



THURBER ENGINEERING LTD.

GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

December 21, 2007

File: 15-85-66

Alberta Infrastructure and Transportation
Unit 2, Jewell Building
3603 – 53 Street
Athabasca, Alberta
T9S-1A9

Attention: Mr. Arthur Kavulok

**NORTH CENTRAL REGION (ATHABASCA AREA)
GEOHAZARD ASSESSMENT
HWY 63:12 BACKSLOPE SLUMPS (NC 17C), NORTH OF FORT MCMURRAY
2007 ANNUAL INSPECTION REPORT**

Dear Sir:

This letter documents the 2007 annual site inspection of an area of former slope instability located along Hwy 63:12 about 11.3 km north of Fort McMurray. The legal description of the site is SW7-91-9-W4M. Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE143/2006) with Alberta Infrastructure and Transportation (INFTRA).

Mr. Don Proudfoot, P.Eng. of Thurber undertook the inspection on July 17, 2007 in the presence of Mr. Roger Skirrow, P. Eng., Mr. Arthur Kavulok and Mr. Ron Behr of INFTRA.

1. BACKGROUND

The geohazard consisted of two slides that had occurred in local high points of the highway backslope. The slides, which were spaced about 200 m apart, were called the North Slump and the South Slump. A major buried oil pipeline owned and operated by Enbridge Pipelines, which services Suncor, is located in a right-of-way (R/W) upslope of the two former slides.

Discussions with Mr. Behr indicate that in addition to the slide problem, ongoing seepage in the winter was causing ditch icing problems in this area.



Thurber last visited the site as part of the geohazard assessment program on May 12, 2006 and the site condition at that time is described in our Part B assessment letter in the site binder. Since that time Thurber carried out a geotechnical investigation and preliminary engineering assessment to determine the conditions leading to failure and potential preliminary remedial measures to mitigate the sliding conditions. The results of the investigation and assessment were presented in a report dated August 18, 2006.

Later in the year Thurber developed a detailed design for remediation of the slides and Prairie North Constr. Ltd constructed the remedial measures in early 2007. The remedial measures consisted of excavating the slide areas and rebuilding the backslope with granular fill. Gravel filled shear keys were incorporated below the toe areas of the rebuilt slopes. A gabion wall was constructed to retain the toe of the South Slump in order to provide sufficient width for the highway ditch. The slide areas and shear keys were excavated and backfilled in sections in order to reduce the risk of failure of the excavation cut slopes.

Subdrains were incorporated at the back of the granular fill in each slide area to intercept seepage and lower the ground water table in the slope. The highway ditch was also regraded to prevent ponding of water in uneven sections. Catchwater ditches were also constructed on the upslope side outside the pipeline R/W to intercept surface flow and train it into riprap-lined swales that drained into the highway ditch. Thurber prepared a construction summary report dated June 25, 2007, which describes the construction of the remedial measures. A copy of the as-built drawings is attached to this letter for inclusion in Section G of the site binder.

2. SITE OBSERVATIONS

Selected photographs of the site taken during our July 17, 2007 visit are attached to this letter. The construction of the remedial measures had already been completed and a good grass growth had already developed on the slopes, ditch and swales. There were no visible signs of distress in the slopes or erosion on site. The grass growth was somewhat retarded along the down slope side of the catchwater ditch due to ongoing all-terrain vehicle traffic through this area.

3. ASSESSMENT AND RECOMMENDATIONS

The recent remedial measures should correct the previous slide condition. The MCI should visually monitor the site a few times over the next year to confirm that there are no further signs of movements and that there are no locations of erosion forming in the newly graded swales, slopes and highway ditch. Due to the high consequence of failure at this location it is recommended that the site be included



for a detailed visual assessment for one more year as part of the geohazard program.

4. CLOSURE

We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions arise or if the conditions of the slides worsen.

Yours very truly,
Thurber Engineering Ltd.

A handwritten signature in black ink, appearing to read 'Don Proudfoot'.

Don Proudfoot, P.Eng.
Review Principal
/dw

Attachments

cc Mr. Roger Skirrow, P.Eng., Director of Geotechnical Services, AIT



Photo 1 - Repaired North Slump Area and swale.



Photo 2 - Repaired South Slump Area.



Photo 3 - Highway Ditch in Regraded Section.



Photo 4 - Catchwater Ditch and Shallow Berm at Top of Cleared Slope.

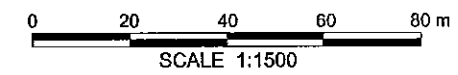
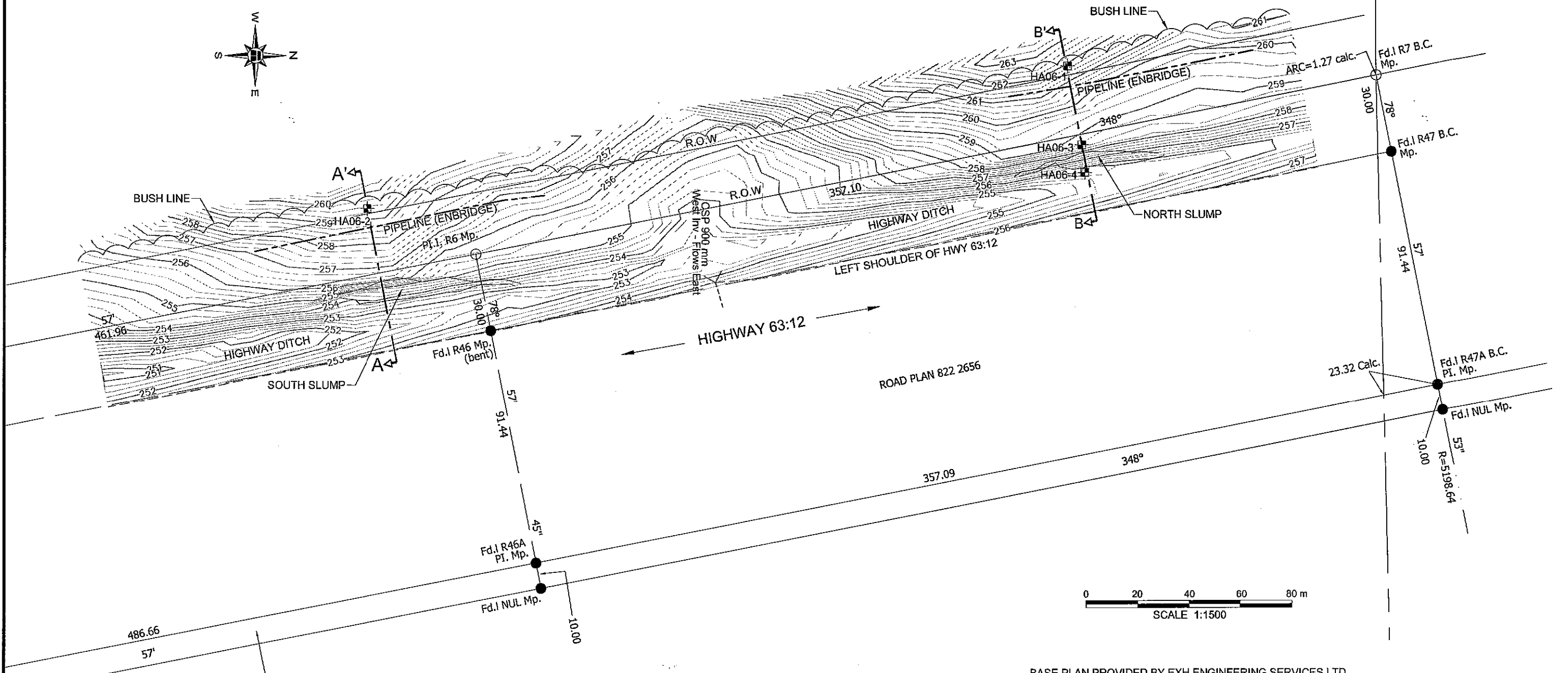
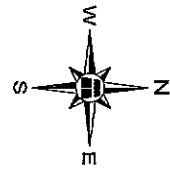


Photo 5 - Armoured Swale Between the Repaired Slump Areas.

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SW7-91-9-W4M

NW7-91-9-W4M



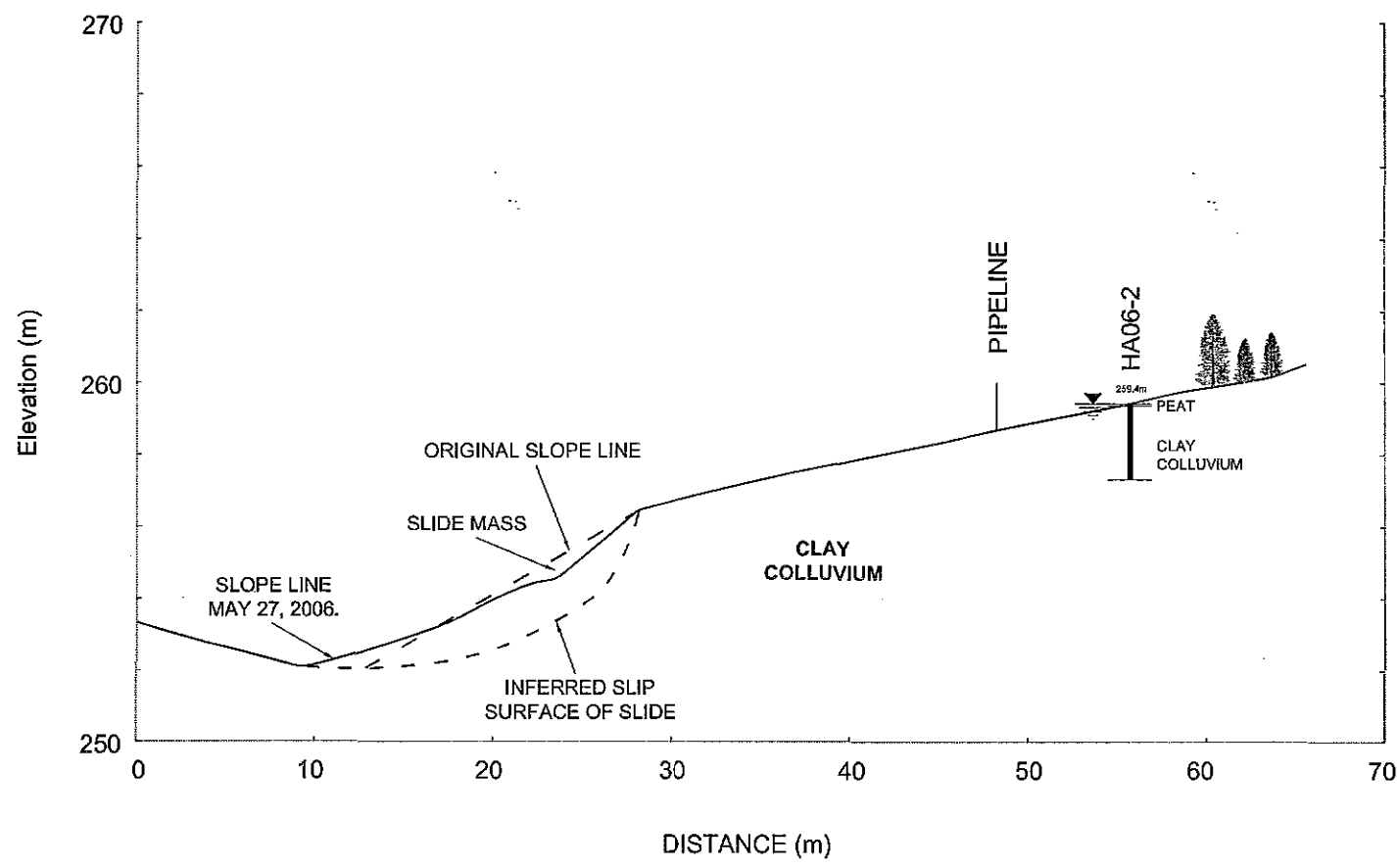
10.00 NORTHWESTERN UTILITIES LTD. PLAN 872 0984

