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**ADDENDUM REPORT
ON**

**TEMPORARY ACCESS ROAD
MISSISSIPPI RIVER WETLANDS
HIGHWAY 417
W.P. 451-90-03/04
ARNPRIOR, ONTARIO**

Submitted to:

Ministry of Transportation, Ontario
Planning and Design
Eastern Region
355 Counter Street
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December 1999

991-1155

**FIGURES 1 to 4 incl.
REVISED JUNE , 2000 .**

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1.0 INTRODUCTION

In a meeting in mid October 1999 in Kingston, Ontario a number of enquiries / design requests were made. These were discussed with us by Mr. David Dundas, P.Eng., Senior Foundation Engineer on October 21, 1999 in a telephone conversation. The more straightforward enquiries were reviewed and the comments submitted by a facsimile dated October 22, 1999, which are as follows and included in an appendix of this report:

- Mudwave;
- Concern for rockfill punching through geotextile / geogrid;
- Multi-season use of the access road;
- Contingency for settlement beyond estimated amount; and
- Clearing and grubbing.

The enquiries that required further study and, in some cases, liaison with Tensar, Thurber Consultants, as well as contractors and suppliers, are given below:

- Access for cranes / dump trucks, and other construction equipment within the right-of-way of Highway 417 towards the floodplain area to construct the geogrid embankments and structure piers / abutments.
- Need for pipe(s) or channel within the levee area to allow passage for fish.

2.0 DISCUSSIONS

Subsequent to the submission of our Stage II report, enquiries / design requests were made, comments were already provided for a number of enquiries. The enquiries, which were not responded previously, are discussed in detail in this report as follows:

2.1 Access for Cranes / Dump Trucks, Within the Highway 417 Right-of-way to the Floodplain Area.

Discussions with contractors, Ministry of Transportation, Ontario (MTO) Construction Office, St. Catharines, Mr. A. Fine, P.Eng., former Vice President, Bermingham Construction concluded that the haul road to reach the temporary access road should have a minimum width of 8 m (crane width of 6 m and a 1 m setback on either side). Contractors suggested a gradient of 7% for the haul road is desirable, however in some cases they would be able to mobilize the equipment up to 8% gradient. Steeper gradients than 8% will require special efforts to move the cranes and other equipment. It is understood from Ministry's construction office that for secondary roads, gradients as steep as 6% have been used in the past. In order to ascertain the best possible location for the haul road, a meeting was held at the Ministry's Foundation Office along with Thurber Consultants. It is understood that the preferred option is to construct the haul road between the EBL and WBL slopes in the median. To accelerate the consolidation of the underlying clay the foundation consultants (Thurber) have specified the installation of wick drains below the embankment footprints. In addition the embankments are to be constructed ahead of the bridge construction and Thurber have specified a 2.0 m surcharge to further accelerate the settlements of the embankments and strength gain of the underlying clay. Recent discussion with Thurber indicates that the temporary side slopes of 1.5H:1.0V towards the median will not impose any stability problems for the proposed highway embankments in this area. The following are selected as base parameters for the haul road to the temporary geotextile / geogrid access road.

Width of the haul road (minimum)	8 m
Gradient (maximum)	8%
Temporary slopes	1.5H:1.0V
Temporary slopes for highway embankments in the area	1.5H:1.0V
Surcharge height	2 m
Surcharge slope	1.5H:1.0V
	or flatter than 1H:1.0V
East abutment for EBL	Station 18+173 (EBL)
East abutment for WBL	Station 18+199 (WBL)

There are no median chainages and therefore all recommendations are referred to WBL chainage.

Our review based on the above data concludes that the gradient should be limited to 7% to 8% maximum. The requirements are discussed for each area as follows:

Station 18+140 to Station 18+400 WBL

We had initially considered the use of a 7% gradient for the access road down to the floodplain area. In order to avoid additional filling on the embankment for the floodplain, it was necessary for this 7% gradient to provide a cut area from about Station 18+170 to about Station 18+220. The depth of the cut in front of the abutments is up to 2.7 m, which is essentially through much of the weathered crust of the clay. This excavation to near the surface of the softer unweathered clay could lead to possible trafficability problems. This could require sub-excavation to provide a total granular depth of the order of 1.0 m.

At and behind the abutments, the cut would be as much as 1.7 m. In addition, in order to provide a road width of 8 m in this area, consideration would have to be given to steepening the embankment slopes to 1.5 horizontal to 1.0 vertical and possibly providing low level retaining wall structures at the toe of the steepened slope.

To require a cut at the toe of these embankment slopes together with steepening of the slopes and possibly vertical low-level toe walls could increase the risk of slope stability. The stability of the altered side slopes would have to be looked at in detail. In order to ensure stability it may require building the embankments in advance of the access road to allow for some strength gain from consolidation of the underlying clay under the embankment plus surcharge loading, accelerated by the wick drains. The delay in construction may not be feasible within the construction schedule. Due to the concerns given above (trafficability and stability) consideration was given to the use of an 8% gradient as discussed below.

Station 18+150 to Station 18+170 EBL

For the proposed 8% gradient for the 8 m wide haul road, fills up to 1.5 m high in the median are required as shown on Figure 1. Some adjustments with regard to fill heights will be necessary during the final design / construction period to facilitate any overlap between the geogrid

embankment and the haul road fill construction between approximate Station 18+150 and Station 18+160. It would not be possible to determine the precise easterly limits of the geogrid embankment until the time of construction by the contractor. The conditions easterly beyond Station 18+150 (WBL) are somewhat favourable and the proposed 1.5 m geogrid embankment may not settle to the extent elsewhere and possibly maintain at Elevation 84.3 m. In such a case the 8% gradient could be terminated at approximate Station 18+154 (WBL) which will smoothly blend with the geogrid embankments. A plan showing the haul road from Station 18+154 to about station 18+250 WBL is shown on Figure 5.

To facilitate removal of the median fill a Tensar Type A biaxial geogrid and a Terrafix non woven geotextile should be placed prior to the placement of the fill materials for the haul road embankment construction. At the end of construction, the contractor shall remove all these materials and restore the ground to the original condition to minimize environmental impacts.

Station 18+170 to Station 18+200 WBL

To develop an 8% gradient from Station 18+170 WBL to Station 18+200 WBL cuts up to 1.1 m will be required as shown on Figure 1. Thurber boreholes (#95-6 #95-7, #95-13, #95-14, #99-4 and #99-5) reveal the presence of a very stiff desiccated silty clay crust in the order of 3.0 m to 5.0 m in thickness with undrained shear strength in excess of 100 kPa. Since highway embankments are not required in this area, the 8.0 m wide haul road can be constructed in cuts 1 to 2 m in height to the grades shown on Figure 1 with 1.5H:1V or flatter side slopes without any stability problems. During the construction of the haul road, if necessary, biaxial geogrid and geotextile may be used to prevent rutting of the road surface.

Station 18+200 to Station 18+400 WBL

If the access road is to be at original ground surface at and behind the abutments, it will be necessary to steepen the embankment side slopes to 1.5 horizontal to 1.0 vertical (refer to Figures 2, 3 and 4).

A preliminary assessment of stability of the temporary slopes of 1.5 horizontal to 1.0 vertical was carried out using Thurber's borehole data in the area of the proposed abutments. The assumptions for the stability analysis are as follows:

Height embankment + 2.0 m surcharge 8.5 m

Earthfill

Unit Weight	19.5 kN/m ³
phi	30 degrees
cohesion	0 kPa

Subsoil Depth (m)	Unit weight (Kv/m ³)	Undrained Shear Strength (Su) (Kpa)
0 - 2	18	80
2 - 8	17.5	50
8 - 18	17.5	45
<18	18	70

Based on the preliminary analyses it is concluded that the temporary slopes of 1.5 horizontal to 1.0 vertical are stable with a factor of safety of 1.5 for a deep seated failure surface. Slope protection measures are necessary to prevent surficial erosion of these steeper slopes by means of hydroseeding and covering with an erosion control blanket. Our analyses also indicate a factor of safety of 1.7 for embankments constructed with 2 horizontal 1 vertical to the above mentioned height and assumptions for a deep seated failure surface. Our analysis does not take into consideration the effects of wick drains on any increase in the shear strength of the clay.

The gradient of the median is fairly flat if the haul road is at the original ground surface behind the abutments. Some temporary excavation would probably be required to provide a granular base for the access road surface. The excavation could proceed in 5.0 m strips moving in a westerly direction and could be filled immediately with the granular fill. As this excavation behind the abutments will be where wick drains have been installed, some flow of water into the excavation should be expected. The access road base should be provided with sub drains to collect this water inflow and lead it downslope to the floodplain area. The subdrains should consist of perforated pipe at least 100 mm in diameter and should be provided with a geotextile surround. The subdrains should be provided below both shoulders of the haul road. Depending

on the condition of the clay subgrade, it may also be necessary to install biaxial geogrid / geotextile to improve trafficability of this section of the access road.

The road gradient behind the abutments could be continued on an 8% grade to about 2.5 m above existing surface in the median at about Station 18+230 WBL to provide a haul road width of 16.0m and two-lane construction traffic. With about 3.0 m fill in the median at approximate station 18+240 WBL the normal 2:0H to 1:0V side slopes can be used. Beyond 18+240 WBL, the haul road can be constructed over just sufficient fill (about 3 m depth) to obtain 16 m width.

2.2 Provision of Pipes Through the Embankment

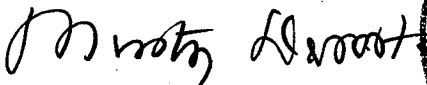
At the time of teleconferences this option was also discussed. The vertical clearance between the base and the upper geogrid is 900 mm. It was agreed that a pipe having a diameter of 0.5 m to 0.75 m is considered suitable. From a road base reinforcement point of view a 0.5 m diameter to provide adequate cover over the pipe would be preferable. Two or three pipes could be considered. With the limited depth of the access road embankment, pipe diameters larger than 0.5 m would require localized increase of embankment height or structural cover to spread the equipment loading. The pipe has to be flexible to accommodate settlements induced by the imposed loads and also compatible to the deformations of the flexible geogrid reinforced embankment.

