

## **RECEIVED**

By Richard Dwyer at 5:20 pm, Mar 31, 2011

## 2011 ABANDONMENT AND RECLAMATION PLAN

Appendix B-7
Mary River Landfill and Access Road
(Included with Electronic Version Only)



834 Mountjoy Street South P.O. Box 120 Timmins, Ontario P4N 7C5 Tel. (705) 264-9413 Fax. (705) 267-2725

September 2, 2010

Jim Millard, M. Sc., P. Geo.
Environmental Superintendent
Mary River Project
Baffinland Iron Mines Corporation
Suite 1016, 120 Adelaide Street West
Toronto, Ontario M5H 1T1

Dear Jim,

RE:

MARY RIVER PROJECT
MARY RIVER LANDFILL
QA/QC REPORT (As-Built Report)
OUR REFERENCE NO. 09-162

Genivar Consultants LP (Genivar) was retained by Baffinland Iron Mines Corporation (BIMC) to design the Solid Waste Landfill and its associated access road in Nunavut, provide QA/QC services during construction and subsequently to compile the required documentation of as-built conditions of the facility.

#### **BACKGROUND**

Part J, Part J (3), of the Water Licence (#2BB-MRY0710) for the Mary River Project issued by the Nunavut Water Board (NWB) states that:

"The Licensee shall provide as-built plans and drawings, stamped and sealed by a professional Engineer registered in Nunavut, within ninety (90) days of completion of all construction works, ..."

Additionally, Qikiqtani Inuit Association (QIA) in their letter of August 27, 2009 entitled "QIA Response, BIMC Request to Commence Inert Landfill Construction and Operation" have made some requirements for As-Built conditions of the landfill which is the subject of this report.

The Construction of the Access Road and the landfill commenced in the first week of July 2010 and was completed within 3 weeks.

### PROPOSED DESIGN OF THE ACCESS ROAD AND LANDSFILL

Figure 1 shows the site map indicating the Mary River Project sites from Steensby in the south to Mary River Camp in the north and Milne Inlet Camp in the north. Figure 2 shows the site plan arrangements of the Acess Road and Landfill at Mary River Site.

As shown in the related drawings in Appendix 1, the Access Road was designed to take off from the existing Explosives Magazines Road. This access road crosses two low areas where culverts were needed to allow for drainage. The Access Road was designed to be constructed of granular material from the nearby borrow pits and the quality of the granular material were to be observed visually by the site engineer performing QA/QC during construction.

The landfill was designed to have containment berms constructed of geanular material. The containment berms are approximately 2-m in height with 3:1 inside slopes and 2:1 outside slopes.

## AS-CONSTRUCTED CONDITIONS OF THE FACILITY

Genivar provided full-time QA/QC inspection of the construction activities for the Access Road and the Landfill containment berms. Attached in Appendix 2 are the As-Constructed Drawings and photographs of construction activities.

#### Access Road construction

The Access Road was constructed in general conformance to the design. Granular material was brought in from nearby borrow pits and placed and compacted. Two culverts at station 0+118 and at station 0+383 were constructed. It should be noted that from Station 0+500 to station 0+600, the road was constructed of blasted inert waste rock for better compaction and drainage. For details on the as-built profile and sections of the Access Road, please refer to drawings AC1 and AC2 in Appendix 2.

#### Containment construction

The containment for the Landfill Facility was constructed in general conformance with the design. For details on the plans and sections of the containment construction, please refer to drawings AC1 and AC2 in Appendix 2.

The material used for the containment berms and base was obtained from nearby borrow sources. The material was free of any deleterious substances and was reviewed by Genivar QA/QC inspector.

It is our opinion that the Landfill Facility containment was designed and built in general conformance with our original design.

We trust this report is satisfactory and meets your requirements. However, should you have any questions, please do not hesitate to contact the undersigned for further discussion.

Yours truly,

Genivar Consultants LP

F.G.Kord

Marz G. Kord, P. Eng., M.Sc., MBA

# > APPENDIX 1

- **DESIGN BRIEFS**
- DESIGN DRAWINGS



834 Mountjoy Street South P.O. Box 120 Timmins, Ontario P4N 7C5 Tel. (705) 264-9413 Fax. (705) 267-2725

August 7, 2009

Dick Matthews
Director, Technical Services
Baffinland Iron Mines Corporation
Suite 1016, 120 Adelaide Street West
Toronto, Ontario M5H 1T1

Dear Dick,

RE:

MARY RIVER PROJECT ACCESS ROAD TO SOLID WASTE DISPOSAL SITE DESIGN REPORT OUR REFERENCE NO. 09-162

Genivar Consultants LP (Genivar) has been retained by Baffinland Iron Mines Corporation (BIMC) to design the access road to the solid waste disposal site at their Mary River Camp site in Nunavut. The purpose of this report is to provide you with the design parameters as well as the methodology in the construction of the access road.

#### PROPOSED DESIGN OF THE FACILITIES AT MARY RIVER CAMP SITE

Figure C01 shows the site plan including a key map indicating the access road to the proposed solid waste disposal site. Figures C02 to C05 show the plan, profiles and sections of the road including the culverts associated with our design.

The access road shall be built over relatively flat stony surfaced areas of the tundra with two lower areas where water may migrate under the road.

The intent is not to excavate into the tundra but to build on top of the stony surface on the flat areas and the minor organics in the depressed areas.

This should minimize to the melting of wedge ice or tabular ice below the surface of the road if it should exist in the permafrost.

Although there is no specification available for the select granular fill, the Contractors have been constructing roads on site with this material including the road to the bulk sample pit on top of the ore body as well as roads about the site.

There are two types of fill found in the borrow pits that have been used in construction in the past. One is a sandy fill with little gravel and the other is a well graded gravel with just adequate fines to construct a stable base that packs readily with the travel from the bulldozers and trucks. This material is what we term as select granular fill and it was identified in the nearby designated borrow pit to mine personnel and was approved by the engineer to be used on the road base and wearing surface.

As shown in the related drawings in Appendix 1, the access road requires two culverts to be installed at two locations to ensure proper drainage away from the road. These culverts were sized based on the precipitation information provided from the nearest measuring station (Pond Inlet) and the availability of culverts at the site. We enclose our design basis for the calculation of culverts to this letter.