LEGEND
 HAND AUGERS ON MAY 26-27 AND JUNE 5, 2006

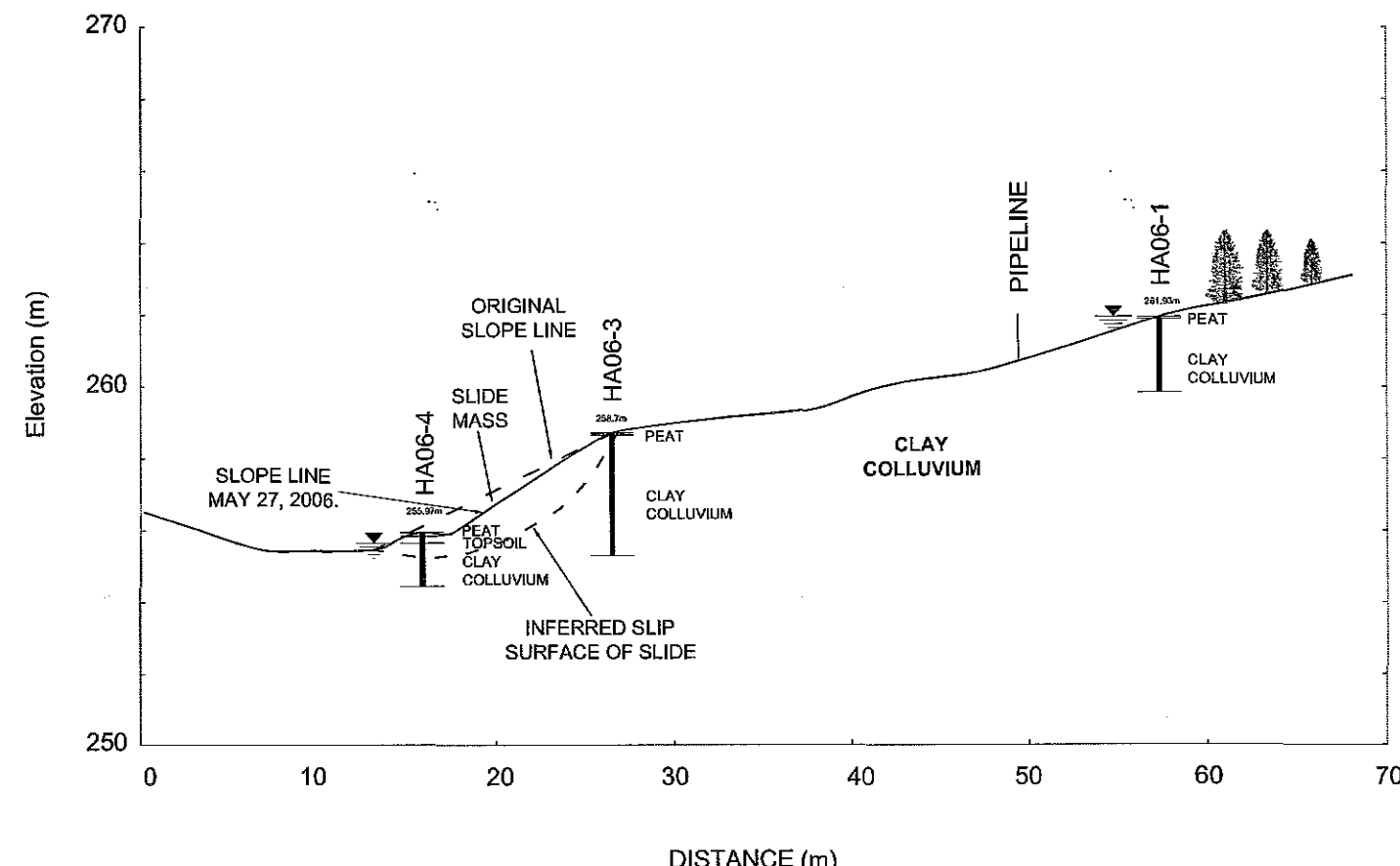
NOTE
 PIPELINE LOCATION SHOWN ON DRAWING IS THE SURVEYED LOCATION OF THE ALIGNMENT FLAGGED AS PART OF ALBERTA ONE CALL.

BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

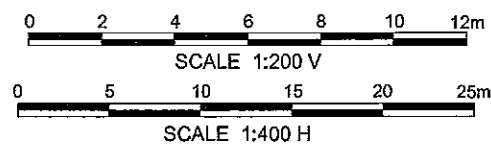
EXISTING CONDITIONS				 METRIC SCALE 1:1,500
NC17C BACKSLOPE SLUMPS REPAIR HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB				
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	DATE: OCT. , 2006
15-85-42-A	1 OF 6	NORTH CENTRAL	7332/06	
 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				



SECTION A-A'



SECTION B-B'



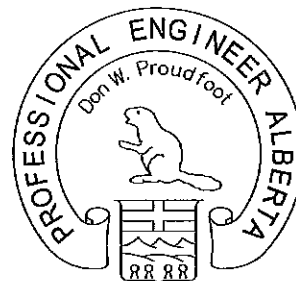
LEGEND

WATER LEVEL MEASURED DURING HAND AUGERING BETWEEN MAY 26 AND JUNE 5, 2006

NOTES:

1. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE HAND AUGER LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN AUGERHOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.
2. SLIDE CROSS-SECTIONS WERE OBTAINED FROM TOPO SURVEY BY EXH ENGINEERING SERVICES LIMITED 2006.

PERMIT TO PRACTICE
 THURBER ENGINEERING LTD.
 Signature _____
 Date _____
 PERMIT NUMBER: P 5186
 The Association of Professional Engineers,
 Geologists and Geophysicists of Alberta



P. ENG
 DATE _____

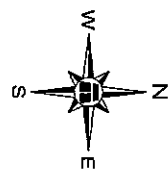
BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

CROSS-SECTION A-A' & B-B'				
NC17C BACKSLOPE SLUMPS REPAIR				
		HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB		SCALE
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	DATE: OCT. , 2006
15-85-42-B	2 OF 6	NORTH CENTRAL	7332/06	



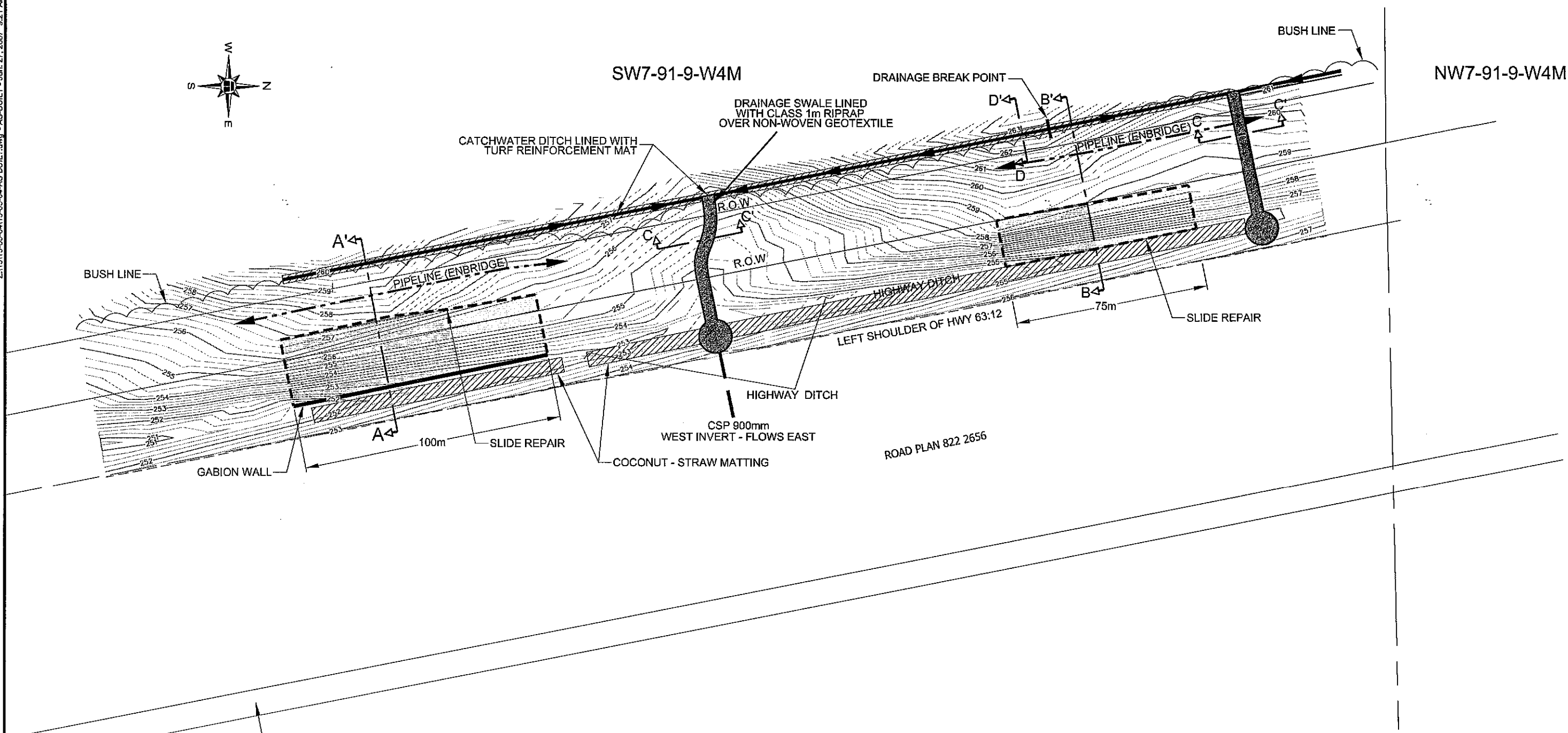
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SW7-91-9-W4M