Due to the limited height of the embankment and the clearance between the geogrid layers a 0.5 m diameter pipe appears to be the most favourable size for this passage from a road base reinforcement point of view. This size of pipe could be provided with minimum bedding and cover to satisfy acceptable engineering standards for the proposed heavy equipment traffic. The two types of pipes considered suitable are as follows:

- Corrugated High-Density Polyethylene Smooth interior wall (0.544 m outside diameter).
- Corrugated Steel Pipe – CST (corrugation profile 68 x 13 mm).

For this type application the corrugated High-Density Polyethylene smooth interior wall pipe should be considered. The product was used on other projects successfully as per Tensar

experience. This pipe has the strength and flexibility to accommodate the anticipated deformations. The pipe is available with an inside 0.460 m smooth wall diameter. Care should be exercised to prevent any damage to the pipe by providing adequate cover to the pipe during the construction of the embankment. Installation details are given on the construction notes of Sheet #2 of #5 Tensar drawings. Details are also shown on typical cross-sections (Drawing #3 of 5) and the locations on geogrid layout (Drawing #5 of 5) which are included in the appendix of this report. The 0.5 m diameter pipe could be installed at three different locations to provide passage for the fish. If 0.5 m diameter pipes are not adequate, larger diameter pipes could be considered but not larger than 0.75 m due to the vertical space restrictions between the geogrids. We also investigated a corrugated High-Density Polyethylene smooth wall pipe with outside diameter of 0.735 m with inside diameter of 0.611 m. However with the 0.735 m diameter pipe there may not be adequate cover at certain stages of the embankment construction. In such case additional granular cover would be necessary to prevent damage to the pipe from the equipment traffic. The details are shown on typical cross-sections (Tensar Drawing No. #3A of 5). If crane traffic warrants further precautions to ensure the integrity of the pipe, timber matts can be used in the pipe area. If larger diameter 0.735 m pipes are necessary, these could be placed at only two locations instead of three locations for 0.544 m diameter pipes. The locations are shown on the geogrid layout (Tensar Drawing #5A of 5).

GOLDER ASSOCIATES LTD.

Murty S. Devata, P.Eng.
Consultant



Fin J. Heffernan, P.Eng.
Designated MTO Contact

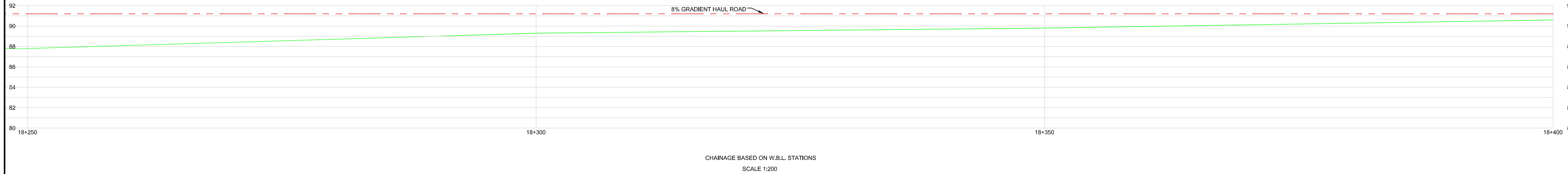
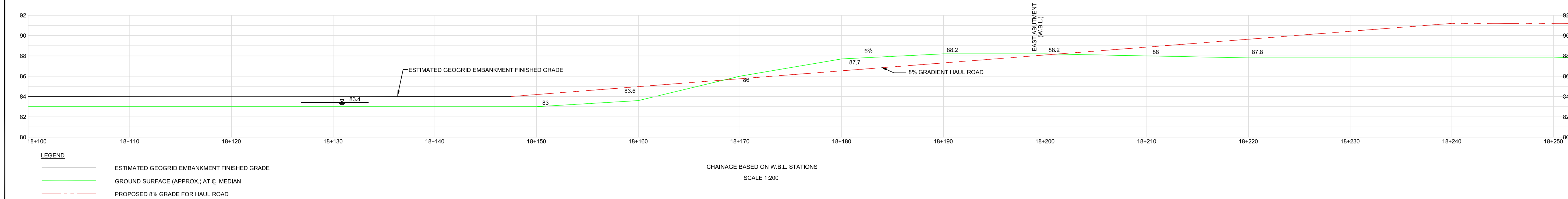


MSD/FJH/clg

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PROFILE
STATION 18+100 TO 18+400
(WESTBOUND STATIONS)

FIGURE 1



01155001.DWG

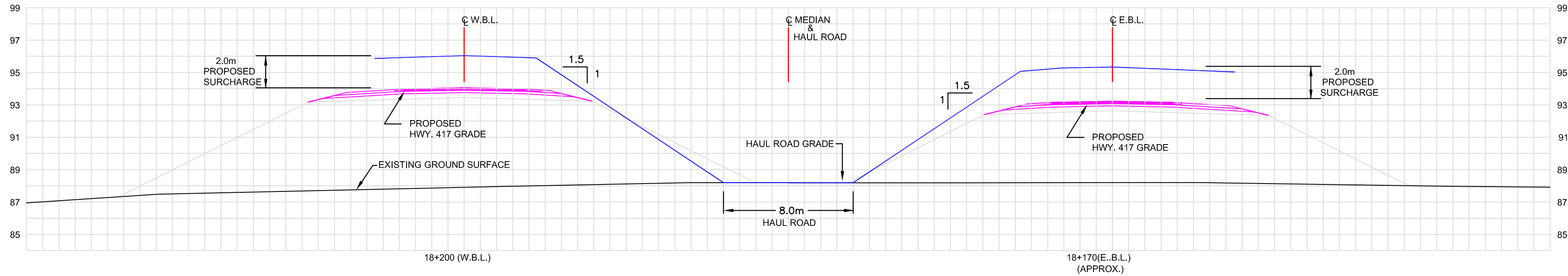
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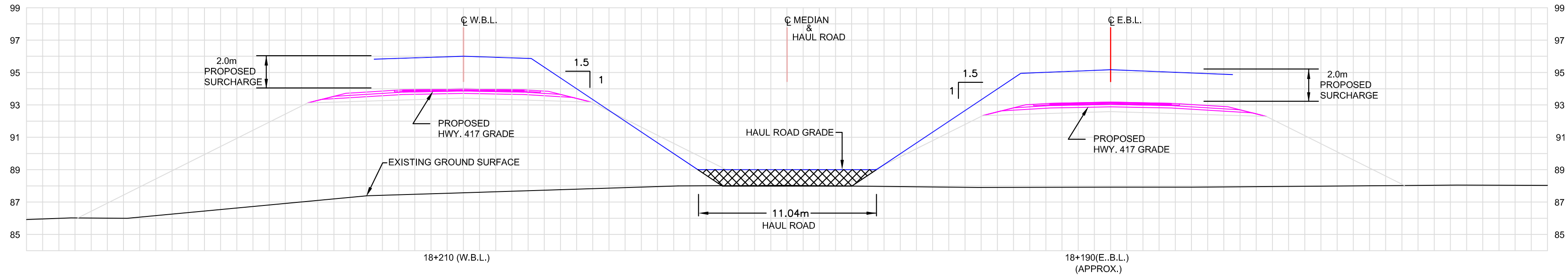
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Chkd



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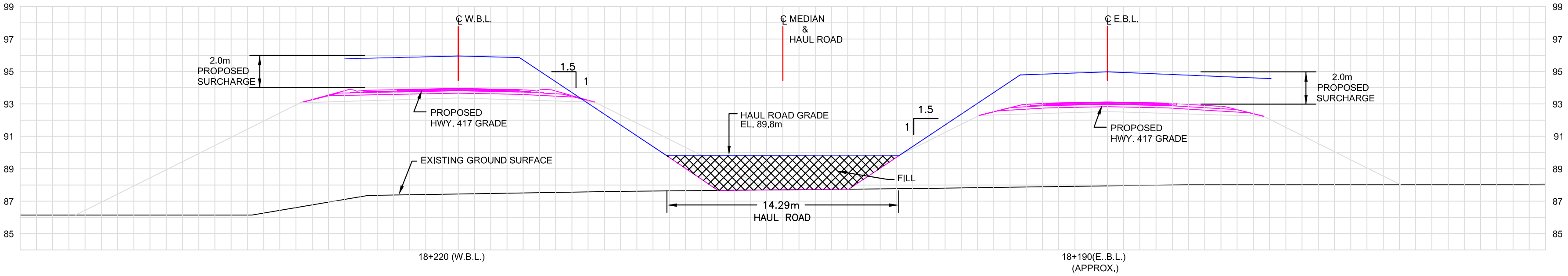


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CROSS SECTION AT
STATION 18+220
(WESTBOUND STATIONS)

