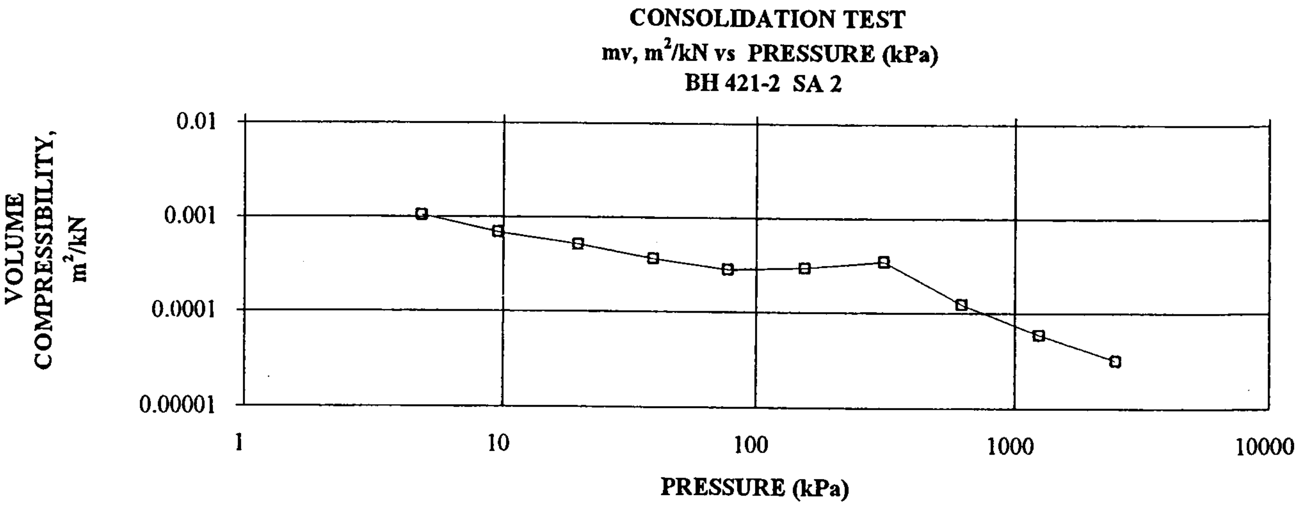
Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.179	1.900				
4.84	1.890	1.168	1.895	56	1.36E-02	1.04E-03	1.39E-06
9.48	1.884	1.161	1.887	46	1.64E-02	6.91E-04	1.11E-06
19.56	1.874	1.149	1.879	40	1.87E-02	5.17E-04	9.49E-07
39.01	1.861	1.134	1.868	53	1.40E-02	3.65E-04	4.99E-07
77.76	1.840	1.110	1.850	46	1.58E-02	2.84E-04	4.39E-07
155.27	1.796	1.060	1.818	60	1.17E-02	2.97E-04	3.40E-07
310.53	1.694	0.943	1.745	130	4.97E-03	3.45E-04	1.68E-07
620.62	1.622	0.860	1.658	53	1.10E-02	1.23E-04	1.33E-07
1240.95	1.551	0.779	1.586	37	1.44E-02	5.98E-05	8.45E-08
2481.74	1.476	0.693	1.514	85	5.71E-03	3.19E-05	1.79E-08
620.62	1.503	0.724	1.490				
155.27	1.533	0.758	1.518				
19.56	1.580	0.812	1.556				
4.84	1.613	0.850	1.597				

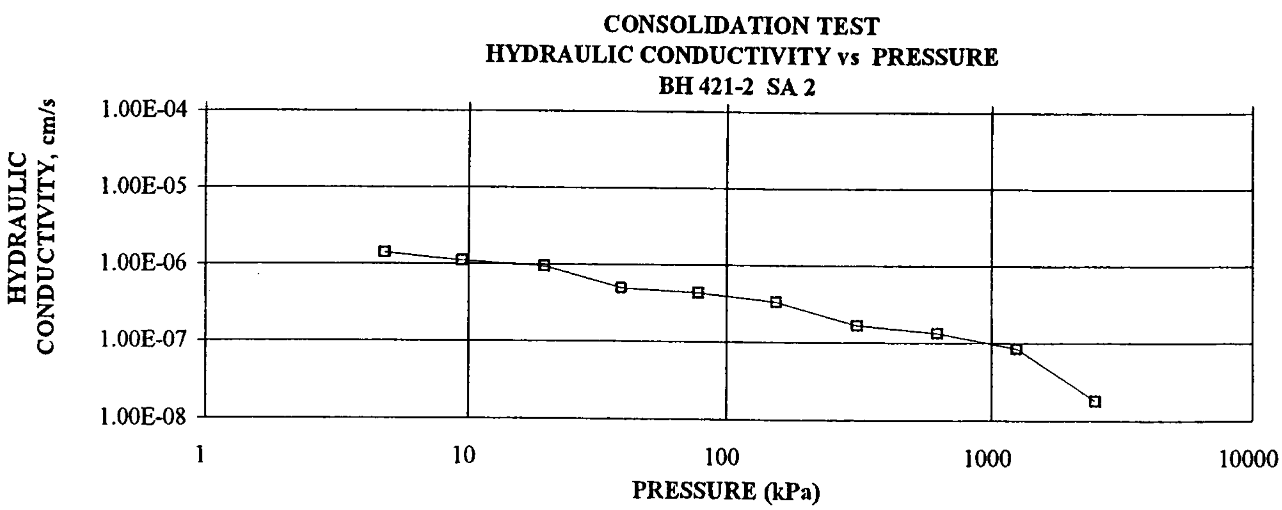
Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.61	Unit Weight, kN/m³	19.29
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m³	14.58
Area, cm²	31.57	Specific Gravity, measured	2.75
Volume, cm³	50.93	Solids Height, cm	0.872
Water Content, %	32.36	Volume of Solids, cm³	27.53
Wet Mass, g	100.21	Volume of Voids, cm³	23.40
Dry Mass, g	75.71		







Project No. 031-116011

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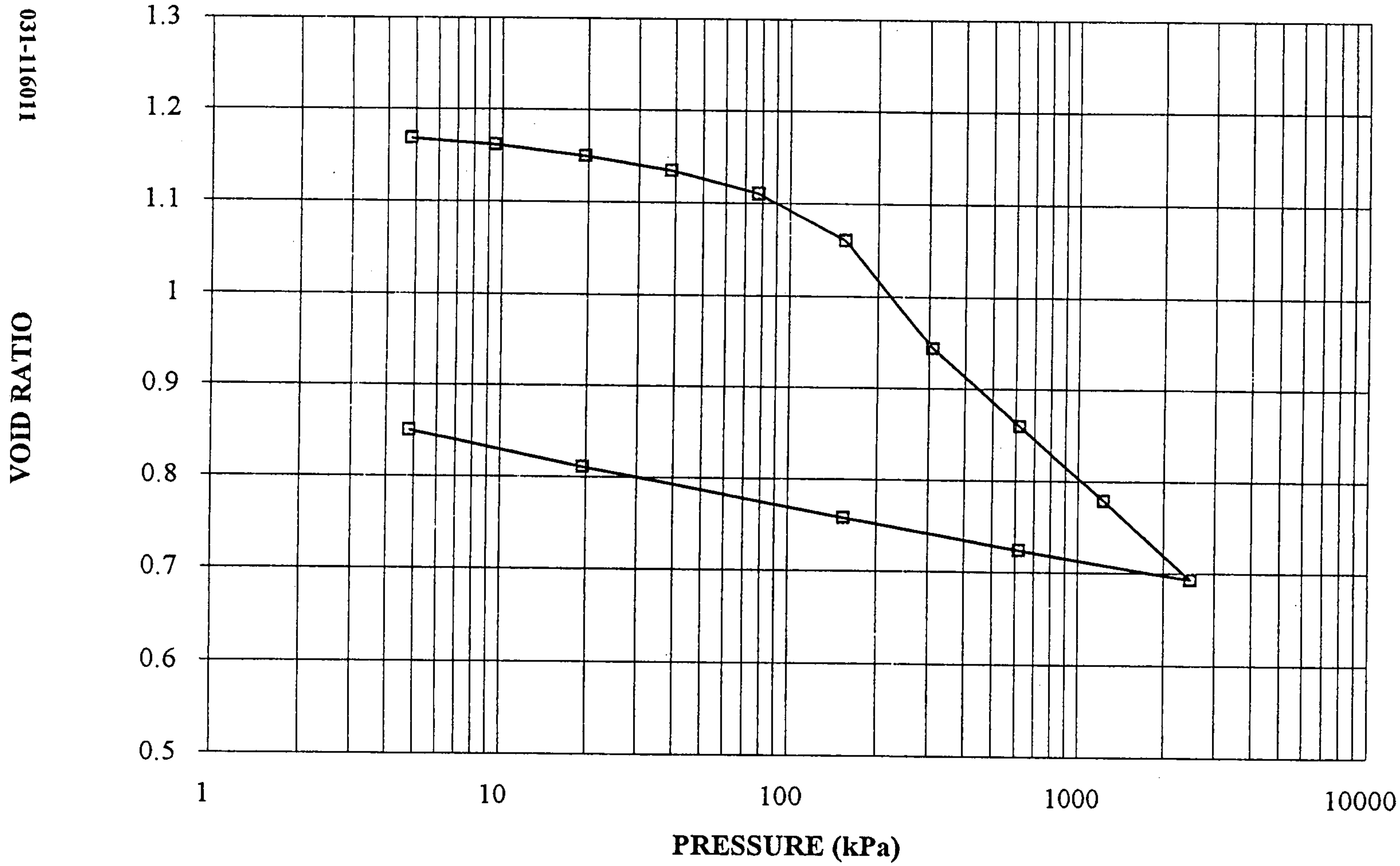
Project No. 031-116011

CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH 421-2 SA 2

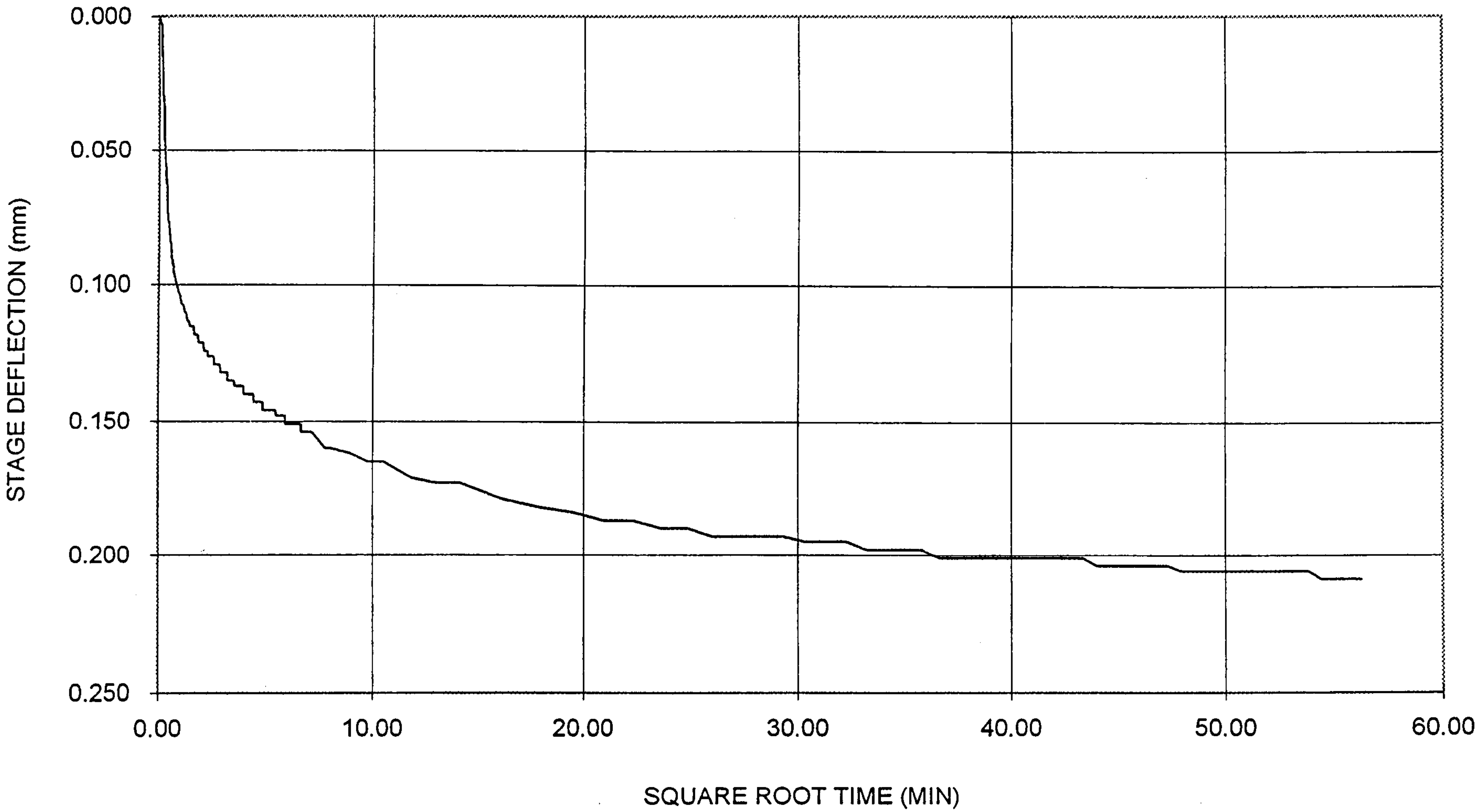


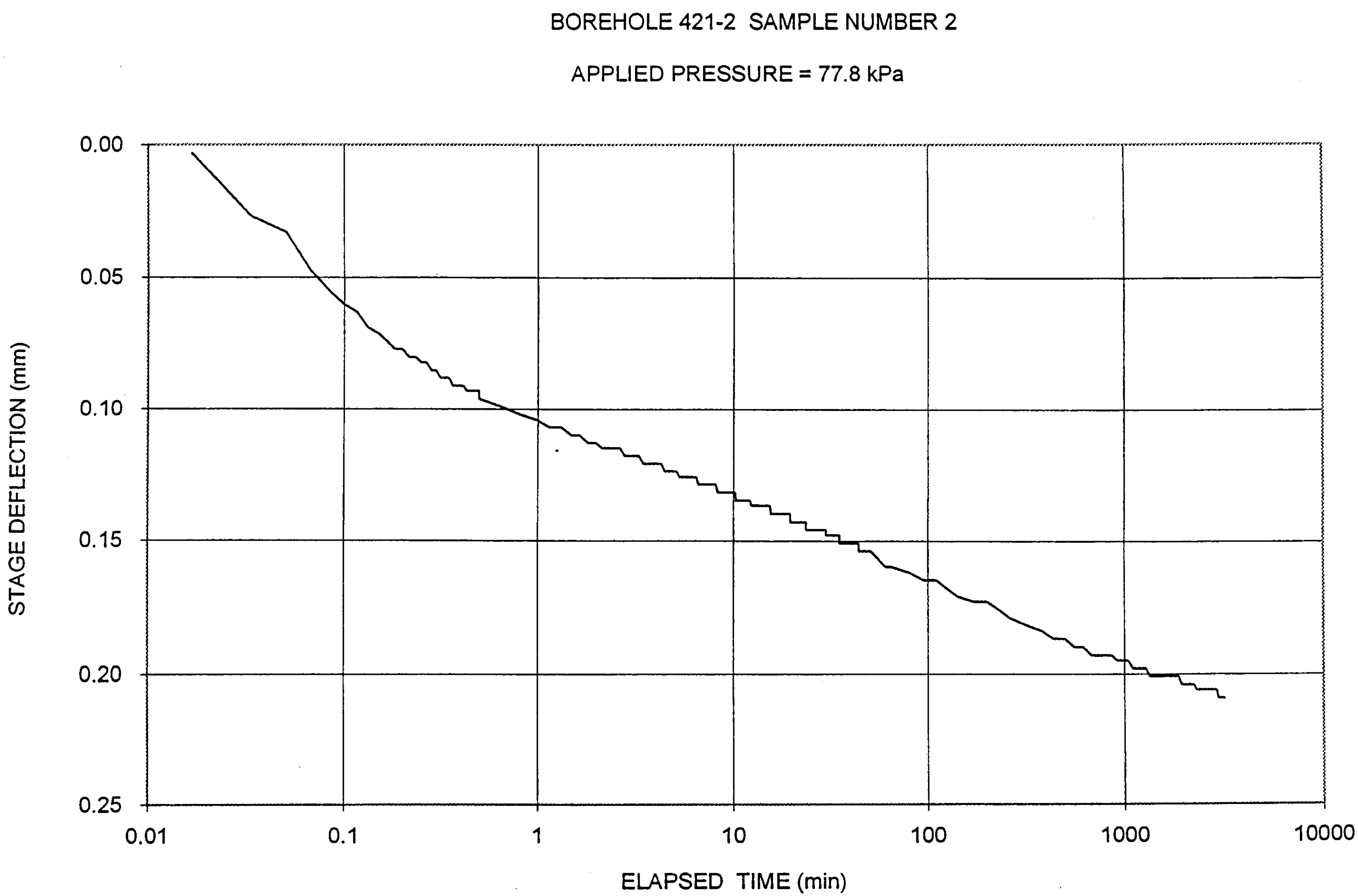
CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

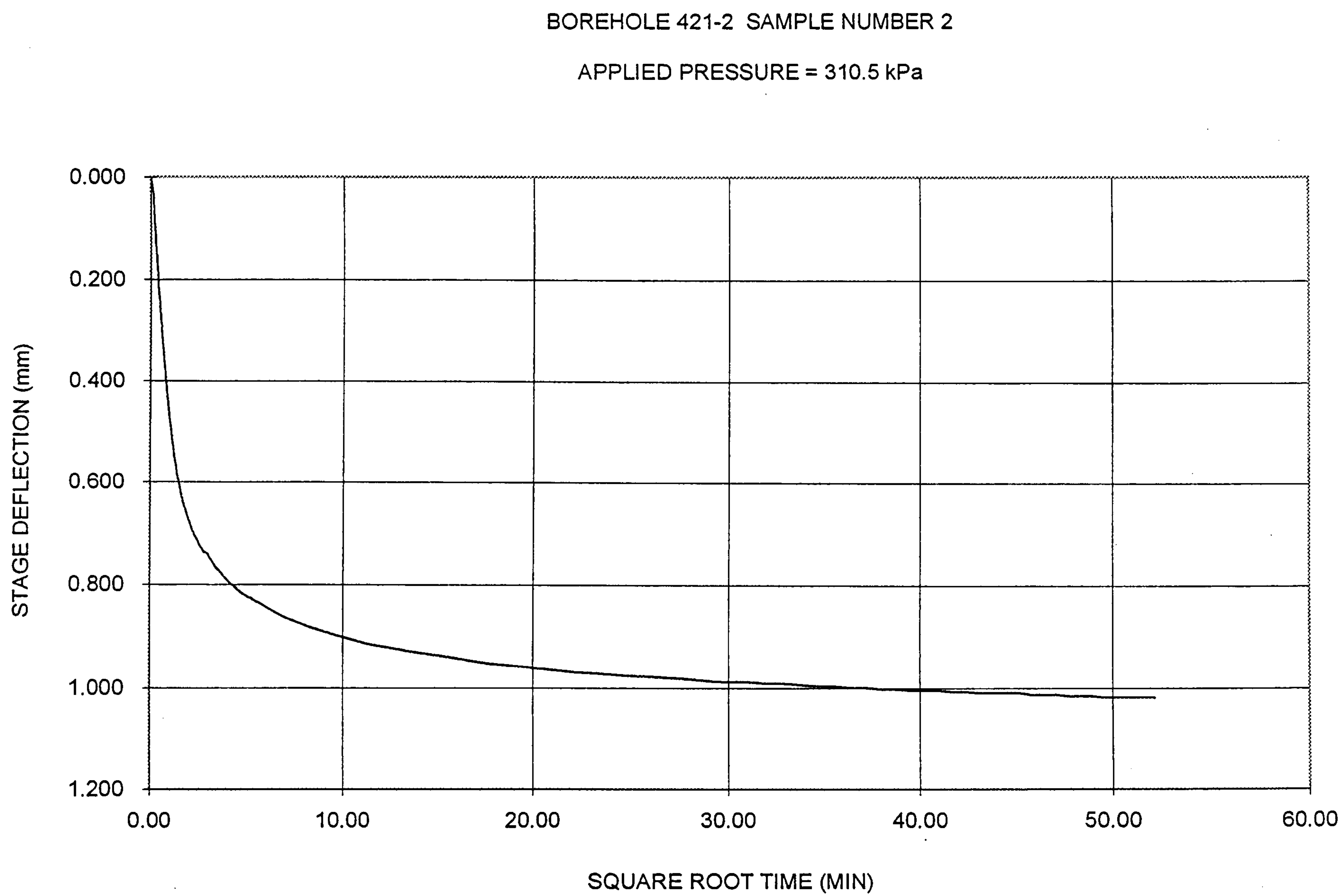
FIGURE

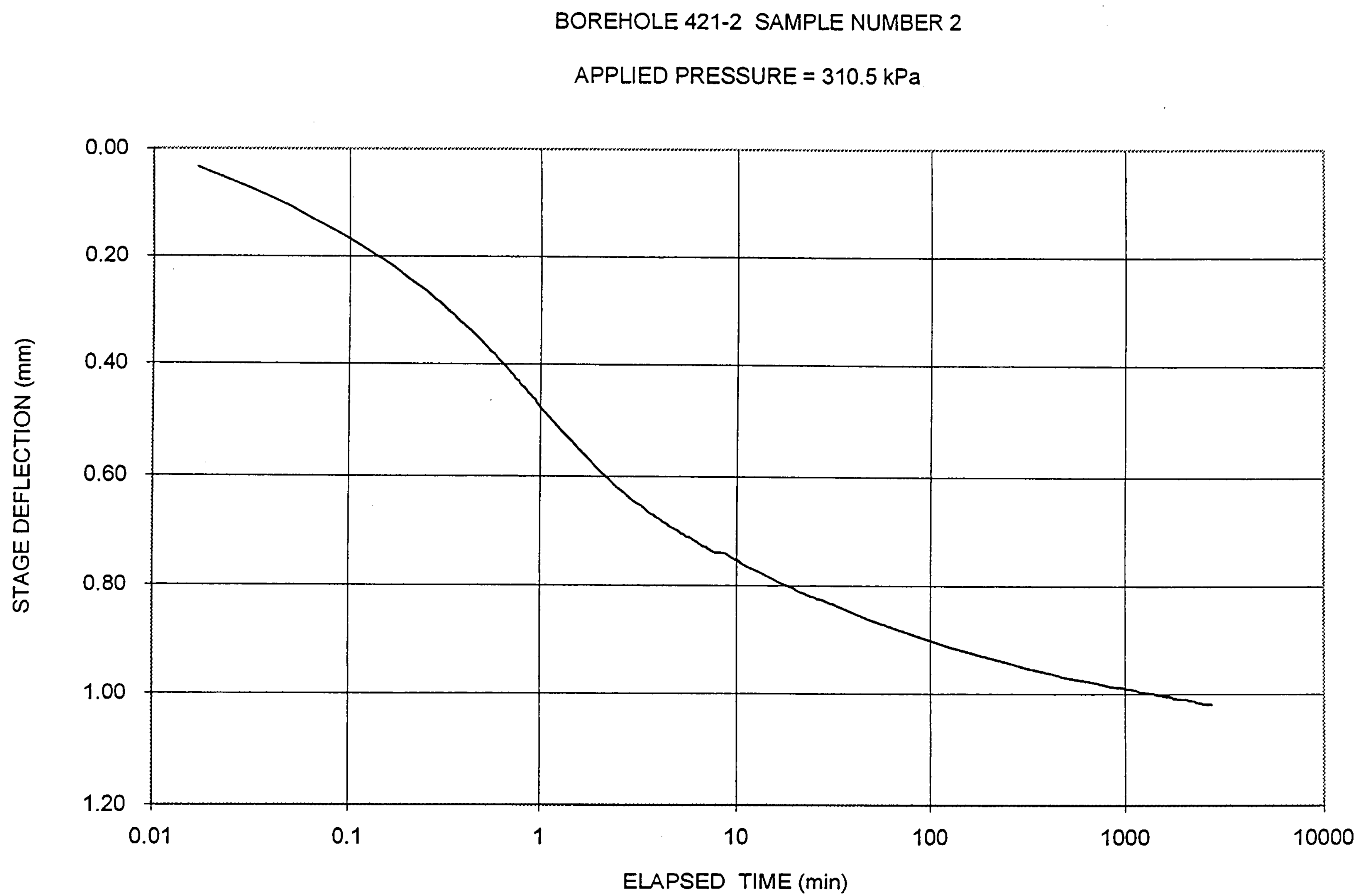
BOREHOLE 421-2 SAMPLE NUMBER 2

APPLIED PRESSURE = 77.8 kPa




BOREHOLE 421-2 SAMPLE NUMBER 2
APPLIED PRESSURE = 77.8 kPa
STAGE DEFLECTION (mm)
0.00
0.05
0.10
0.15
0.20
0.25
0.01
0.1
1
10
100
1000
10000
ELAPSED TIME (min)


BOREHOLE 421-2 SAMPLE NUMBER 2
APPLIED PRESSURE = 310.5 kPa
STAGE DEFLECTION (mm)
0.000
0.200
0.400
0.600
0.800
1.000
1.200
0.00
10.00
20.00
30.00
40.00
50.00
60.00
SQUARE ROOT TIME (MIN)


BOREHOLE 421-2 SAMPLE NUMBER 2
APPLIED PRESSURE = 310.5 kPa
STAGE DEFLECTION (mm)
0.00
0.20
0.40
0.60
0.80
1.00
1.20
0.01
0.1
1
10
100
1000
10000
ELAPSED TIME (min)

SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-00 TEST METHOD A

PROJECT NUMBER	031-116011
PROJECT NAME	Thurber / Lab Testing / 19-1423-12
DATE TESTED	May, 2003

Borehole No.	Sample No.	Specific Gravity
421-2	2	2.75

Note: Test carried out on soil particles <4.75mm using distilled water.

TABLE 1

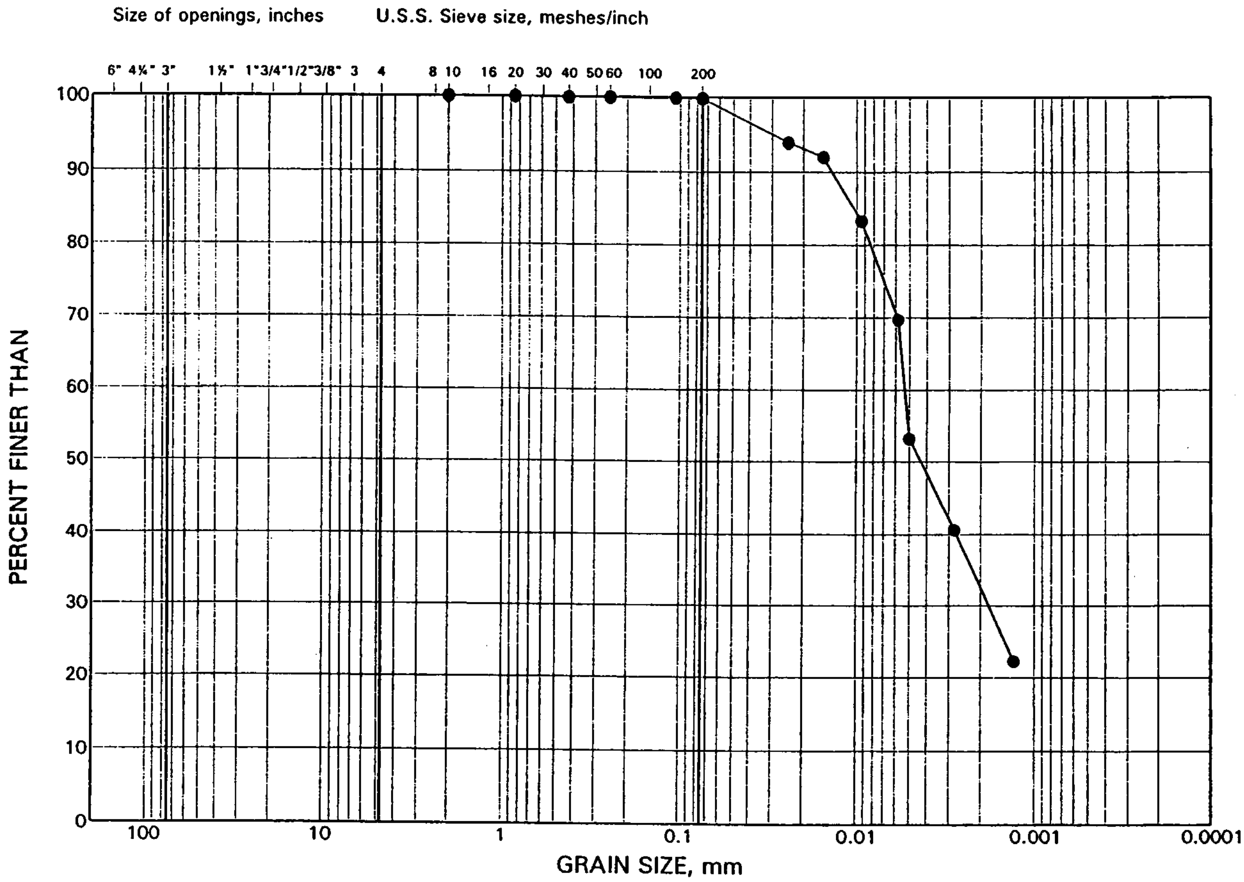
SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER	031-116011
PROJECT NAME	Thurber / Lab Testing / 19-1423-12
DATE TESTED	June, 2003

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
421-2	2	20.0-21.7	6.10-6.61	43.3%	LL=35.2, PL=21.0, PI=14.2

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	421-2	2	6.6

Project 031-116011

Golder Associates

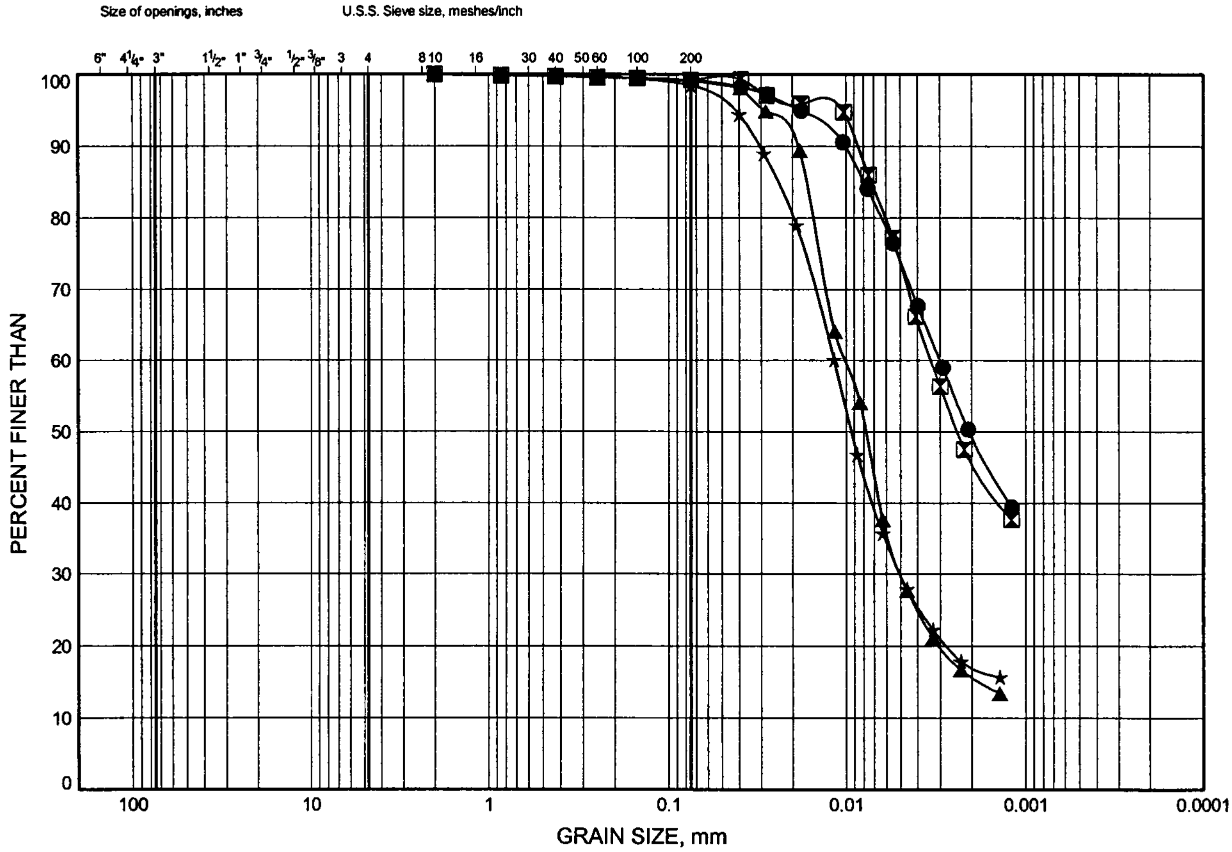
ROBINS ROAD

ROBINS ROAD

GRAIN SIZE DISTRIBUTION

FIGURE B10

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 10+150 L23.2	1.83	
⊠	421 10+150 L23.2	3.35	
▲	421 10+225 R2.5	3.35	313.85
★	421 10+225 R2.5	4.88	312.32

THURBGSD APPENDIX B(ROBINS).GPJ 10/02/05

Date February 2005

Project 742-93-00

THURBER

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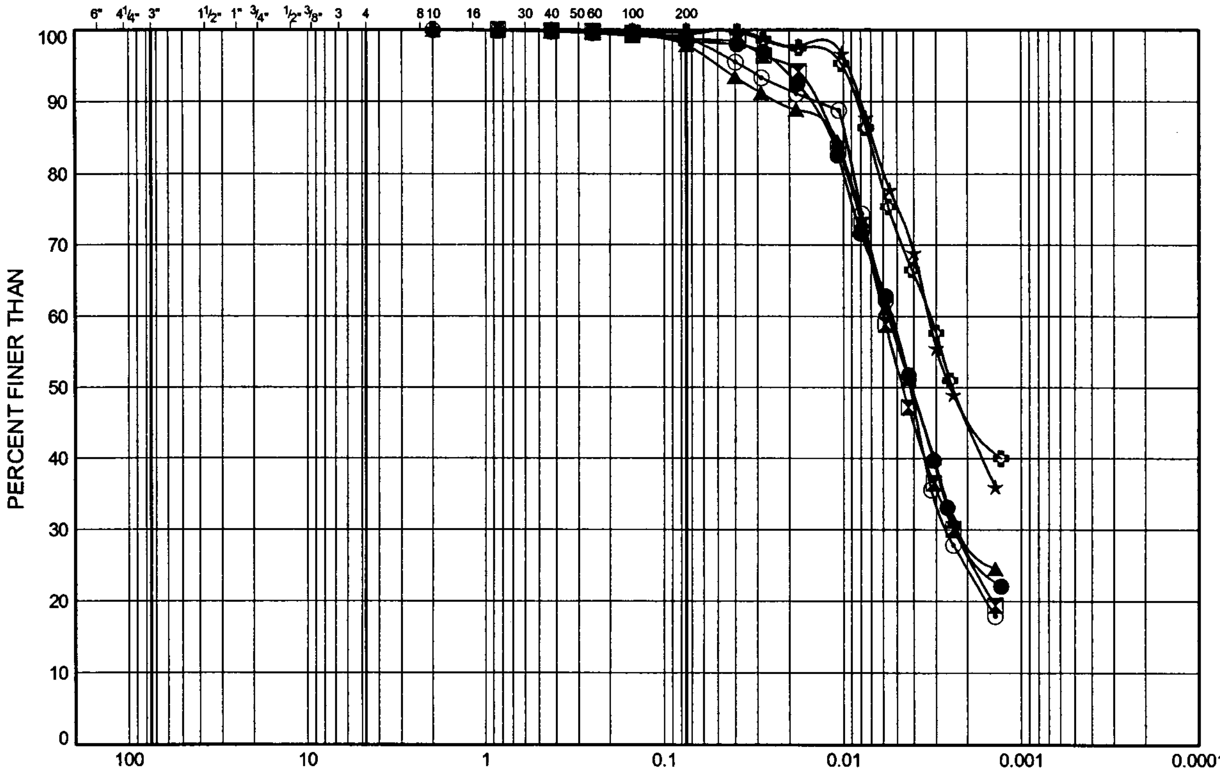
ROBINS ROAD

GRAIN SIZE DISTRIBUTION

FIGURE B9

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 10+050 R34.5	1.83	
⊠	421 10+050 R34.5	4.88	
▲	421 10+075 L7	1.07	
★	421 10+075 L7	4.88	
⊙	421 10+125 L8	1.83	
✪	421 10+125 L8	4.88	

Date February 2005

Project 742-93-00

THURBER

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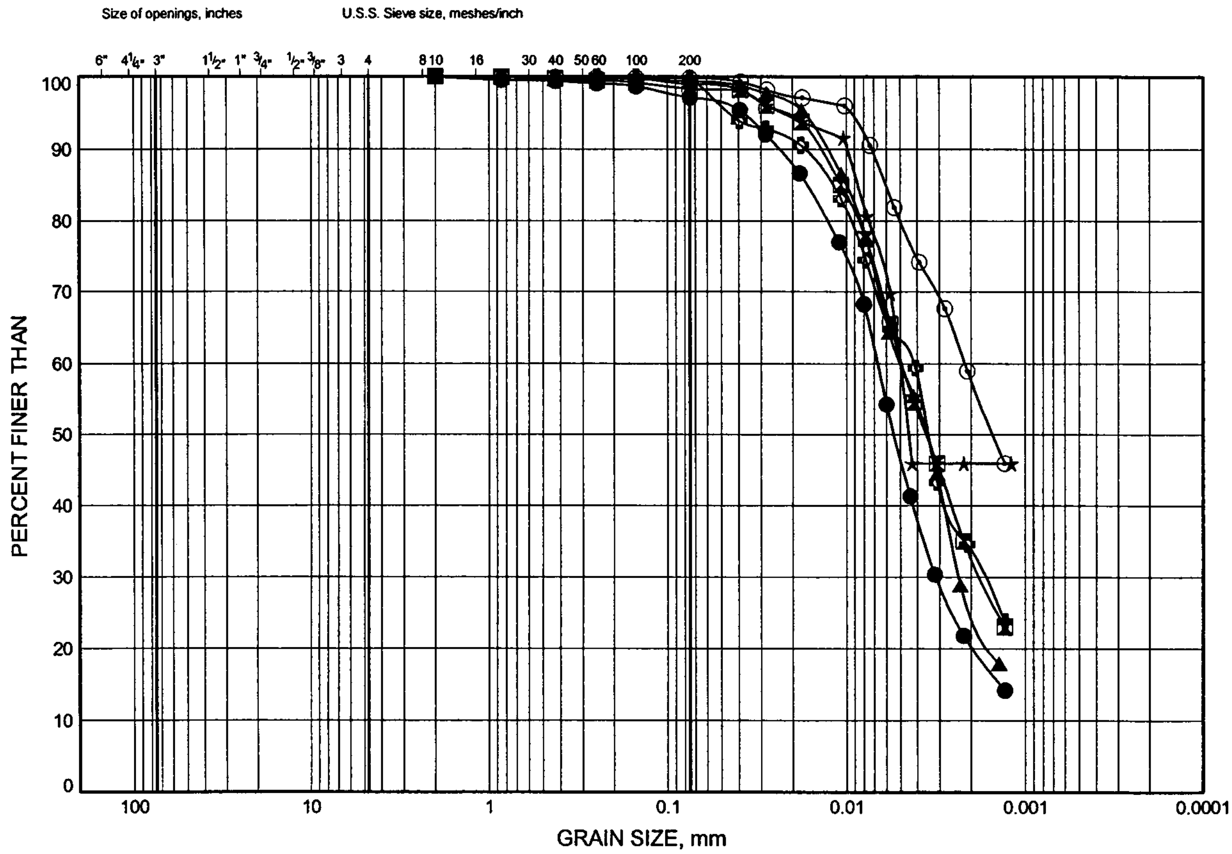
THURBGSD APPENDIX B(ROBINS).GPJ 10/02/05

ROBINS ROAD

GRAIN SIZE DISTRIBUTION

FIGURE B11

SILTY CLAY



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH 421-4	1.83	311.36
⊠	BH 421-4	3.35	309.84
▲	BH 421-4	4.88	308.31
★	BH 421-4	6.40	306.79
⊙	BH 421-4	9.45	303.74
✪	BH 421-4	10.91	302.28

Date February 2005

Project 742-93-00

THURBER

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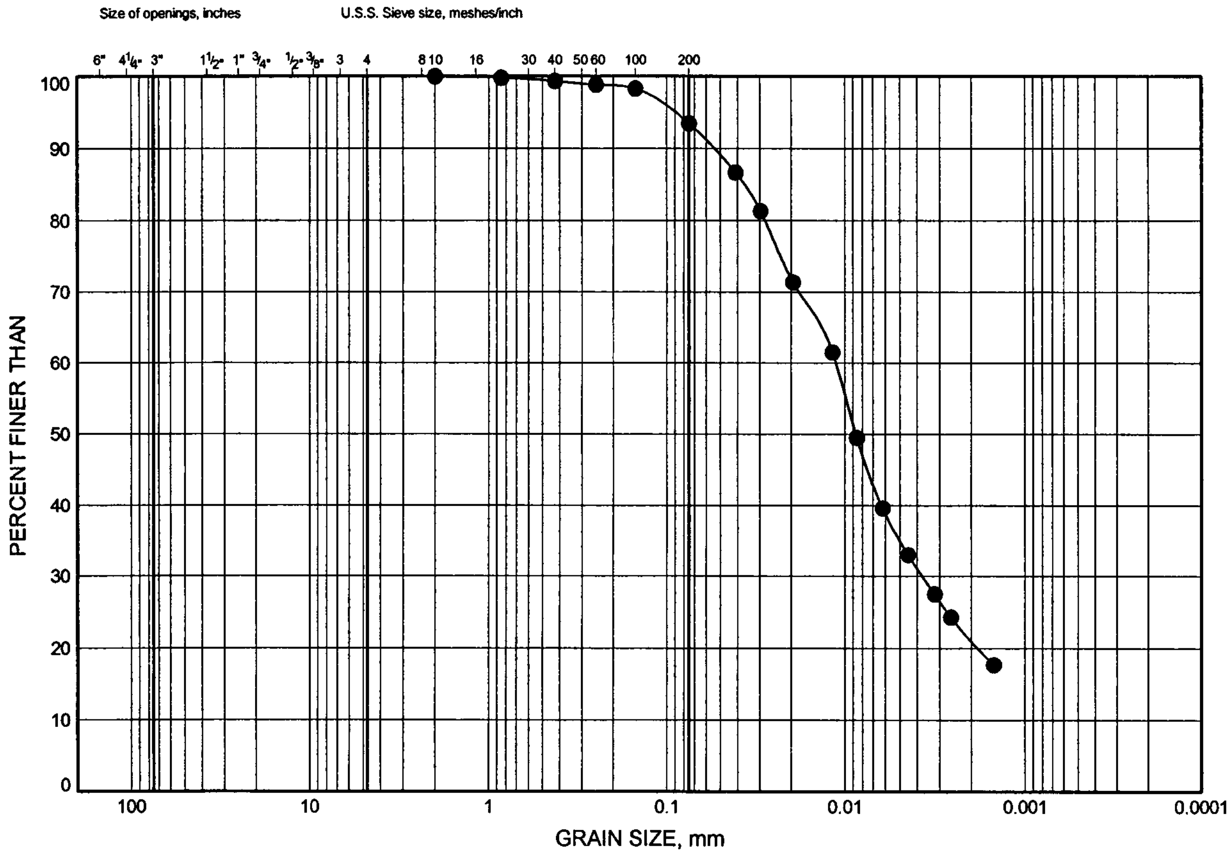
THURBGSD APPENDIX B(ROBINS).GPJ 10/02/05

ROBINS ROAD

GRAIN SIZE DISTRIBUTION

FIGURE B12

CLAYEY SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 10+175 CL	2.59	

Date February 2005

Project 742-93-00

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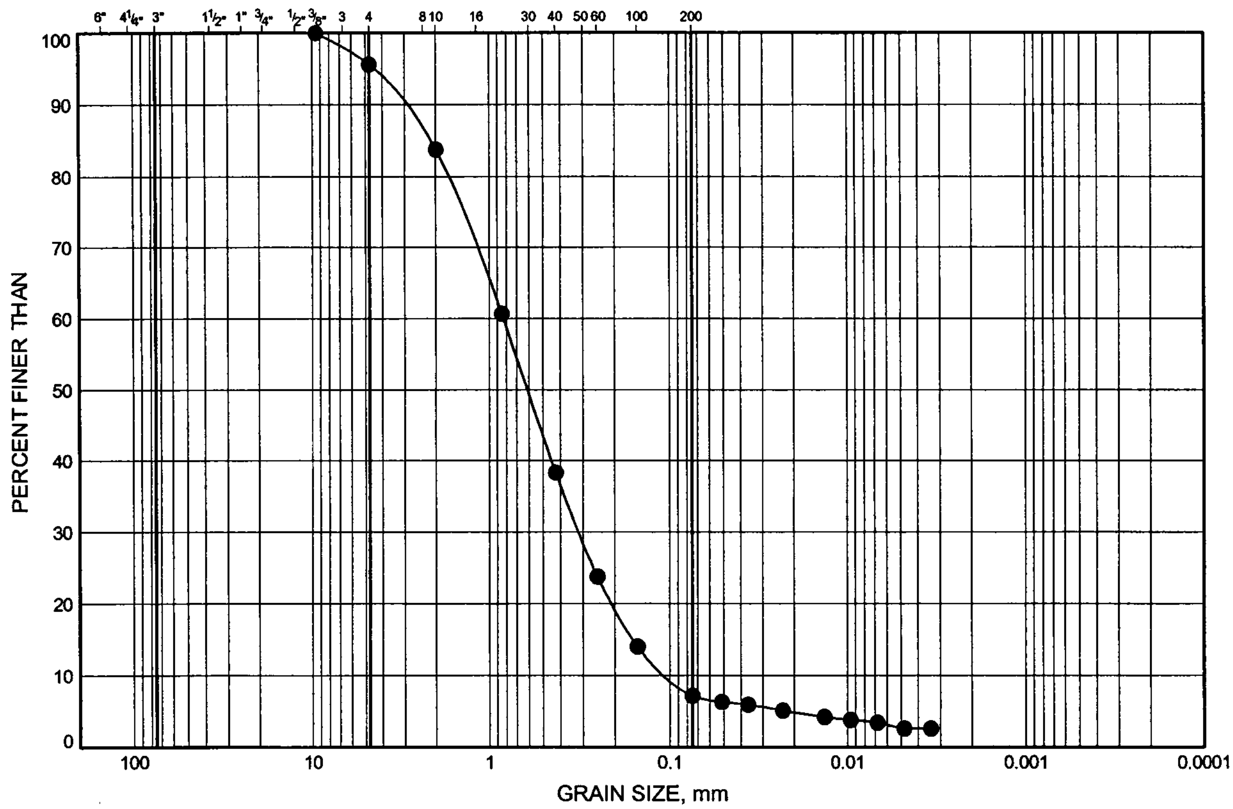
THURBGSD APPENDIX B(ROBINS).GPJ 10/02/05

ROBINS ROAD

GRAIN SIZE DISTRIBUTION

FIGURE B13

GRAVELLY SAND



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH 421-4	17.07	296.12

Date February 2005

Project 742-93-00

THURBER

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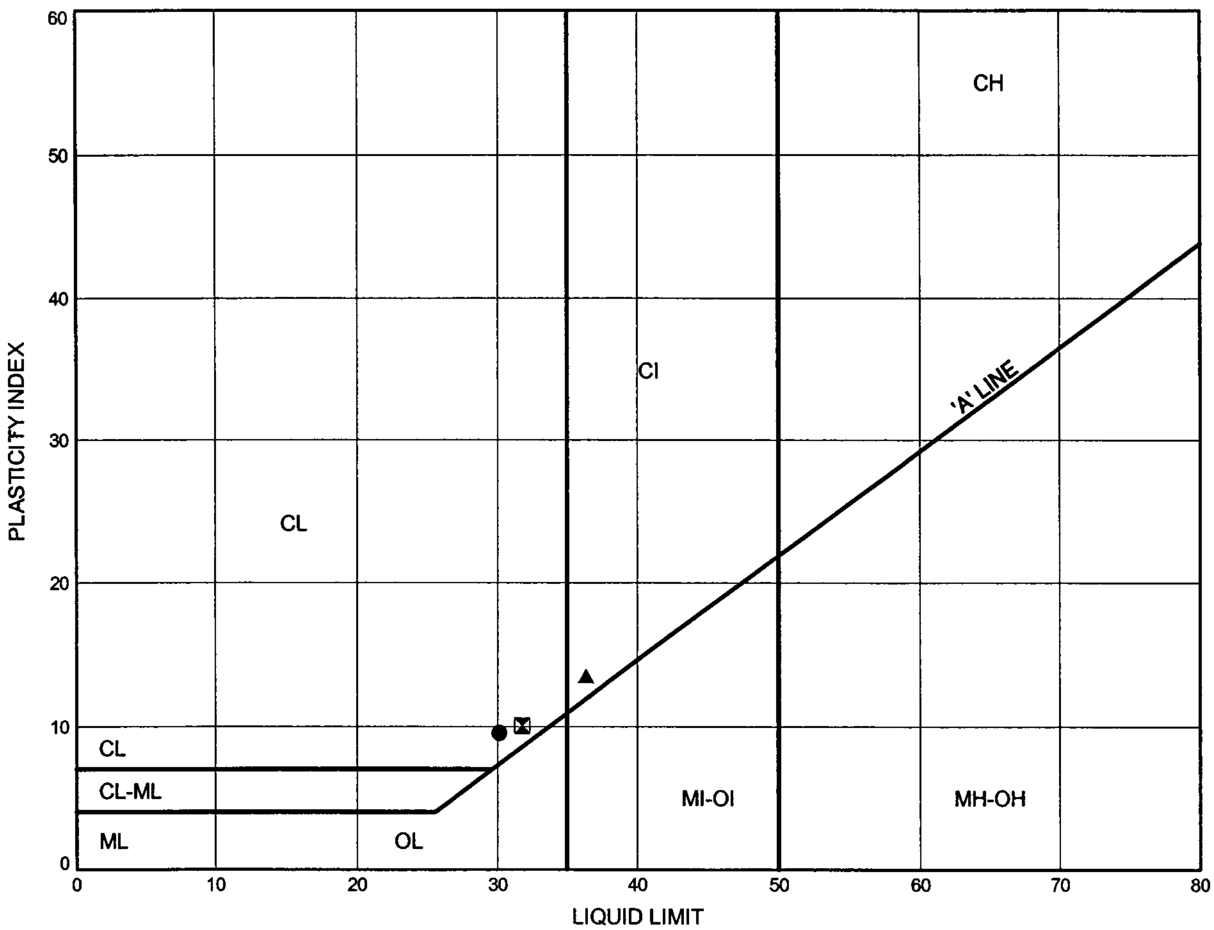
THURBGSD APPENDIX B(ROBINS).GPJ 10/02/05

ROBINS ROAD

ATTERBERG LIMITS TEST RESULTS

FIGURE B14

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 10+075 L7	1.07	
⊠	421 10+075 L7	4.88	
▲	421 10+125 L8	4.88	

Date February 2005

Project 742-93-00

THURBER

Prep'd HS

Chkd. PJB

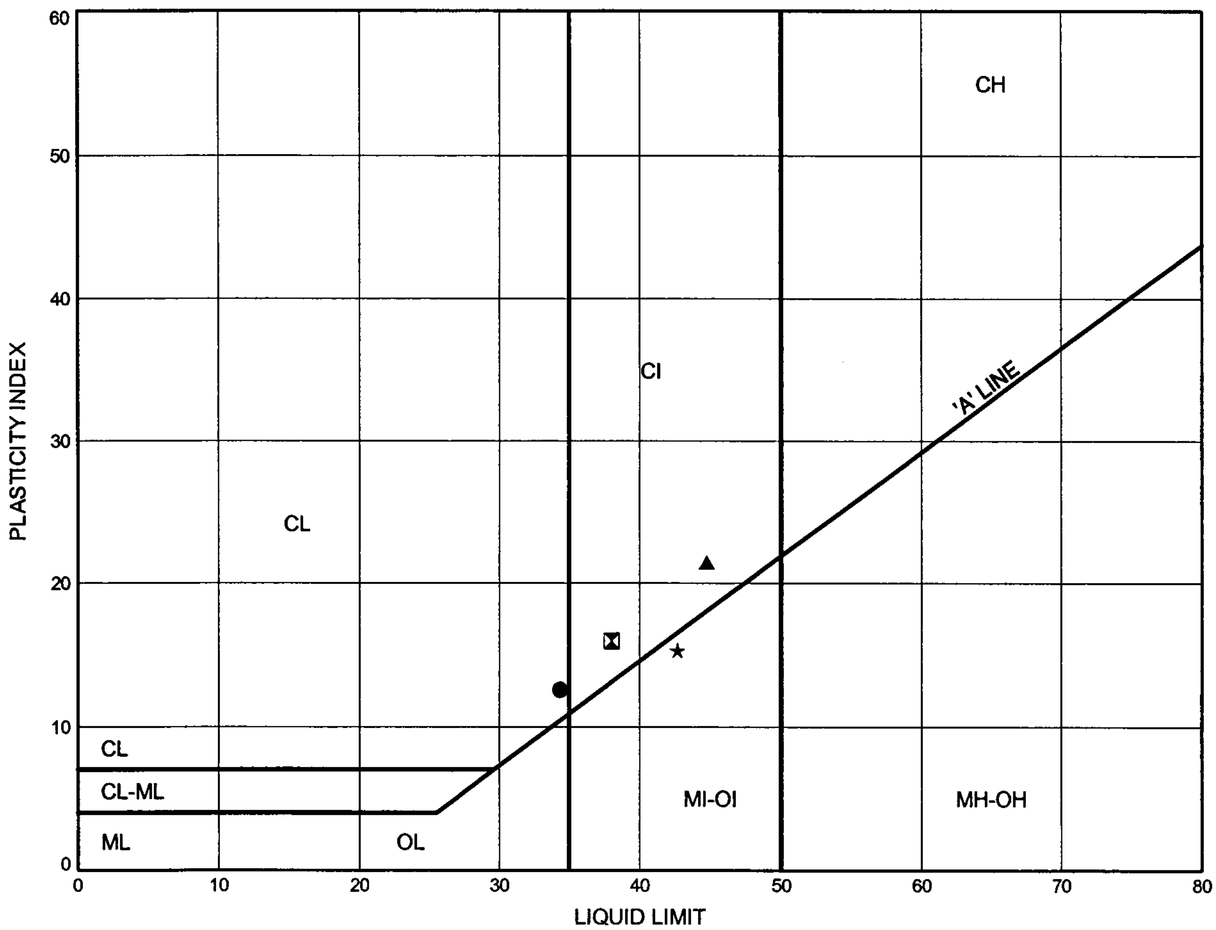
THURBALT APPENDIX B(ROBINS).GPJ 10/02/05

ROBINS ROAD

ATTERBERG LIMITS TEST RESULTS

FIGURE B15

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH 421-4	3.35	309.84
⊠	BH 421-4	6.40	306.79
▲	BH 421-4	9.45	303.74
★	BH 421-4	10.91	302.28

Date February 2005

Project 742-93-00

THURBER

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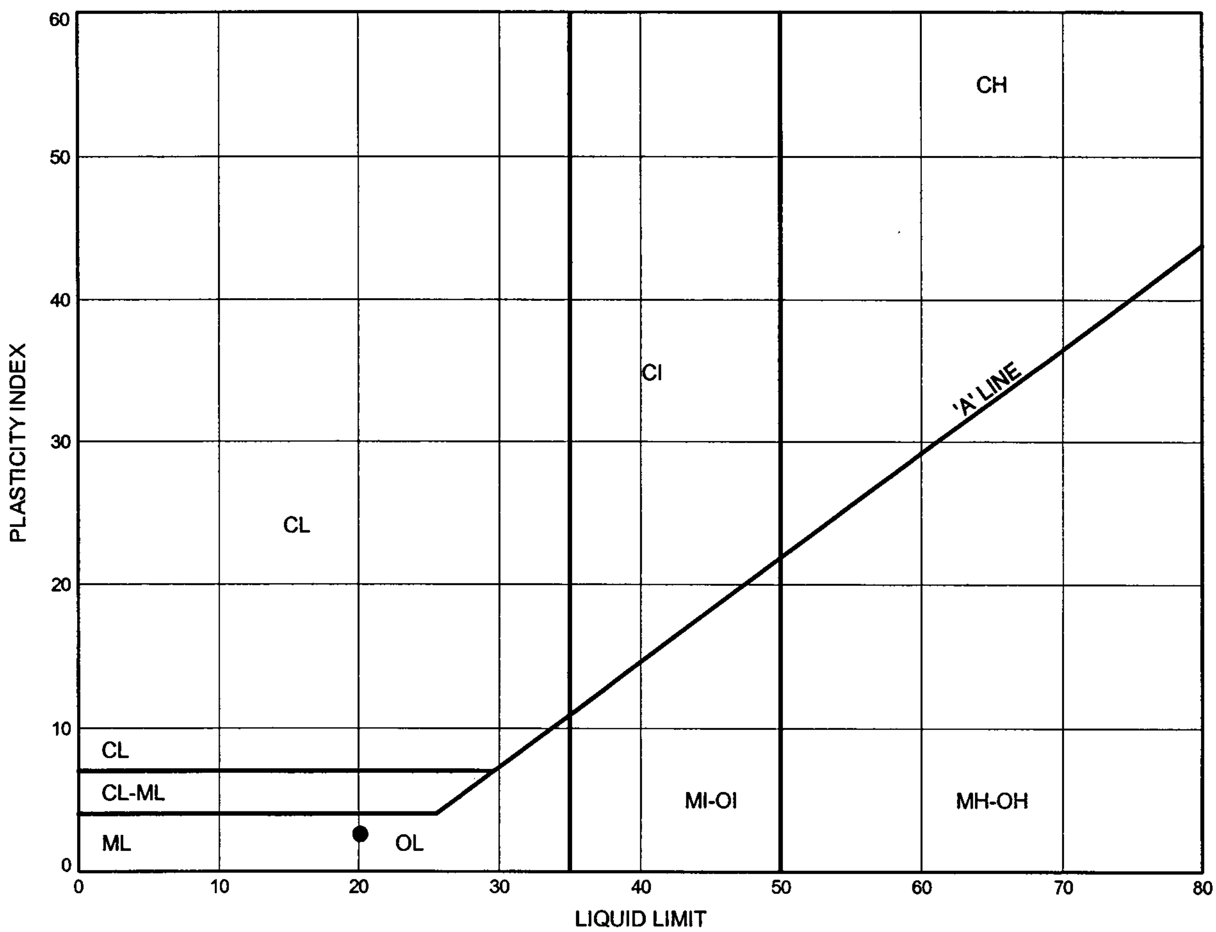
ROBINS ROAD

ATTERBERG LIMITS TEST RESULTS

FIGURE B16

CLAYEY SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 10+175 CL	2.59	

Date February 2005

Project 742-93-00

THURBER

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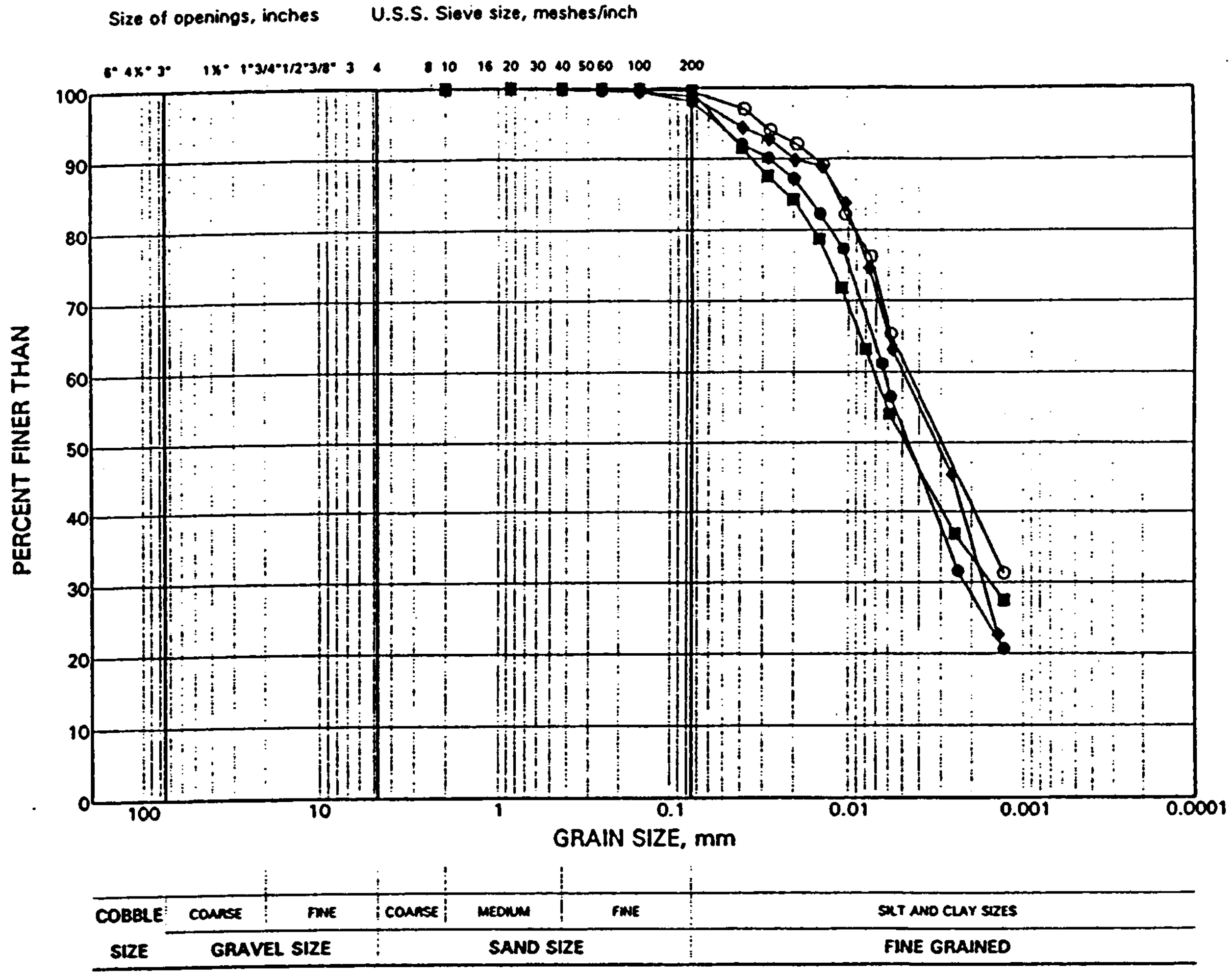
GRAIN SIZE DISTRIBUTION
Silty Clay, trace sand

FIGURE 5



LEGEND

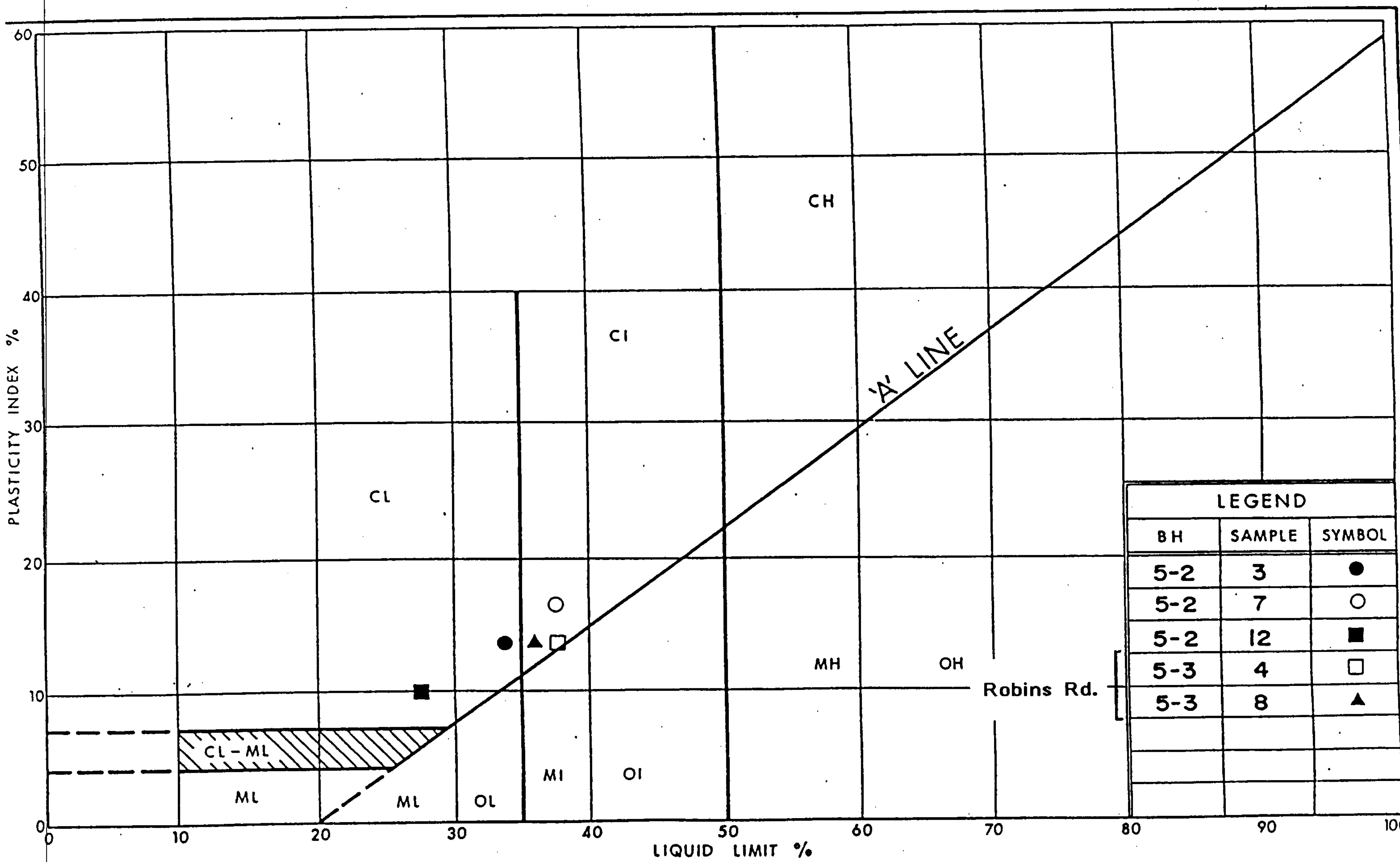
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	5-2	3	311.2
■	5-2	12	298.3
◆	5-3	4	307.4
○	5-3	12	295.0

Robins Rd. (◆, ○)

Project 991-1193

Golder Associates

Oct 75, FF-S-21



Ministry of Transportation
Ontario

PLASTICITY CHART
SILTY CLAY

FIG No. 6

W P 335-98-00

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	031-116011	Sample Number	1
Borehole Number	421-4	Sample Depth, m	6.1-6.6

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	6		
Date Started	03-05-15		
Date Completed	03-06-03		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	17.68
Sample Diameter, cm	6.37	Dry Unit Weight, kN/m^3	12.85
Area, cm^2	31.82	Specific Gravity, measured	2.76
Volume, cm^3	60.46	Solids Height, cm	0.902
Water Content, %	37.61	Volume of Solids, cm^3	28.70
Wet Mass, g	109.00	Volume of Voids, cm^3	31.76
Dry Mass, g	79.21	Degree of Saturation, %	93.8

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.107	1.900				
4.73	1.889	1.094	1.894	146	5.21E-03	1.25E-03	6.36E-07
9.50	1.882	1.086	1.885	76	9.91E-03	7.73E-04	7.51E-07
19.16	1.869	1.072	1.875	85	8.77E-03	6.97E-04	5.99E-07
38.50	1.852	1.053	1.860	146	5.03E-03	4.71E-04	2.32E-07
77.02	1.826	1.024	1.839	60	1.19E-02	3.57E-04	4.17E-07
153.95	1.786	0.980	1.806	76	9.10E-03	2.69E-04	2.40E-07
307.11	1.705	0.890	1.745	135	4.78E-03	2.81E-04	1.32E-07
613.85	1.628	0.805	1.666	113	5.21E-03	1.32E-04	6.73E-08
1230.01	1.551	0.720	1.589	72	7.44E-03	6.56E-05	4.78E-08
2461.85	1.477	0.638	1.514	34	1.43E-02	3.15E-05	4.42E-08
613.85	1.503	0.666	1.490				
153.95	1.534	0.701	1.519				
38.50	1.571	0.742	1.553				
9.50	1.607	0.781	1.589				
4.73	1.631	0.808	1.619				

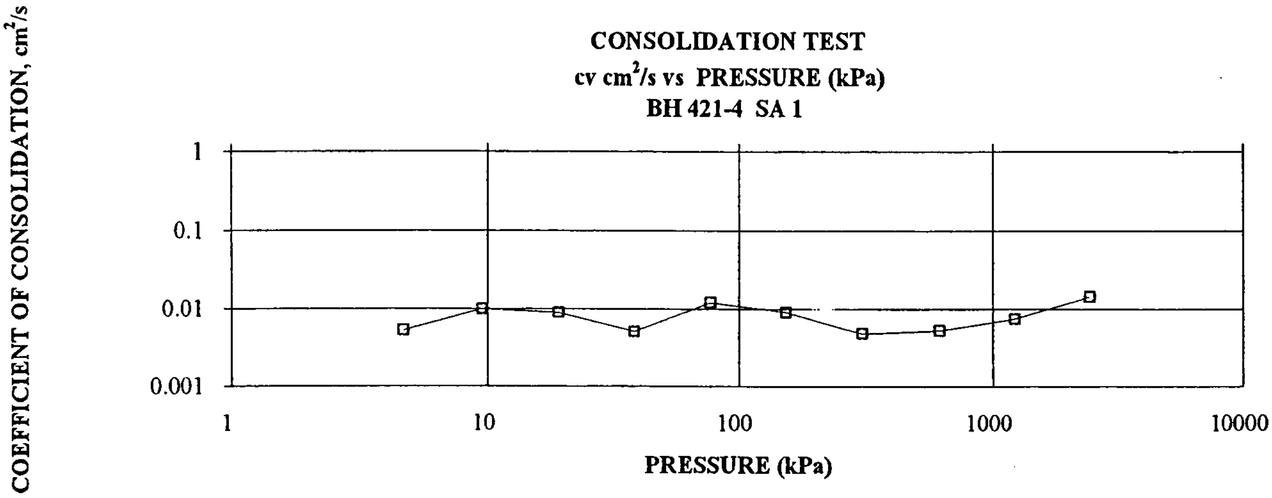
Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

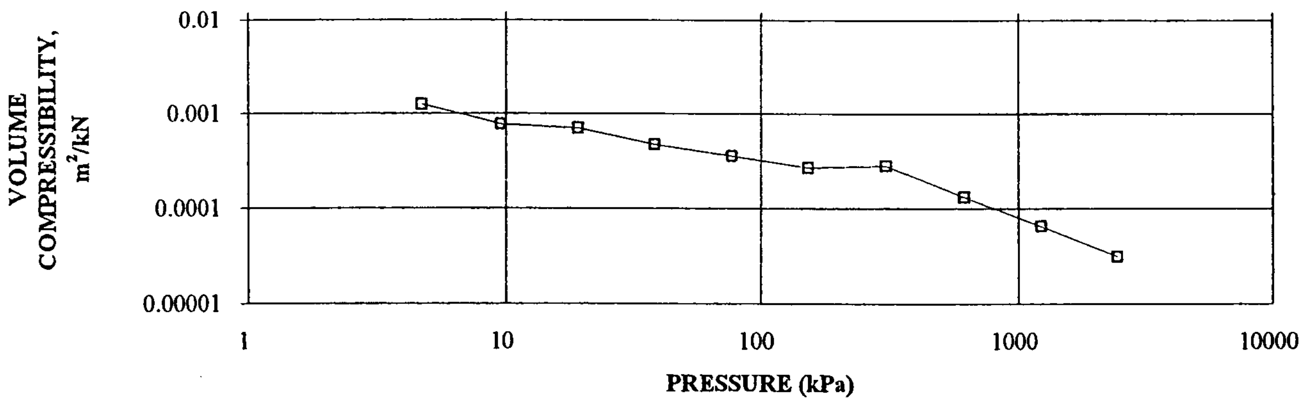
Sample Height, cm	1.63	Unit Weight, kN/m^3	19.97
Sample Diameter, cm	6.37	Dry Unit Weight, kN/m^3	14.97
Area, cm^2	31.82	Specific Gravity, measured	2.76
Volume, cm^3	51.88	Solids Height, cm	0.902
Water Content, %	33.38	Volume of Solids, cm^3	28.70
Wet Mass, g	105.65	Volume of Voids, cm^3	23.18
Dry Mass, g	79.21		

OEDOMETER CONSOLIDATION SUMMARY

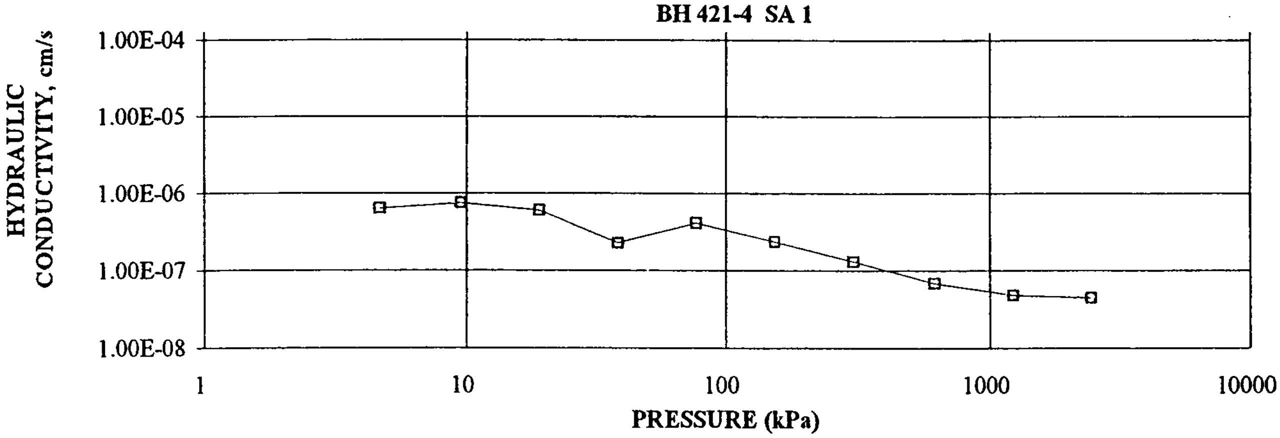
CONSOLIDATION TEST
cv cm^2/s vs PRESSURE (kPa)
BH 421-4 SA 1



CONSOLIDATION TEST
mv, m^2/kN vs PRESSURE (kPa)
BH 421-4 SA 1



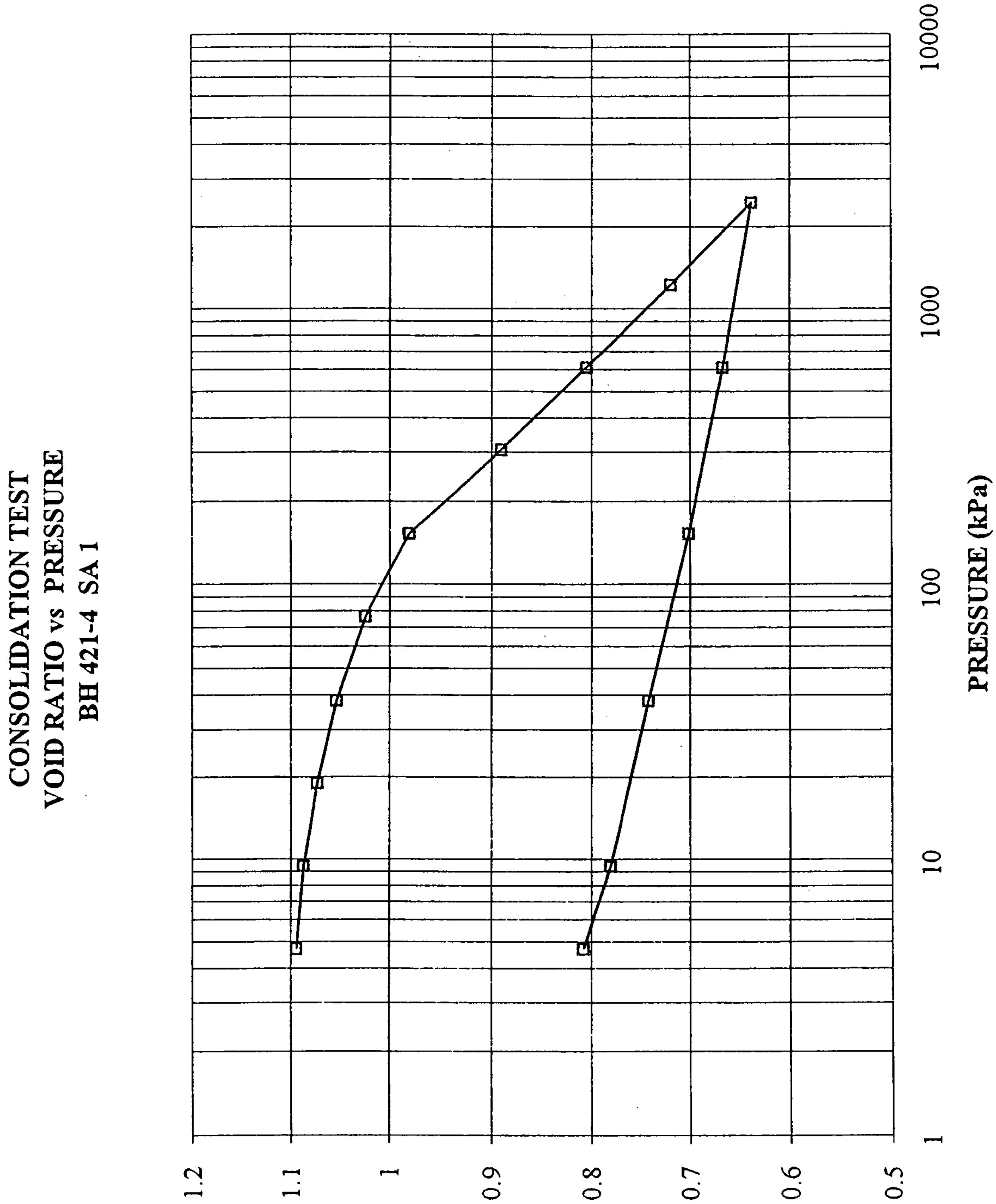
CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH 421-4 SA 1



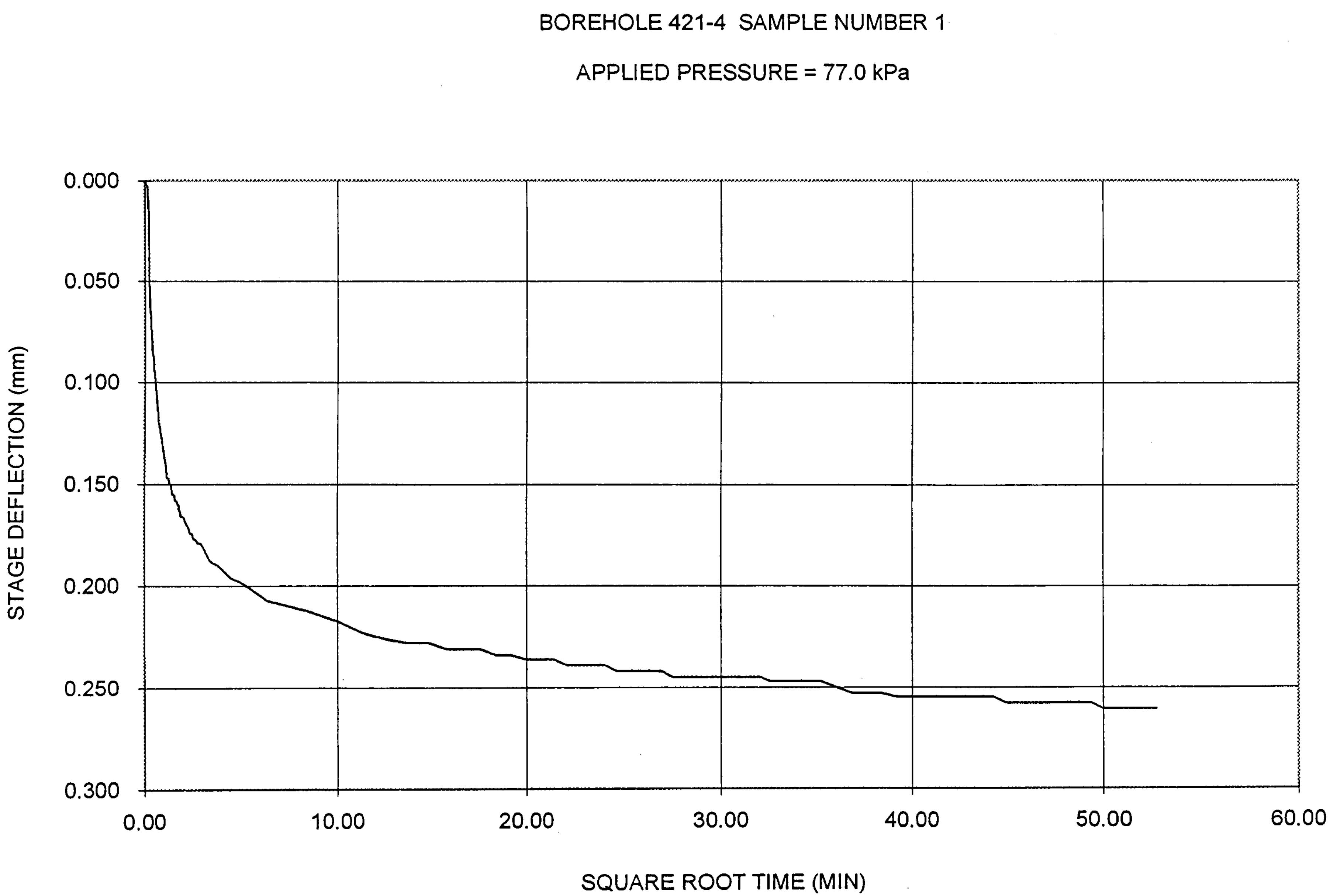
Project No. 031-116011

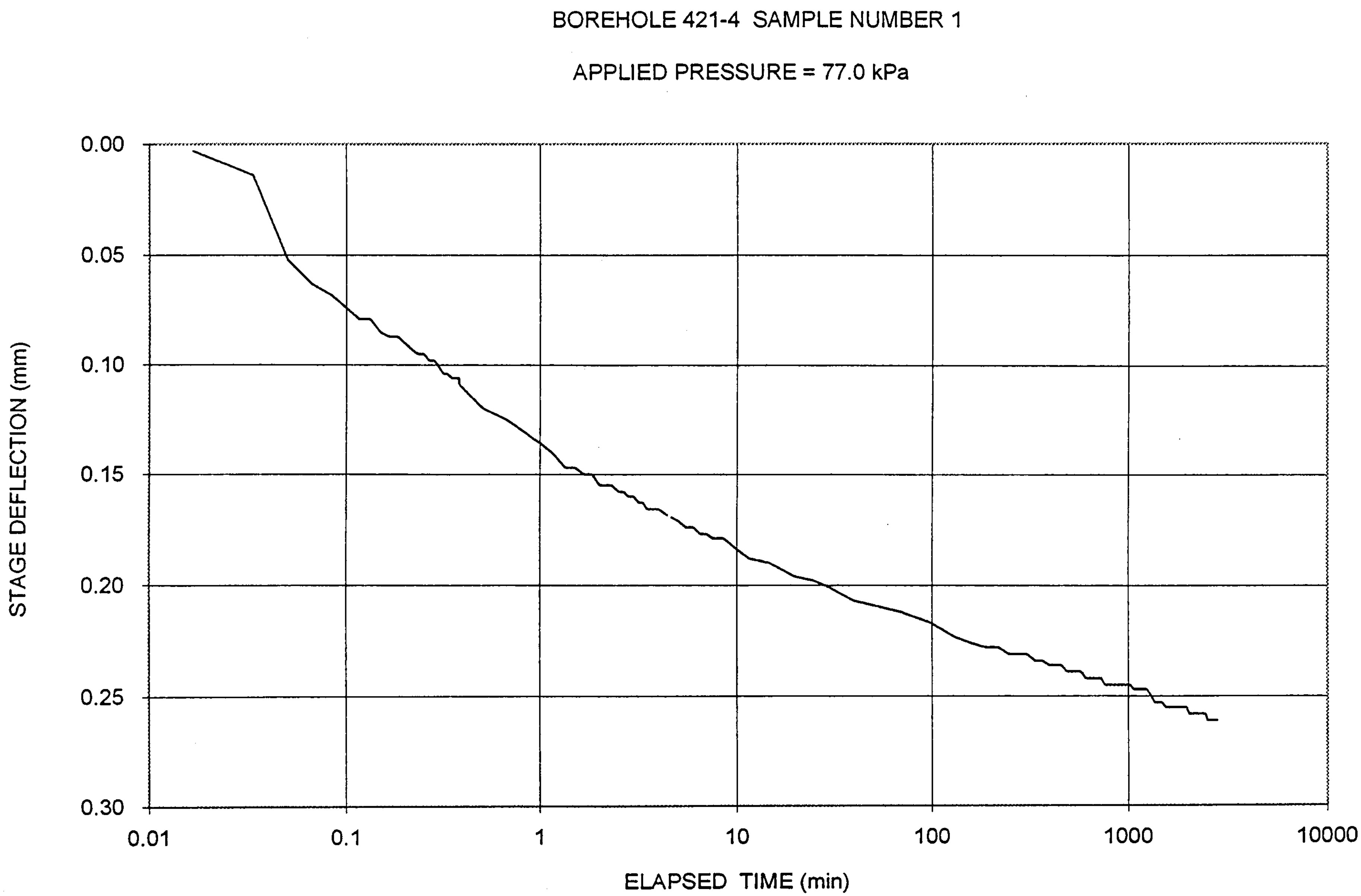
CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE



