LANDSLIDES IN THE CHARLIE LAKE MAP SHEET, FORT ST. JOHN

by

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B.Sc., The University of Waterloo, 2001

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE STUDIES

(Department of Earth and Ocean Sciences)
(Geological Engineering Program)

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

September, 2004

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Title of Thesis: LANDSLIDES IN THE CHARLIE LAKE MAP SHEET, FORT ST. JOHN

Degree: MASTERS SCIENCE Year: 2004

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Abstract

Many large, deep-seated landslides have occurred along the Peace River Valley and its steep-sided tributary valleys. These failures mostly occur within the Lower Cretaceous Shaftesbury Formation, a horizontally-bedded marine shale and the interglacial silt and clay beds in the Quaternary sequence.

A detailed inventory of landslides was compiled in the Fort St. John area, using air photo interpretation and engineering-geological field mapping. The study area is on NTS Map Sheet 94A, comprising 14,000 km^2 of terrain. Practically all slope activity in the study area occurs on slopes of stream valleys. The observed landslides were separated into a series of failure types, involving bedrock, Quaternary deposits or both. The estimated areas of individual slide units range up to approximately 10,000 m^2 and volumes to 10,000,000 m^2. The result of the inventory is a digital landslide map at a 1:20,000 scale and a corresponding database of landslide characteristics.

The main focus of the typological classification is the failure mechanism. The classification was reinforced by more detailed field study of selected type cases. There is a prevalence of multi-level failures, approximately 48%, utilizing weak surfaces at multiple levels. This type of failure occurs extensively both in the Quaternary sequence and the Cretaceous bedrock.

An activity classification was implemented based on field observations and dated air photographs. The classification comprises landslides that are very active, active, of low activity, ancient, and anthropogenically modified. Results indicate that approximately 90% of the total length of valley slopes in the study area are involved in mass movements. Approximately 15% are occupied by very active or active landslides and 61.0% are Inactive - Dormant.

Four areas were chosen to be studied in detail due to their accessibility from Fort St. John, diverse failure mechanisms, and diverse local stratigraphies. A generalized stratigraphic column and landslide model was produced for each area. These were generated from the detailed landslide investigations done.

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ACKNOWLEDGEMENTS

A thesis can be referred to as a work of art full of passion and beauty, the pinnacle of ones knowledge and enthusiasm. It can also be referred to as a pain in the neck. I think all theses belong somewhere in between these extremes. I wish to thank my advisor, Dr. Oldrich Hungr for making my experience closer to the former than the latter. His excellent advice and imparted knowledge will be with me always. He has installed a thirst for knowledge and eagerness to experience all facets of life. I also wish to thank the members of my committee. Thanks to Dr. S. Evans from the Geological Survey of Canada, Dr. M. Bovis of the UBC Department of Geography, and Dr. J. Clague of the SFU Department of Earth Sciences. Dr Evans also provided financial support, documentation, and some great advice on landslides and life.

During my summers in the Peace River Region, I have met some interesting characters. None more so than those who have helped me in the field. I would like to thank Adrian "The Hulk" Hansen for his tireless effort through the brambles and roses in the area and nicotine withdrawal. I would also like to thank Greg "G-Man" Hartman who conducted a sister project on the Quaternary history of the area. I also wish to thank Ina Adams for allowing us such lovely accommodations while in the area. I would also like to thank the 3 black bears that I saw, and the grizzly that I did not, for not making me a casualty of the Peace.

There are others that I am grateful for, Mr. B. Gerath of Thurber Associates and Mr. D. Cavers of AMEC Earth & Environmental for their help and access to files. I wish to extend my gratitude to Dr. L. Dyke of the Geological Survey of Canada who has helped, not only with funding but also with advice and support. I would also like to thank the EOS Men's hockey team for making my time in Vancouver that much more enjoyable.

One person does not write a thesis. They are surrounded by support and in fact driven by it. Without the friendship and inspiration from Scott McDougall, Brooke Smith, Allistar McClymont, John Macklin, and Joshua Caulkins, I would not have succeeded. As the other half of the Landslide Research Team at UBC, Scott McDougall was essential to my success and I count it one of my highest honors, not only to know him, but also to be present when he married his lovely wife Samantha.

Finally, I would like to acknowledge the love and support I received from my lovely partner, Naomi Ellis. Without her, not only would this thesis not have been finished, and it would not have mattered if it hadn't.

1.0 INTRODUCTION

The Peace River Area of northeastern British Columbia and northwestern Alberta is one of the most important oil and gas production districts in Canada. The vast amount of hydrocarbon extraction has created the need for an extensive system of pipelines, railways, and roads to be built that traverse the unstable riverbanks of the region. Many large, deep-seated landslides have occurred within the Peace River Valley and its steep-sided tributary valleys. A better understanding of landslides in the region, type, activity, and failure mechanisms will be beneficial to the management of current and future regional infrastructure. This thesis summarizes a research project devoted to the investigation, mapping, and classification of landslides in the Fort St. John area, which is the centre of the present petrochemical extraction activity. The project was a component in a wider study of landslides in the region conducted by the Geological Survey of Canada and headed by Dr. L. Dyke.

The landslides mostly occur within the Lower Cretaceous Shaftesbury Formation, a horizontally bedded marine shale and the pre-glacial silt and clay beds within the Quaternary sequence. Many landslides occur near critical pipeline crossings and several failures have resulted in pipeline rupture. In other cases, wellheads are threatened by head-ward retrogression of landslides.

Landslides in Cretaceous bedrock involve slow sliding along geological defects in horizontal strata. These defects are a result of primary deposition and valley rebound (Matheson and Thomson, 1973).

Landslides in the fine-grained Quaternary sediments may be rapid catastrophic flowslides, as at Attachie and Flatrock, or more commonly, slow moving slides. Failure is related to the existence of highly plastic horizons, glaciotectonic shears, valley rebound, and syn-erosional slumping.

Pioneering observations on Peace River landslides were made by Mathews (1963, 1978) with further work being undertaken by Evans et al. (1996), Bobrowsky et al. (1991) and Fletcher et al. (1998, 2002). The relationship between pipeline performance and moving slopes in the area has been illustrated by McClarty and Cavers (1998).

Geotechnical aspects of the Cretaceous bedrock in the Peace River have been reported by B.C. Hydro in the geotechnical engineering literature (Hannah and Little, 1992; Imrie, 1991; Cornish and Moore, 1985; Sargent and Cornish, 1985; Maber and Stewart, 1976) and a number of unpublished reports. The failure of the Peace River Bridge at Taylor has been reported by Hardy (1963), Hardy et al. (1962), and Brooker and Peck (1993).

1.1 Objectives

The primary objective of this research was to establish the relations between landslides and geologic conditions in the northeastern B.C. region and to produce a landslide inventory map and database for the Charlie Lake Map sheet (NTS 94A). This was done using air photo interpretation; previously written geotechnical reports; and site-selected fieldwork. This map is to be produced in digital form with locations of landslides denoted by symbols distinguishing bedrock or surficial slides. Although landslides are very wide spread in the region, very little has been published on the relationship between the geology and geotechnics of landslides in the region and no comprehensive or systematic study of the distribution and behaviour of landslides in the Peace area has been undertaken. The inventory will also be used to analyse landslide activity after 1948 and in prehistoric time for selected focus areas.

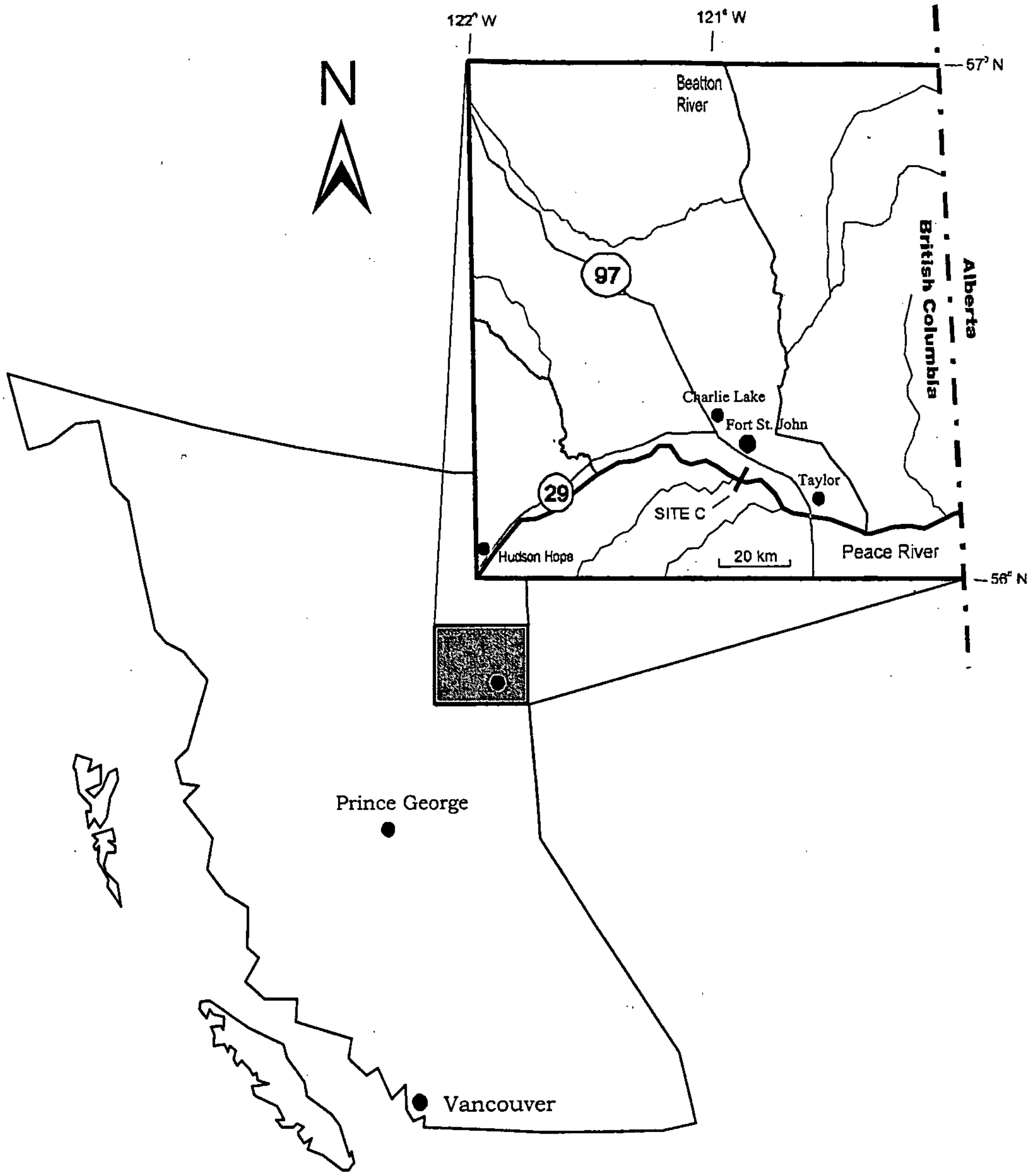
A further objective was to use selected fieldwork to characterize the materials and landslides in the area in order to determine typical failure mechanisms. Investigation of selected slides included detailed mapping, regional landslide models, and materials testing. Fieldwork was necessary to develop type landslide cases in the two main units, find marker horizons, and to form a better understanding of the area.

Using the landslide inventory and site descriptions, the final result is a synthesis of a geological-geotechnical model of slope behaviour. This will hopefully provide the oil and gas transmission industry with a geotechnical framework for understanding the behaviour of slopes in the study area.

1.2 Area Introduction

The study area is defined by the NTS map sheet 94A - Charlie Lake, which encompasses the city of Fort St. John as well as the towns of Hudson Hope, Taylor, and Charlie Lake (Figure 1.1). The study area boundaries are defined by the Alberta boundary to the east (120^0 W), the town of Hudson Hope to the west (1220 W), and by the 56^0 N and 57^0 N parallels of latitude.

Figure 1.1 Site Location Map



2.0 LITERATURE REVIEW

2.1 Landslides in Shale

The body of literature available on landslides in shale is quite extensive, as they represent a unique problem in the field of engineering geology and geological engineering around the world. The Prairie shales of western North America have required a broad amount of investigation and research on the subject (Mollard, 1977; Thomson and Morgenstern, 1978, Locker, 1969; Scott and Brooker, 1968; Sauer et al., 1990; Cruden, 1996).

The following types of mass movements have been noted as important in shale failures within the Peace River Area; 1) Falls, 2) Topples, 3) Rotational Failures, 4) Translational Failures, 5) Compound Failures, and 6) Block Slides. A brief description of each and case histories are provided.

2.1.1 Falls

Rock falls are rapid to extremely rapid (Varnes, 1978) free descents of masses of rock. This type of failure occurs typically at a small scale in shale; however, a few large-scale cases are known (Gray et al, 1978). Few reports of shale falls are documented, as shales do not tend to support large cliffs, therefore, shale falls are generally thought of as insignificant owing to the small volumes involved and small hazards that they present. A shale fall originates from a steep slope; the mass then descends down the slope by a combination of free fall, rolling, and bouncing depending on the angle of the original slope.

Minor falls are commonly observed in natural slopes and excavations. Shale slopes are usually at a shallow enough angle to allow for detritus to accumulate instead of free falling. Vertical or near vertical slopes in shale do commonly occur along river valleys, especially in the Peace River area, however these generally allow the rock to fall directly into the river or creek. Slopes of shallower angles will accumulate colluvial aprons because of the low impact resistance of shale. Pieces of shale are usually tabular and break on contact with a harder surface. The disaggregation of shale releases much of the kinetic energy accumulated during the fall and the smaller pieces will not roll as far as a stronger material. The high plasticity of shale allows small clay flakes or blocks to break down quickly to the properties of clay. A clay talus cone will absorb much of the energy of falling rock instead of allowing the rock to bounce or roll down the slope.

Gray et al (1978) produce an example of shale failure near Ambridge, Pennsylvania. A 15m high nearly vertical cut was made of soft shale, claystone, and sandy silt shale. In this case the shale was compact enough to fall as a single 115-m^3 block, which unfortunately killed 22 persons.

2.1.2 Topples

A shale topple typically involves detachment of a slab of material, defined by near-vertical fissures, followed by forward rotation out of the slope. This rotation takes place about a point or axis below the center of gravity of the displaced mass when an external force is applied, or when softening and ductile deformation of the base causes slight forward rotation of the mass. The motive force is usually supplied by the block's weight or by water or ice pressure exerted in a previously developed tension crack.

Shale can be susceptible to simple or flexural toppling if the bedding planes have been displaced. On a small scale, block toppling can occur although in horizontally bedded shale, however, is rare as the discontinuities are generally horizontal along the bedding plane, not vertical. If the shale has gone through advanced diagenesis the shale may contain fissures or vertical joints, however, a majority of horizontally bedded clay shales are poorly indurated.

2.1.3 Rotational slides (Slumps)

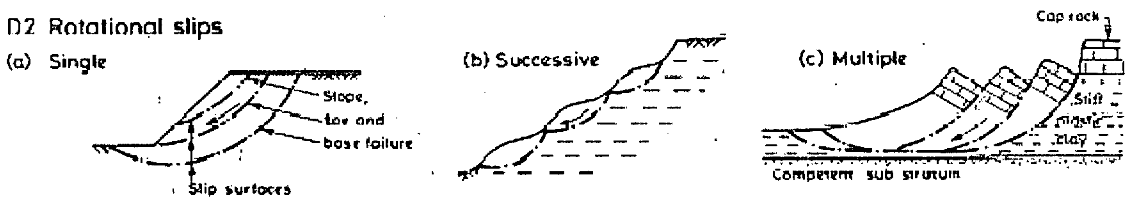
Rotational slides are those in which the movement of a mass is roughly rotational about an axis running parallel to the slope crest (Varnes, 1978). The term 'roughly' is used to allow for a condition where the basal shear surface is partly developed along a horizontal weak layer, which causes truncation of the normally curved or listric shear surface. The weak horizontal basal layer has to play a minor role so that the movement can still be considered rotational and little internal deformation of the sliding body occurs. A rotational movement will show downward displacement of the head of the mass, which commonly tilts backward toward the slope, and upward displacement at the toe. Rotational failures in shale occur on fresh steep scarps, as seen in highway road cuts or eroded riverbanks, or when there is a resistant cap rock. This is because the long-term equilibrium state of shale is at angles too shallow to form rotational failures.

Rotational failures occur mostly in deep, homogenous formations, i.e. London Clay (Hutchinson, 1988). In the Western Canadian Prairies where poorly indurated shales are predominant, rotational failures are rare. Poorly indurated shales, or clay shales, are highly anisotropic having weak-bedding planes that modify the rotational movement.

This type of failure may occur if it is small enough that it can take place between weak layers.

Hutchinson (1988) identified three modes of rotational slides: single, successive, and multiple rotational slides (Figure 2.1). Single rotational slides contain a single concave slip surface and the moving mass acts as a coherent unit. Successive rotational slides refer to many shallow rotational slips that are aligned head to toe up the failing slope. Often this type of failure will produce regular step-like terraces, which can easily be reactivated. Each of the failures can be described as a shallow to moderately deep-seated rotational slip. Multiple rotational slides occur from the retrogression of a single rotational slip with a curved, generally deep-seated failure surface. The retrogression of the slide forms two or more slipped blocks with slip surfaces tangential to a common slip base.

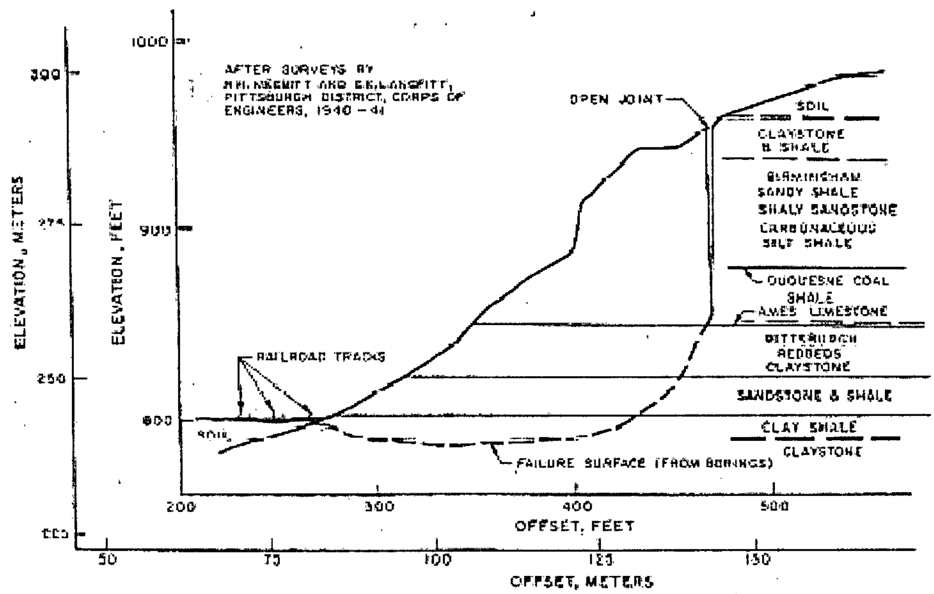
Figure 2.1 Rotational Slide Failure Modes (Hutchinson, 1988).



Gray et al (1978) presented a case history in which a rotational failure did occur within shale. The Brilliant Cut failure in the northern Appalachian Plateau occurred within a sequence of interbedded shale, sandstone, and limestone. A railway cut was made at 45^0 to a height of 50 metres in the early 1930's and within 10 years the slope was severely unstable. Over 70% of the failure surface was located within the soft clay shale

(Figure 2.2). The movement was marked with a rapid drop in the head of the slide, 5m within 90 seconds and was triggered by elevated pore pressures within the slope. The slide had a total volume of roughly 160,000 m^3.

Figure 2.2 Generalized cross-section, Brilliant Cut (Gray et al., 1978)



An open pit mine in Wyoming (Clough et al, 1978) displayed several rotational slides, which took place during excavation. Two of these rotational failures had volumes of 1.4M m^3, and were largely confined to the shale strata.

2.1.4 Translational Slides

Translational slides are a common type of failure in bedded shales. The failed mass progresses along a more or less planar shear surface running sub-parallel to the bedding, with several well-defined blocks separated by oblique shears. Generally, the proximal segment of the rupture surface of the slide is a downward extension of the main

Extensional features and a low angle of movement dominate surface morphology. Horst and graben features within the debris mass may or may not be accompanied by back tilting. The upper blocks are the last to begin moving due to the removal of material near the toe. Other blocks may become detached, pushing material forward to a river or another erosional agent. If unimpeded, the displaced mass will run parallel to the slope, starting out as a coherent unit, but as sliding continues, the mass may become more distorted. The entire shear plane is active within a translational failure and the shear plane must be at a sufficient angle to horizontal to allow for movement in the downslope direction.

Within the Western Canadian Prairies, such failures can occur in Upper Cretaceous marine clay shales and develop retrogressively (Mollard, 1977) providing that the bedding is at a sufficient angle to allow movement. Failures may occur along bentonitic-rich layers within the shale, along weaker layers caused by softening, along interbed slip planes caused by the lateral release of valley rebound or glaciotectonic stresses, or release of residual tectonic forces caused by the mountain building processes to the west.

Examples of this type of failure are found in Section 2.3 Examples of Landslides from the Canadian Prairies.

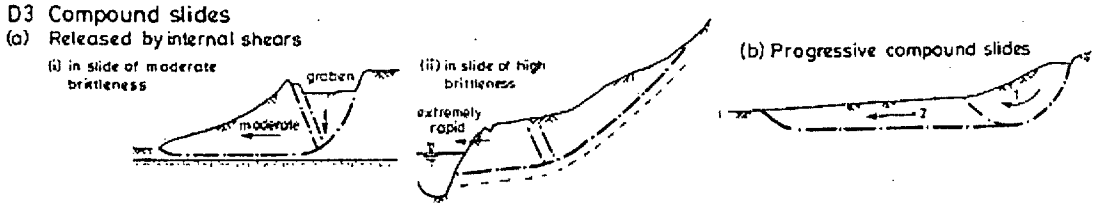
2.1.5 Compound Slides

Compound slides are a form of translational slide in which the head of the slide mass may rotate backward due to a curved proximal segment or subside to form a graben. They differ from translational slides in that sections along the shear plane are passive and

They differ from translational slides in that sections along the shear plane are passive and are simply pushed downslope by the upslope action. The failure plane typically occurs at a much lower angle than required for translational failures. These are a very common type of landslide in horizontally bedded shales within the Canadian Prairies. The failure plane is slightly deeper than the typical translational failure and the debris is normally extremely distorted. Surface morphology of this type of landslide will have both horst and graben type features, possibly combined with back tilting near the head scarp. These failures can also occur at very low angles, 5^0 to 11^0.

Hutchinson (1988) classified compound slides into two categories: progressive compound slides and compound slides released by internal shearing (Figure 2.3). Progressive compound slides are those in which there is a rotational failure at the rear of the slide and the remaining basal slip surface is planar. Compound slides released by internal shearing are those that have a weak basal surface and have undergone internal shearing, to accommodate curvature at the intersection of the basal surface and the back scarp. Sliding will occur once the cohesion within the mass is removed.

Figure 2.3 Compound Slide Modes (Hutchinson, 1988)



Examples of this type of failure can also be found in section 2.3 Examples of Landslides from the Canadian Prairies.

2.2 Landslides in Glacio-lacustrine Clay

Landslides in clay and silt have been investigated more than any other material within the body of landslide literature (Hardy et al, 1962; Skempton, 1964; Skempton and Hutchinson, 1969; Varnes, 1978; Hutchinson, 1988; and Cruden and Varnes, 1996;). Glacio-lacustrine clay has unique properties, which have to be considered in slope stability analysis (Townsend et al, 1965; Kenney, 1975; Evans, 1982; and Giraud et al, 1991). Evans (1982) suggests that within British Columbia, two distinct types of glacio-lacustrine clay are present. Type A (Southern Interior) has more silt than clay layers and is more likely to reflect the properties of the silt. Type B (Northern Interior) has a greater thickness of clay than silt and the properties are thought to reflect the properties of clay. Townsend et al. (1965) quantified the importance of material grain size within glacial varves with laboratory experiments.

The following types of mass movement have been noted as important within glacio-lacustrine materials in the Peace River area; 1) Rotational Slides, 2) Translational Slides, 3) Compound Slides, 4) Sudden Spreading Failures, 5) Earthflows, 6) Flowslides, 7) Mudflows, and 8) Complex Slope Movements. A brief description of each and case histories are provided.

2.2.1 Rotational Failures

Rotational failures in clay show the same mechanisms as rotational slides in shale, although they are more common in these deposits than in shale. Rupture takes place along an identifiable plane that approximates a listric or cylindrical surface. Again we see a degree of backward rotation to the slipped mass accompanied by sinking at the head of the slide and heaving at the toe. Hutchinson (1988) identifies three modes of rotational slides; single, successive, and multiple rotational slides, as described earlier in Section 2.13 (Figure 2.1).

Glaciolacustrine clay is normally varved, which imparts an anisotropic nature to the material, rendering true rotational failures rare, though shearing across laminae can occur in some glaciolacustrine clays (Giraud, et al., 1991). Slides in varved clay deposits may also be approximately circular providing that the pore water pressure in the silt layers is low (Terzaghi and Peck, 1948).

Retrogression of a single rotational slip is more common in these deposits than in shale. An example of retrogression of a rotational failure has been documented near Quesnel, B.C. (Evans, 1982). An active slope movement is taking place in a 150 m thick sequence of varved Quaternary glacio-lacustrine clays and silt. Retrogression at the main scarp takes place by multiple rotational slumping and produces backward tilted slump blocks, which move down the slope and undergo progressive disintegration and remolding.

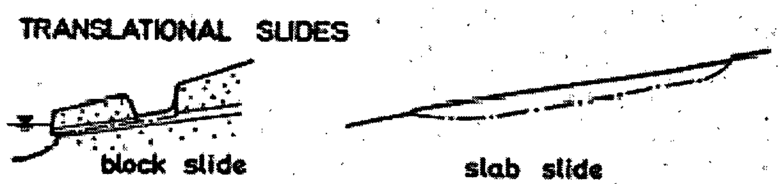
2.2.2 Translational Failures

This is a common type of failure in glacio-lacustrine clay. The clay body needs an exceptionally weak layer at sufficient angle top allow movement to fail along without disturbing most of the overlying debris. Within glaciolacustrine clay, highly plastic varves can serve as the weak layer. In some cases, translational failure can occur due to liquefaction of the basal slip surface. This is normally seen in quick clays in Eastern Canada and Norway, which are glacio-marine clays. Skempton and Hutchinson (1969)

Canada and Norway, which are glacio-marine clays. Skempton and Hutchinson (1969) note that a shallower depth to the weak layer increases the amount of translational movement that the slide will experience.

Two types of translational slides identified by Skempton and Hutchinson (1969) that arise in clays are block slides and slab slides (Figure 2.4). A block slide arises when a hard, jointed block of clay disconnects from the parent mass at a joint or weakness. Then the clay block slides along the plane of weakness with the clay mass. Slab slides take place on more weathered clay slopes when the mantle or crust of a residual soil or sensitive clay is disturbed. The broken crust or slab moves along the slope, with little distortion, as a single unit. This implies that the weak surface is sloping at a steep enough angle top allow for movement.

Figure 2.4 Translational Failure Types (Skempton and Hutchinson, 1969)



A translational slide in glacio-lacustrine sediments occurred in 1977 near the town of McBride, British Columbia (Thomson and Mekechuk, 1982). The failure plane was located within a thick bed of varved clay and silt deposited during the retreat of Cordilleran ice. The clay was medium to high plasticity and dipped slightly toward the river.

2.2.3 Compound Slides

Compound slides are a far more common failure type in glaciolacustrine clay and silt than are translational failures. This is due to the low strength of clay and relative ease with which shear can occur through varves and the horizontal bedding. This allows for a steep or circular head scarp to form in situations in which they could not occur in shale. For the most part, these failures are the same as in shale. Examples of compound failures in glacio-lacustrine are given in Section 2.3 Examples of Landslides from the Canadian Prairies.

2.2.4 Sudden Spreading Failures

Clay spreading involves extension of a cohesive mass combined with a general subsidence into a softer underlying material (Cruden and Varnes, 1996) making it a category of translational failure (Hutchinson, 1988). It commonly displays horst and graben structures where lateral extension has occurred accommodated by shear or tensile fractures. Movement is very rapid even over low gradients (Hutchinson, 1988). This type of failure is most described in soft, sensitive clay; however, Terzaghi and Peck (1948) note that this style of movement can occur in varved clays having high pore water pressures developed in silt or sand layers. Varnes (1978) identifies two types of spreading failure. The first is due to an overall extension of material without a recognizable basal shear surface or zone of plastic flow. This type is predominantly a bedrock feature so will not be discussed here. The second type of failure, called earth lateral spreads, involves fracturing and extension of a coherent material, in this case, a solid clay mass, due to a plastic or liquefied basal layer. The upper unit blocks may move by any mechanism, such as subsidence, translation, or rotation.

Skempton and Hutchinson (1969) described these failures as a particular type of retrogressive compound slide. Gentle slopes, broad fronts, rapidity of movements, and the succession of horst and graben structures characterized them. The retrogressive nature of the slide comes from the subsidence, which drives the displaced mass forward. As the mass subsides, the lateral support acting on the new back scarp is insufficient to hold it in place; thus a new wedge will subside pushing the previous wedge forward.
Mitchell (1978) reports lateral spreading in fresh water varved clays at Wawbewawa and at Beattie Mine, Quebec.

2.2.5 EarthFlows

Earth flows are defined as rapid or slower, intermittent flows of plastic clayey earth (Hungr et al 2001). They involve spatially continuous movement in which surfaces of shear are short lived, closely spaced, and usually not preserved (Cruden and Varnes, 1996), with a distinct boundary between the moving mass and the intact material. This type of failure generally arises from a large influx of water either through an increase of precipitation or by the melting of ice or frozen ground. They are relatively shallow failures that resemble the flow of a viscous fluid and depend on the water content, movement, and mobility of the mass. The disturbed mass is thoroughly broken up and keeps little of its previous structural integrity. Over-consolidated and varved or laminated clays are most susceptible to earth flows.

"Earth flows are commonly tongue or teardrop-like in shape. They have rounded, bulging toes and sinusoidal longitudinal profiles, concave upward near the head of the earth flow and convex upward near the toe" Keefer and Johnson (1983). The Thistle slide in Utah (Duncan et al., 1986) is an example of an earth flow involving silty, sandy, and gravelly clays of medium plasticity (average LL = 40, PI = 18). The landslide mass is roughly 1800 m long and an elevation difference of 305m from the crest to the toe of the slide debris.

2.2.6 Mudflows

Mudflows are very rapid to extremely rapid flows of saturated plastic debris in a channel, involving significantly greater water content relative to that of the source material (Hungr, 2001). Rainstorms can sometimes cause clayey colluvium to become diluted beyond its Liquid Limit in desiccated, especially dispersive clays. The triggering hillslope failures are usually shallow seated (< 5m thick). In areas of low relief, clay flows are generally restricted to oversteepened slopes, such as gully sidewalls and undercut river bluff slopes.

2.2.7 Flow Slides

Hungr et al (2001) describe flow slides as very rapid to extremely rapid movements of sorted fine-grained sediment, involving liquefaction. Clay flow slides occur in association with quick clays and form due to a collapse of an internal structure and the build up of high water pressures. If significant disintegration of the failed mass has occurred it may be difficult to identify the failure mechanism.

The material liquefies when the metastable structure of the clay collapses. The loss of strength gives the failing clay a semi-fluid character, which allows the flow to develop. The result is a high velocity movement that travels a long distance.

Mitchell and Markell (1974) completed an investigation of flow sliding in the sensitive clays of eastern Canada. Their studies conclude that undrained failure in sensitive clays will not occur if the stability number for the clay is greater than 6. The stability number is defined as:

$$Ns = \gamma H / Cu$$

where γ is the bulk unit weight of the soil, H is the slope height, and Cu is the undrained strength of the soil. In this study, three proposed phases of the development of flow slides were introduced. First, an initial slide is caused by the long-term instability of the slope. After the initial slope failure, the slope undergoes a retrogressive failure caused by the undrained short-term instability of the successive slices. The third phase is an earth flow involving the extrusion and flow of the soft underlying materials.

Hutchinson (1988) refers to this type of failure as a flow slide, while others (Varnes, 1978) often group it in with the above category. Skempton and Hutchinson (1969) add a section in their category of multiple and complex landslides, quick clay slides. Here they present a failure peculiar to quick clays, the 'bottle-neck' type of retrogressive, multiple rotational failures. It initially begins with a rotational slip, then the disturbed mass is remolded to a liquid, which runs off, leaving the near scarp unsupported. This new scarp is then attacked; it fails, and flows out like the previous. This continues until a new back scarp is supported by other means.

The Thompson River experienced a flow slide in 1880 that involved approximately 15 Mm^3 of normally consolidated Early Holocene or Late Pleistocene glaciolacustrine sediments (Evans, 1984). The sediments were characterized by varves and laminations within the debris that dammed the Thompson River for approximately 44 hours. The cause of the landslide is speculated to be due to the irrigation of the bench in the area of the failure (Stanton, 1898).

2.3 Examples of Landslides from the Canadian Prairies

As the Peace River area is located with in the Interior Plains, the geotechnical literature from Alberta is more relevant than that from British Columbia. Both shale and glacio-lacustrine examples are given.

2.3.1 Shale

The Little Smoky landslide is an excellent example of a retrogressive compound rotational failure in shale (Thomson and Hayley, 1975). The slide affects a bridge over the Little Smoky River near the town of Valleyview, Alberta. The basal failure plane is nearly horizontal and occurs within clay-shale the Lower Smoky Formation (Figure 2.5). In the Peace River Area this formation is known as the Kaskapau Formation, and crops out to the east of the Kiskatinaw River. The slide occurs within a pre-glacial valley plugged with till and associated glacial deposits. The failure is reported to move at a slow creep toward the river, with each slice acting as a separate entity.

The Lesueur landslide (Thompson, 1971 & Cruden et al., 1998) is on the North Saskatchewan River on the northern outskirts of the city of Edmonton. It is an example of a translational failure within the bentonite-rich Cretaceous shale. The landslide scarp was reported to be 50m wide, with a depth of rupture of 32m deep, and a volume 0.76 Mm^3. The cause was river erosion, ice-blocked drainage, and weakening of the strata due to interbed slip from valley rebound of Upper Cretaceous Mudstone with bentonitic seams. It shows continued differential movement along the shale failure plane. This paper comments on Hutchinson's (1973) cycle of landsliding, which will be considered later in this thesis.

Dewar and Cruden (1998) report a landslide on the MacKay River that shows deep, translational movement (35m) along weak, sheared clay in Lower Cretaceous Clearwater Formation. The failure has a residual angle of 6^0 and the probable cause of shearing is valley rebound and swelling. It has a volume of 0.14 Mm3 with 1 basal shear plane and a large graben at the head of the failure. The presence of bentonite was noted at this site.

A compound failure occurred in Cretaceous shale within the city of Calgary near the Western Irrigation District (WID) (Krahn and Weimer, 1984). The sliding surface was within the Paskapoo Fm, an interbedded mudstone, siltstone, and sandstone (Figure 2.6). The basal deep-seated horizontal movement occurred along a weak clay seam with a residual angle of the slope was 9^0. The head scarp is interpreted as a rotational failure truncated by the same weak layer.

Figure 2.5 Little Smoky landslide (Thomson and Tweedie, 1975)

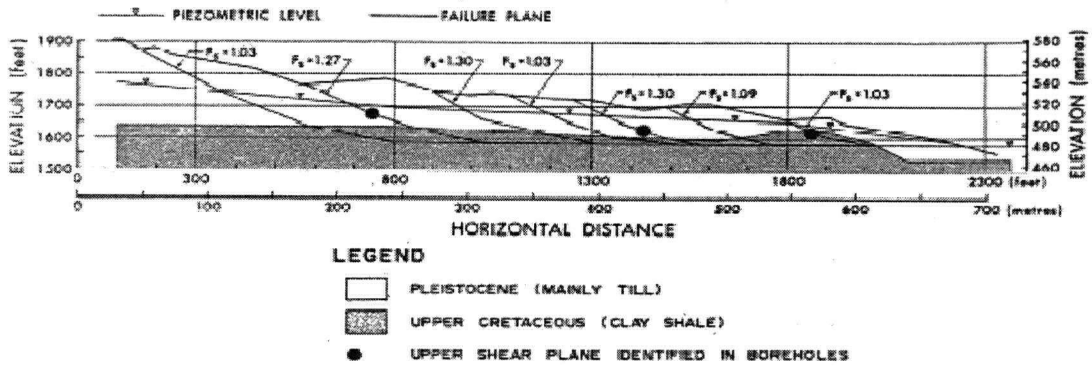
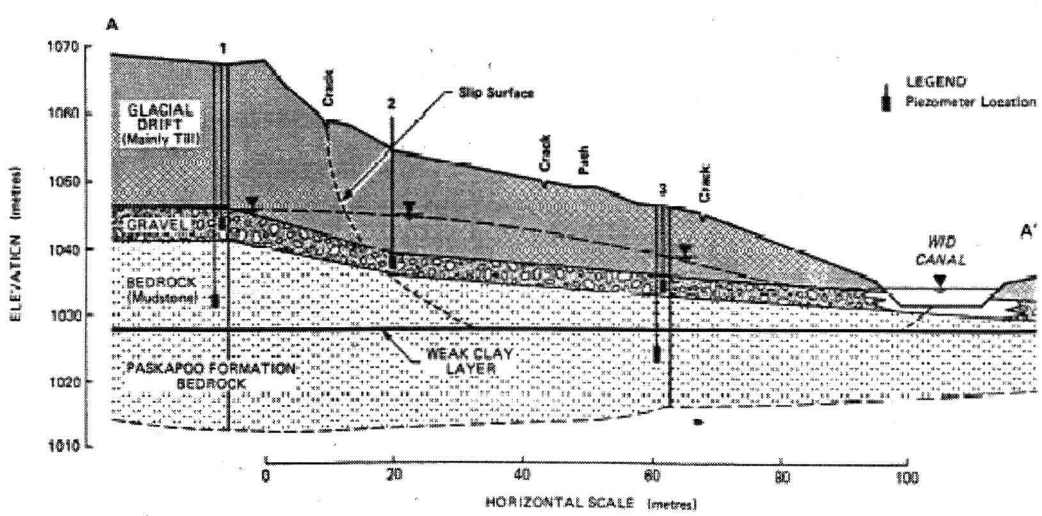


Figure 2.6 Western Irrigation District landslide (Krahn and Weimer, 1984).



2.3.2 Glacio-lacustrine Clay

The Montagneuse slide occurred in 1939 on west wall of the Montagneuse River Valley (Cruden et al 1997). It is a large compound failure noted to be the largest historic rapid landslide on the Interior Plains with a volume of 76 Mm^3 (Figure 2.7). The horizontal failure plane occurs within pre-glacial lacustrine sediments, with the mass subdivided into two main blocks, with the upper block breaking into many smaller blocks with oblique shears. There is little to no tilting of the debris masses and the rupture surface is relatively deep seated. This failure in this valley coincides with Shaftesbury pre-glacial channel of Peace River in common with many of the older, dormant landslides along this valley.

Nasmith (1964) describes 2 different stages of retrogressive rotational slides within the Meikle River Valley in northwestern Alberta. The basal failure plane occurs within pre-glacial lacustrine deposits beneath clay-rich till. The volumes of these are not given but assumed to be quite large as they were hard to view from the ground (Nasmith, 1964). The south facing slopes were noted to be stable at slightly steeper angles, giving rise to a slight asymmetry of the valley. Till is observed within the debris confirming the location of the failure plane below the glacial deposit.

A compound failure, 12 km northeast of the town of Rycroft, Alberta (Cruden et al, 1993), dammed the Saddle River. There is one deep-seated failure plane within a pre-glacial clay unit underneath a thick till unit on which the translational failure occurred (Figure 2.8). The trigger to this slide was lateral vertical and horizontal erosion as a result of a severe rainstorm and it's resultant flood. The landslide was quite large with a volume of roughly 40 Mm^3.

The Attachie slide (Figure 2.9) is a flow slide occurring 50 km west of Fort St. John along the Peace River near the town of Attachie (Evans et al, 1996; Fletcher et al, 2001). This was a catastrophic event involving the glacio-lacustrine unit seen through out the Charlie Lake map sheet. The total volume of the slide was 12.4 Mm^3, similar size to the case above. The clay is pre-sheared parallel to the bedding caused by glaciotectonism and postglacial landsliding. This was a rapid event that dammed the Peace River for approximately 12 hours.

Figure 2.8. 1939 Montagneuse landslide (Cruden et al., 1997)

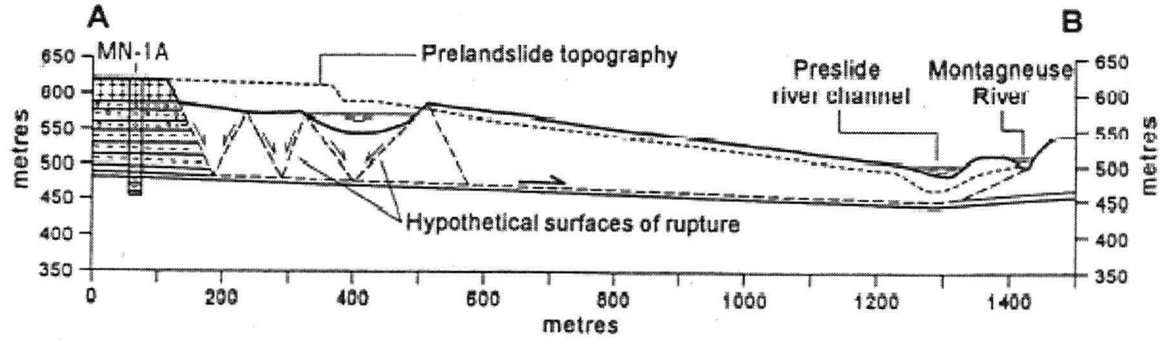


Figure 2.9. Rycroft landslide (Cruden et al., 1993)

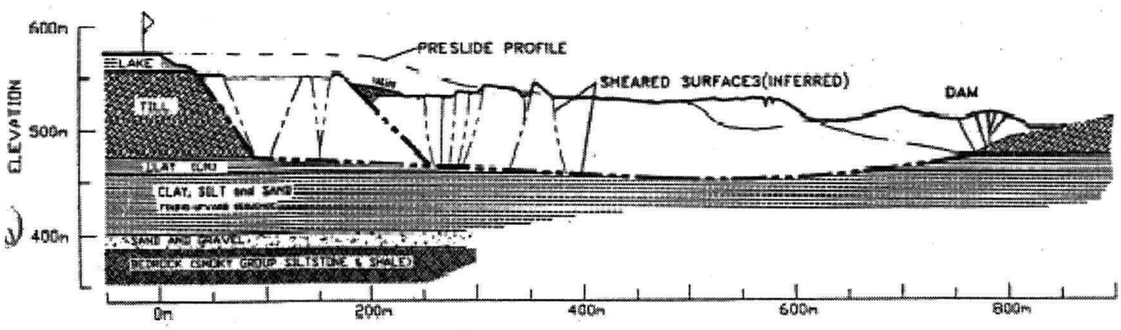
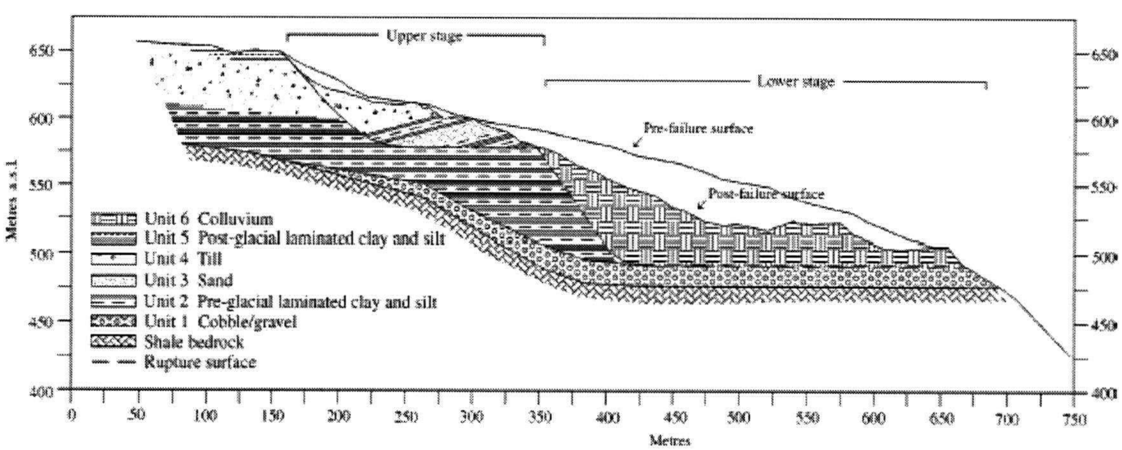


Figure 2.10. Attachie landslide (Fletcher et al., 2001)



3.0 REGIONAL SETTING

3.1 Physiography

The Charlie Lake Map Sheet lies on the western edge of the Alberta Plateau sub-province of the Great Plains (Bostock 1948, Holland 1964). The topography is subdued, reflecting the underlying Cretaceous bedrock, and includes northwesterly trending belts of rolling terrain with northeasterly directed drainage (Stott, 1982). The region is dissected by a deeply incised, integrated dendritic drainage system tributary to the Peace River, flowing through the area from west to east and draining the entire area. The Peace River flows within a broad, flat-floored trench that averages 3.2 km wide and 210 meters deep (Mathews, 1978). The walls of the Peace River and its tributaries rise sharply at angles close to 35^0 where the banks are cut into bedrock (Mathews, 1978), however the wall slope can be as low as 8^0 where failures have occurred. The upper platform above the river trench that connects the upland area to the river valley has a low continuous slope of about $1/4^0$ to 2^0, although it bears a significant amount of micro-relief of mounds and swampy hollows (Mathews, 1978). The current Peace River Valley, cut in post-glacial time, mostly follows an interglacial valley of the Peace, which contains a dissected, complex Pleistocene fill (Mathews, 1978). Where the post-glacial channel follows the interglacial valley, the floor of the present trench is cut into the bedrock floor of the interglacial valley and is therefore lower (Evans, 1996). The significance of this is that the toe and basal shear plane of the landslides in the Pleistocene sediments lie above the present river valley (Evans, 1996). The downcutting also exposes steep sections of Cretaceous bedrock, allowing for failure along weak bedding planes. River elevations from Bobrowsky et al. (1991) at Hudson Hope (520 m) in the west and at the mouth of the Kiskatinaw River (450 m) give an average gradient of the river over the 129 km section of 0.54m/km.

3.2 Climate

The present climate of the Fort St. John area is continental boreal, marked by cold winters (January mean temperature -14^{0}C), warm, humid summers (July mean temperature 15^{0}C), and moderate annual precipitation, 465mm (of which 185 mm as snow). The summer maximum of precipitation includes frequent, intense thunderstorms. These values are averages from the last 30 years and categorize the area as sub-humid (Drinkwater et al., 1969). Annual precipitation in the region is unlike much of British Columbia, with peak monthly precipitation in July and drier in the winter months, however, it mirrors the style seen in most of Alberta. The cold winters are due to rolling uplands and prairies allowing Arctic air to flow unobstructed. With westerly-dominated winds, the nearby Rocky Mountain Range may act as a barrier, placing Fort St. John in a rain shadow.

The Peace River region is within the Boreal White and Black Spruce biogeoclimatic zone (B.C. Ministry of Forests, 1988). On some south facing slopes, warmer plants such as the prickly pear cactus can be found locally in relative abundance. The south facing slopes are often covered with grass and scattered tree cover, while the north facing slopes are generally densely tree covered with few natural clearings.

3.3 Quaternary History

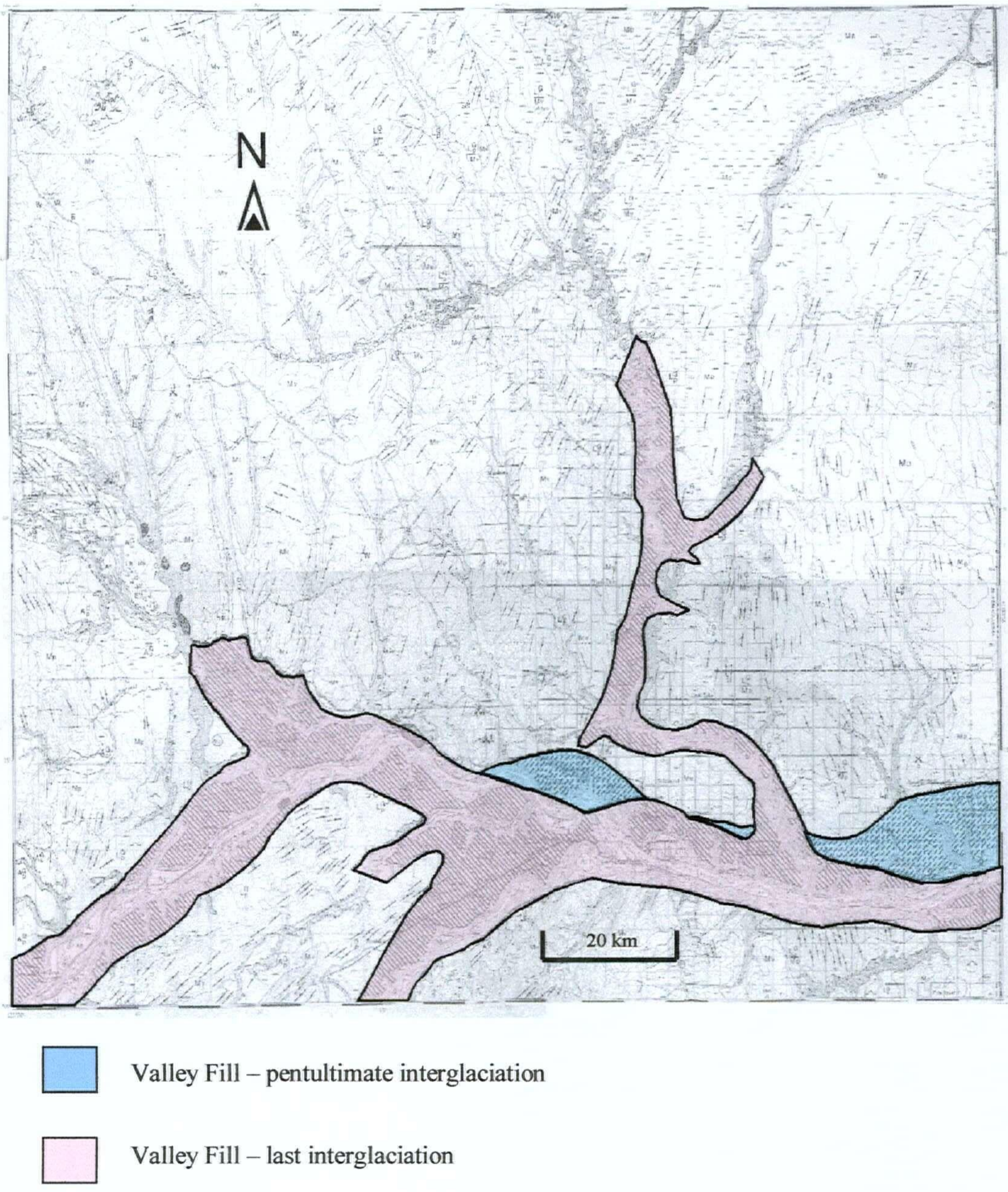
The Laurentide Ice Sheet advanced over the Peace River area on at least three separate occasions during the Quaternary (Mathews, 1978). Cordilleran ice from the Rocky Mountains also reached the area to an unknown extent, and is thought to be contemporaneous with the last Laurentide advance.

A bed of gravels represents the first glaciation with typical Canadian Shield gneiss within it. These gravels are found in one location within the map sheet, near Golata Creek. The second glaciation is represented by a small deposit of till above the aforementioned gravels and a thick bed of silt above the Peace River near Old Fort. These beds are localized and play little to no part in the stabilization of the river valley slopes. These deposits are represented by the light blue colour in Figure 3.1.

This glacial episode was followed by a well-defined erosional interval, widening the valley to 6.5 km – 8 km wide and 30 m above the present level. During this event well-graded gravel was being deposited under aggrading conditions while the valley widening process occurred.

The last, Late Pleistocene Laurentide advance from the east terminated this event. The ice-dammed Peace River likely began ponding early within the advance due to the size of the valley. This initiated a notable period of sedimentation of bedded sands, silts, and clays within a glacio-lacustrine environment. Because the lacustrine materials predate the maximum of the last glaciation, they are commonly referred to in the region as "Interglacial Clays and Silts", or ICS. There are local occurrences of ice rafted pebbles within silt and clay suggesting a close proximity of glacial ice front. These deposits are represented by the light red colour in Figure 3.1.

Figure 3.1 Quaternary Valley Fill Materials Location (based on Mathews, 1978)



The last ice advance is marked by till and glacial grooves from the Laurentide sheet from the east and the Cordilleran from the west. It is thought that the two sheets met between Bear Flat and the town of Attachie (Mathews, 1978).

The ice retreat was slow, and at stages allowed the level of glacial lake Peace to drop, creating smaller ice-damned lakes, ages 13,500 and 9,960 BP (Mathews, 1978). After the ice had retreated, the drainage of the lake occurred. This drainage caused rapid erosion of the present river valley, cutting through all of the sediments and into shale bedrock.

3.4 Local and Regional Infrastructure

Two major highways run through the Charlie Lake map sheet. B.C. Provincial Highway 97, known as the Alaska Highway, stretches from the southeast section of the region through Fort St. John and continues toward the northwest on its way to the Yukon boundary. The Alaska Highway only crosses the Peace River once, however, its significance lies in the fact that many Canadian and American motorists use this roadway on travels toward Alaska. B.C. Provincial Highway 29 runs from Charlie Lake to the town of Hudson Hope at the southwestern corner of the map sheet. This road follows the Peace River Valley for most of its length crossing the valley slope 3 times. There are several smaller roads created for access to homesteads, logging areas, and petroleum exploration sites. Due to the considerable amount of petroleum exploration and extraction activities, an extensive system of oil and gas pipelines runs through the area.

4.0 BEDROCK GEOLOGY AND GÉOTECHNIQUE

4.1 Outcrop Location

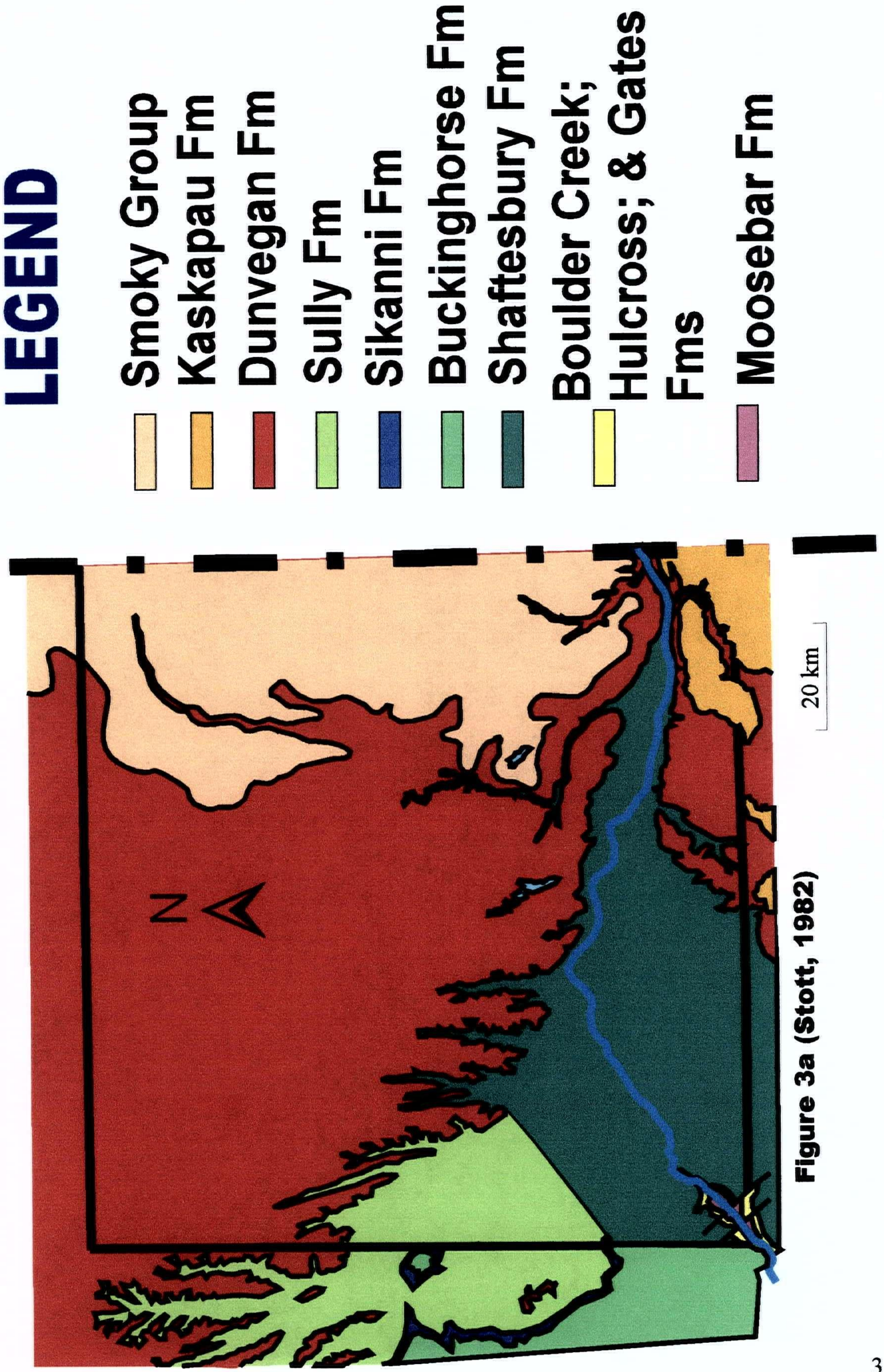
The flat lying succession of transgressive-regressive marine to near-marine formations of the late Cretaceous are generally covered by a thick succession of Quaternary sediments masking much of the bedrock topography, resulting in very few natural bedrock exposures. Most bedrock exposures occur along deeply dissected river and creek valleys within the Charlie Lake map sheet (NTS 94A) (Figure 4.1).

On the western border of the study area, near the town of Hudson Hope, the Peace River Valley exposes the Lower Cretaceous Moosebar, Gates, Hulcross, and Boulder Creek Formations, over a distance of approximately 17 kilometers. These formations are also well exposed along the entire length of Maurice Creek on the south bank of the Peace River; however, these locations are the only exposures in the map sheet.

Stratigraphically above the Hulcross Formation lies the Shaftesbury Shale, which crops out along the rest of the Peace River Valley walls to the Alberta border. The Beatton River Valley also displays Shaftesbury Shale outcrops along its walls for much of its length to the town of Rose Prairie located approximately at 56^0 30'. The Shaftesbury also crops out along the valleys of the Pine, Moberly, and Halfway Rivers within the map area. Other steep tributary channels within the Shaftesbury Formation include the Farrell, Septimus, Red, and Cache Creeks along with the mouth of the Alces and Kiskatinaw Rivers.

The Sully group in the western section of the map sheet crops out only along the upper Halfway and the Cameron Rivers.

Figure 4.1   Bedrock Geology Map (based on Stott, 1982)



At the Peace River and Cache Creek confluence, outcropping of the Upper Cretaceous Dunvegan Sandstone appears above the Shaftesbury Shale on the north bank of the Peace River Valley. This outcropping continues for 5 km where it recedes off the river valley at Wilder Creek. The Dunvegan sandstone appears on the Peace River Valley again near Golata Creek and continues to the Alberta border. West of Cache Creek, the Dunvegan Sandstone trends to the west-northwest toward Cameron River making an escarpment throughout the map sheet. On the southern bank of the Peace River Valley, the Dunvegan Sandstone outcrops near the confluence of the Pine River at the head scarp of a large landslide and within the Kiskatinaw and Alces River Valleys.

The Smoky Group appears north-east of the Peace and Beatton River confluence to the Alberta border and extends to the top of the map sheet. It does not outcrop on either river (Figure 4.1). The Kaskapau shale, a formation with in the Smoky Group, is differentiated along the south walls of the Peace, Alces, and Kiskatinaw River valley walls near the Alberta border.

4.2 Description of Formations

The Moosebar Formation, as mapped by Stott (1982), is part of the Fort St. John Group and consists of marine shales and siltstones. It has a maximum thickness of 290 metres in the Peace River Valley and lies conformably on the Gething Formation within the Bullhead Group and the Gates Formation. The shale of the Moosebar Formation is dark grey, rubbly to blocky, and contains reddish brown sideritic concretions. The basal shale grades upward into mudstone and siltstone until it comes in contact with a thick, continuous sandstone, which is the base of the Gates Formation. The shale beds have a banded appearance with continuous and uniform layers from 1.5 to 10 cm. Stott (1967) reports thin bentonitic layers of up to 1 inch think, however, it is believed that these may in fact be weathered gouge layers created along bedding plane shears caused by valley rebound (Matheson and Thomson, 1973). This unit extends for the first 12 of 17 kilometres covered by the lower Cretaceous unit along the Peace River at the western border of the map sheet.

The Gates Formation (Stott, 1967 and 1982) is a massive to thick bedded, fine-grained, well-sorted sandstone lying stratigraphically above the Moosebar shale and is marked by a thick, continuous sandstone bed. The unit is roughly 18 metres thick at the 'Gates' on the Peace River, a resistant island of rock, but over 61 metres at Steamboat Island. The Gates sandstone represents a complete marine succession with a sequence of sandstone, shale, and conglomerate layers with the on lap sandstones getting coarser upwards within the sequence. The sandstones of the Gates Formation are brownish-grey, slightly rusty, and fine-grained with fine laminations and uniform beds. The beds are dominantly quartz and chert with minor amounts of rock fragments, carbonate detritus, and feldspar. There are often thin beds of platy sandstone and shale, and the sandstone beds grade laterally into shale to the north. Flow rolls are fairly common within the Gates Formation on the Peace River as well as ripple marks and mud cracks within the bedding planes. The upper boundary with the Hulcross Formation shows a distinct change from sandstone to dark, marine shale

Stott (1982) mapped the Hulcross Formation as blocky to rubbly, silty, dark grey to black marine shale with sideritic concretions with no real bedding planes. The Hulcross shale thins to the south due to decreased sedimentation. The formation is stained with limestone or a yellow powdery efflorescence caused by sulphur and iron weathering within the unit. The silt content of the unit increases upward within the unit and even becomes sandy to the top. The thickness and the number of sandstone beds increase upwards until the shale disappears. The shale is dense and structure-less with micro-granular carbonate with quartz, clay, and pyrite. Irish (1955) mapped the shale unit as being up to 113 metres thick east of the Gates Formation along the Peace River. The contact with the coarser Boulder Creek Formation above is also gradational and appears as a succession of siltstone and shale beds.

The Boulder Creek Formation is a succession of conglomerate beds (Stott, 1982), however, along the Peace River, the beds have graded into flaggy, silty marine siltstone with interbedded sandstone. It is almost indistinguishable from the Gates Formation, except for a lower percentage of carbonate detritus. The sandstones are mostly made up of quartz and chert with some rock fragments and matrix. Irish (1955) estimated the thickness of the Boulder Creek Formation as 22 metres. The sandstones are thickly bedded, laminated, and have abundant ripples on the bedding planes with abundant ironstone concretions. Within the map sheet, the Gates Formation, Hulcross Formation, and the Boulder Creek Formation are mapped as one indistinguishable unit.

The Shaftesbury Formation is a dark grey, flaky to fissile, rusty shale to mudstone, equivalent to the Hasler Formation and the Cruiser Formation to the south. The Goodrich sandstone, between the Hasler shale and Cruiser shale, grades into very silty shale within the Peace River Valley making the three formations undifferentiable. The unit contains abundant fish-scale layers, one of which is quite widespread and serves as a regional boundary unit between the Upper and Lower Cretaceous units. The lower boundary of the Shaftesbury shale with the Boulder Creek Formation is distinct as the sandstone layers are directly overlain by dark marine shale, likely marking a hiatus. The upper boundary is gradational showing interbeds of shale and sandstone with the number of beds and their thickness increasing upwards. The beds of the Shaftesbury shale show a rhythmic development; flaky and fissile at the base to silty and blocky near the top. Stott (1982) was not able to give a thickness for the Shaftesbury Formation; however, it must be appreciable as the unit covers the entire Peace River from the Gates to at least the Alberta border. Stott (1982) maps several thin bentonitic layers, which may in fact be weathered clay within valley rebound bedding plane shears. In sections seen during the landslide investigations, there is appreciable degradation of the shale to a flaky texture with iron rich partings between the beds of shale. These partings are likely from alteration of bedding planes that have been disturbed during the valley rebound process. Along much of the Peace River Valley, the Shaftesbury shale represents the only bedrock unit exposed, as many of the Pleistocene sediments are deposited directly on the shale. This is due to the present river valley following the pre-glacial river valley, therefore, only exposing the lower units.

The Sully Formation, generally recognized in the Sikanni Chief region, is seen in the western most area of the Charlie Lake map sheet. It underlies the vicinity west of the Cameron River and is roughly equivalent to the Shaftesbury Shale. The Sully Shale are dark grey to black, silty, rubbly, and contains sideritic concretions as well as the same 'fish scale' marker seen in the Shaftesbury Formation. The formation is conformable to the older sandstones to the west and the Dunvegan Sandstone to the east.

The Upper Cretaceous Dunvegan Formation is a prominent sequence of fluvial and deltaic sandstones and conglomerates, with minor shale, which form distinct escarpments along many river valley walls throughout the map area. This formation is quite large, having been mapped from the Smoky River in Alberta to the Liard River in northern British Columbia. In the Fort St. John area it has been mapped by Crickmay (1944), Russel (1943), and Jones (1968) and is estimated to be of a thickness near 305 meters (Stott, 1982). Although the type section is near Fort Dunvegan, there are well-exposed sections near Bear Flat on the Peace River near Cache Creek and within the canyons on the Beatton River (Figure 4.2). In the Peace River area it is generally a fine-grained sandstone interbedded with shale. The sandstone is dominated by quartz and chert, with minor amounts of lithic fragments. Stott (1982) has done microscopic analyses of the unit, describing quartz grain boundaries and grain deformation. The Dunvegan Sandstone is conformable between the Shaftesbury Shale below marked by a well-bedded fine-grained sandstone that grades downward. South of the Peace River, the Kaskapau shale of the Smoky Group overlies the Dunvegan Sandstone conformably, with the contact being above a coaly horizon.

Figure 4.2. Dunvegan Sandstone within the Beatton River Canyon

The Kaskapau Formation is the youngest of the beds in the area. The beds are thick, over 700 meters, and consist of dark grey, marine shales, separated into members by calcareous or sideritic content and concretions. The basal unit, the Sunkay Member, seen in the Peace River area, contains much siltstone and sandstone. It is part of the Upper Cretaceous Smoky Group, seen undifferentiated north of the Peace River due to lack of outcrop exposure.

In terms of paleo-geography, the marine and near-marine sequence of sandstones, siltstones, and shales represents four transgressive – regressive cycles in the Western Interior Cretaceous Seaway during the Albian and Cenomanian periods (Plint, 1988).

4.4 Geotechnical Properties

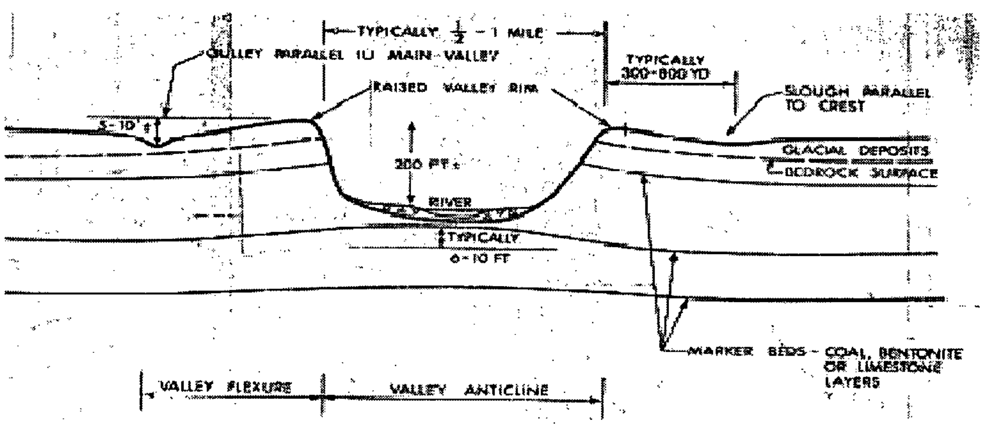
4.4.1 Shaftesbury Shale

During the 1970's and 1980's, several investigations were conducted on behalf of British Columbia Hydro to determine the geotechnical properties of the Shaftesbury shale (Cornish and Moore 1985, Sargent and Moore 1985, Imrie 1991). A proposed dam site, Site C, was investigated in order to establish the feasibility of constructing an earthfill hydroelectric dam on the Peace River, 6 kilometres southwest of Fort St. John.

The Shaftesbury Shale is a compaction shale, heavily overconsolidated by Quaternary glaciations, that outcrops with slopes seldom steeper than 1H: 1V along most of the Peace River valley within the 94A map sheet. The regional dip is 1° to 5° to the northwest with small amounts of localized thrust faulting. The shale is poorly consolidated and therefore is prone to rapid weathering and breakdown as it is conducive to decomposition and swelling. The bedrock has been identified as a soft shale based on the Morgenstern and Eigenbrod (1974) classification. According to Cornish and Moore (1985) the content of clay sized material ranges from 35 to 49%, with Atterberg limits of 40 – 50 % for Liquid Limit (L_L) and 21 – 25 % for the Plastic Limit (P_L). The Shaftesbury Shale was found to be mainly quartz (27 – 52 %), interlayered illite / smectite (34 – 52 %), illite (0 – 11 %), and kaolinite (3 – 10 %). The rock shows swelling pressures ranging form 20 to 50 KPa. The intact rock is moderately strong showing a range of compressive strength of 6 – 28 MPa (Imrie, 1991). The samples tested by Imrie (1991) show an average shear strength of $\phi_p = 45°$ and $\phi_r = 20°$.

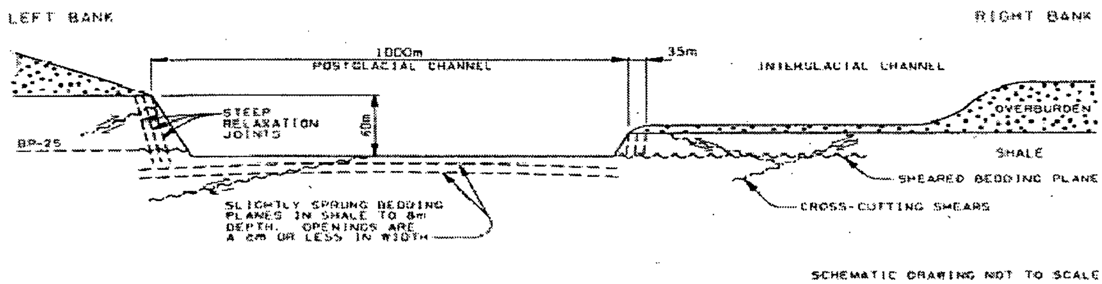
After the removal of late-Wisconsinan ice loads, post-glacial rebound and erosional unloading with associated river valley cutting have caused a bulging of valley floor materials and stress-relief deformation of valley side materials known as valley rebound (Matheson and Thoomson, 1973). This caused an inward relaxation of the valley walls and possible shearing displacements as well as local cross cutting shear zones (Figure 4.3).

Figure 4.3 Valley Rebound with deformation (Matheson and Thomson, 1973)



The outcrop examined in detail at Site C, was found to have three types of major discontinuities (Imrie, 1991); 1) bedding plane failures, 2) cross-cutting shears, and 3) relaxation joints (Figure 4.4). These discontinuities are thought to persist throughout much of the Peace River Valley.

Figure 4.4 Site C Damsite Schmetic with discontinuities (Imrie, 1991).



The changes in stress regimes, vertical unloading, caused arching within the central valley floor, which is accompanied by limited shearing and fracturing along the bedding planes in the river valley walls. These bedding plane shear zones often act as slide surfaces for deep-seated failures within the bedrock even though they appear as tightly interlocked hairline partings. These partings can range up to 1 centimetre thick, allowing for shale softening and the development of gouge filling. These fillings generally have mineralogy similar to the rock, indicating the rock as a parent material. They appear white or yellow and can be confused with seems of bentonite and are laterally discontinuous as they pinch out away from the valley wall. The weak bedding planes also control the foundation strength of the Shaftesbury shale within the Peace River valley (Imrie, 1991).

The cross-cutting shears occur with in the bed of the Peace River mostly dipping south with the remainder dipping to the north, causing the right bank to be more intensely sheared compared to the left bank. They are generally thrust faults in nature and have a maximum thickness of 5 cm, infilled with gouge, breccia, infilling, and distorted bedding. Imrie (1985) found vertical offsets of 0.2 m to 3 m with a dip movement of 7.6 m and vertical offset always less than 3 metres. The south-dipping shears form a complex pattern striking 80^0 to 150^0 and dipping 15^0 to 30^0 away from the river. The residual friction angle was found to vary from $\phi r = 12^0$ to 20^0 with additional strength being provided by plane waviness at $\phi i = 5^0$. Imrie (1991) discounts the remnant orogenic stresses as being a factor in their creation but rather suggests these features are valley rebound structures.

The final structures observed due to valley rebound are rock relaxation joints due to inward movement of the valley walls. These are near-vertical fractures that parallel the river, observed in adits during the investigation of site C. Imrie (1991) reports relaxation joints as far as 35m in from the ground surface. These are at least partially infilled by broken rock and clay.

Through rising and falling head tests, the permeability range was found to be 10^{-7} to 10^{-10} cm/sec with a downward head gradient. This is explained by the presence of the shear zones allowing water to saturate the upper beds of the shale while the lower beds remain out of equilibrium, therefore causing a downward gradient.

During the summer of 2003, samples were collected to determine the bulk properties of the materials found in association with landsliding. The locations of the tested samples can be found on Figure 4.6. The samples consisted of slickenensided, remolded shale (8) and a disturbed gouge material (4) which appears in conjunction with the rupture surface (Figure 4.5). The samples were collected by locating the shear plane and removing the slicked material with a knife. The samples were tested for Atterberg Limits and Grain Size analysis, using both sieve and Hydrometer methods, at the Fort St. John field office of AMEC Earth & Environmental Ltd. The test sheets can be found in Appendix I. A summary of classification results for the samples collected is given in Table 4.1.

The sheared shale was found to have an average Liquid Limit of 49% and Plastic Limit of 20%. This indicates shale of moderate plasticity and not indicative of sheared material (Figure 5.1). The shale was dominated by silt with a mean of 70%, with minor amounts of clay, 20%, and sand, 10%. Hardy et al. (1962) suggest that the propensity of the shale to fail is determined more by bonding agents and pore water chemistry than by grain size alone. The test results of these failed shale samples would agree with their findings.

Figure 4.5 Typical sampling area of sheared shale and gouge.

Figure 4.5 Tested Sample Location Map

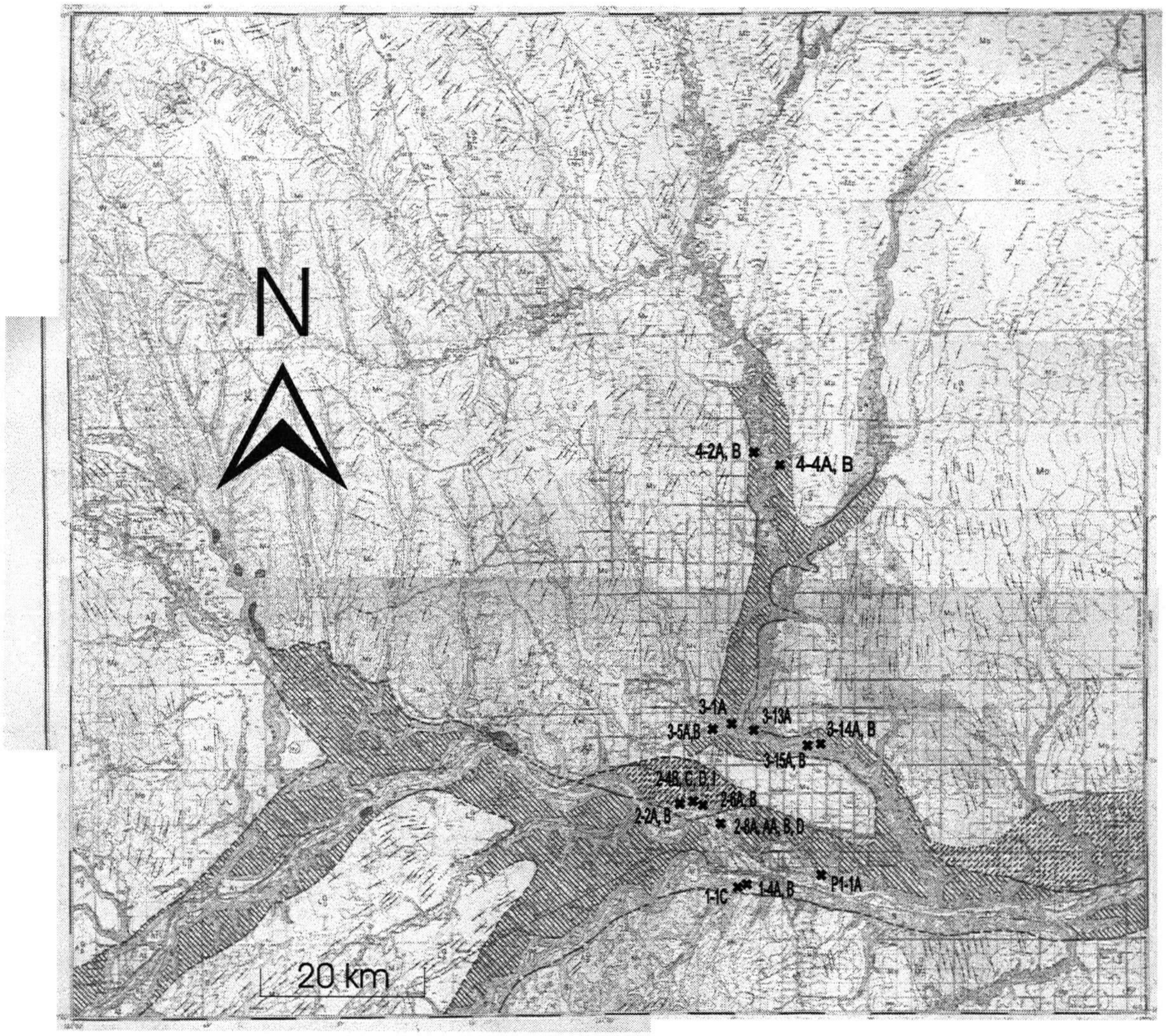


Table 4.1. Summary of classification test results, shale and gouge

Property	Sheared Shale n = 8	Gouge n = 4
Liquid Limit (%)	49.1 {40 – 80}	50.7 {45 – 56}
Plastic Limit (%)	19.9 {16 – 30}	26.4 {23 –30}
Plasticity Index (%)	29.2 {20 – 51}	24.3 {20 – 29}
Clay Content (%)	20 {3 – 36}	11 {4 – 22}
Silt Content (%)	70 {50 – 85}	58 {40 – 68}
Sand Content (%)	10 {1 – 22}	31 {23 – 38}

n = number of samples tested

The gouge material found in relation with the sheared shale displayed a higher Liquid Limit, 51%, however, the Plasticity Index proved to be lower, suggesting a higher concentration of coarser material. From the grain size analysis done on the samples, the sand component, 31%, appears to be higher than the shale and both clay and silt were lower, 11% and 58%, respectively.

4.4.2 Dunvegan Sandstone

The Dunvegan Formation is very competent and acts as a cap rock for the weaker shale below. This allows the valley wall to achieve steeper slopes seen near Bear Flat on the Peace River, within the lower Beatton River, and at the Cameron and Halfway River confluence. In situations where the underlying shale is exposed, large bedrock failures occur as the static load of the Dunvegan Sandstone causes plastic deformation of the ductile shales below. Where the lower shale is not exposed in the upper Beatton, Kiskatinaw, and Alces Rivers, deep canyons with stable walls are produced while the bedrock is exposed. The Dunvegan sandstone does produce large blocks that fall in the canyons, as there are discontinuities along bedding planes and minor amount of vertical jointing.

Saint Simon et al. (1979) had investigated the Peace River Valley near the town of Dunvegan, Alberta, which also shows the Shaftesbury, Dunvegan, and Kaskapau Formations. At this site, stress relief jointing and horizontal bedding joints of the Dunvegan were observed, indicating that the valley rebound process is likely wide spread throughout the prairie environment, not localized to the Peace River. The claystone investigated at this site was found to be moderate to highly plastic and the shear strength of both siltstone and claystone were found to decrease with increased moisture content. The clay stone also shows residual angles of 13^0.

4.5 Comparison with Other Prairie Shales

The geotechnical properties of the Shaftesbury Shale were compared to those of other prairie shales located in Canada and the northwest of the United States. Data for this section was collected from published geotechnical papers (Cornish and Moore, 1985; Scott and Brooker, 1967; Haug et al.,1977; Peterson et al, 1960; Thompson and Hayley, 1975; Thompson and Tweedie, 1971; Thompson & Yacyschyn, (1977); and Beene (1967). Table 4.2 summarizes the Atterberg limits, peak and residual shear angle, and clay percentage are compared between the Shaftesbury Shale and the other shales.

The Shaftesbury Shale has a plastic limit roughly equal to that of other prairie shales allowing plastic deformation at similar moisture content. Deformation occurs without cracking with the consistency of stiff putty to soft butter (Conduto, 1998). This low plastic limit also allows a pre-sheared surface to remain within a plastic state at natural moisture content. The liquid limit of the Shaftesbury Shale is lower than most of the other prairie shales, permitting it to be at a liquid state at lower moisture content. The Shaftesbury Shale has a low plasticity index (29.2%) suggesting that it is of moderate plasticity (Sowers, 1979). The Kaskapau and Pepper Formations also show a medium plasticity, however, the Bear Paw, Belly River, and Edmonton Formations all have high plasticity indexes making them highly plastic shales. The Shaftesbury Shale was sampled using a rotary drill during an investigation for diversion tunnels within the left bank. The rotary drill probably did not allow for the bentonitic-rich layers to be sampled alone. This contamination makes the samples appear to be less plastic than they really are. The Shaftesbury Shale also has lower clay content than many of the other materials sampled.

The residual friction angle of the Shaftesbury Shale at 20° appears to be much higher than the other materials listed below in Table 4.2. However, the listed value of 20° is thought to represent a bentonitic-poor zone within the formation, and therefore should not be used as a practical lower limit for strength within the formation as a whole. A lower value would be more practical to use for the shale of this area. The difference between the two values found for the Bear Paw Formation (Haug et al., 1977 and Peterson et al., 1960) was found to 14^0. A similar difference should exist for the Shaftesbury Formation when testing bentonitic-rich and bentonitic-poor zones. Most of the prairie shales have residual angles within the range of 5^0 to 15^0; therefore, a practical value for the residual angle for the Shaftesbury Shale would lie within this range.

Table 4.2. Geotechnical Properties of Prairie Shales

Formation	Liquid Limit	Plastic Limit	Peak Shear ϕp	Residual Shear ϕr	Clay %	Source
Shaftesbury	40-50 %	21-25 %	45^0	20^0	35–49 %	Cornish & Moore (1985)
Bear Paw	65-100 %	20-25 %	-	8^0 (Haug, 1977)	30-60 %	Scott & Brooker (1967)
Bear Paw	120 %	25 %	28^0	22^0		Peterson et al (1960)
Kaskapau	55 %	31 %	34^0	14^0	38-43 %	Thompson & Hayley (1975)
Belly River	102-149 %	20-30 %	-	8^0	76 %	Thompson & Tweedie (1971)
Edmonton-Bentonitic Shale	125-220 %	30-45 %	14^0	8^0-10^0	-	Thompson & Yacyshyn (1977)
Edmonton - Bentonite	80-400 %	50-60 %	14^0	5^0-10^0	-	Thompson & Yacyshyn (1977)
Pepper	58 %	26 %	14^0	9^0	-	Beene (1967)

5.0 SURFICIAL GEOLOGY AND GEOTECHNIQUE

The surficial geology of the Peace River area has developed primarily from glacial episodes during the Quaternary (Mathews, 1978), as described briefly above. The last two of these episodes left deposits in the region while the evidence of any older glaciations have not been found. Geomorphic processes have altered the glaciated landscape slightly to produce the modern topography.

5.1 Location

Like the Cretaceous bedrock, the best exposures of Pleistocene sediments occur along the deeply dissected valley of the Peace River and its tributaries. Much of the valley exposures are so disturbed that a complete section is difficult to find, therefore, the stratigraphy has to be pieced together using head scarps and slump blocks of the landslides. The glacio-fluvial and glacio-lacustrine deposits are confined to pre-glacial valleys; however, till and post-glacial deposits are more can been observed widespread throughout the map area. The upland area is usually covered in blankets of till and glacial lake sediments with little to no exposure. The middle and north parts of the map sheet are covered in an extensive bog land and muskeg. Much of the area that is not along the river valleys is covered in forest cover.

Another important source of Pleistocene stratigraphy are the many road cuts made throughout the area as the local infrastructure is well developed. Road cuts may also be highly disturbed due to small-scale slumping and disturbance from construction.

From oldest to youngest, the typical sequence of Late Quaternary materials within the Peace River Valley and environs consists of basal fluvial gravel, a thick sequence of interglacial silts, sands, and clays (ICS), a widespread blanket of basal till, and post-glacial lacustrine clay. Within the Beatton River Valley, the sequence is often like Peace to the south, however, around the area of North Pine, a deltaic sequence begins to occur. Sands with minor beds of silt and clay dominate this deltaic sequence. The Halfway River is mostly filled with glacio-fluvial sands and gravels except for in the south where the river enters the pre-glacial valley.

5.2 Late-Quaternary Materials

5.2.1 Gravels

The pre-glacial gravels are seen along the Peace River for most of its length, as well as some parts of the Beatton, Halfway, Pine, and Moberly Rivers. These are confined to the pre-glacial river valleys (Mathews, 1978), and are noticeably missing near Old Fort. The gravels have a rusted colour due to prolonged oxidation, well-rounded clasts up to 15 cm in size, and are partially cemented. The thickness of this unit varies from 1m to 30m. It may act as an aquifer in some slopes. The unit is clean, gap-graded, and contains a sand matrix with pebbles and cobbles. There are a few sand beds up to 25 to 30 cm thick. Quartzite clasts dominate the unit with well-cemented sandstones, gray granites, and volcanics. Shield rocks are present but rare. The gravel has sharp contacts, top and bottom, with the bedrock always underneath. The unit has a fairly constant elevation above river level. Evans et al. (1996) suggest that the gravel unit does not play a part in the instability of the slope.

5.2.2 Pre-glacial Silt, Sand, and Clay

The pre-glacial sand, silt, and clay lies above the gravels with sharp contact along the valley of the Peace River, much of the Beatton River, and the Pine, Moberly, and Halfway Rivers. It is roughly 100 to 150 m thick with silt or sand found at the base. For the most part, silt dominates sequence, except near the pre-glacial lake boundaries, where sand prevails. Sand can occur at any level (up to 35 m thick) and indicates aggrading fluvial condition. The beds are all well sorted, however, there can be extremely complex structures within this unit. Scattered pebbles are observed within the clay indicating the proximity to the glacial ice. Clay layers within the unit can be moderately to highly plastic, and can provide loci for landslides in the area (Mathews, 1978). This pre-glacial sedimentary package is not cemented but acts as a poor drainage element within most slopes on account of the interspersed, low conductivity clay beds.

The upper contact with the till is sharp, although some intact rip-up blocks of silt and clay can be found within the till. Several samples were taken of this unit during the investigation of several of the landslides in order to help characterize the beds.

5.2.3 Late Wisconsinan Till

The unit described in this section is from the final ice advance in this region as it is the only one that is preserved over the area. Mathews (1978) maps the till unit as two separate units from contemporaneous glacial advances from the Laurentian Ice Sheet in the East and Cordilleran Ice in the west. The two sheets coalesce near the town of Attachie. Even though the two tills are different, they are not distinct so will be considered one unit. Both tills rest on the interglacial river and lake deposits and act as an impermeable cap for surface recharge. Both are geotechnically more competent than the deposits below making them analogous to the sandstone above shale in the role that it plays in slope stability. The only difference seen between the two tills is that in the east the deposit has more gneissic clasts from the Canadian Shield and in the west, the deposit has more schist from the Rocky Mountain Trench.

The basal till is clay-rich, massive, and shows a gradation of drop stones near the top as the ice receded above it. The unit has an average thickness of 15 m and a maximum thickness of max 28 m, being slightly thicker in the eastern part of the map area.

5.2.4 Glacial Lake Peace Clay

The upper most unit within a typical section of the Late Pleistocene sequence is clay deposited from Glacial Lake Peace. It formed as water built up behind a glacier slowly retreating down the pre-glacial valley. The duration of deposition is a minimum of 220 years determined from counting varves within the deposit. The silt in the deposit forms distinct layers (fraction of an inch to feet thick) within clay, particularly in the west. The unit acts as an impermeable cap controlling most of the surface morphology over all of the platform and upland areas. The clay has played role in initial drainage pattern in area after the retreat of the area.

The most abundant material within the unit is clay with few or no stones on platforms to east, however, there is clay with scattered pebbles that may look like the till below. Sand and gravel is found within this unit, although it is limited to the former lake limits. The clay is firm when dry, and slick and sticky when wet due to its high plasticity. There are shallow failures contained within this unit on the Beatton and Halfway Rivers, however, it has no importance for deep-seated failures.

The thickness of the clay unit shows greater isostatic rebound to west, suggesting that it has been ice-free for a longer period of time.

5.3 Geotechnical Properties

Several samples of sheared and intact pre-glacial clay were collected during the field investigation of the selected landslides. The location of the tested samples is found on Figure 4.6. These samples were then tested for Atterburg Limits and grain size analysis at AMEC Earth & Environmental Ltd in Fort St. John. Tests to obtain material properties were conducted on the principle units involved in the slide movement and materials resultant from the movement. A summary of classification test is given in Table 5.1. The test sheets can be found in Appendix I.

5.3.1 Bulk Properties

The pre-glacial lake clay deposits are generally classified as inorganic clay of low to medium plasticity (CL/CH) using the Modified Unified Classification System (Figure 5.1). Grain size analyses indicate that most of the samples originally described as clay are actually clayey silt with an average clay fraction of 30%. Few samples were relatively rich in clay, up to 57%. The clay fraction is not an indicator of failure potential as sheared clay beds had as few as 10% clay and intact beds had a high of 57%. Sand content is also a non-factor in stability as intact beds actually showed a lower average fraction of sand at 2%, than the sheared beds at 6% with a high of 25%. Many non-plastic silt beds were witnessed during the slide investigations beneath the sheared beds. These beds were rarely sampled and were not be analyzed.

Figure 5.1 Plasticity Chart (Unified System) – Peace River Samples

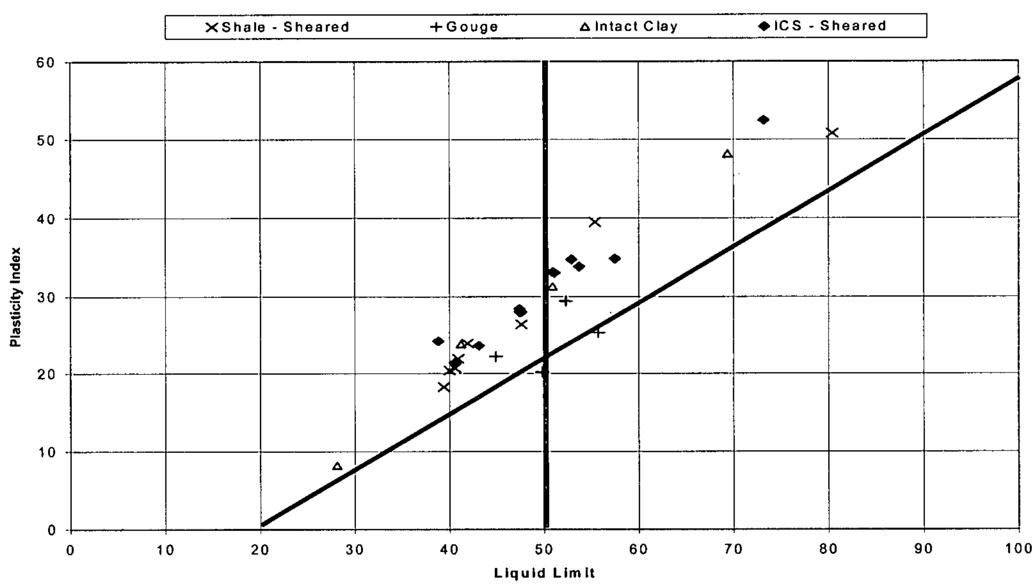


Table 5.1. Summary of classification test results for surficial materials

Property	Pre-glacial lake sediments	
	Intact n = 4	Sheared n = 12
Liquid Limit (%)	47 {28 – 69}	50 {39 – 73}
Plastic Limit (%)	20 {17 – 21}	20 {15 – 23}
Plasticity Index (%)	28 {8 – 48}	30 {18 – 53}
Clay Content (%)	29 {1 – 57}	30 {10 – 50}
Silt Content (%)	70 {43 – 97}	63 {49 – 86}
Sand Content (%)	2 {0 – 4}	6 {0 – 25}

n = number of samples tested

The Atterberg Limits of the clay indicate an average liquid limit is near 50 for both intact and sheared materials, bordering between high- and low-plasticity clay. The plasticity index for the sheared materials is only slightly higher at 30.3, making the clay highly plastic. The Atterberg Limits classify the material as medium to highly plastic clay while the grain size analysis suggests that the material is clayey silt.