The following is a summary of the required material for the proposed access road:

Road Length: 660 meters

Culverts: 1 @ 1-m dia. CSP culverts 11 meters

1 @ 0.3 m dia. CSP culvert 10 meters

Cut: 0 C.M.

Fill (Road base aggregate) 2332 C.M. select granular fill.

The 1.0m culvert being utilized is considerably larger than required but is used due to availability on site.

An explosive magazine designed for 20,000 kg of explosive is located approximately 70 meters from the proposed access road to the solid waste disposal (SWD) site.

Although a majority of the 20,000 kg of explosives were used during the bulk sampling program in 2008, we have ensured that the access road to the SWD site meets the guidelines for Quality Distance to Explosives storage as set out by Natural Resources Canada (NRC).

We trust this report is satisfactory and meets your requirements. However, should you have any questions, please do not hesitate to contact the undersigned for further discussion.

Yours truly,

Genivar Consultants LP

Barry H. Martin, P. Eng., MRAIC

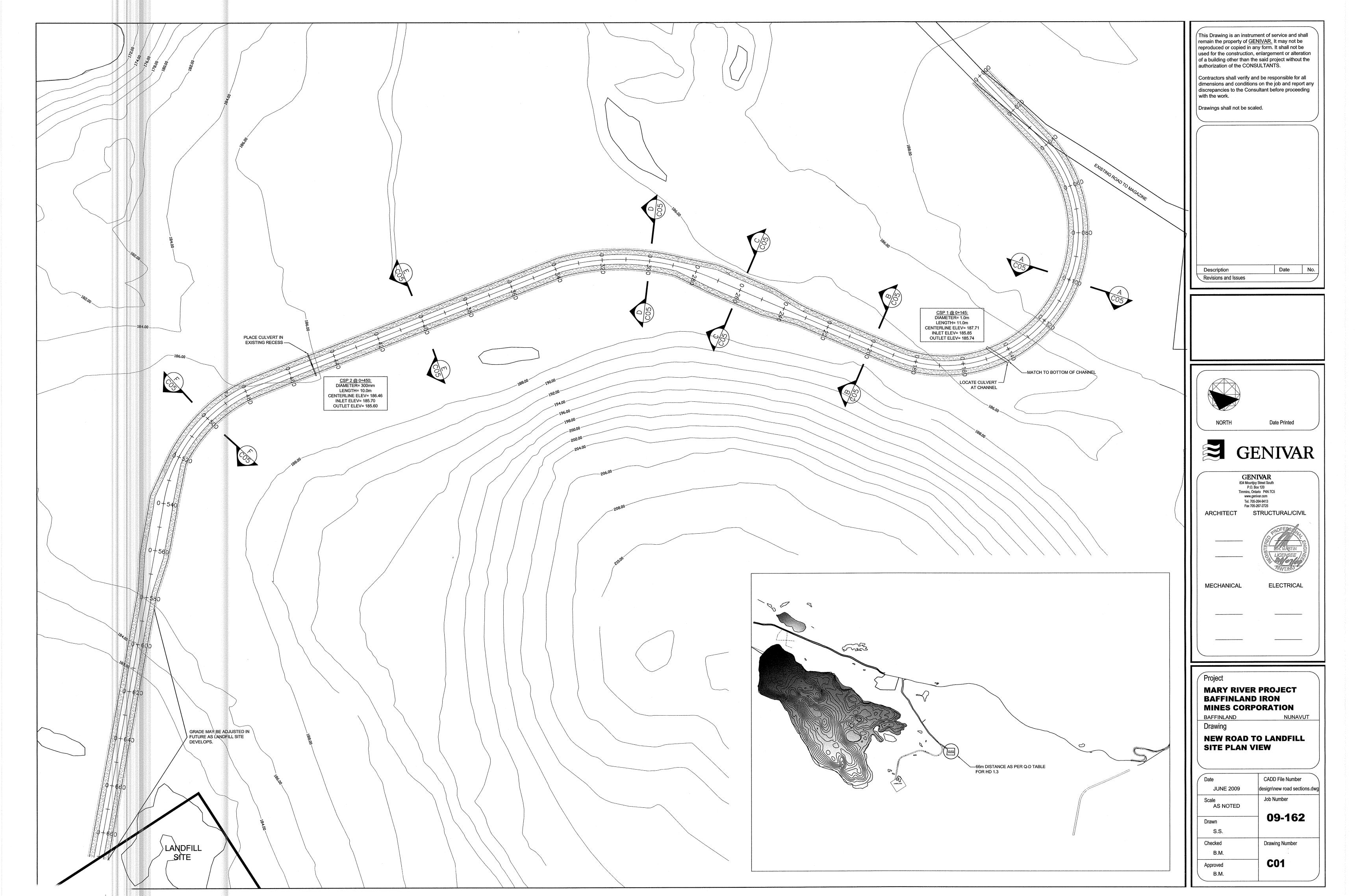
BHM/jw

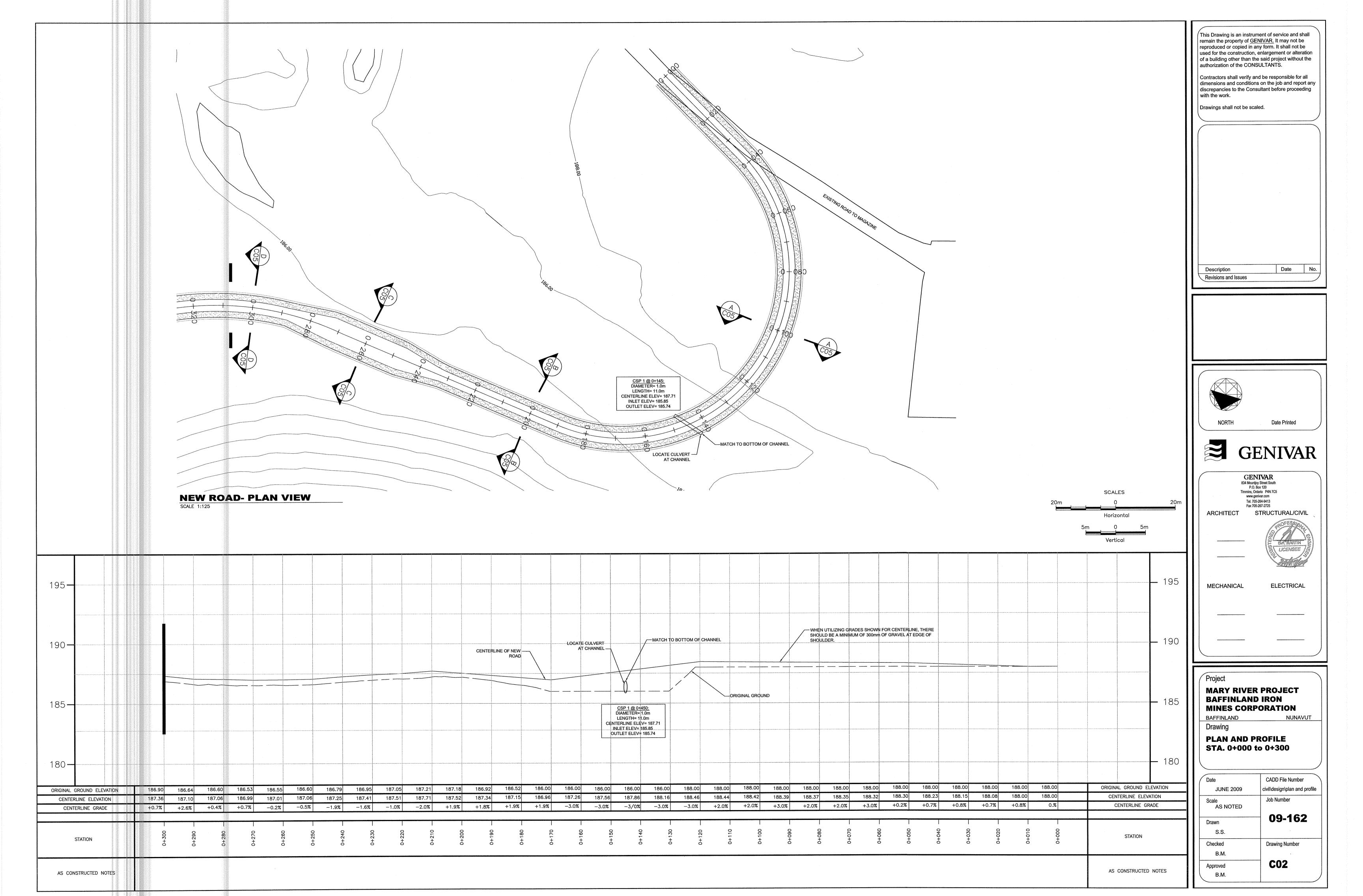
c.c. Derek Chubb Dave McCann

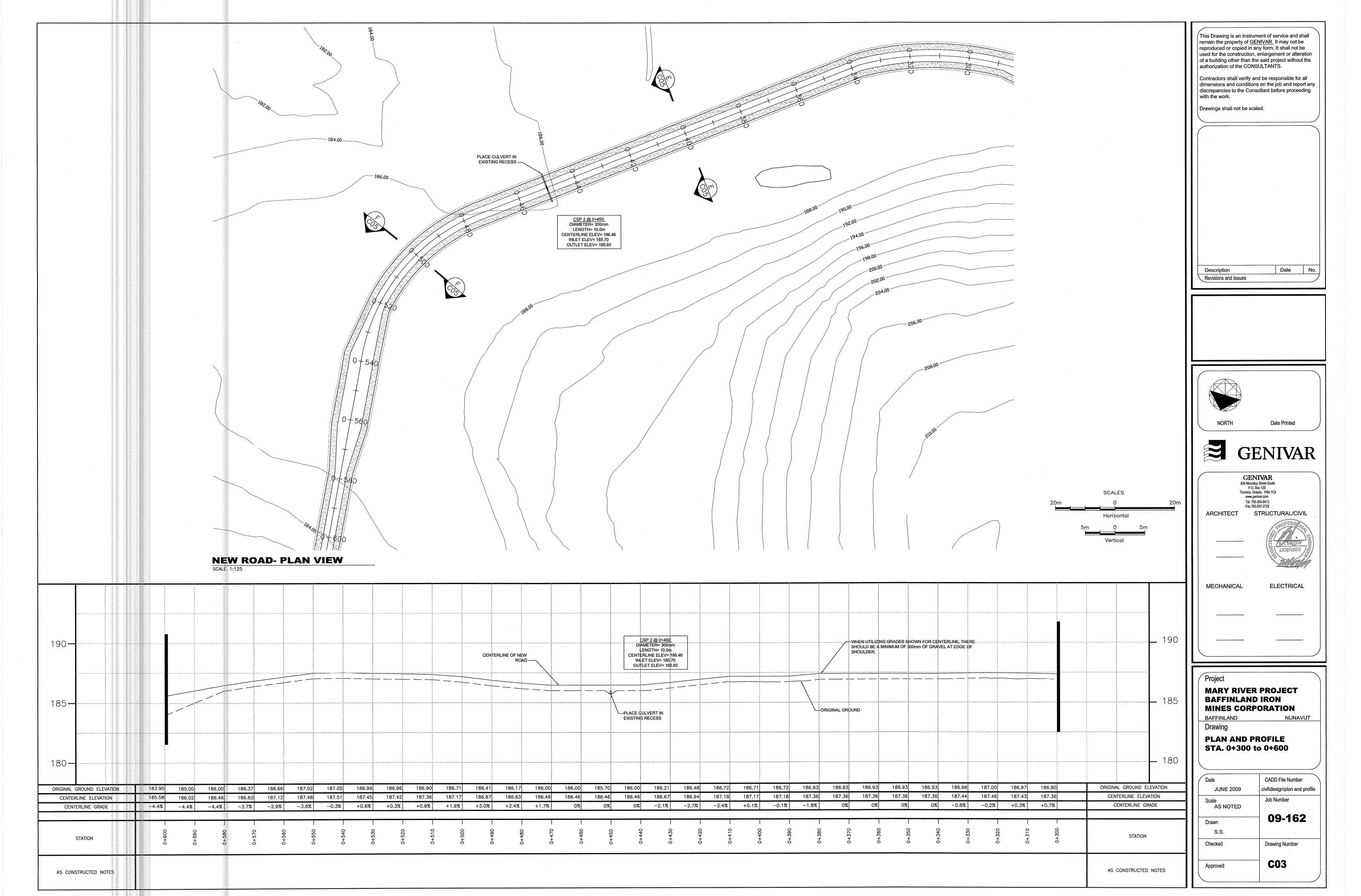
# > APPENDIX 1

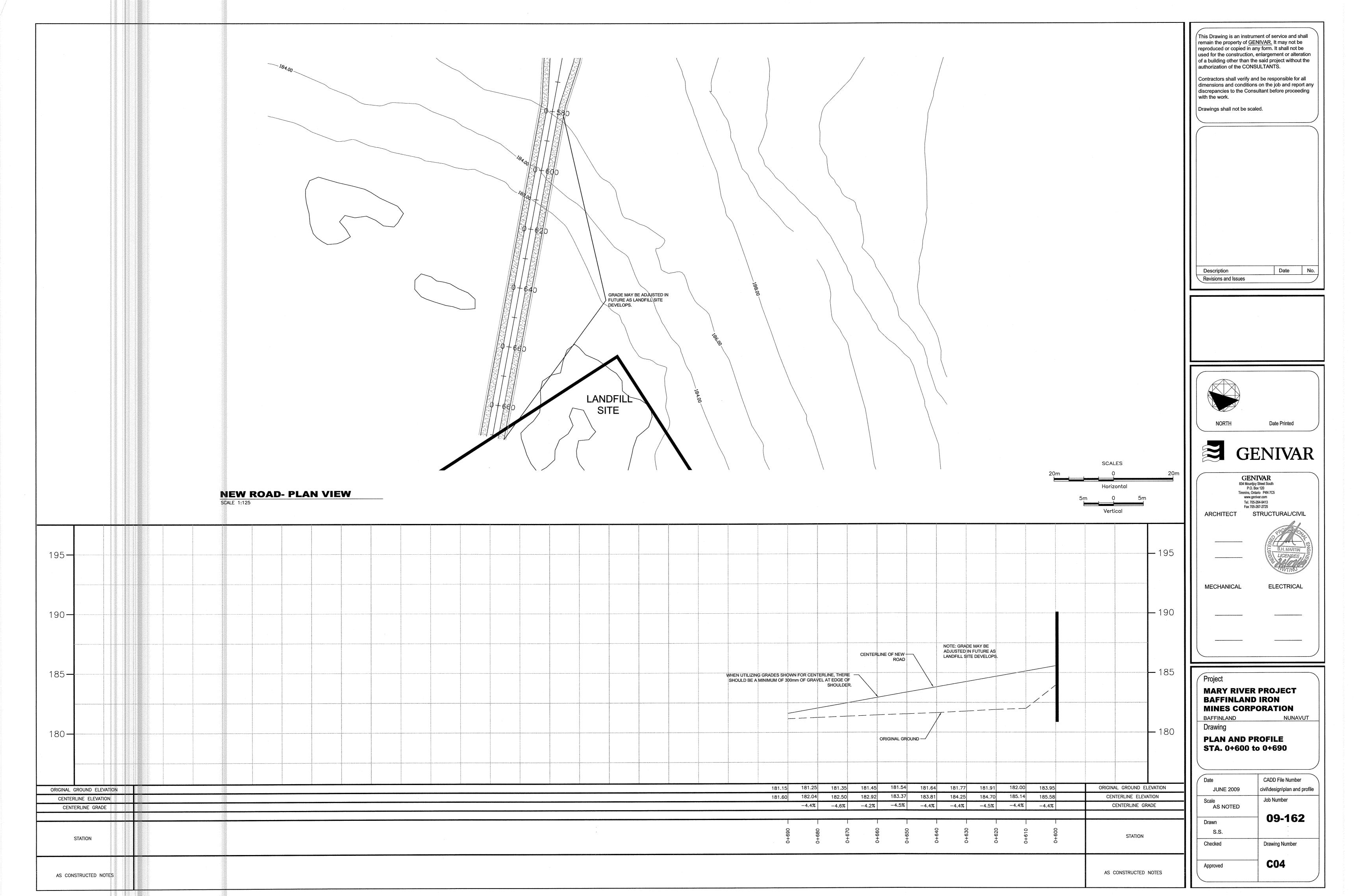
**DRAWINGS** 

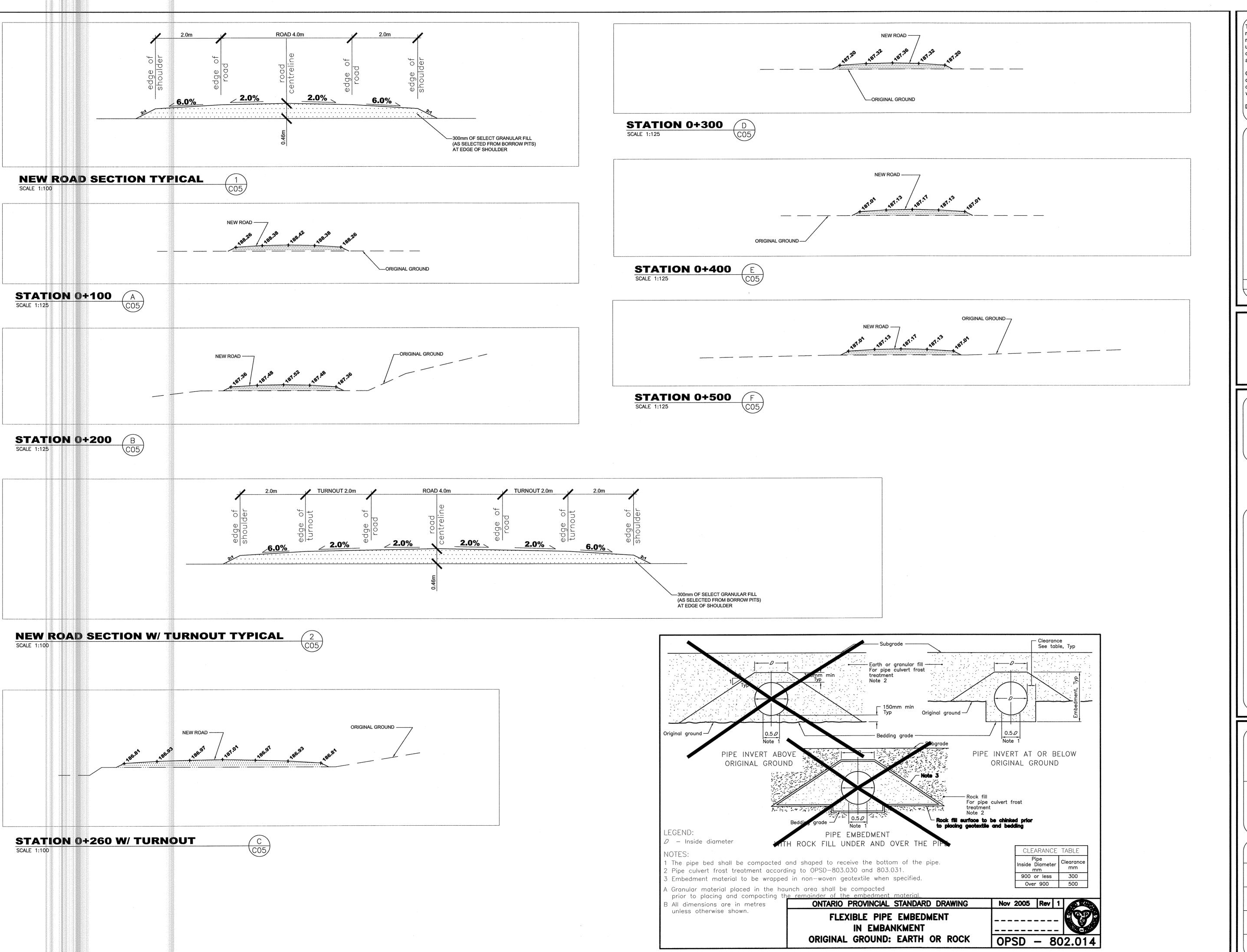
(Forwarded July 20, 2009)











