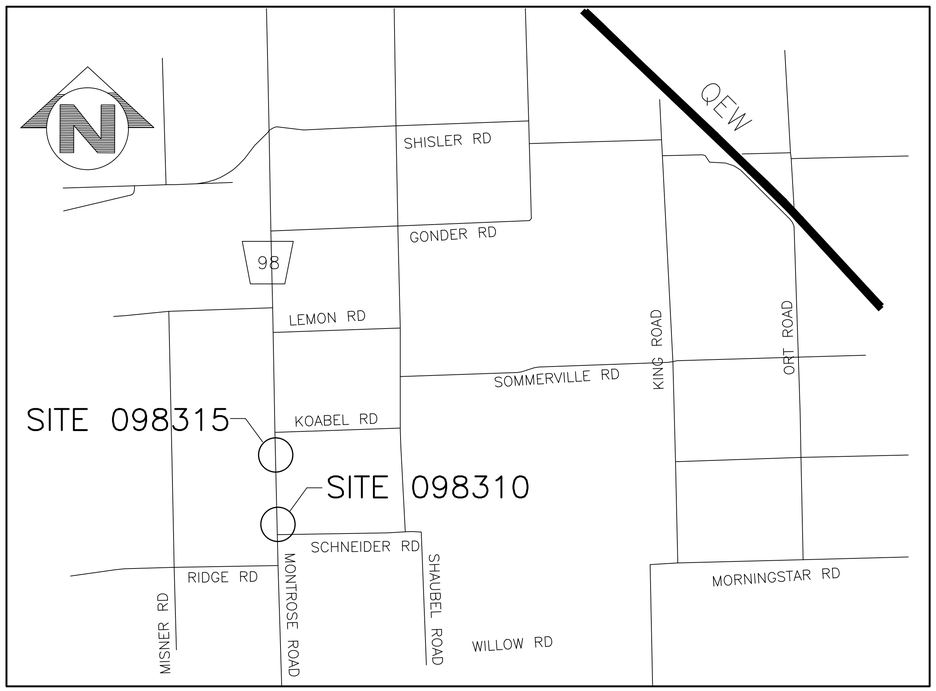
The Regional Municipality of Niagara

Public Works Department

Niagara Region

REPLACEMENT OF MONTROSE ROAD CULVERTS
STRUCTURE NUMBERS 098310 & 098315
REGIONAL ROAD 98 (MONTROSE ROAD)
IN THE CITY OF NIAGARA FALLS



LIST OF DRAWINGS

STRUCTURE NO. 098310

804-1-1: GENERAL ARRANGEMENT
804-1-2: DISTRIBUTION SLAB AND MISC. DETAILS
804-1-3: SBGR POST AND NORTHEAST RETAINING WALL
804-1-4: DURA HOLD 2 RETAINING WALL
804-1-5: PROPOSED SEDIMENT AND EROSION CONTROL PLAN

STRUCTURE NO. 098315

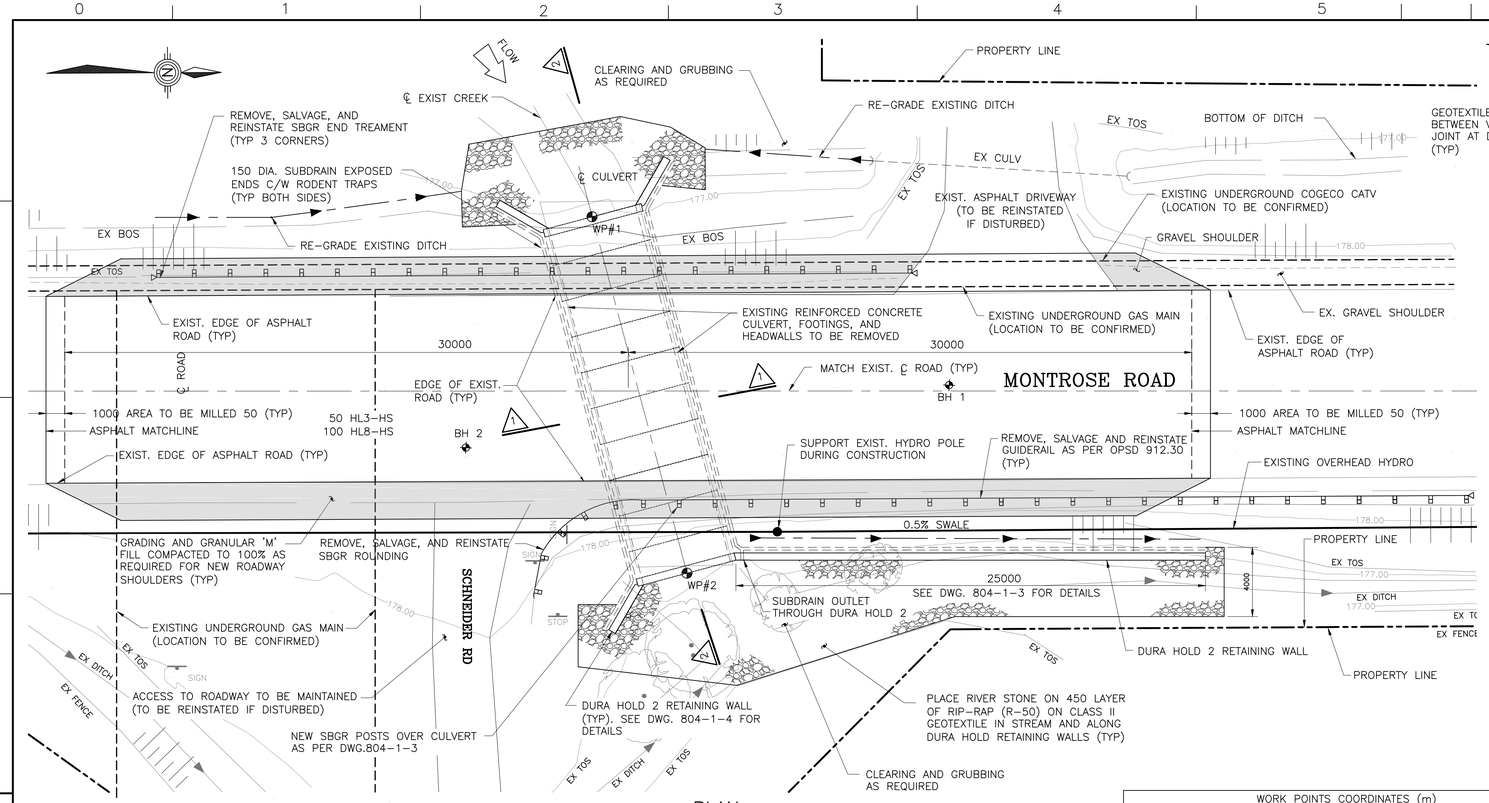
804-2-1: GENERAL ARRANGEMENT
804-2-2: DISTRIBUTION SLAB AND MISC. DETAILS
804-2-3: SBGR POST AND JOINT DETAILS
804-2-4: DURA HOLD 2 RETAINING WALL
804-2-5: PROPOSED SEDIMENT AND EROSION CONTROL PLAN

CATHARINE HABERMEBL
ACTING COMMISSIONER OF
PUBLIC WORKS

JAMES BRADLEY
REGIONAL CHAIR

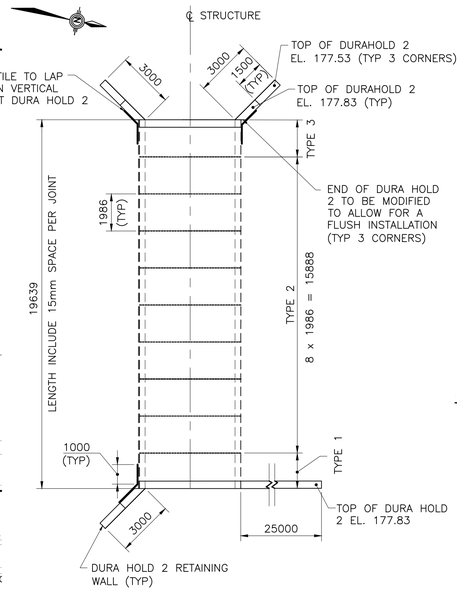
CONTRACT NO. 2019-RFT-155 (RN19-55)

PLOTTED: MAR 29, 2019

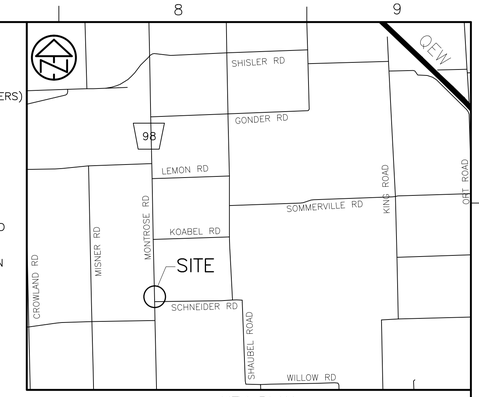


PLAN
1:150

WORK POINTS COORDINATES (m)			
W.P.	NORTHING	EASTING	DESCRIPTION
1	4760042.501	653077.417	CL-WEST END OF CULVERT
2	4760047.920	653096.294	CL-EAST END OF CULVERT



PRECAST CONCRETE CULVERT LAYOUT PLAN
NTS



KEY PLAN
N.T.S.

GENERAL NOTES

1. CLASS OF CONCRETE 35MPa UNLESS NOTED OTHERWISE ON DRAWINGS.
2. GFRP BARS TO BE GRADE 60 Gpa GLASS FIBRE REINFORCED POLYMER AS MANUFACTURED BY SCHOCK BAUTEILE GmbH. V-ROD MANUFACTURED BY PULTRALL OR APPROVED EQUIVALENT.
3. ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT AS SHOWN OTHERWISE.
4. THE STRUCTURE SHALL BE CLOSED TO TRAFFIC.
5. CULVERT AND ROAD CONSTRUCTION IS TO BE AS PER THE ONTARIO PROVINCIAL STANDARDS FOR ROADS AND MUNICIPAL SERVICES AND AS PER DETAILS PROVIDED.
6. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS OF THE EXIST. CONDITIONS AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE REPAIR WORK. THE CONTRACTOR ALSO SHALL VERIFY ALL RELEVANT DIMENSIONS AND ELEVATIONS OF THE EXISTING CONDITIONS PRIOR TO CONSTRUCTION TO SUIT PROPOSED WORK.

