




The Windsor-Essex Parkway Project

Geotechnical Investigation and Design Report – Bridge B-2 (Sta. 10+620.008W to 10+658.422W)

Geocres No. 40J6-45

Revision History					
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0	03/21/2013	Issued for Construction	NR	DD	NSV

	Name, Title	Signature	Date
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Document: Geotechnical Investigation and Design Report
 Bridge B-2 (Sta. 10+620.008W to 10+658.422W)
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Document: I gqygej plecn'Kpxguki cvkqp'cpf "F guki p "Tgr qtv"
 Dtkf i g'D/4 "Uc032- 84202: Y "q"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu'P q06218/67 +"

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Date: O ctej 14235"
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4: 75: 2/26/2; 2/Y R5/2424"	Dtkf i g'D/4'O cvej gwg'Tqcf "Qxgtr cuu"/"Dqtgi qng'Nqecvqpu'cpf "Uqki" Utcvc"
4: 75: 2/26/2; 3/Y R5/2425"	Dtkf i g'D/4'O cvej gwg'Tqcf "Qxgtr cuu"/"Uqki'Utcvi tcr j { ""
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4: 75: 2/26/2; 6/Y R5/244: "	Dtkf i g'D/4'O cvej gwg'Tqcf "Qxgtr cuu"/"Eqpust wekqp'P qvgu'o"" Nki j vy gli j v'Hkn'O cvgtkcn'
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List of Applicable OPSDs

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QRUF "52220872"	Hqwpf cvkqp'Rkgu'Uggn'J /Rkg'Ur rleg"
QRUF "52; 20823"	Hqwpf cvkqp'Hquv'Rgpgt cvkqp'F gr vj "hqt "Uqwj gtp'Qpvctkq"
QRUF "53230872"	Y cmu'Cdwo gpv'Dcenhkn'O kpk wo "I tcpwrt 'Tgs vktgo gpv"
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Hki wtg'504<"	Hkgrf "Xcpg'Wpf tclpgf "Utgpi vj "Tcvkq'cv'QET"? "3"xu0Rrcvkekv{ "Kpf gz'hqt "J qo qi gpgqwu" Enc{ u"Ncf f'(" 'F gI tqqv."4226+"
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Hki wtg'60<"	Ego r tguikdkv{ "Rctco gvgu'cv'Y GR"
Hki wtg'604<"	Ee'xgtuwu'Ea'Tgrcvkpuj kr 'cv'Y GR"
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Hki wtg'606<"	Tgrcvkpuj kr "dgy ggp'ukp p "cpf 'Rrcvkekv{ "Kpf gz'hqt "P qto cm{ "Eqpuqrkf cvgf "Uqlnu" *Mgpp{ ".3; 7; +"
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Document:	I gqvej plecti'Kpxguki cvkqp'cpf "F guki p'Tgr qtv" Dtkf i g'D/4*"Uc032- 84202: Y "vq"32- 87: 0644Y +"	Rev:	2"
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List of Appendices

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" "" k p x g u k i c v k q p "

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Crr gpf k' E< "" I g q v g e j p l e c n' N c d q t c v q t { 'V g u v' T g u w n u "

Crr gpf k' F< "" C p c n' l e c n' N c d q t c v q t { 'V g u v' T g u w n u "

Crr gpf k' G< "" T q e m' E q t g' R j q v q i t c r j u "

Crr gpf k' H< "" U n q r g' U c d k k v { 'C p c n' l u g u' T g u w n u "

Crr gpf k' I< "" U t g u v' F g h q t o c v k q p' C p c n' l u k u' T g u w n u "

Crr gpf k' J< E q p e g r w c n' C d w o g p v' F g u k i p "

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Doc No.:	4: 75: 2/26/33; /233: "I g q e t g u' P q 0 6 2 L 8 / 6 7 + "	Page No.:	k p f g z "

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1 Introduction

1.1 Preface

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Vj g" Rctny c{ u" utcvgi le" kpvgt pcvkpcn" lo r qt vpeg. "vtdcp" nqecvqp. "cpf" wpkxgf" geqmi kecn" eqpvz v" pgeguukxgf" utqpi "f guki p" cpf "r rcpkpi "r tlekr ngu" vq" i wkf g" kplht cutwewt g" f gxgnr o gpv0" Vj g" Rctny c{ "ku" vq" dg" c" ucvg/ qh" vj g/ ctv" hceklv" y kj kp" c" eqpvz wcmf "ugpukxg" rcpf uecr g" ugwkpi "y cv" j cu" geqmi kecn" lpxgi tkv. " dvkrf u" r j { ulecl" cpf "ewwtcn" eqppgev qp. "cpf "guvdrkj gu" c" uwucl pcdng" pgwy qtm" qh" co gpkkgu" yj cv" ecp" dg" gplq{ gf "d{ "r tguv" cpf "hwwt g" i gpgtcvkpu0"

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Pcwten" cpf "ewwtcn" j kvqt { "ctg" r tqr qugf "vq" dg" egrgdtevgf "kp" yj g" ctv" hwnl" f guki p" qh" yj tgg" I cvgy c{ u. "cpf " grxgp" Ncpf "Dtkf i gu" yj cv" uwr r qtv" yj g" gzkupi "o wplek cl" tqcf "u" vgo "cpf "y j g" kpvgt/ eqppgev" o wnk wug" r cvj y c{ "u" vgo 0" Vj g" I cvgy c{ u" ctg" eqpegkxgf "cu" dqrf" cpf "eqo o cpf kpi "rpf uecr gu" yj cv" f tcy "qp" uwr vgf " rpf hqto. " utqpi "r cvgt pki. " cpf "r wdrie" ctv" vq" etgcvg" utqpi "xkucn" gngv gpv" hqt" yj g" f tkkpi "gzt kpeg" y kj kp" yj go gu" qh" sCttkcn" Ugwrgv gpv. "cpf "Hqy 0"

Vj g" Ncpf "Dtkf i gu" f tcy "qp" pcwtcn" cpf "ewwtcn" lphwpgu" vq" etgcvg" f kklpev" cpf "o go qtcdrng" r rnegu" yj cv" ugtxg" cu" o ctngtu. "vtdcp" tguv kkg" ctgcu. "cpf " hqecn" r qkpw" vq" yj g" qxgtcm" i tggp" ur ceg" u" vgo 0" " Qvj gt" qr r qt wpkkgu" hqt" ctv" kke" gzt gukqp" kpenf g" yj g" utgguvcr gu" cpf "vtdcp" co gpkv" ctgcu. "vckl" dtkf i gu" wppgn" cdwo gpv. "cpf "pqkug" y cmu0" Vj g" utwewtcl" gngv gpv" qh" hgt" qr r qt wpkkgu" hqt" uko r ng" gzt gukqp" qh" yj g" utwtqwpf kpi "pcwtcn" gp xktqpo gpv. "ctgc" j kvqt { "cpf "y j g" sr tclt kg" rpf uecr g" kp" r ctvewrt. "y j tqwi j "eqmgt. " hqto. "o cvgtkcu. "cpf "y j g" kpvgi tcvkqp" qh" r wdrie" ctv0"

Vj g"rctwpi "rgi ce{ "qh'yj g"Y kpf uqt "Guugz "Rctny c{ "r tqlgev'y kni'pqv'qpn{ "dg"ku'uki phkcpv'eqpvtkdwkqp"cu" cp"kpvtpcvkqpcn'tcf g"cpf "tqpur qtvckqp"tqwg. "dw'tcvj gt "kpenf g"yj g"guvcdkuj o gpv'qh'c"eqpvi wqwu"cpf " uwvclpcdnr"i tggp"ur ceg"u{ ugo "vj cv'eqpvtkdwgu"vq"vj g"s wcrk{ "qh'rdg"kp"vj g"eqo o wpk{ "cpf "uwr r qtv'u"vj g" tg/guvcdrkuj o gpv'qh'cp"geqmi kcm{ "tkej "Ectqrlkcp"rpf uecr g0

Qp"F gego dgt "39. "4232"Kphtcutwewtg"Qpvtlkq"cpf "O VQ"cppqwpegf "vj cv'yj g"Y kpf uqt "Guugz "O qdtkv{ "I tqwr "Y GO I "tgcgej gf "hpcpekn'emug"cpf "uki pgf "c"hzgf /r tleg"eqpvtcev'y kj "yj g"Rtqxkpeg"vq"f guki p. " dwkf. "hpcpeg"cpf "o ckpckp"vj g"Y kpf uqt /Guugz "Rctny c{ "0"Vq"dwkf "vj g"lpxkcnly qtmu. "Y GO I "j cu'hqto gf "c" F guki p/Dwkf "Lqkpv"Xgpwtg"o "Rctny c{ "Kphtcutwewtg"Eqputwexqtu0"Vj ku'vgco "kpenf gu"Fc i cf qu'Ecpfc c. " Kpe0"Ceekqpc "Kphtcutwewtg"Eqpfc c "Kpe0"cpf "Hwqt "Eqpfc c "Nf 0"Vj ku'eqo dkpcvkqp"dtkpi u'c'y kf g'tcpi g"qh" mrcn'cpf "kpvtpcvkqpcn'gzt gtkepeg"vq"vj g'r tqlgev0

1.2 Report Introduction

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Vj ku'tgr qtv'r tguwpv'yj g"i gqvej plectn'f guki p"qh"Dtkf i g"D/4"O cvej gwg"tqcf "qxgtr cuu. "dgw ggp"Ucvkqpu" 32- 83; 088Y "cpf "32- 87: 06; 6Y +. "mcevgf "kp"vj g"Y kpf uqt "ugevt"qh'yj g"Y kpf uqt /Guugz "Rctny c{ "Y GR-" r tqlgev0"Vj g'tgr qtv'lpenf gu"vj g'tguwu'qh'yj g"cf f kkpkn'i gqvej plectn'lxguki cvkqp"ecttkgf "qwu"vq"uwr r qtv' yj g"f guki p"cpf "qj gt "tgrxcpv'dceni tqwpf "lphqto cvkqp0"Vj ku'tgr qtv'cuq "kpenf gu"f guki p"ej cpi gu"fwg"vq" tgxkukqp"vq"vj g'r tqlgev'ic{ qw"cpf "eqplki wcvkqp"kp"Fc y kpi "4: 75: 2/25/282/Y R5/2423"cpf "cf f tguugu"vj g" tgxkgy "eqo o gpw'htqo "O VQ0"

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Vj g'tgr qtv'ku'qti cpk gf "kp"y q'r ctu"Rctv3"ku'yj g"hcwcn'lphqto cvkqp"cpf "ku'r tguwpvgf "kp"Ugevkqpu"3"vq"6- "cpf "Rctv4"r tguwpv'yj g"i gqvej plectn'f guki p"cpf "tgeqo o gpf cvkqpu"kp"Ugevkqpu"7"cpf "80"Qj gt "lphqto cvkqp" ku'r tguwpvgf "kp"Ugevkqpu"9"vq"; 0"

1"Thgtgpegu'ctg"tkugf "kp"Ugevkp"; 0

2 Background Information

2.1 Geological Setting

Vj g" Y GR" r tqlgev' ukxg" ku" mcevgf " y kj kp" yj g" Guugz" Ernc { " Rrckp" *c" r ctv' qh' yj g" U0' Erck" Ernc { " Rrckp" r j { ukqi tcr j le" tgi kqp" f guetkdgf " kp" tghgtgpegu" T/38. " T/3: . " T/3; " cpf " T/48+0" Vj g" Guugz" Ernc { " Rrckp" y cu" f gr qukgf " f wtłpi " yj g" tgtgcv' qh' yj g" rvg" Rngkngqegpg" Gtc" leg' uij ggu. " y j gp" c" ugtlgu' qh' i ncekn' rncgu' kpwpf cvgf " yj g" ctgc0" Vj g" leg' uij ggu" i gpgtcm { " f gr qukgf " o cvgtkcu" y kj " c" i ncekn' km' rncg" i tcf cvkqp" kp" yj g" Y kpf uqt" ctgc0" F gr gpf kpi " qp" yj g" mcevkpu' qh' yj g" i ncekn' leg' uij ggu" cpf " f gr yj u' qh' y cvgt " kp" yj g" leg' eqpncev' i ncekn' rncgu. " yj g" o cvgtkcu" o c { " j cxcg" dggp" f kgevn { " f gr qukgf " cv' yj g" eqpncev' dgy ggp" yj g" leg' uij ggu" cpf " dgf tqenlqt. " cu" yj g" rncg" rxcgu' tqug" cpf " yj g" leg' uij ggu" tgtgcvgf " cpf " hqcvgf . " yj g" uqk' cpf " tqenlf gdtku" y kj kp" cpf " cv' yj g" dcug' qh' leg' o c { " j cxcg" dggp" f gr qukgf " yj tqwi j " yj g" rncg" y cvgt " *KQ0' rcewut kpg" gp xktqpo gpvi0' K' ku' eqpukf gtgf " yj cv' wprkng" v' r lecn' km' f gr quku" * yj cv' j cxcg" wpf gti qpq" eqpuqrkf cvkqp" cpf " f gpuk' hcevkqp" wpf gt " yj g" y gki j v' qh' yj g" leg' uij ggu. " yj g" o clqtk { " qh' yj g" i ncekn' km' uqku" kp" yj g" Y kpf uqt" cpf " F gvtqk' ctgc" y gtg" f gr qukgf " yj tqwi j " y cvgt" cpf " j cxcg" c" uqhn' v' q' hto " eqpukngpe { " dgmjy " c" uwt hcekn' etwuv' r { gt " yj cv' j cu" dgeqo g" ukt h' v' q' j ctf " f vq" yj gcv' gtłpi " cpf " f guleecvkp0" I gmqi kcm. " yj g" f gr quku' kp" yj g" r tqlgev' ctgc" ku' eqpukf gtgf " v' q' dg" urki j v { " qxgt/eqpuqrkf cvgf . " j cxkpi " gzt gtłpgej " pq" o clqt " qxgtdwtf gp" ut guugu" kp" gzeugu' qh' yj g" gzkvki " ut guugu0'

Vj g" qxgtdwtf gp" kp" yj g" U0' Erck" Ernc { " Rrckp" j cu" xctkqwn { " dggp" f guetkdgf " cu" c" ernc { g { " ukn' km' ukn { " ernc { " km' cpf " i ncekn' rcewut kpg" ernc { 0' " J wf ge" * tgh0' T/48+ " uwo o ctł gf " yj g" qxgtdwtf gp" i gmqi { " kp" Y kpf uqt" cu" eqpuknki " qh' yj g" hmqy kpi " utcv- c' f guleecvgf " rcewut kpg" ernc { . " pqto cm { " eqpuqrkf cvgf " rcewut kpg" ernc { . " ukn { " Vcxkngem' km' i ncekn' rcewut kpg" ernc { " cpf " eqctug" Ec vkuj " Etggm' km' 0' " C" f kpkpev' ej cpi g" kp" qxgtdwtf gp" f gr quku' qeewu" kp" yj g" gcu' y guv' f kgevkp" cmqi " c" dqwpf ct { " mcevgf " i gpgtcm { " cmqi " yj g" J wtq/ Ej wtej " Tqcf 0" Y j gtgc. " yj g" gcu' yj g" r ctv' qh' Y kpf uqt " ku" wpf gtrckp" d { " hto " v' q' ukt h' i ncekn' rcewut kpg" uknu" cpf " ernc { u" y kj " wr r gt " f gr quku' qh' ukt h' ucpf { " v' q' ukn' yj gcv' gtgf " ernc { " cpf " j ctf " v' q' ukt h' rcewut kpg" ernc { / ukn' etwuv. " yj g" y gvgtp" r ctv' qh' Y kpf uqt " ku" ej ctcevgtk gf " d { " c" yj kp" uwt hcekn' i tcpwrt " f gr quku' wpf gtrckp" d { " yj kp" etwuv' r { gt " wpf gtrckp" d { " uqhn' v' q' hto " i ncekn' rcewut kpg" uknu" cpf " ernc { u0'

Cv' yj g" Y GR" r tqlgev' ctgc. " yj g" i ncekn' km' rncg" f gr quku' ku' v' r kcm { " 42" v' q' 57" o " yj km' cpf " eqpuknu' r tko ctłk { " qh' ukn { " ernc { " cpf " ernc { g { " ukn' i tcf cvkqp" y kj " c" tcpf qo " f kwtłdwkqp" qh' eqctugt " r ctv' kngu0' " Tcpf qo " cpf " cr r ctgpn { " f kueqpvkpwqu" ugeo ulrgpugu' qh' uknu" ucpf " cpf " qt" i txcgn' ctg" r tgu' p' cv' xctkqwn' f gr yj u' y kj kp" yj g" o cu' qh' yj g" ukn { " ernc { " f gr quku' 0' " C" hto " v' q' j ctf " uwt hcekn' etwuv' r { gt " j cu' hqto gf " f vq" yj g" guleecvkp0" Wr " v' q' 4" o " yj km' uwt hcekn' r { gt u' qh' rcewut kpg" ukn { " ernc { " qt" ukn' cpf " ucpf " ctg" cuuq" gpeqwpvgf " kp" yj g" y gvgtp" ugevqt " qh' yj g" r tqlgev' 0' " C" 3" o " v' q' 8" o " yj km' xgt { " f gpug" qt" j ctf " dcun' i ncekn' km' qt " f gpug" ukn { " ucpf " o c { " dg" hqwpf " f kgevn { " qxgtn { kpi " yj g" dgf tqenl uwt hceg0' Vj g" dgf tqenl cv' yj g" r tqlgev' ctgc" eqo r tku' yj g" F gxqpkp" F wpf gg" Hqto cvkqp" qh' yj g" J co kmqp" i tqw " qh' hqto cvkqp" cpf " yj g" wpf gtn { kpi " F gxqpkp" Nwecu" Hqto cvkqp" qh' yj g" F gvtqk' Tkxgt " i tqw " qh' hqto cvkqp0'

Vj g" Y kpf uqt " ctgc. " tghgtgf " v' q' cu" yj g" Guugz" F qo clp" * y kj " tgu' gev' v' q' dgf tqenl gmqi { + " ku" mcevgf " kp" yj g" I tgp xkng" Hkqp' Vgevpke" \ qp g" * I HV \ + * tgh0' T/48+0" Vj g" dgf tqenl gmqi { " y kj kp" yj g" Guugz" F qo clp" y cu" hqto gf " cu" r ctv' qh' yj g" o k' eqpvkpgpv' tln' uqwj / gcu' yj g" gztgvpkqp0' Vj g" o k' eqpvkpgpv' tln' uqwj / gcu' yj g" gztgvpkqp " ku' eqo r qugf " qh' Rrcgq { qle" eqxgt " tqenu" yj k' j " hqto " yj g" dgf tqenl hqwpf cvkqp" qh' yj g" Guugz" F qo clp0' Vj g" dgf tqenl y cu" f gr qukgf " kp" yj g" Rrcgq { qle" Gtc" f wtłpi " yj g" O k' f rg" F gxqpkp" r gtlqf 0' Y kj kp" yj g" Guugz"

F qo clp"vj g"hmjy lpi "utcv"y gtg"gr qukgf "vj g"J co knqp"l tqwr."F wpf gg"Hqto cvkqp."cpf "F gtwk/Tkxgt" I tqwr "Qpqpfi ci c"Hqto cvkqp"cm'eqpukvpi "qh'Nko guvqpg."F qmuvqpg."cpf "Uj cng0'

2.2 Site Seismic Background

Y kpf uqt/Vgewo ugi "ctgc"ku"fguetkdgf "kp"vj g"Ecpcfkcp"J ki j y c{"Dtkfi g"F guki p"Eqf g"tgh0T/; + d{"c"ugkuo le"j c| ctf "cuuqekcvgf "vq"Xgmekv\ " qpg\ x"? "2"cpf "Ceegngtcvkqp"ugkuo le"l qpg\ c"? "20"\ qpcn' Xgmekv\ "cvkq"X"cpf \ qpcn'Ceegngtcvkqp"cvkq"C"ctg'dqjy "20'

Kp"ceeqtf cpeg"y kj "vj g"EJ DFE."vj g"uqk'r tqhkg"cv'vj g"ukg"qh'vj g'r tqlgv'i gpgtcm\ "o ggw"vj g"fguetkcvkqp" hqt"Uqk'Rtqkkg"V{r g"KK"uqhv'erc{"cpf "uknu"i tgevgf "vj cp"34"o "kp"fg'vj +0"C"rko kgf "pwo dgt"qh'etquv/j qrg" vguu"y cu"eqo r rvgf "f wtkpi "vj g"dcem tqwpf "lpxguki cvkqp"rtqi tco "tgh0T/43+"cv"nqecvkpu"fkutkdwgf " utcvgi kcm\ "cmipi "ku"vj g'r tqlgv'crki po gpv'dgy ggp"J qy ctf "Cxpwg"gcuv'gpf +cpf "O cvej gwg"tqcf "y guv" gpf +0"Vj g'o gcuv'gf "xgmekv"qh'vj g'uj gct'y cxgu'y gtg"eqpukvgn\ "qxgt"422"o lu"y kj "vj g'dwm'qh'tguvnu" tcpi lpi "dgy ggp"422"cpf "522"o lu0'

2.3 Existing Site Conditions and Proposed Bridge Layout

Dtkfi g"D/4" uksg"ku"ukwcvgf "kp"vj g"y guv'gpf "qh"vj g"Y kpf uqt"ugi o gpv'qh"vj g"Rctny c{0"Vj g"i tqwpf " vqr qi tcr j {"cmipi "Dtkfi g"D/4"ku"i gpgtcm\ "hrcv"y kj "cr r tqzko cvg"grgxcvkqp"39; 2"kp"vj g"ctgc"qh'dqjy "y guv" cpf "gcuv'cdwo gpv0"Cf lcegpv'rcpf "vug"ku"v' lrcm\ "dqjy "tgukf gpv'rcpf "eqo o gtekr0'

Vj g"dtkfi g"utwewtg"y km'dg"eqputwvgf "wpf gt"Y GR"Rj cug"KK"fgxgnr o gpv'cpf "y km'dg"vugf "vq"ectt {" J ki j y c{"623"qxgt"O cvej gwg"tqcf 0"J ki j y c{"623"cv"vj ku"nqecvkqp"y km'dg"eqputwvgf "qp"gtcy hkm' go dcpno gpv0"Eqpetvg"y lpi "y cmu'ctg"lpf kcvgf "cv'gcej "eqtpgt"qh'vj g'cdwo gpv'r ctcngn\q"J ki j y c{"623" qp"F tcy lpi "4: 75: 2/25/282/Y R5/24230'

2.4 Frost Depth

Kp"ceeqtf cpeg"y kj "O VQ6UF Q/; 2/23"Rcxgo gpv'F guki p"cpf "Tgj cdkkcvkqp"O cpwcn'tgh0T/5: +cpf "QRUF" 52; 20B23³."vj g"htquf gr vj "dgmjy "vj g"i tqwpf "uwthceg"kp"Y kpf uqt"ctgc"ku"guvko cvgf "vq"302"o 0"Vj ku"guvko cvg" ku"eqpukf gtgf "cr r ncedng"htq"pcwtcn'uqknu"cpf "l"qt"eqpxgpvkpcn'r cxgo gpv'o cvgtknu"y j gtg"vj g"i tqwpf " uwthceg"ku"uwcm\ "engcpgf "htqo "vj g'upqy "eqxgt0""

Kp"vj g"ecug"qh'tkr "tcr."qt"qvj gty kug"eqctug"tqenhm'eqxgt."vj g"kpucvkvqp"gh'gevu"qh'uwej "o cvgtknu"ctg" eqpukf gtgf "vq"dg"qpg"j crh"qh"vj g"kpucvkvqp"qh'gtgf "d{"uqkni f gr quksulexgt."cpf "vj g"fg'vj "qh'htquv" r gpgtvcvkqp"y km"j cxg"vq"dg'kpetgcugf "ceeqtf lpi n{0'

"

2"Grxgcvkpu'ctg'kp'o gvgu'cpf "ctg'tghgtgf "vq"i gqf gvk'f cwo 0""

3"Qpvtlq"Rtqxkukqpcn'Ucpf ctf "F tcy lpi u'ctg'lpnw'gf "cv'vj g'gpf "qh'vj g'tgr qtv'vgz0'

Project: Y kpf uqt/Gugz'Rctny c{"

Document: I gqvej plectn'lxguki cvkqp"cpf "F guki p"tgr qtv' Dtkfi g"D/4"Uc032- 84202: Y "vq"32- 87: 0644Y +'

Doc No.: 4: 75: 2/26/33; /233: "I gqetgu'P q062L8/67+" "

Date: O ctej 4235"

Rev: 2"

Page No.: 6"

3 Geotechnical Investigations

3.1 Scope and Procedures of Geotechnical Investigations

I gqvej plectrlpxgunki cklqpulpxqkklpi "c"pwo dgt"qh"dqtgj qrgu."eqpg"r gpgtckqp"vguu"ERV+"cpf "P kreqp" xcpg"vguu"j cf "dggp"ecttkgf "qww"lp"4229/2; "d{"I qrf gt "Cuqekcvgu"tgh0/T/38"vq"45+"vq" f gxgnr "vj g" eqpegr wcnlf guki p"cpf "ugtsg"cu"dceni tqwpf "lphqto cklqp"lqt" f gxgnr o gpv"qh"vj g"Y GR"r tqr qucnlf guki pu0" Cffklqpcn"i gqvej plectrlpxgunki cklqp"y cu"eqo r ngvgf "lp"4233"vq"uwr r ngo gpv"vj g"cxckcdrg"uudwhtceg"uqkl" f cvc."cu"tgs wktgf "vq"uwr r qt"vj g" f gckngf "f guki p" f gxgnr o gpv"qh"vj g"Y GR"go dcpno gpv"cpf "utwewtgu0"Vj g" cffklqpcn" lpxgunki cklqp" r tqi tco "cv" cpf "ctqwpf" "vj g" r tqr qugf "mccvklp" qh" Dtkf i g" D/4" eqo r tkugf "8" dqtgj qrgu"lpxmklpi "5"uj cmqy "j qrgu"vq"lccckcvg"ERVu"cpf "FO V+."5"P kreqp"xcpg"vguu."4"ERVu"cpf "3" FO V"lpxmklpi g" f krcqo gvgf "r tqdg+0"Vcdrg"5/3"lpxu"vj g"vgu"j qrgu"r w" f qy p"cv"qt "lp"emug"r tqzko kl" qh"vj g" dtkf i g"ukg" f wklpi "dqj" "vj g" r t gxlqwu"cpf "vj g"ewtgpvi gqvej plectrlpxgunki cklqpul

Table 3-1: Test Holes At and Around Bridge B-2 Site

Reference	Boreholes	Nilcon Vane Tests	CPTs	DMTs
Cffklqpcn" lpxgunki cklqp" *4233+"	DJ "D4/3"	P KN"D4/3"	"	"
	DJ "25/TY "	P KN"25/TY "	"	"
	DJ "26/TY "	P KN"26/TY "	"	"
	DJ IERV"D4/3, "	"	ERV"D4/3"	"
	DJ IERV"2: /TY , "	"	ERV"2: /TY "	"
	DJ FO V"D4/3, "	"	"	FO V"D4/3"
Rt gxlqwu"Uwf lgu" *4229/2; +"	DJ "382"	P KNIDJ "382"	ERV"382"	"
	DJ "382C"	"	"	"
	DJ "565"	"	"	"
	DJ IERV"564"	"	ERV"564"	"
	DJ IERV"566"	"	ERV"566"	"

, "Uj cmqy "dqtgj qrgu"vq"lccckcvg"cf xcpge"qh"ERV"cpf "FO V"r w" f qy p"cf lcegpVguv"J qrgu"DJ "D4/3"cpf "ERV"2: /TY 0"

Ftcy lpi "4: 75: 2/26/2; 2/Y R5/2423" uj qy u" vj g" mcecvklp" qh" vj g" vgu" j qrgu" cpf "cp" lpxgtr tgvf "uqkl" utcvkl tcr j le"r tqhkg"cmqy "vj g"Y GR"egpgrklp"lqt"vj g"i gpgtcltgc"lqo "Uc032- 522Y "vq"Uc032- ; 22Y 0" Vj g"vgu"j qrg"mcecvklp"cpf "utcvkl tcr j le" ugecvklp"cv"vj g" dtkf i g"mcecvklp"cpf "ko o gf lcvg" xklpkl" "ctg" kmwutcvf "qp" Ftcy lpi u"4: 75: 2/26/2; 2/Y R5/2424"cpf "4: 75: 2/26/2; 3/Y R5/24250"

3.2 Fieldwork for Additional Investigation

Vj g"dqtgj qrgu"y gtg"cf xcpgef "wklpi "tcmno qwpvgf "EO G77"cwit tki u"qy pgf "cpf "qr gtcvgf "d{"O ctcvj qp" Ftknklpi "Eq0Nf0"wpf gt "eqpncev"vq"CO EQ"cpf "wpf gt "vej plectrluwr gtxklqp"d{"CO GE" gpi kpggtu"cpf " vej plectcpu0"Dqtgj qrgu"y gtg"i gpgtcmf "cf xcpgef "wklpi "437"o o "QF"j qmqy "uqgo "cwit gu"lpxmklpi g" f "d{" y cuj "dqtklpi "y kj "PY "eculpi 0"Vj g" f gr vj "cv"y j lej "vj g" ftknklpi "o gvy qf u"tcpuksklp"qeewtgf "lpxpvgf "qp"vj g" dqtgj qrg"lqi u0"

Uqkluco r nklpi "y cu"i gpgtcmf "ecttkgf "qww"lpxu" c"72"o o "f lco gvgf "ur rklur qqp"uco r rgt0"Vj lpx/y cmgf "Uj gnd{" wdg"92"o o "f lco gvgf "z"822"o o "mqlpi +uco r ngu"y gtg"cuq"tgeqxtgf "lp"vj g"eqj gukxg"uqkl" f gr quku"dgny " vj g"wr r gt"etwutlct"gt0"Uqkluco r nklpi "y cu"ecttkgf "qww"i gpgtcmf "cv"207"o "f gr vj "lpxgtrcnlpx"vj g"vqr "9"vq": "o " cpf "cv"307"o "f gr vj "lpxgtrcnlpx"vj g"tchgt0"Cmluco r ngu"y gtg" f gpgtcmf "cpf "r megf "lp"ckklpi j v"eqpckpgtu"cpf "

utcpur qtvgf "vq" CO GE u"Vgewo ugj "Y kpf uqt+"rdqtcvqtkgu"htq"htvj gt"gzco kpcvkqp"cpf "vguupi 40""Tqeni eqtkpi "qh"vj g"dgf tqenly cu'ecttkgf "qww"vupi 307"o "hupi "P S "qt"J S "uk gf "eqtg"dcttgnu0

Ucpf ctf "Rgpgtcvkqp" Vguu" *URV." CUVO "F 37: 8⁵+"y gtg" ecttkgf "qww"kp" eqplvpevkqp"y kj "ur rks"ur qqp" uco r npi 0""Hkgrf "xcpvgu"vupi "eqpxgpvkpcn"xcpgu+"y gtg"ecttkgf "qww"kp"dgw ggp"uco r npi "cv'ugrgevgf " f gr vj u0""Vcdrg"5/4"uwo o ctk gu"vj g" f gr vj u"qh"qxgtdwtf gp"r gpgtcvkqp"cpf "tqenleqtkpi "cu'y gni'cu"vj g"rkuv'qh" kputwo gpw"cpf "vj g"ceeqo r cp{ kpi "P kreqp"xcpvgu"0""Vj g"P kreqp"xcpvgu"rkuvgf "kp"Vcdrg"5/4"y gtg" ecttkgf "qww"v{r kcmf "cf lcegp"vj g"dqtgj qrgu0

Dqtgj qrg"nqi u"kmwtcvkpi "vj g"lpvgr tvgf "uqni'eqpf kkpqu."Hkgrf "vgu'tguwu"cpf "rdqtcvqt { "kpf gz "vgu'tguwu" ctg" kpenw gf "kp" Crr gpf legu" C" cpf "D0" "I gqvgj plecn"rdqtcvqt { "vgu'tguwu"ctg" r tguvgf "qp"hi wt gu" kpenw gf "kp" Crr gpf lz "E0

Table 3-2: Overburden Thickness and Instrumentation in Boreholes

Borehole	Location	Overburden Thickness, m	Test Name & Elevation					
			Rock Coring	Nilcon Vane	S- Piez.	VWP	MHSG	IN
DJ "D4/3" *4233+"	P 68: 44750." G54; 35; 08"	4406"	37804"vq" 37607"	39608"vq" 37808"	"	39707." 3890." 37908"	"	"
DJ "25/TY " *4233+"	P 68: 446205." G54; 2: 308"	4408"	3780 "vq" 3730 "	39702"vq" 37707"	"	3970." 38: 06" 39204"	3980." 39204"	3770, "
DJ "26/TY " *4233+"	P 68: 443904." G54; 3520 "	4409"	37708"vq" 37407"	3960 "vq" 37: 06"	"	39209." 3860." 37708"	39406." 38: 06"	37708, "
DJ IERV"D4/3" *4233+"	P 68: 443306." G54; 29906"	507" *DVY Q+"	"	"	"	"	"	"
DJ IERV: /TY " *4233+"	P 68: 44520." G54; 47705"	402" *DVY Q+"	"	"	"	"	"	"
DJ IFOV"D4/3" *4233+"	P 68: 446; 0." G54; 2; 208"	402" *DVY Q+"	"	"	"	"	"	"
DJ "382" *Rtg/dkf +"	P 68: 44380." G54; 37804"	4404"	37804"vq" 37308"	"	37609"	"	"	"
DJ "382C" *Rtg/dkf +"	P 68: 44380." G54; 37804"	360 " *DVY Q+"	"	"	"	38604"	"	"
DJ IERV"564" *Rtg/dkf +"	P 68: 44680." G54; 38: 09"	40 " *DVY Q+"	"	"	"	"	"	"
DJ "565" *Rtg/dkf +"	P 68: 44530." G54; 2: 805"	4506"	37709"vq" 37209"	"	"	37209"	"	"
DJ IERV"566" *Rtg/dkf +"	P 68: 442804." G54; ; 9608"	40 " *DVY Q+"	"	"	"	"	"	"

Ngi gpf <"URlg/ 0' Ucpf r k g"Rlg/ qo gvt" *Uetggp"grgxcvkpu+" XY R" Xkdtcvkpi "Y k g"Rlg/ qo gvt" *Ugpuqt"grgxcvkpu+" O UI " Ur kf gt "O ci pgvJ gcxglUgwgo gpvI cwi g" R " kpenkqo gvt "Eculpi " DVY Q" Dqtgj qrg"Vgto kpcvgf "y kj kp"vj g"Qxgtdwtf gp" , " Dqvqo "grgxcvkpi"qh"lperkqo gvt "eculpi "

P qvg<"Nqecvkqp"eqqtf kpcvgu"cpf "grgxcvkpu" ctg"kp"WWO /P CF " : 5" * qpg"39+"cpf " i gqf gvk "f cwo " "

⁴"Cf xcepgf "rdqtcvqt { "vgu" *eqpuqrf cvkqp"cpf "eqpuqrf cvgf "wpf tclpgf "tkczkn"vgu+"y gtg"ecttkgf "qww"kp"CO GE u'i gqvgj plecn" rdqtcvqt { "kp"Uectdqtqwi j . "QP 0'

⁵"Co gtlecp"Uqelgvf "htq"Vguupi "cpf "O cvgtkcm"

Tqenleqtgu'y gtg"gzco kpgf "lp"vj g"hgfr "cpf "tctpur qtvgf "vq"CO GE u"Vgewo ugj "Y kpf uqt+"rdqtcvqtkgu"htq" hwtvj gt "gzco kpcvqp0" Hqt "gcej "eqtg"twp. "tqenleqtg"tgeqxtg { "cpf "tqen's work { "f guki pcvqp" *TSF +y gtg" f gvgto kpgf 0" Vj g"tgeqxtg { "cpf "TSF "xcnvgu" ctg" i kxgp" qp" vj g" dqtgj qrg" mqi u0" Vj g"tqenleqtgu'y gtg" r j qvqi tcrj gf "lp"vj g"rdqtcvqt { 0

Vj g"dqtgj qrgu'y gtg" fgeqo o kuukppgf "wukpi "c" dgpvpkpg/ego gpv"i tqw" hmqy kpi "eqo r ngvqp"qh"uco r r kpi . " vguiki "cpf "lp"utwo gpv"lpucmckqp0

Vj g"ERV"eqpg"y cu'r wuj gf "cv" c"eqpuwcpv"tcvg"lpvq"vj g"i tqwvf "wukpi "j { ftcwke"tco "u{uvg" "qh"vj g"ftkmltki " *CUVO "F 799: +0" Rqtg"r tguuwtg" f kuuk cvkqp"vguu"y gtg"ecttkgf "qvw"cv"ERV"D4/3"cpf "ERV"2: /TY "cv"360 "cpf " : 0"o . "tgr gevkxgn { . "dgmj "i tqwvf "uwt hceg0

P kreqp"drcf g"y cu'r wuj gf "lp"i tqwvf "wukpi "vj g"j { ftcwke"tco "qh"vj g"ftkmltki 0" Vj g"uj gct "xcpg"vguu"y gtg" eqpf wvgf "lp"ceeqtf cpeg"y kj "CUVO "F 4795/230

Vj g"FO V"r tqdg"y cu'r wuj gf "lp"vj g"i tqwvf "lp"lpetgo gpw"qh"422"o o "wukpi "vj g"j { ftcwke"tco "qh"vj g"ftkmltki 0" Vj g"vguu"y gtg"eqpf wvgf "hmqy kpi "vj g"r tqxkukqpu"qh"CUVO "F "88570

Vj g"mccvkvpu"qh"vj g"dqtgj qrgu. "P kreqp"vguu "ERV"cpf "FO V"gzgewgf "cv"cpf "ctqwpf "Dtkf i g"D/4"ftkmltki "vj g" r t g x k w u "r t g / d k f " c p f " c f f k k q p c n l p x g u k i c v k p u . " c u " c n q " v j g " l p h g t t g f " u q k i r t q h k g " c r q p i " v j g " Y G R " c n k i p o g p v . " c t g " u j q y p " q p " F t c y k p i " 4 : 7 5 : 2 / 2 6 / 2 ; 2 / Y R 5 / 2 4 2 4 0 " D q t g j q r g . " F O V . " P k r e q p " c p f " E R V " m i u " h t q o " v j g " c f f k k q p c n l 4 2 3 3 " l p x g u k i c v k p p " c t g " l p e n m f g f " l p " C r r g p f k z " C 0 " T g r g x c p v d q t g j q r g " m i u " h t q o " v j g " r t g x k w u " l p x g u k i c v k p p " c t g " l p e n m f g f " l p " C r r g p f k z " D 0

3.3 Instrumentation

I gqvgj plecn"lp"utwo gpv"ucpfr kr g"r kgl qo gvgtu. "xkdtcvkpi "y klg"r kgl qo gvgtu" o "XY R." ur kf gt" o ci pgvu" j g x g l u g w r g o g p v i c w i g u o " O J U I " c p f " l p e n k p q o g v g t " e c u k p i u o " R E + y g t g " l p u c m g f " c v u g r g e v g f " m e c v k p u " q p " e q o r n g v k p " q h " d q t g j q r g u " v q " o q p k q t " r q t g " y c v g t " r t g u u w t g " c p f " f g h q t o c v k p p " d g j c x k w " q h " v j g " u q k i u t c v c " f w k p i " c p f " c h g t " e q p u t w e v k p 0 " C " d t k g h f g u e t k r v k p p " h m q y u 0

Standpipe Piezometers: "Vj gug"r kgl qo gvgtu"eqo r tkug"30"o "hpi "32"o krluqwgf "lpvcng"uetggp"mccvkvf "cv" ugrgevgf "fgr vj u"cpf "gzvgpf gf "vq"vj g"i tqwvf "uwt hceg" wukpi "74"o o "fko gvgt. "hwtvj /lqkv. "vj tgc f gf . "uej gf wrg" 62"RXE"tkugt"r kr g0" C"uklec"ucpf "hngt"r cem'y cu'r megf "dgw ggp"vj g"lpvcng"uetggp"cpf "vj g"y cm'qh"vj g" dqtgj qrg"cpf "gzvgpf gf "cr r tqzko cvgn { "205"o "cdqxx"vj g"vqr "qh"vj g"y gm'uetggp0" Dgpvpkpg/ego gpv"i tqw" y cu' wvgf "vq" tguvgtg" i tcf g" vq" vj g"i tqwvf "uwt hceg0" Uetggp" grgxcvkvpu" cpf "f gvcku" qh" lpucmckqp" ctg" r tqxkf gf "lp"Vcdrg"5/4"cpf "cr r rlecdrng"dqtgj qrg"mqi u0

Vibrating Wire Piezometers: "Vj g"XY R"tctpuf vegtu" *TUV"O qf gr XY 4322. "2057"O Rc"htq"uj cmqy "vq" o kf /fgr vj "cpf "20"O Rc"htq" f ggr "lpucmckqp" y gtg"lpucmngf "cv"ugrgevgf "fgr vj u"cpf "grgextlecn'y kgu'y j kej " y gtg"gzvgpf gf "vq"vj g"o qpkqtkpi "ucvkv"mccvkvf "cv"vj g"i tqwvf "uwt hceg0" Vj g"lpucmckqp"qh"vj g"r kgl qo gvgtu" y cu' ceeqtf kpi "y kj "vj g"o cpw hcewtgt" ur geklec vkvpu0" Vj g"lp"utwo gpvgf "dqtgj qrgu"y gtg" hngf "y kj "c" dgpvpkpg/ego gpv" o kzwte" f guki pgf "vq" o cvej . "cu" pgct" cu" r tcevecn" vj g" r gto gcdkrk { " c p f " u t g p i v j / f g h q t o c v k p p " e j c t c e v g t k u k e u " q h " v j g " p c v k x g " u q k u 0 " U g p u q t " g r g x c v k p p " c p f " f g v c k u " q h " l p u c m c k q p u " c t g " r t q x k f g f " l p " V c d r g " 5 / 4 " c p f " c r r r l e c d r n g " d q t g j q r g " m i u 0

Magnetic Heave/Settlement Gauges: "O ci pgwle"tkpi "cti gu"ctg"cepej qtgf "kp"vj g"i tqwpf "ctqwpf "c"RXE" r k r g0Vj g"cepej qtu"ctg"pqv"eqwr ngf "v"vj g"ceegu"r k g."cpf "ctg"htgg"v"o qxg"y kj "vj g"uqk0Cp"guuko cvg"qh" i tqwpf "j gxcglugwgo gpv"ecp"dg"o cf g"d{"o gcuwtgo gpv"qh"tkpi "gngxcvqpu0Ttkpi II cwi g"ngxcvqpu"ctg" r tqxkf gf "kp"Vcdrg"5/4"cpf "cr r ncedrg"dqtgj qrg"mqi u0"Vj g"kpwtwo gpvgf "dqtgj qrgu"y gtg"hgngf "y kj "c" dgpvqpksg/ego gpv"o kzwg"fguki pgf "v"o cvej ."cu"pgct"cu"r tcevekn"vj g"fghto cvkqp"ej ctcevgtkukueu"qh"vj g" pcvkxg"uqku0

Inclinometers: "Kpenkqo gvg"ecukpi u'y gtg"lpucmgf "kp"Dqdgj qrgu"DJ "25/TY "cpf "DJ "26/TY "v"o gcuwtg" vj g"nvgtcn"i tqwpf "o qxgo gpv"cv"vj g"lpucmgf "ngcvkqpu0"Vj g"dqwgo "gpf "qh"vj g"ecukpi "y cu"cepej qtgf " cr r tqzko cvng" "20"v"30"o "kp"vj g"dgf tqem"cpf "vj g"cppwrt"ur ceg"ctqwpf "vj g"ecukpi "y cu"hgngf "y kj " dgpvqpksg/ego gpv"i tqw0"Vj g"kpukqo gvg"eqo r tkugf "92"o o "f kco gvg" "TUV"0Upcr "Ugcn"Kpenkqo gvg" Ecukpi 0."cpf "r tqdg"ku"FE54227"O GO Uf ki kcn"Kpenkqo gvg"u{ ugo "20"o "mqpi +0"Dgpvqpksg/ego gpv"i tqw" y cu"wguf "v"tguqgtg"i tcf g"v"vj g"i tqwpf "uwtcego"

Rtqr gt "hwwt"gf geqo o kuukpkpi "qh"vj g"kpwtwo gpvcvqp"j qrgu"ku"t gur qpukdkrkv{ "qh"Y GO I IRKE0

3.4 Geotechnical and Analytical Laboratory Testing

Cm"tgeqxtgf "uqki"uco r ngu"cpf "tqem"eqtgu"y gtg"gzco kpgf "kp"vj g"hgngf "cpf "vj g"rdqtcvqt{0" "Pcwten" o qkwtg"eqvpgpv"vguu"y gtg"ecttkgf "qww"qp"o quv"qh"vj g"tgeqxtgf "uco r ngu"i tclp"uk g"fg kwtkdwkqp"cpf " Cvgtdgti "hko k'vguu"y gtg"ecttkgf "qww"qp"ugrgevgf "tgr tguvgvkvxg"uco r ngu0"

Ugrgevgf "uco r ngu" qh" vj g" ukv{ "erc{ "v" erc{ g{ "ukv" qdvckpgf "htqo " dqdgj qrgu" y gtg"ugpv" vj "vj g" CNU" Gpxkqpo gpvcn"cpn{ vkcni"ndqtcvqt{ "kp"Nqpf qp."Qpvctkq"v"fgvgo kpg"vj g"r J ."tgr qz"r qvgpvkn"tguukvkv{ ." uwr j kf g"cpf "uwr j cvg"eqvpgpv"qh"vj g"uqki"v"cuuguu"eqttqukqp"r qvgpvkn0

Vj g"tguwmu"qh"i gqvgej plectn"cpf "i gqej go kecn"*cpn{ vkcni"ndqtcvqt{ "vguu"ctg"lpenmf gf "kp"Cr r gpf legu"E" cpf "F ."tgr gevkxgn{0"Uqo g"qh"vj g"rdqtcvqt{ "vgu"tguwmu"gd 0"i gqvgej plectn"lpgf gz"r tqr gt vgu"ctg"lpgf lecvf " qp"vj g"dqdgj qrg"mqi u0

3.5 Data Interpretation

Field Vane Test Data Correction: "Vj g"ej ctv"*Hki wtg"50⁶+f gxcgr gf "kpkkm{ "d{ "Dlgtwo "3; 94+"cpf " w f cvgf "uwdugs wgpvn{ "d{ "Ncf f "gv"cn"3; 99+"dcugf "qp"ekewrt"cte"hcwng"cpn{ ugu"qh"go dcpno gpv"hcwng" uwi i guv"eqttgevkqp"d{ "o wnk r n lpi "vj g"hgngf "xcpg"fcv"d{ "302"v"302"ht"uqku"y kj "r ruvek{ "lpgf gz"qh" cdqw"37"*tgh0T/7"cpf "T/53+0"J qy gxtg."dcugf "qp"tg/gxcnvcvqp"qh"vj g"Dlgtwo "ej ctv"d{ "Ccu"gv"cn03; : 8+." vj g"Ecpcf kcp"Hqwpf cvkqp"O cpvcn"uwi i guu"vj cv"vj g"xcpg"vgu"fcv"ht"erc{ u"y kj "RK42"uj qwf "pqv"dg" eqttgevgf "tgh0T/3."T/ : ."cpf "Hki wtg"50+0"Vj gtghqg."vj g"hgngf "xcpg"vgu"fcv"*htqo "eqpxgvpkpcn"cpf " P kraqp"xcpg"vguu"cv"vj ku"ukg"y gtg"pqv"eqttgevgf "ht"RK0"

Undrained Strength Profiles from Cone Penetration Tests: "Vj g"wpf tclpgf "uj gct"utgpi vj "qh"vj g"ukv{ "erc{ "f gr qukv"y cu"guuko cvgf "wukpi "vj g"ERV"kr "tguukcpeg."S . "cu"hqmqy u"

$$S_{u\text{CPT}} = \frac{Q_t - \sigma_{vo}}{N_{kt}}$$

Y j gtg<

$S_{u\text{CPT}}$ "ku'j g'wpf tclpgf "uj gct'utgpi vj "guko cvgf "htqo "vj g'ERV"vguv="

S_v " ku'j g'eqttevgf "vqcn'eqpg"vr "tgukwpeg="

σ_{xq} " ku'j g'vqcn'xgtv'ecn'utguu'cv'vj g'eqttegur qpf lpi "f gr vj "qh'o gcuwtgo gpv'qh'vj g'S_v'xcnwg="cpf "

P_{mv} " ku'cp"go r k'ecm'f'cevqt "vj cv'xctkgu."f gr gpf lpi "qp"uqkl'v'r g"cpf "vguv'cttcepi go gpv'v'r k'ecm'f' dgvy ggp": "cpf "420'

Vj g'ERV"dcugf "Uw'r tqh'kgu'y gtg'f g'xgnr gf "vq"cej k'xg"ci i gpgtci'ci tggo gpv'y kj "vj g'pgctd { "P k'eqp"xcpg" vguv'r tqh'kgu"0"Kp"vj ku'tgi ctf. "vj g' N_{kt} "h'cevqt'xcnwgu'wugf "vq"ecn'dtcvg'vj g'ERV'utgpi vj "r tqh'kgu'xctkgf "urki j v" hqt"fh'gtgpv'ugi o gpw'qh'vj g"Y GR"cpf "vj g'uqkl'utcv0"Vj wu."cp" N_{kt} "h'cevqt'qh'36'y cu'wugf "vq"gu'ko cvg'vj g' wpf tclpgf "uj gct'utgpi vj "qh'vj g'erc { "etwuv'cpf "t'cpuk'kp"rc { gtu0"Vj g' N_{kt} "h'cevqtu'wugf "hqt"vj g'wpf gtn' lpi " i tg { "ukn'f'erc { g { "ukn'utcvwo "cpf "vj g'nyy gt"erc { g { "ukn'utcvwo "y gtg"38"cpf "34."tgur gev'xgn'0"Kp" ERVu" kpf k'ecv'pi " r qtg" r tguuwtgu" j ki j gt" vj cp" eqpg" vr "tgukwpeg." vj g' wpf tclpgf "uj gct' utgpi vj " y cu' guko cvgf "htqo "vj g'gzegu'r qtg'r tguuwtgu"wkpi "vj g'P_w'o gvj qf +0'

Pre-Consolidation Pressures from Cone Penetration Tests:""Vj g'cr r tqcej "wugf "hqt" guko cv'pi "vj g' r tg/eqpuqrkf cv'kp'r tguuwtgu'htqo "vj g'gu'ko cvgf "Uw'r tqh'kgu'hqmy u'vj g'Utguu"J k'vqt { "cpf "P qto crk' gf "Uqkl' Gpi k'pggt'pi "Rtqr gt'vku"U CP UGR+"o gvj qf "f g'xgnr gf "cv'O K'"Ncf f "cpf "Hq'qw."3; 96."tgh0'T/53+0"Vj g' hqmy lpi "tgr'cv'kupj k' "y cu'wugf "vq"eqo r wv'vj g'r tg/eqpuqrkf cv'kp'r tguuwtgu"<

$$OCR = \frac{\sigma'_p}{\sigma'_{vo}} = \left[\frac{S_u / \sigma'_{vo}}{S} \right]^{\frac{3}{m}}$$

Y j gtg<

S_u " ku'j g'wpf tclpgf "uj gct'utgpi vj ="

σ'_{vo} " ku'j g'xgtv'ecn'gh'gev'xg'utguu="

σ'_p " ku'j g'r tg/eqpuqrkf cv'kp'r tguuwtg"*cuq'tghgttgf "cu'o czko wo "r cuv'r tguuwtg="

S'' " ku'j g'pqto crk' gf "utgpi vj "t'cvkq"*U_w'x'+qh'pqto cm'f' "eqpuqrkf cvgf "uqkn="

OCR " ku'j g'qxgteqpuqrkf cv'kp'r t'cvkq="cpf "

m " ku'cp"go r k'ecm'f'fgvto k'pgf "g'zr qp'gpv'v'r k'ecm'f'xct { lpi "dgvy ggp"20'cpf "300'

Dcugf "qp"r rucwlekf "kpf gz "qh"vj g"erc { g{ "ukw"vq"ukw" "erc { "f gr quku: "xcnwgu"qh" S ? "208: "cpf "m"? "20 7"y gtg" ej qugp"vq"gunko cvg"vj g"o czko wo "r cuv'r tguuwtgu"ltqo "vj g"lphgttgf "wpf tckpgf "uj gct"utgpi vj "r tqhkg0"Vj g" o czko wo "r cuv'r tguuwtg. "σ'p ecp"vj gp"dg"gunko cvgf "cu<

$$\sigma'_p = \sigma'_{vo} \times \left[\frac{S_{uCPT}}{\frac{\sigma'_{vo}}{208}} \right]^{3027}$$

Flat Blade Dilatometer (DMT) Test Data: "FO V"vguwy gtg"eqpf wevgf "hmqy kpi "vj g"CUVO "F 8857/23" *4229+"o gvj qf 0"Vj g"uqkl'r tqr gtvgu"ltqo "vj g"tguuwtgu"qh"vj gug"vguwy gtg"f gxmnr gf "kp"i gpgtcr"vukpi "vj g" i vkf grkpgu"rc{qw"kp"KUO I G."4223"tgh0T/49+."gzegr v"vj cv"vj g"wpf tckpgf "uj gct"utgpi vj "xcnwgu"lqt"vj g"erc { "f gr quku"y gtg"gunko cvgf "vukpi "vj g"tgrcvkpuj kr "Uw?"U"σ'xq "207"Mf+³⁰⁴⁷."y j gtg"U"? "208: 0"Mf"ku"vj g" j qtk qpvcrlutguu"lph gz "tgr tguuwtg"dg<

Mf"? "r2"ó"wo+"I"σ'vo

Y j gtg<

r2" ku"vj g"eqttgevgf "kpuwwo gpv"rcvgtcr"tguuwtg"tgcflpi "cv" gtq"o go dtcpg"f ghqto cvkqp"spwni" o gvj qf ö+ "

" w2" ku"vj g"r qtg"y cvgt"r tguuwtg"lp"vj g"uqkl'r tkqt "vq"vj g"drcf g"kpugt vkqp"

Vj g"wpf tckpgf "uj gct"utgpi vj " *Uw+." r tg/eqpuqrkf cvkqp" r tguuwtg" * r'+" pcwtcr"y cvgt"eqpvgpv" *y p+" cpf " eqo r tguuwtg"lph gz "Ee+"r tqhkgu"dcugf "qp"lgrf "cpf "rdqtcvqt { "vgu"lpi "ltqo "dqtgj qrgu."ERVu"cpf "FO V" eectkfg "qww"dgvy ggp"Uc0'32- 522Y "cpf "32- ; 22Y "ctg"r tguuwtg"lp"lki wtg"500"Cnuq"lpenwf gf "qp"vj gug" lki wtgu"ctg" 208: " " xq" r tqhkg "tgr tguuwtg"wpf tckpgf "utgpi vj " r tqhkg" hqt" QET?3" eqpf kkp+" cpf " uko r rkhgf "uqkl'utcvki ter j le" f gr quku"vq"lcekrkcvg"eqttgrcvkqp"qh"uqkl'r tqr gtvgu"vq"vj g"lph kklf ven"uqkl'vpxu0" Vj g"eqpuwcpv"208: "hqt"Uw/σ'xq"lqt"QET?3"ewtxg"ku"dcugf "qp"cxgtci g"r rucwlekf "kpf gz "qh"vj g"ukw" "erc { "vq"erc { g{ "ukw"utcwwo "cpf "Ej cpf rgt"3; : : "tgrcvkpuj kr "tgh0T/33+0"

"

4 Subsurface Conditions

Vj g'i gpgtcn'uqkn'utcv'ki ter j { "cv'yj g'dqtgj qrg'mqecvkpu"lp'yj g'ctgc"qh'Dtkf i g'D/4"eqpukw"qh'yj g'hqmy lpi "uweeguukxg"utcv<'vqr uqkn"utvhekcn'rc { gtu"qh"qecukqpcn'hkm"cpf "wr r gt"i tcpwrt"f gr quku"cp"gzvgpukxg"eqj gukxg"ukm"erc { "vq"erc { g { "ukm"fg r quku'dgmy "cdqww'grgxcvkp"3980"vq"39: 0."cpf "my gt"i tcpwrt"f gr quku'dgmy "cdqww'grgxcvkp"3770"vq"3790."qxgtm lpi "hko guvqpg'dgf tqenldgmy "cdqww'grgxcvkp"3770"vq"3780 0" Vj g'yj kempguu"qh'yj g'ukm"erc { "vq"erc { g { "ukm"utcvwo 'xctkgf "dgwy ggp"3; 0"cpf "420 "o 0'

Vj g'dgf tqenly cu'gpeqwpvgtgf "cv'f gr yj u'tcpi lpi 'htqo "cdqww'440"o "vq"450"o "dgmy "yj g'i tqwpf "utvheg0'

4.1 Topsoil, Surficial Fills and Upper Granular Deposit

Dtqy p" vq" drcen' vqr uqkn' y cu" gpeqwpvgtgf "cv' yj g" i tqwpf "utvheg" cv' cm' dqtgj qrg" mecvkpu" gzev v' lp" Dqtgj qrgu"DJ "D4/3."DJ "25/TY ."DJ "26/TY ."DJ IERV"D4/3"cpf "DJ IF O V"D4/30"Vj g'yj kempguu"qh'yj g" vqr uqkn'xctkgf "htqo "204"vq"30"o . "dw'ku'ggr gevqf "vq"xct { "lp's wcrkx" cpf "yj kempguu"yj tqwi j "yj g'r tqlgv'ctgc0'

Dqtgj qrgu"DJ "D4/3."DJ "25/TY ."DJ IERV"D4/3"cpf "DJ IF O V"D4/3" gpeqwpvgtgf "utvhekcn'hkm"eqpukn lpi "qh'ukm"erc { . "erc { g { "vqr uqkn"cpf "ukm"ucpf "vq"ucpf 0"Vj g"vqcn'yj kempguu"qh'yj g" hkm"xctkgf "htqo "306"vq"30"o 0" ""

Wr r gt"i tcpwrt"f gr quku" y gtg" gpeqwpvgtgf "cv' cm' qh'vquv'mqecvkpu" gzev v' lp" Dqtgj qrgu"DJ "D4/3" cpf "DJ IF O V"D4/30"Vj g"wr r gt"i tcpwrt"f gr quku'eqpukn"qh'ucpf "vq"ukm"qt"ukm"ucpf 0"Vj g'yj kempguu"qh'yj g" f gr quku'xctkgf "htqo "204"o "vq"i tgcvtg"yj cp"40 "o 0"Uco r npi "y cu'vgtgto kpcvgf "lp'yj g'wr r gt"i tcpwrt"f gr quku'cv" DJ IERV"5660'

4.2 Clayey Silt to Silty Clay Stratum

Vj g'eqj gukxg"erc { g { "ukm"vq"ukm"erc { "utcvwo "y cu" gpeqwpvgtgf "f kgevn"wpf gtn lpi "yj g'utvhekcn'vqr uqkn'qt" hkm' tcpwrt"f gr quku'lp"cm'vquv'j qrgu0"Vj g" gpeqwpvgtgf "f gr yj "dgmy "gzkukpi "i tqwpf "utvheg"y cu'htqo "20 " o "vq"i tgcvtg"yj cp"40 "o 0"Dcugf "qp"yj g'i tcf cvkqp."lp/ukw'o qkwtg"eqpvgp'cpf "utgpi yj "ej ctcevgtkukcu."yj g" utcvwo "o c { "dg"f kxf gf "lpvq"6"uweeguukxg"rc { gtu"cu'hqmy u'o qvngf "dtqy p/i tgl "f gukeecvgf "hko "vq"utvhh"erc { "etwv."tcpukqkp" qpg."wr r gt"i tgl "ukm"erc { "vq"erc { g { "ukm"fg r quku"*tghgtgf "vq"j gtgchgt"cu'wr r gt"ukm"erc { "+"cpf "yj gp" c"i gpgtcn' "eqctugt"my gt"i tgl "erc { g { "ukm"fg r quku"*tghgtgf "vq"j gtgchgt"cu"my gt"erc { g { "ukm"0"Vj g'i gpgtcn'tcpi g"qh'pcwtn'y cvgt'eqpvgp."Cvgtgdgti "hko ku"cpf "dwm'wpx/y gli j w'f vgtgto kpgf "qp"yj g" uco r ngu"qh'yj g"erc { "uud/utcv"tgeqxtgf "f wtkpi "yj g'r tg/dkf"cpf "cf f kkpncn'i gqvej plecti'kpxguki cvkqp"ctg" uwo o ctkgf "lp"Vcdng"6/30"Vj g'r rnuvckx"ej ctw" Hki vtgu"E06"vq"E08"lp"Cr r gpf kz "E+uwi i guv'yj g'ukm"erc { "f gr quku'vq"dg" c"my "vq"o gf kwo "r rnuvckx" "o cvgtkn'y kj "qecukqpcn'ugco ulrc { gtu"qh'j ki j "r rnuvckx" "uqkn0'

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Project: Y kpf uqt/Gugz'Retny c { "
Document: I gqvej plecti'kpxguki cvkqp'cpf "F guki p"Tr qtv"
 Dtkf i g'D/4"Uc032- 84202: Y "vq"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu"p q062L8/67+"
 "

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Table 4-1: Summary of Index Properties of the Clay Stratum

Property	Clay Crust	Clay Transition	Upper Silty Clay	Lower Clayey Silt
Grgxcvkqp "Tcpi g" %o +"	39; 3"6"399"	399"6"397"	397"6"385"	385"6"379"
P cwtcnY cvgt "Eqvpgpv" y p. " "	35"6"47"6"	43"6"59"8"	3; 4"6"72"0"	36"6"47"0"
Nls wkf "Nlo kx" y N"	P IC"	48"0"	48"6"67"0"	4; 8"6"56"0"
Rrcvle "Nlo kx" y R"	P IC"	38"6"3; 0"	36"6"48"0"	36"6"3; 0"
Rrcvlekv "Kpf gz. 'RK'	P IC"	32"0"	34"6"49"0"	36"6"3; 0"
Nls wkf kv "Kpf gz. 'NK'	P IC"	2"6"20 2"	2"6"30 7"	2"6"20 4"
WpkY gki j v. "nP lo 5"	P IC"	P IC"	39"6"42"0 "	42"6"42"0 "

3"/"Grgxcvkqp "xctkgu"

Kpf gz "Rtqr gtvkgu" ctg "dcugf "qp" rcdqtcvt { "tguwmu" qp "uco r ngu" tgeqxtgf "htqo "Dqtgj qrgu" DJ "382. "DJ "565. "DJ "25/TY. "DJ IERV" D4/3. "DJ IF O V D4/3. "DJ "26/TY. "DJ IERV" 2: /TY "cpf "DJ "D4/30"

Vj g"wpf tclpgf "uj gct" utgpi yj "Uw" r tqhkgu" qh" yj g"utewo "dgw ggp" Uco032- 522Y "cpf "Uco032- ; 22Y "cpf " cv" yj g"Dtkf i g"D/4" ukkg" ctg "kmwutcvgf "qp" Hki wtgu" 5"6" cpf "7"0. "tgu gevkxgn { 0""

Cu" kmwutcvgf "qp" Hki wtgu" 5"6" cpf "7"0. " yj g"wpf tclpgf "uj gct" utgpi yj "qh" yj g"erc { "utewo "xctkgf "y kj "f gr yj " i gpgtcm { "cu" hmqy u"

- Etwvrc { gt < "82" nRc"
- Vtcupkqp "rc { gt < "82" nRc" vq" 72"042" nRc"
- Wf r gt "ukm { "erc { < "72"042" nRc" vq" 52"032" nRc"
- Ngy gt "erc { g { "ukm < "72"042" nRc0"

Vj g"utguu/utclp "r tqr gtvkgu" cpf "yj g" gthgevkxg" uj gct" utgpi yj "r tqr gtvkgu" qh" yj g"ukm { "erc { "f gr qukv" y gt g"dcugf " qp" vguv" tguwmu" htqo " yj g" r t g/dkf "i gqvgej plectnlp xguki cvkqu" *tgh0T/38. "T/39. "T/3: "cpf "T/3; + "cpf " yj g" qp g/ f lo gpukpcn" eqpuqrf cvkqp "vguu. " tlczkcn" uj gct "vguu" cpf "f kge v" yj gct "vguu" r gthqto gf "f wtkpi " yj g" cf f kkpccn" i gqvgej plectnlp xguki cvkqp "f guetldgf "kp" Ugevkqp "5"0"0" Vj gug" kpvgtr tgvf "t gpf u" ctg "uwr r qtvgf "d { "r wdrkuj gf " eqttgrcvkqu" kp" yj g" rkgtcwtg" *Mwj cy { "cpf "O c { pg. "3; ; 2. "tgh0T/52. "Ngtqwgkn" cv" cr0" 4223. "tgh0T/56" cpf " Vgt| ci j K'g v" cr0" tgh0T/64+0"

Vj g" utguu/utclp " tgrcvkquj kr u" ctg "eqttgrcvf " vq" pcwtcn" y cvgt "eqvpgpv" *y p. " gztguugf "cu" r gtegpv" cu" kmwutcvgf "kp" Hki wtg" 6"0" cpf "Hki wtg" 6"0" uwo o ctkg gf "cu" hmqy u"

E_e " ? "2"02: 8y p "6"2"02: 8"

E_t " ? "2"03E_e "

E_u " ? "2"047E_e "

E " ? "2"04: E_e "

Vj g" kpvgtr tgvf "cxgtci g" xcnwgu" wugf "hqt" yj g"erc { "uwdutvcw" hqt" yj g" Dtkf i g" D/4" ukkg" ctg "uwo o ctkg gf "kp" Vcdrg" 6/40"

"

"

Project: Y kpf uqt/ Guugz "Rctny c { "
Document: I gqvgej plectnlp xguki cvkqp" cpf "F guki p" Tgr qtv"
Dtkf i g" D/4" *Uco032- 842"02: Y "vq" 32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu" P q062L8/67+ "

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Table 4-2: Summary of Interpreted Compressibility Properties

Property	Clay Crust	Clay Transition	Upper Silty Clay	Lower Clayey Silt
Cxgtci g'PcwtenY cvgt'Eqpvgpv'y p."	42"	46"	46"q'4; "	42"
Xkti kp'Ego r tguukqp'kpf gz.'E _e "	2085"	208; "	208; : "q'20463"	2085"
Tgeqo r tguukqp'kpf gz.'E _t "	2023: 2"	2043: "	2043: "q'20487"	2023: 2"
Uy gnkpi 'kpf gz.'E _u "	2062; "	206; 7"	206; 7"q'20824"	2062; "
Ugeqpf ct{'Ego r tguukqp'kpf gz.'E "	20268"	20277"	20277"q'20289"	20268"

Qgf qo gvg't'vuw'y gtg'ectt'kf'q'w'qp'i tg'{'ukn'erc{'uco r ngu'qdw'kpgf'htqo "Dqtgj qrgu'DJ "26/TY ."DJ "382" cpf'DJ "565."y g't'guw'u'qh'y j k'j 'ctg'uwo o ctk'gf'kp'y g'hqmy kpi 'vcdrg0"

Table 4-3: Summary of Laboratory Oedometer Tests

Borehole / Sample	Elevation	Natural Water Content, w _N , %	Virgin Compression Index, C _c	Recompression Index, C _r	Swelling Index, C _s
DJ "26/TY ."Uco r rg'VY : "	39206"	4; 08"	2043"	2045"	2085"
DJ "382."Uco r rg'35"	38707"	590 "	20527"	2089"	2087"
DJ "382."Uco r rg': "	39408"	4; 08"	20452"	2078"	2082"
DJ "382."Uco r rg': "	39408"	4908"	20468"	2073"	2288"
DJ "565."Uco r rg'7"	39606"	5706"	20582"	2054"	2085"
DJ "565."Uco r rg'9"	39308"	4907"	2045; "	2066"	2072"
DJ "565."Uco r rg': "	38; 02"	7204"	2063: "	206; "	20842"
DJ "565."Uco r rg'38"	37; 0 "	4409"	2087; "	2039"	2052"

Vj g'gh'ge'v'x'g'uj gct'utgpi yj "r tqr gt'vku"cr r r'lecdrg'q'v'y g'ukn'erc{' "q'erc{'g{' "ukn'utcwwo "y gtg'f'gvto kpgf' " hqto " v'lc'z'k'cn' cpf' " f'k'ge'v' uj gct' " v'uwu' r gthqto gf' " f'wt'kpi " yj g' r tg/dk' " cpf' " cf'f'k'k'q'pcn' i gq'gej p'le'cn' k'p'x'g'uki c'v'k'pu'cpf' "u'w' r qt'vgf' "d{' "r'w'd'kuj gf' "RK'x'gt'uwu' "t'g'v'k'p'uj k' r u' "t'gh0T/56"cpf' "T/64+0"Vj g'ug'utgpi yj " r cteo g'v'gtu'ctg'uwo o ctk'gf' "cu'h'q'm'y u' "H'k' i w'gtu'60"cpf' "60+<"

Crr'ctg'p'v'eqj g'ukqp.'e " 2"nRc"

Cpi rg'qh'k'p'v'g't'p'cn'ht'le'v'k'p'." " 52A'

H'le'v'k'p'cpi rg'cv'et'k'le'cn'l'uc'vg." e" 47A'q'48A'7"

Vj g'o qf w'uw'u'qh'g'rc'v'le'k'{" j cu'd'ggp'eq'tt'g'rc'vgf' "y k'j "yj g'w'p'f' t'c'k'p'gf' "uj gct'utgpi yj "qh'y g'o c'v'gt'k'cn' "r'w'd'kuj gf' " k'p'hqto c'v'k'p' "t'gh0T/64+"cpf' "h'q'ec'n'g'z'r g't'k'p'eg' "t'gh0T/3; "+"cu'h'q'm'y u'<"

G'rc'v'le' "O qf w'uw'u' "W'p'f' t'c'k'p'gf' + "G_w"? "522"U_w"

" G'rc'v'le' "O qf w'uw'u' "F' t'c'k'p'gf' + G)?" "20 G_w"

Vj g't'guw'u' "hqt' "yj g'w'p'y g'c'y gt'gf' "r'qt'v'k'p' "qh'y g'ukn'erc{' "q'erc{'g{' "ukn'utcwwo "w'ukpi "yj g'cxgtci g'uj gct' utgpi yj "r't'q'h'g'u' "hqt' "yj g'o c'v'gt'k'cn'ctg'uj qy p'kp' "Vcdrg'6/60"

7. Deugf "qp'r'w'd'kuj gf' "f'c'v'c'p'f' "eq'p'h't'o gf' "d{' "v'lc'z'k'cn'l'v'uwu' "t'gh0T/3: -0'

Project: Y k'p'f' u'q't' /Gu'g'z' "R'ctny c{' "

Document: I gq'gej p'le'cn'k'p'x'g'uki c'v'k'p'cpf' "F'g'uki p' "T'g'r'q't'v' D't'k'i g'D/4" "U'c'032- 84202: Y "q'32- 87: 0644Y +"

Doc No.: 4: 75: 2/26/33; /233: "I g'q'et'gu'P q'06218/67+"

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Table 4-4: Summary of Interpreted Elastic Properties of the Soils

Soils Stratigraphy	Elastic Modulus - Undrained, MPa	Poisson's Ratio – Undrained (*)	Elastic Modulus - Drained, MPa	Poisson's Ratio – Drained (*)
Er{ "Etuv"	52"	206; "	49"	207"
Er{ "Vtcpuqkqp"	380"		37"	
Wf r gt "Ukn{ "Er{ "	: "		9"	
Nqy gt "Er{ g{ "Ukn"	38"		360"	

*, + "Cuwo gf "xwgu"tgh0T/64+""

Vj g"j { f t c w l e " e q p f w e k k l { " q h " y j g " u k n { " e r c { " v q " e r c { g { " u k n " u t c w o " y c u " k p v g r t g v g f " h t q o " r q t g " r t g u w t g " f k u k r c v k p " v g u u e c t t k g f " q w " l p " y j g " E R V " r t q d g u " c u " y g m i c u " y j g " r e d q t c v q t { " q g f q o g v g t " v g u u 0 " V j g " j { f t c w l e " e q p f w e k k l { " x c n g u " q d v k p g f " h t q o " r t g x k w u " * 4 2 2 9 / 2 ; + " c p f " c f f k k q p c n " * 4 2 3 3 + " l p x g u n k i c v k p u " c t g " r t q x k f g f " l p " C r r g p f l z " G O " u k i p k l e c p w { " y j t q w i j q w " y j g " r t q l g e v " c t g c 0 "

4.3 Lower Granular Deposit

Qh'yj g" h x g " d q t g j q r g u " c f x c p e g f " v q " d g f t q e m " D J " 5 6 5 " g p e q w p v g t g f " c " n y j g t " i t c p w r c t " f g r q u k 0 " V j g " i t c f c v k p p " q h ' y j g " o c v g t k e n ' y c u " u c p f " c p f " i t e x g r 0 " D c u g f " q p " y j g " U c p f c t f " R g p g v c v k p p " V g u u " * U R V + " l p " y j k u " o c v g t k e n " o P o " x c n g u " t c p i g f " h t q o " 7 2 " q x g t " 3 2 2 " o o " v q " 7 : . " c p f " y j g t g h t g . " y j k u " o c v g t k e n " l u " e q p u k f g t g f " v q " d g " l p " c " x g t { " f g p u g " u c v g " q h " e q o r c e v p g u u 0 " " V j k u " r c { g t . " y j g t g " r t g u g p v . " y c u " e r r t q z k o c v g n { " 2 0 " o " y j k e m i d w " o c { " x c t { " u k i p k l e c p w { " y j t q w i j q w " y j g " r t q l g e v " c t g c 0 "

4.4 Bedrock

Y j g t g " t q e m e q t k p i " y c u " w p f g t w n g p . " c " i t g { " v q " d t q y p . " n o g u v q p g " d g f t q e m ' y c u " g p e q w p v g t g f 0 " V j g " d g f t q e m ' y c u " e q t u g " v q " x g t { " h k p g " i t c k p g f . " q e e c u k q p c m { " r k w g f . " h e l p w n { " v q " u t q p i n { " r q t q w u " c p f " h t c e w t g f 0 " D g f t q e m ' y c u " g p e q w p v g t g f " c v " g r g x c v k p u " t c p i k p i " h t q o " 3 7 7 0 8 " v q " 3 7 8 0 " l p " y j g " x l e k p k v { " q h " D t k i g " D / 4 0 " R j q v q i t e r j u " q h " t q e m e q t g u " t g e q x g t g f " h t q o " y j g " c f f k k q p c n l p x g u n k i c v k p p " c t g " r t q x k f g f " l p " C r r g p f l z " G O "

T q e m e q t g " u c o r n g u " h t q o " D J " D 4 / 3 " c p f " D J " 3 8 2 " y g t g " v g u v g f " c p f " j c f " w p e q p h k p g f " e q o r t g u k x g " u t g p i y j u " q h " ; 5 0 " c p f " 8 3 0 " O R c . " t g u r g e v k x g n { 0 " " V j g " t g u w n u " q h " y j g " e q o r t g u k x g " u t g p i y j " v g u k p i " l p f l e c v g " y j c v " y j g " n o g u v q p g " t q e m o c { " d g " f g u e t k d g f " c u " o u t q p i o " t q e m 0 "

Q x g t " y j g " g p v k t g " r t q l g e v " c t g c . " y j g " T q e m i S w e r k v { " F g u k i p c v k p p " * T S F + " q h ' y j g " t g e q x g t g f " t q e m i x c t k g f " h t q o " 2 " v q " 3 2 2 " r g t " e g p v . " l p f l e c v k p i " c " x g t { " r q q t " v q " g z e g m g p v ' s w e r k v { 0 " " D c u g f " q p " y j k u " e q t g " n q i i k p i " y j g " t q e m i o c u u " e r c u l h e c v k p p " y c u " g u n k o c v g f " v q " t c p i g " h t q o " 4 0 " v q " 7 " h q t " y j g " S / U { u g o " * D e t v q p " e t . a l . " 3 ; 9 6 . " t g h 0 T / 5 + " c p f " 7 5 " v q " 7 : " h q t " y j g " T q e m i O c u u " T c v k p i " * T O T + " d c u g f " q p " D k g p k y u n k " * 3 ; 9 8 . " t g h 0 T / 7 + " c p f " l p f l e c v g u " y j c v " y j g " t q e m i o c u u " e c p " d g " e q p u k f g t g f " c u " c " H c k " s w e r k v { " t q e m i o c u u " d c u g f " q p " y j g " r e v g t " u { u g o 0 " " T q e m i s w e r k v { " i g p g t c m { " l p e t g c u g u " y k j " f g r y j 0 " "