The till is classified as well graded, medium plastic silty clay (CL) by Fletcher (2001).

6.0 LANDSLIDE INVENTORY MAPPING SYSTEM

6.1 Slide Types in the Study Area

To properly catalogue all of the landslides in the study area, two classification systems were created, based on activity and morphology of the landslides. Taking into account previous classifications already in place (Hungr, Hutchinson, Skempton, etc), new classifications were developed for the activity and the morphology of the landslides. These classifications, as well as previously developed ones are discussed here. Slide types were defined in the order in which they were noted during the initial photo interpretation and desk study phases of the landslide inventory.

Slide Type 1: Raveling

The first type of slide identified in the Peace River region of British Columbia was simple raveling of the shale, sandstone, and cohesive surficial material (Figure 6.1). The scarps are generally clean as the process affecting them is active. The scarp height can vary although the debris apron will normally only accumulate on slopes with a height of at least 5m. There is no unique mechanism indicated here, as the process could be a simple fall, small scale slumping, or flaking of the material. The Shaftesbury Shale is easily slaked so the intact scarp tends to produce a weathered rind along the exposed face. Both the shale and the local clays and silts have very low impact strength so when the material strikes the intact ground or debris below it will accumulate producing an apron of undistinguishable debris. Often the scarp will be directly above the river so no accumulation can occur, however accumulations are common in the smaller creeks. The fissile nature of the shale and the steep relaxation joints and bedding plane discontinuities produced from the valley rebound process allows for small pieces to constantly break off. Often the shale breaks in paper-thin partings. This shale paper will flake off and slides down the shale face. The pre-glacial lacustrine deposits tend to break apart along silt interbeds and vertical jointing, also causing blocks of materials to fall.

Slide Type 2: Retrogressed Rotational Failure

The heterogeneity of both the Shaftesbury shale and the Pleistocene sediments generally does not favour single rotational failures. Instead the rupture surface will extend along a weak layer within the slope. Multiple rotational slides in the Peace River occur from upslope progression of a single rotational slip with a more or less planar basal shear surface, which terminates as a curved back scarp. Retrogression of the slide forms two or more slipped blocks with slip surfaces tangential to a common slip sole (Hutchinson, 1988). After an initial small failure, the intact scarp behind the failed mass becomes unstable, since toe support has been removed. This unstable scarp fails and now removes support for the next failure. In the Peace Region, the new failure can occur along the same plane or on a nearby weaker layer within the slope that can now be utilized. If the curved back scarp has a weak layer within it, a new failure will often occur along that discontinuity, as the toe has now been unloaded. These failures will retrogress further as successive slices become unstable from the removal of lateral support. The slope eventually self-stabilizes when the build up of debris downslope provides sufficient buttress support for materials further upslope (Figure 6.2). When the debris is removed, the intact section will become unstable again. These failures can progress a long distance into the slope as both the shale and the clay can fail at low angles and there are many weak layers with in both that can be mobilized. During air photo interpretation, it can be very hard to distinguish these failures from compound failures. Often the difference is the lack of extensional features and the presence of back tilted blocks both near the head of the failure and within the debris mass. These features are often difficult to locate and the interpretation must by supplemented with a field examination. On older, dormant or abandoned slopes, the ability to distinguish these features is reduced remarkably as the features are overgrown and weathered. A majority of these failures occur within the Pleistocene sequence, although they are not exclusively to it. When the failures occur within the upper portion of a section, removed from the erosive force of the river, they generally become stabilized and difficult to recognize.

Slide Type 3: Rotational Failure

The third type of failure recognized in the study area was a single rotational failure (Figure 6.3). These failures occur mostly within pre-glacial sediments, although they can also occur at a very small scale within Cretaceous shale. A majority of these failures occur on the south-facing slopes, although there are a few cases on north-facing slopes as well. As mentioned, single rotational failures rarely occur in earth materials that are heterogeneous and anisotropic, however, if the basal shear plane truncates the curvilinear failure plane deep within the failed mass, the movement will remain mostly rotational. The Peace River area has many rotational failures, even though the horizontally bedded materials are not a favorable material for such a movement. These rotational failures occur within the pre-glacial sediments at locations were the heterogeneity is at a minimum. The Pleistocene sequence is more favorable than the shale because of the weaker compressive strength of the material and a smaller discrepancy between the plastic and non-plastic materials. Many of the non-plastic clay layers actually act to hold the unconsolidated materials together, allowing for the curved back scarp to occur. As most of the failures within this region occur above river level, the debris of the rotational failure is often disturbed and does not appear as a slumped block but rather broken up debris covering the slope. Pre-sheared surfaces allow the initial movement to occur and in most cases will allow the material behind to mobilize. These failures are important to recognize because many of the larger failures may actually begin as a rotational slide, which unloads the toe and lets a larger mass to fail. Generally, rotational failures in this area are of small size and occur either within Pleistocene materials or within the landslide debris of larger failures. Such failures may involve either intact or remobilized material. The small size of these failures makes their identification difficult using high-level photographs.

Slide Type 4: Mobile Flow

Several highly mobile flows, likely mudflows within the colluvium derived from the pre-glacial sand, silt, and clay or the post-glacial clay (Figure 6.4), were identified during the air photo investigation. These failures generally occur within gullies cut into river bluffs and show the typical fan shape at the exit point of the gully. Hungr et al (2001) classifies these failures as mud flows, which are extremely rapid or slower, fine-grained flows of liquid clayey soil. They are shallow failures occurring during heavy rainfall and snowmelt seasons. These are small, continuing processes that build up to form gentle fans near the mouth of the gullies. They occur in a range of sizes from 5,000 m^3 to 500,000 m^3; however, they are often very small and shallow. These failures were identified and noted within the air photos and database but not examined in detail in the field.

Slide Type 5: Earth Flow

A few slopes were identified as containing earth flows or earth flow complexes (Figure 6.5). These failures occur within the colluvium derived from the underlying

Pleistocene materials. They generally occur in the far western section of the study area around the town of Hudson Hope. Hungr et al. (2001) defines these movements as earth flows that are slow movements of earth near its plastic limit, sliding as a plug-like mass. They mostly occur within the gullies although they can also happen along the main valley walls as well. These failures occur exclusively within the pre-glacial valley boundaries. This type of failure was not examined in the field, only recognized during the air photo interpretation.

Slide Type 6: Multi-level Failures

The majority of the failures within the Peace River area utilize several weak shear planes at different levels. These are considered multi-level failures (Figure 6.6). The compound failures can involve any combination of the other slide types mentioned. The presence of two very weak materials, shale and pre-glacial clay, in which many shear planes can exist at different elevations, make this a dominant type of slide. There are two types of multi-level failures occurring within the study area: those in which the failures are independent of each other and those that appear to have failed together. If the failures are independent of each other, then there is an intact scarp between the two failures that is not covered by debris or colluvium. The debris from the upper failure may play a role in the stability of the lower failure(s) but the shear planes are not connected and distinct form each other and the failures occurred at different times. These failures are generally shallower and can occur in either material. Shear planes that have failed simultaneously, are generally deeper within the slope. The debris mass that has failed is large enough to cause the other failure too occur roughly at the same time. If the mass is not large enough to move a second mass, the disturbed material can either fail by itself or be buttressed and supported by the stable material. When the stable material fails, debris from both shear planes will be mobilized. This also occurs in both materials.

Slide Type 7: Compound Failure

The Shaftesbury shale contains bentonitic-rich layers that are widespread, which allows a sheared surface to propagate deep into the slope leading to the development of large, low-angle compound failures (Figure 6.7). Many of these failures are dormant, so the original morphology of grabens and horsts is not recognizable on air photographs. These failures are prevalent on the north-facing slopes, although not exclusively. Most of these failures are older, making the features difficult to recognize both on the air photos and on the ground. Within the shale, the failures are thought to occur on pre-sheared surfaces at many different elevations above 420 meters a.s.l. Below this, no shear planes were witnessed or inferred. This type of failure also occurs within the pre-glacial sequence with the largest failures occurring near the base of the sequence. These failures can be large, up to 60 Mm^3. Extensional features within the debris, such as horst and grabens, as well as the low angle at which debris can be found, distinguish these failures from all others. At very low angles of slip, a Compound failure is more likely than a rotational failure.

Slide Type 8: Shallow Retrogressive Failure

Shallow retrogressive failures (Figure 6.8) occur exclusively within the Glacial Lake Peace clay. These were only witnessed along the Halfway River (Bobrowsky, 1991) and near the canyons on the Beatton River. The till below acts as a stable base below, which the failure plane cannot penetrate. The basal shear plane normally coincides with

Figure 6.1 Slide Type 1: Raveling - Photo and Schematic Diagram (inset)

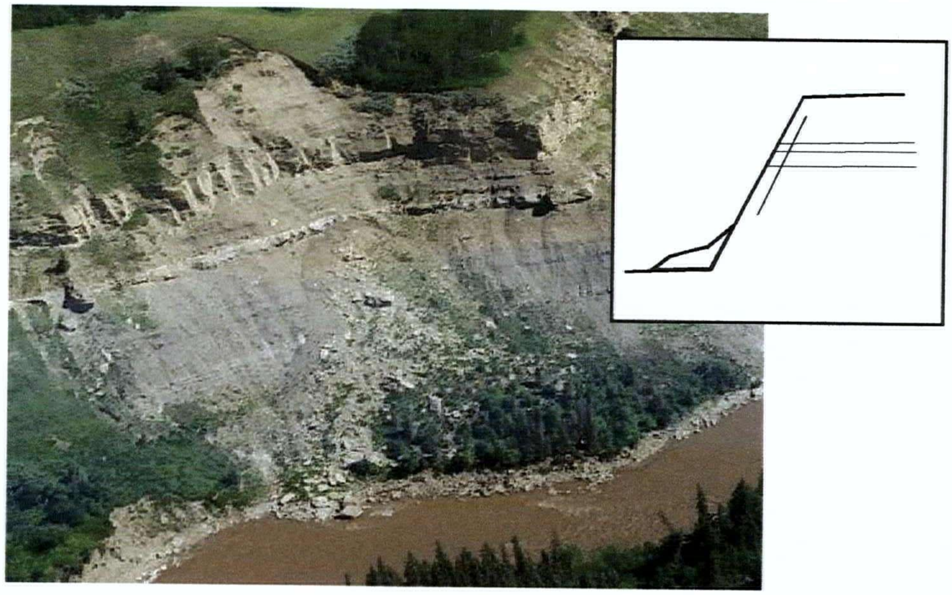


Figure 6.2 Slide Type 2: Retrogressive Rotational Failure - Photo and Schematic Diagram (inset)

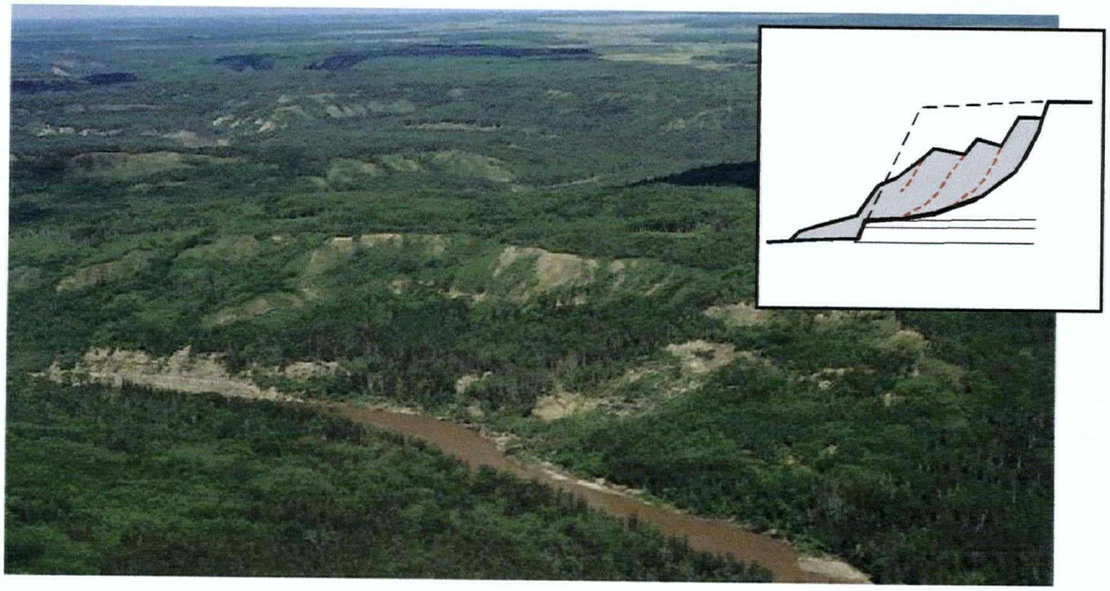


Figure 6.3 Slide Type 3: Rotational Failure - Photo and Schematic Diagram (inset)

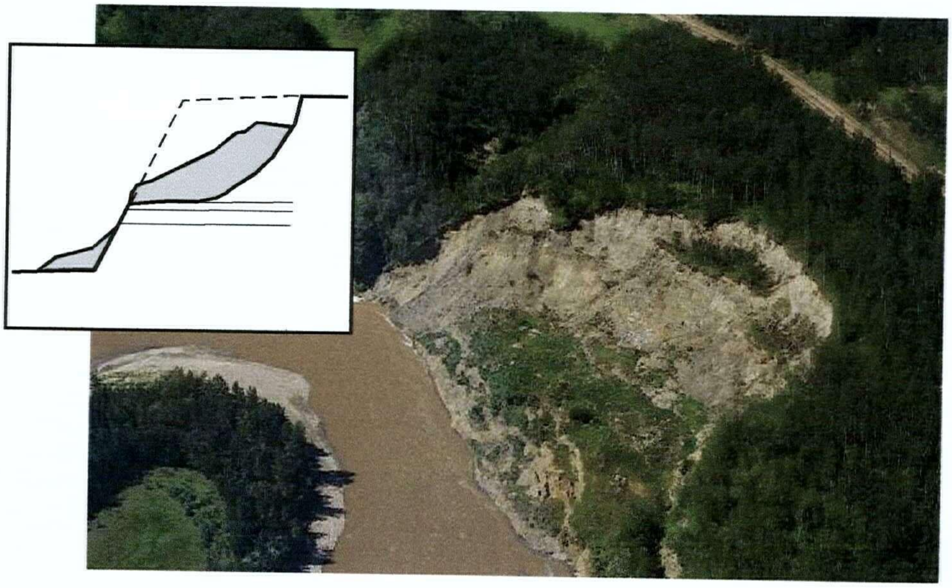


Figure 6.4 Slide Type 4: Mobile Flow - Photo and Schematic Diagram (inset)

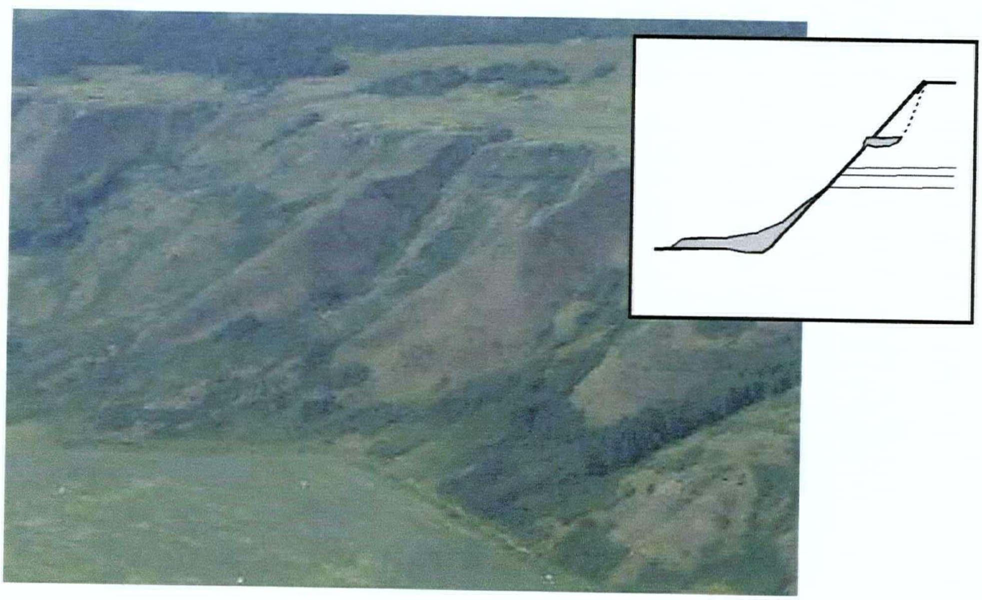


Figure 6.5 Slide Type 5: Earth Flow - Photo and Schematic Diagram (inset)

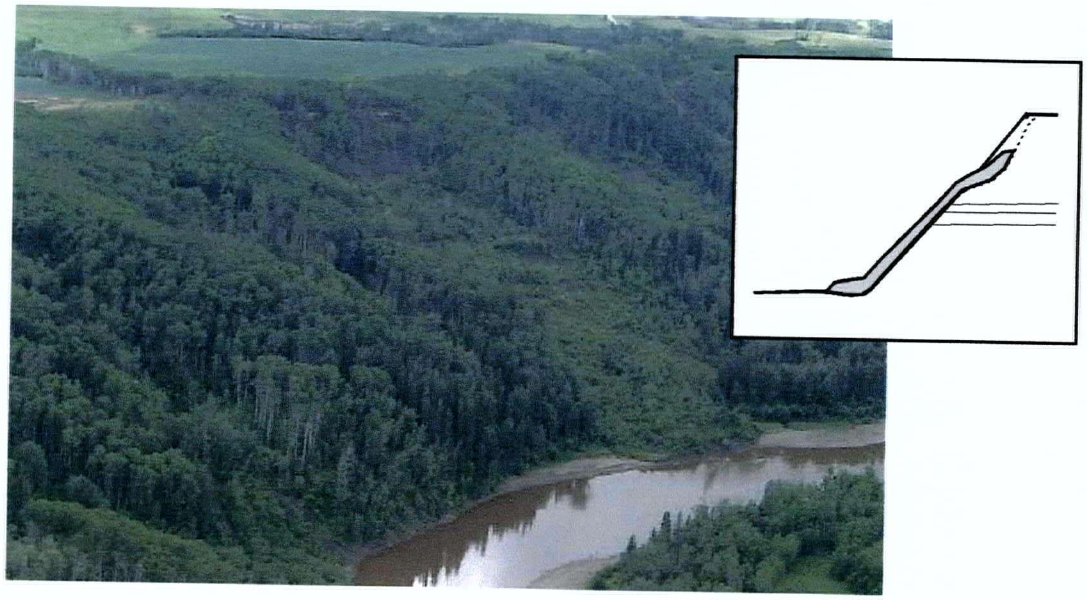


Figure 6.6 Slide Type 6: Multi-level Failure - Photo and Schematic Diagram (inset 1) and shear plane (inset 2)

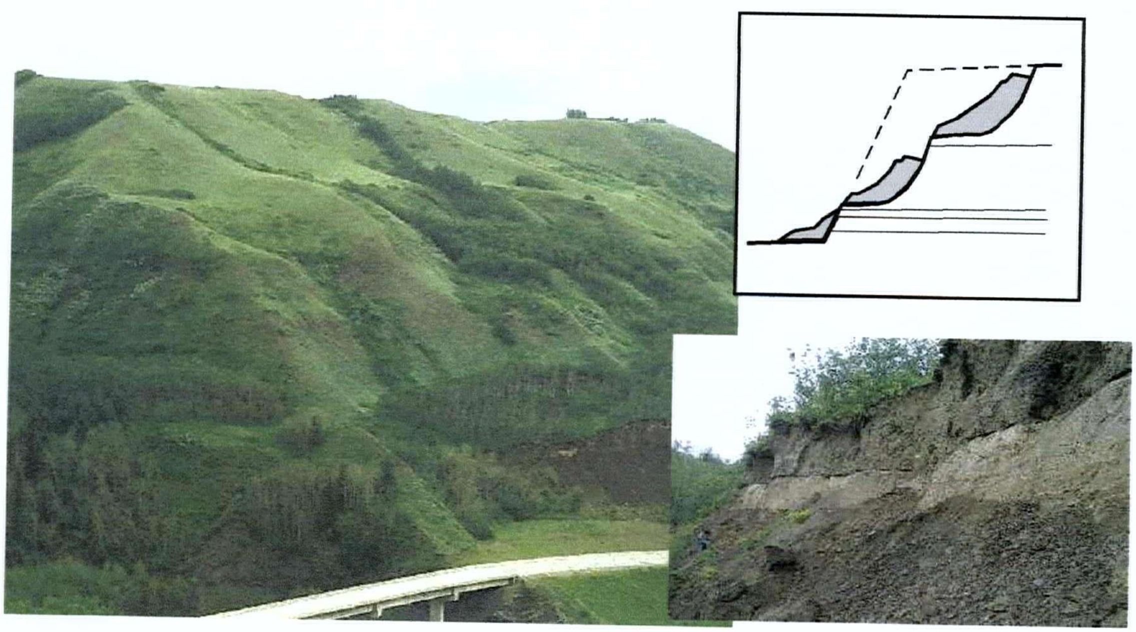


Figure 6.7 Slide Type 7: Compound Failure - Photo and Schematic Diagram (inset)

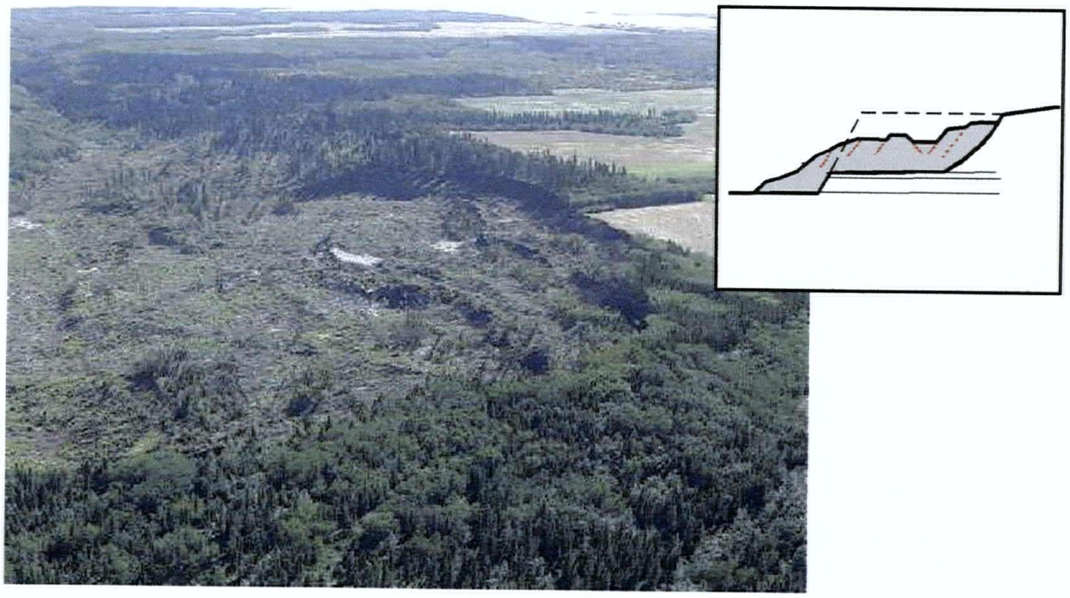
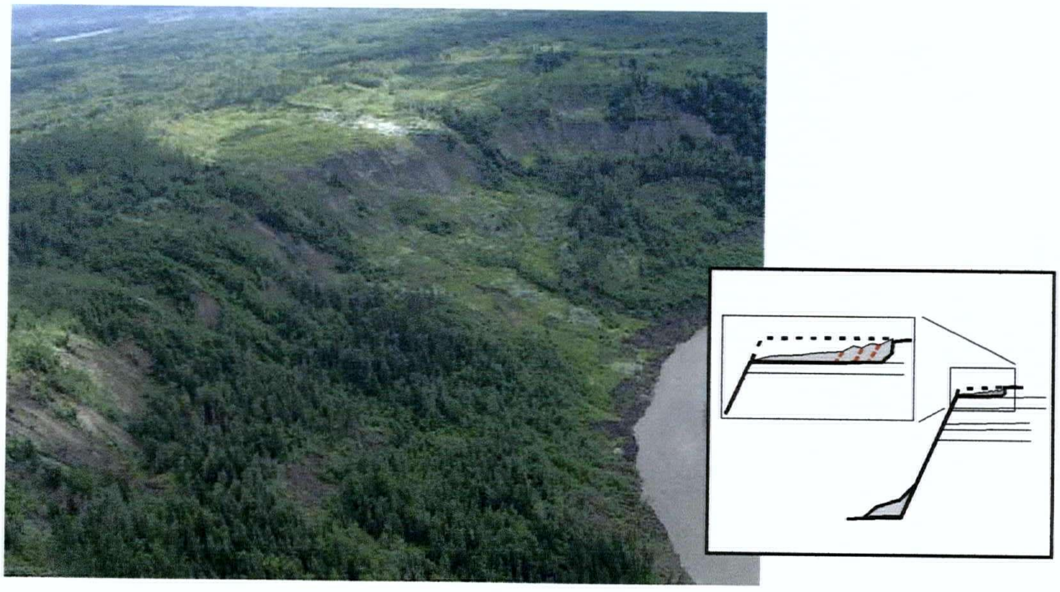


Figure 6.8 Slide Type 8: Shallow Retrogressive Failure - Photo and Schematic Diagram (inset)



the surface of the Wisconsinan till. The sediment involved remobilizes and flows over a stable bench. The debris mass is thought to undergo quick disintegration and flow in a fluid-like manner. The retrogression occurs quickly and can extend for a slope angle of 3.5°. The mandate of this report was to focus on deep-seated failures, so this type of failure was not surveyed during fieldwork, only recognized during air photo interpretation.

6.2 Activity Classifications

Many attempts to create a system in which to map landslides in terms of activity (Cruden and Varnes, 1996), intensity (Hungr, 1997), and morphology (Sissakian et al., 1983 and Yanez, 1979) have been made, however, as of yet none have been fully recognized. This is partly due to the highly variable nature of slope movements around the world and the complexity of the mapping systems needed in order to map them. The landslide mapping system used for this project is a hybrid of previous classifications and unique features used for the Canadian Prairies.

Cruden and Varnes (1996) describe 6 states, Active, Suspended, Reactivated, Dormant, Stabilized, and Relict to describe the activity of a landslide. Active failures are those that are currently moving and reactivated failures are those which are currently active after being inactive. Suspended failures were defined as failures, which have been recently active, within the last annual cycle of seasons but not moving at present. Dormant movements include inactive landslides in which the cause of the movement remains apparent. Failures in which the toe has been protected against erosion are described as being stabilized, and those in which the failure occurred under different geomorphic or climatic conditions are described as Relict. This system is not practical for use in the Peace River Area, as almost all of the slopes within the river valley are actively moving. The rate of the movement is the main difference. The failure planes on which the failures occur extend into the slope further than the current failure boundaries, therefore new movements can occur. This makes an otherwise "stabilized" slope still susceptible to failure, therefore, categorizing it as stable would be misleading. Another issue is that much of the debris of the initial failure remains on the slope due to the low angles of the failure planes. This debris moves very slowly, therefore, it is currently moving but to classify it as active would also be misleading. The contention is that there are very few stable slopes and that the classification has to reflect the relative activity of the failure.

Hungr (1998) describes a method of mapping landslides in terms of intensity. Hungr (1988) defines intensity as the set of quantitative or qualitative spatially distributed parameters, which determine the potential of a given landslide phenomenon to cause damage. If this inventory is to develop into a risk map, then the intensity of the failures should be considered. A map of this nature could not be undertaken at this time due to the lack of full knowledge of the elements of risk. Due to the preliminary and broad nature of this map, only the recognition of a hazard and the estimate of size could be undertaken. Hungr (1988) uses an incremental classification system based on the return period of a landslide to create a system of mapping failures relatively. This method was deemed unfeasible for this project, as the failures are not discrete movements in which a return period can be calculated, but rather constant slow moving failures, which seemingly randomly fail catastrophically.

A hazard map would be difficult to produce in this area as all of the slopes are failing. Generally (the Attachie Slide being an exception), once a slope is failed it is known and can fail again, but it actually reduces the hazard as the slope is at a shallower angle and is closer to stabilizing itself. It is the slopes that have not failed catastrophically in recent times but have known failure planes that are of a high hazard.

An activity classification was developed to distinguish landslides and landslide areas, according to their degree of recent movement activity. This may allow for possible landslide triggers to be identified. As landslides are ubiquitous within in the area, the most active areas were identified to distinguish areas of higher hazard. In this way, a determination of the most active areas can be made for practical purposes. Although the active areas are distinguished, other slopes should not be thought as safe and stable, as dormant slopes have been known to fail catastrophically as in the Minias Creek Slide (Thurber, 1982). Another important reason for developing an activity classification was to help determine whether or not different types of slides had different activities. This may allow for a temporal analysis of mechanism or mode of failure. Cruden and Varnes (1996) discuss activity under three separate headings; State of Activity, Distribution of Activity, and Style of Activity. Within the classification used for this project, only the state of activity is considered, which is defined as what is known about the timing of the movements.

Activity levels were defined from dated air photographs taken between 1997 and 1945, and by site investigation during the summers of 2002 and 2003. Photos used for this purpose are noted in Appendix A. Due to the size of the area, not all river segments were visited in detail and therefore the index may show them as less active than they really are. Also, due to the small scale of the air photos, not all active features may have been recognized. The activity levels created for this project are: 1) Very Active, 2) Active, 3) Low Activity - Dormant, 4) Low Activity - Abandoned, and 5) Modified.

Very Active slides are those that have failed within the last 5 years, in this case since 1997. They show up as a red colour within the inventory and had a very fresh appearance during the investigation (Figure 6.9). These slides were classed by field investigations done by the author and from reports from practicing engineers and geologists in the region. The river valleys were flown over during the summers of 2002 and 2003. The five year cut off for very active slide grouping was chosen because smaller features tend to begin to be muted after this time period and young trees begin to appear. It also allows practioners in the area enough time to add observed slides to the database.

Active slides are those that have failed within the last 50 years, in this case since 1953, excluding the above Very Active cases. In the inventory they appear with a light blue colour. In the field they can range from looking fairly fresh with no vegetation cover to grass covered with smaller trees (Figure 6.10). This activity can be hard to define in the field, as aspen grows at a very fast rate. Landslides with this activity were determined by studying air photos from 1985 and 1945 along with geological and geotechnical reports from practicing professionals within the area. The ground generally looks disturbed with stands of younger trees; however, after about 50 years the slide can become indistinguishable from the rest of the slope. This classification exists because the investigation of these landslides may still be useful for understanding slide mechanics within the area. With a separate classification, they can be selected and visited. After approximately 50 years, the features of the slide can become distorted and muted by weathering, leading to false interpretations. Also the work that has been done in the area within the past 50 years can be added to the inventory in order not to lose a valuable resource.

Low Activity - Dormant landslides (Figure 6.11) are those, in which movements are probably older than 50 years, yet they still have active erosion near the toe (e.g., fluvial undercutting). Within the inventory they appear as a green colour. These failures are mainly determined through air photo interpretation with some selected field studies. This is an important classification because even though some of the river slopes appear to be stable, they still contain one or more pre-sheared layers within them. These pre-sheared planes allow the slope to fail easily with even a small trigger. The probability of failure is higher due to the active erosion as it can either undermine intact material at the toe of the landslide making it more susceptible to failure or transport debris of older sliding movements so that it can not act as support for the toe.

Low Activity - Abandoned landslides are those that are older than 50 years and do not currently have active erosion at the toe (Figure 6.12). They appear as the colour purple in the inventory. For this classification, an understanding of river morphology must be incorporated to deduce where past river erosion has taken place. These slopes are marked as they have failed since glacial times and therefore also likely contain sheared clay layers within the slope. For practical purposes, they are mapped due to the possibility of remobilization along the shear plane if the slopes are disturbed, either naturally or anthropogenically. As river erosion is a major trigger within the area, slides situated away from the river are less likely to fail and therefore of a lower hazard.

The final class of landslide defined within the area is Modified. These are landslides that have been stabilized by artificial earth works after failure (Figure 6.13). They are

Figure 6.9 Very Active Landslide (Photo)

Figure 6.10 Active Landslide (photo)

Figure 6.11 Low Activity – Dormant Slide (Photo)

Figure 6.12 Low Activity – Abandoned Slides (photo)

Figure 6.13 Modified Slide (Photo)

almost always along a part of the infrastructure, including roadways, railways, or pipelines. In order to be part of this grouping, the slide features have to be disturbed enough to be unrecognizable. These are important slides to note because in the years to come, the slope will be weathered and all traces of a failure will be erased. These slides must be noted so that the presence of the shear plane is not lost to other investigators.

One of the problems encountered using this classification is that some slides show different activities within different sections of the slide. A slide with an active toe and a dormant top must be defined as one or the other. In this case, the activity which best describes the majority of the slide will be used.

6.3 Morphological Symbols for the Inventory Map

A set of morphological symbols was designed for use on the landslides in the Peace River Area during this project. The features used for this inventory are seen in Figure 6.14. This is based upon Yanez (1979).

Figure 6.14*a* is the first symbol defined and is used to denote a large scarp within intact material. Intact material is defined as any large mass of material that has not previously failed, whether it is bedrock or Quaternary material. A large intact slump block is, therefore, mapped as debris rather than intact material. A large scarp is defined as any scarp that measures over 1.0 mm in plan width on the air photos used. The air photo sets (BC 86047, BC 86074, BC 86075, and BC 86099) are flown at a high altitude with a resultant scale of 1:60,000. The large scarp therefore corresponds to 60 meters in horizontal length. The same symbol is also used for large, nearly vertical cliff scarps whose length is not represented properly on air photos.

Figure 6.14*b* is used for large scarps within defined debris masses. This includes any materials that have incurred any movement including creep and intact blocks that have moved. Large scarps within the debris mass are rare but do occur on the larger failures. The symbol has the same shape as the intact material in order to allow the large slopes to be easily picked out. Often the determination of intact or debris material is difficult, therefore, when the material is in question, the conservative approach was taken and the material is assumed to be debris.

Figures 6.14*c* and 6.14 identify symbols used to denote small scarps within the study area, in intact material (rock or soil) and debris respectively. The latter symbol was created with a similar appearance to the small scarp in order that all small scarps could easily be identified. The definition of a small scarp includes any scarp with a down slope plan length less than 60 meters. This symbol is also used for a small vertical scarp. This is a very common symbol often used to denote a cliff. It was chosen to represent a small scarp due to the practical smaller size.

An arrow attached to any of the above symbols, indicates a movement in the direction of the arrow. The arrow by itself does not indicate a type of slide but rather the direction itself. A failure with this symbol is usually a rotational failure with no obvious back tilt or an older translational or compound failure. Other symbols within the failure can determine the type of slide. Figure 6.14*e* is a symbol that represents back tilting within the debris mass. The arrows from the head scarp and the arrows from the debris meet at the base of the head scarp. The symbol used for the head scarp depends on if the material is intact or in debris and the size.

Figure 6.14*f* represents the extensional feature of a graben and is usually used in conjunction with Figure 6.14*g*, which represents a horst. These symbols are not dependent on size and because these features only occur in debris, the intact version was not considered. In the case where a horst is at the base of a head scarp, the two features coalesce at the base of the head scarp. This symbol is used exclusively on compound and compoundfeatures.

The symbol for a debris apron is represented by Figure 6.14*h*, which can be used in conjunction with any of the other symbols to represent the debris of the slide. It can also be used by itself if a debris apron is observed at the base of a slope with no clear features. An example of this would be the base of a raveling slope.

The above symbols can by combined in order to define most of the landslide types defined in Section 6, however, two unique symbols were created to describe specific conditions. A highly mobile flow is indicated by Figure 6.14*i*. The scarp at the head of the failure depends on the size and material. The body of the displaced material is outlined with an arrow outlining the suspected path of flow. A less mobile earth flow is represented by Figure 6.14*j* with the head scarp symbol defined by the size and material found. The body of the debris is outlined. The area in which debris has been removed is represented by a concave curve, the center of the mass is a straight line, and the accumulation area is represented by a convex curve. When an earth flow complex covers the whole slope, then the symbol represented by Figure 7.7e is used. The scarp symbol depends on the material and size.

The use of the morphological symbols in describing the eight landslide types described in Section 6.1 is shown in Figure 6.15.

Figure 6.14 Morphological Classification

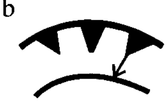
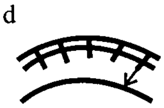
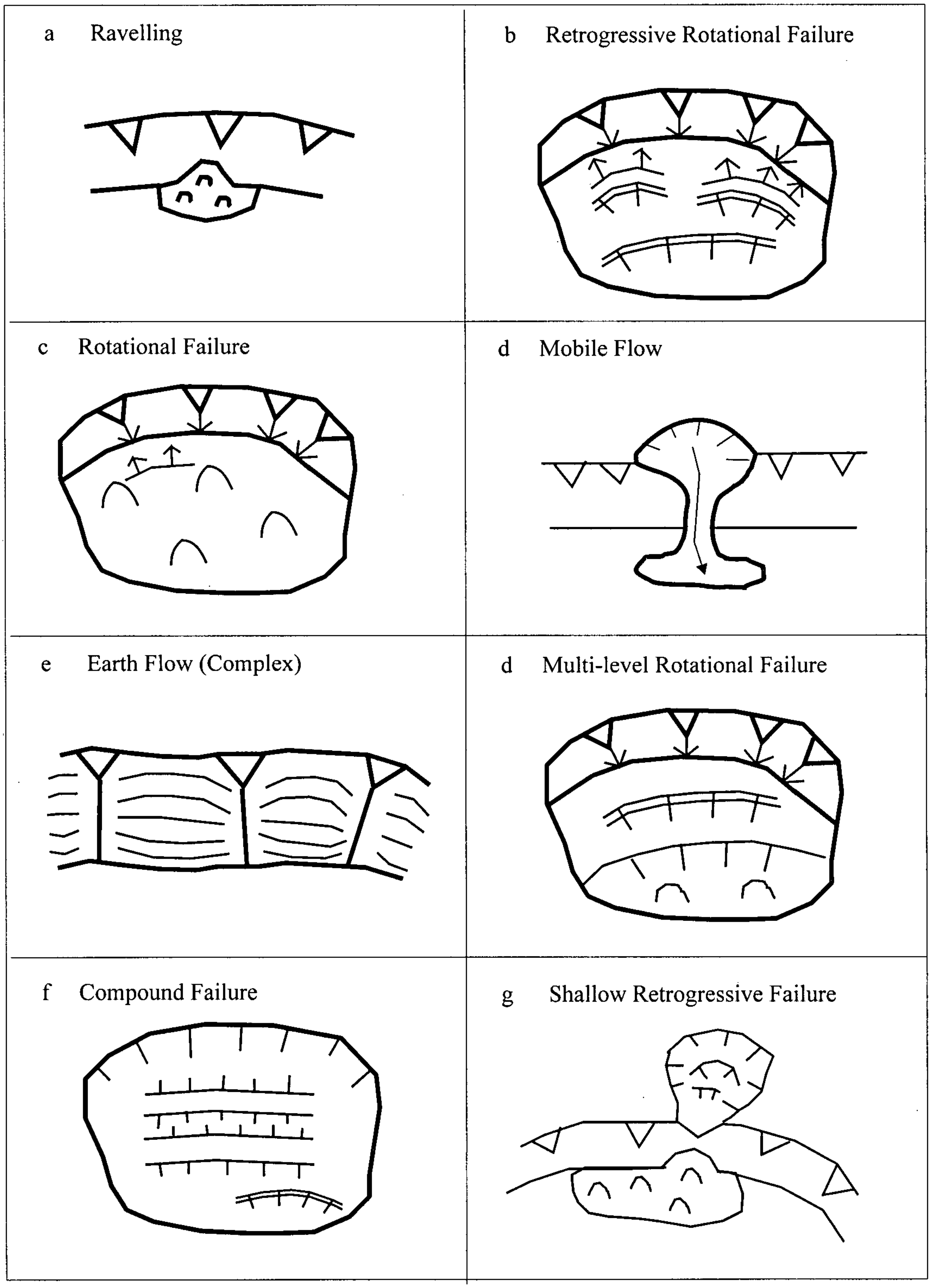
Symbol	Description
a 	Large Scarp (Intact Material) A large scarp is defined as any scarp that measures over 1.0 mm in plan width on 1:60,000 scale air photos, corresponding to 60 meters in length. This symbol is also used for large, nearly vertical scarps whose length is not properly represented on air photos. Intact material is defined as any large mass of material that has not previously failed, whether it is bedrock or Quaternary material.
b 	Large Scarp (in Debris) A large scarp, defined above to be over 60 meters in length in plan view, within a defined debris mass.This includes any materials that have incurred any movement including creep and intact blocks that have moved. The symbol has the same shape as the intact material in order to allow the large scarps to be easily picked out. The arrow indicates that movement in that direction has occurred.
c 	Small Scarp (Intact Material) A small scarps is defined as any scarp mesaureing less than 1.0 mm in plan width on 1:60,000 scale photos, corresponding to less than 60 meters in length. The scarp may be within any intact material, Cretaceous bedrock or Quaternary sediments. It was chosen to represent a small scarp due to the practical smaller size.
d 	Small Scarp (in Debris) A small scarp, defined above to be less than 60 meters in length in plan view, within a defined debris mass.This includes any materials that have incurred any movement including creep and intact blocks that have moved. The symbol has the same shape as the intact material in order to allow the small scarps to be easily picked out. The arrow indicates that movement in that direction has occurred.
e 	Backtilt This symbol represents back tilting within the debris mass. The arrows from the head scarp and the arrows from the debris meet at the base of the head scarp. The symbol used for the head scarp depends on if the material is intact or in debris and the size
f 	Graben This symbol represents the extensional feature of a graben, usually used in conjunction with Figure 7.6*g*. This symbol is not dependent on size and only occurs in debris, therefore the intact version was not considered. This symbol is used exclusively on translational and rotational-translational features.
g 	Horst This symbol represents the extensional feature of a horst, usually used in conjunction with Figure 7.6*f*. This symbol is not dependent on size and only occurs in debris, therefore the intact version was not considered. This symbol is used exclusively on translational and rotational-translational features.
h 	Debris Apron A debris apron is an accumulation of debris. This symbol can be used in conjunction with any of the other symbols to represent the debris of the slide. It can also be used by itself if a debris apron is observed at the base of a slope with no clear features.
i 	Mobile Flow (Mud Flow) Mobile Flow is a highly saturated mass of fines moving in a fluidized manner. The scarp at the head of the failure depends on the size and material. The body of the displaced material is outlined with an arrow outlining the suspected path of flow.
j 	Earth Flow Earth Flow is an intermittent flow of plastic clayey earth moving in plug-like manner. The head scarp symbol defined by the size and material found. The body of the debris is outlined. The area in which debris has been removed is represented by a concave curve, the center of the mass is a straight line, and the accumulation area is represented by a convex curve

Figure 6.15 Landslide Type Examples using Morphological Classification



7.0 LANDSLIDE INVENTORY

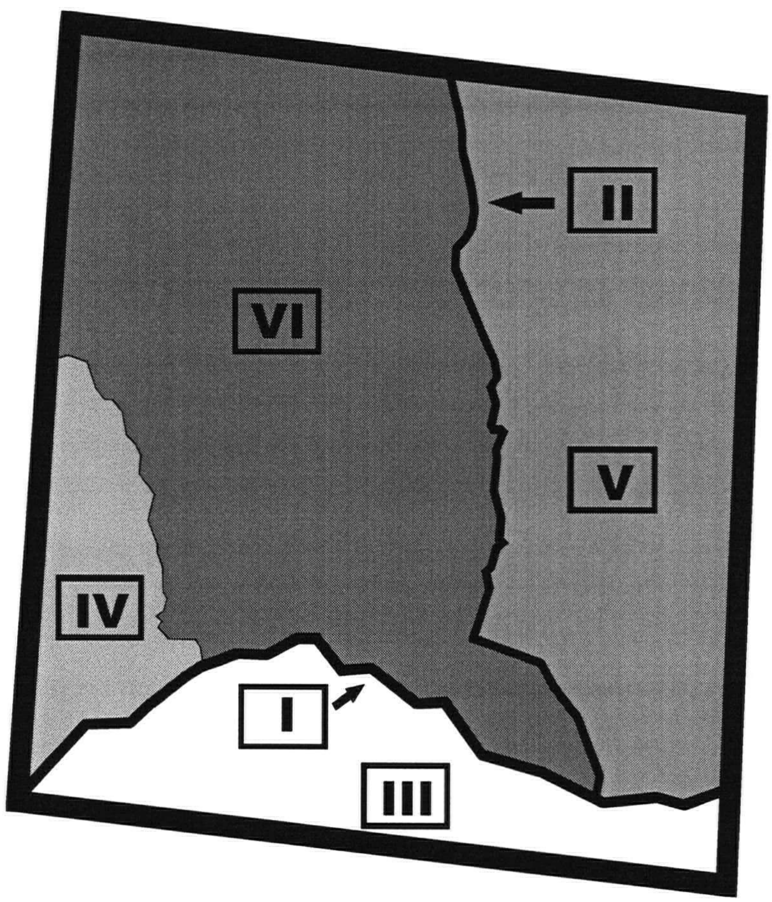
7.1 Objective

The primary focus of this thesis was to create a landslide inventory that could be used by practicing geologists and engineers working in the Peace River area. The hope is that this thesis will form the basis of the most detailed inventory of landslides in Canada, to be continuously added to and updated as more information is collected. The inventory will be implanted into a geographic information system (GIS) that is tied to a database that has been compiled during the inventory. This will hopefully become available through an open file from the Geological Survey of Canada – Terrain Sciences Division webpage. This inventory is not to be used for design purposes; however, it may give an insight to a prospective or practicing landslide investigator. Further detailed fieldwork is necessary in order for the inventory to be more reliable. The inventory is entirely based on air photo interpretation and the relatively limited field experience of two summers. The inventory and models are to provide a basis of ideas, to be added to and argued with. Due to the large size of the study area, small features on individual landslides may have been misinterpreted or missed. These features may help determine or completely change landslide type.

7.2 Referencing System

Before an inventory can be attempted, a referencing system must be in place in order to know where the slides have occurred. The landslide inventory is a linear inventory as almost all of the region's landslides occur within the current river valleys. The linear nature of the inventory requires a linear referencing system, in this case the river valleys had to be referenced. The size of the study area forced the referencing system to be detailed and ordered in a way that is easy to reference. The system breaks down the entire area into 6 smaller, more manageable areas (Figure 7.1); 1) Peace River, 2) Beatton River, 3) Southern Tributaries, 4) Beatton River East, 5) Halfway River West, and 6) Halfway River to Beatton River. Each of these six areas was then broken down into individual rivers or large creeks. Smaller creeks are simply incorporated as tributaries to the larger creek or river numbering system. The total distance covered by this referencing system was 1292 kilometers (Table 7.1).

Figure 7.1 Reference Areas for Landslide Inventory



The Peace River division includes the Peace River and the Peace River Valley and covers 276 kilometers. The distinction is made because the current river level has created its own slope segments within the larger, Peace River Valley. No other rivers were added to this division because of the quantity of landslides and river segments within the Peace River valley. It is a large enough division without adding any other rivers as the river traverses the entire map sheet.

The Beatton River division is another that only has a single river within it. The Beatton River runs for almost the entire map sheet from the north to the south, incorporating 265 kilometers worth of river valleys. The number of tributaries to the Beatton River would make the division unmanageable.

The third division, Southern Tributaries, includes the Pine, Moberly, and Kiskatinaw Rivers. It also includes Maurice and Septimus Creeks. The bottom of the map sheet truncates all of the above-mentioned waterways except Septimus Creek. The rivers and creeks are tied together by the geographic boundary of the Peace River and were an easy target to group. The number of river segments was limited by the map sheet boundary limiting the total amount of distance covered to manageable size of 200 kilometers.

The fourth division established is Beatton River East, which incorporates the Doig, Alces, and Osborn Rivers as well as Milligan Creek. The Beatton River in the west and the Peace River to the south act as the boundaries of the area. The section encompasses 194 kilometers of river valleys, which is 15% of the whole area. Milligan and Osborn Rivers to the north, have only a few slides that are large enough to be recognized, however, if a slide occurs, they will be able to be placed within the referencing system.

The area from the Halfway River west is the fifth area to be defined. It includes the Halfway and Cameron Rivers as well as Ground Birch and Farrell Creeks. There is 263 kilometers of River Valley within this section. This area is mostly outside of the pre-glacial valley and is underlain by the Sully Formation and not the Shaftesbury Shale (Stott, 1982). The Pleistocene sediments here are outwash sands and gravels (Mathews, 1978) so the number of failures and their types should vary in this division. It is also very easy to separate this western section as a separate unit.

The final division is made up of the rivers and creeks between the Halfway River in the west and the Beatton River in the east and north of the Peace River. The waterways include the Blueberry River and St. John, Red, and Cache Creeks. This area is upon the upper plateau and underlain by the competent Dunvegan Sandstone, so a majority of the activity in this section occurs within the pre-glacial valley boundary near the Peace and Beatton Rivers. There is only 94 kilometers (8%) of referenced river slope within this section.

Table 7.1 Measured Distance within Slope Segment Districts

Division	Peace River	Beatton River	S. Tributaries	Halfway West	Beatton East	Halfway to Beatton
Kilometers measured	276	265	200	263	194	94
% of Total	21.4	20.5	15.5	20.4	14.9	7.3

The individual rivers within the divisions were then broken up into separate river segments. This was done by examining the topographic map and breaking the slope up into subjectively defined segments that appear homogeneous in terms of slope dimensions, stratigraphy, morphology, and activity. There were no maximum length criteria used as an entire valley wall could be classified as one slope segment as long as there were no large breaks in the wall (i.e. gullies) or distinct changes in direction or average slope angle. After both banks of each river were broken into these dissimilar slope segments, the segments were then numbered. The banks were numbered independently of each other, starting with the segments nearest to the mouth of that river. In the case of the Peace River, the numbering began in the east at the Alberta border and finished in the west at the Peace Canyon Dam. If a small creek, located along the valley wall, was made of more than two segments, it was labeled independently, with the number scheme matching that of the rivers. The left and right banks were numbered independently starting where that creek meets the larger river valley. In this manner, all slope segments within the study area were numbered independently of each other. For this exercise, the left bank is defined as the bank on the left hand side of the viewer while viewing in a downstream direction. Each river and creek was then given an identifier so that the river and the segment could easily be recognized (Table 7.2). For example, the eleventh segment on the left bank of the Beatton River is labeled as BL-11. Smaller tributaries that were large enough to be labeled separately but not large enough to have their own identifier were given a tributary identifier based on the larger river. The tributaries were also numbered starting at the mouth of the river with the left and right banks labeled separately. For example, the third segment of the right side of the sixth tributary found on the left hand side of the Peace River is labeled as PL-T6R 3.

Table 7.2. River Identifies within Charlie Lake Map Sheet

River	Identifier	River	Identifier	River	Identifier
Alces	A	Ground Birch	GB	Peace	P
Beatton	B	Halfway	H	Peace Valley	Pv
Blueberry	BB	Kiskatinaw	K	Pine	Pi
Cache Creek	Cc	Moberly	M	Red Creek	Rc
Cameron	C	Milligan Creek	Mc	Septimus Creek	Sc
Doig	D	Osborn	O	St. John Creek	SJc
Farrell Creek	Fc	North Cache Creek	NCc		

7.3 Methodology

Once a referencing system was in place, a database of landslides could be compiled. Before any landslides were identified and catalogued, a referencing system for the landslides themselves was created. This system is to be used in combination with the river slope segment referencing system, in order to locate a particular slide. The landslide format is set up similarly to the segment system and uses the same identifiers (Table 7.2). The main difference is that the numbering scheme is different. The landslides are numbered in order of their identification and not geographically oriented. This was done to allow for new slides to be placed within the inventory without using further qualifiers (e.g. BR1b). A new failure would appear as a higher number in the same slope segment. An example of this full labeling system is given for slide PiR-23 located on slope segment PiR-8

PiR-23 - PiR-8

Slide Identifier ↵ ↳ Slope Identifier

With a system of referencing the slides and their location in place, the identification of individual slides and slide complexes above a minimum size of 10,000 m^2 could be properly undertaken. Within the 6 previously defined divisions (Peace, Beatton, Southern Tributaries, Halfway West, East of Beatton, and Halfway to Beatton), the valley slope of each waterway was studied using high level air photographs with a scale of 1:60,000. These photos were used because they matched the 1986 Trim data, for which a complete set of maps is available at 1:20,000 scale. The photos were of good quality with only a small amount of cloud cover and good contrast between tones.

High-level photos were used in this initial interpretation to cover the large study area efficiently. Black and white photos were used to minimize the amount of noise witnessed through the stereoscope. Enlarged laser quality photocopies of the air photocopies were made and used to record the observed features. These copies were enlarged to a scale of 1:30,000, allowing for many of the smaller features to be identified. The enlarged copies were bound together and used for interpretation. The copies were useful during the analysis as they could be marked on. As features were recognized, they were marked on the copied photos with one of four coloured markers, blue, green, orange, and purple (Figure 7.2). These colours corresponded to the defined activity levels of Active, Dormant, Abandoned, and Modified. Active failures were defined by the relative freshness of the failures, marked by a distinct tone change due to the difference in vegetation. Dormant slides were those that were older with toes currently being eroded and abandoned were those that did not appear to be currently eroded. Many modified slopes were previously defined by geotechnical reports. Very Active slides were not defined using the 1986 air photos, as they had not occurred yet. Very Active slides were defined outlined by fieldwork during the summers of 2002 and 2003. As the features were delineated on the photocopies, slide types were recognized and defined (Section 6). All failures outlined to that point were then classified and the same classification applied to all future failures outlined.

7.4 Database

During the interpretation, a set of information was developed and then recorded in a database for every failure. This information set includes: Failure Identity, Slope Segment Identity, Activity Level, Failure Type, Waterway of Occurrence, Air Photo Identity, Probable Material of Basal Shear Plane, Length, Width, Area, Aspect, and Additional Information (Appendix IV). This information was placed within a database of all failures. The waterway of occurrence is simply the river or creek on which the failure occurred. The air photo on which the failure occurred was also recorded so that the photos could be easily retrieved. The probable material of the basal shear plane was identified on the basis of the bedrock geology map created by Stott (1982), the surficial geology map created by Mathews (1978), and by field observations. Both the bedrock and the Pleistocene sequence are made of materials that are horizontally bedded within highly plastic layers. This leads to a similar morphology in landslides within both materials. The similar morphology can make the determination of the materials involved very difficult. Only the basal shear plane material was inferred, as many of the failures have multiple shear planes and only the basal plane can be estimated. The length and the width were estimated from the air photos and the area was calculated from these values. The aspect of the failures was also measured off the air photos in order to help analyze slide type trends. The additional information category incorporates any other pertinent information.

Once the initial inventory was completed using the air photos from 1986, the data was checked against air photos from two other time periods, 1945 and 1997 at a scale of approximately 1:10,000.

This allowed the slides marked as "Active" to be cross-checked against the older photos and the "Very Active" slides to be cross-checked by the younger photos. The larger scale photos also allowed for selected sites to be examined in more detail. Unfortunately, the entire area was not checked and only partial cross-checking could be accomplished. The activity of some of the landslides was very hard to determine as the slopes have all experienced failure since deglaciation. Some of the failures appear to have undergone a slow deformation with periodic larger movements. It is possible that many of the failures are actually younger than they appear on the photographs, with small movements remaining undetected.

After the database had been updated and cross-checked by the secondary photographs, the slide outlines and features were transferred from the photocopies to the hardcopy 1986 TRIM maps (Figure 7.3). This was done manually, drawing the features on the map as they appear on the photocopied air photographs using coloured pencils corresponding to the colours of the activity classification. Once the landslides were transferred to the map sheets, they were digitized in order to create a digital version of the landslide inventory.

The landslides were digitized at a 1:20,000 scale using a Summagraphics ® SummaSketch ® II Professional Tablet (Model: MM II 1812) into AutoCAD ® 2002. This

Figure 8.2 Landslide Outlines on Enlarged Photographs

Figure 8.3 Landslide Outlines on TRIM map

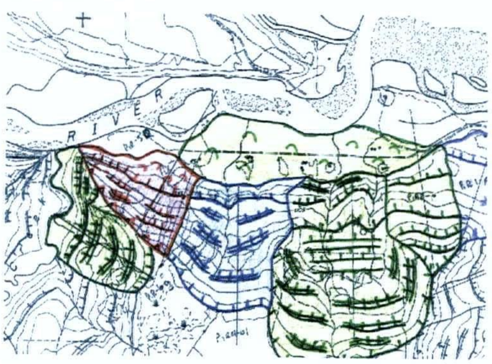
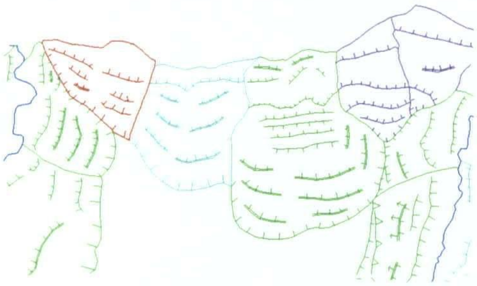


Figure 8.4 Digitized Landslide Outlines



produced a digitized version of the landslide inventory within a single file. All features and outlines were reproduced as they appear on the map sheet (Figure 7.4). The landslide locations were normalized by the Universal Transverse Mercator Projection (UTM) using North American Datum – NAD 83. Within the AutoCAD program, normalizing with UTM allows the slides exact location to be given only in UTM co-ordinates. Map boundaries and labels were also reproduced to serve as a locating device. Only the map sheets in which failures have been found to exist were included. The water way(s) in contact with the landslide were digitized as well.

7.5 Results

7.5.1 Distribution

The total number of slides identified during this inventory is 1610. The analysis of all of the slope failures is done with respect to the divisions defined during the initial stages of the inventory and as an entire area. All results are summarized in Appendices IV and V. The divisions that contain the largest number of slides are the Peace River Valley containing 465 slides, roughly 28.9% of all slides, and the Beatton River Valley containing 407, approximately 25.3%. The higher values for these two rivers are due to the length in which they occur within the pre-glacial valley limits. Within these boundaries, the presence of valley fill and rebound features within the shale bedrock are more prominent than outside of the boundaries. The rest of the slides are allocated as follows, Southern Tributaries contains 255 failures (15.9%), Halfway River West contains 216 failures (13.4%), Beatton River East contains 137 failures (8.5%), and Halfway River to Beatton River contains 130 failures (8.1%) (Table V-3; Appendix V).

As the total number of kilometers was measured during the initial investigation, an average ratio of slide per kilometer was determined for each division (Table V-3). The highest ratios of slide per kilometer are 1.82 occurring within the Peace River Valley and 1.60 within the Beatton River Valley. This ratio for the Peace River Valley is slightly underestimated as the were many slides coalescing and indistinguishable becoming long slide complexes, often persisting longer than several kilometers, especially along the south valley wall. The Beatton River ratio is also somewhat misleading as the ratio is skewed by large tracts of valley walls in the northern part of the river and bedrock canyons within the middle of the river that do not show many failures. The southern section of the river alone would have a much higher ratio. The remaining sections have the following ratios, Southern Tributaries (1.28), Halfway River West (0.82), Beatton River East (0.71) and Halfway River to Beatton River (1.38). The total failed area was also calculated for each division as well as the ratio of area per slide (Table V-3).

Even though the Peace River Valley and the Beatton River Valley have a similar number of failures, the area covered by the Peace River (258.92 km^2) failures far exceeds that of the Beatton River (151.98 km^2) (Table V-3). This suggests larger failures on the Peace River (0.56 km^2/slide) than the Beatton River (0.37 km^2/slide); likely due to pre-sheared bedding planes protruding further into the valley wall. These longer pre-sheared surfaces are likely due to the size of the post-glacial river and the relatively quicker rate of excavation. There are also a larger number of rock falls identified within the Beatton Canyons, which generally have small volumes. The Southern Tributaries division has a 0.59 km^2/slide ratio with an overall area covered of 151.62 km^2. The failures within the Halfway River West section cover a total area of 116.79 km^2 with an average size of 0.54

km^2. The Beatton River East sector covers a total of 33.01 km^2 with failures and an average of 0.25 km^2 per slide. Sandstone bedrock canyons along the Doig and Alces Rivers control this small average failure size. The Halfway to Beatton River section has a total area of 53.13 km^2, which is covered by failures with an average size of 0.49 km^2.

7.5.2 Activity

An activity value was assigned to each slide during the investigation. This allows for the activity to be divided with respect to area, failure type, aspect, and material involved. The results are given as percentages with respect to the respective divisions and as an average through out the entire area (Table V-1; Appendix V). This relative comparison allows for separate divisions to be compared to the whole study area. The dominant activity throughout the entire map sheet is "Low Activity-Dormant" with 61.0% of all failures. This activity has a high in the Halfway to Beatton River division with 80.8%. "Very Active" failures comprise of 1.9% of all failures, or 30 landslides. The area with the highest activity is the Beatton River Valley with 4.2% of all failures in the division being "Very Active" and over half of all of the "Very Active" failures in the region. "Active" failures comprise 12.9% of all failures, with the Beatton River East (16.8%), Halfway to Beatton River (15.4%), and Beatton River Valley (15.2%) with higher than average active failures. Combining "Active" and "Very Active" failures together, allows for the analysis of every slide that has failed within the past 50 years. These activities together comprise 14.7% of all failures in the area, making the Peace Region one of the most active areas in British Columbia, over that time period with 237 landslides. "Low Activity-Abandoned" failures include 22.9% of the areas landslides, with a high of 40.7% in the Halfway River West division. There are 23 “Modified” slides over the area with a majority of that (12) with the Peace River Valley.

The area for each activity level was calculated and compared within the division and throughout the entire study area (Table V-7; Appendix V). The area distribution of the landslides is similar to the location of the slides with respect to activity with Activity 3, “Low Activity-Dormant” dominating with 58.6% and “Low Activity-Abandoned” with 30.7%. The increase with respect to “Low Activity-Abandoned” suggests that the average size of failures is decreasing. This is supported by the “Active” and “Very Active” failures representing smaller areas as a percentage than in number as a percentage. This indicates that the active failures are smaller than the failures with a lower activity. “Modified” slides are represented by a similar percentage in size and number, 1.5%.

The failure type for each activity was determined and compared within the division and throughout the entire study area (Table V-9; Appendix V). “Very Active” slides are dominantly multi-leveled failures, which consist of 73.3% of that activity level. The number of type 6 failures along the Beatton and Peace River Valleys heavily influences this number. “Active” failures are also dominated by multi-leveled failures, 43.0%, however, there is a larger component of rotational, 20.8%, and retrogressive rotational failures, 23.7%, which resembles the values for the overall type values. The values slightly change when analyzing “Low Activity-Dormant” failures as the percentage of retrogressive failures actually falls to 12.6%, and Compound failures rises to 7.3%. Multi-leveled failures and rotational failures consistently comprise of a large percentage of the failures at 48.8% and 25.8%. “Low Activity-Abandoned” failures show a similar distribution of failure types with 44.0% being multi-rotational landslides, and

33.4% being rotational. The value for rotational failures is likely inflated by the conservative classification of a deep-shear plane. A large majority of multi-level failures exists within the activity 5 grouping, "Modified" with a total of 17 failures, which represents 73.9% of this activity. There are no strong trends within this analysis, therefore, it cannot be said that failure type is changing with time. It can however be said that retrogressive rotational failures and multi-level failures are harder to recognize as the features become muted, thus being classified as a rotational failure.

The slope aspect for each activity level was determined and compared within the division and throughout the entire study area (Table V-11; Appendix V) using the groupings described in 8.4.5. 30% of all "Very Active" landslides had a northern aspect, which is twice the average and corresponds to 9 failures. This is opposite to the over all trend of landslides with respect to aspect, which showed a higher number of failures on the south-facing slopes. "Active" slides are fairly evenly distributed with slightly higher values of south-facing, 17.9%, and east-facing, 18.4%, slopes. "Low Activity-Dormant" failures and "Low Activity-Abandoned" failures follow the overall trend displaying a higher proportion of south-facing slopes with both activity levels displaying 19.3% of their landslides having a southern aspect. "Modified" failures are generally on the south-facing valley walls, 26.1%, as a majority of the infrastructure runs along south-facing slopes. This value is influenced far more by location of infrastructure than landslide activity.

The material, suspected or known, containing the basal shear plane for each activity level was determined by geologic maps and field investigations. The values were then compared within the division and throughout the entire study area (Table V-10,

Appendix V). "Very Active" slides are predominantly within the Quaternary sediments, with 73.3% of failures of this activity. Most of these failures, 63.6%, occur within the Beatton River Valley, north of the Sandstone canyons. "Active" failures are more evenly distributed between the materials, with 43.5% of the slides within the shale bedrock, and 56.5% in the pre-glacial sediments. The dominant activity, "Low Activity-Dormant", displays an even distribution of materials, with 47.2% of failures in shale and 52.8% in the Quaternary materials. Two exceptions to this average are the Southern Tributaries, with 66.4% of failures in shale, and Beatton River East, with 64.9% of failures in shale. Of the "Low Activity-Abandoned" failures, 62.8% of the failures are within the Pleistocene sequence, while only 37.2% are in the shale bedrock. The same divisions, Southern Tributaries and Beatton River East, show a dominance of bedrock failures. "Modified" failures occur evenly within the shale, 43.5%, and the silt, sand, and clay, 56.5%.

7.5.3 Failure Type

The failure type of each slide was assigned during the investigation. Each failure type was then divided with respect to area, activity, aspect, and material involved. The results are given as percentages with respect to the respective divisions and as an average through out the entire area (Table V-2, Appendix V). This relative comparison allows for separate divisions to be compared to the whole study area. The dominant failure type within the Charlie Lake map sheet (NTS 94A) is the multi-level failure with 47.8% of all landslides, which corresponds to 769 slides. The Peace River and Beatton River Valleys display higher values than average for this type of failure. This number may be slightly underestimated as slides in which the mode of failure is uncertain are conservatively designated as a deep-seated failure, either single rotational or retrogressive rotational landslide. Conversely, the values of the deep-seated single rotational and retrogressive failures may be bolstered by this conservatism with values of 26.3% and 13.0% respectively. The Halfway River West division has a very high component of single rotational failures, 44.9%, due to the homogenous nature of the pre-glacial material in the area. Compound slides with one shear plane are fairly uncommon in the Peace Region due to the low number of weak shear planes available for failure. Compound failures comprise 6.5% of all failures with a high of 15.4% within the Halfway to Beatton River section. The remaining failures make up a total of 6.4%, with raveling at 0.6%, mudflows at 2.1%, earth flows at 2.4%, and shallow retrogressive failures at 1.4%.

The area for each failure type was also calculated and compared within the division and throughout the entire study area (Table V-8; Appendix V). As expected from above, the failure type, which covers the most area, is the multi-leveled failure with 53.1%. Even though compound failures do not represent many failures in terms of number, they do represent a larger number in terms of area, 13.8%. This suggests that compound failures are larger than other failures, which is supported by the average size calculated for each type of failure. The average size for a compound failure is 1.0 km^2/slide, whereas the average size of the next largest type slides, earth flows, is 0.61 km^2, and multi-leveled failures with an average size of 0.53 km^2.

The activity levels for each failure type was determined and compared within the division and throughout the entire study area (Table V-12, Appendix V). Most retrogressive rotational failures are "Low Activity-Dormant" representing 59.1%, of all slides of this type, while 23.3% are "Active". Rotational failures are also have a dominant activity of "Low Activity-Dormant" at 59.8% with the "Low Activity-Abandoned" activity representing 29.1%. Multi-level failures have a higher than average amount of "Very Active" failures at 2.9%, however, the failure type is also dominated by the "Low Activity-Dormant" activity level, 62.3%. Compound failures have a very high component of the "Low Activity-Dormant" activity level at 68.8%, with 21.0% represented by "Low Activity-Abandoned" failures. There are very few active compound failures.

The slope aspect for each failure type was determined and compared within the division and throughout the entire study area (Table V-14; Appendix V) using the groupings described previously. Raveling occurs with all aspects, although more have been identified on south-facing scarps, 30.0%, then other aspect groups. Of the aspect groups analyzed, retrogressive rotational failures occur at a higher frequency on the east-facing slopes, 19.5%, and west-facing slopes, 19.5%, than on the north-facing slopes and south-facing slopes. Rotational failures occur more often on south-facing slopes, 20.8%, than on the other aspect groups examined. Both mobile mudflows and earth flows are also dominantly on the south facing slopes, with 27.7% and 21.1% respectively. South-facing slopes have more multi-leveled failures, 19.9%, than the other aspect groups. Of the compound failures within the study area, 31.4% of them occur on north-facing slopes, with only 6.7% occur on north-facing slopes. This may in fact be due to the regional dip of the bedrock towards the northeast. 31/8% of all shallow retrogressive failures occur on west-facing slopes, mostly within the western portion of the map sheet.

The material suspected or known to contain the basal shear plane for each failure type was determined by geologic maps and field investigations and compared within the division and throughout the entire study area (Table V-13, Appendix V). Mobile mudflows, earth flows, and shallow retrogressive failures are all completely within the Quaternary materials or colluvium derived from these sediments. The dominant failure type, multi-leveled failures, is evenly distributed between the shale, 51.9% and the silt, sand, and clay, 48.1%. The Southern Tributaries and Beatton River East divisions heavily influence the overall average, with values of 90.7% and 82.1% respectively. Compound failures are dominantly within the shale bedrock, 61.9%, especially within the Peace River Valley, 79.3%, and the Halfway to Beatton River section, 75.0%. Single rotational failures are mainly found within the Quaternary sequence, 64.8%, heavily influenced by the Peace and Beatton River Valleys. Retrogressive rotational failures have basal shear planes with in both materials evenly with shale containing 41.4% and silt, sand, and clay with 58.6%.

7.5.4 Material Involved

Each slide was assigned a material suspected or known to be involved with the basal shear plane during the desk study using geologic and surficial maps and field investigation. This allows for the materials to be divided with respect to activity, failure type, and aspect. The results are given as percentages with respect to the respective divisions and as an average through out the entire area (Table V-4, Appendix V). This relative comparison allows for separate divisions to be compared to the whole study area. Both the consolidated shale bedrock and the pre-glacial sediments have a propensity for failure as observed by the distribution of materials involved in failure. Shale represents 43.7% of material in which the basal shear plane is located, while the Pleistocene sequence represents 56.3%. This equal distribution is one of the reasons why landslide investigation is so difficult in the Peace River Region. The material in which the failures shear plane is not witnessed can be difficult to determine. During this investigation, surficial geology maps and bedrock maps were consulted along with field investigation, but often what is needed is geotechnical drilling. Divisions that have a higher precentage of shale failures are Southern Tributaries with 65.3% and Beatton River East with 60.6%. Quaternary failures dominate the Beatton River Valley, 65.1%, particularly in the northern section, Peace River Valley, 60.4%, Halfway River West, 65.7%, and Halfway to Beatton River, 56.9%.

The activity for each basal shear plane material was determined and compared within the division and throughout the entire study area (Table –15, Appendix V). Mirroring the overall activity, both the shale and the Quaternary sequence are dominated by "Low Activity-Dormant" failures. The value for shale failures that are dormant is slightly higher, with 65.9% than the silts, sand, and clay at 57.5%. Shale and Quaternary failures show similar amounts of "Active" and "Modified" failures, and Quaternary failures have a higher percentage of active failures at 2.4% compared to 1.1% within the shale.

The failure type for each material involved was determined and compared within the division and throughout the entire study area (Table V-16, Appendix V). Multi-rotational failures make up 56.5% of all shale failures, with rotational failures and retrogressed rotational failures comprising 21.1% and 12.4% respectively. Failures in shale have a much higher component of compound failures with 9.3%, over double of the amount within the Pleistocene sediments, 4.4%. The distribution of failures in the silt, sand, and clay is more widely distributed as mudflows, earth flows, and shallow retrogressive failures occur within the sequence. The dominant failure type within the surficial material is multi-leveled failures as well, with 40.7%. The unconsolidated sediments have a higher percentage of rotational failures, 30.3%, and retrogressed rotational failures, 13.6%. The Halfway River West division shows a large component of rotational failures within both of the bedrock, 48.6%, and the surficial materials, 43.0%.

The slope aspect for shale and surficial failures was determined and compared within the division and throughout the entire study area (Table V-17; Appendix V) using the above groupings. This was done primarily to observe the difference between aspects in the Cretaceous bedrock, as it has a slight regional dip towards the northeast. The shale bedrock does show slightly more failures in the south facing and west facing slopes with 18.3% and 17.9% respectively. Conversely, the north-facing and east-facing slopes have below average values at 13.8% and 14.9%, respectively. To understand this, the analysis of type and aspect has to be revisited, as there were a large number of compound failures on the north and east facing slopes. Also, if the analysis of area and type is re-examined, then it can be seen that the average size of compound slides is much larger than others. Therefore, the lower number of shale failures facing the north and east is due to larger compound failures that occur in that direction. Overall, there appear to more failures on the south and east facing slopes, likely related to the size of failures.

7.5.5 Slide Aspect

A slide aspect was determined for each slide using maps and field investigation during the inventory. These aspects were then grouped into north-facing slopes (330^0-30^0), east-facing slopes (60^0-120^0), south-facing slopes (150^0-210^0), and west-facing slopes (240^0-300^0). This allows for the aspect to be divided with respect to activity, failure type, and material involved. The results are given as percentages with respect to the respective divisions and as an average through out the entire area (Table V-5, -6; Appendix V). This relative comparison allows for separate divisions to be compared to the whole study area. If landslides occurred in every direction equally, the average value of occurrence would be 16.7% as the aspects were assembled into 60^0 groups. Therefore, aspect groupings greater than this average have a higher density of failures. These grouping are the east, south, and south-east facing slopes, the highest of which is the south-facing group at 19.1%. The north-facing slopes have a smaller percentage due to the number of failures that coalesce to form complexes.

The activity levels for the aspect groupings were established and compared within the division and throughout the entire study area (Table V-18; Appendix V). Of the north-facing failures, 56.6% are "Low Activity-Dormant", 26.1% are "Low Activity-Abandoned", 12.4% are "Active" and 4.0% are "Very Active". This aspect grouping has a relatively high percentage of "Very Active" failures, when compared to other aspects. East-facing slopes have a higher percentage of "Low Activity-Dormant" slides, with 66.5%, as well as a higher percentage of "Active" failures at 15.3%. South-facing failures also have a high component of "Low Activity-Dormant" failures with 62.4% as well as a high percentage of "Low Activity-Abandoned" failures at 23.4%. West-facing slopes have a similar distribution with respect to activity with 63.6% of the failures being "Low Activity-Dormant" and 20.1% being "Low Activity-Abandoned". No obvious trends of the slide aspect exist with respect to activity.

Failure types for each of the aspect groupings were established and compared within the division and throughout the entire study area (Table V-19; Appendix V). For north-facing slopes, the majority of the failures are multi-leveled failures making up

48.1%, with the conservative value of 19.5% for rotational failures. Compound failures comprise 14.3% of the north-facing slopes, while they only make up 2.2% of the south-facing slopes. Multi-leveled failures account for 47.3% of the south-facing slopes with rotational failures making up 27.8%. East-facing failures have a high percentage of shallow retrogressive failures, 13.2% and conversely a relatively very low percentage of multi-leveled failures, 37.5%. West-facing slopes have a high number of multi-leveled failures, 45.1%, and rotational failures, 27.8%. The trend seen from this analysis is that there are more compound failures on north-facing slopes, whereas all other aspects seem to be fairly evenly distributed between types with higher values belonging to multi-leveled failures.

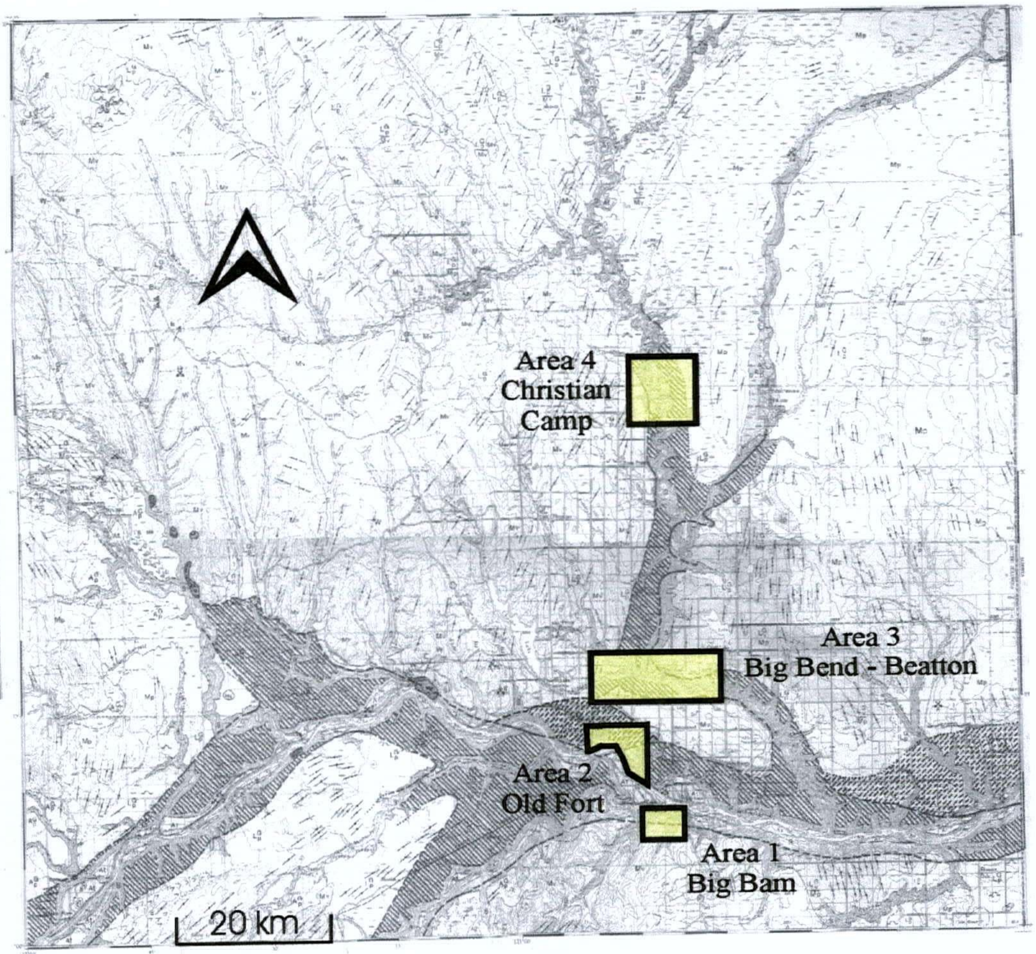
The material suspected or known to contain the basal shear plane for each aspect grouping was determined by geologic maps and field investigations and compared within the division and throughout the entire study area (Table V-20; Appendix V). All of the aspect groupings have a fairly even distribution of materials, with the Quaternary materials being slightly higher in each case. This mirrors the overall allocation of materials involved in basal shear planes. 55.8% of all north-facing failures are within the Quaternary materials, dominated by the Beatton River Valley, 72.3%, and the Halfway River West division with 91.7%. South-facing failures are similarly distributed with 58.0% of all failures within the silt, sand, and clay. East-facing failures have the Pleistocene sequence involved in 57.3%, while west-facing failures are slightly lower at 51.9%. There are no distinct trends involving the material with respect to the aspect of the slide.

8.0 DETAILED INVESTIGATION OF SELECTED LANDSLIDES AREAS

For a directed field study, four areas were chosen to be investigated in detail (Figure 8.1). These area were named : 1) Big Bam Ski Area, 2) Old Fort, 3) Beatton – Big Bend, and 4) Christian Camp. These areas were chosen due to their importance to the area, both sociologically and scientifically, the variety of materials within these sites, the variety of landslide types, their accessibility, and their proximity to the city of Fort St. John.

Each area is described in detail including location, stratigraphy, and profiled landslides. A generalized stratigraphy was created from exposures mapped during the field season and published geologic information on the area. Each slide was investigated in detail with a description and a interpretation within this section. Profiles were conducted using an inclinometer, a range finder, and a 50m measuring tape during the summer of 2003. Given the stratigraphy and the interpreted mechanisms of the landslides, a generalized geologic model was produced to better explain slope movements within that area. These models were then considered at the scale of the map sheet in an attempt to explain landsliding in the Fort St. John area.

Figure 8.1 Detailed Landslide Study Areas



8.1 Slide Area 1

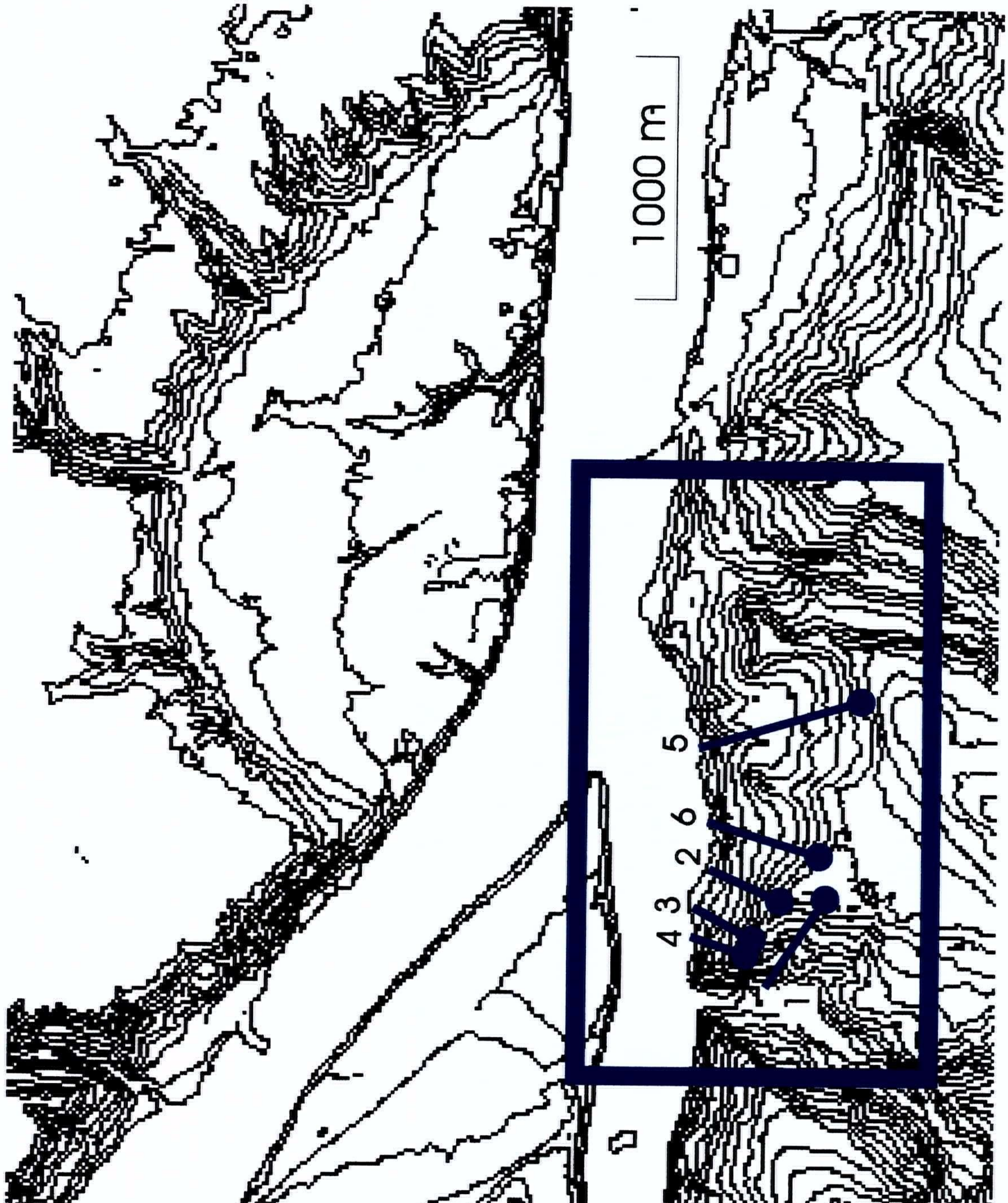
8.1.1 Location

Six slopes were profiled near the old Big Bam Ski Hill approximately 4 kilometers south west of the town of Taylor on the south bank of the Pine River at the confluence with the Peace River (Figure 8.2). The area extends for 3.5 km along the north-facing slope and encompasses the ski hill, part of Septimus Creek, and an abandoned residential area. At the upper elevations, the head scarps of these slides border on a farm field. Much of the area is overgrown except for where the younger landslides have a disturbed surface and where the vegetation has been cleared for the ski hill paths. The ski hill was in operation as late as mid-1996 (Zandbergen, 1999). The area was chosen due to the relative easy accessibility and it's proximity to a highly active, much-discussed area (Hardy, 1952; Maber and Stewart, 1976). The area is also a very distinct landmark with in the Peace River area as many local residents still use the area for recreation purposes such as horseback and ATV riding.

8.1.2 Local Stratigraphy

This site is within the pre-glacial valley (Mathews, 1978) and is underlain by Shaftesbury Shale. The shale bedrock elevation has been noted at three slides (Slides 1-1, 1-5, 1-6) at a constant elevation of approximately 397 meters a.s.l. with a small variation of 0.3 meters. Bedrock was seen in near vertical exposures mirroring the steep sided bedrock exposure on the opposite side of the Pine River. This angle likely persists to the depth of the current river.

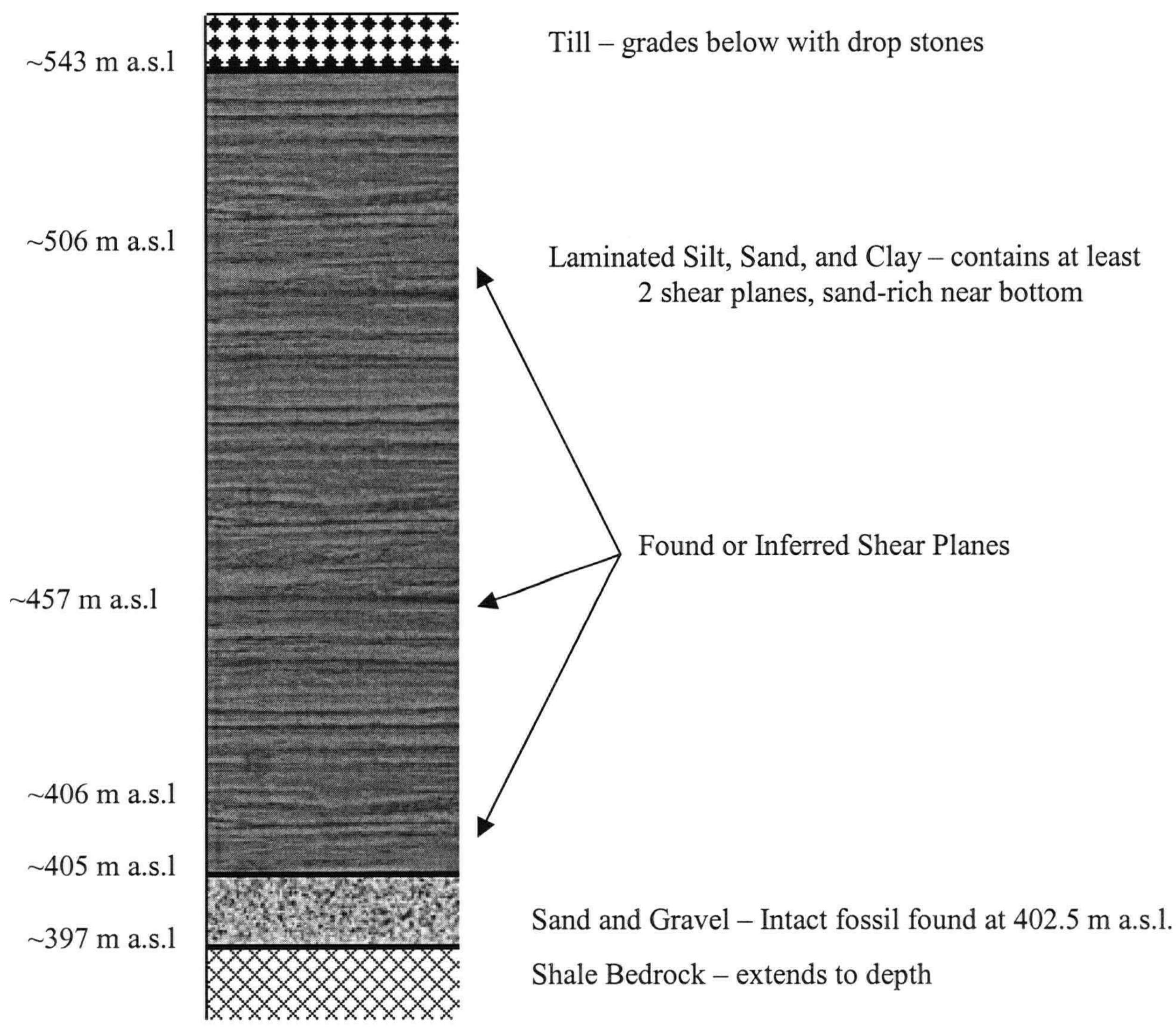
Figure 8.2 Landslide Area 1



Above the bedrock lies a bed of Pleistocene sand and gravel with a fairly constant thickness of 8.5 meters with a variation of approximately meter to an elevation of 405 meters a.s.l. The sand and gravels were noted at three of the six profiles completed (Slides 1-1, 1-5, 1-6). The unit was lightly cemented and iron stained and the well-rounded gravel ranged in size from 4 cm to 12 cm and contained small lenses of sand 20 cm thick. A fossil was found intact within these gravels on Slide 1-6 at 402.5 a.s.l. (Figure 8.6).

Above the gravels lies a thin bed of sand seen in 2 of the profiles. In the west (Slide 1-1), the bed has a thickness 0.2 m and in the east (Slide 1-6) the bed is 0.1m thick. In the two profiles where this unit was seen directly above the gravels, the beds do not show the same facies suggesting the pre-glacial sand, silt, and clay unit is variable at the base. A different section of this unit was seen in Slide 1-4 at 446 m a.s.l. The section was completely dominated by weakly bedded sand with a thickness of 15 m. No shear plane could be found at this locale above the sand although one is inferred to be at approximately 457 m a.s.l. Another intact section of weakly bedded sand was observed in the same profile (Slide 1-4) at 489 m a.s.l. The sand unit was 16.5 m thick extending to an elevation of 505.5 m a.s.l. Above the sand is a 4 cm bed of massive clay (sample 1-4B) followed by a 4 cm bed of laminated silt and clay. Directly above the clay and silt beds is a 1 mm thick softened clay shear plane (sample 1-4A) in which highly polished shear surfaces were observed. Above the shear plane was massive debris made mostly of sand with some silt and clay. These same beds of sand-rich deposits were observed to the west (Slide 1-3) at 493.6 meters a.s.l. This exposure became silt rich near the top (522.6 m a.s.l.) with frequent interbeds of clay. At the top of this unit is a bed of silt with drop stones that resembles till seen at an elevation of 543 m a.s.l. Lake Peace clay and till were not witnessed at this location; however, the silt near the top of Slide 1-2 and Slide 1-3 appears heavily disturbed and could be near the upper limit of the pre-glacial unit. The presence of drop stones suggests a close proximity of ice when deposited. The top 10 metres very well may be till, however, it was difficult to tell the till from the underlying strata. An approximate stratigraphic column is produced (Figure 8.3).

Figure 8.3 Area 1 – Stratigraphic Profile (not to scale)



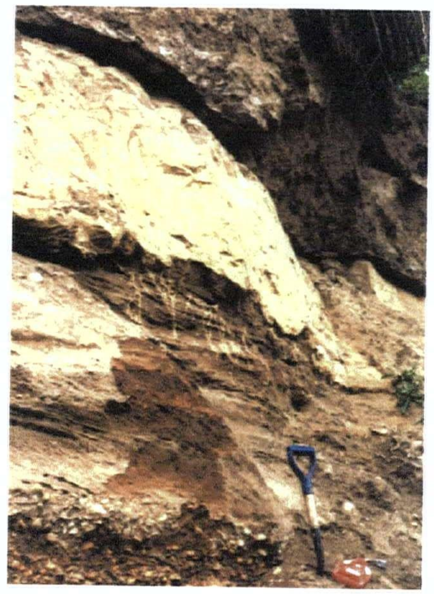
8.1.3 Landslides

Slide 1-1

Slide 1-1 is on a northwest-facing slope, within the Septimus Creek valley (Figure 8.7). The profile starts within a field and continues down slope at an azimuth of 290^0. Using the previously defined activity classification, the upper section is active showing some fresh features, the middle section is dormant, and the toe is very active. The slide contains three failure plains. The upper two planes were both covered with debris and interpreted from surface morphology. Near the head scarp, the features are generally small suggesting that the failure planes are shallow instead of one deep plane. There are minor amounts of back tilt suggesting that the failures are compound. Small mobilized debris flows occurred near the head of the slide, obliquely cutting the profile. A rounded diapiric structure was observed 50 meters off the profile to the east for which an explanation is still not clear.

Then there is a lengthy section with a disturbed hummocky surface with a small overall gradient. The area is thought to be a compound section because of the muted horst and graben features witnessed during the traverse. At the end of this section a remobilization of the debris has occurred which is expressed by major scarp in debris. A shear plane was examined at 407 m a.s.l., 20 m to the northwest. This is thought to be the same failure surface controlling the profiled failure. A sample of this shear plane was sampled and found to be a clayey silt of low plasticity with a silt fraction of 61. Figure 8.4 shows the pre-glacial stratigraphy directly below the shear plane. Below the debris, intact rubbly shale was observed. The bedrock surface likely drops at a steep angle to the level of the current creek elevation, as this was likely a cut bank before the slope above it failed. The debris at the creek level is remobilized debris activated by erosion from the present creek. Downstream of this failure on the opposite bank, a failure within the shale mass was witnessed at 10 metres above the creek bed.