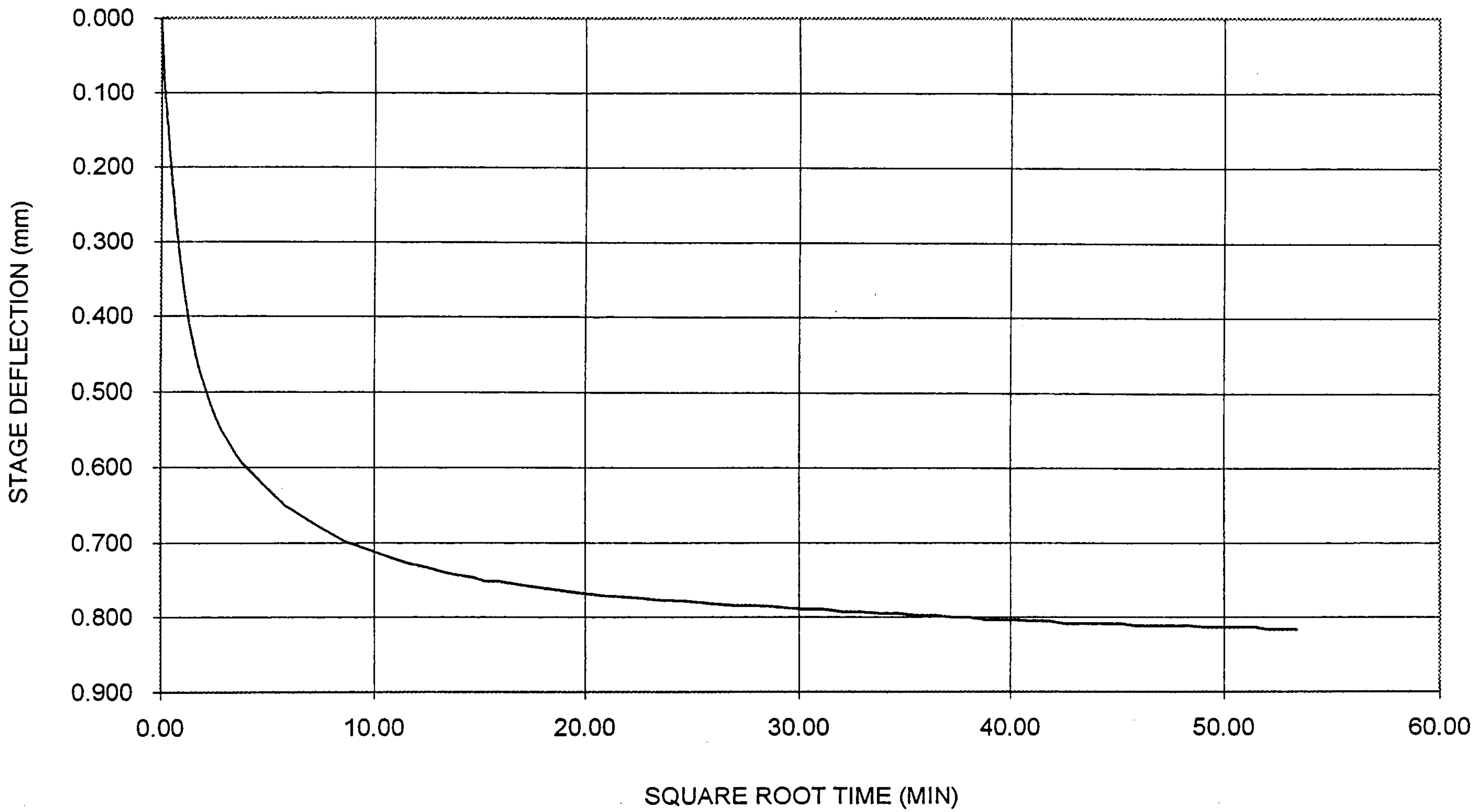
Project No. 031-116011

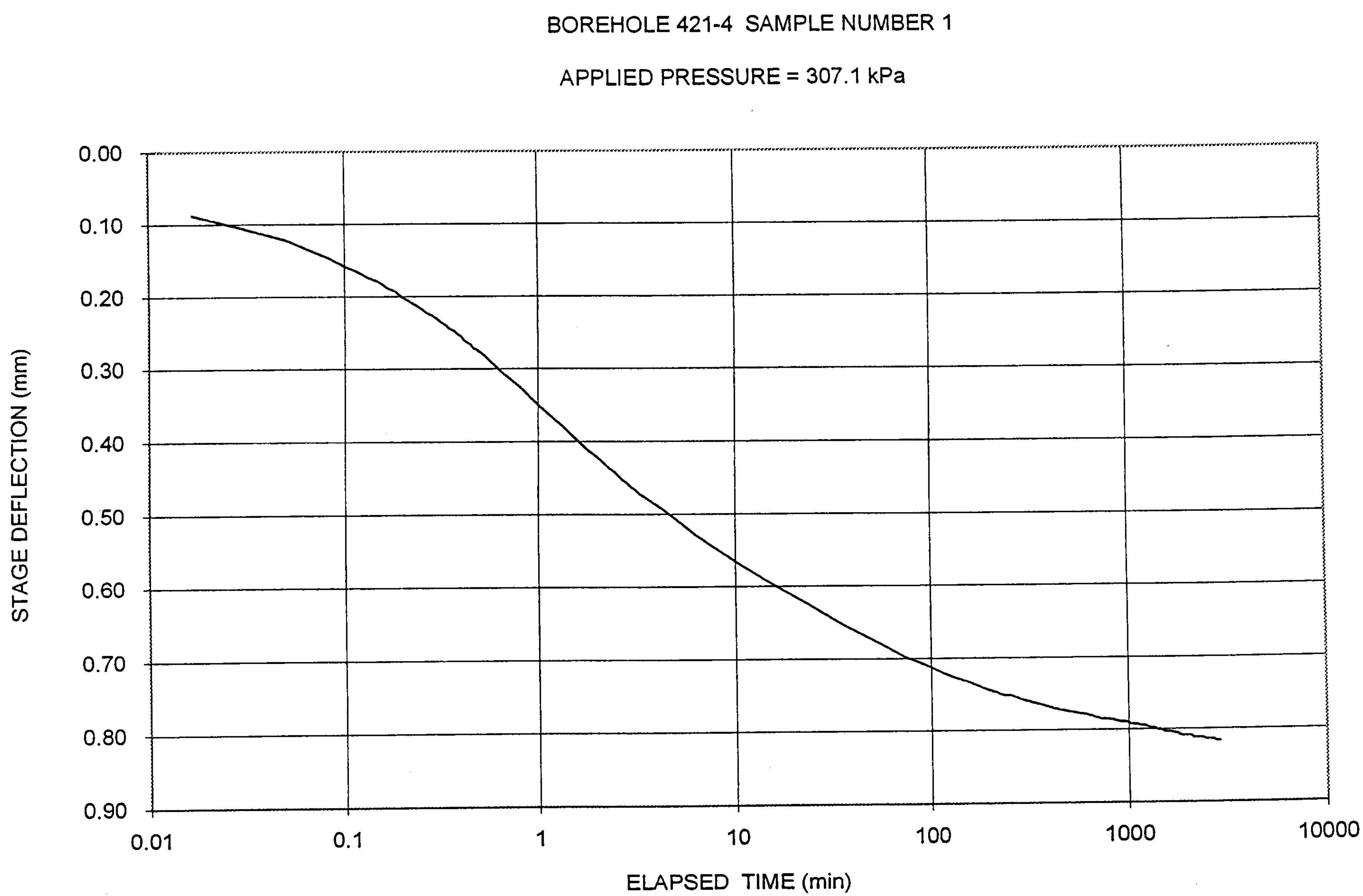

BOREHOLE 421-4 SAMPLE NUMBER 1
APPLIED PRESSURE = 77.0 kPa
STAGE DEFLECTION (mm)
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.00
10.00
20.00
30.00
40.00
50.00
60.00
SQUARE ROOT TIME (MIN)


BOREHOLE 421-4 SAMPLE NUMBER 1
APPLIED PRESSURE = 77.0 kPa
STAGE DEFLECTION (mm)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.01
0.1
1
10
100
1000
10000
ELAPSED TIME (min)

BOREHOLE 421-4 SAMPLE NUMBER 1

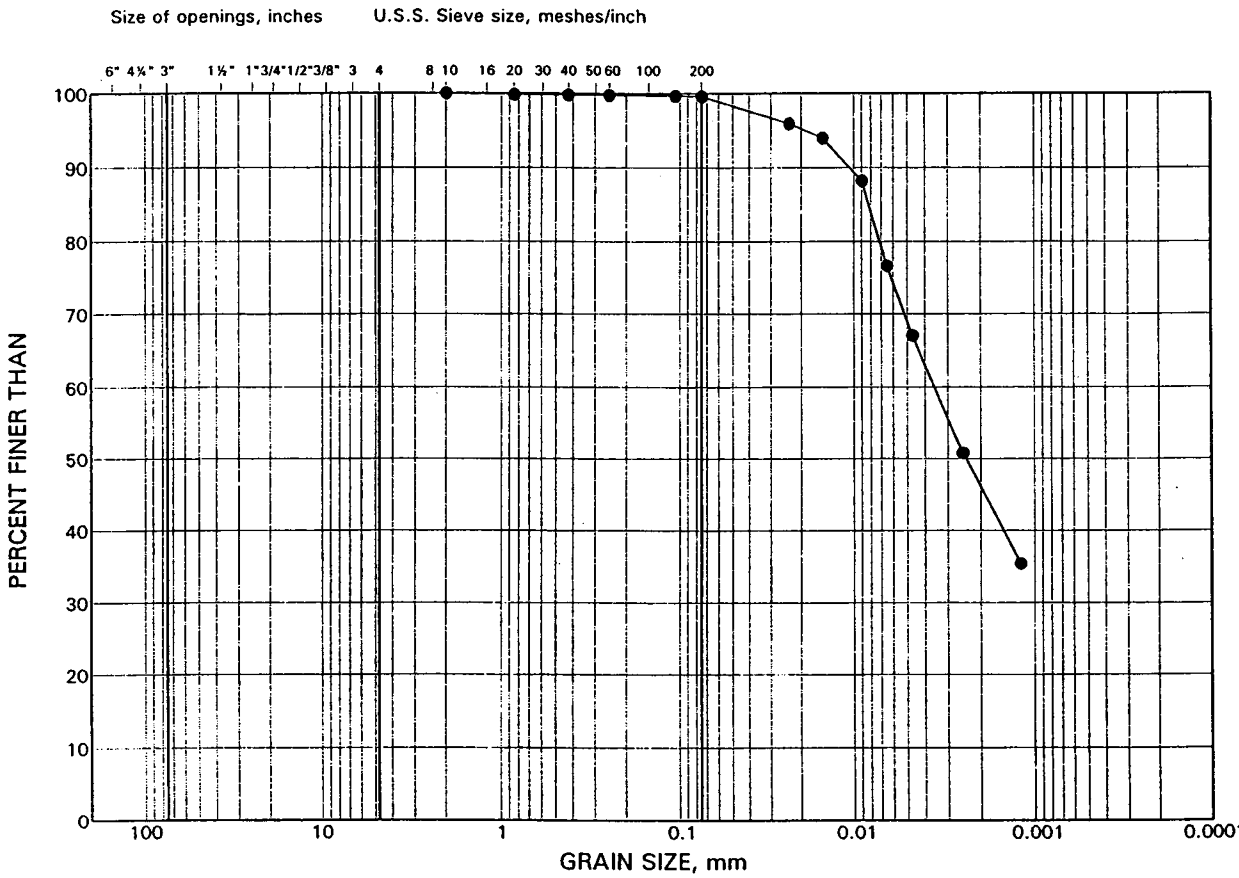
APPLIED PRESSURE = 307.1 kPa




BOREHOLE 421-4 SAMPLE NUMBER 1
APPLIED PRESSURE = 307.1 kPa
STAGE DEFLECTION (mm)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
0.01
0.1
1
10
100
1000
10000
ELAPSED TIME (min)

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	421-4	1	6.3

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER	031-116011
PROJECT NAME	Thurber / Lab Testing / 19-1423-12
DATE TESTED	June, 2003

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
421-4	1	20.0-21.7	6.10-6.61	37.6%	LL=38.0, PL=21.9, PI=16.1

SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-00 TEST METHOD A

PROJECT NUMBER	031-116011
PROJECT NAME	Thurber / Lab Testing / 19-1423-12
DATE TESTED	May, 2003

Borehole No.	Sample No.	Specific Gravity
421-4	1	2.76

Note: Test carried out on soil particles <4.75mm using distilled water.

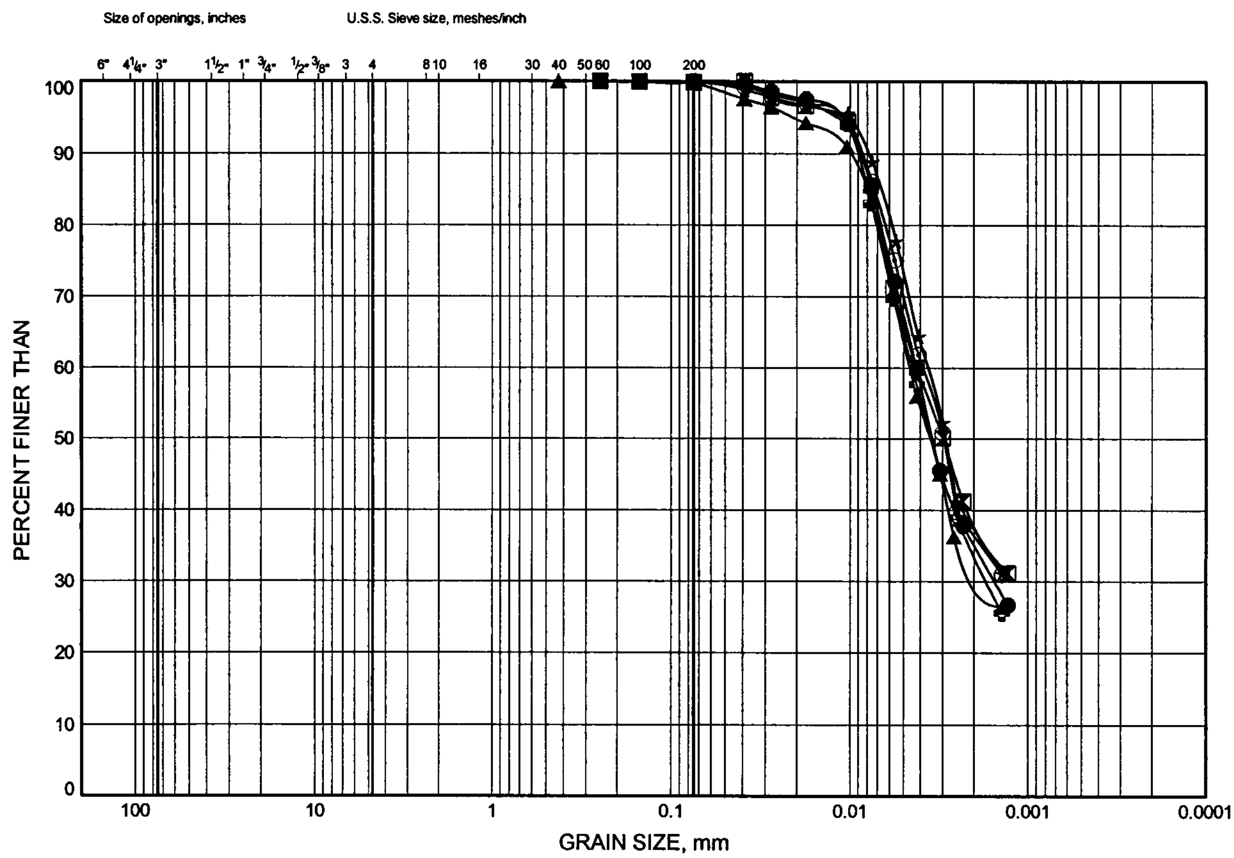
RAMPS WEST OF HWY11

E-S RAMP

GRAIN SIZE DISTRIBUTION

FIGURE B17

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 E-S 14+525 CL	3.35	
⊠	421 E-S 14+550 R23.2	2.59	
▲	421 E-S 14+550 R23.2	4.88	
★	421 E-S 14+575 CL	2.44	
⊙	421 E-S 14+575 CL	4.88	
✪	421 E-S 14+612.5 CL	2.55	

Date February 2005

Project 742-93-00

THURBER

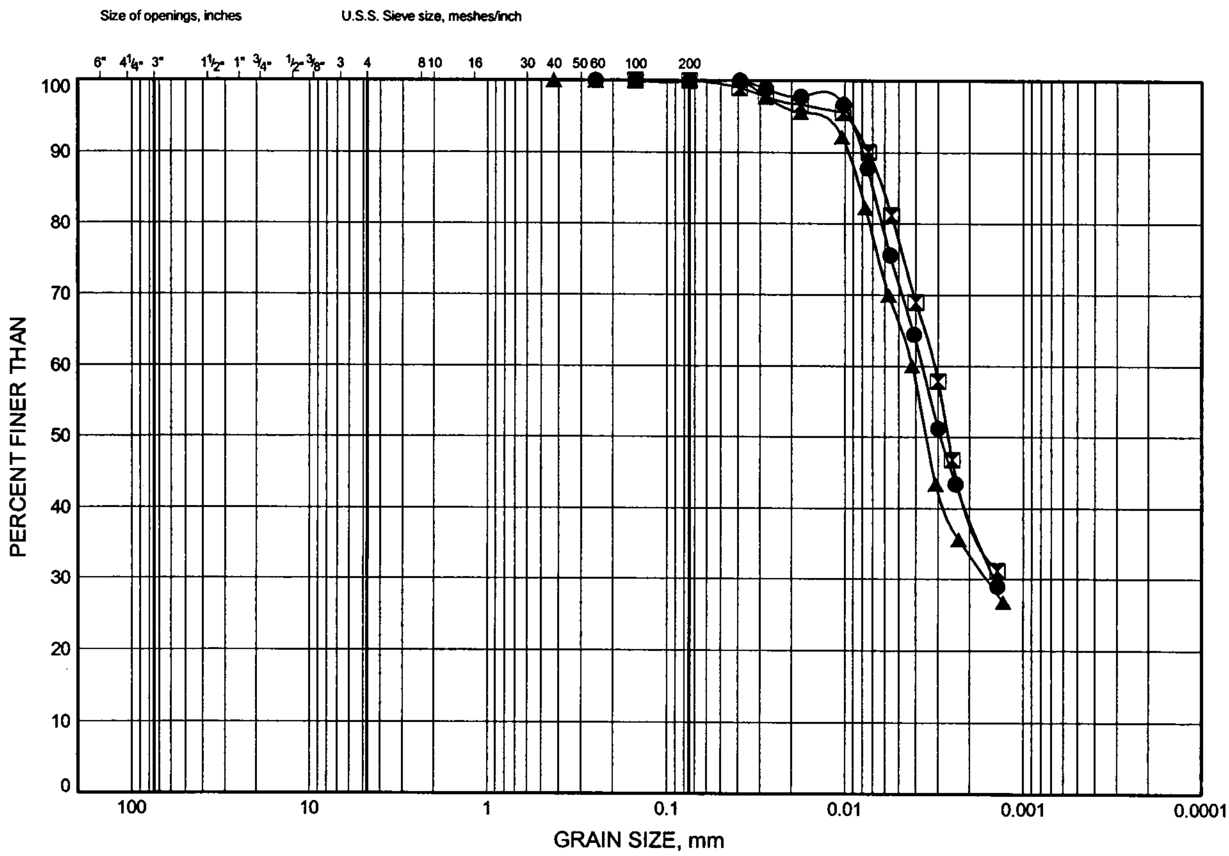
Prep'd HS

Chkd. PJB

GRAIN SIZE DISTRIBUTION

FIGURE B18

SILTY CLAY



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 W-S 14+512.5 CL	3.35	
⊠	421 W-S 14+537.5 R19	2.59	
▲	421 W-S 14+537.5 R19	7.92	

Date February 2005

Project 742-93-00

THURBER

Prep'd HS

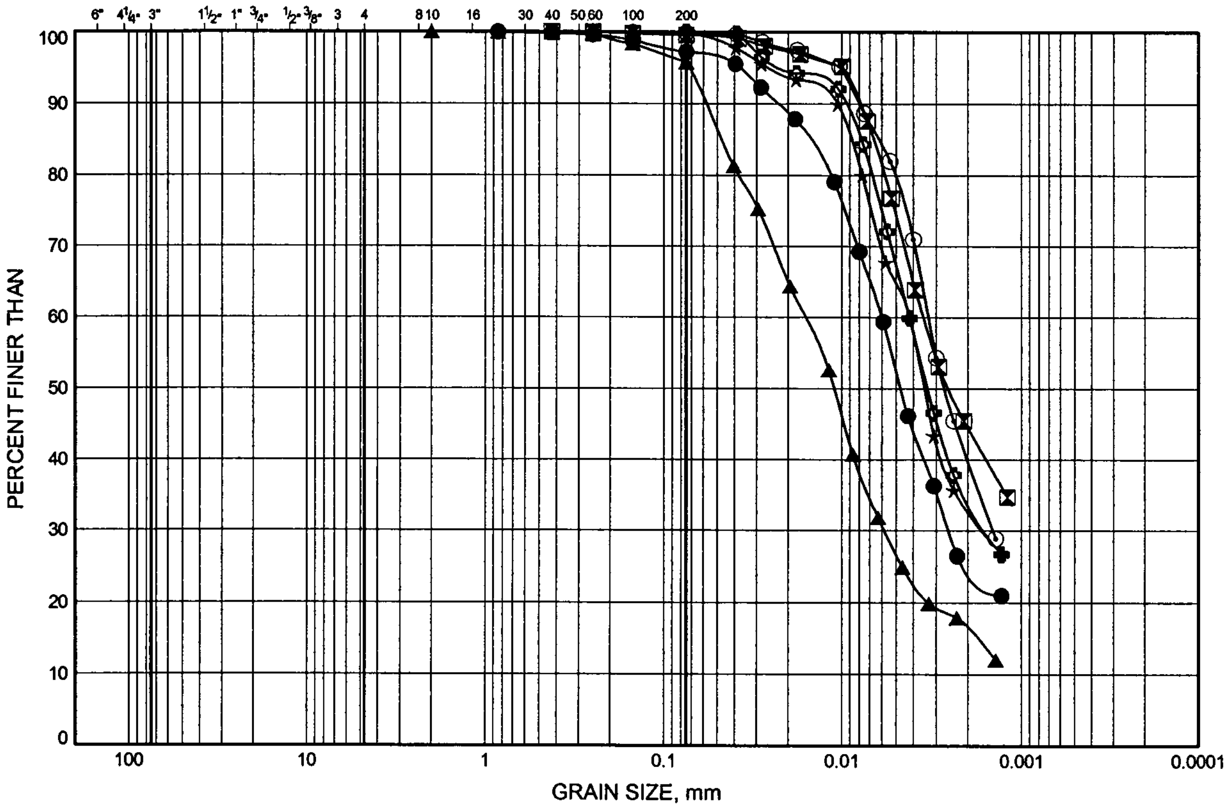
Chkd. PJB

N-EW RAMP

GRAIN SIZE DISTRIBUTION

FIGURE B19

SILTY CLAY AND CLAYEY SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-6	4.88	308.23
⊠	24-6	9.45	303.66
▲	24-6	12.5	300.61
★	421 N-EW 14+075 R18	2.59	
⊙	421 N-EW 14+100 CL	2.59	
✪	421 N-EW 14+100 CL	4.88	

THURBGSD APPENDIX B(RAMP WEST).GPJ 10/02/05

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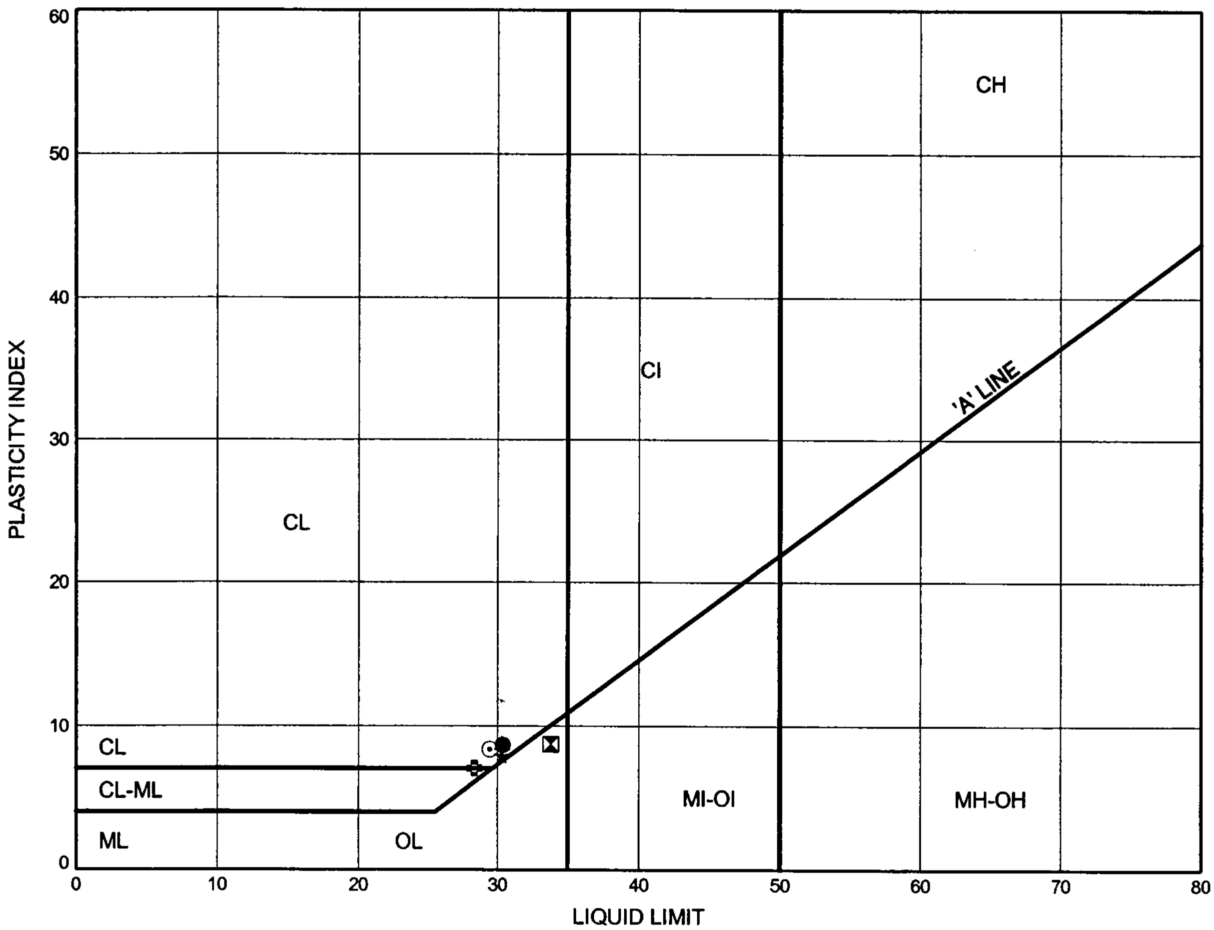
E-S RAMP

ATTERBERG LIMITS TEST RESULTS

FIGURE B20

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 E-S 14+525 CL	3.35	
⊠	421 E-S 14+550 R23.2	2.59	
▲	421 E-S 14+550 R23.2	4.88	
★	421 E-S 14+575 CL	2.44	
⊙	421 E-S 14+575 CL	4.88	
✪	421 E-S 14+612.5 CL	2.55	

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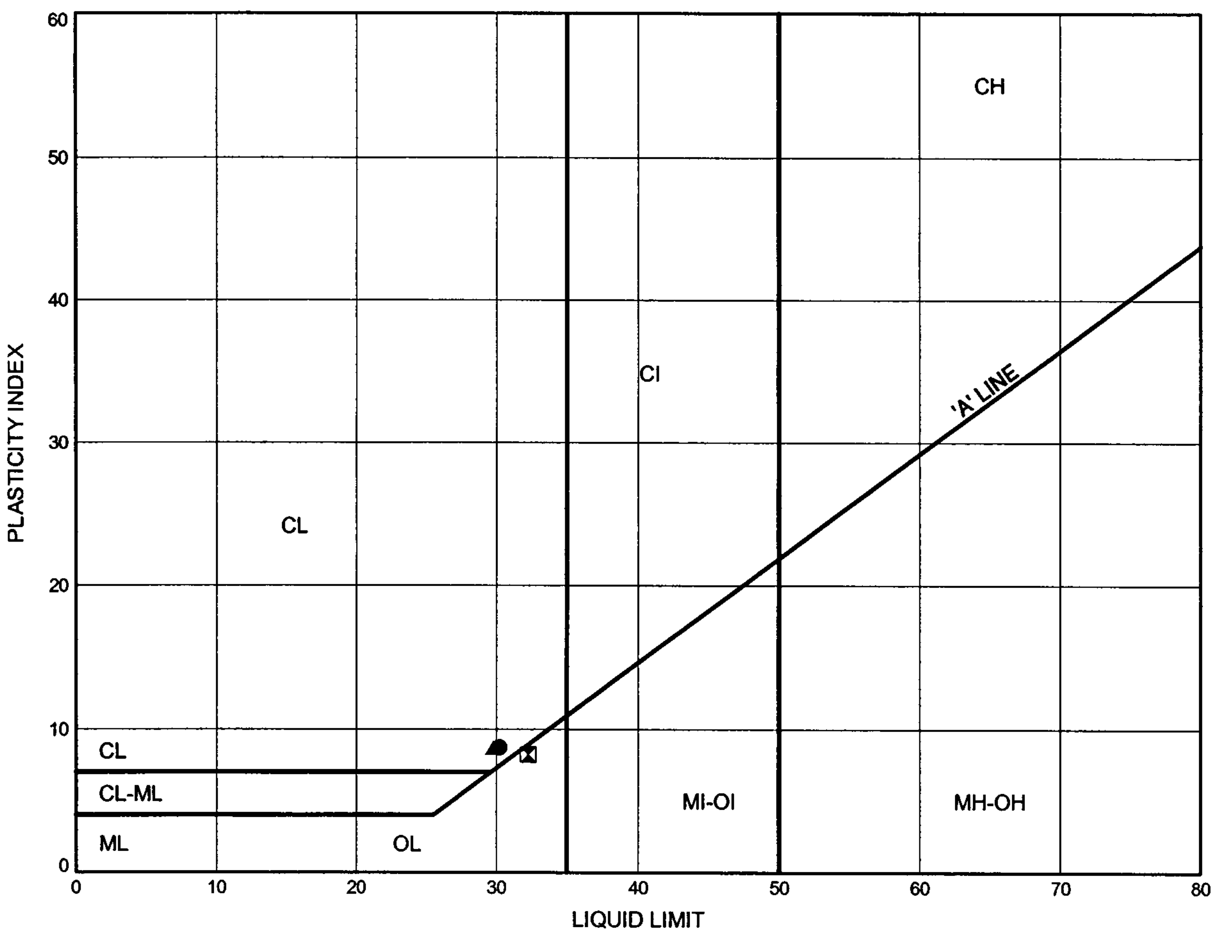
W-S RAMP

ATTERBERG LIMITS TEST RESULTS

FIGURE B21

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 W-S 14+512.5 CL	3.35	
⊠	421 W-S 14+537.5 R19	2.59	
▲	421 W-S 14+537.5 R19	7.92	

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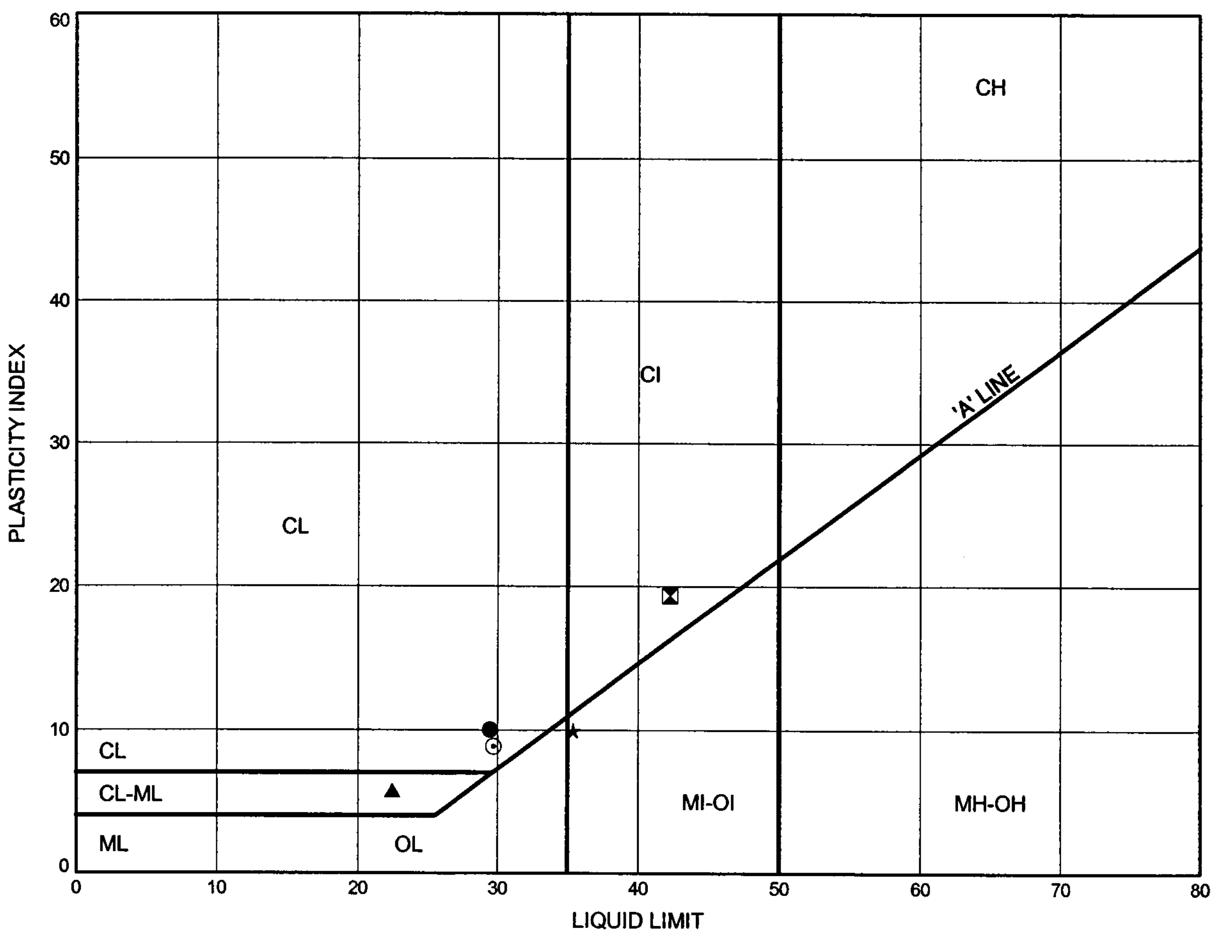
THURBALT APPENDIX B(RAMP WEST).GPJ 10/02/05

N-EW RAMP

ATTERBERG LIMITS TEST RESULTS

FIGURE B22

SILTY CLAY AND CLAYEY SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-6	4.88	308.23
⊠	24-6	9.45	303.66
▲	24-6	12.5	300.61
★	421 N-EW 14+075 R18	2.59	
⊙	421 N-EW 14+100 CL	2.44	

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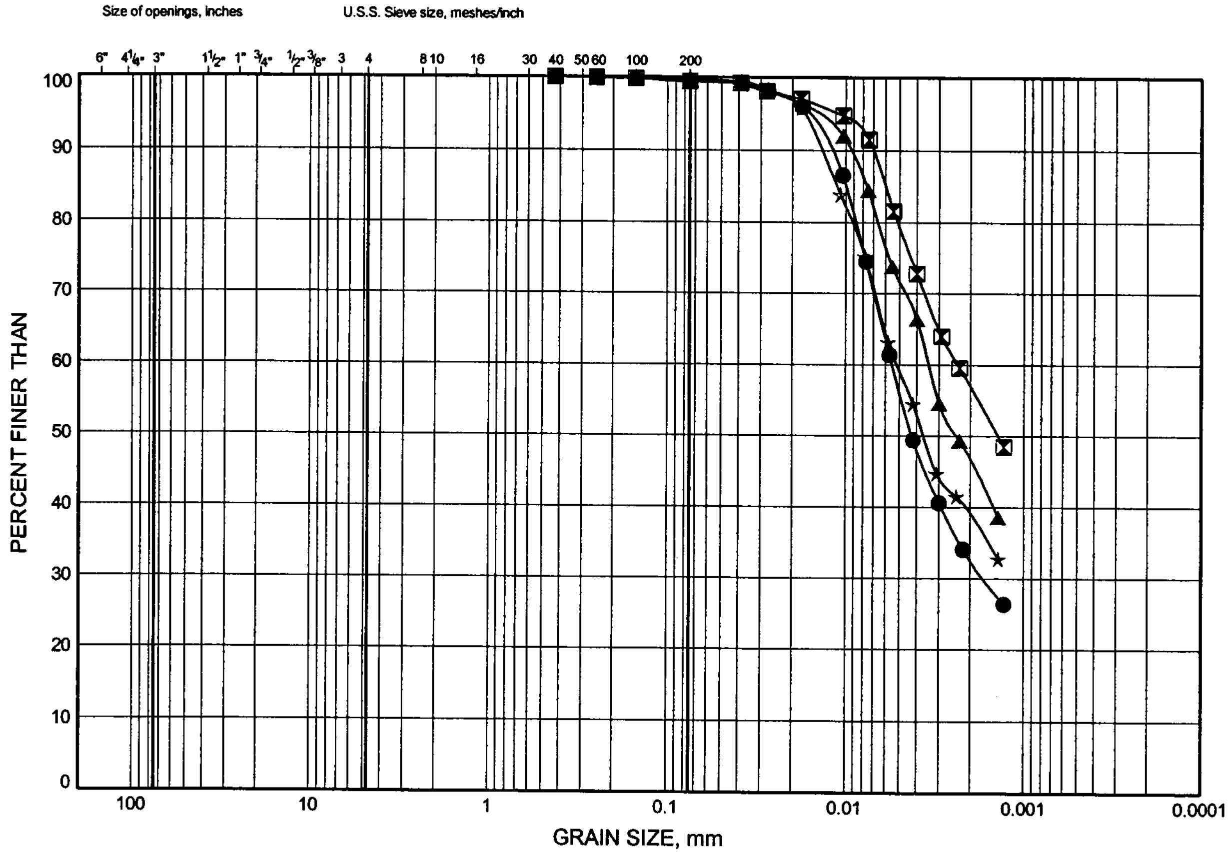
RAMPS EAST OF HWY11

S-EW RAMP

GRAIN SIZE DISTRIBUTION

FIGURE B23

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-4	1.83	313.48
⊠	421 S-EW 14+187.5 CL	2.59	
▲	421 S-EW 14+212.5 L20.5	3.35	
★	421 S-EW 14+239.5 CL	1.83	

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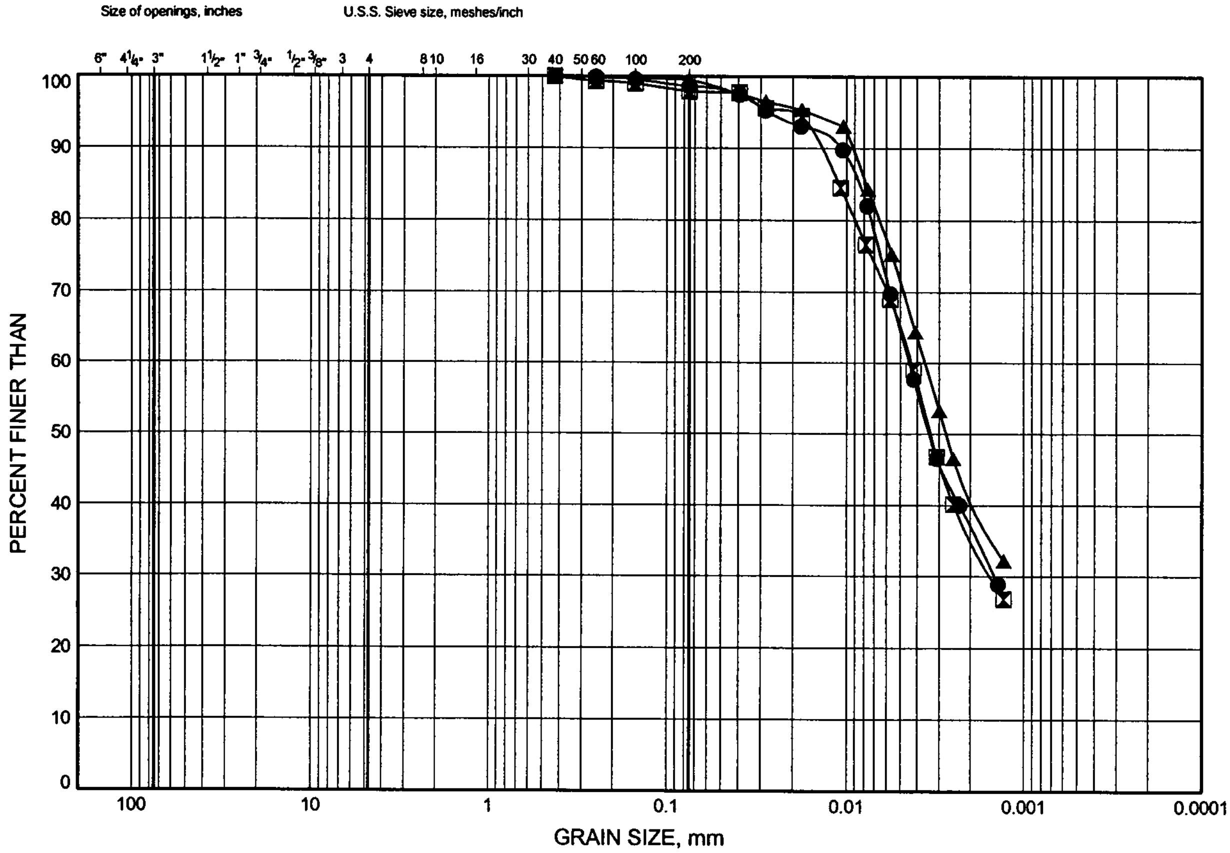
W-N RAMP

GRAIN SIZE DISTRIBUTION

FIGURE B24

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 W-N 13+700 R1.5	2.59	
⊠	421 W-N 13+725 R21.8	1.83	
▲	421 W-N 13+800 CL	1.83	

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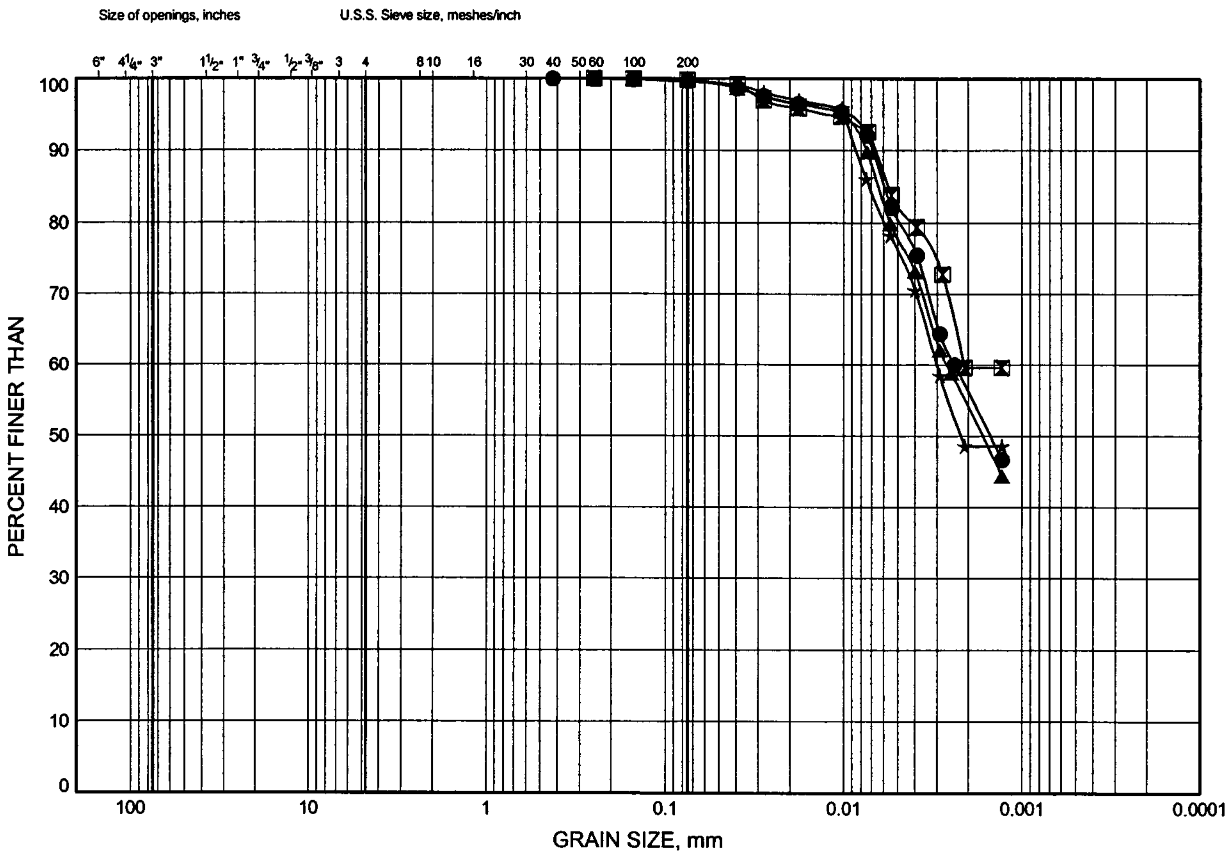
GRAIN SIZE DISTRIBUTION

FIGURE B25

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 W-N 13+700 R1.5	7.92	
⊠	421 W-N 13+725 R21.8	7.92	
▲	421 W-N 13+750 CL	6.40	
★	421 W-N 13+800 CL	4.88	

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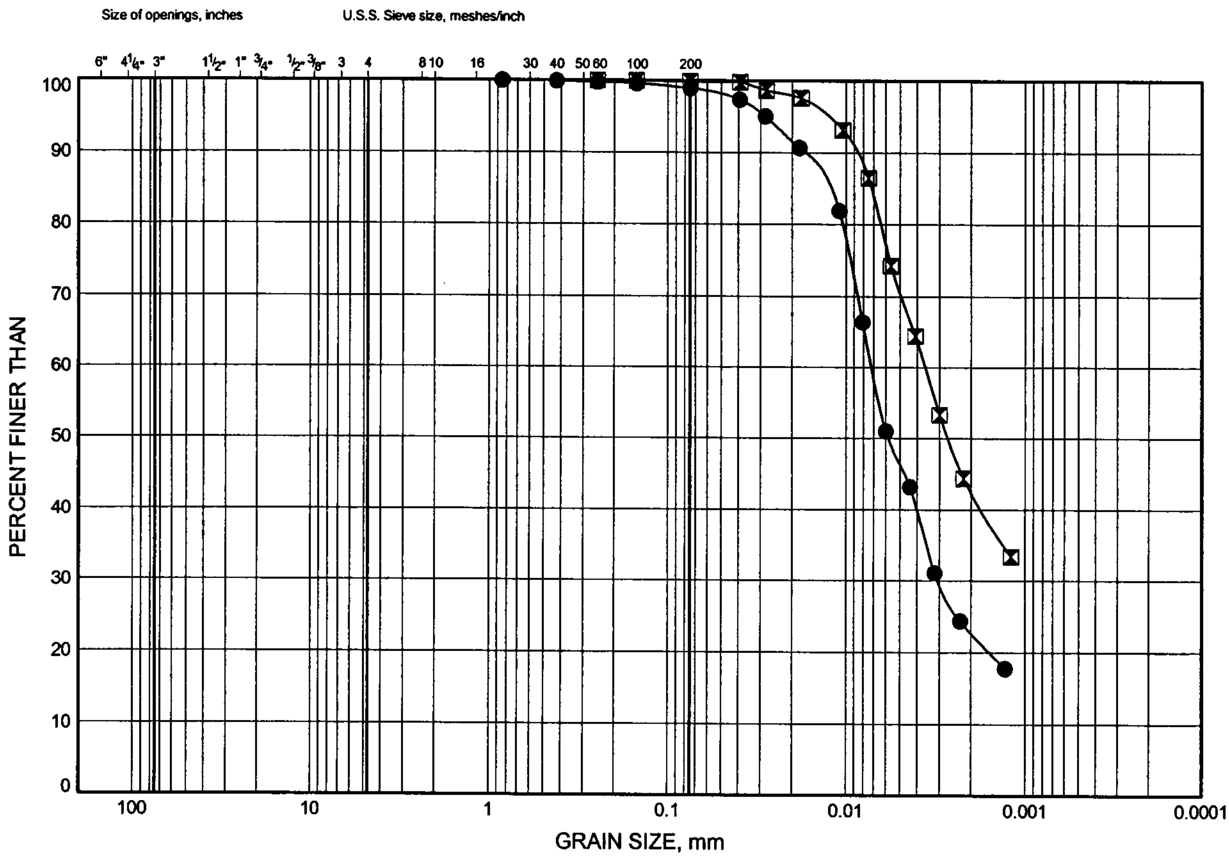
E-N RAMP

GRAIN SIZE DISTRIBUTION

FIGURE B26

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 E-N 13+754 CL	2.59	
⊠	421 E-N 13+754 CL	3.35	

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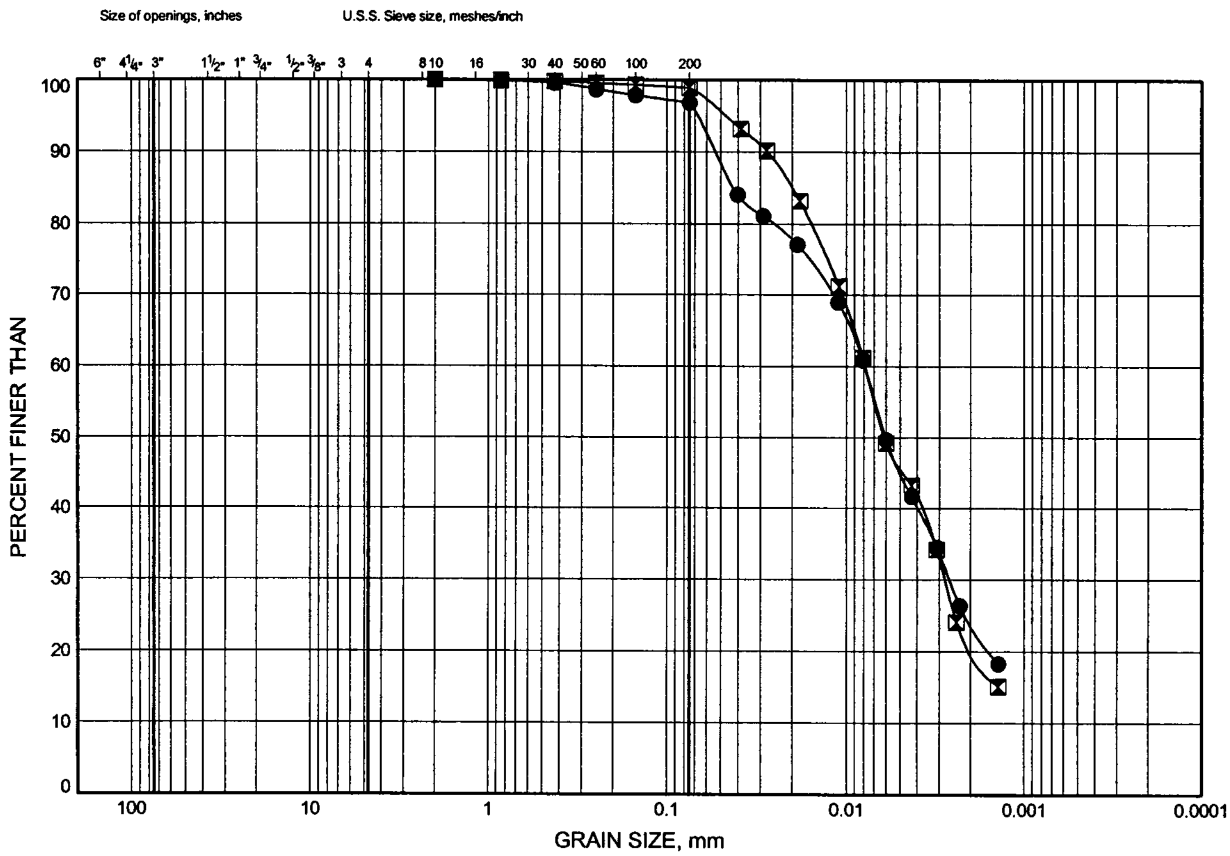
VALLEY VIEW ROAD

GRAIN SIZE DISTRIBUTION

FIGURE B27

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 VV 10+075 L20	1.83	
⊠	421 VV 10+075 L20	3.35	

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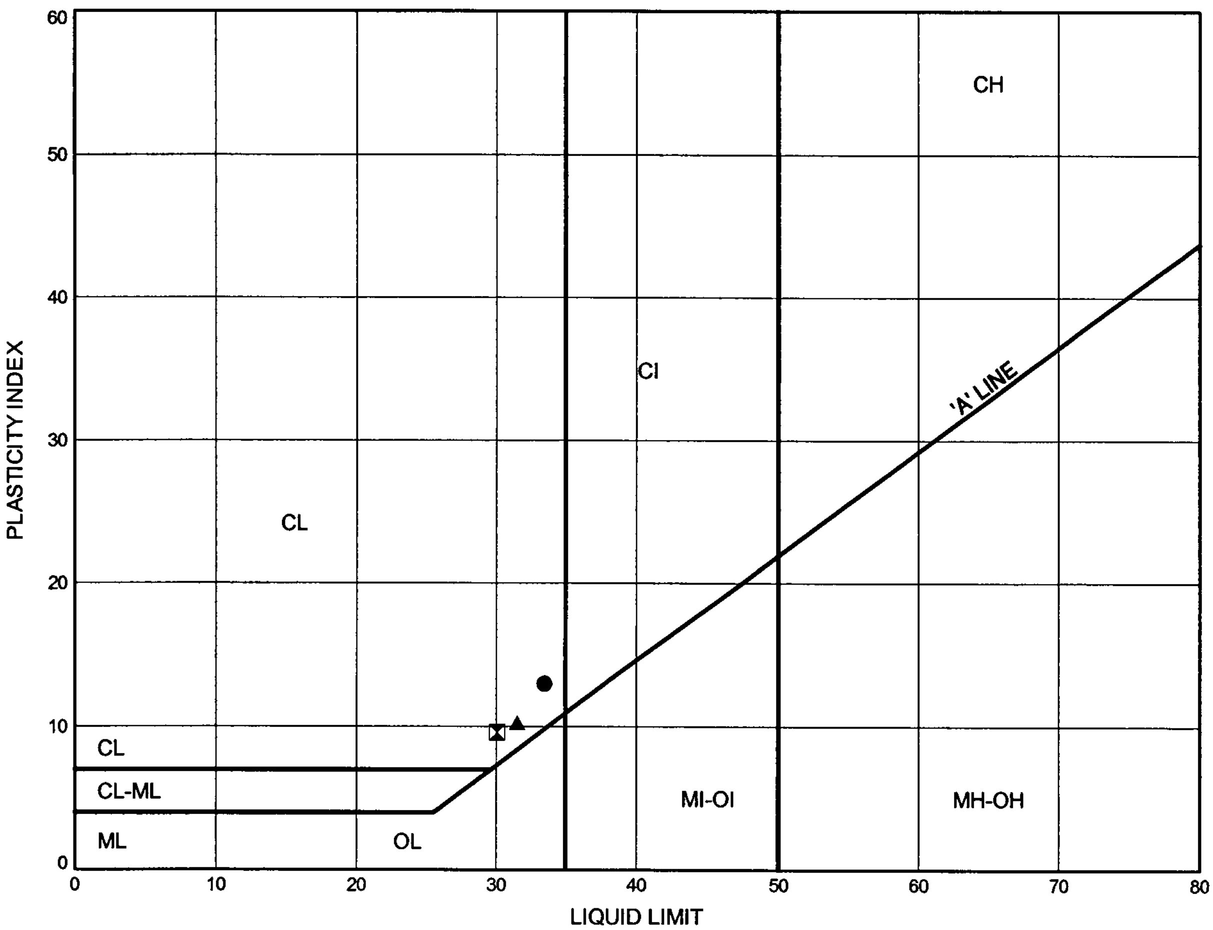
S-EW RAMP

ATTERBERG LIMITS TEST RESULTS

FIGURE B28

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-4	1.83	313.48
⊠	421 S-EW 14+212.5 L20.5	6.40	
▲	421 S-EW 14+239.5 CL	2.59	

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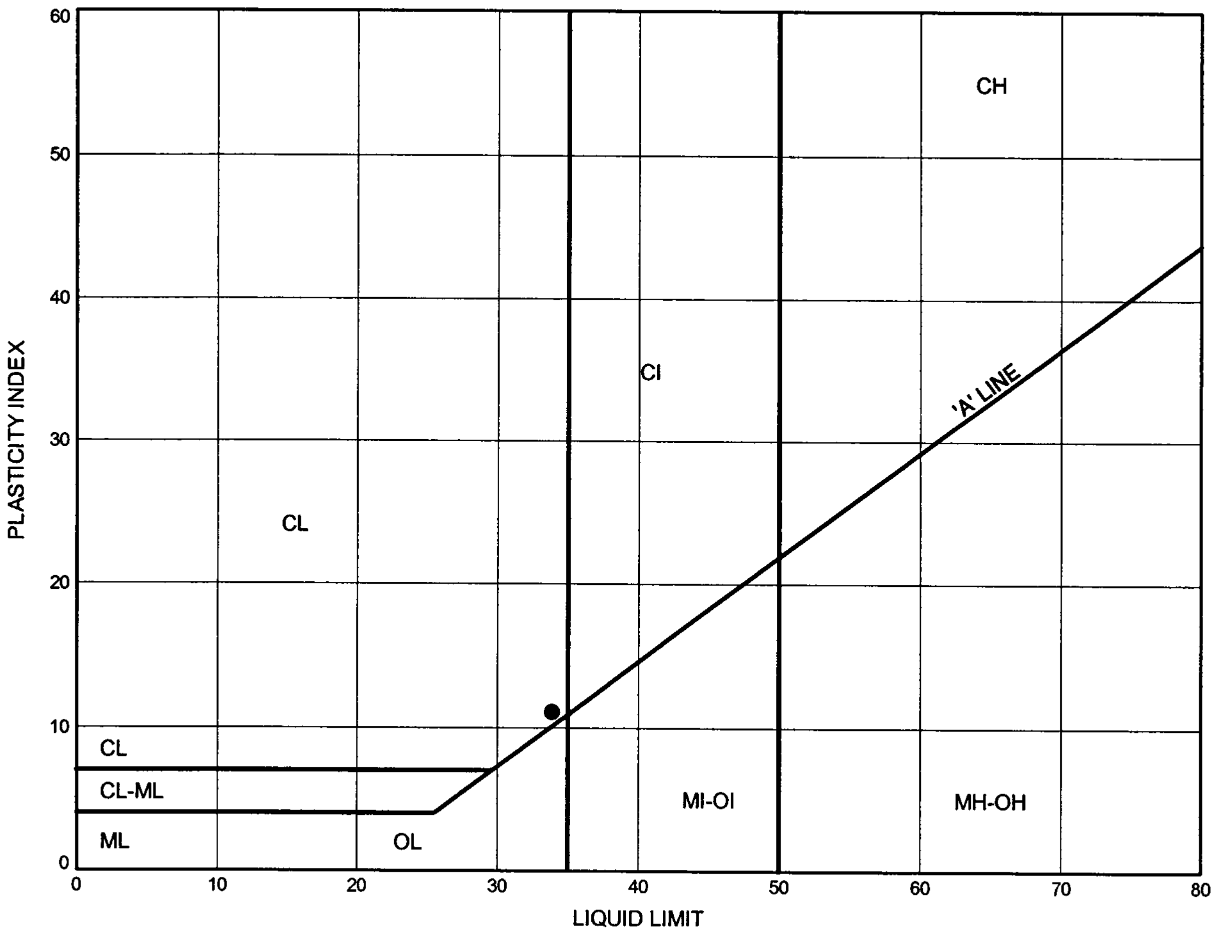
THURBALT APPENDIX B(RAMP EAST).GPJ 10/02/05

W-N RAMP

ATTERBERG LIMITS TEST RESULTS

FIGURE B29

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 W-N 13+725 R21.8	2.59	

THURBALT APPENDIX B(RAMP EAST).GPJ 10/02/05

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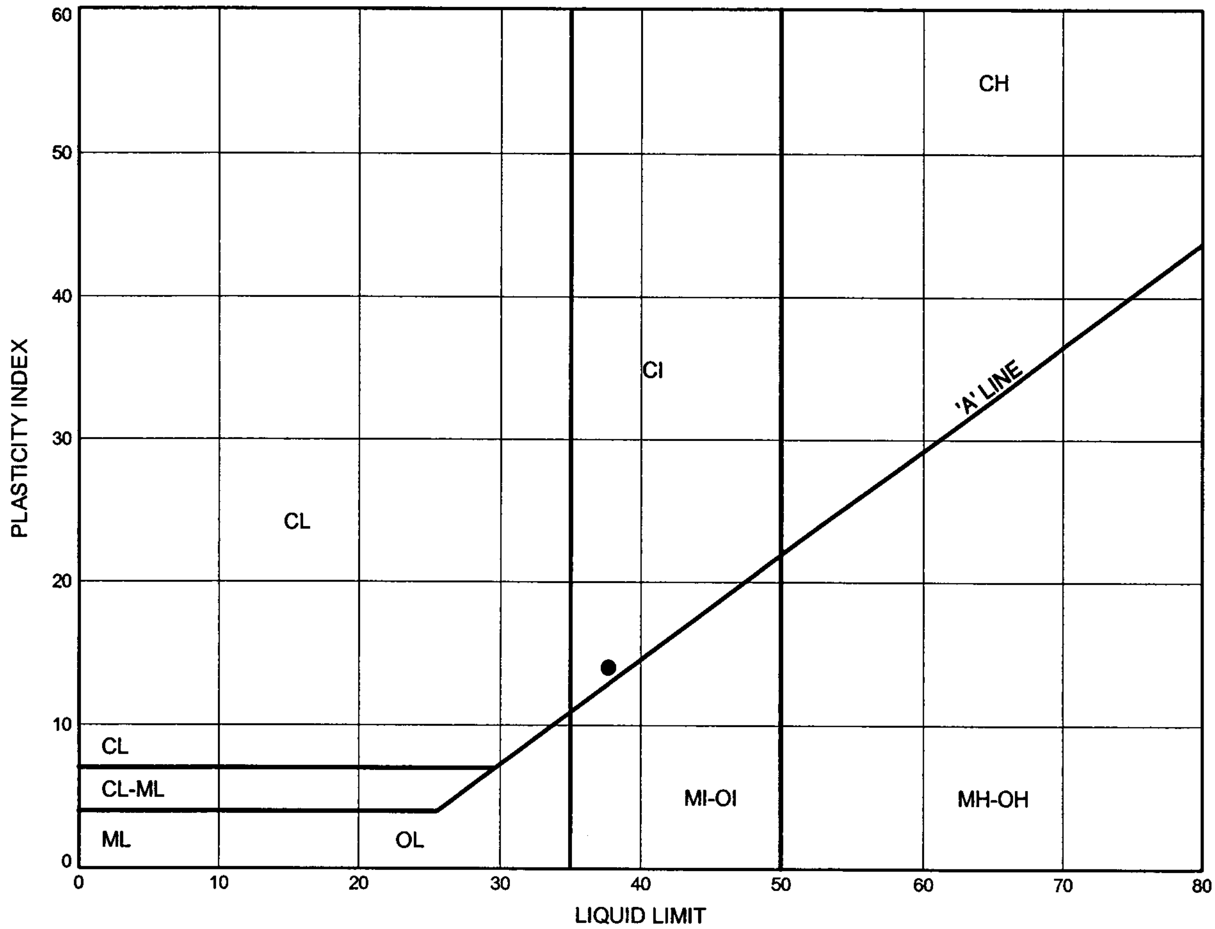
E-N RAMP

ATTERBERG LIMITS TEST RESULTS

FIGURE B30

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 E-N 13+754 CL	1.83	

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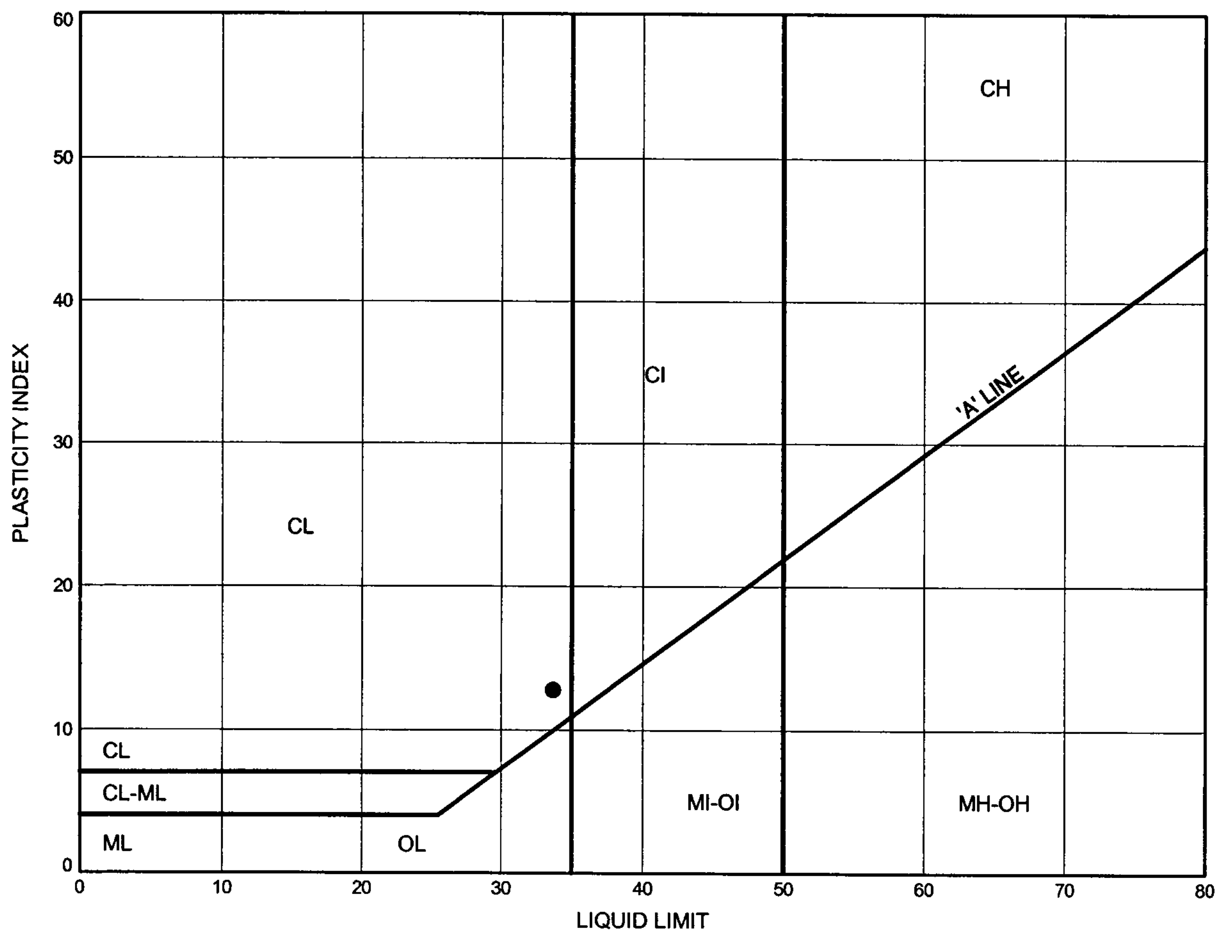
VALLEY VIEW ROAD

ATTERBERG LIMITS TEST RESULTS

FIGURE B31

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	421 VV 10+075 L20	1.83	

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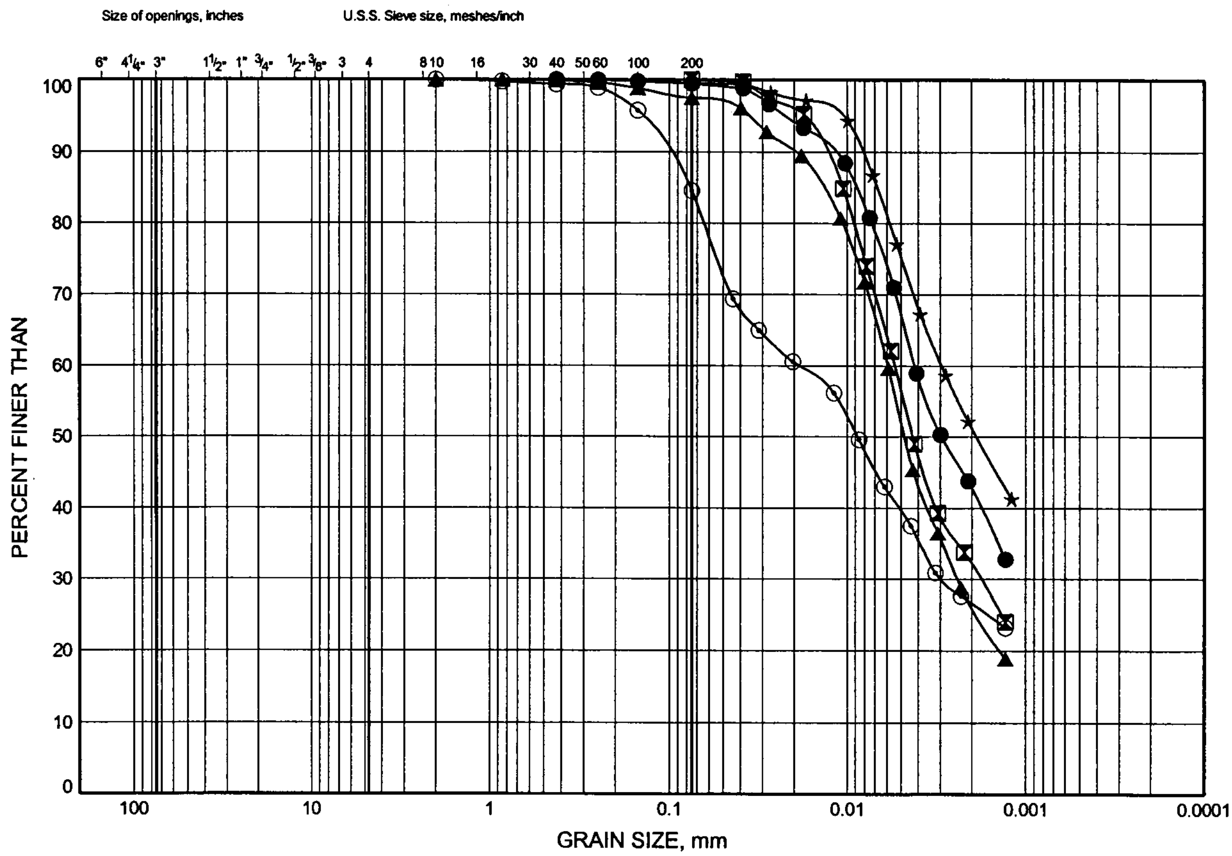
HWY11 MAINLINE

HWY 11 MAINLINE

GRAIN SIZE DISTRIBUTION

FIGURE B32

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-1	10.97	303.80
⊠	24-1	21.34	293.43
▲	24-2	3.35	308.95
★	24-5	1.83	312.59
⊙	24-7	1.83	311.63

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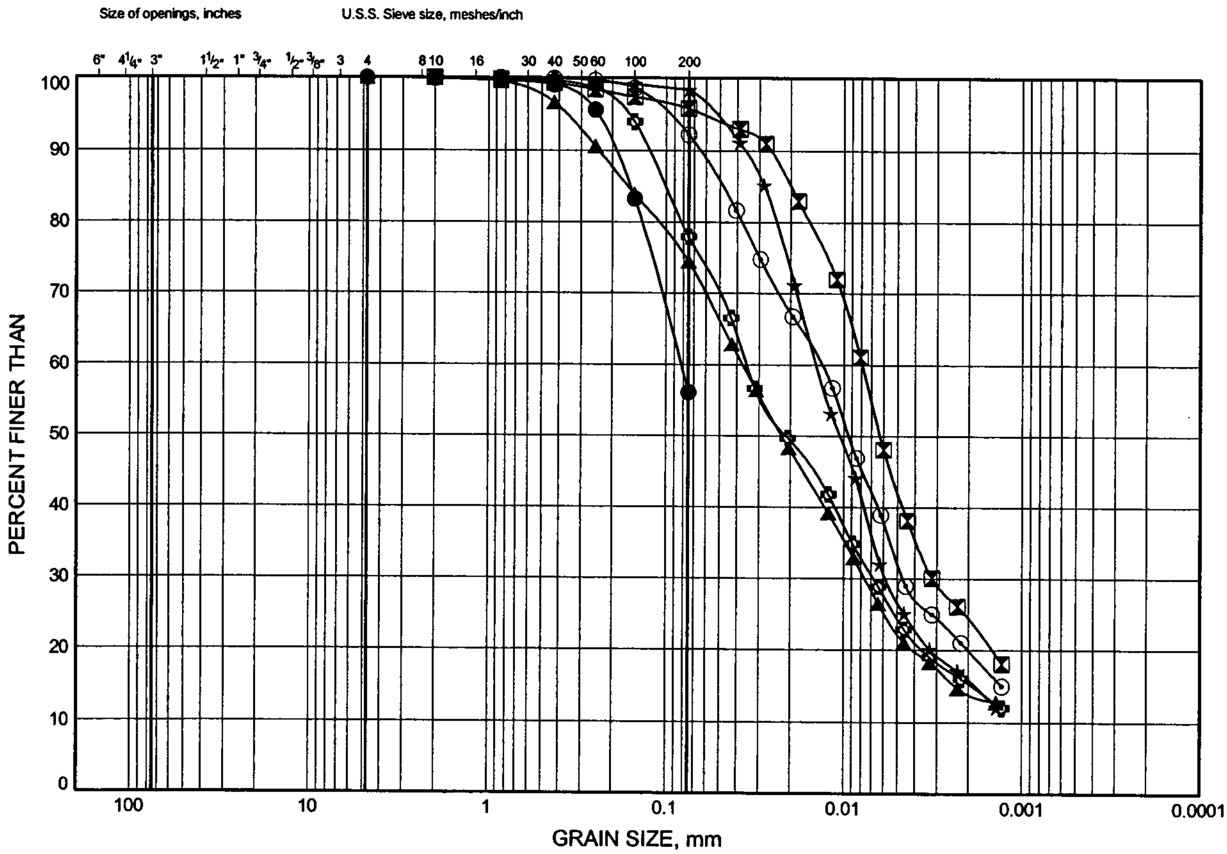
HWY 11- BERNARD CREEK BRIDGE

GRAIN SIZE DISTRIBUTION

FIGURE B33

SILT AND SAND



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99S-1	3.35	309.25
⊠	99S-1	6.40	306.20
▲	99S-2	4.88	307.32
★	99S-5	6.40	305.80
⊙	99S-6	1.83	311.07
✪	99S-6	4.88	308.02

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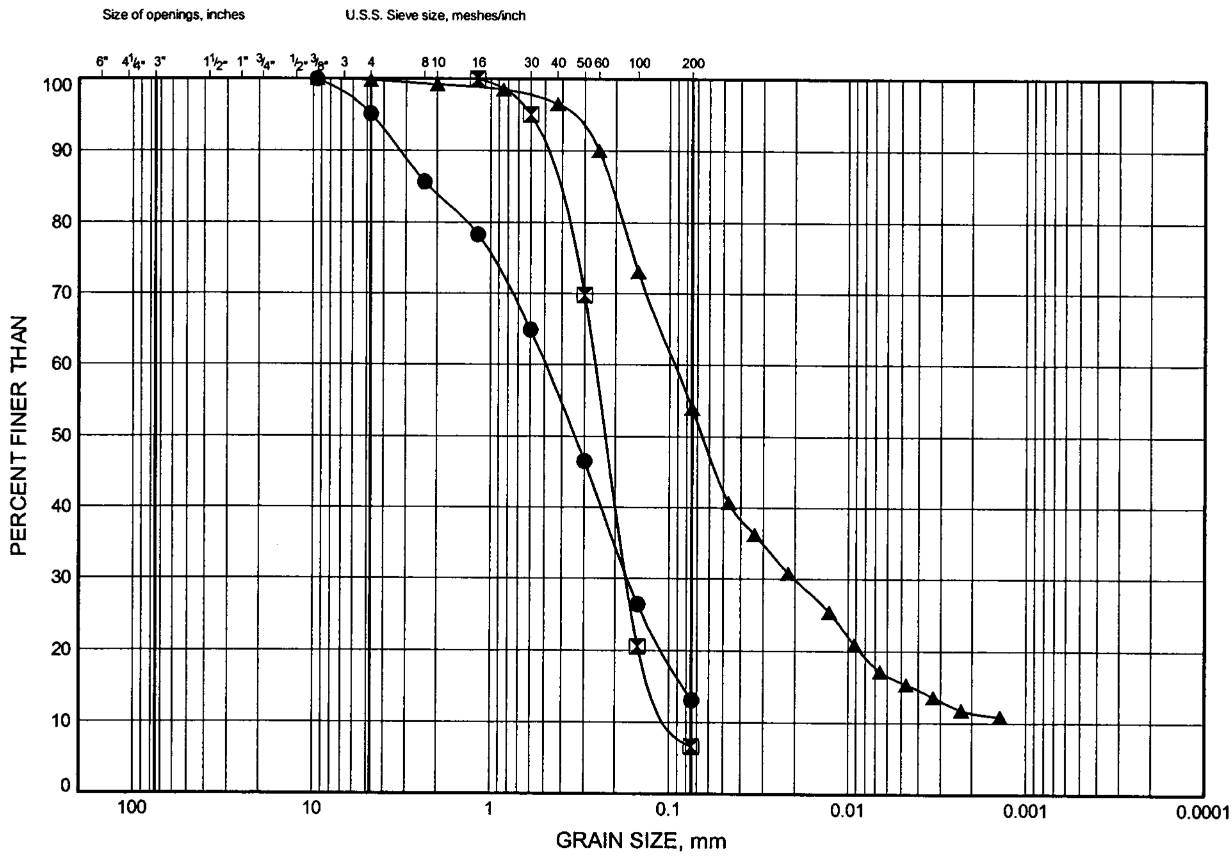
Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B34

SILT AND SAND



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99N-2	2.29	309.45
⊠	99S-2	7.77	304.43
▲	99S-5	3.35	308.85

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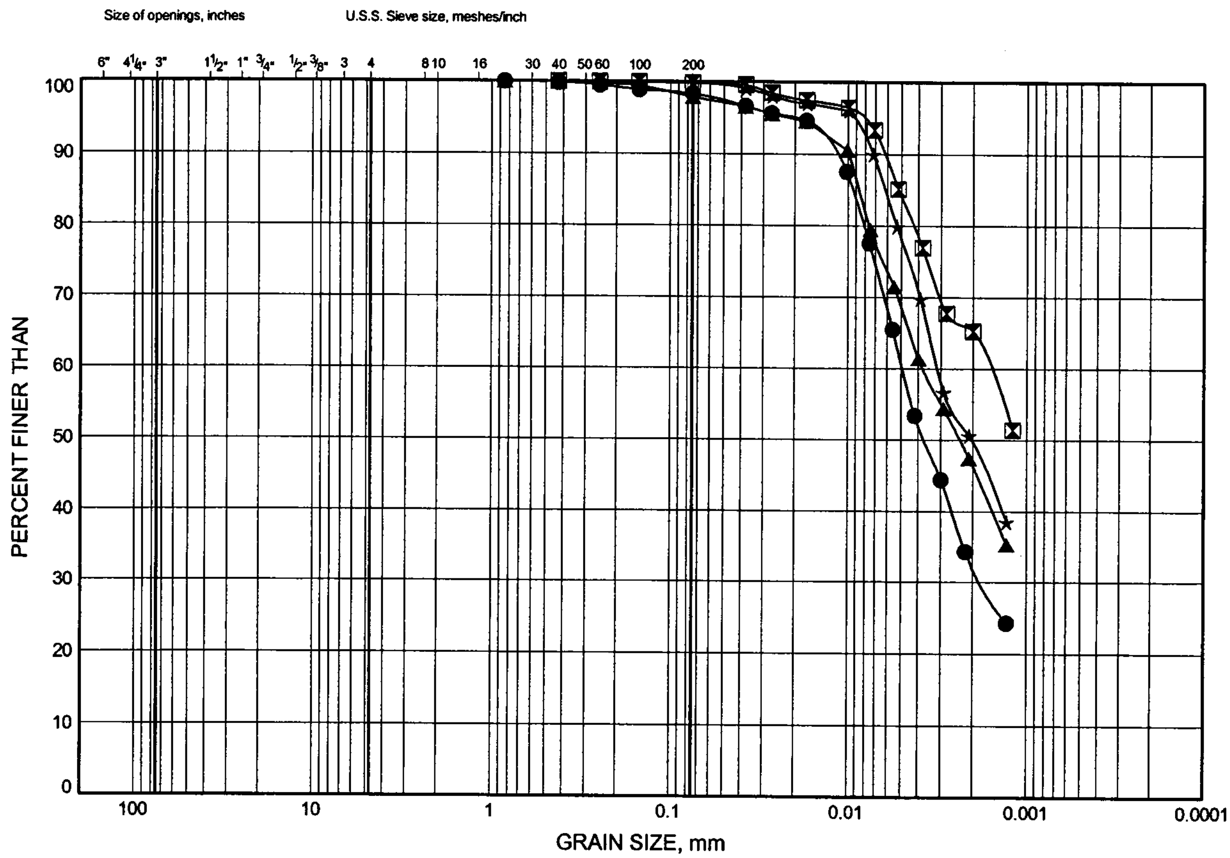
HWY 11- BERNARD CREEK BRIDGE