K ' y c u " h q w p f " f w t k p i " y j g " r t g n k o k p c t { " l p x g u n k i c v k p u " * t g h 0 T / 3 ; + " y j c v " d w r g " x c t k c v k p p " l p " y j g " u t g p i y j " q h ' y j g " t q e m i o c u u " e q p f k k q p u " y c u " k f g p v k l g f " h t q o " u k x g " v q " u k x g 0 " " H q t " y j k u " t g c u q p " l p " q t f g t " v q " q d v k p " c " t g c u q p c d r g " u c v k u k e c n " u c o r n g . " y j g " f g p u k v { . " w p k v " y g l i j v " c p f " w p k c z k e n " e q o r t g u k x g " u t g p i y j " q h ' y j g " u c o r n g u " h t q o " c m i q h " y j g " n g { " u k g u " y c x g " d g g p " i t q w r g f " c p f " c t g " u w o o c t k u g f " l p " V c d r g " 6 / 7 0 " " C " v q v e n " q h " 3 4 " u c o r n g u " y g t g " l p e n m f g f " h q t " f g p u k v { " c p f " w p k v " y g l i j v . " y j k r g " 3 8 " y g t g " l p e n m f g f " h q t " w p e q p h k p g f " e q o r t g u k x g " u t g p i y j 0 " " V j g " c x g t c i g " u t g p i y j " q h ' y j g " n o g u v q p g " l u " f g y g t o k p g f " v q " d g " : 7 0 " O R c " c p f " l u " s u t q p i " t q e m " d c u g f " q p " y j g " R U T O " * 3 ; 9 : + 0 " "

Cf f k k p c m f . " d c u g f " q p " y j g " e q g h l e k p v " q h " x c t k v k p . " g p q w i j " v g u u " j c x g " d g g p " r g t h q t o g f " v q " e j c t c e v g t k u g " y j g " e q o r t g u u k x g " u t g p i y j 0 "

Table 4-5: Summary of Intact Properties of Rock Core Samples

	Density *m l o 5+	Unit Weight *m P l o 5+	UCS *O R c +
C x g t c i g "	4724 "	46076 "	: 70 "
U c p f c t f " F g x l e v k p "	: 8 "	20 6 "	4706 "
O k p k o w o " X c m g "	4562 "	440 7 "	570 "
O c z k o w o " X c m g "	4882 "	480 ; "	3570 "

D c u g f " q p " y j g " t q e m l o c u u " e r c u u k h l e c v k p " c p f " y j g " u t g p i y j " r t q r g t v k u " c u u w o k p i " c p " o k " ? " 34 " h q t " c " e t { u c m k p g " r k o g u v q p g . " c " f k u w t d c p e g " h c e v t " q h " 20 . " c p f " c " h c e v t " q h " u c h g v " q h " 50 . " c p " c m q y c d r g " d g c t k p i " e c r c e k v " q h " y j g " t q e m j c u " d g g p " e c r e w e v g f " v q " t c p i g " h t q o " 70 " O R c " v q " 350 " O R c 0 " V j g " o g c p " c m q y c d r g " d g c t k p i " e c r c e k v " k u " f g v g t o k p g f " v q " d g " ; 0 " O R c " w u k p i " y j g " J q g m " c p f " D t q y p " u t g p i y j " e t k g t k p " h q t " f g v g t o k p k p i " y j g " d g c t k p i " e c r c e k v " q h " c " h c e w t g f " t q e m l o c u u " * Y { m k g . " 3 ; ; ; . " t g h 0 T / 66 - 0 "

4.5 Groundwater Conditions

U j c m q y " c p f " f g g r " u c p f r k r g " * U R l g l + " c p f " x l d t c v k p i " y k t g " r k l q o g v g t u " * X Y R + " y g t g " k p u c m g f " k p " u g r g e v g f " d q t g j q r g u " v q " o g c u w t g " y j g " y c v g t " r g x g n " y k j k p " q x g t d w f g p " c p f " d g f t q e m " * V c d r g " 5 / 4 - 0 " V j g " t g r q t v g f " y c v g t " r g x g n " c t g " r t g u g p v g f " k p " V c d r g " 6 / 8 . " d g m y 0 "

V j g " t g e q t f g f " r q t g " y c v g t " j g c f u " l p " u j c m q y " r k l q o g v g t u " * k r " g r g x c v k p u " d g y g g p " 3920 " c p f " 3970 + " o k f / f g r y j " r k l q o g v g t u " * k r " g r g x c v k p u " d g y g g p " 3860 " c p f " 38 : 06 + " c p f " f g g r " r k l q o g v g t u " * k r " g r g x c v k p u " d g y g g p " 3720 " c p f " 3790 + " t c p i g f " h t q o " 3980 " v q " 39 : 0 . " 3990 " v q " 3 : 60 " c p f " 3990 " v q " 3 : 30 . " t g u r g e v k x g n " 0 " " V j g " t g c f k p i u " c v " f h h g t g p v " f g r y j u " c v " D q t g j q r g u " D J " D4 / 23 . " D J " 25 / T Y " c p f " D J " 26 / T Y " k p f k e c v g " r t q i t g u u k x g n " k p e t g c u k p i " r q t g " y c v g t " j g c f u " y k j " f g r y j 0 " " V j g u g " t g c f k p i u " k p f k e c v g " r k l q o g t l e " j g c f u " p g c t " y j g " i t q w p f " u w t h c e g " v q " c t v g u k p " e q p f k k p u " v q " c u " o w e j " c u " 40 " o " c d q x g " y j g " i t q w p f " u w t h c e g 0 "

V j g " o k f / f g r y j " X Y R u " c v " D J " D4 / 3 " c p f " D J " 25 / T Y " d q v j " g z r g t l e p e g f " c " p q v k e g c d r g " k p e t g c u g " k p " r t g u u w t g u " v q " c t v g u k p " r g x g n " d g y g g p " y j g " f c v g u " q h " F g e g o d g t " 44 . " 4233 " c p f " F g e g o d g t " 4 : . " 4233 . " h q m y g f " d { " c " i t c f w e n " f g e n k p g " v q " p g c t " s p q t o c n " r g x g n 0 " K k u " p q v g f " y j c v u q o g " e q p u t w e v k p " c e v k x v " y c u " q e e w t k p i " k p " y j g " x l e k p k v " c v " y j k u " k o g 0 " " "

F w t k p i " f t k n k p i " c v " D q t g j q r g " D J " 26 / T Y . " c t v g u k p " i t q w p f y c v g t " y c u " g p e q w p v g t g f " w r q p " e q p w e v " y k j " d g f t q e m " k " y c u " c e e q o r c p l g f " d { " c " u t q p i " q f q w t " c u u q e l c v g f " y k j " j { f t q i g p " u w r j k f g " * U g e v k p " 608 - 0 " F w t k p i " f t k n k p i " c v " D q t g j q r g " D J " 25 / T Y . " u r k i j v n " c t v g u k p " i t q w p f y c v g t " h q y " q e e w t g f " y j g p " y j g " f t k n k p i " r g p g t c v g f " c r r t q z k o c v g n " 4 " o " k p v q " d g f t q e n 0 " P q " q f q w t " y c u " p q v g f " c v " y j k u " m e c v k p 0 " " V j g " q v j g t " d q t g j q r g u " c p f " k p u t w o g p v c v k p " k p u c n e v k p u " k p " y j g " k o o g f k e v g " x l e k p k v " q h " D t k f i g " D / 4 " f k f " p q v " g p e q w p v g t " c t v g u k p " e q p f k k p u 0 "

R g t e j g f " i t q w p f y c v g t " k u " n p q y p " v q " c e e w o w e v g " u g c u q p c m f " y k j k p " y j g " w r r g t " f g r q u k u " q h " h k m " v q r u q k i " c p f " i t c p w r t " n { g t u . " c p f " y k j k p " y j g " h k u w t g u " k p " y j g " u k m " e r c { " e t w u 0 " " k p " c f x g t u g " e q p f k k p u . " y j g " r g t e j g f " i t q w p f y c v g t " r g x g n " e c p " t k u g " v q " p g c t " y j g " i t q w p f " u w t h c e g 0 "

Table 4-6: Summary of Measured Water Levels

Borehole	Surface Elevation	Piezometer Type	Screen / Sensor Elevation	Strata Type at Screen / Sensor Depth	Measured Water level	
					Date	Elevation
DJ "D4/3"	39: 08"	XY R"	3970"	Ukn{"Ern{" "	Lwn{" ".4233" Lwn{"44."4233" Cwi 045."4233" Ugr v042."4233" ³ "vq"F ge0' 53."4233"	3980" 3980" 3980" 3980 "vq" 39: 08"
		XY R"	38: 02"	Ukn{"Ern{" "	Lwn{" ".4233" Lwn{"44."4233" Cwi 045."4233" Ugr v042."4233" ³ "vq"F ge0' 53."4233"	39: 0 " 39: 0 " 39: 0 " 39: 0 "vq" 3: 20"
		XY R"	3790"	Nlo guvpg"	Lwn{" ".4233" Lwn{"44."4233" Cwi 045."4233" Ugr v042."4233" ³ "vq"F ge0' 53."4233"	3: 20" 39: 0 " 39: 0 " 39: 0 "vq" 3: 36"
DJ "25/TY "	39: Q "	XY R"	3970 "	Ukn{"Ern{" "	O c{"46."4233" Lwp g'6."4233" Lwp g'47."4233" Lwn{" ".4233" Lwn{"44."4233" Ugr v043."4233" ³ "vq"F ge0' 53."4233"	3990" 3990" 3990" 3990" 3980 " 3980 "vq" 3990"
		XY R"	38: 06"	Ukn{"Ern{" "	O c{"46."4233" Lwp g'6."4233" Lwp g'47."4233" Lwn{" ".4233" Lwn{"44."4233" Ugr v043."4233" ³ "vq"F ge0' 53."4233"	3: 20" 39: 08" 39: 08" 39: 04" 39: 08" 39: 0 "vq" 3: 60 "
DJ "26/TY "	39: 05"	XY R"	3920"	Ukn{"Ern{" "	Lwn{" ".Lwn{" ".4233" Lwn{"44."4233" Cwi 045."4233" Ugr v042."4233" ³ "vq"P qx0' 4."4233" ⁴ "	3980 " 3980" 3980 " 3980 "vq" 3990"
		XY R"	3890 "	Ukn{"Ern{" "	Lwn{" ".Lwn{" ".4233" Lwn{"44."4233" Cwi 045."4233" Ugr v042."4233" ³ "vq"P qx0' 4."4233" ⁴ "	39: 08" 39: 06" 39: 06" 39: 08 "vq" 39: 08"
		XY R"	3780"	Nlo guvpg"	Lwn{" ".4233" Lwn{"44."4233" Cwi 045."4233" Ugr v042."4233" ³ "vq"F ge0' 53."4233"	3: 20" 39: 0 " 39: 0 " 39: 0 "vq" 3: 20 "
DJ "382"	39: 07"	U'Rlgj "	3760"	Nlo guvpg"	Lwn{"38."422: " P qx033."422: " Lcp04: ".422: " Lwn{"44."4233"	39: 05" 3990" 39: 0 " 39: 08"
DJ "382C"	39: 07"	XY R"	3860"	Ukn{"Ern{" "	Ugr v03: ".4233" Lcp04: ".4233"	39: 08" 39: 08"
DJ "565"	39: 08"	XY R"	3720"	Nlo guvpg"	Lcp08."4232" Hgd046."4232"	3: 208" 3: 208"

Ngj gpf <""
" U'Rlgj 0Ucpf r k g'Rlgj qo gvgt"
" XY R"Xldtcvpi "Y k g'Rlgj qo gvgt"

P qvgu<"

3+ F cvnpi i gtu'lpucngf "qp"fcvg"uj qy p0"I tqwpf"y cvgt"grxcvqpu"uj qy p"lp"vj g'eqmo p"vq"vj g'tli j v'ctg"vj g'o lpko wo "cpf"o czko wo "
y cvgt'gvgu'tgeqtf gf "T cki "T vtlpi "vj ku'lpvgtxcid'

4+ F cvnpi i gtu'f co ci gf "d{"eqputvewqp'cevxkld' "qp"fcvg"uj qy p0'
"

"

Project: Y kpf uqt/Gugz'Retny c{"
Document: I gqvgj plecn'lxgunki cvkqp'cpf "F guki p"Trg qtv'
Dtk'i g'D/4"Uc032- 842022: Y "vq"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu'P q062L8/67+ "

Date: O ctej 4235"
Rev: 2"
Page No.: 38"

4.6 Subsurface Gases

Vj g'i tqwpf y cvgt "lp"vj g'r tqlgv'ctgc. "gur gekm" y kj lp"vj g'my gt"i tcpwrt "f gr quk"cpf "dgt tqem"ku"npqy p" vq"eqpvc"p" f kuqrxgf "j { f tqi gp"uwr j kf g"J 4U+cpf "o gjv cpg" EJ 6+i cugu"vj cv'ctg"rdgtcvgt "htqo "vj g'y cvgt" qp"gzr quwtg"vq" cvo qur j gtle"r tguwtg0

Vj g"J 4U"i cu"ecp"htgs wgpv"dg" f gvgevgf "d { "qf qwt"cv'err tqzko cvg"eqpegpvcvkpu"qh"20/"o i IN"cpf "ecp"dg" eqttqukxg"cv'eqpegpvcvkpu"qh"cdqw"4"o i IN"vq"5"o i IN"lp"vj g'i tqwpf y cvgt0"Vj g'r tgupeg"qh"vj g'i cu'y cu" pqvgf "f wtkpi "vj g'ewttgpv'f tlnkpi "cv'vj g'Dtkf i g'D/4"ukg0"Cu'f guetkdgf "lp"Ugevkp"60".ctvgukp"i tqwpf y cvgt" y cu" gpeqwpvgtf " wr qp" eqpvcv" y kj " yj g" dgt tqem" qp" Lxpg" 42." 4233." cpf " j { f tqi gp" uwr j kf g" y cu" gpeqwpvgtf "f wtkpi "f tlnkpi "qh"Dgtgj qrg"DJ "26/TY 0"Vj g'tgrcug"qh"j { f tqi gp"uwr j kf g"i cu"lpenxf gf "c" utqpi "gpqwi j "qf qwt"vj cv'vj g'f tlnkpi"etgy "cpf "vgej plekpu"r tqo r v"uj wv qy p"cpf "cdcpf qpvgf "vj g"ukg0"Vj g" f tlnkpi"tgwtpgf "uqo g" f c { u"rcvgt"vq" f geqo o kuukp"vj g"lpkkn"dqtkpi "wukpi "tgr kcvgt { "r tqvgvkp"cpf " o qpkktpi "gs vkr o gpv" j qy gxgt" i cu" eqpegpvcvkpu"ctg"pqv"cxckrdng0" F wtkpi "f tlnkpi "cv" DJ "D5/5" *dqgtgj qrg"cv'Dtkf i g'D/5"y j lej "ku'emug"vq"Dtkf i g'D/4+.unli j v"ctvgukp"i tqwpf y cvgt"mry "ceeqr cplkf "d { " cp"qf qwt"cuqekcvgt"y kj "j { f tqi gp"uwr j kf g" f gxgrgf "cr r tqzko cvgn"qpj"qwt"chgt"eqpvcv"y kj "dgt tqem" qp"Lxpg"44."42330"P q'o gcwvgt "eqpegpvcvkpu"qh"i cu'ctg"cxckrdng"htq"vj ku"qewtgpge0"

Rwo r kpi "vgu"y gtg"eqpf wvgt "cv'vj tgg"mcevkpu"cetqu"vj g'r tqr qugf "r ctny c { "vq" f gvgt o kpg"eqpegpvcvkp" r xgn"qh"j { f tqi gp"uwr j kf g"i cu"lp"vj g'i tqwpf y cvgt"qh"vj g'ctgc0"C"uwo o ct { "qh"vj g'tguvnu"qh"vj gug"vgu"ku" r tqxkf gf "lp"Vcdng"6/90"O qtg" f gvcku"cdqw"vj g'r wo r kpi "vgu"tguvnu"cpf "lpvgr tgvvkpu"ctg"r tqxkf gf "lp"vj g" oJ { f tqi gqmi kcnCuuguo gpv"qh"J 4UO ki tvkppö'tgr qtv" F qewo gpv" P q04: 75: 2/: 5/33; /2227+0

Table 4-7: Pumping Tests Data

Test Number	Approximate Location	H ₂ S Gas Concentration (mg/L)
VQY /3"	Gcu'qh"Vwppgn"V/32C"	>20"
VQY /4"	Pqt"vj "qh"Vwppgn"V/9"	420"
VQY /5"	Uqwj "qh"Vwppgn"V/6"	90"

Vj g'wpf gtucpf kpi "qh"vj g'gpi kpggtkpi "dgj cxkqwt"tgrvgt "vq"vj g"lo r cev"qp" f guki p"cpf "eqpustwvkp+"qh"vj g" i cuu { "uqku"ku"tcvj gt "rko ksf 0"K"vj g'ecug"qh"mry "r gto gcdkx" "eqj gukxg"uqku"ku"npqy p"vj cv'vj gug"uqku" o c { "gzr gtlpegt"ter kf "f tqr "lp"wpf tckpgf "uj gct"utgpi vj "f wtkpi "wpmcf kpi 0" F wg"vq"vj g'tgrvkn { "j ki j " eqo r tguukdkx { "qh"vj g'r qtg"y cvgt" hnkf "lp"i cuu { "uqku"vj g"lo o gf kcvgt"r qtg"y cvgt"r tguvgt"tgr qpug"ΔW+"vq" vqcn"utguu"ej cpi gu"ecp"dg"xgt { "mry 0"Vj ku"r j gpqo gpc"ngcf u"vq"tgf wvkp"lp"ghgevkxg"utguu"cpf "j gpeg" uj gct"utgpi vj "tgh0T/47"cpf "T/63+0" K"ku"vj g'tghgtg. "tgeqo o gpf gf "vj cv'vj g' f guki p"cpf "eqpustwvkp" o gjv qf qmri kgu"uj qwf "dg" f gxgrgf "lp"eqpukf gtcvkp"qh"vj g'r qvgpvcn'r tgupeg"qh"vj gug"i cugu"tgh0T/36+0

"

5 Development of Geotechnical Designs

5.1 Bridge Configuration

Dtkf i g"D/4" *O cvej gwg" Tqcf "qxgtr cuu+ y kn' dg" eqpwtwvxf "cmipi "J ki j y c{ "623" qxgt "O cvej gwg" Tqcf " dgw ggp "Uc032- 84202: Y "cpf "Uc032- 87: 0644Y ."cpf "y kn'cee qo o qf cvg" yj g" tchke" qh" J ki j y c{ "623" *F tcy lpi "4: 75: 2/25/282/Y R5/2423+0" Vj g'r tqr qugf "Dtkf i g"D/4" kn'57" o "hpi "cpf "640/97" o "y kf g0

Cu'uj qy p"qp" F tcy lpi "4: 75: 2/25/282/Y R5/2423. "Dtkf i g"D/4" kn'c" ukpi ng" ur cp" f gem/qp/i kf gt "utwewt g" kpeqtr qtcvpi "ugo k'kpxgi tcn' cdwo gpw" qp" r kgu0 "Emug" hcnug" cdwo gpw" wulpi "TUU" *Tgkphqtegf "Uqki" Uf ugo +y cmu'ctg" cmu' kpenxf gf 0" Dtkf i g" f gem/grxcvqpu" y gt g" guko cvgf "wulpi "yj g" grxcvqpu" qh" Y qtnkpi " Rqkpw" *Y R+ % "4. "5" cpf "6. "cpf "ecrwcvgf "hqt" yj g" ugrgevgf "f guki p" ugevkqp" r qecvqpu" wulpi "yj g" i tcf gu" uj qy p" qp" F tcy lpi "4: 75: 2/25/282/Y R5/2423" f cvgf "Lcpwt { "46. "42350" Vj g" ugo k'kpxgi tcn' cdwo gpw" eqpukv' qh" 30" o "y kf g" y kj "c" xctkdrj" j gli j v'r krg" ecr "hqwpgf gf "qp" f ggr "gpf /dgctkpi "J R'532 332" uvggn" J / r kgu0" Eqpetgvg" y lpi "y cmu'ctg" kpf kcvgf "cv'gcej "eqtpgt" qh" yj g" cdwo gpv' r ctcngn" vq" J ki j y c{ "6230

Vj g" i gqvgj plecn' f guki p" kpeqtr qtcvpi "cp" TUU" y cm'cu' hcnug" cdwo gpv' y cmu' y kj "rki j v'y gli j v'hkn" *NY H+ cpf " ggr cpf gf " r qn' uq' tpgg" *GRU+ " j cu' dggp" f gxgnr gf "cu" knwutcvgf "kp" Hki wtg" J 00" Vj g" TUU" hcnug" cdwo gpw" y kn' dg" hqwpgf gf "qp" tglphqtegf "i tcpwt" o cv' *TI O +. "y j kej "kp" wtp. "y kn' dg" kpxcngf "qxgt" wpg knwt dgf "pcvkg" ukn' "erc { "uwdi tcf g0" Vcdrg" 7/3" r tqxkf gu" c" uwo o ct { "qh' eqpwtqn' grxcvqpu" cv' yj g" dtkf i g" cdwo gpw" wugf "hqt" yj g" i gqvgj plecn' f guki p" f gxgnr o gpv0

Table 5-1: Summary of Interpreted Elevations at Abutments

Location	Station	Finished Ground Surface Elevation	Top of Deck Elevation	RSS Wall Top Elevation	RSS Wall Bottom Elevation*
Y R%0/"Y guv' Cdwo gpv'	32- 84202: Y "	39; 0"	3: 90'; 4"	3: 30 "	39: 0"
Y R%4/"Y guv' Cdwo gpv'	32- 8450/76Y "	39; 0"	3: 90824"	3: 30 "	39: 0"
Y R%5/"Gcu' Cdwo gpv'	32- 877069Y "	39; 0"	3: 90'; : "	3: 30 "	39: 0"
Y R%6/"Gcu' Cdwo gpv'	32- 87: 0644Y "	39; 0"	3: 90'; 2"	3: 30 "	39: 0"

" *, +kpf kcvg" grxcvqpu" r tqr qugf "cv'cr r tqzko cvgn { "3" o "dgnq" yj g" hpluj gf "i tcf gu0
" P qvg<" Vqr "qh' f gem/grxcvqpu" y gt g" kpxtr tvgf "ltqo " F tcy lpi "4: 75: 2/25/282/Y R5/24230

5.2 Geotechnical Design Criteria and Considerations

Vj g" i gqvgj plecn' f guki p" j cu' dggp" eqo r ngvgf "kp" eqo r rkcpeg" y kj " yj g" tgs vktgo gpw" qh" yj g" gzwewkqp" xgtukqp" qh" yj g" Rtqlgev' Ci tggo gpv' Uej gf wrg" 37/4" Rctv' 4. "Ct veng" 7" *RC+ "hqt" yj g" Y kpf uqt/ Guugz "Rctny c { " Rtqlgev0" Vj g" hqwpgf cvkqp" f guki p" y cu' cu' r gt "yj g" r tlpkr ngu" qh" Nko k' Ucvgu" F guki p" *NU" O gvj qf +dcugf "qp" Nqcf "cpf "T gukwcpeg" Hcvqtu" *EHGO. "tgh0T/: "cpf "EJ DFE. "tgh0T/: +0

Y qtnkpi "Utguu" F guki p" *Y U" O gvj qf +y cu' go r nq { gf "hqt" i mdcn' ucdkkr { "qh" yj g" gct yj y qtnu. "yj g" uqki' o cuu" eqpvclpki "gct yj "tgvcplpki "utwewt gu" cpf "yj g" gzwtpcn' ucdkkr { "dgctkpi. "unf lpi. "cpf "qxgtwtpkpi +qh" yj g" TUU" utwewt gu0" Vj g" ucdkkr { "qh" yj g" uqki' o cuu" eqpvclpki "yj g" cdwo gpw" cpf "y lpi /y cmu' y cu' ej gengf "hqt" cmr qvgpvcn' utwecgu" qh' unf lpi 0

- T go qxcn'qh'gzeguu'dcenthkn'wugf "cu" c "uwej cti g" qxgt "y kenif tclp" ctgcu" cpf "tqcf "uj qwf gtu" vj "g" f guki p" grgxcvkqp "qh'wpf gtukf g" qh' TI O "vq' hcekikcvg" vj g' kpuvcnvkqp "qh'r kgu="
- Kpuvcnvkqp "qh" c "307" o " vj ken' TI O " hqwpf cvkqp " cv" vj g" cdwo gpw " xqkf " hqto u" o c { " dg" wugf " vq" ceeqo o qf cvg' r krg' kpuvcnvkqp " cv' rvg' t' uci g' vj tqwi j " TI O =
- Kpuvcnvkqp "qh'r kgu" *J R532 332 + hqt " dtkf i g' uwr r qt v =
- Kpuvcnvkqp "qh" 722" o o " f kco gvg " EUR " ctqwpf " vj g" cdwo gpv' r krg' ukenwv " hknf " wr " y kj " eqpet gvg " *vj g' EUR " eqpet gkpi " cuuwo gf " vq' vcnr " r nceg " chgt " eqo r rgvkqp " qh' TUU =
- Eqputwkvkqp "qh' vj g" hcnr " cdwo gpw " eqo r tkukpi " TUU " utwewt gu " kpenw kpi " cuuqekcvgf " r gto cpgrp " uwd / f tclpci g' y qtnu. " cpf " cr r tqxgf " dcenthkn' dgi kpf " vj g' TUU " utwewt g =
- Eqputwkvkqp "qh' cdwo gpv' uwd u" cpf " dtkf i g' f gen =
- Eqo r rgvkqp "qh' hkn' uci g' qh' cr r tqxgf " dcenthkn' dgi kpf " vj g' ugo k / kpgi tcn' cdwo gpw =
- Eqo r rgvkqp "qh' vj g" tqcf " o cvgtkcn' hqt " vj g' O cvej gwg " Tqcf = cpf "
- Eqo r rgvkqp "qh' vj g" J ki j y c { " 6230 "

5.3 Design Soil Properties

Vj g' vguv' j qrgu' hqecvgf " cv' vj g' Dtkf i g' D / 4 " uksg " cpf " kpenw gf " kp " vj g' ewtt gpv' cuuguuo gpv' kpenw gf " 33 " dqt gj qrgu. " 7 " ERVu. " 6 " P kraqp " xcp g' r tqh kgu " cpf " 3 " F O V " r tqdg " r kugf " kp " Vcdng " 5 / 3 + 0 "

Vj g' f guki p " uqkn' r tqr gt vku " hqt " vj g' ukw " enc { " vq " enc { g { " ukw " f gr quki " y gtg " kpgtr tgygf " hqo " vj g' ERV " cpf " P kraqp " xcp g' " vguv' r tqh kgu " cpf " vj g' rcdqtcvt { " vguv' tguwu " " Vj g' wpf tclpgf " uj gct " utgpi vj " * U_w " cpf " r tgequqrkf cvkqp " r tguw t g " * σ_r + " kphgtt gf " hqo " vj g' ERV. " F O V " cpf " P kraqp " vguu " cf xcp egf " cv' cpf " ctqwpf " Dtkf i g' D / 4 " cpf " vj g' f guki p " xcnwgu " qdvckpgf " hqo " vj g' ugr " r tqh kgu " ctg " uj qy p " kp " Hki wt g " 70 " cpf " uwo o ctk gf " j gt gchgt " kp " Vcdng " 7 / 40 " "

Table 5-2: Summary of Interpreted Design Clay Strength and Consolidation History

Clay Substratum	Elevation Range	Undrained Shear Strength (S _u), kPa	Effective Strength Parameters	Preconsolidation Pressure (σ _p '), kPa	OCR
Enc { " Etwuv "	39; * " vq " 399 "	97 " * , " "	e " ? " 2. " " ? " 52 Å "	622 "	602 "
Enc { " Vtcupukqp "	399 " vq " 397 "	97 " vq " 57 "		622 " vq " 422 "	502 "
Wr r gt " Uk w " Enc { " / " 3 "	397 " vq " 389 "	57 " vq " 45 "		422 " vq " 347 "	3072 "
Wr r gt " Uk w " Enc { " / " 4 "	389 " vq " 385 "	45 " vq " 52 "		347 " vq " 387 "	3077 "
Nqy gt " Enc { g { " Uk w "	385 " vq " 379 "	52 " vq " 97 "		387 " vq " 622 "	4022 "

" * , + " Grgxcvkqp " xct lgu "

" e " ? " Eqj gukqp " kpgtegr v "

" Å ? " Ghgevkxg " Cpi rg' qh' kpgtpcn' Hilevkqp " * + Å "

" * , + " Nqy gt " dqwpf " qh' uj gct " utgpi vj " wugf " hqt " i nqden' ucdkrk " "

" QET " ? " Qxgt " Eqpuqrkf cvkqp " Tcvkq "

Cp " guko cvgf " wpf tclpgf " uj gct " utgpi vj " i clp " * U_w + " cdq xg " vj g' kp / ukw " wpf tclpgf " uj gct " utgpi vj " y cu' wugf " hqt " i nqden' ucdkrk " " cpcn' ugu " kp " eqpukf gt cvkqp " qh' vj g' eqpuqrkf cvkqp " f vg " vq " vj g' go dcpno gpv' hkn' hqcf kpi " y kj " vj g' ugr gvgf " RXF " eqphki wt cvkqp u " F guki p " xcnwgu " chgt " vj g' utgpi vj " i clp " ctg " cnu " uj qy p " kp " Hki wt g " 700 " " Vj g "

Project: Y kpf uqt / Guuz " Retny c { " **Date:** O ctej 4235 "

Document: I gqvgj plecn' kpxguki cvkqp " cpf " F guki p " Tgr qt v " **Rev:** 2 "

Doc No.: 4: 75: 2 / 26 / 33; / 233: " I gqetgu " P q06218 / 67 + " **Page No.:** 42 "

utgpi yj 'i clp'lp'vj g'ukm' 'em' { 'utcwwo 'y kn'dg'xgt'kkgf 'd' { 'cr r tqr tlcg' hgrf 'vgu'kpi 'cu'lpf kcv'gf 'lp'vj g'ōJ ki j " Go dcpno gpwō'tgr qtvō'

Vj g'f guki p'xcn'gu'qh'vj g'eqgh'hekgp'qh'j qtk qpvcn'r gto gcdk'k' { "m+ 'vj g'j { f tcv'le'eqpf wex'k'k' { "cpk'q'v'qr { " tcv'k' "C"? "m'lm+ 'cpf 'vj g'lp'ukw'xqkf 't'cv'ku't'gs w'k'gf 'hqt 'vj g'cpcn' { uku'qh'ut'guw/f ghqto cvk'qp't'gur qpug'qh'vj g' uq'ku'ctg'r tqx'kf gf 'lp'Vcdng'7/50" Vj g'r gto gcdk'k' { "xcn'gu'wugf 'lp'vj g'o qf g'kpi 'ctg'urki j v' { "4"v'q'7"v'ko gu+ " j ki j gt 'vj cp'vj g'xcn'gu'lp'vgr t'gv'gf 'htqo 'vj g'hgrf 'vgu't'guw'm' "Hki w'g'60/-0'

Table 5-3: Design Hydraulic Conductivity Parameters and Initial Void Ratio

Clay Substratum	Horizontal Permeability, cm/sec	Anisotropy ratio, k_h/k_v	Initial Void Ratio, e_0
Em { 'Etuv'	80 " 32 ⁻⁹ "	3"	2076"
Em { 'Vtc'puk'k'p'	50 " 32 ⁻⁹ "		2087"
W'r gt 'Ukn' { 'Em' { "/3"	308 " 32 ⁻⁹ "	4"	209: "
W'r gt 'Ukn' { 'Em' { "/4"	308 " 32 ⁻⁹ "		2087"
Nqy gt 'Em' { g' { 'Ukn'	308 " 32 ⁻⁹ "		2076"
Nqy gt 'I t'cpw'ct'	304 " 32 ⁻⁷ "	3"	2063"

"

Hqt 'f guki p'r wtr qugu'vj g'hpi /v'gto 'i tqw'pf y cvgt 'h'x'gn'lp'vj g'q'x'gtdw'f gp'y cu'eqpuk'f gt'gf 'cv'g'g'x'cv'k'p'39; 0'

5.4 Pile Foundations

5.4.1 Resistance to Axial Loads

K'ku'wpf gtuv'q'f 'vj cv'J R532z332'uv'gn'J /r k'gu'y kn'dg'wugf 'cv'vj ku'r tql'gev'0" Vj g'r k'g'f'f' t'k'k'p' 'gs w'k' o gpv'cpf " lp'ucm'cv'k'p'r tqegf w'g'uj q'w'f "dg'gu'cd'k'uj gf 'lp'vj g'hgrf 'd' { 'vj g'Eq'p't'cev'qt'y k'j "cr r tq'x'cn'qh'vj g'Gpi lp'ggt'0" C"pwo dgt 'qh'uc'v'k' m'cf "vgu'u'uj q'w'f "dg'ect'k'gf "q'w'cv'ng' { "m'ec'v'k'p'u'cm'pi "vj g'crki po gpv'qh'Y GR"lp' eqplw'p'ev'k'p'y k'j "Rk'g'F' t'k'k'p' "Cpcn' { gt "RF C+ 'vgu'kpi "v'q' h'c'ek'k'cv'g'r tqr gt "ec'k'd't'cv'k'p'qh'vj g'RF C."cpf " f g'v'gto k'p'g'vj g'j co o gt 'r gth'qto c'peg'cpf "cr r tqr tlcg'f' t'k'k'p' "et'k'gt'k'c "vgv'0'

Vj g'r k'gu'ctg'g'zr g'ev'gf "v'dg'f' t'k'g'p'v'q'dgf tqem'cu'r gt "QRUU"; 25"cpf "cee'q't'f'k'p' n' "cp'Wn'ko cv'g'N'ko k'U'cv'gu' *WNU+ "cz'k'cn'i g'q'v'ej p'lec'n't'guk'uc'peg"lp' g'zeguu'qh'6222" nP "ku' r'k'gn' { "v'q'dg" o qd'k'k'ug'f'0" "Cee'q't'f'k'p' n' ."c" h'cev'q't'gf "i g'q'v'ej p'lec'n'WNU't'guk'uc'peg"qh'c'v'g'cu'v'4222" nP "ku'c'p'v'k'c'v'gf'0"

Vj g'Ugt'x'legcd'k'k' { "N'ko k'U'cv'g' *UNU+ "t'guk'uc'peg"qh'vj g'J R532z332"r k'gu."dcugf "qp"vj g'eq'p'x'gp'v'k'p'cn'47" o o "ugw'go gpv."ku'g'uko cv'gf "v'q'g'zeggf "vj g'WNU't'guk'uc'peg" f w'g'v'q"vj g'x'k'w'cm' { "wp' { k'gn' k'p' "pcwt'g'qh'vj g' dgct'k'p' "u'w'h'ceg'0"J g'peg."vj g'UNU't'guk'uc'peg" f'q'gu'p'qv'i q'x'g't'p'vj g'f' guki p'0'

Dcugf "qp"vj g'cx'ck'æ'd'ng'dqt'gj q'rg'f'c'v'c'v'd't'kf i g'm'ec'v'k'p'."vj g'dgf tqem'u'w'h'ceg" g'g'x'cv'k'p'x'ct'k'gu'd'gwy g'gp' 37708"cpf "3780 ."y j gt'g'vj g'v'k' u'qh'r k'gu'ctg'cp'v'k'c'v'gf "v'q'dg'ug'v'0"K'p'ec'ugu'y j gt'g'uo g'qh'vj g'r k'gu'ec'pp'qv' dg'f' t'k'g'p'v'q'dgf tqem'f'w'g'v'q' r t'gug'peg'qh'f'gpug'v'm' n'k'p' "ko o g'f'k'v'gn' { "cd'q'x'g'vj g'dgf tqem'cpf l'qt" c" r g'teg'k'x'gf "t'k'um' q'h'f co ci k'p' "vj g'r k'gu'd' { "q'x'g't'f' t'k'k'p' "ku'cr r ct'gpv."eq'puk'f'gt'cv'k'p'uj q'w'f "dg"i k'x'gp"v'q' u'w'r r'go gp'v'k'p' "vj g'hgrf "vgu'kpi "v'q' r tq'x'g'vj g'cew'cn' o qd'k'k'gf "t'guk'uc'peg'0" K'i m'y gt" o qd'k'k'gf "r k'g' t'guk'uc'pegu' ctg' r tq'x'g'p."qr v'k'p'u' dcugf "qp"vj g'o quv' ge'q'p'qo k'ec'n' cr r tq'cej gu" o c' { "dg" eq'puk'f'gt'gf " *g'q'0"ej c'pi gu'v'q'vj g'f' t'k'k'p' "o g'y q'f "cpf "gs w'k' o gpv."qt'cf f'k'k'p'qh'o q't'g'r k'gu'0'

Vj g"cewcn'o qdrlk gf "tgukcpeg"qh'v'j g'r tqf wevkp"r kgu'uj qwf "dg"eqphkto gf "d{ "f { pco le"vgukpi "wukpi " RF C"o gj qf u'qp"o kpo wo "qh'5' "qh'v'j g'r kgu0"

Vj g'hmqy kpi "i gpgtcn'r krg'kpucm:vkp"tgeqo o gpf cvkpu'uj qwf "dg"eqpukf gtgf <"

- Vj g"uvggriJ /r kgu'uj qwf "dg"kpucmgf "cpf "o qpkqtf gf "kp"ceeqtf cpeg"y kj "QRUU"; 25'tgs wkt go gpw0" Vj g'r kgu'uj qwf "dg"tgphqtegf "y kj "V{r g" Kuj qg" hrcpi gu"cu"uj qy p"lp" QRUF "5222022." qt " cr r tqxgf "cngtpevkxu0"
- Uwtxg{ "qh'cm'v'j g'r krg"j gcf "grgxcvkpu'uj qwf "dg"eqo r rvgf "cv'v'j g"gpf "qh'f tkxkpi "cpf "lwv'r tkqt "vq" hqto kpi "v'j g'r krg"ecr 0" Tg/vcr r kpi "qh'v'j g'r kgu'y kn'dg"pgeguet { "y j gtg"wr rkh'gzeggf kpi "7"o o "ku" pqvgf . "qt"cu'f kgevgf "d{ "gpi kpggt0"
- Eqpukf gt kpi "v'j g"i gpgtcn'i gmqi le"eqpf kkpku"lp"v'j g"tgi kqp"cpf "v'j g"gzr gtkepeg"qh"J 4U'tgrgcug" f wtkpi "kpxguki cvkqp"cv"Dtkf i g"D/4"mcevkqp."kpf kecvkpu"qh'pewtcn'i cu"xgpvki . "y cvgt"cpf "hkgu" y cuj qw'uj qwf "dg"o qpkqtf gf "f wtkpi "f tkxkpi 0"Rtqxkukap"vq"o kki cvg'uwej "qeewtgpegu'uj qwf "dg"lp" r rceg"j gcx{ "o wf "r qwtu"y kj lp"v'j g"i cr u'dgvy ggp"uqkn'cpf "r krg"uj chw"vgo r qtct { "uqkn'o qwpf kpi " ctqwpf "v'j g'r krg."gve00"K'ku'tgeqo o gpf gf "v'j cv'v'j g'r krg"ur rkelpi "dg"cxqkf gf "kh'v'j ku'ku'pqv'r quukdrg." ur rkelpi "d{ "dww/y grf kpi "QRUF "5222072."Ugevkp"C/C+"uj qwf "dg"eqpukf gtgf "vq"o kpo k'g'v'j g" r cvj y c{ "u'ht"wr y ctf "hmqy "qh'ctgukp"y cvgt "cmqpi "v'j g'r kgu"vq"v'j g'uwthceg0"
- Y j krg"pqv'qdugtxgf "cv'v'j g'dqtgj qrgu"cv'v'j ku'uksg."eqpukf gtcvkp"uj qwf "dg"i kxgp"vq"r qvgpvkn'f tkxkpi " f kh'ewknku"fwg"vq"v'j g'r tgugpeg"qh'f gpug"vq"xgt { "f gpug"mqy gt"i tcpwrt "uqkn'qt"r qvgpvkn'r tgugpeg" qh'eqddrgu"cpf "dqwf gtu'cdqxg"v'j g'dgf tqen0"
- Cf gs wevg"j co o gtu'uj qwf "dg"uugf "vq"gpwtg"v'j g'o qdrlk cvkqp"qh'v'j g'f guki p"wnko cvg"i gqvgj plecn' tgukcpeg"cpf "r tgxgpv'f co ci gu"vq"v'j g'r kgu'f wtkpi "f tkxkpi 0"
- Xkdtcvkpu"i gpgtcvgf "d{ "r ktkpi "uj qwf "dg"o qpkqtf gf 0"K'ku'pqv'gzr gevgf "v'j cv'v'j g'xkdtcvkpu"f wtkpi " r ktkpi "y kn'j cxg"o uki pkhecpv"ko r cev"qp"v'j g"uwcdkxk{ "qh'vgo r qtct { "unqr gu0" P qpgvj grguu."kh'v'j g" xkdtcvkqp"kpvgpukku"cv'v'j g"vqg"cpf "vqr"qh'v'j g"unqr gu"gzeggf "32"o o lu."cr r tqr tkcvg"o kki cvkqp" o gcuwt gu"unqr g"hrwepkpi "qt"xkdtcvkqp"f co r gpkpi "d{ "f wo r kpi "ucpf "ctqwpf "v'j g'r kgu+"uj qwf "dg" eqpukf gtgf 0"
- P qkug"o qpkqtkpi "uj qwf "dg"ecttkgf "qwf wtkpi "r krg"f tkxkpi "cv'v'j g'uksg0"

5.4.2 ULS and SLS Resistance to Lateral Loads

Vj g"WNU"cpf "UNU"i gqvgj plecn'tgukcpegu"vq"rvgtcn'rqcf u'uj qwf "dg"f gyto kpgf "qp"v'j g"dcuku"qh'hkgrf "mqcf " vguu0" Dqv "v'j g"WNU"cpf "UNU"rvgtcn'rqcf "tgukcpegu"ctg"utqpi n{ "f gr gpf gpv"qp"v'j g"uqkn'r tqr gtvku." utvewtcn'eqphki wtcvkp"qh'v'j g'r krg"cpf "r krg"hwpf cvkqp."mqcf "eqphki wtcvkp"cpf "f ghqto cvkpu0"

Vj g"UNU"i gqvgj plecn'tgukcpeg"vq"rvgtcn'rqcf u'ku"f gr gpf gpv"qp"v'j g"ceegr wdrng"rgxgnu"qh'v'j g"rvgtcn'r krg" f ghrgcvkpu"wpf gt "v'j g'f guki p"mqcf u'cpf "uj qwf "dg"qdvkpgf "qp"v'j g"dcuku"qh'hkgrf "mqcf "vguu0"K'v'j g"cdugpeg" qh'hkgrf "vguu."v'j g'r tgrko kpct { "f guki p"o c{ "dg"dcugf "qp"o deqpxgpvkpcn"UNU'tgukcpeg"qh'82"nP"cmqpi "v'j g" utqpi "czku."cpf "67"nP"cmqpi "v'j g"y gen'czku"qh'v'j g"J R532z3320" Vj ku"eqpxgpvkpcn"UNU'tgukcpeg" tgr tgugpw"v'j g"rvgtcn'uj gct"hqteg"cr r rkgf "qp"o htgg/j gcf "r krg"v'j cv'ecwugu"o rvgtcn'f ghrgcvkqp"qh'32"o o " o gcuwt gf "cv'v'j g'i tqwpf "uwthceg0"

Vj g"WNUnvgtcn'tgukncpeg'ku'f ghkpgf "cu'v'j g"rvgtcn'hqteg'cr r rkgf "v'j g'r krg'uj ch'ecwulpi "wpucdkrkugf "r krg' f kur nrego gpw'f w'g'v'q' uqkn'hkntg'qt "r krg'utwewtci'hkntg'o' "k'p'v'j g"cdugpeg'qh'hkrgf "v'g'u'u. "v'j g"WNUnvgtcn' t'gukncpeg'o c { "dg'cuwo gf "cu'437'nP. "cpf "332'nP "cmppi "v'j g'utqpi "czku'cpf "y gcm'czku. "t'gur gev'kxgn { 0"

Vj g"cdqxs'gunko cvgu'y gtg'dcugf "qp'c'r krg'o qf gn'cuwo gf "v'q'dg'go dgf f gf "y kj kp'ukh'h'v'q'uqhn'ukm { "erc { " dgm'y "gngxcv'kqp'3980'0" Vj g"cdqxs'g'gukncpegu'y gtg'gunko cvgf "wulpi "v'j g"ör / { ö"o qf gn' "NRkrg'70"o qf gn' Gpuqhn'4232+0' "Vj g"ör / { ö"ewt'xgu'y gtg'i gpgtcv'gf "wulpi "v'j g" "Tggug'o gv'j qf "f guet'kdgf "kp'v'j g"Vgej plecn' o cpwcn'hqt "NRKNG. "wulpi "v'j g" "Tggug'o Ukh'Ernc { "y kj qw'ht gg'y cvgtö"cpf "O cwnqen'sUqhn'Ernc { "o qf gnu'kp' eqplwpev'kqp'y kj "v'j g'hqmy kpi "uqkn'ctco gvtu'f ghkpgf "kp'Vcdrg'7/6'cpf "7/70"

Table 5-4: Soil Parameters for Pile Interaction Assessment

Soils Around the Piles	Elevation	Design Bulk Unit Weight (kN/m ³)	Undrained Shear Strength, S _u (kPa)	72"
Ernc { "Etuvu"	39; "v'q'399"	44"	97"	2029"
Vtcpu'kqp'Ernc { ""	399"v'q'397"	44"	97"v'q'57"	2029"v'q'2032"
W'r gt'Ukm'Ernc { "/'3"	397"v'q'389"	420"	57"v'q'45"	2032"v'q'2042"
W'r gt'Ukm'Ernc { "/'4"	389"v'q'385"	420"	45"v'q'52"	2042"v'q'2032"
Ngy gt'Ernc { g' "Ukm"	385"v'q'379"	420"	52"v'q'97"	2032"v'q'2029"

" 72"? "Uqkn'czkn'utclp'cv'72' "qh'v'j g'o czko wo "f gxlcv'qtke'utguu'f gvgto kpgf "htqo "wpf tclp'gf "tkczkn'eqo r t'gukqp'v'g'u'u'qt' gunko cvgf "htqo "eqttgr'v'kpu'dgvy ggp'Uw'cpf " 720"

Table 5-5: Fill Properties for Pile Interaction Assessment

Material	Soil Model in L-Pile	Design Bulk Unit Weight, kN/m ³	φ°	n _h , MPa/m
TUUhkn'i tcpuwct, +"	Ucpf "Tggug+"	43"	57"	32"

" +Vj g"TUU'w'r r'kgu'uj qw'r "dg'kphqto gf "cpf "eqpuwngf"qp'v'j g'ko r cew'htqo "v'j g'cpv'ekr cvgf "mqcf u'atcpu'gtt'gf "v'q'v'j g"TUU'hkn' cpf 'hckpi "d { "v'j g'f ghgev'kpi "r krgu'

Cu'o gpv'kpgf "gct'rgt. "v'j g"UNU'etk'kgtkqp'y cu'ugv'v'q'32"o o "rvgtcn'f gh'gev'kqp'cv'v'j g"cuwo gf "i tqwpf " uwt'hceg0"Vj g"WNUnvgtcn'k'qt'v'j g"cdqxs'g'o qf g'kpi "y cu'ugv'cv'v'j g"qpugv'qh'v'j g'r ncu'k { k'rgf kpi "kp'v'j g'r krg' ugev'kqp'uwld'gev'gf "v'q'cp'kpf w'egf "d'gpf kpi "o qo gpv'o'

Vj g"cewcn'UNU'cpf "WNUnvgtcn'tgukncpegu'y kn'kpet'cgug'kp'v'j g"ecug'qh'r krgu'y kj "utwewtci't'gunt'ckpu'cv' v'j g'r krg'j gcf "f w'g'v'q'go dgf o gpv'y kj kp'v'j g'r krg'ecr u0"Dq'v'j g"WNU'cpf "UNUnvgtcn'k'qcf u't'gukncpegu'ct'g' cnq'utqpi n' "f gr gpf gpv'qp'v'j g'utwewtci'cpf "mqcf "eqph'ki wt'cv'kqp'cpf "qp'v'j g"ceegr vcdrg'f ghqto cv'kpu0"

K'uj qw'r "dg'pqv'gf "v'j cv'f wtkpi "f tkk'kpi. "uki p'hk'ecpv'uqkn'f kuwtdcpeg'cpf "f co ci g'qeew't'ctqwpf "v'j g'r krg'uj ch'v' hqto kpi "uk'gcdrg'i cr u'dgvy ggp'v'j g'r krg'cpf "v'j g'uwtt'qwpf kpi "uqknu0"Vj g'ug'i cr u'ecwug'uki p'hk'ecpv't'gf w'ev'kqp' qh'v'j g"cewcn'UNU'cpf "WNUnvgtcn'k'g'u'Y j gtg'v'j g'f guki p't'g'k'gu'qp'v'j g'rvgtcn't'gukncpeg'r tqxkf gf "d { "v'j g" uqknu. "ötgr'ekt'uo'v'q'v'j g'f kuwtd'gf "uqknu'o wuv'dg'wpf gt'cvngp' "v'j r k'ecm { "v'j g"xqkf u'ct'g'i tqw'gf "wulpi "ppq/ u'j t'kpm'hknu+0'

Vj g'ugo k'lpvgi tcn'cdwo gpv'r krgu'go dgf f gf "y kj kp'eqpet'gvg'hkrgf "EUR'cpf "eqo r cev'gf "tgkphqtegf "TUU'hkn' o c { "f g'xgmr "rti gt' "t'gukncpegu'v'q'rvgtcn'k'qcf u'f w'g'v'q'v'j g"eqpl'k'pgo gpv'qh'v'j g'r krg'uj ch'v'y kj kp'v'j g"TUU' utwewt'g0'

Vj g'ut guu/f ghqto cvkp'cpcn{uku'qh'yj g'r kgu'v'rcvgtcn'ncf u'o c{ "dg'ectt'lgf "qww'wulpi "qpg'qh'yj g'h'mmy kpi " o gvj qf u0"

Vj g'eqghlekp'qh'j qtk qpvcn'uwdi tcf g'tgcev'kp."m."o c { "dg'dcu'gf "qp"vj g'hqmy kpi "gs wcv'kpuz

f "o +" ? "Rkg" f kco gvgt ly kf vj "

I tqwr "cevkqp" hqt "rcvgtcn" mcf kpi "uj qwr "dg" eqpukf gtgf "y j gp" y j g" r kg" ur celkpi "kp" y j g" f k g evkqp" qh" y j g" mcf kpi " ku" ngu" y j cp" gk j v" r kg" f lco gvtu0" I tqwr "cevkqp" o c { "dg" gxcnwcvgf "d { "tgf wekpi "y j g" eqghlekp v" qh" rcvgtcn" uwdi tcf g" tgcevkqp" kp" y j g" f k g evkqp" qh" mcf kpi "d { "c" tgf wekqp" hcevqt "kp f kcvgf "kp" Vcdrg" 7/80" Uwdi tcf g" tgcevkqp" tgf wekqp" hcevqtu" hqt "qv j gt" r kg" ur celkpi "xcnwg u" o c { "dg" kp vtr qrcvgf "hqt" r kg" ur celkpi "kp" dgwy ggp" y j qug" hkvf "y j ku" vcdrg0

Pile Spacing in Direction of Loading	Subgrade Reaction Reduction Factor
: f "	3"
8f "	20"
6f "	26"
5f "	247"

Project: Y lpf uqt/ Gung' Rctny c ("

Document: I gq'gej plect'kpxgwni c'wqp'cpf 'F guli p'Tgr qtv'
Dtkf: g'D/4"/Uc032- 84202: Y 'uq'32- 87: (644Y +'

Doc No.: 4: 75: 2/26/33; /233: "gaetgu' p'a06218/67+ "

Date: O ctej 14235"
Rev: 2"
Page No.: 46"

Alternative Nonlinear 'p-y' Curve Method:

Cngtpevkxg"r krg" f guki p"o gyj qf u"ecp" dg"eqpukf gt gf "wukpi "vj g"pqpkpget"ör / {ö"kpvtcevkqp"o gyj qf "cpf" grucle"eqpvpwwo "vj ggt { "cu" f kuewugf "kp"vj g"Ecpcf kcp"Hqwpf cvkqp"Gpi kpggtkpi "O cpwcn"tgh0T/: +0"Vj g"r / { "ewtxgu" f guetkdg"vj g"rcvgtcn"uqkn'tgukcpeg"cmqpi "vj g"r krg" f gr yj 0"Hqt" gcej "uqkn'rc { gt"cmqpi ""vj g"r krg"uj chv" vj g"r / { "ewtxgu" f guetkdg"rcvgtcn"uqkn' r tguuwtg"sr "nRc+"r gt" wplv"ngpi yj "o qdkk gf "d { "vj g"r krg"rcvgtcn' f ghgevkqp"š { "o +0"Y j gtg"qpnl "r krg"j gcf "mqcf u"ctg"cr r rkgf "cpf"vj gtg"ctg"pq"rcvgtcn'o qxgo gpw"qh"vj g" uwtqwpf kpi "uqkn'o cuu.š { "ku"vj g"cdugnwg"rcvgtcn'f ghgevkqp0"Y j gtg"rcvgtcn'i tqwpf "o qxgo gpw"qeewt.š { "ku"vj g"tgrvwxg"o qxgo gpv"dgvy ggp"vj g"r krg"cpf "vj g"uqkn0" Vj g"r / { "ewtxgu" tghgeev"vj g"pqp/rkpget"uqkn' dgj cxkqwt"wpf gt"o qf gtcvg"vq"j ki j "utguu"rgxgu"y j gtg"vj g"o qtg"tcf kkpncn"grucle"o qf grkpi "qh"vj g"uqkn' tgr qpug"ku"eqpukf gt gf "vq"dg"kpwhhkekp0"

Vj g"i gpgtcn'r tqegf wtg"ht"eqo r wukpi "r / { "ewtxgu"ku"uwo o ctg gf "kp"vj g"Ecpcf kcp"Hqwpf cvkqp"Gpi kpggtkpi " O cpwcn"tgh0T/: +0"C" f gvckrgf "f guetkr vkp"ht"vj g"i gpgtcvkqp"qh"vj g"sr / { "ewtxgu"ecp"dg"htqwpf "kp"vj g" Vgej plecn"O cpwcn'ht"vj g"eqo o gtekn' uqhy ctg"NRkrg"Rnw" d { "Gpuqhv" kpe" tgh0 T/37+0" Hqt" c" i kxgp" hqwpf cvkqp"eqphk wtcvkqp."r krg"uk g."cpf "uqkn'utcvhkecvkqp."vj g"uqkn'r tqr gt vgu'tgs vkt gf "ht"vj g"i gpgtcvkqp"qh" vj g"sr / { "ewtxgu"ctg"r tqxkf gf "kp"Vcdrg"7/60"öUkh"cpf "Uqhv"En { ö"r / { "ewtxgu."cu"i kxgp"kp"vj g"NRKNG" o cpwcn"uj qwf "dg" f gxgmqr gf "cr r tqr tkvg"ht" gky gt"ucvke"qt"e { enke"mqcf kpi "eqpf kkpqu"kp"cdugpeg"qh"ht gg" y cvgt0"Hqt"sr / { "ewtxgu"dgmy "vj g"y cvgt"vcdrg."ghgevkxg"wpk'y gli j w"kp"vj g"uqkn'o cuu"uj cm'dg"wgf 0"

Vj g"qdvckpgf "sr / { "ewtxgu"o c { "tgs vkt g"vq"dg"uecnrgf "d { "c" hcevt "šöo qf kktö+"vq"ceeqpvl'ht"dcwgt"cpf"ht" i tqwr "ghgeu0"Vj g"o qf kktg" hcevt"cr r rkgu"vq"vj g"sr "xcnwgu0"

Kp"vj g"ecug"qh"dcwgt"qh"3J 7X"r kgt+"vj g"r / { "ewtxg"o qf kktg"y kn'dg"Bm"? "207"cpf "3047"ht"vj g"dcwgt"kp" vj g" f kgevkqp"qh"vj g"rcvgtcn'htcf."cpf"qr r quks" f kgevkqp"qh"vj g"rcvgtcn'htcf."tgr gevkxgn 0"

Kp"vj g"ecug"qh"i tqwr "qh'r krgu."vj g"o qf kktg" hcevtu"ht"vj g"r / { "ewtxgu"ctg"ecrewrcvgf "cu"htmqy u<"

$$F_{mi} = \prod \beta_{ki}$$

" y j gtg"<

β_{ki} "? "vj g"kpwngepeg" hcevt"qh'r krg"šm"kp"vj g"i tqwr "qp"r krg"šk."y kj "mNk"cpf "ku"ecrewrcvgf "y kj "qpg" qh"vj g"htmqy kpi "gzr tguukpu" f gr gpf kpi "qp"vj g"tgrvwxg"r qukskp"qh'r krg"šm"kp"vj g"i tqwr "y kj " tgr gev"vq"r krg"šk "Vcdrg"7/9+0"

Table 5-7: Lateral Load Capacity Reduction Factor for Pile Groups using Nonlinear 'p-y' Curve Method

Relative Pile Position	Pile Spacing Ratio, s/d	β_{ki}
Kp"Ty "r gtr gpf lewrt "vq"vj g"mqcf "f kgevkqp+"	>"507"	2086*ulf + ²⁰⁵⁶ "≥"3"
Ngcf kpi "r krg"kp"Nlpg"htuv'r krg"kp"rkpg'r ctcngr"vq"vj g"mqcf "f kgevkqp+"	≥"6"	2092*ulf + ²⁰⁴⁸ "≥"3"
Vtckkpi "r krgu"kp"rkpg"r krgu'dgj kpf "vj g"ngcf kpi "r krg+"	≥"9"	206: *ulf + ²⁰⁵ "≥"3"

Tgf wevkqp" hcevtu"cu"htmgf "kp"Vcdrg"7/9"y qwf "cr r nq"qp"vj g"r krgu0"

NRKNG' uqhy ctg' cpf "qy gt' uko krt' r tgf wew' r tqxf g' cwqo cve' i gpgtckqp' qh' yj g' r / { "ewxgu' cmppi "y kj "y g' utguu' f ghqto cckqp' ecrewckqp' qh' c' r kg' uwdlgevgf "vq' xctkqu' r vgtcn' mcf u' cr r rkgf "cv' yj g' r kg' ecr " cpf kqt' cmppi "y g' r kg' u' j ch' cpf "xctkqu' dqwpf ct { "eqpf kkkpu' cv' yj g' r kg' j gcf " cpf "Tqt' cmppi "y g' r kg' u' j ch' }

5.4.3 Soil Pile Interaction Assessment

Downdrag Loads (Negative Skin Friction – NSF):"

Rqvgpckn' hqt' f qy pf tci " mcf u' qp' r kgu' y cu' gzcw kpgf " kp' eqplwpeckqp' y kj " yj g' cpckekr cvgf " r quw' r kg' kpuwckqp' i tqwpf " o qxgo gpw' yj cv' ctg' guko cvgf " vq' qeewt' f wtkpi " cpf " hmqy kpi " yj g' eqputwckqp' qh' yj g' dtkf i g' "

Uqkn' utguu' f ghqto cckqp' cpcn' ugu' f guetkdgf " r vgt' kp' " Ugeckqp' 70704' y gtg' eqpf wewgf " wulpi " yj g' UK O C IY " uqhy ctg' 0' Vj g' guko cvgf " i tqwpf " xgtckcn' o qxgo gpv' " ugwgo gpv' j gcxg' + ctg' r tguvgf " kp' Hki wtu' I B. I 04' cpf " I B' kp' Cr r gpf k' I 0' Vj g' guko cvgf " xgtckcn' o qxgo gpw' eqttgur qpf " vq' yj g' hmqy kpi " tgr tguvgf " uci gu' chgt' cr r tqcej " go dcpno gpv' eqputwckqp' y kj " y kmf f tckpu. " chgt' eqo r rkvqp' qh' yj g' dtkf i g' eqputwckqp' " Cpf " qh' Eqputwckqp' / " GQE' + cpf " kp' mqi / vgt' " uvgcf { " uvcg' " NV' + mcf kpi " eqpf kkkpu' " Gzeguu' r qtg' y cvgt' r tguwgt' g' cv' y kmf f tckp. " r qtg' y cvgt' r tguwgt' g' cv' y kmf f tckp. " cpf " xgtckcn' ghgckg' utguu' cmppi " r kg' rkg' ctg' kmwckvgf " kp' Hki wtu' I B3. I B4' cpf " I B5. " tgr gckxgn' 0' Vj g' cpcn' ugu' kpf kcvg' yj g' hmqy kpi <

- I tqwpf " ugwgo gpv' ku' g' zr gevfgf " vq' qeewt' cmppi " yj g' r kg' u' j ch' f wtkpi " eqputwckqp' qh' yj g' TUU' cdwo gpw' dtkf i g' cpf " yj g' cuqckcvgf " dcentkm' "
- I tqwpf " j gcxg' tgp' cmppi " yj g' r kg' u' j ch' ku' g' zr gevfgf " chgt' eqo r rkvqp' qh' yj g' eqputwckqp' = cpf " "
- Ugeqpf ct { " eqpuqkf cckqp' " etggr + ku' pqv' zr gevfgf " hqt' yj g' uqkn' kp' yj g' xckpck { " qh' yj g' r kg' u' j ch' 0' "

Eqpukf gt kpi " yj g' eqputwckqp' uci kpi " cpf " yj g' cpckekr cvgf " ugwgo gpv' qh' yj g' uqkn' f guetkdgf " cdqcg. " c' f qy pf tci " qh' cdqw' 647' nP " ku' guko cvgf " vq' f gxmqr " hqt' yj g' cdwo gpv' r kgu' f wtkpi " eqo r rkvqp' qh' yj g' dcentkm' kpi " ci ckpu' yj g' dtkf i g' cdwo gpv' " C' tgu' wcn' " mqi / vgt' + f qy pf tci " qh' cdqw' 572' nP " ku' tgeqo o gpf gf " vq' dg' eqpukf gt gf " hqt' yj g' mqi / vgt' " eqpf kkkp' 0' "

Kp' ceeqtf cpeg' y kj " yj g' Ecpcf kcp' Hqwpf cckqp' Gpi kpggt kpi " O cpwcn' t gh0T / : + " yj g' ugtckeg' mcf u' u' j qwf " pqv' dg' tgf wewgf " d { " cp { " r qtckqp' qh' yj g' f tci " mcf u' wprgu' tgs vktgf " d { " kpuwckekgpv' utwewcn' utgpi yj " qh' yj g' r kg' 0' " F qy pf tci " mcf " cpf " rkg' mcf " f q' pqv' eqo dkg' cpf " y q' ugr ctcg' mcf kpi " ecugu' u' j qwf " dg' eqpukf gt gf <

- F gcf " mcf " r nu' f qy pf tci " mcf " *dw' pq' tckpckpv' rkg' mcf = cpf " "
- F gcf " mcf " cpf " rkg' mcf " *dw' pq' f qy pf tci " mcf + 0' "

Shaft Bending due to Lateral Soil Displacement: ""

Vj g' cr r tqcej " vq' guko cvgf " yj g' r kg' u' j ch' dgpf kpi " ecwugf " d { " f ghqto kpi " uqkn' o cuu' uttqwpf kpi " yj g' r kgu' y cu' cu' hmqy u' "

- Vj g' i tqwpf " r vgtcn' o qxgo gpv' " Hki wtu' I B7' + cmppi " yj g' r kg' u' j ch' cpckekr cvgf " vq' qeewt' chgt' yj g' kpuwckqp' qh' yj g' r kgu' y cu' guko cvgf " wulpi " yj g' utguu' f ghqto cckqp' cpcn' uku' f guetkdgf " dgrqy " kp' Ugeckqp' 70704' "

- Vj g"r krg"y cu"o qf gmgf "y kj "c"722"o o "f lco gvg"eqmct"ugevkqp"EUR"r krg"y kj "eqpetgvg" ctqwpf "vj g"r krg"uj chv"y kj lp"vj g"UUy cm0"Dmny "vj g"UUy cm"vj g"r krg"ugevkqp"y cu"J R"ugevkqp0" Vj g"cttcepi go gpw"qh'r krg"ecr .r krg"cpf "UUy cm'tctg"uj qy p"qp"Hk wtg"J 00
- Vj g"r krg"j gcf "y cu'cuuwo gf "vq"dg"cttgg"j gcf 0"
- " Vj g"cdqxs"uqk'f ghqto cvkqp"hgkf "y cu"lo r qugf "cu"omqcf uo"cmqpi "vj g"r krg"uj ch0"Vj g"ecrewcvkqp" y cu"eqpf wvgf "wulpi "vj g"or / { o"o qf gn"NRkrg"70"o qf gn"Gpuqlh"4232+0"Vj g"or / { o"ewtxgu"y gtg" i gpqtcvgf "wulpi "vj g"Uggug"o gvj qf "f guetkdgf "lp"vj g"Vgej plectn'o cpwcn'hqt "NRKNG."wulpi "vj g"uqkl' r ctco gvgu'lpf kcvgf "lp"Vcdrgu"7/6"cpf "7/70
- Vj g"gtcj "r tguuwtgu"tqo "dcen'hkml'cpf "uwej cti g"mqcf u'ci ckpu'vj g"r krg"ecr "y gtg"pqv'eqpukf gtgf "lp" vj g"cpn'ugu"cuuwo lpi "vj cv'vj g"r krg"ecr "y kndg'tguv'clp'gf "d { "utkr u'go dgf f gf "lpvq'dcen'hkml'
- Vj g"uj gct "hqtg."dgpflpi "o qo gpv'cpf "f kur mogo gpv'y kj lp"vj g"r krg"y gtg"ecrewcvgf "tqo "NRkrg" o qf gn0

Dcugf "qp"vj g"cdqxs"cr r tqcej "cpf "cpv'ekr cvgf "rvgtcn'i tqwpf "f kur mogo gpv."vj g"guvko cvgf "o czko wo " wphcevtgf "dgpflpi "o qo gpv'lp"vj g"uj chv"y cu"324"nP / o 0"Vj g"xctkcvkqp"qh"vj g"uj gct "hqtg"y kj "f gr vj " r tqxkf g"lpf kcvkqp"qh"vj g"rvgtcn'hqtg"u'cpu'gttgf "d { "vj g"r krg"uj chv"q"vj g"uwtqwpf lpi "uqkl'y kj lp"vj g" TUU0"Vj g"ecrewcvgf "o czko wo "r krg"fhgrevkqp"cv'vj g"dcug"qh"UUy cm'y cu"34"o o 0

Vj gug'tguuwt'uj qwr "dg'eqpukf gtgf "lp"vj g"utwewt'cn'f guki p"qh'vj g"r krgu'cpf "lp"vj g"f guki p"qh"UU'utwewt'cn' eqo r qp'gpw0"Vj gug"dgpflpi "o qo gpv."uj gct "hqtg"cpf "f ghgrevkqp"ctg"lp"cf f kkp"vq"vj qug"ecwugf "d { " wppgn'mqcf u'cr r rkgf "vq"vj g"r krgu0

5.4.4 Pile Cap/Abutment Stem Anchoring

K'ku'wpf gtuvqf "vj cv'cpej qtlpi "qh'vj g"cdwo gpv'ugo "y kj lp"vj g"dcen'hkml'cdqxs"vj g"UUy cm'ku'lpv'p'gf " wulpi "go dgf f gf "uqku'tgkphqtg"o gpv'utkr u'eqppgvgf "vq"vj g"r krg"ecr 0"Vj g"fv'g'krgf "f guki p"qh'vj g"cpej qtlpi " ku'vq"dg'r tqxkf gf "d { "vj g"uwr r rkgf "qh'vj g"t'gkphqtg"o gpv'0"Vj g"hmny lpi "ku'c'dt'gh'q'w'kp"qh'vj g'i gqvgj plectn' cur gew'ur gekh"vq"vj g"qr vkp"qh'cdwo gpv'r t'gugpvgf "lp"vj ku'tgr qt0

Vj g"uqkl'o cvgtcn'hqt"vj g"t'gkphqtg"uqkl' qp'g"ht"r krg"ecr "I"cdwo gpv'ugo "cpej qtlpi "uj qwr "dg"cp" cr r tqxgf "j ki j "s wcrk' "i tcpwrt "hkn'eqo r cvkdg"y kj "vj g"t'gkphqtg"o "o cvgtcn'cpf "o gvgkpi "cuq"vj g"RC" tgs vktgo gpw0"Hqt"vj ku'r ct'kwrt "utwewt"y "c"y gmi' tcf gf "tggf/f tclpki "rki j v'y gli j v'hkn"NY H"o cvgtcn' j cu'dggp'eqpukf gtgf 0"Vj g"f guki p"r tqr gt'ku'cuuqekcvgf "y kj "uwej "o cvgtcn'y kj "ur gekhgf "eqo r cevkqp"vq"dg" eqpukf gtgf "lp"vj g"t'gkphqtg"uqkl' qp'g'ctg<

Wpk'y gli j v< " 34"nP lo ⁵"

H'ekvqp"Cpi ng" +< 57²"

M< " " 2049"

Vj g"rvgtcn'gctj "r tguuwtg."rj . "ci ckpu'vj g"r krg"ecr "o c { "dg"guvko cvgf "wulpi "vj g"gzr tguuqpu"<

rj "? "MM x" " " j " *tgh0T/5; +"

Y j gtg<

- x" xgtvlecn'utguu'cv'yj g'r qlpv'qh'ecrewevqp" kpenf kpi "vj g'ghgevu'qh'yj g'f gcf "mqcf u'cpf" cr r rkecdrg'hxg'mqcf u"
- J" uwr r ngo gpvcn'j qtk qpvcn'r tguuwtgu'ltqo "gzvgtpcn'rvgtcn'hqtegu"*h'r tguvpv."uwej "cu"uj gct" hqteg'cv'yj g'dqwqo "qh'hqqlpi u'tgukpi "qp"qr "qht'gkphqtegf" | qpg+
- M" cevxg'gctvj 'r tguuwtg'eqghlelcpv"
- M" eqttgevpqp" hcevt" xct { kpi " ltqo " 304" vq" 407" f gr gpf kpi " qp" yj g' v r g" qh' tglphqtego gpv" *gzvgpukdrg" rlng" i gqu{ pyj gveu. "qt" kpgzvgpukdrg" rlng" o gvcn' utkr u" qt" o gvcn' dct" o cu" (" y grf gf 'y k g' i t k f u+. "cpf" f gr yj "qh'ecrewevqp"ugevqp"

Vj g'dcenthkm'cdqxs'vj g'tglphqtegf" | qpg'eqwrf "dg"cp{ "cr r tqxgf "GRU"ltqo" Hqt"vj g'r vtr qug"qh'ecrewevqp"qh' yj g'ghgevxg'xgtvlecn'utguu."yj g'hmqy kpi "wpl'y gli j wu"uj qwrf "dg"wgf "hqt"vj g'hkm'cdqxs'vj g'tglphqtegf" | qpg<

Tgi wrct'Dcenthkm< 43"nP lo 5"

GRU< " " 207"nP lo 5"

Vj g'r kg'ecr "f guki p"qh'yj g'cdwo gpv'y kn'xct { "cnpi "yj g'dtkf i g"cpf "cu"uwej . "uki plhkecpv'xctkcvkpu"kp"yj g' o cngwr "qh'yj g'hkn'y kj kp"yj g'tglphqtegf" | qpg'uj qwrf "dg"cpvlekr cvgf O"kp"cf f kkp."eqpukf gtcvqp"uj qwrf "dg" i kxgp"vq"yj g'r quukdkk{ "yj cv'go r qtct { "tgo qxcn'qh'yj g'wr r gt "hkm"o c { "qeevt'cv'vko gu. "f vtlpi "yj g'hkg"ur cp" qh'yj g'hcekrk{ O'

Dcuqf "qp" yj g' cdqxs. "cpf" kp" eqplwpevqp" y kj " yj g' r tqr qugf " cdwo gpv' eqphk wtcvqp. " yj g' hmqy kpi " wphcevtqgf 'rvgtcn'gctvj 'r tguuwtg'hqcf u'y gtg'guko cvgf 'cv'rti guv*cdqws5Q 'o 'j ki j +r kg'ecr "Vcdrg'7/: +<

Table 5-8: Assumed Earth Pressures on Pile Cap Straps

Earth Pressure, kN/m		
ELL	EDS	EB
45"	57"	55"

Ngj gpf <

GNN"nP lo +"

GF U"nP lo +"

GD"nP lo +"

Gctvj 'r tguuwtg'ltqo 'hxg'hqcf u'cuuwo gf "38"nRe'y kj kp'ltqcf y c { "ctgeu+"

Gctvj 'r tguuwtg'ltqo 'F gcf "Utej cti g'hqcf "cdqxs'vj g'r kg'ecr "

Gctvj 'r tguuwtg'f wg'vq'dcenthkmldgj kpf "yj g'r kg'ecr "

Vj g'hqcf 'tgf wevqp"fwg'vq"yj g'cr r tqcej "urdu'r rcegf "qp"qr "qh'r kg'ecr "y cu'ki pqtgf "kp"yj g'cdqxs'guko cvguO'

Nvgtcn'hqcf 'ltqo "yj g'yj gto cn'gzr cpukp huj tlpnei g'uj qwrf "cnq"dg'eqpukf gtgf "cu'pgeguuct { O'

Vj g'lpvgtpcn'f guki p'hqt"yj g'tglphqtekp i "utkr u'uj qwrf "dg'r tqxkf gf "d { "yj g'uw r rgtuO'

5.5 RSS False Abutment Walls

Cu'o gpvkpgf "gctrktg."qr gp"hcng"cdwo gpw"uulpi "TUU"y cm'u{ ugo "y gtg"kpemf gf "cv'yj g"gcuv'cpf "y guv' ukf gu"Vj g'i gpgtcn'eqphki wcvkpu'f gxnqr gf "hqt"y g"v{r lecn'cdwo gpw'cv'Dtkf i g"D/4"ctg'uj qy p"lp'Hki wtg" J (80)"Vj g"TUU"cdwo gpw'ctg"hwpgf gf "qp"ctgkphqtegf "i tcpwrt"o cv."cpf"eqo r tkug"NY H'y kj "GRU"cpf " cr r tqxgf "dcen'hm'qp"vqr "qh'k0

Vj gug'eqphki wcvkpu'cpf "f ko gpukpu'y gtg"f gxnqr gf "cv'tr tgugpvcxg"ugev'kpu'cmppi "y g'dtkf i g"v'xgtkh{ " yj g'i gqvej plectn'f guki p"tgs wkt go gpw'y kj "tgr gev'v"e+yj g"i tqwpf "f ghqto cvkpu"e+yj g"i mdcn'ucdkrk{ " qh'yj g'uqkno cuu'eqpvclopi "y g'utwewt'g'cpf "e+yj g'hwpgf cvkp"uqkndgctkpi "tgukncepogu

Vj g'f guki p"cuuguu gpw'y gtg"dcugf "qp"e+cuuwo gf "utgpi yj "cpf "f ghqto cvkp"r tqr gtvgu'qh'yj g'r tqr tkgvt { " eqo r qp'gpw"e+TUU."TI O ."NY H'cpf "GRU"y j lej "y kmj cxg"v"dg'eqphkto gf "d { "r tqr tkgvt { "uwr r rktu."cpf " e+yj g"cuuwo gf "cr r rktu"gzvtpcn'mcf u'cpf "dcen'hm'r tqr gtvgu"Vj g'hwpgf guki p"qh'yj g"cdwo gp'vo c { " tgs wkt g"cf lwuo gpw'dcugf "qp"y g'r tqr tkgvt { "eqo r qp'gpw"cpf "utwewt'cn'f guki p0"kp"i gpgtcn'yj g"TUU"y cm' ku"v"dg" f guki pgf "cpf "eqpwtwv"gf "kp"ceeqtf cpeg"y kj "O VQ u" TUU" F guki p" I vkf gkpgu"cpf "Ur gekn' Rtqxkukpu"UR7; ; U44"cpf "UR7; ; U450

Vj g'r tqr gtvgu'qh'yj g'r tqr tkgvt { "r tqf wew"cpf "dcen'hm'o cvgtknu'cuuwo gf "kp"y g'i gqvej plectn'cpcn'ugu'ctg" f guetkdgf "kp"Vcdrgu"7/; "cpf "7/320

Table 5-9: Assumed Proprietary Product Properties

Material	Unit weight, kN/m ³	Limit Equilibrium (Slope/W Models)		Stress Deformation (Sigma/W Models)	
		Friction angle, degree	Apparent Cohesion, kPa	Modulus of Elasticity, E, MPa	Poisson's ratio, μ
TUU*yj kj "NY H"	34"	57°	72, "	62"	207"
TI O "	43"	57°	72, "	82"	207"
NY H"	34"	57°	2"	52"	207"
GRU"	207"	2°	32"	32"	202"

*, +Cuuwo gf "xcmgu"v"q"rktkscv"i mdcn'ucdkrk{ "cpcn'ugu."