Figure 8.4 Intact Pre-glacial Stratigraphy (Slide 1-1)



Slide 1-2

The second profile in the area was done along the tower line of the Big Bam Ski Hill that failed in 1997 closing operations permanently (Figure 8.5). The profile started near a farmer's field and continued down the north-facing slope on an azimuth of 345^0. There were no exposures of shear planes or intact materials found during the traverse, however, many of the features can be interpreted from surface morphology and comparisons with nearby slopes. The slide is understood as having three failure planes, all within the pre-glacial sand, silt, and clay unit (Figure 8.8). During the upper part of the failure, the features were small indicating that the failure planes were relatively shallow.

There was enough displacement in the upper portion of the failure to force many of the ski towers to fall over or tilt, however, the movement appeared to have been compound with little rotational component. Further down slope, a large horst was observed, suggesting a new failure surface much deeper with little or no rotational displacement being observed. The bedrock is suspected to underlie the deep compound failure and then sharply dropping off causing debris to slide over and producing a steeper slope within the debris. The toe of the slide is remobilized debris.

Figure 8.5 Former Big Bam Ski Hill Tower Line (Slide 1-2)

Slide 1-3

This active slide is at the western edge of the Big Bam ski area and has a north-facing slope. The profile starts on a ridge caused by an abutting failure on Septimus Creek. The profile goes down slope at an azimuth of 7^0. The failure consists of two successive compound slides within the pre-glacial sand, silt, and clay unit (Figure 8.9).

No shear planes or intact sections were observed as they were covered by debris, but rather inferred by slope morphology. Both failures show a definite component of back tilting and the resultant ponding of water as well as horst and graben structures. Intact slopes underneath the debris are expressed as steeper slopes within the profile. The start of the profile is at the exposed head scarp of till above bedded silt-rich pre-glacial silts of a rotational component of the failure. The two failure plane hypothesis is supported by the small nature of most of the features seen on the slide. Locally, the bedrock is inferred from neighbouring slides, bedrock elevation across the Pine River, and that the site is completely within the pre-glacial valley (Mathews, 1978). The toe is made of remobilized debris that is heavily treed and shows small-scale back tilting and compound features.

Slide 1-4

Slide 1-4 is an active failure consisting of three failure planes within the pre-glacial sand, silt, and clay unit (Figure 8.10). It is located in between Slides 1-2 and 1-3 and also has a north-facing slope. The profile started on an undisturbed surface near a field at the top of the failure and traversed at an azimuth of 0^0 to the toe. The head scarp of the slide is made entirely of till and the debris near the top was slightly back tilted suggesting a rotational component to the failure. The upper shear plane was observed and sampled (1-4A) during the traverse, however, the lower two failures are an interpretation. The upper failure plane lies directly above a massive intact sand bed with minor interbeds of silt and clay . The shear plane has a clay fraction of 38 with a liquid limit of 51% and a plasticity index of 33%.

The middle failure shows back tilting and ponding so it is also considered a compound failure. The debris of this failure had small features suggesting the failure surface is shallow. Below this debris, another intact section of sand with clay beds was observed, however the shear surface above it could not be found. One of the intact beds of clay was determined to be mostly silt at 72%, with a liquid limit of 41% and a plasticity index of 24%. The horst and graben features within the debris mass of the lowest failure below the second intact bed of sand were also small so a third, shallow failure plane is inferred here. The bedrock surface is again assumed from other profiles to be below this failure plane forcing the debris to slide and remobilize below. An interesting element of this slide was a series of laterally extending ridges within the remobilized debris, which appeared to be compressional features as if the debris is being loaded on to and pushed toward the river.

Slide 1-5

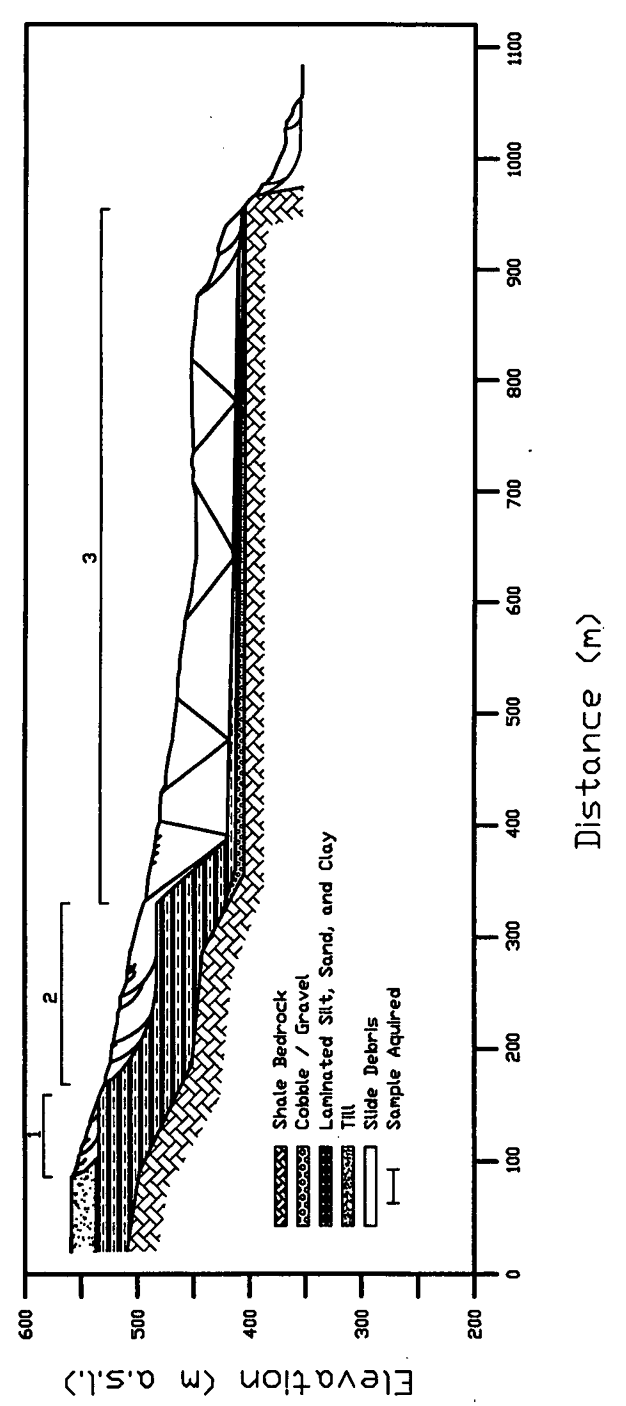
This failure is at the eastern end of the area and has a north-facing slope. The slide is dormant with three shear planes within the pre-glacial unit (Figure 8.11). The upper shear planes are interpreted from slide morphology and the lower shear was seen although not accessible. The profile starts in a farmer's field at an azimuth of 323° and continues down slope to an abandoned property. Within the field, a small crack was observed which might be a tension crack, however with the amount of seasonal modification caused by plowing of the field, features within a field can be deceptive. The head scarp for the upper failure is shallow at 23.5 and all the features are overgrown and muted. This is likely a compound failure with a shallow failure plane with little to no rotational movement. The trees on the slope are J-shaped and have an estimated age of 60 to 80 years. Wide scale ponding marks the head of the next compound failure and represents subsidence of a graben. Several large horst and graben structures were observed representing a deep compound failure. The third failure plane is at a very low angle and is quite long, roughly 9000 meters, and is represented by large-scale horst and graben features and hummocky terrain. The toe of this section is remobilized and shows a rotational failure. The shear plane was covered along the traverse but it was detected in a ravine next to the profile, making sampling impossible. Gravel was also seen at this section as well as the intact shale below. Elevations were taken obliquely off the profile. The bedrock surface dips steeply toward the current river level. The debris below is remobilized and highly disturbed. The slide surface was modified at the toe due to the development of a residence.

<u>Slide 1-6</u>

Slide 1-6 is located just west of Slide 1-5 and is very similar to it (Figure 8.12). It is dormant near the top of the slide and active at the toe and within the debris apron. The profile starts within the same farmers' field and goes down slope at an azimuth of 330^0 towards an abandoned property. There are three shear planes within the pre-glacial sand, silt, and clay. The two upper failure surfaces are inferred from Slide 1-6 and surface morphology. These are shallow compound slides in a successive manner with small horst and graben features along with shallow head scarps. There is little to no back tilt, however, trees with ages up 60 years are J-shaped suggesting that this failure is a continuous slow movement. The lower failure is a long, deep compound failure interpreted from the large horst and graben features. The toe is actually failing with fresh scarps in a rotational manner. The toe is very hummocky and disturbed with a gully obliquely cutting the profile exposing the lower gravels. In the bank of the gully, a fossil was found intact within the gravels, location marked in Figure 8.6. The fossil has tentatively been identified as a Pleistocene bison's 4th cervical vertebra and was dated as being 26,530 $\pm$ 320 years BP (Hartman, In Progress). Off the debris on the other side of the gully, intact gravels and sands were found, however, no shear plane could be located. A smaller bone fragment was also found at this location. Below the gravels, intact rubbly shale was detected to dip steeply into the slope, likely to the present river level. The toe was made of remobilized debris. Previous development caused the slope to be modified. This property was to be later abandoned due to landslide hazard.

Figure 8.6 Bison Vertebrae found in place (Slide 1-6)

Figure 8.7   Landslide Profile 1-1



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin	Landslide Profile	1-1
SCALE As Shown	Figure No. 8.7	

Figure 8.8 Landslide Profile 1-2

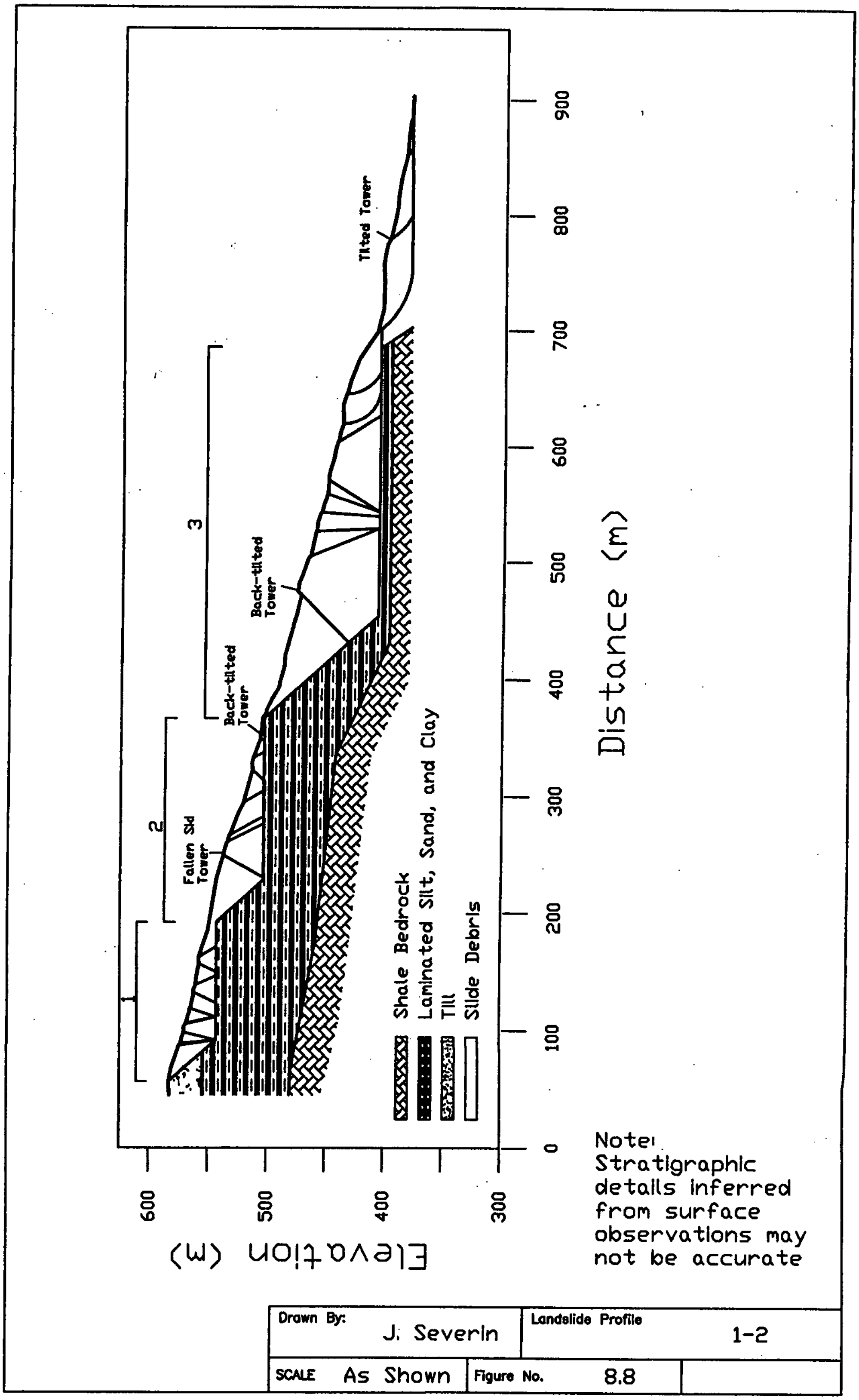


Figure 8.9 Landslide Profile 1-3

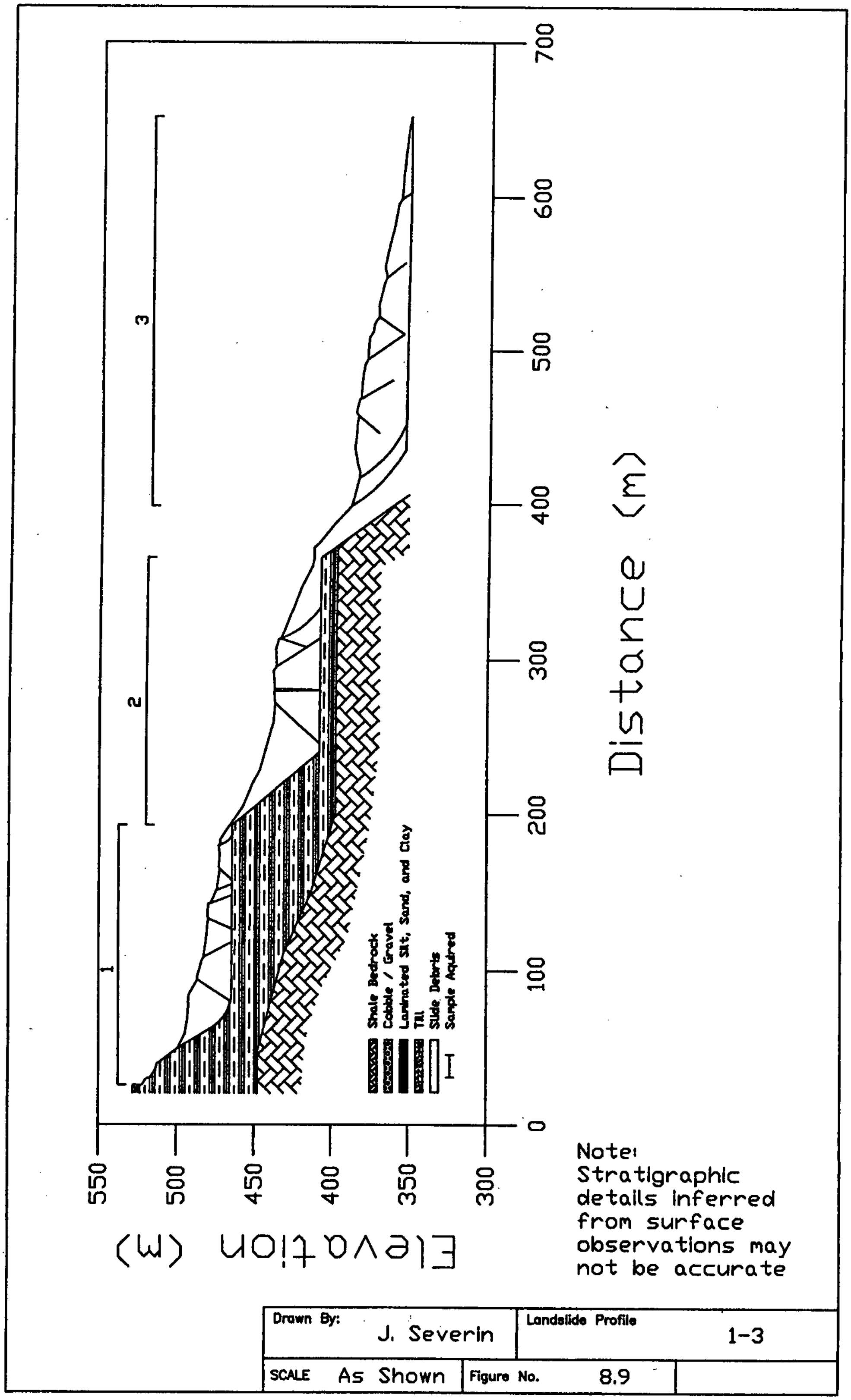


Figure 8.10 Landslide Profile 1-4

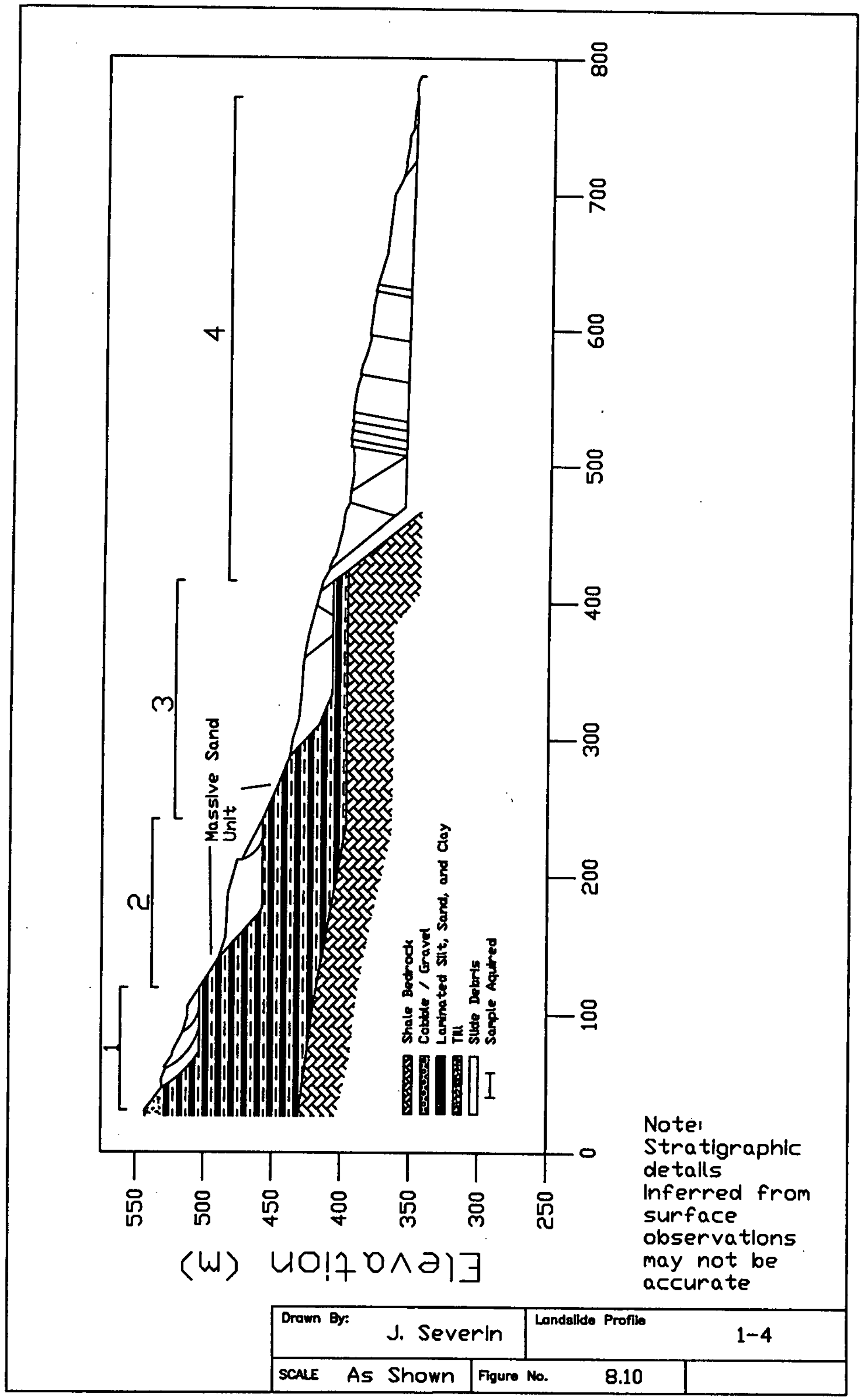
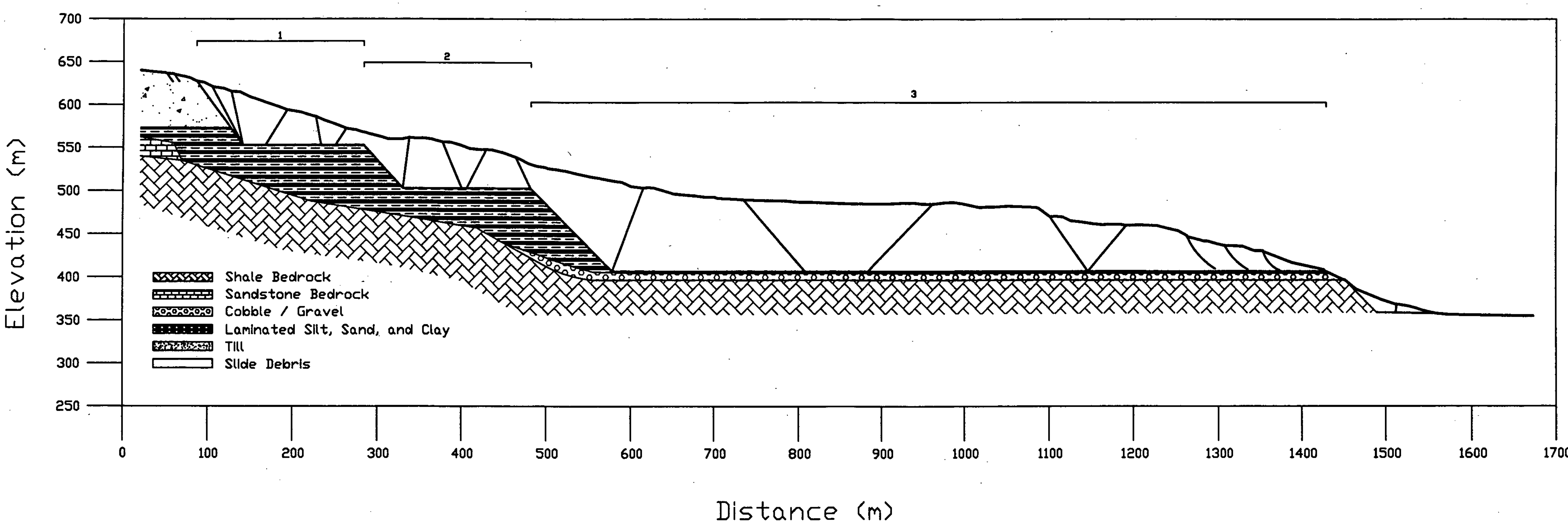


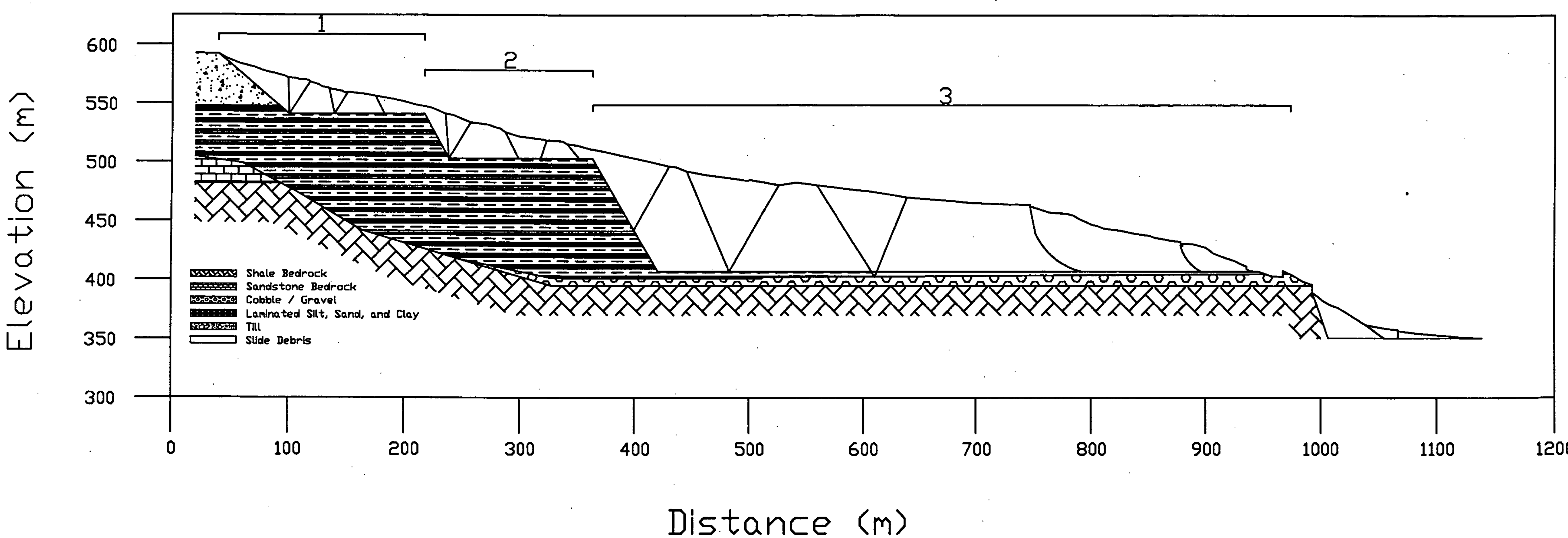
Figure 8.11 Landslide Profile 1-5



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin	Landslide Profile 1-5	
SCALE As Shown	Figure No. 8.11	Page No. 115

Figure 8.12 Landslide Profile 1-6



Note: Stratigraphic details inferred from surface observations may not be accurate

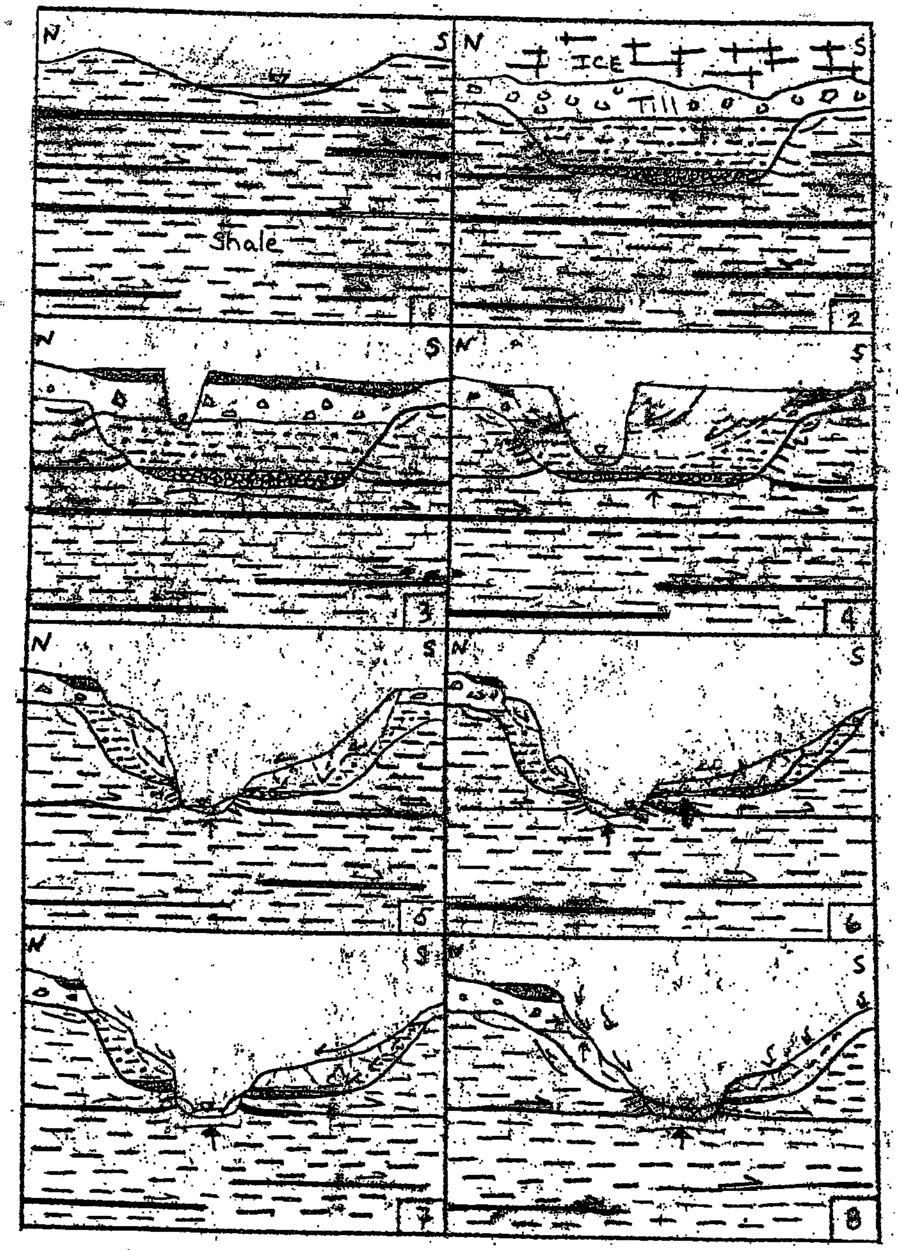
Drawn By: J. Severin	Landslide Profile 1-6
SCALE As Shown	Figure No. 8.12

8.1.4 Area Model

This area is located completely (Figure 8.13) within the pre-glacial valley (1), which has undergone glaciation (2), re-established its drainage (3) and eroded to a lower elevation (4) (397 metres a.s.l). During this erosional event several landslides likely occurred, starting the valley widening process. The slides that occur in this area are completely within the Pleistocene sediments with at least two failure planes and sometimes three. The rapid downcutting into the soft sediments of the Pine River and Septimus Creek has exposed weak clay layers (4), on which the slides occur. The clay layers are pre-sheared surfaces, although the cause of the shearing is not obvious. The pre-shearing could have occurred due to glacial loading, syn-erosional slumping, or the release of lateral stresses during valley rebound. The valley expanded with a migrating river constantly eroding the resultant debris. As the river cut down into the bedrock, this abandons the basal shear surface (5). The first-time failures in this area are likely due to erosion from the river, however, reactivation of failures can occur if the debris mass is eroded and the river once again attacks the intact slope (6). Most continued failures are likely due to increased pore pressure from precipitation, softening of the clay layers, and simple creep along these pre-sheared failures (7 and 8).

In this area, there seems to be one major shear surface within a meter of the gravel contact, which was sheared in all the landslides. At the eastern edge of this area the plane is extended for quite a distance, allowing for a more translational movement. Several planes appear to extend over a few slides but not the whole area. These are smaller localized beds with limited area. There is another failure plane near the top of the

Figure 8.13 Landslide Area 1 - Geologic Model



1) Broad, stable pre-glacial bedrock channel; 2) Aggregating deltaic environment into encroaching ice-damned lake followed by glaciation; 3) Drainage re-establishes; 4) Post-glacial river erodes down into till leaving steep banks, once softer, laminated sediments below are reached, initial failures occur; 5 & 6) Failures continue to occur, on older, upper lower bedding planes and lower planes once exposed; 7) Debris at base acts as a berm for debris on slope; 8) Erosion of debris and intact bank and increases in pore pressure in pre-glacial units cause

sequence, which appears in all slides that reach this elevation. Bedrock plays little or no part in these failures except to provide an intact ledge for the debris to slide over.

In general, this area has a few clay beds within the Pleistocene sequence that seem to be more apt to failure; however, failure is not confined to these beds. As the lowest failure plane usually contains the largest slide, it seems unlikely that the failures are successive, but rather retrogressive. The lower slide would fail, unloading the toe for the next failure in sequence.

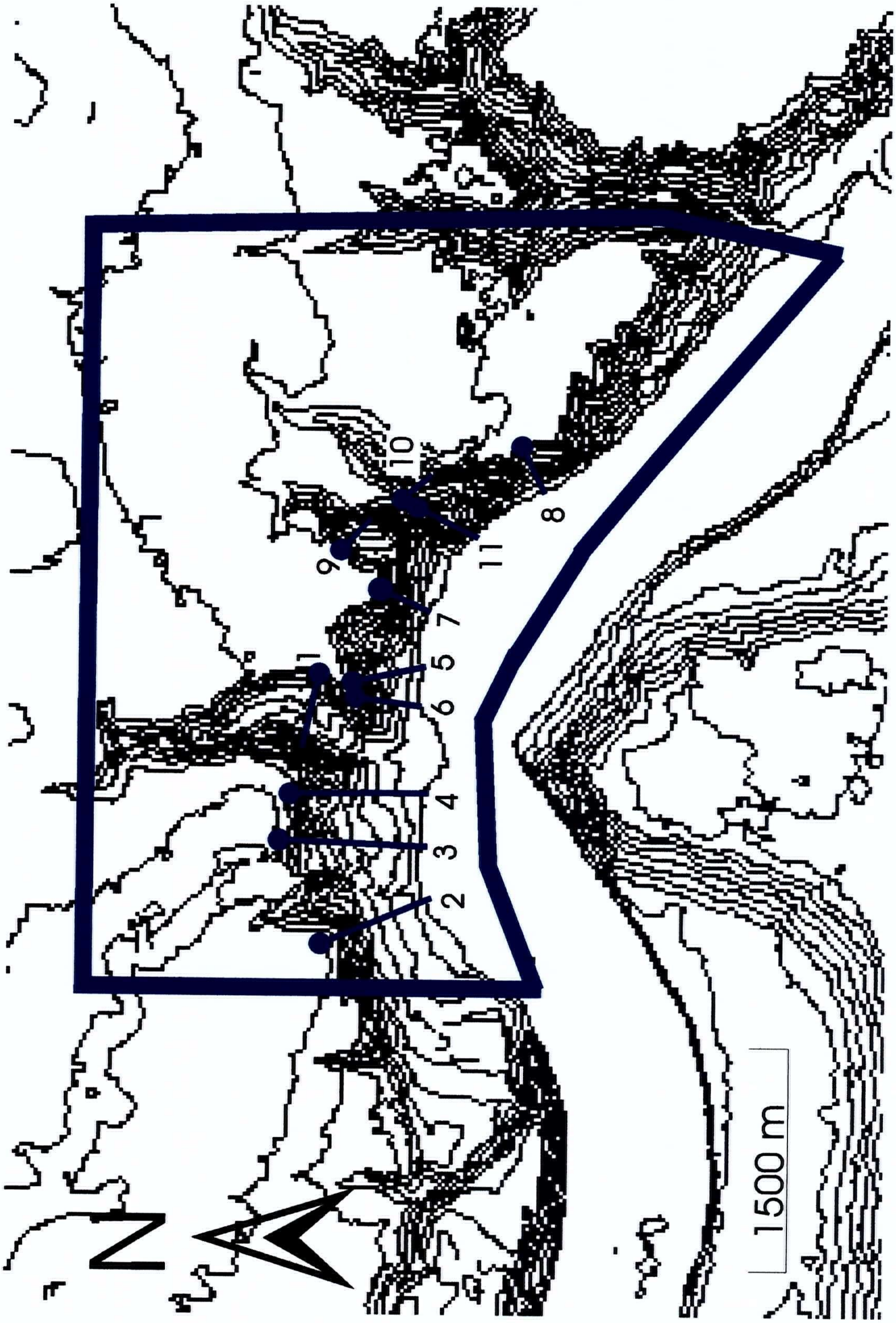
8.2 Slide Area 2

8.2.1 Location

Eleven slopes were profiled near Old Fort, approximately 2 kilometers south of the City of Fort St. John, on the north bank of the Peace River (Figure 8.14). The area extends for 5 km along the south-facing slope and encompasses the settlement of Old Fort, several coulees, and the Peace River Valley. At the upper elevations, the head scarps of these slides border on a bison farm owned by Mr. Bouffioux, a sewage treatment plant, a gravel pit, and a garbage dump. Most of the slopes are south-facing.

Much of the area is developed and only has localized tree cover at the base of the slope. The area was chosen due to the relative easy accessibility, the location of a human settlement, the location of a pipeline crossing and a few oil wells, and its distinct geologic setting. The area is also a very important historical landmark with in the Peace River region as it is the location of an original location of Fort. St. John. Residents and tourists alike visit this location to view the scenic Peace River Valley.

Figure 8.14 Landslide Area 2



8.2.2 Local Stratigraphy

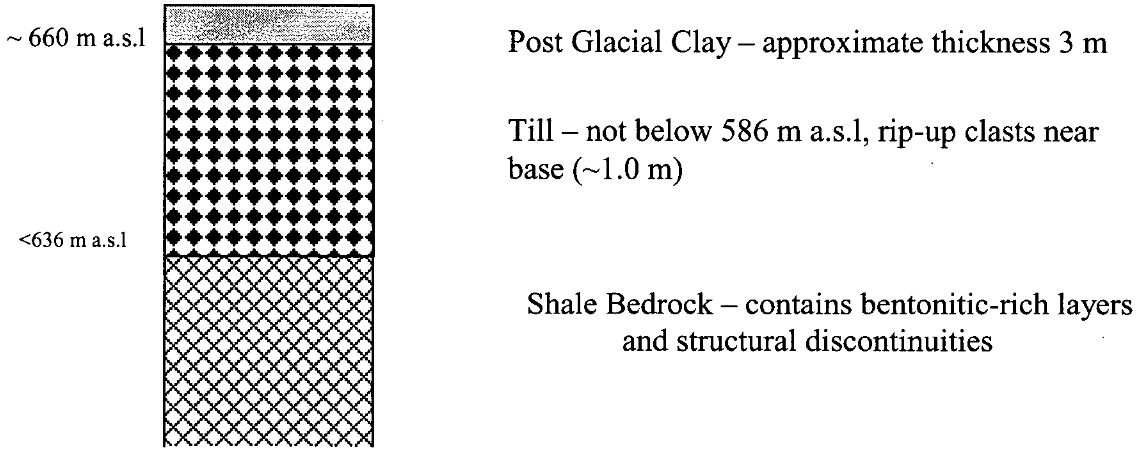
The local stratigraphy at this site is very complex and poorly understood. Most of the section is outside of the pre-glacial valley so there is a distinct lack of pre-glacial sediments at these locals. Shaftesbury shale, observed in 9 of the 12 slides, underlies the area, outcropping quite high in the profiles. The actual height of the Shaftesbury shale is hard to determine as in most sections the top was not actually seen, but rather a shear surface and not actually representative of the maximum shale height. The highest elevation at which the shale was seen at was 636 metres a.s.l (Slide 2-3). The top of the shale unit is irregular as intact till and clay are seen below this elevation.

The material directly above the shale was seen intact once (Slide 2-5) where rip-up clasts of shale were observed within till. The debris directly above the shear plane is thought to be disturbed till which contains clay, silt, and minor amounts of sand and gravel. The till unit was seen at varying elevations but never lower than 568 metres a.s.l (Slide 2-11). The till has a maximum thickness of 44 meters (Slide 2-7), which may actually contain till from the previous glacial advance. The locations of the till are controlled by the pre-glacial bedrock topography. Above the till unit lies a blanket of post-glacial clay seen at most locations at approximately 660 meters a.s.l., with an average thickness of 3 meters.

The pre-glacial sediments are seen again at Slide 2-8 in the east, marking the extent of the pre-glacial valley.

An approximate stratigraphic column is produced (Figure 8.15).

Figure 8.15 Area 2 – Stratigraphic Profile (not to scale)



8.2.3 Landslides

Slide 2-1

Slide 2-1 is located on a west-facing slope within Bouffioux Coulee. The profile starts at the top within a field and continues down slope at an azimuth of 262^0. The failure is currently dormant except near the toe where some of the debris has remobilized. The failure is interpreted as having three failure planes within shale (Figure 8.17). The lowest failure plane was the only one observed, however it could not be sampled. The upper two failure planes are simply inferred due to surface morphology and neighbouring slides. A vertical face of post-glacial clay was seen near the top at an elevation of 663 meters a.s.l, within the head scarp of a small compound failure. The profile goes down a covered intact scarp. The scarp is likely intact because the slope is likely too steep for the debris to maintain. Large horst and graben structures appear along the next failure plane. The depth of this failure plane is interpreted from the size of the features. The toe of this failure slides over another intact scarp where a large compound failure occurs. Back tilting and ponding occur within the slide mass at this point, suggesting a rotational component. At the base of this failure, intact shale is seen overlain by debris within a ravine. There is no sign of the pre-glacial sand, silt, and clay so they bedrock surface in the area must be controlled by failure surfaces.

Slide 2-2

Slide 2-2 has a south facing profile down the Peace River Valley at an azimuth of 138 . The profile begins at a common sight seeing location directly above Old Fort (Figure 8.14) where there has been a great amount of modification in order to incorporate parking. Garbage within the landslide debris, including several automobile bodies, suggests that this may have been a trash disposal site in the past. Several shear planes, four or five, all of which are in the shale bedrock, control the dormant landslide (Figure 8.18). At the head scarp of the slide, a 10m intact section of Quaternary materials was found to have 4 m of glacial Lake Peace clay and 6 m of till. The upper most shear plane was observed within the shale and sampled (sample 2-2A). The shear plane had undergone some alteration and shale clasts were seen within the debris. The shear plane consisted mainly of silt, 70%, and has a liquid limit of 40% and a plasticity index of 20%. A sample of the shear plane within the debris was also sampled and found to have the exact composition but with a slightly higher liquid limit, 43%, and plasticity index, 24%. Below the shear plane a displaced slump block with a heavy concentration of garbage was encountered. No controlling shear plane was observed beneath this failure, however, below the debris, intact but rubbly shale was found allowing the shear plane to be inferred within a certain elevation range. A third shear plane is also inferred below based on surface morphology and thought to be in shale as well. This part of the failure may be interpreted as two failure planes. Below this, the slide has a large translational component, made up largely of remobilized debris with a few large-scale horst and graben features. Along the profile, ponding and highly disturbed terrain was encountered. At the toe, the debris is remobilized in a rotational slump, thought to represent the edge of the underlying intact shale.

Slide 2-3

This slide is on a south-facing slope within the Peace River Valley. The profile starts at a fence line near the sewage lagoon and heads down slope at an azimuth of 192 . Even though this slide has an active upper section, overall it would be classified as a dormant slide. This slide has multiple failure planes, four or five, all thought to be within the shale bedrock (Figure 8.19). The depth of the failures planes are inferred from surface morphology and the material is inferred from neighbouring slide reports. The upper most failure is interpreted as a compound failure with till and glacial Lake Peace clay within the head scarp. This was the only section of unconsolidated sediments found during the profile. There was one intact section of shale seen during the profile below the upper failure. Further down in the profile, the debris is very hummocky with small-scale features. The location of the sewage lagoon makes this an important failure to study as further movement could cause rupture of the lagoon leading to a higher risk in failure.

Slide 2-4

Slide 2-4 is a dormant slide on the south-facing slope of the Peace River Valley, with an active upper most section. The profile starts on the fence of the sewage lagoon 50 meters east of the beginning of profile 2-3 and continues down slope at an approximate azimuth of 160 . The top of the profile is within a plowed field so some features may have been disturbed. The intact section at the head scarp of this upper failure shows glacial Lake Peace clay above till within an 8-meter section. The upper most failure plane is within shale so the failure planes lower in the slide are also thought to be within the shale unit. The upper failure is a retrogressed rotational slide with large, tilted slump blocks. The shale failure plane was located about 30 meters off the profile (Figure 8.16) and sampled (sample 2-4 A and B). Sample 2-4B consisted of 32% clay, 49% silt, and 19% sand. The shear plane has a liquid limit of 47% with a plasticity index of 28%. The failure plane was partially altered to a gouge that was also sampled (sample 2-4 C and I) and tested. The gouge had an average of 67% silt and 27% sand; it has a high liquid limit

Figure 8.16 Shear Plane found and sampled (Slide 2-4)

of 53% and a low plasticity index of 23%. Below the gouge, a sheared surface in the shale was observed and found to consist mostly of silt, 85%, with a liquid limit of 41% and a plasticity index of 22%. Another intact section was beneath the upper failure made of weather shale. The rest of the slope is made of 2 inferred failure planes, both showing small, muted compound features (Figure 8.20). This slide shows 2 interesting features not seen elsewhere. The first is a large amount of cobbles near the base of a gully at the top of the slide. This is simply a collection of weathered cobbles that have been released from the till unit. The second, a banded diamicton found near the top of the slide within the debris, is thought to represent several surges of debris that have been deposited and then broken up by a later failure.

Slide 2-5

Slide 2-5 is on a southeast-facing slope within the Peace River Valley. The profile starts at the edge of a field, same field as Slide 2-1, and continues down slope at an azimuth of 132 . The slide is mostly dormant and contains three failure planes all with in the Shaftesbury Shale (Figure 8.21). The head scarp of the slide shows a thick layer of glacial Lake Peace clay of 9.5 meters above a till unit of 25 meters in thickness. At the base of the till unit is the contact with the shale below. This contact is a zone of shale rip-up clast dominated till with a clay-rich matrix of about a meter in thickness. Below this contact is a 2.5-meter vertical section of intact shale above the talus of the slope. At the base of this intact section is a large slump block of a rotational failure. The failure plane was not observed, however, below the failure another section of intact shale was found suggesting that the failure is in shale. The intact section of shale is approximately 50 meters thick and below this is two compound failures interpreted from surface morphology with several small horst and graben features. The toe of this failure is a modified river terrace that has since been farmed that shows no natural features.

Slide 2-6

This slide is dormant with a south-facing aspect in the Peace River Valley and an azimuth of 154 . The profile starts on a knife-edge with Bouffioux Coulee, so a stable top section in not possible to attain. The head scarp is completely grassed so no intact section was observed, although the small flake slides within the head scarp and the neighbouring slide suggest that the head is made of till and post-glacial clay. The slide is composed of two independent failure planes within the slope (Figure 8.22). The upper failure plane is abandoned and currently stable and represented by a small dip in the profile. No failure surface was observed, but rather interpreted from surface morphology and neighbouring slides to be within the shale. At the base of the main scarp, a small, rotated block was found with shear planes (sample 2-6 A), was observed. The shear plane has a clay fraction of 34 and a silt fraction of 57. The liquid limit of the sample is 48% with a plasticity index of 28%. Below this, a layer of gouge within the shale, which does not look sheared, was located (sample 2-6 B). This sample consisted of 38% sand, 40% silt, and 22% clay. The sample displayed a liquid limit of 45% and a plasticity index of 22%. The second failure is a retrogressed rotational failure that has been weathered and the features are now muted, although ponding is still prevalent in the debris mass. No intact sections or failure planes were observed during this profile. The toe of the slide has been modified by a river terrace and subsequent farming activity.

Slide 2-7

Slide 2-7 is south-facing with an aspect of 188 in the Peace River Valley. The profile begins on a hummocky, plowed field within a Bison Ranch belonging to Mr. Bouffioux. This is an active failure with three shear planes within the shale (Figure 8.23). The head scarp of the failure shows an anomalous section of Quaternary sediments. This section is at least 56 meters thick and dominated by a unit of till. The top of the section displays a 10-meter unit of glacial clay underlain by 44 meter thick of till and at least 2 meters of sand and gravels at the base. The till displays glaciotectonic shears near the base, however, these shears don't seem to control the stability of the vertical till face. There is a rotational failure below the intact face with a shear plane in the shale. Below this failure, an intact shale face was encountered that leads to the debris mass of the middle failure on the slope. This failure is also a rotational failure with shale found directly below in a nearby gully. A third rotational failure exists below this intact face. The debris of this lower failure flows over an intact shale bed below, with the toe being remobilized debris. This slide has three failure planes allowing for independent rotational failures. All failure planes are inferred as none were witnessed during the profile.

Slide 2-8

This slide represents the edge of the pre-glacial valley of the Peace River and is on the eastern edge of the slide area. The profile has a western aspect with an azimuth of 252 and starts upon a flat where several pump jacks and a field exists. The slide is active and contains three failure planes, however, only one is in shale (Figure 8.24). There is a small rise within the field and back tilted trees, which may be a filled tension crack. The main head scarp is dominated by till with a thin layer of glacial clay near the surface. The displaced debris is slightly back-tilted from a rotational movement. The shear plane for this failure was located within a clay bed above a thick unit of silt. Both the failed clay bed and intact clay beds below were sampled (sample 2-8A and 2-8B). The failed clay consisted of 57% clay and 43% silt, whereas the intact clay below consisted of 32% clay and 68% silt. The Liquid Llimit for the failed clay was 47% with the Plasticity Index at 28%. The intact clay showed a higher Liquid Limit of 69% and a Plasticity Index of 48%. The silt unit has some smaller beds of clay, up to 3 cm in thickness, and lenses of sand, up to 45 cm thick. The failure below this intact section is a rotational failure moving along a clay layer within the pre-glacial sediments (sample 2-8 D). This surface occurs 0.1 meters above the gravel contact and is composed of 36% clay and 63% silt. The Plasticity Index of the failed clay is 26% and a Liquid Limit of 48%. A bed of intact clay below the slide plane was sampled (sample 2-8 AA) and found to be 57% clay with 43% silt. The intact bed has a Liquid Limit of 51% and a Plasticity Index of 31%. The gravel unit is anomalously thick in this section at 36 meters with an over steepened angle of 45^0. Below this intact section, highly disturbed debris with ponding and minor back tilting suggests another failure plane within the shale. The steeper slope within this debris is likely caused by the presence of an intact scarp below. The toe along the river's edge is very active, failing within the last 5 years.

Slide 2-9

The profile of slide 2-9 begins in a field near many bent, twisted, and tilted trees and heads down slope at an azimuth of 104 . The slide occurs within Crawfords Coulee near the eastern edge of the area with an eastern aspect. The 6-meter vertical head scarp shows glaciolacustrine clay for most of the face with till composing the bottom 0.2 meters. The head scarp shows distinct pinnacles of till and clay 3 to 5 meters high that have moved several meters. The failure is a retrogressed rotational failure with a slide surface that daylights in the scarp below (Figure 8.25). There is a large amount of back tilting and small scarps within the debris. The failure plane occurs within a clay bed of the pre-glacial sediments (sample 2-9 A). Below the shear plane, the quaternary sediment sequence is dominated by silt with minor amounts of sand and discreet clay beds. The lower failure is a compound failure displaying steps within the debris and extends the rest of the slope. The toe of the failure is very active with fresh features and disturbed material. A lower shear plane within in the shale was located within the ravine that the debris mass is sliding on.

Slide 2-10

This small slide has an eastern aspect, occurring within a coulee east of Crawfords Coulee. The profile begins on a knife-edge between two coulees and continues down slope at an azimuth of 96 . The profile goes down into a large tension crack and back to a vertical face of a diamicton, which may be disturbed till. The failure is active and has one failure plane within the shale (Figure 8.26). The head scarp is steep and the debris below exhibits major back tilt within several steps. The slide is interpreted as a retrogressed rotational failure within the shale bedrock. The debris steps are large suggesting that there is a deep failure plane. The toe of the slide has been reactivated with a disturbed surface and small pockets of ponding. No shear surfaces or intact sections were observed in the slide mass, however, a shale scarp was witnessed nearby extending above the elevation that the shear plane is interpreted to be at.

Slide 2-11

This short failure occurs within the Peace River Valley on a south-facing slope. The profile begins on a ridge between coulees and follows along it and down slope on an azimuth of a 192 . The failure is very active and has two failure planes within the Shaftesbury Shale (Figure 8.27). The head scarp is composed of 9 meters of glaciolacustrine clay above 5 meters of exposed till. Pre-glacial sediments were not

Figure 8.17 Landslide Profile 2-1

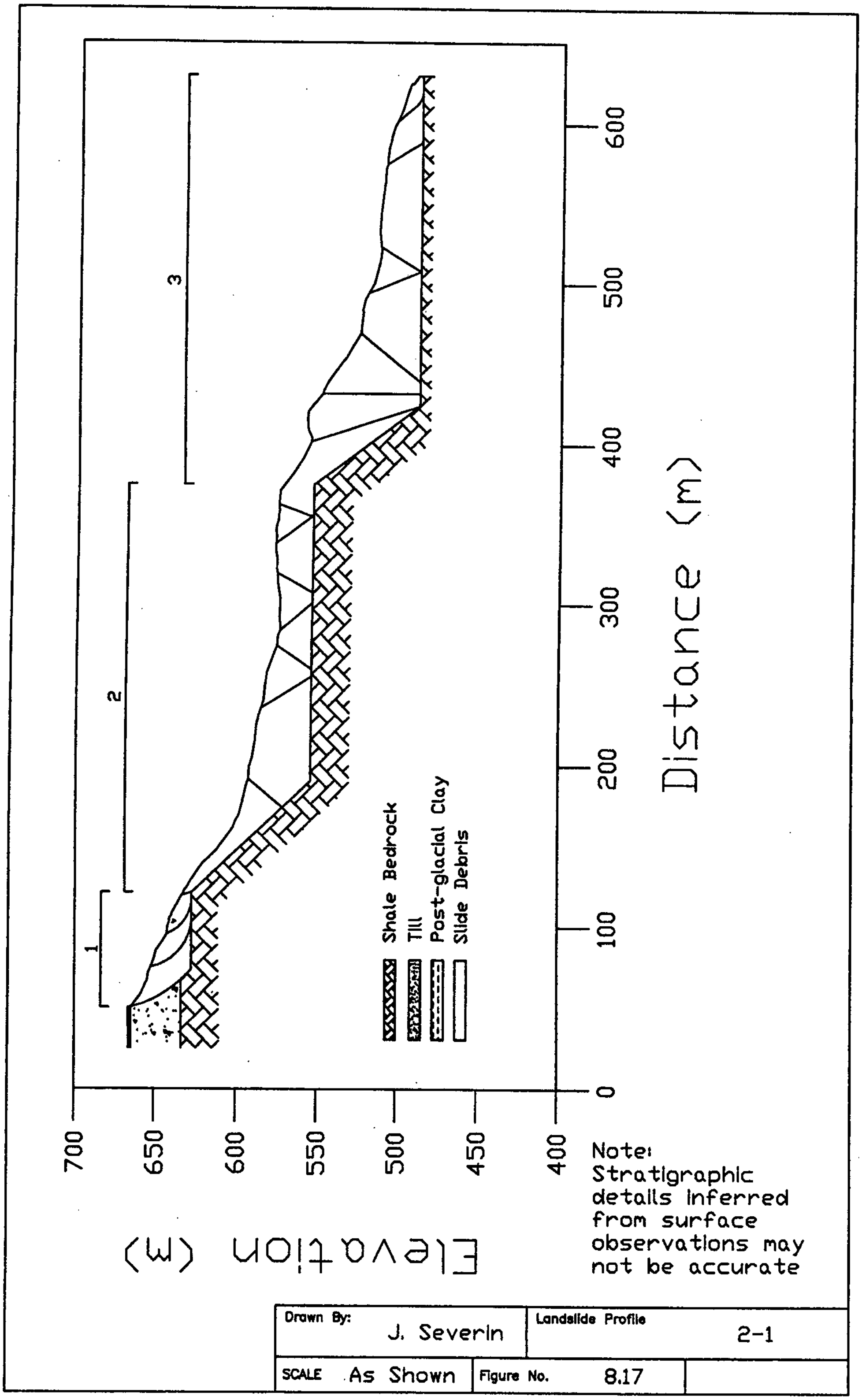


Figure 8.18 Landslide Profile 2-2

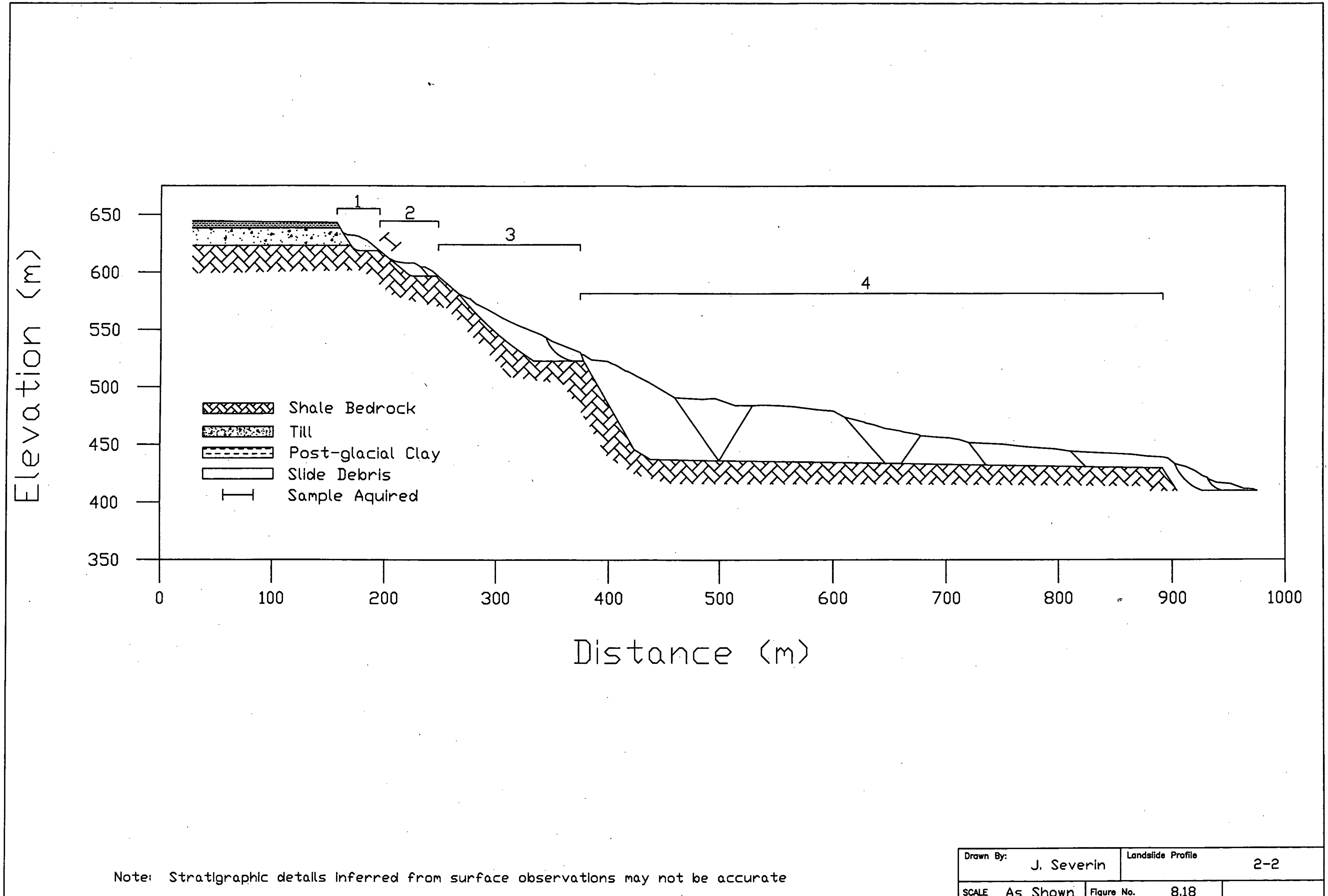
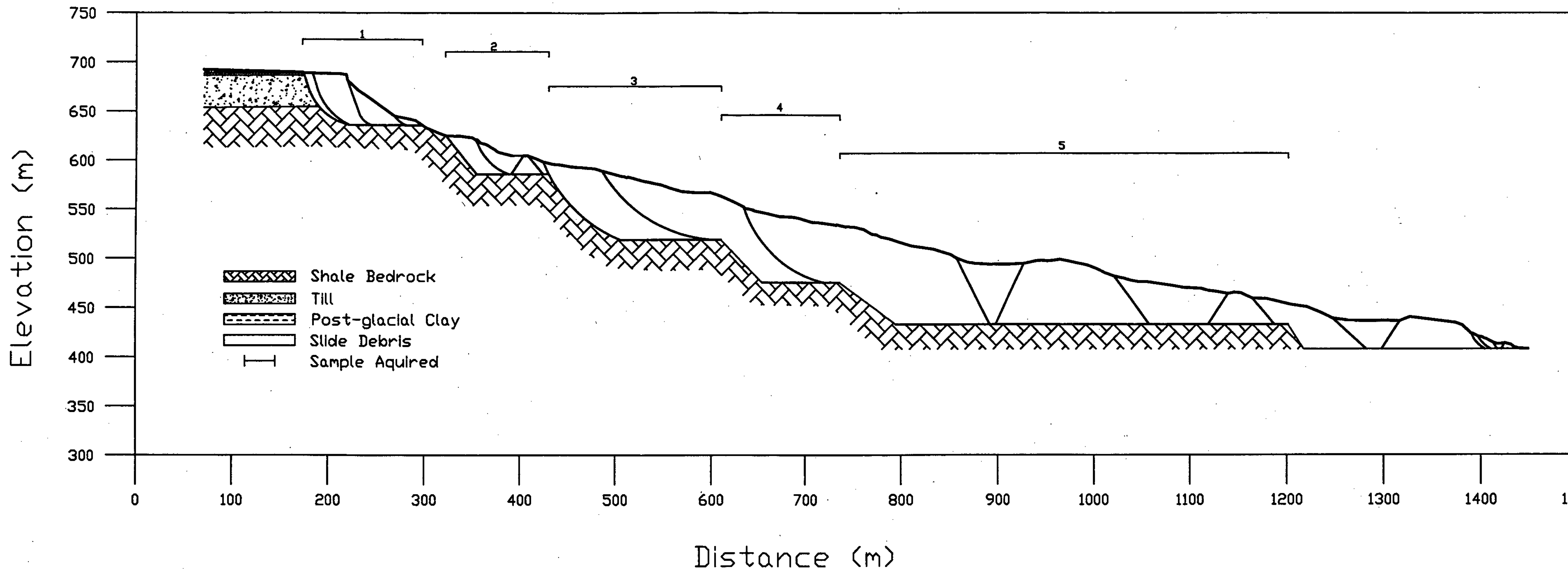


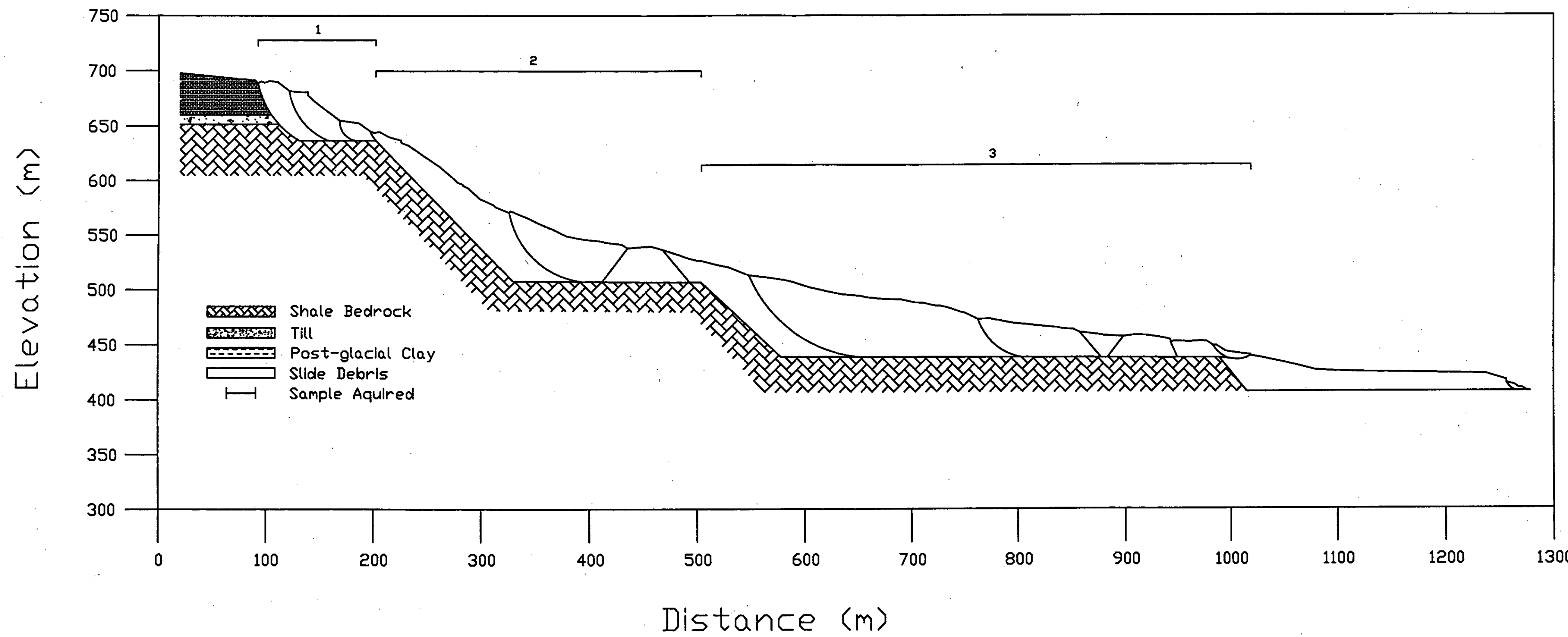
Figure 8.19 Landslide Profile 2-3



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin		Landslide Profile	2-3
SCALE As Shown		Figure No. 8.19	

Figure 8.20 Landslide Profile 2-4



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin		Landslide Profile	2-4
SCALE As Shown	Figure No.	8.20	

Figure 8.21   Landslide Profile 2-5

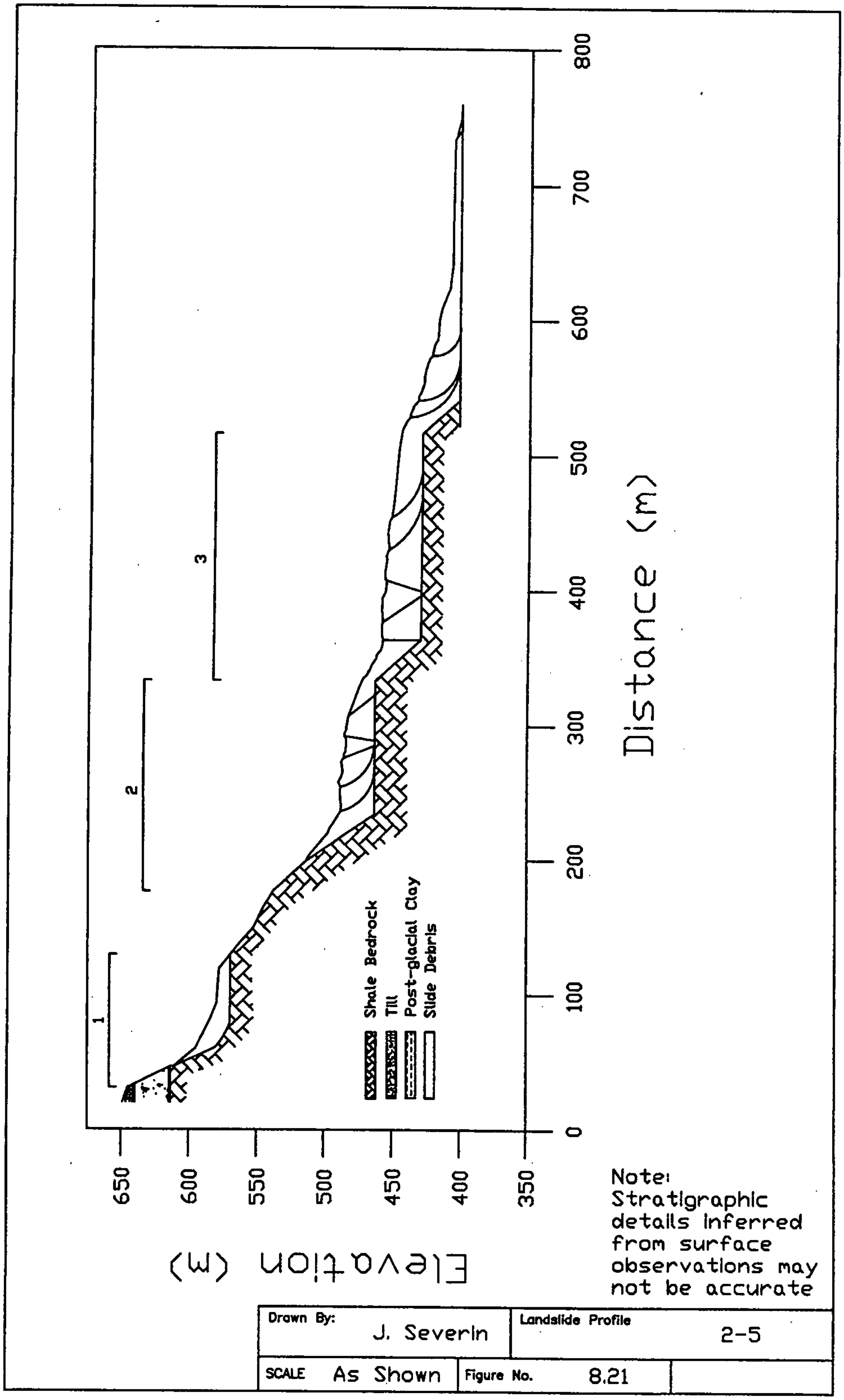


Figure 8.22 Landslide Profile 2-6

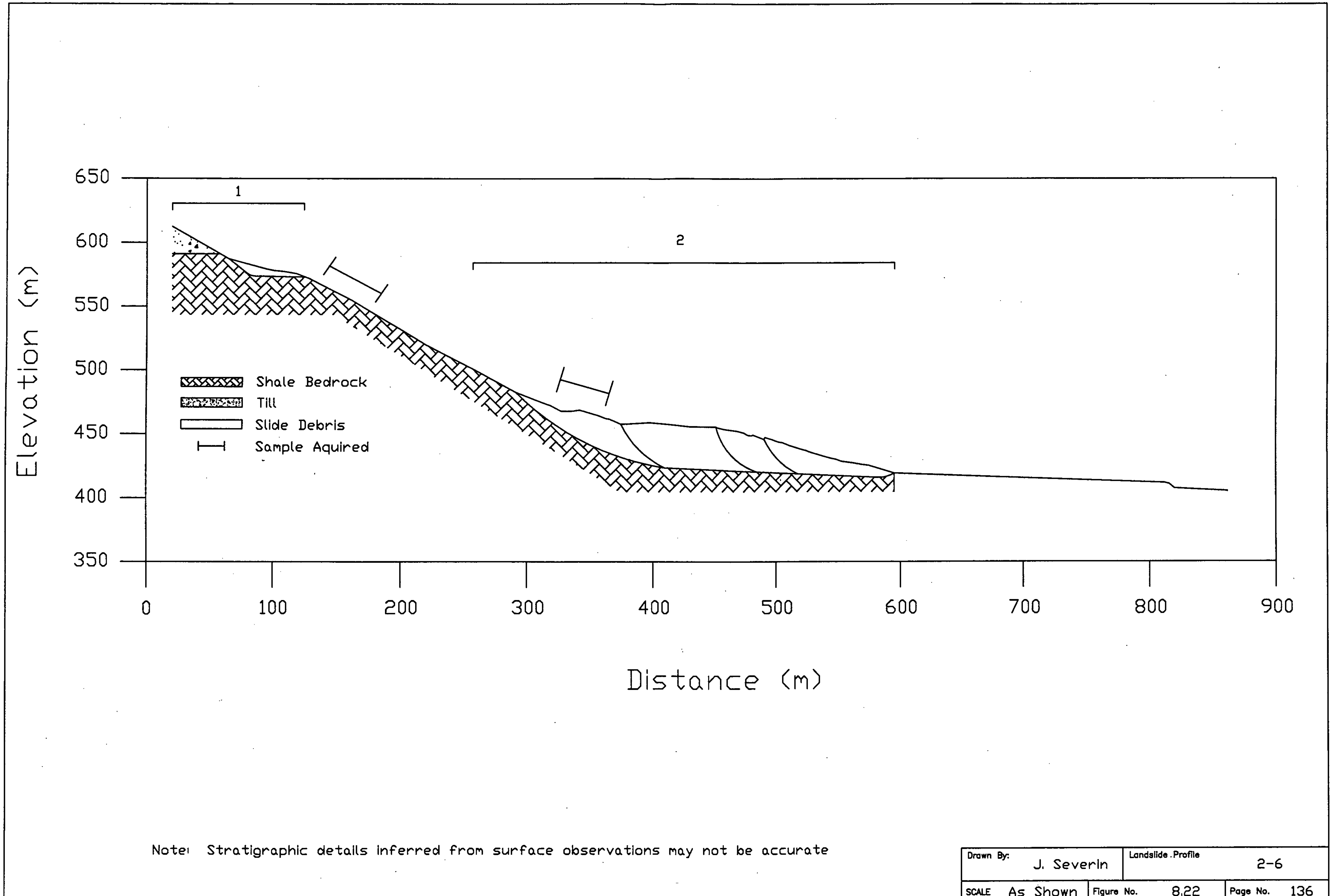


Figure 8.23 Landslide Profile 2-7

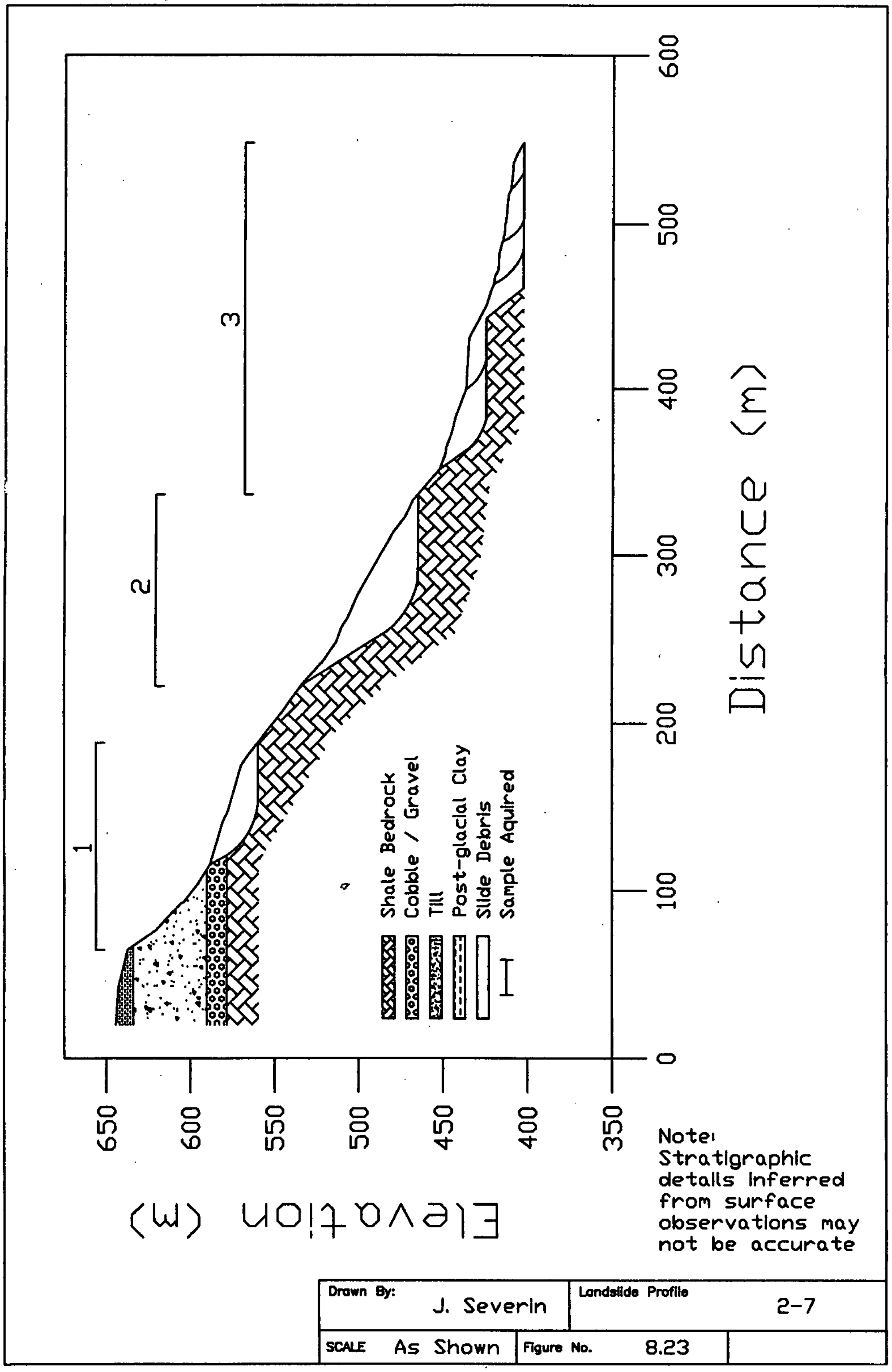


Figure 8.24 Landslide Profile 2-8

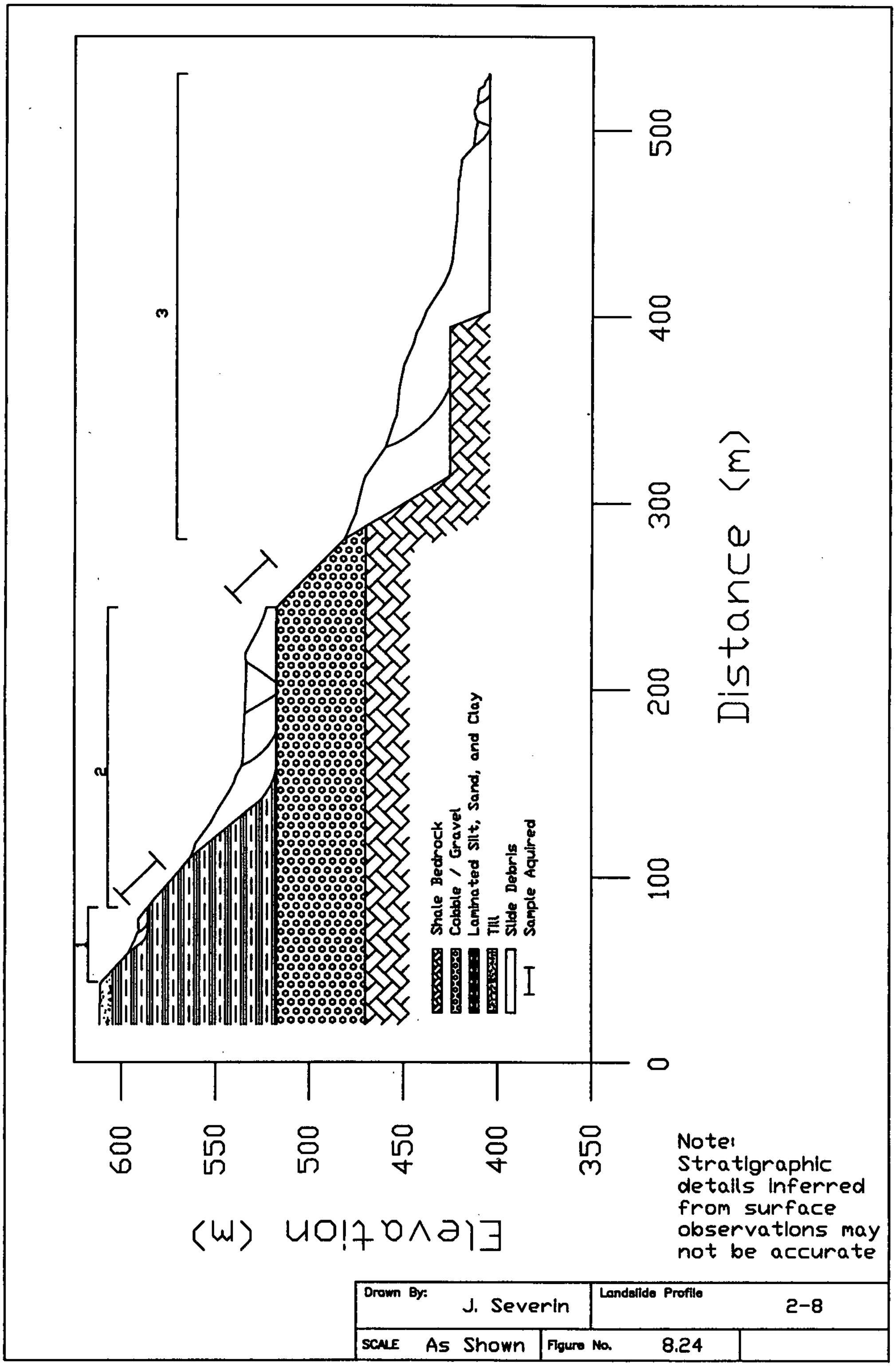


Figure 8.25 Landslide Profile 2-9

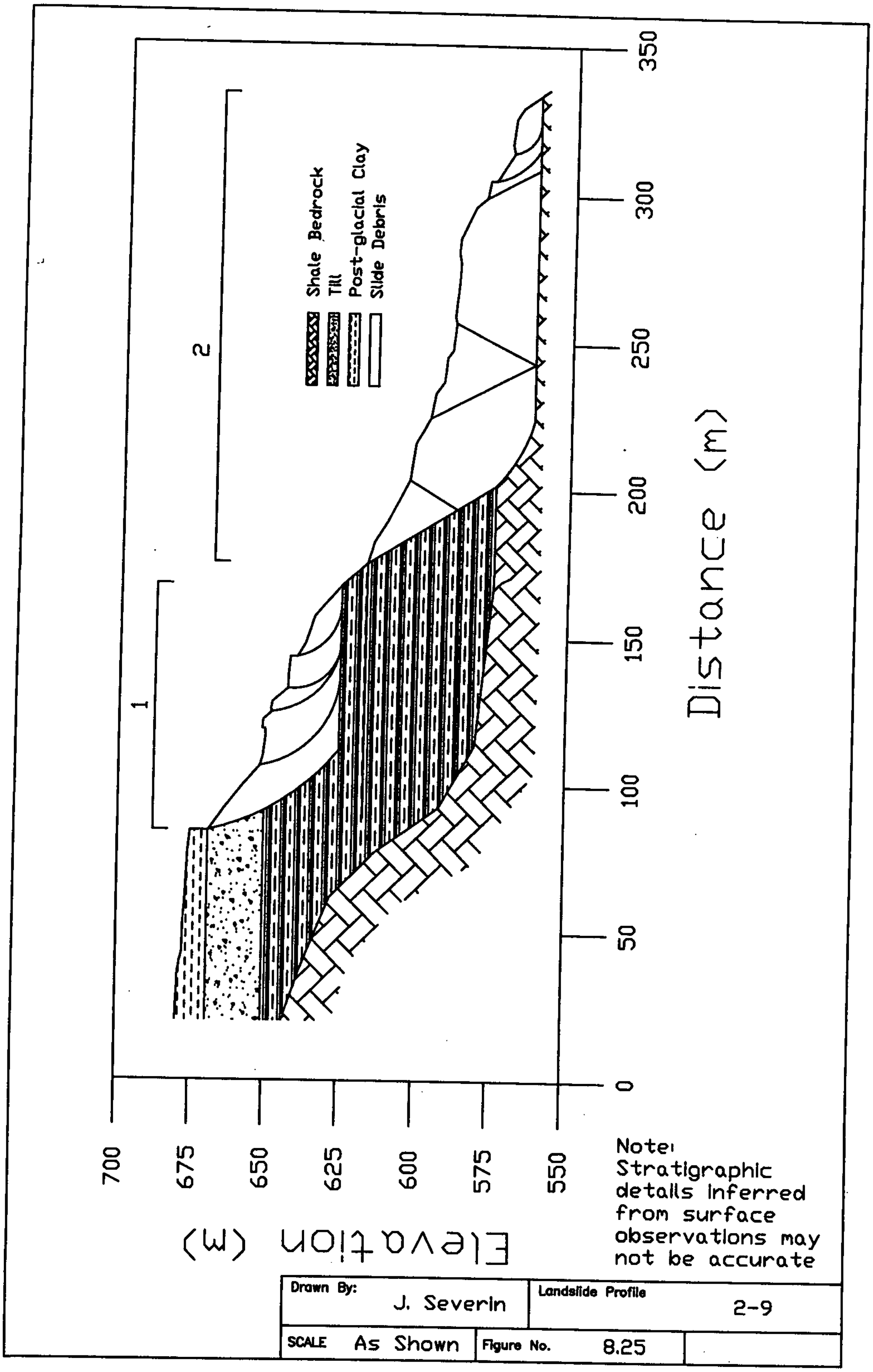


Figure 8.26 Landslide Profile 2-10

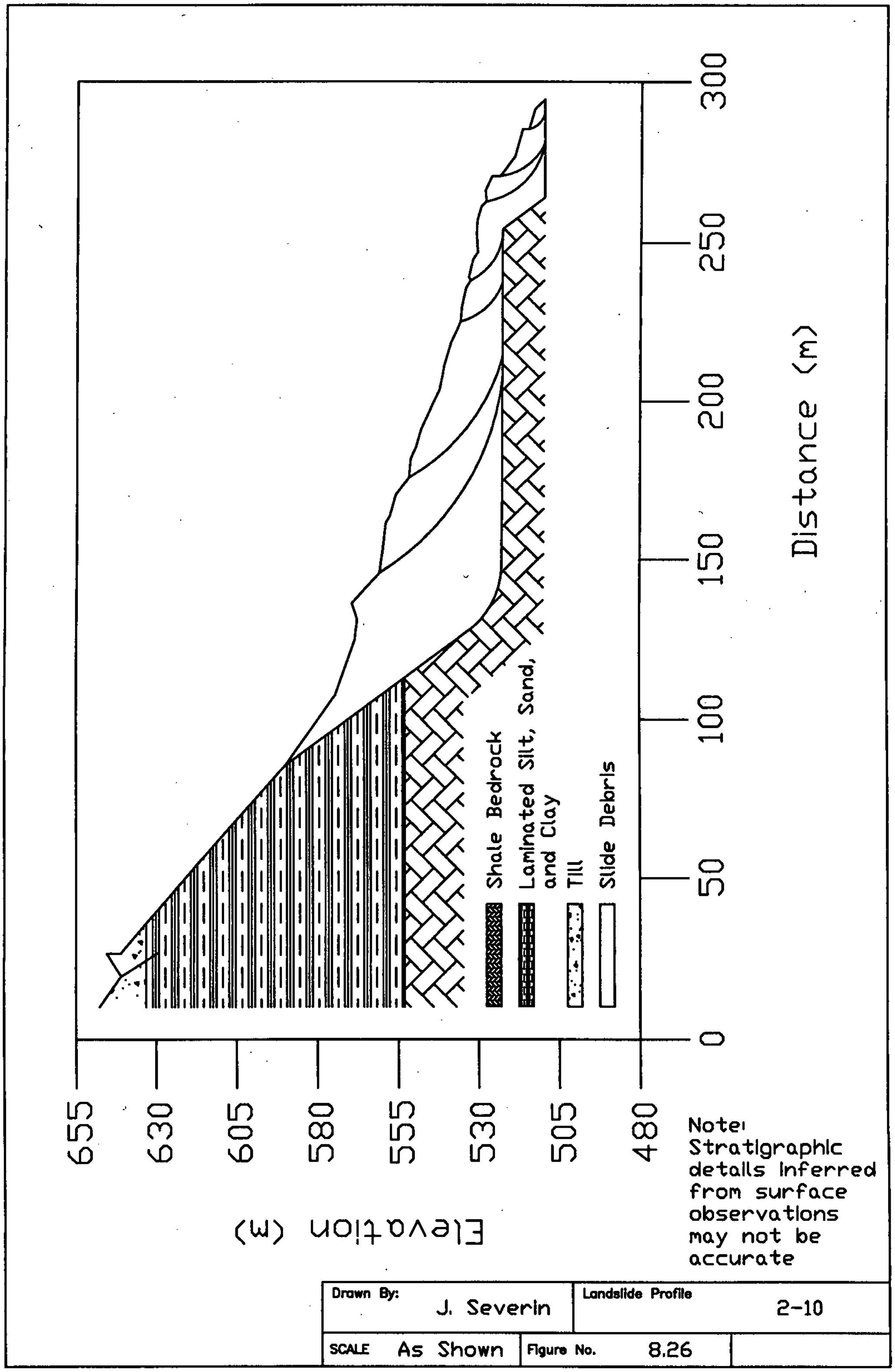
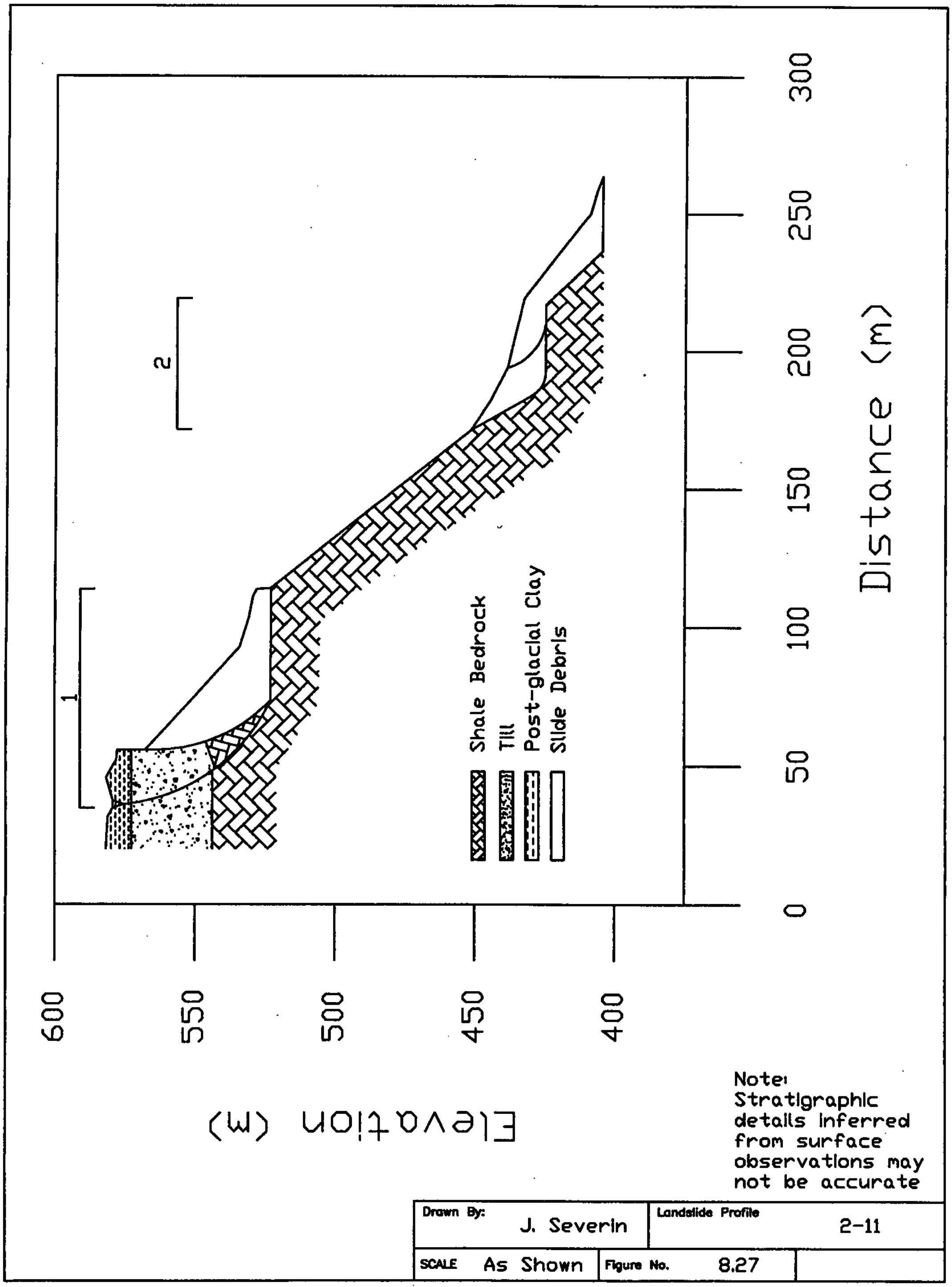


Figure 8.27 Landslide Profile 2-11



detected during the profile. Behind the head scarp is a large crack thought to be a tension crack connecting with the failure plane used for the upper failure. It is likely that this whole section is unstable. The talus below the vertical section is till-like and ends at a bench within the slide. The upper failure is a rotational failure completely separated from the lower failure. The failure plane was observed in the shale but could not be sampled. Below this shear plane, an intact section of weathered shale was found and extends until a debris bench overlying a stable bedrock layer likely containing another shear plane within the shale.