NW7-91-9-W4M

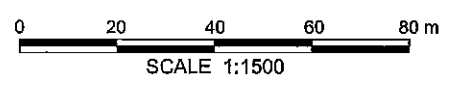


ROAD PLAN 822 2656

10.00 NORTHWESTERN UTILITIES LTD. PLAN 872 0984

NOTE

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BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

THURBER PROJECT #15-85-42

AS-BUILT PLAN

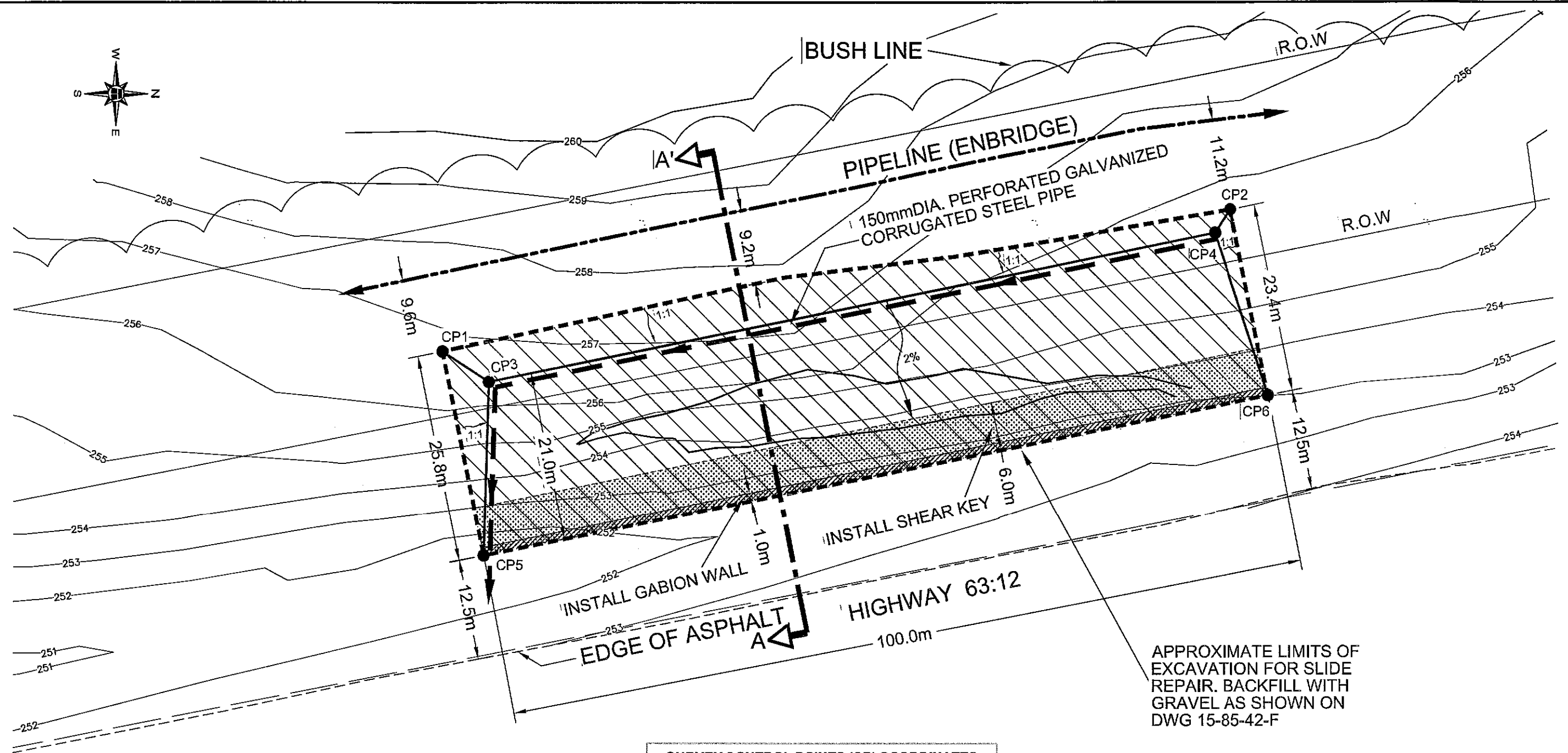
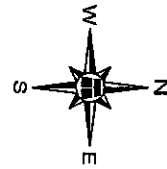


NC17C BACKSLOPE SLUMPS REPAIR		HWY 63:12, km 11.3 - 11.6 FORT McMURRAY, AB	
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.
15-85-64-AS-BUILT	1 OF 1	NORTH CENTRAL	7332/06

SCALE
1:1,500
DATE: JUNE 2007







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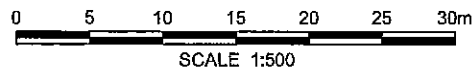


APPROXIMATE LIMITS OF EXCAVATION FOR SLIDE REPAIR. BACKFILL WITH GRAVEL AS SHOWN ON DWG 15-85-42-F



SURVEY CONTROL POINTS (CP) COORDINATES			
CP	NORTHING	EASTING	ELEVATION (m)
CP1	6344.69	72848.67	256.785
CP2	6443.17	72831.13	255.729
CP3	6350.49	72852.43	252.006
CP4	6441.25	72834.02	253.244
CP5	6349.83	72874.00	251.520
CP6	6447.83	72854.11	253.010

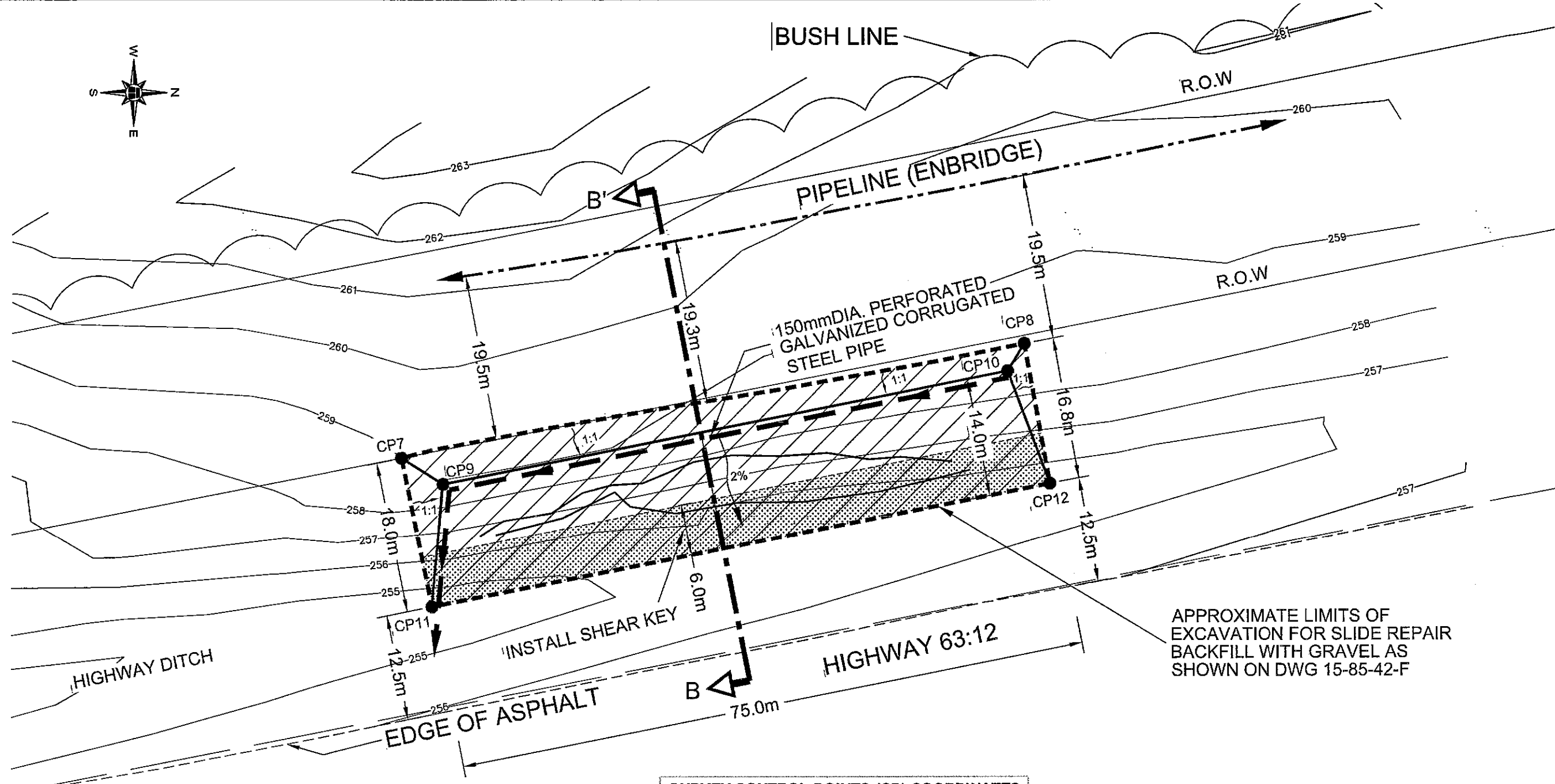
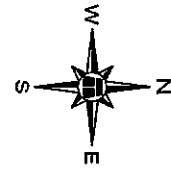
LEGEND

-  OR 1:1 DESIGN SLOPE OF UNDERSIDE OF BACKFILL ZONE
-  AREA OF EXCAVATION
-  GRAVEL SHEAR KEY LIMITS
-  GABBION WALL LIMITS



BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.