Table 5-10: Assumed Backfill Material Properties

Backfill Material	Unit weight, kN/m ³	Undrained Shear Strength, kPa	Drained Angle of Internal Friction, degree	Modulus of Elasticity, E, MPa	Poisson's ratio, μ
Eqo rcev'gf "Erc { "Hkm"	43"	72"	52"	4407"	207"
Eqo rcev'gf "I tcpwrt" Hkm"	43"	P IC"	54"	4407"	207"

5.5.1 Global Stability

Unqr g'ucdkrk{ "cpcn'ugu"e+Nko k'Gs wktkdkwo +y gtg"ectt'kf "qw'uulpi "UNQRGIY "Xgtukp"4229."cf qr vki "y g" O qti gpugt'p/Rtleg"o gvj qf "qh'cpcn'uku0

Hki wtgu"HB"cpf "H04"knwutcvg"vj g"ucdtkrkf "o qf gnu"htq"vj g"cdwo gpw0"Vj g"cdwo gpw"cv'gcu'cpf "y guv'ukf gu" ctg" f lo gpukqpcmf "uko krt0" "Vj g"i mden'ucdtkrkf "cpcnf ugu"j cxg" dgpp"ecttkgf "qw"htq" dqj "uj qt v'vgt0 " *wpf tclpgf "uqkl'r tqr gt v'gu"cpf "mpf /vgt0 "f tclpgf "uqkl'r tqr gt v'gu"mpf kpi "eqpf kkp0"Vj g"uj qt v'vgt0 " mpf kpi "eqpf kkp"y cu'dcugf "qp"wpf tclpgf "uj gct"utgpi vj "r ctco gvtu."y j kej "tgrcvu"q" f v'kpi "cpf "gpf "qh" eqput v'v'qp"eqpf kkp0"

Vj g"wpf tclpgf "uj gct"utgpi vj "cv'eqo r ngv'kp"qh"vj g"cr r tqcej y c{ "go dcpno gpv'hkn'y cu'dcugf "qp"vj g"lp/ukw" uj gct"utgpi vj "r nu"vj g"cr r rkecdng"utgpi vj "i clp" f v'g"q"r tgmcf kpi 0"Vj g"lpetgcug"lp"vj g"wpf tclpgf "utgpi vj " * Uw"qh"vj g"wr r gt"cpf "mqy gt"erc{ "f gr quk/hmqy kpi "gzegu'r qtg'r tguwtg" f kuik cvkqp"cpf "eqpuqkf cvkqp"qh" vj g"erc{ "utcv"wpf gt "uweegukxg"go dcpno gpv'hkn'htqf u'y cu'ecrewcvf "dcugf "qp"vj g"pgv'lpetgcug"lp"vj g"r tg/ eqpuqkf cvkqp"r tguwtg" * R.I"i gpgtcvf "d{ "vj g"r tgmcf kpi "wukpi "vj g"tgrcvkupj k" Uw" "Wz20: " "R.I." y j gtg" W" + "ku"vj g" f gi gtg"qh"eqpuqkf cvkqp0" "K"cf f kkp."utgpi vj "i clp"lp"vj g"erc{ "tcpu'kqp"rc{ gt" eqphko gf "d{ "hgrf "v'gu'y cu'ceeqwpvf "htq"lp"vj g"i mden'ucdtkrkf "cpcnf ugu0"

Vj g"r tgupeg"qh"vj g"r kgu"y cu"ki pqtgf "lp"vj g"ucdtkrkf "o qf gnu"uqo gy j cv'eqpugt xcv'xg"cr r tqcej +0"Nkxg" Nqcf u"qh"34"nRc"htq"uj qt v'vgt0 "cpf "mpf /vgt0 "o qf gnu"y gtg"cr r rkgf "cv'vj g"qr "qh"i tqwpf "utwceg."y j krg" v'gukqp"etcm'y cu'cuwo gf "htq"uj qt v'vgt0 "qpn0" "Vj g"ecrewcvf "hcevtu"qh"uchgv{ "HU"o gg'vj g"RC" tgs v'kgo gpw" *Hki wtgu"HB"cpf "H04."cpf "Vcdng"7/33+0

Table 5-11: Summary of the Results for Slope Stability Analyses for Abutment

Calculated Factors of Safety for		Reference Figure
Undrained Loading Condition	Long-term Drained Loading Condition	
305*305+	309*308+	HB"cpf "H04"

" " " P qv<"Xcnwgu"lp"dtcengut'ghgt"v'pqp/ekewrt" *qr v'ko k gf +hcnwgu"utwceg0

5.5.2 Stress Deformation Analyses

Utguu/f ghqto cvkqp" cpcnf ugu" *UF C+" y gtg" ecttkgf "qw" d{ "hpkkg" grgo gpv" o qf gnu"pi "wukpi " UK O C IY " uqhy ctg"Xgtukp"42290"Vj g"o clp" hqewu"qh"vj g"UF C"y cu"v'q"cuuguu"vj g" f ghqto cvkqp"qh"vj g"uqkl'o cuu" uwr r qt v'kpi "cpf "utwtqwpf kpi "vj g"dtkf i g"utwewt0"Cu'uwej ."vj g"utwewt'cn'grgo gpw" f gem"i kf gtu."r krg"ecr u" cpf "r kgu"y gtg"pqv'kpenf gf "lp"vj g"o qf gnu"cn'dgk'v'gk"r tgupeg"y cu'uko wrcvf "y kj "dqwpf ct{ "tgutclp0

Vj g"utcvki tcr j { "cpf "ugrgevkp"qh"vj g"uqkl'r tqr gt v'gu" *gzegr v'htq"vj g" TUU"utwewt" g"cpf "r cxgo gpv'dqz +y cu" dcugf "qp"vj g" f guki p"uqkl'r tqr gt v'gu" f kuewugf "lp"Ugevkp"7050

Vj g"UF C"y gtg"ecttkgf "qw" wukpi "cp"ghgevkxg"utguu"dcugf "o qf gnu"Vj g"mpf /vgt0 "r j tgcve"utwceg"y cu" cuwo gf "v'q"eqttgur qp"v'q"vj g"lpkkn'i tqwpf y cvgt"ngxgn'cv'grgxcvkp"39; 00"Grucv'k/r rcv'k"O qj t/Eqwrqo d" o qf gnu"y gtg" wugf "htq"cm' uqkl'rc{ gtu"gzegr v'htq"vj g"vpy gc'v'gtgf "hko "v'q"ukh'ukm{ "erc{ ."y j kej "y cu" f guetkdgf "d{ "vj g"O qf hkgf "Eco /Erc{ "o qf gnu"J { f tcv'k"eqpf v'v'xk{ "r tqr gt v'gu" f guetkdgf "lp"Vcdng"7/5" y gtg"cuuki pgf "v'q"vj g" f khtgt gpv'uqkl'rc{ gtu0

Vj g"utcvki tcr j { "cpf "ugrgevkp"qh"vj g"uqkl'r tqr gt v'gu" *gzegr v'htq"vj g" TUU"utwewt" g"cpf "r cxgo gpv'dqz +y cu" dcugf "qp"vj g" f guki p"uqkl'r tqr gt v'gu" f kuewugf "lp"Ugevkp"7050"Vj g" TUU"utwewt" g"TI O "cpf "r cxgo gpv" y gtg"cuwo gf "cu" c'j qo qi gpgquw'grucv'k"o cvgtkcn' f guetkdgf "lp"Vcdng"7/; 0

Vj g"eqphki wcvkqp"qh'yj g"ecrewcvkqp"o qf gni'ku'r tguuvgf "kp" Hki wtu' I 08" Vj g"ecrewcvkqp"o qf gni' w' r kcmf "cuwo gf "vj g'hmqy kpi "hcf kpi "uvg u"

- c+ F ghpkkqp"qh'yj g"lpkkn"kp/ukw+ "utguu"eqpf kkp "hqt" r xgn' t qwpf "cuwo kpi "cp" cxgtci g" dwn' wplv" y gli j v'qh'43" nP lo ⁵ "cpf "cp" cvtgu' gctvj "r tguuvg" eqghkcpvM₂ "qh'207" *dcugf "qp" r wdkuj gf "f cvc" *tgh0T/64+ "cpf "eqphkto gf "d{ "F O V" cv'vj g"ukg+ "hqt" vj g"uqkf gr quk" *2" f c{ u="
- d+ Kpucrcvkqp"qh'y lenif tclpu'y kj "eqputwcvkqp"qh'8"o "j ki j "cr r tqcej y c{ "go dcpno gpv" *qpg" uci g" eqputwcvkqp+ "hqt" cpf "cuqekcvgf "eqpuqkf cvkqp" *342" f c{ u' f wcvkqp" o' f c{ "3" v'q" 342="
- e+ Eqputwcvkqp"qh'go dcpno gpv'w "v' hwn'j gli j v'dg{ qpf "c" f kucpeg"qh'42"o "o gcuwgf "cy c{ "htqo "vj g" hwwt" dtkf i g" cdwo gpw" *52" f c{ u' f wcvkqp" o' f c{ "343" v'q" 372="
- f+ Gzecxvkqp"qh' dcenthkn' wugf "cu" c" uwtej cti g" qxgt" y leni f tclp" ctgcu" vq" vj g" uwdi tcf g" r xgn' qh' TUUTI O " *9" f c{ u' f wcvkqp" o' f c{ "373" v'q" 379="
- g+ Eqputwcvkqp"qh'yj g" TI O "cpf "TUU" utwewt g" cpf "cuqekcvgf " dcenthkn' dgj kpf "vj g" y cmi" *37" f c{ u' f wcvkqp" o' f c{ "37: "v'q" 394+ " *f tkkpi "qh'yj g" r kgu" qeewt u" chgt "eqo r r gvkqp" qh'yj g" TI O " dw' y ku" cewkxk' j cu' p' q' t g r x c p e g " vj g " e c r e w c v k q p " o q f g n = "
- h+ Eqo r r gvkqp"qh'yj g' tgo cklpi "hmi'cdqsg" vj g' TUU" utwewt g" *37" f c{ u' f wcvkqp" o' f c{ "395" v'q" 3: 9="
- i + Eqo r r gvkqp"qh'yj g' r cxgo gpv' utwewt g" hqt "O cvej gwg" Tqcf "o" gpf "qh'eqputwcvkqp" *3" f c{ "f wcvkqp" o' f c{ "3: : = "cpf "
- j + Nqpi /vgto "f kuuk cvkqp"qh'gzegu' r qt g' r tguuvg" hcf kpi "v'q" uvgf { "ucvg" eqpf kkp o'

Vj g"utguu/f ghqto cvkqp"o qf gni'wi i guu'f kuuk cvkqp"qh'o clqt "r tqr qt vqp"qh'yj g"gzegu' r qt g' y cvgt "r tguuvg" i gp gcvf "d{ "vj g" uqkf hcf kpi "qh'yj g" r kugf "eqputwcvkqp" uci gu" *hcf kpi "uvg u" f guetkdgf "cdqsg+ "f wg" vq" ghgcvxg" q r g t c v k p " q h ' y l e n i f t c l p u ' f w t k p i " v j g " c u w o g f " v o g r k p g " h q t " e q p u t w c v k p o " C h g t " v j g " e q o r r g v k p " q h " v j g " g p v k g " e q p u t w c v k p . " v j g " o q f g n i ' k u ' c m i y g f " v q " f k u u k c v g " v j g " t g o c k l p i " g z e g u u ' r q t g / r t g u u w g " q x g t " c " r g t k f " q h ' v o g " v p v k i c " u v g f { / u v g " r q t g " r t g u u w g " e q p f k k p " k u ' c e j k x g f O'

Vj g"Uk O C"o qf gni' y cu'f g x g n r g f "hqt" cp" cdwo gpv'j gli j v'qh'; 07"o 0" Vj ku' cdwo gpv'o qf gni' u q w f " r t q x k f g " cp' w r g t " i k o k ' h q t " v j g " f g h q t o c v k p " g u k o c v g u O'

Hki wtu' I 08." I 04" cpf " I 05" u j q y " v j g " e w o w r c v x g " u g w g o g p v j g c x g " h q t " v j g " g p f " q h " e q p u t w c v k p " q h " c r r t q c e j y c { " g o d c p n o g p v ' y k j " y l e n i f t c l p u " * 3 7 2 " f c { u + " g p f " q h " e q p u t w c v k p " * 3 : : " f c { u o + " q h ' y j g " d t k f i g " c p f " v j g " n p i / v g t o " * 3 3 . 3 : : " f c { u o + " f t c l p g f " h c f k p i " e q p f k k p u O " H k i w t u ' I 0 6 " c p f " I 0 7 " u j q y " v j g " e w o w r c v x g " r w g t c n f g h q t o c v k p " c v ' v j g " g p f " q h " e q p u t w c v k p " c p f " v j g " n p i / v g t o " f t c l p g f " h c f k p i " e q p f k k p o " H k i w t u ' I 0 8 " k n w u t c v g u ' v j g " u c d k k i g f " r q t g ' y c v g t " r t g u u w g " e q p v w t u ' c v ' v j g " g p f " q h ' f k u u k c v k p " * n p i / v g t o + " r g t k f O'

5.5.3 Serviceability Limit States (SLS) Assessment

Vj g"UNU" r gthqto cpeg" y cu" cuugugf "qp" vj g" dcuku" qh' yj g" UF C " f guetkdgf "cdqsg" kp" Ugevkqp" 707040" Vj g" ewo wrcvkg" f ghqto cvkqp" ctg" uwo o ctk gf "kp" Vcdng" 7/340'

Table 5-12: Summary of Calculated Cumulative Deformations

Parameter	End of RSS Construction	End of Construction of Bridge	Long-term (Drained)	Net Deformation	Remarks
Ugwrgo gpw'cv'Vqr "qh" Hkpjij gf "I tqwpf "cv" F kncpegu"o +Itqo "y g"Gf i g" qh'Dtkf i g" F genlqh"Ät"	"	"	"	"	Hi wtg'I 9"
2"o +"	P IC"	/77"o o "*, +"	/77"o o "*, +"	P qo kpcn"	
7"o "	P IC"	/82"o o "*, +"	/87"o o "*, +"	/7"o o "	
32"o "	P IC"	/87"o o "*, +"	/92"o o "*, +"	/7"o o "	
42"o "	P IC"	/72"o o "*, +"	/77"o o "*, +"	/7"o o "	
52"o "	P IC"	/52"o o "*, +"	/57"o o "*, +"	/7"o o "	
72"o "	P IC"	/472"o o "*, +"	/477"o o "*, +"	/7"o o "	
97"o "	P IC"	/472"o o "*, +"	/477"o o "*, +"	/7"o o "	
Ugwrgo gpv'cv'yj g'vqr "qh'TUU" hcelpi "	/62"o o "*, +"	/67"o o "	/62"o o "	7"o o "	Hi wtg'I 0 "
NcvtcnF kur nrego gpv'qh'TUU" hcelpi "	32"o o "	7"o o "	32"o o "	7"o o "	Hi wtg'I 0 "
Tqcvkqp"qh'yj g'TUU'hcelpi "	2025"	2023"	2025"	P qo kpcn'	Hi wtg'I 0 "
Oczko wo "Ugwrgo gpvl gcxg" cv'egpvg'qh'O cvej gwg" Tqcf "	92"o o "	87"o o "	77"o o "	/32"o o "	Hi wtg'I 02"

P IC"P qv'Cr r necdrg"

*xg" f gpqgu'ugwrgo gpw"

*Ät" F kncpegu'o gcwtf "r gtr gpf lewrt "q'yj g'dtkf i g'cdwo gpv'

*, + Ewo wrcxg'f ghqto cvkqp'cv'vqr "qh'cdwo gpv'dcenthknly cni'q'dg'eqo r gpucvgf "f wtkpi "eqpustwckqp'0"

*, + Ewo wrcxg'f ghqto cvkqp'y kj qw'r qvgp'cn'etggr "

Vj g'ewo wrcxg'f ghqto cvkqp'ctg'tqwpf gf "wr "q'equguv'7"o o 0""

Hi wtgu" I 06"cpf " I 07"uj qy "uqkl'ugwrgo gpv'cpf "ncvtcn'uqkl'f kur nrego gpv'cnppi " yj g"r krg"rkpg"cv' yj g" cdwo gpv'0" Vj gug" f ghqto cvkqp'u y gtg" guko cvgf "Itqo " U.F.C." y j lej " y gtg" wugf " kp" r krg" ecrewrcvqp" kp" Ugevqp'7060"

Cu'o gpvkpgf "gctrktg."k'u'uj qwf "dg"pqvgf "yj cv'yj g'cdqvg'utguu'f ghqto cvkqp'cpcn' uku'f qgu'pqv'eqpukf gt'yj g" ghge'v'qh'cr r necdrg"ugeqpf ct { "ugwrgo gpv'yj cv'ctg"eqpukf gtg" pgo kpcn'hmqy kpi "yj g"i tqwpf "lo r tqxgo gpv' cpf "wprqcf kpi hqcf kpi 0""

Matchette Road Gas Line at Bridge:

K'ku'w'pf gtuvqf "yj cv'eqpukf gtcvqp"ku'dgkpi "i kxgp"q"tgmevcg"yj g'gzkukpi "j ki j "rtguwtg"i cu'rkpg"ltqo "ku" ewtgpv'nqecvqp"dpggcj "yj g'tqcf "uj qwf gt "q"yj g'egpvrkpg"qh'O cvej gwg" Tqcf "kp" qtf gt "q"cxqkf "f kgev" uwtj cti g'hqcf u'cpvkr cvgf "kp"yj g'ctgc"qh'hwwt"J ki j y c { "623"cr r tqcej y c { "go dcpno gpw'0"Vj g'kphwpeg" qh'J ki j y c { "623"go dcpno gpv'cpf "Dtkf i g"D/4"cdwo gpv'qp"i tqwpf "ugwrgo gpw'cnppi "yj g"r tqr qugf "i cu" rkpg"crki po gpv'y cu'guko cvgf "q"cuugu'yj g'hgcukdkkx "qh'tgmecvqp"qh'yj g'i cu'rkpg'0"

Vj g'ecrewrcvgf "ugwrgo gpvlj gcxg"r tqhrgu"wkpi "uqhy ctg"UK O C I Y "ctg'uj qy p"qp"Hi wtg'I 02"cnppi "yj g" J ki j y c { "623"cv'i cu'rkpg"cv'ewtgpv'nqecvqp"cdqw'36"o "qh'ugv'ltqo "O cvej gwg" Tqcf "egpvrkpg" +cpf "cv"

Project: Y kpf uqt/Gugz'Retny c { "

Date: O ctej 4235"

Document: I gqvgj plecn'kpxguki cvkqp'cpf "F guki p" Tgr qtv' Dtkf i g"D/4"Uc032- 84202: Y "q"32- 87: 0644Y +"

Rev: 2"

Doc No.: 4: 75: 2/26/33; /233: "I gqetgu'P q062L8/67+" "

Page No.: 54"

egpvtg'qh'O cvej gwg'Tqcf 0"Vj g"ecrewrvgf "ugwrgo gpvlj gcxg'xcnrgu'cv'j g'i cu'rkpg'cmipi "egpvtg'qh'J ki j y c{" 623"cpf "cv'egpvtg'qh'O cvej gwg'Tqcf "cmipi "J ki j y c{" 623"ctg'kmwrtcvgf "kp"Vcdrg'7/350"

Vj g"grcuk" f ghqto cvkqp" cpf "r tko ct{" "eqpuqrkf cvkqp" cv" i cu" rkpg" cpf "egpvtg" qh' O cvej gwg" Tqcf " cmipi " J ki j y c{" 623"y cu'cnq"ecrewrvgf "wulpi "uqhy ctg"Ugwrg5F 0"Vj g"tguwru'qh'jy ku"cpn'uku"ctg"lpf lecvgf "kp" Vcdrg'7/350"Vj g"ugwrgo gpv'xcnrgu'gunko cvgf "wulpi "Ugwrg5F "ctg"uki plklecpv' "rti gt"cv'j g"i cu'rkpg"cpf " uki plklecpv' "f khtgtpv' cv' j g" O cvej gwg" Tqcf "egpvtg" tgrcukg"v" j g"xcnrgu"eqo r wgf "wulpi "UK O C IY " *Vcdrg'7/35-40

Table 5-13: Estimated Cumulative Settlement/Heave at Gas Line and Centre of Matchette Road using SIGMA/W and Settle3D

Software	Estimated Deformation at Gas Line at Current Location, mm		Estimated Deformation at Matchette Road Centre, mm	
"	F wtkpi "Go dcpno gpv" Eqpwtvexqp"	Nqpi /vgtto "	F wtkpi "Go dcpno gpv" Eqpwtvexqp"	Nqpi /vgtto "
UK O C IY "	/382"	/362"	: 2"	77"
Ugwrg5F "	/442"	/387"	/37"	/52"

" */+f gpqvgu'ugwrgo gpv0 "

Cni' i tqwpf " o qxgo gpv" cpf " f ghqto cvkqp" f kuewugf " cdqxg" ctg" gunko cvgu" dcugf" qp" uqni' f ghqto cvkqp leqo r tguukdkk' "r tqr gtvgu'ltqo "rdqtcvqt {" "vguu"cpf "go r kklecn'eqttgrcukpu0"Vj g"f khtgpegu" dgvy ggp"cdqxg"ugwrgo gpvlj gcxg'xcnrgu"ecrewrvgf "d{" "j g"y q"o qf grn'ctg"f wg"v"j g" f khtgpegu"lp"j g" o qf grkpi "cr r tqcej gu0"Vj g"ecrewrvgf "xcnrgu"ctg"eqpukf gtgf "v"dg"öcr r tqzko cvg"gunko cvgulr tgf levkpuö" cpf "uj qwf "dg"eqpukf gtgf "qpn' "cu"cp"lpf lecvkqp"qh'j g"o ci pkwf g'qh'j g"uqni'tgur qpug0"Vj gug"gunko cvgu" uj qwf "dg"xgtkkf "cpf "tghkpgf "y kj "tgr gev'v"j g"cewcnr gthqto cpeg'o qpkqtkpi "lp"j g'hgrf 0

Vj g"ugwrgo gpv" f kuewugf " cdqxg" f q"pqv' kpenf g" f ghqto cvkqp" ecwugf " d{" "ugcuqpcn' vgo r gtcwtg" cpf " o qkwtg"xctkcvkqp"cpf "f wg"v"j g"ghgcu'qh'j g"mipi /vgtto "eqo r tguukqp"qh'j g"dcenthkn'o cvgtkcu'j cv'ctg" gZR gev'f "v"dg"pqo kpcn0"kp"j ku'tgi ctf . "utkpi gpv'eqo r cevkqp"eqpvtqn'o wuv'dg"gz gtekugf "v"o kpo k g"j g" o ci pkwf g'qh'dcenthkn'eqo r tguukqp0

5.5.4 RSS Wall External Stability

Vj g"gzvgtpcn'uedkkrk' "hcevtu'qh'uchgv' "ci ckpu'dcug'utkf lpi . "qxgtwtplpi "cdqw'j g'vqg'cpf "dgetlpi "ecr cekv' " hckwtgu'y gtg'ej gengf "d{" "o gcpu'qh'j g"Y qtnkpi "Utguu'o gj qf "kp"ceeqtf cpeg'y kj "j g"EHGO "i wkf grkpgu0" Wpf tckpgf "cpf "f tckpgf "uqni'uj gct'utgpi j "r tqr gtvgu'f guetkdgf "kp"Ugevkqp'70'y gtg'wugf 0

Bearing Capacity:

Vj g"hmuy lpi "pgv' wko cvg"i gqvej plecn'dgetlpi "ecr cekv' "xcnrgu"*s_w"y gtg"f gvgtto kpgf "hqt"j g"pcvkg" uwdi tcf g'uqni'cv'j g"cdwo gpv'hqt'uj qtv'vgtto "wv'f tckpgf +cpf "rpi /vgtto "f tckpgf +hqc lpi "eqpf kkpau0"

"

"

"

Table 5-14: Subgrade Ultimate Bearing Capacity

Assumed Lowest Subgrade Elevation	Loading Condition	q _{uls} (kPa)
398.0	Uj qt v/Vgto "Wpf tckpgf +"	452
	Nqpi /Vgto "F tckpgf +"	622

*3+ Dgrqy "307"o "j leniTI O "cvCdwo gpv"

*4+ Dcugf "qp"guvko cvgf "o qdtk gf "cxgtci g"eqj gukqp"qh"67"nRc"y kj kp "j g"cuwo gf "l qpg"qh"lphwpeg"qh"j g"TIU"y cm" lqwpf cvkqp"

*5+ Dcugf "cp"cuwo gf "uqkltkcvkqp"cpj ng"r j k"? "52"0

Sliding Resistance:

Vj g"wnko cvg"i gqvej plecnj qtk qpwn'tgukvcepg"J i+"ecp"dg"f gvgto kpgf "lp"ceeqtf cpeg"y kj "j g"lqmy kpi "gzrt gukqp"

J i"? "C e " "Xvcp "307"J h "

Y j gtg< C " " ? "hgevkxg"eqpcev'tgc"qh"j g"dcug"o 4="

" " e " " ? "eqj gukqp lcf j gukqp"cv'ukf kpi "lpvthceg"nRc="

" " " " ? "hgevkxg"eqpcev'tgc"qh"j g"dcug"o 4="

" " X " " ? "xgtvlecnlqteg"nRc="cpf "

" " J h " " ? "f guk p"j qtk qpwn'lqcf "nRc="0'

Vj g"lqmy kpi "uqk"r tqr gtvgu" *Vcdng"7/37+"cv" j g"lpvthcegu"dgvy ggp" j g"TIU"TI O "cpf "ukv" "erc" "uwdi tcf g"ecp"dg"vugf "lp"j g"f guk p<"

Table 5-15: Soil Properties for use at Sliding Resistance

Interface	Undrained (Short-Term)		Drained (Long-Term)	
	δ, deg	c, kPa	δ', deg	c', kPa
TIU"vq"TI O "	52"	2"	52"	2"
TI O "vq"Ukv" "Erc" "	2"	77"		

Dcugf "qp"i gqvej plecn'pcpn'ugu" f kuewugf "lp"Ugevkpu"707/3"vq"707/6."r tgrko kpc{ "cdwo gpv'eqphki wcvkqp" cpf "f ko gpukpu"y gtg" f gvgto kpgf " *Vcdng"7/38+0' "Cu"pqvgf "r tgrxkwun" "lp"Ugevkpu"707/3." j g"cdwo gpv' eqphki wcvkqp" cpf "f ko gpukpu" kpf kcvgf "lp" j g"ug" cpcn' ugu"ctg" j g"o kpo wo "tgs vktgf "cpf "ctg"vq"dg" hpcrk gf "d{ "r tqr tkgvt{ "uwr r rkgu0"Vj g"lqmy kpi p"qh"j g"cdwo gpv'ku"vq"dg" f gxgnr gf "lp"eqpuwncvqp" y kj "j g"uwr r rkgu"qh"j g"r tqr tkgvt{ "eqo r qpgrpu0"Vj g"r tqr qugf "cdwo gpv'eqphki wcvkqp"ctg"uj qy p"lp" Hki wtg"J 3"lp"Cr r gpf kz"J 0'

"

"

"

Table 5-16: Tentative Dimensions of the Abutment

Assumed Total Height ⁽¹⁾ , m	RGM Size (Thickness x Min. Width at Base), m	EPS Volume, m ³ /m	RSS Structure Size (Width x Height) ⁽²⁾ , m
30.7	30.7'x33.0'	72	90'x50'

*3+ O gcuwtgf "tqo "qqr "qh"tqkf i tcf g"cv'dtlf i g"t gen'v'j g"dcug"qh'j g"tuu'utwewtg0

*4+ Vj g"tuu'ur r rgt'o c{ 'tgs vktg'y kf gt'utwewtg'v'q'o gg'v'j g'lvgtpcn'f guki p'tgs vktgo gpw0"Vj g"ghgeu'qh'c'y kf gt'utwewtg" qp'dgctkpi "ecr cekf 'y kn'p'ggf "v'dg"cuugugf 0

*5+ Wpk'y gki j v'qh'tuu'y cmly cu'cuwo gf "v'dg"34'nP lo 5"cu'cp'cr r tqxgf "NY H'o cvgtkrf

5.6 RGM Foundation Loads

C"30.7"o "y km'ti O "h'wpf cvkqp"eqo r tkulpi "I tcpwrt"D"V{r g"K'y cu'eqpukf gtgf "wpf gt"y g"tuu'hcnug" cdwo gpv'y cmu"v'q"ko r tqxg"y j g"mcf "f kntkdwkqp"v'j g"dgctkpi "uqku"cpf "ucvuhf "y j g"dgctkpi "ecr cekf " tgs vktgo gpw'ht'wpf tclpgf "eqpf kkp'u'cv'j g'cdwo gpw0"C"uko r rktk'f "cr r tqcej "y cu'wugf "eqpukf gtkpi "y cv" y j g"ti O "h'wpf cvkqp"f kntkdwgu"y j g'xgt'v'ecr'f tguwtgu'cv'j g"dcug"qh'j g"tuu'y cmu"v'q"y j g'uwdi tcf g'dgrny " y j g"ti O "cv'c"67"f gi tgg"cp' r g0"Vj g"hmny kpi "mcf u"*Vcdrg"7/39+"y gtg"guko cvgf "v'cev'qp"vqr "qh'j g" ti O "qp"y j g'dcuk'qh'eqpxgp'v'p'cd'ecr'w'cvkqp'qh'j g"dgctkpi "r tguwtgu'wpf gt'i tckxkf "tgcklpi "y cmu0

Table 5-17: Estimated Load on RGM

Maximum Unfactored Bearing Pressure, kPa	Average Unfactored Bearing Pressure, kPa
352	337

Dcugf "qp"y j g"cdqsg"mcf "qp"ti O ."cp"guko cvgf "h'ewt'gf "j qtk qpwn'v'pukg"mcf "qh"76'nP "r gt'o gvgf "qh" ti O "y cu'guko cvgf "cetqu"y j g'gpv'g'j gki j v'qh'30.7'o 0"

Vj g"cdqsg"mcf u"ctg"ht"y j g"wg"d{ "y j g"ti O "uwr r rgtu"v'cuukv'kp"y j g"ti O u"lvgtpcn'f guki p0"Vj g" cuuqekcvgf "uqknt'gukv'pegu'cv'j g'wpf gtukf g'qh'j g"ti O "ctg'r tqxkf gf "kp"Vcdrg"7/360

5.7 Wing Walls (Concrete Wing Walls and Tapered RSS Walls)

Cu'o gpv'kpgf "gctrtgt."c"ecp'v'xgt"eqpetg'y kpi "y cm'ku"kp'f'ecv'f "cv'gcej "eqtpgt"qh'j g"utwewtg0"Cnuq." vcr gtgf "tuu'y cmu'ctg'gz'v'p'gf "r ct'cngn'v'O cvej gw'g"tqcf "dg{ qpf "y j g'dtlf i g'cdwo gpw0"

Uko krt"v'j g"tuu'y cmu'cv'j g'cdwo gpv."y j g"tuu'vcr gtgf "y cmu"j cxg"dggp"r tgrko k'pctk'f "ej gengf "hqt" dgctkpi "ecr cekf "cpf "urkf kpi "tguv'pegu0"Nki j v'y gki j v'hm"NY H'y cu'tgs vktgf "hqt"tuu'vcr gtgf "y cmu'hqt" y j g'dgctkpi "tguv'peg"r wtr qugu0"Vj gtghgtg."y j g"tuu'vcr gtgf "y cmu"cu'dggp"f guki pgf "y kj "NY H'y kj kp"y j g" tuu'y cmu'cpf "GRU"y j gtg"cr r r'ecdr'g'dg'kp'f "y cmu"Vj g'i m'cdn'wcdk'k'f "cpn'ugu"j cxg"dggp"ectk'f "q'w'qp" eqpetg'y kpi "y cmu'cpf "tuu'vcr gtgf "y cmu"Vj g'ecr'w'v'f "h'ewt'qh'uch'v'f "o gg'v'j g"RC"tgs vktgo gpw' ci clpu'i m'cdn'k'p'wcdk'k'f 0"Vj g'ecr'w'v'f "h'ewt'qh'uch'v'f "ctg"uwo o ct'k'gf "kp"Vcdrg"7/3: 0"Hki wtu'g'H0"v'q" H0"kp"Cr r gpf lz "H'k'w'v'cv'g'v'j g'wcdk'k'f "o qf gnu'hqt"y j g'y kpi "y cmu0

"

"

Table 5-18: Calculated Factors of Safety for Wing Walls against Global Instability

Type of Wing Wall	Preliminary Width of RSS Tapered Wall, m	Calculated Factor of Safety	
		Undrained Condition	Drained Condition
Vcr gtgf "TUU"Y cni'y kj "NY H" *cv'j ki j guv'ugev'kp+"	9.0"	3.05*3.05+"	3.09*3.08+"
Eqpetgvg"Y kpi "Y cni'	P IC"	3.0 *3.0 +"	4.02*3.0 +"

" " P qvg<Xcnwgu"qwu'kf g'r ctgpy gugu'tghgt"v'ekewrt'hc'kw'g'uw'hcegu'cpf "y g'xcnwgu'kp'r ctgpy gugu" tghgt"v'pqp/ekewrt'hc'kw'g'uw'hceg0"

Vcdrg"7/36"uwo o ctk' gu"y g'pgv'wnko cvg'dgctkpi "ecr cekv' "xcnwgu" *s_w+f gvgto kpgf "hqt"y g'pcv'xg'ukn' "enr { " uwr r qtv'kpi "y g'vcr gtgf "TUU"y cni'qp'gcu'cpf "y guv'ukf gu0"

5.8 Backfilling

Dgj kpf "y g'eqpetgvg"cdwo gpv'cpf "y kpi "y cni' "pqp/hquv'uwuegr vcdrg"ht gg'f tcl'kpi "i tcpwrt'hc'kw'g'uw'hcegu'cpf "y g'xcnwgu'kp'r ctgpy gugu" tghgt"v'pqp/ekewrt'hc'kw'g'uw'hceg0"

Nqpi kwf kpcn'f tcl'kpi "y g'eqpetgvg"cdwo gpv'cpf "y kpi "y cni' "pqp/hquv'uwuegr vcdrg"ht gg'f tcl'kpi "i tcpwrt'hc'kw'g'uw'hcegu'cpf "y g'xcnwgu'kp'r ctgpy gugu" tghgt"v'pqp/ekewrt'hc'kw'g'uw'hceg0"

J gcx { "eqo r cev'kp"gs vkr o gpv'uj qwf "pqp/hquv'uwuegr vcdrg"ht gg'f tcl'kpi "i tcpwrt'hc'kw'g'uw'hcegu'cpf "y g'xcnwgu'kp'r ctgpy gugu" tghgt"v'pqp/ekewrt'hc'kw'g'uw'hceg0"

Hqt'tgv'kpgf "dcen'kni'v' cv'ku'r rnegf "cpf "eqo r cev'kp"gs vkr o gpv'uj qwf "pqp/hquv'uwuegr vcdrg"ht gg'f tcl'kpi "i tcpwrt'hc'kw'g'uw'hcegu'cpf "y g'xcnwgu'kp'r ctgpy gugu" tghgt"v'pqp/ekewrt'hc'kw'g'uw'hceg0"

Gctv' "r tguuwt'gu"qp"cdwo gpv'cpf "y kpi "y cni' "pqp/hquv'uwuegr vcdrg"ht gg'f tcl'kpi "i tcpwrt'hc'kw'g'uw'hcegu'cpf "y g'xcnwgu'kp'r ctgpy gugu" tghgt"v'pqp/ekewrt'hc'kw'g'uw'hceg0"

"

"

"

Soil Parameter	Group I Soils	Group II Soils	Group III Soils
HkmiWpk/Y gki j v.'nP lo ⁵ "	44"	43"	420"
Hilevqp"cpirg." "f gi tggut"	55"q'57"	4; "q'54"	44"q'52"
Eqghilegpw'qh'Ucve'NcvgtrGctvj " Rtguwtg<"	"	"	"
Cevkxg)'qt'Wptgwtckpgf.'M _q ^{*+n}	2049"q'2052"	20532"q'2057"	2055"q'2067"
CvTgun)'qt'Tgwtckpgf.'M _q ^{*+n}	2065"q'2068"	2069"q'2074"	2072"q'2084"
šRcuukxg.'M _q ^{*+n}	50"q'500"	40 "q'504"	404"q'502"

6 Other Geotechnical Recommendations

6.1 Construction Dewatering

Vj g'f guki p'qh'v'j g'f gy cvgtkpi "u{ uvgu "uj qwrf "eqo r n{ "y kj "y g'QRUU739"cpf "73: "rtqxkukqpu0'

F wg"vq"y'j g'tgrvkgxgn{ "ny "r gto gcdkxk{ "qh'v'j g'ukn{ "erc{ "f gr qukw"i tqwpf y cvgt "uggr ci g"ku"cpvlekr cvgf "vq"dg" o kpkt. "y j lej "uj qwrf "dg"eqpvtqmcdrng"d{ "eqpvgpvkqpcn'vgo r qtct{ "f gy cvgtkpi "o g'v'j qf u0"Twpqh'cpf "uggr ci g" kpq"y'j g"gzecxcvkpu"ltqo "r gtej gf "i tqwpf y cvgt "ltqo "y'j g"lkm"qrf "hcto "vkgu"cpf kq "wkxk{ "v'gpej gu."cpf " wr r gt "i tcpwrt "rc{ gtu'ctg"lkgxk{ "vq"qeewt0"kp"cf f kxkp. "tcpf qo "y cvgt "dgctkpi "ugco u'qt "r qengw'qh'hkg"ucpf " cpf "uknu"ucpf "o c{ "dg"lpvgtugevgf "d{ "y'j g"gzecxcvkpu"unqr gu0"kp"cf xgtug"eqpf kxkp. "y'j g'wpqh'cpf "uggr ci g" ltqo "r gtej gf "i tqwpf y cvgt "cpf "ucpf luku'r qengw'ecp"dg"uki pkhcepv'cpf "ceeqo r cplgf "d{ "r k kpi "cpf "y cuj / qwu'qh'v'j g'hkgu'ecwukpi "unqr j kpi "qh'v'j g'unqr gu0'

Ceeqtf kpi n{. "rtqxkukq"uj qwrf "dg"o cf g"vq"r tgrvkv'wpqh'cpf "r k kpi "gtqkq"qh'v'j g'unqr g'uwthcegu"d{ " dncpngv'kpi "y'j g"gzecxcvkq"unqr gu'y kj "c"i gqvgz vkg"cpf "ltgg"ftclpki "i tcpwrt "o cvgtkcn0"Vj g'uggr ci g"lky " uj qwrf "dg"ftkgevgf "vq"eqmgevkq"uwo r u'd{ "vgo r qtct{ "f tclpki g"i kej gu'r tqr gtn{ "uk gf. "hkgv'gf "cpf "hkgf "vq" ceeqo o qf cvg'v'j g'ly "tcgu0'

Ghgevg"ftclpki g"ku"cp"ko r qtvcv'cur gev'kp"y'j g"rkg"gzr gevce{ "cpf "r gthqto cpeg"qh'cp{ "cdwo gpv'y cm" y kpi "y cm"qt "r exgo gpv'uwvwtg"cuqekcvgf "y kj "y'j g"dtkf i g0"Rgto cpvgv'uwdf/ftclpki g'uj qwrf "dg"kpucngf " dgj kpf "cdwo gpv'cpf "y kpi "y cmu0"P qp/ltqu'uwvgr vkg"cpf "ltgg"ftclpki "i tcpwrt "o cvgtkcn"i tcpwrt "D" V{r g"3"qt "cr r tqxgf "gs wkxngpv"uj qwrf "dg"kpucngf "ko o gf lcvgn{ "cf lcegpv"vq"y cmu"vq"r tgrvkv'y cvgt " r tguvwtg"cev'kpi "qp"y'j g"y cmu"cpf "vq"r gto k'f qy py ctf "lky "qh'uwthceg"y cvgt "f qy p"kpq"y'j g"y cm'uwdf/ f tclpu0"Vj g'uwdf tclpu"uj qwrf "dg"uwvwtg"v'gf "d{ "cr r tqxgf "i tcpwrt "o cvgtkcn'cpf "f kej cti gf "xk"i tckxk{ " lky "vq"y'j g'uwqto "ftclp"qt "tqcf "f kej "u{ uvgu "cmqi "O cvej gwg"tqcf 0'

Cm'uwthceg"y cvgt "uj qwrf "dg"ftkgevgf "cy c{ "ltqo "cm'qr gp"gzecxcvkqpu0'

6.2 General Construction Requirements

Vj g"cpvlekr cvgf "eqputwvkvq"eqpf kxkp"kp"y'j ku'tgr qtv'ctg"fkuewugf "qpn{ "vq"y'j g"gzv'v'qh'v'j gkt "r qvgpv'cn' kphwpeg"qp"y'j g'f guki p'qh'v'j g'r gto cpvgv'gng gpw'qh'v'j g'wppgr0"Thgtgpegu"vq"eqputwvkvq"o g'v'j qf u'ctg" pqv'kpvgf gf "vq"dg"y'j g'uw i gukqpu"qt "ftkgevkq"qp"y'j g"eqputwvkvq"o g'v'j qf qm'j lgu0"Eqputcevqtu"uj qwrf "dg" cy ctg"y'j cv'v'j g'f cv"r tguvgv'gf "kp"y'j ku'tgr qtv'cpf "y'j gkt "kpvgtr tgcvkqpu"o c{ "pqv'dg"uwthelgpv'vq"cuugu"cm' hcevtu"y'j cv'o c{ "chgevg"y'j g"eqputwvkvq0"Eqputwvkvq"tgs vkt go gpw'tgrv'gf "vq"y'j len'f tclpu."go dcpno gpv' cpf "dtkf i g"cr r tqcej y c{ u'ctg"fguetkdgf "lp"oF guki p"tgr qtv/"J li j "Go dcpno gpw00'

Cu"o gpv'kpgf "gctrigt. "y'j g"Eqputcevqtu"ctg"hwk{ "tgr qpukdrng"ht"y'j g'f guki p."eqputwvkvq"o g'v'j qf u'cpf " r gthqto cpeg"uwcdkxk{ "f ghqto cdkxk{ "cpf "f gvgtkqtcvkq"qh'v'j g"vgo r qtct{ "unqr gu"cpf "vgo r qtct{ "y qtmu0" Vj g'hqmy kpi "tgeqo o gpf cvkqpu"cpf "eqo o gpw'ctg"eqpukf gtgf "cr r rkecdrg<

- Cm' gzecxcvkq" y qtmu" uj qwrf "dg" ecttkgf "qww" kp" ceeqtf cpeg" y kj "y'j g"i wkf gkpgu" qwv'kpgf "kp" Qeewr cvkqpcn'J gcnj "cpf "Uchgv{ "Cev"QJ UC"cpf "QRUU"; 240"Vj g"pcvkg"wpf kwwd'gf "uqknu"o c{ " dg"ercuukhgf "cu"V{r g"5"uqknu0"Vj g"gzecxcvkqpu"dgmy "y'j g"qtki kpcn'i tqwpf "ngxgn"o c{ "lpvgtugev'

y cvgt "dgctkpi "dcenhtkly kj kp "t gpej gu"qh"cevkxg"cpf lqt "cdcpgf qpgf "wkrkku0"kp "vj gug"ecugu. "V{r g"6" uqln'eqpf kkpup"o c{ "qeewt "cpf "uj qwrf "dg"cf f tguugf "ceeqt f kpi n{ 0"

- Vj g"pcvkxg"uqln"cv"vj g"r tqlgev"ukg"ctg"j ki j n{ "uwuegr vldng"vq"ter kf "f gvgtkqtcvkqp"y j gp"gzr qugf "vq" grego gpw. "y gcvj gtpi "cpf lqt "uwlgevvgf "vq"fk gev'eqputwevkqp"tchhke0"
- Vgo r qtct { "unqr gu. "r gto cpgrp"unqr gu. "cpf "uwdi tcf g"ctgeu"o wuv'dg"cr r tqr tlcvg" "r tqvevgf "cv"cmi" vko gu"ci ckpuv'whtceg"gtqukqp"fg"vq"twpqhh"fguleecvkqp. "ftgg| g/vj cy "ghggu. "gve0"
- Vq"r tqvevgf"y g"kpvgi tkv{ "qh'uwdi tcf g"ht "hwpf cvkpu"cpf "rcxgo gpw. "vj g"hpkn'gzeexcvkqp"rkn'cdqyg" yj g"f guki p"grgxcvkqp"uj qwrf "pqv'dg"ngu"yj cp"722"o o "cpf "uj qwrf "dg"ecttkgf "qw"qpn{ "y j gp"vj g" Eqpvtcevqt "ku"tgcf { "vq"r tgr ctg"cpf "eqxgt"vj g"uwdi tcf g"y kj "vj g"o cvgtkcu"ur gekhgf "kp"vj g"f guki p" uco g"f c{ " yj g" hpkn'gzeexcvkqp"ku"gzr qugf "cpf "cr r tqxgf 0" "P q"eqputwevkqp"tchhke"uj qwrf "dg" r gto kwgf "qxtg"uwdi tcf g"y kj qw"cr r tqxgf "r tqvevkxg"eqxgtu0"
- Vj g"hpkn'gzeexcvkqp"rkn'cdqyg"vj g"f guki p"uwdi tcf g"uj qwrf "dg"ecttkgf "qw"vulpi "dwengw"gs vkr r gf " y kj "uo qqy "rku0"Qpeg"gzr qugf. "vj g"uwdi tcf g"o wuv'dg"ko o gf kcvgn{ "kpur gevvgf 0" "Wf qp"cr r tqxcn" yj g"uwdi tcf g"uj qwrf "dg"ko o gf kcvgn{ "r tqvevgf "f gr gpf kpi "qp"vj g"v{r g"qh'eqputwevkqp. "i ghcdtkeu. " i tcpwrt "o cuu. "c"unko "eqcv"o kpo wo "97"o o "vj kema"qh"ngcp"eqpetgvg"r tqvevkqp"o wf "o cvt. "gve0" uj qwrf "dg"vugf 0"
- Tgi wrt "o qpkqtkpi " cpf " kpur gevkpup" qh" yj g" eqpf kkp" qh" yj g" vgo r qtct { " unqr gu" hqt " uki pu" qh" kpucdkkv{. "f gvgtkqtcvkqp. "unqwi j kpi . "gve"uj qwrf "dg"ecttkgf "qw"d{ "s wcrkhgf "r gtupppgr0"Cr r tqr tlcvg" o kki cvkp"o gcuvtgu"uj qwrf "dg"ko r ngo gpvgf 0"
- Gzeexcvkpu"kp"vj ku"ctgc"uj qwrf "dg"rko kgf "kp"uk g"kp"vj g"ctgc"cpf "cr r tqr tlcvg"o qpkqtkpi "qh"vj g" tgukf gpeg"uj qwrf "vcng"r rneg0" "O qpkqtkpi "uj qwrf "eqpukv"qh" c"r tgeqpf kkp"uwxg{ "cuipi "y kj " tgi wrt"uwxg{ kpi "eqpf wevgf "qh"vj g"pgctd{ "wkrkku. "tgukf gpegu. "gve0"
- Kp"tgeqi pkkqp"qh"r qvgpvkn'ht "uqln' cugu"cu" f guetldgf "kp"Ugevkqp"608. "ck"s wcrkv{ "cpf "uwdi tcf g"r qtg" r tguwtg"o qpkqtkpi "uj qwrf "dg"ecttkgf "qw" f wtkpi "eqputwevkqp0" "Vj g"gs vkr o gpv"qr gtcvpi "kp" eqphkpgf "ur cegu"uj qwrf "dg"ugrgevvgf "vq"uchgn{ "qr gtcvg"kp" c"r qvgpvkn{ "i cugquw" gpvktqpo gpv0" Gzeexcvkqp"rkn"uj qwrf "dg" f gekf gf "kp"eqpukf gtcvkqp"qh"vj g"r qtg"r tguwtg"o qpkqtkpi "f cv"cpf "vj g" r qvgpvkn' tqpwf "uqlhgpki 0"

6.3 Instrumentation and Monitoring during Construction

Cu"o gpvkpgf "gctrkt "kp"Ugevkqp"706. "c"r tqi tco "qh"ukg"kpwtwo gpvcvkqp"cpf "o qpkqtkpi "qh"vj g"vgo r qtct { " y qtmu" f wtkpi " eqputwevkqp" uj qwrf " dg" ko r ngo gpvgf " d{ " yj g" Eqpvtcevqt " kp" cf f kkp" vq" yj g" rko kgf " kpwtwo gpvcvkqp"ctgcf { "kpucngf "f wtkpi "vj g"i gqgej plectn'kpxguki cvkp"Vcdng"5/4+0"

Tgeqo o gpf cvkpu"ht "cf f kkpkn'kpwtwo gpvcvkpu"cpf "o qpkqtkpi "r tqi tco o g"cu"y gm'cu"i wkf grkpgu"ht" kpvgtr tgvvkqp. "cngt v'hxgn"cpf "eqvki gpekgu"ctg"r tqxkf gf "kp" c"ugr ctcvg"tgr qtv" F qewo gpv" P q04: 75: 2/26/ 33: /2223+0"

Vj g"Eqpvtcevqt "ku"t gur qpukdg"ht "r nppkpi . "kpucmvkqp"cpf "o ckpgpcpeg"qh'kpwtwo gpvcvkqp"cu"y gm'cu"vj g" eqo r ngvkqp"qh"o qpkqtkpi "qh"vj g"t gur qpug"qh"vj g" gzeexcvkpu"i tqwpf "o qxgo gpv" f wtkpi "eqputwevkqp0" F gvckgf "r npu"cpf "r tqegf wtu"uj qwrf "dg"uwo kwgf "vq"J O S "ht"cr r tqxcn'cv'ngcu"vj tgg"o qpj u"r tkqt"vq" eqo o gpego gpv'qh"vj g"o qpkqtkpi "qh"vj g"y qtmu0"

O qpkqt kpi "ku'tgs wktgf "v"ej gen'ij g"uchgv "qh'ij g'y qtm"cuugu"ij g"ghgew"qh'eqputwekq"qp"uwtqwpf kpi " i tqwpf "cpf "gz kpi "hckkkgu."gxcnvcg" f guli p"cuuwo r vkpu."cpf "tghkpg"guko cvgu'qh'hwmtg'r gthqto cpeg0

6.4 Corrosion Potential

Cpcn' vlecn'vukpi "y cu'ecttkgf "qw'qp"uco r ngu'qh'ij g'ukn' "erc{ "v"erc{ g{ "ukn'utcwwo "qdvckpgf "lp"Dqtgj qrgu" DJ "D4/3" *Uco r rg"5+ "DJ "25/TY " *Uco r rg"3: + "cpf "DJ "26/TY " *Uco r rg"39+0" "Vcdrg"8/3" uwo o ctk' gu'ij g" tguwnu'qh'xctkqu" cpcn' ugu'ecttkgf "qw'qp"ij g'uqkl'uco r ngu'v"cuugu"ij g'r qvgpvkn' hqt "eqttqukq"qp"eqpetvg" cpf "o gvcnle"grgo gpw0

Table 6-1: Results of Analytical Testing on Soils

Location of Soil Samples	Elevation of Soil Sample	pH	Redox Potential, mV	Resistivity, ohm.cm	Sulphide, mg/kg	Sulphate, mg/kg
Dqtgj qrg"DJ "D4/3" *Uco r rg"5+	3980"	9073"	378"	3892"	>204"	99; "
Dqtgj qrg"DJ "25/TY " *Uco r rg"3: +"	3790"	9007"	46: "	3982"	>204"	6; : "
Dqtgj qrg"DJ "26/TY " *Uco r rg"39+	3780 "	90 9"	35: "	3; 62"	>204"	662"

"

Vj g'tgr qtvgf "tguwnu'qh'ndqtcvqt { "vgukpi "lpf lecv"ij cv'dcugf "qp"EUC"C450."eqpetvg"lp"eqpvcev'y kj "ij g" vguvgf "uqkl'o cvgtkn'y qwrf "j cxg" c"pgi rki kdrf "f gi tgg'qh'gzr quwtg"v"uwr j cvg'cvcem"t gh0T/32+0

Dcugf "qp"ij g"o gcuwtgf "grgevtlecn'tgukn'xkxk{ ."r J . "tgf qz"r qvgpvkn"uwr j kf g"eqpvgpw" gve0"ij g"vguvgf "uqkl' y qwrf "dg"eqpukf gtgf "eqttqukxg"v"dwtkgf "o gvcnle"grgo gpw"t gh0T/4+0

Vj g'cdqxs'tguwnu'uj qwrf "dg'hw'ij gt'tgxkgy gf "d{ "c"eqttqukq"ur gekcrkx0

6.5 Construction Quality Control

Vq"gpwtg"ij cv'eqputwekq"ku'ecttkgf "qw'lp" c"o cppgt"eqpukngpv'y kj "ij g"lpvgpv'qh'ij g'tgego o gpf cvkqu" ugv' hqtij "lp" ij ku' tgr qtv. "c" eqputwekq" s wcrk{ "eqpvqr" r tqi tco . "kpenw' kpi " i gqvgj plecn' kpur gev'kq." kputwo gpwcvkq."vgukpi "cpf "kputwo gpv'o qpkqt kpi . "uj qwrf "dg" f gxgnr gf "cpf "ko r ngo gpvgf "ij tqwi j qw'ij g" eqputwekq"r j cuo0" kpf cf f kkkq."tgrvgf "ndqtcvqt { "vgukpi "ij qwrf "dg"ecttkgf "qw'lp"eqplwpevkq"y kj "ij g" hkrf y qtm'v"o qpkqt "eqo r rdcpeg'y kj "ij g'xctkqu"o cvgtkn"cpf "r tqlgev'ur gekhcvkqu0

"

"

"

7 Limitations of Report

Vj g'y qtnlr gthqto gf "lp"vj ku'tgr qtv'y cu'ecttkgf "qwl"p"ceeqtf cpeg'y kj "vj g'Ucpf ctf "Vgto u'cpf "Eqpf kkpup" o cf g'r ctv'qh'qwt'eqpvtcew"Vj g'eqpenwukpu"cpf "tgeqo o gpf cvkpu"rtgugpvf "j gtgk"ctg"dcugf "uqrgn" "wr qp" vj g'ueqr g'qh'ugtxlegu"cpf "ko g'cpf "dwf i gwt {"nko kcvkpu"t guetkdgf "lp"qwt'eqpvtcew"

Vj ku" tgr qtv" r tguvpu" vj g" uwdwthceg" uqkn" cpf " i tqwpf y cvgt" eqpf kkpup" kphgttgf "htqo " i gqvgej plecn" kpxguki cvkpp"cpf "i gqvgej plecn" f guki p"qh"vj g'utwewtgu'o gpvkppgf "lp"vj g'tgr qtv"Vj g'tgr qtv'y cu'r tgr ctgf " y kj "vj g'eqpf kkpup"vj cv'y g'utwewtgu'cpf "qvj gt "f guki pu"qh"vj g"Y GR"y km'dg"lp"ceeqtf cpeg'y kj "cr r rkecdng" ucpf ctf u" cpf " eqf gu." tgi wrcvku" qh" cwj qtkkgu" j cxkpi " lwtkf levkp." cpf " i qqf " gpi kpggtkpi " r tcevegu" Hwtvj gt. "vj g'tgeqo o gpf cvkpu"cpf "qr kkpup"gzr tguvgf "lp"vj ku'tgr qtv'ctg"qpn" "cr r rkecdng"vq"vj g'r tqr qugf " r tqlgv"cu'f guetkdgf "y kj lp"CO GE u'tgr qtv"

Vj gtg"uj qwf "cnuq"dg"cp"qpi qkpi "rkcuqp"y kj "CO GE" f wtkpi "dqy "vj g'f guki p"cpf "eqputwvku"r j cugu"qh" vj g'r tqlgv"vq" gputg"vj cv"vj g"tgeqo o gpf cvkpu"lp"vj ku"tgr qtv"j cxg"dggr"kvgr tgvf "cpf "ko r rgo gpvf " eqttgwn"O" Cnuq. "kh"cp {"hwtvj gt "emtkkcvkpp"cpf lqt "grdqtcvkpp"ctg"pggf gf "eqpegtkpi "vj g'i gqvgej plecn" cur gew"qh"vj ku'r tqlgv."CO GE"uj qwf "dg"eqpvcevgf "ko o gf kcvgn"O"

Vj g'eqpenwukpu"cpf "tgeqo o gpf cvkpu"i kxgp"lp"vj ku"tgr qtv'ctg"dcugf "qp"fcv"r tguvvgf "lp"vj g'r tg/dkf " i gqvgej plecn" kpxguki cvkpp" tgr qtu" cpf " kphqto cvkpp" f gvgto kpgf "cv" vj g'vgu"j qrg" mecvkpu" f wtkpi " vj g" cf f kkpncn" kpxguki cvkpp"ecttkgf "qwl"ht"vj g'i gqvgej plecn" f guki p"y qtn"Vj g'fcv"qdvkpgf "htqo "vj g'r tg/dkf " kpxguki cvkpu"ecttkgf "qwl"d {"qvj gtu"y cu'cuwo gf "vq"dg"xcrkf" cpf "cr r rkecdng"O"

Vj g'kphqto cvkpp"eqpvkpgf "j gtgk"lp"pq"y c {"tghrgew"qp"vj g'gpxkqpo gpcn"cur gew"qh"vj g'r tqlgv."wrguu" qvj gty kug'ucvgf O"

Vj g'uqkn'dqwpf ctkgu"lpf lecvf "j cxg"dggr"kphgttgf "htqo "pqp/eqpvkpwqwu"uco r rkpi . "qdugtxcvku"qh" f tknki " tguvcepg. "P kreg"xcpg. "ERV"cpf "FO V"r tqdkpi O"Vj g'dqwpf ctkgu"v" r kcm {"tgr tguvp"v"tvpukv"htqo "qpg" uqkn"v"r g"vq"cpqvj gt "cpf "ctg"pqv"kvpgf gf "vq" f ghkg"gzcev"r rcpgu"qh"i gqrgi kcn"ej cpi gO" "Uwdwthceg"cpf " i tqwpf y cvgt"eqpf kkpup"dgw ggp"cpf "dg { qpf "vj g'vgu"j qrgu"o c {"f khtg"htqo "vj qug" gpeqwpvgf "cv"vj g'vgu" j qrg" mecvkpu. "cpf "eqpf kkpup"o c {"dgeo g"cr r ctgvp" f wtkpi "eqputwvku. "y j lej "eqw" "pqv"dg" f gvgvgt "qt" cpvkr cvgf "cv"vj g'vko g'qh"vj g'ukg" kpxguki cvkpp"Vj wu. "wpuwkcdng" hqwpf cvkpp"uqkn"o c {"dg" gpeqwpvgf "cv" vj g' hqwpf cvkpp" i tcf g" tgs wtkpi "gztc" uwd/gzecxcvku. " uwdi tcf g" ko r tqxgo gpv. " cpf lqt "ej cpi gu" vq" vj g" f guki pO" "K"ku"ko r qtcvp"vj cv"vj g"CO GE" i gqvgej plecn" f guki p" gpi kpggt "dg" kpxqrgf " f wtkpi "eqputwvku" vj tqwi j qwl"vj g"Y GR"r tqlgv"ukg"vq"eqpht "vj cv"vj g'uwdwthceg"eqpf kkpup" f q"pqv" f gxlcvg"o cvgtkcm {"htqo " vj qug" gpeqwpvgf "lp"vgu"j qrgu. "cpf "vj cv"cp {"o cvgtkcn" f gxlcvku. "kh" gpeqwpvgf . "f q"pqv"cf xgtugn {"chge" vj g'i gqvgej plecn" f guki pO"

Vj g'ucdkk {"cpn" ugu"cuwo gf "c"egtckp"ugs wgepg"qh"vj g'eqputwvku="kh" f khtg gpv"eqputwvku"cr r tqcej gu" ctg"eqpukf gtgf "vj g'i gqvgej plecn" f guki p"y kmj cxg"vq"dg"tgxgy gf O"Vj g'ecrwcvgf "hcevtu"qh"uchgv {"cuwo g" utlev"cf j gtgpeg"vq"vj g'i qqf "eqputwvku"r tcevegu"y kj "tgr gev"vq"vj g'r tqvgekv"qh"vj g'gzr qugf "unqr gu"O"

Vj g" f guki p" tgeqo o gpf cvkpu" i kxgp" kp" vj ku" tgr qtv" ctg" cr r rkecdrg" qpnf "vq" vj g" r tqlgevf" f guetldgf "kp" vj g" vgzv" cpf "vj gp" qpnf "kh" eqputwevgf "uwdncpvkcmf "kp" ceeqtf cpeg" y kj "vj g" f gvcku" uvcvgf "kp" vj ku" tgr qtv" "Ukpeg" cmf " f gvcku" qh" vj g" f guki p" o c{ "pqv" dg" hpqy p. "kv" ku" tgeqo o gpf gf "vj cv" CO GE "dg" gpi ci gf "f wtkpi "vj g" hpcnlf guki p" cpf " eqputwevkp" uci gu" vq" xgtkhf " vj cv" vj g" f guki p" cpf " eqputwevkp" ctg" eqpukvgpv" y kj " CO GE u" tgeqo o gpf cvkpu0

Vj g" eqo o gpv" o cf g" kp" vj ku" tgr qtv" qp" r qvgpvkn" eqputwevkp" r tqdrgo u" cpf "r quikdr" o gyj qf u" ctg" kpvgpf gf " qpnf "hqt" vj g" i wkf cpeg" qh" vj g" utwevtn" cpf "qvj gt" f guki pgtu" cpf "eqputwevt0" Vj g" pwo dgt "qh" vguv" j qrgu" o c{ " pqv" dg" uwhlekp" vq" f gvgto kpg" cmf vj g" hcevtu" vj cv" o c{ "chgev" eqputwevkp" o gyj qf u" cpf "equu0" Hqt "gzco r rg." vj g" vj kempgu" qh" vj g" utwhekn" vqr uqkf" cpf "vj g" enc{ "etwuv" r{ gt. "vj g" r tgupeg" qh" ctvgukp" eqpf kkp" u" cpf " gzuqkxgf "pcwtn" i cugu. "cpf "vj g" utgpi vj "qh" vj g" ukm" enc{ "utcwwo "o c{ "xct{ "o ctngf n" cpf "wpr tgf levcn" 0" Vj g" eqputwevt "uj qwf. "vj gtghqg. "o cng" vj gkt "qy p" kpvgtr tgvkqp" qh" vj g" hcewcn" kphqto cvkqp" r tguvgf "cpf " f tcy "vj gkt" qy p" eqpenwkpu" cu" vq" j qy "vj g" uwdutheg" eqpf kkp" u" o c{ "chgev" vj gkt "y qtn0" Vj g" y qtnf " r tguvgf " kp" vj ku" tgr qtv" j cu" dggp" wpf gtwngp" kp" ceeqtf cpeg" y kj " pqto cmf " ceegr vgf " i gqvej pkecn" gpi kpggtkpi "r tcevegu0" P q"qvj gt" y ctcpvf "ku" gztguugf "qt" lo r rkgf 0

Vj g" dgpej o ctnf" cpf "grgxcvkpu" o gpvkpgf "kp" vj ku" tgr qtv" y gtg" utxg{ gf "cpf "r tqxkf gf "d{ "CO EQ0" Vj g{ " uj qwf "pqv" dg" wugf "d{ "cp{ "qvj gt" r ctvf "hqt" cp{ "qvj gt" r wtr qug0

Cp{ "wug" y j lej "c" vj ktf "r ctvf "o cngu" qh" vj ku" tgr qtv. "qt" cp{ "tgnkpeg" qp" qt" f gekukpu" vq" dg" o cf g" dcugf "qp" kv" ctg" vj g" tgr qpukdkkvf "qh" uvej "vj ktf "r ctvku0" CO GE "ceegr w" pq" tgr qpukdkkvf "hqt" f co ci gu. "kh" cp{ ". uwhgtgf " d{ "cp{ "vj ktf "r ctvf "cu" c" tguwn" qh" f gekukpu" o cf g" qt" cevku" dcugf "qp" vj ku" tgr qtv0

"

8 Closure

Vj g"i gqvej plecn'tgr qtv"lqt "Dtkf i g"D/4"y cu"r tgr ctgf "d{ "O t0'P c| o wt "Tcj o cp."R0Gpi "cpf "ej gengf "d{ "F t0'F cp"F ko ktkw."R0Gpi 0'"Vj g"r tqlgev'y cu"gz gewgf "wpf gt"vj g"vej plecn'f k gevkp"qh"F t0'P ctgpf tc"U0' Xgto c."R0Gpi 0'y j q"cuq"r tqxkf gf "vj g"ugpkqt"tgxky "qh"vj g"tgr qtv0' "O t0' O cw" Qrf gy gplpi ."R0Gpi 0' o cpci gf "vj g"i gqvej plecn'lxgunki cvkp"cpf "O t0'Dtkcp"Ncr qu."R0Gpi 0'ku'vj g"r tqlgev'o cpci gt0'

Vj g"eqqr gtevkp"tgegxgf "ltqo "O u0'Dtklpc"Tblke."R0Gpi 0'cpf "O t0'Rj ktk "O wtte{ ."R0Gpi 0'qh"J cvej "O qw" O eF qpcrf "cpf "O t0'F cplgn'O w0 q| ."R0Gpi 0'qh"RE "f wtkpi "vj g"t guki p"uwf { "ku'i tcvghwm{ "cempqy ngf i gf 0'

"

[qwtu"twq{."