CONSTRUCTION NOTES

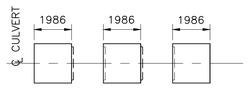
1. CULVERT CONSTRUCTION CONSISTS OF PRECAST CONCRETE. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT LIFTING METHODS AND INSERTS DO NOT OVERSTRESS THE PRECAST SECTIONS.
2. BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 400mm.
3. NO CULVERT SECTION SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BT THE CONTRACT ADMINISTRATOR.

LIST OF DRAWINGS

804-1-1. GENERAL ARRANGEMENT
804-1-2. DISTRIBUTION SLAB AND MISCELLANEOUS DETAILS
804-1-3. SBGR POST AND NORTHEAST RETAINING WALL
804-1-4. DURA HOLD 2 RETAINING WALL
804-1-5. PROPOSED SEDIMENT AND EROSION CONTROL PLAN

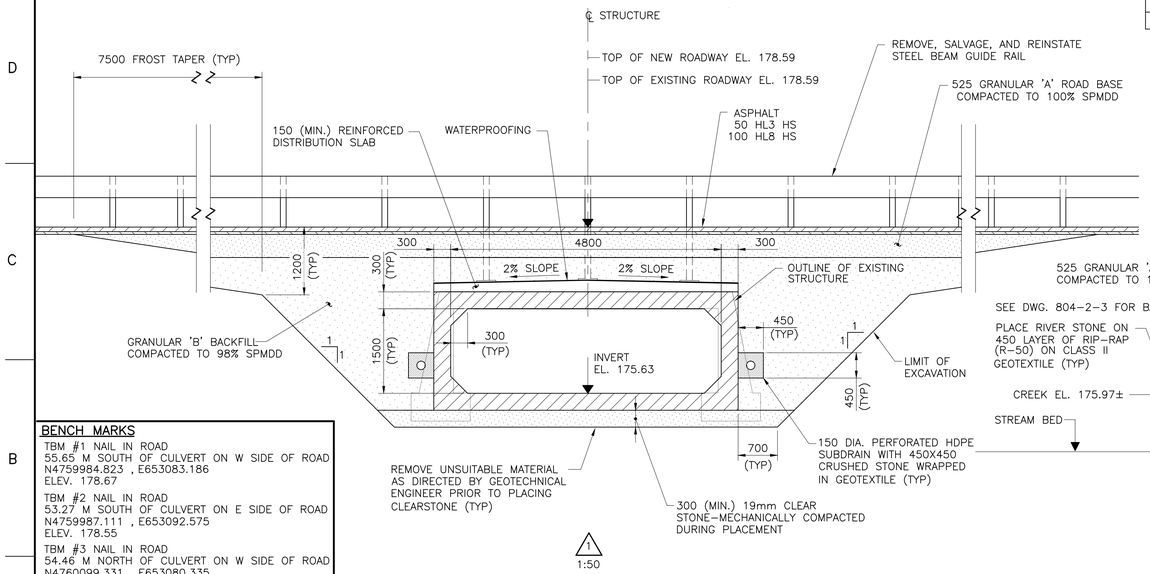
APPLICABLE STANDARD DRAWINGS

OPSD-219.110 – LIGHT DUTY SILT FENCE BARRIER
OPSD-219.180 – STRAW BALE FLOW CHECK DAM
OPSD-912.130 – GUIDE RAIL SYSTEM, STEEL BEAM STEEL POST WITH OFFSET BLOCK ASSEMBLY INSTALLATION-SINGLE RAIL



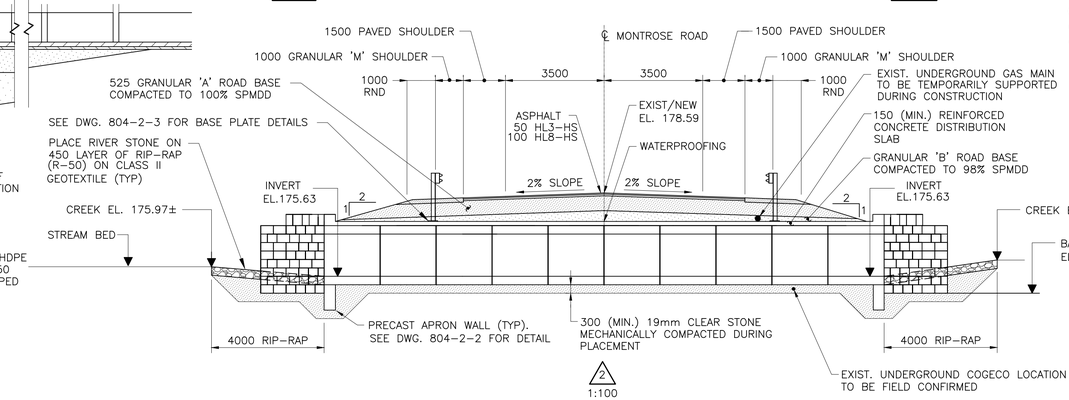
TYPE 1 N.T.S. TYPE 2 N.T.S. TYPE 3 N.T.S.

ELEVATION
SEE DRAWING 804-2-4 FOR JOINT DETAILS



1
1:50

EAST



2
1:100

WEST

BENCH MARKS

TBM #1 NAIL IN ROAD
55.65 M SOUTH OF CULVERT ON W SIDE OF ROAD
N4759984.823 , E653083.186
ELEV. 178.67

TBM #2 NAIL IN ROAD
53.27 M SOUTH OF CULVERT ON E SIDE OF ROAD
N4759987.111 , E653092.575
ELEV. 178.55

TBM #3 NAIL IN ROAD
54.46 M NORTH OF CULVERT ON W SIDE OF ROAD
N4760099.331 , E653080.335
ELEV. 178.49

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

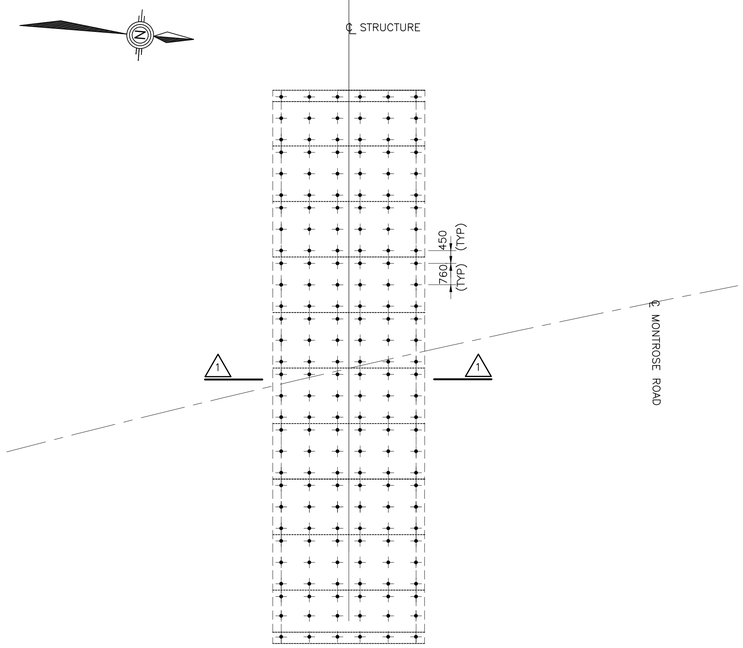
Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098310
MONTROSE ROAD CULVERT REHABILITATION

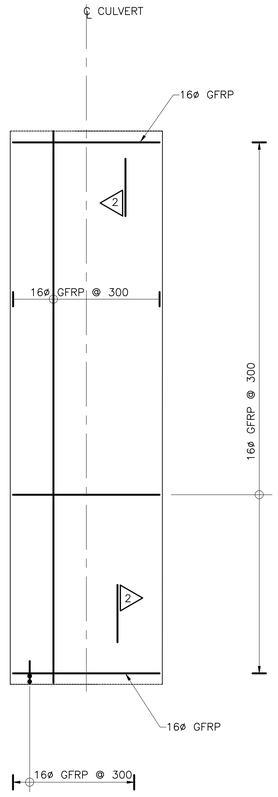
GENERAL ARRANGEMENT

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804-1-1
MUN. REF. No.: 2019-RFT-155 (RN19-55)
REV.: 0

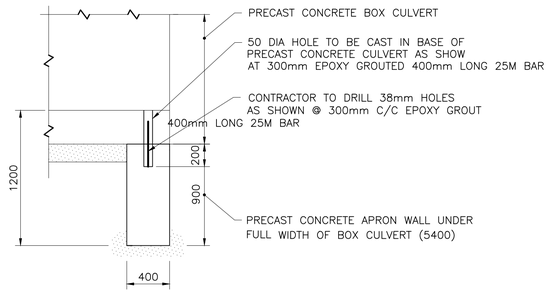
PLOTTED MAR 29, 2019



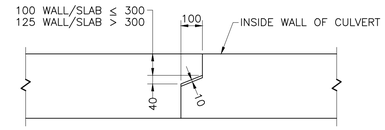
PLAN SHOWING DOWEL LAYOUT
1:100



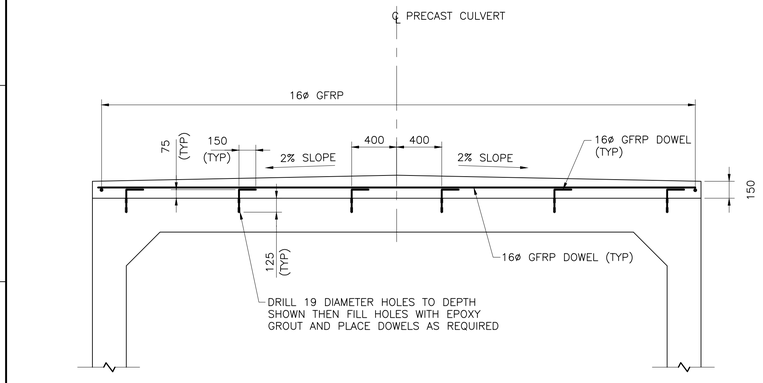
PLAN OF DISTRIBUTION SLAB
1:100



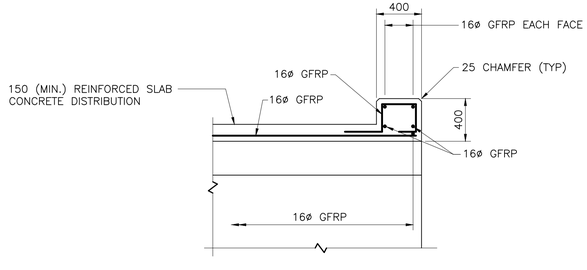
PRECAST APRON WALL
(TYP UNDER ENDS OF CULVERT)
N.T.S.