GRAIN SIZE DISTRIBUTION

FIGURE B35

SILTY CLAY



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99S-2	12.50	299.70
⊠	99S-2	21.03	291.17
▲	99S-5	15.54	296.66
★	99S-5	24.08	288.12

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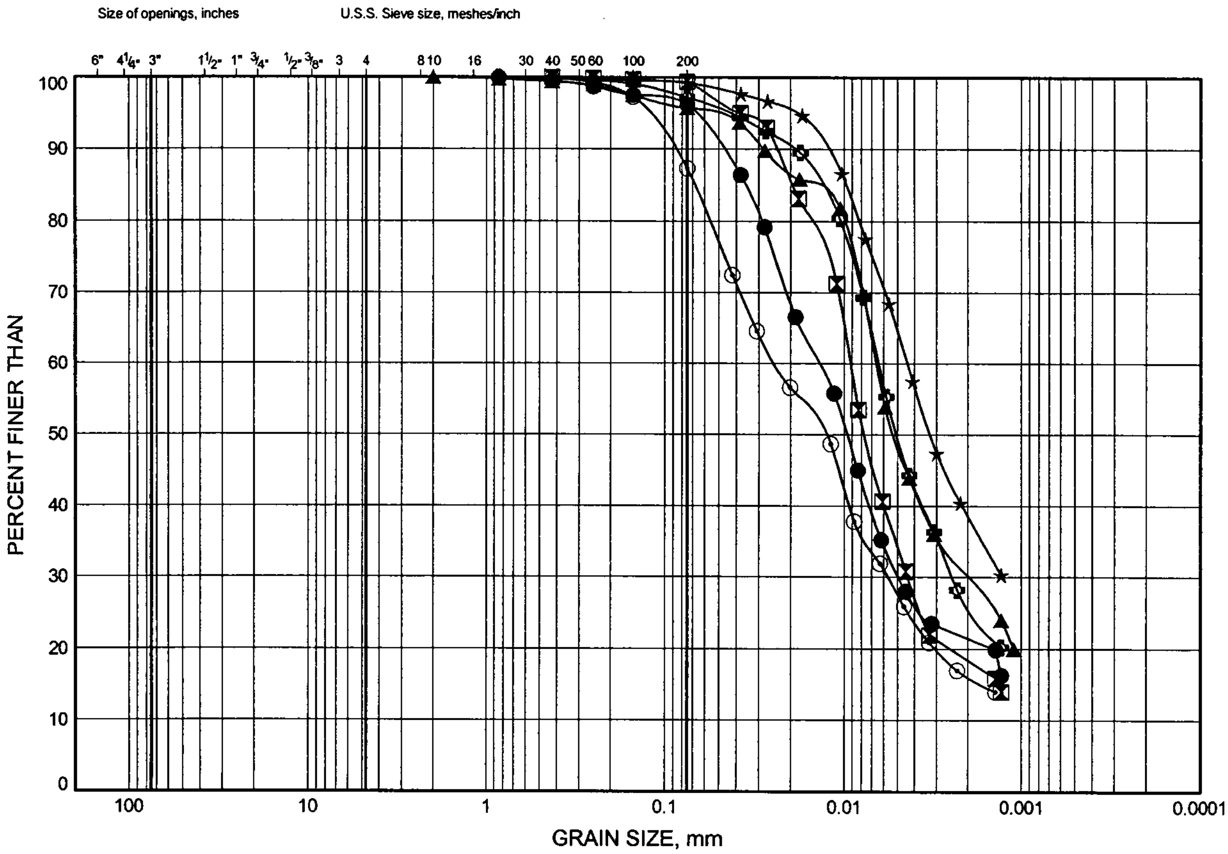
Hwy 11 Four Laning
GRAIN SIZE DISTRIBUTION

FIGURE B36

SILTY CLAY



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99N-1	3.35	308.86
⊠	99N-2	6.10	305.64
▲	99N-2	7.62	304.11
★	99N-5	2.59	309.13
⊙	99N-6	3.35	308.84
✪	99N-6	7.92	304.27

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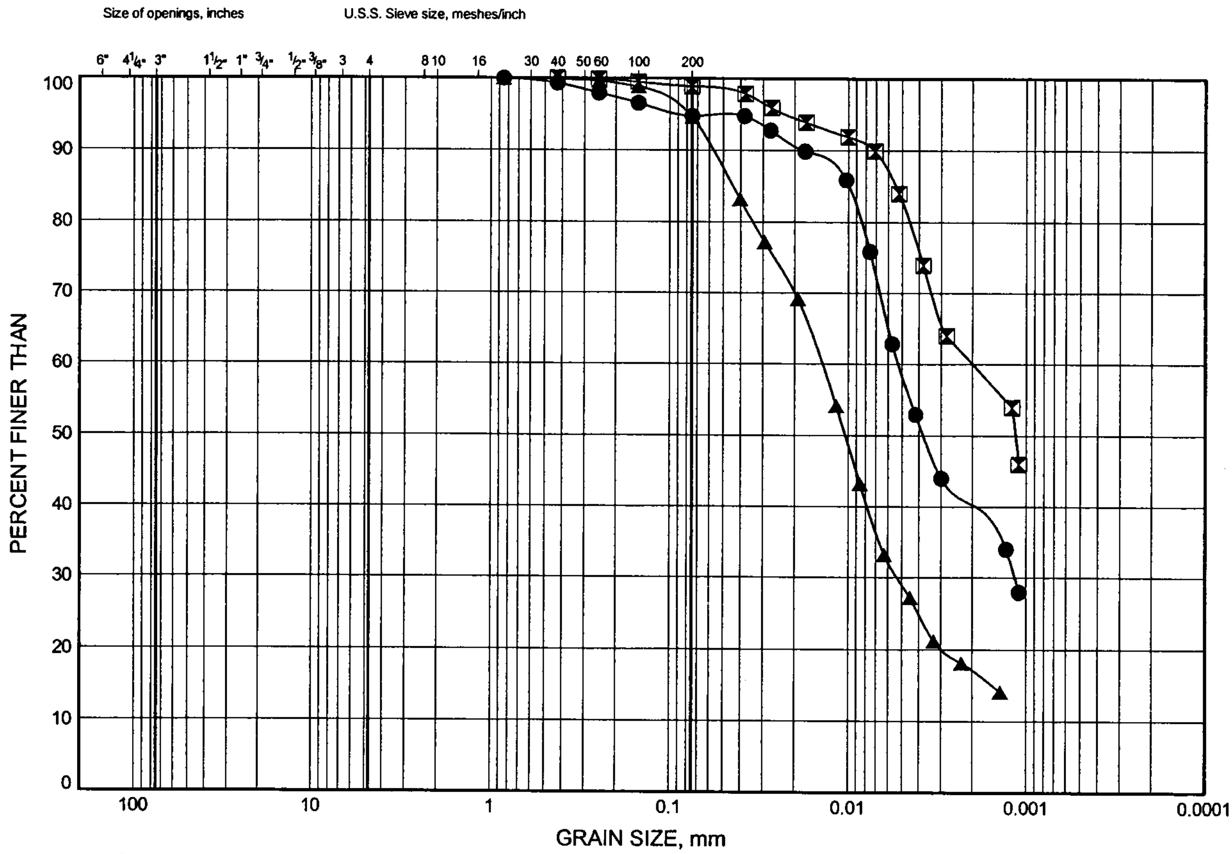
Hwy 11 Four Laning

GRAIN SIZE DISTRIBUTION

FIGURE B36a

SILTY CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99N-2	12.19	299.54
⊠	99N-2	19.81	291.92
▲	99N-5	11.73	299.99

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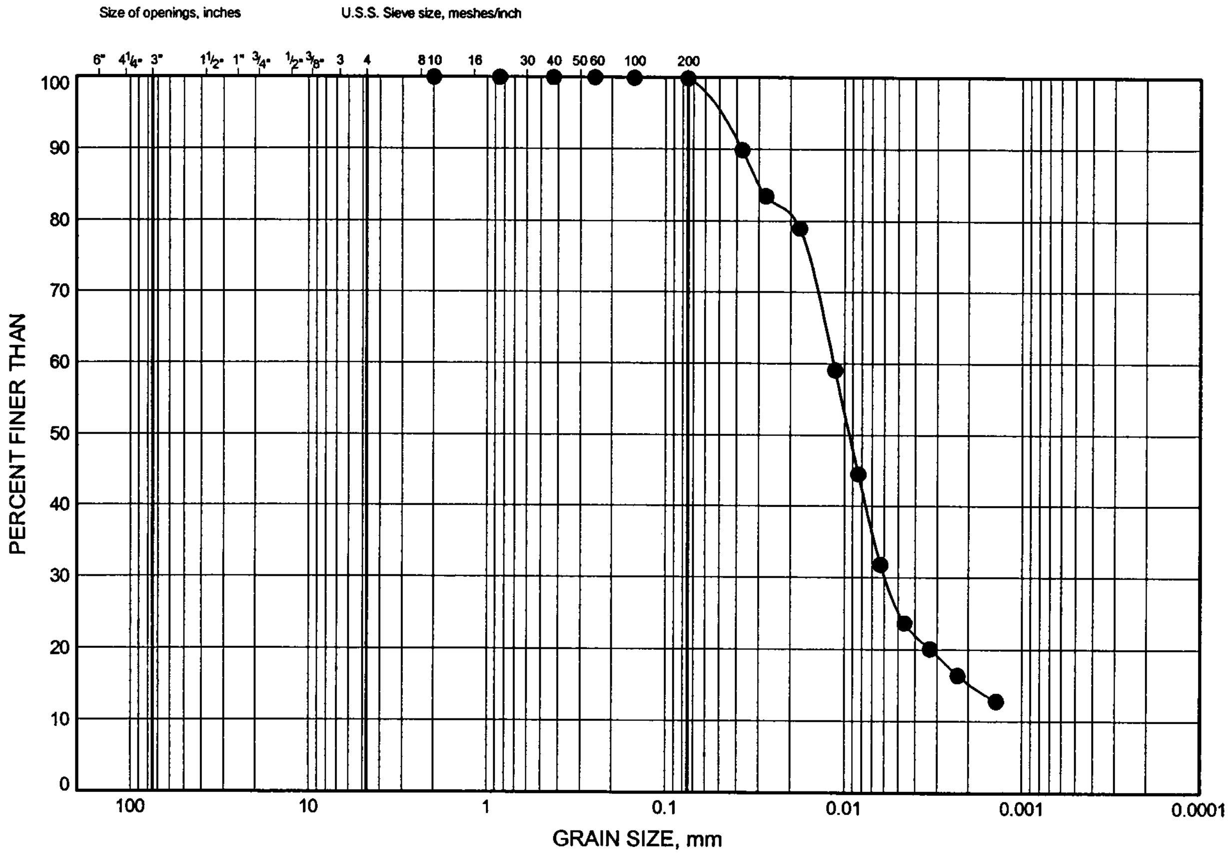
HWY 11- BERNARD CREEK BRIDGE

GRAIN SIZE DISTRIBUTION

FIGURE B37

CLAYEY SILT



COBBLE SIZE	GRAVEL		SAND			FINE GRAINED
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99S-2	30.18	282.02

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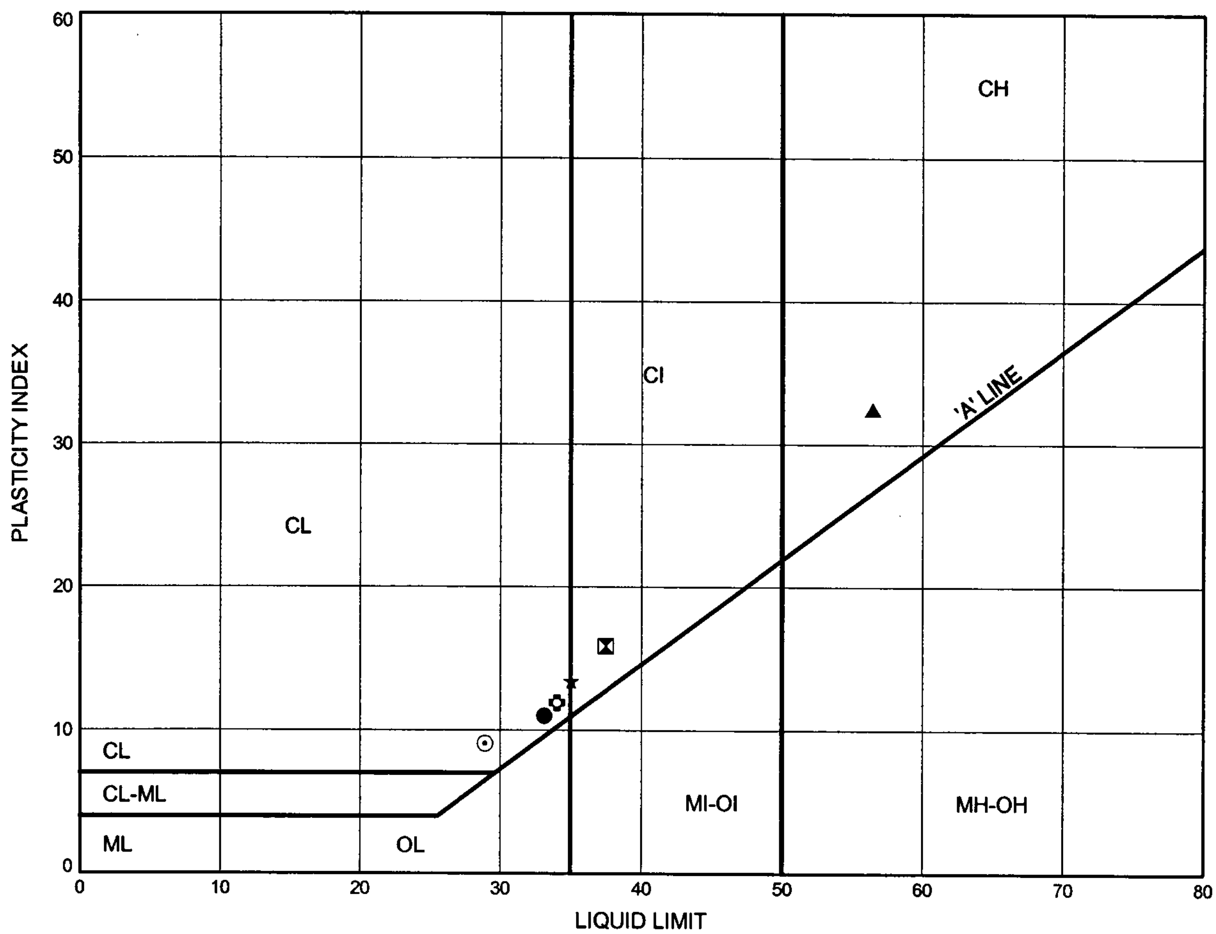
THURBGSD 99SBERNARD.GPJ 10/02/05

HWY 11 MAINLINE

ATTERBERG LIMITS TEST RESULTS

FIGURE B38

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-1	6.40	308.37
⊠	24-1	10.97	303.80
▲	24-1	15.54	299.23
★	24-1	21.34	293.43
⊙	24-2	3.35	308.95
✪	24-2	6.40	305.90

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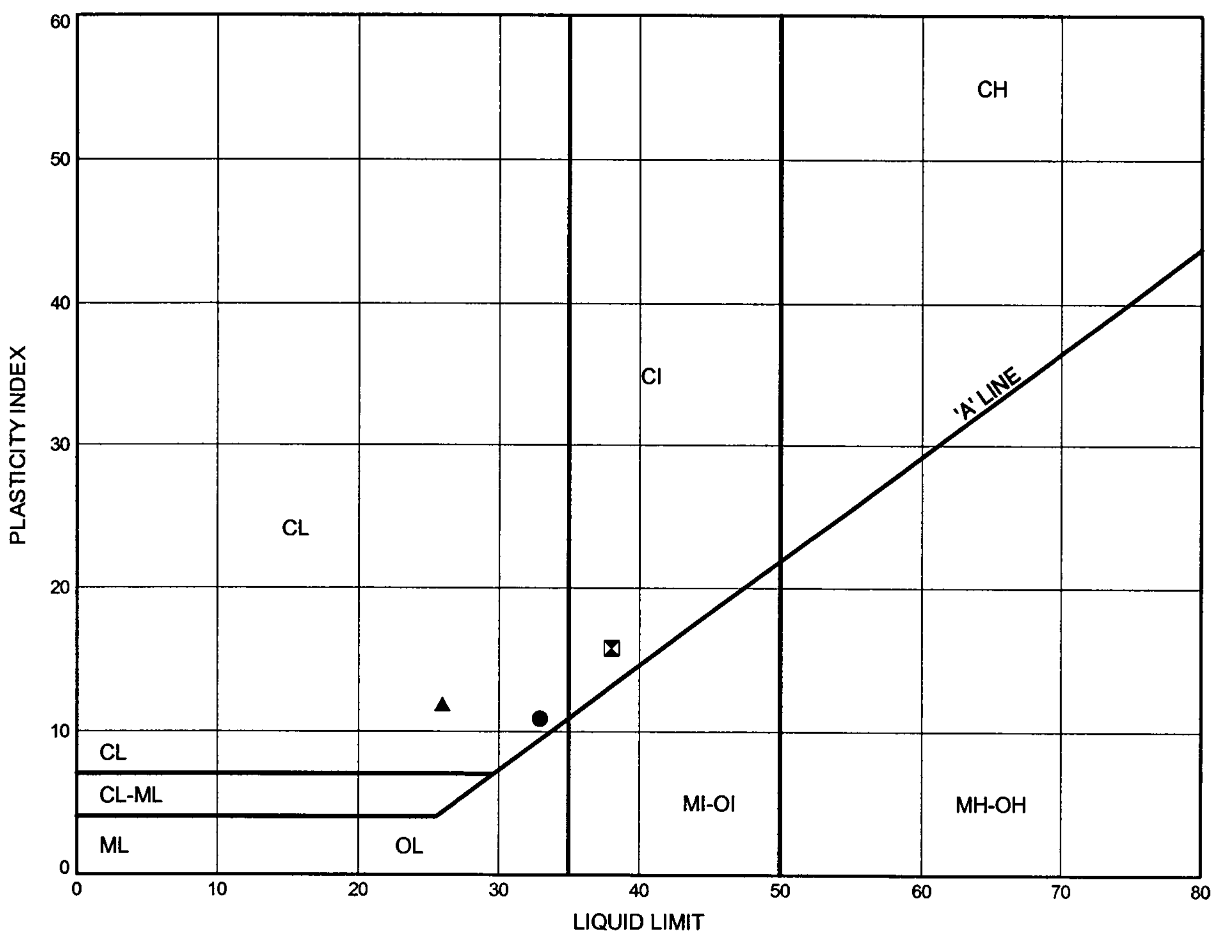
HWY 11 MAINLINE

ATTERBERG LIMITS TEST RESULTS

FIGURE B39

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	24-2	10.97	301.33
⊠	24-5	1.83	312.59
▲	24-7	1.83	311.63

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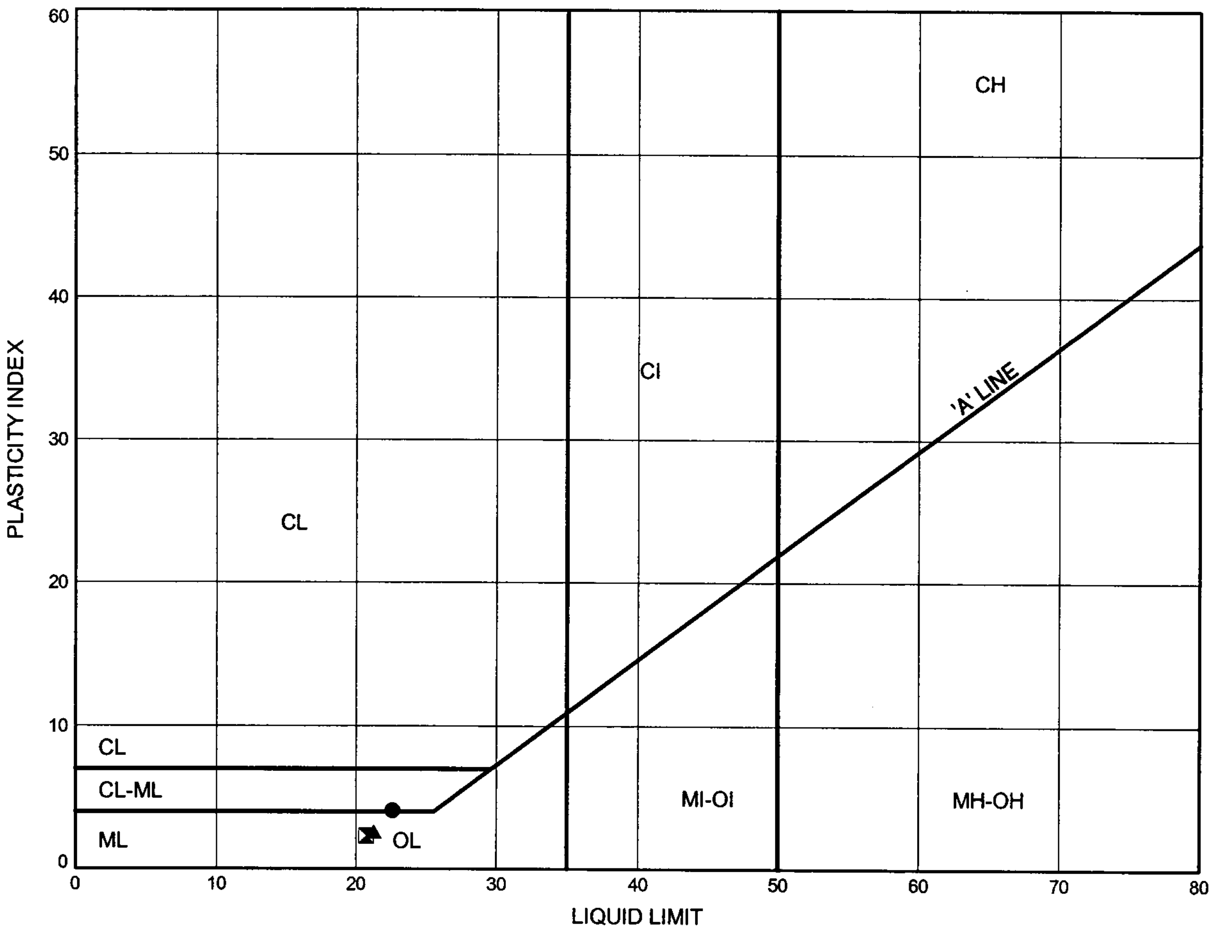
Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE B40

SILT AND SAND (SELECTED CONESIVE SEAMS)



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99S-1	6.40	306.20
⧗	99S-2	6.48	305.72
▲	99S-5	6.40	305.80

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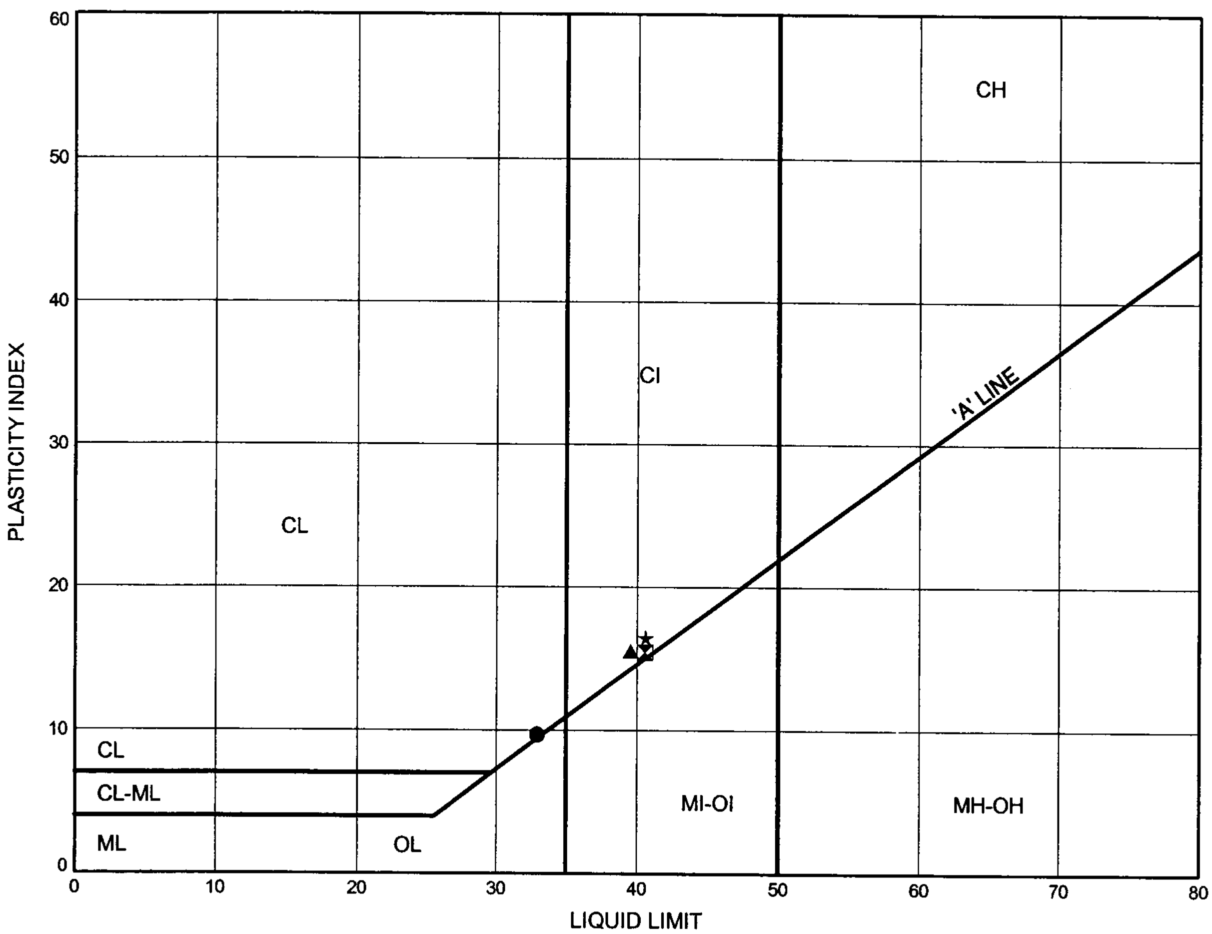
Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE B41

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99S-2	12.50	299.70
⊠	99S-2	21.03	291.17
▲	99S-5	15.54	296.66
★	99S-5	24.08	288.12

Date February 2005

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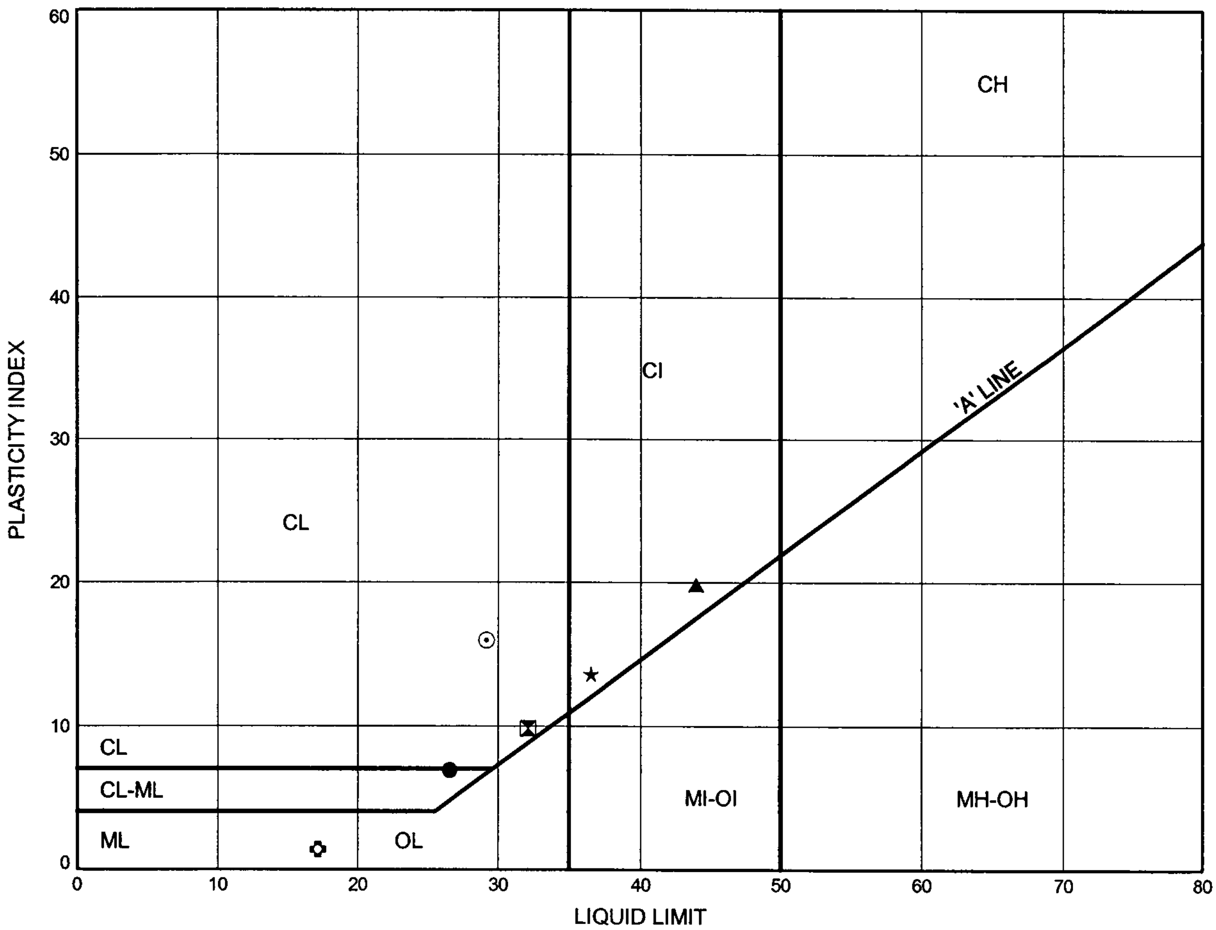
Hwy 11 Four Laning

ATTERBERG LIMITS TEST RESULTS

FIGURE B42

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	99N-2	7.62	304.11
⊠	99N-2	12.19	299.54
▲	99N-2	19.81	291.92
★	99N-5	2.59	309.13
⊙	99N-5	5.64	306.09
✿	99N-5	11.73	299.99

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THURBALT 99NBERNARD-I.GPJ 24/02/05

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	ST#1
Borehole Number	24-1	Sample Depth, m	6.1-6.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	9		
Date Started	10/20/2004		
Date Completed	11/03/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.92	Unit Weight, kN/m^3	18.71
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	14.03
Area, cm^2	31.52	Specific Gravity, measured	2.74
Volume, cm^3	60.36	Solids Height, cm	1.000
Water Content, %	33.40	Volume of Solids, cm^3	31.51
Wet Mass, g	115.18	Volume of Voids, cm^3	28.85
Dry Mass, g	86.34	Degree of Saturation, %	100.0

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.915	0.916	1.915				
4.87	1.884	0.885	1.900	443	1.73E-03	3.32E-03	5.62E-07
9.55	1.876	0.877	1.880	218	3.44E-03	8.93E-04	3.01E-07
19.50	1.862	0.863	1.869	135	5.49E-03	7.35E-04	3.95E-07
38.82	1.844	0.845	1.853	60	1.21E-02	4.87E-04	5.78E-07
77.80	1.818	0.819	1.831	60	1.18E-02	3.48E-04	4.04E-07
155.39	1.773	0.773	1.796	76	8.99E-03	3.03E-04	2.67E-07
310.39	1.706	0.706	1.740	124	5.17E-03	2.26E-04	1.14E-07
620.05	1.640	0.640	1.673	60	9.89E-03	1.11E-04	1.08E-07
1241.68	1.579	0.579	1.610	46	1.19E-02	5.12E-05	6.00E-08
2484.38	1.513	0.513	1.546	46	1.10E-02	2.77E-05	2.99E-08
1241.68	1.525	0.525	1.519				
310.39	1.549	0.549	1.537				
77.80	1.578	0.578	1.564				
19.50	1.605	0.605	1.592				
4.87	1.634	0.634	1.620				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

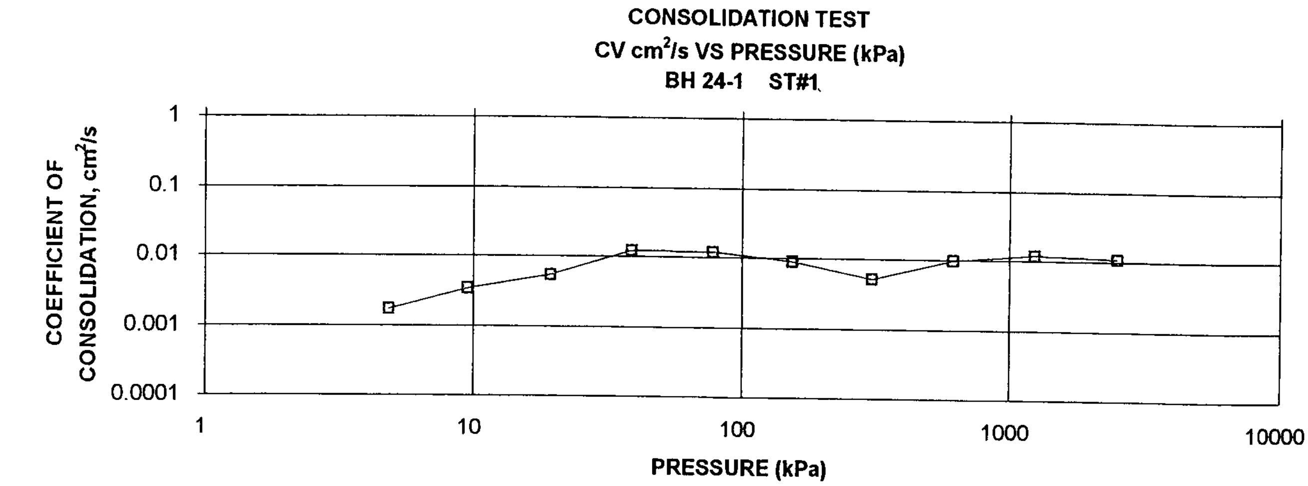
Sample Height, cm	1.63	Unit Weight, kN/m^3	20.80
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	16.44
Area, cm^2	31.52	Specific Gravity, measured	2.74
Volume, cm^3	51.50	Solids Height, cm	1.000
Water Content, %	26.50	Volume of Solids, cm^3	31.51
Wet Mass, g	109.22	Volume of Voids, cm^3	19.99
Dry Mass, g	86.34		

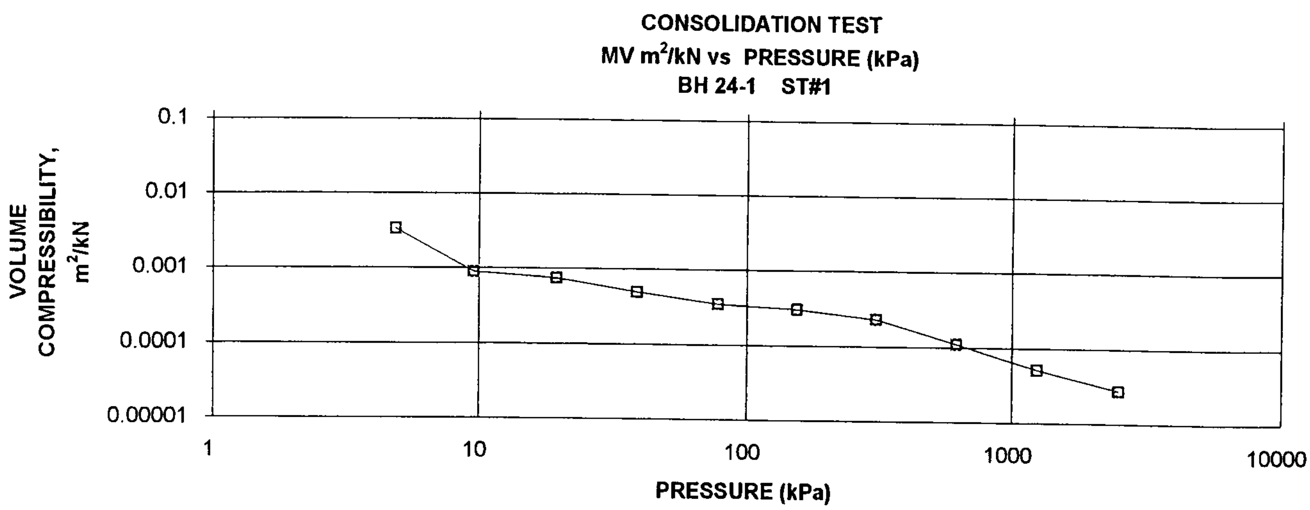
Prepared By: LFG

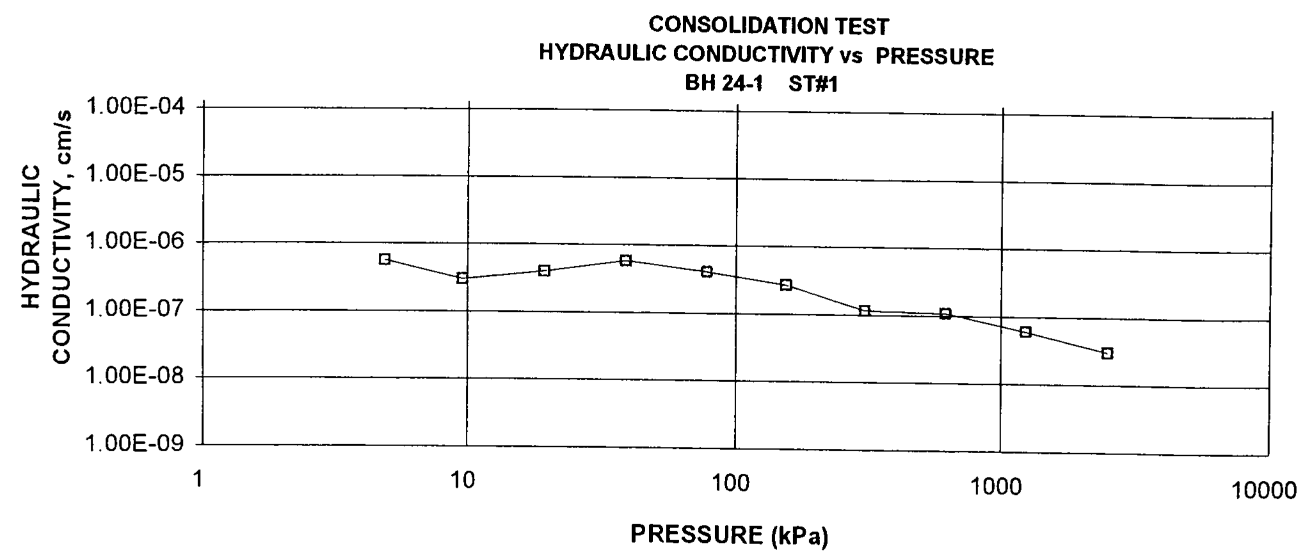
Golder Associates

Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY







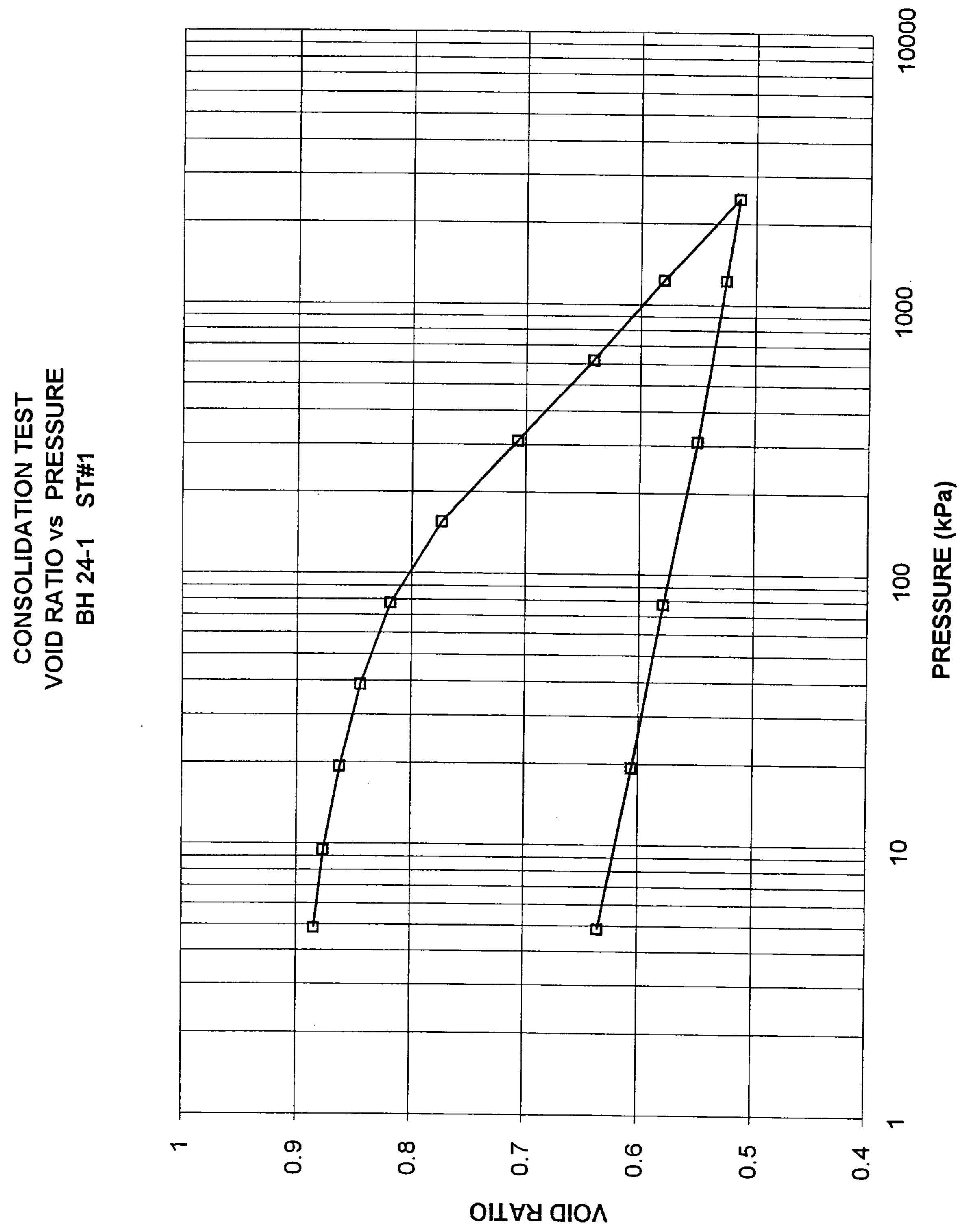
Project No. 04-1116-100

Prepared By: LFG

Golder Associates

Checkey By: MM

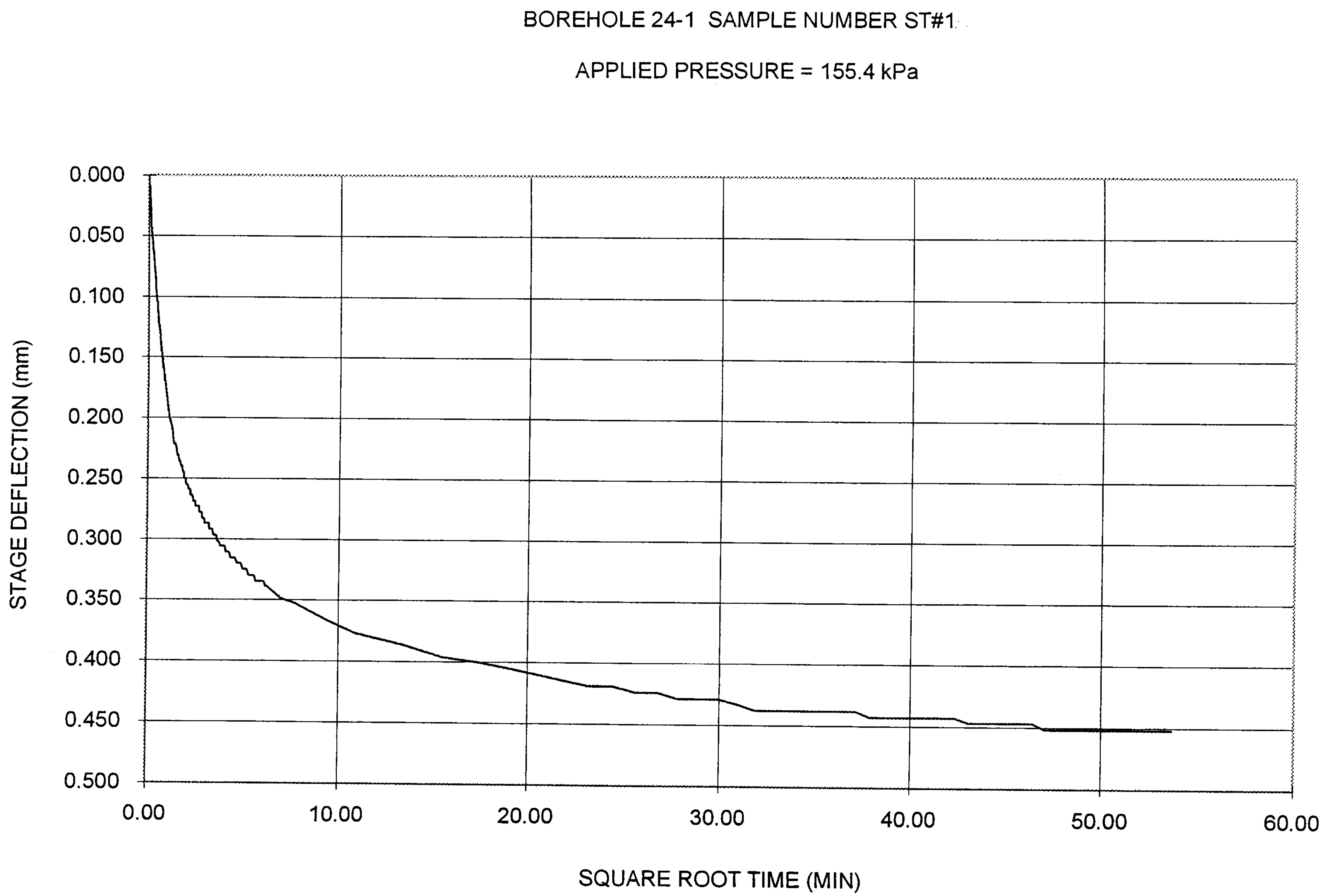
CONSOLIDATION TEST VOID RATIO VS. LOG PRESSURE	FIGURE



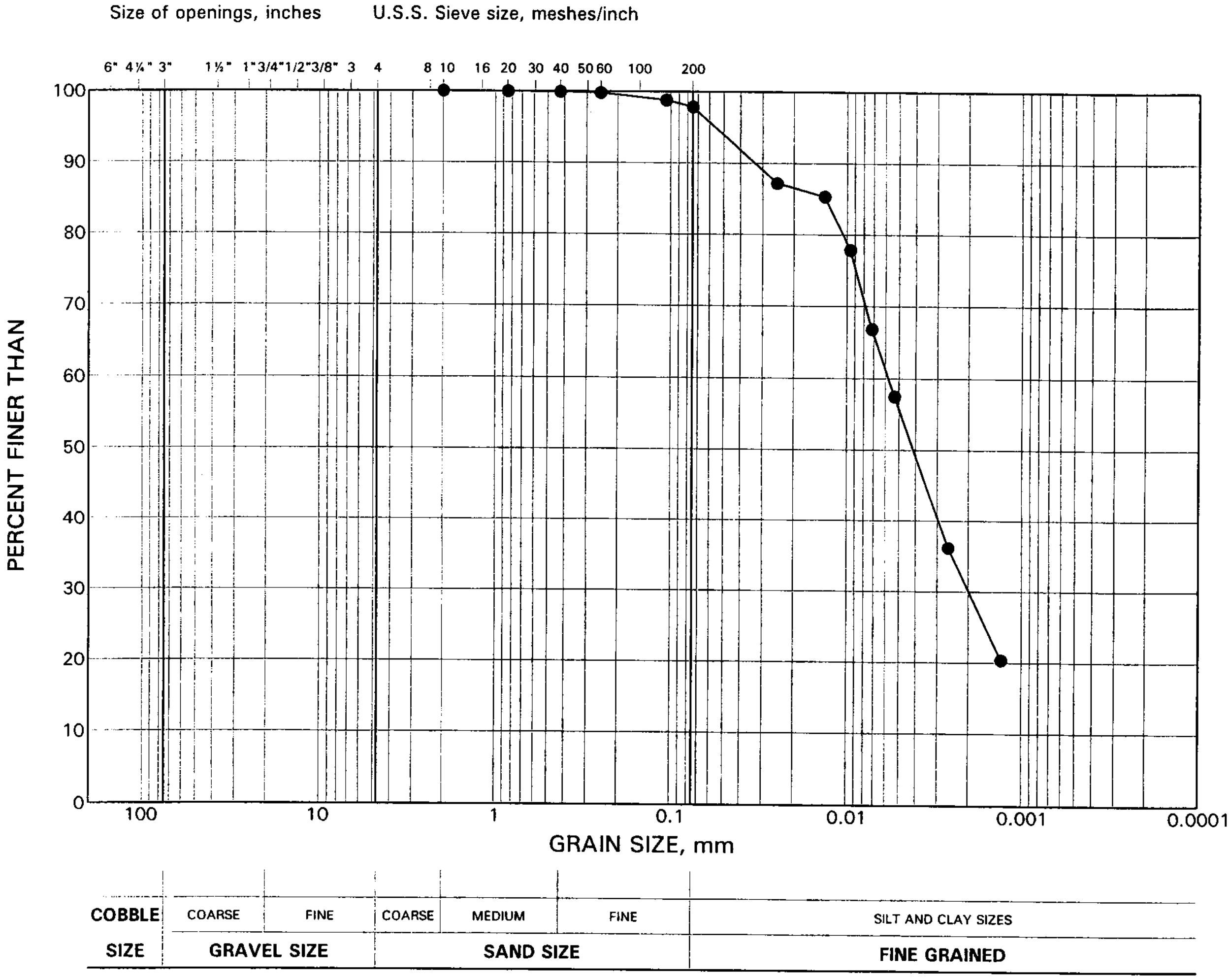
Project No. 04-1116-100
Prepared By: LFG

Golder Associates

Checked By: MM


BOREHOLE 24-1 SAMPLE NUMBER ST#1
APPLIED PRESSURE = 155.4 kPa
STAGE DEFLECTION (mm)
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
0.450
0.500
0.00
10.00
20.00
30.00
40.00
50.00
60.00
SQUARE ROOT TIME (MIN)

GRAIN SIZE DISTRIBUTION	FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-1	ST#1	6.1-6.7

Date 11/2/2004

Project 04-1116-100

Golder Associates

Prepared by LG

Checked by

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	ST#2
Borehole Number	24-1	Sample Depth, m	15.2-15.8

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	6		
Date Started	10/20/2004		
Date Completed	11/01/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	16.61
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	10.69
Area, cm^2	31.67	Specific Gravity, measured	2.76
Volume, cm^3	60.17	Solids Height, cm	0.750
Water Content, %	55.44	Volume of Solids, cm^3	23.76
Wet Mass, g	101.94	Volume of Voids, cm^3	36.41
Dry Mass, g	65.58	Degree of Saturation, %	99.9

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.532	1.900				
4.75	1.892	1.522	1.896	146	5.22E-03	8.86E-04	4.53E-07
9.54	1.887	1.515	1.890	103	7.35E-03	5.49E-04	3.96E-07
19.25	1.877	1.502	1.882	124	6.06E-03	5.42E-04	3.22E-07
38.68	1.863	1.483	1.870	56	1.32E-02	3.79E-04	4.92E-07
77.38	1.843	1.456	1.853	53	1.37E-02	2.72E-04	3.66E-07
154.68	1.814	1.418	1.829	60	1.18E-02	1.97E-04	2.29E-07
309.73	1.660	1.212	1.737	158	4.05E-03	5.23E-04	2.07E-07
618.86	1.522	1.029	1.591	165	3.25E-03	2.35E-04	7.49E-08
1236.93	1.419	0.891	1.471	124	3.70E-03	8.77E-05	3.18E-08
2472.53	1.326	0.767	1.373	76	5.25E-03	3.96E-05	2.04E-08
1236.93	1.337	0.782	1.332				
309.73	1.360	0.813	1.349				
77.38	1.397	0.862	1.379				
19.25	1.432	0.909	1.415				
4.75	1.468	0.957	1.450				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

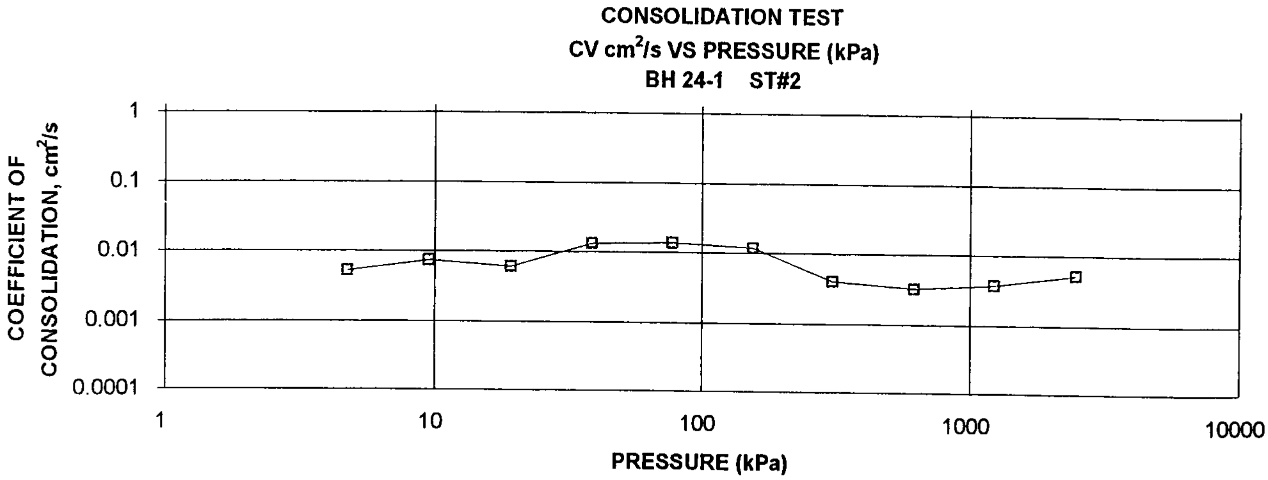
Sample Height, cm	1.47	Unit Weight, kN/m^3	19.23
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	13.83
Area, cm^2	31.67	Specific Gravity, measured	2.76
Volume, cm^3	46.49	Solids Height, cm	0.750
Water Content, %	39.04	Volume of Solids, cm^3	23.76
Wet Mass, g	91.18	Volume of Voids, cm^3	22.73
Dry Mass, g	65.58		

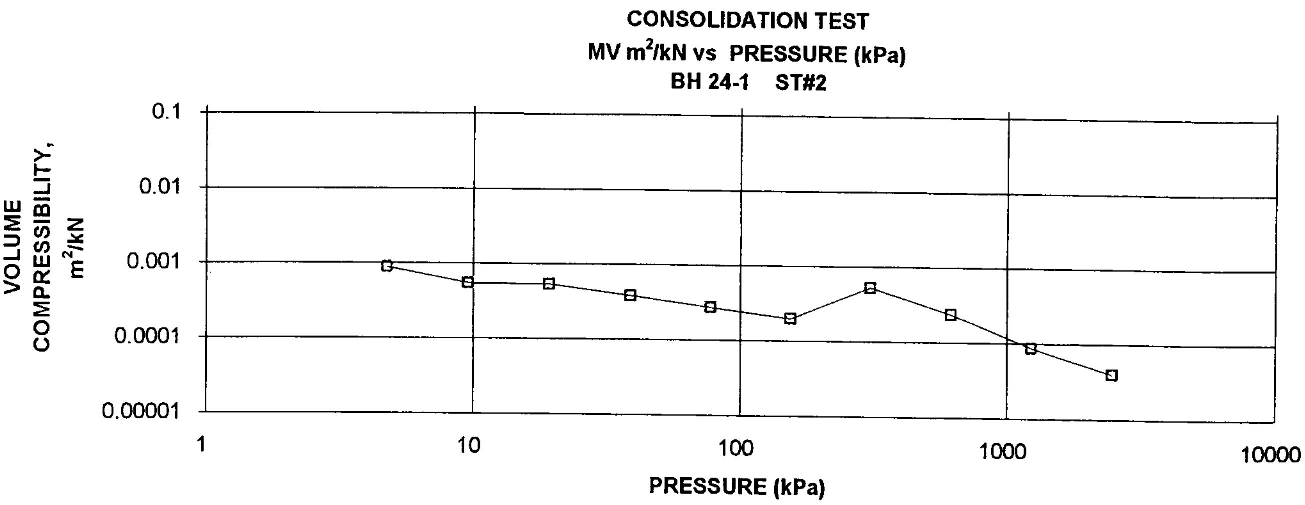
Prepared By: LFG

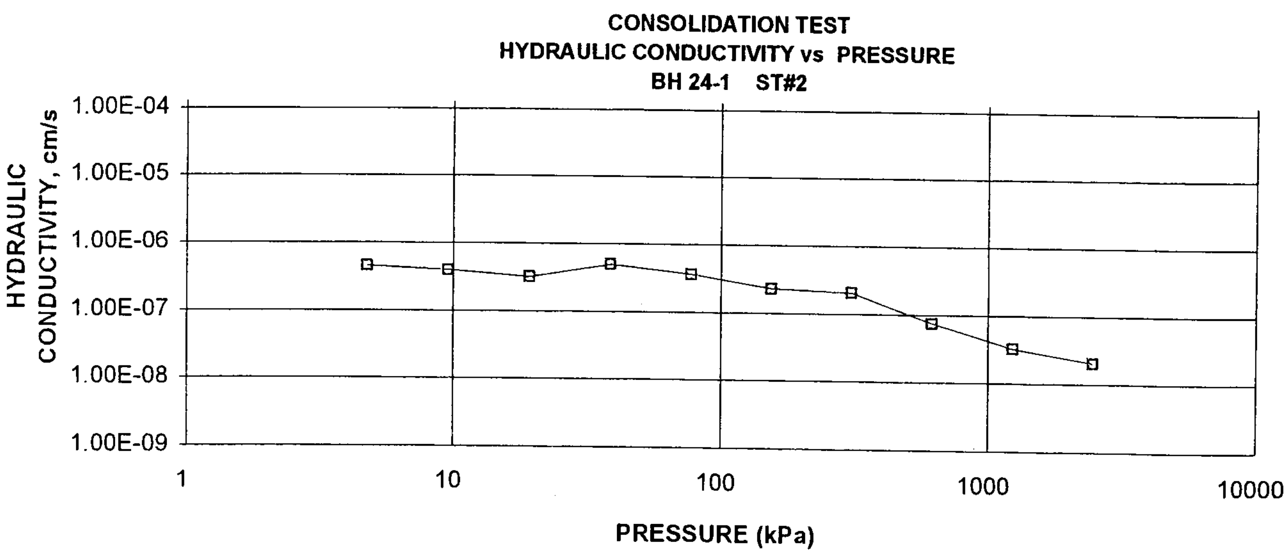
Golder Associates

Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY







Project No. 04-1116-100
Prepared By: LFG

Golder Associates

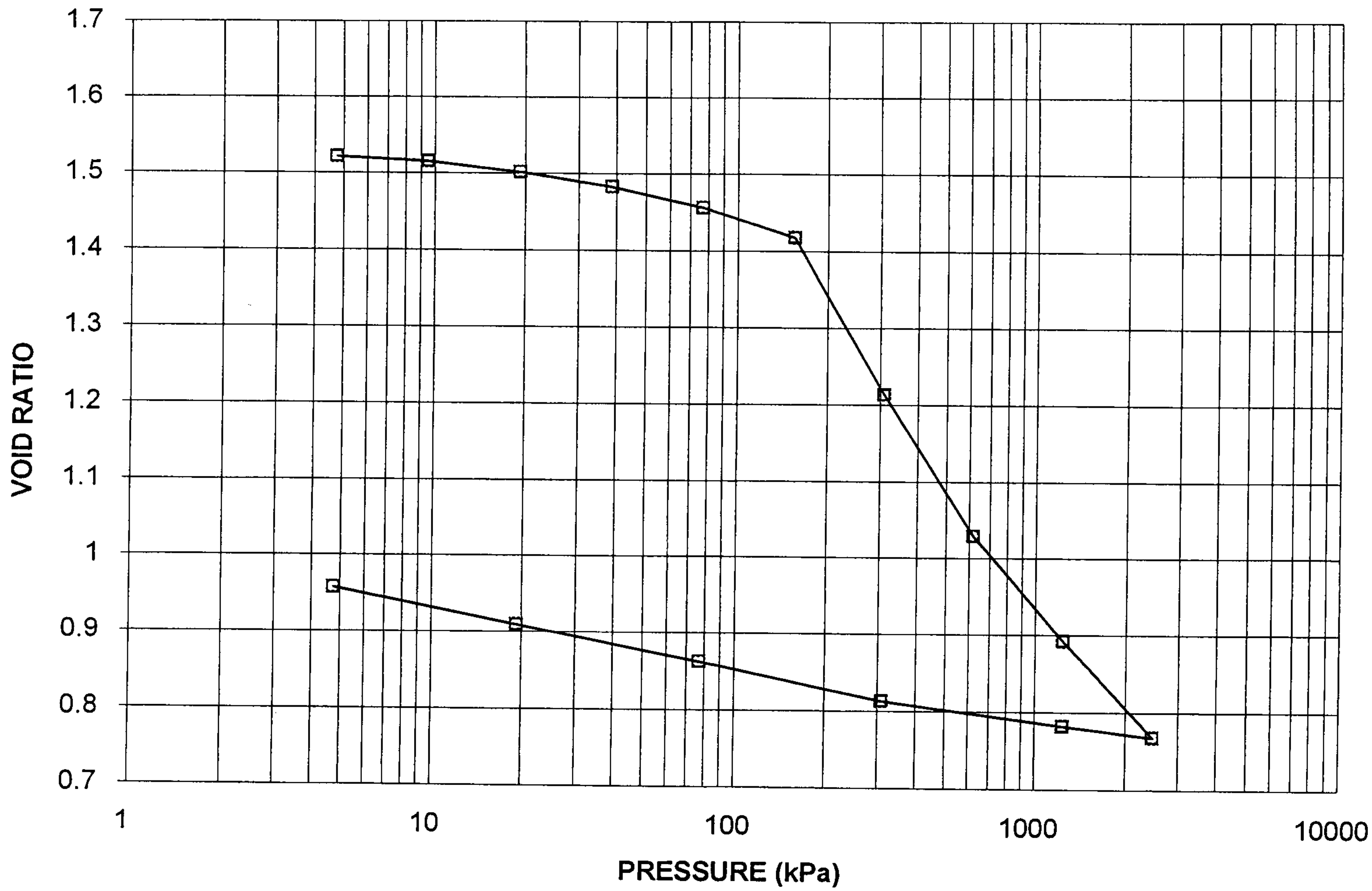
Checkey By: MM

Project No. 04-1116-100
Prepared By: LFG

Golder Associates

Checked By: MM

CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH 24-1 ST#2

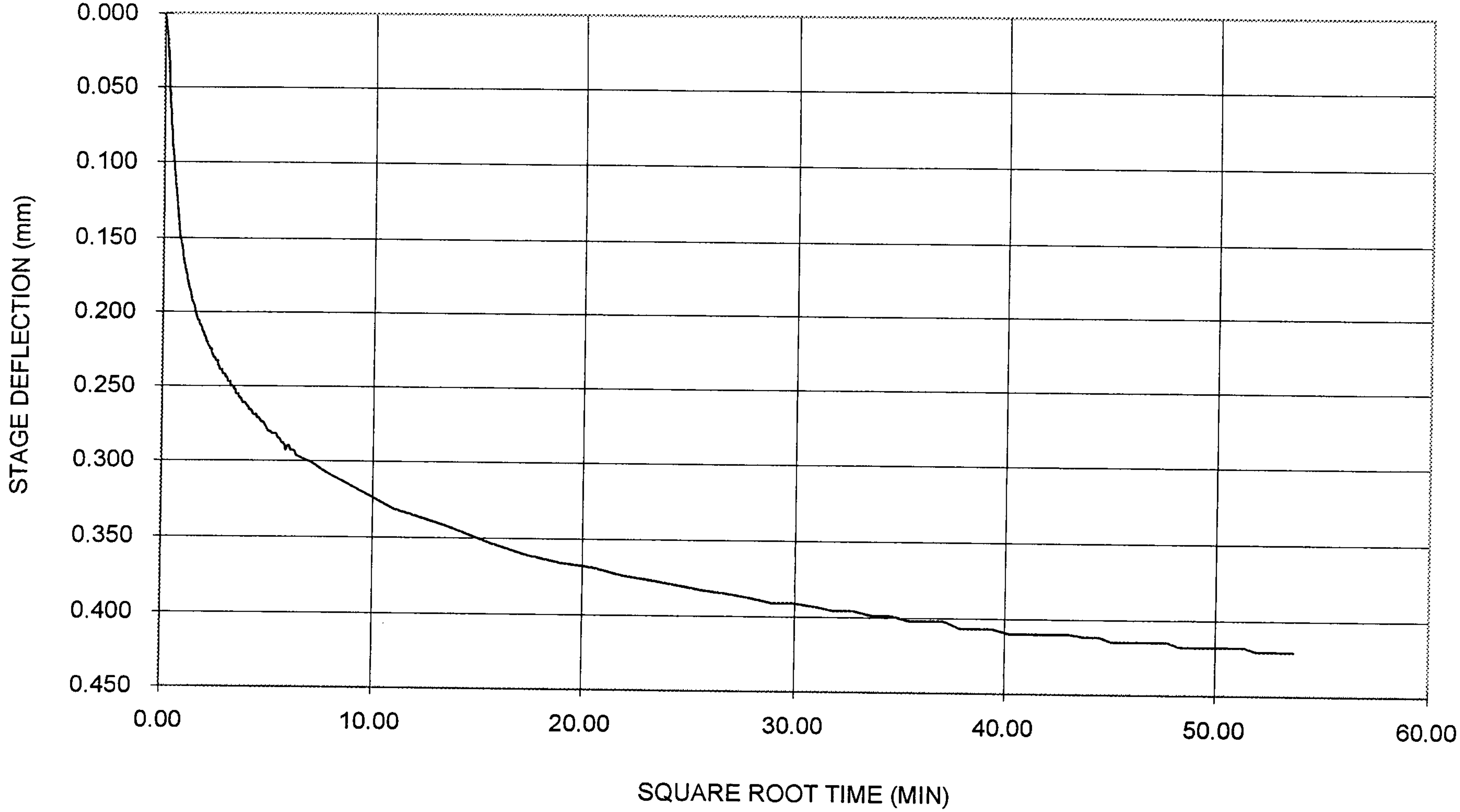


CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE

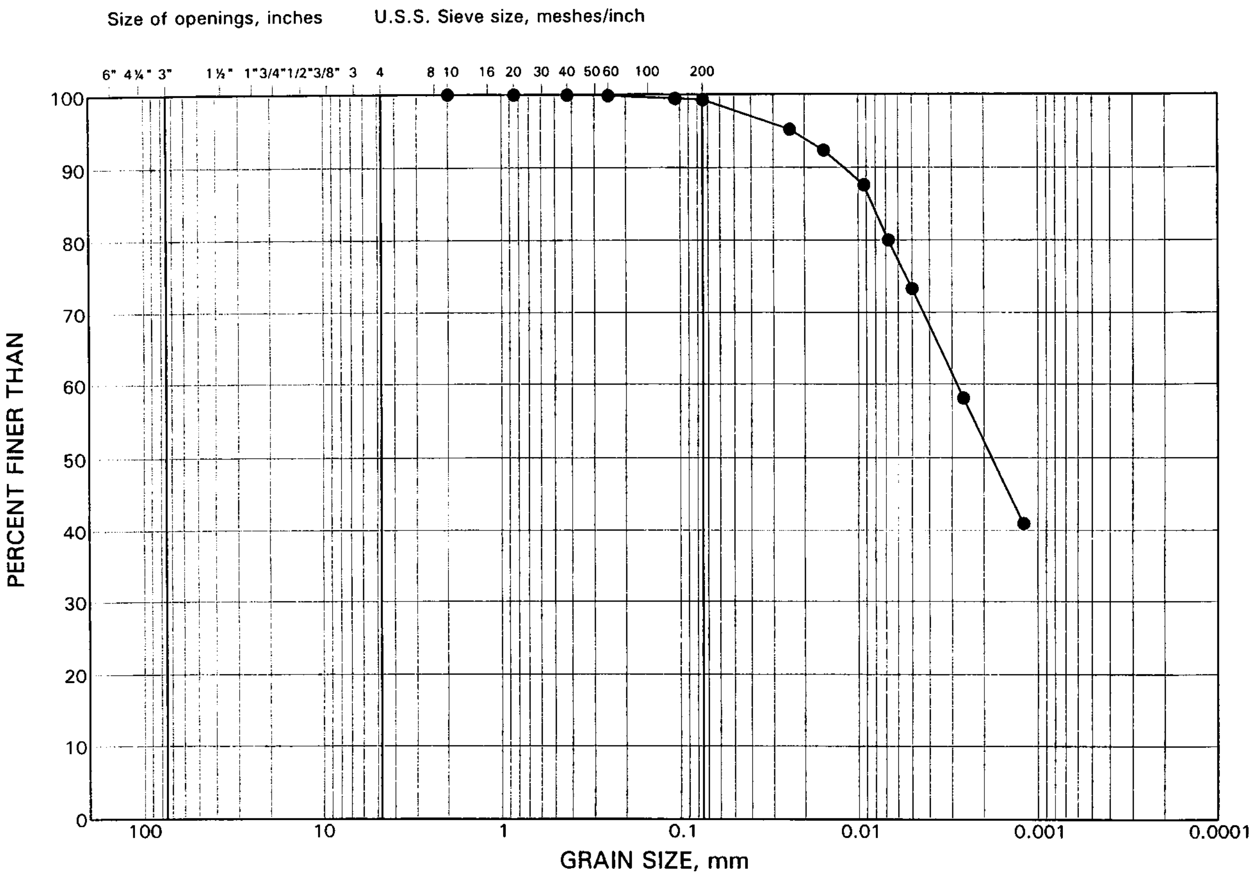
BOREHOLE 24-1 SAMPLE NUMBER ST#2

APPLIED PRESSURE = 154.7 kPa



GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-1	ST#2	15.2-15.9

Date 11/2/2004

Project 04-1116-100

Golder Associates

Prepared by LG

Checked by

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	ST#1
Borehole Number	242	Sample Depth, m	6.1-6.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	5		
Date Started	10/12/2004		
Date Completed	10/24/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.91	Unit Weight, kN/m^3	18.50
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	13.67
Area, cm^2	31.65	Specific Gravity, measured	2.75
Volume, cm^3	60.45	Solids Height, cm	0.968
Water Content, %	35.30	Volume of Solids, cm^3	30.65
Wet Mass, g	114.03	Volume of Voids, cm^3	29.80
Dry Mass, g	84.28	Degree of Saturation, %	99.8

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.910	0.972	1.910				
4.70	1.868	0.929	1.889	540	1.40E-03	4.68E-03	6.42E-07
9.54	1.856	0.917	1.862	141	5.21E-03	1.30E-03	6.63E-07
19.29	1.839	0.899	1.848	124	5.84E-03	9.13E-04	5.22E-07
38.71	1.817	0.876	1.828	89	7.96E-03	5.93E-04	4.63E-07
77.44	1.788	0.846	1.803	46	1.50E-02	3.92E-04	5.75E-07
154.67	1.751	0.808	1.770	46	1.44E-02	2.51E-04	3.55E-07
309.36	1.711	0.767	1.731	40	1.59E-02	1.35E-04	2.11E-07
618.24	1.667	0.722	1.689	32	1.89E-02	7.46E-05	1.38E-07
1236.92	1.620	0.673	1.644	28	2.05E-02	3.98E-05	7.97E-08
2475.31	1.570	0.621	1.595	40	1.35E-02	2.11E-05	2.79E-08
1236.92	1.579	0.631	1.575				
309.36	1.602	0.654	1.591				
77.44	1.629	0.682	1.616				
19.29	1.655	0.709	1.642				
4.70	1.681	0.736	1.668				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.68	Unit Weight, kN/m^3	19.75
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	15.54
Area, cm^2	31.65	Specific Gravity, measured	2.75
Volume, cm^3	53.20	Solids Height, cm	0.968
Water Content, %	27.16	Volume of Solids, cm^3	30.65
Wet Mass, g	107.17	Volume of Voids, cm^3	22.56
Dry Mass, g	84.28		

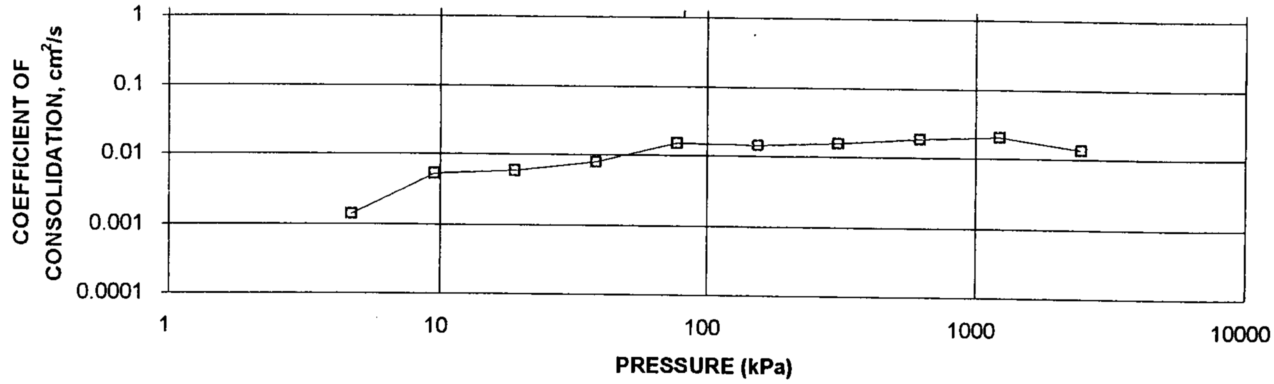
Prepared By: LFG

Golder Associates

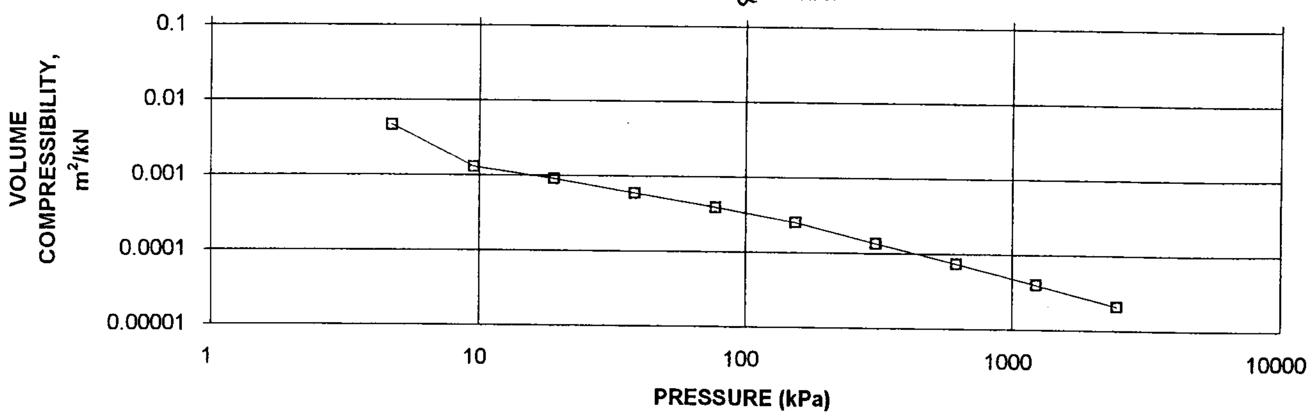
Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY

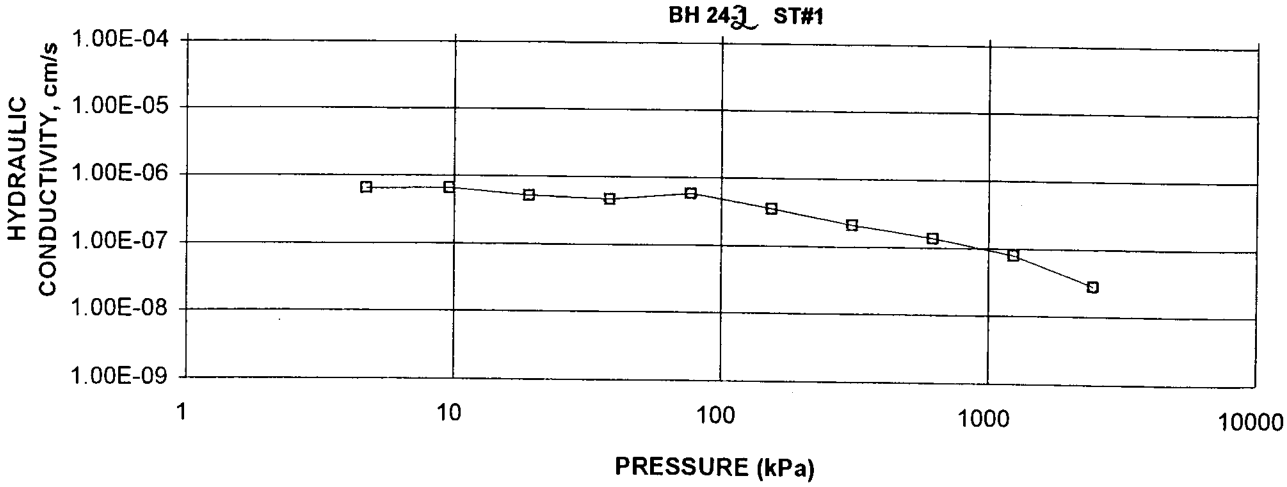
CONSOLIDATION TEST
CV cm^2/s VS PRESSURE (kPa)
BH 24-2 ST#1



CONSOLIDATION TEST
MV m^2/kN vs PRESSURE (kPa)
BH 24-2 ST#1



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH 24-2 ST#1



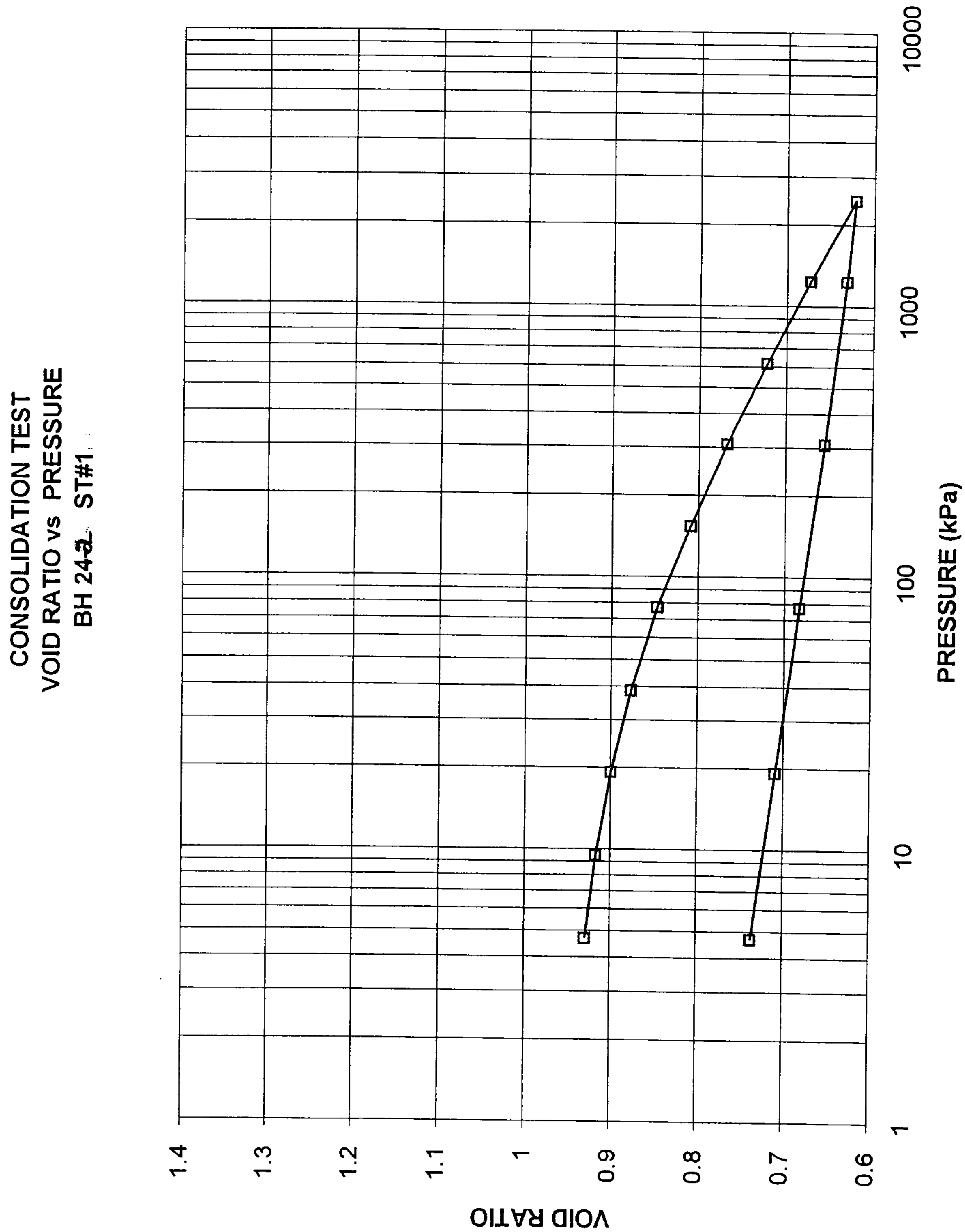
Project No. 04-1116-100
Prepared By: LFG