**AMEC Environment & Infrastructure,
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P c| o wt "Tcj o cp."O 0C0e0'R0G0'R0Gpi 0'
Ugpkqt "I gqvej plecn'Gpi kpggt"



"

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F cp"F ko ktkw"Rj (F 0'R0Gpi 0'
Cuqekcvg"I gqvej plecn'Gpi kpggt"
*Rtqlgev'Ngcf "F guki pgt+"

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P ctgpf tc"U0'Xgto c."Rj (F 0'R0Gpi 0'HCUEG."F 0 G0'
Rtkpek rnl gqvej plecn'Gpi kpggt"
*F guki pcvgf "O VQ"TCs UEqpvcev"

9 References

- T/30 Ccu."I 0"Ncecuug."U0"Nwppg."V0"cpf "J qgi . "M0"3; : 8."Wug"qh"lp"ukw"vguu"htq"t"hwpf cvkqp" f guki p"qp" erc { u0Rtqe0CUEG"Ur ge0Eqh0"lp"Ukw"} 8."CUEG"U UR"8."3/520'
- T/40 Co gtkecp"Y cvgt"Y qtnu"Cuuqekcvkqp."4227."CP UKCY Y C"E327 IC430/27"Co gtkecp"P cvkqpcn" Ucpf ctf"htq"Rqn{ gij { ngpg"Gpecugo gpv"htq" F wekg/Kqp"Rkr g"U{ ugo u0'
- T/50 Dctvqp."P0T0"Nlqp."T0"cpf "Nwpf g."L0"3; 960"Gpi kpggtkpi "Ercuukhcvkqp"qh"Tqem'O cuugu"htq"vj g" F guki p"qh"Vwppgn"Uwr r qtv."Tqem'O geij 0"8*6+."3; : /45; 0'
- T/60 Dj wuj cp."Mwn"Co cpvg."Ectnu"X0"cpf "Uccv{ . "Tco | k"4222."Uqkn"ko r tqxgo gpv'd{ "rtgeqo r tguukqp" cvc"cpnlncto "ukg"lp"EgptcnLxc."Kpf qpgukc."Hgd0360'
- T/70 Dlgpky unk" \ 0V0"3; 980'Tqem'o cuu"ercuukhcvkqp"lp"tqem'gpi kpggtkpi 0'Kp"gzr mtcvkvq"htq"tqem' gpi kpggtkpi . "Rtqe0qh"vj g"U{ o r 0qp"Gzr mtcvkvq"htq"tqem'Gpi kpggtkpi " *gf 0\ 0V0Dlgpky unk" C0C0' Dcmgo c."Tqwtgfc o . "3."; 9/3280Ecr g"Vqy p0'
- T/80 Dlggtwo . "N0"3; 94."Go dcpno gpvu"qp"uqh"i tqwpf < "UQC" Tgr qtv0'Rtqe0'Ur gekm{ "Eqphgtgpeg"qp" Rgthqto cpeg"qh"Gctvj "cpf "Gctvj /Uwr r qtvgf "Utwewtgu."CUEG."Rwtf wg."4."3/760'
- T/90 Eco r cpgmc."T0 0"cpf "J qy kg."L0C0"4227."I wkf grkpgu"htq"vj g" Wug."Kpvtg tgcvkqp"cpf "cr r hcvkvq" qh"ugkuo le"r kg| qeapg"vgu"fcv."C"O cpwcn"qp"Kpvtg tgcvkqp"qh"Ugkuo le"Rkg| qeapg"Vgu"Fc"htq" I gqvgj plecnF guki p."Lwpg0'
- T/: 0 Ecpcf kcp" I gqvgj plecn"Uqekgv{ . "4228."Ecpcf kcp" Hqwpf cvkqp" Gpi kpggtkpi "O cpwcn" *EHGO +."6vj " Gf kkp0'
- T/: 0 Ecpcf kcp" Ucpf ctf" Cuuqekcvkqp." 4228." Ecpcf kcp" J ki j y c{ " Dtkf i g" F guki p" Eqf g" *EJ DFE+." ECP IEUC/U8/28"U80080'
- T/320 Ecpcf kcp" Ucpf ctf" Cuuqekcvkqp." 422; ." Eqpetgvg" O cvgtkcn" cpf " O gvj qf u" qh" Eqpetgvg" Eqputwcvkqp IVgu' O gvj qf u'cpf "Ucpf ctf "Rtcevkgu"htq"Eqpetgvg"ECP IEUC/C450'
- T/330 Ej cpf rgt."T00"3; : : ."Vj g"lp"ukw"o gcuwtgo gpv"qh"vj g"wpf tclpgf "uj gct"utgpi vj "qh"erc { u'wukpi "vj g" hgrf " xcpg< "UQC" r cr gt0' Xcpg" Uj gct" Utgpi vj " Vgukpi "lp" Uqkn" Hgrf " cpf " Ncdqtcvqt { "Uwf kgu." CUVO "UVR"3236."35/660'
- T/340 F go gtu." F0' cpf " Ngtqwgkn" U0" 4224." Gxcnvcvkqp" qh" rtgeqpuqrkf cvkqp" rtguuwtg" cpf " vj g" qxgteqpuqrkf cvkqp"tcvkq"htqo "r kg| qeapg"vguu"qh"erc { "f gr quku"lp" S wgdge0'Ecpcf kcp" I gqvgj plecn' Lqwtpcn"5; *3+ "396/3; 40'
- T/350 F gr ctwo gpv" qh" vj g" Pcx{ . "3; : 8." Hqwpf cvkqpu" cpf " Gctvj " Utwewtgu" 0" F guki p" O cpwcn' 904." P CXHCE" F O /904." P cxenHcknkkgu" Gpi kpggtkpi "Eqo o cpf 0'
- T/360 F kwtlej . "L0R0" Tqy g." T0M0Dgengt." F 0G0"cpf "Nq." M0 0"4232." Kphwpgvg"qh"gz/ uqrkgf "i cugu"qp"utqr g" r gthqto cpeg"cv"vj g" Uctpkc" cr r tqcej "ew"vq"vj g" U0'Ernk" Vwppgn" Ecpcf kcp" I gqvgj plecn' Lqwtpcn" 69."; 93; : 60'
- T/370 Gpuqh"Kpe0"42260NRKNG"Vgej plecn'O cpwcn0'
- T/380 I qrf gt" Cuuqekcvgu" Nvf 0"4229." Rtgrko kpct { "hwpf cvkqp" kpxgukc cvkqp" cpf " f guki p" tgr qtv." F gvtqkv" Tkxgt "Kpvtgpcvqpcn' Etquukpi " Dtkf i g" Cr r tqcej "Eqttkf qt." I gqetgu" P q062L8/3: ." Qeqdgt0'
- T/390 I qrf gt" Cuuqekcvgu" Nvf 0"422; ." Y kpf uqt/ Guuz "Retny c{ . "I gqvgj plecn' F cv" Tgr qtv." I gqetgu" P q0' 62L8/49." Lwpg0'

"

Project: Y kpf uqt/ Guuz "Retny c{ "
Document: I gqvgj plecn' kpxgukc cvkqp" cpf " F guki p" tgr qtv"
 Dtkf i g" D/4" *Uc032- 84202: Y "q"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu" P q062L8/67+ "

Date: O ctej 4235"
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T/3: 0 I qrf gt" Cuuqekcvgu" Nf 0" 422; . " Y kpf uqt/ Guugz" Rctny c{ . " Uwdwhtceg" Eqpfc kkpqu" o" Dcugrkpg" Tgr qtv" I gqetgu" P q062L8/4: . " Lxpg0"

T/3: 0 I qrf gt" Cuuqekcvgu" Nf 0" 422; . " Y kpf uqt/ Guugz" Rctny c{ . " Uwdwhtceg" Eqpfc kkpqu" o" Kpvgtr tgcvkqp" Tgr qtv" I gqetgu" P q062L8/4: . " Tgxkukqp" F gego dgt0"

T/420 I qrf gt" Cuuqekcvgu" Nf 0" 422; . " Y kpf uqt/ Guugz" Rctny c{ . " I gqvgej plecn" F cvc" Tgr qtv" Cff gpf wo" P q03" o" Uqkn" Ej go knt { " F cvc" I gqetgu" P q062L8/49. " Hgdtwct { 0"

T/430 I qrf gt" Cuuqekcvgu" Nf 0" 422; . " Y kpf uqt/ Guugz" Rctny c{ . " I gqvgej plecn" F cvc" Tgr qtv" Cff gpf wo" P q04" o" Kp" Ukw" Etquu" J qrg" cpf" Xgt vlecn" Ugluo le" Rtqhkrg" Vgukpi . " I gqetgu" P q062L8/49. " O ctej 0"

T/440 I qrf gt" Cuuqekcvgu" Nf 0" 422; . " Y kpf uqt/ Guugz" Rctny c{ . " I gqvgej plecn" F cvc" Tgr qtv" Cff gpf wo" P q05" o" Uwr r ngo gpvct { " Eqp" Rgp gtcvkqp" Vgukpi . " I gqetgu" P q062L8/49. " Hgdtwct { 0"

T/450 I qrf gt" Cuuqekcvgu" Nf 0" 422; . " Y kpf uqt/ Guugz" Rctny c{ . " I gqvgej plecn" F cvc" Tgr qtv" Cff gpf wo" P q06" o" Uwr r ngo gpvct { " I gqvgej plecn" Kpxguki cvkqp. " O ctej 0"

T/460 I tqj le. " LNO" P cf ko . " H" cpf" Mxncnf . " VLO" 4227. " Qp" yj g" wpf tclpgf" uj gct" utgpi yj" qh" i cuu { " erc { u. " Ego r wgtu" cpf" I gqvgej pleu. " Gngxkgt. " 6: 5/6; 20"

T/470 I tqj le. " LNO" T qdgtuqp. " ROM" cpf" O qti gpvgt. " P 0T0" 3; ; . " Vj g" dgj cxkwt" qh" iqqug" i cuu { " ucpf . " Ecpcf kcp" I gqvgej plecn" Lqwtpcn" 58. " 6: 4/6; 40"

T/480 J wf ge. " RRO" 3; ; . " I gqmi { " cpf" I gqvgej plecn" Rtqr gtvgu" qh" I rnekn" Uqkn" kp" Y kpf uqt0"

T/490 KUOI G" Ego o kwgg" VE38. " 4223. " Vj g" Hrv" F krcvo gvg" vguu" F O V+ kp" uqkn" kpxguki cvkqp" Tgr qtv" d { " yj g" Kpvgtr tgcvkqp" Eqpht gpeg" qp" Kp" ukw" O gcwt go gpw" qh" Uqkn" Rtqr gtvgu. " Dcrk" Kp" qp gulk0"

T/4: 0 Kpvgtr tgcvkqp" Uqekvg" hqt" Tqeni" O gej cpleu" KUTO + " 3; 9: 0" Uwi i guvgf" o gy qf u" hqt" yj g" s wcpkcvkxg" f guetkr vkqp" qh" f kueqp vkvgu" kp" t qeni" o cuugu" Kp" 0LT qeni" O gej 0O kp" Uek0(" I ggo gej 0C dwt 037. " 53; /58: 0"

T/4: 0 Mpppg { . " VEO" 3; 7; . " F kuewukqp" qh" I gqvgej plecn" Rtqr gtvgu" qh" I rnekn" Ncng" Erc { u. " d { " VO" 0Y w. " Lqwtpcn" qh" yj g" Uqkn" O gej cpleu" cpf" Hqwpf cvkqp" F kxkukqp. " C" UEG. " Xqr0: 7. " P q0UO " 5. " RR089" 6" 9; 0"

T/520 Mwj cy { . " HJ" 0" cpf" O c { pg. " ROY" 0" 3; ; 2. " O cpwen" qp" Guko cvkpi " Uqkn" Rtqr gtvgu" hqt" Hqwpf cvkqp" F guki p. " Tgr qtv" GRT KGN8: 22. " Rcmj" Cnq. " EC. " Grgvle" Rqy gt" Tgugctej " Kpukwvg0"

T/530 Nc f f. " EEO" cpf" Hqgw. " T0" 3; 96. " P gy" f guki p" r tqegf wtg" hqt" ucdkxk { " qh" uqhw" erc { u. " Lqwtpcn" qh" yj g" I gqvgej plecn" Gpi kpggtkpi " F kxkukqp. " 322" 1 V9+ " 985/9: 80"

T/540 Nc f f. " EEO" Hqgw. " T0" Kij kj etc. " MO" Uej mqugt. " HO" cpf" Rqwrqu. " J I 03; 99. " Utguu/ f ghqto cvkqp" cpf" utgpi yj " ej ctcevgtkueu" UQC" tgr qtv" Rtqe0"; yj " Kp" 0" Eqpht" qp" Uqkn" O gej cpleu" cpf" Hqwpf cvkqp" Gpi 0" Vqm { q. " 4. " 643/6; 60"

T/550 Nc f f. " Ej ctrgu" E0" cpf" F gl tqqv. " F qp" LO" 4226. " Tgeqo o gpf gf" r tceveg" hqt" uqhw" i tqwpf" usg" ej ctcevgtk cvkqp" Ct y wt" Ecuci tcpf g" Ngewtg. " 34 yj " Rcp/ Co gtlecp" Eqpht gpeg" qp" Uqkn" O gej cpleu" cpf" I gqvgej plecn" Gpi kpggtkpi . " O K" Eco dtkf i g. " O C" WUC. " Lxpg" 44/47. " 4225. " Tgxkugf" O c { ; 0"

T/560 Ngtrqwgk" UO" O ci pcp. " LR0" cpf" Vcxgpcu. " HO" 3; ; 2. " Go dcpno gpw" qp" Uqhw" erc { u. " Gmku" J qty qqf 0"

T/570 Ngtrqwgk" UO" F go gtu. " F 0" cpf" Uckj k" HO" 4223. " Eqpukf gtcvkqp" qp" ucdkxk { " qh" go dcpno gpw" qp" erc { . " Uqkn" cpf" Hqwpf cvkqp. " Lcr cpgug" I gqvgej plecn" Uqekvg. " Xqr063. " P q07. " 339/349. " Qex0"

T/580 Nq. " MJ" 0" cpf" J kpej dgti gt. " UF0" 4228. " Ucdkxk { " cpcn { uku" ceeqwpkpi " hqt" o cetqueqr le" cpf" o ketqueqr le" utwewtgu" kp" erc { u. " Mg { pqvg" Ngewtg. " Rtqeggf kpi " 6 yj " Kpvgtr tgcvkqp" Eqpht gpeg" qp" Uqhw" Uqkn" Gpi kpggtkpi . " Xcpeqwxgt. " Ecpcf c. " r r " 5/56. " Qex06/80"

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Project: Y kpf uqt/ Guugz" Rctny c{ "
Document: I gqvgej plecn" Kpxguki cvkqp" cpf" F guki p" Tgr qtv"
 Dtkf i g" D/4" *Uc032- 84202: Y " q" 32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: " I gqetgu" P q062L8/67+ "

Date: O ctej 4235"
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T/590 Nwppg."V0" Tqdg tvqp."R0M0" cpf "Rqy gn" L0" 3; ; 9."Eqp" Rpggtcvkp" Vgukpi "kp" I gqvgej plecn' Rtcevleg0'

T/5; 0 O kpkmt { "qh" Vtcur qt cvkp "Qpwtck." 3; ; 2."Rcxgo gpvF guki p" cpf "Tgj cdkkcvkp" O cpwn "UF Q/; 2/ 230'

T/5; 0 P cvkpcn' J ki j y c { " Kpukwng." Hgf gten' J ki j y c { " Cf o kpkmtcvkp." P qxgo dgt" 422; ." F guki p" qh" O gej cplecm { "Ucdkkl gf "Gctvj "Y cmu" cpf "Tgkphqtegf "Y cmu" cpf "Tgkphqtegf "Uqkl'Uqr gu"6" Xqno g" K'HJ Y C/P J K32/2460'

T/620 S wki ng { ." Tqdg tv" O 0" 3; ; 2." I gqmi { ." o kpgtcmi { ." cpf "i gqej go kmt { "qh" Ecpcf kcp" uqhn" uqknc" c" i gqvgej plecn' r gtur gevkg. "P cvkpcn' Tgugctej "Eqwpekl'qh" Ecpcf c. "Ecpcf kcp" I gqvgej plecn' Lqwtpcn" Xqr039.'r r 0483/4: 70'

T/630 Uqdnqy kel. "L0E0" cpf "O qti gpungtp." P 0T0" 3; ; 6." Vj g" wpf tckpgf "gs wkldtkwo "dgj cxkqwt" qh" i cuu { " ugfk o gpw. "Ecpcf kcp" I gqvgej plecn' Lqwtpcn" Xqr043.'r r 065; /66: 0'

T/640 Vgt| ci j k" M0" Rgem" T0D0" cpf "O gutk" I 0" 3; ; 2." Uqkl' O gej cpleu" kp" Gpi kpggtkpi "Rtcevleg." Lqj p" Y kg { "cpf "Uqpu." P [0'

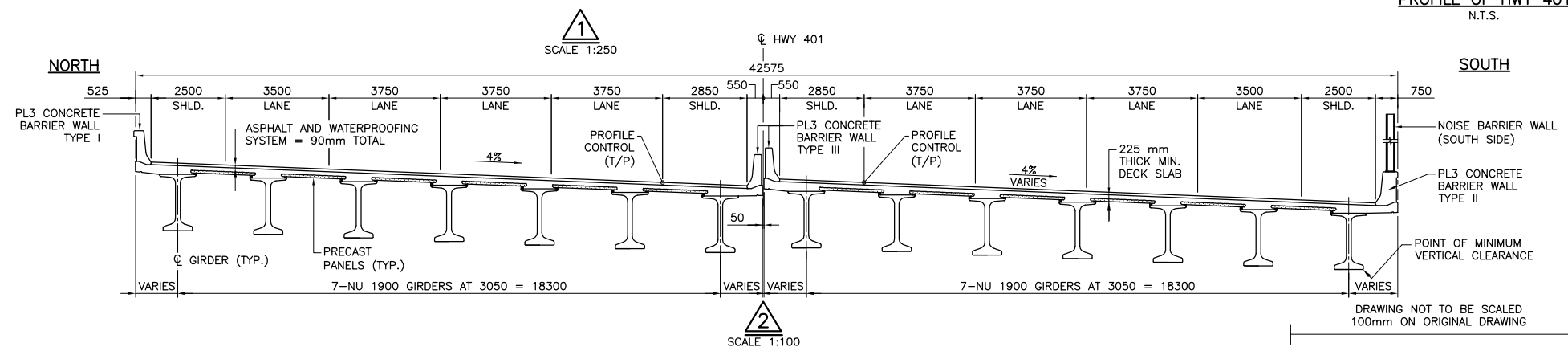
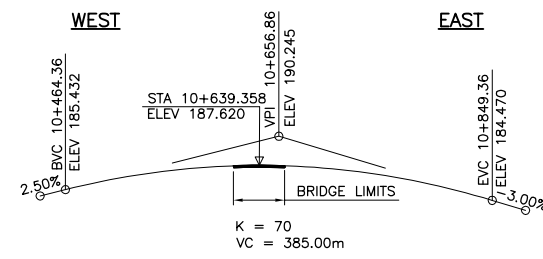
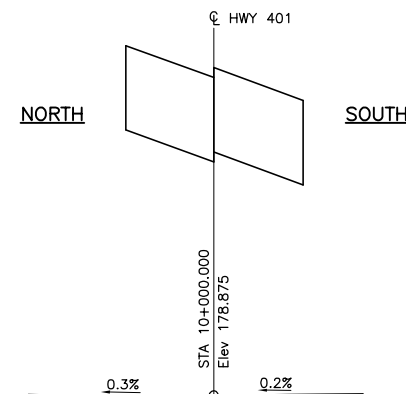
T/650 Y kpf uqt/ Guugz "O qdkkv { "I tqwr. "4232." F guki p" Uwdo kuukp. "Ugevkp" 7065"6" I gqvgej plecn' F guki p0'

T/660 Y { mkg. "F 0E0" 3; ; ; . "Hqwpf cvkpu" qp" Tqem" 4pf "gfp. "Vc { nqt" cpf "Hcpeku. "Nqpf qp. "WM." 623" r r 0'

"

"

"



DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



Windsor-Essex
Parkway Project
RFP No. 09-54-1007



NEW CONSTRUCTION
BRIDGE B-2
MATCHETTE ROAD OVERPASS
GENERAL ARRANGEMENT

SHEET

Phase 3
90% Sub

GENERAL NOTES

- | | | |
|--|--|---------|
| 1. CLASS OF CONCRETE: | | Phase 3 |
| <ul style="list-style-type: none"> • PRECAST GIRDERS: 60 MPa • PRECAST DECK PANELS: 40 MPa • CAST-IN-PLACE DECK OVERLAY: 40 MPa • REMAINDER: 30 MPa | | 90% Sub |
| 2. CLEAR COVER TO REINFORCING STEEL: | | |
| <ul style="list-style-type: none"> • FOOTINGS: 100 ± 25 • DECK: TOP 70 ± 20 BOTTOM 40 ± 10 • REMAINDER U.N.O: 70 ± 20 | | |
| 3. REINFORCING STEEL: | | |
| <ul style="list-style-type: none"> • REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED. • BAR MARKS WITH PREFIX 'C' DENOTE COATED BARS. • BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS. • BAR MARKS WITH PREFIX 'G1' DENOTE GFRP GRADE 1 BARS. • STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 OR TYPE XM-28 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa, UNLESS OTHERWISE SPECIFIED. • UNLESS SHOWN OTHERWISE, TENSION LAP SPICES SHALL BE CLASS B. • BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2 UNLESS SHOWN OTHERWISE. | | |

CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESS FROM THE TOP OF BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT THAN THOSE SPECIFIED IN THE BEARING DESIGN DATA TABLE, THE CONTRACTOR SHALL ADJUST THE REINFORCING STEEL AND CONCRETE FORMWORK TO SUIT.
2. BACKFILL SHALL NOT BE PLACED AGAINST ANY PORTION OF THE ABUTMENTS OR WINGWALLS UNTIL THE CONCRETE FOR THE DECK HAS BEEN PLACED AND ITS COMPRESSIVE STRENGTH HAS REACHED 30 MPa. BACKFILL SHALL BE PLACED BEHIND BOTH ABUTMENTS SIMULTANEOUSLY KEEPING THE HEIGHT OF BACKFILL APPROXIMATELY THE SAME AT ALL TIMES. DURING PLACEMENT, THE HEIGHT OF THE BACKFILL AGAINST ONE ABUTMENT SHALL NEVER EXCEED THE HEIGHT OF BACKFILL AGAINST THE OTHER ABUTMENT BY MORE THAN 500 mm. THE CONTRACTOR MUST ENSURE THE STABILITY OF THE ABUTMENTS DURING CONSTRUCTION.
3. ALL EXISTING UTILITIES SHALL BE ACCURATELY LOCATED PRIOR TO ANY CONSTRUCTION BEING CARRIED OUT. UNLESS NOTED OTHERWISE ON STRUCTURAL AND UTILITIES DRAWINGS, ALL EXISTING UTILITIES ARE TO REMAIN IN PLACE AND SHALL BE PROTECTED FROM DAMAGE DURING CONSTRUCTION OF THE BRIDGE AND EMBANKMENTS.
4. TEMPORARY EXCAVATION, SUBGRADE EXPOSURE AND PROTECTION, AND BACKFILLING SHALL CONFORM TO OPSS 902.
5. SETTLEMENTS AND GROUND DEFORMATIONS SHALL BE MONITORED DURING AND AFTER CONSTRUCTION.
6. VIBRATIONS SHALL BE MONITORED AT STRATEGIC LOCATIONS DURING PILING AND CONSTRUCTION ON TEMPORARY SLOPES AND ADJACENT TO UTILITIES.
7. FOR ALL HIGHWAY WORKS REFER TO HIGHWAY NEW CONSTRUCTION DRAWINGS.
8. FOR ALL ELECTRICAL AND ATMS WORKS REFER TO ELECTRICAL AND ATMS NEW CONSTRUCTION DRAWINGS.
9. FOR ALL UTILITY WORKS REFER TO UTILITY NEW CONSTRUCTION DRAWINGS.
10. FOR RSS NOTES SEE DRAWING S0210.
11. FOR INFORMATION ON EXISTING PAVEMENT AND INFRASTRUCTURE REFER TO HIGHWAYS REMOVAL DRAWINGS AND GENERAL NOTES PROVIDED WITHIN HIGHWAY REMOVALS DRAWING PACKAGE.

LIST OF ABBREVIATIONS

ABUT.	ABUTMENT	EXP	EXPANSION	THK.	THICK
BRS.	BEARINGS	FIX	FIXED	T.O.	TOP OF
BVC	BEGINNING OF	HORIZ.	HORIZONTAL	T/P	TOP OF PAVEMENT
	VERTICAL CURVE	HWY	HIGHWAY	TYP.	TYPICAL
C	CENTER LINE	MAX.	MAXIMUM	U.N.O.	UNLESS NOTED
CSP	CORRUGATED	MIN.	MINIMUM		OTHERWISE
	STEEL PIPE	NB	NORTHBOUND	U/S	UNDERSIDE
DIA.	DIAMETER	N.T.S.	NOT TO SCALE	VERT.	VERTICAL
EB	EASTBOUND	RSS	RETAINED SOIL	VPI	VERTICAL POINT OF
EL.	ELEVATION	SB	SOUTHBOUND		INTERSECTION
EVC	END OF VERTICAL	SHL	SHOULDER	WB	WESTBOUND
	CURVE	STA.	STATION	WP	WORKING POINT

APPLICABLE STANDARD DRAWINGS

OPSD 3000.100	FOUNDATION, PILES, STEEL H-PILE DRIVING SHOE
OPSD 3000.150	FOUNDATION, PILES, STEEL H-PILE SPLICE
OPSD 3101.150	WALLS, ABUTMENT, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD 3121.150	WALLS, RETAINING, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD 3190.100	WALLS, RETAINING AND ABUTMENT, WALL DRAIN
OPSD 3360.200	DECK LIGHT POLE BASES STRUCTURES WITH PARAPET WALLS
OPSD 3370.100	DECK, WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD
OPSD 3370.101	DECK, WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2 mm WIDE AND CONSTRUCTION JOINTS
OPSD 3390.100	DECK DRIP CHANNEL
OPSD 3419.100	BARRIERS AND RAILINGS, STEEL GUARDRAIL AND CHANNEL ANCHORAGE
OPSD 3941.200	FIGURES IN CONCRETE, SITE NUMBER AND DATE, LAYOUT
OPSD 3950.100	JOINTS, CONCRETE EXPANSION AND CONSTRUCTION, ON STRUCTURE

NOT FOR
CONSTRUCTION

REVISIONS								
	24-JAN-13	B	LM		90% MTO SUBMISSION			
	10-OCT-12	A	LM		60% MTO SUBMISSION			
	DATE	REV.	BY		DESCRIPTION			
DESIGN	LM	CHK	DO	CODE	CAN/CSA	S6-06	LOAD	CL 625-ONT
DRAWN	SC	CHK	LM	SITE	6-602		DATE	17-AUG-12

DOC: 285380-03-060-WIP3-0201



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

**Parkway
Infrastructure
Engineers**



Windsor-Essex
Parkway Project
RFP No. 09-54-1007



NEW CONSTRUCTION
BRIDGE B-2
MATCHETTE ROAD OVERPASS
FOUNDATION LAYOUT

SHEET

S----

Phase 3

90% Sub

NOTES

- FOR GENERAL NOTES, SEE DRAWING SHEET S0201.
- PRIOR TO COMMENCING INSTALLATION OF PILES, SEE NOTES ON DRAWING SHEET S0227. PILE INSTALLATION CAN COMMENCE SUBJECT TO APPROVAL BY THE GEOTECHNICAL ENGINEER TO CONFIRM SUBSTANTIAL GROUND CONSOLIDATION HAS OCCURRED BY PRELOADING AS DESCRIBED IN THE DESIGN REPORT - HIGH EMBANKMENT FOR PHASE III.
- ALL PILES SHALL BE HP 310 X 110 WITH STEEL CONFORMING TO CSA G40.20-04/G40.21-04, GRADE 350W.
- PILE SPACING SHALL BE MEASURED AT THE UNDERSIDE OF ABUTMENT SEAT.
- EACH PILE LENGTH SHOWN IN THE PILE DATA TABLE IS THE THEORETICAL LENGTH FROM THE SPECIFIED CUT-OFF ELEVATION TO THE ESTIMATED TIP ELEVATION.
- ALL PILES SHALL HAVE TYPE I DRIVING SHOES IN ACCORDANCE WITH OPSD 3000.100 OR APPROVED EQUIVALENT.
- ALL PILE SPLICES SHALL BE BUTT WELDED IN ACCORDANCE WITH STANDARD DRAWING SS103-12, OPSD 3000.150, AND OPSS 903. SPICE PLATES ARE NOT PERMITTED.
- SUPPLY PILE LENGTHS TO AVOID HAVING FIELD SPLICES WITHIN 6 METRES OF THE UNDERSIDE OF ABUTMENT SEATS.
- PILE DRIVING EQUIPMENT SHALL BE APPROPRIATE TO THE SUBSURFACE AND DRIVING CONDITIONS TO DEVELOP THE ULTIMATE GEOTECHNICAL RESISTANCE AND PREVENT DAMAGE TO THE PILES DURING DRIVING. CONSIDERATION SHALL BE GIVEN TO POTENTIAL DRIVING DIFFICULTIES DUE TO THE PRESENCE OF COBBLES AND/OR BOULDERS.
- HAMMER DETAILS (HAMMER TYPE AND MODEL, RATED ENERGY, HELMET AND CUSHION DETAILS) SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW 10 DAYS PRIOR TO EQUIPMENT MOBILIZATION ON SITE.
- EACH PILE SHALL BE DRIVEN IN ACCORDANCE WITH OPSS 903 TO BEDROCK OR REFUSAL IN THE VERY DENSE COHESIONLESS DEPOSIT OVERLYING THE BEDROCK TO DEVELOP AN ULTIMATE GEOTECHNICAL RESISTANCE OF 4000 kN GIVING A DESIGN FACTORED ULS RESISTANCE OF 2000 kN.
- THE ULTIMATE GEOTECHNICAL RESISTANCE OF A PILE AND REFUSAL CRITERIA SHALL BE CONFIRMED ON AT LEAST 3% OF THE PILES BY THE PDA METHOD SUPPLEMENTED WITH STATIC LOAD TESTS IN THE AREA OF THE STRUCTURE.
- SURVEY ALL PILE HEAD ELEVATIONS AT THE END OF DRIVING AND JUST PRIOR TO FORMING OF PILE CAP. RE-TAP PILES WHERE UPLIFT IS GREATER THAN 5 mm, OR AS DIRECTED BY THE ENGINEER.
- THE 600 mm DIAMETER CSP DENOTES GALVANIZED CORRUGATED STEEL PIPES WITH SQUARE ENDS AND A WALL THICKNESS OF 1.6 mm.
- DURING PILE DRIVING THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE MITIGATION MEASURES AGAINST ANY SEEPAGE OF NATURAL GAS AND GROUNDWATER THAT MIGHT CAUSE LOSS OF BEARING RESISTANCE.
- THE CONTRACTOR SHALL MONITOR VIBRATIONS AT STRATEGIC LOCATIONS (e.g. TEMPORARY SLOPES, UTILITIES, AND STRUCTURES) AND ESTABLISH APPROPRIATE FREQUENCY BASED UNITS ON PEAK PARTICLE VELOCITIES IN ORDER TO PREVENT DAMAGE CAUSED BY PILE DRIVING.

APPLICABLE STANDARD DRAWINGS

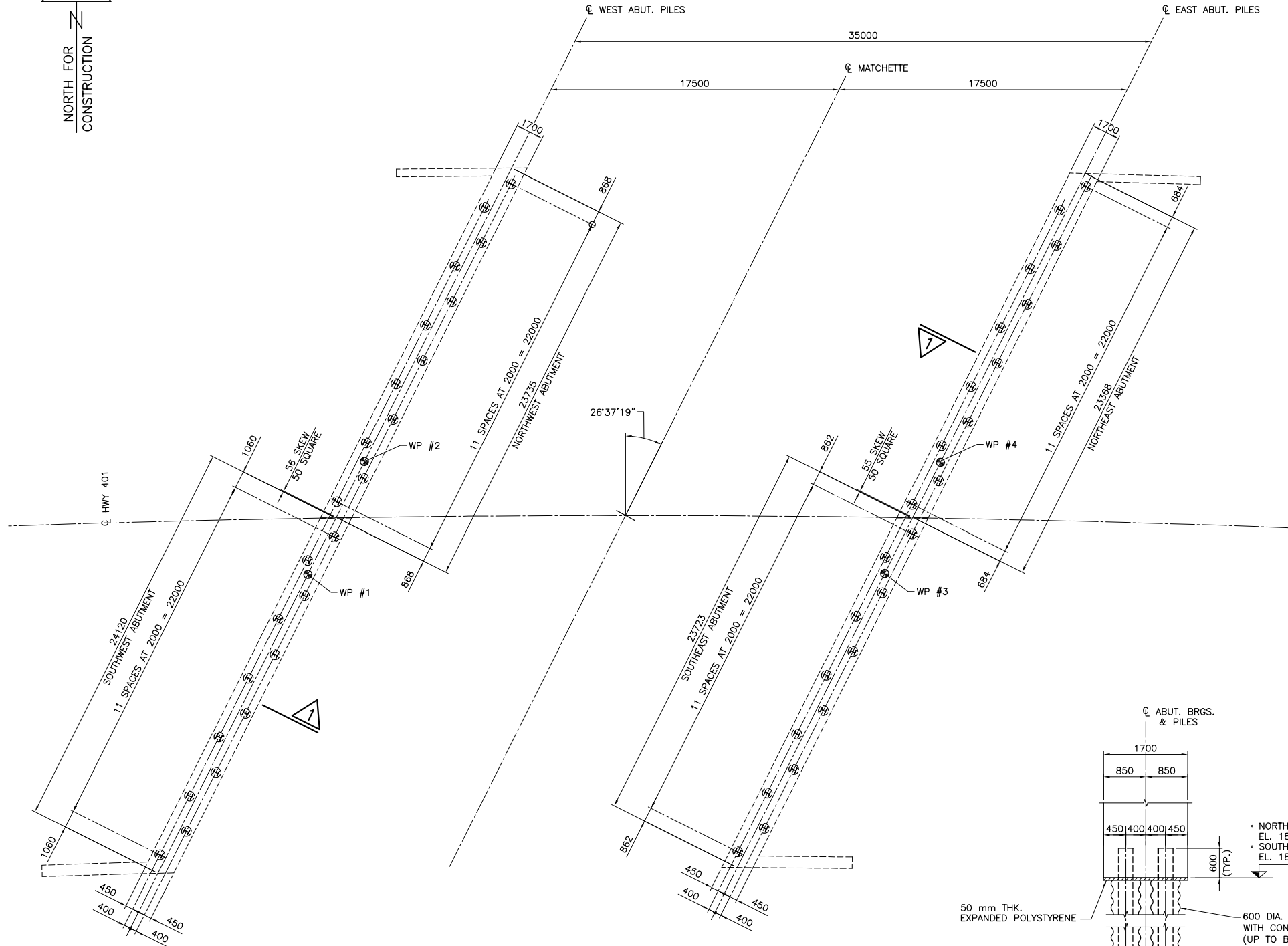
OPSD-3000.100 FOUNDATION PILES - STEEL H-PILE DRIVING SHOE
OPSD-3000.150 FOUNDATION PILES - STEEL H-PILE SPLICE

WORKING POINT DATA			
WORK POINT No.	STATION	CO-ORDINATES	
		NORTHING	EASTING
WP #1	10 + 620.008	4 682 225.493	329 089.633
WP #2	10 + 623.554	4 682 232.811	329 091.926
WP #3	10 + 655.147	4 682 231.163	329 124.199
WP #4	10 + 658.422	4 682 238.365	329 129.456

PILE DATA			
LOCATION	NUMBER OF PILES REQUIRED	LENGTH (m)	BATTER
NORTHWEST ABUTMENT	12	24.8	VERTICAL
NORTHEAST ABUTMENT	12	24.8	VERTICAL
SOUTHWEST ABUTMENT	12	24.8	VERTICAL
SOUTHEAST ABUTMENT	12	24.8	VERTICAL

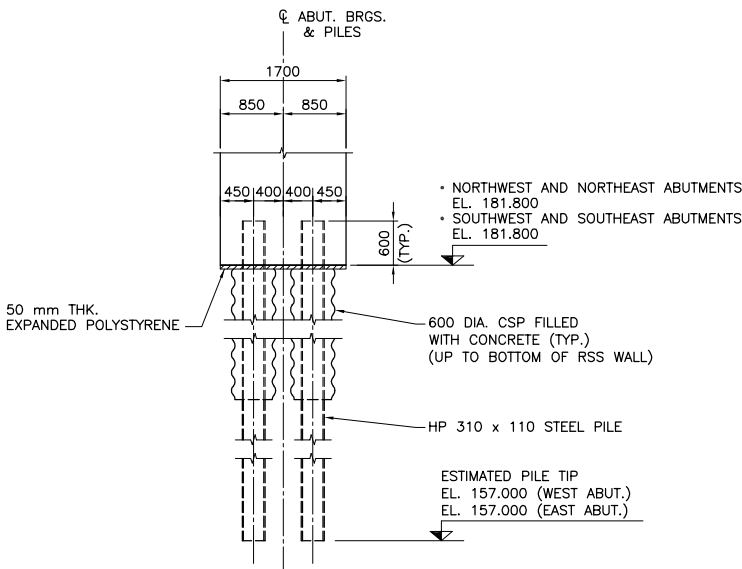
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10-OCT-12	A	LM	60% MTO SUBMISSION
DATE	REV.	BY	DESCRIPTION
DESIGN	LM	CHK DO	CODE CAN/CSA S6-06/LOAD CL 625-ONT
DRAWN	SC	CHK LM	SITE 6-602 DATE 17-AUG-12

DOC: 285380-03-061-WIP3-0204



PILE LAYOUT PLAN

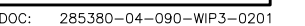
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100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



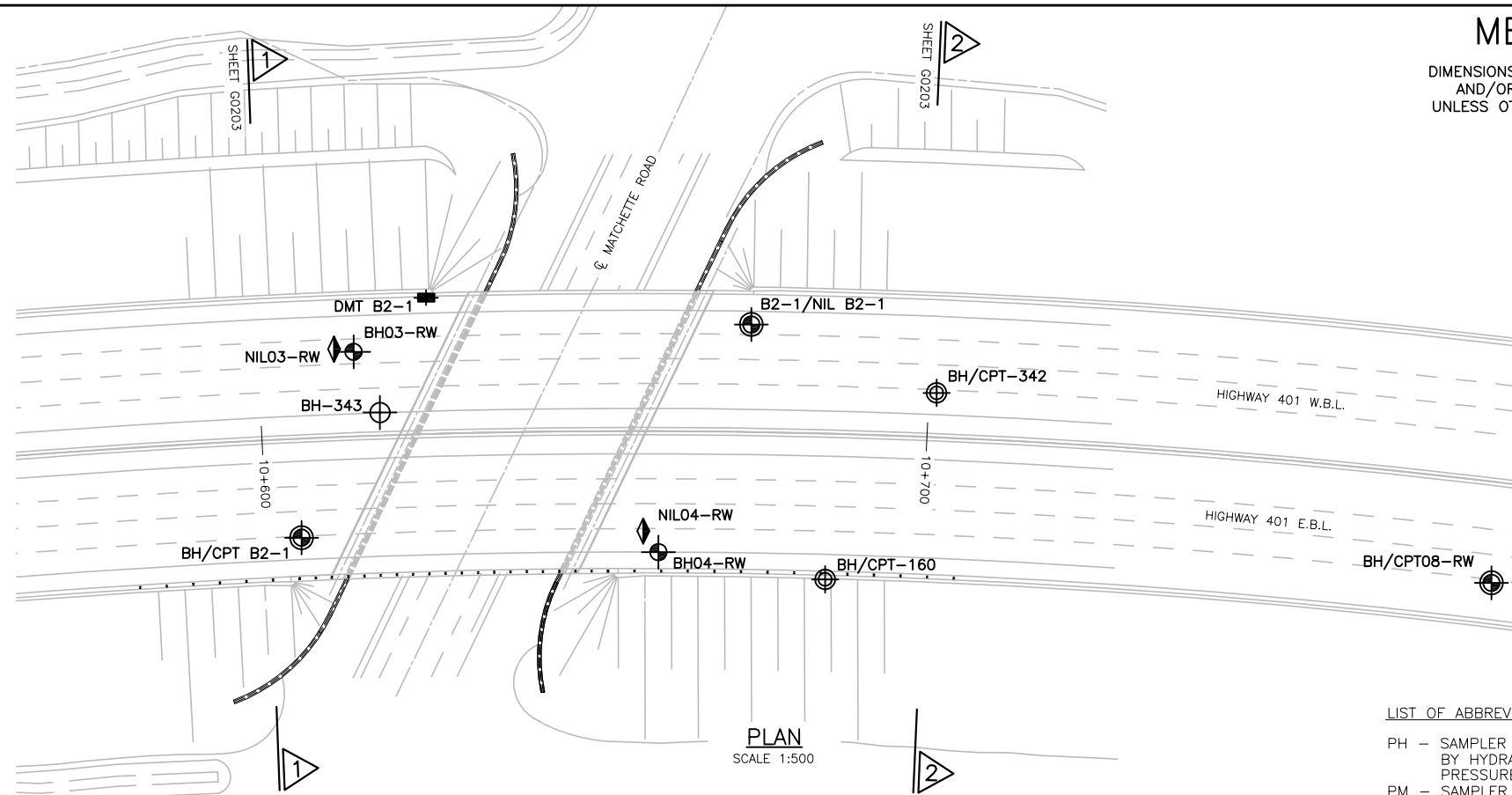
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
BRIDGE B-2
MATCHETTE ROAD OVERPASS
BOREHOLE LOCATIONS & SOIL STRATA



SHEET
G0202

Phase 3
IFC



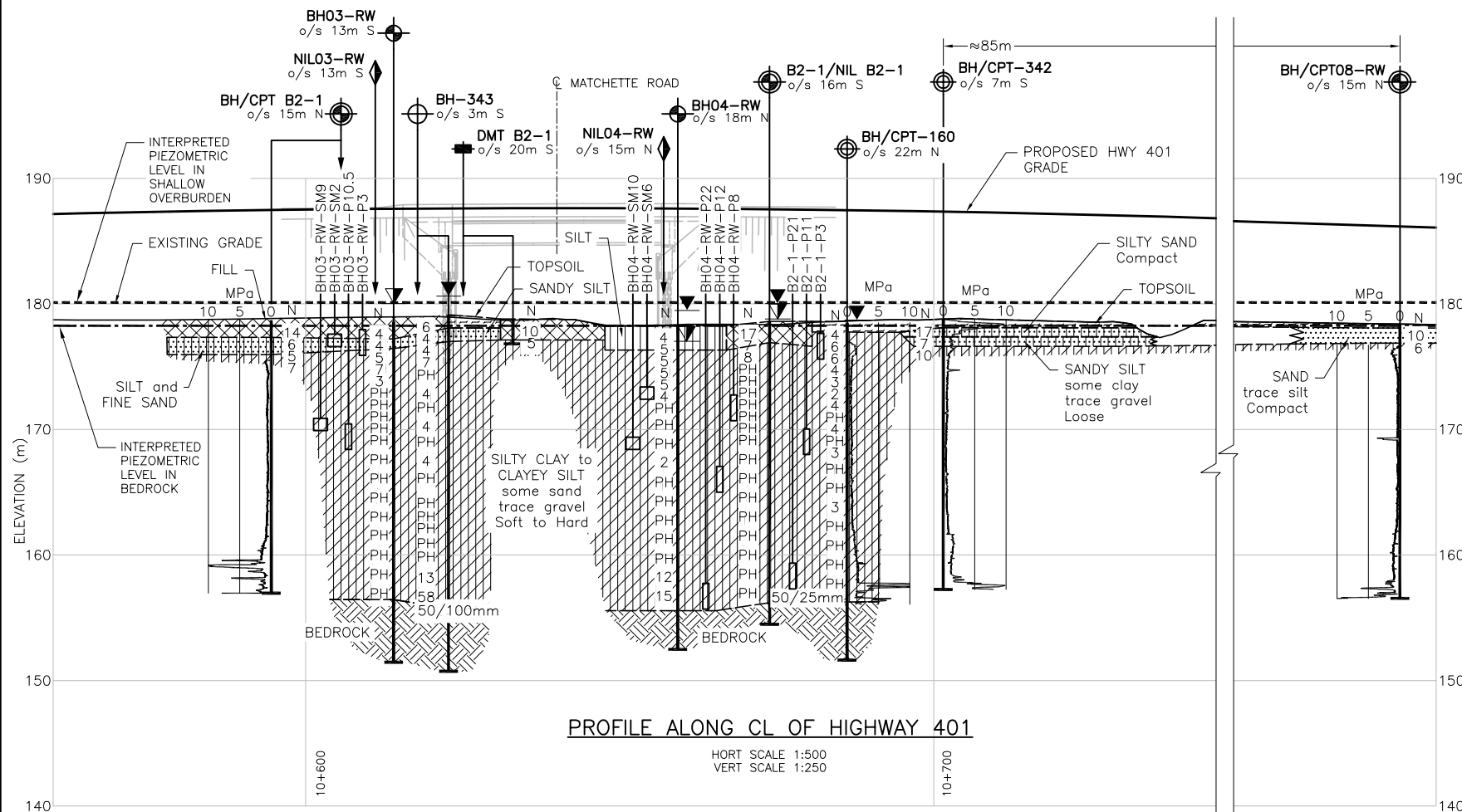
PLAN
SCALE 1:500

LIST OF ABBREVIATIONS

- PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

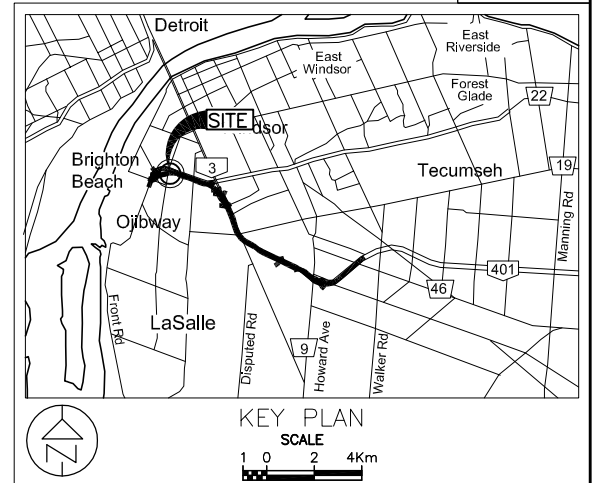
	TOPSOIL/ORGANICS		SILTY SAND
	FILL		SILTY SAND AND GRAVEL
	SAND		LIMESTONE /BEDROCK
	SILTY CLAY		
	SAND AND GRAVEL		
	SILTY SAND		
	COBBLES AND BOULDERS		
	SILTY CLAY to CLAYEY SILTY		
	SANDY SILT		
	SILTY SAND Compact		
	SILTY SAND some clay trace gravel Loose		
	SAND trace silt Compact		



PROFILE ALONG CL OF HIGHWAY 401

HORT SCALE 1:500
VERT SCALE 1:250

ELEVATION (m)	No.		ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
				NORTHING	EASTING
	AMEC BOREHOLES				
	B2-1/NIL	B2-1	178.6	4682253.0	329139.6
	BH03-RW		178.9	4682240.3	329081.1
	BH04-RW		178.3	4682217.2	329130.8
	DMT B2-1		178.8	4682249.9	329090.6
	BH/CPT08-RW		178.4	4682230.8	329255.3
	BH/CPT B2-1		178.8	4682211.4	329077.4
	NIL03-RW		178.9	4682240.3	329078.1
NIL04-RW		178.4	4682220.0	329128.1	
PREVIOUS BOREHOLES					
BH-343		179.1	4682231.8	329086.3	
BH/CPT-160		178.5	4682216.8	329156.2	
BH/CPT-342		178.8	4682246.9	329168.7	



KEY PLAN

SCALE
1 0 2 4Km

LEGEND

- BOREHOLE CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
- SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
- NILCON VANE CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- N SPT N-VALUE
- BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- MHS - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
- P - VIBRATING WIRE PIEZOMETER (VWP)
- DRY BOREHOLE DRY DURING DRILLING
- WATER LEVEL DURING DRILLING
- WATER LEVEL (SHALLOW PIEZO)
- WATER LEVEL (DEEP PIEZO)

NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
- THE INTERPRETED STRATIGRAPHY REPRESENTS SIMPLIFIED SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS BETWEEN BOREHOLE LOCATIONS COULD DIFFER FROM ILLUSTRATED CONDITIONS.
- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

REVISIONS	20-MAR-13				ISSUED FOR CONSTRUCTION			
	DATE	REV.	BY		DATE	REV.	BY	
DESIGN	NR	CHK	NSV	CODE	CAN/CSA	S6-06	LOAD	CL-625-ONT
DRAWN	MM	CHK	DD	SITE	6-602		DATE	03-JAN-12

METRIC

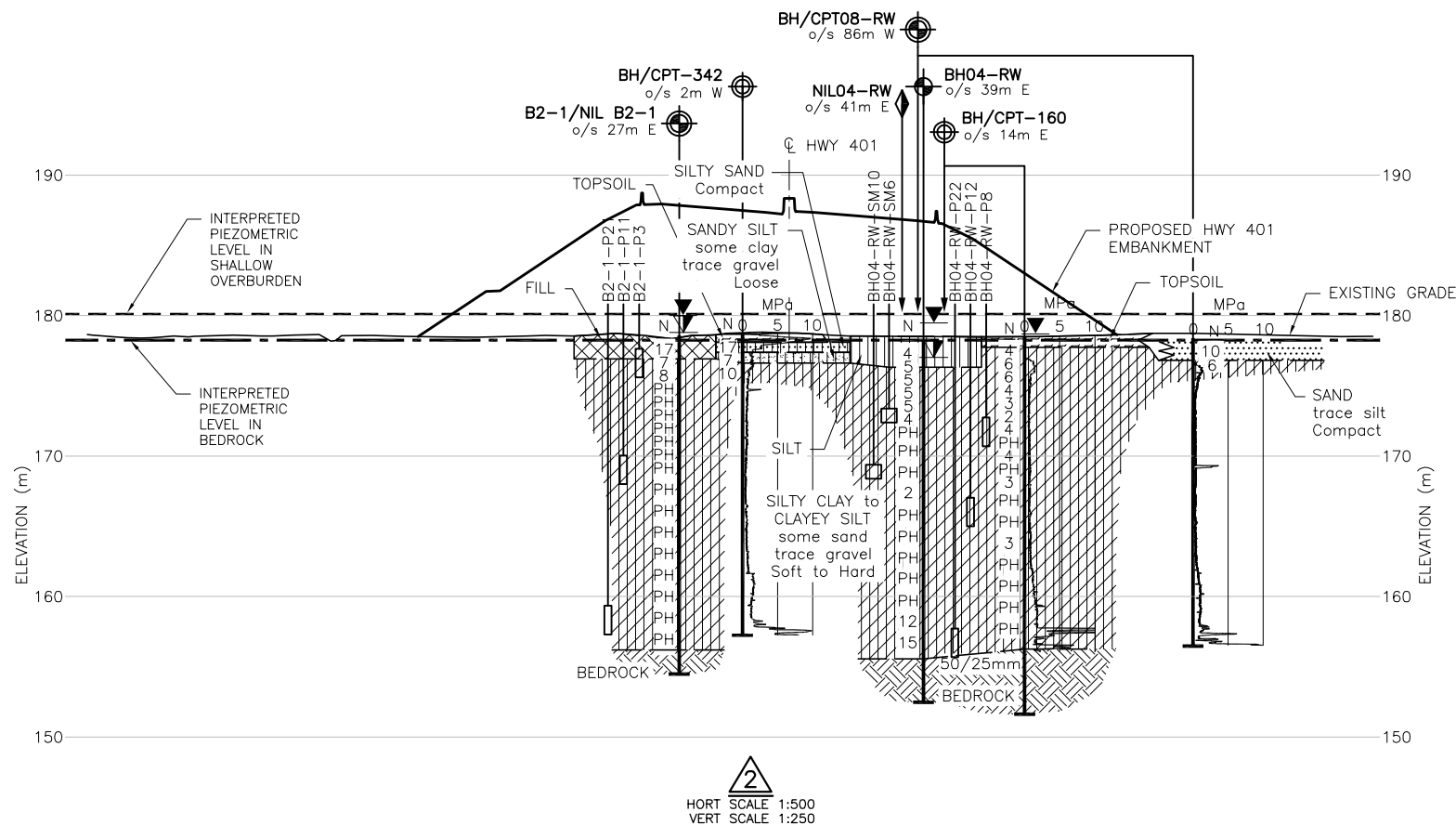
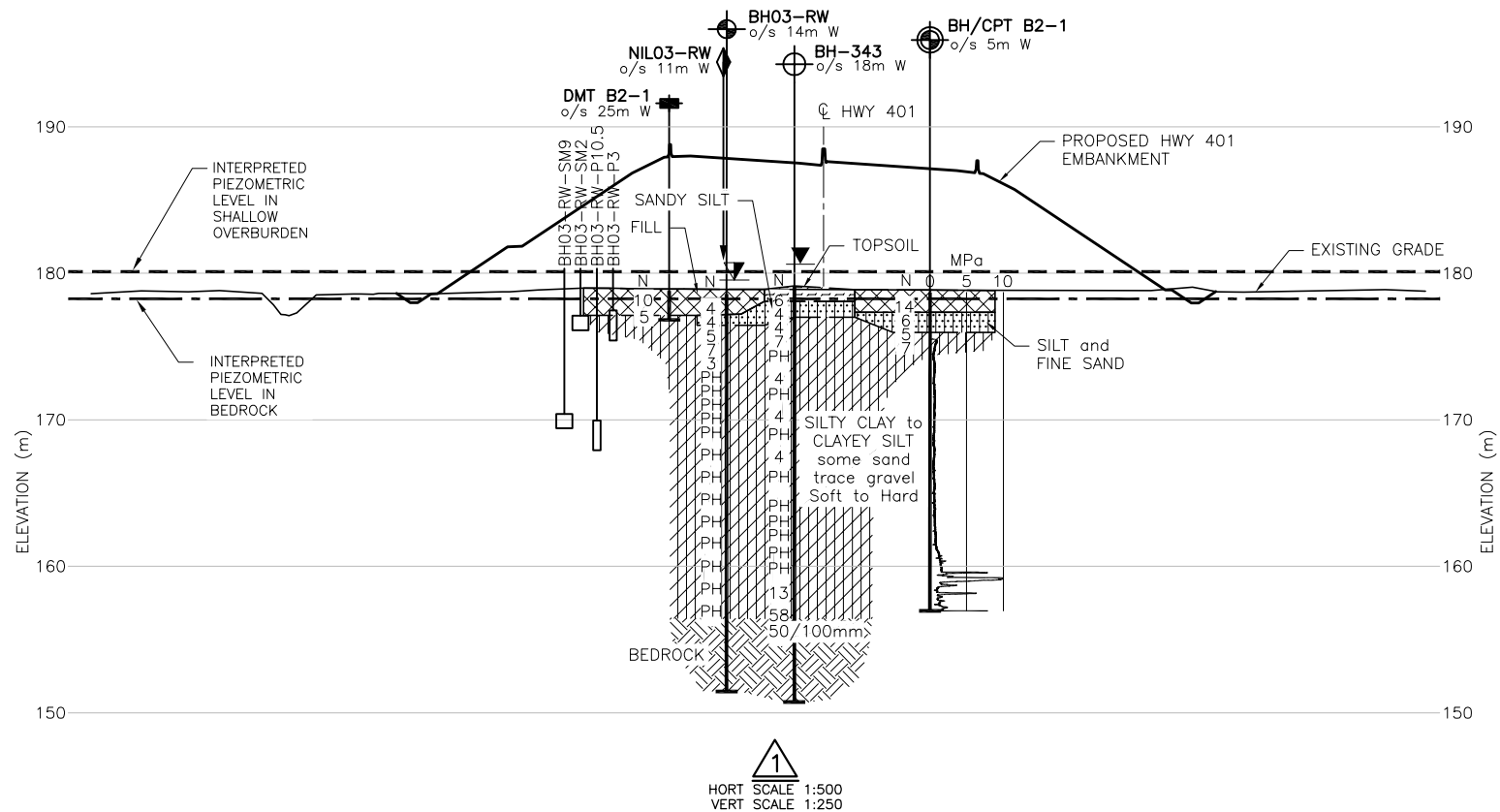
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
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Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
BRIDGE B-2
MATCHETTE ROAD OVERPASS
SOIL STRATIGRAPHY

SHEET

G0203

Phase 3

IFC

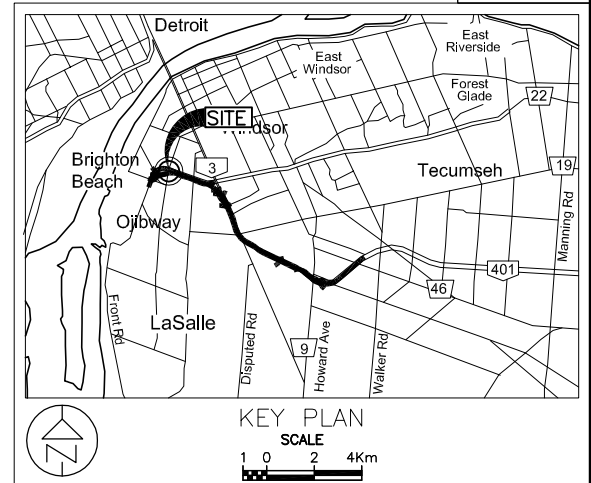


LIST OF ABBREVIATIONS

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PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

	TOPSOIL/ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE DOLOSTONE /BEDROCK



LEGEND

	BOREHOLE CURRENT INVESTIGATION
	BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
	SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
	NILCON VANE CURRENT INVESTIGATION
	CPT - CURRENT INVESTIGATION
	DMT - CURRENT INVESTIGATION
	BOREHOLE PREVIOUS INVESTIGATION
	BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
	CPT -PREVIOUS INVESTIGATION
N	SPT N-VALUE
16	BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
	P - VIBRATING WIRE PIEZOMETER (VWP)
DRY	BOREHOLE DRY DURING DRILLING
	WATER LEVEL DURING DRILLING
	WATER LEVEL (SHALLOW PIEZO)
	WATER LEVEL (DEEP PIEZO)
	MHSg - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
	CPT-qc

NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	DATE	REV.	BY	DESCRIPTION
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DESIGN NR	CHK NSV	CODE CAN/CSA S6-06	LOAD	CL-625-ONT
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DOC: 285380-04-091-WIP3-0203

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MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707
BR-05

CONSTRUCTION NOTES – BACKFILL AT STRUCTURES

1.0 GENERAL REQUIREMENTS

- 1.1. THESE CONSTRUCTION NOTES RELATE TO THE SUPPLY AND PLACEMENT OF BACKFILL MATERIALS AT THE STRUCTURES AT THE WINDSOR-ESSEX PARKWAY (WEP) PROJECT AS ILLUSTRATED ON THE ACCOMPANYING DRAWINGS. THE REQUIREMENTS GIVEN HEREFTER ARE THE GENERAL REQUIREMENTS. FOR DETAILED REQUIREMENTS, THE CONTRACTOR SHOULD REFER TO APPROPRIATE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS (OPSS) LISTED IN SECTION 1.6.
- 1.2. THESE CONSTRUCTION NOTES ARE TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN DRAWINGS AND REPORT.
- 1.3. FOR LIGHTWEIGHT FILL (LWF), REFER TO CONSTRUCTION NOTES FOR LIGHTWEIGHT FILL MATERIAL.
- 1.4. FOR EXPANDED POLYSTYRENE (GEOFOAM, EPS) FILL, REFER TO CONSTRUCTION NOTES FOR EXPANDED POLYSTYRENE FILL.
- 1.5. THESE REQUIREMENTS DO NOT APPLY TO THE HIGHWAY PAVEMENT CONSTRUCTION.
- 1.6. THE CONSTRUCTION WORKS SHALL BE EXECUTED IN ACCORDANCE WITH THE GEOTECHNICAL DESIGN ILLUSTRATED ON THE ACCOMPANYING DRAWINGS, THE SUPPLIER SPECIFICATIONS AND THE REQUIREMENTS SPECIFIED IN THE FOLLOWING STANDARDS, SPECIFICATIONS AND PUBLICATIONS:

- ASTM D422 PARTICLE-SIZE ANALYSIS OF SOILS
- ASTM D2216 MOISTURE CONTENT OF SOILS
- ASTM D2850 UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS
- ASTM D2922 DENSITY OF SOIL AND SOIL-AGGREGATE IN PLACE BY NUCLEAR METHODS
- ASTM D3017 WATER CONTENT OF SOIL AND ROCK IN PLACE BY NUCLEAR METHODS
- ASTM D5856 HYDRAULIC CONDUCTIVITY OF POROUS MATERIALS USING A RIGID WALL PERMEAMETER

- OPSS 201 CLEARING, CLOSE CUT CLEARING, GRUBBING, REMOVAL OF SURFACE AND PILES BOULDERS
- OPSS 206 GRADING
- OPSS 212 BORROW
- OPSS 401 TRENCHING, BACKFILLING AND COMPACTING
- OPSS 501 COMPACTING
- OPSS 517 DEWATERING AT PIPELINE, UTILITY AND ASSOCIATED STRUCTURE EXCAVATION
- OPSS 518 CONTROL OF WATER FROM DEWATERING OPERATIONS
- OPSS 805 TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES
- OPSS 902 CONSTRUCTION SPECIFICATIONS FOR EXCAVATING AND BACKFILLING – STRUCTURES
- OPSS 1001 AGGREGATES – GENERAL
- OPSS 1004 AGGREGATES – MISCELLANEOUS
- OPSS 1010 AGGREGATES – BASE, SUBBASE, SELECT SUBGRADE AND BACKFILL MATERIAL
- OPSS 1860 GEOTEXTILE
- OPSD 208.010 BENCHING OF EARTH SLOPES

- 1.7 IF THERE IS ANY CONFLICT BETWEEN THE REQUIREMENTS GIVEN ON THIS DRAWING AND THE STANDARDS AND SPECIFICATIONS DOCUMENTS LISTED IN SECTION 1.6, THE DESIGNER SHOULD BE CONSULTED FOR CLARIFICATION AND RECOMMENDATIONS.
- 1.8 IN THE FOLLOWING CONSTRUCTION NOTES, THE CONTRACTOR MEANS PIC AND ITS SUB-CONTRACTORS, THE SUPPLIER MEANS THE MANUFACTURER AND PROPRIETARY SUPPLIER, THE ENGINEER MEANS THE GEOTECHNICAL SITE ENGINEER, AND THE DESIGNER MEANS THE GEOTECHNICAL DESIGNER OF THE PROJECT.

2.0 SITE PREPARATION AND EXCAVATION

- 2.1 CLEARING AND GRUBBING AREA SHALL EXTEND MINIMUM 3 m BEYOND THE FOOTPRINT AREA OF THE STRUCTURE, OR AS REQUIRED BY THE ENGINEER. THE TREES AND SHRUBS REMOVED FROM THE GROUND SHALL BE TRANSPORTED TO DESIGNATED AREAS.
- 2.2 THE STRIPPING AREA SHALL EXTEND MINIMUM 1 m BEYOND THE FOOTPRINT AREA OF THE STRUCTURE, OR AS REQUIRED BY THE ENGINEER. ALL PEAT/MUSKEG, WETLAND VEGETATION AND OTHER UNSUITABLE MATERIAL SHOULD BE STRIPPED AND TRANSPORTED TO DESIGNATED AREAS.
- 2.3 CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN, CONSTRUCTION METHODS AND PERFORMANCE OF THE TEMPORARY SLOPES AND WORKS.
- 2.4 ALL EXCAVATION WORKS SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE GUIDELINES OUTLINED IN OCCUPATIONAL HEALTH AND SAFETY ACT (OHSA) AND ONTARIO PROVINCIAL STANDARD SPECIFICATION (OPSS) 902. NATIVE DEWATERED SOILS AT THE SITE AND COMPACTED FILLS MAY BE CLASSIFIED IN GENERAL AS TYPE 3 SOILS. UNDEWATERED FILLS, NATIVE SAND AND SILTS, AND WATER BEARING BACKFILL WITHIN TRENCHES OF ACTIVE AND/OR ABANDONED UTILITIES MAY DEVELOP TYPE 4 SOIL CONDITIONS AND SHALL BE ADDRESSED ACCORDINGLY.

- 2.5 THE SOILS AT THE PROJECT SITE ARE HIGHLY SUSCEPTIBLE TO RAPID DETERIORATION WHEN EXPOSED TO ELEMENTS, WEATHERING, WATER INFLOW AND PONDING, DISTURBANCE FROM CONSTRUCTION TRAFFIC, AND THE LIKE. SUBGRADE SOILS AND BACKFILL IN PROGRESS SHALL BE APPROPRIATELY PROTECTED AT ALL TIMES AGAINST SURFACE EROSION, DESICCATION, AND FREEZE-THAW EFFECTS, REGULARLY INSPECTED AND MONITORED, AND TREATED AS REQUIRED.
- 2.6 TO PROTECT THE SUBGRADE INTEGRITY, THE FINAL EXCAVATION LAYER ABOVE THE DESIGN ELEVATION IN GENERAL SHOULD NOT BE LESS THAN 0.5 m AND SHOULD BE CARRIED OUT ONLY WHEN THE CONTRACTOR IS READY TO PREPARE AND COVER/PROTECT THE SUBGRADE SAME DAY THE FINAL EXCAVATION IS EXPOSED AND APPROVED.
- 2.7 NO CONSTRUCTION TRAFFIC SHOULD BE PERMITTED OVER THE SUBGRADE WITHOUT APPROVED PROTECTIVE COVERS.
- 2.8 THE SUBGRADE EXCAVATION SHALL BE CUT TO NEAT LINES AND GRADES USING BUCKETS EQUIPPED WITH SMOOTH LIPS. ONCE EXPOSED, THE SUBGRADE MUST BE IMMEDIATELY INSPECTED. UPON APPROVAL, THE SUBGRADE SURFACE SHOULD BE COVERED WITH SKIM COAT OF LEAN CONCRETE MUD MAT, GRANULAR OVER GEO-FABRIC, GRANULAR OVER SUBGRADE, ETC., AS APPROVED BY THE ENGINEER, FOR PROTECTION AGAINST DISTURBANCE AND TO PROVIDE A WORKING SURFACE.
- 2.9 THE TEMPORARY EXCAVATION SURFACES SHALL BE BENCHED ACCORDING TO OPSD 208.010. UNLESS THE GRANULAR BACKFILL IS FILTER GRADED WITH RESPECT TO THE NATIVE SUBGRADE MATERIAL, A GEOTEXTILE LAYER (TERRAFIX 360R OR EQUIVALENT) SHALL BE PLACED AT THE BENCHED INTERFACE BETWEEN THE EXCAVATED SURFACE AND THE GRANULAR BACKFILL TO FUNCTION AS A SEPARATOR AND PREVENT MIGRATION OF FINES.
- 2.10 IF PRESENCE OF GASSY SOILS IS EVIDENCED (FOR EXAMPLE, DISSOLVED GAS BUBBLES COMING OUT OF SOLUTION AND/OR SOFTENING OF THE EXCAVATION FACE), THE EXCAVATION PROGRESS SHALL BE REVIEWED WITH THE ENGINEER IN TERMS OF TIMING, STAGING AND OTHER MITIGATION MEASURES.
- 2.11 THE CONTRACTOR SHOULD EMPLOY APPROPRIATE GROUND IMPROVEMENT APPROACH (E.G., SUITABLE FILL LAYER, GEOGRID SHEET, ETC.) TO FACILITATE CONSTRUCTABILITY, WHERE REQUIRED, AS APPROVED BY THE ENGINEER.
- 2.12 THE SUBGRADE SHOULD BE SLOPED APPROPRIATELY TO ACHIEVE POSITIVE DRAINAGE OF SEEPAGE AND SURFACE WATER TO SUBDRAINS, DITCHES OR SUMPS TO AVOID PONDING BENEATH ANY FILL PLACED. NO PONDING OR FLOODING SHALL BE ALLOWED TO OCCUR IN AREAS OF FINAL EARTHWORKS (SEE SECTION 6 ON DRAINAGE – REQUIREMENTS).

3.0 REINFORCED GRANULAR MAT (RGM)

- 3.1 THE RGM ARE REINFORCED SOIL MATS COMPRISING SELECT COMPACTED GRANULAR FILL AND REINFORCEMENT (GEOSYNTHETICS OR METALLIC)
- 3.2 GRANULAR FILL FOR RGM: THE FILL MATERIAL SHALL BE GRANULAR 'A' OR GRANULAR 'B' TYPE II (OPSS 1010) PLACED AS PER NOTE 5.3 AND COMPACTED TO NOT LESS THAN 98%.
- 3.3 REINFORCEMENT FOR RGM: AS PER CONTRACT DOCUMENTS.

4.0 FILL MATERIALS

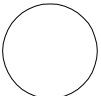
- 4.1 ALL FILL MATERIALS TO BE USED AS BACKFILL FOR STRUCTURES SHALL BE INERT MATERIAL, FREE OF ORGANIC MATERIAL AND DELETERIOUS SUBSTANCES. ALL FILL MATERIALS SHALL BE APPROVED BY THE ENGINEER AT THE BORROW SOURCE AND AT PLACEMENT LOCATION.
- 4.2 SILTY CLAY FILL: THE UPPER CLAY CRUST ZONE MATERIAL OBTAINED FROM REQUIRED EXCAVATIONS IN THE DEPRESSED SEGMENTS OF THE WEP OR OTHER SOURCES APPROVED BY THE ENGINEER SHALL BE USED AS PER DRAWINGS PROVIDED IT MEETS THE OPSS 902 REQUIREMENTS AND CAN BE COMPACTED TO AT LEAST 95% SPMDD. THE SUITABILITY OF THE CLAY FILL MATERIALS SHALL BE VERIFIED IN TERMS OF ITS GRADATION (E.G., SILTY CLAY TO CLAYEY SILT), PLASTICITY CHARACTERISTICS (LOW TO MEDIUM PLASTICITY INDEX) AND THE IN-SITU MOISTURE CONTENT. ALL SUITABLE METHODS TO ACHIEVE THE SPECIFIED PLACEMENT MOISTURE CONTENT SHALL BE EMPLOYED.
- 4.3 GRANULAR FILL FOR GENERAL BACKFILL: THE GRANULAR FILL MATERIAL SHALL BE GRANULAR 'B' TYPE I OR II, OR ALTERNATIVE GRANULAR MATERIALS APPROVED BY THE ENGINEER. THE SUITABILITY OF GRANULAR FILL MATERIALS SHALL BE DETERMINED AS PER THE OPSS 1010 STANDARD AND THE REQUIREMENTS OF THE RSS/RGM SUPPLIER.
- 4.4 RIPRAP: THE RIPRAP MATERIAL FOR EROSION PROTECTION OF PERMANENT SLOPES AND CHANNEL SURFACES SHALL BE R-10 (MINUS 180 mm) FOR LIGHT TO MEDIUM EROSION RISK CONDITIONS AND R-50 (MINUS 305 mm) FOR HIGH RISK CONDITIONS, AS SHOWN ON THE DESIGN DRAWINGS OR AS REQUIRED BY THE ENGINEER (OPSS 1004). GEOTEXTILE SHALL BE USED AT INTERFACE BETWEEN THE SOIL SLOPES AND RIPRAP LAYER TO PREVENT LOSS OF MATERIAL FROM THE SOIL SLOPE.
- 4.5 LWF AND EPS: SEE RESPECTIVE CONSTRUCTION NOTES.

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



Windsor–Essex
Parkway Project
RFP No. 09–54–1007



NEW CONSTRUCTION
BRIDGE B-2
MATCHETTE ROAD OVERPASS
CONSTRUCTION NOTES – BACKFILL AT STRUCTURES

SHEET
G0228

Phase 3

IFC

5.0 FILL PLACEMENT AND COMPACTION

5.1 GENERAL:

- THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER THEIR QC/QA INSPECTION AND TEST PLAN FOR REVIEW/COMMENT PRIOR TO THE PLACEMENT/COMPACTION OF FILL.
- FILL SHALL NOT BE PLACED ON SURFACES HAVING STANDING WATER, OR SURFACES WHICH HAVE BEEN RUTTED AND HEAVED BY TRAFFICKING. FILL SHALL NOT BE PLACED ON FROZEN SURFACES. FROZEN FILL IS DEFINED AS MATERIALS WITH SOIL WATER IN FROZEN STATE.
- ALL EARTHWORKS TO BE ADEQUATELY PROTECTED AGAINST EROSION, FROST AND WATER INGRESS UNTIL THE LANDSCAPING REQUIREMENTS HAVE BEEN INSTALLED (SEE SECTIONS 2.6 TO 2.8).

5.2 IF NOT SPECIFIED IN THE CONTRACT DOCUMENTS, TARGET DENSITIES WILL BE ESTABLISHED UTILIZING CONTROL STRIPS AS PRESENTED IN OPSS 501. THE MINIMUM TARGET DENSITIES SHALL BE AS PER NOTES 5.3 AND 5.4.

5.3 THE SILTY CLAY FILL SHALL BE PLACED IN MAXIMUM 200 mm THICK LOOSE LIFTS AND COMPACTED AT WOPT±2% MOISTURE CONTENT TO A MINIMUM OF 95% SPMDD UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS. THE TERMS WOPT AND SPMDD REFER TO OPTIMUM WATER CONTENT AND MAXIMUM DRY DENSITY, RESPECTIVELY, DETERMINED BY STANDARD PROCTOR TESTS.

5.4 THE GRANULAR FILL MATERIALS SHALL BE PLACED IN MAXIMUM 300 mm THICK LOOSE LIFTS AND COMPACTED AT WOPT±2% MOISTURE CONTENT TO A MINIMUM OF 95% SPMDD UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS.

5.5 THE COMPACTION EQUIPMENT SHALL BE APPROPRIATE FOR THE MATERIAL TO BE COMPACTED AND THE SITE CONDITIONS, AND SHOULD BE PROPOSED TO THE ENGINEER FOR APPROVAL. ADEQUATE NUMBER OF PASSES SHALL BE EMPLOYED TO ACHIEVE THE SPECIFIED PLACEMENT DENSITIES. HEAVY COMPACTION EQUIPMENT SHOULD NOT BE EMPLOYED NEAR STRUCTURAL WALLS.

5.6 COMPACTION AND PLACEMENT OF GRANULAR MATERIALS FOR RSS WALLS SHALL CONFORM TO THE MANUFACTURER'S RECOMMENDATIONS.

5.7 FILL PLACEMENT SHALL CONFORM TO THE REQUIREMENTS PRESENTED IN OPSS 501. THE CONTRACTOR SHOULD USED APPROPRIATELY SIZED EQUIPMENT TO AVOID DAMAGING ANY STRUCTURES, DEGRADING THE AGGREGATE, OR EPS BLOCKS.

6.0 DRAINAGE – DEWATERING

- 6.1 REFER TO OPSS 518 FOR DEWATERING REQUIREMENTS.
- 6.2 THE CONSTRUCTION SITE WILL BE KEPT CLEAN AND DRY, FREE OF WATER PUDDLES, MUD AND DEBRIS.
- 6.3 MINOR TO SIGNIFICANT SEEPAGE FROM RUNOFF INFILTRATIONS OR PERCHED WATER WITHIN UPPER GRANULAR DEPOSITS AND/OR FILL IS ANTICIPATED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE TEMPORARY DEWATERING SYSTEM.

7.0 USE

- 7.1 THIS DRAWING PROVIDES CONSTRUCTION REQUIREMENTS FOR GEOTECHNICAL ASPECTS OF BACKFILLING AT BRIDGES.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS					
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	DATE	REV.	BY	DESCRIPTION	
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BB-05
PR-D-707
MINISTRY OF TRANSPORTATION, ONTARIO

CONSTRUCTION NOTES – LIGHTWEIGHT FILL MATERIAL

1.0 GENERAL REQUIREMENTS

- 1.1.

THE CONSTRUCTION NOTES ON THIS DRAWING COVER THE REQUIREMENTS FOR THE SUPPLY AND PLACEMENT OF WATER COOLED ULTRA LIGHTWEIGHT BLAST FURNACE SLAG TO BE USED FOR CONSTRUCTION OF THE STRUCTURES FOR THE WINDSOR–ESSEX PARKWAY (WEP) PROJECT. AT THE WEP PROJECT, THE ULTRA LIGHTWEIGHT BLAST FURNACE SLAG MATERIAL IS GENERALLY REFERRED TO AS THE LIGHT WEIGHT FILL (LWF).
- 1.2.

THESE CONSTRUCTION NOTES ARE TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING DESIGN DRAWING(S), OTHER RELEVANT CONSTRUCTION NOTES AND GEOTECHNICAL REPORT.
- 1.3.

THE CONSTRUCTION WORKS SHALL BE EXECUTED IN ACCORDANCE WITH THE DESIGN ILLUSTRATED ON THE ACCOMPANYING DRAWINGS, AND THE REQUIREMENTS SPECIFIED IN THE FOLLOWING STANDARDS, SPECIFICATIONS AND PUBLICATIONS:

•

MTO

•

ASTM D422

•

ASTM D2216

•

ASTM D2850

•

ASTM D2922

•

ASTM D3017

•

OPSS 212

•

OPSS 501

•

OPSS 517

•

OPSS 1010

•

OPSS 1860

NSSP ULTRA LIGHTWEIGHT BLAST FURNACE SLAG (WATER COOLED)

PARTICLE–SIZE ANALYSIS OF SOILS

MOISTURE CONTENT OF SOILS

UNCONSOLIDATED–UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

DENSITY OF SOIL AND SOIL–AGGREGATE IN PLACE BY NUCLEAR METHODS

WATER CONTENT OF SOIL AND ROCK IN PLACE BY NUCLEAR METHODS

BORROW

COMPACTION

DEWATERING

AGGREGATES–BASE, SUBBASE, SELECT SUBGRADE, AND BACKFILL MATERIAL

GEOTEXTILES

1.4

IF THERE IS ANY CONFLICT BETWEEN THE REQUIREMENTS GIVEN ON THIS DRAWING AND THE STANDARDS AND SPECIFICATIONS DOCUMENTS LISTED IN SECTION 1.3, THE DESIGNER SHOULD BE CONSULTED FOR CLARIFICATION AND RECOMMENDATIONS.

1.5

IN THE FOLLOWING SPECIFICATIONS, THE CONTRACTOR MEANS PIC AND ITS SUB–CONTRACTORS, AND THE ENGINEER MEANS THE GEOTECHNICAL SITE ENGINEER, AND THE DESIGNER MEANS THE GEOTECHNICAL DESIGNER OF THE PROJECT.
- 2.0 SITE PREPARATION AND EXCAVATION
- 2.1

THE SITE PREPARATION AND EXCAVATION REQUIREMENTS ON THE CONSTRUCTION NOTES FOR THE BACKFILL AT STRUCTURES ARE APPLICABLE.
- 3.0 SUBMISSION AND DESIGN REQUIREMENTS
- 3.1

THE CONTRACTOR SHALL SUBMIT TO PIC AND THE ENGINEER CERTIFICATES OF CONFORMANCE SEALED AND SIGNED BY THE QUALITY VERIFICATION ENGINEER AS FOLLOWS:

a.

PRIOR TO THE PLACEMENT OF THE LIGHTWEIGHT FILL MATERIAL ON THE PROJECT, THE CONTRACTOR SHALL SUBMIT TO THE CONTRACT ADMINISTRATOR A CERTIFICATE OF CONFORMANCE STATING THAT THE MATERIAL SATISFIES THE MATERIAL PROPERTIES SPECIFIED IN SECTION 4.1.

b.

FOLLOWING FILL PLACEMENT, THE CONTRACTOR SHALL SUBMIT TO THE CONTRACT ADMINISTRATOR A CERTIFICATE OF CONFORMANCE STATING THAT THE MATERIAL SATISFIES THE REQUIREMENTS OF THIS SPECIFICATION AND THAT THE WORK HAS BEEN CARRIED OUT IN GENERAL CONFORMANCE WITH THE CONTRACT DOCUMENTS AND SPECIFICATIONS. THE CONTRACTOR SHALL ALSO SUBMIT ALL QUALITY CONTROL TEST RESULTS FOR INFORMATION ONLY.
- 4.0 MATERIAL
- 4.1

THE LWF SHALL SATISFY THE FOLLOWING PHYSICAL, MECHANICAL AND CHEMICAL PROPERTY REQUIREMENTS:

•

ANGLE OF INTERNAL FRICTION

>35° (ASTM 2850–85)

•

HYDRAULIC CONDUCTIVITY

>8 E–03 CM/S (ASTM 5856–95, METHOD A)

•

CHEMICAL COMPOSITION

THE MATERIAL SHALL MEET THE LEACHATE CRITERIA ESTABLISHED UNDER ONTARIO REGULATIONS 347

•

IN SITU WET UNIT WEIGHT

<12.5 kN/m³ (ASTM D2922) (MAXIMUM WHEN PLACED AND COMPACTED IN ACCORDANCE WITH THE SPECIFICATIONS)
- 5.0 CONSTRUCTION
- 5.1

THE LWF (BLAST FURNACE SLAG) IS SUSCEPTIBLE TO CRUSHING IF OVERCOMPACTED AND CAREFUL CONSTRUCTION PROCEDURES AND SUPERVISION ARE REQUIRED. THE CONTRACTOR SHALL PLACE THE LWF MATERIAL AND SHALL ACHIEVE COMPACTION WITHOUT CRUSHING THE MATERIAL SINCE CRUSHING INCREASES ITS UNIT WEIGHT. THE CONTRACTOR SHALL PLACE THE LWF MATERIAL WITHOUT EXCEEDING THE SPECIFIED IN SITU UNIT WEIGHT AND MAINTAINING CRUSHING OF THE MATERIAL BELOW 5%.

5.2

TO PREVENT OVER–CRUSHING AND OVER–COMPACTION, THE LWF SHALL BE PLACED AS FOLLOWS:

a.

FOR EMBANKMENTS THE LWF SHALL BE PLACED IN LIFTS OF 300 mm AND COMPACTED BY 3 PASSES OF SINGLE DRUM VIBRATORY EQUIPMENT APPROVED BY THE ENGINEER (E.G., BOMAG 142 OR EQUIVALENT, TABLE 1).

b.

FOR BACKFILL TO STRUCTURES, THE LWF SHALL BE PLACED IN LIFTS OF 300 mm AND COMPACTED WITH 8 PASSES OF MANUALLY GUIDED TAMPER SUCH AS A BOMAG BPR 30/38 D OR EQUIVALENT (TABLE 1).

c.

THE CONTRACTOR SHALL PLACE AND SPREAD THE LOOSE LIFTS USING A RUBBER TIRE FRONT–END LOADER SUCH AS A CATERPILLAR 980 F OR EQUIVALENT.

5.3

COMPACTION EQUIPMENT TECHNICAL DETAILS ARE PROVIDED IN TABLE 1.

5.4

THE LWF ZONES SHALL BE APPROPRIATELY WRAPPED IN GEOTEXTILE TO AVOID LOSS OF FINES FROM THE ADJACENT BACKFILL OR NATIVE MATERIALS IN CONTACT WITH THE LWF ZONES.
- 6.0 QUALITY CONTROL
- 6.1

QUALITY CONTROL (QC) TESTING SHALL BE CARRIED OUT BY THE CONTRACTOR TO ENSURE THAT THE LWF MATERIAL IS PLACED AND COMPACTED AS SPECIFIED. FIELD DENSITY AND FIELD MOISTURE DETERMINATION SHALL BE MADE IN ACCORDANCE WITH ASTM D2922 AND ASTM D3017, RESPECTIVELY.

6.2

THE CONTRACTOR SHALL BUILD A CONTROL STRIP TO VERIFY THAT THE PLACEMENT AND COMPACTION PROCEDURE WILL ACHIEVE THE REQUIREMENTS OF THESE SPECIFICATIONS WITHOUT EVIDENCE OF CRUSHING AND WITHOUT EXCEEDING THE SPECIFIED MAXIMUM IN SITU WET UNIT WEIGHT OF 12.5 kN/m³.

6.3

MATERIAL PLACED IN THE CONTROL STRIP SHALL HAVE THE MOISTURE CONTENT THAT WILL YIELD THE SPECIFIED IN–SITU UNIT WEIGHT. FOR THE CONTROL STRIP DETERMINATION, THE NUCLEAR GAUGE METHOD WILL NOT BE CONSIDERED AN ACCEPTABLE METHOD OF DETERMINING THE IN–SITU MOISTURE CONTENT OF THE LWF MATERIAL. MOISTURE CONTENT SHALL BE DETERMINED BY THE OVEN DRY METHOD ON SELECTED COMPACTED EMBANKMENT MATERIAL SAMPLES IN ACCORDANCE WITH ASTM D2216.

6.4

AFTER THE TRIAL AREA IS COMPLETE, SAMPLES FOR MOISTURE CONTROL AND IN SITU UNIT WEIGHT DETERMINATION TESTING SHALL BE AS PER ASTM D2922.

6.5

IN ADDITION, GRADATION AS PER ASTM D422–63 BEFORE AND AFTER COMPACTION EFFORT SHALL BE PERFORMED TO DETERMINE THAT CRUSHING IS KEPT WITHIN 5%.