FIGURE 3



01155003.DWG

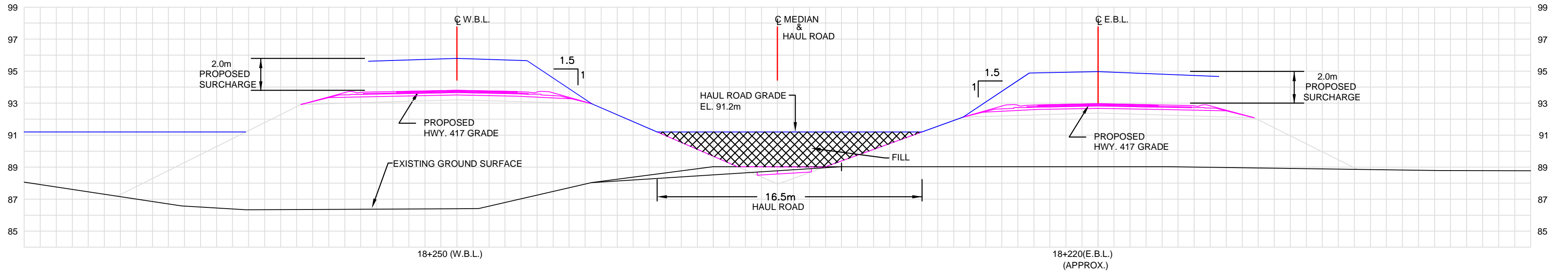
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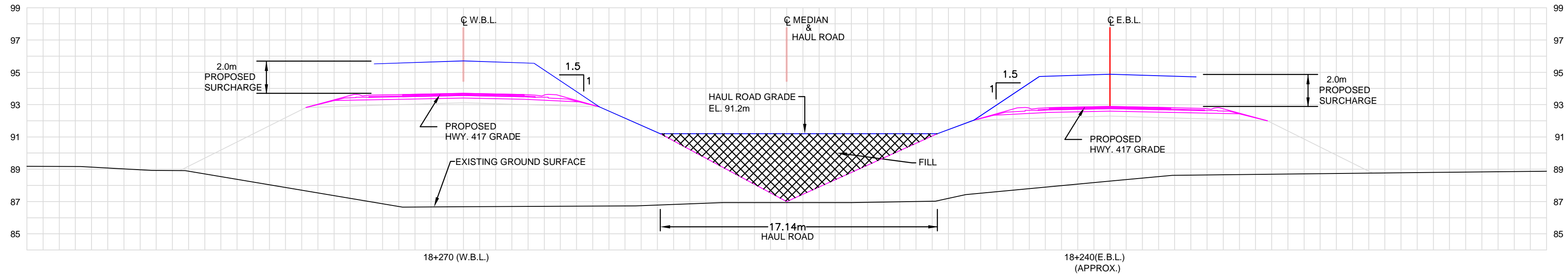
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Chkd

CROSS SECTIONS AT
STATION 18+250 AND 18+270
(WESTBOUND STATIONS)

FIGURE 4



SCALE 1:200



SCALE 1:200

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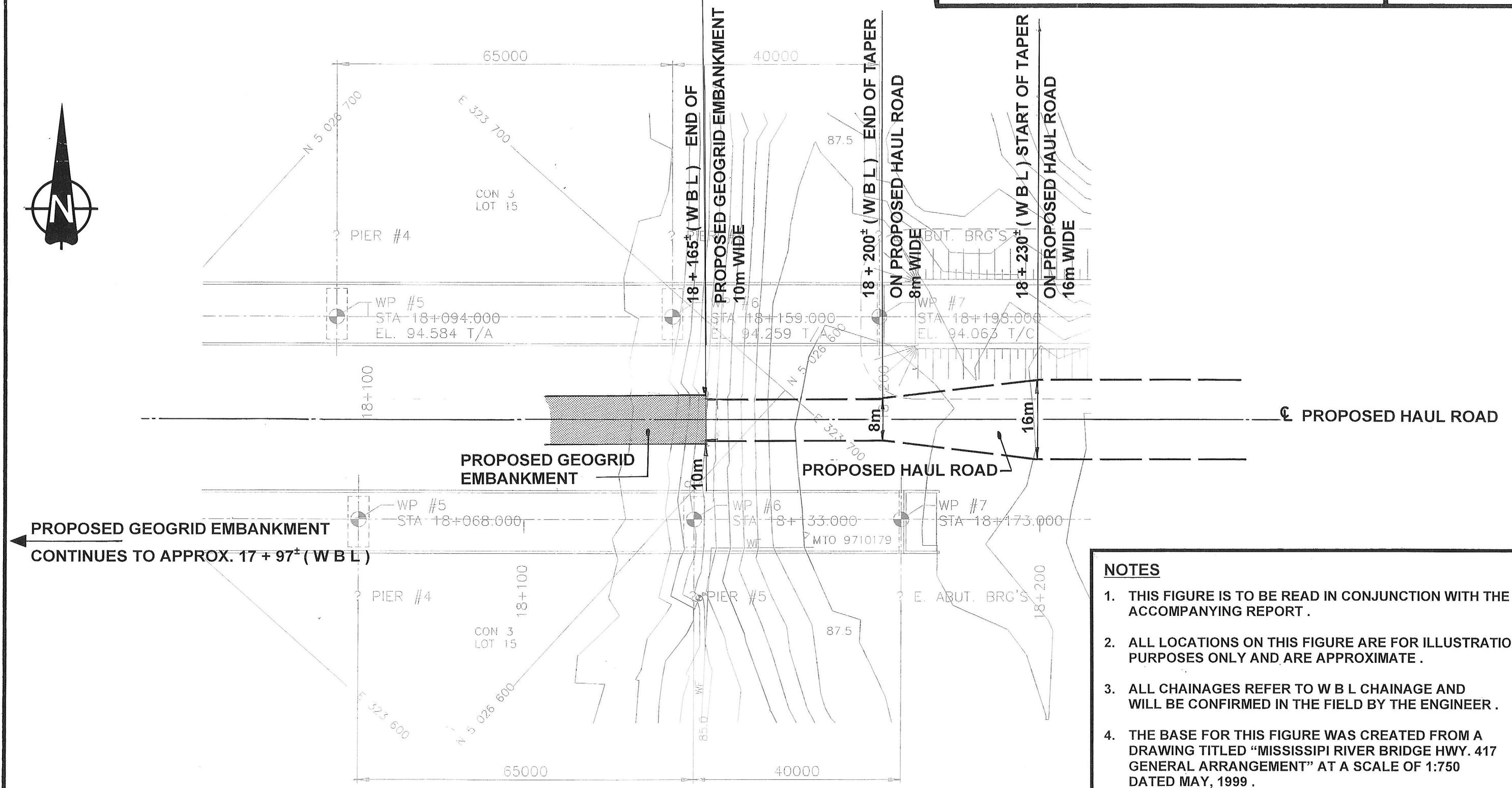
Chkd

01155004.DWG

1"= 1" IMP. (1:200MS)

PLAN OF PROPOSED
HAUL ROAD
(FILL IN MEDIAN OPTION)

FIGURE 5



NOTES

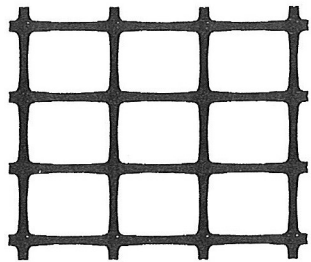
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT .
2. ALL LOCATIONS ON THIS FIGURE ARE FOR ILLUSTRATION PURPOSES ONLY AND ARE APPROXIMATE .
3. ALL CHAINAGES REFER TO W B L CHAINAGE AND WILL BE CONFIRMED IN THE FIELD BY THE ENGINEER .
4. THE BASE FOR THIS FIGURE WAS CREATED FROM A DRAWING TITLED "MISSISSIPPI RIVER BRIDGE HWY. 417 GENERAL ARRANGEMENT" AT A SCALE OF 1:750 DATED MAY, 1999 .

SCALE 1 : 750

Date.....DECEMBER, 1999 .
Project.....991-1155

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Drawn.....R.B.C.....
Chkd.....MA.....



Tensar
Earth Technologies, Inc.

CONSTRUCTION DRAWINGS
Prepared For

MTO HIGHWAY 417
MISSISSIPPI RIVER TEMPORARY ACCESS ROAD
ARNPRIOR, ONTARIO

INDEX

SHEET	DESCRIPTION
1.	Title Sheet
2.	Construction Notes
3.	Typical Cross-Sections
4.	Typical Cross-Sections
5.	Geogrid Layout



E9950101.DWG

THIS DESIGN IS BASED UPON SPECIFIC PROPERTIES OF TENSAR PRODUCTS (GEOGRIDS, DRAINAGE COMPOSITES AND EROSION MEDIA), WHICH ARE PROPRIETARY TO THE TENSAR CORPORATION 1210 CITIZENS PARKWAY, MORROW GA. 30260. ANY SUBSTITUTION OF THE SPECIFIED PRODUCTS WILL INVALIDATE THIS DESIGN. THIS DRAWING IS BEING FURNISHED FOR USE ON THIS SPECIFIC PROJECT ONLY. ANY PARTY ACCEPTING THIS DOCUMENT DOES SO IN CONFIDENCE AND AGREES THAT IT SHALL NOT BE DUPLICATED WHOLE OR IN PART, NOR DISCLOSED TO OTHERS, WITHOUT THE CONSENT OF TENSAR EARTH TECHNOLOGIES, INC.

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PRISM™

FOUNDATION SUPPORT SYSTEM

[SEAL]

REVISIONS \ ISSUE			
0	9/3/99	ISSUED FOR REVIEW	
1	9/15/99	ISSUED FOR REVIEW	
2	12/17/99	REVISED PER GOLDER	

Project Number E99501
Date Drawn 9/3/99
Scale As Shown
Designed by KL
Drawn by BBC
Checked by

MTO HIGHWAY 417

ARNPRIOR, ONTARIO

TITLE SHEET

Sheet Number
1 of 5

CONSTRUCTION NOTES FOR PLACEMENT OF TENSAR® GEOGRIDS AND BACKFILL SOILS FOR PRISM® REINFORCED SYSTEM

- 1.0

MATERIALS
- 1.1

BACKFILL SOILS
- 1.1.1

REINFORCED BACKFILL MATERIALS SHALL BE APPROVED BY THE OWNER OR OWNER'S REPRESENTATIVE AND SHALL MEET THE STRENGTH REQUIREMENTS AS DEFINED IN SECTION 6.0. THE ROCK BACKFILL SHALL BE 300 mm MINUS ROCK. THE SAND BACKFILL MATERIAL SHALL MEET THE FOLLOWING GRADATION:
- SIEVE SIZE

101.6 mm

No. 4

No. 40

No. 200

PERCENT PASSING

100 - 75 %

100 - 20%

0 - 60% max.