Golder Associates

Checkey By: MM

CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

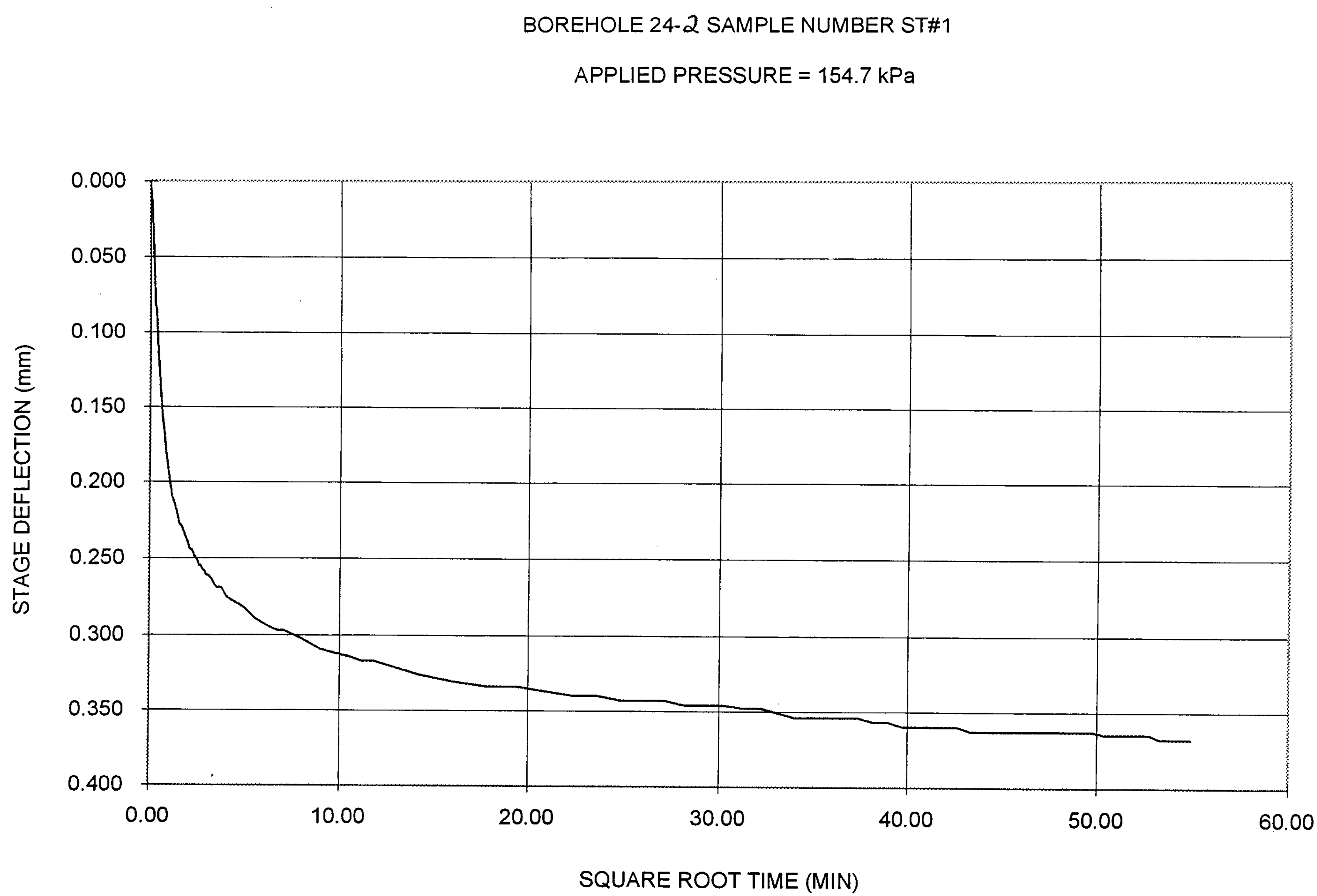
FIGURE



Project No. 04-1116-100
Prepared By: LFG

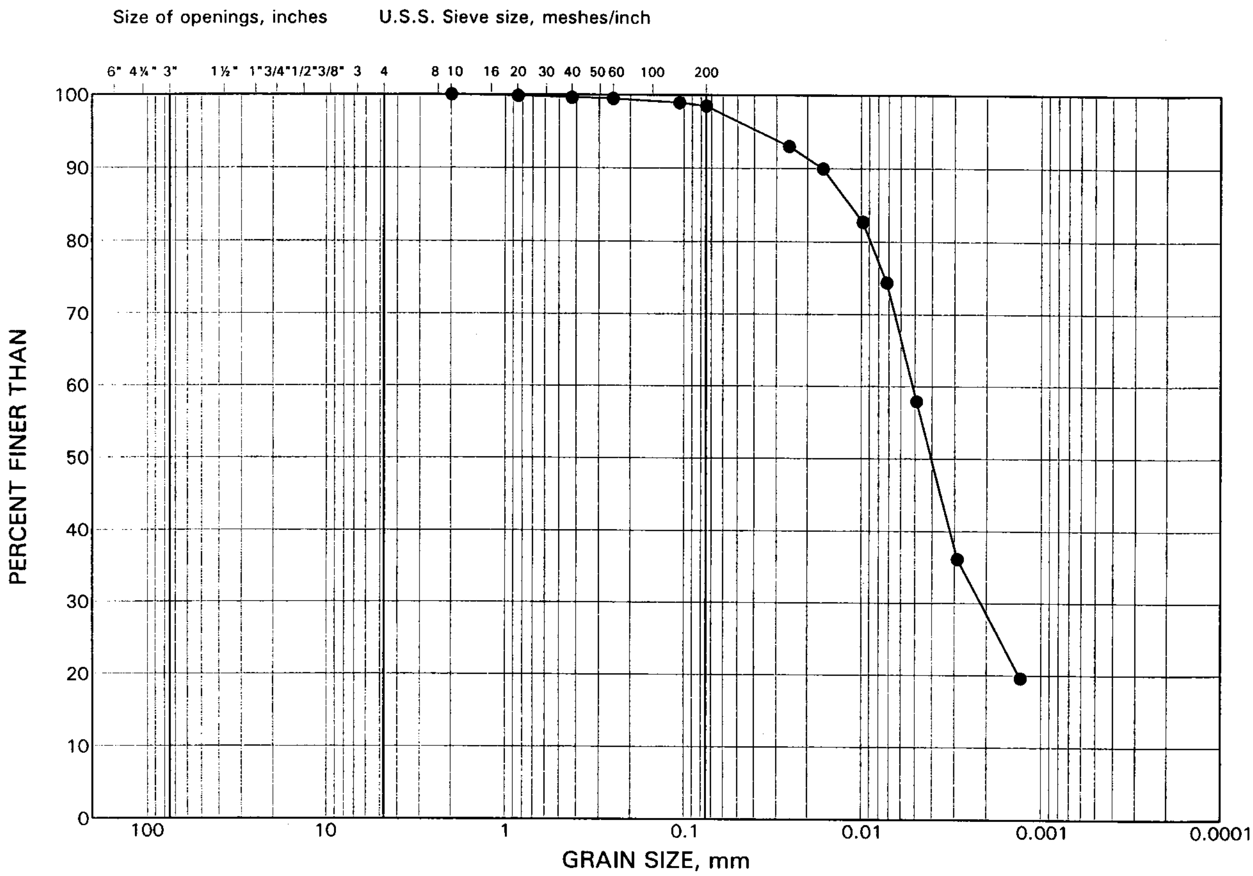
Golder Associates

Checked By: MM


BOREHOLE 24-2 SAMPLE NUMBER ST#1
APPLIED PRESSURE = 154.7 kPa
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
STAGE DEFLECTION (mm)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
SQUARE ROOT TIME (MIN)

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-1	ST#1	6.1-6.7

Date 10/26/2004
Project 04-1116-100

Golder Associates

Prepared by LG
Checked by

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-100	Sample Number	ST#2
Borehole Number	24-2	Sample Depth, m	10.7-11.3

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	7		
Date Started	10/21/2004		
Date Completed	11/02/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	17.22
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	11.65
Area, cm^2	31.65	Specific Gravity, measured	2.76
Volume, cm^3	60.13	Solids Height, cm	0.818
Water Content, %	47.83	Volume of Solids, cm^3	25.88
Wet Mass, g	105.58	Volume of Voids, cm^3	34.26
Dry Mass, g	71.42	Degree of Saturation, %	99.7

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.900	1.324	1.900				
4.83	1.894	1.317	1.897	13	5.87E-02	6.54E-04	3.76E-06
9.46	1.888	1.309	1.891	28	2.71E-02	6.82E-04	1.81E-06
19.51	1.877	1.296	1.883	46	1.63E-02	5.76E-04	9.22E-07
38.91	1.865	1.281	1.871	43	1.73E-02	3.26E-04	5.51E-07
77.57	1.845	1.257	1.855	19	3.84E-02	2.72E-04	1.02E-06
154.88	1.787	1.186	1.816	23	3.04E-02	3.95E-04	1.18E-06
309.92	1.660	1.030	1.724	124	5.08E-03	4.31E-04	2.15E-07
620.07	1.573	0.924	1.617	46	1.20E-02	1.48E-04	1.74E-07
1238.91	1.495	0.828	1.534	40	1.25E-02	6.63E-05	8.11E-08
2477.08	1.417	0.733	1.456	46	9.77E-03	3.32E-05	3.17E-08
1238.91	1.429	0.748	1.423				
309.92	1.454	0.778	1.442				
77.57	1.485	0.816	1.470				
19.51	1.518	0.857	1.502				
4.83	1.555	0.902	1.537				

Notes:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

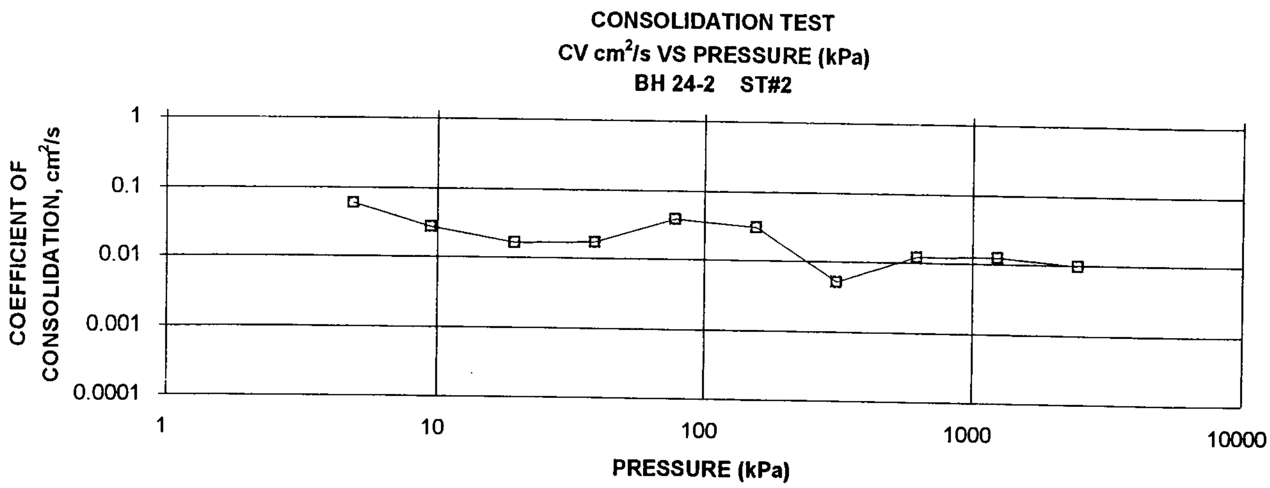
Sample Height, cm	1.56	Unit Weight, kN/m^3	19.05
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	14.23
Area, cm^2	31.65	Specific Gravity, measured	2.76
Volume, cm^3	49.21	Solids Height, cm	0.818
Water Content, %	33.84	Volume of Solids, cm^3	25.88
Wet Mass, g	95.59	Volume of Voids, cm^3	23.34
Dry Mass, g	71.42		

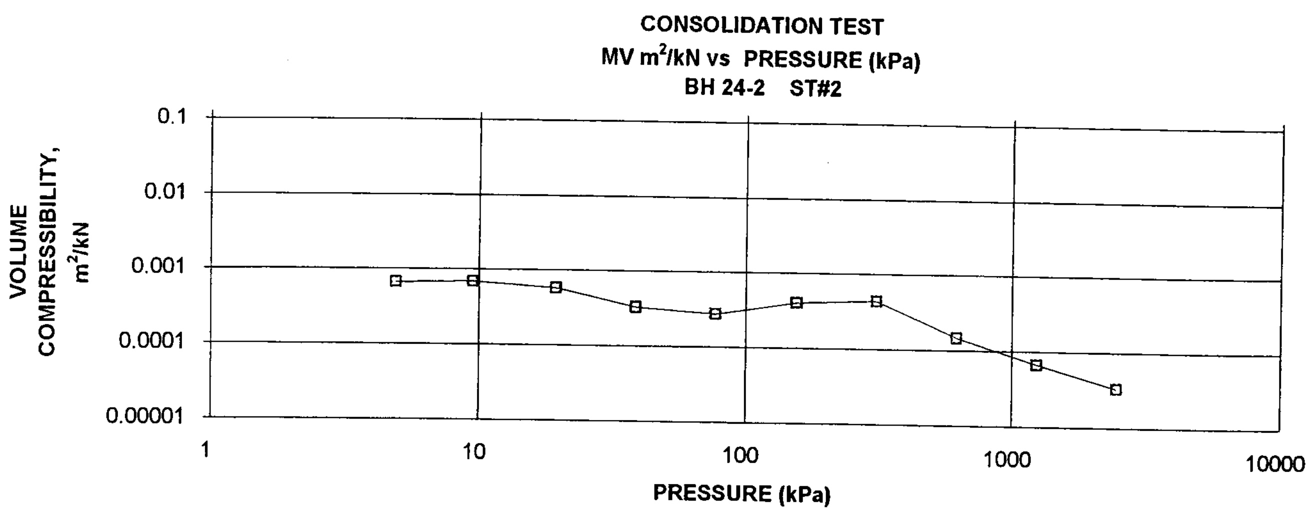
Prepared By: LFG

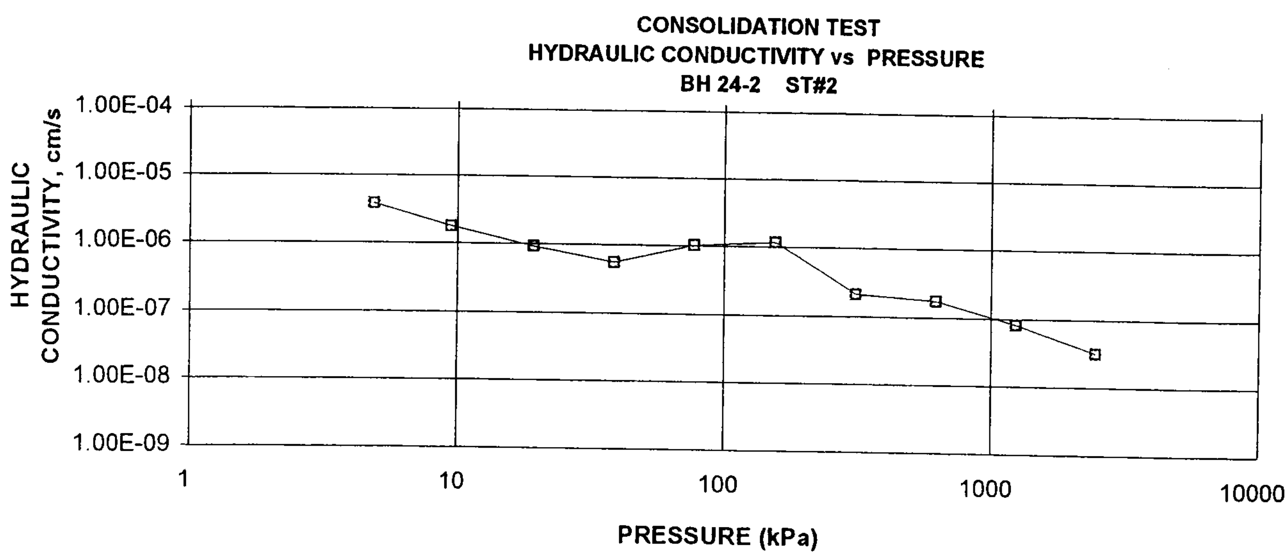
Golder Associates

Checked By: MM

OEDOMETER CONSOLIDATION SUMMARY







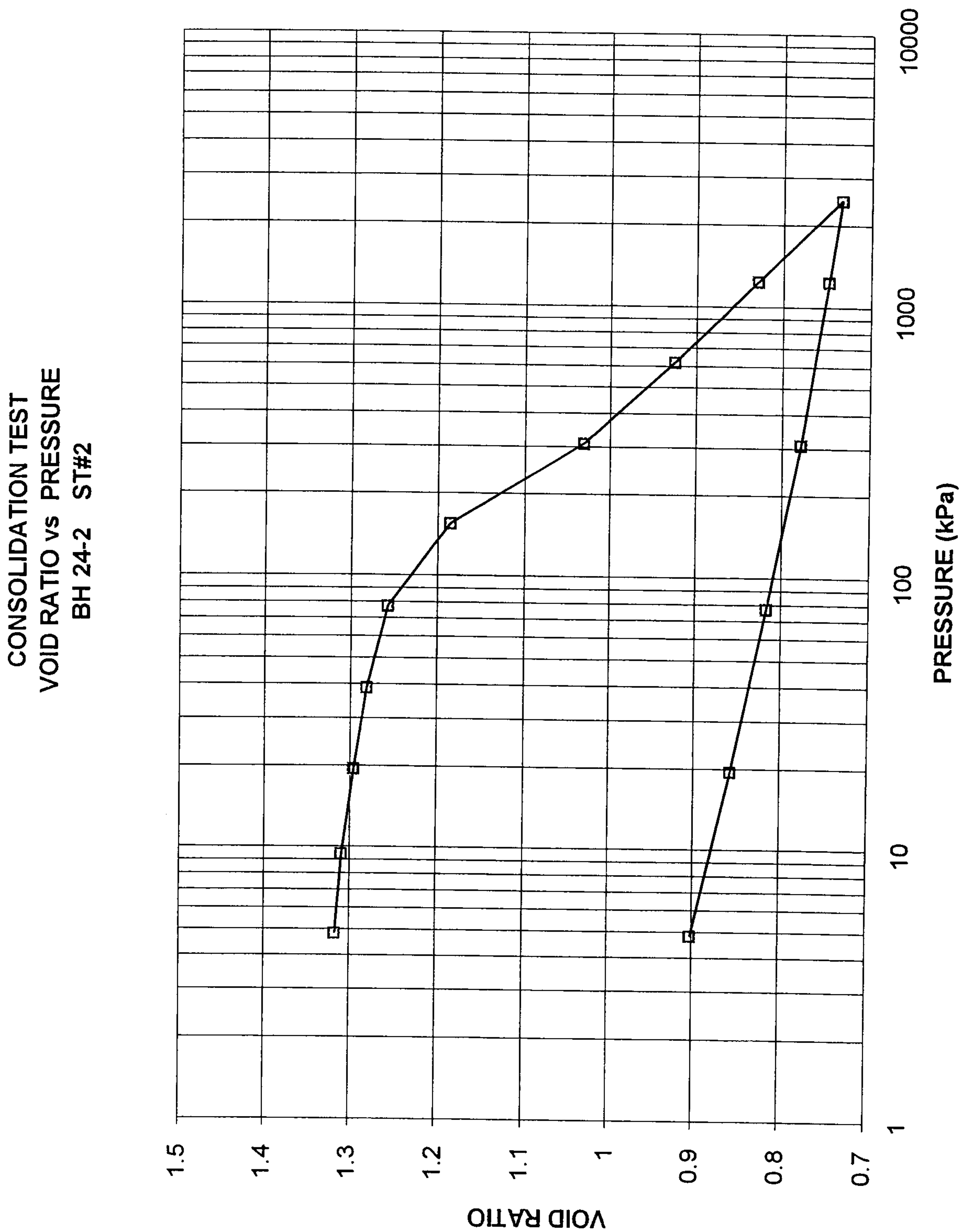
Project No. 04-1116-100

Prepared By: LFG

Golder Associates

Checkey By: MM

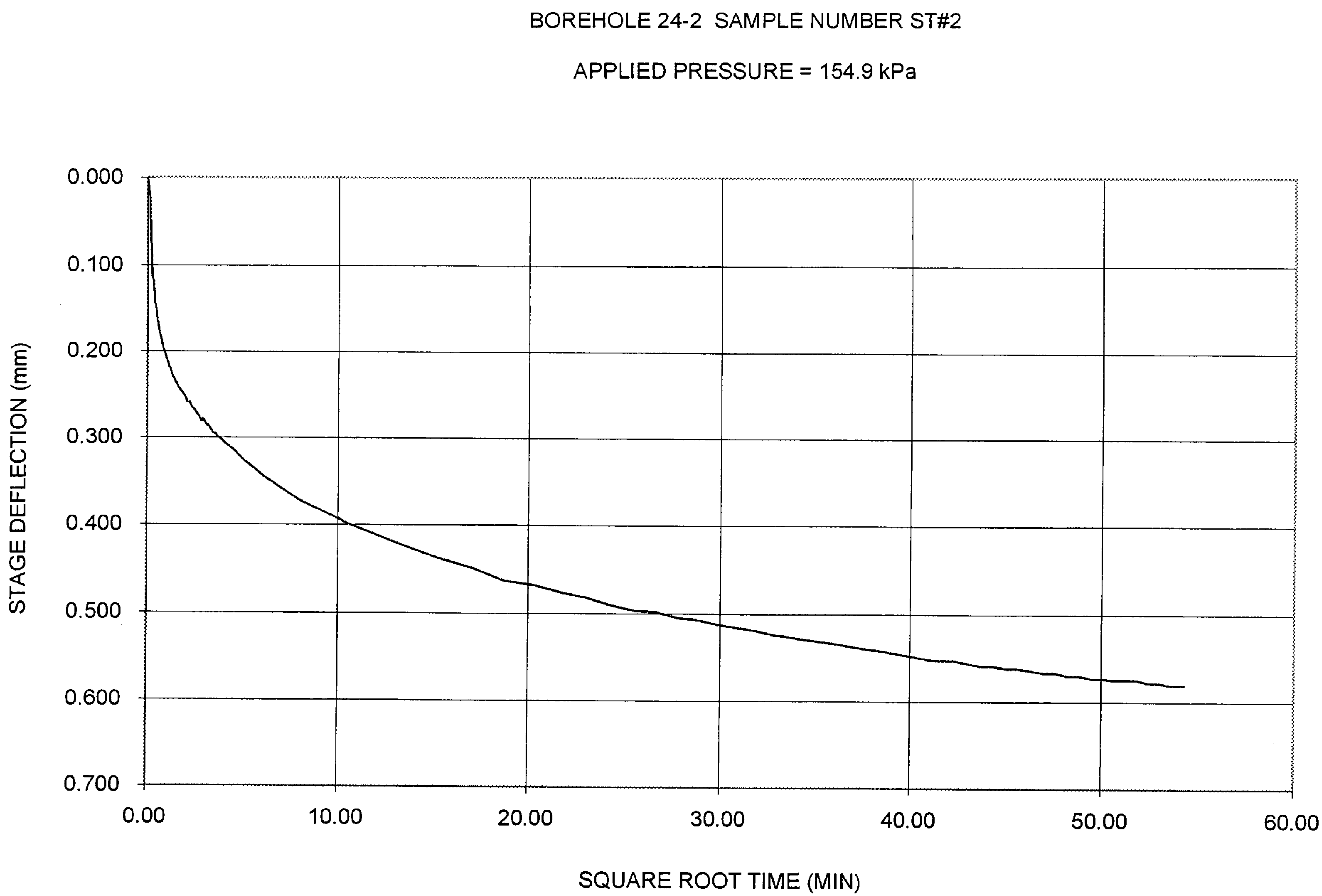
CONSOLIDATION TEST VOID RATIO VS. LOG PRESSURE	FIGURE



Project No. 04-1116-100
Prepared By: LFG

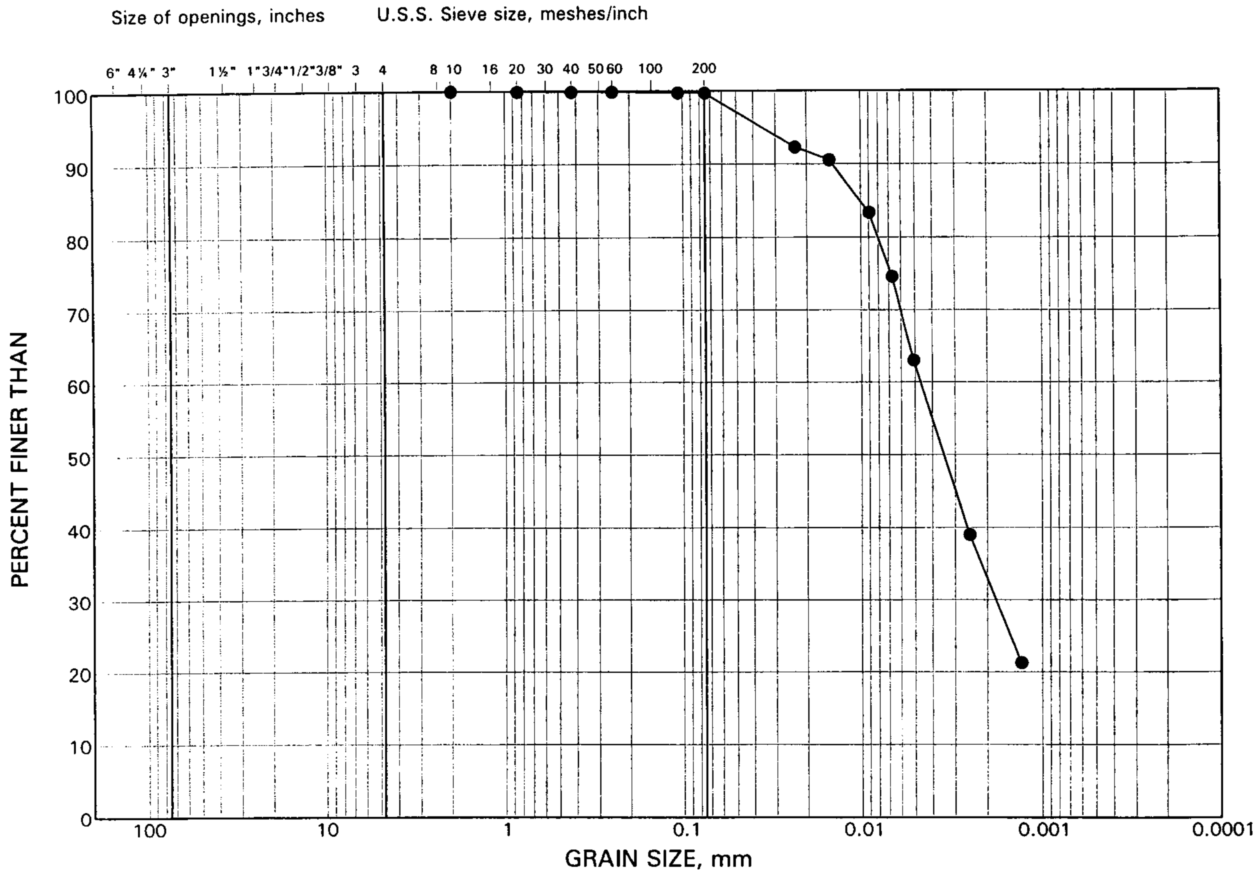
Golder Associates

Checked By: MM


BOREHOLE 24-2 SAMPLE NUMBER ST#2
APPLIED PRESSURE = 154.9 kPa
STAGE DEFLECTION (mm)
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.00
10.00
20.00
30.00
40.00
50.00
60.00
SQUARE ROOT TIME (MIN)

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	24-2	ST#2	10.7-11.3

Date 11/2/2004
Project 04-1116-100

Golder Associates

Prepared by LG
Checked by

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER	04-1116-100
PROJECT NAME	Thurber / Lab Testing / 19-1423-24
DATE TESTED	October, 2004

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI	
24-3	TW#1	30.0-32.0	9.14-9.75	46.6%	LL=32.9, PL=21.2, PI=11.7	
24-3	TW#2	65.0-67.0	19.81-20.42	38.2%	LL=32.5, PL=20.5, PI=12.0	Black Creek Rd.
24-3	TW#3	100.0-102.0	30.48-31.09	57.2%	LL=50.9, PL=23.4, PI=27.5	
24-2	ST#1	20.0-22.0	6.10-6.71	35.3%	LL=34.0, PL=22.1, PI=11.9	
24-1	ST#2	50.0-52.0	15.24-15.85	55.4%	LL=56.4, PL=23.9, PI=32.5	
24-1	ST#1	20.0-22.0	6.10-6.71	36.7%	LL=33.1, PL=22.1, PI=11.0	Hwy 11
24-2	ST#2	35.0-37.0	10.67-11.28	47.8%	LL=32.9, PL=22.0, PI=10.9	

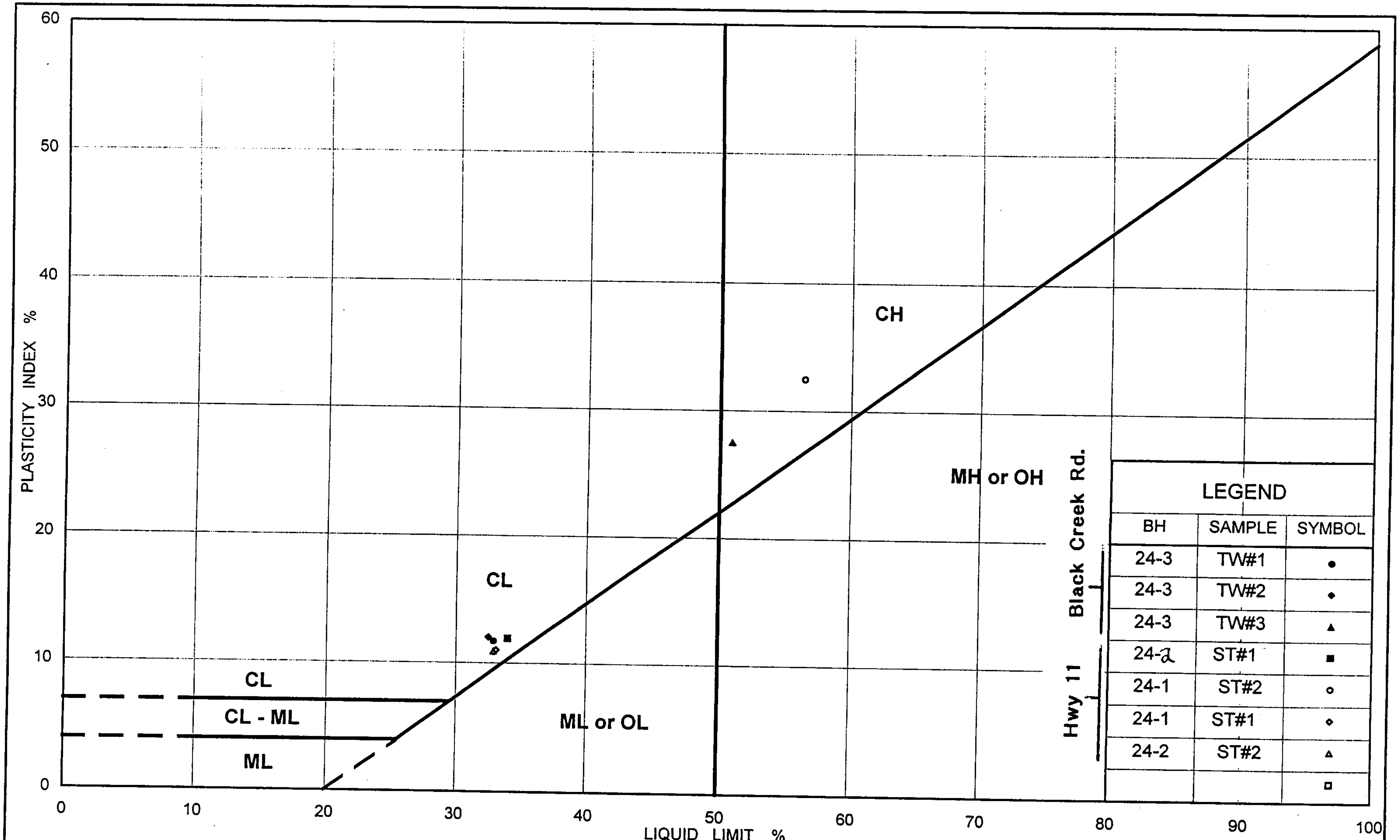
SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-00 TEST METHOD A

PROJECT NUMBER	04-1116-100
PROJECT NAME	Thurber / Lab Testing / 19-1423-24
DATE TESTED	October, 2004

Borehole No.	Sample No.	Specific Gravity	
24-3	TW#1	2.75	
24-3	TW#2	2.78	Black Creek Rd.
24-3	TW#3	2.78	
24-2	ST#1	2.75	
24-1	ST#2	2.76	
24-1	ST#1	2.74	Hwy 11
24-2	ST#2	2.76	

Note: Test carried out on soil particles <4.75mm using distilled water.



Golder Associates

PLASTICITY CHART

FIG No.

Project No. 04-1116-100

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-019	Sample Number	ST#2
Borehole Number	99S-2	Sample Depth, m	17.7-18.3

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	5		
Date Started	3/04/2004		
Date Completed	3/17/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.91	Unit Weight, kN/m^3	16.70
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	10.71
Area, cm^2	31.65	Specific Gravity, measured	2.81
Volume, cm^3	60.45	Solids Height, cm	0.742
Water Content, %	55.92	Volume of Solids, cm^3	23.49
Wet Mass, g	102.92	Volume of Voids, cm^3	36.96
Dry Mass, g	66.01	Degree of Saturation, %	99.9

TEST COMPUTATIONS

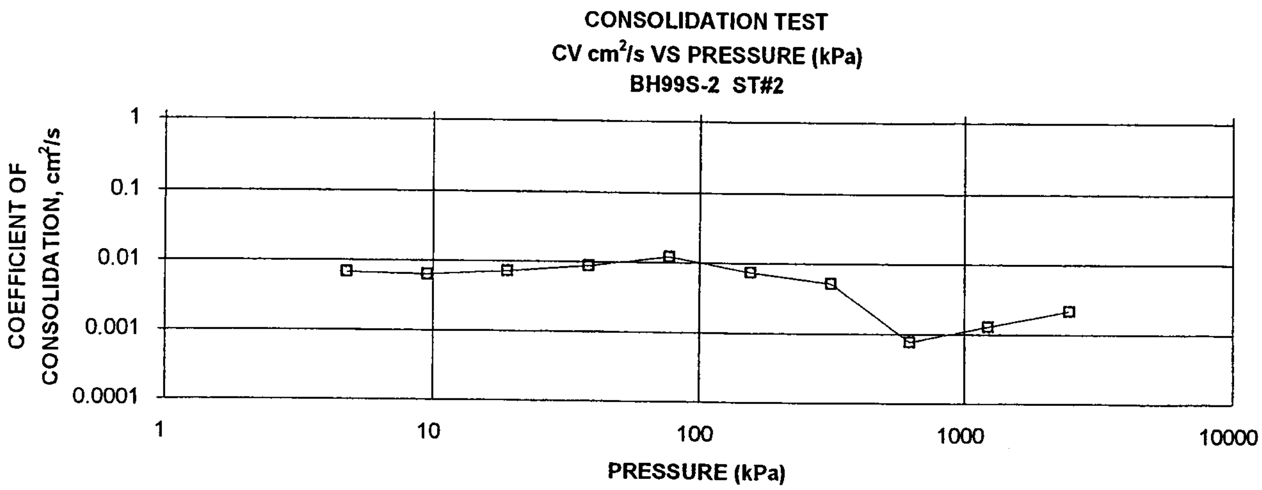
Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.910	1.573	1.910				
4.70	1.895	1.553	1.903	113	6.79E-03	1.67E-03	1.11E-06
9.54	1.888	1.544	1.892	119	6.37E-03	7.58E-04	4.73E-07
19.29	1.876	1.528	1.882	103	7.29E-03	6.44E-04	4.60E-07
38.71	1.860	1.506	1.868	85	8.70E-03	4.31E-04	3.68E-07
77.44	1.837	1.475	1.849	60	1.21E-02	3.11E-04	3.68E-07
154.52	1.797	1.421	1.817	94	7.45E-03	2.72E-04	1.98E-07
309.92	1.689	1.276	1.743	124	5.19E-03	3.64E-04	1.85E-07
619.04	1.483	0.998	1.586	696	7.66E-04	3.49E-04	2.62E-08
1236.79	1.363	0.836	1.423	338	1.27E-03	1.02E-04	1.27E-08
2474.94	1.264	0.703	1.314	171	2.14E-03	4.19E-05	8.78E-09
1236.79	1.273	0.715	1.269				
309.92	1.315	0.771	1.294				
154.52	1.340	0.805	1.327				
38.71	1.401	0.888	1.371				
9.54	1.475	0.987	1.438				
4.70	1.486	1.002	1.481				

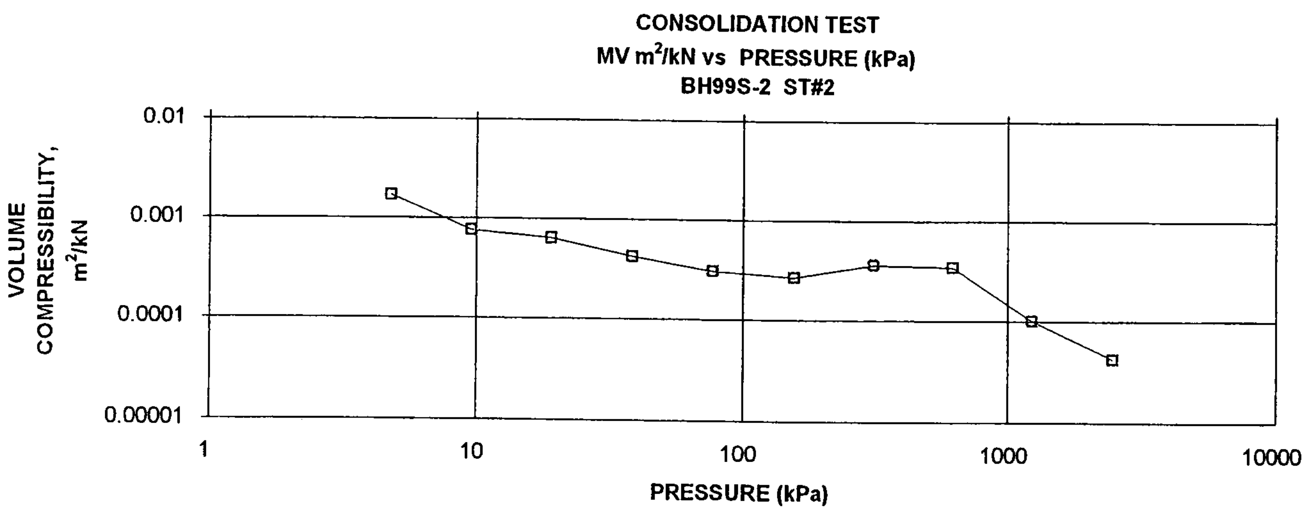
Notes:
k calculated using cv based on t_{90} values.

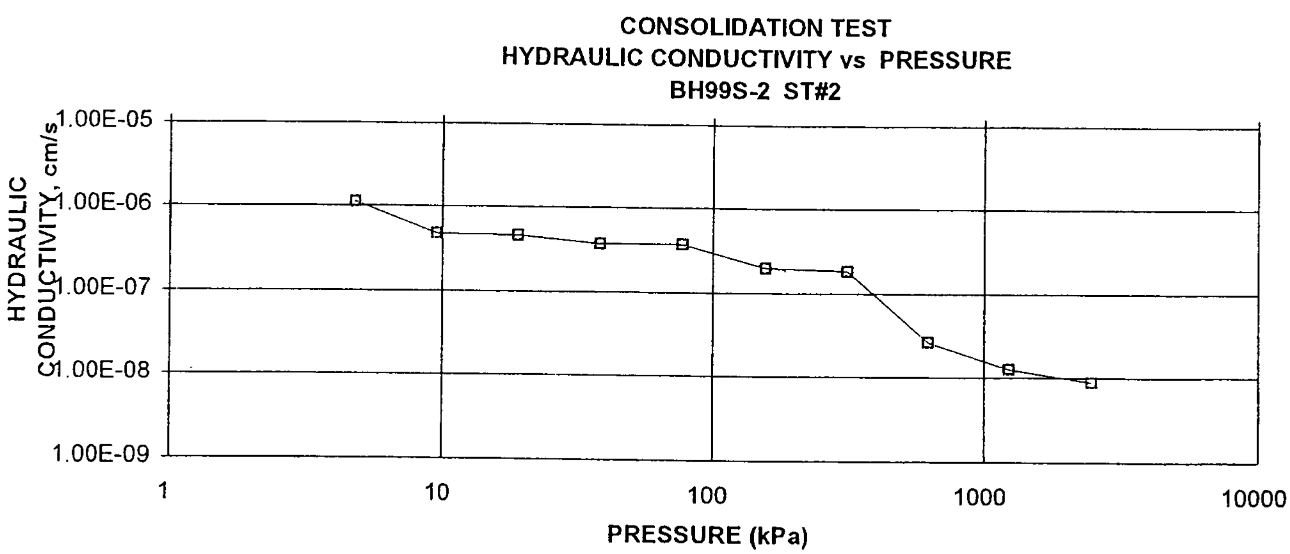
SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.49	Unit Weight, kN/m^3	19.43
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m^3	13.76
Area, cm^2	31.65	Specific Gravity, measured	2.81
Volume, cm^3	47.03	Solids Height, cm	0.742
Water Content, %	41.18	Volume of Solids, cm^3	23.49
Wet Mass, g	93.19	Volume of Voids, cm^3	23.54
Dry Mass, g	66.01		

OEDOMETER CONSOLIDATION SUMMARY

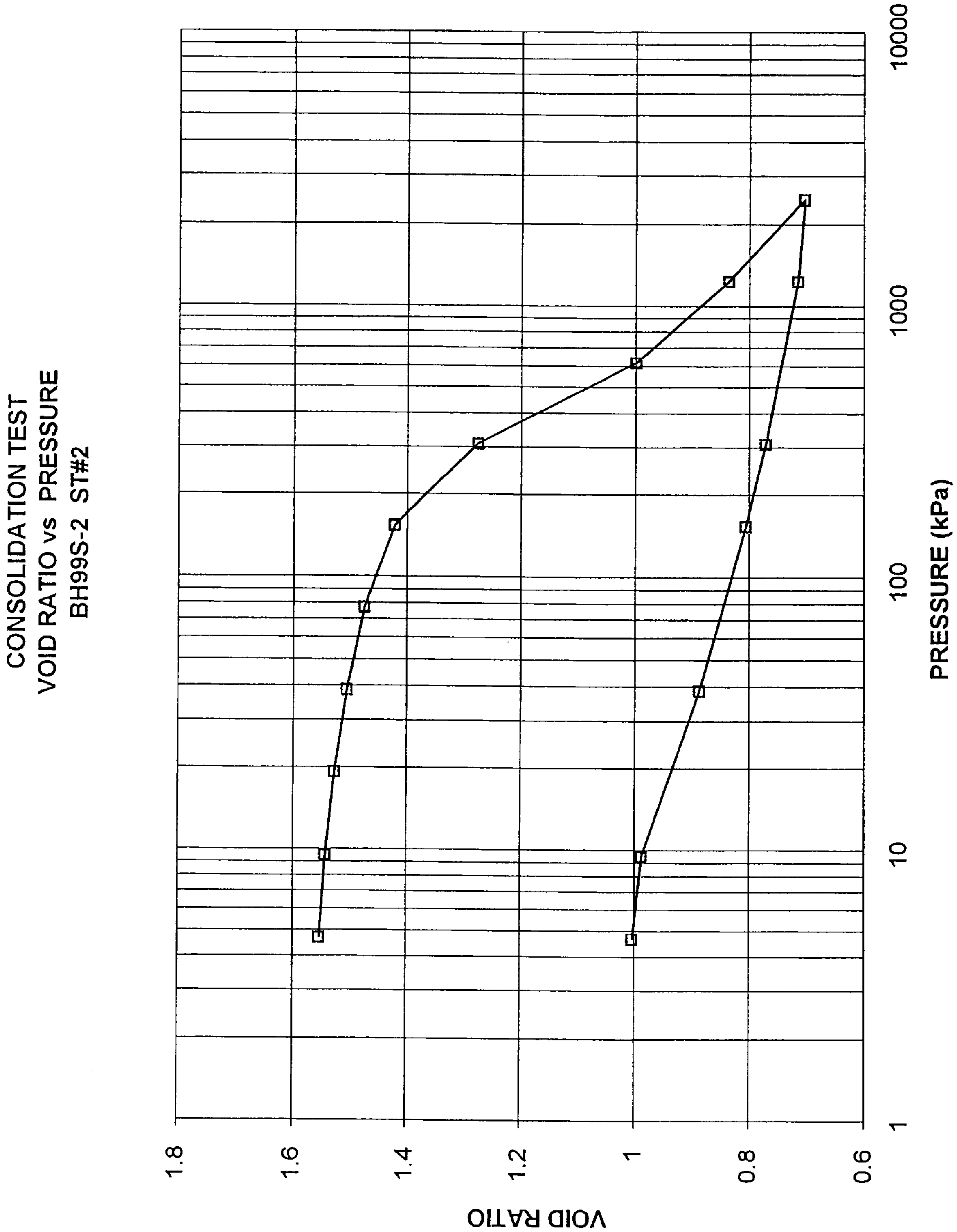






CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE



Project No. 04-1116-019

Golder Associates

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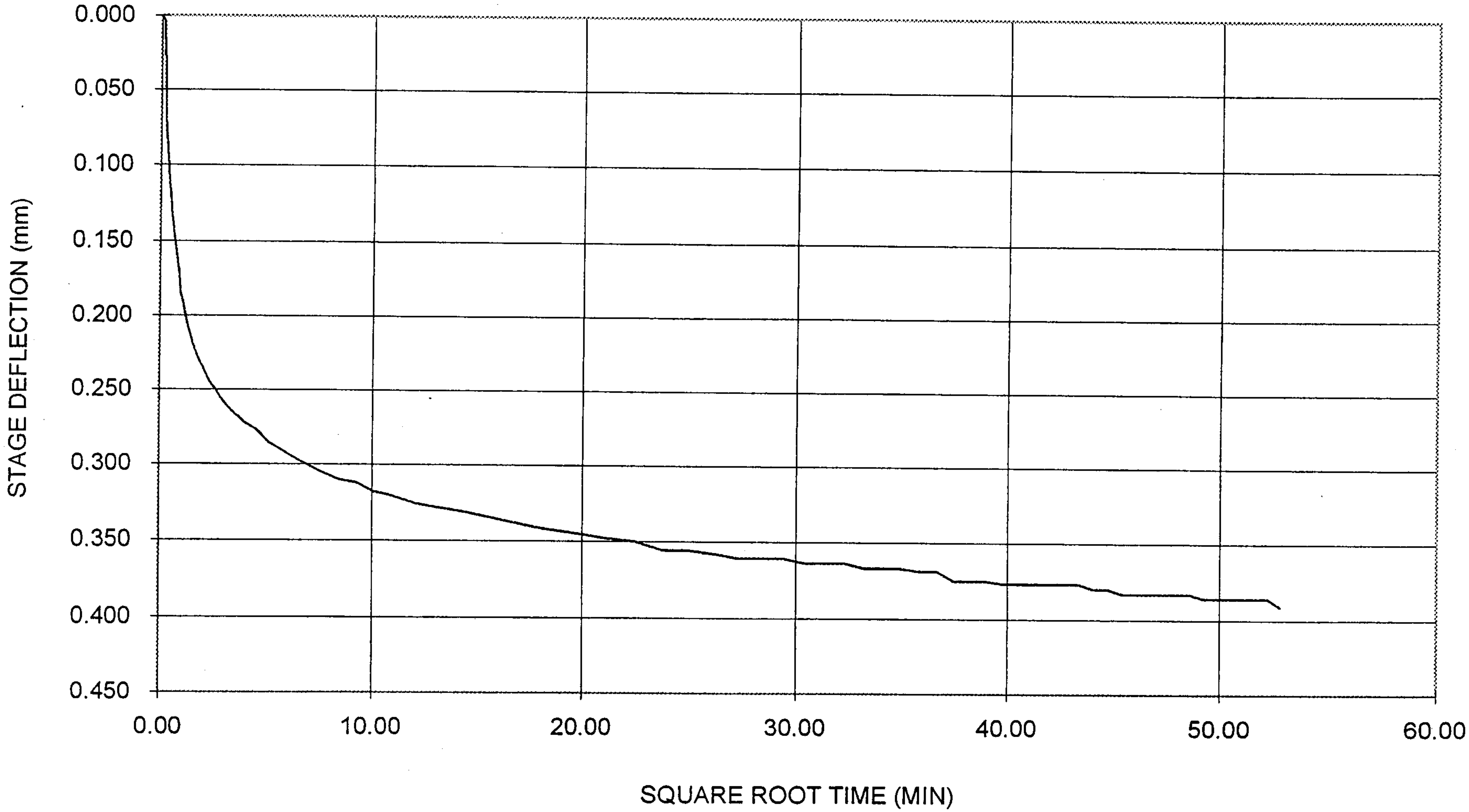
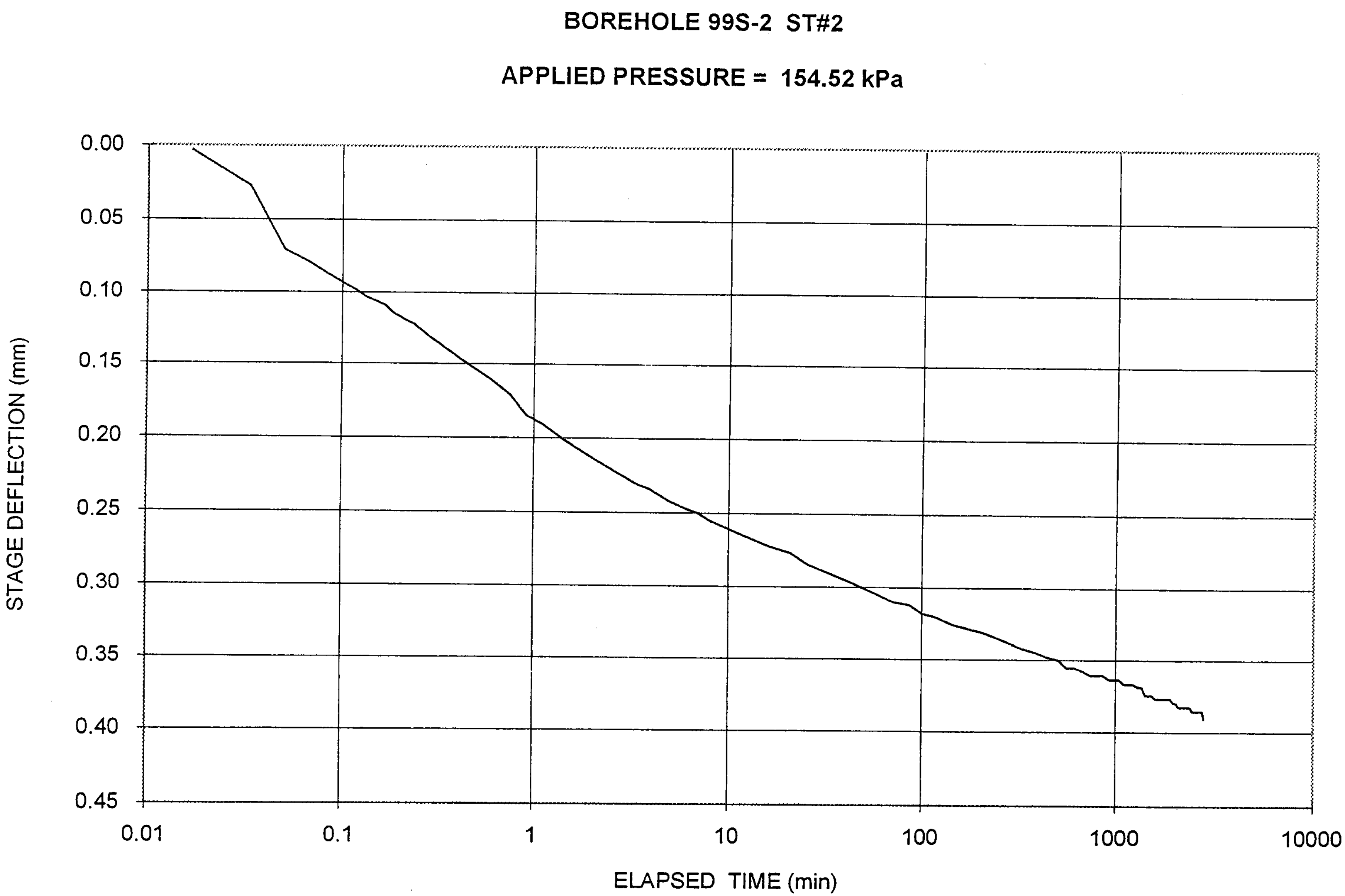
BOREHOLE 99S-2 ST#2

APPLIED PRESSURE = 154.52 kPa

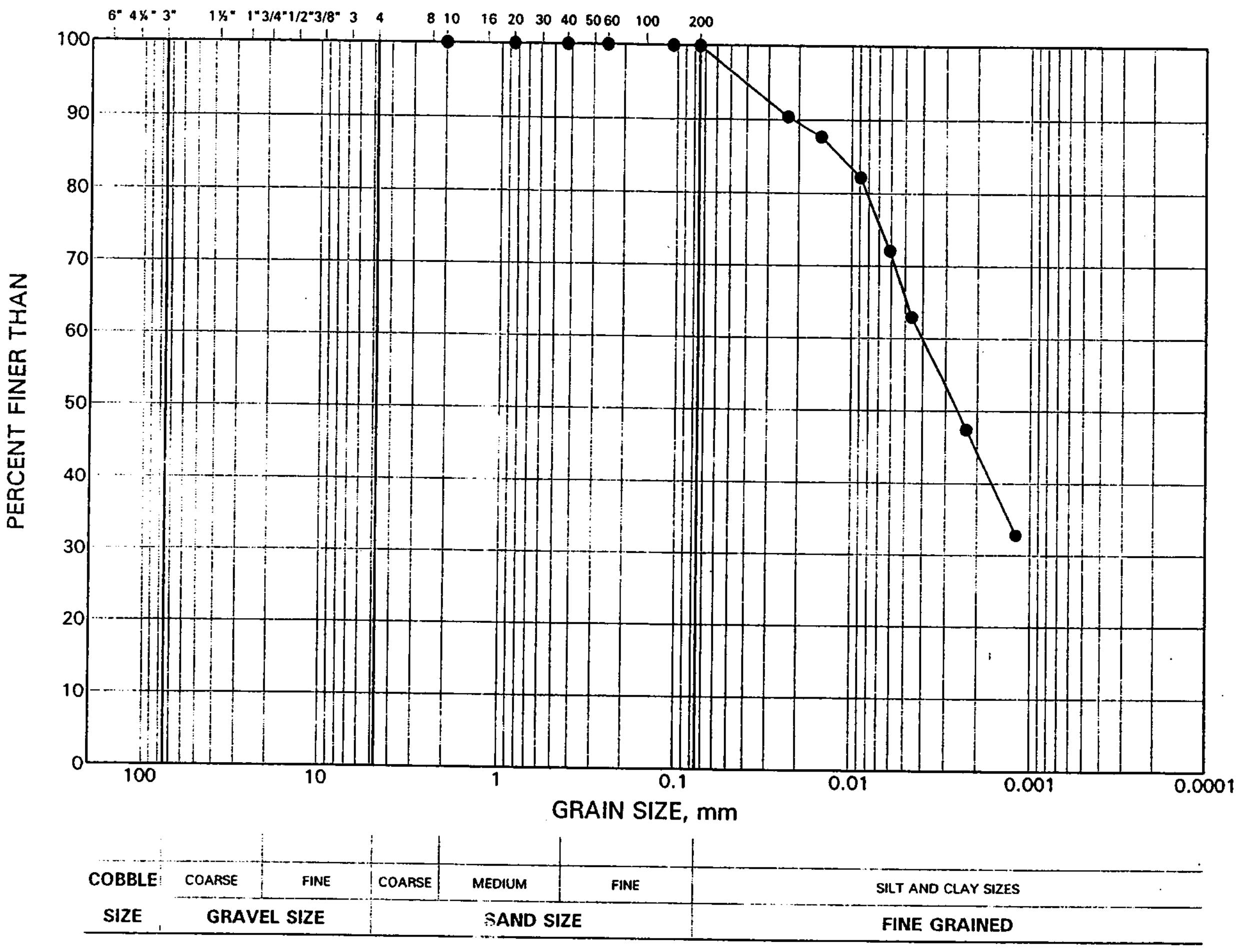




BOREHOLE 99S-2 ST#2
APPLIED PRESSURE = 154.52 kPa
STAGE DEFLECTION (mm)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.01
0.1
1
10
100
1000
10000
ELAPSED TIME (min)

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	99S-2	ST#2	17.7-18.3

Project 04-1116-019

Golder Associates

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-019	Sample Number	ST#2
Borehole Number	99S-5	Sample Depth, m	16.8-17.4

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24-48
Oedometer Number	6		
Date Started	3/04/2004		
Date Completed	3/17/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.91	Unit Weight, kN/m^3	17.77
Sample Diameter, cm	6.36	Dry Unit Weight, kN/m^3	12.54
Area, cm^2	31.79	Specific Gravity, measured	2.77
Volume, cm^3	60.72	Solids Height, cm	0.882
Water Content, %	41.62	Volume of Solids, cm^3	28.04
Wet Mass, g	110.00	Volume of Voids, cm^3	32.68
Dry Mass, g	77.67	Degree of Saturation, %	98.9

TEST COMPUTATIONS

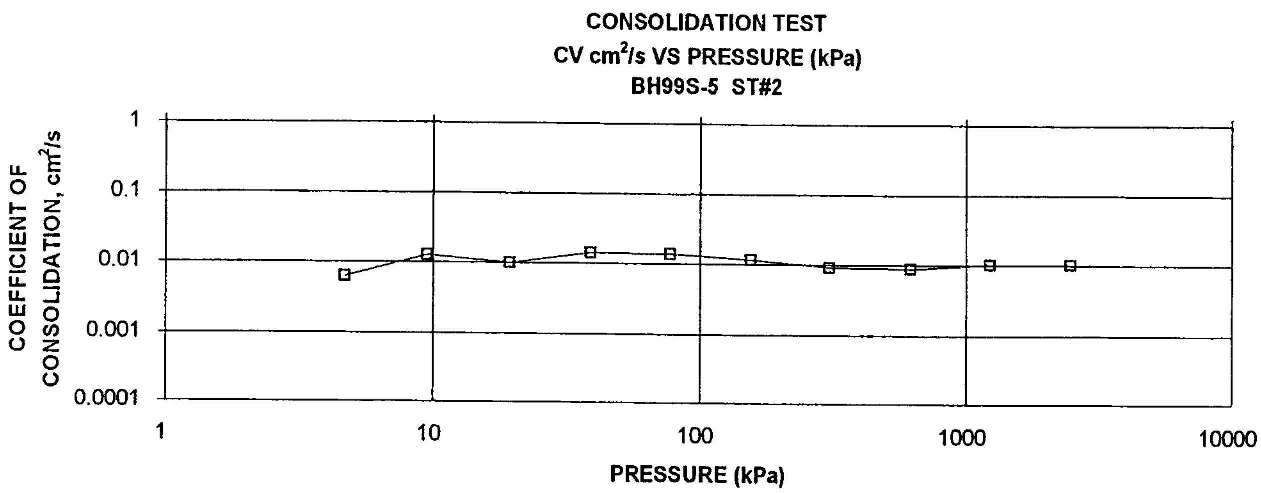
Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	cv. cm^2/s	mv m^2/kN	k cm/s
0.00	1.910	1.165	1.910				
4.70	1.902	1.156	1.906	124	6.21E-03	8.91E-04	5.42E-07
9.55	1.894	1.147	1.898	60	1.27E-02	8.64E-04	1.08E-06
19.30	1.882	1.134	1.888	76	9.94E-03	6.44E-04	6.28E-07
38.70	1.865	1.114	1.874	53	1.40E-02	4.59E-04	6.31E-07
77.43	1.841	1.087	1.853	53	1.37E-02	3.24E-04	4.37E-07
154.78	1.799	1.040	1.820	60	1.17E-02	2.84E-04	3.26E-07
309.24	1.718	0.948	1.759	72	9.11E-03	2.75E-04	2.45E-07
618.72	1.637	0.856	1.678	68	8.77E-03	1.37E-04	1.18E-07
1237.12	1.566	0.775	1.602	53	1.03E-02	6.01E-05	6.04E-08
2476.10	1.492	0.692	1.529	49	1.01E-02	3.13E-05	3.10E-08
1237.12	1.506	0.707	1.499				
309.24	1.524	0.728	1.515				
154.78	1.535	0.740	1.530				
38.70	1.561	0.770	1.548				
9.55	1.593	0.806	1.577				
4.76	1.615	0.831	1.604				

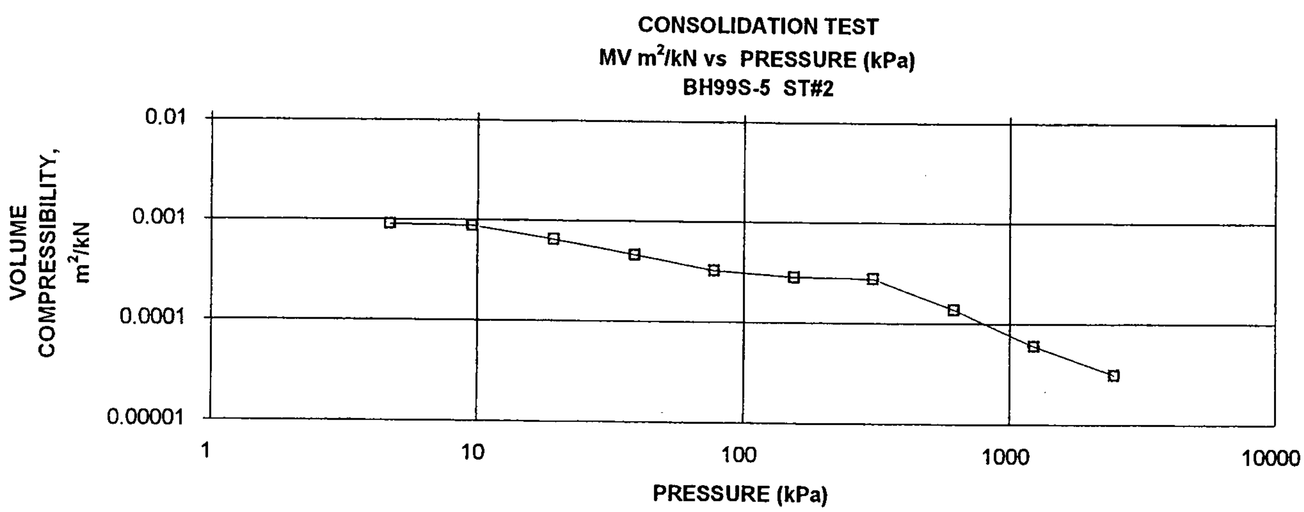
Notes:
k calculated using cv based on t_{90} values.

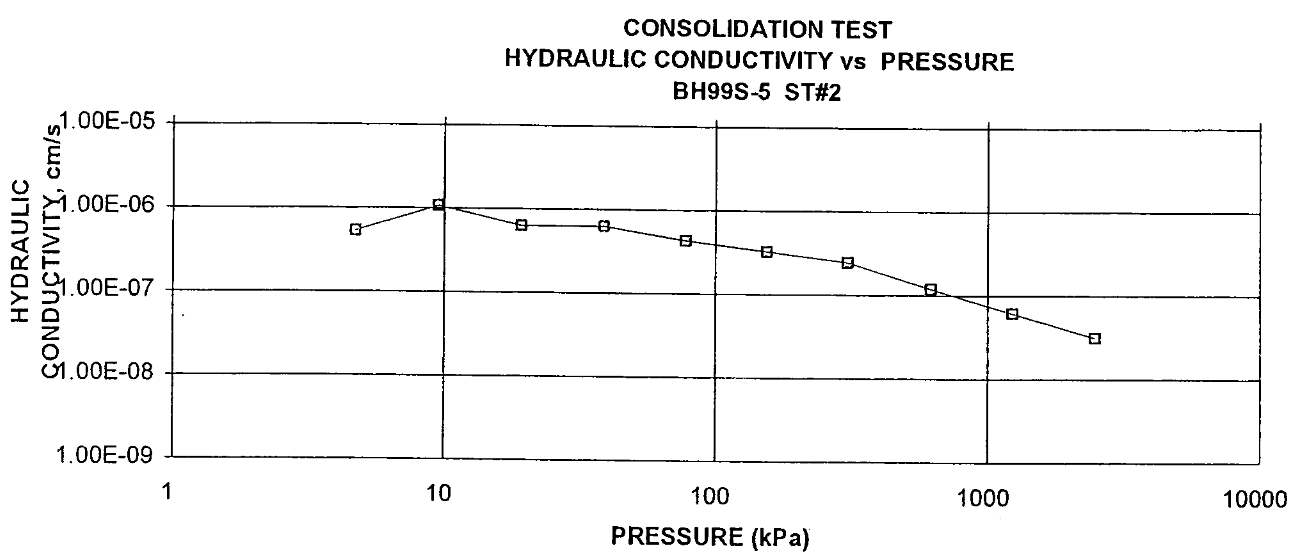
SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.62	Unit Weight, kN/m^3	19.49
Sample Diameter, cm	6.36	Dry Unit Weight, kN/m^3	14.84
Area, cm^2	31.79	Specific Gravity, measured	2.77
Volume, cm^3	51.34	Solids Height, cm	0.882
Water Content, %	31.36	Volume of Solids, cm^3	28.04
Wet Mass, g	102.03	Volume of Voids, cm^3	23.30
Dry Mass, g	77.67		

OEDOMETER CONSOLIDATION SUMMARY





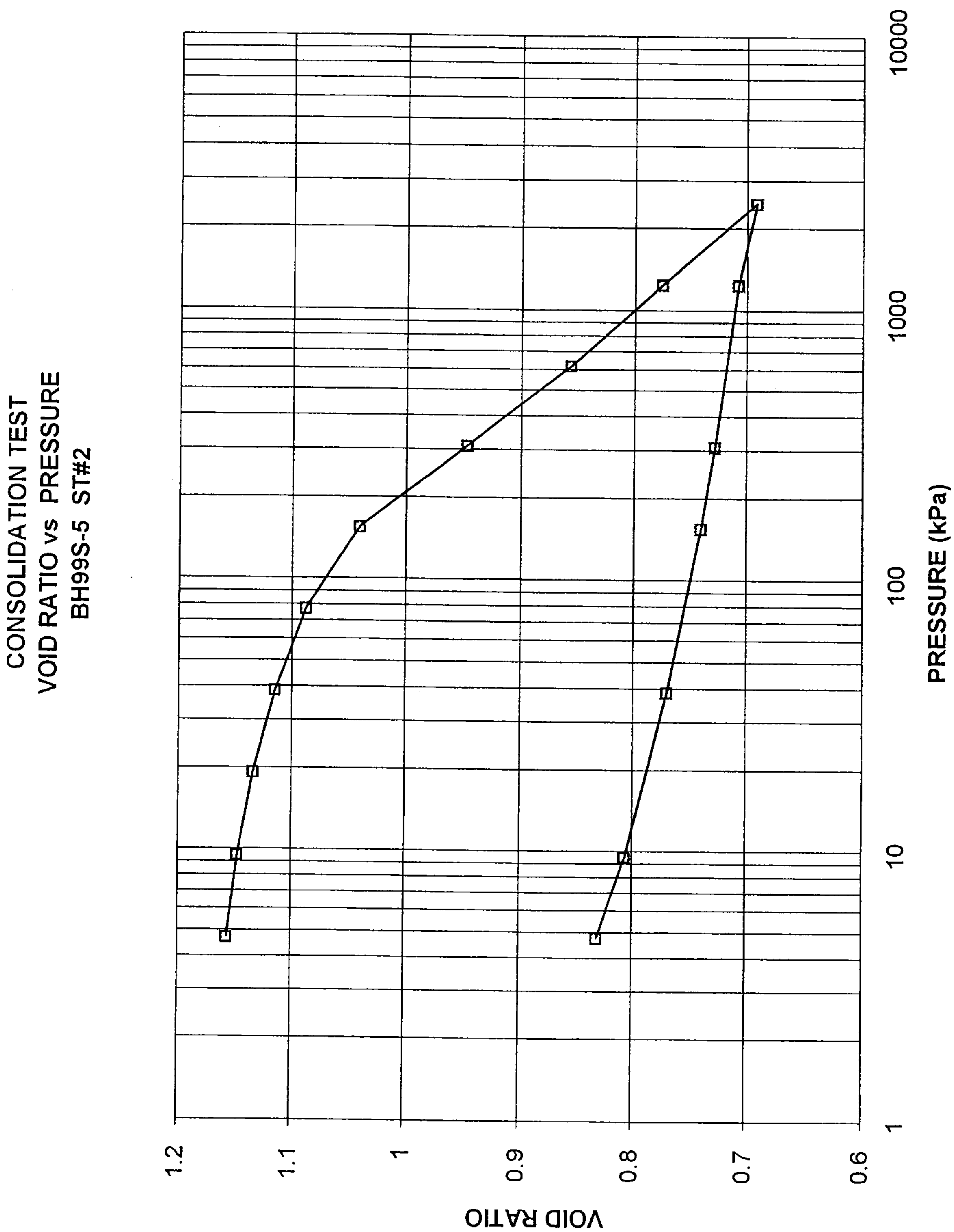


Project No. 04-1116-019

Golder Associates

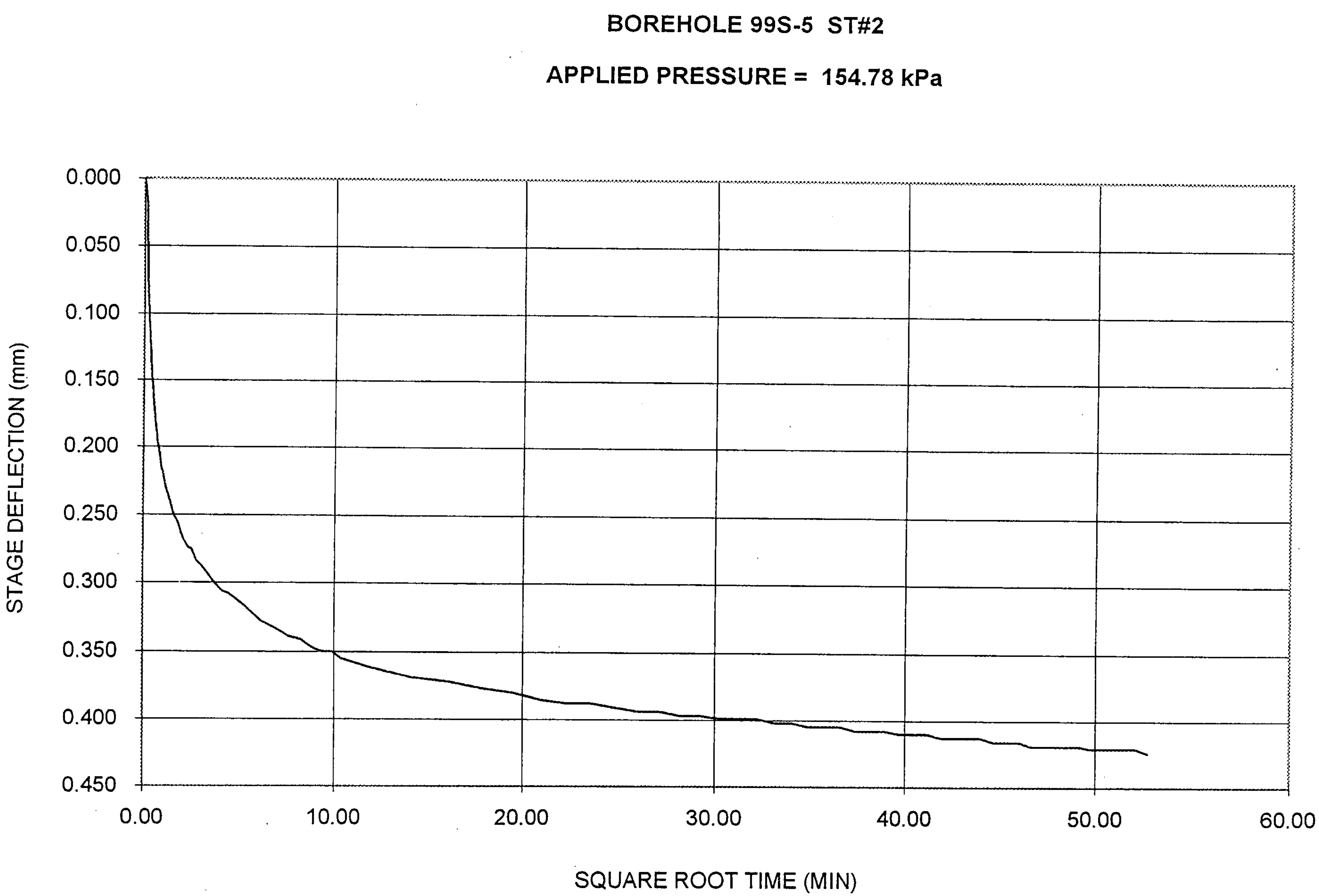
CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE

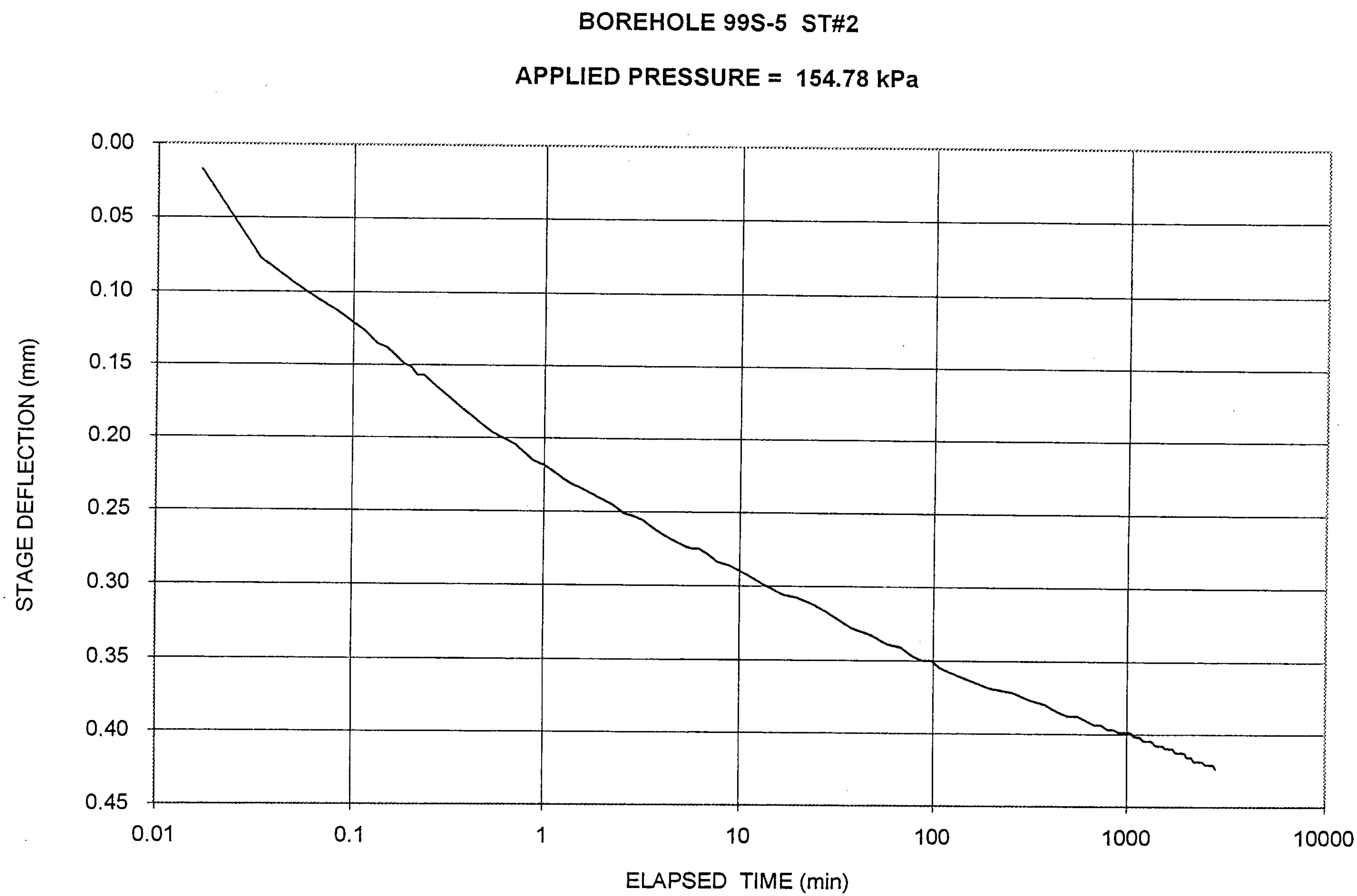


Project No. 04-1116-019

Golder Associates



Golder Associates



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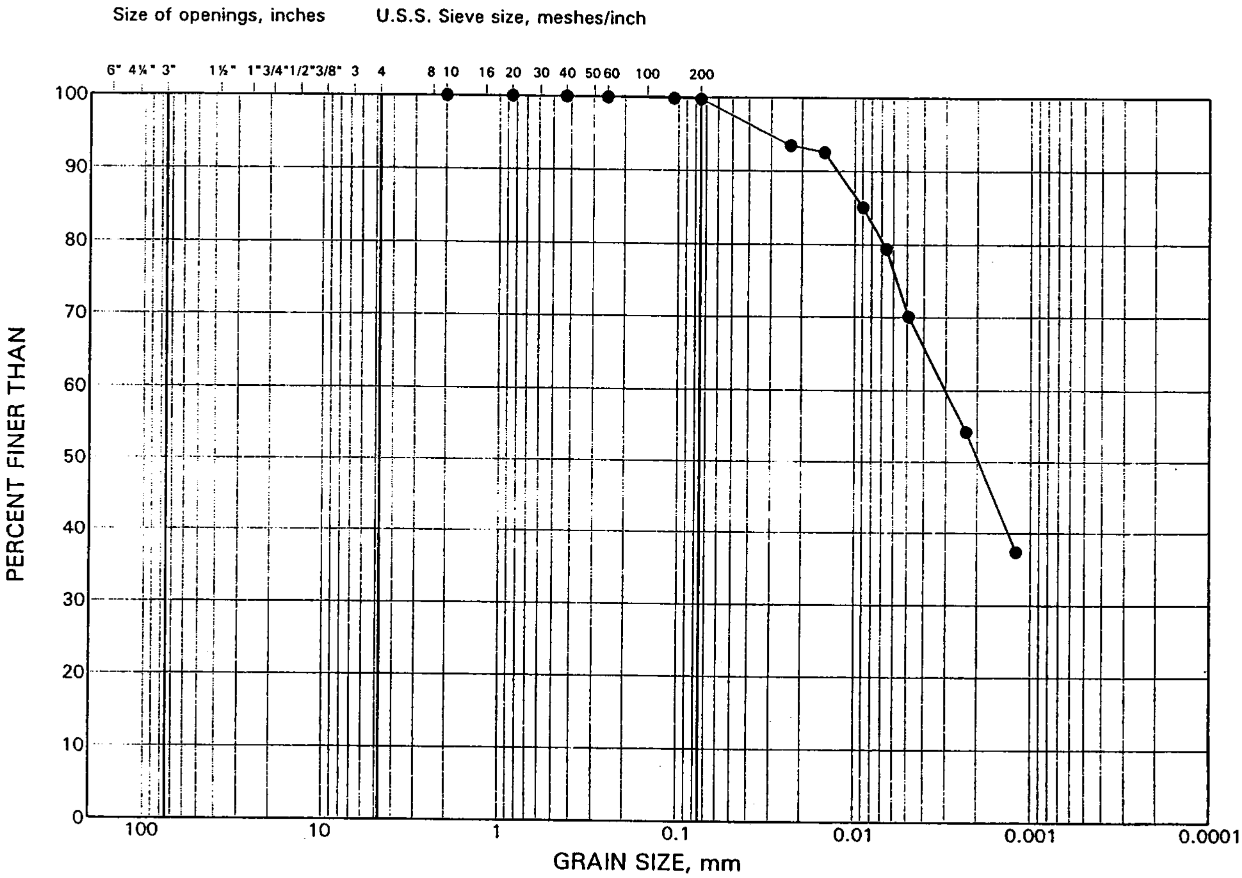
GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	99S-5	ST#2	16.7-17.4

Project 04-1116-019

Golder Associates

SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-00 TEST METHOD A

PROJECT NUMBER	04-1116-019
PROJECT NAME	Thurber / Lab Testing / 19-1423-12
DATE TESTED	March, 2004

Borehole No.	Sample No.	Specific Gravity
99S-2	ST#2	2.81
99S-5	ST#2	2.77

Note: Test carried out on soil particles <4.75mm using distilled water.

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER	04-1116-019
PROJECT NAME	Thurber / Lab Testing / 19-1423-12
DATE TESTED	March, 2004

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
99S-2	ST#2	58.0-60.0	17.68-18.29	55.9%	LL=45.1, PL=25.0, PI=20.1
99S-5	ST#2	55.0-57.0	16.76-17.37	41.6%	LL=33.7, PL=23.5, PI=10.2

APPENDIX C

2000 INVESTIGATION BY GOLDER

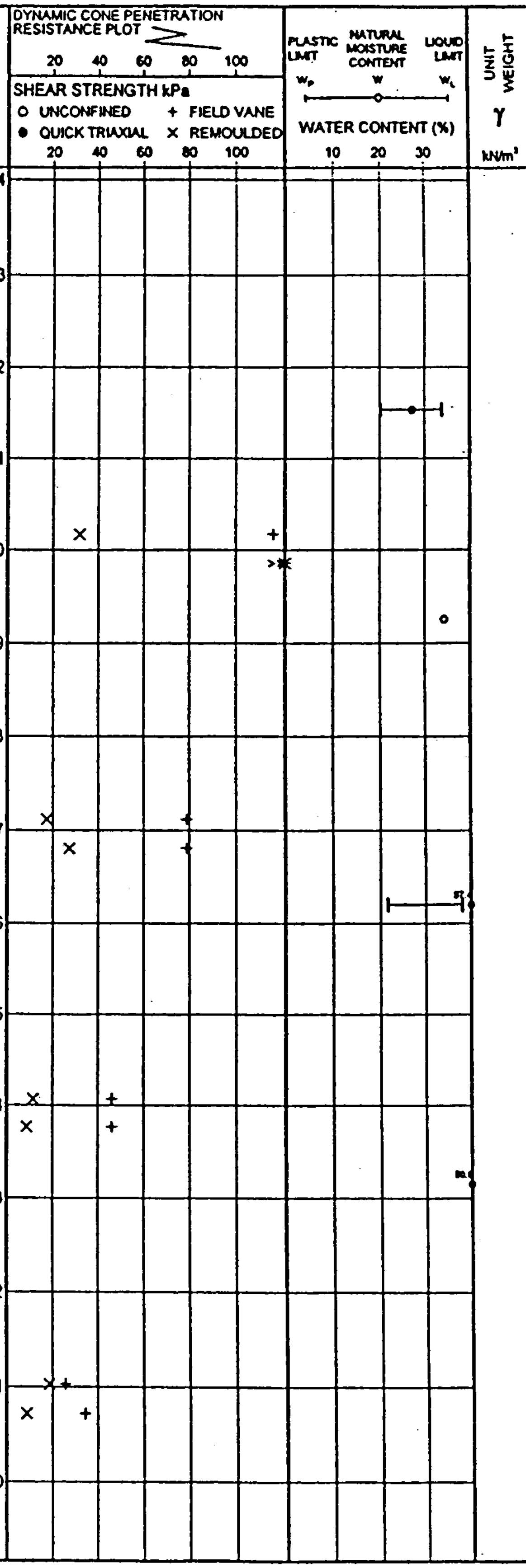
Transportation Ontario

RECORD OF BOREHOLE No 5-2

METRIC

PROJECT 991-1193			
W.P. 335-98-00	LOCATION N 5063087.04; E 309374.04		ORIGINATED BY SB
DIST 54	HWY 11	BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS	COMPILED BY DKB
DATUM GEODETIC	DATE March 1/00		CHECKED BY ASP

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
314.13	GROUND SURFACE					
0.05	Topsoil				314	
	Sand and Gravel, trace silt, occ. cobbles and/or boulders Loose Brown Wet (Fill)	1	SS	6	313	
312.68 1.45	Silty Clay, trace sand Firm to very stiff Grey Moist to wet	2	SS	9	312	
		3	SS	15		0 2 70 28
		4	SS	7	311	
					310	
		5	SS	7	309	
					308	
		6	SS	3	307	
		7	SS	2	306	
					305	
		8	SS	1	304	
		9	SS	1	303	
					302	
		10	SS	2	301	
		11	SS	2	300	



Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity $O^{3\%}$ STRAIN AT FAILURE

RECORD OF BOREHOLE No 5-2

METRIC

PROJECT 991-1193
W.P. 335-98-00
LOCATION N 5063087.04; E 309374.04
ORIGINATED BY SB
DIST 54 HWY 11
BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS
COMPILED BY DKB
DATUM GEODETIC
DATE March 1/00
CHECKED BY ASP

— CONTINUED FROM PREVIOUS PAGE —

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" VALUES	NATURAL MOISTURE CONTENT / LIMITS	GR	SA	SI	CL
	Silty Clay, trace sand Firm to very stiff Grey Moist to wet	12	SS	3	LL 47.5	0	1	65	34
		13	SS	4					
296.30 17.83	Sand and Gravel, trace silt, occ. cobbles and/or boulders Very dense Grey Wet	~~14~~	~~SS~~	~~50/.05~~					
295.79 18.34	Coring carried out from 18.34m to 21.41m -boulder encountered from 18.34m to 19.05m TCR=63%, SCR=30%, RQD=49% -sand noted from 19.05m to 19.51m -no recovery from 19.51m to 21.41m depth, cobbles inferred from grinding/resistance to coring								
292.72 21.41	END OF HOLE Attempted cone penetration testing below 21.4m; Refusal to cone penetration; probable boulder or bedrock Note: 1. Water level measured in piezometer at 12.2m depth (EL 301.9m) upon completion of installation. 2. Water level measured in piezometer at 0.6m depth (EL 313.5m) on March 8, 2000. 3. Water level measured in piezometer at 0.7m depth (EL 313.4m) on March 26, 2000.								