8.2.4 Area Model

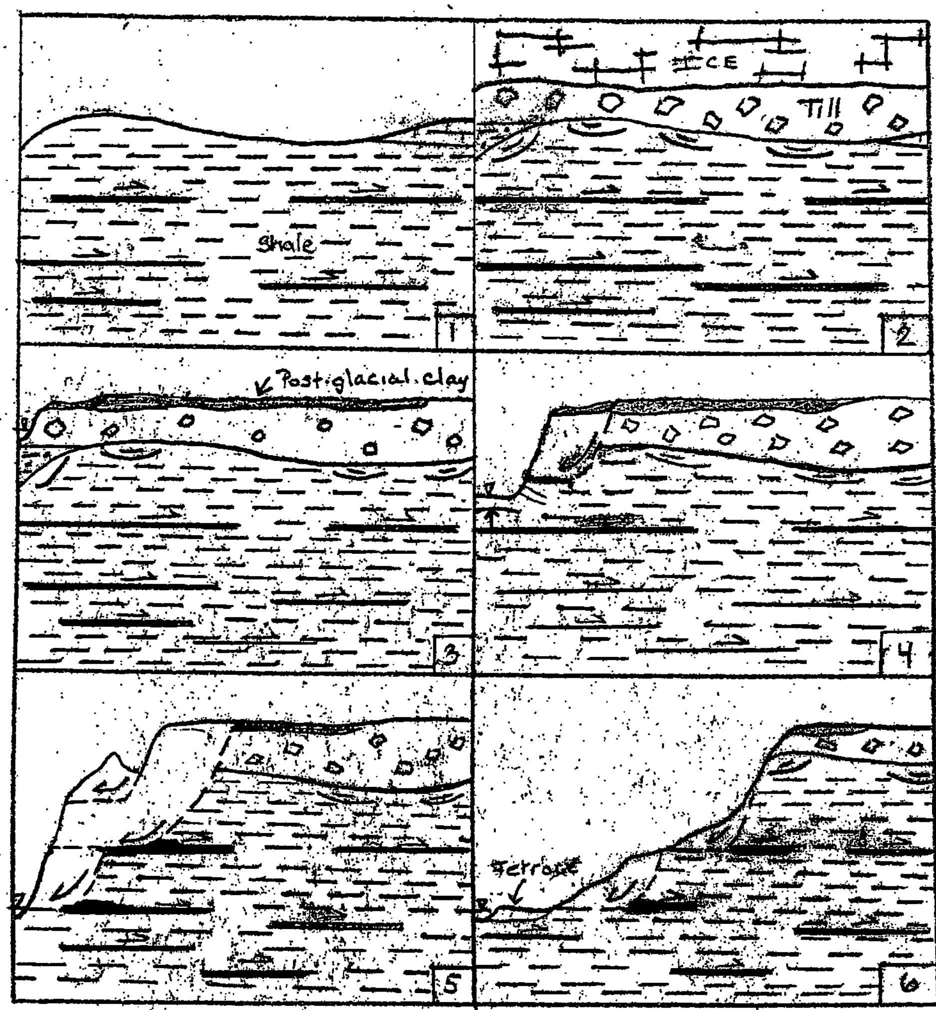
This area occurs completely within the Shaftesbury Shale boundaries making the more resistant Dunvegan Sandstone irrelevant to slope stability studies (Figure 8.28). The highest intact elevation that the shale was observed at was 636 meters a.s.l.; however, in most cases the exposures were truncated by a shear plane. This area is unique within the map sheet because it represents a location in which the present river valley does not follow the pre-glacial valley (1), shown by the high shale elevation and distinct lack of pre-glacial sediments. Only one slide to the east is within the boundaries of the pre-glacial valley. The area was then glaciated (2), represented by till and glaciolacustrine clay in the headscarp and debris through out the slide profiles. Drainage re-established itself within the pre-glacial valley (3) and eventually migrated to erode the bedrock shale, exposing the weak strata (4). As the site is outside of the pre-glacial valley, the shale is found at a high elevation and the shear planes are located within the bedrock. The shale, being a marine deposit, has much less variability than the pre-glacial sand, silt, and clay.

With this in mind, the shear planes are more likely to be correlated over a small area as the lithology plays a role in the slope stability. As the river migrated throughout its channel, proven by current terraces, it also eroded into the bedrock valley wall exposing older weak planes and creating new ones through valley rebound (5). Eventually the river became smaller and controlled by the upstream dam, the lower shear planes were abandoned.

Near the bottom of the river valley, there is a 14-meter thick zone, between the elevations of 420 meters a.s.l and 433 meters a.s.l., in which all profiles that extend to that elevation show a failure. This widespread failure zone is likely a bentonite-rich section of the Shaftesbury Shale reported by others (Sargent and Moore, 1988; Imrie, 1991). Another failure zone exists between 465 meters a.s.l and 478 meters a.s.l. in which 6 of the 9 profiles that are at that depth show a failure plane. Within this study site, there are four more such groupings that can be made that correlate failure planes from at least three profiles. These groupings occur near 522 meters, 555 meters, 585 meters, and 633 meters a.s.l. These shear plane groupings are expected in a material within such a uniform depositional environment. The amount of groupings suggests that bentonite is quite prevalent within the formation, confirmed by other reports on the Shaftesbury Shale and other Cretaceous shales. This bentonite-rich shale occurs in discreet zones roughly correlatable because of the sporadic nature of deep-sea deposition. The shale will fail along the weakest of these zones given the proper setting or else it will fail along the next weakest layer. The bentonite does not occur in discrete beds but rather dispersed within a larger zone. The slides occur along planes that have been sheared due to one of many causes. These planes may be pre-sheared due to relaxation along bedding planes due to valley rebound, over steepening of valley walls during erosion causing syn-erosional slumping, and larger horizontal stresses cause by the orogenic events to the west. The Peace River area is close enough to the mountains that horizontal stresses cannot be ruled out. With the amount of weak zones within the unit and the number of possible causes for pre-shearing, it is no surprise to see individual slides with multiple shear planes. The slides occurring within the coulees generally only have one to three failure planes, simply because the lower failure zones have not been reached by the downcutting of the small streams. One interesting feature of this area is the asymmetry of the coulee slopes. The coulees are generally aligned north-south, however the asymmetry is not consistent. In some of the coulees, the shallower slope is to the east, and in others, to the west. The failures not occurring in the shale show a similar morphology to the slide area around Big Bam Ski Area. A weak clay layer less than a meter above the gravel contact and another failure plane occurring higher in the pre-glacial succession.

In general, there are several weak layers within the shale due to the inclusion of bentonite allowing the shale to fail at many elevations. All of these failures occurred post-glacially as the current valley wall did not exist and as scouring action of the glaciers eroded previous landslide deposits. Therefore, the rapid erosion of the current Peace River Valley, caused relaxation of the valley walls along bedding planes, pre-sheared surfaces caused by tectonic forces, and perhaps glacio-tectonics. As the river level dropped, many of the slides became abandoned and some debris features were destroyed by river erosion.

Figure 8.28 Landslide Area 2 – Geologic Model



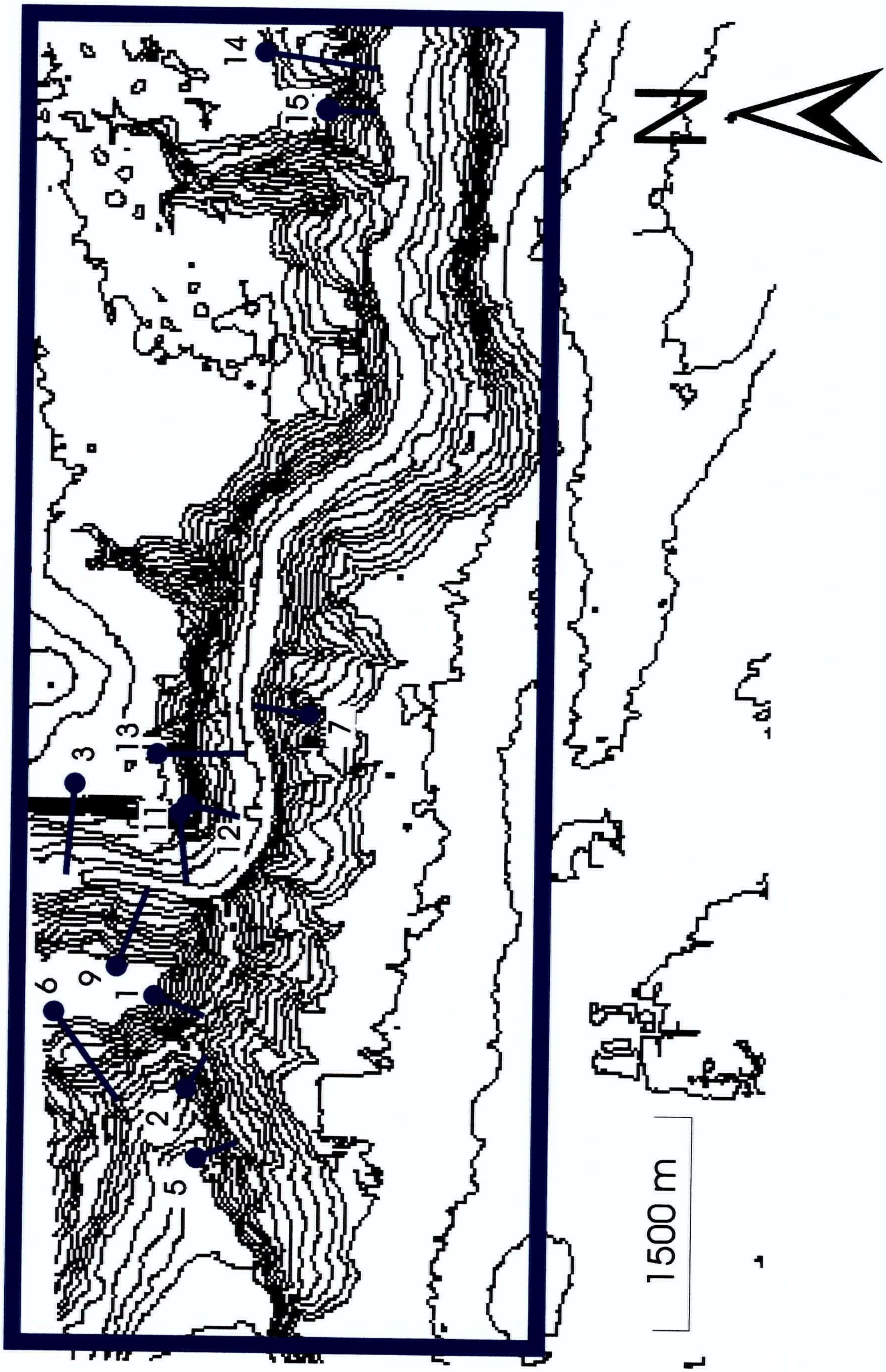
1) Bedrock dominated plain near edge of pre-glacial river valley; 2) Aggregating deltaic environment into encroaching ice-damned lake followed by glaciation; 3) Drainage re-establishes in pre-glacial river valley; 4) Migrating river allows intact material to be eroded and failures to occur exposing weak strata; 5) Migrating river continues to expose weak strata allowing failures to occur; 6) Debris from failures acts as a stabilizing berm of unstable material, although erosion of debris may cause reactivation of failure plane.

8.3 Slide Area 3

8.3.1 Location

The third area chosen was approximately 12 kilometers long and located near the confluence of the Beatton River and St John Creek (Figure 8.29). The area encompasses the large bend in the river where general course changes from the south to the east, roughly 7 km to the northeast of the City of Fort St. John. It also includes most of the lower St. John Creek, Stoddart Creek, and some sites further downstream on the Beatton River. Within the area, 15 slides were profiled within the study site encompassing 5 kilometers of valleys. The area was chosen because of the extensive infrastructure located within it. It contains Cecil Lake Road 103, which has two bridges crossing the Beatton River and St. John Creek, a pump station owned and operated by Devon Gas Services, approximately 15 operating pump jacks, and several pipelines crossing the river valleys. One bridge crossing the Beatton River has been rendered inactive due to the failures making the approach unstable. The area constantly undergoes movements that affect the roadway and pipelines and is currently undergoing slope stabilization project. The area was also very accessible because of the amount of infrastructure. The south-facing slopes show little to no vegetation and steeper slopes while the north-facing slopes are heavily vegetated and generally much gentler slopes producing a distinct asymmetry to the riverbanks.

Figure 8.29 Landslide Area 3



8.3.2 Local Stratigraphy

As in many cases, when the study area is larger, the complexity of the stratigraphy is increased. The stratigraphy of Slide Area 3 is best described by dividing the area into three sections, the north and east walls of the Beatton River, the south and west walls of the Beatton River, and the valley walls of St. John and Stoddart Creeks.

The first section is the north and east valley walls and incorporates the left-hand side of the valley wall, facing the down stream direction. Six profiles were completed within this section. This section contains both Shaftesbury Shale and Dunvegan Sandstone (Stott, 1988) and is interpreted as being the boundary of the pre-glacial valley (Mathews, 1978). The Shaftesbury Shale extends to an elevation of approximately 560 meters a.s.l; however, because the contact is gradational and exact elevation is hard to determine. The Dunvegan Sandstone reaches to an elevation of approximately 590 meters a.s.l with a local high of 621 meters a.s.l. on landslide profile 3-13. Above the sandstone is a silt-rich unit of the pre-glacial sequence. This unit contains interbedded clay and sand on which the upper failures occur. This unit was not witnessed intact but rather inferred from the material within the colluvium and within the debris. This unit is capped by a till blanket which extends to an approximate elevation of 710 meters a.s.l. The post-glacial clay was not observed at this site. An approximate stratigraphic column is produced (Figure 8.30).

Four slide profiles were completed in the second section, the south and west valley walls, which is the right hand side of the valley when looking down stream. This section is within the pre-glacial valley (Mathews, 1978) and therefore the sandstone unit is missing and the shale unit has been eroded down to an elevation of 460 meters a.s.l.

Above the shale is a thin unit of gravels with a thickness of 2 meters. The gravels are clean, uncemented and has a reddish colour. Above the gravels are the pre-glacial bedded sand, silt, and clay beds observed to extend to an elevation of approximately 592 meters a.s.l. At this elevation, the unit becomes clay-rich and contains drop stones with the bedded material to an elevation of approximately 609 meters a.s.l. An approximate stratigraphic column is produced (Figure 8.31).

The third section has five profiles and encompasses the valley walls of St. John and Stoddart Creeks. This section has a similar stratigraphy to the south wall of the Beatton River. The shale was found at an elevation of 487 meters a.s.l on the north side of the valley and lower at 455 meters a.s.l on the south walls. This section is also thought be within the pre-glacial valley (Mathews, 1978) and is therefore missing the Dunvegan Sandstone in all sections except the north wall of Stoddart Creek. The gravel unit is located above the shale with a thickness of 4 meters. The gravels are partially cemented and contain cross bedding indicating an aggrading condition during deposition. Above the gravels, with a gradational contact, is the pre-glacial sequence, dominated here by silt and clay. The sequence continues to an estimated elevation of 650 meters a.s.l. A till blanket of unknown thickness is located at the top of the plateau. An approximate stratigraphic column is produced (Figure 8.32).

8.3.3 Landslides

Slide 3-1

The first slide studied within this area was a multi-leveled failure on a south-facing slope with an azimuth of 198 . The profile began on the upper plateau and

Figure 8.30 Area 3 – Stratigraphic Profile – North and East Valley Walls (not to scale)

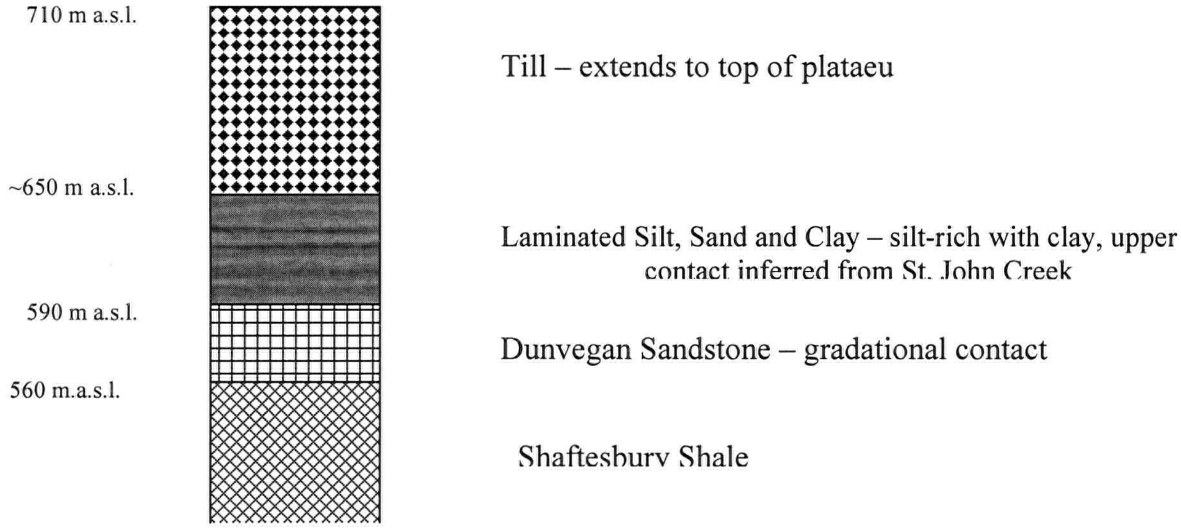


Figure 8.31 Area 3 – Stratigraphic Profile – South Valley Wall (not to scale)

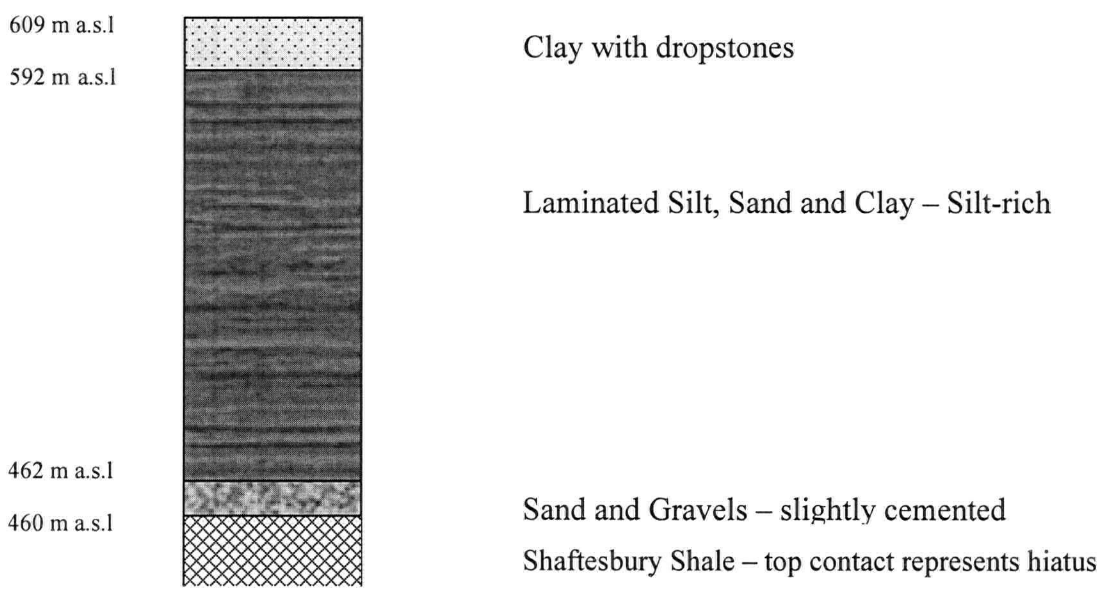
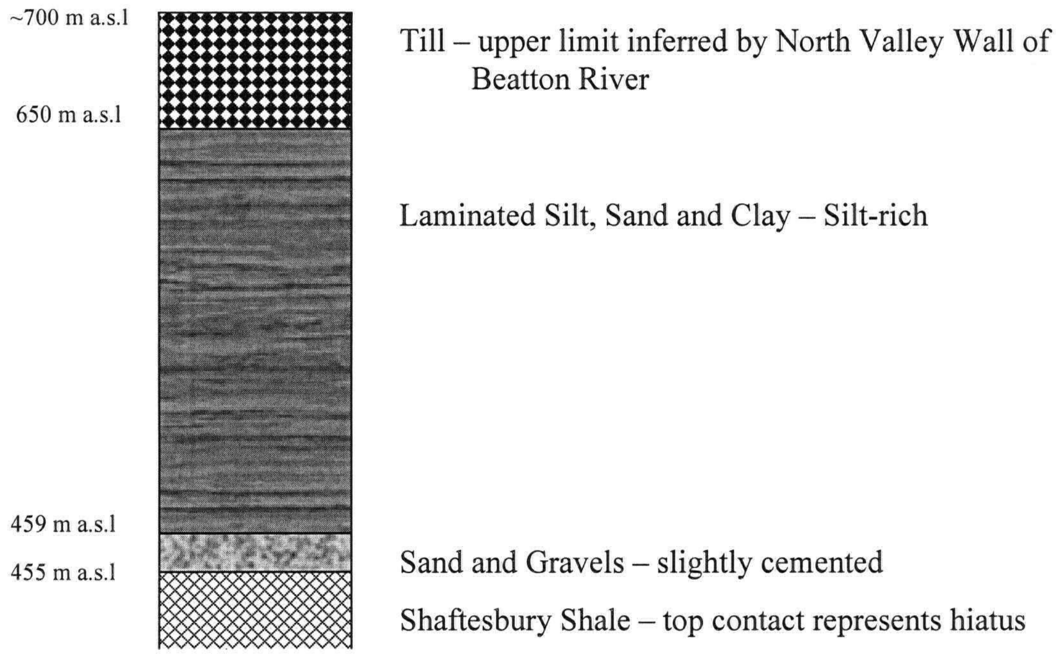


Figure 8.32 Area 3 – Stratigraphic Profile – Stoddart & St. John Creeks



headed down slope towards St. John Creek, near its confluence with Stoddart Creek (Figure 8.29). The slide has two failure planes both within the pre-glacial sequence (Figure 8.34). The top failure is abandoned and completely independent of the lower, very active bottom failure. The head scarp is completely grassed over and appears stable, though morphology indicates that this part of the slope was previously active. The upper failure plane was not observed but rather inferred from the terrain. The lower failure has fresh features even though the main scarp is grassy and appears stable. The lower failure is rotational with many scarps within the debris mass. The failure plane was observed with the vertical face visible from the roadway and sampled (sample 3-1A). Slickensided surfaces were located near the bottom of the pre-glacial unit, 3 meters above the gravel. The debris mass protruded up to 7 cm from the intact section. The shear plane consisted of 47% clay and 52% silt. The liquid limit of the layer is 54% and a plasticity index of

34%. The gravel unit extends for 5 meters until the shale was reached. The toe of the slide, on which a roadway is located, is remobilized debris. This toe has been armored at the creek level in order to stop the remobilization of the debris and to add stability to small slumps that threaten the roadway.

Slide 3-2

Slide 3-2 is multi-level failure located on an east-facing slope on Stoddart Creek near its confluence with St. John Creek (Figure 8.29). The profile begins along a knife-edge and continues down slope at an azimuth of 100 . This slide is a very active part of a larger, south-facing slide complex extending further to the west. The slide incorporates two failure planes, both within the pre-glacial sequence above the bedrock (Figure 8.35). Neither shear plane was observed, but rather their location is inferred from slide morphology. The failure planes are thought to be in the unconsolidated sediments because of the low elevation that the shale is found around the area. The shale outcrops only 2.5 meters above the creek level. The material within head scarp of the upper failure appears to have been disturbed from the abutting slide to the north. Even though the material is disturbed, it can still be noted that it is dominated by silt and sand with minor clay. The upper failure is a retrogressed rotational failure displaying back tilt of a slump block and scarps within the debris. This failure appears to be independent of a lower failure, which is more of a compound failure with the typical horst and graben extensional features. The toe of the failure had failed earlier in the summer of 2003 in as a rotational slump.

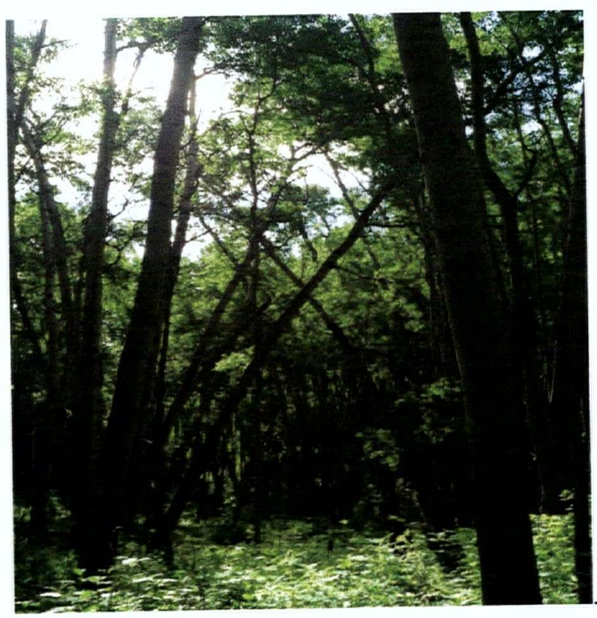
Slide 3-3

Even though this large landslide has two distinct failure planes, it is best classified as a compound failure (Figure 8.36). The failure occurs within the Beatton River Valley on a slope that has a western aspect (Figure 8.29). The profile begins within a field on the upper plateau and continues down slope at an azimuth of 262 . The failure is dormant with a few sections that are active to very active. The upper failure is a small rotational slump within a silt-dominated sequence of the pre-glacial unit that appears abandoned. This failure is above a steep face controlled by the Dunvegan Sandstone, which acts as a head scarp for the lower compound failure. The large pond at the base of the scarp abuts against a large horst block with smaller scale hummocky terrain within in. Other large-scale horst and graben features are seen further down slope including a second pond near the road, which services a pump jack within the debris. Sandstone blocks were seen through out much of the failure up to the location of the second pond. The toe of the failure is at a low angle and drops near the current river level. This is interpreted as the edge of the stable bedrock below. The failure is thought to be deep as the size of the features are quite large and must be in shale due to the presence of the sandstone strata. This type of failure is common along the Beatton River Valley within this section of the river.

Slide 3-4

This failure profile begins at the fence of a bison ranch south of Stoddart Creek (Figure 8.29) and continues down slope at an azimuth of 336 . The ranch is within the flat, stable plateau above the river valley underlain by the Dunvegan Sandstone. The profile follows along a seismic line that has cut through the dense vegetation on the north-facing slope. The slide has some small active sections, although in general it would be classified as dormant. The slide is interpreted conservatively as having one dominant basal shear plane within the shale bedrock allowing for a large compound failure (Figure 8.37). This surface was not seen, but rather inferred from the slide terrain. No intact sections or failure planes were seen along this profile, however the bedrock elevation is projected from neighbouring intact sections. Much of the morphology of this slide is interpreted from the tree cover, as there was several sections within this slide that displayed a distinct cross tilting of the trees (Figure 8.33). The cross tilting is interpreted as an extensional feature where discrete blocks are separating from each other. Several muted horst and graben features were encountered during this profile supporting the compound interpretation.

Figure 8.33 Cross-Tilting of trees on Landslide Profile 3-4



Slide 3-5

The profile of Slide 3-5 on the south-facing slope occurs opposite of Slide 3-4 on Stoddart Creek (Figure 8.29). The profile starts upon the stable plateau above the creek near a cluster of pump jacks and continues down slope at an azimuth of 129 . This multi-level slide has three distinct failure planes independent of each other with the upper failure being abandoned and the lower failures being very active (Figure 8.38). The upper failure has no distinct features, however, from the shape of the slope the failure might have been a compound failure. The sandstone face below the failure indicates that the failure plane is within the pre-glacial sediments. The second failure, below the sandstone face, is a small rotational failure with a shear plane that is within the shale bedrock. The active debris shows minor back tilt although the features are fairly muted. There were sandstone blocks scattered throughout the debris of this section from the bedrock above and below. The shear plane for this failure was not found here although debris was observed directly above intact shale. The failure plane was located deep within the slope and could be sampled with a shovel; however, the same plane was sampled (sample 3-5A) approximately 200 meters giving enough field evidence to support that the failure plane was located at this level. This shear plane was found to consist mostly of silt, 68%, with minor clay, 19%. The Liquid Limit of the shear was found to be 53% with a Plasticity Index of 35%. The intact shale below the failure plane was heavily weathered and produces a large talus cone of raveled shale. A gouge layer within the shale was sampled (sample 3-5B) and tested. The gouge consisted of 32% sand, 58% silt, and 10% clay. The layer has a Liquid Limit of 52% and a Plasticity Index of 29%. Below this section, distinct horst and graben features were observed indicating a translational movement of the debris. Near the river, intact shale was observed again signifying that the lowest shear plane is also within the shale and not simply remobilized debris.

Slide 3-6

Slide 3-6 is a multi-level failure occurring on a southwest-facing slope within the valley created by St. John Creek (Figure. 8.29). The profile begins at the base of a pump jack within a field on the stable plateau and continues down slope at an azimuth of 206 . The slide is classified as dormant although the upper sections are likely to be abandoned. The slide has three distinct failure planes independent of each other (Figure 8.39). The upper most failure is abandoned and has muted features making the failure type hard to distinguish. It likely a compound failure based on the slope morphology, however, no shear plane was found. A steeper section of the slope is interpreted as being a stable back scarp for a lower compound failure. The debris within this section shows large-scale horst and graben features with little to no back tilt observed. The slope in this section has a low angle until a large scarp is reached. This large scarp was vegetated with grass and shrubs and thought to be the head scarp for the third ad lowest failure. Originally it was thought that the debris below this scarp was remobilized debris from the failure above, however, a failure plane was located within the shale near a vertical section by the creek. This lower failure is a retrogressed rotational failure displaying back tilt and scarps within the debris. As most of the slide had no exposure, the shale elevation was inferred by projecting near by elevations found. The inferred shale elevation leads to the conclusion that the upper two failures occur within the pre-glacial material while the lower most failure occurs within the shale.

Slide 3-7

This is an active, multi-level failure on the north-facing slope along the Beatton River (Figure 8.40). The profile begins along a ridge between a gully towards the west and a large bowl-shaped failure to the east, and continues down slope at an azimuth of 350 (Figure 8.29). This failure has partially destroyed a road that approached a now decommissioned bridge making it impassable. This occurred some years ago and has now been partially reclaimed. There is still danger associated with this slope as there are still a few residents serviced by this road further upslope. The failure incorporates three failure planes all within the pre-glacial sediments. The upper most failure is an independent, dormant rotational slide. It is heavily modified as heavy equipment is in the process of moving earth and really can only be recognized by the hummocky terrain and the existence of shear planes found in the scarp of the next failure. The vertical face of the next failure is of intact clay-rich material with drop stones through the mass. A distinct shear plane was observed and sampled (sample 3-7A) for a slide that occurs next to the one profiled. A similar failure plane likely exists for the above failure, however was not actually observed. The second failure shows back tilting and scarps within the debris indicating a retrogressed rotational failure. The failure plane for this section was not observed either, although because the section is active, it can be inferred due to the fresh features and the total lack of shale within the debris. An intact scarp below the debris is interpreted from a small scarp within the debris that begins a steeper section of the slope. It is unknown whether this failure is within the Quaternary sequence or within the bedrock, however it is believed to be within the pre-glacial progression as little to no shale was found within the debris. This is the approximate location of the intact road section on the slope. The toe of the failure is interpreted as being remobilized debris from the above failures. This failure is located on an outlying section of pre-glacial material, as failures have retrogressed the slopes on either side of this section.

Slide 3-8

Slide 3-8 is compound failure on a north-facing slope along the Beatton River (Figure 8.41). The slide profile starts on the plateau above the river and mostly follows the edge of a pipeline right of way down slope at an azimuth of 340 . The failure is dormant and many of the slide features are small and muted. The profile was taken 20 meters off the right of way so that disturbance from the pipeline would not be added to the data. The slope is interpreted as having one major basal shear plane within the shale and another near the top within the unconsolidated material. The upper shear plane was not actually observed, although the surface expression of the slope would indicate that a failure had occurred in that location. The only section of intact material observed was at the bottom of the slope within a ravine less than 10 meters of the profile. The ravine revealed a section of intact shale that was rubbly and slaked. Near the bottom of the shale section, more intact shale was found. Within this more competent shale, several shear planes were located suggesting that the shale was undergoing creep within this section. This suggesting the presence of a deep-seated shear plane on which the shale mass is moving, albeit, very slowly. Above the shale was a slightly disturbed bed of sands and gravels, common to this side of the river valley. The material was loose and easily excavated. The controlling shear plane of the failure is thought to occur below this and movement along it must be very slow as not to cause the gravel bed to be disturbed more than it was. The material above the gravel was bedded silt with plumes of gravel intruding from below.

Slide 3-9

This is a multi-leveled failure with three distinct failure areas (Figure 8.42) on an east-facing slope across from Slide 3-11 within the Beatton River valley. The profile for the slide starts upon the stable plateau on an access road and heads down slope at an azimuth of 80 (Figure 8.29). This slide is entirely dormant and is currently used by recreational vehicles. None of the shear planes were observed, however their location was inferred from surface morphology. The upper two shear planes are thought to be within the Quaternary materials while the lower failure is thought to be in shale. The lower shear plane was placed in the shale due to the amount of shale within in the debris near the base of the slope. Shale was not witnessed in other sections of the slide. The upper most failure is dormant and many of the features were either to muted or disturbed to make a decision on what type of failure it may have been. The debris of the middle failure displayed back tilting with little to no extensional features so it was likely a rotational failure. The lowest compound failure was longer than the upper two and did show horst and graben features with little rotation. The debris at the toe of the slide was vegetated and appeared to be stabilized debris from the above failures. The elevation of the shale is low in this area due to the pre-glacial valley so many of the shear planes in this area are within the Pleistocene sequence.

Slide 3-11

Slide 3-11 is a large compound failure occurring on a southwest-facing slope within the large bend of the Beatton River Valley (Figure 8.29). The profile begins on the corner of the upper plateau above the river and heads down slope at an azimuth of 241 . The failure is dormant and is controlled by one dominant failure plane (Figure 8.43). The slope morphology suggests a second failure plane that may be in the intact material or within the debris. The main head scarp is covered in grass and colluvium and shows signs of minor shallow slumping. The debris close to the head scarp shows decided back tilting and translational horst and graben features further down the profile. The toe of the failure is modified for the right of way of a pipeline. If the debris remobilized along the shear plane, this pipeline would be under extreme hazard. Near the river, a series of scarps within the debris show that the debris has moved in the past and may move again in the future.

Slide 3-12

This slide profile is on a south-facing slope at the large bend within the Beatton River Valley on an azimuth of 184 (Figure 8.29). The profile begins within a field and continues along a pipeline right of way down slope and ends at the gas plant fence line. The slide, like others around it, has one dominant basal shear plane and a smaller, independent failure above the bedrock face (Figure 8.44). The failure is dormant with no recent deep-seated movements, although there are some shallow failures within the colluvium cover forced at an unstable angle due to the underlying bedrock. The upper shear plane was not observed as the slope had a thin cover of colluvium but the slope morphology suggests an abandoned slide. Several reflectors were set up on the slope to monitor movement by an unknown party. An intact sandstone scarp was encountered, beneath which debris from the deep-seated failure within the shale begins. The bottom part of this failure mirrors that of Slide 3-13, although the features along this profile were much more muted than the neighbouring slide. The roadway also crosses this profile increasing the risk of this failure but more importantly, the gas plant is located on the debris of this old failure. The profile was truncated by the presence of the plant and finished from topographical data.

Slide 3-13

Slide 3-13 is a large failure on a south-facing slope along the Beatton River near a pump house for a pipeline that transects the area (Figure 8.45). The profile starts near a pump jack up on the stable plateau within a field and continues down slope at an azimuth of 344 . The failure resembles Slide 3-3, in that it should be classified as a multi-level failure but because a majority of the movement occurs along one shear plane, it can be considered a compound failure. The upper two failures that occur within the Pleistocene unit are dormant and covered in light vegetation. They are compound failures and neither shear plane was witnessed but rather inferred from surface morphology. They are believed to occur within the Pleistocene sequence, as the vertical face below is composed of Dunvegan Sandstone and not likely to failure. The dominant lower failure is a compound failure occurring along within the Shaftesbury Shale. The debris has recently become active, failing along the same deep-seated shear plan. A sample of the remolded shale was collected (sample 3-13A) and found to be 78% silt and 19% sand. The Liquid Limit of the shale is 42% with a Plasticity Index of 24%. The debris is very hummocky with major ponding occurs where is an intact scarp beneath the debris. The toe of the slide has been disturbed as the debris that blocked the roadway was removed and used as fill in another location. The landslide also damaged a transmission line and forced one of the wells off line.

Slide 3-14

Slide 3-14 is on a south-facing slope of the Beatton River approximately 7 kilometers down stream of the St. John Creek confluence (Figure 8.29). The profile begins on the stable plateau near the edge of the slide and continues down slope at an azimuth of 180 . This is a multi-level failure with three shear planes with the upper section being abandoned and lower two being active (Figure 8.46). The upper most failure is distinct and should be considered of a special type. It is bowl-shaped failure with a very low angle, somewhat resembling quick clay failures occurring within the Leda Clay in Eastern Ontario and Quebec (Mitchell, 1977). The failure has the appearance of an abandoned meander scar, however there is a distinct set of sub-parallel ridges, thought to be debris scarps. The interpretation of the upper failure is that it is a shallow retrogressed rotational failure that has receded for an extensive distance with highly mobile debris. The failure has occurred within the pre-glacial unit, which makes it unique. Most of the failures that have this morphology within the map sheet occur within the post-glacial clay. The middle failure is a retrogressed rotational slide that occurs within the shale unit. The failure plane was sampled (sample 3-14 A, B, C) and a thin unit of remobilized shale was found above the bottom shear plane. Both the shear plane found in the shale (sample 3-14A) and the remobilized material (sample 3-14B) consisted dominantly of silt 77% and 74%, respectively and minor clay, 22% and 25%. Both materials have a Liquid Limit of 41% and a Plasticity Index of 21%. The debris contains till, sand, silt, and pockets of weathered shale. Near the edge of the slide, an intact layer of cemented gravel was found above the location of the shear also supporting the location of the failure plane within the shale. Below the middle failure, an intact scarp in which the failure plane daylights, is made of bedded shale. At the base of this scarp is a large, intact, rotated block of shale indicating that a compound failure below the scarp. This bottom failure plane was not observed, however it can be placed with confidence within the shale. The debris mass is very disturbed and is mostly made-up of shale with minor a minor amount of till and sandstone. The underlying intact shale bed abruptly stops where the debris thins toward the toe.

Slide 3-15

Slide 3-15 is on a south-facing slope of the Beatton River less than 1 kilometer up stream from Slide 3-14 (Figure 8.29). The profile starts at the river level and continues up to the plateau at an azimuth of 350 . This is a multi-level slide incorporating two independent failures, with the upper section being abandoned and the lower section being active (Figure 8.47). The upper failure has a steep, grassy head scarp with a disturbed and back tilted debris mass. The failure by itself could be described as a single rotational failure. The shear plane of this failure was not observed as it likely daylights behind the lower grassed scarp below the ledge. The total lack of sandstone and shale within the debris, allows the assumption that the failure is within the pre-glacial unit to be made. The grassed scarp below the first failure is the head scarp of the active lower failure. The lower failure is a compound slide with a shear plane with in the shale. This shear plane was located and sampled (sample 3-15A) in the vertical face below the second debris mass. The shear plane consists of 22% sand, 57% silt, and 21% clay. The Liquid Limit of the sheared layer is 55% with a Plasticity Index of 40%. A distinct layer of remolded shale was also observed and sampled (sample 3-15B). This layer had high plasticity with a plasticity index of 51% and a liquid limit of 80% and contained fragments of intact shale. Above this layer, a disturbed layer of gravels, often found in pockets or included was found within the debris above suggesting that the movement was slow enough not to completely disturb the pre-slide stratigraphy. The failure occurred near the top of the shale unit with the section of disturbed shale being mostly transported out of the slope. Secondary shears also occurred within the Pleistocene sequence, however these were not the controlling structures within the slope.

Figure 8.34 Landslide Profile 3-1

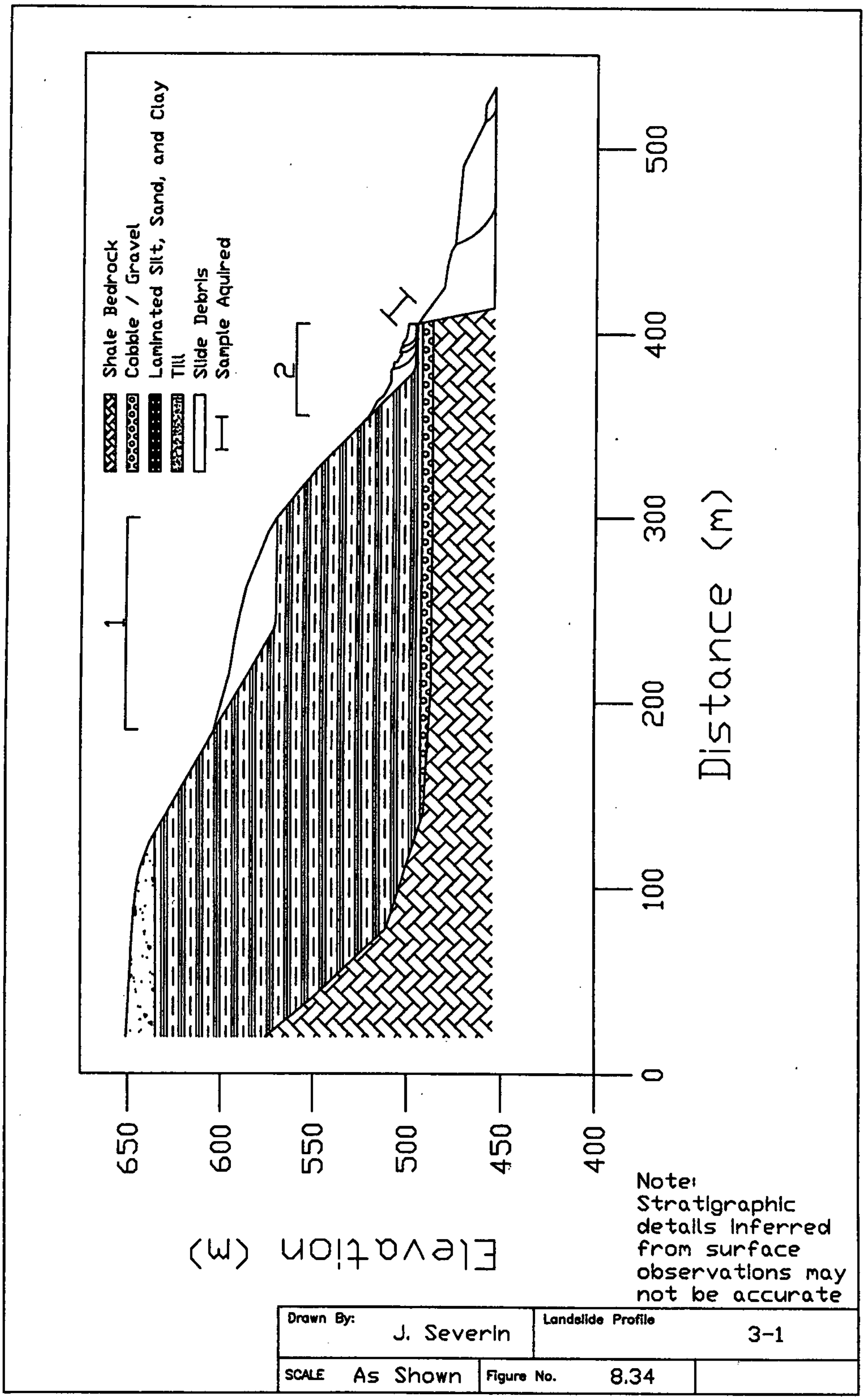


Figure 8.35   Landslide Profile 3-2

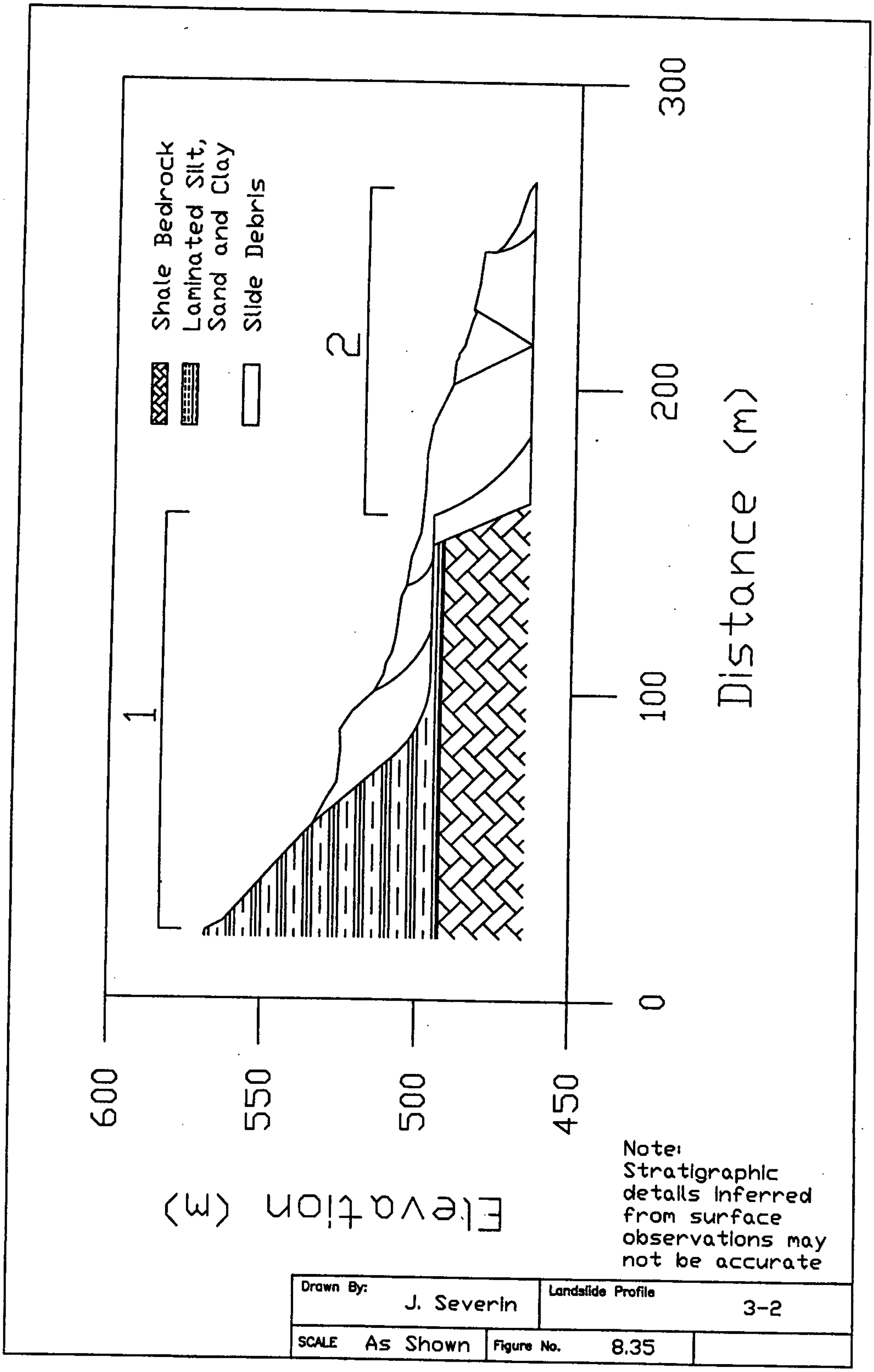


Figure 8.36 Landslide Profile 3-3

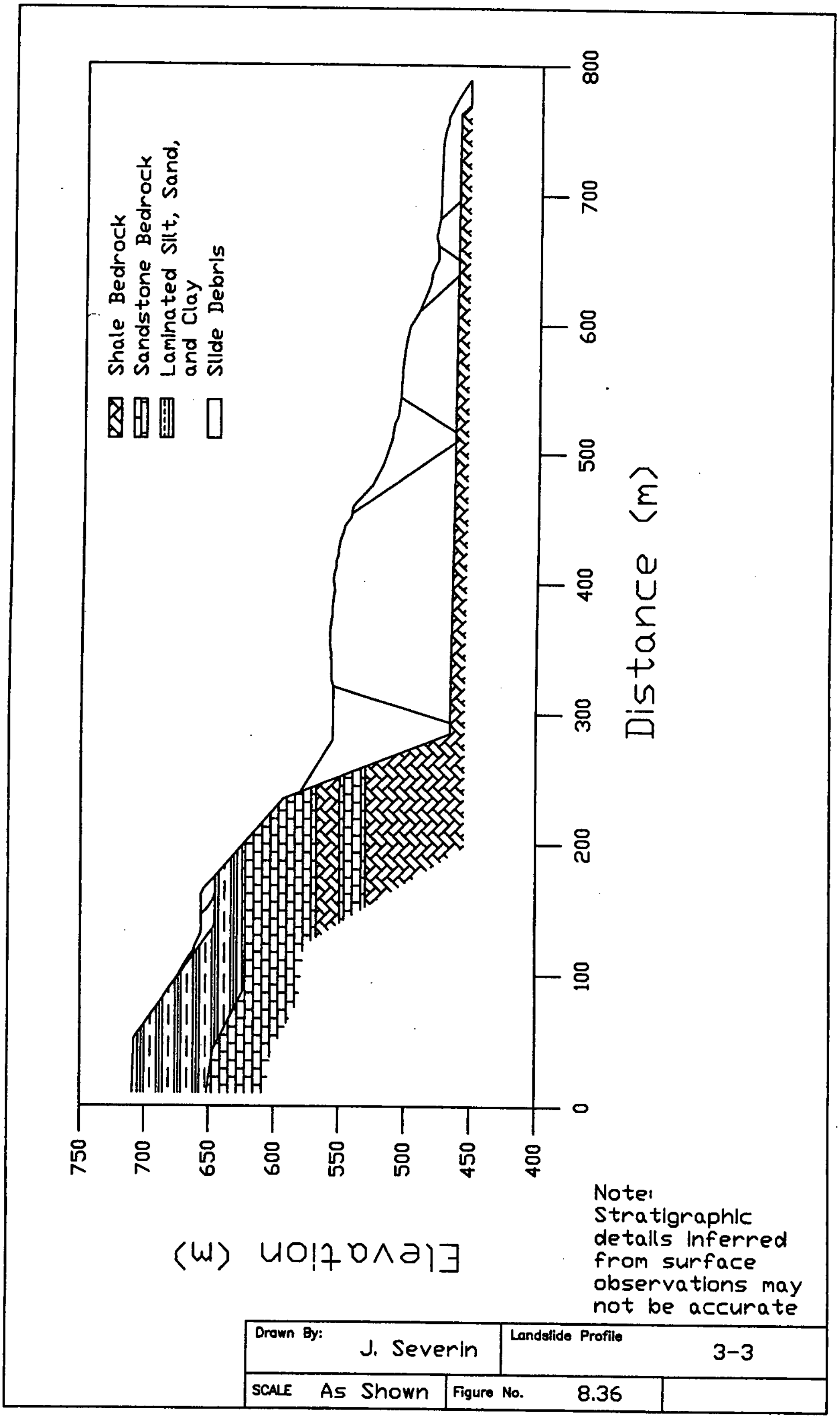
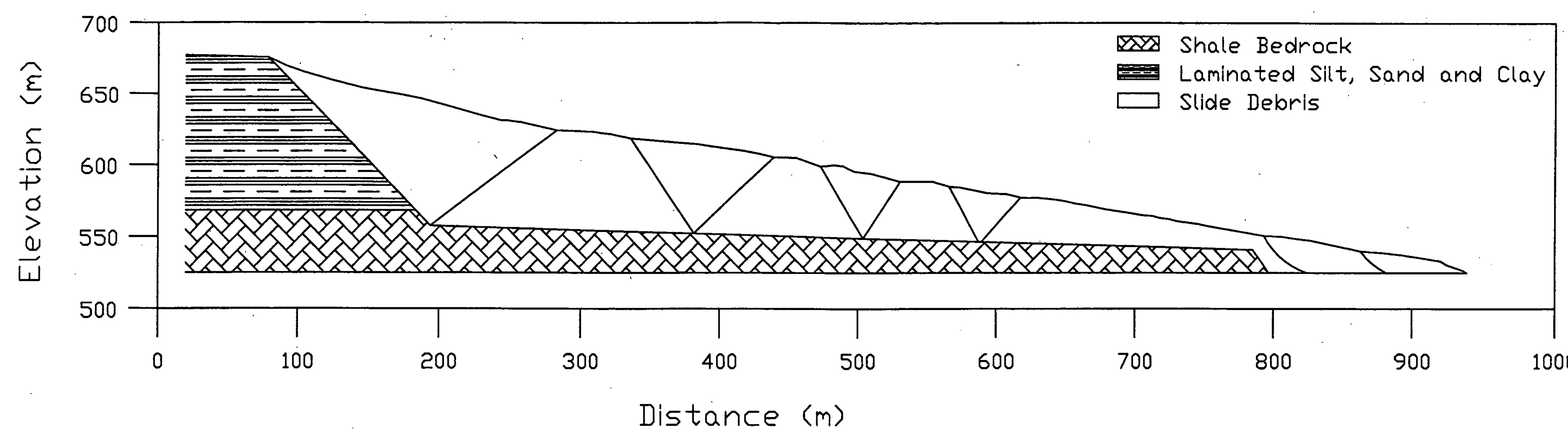


Figure 8.37 Landslide Profile 3-4



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin		Landslide Profile	3-4
SCALE As Shown	Figure No. 8.37		

Figure 8.38 Landslide Profile 3-5

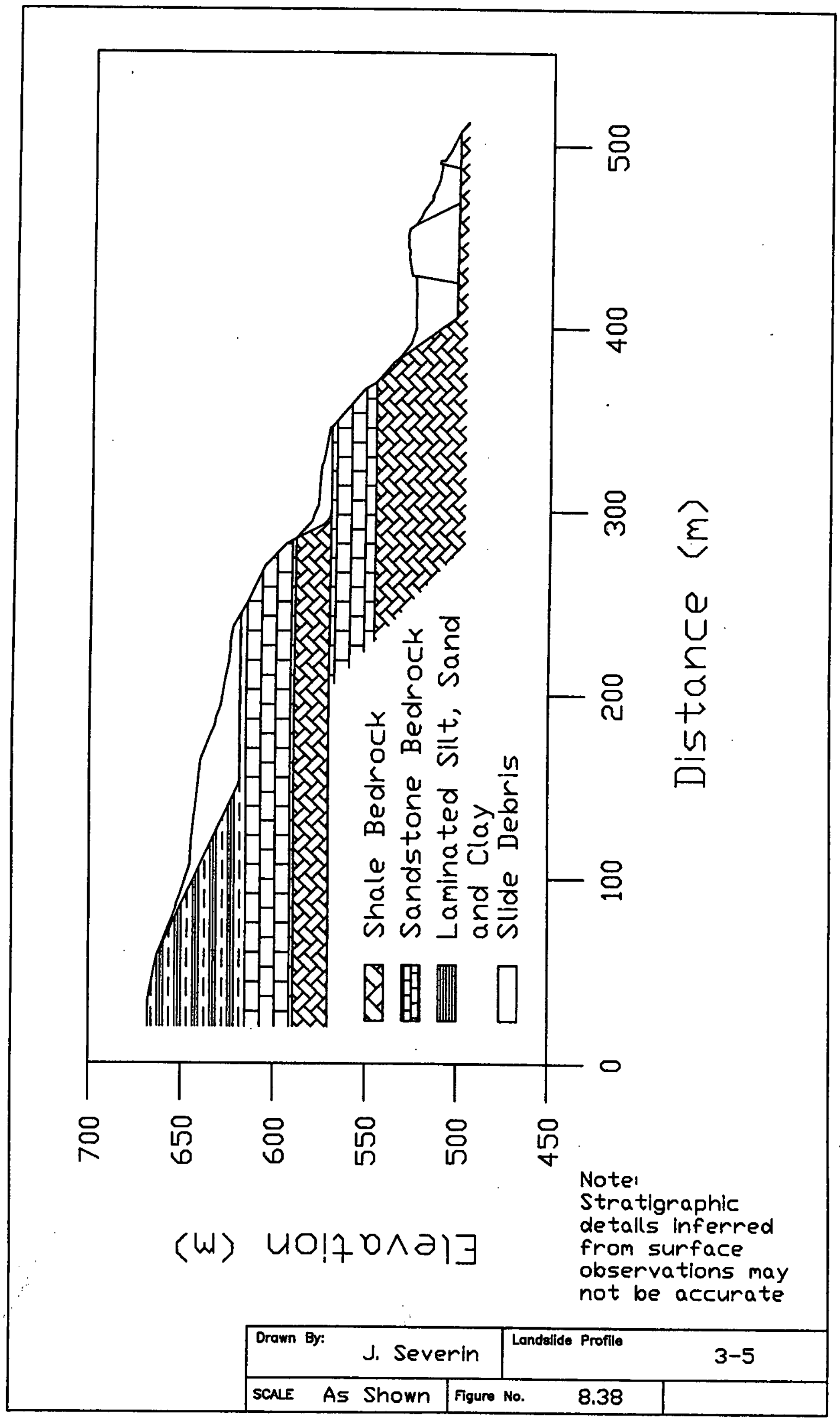
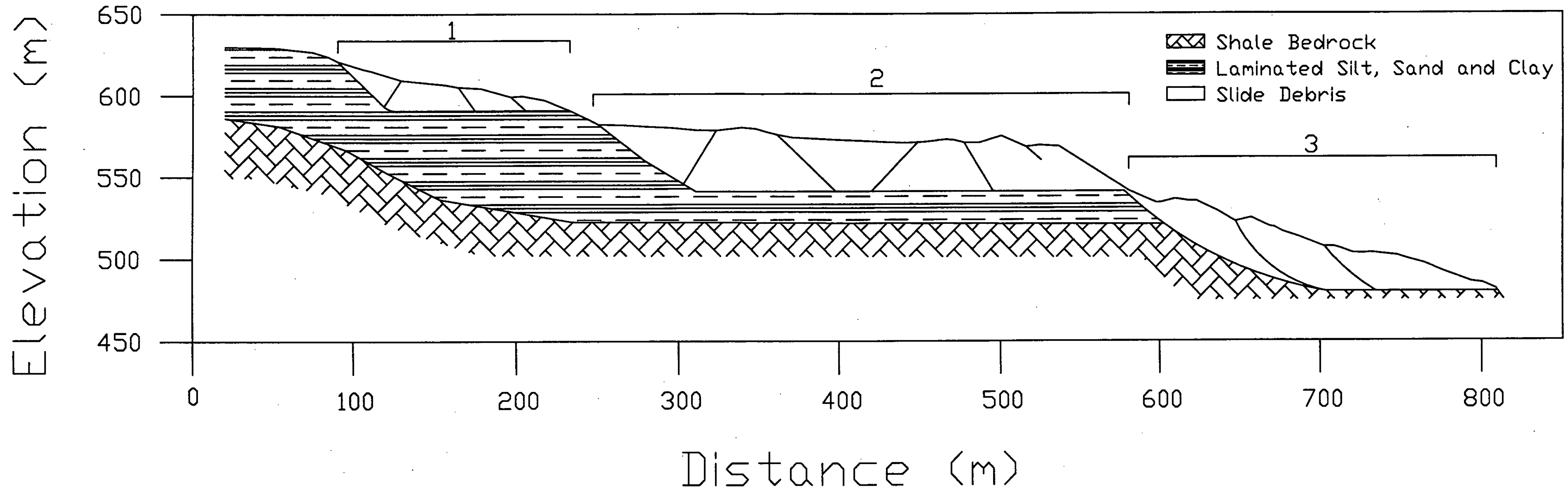


Figure 8.39 Landslide Profile 3-6



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By:	J. Severin	Landslide Profile	3-6
SCALE	As Shown	Figure No.	8.39

Figure 8.40 Landslide Profile 3-7

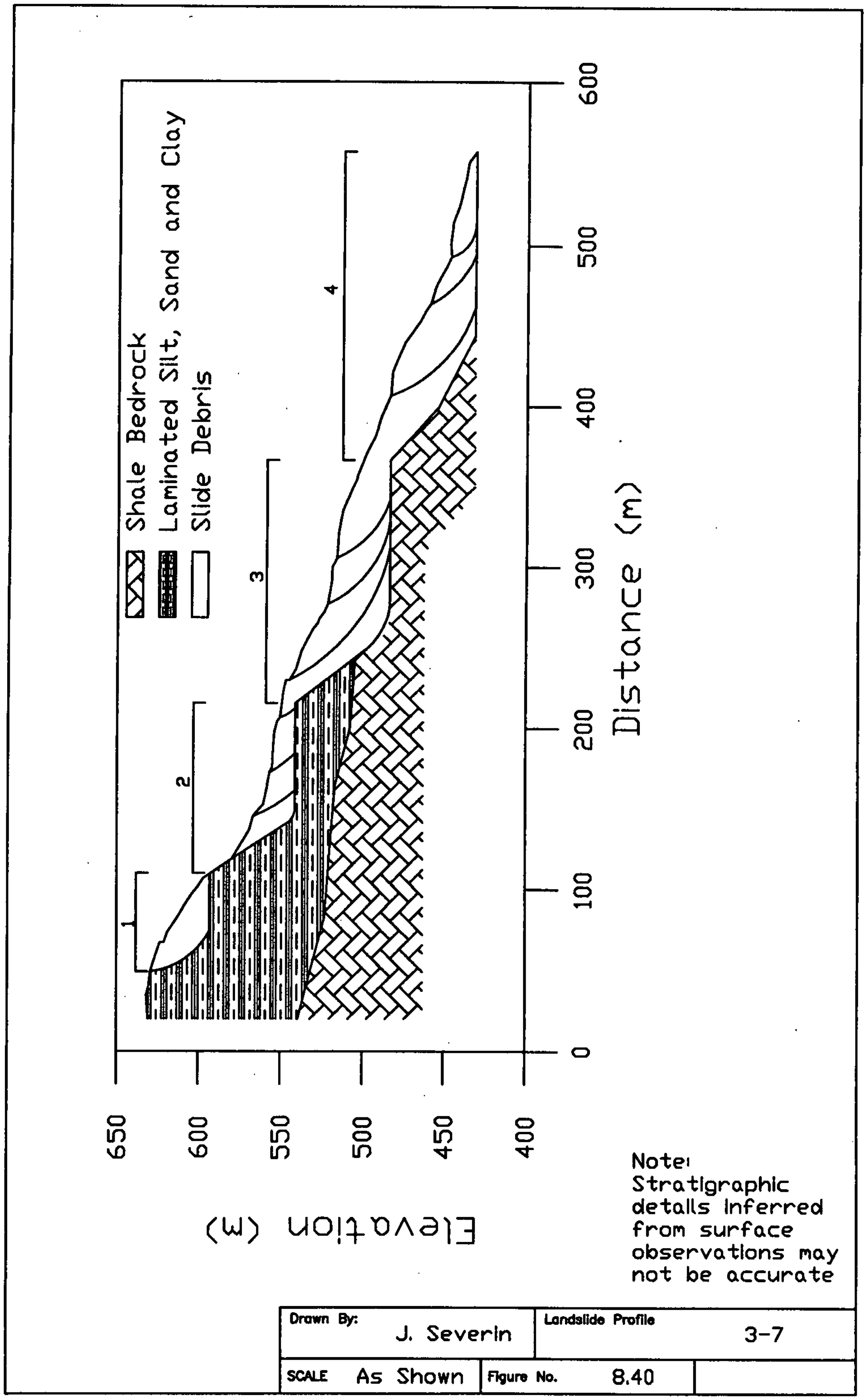
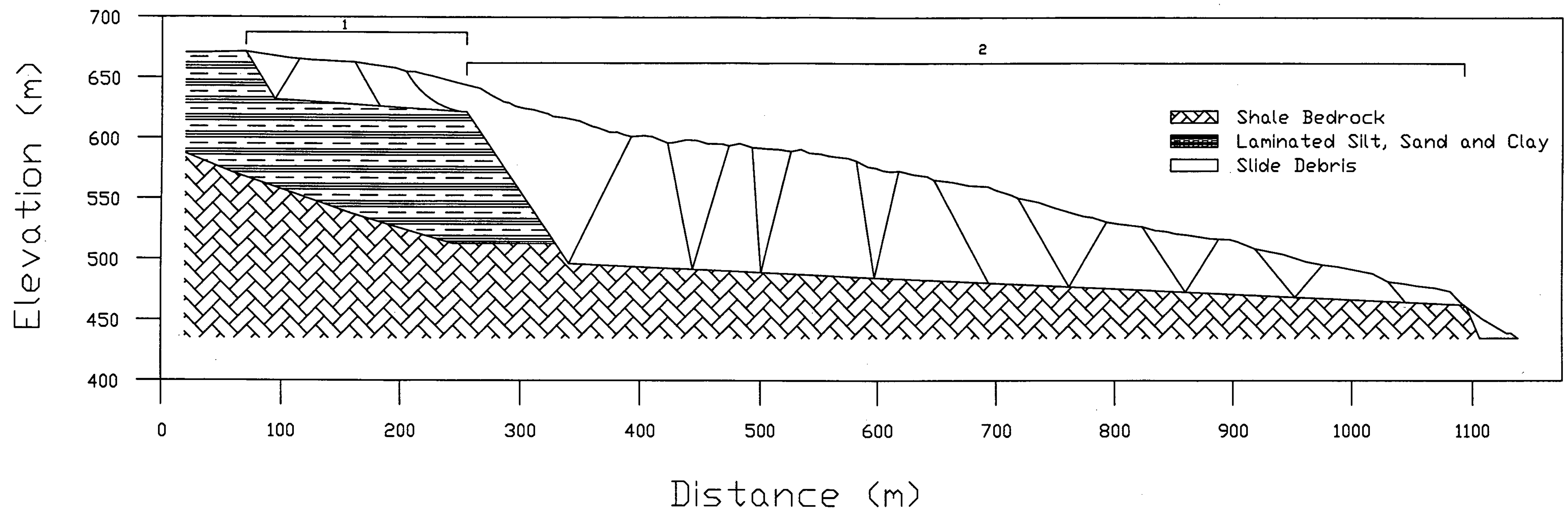


Figure 8.41 Landslide Profile 3-8



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin		Landslide Profile	3-8
SCALE As Shown	Figure No. 8.41		

Figure 8.42 Landslide Profile 3-9

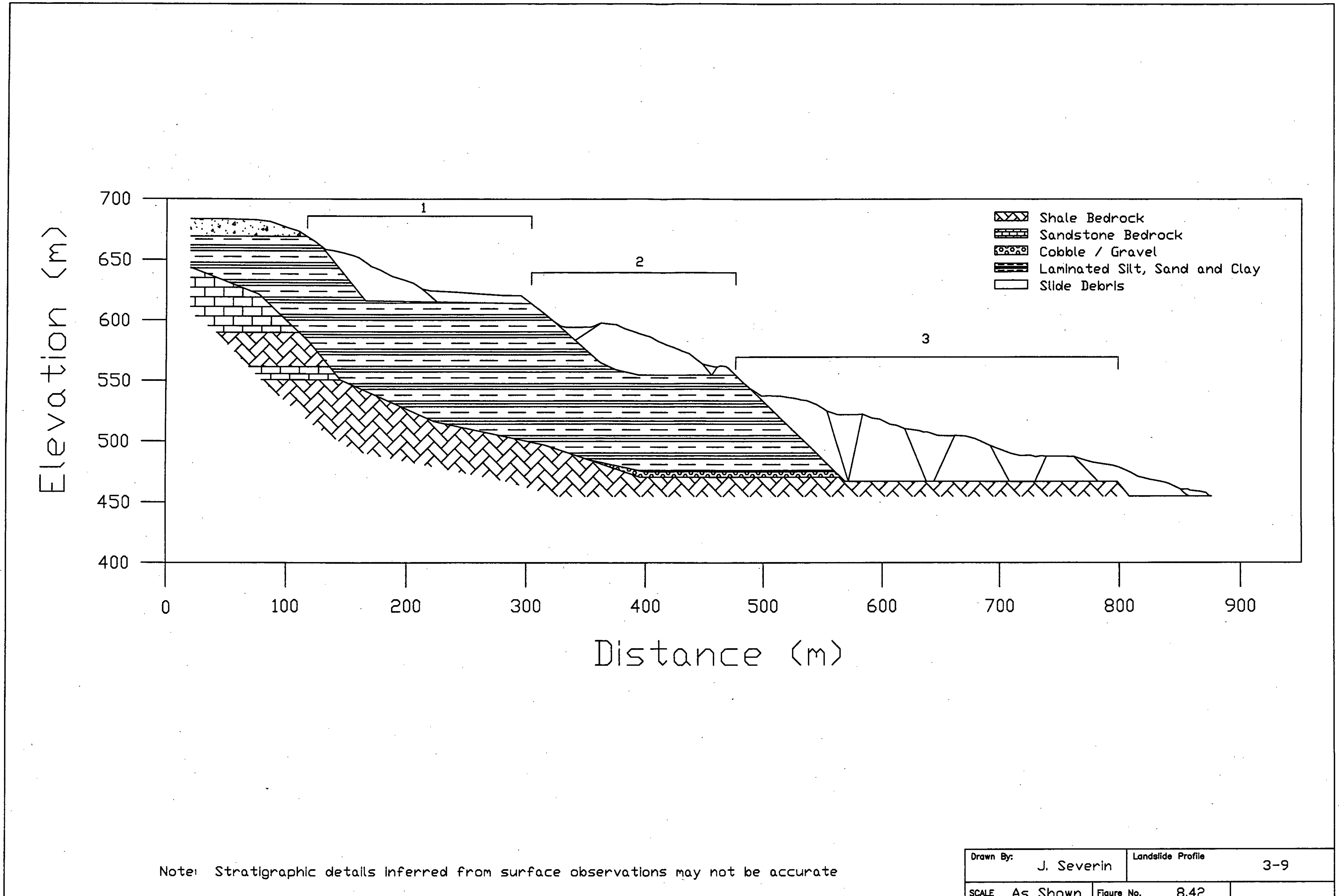


Figure 8.43 Landslide Profile 3-11

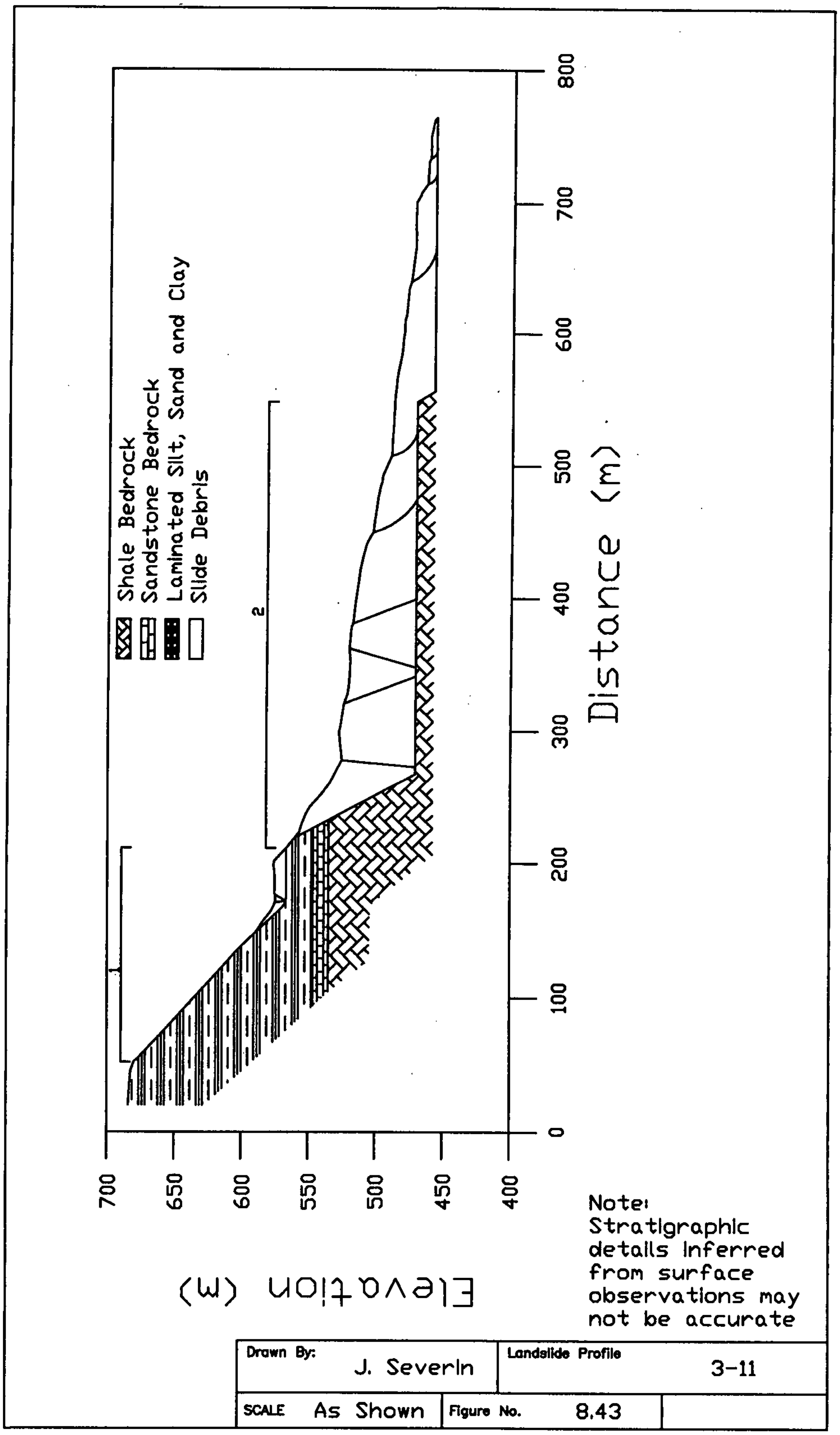


Figure 8.44   Landslide Profile 3-12

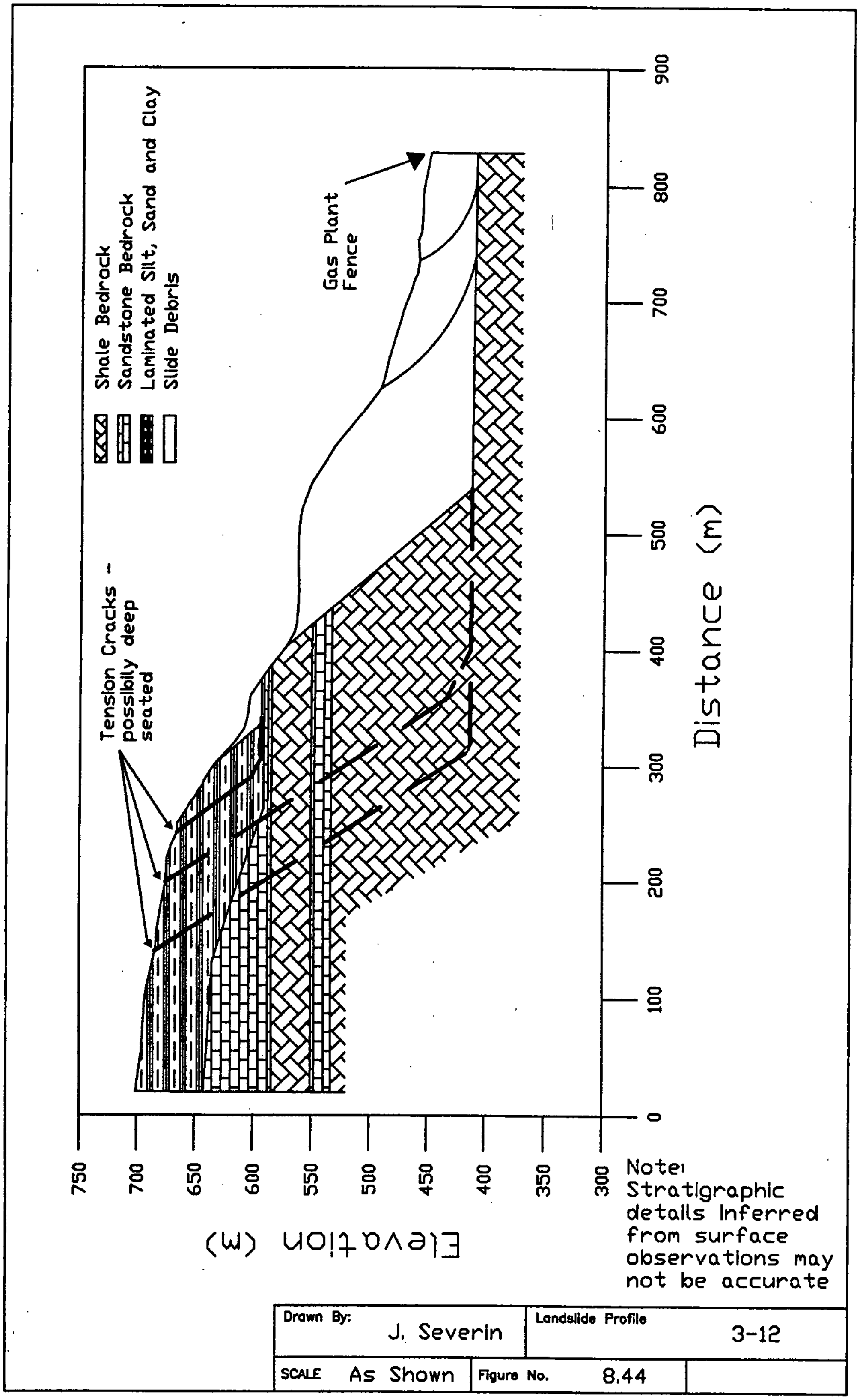


Figure 8.45 Landslide Profile 3-13

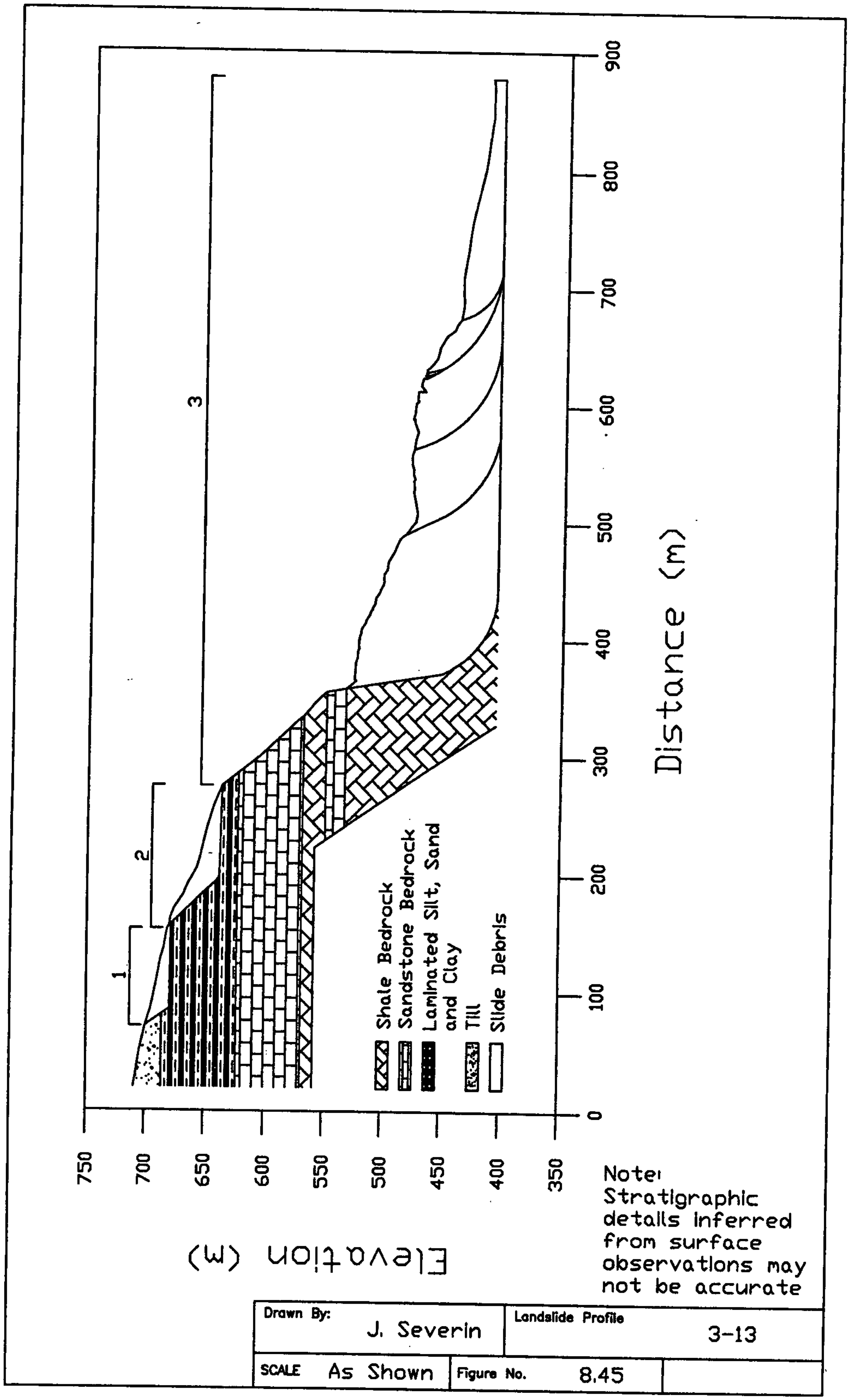
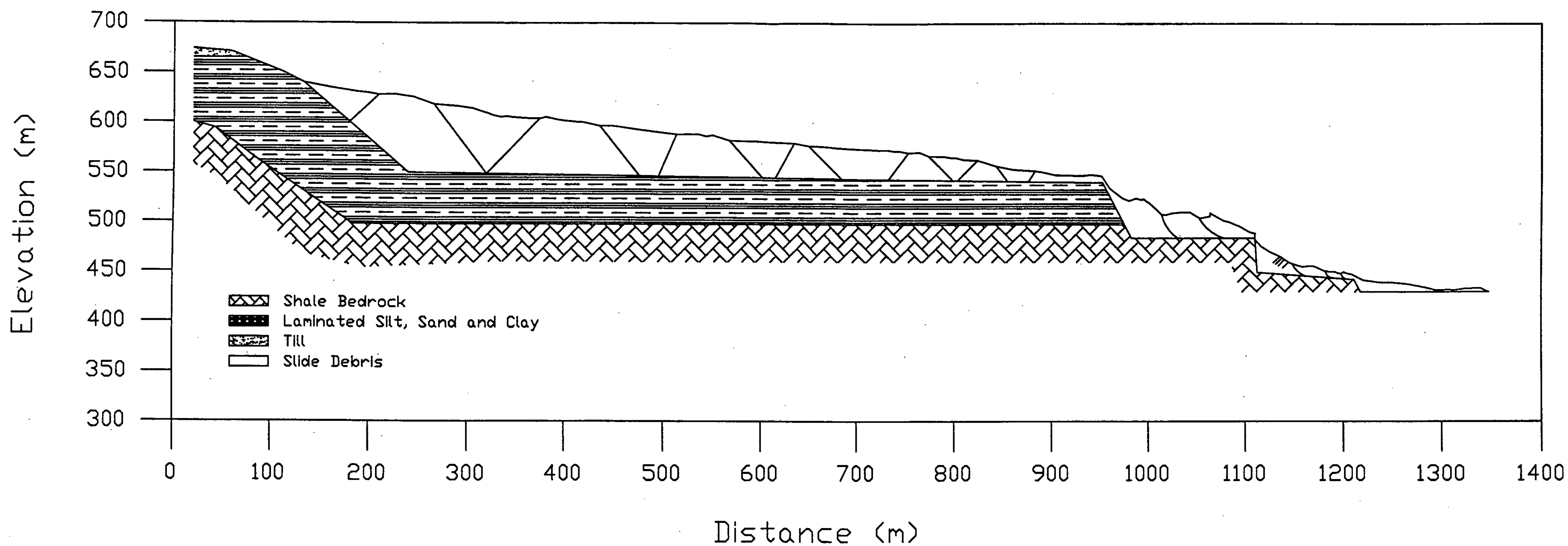


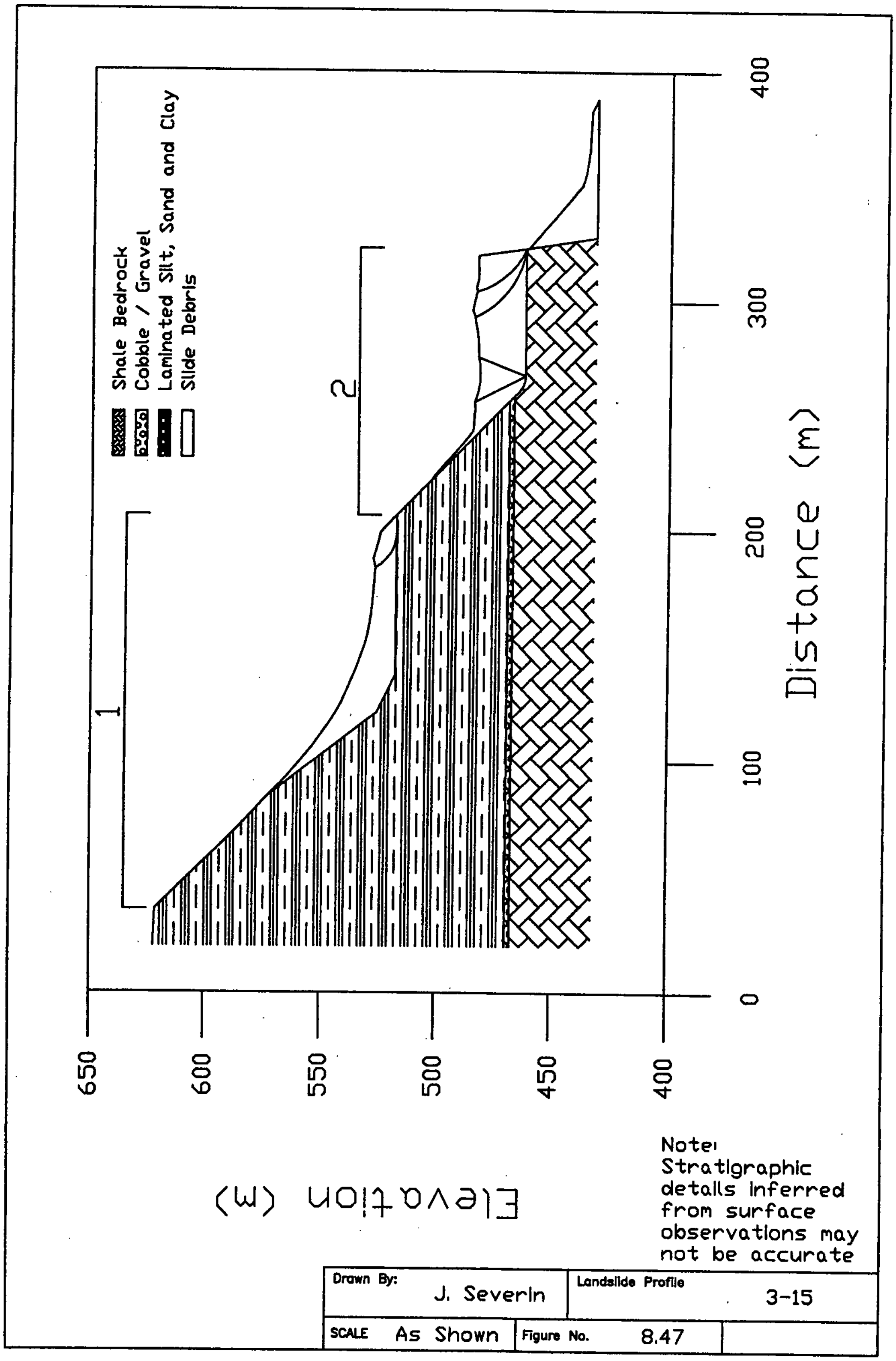
Figure 8.46 Landslide Profile 3-14



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin	Landslide Profile 3-14
SCALE As Shown	Figure No. 8.46

Figure 8.47 Landslide Profile 3-15



8.3.4 Area Model

The most interesting feature of this slide area is the marked asymmetry of all the river valley walls. Three models are presented to explain both the landslides in the area and the valley wall asymmetry. The three models presented are for; 1) south-facing slopes, 2) north-facing slopes, and 3) slopes that are at an oblique angle to the previous two.

South-facing Slopes (Model 1)

There are six profiles within the area that have south-facing slopes, four on the Beatton River, and a single profile on each of St. John and Stoddart Creeks. Common features seen in all of these slopes are that the all contain multiple failure planes, have steep overall angles, and are only lightly vegetated.

When the north wall is outside of the pre-glacial valley boundary, the failures show a dominant basal failure plane in the shale and smaller failures within the Quaternary sequence. Since the shale has very weak and often pre-sheared bedding planes, a long compound failure would be expected. This does not occur in the south-facing slopes of the Beatton River because of the regional dip of the strata and the presence of the overlying sandstone. The Cretaceous bedrock dips gently to the northeast, (into the slope) at a value of 5 . If the slope were made entirely of shale, then there would be several short failure surfaces utilizing the bedding planes even with the bedrock dip into the slope. This insignificant angle provides enough friction to make a long compound failure impossible, but would still allow for a steeper failure. The sandstone cap and sandstone interbeds within the shale acts as a stabilizing factor allowing for a much steeper angle and to act as a cohesive agent to keep the material above a weak plane from failing. Lower in the slope, where the sandstone interbeds occur less frequently, the weak bedding planes are mobilized making deep failures with steep head scarps possible (Figure 8.48).

The initial river valley (1) was filled with ice-damned pre-glacial sediments and eventually glaciated (2). The formation of the failures occurs by an initial stage of river erosion near the edge of the pre-glacial valley (3) causing the nearby pre-glacial sediments to fail (4). Eventually the river erodes to a weak layer that can be mobilized (5). The slide may utilize a slip surface caused by horizontal stress relief during the valley rebound process (Matheson and Thomson, 1973). After the slope fails, the river adjusts its course around the debris and active erosion takes place (6). After enough erosion has occurred, a remobilization of the debris will occur (7). Eventually the failure plane will be allowed to fail again after the buttressing debris is removed (8). The local dip and the sandstone layers allow the south-facing slopes to stand at much steeper angles than their north-facing counterparts and only allow for short failure planes.

When the north wall is inside the boundary of the pre-glacial valley, a number of situations could occur. If the shale is stable and the failure planes are only within the silt and clay, then the failures can occur at any level and often several failure planes are mobilized. The failure planes still appear to be much shorter and there is an absence of the long compound failures. When the basal failure is in shale, the shear surface is short due to the local dip making a forced rotational failure. If the dip were not present, the failure plane would retrogress further into the slope.

North-facing Slopes (Model 2)

There are three slide profiles on south-facing slopes within the area, two within the Beatton River and one within Stoddart Creek. This section is wholly within the pre-glacial valley (Mathews, 1978) and is also affected by the process of valley rebound. In general, the south facing slopes are gentle and highly vegetated and contain mostly ancient compound failures (Figure 8.49). These slopes have a dominant shear surface affected by bedrock creep within the shale. The post-glacial valley down cutting and pre-glacial valley down cutting affects these slopes. The process of valley rebound is well-defined (Matheson and Thomson, 1973) and in this area, two cycles of valley rebound may affect the stability of the slope. The initial valley formation eroded to the top of the Shaftesbury Shale. In this location, crosscutting shears and vertical relaxation joints are of minor importance because of the competence of the Dunvegan Sandstone. The most important feature created during this first down cutting is the upward arching of the riverbed within the shale. The north-facing slopes within the valley are currently above the pre-glacial riverbed. The discontinuities created by upward arching now affect the shale slope allowing for creep to occur along the horizontal planes. Upward arching affects a large area under the riverbed, allowing a large failure to occur along the shale bedding. The second series of valley down cutting exposed this riverbed and also allows for horizontal bedding plane joints to shear. These horizontal bedding plane joints allow the arching to be mobilized within the slope.

The pre-glacial valley existed with steep valley walls due to the competency of the sandstone bedrock (1). The area became filled with ice-damed, pre-glacial valley fill sediments and eventually became glaciated (2). Drainage re-established itself near the north end of the pre-glacial valley (3) and eroded down until a layer of weak material could be mobilised (4). These layers were very weak and had only a small amount of time to consolidate under the load of the glacial ice. As the river continued to erode down, more weak layers were sheared and mobilized (5) until eventually the river channel was confined by the shale bedrock. The overlying weight has allowed movement along the pre-sheared layers within the shale allowing for a bedrock creep to occur forcing the slope to move slowly toward the river (6). Failure in the shale likely occurs along weak bedding planes; therefore the structural properties of the rock control the slope angle and movement.

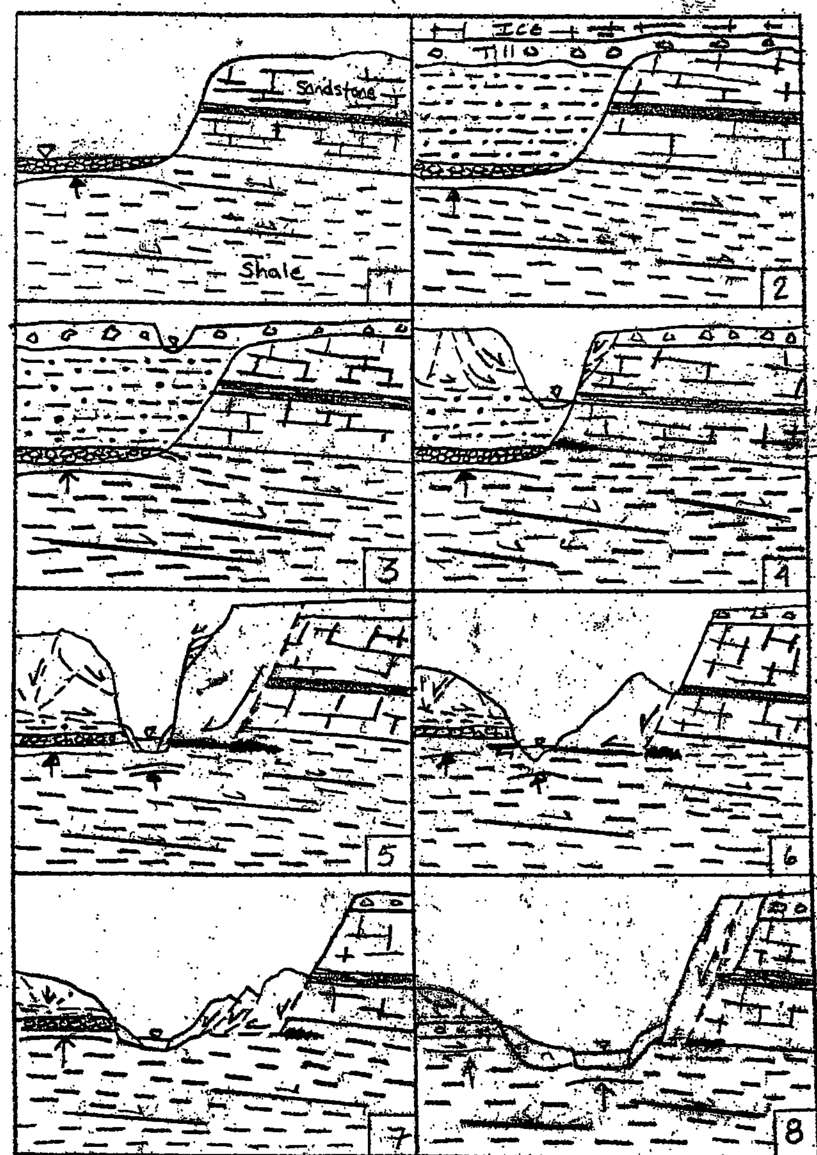
Oblique Slopes (Model 3)

Within this area, there are six slide profiles where the slides are at oblique angles to the regional dip, three east facing and three west facing. Of the west facing slopes, two of these are outside of the pre-glacial valley. These failures show the same mechanism and morphology as the south facing slopes outside of the valley. They are deep-seated failures within the shale with slightly longer failure planes. The other west-facing slope has a basal shear plane within the shale and upper shear planes within pre-glacial sequence. The shear plane within the shale is of an intermediate length, however, the failure planes within the pre-glacial materials are longer as they do not correspond to the bedrock geology.