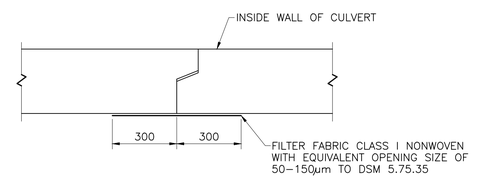
TYPICAL JOINT DETAIL
N.T.S



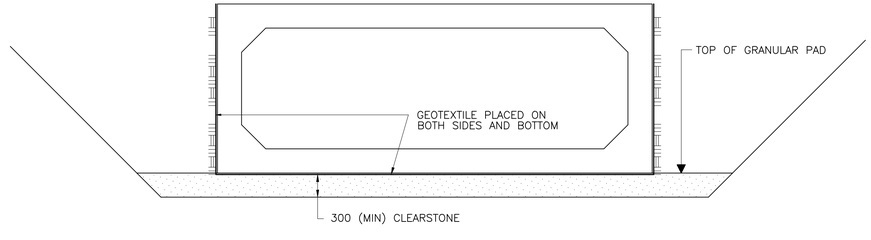
CROSS SECTION OF GFRP LAYOUT
1
1:25



HEADWALL ON PRECAST CULVERT
2
1:25



BURIED JOINT TREATMENT
N.T.S



EXTENT BURIED JOINT TREATMENT
1:35

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER
B.J.J. ELLIS
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
D.N. VANGEEST
100127085
PROVINCE OF ONTARIO

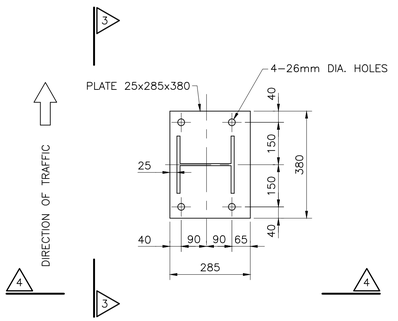
Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098310
MONTROSE ROAD CULVERT REHABILITATION

DISTRIBUTION SLAB AND MISC. DETAILS

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804–1–2
MUN. REF. No.: 2019–RFT–155 (RN19–55)
REV.: 0

PLOTTED MAR 29, 2019

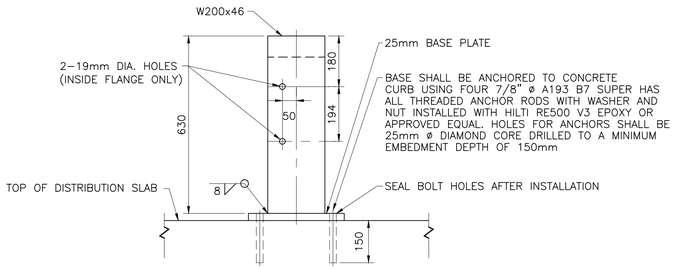


PLAN OF THRIE BEAM POST BASE PLATE

N.T.S.

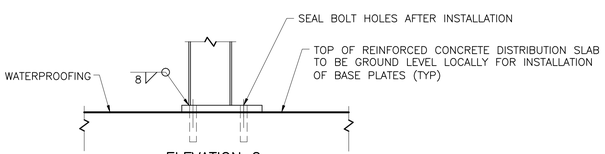
THE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE TO CSA STANDARD G164–M92.

NOTE: NO FIELD CUTTING IS PERMITTED. POSTS TO BE CUT TO SIZE PRIOR TO GALVANIZING.



ELEVATION 1

N.T.S.

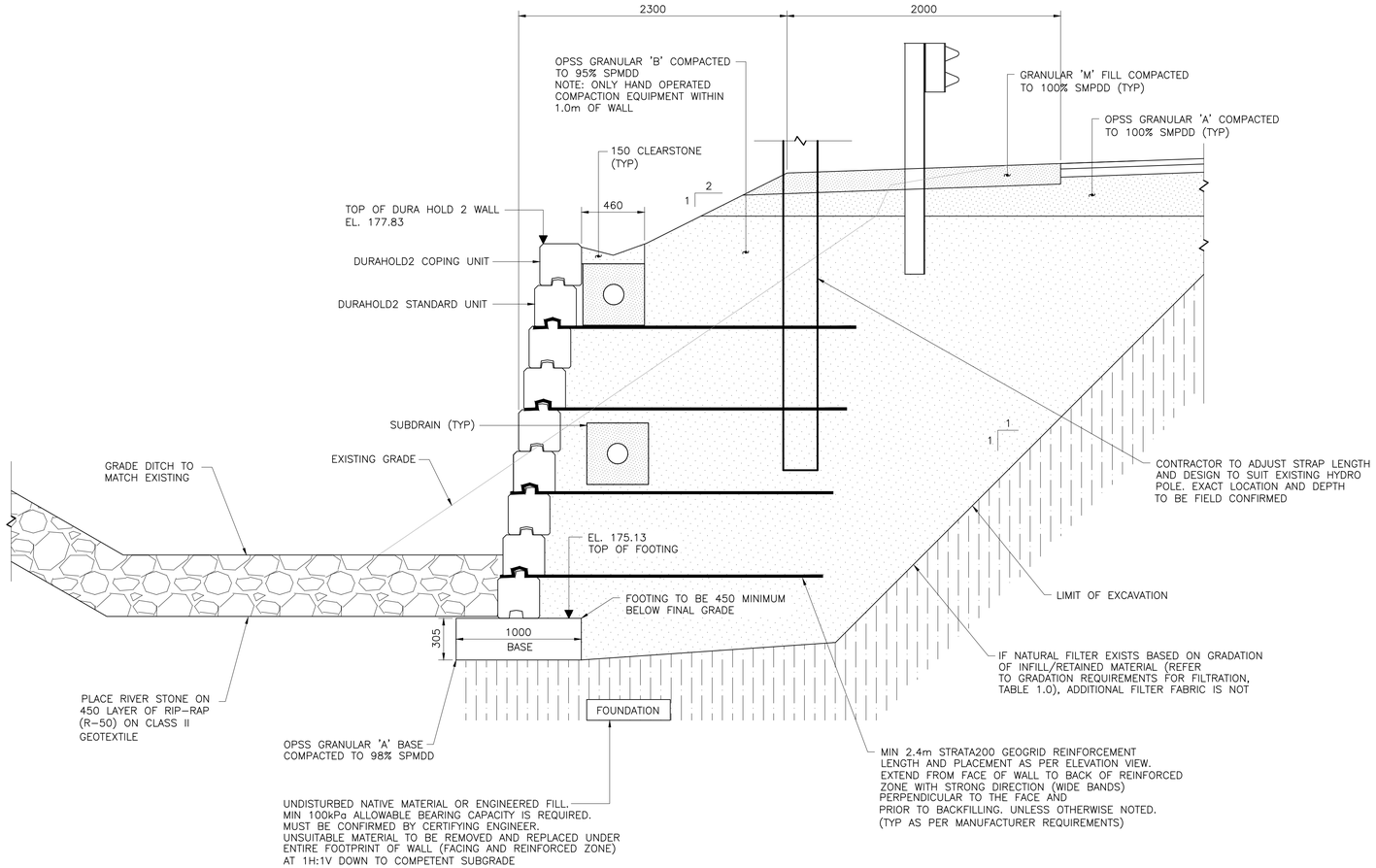


ELEVATION 2

3 EAST SIDE MIRROR 3 WEST SIDE

N.T.S.

NOTE: ONLY HAND–OPERATED COMPACTION AND/OR PAVING EQUIPMENT TO BE USED WITHIN 1.0m OF BACK OF RETAINING WALL



TYPICAL NORTHEAST WALL CROSS SECTION

1:20

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

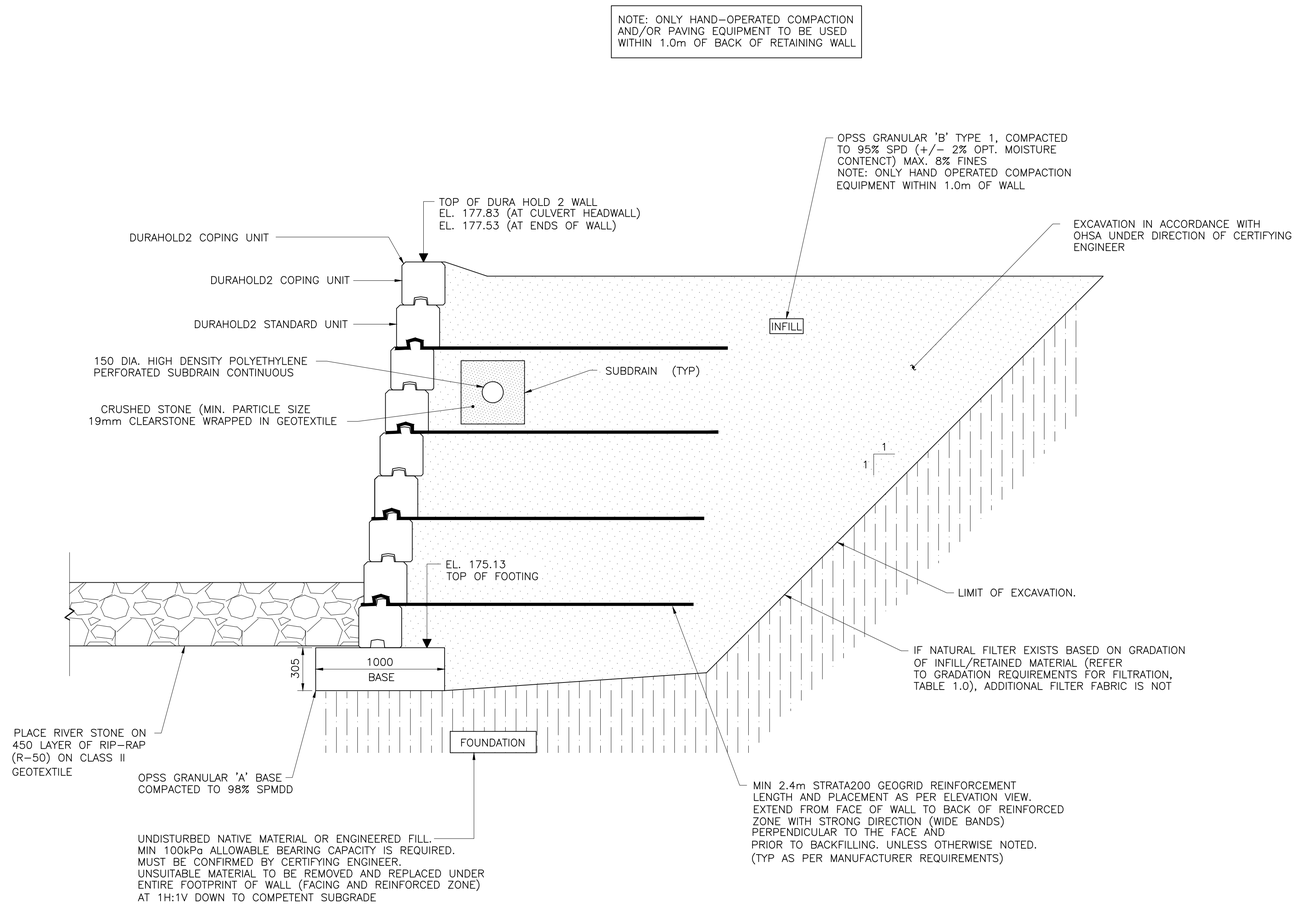
Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098310 MONTROSE ROAD CULVERT REHABILITATION

