



November 14, 2003

Alberta Transportation
Central Region
#401, 4902 – 51 Street
Red Deer, Alberta
T4N 6K8

Mr. Melvin Mayfield, P.Eng.
Project Engineer

Dear Mr. Mayfield:

Central Region Landslide Assessment Site C2
SH575:04 Nacmine Slide
November 2003 Instrumentation Monitoring Report

Alberta Transportation has initiated a process of risk management at specific slope movement sites that includes a 3-ring binder document control system. This Bi-annual Instrumentation Monitoring report forms Section C of the document control system for the above site. The instruments were read by Mr. Joel Hilderman, EIT, of Klohn Crippen Consultants Ltd. on October 31, 2003.

This report was prepared by Klohn Crippen Consultants Ltd. for Alberta Transportation Central Region under Contract No. CE053/2000.

1. PROJECT BACKGROUND

The town of Nacmine is situated in the flood plain of the Red Deer River and has been the site of intense coal mining activity. Based on information provided by Alberta Transportation and EUB, a mine known as #1473 exists directly under the slide area. The mine plans indicate that some rooms were depillared, which is the removal of roof support to collapse the room, while some were not. The main shafts were also heavily timbered and likely remain open today. Secondary shafts and rooms that were not depillared are subject to collapse at any time. Based on a review of the coal seam records, it is inferred that the mine rooms are about 60 m below the road elevation or about elevation 630 m.

SH575 is located between the town and the valley slopes to the south. The slide area is located on the south side of SH575 and extends for a length of about 400 m (Sta. 33+600 – Sta. 34+000). The slide was first observed in 1991 and has required periodic removal of material from the south highway ditch. An estimated 1 m thickness of material per year was removed from the ditch in the early years, but this has steadily reduced to periodic cleaning only.

Conjectured reasons for the slope failure include the build up of water in and the collapse of underground mine workings resulting in settlement and lateral movement of the slope. This could have been initiated due to the side slope cut (about 6 m) in 1985 for construction of the new highway alignment.

The hillside stratigraphy consists of interbedded sands, silts, clays and clayshales with occasional coal seams overlying shale bedrock. The bedrock was located at depths below the slope varying from 15 m to 30 m and was observed to contain slickensided surfaces. Clays and clayshales were typically of medium to high plasticity.

It is understood that the parcel of land containing the slide has recently been sold by Alberta Transportation.

The slide location, site plan, instrument location plan and cross sections are illustrated on Figures 1 to 3.

2. SITE OBSERVATIONS

In total, twelve inclinometers were installed in 1993-1994, designated as SI #1 to SI #12 inclusive. SI #1 to #8 and #11 have sheared due to slope movements at the depths shown on Figures 2 and 3.

Three inclinometers remain operational and are in good condition as noted on the attached "Field Summary of Instrumentation Monitoring Form". The following data plots are provided for Section D of the document control system for SI #9 and #10 on the north side of the road, and SI #12 on the south side of the road:

- Cumulative and incremental displacement in A direction on same page.
- Cumulative and incremental displacement in B direction on same page.
- Resolved single movement vector plots

Comments on the SI data are provided below:

SI #9

No movement was observed in this reporting period.

SI #10

A very small movement (~1 mm) was observed in this reporting period. The total resolved deflection to the northeast at the surface is about 30 mm.

SI #12

No observed movement in this reporting period. The total resolved deflection to the northeast at the surface is about 50 mm.

The previously observed subsidence cracks were not inspected during this visit.

3. INTERPRETATION

Based on a review of this inspection and previous site observations, the following assessment is provided:

- There is evidence of subsidence cracking in the slopes, possibly related to the collapse of old mine rooms. There is also extensive evidence of historic landslide activity in the valley slopes, but there is no sign of imminent slope instability that extends below highway level.
- The movements to date in the inclinometers immediately adjacent to the highway have been relatively small and cannot be seen as a deflection in the highway alignment. Movements have occurred above the highway on the south side due most likely to the ditch excavation work in recent years. Despite the ditch cleaning, it would appear that the rate of slope movement at the toe has declined or ceased for the present.
- The toe section of the slope is showing signs of cracking and slumping that is likely related to seepage softening the lower zone of the slope.
- Based on the risk level criteria provided by Alberta Transportation, a risk rating of 28 has been assigned to this site. This is based on a probability factor of 7 for an inactive slide but with high uncertainty, and a consequence factor of 4 due to the height of the slope and the possible affect on the highway.