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Contractors shall verify and be responsible for all dimensions and conditions on the job and report any

Contractors shall verify and be responsible for all dimensions and conditions on the job and report any discrepancies to the Consultant before proceeding with the work.

Drawings shall not be scaled.

Description
Revisions and Issues

Date

NORTH Date Printed

GENIVAL

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ARCHITECT STRUCTURAL/CIVIL

BAT. MARTIN LIGENSEE

MECHANICAL

ELECTRICAL

Project

MARY RIVER PROJECT BAFFINLAND IRON MINES CORPORATION

Drawing

CROSS SECTIONS & CULVERT DETAIL

Date	CADD File Number
JUNE 2009	design\new road sections.dv
Scale AS NOTED	Job Number
Drawn	09-162
S.S.	
Checked	Drawing Number
Approved	C05

## Design Chart 1.07: Runoff Coefficients (Continued)

## - Rural

T 3 YY - 0 m - 1 3	Soil Texture		
Land Use & Topography <sup>3</sup>	Open Sand Loam	Loam or Silt Loam	Clay Loam or Clay
CULTIVATED Flat 0 - 5% Slopes Rolling 5 - 10% Slopes Hilly 10- 30% Slopes	0.22 0.30 0.40	0.35 0.45 0.65	0.55 0.60 0.70
PASTURE Flat 0 - 5% Slopes Rolling 5 - 10% Slopes Hilly 10- 30% Slopes	0.10 0.15 0.22	0.28 0.35 0.40	0.40 0.45 0.55
WOODLAND OR CUTOVER Flat 0 - 5% Slopes Rolling 5 - 10% Slopes Hilly 10- 30% Slopes	0.08 0.12 0.18	0.25 0.30 0.35	0.35 0.42 0.52
BARE ROCK	COVERAGE <sup>3</sup>		
	30%	50%	70%
Flat 0 - 5% Slopes Rolling 5 - 10% Slopes Hilly 10- 30% Slopes	0.40 0.50 0.55	0.55 0.65 0.70	0.75 0.80 0.85
LAKES AND WETLANDS	0.05		

<sup>&</sup>lt;sup>2</sup> Terrain Slopes

Sources: American Society of Civil Engineers - ASCE (1960)

U.S. Department of Agriculture (1972)

Interpolate for other values of % imperviousness

## **CULVERT @ STATION 0+145**

Total Area= 4.85 ha

Two Areas

Area 1 (A1)= 2.40 ha Area 2 (A2)= 2.45 ha

Flow Line

A1 = 172mA2 = 224m

## A1 Slope (Equivalent Slope Method):

Elevation	Fall (m)	Length (m)	Sn (m/m)	Sn^-0.5
212.00	1.22	43	0.028	5.98
210.78	4.07	43	0.095	3.24
206.71	17.89	43	0.416	1.55
188.82	2.82	43	0.066	3.89
186.00				
Total	26.00	172		14.66

Sw:

= 100 (n/Sntotal^-0.5)^2 = 100 x (4 / 14.66)^2 = 7.45%

Time of Concentration (tc):

=  $(0.057 \times L) / (S^0.2 \times A^0.1)$ =  $(0.057 \times 172) / (7.45^0.2 \times 2.40^0.1)$ = 6.01 minutes

## A2 Slope (Equivalent Slope Method):

Elevation	Fall (m)	Length (m)	Sn (m/m)	Sn^-0.5
190.00	0.58	56	0.010	10.00
189.42	0.66	56	0.012	9.13
188.76	0.76	56	0.014	8.45
188.00	2.00	56	0.036	5.27
186.00				
Total	4.00	224		32.85

Sw:

=  $100 (n/Sntotal^-0.5)^2$ =  $100 \times (4/32.85)^2$  Time of Concentration (tc):

= 
$$(0.057 \times L) / (S^0.2 \times A^0.1)$$
  
=  $(0.057 \times 224) / (1.48^0.2 \times 2.45^0.1)$   
=  $10.79$  minutes

Weighted Average tc:

= 
$$[(2.40 \times 6.01) + (2.45 \times 10.79)] / (2.40 + 2.45)$$
  
= 8.43 minutes

Using IDF Curve, Rainfall Intensity= 9.6 mm/hr

Flow, Q: = 
$$2.78 \times At \times I \times C$$
  
=  $2.78 \times 4.85 \times 9.6$ mm/hr x 0.22  
=  $28.48 \text{ L/s}$   
=  $0.029 \text{ m}^3/\text{s}$ 

#### tmp#35.txt

## Culvert Calculator @ Station 0+145

All calculator output should be verified prior to design use

Entered Data:	
Shape	Circular
Number of Barrels	1
Solving for	Headwater
Chart Number	2
Scale Number	3

Chart Description ...... CORRUGATED METAL PIPE CULVERT Scale Description ...... PIPE PROJECTING FROM FILL

 Overtopping
 Off

 Flowrate
 0.0290 cms

 Manning's n
 0.2600

 Roadway Elevation
 187.7100 m

 Inlet Elevation
 185.8500 m

Computed Results:

Headwater ...... 186.7465 m Outlet Control

 Slope
 0.0100 m/m

 velocity
 0.0369 mps

Messages:

Outlet head > Inlet head.