0 - 15% max.
- 1.1.2

FURTHERMORE, REINFORCED BACKFILL MATERIALS SHALL BE FREE OF EXCESS MOISTURE, ROOTS, MUCK, SOD, SNOW, FROZEN LUMPS, ORGANIC MATTER OR OTHER DELETERIOUS MATERIALS. ALL ROCK PARTICLES SHALL BE LESS THAN 300 mm IN THE LONGEST DIMENSION. REINFORCED BACKFILL MATERIALS WHICH DO NOT MEET THIS CRITERIA SHALL BE CONSIDERED UNSUITABLE AND SHALL BE REMOVED.
- 1.2

GEOGRID REINFORCING SHALL BE TENSAR BIAXIAL AND UNIAXIAL GEOGRIDS MANUFACTURED BY THE TENSAR CORPORATION, MORROW, GEORGIA.
- 1.3

BODKIN BARS SHALL BE 1.5" X 1/4" HDPE BARS MANUFACTURED BY THE TENSAR CORPORATION, MORROW, GEORGIA.
- 2.0

TECHNICAL REQUIREMENTS
- 2.1

THE OWNER OR OWNER'S REPRESENTATIVE SHALL SUBMIT TO TENSAR EARTH TECHNOLOGIES, INC. REINFORCED BACKFILL MATERIAL AND RETAINED SOIL/FILL GRADATIONS FOR APPROVAL PRIOR TO PROCEEDING WITH CONSTRUCTION.
- 2.2

PRIOR TO CONSTRUCTION OF THE TENSAR REINFORCED EMBANKMENT, THE CONTRACTOR SHALL CLEAR AND GRUB THE REINFORCED BACKFILL ZONE AREA.
- 2.3

THE OWNER OR OWNER'S REPRESENTATIVE SHALL CONFIRM THAT THE SITE HAS BEEN PROPERLY PREPARED AND THE DESIGN PARAMETERS IN SECTION 6.0 ARE APPROPRIATE PRIOR TO FILL PLACEMENT.
- 2.4

TERRAFIX NONWOVEN GEOTEXTILE, TENSAR TYPE A BIAXIAL GEOGRID AND TYPE B GEOGRID SHALL BE PLACED ON THE PREPARED GROUND SURFACE AND COVERED BY AN INITIAL LIFT OF 900 mm THICK ROCK FILL. ANOTHER LAYER OF TENSAR TYPE B GEOGRID SHALL BE PLACED ON TOP OF THE INITIAL LIFT AND COVERED BY A LAYER OF 150 mm THICK SAND.
- 2.5

FILL MATERIALS SHALL BE PLACED FROM THE MIDDLE OF THE REINFORCED ZONE TOWARDS THE ENDS OF THE GEOGRID TO ENSURE FURTHER TENSIONING.
- 2.6

TESTING METHODS AND FREQUENCY, AND VERIFICATION OF MATERIAL SPECIFICATIONS SHALL BE THE RESPONSIBILITY OF THE OWNER OR OWNER'S REPRESENTATIVE.
- 2.7

A COMPLETE SET OF CONSTRUCTION DRAWINGS AND CONTRACT SPECIFICATIONS SHALL BE ON-SITE AT ALL TIMES, DURING CONSTRUCTION OF THE PRISM SYSTEM, IF ANY.
- 3.0

TENSAR GEOGRID PLACEMENT
- 3.1

TENSAR GEOGRID SHALL BE PLACED AT THE LOCATIONS, ELEVATIONS AND ORIENTATIONS SHOWN ON THE DRAWINGS.
- 3.2

TENSAR GEOGRID LENGTH SHALL BE AS SHOWN ON THE CONSTRUCTION DRAWINGS.
- 3.2.1

TENSAR GEOGRID REINFORCEMENT SHALL BE CONTINUOUS THROUGHOUT THEIR EMBEDMENT LENGTH(S). THE BODKIN CONNECTION SHALL NOT BE UTILIZED UNLESS PRE-APPROVED BY THE OWNER OR OWNER'S REPRESENTATIVE PRIOR TO CONSTRUCTION.
- 3.2.2

IF PRE-APPROVED, TENSAR UNIAXIAL GEOGRIDS MAY BE SPLICED UTILIZING THE BODKIN CONNECTION DETAIL. NO MORE THAN ONE SPICE SHALL BE ALLOWED IN ANY ONE LENGTH OF REINFORCING AND NO SPLICES SHALL BE ALLOWED FOR GEOGRIDS LESS THAN 2.0 m IN LENGTH (EACH).
- 3.3

PRIOR TO PLACING FILL, THE GEOGRID MATERIALS SHALL BE PLACED TO LAY FLAT AND PULLED TAUT TO REMOVE ANY SLACK IN THE GEOGRIDS.
- 3.4

TRACKED CONSTRUCTION EQUIPMENT SHALL NOT BE OPERATED DIRECTLY ON THE GEOGRID. A MINIMUM BACKFILL THICKNESS OF 150 mm IS REQUIRED FOR OPERATION OF TRACKED VEHICLES OVER THE GEOGRID. TURNING OF TRACKED VEHICLES SHOULD BE KEPT TO A MINIMUM TO PREVENT TRACKS FROM DISPLACING THE FILL AND/OR THE GEOGRID.
- 3.5

RUBBER-TIRED VEHICLES MAY PASS OVER THE GEOGRID REINFORCEMENT AT SLOW SPEEDS, LESS THAN 16 KM/HR. SUDDEN BRAKING AND SHARP TURNING SHALL BE AVOIDED.

- 3.6

LOW GROUND PRESSURE CONSTRUCTION EQUIPMENT SHOULD BE USED; ESPECIALLY DURING THE INITIAL STAGES OF CONSTRUCTION. SMALL WIDE TRACK DOZERS (WITH MAXIMUM 15 kPa GROUND PRESSURE) SHOULD BE USED FOR SPREADING FILL MATERIAL.
- 3.7

A MINIMUM OF 75 mm OF FILL MATERIAL SHALL BE REQUIRED BETWEEN LAYERS OF BIAXIAL, UNIAXIAL AND FILTER FABRIC, UNLESS OTHERWISE SHOWN.
- 4.0

CHANGES TO GEOGRID LAYOUT OR PLACEMENT
- 4.1

NO CHANGES TO THE TENSAR GEOGRID LAYOUT, INCLUDING, BUT NOT LIMITED TO, LENGTH, GEOGRID TYPE, OR ELEVATION, SHALL BE MADE WITHOUT THE EXPRESSED PRIOR WRITTEN CONSENT OF TENSAR EARTH TECHNOLOGIES, INC.
- 5.0

DRAINAGE
- 5.1

THE ENGINEERING, DESIGN, ANALYSIS, DETAILING AND MITIGATION OF BOTH SURFACE DRAINAGE AND SEEPAGE OF GROUNDWATER SHALL BE THE RESPONSIBILITY OF THE OWNER OR OWNER'S REPRESENTATIVE.
- 6.0

DESIGN PARAMETERS
- 6.1

DESIGN OF THE REINFORCED SOIL STRUCTURE IS BASED ON THE FOLLOWING PARAMETERS:
- | | FRICITION ANGLE (°) | UNDRAINED PEAK SHEAR STRENGTH (kpa) | MOIST UNIT WEIGHT (kN/m³) |
|----------------------------|---------------------|-------------------------------------|---------------------------|
| ROCK FILL FOUNDATION SOILS | 38 | 0 | 17.0 |
| 0.0 - 0.7 m | 30 | 0 | 12.0 |
| 0.7 - 2.0 m | 0 | 15 | 13.0 |
| 2.0 - 2.2 m | 0 | 20 | 17.0 |
| 2.2 - 4.2 m | 0 | 25 | 17.0 |
| 4.2 - 8.0 m | 0 | 34 | 17.0 |
| 8.0 - 10.0 m | 0 | 38 | 17.0 |
| 10.0 - 14.0 m | 0 | 45 | 17.0 |
| 14.0 - 22.0 m | 0 | 50 | 17.0 |
- 6.2

FACTORS OF SAFETY: MINIMUM FACTOR OF SAFETY FOR GEOGRID PULLOUT SOIL-GEOGRID INTERACTION COEFFICIENT
- 6.3

GLOBAL STABILITY:
- 6.4

LOADINGS:
- 6.5

HYDROSTATIC FORCES
- 6.6

SEISMIC DESIGN
- 6.7

DESIGN WATER ELEVATION
- 6.8

RAPID DRAWDOWN CONDITION
- 7.0

SPECIAL PROVISIONS
- 7.1

THE DESIGN PRESENTED HEREIN IS BASED ON SOIL PARAMETERS, FOUNDATION CONDITIONS, GROUNDWATER CONDITIONS, AND LOADINGS STATED IN SECTION 6.0. THESE PARAMETERS ARE AS OBTAINED FROM GOLDER ASSOCIATES AND THURBER ENGINEERING LTD., ETOBICOKE, ONATRIO.
- 7.2

ELEVATION VIEWS, LOCATIONS, AND GEOMETRY OF EXISTING STRUCTURES MUST BE VERIFIED BY THE OWNER OR OWNER'S REPRESENTATIVE PRIOR TO CONSTRUCTION.
- 7.3

TENSAR EARTH TECHNOLOGIES, INC. AND TERRAFIX GEOSYNTHETICS, INC. ASSUME NO LIABILITY FOR INTERPRETATION OR VERIFICATION OF SUBSURFACE CONDITIONS, SUITABILITY OF SOIL DESIGN PARAMETERS AND INTERPRETATION OF SUBSURFACE GROUNDWATER CONDITIONS.
- 7.4

THE OWNER OR OWNER'S REPRESENTATIVE IS RESPONSIBLE FOR REVIEWING AND VERIFYING THAT THE ACTUAL SITE CONDITIONS ARE AS DESCRIBED IN SECTION 6.0 PRIOR TO AND DURING CONSTRUCTION.