6.6

THE REQUIREMENTS OF THE CONTROL STRIP MUST BE SATISFIED AS PART OF THE ACCEPTANCE CRITERIA OF ANY PROPOSED CHANGE TO THE SPECIFIED COMPACTION METHOD OF THIS SPECIAL PROVISION.
- 7.0 USE
- 7.1

THIS DRAWING PROVIDES CONSTRUCTION REQUIREMENTS FOR GEOTECHNICAL ASPECTS OF BACKFILLING AT BRIDGES.
- METRIC
- DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN
-
- Windsor–Essex
Parkway Project
RFP No. 09–54–1007
- NEW CONSTRUCTION
BRIDGE B–2
MATCHETTE ROAD OVERPASS
CONSTRUCTION NOTES – LIGHTWEIGHT FILL MATERIAL
-
- SHEET
G0229
- Phase 3
- IFC
- TABLE 1: COMPACTION EQUIPMENT TECHNICAL DETAILS
- | | BOMAG 142 D | BOMAG BPR 30/38 D |
|---|-------------|-------------------|
| WEIGHTS | | |
| • OPERATING WEIGHT (kg) | 4690± | 175± |
| • MASS PER SQUARE METRE OF BASE PLATE (kg/m²) | N/A | 1439 |
| DIMENSIONS | | |
| • DRUM WIDTH (mm) | 1426± | N/A |
| • DRUM DIAMETER (mm) | 1058± | N/A |
| • WIDTH OF BASE PLATE (mm) | N/A | 380 |
| • LENGTH OF BASE PLATE (mm) | N/A | 730 |
| DRIVE | | |
| • PERFORMANCE DIN 6271 IFN (kW) | 37± | 3.7 |
| • PERFORMANCE SAE (kW) | 39.5 | N/A |
| • SPEED (RPM) | 2300 | 3600 |
| VIBRATORY SYSTEM | | |
| • FREQUENCY (Hz) | 32± | 68± |
| • AMPLITUDE (mm) | 1.24± | N/A |
| • CENTRIFUGAL FORCE (KN) | 66± | 30± |
- DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING
- | | | | | | |
|-----------|-----------|------|-----|-------------------------|-----------------|
| REVISIONS | | | | | |
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| | | | | | |
| | 20–MAR–13 | 0 | NR | ISSUED FOR CONSTRUCTION | |
| | DATE | REV. | BY | DESCRIPTION | |
| DESIGN | SF | CHK | NSV | CODE CAN/CSA S6–06 | LOAD CL–625–ONT |
| DRAWN | MM | CHK | DD | SITE 6–602 | DATE 20–DEC–11 |
- DOC: 285380–04–094–WIP3–0229

DATE PLOTTED: 3/20/2013 4:41:42 PM
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MINISTRY OF TRANSPORTATION, ONTARIO

PR-D-707
BB-05

CONSTRUCTION NOTES – EXPANDED POLYSTYRENE FILL

1.0 GENERAL REQUIREMENTS

- 1.1.THE REQUIREMENTS ON THIS DRAWING RELATE TO THE CONSTRUCTION OF THE EXPANDED POLYSTYRENE (EPS) FILL WITHIN BACKFILL AT THE STRUCTURES AND HIGH EMBANKMENTS TO BE BUILT ALONG THE WINDSOR–ESSEX PARKWAY (WEP) PROJECT AS ILLUSTRATED ON THE DRAWINGS. THE REQUIREMENTS GIVEN HEREFTER ARE THE PRINCIPAL REQUIREMENTS. FOR DETAILED REQUIREMENTS, THE CONTRACTOR SHOULD REFER TO MTO MATERIAL SPECIFICATION REQUIREMENTS STATED IN NSSP EXPANDEDPOLYSTYRENEREQUIREMENT.DOC.
- 1.2.THESE CONSTRUCTION NOTES ARE TO READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN DRAWINGS AND REPORT.
- 1.3.THE CONSTRUCTION WORKS SHALL BE EXECUTED IN ACCORDANCE WITH THE GEOTECHNICAL DESIGN ILLUSTRATED ON THE ACCOMPANYING DRAWINGS, THE SUPPLIER SPECIFICATIONS AND THE REQUIREMENTS SPECIFIED IN THE FOLLOWING STANDARDS, SPECIFICATIONS AND PUBLICATIONS:

- MTO NSSP EXPANDED POLYSTYRENE REQUIREMENT
- CAN/ULC–S701–11 THERMAL INSULATION, POLYSTYRENE BOARDS AND PIPE COVERING
- ASTM D1621 COMPRESSIVE PROPERTIES OF RIGID CELLULAR PLASTICS
- ASTM C203 BREAKING LOAD AND FLEXURAL PROPERTIES OF BLOCK TYPE THERMAL INSULATION
- ASTM C177 STEADY STATE HEAT FLUX MEASUREMENTS AND THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE HEAT FLOW APPARATUS
- ASTM D2842 WATER ABSORPTION BY RIGID CELLULAR PLASTICS
- ASTM D2863 MEASURING THE MINIMUM OXYGEN CONTENT
- ASTM D2126 RESPONSE OF RIGID CELLULAR PLASTICS TO THERMAL AND HUMID AGING
- ASTM D6817 STANDARD SPECIFICATION FOR RIGID CELLULAR POLYSTYRENE GEOFOAM
- OPSS 201 CLEARING, CLOSE CUT CLEARING, GRUBBING, REMOVAL OF SURFACE AND PILES BOULDERS
- OPSS 212 BORROW
- OPSS 501 COMPACTION
- OPSS 518 DEWATERING
- OPSS 904 CONSTRUCTION SPECIFICATION FOR CONCRETE STRUCTURES
- OPSS 905 CONSTRUCTION SPECIFICATION FOR STEEL REINFORCEMENT FOR CONCRETE
- OPSS 1010 AGGREGATES – GRANULAR A, B, M, AND SELECTED SUBGRADE MATERIAL
- OPSS 1440 MATERIAL SPECIFICATION FOR STEEL REINFORCEMENT FOR CONCRETE
- OPSS 1605 EXPANDED EXTRUDED POLYSTYRENE PAVEMENT INSULATION
- OPSS 1860 GEOTEXTILES
- NCHRP REPORT 529 GEOFOAM APPLICATIONS IN HIGHWAY EMBANKMENTS
- CAN/ULC–S102.2–10–EN BURNING CHARACTERISTICS

- 1.4 IF THERE IS ANY CONFLICT BETWEEN THE REQUIREMENTS GIVEN ON THIS DRAWING AND THE STANDARDS AND SPECIFICATIONS DOCUMENTS LISTED IN SECTION 1.3, THE DESIGNER SHOULD BE CONSULTED FOR CLARIFICATION AND RECOMMENDATION.
- 1.5 IN THE FOLLOWING CONSTRUCTION NOTES, THE CONTRACTOR MEANS PIC AND ITS SUB–CONTRACTORS, THE SUPPLIER MEANS THE MANUFACTURER AND PROPRIETARY SUPPLIER OF THE EPS, THE ENGINEER MEANS THE GEOTECHNICAL SITE ENGINEER, AND THE DESIGNER MEANS THE GEOTECHNICAL DESIGNER OF THE PROJECT.

2.0 SITE PREPARATION

- 2.1 CLEAR AND GRUB SITE AND REMOVE ANY SUBGRADE MATERIAL UNSUITABLE FOR EPS BLOCK PLACEMENT AS PER TECHNICAL SPECIFICATIONS FOR CLEARING, GRUBBING AND STRIPPING (OPSS 201).
- 2.2 DEWATERING: THERE SHALL BE NO STANDING WATER OR ACCUMULATED SNOW OR ICE ON THE SUBGRADE WITHIN THE AREA WHERE EPS BLOCKS ARE PLACED. EPS BLOCKS SHALL NOT BE PLACED ON A FROZEN SUBGRADE (OPSS 518).
- 2.3 PLACE GRANULAR LEVELLING PAD AS PER DRAWINGS BUT NOT LESS THAN 150 mm THICK CONSISTING OF GRANULAR 'A' OR GRANULAR 'B' MATERIAL WITH GRADATION AND PHYSICAL REQUIREMENTS AS SPECIFIED IN OPSS 1010. WHERE LEVELLING PAD IS THICKER THAN 100 mm, THE PAD SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
- 2.4 EPS SHALL NOT BE FOUNDED DIRECTLY ON EXISTING ASPHALT PAVEMENT. THE CONSTRUCTOR SHALL REMOVE EXISTING PAVEMENT IN ADDITION TO ANY MATERIAL CONTAINING HYDROCARBONS AND REPLACE WITH CLEAN GRANULAR MATERIAL. WHERE AN EPS EMBANKMENT IS FOUNDED ABOVE A PRE–EXISTING SUBSURFACE PAVEMENT LAYER THERE SHALL BE MINIMUM 200 mm OF FREE DRAINING LEVELING COURSE BELOW THE EPS BLOCKS.

3.0 MATERIALS

- 3.1 THE CONTRACTOR SHALL SUBMIT INFORMATION ON THE EPS MATERIAL, MANUFACTURER, PHYSICAL AND MECHANICAL PROPERTIES OF THE MATERIAL, AND AGING AND DURABILITY CHARACTERISTICS AS PER THE MTO–NSSP REQUIREMENTS.
- 3.2 THE CONTRACTOR SHALL PROVIDE CERTIFICATE OF COMPLIANCE OF PHYSICAL AND MECHANICAL PROPERTIES AND THE IDENTIFICATION OF THE LABORATORY ACCREDITED BY THE STANDARDS COUNCIL OF CANADA TO TEST THE EPS. THE PHYSICAL AND MECHANICAL PROPERTIES INCLUDE GEOMETRY, NOMINAL DENSITY, COMPRESSIVE STRENGTH, FLEXURAL STRENGTH, THERMAL RESISTANCE, DIMENSIONAL STABILITY, FLAMMABILITY AND WATER ABSORPTION.
- 3.3 THE PRODUCT SHALL BE SUITABLY MARKED TO IDENTIFY ITS TYPE, NUMBER AND THE MANUFACTURER’S NAME OR TRADEMARK.
- 3.4 EPS BLOCKS SHALL MEET ASTM D6817 STANDARD SPECIFICATION FOR RIGID CELLULAR POLYSTYRENE GEOFOAM AS PER THE FOLLOWING:

ASTM DESIGNATION	DENSITY, kg/m ³	COMPRESSIVE RESISTANCE, kPa		MAXIMUM WATER ABSORPTION, %
		AT 1% DEFORMATION	AT 5% DEFORMATION	
EPS 22	22	50	115	4
EPS 24	24	65	140	3
EPS 29	29	75	170	2

- 3.5 TESTING OF EPS SAMPLES SHALL BE UNDERTAKEN ACCORDING TO ASTM D1621 (PROCEDURE A). FOR EACH EPS GRADE PRODUCED BY THE SUPPLIER, A MINIMUM OF ONE SAMPLE SHALL BE TESTED PER 500 m³ FOR THE FIRST 2000 m³. A MINIMUM OF ONE SAMPLE PER 2000 m³ SHALL BE TESTED THEREAFTER.
- 3.6 THE CONTRACTOR SHALL SUBMIT THE METHOD OF DELIVERY, STORAGE, HANDLING AND PROTECTION FROM DAMAGE BY WEATHER, TRAFFIC, CONSTRUCTION STAGING AND OTHER CAUSES AS PER THE RIGID EXPANDED POLYSTYRENE MANUFACTURER’S REQUIREMENTS.
- 3.7 THE CONTRACTOR SHALL PROTECT THE EXPANDED POLYSTYRENE FROM EXPOSURE TO SUNLIGHT TO AVOID ULTRAVIOLET DEGRADATION AS PER MANUFACTURER’S RECOMMENDATION. PROTECTION OF MATERIALS AND WORKS FROM DAMAGE BY WEATHER, TRAFFIC, CONSTRUCTION STAGING, FIRE OR VANDALISM AND OTHER CAUSES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- 3.8 CONCRETE AND CONCRETE MATERIALS SHALL CONFORM TO OPSS 1350 WITH THE FOLLOWING EXCEPTIONS AND/OR ADDITIONS: CLASS OF CONCRETE 36 MPa AT 28 DAYS, COARSE AGGREGATE 19 mm NOMINAL MAXIMUM SIZE, AIR CONTENT 7% ± 1.5%, AND MAXIMUM SLUMP 60 mm. THE STEEL REINFORCEMENT SHALL CONFORM TO THE REQUIREMENT OF OPSS 1440 AND SHALL BE PLACED IN ACCORDANCE WITH OPSS 905.

4.0 CONSTRUCTION

- 4.1 THE CONTRACTOR SHALL SUBMIT FULL DETAILS OF THE METHOD OF FOUNDATION EXCAVATION AND PREPARATION, CONSTRUCTION OF LEVELLING PAD, METHOD OF PLACEMENT OF THE EPS BLOCKS, AND THE METHODS OF PLACEMENT OF MINIMUM 125 mm THICK REINFORCED CONCRETE BASE PAD, SUBBASE MATERIAL AND SIDE SLOPE COVER.
- 4.2 FOUNDATION EXCAVATION SHALL BE CARRIED OUT TO THE DESIGN ELEVATION SHOWN ON THE DRAWINGS. ANY SOFTENED, LOOSENED OR DELETERIOUS MATERIALS AT THE FOUNDATION FOOTING ELEVATION SHALL BE SUBEXCAVATED AND REPLACED WITH GRANULAR 'A' OR GRANULAR 'B' MATERIAL.
- 4.3 PLACE, LEVEL AND COMPLETE A LAYER OF GRANULAR 'A' OR GRANULAR 'B' MATERIAL IN ACCORDANCE WITH OPSS 501 TO WITHIN ±30 mm OF THE DESIGN ELEVATION. THE LEVELLING PAD SHALL NOT DEVIATE BY MORE THAN 10 mm AT ANY PLACE ON A 3 m STRAIGHT EDGE OVER THE LIMITS OF THE BOTTOM COURSE OF BLOCKS. THE LEVELLING PAD SHALL NOT BE PLACED ON FROZEN GROUND.
- 4.4 THE EPS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER’S INSTRUCTIONS AND GOOD CONSTRUCTION PRACTICE. THE INDIVIDUALLY MARKED BLOCKS SHALL BE PLACED ON THE PREPARED LEVELLING PAD. THE TOP SURFACE OF THE FIRST LAYER OF BLOCKS IS TO BE SET PLANE AND LEVEL. LOCAL TRIMMING OF THE BLOCKS MAY BE NECESSARY. SUBSEQUENT SUCCESSIVE LAYERS SHALL BE ORIENTED WITH THE LONG AXIS OF BLOCKS POSITIONED AT 90° TO THE PREVIOUS LAYER IN ORDER TO AVOID CONTINUOUS JOINTS. BLOCK JOINTS SHALL BE OFFSET AND STAGGERED BETWEEN LAYERS AS ILLUSTRATED ON THE DRAWINGS OR RECOMMENDED BY THE SUPPLIER.
- 4.5 SLOPING END ADJUSTMENTS AT THE ABUTMENTS SHALL BE ACCOMPLISHED BY LEVELLING TERRACES IN THE SUBSOIL IN ACCORDANCE WITH THE BLOCK THICKNESS.

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



Windsor–Essex
Parkway Project
RFP No. 09–54–1007



NEW CONSTRUCTION
BRIDGE B–2
MATCHETTE ROAD OVERPASS
CONSTRUCTION NOTES – EXPANDED POLYSTYRENE

SHEET
G0230

Phase 3

IFC

- 4.6 TEMPORARY BALLAST SHALL BE PROVIDED AS NECESSARY TO PREVENT MOVEMENT OF EXPANDED POLYSTYRENE BOTH IN STORAGE AND AS PLACED DUE TO WINDY CONDITIONS. TIMBER FASTENERS OR EQUIVALENT SHALL BE USED AS NECESSARY.
- 4.7 THE EXPANDED POLYSTYRENE FILL/EMBANKMENTS SHALL BE PROTECTED FROM ACCIDENTAL IGNITION DUE TO WELDING, SMOKING, GRINDING OR CUTTING TOOLS, ETC. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT IGNITION OF THE EXPANDED POLYSTYRENE.
- 4.8 THE EXPANDED POLYSTYRENE SHALL BE PROTECTED FROM ORGANIC SOLVENTS AND OTHER AGGRESSIVE, HARMFUL CHEMICALS DURING CONSTRUCTION. THE PROPOSED METHOD OF PROTECTION DURING CONSTRUCTION SHALL BE SUBMITTED TO THE CONTRACTOR’S QUALITY VERIFICATION ENGINEER FOR REVIEW AND TO THE CONTRACT ADMINISTRATOR FOR INFORMATION PURPOSES.
- 4.9 EXPOSED BLOCKS SHALL BE COVERED IMMEDIATELY TO AVOID POSSIBLE BURROWING BY ANIMALS.
- 4.10 INDIVIDUALLY MARKED BLOCKS SHALL BE FABRICATED AND PLACED TO ENSURE THE TOP SURFACE MATCHES THE ELEVATION AND CROSSFALL SHOWN ON THE DRAWINGS.
- 4.11 THE TOP SURFACE AND SIDE SURFACES OF THE EXPANDED POLYSTYRENE SHALL BE COVERED WITH 10 MIL POLYETHYLENE SHEETING EXTENDING ONTO ADJACENT WORK AT THE LONGITUDINAL ENDS OF THE EMBANKMENT/ABUTMENTS. ALL JOINTS SHALL BE LAPPED A MINIMUM 300 mm TO PROVIDE A FULLY SEALED ENCLOSURE. THE JOINTS IN THE LONGITUDINAL AND TRANSVERSE DIRECTIONS SHALL BE ARRANGED TO OVERLAP THE BLOCKS IN THE LOWER LAYER OF THE EPS.
- 4.12 THE CONTRACTOR SHALL INSTALL THE CONCRETE PAD COVER AS DESCRIBED IN SECTIONS 3.8 AND 4.1 ABOVE. THE STEEL REINFORCEMENT SHALL BE PLACED IN ACCORDANCE WITH OPSS 905. THE TOP OF THE EPS SHOULD BE SLOTTED TO PREVENT RELATIVE DISPLACEMENT BETWEEN THE EPS AND CONCRETE PAD.
- 4.13 THE CONTRACTOR SHALL SUBMIT DETAILS OF THE SEQUENCE AND METHOD OF INSTALLATION TO THE ENGINEER FOR REVIEW AT LEAST 3 WEEKS PRIOR TO THE INSTALLATION OF THE EPS. THE SUBMITTAL SHALL SATISFY ALL SPECIFICATIONS.
- 4.14 TRAFFIC: EQUIPMENT OTHER THAN RUBBER–TIRE SAWING EQUIPMENT SHALL NOT BE PERMITTED ON THE CONCRETE UNTIL IT HAS ATTAINED A MINIMUM COMPRESSIVE STRENGTH OF 2 MPa. A LIFT OF GRANULAR NO LESS THAN 600 mm IN THICKNESS SHALL BE PLACED ON THE CONCRETE PAD BEFORE TRAFFIC IS PERMITTED. EQUIPMENT SHALL BE LIMITED IN WEIGHT AND SIZE AND RESTRICTED IN OPERATION TO AVOID DAMAGING THE EPS AS PER THE SUPPLIER’S REQUIREMENT.

5.0 DRAINAGE

- 5.1 TOP SURFACE OF EPS BLOCKS SHALL BE STEPPED OR SLOPED TO MATCH SUPER ELEVATION OR CROSSFALL. DRAINAGE CHANNELS COMPRISING 19 mm CLEAR CRUSH STONE WRAPPED WITH NON–WOVEN GEOTEXTILE (AMOCO 4545 OR APPROVED EQUIV.) SHALL BE PROVIDED UNLESS REQUIRED OTHERWISE BY THE DESIGNER OR NOTED ON THE DESIGN DRAWINGS. SUBDRAINS SHALL BE PERFORATED PVC DRAIN PIPE WITHIN 19 mm CLEAR CRUSH BEDDING WRAPPED IN NON–WOVEN GEOTEXTILE AS PER DESIGN DRAWINGS.
- 5.2 APPROPRIATE DRAINAGE SHALL BE PROVIDED IN EPS EMBANKMENT/FILL FOUNDATION TO ENSURE EFFECTIVE DRAINAGE AND PREVENT PRESENCE OF STANDING WATER OR ACCUMULATED SNOW OR ICE ON THE SUBGRADE WITHIN THE AREA WHERE EPS BLOCKS ARE PLACED.

6.0 USE

- 6.1 THIS DRAWING PROVIDES CONSTRUCTION REQUIREMENTS FOR GEOTECHNICAL ASPECTS OF BACKFILLING AT BRIDGES.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS					
	20–MAR–13	0	NR	ISSUED FOR CONSTRUCTION	
	DATE	REV.	BY	DESCRIPTION	
DESIGN	SF	CHK	NSV	CODE CAN/CSA S6–06	LOAD CL–625–ONT
DRAWN	MM	CHK	DD	SITE 6–602	DATE 20–DEC–11

DOC: 285380–04–094–WIP3–0230

Applicable OPSDs

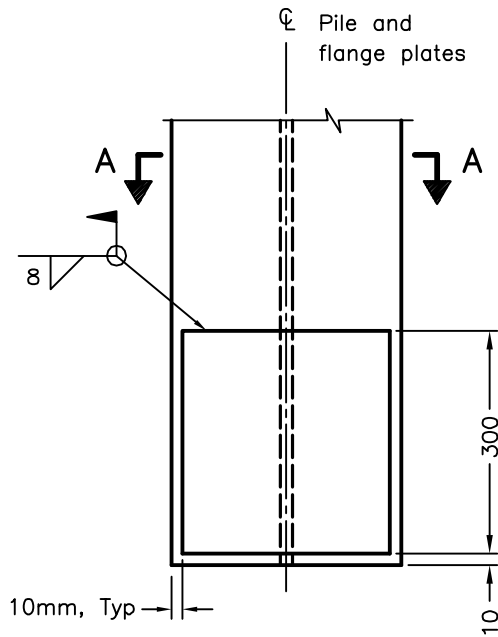
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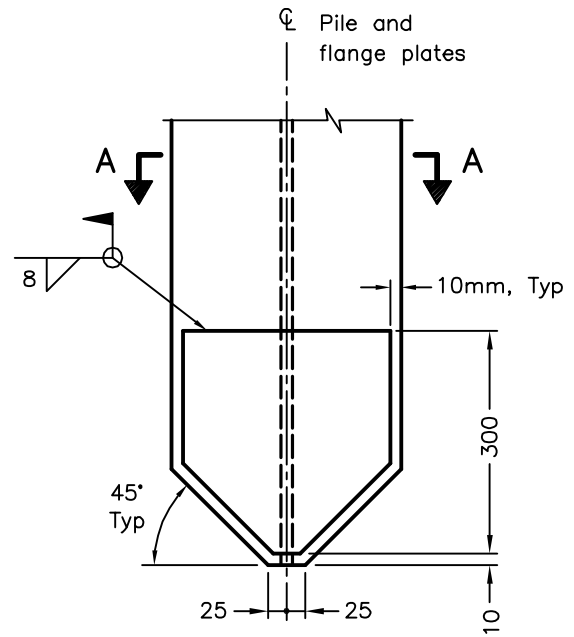
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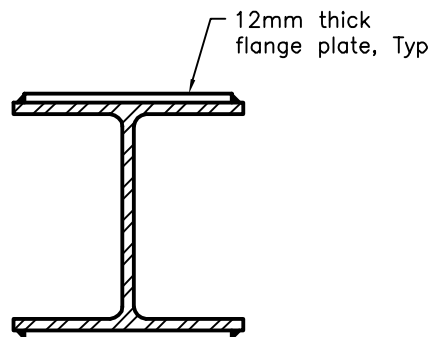


TYPE I



TYPE II

ELEVATION



PILE DRIVING SHOE
SECTION A-A

NOTES:

- A Flange plates shall be according to CSA G40.20/G40.21, Grade 300W.
- B Welding shall be according to CSA W59.
- C Driving shoe Type I shall be used unless Type II is specified.
- D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2010

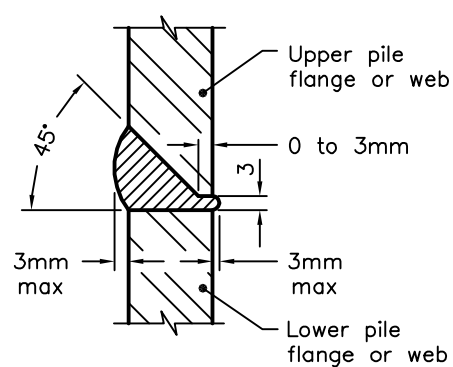
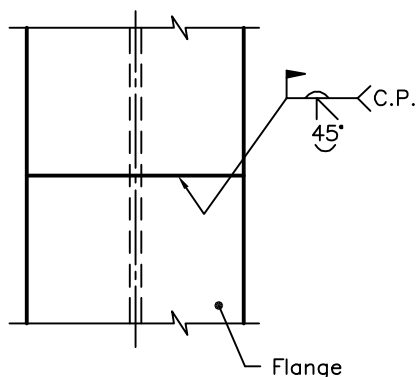
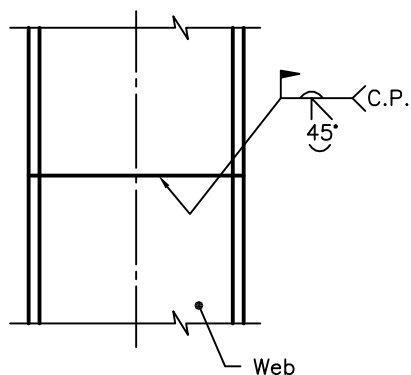
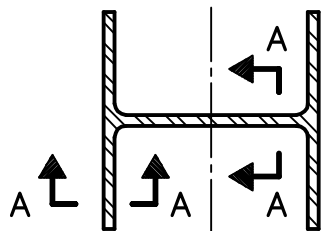
Rev 2

FOUNDATION
PILES

STEEL H-PILE DRIVING SHOE

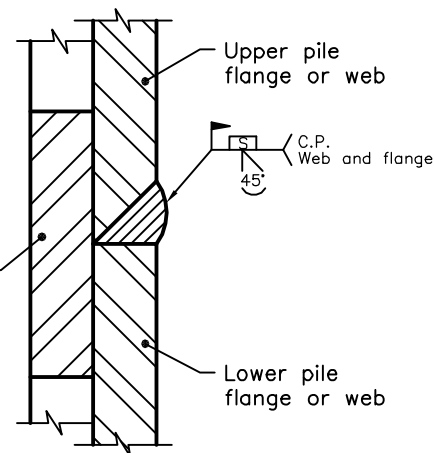
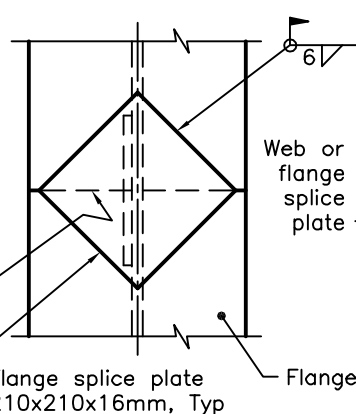
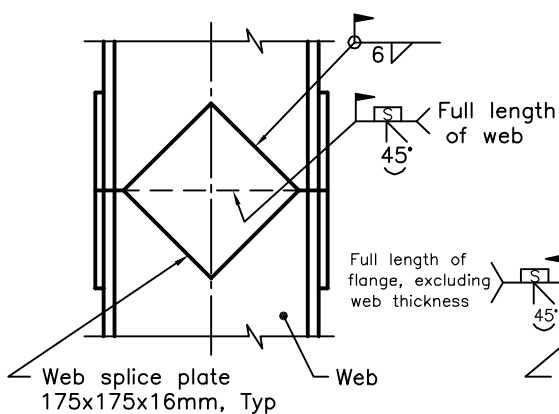
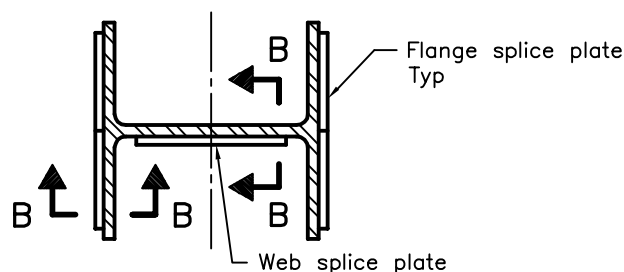
OPSD 3000.100





BUTT WELD

SECTION A-A



BUTT WELD WITH SPLICE PLATES

SECTION B-B

NOTES:

- A The pile splice shall be perpendicular to the centreline of pile.
- B Splice plates shall be according to CSA G40.20/G40.21, Grade 300W.
- C Welding shall be according to CSA W59.
- D Splice plate alternative is only applicable to H-pile sizes HP310x79, HP310x110, and HP310x132.
- E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2010

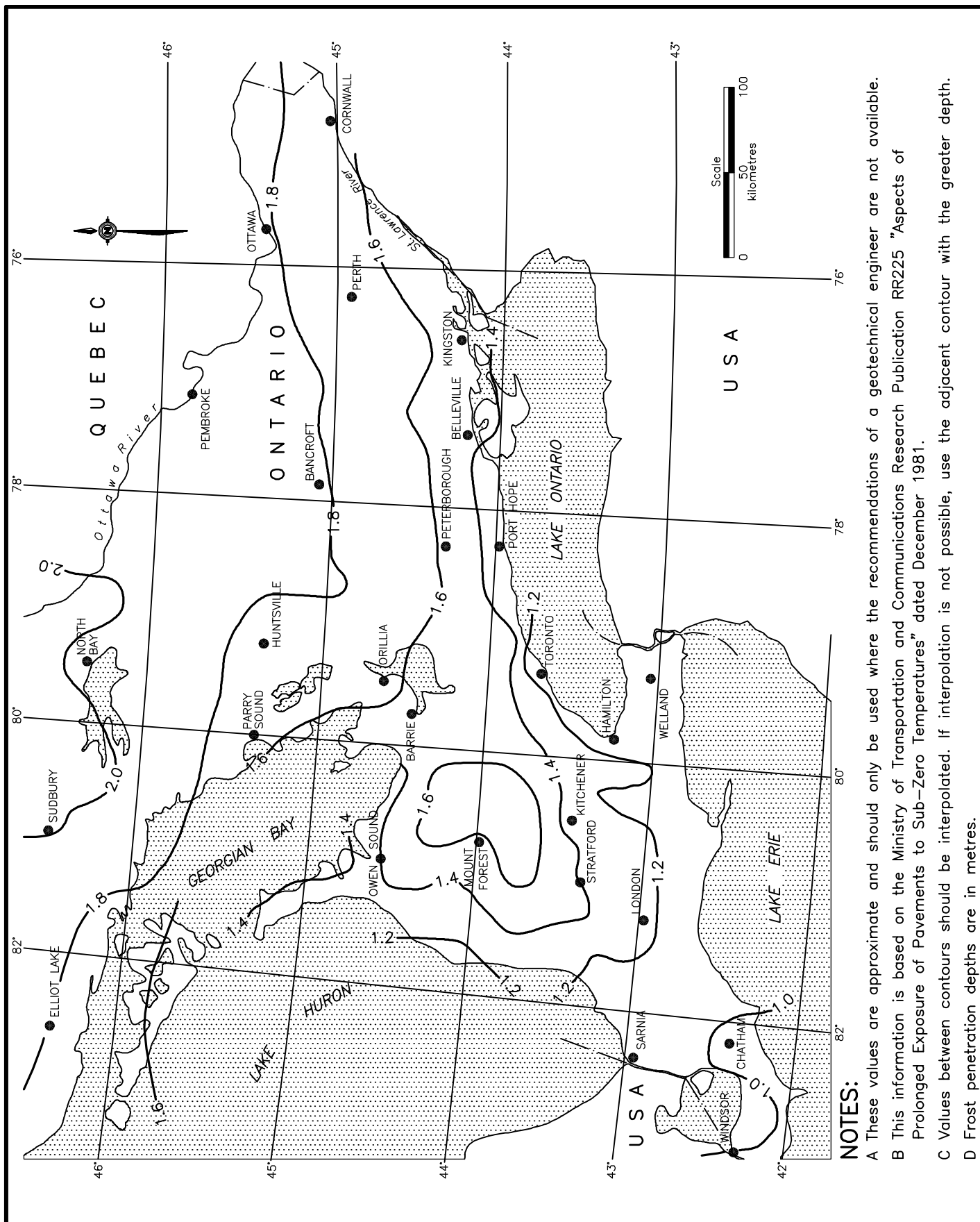
Rev

1

**FOUNDATION
PILES
STEEL H-PILE SPLICE**

OPSD 3000.150





NOTES:

- A These values are approximate and should only be used where the recommendations of a geotechnical engineer are not available.
- B This information is based on the Ministry of Transportation and Communications Research Publication RR225 "Aspects of Prolonged Exposure of Pavements to Sub-Zero Temperatures" dated December 1981.
- C Values between contours should be interpolated. If interpolation is not possible, use the adjacent contour with the greater depth.
- D Frost penetration depths are in metres.

ONTARIO PROVINCIAL STANDARD DRAWING

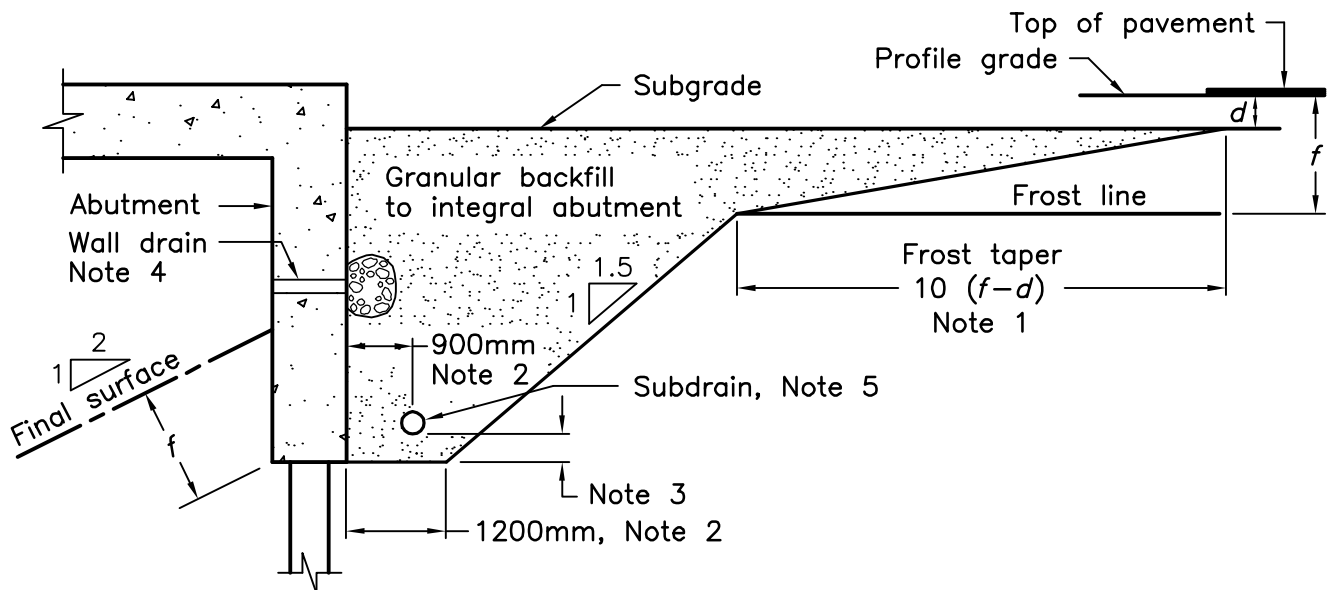
Nov 2010

Rev 1

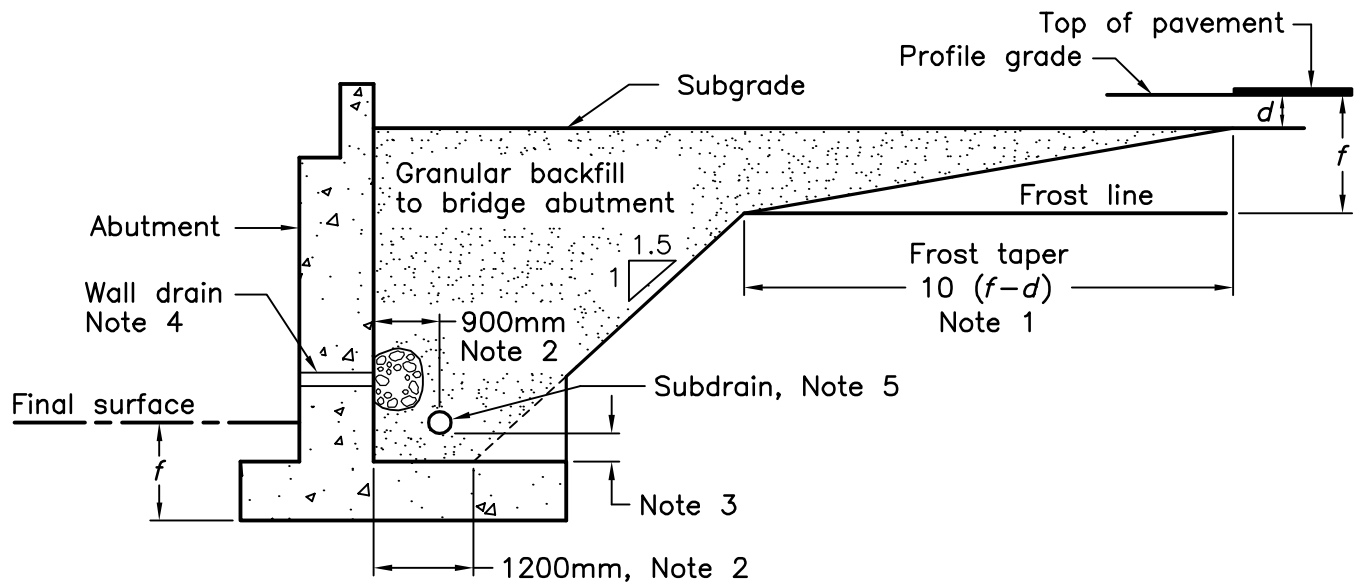
**FOUNDATION
FROST PENETRATION DEPTHS
FOR SOUTHERN ONTARIO**



OPSD 3090.101



INTEGRAL ABUTMENT



ABUTMENT

NOTES:

- 1 d = depth of combined base and subbase courses
 f = frost penetration depth as specified
- 2 Dimensions perpendicular to back face of abutment.
- 3 Height to be consistent with positive drainage of subdrain as specified.
- 4 Where specified, wall drains shall be installed according to OPSD 3190.100.
- 5 150mm dia perforated pipe subdrain wrapped with geotextile.
- A Lateral limits of granular backfill to bridge abutment to be inside face to inside face of retaining wall or wingwall. Frost taper shall extend the full width of the backfill unless interrupted by the retaining wall or wingwall.
- B Sections shown are parallel to centreline of roadway.
- C Subdrain shall be installed with a 2% gradient behind wall.
- D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2010

Rev 1



WALLS
ABUTMENT, BACKFILL
MINIMUM GRANULAR REQUIREMENT

OPSD 3101.150

Figures

"

Project: Y kpf uqt/Gugz'Retny c{"

Document: I gq'gej plecn'p'xgunki c'vkqp'c'pf "F guki p"Tr qtv"
Dtkf i g'D/4"Uc032- 84202: Y "q"32- 87: 0644Y +"

Doc No.: 4: 75: 2/26/33; /233: "I gqetgu"P q062L8/67+"

"

Date: O ctej 4235"

Rev: 2"

Page No.: Hki wtgu"

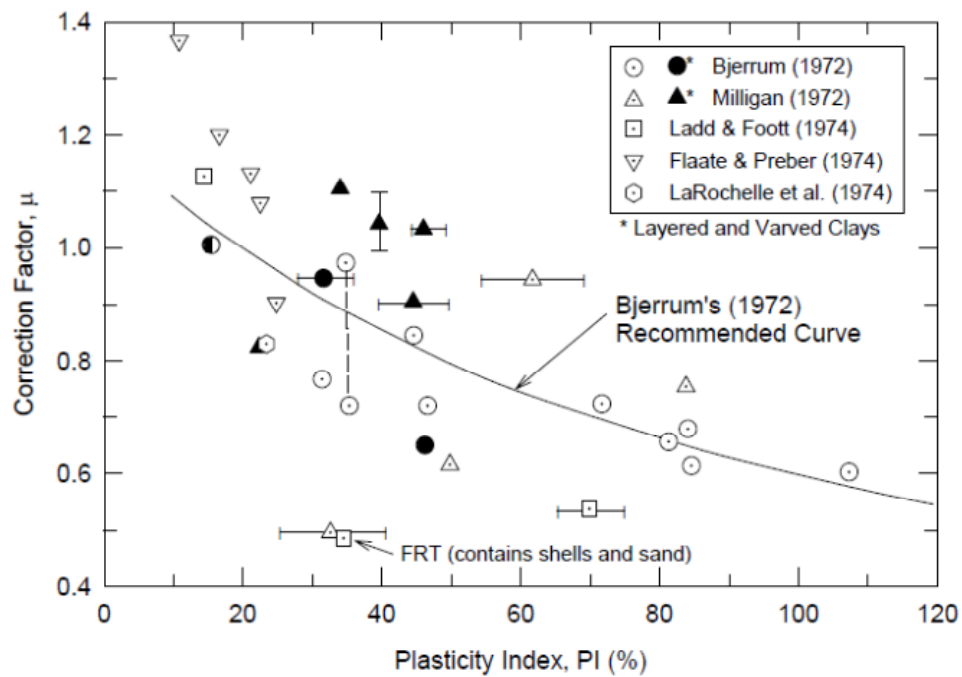


Figure 3.1: Field Vane Correction Factor vs. Plasticity Index Derived from Embankment Failures (Ladd & DeGroot, 2004)

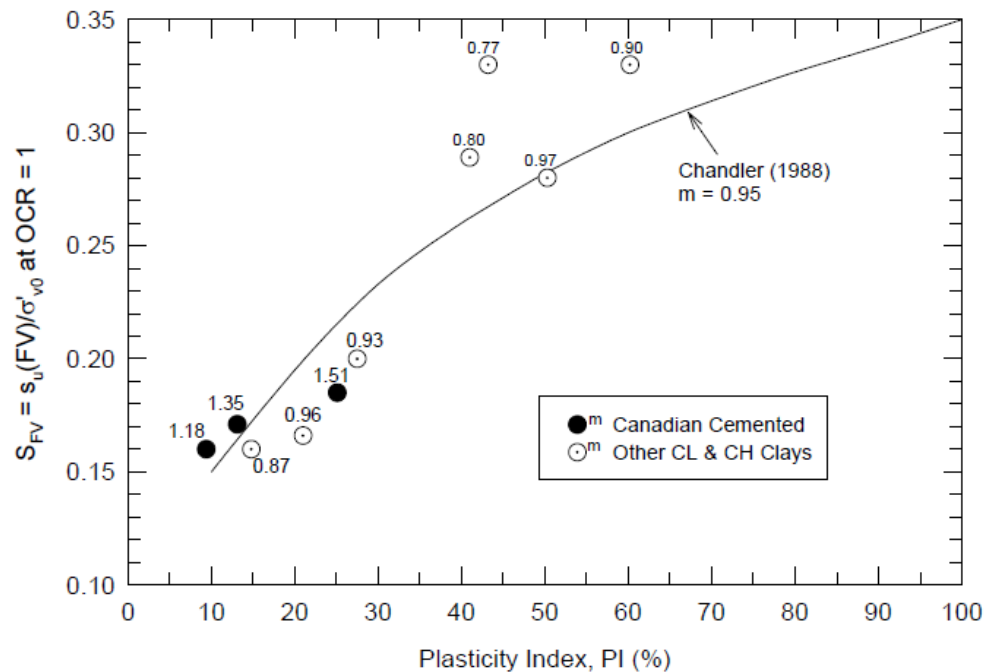
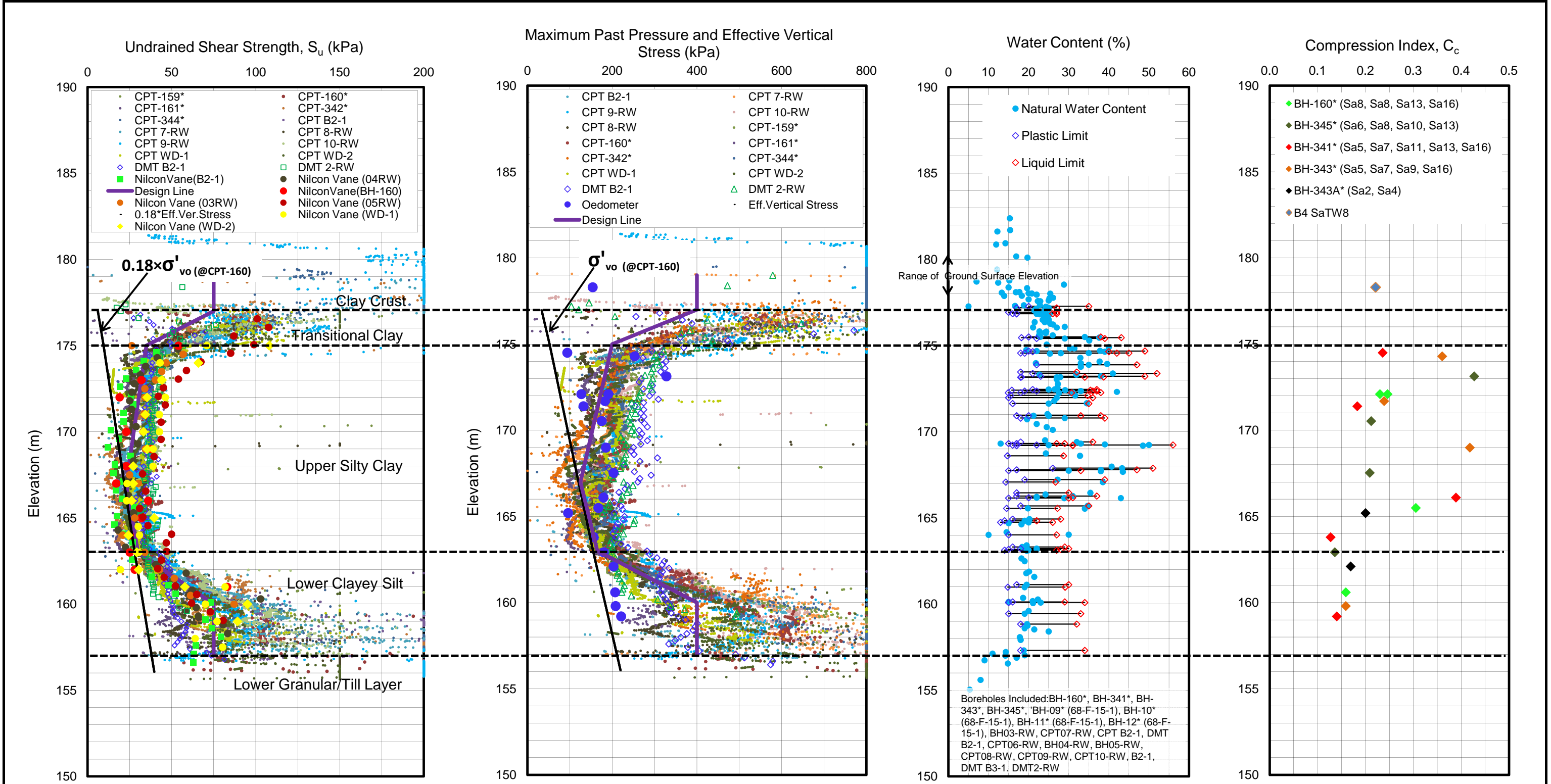


Figure 3.2: Field Vane Undrained Strength Ratio at OCR = 1 vs. Plasticity Index for Homogeneous Clays (Ladd & DeGroot, 2004)



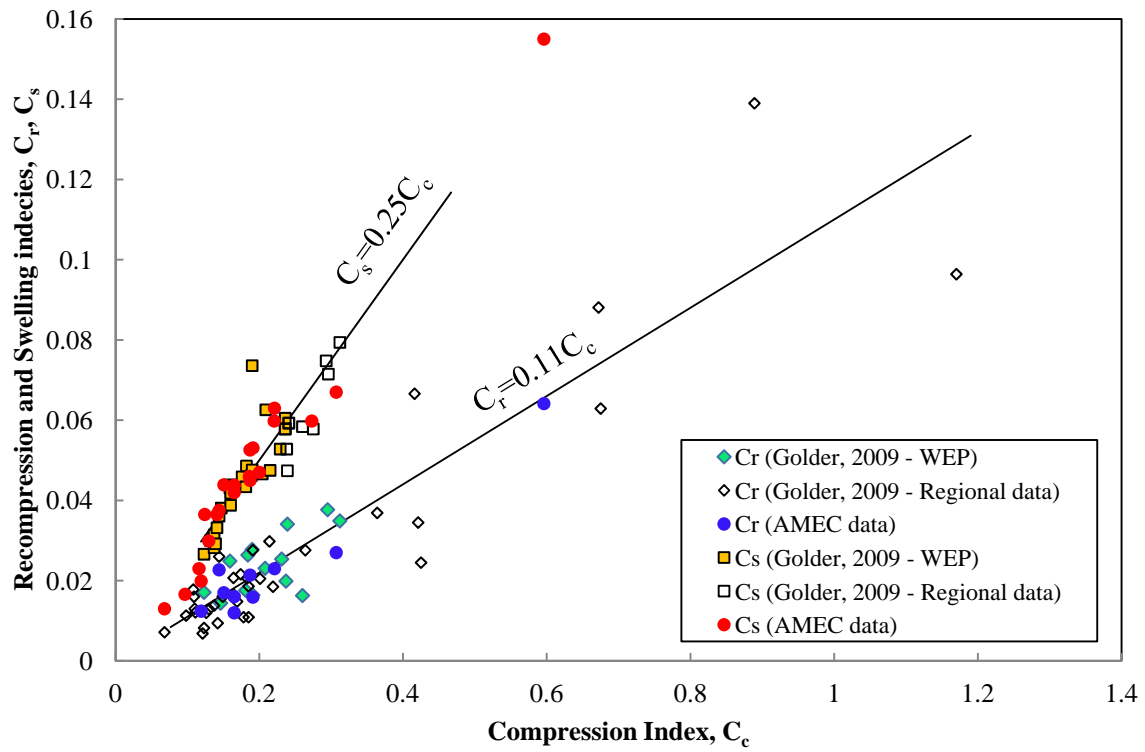
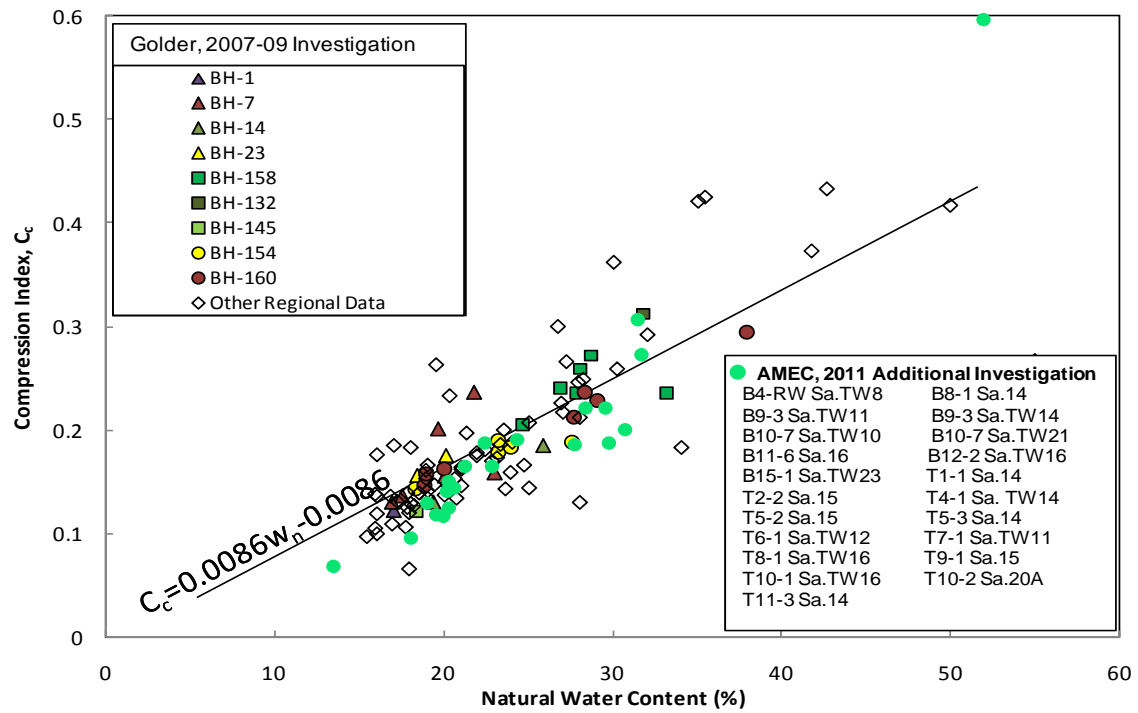


Figure 4.1: Compressibility Parameters at WEP

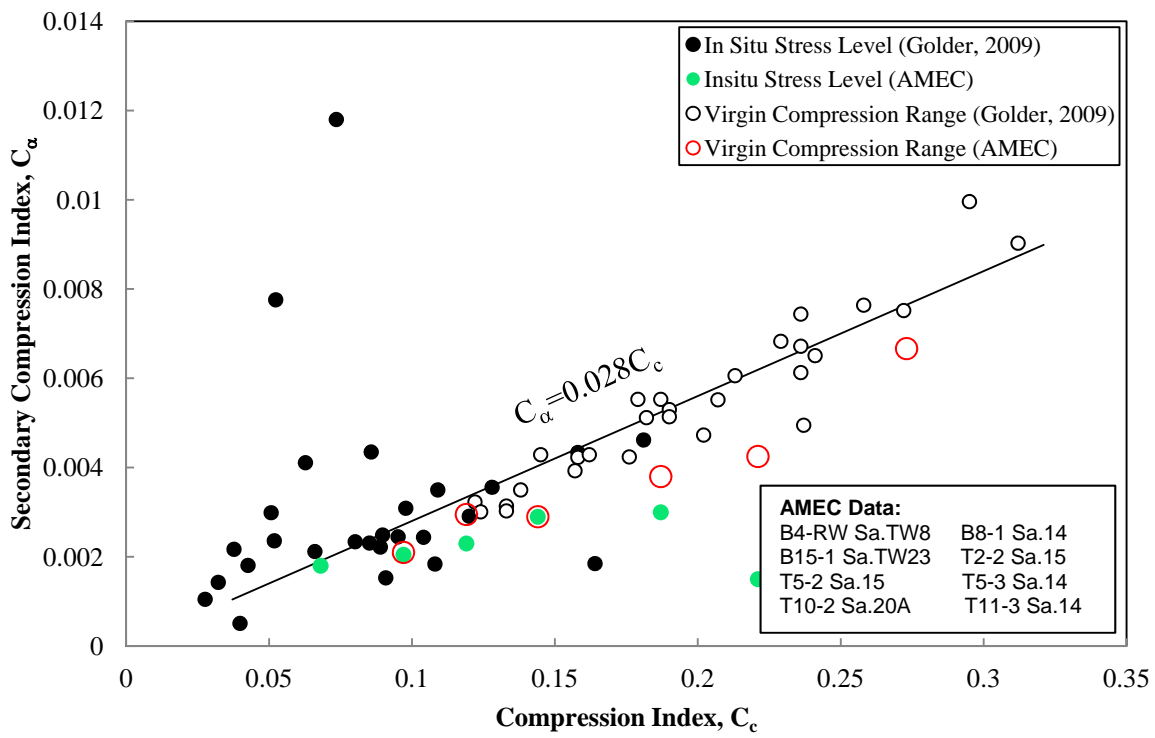


Figure 4.2: C_c versus C_α Relationship at WEP

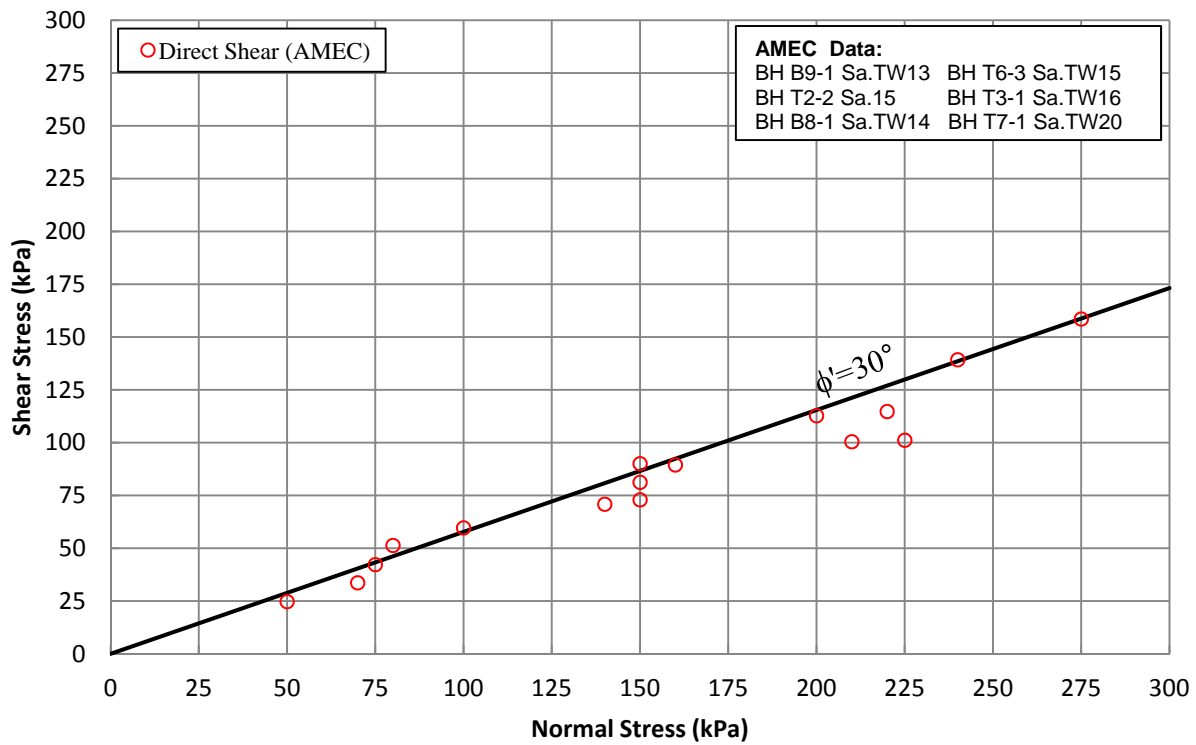
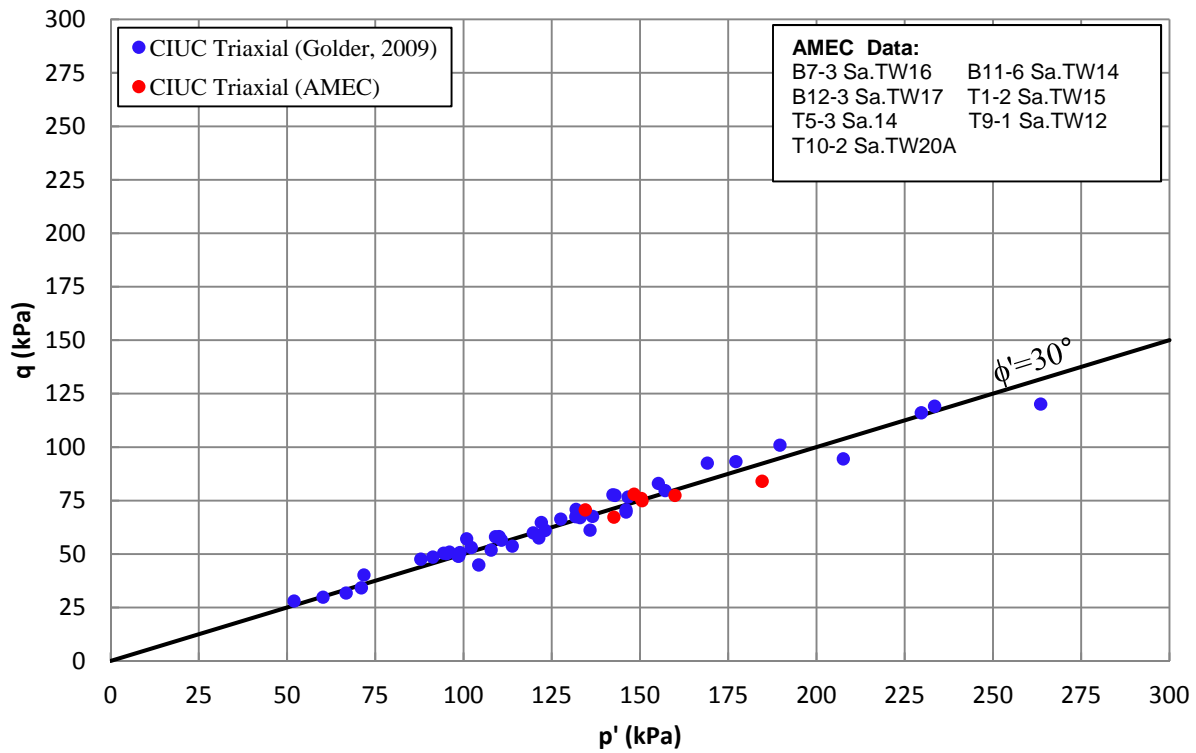


Figure 4.3: Effective Friction Angle (ϕ') for Silty Clay to Clayey Silt Stratum at WEP

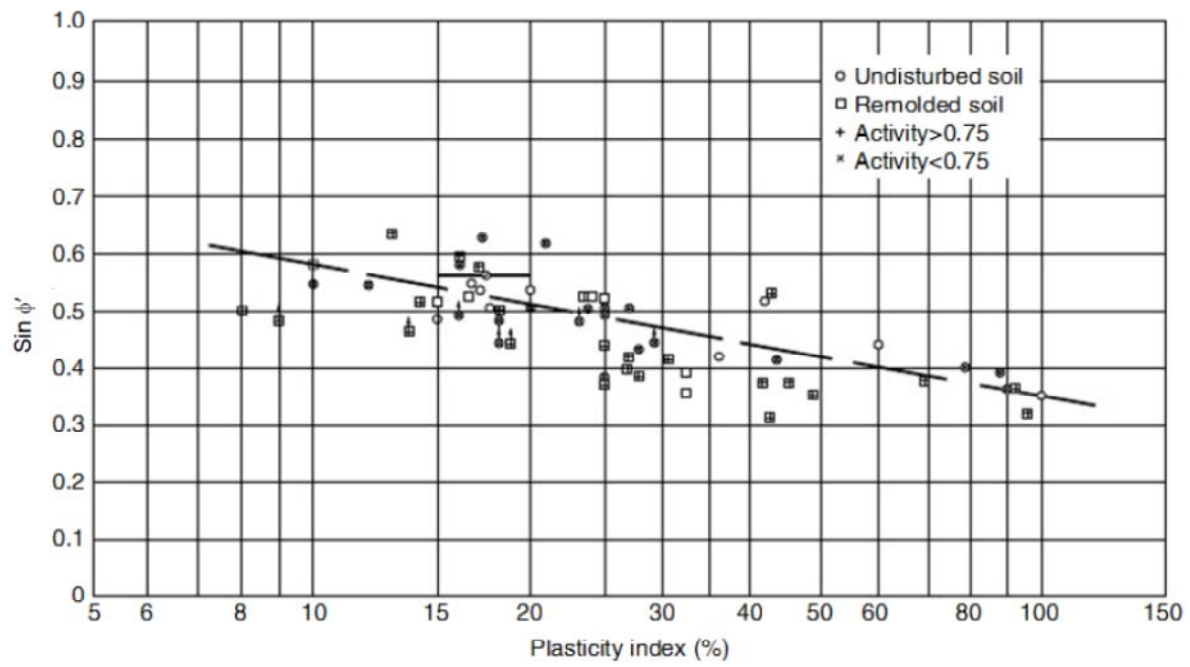


Figure 4.4: Relationship between $\sin \phi'$ and Plasticity Index for Normally Consolidated Soils
(Kenney, 1959)

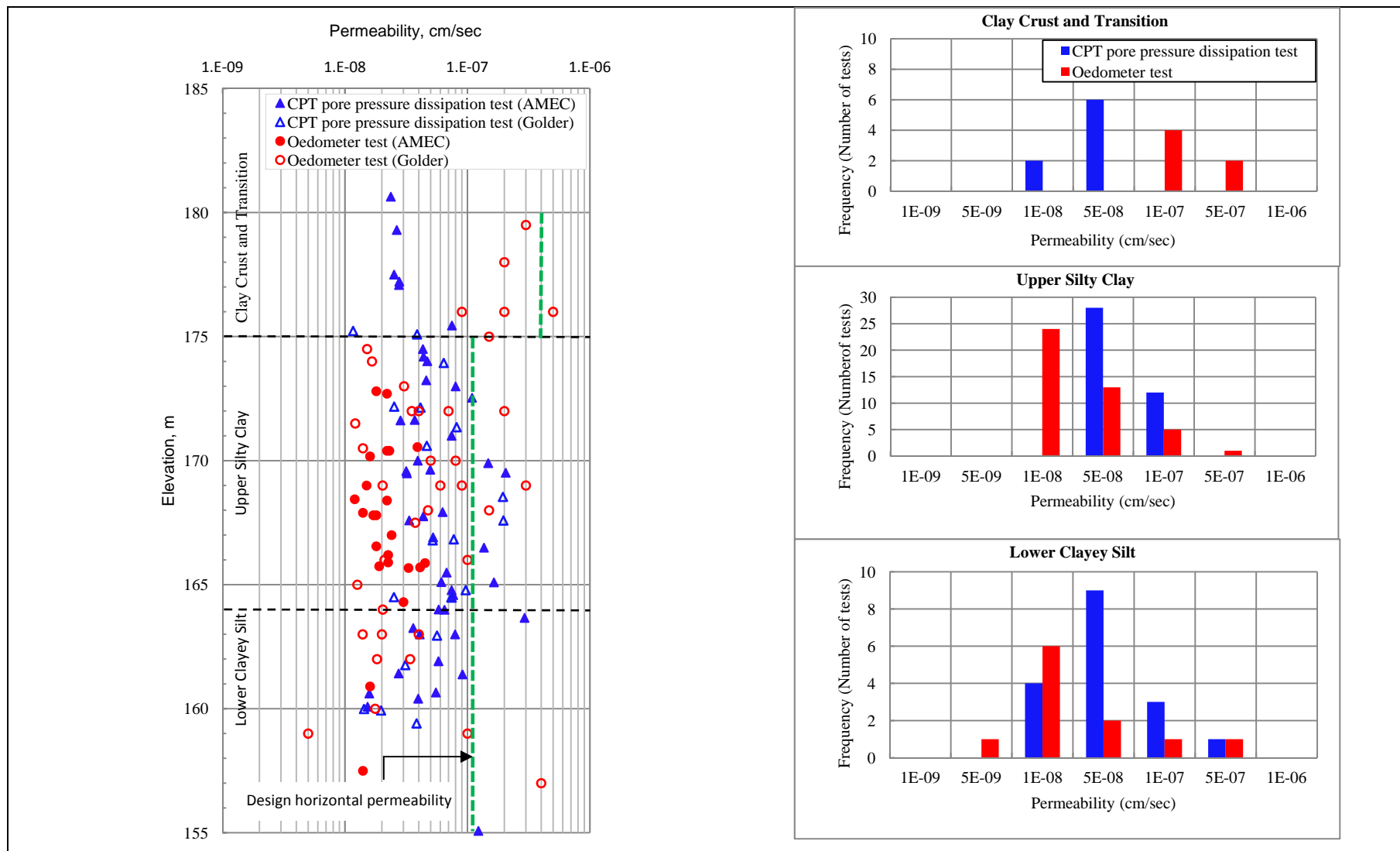
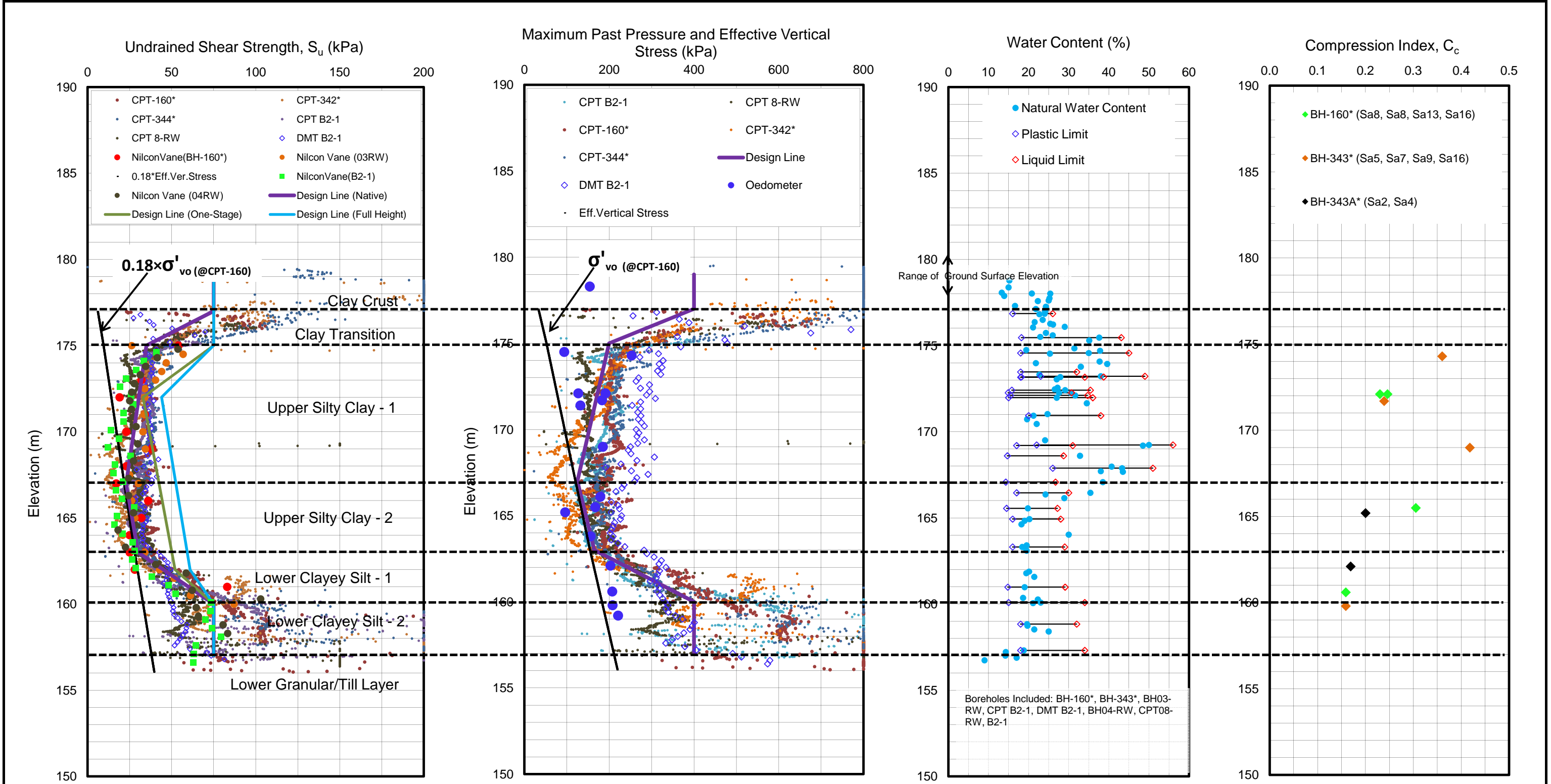


Figure 4.5: Inferred Clay Stratum Permeability from CPT Pore Pressure Dissipation and Oedometer Tests




Notes:

1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{vo}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.

2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_v) / S]^{1/m}$

*From previous investigations (ref. R-16 to R-23).