DESIGN PLAN - SOUTH SLUMP			 METRIC	
NC17C BACKSLOPE SLUMPS REPAIR HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB				
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	SCALE
15-85-42-D	4 OF 6	NORTH CENTRAL	7332/06	1:500
 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				DATE: OCT. , 2006

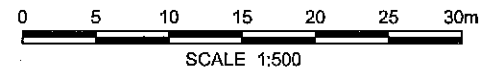


SURVEY CONTROL POINTS (CP) COORDINATES



CP	NORTHING	EASTING	ELEVATION (m)
CP7	6620.78	72802.95	258.988
CP8	6694.94	72789.43	258.685
CP9	6625.72	72806.04	255.043
CP10	6692.92	72792.66	255.879
CP11	6624.39	72820.58	254.711
CP12	6697.95	72805.94	255.629

LEGEND

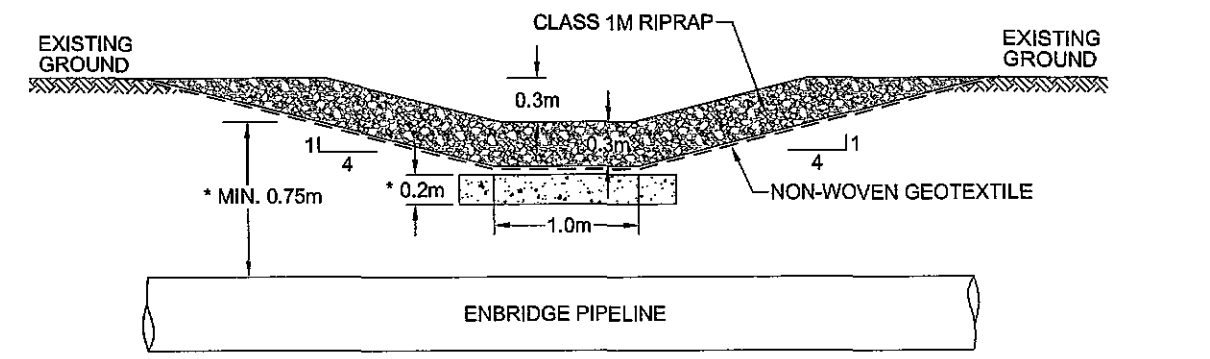
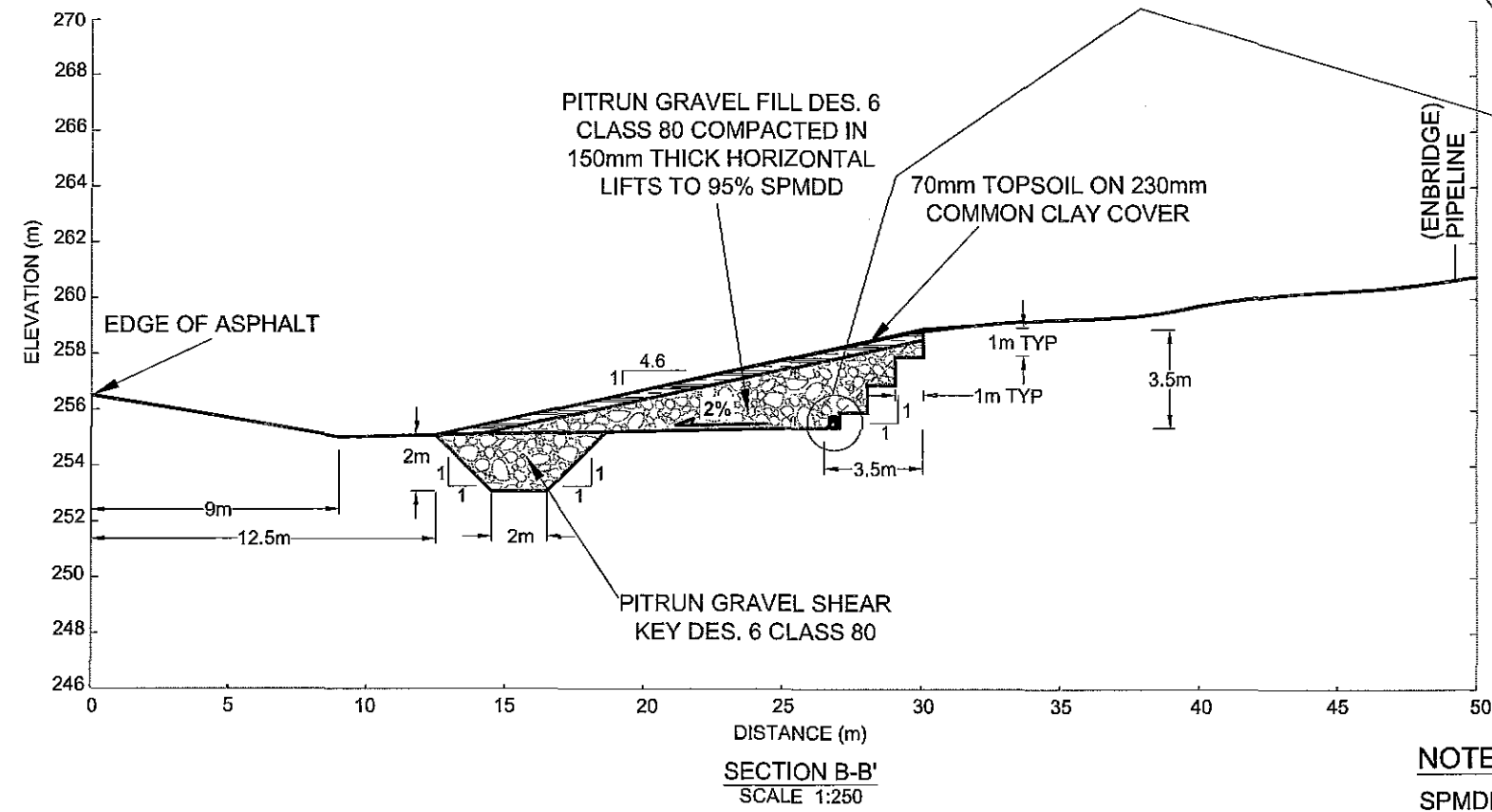
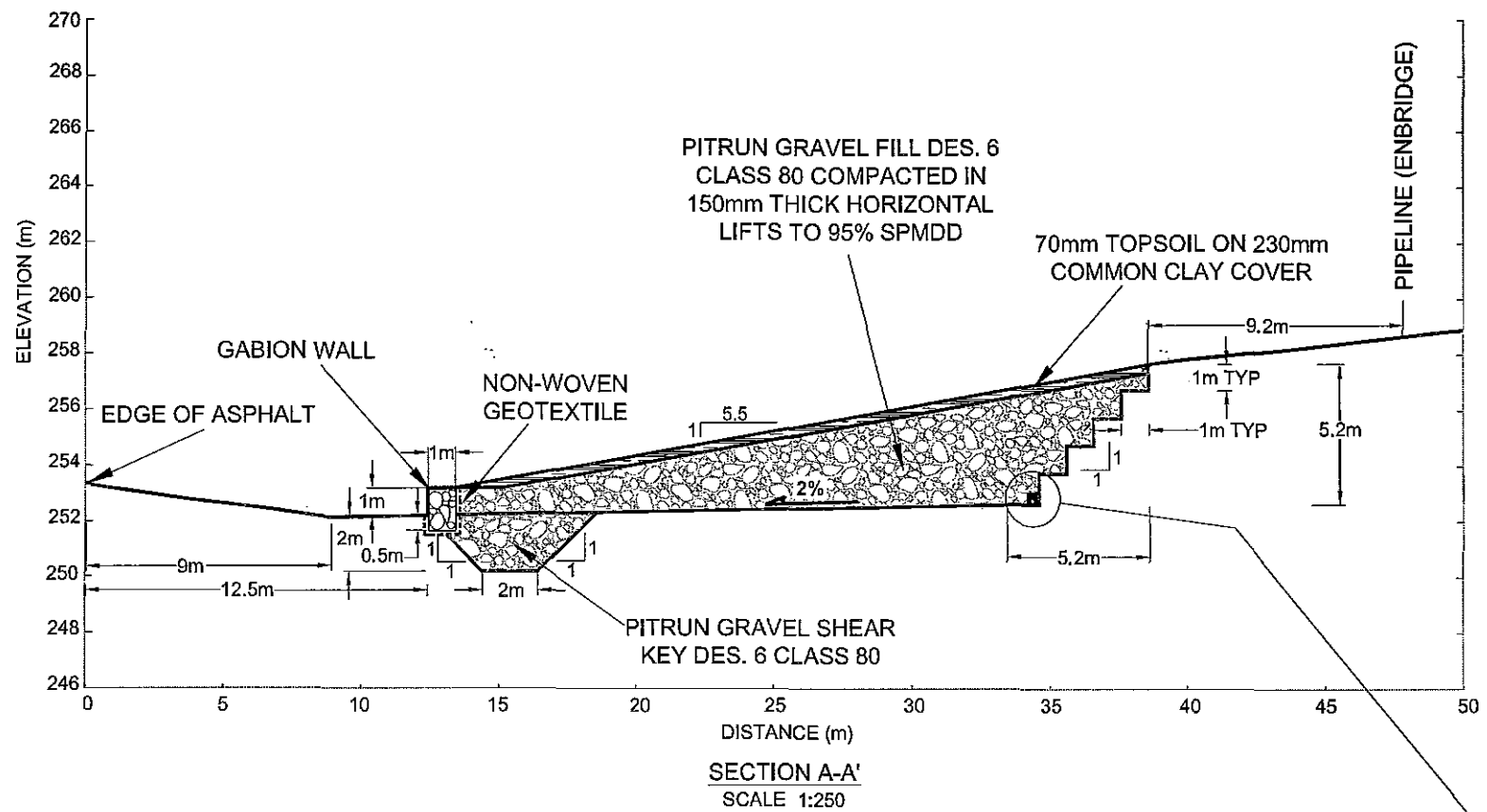
-  OR 1:1 DESIGN SLOPE OF UNDERSIDE OF BACKFILL ZONE
-  AREA OF EXCAVATION
-  GRAVEL SHEAR KEY LIMITS



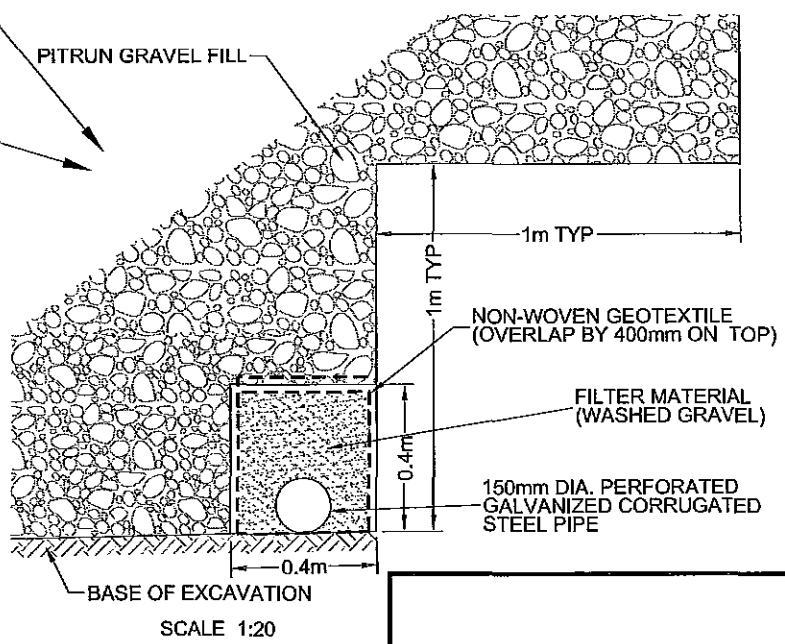
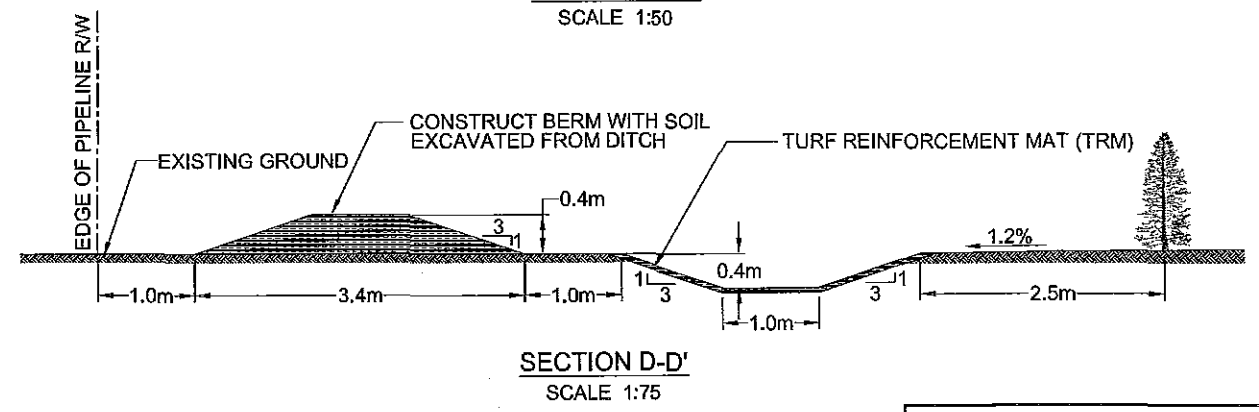
BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