- 7.5

THE SOIL DESIGN PARAMETERS STATED IN SECTION 6.0 SHALL BE VERIFIED BY THE OWNER OR OWNER'S REPRESENTATIVE. WRITTEN VERIFICATION OF DESIGN PARAMETERS SHALL BE SUBMITTED TO TENSAR EARTH TECHNOLOGIES, INC. PRIOR TO COMMENCING WITH CONSTRUCTION.
- 7.6

PROCEEDING WITH CONSTRUCTION WITHOUT FIRST PROVIDING TENSAR EARTH TECHNOLOGIES, INC. AND TERRAFIX GEOSYNTHETICS, INC. A WRITTEN REPORT VERIFYING CONDITIONS DISCUSSED IN SECTION 6.0. SHALL ABSOLVE TENSAR EARTH TECHNOLOGIES, INC. AND TERRAFIX GEOSYNTHETICS, INC. FROM ALL LIABILITY FOR THE DESIGN AND CONSTRUCTION OF THIS STRUCTURE AND CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS TENSAR EARTH TECHNOLOGIES, INC. AND TERRAFIX GEOSYNTHETICS, INC. FROM ALL RESULTING CLAIMS, DAMAGES, LOSSES AND EXPENSES.
- 7.7

ANY REVISIONS TO DESIGN PARAMETERS STATED IN SECTION 6.0 OR STRUCTURE GEOMETRY SHALL REQUIRE DESIGN MODIFICATIONS PRIOR TO PROCEEDING WITH CONSTRUCTION.
- 7.8

ONCE THE TEMPORARY ACCESS ROAD IS NO LONGER REQUIRED, ALL OF THE ROCK FILL AND GEOSYNTHETICS SHALL BE REMOVED IN SUCH A MANNER SO AS TO MINIMIZE ANY FURTHER DISTURBANCE TO THE UNDERLYING SOILS.
- 7.8.1.

THE ROCK FILL AND UPPER LAYERS OF GEOGRIDS MAY BE REMOVED IN ONE LIFT. CARE SHALL BE EXERCISED SO AS TO NOT PUNCTURE THROUGH THE BOTTOM LAYERS OF GEOGRIDS.
- 7.8.2.

THE LOWER LAYERS OF GEOGRID AND THE GEOTEXTILE LAYER SHALL BE PEELED UP AND REMOVED AS THE REMOVAL OF THE ROCK FILL PROGRESSES.
- 7.9

THE SPACE REQUIRED FOR CONSTRUCTION EQUIPMENT MANEUVERING ON THE EMBANKMENT SHOULD BE CHECKED BY AN EQUIPMENT SPECIALIST.
- 8.0

FISH PASSAGE WAYS
- 8.1

CORRUGATED HDPE PIPES (SMOOTH INNER WALL) SHALL BE INSTALLED AT THE LOCATIONS INDICATED IN THE DRAWINGS TO ALLOW FOR THE PASSAGE OF FISH FROM ONE SIDE OF THE TEMPORARY ACCESS ROAD TO THE OTHER.
- 8.2

DURING PLACEMENT OF THE FIRST LIFT OF ROCK FILL, THE PIPES SHALL BE INSTALLED ON A BEDDING OF 150 MM OF HL8 COARSE AGGREGATE. THE PIPES SHALL THEN BE COVERED WITH HL8 COARSE AGGREGATE TO THE EXTENT SHOWN IN THE DRAWINGS.
- 8.3

DURING PLACEMENT OF THE FIRST LIFT OF ROCK FILL, A COVER OF 300 MM MINIMUM OF HL8 COARSE AGGREGATE SHALL BE MAINTAINED ABOVE THE TOP OF THE PIPE TO ALLOW FOR CONSTRUCTION TRAFFIC TO PASS OVER THE PIPE. JUST PRIOR TO PLACEMENT OF THE SECOND LAYER OF PRIMARY GEOGRID, THE HL8 COVER MAY BE ADJUSTED TO ACCOMMODATE PLACEMENT OF THE SECOND LAYER OF GEOGRID AT THE REQUIRED ELEVATION. AFTER PLACEMENT OF THE SECOND LAYER OF PRIMARY GEOGRID, THE COVER OF 300 MM MINIMUM OF HL8 COARSE AGGREGATE SHALL BE RESTORED.
- 8.4

AT NO TIME SHALL ANY CONSTRUCTION EQUIPMENT CROSS OVER THE PIPE WITHOUT A MINIMUM OF 300 MM COVER OF HL8 COARSE AGGREGATE.

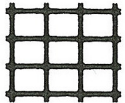


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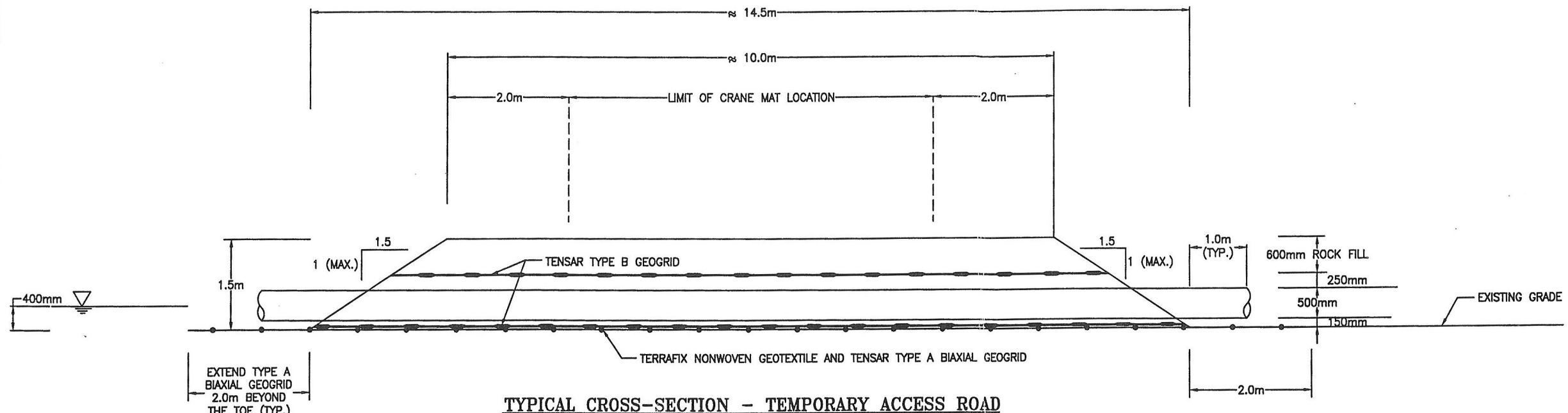
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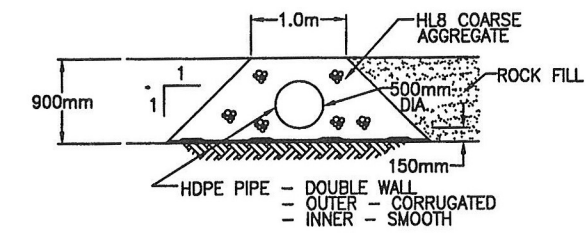
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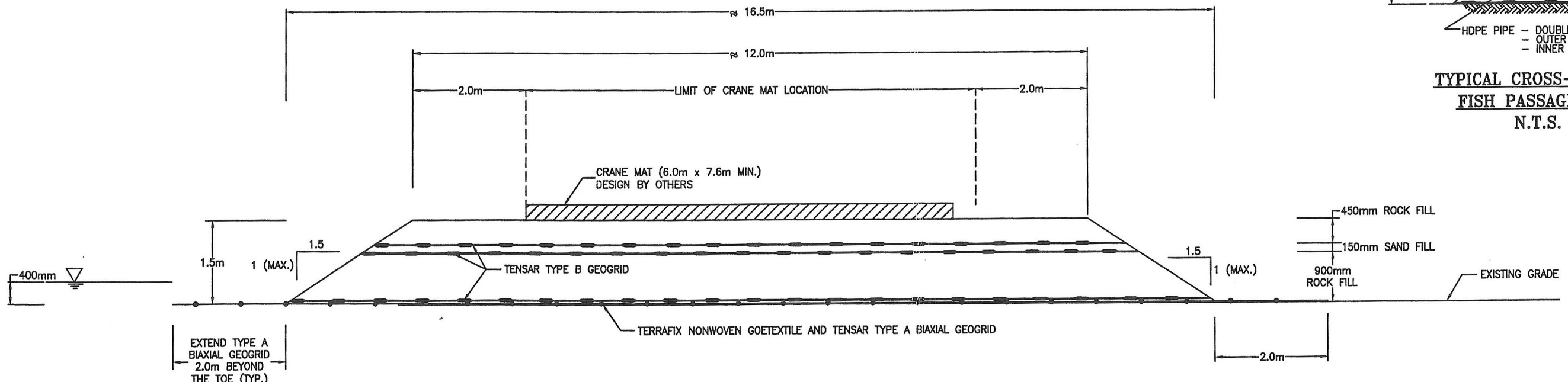
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CONSTRUCTION NOTES	Sheet Number 2 of 5



TYPICAL CROSS-SECTION - TEMPORARY ACCESS ROAD

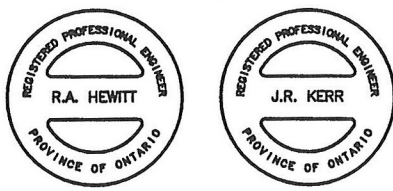
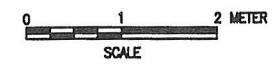


**TYPICAL CROSS-SECTION
FISH PASSAGE WAY
N.T.S.**



TYPICAL CROSS-SECTION - CRANE PAD

NOTE:
SEE SHEET 5 FOR GEOGRID LAYOUT.