Elevation scale: 299, 298, 297, 296, 295, 294, 293

Column headings: SOIL PROFILE; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

RECORD OF BOREHOLE No 5-3

METRIC

PROJECT 991-1193
W.P. 335-98-00
DIST 54 HWY 11
DATUM GEODETIC

LOCATION N 5063055.70; E 309304.54
BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS
DATE Jan.26/00

ORIGINATED BY SB
COMPILED BY DKB
CHECKED BY ASP

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
312.38	GROUND SURFACE
312.38 / 0.00	Sand and Gravel, trace silt, Brown, Moist (Fill)
312.15 / 0.23	Fibrous Peat, Black, Moist
311.62 / 0.76	Silty Clay, trace sand, Firm to stiff, Grey, Moist to wet

SAMPLES

NUMBER	TYPE	"N" VALUES
1	SS	2
2	SS	4
3	75 TO	PH
4	SS	2
5	75 TO	PH
6	SS	2
7	75 TO	PH
8	SS	2
9	SS	5
10	SS	1

GROUND WATER CONDITIONS: ∇ (at approx. elev. 311.5)

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

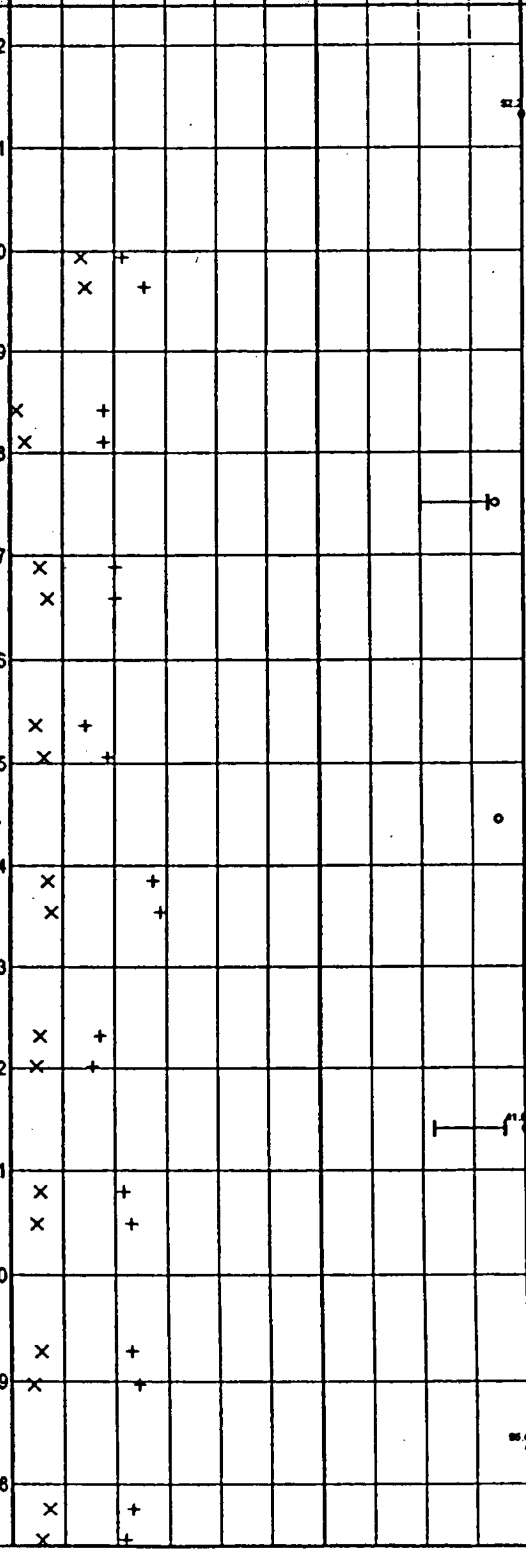
SHEAR STRENGTH kPa: O UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × REMOULDED: 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m³

ELEVATION SCALE: 312, 311, 310, 309, 308, 307, 306, 305, 304, 303, 302, 301, 300, 299, 298



REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	2	61	37

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity $O^{3\%}$ STRAIN AT FAILURE

RECORD OF BOREHOLE No 5-3

METRIC

PROJECT 991-1193			
W.P. 335-98-00	LOCATION N 5063055.70; E 309304.54		ORIGINATED BY SB
DIST 54	HWY 11	BOREHOLE TYPE 108mm I.D. HOLLOW STEM AUGERS	COMPILED BY DKB
DATUM GEODETIC	DATE Jan.26/00		CHECKED BY ASP

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
	— CONTINUED FROM PREVIOUS PAGE —												
	Silty Clay, trace sand Firm to stiff Grey Moist to wet		11	SS	1		297						
							296						
			12	SS	2			40.0		0	1	58	41
294.55							295						
17.83	Sand and Gravel, trace silt, occ. cobbles and/or boulders Compact Brown and grey Wet		13	SS	10		294						
							293						
292.44			14	SS	26/15								
19.94	END OF BOREHOLE Refusal to further auger penetration; probable boulder or bedrock Note: Water level measured in open borehole at 0.9m depth (El. 311.5m) upon completion of drilling.												

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: O UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × REMOULDED — 20 40 60 80 100

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

REMARKS & GRAIN SIZE DISTRIBUTION (%)

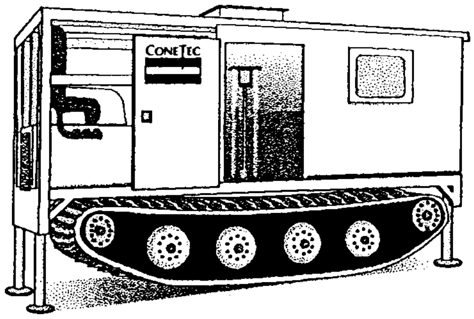
$+^3, \times^3$: Numbers refer to Sensitivity $O^{3\%}$ STRAIN AT FAILURE

APPENDIX D

PIEZOCONE TEST RESULTS

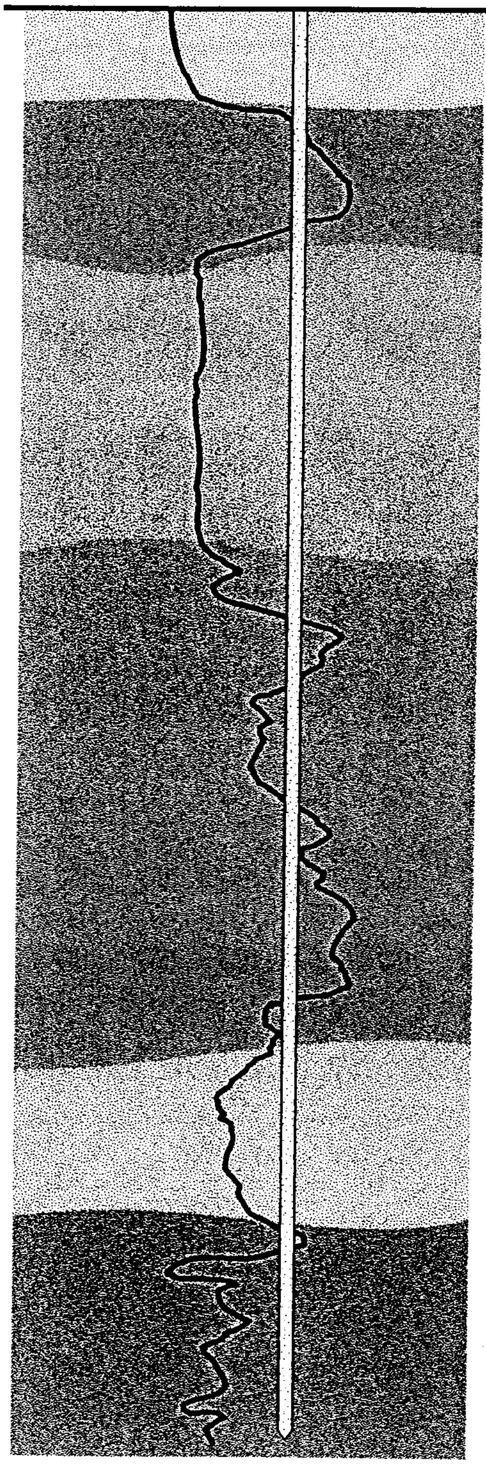
APPENDIX D1

CONETEC REPORT – JULY 2003



CONETEC

Geotechnical and Environmental In Situ Testing Contractors



ConeTec Field Report

Presentation of CPTU Test Results for:

Robins Road / Black Creek Road Highway 11 Interchange Burk's Falls to South River, ON

Presented to: Thurber Engineering

Date: July 30, 2003

Presented by: ConeTec Investigations Ltd.
9113 Shaughnessy Street
Vancouver, BC V6P 6R9
(604) 327-4311

Vancouver • Edmonton • Salt Lake City • New Jersey • Denver • Los Angeles • San Francisco • Houston • Hong Kong

PRESENTATION OF IN SITU TESTING PROGRAM RESULTS

Robins Road / Black Creek Road Interchange
Highway 11, Burk's Falls to South River, ON

July 23rd and 24th, 2003

Prepared for:

Thurber Engineering Ltd.
Oakville, Ontario

Prepared by:

ConeTec Investigations Limited
Vancouver, BC

July 30, 2003

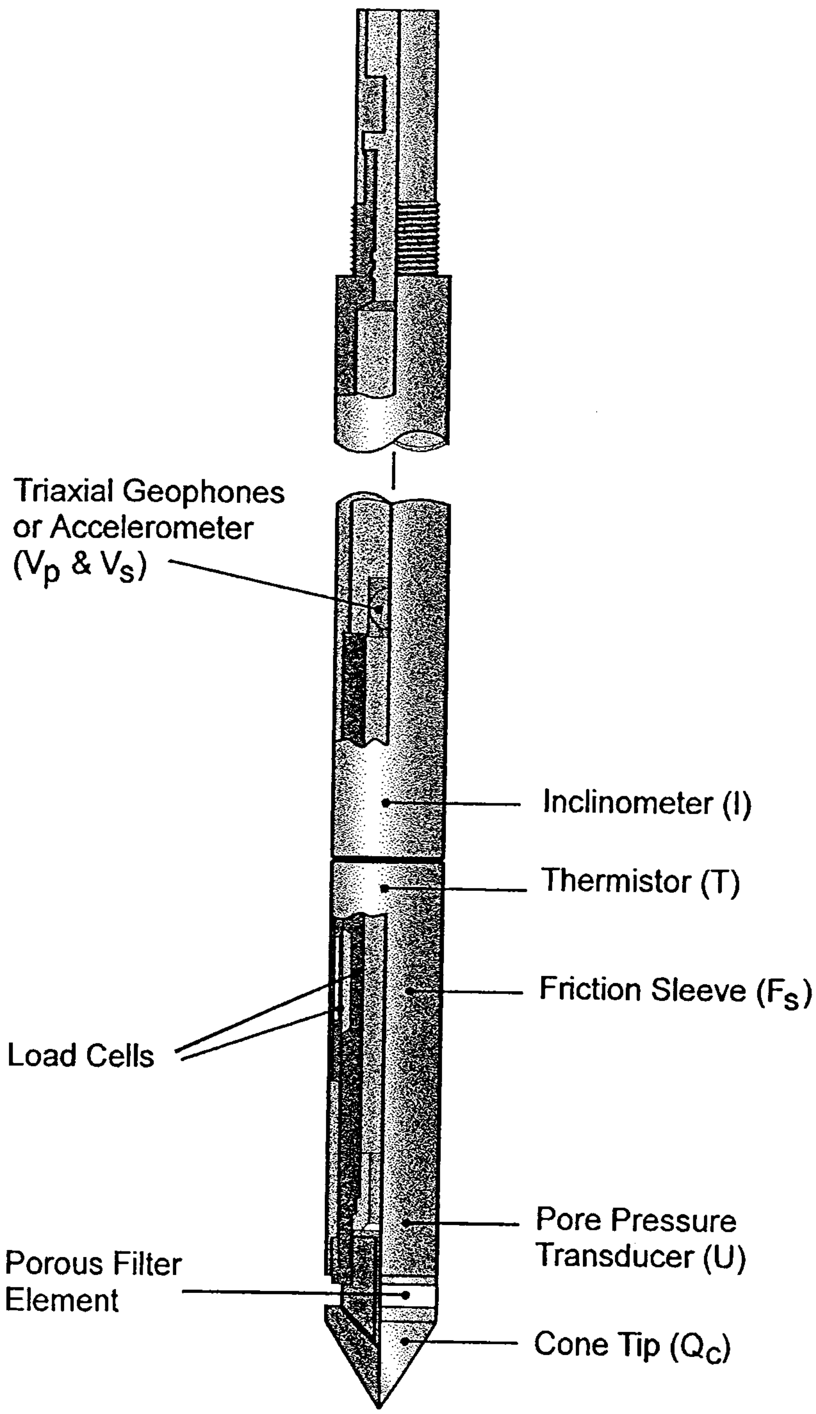


Figure 1 – Typical Cone Penetrometer

2.2 PORE PRESSURE DISSIPATION TESTS

When cone penetration is stopped, the piezo cone essentially becomes a piezometer. While stopped, pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file (.ppd). Dissipation data can then be plotted onto a dissipation curve consisting of pore water pressure (U) verses time (t). The shapes of dissipation curves are very useful in evaluating soil type, drainage and in situ static water level. A list of dissipation tests and depths in which they were performed can be found in Table 2.

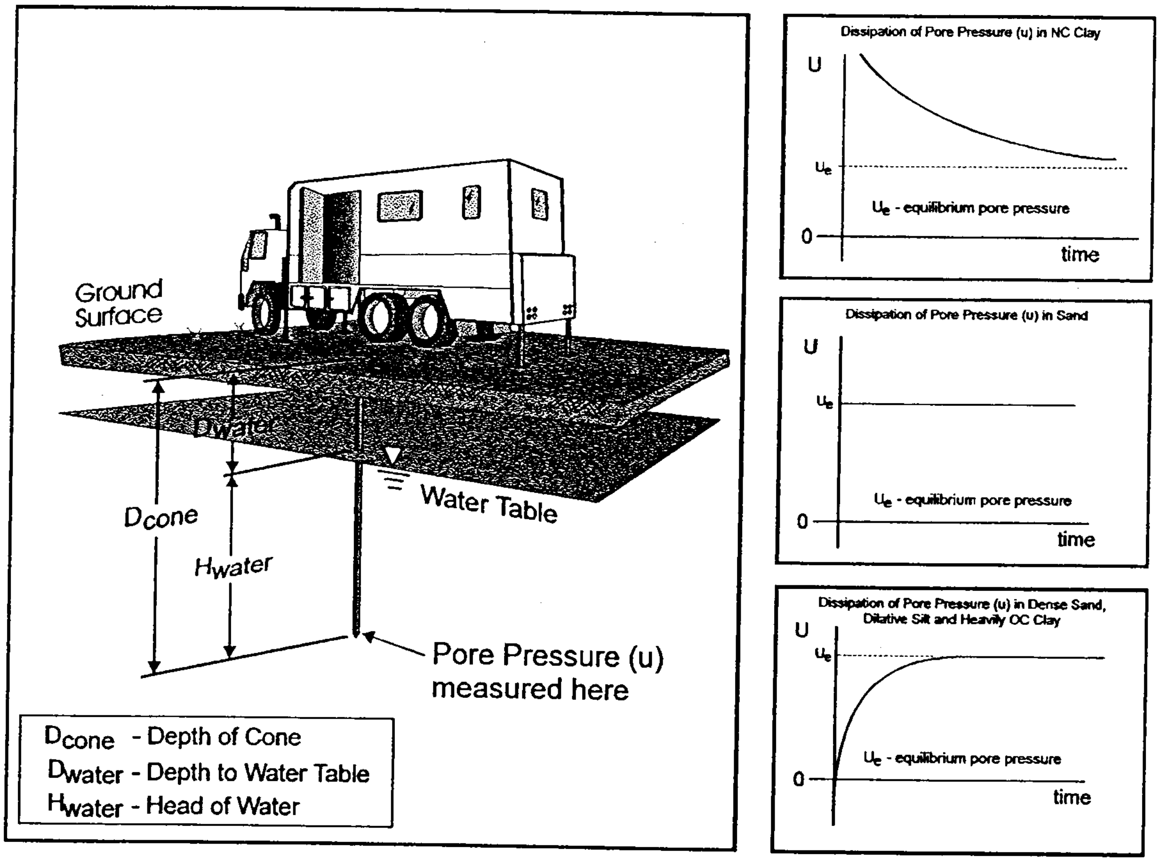
A flat curve that stabilizes quickly (i.e. less than 30 seconds) is typical of a free draining sand. In this case, the final measured pore water pressure is the static in situ water pressure.

Soils that generate excess dynamic pore water pressure during penetration will dissipate this excess pressure when penetration stops. The shape of the dissipation curve and the time of dissipation can be used to estimate C_h, the coefficient of consolidation that can in turn be used to calculate K_h, the horizontal permeability.

Figure 2 shows some idealized shapes of various pore water pressure dissipation curves.

The reader is referred Robertson et. al., 1990 to reference dissipation test data analytical techniques.

Estimation of Ground Water Table from CPT Dissipation Tests



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors:
1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

FIGURE 2 - TYPICAL DISSIPATION TESTS

ConeTec Investigations Limited

3.0 CONE PENETRATION TEST DATA AND INTERPRETATION

3.1 ANALYSIS OF PIEZOCONE DATA - GENERAL

A total of eight CPTU soundings at eight locations, involving 184.84 meters of testing, were completed.

The interpretation of cone data is based on the relationship between cone bearing, Qc, sleeve friction, Fs, and penetration pore water pressure, U. The friction ratio, Rf , (sleeve friction divided by cone bearing) is a calculated parameter which is used to infer soil behavior type. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

The interpretation of soils encountered on this project was carried out using correlations developed by Robertson et al., 1986. It should be noted that it is not always possible to clearly identify a soil type based on Qc, Fs and Ut. Occasionally soils will fall within different soil categories on the classification charts. In these situations, experience and judgment and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type. Computer tabulations of the interpreted soil types along with certain other geotechnical parameters for each cone hole is presented in Appendix C.

Each of the parameters measured in the sounding is discussed briefly below. A detailed explanation of CPTU testing and interpretation of the results can be found in "Guidelines for Geotechnical Design Using CPT and CPTU" by P. K. Robertson and R. G. Campanella, listed in the references.

TIP RESISTANCE (Q_c): The resistance to penetration, measured at the cone tip, provides an accurate profile of subsurface strata. The recorded tip resistance is a composite of the penetration resistance of the soils located five to ten cone diameters (7 to 14 inches) in front of and behind the tip. The actual resistance "sensed" by the tip depends on the soil properties and on the relative stiffness of the layers encountered. Tip resistance is often corrected for pore pressure effects when testing in soft saturated cohesive soils.

For this project the correction was made and the tip resistance shown, Q_t is the corrected tip resistance.

The correction used is: $Q_t = Q_c + (1+a)U$

Where:
Q_t = corrected tip resistance
Q_c = measured tip resistance
a = net area ratio for cone (0.85 for this project)

U = dynamic pore water pressure measured behind tip

SLEEVE FRICTION (F_s) The resistance recorded on the friction sleeve, is a measure of the remolded strength of the soil. Values of sleeve friction in very soft soils (such as peat) may fluctuate due to the measured force being small relative to the capacity of the measuring load cell.

FRICTION RATIO (R_f) The ratio of sleeve friction to tip resistance expressed as a percentage, is an indicator of soil type. Cohesive soils generally have friction ratios that are greater than two, while sands and non-plastic silts have friction ratios that are lower than two.

PORE PRESSURE (U) Dynamic pore water pressure is measured during penetration. (dynamic pore water pressure data can be found in the .cor, .ifi (importable) and .ifp (printable) files). Static pore water pressure is measured when cone penetration is stopped (static pore water pressure data can be found in the .ppd files). The measured dynamic pore water pressure changes with the location of the porous filter and negative readings are possible when the filter is located behind the tip.

It is important to note that the CPTU classifies soil by physical behavior, not by grain size, therefore, the CPTU classification should be verified against samples obtained from a conventional drilling program. While the CPTU soil classification may not always be accurate in terms of the actual label it applies to a particular soil, it is very accurate in grouping soils with similar mechanical properties.

Table 1 presents a summary of CPTU soundings, including sounding depths.

3.2 CONE PLOTS

The data from each sounding was plotted using the computer program ScreenZ. The plots are included in Appendix A and Appendix B (full scale plots). ScreenZ was developed by ConeTec and it incorporates soil behavior type (SBT) classification as part of the plot. The soil classification is based on the classification chart reproduced chart in Appendix C.

3.3 PORE PRESSURE DISSIPATION TEST RESULTS

When conducting CPTU investigations, pore water pressure dissipations are automatically recorded during pauses in penetration. The pore water pressure data is recorded at five second intervals. Dissipations were conducted at depths selected by Thurber personnel (Mr. Paulo Branco). Dissipations conducted within the softer clayey stratum were performed in order to estimate consolidation parameters. Dissipations conducted at the bottoms of each sounding were performed to determine whether equilibrium or excess pore pressures exist. The highest artesian pore pressures were observed at refusal in CPTU's 1 and 7.

The pore pressure dissipation data for each CPTU is included on the data disk. A summary of the dissipation tests that were performed is included in Table 2. Plots of these dissipation tests are presented in Appendix D.

4.0 REFERENCES

Robertson, P.K. and Campananella, R.G., 1989, "Guidelines for Geotechnical Design using CPT and CPTU", Soil Mechanics Series No. 120, The University of British Columbia.

Robertson, P.K., Sully, J., Woeller, D.G., Lunne, T., Powell, J.M., and Gillespie, D.J., 1990, "Guidelines for Interpretation of CPTU Test Data for determination of consolidation and permeability Parameters for Soils, Report prepared by ConeTec Investigations Ltd. for Energy Mines and Resources, Contract No. 23420-9-m644/01-OSC (copies available from ConeTec).

TABLE 1 - SUMMARY OF CPTU SOUNDINGS

ConeTec Investigations Limited
Job No.: 03-745
Location: Robins Road / Black Creek Road, Highway 11 Interchange - Burk's Falls to South River, ON
Client: Thurber Engineering
Date: July 23rd and 24th, 2003

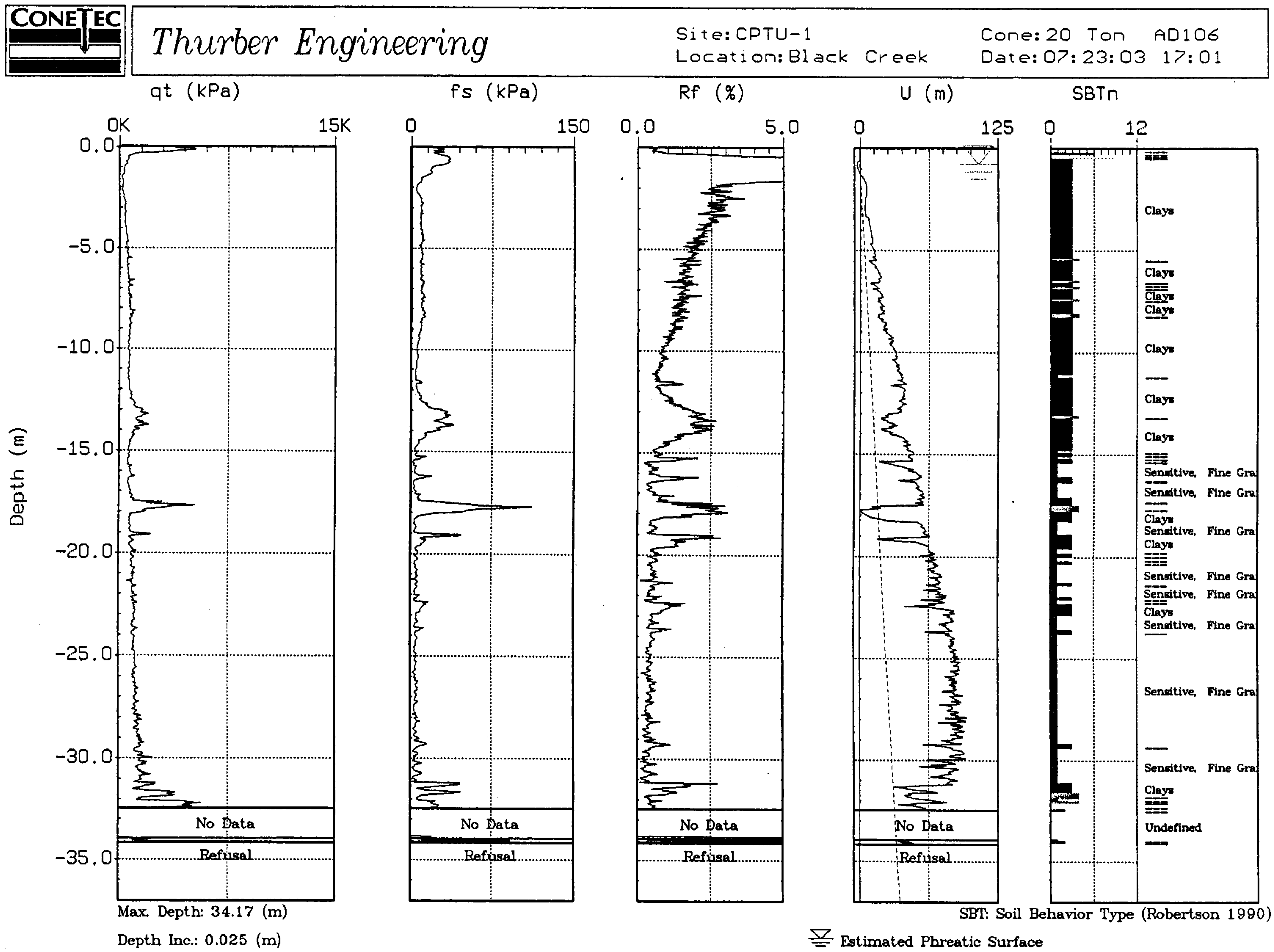
Date	CPTU Sounding	File Name	Total Depth (m)
23-Jul-03	CPTU-1	745CP001.COR	34.17
24-Jul-03	CPTU-2	745CP002.COR	29.10
24-Jul-03	CPTU-3	745CP003.COR	20.45
23-Jul-03	CPTU-4	745CP004.COR	9.43
23-Jul-03	CPTU-5	745CP005.COR	17.52
23-Jul-03	CPTU-6	745CP006.COR	4.32
24-Jul-03	CPTU-7	745CP007.COR	36.60
24-Jul-03	CPTU-8	745CP008.COR	33.25
		8	184.84

TABLE 2 - SUMMARY OF PORE PRESSURE DISSIPATION TESTS

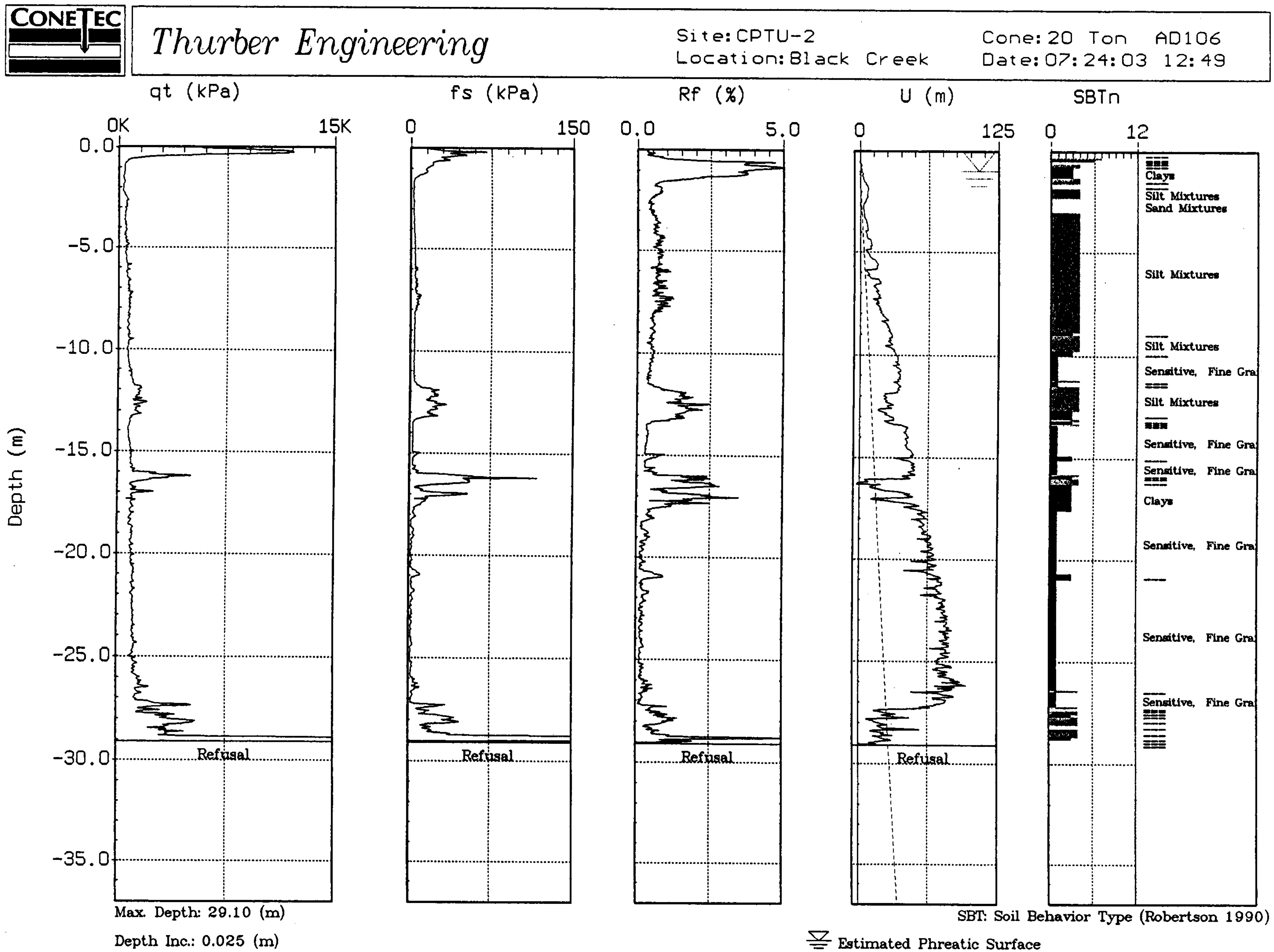
ConeTec Investigations Limited
Job No.: 03-745
Location: Robins Road / Black Creek Road, Highway 11 Interchange - Burk's Falls to South River, ON
Client: Thurber Engineering
Date: July 23rd and 24th, 2003

Date	CPTU Sounding	Pore Water Pressure Diss. Test Depth (m)	SBT	SBT Zone Text	Pore Water Pressure Diss. Tests (sec)	Est. Water Table Depth (m)	Water Table Depth Used in Data (m)	Est. t_{50} (sec)	Est. C_h (cm^2 /min)	U max (m)
23-Jul-03	CPTU-1	15.32	1	Sensitive Fines	2,000		0.8	395	1.81	48.7
		31.27	6	Sandy Silt to Clayey Silt	265		0.8	60	11.89	70.2
		32.45	8	Sand to Silty Sand	1,355	-0.5				
		34.18	5	Clayey Silt to Silty Clay	375	0.1				
23-Jul-03	CPTU-2	16.35	6	Sandy Silt to Clayey Silt	1,275		1.0	424	1.69	37.9
		29.12	10	Gravelly Sand to Sand	240	0.0				
23-Jul-03	CPTU-3	6.30	1	Sensitive Fines	1,800		1.1	235	3.04	22.1
		10.80	1	Sensitive Fines	3,635		1.1	546	1.31	34.3
		15.32	5	Clayey Silt to Silty Clay	8,030		1.1	400	1.79	59.9
		20.45	9	Sand	335	-0.1				
23-Jul-03	CPTU-4	2.33	7	Silty Sand to Sandy Silt	530		0.5	219	3.27	10.3
		6.35	4	Silty Clay to Clay	1,805		0.5	261	2.75	47.8
		9.30	10	Gravelly Sand to Sand	800	0.5				
23-Jul-03	CPTU-5	5.38	5	Clayey Silt to Silty Clay	3,625		0.8	368	1.94	44.4
		12.25	5	Clayey Silt to Silty Clay	3,705		0.8	137	5.21	46.6
		17.52	10	Gravelly Sand to Sand	560	0.8				
23-Jul-03	CPTU-6	4.33	9	Sand	1,120	1.8				
23-Jul-03	CPTU-7	10.35	5	Clayey Silt to Silty Clay	1,400		0.8	316.0	2.27	29.4
		20.30	5	Clayey Silt to Silty Clay	1,600		0.8	320.0	2.24	66.2
		36.60	7	Silty Sand to Sandy Silt	225	-0.4				
23-Jul-03	CPTU-8	33.20	7	Silty Sand to Sandy Silt	330	-0.1				
					35,010					
					9.7	hours				

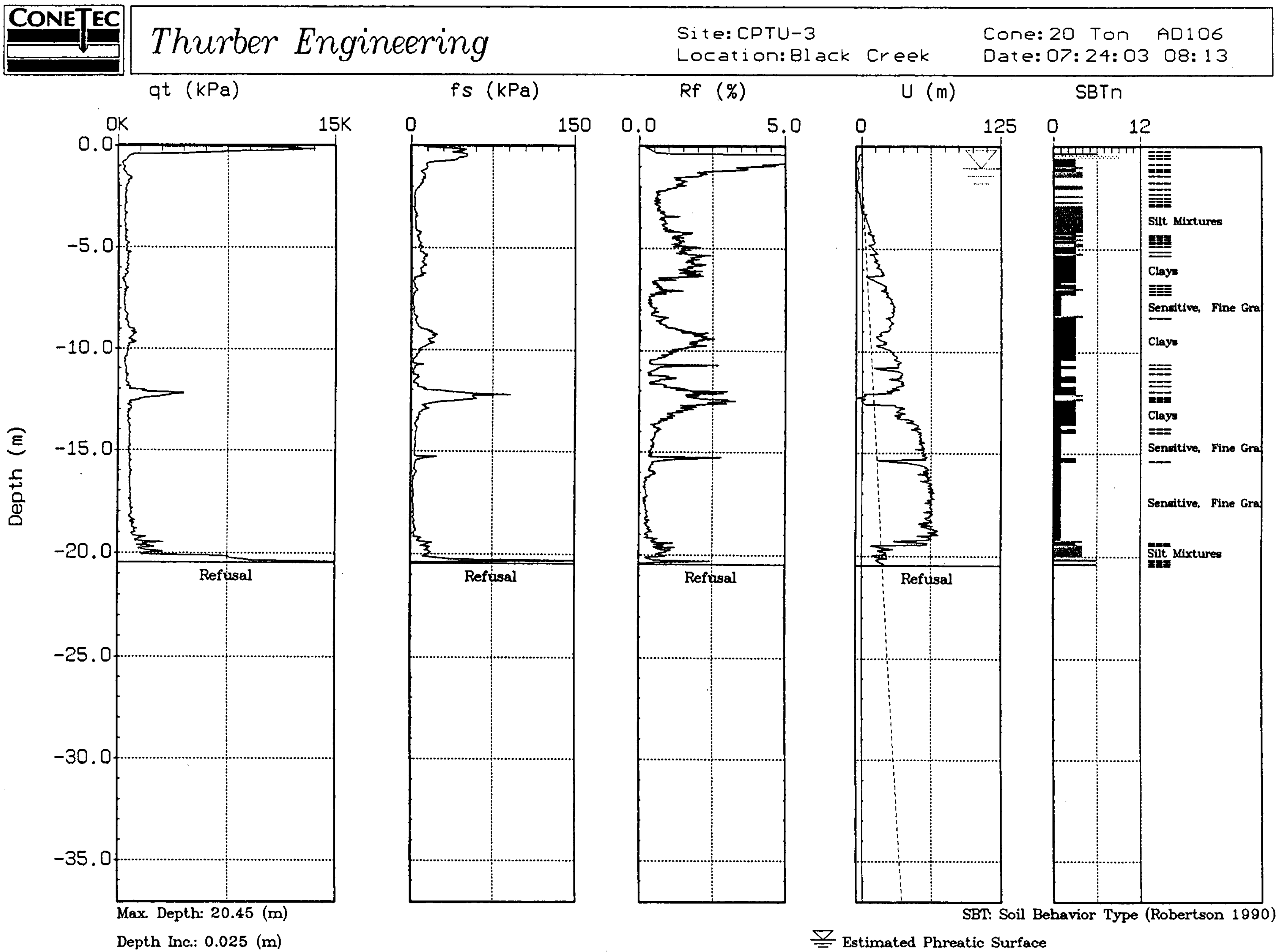
Note: Water table depths used for estimating Ch and t50 calculations provided by Thurber Engineering.



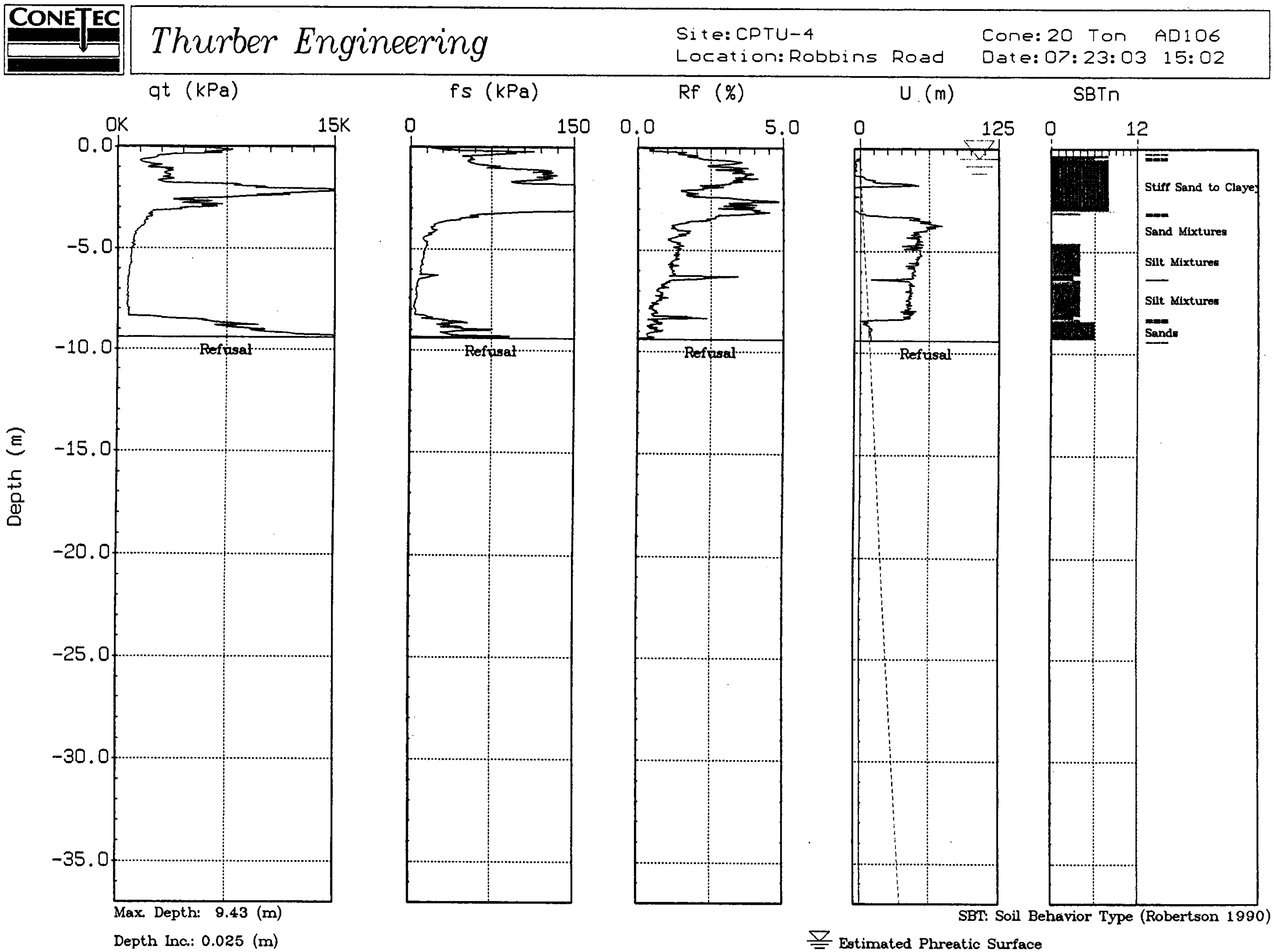
CONETEC
Thurber Engineering
Site: CPTU-1
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:23:03 17:01
qt (kPa)
fs (kPa)
Rf (%)
U (m)
SBTn
0K
15K
0
150
0.0
5.0
0
125
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Clays
Sensitive, Fine Gra
Undefined
No Data
Refusal
Max. Depth: 34.17 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface



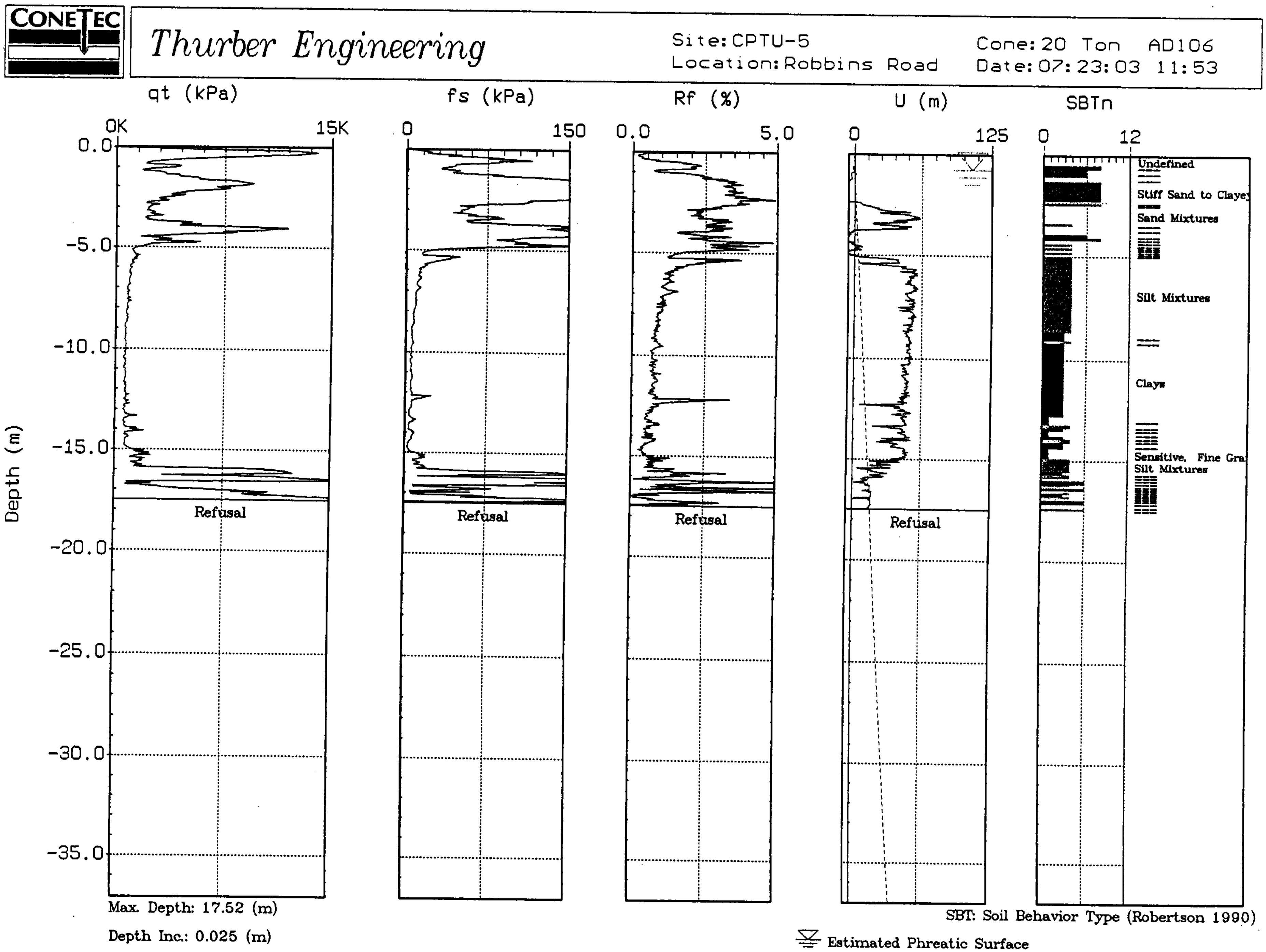
CONETEC
Thurber Engineering
Site: CPTU-2
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:24:03 12:49
qt (kPa)
fs (kPa)
Rf (%)
U (m)
SBTn
Depth (m)
Clays
Silt Mixtures
Sand Mixtures
Sensitive, Fine Gra
Refusal
Max. Depth: 29.10 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface



CONETEC
Thurber Engineering
Site: CPTU-3
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:24:03 08:13
qt (kPa)
fs (kPa)
Rf (%)
U (m)
SBTn
0K
15K
0
150
0.0
5.0
0
125
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Silt Mixtures
Clays
Sensitive, Fine Gra
Clays
Clays
Sensitive, Fine Gra
Sensitive, Fine Gra
Silt Mixtures
Refusal
Refusal
Refusal
Refusal
Max. Depth: 20.45 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface



CONETEC
Thurber Engineering
Site: CPTU-4
Location: Robbins Road
Cone: 20 Ton AD106
Date: 07:23:03 15:02
qt (kPa)
0K
15K
fs (kPa)
0
150
Rf (%)
0.0
5.0
U (m)
0
125
SBTn
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Refusal
Refusal
Refusal
Refusal
Stiff Sand to Claye
Sand Mixtures
Silt Mixtures
Silt Mixtures
Sands
Max. Depth: 9.43 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

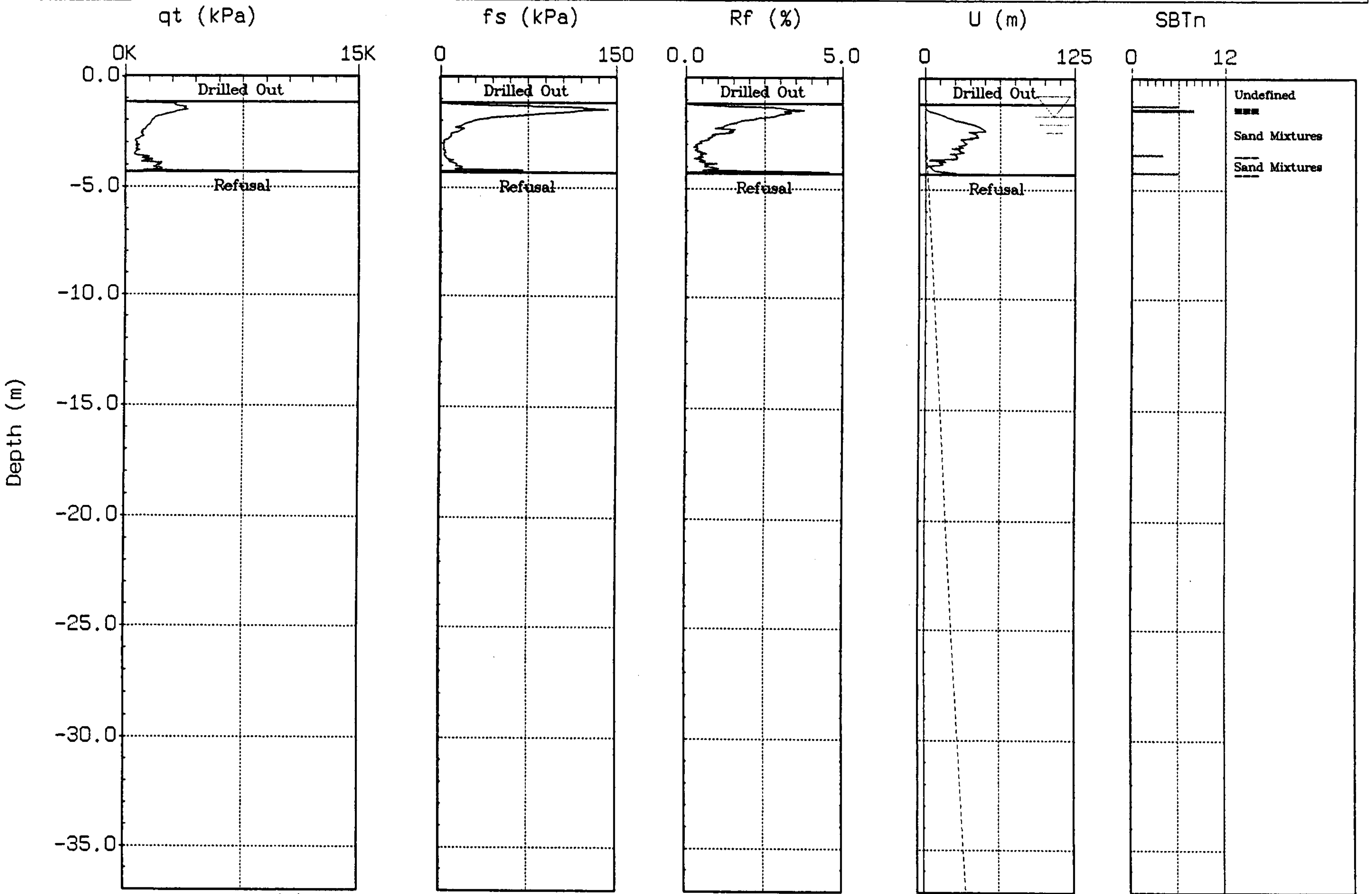

CONETEC
Thurber Engineering
Site: CPTU-5
Location: Robbins Road
Cone: 20 Ton AD106
Date: 07:23:03 11:53
qt (kPa)
fs (kPa)
Rf (%)
U (m)
SBTn
0K
15K
0
150
0.0
5.0
0
125
0
12
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Depth (m)
Refusal
Refusal
Refusal
Refusal
Undefined
Stiff Sand to Clayey
Sand Mixtures
Silt Mixtures
Clays
Sensitive, Fine Gra
Silt Mixtures
Max. Depth: 17.52 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

CONETEC

Thurber Engineering

Site: CPTU-6
Location: Robins Road

Cone: 20 Ton AD106
Date: 07:23:03 10:44

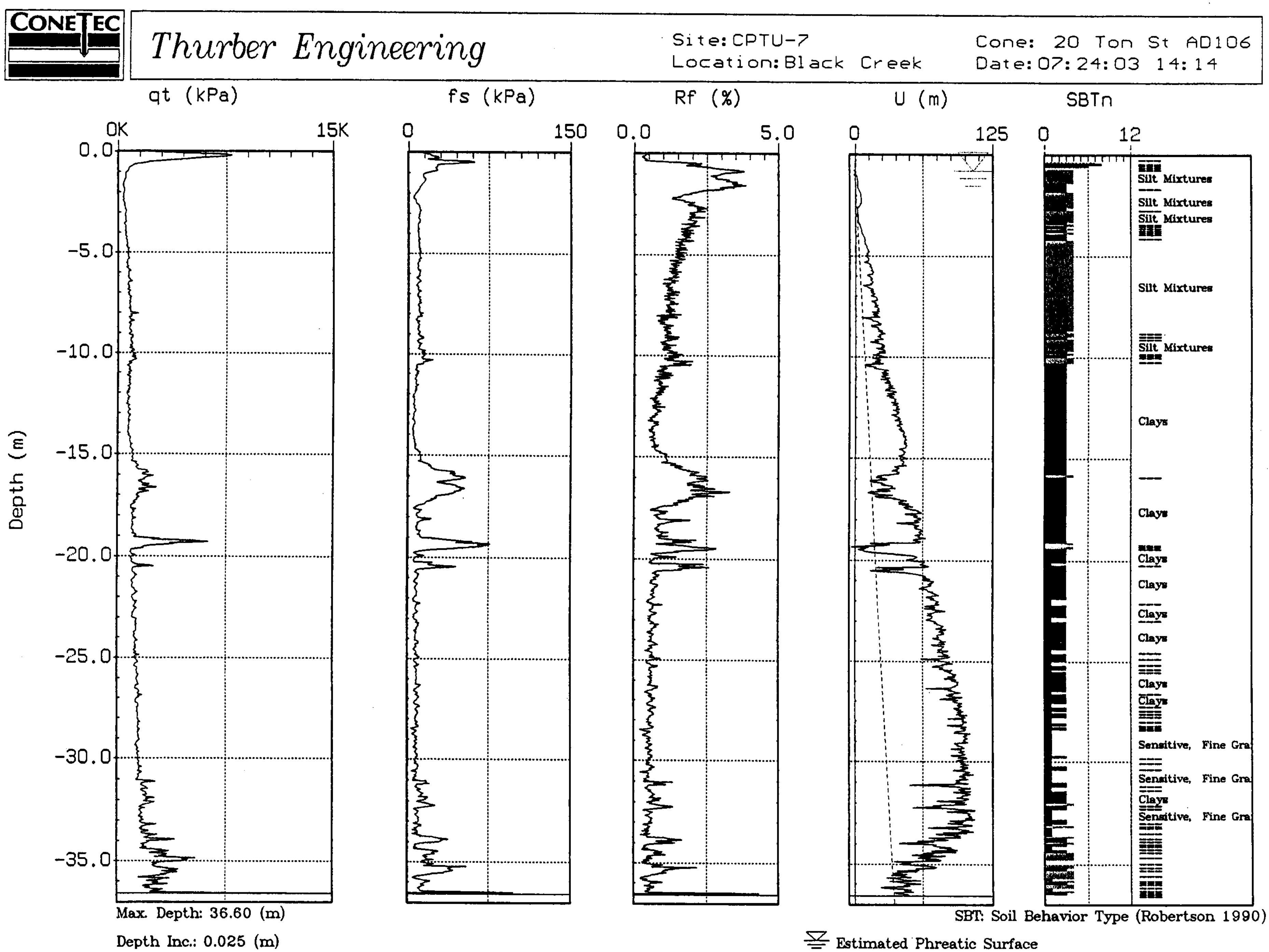


Max. Depth: 4.32 (m)

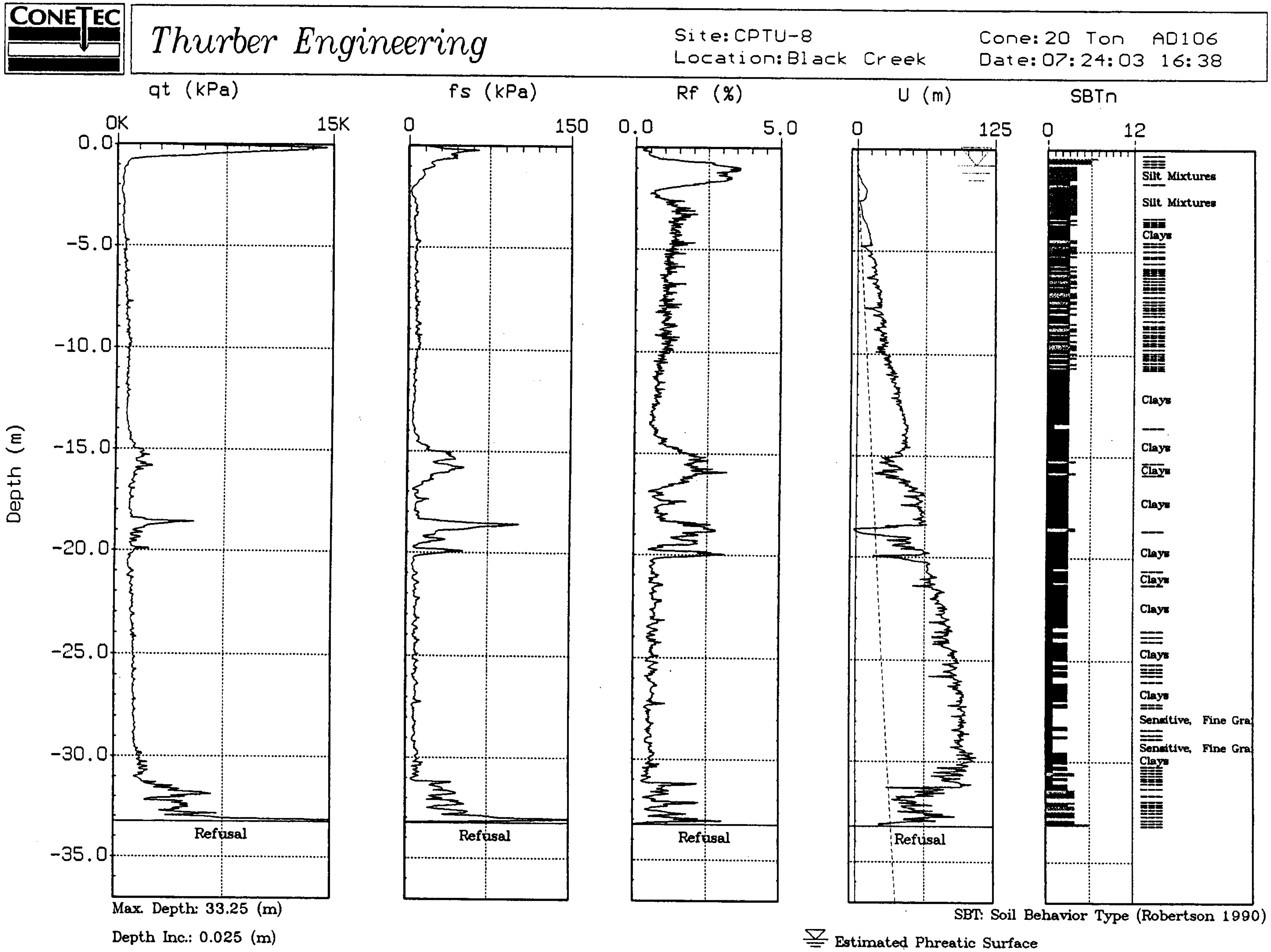
Depth Inc.: 0.025 (m)

SBT: Soil Behavior Type (Robertson 1990)

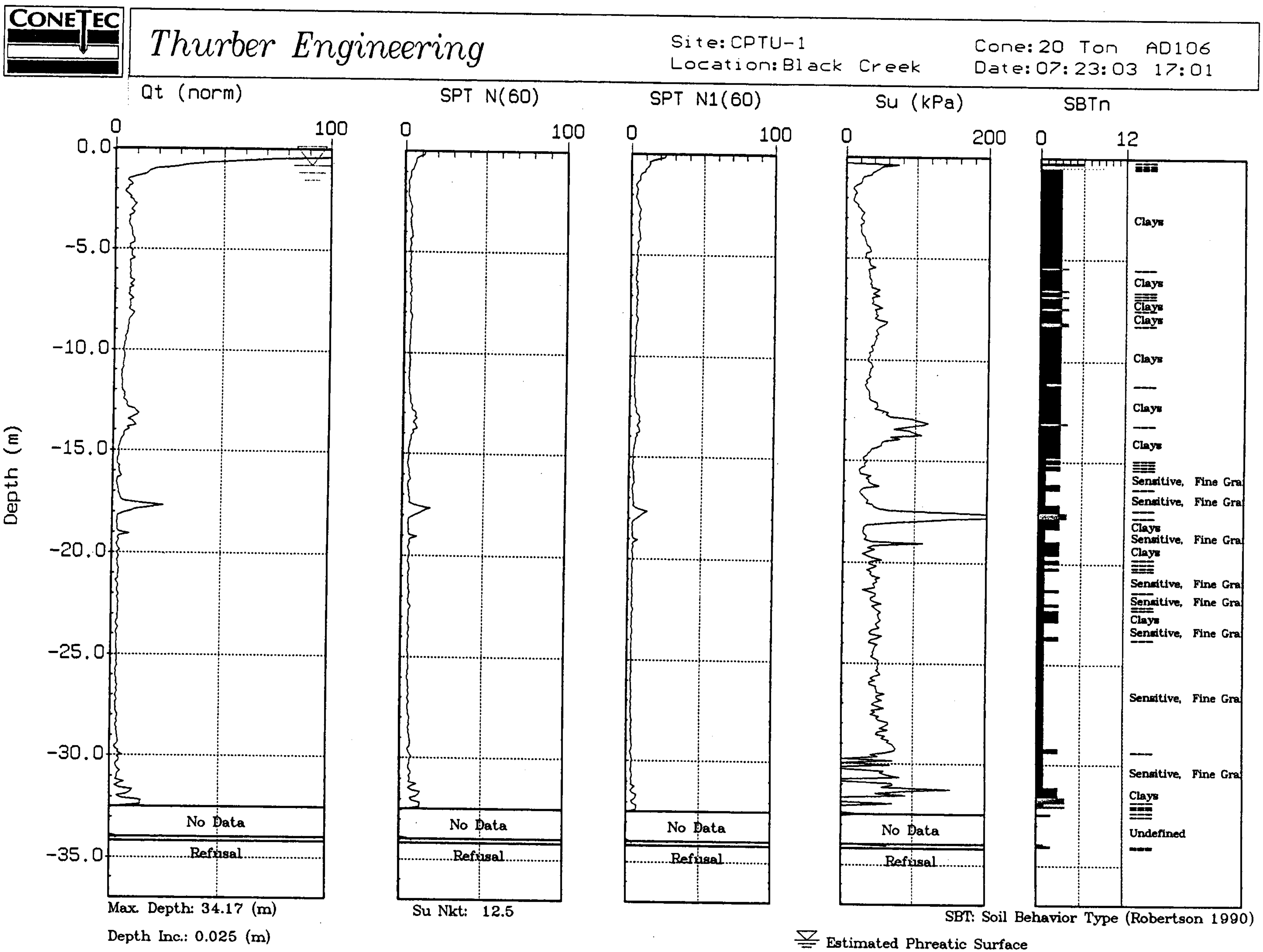
Estimated Phreatic Surface

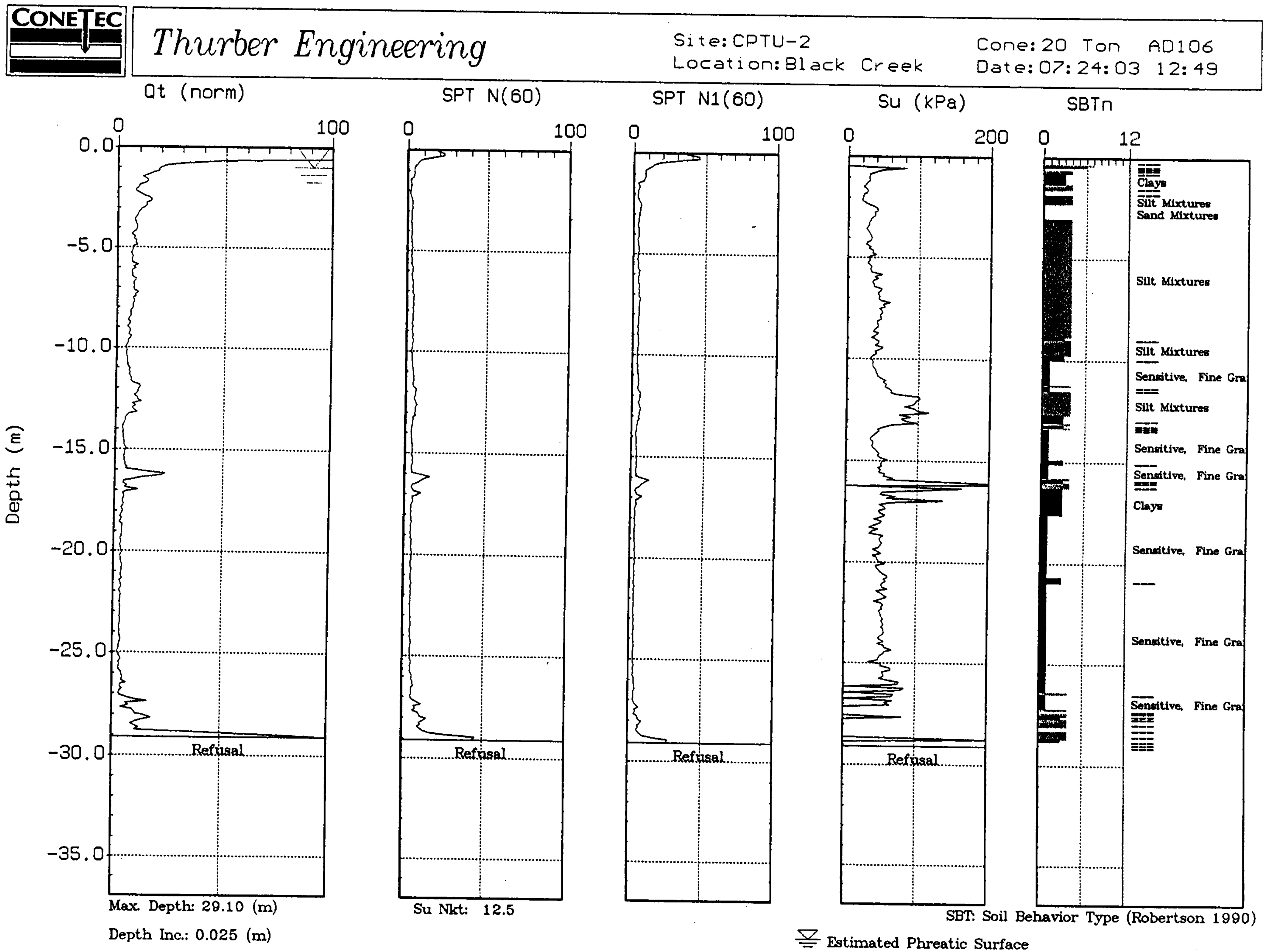


CONETEC
Thurber Engineering
Site: CPTU-7
Location: Black Creek
Cone: 20 Ton St AD106
Date: 07:24:03 14:14
qt (kPa)
0K
15K
fs (kPa)
0
150
Rf (%)
0.0
5.0
U (m)
0
125
SBTn
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Silt Mixtures
Silt Mixtures
Silt Mixtures
Silt Mixtures
Silt Mixtures
Clays
Clays
Clays
Clays
Clays
Clays
Clays
Clays
Sensitive, Fine Gra
Sensitive, Fine Gra
Clays
Sensitive, Fine Gra
Max. Depth: 36.60 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface



CONETEC
Thurber Engineering
Site: CPTU-8
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:24:03 16:38
qt (kPa)
fs (kPa)
Rf (%)
U (m)
SBTn
0K
15K
0
150
0.0
5.0
0
125
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Refusal
Silt Mixtures
Silt Mixtures
Clays
Sensitive, Fine Gra
Max. Depth: 33.25 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface


CONETEC
Thurber Engineering
Site: CPTU-1
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:23:03 17:01
Qt (norm)
SPT N(60)
SPT N1(60)
Su (kPa)
SBTn
Depth (m)
No Data
Refusal
Clays
Sensitive, Fine Gra
Undefined
Max. Depth: 34.17 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 12.5
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

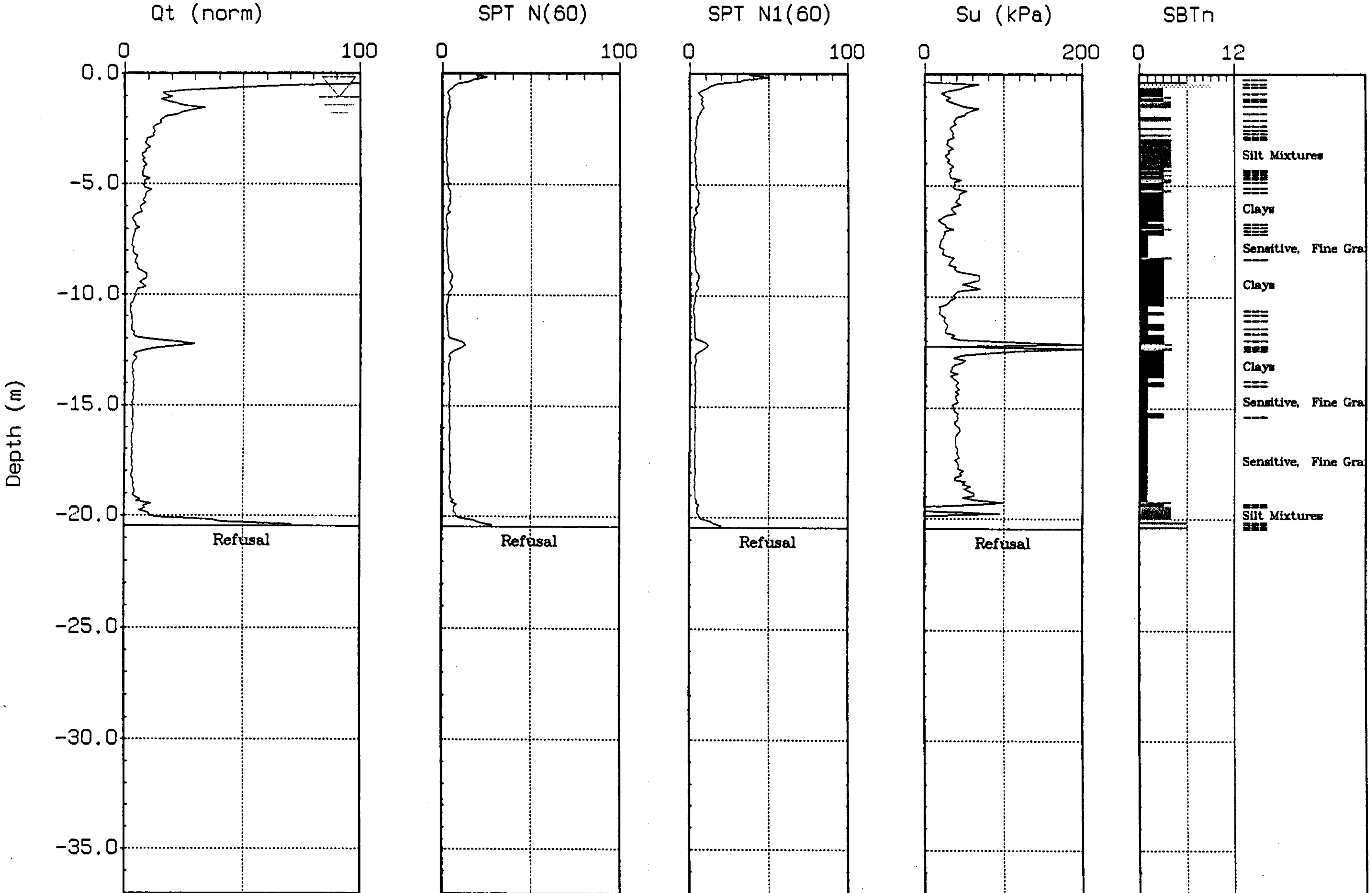

CONETEC
Thurber Engineering
Site: CPTU-2
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:24:03 12:49
Qt (norm)
SPT N(60)
SPT N1(60)
Su (kPa)
SBTn
Depth (m)
Refusal
Clays
Silt Mixtures
Sand Mixtures
Sensitive, Fine Gra
Max. Depth: 29.10 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 12.5
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

CONETEC

Thurber Engineering

Site: CPTU-3
Location: Black Creek

Cone: 20 Ton AD106
Date: 07:24:03 08:13



Max. Depth: 20.45 (m)

Depth Inc.: 0.025 (m)

Su Nkt: 12.5

SBT: Soil Behavior Type (Robertson 1990)

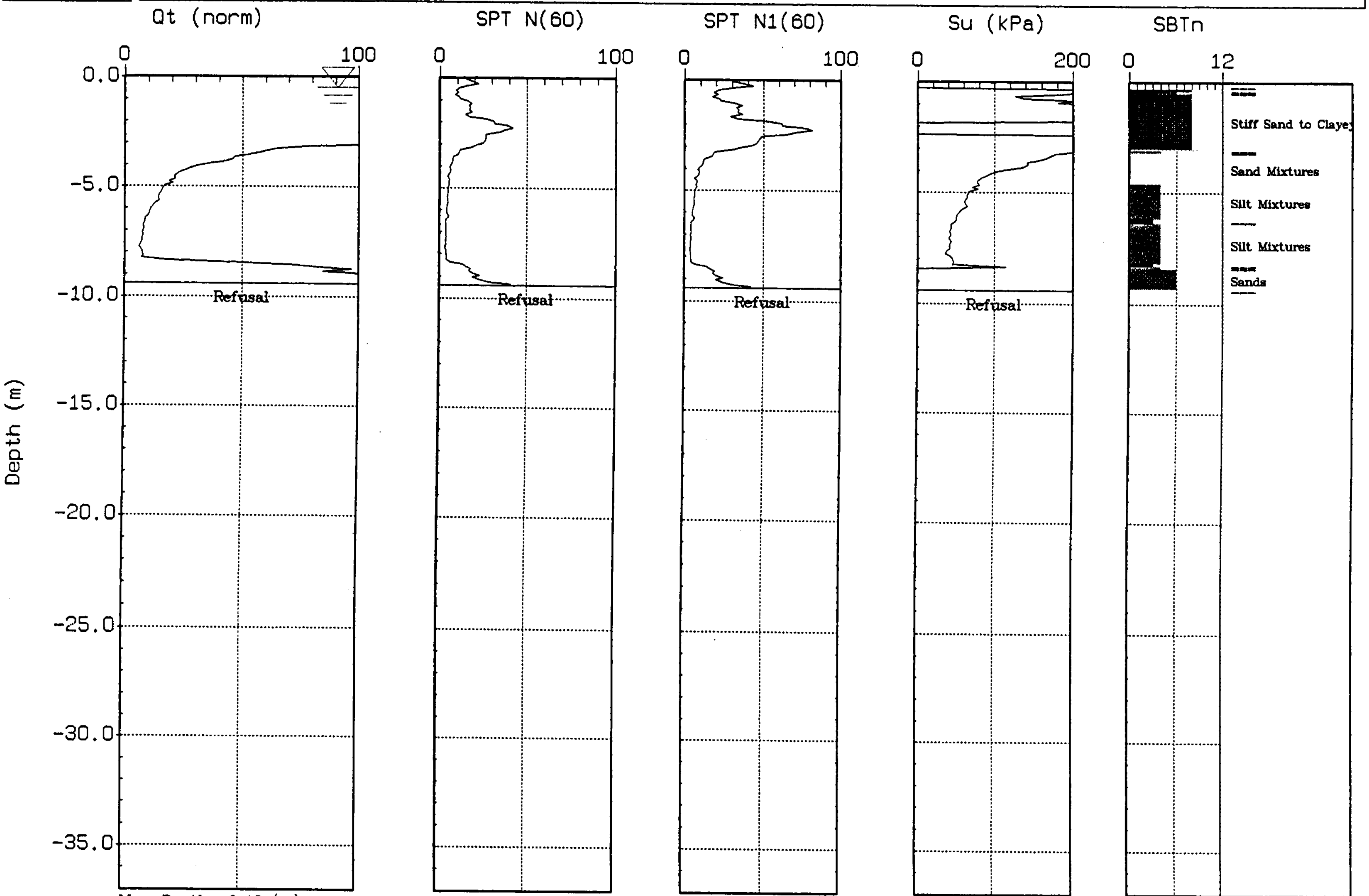
Estimated Phreatic Surface

CONETEC

Thurber Engineering

Site: CPTU-4
Location: Robbins Road

Cone: 20 Ton AD106
Date: 07:23:03 15:02



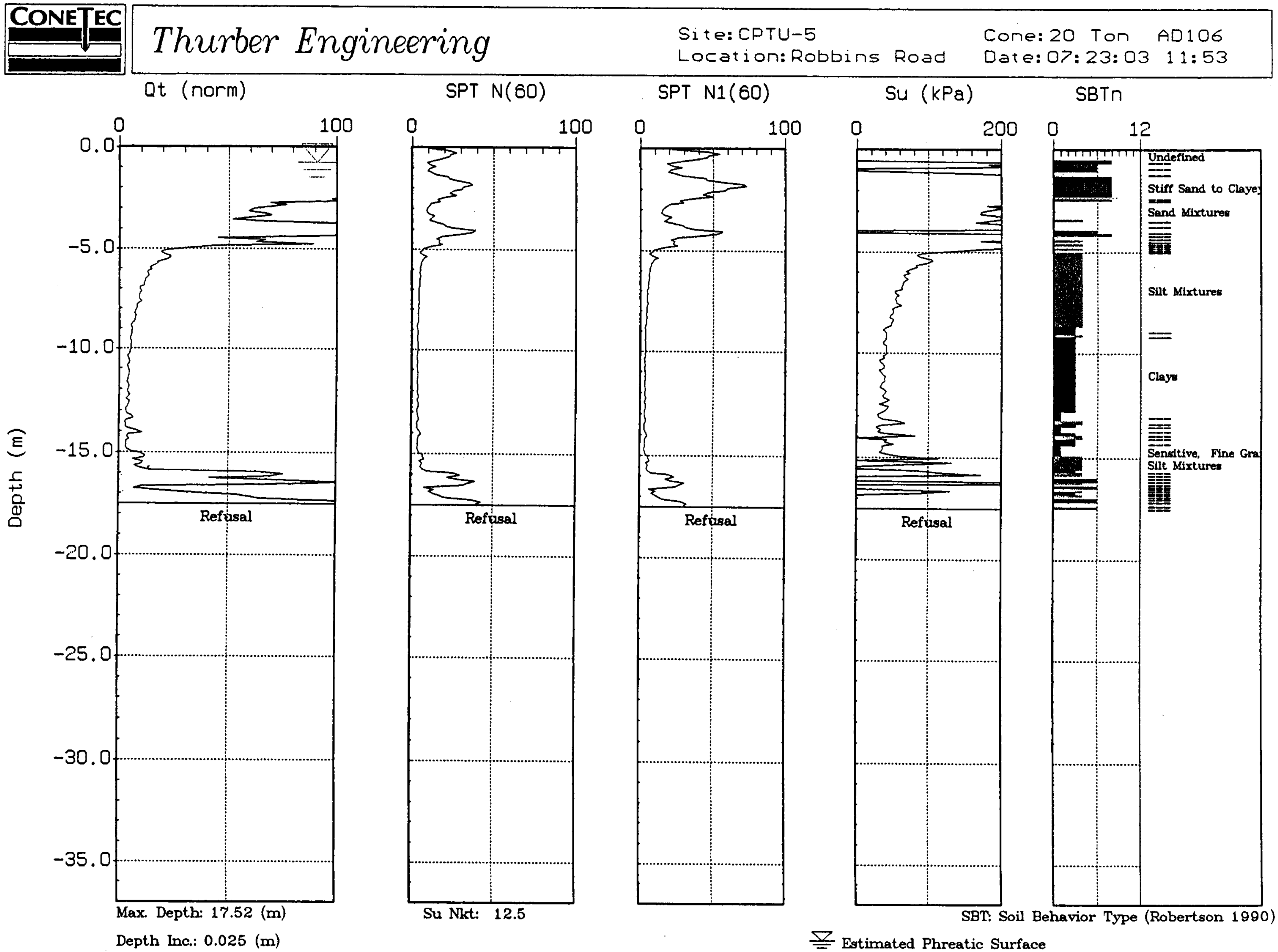
Max. Depth: 9.43 (m)

Depth Inc.: 0.025 (m)

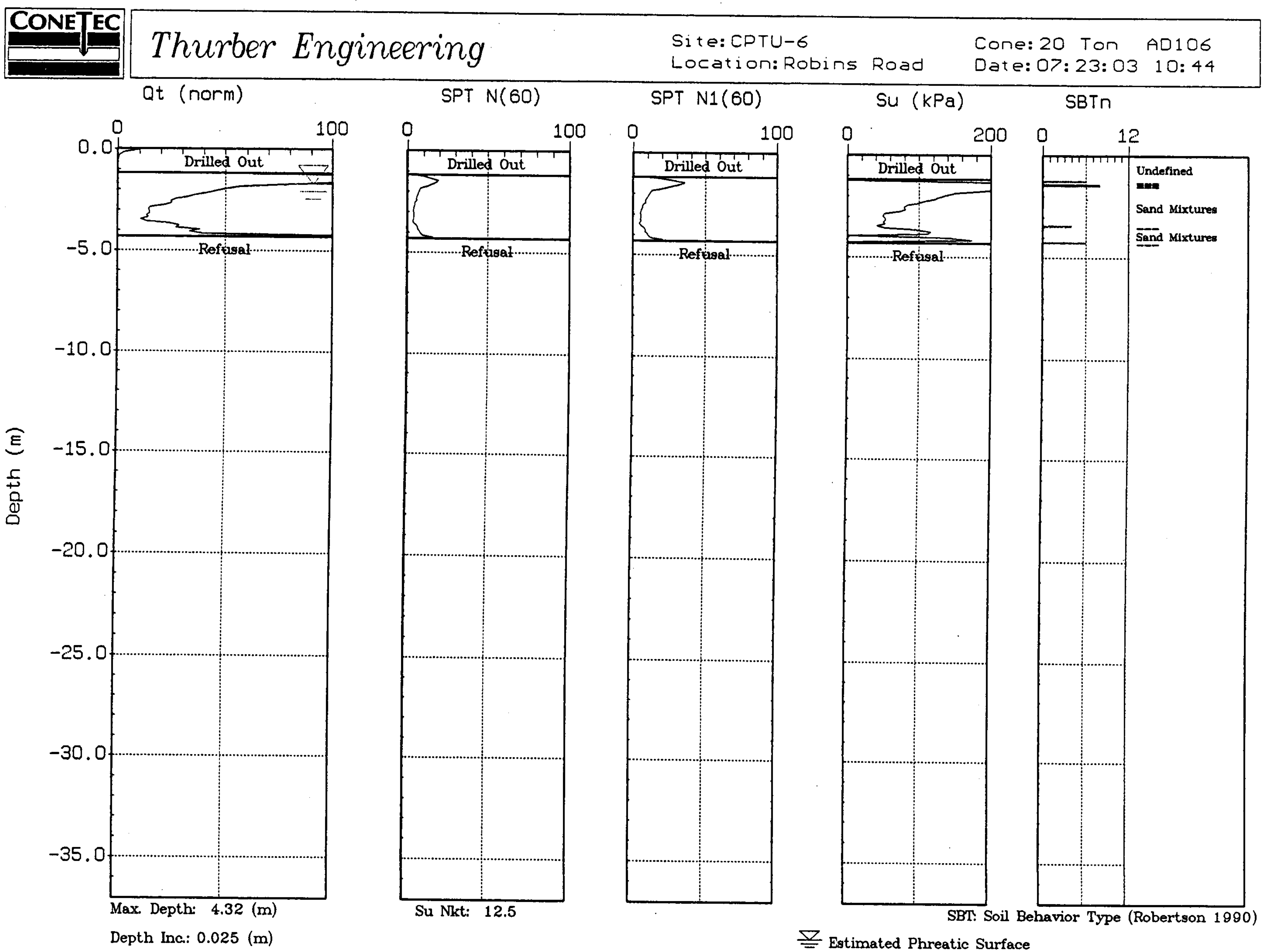
Su Nkt: 12.5

SBT: Soil Behavior Type (Robertson 1990)

Estimated Phreatic Surface



CONETEC
Thurber Engineering
Site: CPTU-5
Location: Robbins Road
Cone: 20 Ton AD106
Date: 07:23:03 11:53
Qt (norm)
SPT N(60)
SPT N1(60)
Su (kPa)
SBTn
0
100
200
12
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
Depth (m)
Refusal
Undefined
Stiff Sand to Clayey
Sand Mixtures
Silt Mixtures
Clays
Sensitive, Fine Gra
Silt Mixtures
Max. Depth: 17.52 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 12.5
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

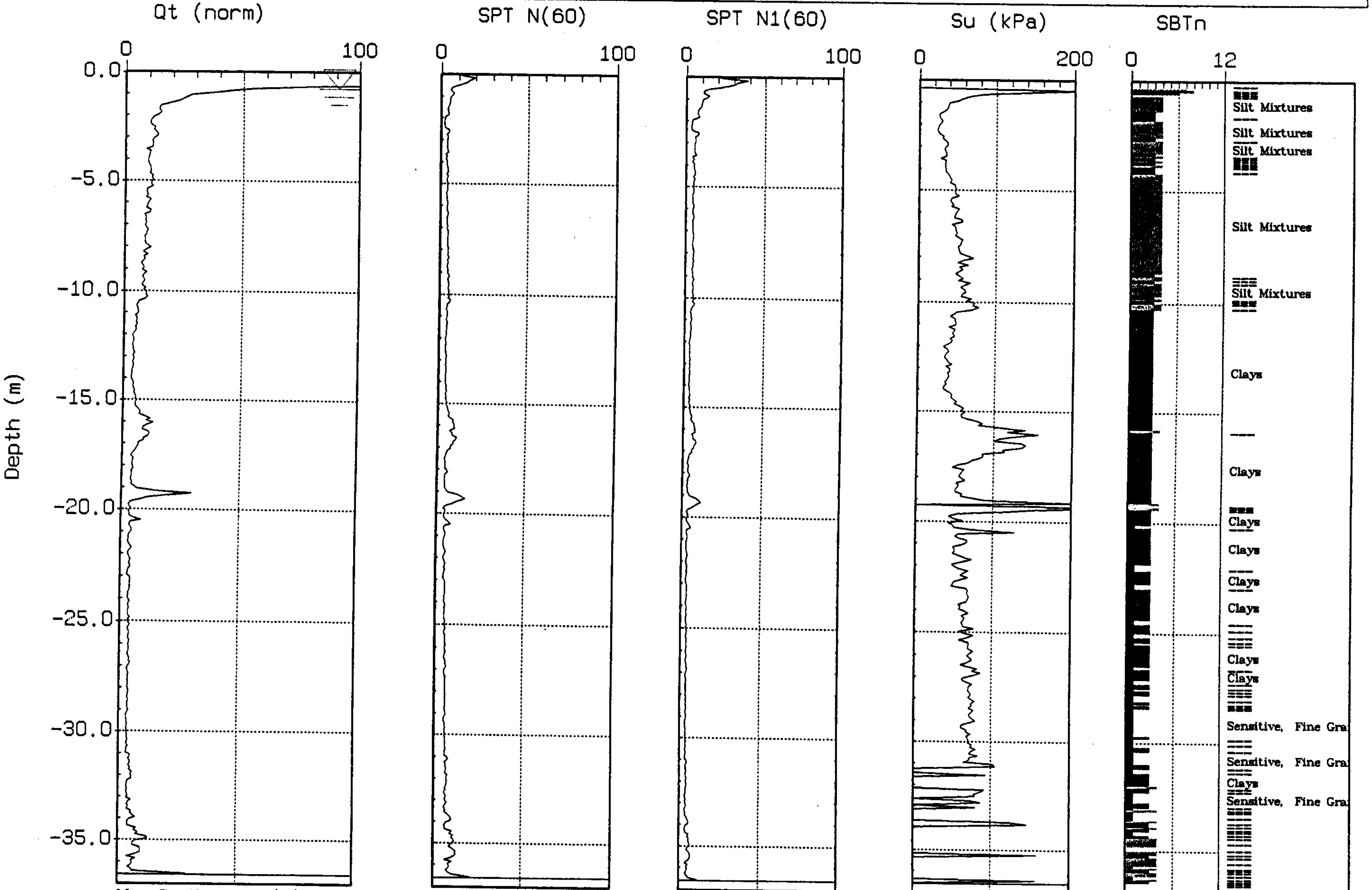


CONETEC
Thurber Engineering
Site: CPTU-6
Location: Robins Road
Cone: 20 Ton AD106
Date: 07:23:03 10:44
Qt (norm)
SPT N(60)
SPT N1(60)
Su (kPa)
SBTn
Depth (m)
Drilled Out
Refusal
Undefined
Sand Mixtures
Sand Mixtures
Max. Depth: 4.32 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 12.5
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

Thurber Engineering

Site: CPTU-7
Location: Black Creek

Cone: 20 Ton St AD106
Date: 07:24:03 14:14

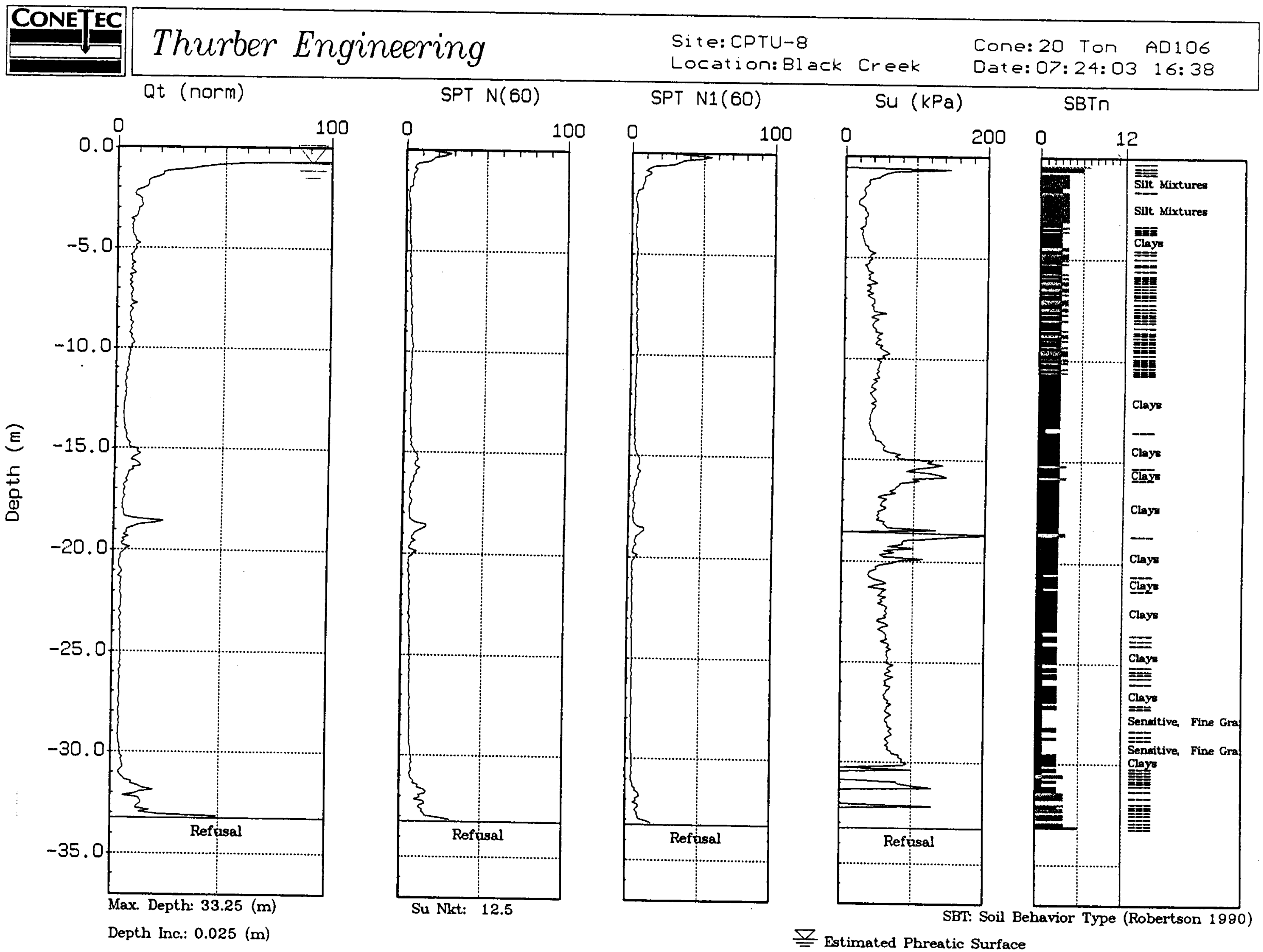


Max. Depth: 36.60 (m)
Depth Inc.: 0.025 (m)

Su Nkt: 12.5

SBT: Soil Behavior Type (Robertson 1990)

Estimated Phreatic Surface



CONETEC
Thurber Engineering
Site: CPTU-8
Location: Black Creek
Cone: 20 Ton AD106
Date: 07:24:03 16:38
Qt (norm)
SPT N(60)
SPT N1(60)
Su (kPa)
SBTn
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
0
100
200
12
Silt Mixtures
Silt Mixtures
Clays
Sensitive, Fine Gra
Refusal
Max. Depth: 33.25 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 12.5
SBT: Soil Behavior Type (Robertson 1990)
Estimated Phreatic Surface

ConeTec Investigations Ltd., CPT Interpretations as of January 11, 2002 (Release 1.00.19)

ConeTec's interpretation routine should be considered a calculator of current published CPT correlations and is subject to change to reflect the current state of practice. The interpreted values are not considered valid for all soil types. The interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design. Reference to current literature is strongly recommended.