The west facing slopes are all within the pre-glacial valley and therefore the shear planes are mostly within the Pleistocene sequence. The failure planes within the shale also have an intermediate length and those within the surficial material are variable.

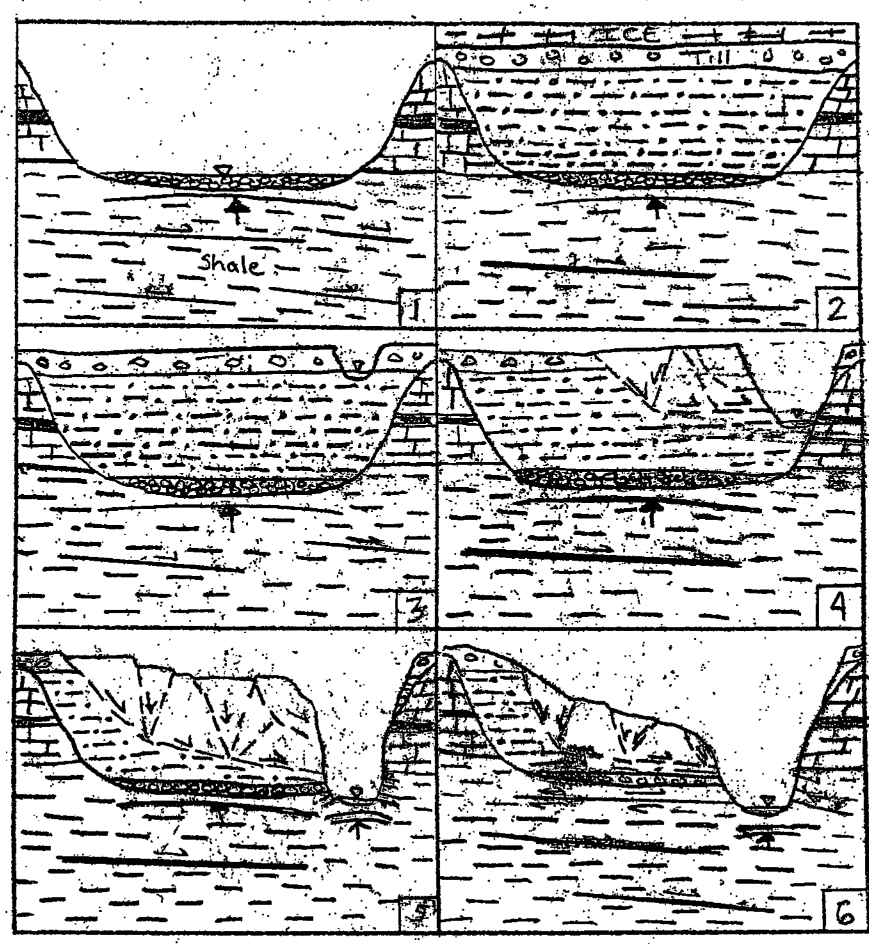
In general, if the slopes are at an oblique angle to the north and south, the failure planes within the shale are longer than those on south-facing slopes and shorter than those on north-facing slopes. Failure planes within the Pleistocene sequence are variable and do not correspond to any trends.

Figure 8.48 Landslide Area 3 – Model 1



1) Broad, stable pre-glacial bedrock channel; 2) Aggregating deltaic environment into encroaching ice-damned lake followed by glaciation; 3) Drainage re-establishes; 4) Post-glacial river erodes down into till and sandstone leaving steep banks; 5) Once softer shale is reached, initial failures occur along near-horizontal surface unloading slope; 6) Failures continue to occur, on older, upper bedding planes and lower planes once exposed; 7) Debris at base acts as a berm for debris on slope, internal deformation of debris occurs; 8) Erosion of debris and intact bank cause failure.

Figure 8.49 Landslide Area 3 – Model 2



1) Broad, stable pre-glacial bedrock channel; 2) Aggregating deltaic environment into encroaching ice-damned lake followed by glaciation; 3) Drainage re-establishes; 4) Post-glacial river erodes down into till and sandstone leaving steep banks, once softer, laminated sediments below are reached, initial failures occur; 5) Failures continue to occur, on older, upper lower bedding planes and lower planes once exposed, debris at base acts as a berm for debris on slope; 8) Erosion of debris and intact bank and increases in pore pressure in pre-glacial units cause failure.

8.4 Slide Area 4

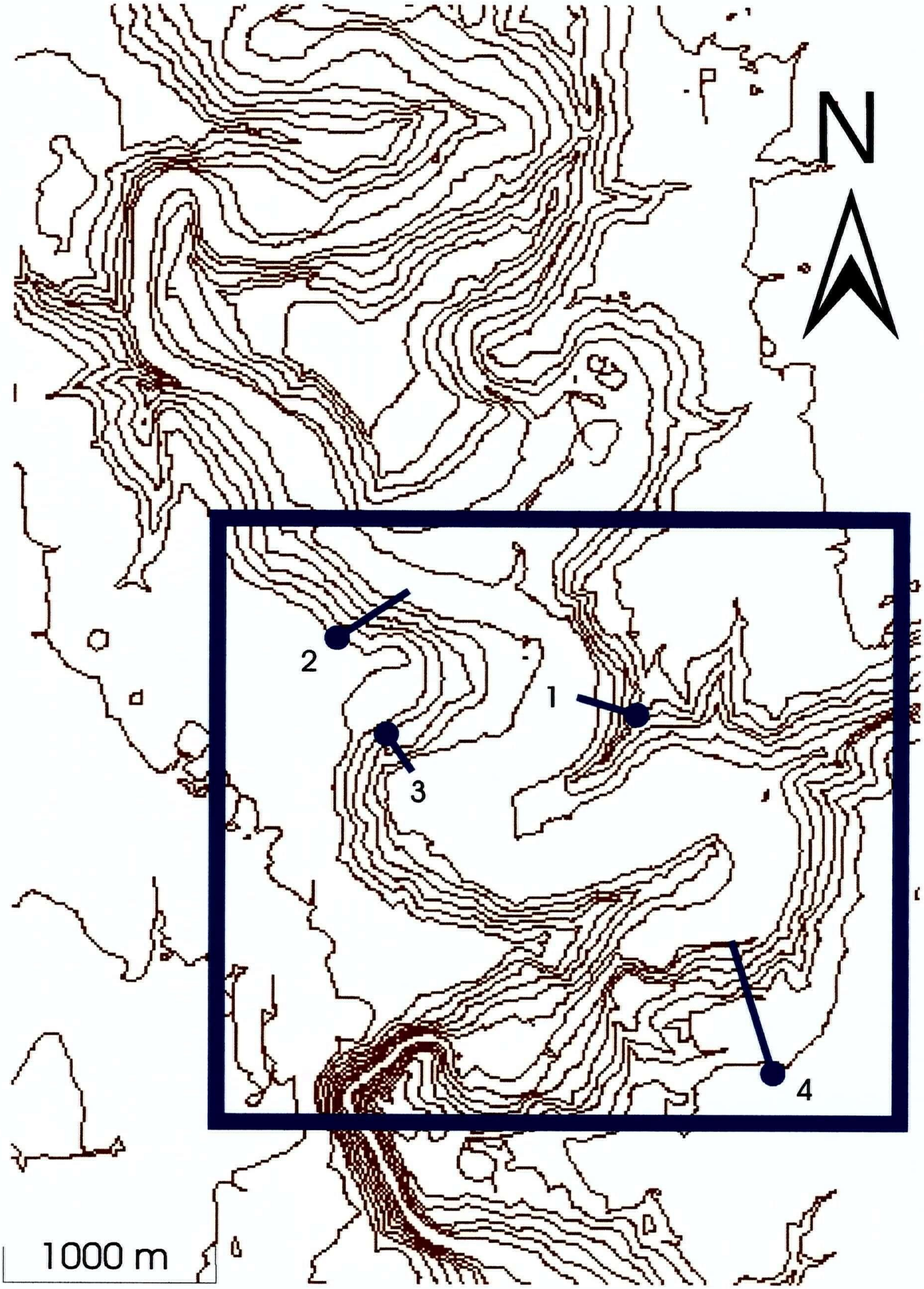
8.4.1 Location

The fourth area chosen to study was along the Beatton River, north of the town of North Pine (Figure 8.50). The area was chosen due to its accessibility and because all of the landslides are completely within the Pleistocene sequence. In fact, the shale bedrock is at or beneath the river level and does not play a role in slope stability in the area. Both sides of the river are easily reached as there is a bridge in the immediate area and the approach to the bridge has undergone recent failure, undermining the foundation of the road. The road services a petroleum extraction area to the north east of the site. This locale was also selected due to the high number of very active and active slides in the area. Four slides were profiled in this area. The area encompasses both banks along an 8-kilometer stretch of the Beatton River. This region is also home to 'Kings Valley Christian Camp" which provide valuable assistance in accessing areas and providing witnessed accounts of some of the local failures.

8.4.2 Local Stratigraphy

This area is located within the boundaries of the pre-glacial valley near its northern end (Mathews, 1978). The local stratigraphy is pieced together from the four slides in the area (Slide 4-1, 4-2, 4-3, and 4-3). The bedrock extends to an elevation of 531 meters a.s.l if the slide is located near the edge of the pre-glacial valley; otherwise, the bedrock is not present. This location is within the Dunvegan Formation as the regional dip places the Shaftesbury Shale at an elevation not yet reached by the river. Above the bedrock occurs a thin unit of gravel (<1m) within two of the profiles. All of

Figure 8.50 Landslide Area 4



the slides show good intact sequences within some of the scarps, where all the detailed stratigraphy is noted. Unfortunately, the stratigraphy of the Quaternary deposits is complex and cannot be correlated from one section to another. The pre-glacial unit is variable, laterally and vertically, within these separate sections so it is not likely that beds match up over longer distance. This area is interpreted as being part of a deltaic sequence due to the silt and sand cross beds observed and the variability of the materials over a small distance. The intact section neighbouring Slide 4-3 shows a detailed deltaic sequence supporting this interpretation (Figure 8.51). A till cap was witnessed at an elevation of 640 meters a.s.l. A hypothetical stratigraphic column is produced (Figure 8.52).

Figure 8.51 Deltaic Sequence (Slide 4-3, * G.Hartman-notes)

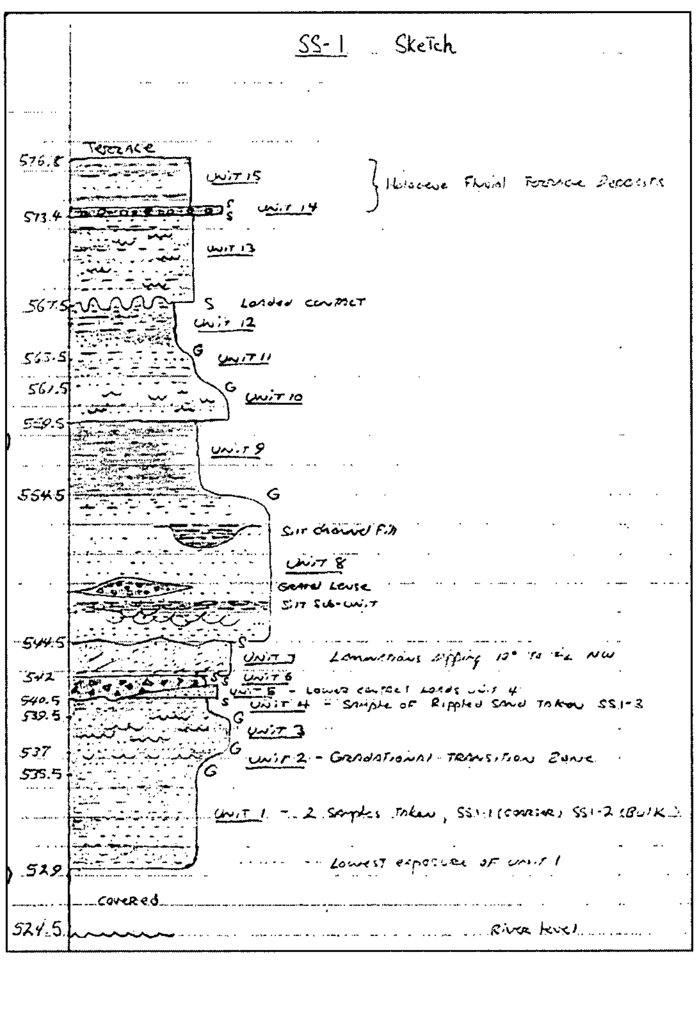
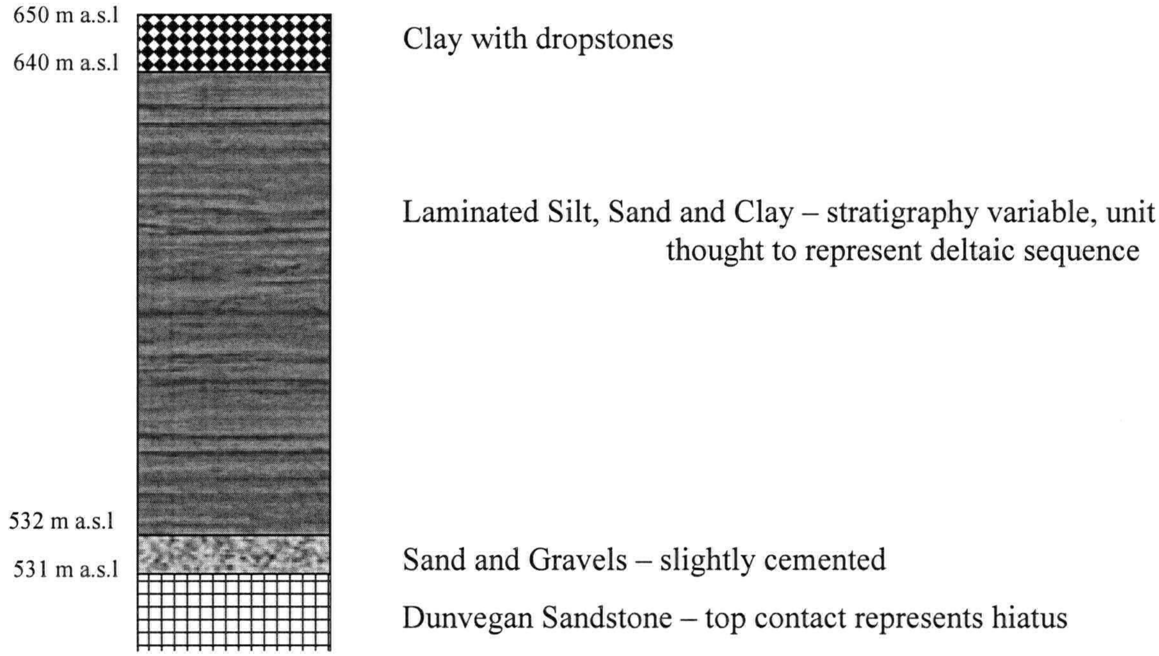


Figure 8.52 Area 4 – Stratigraphic Profile



8.4.3 Landslides

Slide 4-1

Slide 4-1 is an active, multi-leveled failure with two slide planes within the pre-glacial unit (Figure 8.55). The slide occurs on a west-facing slope along the Beatton River directly across the river from the Christian Campground (Figure 8.50). The profile begins on a knife-edge with a larger dormant slide with an aspect that is opposite of the 256° azimuth of this slide. The head scarp is made of a disturbed material likely caused by the older abutting failure. The upper shear zone was observed to be within silt dominated facies of the pre-glacial unit at an elevation of 595.65 meters a.s.l. A slickensided surface was not found within this degraded and modified shear zone, however, a sample of the clay zone was taken (sample 4-1A). An intact section of the facies was found 30 meters to the north (Figure. 8.53) and was found to be sand dominated with larger cross beds and few clay layers. The fine-grained beds below the shear surface have smaller-scale cross beds with a higher percentage of clay. The second failed mass shows some back tilt and horst and graben structures although the shear plane was not observed. The morphology of the slope suggests that the debris slides over an intact section and the toe appears to be remobilized debris. A bedrock elevation was found at an outcrop near the toe of the failure with a thin (< 1m) intact unit of gravel above along with a sand-dominated pre-glacial section.

Figure 8.53 Intact Section Photo (Slide 4-1)

Slide 4-2

This failure is a very active multi-level failure within the Pleistocene sequence on a north facing slope on the Beatton River (Figure 8.56). The failure is located approximately 500 meters upstream from the bridge within the area. The profile begins upon a stable plateau underlain by till and heads down slope at an azimuth of 26°. The failure contains three failure planes all within the sand-dominated pre-glacial sediments. Most of the upper section of the slope is covered in colluvium and the shear planes are

Most of the upper section of the slope is covered in colluvium and the shear planes are not visible. The upper failures are interpreted from slope morphology to have rotational and translational failure mechanisms. Most of the features are muted and older than the toe. Below the upper failures is an intact section of massive sand with small interbeds of silt and clay. The lower failure is fresh with a shear surface (sample 4-2 A) within a silt-rich package within the sequence (sample 4-2 B). The shear plane is composed mostly of silt (77%) with some clay (18%). The plasticity of the sheared material is fairly low, with a liquid limit of 39% and a plasticity index of 24%. The intact clay bed sampled is actually 97% silt, which has low plasticity with a liquid limit of 28% and a plasticity index of 8%. Below the intact section where the shear plane was found, is a toe of remobilized debris.

Slide 4-3

Slide 4-3 is a small, very active, rotational failure on a south-facing slope on the Beatton River (Figure 8.57). The profile begins mid-slope on a stable bench and heads down towards the river level at an azimuth of 147 (Figure 8.50). The slope above this failure is likely part of a separate failure. It could not be profiled, as the roadway that bisects the slope was heavy with traffic. The debris surface is fresh with ponding and intact slump blocks within the debris mass. The head scarp has a complex stratigraphy with silt, gravel, and massive clay. The single failure plane for this slide is within the pre-glacial unit with the bedrock missing at this section. The basal shear plane was not found but is interpreted as being slightly below the river level. The slump blocks within the debris have matching stratigraphy found in the head scarp and in an intact section near the slide.

Slide 4-4

Slide 4-4 occurs on a north-facing slope on the Beatton River roughly 3 kilometers south of the Christian Camp (Figure 8.50). The profile begins on a stable section of the slope. It is presumed stable due to the lack of any landslide features and the low angle of the slope (1). The profile continues down the slope at an azimuth of 330 . The slide has two failure planes, both within the pre-glacial sediments (Figure 8.58). The upper failure is a deep, compound failure approximately 700 meters long and 50 meters deep. The debris mass exhibits dormant, translational features, i.e. horst, grabens, and cross-tilted trees. A rotational failure occurs behind the toe of the upper slide because of an intact scarp in which the shear plane for the compound failure was located (sample 4-4 A). The shear plane is made of silt, 76%, and clay, 13% and has a medium plasticity with a liquid limit of 58% and a plasticity index of 35%. Below the main shear, smaller shear planes were found and sampled (sample 4-4 B). These shear planes are also mostly made up of silt, 86%, with minor clay, 10%. The secondary shears are much more plastic with a Liquid Limit of 73% and a Plasticity Index of 53%. The intact face shows a complex stratigraphy (Figure 8.54) with several shear planes and massive clay unit with drop stones and gravel lenses. Below this intact face exists a second debris mass with rotational slide features, including ponding and back tilted slump blocks and trees. This lower failure has fresh features and is very active as it occurred 2 years ago. The toe of the slide is assembled of remobilized debris.

Figure 8.54 Complex Stratigraphy (Slide 4-4)

Figure 8.55 Landslide Profile 4-1

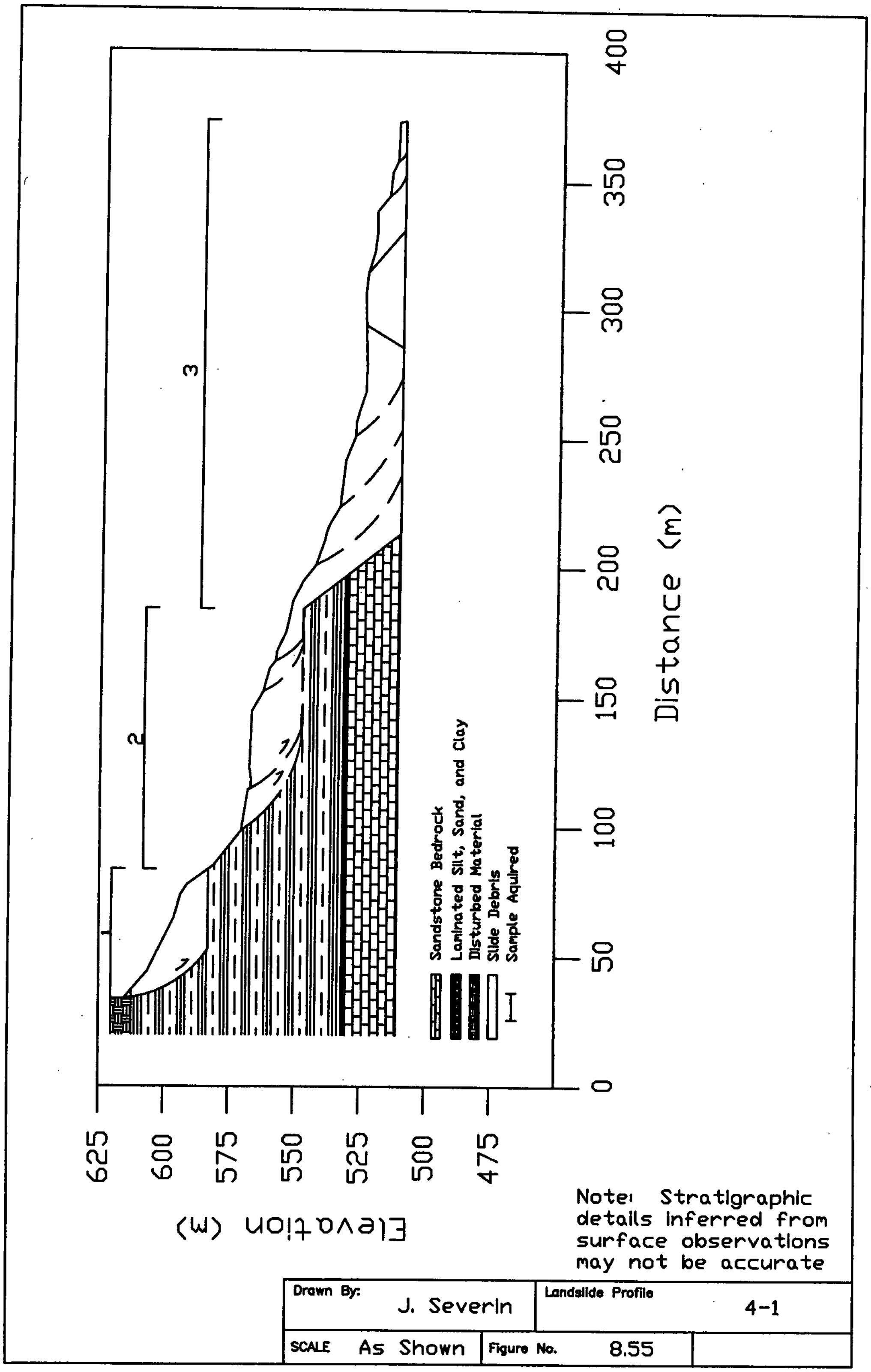
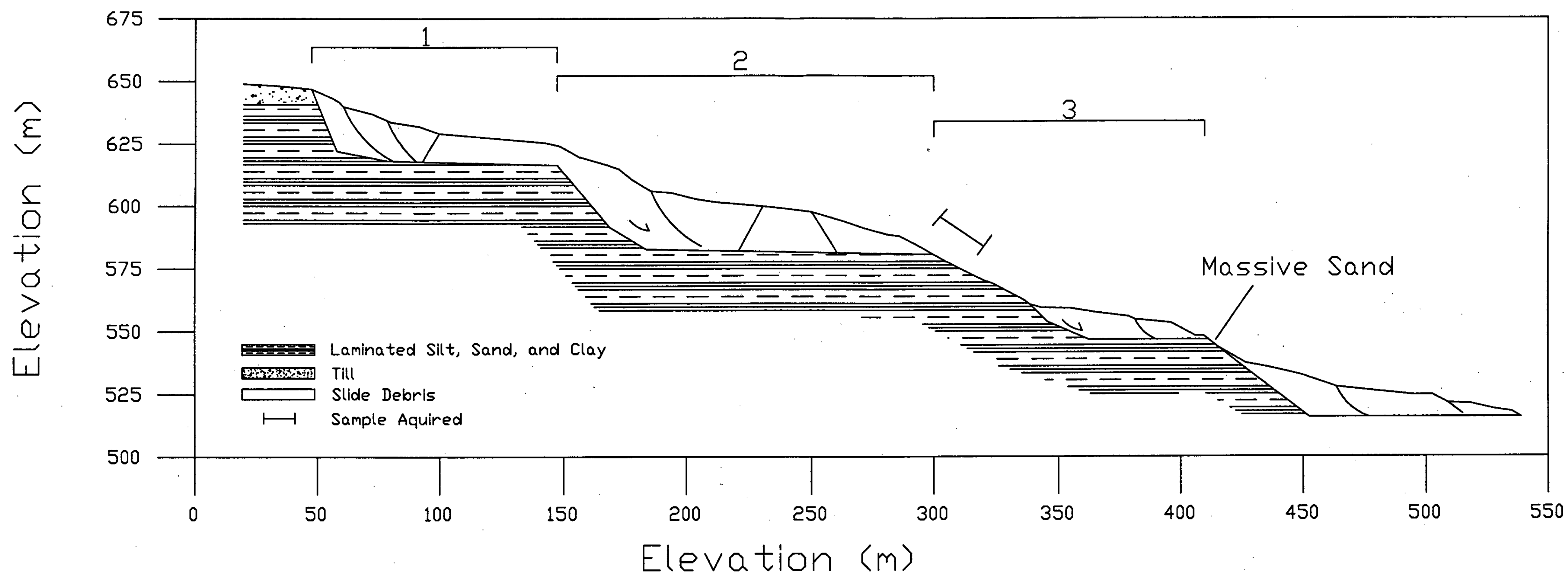


Figure 8.56 Landslide Profile 4-2



Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin	Landslide Profile 4-2
SCALE As Shown	Figure No. 9.56

Figure 8.57 Landslide Profile 4-3

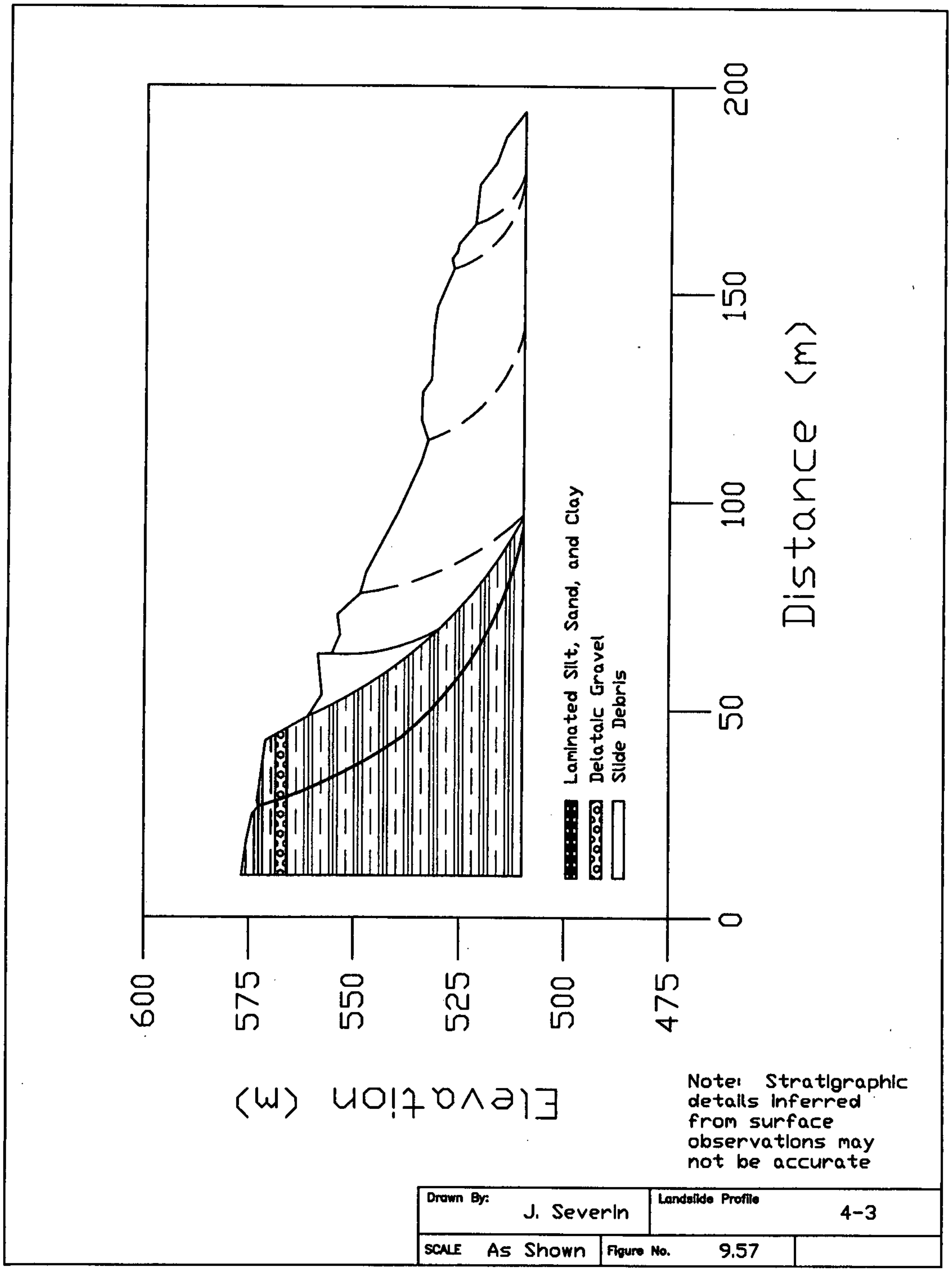
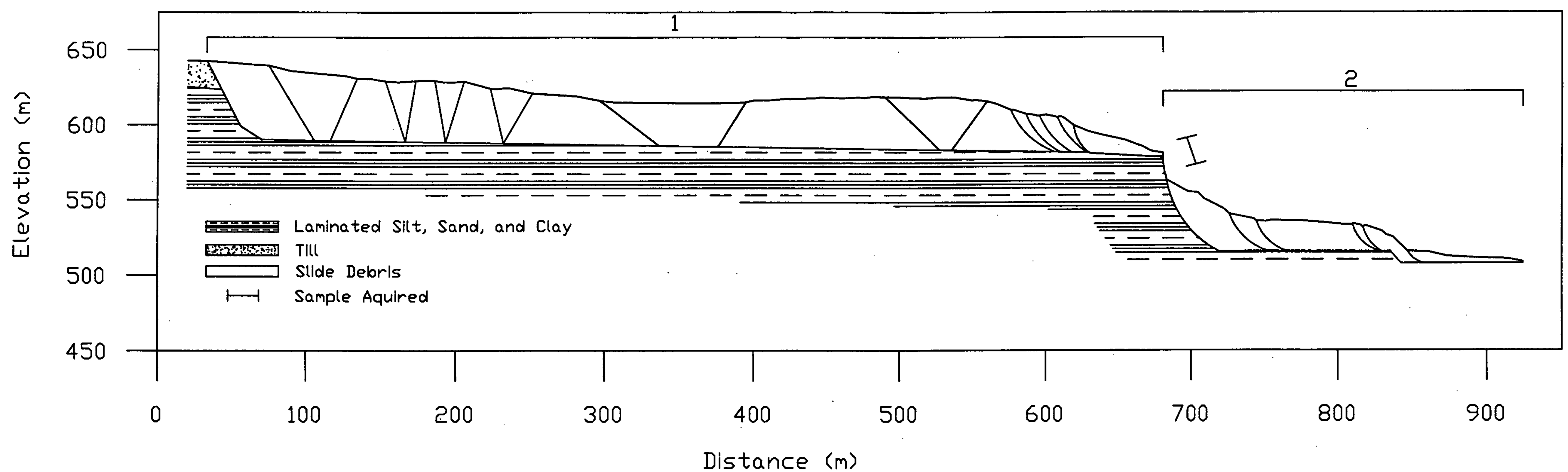


Figure 8.58 Landslide Profile 4-4



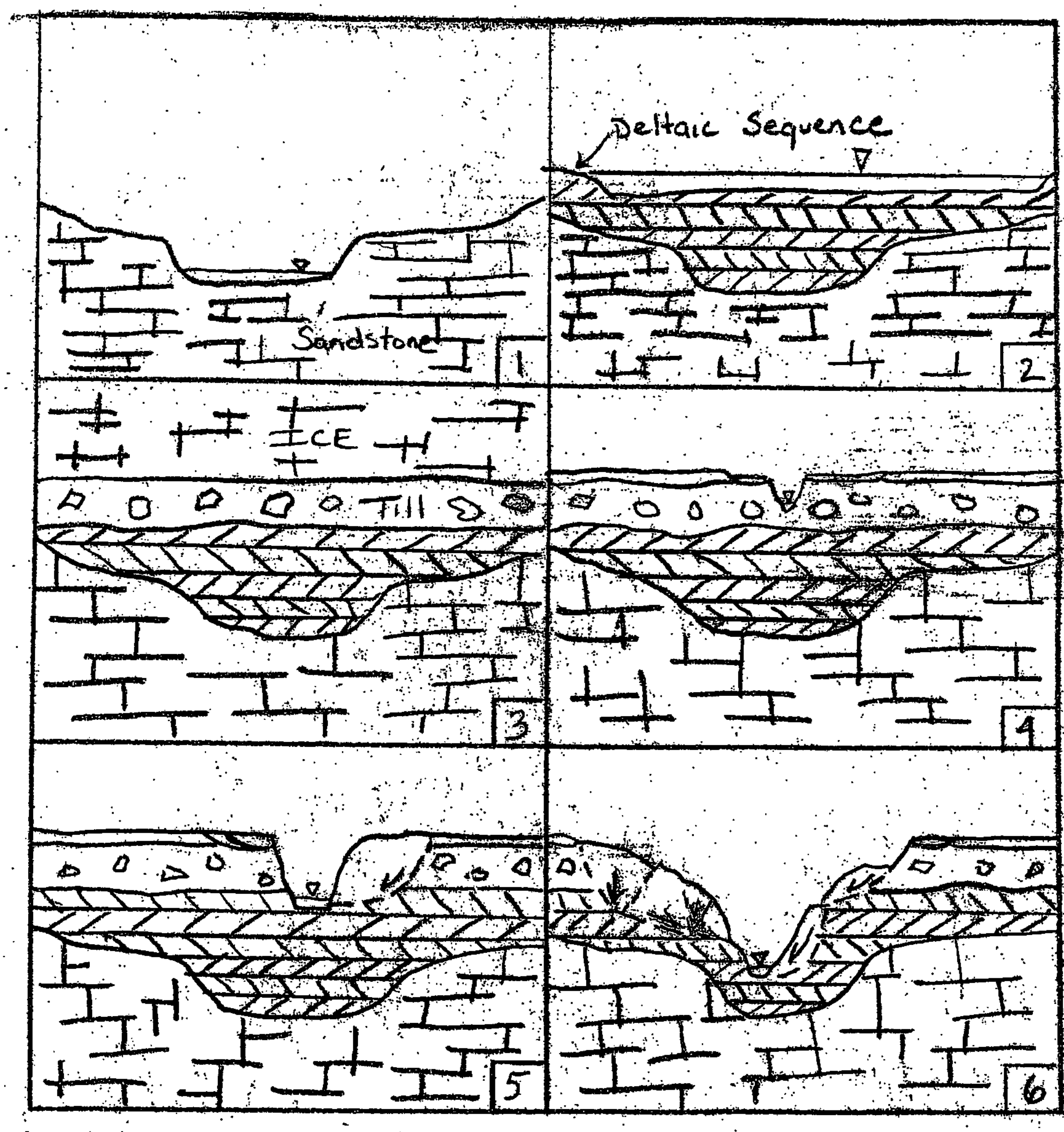
Note: Stratigraphic details inferred from surface observations may not be accurate

Drawn By: J. Severin		Landslide Profile	4-4
SCALE As Shown	Figure No.	8.58	

8.4.4 Area Model

This area represents a deltaic sequence within the pre-glacial materials above a stable bedrock channel of sandstone (1). The materials of this sequence are variable and therefore the failure planes cannot be correlated over a longer distance (Figure 8.59). The pre-glacial unit represents a deltaic environment as the Beatton River continued to transport sediment into an expanding ice-damned lake within the river valley (2). The area then became glaciated (3) as evidenced by the till and post-glacial lake sediments. Drainage became re-established (4) and eventually cut into the deltaic silts, sands, and clays. The river channel at this time likely had steep walls, as the till in this area is mostly competent. Once the river eroded down into the pre-glacial sediments, layers of weaker, more plastic materials were exposed and failures occurred along them. The debris mass likely acted as a protection berm until it was eroded. As the river continued to cut downward, new layers were exposed and failures occurred along several failure planes as the intact material weakened and softened. This process is still occurring, shown by the high activity of landslides found on this river. Several of the failure planes occur at similar elevations, so there may be larger beds which can extend over a large area, but for the most part, failures that occur at similar levels at this site do so by coincidence. The failures at this location are generally rotational with shorter shear planes than in other areas. The variability of the materials is directly responsible for the shorter shear planes. The valley was created by rapid erosion and down cutting. This process has exposed the plastic layers and allowed them to fail. The clay beds within the sequence may have been pre-sheared by glaciotectonics and by horizontal relaxation during the valley rebound. During valley rebound, the weakest layers undergo the most deformation; in this case, the

Figure 8.59 Landslide Area 4 – Geologic Model



1) Stable pre-glacial bedrock channel; 2) Aggregating deltaic environment into encroaching ice-damned lake; 3) Glaciation; 4) Drainage re-establishes; 5) Post-glacial river erodes down into till leaving steep banks, once softer, laminated sediments below are reached, initial failures occur; 6) Failures continue to occur, on older, upper lower bedding planes and lower planes once exposed. Debris at base acts as a berm for debris on slope.

plastic clay layers are the victims. As downcutting occurs, these failure planes are exposed and allowed to fail. Often the upper sections of the slope contain older, dormant failures, suggesting that toe erosion is the major trigger of landslides in this area.

9.0 DISCUSSION

9.1 Landslide Mechanisms and Distribution

This study of slope movements in the Peace River area has led to the formation of several interesting discussion points. The most important one is the understanding of the river valley slope morphology in shale and unconsolidated valley fill sediments. This project also helps to characterize the geotechnical properties of the sediments located within the Peace River Valley and associated tributary valleys. This project is also the first attempt to systematically map and take inventory of landslides within the Peace River Valley, one of the many valleys in the Canadian Prairies, which shows ubiquitous landsliding throughout its length.

The first major result of this project is that a majority of the failures contain more than one shear plane on which the landslides mobilize. These multiple failure planes are located both within the Cretaceous shale and the Pleistocene laminated silts, sands, and clay. Further, there are several elevations within the shale that are apt to fail, that is to say that there is no one unique elevation at which all failures occur within the shale. There are several bentonite-rich layers within the shale that are weak enough to fail. No pure bentonite layers were found within this extensive field-based project, however, as there are numerous failures, most of which with covered shear planes, it is possible that such bentonite layers exist. Many slides, especially those that occur outside the preglacial valley, noted in the "Old Fort" area, have multiple shear planes within the shale. In other areas, located within the pre-glacial valley, there are often failure surfaces within both the Cretaceous bedrock and Pleistocene sediments, or often exclusively within the unconsolidated silts, sands, and clay.

Another result from this project is the recognition that morphology can rarely be used to determine the material in which the shear plane is located. Failures in both Cretaceous shale and Pleistocene sediments are morphologically similar with comparable features and sizes. Even though the materials are geologically different from each other, their engineering properties, which control the stability of the slopes and the failure mechanisms, can be similar. During this investigation, the location of the failure surface was often inferred by an understanding of material distribution and deposit geometry as understood by past geologic investigations of the area (Stott, 1982, and Mathews, 1978).

From the detailed landslide map and resultant inventory, a number of trends can be noticed. As mentioned in Section 8.4, a total of 1610 slope failures covering 1262 km were analyzed in terms of their distribution, activity, type, material involved, and aspect.

The Peace river contained nearly a third (28.9%) of all failures catalogued and together with the Beatton River, contains over a half of all failures, 54.2%. The average slide per kilometer ratio is 1.28 slide/km, with the Peace and Beatton Rivers showing the highest values of 1.82 and 1.60 respectively. The overall area covered by all failures was 765.5 km^2 with an average area per slide of 0.48 km^2.

The dominant activity level throughout the entire map sheet is "Low Activity – Dormant" with 61.0% of all failures classified as this level. "Very Active" and "Active" failures comprise 1.9% and 12.9% of all failures, respectively. "Very Active" and

"Active" slides are also both dominantly multi-leveled failures, 73.3% and 43.0%, respectively. Approximately 30.0% of all "Very Active" failures had a northern aspect, twice the average percentage and are dominantly in the Quaternary sedimentary sequence (73.3%).

The dominant failure type within the study area is the multi-leveled failure comprising nearly half of all failures, 47.8%, or over 769 failures. This value is thought to be conservatively low as the worst-case scenario, or deeper failure plane was assigned if doubt existed as to its location. Multi-rotational failures are the most active with 2.9%, which is to be expected due to the distribution of landslide types. Compound failures occur mostly on north-facing slopes, likely a reflection of the regional dip in the bedrock towards the northeast. East and west-facing slopes are dominated by retrogressive rotational failures each with 19.5% on slopes of those aspects. South facing slopes are dominated by multi-level failures, with 19.9 %. The dominant failure type, multi-leveled failures, is evenly distributed between the shale, 51.9%, and the Pleistocene sequences, 48.1%. Compound failures occur mostly within the shale bedrock (61.9%). This is probably due to the relative ease with which the overlying Quaternary sand, silt and clay can be sheared through in order to produce a curved head scarp. The higher number of single rotational failures occurring in the unconsolidated sediments, 64.8%, supports this fact.

Shale is the basal material in 43.7% of all failures, while the Pleistocene sequence represents 56.3%. This equal distribution is one of the reasons why landslide investigation is so difficult in the Peace River Region. The value for shale failures is slightly higher in north-facing failures as the regional dip of the bedrock is more favorable for failure.

9.2 Generalized Geologic Model

A series of generalized geologic models depicting the occurrence of landslides in the Peace River Region has been produced. Each investigated site fits into an aspect of this model depending on local conditions. The model starts with the deposition of the low energy sediments into an inland sea during the Cretaceous Period. During this time, several volcanic events occurred, associated with the orogenic activity to the west, depositing ash in the deep sea environment. This was followed by continued deposition, which allowed the sediments to compact into shale incorporating the weathered ash, or bentonite, into laminations of the shale. During the Tertiary and Quaternary Periods, a long period of erosion allowed broad valleys to form in to a mature drainage system. It is possible that these broad valleys developed by extensive landsliding that developed along the weak layers within the shale to retrogress back from the river and become stable at a very low angle. During the ice advances of recent geologic time, the valleys have been plugged with valley fill sediments, such as silt, sand, and clay followed by a glacial diamicton unit that overlies the sedimentary sequence. The weight and movement of the glaciers may have caused further failure in the shale and shearing within the unconsolidated sediments below. Upon retreat of the glaciers, a post-glacial lake occurred, and another unit was deposited of normally consolidated clays. Once the ice or sediment dam, which retained the post-glacial lake, was breached, a rapid downcutting through the Pleistocene sequence occurred, uncovering the sheared planes and allowing syn-erosional slumping to occur. The rapid downcutting may have also caused some new shear planes to develop as riverbanks became too steep to be supported. Valley rebound features occurred within both the horizontal shale bedrock along the bentonitic-rich layers and within the Quaternary sedimentary package along the plastic clay layers. As further erosion occurred, the current river valley began to take shape with slow moving failures along the pre-defined shear planes. The valley developed as a series of landslide cycles, in which the valleys walls retrogress back, stabilize, are eroded, and retrogress back again. A similar sequence involving the London Clay and wave erosion was noted near the Thames estuary in England (Hutchinson, 1975) and has been postulated to occur in Alberta (Cruden et al., 1998). Of course, several (of the) parameters would have to be taken into account; however, the same type of cycle could be responsible for the development of the pre-glacial and current Peace River Valleys.

A secondary conclusion, based on air photograph interpretation and field investigation, is that the river morphology of the Peace River is completely dependent on the slope morphology of the river valley slopes. Several of the large islands within the Peace River are at the base of failed slopes. The large slide at Attachie in 1973, allows us to examine the effects of failures on the river morphology. Smaller areas of the slide debris have stabilized within the riverbed, making islands at the edges of the river. Conversely, the islands themselves can help the investigation of slopes as well. The islands may indicate that a large amount of debris has been deposited denoting the presence of a large landslide. In the Peace River, it can then be said that the slope was unstable and may still be. The slope may consist of several shear planes and can then be marked as an abandoned failure even though the slide morphology has been completely destroyed.

10.0 CONCLUSIONS

One of the main objectives of this research project was to complete a comprehensive landslide inventory and map to be used in future engineering and geological work done in the Peace River region. The landslide map, containing over 1600 slope movements, is one of the main products of this project. The detail contained within the map, including activity and morphological features, make it a valuable document to be included in any desk or field study with respect to the Peace River region.

The detailed inventory database, created to accompany the map, includes: River Segment, Activity, Failure Type, Slide Aspect, Likely basal shear material, Length, Width, Area, and Morphological features (Appendix II). This inventory, based on air photo interpretation and field proofing, was used to analyze the landslides with respect to these characteristics, in order to make some basic conclusions about landslides in the Charlie Lake map sheet.

The most important conclusion derived from an analysis of this data was that a majority of the failures were multi-leveled, containing at least two shear planes. Almost 48% (769) of all failures were multi-level. This number is thought to be conservative as many of the failures are now dormant and their features obscured. In this case, the worst case scenario was used, i.e., a single large failure, therefore, the number of multi-level failures is likely to be higher and the number of rotational, retrogressive rotational, and compound failures would be lower than shown. A corollary to this conclusion is that instead of having one single weak layer within the region, there are many relatively weak horizons both in the unconsolidated material and in the bedrock. Based on laboratory testing of both failed and intact materials, there was little difference in bulk properties between the two types of material tested and the failed materials were not highly plastic. Of the 28 samples collected, four were a gouge material, eight were of sheared or disturbed shale, and 16 were of clay, sheared and intact. The average value of the Liquid Limit of the intact clay beds was 47.4%, while the sheared beds had a Liquid Limit of 49.8%. The Plasticity Indices of the intact and sheared beds are 30.3% and 27.9%, respectively. The sheared beds are silt dominated, 70% and 63%, respectively. The shale has a slightly higher Liquid Limit of 49.1% and a Plastic Index of 29.2%. Thus, the physical differences between weaker and stronger horizonz is subtle. The preferences for failure occurring on certain horizons is probably due to pre-shearing as a result of flexural slip.

Another important result was that the Beatton River seems to be the most active of all areas. Over half of all the Very Active failures were found within the Beatton River Valley. This thought to be because the rate of erosion is slightly higher that the Peace River, with the same weak materials. The higher rate of erosion is due to the steeper gradient of the river.

The third conclusion is that north-facing slopes appear to be more active than their south facing counterparts. 226 failures (14%) occurred on north-facing slopes as opposed to the 113 (7%) on south-facing slopes. The reason is thought to be the gentle northeastern dip of the underlying bedrock. The dip of the shale bedrock in to the valley allows for more failures to occur than would otherwise be allowed at such shallow angles. This gentle dip can also dramatically affect the type of slide observed in the river valleys. On the north-facing slopes, a distinct majority of long, compound failures were found. These failures are thought often to utilize weak layers in the Cretaceous shale rather than the Quaternary sequence above. Unfortunately, this is not always the case, therefore it can not be a rule, but rather a generality. Often, morphology alone can be a deciding factor in determining which type of material has failed. This can occur only if the preferred failure mechanism it is known for a material in that situation. This study presents the opposite situation in which knowing the type of failure can not really help determine which material had failed. This is due to the similarities in the failure setting for both the shale and the pre-glacial clays. The Peace River region provides an example where making assumptions on failed material based on morphology could prove incorrect.

The final conclusion to be made from this work is derived from field work completed during the summers of 2002/2003, when a total of 40 landslides were profiled within the Peace River Area. These profiles were completed in four landslide investigation areas; Big Bam Ski Hill, Old Fort, Beatton Big Bend, and Beatton Christian camp. These areas were investigated in greater detail in the field with profiles of individual slides and several samples being collected and tested. From this work, geologic models were created for each of the areas and then combined to produce a generalized model for failures in the Peace River region. The generalized model is discussed in Section 9.2.

The results of the research indicate how a landslide inventory can be compiled, the necessary steps that must be taken in order to make it valid and useful, and what types of information can be harvested from such an inventory.

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APPENDIX I

Geotechnical Lab Results

Grain Size Analysis

Atterberg Limits

SUMMARY OF HYDROMETERS

amec

TO: Geological Survey of Canada
601 Booth Street
Ottawa ON K1A 0E8

ATTENTION: Mr. Larry Dyke

PROJECT: Peace & Beatton Rivers

OFFICE: Fort St. John
PROJECT NO: GX04091
CLIENT: Geological Survey of Canada
COPIES TO: Mr. Jordan Severin

SAMPLE NO.	DATE	SOIL DESCRIPTION	Sand	Silt	Clay	D30 mm	D60 mm
1-1C	July 20/03	Shale Failure Plane	25%	61%	14%	.0054	.023
1-4A	June 21/03	Shear Surface #1 ICS	3%	59%	38%	.0011	.0086
1-4B	July 23/03	Massive Clay	4%	72%	24%	.0029	.018
2-2A	June 26/03	Shale/Shear?	7%	70%	23%	.0032	.046
2-2B	June 27/03	Debris/shear	7%	70%	23%	.0030	.027
2-4B	June 29/03	Debris Shear Plane	19%	49%	32%	.0018	.026
2-4C	June 29/03	Gouge	30%	66%	4%	.021	.061
2-4D	June 29/03	Shale Shear Plane	4%	85%	11%	.0066	.033
2-4I	July 23/03	Shear Gouge	23%	68%	9%	.014	.054
2-6A	June 30/03	Failed Clay	9%	57%	34%	.0015	.011
2-6B	June 30/03	Shear Gouge in Shale	38%	40%	22%	.0042	.070
2-8A	July 3/03	Upper Shear Plane	0%	50%	50%	.0010	.0032
2-8AA	July 23/03	Intact Clay II	0%	43%	57%	.00082	.0025
2-8B	July 3/03	Intact Clay Beneath Shear (5cm)	0%	68%	32%	.0018	.051
2-8D	July 3/03	Lower Slide Plane	1%	63%	36%	.0014	.013
3-1A	July 6/03	Shear Plane ICS	1%	52%	47%	.00088	.0037
3-5A	July 8/03	Adjacent Shear	13%	68%	19%	.0056	.030
3-5B	July 8/03	Gouge	32%	58%	10%	.016	.055
3-13A	July 12/03	Remolded Shale	19%	78%	3%	.045	.063
3-14A	July 13/03	Shale Shear	1%	77%	22%	.0035	.027
3-14B	July 13/03	Remolded Clay? Middle Material	1%	74%	25%	.0026	.0088
3-15A	July 13/03	Shale Shear	22%	57%	21%	.0038	.044
3-15B	July 13/03	Remolded Shale	14%	50%	36%	.0012	.023
4-2A	July 19/03	ICS Shear	5%	77%	18%	.0063	.038
4-2B	July 19/03	Intact Clay	2%	97%	1%	.016	.031
4-4A	July 22/03	Shear Upper ICS	11%	76%	13%	.028	.060
4-4B	July 22/03	Shear ICS	4%	86%	10%	.0031	.0059
PI-1A	June 24/03	Shear Plane	4%	57%	39%	.0012	.0055

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GRAIN SIZE ANALYSIS

13

PROJECT		SAMPLE P1-1A June 24/03 Shear Plane.	
LAB ORDER		TEST HOLE	DEPTH
		TECHNICIAN	DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	ϕ
WT. PASS. #10 & PAN —	ϕ
WT. PAN —	ϕ
WT. PASSING #10 —	259.4
TOTAL WT. —	259.4

HYDROMETER SAMPLE	
TARE NO.	
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	50.10
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.40	
40	0.36	
60	0.25	
100	0.26	
200	0.79	

WATER CONTENT	
TARE NO.	~~429~~ P1-1A
WT. TARE & WET SOIL —	20.53
WT. TARE & DRY SOIL —	20.06
WT. TARE —	1.25
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 9:00

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	9:01	1	49					
21	9:02	2	48					
21	9:04	4	47.5					
21	9:08	8	47					
21	9:15	15	46.5					
21	9:30	30	44					
21	10:00	60	39.5					
21	11:00	120 2h	36					
21	1:00	240 4h	32					
21	5:00	480 8h	29.5					
21	~~9:00~~ 8:07	1440 24h	25					

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GRAIN SIZE ANALYSIS

PROJECT

LAB ORDER

SAMPLE 1-1C July 20/03 Shale failure plane

~~TEST HOLE~~ across from ~~DEPTH~~ 1-1 downstream

TECHNICIAN

DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10 — 6.6

WT. PASS. #10 & PAN — 0

WT. PAN — 0

WT. PASSING #10 — 433.5

TOTAL WT. — 440.1

HYDROMETER SAMPLE

TARE NO.

~~WT. TARE~~ & WET SOIL — 50.37

~~WT. TARE~~ —

~~WT. WET SOIL~~ — 50.37

WATER CONTENT —

WT. DRY SOIL —

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	3.69	
40	3.59	
60	1.79	
100	1.47	
200	1.53	

WATER CONTENT

TARE NO. ~~T-2?~~ 1-1C

WT. TARE & WET SOIL — 29.20

WT. TARE & DRY SOIL — 28.58

WT. TARE — 1.22

WT. WATER —

WT. DRY SOIL —

WATER CONTENT % —

START TIME — 855

HYDROMETER TEST

TEMP °C	TIME	TIME INTERVAL	"K" FACTOR HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	"A" FACTOR DIAMETER	PERCENT PASSING
21	8:56	1	47					
21	8:58	2	46					
21	8:59	4	38					
21	9:03	8	35					
21	9:10	15	31					
21	9:25	30	29					
21	9:55	60	26					
21	10:55	120 2h	23					
21	12:55	240 4h	20					
21	4:55	480 8h	18					
21	8:06	1440 24h	14					

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GRAIN SIZE ANALYSIS 20

PROJECT
LAB ORDER

SAMPLE 1-4A June 21/03 Shear Surface #1 IC
TEST HOLE — DEPTH
TECHNICIAN — DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10	3.40
WT. PASS. #10 & PAN	872.0
WT. PAN	551.9
WT. PASSING #10	320.1
TOTAL WT.	323.5

HYDROMETER SAMPLE	
TARE NO.	1
WT. TARE & WET SOIL	
WT. TARE	
WT. WET SOIL	50.51
WATER CONTENT	
WT. DRY SOIL	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.11	
40	0.13	
60	0.14	
100	0.31	
200	0.77	

WATER CONTENT	
TARE NO.	1-4A
WT. TARE & WET SOIL	27.86
WT. TARE & DRY SOIL	27.33
WT. TARE	1.24
WT. WATER	
WT. DRY SOIL	
WATER CONTENT %	

START TIME — 10:05 "K" FACTOR

HYDROMETER TEST "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	10:06	1	51					
20	10:07	2	49					
20	10:09	4	47					
20	10:13	8	44.5					
20	10:20	15	42.5					
20	10:35	30	39.5					
20	11:05	60	37					
20.5	12:05	120 2h	34					
21	13:53 ~~14:05~~	240 4h	31.5					
21	16:25	480 8h	29					
21	13:00 ~~10:05~~	1440 24h	25.5					

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GRAIN SIZE ANALYSIS 21

PROJECT GX04091	SAMPLE 1-4B Massive Clay
LAB ORDER	TEST HOLE DEPTH
	TECHNICIAN DATE July 23/03

TOTAL SAMPLE

TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	

HYDROMETER SAMPLE

TARE NO.	1-4B
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	49.85
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.20	
40	0.41	
60	0.35	
100	0.41	
200	0.59	

WATER CONTENT

TARE NO.	1-4B
WT. TARE & WET SOIL —	17.93
WT. TARE & DRY SOIL —	17.46
WT. TARE —	1.24
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 10:00

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	10:01	1	47					
	10:02	2	43					
	10:04	4	41					
	10:08	8	38					
	10:15	15	36					
	10:30	30	33.5					
	11:00	60	31					
	12:00	120 2h	28					
	14:00	240 4h	25					
21.5	18:00	480 8h	22					
21	10:00	1440 24h	19					

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GRAIN SIZE ANALYSIS 22

PROJECT
LAB ORDER

SAMPLE 2-2A Jan26/03 Shale/Shear?
TEST HOLE
DEPTH
TECHNICIAN
DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10 — 9.46
WT. PASS. #10 & PAN — 1107.6
WT. PAN — 327.9
WT. PASSING #10 — 779.7
TOTAL WT. — 789.16

HYDROMETER SAMPLE

TARE NO. 2
WT. TARE & WET SOIL —
WT. TARE —
WT. WET SOIL — 50.74
WATER CONTENT —
WT. DRY SOIL —

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.33	
40	0.75	
60	0.51	
100	0.59	
200	1.12	

WATER CONTENT

TARE NO. 2-2A
WT. TARE & WET SOIL — 38.43
WT. TARE & DRY SOIL — 37.57
WT. TARE — 1.26
WT. WATER —
WT. DRY SOIL —
WATER CONTENT % —

612-9403

START TIME — 10:00 "K" FACTOR

HYDROMETER TEST "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	10:01	1	38.5					
20	10:02	2	37					
20	10:04	4	36					
20	10:08	8	34.5					
20	10:20	15	33					
20	10:30	30	31.5					
20	11:00	1hr	29.5					
21.5	12:00	2hr	26					
21	13:55	4hr	25					
21	18:25	8hr	22					
	13:00	24hr	19.5					

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GRAIN SIZE ANALYSIS

23

PROJECT

LAB ORDER

SAMPLE 2-2B June 27/03 Debris/shear ?

TEST HOLE DEPTH

TECHNICIAN DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10 — 38.38

WT. PASS. #10 & PAN — 843.4

WT. PAN — 328.0

WT. PASSING #10 — 515.4

TOTAL WT. — 553.78

HYDROMETER SAMPLE

TARE NO. 3

~~WT. TARE~~ & WET SOIL — ~~49.64~~

~~WT. TARE~~ —

WT. WET SOIL — 49.64

WATER CONTENT

WT. DRY SOIL

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	1.01	
40	0.80	
60	0.39	
100	0.38	
200	0.75	

WATER CONTENT

TARE NO. 2-2B

WT. TARE & WET SOIL — 22.92

WT. TARE & DRY SOIL — 22.49

WT. TARE — 1.25

WT. WATER —

WT. DRY SOIL —

WATER CONTENT % —

START TIME — 9:50 10-4

"K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
19	9:51	1	42					
19	9:52	2	40.5					
19	9:54	4	39					
19	9:58	8	37.5					
~~20~~ 19.5	10:05	15	35.5					
20	10:20	30	34					
20.5	10:50	60	31					
20.0	11:50	120 2h	29					
20	14:15	240 4h	24.5					
21.0	17:50	480 8h	22.0					
20	9:50 10-5	1440 24h	18.5					

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GRAIN SIZE ANALYSIS

24

PROJECT GX04091

LAB ORDER

SAMPLE June 29/03 2-4B Debris Slear

TEST HOLE

DEPTH

TECHNICIAN

DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10 — 66.68

WT. PASS. #10 ~~& PAN~~ wet — 921.66

~~WT. PAN~~ —

WT. PASSING #10 Dry —

TOTAL WT. —

HYDROMETER SAMPLE

TARE NO. 2-4B

WT. TARE & WET SOIL —

WT. TARE —

WT. WET SOIL — 50.53

WATER CONTENT —

WT. DRY SOIL —

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"	8.03	
4	22.48	
10	36.17	
20	0.74	
40	0.71	
60	1.37	
100	1.69	
200	2.24	

WATER CONTENT

TARE NO. 2-4B

WT. TARE & WET SOIL — 32.08

WT. TARE & DRY SOIL — 31.43

WT. TARE — 1.25

WT. WATER —

WT. DRY SOIL —

WATER CONTENT % —

START TIME — 9:45

"K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20.5	9:46	1	44					
	9:47	2	43					
	9:49	4	41					
	9:53	8	40					
	10:00	15	38.5					
20	10:15	30	37					
	10:45	60	34					
20.5	11:45	120 2h	32					
20.5	13:45	240 4h	29					
21	17:45	480 8h	27					
20.5	9:45	1440 24h	24					

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GRAIN SIZE ANALYSIS 25

PROJECT	SAMPLE 2-4C Gouge June 29/03
LAB ORDER	TEST HOLE DEPTH
	TECHNICIAN DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	1.44
WT. PASS. #10 & PAN —	860.7
WT. PAN —	307.7
WT. PASSING #10 —	553.0
TOTAL WT. —	554.44
HYDROMETER SAMPLE	
TARE NO.	1
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	51.25
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.03	
40	0.26	
60	0.65	
100	3.37	
200	10.09	

WATER CONTENT	
TARE NO.	2-4C
WT. TARE & WET SOIL —	26.11
WT. TARE & DRY SOIL —	24.73
WT. TARE —	1.25
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 10:00 "K" FACTOR

HYDROMETER TEST "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
19.5	10:01	1	34					
19.5	10:02	2	30					
19.5	10:04	4	26					
20.0	10:08	8	23					
20.0	10:15	15	21					
20.0	10:30	30	18					
20.5	11:00	60	17					
21.0	12:00	120	15.5					
20	14:15	240	[redacted] 13.5					
21	18:55	480	[redacted] 12.5					
20	10:00	1440	11					

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GRAIN SIZE ANALYSIS 26

PROJECT
LAB ORDER

SAMPLE 24D June 29,03 Shale Sheart
TEST HOLE
DEPTH
TECHNICIAN
DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10 —
WT. PASS. #10 & PAN —
WT. PAN —
WT. PASSING #10 —
TOTAL WT. —

HYDROMETER SAMPLE

TARE NO. 24D
WT. TARE & WET SOIL —
WT. TARE —
WT. WET SOIL — 50.25
WATER CONTENT —
WT. DRY SOIL —

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10	∅	
20	0.15	
40	0.16	
60	0.09	
100	0.14	
200	1.32	

WATER CONTENT

TARE NO. 24D
WT. TARE & WET SOIL — 26.98
WT. TARE & DRY SOIL — 26.31
WT. TARE — 1.26
WT. WATER — [illegible]
WT. DRY SOIL —
WATER CONTENT % —

START TIME — 9:45

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	9:46	1	42					
20	9:47	2	39					
20	9:49	4	38					
20	9:53	8	36					
20	10:00	15	31					
20	10:15	30	29					
20	10:45	60	24					
20	11:45	120 2h	22					
20	1:45	240 4h	~~20~~ 20					
20	5:45	480 8h	16					
20	9:45	1440 24h	15					

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GRAIN SIZE ANALYSIS

27

PROJECT	SAMPLE 2-41 July 23/03 Shear Gouge
LAB ORDER	TEST HOLE / DEPTH
	TECHNICIAN / DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	13.96
WT. PASS. #10 & PAN —	817.3
WT. PAN —	471.2
WT. PASSING #10 —	346.1
TOTAL WT. —	360.06
HYDROMETER SAMPLE	
TARE NO.	~~[illegible]~~ 2
~~WT. TARE & WET SOIL~~ —	
~~WT. TARE~~ —	1.24
WT. WET SOIL —	50.34
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.06	
40	0.09	
60	0.54	
100	3.03	
200	7.58	

WATER CONTENT	
TARE NO.	2-41
~~WT. TARE &~~ WET SOIL —	23.65
WT. TARE & DRY SOIL —	23.14
WT. TARE —	1.24
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 9:55

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
19	9:56	1	36.5					
19	9:57	2	33					
19.5	9:59	4	29.5					
19.5	10:03	8	27					
20	10:10	15	24.5					
20	10:25	30	22					
20.5	10:55	1hr	20.5					
21.0	11:55	2hr	19					
20	~~[illegible]~~ 14:15	4hr	17					
21	17:55	8hr	15					
20	9:55 11.5	24hr	14					

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GRAIN SIZE ANALYSIS

28

PROJECT
LAB ORDER

SAMPLE 2-6A June 30/03 failed Clay
TEST HOLE DEPTH
TECHNICIAN DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10	~~0~~
WT. PASS. #10 & PAN	~~0~~
WT. PAN	~~0~~
WT. PASSING #10	579.2
TOTAL WT.	579.2
HYDROMETER SAMPLE	
TARE NO.	
WT. TARE & WET SOIL	
WT. TARE	
WT. WET SOIL	50.07
WATER CONTENT	
WT. DRY SOIL	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.80	
40	0.91	
60	0.75	
100	0.85	
200	1.00	

WATER CONTENT	
TARE NO.	~~124~~ 2-6A
WT. TARE & WET SOIL	28.11
WT. TARE & DRY SOIL	27.35
WT. TARE	1.24
WT. WATER	
WT. DRY SOIL	
WATER CONTENT %	

START TIME — 9:05

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	9:06	1	44					
21	9:07	2	43					
21	9:09	4	43					
21	9:13	8	42					
21	9:20	15	39.5					
21	9:35	30	37					
21	10:05	60	34					
21	11:05	120 2h	32					
21	1:05	240 4h	29.5					
21	5:05	480 8h	27					
21	8:??	1440 24h	24					

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GRAIN SIZE ANALYSIS

29

PROJECT

LAB ORDER

SAMPLE 2-6B June 30/03 Shear gouge in shal

TEST HOLE — DEPTH

TECHNICIAN — DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10	20.72
WT. PASS. #10 & PAN	601.1
WT. PAN	337.4
WT. PASSING #10	263.7
TOTAL WT.	284.42

HYDROMETER SAMPLE	
TARE NO.	8
WT. TARE & WET SOIL	
WT. TARE	
WT. WET SOIL	93.81
WATER CONTENT	
WT. DRY SOIL	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10	[illegible]	
20	12.27	
40	10.69	
60	5.04	
100	3.33	
200	3.02	

WATER CONTENT	
TARE NO.	~~C24~~
WT. TARE & WET SOIL	28.74
WT. TARE & DRY SOIL	27.79
WT. TARE	1.24
WT. WATER	
WT. DRY SOIL	
WATER CONTENT %	

START TIME — 10:30 "K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	10:31	1	52					
20	10:32	2	50					
20	10:34	4	48					
20	10:38	8	46					
20	10:45	15	44					
20	11:00	30	42					
20	11:30	60	40					
20.5	12:30	120	37					
20	14:30	240	~~35~~ 34					
21	20:13 ~~18:30~~	480	30					
.5	9:25 ~~10:40~~	24hr	25.5					

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GRAIN SIZE ANALYSIS 30

PROJECT
LAB ORDER

SAMPLE 2-8A July 3/03 Upper Shear Plane
TEST HOLE DEPTH
TECHNICIAN DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10	5.95
WT. PASS. #10 & PAN	881.0
WT. PAN	469.0
WT. PASSING #10	411.0
TOTAL WT.	416.95

HYDROMETER SAMPLE	
TARE NO.	2
~~WT. TARE~~ & WET SOIL	
~~WT. TARE~~	
WT. WET SOIL	50.30
WATER CONTENT	
WT. DRY SOIL	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20		
40	0.01	
60	0.05	
100	0.08	
200	0.06	

WATER CONTENT	
TARE NO.	2-8A
WT. TARE & WET SOIL	27.83
WT. TARE & DRY SOIL	27.49
WT. TARE	1.25
WT. WATER	
WT. DRY SOIL	
WATER CONTENT %	

START TIME — 10:35 "K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	1	10:36	53					
20	2	10:37	52.5					
20	4	10:39	51.5					
20	8	10:43	50.5					
20	15	10:50	49					
20	30	11:05	47					
20	1hr	11:35	45					
20.5	2hr	12:35	42.5					
21	4hr	14:35	38					
21	8hr	~~18:35~~ 20:14	34					
19.5	24hr	~~[illegible]~~ Nov 9:25	29					

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GRAIN SIZE ANALYSIS

3(

PROJECT 6X04091
LAB ORDER

SAMPLE 2-8AA Intact Clay II
TEST HOLE
DEPTH
TECHNICIAN
DATE 23 July 2003

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	

HYDROMETER SAMPLE	
TARE NO.	
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	50.14
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20		
40		
60		
100		
200	0.0	

WATER CONTENT	
TARE NO.	~~P25~~
WT. TARE & WET SOIL —	16.14
WT. TARE & DRY SOIL —	15.91
WT. TARE —	1.25
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:30 "K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	8:31	1	52					
20	8:32	2	50.5					
20	8:34	4	50					
20	8:38	8	50					
20	8:45	15	49					
20	9:00	30	48.5					
20	9:30	60	46					
20	10:30	120 2h	44					
20	12:30	240 4h	41					
21	16:30	480 8h	38					
19.5	8:30	1440 24h	32					

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GRAIN SIZE ANALYSIS 32

PROJECT

LAB ORDER

SAMPLE 2-8B July 3/03 intact clay, Bergath shear

TEST HOLE

DEPTH (5cm)

TECHNICIAN

DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10	0.34
WT. PASS. #10 & PAN	603.9
WT. PAN	331.4
WT. PASSING #10	272.5
TOTAL WT.	272.84

HYDROMETER SAMPLE

TARE NO.	2-8B
WT. TARE & WET SOIL	
WT. TARE	
WT. WET SOIL	49.96
WATER CONTENT	
WT. DRY SOIL	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.01	
40	0.01	
60	0.01	
100	0.02	
200	0.04	

WATER CONTENT

TARE NO.	2-8B
WT. TARE & WET SOIL	24.20
WT. TARE & DRY SOIL	23.68
WT. TARE	1.24
WT. WATER	
WT. DRY SOIL	
WATER CONTENT %	

START TIME 8:25

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
	8:26	1	35					
	8:27	2						
	8:30	4	33					
	8:33		31					
	8:40	8	30					
	8:55	15	29.5					
	9:25	30	29					
	10:25	60	28					
	12:30	120	28					
	4:25	240	27					
	8:30	480	26					
		1440	22.5					

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GRAIN SIZE ANALYSIS

33

PROJECT	GX04091	SAMPLE	2-8D Lower Slide Pane
LAB ORDER		TEST HOLE	DEPTH
		TECHNICIAN	DATE July 3/02

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	
HYDROMETER SAMPLE	
TARE NO.	2-8D
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	49.93
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.02	
40	0.03	
60	0.04	
100	0.08	
200	0.38	

WATER CONTENT	
TARE NO.	2-8D
WT. TARE & WET SOIL —	19.09
WT. TARE & DRY SOIL —	18.77
WT. TARE —	1.25
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:35

"K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
22	8:36	1	~~40~~ 44					
22	8:37	2	43					
22	8:39	4	42					
22	8:423	8	40					
22	8:50	15	39					
22	9:05	30	37					
22	9:35	60	36					
22	10:35	120 2h	32					
22	12:35	240 4h	30					
21	4:35	480 8h	28					
22	8:35	1440 24h	24					

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GRAIN SIZE ANALYSIS 3(

PROJECT	SAMPLE 3-1A July 6/03 Shear Plane (1(
LAB ORDER	TEST HOLE DEPTH
	TECHNICIAN DATE

TOTAL SAMPLE

TOTAL WT. RET. ON #10 — 5.20
WT. PASS. #10 & PAN — 701.7
WT. PAN — 299.6
WT. PASSING #10 — 402.1
TOTAL WT. — 407.3

HYDROMETER SAMPLE

TARE NO. 3
WT. TARE & WET SOIL —
WT. TARE —
WT. WET SOIL — 50.02
WATER CONTENT —
WT. DRY SOIL —

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.09	
40	0.14	
60	0.13	
100	0.13	
200	0.22	

WATER CONTENT

TARE NO. 3-1A
WT. TARE & WET SOIL — 25.49
WT. TARE & DRY SOIL — 24.94
WT. TARE — 1.25
WT. WATER —
WT. DRY SOIL —
WATER CONTENT % —

HYDROMETER TEST

START TIME — 9:55
"K" FACTOR
"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCE PASSI
20	9:56	1	55					
20	9:57	2	55					
20	9:59	4	53.5					
20	10:03	8	52					
20	10:10	15	50					
20	10:25	30	47					
20	10:55	60	44					
20.5	11:55	120	40					
21	13:55	240	36.5					
20	18:25	480	33					
21	13:00	1440	29					

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GRAIN SIZE ANALYSIS 35

PROJECT	SAMPLE 3-5A July 8/03 Adjacent Shear
LAB ORDER	TEST HOLE / DEPTH
	TECHNICIAN / DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	1.08
WT. PASS. #10 & PAN —	1002.8
WT. PAN —	566.0
WT. PASSING #10 —	436.8
TOTAL WT. —	437.88

HYDROMETER SAMPLE	
TARE NO.	1
WT. TARE & ~~WET SOIL~~ —	
~~WT. TARE~~ —	
WT. WET SOIL —	50.47
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.26	
40	0.49	
60	0.74	
100	1.39	
200	3.40	

WATER CONTENT	
TARE NO.	3-5A
WT. TARE & WET SOIL —	34.94
WT. TARE & DRY SOIL —	33.4
WT. TARE —	1.24
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 10:40 "K" FACTOR

HYDROMETER TEST "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	1	10:41	42					
20	2	10:42	39.5					
20	4	10:44	37					
20	8	10:48	34					
20	15	10:55	31					
20	30	11:10	30					
20	1hr	11:40	25.5					
20	2hr	12:40	23					
20	4hr	14:40	21.5					
21	8hr	~~18:40~~ 20:15	19.5					
9.5	24hr	Wed 9:25	19					

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GRAIN SIZE ANALYSIS 36

PROJECT	GX04091	SAMPLE	3-5B Gouge
LAB ORDER		TEST HOLE	DEPTH
		TECHNICIAN	DATE July 8/03

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	
HYDROMETER SAMPLE	
TARE NO.	3-5B
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	99.81
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	1.28	
40	1.37	
60	1.17	
100	8.56	
200	18.04	

WATER CONTENT	
TARE NO.	3-5B
WT. TARE & WET SOIL —	25.28
WT. TARE & DRY SOIL —	24.06
WT. TARE —	1.26
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:40

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
22	8:41	1	59					
22	8:42	2	53					
22	8:44	4	48					
22	8:48	8	56					
22	8:55	15	34					
22	9:10	30	30					
22	9:40	60	26					
22	10:40	120 2h	24					
22	12:40	240 4h	20					
22	4:40	480 8h	19					
22	08:30	1440 24h	18					

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GRAIN SIZE ANALYSIS 38

PROJECT	SAMPLE 3-13A July 12/03 Remolded Shale
LAB ORDER	TEST HOLE / DEPTH
	TECHNICIAN / DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	29.73
WT. PASS. #10 & PAN —	1250.6
WT. PAN —	552.0
WT. PASSING #10 —	698.6
TOTAL WT. —	728.33
HYDROMETER SAMPLE	
TARE NO.	3-13A
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	49.82
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	3.58	
40	2.68	
60	1.04	
100	0.82	
200	1.12	

WATER CONTENT	
TARE NO.	3-13A
WT. TARE & WET SOIL —	35.17
WT. TARE & DRY SOIL —	34.40
WT. TARE —	1.24
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:30

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	8:31	1	25					
21	8:32	2	23					
21	8:34	4	23					
21	8:38	8	22					
21	8:45	15	21					
21	~~8~~9:00	~~60~~ 30	19.5					
21	9:30	~~120~~ 60	18					
21	10:30	~~240~~ 120	16					
21	12:30	~~480~~ 240	14					
21	4:30	480	12					
	8:32	1440	10					

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GRAIN SIZE ANALYSIS

39

PROJECT (X04091)
LAB ORDER

SAMPLE 3-14A Shale Shear
TEST HOLE
DEPTH
TECHNICIAN
DATE 13 July 2003

TOTAL SAMPLE

TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	

HYDROMETER SAMPLE

TARE NO.	
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	50.11
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.02	
40	0.05	
60	0.06	
100	0.10	
200	0.30	

WATER CONTENT

TARE NO.	~~23~~
WT. TARE & WET SOIL —	22.89
WT. TARE & DRY SOIL —	22.46
WT. TARE —	1.25
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:35

"K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	8:36	1	40					
20	8:37	2	38.5					
20	8:39	4	37					
20	8:43	8	35					
20	8:50	15	34					
20	9:05	30	31					
20	9:35	60	29					
20	10:35	120 2h	27					
20	12:35	240 4h	24					
21	16:35	480 8h	22					
19.5	8:35	1440 24h	16					

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GRAIN SIZE ANALYSIS

40

PROJECT	GX04091	SAMPLE	July 13/03 3-14B Shear remolded Clay
LAB ORDER		TEST HOLE	DEPTH Middle material
		TECHNICIAN	DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	
HYDROMETER SAMPLE	
TARE NO.	3-14B
~~WT. TARE & WET SOIL~~ —	
~~WT. TARE~~ —	
WT. WET SOIL —	49.84
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.07	
40	0.08	
60	0.09	
100	0.10	
200	0.17	

WATER CONTENT	
TARE NO.	3-14B
WT. TARE & WET SOIL —	28.22
WT. TARE & DRY SOIL —	27.70
WT. TARE —	1.25
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 9:55 "K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20.5	9:56	1	51					
	9:57	2	50					
	9:59	4	48					
	10:03	8	46					
	10:10	15	42					
20	10:25	30	38.5					
	10:55	60	34					
20.5	11:55	120 2h	30					
20.5	13:55	240 4h	26.5					
21	17:55	480 8h	23					
20.5	9:55	1440 24h	18					

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GRAIN SIZE ANALYSIS 41

PROJECT GX04091
LAB ORDER

SAMPLE July 13/03 3-15A Shale Slear
TEST HOLE
DEPTH
TECHNICIAN
DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	45.55
WT. PASS. #10 ~~& PAN~~ wet —	425.52
~~WT. PAN~~ —	
WT. PASSING ~~#10~~ Dry —	
TOTAL WT. —	

HYDROMETER SAMPLE	
TARE NO.	3-15A
WT. TARE & ~~WET~~ SOIL —	
~~WT. TARE~~ —	
WT. WET SOIL —	49.94
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4	4.22	
10	41.33	
20	0.48	
40	0.42	
60	0.34	
100	0.75	
200	4.55	

WATER CONTENT	
TARE NO.	3-15A
WT. TARE & WET SOIL —	24.14
WT. TARE & DRY SOIL —	23.64
WT. TARE —	1.27
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 9:50

HYDROMETER TEST

"K" FACTOR

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20.5	9:51	1	42					
↓	9:52	2	39.5					
	9:54	4	37.5					
	9:58	8	36					
↓	10:05	15	35					
20	10:25	30.5	32					
↓	10:50	60	29.5					
20.5	11:50	120 2h	27.5					
20.5	13:50	240 4h	24.5					
21	17:50	480 8h	22.5					
20.5	9:50	1440 24h	19.0					

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GRAIN SIZE ANALYSIS 42

PROJECT 6X0409
LAB ORDER

SAMPLE 3-15AB Remolded Shale
TEST HOLE
DEPTH
TECHNICIAN
DATE 13 July 2003

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	

HYDROMETER SAMPLE	
TARE NO.	
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	50.78
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.65	
40	0.36	
60	0.21	
100	0.77	
200	4.83	

WATER CONTENT	
TARE NO.	[illegible]
WT. TARE & WET SOIL —	23.71
WT. TARE & DRY SOIL —	22.87
WT. TARE —	1.24
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:25

"K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
20	8:26	1	45					
20	8:27	2	42					
20	8:29	4	39					
20	8:33	8	37					
20	8:40	15	36					
20	8:55	30	34.5					
20	9:25	60	33					
20	10:25	120 2h	31					
20	12:25	240 4h	29					
21	16:25	480 8h	28					
19.5	8:25	1440 24h	25.5					

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HBLT 70 - 88/09

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GRAIN SIZE ANALYSIS 43

PROJECT GX04091		SAMPLE 4-2A ICS Shear	
LAB ORDER		TEST HOLE	DEPTH
		TECHNICIAN	DATE July 19, 03

TOTAL SAMPLE	
TOTAL WT. RET. ON #10	
WT. PASS. #10 & PAN	
WT. PAN	
WT. PASSING #10	
TOTAL WT.	
HYDROMETER SAMPLE	
TARE NO.	4-2A
WT. TARE & WET SOIL	
WT. TARE	
WT. WET SOIL	50.17
WATER CONTENT	
WT. DRY SOIL	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.28	
40	0.22	
60	0.28	
100	0.40	
200	1.35	

WATER CONTENT	
TARE NO.	4-2A
WT. TARE & WET SOIL	19.96
WT. TARE & DRY SOIL	19.43
WT. TARE	1.24
WT. WATER	
WT. DRY SOIL	
WATER CONTENT %	

START TIME 8:30

HYDROMETER TEST

"K" FACTOR

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
22	8:31	1	40					
22	8:32	2	37.5					
22	8:34	4	36					
22	8:38	8	34					
22	8:45	15	31					
22	9:00	30	~~28~~ 28					
22	9:30	60	~~26~~ 24					
22	10:30	120 2h	22					
22	12:30	240 4h	20					
22	4:30	480 8h	19					
22	8:30	1440 24h	18					

HBLT 70 - 88/09

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GRAIN SIZE ANALYSIS 44

PROJECT	6X04091	SAMPLE	4-2B Intact ~~Clay~~ Silt+Clay
LAB ORDER		TEST HOLE	DEPTH
		TECHNICIAN	DATE July 19/03

TOTAL SAMPLE

TOTAL WT. RET. ON #10 —
WT. PASS. #10 & PAN —
WT. PAN —
WT. PASSING #10 —
TOTAL WT. —

HYDROMETER SAMPLE

TARE NO. 4-2B
WT. TARE & WET SOIL —
WT. TARE —
WT. WET SOIL — 50.12
WATER CONTENT —
WT. DRY SOIL —

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.06	
40	0.07	
60	0.17	
100	0.33	
200	0.53	

WATER CONTENT

TARE NO. 4-2B
WT. TARE & WET SOIL — 17.04
WT. TARE & DRY SOIL — 16.75
WT. TARE — 1.26
WT. WATER — ~~[illegible]~~
WT. DRY SOIL —
WATER CONTENT % —

START TIME — 10:10

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	10:11	1	44					
	10:12	2	39					
	10:14	4	32.5					
	10:18	8	25.5					
	10:25	15	20					
	10:40	30	15					
	11:10	60	13					
	12:10	120 2h	12.5					
	14:10	240 4h	11					
21.5	1810	480 8h	10					
21	10:10	1440 24h	9					

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GRAIN SIZE ANALYSIS 45

ROJECT	SAMPLE 4-4A July 22/03 Shear upper ICS
LAB ORDER	TEST HOLE DEPTH
	TECHNICIAN DATE

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	10.35
WT. PASS. #10 & PAN —	793.6
WT. PAN —	323.6
WT. PASSING #10 —	470.0
TOTAL WT. —	480.35
HYDROMETER SAMPLE	
TARE NO.	4-4A
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	49.96
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.26	
40	0.73	
60	1.16	
100	1.58	
200	1.71	

WATER CONTENT	
TARE NO.	4-4A
WT. TARE & WET SOIL —	25.96
WT. TARE & DRY SOIL —	24.82
WT. TARE —	1.23
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 8:20

HYDROMETER TEST

"K" FACTOR "A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	821	1	26.5					
21	8:22	2	25					
21	8:24	4	24					
21	8:28	8	23					
21	8:35	15	22.5					
21	8:50	30	22					
21	9:20	60	21					
21	10:20	120	19.5					
21	12:20	240	18.5					
21	4:20	480	16.5					
21	8:30	1440	14					

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GRAIN SIZE ANALYSIS 46

PROJECT GX04091		SAMPLE 4-4B Shear 1C S	
LAB ORDER		TEST HOLE	DEPTH
		TECHNICIAN	DATE July 22/03

TOTAL SAMPLE	
TOTAL WT. RET. ON #10 —	
WT. PASS. #10 & PAN —	
WT. PAN —	
WT. PASSING #10 —	
TOTAL WT. —	
HYDROMETER SAMPLE	
TARE NO.	4-4B
WT. TARE & WET SOIL —	
WT. TARE —	
WT. WET SOIL —	49.98
WATER CONTENT —	
WT. DRY SOIL —	

SIEVE ANALYSIS

SIEVE SIZE	WT. RETAINED	PERCENT PASS.
1"		
¾"		
½"		
⅜"		
4		
10		
20	0.09	
40	0.25	
60	0.60	
100	0.45	
200	0.37	

WATER CONTENT	
TARE NO.	4-4B
WT. TARE & WET SOIL —	21.03
WT. TARE & DRY SOIL —	19.86
WT. TARE —	1.21
WT. WATER —	
WT. DRY SOIL —	
WATER CONTENT % —	

START TIME — 10:05 "K" FACTOR

HYDROMETER TEST

"A" FACTOR

TEMP °C	TIME	TIME INTERVAL	HYD. RDG.	COMP. CORR.	R	EFFECTIVE DEPTH	DIAMETER	PERCENT PASSING
21	10:06	1	46					
	10:07	2	45					
	10:09	4	44					
	10:13	8	43					
	10:20	15	42.5					
	10:35	30	40.5					
	11:05	60	38					
	12:05	120 2h	33.5					
	14:05	240 4h	19					
21.5	18:05	480 8h	8.5					
21	10:05	1440 24h	4					

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HBLT 70 , 88/09

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ATTERBERG LIMITS

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TO: Geological Survey of Canada
601 Booth Street
Ottawa ON K1A 0E8

ATTENTION: Mr. Larry Dyke

OFFICE: Fort St. John
PROJECT NO: GX04091
CLIENT: Geological Survey of Canada
COPIES TO: Mr. Jordan Severin

PROJECT: Peace & Beatton Rivers

SAMPLE NO.	DATE	SOIL DESCRIPTION	LL	PL	PI	MUSC
1-1C	July 20/03	Shale Failure Plane	39.4	21.1	18.3	CI
1-4A	June 21/03	Shear Surface #1 ICS	50.9	17.8	33.1	CH
1-4B	July 23/03	Massive Clay	41.2	17.4	23.8	CI
2-2A	June 26/03	Shale/Shear?	40.0	19.6	20.4	CI
2-2B	June 27/03	Debris/shear	43.1	19.5	23.6	CI
2-4B	June 29/03	Debris Shear Plane	47.4	19.0	28.4	CI/CH
2-4C	June 29/03	Gouge	49.8	29.6	20.2	CI/CH
2-4D	June 29/03	Shale Shear Plane	40.9	19.0	21.9	CI
2-4I	July 23/03	Shear Gouge	55.7	30.4	25.3	CH
2-6A	June 30/03	Failed Clay	47.6	19.6	28.0	CI/CH
2-6B	June 30/03	Shear Gouge in Shale	44.9	22.7	22.2	CI
2-8A	July 3/03	Upper Shear Plane	47.4	19.4	28.0	CI/CH
2-8AA	July 23/03	Intact Clay II	50.9	19.6	31.3	CI/CH
2-8B	July 3/03	Intact Clay Beneath Shear (5cm)	69.4	21.2	48.2	CH
2-8D	July 3/03	Lower Slide Plane	47.6	21.2	26.4	CI/CH
3-1A	July 6/03	Shear Plane ICS	53.7	19.9	33.8	CI/CH
3-5A	July 8/03	Adjacent Shear	52.9	18.2	34.7	CI/CH
3-5B	July 8/03	Gauge	52.3	22.9	29.4	CI/CH
3-13A	July 12/03	Remolded Shale	41.9	18.0	23.9	CI
3-14A	July 13/03	Shale Shear	40.6	19.9	20.7	CI
3-14B	July 13/03	Remolded Clay? Middle Material	40.6	19.2	21.4	CI
3-15A	July 13/03	Shale Shear	55.4	15.9	39.5	CH
3-15B	July 13/03	Remolded Shale	80.4	29.6	50.8	CH
4-2A	July 19/03	ICS Shear	38.8	14.6	24.2	CI
4-2B	July 19/03	Intact Clay	28.1	19.9	8.2	CL
4-4A	July 22/03	Shear Upper ICS	57.5	22.7	34.8	CH
4-4B	July 22/03	Shear ICS	73.2	20.7	52.5	CH
PI-1A	June 24/03	Shear Plane	51.1	18.1	33.0	CI/CH

LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
MUSC = Modified Unified Classification System

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____ Job No. 6X04811

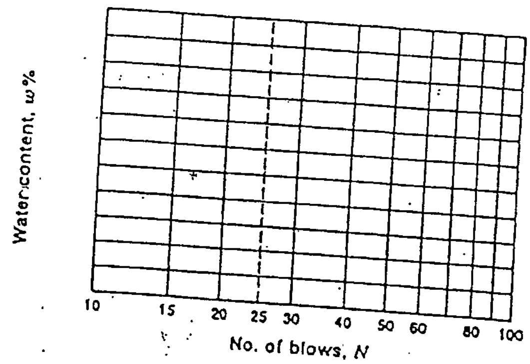
Location of Project ____ Boring No. ____ Sample No. 1-1C

Description of Soil Shale Failure Plane (20 July)

Depth of Sample ____ Tested By ____ Date ~~20 ...~~

Liquid Limit Determination

Can no.	A	B				
Wt. of wet soil + can	28.95	24.35				
Wt. of dry soil + can	21.11	17.84				
Wt. of can	1.24	1.23				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	39.5	39.2				
No. of blows, N	26	24				
	39.7	39.0				



Flow index F_i = ____

Liquid limit = 39.4

Plastic limit = 21.1

Plasticity index I_p = 18.3

CI

Plastic Limit Determination

Can no.	C	D		
Wt. of wet soil + can	8.65	6.35		
Wt. of dry soil + can	7.28	5.46		
Wt. of can	1.24	1.24		
Wt. of dry soil	~~6.04~~			
Wt. of moisture				
Water content, $w\% = w_p$	21.0	21.1		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______________ Job No. GX04091

Location of Project ______________ Boring No. 1-4A Sample No. ______

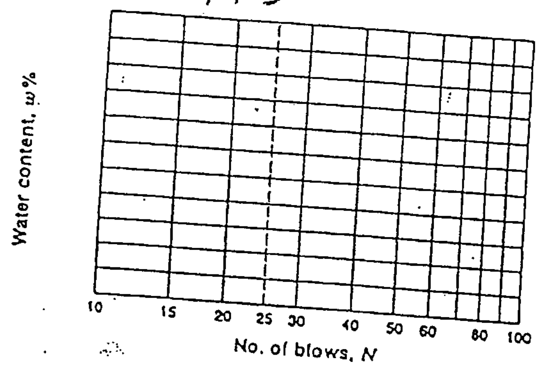
Description of Soil Shear Surface #1 / CS

Depth of Sample ______ Tested By ______ Date ~~May~~ June 21

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	30.~~1~~09	31.14				
Wt. of dry soil + can	21.26	21.97				
Wt. of can	1.24	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	44.1	44.2				
No. of blows, N	26	29				

44.3



Flow index F_i = ______

Liquid limit = 50.9

Plastic limit = 17.8

Plasticity index I_p = 33.1

CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	4.27	4.04		
Wt. of dry soil + can	3.82	3.61		
Wt. of can	1.25	1.23		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	17.5	18.1		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

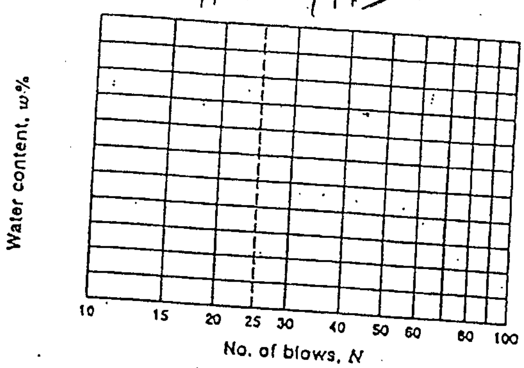
Location of Project ______ Boring No. 1-4B Sample No. ______

Description of Soil Massive Clay

Depth of Sample ______ Tested By ______ Date July 23

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	34.52	29.62				
Wt. of dry soil + can	24.65	21.20				
Wt. of can	1.24	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, ω%	42.2	42.2				
No. of blows, N	20	21				
	41.1	41.3				



Flow index F_I = 41.2

Liquid limit = 17.4

Plastic limit = 17.4

Plasticity index I_P = 23.8

CL

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	9.55	8.16		
Wt. of dry soil + can	8.31	7.14		
Wt. of can	1.24	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $\omega\% = \omega_P$	17.5	17.3		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

Location of Project ______ Boring No. 2-2A Sample No. ______

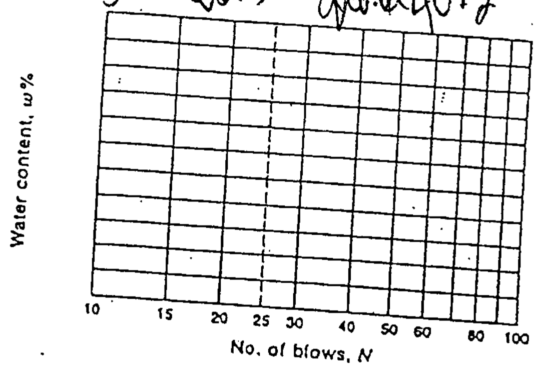
Description of Soil Shale/Shear?