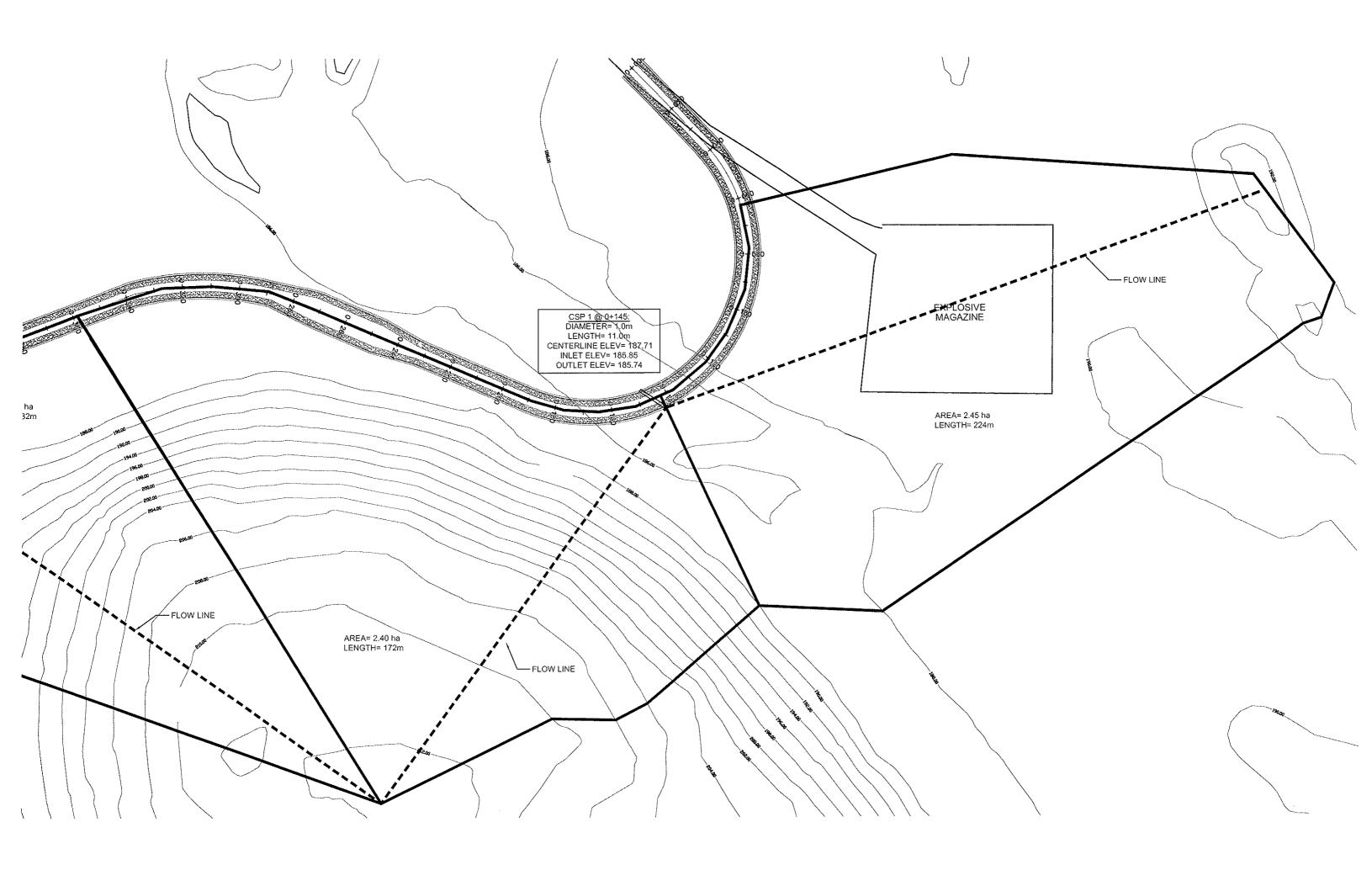
Computing Outlet Control headwater.

Outlet submerged.

Full flow.

Headwater depth computed using FHWA equation.

Headwater: 186.7465 m



## **CULVERT** @ STATION 0+450

Total Area= 1.84 ha

Flow Line= 232m

Slope (Equivalent Slope Method):

Elevation	Fall (m)	Length (m)	Sn (m/m)	Sn^-0.5
212.00	1.5	58	0.026	6.20
210.50	5.5	58	0.095	3.24
205.00	12.5	58	0.216	2.15
192.50	4.9	58	0.085	3.43
187.60				
Total	24.40	232		15.02

Sw:

 $= 100 (n/Sntotal^-0.5)^2$ 

 $= 100 \times (4 / 15.02)^2$ 

= 7.09%

Time of Concentration (tc):