 Environment & Infrastructure	PROJECT: WINDSOR ESSEX PARKWAY				
	TITLE: SOIL PROPERTIES PROFILES AT AND AROUND BRIDGE B-2				
	CLIENT :	DATE: Jan 2013	JOB NO.: SW8801.1002	CAD FILE:	FIGURE NO.: 5.1

Appendix A Borehole, Nilcon Vane, CPT and DMT Logs from Additional 2011 Geotechnical Investigation

"

"

Project: Y kpf uqt/Gugz'Rctny c{"
Document: I gqvej plecn'p'xgunki c'vqp'cpf "F guki p"Tgr qtv"
 Dtkf i g'D/4"Uc032- 84202: Y "q"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu'P q062L8/67+"
 "

Date: O ctej 4235"
Rev: 2"
Page No.: Crr gpf kz"C"

METRIC

Continued Next Page


+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No B2-1

2 OF 2

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4682253, E329139.6 ORIGINATED BY DG
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE Jun 11, 11 - Jun 12, 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											WATER CONTENT (%)		
								○ UNCONFINED			+ FIELD VANE								w _p w w _L		
								● POCKET PEN.			× LAB VANE										
							20	40	60	80	100										
	CLAYEY SILT (continued)		14	TW	PH																
												</									

-VWP #P21 installed at elevation 157.3m

Rock Core Cu = 93.9 MPa
ROD = 77%
TCR = 100%
SCR = 64%
RQD = 98%
TCR = 100%
SCR = 93%

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/02/13

RECORD OF BOREHOLE No BH03-RW

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4682240.3, E329081.1 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE May 9, 11 - May 11, 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE LIQUID LIMIT LIMIT CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								20 40 60 80 100	20 40 60 80 100	10 20 30						
178.9	Ground Surface															
0.0	FILL Silty clay, some sand, trace gravel, topsoil Brown															
177.5	FINE SAND and SILT Laminated Very loose Mottled brown and grey		1	SS	4											
176.8			2	SS	4											
2.1	CLAYEY SILT laminated, varved Firm Grey		3	SS	5											
			4	SS	7											
175.2	SILTY CLAY Pink clay nodules, trace sand and gravel Soft Grey		5	SS	3											
3.7			6	TW	PH											
			7	TW	PH											
			8	TW	PH											
	Some sand, trace gravel		9	TW	PH											
170.4	CLAYEY SILT Some sand, trace gravel Soft Grey		10	TW	PH											
8.5	-Sand/silt seam inferred at approx. 9.6m		VT													
			11	TW	PH											
			VT													
			12	SS	PH											
			VT													
			13	SS	PH											
			VT													
												</				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/02/13

METRIC

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/02/13

3 OF 3

METRIC

SOIL PROFILE						GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20	40	60	80	100			W _p	W	W _L
	Water level measured in Piezometer VWP #P10.5 at elevation 180.0m on May 24, 2011 Water level measured in Piezometer VWP #P10.5 at elevation 179.6m on June 4, 2011 Water level measured in Piezometer VWP #P10.5 at elevation 178.5m on June 25, 2011 Water level measured in Piezometer VWP #P10.5 at elevation 178.2m on July 9, 2011 Water level measured in Piezometer VWP #P10.5 at elevation 178.1m on July 22, 2011																
							148										
							147										
							146										
							145										
							144										
							143										
							142										
							141										
							140										
							139										
							138										
							137										
							136										
							135										
							134										

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/02/13

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH04-RW

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4682217.2, E329130.8 ORIGINATED BY DG
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE Jun 13, 11 - Jun 14, 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _P	W	W _L			
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE										
178.3	Ground Surface							20	40	60	80	100						GR SA SI CL
0.0	SILT Some clay, some fine sand, laminated Loose Mottled brown and grey		1	SS	4		178											-indicator casing installed in boring for nilcon vane at (N4682217, E329131); vibrating wire piezometers (VWP) installed at shallow and mid-depth in adjacent boring at (N4682220, E329128.1) and (N4682221.4, E329131.8); Spider Magnets (MG) installed in adjacent boring at (N4682219.4, E329131.5)
	-Trace fissures and rootlets		2	SS	5		177											
176.3	SILTY CLAY/CLAYEY SILT Trace fissures and sand seams layered Firm Grey		3	SS	5		176											
2.0	-Trace fine-medium gravel, pink clay nodules, layered		4	SS	5		175											
			5	SS	5		174											
	-Trace fine gravel		6	SS	4		173											
			VT				172											
			7	TW	PH		171											
	-Pink clay nodules		8	TW	PH		170											
			VT				169											
	-Some sand, trace gravel		9	TW	PH		168											
			VT				167											
			10	SS	2		166											
			VT				165											
			11	TW	PH		164											
			VT				163											
164.9	CLAYEY SILT Some sand, trace gravel Stiff to very stiff Grey		12	TW	PH		162											
13.4			VT				161											
			VT				160											

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 18/03/12

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIMIT OF LIQUID W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		UNCONFINED	+ FIELD VANE			POCKET PEN.	X LAB VANE	WATER CONTENT (%)
								20 40 60 80 100								10 20 30
	CLAYEY SILT Some sand, trace gravel Stiff to very stiff Grey (<i>continued</i>)		13	TW	PH		163							4 19 43 34		
							162									
			14	SS	PH		161									
				VT			160									
			15	SS	PH		159									
	-Trace sand and gravel		16	SS	12		158									
			17	SS	15		157									
155.6 22.7 155.3 23.0	LIMESTONE Fine grained, porous Grey						155							-no recovery in shelly tube; sample retrieved by pushing split spoon		
	LIMESTONE Medium to coarse grained, oil stains Fossiliferous, calcite mineralization and pyrite crystals and visible Grey to brown						154							-corrosivity sample 1 7 56 36		
153.6 24.7	LIMESTONE Medium to fine grained Fossiliferous, stylolites present, porous Grey						153							-VWP #P22 installed at elevation 155.6m -After core retrieved from borehole site abandoned due to strong H2S odour. Core data not recorded on field logs.		
152.5 25.8	END OF BOREHOLE						152									
	Water level measured in Piezometer VWP #P8 at elevation 177.0m on July 9, 2011 Water level measured in Piezometer VWP #P8 at elevation 176.8m on July 22, 2011 Water level measured in Piezometer VWP #P8 at elevation 176.9m on August 23, 2011					151										
	Water level measured in Piezometer VWP #P13 at elevation 175.8m on July 9, 2011 Water level measured in Piezometer VWP #P13 at elevation 175.6m on July 22, 2011 Water level measured in Piezometer VWP #P13 at elevation 175.6m on August 23, 2011					150										
	Water level measured in Piezometer VWP #P22 at elevation 179.5m on					149										

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 18/03/12

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No CPT B2-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4682211.4, E329077.4 ORIGINATED BY TA
DIST HWY WEP BOREHOLE TYPE Track Mounted Drill - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE May 9, 11 - May 9, 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa													WATER CONTENT (%)					
								○ UNCONFINED	+	FIELD VANE																
								● POCKET PEN.	×	LAB VANE																
178.8	Ground Surface							20	40	60	80	100														
0.0	FILL Silty clay with sand, trace gravel, trace topsoil																									
178.0	FILL Silty sand mixed with topsoil, trace concrete pieces		1	SS	14		178																			
177.4	SILT And Fine SAND Varved Loose Grey		2	SS	6		177																			
1.4																										
176.1	CLAYEY SILT Varved Firm Grey		3	SS	5		176																			
2.7																										
175.3	END OF SAMPLED BOREHOLE (Continued with CPT to refusal) Borehole dry on completion		4	SS	7																					
3.5								175																		
								174																		
								173																		
								172																		
								171																		
								170																		
								169																		
								168																		
								167																		
								166																		
								165																		
						164																				

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No DMT B2-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4682249.9, E329090.6 ORIGINATED BY LC
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE May 12, 11 - May 12, 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE								
178.8	Ground Surface						20	40	60	80	100					
0.0	FILL Mixed sand, silt and topsoil Trace gravel, some construction debris															
			1	SS	10											
177.1			2,A,B	SS	5											
178.8	CLAYEY SILT With wet fissures, sand seams (possible FILL) Soft to firm Brown-grey															
2.0	END OF SAMPLED BOREHOLE (Continued with DMT to refusal) Borehole dry on completion															
													</			

+ ³, × ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No CPT08-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4682230.8, E329255.3 ORIGINATED BY TA
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE Jun 18, 11 - Jun 18, 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
178.4	Ground Surface														
0.0	TOPSOIL														
178.1															
0.3	SAND Poorly graded (Fine) Compact Brown-grey -Trace silt		1	SS	10										
176.9															
1.5	CLAYEY SILT Trace to some sand Firm Brown-grey		2	SS	6										
176.4															
2.0	END OF SAMPLED BOREHOLE (Continued with CPT to refusal) Borehole dry on completion														
							176								
							175								
							174								
							173								
							172								
							171								
							170								
							169								
							168								
							167								
							166								
							165								
							164								

+ ³, × ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF NILCON VANE TEST NIL B2-1

Project : Windsor-Essex Parkway

Test Date: 6/20/2011

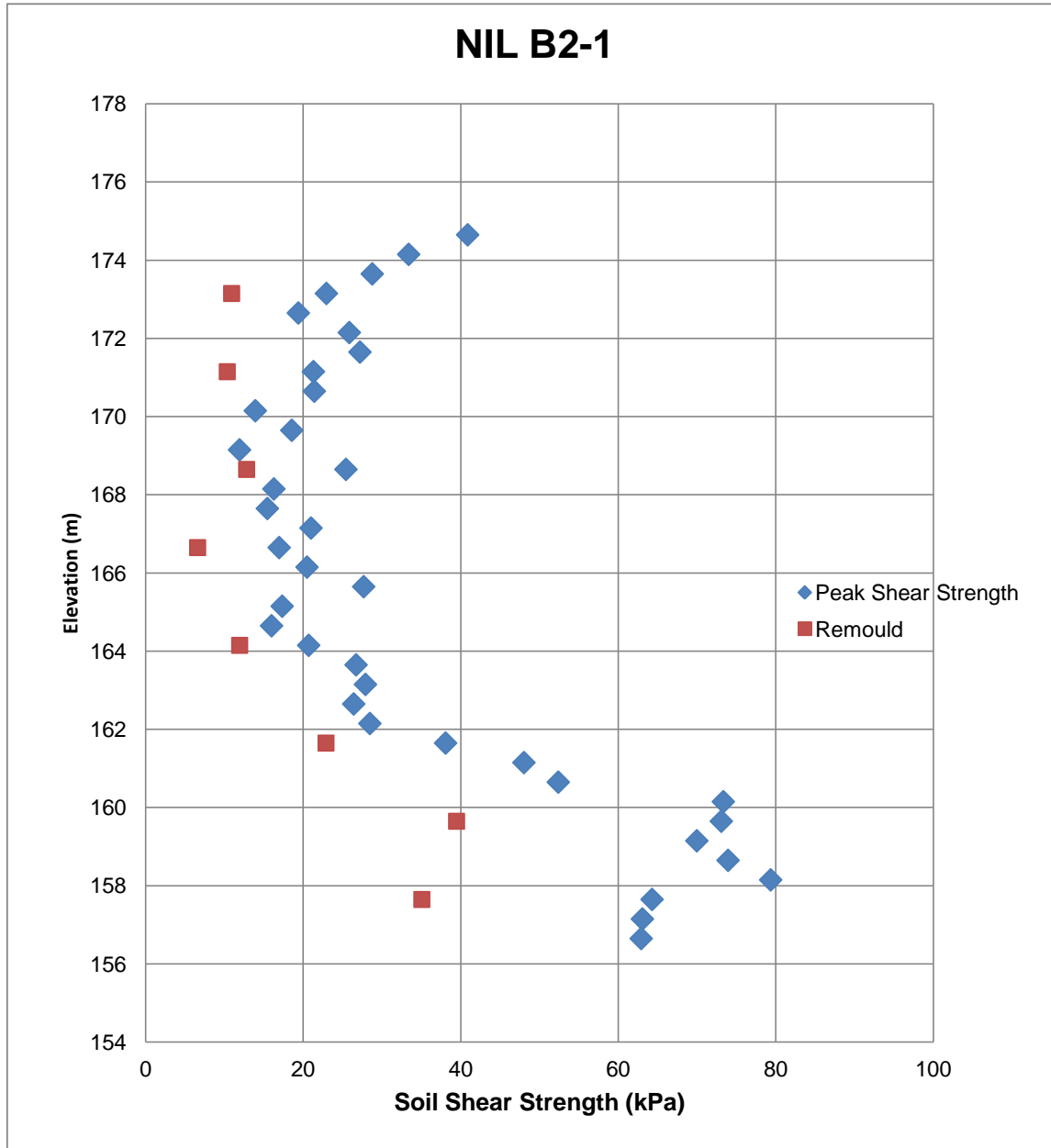
Sheet 1 of 1

Location: N4682253.0; E329139.6

Predrill Depth : 4.0 m

Datum Geodetic

Ground Surface Elevation: 178.6 m



RECORD OF NILCON VANE TEST NIL 03-RW

Project : Windsor-Essex Parkway

Test Date: 6/21/2011

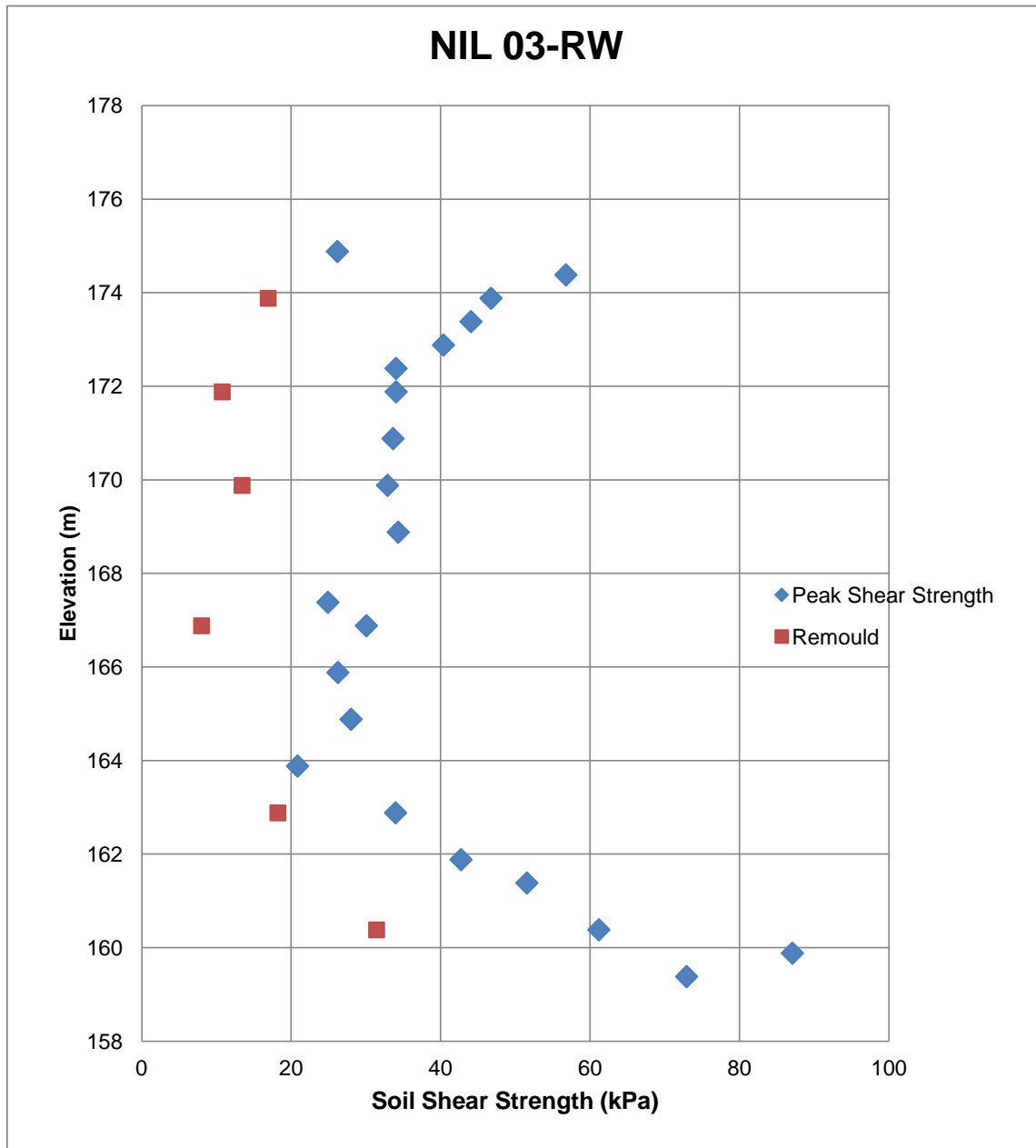
Sheet 1 of 1

Location: N4682240.3; E329078.1

Predrill Depth : 4.0 m

Datum Geodetic

Ground Surface Elevation: 178.9 m



Operator: NB

Checked: DD

RECORD OF NILCON VANE TEST NIL 04-RW

Project : Windsor-Essex Parkway

Test Date: 6/23/2011

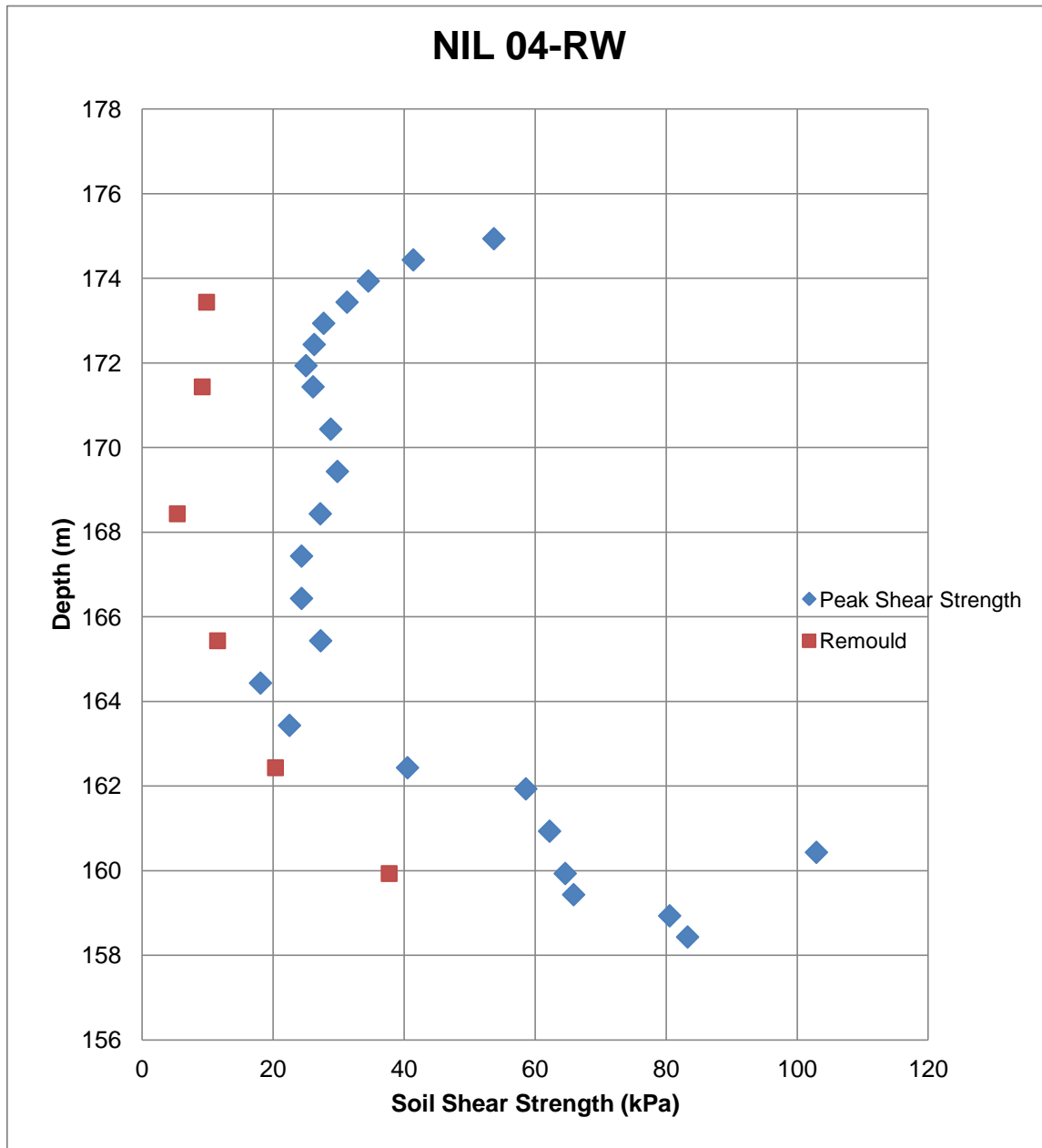
Sheet 1 of 1

Location: N4682220.0; E329128.1

Predrill Depth : 3.5 m

Datum Geodetic

Ground Surface Elevation: 178.4 m



Operator: NB

Checked: DD

RECORD OF CONE PENETRATION TEST CPT B2-1

METRIC

PROJECT Windsor-Essex Parkway

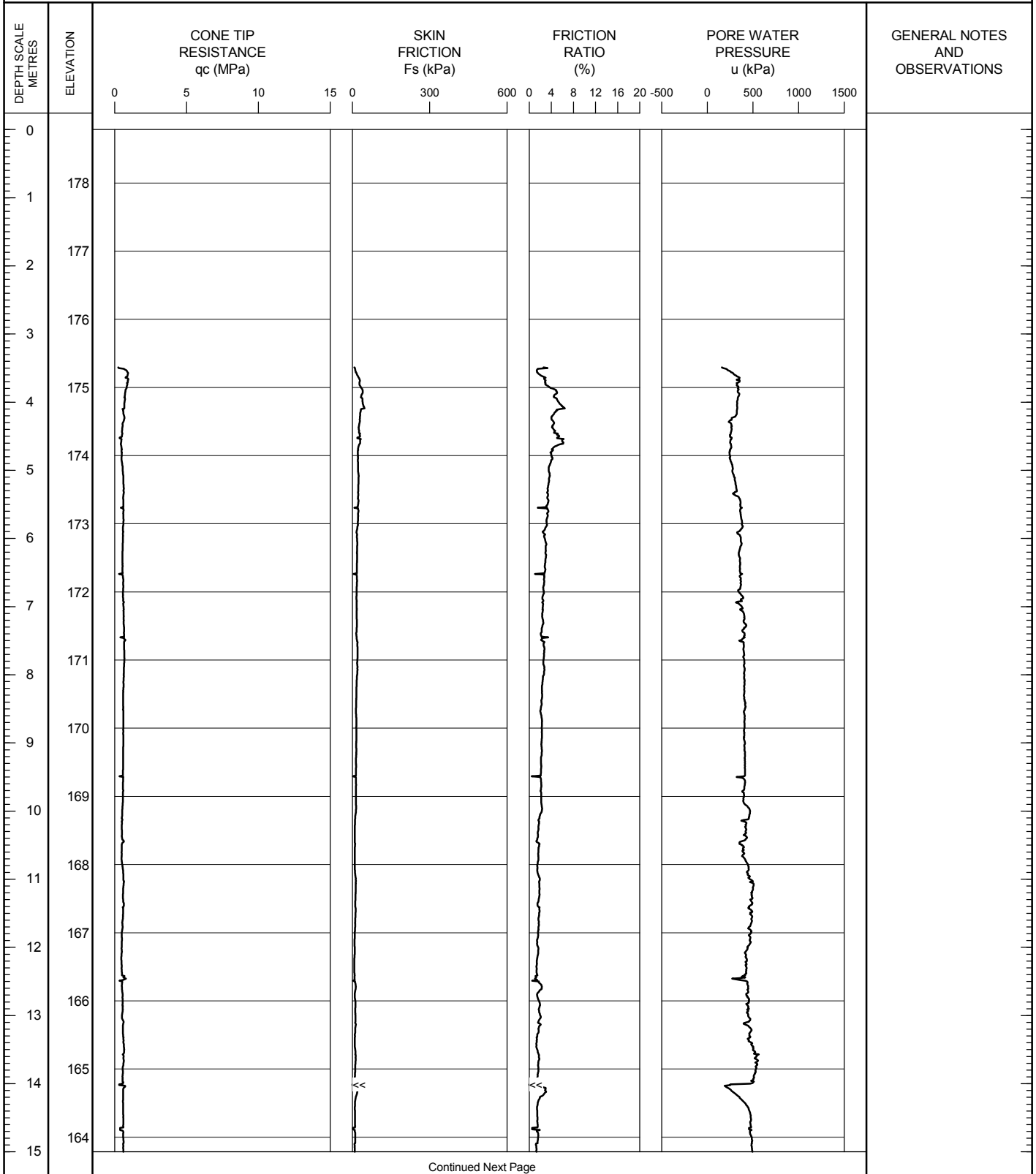
TEST DATE 5/9/2011 - 5/9/2011

SHEET 1 OF 2

LOCATION N4682211.4; E329077.4

DATUM Geodetic

GROUND SURFACE ELEVATION: 178.8 PREDRILL DEPTH: 3.49 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT B2-1

METRIC

PROJECT Windsor-Essex Parkway

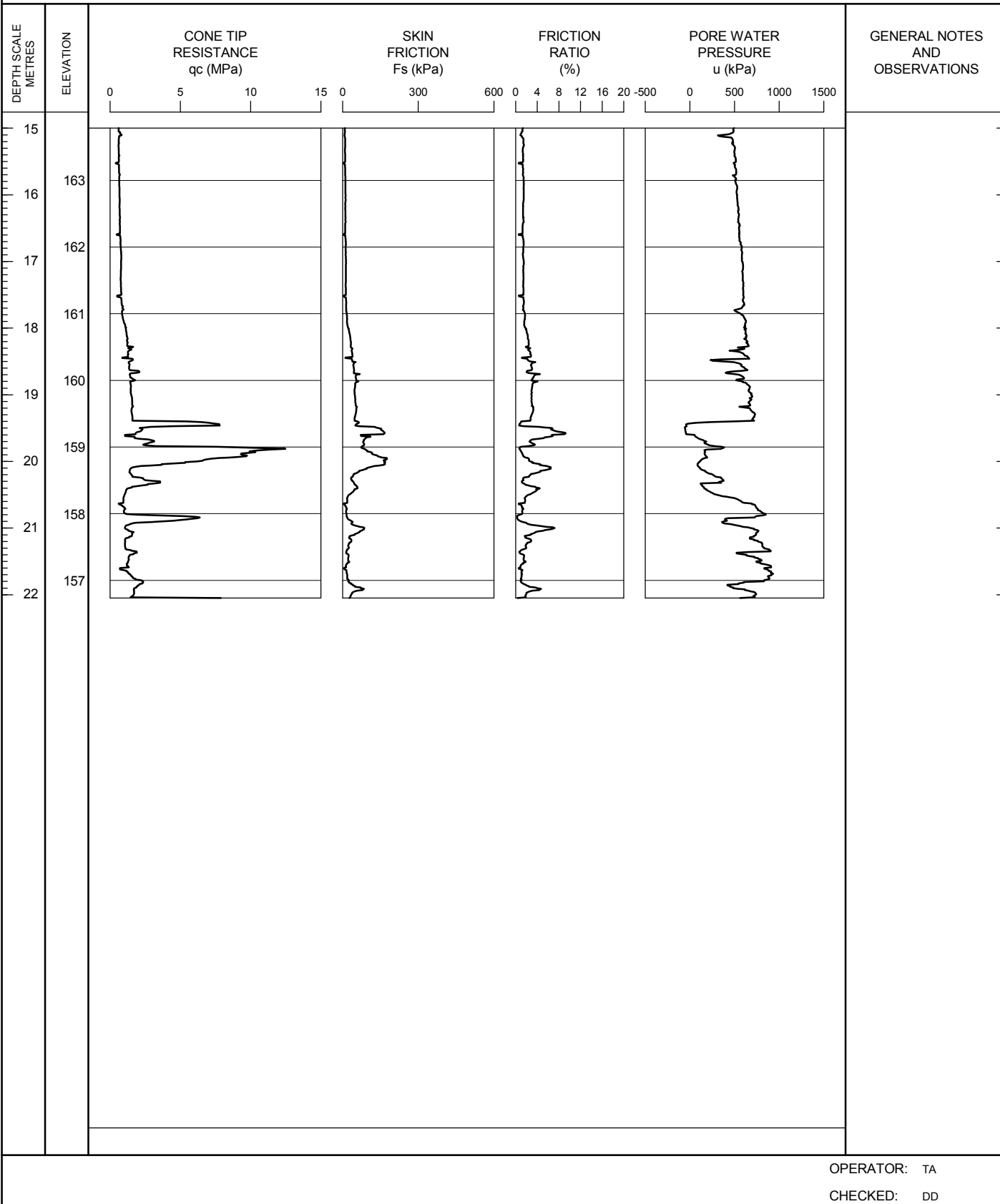
TEST DATE 5/9/2011 - 5/9/2011

SHEET 2 OF 2

LOCATION N4682211.4; E329077.4

DATUM Geodetic

GROUND SURFACE ELEVATION: 178.8 PREDRILL DEPTH: 3.49 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



RECORD OF CONE PENETRATION TEST CPT 08-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 6/19/2011 - 6/19/2011

SHEET 1 OF 2

LOCATION N4682230.8; E329255.3

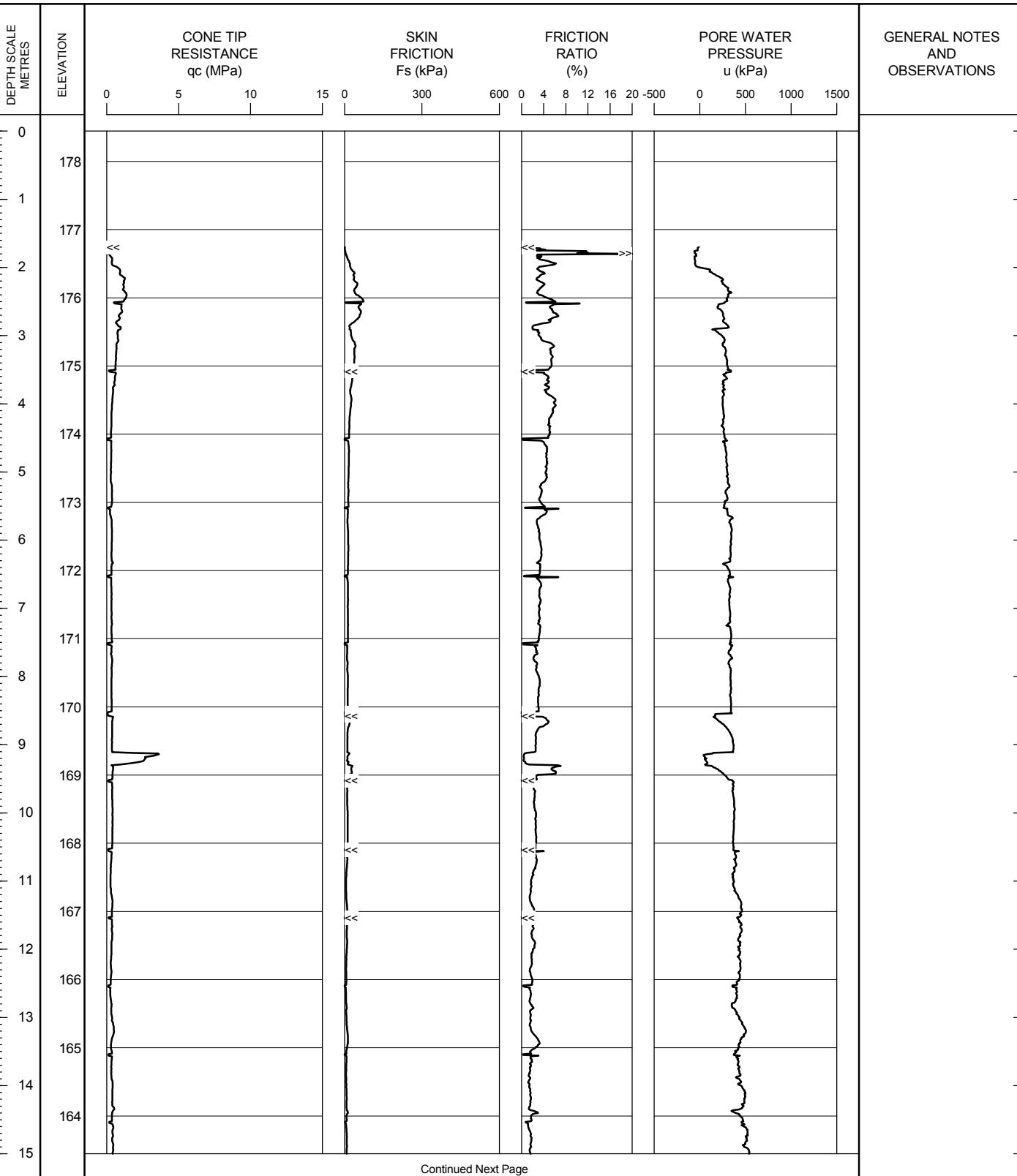
DATUM Geodetic

GROUND SURFACE ELEVATION: 178.4

PREDRILL DEPTH: 1.67

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 08-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 6/19/2011 - 6/19/2011

SHEET 2 OF 2

LOCATION N4682230.8; E329255.3

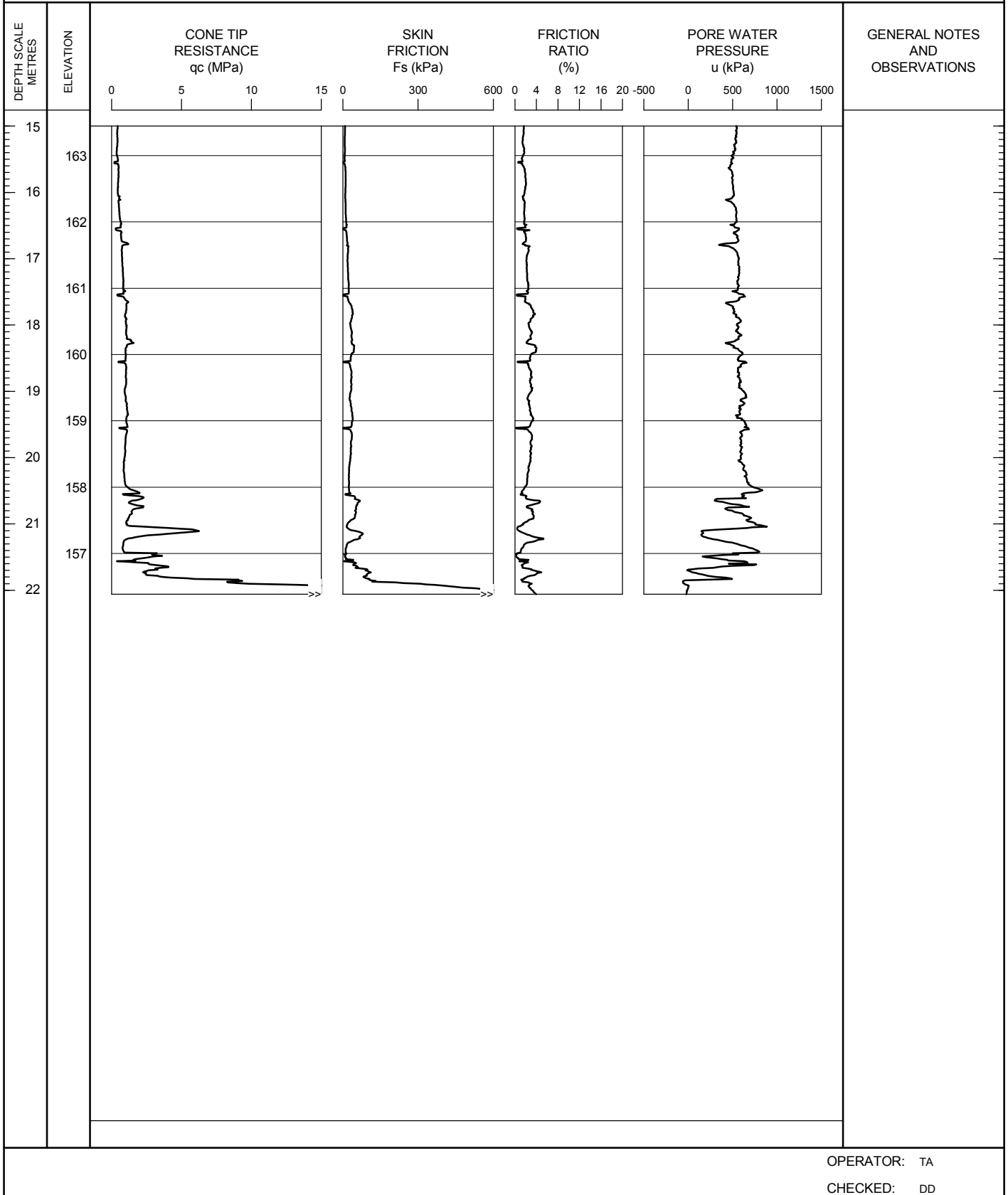
DATUM Geodetic

GROUND SURFACE ELEVATION: 178.4

PREDRILL DEPTH: 1.67

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

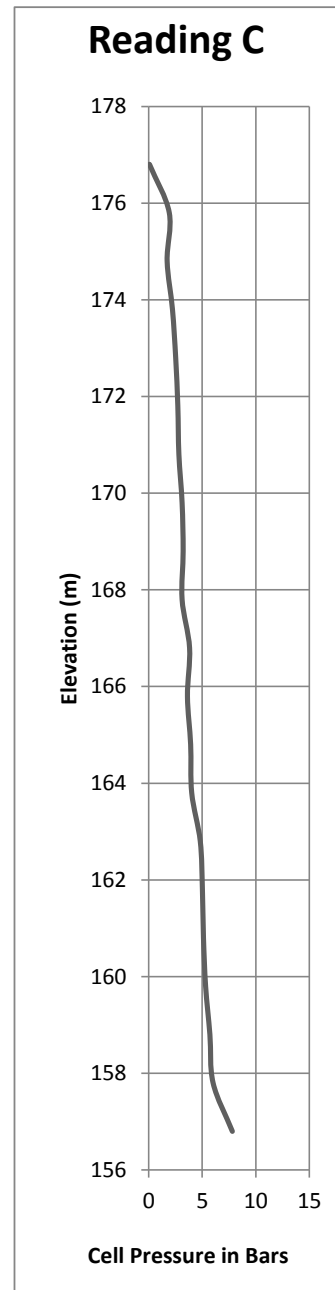
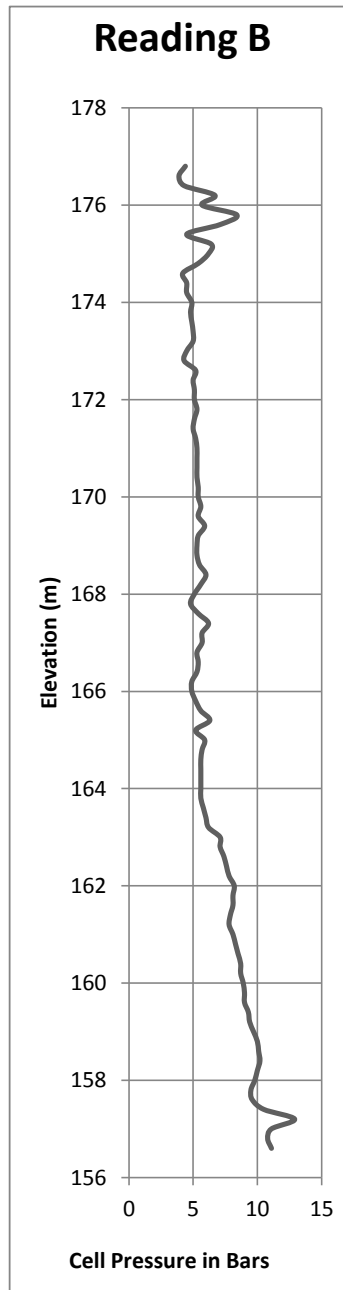
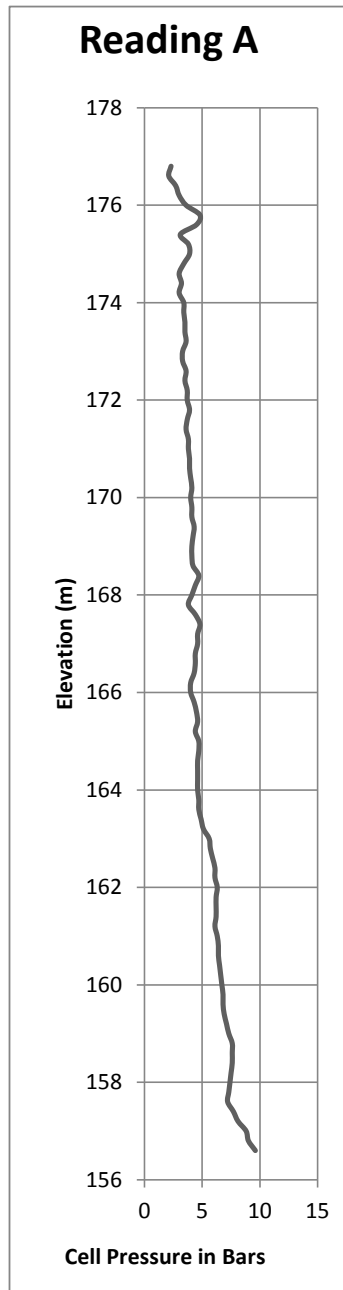
CHECKED: DD

RECORD OF DILATOMETER TEST DMT B2-1

Project : Windsor-Essex Parkway
Location: N 4682249.9; E 329090.6
Ground Surface Elevation : 178.8

Test Date: 5/12/2011
Predrill Depth : 1.98 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.32 Bar



Operator: LC

Checked: DD

Appendix B Borehole and CPT Logs from Previous Investigations

"

"

Project: Y kpf uqt/Gugz'Retny c{"
Document: I gq'gej plecn'fpxgunki c'vkp"cpf "F guki p"Tgr qtv"
Dtkf i g'D/4"Uc032- 84202: Y "q"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu"P q062L8/67+"
"

Date: O ctej 4235"
Rev: 2"
Page No.: Crr gpf kz'D"

PROJECT 07-1130-207-0

RECORD OF BOREHOLE No 160

1 OF 3

METRIC

W.P.

LOCATION

N 4682216.8 : E 329156.2

ORIGINATED BY SM

DIST

WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

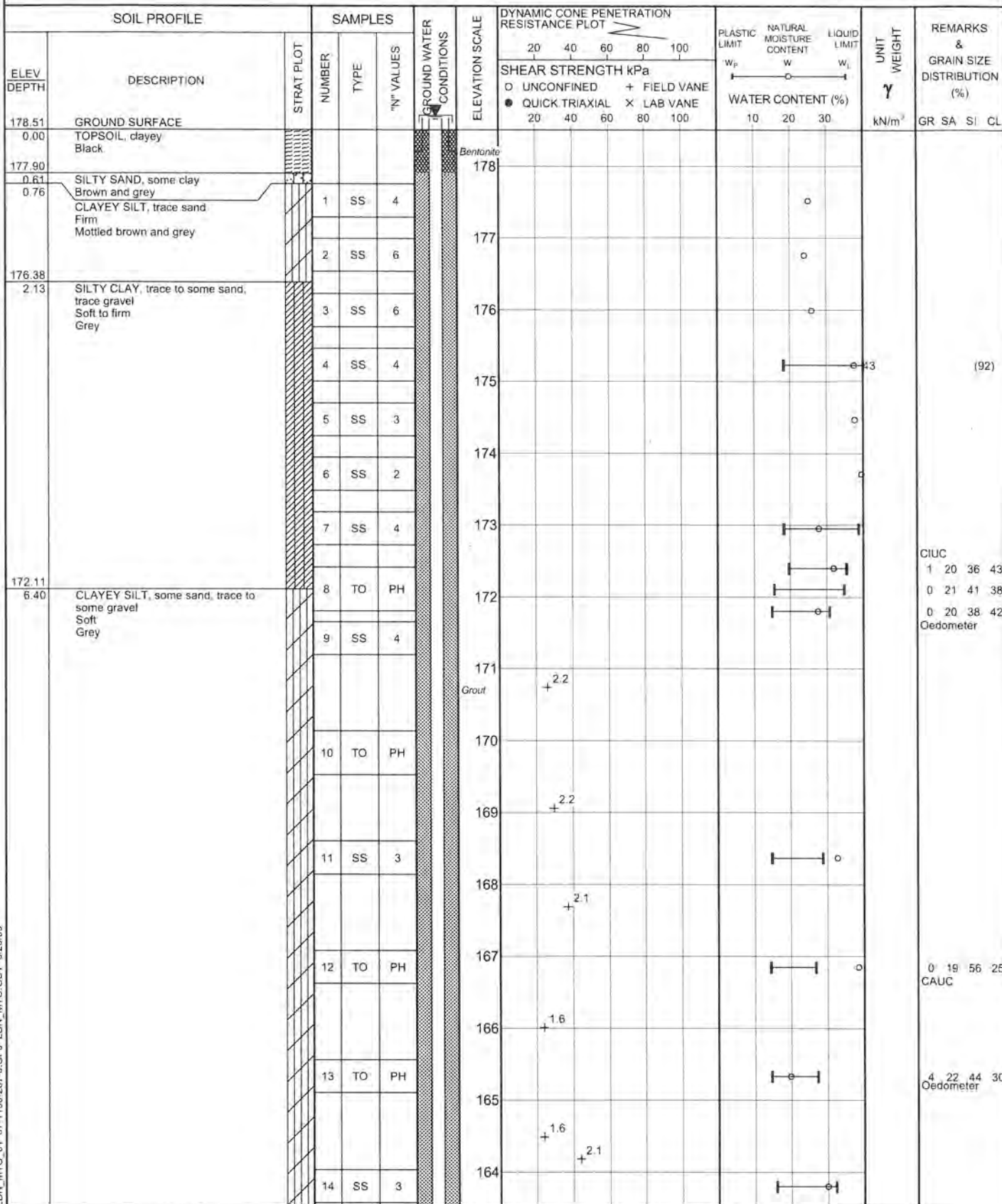
DATUM GEODETIC

DATE

July 14, 2008 - July 15, 2008

CHECKED BY

SSB



Continued Next Page

+ 3 × 3

Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 160

2 OF 3

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4682216.8 ; E 329156.2

ORIGINATED BY SM

DIST

WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

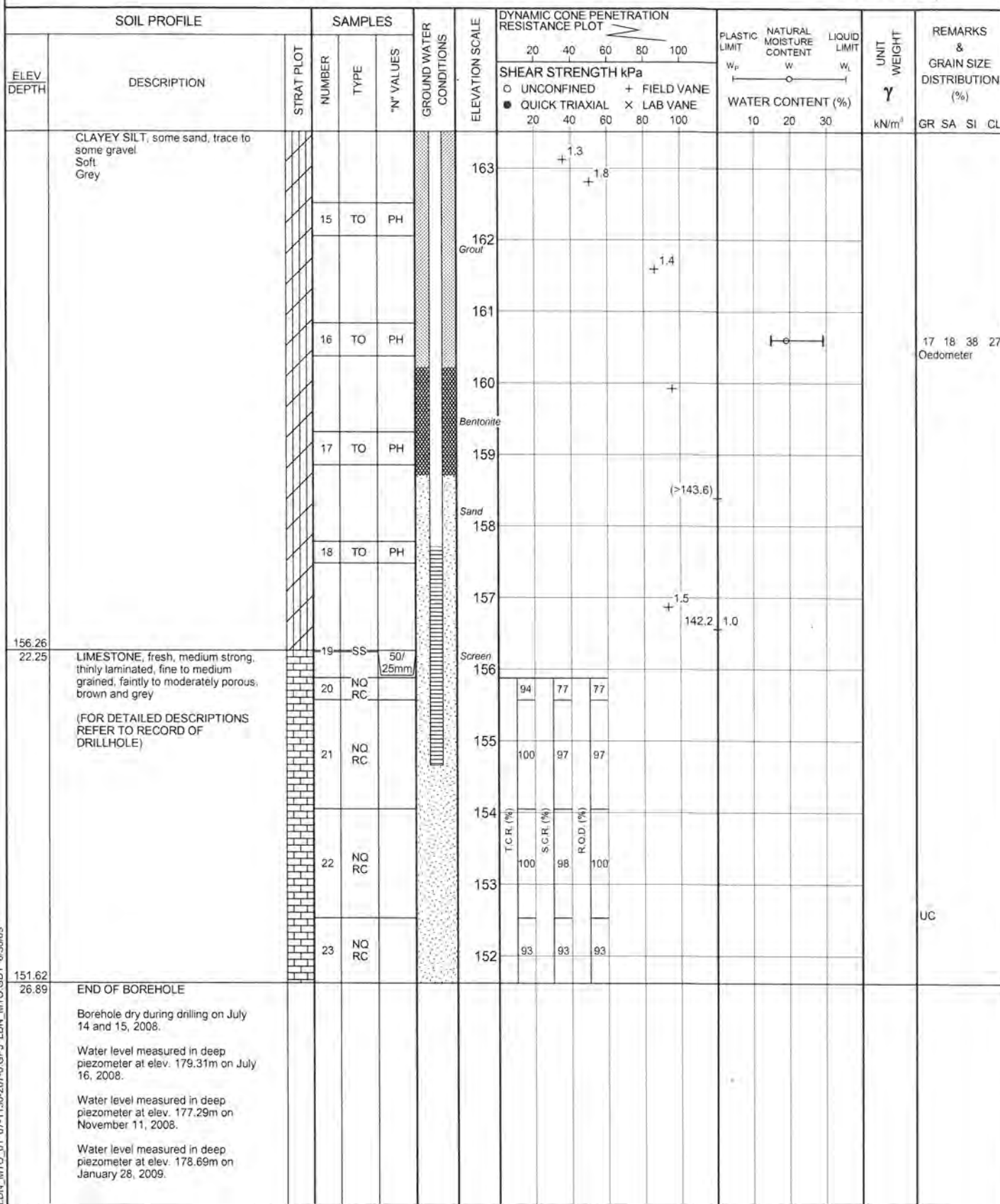
DATUM

GEODETIC

DATE

July 14, 2008 - July 15, 2008

CHECKED BY SB



+³ ×³ Numbers refer to Sensitivity ○³% STRAIN AT FAILURE

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/30/09

LOCATION: N 4682216.8 E 329156.2

DRILLING DATE: July 14, 2008 - July 15, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE. NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

[illegible]

DN ROCK 03 07-1130-207-0-ROCK.GPJ GLDR LDN.GDT 5/29/09 DATA INPUT: WDF

DEPTH SCALE

1:75

LOGGED: SG

CHECKED: SJR

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 343		1 OF 3	METRIC
W.P. _____	LOCATION <u>N 4682231.8 ;E 329086.3</u>	ORIGINATED BY <u>MR/LK</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>	BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>	COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>	DATE <u>November 18, 2009 - November 19, 2009</u>	CHECKED BY _____			

[illegible]

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

○ 3% STRAIN AT FAILURE

DN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 12/03/10

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 343		2 OF 3	METRIC
W.P. _____		LOCATION <u>N 4682231.8 ; E 329086.3</u>		ORIGINATED BY <u>MR/LK</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>November 18, 2009 - November 19, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						

156.43 22.71 155.70 23.44	CLAYEY SILT, some sand, trace gravel Firm to very stiff Grey		12	TO	PH		164							4 14 44 38 Oedometer	
			13	SS	PH		163								
			14	TO	PH		162								
			15	TO	PH		161								
			16	TO	PH		160								
150.74 28.40	SAND AND GRAVEL, trace silt Very dense Grey		17	SS	13		159								
150.74 28.40	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, with hydrocarbon staining Grey to dark brown (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		18	SS	58		156								
			19	SS	50/ 100mm										
			20	NQ RC	-		155	100	71	60					
			21	NQ RC	-		154	63	61	61					
			22	NQ RC	-		153	100	99	99					
			23	NQ RC	-		152	98	72	77					
150.74 28.40	END OF BOREHOLE Groundwater encountered at about elev. 177.3m during drilling between Nov. 18 and 19, 2009. Borehole sealed with cement-bentonite grout.						151								
150.74 28.40	END OF BOREHOLE Groundwater encountered at about elev. 177.3m during drilling between Nov. 18 and 19, 2009. Borehole sealed with cement-bentonite grout.														

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT: 09-1132-0080

RECORD OF DRILLHOLE: 343

SHEET 3 OF 3

LOCATION: N 4682231.8 ;E 329086.3

DRILLING DATE: November 18, 2009 - November 19, 2009

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: LANTECH

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.										HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				TOTAL CORE %						SOLID CORE %	DIP W.R.T. CORE AXIS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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DEPTH SCALE

1 : 75



LOGGED: SG

CHECKED:

LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-342		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4682246.9 ; E 329168.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 4, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) w _p w w _L				GR	SA	SI	CL
								20	40	60	80	100	10	20	30					
178.75	GROUND SURFACE																			
0.00	TOPSOIL, sandy, trace to some clay Black																			
178.10																				
0.65	SILTY FINE SAND Compact Brown		1	SS	17															
177.38																				
1.37	SANDY SILT, some clay, trace gravel, with silt partings Loose Grey		2	SS	7								○							
176.62																				
2.13	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Stiff Grey		3	SS	10								○							
175.85																				
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on December 4, 2009.																			

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-344		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4682206.2 ; E 328974.6</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 2, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w _p	w	w _L		GR	SA	SI	CL	
								20	40	60	80	100									
179.56	GROUND SURFACE																				
0.00	TOPSOIL, sandy, trace to some rootlets																				
0.15	Black																				
	SAND, fine some silt		1	SS	10								o								
	Compact																				
	Brown																				
177.86	SAND AND GRAVEL, some silt		2	SS	10																
1.80	Compact																				
	Brown																				
	SILT, some clay, trace to some sand, trace gravel																				
	Compact		3	SS	16									o							
176.66	Brown becoming grey below about elev. 177.4m																				
2.90	END OF BOREHOLE																				
	Groundwater encountered at about elev. 177.9m during drilling on December 2, 2009.																				

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-160

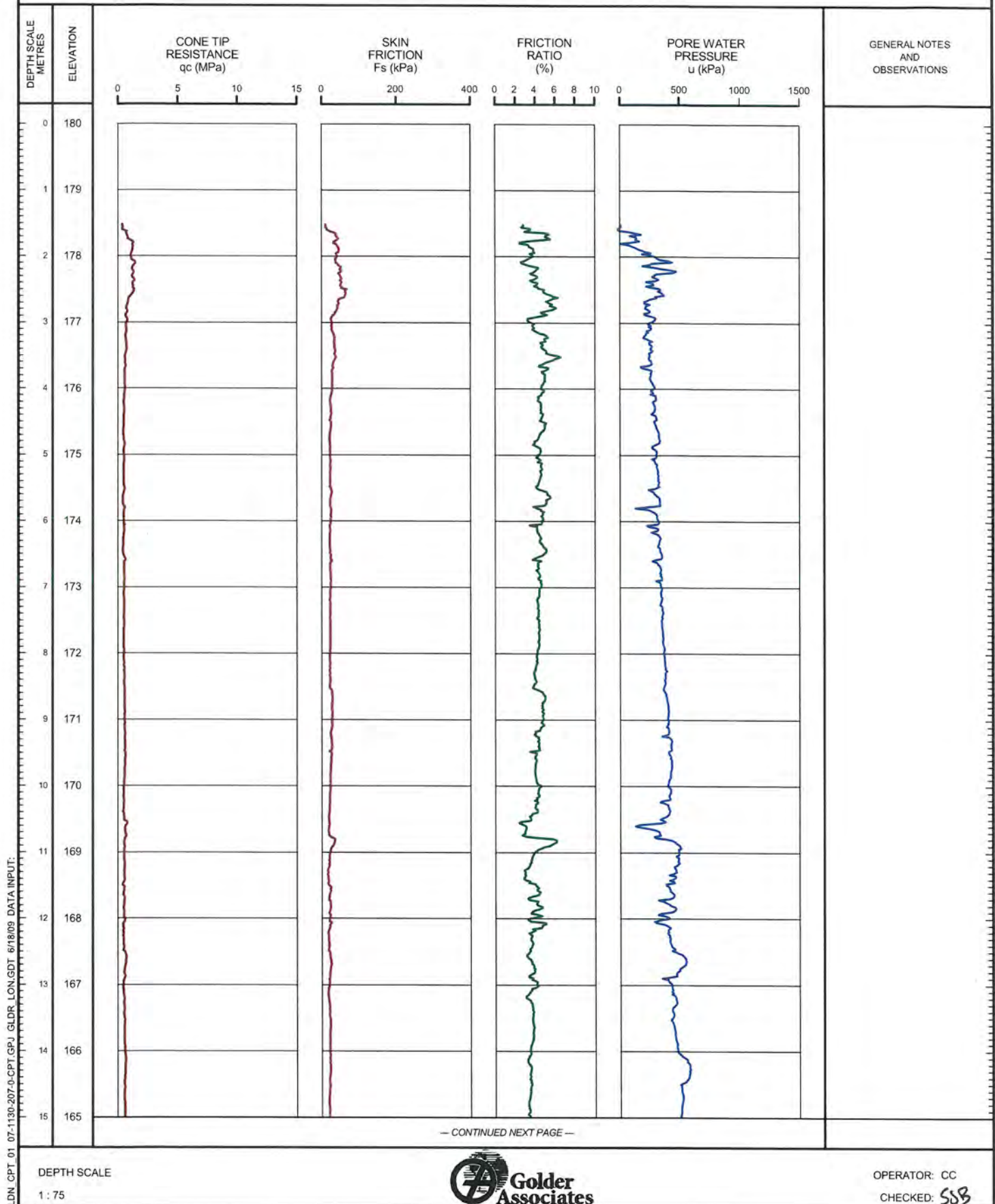
SHEET 1 OF 2

LOCATION: N 4682216.8 E 329156.2

TEST DATE: August 12, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.53m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LON CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-160

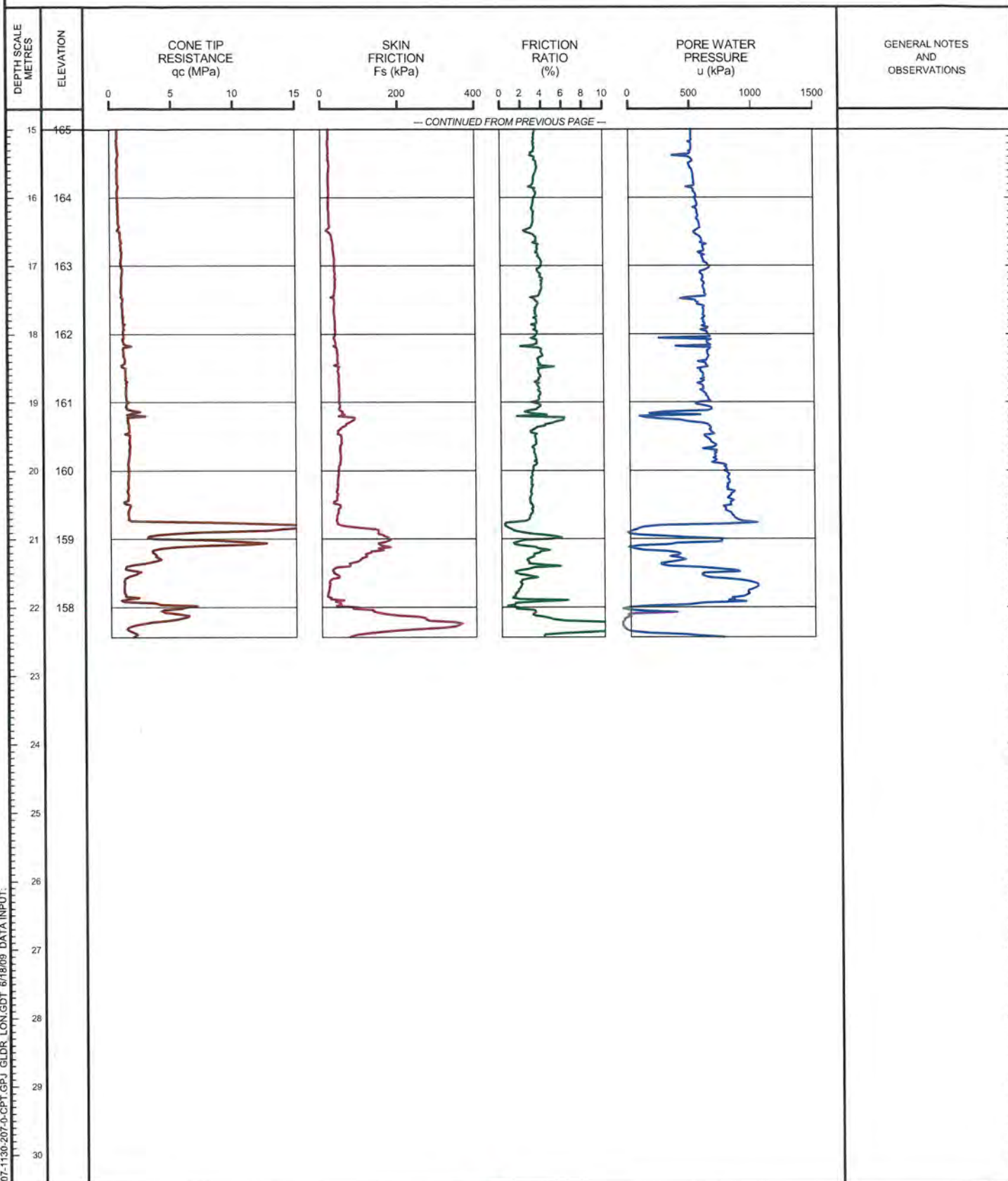
SHEET 2 OF 2

LOCATION: N 4682216 8 :E 329156.2

TEST DATE: August 12, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.53m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: SJB

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-342

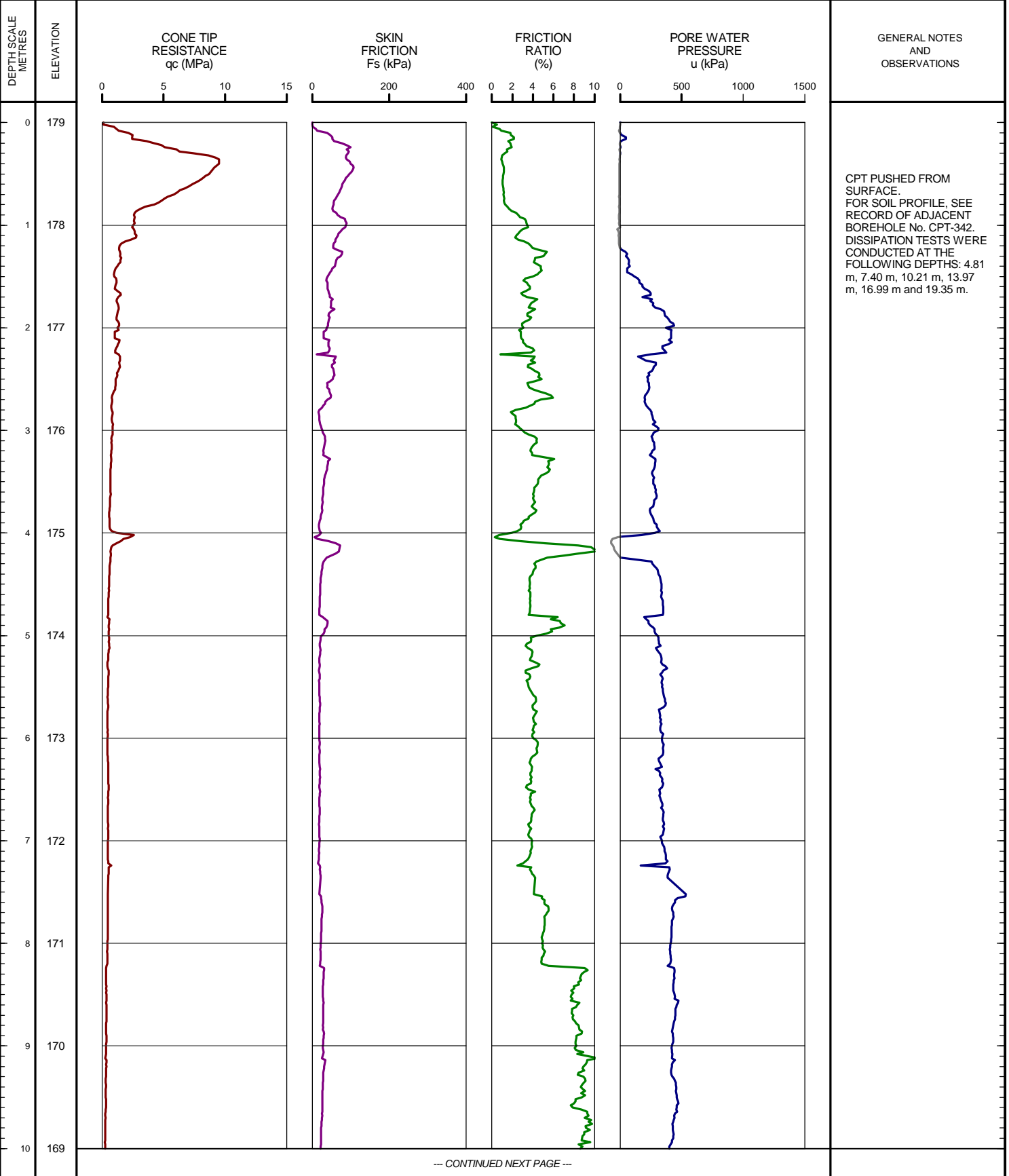
SHEET 1 OF 3

LOCATION: N 4682246.9 ;E 329168.7

TEST DATE: December 4, 2009 - December 8, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 178.75m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-342

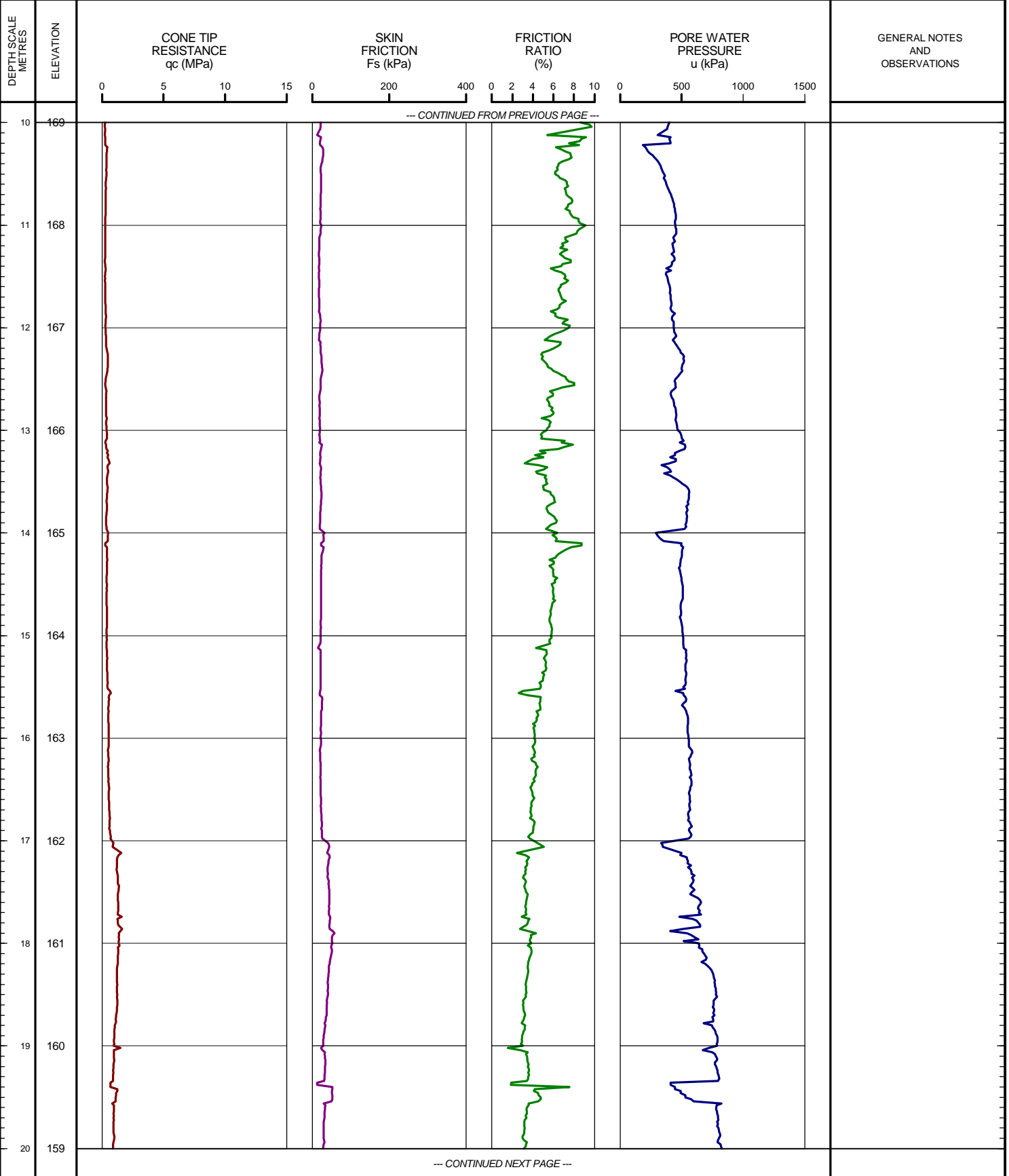
SHEET 2 OF 3

LOCATION: N 4682246.9 ;E 329168.7

TEST DATE: December 4, 2009 - December 8, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 178.75m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-342

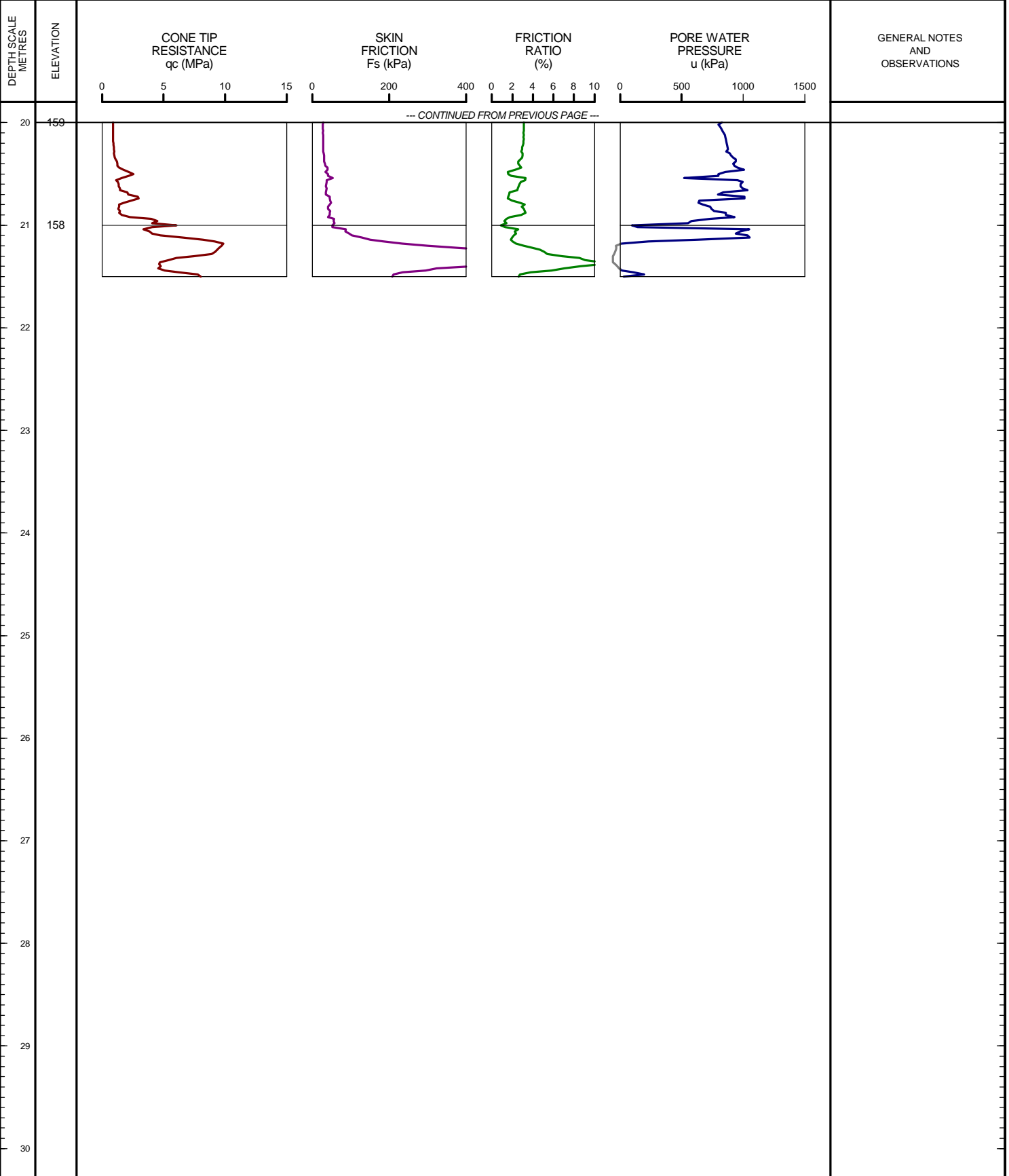
SHEET 3 OF 3

LOCATION: N 4682246.9 ;E 329168.7

TEST DATE: December 4, 2009 - December 8, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 178.75m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-344

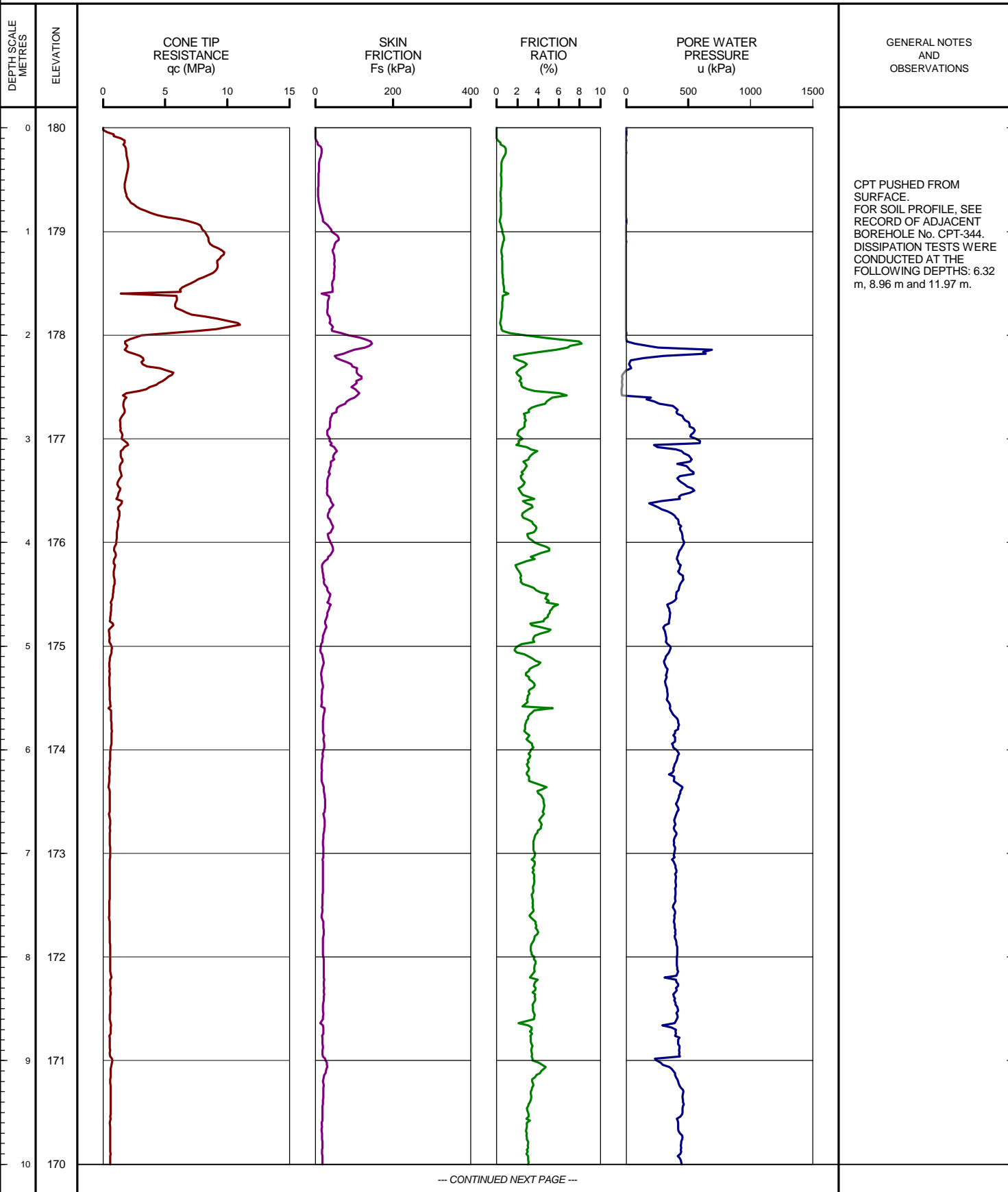
SHEET 1 OF 3

LOCATION: N 4682206.2 ;E 328974.6

TEST DATE: December 2, 2009 - December 3, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 179.56m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-344

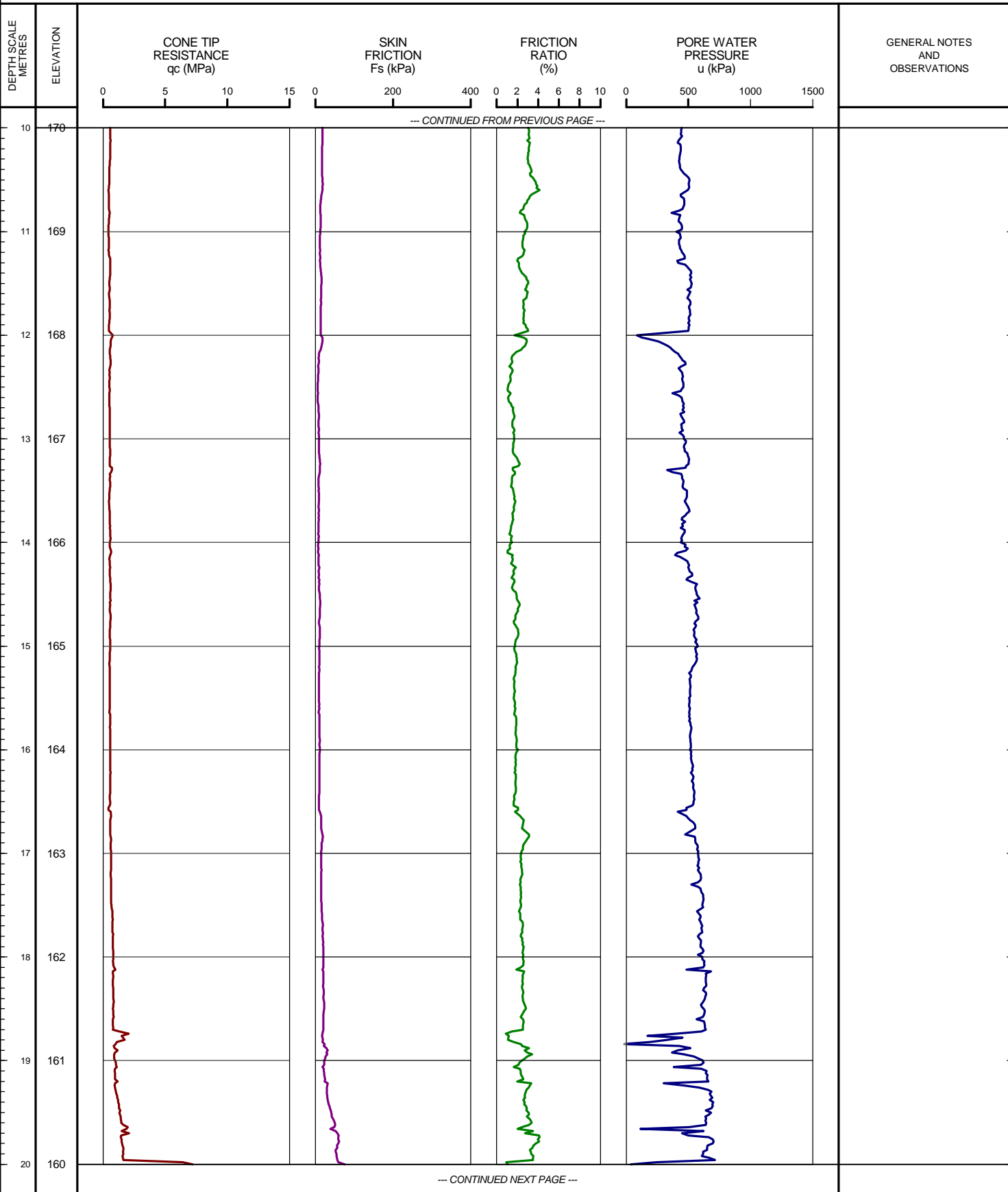
SHEET 2 OF 3

LOCATION: N 4682206.2 ;E 328974.6

TEST DATE: December 2, 2009 - December 3, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 179.56m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-344

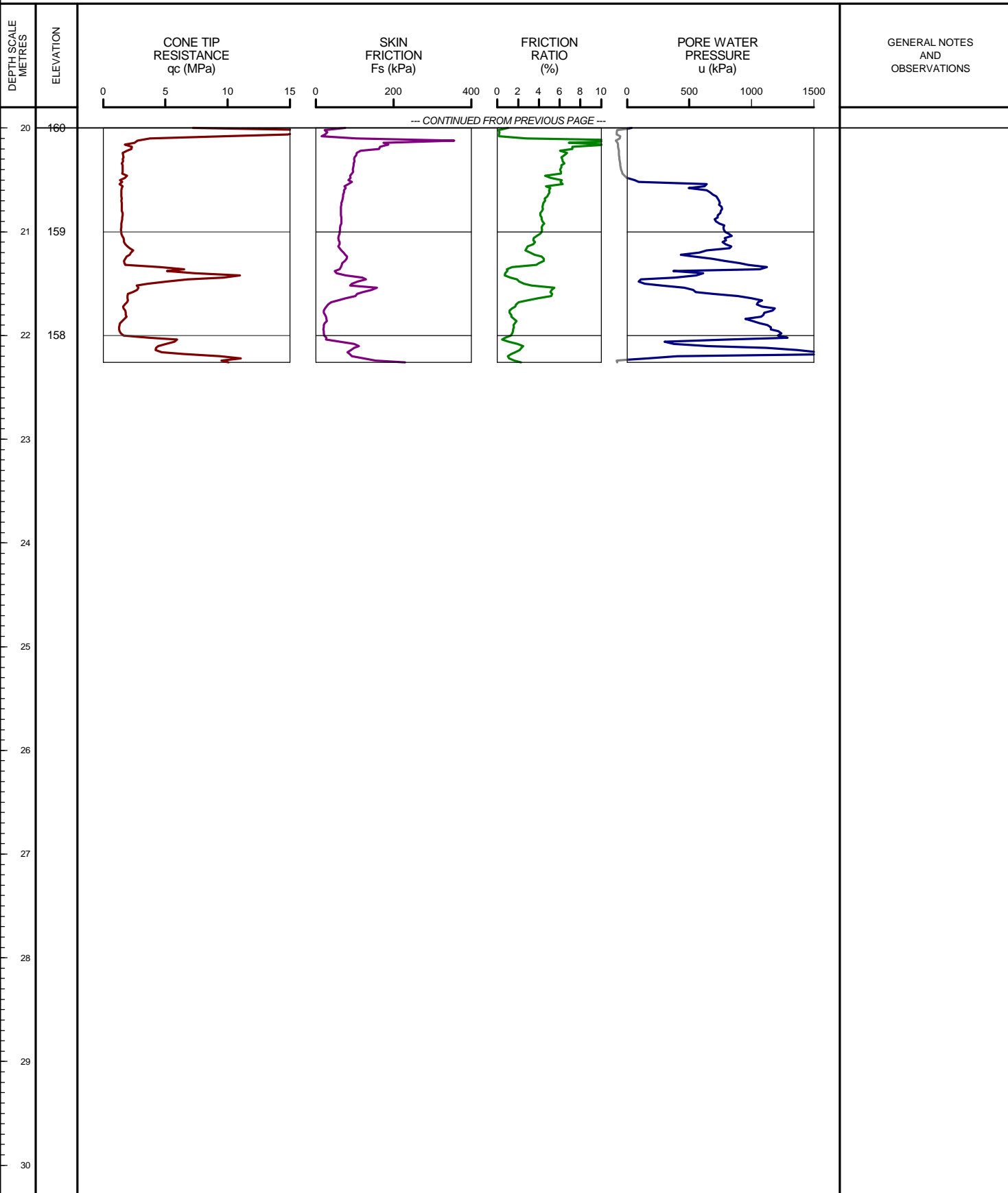
SHEET 3 OF 3

LOCATION: N 4682206.2 ;E 328974.6

TEST DATE: December 2, 2009 - December 3, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 179.56m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