The CPT interpretations are based on values of tip, sleeve friction and pore pressure averaged over a user specified interval (typically 0.20). Note that qt is the recorded tip value, qc, corrected for pore pressure effects. Since all of ConeTec's cones have equal end area friction sleeves, pore pressure corrections to sleeve friction, fs, are not required.

The tip correction is: $qt = qc + (1\text{-}a) \bullet u2$

where:
- qt is the corrected tip load
- qc is the recorded tip load
- u_2 is the recorded dynamic pore pressure (behind the tip)
- a is the Net Area Ratio for the cone (typically 0.85 for ConeTec's cones)

Effective vertical overburden stresses are calculated based on a hydrostatic distribution of equilibrium pore pressures below the water table or from a user defined equilibrium pore pressure profile (this can be obtained from CPT dissipation tests). The stress calculations use unit weights assigned to the Soil Behaviour Type zones or from a user defined unit weight profile.

Details regarding the interpretation methods for all of the interpreted parameters is given in table 1. The appropriate references referred to in table 1 are listed in table 2.

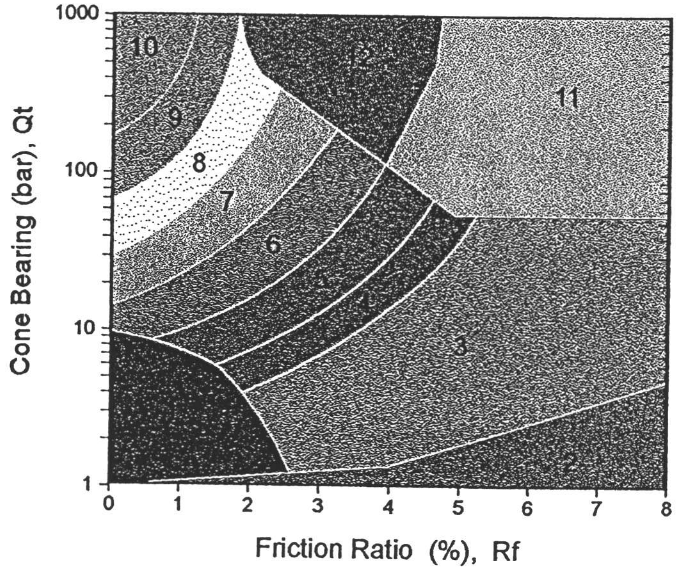
The estimated Soil Behaviour Type is based on the charts developed by Robertson and Campanella shown in Figure 1.

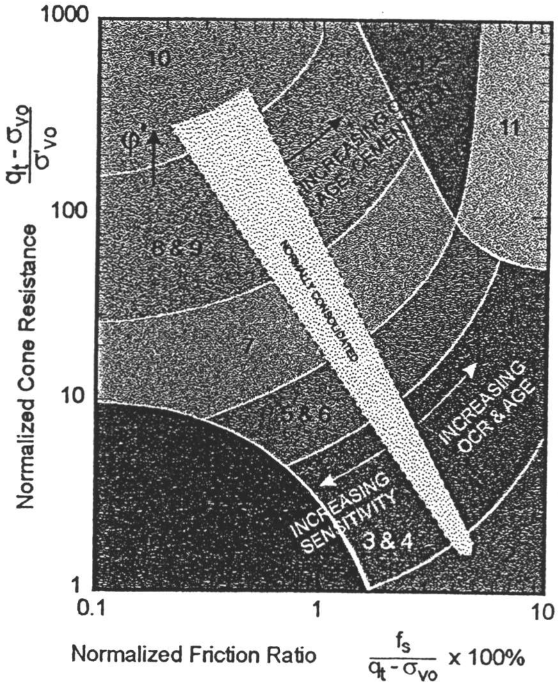
Table 1 CPT Interpretation Methods

Interpreted Parameter	Description	Equation	Ref
Depth	mid layer depth		
AvgQt	Averaged corrected tip (Qt)	$AvgQt = \frac{1}{n}\sum_{i=1}^{n} Qt_i$	
AvgFs	Averaged sleeve friction (Fs)	$AvgFs = \frac{1}{n}\sum_{i=1}^{n} Fs_i$	
AvgRf	Averaged friction ratio (Rf)	$AvgRf = 100\% \bullet \frac{AvgFs}{AvgQt}$	
AvgUd	Averaged dynamic pore pressure (Ud)	$AvgUd = \frac{1}{n}\sum_{i=1}^{n} Ud_i$	
SBT	Soil Behavior Type as defined by Robertson and Campanella		1

U.Wt.	Unit Weight of soil determined from: 1) uniform value or 2) value assigned to each SBT zone 3) user supplied unit weight profile		
TStress	Total vertical overburden stress at mid layer depth	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ where γ_i is layer unit weight h_i is layer thickness	
EStress	Effective vertical overburden stress at mid layer depth	$EStress = TStress - Ueq$	
Ueq	Equilibrium pore pressure determined from: 1) hydrostatic from water table depth 2) user supplied profile		
Cn	SPT N_{60} overburden correction factor	$Cn = (\sigma_v')^{-0.5}$ where σ_v' is in tsf $0.5 < C_n < 2.0$	
N_{60}	SPT N value at 60% energy calculated from Qt/N ratios assigned to each SBT zone		3
$(N1)_{60}$	SPT N_{60} value corrected for overburden pressure	$N1_{60} = Cn \bullet N_{60}$	3
$\Delta(N1)_{60}$	Equivalent Clean Sand Correction to $(N1)_{60}$	$\Delta(N1)_{60} = \frac{K_{SPT}}{1-K_{SPT}} \bullet (N1)_{60}$ Where: K_{SPT} is defined as: 0.0 for FC < 5% 0.0167 • (FC - 5) for 5% < FC < 35% 0.5 for FC > 35% FC - Fines Content in %	7
$(N1)_{60cs}$	Equivalent Clean Sand $(N1)_{60}$	$(N1)_{60cs} = (N1)_{60} + \Delta(N1)_{60}$	7
Su	Undrained shear strength - Nkt is use selectable	$Su = \frac{Qt - \sigma_v}{N_{kt}}$	2
K	Coefficient of permeability (assigned to each SBT zone)		6
Bq	Pore pressure parameter	$Bq = \frac{\Delta u}{Qt - \sigma_v}$	2
Qtn	Normalized Qt for Soil Behavior Type classification as defined by Robertson, 1990	$Qtn = \frac{Qt - \sigma_v}{\sigma'_v}$	4
Rfn	Normalized Rf for Soil Behavior Type classification as defined by Robertson, 1990	$Rfn = 100\% \bullet \frac{f_s}{Qt - \sigma_v}$	4
SBTn	Normalized Soil Behavior Type (slightly modified from that published by Robertson, 1990. This version includes all the soil zones of the original non-normalized SBT chart - see figure 1)		4
Qc1	Normalized Qt for seismic analysis	$qc1 = qc \bullet (Pa/\sigma_v')^{0.5}$ where: Pa = atm. pressure	5
Qc1N	Dimensionless Normalized Qt1	qc1N = qc1 / Pa where: Pa = atm. pressure	

ΔQc1N1	Equivalent clean sand correction	$\Delta qc1N = \frac{K_{CPT}}{1-K_{CPT}} \bullet qc1N$ Where: K_{CPT} is defined as: 0.0 for FC < 5% 0.0267 • (FC - 5) for 5% < FC < 35% 0.5 for FC > 35% FC - Fines Content in %	5
Qc1Ncs	Clean Sand equivalent Qc1N	$qc1Ncs = qc1N + \Delta qc1N$	5
Ic	Soil index for estimating grain characteristics	$Ic = [(3.47 - \log Q)^2 + (\log F + 1.22)^2]^{0.5}$	5
FC	Fines content (%)	$FC=1.75(Ic^{3.25}) - 3.7$ $FC=100$ for $Ic > 3.5$ $FC=0$ for $Ic < 1.26$ $FC = 5\%$ if $1.64 < Ic < 2.6$ AND $Rfn<0.5$	8
PHI	Friction Angle	Campanella and Robertson Durunoglu and Mitchel Janbu	1
Dr	Relative Density	Ticino Sand Hokksund Sand Schmertmann 1976 Jamiolkowski - All Sands	1
OCR	Over Consolidation Ratio		1
State Parameter			9
CRR	Cyclic Resistance Ratio		7





Zone	Q_t / N	Soil Behavior Type
1	2	sensitive fine grained
2	1	organic material
3	1	clay
4	1.5	silty clay to clay
5	2	clayey silt to silty clay
6	2.5	sandy silt to clayey silt
7	3	silty sand to sandy silt
8	4	sand to silty sand
9	5	sand
10	6	gravelly sand to sand
11	1	very stiff fine grained *
12	2	sand to clayey sand *

* overconsolidated or cemented

Figure 1. Non-Normalized and Normalized Soil Behaviour Type Classification Charts

Table 2 References

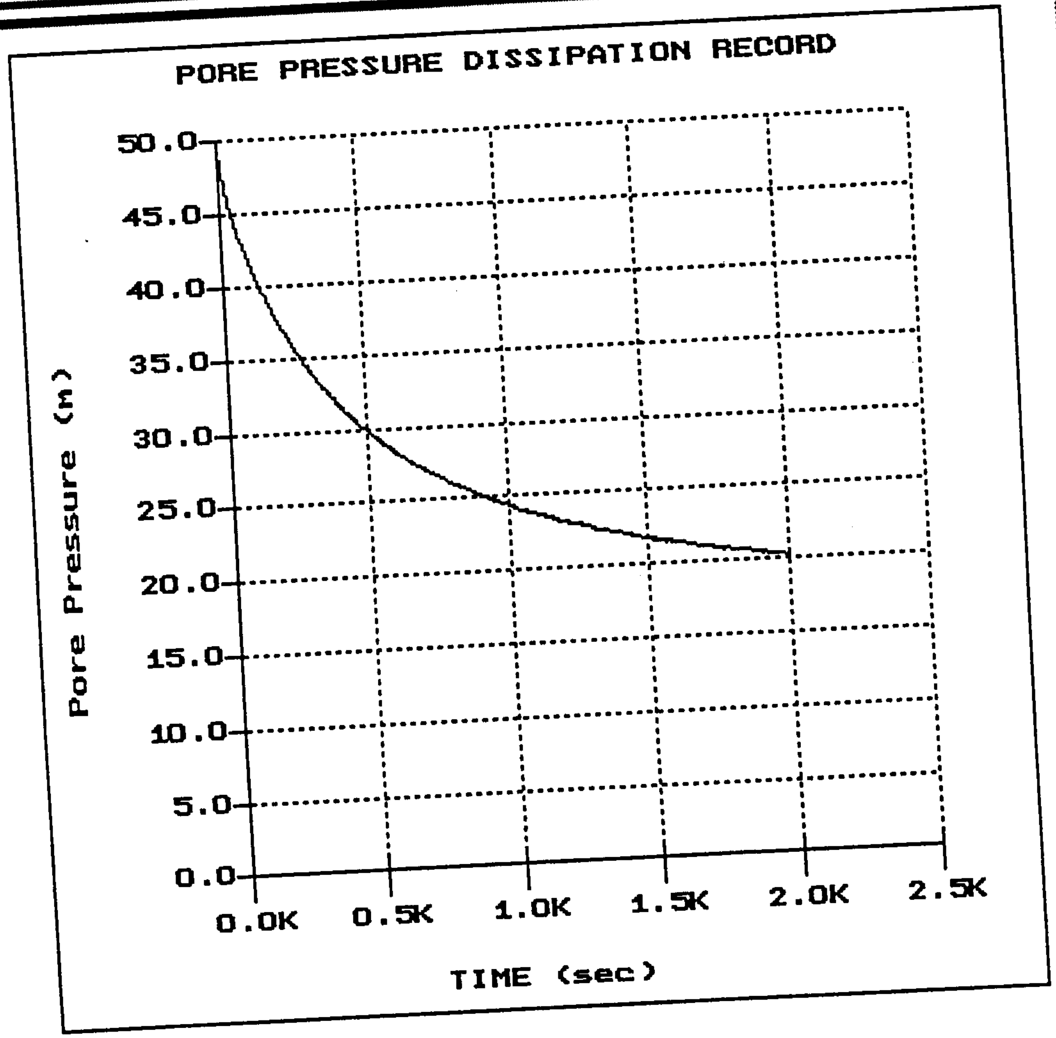
No.	Reference
1	Robertson, P.K. and Campanella, R.G., 1986, "Guidelines for Use, Interpretation and Application of the CPT and CPTU", UBC, Soil Mechanics Series No. 105, Civil Eng. Dept., Vancouver, B.C., Canada
2	Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, "Use of Piezometer Cone Data", Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.
3	Robertson, P.K. and Campanella, R.G., 1989, "Guidelines for Geotechnical Design Using CPT and CPTU", UBC, Soil Mechanics Series No. 120, Civil Eng. Dept., Vancouver, B.C., Canada
4	Robertson, P.K., 1990, "Soil Classification Using the Cone Penetration Test", Canadian Geotechnical Journal, Volume 27.
5	Robertson, P.K. and Fear, C.E., 1995, "Liquefaction of Sands and its Evaluation", Keynote Lecture, First International Conference on Earthquake Geotechnical Enginnering, Tokyo, Japan.
6	ConeTec Internal Report
7	Robertson, P.K. and Wride, C.E., 1997, "Cyclic Liquefaction and its Evaluation Based on SPT and CPT", NCEER Workshop Paper, January 22, 1997
8	Wride, C.E. and Robertson, P.K., 1997, "Phase II Data Review Report (Massey and Kidd Sites, Fraser River Delta)", Volume 1 - Data Report (June 1997), University of Alberta.
9	Plewes, H.D., Davies, M.P. and Jefferies, M.G., 1992, "CPT Based Screening Procedure for Evaluating Liquefaction Susceptibility", 45th Canadian Geotechnical Conference, Toronto, Ontario, October 1992.

Thurber

Hole:CPTU-1
Location:Black Creek

Cone:20 Ton AD106
Date:07:23:03 17:01

File: 745CP001.PPD
Depth (m): 15.32
(ft): 50.26
Duration : 2000.0s
U-min: 20.15 2000.0s
U-max: 48.68 5.0s

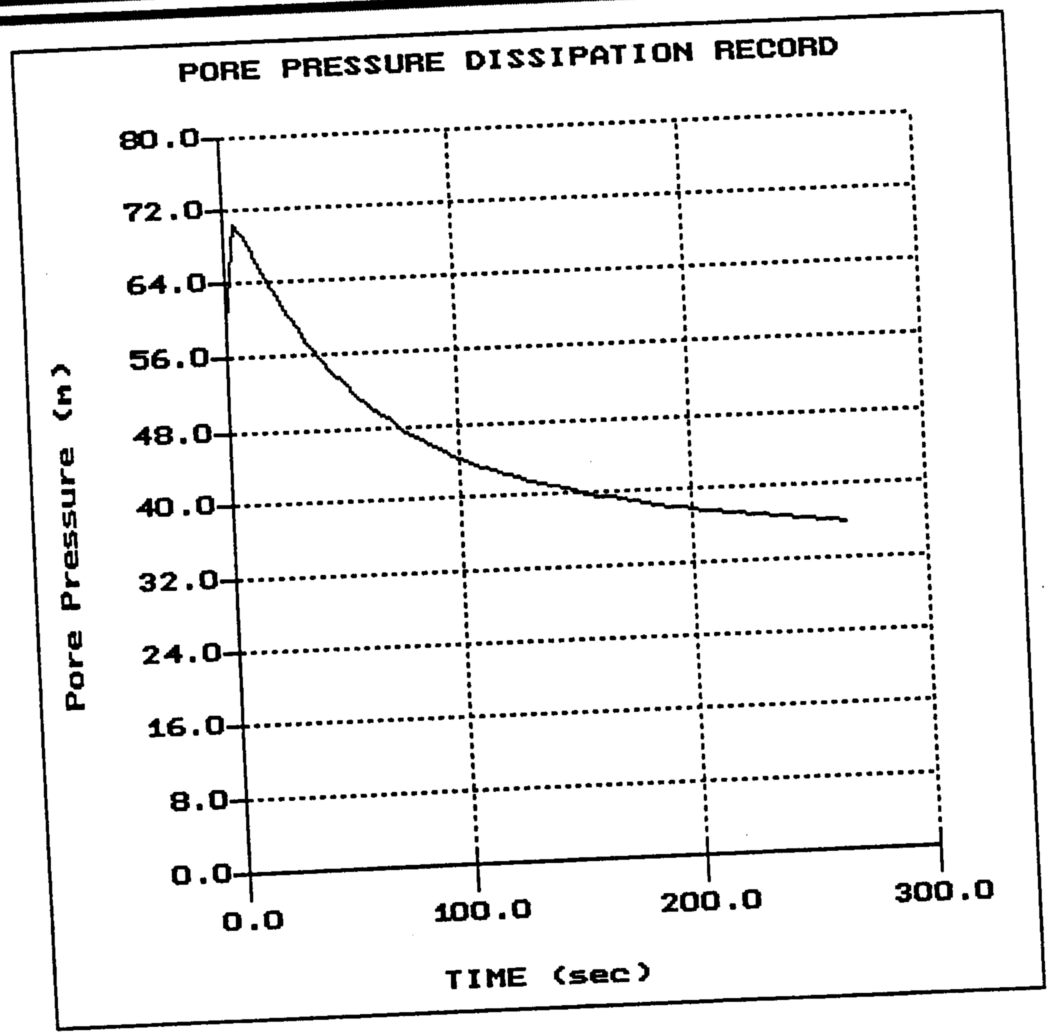


Thurber

Hole:CPTU-1
Location:Black Creek

Cone:20 Ton AD106
Date:07:23:03 17:01

File: 745CP001.PPD
Depth (m): 31.27
(ft): 102.59
Duration : 265.0s
U-min: 35.95 265.0s
U-max: 70.20 5.0s



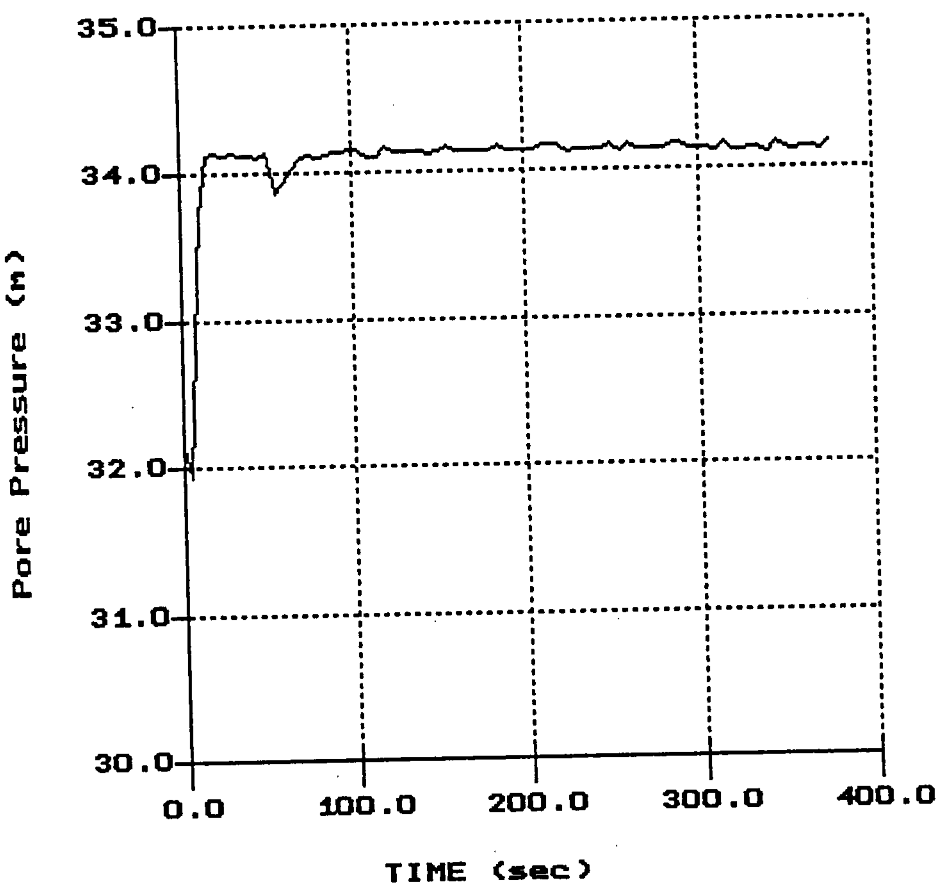
Thurber

Hole:CPTU-1
Location:Black Creek

Cone:20 Ton AD106
Date:07:23:03 17:01

File: 745CP001.PPD
Depth (m): 34.18
(ft): 112.14
Duration : 375.0s
U-min: 31.93 5.0s
U-max: 34.17 290.0s

PORE PRESSURE DISSIPATION RECORD

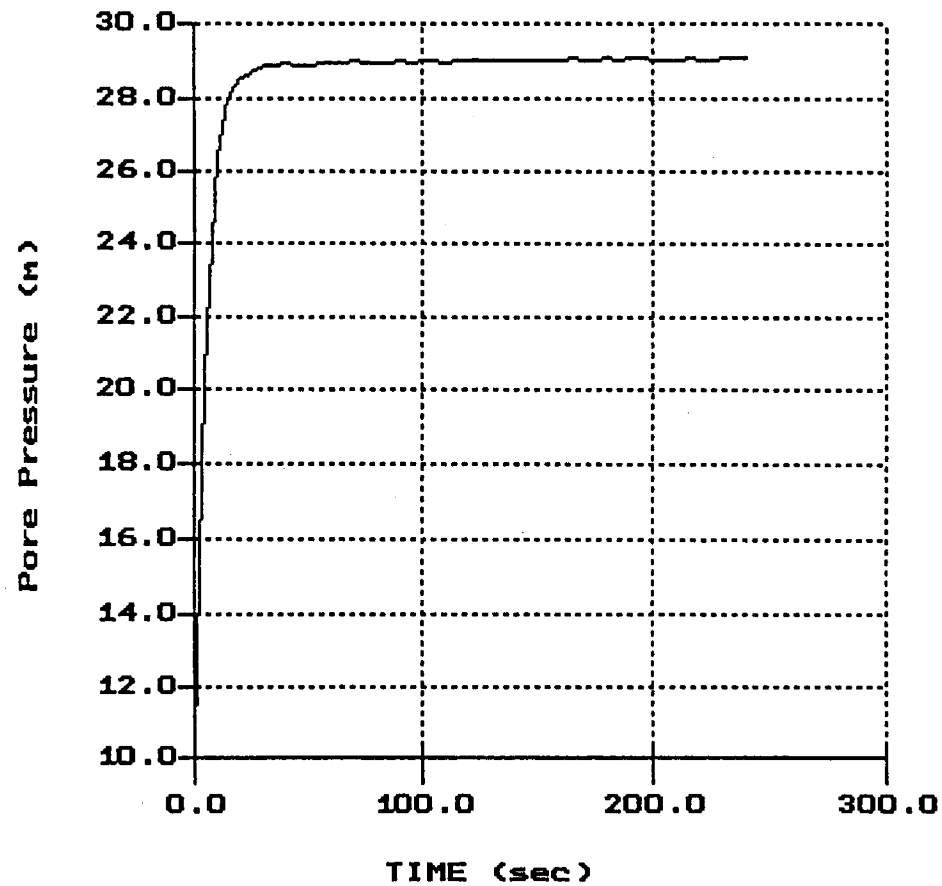


Thurber

Hole:CPTU-2
Location:Black Creek

Cone:20 Ton AD106
Date:07:24:03 12:49

PORE PRESSURE DISSIPATION RECORD



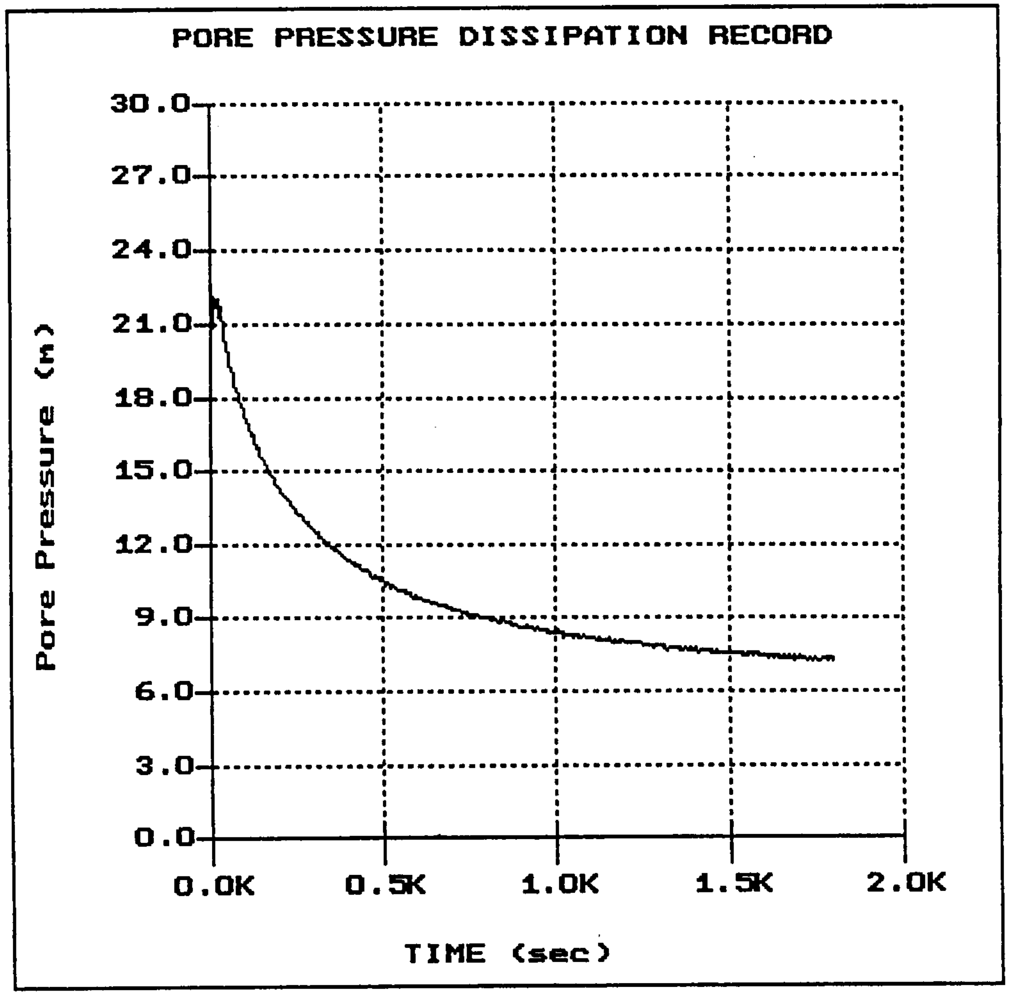
File: 745CP002.PPD
Depth (m): 29.10
(ft): 95.47
Duration : 240.0s
U-min: 10.11 0.0s
U-max: 29.09 230.0s

Thurber

Hole:CPTU-3
Location:Black Creek

Cone:20 Ton AD106
Date:07:24:03 08:13

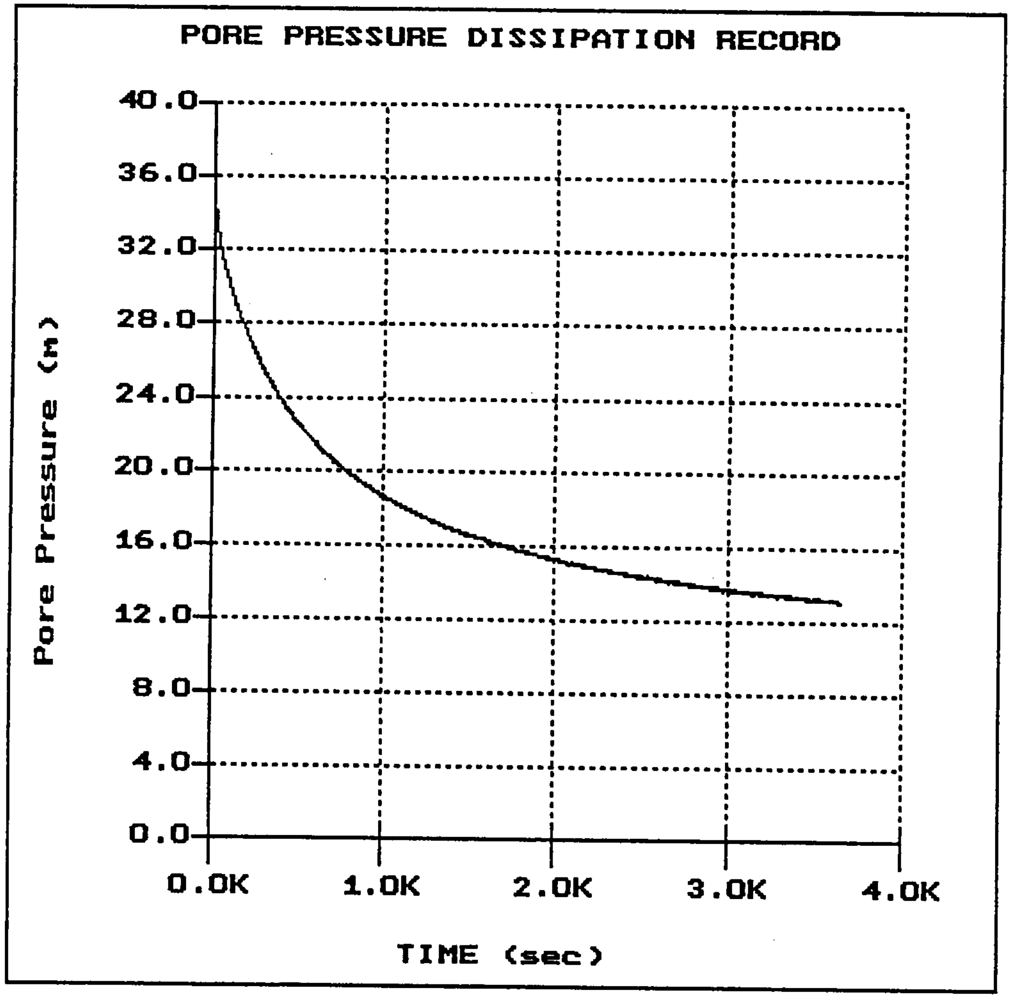
File: 745CP003.PPD
Depth (m): 6.30
(ft): 20.67
Duration : 1800.0s
U-min: 7.19 1725.0s
U-max: 22.08 10.0s



Thurber

Hole:CPTU-3
Location:Black Creek

Cone:20 Ton AD106
Date:07:24:03 08:13



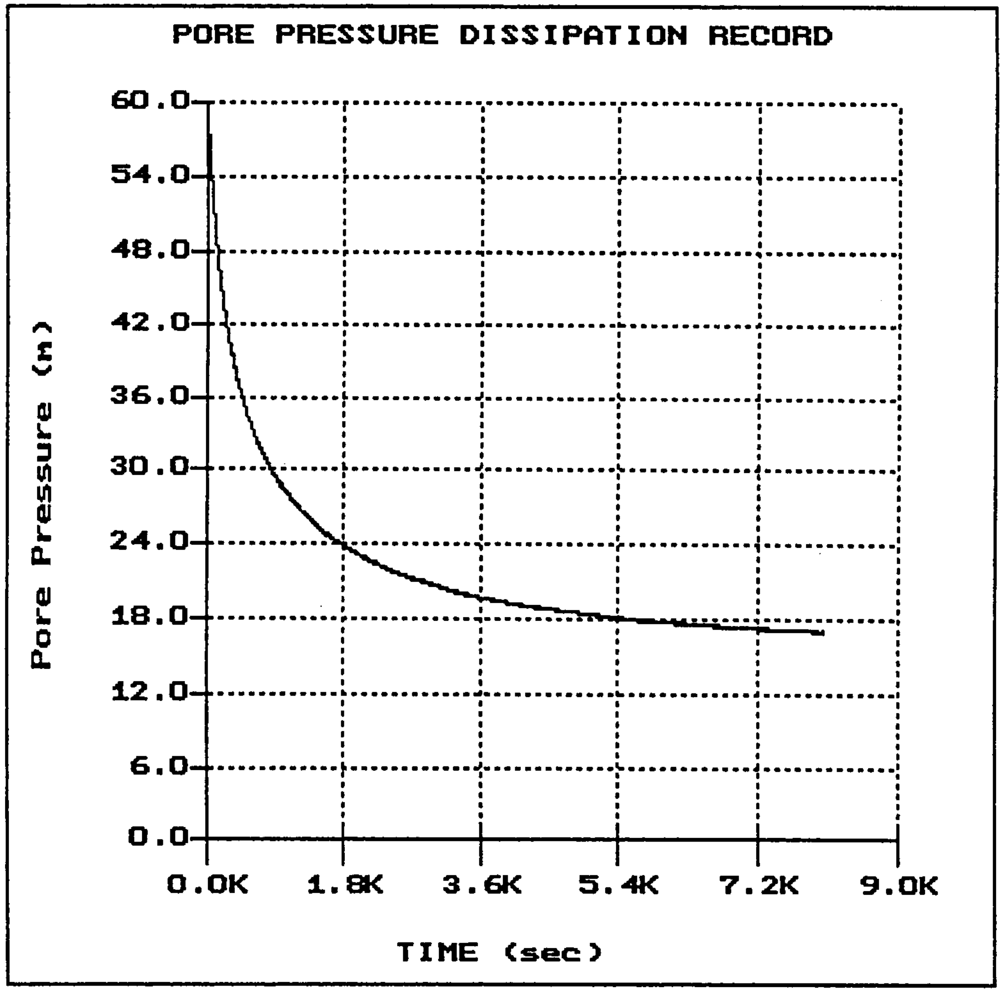
File: 745CP003.PPD
Depth (m): 10.80
(ft): 35.43
Duration : 3635.0s
U-min: 13.10 3630.0s
U-max: 34.29 5.0s

Thurber

Hole:CPTU-3
Location:Black Creek

Cone:20 Ton AD106
Date:07:24:03 08:13

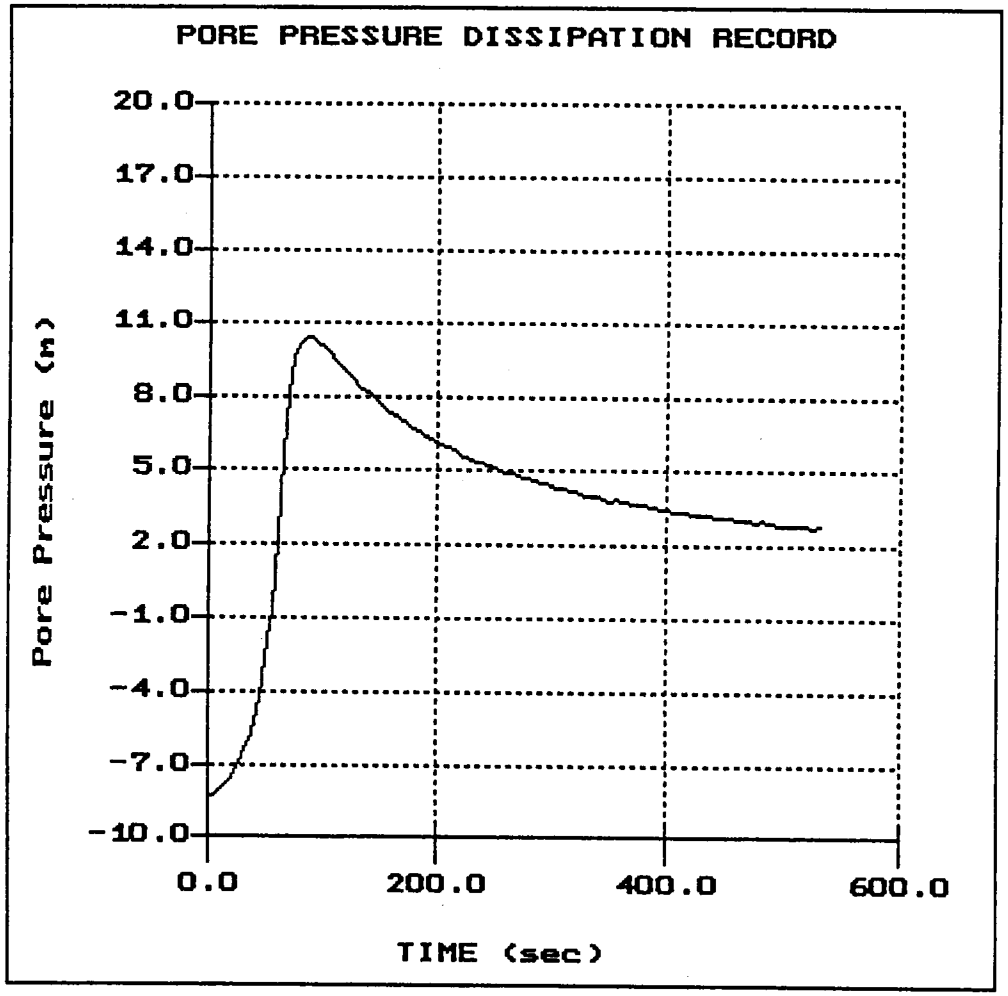
File: 745CP003.PPD
Depth (m): 15.32
(ft): 50.26
Duration : 8030.0s
U-min: 16.91 8010.0s
U-max: 59.85 5.0s



Thurber

Hole:CPTU-4
Location:Robbins Road

Cone:20 Ton AD106
Date:07:23:03 15:02

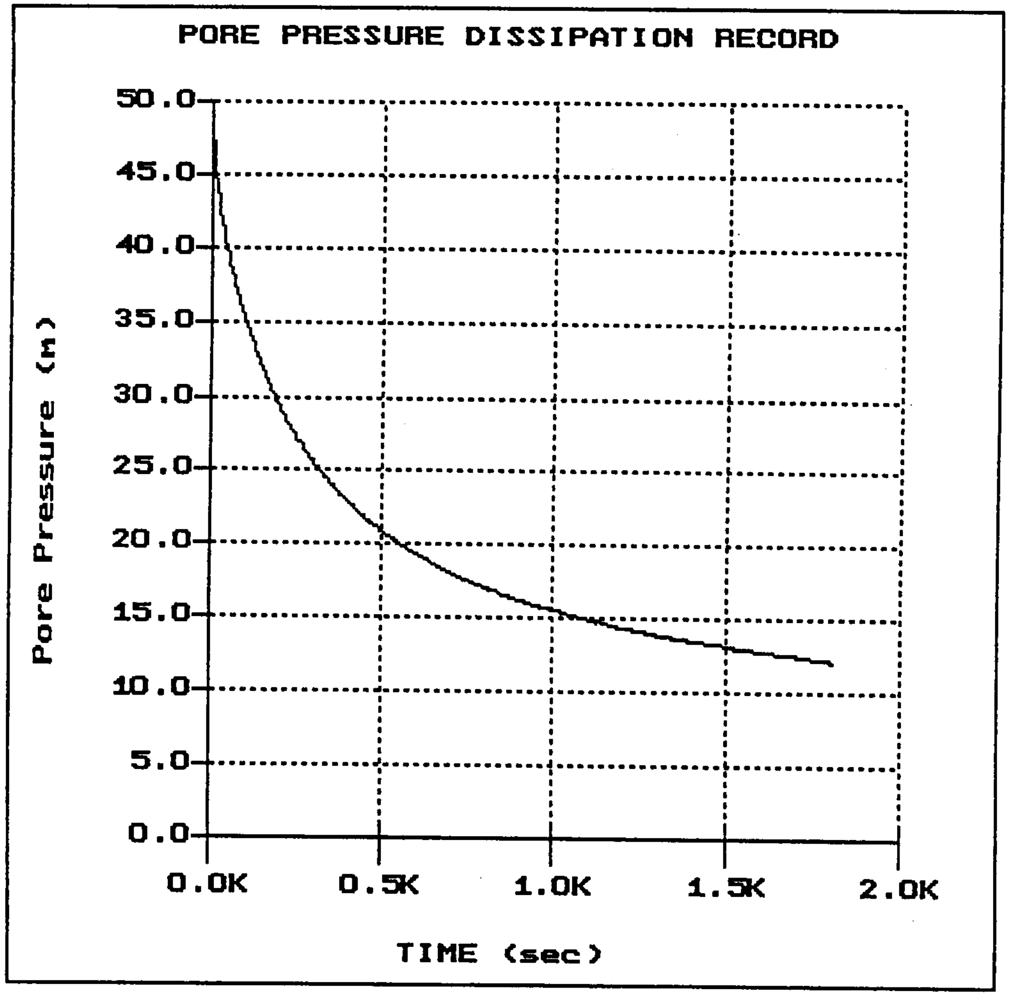


File: 745CP004.PPD
Depth (m): 2.33
(ft): 7.64
Duration : 530.0s
U-min: -8.35 0.0s
U-max: 10.33 90.0s

Thurber

Hole:CPTU-4
Location:Robbins Road

Cone:20 Ton AD106
Date:07:23:03 15:02

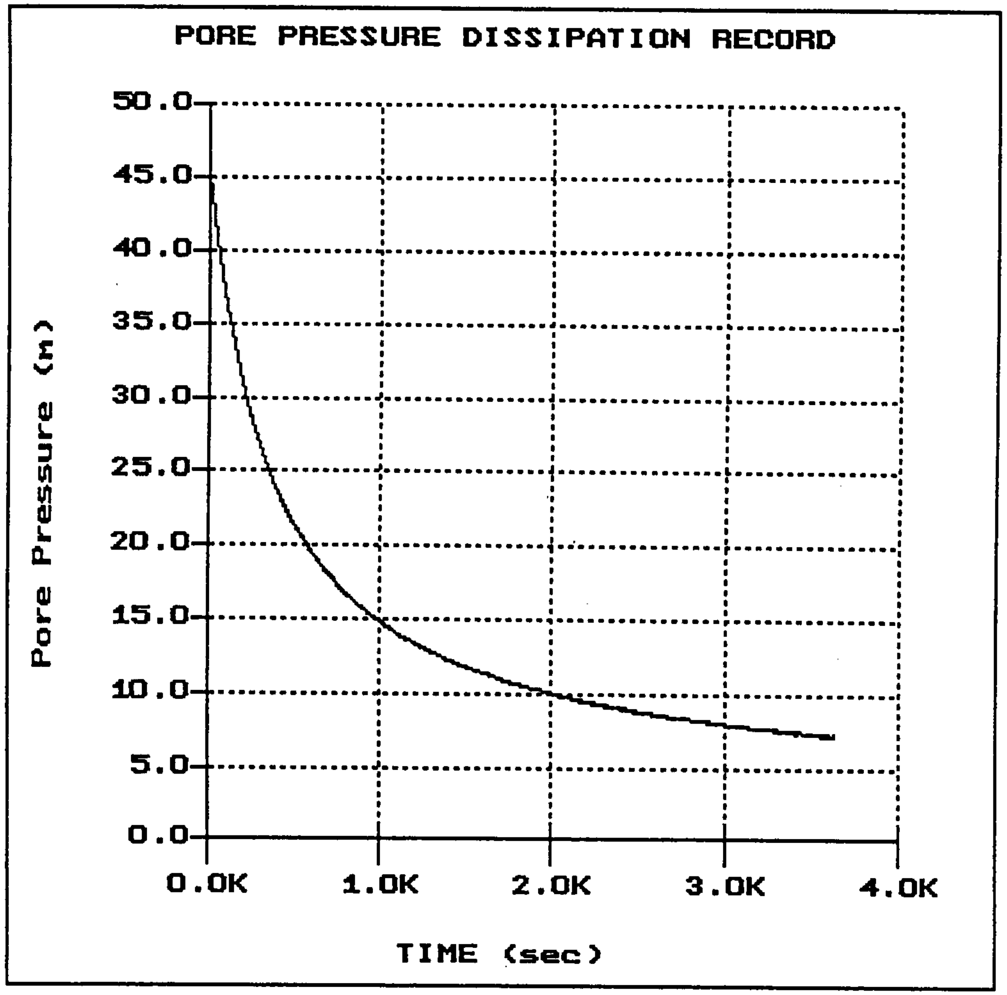


File: 745CP004.PPD
Depth (m): 6.35
(ft): 20.83
Duration : 1805.0s
U-min: 12.06 1805.0s
U-max: 47.76 0.0s

Thurber

Hole:CPTU-5
Location:Robbins Road

Cone:20 Ton AD106
Date:07:23:03 11:53



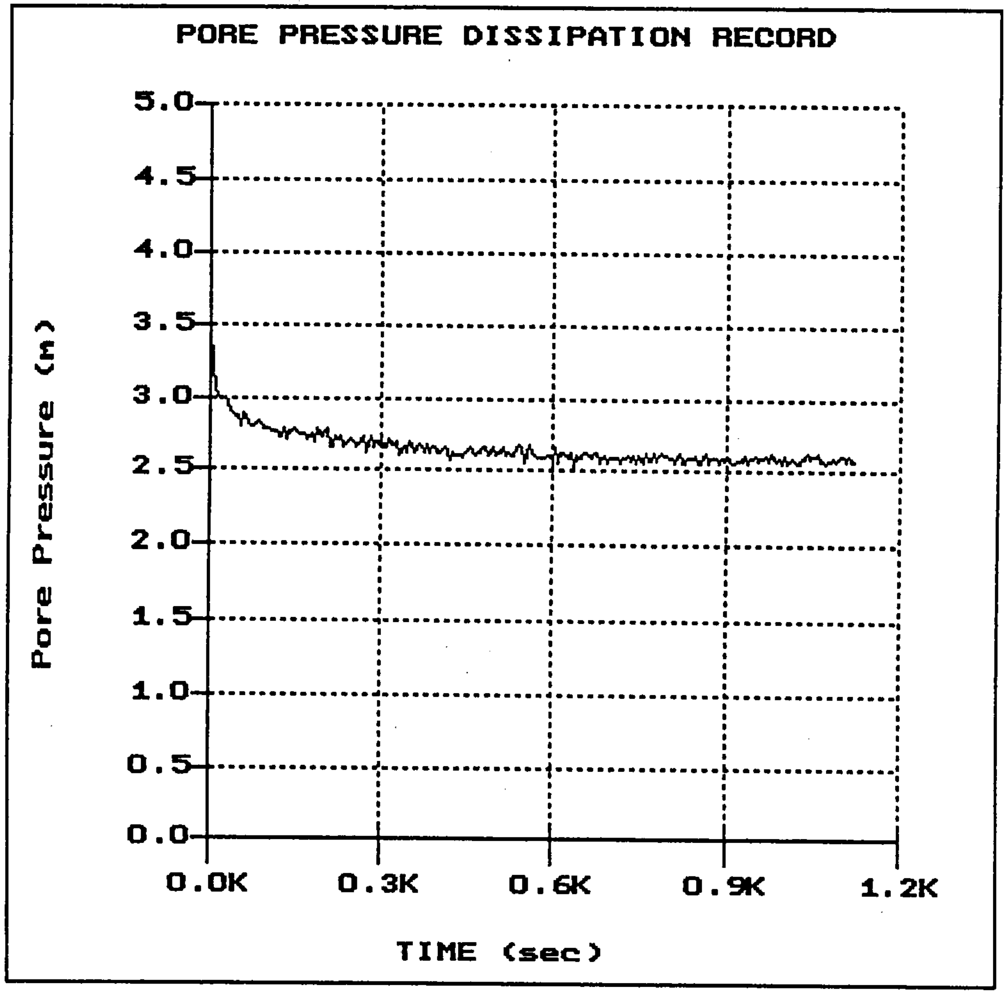
File: 745CP005.PPD
Depth (m): 5.38
(ft): 17.65
Duration : 3625.0s
U-min: 7.15 3610.0s
U-max: 44.40 10.0s

Thurber

Hole:CPTU-6
Location:Robins Road

Cone:20 Ton AD106
Date:07:23:03 10:44

File: 745CP006.PPD
Depth (m): 4.33
(ft): 14.21
Duration : 1120.0s
U-min: 2.52 635.0s
U-max: 3.46 0.0s

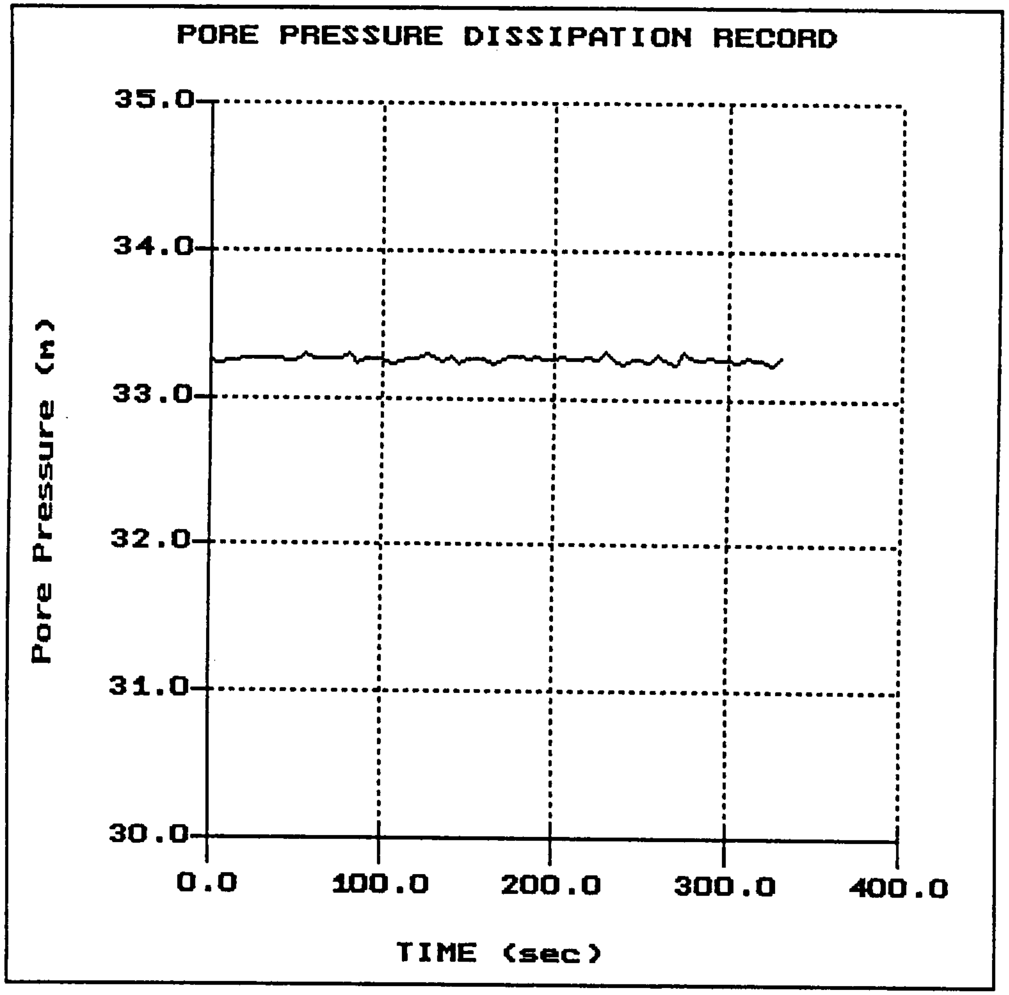


Thurber

Hole:CPTU-8
Location:Black Creek

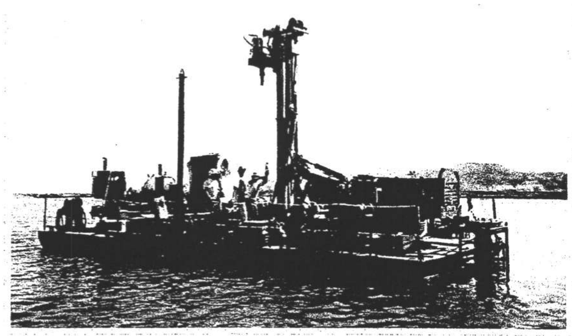
Cone:20 Ton AD106
Date:07:24:03 16:38

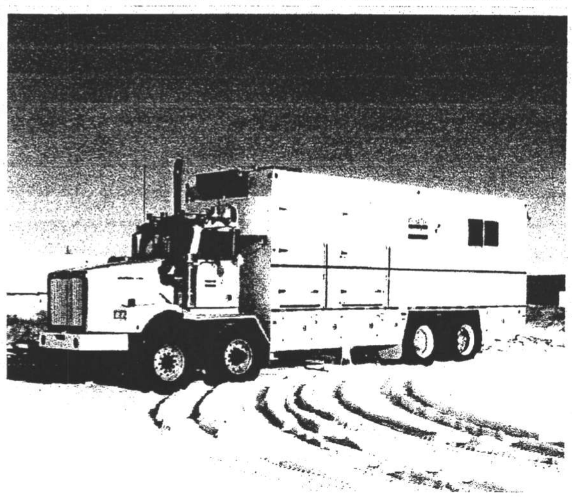
File: 745CP008.PPD
Depth (m): 33.20
(ft): 108.92
Duration : 330.0s
U-min: 33.23 325.0s
U-max: 33.31 275.0s



APPENDIX D2

CONETEC REPORT – SEPTEMBER 2004





Field Data Report

ConeTec Investigations Ltd.

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Vancouver, BC V6P 6R9

Tel: 604-327-4311
Fax: 604-327-4066

Toll Free: 800-567-7969

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Prepared for:

Thurber Engineering Ltd.,
Oakville, Ontario
Hwy11 - Burk's Falls, ON

Our Job No: 04-244

- September 21 - 23, 2004 -

Cone Penetration Tests (CPTU)

The cone penetration tests (CPTU) with pore pressure measurement were carried out by ConeTec using an integrated electronic cone system.

20 ton and 10 ton compression type cones (refer to Figure CPTU) were used for all of the soundings. The 20 ton cone has a tip area of 15 sq. cm. and a friction sleeve area of 225 sq. cm where the 10 ton cone has a tip area of 10 sq. cm. and a friction sleeve area of 150 sq. cm. The compression cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.85. A porewater pressure filter was located directly behind the cone tip. The filter was made of porous plastic and was 5.0 mm thick. Each of the porewater pressure filters was saturated under vacuum pressure prior to penetration. Porewater pressure dissipation data was recorded at 5-second intervals during pauses in penetration as directed by the field representative.

The cone was capable of recording the following parameters at varying depth intervals:

Tip Resistance (q_c)
Sleeve Friction (f_s)
Dynamic Pore Pressure (u)
Temperature (T)
Cone Inclination (I)

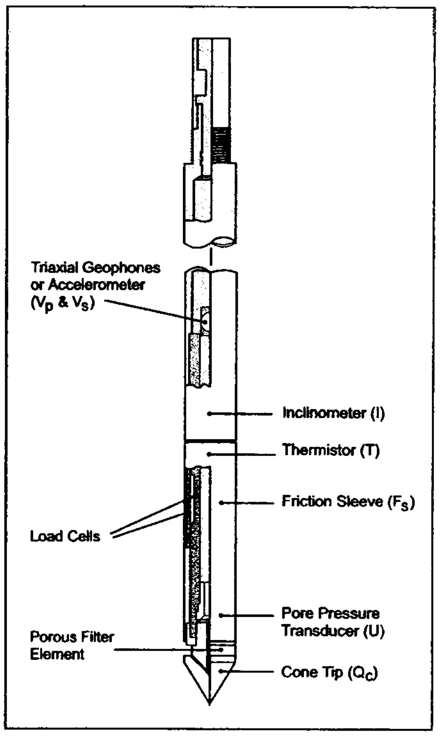


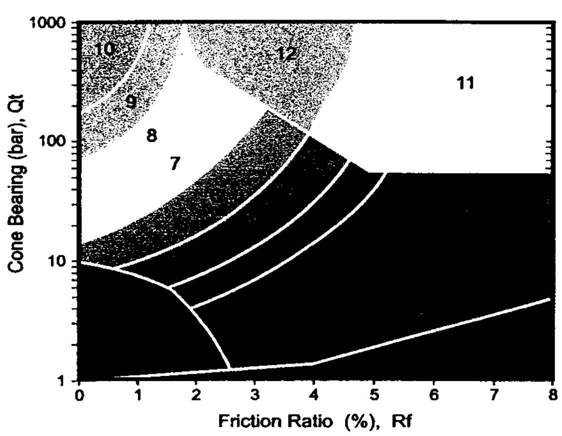
Figure - CPTU

A summary of the cone penetration tests carried out is presented in Table CPTU (Appendix CPTU).

Selected parameters were printed simultaneously on a printer and stored on a floppy disk for future analysis and reference. All cone penetration testing was carried out in accordance with ASTM D-5778-95.

A complete set of baseline readings was taken prior to and at the completion of each sounding to determine temperature shifts and any zero load offsets. Corrections for temperature shifts and zero load offsets can be extremely important, especially when the recorded loads are relatively small. In sandy soils, however, these corrections are generally negligible. Graphical plots of all CPT data are presented in Appendix CPTU.

The inferred stratigraphic profile at each CPT test location is included with this report. The stratigraphic interpretations are based on relationships between cone bearing, q_t, sleeve friction, f_s, and dynamic pore pressure, u. The friction ratio, R_f (100 x f_s/q_t), is a calculated parameter which is used to identify the type of soil and hence gives an indication of its behavior. Generally, soft cohesive soils have high friction ratios, low cone bearing pressures and generate large porewater pressures during penetration. Cohesionless soils have lower friction ratios, high cone bearing pressures and generate little in the way of excess porewater pressure during penetration. The classification of soils is based on correlations summarized by Robertson (1990), as shown in Figure SBT. It is not always possible to clearly identify a soil type based on q_t and f_s alone. Experience, judgment and analyses of porewater pressure generation during penetration and subsequent dissipation tests should be used in arriving at the soil type in these ambiguous situations.



Zone	Q_t / N	Soil Behaviour Type
1	2	sensitive fine grained
2	1	organic material
3	1	clay
4	1.5	silty clay to clay
5	2	clayey silt to silty clay
6	2.5	sandy silt to clayey silt
7	3	silty sand to sandy silt
8	4	sand to silty sand
9	5	sand
10	6	gravelly sand to sand
11	1	very stiff fine grained *
12	2	sand to clayey sand *

* overconsolidated or cemented

Figure SBT – Non-Normalized Soil Behavior Type Chart, Robertson (1990)

It should be noted that stratigraphic interpretation using CPTU data can also be carried out using a normalized (stress corrected) soil behavior type chart (Robertson, 1990). The Robertson publication emphasizes when normalized stratigraphic interpretation is appropriate.

Pore Pressure Dissipation Testing (PPD)

The penetration of the piezocone was halted at specific depths to carry out pore pressure dissipation tests as directed by the field representative. The variation of the penetration pore pressure (u) with time was measured and recorded. All pore pressure data was recorded immediately behind the cone tip at the u_2 location (refer to Figure PTL).

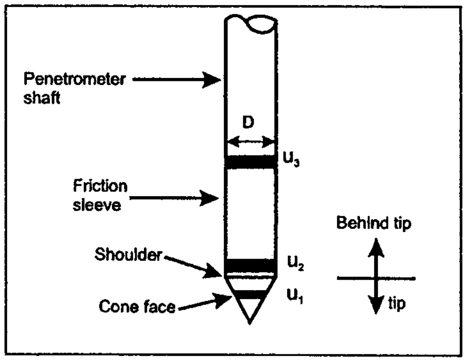


Figure – PTL

Pore pressure dissipation data can be interpreted to provide estimates of :

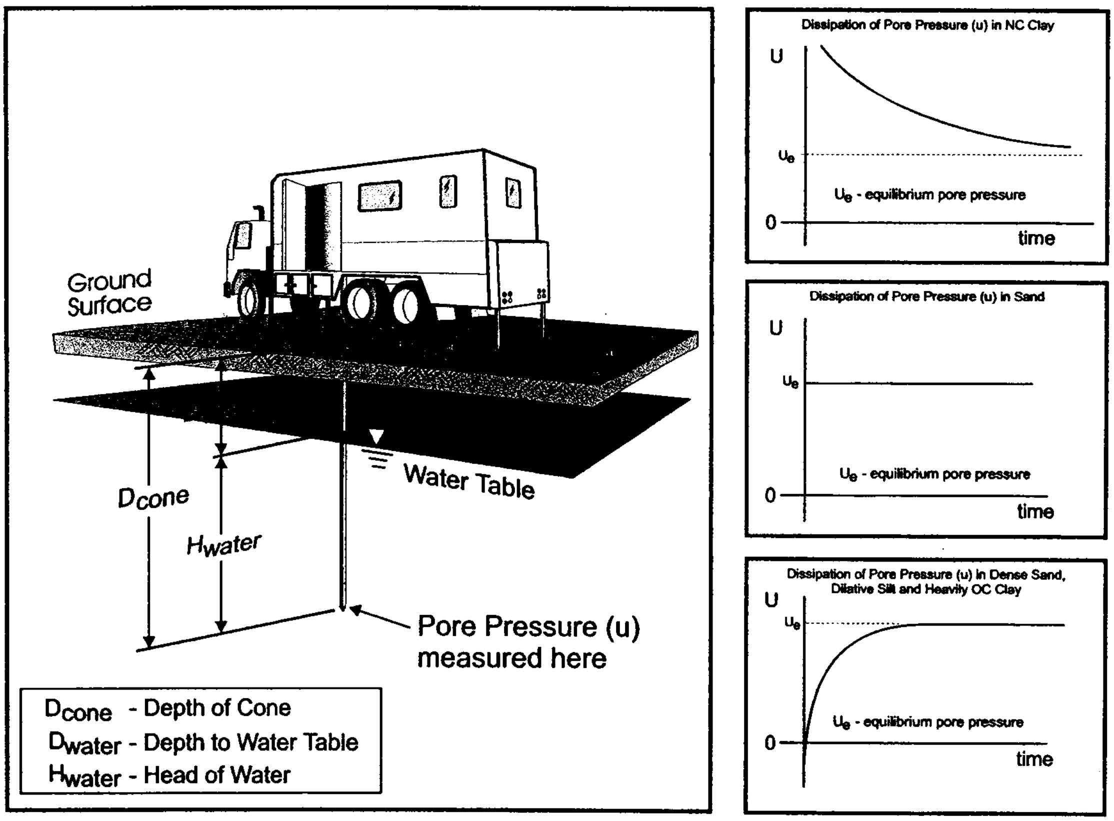
- equilibrium piezometric pressure
- phreatic surface
- in situ horizontal coefficient of consolidation, c_h
- in situ horizontal coefficient of permeability, k_h

In order to interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until such time as there is no variation in pore pressure with time (refer to Figure PPD). This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

Interpretation of either c_h and k_h from dissipation results can be most easily achieved using either of two analytical approaches: cavity-expansion theory or the strain-path approach. Comparisons of the available solutions and results from field studies suggest that the cavity-expansion method of Torstensson (1977) and the strain-path approaches of Levadous (1980) and Teh (1987) all provide similar predications of consolidation parameters from CPTU dissipation data (Gillespie 1981; Kabir and Lutenegger 1990; Robertson et al. 1991). Robertson et al. (1991) have shown that these methods, although developed for normally consolidated soils, can be equally applied to overconsolidated soils. Furthermore, comparisons of field and laboratory data indicate that the trends in the measured (laboratory) and predicated (CPTU) data are consistent provided the micro fabric and nature of the soils being tested are taken into consideration (Danziger 1990; Robertson et al. 1991).

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1991.

The pore pressure dissipation tests are summarized in Table PPD (Appendix PPD). Pore pressure dissipation data is presented in Appendix PPD.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors:
1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

Figure - PPD

ConeTec Digital File Formats

CPT Data Files

Unless otherwise requested by the client ConeTec CPT data files are named such that the first 3 characters contain the job number, the next two characters are typically CP followed by two characters indicating the sounding number. The last DOS character position is reserved for the letters a, b, c, d etc to uniquely identify multiple soundings at the same location. The CPT sounding file has the extension COR and pore pressure dissipation files have the extension PPD. As an example, for job number 99-127 the first sounding will have file names 127CP01.COR and 127CP01.PPD.

The CPT (COR) file consists of the following components:

1. Two lines of header information
2. Data records
3. End of data marker
4. Units information

Header Lines

Line 1: Columns 1-6 are blank (future use)
Columns 7-21 contain the sounding Date and Time
Columns 22-36 contain the sounding Operator

Line 2: Columns 1-16 contain the Job Location
Columns 17-31 contain the Cone ID
Columns 32-47 contain the sounding number

Data Records

The data records contain 4 or more columns of data in floating point format. A comma (and spaces) separates each data item:

Column 1:	Sounding Depth (meters)
Column 2:	Tip (q_c) data uncorrected for pore pressure effects. Recorded in units selected by the operator.
Column 3:	Sleeve (f_s) data. Recorded in units selected by the operator
Column 4:	Dynamic pore pressure readings. Recorded in units selected by the operator
Column 5:	Exists only if specialty modules (Resistivity and/or UVIF) have been used

End of Data Marker

After the last line of data a line containing ASCII 26 (CTL-Z) and a newline (carriage return/ line feed) character. This is used to mark the end of data.

Units Information

The last section of the file contains information about the units that were selected for the sounding. A separator bar makes up the first line. The second line contains the type of units used for depth, q_c, f_s and u. The third line contains the conversion values required for ConeTec's software to convert the recorded data to an internal set of base units (bar for q_c, bar for $_{fs}$ and meters for u).

CPT Dissipation Files

CPT Dissipation files have the same naming convention as the CPT sounding files and have the extension PPD. PPD files consist of the following components:

1. Two lines of header information
2. Data records

Header Lines (same as COR file):

Line 1: Columns 1-6 are blank (future use)
Columns 7-21 contain the sounding Date and Time
Columns 22-36 contain the sounding Operator

Line 2: Columns 1-16 contain the Job Location
Columns 17-31 contain the Cone ID
Columns 32-47 contain the sounding number

Data Records

The data records immediately follow the header lines. Each data record can occupy several lines in the file and is a complete record of a dissipation test at a particular depth. Each data record starts with a line containing two values separated by spaces; the first value being an index number (not currently used by the Software) and the second being the dissipation test depth in meters. Following this line are the dissipation pore pressure values stored at 5 second intervals with a maximum of 12 entries per line. The last line of the dissipation record may not contain a full 12 entries. The data record is terminated with an ASCII 30 character (appears as a triangle in some editors).

This sequence is repeated for every dissipation test in the sounding. No marker is used to indicate end of file. Units information is not stored in this file. Users would have to check the CPT file for the units that were used.

CPT Interpretations

ConeTec's CPT interpretation output files are generally delivered in two styles knows as IFP and IFI files (printable and importable). One style has page formatting (IFP) and only uses up to 132 columns across the file. This allows the file to be printed on standard office printers. The files are usually formatted for 70 lines per page with form feed characters embedded into the file. They have been designed for use with the HP laserjet lineprinter or compressed (16.7 characters/inch) fixed pitch font style. Multiple pages are required to print an entire sounding. There are multiple parts to each page (pages 1a and 1b) to accommodate all the geotechnical parameters that are output.

The Importable file type (IFI) contains the same data as the IFP files but is set up with all the columns across the file. No page formatting is done. This file is designed for importing into spreadsheet programs.

Bibliography

Robertson, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol 27, 1990 pp 151-158.

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp 791-803.

Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal,Vol. 27 No. 5, 1990 pp 557-567.

Kurfurst, P.J. and D.J. Woeller, "Electric cone Penetrometer – Development and Field Results From the Canadian Arctic", Penetration Testing 1988 ISOPT, Orlando,Volume 2 pp 823-830.

Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT Enviroprobe and QED Hydropunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

Lunne, T., Robertson, P.K. and Powell, J.J.M., 1997, "Cone Penetration Testing in Geotechnical Practice", E & FN Spon, ISBN 0 419 23750, www.sponpress.com, 312 pages, 3rd printing.

Greig, J.W., R.G. Campanella and P.K. Robertson, "Comparison of Field Vane Results With Other In-Situ Test Results", Internaitonal Symposiu, on Laboratory and Field Vane Shear Strength Testing, ASTM, Tampa, FL, Proceedings, 1987.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

Daniel, C.R., J.A. Howie and A. Sy, "A Method for Correlating Large Penetration Test (LPT) to Standard Penetration Test (SPT) Blow Counts", 55th Canadian Geotechnical Conference, Niagra Falls, Ontario, Proceedings ,2002.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp 733739, 2000.