DESIGN PLAN - NORTH SLUMP				 METRIC
NC17C BACKSLOPE SLUMPS REPAIR				
HWY 63:12, KM 11.3 - 11.6 FORT McMURRAY, AB		SCALE		1:500
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	DATE: OCT. , 2006
15-85-42-E	5 OF 6	NORTH CENTRAL	7332/06	
 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				

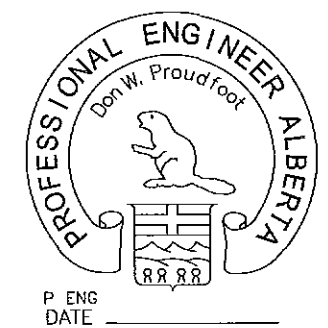
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NOTE: * WHERE EVER THE 0.75m SEPERATION BETWEEN THE TOP OF THE RIPRAP AND THE TOP OF THE PIPELINE CANNOT BE MAINTAINED A 200mm THICK X2.5m X3m CONCRETE SLAB MUST BE INSTALLED.



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Date _____
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DESIGN STRATIGRAPHIC CROSS SECTIONS

NOTE
SPMDD = STANDARD PROCTOR
MAXIMUM DRY DENSITY

DESIGN CROSS-SECTIONS AND DETAILS

NC17C BACKSLOPE SLUMPS REPAIR HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB

DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	SCALE
15-85-42-F	6 OF 6	NORTH CENTRAL	7332/06	AS SHOWN

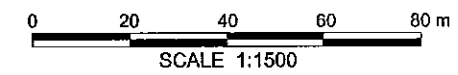
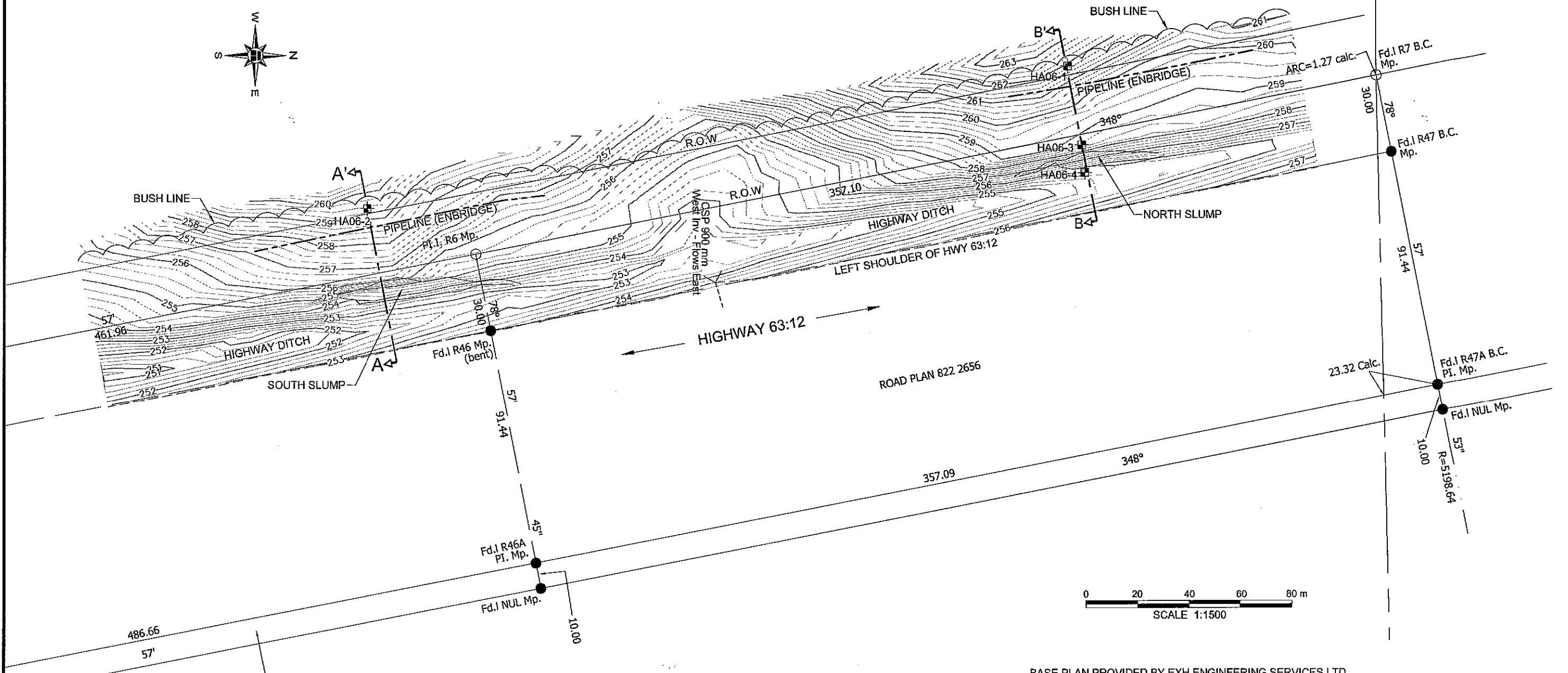
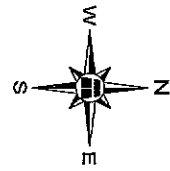
DATE: OCT. , 2006

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SW7-91-9-W4M

NW7-91-9-W4M



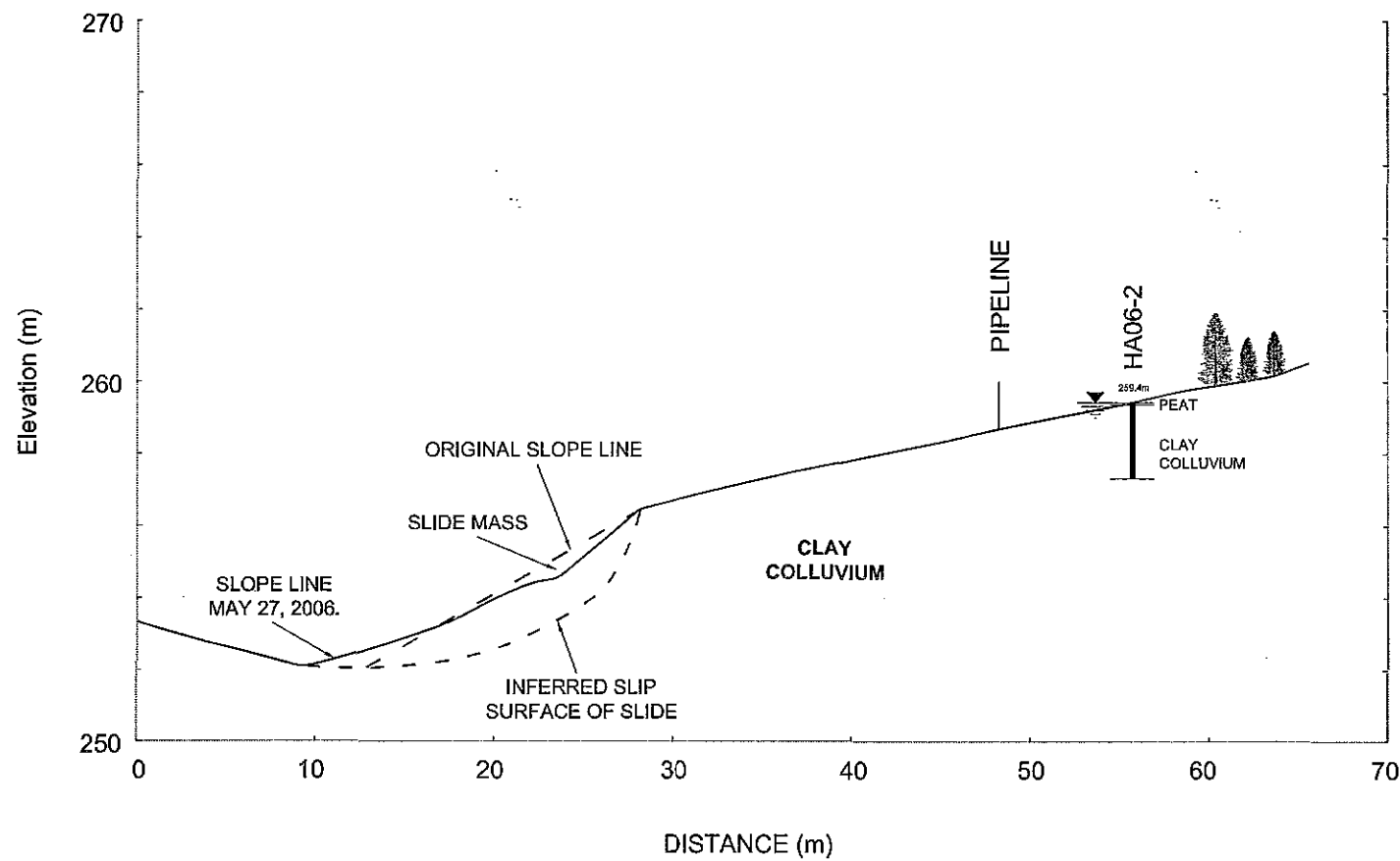
10.00 NORTHWESTERN UTILITIES LTD. PLAN 872 0984