SBGR POST AND NORTHEAST RETAINING WALL

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804–1–3
MUN. REF. No.: 2019–RFT–155 (RN19–55)
REV.: 0

PLOTTED MAR 29, 2019



TYPICAL DURA HOLD 2 WALL DETAIL (NE, SE, AND SW CORNERS)

1:20

TABLE 2.0 – DESIGN SPECIFIC GEOMETRIC INFORMATION FOR DURA HOLD WALLS

RETAINING WALL SYSTEM	DURAHOLD2 WITH GEOGRID	GEOGRID TYPE	STRATAGRID 200
MAX. HEIGHT (mm)	3050	MIN. GEOGRID LTDS kN/m	13.7 kN/m
MAX. SLOPE ABOVE WALL	2:1	MAX. SLOPE BELOW WALL	NONE
MAX. SURCHARGE ABOVE WALL (kPa)	12	DEPTH OF EMBEDMENT (mm)	10%H
BATTER OF WALL	7.12°	COMPACTED BASE DIMENSION (mm)	305x1000

TABLE 1.0 – SOIL ZONES AND ASSUMED PROPERTIES FOR DURA HOLD WALLS

	SOIL REGION				
	INFILL	RETAINED	FOUNDATION	BASE	DRAINAGE
DESCRIPTION (BY USCS)	GW WELL GRADED, FREE DRAINING GRANULAR	ML-CL INORGANIC SILT-CLAY LOW PLASTICITY	ML-CL INORGANIC SILT-CLAY LOW PLASTICITY	GW WELL GRADED, FREE DRAINING GRANULAR	SEE INFILL
EFFECTIVE INTERNAL FRICTION ANGLE	33°	28°	28°	39°	NR
MOIST UNIT WEIGHT kN/cu.m (lb/cu.ft)	22 (140)	20 (127)	20 (127)	22 (140)	NR
EFFECTIVE COHESION kPa (lb/sq.ft)	NR	NR	13 (270)	NR	NR
SOIL NOTES	PLACED IN 150mm (6in) LIFTS AND COMPACTED TO 95% SPD.	MUST BE UNDISTURBED DENSE SOIL OR WELL-COMPACTED ENGINEERED FILL.	THE ALLOWABLE BEARING CAPACITY MUST EXCEED 100kPa.	WELL GRADED, CRUSHED, NON FROST SUSCEPTIBLE GRANULAR SOIL, COMPACTED TO 98% SPD.	GRANULAR FILL MUST BE WELL GRADED, FREE DRAINING WITH MAX. 5-8% FINES.
GEOTEXTILE SEPARATING FROM ADJACENT SOIL*	FLOW - RETAINED TO INFILL NOT REQUIRED IF GRADATION (BELOW) MET	FLOW - RETAINED TO INFILL NOT REQUIRED IF GRADATION (BELOW) MET	FLOW - FOUNDATION TO INFILL NOT REQUIRED IF GRADATION (BELOW) MET	NR	
ASSUMED GRADATION FOR FILTRATION REQ.**	D(15) < 0.3mm D(50) < 1.18mm MAX 8% FINES	D(85) > 0.075mm D(15) < 0.002mm D(50) > 0.05mm	D(85) > 0.075mm D(15) < 0.002mm D(50) > 0.05mm		

* REFER TO TABLE 3.0, DRAINAGE PROVISIONS
** IF THE ABOVE GRADATION REQUIRMENTS ARE NOT MET, AN ALTERNATIVE FABRIC WILL BE REQUIRED. CONTACT RSS TO DISCUSS ALTERNATIVES.

TABLE 3.0 – DRAINAGE PROVISIONS FOR DURA HOLD WALLS

POTENTIAL WATER SOURCE	DRAINAGE MEASURES (TO BE VERIFIED BY CERT. GEOTECH. ENG.)	ADD. NOTES
SURFACE INFILTRATION: (ABOVE REINFORCED ZONE AND BEYOND. RAINFALL, NORMAL SNOW MELT, RUN-OFF, ETC. IF IRRIGATION SYSTEMS ARE USED IMMEDIATELY ABOVE THE REINFORCED ZONE OF THE WALL, ADDITIONAL MEASURES WILL BE REQUIRED IN CASE OF LEAKAGE/FAILURE OF THE SYSTEM.) CONTRACTOR MUST VERIFY THAT AREA ABOVE WALL IS NOT USED FOR STORAGE OF SNOW DURING WINTER MONITHS DRAINAGE SYSTEM AND ASSUMED LOADING CONDITIONS DO NOT ACCOUNT FOR THIS USE.	GRADE BEHIND MUST DIRECT WATER AWAY FROM BACK OF WALL. IF SLOPE TOWARD WALL EXISTS, SWALE SYSTEM MUST BE IMPLEMENTED TO CARRY WATER AT MIN. 2% GRADE TO POSITIVE DRAINAGE AREA. DIMENSIONS OF SWALE WILL BE BASED ON ANTICIPATED WATER COLLECTION REQUIREMENTS AS SPECIFIED BY THE CIVIL ENGINEER AS PART OF THE OVERALL SITE DRAINAGE PLAN. THE SWALE SYSTEM MUST BE CONSTRUCTED WITH A LOW PERMEABILITY LAYER (100-150mm) OF ENGINEERED FILL MATERIAL COMPACTED TO 95% SPD TO ACT AS A CONDUIT FOR THE SURFACE WATER AND PREVENT INFILTRATION BEHIND THE WALL FACING AND INTO THE REINFORCED ZONE.	OTHER STRUCTURES/PAVED SURFACES ADJACENT TO WALL: OTHER STRUCTURES ADJACENT TO THE RETAINING WAL MUST HAVE INDEPENDENT DRAINAGE SYSTEMS. FOR EXAMPLE, PAVEMENTS MUST HAVE INDEPENDENT COLLECTION SYSTEMS (PERIMETER DRAINS) TO COLLECT WATER THAT PENETRATES CRACKS IN THE SURFACE, ETC. BUILDING DOWNSPOUTS MUST NOT DIRECT WATER TOWARDS THE WALLS AND MUST BE CONNECTED TO INDEPENDENT OUTLETS.
LATERAL UNDERGROUND: DESIGN ASSUMES THAT GROUNDWATER IS BELOW BOTTOM OF WALL. THE FOLLOWING DRAINAGE MEASURES ADDRESS OTHER POTENTIAL SOURCES OF LATERAL GROUNDWATER THAT MAY BE THE RESULTS OF INFILTRATION THROUGH THE SURFACE (i.e. CRACKS IN ASPHALT BEYOND THE REINFORECED ZONE) OR OTHER BELOW GRADE SOURCES.	DRAINAGE SYSTEM: THE REINFORCED ZONE OF THE WALL IS SPECIFIED AS A WELL GRADED GRAVEL WITH A MAX. OF 8% FINES WITH A COLLECTION PIPE AT THE BOTTOM. THE RETAINED ZONE (UP STREAM SOURCE OF POTENTIAL WATER) IS ASSUMED TO BE OF A LOWER PERMEABILITY AS COMPARE TO THE IMPORTED FILL. THE REINFORCED ZONE IS THEREFORE ASSUMED TO ALLOW FOR THE DRAINAGE OF POTENTIAL WATER SEEPAGE AS DISCUSSED IN COLUMN 1. THE PERFORATED COLLECTION PIPE (MIN. 100mm DIA. AT 2% GRADE) MUST BE CONNECTED TO A POSITIVE OUTLET AS DETERMINED BY THE CIVIL ENGINEER PRIOR TO CONSTRUCTION. NOTE: THESE DRAINAGE MEASURES ARE PROVIDED AS AN EXTRA PRECAUTION AGAINST THE POSSIBILITY OF AN UNKNOWN WATER THAT MAY OR MAY NOT OCCUR AT SOME POINT DURING THE LIFE OF THE STRUCTURE. IF, UPON EXCAVATION, A SPECIFIC WATER SOURCE IS IDENTIFIED (PERCHED WATER CONDITION, SAND SEAMS, ETC.) IN THE CUT OR IS ANTICIPATED, ADDITIONAL DRAINAGE MEASURES WILL BE REQUIRED (i.e. CHIMNEY DRAINS).	WATER MANAGEMENT DURING CONSTRUCTION: AT ALL TIME THE CONTRACTOR MUST ENSURE MEASURES SUCH AS TEMPORARY SWALES AND DRAINAGE DITCHES ARE EMPLOYED TO MANAGE SURFACE WATER AND SEEPAGE DURING AND AFTER THE CONSTRUCTION OF THE WALL. IF FINAL GRADING IS NOT PART OF THE CONTRACTOR'S SCOPE OF WORK, THE AREA AROUND THE WALL MUST STILL BE PROPERLY GRADED TO ENSURE WATER DOES NOT COLLECT BEHIND OR IS DIRECTED TOWARD THE WALL.