Appendix CPTU
Cone Penetration Tests

CONETEC

Job No: 04-244
Client: Thurber Engineering Ltd.
Project: Highway 11, Burk's Falls - ON
Date: September 21 - 23, 2004

CPT SUMMARY

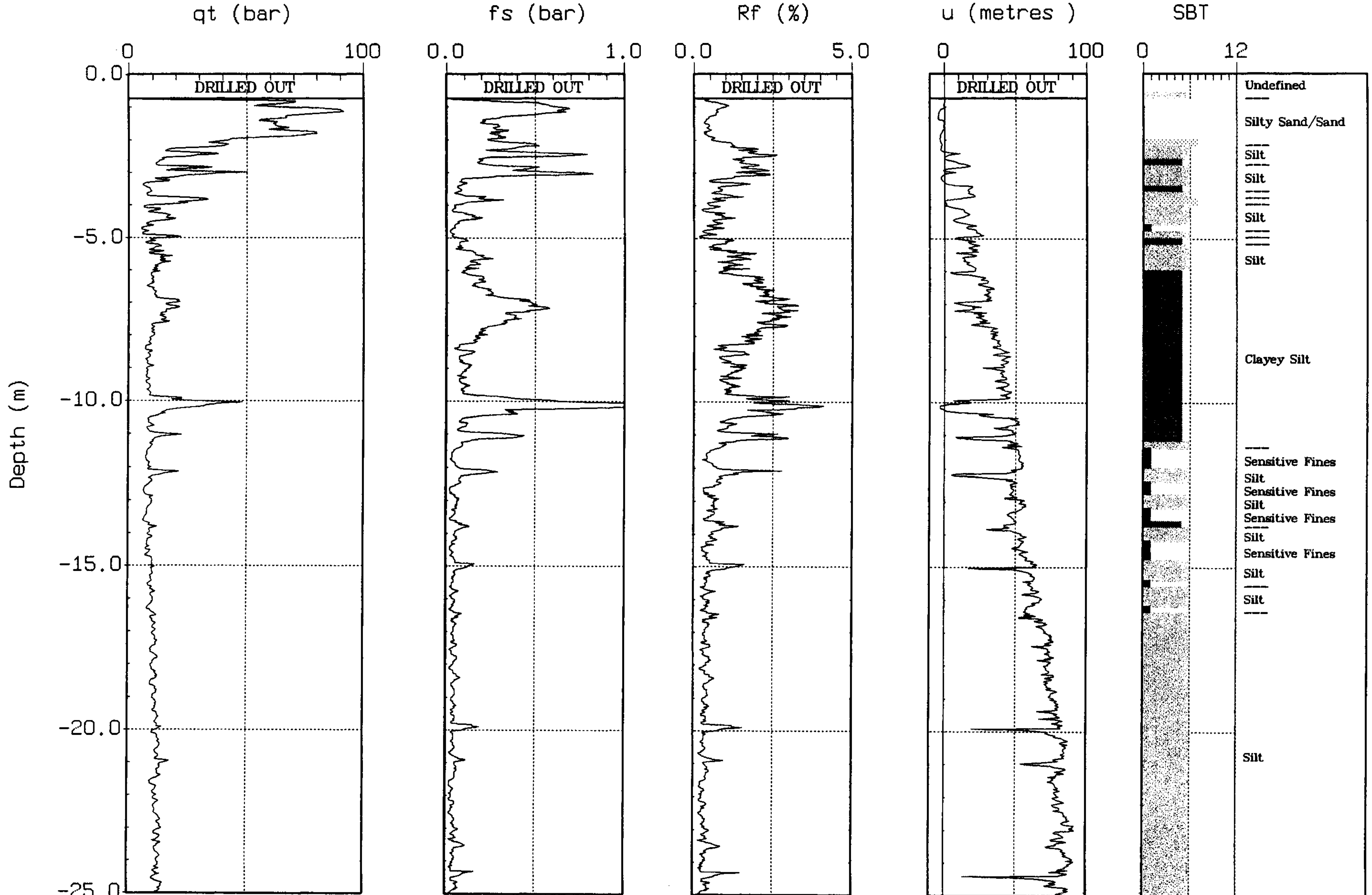
CPT Sounding	Filename	Date	Type Of Cone	Assumed Water Table (m)	Final Depth (m)
CPTU-09	244CP09.COR	09/21/04	20 ton, 15 cm^2	0.0	30.55
CPTU-10	244CP10.COR	09/22/04	10 ton, 10 cm^2	0.0	21.70
CPTU-11	244CP11.COR	09/21/04	10 ton, 10 cm^2	0.0	17.95
CPTU-12	244CP12.COR	09/23/04	10 ton, 10 cm^2	0.0	22.88
CPTU-13	244CP13.COR	09/23/04	10 ton, 10 cm^2	0.0	16.65
CPTU-14	244CP14.COR	09/22/04	10 ton, 10 cm^2	0.0	3.03
CPTU-14B	244CP14B.COR	09/22/04	10 ton, 10 cm^2	0.0	2.40
CPTU-15	244CP15.COR	09/23/04	10 ton, 10 cm^2	0.0	19.92
CPTU-16	244CPC16.COR	09/22/04	10 ton, 10 cm^2	0.0	5.55
CPTU-16B	244CP16B.COR	09/22/04	10 ton, 10 cm^2	0.0	5.65

CONETEC

Thurber Engineering

Site: CPTU-09
Location: Burk's Falls

Cone: 20 Ton St 095
Date: 09:21:04 08:40



Max. Depth: 30.55 (m)

Depth Inc.: 0.025 (m)

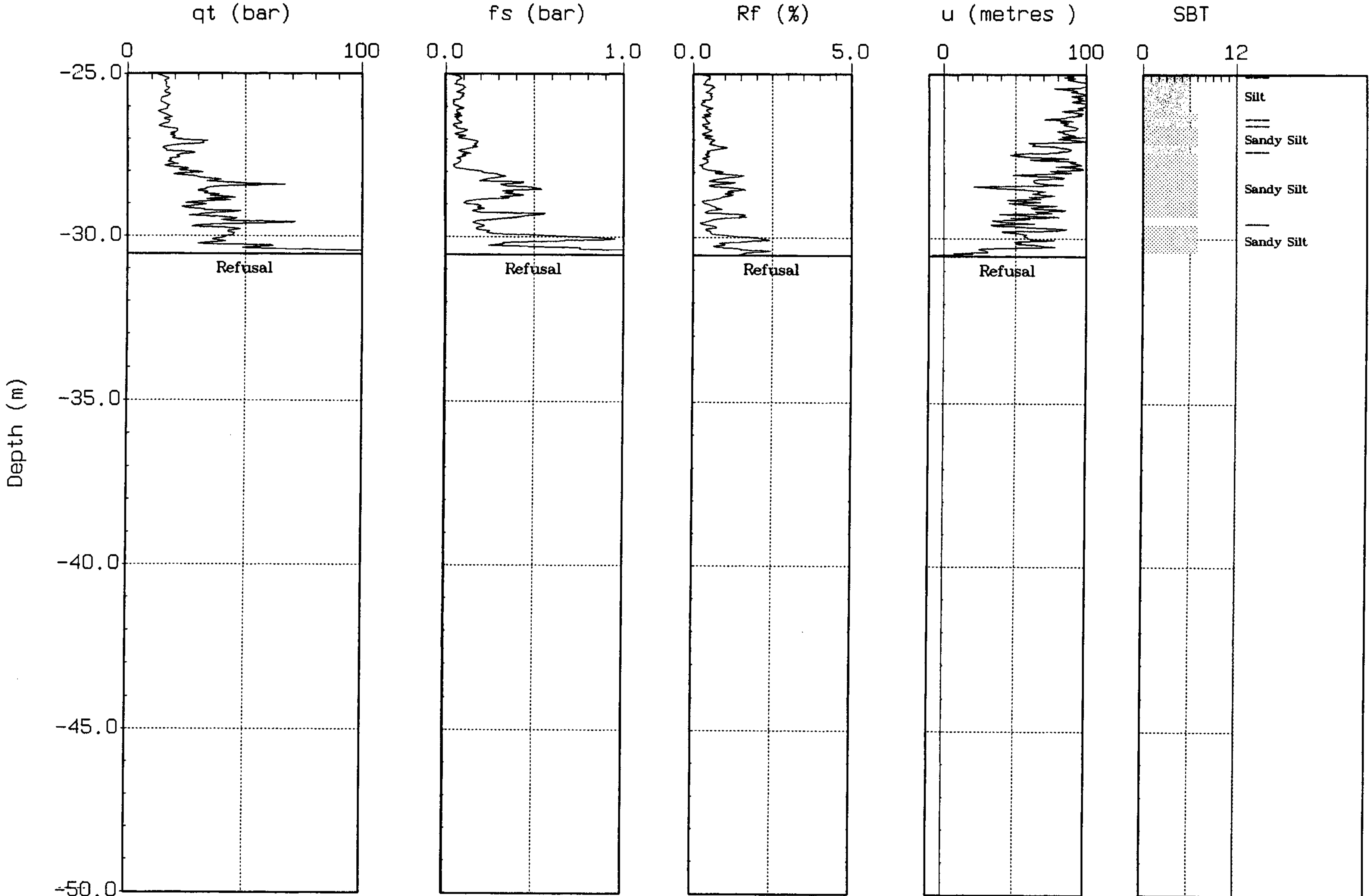
SBT: Soil Behavior Type (Robertson 1990)

ConeTec

Thurber Engineering

Site: CPTU-09
Location: Burk's Falls

Cone: 20 Ton St 095
Date: 09:21:04 08:40



Max. Depth: 30.55 (m)

Depth Inc.: 0.025 (m)

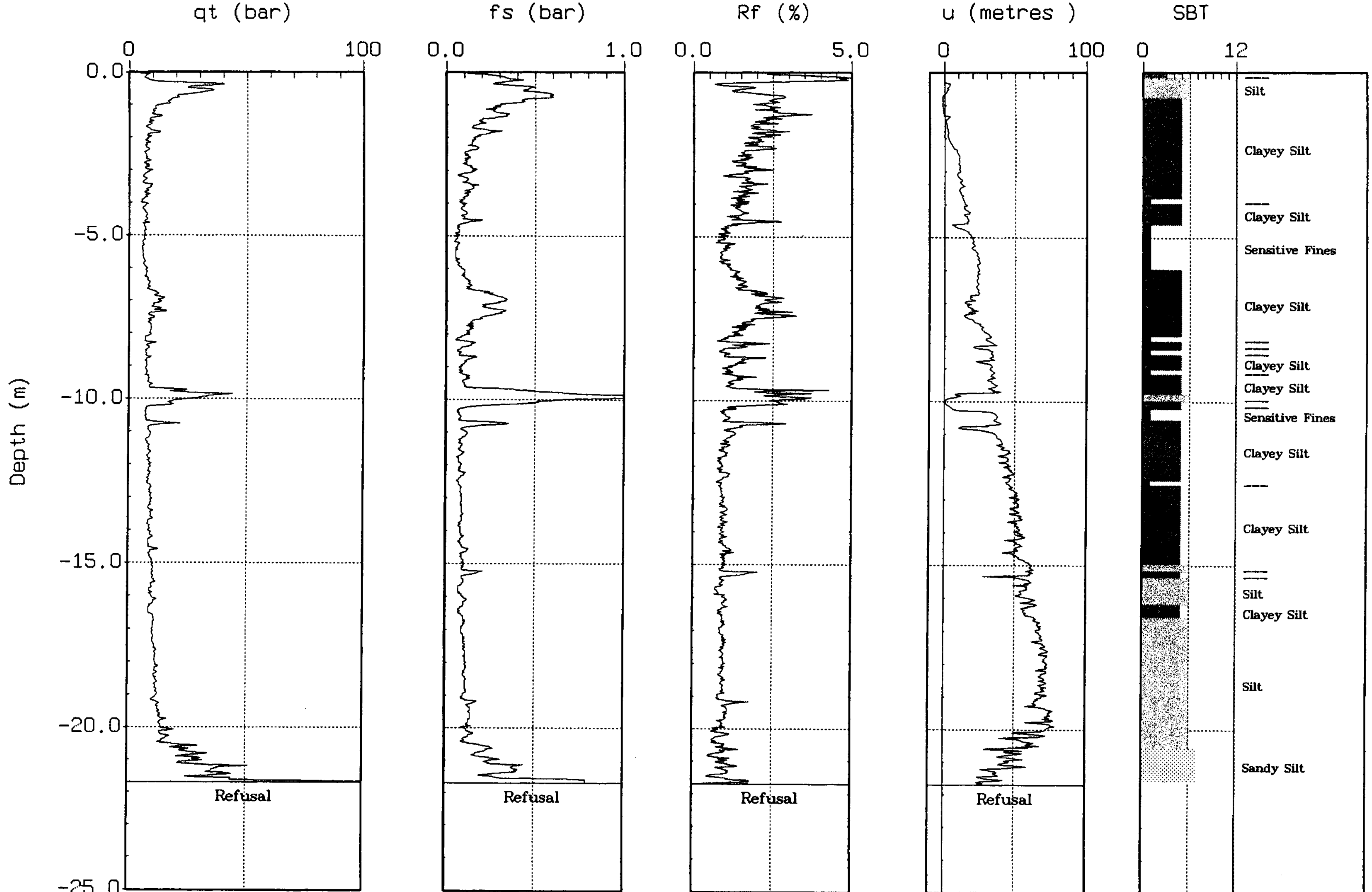
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-10
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:22:04 07:33



Max. Depth: 21.70 (m)

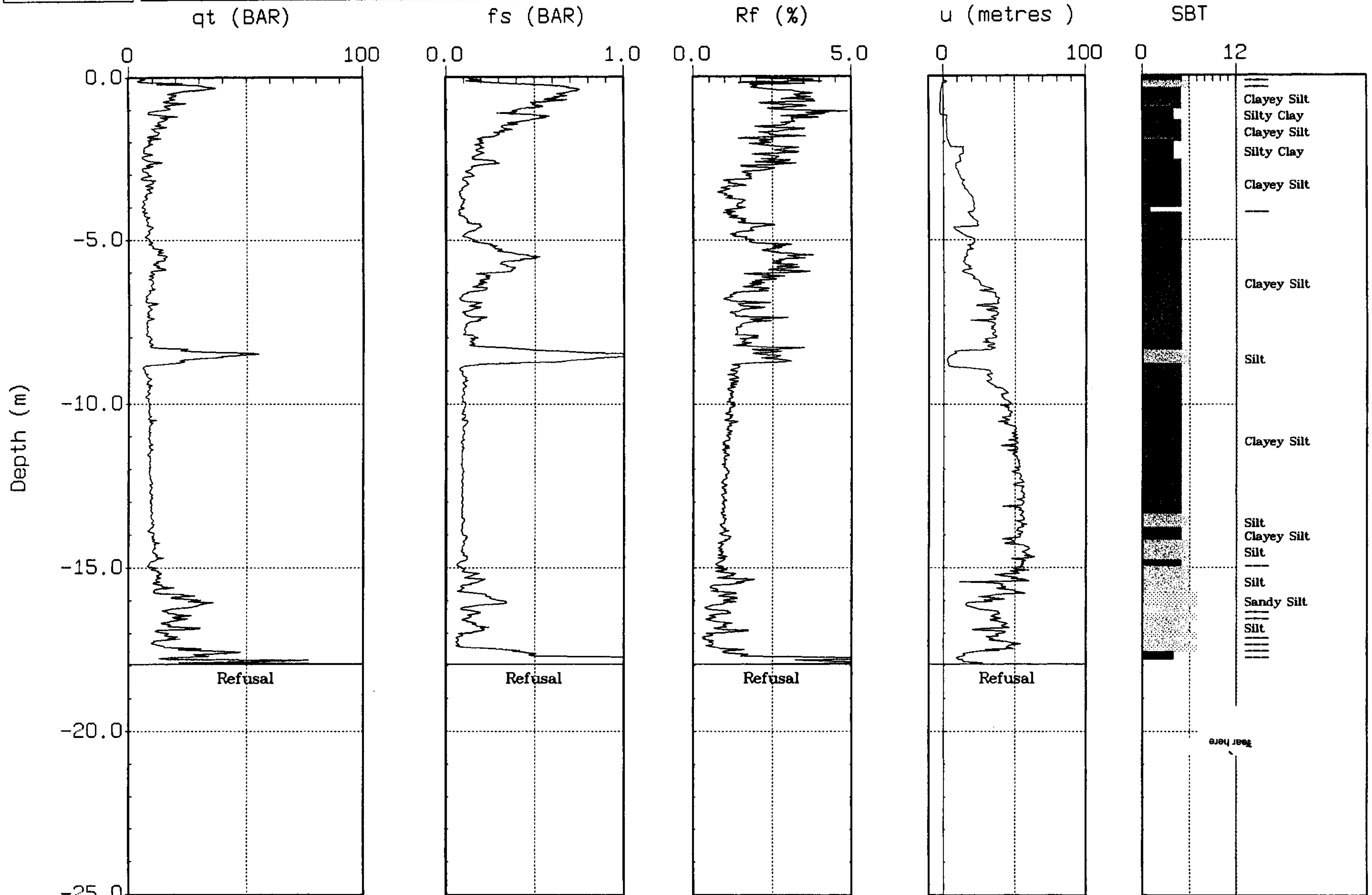
Depth Inc.: 0.025 (m)

SBT: Soil Behavior Type (Robertson 1990)

Thurber Engineering

Site: CPTU-11
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:21:04 14:50



Max. Depth: 17.95 (m)

Depth Inc.: 0.025 (m)

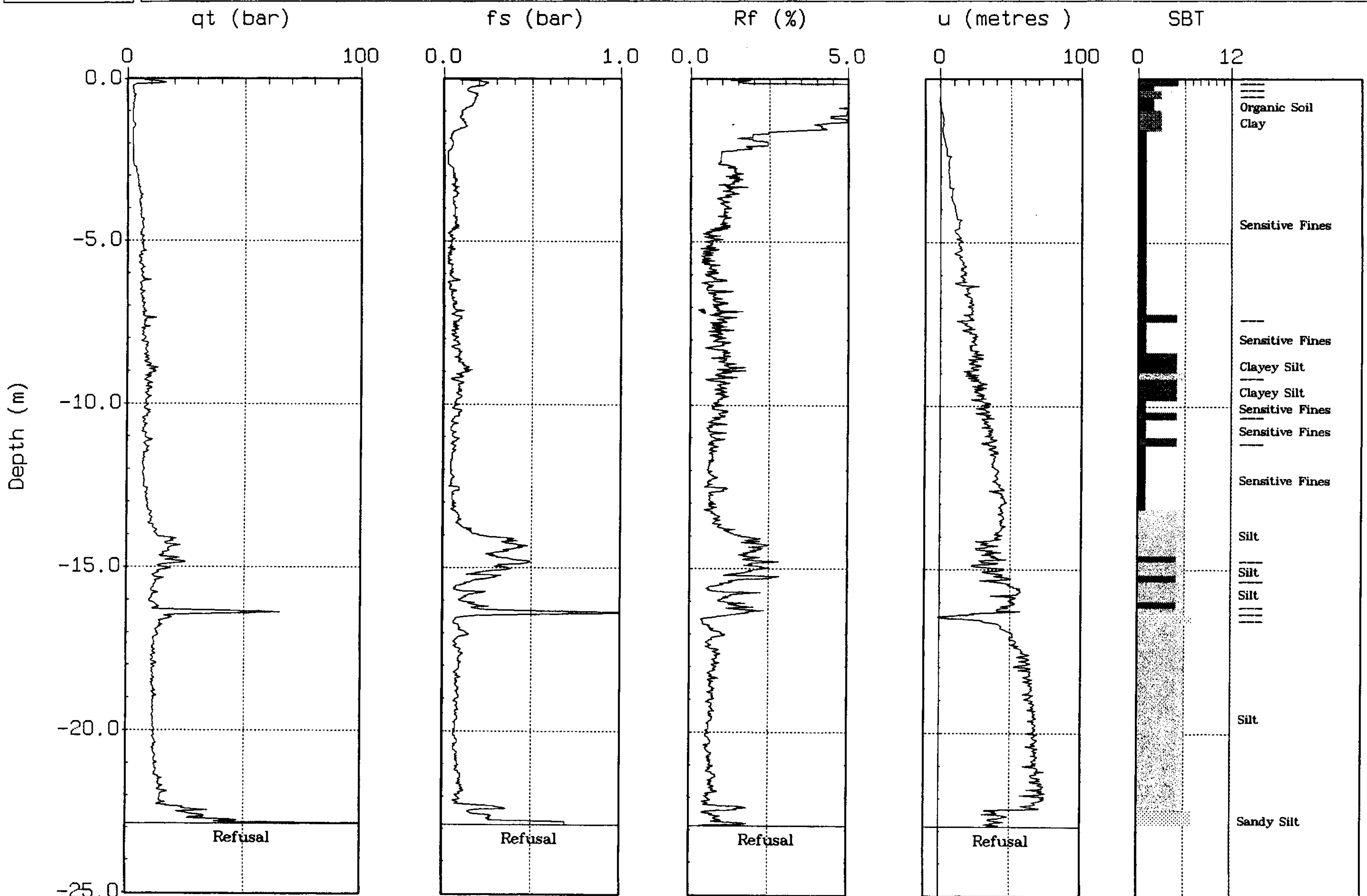
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-12
Location: Burk's Falls

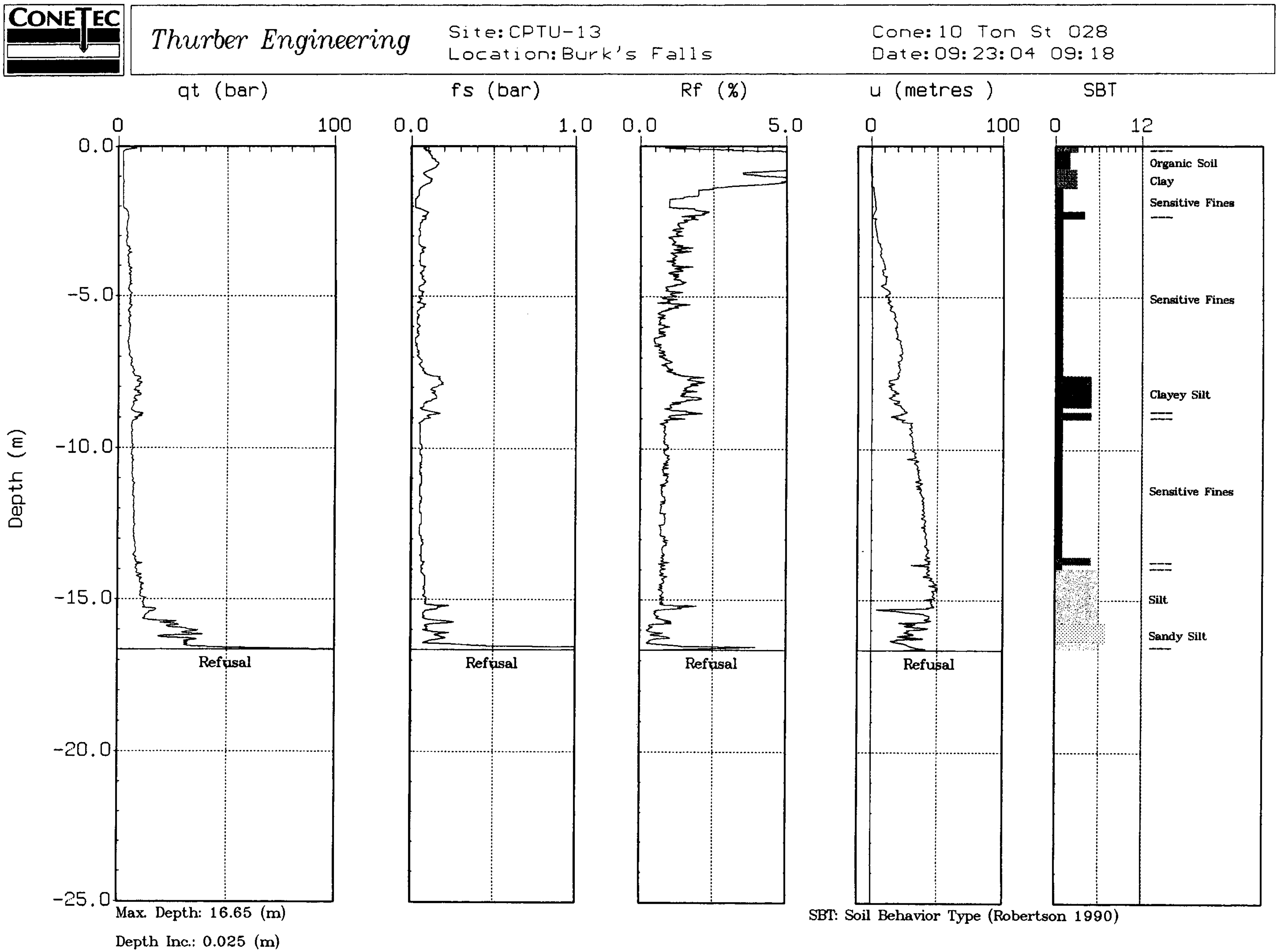
Cone: 10 Ton St 028
Date: 09:23:04 11:17



Max. Depth: 22.88 (m)

Depth Inc.: 0.025 (m)

SBT: Soil Behavior Type (Robertson 1990)

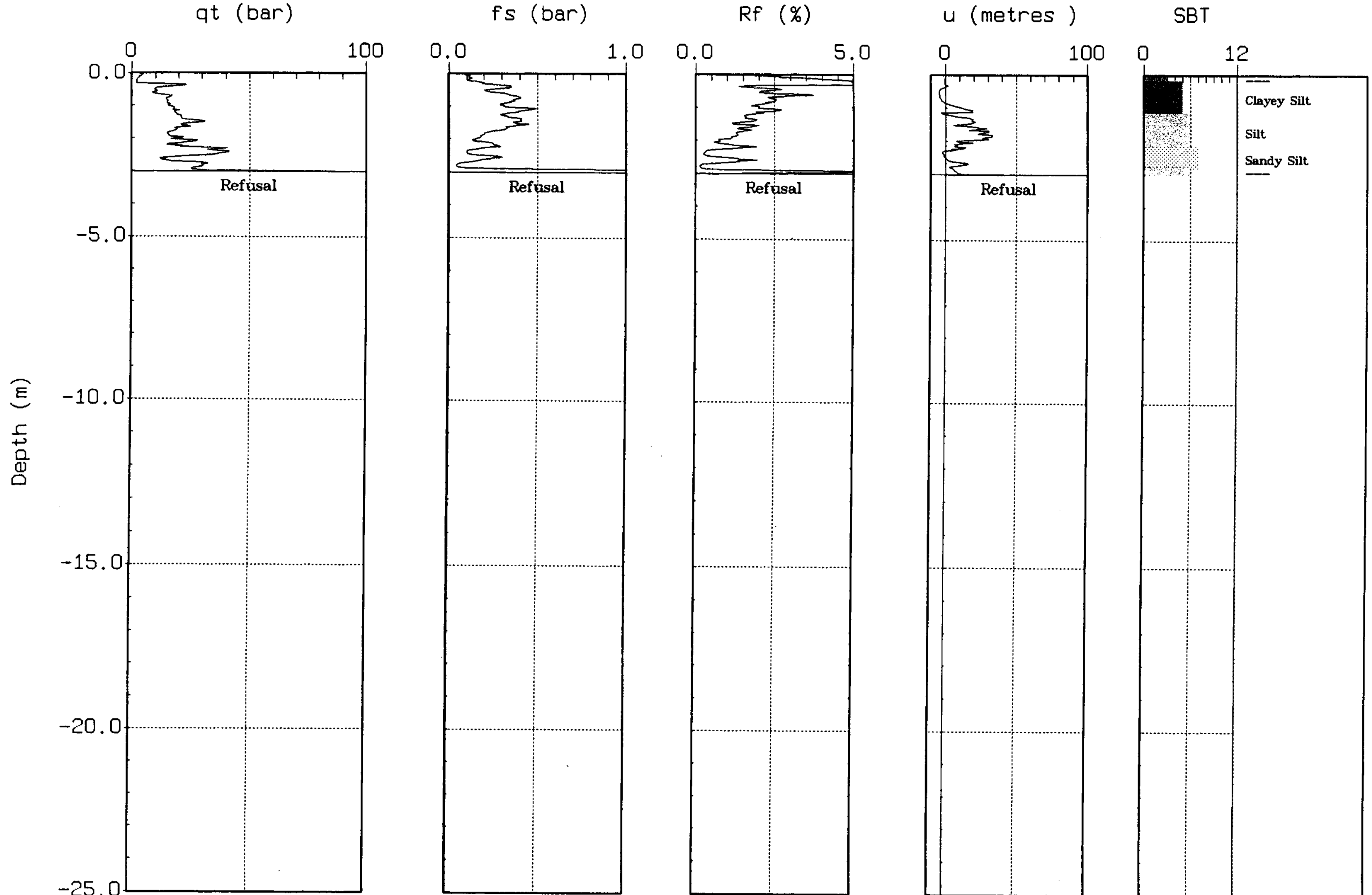

CONETEC
Thurber Engineering
Site: CPTU-13
Location: Burk's Falls
Cone: 10 Ton St 028
Date: 09:23:04 09:18
qt (bar)
fs (bar)
Rf (%)
u (metres)
SBT
0
100
0.0
1.0
0.0
5.0
0
100
0
12
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
Depth (m)
Organic Soil
Clay
Sensitive Fines
Sensitive Fines
Clayey Silt
Sensitive Fines
Silt
Sandy Silt
Refusal
Refusal
Refusal
Refusal
Max. Depth: 16.65 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-14
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:22:04 11:10



Max. Depth: 3.03 (m)

Depth Inc.: 0.025 (m)

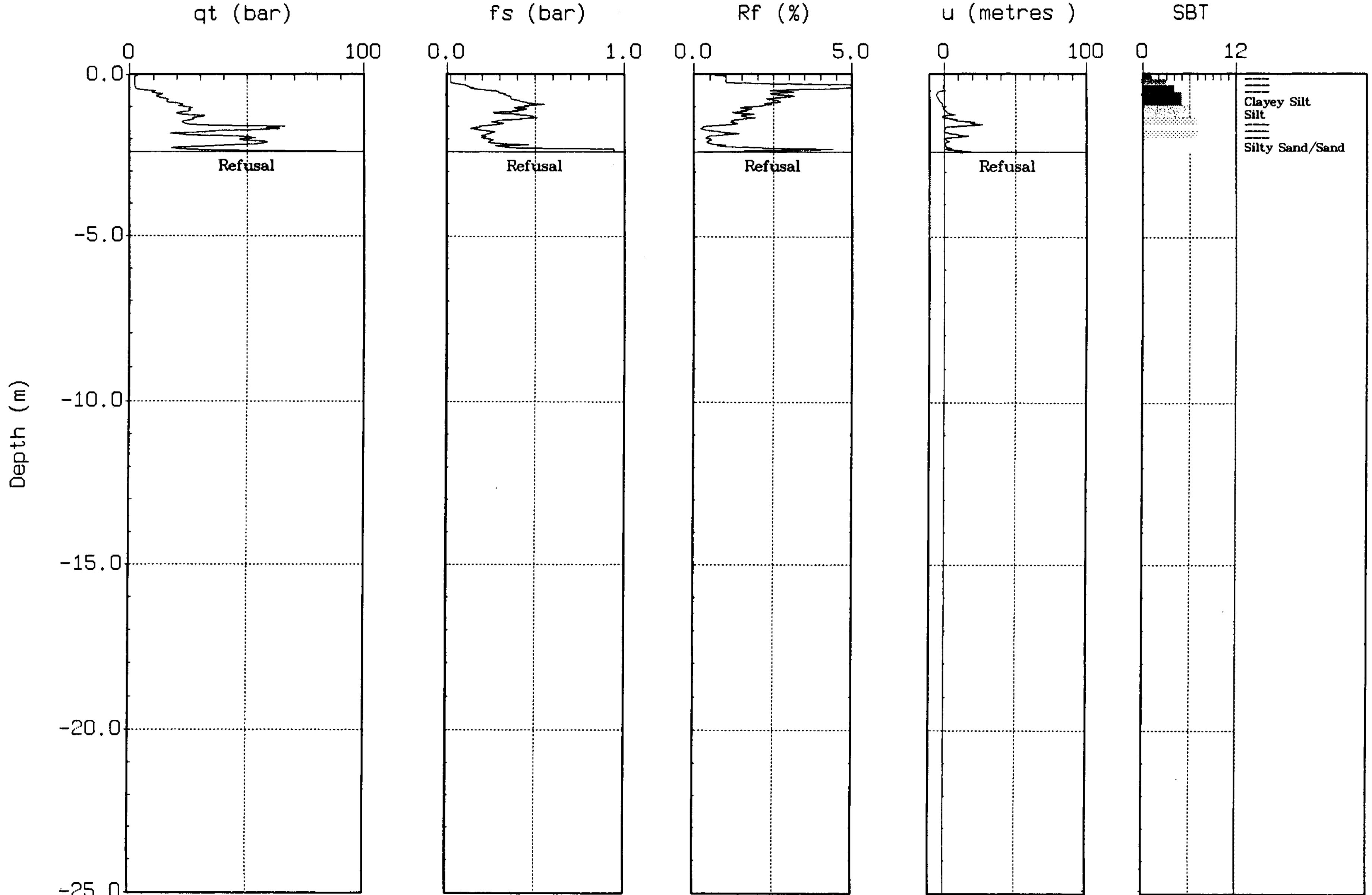
SBT: Soil Behavior Type (Robertson 1990)

ConeTec

Thurber Engineering

Site: CPTU-14B
Location: Burk's Falls

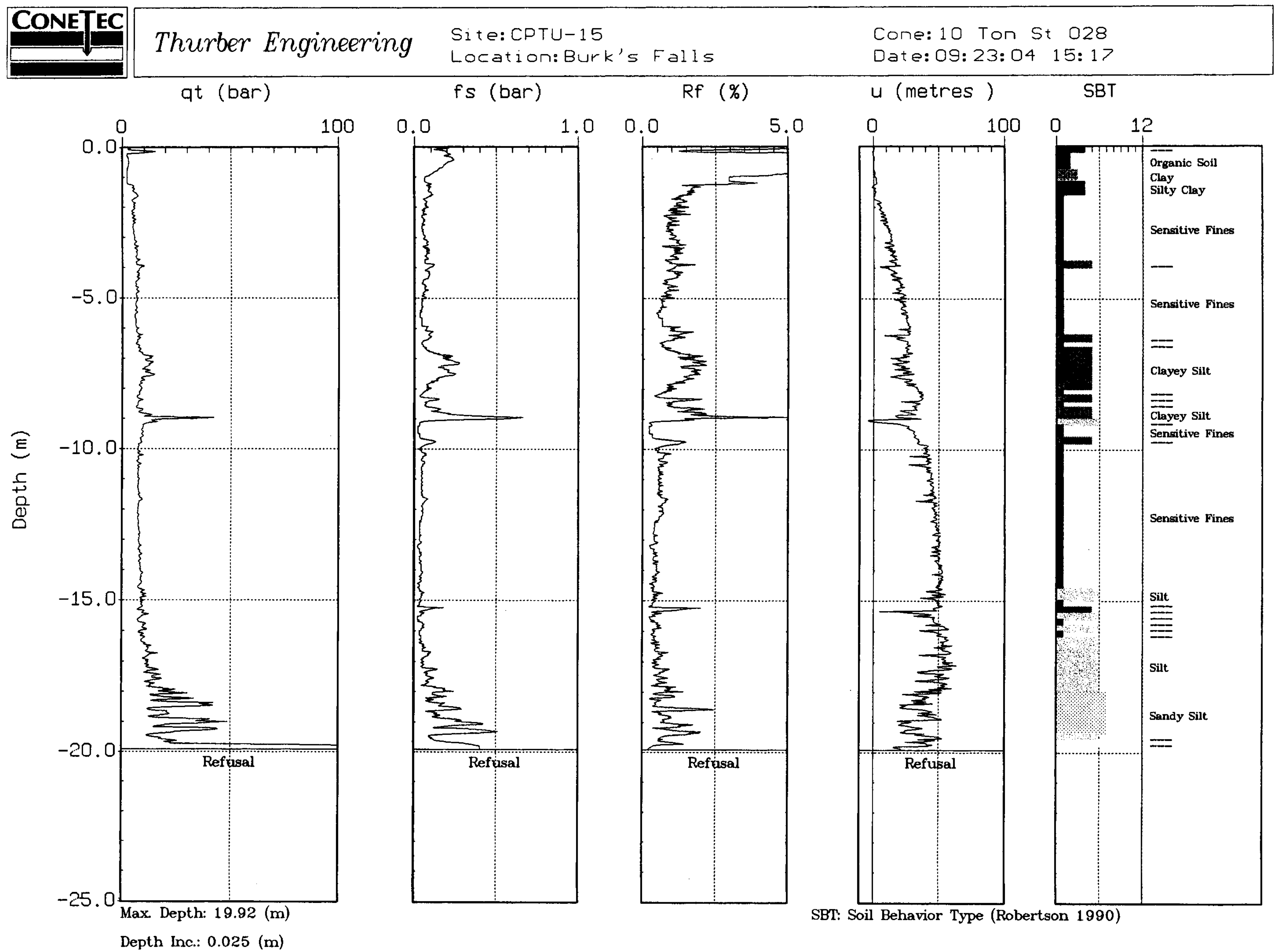
Cone: 10 Ton St 028
Date: 09:22:04 11:26



Max. Depth: 2.40 (m)

Depth Inc.: 0.025 (m)

SBT: Soil Behavior Type (Robertson 1990)

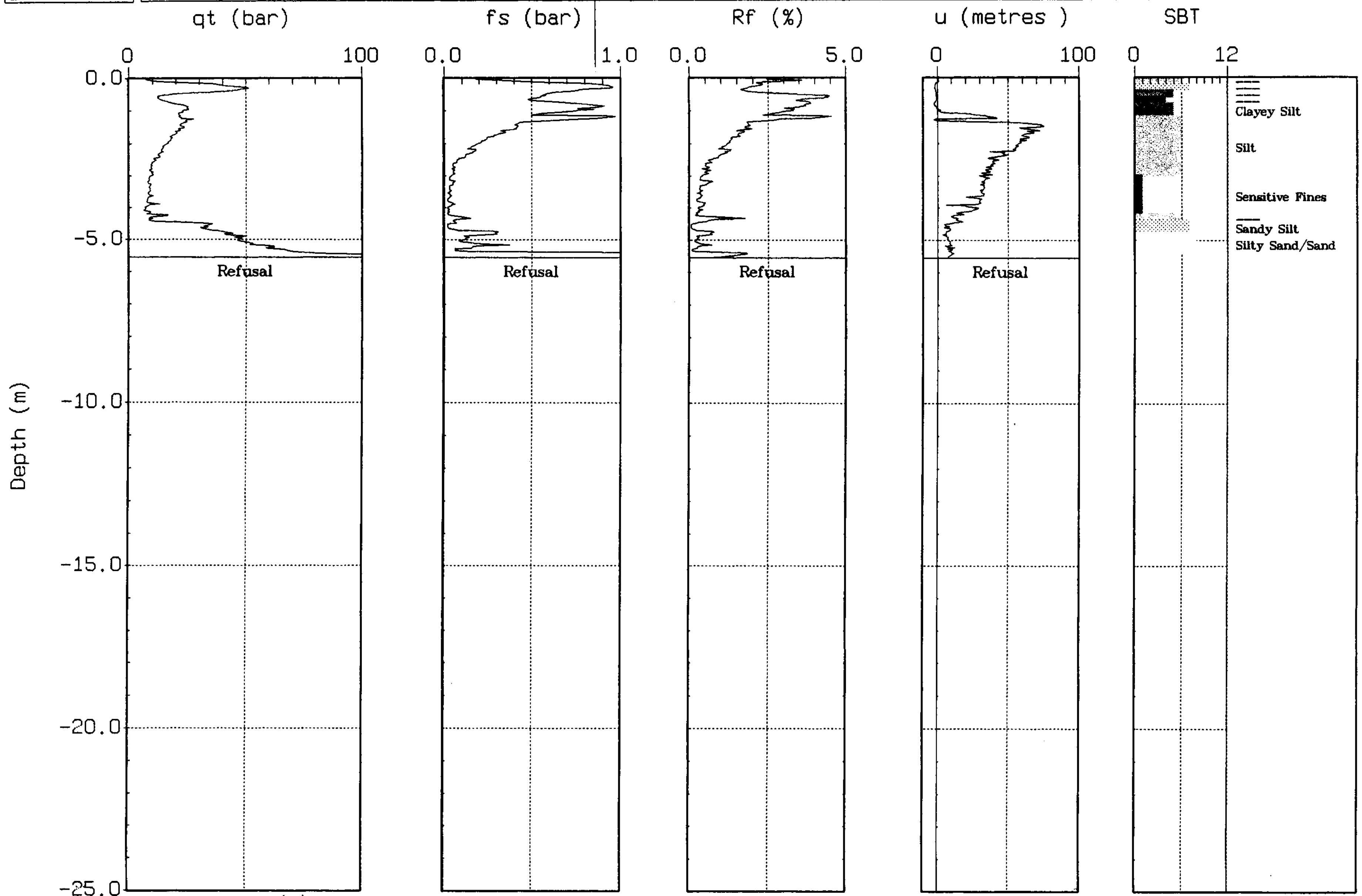

CONETEC
Thurber Engineering
Site: CPTU-15
Location: Burk's Falls
Cone: 10 Ton St 028
Date: 09:23:04 15:17
qt (bar)
fs (bar)
Rf (%)
u (metres)
SBT
Depth (m)
Organic Soil
Clay
Silty Clay
Sensitive Fines
Sensitive Fines
Clayey Silt
Clayey Silt
Sensitive Fines
Sensitive Fines
Silt
Silt
Sandy Silt
Refusal
Max. Depth: 19.92 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-16
Location: Burk's Falls

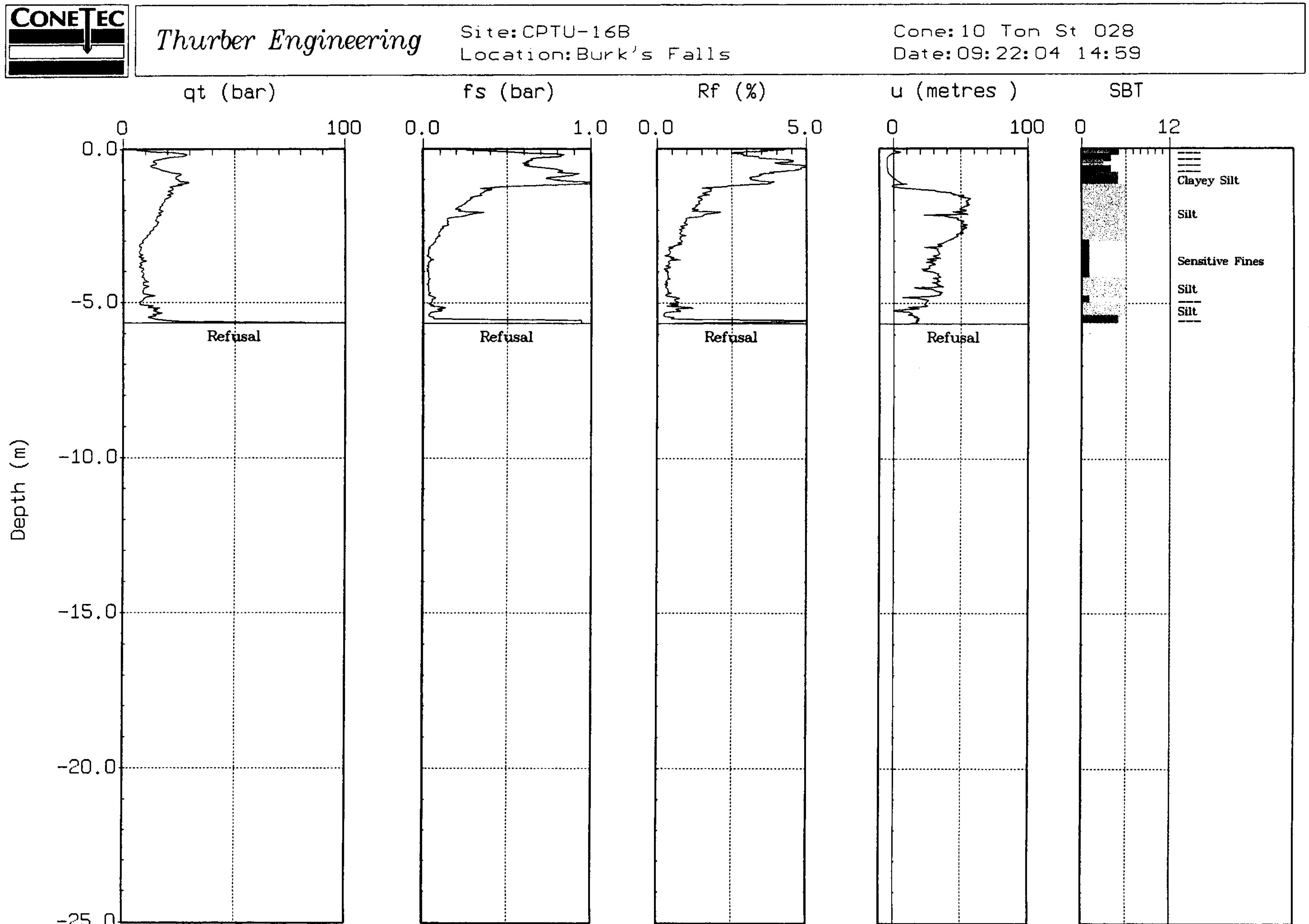
Cone: 10 Ton St 028
Date: 09:22:04 14:08



Max. Depth: 5.55 (m)

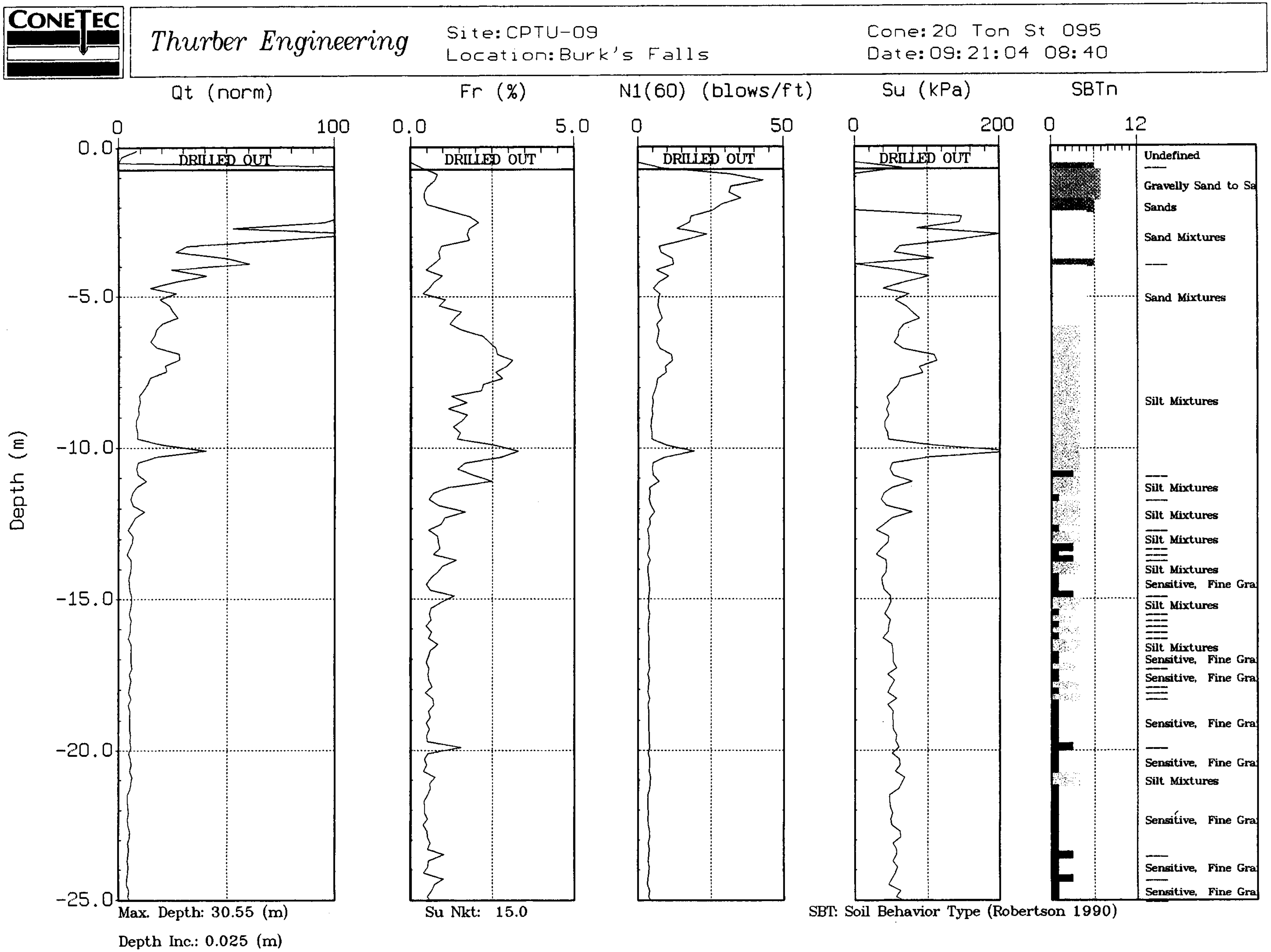
Depth Inc.: 0.025 (m)

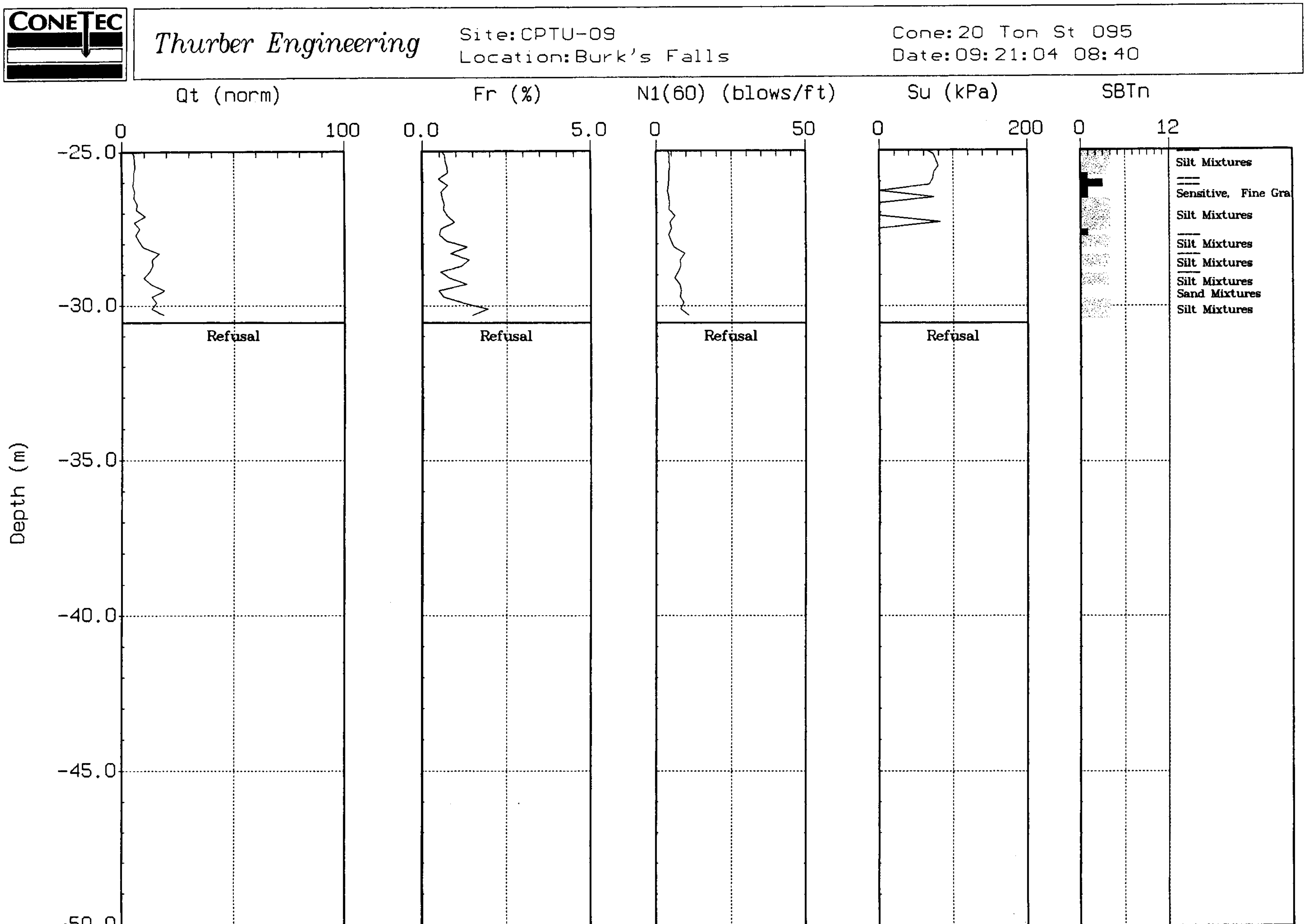
SBT: Soil Behavior Type (Robertson 1990)



Max. Depth: 5.65 (m)
Depth Inc.: 0.025 (m)
SBT: Soil Behavior Type (Robertson 1990)

Appendix CPTU
Cone Penetration Tests
with Su & N160


ConeTec
Thurber Engineering
Site: CPTU-09
Location: Burk's Falls
Cone: 20 Ton St 095
Date: 09:21:04 08:40
Qt (norm)
Fr (%)
N1(60) (blows/ft)
Su (kPa)
SBTn
DRILLED OUT
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
0
100
0.0
5.0
0
50
0
200
0
12
Undefined
Gravelly Sand to Sa
Sands
Sand Mixtures
Sand Mixtures
Silt Mixtures
Silt Mixtures
Silt Mixtures
Silt Mixtures
Silt Mixtures
Sensitive, Fine Gra
Silt Mixtures
Silt Mixtures
Sensitive, Fine Gra
Sensitive, Fine Gra
Sensitive, Fine Gra
Sensitive, Fine Gra
Silt Mixtures
Sensitive, Fine Gra
Sensitive, Fine Gra
Sensitive, Fine Gra
Max. Depth: 30.55 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 15.0
SBT: Soil Behavior Type (Robertson 1990)



Max. Depth: 30.55 (m)

Depth Inc.: 0.025 (m)

Su Nkt: 15.0

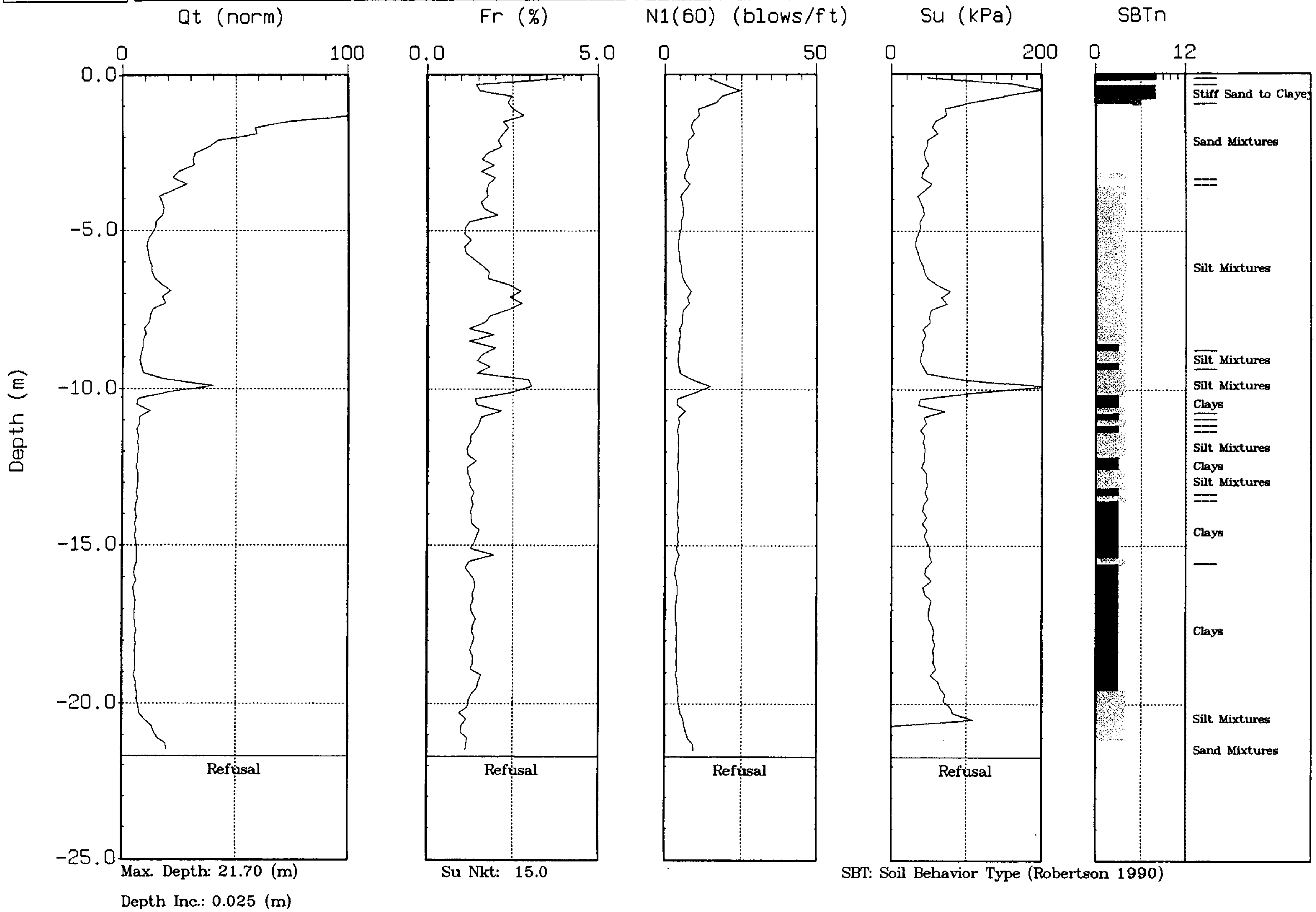
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-10
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:22:04 07:33

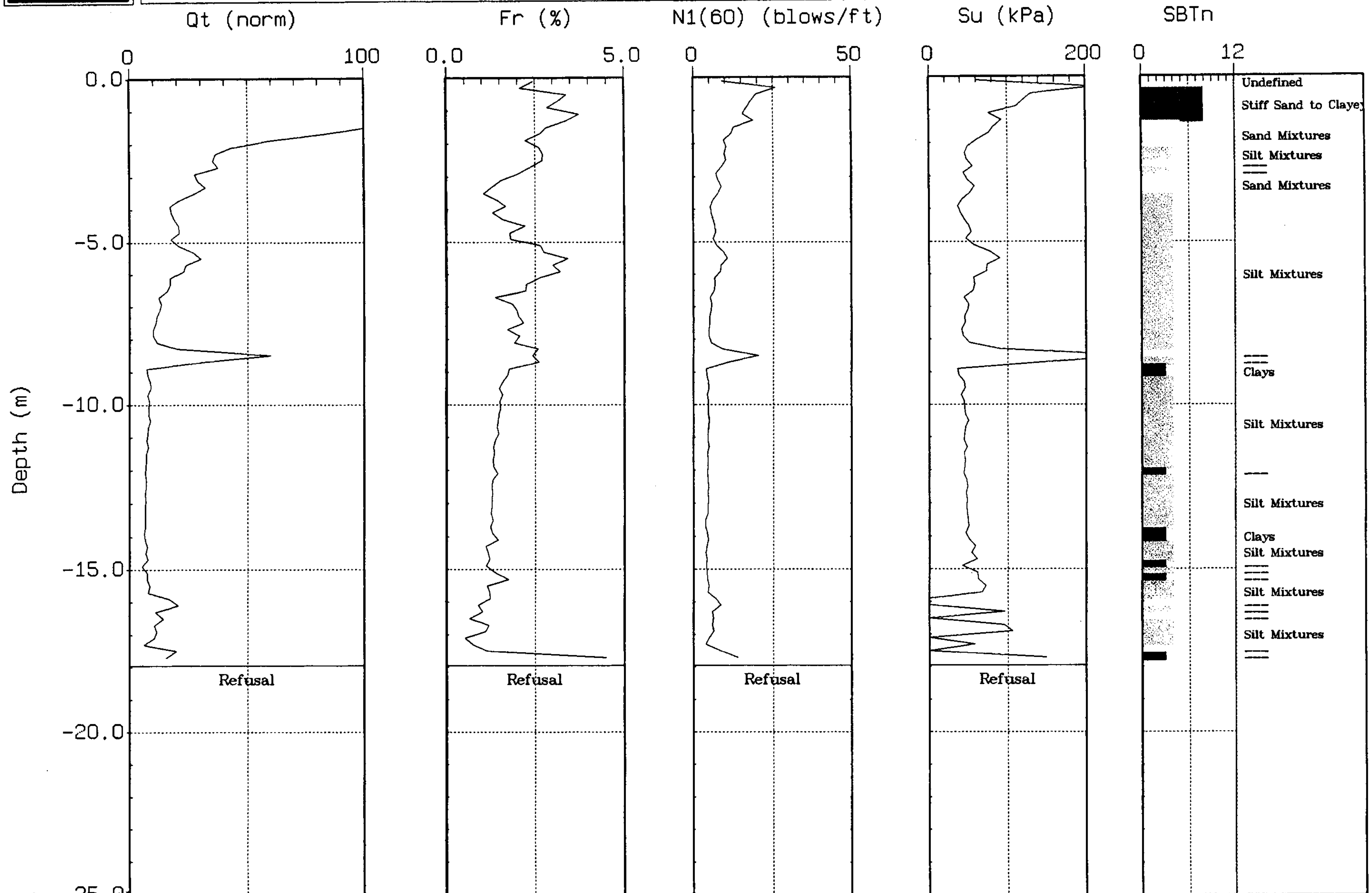


CONETEC

Thurber Engineering

Site: CPTU-11
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:21:04 14:50

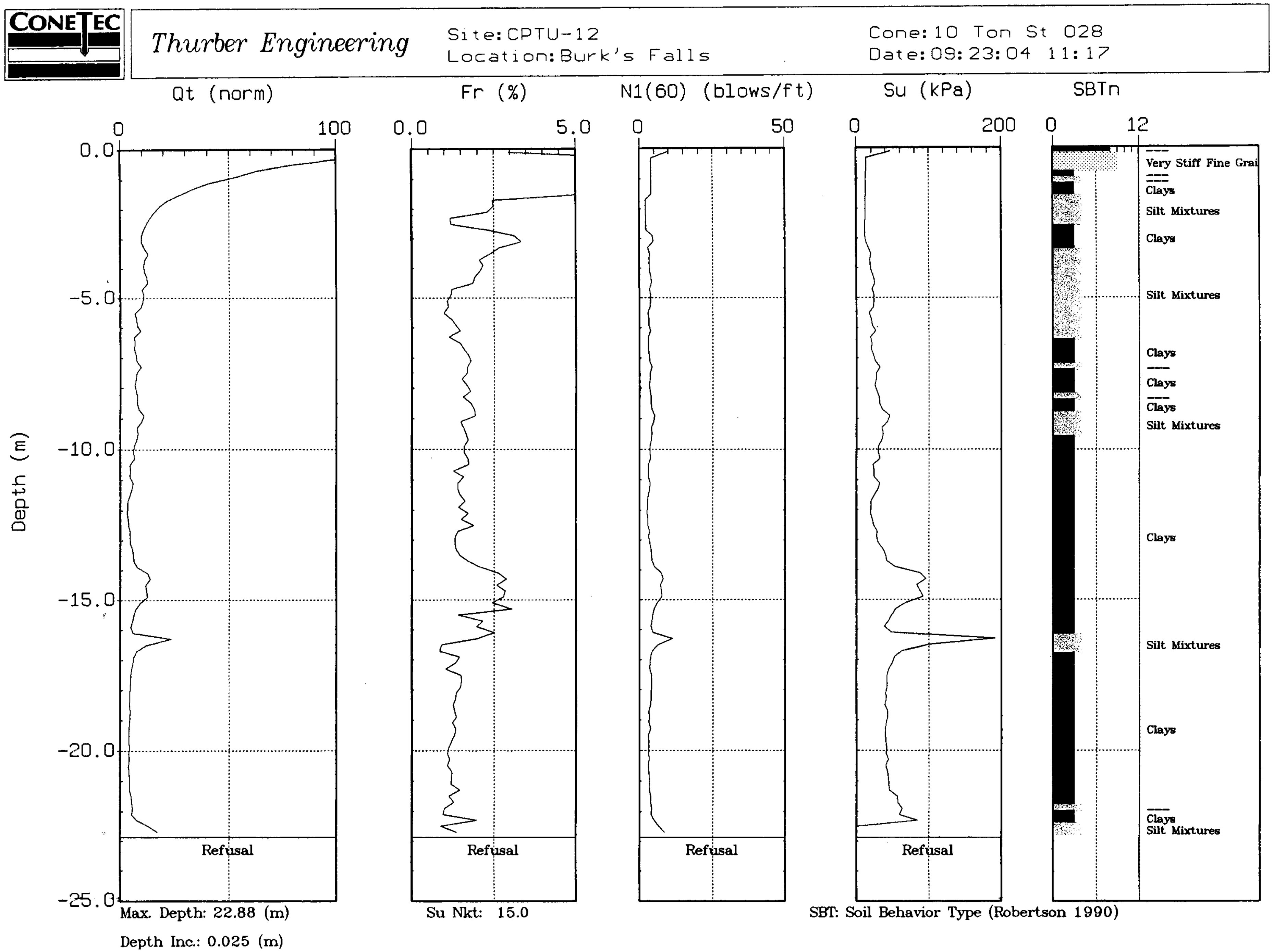


Max. Depth: 17.95 (m)

Depth Inc.: 0.025 (m)

Su Nkt: 15.0

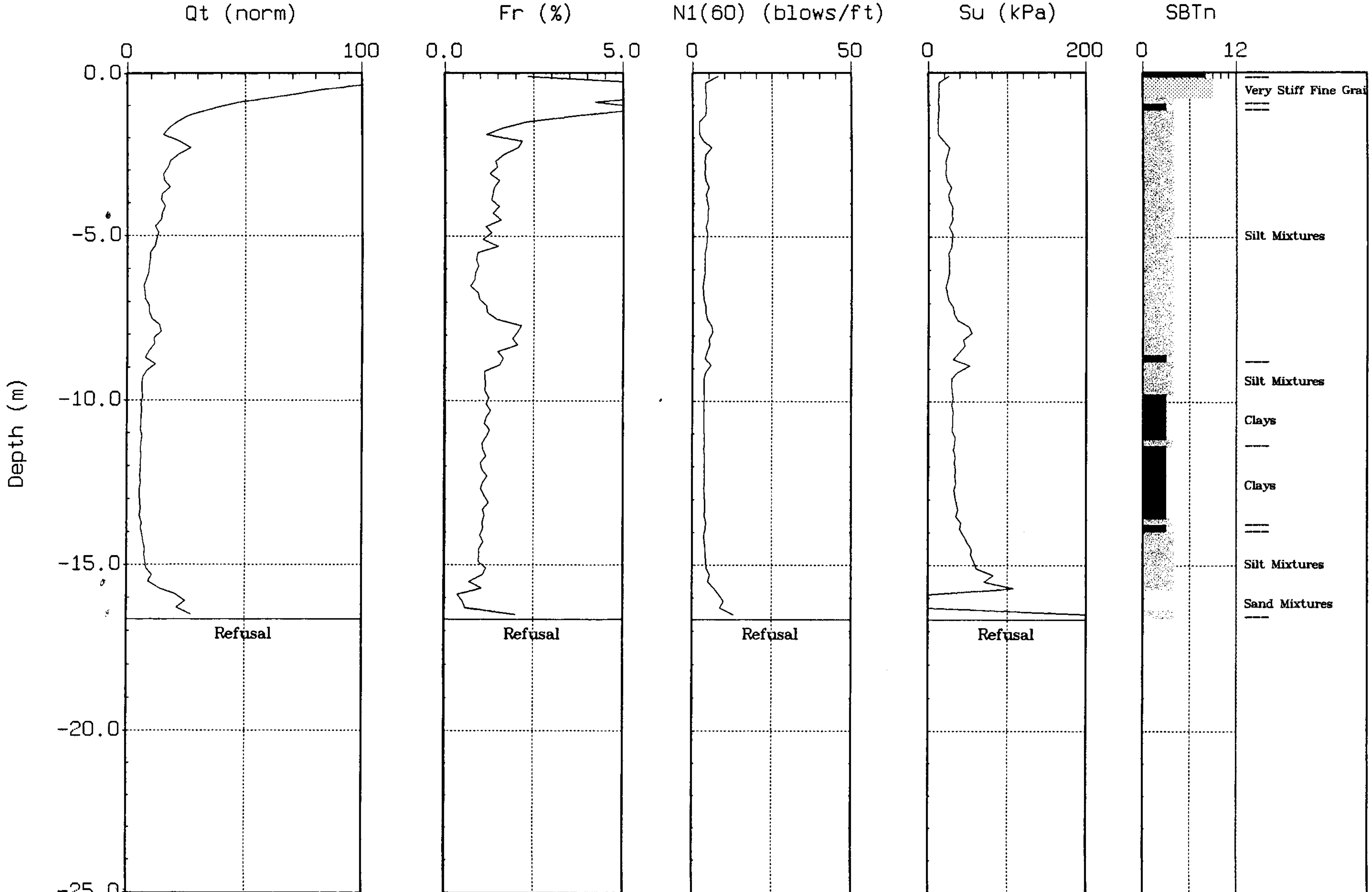
SBT: Soil Behavior Type (Robertson 1990)


CONETEC
Thurber Engineering
Site:CPTU-12
Location:Burk's Falls
Cone:10 Ton St 028
Date:09:23:04 11:17
Qt (norm)
Fr (%)
N1(60) (blows/ft)
Su (kPa)
SBTn
0
100
0.0
5.0
0
50
0
200
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
Very Stiff Fine Grai
Clays
Silt Mixtures
Clays
Silt Mixtures
Clays
Clays
Clays
Silt Mixtures
Clays
Silt Mixtures
Clays
Clays
Silt Mixtures
Refusal
Refusal
Refusal
Refusal
Max. Depth: 22.88 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 15.0
SBT: Soil Behavior Type (Robertson 1990)

Thurber Engineering

Site: CPTU-13
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:23:04 09:18



Max. Depth: 16.65 (m)

Depth Inc.: 0.025 (m)

Su Nkt: 15.0

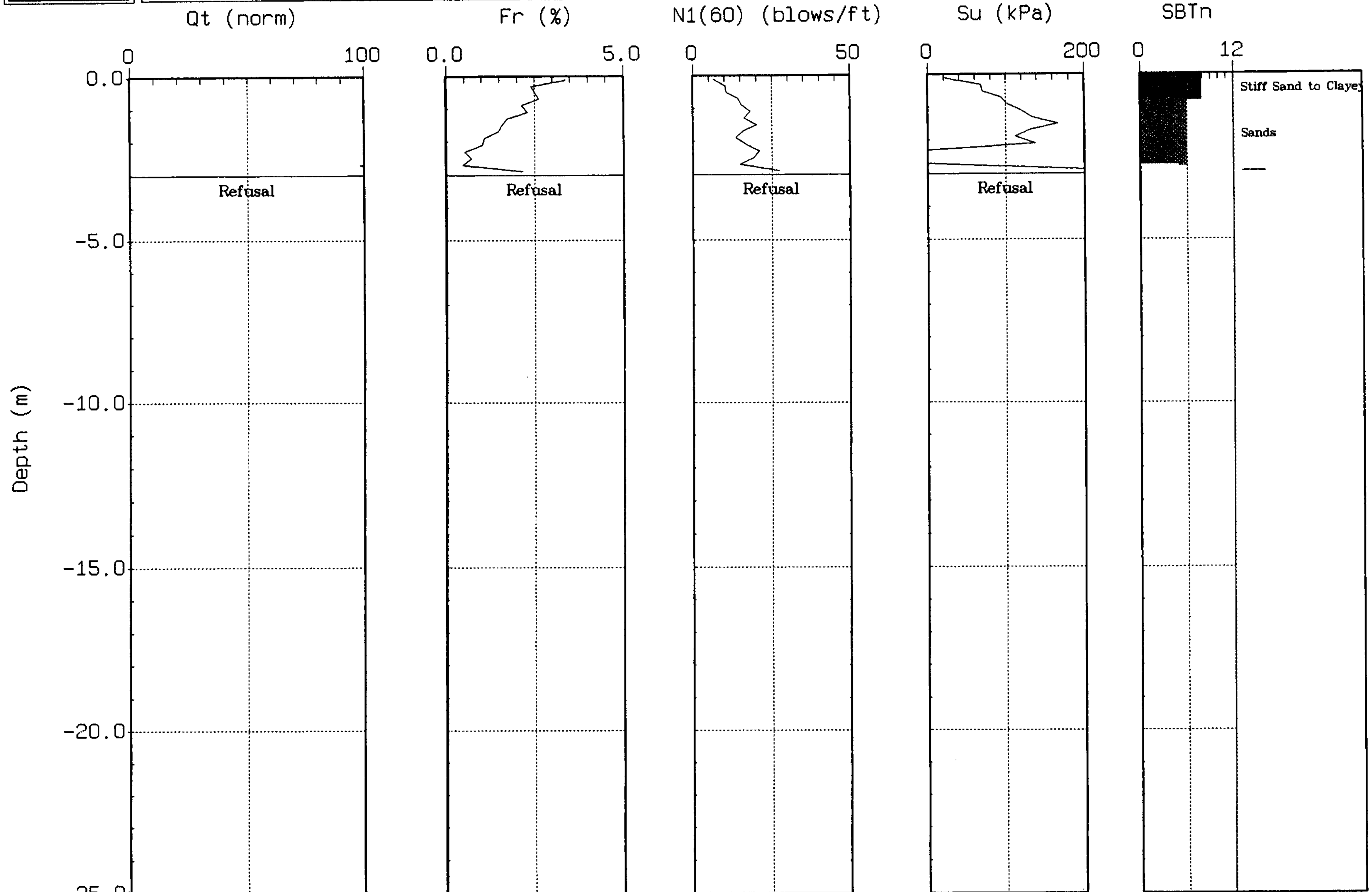
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-14
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:22:04 11:10



Max. Depth: 3.03 (m)

Depth Inc.: 0.025 (m)

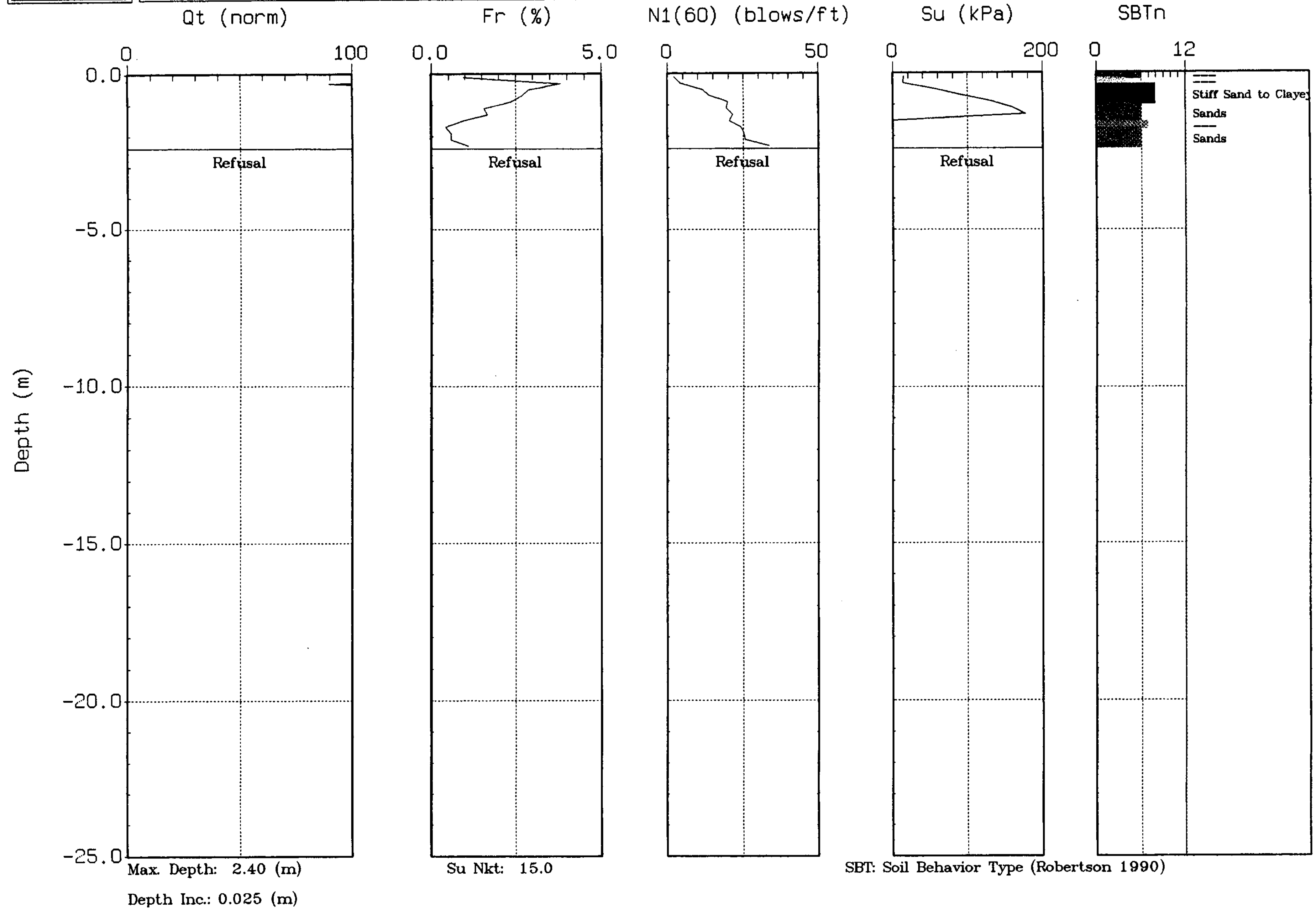
Su Nkt: 15.0

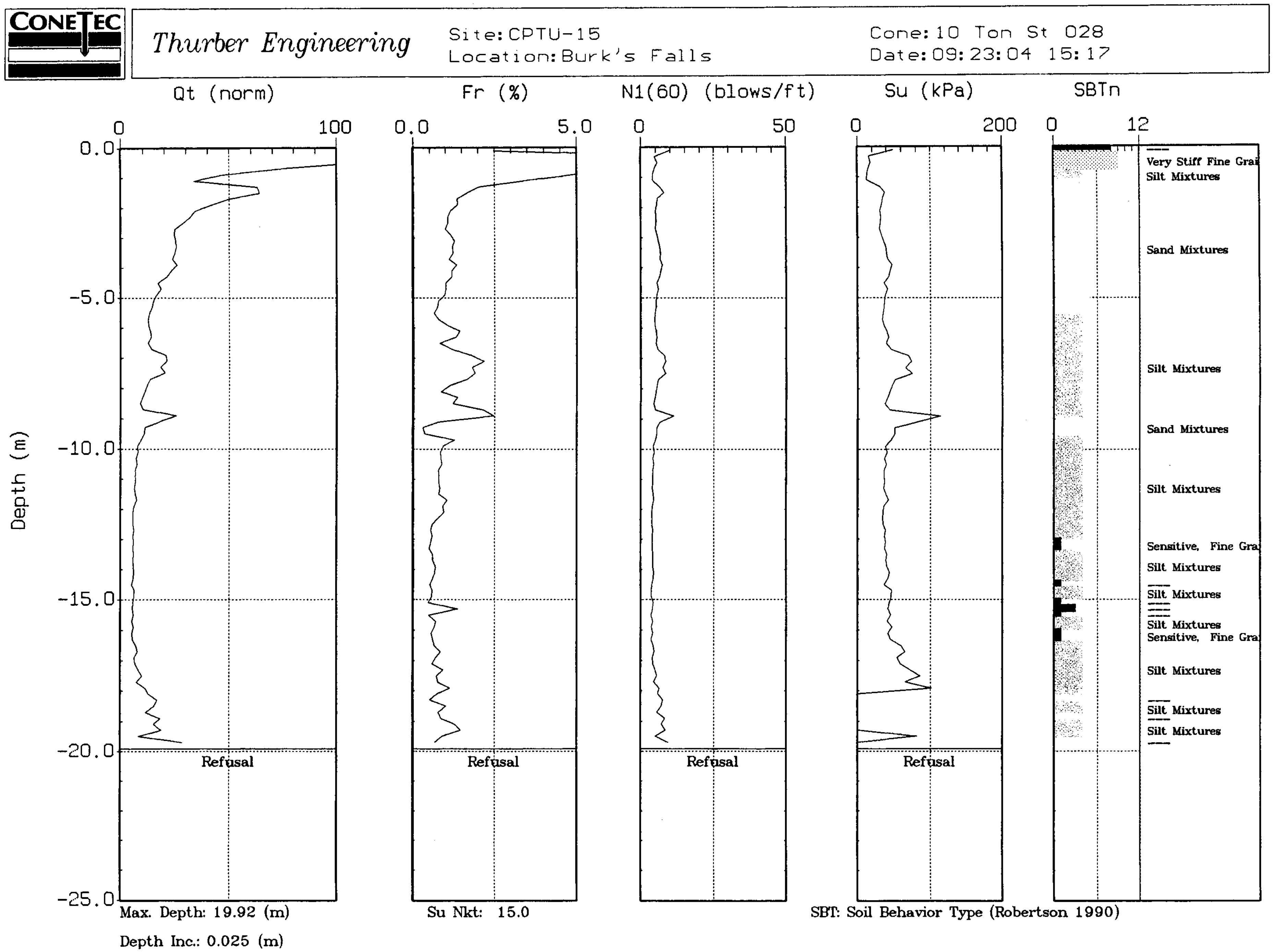
SBT: Soil Behavior Type (Robertson 1990)

Thurber Engineering

Site: CPTU-14B
Location: Burk's Falls

Cone: 10 Ton St 028
Date: 09:22:04 11:26





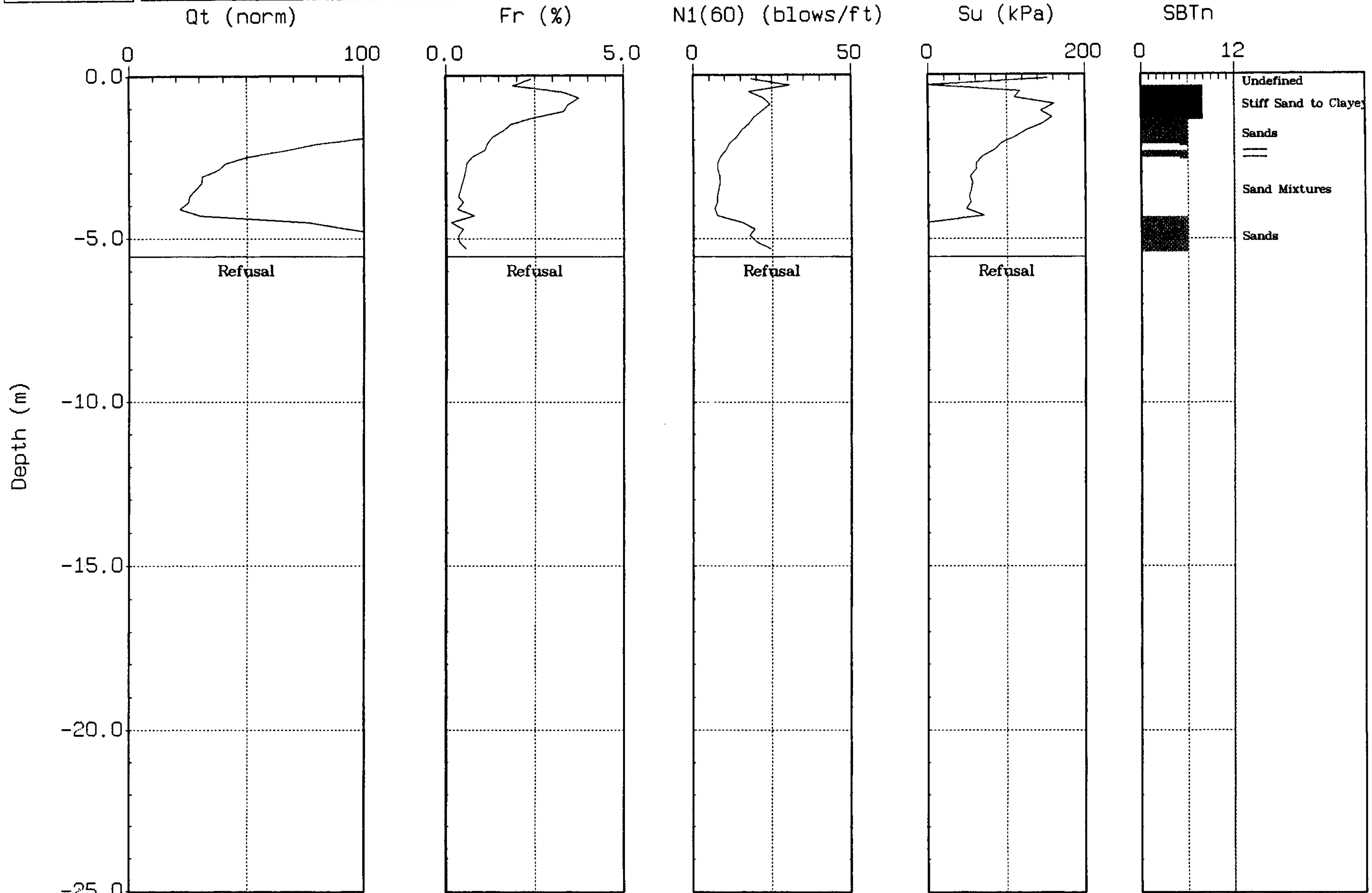
CONETEC
Thurber Engineering
Site: CPTU-15
Location: Burk's Falls
Cone: 10 Ton St 028
Date: 09:23:04 15:17
Qt (norm)
Fr (%)
N1(60) (blows/ft)
Su (kPa)
SBTn
0
100
0.0
5.0
0
50
0
200
0
12
Depth (m)
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
Very Stiff Fine Grai
Silt Mixtures
Sand Mixtures
Silt Mixtures
Sand Mixtures
Silt Mixtures
Sensitive, Fine Gra
Silt Mixtures
Silt Mixtures
Silt Mixtures
Sensitive, Fine Gra
Silt Mixtures
Silt Mixtures
Silt Mixtures
Refusal
Refusal
Refusal
Refusal
Max. Depth: 19.92 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 15.0
SBT: Soil Behavior Type (Robertson 1990)

CONETEC

Thurber Engineering

Site: CPTU-16
Location: Burk's Falls

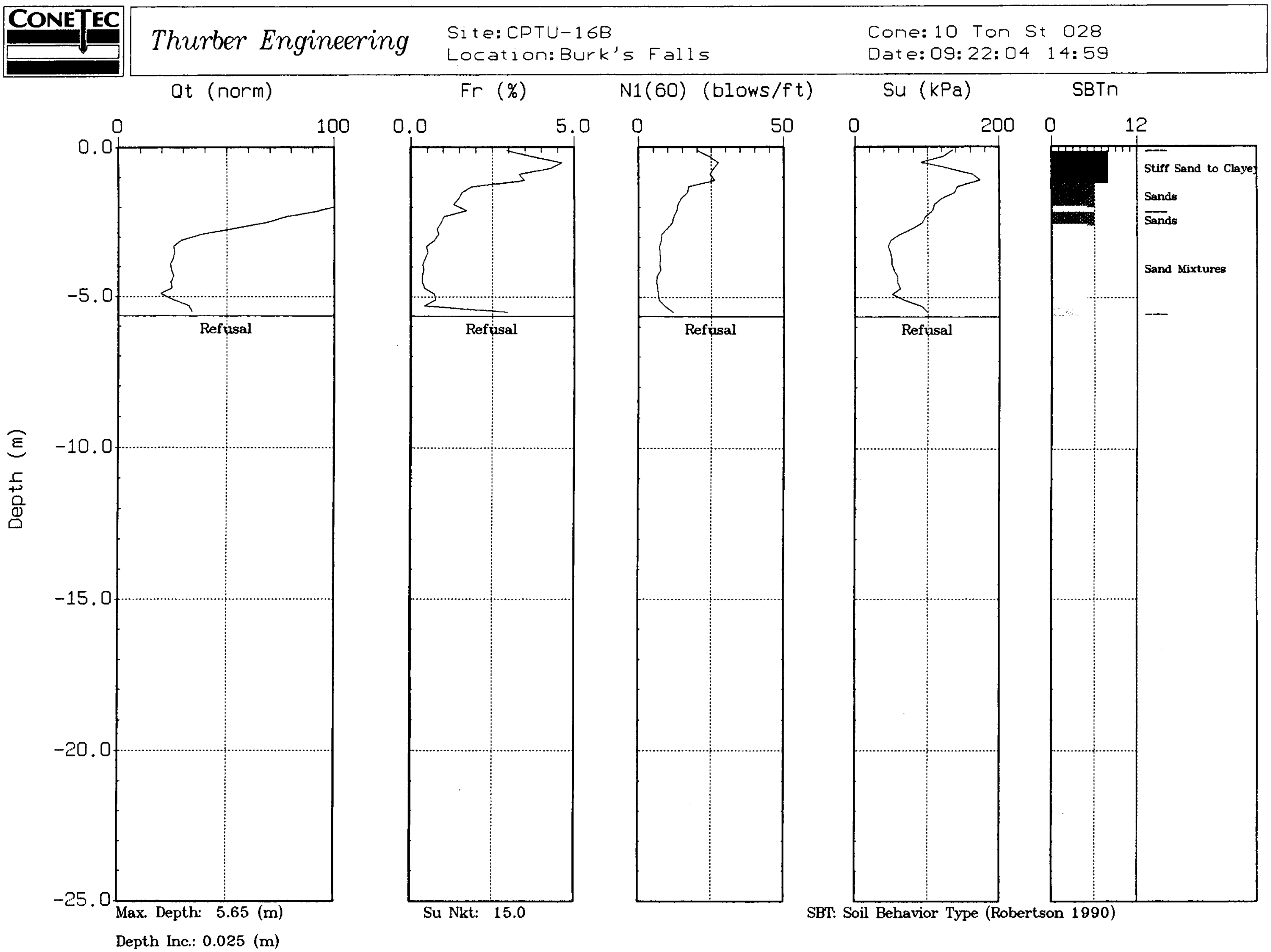
Cone: 10 Ton St 028
Date: 09:22:04 14:08