LEGEND
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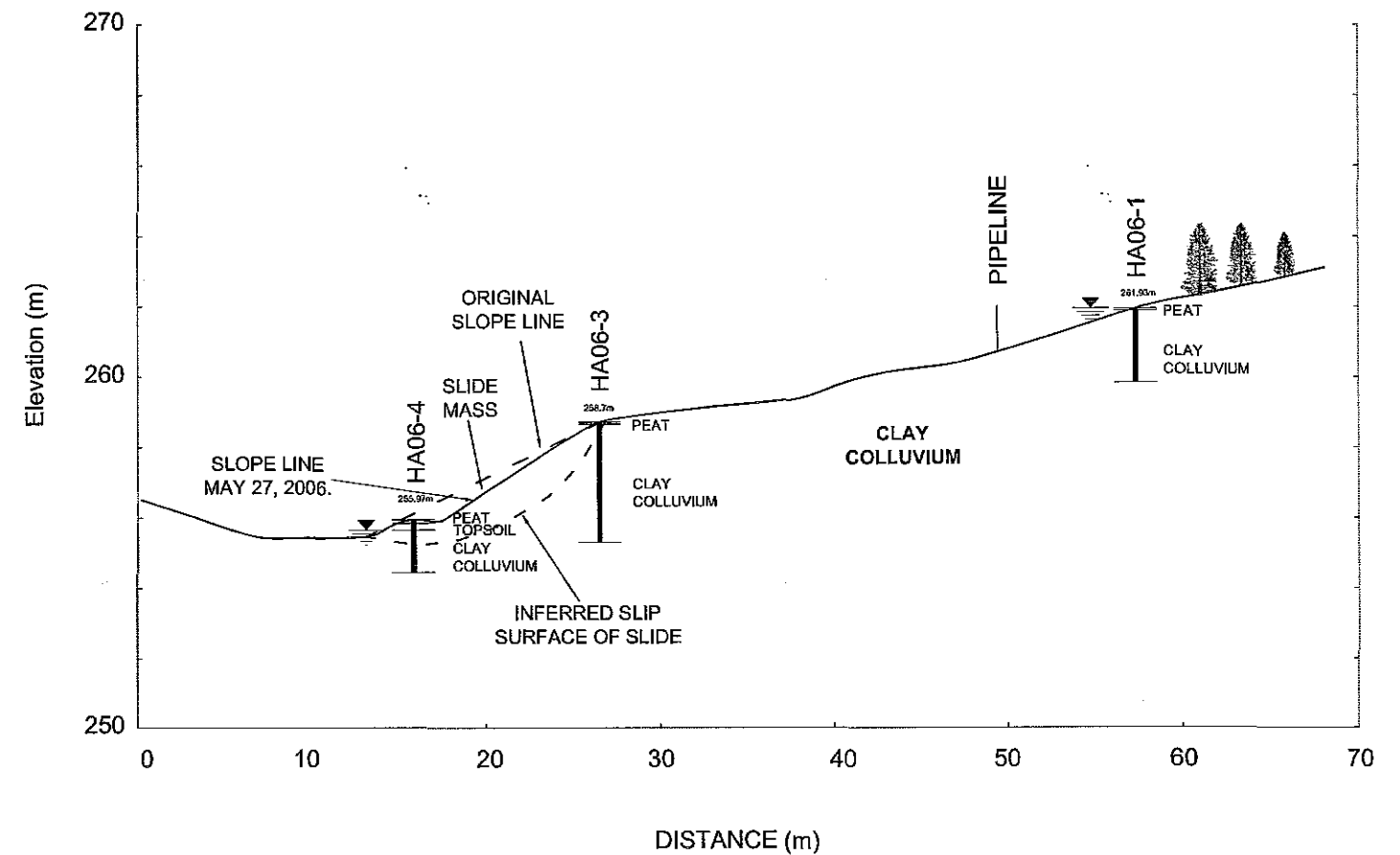
NOTE
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BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

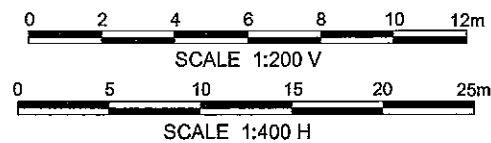
EXISTING CONDITIONS				 METRIC SCALE 1:1,500
NC17C BACKSLOPE SLUMPS REPAIR HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB				
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	DATE: OCT. , 2006
15-85-42-A	1 OF 6	NORTH CENTRAL	7332/06	
 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				



SECTION A-A'



SECTION B-B'



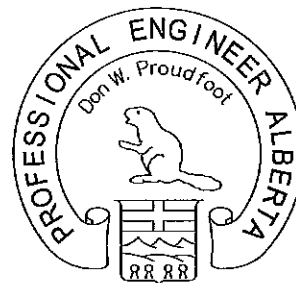
LEGEND

WATER LEVEL MEASURED DURING HAND AUGERING BETWEEN MAY 26 AND JUNE 5, 2006

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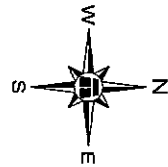


P. ENG
 DATE _____

BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

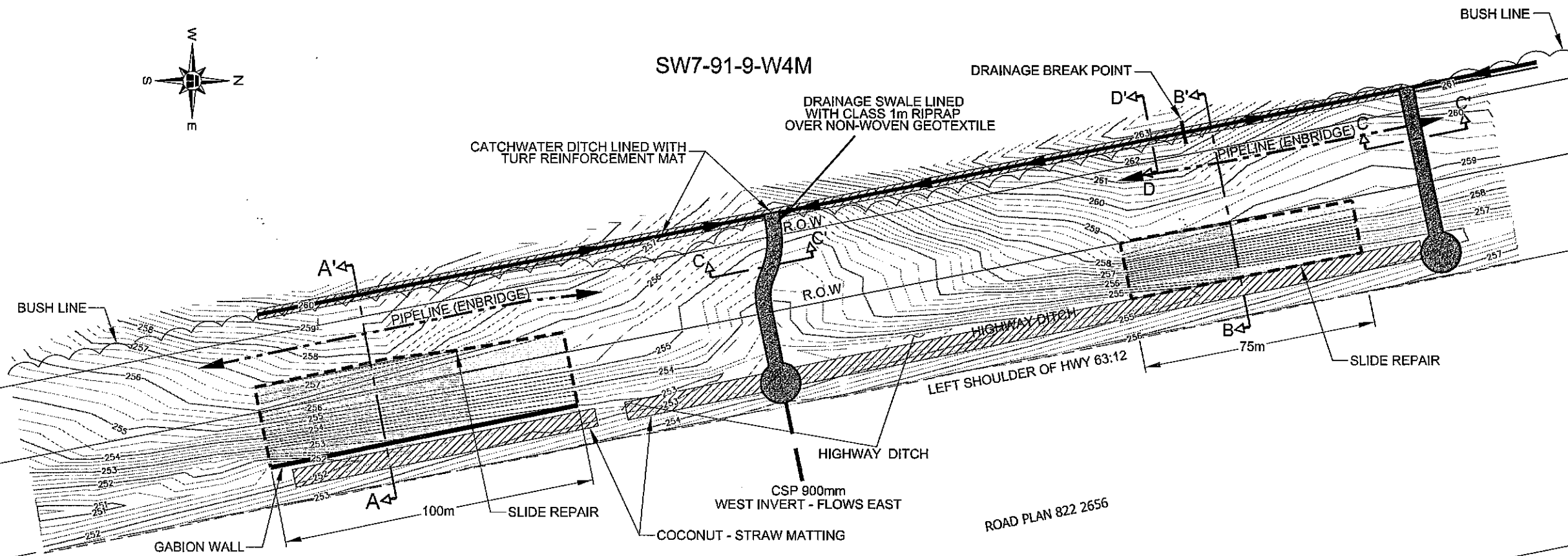
CROSS-SECTION A-A' & B-B'				 METRIC SCALE
NC17C BACKSLOPE SLUMPS REPAIR		HWY 63:12, KM 11.3 - 11.6 FORT McMURRAY, AB		
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	DATE: OCT. , 2006
15-85-42-B	2 OF 6	NORTH CENTRAL	7332/06	
 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				

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SW7-91-9-W4M

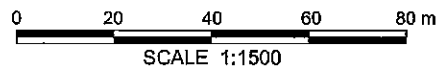
NW7-91-9-W4M



10.00 NORTHWESTERN UTILITIES LTD. PLAN 872 0984

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BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

THURBER PROJECT #15-85-42

AS-BUILT PLAN

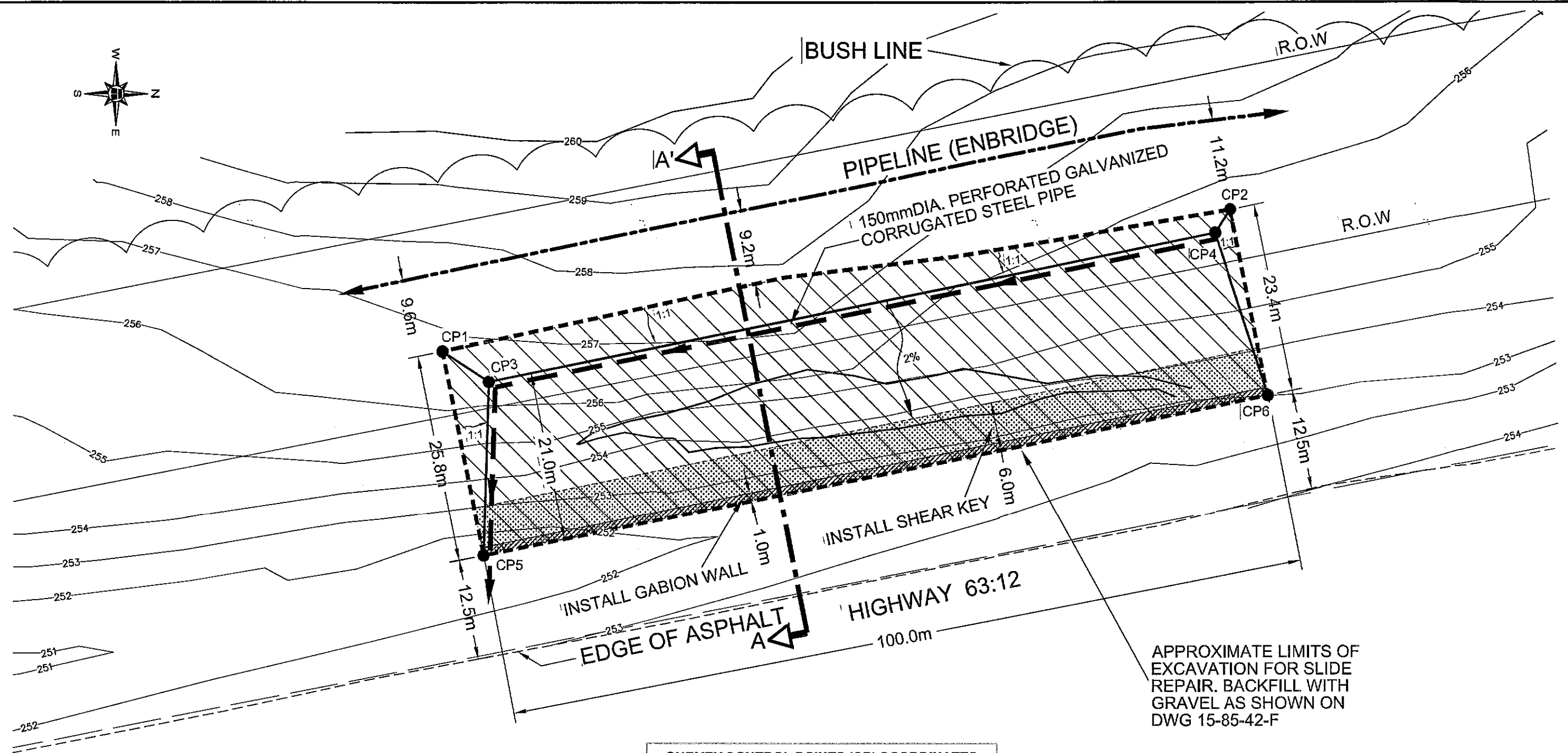
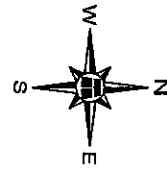