Depth of Sample ______ Tested By ______ Date Jun 26/03

Liquid Limit Determination

	1	2				
Can no.	1	2				
Wt. of wet soil + can	31.92	32.58				
Wt. of dry soil + can	23.01	23.45				
Wt. of can	1.24	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	40.9	41.1				
No. of blows, N	20	21				

39.8 40.2



Flow index F_i = ______

Liquid limit = 40.0

Plastic limit = 19.6

Plasticity index I_p = 20.4

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	4.37	4.55		
Wt. of dry soil + can	3.86	4.01		
Wt. of can	1.24	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	19.5	19.6		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____________________ Job No. GX04091

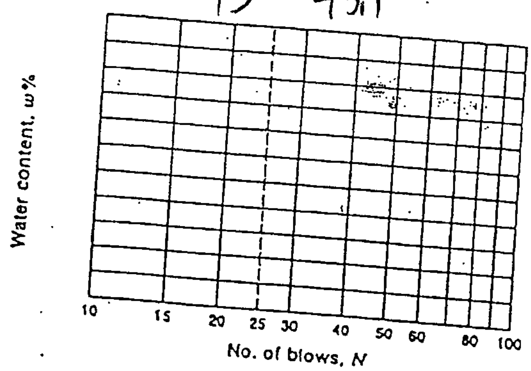
Location of Project ____________________ Boring No. 2-28 Sample No. ______

Description of Soil Debris/Shear

Depth of Sample ______ Tested By ______ Date June 27

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	27.23	34.75				
Wt. of dry soil + can	19.49	24.79				
Wt. of can	1.23	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	42.4	42.3				
No. of blows, N	28	29				
	43	43.1				



Flow index F_i = ______

Liquid limit = 43.1

Plastic limit = 19.5

Plasticity index I_p = 23.6

CL

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	5.09	4.17		
Wt. of dry soil + can	4.46	3.70		
Wt. of can	1.26	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, w% = w_p	19.7	19.2		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

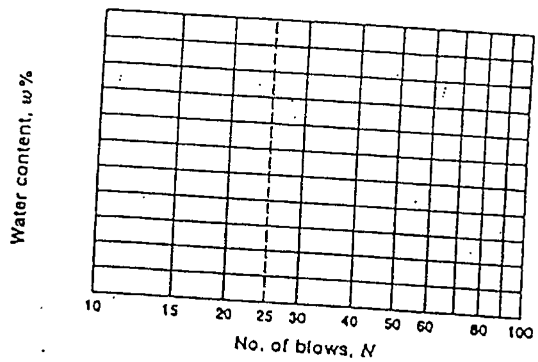
Location of Project ______ Boring No. ______ Sample No. 2-4B

Description of Soil Debris Shear Plane, 29 June 2003

Depth of Sample ______ Tested By ______ Date ______

Liquid Limit Determination

Can no.	A	B				
Wt. of wet soil + can	31.43	31.87				
Wt. of dry soil + can	21.68	22.02				
Wt. of can	1.24	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	47.7	47.4				
No. of blows, N	26	23				
	47.9	46.9				



Flow index F_i = ______

Liquid limit = 47.4

Plastic limit = 19.0

Plasticity index I_p = 28.4

CI/CH

Plastic Limit Determination

Can no.	C	~~B~~ D		
Wt. of wet soil + can	3.40	3.28		
Wt. of dry soil + can	3.07	2.94		
Wt. of can	1.24	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	18.0	20.0		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

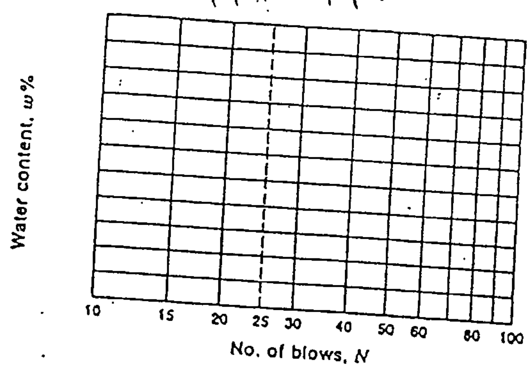
Location of Project ______ Boring No. 2-4C Sample No. ______

Description of Soil Gouge

Depth of Sample ______ Tested By ______ Date June 29/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	34.24	33.29				
Wt. of dry soil + can	23.10	22.45				
Wt. of can	1.25	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	51.0	51.1				
No. of blows, N	20	20				
	49.1	49.8				



Flow index F_i = ______

Liquid limit = 49.8

Plastic limit = 29.6

Plasticity index I_p = 20.2

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	6.99	6.87		
Wt. of dry soil + can	5.68	5.59		
Wt. of can	1.27	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	29.7	29.5		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. 6X04091

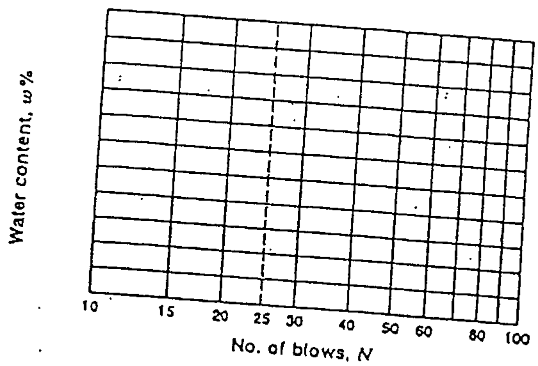
Location of Project ______ Boring No. ______ Sample No. 240

Description of Soil Shale Shear Plane, 29 June 2003

Depth of Sample ______ Tested By ______ Date ______

Liquid Limit Determination

Can no.	A	B			
Wt. of wet soil + can	22.98	30.43			
Wt. of dry soil + can	16.58	21.84			
Wt. of can	1.24	1.23			
Wt. of dry soil					
Wt. of moisture					
Water content, w%	41.6	41.6			
No. of blows, N	23	20			
	41.2	40.5			



Flow index F_i = ______

Liquid limit = 40.9

Plastic limit = 19.0

Plasticity index I_p = 21.9

CI

Plastic Limit Determination

Can no.	C	D		
Wt. of wet soil + can	3.86	3.71		
Wt. of dry soil + can	3.44	3.32		
Wt. of can	1.25	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	19.2	18.8		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. Gx04091

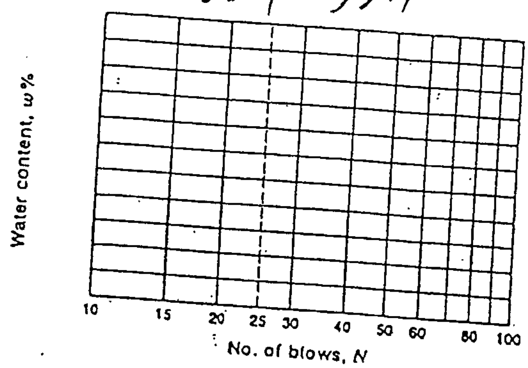
Location of Project ______ Boring No. 2-4I Sample No. ______

Description of Soil Shear Gouge

Depth of Sample ______ Tested By ______ Date July 23/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	32.30	29.98				
Wt. of dry soil + can	21.36	19.84				
Wt. of can	1.24	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	54.4	54.5				
No. of blows, N	30	30				
	55.7	55.7				



Flow index F_i = ______

Liquid limit = 55.7

Plastic limit = 30.4

Plasticity index I_p = 25.3

CK

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	7.13	7.98		
Wt. of dry soil + can	5.77	6.39		
Wt. of can	1.24	1.23		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	30.0	30.8		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

Location of Project ______ Boring No. 2-6A Sample No. ______

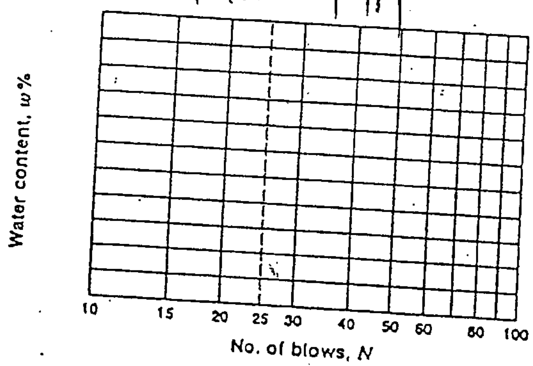
Description of Soil Failed Clay

Depth of Sample ______ Tested By ______ Date June 30/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	31.80	32.71				
Wt. of dry soil + can	21.97	22.60				
Wt. of can	1.24	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	47.4	47.4				
No. of blows, N	27	25				

47.8 47.4



Flow index F_i = ______

Liquid limit = 47.6

Plastic limit = 19.6

Plasticity index I_p = 28

[redacted]

CI/CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	9.33	10.25		
Wt. of dry soil + can	8.02	8.76		
Wt. of can	1.25	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	19.4	19.8		

amec

ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______________________

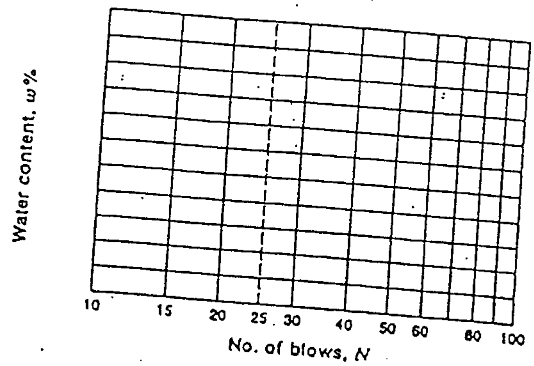
Location of Project ______________________ Job No. ~~70~~ GX04091

Description of Soil Shear Gouge in Shale Boring No. 2-6B Sample No. ________

Depth of Sample ____________ Tested By ____________ Date June 30/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	30.32	30.10				
Wt. of dry soil + can	21.50	21.12				
Wt. of can	1.25	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, $\omega\%$	43.6	45.7				
No. of blows, N	29	26				
	44.3	45.4				



Flow index F_i = ________

Liquid limit = 44.9

Plastic limit = 22.7

Plasticity index I_p = 22.2

CI

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	6.36	6.90		
Wt. of dry soil + can	5.85	5.42	6.36	6.90
Wt. of can	1.24	1.25	5.42	5.85
Wt. of dry soil			1.24	1.25
Wt. of moisture				
Water content, $\omega\% = \omega_p$	18.0	35.5	22.5	22.8

retest

amec

ATTERBERG LIMITS DETERMINATION

Project ______________________ Data Sheet 3

Location of Project ______________ Job No. GX04091

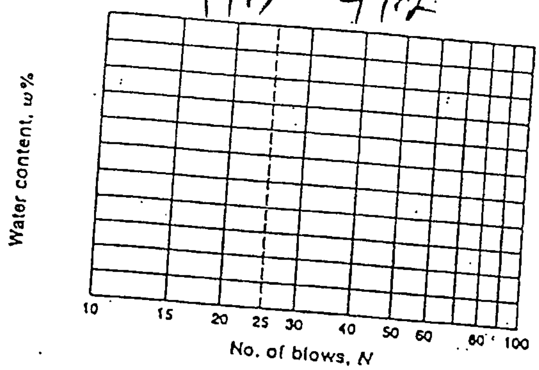
Description of Soil Upper Shear Plane Boring No. 2-8A Sample No. ______

Depth of Sample ______________ Tested By ______________ Date July 3/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	28.38	31.24				
Wt. of dry soil + can	19.52	21.44				
Wt. of can	1.24	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	48.5	48.5				
No. of blows, N	21	20				

47.5 47.2



Flow index F_t = ______

Liquid limit = 47.4

Plastic limit = 19.4

Plasticity index I_p = 28

C/CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	7.85	8.62		
Wt. of dry soil + can	6.78	7.42		
Wt. of can	1.25	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	19.3	19.4		

amec

ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. 4091

Location of Project ______ Boring No. 2-8AA

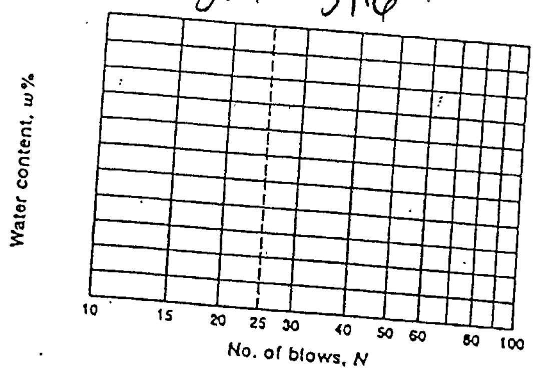
Description of Soil Intact Clay II Sample No. ______

Depth of Sample ______ Tested By ______ Date ______

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	27.27	28.55				
Wt. of dry soil + can	18.46	19.32				
Wt. of can	1.24	1.26				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	51.2	51.1				
No. of blows, N	22	27				

50.1 51.6



Flow index F_t = ______

Liquid limit = 50.9

Plastic limit = 19.6

Plasticity index I_p = 31.3

[redacted]

CI/CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	4.52	5.31		
Wt. of dry soil + can	3.98	4.65		
Wt. of can	1.24	1.26		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	19.7	19.5		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____________ Job No. GX04091

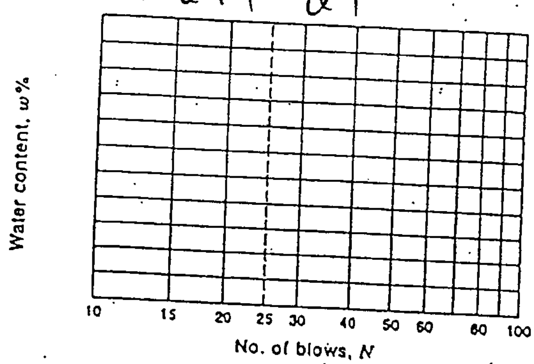
Location of Project ____________ Boring No. 2-8B Sample No. ______

Description of Soil Intact Clay Bengath Shear (5cm)

Depth of Sample ______ Tested By ______ Date July 3/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	30.27	30.01				
Wt. of dry soil + can	18.24	18.67				
Wt. of can	1.24	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	70.8	70.8				
No. of blows, N	22	20				
	69.7	69				



Flow index F_i = ______

Liquid limit = 69.4

Plastic limit = 21.2

Plasticity index I_p = 48.2

CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	6.13	4.99		
Wt. of dry soil + can	5.28	4.33		
Wt. of can	1.23	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, w% = w_p	21	21.4		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____________________ Job No. 6X04091

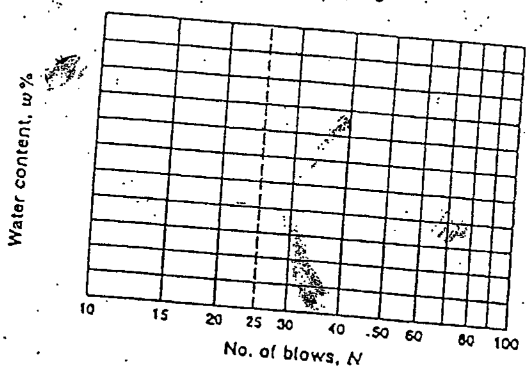
Location of Project ____________________

Description of Soil Lower Slide Plane, 3 July 2003 Boring No. ________ Sample No. 2-8D

Depth of Sample ________ Tested By ________ Date 9 Dec 03

Liquid Limit Determination

Can no.	A	B				
Wt. of wet soil + can	25.48	24.23				
Wt. of dry soil + can	17.67	16.82				
Wt. of can	1.25	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	47.6	47.6				
No. of blows, N	24	26				
	47.4	47.8				



Flow index F_i = ______

Liquid limit = 47.6

Plastic limit = 21.2

Plasticity index I_p = 26.4

CI

Plastic Limit Determination

Can no.	C	D		
Wt. of wet soil + can	[redacted] 6.86	[redacted] 6.44		
Wt. of dry soil + can	5.81	5.60		
Wt. of can	1.26	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	23.1	19.3		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

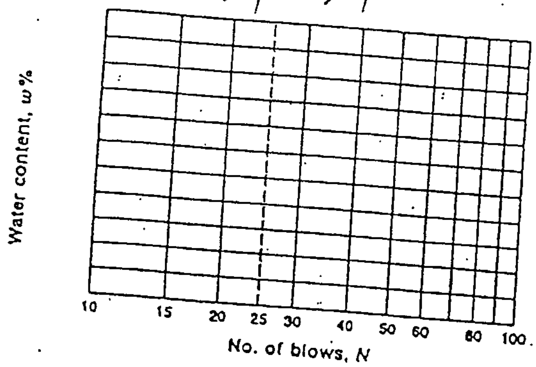
Location of Project ______

Description of Soil Shear Plane/CS Boring No. 3-1A Sample No. ______

Depth of Sample ______ Tested By ______ Date ______

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	31.56	38.08				
Wt. of dry soil + can	21.13	25.36				
Wt. of can	1.25	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	52.5	52.8				
No. of blows, N	29	30				
	53.4	54				



Flow index F_i = ______

Liquid limit = 53.7

Plastic limit = 19.9

Plasticity index I_p = 33.8

CYCH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	5.62	7.54		
Wt. of dry soil + can	4.90	6.49		
Wt. of can	1.25	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	19.7	20.0		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

Location of Project ______ Boring No. 3-5A Sample No. ______

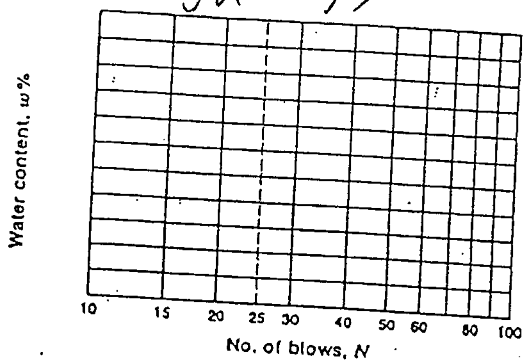
Description of Soil Adjacent Shear

Depth of Sample ______ Tested By ______ Date July 8/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	29.03	25.79				
Wt. of dry soil + can	19.26	17.17				
Wt. of can	1.25	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	54.2	54.1				
No. of blows, N	20	21				

52.8 53



Flow index F_I = 52.9

Liquid limit = 52.9

Plastic limit = 18.2

Plasticity index I_P = 34.7

CL/CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	4.03	3.88		
Wt. of dry soil + can	3.60	3.48		
Wt. of can	1.26	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	18.4	17.9		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____________ Job No. 6X04091

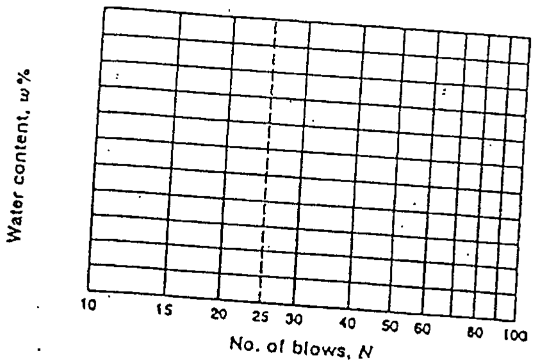
Location of Project ____________

Description of Soil Gauge 8 July 2003 Boring No. ______ Sample No. 3-53

Depth of Sample ______ Tested By ______ Date 9 Dec 2003

Liquid Limit Determination

Can no.	A	B				
Wt. of wet soil + can	31.83	33.78				
Wt. of dry soil + can	21.13	22.50				
Wt. of can	1.25	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	53.8	53.1				
No. of blows, N	21	20				
	52.6	51.7				



Flow index F_i = ______

Liquid limit = 52.3

Plastic limit = 22.9

Plasticity index I_p = 29.4

Cl/CH

Plastic Limit Determination

Can no.	C	D		
Wt. of wet soil + can	5.85	5.22		
Wt. of dry soil + can	5.00	4.48		
Wt. of can	1.25	1.26		
Wt. of dry soil				
Wt. of moisture				
Water content, w% = w_p	22.7	23.0		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

Location of Project ______ Boring No. 3-13A Sample No. ______

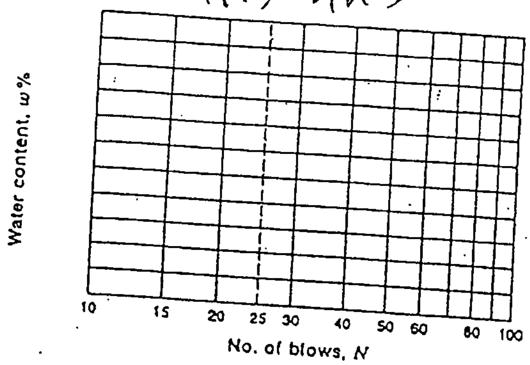
Description of Soil Remolded Shale

Depth of Sample ______ Tested By ______ Date July 12/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	35.76	34.56				
Wt. of dry soil + can	25.49	24.66				
Wt. of can	1.25	1.26				
Wt. of dry soil						
Wt. of moisture						
Water content, $w\%$	42.4	42.3				
No. of blows, N	21	25				

41.5 42.3



Flow index F_i = ______

Liquid limit = 41.9

Plastic limit = 18

Plasticity index I_p = 23.9

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	5.11	7.27		
Wt. of dry soil + can	4.52	6.35		
Wt. of can	1.25	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	18	14		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. 4091

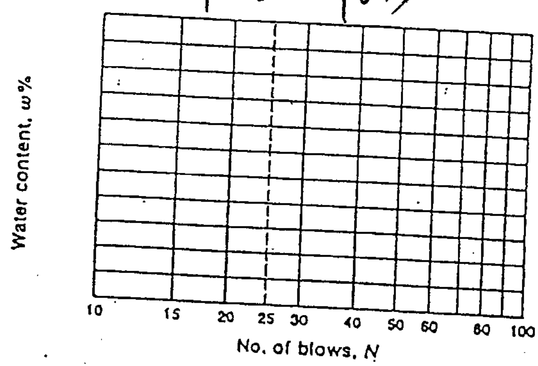
Location of Project Shale Shear Boring No. 3-14A Sample No. ______

Description of Soil ______

Depth of Sample ______ Tested By ______ Date July 13/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	33.69	34.74				
Wt. of dry soil + can	24.47	25.24				
Wt. of can	1.23	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	39.1	39.6				
No. of blows, N	30	30				
	40.6	40.5				



Flow index F_i = ______

Liquid limit = 40.6

Plastic limit = 19.9

Plasticity index I_p = 20.7

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	6.44	6.96		
Wt. of dry soil + can	5.58	6.01		
Wt. of can	1.23	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	19.8	20.		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____________ Job No. GX04091

Location of Project ____________ Boring No. 3-14B Sample No. ______

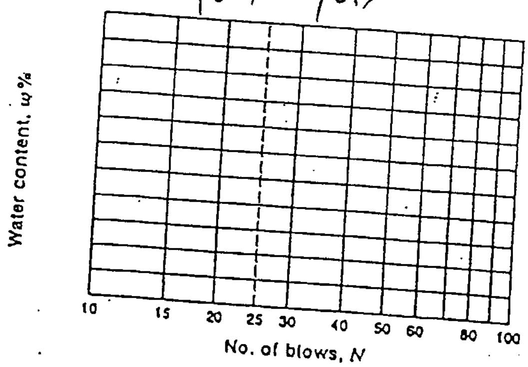
Description of Soil Remolded Clay? Middle Material

Depth of Sample ______ Tested By ______ Date July 13/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	32.09	34.67				
Wt. of dry soil + can	23.11	24.93				
Wt. of can	1.24	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	41.1	41.1				
No. of blows, N	23	22				

40.7 40.5



Flow index F_i = 40.6

Liquid limit = 40.6

Plastic limit = 19.2

Plasticity index I_p = 21.4

Cl

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	7.92	11.27		
Wt. of dry soil + can	6.86	9.64		
Wt. of can	1.24	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	18.9	19.4		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

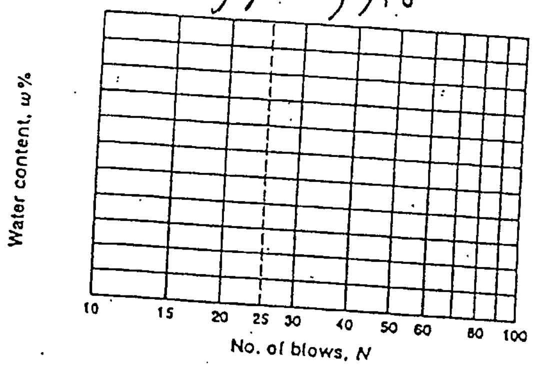
Location of Project ______ Boring No. 3-15A Sample No. ______

Description of Soil Shale Shear

Depth of Sample ______ Tested By ______ Date July 13/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	30.22	28.12				
Wt. of dry soil + can	19.88	18.53				
Wt. of can	1.24	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	55.5	55.5				
No. of blows, N	23	26				
	55	55.8				



Flow index F_i = 55.4

Liquid limit = 55.4

Plastic limit = 15.9

Plasticity index I_p = 39.5

CH [redacted]

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	10.59	10.85		
Wt. of dry soil + can	9.31	9.53		
Wt. of can	1.24	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	15.9	15.9		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______________________ Job No. GX04091

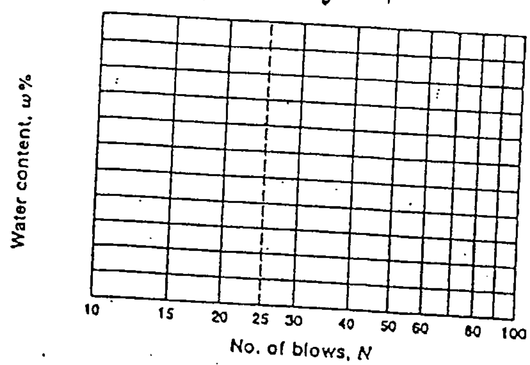
Location of Project ______________________ Boring No. 3-15B Sample No. ________

Description of Soil Remolded Shale

Depth of Sample ____________ Tested By ______________ Date July 13/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	26.48	26.87				
Wt. of dry soil + can	15.29	15.41				
Wt. of can	1.25	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	79.7	80.9				
No. of blows, N	21	30				
	78.0	82.1				



Flow index F_i = 80.4

Liquid limit = 80.4

Plastic limit = 29.6

Plasticity index I_p = 50.8

CH [redacted]

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	5.66	4.57		
Wt. of dry soil + can	4.99	4.06		
Wt. of can	1.26	1.25		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	18	18.1		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______________________ Job No. GX04091

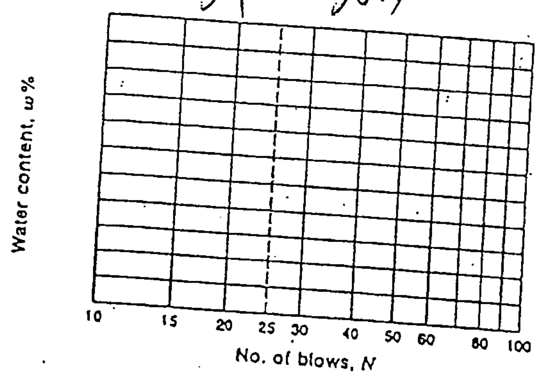
Location of Project ______________________ Boring No. 4-2A Sample No. ________

Description of Soil 105 Shear

Depth of Sample ____________ Tested By ____________ Date July 19/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	33.41	36.96				
Wt. of dry soil + can	24.44	27.00				
Wt. of can	1.24	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	38.1	38.1				
No. of blows, N	27	24				
	39	384				



Flow index F_i = ________

Liquid limit = 38.8

Plastic limit = 14.6

Plasticity index I_p = 24.2

a [redacted]

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	7.54	6.19		
Wt. of dry soil + can	6.73	5.57		
Wt. of can	1.25	1.23		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	14.8	14.3		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX040091

Location of Project ______ Boring No. 4-2B Sample No. ______

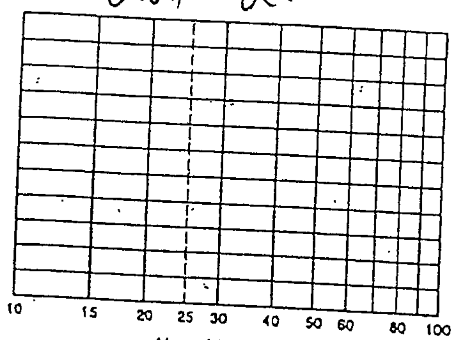
Description of Soil Intact Clay

Depth of Sample ______ Tested By ______ Date July 9/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	36.06	36.97				
Wt. of dry soil + can	28.28	28.99				
Wt. of can	1.25	1.23				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	28.8	28.7				
No. of blows, N	20	20				

28.1 28



Flow index F_I = ______

Liquid limit = 28.1

Plastic limit = 19.9

Plasticity index I_P = 8.2

CV [redacted]

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	13.27	10.58		
Wt. of dry soil + can	11.26	9.05		
Wt. of can	1.24	~~[illegible]~~ 1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	20.1	19.6		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. GX04091

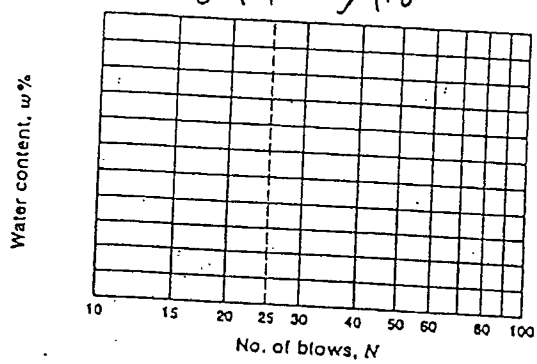
Location of Project ______ Boring No. 4-4A Sample No. ______

Description of Soil Shear Upper ICS

Depth of Sample ______ Tested By ______ Date July 22/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	29.06	~~[illegible]~~ 32.63				
Wt. of dry soil + can	19.00	21.26				
Wt. of can	1.24	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	56.6	56.8				
No. of blows, N	27	29				
	57.1	57.8				



Flow index F_I = 57.5

Liquid limit = 57.5

Plastic limit = 22.7

Plasticity index I_P = 34.8

CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	5.39	7.48		
Wt. of dry soil + can	4.63	6.32		
Wt. of can	1.25	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	22.5	22.9		

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ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ______ Job No. Gx04091

Location of Project ______ Boring No. 4-4B Sample No. ______

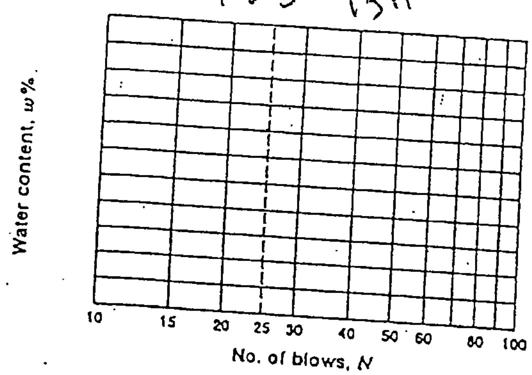
Description of Soil Shear ICS

Depth of Sample ______ Tested By ______ Date July 22/03

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	27.57	27.53				
Wt. of dry soil + can	16.26	16.25				
Wt. of can	1.25	1.24				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	75.3	75.1				
No. of blows, N	20	20				

73.3 73.1



Flow index F_i = ______

Liquid limit = 73.2

Plastic limit = 20.7

Plasticity index I_p = 52.5

[redacted] CH

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	4.71	5.46		
Wt. of dry soil + can	4.12	4.73		
Wt. of can	1.24	1.23		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_p$	20.5	20.9		

amec

ATTERBERG LIMITS DETERMINATION

Data Sheet 3

Project ____________ Job No. GX04091

Location of Project ____________ Boring No. P1-1A Sample No. ____________

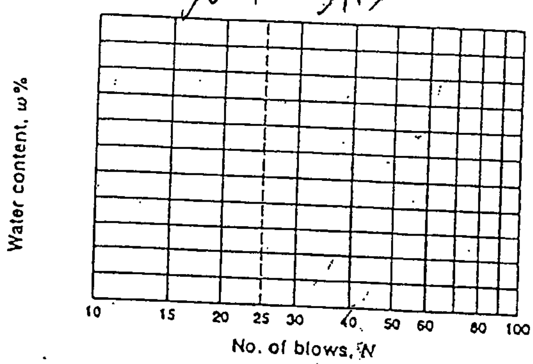
Description of Soil Shear Plane

Depth of Sample ____________ Tested By ____________ Date June 24

Liquid Limit Determination

Can no.	1	2				
Wt. of wet soil + can	29.41	27.41				
Wt. of dry soil + can	19.94	18.62				
Wt. of can	1.25	1.25				
Wt. of dry soil						
Wt. of moisture						
Water content, w%	50.1	50.6				
No. of blows, N	25	29				

50.1 51.5



Flow index F_I = ____

Liquid limit = 51.1

Plastic limit = 18.1

Plasticity index I_P = 33

CL/CH [redacted]

Plastic Limit Determination

Can no.	3	4		
Wt. of wet soil + can	5.88	5.29		
Wt. of dry soil + can	5.17	4.67		
Wt. of can	1.24	1.24		
Wt. of dry soil				
Wt. of moisture				
Water content, $w\% = w_P$	18.1	18.1		

APPENDIX II

Air Photograph List

Appendix II - Table 1
Air Photograph Sets Used during Initial Investigation

Refernce Area	Flight Line No.	Photograph No.
Peace River	BC 86047	60 - 64, 75 - 82, 87 - 97, 102 - 108, 122 - 133, 139, 140, 155 - 162
Beatton River	BC 86047	90 - 92, 132 - 136, 150 - 154
	BC 86075	15 - 18, 61, 62, 81 - 83
	BC 86074	163 - 166, 209 - 211, 232 - 234, 253, 254
Southern Tributaries	BC 86047	60 - 82, 88 - 103, 125 - 131
Beatton River - East	BC 86047	87, 88, 136 - 140, 145 - 148
	BC 86075	8 - 15, 61 - 69, 75 - 79
	BC 86074	254 - 261, 226 - 231, 213 - 218, 267 - 273
Halway River - West	BC 86047	105 - 110, 118 - 125, 162 - 168
	BC 86075	26 - 32, 47- 52, 151 - 155
	BC 86099	171 - 173
Halfway River to Beatton River	BC 86047	153 - 162
	BC 86075	16 - 28, 51 - 61, 87 - 91, 136 - 149
	BC 86074	151 - 165, 181 - 210, 232 - 238, 244 - 250
	BC 86099	173 - 177

Appendix II - Table 2
Air Photograph Sets Used during Activity Determination

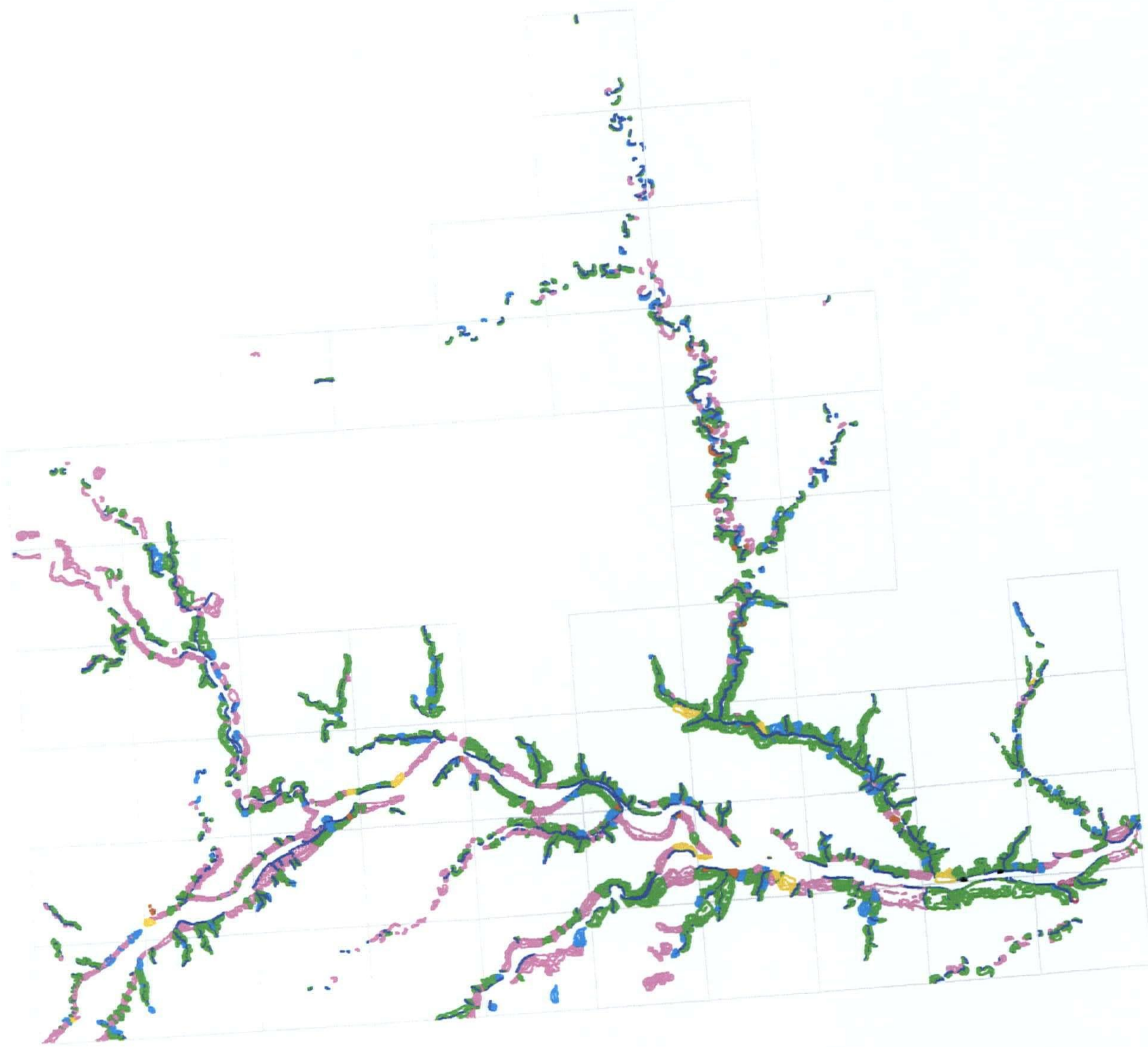
Date	Flight Line No.	Photograph No.
1997	30BCC 97159	1 - 290
1945	A 7904	71 -75
	A 8000	30 - 55, 60 - 66, 68 - 72, 74 - 97
	A 8001	1 - 6
	A 8002	100 - 106
	A 8050	1 - 6, 38 -55, 70 - 84
	A 8101	1 - 10
	A 8103	57 - 66
	A 8104	1 - 34, 61 - 70, 77 - 108
	A 8105	5 - 26, 37 - 44
	A 8108	80 - 101
	A 8109	17 - 30
	A 8109	20 - 30, 44 - 47, 56 - 78, 80 - 92
	A 8141	16 - 35
	A 8145	8 - 16, 28 - 38, 45 - 59, 69 - 79, 88 - 97
	A 8146	9 - 14, 24 - 29, 56 - 73
	A 8148	1 - 10. 18 - 35, 49 - 53, 65 - 77
	A 8149	14 - 30, 43 - 48, 58 - 67, 73 - 75, 77 - 80, 82 - 84, 89 - 92
	A 8150	14 - 26, 40 - 50, 80 - 88
	A 8151	5 - 15, 27 - 55, 61 - 71
	A 8153	17 -21, 25 - 33, 37 - 39, 81 - 86
	A 8155	13 - 25, 40 - 57, 60 - 80
	A 8156	26 - 29, 34 - 44
	A 8288	1 - 14, 17 - 29, 43 - 47, 53 - 64, 88 - 96
	A 8291	22 - 25, 29 - 32, 38 - 41, 52 - 54, 58 - 60, 85 - 95
	A 8292	45 - 56
	A 8294	5 - 15, 25 - 40, 57 - 70, 74 - 78
	A 8296	3 - 10
	A 8302	3 - 23, 80 - 89
	A 8305	3 - 20, 65 - 76
	A 8349	38 - 47
	A 8350	46 - 60
	A 8353	70 - 75
	A 8402	1 - 10, 20 - 43, 53 - 59
	A 8403	1 - 26, 40 - 54
	A 8404	15 - 23, 47 - 52, 57 - 72
	A 8407	10 - 15, 74 - 80
	A 8410	27 - 33
	A 8411	59 - 64
	A 8440	3 - 18
	A 8450	42 - 45
	A 8504	74 - 77, 80 - 85
	A 8507	5 - 12
	A 8514	1 - 10
	A 8528	50 - 60, 65 - 74
	A 8531	27 - 36, 46 - 56
	A 8532	32 - 45, 76 - 80
	A 8537	62 - 68
	A 8540	55 - 67
	A 8541	76 - 81
	A 8542	66 - 72
	A 8543	69 - 74
	A 8544	15 - 24
	A 8577	1 - 5
	A 8580	10 - 15
	A 8587	76 - 83
	A 8597	17 - 23
	A 8598	67 - 70
	A 8600	39 - 45
	A 9111	11 - 17
	A 9137	15 - 18
	A 10429	5 - 12
	A 10431	33 - 37, 51 -55
	A 10434	56 - 67
	A 10457	65 - 69
	A 10461	1 - 10, 24 - 31

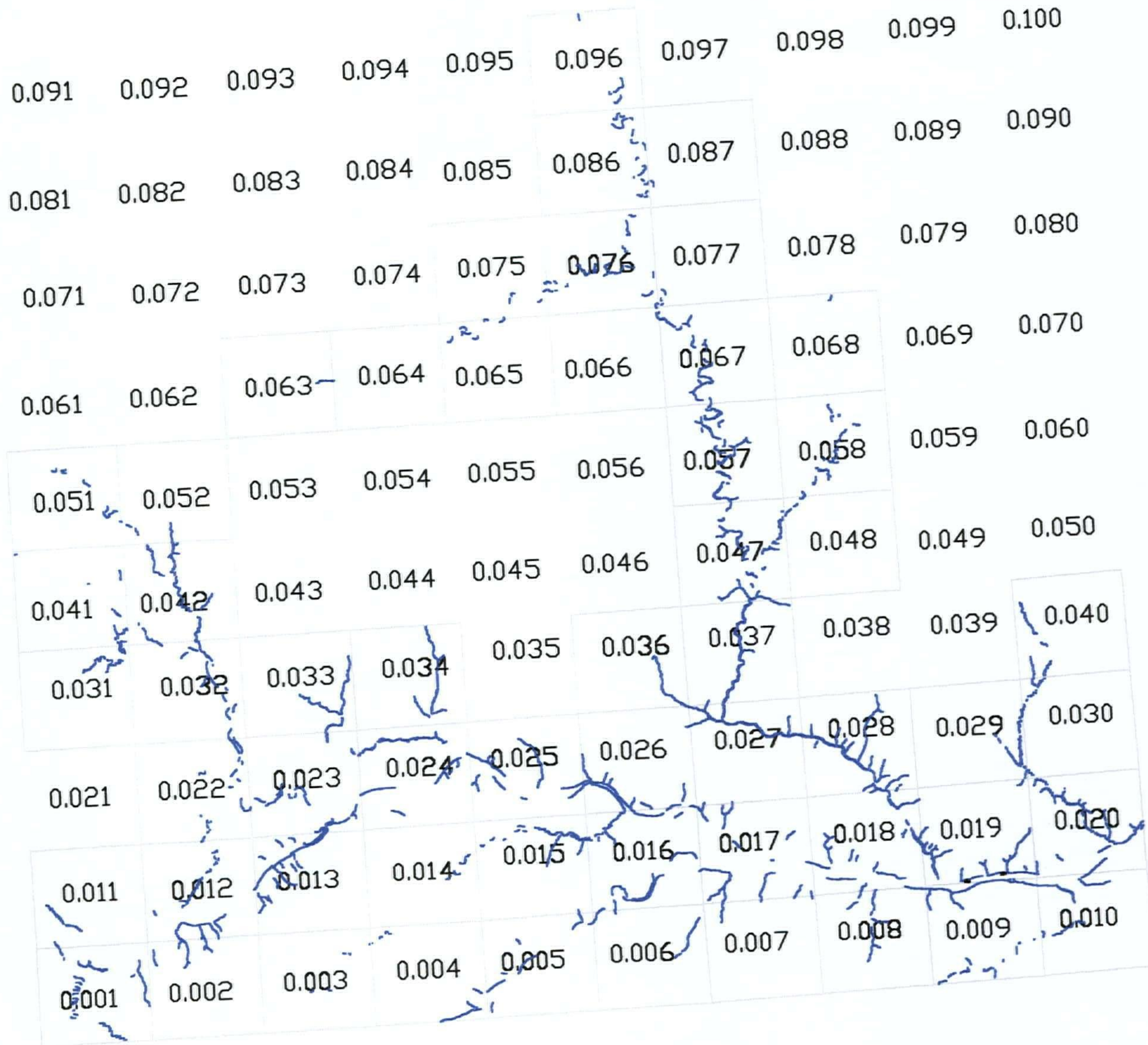
APPENDIX III

Landslide Maps

Region

Individual TRIM Sheets





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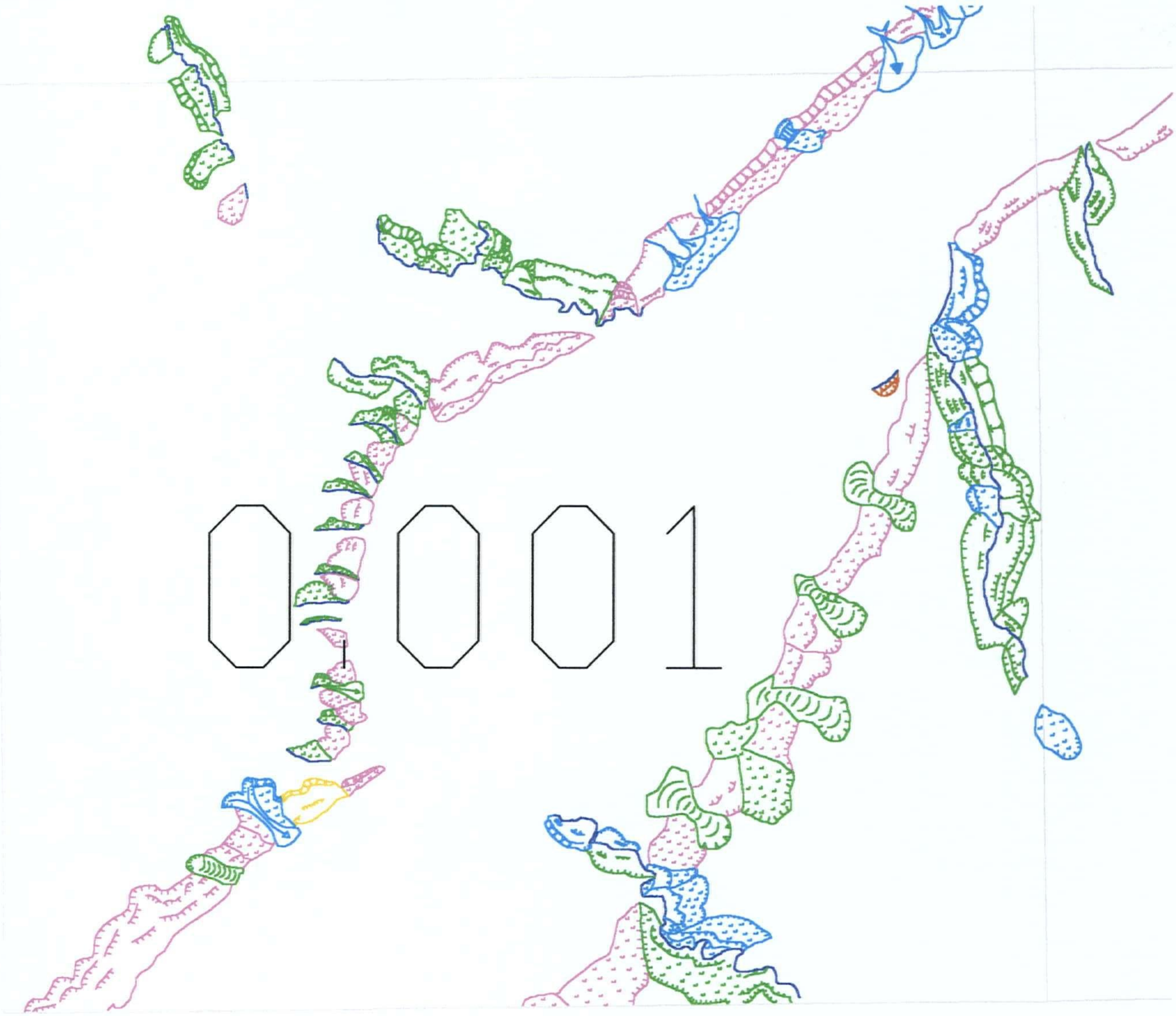
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Intact Silt
and clay
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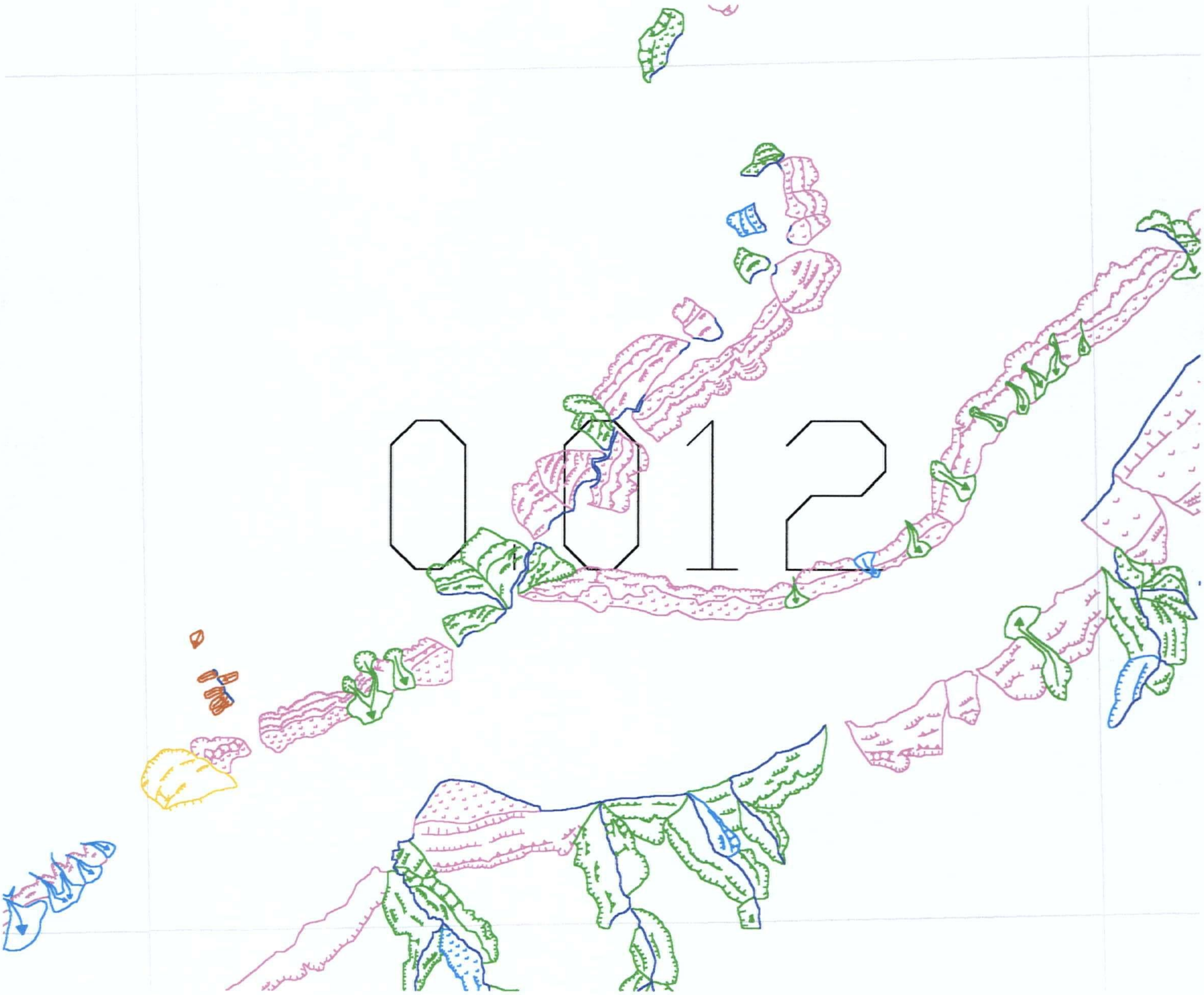
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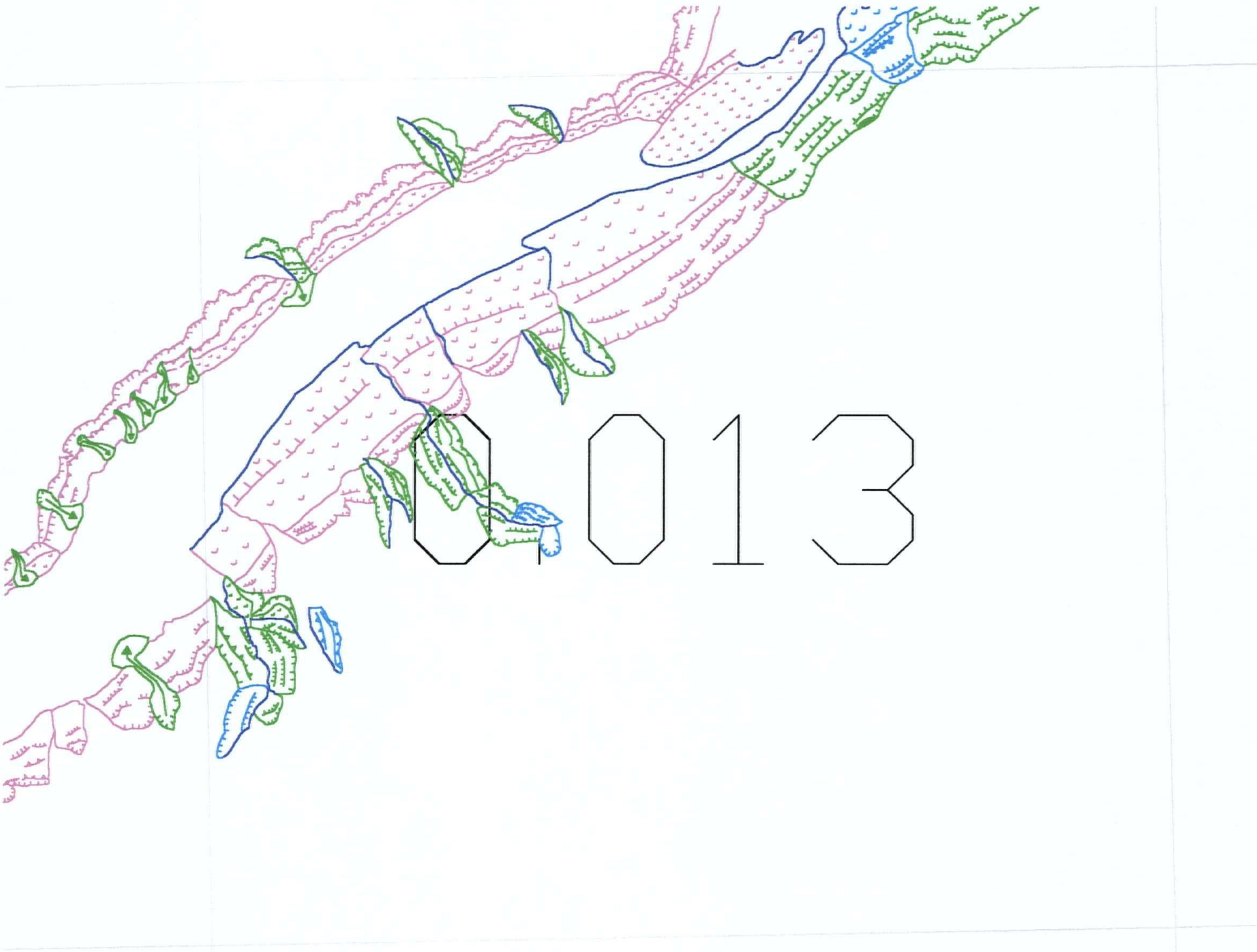
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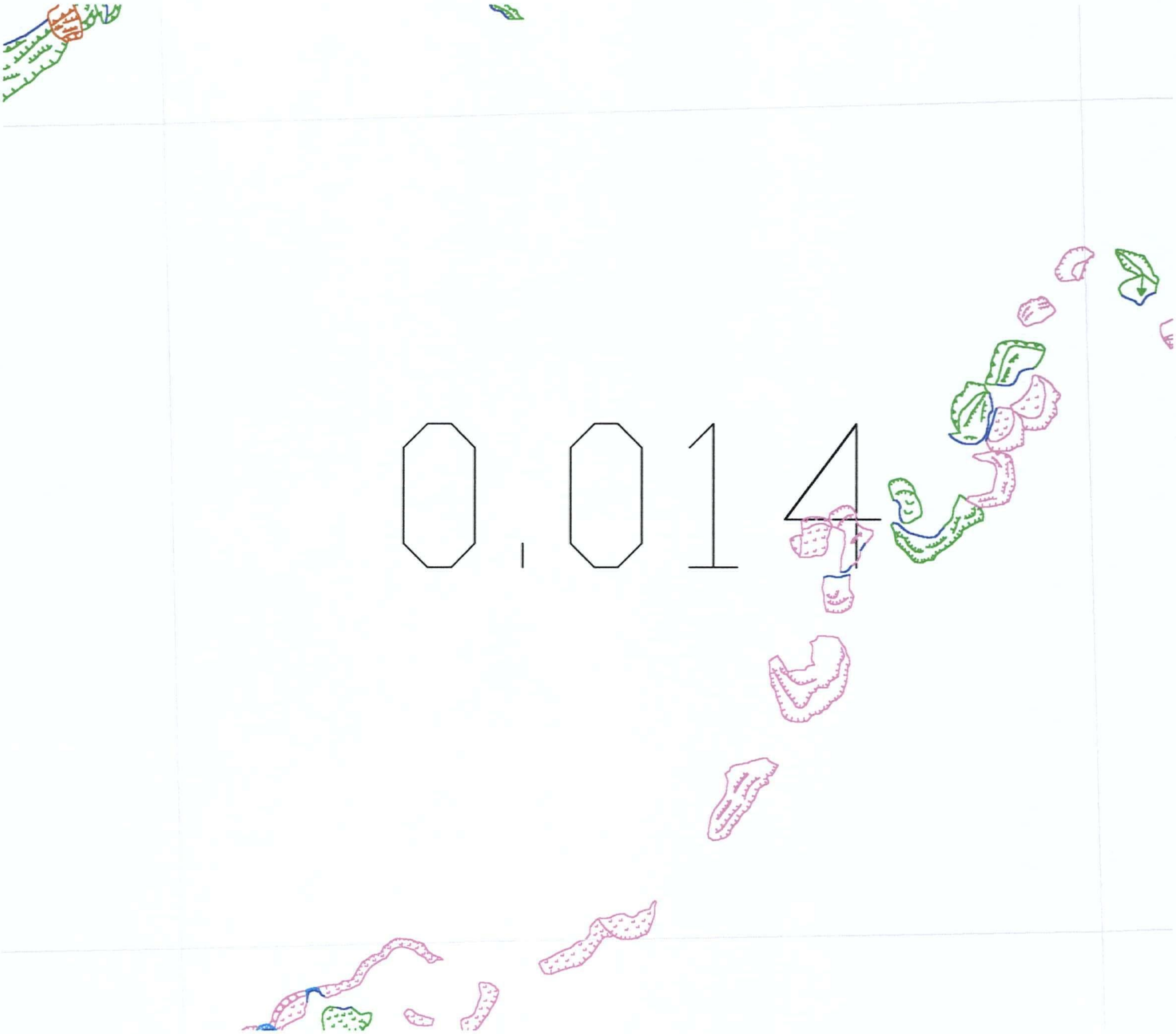
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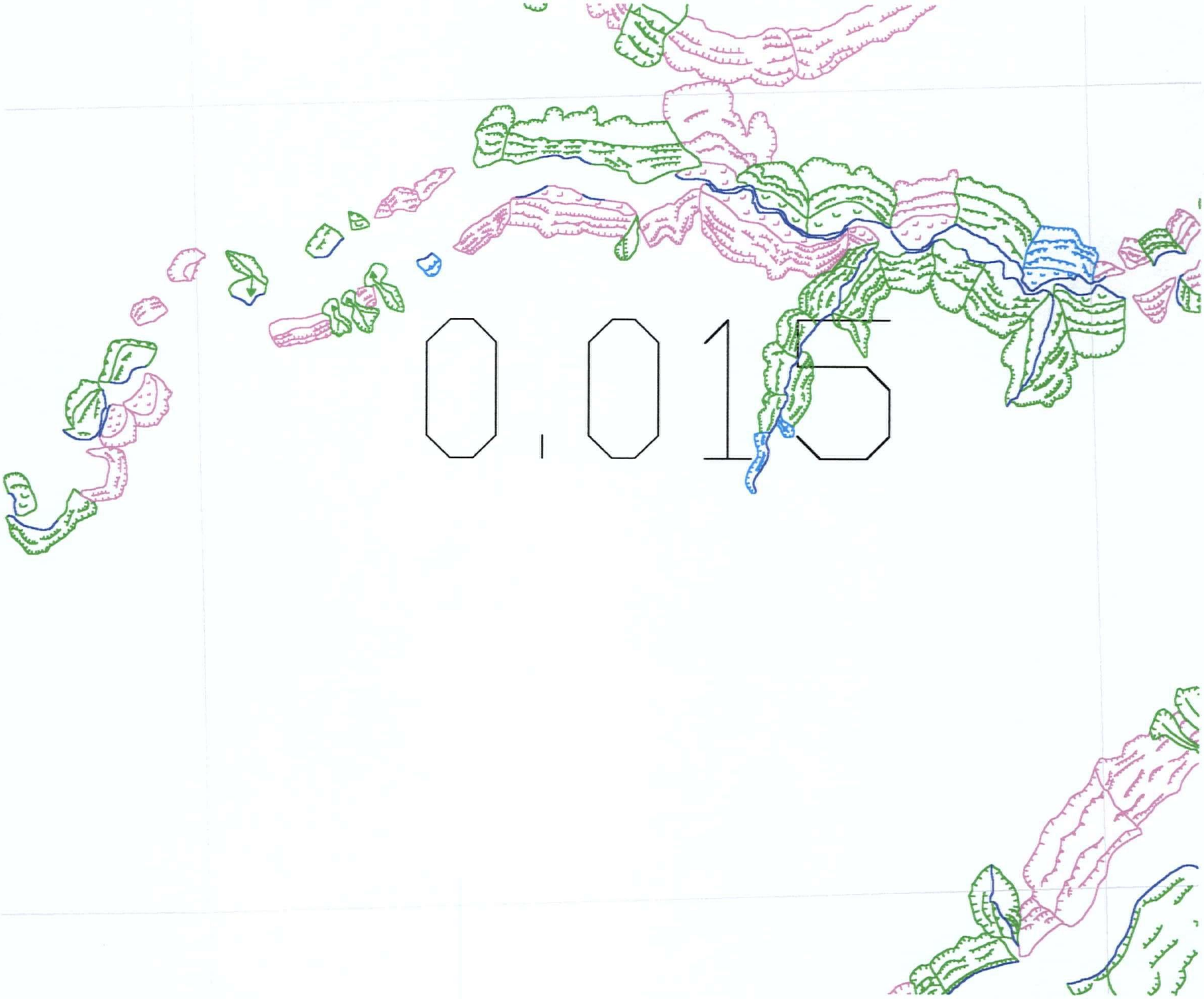

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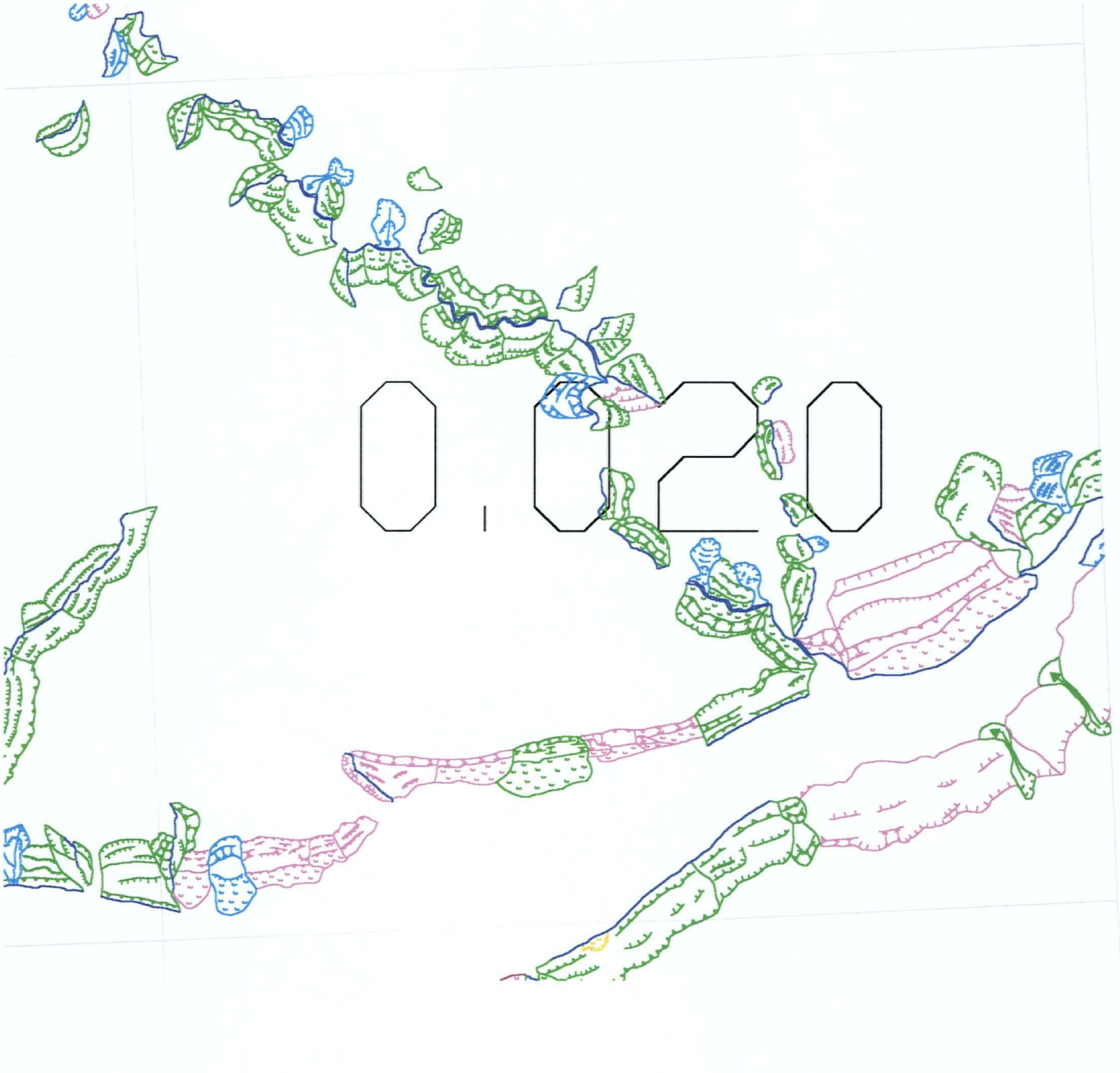
Intact Silt
and clay
Debris on
shale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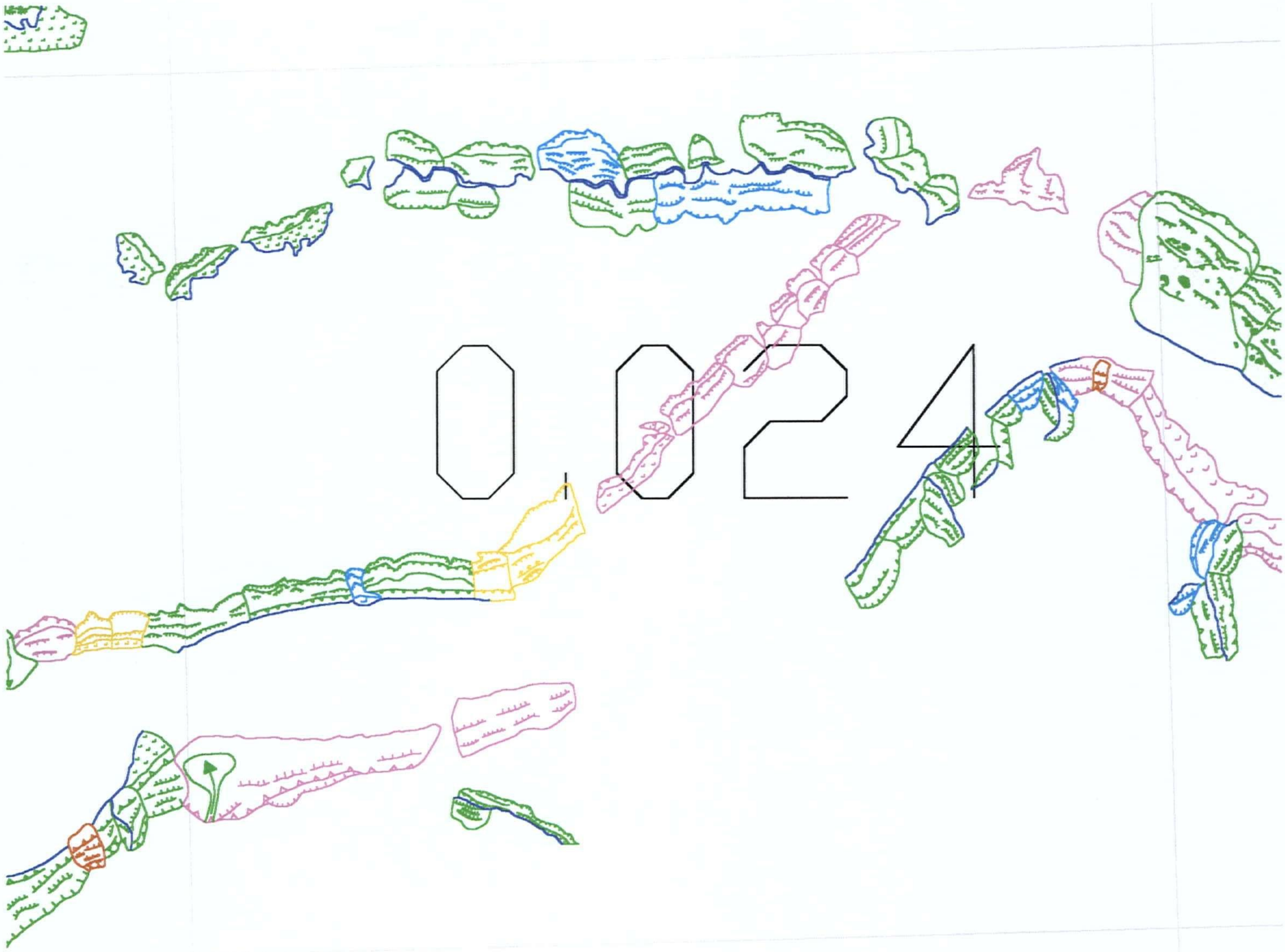
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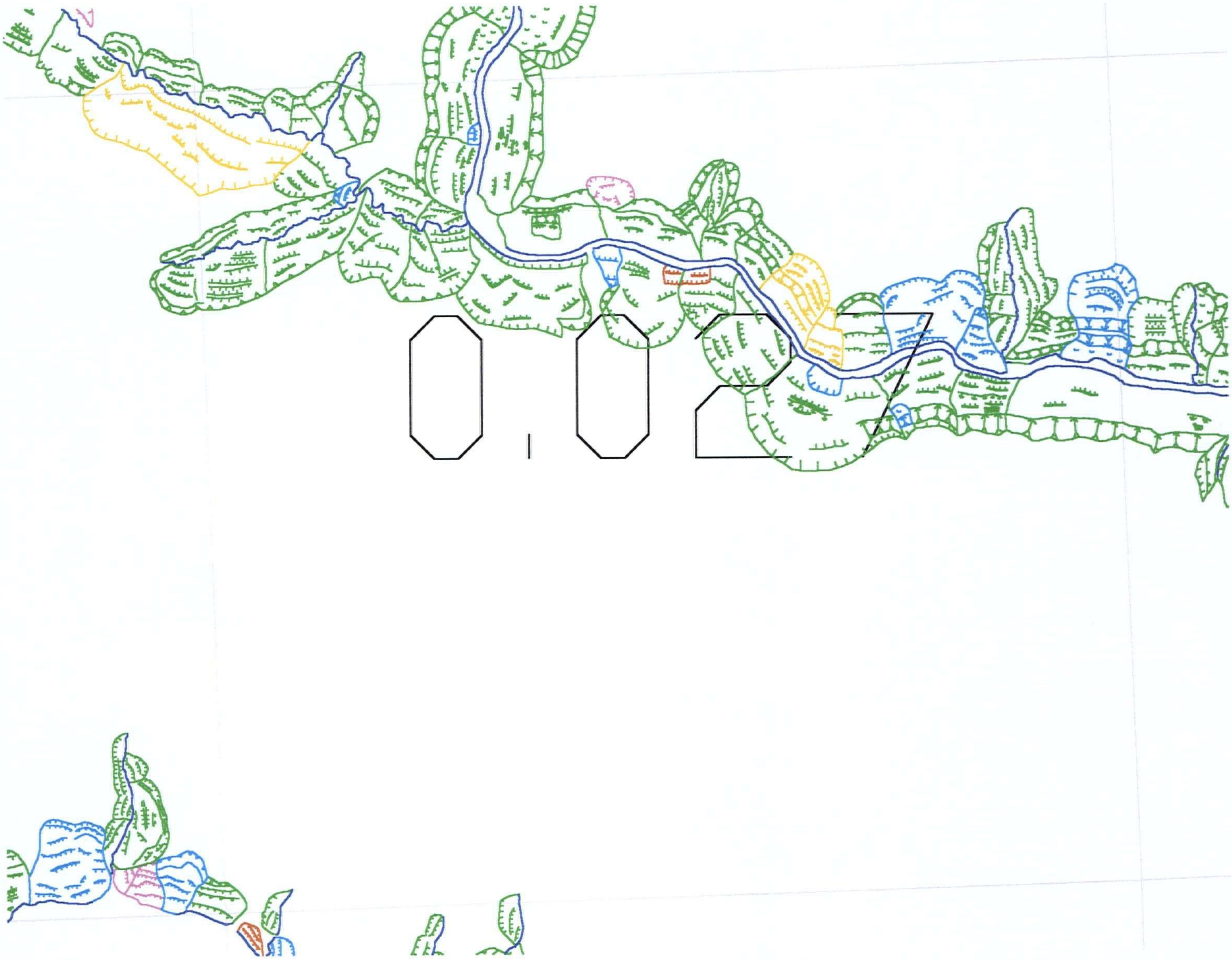
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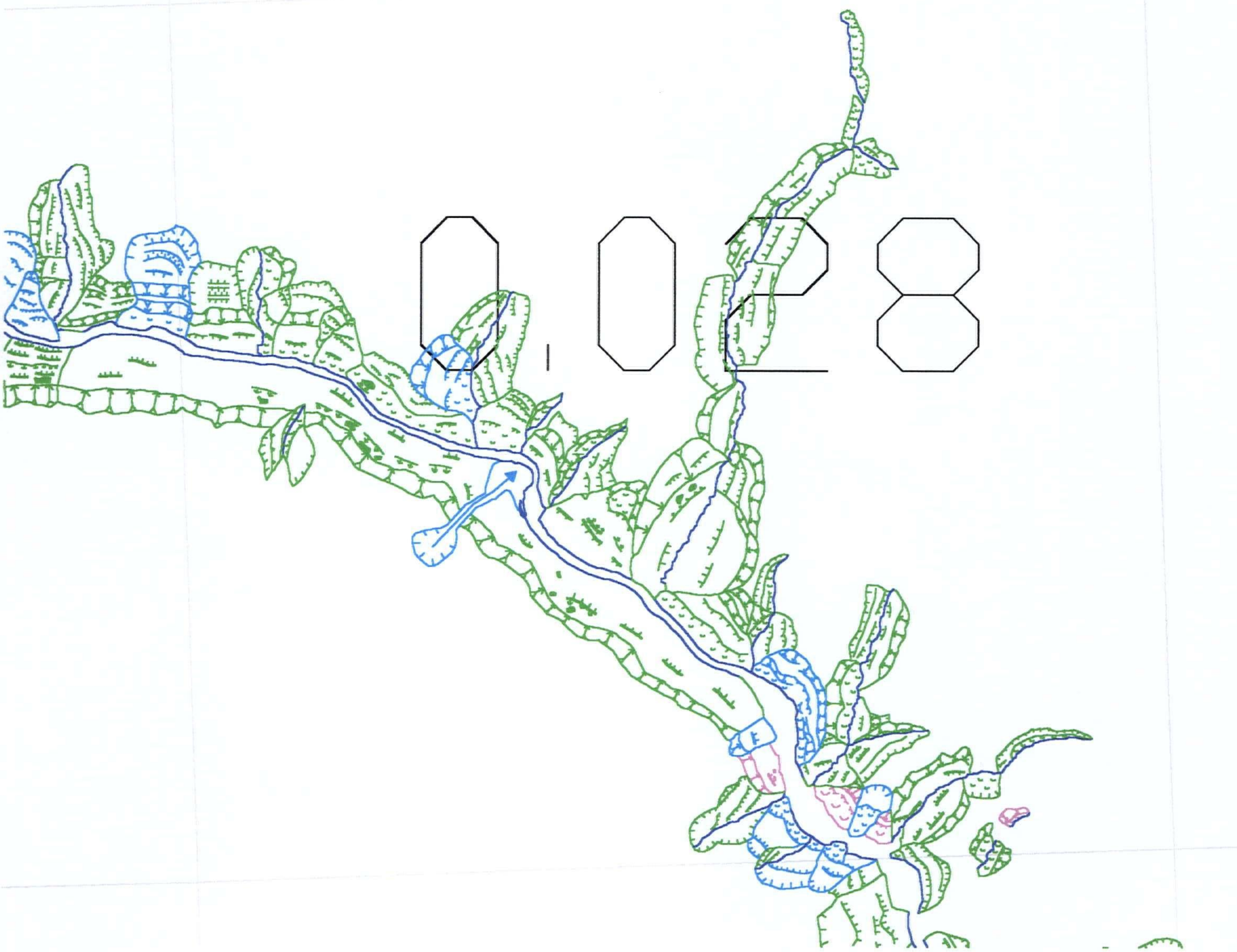
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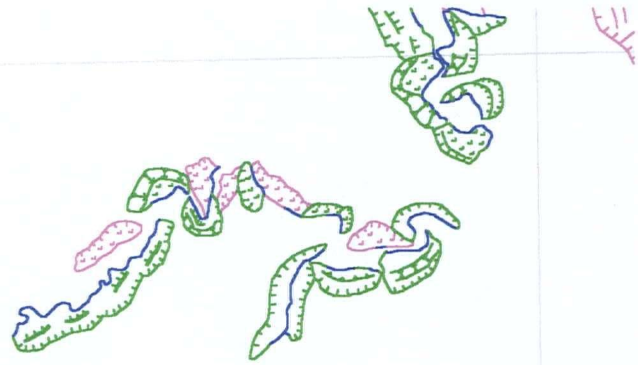

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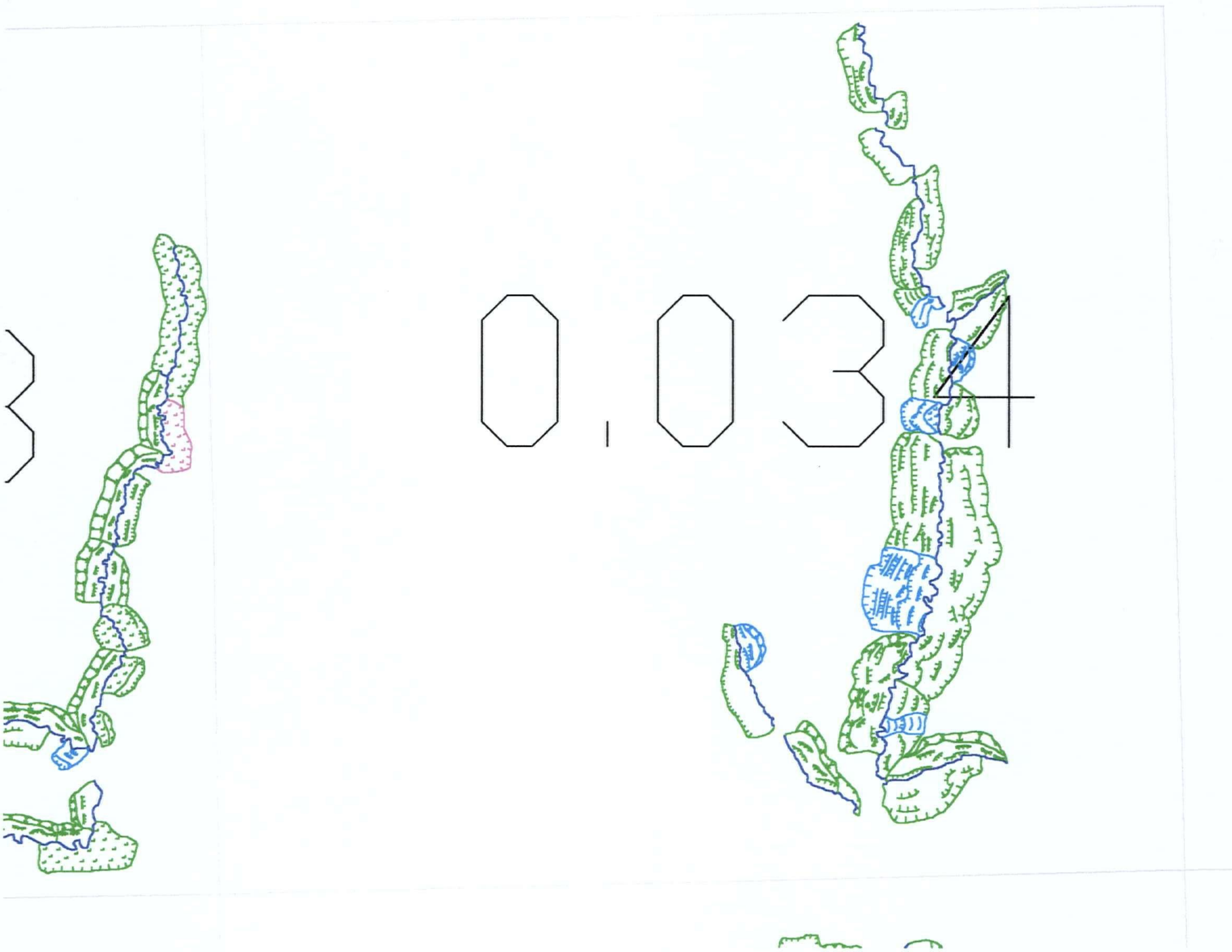
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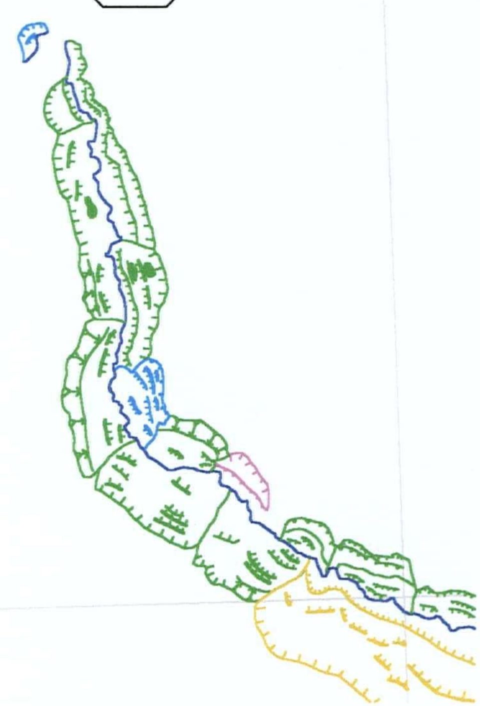

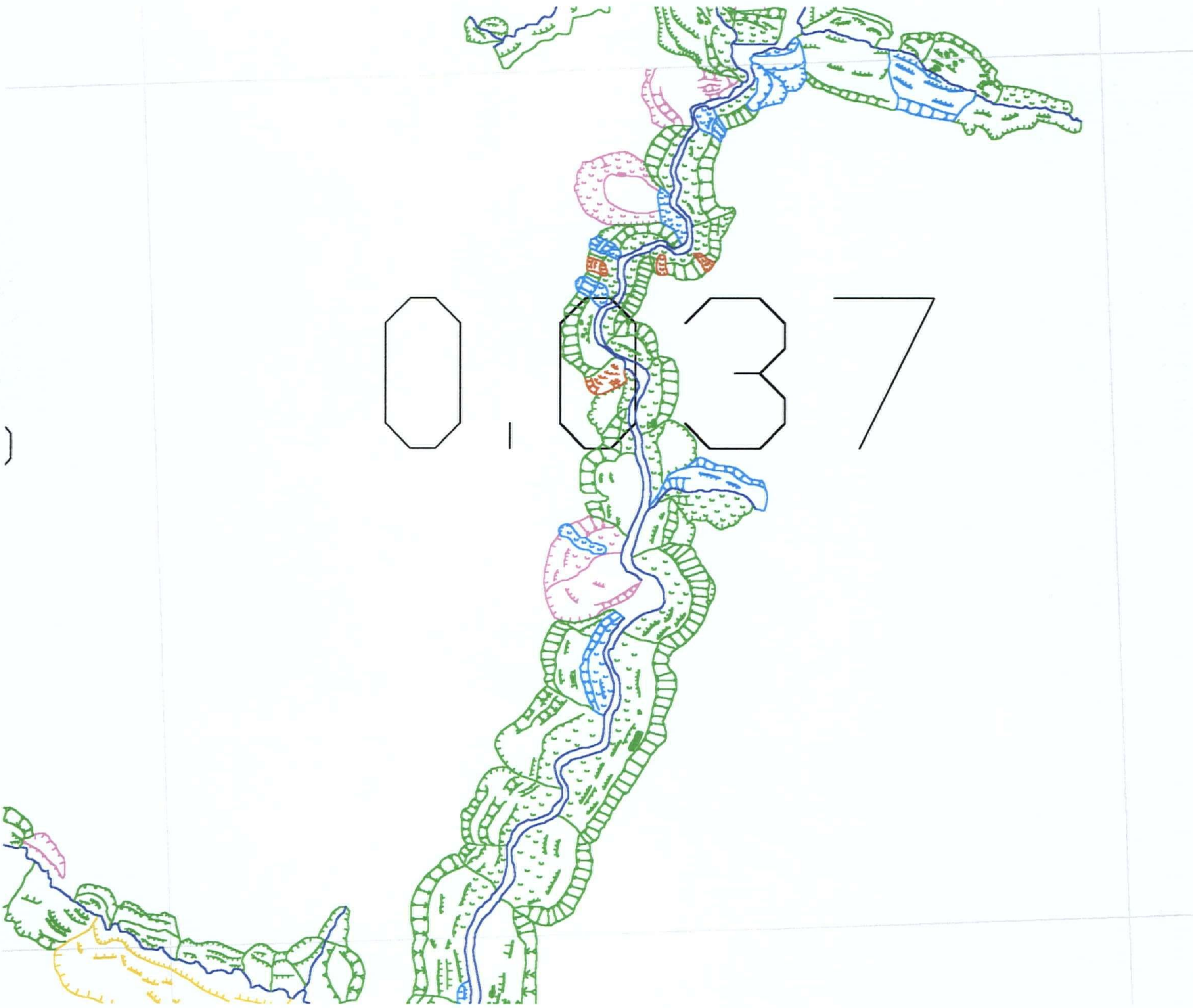
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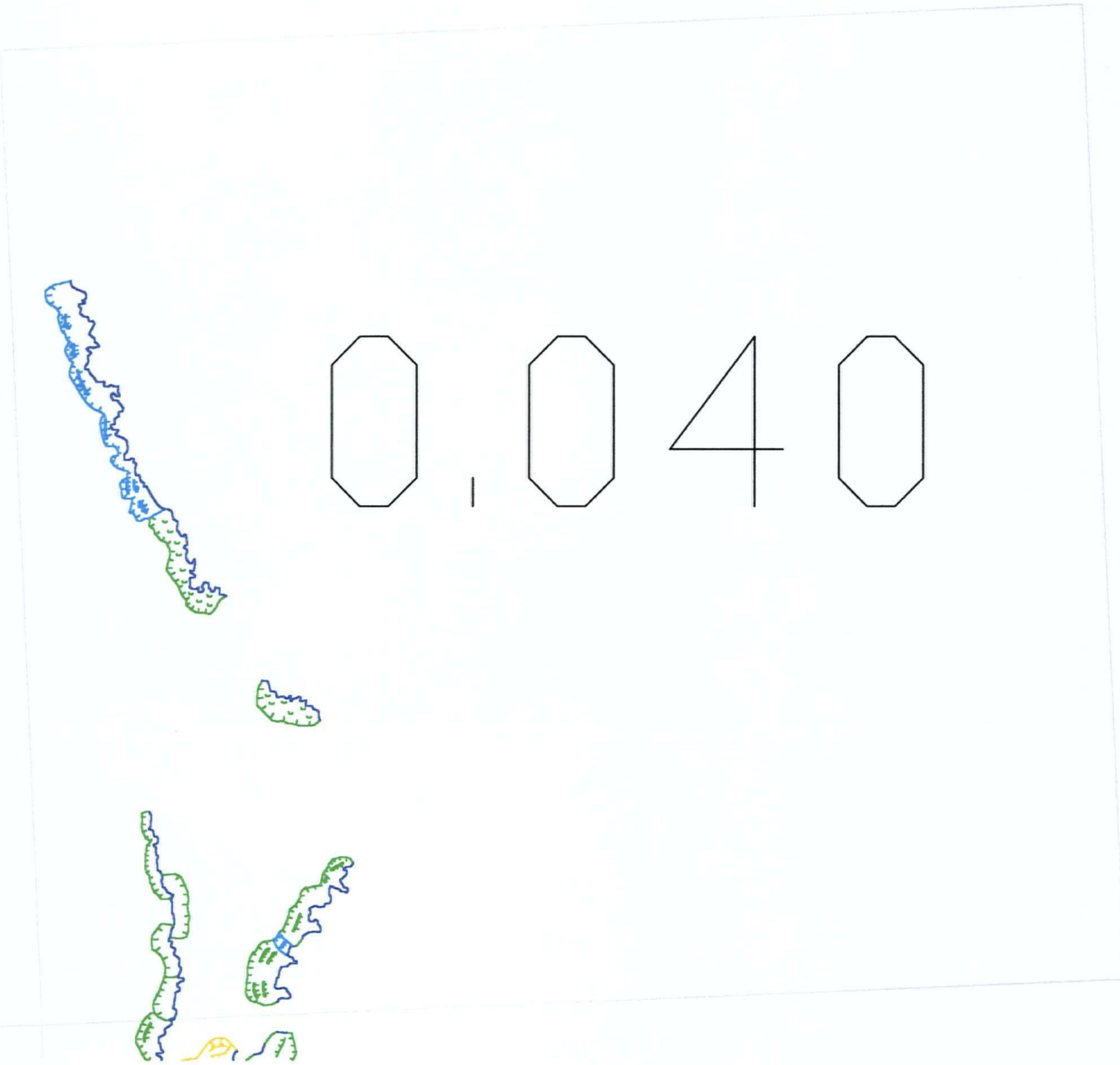
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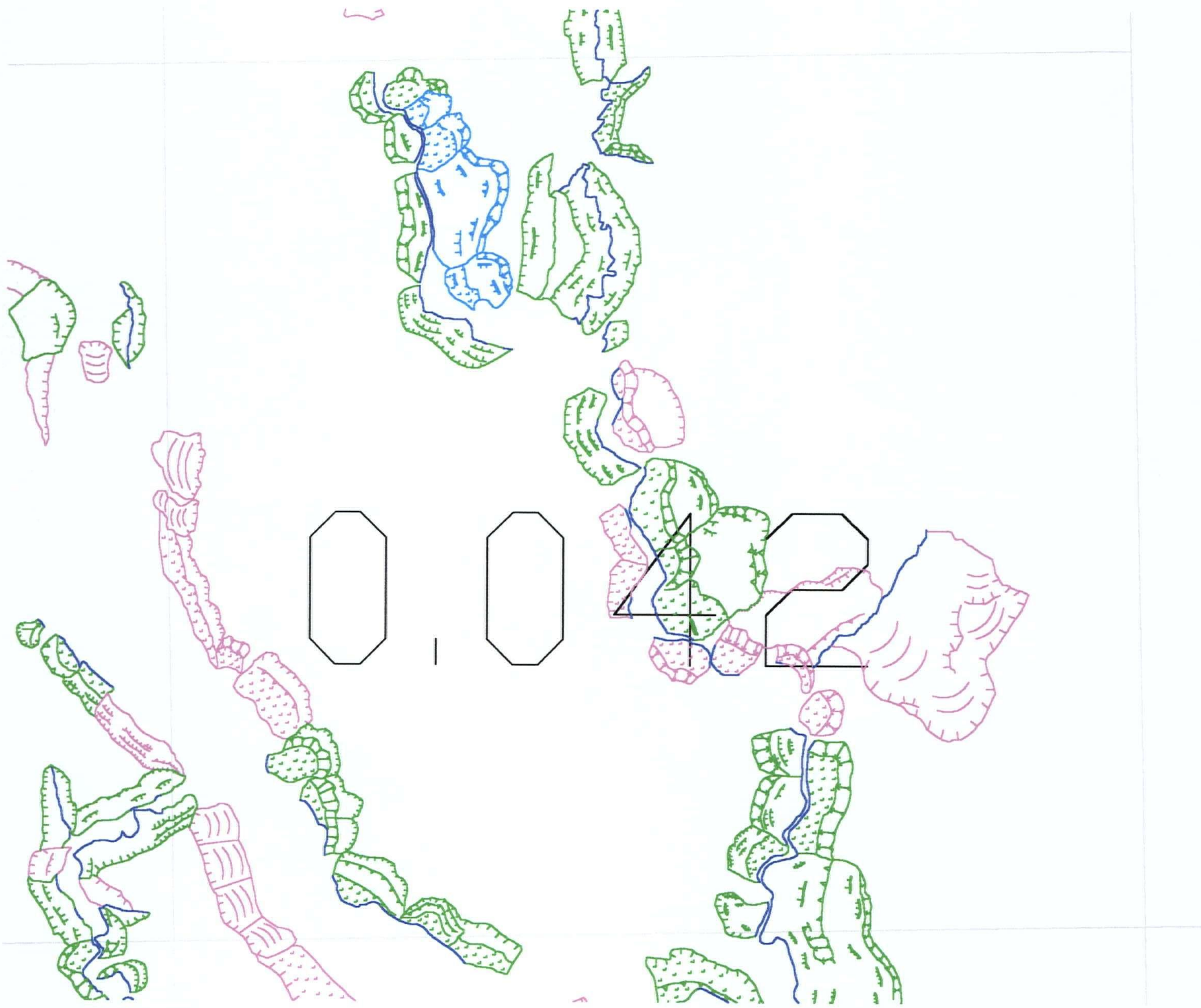
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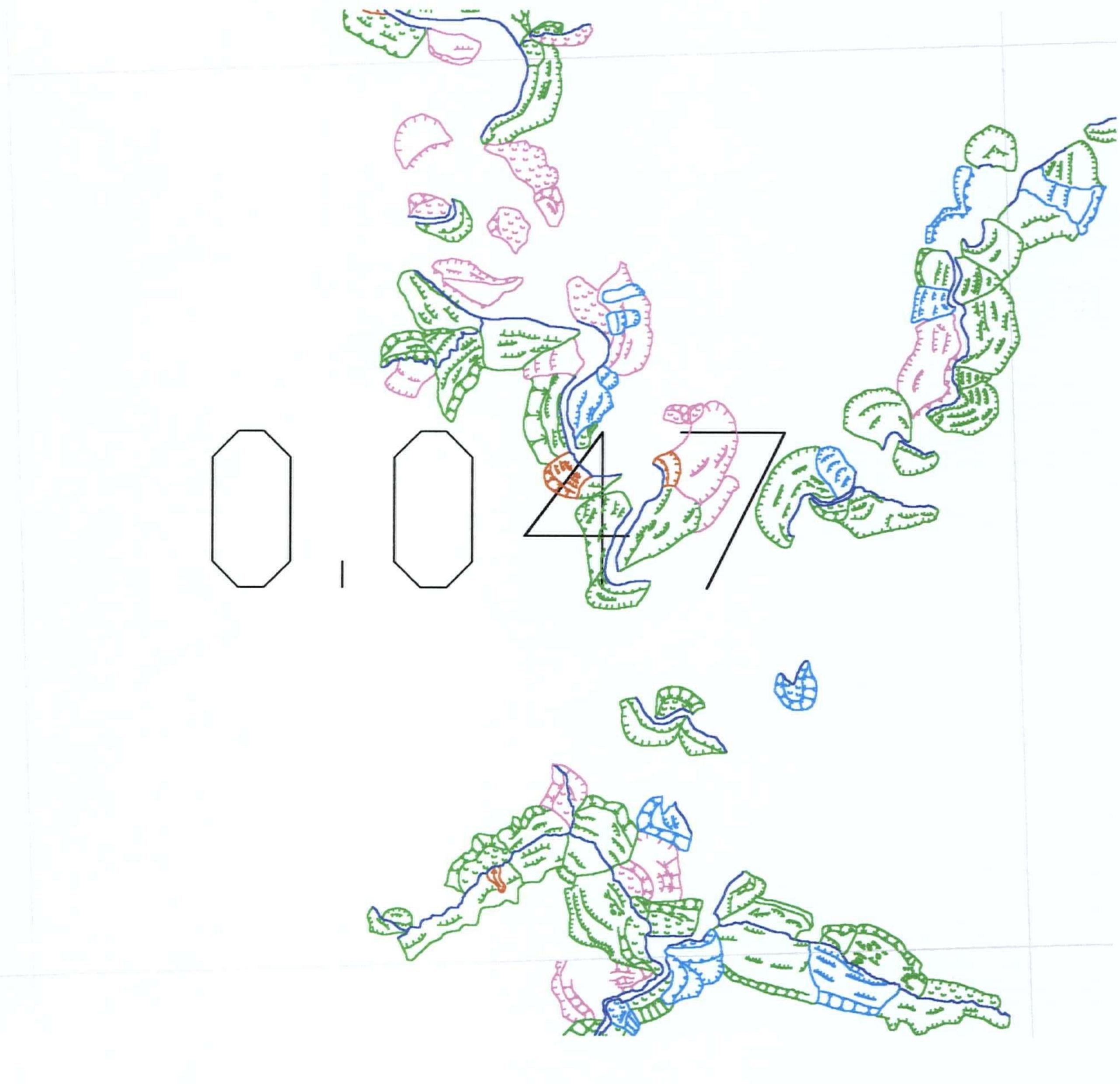
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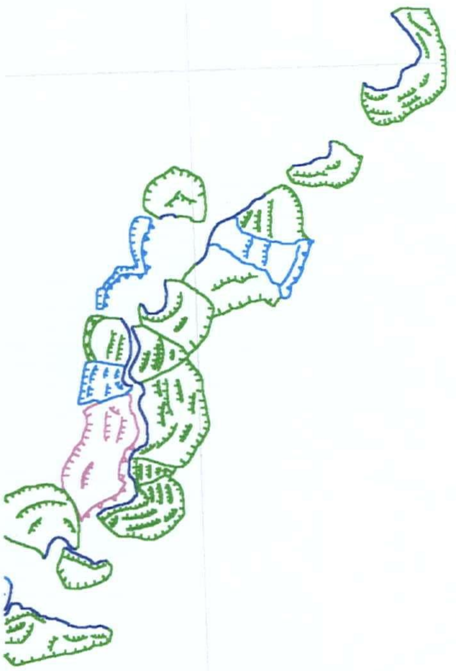