4. **RECOMMENDATIONS**

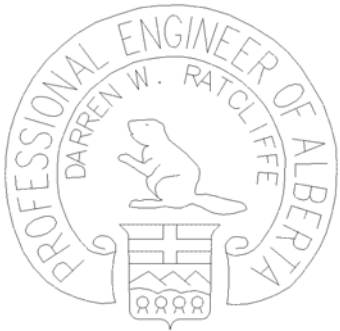
The slumping of the ditch slopes should be monitored and the ditches cleaned out as required to ensure the free flow of water. On-going maintenance in this area is expected. However, a power pole is located in this area and the clean up work of the ditch should be assessed to prevent the undermining of the pole.

The site should be periodically monitored for any signs of distress as a result of any development work carried out by the new landowner.

Please contact the undersigned if you have any questions regarding this report.

Yours truly,

KLOHN CRIPPEN CONSULTANTS LTD.



Darren Ratcliffe, P.Eng.
Senior Geotechnical Engineer

Reviewed by Tim Eaton, P.Eng.
Senior Reviewer

APEGGA Permit to Practice No. 433

FIGURES

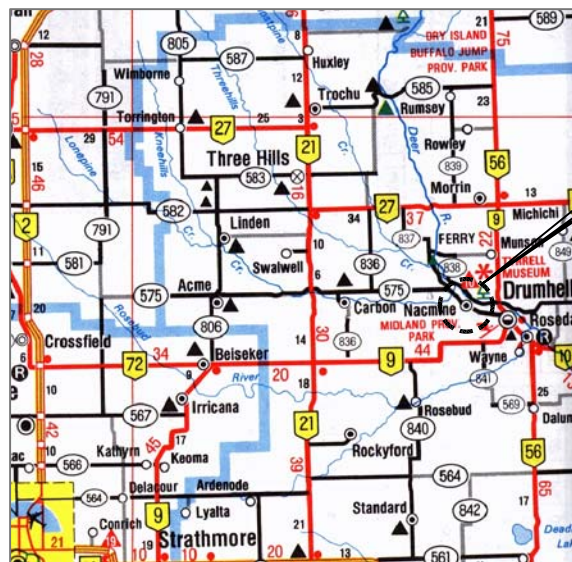
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PWSS PLAN No.

DRAWING No.

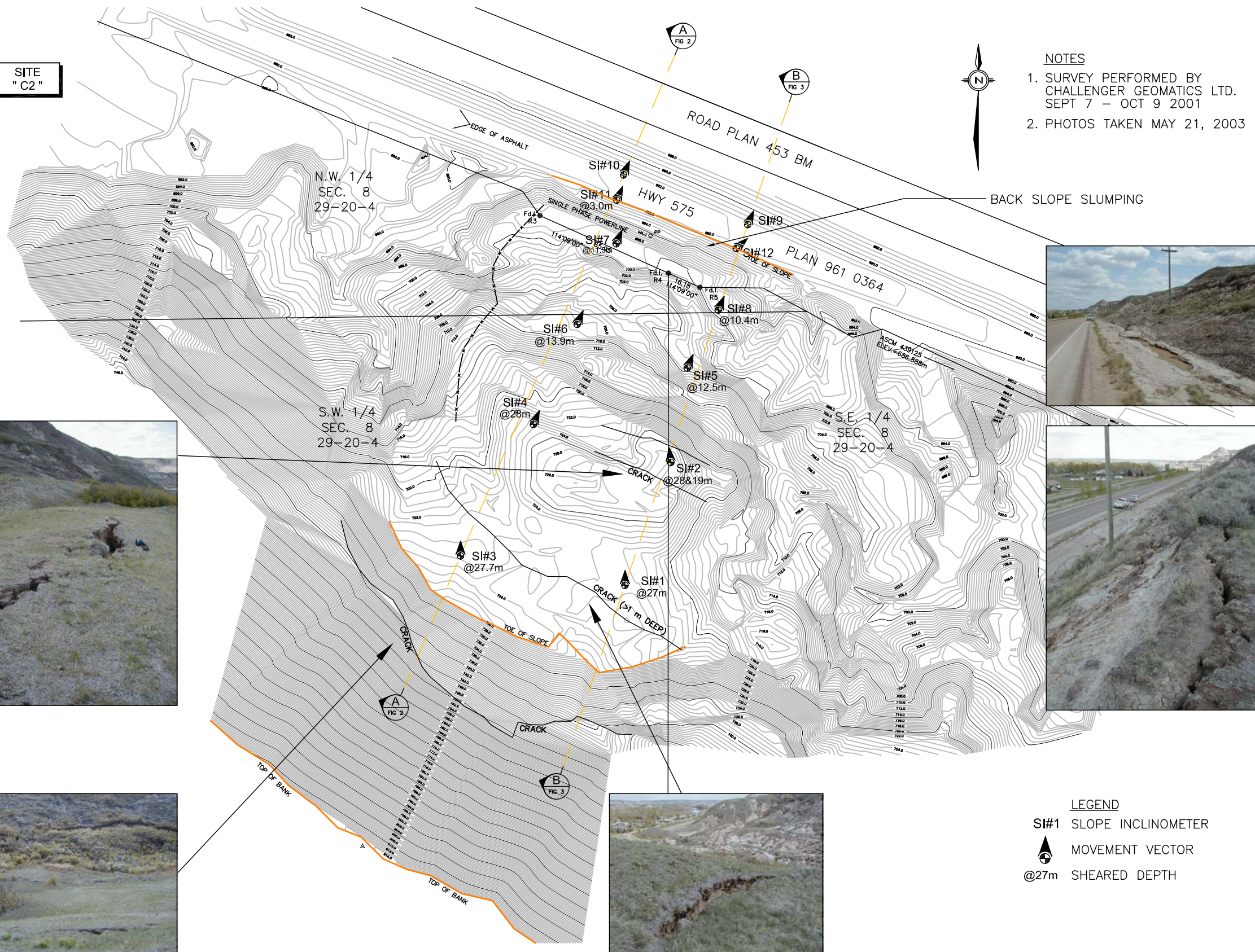
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KEY MAP
N.T.S.