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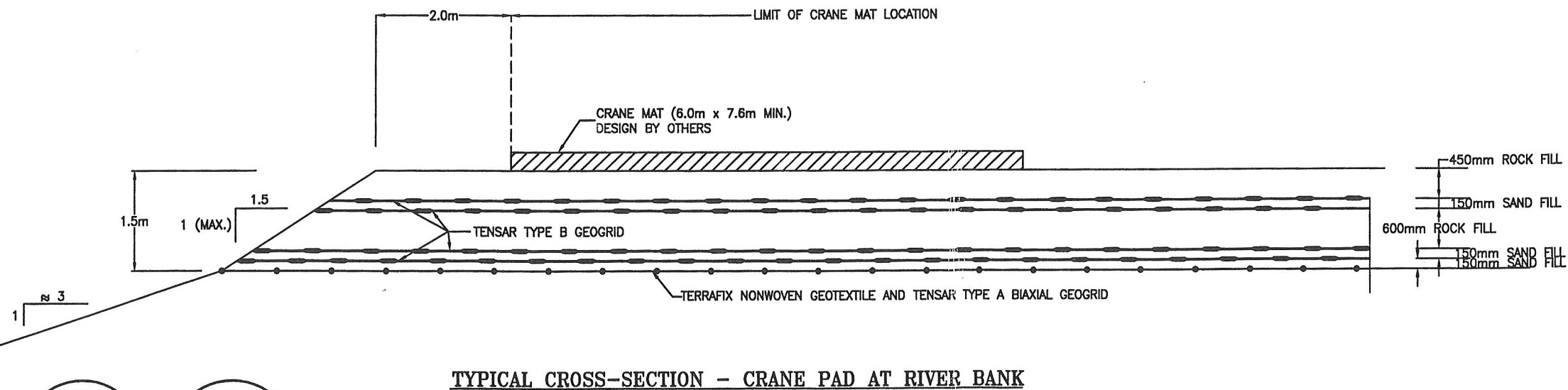
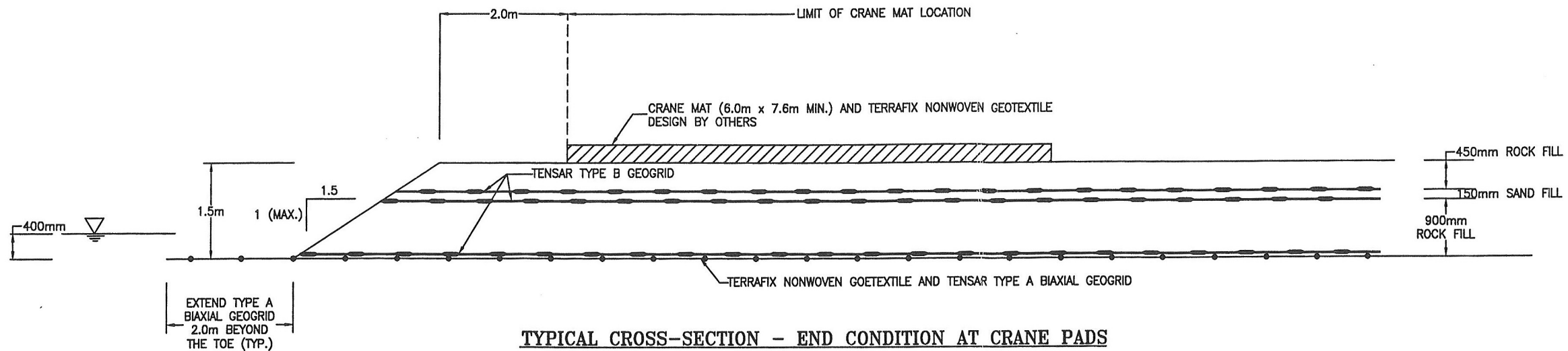
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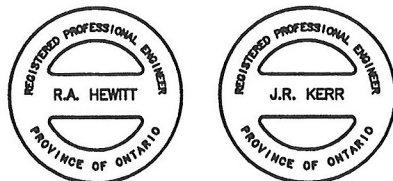
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TYPICAL CROSS-SECTIONS

Sheet Number
3 of 5



NOTE:
SEE SHEET 5 FOR GEOGRID LAYOUT.



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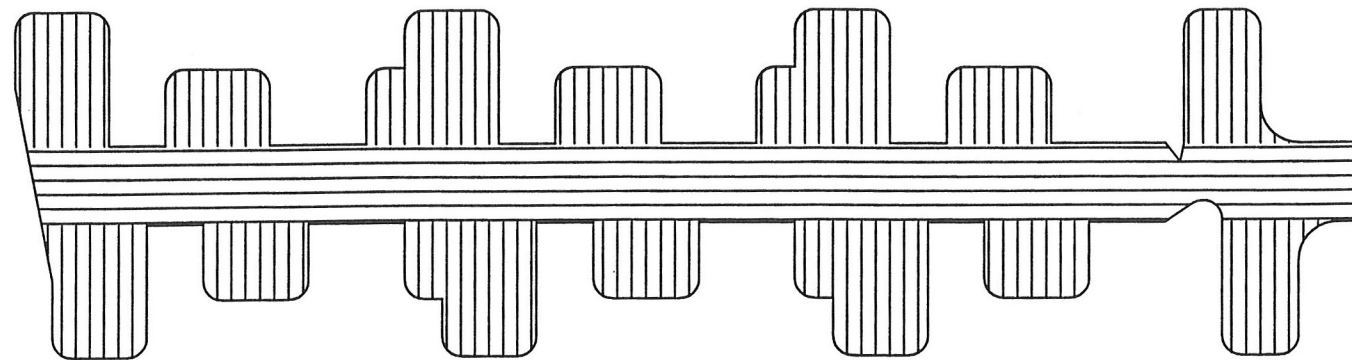
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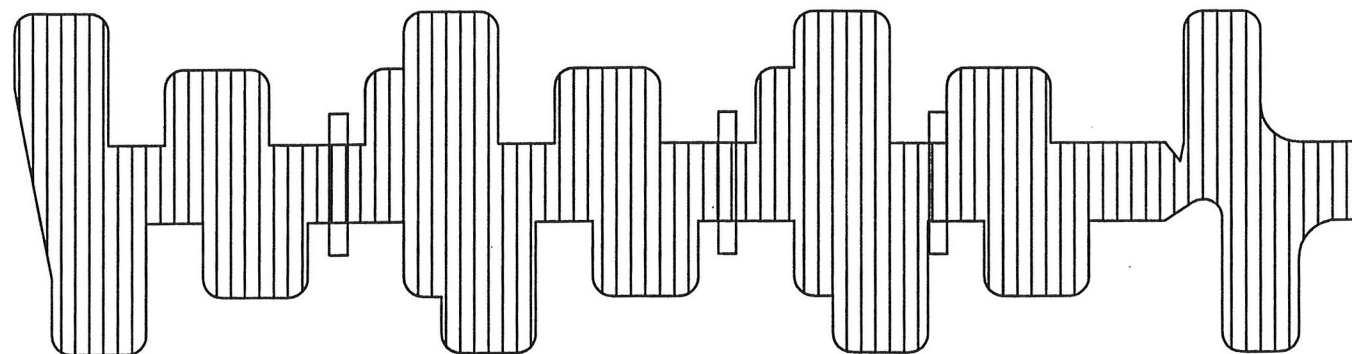
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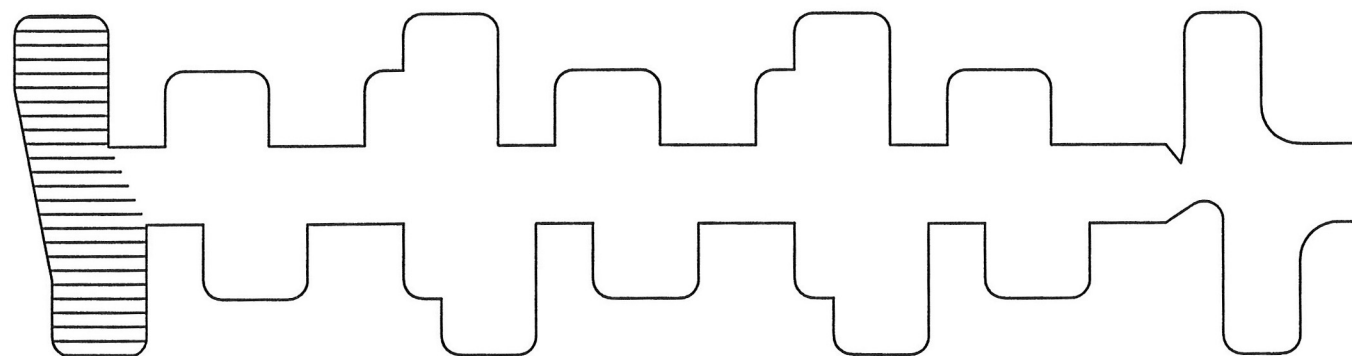
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ARNPRIOR, ONTARIO
TYPICAL CROSS-SECTIONS
Sheet Number
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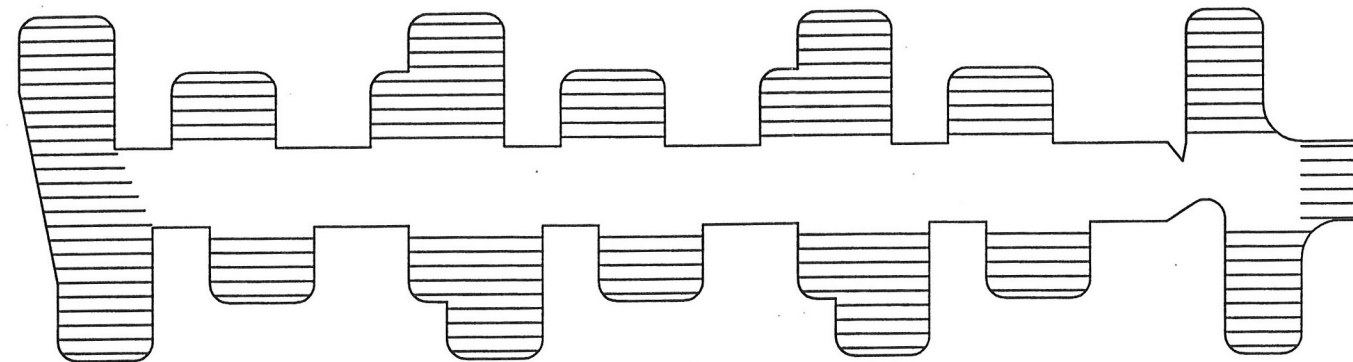
STEP 1: PLACE TERRAFIX NONWOVEN GEOTEXTILE AND TENSAR TYPE A BIAXIAL GEOGRID AT THE BASE OF EMBANKMENT
TYPE A BIAXIAL GEOGRID SHOULD HAVE A 1.0 m MINIMUM OVERLAP AT THE SIDES AND 2.0 m AT THE ENDS OF ADJACENT ROLLS.