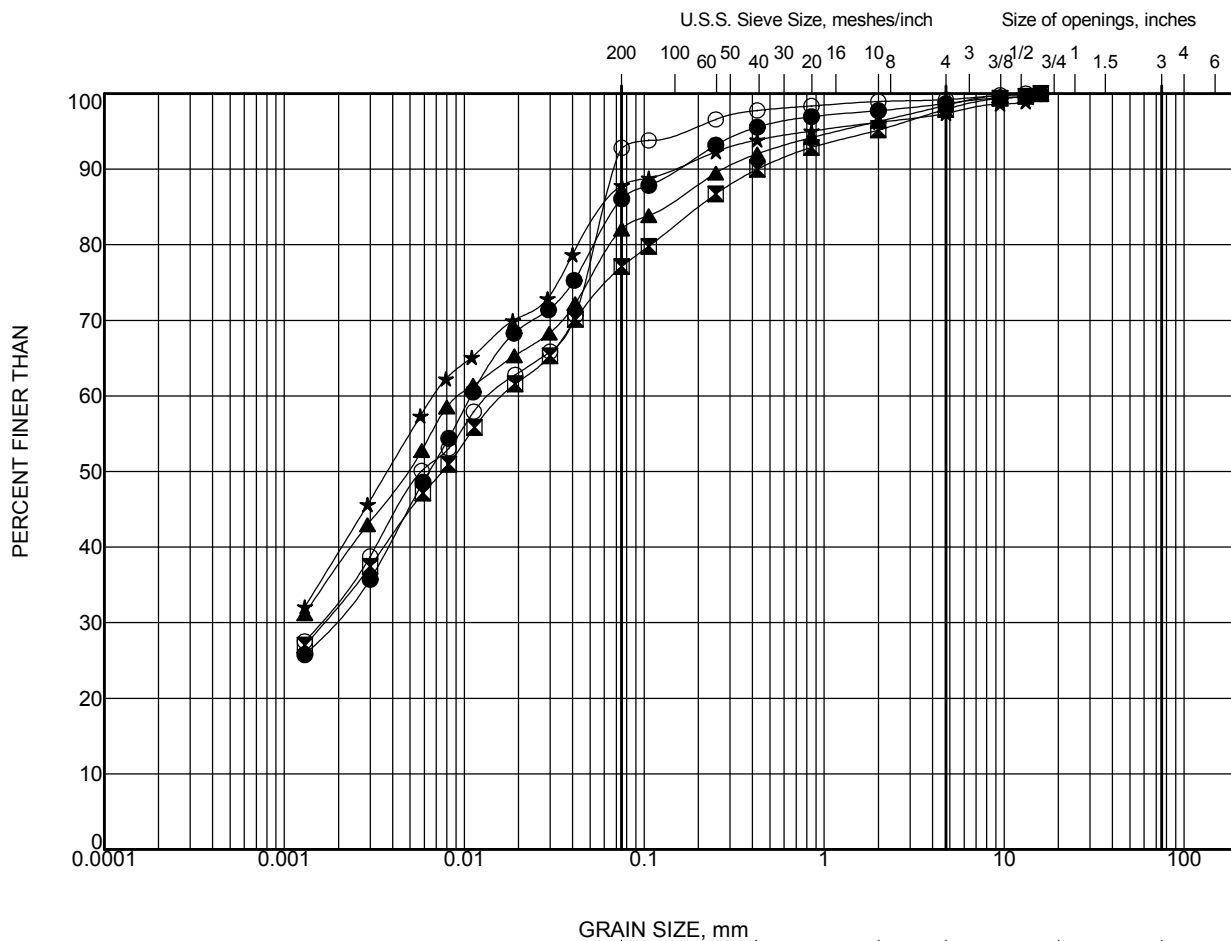
Appendix C Geotechnical Laboratory Test Results

"

"



Project: Y kpf uqt/Gugz'Retny c{"
Document: I gq'gej plecn'fpxgunki c'vkqp'c'pf "F guki p"Tr qtv"
Dtkf i g'D/4"Uc032- 84202: Y "q"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu"62L8/67+"
"

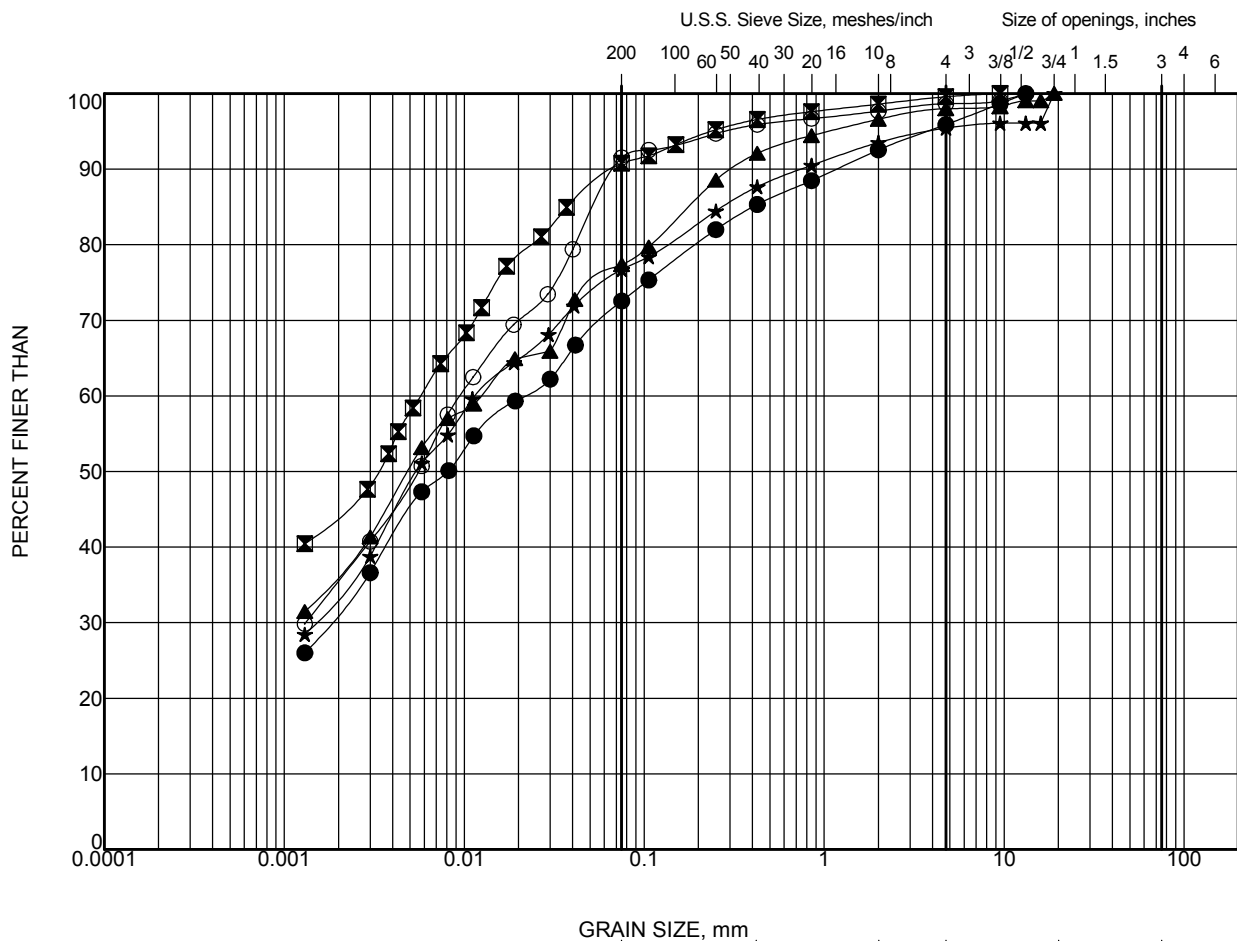
Date: O ctej 4235"
Rev: 2"
Page No.: Crr gpf kz'E"



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	B2-1	12	12.2
■	B2-1	13	13.7
▲	B2-1	17	19.8
★	B2-1	18	21.3
○	BH03-RW	11	10.7

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN EA		CHECK MSO	SCALE
			REV.
		FIGURE C.1	

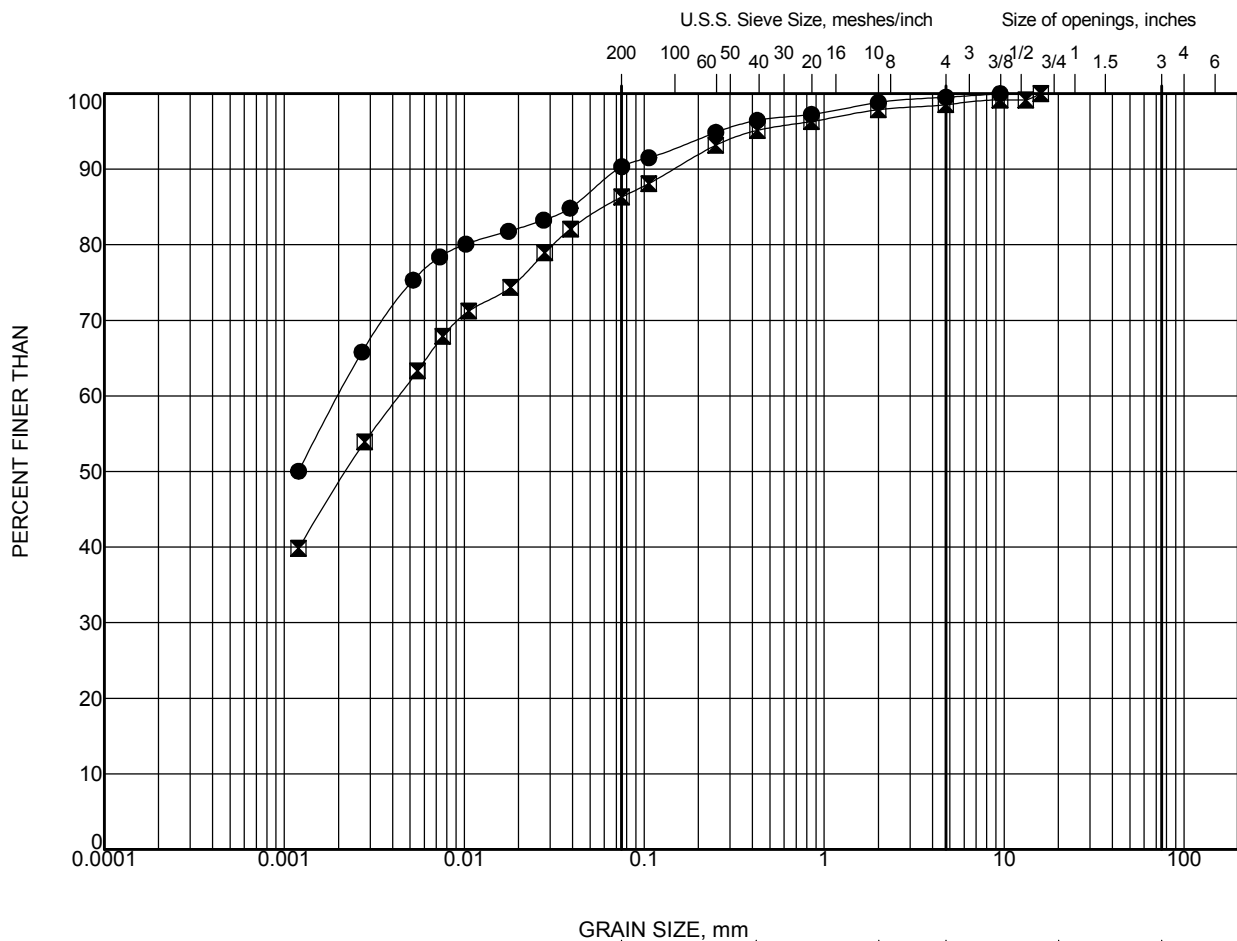


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	BH03-RW	14	15.2
■	BH04-RW	8	7.6
▲	BH04-RW	9	9.1
★	BH04-RW	13	15.2
○	BH04-RW	17	21.3

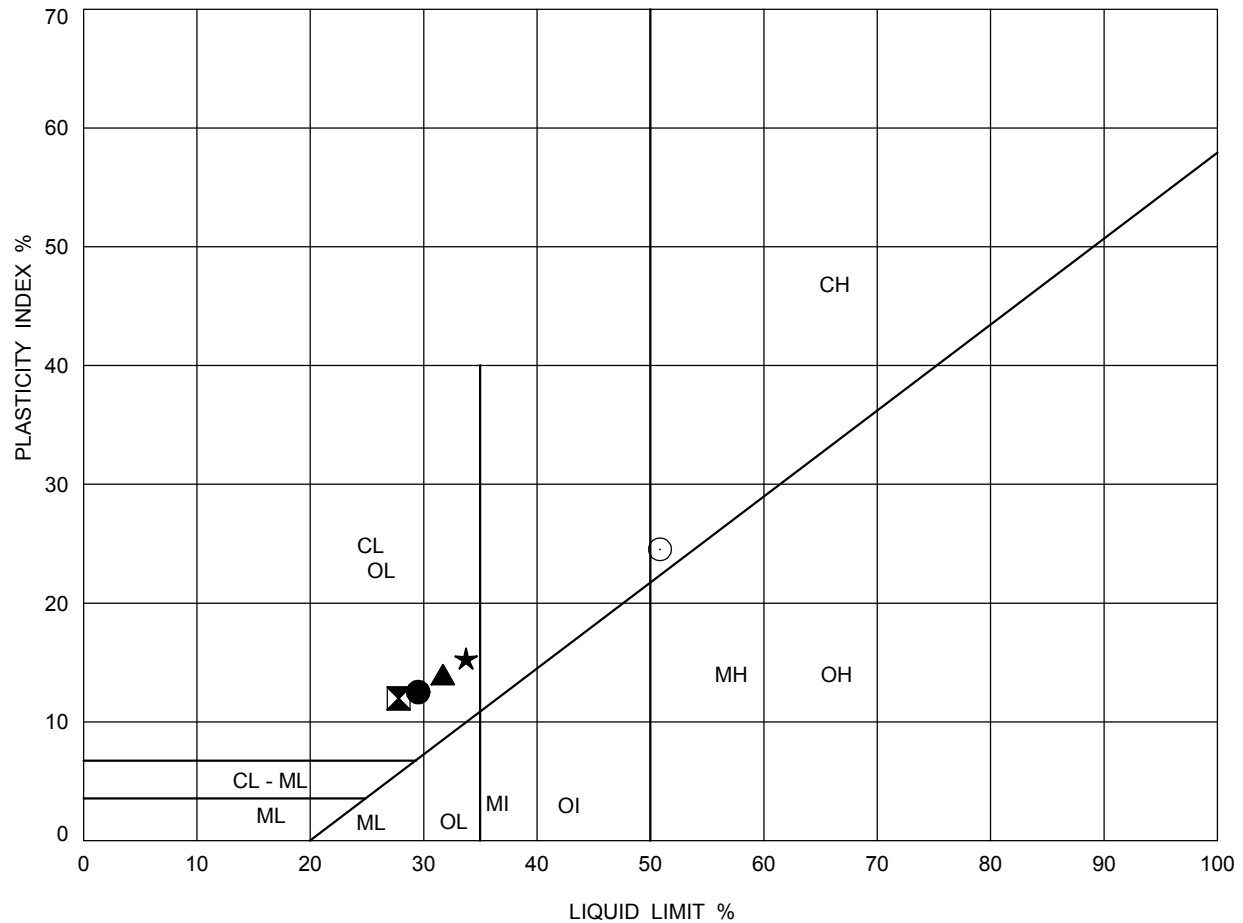
PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
FIGURE C.2			



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	BH03-RW	6	4.6
⊠	BH03-RW	9	7.6

PROJECT		Windsor Essex Parkway (WEP)	
		Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION	
		SILTY CLAY	
PROJECT No. SW8801.1004.101		FILE No.	
DRAWN EA		SCALE	
CHECK MSO		REV.	
Parkway Infrastructure Engineers  		FIGURE C.3	



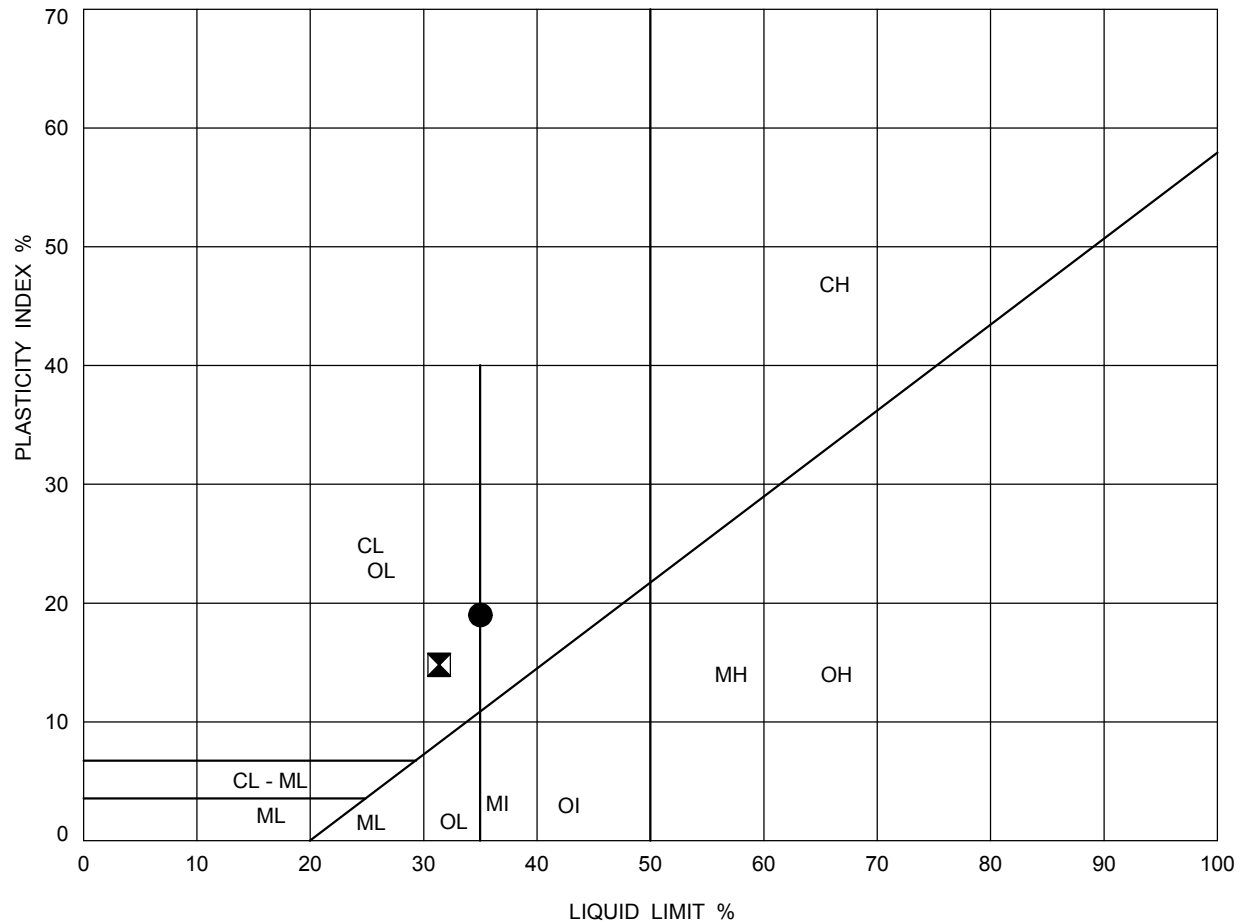
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	B2-1	12	12.2	30	17	13
⊠	B2-1	13	13.7	28	16	12
▲	B2-1	17	19.8	32	18	14
★	B2-1	18	21.3	34	18	16
○	BH03-RW	11	10.7	51	26	25

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
	FIGURE C.4		





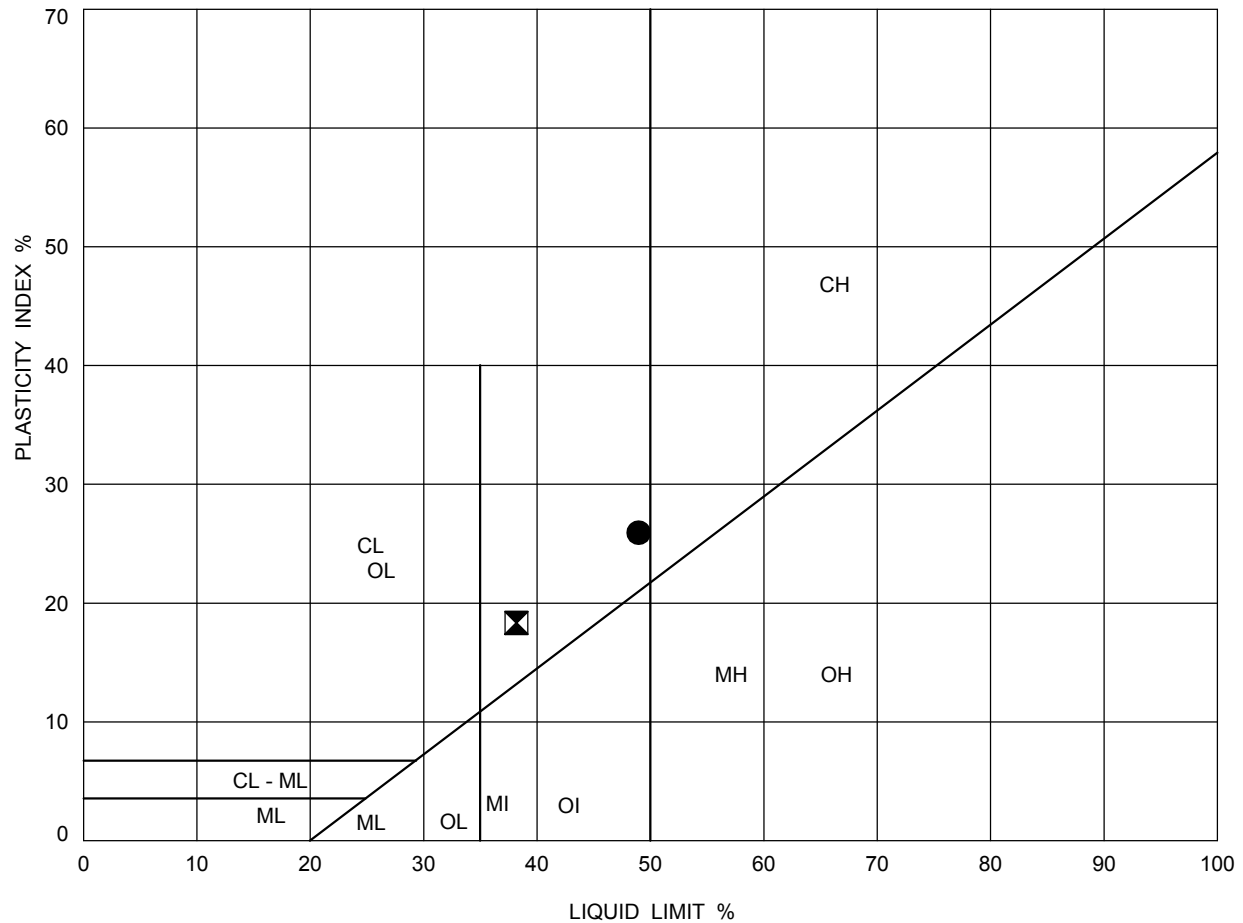
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	BH04-RW	8	7.6	35	16	19
⊠	BH04-RW	9	9.1	31	17	14

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.5	



SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	BH03-RW	6	4.6	49	23	26
⊠	BH03-RW	9	7.6	38	20	18

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY	
PROJECT No. SW8801.1004.101		FILE No.	
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.6	

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D 2435)

Project: **WEP**
 Client: **Hatch Mott MacDonald Limited**
 Date: **9-Sep-11**

Job N **SW8801.1004.101**

Sample ID: **4-RW_TW8**

Depth(m): **7.6 to 8.2**

Test Data

Ring # :	A	Ring Height (in) =	0.760	Wt of dry filter paper (g)	0.69
Wet soil + Ring Wt (g)			196.14	Wt of ring (g)	76.59
Wet soil + Wet Paper + Ring (g)			192.60	Wet Paper (g)	2.10
Dry Soil + Dry Paper + Ring (g)			169.54	Ring Dia (in)	2.498
Initial moisture Content (%)			29.58	Final moisture Content (%)	23.47
Area of Ring (in ²)			4.90	Initial Volume (in ³)	3.7247
Initial Bulk Density (kg/m ³)			1959	Initial Dry Density (kg/m ³)	1512
Specific Gravity of Soil			2.73	Equiv. Thick. of solids (mm)	10.688
Final Bulk Density (kg/m ³)			2056	Final Dry Density (kg/m ³)	1587
Initial gauge reading for Load 1			0.2532	Gauge reading for last Loading	0.1831
Initial Voids Ratio			0.806	Final Void Ratio	0.639
Initial Degree of Saturation (%)			100	Final Degree of Saturation (%)	100

Trial #	1	2	3	4	5	6	7
Load (kPa)	4.0	6.0	9.0	13.0	20.0	30.0	45.0
Load (tsf)	0.0416	0.0624	0.094	0.135	0.208	0.312	0.468
Gauge Reading (in)	0.2531	0.2524	0.2502	0.2480	0.2447	0.2409	0.2356
(H-Hs) mm	8.613	8.594	8.541	8.484	8.400	8.302	8.169
Voids ratio	0.806	0.804	0.799	0.794	0.786	0.777	0.764
t90 (min)		10.24	6.76	18.92	15.60	11.56	9.30
Cv (m ² /day)		0.011	0.017	0.006	0.007	0.010	0.012
k' (MPa)		2.000	1.079	1.352	1.606	1.947	2.144
Mv (mm ² / N)		0.5001	0.9265	0.7397	0.6227	0.5136	0.4664

Trial #	8	9	10	11	12	13	14
Load (kPa)	65	100.0	65.0	45.0	30.0	20.0	13.0
Load (tsf)	0.676	1.040	0.676	0.468	0.312	0.208	0.135
Gauge Reading (in)	0.23015	0.2215	0.2228	0.2234	0.2251	0.2268	0.2290
(H-Hs) mm	8.030	7.811	7.843	7.859	7.901	7.945	8.001
Voids ratio	0.751	0.731	0.734	0.735	0.739	0.743	0.749
t90 (min)	9.00	12.25					
Cv (m ² /day)	0.012	0.009					
k' (MPa)	2.715	2.982					
Mv (mm ² / N)	0.3684	0.3354					

Trial #	15	16	17	18	19	20	21
Load (kPa)	9.0	13.0	20.0	30.0	45.0	65.0	100.0
Load (tsf)	0.0936	0.135	0.208	0.312	0.468	0.676	1.040
Gauge Reading (in)	0.23075	0.2304	0.2292	0.2276	0.2255	0.2235	0.2198
(H-Hs) mm	8.045	8.037	8.007	7.965	7.912	7.860	7.766
Voids ratio	0.753	0.752	0.749	0.745	0.740	0.735	0.727
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							

Trial #	22	23	24	25	26	27	28
Load (kPa)	150	225.0	335.0	505.0	760.0	1140.0	570.0
Load (tsf)	1.56	2.340	3.484	5.252	7.904	11.856	5.928
Gauge Reading (in)	0.21109	0.1992	0.1843	0.1679	0.1514	0.1351	0.1377
(H-Hs) mm	7.546	7.245	6.864	6.449	6.029	5.615	5.683
Voids ratio	0.706	0.678	0.642	0.603	0.564	0.525	0.532
t90 (min)	7.56	11.22	12.25	10.56	7.84	6.25	
Cv (m ² /day)	0.014	0.009	0.008	0.009	0.011	0.013	
k' (MPa)	4.195	4.536	5.188	7.176	10.408	15.343	
Mv (mm ² / N)	0.2384	0.2205	0.1928	0.1393	0.0961	0.0652	

Trial #	29	30	31	32	33	34	35
Load (kPa)	285	140.0	70.0	35.0	17.5	9.0	4.5
Load (tsf)	2.964	1.456	0.728	0.364	0.182	0.094	0.047
Gauge Reading (in)	0.14172	0.1475	0.1547	0.1626	0.1705	0.1785	0.1831
(H-Hs) mm	5.784	5.932	6.114	6.313	6.515	6.717	6.834
Voids ratio	0.541	0.555	0.572	0.591	0.610	0.628	0.639
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							

Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
BRIDGE B-2 (BH 4-RW-TW8)**

Date

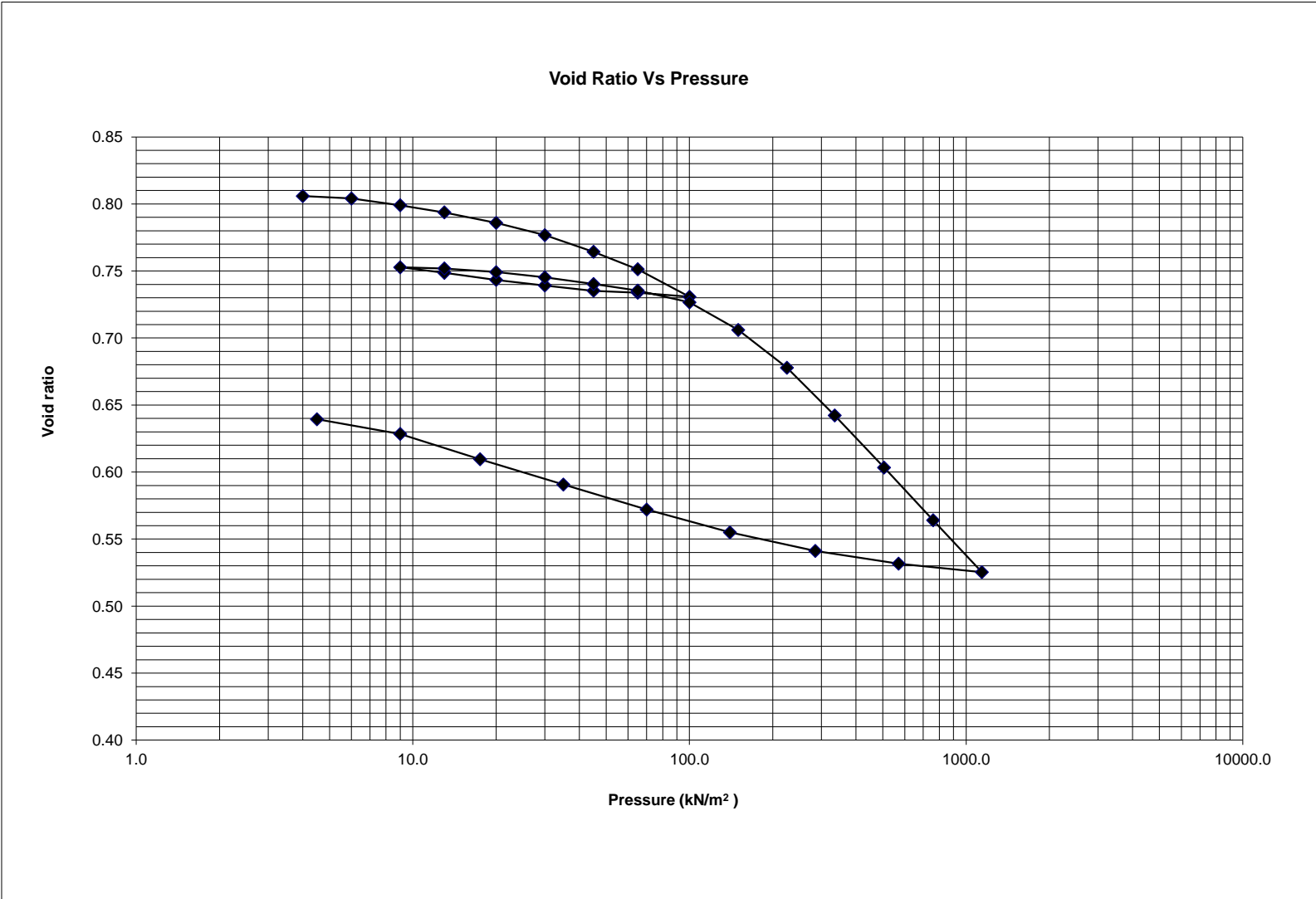
Feb 2012

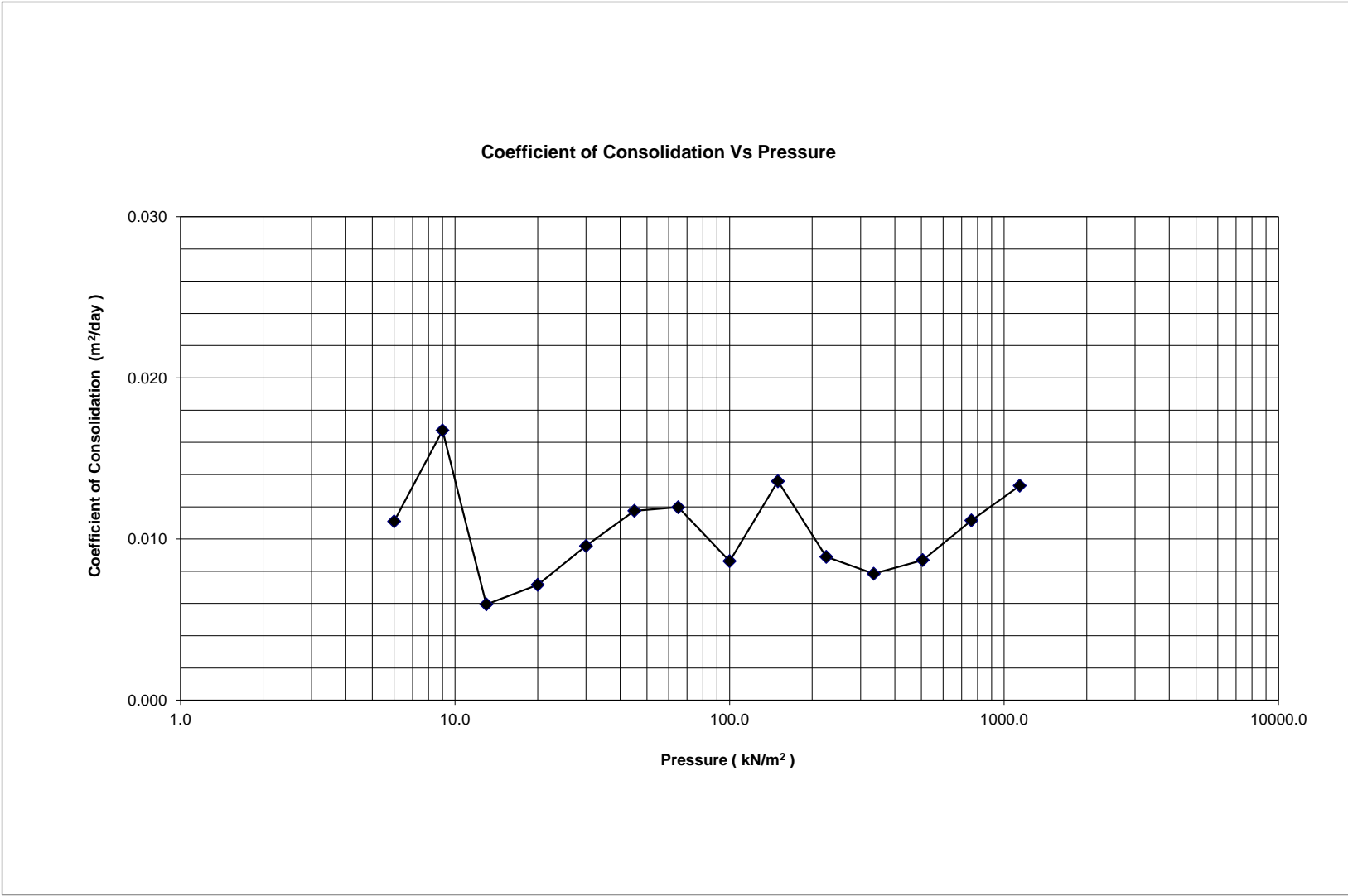
JOB NO

SW8801.1004.101

FIGURE NO.
C.7-B

REV



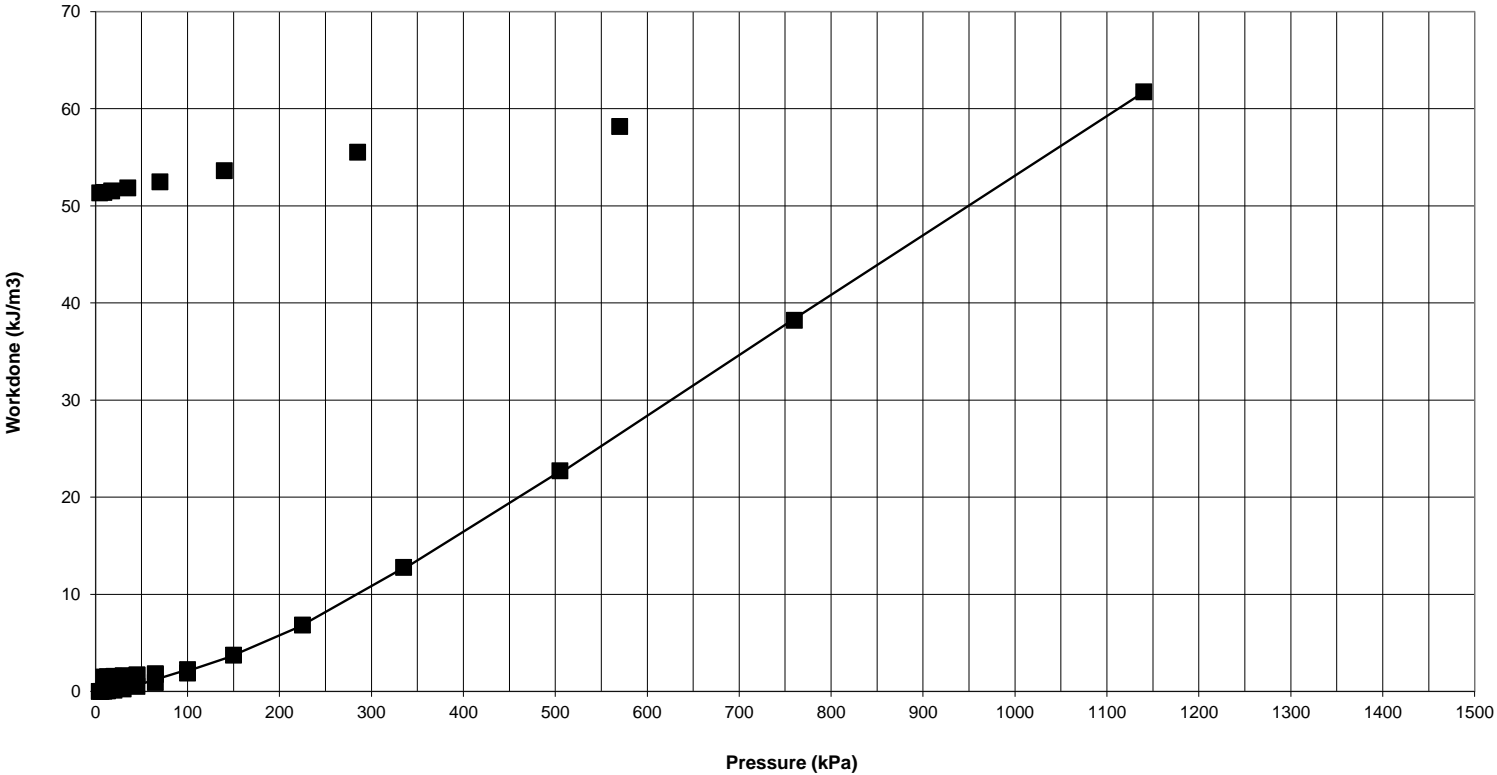


Strain Energy Data

Presssure (kN/m ²)	cv (m ² /day)	Void ratio
4.0		0.806
6.0	0.011	0.804
9.0	0.017	0.799
13.0	0.006	0.794
20.0	0.007	0.786
30.0	0.010	0.777
45.0	0.012	0.764
65.0	0.012	0.751
100.0	0.009	0.731
65.0		0.734
45.0		0.735
30.0		0.739
20.0		0.743
13.0		0.749
9.0		0.753
13.0		0.752
20.0		0.749
30.0		0.745
45.0		0.740
65.0		0.735
100.0		0.727
150.0	0.014	0.706
225.0	0.009	0.678
335.0	0.008	0.642
505.0	0.009	0.603
760.0	0.011	0.564
1140.0	0.013	0.525
570.0		0.532
285.0		0.541
140.0		0.555
70.0		0.572
35.0		0.591
17.5		0.610
9.0		0.628
4.5		0.639

Presssure (KN/m ²)	Height mm	Total Work (KJ/m ³)
4.0	19.304	0.000
6.0	19.285	0.005
9.0	19.231	0.026
13.0	19.174	0.058
20.0	19.091	0.130
30.0	18.993	0.259
45.0	18.860	0.521
65.0	18.721	0.926
100.0	18.501	1.894
65.0	18.534	1.749
45.0	18.549	1.703
30.0	18.591	1.618
20.0	18.636	1.558
13.0	18.692	1.508
9.0	18.736	1.482
13.0	18.727	1.488
20.0	18.698	1.514
30.0	18.656	1.569
45.0	18.603	1.676
65.0	18.551	1.830
100.0	18.457	2.248
150.0	18.237	3.738
225.0	17.935	6.838
335.0	17.555	12.774
505.0	17.139	22.722
760.0	16.719	38.217
1140.0	16.305	61.741
570.0	16.373	58.172
285.0	16.475	55.526
140.0	16.622	53.622
70.0	16.804	52.472
35.0	17.004	51.849
17.5	17.206	51.537
9.0	17.408	51.382
4.5	17.524	51.336

Strain Energy Method for Preconsolidation Pressure



Appendix D Analytical Laboratory Test Results

"

"

Project: Y kpf uqt/Gugz'Retny c{"
Document: I gq'gej plecn'p'xgunki c'vkp'c'pf "F guki p"Tr qtv"
Dtkf i g'D/4"Uc032- 84202: Y "q"32- 87: 0644Y +"
Doc No.: 4: 75: 2/26/33; /233: "I gqetgu"P q062L8/67+"
"

Date: O ctej 4235"
Rev: 2"
Page No.: Crr gpf kz'F "



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 16-JUN-11
Report Date: 22-JUN-11 12:40 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #: L1018331
Project P.O. #: NOT SUBMITTED
Job Reference: SW8801.1004.101
Legal Site Desc:
C of C Numbers: 092981

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

		<div>Sample ID Description Sampled Date Sampled Time Client ID</div>	<div>L1018331-1 SOIL 11-JUN-11 B2-1 SA#3 7.5'-9'</div>				
Grouping	Analyte						
SOIL							
Physical Tests	% Moisture (%)	24.3					
	pH (pH units)	7.51					
	Redox Potential (mV)	156					
	Resistivity (ohm cm)	1670					
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20					
Anions and Nutrients	Sulphate (mg/kg)	779					

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092981

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1018331

Report Date: 22-JUN-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2205273							
WG1297119-2	LCS							
% Moisture			95		%		70-130	16-JUN-11
WG1297119-1	MB							
% Moisture			<0.10		%		0.1	16-JUN-11
PH-WT								
	Soil							
Batch	R2207258							
WG1299570-1	CVS							
pH			99		%		80-120	21-JUN-11
RESISTIVITY-WT								
	Soil							
Batch	R2207262							
WG1299566-1	CVS							
Resistivity			100		%		70-130	21-JUN-11
SO4-WT								
	Soil							
Batch	R2207781							
WG1299485-3	LCS							
Sulphate			98		%		60-140	21-JUN-11
WG1299485-1	MB							
Sulphate			<20		mg/kg		20	21-JUN-11
SULPHIDE-WT								
	Soil							
Batch	R2206609							
WG1298908-1	CVS							
Sulphide			85		%		50-120	20-JUN-11
WG1298740-1	MB							
Sulphide			<0.20		mg/kg		0.2	20-JUN-11

Quality Control Report

Workorder: L1018331

Report Date: 22-JUN-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1018331

Report Date: 22-JUN-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	11-JUN-11	21-JUN-11 15:11	24	243	hours	EHTR
Resistivity	1	11-JUN-11	21-JUN-11 15:14	7	10	days	EHT
Leachable Anions & Nutrients							
Sulphide	1	11-JUN-11	20-JUN-11 16:08	7	9	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1018331 were received on 16-JUN-11 10:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



AMEC EARTH & ENVIRONMENTAL
ATTN: Brian Lapos
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 30-JUN-11
Report Date: 08-JUL-11 07:12 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #: L1025374
Project P.O. #: NOT SUBMITTED
Job Reference: SW8801.1004.101
Legal Site Desc:
C of C Numbers: 092732-5

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1025374-1 SOIL 29-JUN-11 BH03-RW SA#18 70'				
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	17.8				
	pH (pH units)	7.75				
	Redox Potential (mV)	248				
	Resistivity (ohm cm)	1760				
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20				
Anions and Nutrients	Sulphate (mg/kg)	498				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092732-5

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1025374

Report Date: 08-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL
11865 County Road 42
TECUMSEH ON N8N 2M1

Contact: Brian Lapos

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
Soil								
Batch	R2212765							
WG1305352-2	LCS							
% Moisture			92		%		70-130	30-JUN-11
Batch	R2212765							
WG1305352-1	MB							
% Moisture			<0.10		%		0.1	30-JUN-11
PH-WT								
Soil								
Batch	R2214528							
WG1307906-1	CVS							
pH			100		%		80-120	06-JUL-11
RESISTIVITY-WT								
Soil								
Batch	R2215155							
WG1308646-1	CVS							
Resistivity			100		%		70-130	07-JUL-11
SO4-WT								
Soil								
Batch	R2213607							
WG1306314-3	LCS							
Sulphate			101		%		60-140	04-JUL-11
Batch	R2213607							
WG1306314-1	MB							
Sulphate			<20		mg/kg		20	04-JUL-11
SULPHIDE-WT								
Soil								
Batch	R2213798							
WG1307079-1	CVS							
Sulphide			79		%		50-120	05-JUL-11
Batch	R2213798							
WG1307075-1	MB							
Sulphide			<0.20		mg/kg		0.2	05-JUL-11

Quality Control Report

Workorder: L1025374

Report Date: 08-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1025374

Report Date: 08-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	29-JUN-11	07-JUL-11 17:08	24	197	hours	EHTL
Resistivity	1	29-JUN-11	07-JUL-11 17:05	7	8	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1025374 were received on 30-JUN-11 11:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 16-JUN-11
Report Date: 22-JUN-11 12:40 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #: L1018329
Project P.O. #: NOT SUBMITTED
Job Reference: SW8801.1004.101
Legal Site Desc:
C of C Numbers: 092985

Gayle Braun
Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

<div>Sample ID Description Sampled Date Sampled Time Client ID</div>		L1018329-1 SOIL 13-JUN-11 B4-RW SA#17				
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	23.2				
	pH (pH units)	7.87				
	Redox Potential (mV)	138				
	Resistivity (ohm cm)	1940				
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20				
Anions and Nutrients	Sulphate (mg/kg)	440				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092985

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1018329

Report Date: 22-JUN-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	Soil							
Batch	R2205273							
WG1297119-2	LCS							
% Moisture			95		%		70-130	16-JUN-11
WG1297119-1	MB							
% Moisture			<0.10		%		0.1	16-JUN-11
PH-WT	Soil							
Batch	R2207258							
WG1299570-1	CVS							
pH			99		%		80-120	21-JUN-11
RESISTIVITY-WT	Soil							
Batch	R2207262							
WG1299566-1	CVS							
Resistivity			100		%		70-130	21-JUN-11
SO4-WT	Soil							
Batch	R2207781							
WG1299485-3	LCS							
Sulphate			98		%		60-140	21-JUN-11
WG1299485-1	MB							
Sulphate			<20		mg/kg		20	21-JUN-11
SULPHIDE-WT	Soil							
Batch	R2206609							
WG1298908-1	CVS							
Sulphide			85		%		50-120	20-JUN-11
WG1298740-1	MB							
Sulphide			<0.20		mg/kg		0.2	20-JUN-11

Quality Control Report

Workorder: L1018329

Report Date: 22-JUN-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1018329

Report Date: 22-JUN-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	13-JUN-11	21-JUN-11 15:10	24	195	hours	EHTR
Resistivity	1	13-JUN-11	21-JUN-11 15:13	7	8	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1018329 were received on 16-JUN-11 10:15.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Appendix E Rock Core Photographs



Photo 1: Borehole B2-1 - Rock Core. Elevation 156.2 meters to 154.2 meters



Photo 2 Borehole BH03-RW - Rock Core. Elevation 156.8 meters to 151.5 meters



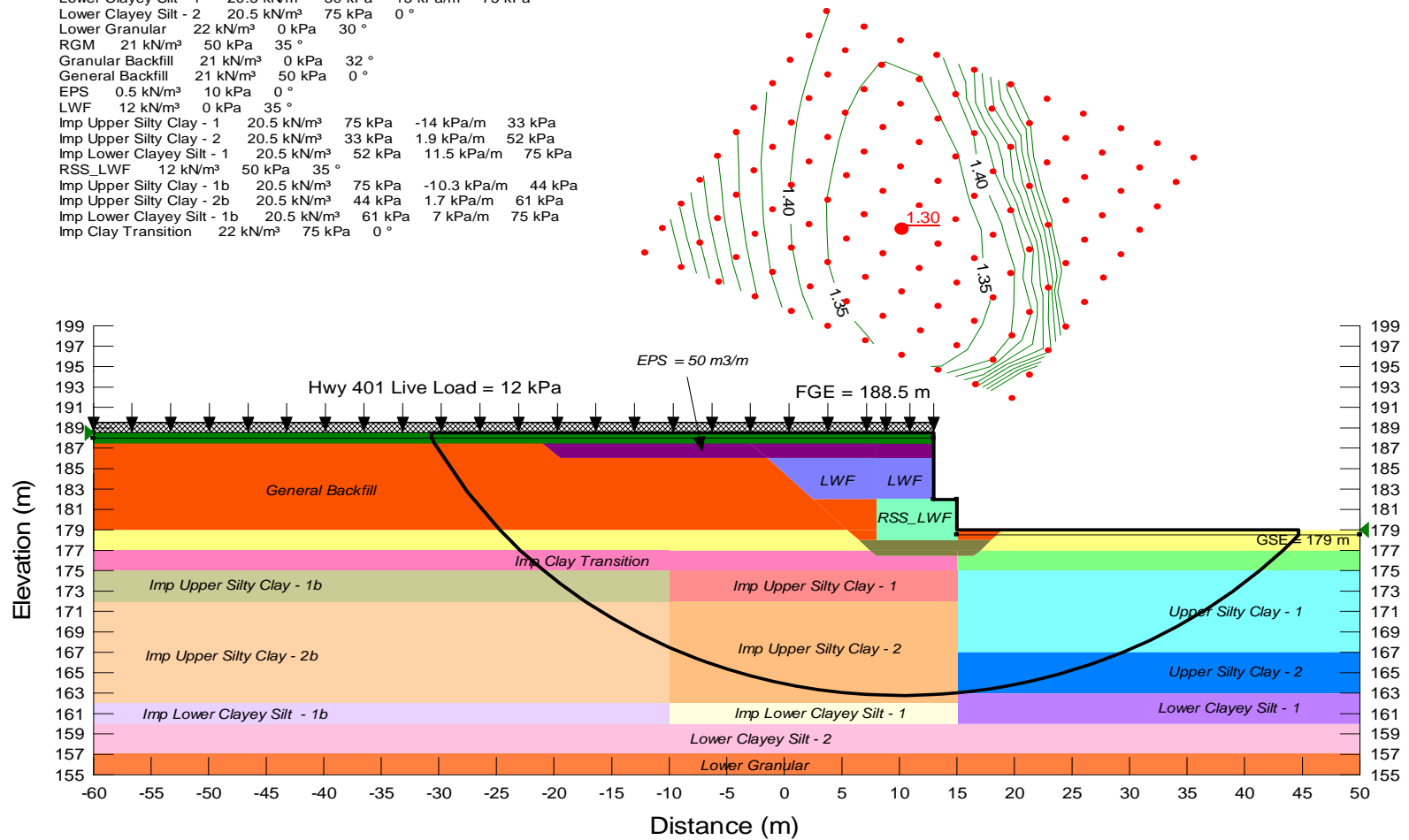
Photo 3 Borehole BH04-RW - Rock Core. Elevation 155.6 meters to 152.5 meters

Appendix F Slope Stability Analyses Results

Bridge B-2 - RSS Abutment - Undrained.gsz

WEP SW8801.1002.101

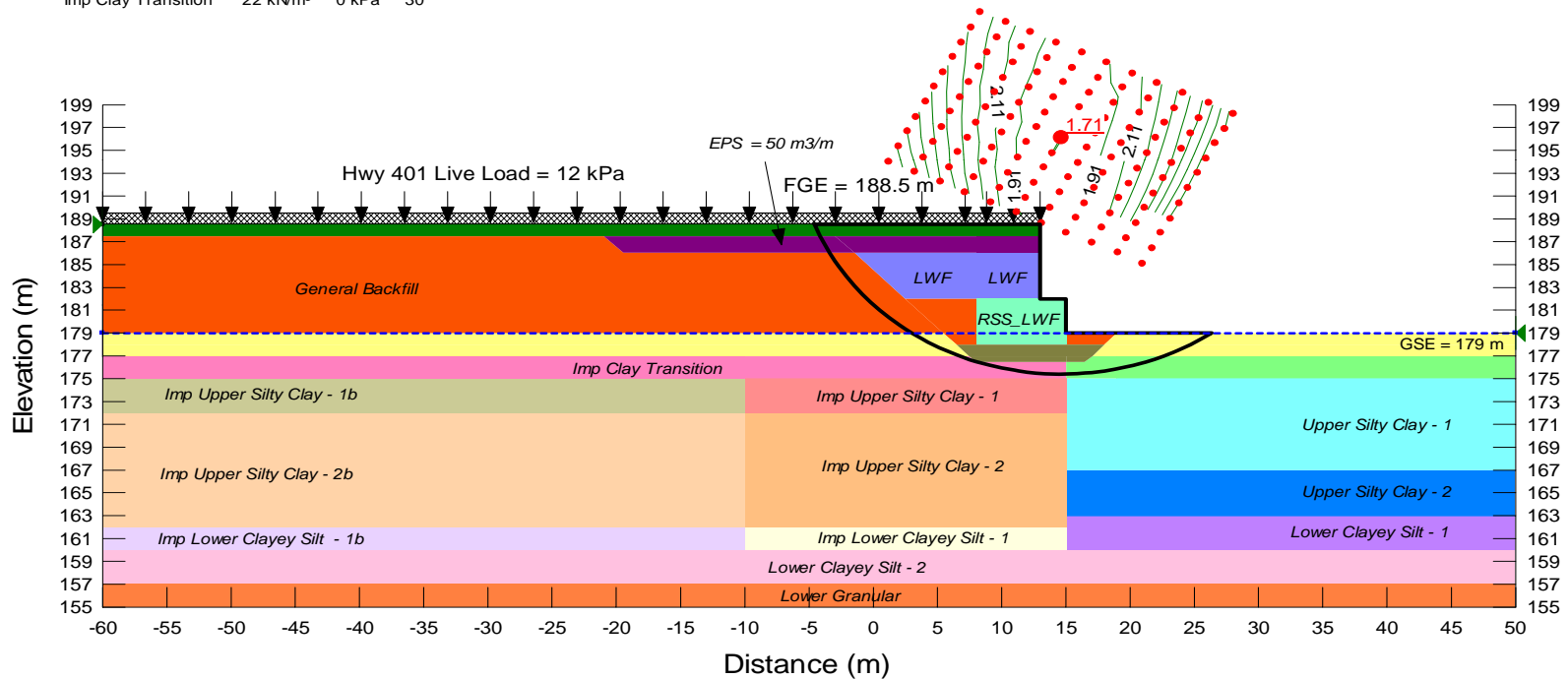
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Clay Transition	22 kN/m³	75 kPa	-20 kPa/m	35 kPa	
Upper Silty Clay - 1	20.5 kN/m³	35 kPa	-1.5 kPa/m	23 kPa	
Upper Silty Clay - 2	20.5 kN/m³	23 kPa	1.8 kPa/m	30 kPa	
Lower Clayey Silt - 1	20.5 kN/m³	30 kPa	15 kPa/m	75 kPa	
Lower Clayey Silt - 2	20.5 kN/m³	75 kPa	0 °		
Lower Granular	22 kN/m³	0 kPa	30 °		
RGM	21 kN/m³	50 kPa	35 °		
Granular Backfill	21 kN/m³	0 kPa	32 °		
General Backfill	21 kN/m³	50 kPa	0 °		
EPS	0.5 kN/m³	10 kPa	0 °		
LWF	12 kN/m³	0 kPa	35 °		
Imp Upper Silty Clay - 1	20.5 kN/m³	75 kPa	-14 kPa/m	33 kPa	
Imp Upper Silty Clay - 2	20.5 kN/m³	33 kPa	1.9 kPa/m	52 kPa	
Imp Lower Clayey Silt - 1	20.5 kN/m³	52 kPa	11.5 kPa/m	75 kPa	
RSS_LWF	12 kN/m³	50 kPa	35 °		
Imp Upper Silty Clay - 1b	20.5 kN/m³	75 kPa	-10.3 kPa/m	44 kPa	
Imp Upper Silty Clay - 2b	20.5 kN/m³	44 kPa	1.7 kPa/m	61 kPa	
Imp Lower Clayey Silt - 1b	20.5 kN/m³	61 kPa	7 kPa/m	75 kPa	
Imp Clay Transition	22 kN/m³	75 kPa	0 °		



Bridge B-2 - RSS Abutment - Drained.gsz

WEP SW8801.1002.101

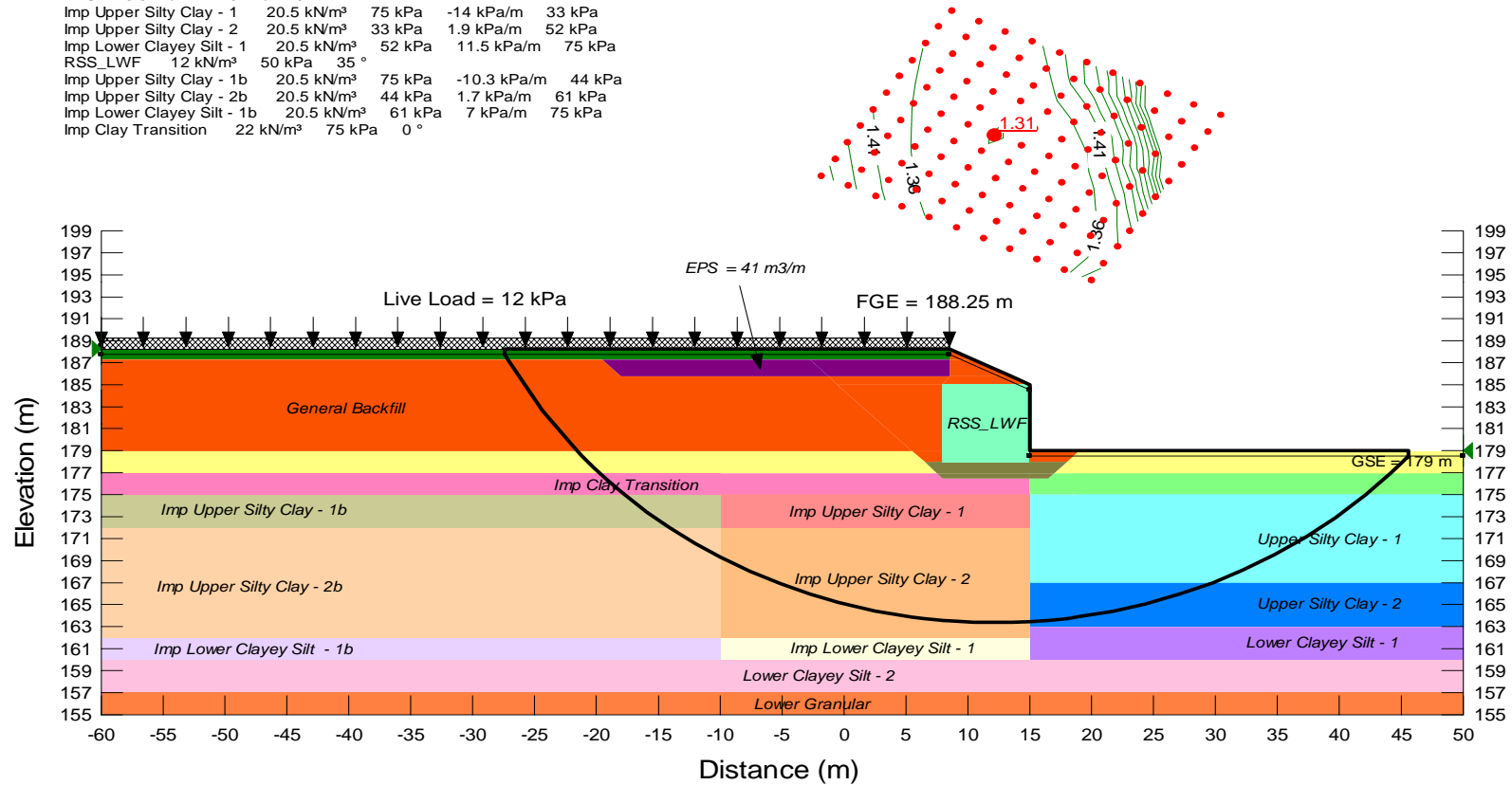
Clay Crust	22 kN/m³	0 kPa	30 °
Clay Transition	22 kN/m³	0 kPa	30 °
Upper Silty Clay - 1	20.5 kN/m³	0 kPa	30 °
Upper Silty Clay - 2	20.5 kN/m³	0 kPa	30 °
Lower Clayey Silt - 1	20.5 kN/m³	0 kPa	30 °
Lower Clayey Silt - 2	20.5 kN/m³	0 kPa	30 °
Lower Granular	22 kN/m³	0 kPa	30 °
RGM	21 kN/m³	50 kPa	35 °
Granular Backfill	21 kN/m³	0 kPa	32 °
General Backfill	21 kN/m³	0 kPa	30 °
EPS	0.5 kN/m³	10 kPa	0 °
LWF	12 kN/m³	0 kPa	35 °
Imp Upper Silty Clay - 1	20.5 kN/m³	0 kPa	30 °
Imp Upper Silty Clay - 2	20.5 kN/m³	0 kPa	30 °
Imp Lower Clayey Silt - 1	20.5 kN/m³	0 kPa	30 °
RSS_LWF	12 kN/m³	50 kPa	35 °
Imp Upper Silty Clay - 1b	20.5 kN/m³	0 kPa	30 °
Imp Upper Silty Clay - 2b	20.5 kN/m³	0 kPa	30 °
Imp Lower Clayey Silt - 1b	20.5 kN/m³	0 kPa	30 °
Imp Clay Transition	22 kN/m³	0 kPa	30 °



Bridge B-2 - Tapered RSS Wall - Undrained.gsz

WEP SW8801.1002.101

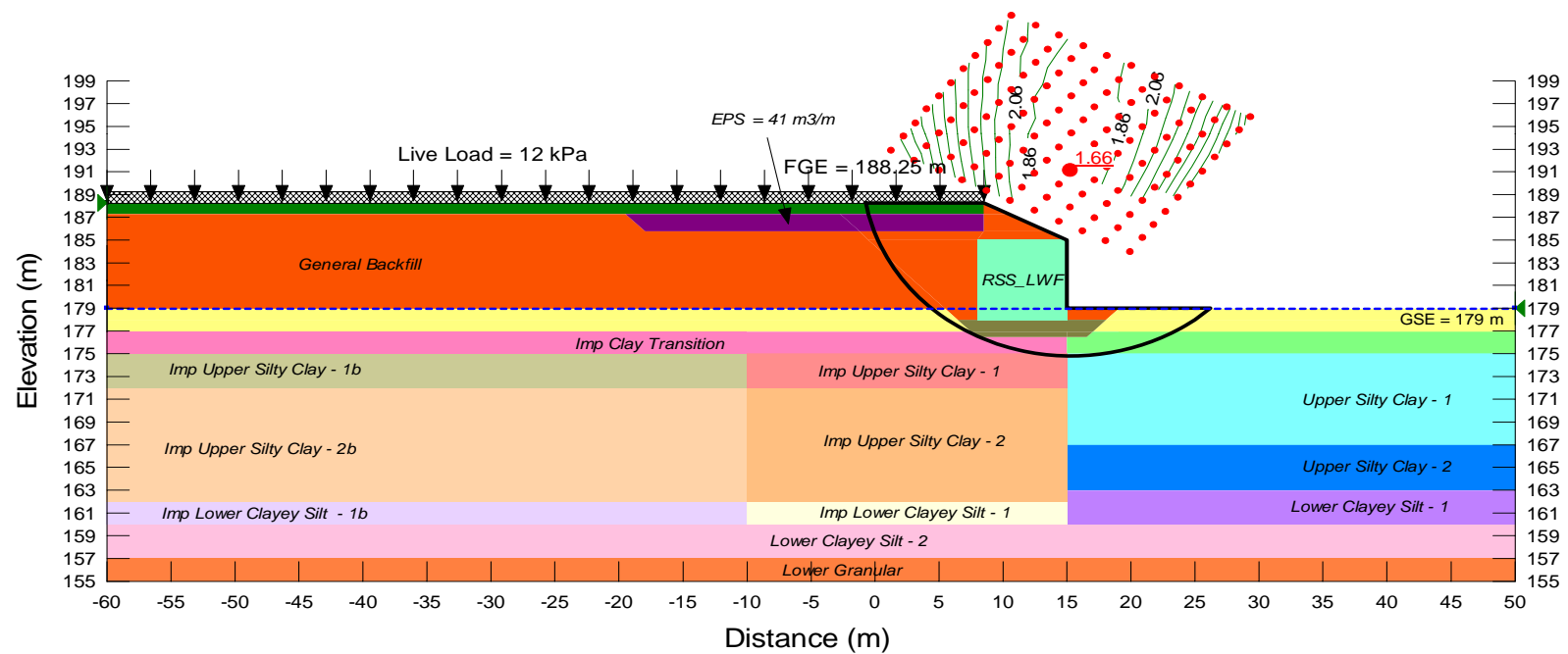
Clay Crust	22 kN/m³	75 kPa	0 °		
Clay Transition	22 kN/m³	75 kPa	-20 kPa/m	35 kPa	
Upper Silty Clay - 1	20.5 kN/m³	35 kPa	-1.5 kPa/m	23 kPa	
Upper Silty Clay - 2	20.5 kN/m³	23 kPa	1.8 kPa/m	30 kPa	
Lower Clayey Silt - 1	20.5 kN/m³	30 kPa	15 kPa/m	75 kPa	
Lower Clayey Silt - 2	20.5 kN/m³	75 kPa	0 °		
Lower Granular	22 kN/m³	0 kPa	30 °		
RGM	21 kN/m³	50 kPa	35 °		
Granular Backfill	21 kN/m³	0 kPa	32 °		
General Backfill	21 kN/m³	50 kPa	0 °		
EPS	0.5 kN/m³	10 kPa	0 °		
Imp Upper Silty Clay - 1	20.5 kN/m³	75 kPa	-14 kPa/m	33 kPa	
Imp Upper Silty Clay - 2	20.5 kN/m³	33 kPa	1.9 kPa/m	52 kPa	
Imp Lower Clayey Silt - 1	20.5 kN/m³	52 kPa	11.5 kPa/m	75 kPa	
RSS_LWF	12 kN/m³	50 kPa	35 °		
Imp Upper Silty Clay - 1b	20.5 kN/m³	75 kPa	-10.3 kPa/m	44 kPa	
Imp Upper Silty Clay - 2b	20.5 kN/m³	44 kPa	1.7 kPa/m	61 kPa	
Imp Lower Clayey Silt - 1b	20.5 kN/m³	61 kPa	7 kPa/m	75 kPa	
Imp Clay Transition	22 kN/m³	75 kPa	0 °		



Bridge B-2 - Tapered RSS Wall - Drained.gsz

WEP SW8801.1002.101

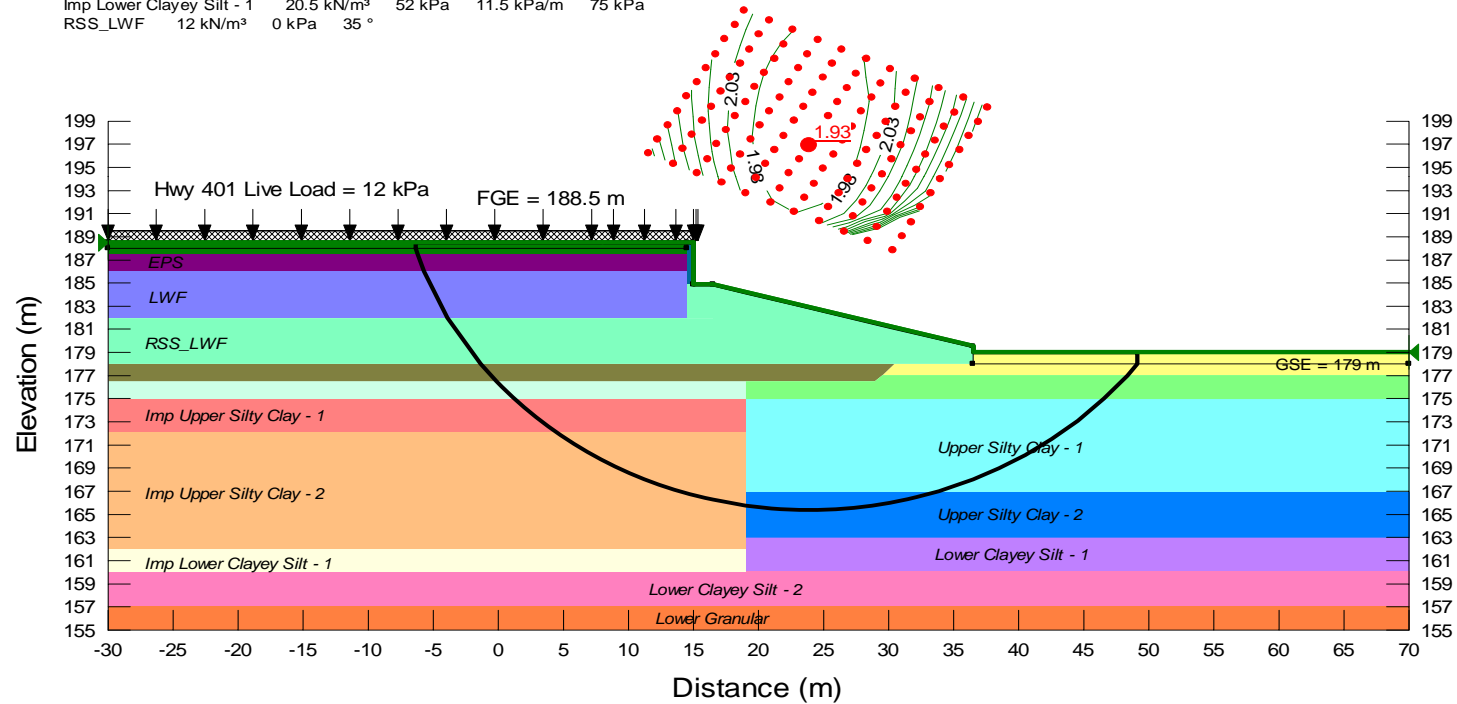
Clay Crust	22 kN/m³	0 kPa	30 °
Clay Transition	22 kN/m³	0 kPa	30 °
Upper Silty Clay - 1	20.5 kN/m³	0 kPa	30 °
Upper Silty Clay - 2	20.5 kN/m³	0 kPa	30 °
Lower Clayey Silt - 1	20.5 kN/m³	0 kPa	30 °
Lower Clayey Silt - 2	20.5 kN/m³	0 kPa	30 °
Lower Granular	22 kN/m³	0 kPa	30 °
RGM	21 kN/m³	50 kPa	35 °
Granular Backfill	21 kN/m³	0 kPa	32 °
General Backfill	21 kN/m³	0 kPa	30 °
EPS	0.5 kN/m³	10 kPa	0 °
Imp Upper Silty Clay - 1	20.5 kN/m³	0 kPa	30 °
Imp Upper Silty Clay - 2	20.5 kN/m³	0 kPa	30 °
Imp Lower Clayey Silt - 1	20.5 kN/m³	0 kPa	30 °
RSS_LWF	12 kN/m³	50 kPa	35 °
Imp Upper Silty Clay - 1b	20.5 kN/m³	0 kPa	30 °
Imp Upper Silty Clay - 2b	20.5 kN/m³	0 kPa	30 °
Imp Lower Clayey Silt - 1b	20.5 kN/m³	0 kPa	30 °
Imp Clay Transition	22 kN/m³	0 kPa	30 °