SITE "C2"



- NOTES
1. SURVEY PERFORMED BY CHALLENGER GEOMATICS LTD. SEPT 7 - OCT 9 2001
 2. PHOTOS TAKEN MAY 21, 2003

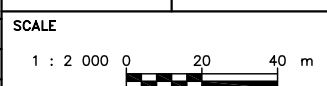


AERIAL VIEW
JULY 7, 1999



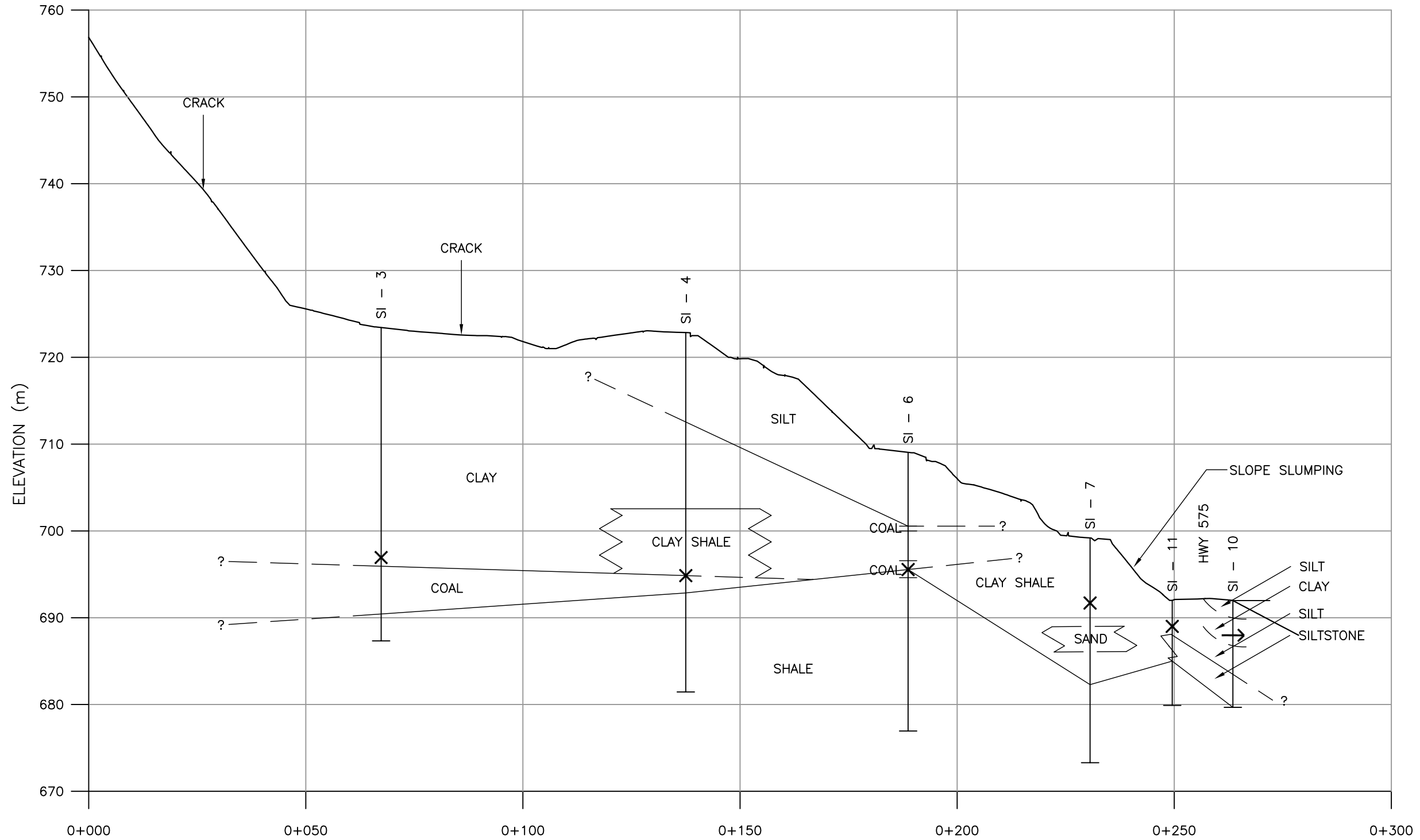
- LEGEND
- SI#1 SLOPE INCLINOMETER
 - ▲ MOVEMENT VECTOR
 - @27m SHEARED DEPTH

PERMIT	SEAL	<table border="1"> <tr><td>Ⓐ</td><td></td><td></td><td></td><td></td></tr> <tr><td>Ⓑ</td><td></td><td></td><td></td><td></td></tr> <tr><td>Ⓒ</td><td>NOV. 03 INSPECTION</td><td>NOV. 03</td><td>M.D.</td><td>D.W.R.</td></tr> <tr><td>Ⓓ</td><td>MAY 03 INSPECTION</td><td>MAY 03</td><td>M.D.</td><td>D.W.R.</td></tr> <tr><td>Ⓔ</td><td>NOV 02 INSPECTION</td><td>NOV 02</td><td>M.D.</td><td>D.W.R.</td></tr> <tr><td>Ⓕ</td><td>MAY 02 SITE VISIT</td><td>MAY 02</td><td>N.R.K.</td><td>D.W.R.</td></tr> <tr> <th>MARK</th> <th>DESCRIPTION OF REVISIONS</th> <th>DATE</th> <th>DWN.</th> <th>ENG.</th> </tr> </table>	Ⓐ					Ⓑ					Ⓒ	NOV. 03 INSPECTION	NOV. 03	M.D.	D.W.R.	Ⓓ	MAY 03 INSPECTION	MAY 03	M.D.	D.W.R.	Ⓔ	NOV 02 INSPECTION	NOV 02	M.D.	D.W.R.	Ⓕ	MAY 02 SITE VISIT	MAY 02	N.R.K.	D.W.R.	MARK	DESCRIPTION OF REVISIONS	DATE	DWN.	ENG.	DESIGNED BY DWR	APPROVED BY	CONSULTANT	PROJECT CENTRAL REGION
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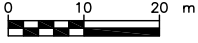
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TOP OF BANK AT 814m