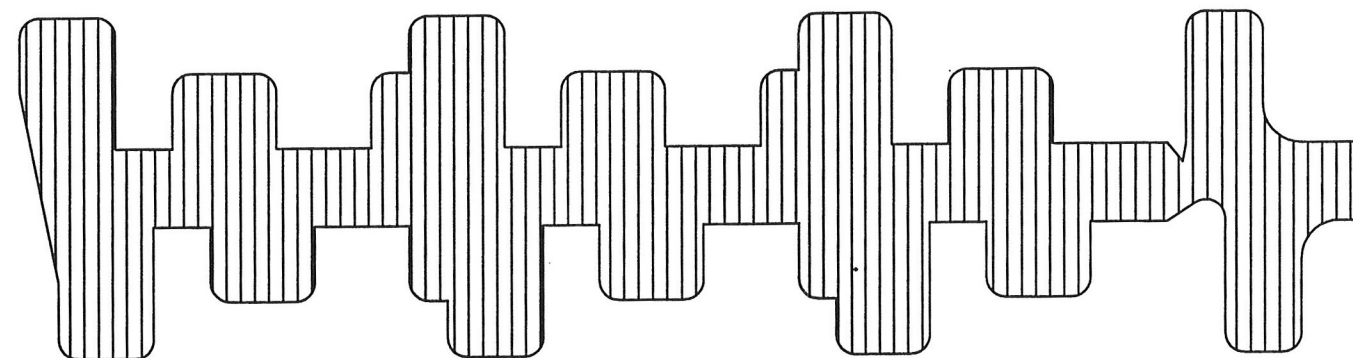
STEP 2: PLACE ONE LAYER TENSAR TYPE B GEOGRID ON TOP OF TYPE A BIAXIAL GEOGRID
INSTALL THREE 500mm HDPE PIPES AT THE LOCATIONS INDICATED ABOVE AS SHOWN IN TYPICAL CROSS SECTIONS.



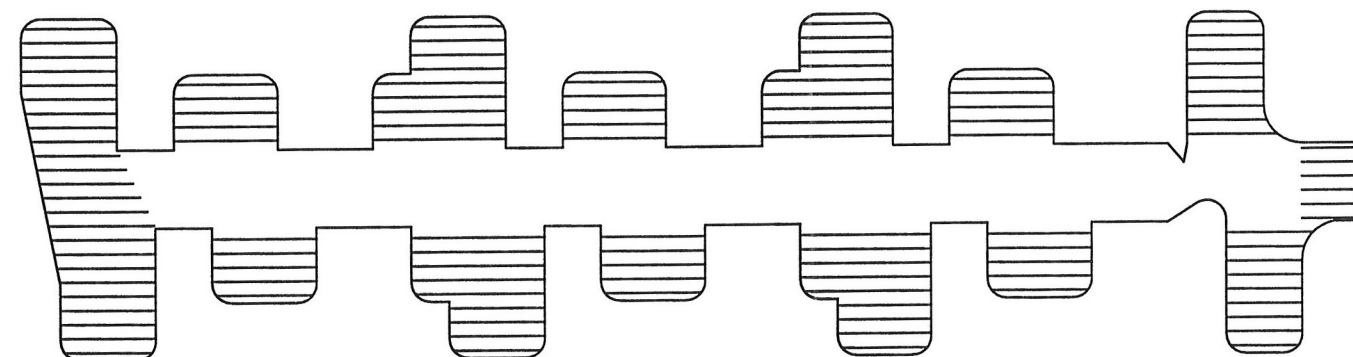
STEP3: PLACE 2 LAYERS TENSAR TYPE B GEOGRID AT 150mm AND 300mm ABOVE BASE OF EMBANKMENT



STEP 4: PLACE ONE LAYER TENSAR TYPE B GEOGRID AT 900mm ABOVE THE BASE OF EMBANKMENT

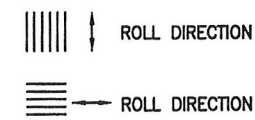


STEP 5: PLACE ONE LAYER TENSAR TYPE B GEOGRID ON TOP OF THE TYPE B GEOGRID INSTALLED IN STEP 4



STEP 6: PLACE ONE LAYER TENSAR TYPE B GEOGRID AT 1050mm ABOVE BASE OF EMBANKMENT

LEGEND



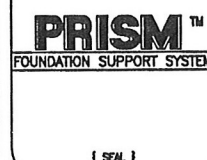
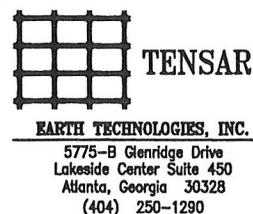
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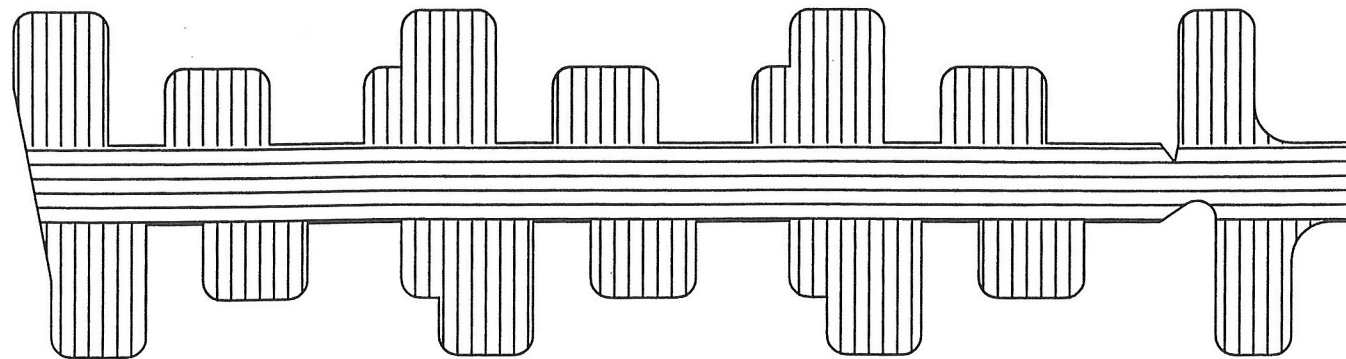
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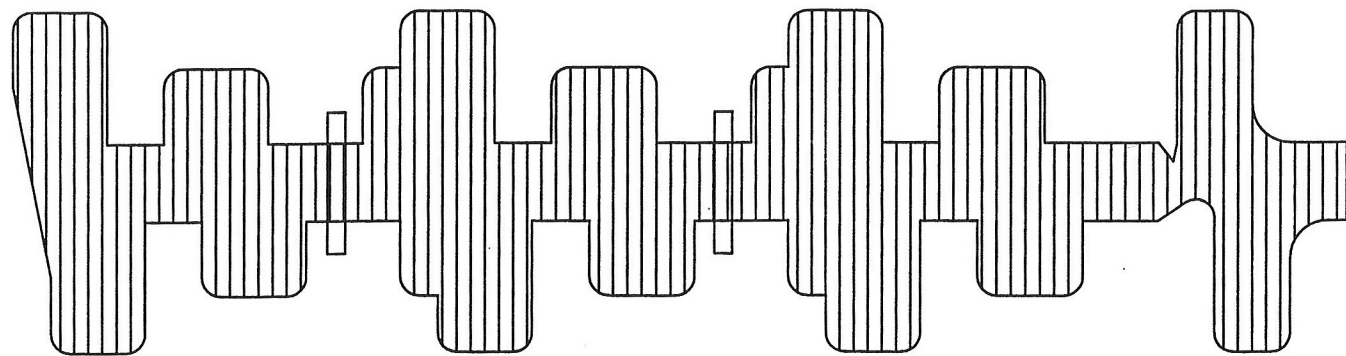
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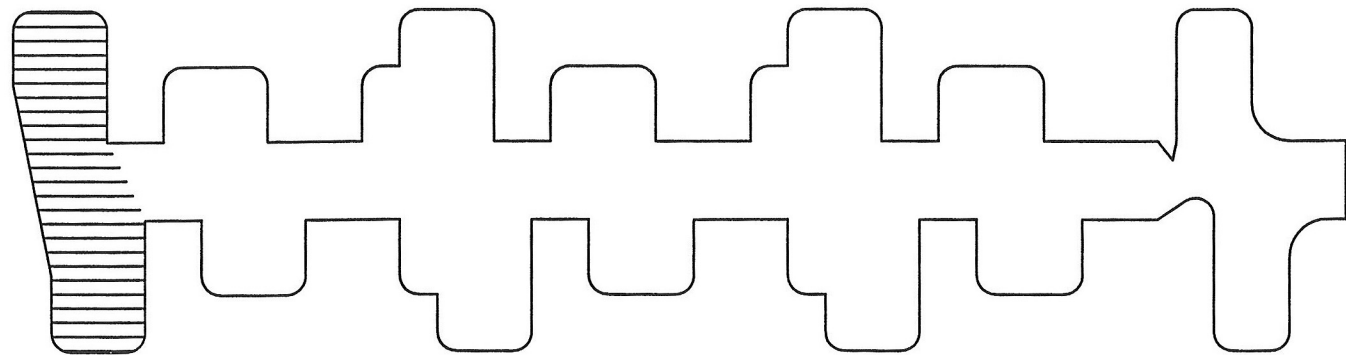
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GEOGRID LAYOUT	
Sheet Number 5 of 5	