Max. Depth: 5.55 (m)
Depth Inc.: 0.025 (m)

Su Nkt: 15.0

SBT: Soil Behavior Type (Robertson 1990)



CONETEC
Thurber Engineering
Site: CPTU-16B
Location: Burk's Falls
Cone: 10 Ton St 028
Date: 09:22:04 14:59
Qt (norm)
Fr (%)
N1(60) (blows/ft)
Su (kPa)
SBTn
0
100
0.0
5.0
0
50
0
200
0
12
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
Depth (m)
Refusal
Refusal
Refusal
Refusal
Stiff Sand to Clayey
Sands
Sands
Sand Mixtures
Max. Depth: 5.65 (m)
Depth Inc.: 0.025 (m)
Su Nkt: 15.0
SBT: Soil Behavior Type (Robertson 1990)

Appendix PPD
Pore Pressure Dissipation Tests

CONETEC

Job No: 04-244
Client: Thurber Engineering Ltd.
Project: Highway 11, Burk's Falls - ON
Date: September 21 - 23, 2004

PPD SUMMARY

CPT Sounding	Filename	Test Depth (m)	Time (s)	Equilibrium Pore Pressure (Ueq, m)*	Calculated Water Table (m)**	Assumed Water Table (m)***	T_{50} (s)****	C_h (cm^2/min)*****
CPTU-09	244CP09.PPD	6.00	615	N/A	N/A	0.0	50	13.77
		15.00	600	N/A	N/A	0.0	305	2.35
		19.90	1400	N/A	N/A	0.0	367	1.95
		24.40	700	N/A	N/A	0.0	237	3.02
		30.35	355	30.5	-0.1	0.0	N/A	N/A
CPTU-10	244CP10.PPD	4.58	750	N/A	N/A	0.0	170	2.81
		15.30	725	N/A	N/A	0.0	262	1.83
		21.70	300	22.6	-0.9	0.0	N/A	N/A
CPTU-11	244CP11.PPD	4.58	600	N/A	N/A	0.0	185	2.58
		15.40	1005	N/A	N/A	0.0	75	6.39
		17.95	500	18.5	-0.6	0.0	N/A	N/A
CPTU-12	244CP12.PPD	4.58	1025	N/A	N/A	0.0	526	0.91
		15.30	600	N/A	N/A	0.0	313	1.53
		22.88	440	23.0	-0.1	0.0	N/A	N/A
CPTU-13	244CP13.PPD	4.58	1220	N/A	N/A	0.0	860	0.56
		15.28	400	N/A	N/A	0.0	81	5.91
		16.65	240	16.6	0.0	0.0	N/A	N/A
CPTU-15	244CP15.PPD	6.18	750	N/A	N/A	0.0	333	1.43
		15.30	2050	N/A	N/A	0.0	129	3.71
		19.92	180	19.8	0.1	0.0	N/A	N/A
CPTU-16	244CP16.PPD	1.23	500	N/A	N/A	0.0	68	7.00
		4.58	240	5.2	-0.6	0.0	N/A	N/A
		5.55	155	5.7	-0.2	0.0	N/A	N/A

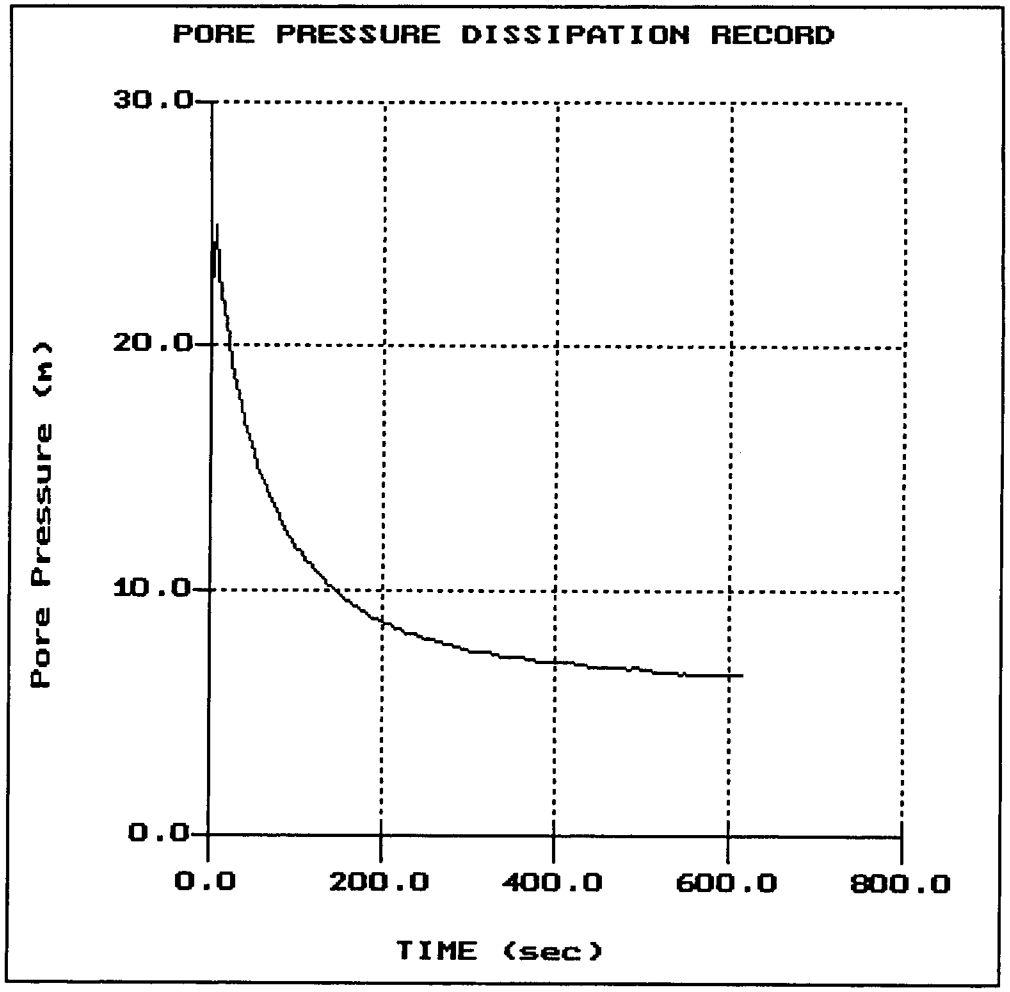
* Equilibrium pore pressure estimated from complete dissipation test (T100).
** Calculated water table based on test depth and Ueq.
***Assumed Water Table is used to estimate Ueq for T50 calculation. It is calculated from complete dissipation tests in same hole.
**** T_{50} is calculated based on U initial and estimated equilibrium pore pressure
*****C_h calculated based on Robertson et al., 1992

Thurber

Hole:CPTU-09
Location:Burk's Falls

Cone:20 Ton St 095
Date:09:21:04 08:40

File: 244CP09.PPD
Depth (m): 6.00
(ft): 19.69
Duration : 615.0s
U-min: 6.52 615.0s
U-max: 24.87 5.0s

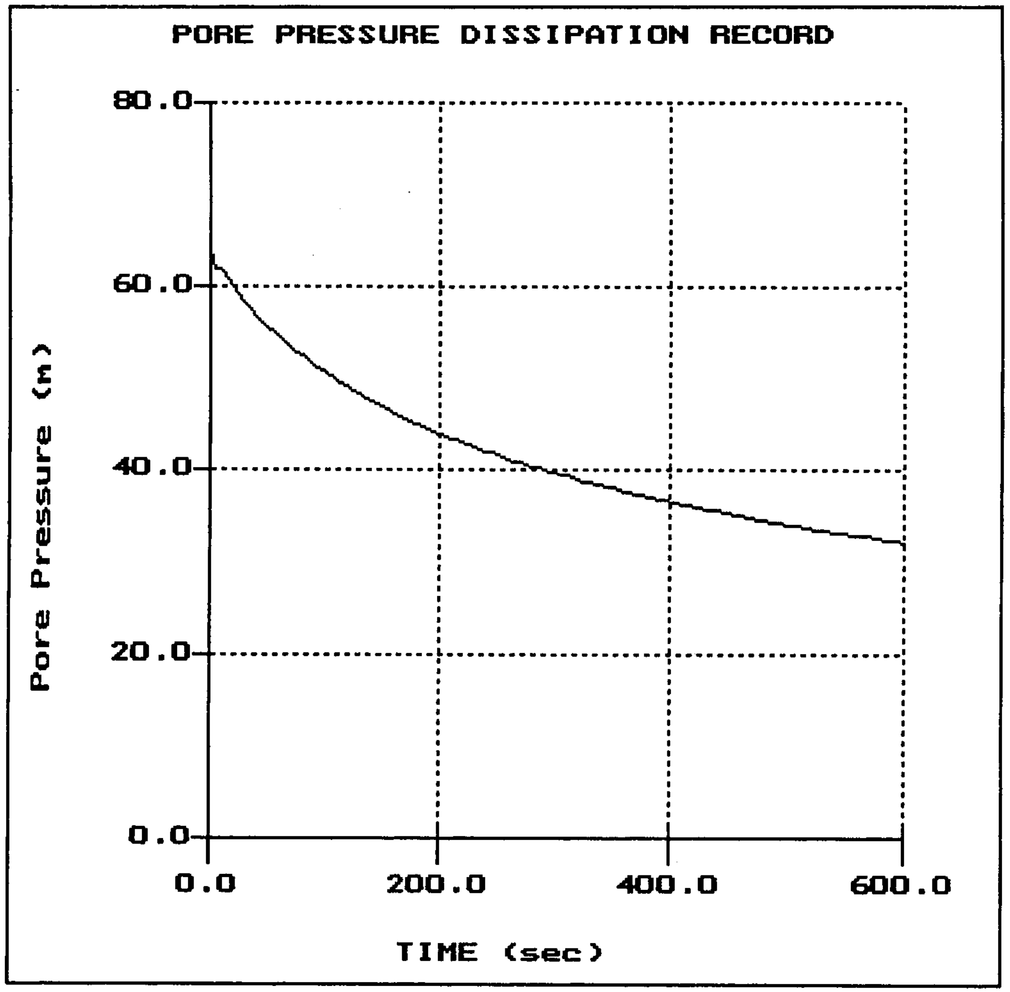


Thurber

Hole:CPTU-09
Location:Burk's Falls

Cone:20 Ton St 095
Date:09:21:04 08:40

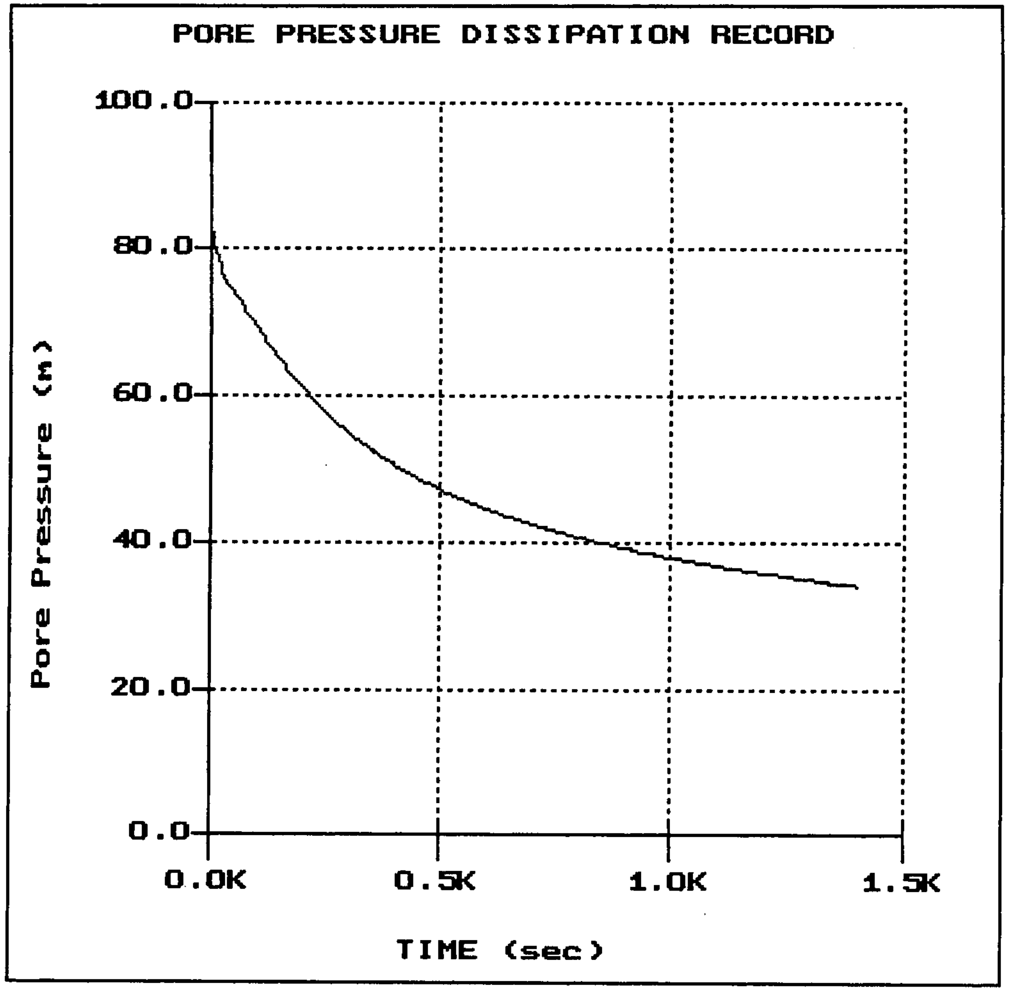
File: 244CP09.PPD
Depth (m): 15.00
(ft): 49.21
Duration : 600.0s
U-min: 32.01 600.0s
U-max: 63.77 0.0s



Thurber

Hole:CPTU-09
Location:Burk's Falls

Cone:20 Ton St 095
Date:09:21:04 08:40

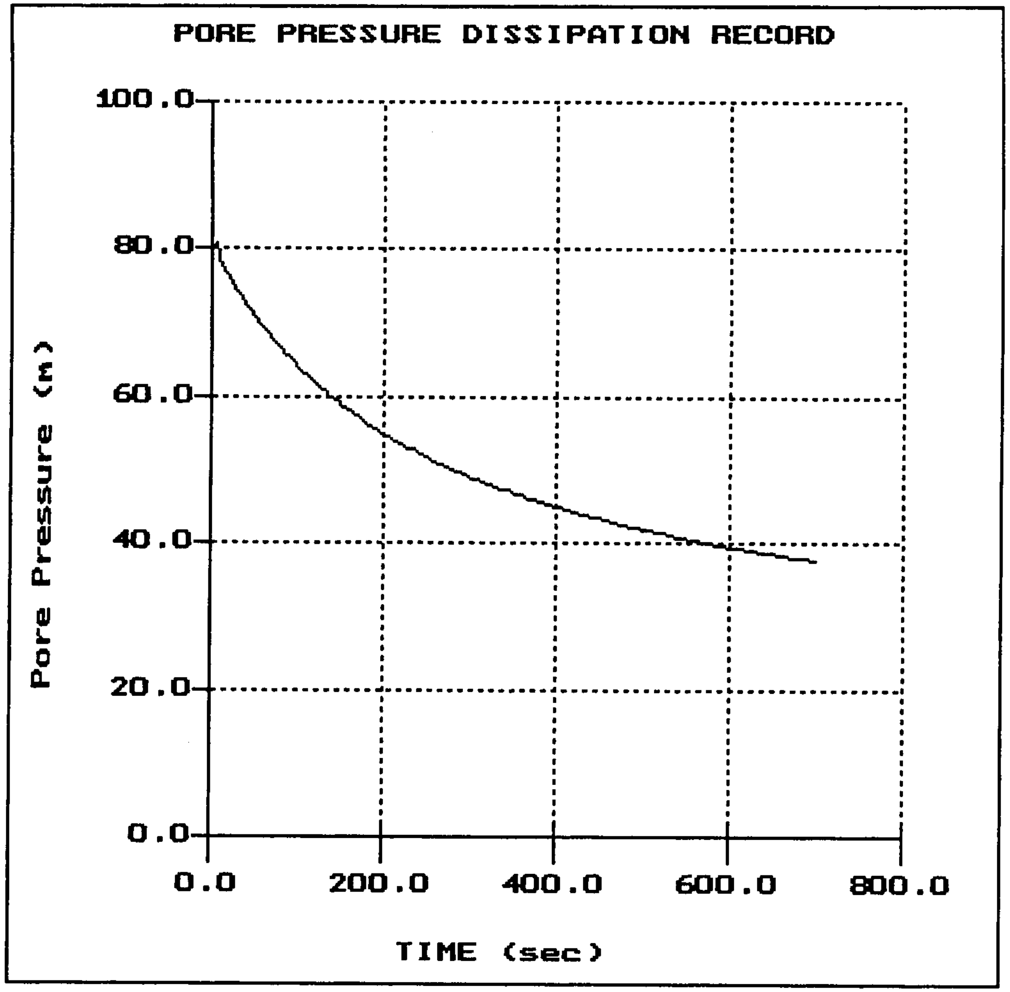


File: 244CP09.PPD
Depth (m): 19.90
(ft): 65.29
Duration : 1400.0s
U-min: 34.20 1400.0s
U-max: 83.32 0.0s

Thurber

Hole:CPTU-09
Location:Burk's Falls

Cone:20 Ton St 095
Date:09:21:04 08:40



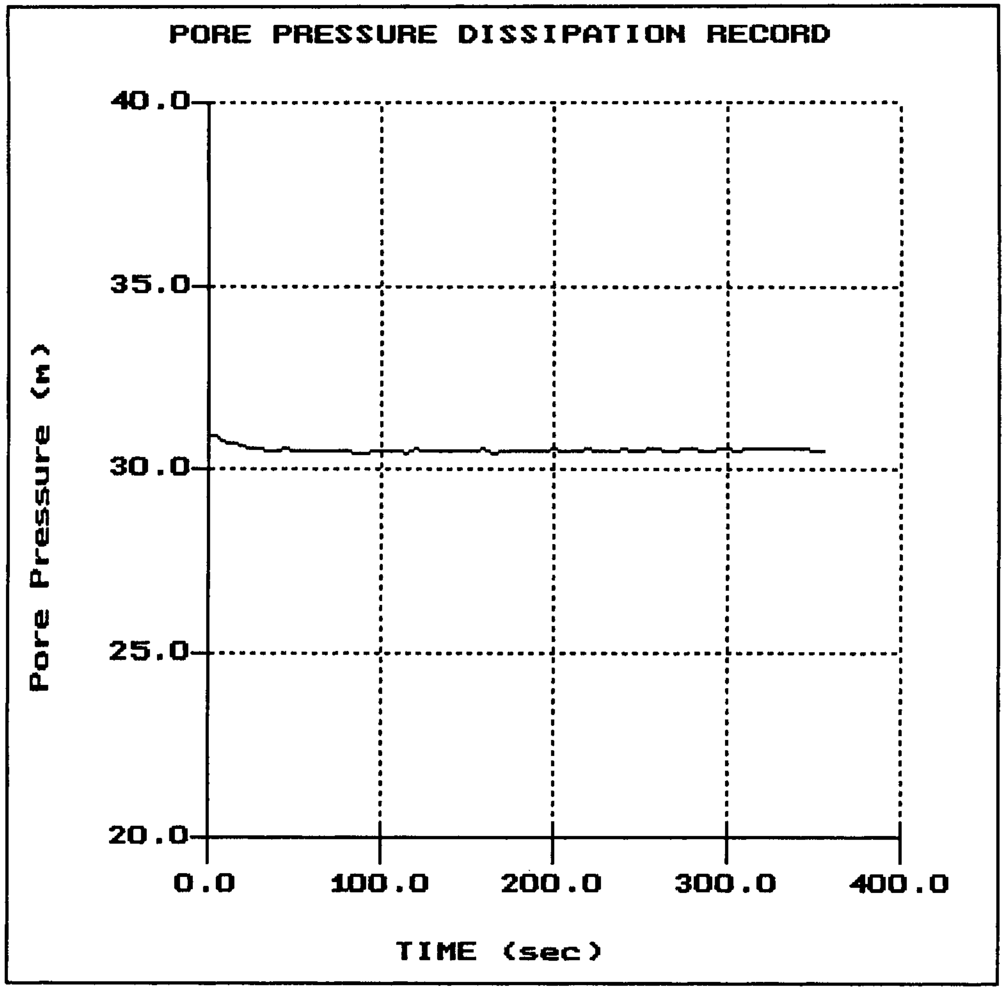
File: 244CP09.PPD
Depth (m): 24.40
(ft): 80.05
Duration : 700.0s
U-min: 37.50 700.0s
U-max: 80.53 5.0s

Thurber

Hole:CPTU-09
Location:Burk's Falls

Cone:20 Ton St 095
Date:09:21:04 08:40

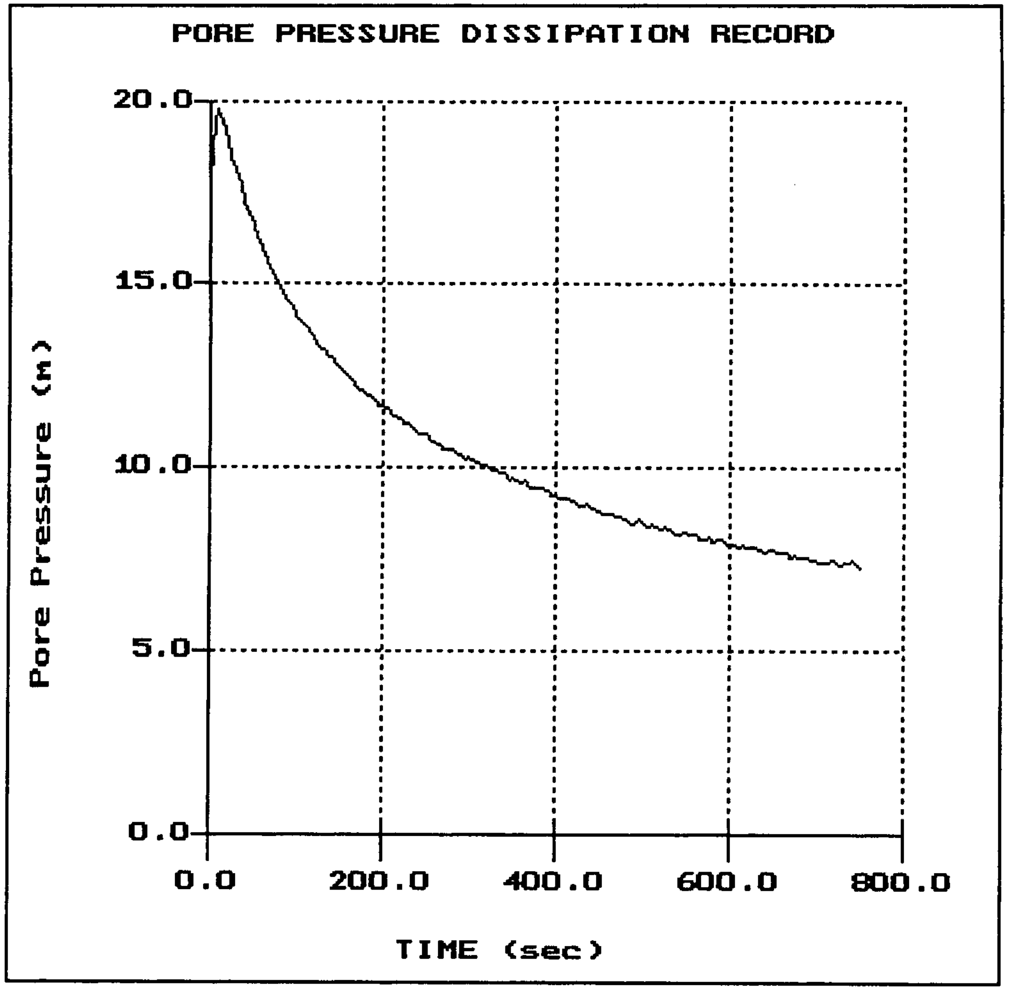
File: 244CP09.PPD
Depth (m): 30.35
(ft): 99.57
Duration : 355.0s
U-min: 30.44 85.0s
U-max: 30.92 5.0s



Thurber

Hole:CPTU-10
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:22:04 07:33



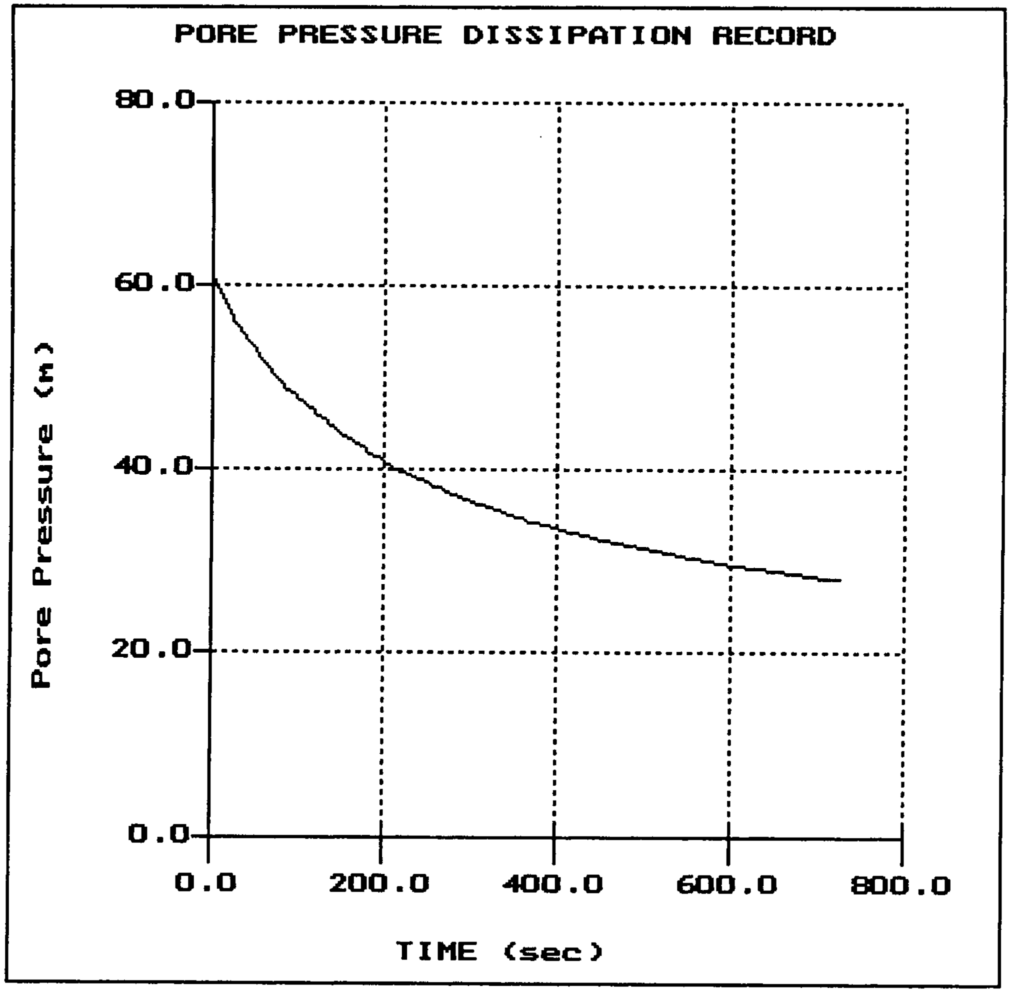
File: 244CP10.PPD
Depth (m): 4.58
(ft): 15.03
Duration : 750.0s
U-min: 7.31 750.0s
U-max: 19.77 10.0s

Thurber

Hole:CPTU-10
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:22:04 07:33

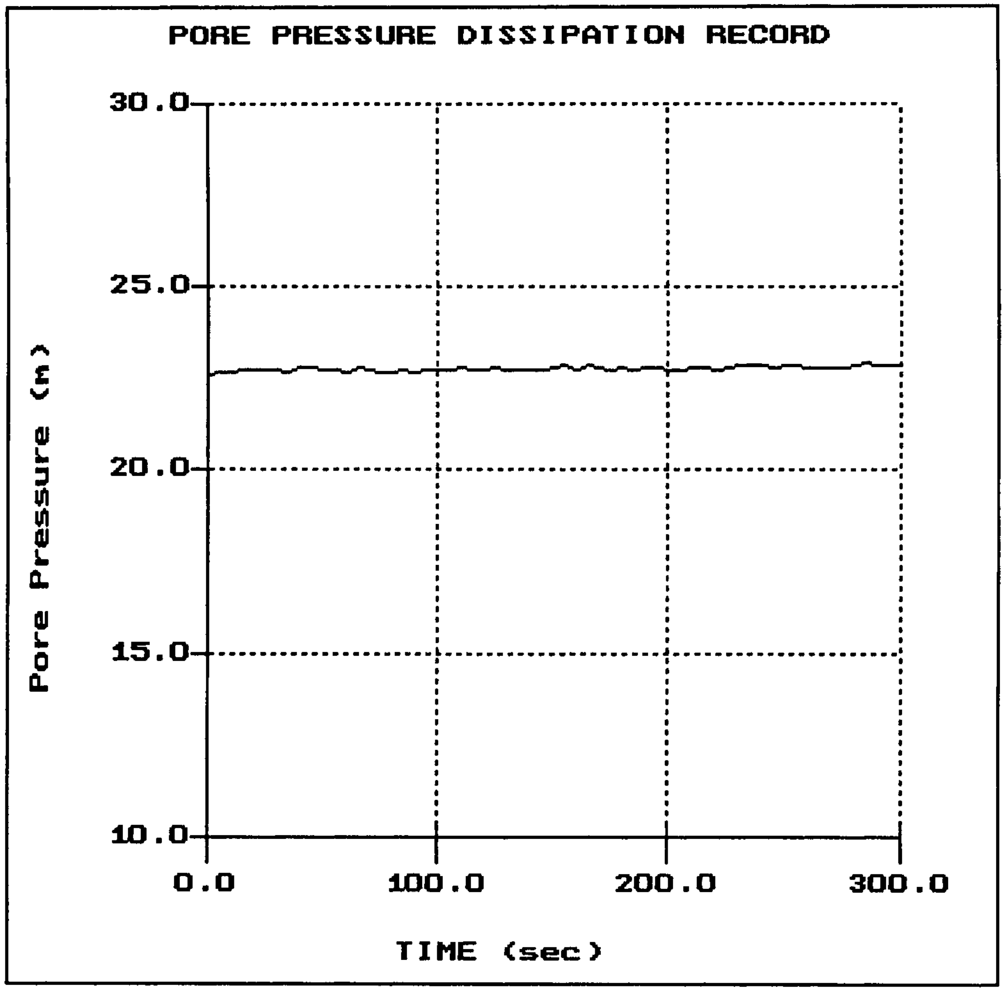
File: 244CP10.PPD
Depth (m): 15.30
(ft): 50.20
Duration : 725.0s
U-min: 27.92 725.0s
U-max: 60.84 0.0s



Thurber

Hole:CPTU-10
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:22:04 07:33



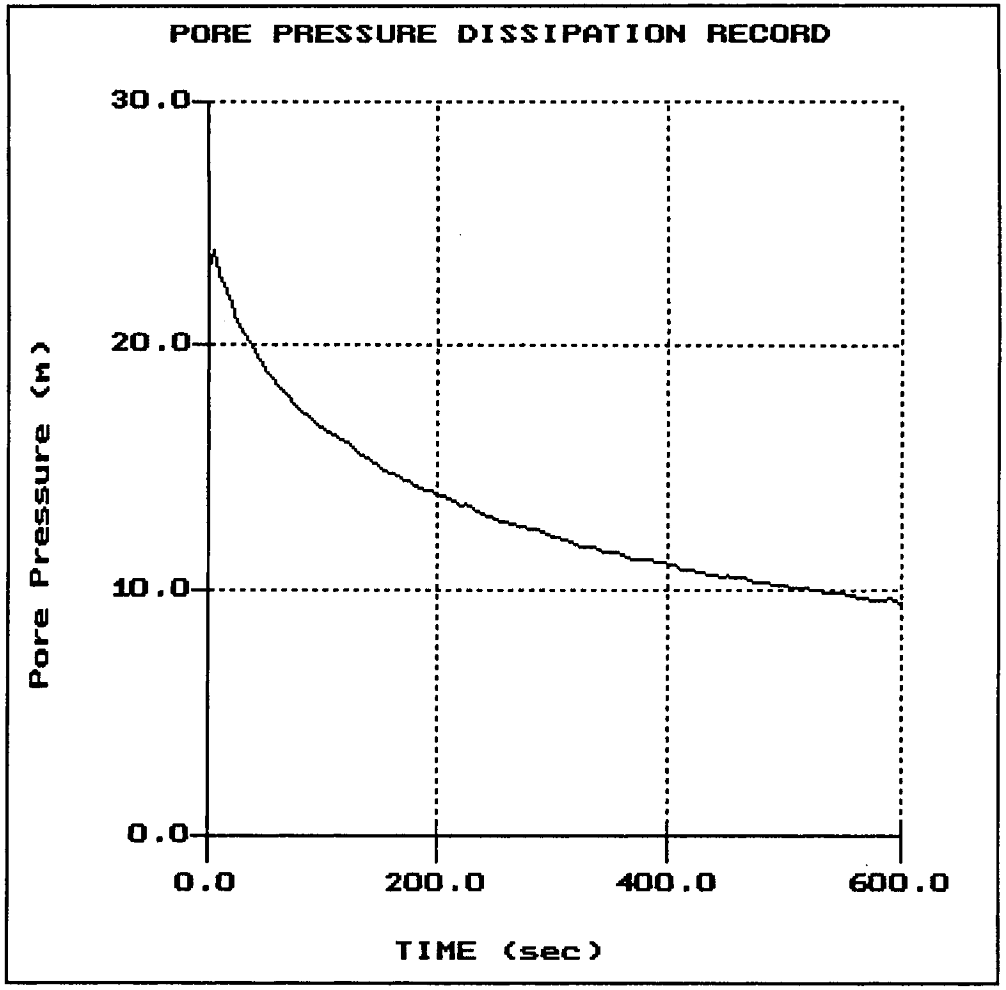
File: 244CP10.PPD
Depth (m): 21.70
(ft): 71.19
Duration : 300.0s
U-min: 22.54 0.0s
U-max: 22.90 285.0s

Thurber

Hole:CPTU-11
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:21:04 14:50

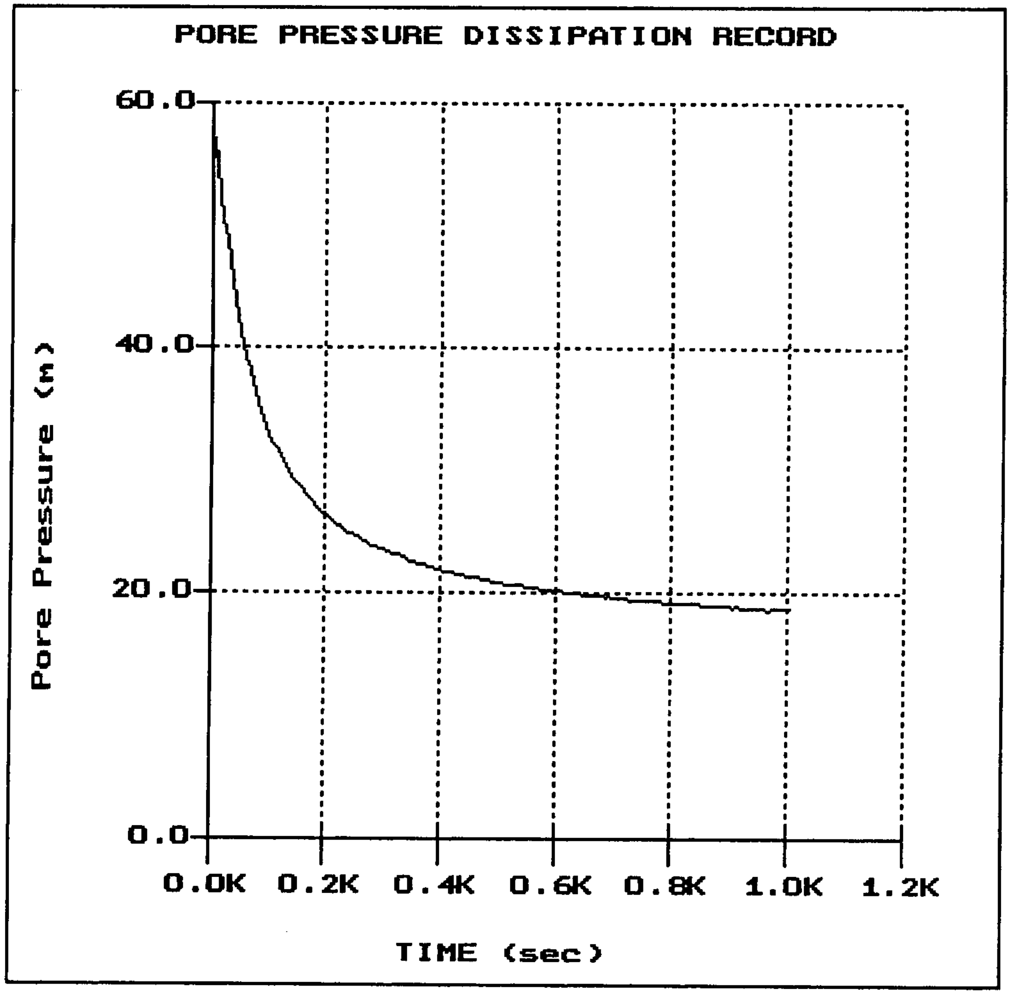
File: 244CP11.PPD
Depth (m): 4.58
(ft): 15.03
Duration : 600.0s
U-min: 9.50 600.0s
U-max: 23.85 5.0s



Thurber

Hole:CPTU-11
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:21:04 14:50

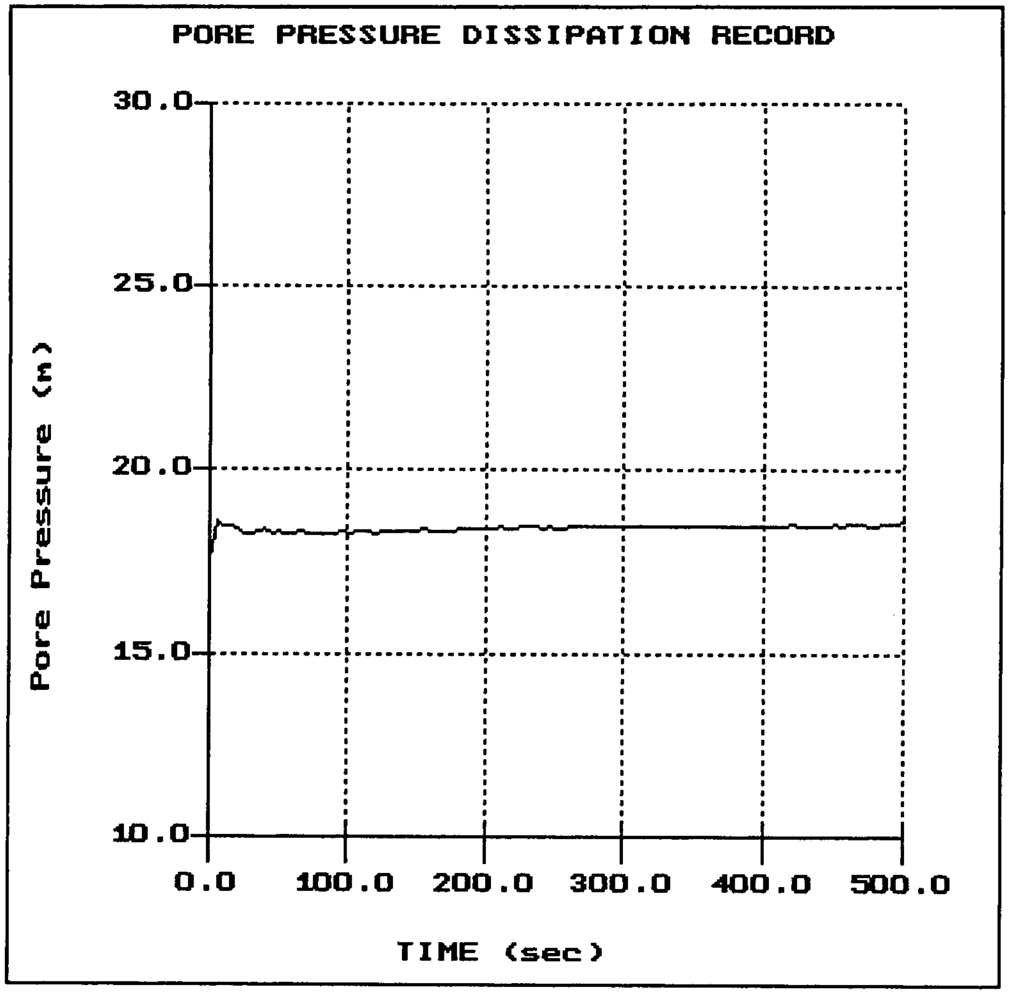


File: 244CP11.PPD
Depth (m): 15.40
(ft): 50.52
Duration : 1005.0s
U-min: 18.60 1000.0s
U-max: 57.00 5.0s

Thurber

Hole:CPTU-11
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:21:04 14:50

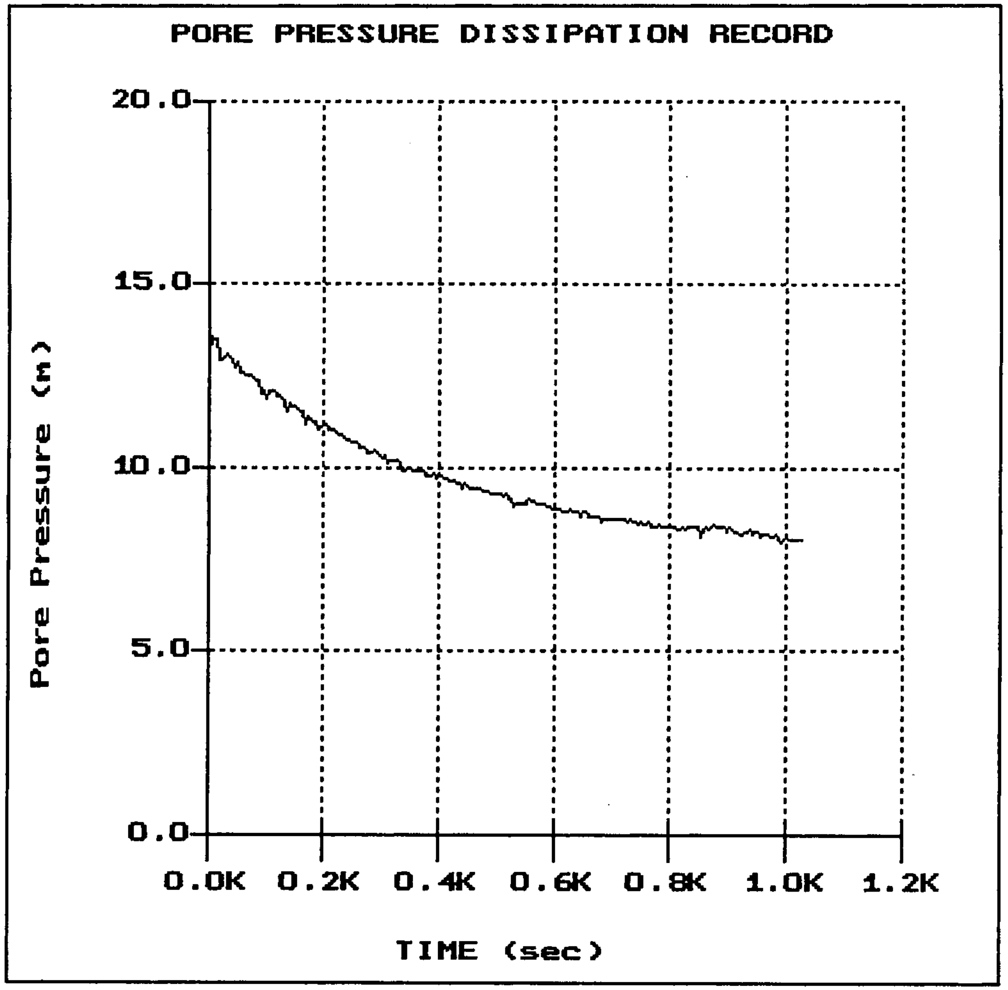


File: 244CP11.PPD
Depth (m): 17.95
(ft): 58.89
Duration : 500.0s
U-min: 17.58 0.0s
U-max: 18.60 500.0s

Thurber

Hole:CPTU-12
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 11:17



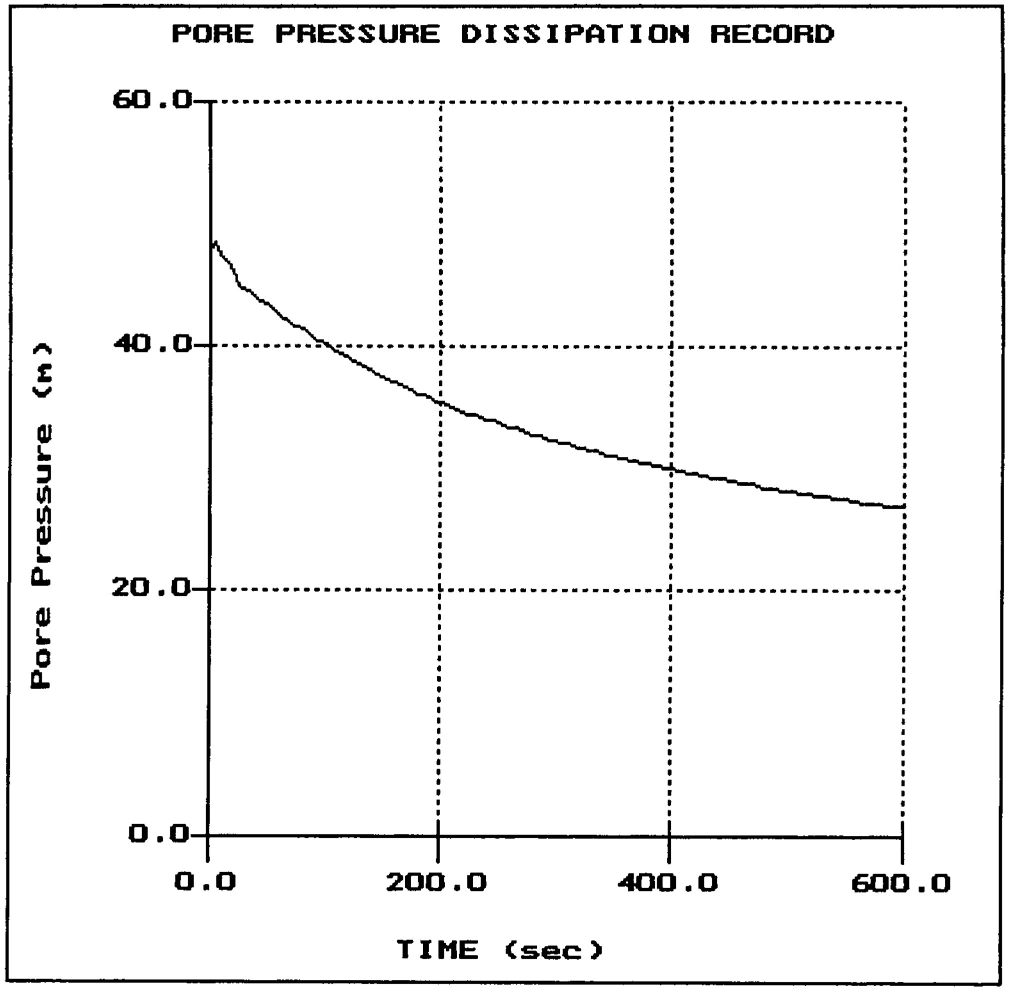
File: 244CP12.PPD
Depth (m): 4.58
(ft): 15.03
Duration : 1025.0s
U-min: 8.00 990.0s
U-max: 13.72 0.0s

Thurber

Hole:CPTU-12
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 11:17

File: 244CP12.PPD
Depth (m): 15.30
(ft): 50.20
Duration : 600.0s
U-min: 26.81 600.0s
U-max: 48.51 5.0s

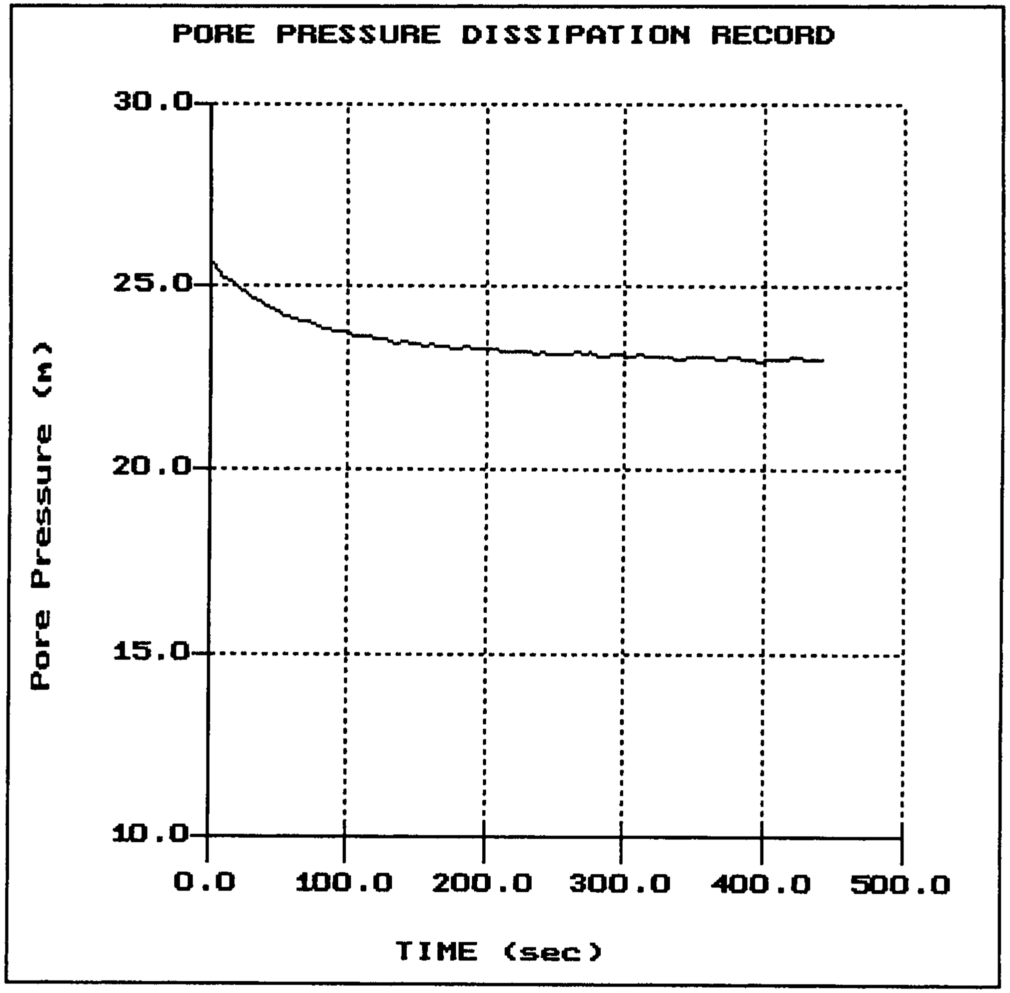


Thurber

Hole:CPTU-12
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 11:17

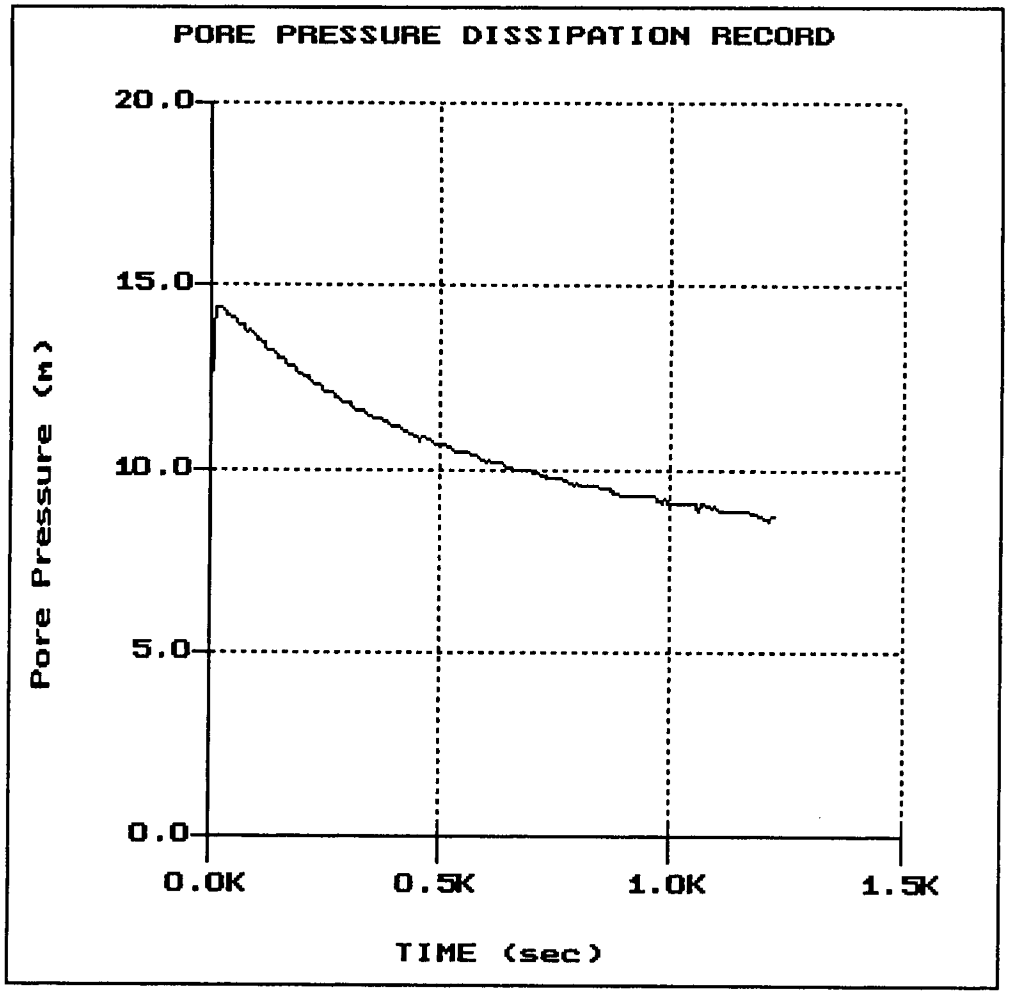
File: 244CP12.PPD
Depth (m): 22.88
(ft): 75.07
Duration : 440.0s
U-min: 22.95 395.0s
U-max: 25.68 0.0s



Thurber

Hole:CPTU-13
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 09:18

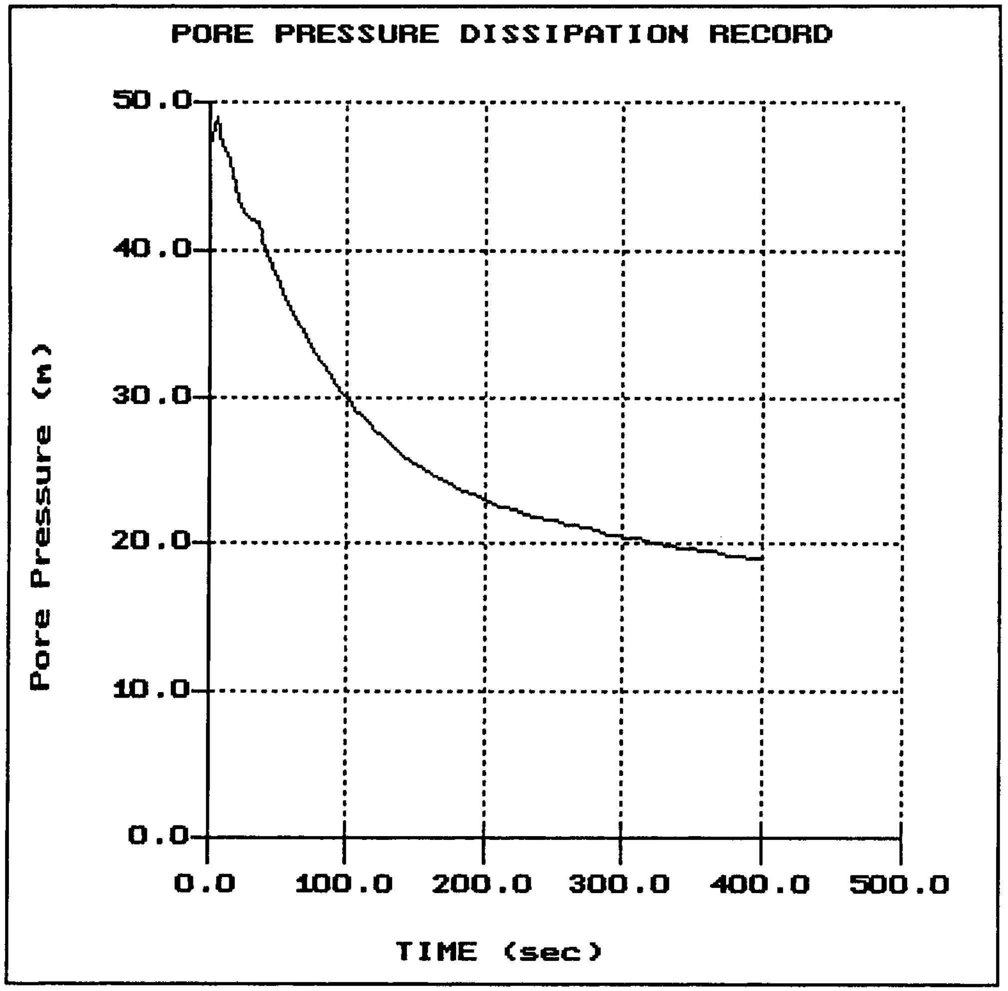


File: 244CP13.PPD
Depth (m): 4.58
(ft): 15.03
Duration : 1220.0s
U-min: 8.64 1210.0s
U-max: 14.39 15.0s

Thurber

Hole:CPTU-13
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 09:18

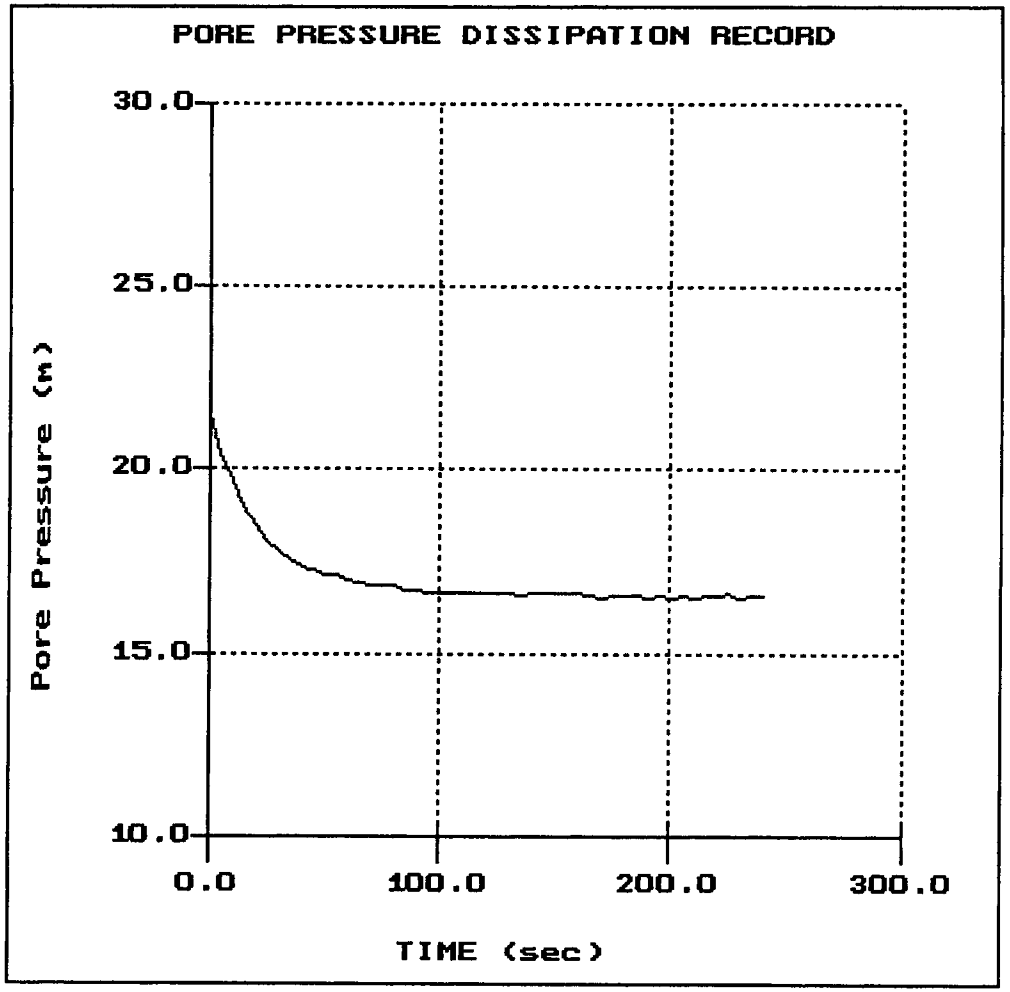


File: 244CP13.PPD
Depth (m): 15.28
(ft): 50.13
Duration : 400.0s
U-min: 18.95 400.0s
U-max: 48.91 5.0s

Thurber

Hole:CPTU-13
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 09:18

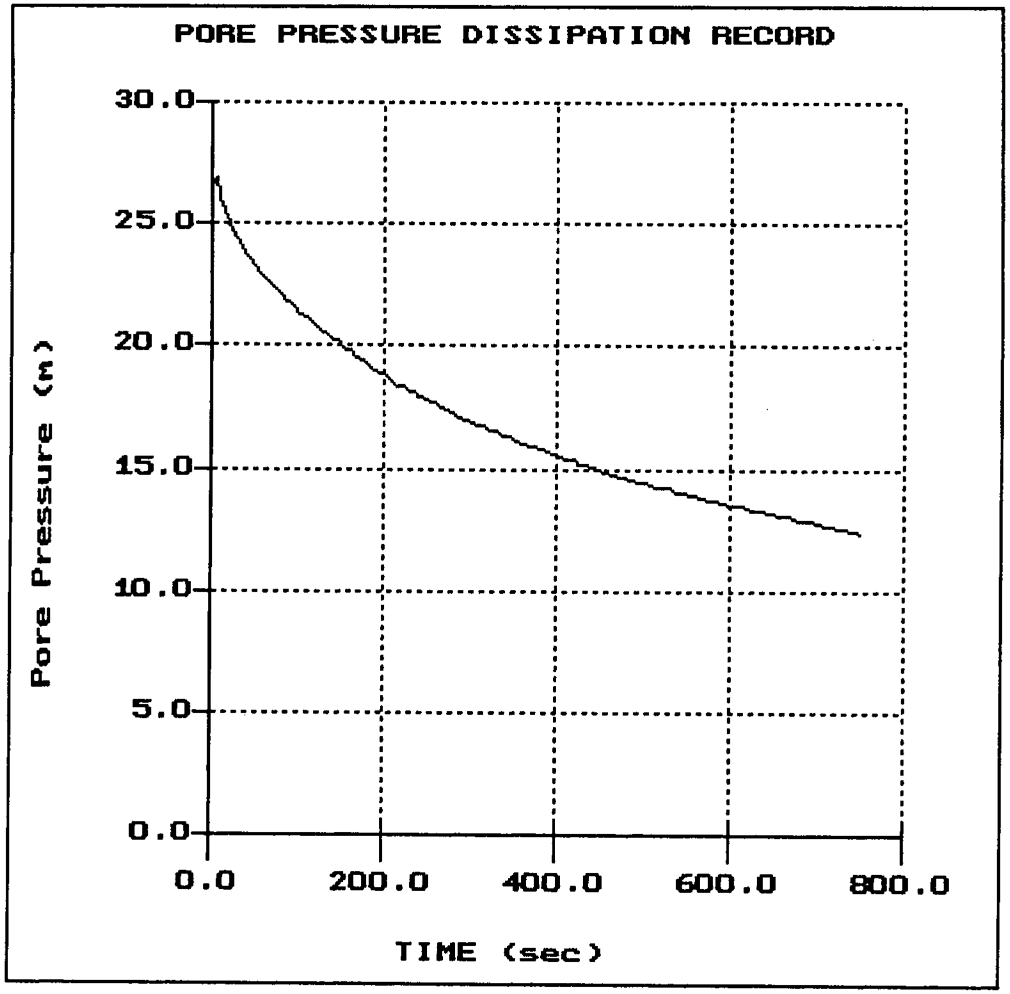


File: 244CP13.PPD
Depth (m): 16.65
(ft): 54.63
Duration : 240.0s
U-min: 16.54 230.0s
U-max: 21.49 0.0s

Thurber

Hole:CPTU-15
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 15:17



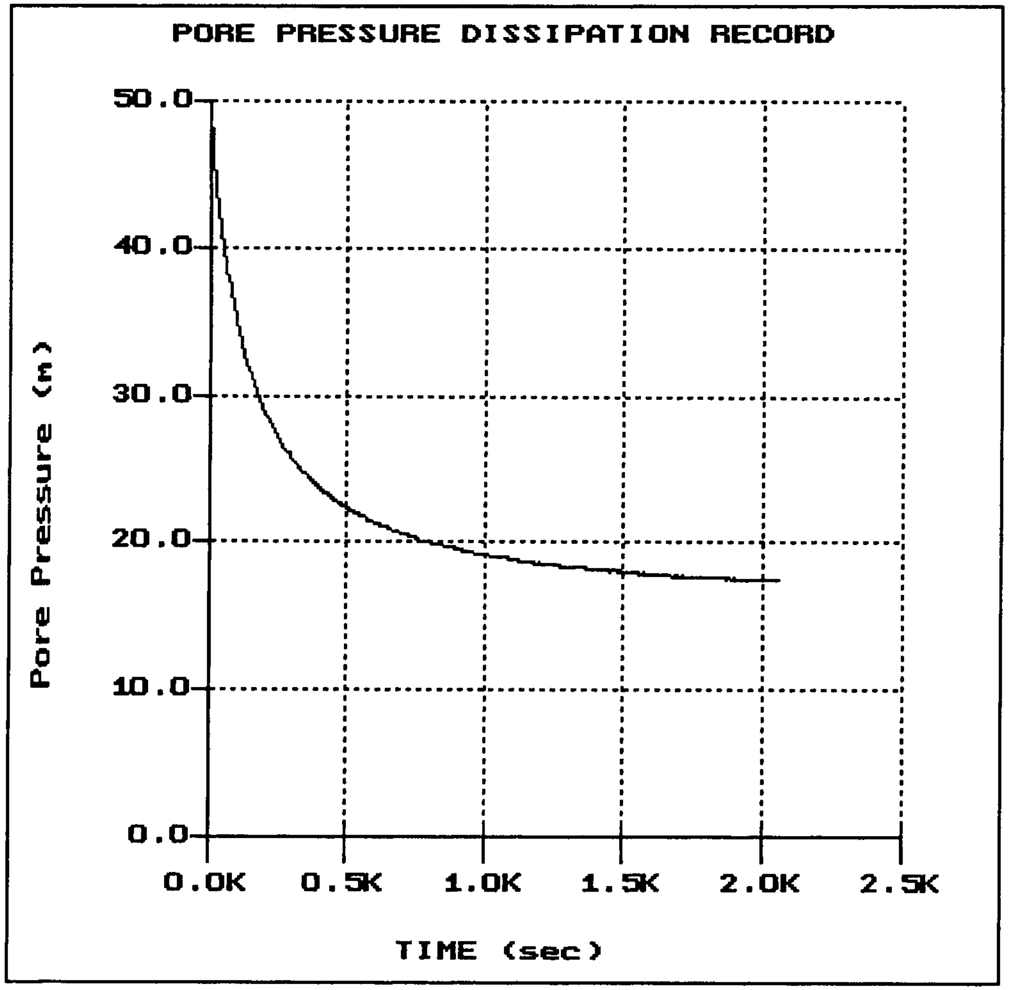
File: 244CP15.PPD
Depth (m): 6.18
(ft): 20.28
Duration : 750.0s
U-min: 12.42 750.0s
U-max: 26.84 5.0s

Thurber

Hole:CPTU-15
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 15:17

File: 244CP15.PPD
Depth (m): 15.30
(ft): 50.20
Duration : 2050.0s
U-min: 17.28 2050.0s
U-max: 49.29 0.0s

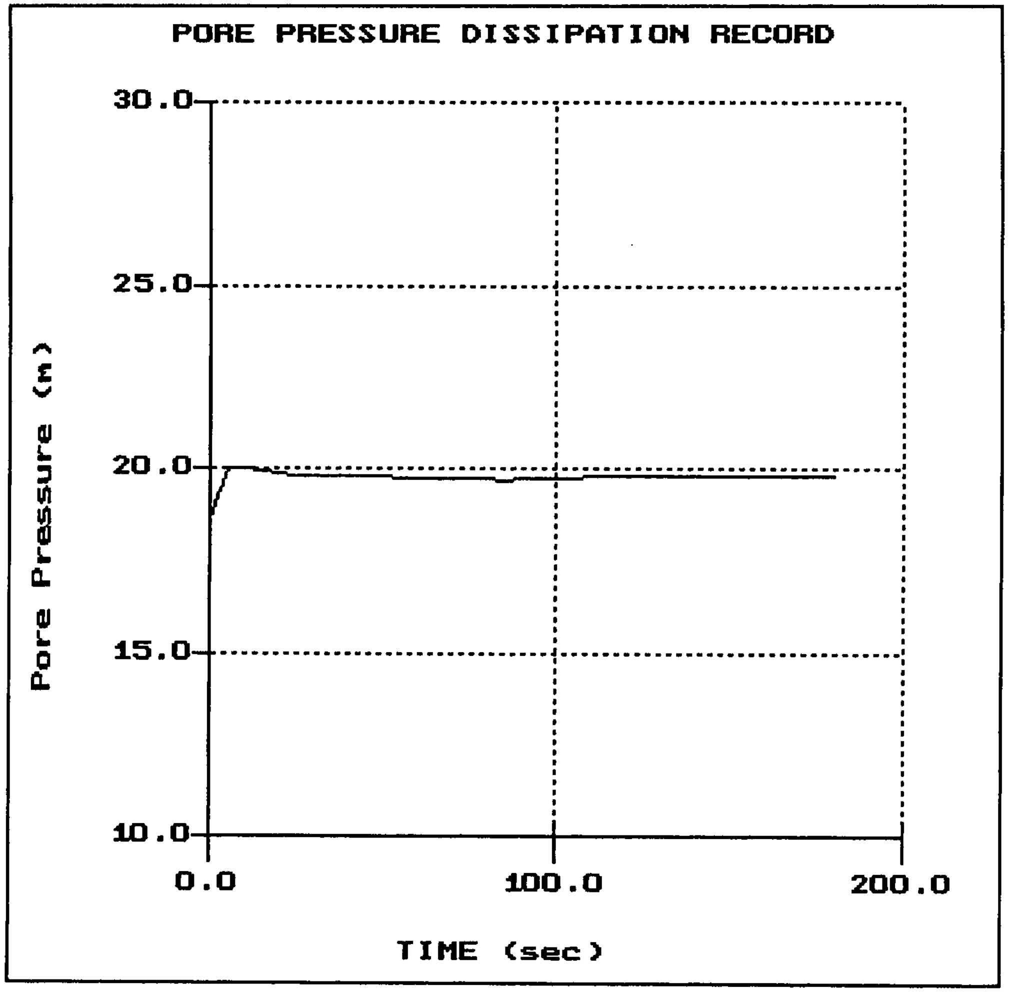


Thurber

Hole:CPTU-15
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:23:04 15:17

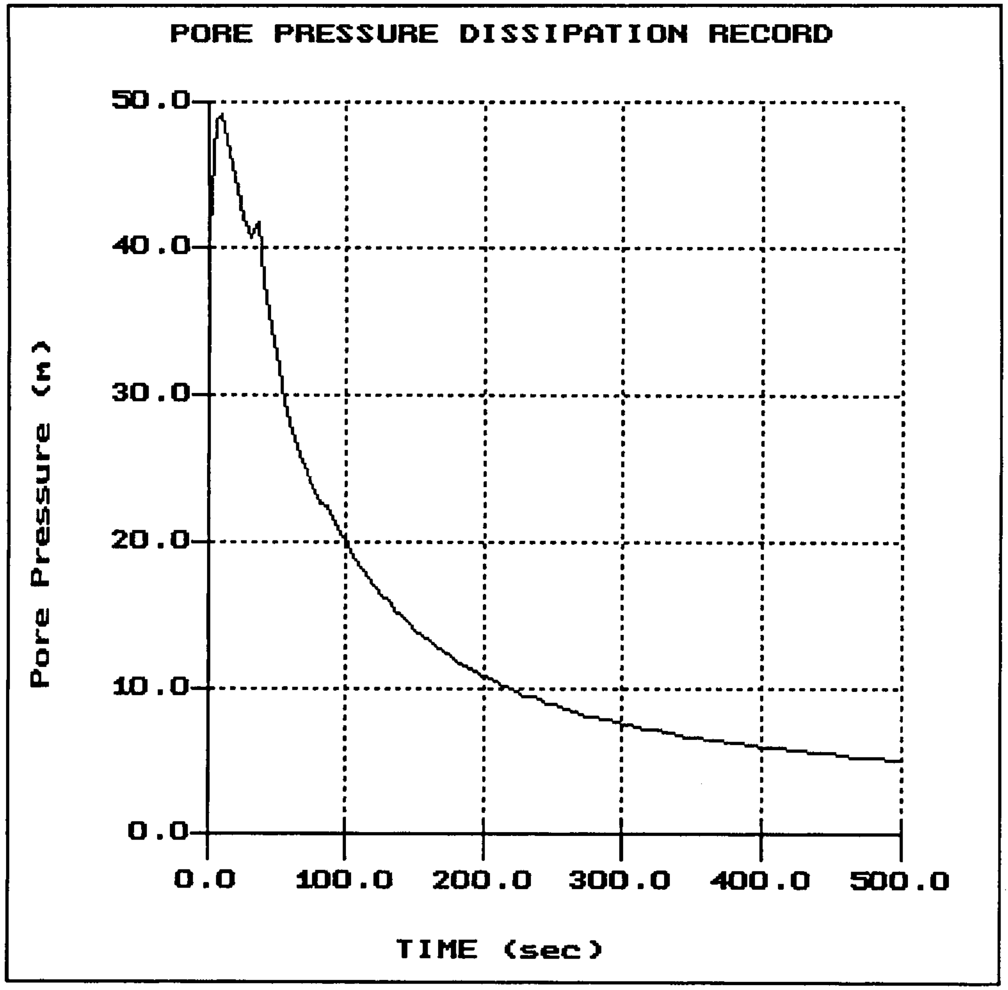
File: 244CP15.PPD
Depth (m): 19.92
(ft): 65.35
Duration : 180.0s
U-min: 18.61 0.0s
U-max: 20.03 5.0s



Thurber

Hole:CPTU-16
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:22:04 14:08



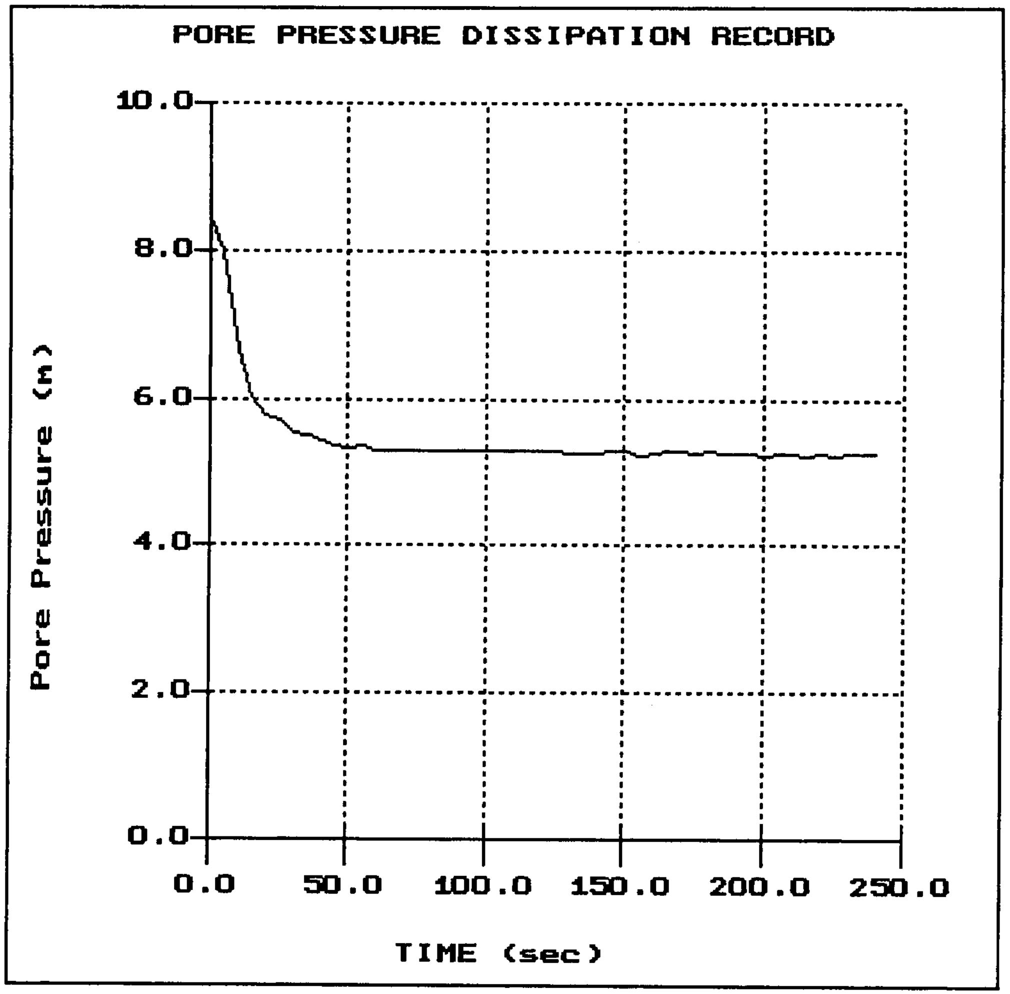
File: 244CP16.PPD
Depth (m): 1.23
(ft): 4.04
Duration : 500.0s
U-min: 4.99 500.0s
U-max: 49.05 10.0s

Thurber

Hole:CPTU-16
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:22:04 14:08

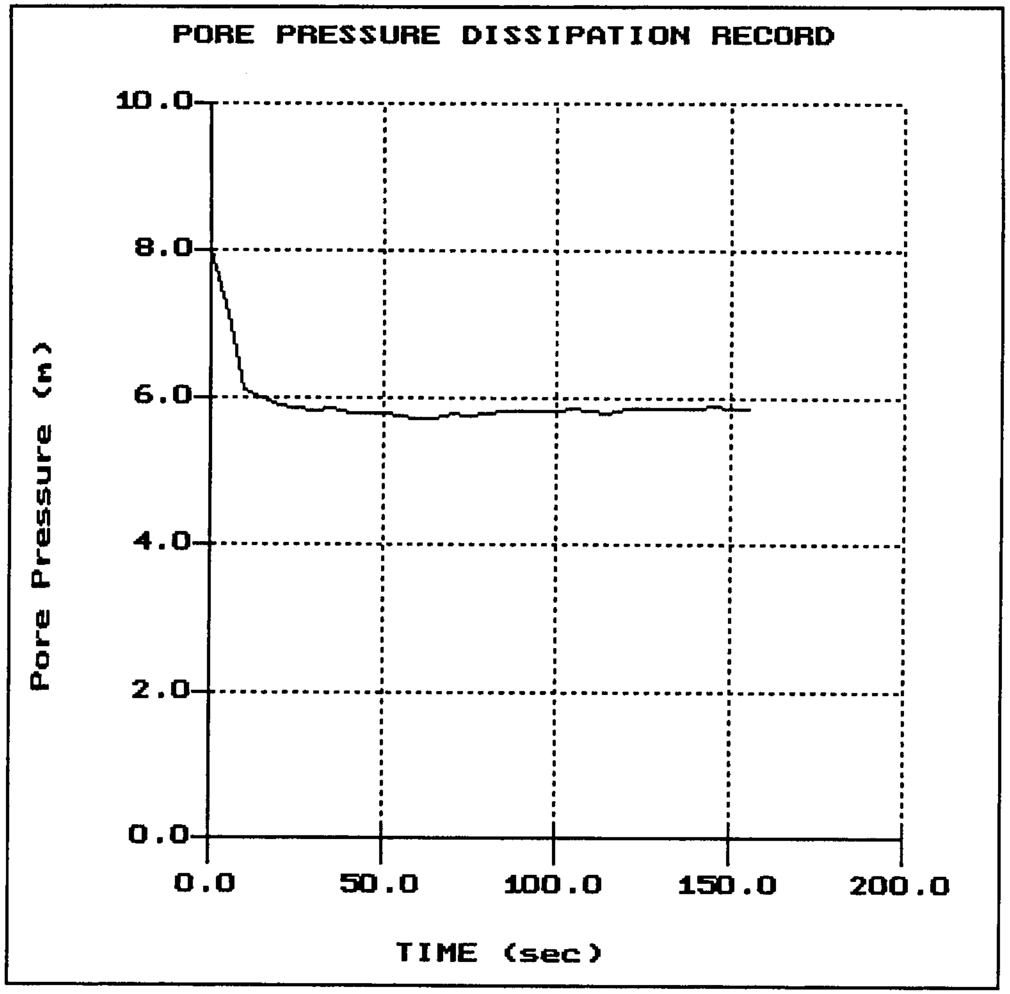
File: 244CP16.PPD
Depth (m): 4.58
(ft): 15.03
Duration : 240.0s
U-min: 5.21 225.0s
U-max: 8.43 0.0s



Thurber

Hole:CPTU-16
Location:Burk's Falls

Cone:10 Ton St 028
Date:09:22:04 14:08



File: 244CP16.PPD
Depth (m): 5.55
(ft): 18.21
Duration : 155.0s
U-min: 5.70 60.0s
U-max: 7.97 0.0s