NC17C BACKSLOPE SLUMPS REPAIR		HWY 63:12, km 11.3 - 11.6 FORT McMURRAY, AB	
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.
15-85-64-AS-BUILT	1 OF 1	NORTH CENTRAL	7332/06

SCALE
1:1,500
DATE: JUNE 2007







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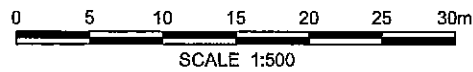


APPROXIMATE LIMITS OF EXCAVATION FOR SLIDE REPAIR. BACKFILL WITH GRAVEL AS SHOWN ON DWG 15-85-42-F



SURVEY CONTROL POINTS (CP) COORDINATES			
CP	NORTHING	EASTING	ELEVATION (m)
CP1	6344.69	72848.67	256.785
CP2	6443.17	72831.13	255.729
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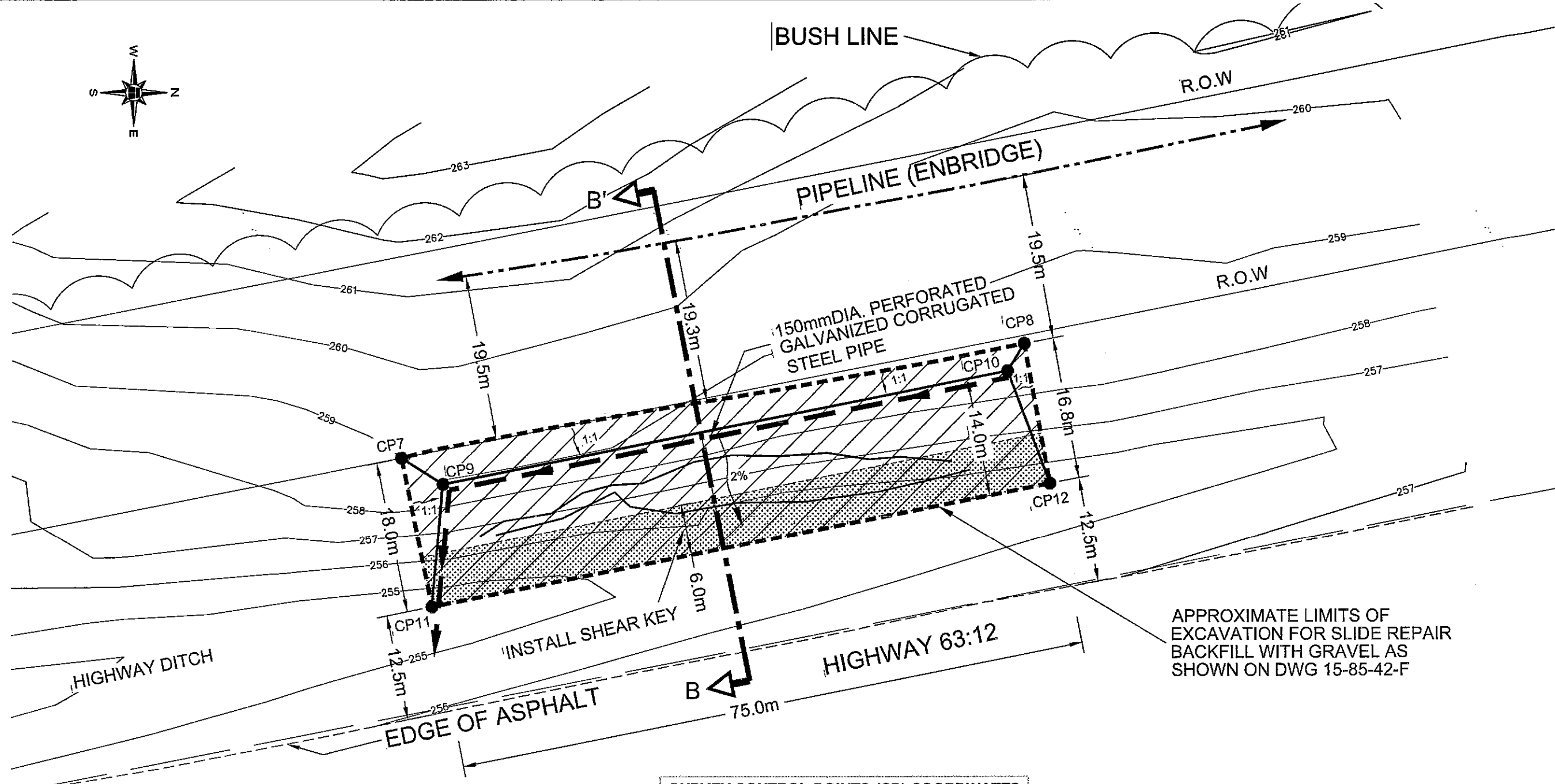
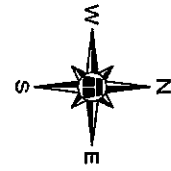
LEGEND

-  OR 1:1 DESIGN SLOPE OF UNDERSIDE OF BACKFILL ZONE
-  AREA OF EXCAVATION
-  GRAVEL SHEAR KEY LIMITS
-  GABBION WALL LIMITS



BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

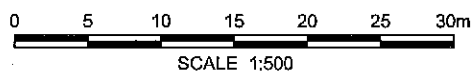
DESIGN PLAN - SOUTH SLUMP			 METRIC
NC17C BACKSLOPE SLUMPS REPAIR			
HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB			SCALE
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.
15-85-42-D	4 OF 6	NORTH CENTRAL	7332/06
			DATE: OCT. , 2006
 THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS			



APPROXIMATE LIMITS OF EXCAVATION FOR SLIDE REPAIR BACKFILL WITH GRAVEL AS SHOWN ON DWG 15-85-42-F

SURVEY CONTROL POINTS (CP) COORDINATES			
CP	NORTHING	EASTING	ELEVATION (m)
CP7	6620.78	72802.95	258.988
CP8	6694.94	72789.43	258.685
CP9	6625.72	72806.04	255.043
CP10	6692.92	72792.66	255.879
CP11	6624.39	72820.58	254.711
CP12	6697.95	72805.94	255.629