 $= (0.057 \times L) / (S^0.2 \times A^0.1)$ 

 $= (0.057 \times 232) / (7.09^{0.2} \times 1.84^{0.1})$ 

= 8.41 minutes

Using IDF Curve, Rainfall Intensity= 9.6 mm/hr

Flow, Q:  $= 2.78 \times At \times I \times C$ 

 $= 2.78 \times 1.84 \times 9.6 \text{mm/hr} \times 0.22$ 

= 10.80 L/s

 $= 0.011 \text{m}^3/\text{s}$ 

## tmp#33.txt

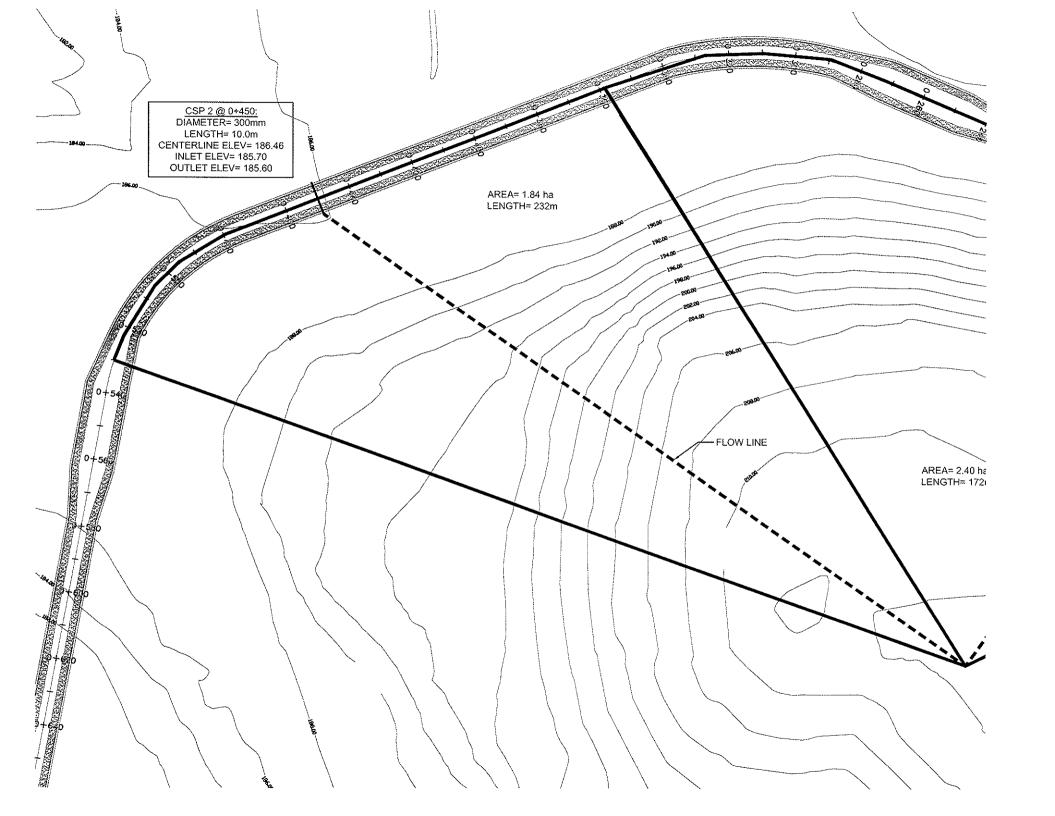
### Culvert Calculator @ Station 0+450

All calculator output should be verified prior to design use

#### Entered Data: Shape ...... Circular Number of Barrels ..... Solving for ..... Headwater Chart Number ..... Scale Number ..... Chart Description ..... CORRUGATED METAL PIPE CULVERT Scale Description ..... PIPE PROJECTING FROM FILL Overtopping ..... off Flowrate ..... 0.0110 cms Manning's n ..... 0.2600 Roadway Elevation ..... 186.4600 m Inlet Elevation ..... 185.7000 m Outlet Elevation ..... 185.6000 m Diameter ..... 300.0000 mm Length ..... 10.0000 m Entrance Loss ..... 0.0000 Tailwater ..... $0.3000 \, \text{m}$ Computed Results: Headwater ..... 186.4163 m Outlet Control Slope ..... 0.0100 m/m Velocity ..... 0.1556 mps Messages: Outlet head > Inlet head. Computing Outlet Control headwater. Outlet submerged. Full flow.

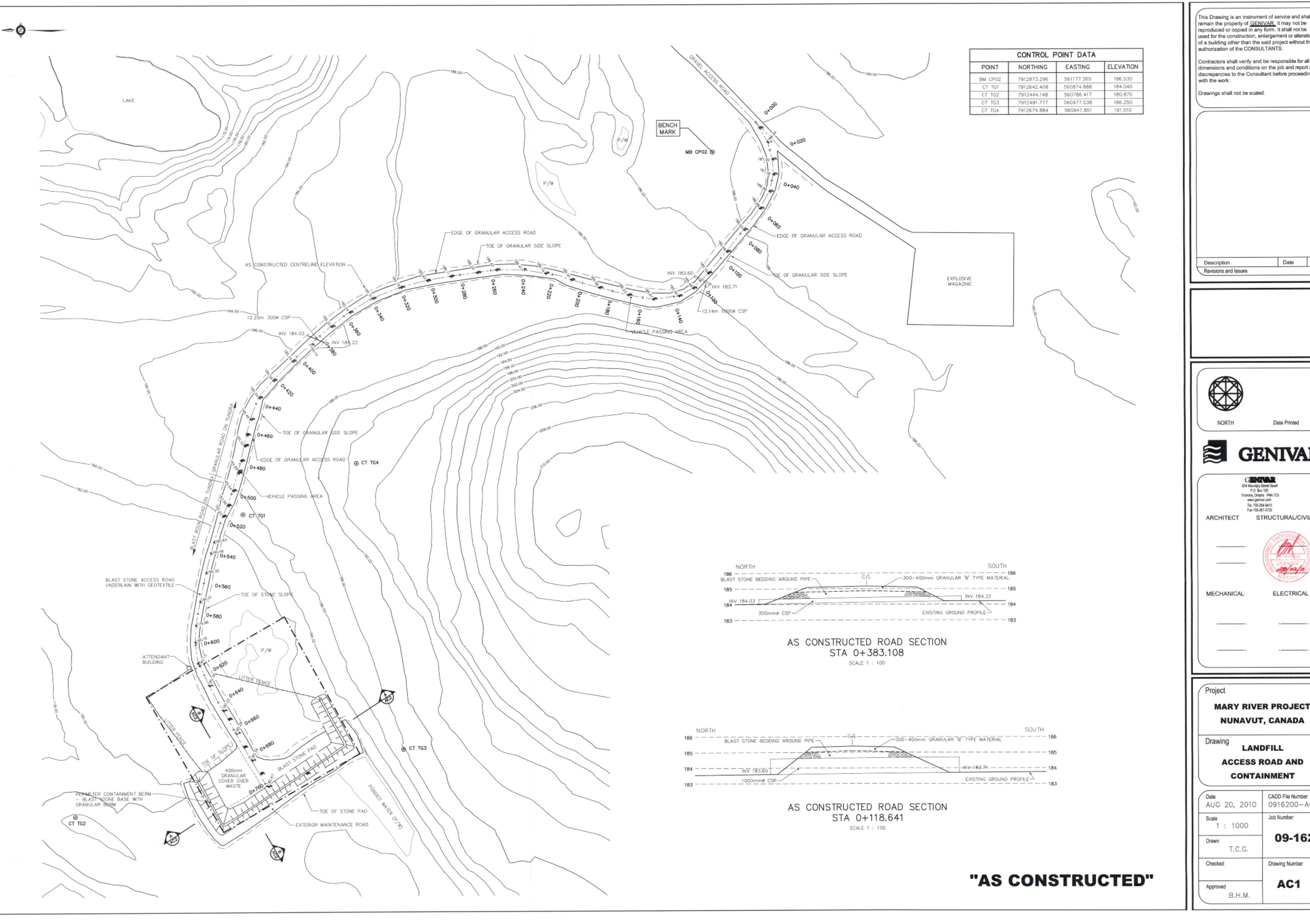
Headwater depth computed using FHWA equation.