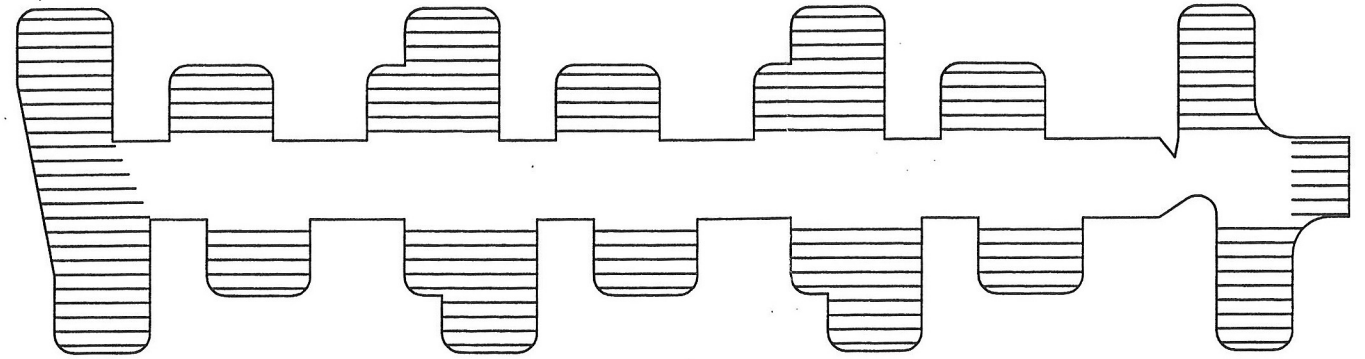
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TYPE A BIAXIAL GEOGRID SHOULD HAVE A 1.0 m MINIMUM OVERLAP AT THE SIDES AND 2.0 m AT THE ENDS OF ADJACENT ROLLS.



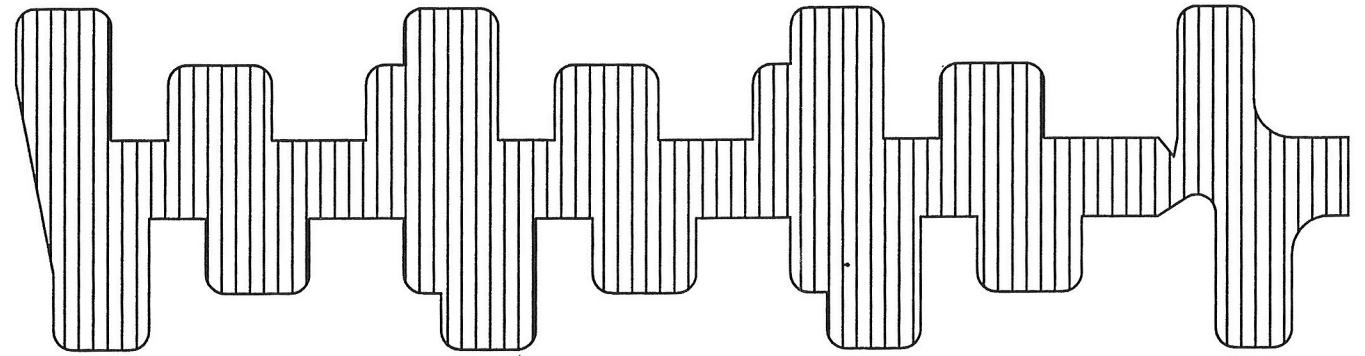
STEP 2: PLACE ONE LAYER TENSAR TYPE B GEOGRID ON TOP OF TYPE A BIAXIAL GEOGRID
INSTALL TWO 750 mm HDPE PIPES AT THE LOCATIONS INDICATED ABOVE AS SHOWN IN TYPICAL CROSS SECTIONS.



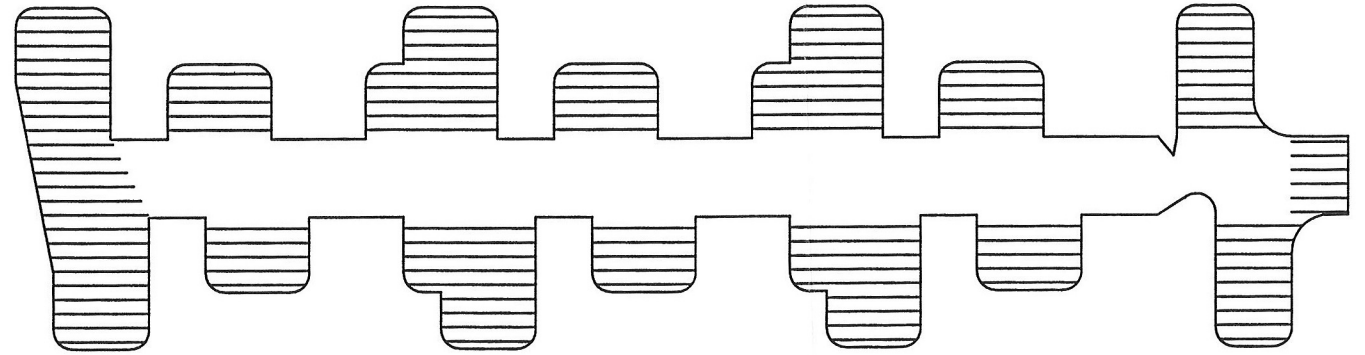
STEP 3: PLACE 2 LAYERS TENSAR TYPE B GEOGRID AT 150mm AND 300mm ABOVE BASE OF EMBANKMENT



STEP 4: PLACE ONE LAYER TENSAR TYPE B GEOGRID AT 900mm ABOVE THE BASE OF EMBANKMENT



STEP 5: PLACE ONE LAYER TENSAR TYPE B GEOGRID ON TOP OF THE TYPE B GEOGRID INSTALLED IN STEP 4



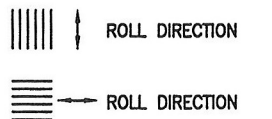
STEP 6: PLACE ONE LAYER TENSAR TYPE B GEOGRID AT 1050mm ABOVE BASE OF EMBANKMENT



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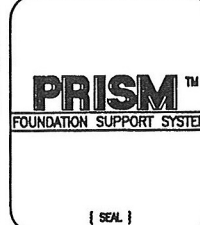
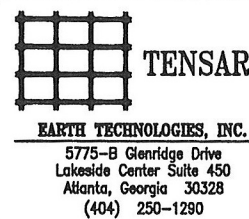
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APPENDIX A

**FACSIMILE DATED OCTOBER 25, 1999
COVERING POINTS RAISED IN
OCTOBER 21, 1999 MEETING**



2180 Meadowvale Boulevard, Mississauga, Ontario L5N 5S3

FACSIMILE: (905) 567-6561 or (905) 567-6566

TELEPHONE: (905) 567-4444

FACSIMILE TRANSMISSION

To: Ministry of Transportation, Ontario
Pavements and Foundations Section
Room #223, Central Building
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

**ATTENTION: MR. DAVE DUNDAS, P.ENG.
SENIOR FOUNDATION ENGINEER**

Facsimile Number: (416) 235-5240 / (416) 235-3919

Telephone Number: (416) 235-3482

From: Murty S. Devata / Fin J. Heffernan

Date Transmitted: October 25, 1999

RE: TEMPORARY ACCESS ROAD
MISSISSIPPI RIVER WETLANDS, HIGHWAY 417

Project Number: 991-1155

Number of Pages: 1 (one) including cover page

Original to Follow: No

Further to our telephone conversation of October 21, 1999, we have the following comments on some of the points raised yesterday.

Item 1 – Mud Wave

The term mud waves in geotechnical engineering is used to describe the lateral displacement of very soft deposits from below embankment construction. The displacement generally is arrested when stability is reached and results in a mound or berm of material adjacent to the embankment.

From our borings about 0.7 m depth of very soft material is susceptible to lateral displacement. As stated in Page 7 of the report, the provision of geogrid / geotextile will help to reduce the size of the displacement (mud wave). We estimate that the mud wave will be about 0.3 m height above the flood plain and have a width of about 5 m. In addition the configuration of the access road with numerous side pads will tend to trap the displaced materials and restrict the width of the mud wave.

Golder Associates

The specialty contractor will have a supervisor on site who is experienced in geogrid construction over soft material. He will advise the contractor in means to minimize the displacement of soft material. As well, notes will be added to the special provisions to warn the contractor that careful fill control measures will be required.

Item 2 - Concern for Rock Fill Punching Through Geotextile / Geogrid

During the reporting period the question of punching failure was discussed with Tensar, who stated that their chosen geogrid has adequate strength and sufficiently small openings to avoid punching. We have discussed this again with Tensar who assure us that their products will avoid this problem.

Item 3 - Multi-Season Use of the Access Road

The access road has been designed to bear on the soft deposits in their unfrozen state which would be prevalent for most of the year. The placement of the embankment on a frozen subgrade will limit the initial settlement of the geogrid embankment. However, on thawing, settlement of the subgrade will take place and the embankment would then have to be brought up to grade with additional rock fill.

We envisaged that construction activities on this access road would have to be suspended during the spring freshet when the access road would be overtopped. This generally takes place in late April early May. The roadway may be subject to erosion through this period and some filling may be required before construction continues.

Item 4 - Contingency for Settlement Beyond Estimated Amount

The organic materials are variable in nature and the settlement in some areas could be greater than estimated. Provision should be made in the contract to raise the grade with additional quantities of rock fill. Payment for this rock fill should be at the tender unit price.

Item 5 - Clearing and Grubbing

We have discussed this item with Tensar and it was not their intention to remove vegetation but rather to remove any trees or large brushes. Tensar agreed to modify Section 2.2 of the technical requirements.

The other issues raised in our telephone conversation, fish passage by pipes or through channels and the connection to the adjacent surcharged embankment will be studied in detail and reported on at a later date.

MSD/FJH/clg

WORD S/FINAL DAT/1100/991-1155/91155JX1

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