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING RE
DESIGN DV
CHECKED BY BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

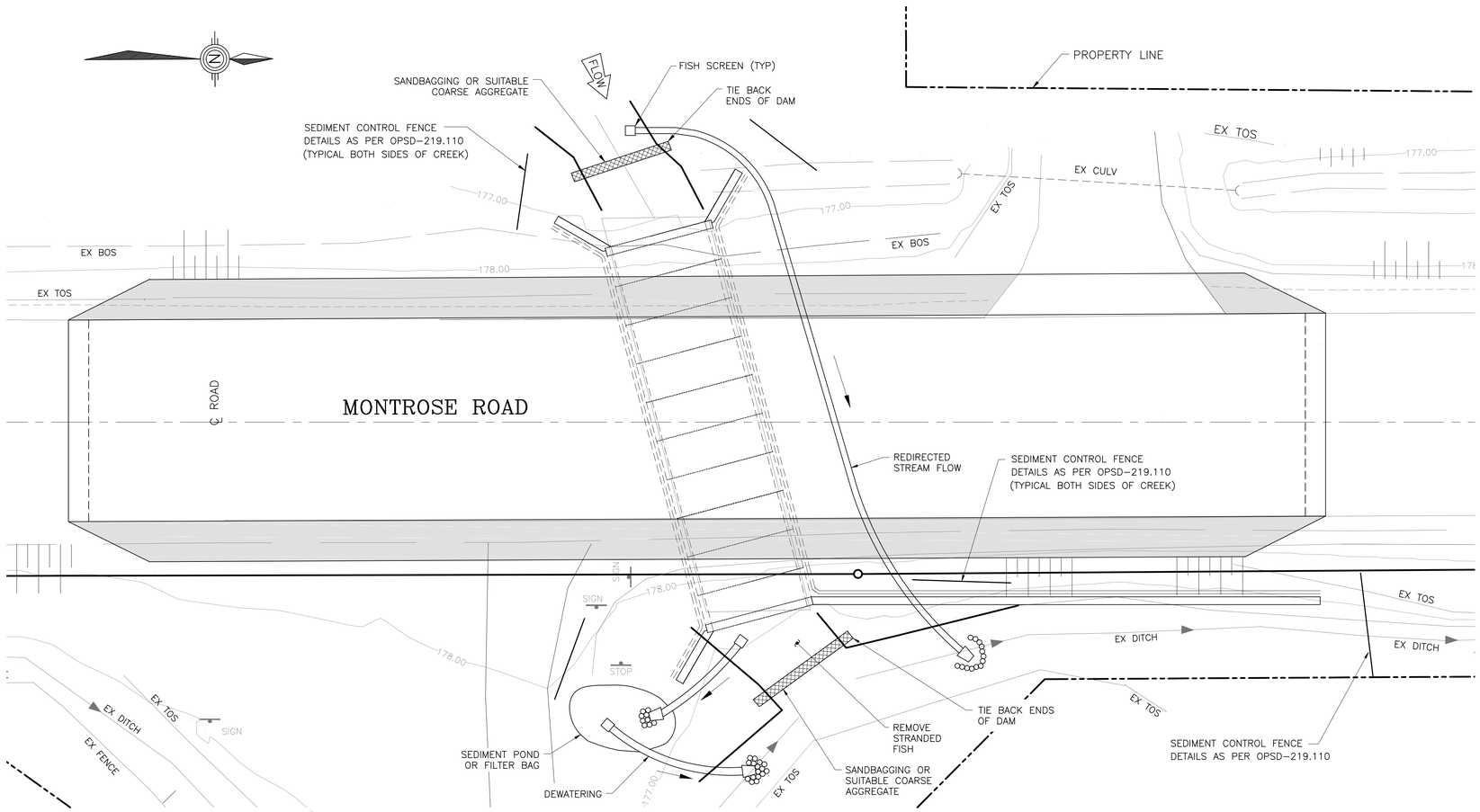
Niagara Region PUBLIC WORKS

STRUCTURE NUMBER 098310
MONTROSE ROAD CULVERT REHABILITATION

DURA HOLD 2 RETAINING WALL

DATE APRIL 2019
SCALE AS SHOWN
DWG No. 804-1-4
MUN. REF. No. 2019-RFT-155 (RN19-55)
REV. 0

PLOTTED MARCH 29, 2019



PLAN
N.T.S

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: JPD

REGISTERED PROFESSIONAL ENGINEER — B.J.J. ELLIS — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — D.N. VANGEEST 100127085 — PROVINCE OF ONTARIO

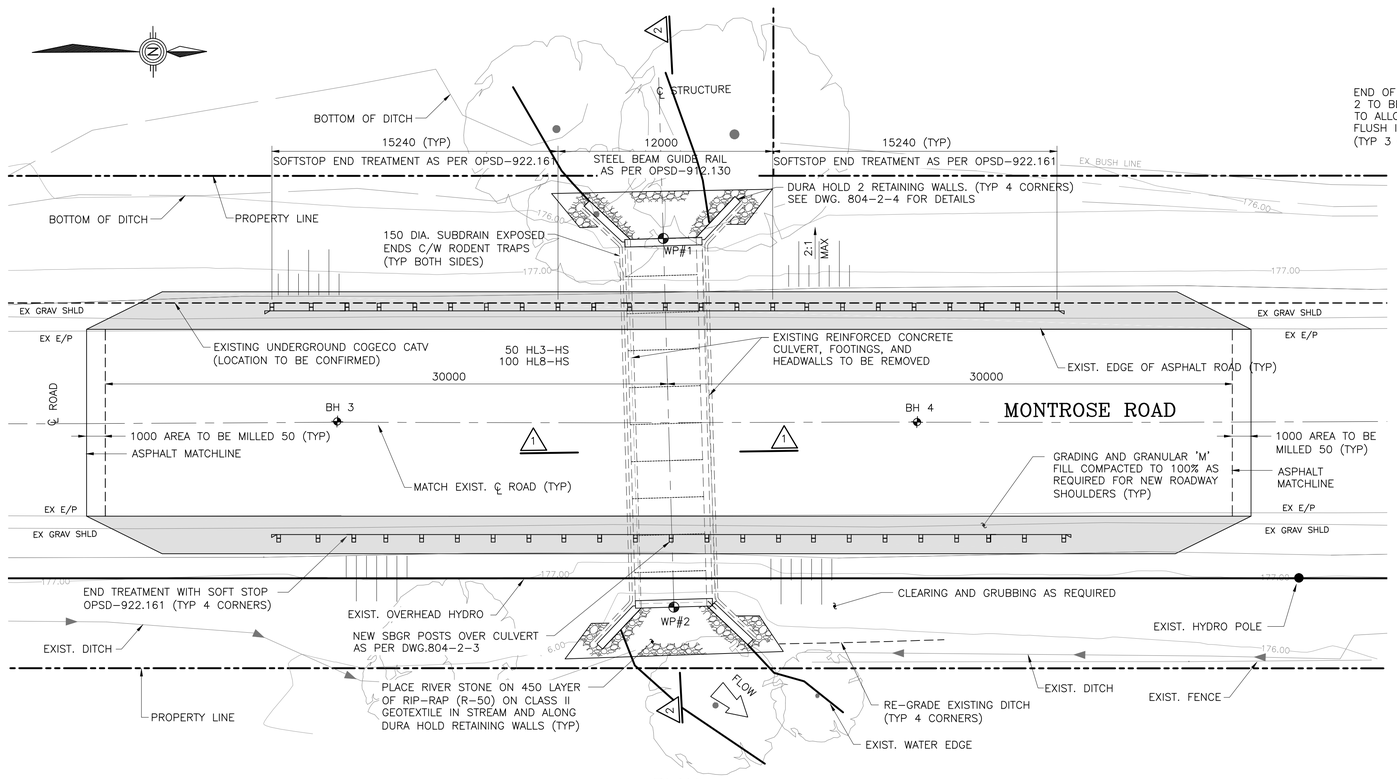
Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098310
MONTROSE ROAD CULVERT REHABILITATION

SEDIMENT CONTROL PLAN

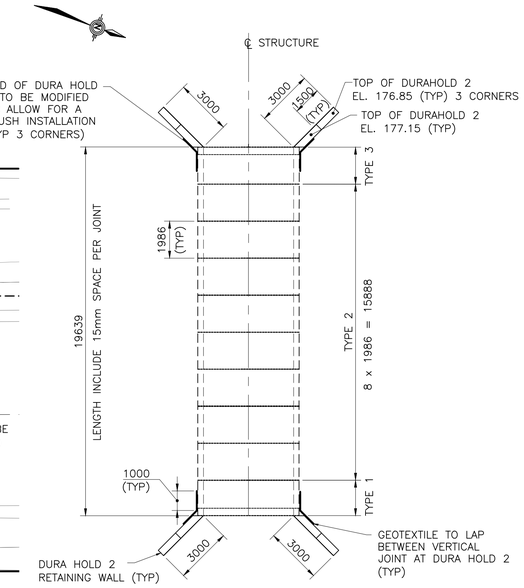
DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804-1-5
MUN. REF. No.: 2019-RFT-155 (RN19-55)
REV.: 0

PLOTTED MARCH 29, 2019

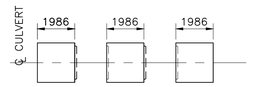


PLAN
1:150

WORK POINTS COORDINATES (m)			
W.P.	NORTHING	EASTING	DESCRIPTION
1	4760559.258	653063.851	CL-WEST END OF CULVERT
2	4760560.562	653083.448	CL-EAST END OF CULVERT

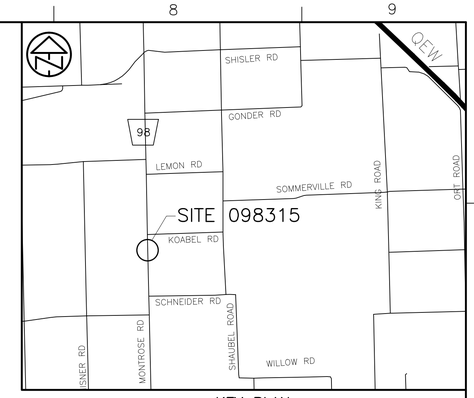


PRECAST CONCRETE CULVERT LAYOUT PLAN
NTS



TYPE 1 N.T.S. TYPE 2 N.T.S. TYPE 3 N.T.S.

ELEVATION
SEE DRAWING 804-2-3 FOR JOINT DETAILS



KEY PLAN
N.T.S.

GENERAL NOTES

1. CLASS OF CONCRETE 35MPa UNLESS NOTED OTHERWISE ON DRAWINGS.
2. GFRP BARS TO BE GRADE 60 Gpa GLASS FIBRE REINFORCED POLYMER AS MANUFACTURED BY SCHOCK BAUTEILE GmbH. V-ROD MANUFACTURED BY PULTRALL OR APPROVED EQUIVALENT.
3. ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT AS SHOWN OTHERWISE.
4. THE STRUCTURE SHALL BE CLOSED TO TRAFFIC.
5. CULVERT AND ROAD CONSTRUCTION IS TO BE AS PER THE ONTARIO PROVINCIAL STANDARDS FOR ROADS AND MUNICIPAL SERVICES AND AS PER DETAILS PROVIDED.
6. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS OF THE EXIST. CONDITIONS AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE REPAIR WORK. THE CONTRACTOR ALSO SHALL VERIFY ALL RELEVANT DIMENSIONS AND ELEVATIONS OF THE EXISTING CONDITIONS PRIOR TO CONSTRUCTION TO SUIT PROPOSED WORK.