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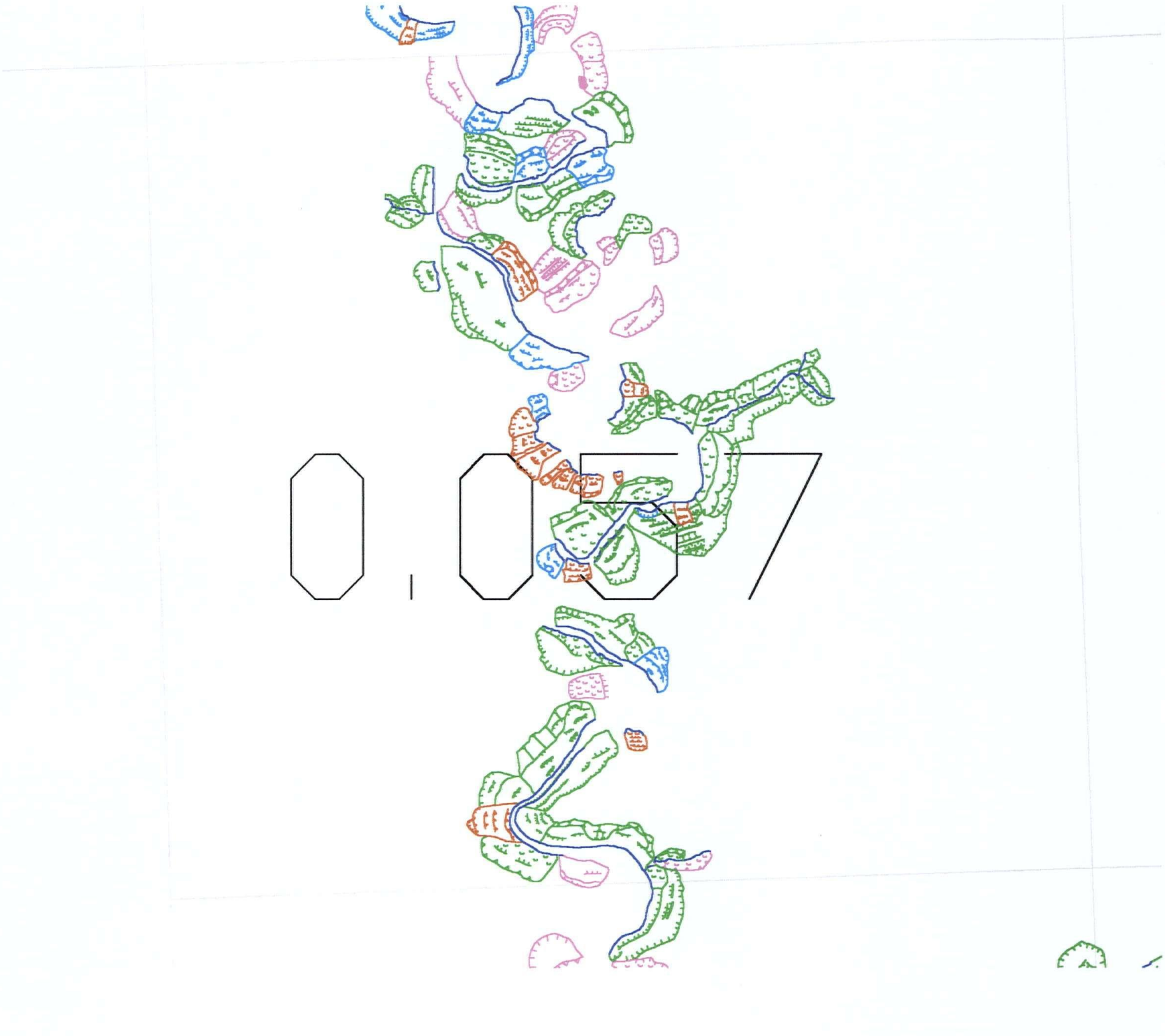
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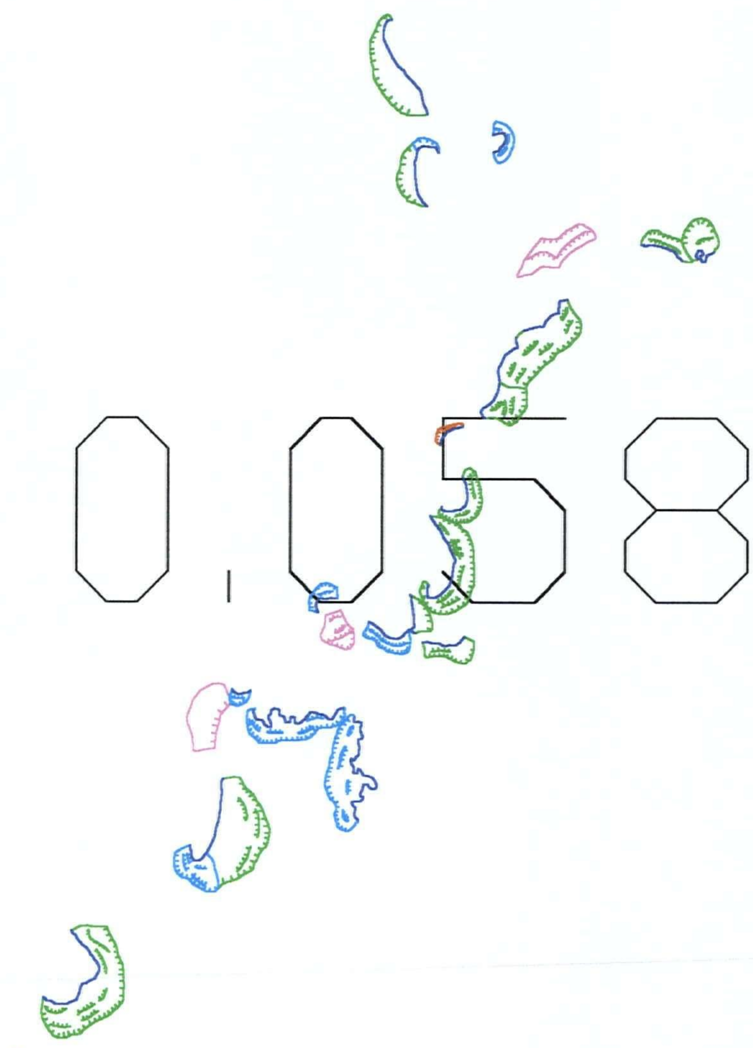
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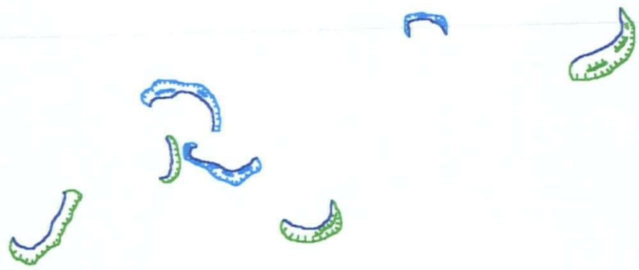

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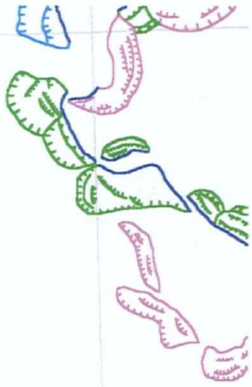

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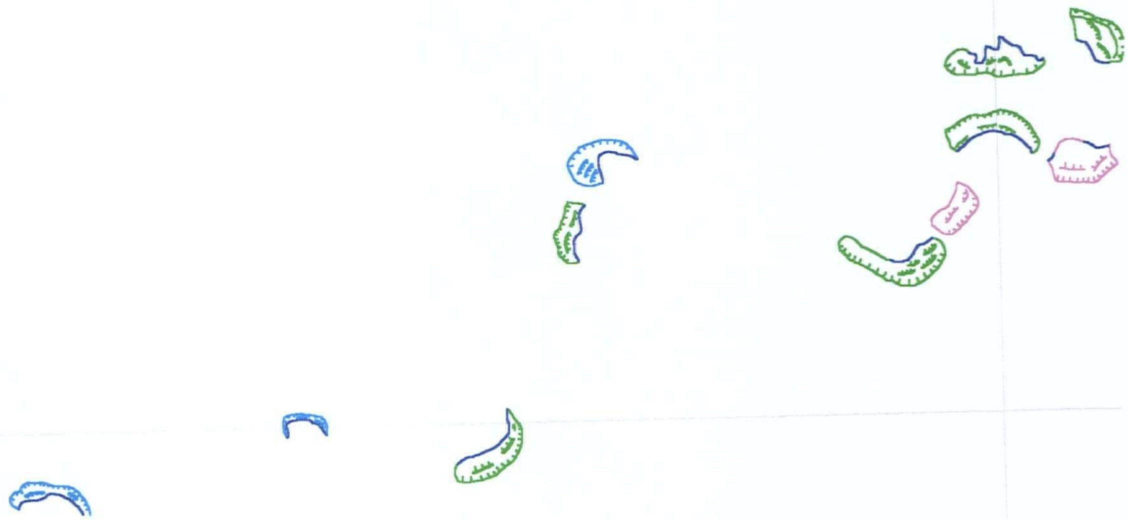


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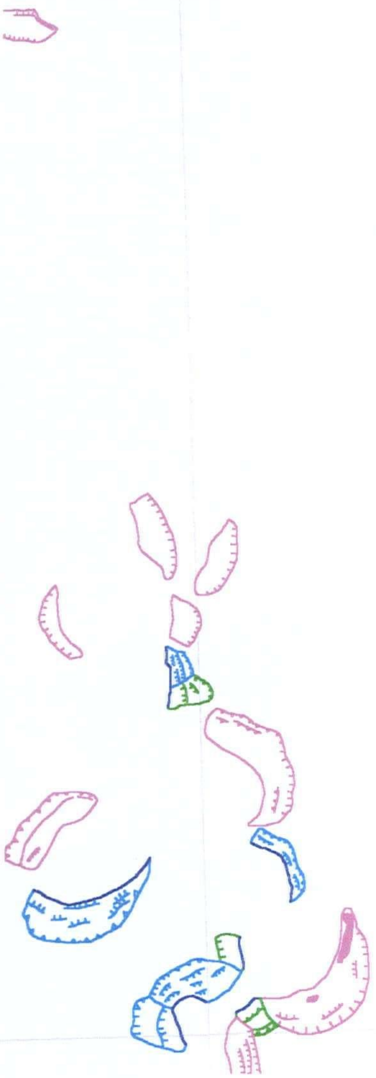

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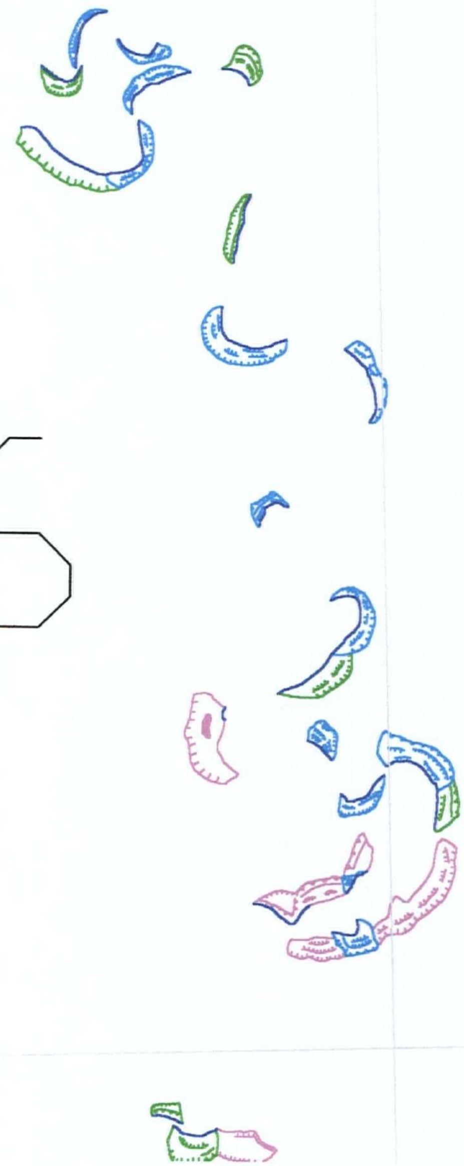

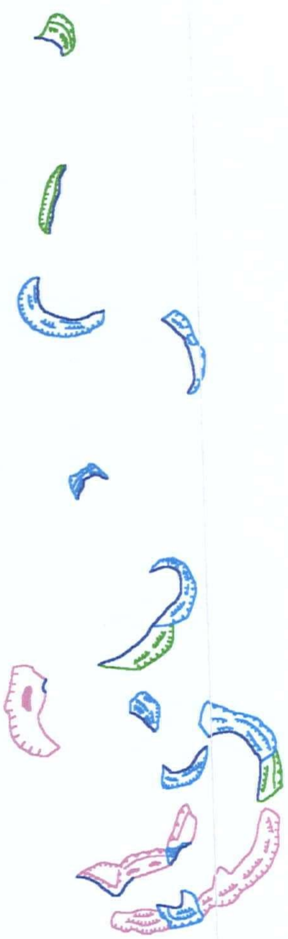

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APPENDIX IV

Landslide Inventory

Peace River Division

Beatton River Division

Southern Tributaries Division

Beatton River East Division

Halfway River West Division

Halfway River to Beatton River Division

Appendix IV - Landslide Inventory

Table IV - 1 Peace River Division

Failure Name	River	Photo	River Segment	Activity	Failure Type	Slide Aspect	Probable Basal Failure Material	Length (m)	Width (m)	Area m^2	Secondary Scarps	Over Scarp	Debris Apron	Defined Head Scarp	Single or Complex	Slope Angle	Feature Clarity	may be mapped as	Additional Comments
PcL-001	Peace	BC 86047 no 158	PvR 129	3	6	212	Shale	1700	1600	2720000	intact	No	yes	yes	complex	steep	good		Bear Flat slide
PcL-002	Peace	BC 86047 no 91	PvL 43	2	6	209	Quaternary	500	400	200000	intact	No	yes	yes	single	steep	good		excellent slide
PcL-003	Peace	BC 86047 no 131	PvL 83	3	6	179	Shale	1100	1000	1100000	intact	No	yes	yes	complex	steep	good		excellent slide
PcL-004	Peace	BC 86047 no 160	PvR 145	5	6	177	Quaternary	500	500	250000	intact	yes	yes	yes	single	steep	changed		
PcL-005	Peace	BC 86047 no 87	PvL 3	2	7	137	Quaternary	?	?		debris	yes	yes	yes	single	steep	vegetated		
PcL-006	Peace	BC 86047 no 87	PvL 1	3	6	161	Shale	500	550	275000	intact	No	yes	yes	single	steep	good		small sec scarps could be in debris
PcL-007	Peace	BC 86047 no 87	PvL 6	3	6	133	Shale	600	700	420000	intact	No	yes	yes	single	steep	good		
PcL-008	Peace	BC 86047 no 87	PvL 6	4	6	190	Shale	700	500	350000	intact	No	yes	yes	single	steep	muted		
PcL-009	Peace	BC 86047 no 87	PvL 7	3	6	129	Shale	1000	800	800000	intact	No	yes	yes	complex	gentle	vegetated		bowl shaped failure, translational component high
PcL-010	Peace	BC 86047 no 87	PvL 9	4	7	157	Shale	1500	2000	3000000	debris	yes	no	no	complex	gentle	vegetated		failure of 1/2 of a bench, hard to distinguish
PcL-011	Peace	BC 86047 no 87	PvL 11	3	6	175	Shale	700	1000	700000	intact	No	yes	yes	complex	steep	good		
PcL-012	Peace	BC 86047 no 87	PvL 11	3	3	174	Shale	400	1000	400000	no	No	yes	yes	complex	steep	good		
PcL-013	Peace	BC 86047 no 87	PvL 12	3	7	190	Shale	500	1200	600000	debris	No	yes	gullied	complex	steep	muted		
PcL-014	Peace	BC 86047 no 87	PvL 14b	4	2	143	Shale	350	600	210000	debris	No	yes	gullied	single	steep	muted		old slide
PcL-015	Peace	BC 86047 no 89	PvL 17	4	6	166	Shale	400	400	160000	intact	No	yes	yes	single	steep	muted		
PcL-016	Peace	BC 86047 no 89	PvL 17	4	6	173	Shale	600	850	510000	intact	yes	yes	yes	single	steep	muted		
PcL-017	Peace	BC 86047 no 89	PvL 17	2	6	165	Shale	1000	500	500000	intact	yes	yes	no	single	steep	good		
PcL-018	Peace	BC 86047 no 89	PvL 17	3	6	194	Shale	750	400	300000	intact	yes	yes	gullied	single	steep	muted		
PcL-019	Peace	BC 86047 no 89	PvL 18	3	6	257	Shale	300	800	240000	intact	No	yes	yes	single	steep	covered		
PcL-020	Peace	BC 86047 no 89	PvL 19	3	6	110	Quaternary	150	850	127500	intact	No	yes	yes	single	steep	muted		
PcL-021	Peace	BC 86047 no 89	PvL 20	3	6	150	Quaternary	800	700	560000	intact	yes	yes	yes	single	steep	good		
PcL-022	Peace	BC 86047 no 89	PvL 22	3	6	162	Quaternary	500	700	350000	intact	yes	eroded	gullied	single	steep	muted		
PcL-023	Peace	BC 86047 no 89	PvL 23	2	4	172	Quaternary	800	400	320000	no	No	eroded	gullied	complex	steep	good		pair of highly mobile flows
PcL-024	Peace	BC 86047 no 89	PvL 24	3	6	191	Quaternary	700	1000	700000	intact	yes	eroded	gullied	single	steep	muted		
PcL-025	Golata Ck	BC 86047 no 89	PL-T1L 1	3	6	272	Quaternary	700	1000	700000	intact	No	no	gullied	complex	gentle	covered		
PcL-026	Golata Ck	BC 86047 no 89	PL-T1L 2	3	6	301	Shale	600	2000	1200000	intact	No	no	gullied	complex	gentle	covered		
PcL-027	Golata Ck	BC 86047 no 89	PL-T1R 10/11	3	6	141	Shale	300	1400	420000	intact	No	yes	yes	complex	steep	muted		
PcL-028	Golata Ck	BC 86047 no 89	PL-T1R 6	3	6	109	Shale	600	900	540000	intact	No	yes	yes	complex	gentle	muted		
PcL-029	Golata Ck	BC 86047 no 89	PL-T1R 2	3	3	196	Shale	400	350	140000	no	No	yes	yes	single	steep	muted		
PcL-030	Golata Ck	BC 86047 no 89	PL-T1R 1	3	6	100	Quaternary	600	1100	660000	intact	No	yes	gullied	complex	gentle	muted		
PcL-031	Peace	BC 86047 no 89	PvL 25	3	6	175	Quaternary	600	900	540000	intact	yes	eroded	yes	single	steep	muted		
PcL-032	Peace	BC 86047 no 89	PvL 26	3	6	165	Quaternary	800	450	360000	intact	yes	eroded	gullied	single	steep	muted		Part of PcL 31
PcL-033	Peace	BC 86047 no 89	PvL 27	3	6	239	Quaternary	450	300	135000	intact	No	yes	yes	single	gentle	good		
PcL-034	Peace	BC 86047 no 89	PvL 27	3	6	238	Quaternary	550	650	357500	intact	No	yes	yes	single	steep	covered		
PcL-035	Peace	BC 86047 no 89	PvL 30/31	3	6	155	Quaternary	500	500	250000	intact	No	yes	yes	complex	steep	muted		
PcL-036	Peace	BC 86047 no 89	PvL 34	3	6	82	Quaternary	600	1200	720000	intact	No	yes	gullied	complex	gentle	covered		
PcL-037	Peace	BC 86047 no 89	PvL 35	3	6	158	Quaternary	600	1600	960000	intact	yes	eroded	gullied	complex	steep	muted		
PcL-038	Peace	BC 86047 no 93	PL-T3R 2	3	6	80	Shale	350	1600	560000	intact	yes	no	yes	complex	steep	good	PcL-066a	
PcL-039	Peace	BC 86047 no 89	PvL 35	3	6	165	Quaternary	600	700	420000	intact	yes	eroded	gullied	single	steep	muted		
PcL-040	Peace	BC 86047 no 89	PL-T2L 1	3	6	253	Quaternary	500	1000	500000	intact	No	yes	yes	single	gentle	vegetated		
PcL-041	Peace	BC 86047 no 89	PL-T2R 1	3	6	125	Quaternary	600	1000	600000	intact	No	yes	yes	complex	gentle	vegetated		
PcL-042	Peace	BC 86047 no 89	PvL 36	5	3	186	Quaternary	900	2000	1800000	no	yes	yes	gullied	single	steep	muted		now has farm field on it
PcL-043	Peace	BC 86047 no 91	PvL 37	3	6	175	Quaternary	600	600	360000	intact	yes	no	gullied	complex	steep	muted		can't really tell
PcL-044	Peace	BC 86047 no 91	PvL 38	4	2	196	Quaternary	800	800	640000	debris	yes	eroded	gullied	single	steep	muted		
PcL-045	Peace	BC 86047 no 91	PvL 39	4	6	191	Quaternary	600	500	300000	intact	yes	eroded	gullied	single	steep	muted		older than above
PcL-046	Peace	BC 86047 no 91	PvL 40	3	4	181	Quaternary	900	300	270000	no	yes	yes	yes	single	steep	good		highly mobile flow
PcL-047	Peace	BC 86047 no 91	PvL 39	4	6	181	Quaternary	600	750	450000	intact	yes	eroded	gullied	complex	steep	muted		
PcL-048	Peace	BC 86047 no 91	PvL 41	3	6	206	Quaternary	800	600	480000	intact	No	yes	gullied	complex	steep	covered		
PcL-049	Peace	BC 86047 no 91	PvL 42	3	6	198	Quaternary	700	400	280000	intact	yes	eroded	no	single	steep	muted		
PcL-050	Peace	BC 86047 no 91	PvL 42	3	6	201	Quaternary	700	1200	840000	intact	yes	eroded	gullied	complex	steep	good		
PcL-051	Peace	BC 86047 no 91	PvL 42	3	6	188	Quaternary	600	500	300000	intact	No	partial	yes	single	steep	muted		
PcL-052	Peace	BC 86047 no 91	PvL 43	3	6	187	Quaternary	450	450	202500	intact	yes	partial	yes	single	steep	muted		debris still mobile
PcL-053	Peace	BC 86047 no 91	PvL 46	3	6	158	Quaternary	600	800	480000	intact	yes	yes	yes	single	steep	vegetated		
PcL-054	Peace	BC 86047 no 91	PvL 47	2	6	210	Quaternary	700	1000	700000	intact	No	yes	gullied	complex	steep	vegetated		
PcL-055	Peace	BC 86047 no 91	PvL 47	2	5	205	Quaternary	1100	300	330000	debris	No	yes	yes	complex	steep	good		less mobile flow
PcL-056	Peace	BC 86047 no 91	PvL 47	4	6	205	Quaternary	600	700	420000	intact	No	yes	yes	single	steep	good		
PcL-057	Peace	BC 86047 no 91	PvL 49	3	3	123	Quaternary	250	600	150000	no	No	yes	gullied	single	steep	vegetated		
PcL-058	Peace	BC 86047 no 91	PvL 51	3	6	260	Quaternary	300	600	180000	intact	No	no	gullied	single	gentle	vegetated		
PcL-059	Peace	BC 86047 no 91	PvL 53	4	3	188	Quaternary	500	500	250000	no	No	yes	gullied	single	steep	muted		
PcL-060	Peace	BC 86047 no 93	PvL 53	3	4	166	Quaternary	800	400	320000	no	No	yes	no	single	steep	vegetated		mobile flow
PcL-061	Peace	BC 86047 no 93	PvL 53	4	6	182	Quaternary	600	1100	660000	intact	No	yes	gullied	complex	gentle	muted		
PcL-062	Peace	BC 86047 no 93	PL-T3L 1	3	6	255	Shale	500	1300	650000	intact	No	no	gullied	complex	gentle	vegetated		translational
PcL-063	Peace	BC 86047 no 93	PL-T3L 2	3	6	291	Shale	400	400	160000	intact	No	yes	gullied	single	steep	muted		
PcL-064	Peace	BC 86047 no 93	PL-T3L 4	3	6	230	Shale	400	500	200000	intact	yes	yes	yes	single	steep	covered		
PcL-065	Peace	BC 86047 no 93	PL-T3R 1	2	6	56	Shale	600	250	150000	intact	yes	yes	yes	single	steep	good		good for looking at
PcL-066	Peace	BC 86047 no 93	PL-T3R 1	3	6	134	Shale	600	2000	1200000	intact	No	yes	gullied	complex	steep	vegetated		
PcL-067	Peace	BC 86047 no 93	PvL 54	3	6	203	Shale	700	1300	910000	intact	yes	yes	gullied	complex	steep	good		
PcL-068	Peace	BC 86047 no 93	PvL 55	3	6	190	Shale	500	500	250000	intact	yes	yes	yes	complex	steep	good		a 2 with 5's on the side
PcL-069	Peace	BC 86047 no 93	PvL 55	3	6	168	Quaternary	450	400	180000	intact	yes	eroded	yes	complex	steep	good	PcL-069a	
PcL-070	Peace	BC 86047 no 93	PvL 56	4	2	250	Quaternary	800	700	560000	debris	No	yes	yes	single	gentle	good		
PcL-071	Peace	BC 86047 no 93	PvL 59	4	5	225	Quaternary	800	600	480000	no	No	yes	no	single	gentle	vegetated		old mudflow
PcL-072	Peace	BC 86047 no 93	PvL 64/65	3	6	305	Quaternary	300	1300	390000	intact	No	yes	no	single	gentle	vegetated		old mudflow
PcL-073	Peace	BC 86047 no 93	PvL 63	4	6	206	Quaternary	500	600	300000	intact	yes	no	gullied	complex	steep	muted		
PcL-075	Peace	BC 86047 no 93	PL 12	5	3	189	Shale	200	300	60000	no	No	yes	yes	single	steep	removed		taylor bridge

PcL-076	Peace	BC 86047 no 93	PL 13	5	6	233	Shale	400	350	140000	intact	No	no	yes	single	steep	removed		mill yard
PcL-077	Peace	BC 86047 no 93	PL 13	3	6	227	Shale	600	400	240000	intact	yes	yes	yes	single	steep	good	PcL-226	railway
PcL-078	Peace	BC 86047 no 95	PvL 73	4	6	234	Shale	500	1400	700000	intact	yes	yes	gullied	complex	steep	muted		
PcL-079	Peace	BC 86047 no 95	PL-T5L 1	3	6	280	Shale	400	900	360000	intact	yes	yes	gullied	single	gentle	vegetated		
PcL-080	Peace	BC 86047 no 95	PL-T5R 2	3	6	65	Quaternary	400	800	320000	intact	No	yes	gullied	complex	steep	muted		
PcL-081	Peace	BC 86047 no 95	PL-T5R 1	3	2	94	Quaternary	400	900	360000	debris	yes	yes	gullied	single	gentle	good		
PcL-082	Peace	BC 86047 no 95	PvR 74/75/76	4	6	219	Quaternary	500	2200	1100000	intact	No	eroded	gullied	complex	steep	old		
PcL-083	Peace	BC 86047 no 131	PvR 76	3	6	249	Quaternary	400	800	320000	intact	yes	partial	yes	single	steep	old		high failure
PcL-084	Peace	BC 86047 no 131	PvR 76	2	6	274	Shale	350	300	105000	intact	yes	yes	yes	single	steep	muted		
PcL-085	Peace	BC 86047 no 131	PvR 78	1	6	116	Shale	300	300	90000	intact	No	yes	yes	single	steep	good		
PcL-086	Peace	BC 86047 no 131	PvR 78/79	1	6	227	Shale	300	500	150000	intact	No	eroded	yes	single	steep	good		
PcL-087	Peace	BC 86047 no 131	PvR 80	2	6	105	Quaternary	400	600	240000	intact	yes	yes	yes	single	steep	good		
PcL-088	Peace	BC 86047 no 131	PvR 81	3	6	198	Shale	500	600	300000	intact	yes	yes	yes	single	steep	good		
PcL-089	Peace	BC 86047 no 131	PvR 82	2	6	195	Shale	900	500	450000	intact	yes	yes	yes	single	steep	good		
PcL-090	Peace	BC 86047 no 131	PvR 82	4	6	200	Shale	600	500	300000	intact	yes	yes	yes	single	steep	good		
PcL-091	Peace	BC 86047 no 131	PL-T6L 1	3	7	269	Shale	500	1200	600000	debris	No	yes	gullied	single	gentle	good		
PcL-092	Peace	BC 86047 no 131	PL-T6L 2	3	6	258	Quaternary	300	400	120000	intact	No	yes	yes	single	steep	good		
PcL-093	Peace	BC 86047 no 131	PL-T6L 1	4	6	241	Shale	400	200	80000	intact	No	yes	yes	single	steep	muted		
PcL-094	Peace	BC 86047 no 131	PvL 86	4	6	160	Shale	1000	1200	1200000	intact	yes	yes	gullied	complex	steep	muted		
PcL-095	Peace	BC 86047 no 131	PvL 87	4	6	168	Shale	600	800	480000	intact	No	yes	yes	complex	gentle	old		
PcL-096	Peace	BC 86047 no 131	PvL 92	3	6	207	Quaternary	200	1300	260000	intact	No	yes	yes	complex	steep	good		
PcL-097	Peace	BC 86047 no 131	PvL 95	3	6	196	Shale	300	2400	720000	intact	yes	eroded	yes	complex	steep	good		
PcL-098	Peace	BC 86047 no 131	PvL 96	2	6	227	Shale	400	1700	680000	intact	yes	yes	yes	complex	steep	good		
PcL-099	Peace	BC 86047 no 131	PvL 97	2	2	296	Shale	400	900	360000	debris	No	yes	no	single	gentle	covered		
PcL-100	Peace	BC 86047 no 131	PvL 98	3	6	136	Shale	300	800	240000	intact	No	no	yes	single	steep	old		
PcL-101	Peace	BC 86047 no 129	PvL 101	3	6	229	Shale	450	250	112500	intact	No	yes	gullied	single	steep	old		tianglar scarp, old failure, mech unknown
PcL-102	Peace	BC 86047 no 129	PvL 101	3	6	227	Shale	600	2800	1680000	intact	yes	yes	gullied	complex	steep	good		
PcL-103	Peace	BC 86047 no 129	PvL 103	3	6	148	Quaternary	400	400	160000	intact	No	no	yes	single	steep	good		
PcL-104	Peace	BC 86047 no 129	PvL 104	3	6	223	Shale	450	400	180000	intact	yes	yes	yes	single	steep	old		
PcL-105	Peace	BC 86047 no 129	PvL 101	3	6	227	Shale	800	600	480000	intact	yes	yes	debris	single	steep	good		
PcL-106	Peace	BC 86047 no 129	PvL 102	3	3	97	Quaternary	400	450	180000	no	yes	yes	yes	single	steep	vegetated		
PcL-107	Peace	BC 86047 no 129	PvL 104	3	6	246	Quaternary	450	350	157500	intact	No	no	yes	single	gentle	vegetated		
PcL-108	Peace	BC 86047 no 129	PvL 105	3	6	155	Quaternary	500	400	200000	intact	yes	no	yes	single	steep	muted		
PcL-109	Peace	BC 86047 no 129	PvL 106	3	6	211	Shale	400	500	200000	intact	yes	yes	yes	single	steep	muted		
PcL-110	Peace	BC 86047 no 129	PvL 106	3	6	255	Quaternary	400	800	320000	intact	No	yes	gullied	complex	steep	covered		
PcL-111	Peace	BC 86047 no 129	PvL 107	3	6	140	Quaternary	400	800	320000	intact	yes	yes	yes	single	steep	muted		
PcL-112	Peace	BC 86047 no 129	PvL 108	3	6	197	Quaternary	500	600	300000	intact	yes	eroded	yes	complex	steep	old		
PcL-113	Peace	BC 86047 no 129	PvL 109	3	6	188	Quaternary	600	500	300000	intact	yes	yes	yes	single	steep	old		
PcL-114	Peace	BC 86047 no 129	PL-T7L 1	3	6	238	Quaternary	400	100	40000	intact	No	yes	gullied	single	steep	old		
PcL-115	Peace	BC 86047 no 129	PL-T7L 1	2	3	214	Quaternary	600	500	300000	no	No	yes	yes	complex	steep	good		
PcL-116	Peace	BC 86047 no 129	PL-T7R 1	2	6	63	Shale	900	2000	1800000	intact	No	yes	no	complex	gentle	vegetated		
PcL-117	Peace	BC 86047 no 129	PL-T7R 1	3	6	100	Shale	500	600	300000	intact	yes	no	no	single	gentle	vegetated		
PcL-118	Peace	BC 86047 no 129	PvL 111	4	2	219	Quaternary	450	650	292500	debris	yes	no	yes	single	steep	muted		old, small 3 above stable scarp
PcL-119	Peace	BC 86047 no 129	PvL 111	3	6	177	Shale	800	1200	960000	intact	yes	yes	yes	complex	steep	old		
PcL-120	Peace	BC 86047 no 129	PvL 111	3	2	166	Shale	700	700	490000	debris	yes	yes	yes	complex	steep	old		old, don't know
PcL-121	Peace	BC 86047 no 129	PvL 111	3	4	180	Quaternary	900	200	180000	no	yes	yes	yes	single	gentle	good		highly mobile flow
PcL-122	Peace	BC 86047 no 129	PvL 111	2	6	168	Shale	700	1000	700000	intact	yes	yes	gullied	complex	steep	muted		Minias get profile
PcL-123	Peace	BC 86047 no 129	PvL 111	4	6	170	Shale	550	600	330000	intact	No	partial	gullied	complex	steep	old		
PcL-124	Peace	BC 86047 no 129	PvL 113-5	4	6	176	Shale	400	2000	800000	intact	No	yes	gullied	complex	steep	old		reactivation in debris
PcL-125	Peace	BC 86047 no 129	PvL 116/118	4	3	197	Quaternary	300	1000	300000	no	No	yes	gullied	complex	steep	old		
PcL-126	Peace	BC 86047 no 129	PL-T7L 2	3	3	260	Quaternary	300	700	210000	no	yes	yes	yes	single	steep	good	PcL-115b	
PcL-127	Wilder Ck	BC 86047 no 129	PL-T8L 2	3	6	278	Shale	400	800	320000	intact	No	yes	yes	complex	steep	vegetated		
PcL-128	Wilder Ck	BC 86047 no 129	PL-T8L 3	3	7	260	Shale	1300	3000	3900000	debris	yes	no	no	complex	gentle	vegetated		
PcL-129	Wilder Ck	BC 86047 no 129	PL-T8L 4	3	6	251	Shale	600	600	360000	intact	yes	no	no	complex	gentle	vegetated		
PcL-130	Wilder Ck	BC 86047 no 129	PL-T8L 4	3	6	256	Quaternary	500	500	250000	intact	yes	no	yes	complex	gentle	vegetated		
PcL-131	Wilder Ck	BC 86047 no 129	PL-T8L 4	3	2	230	Quaternary	300	1000	300000	debris	yes	yes	yes	complex	steep	good		
PcL-132	Wilder Ck	BC 86047 no 129	PL-T8R 4	3	6	37	Quaternary	400	1400	560000	intact	No	yes	yes	single	steep	good		
PcL-133	Wilder Ck	BC 86047 no 129	PL-T8R 3	2	6	66	Shale	500	600	300000	intact	yes	no	yes	complex	gentle	vegetated		
PcL-134	Wilder Ck	BC 86047 no 129	PL-T8R 2	3	6	79	Shale	1000	1800	1800000	intact	yes	yes	gullied	complex	steep	vegetated		
PcL-135	Wilder Ck	BC 86047 no 129	PL-T8R 2	2	6	86	Shale	500	1000	500000	intact	yes	yes	yes	single	steep	good		
PcL-136	Wilder Ck	BC 86047 no 129	PL-T8R 1	3	6	118	Shale	400	600	240000	intact	yes	yes	yes	single	steep	muted		
PcL-137	Peace	BC 86047 no 127	PvL 118	3	6	226	Quaternary	500	2000	1000000	intact	No	yes	yes	complex	steep	good		very mobile
PcL-138	Peace	BC 86047 no 127	PvL 121	3	6	223	Shale	1400	900	1260000	intact	No	yes	yes	single	steep	good		Includes sst headscarp
PcL-139	Peace	BC 86047 no 158	PvL 129	4	6	213	Quaternary	300	1200	360000	intact	yes	eroded	yes	single	steep	good		
PcL-140	Peace	BC 86047 no 158	PvL 122	3	6	232	Shale	600	1400	840000	intact	yes	eroded	gullied	complex	steep	old		
PcL-141	Peace	BC 86047 no 158	PvL 122/123	2	6	232	Quaternary	800	300	240000	intact	yes	yes	yes	single	steep	good		
PcL-142	Peace	BC 86047 no 158	PvL 124	3	3	151	Quaternary	200	300	60000	no	No	yes	yes	single	steep	muted		
PcL-143	Peace	BC 86047 no 158	PvL 125	3	6	215	Shale	550	400	220000	intact	yes	yes	yes	single	steep	good		
PcL-144	Peace	BC 86047 no 158	PvL 126	2	3	160	Quaternary	250	250	62500	no	No	yes	yes	single	steep	vegetated		
PcL-145	Peace	BC 86047 no 158	PvL 127	3	6	205	Shale	750	550	412500	intact	No	yes	yes	single	steep	good		
PcL-146	Peace	BC 86047 no 158	PvL 127	3	6	216	Shale	1300	600	780000	intact	No	yes	yes	single	steep	good		
PcL-147	Peace	BC 86047 no 158	PvL 128	3	6	228	Shale	900	550	495000	intact	yes	yes	yes	single	steep	vegetated		
PcL-148	Peace	BC 86047 no 158	PvL 130	4	6	199	Shale	1000	500	500000	intact	No	yes	no	complex	gentle	good		
PcL-149	Peace	BC 86047 no 158	PvL 135	4	6	124	Quaternary	400	600	240000	intact	No	yes	gullied	complex	steep	old		
PcL-150	Peace	BC 86047 no 158	PvL 135	4	6	120	Quaternary	600	500	300000	intact	No	yes	yes	single	steep	good		
PcL-151	Peace	BC 86047 no 158	PvL 135	4	2	129	Quaternary	500	400	200000	debris	No	yes	yes	single	steep	good		
PcL-152	Peace	BC 86047 no 158	PvL 136	4	3	130	Quaternary	600	700	420000	no	No	yes	gullied	complex	steep	old		
PcL-153	Peace	BC 86047 no 158	PvL 137	4	3	139	Quaternary	550	500	275000	no	No	yes	yes	single	steep	muted		
PcL-154	Peace	BC 86047 no 160	PvL 137	4	6	136	Quaternary	400	1000	400000	intact	No	yes	yes	single	steep	old		
PcL-155	Peace	BC 86047 no 160	PvL 139	4	3	47	Quaternary	100	300	30000	no	No	no	no	complex	gentle	vegetated		
PcL-156	Peace	BC 86047 no 160	PvL 140	4	3	144	Quaternary	250	1300	325000	no	No	yes	yes	single	steep	old		

PcL-157	Peace	BC 86047 no 160	PvL 143	5	6	173	Quaternary	600	500	300000	intact	No	yes	no	single	gentle	small		
PcL-158	Peace	BC 86047 no 160	PvL 144	3	6	176	Quaternary	600	2900	1740000	intact	yes	eroded	yes	complex	steep	old		
PcL-159	Peace	BC 86047 no 160	PvL 144	2	6	160	Quaternary	500	200	100000	intact	yes	yes	yes	single	steep	good		
PcL-160	Peace	BC 86047 no 160	PvL 144/145	3	6	164	Quaternary	550	1400	770000	intact	No	yes	no	complex	steep	muted		
PcL-161	Peace	BC 86047 no 129	PL-T7L 2	3	3	236	Quaternary	350	450	157500	no	No	yes	yes	single	gentle	good	PcL-115c	
PcL-162	Peace	BC 86047 no 160	PvL 145	5	6	183	Quaternary	500	400	200000	intact	No	yes	yes	single	steep	changed		Halfway Hill Slide
PcL-163	Peace	BC 86047 no 160	PvL 145	3	2	175	Quaternary	600	800	480000	debris	No	yes	yes	single	steep	vegetated		
PcL-164	Peace	BC 86047 no 124	PvL 145	4	6	150	Quaternary	500	1200	600000	intact	No	yes	yes	complex	steep	muted		
PcL-165	Halfway	BC 86047 no 124	HL 2	4	6	167	Quaternary	500	600	300000	intact	yes	yes	yes	single	steep	good		
PcL-166	Peace	BC 86047 no 124	PvL 146	4	6	125	Quaternary	300	1200	360000	intact	No	yes	yes	complex	steep	muted		
PcL-167	Peace	BC 86047 no 124	PvL 146	4	6	106	Quaternary	500	1300	650000	intact	No	yes	no	complex	steep	muted		
PcL-168	Peace	BC 86047 no 124	PvL 147	3	3	148	Quaternary	700	900	630000	no	No	yes	yes	complex	steep	vegetated		
PcL-169	Peace	BC 86047 no 124	PvL 147	4	3	168	Quaternary	400	600	240000	no	No	yes	yes	complex	steep	old		High failures above stable cliff
PcL-170	Peace	BC 86047 no 124	PvL 149/150	3	6	93	Quaternary	400	300	120000	intact	No	no	no	complex	gentle	vegetated		
PcL-171	Peace	BC 86047 no 124	PvL 151	4	3	154	Quaternary	500	1200	600000	no	No	yes	yes	complex	steep	old		high failures above stable cliff
PcL-172	Peace	BC 86047 no 124	PvL 152	3	3	225	Quaternary	300	900	270000	no	No	yes	yes	complex	steep	muted		
PcL-173	Peace	BC 86047 no 124	PvL 153	3	6	78	Quaternary	300	1100	330000	intact	No	no	no	complex	gentle	vegetated		
PcL-174	Peace	BC 86047 no 124	PvL 154	4	3	143	Quaternary	500	2000	1000000	no	yes	yes	yes	complex	gentle	muted		
PcL-175	Peace	BC 86047 no 103	PvL 155	3	3	174	Quaternary	400	250	100000	no	yes	yes	no	single	gentle	good		
PcL-176	Peace	BC 86047 no 103	PvL 155	3	3	193	Quaternary	300	400	120000	no	yes	no	no	single	gentle	vegetated		
PcL-177	Peace	BC 86047 no 103	PvL 157/158	4	6	137	Quaternary	500	3000	1500000	intact	No	yes	yes	complex	steep	old		
PcL-178	Peace	BC 86047 no 105	PvL 159/160	4	6	165	Quaternary	500	5600	2800000	intact	No	yes	gullied	complex	steep	old		
PcL-179	Peace	BC 86047 no 105	PvL 164	3	6	141	Quaternary	300	800	240000	intact	No	yes	yes	single	steep	muted		
PcL-180	Peace	BC 86047 no 105	PvL 164	4	6	141	Quaternary	300	2700	810000	intact	No	yes	gullied	complex	steep	old		
PcL-181	Peace	BC 86047 no 105	PvL 164	3	4	152	Quaternary	600	200	120000	no	yes	yes	no	complex	gentle	good		variety of flows
PcL-182	Peace	BC 86047 no 107	PvL 165	4	6	144	Quaternary	400	500	200000	intact	No	yes	gullied	single	steep	muted		
PcL-183	Peace	BC 86047 no 107	PvL 165	5	6	135	Quaternary	800	900	720000	intact	partial	yes	gullied	single	steep	muted		
PcL-184	Peace	BC 86047 no 107	PvL 169	4	1	140	Quaternary	200	1300	260000	no	No	yes	gullied	complex	steep	old		
PcL-185	Peace	BC 86047 no 107	PvL 172/173	4	1	132	Quaternary	400	2400	960000	no	No	yes	yes	complex	steep	good		
PcL-186	Peace	BC 86047 no 107	PvL 173	3	3	116	Quaternary	600	200	120000	no	yes	yes	yes	single	steep	good		
PcL-187	Peace	BC 86047 no 60	PvL 173	4	6	131	Quaternary	400	1200	480000	intact	yes	yes	yes	complex	steep	vegetated		
PcL-188	Peace	BC 86047 no 60	PvL 174	4	6	157	Quaternary	500	2000	1000000	intact	yes	yes	yes	complex	steep	good		
PcL-189	Peace	BC 86047 no 60	PvL 175	3	6	214	Quaternary	350	500	175000	intact	No	yes	no	complex	steep	good		
PcL-190	Peace	BC 86047 no 60	PvL 177/178/179	4	6	105	Quaternary	300	500	150000	intact	No	yes	yes	complex	steep	vegetated		
PcL-191	Peace	BC 86047 no 60	PvL 177/178/179	3	2	180	Quaternary	200	500	100000	debris	No	yes	yes	complex	gentle	vegetated		
PcL-192	Peace	BC 86047 no 60	PvL 180	4	3	148	Quaternary	200	500	100000	no	No	yes	no	single	steep	vegetated		
PcL-193	Peace	BC 86047 no 60	PvL 180	5	6	147	Quaternary	400	600	240000	intact	yes	yes	no	complex	gentle	good		
PcL-194	Peace	BC 86047 no 60	PvL 181	2	5	134	Quaternary	900	300	270000	no	yes	yes	yes	single	gentle	vegetated		
PcL-195	Peace	BC 86047 no 60	PvL 182/183	4	6	135	Quaternary	800	3400	2720000	intact	No	no	yes	complex	steep	muted		
PcL-196	Peace	BC 86047 no 61	PL-T10L 1	4	6	189	Quaternary	300	400	120000	intact	No	partial	yes	single	steep	muted		
PcL-197	Peace	BC 86047 no 61	PL-T10L 1	3	7	206	Quaternary	?	?		debris	No	yes	yes	complex	steep	good		
PcL-198	Peace	BC 86047 no 61	PL-T10L 1	3	2	208	Quaternary	?	?		debris	No	yes	yes	single	steep	good		
PcL-199	Peace	BC 86047 no 61	PL-T10L 1	3	3	216	Quaternary	?	?		no	No	yes	yes	single	steep	good		
PcL-200	Peace	BC 86047 no 61	PL-T10L 2	3	2	276	Quaternary	?	?		debris	No	yes	yes	single	steep	good		
PcL-201	Peace	BC 86047 no 61	PL-T10R 1	3	3	129	Quaternary	?	?		no	No	yes	gullied	single	steep	vegetated		
PcL-202	Peace	BC 86047 no 61	PL-T10R 1	3	6	140	Quaternary	?	?		intact	No	yes	yes	single	steep	vegetated		
PcL-203	Peace	BC 86047 no 61	PL-T11L 1	3	1	203	Quaternary	?	?		no	No	yes	yes	complex	steep	vegetated		
PcL-204	Peace	BC 86047 no 61	PL-T11R 3	3	3	40	Quaternary	?	?		no	yes	no	no	single	gentle	vegetated		
PcL-205	Peace	BC 86047 no 61	PL-T11R 4	3	3	63	Quaternary	?	?		no	No	yes	yes	single	gentle	vegetated		
PcL-206	Peace	BC 86047 no 108	PL-T11L 5/6	3	6	240	Shale	200	1200	240000	intact	No	yes	yes	complex	steep	good		
PcL-207	Peace	BC 86047 no 108	PL-T11R 4	3	3	63	Quaternary	300	700	210000	no	No	yes	gullied	single	steep	good		
PcL-208	Peace	BC 86047 no 108	PL-T11R 6	3	3	67	Shale	300	300	90000	no	yes	yes	no	single	gentle	vegetated		
PcL-209	Peace	BC 86047 no 108	PL-T10L 17	3	3	216	Shale	200	700	140000	no	No	yes	yes	complex	steep	covered		
PcL-210	Peace	BC 86047 no 108	PL-T10L 18	3	3	196	Shale	200	900	180000	no	No	yes	yes	complex	steep	covered		
PcL-211	Peace	BC 86047 no 108	PL-T10L 19	3	3	236	Shale	300	1000	300000	no	No	no	no	single	gentle	vegetated		
PcL-212	Peace	BC 86047 no 108	PL-T10L 19	3	3	231	Shale	300	1000	300000	no	No	yes	yes	complex	steep	vegetated		
PcL-213	Peace	BC 86047 no 108	PL-T10R 9	3	7	60	Shale	300	900	270000	debris	No	no	no	single	gentle	vegetated		
PcL-214	Peace	BC 86047 no 108	PL-T10R 8	3	3	48	Shale	300	800	240000	no	No	yes	yes	single	steep	muted		
PcL-215	Peace	BC 86047 no 108	PL-T10R 5	4	2	7	Shale	250	400	100000	debris	yes	no	no	single	steep	muted		
PcL-216	Peace	BC 86047 no 107	PvL 169	3	4	130	Quaternary	600	200	120000	no	yes	yes	yes	complex	gentle	vegetated	PcL-184b	
PcL-217	Peace	BC 86047 no 060	PvL 176	3	6	23	Quaternary	200	600	120000	intact	No	yes	no	single	gentle	good	PcL-189b	
PcL-218	Peace	BC 86047 no 87	PvL 9	3	6	155	Shale	500	1500	750000	intact	yes	yes	yes	single	steep	good		
PcL-219	Peace	BC 86047 no 87	PvL 9	4	6	164	Shale	400	1400	560000	intact	No	no	no	complex	gentle	muted		
PcL-220	Peace	BC 89047 no 89	PvL 20	3	3	210	Quaternary	200	400	80000	no	No	yes	yes	single	steep	good		
PcL-221	Peace	BC 89047 no 89	PvL 20	3	6	91	Quaternary	300	200	60000	intact	No	yes	yes	complex	gentle	good		
PcL-222	Golata Ck	BC 86047 no 89	PL-T1R 6	3	6	140	Shale	400	350	140000	intact	No	yes	yes	single	steep	good		
PcL-223	Peace	BC 86047 no 91	PvL 46	3	6	283	Quaternary	600	400	240000	intact	No	yes	yes	complex	gentle	good		
PcL-224	Peace	BC 86047 no 93	PvL 63	4	6	237	Quaternary	500	300	150000	intact	No	yes	no	single	gentle	good		
PcL-225	Peace	BC 86047 no 93	PvL 63	3	5	215	Quaternary	500	250	125000	no	No	yes	yes	single	steep	good		
PcL-226	Peace	BC 86047 no 93	PL 65	4	6	217	Quaternary	400	1500	600000	intact	No	yes	yes	complex	steep	vegetated	PcL-225b	
PcL-227	Peace	BC 86047 no 95	PL-T5R 5	3	6	316	Quaternary	400	1100	440000	intact	yes	yes	yes	single	steep	muted		
PcL-228	Peace	BC 86047 no 129	PvL 113	3	6	202	Quaternary	300	250	75000	intact	yes	yes	yes	single	steep	good		
PcL-229	Peace	BC 86047 no 124	PvL 146	3	4	154	Quaternary	700	400	280000	no	yes	yes	yes	single	gentle	muted		
PcL-230	Peace	BC 86047 no 108	PL-T10R 10	4	3	290	Shale	200	300	60000	no	No	yes	yes	single	gentle	vegetated	PcL-305	
PcL-231	Peace	BC 86047 no 105	PvL 157/158	3	5	137	Quaternary	600	200	120000	no	yes	yes	yes	complex	gentle	vegetated	PcL-177b	ave length and with
PcL-232	Peace	BC 86047 no 131	PvL 98	3	3	94	Quaternary	300	300	90000	no	yes	yes	yes	single	gentle	old	PcL-100b	
PcL-233	Peace	BC 86047 no 131	PL-T6R 2	3	6	81	Shale	200	1200	240000	intact	yes	no	yes	complex	steep	good	PcL-092b	
PcL-234	Peace	BC 86047 no 131	PL-T6R 1	3	6	132	Shale	300	600	180000	intact	yes	no	yes	complex	steep	good	PcL-092c	
PcL-235	Peace	BC 86047 no 93	PvL 55	3	6	195	Quaternary	550	400	220000	intact	yes	eroded	yes	complex	steep	good	PcL-069b	
PcL-236	Allens Coul.	BC 86047 no 131	PL-T5R 8	3	6	94	Quaternary	300	650	195000	intact	yes	yes	yes	complex	steep	vegetated	PcL-227b	
PcL-237	Allens Coul.	BC 86047 no 131	PL-T5R 7	3	2	140	Quaternary	300	800	240000	debris	yes	yes	yes	complex	steep	vegetated	PcL-227c	

PcL-238	Allens Coul.	BC 86047 no 131	PL-T5R 6	3	3	225	Quaternary	300	450	135000	no	yes	yes	yes	complex	steep	vegetated	PcL-227d	
PcL-239	Allens Coul.	BC 86047 no 131	PL-T5R 4	3	6	111	Quaternary	300	800	240000	intact	yes	yes	yes	complex	steep	vegetated	PcL-227e	
PcL-240	Peace	BC 86047 no 93	PL-T3L 5	2	6	313	Shale	400	800	320000	intact	No	yes	yes	single	steep	good	PcL-064a	
PcL-241	Peace	BC 86047 no 93	PL-T3L 5	3	6	298	Shale	400	500	200000	intact	No	yes	yes	single	steep	good	PcL-064b	
PcL-242	Peace	BC 86047 no 91	PvL 52	3	6	114	Quaternary	350	1200	420000	intact	yes	yes	yes	single	steep	good	PcL-058b	
PcL-243	Peace	BC 86047 no 91	PvL 51	4	6	189	Quaternary	500	600	300000	intact	No	yes	yes	single	steep	good	PcL-056b	
PcL-244	Golata Ck	BC 89047 no 89	PL-T1L 3	3	6	309	Shale	400	800	320000	intact	No	yes	yes	complex	gentle	vegetated	PcL-026b	
PcL-245	Golata Ck	BC 89047 no 89	PL-T1L 4	3	6	316	Shale	300	1600	480000	intact	No	yes	yes	complex	gentle	vegetated	PcL-026c	
PcL-246	Golata Ck	BC 89047 no 89	PL-T1R 3	3	6	151	Quaternary	400	300	120000	intact	No	yes	yes	single	steep	vegetated	PcL-029b	
PcL-247	Golata Ck	BC 89047 no 89	PL-T1R 4	3	6	118	Quaternary	500	400	200000	intact	No	yes	yes	single	steep	vegetated	PcL-029c	
PcL-248	Peace	BC 86047 no 160	PvL 142	5	6	146	Quaternary	600	1100	660000	intact	No	yes	no	complex	gentle	modified	PcL-220	
PcR-001	Peace	BC 86047 no 129	PvR 73	2	6	323	Quaternary	1800	800	1440000	intact	Yes	Yes	Yes	single	steep	good		Attachie Slide
PcR-002	Peace	BC 86047 no 129	PvR 71	1	2	334	Quaternary	600	400	240000	debris	Yes	Yes	Yes	single	steep	good		Attachie's Little Brother
PcR-003	Peace	BC 86047 no 158	PvR 51	1	2	6	Quaternary	350	200	70000	debris	Yes	Yes	Yes	single	steep	good		across from bear flat
PcR-004	Peace	BC 86047 no 129	PvR 44	1	3	65	Quaternary	700	400	280000	No	No	Yes	Yes	single	steep	good		By mouth of Moberly
PcR-005	Peace	BC 86047 no 93	PvR 36	1	7	40	Quaternary	?	?		debris	Yes	Yes	no	Complex	gentle	vegetated		Taylor Hill Slide
PcR-006	Peace	BC 86047 no 87	PvR 1	4	7	303	Shale	800	1800	1440000	debris	No	No	no	Complex	gentle	vegetated		whole slope is old bank, could be earthflow complex or fully retrogressed rotational
PcR-007	Peace	BC 86047 no 87	PvR 3	4	7	315	Shale	800	1200	960000	debris	No	No	no	Complex	gentle	vegetated		whole slope is old bank, could be earthflow complex or fully retrogressed rotational
PcR-008	Peace	BC 86047 no 87	PvR 3	4	7	344	Shale	1000	2800	2800000	debris	No	Yes	Yes	Complex	steep	vegetated		whole slope is old bank, could be earthflow complex or fully retrogressed rotational
PcR-009	Peace	BC 86047 no 87	PR 1	2	6	322	Shale	300	450	135000	intact	No	Yes	Yes	single	steep	good		small slide, features muted
PcR-010	Peace	BC 86047 no 87	PvR 4/5	3	6	329	Shale	800	1200	960000	intact	Yes	eroded	no	Complex	gentle	vegetated		whole slope is old bank, could be earthflow complex or fully retrogressed rotational
PcR-011	Peace	BC 86047 no 87	PvR 6	3	6	325	Shale	600	2200	1320000	intact	Yes	eroded	Yes	Complex	steep	vegetated		a pair of old rotational slides
PcR-012	Peace	BC 86047 no 87	PR 5	5	6	331	Quaternary	200	400	80000	intact	Yes	eroded	Yes	single	steep	good		small pit slide - blue earthflow
PcR-013	Peace	BC 86047 no 87	PR-T1R 1	3	2	56	Shale	600	1000	600000	debris	No	Yes	gullied	single	steep	good		good example of type 2
PcR-014	Peace	BC 86047 no 87	PR-T1R 1	2	2	193	Shale	500	600	300000	debris	No	Yes	gullied	single	steep	good		good example of type 2
PcR-015	Peace	BC 86047 no 87	PR-T1R 1	3	2	195	Shale	400	600	240000	debris	No	Yes	gullied	single	steep	good		
PcR-016	Peace	BC 86047 no 87	PR-T1R 1	3	3	190	Shale	300	400	120000	No	No	Yes	gullied	single	steep	good		
PcR-017	Peace	BC 86047 no 87	PR-T1R 1	3	3	176	Shale	300	300	90000	No	No	Yes	gullied	Complex	steep	good		
PcR-018	Peace	BC 86047 no 87	PR-T1L 7	3	7	329	Shale	400	600	240000	debris	No	No	no	single	gentle	vegetated		retrogressed rot?
PcR-019	Peace	BC 86047 no 87	PR-T1L 5	3	7	338	Shale	400	600	240000	debris	No	Yes	vegetated	single	steep	vegetated		
PcR-020	Peace	BC 86047 no 87	PR-T1L 4	3	7	346	Shale	600	1000	600000	debris	No	Yes	no	single	steep	vegetated		
PcR-021	Peace	BC 86047 no 87	PR-T1L 2	3	7	6	Shale	700	500	350000	debris	No	Yes	gullied	single	steep	vegetated		
PcR-022	Peace	BC 86047 no 87	PR-T1L 1	3	7	36	Shale	800	900	720000	debris	No	Yes	gullied	Complex	steep	vegetated		
PcR-023	Peace	BC 86047 no 87	PvR 7	4	6	337	Shale	700	1700	1190000	intact	Yes	Yes	Yes	Complex	gentle	vegetated		weathered head wall, flows over BD scarp, features muted due to veg
PcR-024	Peace	BC 86047 no 89	PvR 8	3	7	10	Shale	1000	2000	2000000	debris	Yes	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-025	Peace	BC 86047 no 89	PvR 9/10	3	6	15	Shale	1800	2400	4320000	intact	Yes	No	no	Complex	gentle	vegetated		can make out two older bowls but not quite distinguishable
PcR-026	Peace	BC 86047 no 89	PvR 11/12/13	3	6	10	Shale	1200	1400	1680000	intact	Yes	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-027	Peace	BC 86047 no 89	PvR 14	3	6	330	Shale	1800	800	1440000	intact	Yes	No	Yes	single	gentle	vegetated		looks like old earth flow lobe
PcR-028	Peace	BC 86047 no 89	PvR 15	4	7	340	Shale	?	?		No	Yes	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-029	Peace	BC 86047 no 89	PvR 15	3	6	233	Shale	300	2000	600000	No	No	Yes	Yes	Complex	steep	muted		old gully failures
PcR-030	Peace	BC 86047 no 89	PvR 16/17	3	7	18	Shale	2300	2800	6440000	intact	Yes	No	gullied	Complex	gentle	vegetated		old failures on paleoriver
PcR-031	Peace	BC 86047 no 91	PvR 18-24	4	7	21	Shale	1900	5500	10450000	debris	Yes	No	gullied	Complex	gentle	vegetated		old failures on paleoriver
PcR-032	8 mile Ck	BC 86047 no 91	PR-T2R 1	3	7	314	Shale	1200	800	960000	debris	Yes	No	Yes	Complex	steep	muted		
PcR-033	8 mile Ck	BC 86047 no 91	PR-T2R 1	3	7	304	Shale	1700	1000	1700000	debris	Yes	Yes	gullied	single	steep	good		
PcR-034	8 mile Ck	BC 86047 no 91	PR-T2R 2	3	6	296	Shale	900	800	720000	intact	No	No	gullied	Complex	gentle	vegetated		
PcR-035	8 mile Ck	BC 86047 no 91	PR-T2R 3	2	3	237	Shale	500	800	400000	No	Yes	Yes	Yes	single	steep	good		
PcR-036	8 mile Ck	BC 86047 no 91	PR-T2R 6	2	2	347	Shale	800	700	560000	debris	No	Yes	Yes	single	gentle	vegetated		
PcR-037	8 mile Ck	BC 86047 no 91	PR-T2L 2	2	3	66	Shale	1400	900	1260000	No	partial	Yes	Yes	Complex	gentle	good		
PcR-038	8 mile Ck	BC 86047 no 91	PR-T2L 1	3	6	92	Shale	700	600	420000	intact	Yes	Yes	no	Complex	gentle	vegetated		
PcR-039	8 mile Ck	BC 86047 no 91	PR-T2L 1	3	6	69	Shale	1000	500	500000	intact	Yes	Yes	no	Complex	gentle	muted		flow with a 7 by sude
PcR-040	Peace	BC 86047 no 91	PR-T2L 1	4	6	37	Shale	1100	800	880000	intact	Yes	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-041	8 mile Ck	BC 86047 no 91	PR-T2L 1	2	3	107	Shale	200	450	90000	No	No	Yes	Yes	single	steep	good		small,on creek
PcR-042	Peace	BC 86047 no 91	PvR 25	2	6	313	Shale	900	1000	900000	intact	Yes	Yes	no	Complex	steep	vegetated		
PcR-043	Peace	BC 86047 no 91	PR-T3R 2	3	2	328	Shale	500	1400	700000	debris	Yes	No	no	Complex	gentle	vegetated		
PcR-044	Peace	BC 86047 no 91	PR-T3L 2	3	3	152	Shale	200	600	120000	No	No	Yes	Yes	single	steep	muted		
PcR-045	Peace	BC 86047 no 91	PvR 26	3	6	107	Shale	800	1200	960000	intact	Yes	No	no	single	gentle	vegetated		
PcR-046	Peace	BC 86047 no 91	PvR 27	4	6	29	Shale	1200	1000	1200000	intact	No	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-047	Peace	BC 86047 no 91	PvR 28	3	6	12	Shale	1600	2000	3200000	intact	Yes	Yes	no	Complex	gentle	vegetated		
PcR-048	Peace	BC 86047 no 93	PvR 29	4	6	3	Shale	1500	1600	2400000	intact	Yes	Yes	no	Complex	gentle	vegetated		
PcR-049	Peace	BC 86047 no 93	PvR 30	4	6	0	Shale	1000	1000	1000000	intact	Yes	Yes	no	single	gentle	vegetated		old failures on paleoriver
PcR-050	Peace	BC 86047 no 93	PvR 30/31	4	6	338	Shale	600	300	180000	intact	Yes	No	no	single	gentle	vegetated		old failures on paleoriver
PcR-051	Peace	BC 86047 no 93	PvR 31	3	3	285	Shale	300	600	180000	No	No	No	no	single	gentle	vegetated		
PcR-052	Peace	BC 86047 no 93	PvR 33	4	6	14	Shale	1700	800	1360000	intact	Yes	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-053	Peace	BC 86047 no 93	PvR 34	3	7	329	Quaternary	600	500	300000	debris	No	No	no	single	gentle	vegetated		
PcR-054	Peace	BC 86047 no 93	PvR 35	5	6	107	Shale	300	1200	360000	intact	No	Yes	Yes	Complex	steep	good		along highway
PcR-055	Peace	BC 86047 no 93	PvR 36	5	5	37	Quaternary	1200	300	360000	No	No	Yes	Yes	single	gentle	good		crosses highway
PcR-056	Peace	BC 86047 no 93	PvR 36	4	6	30	Shale	1600	3200	5120000	intact	Yes	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-057	Peace	BC 86047 no 93	PvR 37/38	4	6	0	Shale	1600	800	1280000	intact	No	No	no	Complex	gentle	vegetated		old failures on paleoriver
PcR-058	Pingel	BC 86047 no 93	PR-T4R 1	3	6	341	Shale	900	900	810000	intact	Yes	No	Yes	single	gentle	vegetated		
PcR-059	Pingel	BC 86047 no 93	PR-T4R 1	2	7	294	Shale	600	1200	720000	debris	Yes	Yes	Yes	Complex	gentle	vegetated		
PcR-060	Pingel	BC 86047 no 93	PR-T4R 1	3	6	294	Shale	600	350	210000	intact	No	No	Yes	single	gentle	vegetated		
PcR-061	Pingel	BC 86047 no 93	PR-T4R 1	3	6	304	Shale	500	300	150000	intact	Yes	Yes	Yes	single	steep	good		
PcR-062	Pingel	BC 86047 no 93	PR-T4R 2	3	6	282	Shale	400	600	240000	intact	No	No	no	Complex	gentle	vegetated		
PcR-063	Pingel	BC 86047 no 93	PR-T4L 2	3	6	109	Shale	500	400	200000	intact	No	Yes	Yes	Complex	steep	muted		
PcR-064	Pingel	BC 86047 no 93	PR-T4L 1	3	7	100	Shale	600	1200	720000	debris	Yes	Yes	Yes	Complex	steep	vegetated		ponding
PcR-065	Pingel	BC 86047 no 93	PR-T4L 1	3	3	66	Quaternary	800	550	440000	No	Yes	No	no	Complex	gentle	vegetated		
PcR-066	Peace	BC 86047 no 93	PR 14a	2	5	20	Quaternary	200	500	100000	No	No	Yes	Yes	Complex	steep	vegetated		lots of little flows
PcR-067	Peace	BC 86047 no 95	PvR 39	4	6	53	Quaternary	550	2100	1155000	intact	No	Yes	Yes	Complex	steep	vegetated		Paleo-failures with high 8's
PcR-068	Peace	BC 86047 no 95	PvR 39	4	2	58	Shale	650	1300	845000	debris	No	Yes	Yes	Complex	gentle	vegetated		Paleo-failures with high 8's
PcR-069	Peace	BC 86047 no 95	PvR 39	4	6	68	Shale	500	1700	850000	intact	No	No	no	Complex	gentle	vegetated		Paleo-failures with high 8's

PcR-070	Peace	BC 86047 no 95	PvR 40/41	4	6	43	Shale	600	1300	780000	intact	Yes	No	no	Complex	gentle	vegetated		Paleo-failures
PcR-071	Peace	BC 86047 no 95	PvR 41/42	4	6	20	Shale	1000	4000	4000000	intact	No	Yes	no	Complex	gentle	vegetated		Paleo-failures
PcR-072	Peace	BC 86047 no 131	PvR 41	1	6	300	Shale	?	?		intact	Yes	Yes	Yes	single	steep	good		
PcR-073	Peace	BC 86047 no 131	PvR 41	1	6	300	Shale	?	?		intact	No	Yes	Yes	single	steep	good		
PcR-074	Peace	BC 86047 no 129	PvR 46	3	6	335	Quaternary	400	600	240000	intact	Yes	Yes	gullied	single	steep	muted		
PcR-075	Peace	BC 86047 no 129	PvR 47	2	6	317	Quaternary	400	300	120000	intact	Yes	Yes	Yes	Complex	steep	good		not present
PcR-076	Peace	BC 86047 no 129	PvR 47	4	6	235	Quaternary	500	1200	600000	intact	No	Yes	no	Complex	gentle	vegetated		
PcR-077	Peace	BC 86047 no 129	PvR 47	4	6	8	Quaternary	600	1800	1080000	intact	No	Yes	no	single	gentle	vegetated		
PcR-078	Peace	BC 86047 no 129	PvR 47	3	8	24	Quaternary	1300	700	910000	No	Yes	Yes	Yes	single	gentle	vegetated		Lake Peace Failure
PcR-079	Peace	BC 86047 no 129	PvR 47	4	6	43	Quaternary	800	600	480000	intact	No	Yes	Yes	single	gentle	vegetated		Lake Peace Failure
PcR-080	Peace	BC 86047 no 129	PvR 44/45	3	6	44	Quaternary	1000	4000	4000000	No	Yes	Yes	gullied	Complex	steep	vegetated		Paleo-failures with 8's
PcR-081	Peace	BC 86047 no 129	PvR 45/46	3	6	347	Shale	1100	850	935000	No	No	Yes	gullied	Complex	steep	vegetated		Paleo-failures with 8's
PcR-082	Peace	BC 86047 no 127	PR-T5L 3	2	2	346	Shale	300	300	90000	debris	No	Yes	Yes	single	steep	good	PcR-087b	
PcR-083	Peace	BC 86047 no 127	PvR 48	3	6	30	Shale	1300	1400	1820000	debris	Yes	Yes	Yes	Complex	gentle	vegetated		Lake Peace Failure
PcR-084	Peace	BC 86047 no 127	PvR 48	3	6	45	Shale	600	2000	1200000	intact	Yes	No	no	Complex	steep	vegetated		Paleo-failures
PcR-085	Peace	BC 86047 no 127	PvR 49/50	4	3	40	Shale	700	2850	1995000	No	Yes	No	no	Complex	steep	vegetated		Paleo-failures
PcR-086	Peace	BC 86047 no 127	PR-T5R 1	3	6	302	Shale	400	600	240000	intact	No	Yes	Yes	single	steep	vegetated		
PcR-087	Peace	BC 86047 no 127	PR-T5L 1	2	2	114	Shale	300	700	210000	debris	No	Yes	Yes	single	steep	good		
PcR-088	Peace	BC 86047 no 158	PvR 50/51	4	6	11	Quaternary	600	1000	600000	intact	Yes	Yes	no	Complex	steep	vegetated		Paleo-failures
PcR-089	Peace	BC 86047 no 158	PvR 52	2	2	273	Quaternary	150	300	45000	debris	No	Yes	Yes	Complex	steep	good		
PcR-090	Peace	BC 86047 no 158	PvR 54	3	2	52	Quaternary	250	400	100000	debris	Yes	Yes	Yes	Complex	steep	muted		
PcR-091	Peace	BC 86047 no 158	PvR 52/53	3	7	311	Quaternary	200	400	80000	debris	No	No	no	Complex	gentle	vegetated		
PcR-092	Peace	BC 86047 no 158	PvR 55	2	2	325	Quaternary	300	400	120000	debris	Yes	eroded	Yes	single	steep	good		
PcR-093	Peace	BC 86047 no 158	PvR 55	3	2	310	Quaternary	400	300	120000	debris	Yes	eroded	Yes	single	steep	vegetated		
PcR-094	Peace	BC 86047 no 158	PvR 55	3	3	267	Quaternary	200	600	120000	No	No	Yes	gullied	Complex	steep	good		
PcR-095	Peace	BC 86047 no 158	PvR 56	3	7	130	Quaternary	150	400	60000	debris	No	Yes	Yes	Complex	steep	vegetated		
PcR-096	Peace	BC 86047 no 158	PvR 56	3	2	318	Quaternary	400	600	240000	debris	Yes	eroded	Yes	single	steep	vegetated		
PcR-097	Peace	BC 86047 no 158	PvR 57	3	6	246	Shale	200	500	100000	intact	No	Yes	Yes	single	steep	good		
PcR-098	Peace	BC 86047 no 158	PvR 62	3	6	27	Shale	500	800	400000	intact	No	No	no	Complex	gentle	vegetated		
PcR-099	Peace	BC 86047 no 158	PvR 63	3	3	310	Quaternary	400	600	240000	No	Yes	eroded	gullied	single	steep	vegetated		
PcR-100	Peace	BC 86047 no 158	PvR 64	3	6	311	Shale	600	800	480000	intact	Yes	eroded	gullied	single	gentle	vegetated		
PcR-101	Peace	BC 86047 no 126	PvR 69	3	4	14	Quaternary	1100	500	550000	No	Yes	Yes	no	single	gentle	vegetated		
PcR-102	Peace	BC 86047 no 126	PvR 67	4	6	345	Quaternary	500	1600	800000	intact	No	eroded	gullied	Complex	steep	vegetated		
PcR-103	Peace	BC 86047 no 126	PvR 68/69	4	6	5	Quaternary	900	3200	2880000	intact	no	No	gullied	Complex	gentle	vegetated		
PcR-104	Peace	BC 86047 no 126	PR-T6R 2	3	6	212	Quaternary	200	1600	320000	intact	No	No	no	single	steep	muted		
PcR-105	Peace	BC 86047 no 124	PvR 70	4	6	9	Quaternary	1000	700	700000	intact	Yes	Yes	no	single	gentle	vegetated		
PcR-106	Peace	BC 86047 no 124	PvR 70	3	6	339	Quaternary	1000	600	600000	intact	Yes	No	Yes	single	gentle	vegetated		
PcR-107	Peace	BC 86047 no 124	PvR 71	3	6	308	Quaternary	600	400	240000	intact	Yes	Yes	Yes	single	steep	good		
PcR-108	Peace	BC 86047 no 124	PvR 72	3	6	341	Quaternary	800	1900	1520000	intact	Yes	No	no	Complex	gentle	vegetated		
PcR-109	Peace	BC 86047 no 124	PvR 73	3	6	338	Quaternary	600	1100	660000	intact	Yes	No	no	Complex	steep	vegetated		
PcR-110	Peace	BC 86047 no 124	PvR 73	4	6	325	Quaternary	600	1100	660000	intact	Yes	No	no	Complex	steep	vegetated		
PcR-111	Peace	BC 86047 no 103	PvR 74/75	3	3	20	Quaternary	600	900	540000	No	Yes	Yes	Yes	single	gentle	vegetated		
PcR-112	Peace	BC 86047 no 103	PvR 76	3	2	252	Quaternary	200	1000	200000	debris	No	Yes	Yes	Complex	steep	good		
PcR-113	Peace	BC 86047 no 103	PvR 75/78	4	6	328	Quaternary	1200	1500	1800000	intact	No	Yes	no	Complex	steep	vegetated		
PcR-114	Peace	BC 86047 no 103	PvR 81	4	6	325	Quaternary	1400	700	980000	intact	Yes	Yes	no	single	steep	vegetated		
PcR-115	Peace	BC 86047 no 103	PR-T7R 1	3	6	247	Quaternary	300	1200	360000	intact	No	Yes	Yes	Complex	steep	good		
PcR-116	Peace	BC 86047 no 103	PR-T7R 1	3	3	220	Quaternary	300	600	180000	No	No	Yes	Yes	Complex	steep	good		
PcR-117	Peace	BC 86047 no 103	PR-T7R 2	2	6	208	Quaternary	300	500	150000	intact	No	Yes	Yes	single	steep	good		
PcR-118	Peace	BC 86047 no 103	PR-T7L 3	2	3	4	Quaternary	400	200	80000	No	No	Yes	no	single	gentle	good		
PcR-119	Peace	BC 86047 no 103	PR-T7L 3	3	6	17	Quaternary	300	800	240000	intact	No	No	no	Complex	gentle	vegetated		
PcR-120	Peace	BC 86047 no 103	PR-T7L 1	3	6	53	Quaternary	350	1100	385000	intact	No	No	no	Complex	gentle	vegetated		
PcR-121	Peace	BC 86047 no 103	PvR 82/85	4	6	317	Quaternary	1500	2200	3300000	intact	No	Yes	no	Complex	gentle	muted		
PcR-122	Peace	BC 86047 no 103	PvR 83	2	3	246	Quaternary	300	900	270000	No	No	Yes	Yes	single	steep	good		
PcR-123	Peace	BC 86047 no 103	PvR 84	3	6	71	Quaternary	250	1000	250000	intact	Yes	Yes	Yes	single	gentle	vegetated		
PcR-124	Peace	BC 86047 no 103	PvR 88	4	6	312	Quaternary	400	300	120000	intact	No	Yes	Yes	Complex	steep	muted		
PcR-125	Peace	BC 86047 no 103	PR-T8R 1	3	3	86	Quaternary	300	500	150000	No	No	Yes	Yes	single	steep	good		
PcR-126	Peace	BC 86047 no 103	PR-T8R 1	3	3	209	Quaternary	300	600	180000	No	No	Yes	Yes	single	steep	good	PcR-126a	
PcR-127	Peace	BC 86047 no 103	PR-T8R 1	3	6	309	Quaternary	400	1200	480000	intact	Yes	Yes	Yes	Complex	steep	muted		
PcR-128	Peace	BC 86047 no 103	PR-T8L 2	2	6	112	Quaternary	400	1000	400000	intact	Yes	Yes	Yes	single	steep	good		
PcR-129	Peace	BC 86047 no 103	PvR 89	4	6	327	Quaternary	500	1100	550000	intact	No	Yes	no	Complex	steep	muted		
PcR-130	Peace	BC 86047 no 105	PvR 89	3	4	326	Quaternary	1400	300	420000	No	Yes	Yes	no	single	gentle	vegetated		mobile flow
PcR-131	Peace	BC 86047 no 105	PvR 89	3	6	320	Quaternary	700	1850	1295000	intact	Yes	Yes	no	single	gentle	vegetated		less mobile flow
PcR-132	Peace	BC 86047 no 105	PvR 89b	4	6	345	Quaternary	600	1000	600000	intact	No	Yes	no	Complex	steep	vegetated		
PcR-133	Peace	BC 86047 no 105	PvR 93	4	6	332	Quaternary	600	1200	720000	intact	No	Yes	gullied	Complex	steep	vegetated		
PcR-134	Peace	BC 86047 no 105	PvR 94	3	3	19	Quaternary	300	800	240000	No	Yes	Yes	no	Complex	gentle	vegetated		
PcR-135	Peace	BC 86047 no 105	PvR 95	3	6	331	Quaternary	700	500	350000	intact	No	No	no	Complex	gentle	vegetated		
PcR-136	Peace	BC 86047 no 105	PR-T11R 1	2	2	265	Quaternary	450	700	315000	debris	No	Yes	Yes	single	gentle	good		
PcR-137	Peace	BC 86047 no 105	PR-T11R 2	3	3	243	Quaternary	150	700	105000	No	Yes	No	no	single	gentle	vegetated		
PcR-138	Peace	BC 86047 no 105	PR-T11L 1	3	3	44	Quaternary	500	1400	700000	No	Yes	No	no	Complex	gentle	vegetated		
PcR-139	Peace	BC 86047 no 105	PR-T12R 1	3	6	258	Quaternary	300	1000	300000	intact	No	Yes	gullied	Complex	steep	good		
PcR-140	Peace	BC 86047 no 105	PvR 97	4	6	342	Quaternary	1300	2200	2860000	intact	No	Yes	gullied	Complex	steep	vegetated		

PcR-141	Peace	BC 86047 no 105	PR-T13R 2	3	6	307	Quaternary	500	300	150000	intact	Yes	No	no	single	gentle	vegetated		
PcR-142	Peace	BC 86047 no 105	PR-T13R 2	3	2	236	Quaternary	350	1500	525000	debris	No	Yes	Yes	Complex	steep	vegetated		
PcR-143	Peace	BC 86047 no 105	PR-T13R 2	3	6	222	Quaternary	400	650	260000	intact	No	Yes	Yes	Complex	steep	good		
PcR-144	Peace	BC 86047 no 105	PR-T13L 2/3	3	6	65	Quaternary	300	1200	360000	intact	Yes	No	no	Complex	gentle	vegetated		
PcR-145	Peace	BC 86047 no 105	PvR 98	4	6	315	Quaternary	400	2600	1040000	intact	No	Yes	gullied	Complex	steep	old		
PcR-146	Peace	BC 86047 no 62	PvR 99	3	2	309	Quaternary	300	1000	300000	debris	No	No	no	single	gentle	vegetated		
PcR-147	Peace	BC 86047 no 62	PvR 101/102	3	2	44	Quaternary	300	1500	450000	debris	No	Yes	Yes	Complex	gentle	good		
PcR-148	Peace	BC 86047 no 105	PR-T13L 6	2	3	66	Quaternary	300	1100	330000	No	Yes	No	no	Complex	gentle	good		
PcR-149	Peace	BC 86047 no 62	PvR 103	4	6	335	Quaternary	500	800	400000	intact	No	No	no	Complex	steep	vegetated		
PcR-150	Peace	BC 86047 no 62	PvR 104	2	6	288	Shale	500	800	400000	intact	Yes	eroded	gullied	single	steep	good		
PcR-151	Peace	BC 86047 no 62	PR-T14R 1	2	3	244	Shale	500	600	300000	No	No	Yes	Yes	single	steep	good		
PcR-152	Peace	BC 86047 no 62	PR-T14R 1	3	3	253	Shale	300	1100	330000	No	No	Yes	Yes	Complex	steep	muted		
PcR-153	Peace	BC 86047 no 62	PR-T14R 2	3	6	286	Quaternary	500	1400	700000	intact	No	No	no	Complex	gentle	vegetated		
PcR-154	Peace	BC 86047 no 62	PR-T14L 2/3	3	6	84	Quaternary	400	1600	640000	intact	Yes	Yes	Yes	Complex	gentle	vegetated		
PcR-155	Peace	BC 86047 no 62	PR-T14L 2	2	3	92	Quaternary	400	400	160000	No	No	Yes	Yes	single	steep	good		
PcR-156	Peace	BC 86047 no 62	PR-T14L 2	3	6	95	Quaternary	400	300	120000	intact	Yes	Yes	Yes	single	steep	good		
PcR-157	Peace	BC 86047 no 62	PR-T14L 1	3	3	69	Quaternary	400	500	200000	No	Yes	Yes	no	Complex	gentle	vegetated		
PcR-158	Peace	BC 86047 no 62	PR-T14L 1	2	6	75	Quaternary	400	100	40000	intact	Yes	Yes	Yes	single	gentle	good		
PcR-159	Peace	BC 86047 no 62	PR-T14L 1	3	6	59	Quaternary	400	1000	400000	intact	Yes	No	no	Complex	steep	muted		
PcR-160	Peace	BC 86047 no 62	PvR 105	4	6	290	Quaternary	500	1600	800000	intact	No	No	no	Complex	steep	old		
PcR-161	Peace	BC 86047 no 62	PvR 105	3	4	299	Quaternary	1000	300	300000	No	Yes	Yes	Yes	single	gentle	vegetated		
PcR-162	Peace	BC 86047 no 62	PvR 105	4	6	297	Quaternary	400	1200	480000	intact	No	No	no	Complex	steep	old		
PcR-163	Peace	BC 86047 no 60	PvR 106	4	6	297	Quaternary	700	1000	700000	intact	No	No	no	single	steep	vegetated		area makes up large earthflow type complex
PcR-164	Peace	BC 86047 no 60	PvR 107	3	5	292	Quaternary	1400	400	560000	No	Yes	Yes	no	single	gentle	vegetated		area makes up large earthflow type complex
PcR-165	Peace	BC 86047 no 60	PvR 108	4	3	296	Quaternary	500	700	350000	No	No	No	Yes	Complex	steep	old		area makes up large earthflow type complex
PcR-166	Peace	BC 86047 no 60	PvR 108/109	3	5	325	Quaternary	1300	600	780000	No	Yes	Yes	no	single	gentle	vegetated		area makes up large earthflow type complex
PcR-167	Peace	BC 86047 no 60	PvR 110	4	6	322	Quaternary	600	800	480000	intact	No	No	Yes	Complex	steep	old		area makes up large earthflow type complex
PcR-168	Peace	BC 86047 no 60	PvR 110	3	5	312	Quaternary	1000	500	500000	No	Yes	Yes	no	single	gentle	vegetated		area makes up large earthflow type complex
PcR-169	Peace	BC 86047 no 60	PvR 110	4	6	295	Quaternary	600	700	420000	intact	No	No	gullied	Complex	steep	old		area makes up large earthflow type complex
PcR-170	Peace	BC 86047 no 60	PvR 111	4	6	311	Quaternary	700	1300	910000	intact	No	No	no	Complex	steep	old		area makes up large earthflow type complex
PcR-171	Peace	BC 86047 no 60	PvR 111	4	5	310	Quaternary	850	650	552500	No	No	Yes	no	single	gentle	vegetated		area makes up large earthflow type complex
PcR-172	Peace	BC 86047 no 60	PvR 111	4	5	310	Quaternary	?	?		No	No	Yes	no	Complex	gentle	vegetated		area makes up large earthflow type complex
PcR-173	Peace	BC 86047 no 60	PvR 105	3	4	309	Quaternary	1000	400	400000	No	Yes	Yes	Yes	single	steep	vegetated	PvR-162a	
PcR-174	Peace	BC 86047 no 62	PR-T14R 5	2	4	228	Quaternary	700	400	280000	No	Yes	Yes	no	single	gentle	good		flow
PcR-175	Peace	BC 86047 no 87	PvR 3	3	4	333	Quaternary	1200	100	120000	No	Yes	Yes	Yes	single	steep	good		
PcR-176	Peace	BC 86047 no 87	PvR 5	3	6	351	Shale	900	300	270000	intact	Yes	eroded	Yes	Complex	steep	covered		
PcR-179	Peace	BC 86047 no 91	PR-T3L 2	3	7	165	Shale	?	?		debris	No	Yes	Yes	single	gentle	good		
PcR-180	Peace	BC 86047 no 91	PvR 27	3	4	20	Quaternary	1000	300	300000	No	Yes	Yes	Yes	Complex	gentle	good		
PcR-181	Pingel	BC 86047 no 93	PR-T4L 2	3	2	132	Shale	400	400	160000	debris	No	Yes	Yes	single	steep	good		
PcR-182	Peace	BC 86047 no 127	PvR 48	3	6	43	Shale	500	1200	600000	intact	Yes	Yes	Yes	Complex	gentle	vegetated		
PcR-183	Peace	BC 86047 no 127	PR-T5R 2/3	3	6	260	Shale	300	1100	330000	intact	No	Yes	Yes	Complex	steep	vegetated		
PcR-184	Peace	BC 86047 no 127	PR-T5L 4/5	3	7	58	Shale	?	?		debris	No	Yes	Yes	Complex	steep	vegetated		
PcR-186	Peace	BC 86047 no 126	PR-T6R 2	4	2	12	Quaternary	300	500	150000	debris	Yes	Yes	Yes	single	steep	muted		
PcR-187	Peace	BC 86047 no 103	PR-T8L 1	3	6	61	Quaternary	500	1000	500000	intact	No	Yes	Yes	Complex	gentle	good		
PcR-188	Peace	BC 86047 no 105	PR-T8L 3	3	6	264	Quaternary	400	700	280000	intact	Yes	Yes	no	Complex	gentle	vegetated		
PcR-189	Peace	BC 86047 no 105	PR-T8L 3	3	6	280	Quaternary	400	600	240000	intact	Yes	Yes	no	single	gentle	vegetated		
PcR-190	Peace	BC 86047 no 105	PR-T8L 4	3	2	247	Quaternary	400	400	160000	debris	Yes	Yes	no	single	gentle	vegetated		
PcR-191	8 mile Ck	BC 86047 no 076	PR-T2R 9	3	6	21	Shale	200	700	140000	intact	No	Yes	Yes	single	gentle	good	PcR-037g	
PcR-192	Peace	BC 86047 no 103	PR-T8R 1	3	6	2	Quaternary	300	600	180000	intact	No	No	no	Complex	gentle	vegetated	PcR-126b	
PcR-193	Peace	BC 86047 no 103	PvR 86	2	2	266	Quaternary	300	800	240000	debris	No	Yes	Yes	single	gentle	good	PcR-124b	
PcR-194	Peace	BC 86047 no 129	PvR 46	2	3	320	Shale	200	300	60000	No	No	Yes	Yes	single	steep	good	PcR-074b	
PcR-195	Peace	BC 86047 no 129	PvR 46	2	6	329	Shale	600	600	360000	intact	Yes	Yes	Yes	Complex	steep	good	PcR-074c	
PcR-196	8 mile Ck	BC 86047 no 076	PR-T2R 10	3	3	293	Quaternary	200	1300	260000	No	No	Yes	Yes	single	gentle	good	PcR-037f	
PcR-197	Peace	BC 86047 no 95	PvR 41	1	6	334	Quaternary	400	500	200000	intact	Yes	Yes	Yes	Complex	steep	good	PcR-071c	
PcR-198	Peace	BC 86047 no 95	PvR 41	2	6	307	Quaternary	500	400	200000	intact	Yes	Yes	Yes	single	steep	good	PcR-071b	
PcR-199	8 mile Ck	BC 86047 no 076	PR-T2R 10	3	3	294	Quaternary	200	800	160000	No	No	Yes	Yes	single	gentle	good	PcR-037e	
PcR-200	8 mile Ck	BC 86047 no 076	PR-T2L 6	3	6	100	Quaternary	300	900	270000	intact	No	Yes	Yes	Complex	gentle	good	PcR-037d	
PcR-201	8 mile Ck	BC 86047 no 076	PR-T2L 6	3	2	117	Shale	300	1300	390000	debris	No	Yes	Yes	single	gentle	good	PcR-037c	
PcR-202	8 mile Ck	BC 86047 no 076	PR-T2L 5	2	2	84	Shale	600	1400	840000	debris	No	Yes	Yes	Complex	steep	good	PcR-037b	
PcR-203	8 mile Ck	BC 86047 no 076	PR-T2R 7	3	6	263	Shale	200	400	80000	intact	No	Yes	Yes	single	steep	good	PcR-037h	
PcR-204	8 mile Ck	BC 86047 no 076	PR-T2R 7	3	2	278	Shale	300	1000	300000	debris	No	Yes	Yes	single	gentle	vegetated	PcR-037i	
PcR-205	8 mile Ck	BC 86047 no 076	PR-T2R 7	3	2	268	Shale	400	1000	400000	debris	No	Yes	Yes	Complex	gentle	vegetated	PcR-037j	
PcR-206	8 mile Ck	BC 86047 no 076	PR-T2R 5	3	6	355	Shale	200	900	180000	intact	No	Yes	Yes	single	gentle	vegetated	PcR-036b	
PcR-207	8 mile Ck	BC 86047 no 076	PR-T2R 4	3	3	192	Shale	200	900	180000	No	Yes	No	Yes	single	gentle	vegetated	PcR-036c	
PcR-246	Peace	BC 86047 no 105	PR-T13L 3	3	6	98	Quaternary	300	1000	300000	intact	Yes	No	no	single	gentle	good	PcR-144b	
PcR-247	Peace	BC 86047 no 105	PR-T13L 7	3	3	107	Quaternary	300	500	150000	No	Yes	No	no	single	gentle	vegetated	PcR-148b	
PcR-248	Peace	BC 86047 no 105	PR-T13L 8	3	3	78	Quaternary	300	500	150000	No	Yes	No	no	single	gentle	vegetated	PcR-148c	
PcR-249	Peace	BC 86047 no 105	PR-T13L 8	3	3	101	Quaternary	300	700	210000	No	Yes	No	no	single	gentle	vegetated	PcR-148d	
PcR-250	Peace	BC 86047 no 105	PR-T12L 2	3	8	61	Quaternary	250	700	175000	No	No	Yes	no	single	steep	vegetated		
PcR-251	Peace	BC 86047 no 105	PR-T12L 2	3	3	95	Quaternary	200	500	100000	No	No	Yes	no	single	steep	vegetated		
PcR-252	Peace	BC 86047 no 105	PR-T12L 4	3	6	35	Quaternary	300	1200	360000	No	No	Yes	no	single	steep	vegetated		
PcR-253	Peace	BC 86047 no 105	PR-T12R 3	3	3	228	Quaternary	200	1000	200000	No	No	Yes	no	single	steep	vegetated		
PcR-254	Peace	BC 86047 no 105	PR-T12R 1	2	3	256	Quaternary	300	1100	330000	No	No	Yes	no	single	steep	vegetated		
PcR-255	Peace	BC 86047 no 62	PR-T14R 1/2	3	3	266	Shale	300	300	90000	No	Yes	Yes	Yes	single	steep	covered		
PcR-256	Peace	BC 86047 no 62	PR-T14L 2	3	3	261	Quaternary	300	600	180000	No	Yes	Yes	Yes	single	steep	covered		
PcR-257	Peace	BC 86047 no 62	PR-T14L 4	3	3	65	Quaternary	200	1000	200000	No	Yes	No	Yes	Complex	steep	covered		
PcR-258	Peace	BC 86047 no 106	PR-T12L 1	3	3	63	Quaternary	400	1300	520000	No	Yes	Yes	no	Complex	steep	vegetated		
PcR-259	Peace	BC 86047 no 106	PvR 96	3	3	354	Quaternary	600	700	420000	No	Yes	No	Yes	Complex	steep	vegetated		
									Total	2.59E+08	m2								
									Area	258.92	km2								