SECTION A
FIG 1

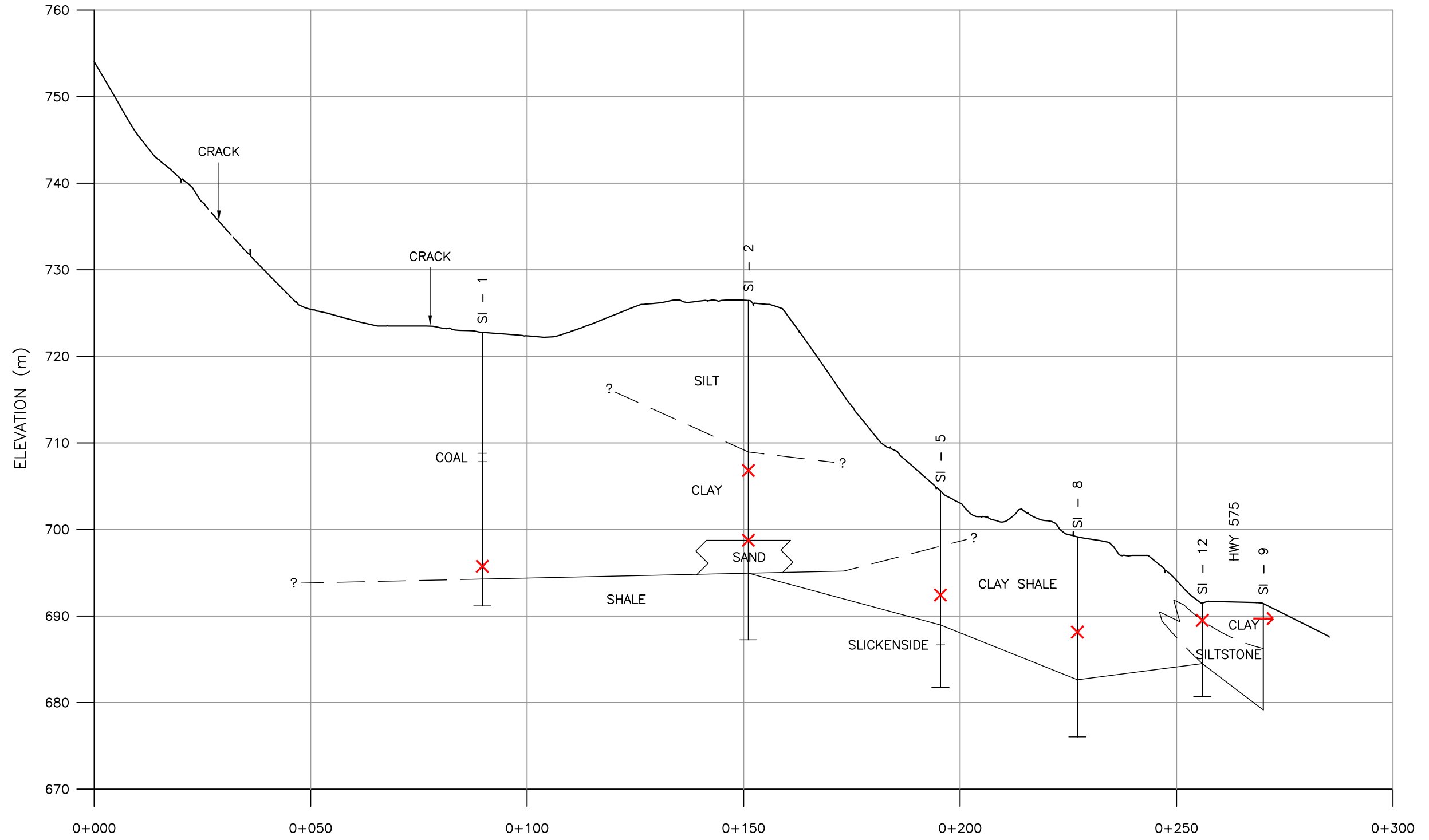
X SHEAR ZONE
→ MOVEMENT ZONE

PERMIT	SEAL					DESIGNED BY NE	APPROVED BY	CONSULTANT
						DRAWN BY JD	CHECKED BY	 
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		MAY 03 INSPECTION	MAY 03	M.D.	D.W.R.			
		NOV 02 INSPECTION	NOV 02	M.D.	D.W.R.			
		MAY 02 SITE VISIT	MAY 02	N.R.K.	D.W.R.			
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				LANDSLIDE RISK ASSESSMENT			
TITLE				SITE : C2 NACMINE SLIDE SECTION ' A '			
DATE	SHEET	DRAWING No.	REV.	DATE	SHEET	DRAWING No.	REV.
NOV. 2003	2 of 3	FIGURE 2	D				



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TOP OF BANK AT 814m



SECTION B
FIG 1

- ✕ SHEAR ZONE
- ➔ MOVEMENT ZONE

PERMIT	SEAL	Ⓐ				DESIGNED BY	APPROVED BY	CONSULTANT			PROJECT	CENTRAL REGION			
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		Ⓓ	MAY 03 INSPECTION	MAY 03	M.D.	D.W.R.							SECTION ' B '		
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		Ⓕ	MAY 02 SITE VISIT	MAY 02	N.R.K.	D.W.R.			NOV. 2003	3 of 3	FIGURE 3	D			
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