CONSTRUCTION NOTES

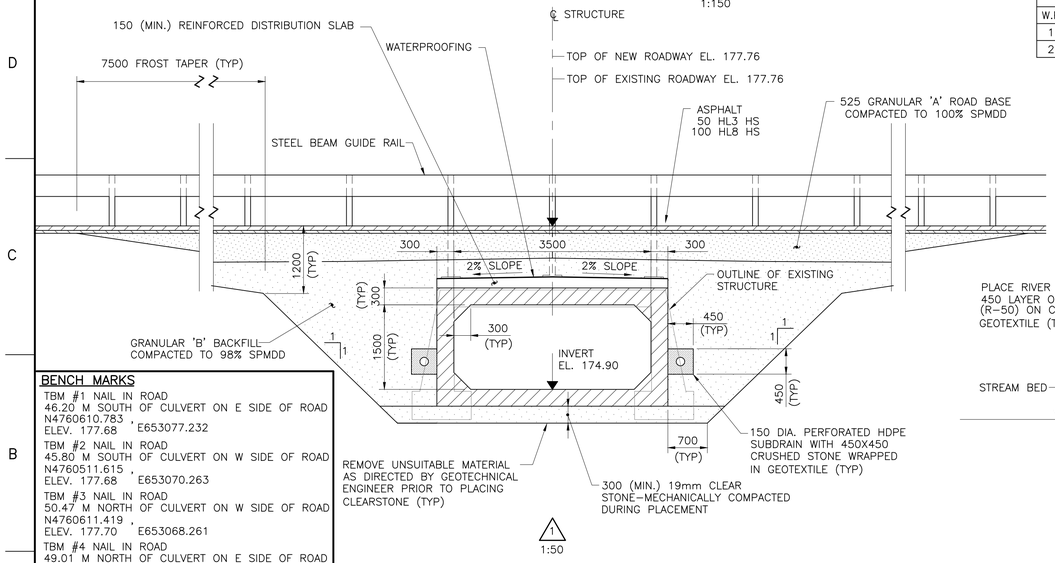
1. CULVERT CONSTRUCTION CONSISTS OF PRECAST CONCRETE. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT LIFTING METHODS AND INSERTS DO NOT OVERSTRESS THE PRECAST SECTIONS.
2. BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 400mm.
3. NO CULVERT SECTION SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BT THE CONTRACT ADMINISTRATOR.

LIST OF DRAWINGS

804-2-1. GENERAL ARRANGEMENT
804-2-2. DISTRIBUTION SLAB AND MISCELLANEOUS DETAILS
804-2-3. JOINT AND SBGR POST ANCHOR DETAILS
804-2-4. DURA HOLD 2 RETAINING WALL
804-2-5. PROPOSED SEDIMENT AND EROSION CONTROL PLAN

APPLICABLE STANDARD DRAWINGS

OPSD-219.110 – LIGHT DUTY SILT FENCE BARRIER
OPSD-219.180 – STRAW BALE FLOW CHECK DAM
OPSD-912.130 – GUIDE RAIL SYSTEM, STEEL BEAM STEEL POST WITH OFFSET BLOCK ASSEMBLY INSTALLATION-SINGLE RAIL
OPSD-922.161 – ENERGY ATTENUATOR, END TREATMENT STEEL BEAM ENERGY ATTENUATING TERMINAL MASH SOFTSTOP TERMINAL SYSTEM INSTALLATION



1:50

BENCH MARKS

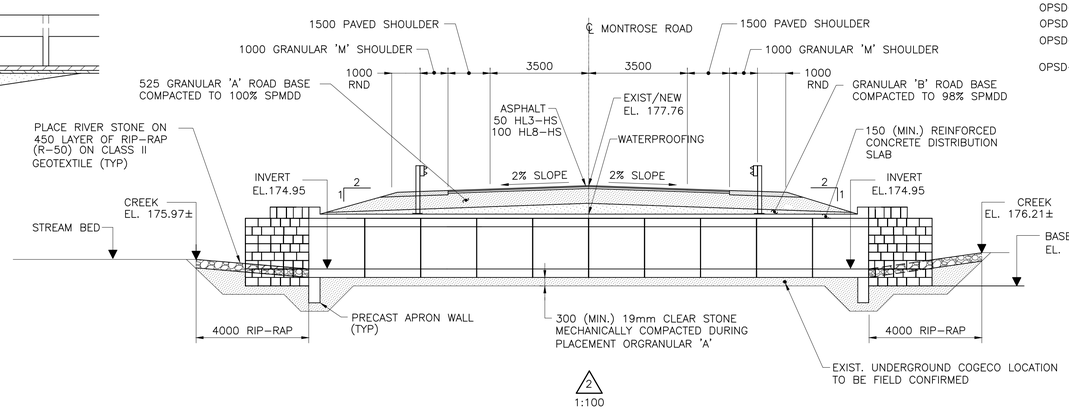
TBM #1 NAIL IN ROAD
46.20 M SOUTH OF CULVERT ON E SIDE OF ROAD
N4760610.783 , E653077.232
ELEV. 177.68

TBM #2 NAIL IN ROAD
45.80 M SOUTH OF CULVERT ON W SIDE OF ROAD
N4760511.615 , E653070.263
ELEV. 177.68

TBM #3 NAIL IN ROAD
50.47 M NORTH OF CULVERT ON W SIDE OF ROAD
N4760611.419 , E653068.261
ELEV. 177.70

TBM #4 NAIL IN ROAD
49.01 M NORTH OF CULVERT ON E SIDE OF ROAD
N4760610.783 , E653077.232
ELEV. 177.74

EAST WEST



1:100

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING RE
DESIGN DV
CHECKED BY BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

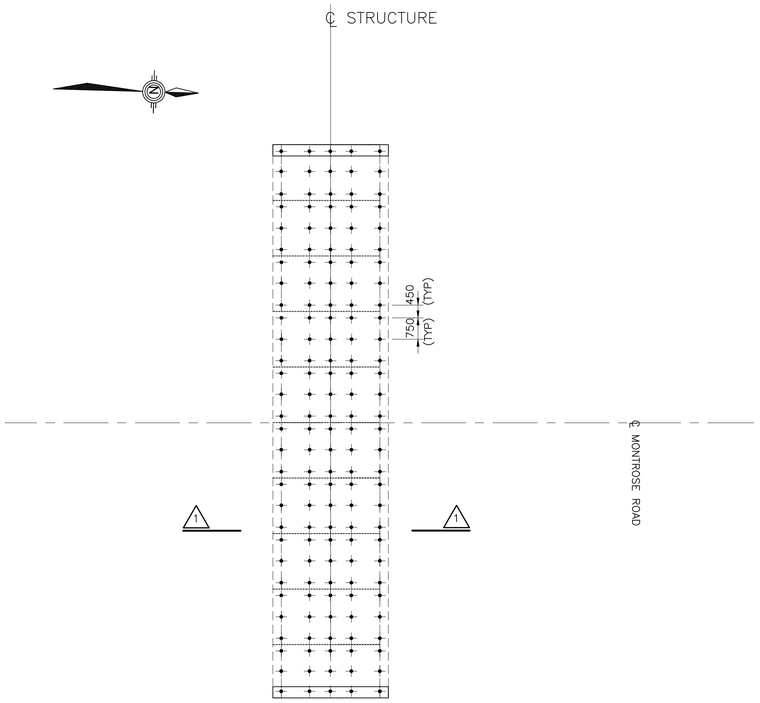
Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098315
MONTROSE ROAD CULVERT REHABILITATION

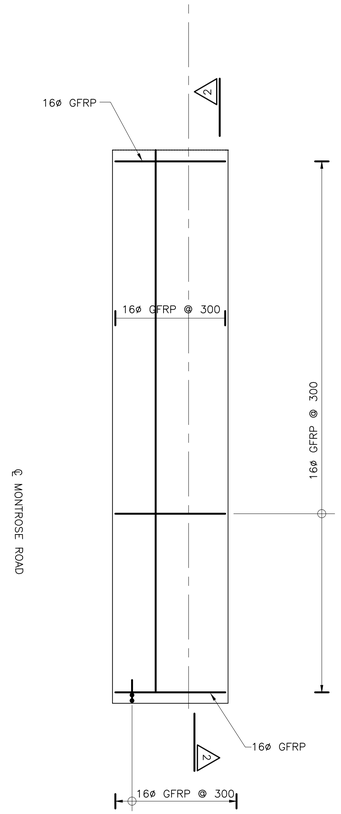
GENERAL ARRANGEMENT

DATE APRIL 2019
SCALE AS SHOWN
DWG No. 804-2-1
MUN. REF. No. 2019-RFT-155 (RN19-55)
REV. 0

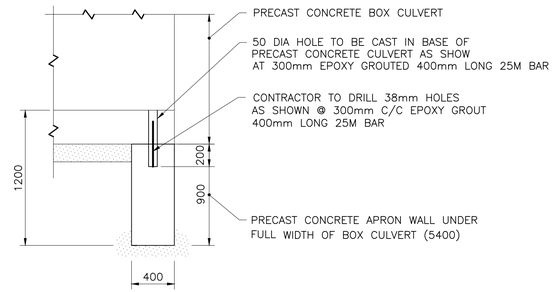
PLOTTED MARCH 29, 2019



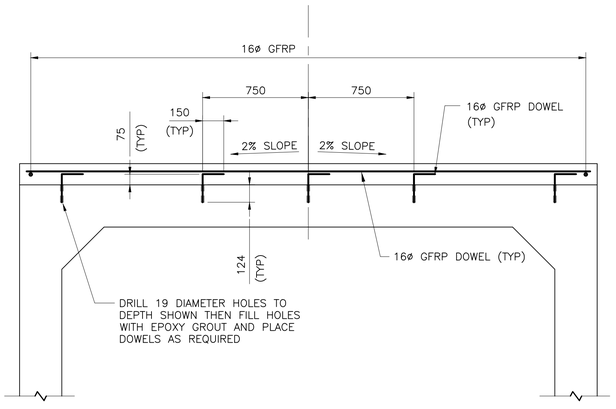
PRECAST CONCRETE CULVERT LAYOUT PLAN
1:100



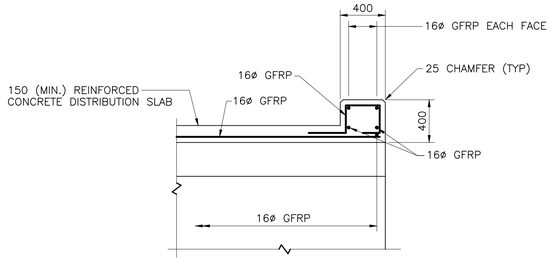
PLAN OF DISTRIBUTION SLAB
1:100



PRECAST APRON WALL
(TYP UNDER ENDS OF CULVERT)
N.T.S.