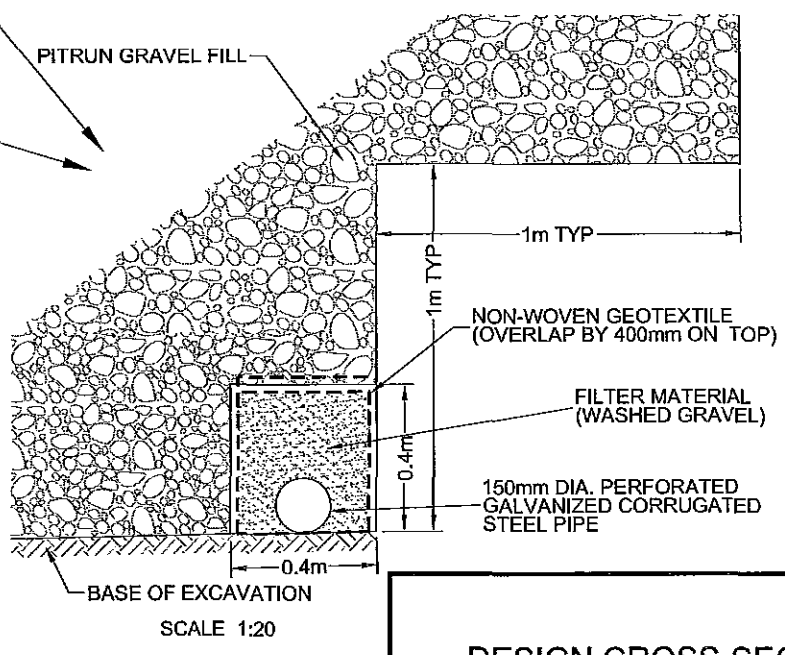
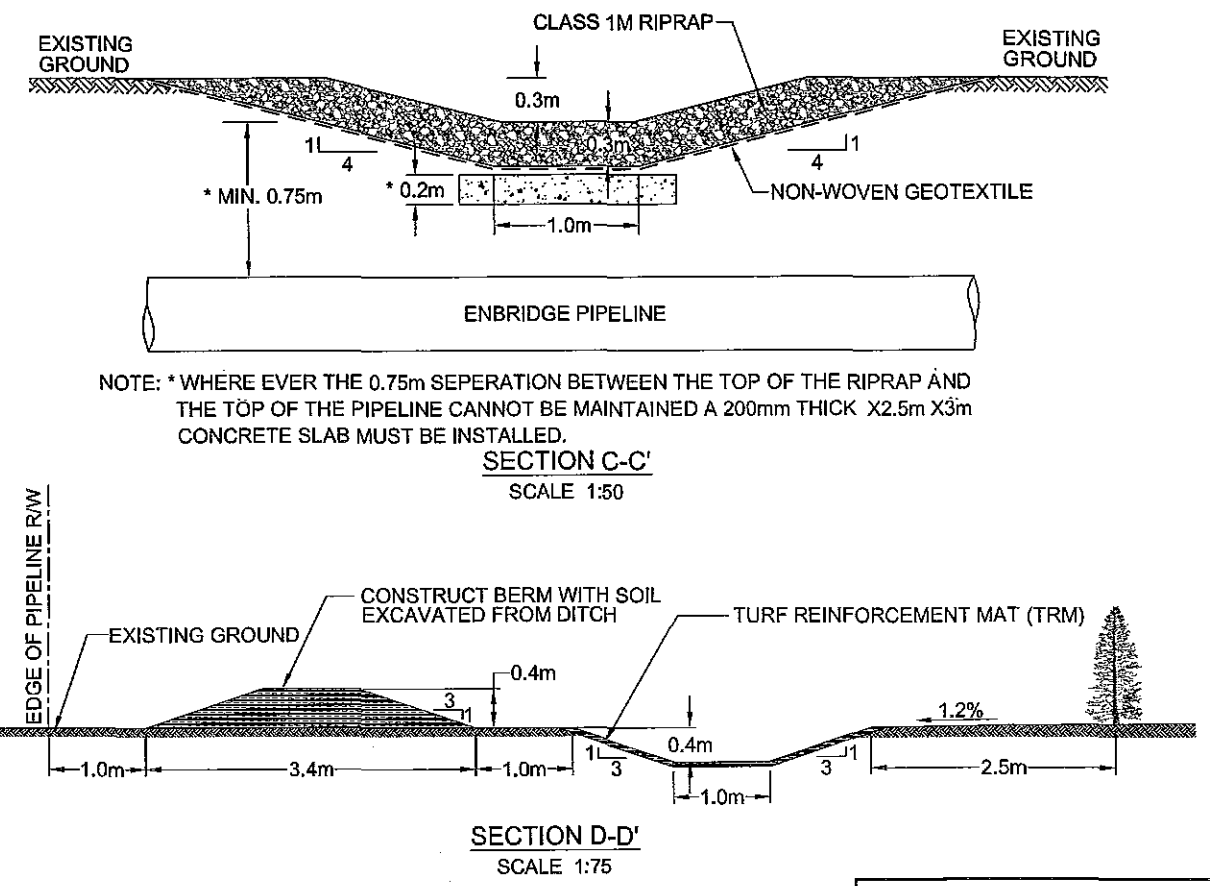
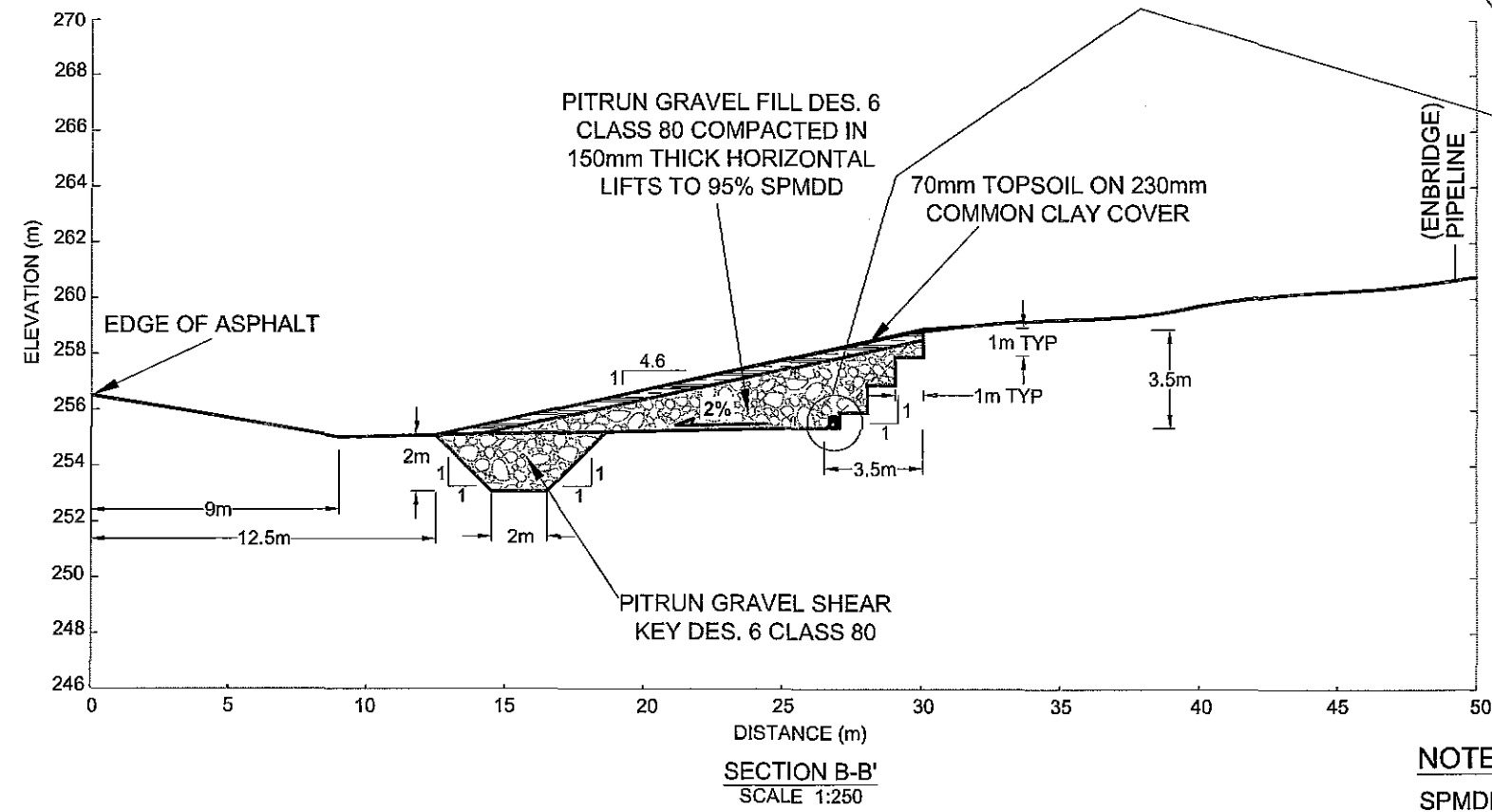
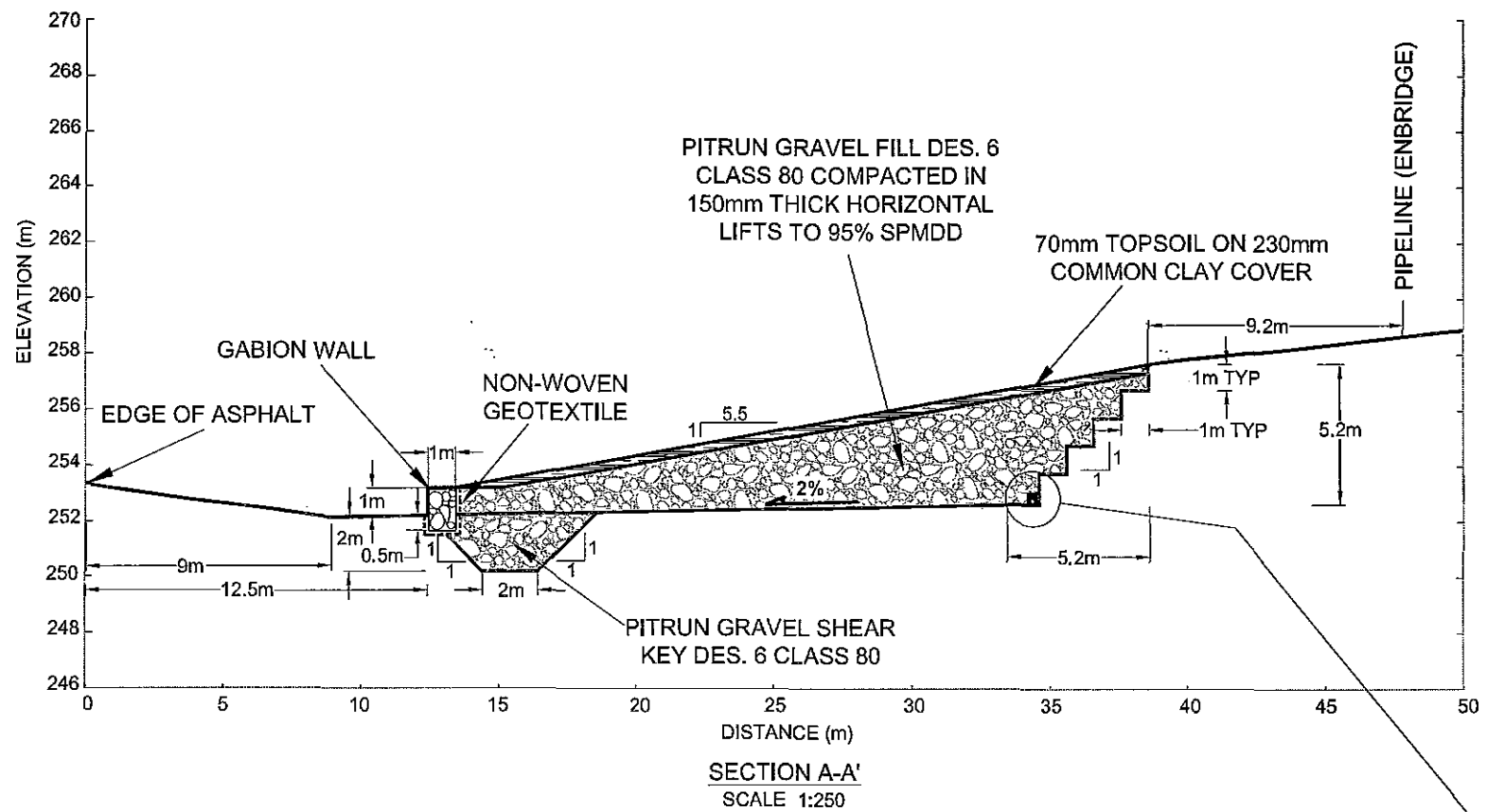
- LEGEND**
- 2% OR 1:1 DESIGN SLOPE OF UNDERSIDE OF BACKFILL ZONE
 - AREA OF EXCAVATION
 - GRAVEL SHEAR KEY LIMITS



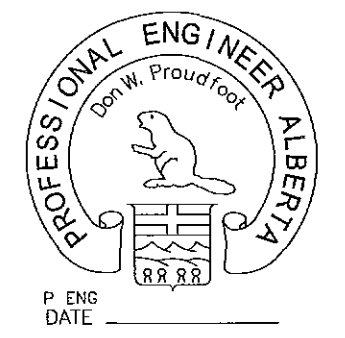
BASE PLAN PROVIDED BY EXH ENGINEERING SERVICES LTD.

DESIGN PLAN - NORTH SLUMP				
NC17C BACKSLOPE SLUMPS REPAIR HWY 63:12, KM 11.3 - 11.6 FORT McMURRAY, AB				
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	SCALE
15-85-42-E	5 OF 6	NORTH CENTRAL	7332/06	1:500
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				DATE: OCT. , 2006

Z:\1515-85-42\15-85-42-F.dwg



PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
Signature _____
Date _____
PERMIT NUMBER: P 5186
The Association of Professional Engineers,
Geologists and Geophysicists of Alberta



DESIGN STRATIGRAPHIC CROSS SECTIONS

NOTE
SPMDD = STANDARD PROCTOR
MAXIMUM DRY DENSITY

DESIGN CROSS-SECTIONS AND DETAILS				
NC17C BACKSLOPE SLUMPS REPAIR				
HWY 63:12, KM 11.3 - 11.6 FORT MCMURRAY, AB				
DWG. NO.	SHEET	DISTRICT	CONTRACT NO.	
15-85-42-F	6 OF 6	NORTH CENTRAL	7332/06	SCALE AS SHOWN
				DATE: OCT., 2006
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS				



Photo 1 - Repaired North Slump Area and swale.



Photo 2 - Repaired South Slump Area.



Photo 3 - Highway Ditch in Regraded Section.



Photo 4 - Catchwater Ditch and Shallow Berm at Top of Cleared Slope.



Photo 5 - Armoured Swale Between the Repaired Slump Areas.