Bridge B-2-Wing Wall-Rev3-Undrained.gsz

WEP SW8801.1002.101

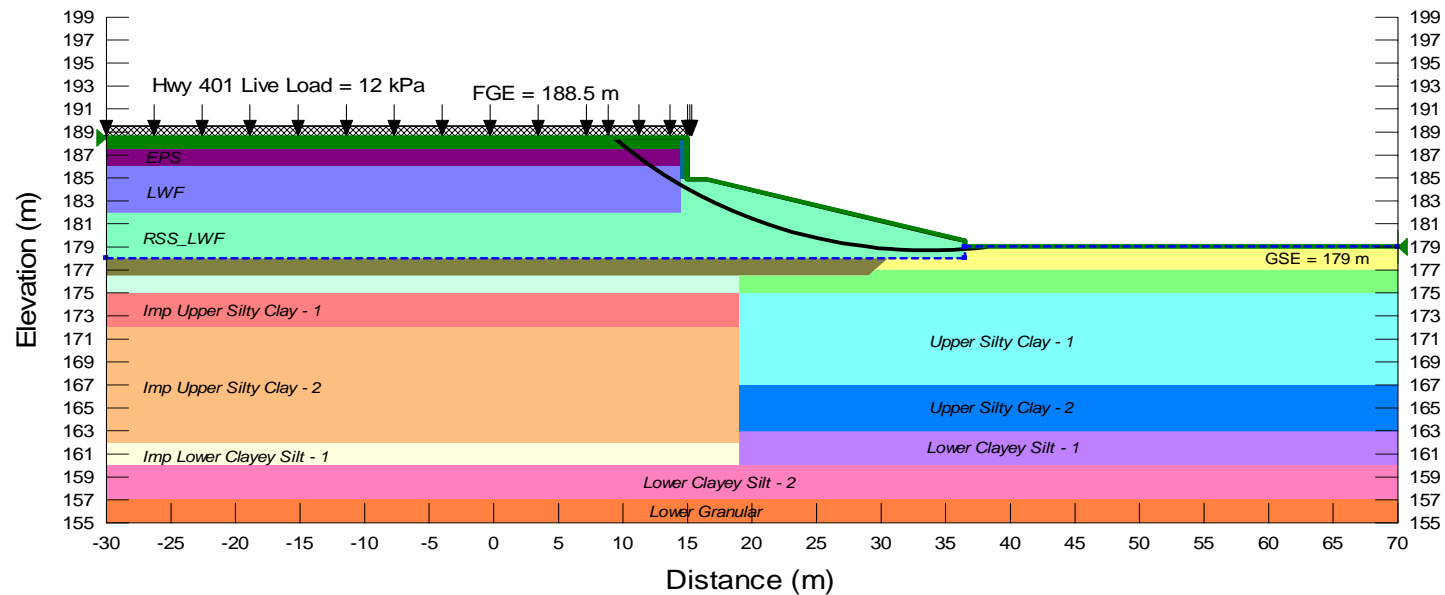
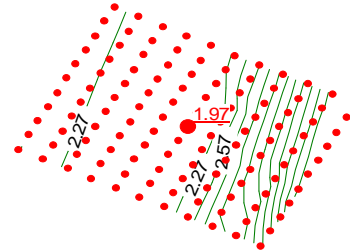
Clay Crust	22 kN/m ³	75 kPa	0 °		
Clay Transition	22 kN/m ³	75 kPa	-20 kPa/m	35 kPa	
Upper Silty Clay - 1	20.5 kN/m ³	35 kPa	-1.5 kPa/m	23 kPa	
Upper Silty Clay - 2	20.5 kN/m ³	23 kPa	1.8 kPa/m	30 kPa	
Lower Clayey Silt - 1	20.5 kN/m ³	30 kPa	15 kPa/m	75 kPa	
Lower Clayey Silt - 2	20.5 kN/m ³	75 kPa	0 °		
Lower Granular	22 kN/m ³	0 kPa	30 °		
RGM	21 kN/m ³	0 kPa	35 °		
Granular Backfill	21 kN/m ³	0 kPa	32 °		
EPS	0.5 kN/m ³	10 kPa	0 °		
LWF	12 kN/m ³	0 kPa	35 °		
Imp Clay Transition	22 kN/m ³	75 kPa	0 °		
Concrete Wing Wall	0.5 kN/m ³	1000 kPa	0 °		
Imp Upper Silty Clay - 1	20.5 kN/m ³	75 kPa	-14 kPa/m	33 kPa	
Imp Upper Silty Clay - 2	20.5 kN/m ³	33 kPa	1.9 kPa/m	52 kPa	
Imp Lower Clayey Silt - 1	20.5 kN/m ³	52 kPa	11.5 kPa/m	75 kPa	
RSS_LWF	12 kN/m ³	0 kPa	35 °		



Bridge B-2-Wing Wall-Rev3-Drained.gsz

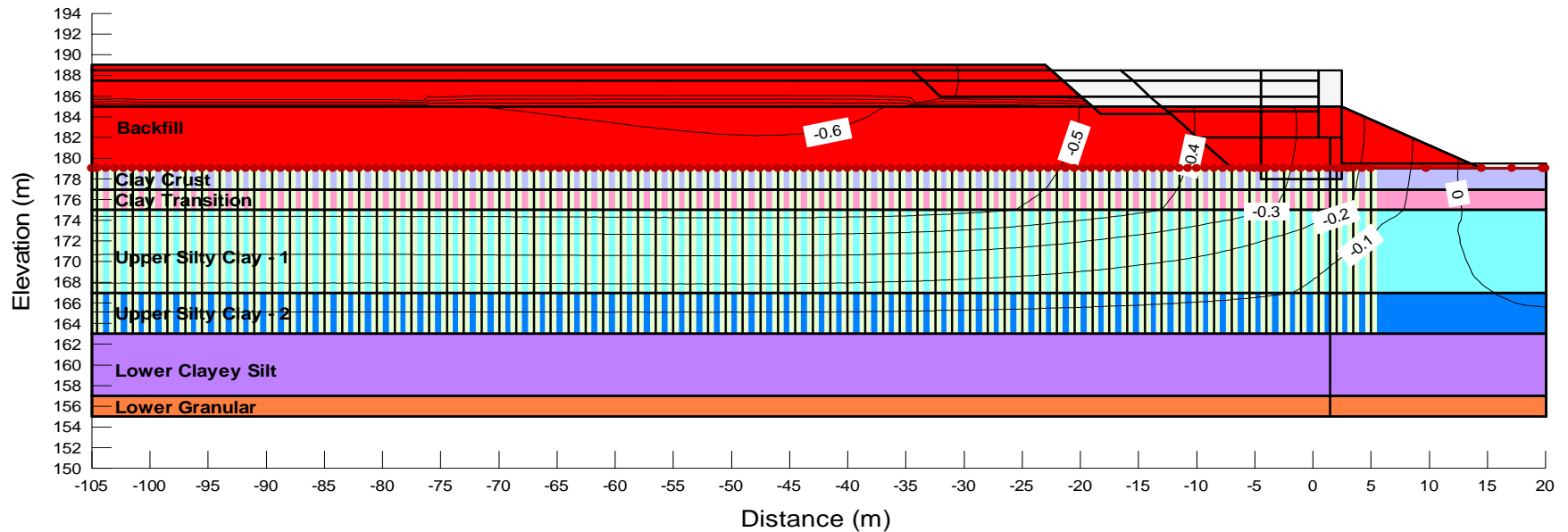
WEP SW8801.1002.101

Clay Crust 22 kN/m³ 0 kPa 30 °
 Clay Transition 22 kN/m³ 0 kPa 30 °
 Upper Silty Clay - 1 20.5 kN/m³ 0 kPa 30 °
 Upper Silty Clay - 2 20.5 kN/m³ 0 kPa 30 °
 Lower Clayey Silt - 1 20.5 kN/m³ 0 kPa 30 °
 Lower Clayey Silt - 2 20.5 kN/m³ 0 kPa 30 °
 Lower Granular 22 kN/m³ 0 kPa 30 °
 RGM 21 kN/m³ 0 kPa 35 °
 Granular Backfill 21 kN/m³ 0 kPa 32 °
 EPS 0.5 kN/m³ 10 kPa 0 °
 LWF 12 kN/m³ 0 kPa 35 °
 Imp Clay Transition 22 kN/m³ 0 kPa 30 °
 Concrete Wing Wall 0.5 kN/m³ 1000 kPa 0 °
 Imp Upper Silty Clay - 1 20.5 kN/m³ 0 kPa 30 °
 Imp Upper Silty Clay - 2 20.5 kN/m³ 0 kPa 30 °
 Imp Lower Clayey Silt - 1 20.5 kN/m³ 0 kPa 30 °
 RSS_LWF 12 kN/m³ 0 kPa 35 °



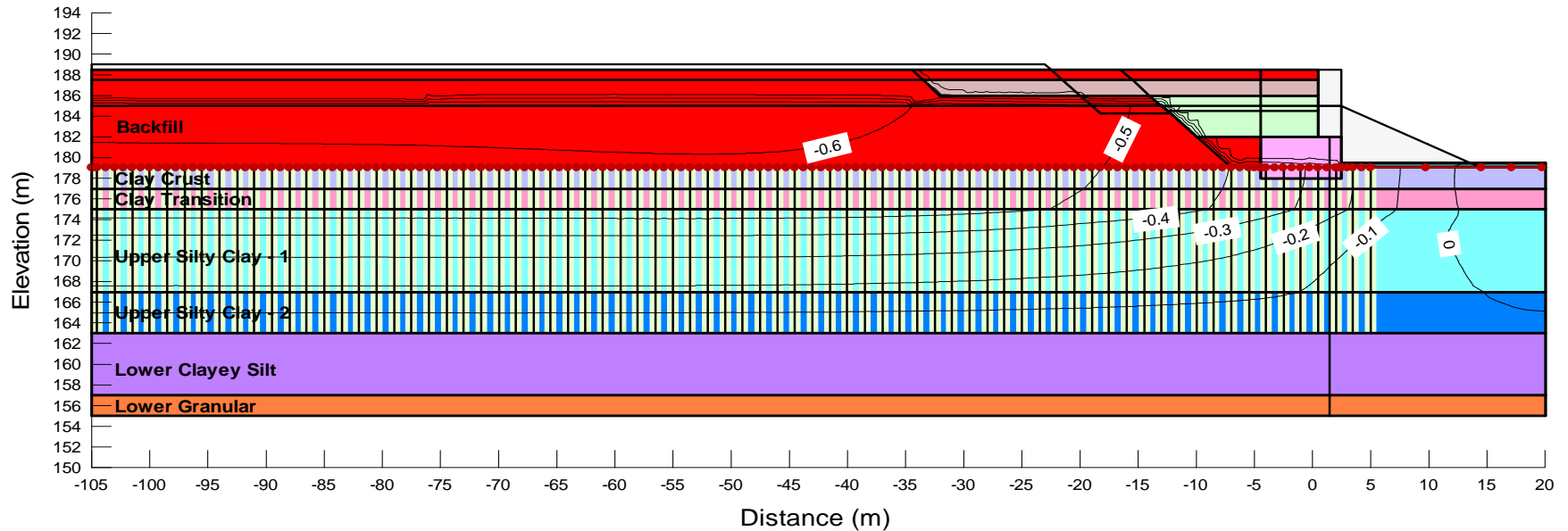
Appendix G Stress-Deformation Analysis Results

Name: Clay Crust Effective Young's Modulus (E'): 27000 kPa Poisson's Ratio: 0.35 Φ i: 30 ° Unit Weight: 22 kN/m³
 Name: Clay Transition Effective Young's Modulus (E'): 15000 kPa Poisson's Ratio: 0.35 Φ i: 30 ° Unit Weight: 22 kN/m³
 Name: Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.1046 Kappa: 0.0115 Initial Void Ratio: 0.78 Unit Weight: 20.5 kN/m³ Φ i: 25 °
 Name: Upper Silty Clay - 2 O.C. Ratio: 1.05 Poisson's Ratio: 0.35 Lambda: 0.0859 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Φ i: 25 °
 Name: Lower Clayey Silt O.C. Ratio: 1.8 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Φ i: 26 °
 Name: Lower Granular Effective Young's Modulus (E'): 32000 kPa Poisson's Ratio: 0.35 Φ i: 30 ° Unit Weight: 22 kN/m³
 Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Φ i: 30 ° Unit Weight: 21 kN/m³
 Name: Wick Drain Effective Young's Modulus (E'): 3000 kPa Poisson's Ratio: 0.35 Unit Weight: 0 kN/m³



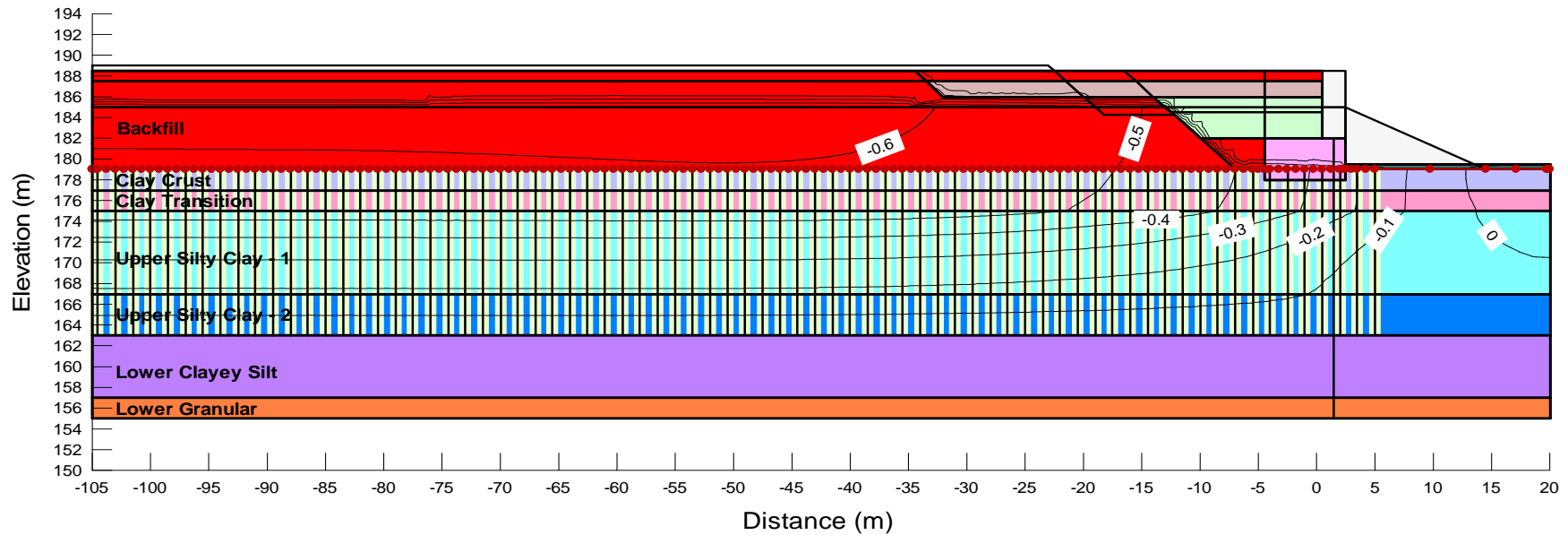
Legend:
 (-) Sign on Contour Labels = Settlement
 No Sign on Contour Labels = Heave

Name: Clay Crust Effective Young's Modulus (E'): 27000 kPa Poisson's Ratio: 0.35 Φ i': 30 ° Unit Weight: 22 kN/m³
 Name: Clay Transition Effective Young's Modulus (E'): 15000 kPa Poisson's Ratio: 0.35 Φ i': 30 ° Unit Weight: 22 kN/m³
 Name: Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.1046 Kappa: 0.0115 Initial Void Ratio: 0.78 Unit Weight: 20.5 kN/m³ Φ i': 25 °
 Name: Upper Silty Clay - 2 O.C. Ratio: 1.05 Poisson's Ratio: 0.35 Lambda: 0.0859 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Φ i': 25 °
 Name: Lower Clayey Silt O.C. Ratio: 1.8 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Φ i': 26 °
 Name: Pavement Young's Modulus (E): 54000 kPa Unit Weight: 22 kN/m³ Poisson's Ratio: 0.35
 Name: Lower Granular Effective Young's Modulus (E'): 32000 kPa Poisson's Ratio: 0.35 Φ i': 30 ° Unit Weight: 22 kN/m³
 Name: EPS Young's Modulus (E): 10000 kPa Unit Weight: 0.5 kN/m³ Poisson's Ratio: 0.2
 Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Φ i': 30 ° Unit Weight: 21 kN/m³
 Name: Wick Drain Effective Young's Modulus (E'): 3000 kPa Poisson's Ratio: 0.35 Unit Weight: 0 kN/m³
 Name: RSS_LWF Wall Young's Modulus (E): 40000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35
 Name: LWF Young's Modulus (E): 30000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35



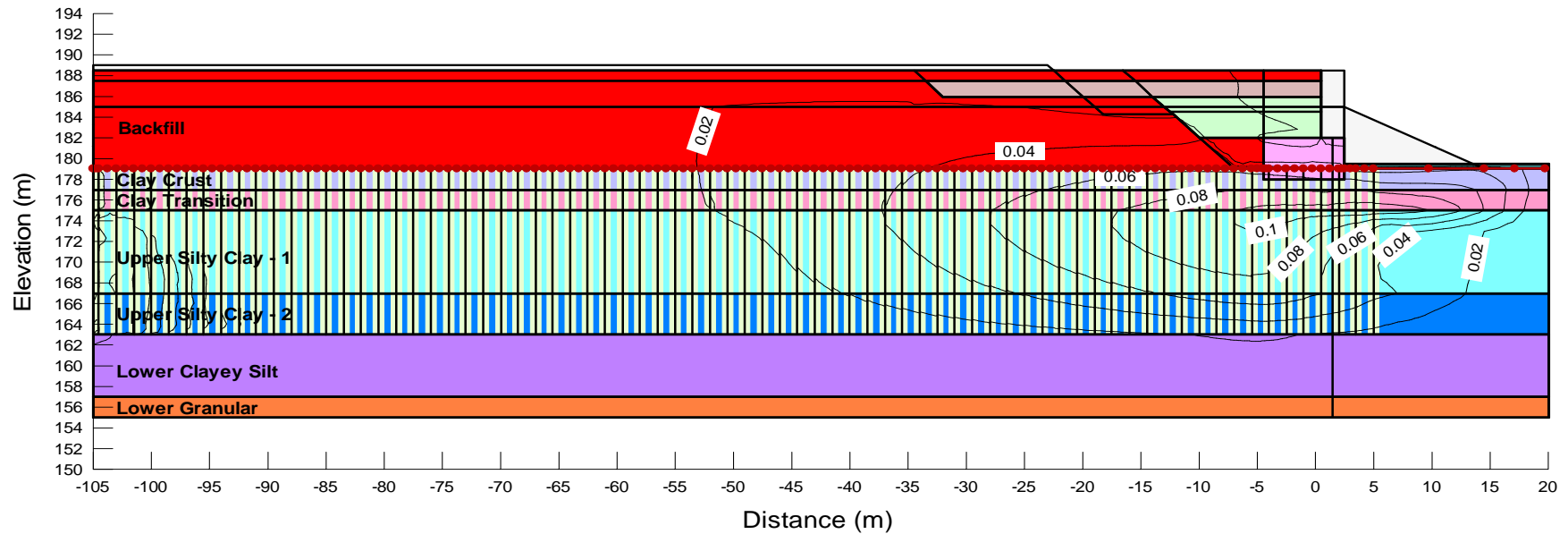
Legend:
 (-) Sign on Contour Labels = Settlement
 No Sign on Contour Labels = Heave

Name: Clay Crust Effective Young's Modulus (E): 27000 kPa Poisson's Ratio: 0.35 Φ i: 30 ° Unit Weight: 22 kN/m³
 Name: Clay Transition Effective Young's Modulus (E): 15000 kPa Poisson's Ratio: 0.35 Φ i: 30 ° Unit Weight: 22 kN/m³
 Name: Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.1046 Kappa: 0.0115 Initial Void Ratio: 0.78 Unit Weight: 20.5 kN/m³ Φ i: 25 °
 Name: Upper Silty Clay - 2 O.C. Ratio: 1.05 Poisson's Ratio: 0.35 Lambda: 0.0859 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Φ i: 25 °
 Name: Lower Clayey Silt O.C. Ratio: 1.8 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Φ i: 26 °
 Name: Pavement Young's Modulus (E): 54000 kPa Unit Weight: 22 kN/m³ Poisson's Ratio: 0.35
 Name: Lower Granular Effective Young's Modulus (E): 32000 kPa Poisson's Ratio: 0.35 Φ i: 30 ° Unit Weight: 22 kN/m³
 Name: EPS Young's Modulus (E): 10000 kPa Unit Weight: 0.5 kN/m³ Poisson's Ratio: 0.2
 Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Φ i: 30 ° Unit Weight: 21 kN/m³
 Name: Wick Drain Effective Young's Modulus (E): 3000 kPa Poisson's Ratio: 0.35 Unit Weight: 0 kN/m³
 Name: RSS_LWF Wall Young's Modulus (E): 40000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35
 Name: LWF Young's Modulus (E): 30000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35



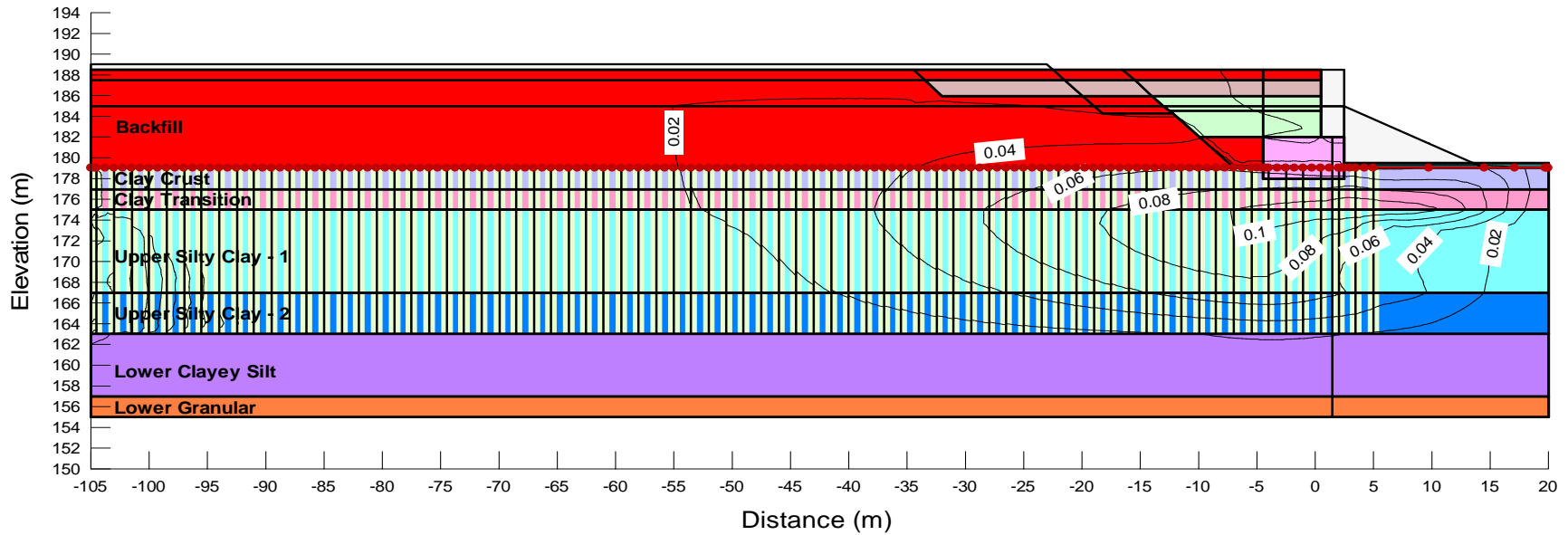
Legend:
 (-) Sign on Contour Labels = Settlement
 No Sign on Contour Labels = Heave

Name: Clay Crust Effective Young's Modulus (E'): 27000 kPa Poisson's Ratio: 0.35 Φ i': 30 ° Unit Weight: 22 kN/m³
 Name: Clay Transition Effective Young's Modulus (E'): 15000 kPa Poisson's Ratio: 0.35 Φ i': 30 ° Unit Weight: 22 kN/m³
 Name: Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.1046 Kappa: 0.0115 Initial Void Ratio: 0.78 Unit Weight: 20.5 kN/m³ Φ i': 25 °
 Name: Upper Silty Clay - 2 O.C. Ratio: 1.05 Poisson's Ratio: 0.35 Lambda: 0.0859 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Φ i': 25 °
 Name: Lower Clayey Silt O.C. Ratio: 1.8 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Φ i': 26 °
 Name: Pavement Young's Modulus (E): 54000 kPa Unit Weight: 22 kN/m³ Poisson's Ratio: 0.35
 Name: Lower Granular Effective Young's Modulus (E'): 32000 kPa Poisson's Ratio: 0.35 Φ i': 30 ° Unit Weight: 22 kN/m³
 Name: EPS Young's Modulus (E): 10000 kPa Unit Weight: 0.5 kN/m³ Poisson's Ratio: 0.2
 Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Φ i': 30 ° Unit Weight: 21 kN/m³
 Name: Wick Drain Effective Young's Modulus (E'): 3000 kPa Poisson's Ratio: 0.35 Unit Weight: 0 kN/m³
 Name: RSS_LWF Wall Young's Modulus (E): 40000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35
 Name: LWF Young's Modulus (E): 30000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35



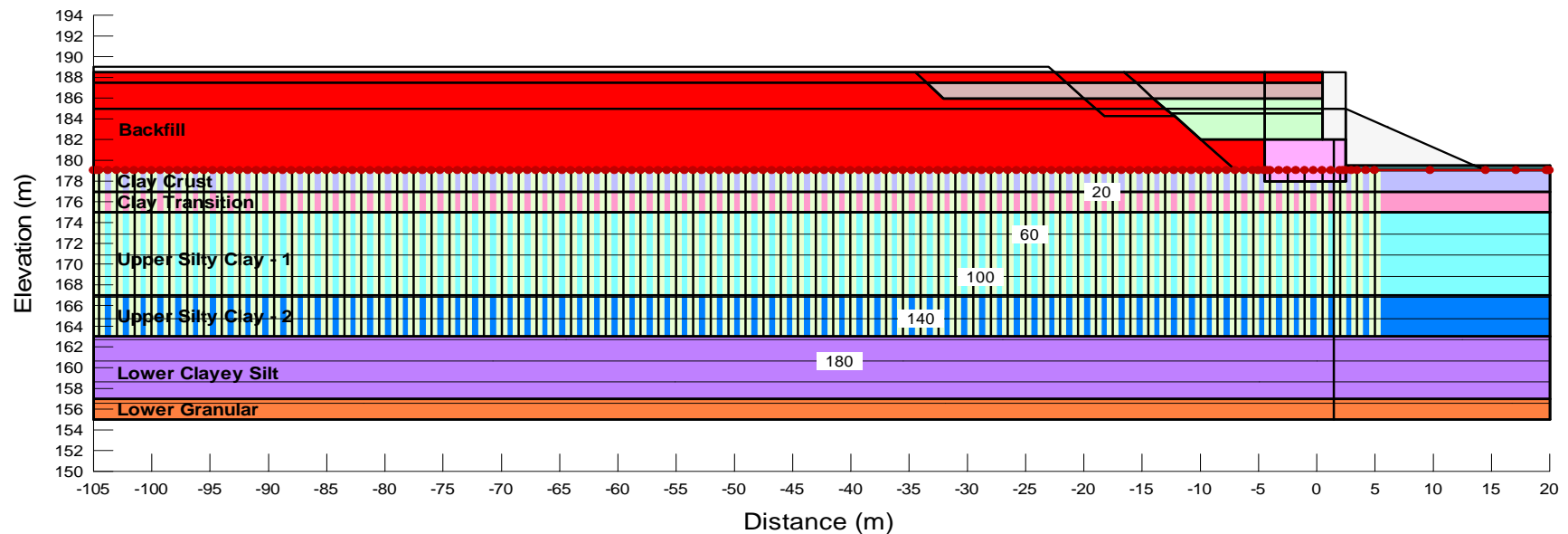
Legend:
 (-) Sign on Contour Labels = Lateral Deformation opposite to Matchette Road
 No Sign on Contour Labels = Lateral Deformation towards Matchette Road

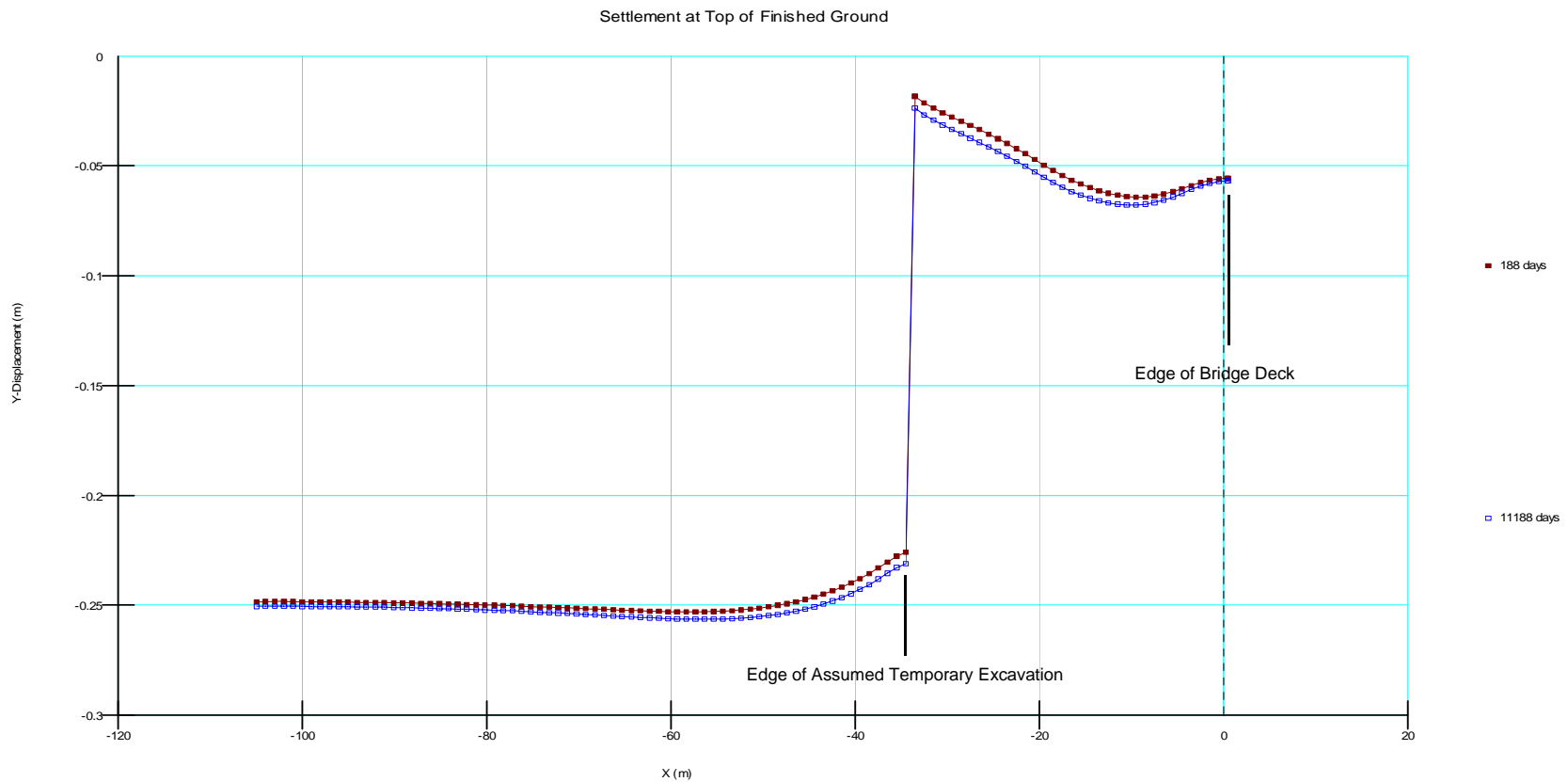
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 Name: Clay Transition Effective Young's Modulus (E'): 15000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
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 Name: LWF Young's Modulus (E): 30000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35



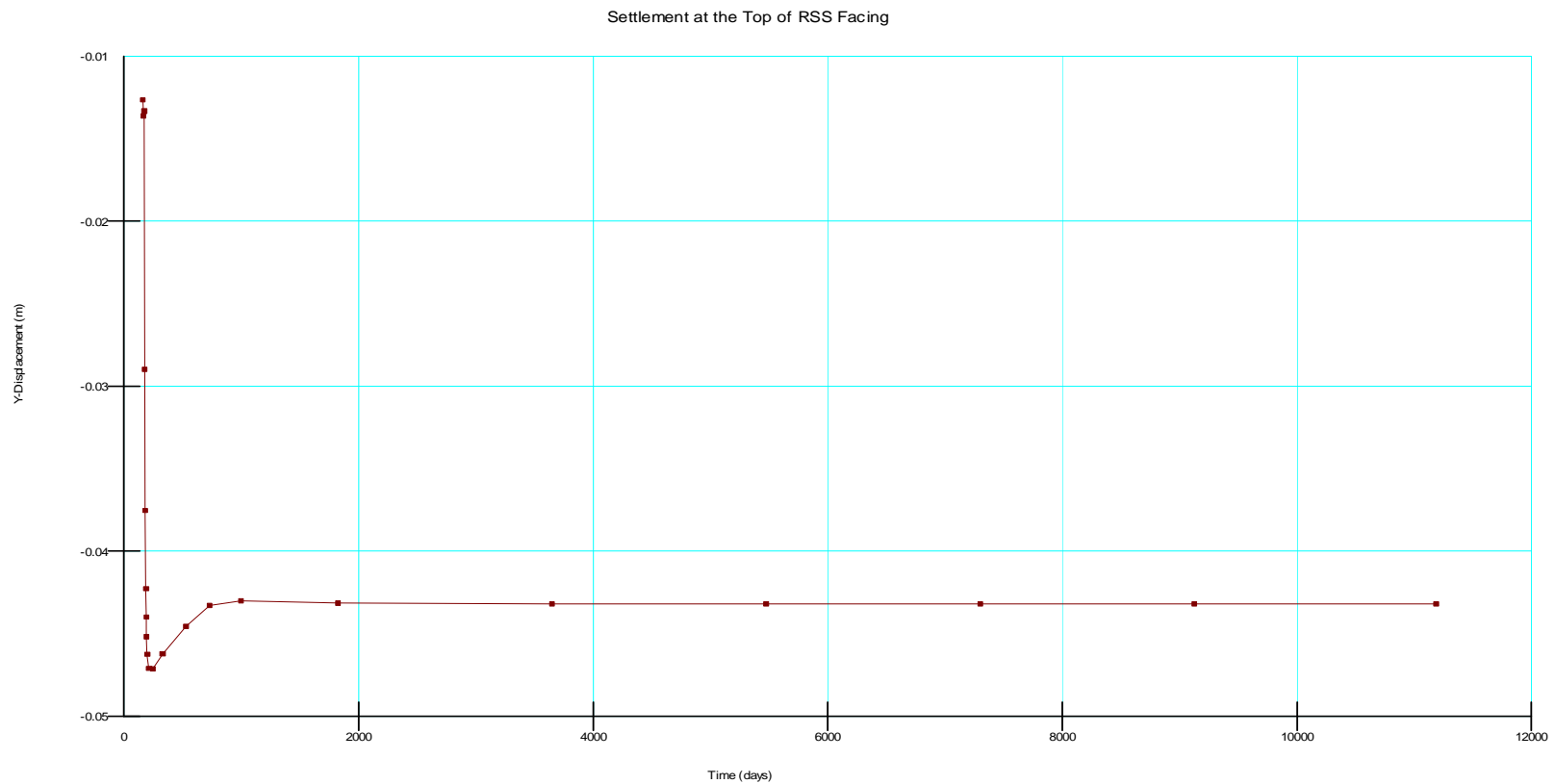
Legend:
 (-) Sign on Contour Labels = Lateral Deformation opposite to Matchette Road
 No Sign on Contour Labels = Lateral Deformation towards Matchette Road

Name: Clay Crust Effective Young's Modulus (E'): 27000 kPa Poisson's Ratio: 0.35 Φ' : 30 ° Unit Weight: 22 kN/m³
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Name: Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.1046 Kappa: 0.0115 Initial Void Ratio: 0.78 Unit Weight: 20.5 kN/m³ Φ' : 25 °
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Name: LWF Young's Modulus (E): 30000 kPa Unit Weight: 12 kN/m³ Poisson's Ratio: 0.35

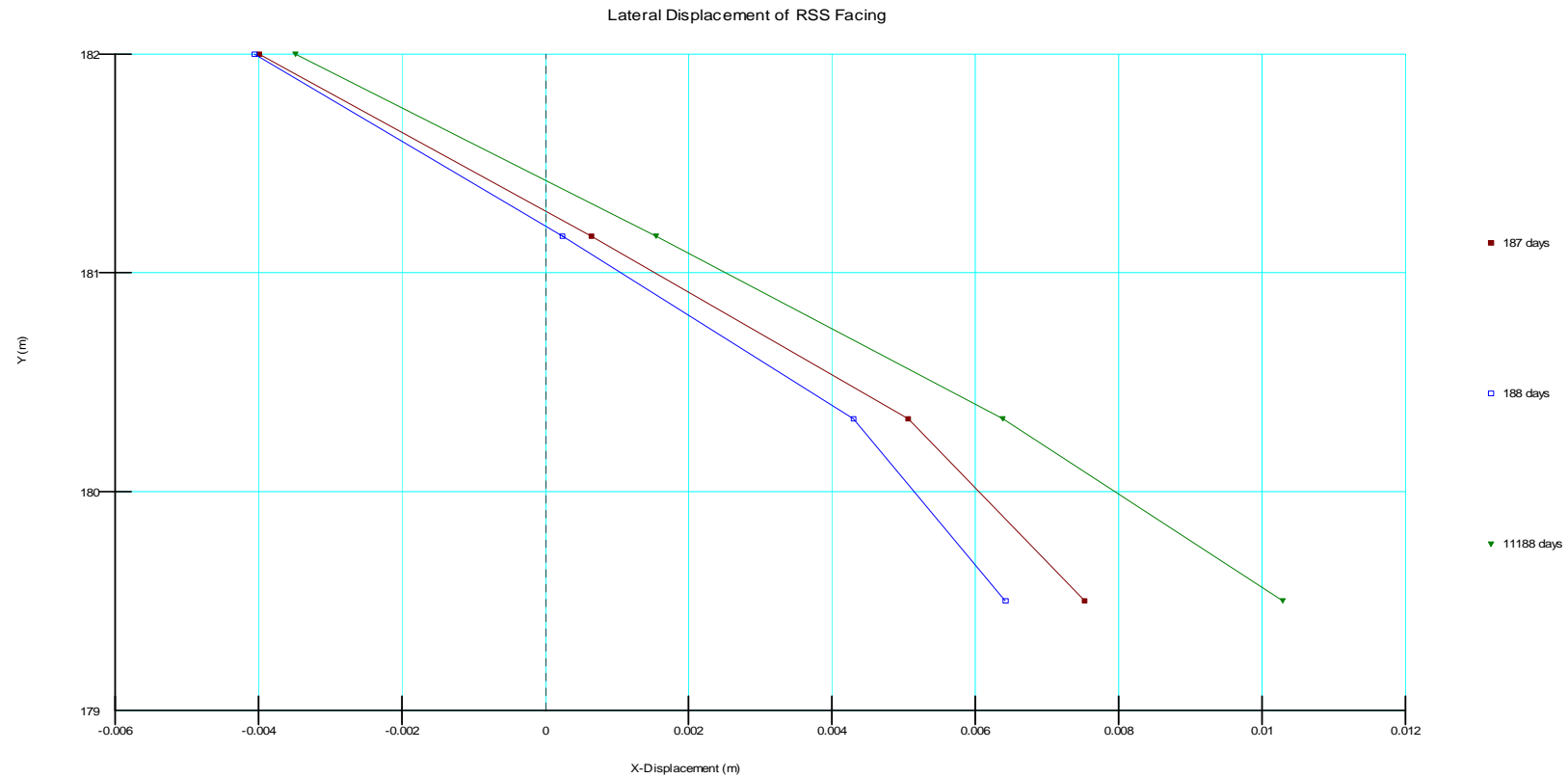


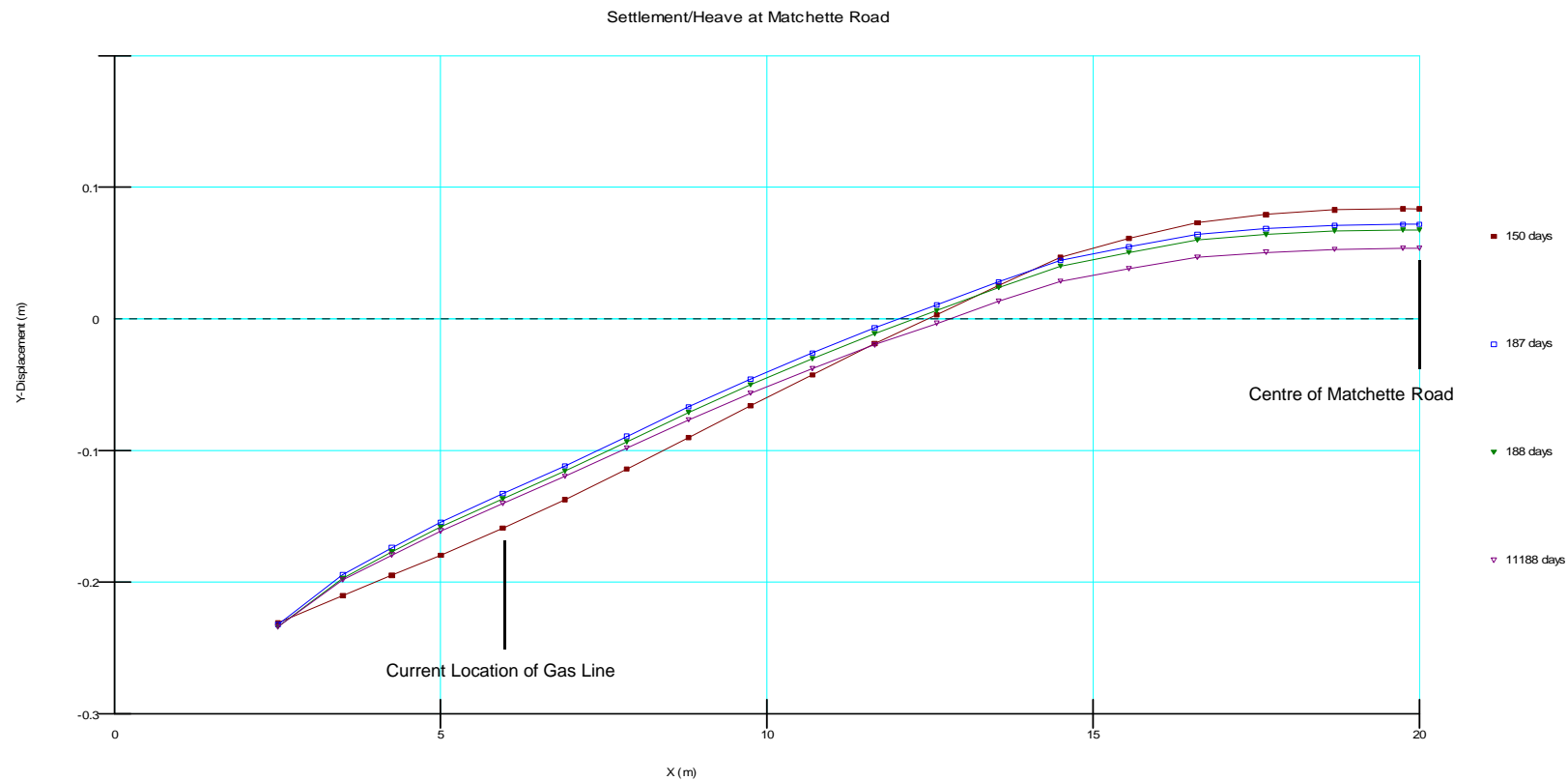


Legend:
 188 days = End of Construction of Bridge
 11188 days = Long-term Condition
 (-) Displacement = Settlement
 (+) Displacement = Heave



Legend:
 187 days = End of RSS Construction
 188 days = End of Bridge Construction
 11188 days = Long-term Condition





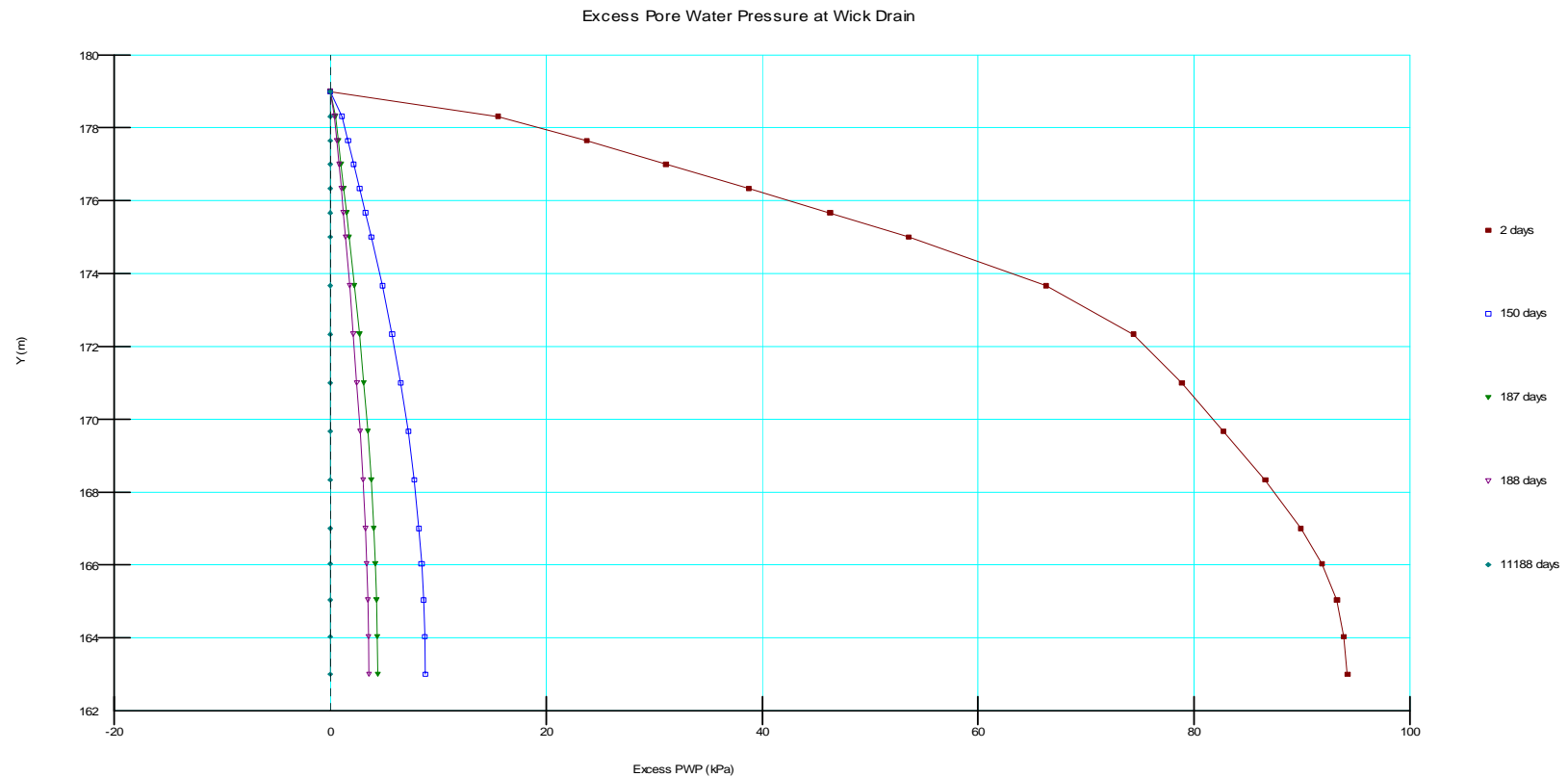
Legend:

150 days = End of Total Embankment Construction with Wick Drain

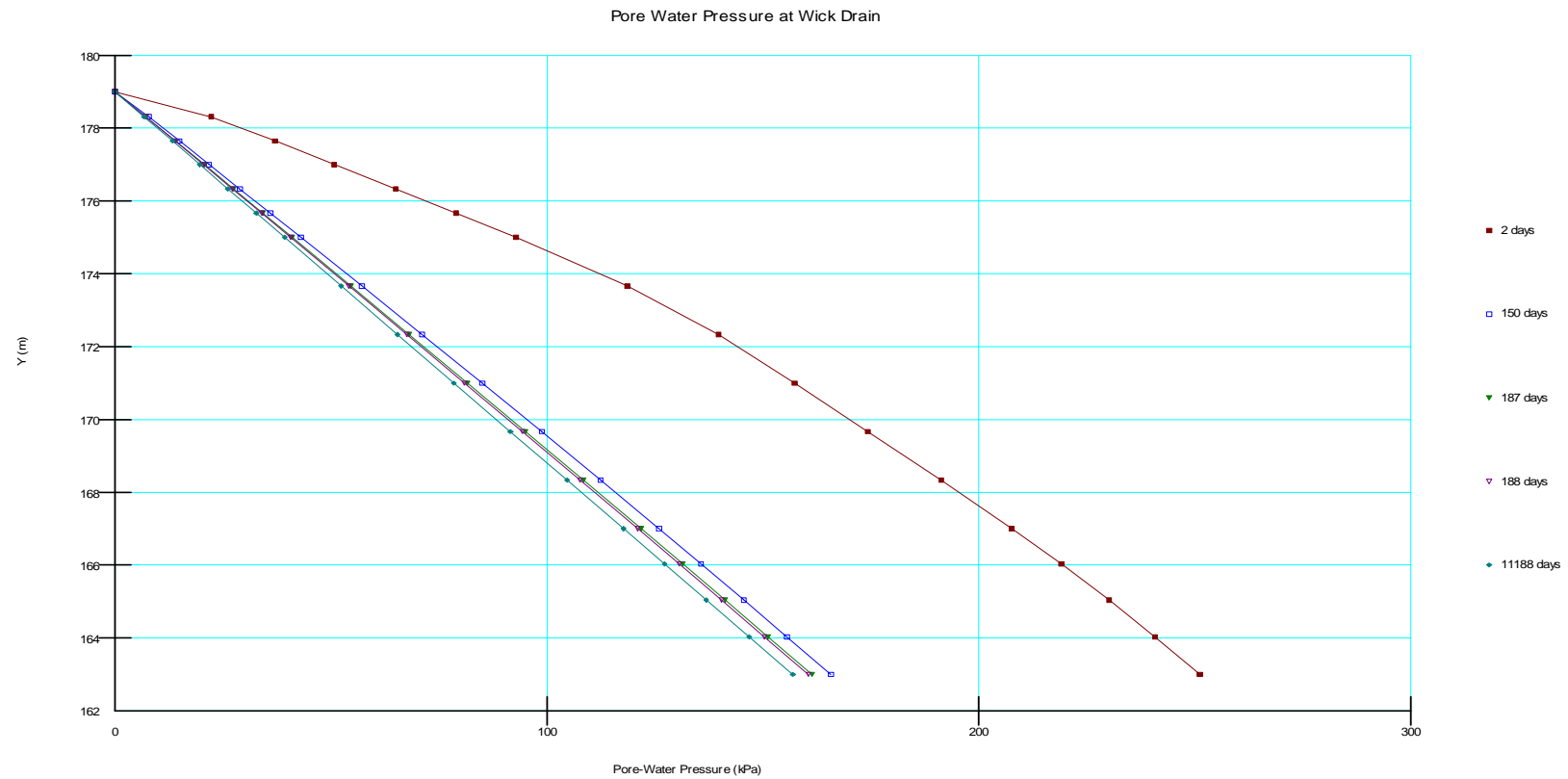
187 days = End of RSS Construction

188 days = End of Bridge Construction

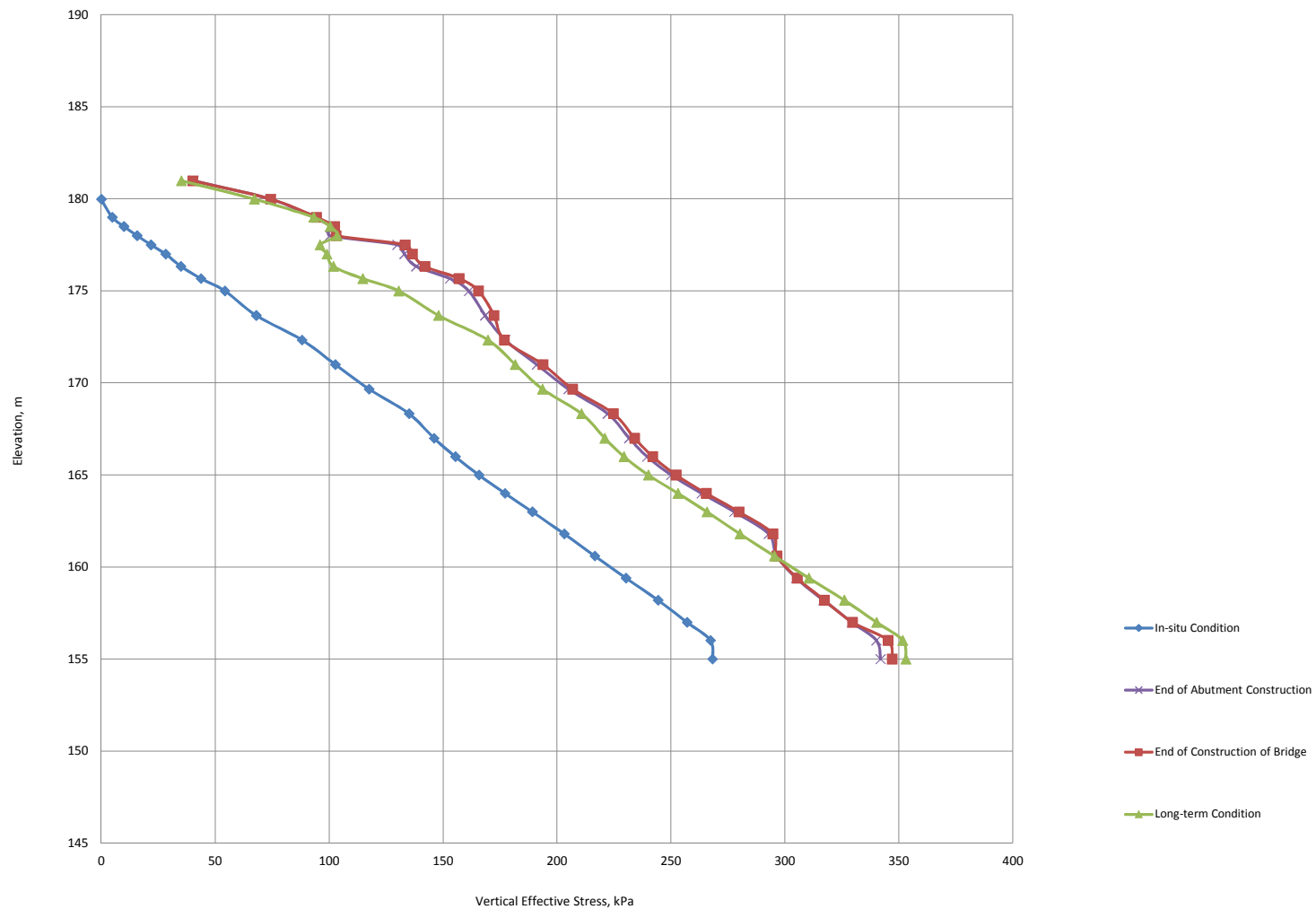
11188 days = Long-term Condition

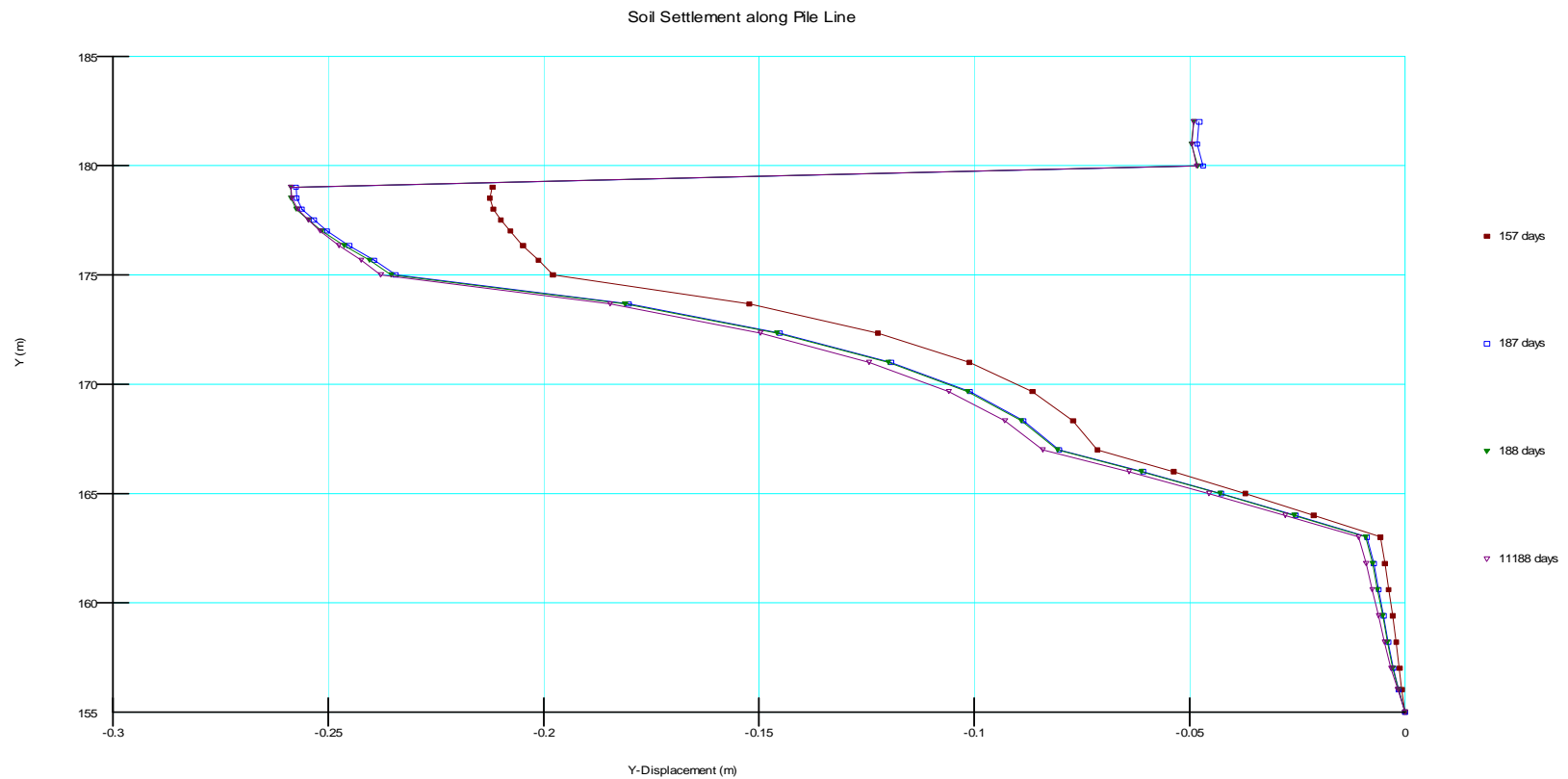


Legend:
 2 days = 2nd Day of Embankment Construction with Wick Drain
 150 days = End of Embankment Construction with Wick Drain
 187 days = End of RSS Abutment Construction
 188 days = End of Construction of Bridge
 11188 days = Long-term Condition



Legend:
 2 days = 2nd Day of Embankment Construction with Wick Drain
 150 days = End of Embankment Construction with Wick Drain
 187 days = End of RSS Abutment Construction
 188 days = End of Construction of Bridge
 11188 days = Long-term Condition





Legend:

157 days = End of Backfill Excavation

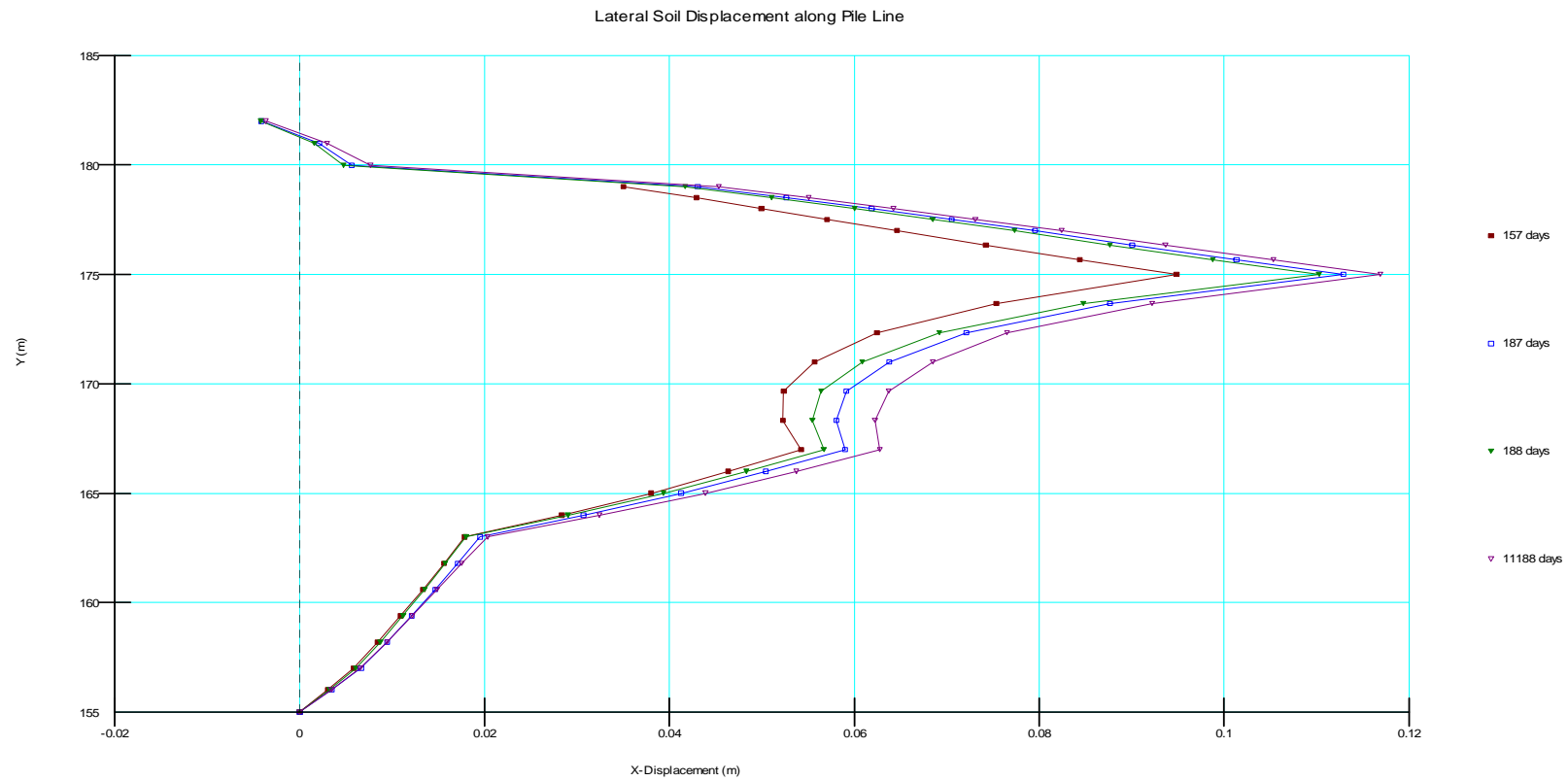
187 days = End of RSS Abutment Construction

188 days = End of Construction of Bridge

11188 days = Long-term Condition

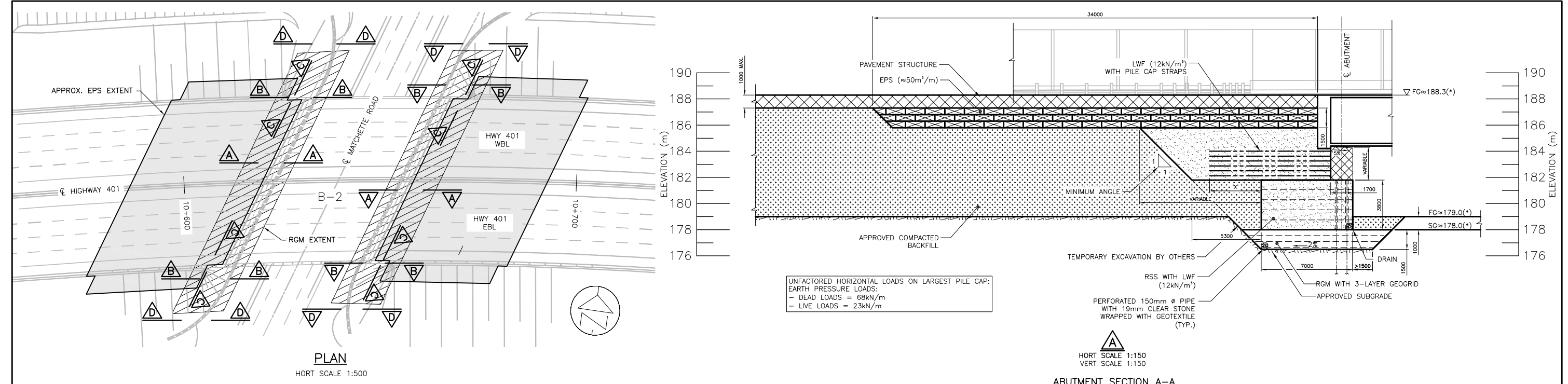
(-) Displacement = Settlement

(+) Displacement = Heave

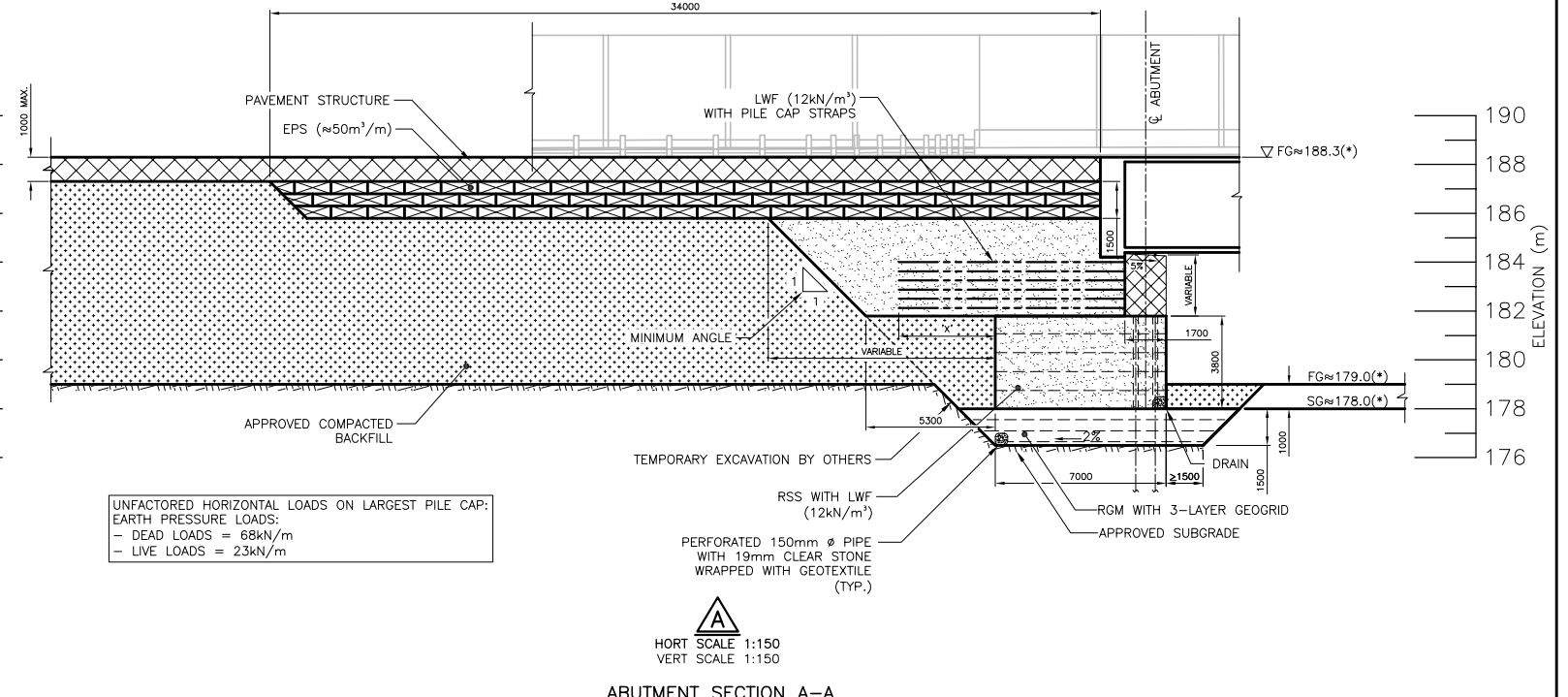


Legend:
 157 days = End of Backfill Excavation
 187 days = End of RSS Abutment Construction
 188 days = End of Construction of Bridge
 11188 days = Long-term Condition

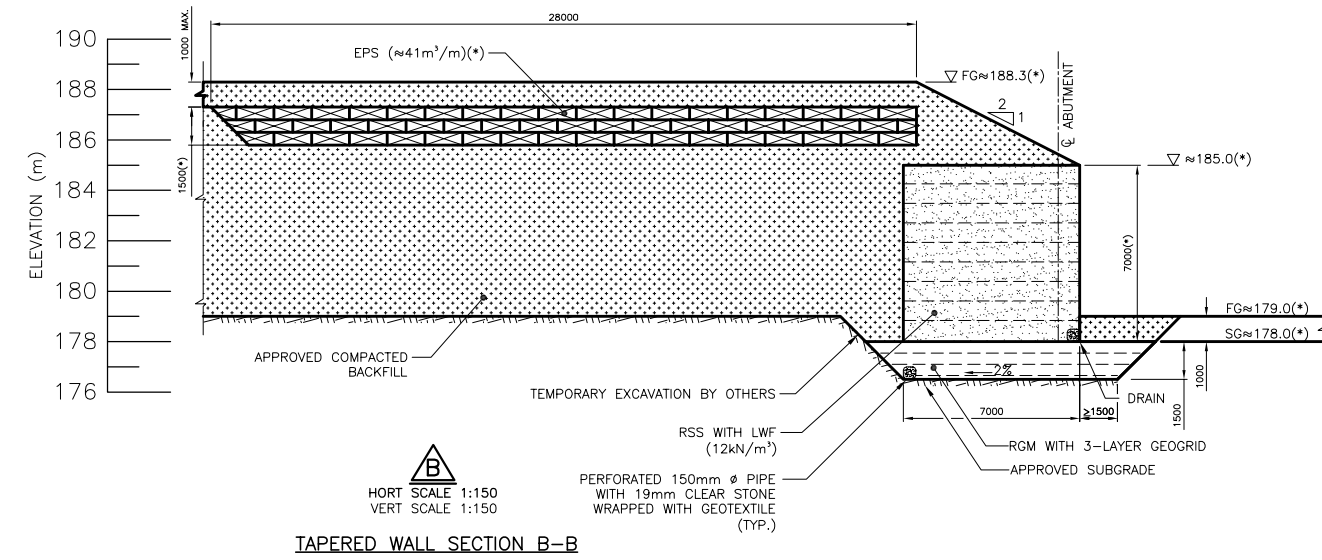
Appendix H Conceptual Abutment Design



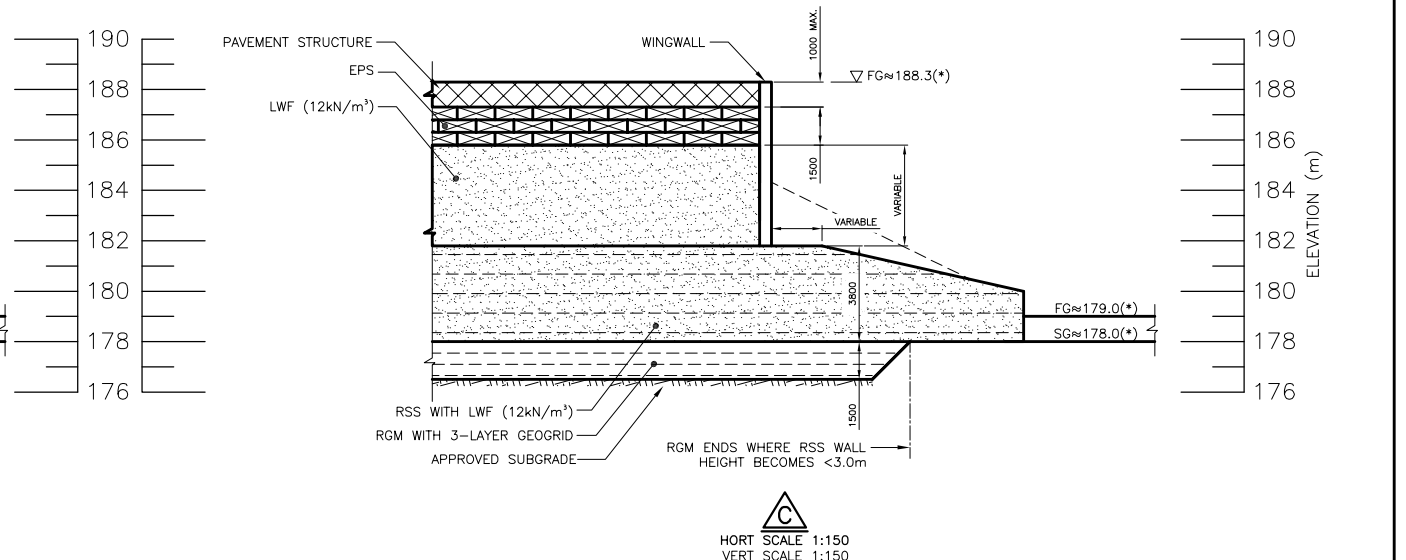
PLAN
HORIZONTAL SCALE 1:500



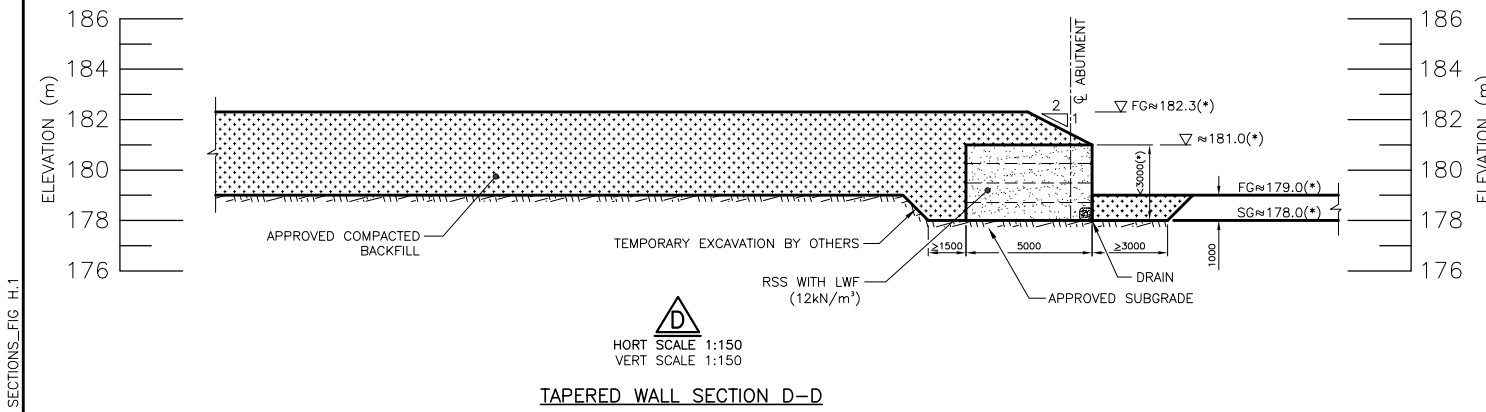
ABUTMENT SECTION A-A



TAPERED WALL SECTION B-B



WINGWALL SECTION C-C



TAPERED WALL SECTION D-D

- NOTES:
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
 2. THIS DRAWING ILLUSTRATES THE GENERAL ARRANGEMENTS AT SELECTED REPRESENTATIVE LOCATIONS OF THE ABUTMENTS OF BRIDGE B-2 BASED ON GEOTECHNICAL DESIGN ANALYSES.
 3. THE ILLUSTRATED RSS WALL WIDTH REPRESENTS THE MINIMUM WIDTH BASED ON GEOTECHNICAL REQUIREMENTS. THE DESIGN OF THE RSS WALL AND RGM IS TO BE DEVELOPED BY OTHERS.
 4. BRIDGE ELEVATIONS AND DIMENSIONS FOR THE GEOTECHNICAL DESIGNS WERE OBTAINED FROM STRUCTURAL DRAWINGS AVAILABLE IN JANUARY 2013. ABUTMENT ELEVATIONS VARY ALONG THE BRIDGE.
 5. SUBGRADE IS SUSCEPTIBLE TO DISTURBANCE AND LOSS OF STRENGTH DUE TO WATER INFLOW/PONDING, CONSTRUCTION TRAFFIC AND THE LIKE. SUITABLE EXCAVATION METHODS, DEWATERING AND SUBGRADE PROTECTION MUST BE EXERCISED.
 6. CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN, CONSTRUCTION METHODS AND PERFORMANCE OF THE TEMPORARY SLOPES AND WORKS. EXCAVATED CLAY SURFACES ARE SUSCEPTIBLE TO DETERIORATION AND EXPERIENCE DEFORMATIONS AND INSTABILITY; THEY ARE TO BE APPROPRIATELY PROTECTED, REGULARLY INSPECTED AND TREATED AS REQUIRED.
 7. SEE ACCOMPANYING DRAWINGS FOR APPLICABLE CONSTRUCTION NOTES.

- LEGEND:
- RSS - REINFORCED SOIL STRUCTURE
 - RGM - REINFORCED GRANULAR MAT (LONG-TERM FACTORED LOAD CAPACITY OF GEOGRID SHALL BE MINIMUM 18kN/m)
 - EPS - EXPANDED POLYSTYRENE
 - LWF - LIGHT WEIGHT FILL (ULTRALIGHT WATER-COOLED IRON FURNACE SLAG)
 - 'X' - LENGTH OF PILE CAP STRAPS TO BE DETERMINED BY SUPPLIER
 - (*) - VARIES