CROSS SECTION OF GFRP LAYOUT
1
1:25



HEADWALL ON PRECAST CULVERT
2
1:25

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER — B.J.J. ELLIS — PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER — D.N. VANGEEST — 100127085 — PROVINCE OF ONTARIO

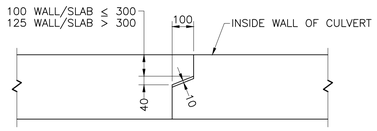
Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098315
MONTROSE ROAD CULVERT REHABILITATION

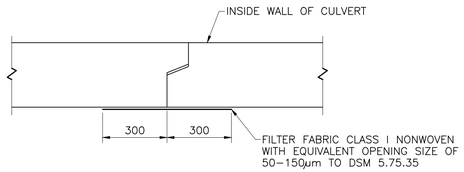
DISTRIBUTION SLAB AND MISC. DETAILS

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804-2-2
MUN. REF. No.: 2019-RFT-155 (RN19-55)
REV.: 0

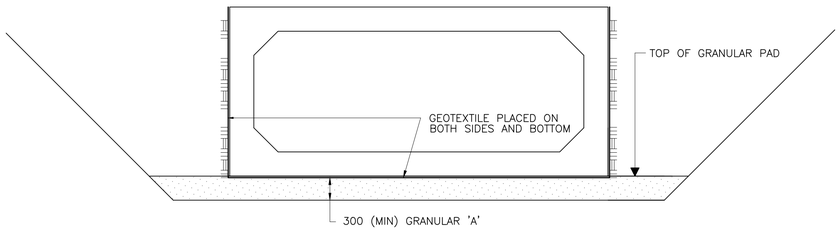
PLOTTED MARCH 29, 2019



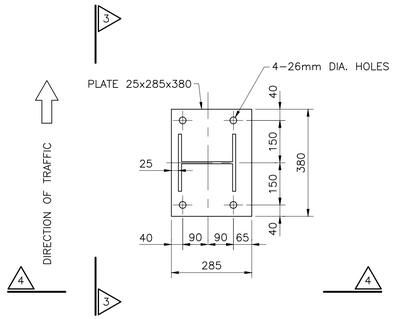
TYPICAL JOINT DETAIL
N.T.S



BURIED JOINT TREATMENT
N.T.S



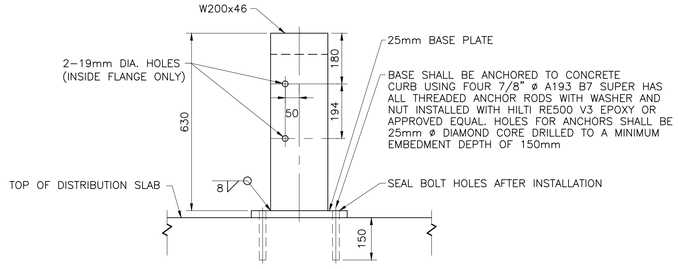
EXTENT BURIED JOINT TREATMENT
N.T.S



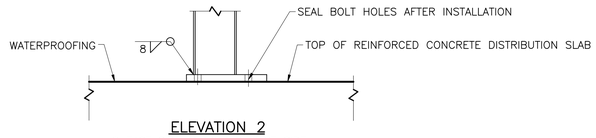
PLAN OF THRIE BEAM POST BASE PLATE
N.T.S.

THE ANCHORAGE ASSEMBLY INCLUDING BOLTS, NUTS AND WASHERS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE TO CSA STANDARD G164–M92.

NOTE: NO FIELD CUTTING IS PERMITTED. POSTS TO BE CUT TO SIZE PRIOR TO GALVANIZING.



ELEVATION 1
N.T.S.



ELEVATION 2
2 EAST SIDE MIRROR 2 WEST SIDE
N.T.S.

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

Niagara Region PUBLIC WORKS

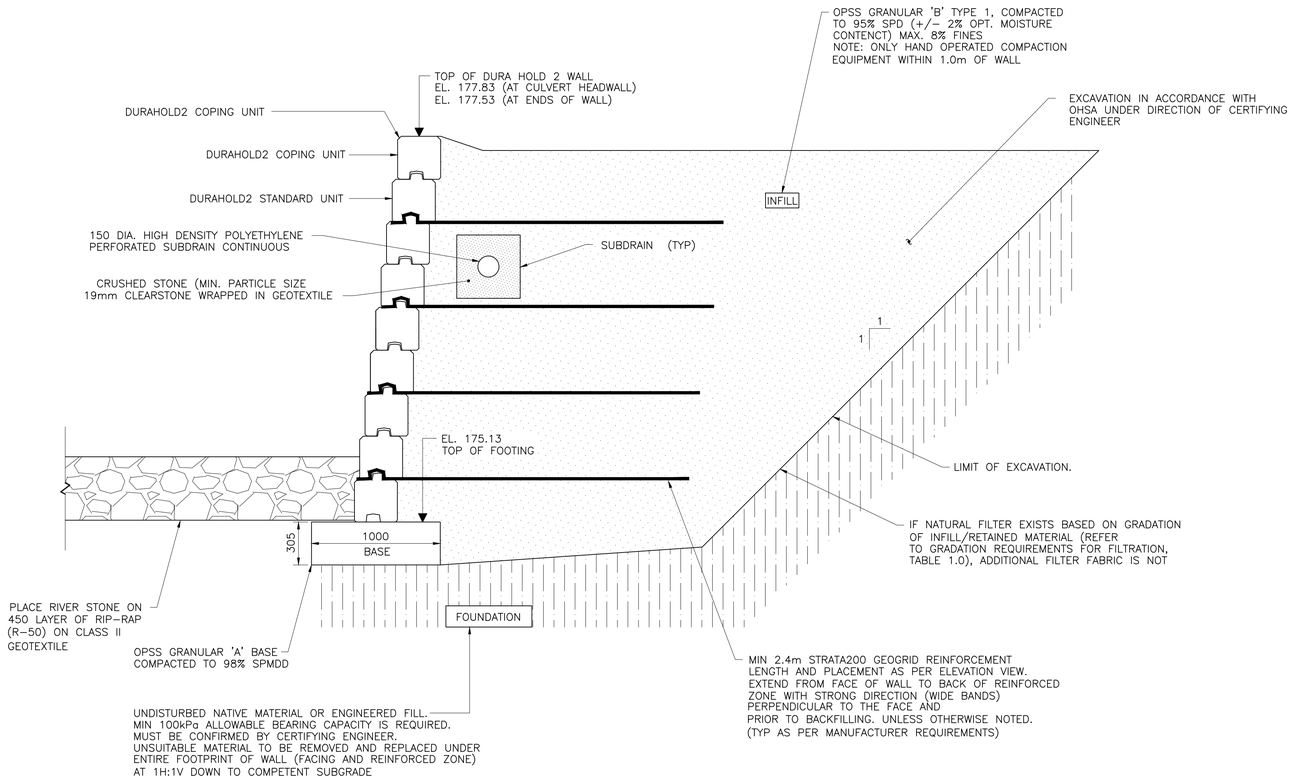
STRUCTURE NUMBER 098315
MONTROSE ROAD CULVERT REHABILITATION

SBGR POST AND JOINT DETAILS

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804–2–3
MUN. REF. No.: 2019–RFT–155 (RN19–55)
REV.: 0

PLOTTED MARCH 29, 2019

NOTE: ONLY HAND-OPERATED COMPACTION AND/OR PAVING EQUIPMENT TO BE USED WITHIN 1.0m OF BACK OF RETAINING WALL



TYPICAL DURA HOLD 2 WALL DETAIL (ALL CORNERS)
1:20

TABLE 2.0 – DESIGN SPECIFIC GEOMETRIC INFORMATION FOR DURA HOLD WALLS

RETAINING WALL SYSTEM	DURAHOLD2 WITH GEOGRID	GEOGRID TYPE	STRATAGRID 200
MAX. HEIGHT (mm)	3050	MIN. GEOGRID LTDS kN/m	13.7 kN/m
MAX. SLOPE ABOVE WALL	2:1	MAX. SLOPE BELOW WALL	NONE
MAX. SURCHARGE ABOVE WALL (kPa)	12	DEPTH OF EMBEDMENT (mm)	10%H
BATTER OF WALL	7.12°	COMPACTED BASE DIMENSION (mm)	305x1000

TABLE 1.0 – SOIL ZONES AND ASSUMED PROPERTIES FOR DURA HOLD WALLS

	SOIL REGION				
	INFILL	RETAINED	FOUNDATION	BASE	DRAINAGE
DESCRIPTION (BY USCS)	GW WELL GRADED, FREE DRAINING GRANULAR	ML-CL INORGANIC SILT-CLAY LOW PLASTICITY	ML-CL INORGANIC SILT-CLAY LOW PLASTICITY	GW WELL GRADED, FREE DRAINING GRANULAR	SEE INFILL
EFFECTIVE INTERNAL FRICTION ANGLE	33°	28°	28°	39°	NR
MOIST UNIT WEIGHT kN/cu.m (lb/cu.ft)	22 (140)	20 (127)	20 (127)	22 (140)	NR
EFFECTIVE COHESION kPa (lb/sq.ft)	NR	NR	13 (270)	NR	NR
SOIL NOTES	PLACED IN 150mm (6in) LIFTS AND COMPACTED TO 95% SPD.	MUST BE UNDISTURBED DENSE SOIL OR WELL-COMPACTED ENGINEERED FILL.	THE ALLOWABLE BEARING CAPACITY MUST EXCEED 100kPa.	WELL GRADED, CRUSHED, NON FROST SUSCEPTIBLE GRANULAR SOIL, COMPACTED TO 98% SPD.	GRANULAR FILL MUST BE WELL GRADED, FREE DRAINING WITH MAX. 5-8% FINES.
GEOTEXTILE SEPARATING FROM ADJACENT SOIL*	FLOW - RETAINED TO INFILL NOT REQUIRED IF GRADATION (BELOW) MET	FLOW - RETAINED TO INFILL NOT REQUIRED IF GRADATION (BELOW) MET	FLOW - FOUNDATION TO INFILL NOT REQUIRED IF GRADATION (BELOW) MET	NR	
ASSUMED GRADATION FOR FILTRATION REQ.**	D(15) < 0.3mm D(50) < 1.18mm MAX 8% FINES	D(85) > 0.075mm D(15) < 0.002mm D(50) > 0.05mm	D(85) > 0.075mm D(15) < 0.002mm D(50) > 0.05mm		

* REFER TO TABLE 3.0, DRAINAGE PROVISIONS
** IF THE ABOVE GRADATION REQUIRMENTS ARE NOT MET, AN ALTERNATIVE FABRIC WILL BE REQUIRED. CONTACT RSS TO DISCUSS ALTERNATIVES.