Headwater: 186.4163 m



## > APPENDIX 2

- AS-CON STRUCTED DRAWINGS
- **CONSTRUCTION PHOTOGRAPHS**



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Date



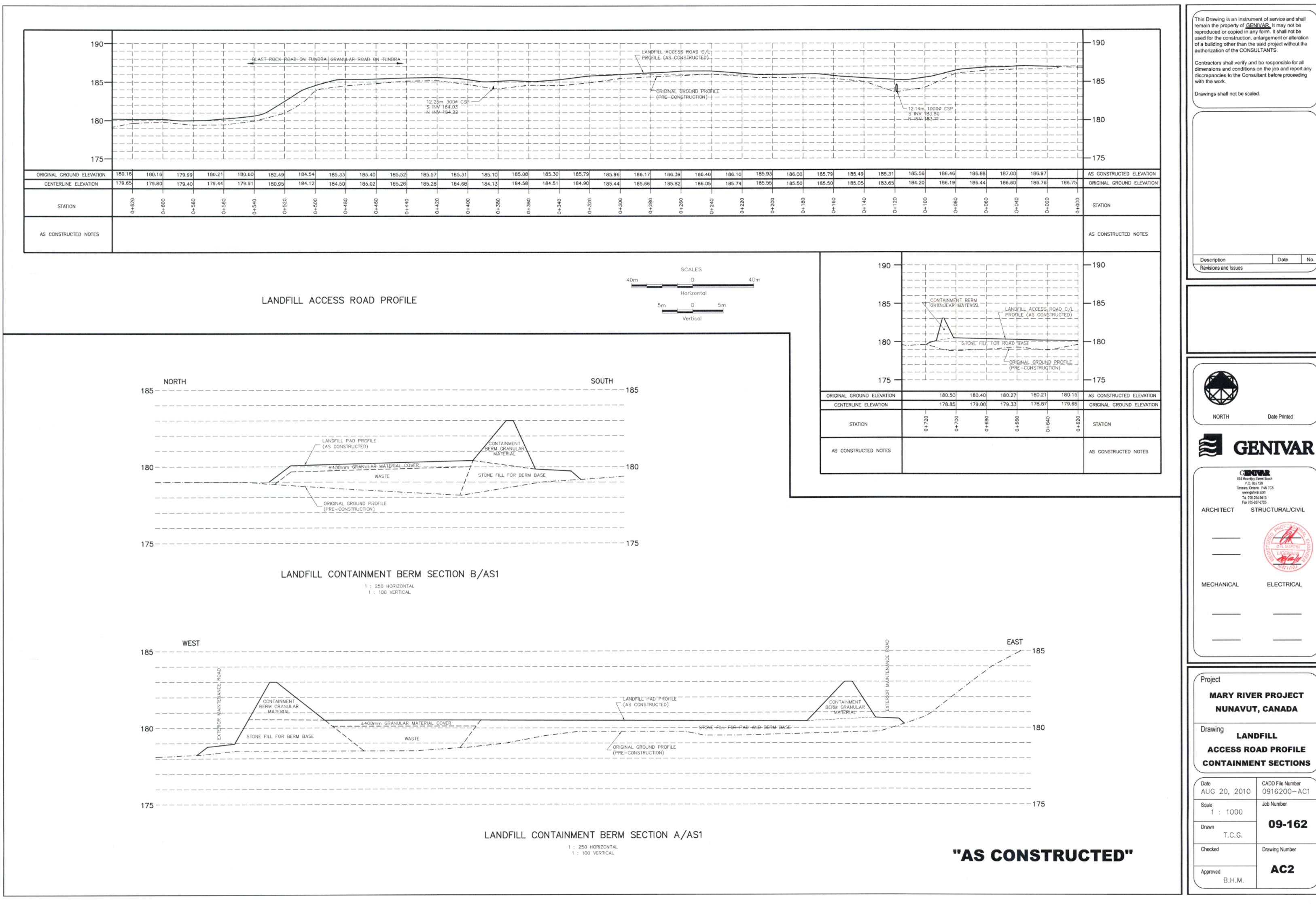
834 Mountjoy Street South P.O. Box 120 Timmins, Ontario P4N 7C5 www.genixar.com Tel. 705-264-9413 Fax 705-267-2725 ARCHITECT STRUCTURAL/CIVIL

MARY RIVER PROJECT NUNAVUT, CANADA

LANDFILL

ACCESS ROAD AND CONTAINMENT

CADD File Number AUG 20, 2010 0916200-AC1 Job Number 09-162 Drawing Number



Date AUG 20, 2010	CADD File Number 0916200—AC1
Scale 1 : 1000	Job Number
Drawn T.C.G.	09-162
Checked	Drawing Number
Approved B.H.M.	AC2



Photo 1: Access Road to landfill from the existing Explosive Magazine



Photo 2: Access Road at the landfill, landfill containment berm seen in background



Photo 3: Access Road at the landfill. The containment berm is seen in the back.



Photo 4: Another view of the completed Access Road



Photo 5: Completed Access Road to landfill, the attendant shack can be seen.



Photo 6: small Culvert at Station 0+118



Photo 7: Large culvert at Station 0+500



Photo 8: Large Culvert at Station 0+500



Photo 9: Inside the landfill containment



Photo 10: Landfill access and fence