TABLE 3.0 – DRAINAGE PROVISIONS FOR DURA HOLD WALLS

POTENTIAL WATER SOURCE	DRAINAGE MEASURES (TO BE VERIFIED BY CERT. GEOTECH. ENG.)	ADD. NOTES
SURFACE INFILTRATION: (ABOVE REINFORCED ZONE AND BEYOND. RAINFALL, NORMAL SNOW MELT, RUN-OFF, ETC. IF IRRIGATION SYSTEMS ARE USED IMMEDIATELY ABOVE THE REINFORCED ZONE OF THE WALL, ADDITIONAL MEASURES WILL BE REQUIRED IN CASE OF LEAKAGE/FAILURE OF THE SYSTEM.) CONTRACTOR MUST VERIFY THAT AREA ABOVE WALL IS NOT USED FOR STORAGE OF SNOW DURING WINTER MONTHS DRAINAGE SYSTEM AND ASSUMED LOADING CONDITIONS DO NOT ACCOUNT FOR THIS USE.	GRADE BEHIND MUST DIRECT WATER AWAY FROM BACK OF WALL. IF SLOPE TOWARD WALL EXISTS, SWALE SYSTEM MUST BE IMPLEMENTED TO CARRY WATER AT MIN. 2% GRADE TO POSITIVE DRAINAGE AREA. DIMENSIONS OF SWALE WILL BE BASED ON ANTICIPATED WATER COLLECTION REQUIREMENTS AS SPECIFIED BY THE CIVIL ENGINEER AS PART OF THE OVERALL SITE DRAINAGE PLAN. THE SWALE SYSTEM MUST BE CONSTRUCTED WITH A LOW PERMEABILITY LAYER (100-150mm) OF ENGINEERED FILL MATERIAL COMPACTED TO 95% SPD TO ACT AS A CONDUIT FOR THE SURFACE WATER AND PREVENT INFILTRATION BEHIND THE WALL FACING AND INTO THE REINFORCED ZONE.	OTHER STRUCTURES/PAVED SURFACES ADJACENT TO WALL: OTHER STRUCTURES ADJACENT TO THE RETAINING WAL MUST HAVE INDEPENDENT DRAINAGE SYSTEMS. FOR EXAMPLE, PAVEMENTS MUST HAVE INDEPENDENT COLLECTION SYSTEMS (PERIMETER DRAINS) TO COLLECT WATER THAT PENETRATES CRACKS IN THE SURFACE, ETC. BUILDING DOWNSPOUTS MUST NOT DIRECT WATER TOWARDS THE WALLS AND MUST BE CONNECTED TO INDEPENDENT OUTLETS.
LATERAL UNDERGROUND: DESIGN ASSUMES THAT GROUNDWATER IS BELOW BOTTOM OF WALL. THE FOLLOWING DRAINAGE MEASURES ADDRESS OTHER POTENTIAL SOURCES OF LATERAL GROUNDWATER THAT MAY BE THE RESULTS OF INFILTRATION THROUGH THE SURFACE (i.e. CRACKS IN ASPHALT BEYOND THE REINFORECED ZONE) OR OTHER BELOW GRADE SOURCES.	DRAINAGE SYSTEM: THE REINFORCED ZONE OF THE WALL IS SPECIFIED AS A WELL GRADED GRAVEL WITH A MAX. OF 8% FINES WITH A COLLECTION PIPE AT THE BOTTOM. THE RETAINED ZONE (UP STREAM SOURCE OF POTENTIAL WATER) IS ASSUMED TO BE OF A LOWER PERMEABILITY AS COMPARE TO THE IMPORTED FILL. THE REINFORCED ZONE IS THEREFORE ASSUMED TO ALLOW FOR THE DRAINAGE OF POTENTIAL WATER SEEPAGE AS DISCUSSED IN COLUMN 1. THE PERFORATED COLLECTION PIPE (MIN. 100mm DIA. AT 2% GRADE) MUST BE CONNECTED TO A POSITIVE OUTLET AS DETERMINED BY THE CIVIL ENGINEER PRIOR TO CONSTRUCTION. NOTE: THESE DRAINAGE MEASURES ARE PROVIDED AS AN EXTRA PRECAUTION AGAINST THE POSSIBILITY OF AN UNKNOWN WATER THAT MAY OR MAY NOT OCCUR AT SOME POINT DURING THE LIFE OF THE STRUCTURE. IF, UPON EXCAVATION, A SPECIFIC WATER SOURCE IS IDENTIFIED (PERCHED WATER CONDITION, SAND SEAMS, ETC.) IN THE CUT OR IS ANTICIPATED, ADDITIONAL DRAINAGE MEASURES WILL BE REQUIRED (i.e. CHIMNEY DRAINS).	WATER MANAGEMENT DURING CONSTRUCTION: AT ALL TIME THE CONTRACTOR MUST ENSURE MEASURES SUCH AS TEMPORARY SWALES AND DRAINAGE DITCHES ARE EMPLOYED TO MANAGE SURFACE WATER AND SEEPAGE DURING AND AFTER THE CONSTRUCTION OF THE WALL. IF FINAL GRADING IS NOT PART OF THE CONTRACTOR'S SCOPE OF WORK, THE AREA AROUND THE WALL MUST STILL BE PROPERLY GRADED TO ENSURE WATER DOES NOT COLLECT BEHIND OR IS DIRECTED TOWARD THE WALL.

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

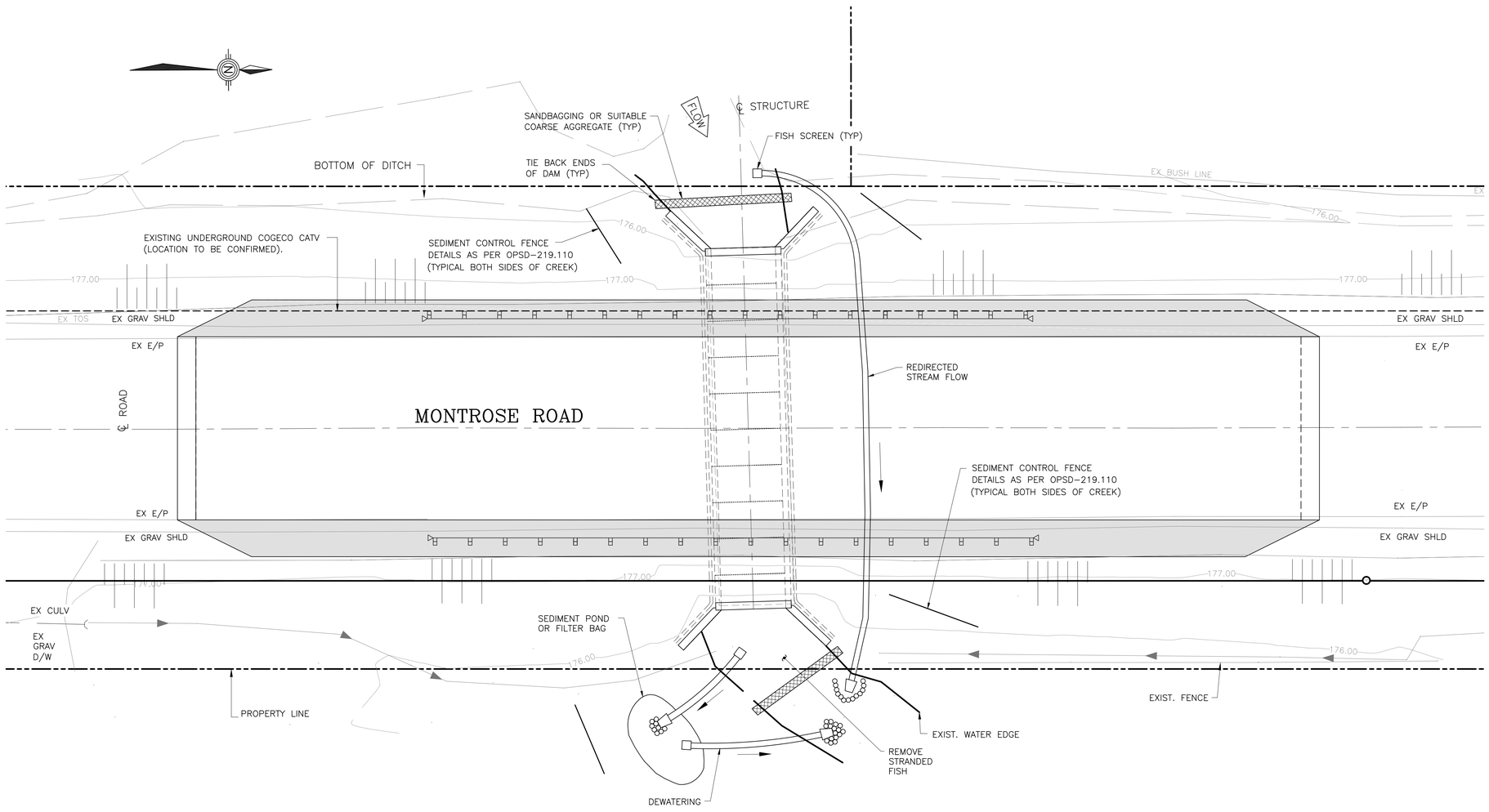
Niagara Region PUBLIC WORKS

STRUCTURE NUMBER 098310
MONTROSE ROAD CULVERT REHABILITATION

DURA HOLD 2 RETAINING WALL

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804-2-4
MUN. REF. No.: 2019-RFT-155 (RN19-55)
REV.: 0

PLOTTED MARCH 29, 2019



PLAN
N.T.S

NO.	REVISION	DATE	INIT.
0	ISSUED FOR TENDER	04/02/19	RE

NOTES

ELLIS
Ellis Engineering Inc.

DRAFTING: RE
DESIGN: DV
CHECKED BY: BE

REGISTERED PROFESSIONAL ENGINEER B.J.J. ELLIS PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER D.N. VANGEEST 100127085 PROVINCE OF ONTARIO

Niagara Region
PUBLIC WORKS

STRUCTURE NUMBER 098315
MONTROSE ROAD CULVERT REHABILITATION

PROPOSED SEDIMENT AND EROSION CONTROL PLAN

DATE: APRIL 2019
SCALE: AS SHOWN
DWG No.: 804-2-5
MUN. REF. No.: 2019-RFT-155 (RN19-55)
REV.: 0

PLOTTED MARCH 29, 2019