Appendix IV - Landslide Inventory

Table IV - 2 Beatton River

Failure Name	River	Photo	River Segment	Activity	Failure Type	Slide Aspect	Probable Basal Failure Material	Length (m)	Width (m)	Area m²	Secondary Scarps	Over Scarp	Debris Apron	Defined Head Scarp	Single or Complex	Slope Angle	Feature Clarity	May Be Mapped As	Additional Comments
BL-003	Beatton	BC 86074 no 254	BL 94	1	7	348	Quaternary	800	1200	960000	debris	No	Yes	yes	single	steep	good		features don't show on 86 photos, but there is an older scar there
BL-005	Beatton	BC 86074 no 254	BL 96	1	6	280	Quaternary	400	200	80000	intact	No	Yes	yes	single	steep	good		Christian camp slide, large head wall with till, intact scarp with slide plane exposed, rest of slide is fairly reveg.
BL-006	Beatton	BC 86047 no 91	BL 13	1	6	241	shale	?	?		intact	yes	Yes	debris	complex	steep	good		With tilting trees, obviously layered
BL-007	Beatton	BC 86047 no 153	BL 59	3	6	145	shale	500	300	150000	intact	No	no	yes	single	steep	good	BL-035a	
BL-008	Beatton	BC 86075 no 16	BL-T8L 2/3	3	7	8	Quaternary	400	1600	640000	debris	yes	Yes	yes	complex	gentle	modified	BL-024b	
BL-009	Beatton	BC 86047 no 91	BL 10	3	6	228	shale	800	900	720000	intact	yes	Yes	yes	complex	steep	good		
BL-010	Beatton	BC 86075 no 16	BL 69	3	3	320	shale	400	1000	400000	No	No	Yes	yes	single	steep	covered		on large bend of river, steep scarp, in canyon, may have shallower slides at top
BL-011	Beatton	BC 86075 no 16	BL 67	4	3	211	shale	500	600	300000	No	yes	Yes	gullied	single	steep	muted		Small slide, steep head scarp, in canyon
BL-012	Beatton	BC 86075 no 16	BL 68	3	3	290	shale	300	1200	360000	No	yes	eroded	yes	single	steep	old		not much debris, steep scarp, in canyon
BL-013	Beatton	BC 86075 no 16	BL 66	4	3	244	shale	700	600	420000	No	yes	Yes	yes	single	gentle	covered		shallower head scarp, debris on scarp and fan, like BL 17, no real head scarp
BL-014	Beatton	BC 86075 no 16	BL 66	3	3	273	shale	500	900	450000	No	No	Yes	gullied	single	steep	old		Steep head scarp, smaller debris fan, more like a build up of debris instead of large event
BL-015	Beatton	BC 86075 no 16	BL-T7R 1/2	2	6	200	shale	400	1300	520000	intact	No	Yes	yes	single	steep	good		in tributary, shallower than in canyon, south facing, small head scarp
BL-016	Beatton	BC 86075 no 16	BL-T7L 1	3	7	5	shale	500	1000	500000	debris	No	no	yes	single	gentle	covered		in tributary, shallower than in canyon, north facing
BL-017	Beatton	BC 86075 no 16	BL 65	3	6	284	shale	700	700	490000	intact	yes	Yes	yes	single	gentle	covered		shallower head scarp, debris on scarp and fan
BL-018	Beatton	BC 86075 no 16	BL 64	3	2	273	shale	600	1300	780000	debris	No	Yes	yes	complex	steep	old		Steep head scarp (vert.), debris covers competent beds, Dunvegan in scarp.
BL-019	Beatton	BC 86075 no 16	BL 62/63/64	3	2	298	shale	800	2600	2080000	debris	No	Yes	yes	complex	steep	old		Steep Head scarp (nearly vert.), large debris apron, Dunvg Outcrops in head scarp,may include several slides
BL-020	Beatton	BC 86075 no 16	BL 70	3	3	272	shale	500	1100	550000	No	No	Yes	yes	complex	steep	old		on convex curve, may ecompass several slide, steep scarp, little debris
BL-021	Beatton	BC 86075 no 16	BL 71	3	3	330	shale	350	600	210000	No	yes	partial	yes	complex	steep	covered		2 slides, northern is shallow and younger, near tributary mouth, south is steep, little debris, in canyon
BL-022	Beatton	BC 86075 no 16	BL 72	2	3	339	Quaternary	400	1000	400000	No	yes	Yes	yes	single	gentle	covered		shallower slide, not much of head scarp, debris covered
BL-023	Flatrock Ck	BC 86075 no 16	BL-T8L 1	3	7	9	Quaternary	700	1200	840000	debris	No	no	yes	complex	gentle	covered		shallow slide, small head scarp, quite wide
BL-024	Flatrock Ck	BC 86075 no 16	BL-T8L 1/2	2	7	15	Quaternary	600	1200	720000	debris	yes	no	yes	complex	gentle	covered		Flatrock Slide, small slide, several large slices, low angle, wide, small head scarp
BL-025	Flatrock Ck	BC 86075 no 16	BL-T8R 3	3	2	197	Quaternary	200	1000	200000	debris	No	Yes	yes	complex	steep	muted		distinct scarp, small scarp, shallow top scarp with steeper bottom scarp in competent rock
BL-026	Flatrock Ck	BC 86075 no 16	BL-T8R 2	3	6	224	Quaternary	500	1050	525000	intact	No	Yes	yes	single	gentle	covered		distinct small scarp, low mobility debris, wide
BL-027	Flatrock Ck	BC 86075 no 16	BL-T8R 2	3	3	203	Quaternary	300	400	120000	No	yes	Yes	yes	single	steep	muted		small slide, small head scarp but distinct, like BL-26
BL-028	Flatrock Ck	BC 86075 no 16	BL-T8R 1	4	2	217	Quaternary	400	900	360000	debris	No	no	yes	complex	steep	old		Little to no debris, not wide, several scarps in mass, looks more like a low mobility slump
BL-029	Beatton	BC 86075 no 16	BL 72	4	3	290	Quaternary	300	500	150000	No	yes	no	yes	single	gentle	covered		shallow head scarp, debris covered, like BL-22
BL-030	Beatton	BC 86047 no 153	BL 75	4	1	187	shale	300	600	180000	No	No	Yes	gullied	single	steep	old		Steep Wall with a build up of debris at base
BL-031	Beatton	BC 86047 no 153	BL 61	3	2	304	shale	1200	1300	1560000	debris	No	Yes	gullied	single	steep	muted		Steep scarp, well developed debris
BL-032	Beatton	BC 86047 no 153	BL 60	4	2	273	shale	800	2000	1600000	debris	No	Yes	gullied	complex	steep	muted		Steep head wall, well developed debris
BL-033	Beatton	BC 86047 no 153	BL 59	2	2	177	shale	800	1400	1120000	debris	No	Yes	gullied	complex	steep	good		Steep head wall in SST and shale base, well developed debris
BL-034	Beatton	BC 86047 no 153	BL 59	4	6	182	Quaternary	400	650	260000	intact	yes	no	yes	single	steep	muted		Small encroachment of headscarp, no debris morphology, just on slope
BL-035	Beatton	BC 86047 no 153	BL 59	3	2	203	shale	600	1200	720000	debris	No	Yes	gullied	complex	steep	old		Continuation of BL-33, same head scarp, sst head scarp, nearly vertical
BL-036	Beatton	BC 86047 no 153	BL 58	3	3	126	shale	300	650	195000	No	No	Yes	gullied	single	steep	muted		west side of gully, defined head scarp, debris choking gully, low mobility
BL-037	Beatton	BC 86047 no 153	BL 57	3	6	257	shale	400	900	360000	intact	yes	Yes	gullied	single	steep	covered		east side of gully, head scarp pinches out to debris filled slope, low mobility
BL-038	Beatton	BC 86047 no 153	BL 56	3	6	217	shale	900	500	450000	intact	No	Yes	yes	single	steep	covered		No head wall, good scarp, debris filled slope
BL-039	Beatton	BC 86047 no 153	BL 55	3	6	231	shale	650	650	422500	intact	No	eroded	no	complex	gentle	covered		no head wall, good scarp, debris filled slope except where sst cliff exposed
BL-040	Beatton	BC 86047 no 153	BL 55	5	6	232	shale	800	900	720000	intact	No	Yes	yes	complex	gentle	modified		Passing hill failure, road in middle zone with failure destroying road, second scarp in debris near road level
BL-041	Beatton	BC 86047 no 153	BL 55	5	6	199	shale	700	400	280000	intact	No	Yes	yes	complex	gentle	modified		Passing hill failure, road in middle zone with failure destroying road, second scarp in debris near road level, around corner
BL-042	Beatton	BC 86047 no 153	BL 54	3	6	168	shale	1000	600	600000	intact	yes	Yes	yes	single	steep	good		3 failures,1 in ICS above & 2 in BD, road runs through top head scarp, well defined scarps in debris below road, good head wall
BL-043	Beatton	BC 86047 no 153	BL 53/54	2	6	176	shale	800	1300	1040000	intact	yes	partial	yes	complex	steep	good		well definrd failure, well defined scarps in debris, deep seated failure, two rounded head scarps, just below road
BL-044	Beatton	BC 86047 no 153	BL 53	2	6	186	shale	800	500	400000	intact	No	Yes	debris	single	steep	good		small head wall, well defined scarps in debris
BL-045	Beatton	BC 86047 no 153	BL 52	3	2	135	shale	600	400	240000	debris	No	Yes	yes	single	steep	muted		small head wall, no other scarps, in gully west side, low mobility
BL-046	Beatton	BC 86047 no 153	BL 52	3	6	95	shale	500	300	150000	intact	No	Yes	yes	single	steep	muted		small head wall, well defined scarp in debris, small, low mobility, west side of gully
BL-047	Beatton	BC 86047 no 153	BL 52	3	6	96	shale	500	1000	500000	intact	No	Yes	yes	single	gentle	covered		head scarp, but no wall, debris choked, low mobolity
BL-048	Beatton	BC 86047 no 153	BL 51/50	3	6	247	shale	600	1600	960000	intact	yes	Yes	gullied	complex	steep	old		head scarp, but no head wall, debris choked, low mobility, small scarp but cant tell if it is intact, east side of gully
BL-049	Beatton	BC 86047 no 153	BL 49	3	6	203	shale	600	700	420000	intact	No	eroded	yes	complex	steep	old		small head wall, 4 to 5 steps, not even to next door, likely deep seated and not leveled, well defined steps in debris
BL-050	Beatton	BC 86047 no 153	BL 48	2	6	182	shale	1200	800	960000	intact	No	no	yes	single	gentle	good		wide, circular shallow failure, flows over scarp close to river with small scarps in debris, good head wall up top for shallow failure
BL-051	Beatton	BC 86047 no 153	BL 47	3	6	200	shale	600	500	300000	intact	yes	eroded	yes	single	steep	good		good head wall, well defined scarps in debris
BL-052	Beatton	BC 86047 no 151	BL 47	3	6	185	shale	1100	800	880000	intact	No	Yes	yes	single	steep	good		deep upper bowl, good scarp debris covered head wall (mostly), above competent strata, then below there is some scarps in debris
BL-053	Beatton	BC 86047 no 151	BL-T8R 1	3	3	140	Quaternary	400	800	320000	No	No	no	no	complex	gentle	covered		debris covered slope, good scarp, no wall, in west side of gully
BL-054	Beatton	BC 86047 no 151	BL-T6L 1	3	3	250	Quaternary	400	500	200000	No	No	Yes	yes	single	steep	old		debris covered slope, good scarp, poor wall, east side of gully, circular shape
BL-055	Beatton	BC 86047 no 151	BL-T6L 1	3	6	225	Quaternary	500	400	200000	intact	No	Yes	yes	single	steep	old		small head wall, good scarp, three scarps in debris
BL-056	Beatton	BC 86047 no 151	BL 46	3	6	192	shale	1000	500	500000	intact	yes	Yes	yes	complex	steep	good		small shallow head wall with debris, big debris apron at base, scarp in failure may be intact or debris, debris covered
BL-057	Beatton	BC 86047 no 151	BL 46	3	6	224	shale	600	300	180000	intact	No	Yes	yes	single	steep	old		small failure, small partially covered head wall, rest of slope is disturbed debris, interupted by BL-58
BL-058	Beatton	BC 86047 no 151	BL 46	3	6	207	shale	750	500	375000	intact	yes	Yes	yes	single	steep	muted		smaller reactivation near current rivers edge
BL-059	Beatton	BC 86047 no 151	BL 41	3	7	213	shale	600	1600	960000	intact	yes	Yes	yes	complex	steep	old		collection of small single failures above sst
BL-060	Beatton	BC 86047 no 151	BL-T5R 1	2	6	121	shale	800	800	640000	intact	No	Yes	gullied	single	steep	covered		Gullied head wall, but it is there, rest of slope debris scovered no scarps
BL-061	Beatton	BC 86047 no 151	BL-T5R 1	3	6	140	Quaternary	400	1000	400000	intact	No	Yes	yes	complex	steep	muted		Head wall, broad circular shape, scarps in debris at different levels
BL-062	Beatton	BC 86047 no 151	BL-T5L 2/3	3	6	257	shale	600	1400	840000	intact	No	no	yes	complex	gentle	covered		Slide has no head wall,but appears to the north but small,debris choked,low mobility,south end of Slide has a couple of intact scarps
BL-063	Beatton	BC 86047 no 151	BL 40	3	6	226	shale	800	600	480000	intact	No	Yes	yes	single	steep	old		nice head wall, circular shape, slanted scarps in debris, must be deep seated
BL-064	Beatton	BC 86047 no 151	BL 39	3	3	159	Quaternary	150	600	90000	No	No	Yes	yes	single	steep	old		small, in west side of small gully, clean high head scarp, could just be gully but it looks like debris at base with scarp
BL-065	Beatton	BC 86047 no 151	BL 38	3	6	221	shale	700	600	420000	intact	yes	eroded	yes	single	steep	good		good circular shape, clean head wall, good scarp in debris, debris flowing over intact scarp at river bend
BL-066	Beatton	BC 86047 no 151	BL 37	3	3	161	shale	200	1400	280000	No	No	Yes	gullied	single	steep	muted		clean head scarps,in west side of gully,intact blocks have stopped at base of slope, 2 failures, masses at different levels
BL-067	Beatton	BC 86047 no 151	BL 36	3	6	278	Quaternary	600	900	540000	intact	No	Yes	no	complex	gentle	covered		
BL-068	Beatton	BC 86047 no 151	BL 35	3	6	226	shale	1200	1200	1440000	intact	yes	Yes	gullied	complex	steep	good		older,shallow top failure,debris on head wall,low mobility,mass visible, younger lower failure,wider, no features, large debris apron
BL-069	Beatton	BC 86047 no 151	BL-T4R 1	3	6	153	shale	800	1700	1360000	intact	No	Yes	gullied	single	steep	good		Big,steep head next to debris block with small,clean head in w.side of gully,debris flow towards south and thicker at beatton
BL-070	Beatton	BC 86047 no 151	BL-T4L 1	3	6	300	shale	900	2000	1800000	intact	No	Yes	gullied	complex	steep	good		part of slide has nice clean head wall other is covered with debris to the scarp, debris looks thin, covers most of slope, low mobility
BL-071	Beatton	BC 86047 no 151	BL-T4R 2	3	3	112	Quaternary	500	800	400000	No	No	Yes	gullied	complex	steep	covered		good clean head scarp, small scarp in debris, low mobiity
BL-072	Beatton	BC 86047 no 151	BL-T4R 3	3	3	95	shale	400	1500	600000	No	No	Yes	gullied	single	steep	muted		older failure, gullied head wall, low mobility, debris at base in gully
BL-073	Beatton	BC 86047 no 151	BL-T4L 3	3	6	284	shale	600	1300	780000	intact	No	no	gullied	single	gentle	covered		little to no head wall, good scarp, debris covered slope, low mobility, translational
BL-074	Beatton	BC 86047 no 151	BL-T4R 6	3	6	137	Quaternary	300	2000	600000	intact	No	Yes	gullied	complex	steep	good		head wall partially exposed, debris disturbed, broken up, small scarps in debris
BL-075	Beatton	BC 86047 no 151	BL-T4L 4	3	6	307	Quaternary	400	1800	720000	intact	No	no	gullied	complex	gentle	covered		good scarp, no head wall, debris covered scarp
BL-076	beatton	BC 86047 no 151	BL-T4L 7	3	3	111	Quaternary	200	600	120000	No	yes	no	no	single	gentle	covered		
BL-077	Beatton	BC 86047 no 151	BL-T4L 12	3	3	258	Quaternary	150	1200	180000	No	No	no	yes	complex	gentle	covered		like BL-75
BL-078	Beatton	BC 86047 no 151	BL-T4L 5	3	3	16	Quaternary	300	500	150000	No	No	no	yes	single	gentle	covered		like BL-75
BL-079	Beatton	BC 86047 no 151	BL-T4L 6	3	6	233	Quaternary	200	500	100000	intact	No	Yes	gullied	single	steep	covered		small head scarp, mostly debris covered scarp
BL-080	Beatton	BC 86047 no 151	BL 34	3	6	226	shale	900	1200	1080000	intact	No	eroded	gullied	single	steep	muted		small, clean headscarp, intact scarp at base, smaller scarps in mass, can't tell if intact or debris

BL-081	Beatton	BC 86047 no 151	BL 33	3	3	160	shale	350	400	140000	No	No	Yes	gullied	single	steep	muted		good head wall with little debris, build up of debris at base
BL-082	Beatton	BC 86047 no 151	BL 32	3	6	90	shale	500	700	350000	intact	No	Yes	yes	complex	gentle	muted		high, clean wall, with build up of debris at base, shallow 5's on top
BL-083	Beatton	BC 86047 no 151	BL 31	2	6	219	shale	500	1300	650000	intact	No	eroded	yes	complex	steep	old		high, clean wall,build up of debris at base upstream, downstream clean head wall with blocks of debris at levels, deep seated
BL-084	Beatton	BC 86047 no 135	BL -T3R 1	3	3	108	shale	400	1000	400000	No	No	Yes	gullied	complex	steep	old		large weathered head wall, 2 small pockets of debris, low mobility
BL-085	Beatton	BC 86047 no 135	BL-T3R 1	3	2	174	shale	400	550	220000	debris	No	Yes	yes	single	gentle	covered		Highly translational
BL-086	Beatton	BC 86047 no 135	BL-T3L 3	3	6	261	shale	500	400	200000	intact	No	Yes	gullied	single	steep	covered		
BL-087	Beatton	BC 86047 no 135	BL-T3R 1	3	6	124	shale	200	900	180000	intact	No	no	gullied	complex	steep	good		large weathered head wall, intact sec scarp abuted against gully bottom, west side, low mobility
BL-089	Beatton	BC 86047 no 135	BL-T3L 1	3	2	312	shale	500	1000	500000	debris	No	Yes	gullied	complex	steep	old		weathered head wall, debris chokes gully, no sec scarps, low mobility
BL-090	Beatton	BC 86047 no 135	BL-T3L 1	3	6	304	shale	500	400	200000	intact	No	Yes	gullied	single	gentle	old		trinagle shape head wall, clean, weathered, debris comes up pretty high, no sec scarps, low mobility
BL-091	Beatton	BC 86047 no 135	BL 30	4	6	241	Quaternary	500	500	250000	intact	No	no	gullied	single	steep	good		shallow triangle clean head wall, no sec scarps, low mobilityfailure surface probaly high
BL-092	Beatton	BC 86047 no 135	BL 30	2	3	214	Quaternary	800	400	320000	No	yes	Yes	yes	single	steep	good		good head wall, no sec scarps, debris looks like toungue down slope, low mobility
BL-093	Beatton	BC 86047 no 135	BL 30	4	6	203	Quaternary	500	300	150000	intact	yes	no	gullied	single	steep	muted		small failure, good triangle clean scarp, intact block against floor, low mobility, heavily weathered
BL-094	Beatton	BC 86047 no 135	BL-T2R 1	3	2	156	Quaternary	350	1300	455000	debris	No	Yes	gullied	complex	steep	muted		translational
BL-095	Beatton	BC 86047 no 135	BL-T2R 3	3	3	162	Quaternary	200	1300	260000	No	No	Yes	gullied	complex	steep	muted		steep wall, maybe gully with debris, gully schoked but not much debris
BL-096	Beatton	BC 86047 no 135	BL-27	4	3	149	Quaternary	200	300	60000	No	No	no	gullied	single	steep	muted		nw side of gully, small failure, steep head, little amount of debris, no sec scarps
BL-097	Beatton	BC 86047 no 135	BL 29	3	6	249	shale	400	750	300000	intact	yes	no	gullied	single	steep	good		on sharp band on beatton, good head scarp, steep,
BL-098	Beatton	BC 86047 no 135	BL 28	3	3	141	Quaternary	200	300	60000	No	No	Yes	gullied	single	gentle	muted		small failure, nw side of gully, relatively large head scarp, no sec scaprs, small amount of debris
BL-099	Beatton	BC 86047 no 135	BL 26	3	3	284	Quaternary	200	150	30000	No	No	Yes	gullied	single	gentle	muted		like BL-95 except on se sideof gully
BL-100	Beatton	BC 86047 no 135	BL 23	3	3	244	shale	400	1300	520000	No	yes	Yes	gullied	single	steep	muted		steep head wall, good debris apron,
BL-101	Beatton	BC 86075 no 082	BL 100	3	6	270	Quaternary	600	700	420000	intact	No	no	yes	complex	gentle	vegetated	BL-178	small head scarp, on abandonded meander, complex slide but can't differentiate,veg, colluvium covered
BL-102	Beatton	BC 86047 no 135	BL-T1R3	3	2	172	Quaternary	300	700	210000	debris	No	Yes	gullied	complex	steep	muted		on nw side of gully,, steep head wall, debris in gully thick, small failure, may be just gully action with build up, no sec scarps
BL-103	Beatton	BC 86047 no 135	BL-T1R3	3	7	325	Quaternary	350	1100	385000	debris	No	Yes	gullied	complex	steep	muted		translational
BL-104	Beatton	BC 86047 no 135	BL-T1L 1/2	3	6	345	Quaternary	400	1500	600000	intact	No	Yes	gullied	complex	gentle	covered		on SE side of gully, large weathered head, may just be gully, debris at base is thick, low mobility
BL-105	Beatton	BC 86047 no 135	BL 14	3	6	292	shale	400	1200	480000	intact	No	Yes	yes	complex	gentle	muted	BL-111b	
BL-106	Beatton	BC 86047 no 135	BL 22	4	2	257	shale	400	400	160000	debris	yes	partial	gullied	single	steep	muted		steep clean head wall, good apron, no sec scarps, gully in wall
BL-107	Beatton	BC 86047 no 135	BL 22	4	3	216	shale	400	300	120000	No	No	Yes	gullied	single	steep	muted		next to wide gully, little debris at base, small failure
BL-108	Beatton	BC 86047 no 135	BL 19	3	6	303	shale	600	600	360000	intact	No	Yes	gullied	complex	gentle	covered		large weathered head scarp, lots of debris at base, no sec scarps, low mobility
BL-109	Beatton	BC 86047 no 135	BL 18	3	6	246	shale	600	600	360000	intact	yes	Yes	yes	single	steep	good		smaller head wall, no sec scarps, large debris apron
BL-110	Beatton	BC 86047 no 135	BL 17	3	6	230	shale	800	1200	960000	intact	No	eroded	yes	single	steep	good		large failure, smaller head scarp with several sec scarps 3-4, look like slices ie deep seated but could be levels, good debris apron
BL-111	Beatton	BC 86047 no 135	BL 13	3	6	250	shale	450	200	90000	intact	No	Yes	gullied	single	gentle	muted		no head scarp, debris to top of slope, good apron, no sec scarps, low mobility
BL-112	Beatton	BC 86047 no 135	BL 13	2	3	238	Quaternary	800	400	320000	intact	yes	Yes	yes	single	gentle	good		good head wall, slightly circular, debris looks like toungue, no sec scarps
BL-113	Beatton	BC 86047 no 135	BL 16	4	3	260	shale	450	300	135000	No	No	eroded	gullied	complex	gentle	muted		small failure
BL-114	Beatton	BC 86047 no 135	BL-T2L 1	3	2	300	shale	500	1100	550000	debris	No	Yes	yes	single	steep	muted		SE side of gully, large weathered head scarp/wall, no sec scarps, low mobility, likely thin
BL-115	Beatton	BC 86047 no 91	BL 10	2	6	247	shale	500	400	200000	intact	No	Yes	yes	single	steep	muted		too small
BL-116	Beatton	BC 86047 no 91	BL 10	3	3	163	shale	200	400	80000	No	No	Yes	yes	single	gentle	muted		se side of gully, low mobility, debris choked gully
BL-117	Beatton	BC 86047 no 91	BL 10	3	6	269	shale	400	400	160000	intact	No	Yes	yes	single	steep	muted		nw side of gully, little amount of debris
BL-118	Beatton	BC 86047 no 91	BL 9	2	2	141	shale	300	600	180000	debris	No	Yes	gullied	single	steep	good		west side of gully, debris choked gully, ltsr gully in debris
BL-119	Beatton	BC 86047 no 91	BL 8	3	3	260	shale	300	300	90000	No	No	Yes	gullied	single	steep	covered		too small
BL-120	Beatton	BC 86047 no 91	BL 7	3	6	312	shale	500	500	250000	intact	No	Yes	gullied	single	steep	covered		may have tension cracks, in shadow in photo, se side of gully, debris in gully
BL-121	Beatton	BC 86047 no 91	BL 7	3	3	260	Quaternary	400	400	160000	No	No	Yes	yes	single	steep	good		
BL-122	Beatton	BC 86047 no 91	BL 6	2	6	173	shale	400	1500	600000	intact	yes	Yes	yes	complex	steep	good		combination of 3 failures, clean head wall, debris choked, low mobility, uneven sec scarps
BL-123	Beatton	BC 86047 no 91	BL 5	3	6	316	shale	400	1200	480000	intact	No	Yes	yes	complex	steep	covered	BL-124c	
BL-124	Beatton	BC 86047 no 91	BL 3	3	6	337	shale	600	800	480000	intact	No	Yes	yes	complex	gentle	covered	BL-124a	fully recessed
BL-125	Beatton	BC 86047 no 91	BL 2	3	6	255	Quaternary	800	400	320000	intact	No	Yes	yes	single	steep	good		north side of gully, good head wall, clean, debris choked gully
BL-126	Beatton	BC 86047 no 91	BL 1	3	6	258	Quaternary	600	1300	780000	intact	No	Yes	gullied	single	steep	good		large failure, near mouth of beatton, head wall with debris scarps and debris build up at base, veg and weathered
BL-127	Beatton	BC 86047 no 91	BL 2	3	6	268	Quaternary	800	400	320000	intact	No	Yes	yes	single	steep	muted		triangular head scarp, debris covered slope
BL-128	Beatton	BC 86075 no 62	BL 79	3	7	309	shale	600	1300	780000	debris	yes	no	no	single	gentle	covered		debris covered slope, steeper to the west, steep near base and shallower up slope
BL-129	Beatton	BC 86075 no 62	BL 79	3	6	308	Quaternary	200	600	120000	No	yes	no	no	single	gentle	covered		debris covered slope, shallow, reveg.
BL-130	Beatton	BC 86075 no 62	BL 79	4	2	295	shale	700	1200	840000	debris	yes	no	no	single	gentle	covered		debris covered slope, no sec scarps, steeper near base due to BD, shallower head, part of complex with BL128/129
BL-131	Beatton	BC 86075 no 62	BL 79	4	6	143	shale	200	200	40000	intact	yes	Yes	yes	single	steep	old		small failure, large head scarp, no sec scarps, in gully, chokes it, south facing,
BL-132	Beatton	BC 86075 no 62	BL 79	4	3	210	shale	200	300	60000	No	yes	Yes	yes	single	steep	old		Like BL 131 but part of larger BD scarp that does not look it like failed
BL-133	Beatton	BC 86075 no 62	BL 80	3	3	214	shale	400	150	60000	No	No	Yes	yes	single	steep	covered		small failure, erosion at base
BL-134	Beatton	BC 86075 no 62	BL 80	2	6	289	Quaternary	550	800	440000	intact	No	Yes	no	single	steep	covered		debris covered slope, no sec scarps, debris protrudes into river, reveg
BL-135	Beatton	BC 86075 no 62	BL 80	2	3	319	Quaternary	300	200	60000	No	yes	no	no	single	gentle	covered		small failure, most of it is a shallow slide, no head scarp, that slides over steep BD scarp
BL-136	Beatton	BC 86075 no 62	BL 80/81	2	2	258	Quaternary	600	1200	720000	debris	yes	Yes	no	complex	gentle	good		complex of several smaller slides, some look like flows, and part of it shows a stable scarp in BD with large debris apron
BL-137	Beatton	BC 86075 no 62	BL 81	4	2	215	Quaternary	300	400	120000	debris	No	Yes	yes	single	steep	muted		ne amouth of gully, debris on a terrace of some sort
BL-138	Beatton	BC 86075 no 62	BL 81	4	3	235	Quaternary	300	800	240000	No	No	no	no	complex	steep	muted		complex of several smaller slides, small head scarps, colluvium covered
BL-139	Beatton	BC 86075 no 62	BL 81a	4	3	69	Quaternary	600	400	240000	No	No	Yes	no	single	steep	muted		might not be a slide, on inside river bend, undistinguishable characteristics
BL-141	Beatton	BC 86075 no 62	BL 81a	3	6	188	Quaternary	400	1000	400000	intact	No	partial	yes	single	steep	covered		along old river channel but partially eroded by new channel, head wall covered and weathered, partially exposed to west
BL-142	Beatton	BC 86075 no 62	BL 81a	3	3	318	Quaternary	300	500	150000	No	yes	eroded	yes	single	steep	covered		circular shallow failure above bedrock scarp, no head scarp, debris covered slope
BL-143	Beatton	BC 86075 no 62	BL 82	3	6	286	Quaternary	400	2000	800000	intact	No	Yes	yes	complex	steep	covered		large failure along river, main head scarp is exposed to north, most is debris covered slope, shallow failures above BD
BL-144	Beatton	BC 86075 no 62	BL 82	3	7	328	Quaternary	150	800	120000	debris	No	no	no	single	gentle	covered		small failure, no distinct head wall, debris covered slope, north facing
BL-145	Beatton	BC 86075 no 62	BL 82	3	3	185	shale	150	400	60000	No	No	Yes	yes	single	steep	old		small failure, distinct head scarp, debris at base, low mobility, south facing in gully
BL-146	Beatton	BC 86074 no 233	BL 135	4	3	300	Quaternary	300	750	225000	No	No	Yes	yes	complex	gentle	good	BL-206a	
BL-147	Beatton	BC 86075 no 62	BL 82/83	3	3	195	Quaternary	1500	400	600000	No	partial	partial	yes	complex	steep	muted		slide complex, river eroded debris, weather head scarps with gulls, deep seated for sure
BL-148	Beatton	BC 86075 no 62	BL 83	3	6	248	Quaternary	500	450	225000	intact	No	Yes	yes	single	steep	vegetated		at corner of river, debris covered slope, no sec scarps, reveg, is layered but no scarps visible
BL-149	Beatton	BC 86074 no 254	BL 84	3	6	303	Quaternary	350	1500	525000	intact	yes	Yes	gullied	complex	steep	covered		steep BS cliff at base, shallower failure at top, debris covered, old and indistinguishable features from the scale
BL-150	Beatton	BC 86074 no 254	BL 85	1	6	354	Quaternary	300	300	90000	intact	No	Yes	yes	single	steep	good		doesn't show up on '86 photo
BL-151	Beatton	BC 86074 no 254	BL 90	2	6	224	Quaternary	400	500	200000	intact	yes	Yes	yes	single	steep	good		multi-layered slide?, may be debris blocks, most of debris eroded
BL-152	Beatton	BC 86074 no 254	BL 90	3	6	232	Quaternary	400	300	120000	intact	No	Yes	yes	single	steep	covered		small head scarp, mostly debris covered with small scarp, might be intact
BL-153	Beatton	BC 86074 no 254	BL 90	3	3	221	Quaternary	400	1100	440000	No	yes	Yes	yes	complex	steep	covered		big head scarp, cliff in BD at base to slide over, in ICS, pinches out in to canyon, no sec scarps
BL-154	Beatton	BC 86074 no 254	BL 93	1	6	357	Quaternary	300	400	120000	intact	No	Yes	yes	single	steep	good		big head scarp, in ICS, good sec scarp, can't tell if intact or debris,
BL-155	Beatton	BC 86074 no 254	BL 93	1	6	52	Quaternary	300	400	120000	intact	No	Yes	yes	single	steep	good		doesn't show up on '86 photo
BL-156	Beatton	BC 86074 no 210	BL 161	3	6	330	Quaternary	300	2300	690000	intact	yes	Yes	yes	complex	gentle	good	BL-213b	
BL-157	Beatton	BC 86074 no 254	BL 94	3	8	274	Quaternary	500	1100	550000	No	yes	Yes	gullied	complex	steep	covered		older slide, gulleyed head wall, no sec scarps, reveg, large head scarp
BL-158	Beatton	BC 86074 no 254	BL-T9R 1	3	3	162	Quaternary	350	550	192500	No	No	Yes	gullied	single	steep	muted		in south facing slope of gully, large head wall, low mobility, no sec scarps
BL-159	Beatton	BC 86074 no 254	BL 95	3	3	210	Quaternary	400	550	220000	No	No	Yes	gullied	complex	steep	old		large, weathered head scarp, build up of debris eroded by river, no sec scarps
BL-160	Beatton	BC 86074 no 254	BL 95	3	3	160	Quaternary	250	700	175000	No	No	Yes	gullied	single	steep	covered		debris not on river, large triangle head scarp, no sec scarps,
BL-161	Beatton	BC 86074 no 254	BL 96	3	6	249	Quaternary	250	800	200000	intact	No	Yes	gullied	complex	steep	covered		part of complex with BL 162, interupted by newer BL 5, across from camp, main scarp, no sec scarps, reveg
BL-162	Beatton	BC 86074 no 254	BL-T10L 1	4	6	323	Quaternary	300	800	240000	intact	No	no	no	complex	gentle	covered		
BL-163	Beatton	BC 86074 no 254	BL-T10L 2	4	3	255	Quaternary	350	400	140000	No	yes	no	yes	single	gentle	old		shallow failure, flows over stable BD cliff, no sec scarps, near road, slow movement
BL-164	Beatton	BC 86074 no 254	BL-T10L 2	4	3	155	Quaternary	200	500	100000	No	yes	no	yes	single	steep	muted		road travels on debris, large circular head scarp, no sec scarps

BL-165	Beatton	BC 86074 no 254	BL-T10R 1	4	7	137	Quaternary	800	750	600000	debris	No	Yes	yes	complex	steep	covered		not sure if it's a slide but it looks like BL-167, large weathered head scarp, no sec scarps, reveg, road on debris
BL-166	Beatton	BC 86074 no 254	BL-T10R 3	3	3	156	Quaternary	200	450	90000	No	No	Yes	gullied	single	steep	old		in South facing slope of gully, head wall, low mobility, no sec scarps
BL-167	Beatton	BC 86074 no 254	BL 97	1	6	232	Quaternary	350	700	245000	intact	No	eroded	yes	complex	gentle	good		large fresh head scarp,1 sec scarp in debris, 2 parts, one really fresh and one not so fresh, the fresh part looks like no sec scarps
BL-168	Beatton	BC 86074 no 254	BL 97	3	6	228	Quaternary	300	350	105000	intact	No	Yes	yes	complex	gentle	good		like the not so fresh part of BL-166, one main head scarp, small sec scarp, lots of colluvium
BL-169	Beatton	BC 86074 no 254	BL 98	3	3	18	Quaternary	250	800	200000	No	yes	no	yes	single	steep	muted		doesn't retrogress far back, likely in ICS above BD, BD scarp at base, no sec scarps, debris covered slope
BL-170	Beatton	BC 86074 no 254	BL 98/99	3	6	1	Quaternary	500	400	200000	intact	yes	eroded	yes	complex	gentle	good		slide goes back, in ICS above BD, BD scarp at base, no sec scarp
BL-171	Beatton	BC 86074 no 254	BL 99	3	6	331	Quaternary	300	400	120000	Intact	No	no	yes	single	steep	covered		debris covered slope, small failure, over BD, ICS, reveg, no sec scarps
BL-172	Beatton	BC 86074 no 254	BL 99	2	6	339	Quaternary	400	500	200000	intact	No	Yes	yes	single	gentle	good		head wall, no sec scarps, debris protrudes into river, road on debris
BL-173	Beatton	BC 86074 no 254	BL 99	3	3	234	Quaternary	500	700	350000	No	No	Yes	gullied	single	steep	covered		large weathered head wall, no sec scarps, good debris apron, reveg
BL-174	Beatton	BC 86074 no 254	BL 100	4	3	169	Quaternary	300	300	90000	No	yes	Yes	gullied	single	steep	old		Large gulleyed head scarp, off river, small debris build up
BL-175	Beatton	BC 86074 no 254	BL 101	2	6	93	Quaternary	150	700	105000	intact	No	eroded	yes	complex	gentle	muted		thin, small eroded debris apron, one head scarp. No sec scarps
BL-176	Beatton	BC 86074 no 254	BL 100	4	8	222	Quaternary	300	600	180000	No	yes	Yes	yes	complex	gentle	good	BL-174b	
BL-177	Beatton	BC 86074 no 254	BL 101	2	6	261	Quaternary	200	300	60000	intact	No	Yes	yes	single	steep	good		small failure, one head scarp, no sec scarps, too small to see
BL-178	Beatton	BC 86074 no 254	BL 93	4	2	317	Quaternary	300	600	180000	debris	yes	eroded	yes	single	steep	covered		large head wall, no sec scarps, cliff at base in BD to slide over, build up of debris on BD,
BL-179	Beatton	BC 86075 no 082	BL 102	4	6	257	Quaternary	300	400	120000	intact	No	no	yes	single	gentle	vegetated		like BL-178 but a single slide, not a complex
BL-180	Beatton	BC 86075 no 082	BL 103	2	3	332	Quaternary	150	500	75000	No	No	eroded	yes	complex	steep	good		on a steep section of bank, no debris at base, not likely deep seated, on outside bend, possible danger
BL-181	Beatton	BC 86075 no 082	BL 104	4	6	313	Quaternary	200	500	100000	intact	yes	Yes	gullied	complex	steep	old		on abandonded meander, large weathered head wall, debris at base and building up, no sec scarps
BL-182	Beatton	BC 86075 no 082	BL 104	4	3	200	Quaternary	300	800	240000	No	yes	Yes	gullied	single	steep	old		like BL-181 but bigger and not close to river, more gullys in head wall
BL-183	Beatton	BC 86075 no 082	BL 106	3	7	161	Quaternary	200	900	180000	debris	yes	eroded	no	complex	gentle	vegetated		may not be slide, but rather a river terrace, long section with small head scarp covered in debris close to river edge
BL-184	Beatton	BC 86075 no 082	BL 106	3	3	287	Quaternary	300	800	240000	No	No	partial	gullied	single	steep	muted		large weathered, gulleyed, veg head scarp, with a build up of debris apron, no sec scarps, river erosion on part of debris mass
BL-185	Beatton	BC 86075 no 082	BL 107	4	6	323	Quaternary	400	700	280000	intact	No	no	yes	complex	gentle	vegetated		like BL-178 but a single slide, not a complex
BL-186	Beatton	BC 86075 no 082	BL 106	4	3	224	Quaternary	300	700	210000	No	No	Yes	yes	single	steep	muted		on center part of old meander towards river, like BL-182 but not as big
BL-187	Beatton	BC 86075 no 082	BL 110	4	3	280	Quaternary	300	450	135000	No	No	Yes	yes	complex	gentle	vegetated		abandoned but no on merander, no sec scarps, colluvium covered, small covered head scarp, no river erosion
BL-188	Beatton	BC 86075 no 082	BL 111	3	6	269	Quaternary	400	1000	400000	intact	yes	no	yes	single	gentle	vegetated		large circular failure, small head scarp, no sec scarps, river erosion at base, veg.
BL-189	Beatton	BC 86075 no 082	BL-T11L 1	3	3	253	Quaternary	300	300	90000	No	No	Yes	yes	single	gentle	vegetated		like BL-188 but in south side of gully, no active erosion at base,
BL-190	Beatton	BC 86075 no 082	BL-T11R 1	3	6	162	Quaternary	350	300	105000	intact	No	Yes	yes	single	steep	muted		large head scarp weathered and gullyed, low mobility, no sec scarps
BL-191	Beatton	BC 86075 no 082	BL 112	4	6	196	Quaternary	200	900	180000	intact	No	Yes	yes	complex	steep	vegetated		
BL-192	Beatton	BC 86075 no 082	BL 113	3	2	269	Quaternary	300	800	240000	debris	No	Yes	gullied	single	steep	vegetated		like BL-188 but with more active erosion at base, produced steep scarp
BL-193	Beatton	BC 86075 no 082	BL 118	2	8	244	Quaternary	50	650	32500	debris	yes	no	no	complex	gentle	muted		shallow failure above canyon, lake peace failure complext
BL-194	Beatton	BC 86075 no 082	BL 118	3	2	248	Quaternary	250	300	75000	debris	yes	no	no	single	gentle	muted		like BL-193 but retrogreses back further
BL-195	Beatton	BC 86075 no 082	BL-T12L 1	3	6	295	Quaternary	300	1000	300000	intact	No	Yes	yes	single	gentle	vegetated		large headscarp gullied, low mobility,debris covers slope,small scarp near creek but can't tell in it's syngentic,south side of gully
BL-196	Beatton	BC 86074 no 233	BL-T12R 1	3	6	131	Quaternary	250	650	162500	intact	No	Yes	yes	single	steep	muted		small scarp, in gully, low mobilty
BL-197	Beatton	BC 86074 no 233	BL-T12R 1	3	2	159	Quaternary	300	200	60000	debris	No	Yes	yes	single	steep	muted		small failure, small scarp, like BL-196
BL-198	Beatton	BC 86074 no 233	BL 119	2	2	180	Quaternary	400	400	160000	debris	No	Yes	yes	single	steep	muted		eroded base, scarp at base, large head scarp, debris above second scarp
BL-200	Beatton	BC 86074 no 233	BL 122	3	6	217	Quaternary	300	400	120000	intact	yes	Yes	yes	single	steep	good		sec scarp above river, features muted
BL-201	Beatton	BC 86074 no 233	BL 122	3	3	221	Quaternary	250	400	100000	No	yes	Yes	yes	single	steep	muted		large head wall, features muted
BL-202	Beatton	BC 86074 no 233	BL 126	3	3	172	Quaternary	200	500	100000	No	No	Yes	yes	single	steep	good		small failure, small scarp, river erodes base
BL-203	Beatton	BC 86074 no 233	BL 128	4	3	294	Quaternary	200	800	160000	intact	No	Yes	yes	single	gentle	good		old river bend, large head wall, muted features
BL-204	Beatton	BC 86074 no 233	BL 130	4	6	312	Quaternary	500	1200	600000	intact	No	Yes	yes	complex	steep	covered		like BL-203, but smaller head scarp
BL-205	Beatton	BC 86074 no 233	BL 141	4	3	283	Quaternary	300	500	150000	No	No	no	yes	single	gentle	covered		like BL 204
BL-206	Beatton	BC 86074 no 233	BL 141	4	3	236	Quaternary	400	900	360000	No	No	no	yes	single	gentle	covered		like BL 204
BL-207	Beatton	BC 86047 no 91	BL 10	4	6	253	shale	500	400	200000	intact	No	Yes	gullied	single	steep	muted		head is now gullied, debris has left a bend in river, smaller newer failure within mass
BL-208	Beatton	BC 86074 no 233	BL 135	4	6	234	Quaternary	400	1300	520000	intact	No	no	yes	complex	gentle	covered		
BL-209	Beatton	BC 86074 no 233	BL 140	2	6	255	Quaternary	200	350	70000	intact	No	Yes	yes	single	steep	good		
BL-210	Beatton	BC 86074 no 210	BL 152	3	2	210	Quaternary	300	800	240000	debris	No	no	yes	complex	gentle	vegetated		
BL-211	Beatton	BC 86074 no 210	BL 155	3	6	6	Quaternary	300	500	150000	intact	No	Yes	gullied	single	steep	good		
BL-212	Beatton	BC 86074 no 210	BL 156	4	7	13	Quaternary	350	600	210000	debris	No	no	no	complex	gentle	vegetated		
BL-213	Beatton	BC 86074 no 210	BL 161	2	6	335	Quaternary	300	350	105000	intact	yes	Yes	yes	single	steep	good		
BL-214	Beatton	BC 86074 no 210	BL 163	3	6	249	Quaternary	300	400	120000	intact	No	no	yes	single	gentle	vegetated		
BL-215	Beatton	BC 86074 no 210	BL 163	3	6	201	Quaternary	200	1000	200000	intact	No	Yes	gullied	complex	steep	muted		
BL-216	Beatton	BC 86074 no 210	BL 164	2	6	213	Quaternary	200	300	60000	intact	No	Yes	yes	single	steep	good		
BL-217	Beatton	BC 86074 no 210	BL 165	3	6	315	Quaternary	300	700	210000	intact	No	no	no	complex	gentle	vegetated		
BL-218	Beatton	BC 86074 no 210	BL 165	2	6	247	Quaternary	200	600	120000	intact	No	Yes	yes	complex	steep	good		
BL-219	Beatton	BC 86074 no 181	BL 168	3	6	239	Quaternary	200	800	160000	intact	No	Yes	yes	complex	steep	good		
BL-220	Beatton	BC 86074 no 181	BL 172	3	2	221	Quaternary	300	700	210000	debris	No	Yes	yes	single	steep	good		
BL-221	Beatton	BC 86074 no 181	BL 176	2	2	144	Quaternary	200	700	140000	debris	No	Yes	yes	single	steep	good		
BL-222	Beatton	BC 86074 no 181	BL 179	3	6	5	Quaternary	200	400	80000	intact	yes	eroded	yes	single	steep	vegetated		
BL-223	Beatton	BC 86074 no 181	BL 180	2	6	299	Quaternary	200	400	80000	intact	No	Yes	yes	single	steep	good		
BL-224	Beatton	BC 86074 no 181	BL 182	3	6	316	Quaternary	200	1200	240000	intact	No	eroded	yes	complex	gentle	vegetated		
BL-225	Beatton	BC 86074 no 181	BL 184	3	6	331	Quaternary	300	1200	360000	intact	No	eroded	yes	complex	gentle	vegetated		
BL-226	Beatton	BC 86074 no 181	BL 186	3	6	235	Quaternary	150	300	45000	intact	No	eroded	yes	single	steep	muted		
BL-230	Beatton	BC 86075 no 16	BL 71	2	3	316	shale	600	300	180000	No	yes	Yes	yes	single	steep	good		
BL-231	beatton	BC 86047 no 151	BL 32	3	6	110	shale	300	700	210000	intact	No	Yes	yes	complex	steep	good		translational
BL-232	Beatton	BC 86047 no 135	BL-T3L 2	3	7	294	shale	300	1300	390000	No	No	Yes	yes	complex	gentle	vegetated		
BL-233	Beatton	BC 86047 no 135	BL 20	3	2	199	shale	300	600	180000	debris	No	Yes	yes	single	steep	muted		
BL-235	Beatton	BC 86047 no 91	BL 3	3	6	285	Quaternary	700	300	210000	intact	yes	Yes	yes	single	steep	good		
BL-236	Beatton	BC 86074 no 254	BL-T9R 2	3	6	160	Quaternary	300	250	75000	intact	No	Yes	yes	single	gentle	good		
BL-237	Beatton	BC 86074 no 254	BL 142	3	3	302	Quaternary	300	1000	300000	No	yes	Yes	yes	complex	gentle	old		
BL-238	Beatton	BC 86074 no 233	BL 133	2	6	319	Quaternary	200	350	70000	intact	No	Yes	yes	complex	steep	good		
BL-239	Beatton	BC 86074 no 181	BL 185	3	3	272	Quaternary	200	400	80000	No	No	Yes	no	single	gentle	vegetated		
BL-240	Beatton	BC 86074 no 254	BL-T9L 3	3	3	245	Quaternary	200	500	100000	No	yes	Yes	yes	single	gentle	old		
BL-241	Beatton	BC 86074 no 254	BL-T9L 4	3	3	293	Quaternary	150	300	45000	No	yes	Yes	yes	single	gentle	old		
BL-242	Beatton	BC 86074 no 254	BL-T9R 2	3	6	150	Quaternary	200	700	140000	intact	yes	Yes	yes	complex	gentle	old		
BL-243	Beatton	BC 86074 no 254	BL-T10R 2	4	3	157	Quaternary	300	200	60000	No	yes	Yes	yes	single	gentle	good		
BL-244	Beatton	BC 86074 no 254	BL-T10R 2	3	3	89	Quaternary	400	700	280000	No	yes	Yes	yes	complex	gentle	good		
BL-245	Beatton	BC 86074 no 254	BL 97	4	6	238	Quaternary	500	600	300000	intact	yes	Yes	yes	single	gentle	covered		
BL-246	Beatton	BC 86074 no 254	BL-T9L 1	3	3	231	Quaternary	300	300	90000	No	yes	Yes	yes	single	gentle	old		
BL-247	Beatton	BC 86074 no 254	BL-T9L 2	3	3	47	Quaternary	200	600	120000	No	yes	Yes	yes	single	gentle	old	BL-238	
BL-248	Beatton	BC 86074 no 233	BL 130	3	6	328	Quaternary	350	250	87500	intact	yes	Yes	no	single	steep	good	BL-239	

BR-001	Beatton	BC 86075 no 62	BR 65	1	6	91	Quaternary	550	500	275000	intact	yes	yes	yes	single	steep	good		oldrich slide, small head scarp in Peace Clay, several scarps in intact material, levels
BR-007	Beatton	BC 86047 no 135	BR 15	3	6	84	shale	900	350	315000	intact	no	yes	yes	single	steep	covered	BL-60b	
BR-008	Beatton	BC 86075 no 62	BR 58	1	6	52	Quaternary	400	400	160000	intact	yes	yes	yes	single	steep	good		
BR-009	Beatton	BC 86047 no 135	BR 19	2	2	62	shale	600	350	210000	debris	no	yes	yes	single	gentle	good		
BR-010	Beatton	BC 86075 no 16	BR 42	3	2	100	shale	800	900	720000	debris	no	yes	yes	single	steep	covered		nice head wall, deep rot., small sec scarp to north in debris, good debris build up
BR-011	Beatton	BC 86075 no 16	BR 40/41	4	7	30	shale	1100	700	770000	debris	no	yes	yes	single	steep	covered		large top scarp in intact, large scarp in disturbed to north, lots of debris
BR-012	Beatton	BC 86075 no 16	BR 40	2	6	113	shale	900	1200	1080000	intact	yes	yes	yes	complex	steep	covered		large scarp at top, in old channel scar, debris flows around scar to west, flow to north
BR-013	Beatton	BC 86075 no 16	BR 39	3	6	126	shale	900	1100	990000	intact	yes	yes	yes	complex	steep	covered		large, distinct scarp, more debris in land, less around outlyer, intact scarp in middle of debris mass
BR-014	Beatton	BC 86075 no 16	BR 38	3	6	118	shale	900	1100	990000	intact	yes	eroded	yes	complex	steep	covered		no scarp in south, more of a distinct scarp in north, scarp in intact material in debris mass,lots of debris
BR-015	Beatton	BC 86075 no 16	BR 43	4	3	78	shale	350	600	210000	no	no	yes	yes	complex	steep	old		Distinct scarp, scarps in debris, lots of debris, maybe 2 slides, east facing
BR-016	Beatton	BC 86075 no 16	BR 41	4	6	128	shale	900	1000	900000	intact	no	no	gullied	complex	steep	old		large intact scarp at top, not much debris, more like a build up
BR-017	Beatton	BC 86075 no 16	BR 44	1	6	43	shale	600	500	300000	intact	no	yes	debris	single	steep	gone		Large intact scarp at top, large scarp in debris, not much debris
BR-018	Beatton	BC 86075 no 16	BR 44	4	3	101	Quaternary	400	2500	1000000	no	yes	yes	yes	complex	steep	good	BR-18b	maybe canola slide, small top scarp, large intact scarp in slide, lots of debris
BR-019	Beatton	BC 86075 no 16	BR 44	3	7	70	shale	400	2400	960000	debris	no	yes	debris	complex	gentle	good		failure in debris at base of scarp
BR-020	Beatton	BC 86075 no 16	BR 45	2	6	119	shale	500	800	400000	intact	no	eroded	yes	single	steep	muted		large bedrock scarp, debris at base
BR-021	Beatton	BC 86075 no 16	BR 46	2	7	64	shale	200	750	150000	debris	no	eroded	yes	single	gentle	covered		large intact head scarp, large scarp in disturbed material, lots of debris
BR-022	Beatton	BC 86075 no 16	BR 46	3	7	116	shale	300	800	240000	debris	no	eroded	gullied	single	steep	gone		small slide, scarp with no distinct head wall, debris covered
BR-023	Beatton	BC 86075 no 16	BR 48	4	3	134	shale	500	1200	600000	no	yes	yes	yes	complex	gentle	covered		upper type 8 failure
BR-024	Beatton	BC 86075 no 16	BR 53	4	3	40	Quaternary	300	700	210000	no	yes	eroded	yes	single	gentle	vegetated		complex slide, shallow head scarp, debris covered , intact scarp in middle of slide, large scarp to north
BR-025	Beatton	BC 86075 no 16	BR 52	3	3	39	Quaternary	350	600	210000	no	yes	eroded	yes	single	gentle	vegetated		
BR-026	Beatton	BC 86075 no 16	BR 50/51	2	2	78	shale	500	700	350000	debris	yes	yes	yes	single	steep	good		
BR-027	Indian Ck	BC 86075 no 16	BR-T1R 1/2	2	6	63	Quaternary	800	1400	1120000	intact	yes	yes	yes	complex	gentle	vegetated		shallow head scarp, debris covered, small scarp ini slide, lots of debris
BR-028	Indian Ck	BC 86075 no 16	BR-T1R 3	3	6	50	Quaternary	500	600	300000	intact	no	no	yes	single	steep	vegetated		
BR-029	Indian Ck	BC 86075 no 16	BR-T1R 4	4	6	333	Quaternary	400	500	200000	intact	yes	yes	gullied	single	steep	vegetated		small, steep head scarp, lots of debris
BR-030	Indian Ck	BC 86075 no 16	BR-T1L 3	3	3	150	Quaternary	400	800	320000	no	yes	yes	gullied	complex	steep	muted		
BR-031	Indian Ck	BC 86075 no 16	BR-T1L 2/3	4	3	245	Quaternary	300	600	180000	no	yes	no	gullied	single	steep	old		
BR-032	Indian Ck	BC 86075 no 16	BR-T1L 1	3	3	201	shale	500	600	300000	no	no	yes	gullied	single	steep	good		Large intact scarp, debris at base
BR-033	Indian Ck	BC 86075 no 16	BR-T1L 1	4	6	245	shale	750	700	525000	intact	no	no	yes	complex	gentle	covered		Shallow head scarp, debris covered, intact scarp in middle of slide, lots of debris at base
BR-034	Indian Ck	BC 86075 no 16	BR-T1L 2	3	6	226	Quaternary	600	800	480000	intact	no	yes	gullied	complex	steep	muted		steep head scarp, lots of debris
BR-035	Beatton	BC 86047 no 153	BR 37	3	2	120	shale	600	500	300000	debris	no	yes	gullied	single	steep	vegetated		Large head wall/scarp, debris at base, not wide
BR-036	Beatton	BC 86047 no 153	BR 37	3	6	83	shale	800	2000	1600000	intact	no	yes	gullied	complex	steep	vegetated		large head wall/scarp, well developed debris at base
BR-037	Beatton	BC 86047 no 153	BR 36	3	6	102	Quaternary	800	900	720000	intact	no	yes	gullied	single	steep	vegetated		Large head wall/scarp, good scarp in debris, wll developed debris
BR-038	Beatton	BC 86047 no 153	BR 35	3	7	5	shale	900	1600	1440000	debris	yes	eroded	yes	complex	gentle	vegetated		good scarp, no head wall, debris covered slope, good scarp/wall in shale near river, debris flows over
BR-039	Beatton	BC 86047 no 153	BR 34	2	6	359	shale	600	300	180000	intact	no	eroded	debris	complex	gentle	vegetated		took out road, disturbed material there still, low mobility, slump
BR-040	Beatton	BC 86047 no 153	BR 33	3	6	14	shale	1200	900	1080000	intact	yes	eroded	yes	complex	gentle	vegetated		shallow bowl slides over intact scarp
BR-041	Beatton	BC 86047 no 153	BR 32	3	6	20	shale	800	800	640000	intact	yes	eroded	yes	complex	gentle	vegetated		small scarp, debris covered slope, competent scarp in mass, smaller debris scarp in mass looks like a tension crack in mass
BR-042	Beatton	BC 86047 no 153	BR 31	3	6	62	shale	1000	1200	1200000	intact	yes	eroded	gullied	complex	steep	covered		good head scarp but no wall, competent scarp in intact material, debris covered slide
BR-043	Beatton	BC 86047 no 153	BR 30	3	6	13	shale	1300	2200	2860000	intact	no	yes	gullied	complex	gentle	vegetated		Vegetated head scarp but still visible, large rounded shape, small intact scrap in from river, well veg.
BR-044	Beatton	BC 86047 no 153	BR 29	3	2	356	shale	1000	900	900000	debris	no	yes	gullied	complex	steep	vegetated		like BR-46 except with ponding
BR-045	Beatton	BC 86047 no 153	BR 29/28	3	2	15	shale	800	800	640000	debris	no	yes	gullied	complex	steep	vegetated		
BR-046	Beatton	BC 86047 no 153	BR 28/27/26	3	7	9	shale	800	3000	2400000	debris	no	yes	gullied	complex	steep	vegetated		subject to reactivation, good head scarp but vegetated, developed debris, complex including several indistinguishable slides
BR-047	Beatton	BC 86047 no 151	BR 25	3	3	61	Quaternary	300	500	150000	no	no	no	yes	single	gentle	covered		no head wall, small scarp, debris covered slope, in gully
BR-048	Beatton	BC 86047 no 151	BR 24	3	3	326	Quaternary	500	500	250000	no	yes	no	no	single	gentle	covered		
BR-049	Beatton	BC 86047 no 151	BR 23/22	3	7	33	shale	700	2200	1540000	debris	no	yes	gullied	complex	steep	vegetated		like BR-46 with ponding near base of head wall
BR-050	Beatton	BC 86047 no 151	BR 22	2	4	52	Quaternary	1700	300	510000	no	no	yes	yes	single	gentle	good		shallow circular failure at top with no head wall, looks like it fluidized and flowed in gully
BR-051	Beatton	BC 86047 no 135	BR 22/21/20/19	3	7	39	shale	900	4900	4410000	debris	no	yes	gullied	complex	steep	vegetated		
BR-052	Beatton	BC 86047 no 135	BR 19	4	2	72	shale	500	600	300000	debris	no	yes	gullied	single	steep	vegetated		
BR-053	Beatton	BC 86047 no 135	BR 18	3	6	105	Quaternary	600	1000	600000	intact	no	no	debris	single	steep	covered		
BR-054	Beatton	BC 86047 no 135	BR 18	3	3	25	Quaternary	400	600	240000	no	no	yes	gullied	complex	gentle	covered		all of gully, headwall only partially exposed, most of slide has debris cover, compilation of several small slides now indistinguishable
BR-055	Beatton	BC 86047 no 135	BR 17	2	6	58	shale	700	600	420000	intact	yes	no	yes	complex	steep	covered		
BR-056	Beatton	BC 86047 no 135	BR 16	3	6	117	Quaternary	300	400	120000	intact	no	yes	yes	single	gentle	muted		
BR-057	Beatton	BC 86047 no 135	BR 15	2	3	30	Quaternary	600	300	180000	no	yes	yes	yes	complex	steep	covered		debris covered slope, scarp, no head wall, debris very disturbed, small intact scarp near river to slide over
BR-058	Beatton	BC 86047 no 135	BR 15	2	6	36	shale	700	400	280000	intact	yes	yes	yes	single	steep	covered		debris covered slope, scarp, no head wall, debris very disturbed, small intact scarp near river to slide over
BR-059	Beatton	BC 86047 no 135	BR 15	4	6	70	shale	650	250	162500	intact	yes	yes	no	single	steep	muted		
BR-060	Beatton	BC 86047 no 135	BR 15	3	6	70	shale	1100	1200	1320000	intact	yes	no	yes	complex	steep	covered		large, wide failure, circular shape, large gullied head wall, flat flake in slide mass, no ther scarpsdebris covered
BR-061	Beatton	BC 86047 no 135	BR 13	3	2	130	shale	400	600	240000	debris	no	yes	gullied	single	steep	muted		
BR-062	Beatton	BC 86047 no 135	BR 13	3	6	43	shale	1000	300	300000	intact	no	no	yes	single	gentle	covered		nw side of gully, large head scarp, low mobility, debris chokes gulley, no other scarps
BR-063	Beatton	BC 86047 no 135	BR 13	4	6	50	shale	800	600	480000	intact	yes	yes	yes	complex	gentle	complex		there is a flow in the gully in the head wall which post dates the larger slide
BR-064	Beatton	BC 86047 no 135	BR 12	4	6	57	shale	700	500	350000	intact	yes	yes	yes	complex	steep	covered		older slide, colluvial covered thick
BR-065	Beatton	BC 86047 no 135	BR 11	1	6	33	shale	600	700	420000	intact	yes	no	yes	complex	steep	complex		2 failures, 1st shallow on top of slope that extends into gully, 2nd failure is younger due to river erosion, very steep but shallow
BR-066	Beatton	BC 86047 no 135	BR 10	4	6	75	shale	600	1200	720000	intact	no	yes	gullied	complex	steep	muted		gullied head wall, slide predates large gullies
BR-067	Beatton	BC 86047 no 135	BR 10	3	4	53	Quaternary	1100	400	440000	no	yes	yes	yes	complex	gentle	vegetated		flow
BR-068	Beatton	BC 86047 no 135	BR 9	3	6	120	Quaternary	400	500	200000	intact	no	yes	gullied	single	steep	covered		
BR-069	Beatton	BC 86047 no 135	BR 6	3	2	329	Quaternary	400	300	120000	debris	no	yes	yes	single	steep	covered		nw side of gully, med. Head scarp, debris chokes gully, low mobility, no secondary scarp
BR-070	Beatton	BC 86047 no 135	BR 6	3	6	0	shale	800	200	160000	intact	no	no	yes	single	gentle	covered		se side of gully, med head wall, no secondary scarps, debris chokes gully, low mobility , weathered head wall
BR-071	Beatton	BC 86047 no 135	BR 6	4	6	35	shale	600	400	240000	intact	yes	yes	yes	single	steep	covered		se side of gully, med head wall, no secondary scarps, debris chokes gully, low mobility , weathered head wall
BR-072	Beatton	BC 86047 no 135	BR 5	3	2	57	shale	800	1400	1120000	debris	no	eroded	yes	single	steep	covered		good, weathered head wall, no secondary scarps, low mobility, muted features
BR-073	Beatton	BC 86047 no 91	BR 5	3	2	97	Quaternary	300	300	90000	debris	no	yes	yes	single	steep	muted		
BR-074	Beatton	BC 86047 no 91	BR 5	3	6	46	shale	1000	1100	1100000	intact	no	yes	gullied	single	steep	covered		several small 8's above
BR-075	Beatton	BC 86047 no 91	BR 4	3	2	104	Quaternary	300	400	120000	debris	no	yes	yes	single	steep	muted		like BR-73
BR-076	Beatton	BC 86047 no 91	BR 2	3	7	35	shale	700	600	420000	debris	no	yes	gullied	single	steep	covered		
BR-077	Beatton	BC 86047 no 91	BR 2	2	6	71	shale	900	350	315000	intact	no	yes	yes	single	gentle	covered		earth flow
BR-078	Beatton	BC 86047 no 91	BR 2	3	6	55	shale	1000	600	600000	intact	no	partially erod	yes	single	steep	muted		
BR-079	Beatton	BC 86047 no 91	BR 1	4	6	116	Quaternary	900	600	540000	intact	no	eroded	yes	complex	steep	covered		
BR-080	Beatton	BC 86075 no 62	BR 57	3	2	22	Quaternary	300	700	210000	debris	yes	eroded	no	single	gentle	covered		by oil pump, north facing, debris covered slope, large intact scarp of rock that lcs slides over into canyon, no headscarp, highly veg.
BR-081	Beatton	BC 86075 no 62	BR 57	3	6	94	Quaternary	600	1000	600000	intact	yes	eroded	yes	single	gentle	covered		large bowlshaped upper structure,east facing,scarps in debris,cliff at base,debris on slope with headscarps in N near debris scarpe.
BR-083	Beatton	BC 86075 no 62	BR 58	4	6	86	Quaternary	500	1000	500000	intact	yes	eroded	yes	complex	steep	old		steep and weathered, not much debris build up, may be supseptible to slide
BR-084	Beatton	BC 86075 no 62	BR 58	4	6	77	Quaternary	700	300	210000	intact	no	no	no	single	gentle	old		debris covered slope, no head wall, thin, exposed side wall,
BR-085	Beatton	BC 86075 no 62	BR 59/60	3	6	30	Quaternary	700	1000	700000	intact	no	eroded	no	complex	gentle	covered		cut by large gully, old, could be rotational that is so old it has retrogressed to stable angle
BR-086	Beatton	BC 86075 no 62	BR-T2R 1	3	2	326	Quaternary	500	900	450000	debris	no	yes	yes	single	steep	muted		
BR-087	Beatton	BC 86075 no 62	BR-T2R 3	3	6	35	Quaternary	500	400	200000	intact	no	no	no	single	gentle	covered		
BR-088	Beatton	BC 86075 no 62	BR-T2L 1	3	2	168	Quaternary	400	600	240000	debris	yes	yes	yes	complex	steep	muted		head scarp, no sec scaprs, intact cliff at base to slide over, due to under cutting
BR-089	Beatton	BC 86075 no 62	BR-T2L 1	3	6	126	Quaternary	400	400	160000	intact	yes	yes	yes	complex	steep	muted		small diamond shaped head scarp, most of slope is covered, small sec scarps in debris mass,

BR-090	Beatton	BC 86074 no 254	BR 76	3	3	170	Quaternary	200	300	60000	no	yes	yes	yes	single	steep	good	BR-170	
BR-091	Beatton	BC 86075 no 62	BR 61	4	1	145	shale	500	400	200000	no	no	partially erod	yes	single	steep	old		located in canyon, likely a rockfall zone, small build of debris at base of slope with small head scarp
BR-092	Beatton	BC 86075 no 62	BR 62	4	3	133	Quaternary	400	700	280000	no	yes	no	no	single	gentle	covered		
BR-093	Beatton	BC 86075 no 62	BR 65	3	6	31	Quaternary	400	600	240000	intact	yes	no	no	single	gentle	covered		debris covered slope, intact rock scarp at base, no head wall
BR-094	Beatton	BC 86075 no 62	BR 65	3	6	37	Quaternary	500	800	400000	intact	yes	eroded	no	complex	steep	muted		deep seated no head scarp, debris covered slop, doesn't appear to have sec scarps, interupted by guuly
BR-095	Beatton	BC 86075 no 62	BR 68	3	6	138	Quaternary	600	2000	1200000	intact	no	yes	gullied	complex	steep	old		old, colluvial covered
BR-096	Beatton	BC 86074 no 254	BR 69	4	3	94	Quaternary	500	300	150000	no	yes	no	no	single	gentle	old		head scarp, no sec scaprs, intact cliff at base where debris ends, not on river, debris covered slope
BR-097	Beatton	BC 86074 no 254	BR 69	3	3	43	Quaternary	600	900	540000	no	yes	yes	yes	single	gentle	covered		debris covered slope, small head scarp, no sec scarps except one near river in BD
BR-098	Beatton	BC 86074 no 254	BR 71	2	2	167	Quaternary	550	800	440000	debris	yes	yes	yes	single	steep	covered		large head wall weathered, debris protrudes into river, no sec scarps, good mobility
BR-099	Beatton	BC 86074 no 254	BR 71	3	6	142	Quaternary	300	900	270000	intact	yes	eroded	yes	complex	steep	muted		large head wall weathered, debris eroded, no sec scarps,
BR-100	Beatton	BC 86074 no 254	BR 72	1	6	50	Quaternary	500	250	125000	intact	no	yes	yes	complex	steep	good		many small failures that won't normally be above size but because so many on slope
BR-101	Beatton	BC 86047 no 91	BR 1	3	6	77	Quaternary	500	400	200000	intact	no	yes	yes	single	steep	good	BR-079c	
BR-102	Beatton	BC 86047 no 91	BR 1	3	6	85	Quaternary	800	700	560000	intact	no	yes	yes	single	steep	good	BR-079b	
BR-103	Beatton	BC 86074 no 254	BR 77	3	3	56	Quaternary	200	500	100000	no	yes	no	no	single	gentle	good	BR-171	
BR-104	Beatton	BC 86074 no 254	BR 79	4	6	155	Quaternary	300	550	165000	intact	no	yes	yes	single	steep	covered	BR-172	
BR-108	Beatton	BC 86074 no 254	BR 72	5	6	158	Quaternary	300	200	60000	intact	no	yes	yes	single	steep	good		modified head scarp due to road, small scarp in debris near river
BR-109	Beatton	BC 86074 no 254	BR 72	4	3	80	Quaternary	500	300	150000	no	no	yes	yes	single	steep	good		large weatherd head wall, debris apron at base, road crosses it, away from river, no sec scarps
BR-110	Beatton	BC 86074 no 254	BR 73	1	6	40	Quaternary	500	700	350000	intact	yes	eroded	yes	single	steep	good		small head scarp, several intact scarps in mass, river erodes debris at base,
BR-111	Beatton	BC 86074 no 254	BR 73	3	6	55	Quaternary	800	1600	1280000	intact	no	yes	yes	complex	gentle	covered		small head scarp, no distinguishable sec scarps, debris covered slope, large in size
BR-112	Beatton	BC 86074 no 254	BR 78	3	6	200	Quaternary	700	700	490000	intact	yes	yes	gullied	single	steep	good		large weathered head wall in sst, large debris apron protruding into river, small sec scarps intact on one side
BR-113	Beatton	BC 86074 no 254	BR 79	2	6	168	Quaternary	350	400	140000	intact	no	yes	gullied	single	steep	good		large weathered head wall in sst, large debris apron, no sec scarps
BR-114	Beatton	BC 86074 no 254	BR 80	3	6	5	Quaternary	500	900	450000	intact	yes	yes	yes	single	gentle	covered		small head scarp, debris covered slope, shaded in photos
BR-115	Beatton	BC 86074 no 254	BR 81	2	2	20	Quaternary	350	400	140000	debris	yes	yes	yes	single	gentle	good		large head scarp, debris covered slope, sec scarp in BD, likely in ICS
BR-116	Beatton	BC 86075 no 082	BR 82	1	6	41	Quaternary	500	1600	800000	intact	no	yes	yes	complex	gentle	good		complex of many small slides, some very active but small
BR-121	Beatton	BC 86075 no 082	BR 82	3	6	138	Quaternary	400	600	240000	intact	no	yes	gullied	single	steep	good		large weathered head wall, large debris apron, low mobility, debris being eroded by river
BR-122	Beatton	BC 86075 no 082	BR 82	3	6	144	Quaternary	300	400	120000	intact	no	yes	yes	single	steep	good		like BR-121
BR-123	Beatton	BC 86075 no 082	BR 82	3	6	153	Quaternary	400	500	200000	intact	no	yes	gullied	single	steep	good		like BR-121
BR-117	Beatton	BC 86075 no 082	BR 89	4	6	115	Quaternary	300	600	180000	intact	no	yes	yes	single	gentle	vegetated	BR-134b	
BR-118	Beatton	BC 86075 no 082	BR 90	3	6	60	Quaternary	600	350	210000	intact	no	yes	yes	single	gentle	vegetated	BR-135b	
BR-119	Beatton	BC 86075 no 082	BR 96	4	6	42	Quaternary	250	900	225000	intact	no	yes	yes	complex	gentle	vegetated	BR-137b	
BR-124	Beatton	BC 86075 no 082	BR 83	3	6	173	Quaternary	300	400	120000	intact	no	yes	gullied	single	steep	good		like BR-121
BR-125	Beatton	BC 86075 no 082	BR 83	3	6	143	Quaternary	300	600	180000	intact	no	yes	gullied	single	steep	old		backed up against BR-126 due to river erosion, debris being actively eroded, no visible sec scarps, older then BR-126
BR-126	Beatton	BC 86075 no 082	BR 84	3	3	48	Quaternary	500	600	300000	no	yes	eroded	yes	single	gentle	vegetated		small head scarp, larger scarp near base due to river erosion, debris covered, no sec scarps
BR-127	Beatton	BC 86075 no 082	BR 84	3	6	6	Quaternary	400	500	200000	intact	yes	no	yes	single	gentle	vegetated		small head scarp, no sec scarp, debris covered, scarp at base due to river erosion
BR-128	Beatton	BC 86075 no 082	BR 85	2	6	350	Quaternary	300	150	45000	intact	yes	yes	yes	single	gentle	good		failure with upper part bowl,small headscarp,lower part over a scarp is debris apron, like small slide over scarp and became debris
BR-129	Beatton	BC 86075 no 082	BR 85	3	2	50	Quaternary	200	600	120000	debris	no	yes	yes	complex	steep	good		large head scarp, most of debris is eroded, weathered head wall, backed up into gully
BR-130	Beatton	BC 86075 no 082	BR 85	3	6	106	Quaternary	300	550	165000	intact	yes	eroded	yes	single	gentle	good		like BR-118
BR-131	Beatton	BC 86075 no 082	BR 86	2	2	147	Quaternary	100	400	40000	debris	no	eroded	yes	single	steep	good		small failure on on scarp at front of old meander, scarp with some debris at base being eroded
BR-132	Beatton	BC 86075 no 082	BR 87	2	6	162	Quaternary	400	700	280000	intact	yes	yes	yes	single	steep	good		mid sized head wall with some weathering, debris being eroded, no sec scarps,
BR-133	Beatton	BC 86075 no 082	BR 88	3	6	43	Quaternary	300	600	180000	intact	yes	yes	yes	single	steep	vegetated		like BR-118 but with a scarp at base due to river erosion
BR-134	Beatton	BC 86075 no 082	BR 89	4	6	130	Quaternary	300	600	180000	intact	no	yes	yes	single	gentle	vegetated		on middle of old meander river side, highly weatherd large head scarp, debris starteing to pile up, no river erosion, no sec scarps
BR-135	Beatton	BC 86075 no 082	BR 90	1	6	46	Quaternary	450	400	180000	intact	yes	yes	yes	single	steep	good		small head scarp with debris covering top, then a larger more active scarp with debris at base into river, sec scarp looks intact
BR-136	Beatton	BC 86075 no 082	BR 94	3	6	344	Quaternary	150	800	120000	intact	yes	no	yes	single	gentle	covered		shallow failure above large river eroded scarp, no debris at base, no sec scarps
BR-137	Beatton	BC 86075 no 082	BR 95	4	6	321	Quaternary	300	1000	300000	intact	no	no	yes	single	gentle	vegetated		on old river meander, covered in colluvium, no sec scarps visible, no erosion, veg., small weathered head scarp
BR-138	Beatton	BC 86074 no 233	BR 97	4	6	71	Quaternary	150	400	60000	intact	no	yes	yes	complex	gentle	vegetated		small scarp, no sec scarp, low mobility
BR-139	Beatton	BC 86074 no 233	BR 99/100	3	3	55	Quaternary	?	?		no	yes	no	yes	complex	steep	good		upper peace clay shallow failure, slides over scarp
BR-140	Beatton	BC 86074 no 233	BR 101	3	6	72	Quaternary	600	600	360000	intact	yes	no	yes	single	steep	covered		same as BR-139 but maybe older
BR-141	Beatton	BC 86074 no 233	BR 102	3	3	107	Quaternary	450	450	202500	no	no	yes	yes	single	steep	good		large head scarp, debris being eroded, no visible sec scarps
BR-142	Beatton	BC 86074 no 233	BR 102	2	6	149	Quaternary	300	600	180000	intact	no	yes	yes	single	gentle	good		large head scarp, partially covered slope, debris at base
BR-143	Beatton	BC 86074 no 233	BR 103	3	3	105	Quaternary	200	300	60000	no	yes	no	yes	single	steep	covered		small head scarp, debris being eroded
BR-144	Beatton	BC 86074 no 233	BR 104	2	6	7	Quaternary	400	1200	480000	intact	no	yes	yes	complex	gentle	good		small head scarp, many sec scarps, debris eroded,
BR-145	Beatton	BC 86074 no 233	BR 110	4	3	70	Quaternary	200	800	160000	no	no	no	yes	single	gentle	covered		debris blends with base, away from river, small head scarp, np sec scarps
BR-146	Beatton	BC 86074 no 233	BR 98/99	3	2	88	Quaternary	250	500	125000	debris	no	yes	yes	single	gentle	good		small head scarp, sec scarps, debris in river
BR-147	Beatton	BC 86074 no 233	BR 108	4	2	136	Quaternary	300	1000	300000	debris	no	no	yes	complex	steep	covered		
BR-148	Beatton	BC 86074 no 233	BR 114	3	3	40	Quaternary	400	800	320000	no	yes	no	yes	single	gentle	vegetated		
BR-149	Beatton	BC 86074 no 210	BR 117/118	3	3	92	Quaternary	300	1000	300000	no	partial	no	yes	complex	gentle	vegetated		
BR-150	Beatton	BC 86074 no 210	BR 118	3	3	186	Quaternary	200	300	60000	no	yes	no	no	single	gentle	vegetated		
BR-151	Beatton	BC 86074 no 210	BR 121	4	2	162	Quaternary	300	900	270000	debris	yes	yes	yes	complex	steep	vegetated		
BR-152	Beatton	BC 86074 no 210	BR 122	4	3	109	Quaternary	200	400	80000	no	yes	yes	yes	complex	steep	muted		
BR-153	Beatton	BC 86074 no 210	BR 123	2	6	348	Quaternary	200	600	120000	intact	no	eroded	yes	complex	steep	good		
BR-154	Beatton	BC 86074 no 210	BR 124	4	7	77	Quaternary	400	900	360000	debris	no	no	yes	complex	gentle	vegetated		
BR-155	Beatton	BC 86074 no 210	BR 125b	2	2	149	Quaternary	150	350	52500	debris	no	yes	yes	single	steep	good		
BR-156	Beatton	BC 86074 no 182	BR 129	2	6	32	Quaternary	200	800	160000	intact	no	eroded	yes	single	gentle	good		long translational
BR-157	Beatton	BC 86074 no 182	BR 134	2	6	320	Quaternary	150	650	97500	intact	no	yes	yes	single	gentle	good		
BR-158	Beatton	BC 86074 no 182	BR 134/135	3	3	26	Quaternary	200	1200	240000	no	yes	eroded	yes	complex	gentle	vegetated		
BR-159	Beatton	BC 86074 no 182	BR 135	1	6	359	Quaternary	200	100	20000	intact	no	yes	yes	single	steep	good		
BR-160	Beatton	BC 86074 no 182	BR 137	2	2	138	Quaternary	100	600	60000	no	yes	no	yes	single	gentle	good		translational
BR-161	Beatton	BC 86074 no 182	BR 141	3	6	136	Quaternary	200	700	140000	intact	yes	no	yes	complex	gentle	vegetated		
BR-162	Beatton	BC 86074 no 182	BR 131	3	6	115	Quaternary	150	700	105000	intact	yes	yes	yes	single	steep	muted		
BR-163	Beatton	BC 86074 no 165	BR 148	3	7	82	Quaternary	200	800	160000	both	yes	eroded	yes	complex	gentle	vegetated		
BR-164	Indian C	BC 86975 no 17	BR-T1L 4	2	2	142	Quaternary	300	300	90000	debris	no	yes	yes	single	steep	good		
BR-165	Indian C	BC 86975 no 17	BR-T1L 6	1	6	77	Quaternary	350	200	70000	intact	no	yes	yes	single	gentle	good		
BR-166	Indian C	BC 86975 no 17	BR-T1L 10	2	6	118	Quaternary	500	300	150000	intact	no	yes	yes	single	steep	good		
BR-167	Beatton	BC 86074 no 254	BR 75	3	6	57	Quaternary	300	400	120000	intact	no	yes	yes	single	steep	good		
BR-168	Beatton	BC 86074 no 254	BR 76	3	3	187	Quaternary	150	200	30000	no	yes	yes	yes	single	gentle	good		
BR-169	Beatton	BC 86074 no 254	BR 77	3	3	28	Quaternary	300	400	120000	no	yes	yes	yes	single	steep	good		
BR-170	Beatton	BC 86047 no 91	BR 2	3	5	69	Quaternary	900	300	270000	no	yes	yes	yes	single	gentle	good		flow
BR-171	Beatton	BC 86075 no 082	BR 82	3	6	98	Quaternary	300	400	120000	intact	no	yes	yes	single	steep	good		
BR-172	Beatton	BC 86074 no 210	BR 117/118	3	6	134	Quaternary	400	300	120000	intact	no	yes	yes	single	gentle	vegetated		
BR-173	Beatton	BC 86074 no 254	BR 82	4	6	53	Quaternary	450	900	405000	intact	no	yes	no	single	gentle	covered		
BR-174	Beatton	BC 86075 no 16	BR 43	3	3	104	Quaternary	500	600	300000	no	yes	yes	no	single	gentle	vegetated		
BR-175	Indian Ck	BC 86075 no 16	BR-T1L 7	2	6	47	Quaternary	200	500	100000	intact	no	no	no	single	gentle	good	BR 202	
BR-176	Indian Ck	BC 86075 no 16	BR-T1L 6	2	6	190	Quaternary	250	350	87500	intact	no	no	no	single	gentle	good	BR 203	
BR-177	Indian Ck	BC 86075 no 16	BR-T1R 5	3	6	326	Quaternary	300	1200	360000	intact	no	no	no	complex	gentle	good	BR 201	
BR-178	Indian Ck	BC 86075 no 16	BR-T1L 4	2	3	138	Quaternary	400	800	320000	no	no	yes	yes	complex	steep	good	BR 204	
BR-179	Indian Ck	BC 86075 no 16	BR-T1R 4	3	6	331	Quaternary	400	650	260000	intact	no	no	no	complex	gentle	good	BR 200	
									Total	########	m2								
									Area	151.98	km2								

Appendix IV - Landslide Inventory
Table IV - 3 Southern Tributaries

Failure Name	River	Photo	River Segement	Activity	Failure Type	Slide Aspect	Probable Basal Failure Material	Length (m)	Width (m)	Area m^2	Secondary Scarps	Over Scarp	Debris Apron	Defined Head Scarp	Single or Complex	Slope Angle	Feature Clarity	May Be Mapped As	Additional Comments
KL-001	Kiskatinaw	BC 86047 no 87	KL 1	2	2	62	Quaternary	500	500	250000	debris	YES	eroded	no	single	steep	covered		good exposure of sliding plane
KL-002	Kiskatinaw	BC 86047 no 87	KL 1/2	4	7	43	Shale	1100	2000	2200000	NO	YES	yes	no	complex	gentle	vegetated		large vegetated area
KL-003	Kiskatinaw	BC 86047 no 81	KL 7	3	3	162	Shale	400	400	160000	NO	no	partial	yes	complex	steep	old		
KL-004	Kiskatinaw	BC 86047 no 81	KL 7	4	3	164	Quaternary	200	200	40000	NO	YES	no	yes	single	steep	muted		small failures above canyon wall, not likely peace lake failures
KL-005	Kiskatinaw	BC 86047 no 81	KL 10	4	3	149	Quaternary	200	600	120000	NO	YES	no	no	single	steep	muted		
KL-006	Kiskatinaw	BC 86047 no 81	KL 11	4	3	186	Quaternary	200	300	60000	NO	YES	no	yes	single	steep	muted		
KL-007	Kiskatinaw	BC 86047 no 81	KL 14	4	7	288	Quaternary	200	700	140000	NO	no	yes	no	single	gentle	covered		
KL-008	Kiskatinaw	BC 86047 no 80	KL 19	3	6	131	Shale	700	500	350000	intact	YES	no	yes	single	steep	good		
KL-009	Kiskatinaw	BC 86047 no 80	KL 20	4	3	190	Shale	300	500	150000	NO	YES	no	yes	single	steep	good		
KL-010	Kiskatinaw	BC 86047 no 80	KL 25	4	3	170	Shale	300	900	270000	NO	YES	no	no	single	steep	good		
KL-011	Kiskatinaw	BC 86047 no 79	KL 35	4	3	130	Shale	400	400	160000	NO	YES	no	no	single	gentle	old		
KL-012	Kiskatinaw	BC 86047 no 79	KL 36	4	2	193	Shale	400	600	240000	debris	YES	no	no	single	gentle	old		
KL-014	Kiskatinaw	BC 86047 no 79	KL 37	4	3	144	Shale	500	500	250000	NO	YES	no	no	single	gentle	vegetated		
KL-015	Kiskatinaw	BC 86047 no 79	KL 41	3	7	101	Shale	400	700	280000	NO	no	yes	no	single	gentle	vegetated		
KL-016	Kiskatinaw	BC 86047 no 79	KL 42	3	6	147	Shale	600	1300	780000	intact	no	no	no	complex	gentle	vegetated		
KL-017	Kiskatinaw	BC 86047 no 81	KL 10	3	3	155	Shale	300	500	150000	NO	no	yes	yes	complex	steep	old		
KL-018	Kiskatinaw	BC 86047 no 81	KL 10	3	3	155	Shale	400	300	120000	NO	no	yes	yes	complex	steep	old		
KL-019	Kiskatinaw	BC 86047 no 81	KL 11	3	3	155	Shale	300	400	120000	NO	no	yes	yes	complex	steep	old		
KR-001	Kiskatinaw	BC 86047 no 87	KR 1	3	3	256	Shale	400	500	200000	no	yes	yes	yes	single	steep	muted		
KR-002	Kiskatinaw	BC 86047 no 87	KR 2	3	6	246	Shale	500	700	350000	intact	yes	yes	yes	single	steep	muted		
KR-003	Kiskatinaw	BC 86047 no 87	KR 2	3	3	227	Shale	400	1000	400000	no	yes	eroded	yes	complex	steep	muted		
KR-004	Kiskatinaw	BC 86047 no 87	KR 2	3	7	265	Shale	800	600	480000	debris	yes	no	no	complex	gentle	vegetated		
KR-005	Kiskatinaw	BC 86047 no 87	KR 2	4	7	308	Shale	800	500	400000	debris	yes	yes	no	single	steep	vegetated		in darkness
KR-006	Kiskatinaw	BC 86047 no 81	KR-T1R 1	3	6	215	Shale	200	1000	200000	intact	yes	no	yes	complex	steep	muted		
KR-007	Kiskatinaw	BC 86047 no 81	KR 9	3	6	320	Shale	500	500	250000	intact	no	partial	yes	complex	steep	covered		
KR-008	Kiskatinaw	BC 86047 no 81	KR 11	3	3	335	Shale	400	500	200000	no	no	no	no	single	steep	covered		
KR-009	Kiskatinaw	BC 86047 no 81	KR 11	3	3	4	Shale	100	800	80000	no	no	yes	no	single	steep	covered		
KR-010	Kiskatinaw	BC 86047 no 81	KR 12	4	2	348	Quaternary	500	1100	550000	debris	yes	yes	no	complex	gentle	covered		
KR-011	Kiskatinaw	BC 86047 no 81	KR 13	3	3	287	Quaternary	400	600	240000	no	yes	no	no	single	steep	covered		
KR-012	Kiskatinaw	BC 86047 no 80	KR-T2L 1	3	7	65	Shale	300	500	150000	intact	yes	no	no	single	gentle	vegetated		
KR-013	Kiskatinaw	BC 86047 no 80	KR 16	3	2	340	Quaternary	300	1200	360000	debris	yes	no	no	complex	gentle	vegetated		
KR-014	Kiskatinaw	BC 86047 no 80	KR 17	3	6	335	Shale	800	600	480000	intact	no	yes	yes	single	gentle	vegetated		
KR-015	Kiskatinaw	BC 86047 no 80	KR-T2R 1	3	6	294	Shale	300	800	240000	intact	no	yes	yes	complex	steep	muted		
KR-016	Kiskatinaw	BC 86047 no 80	KR 20	4	2	256	Shale	700	600	420000	debris	no	yes	yes	single	gentle	covered		
KR-017	Kiskatinaw	BC 86047 no 80	KR 21	4	3	343	Shale	200	800	160000	no	yes	no	yes	single	steep	covered		
KR-018	Kiskatinaw	BC 86047 no 80	KR 23	3	2	282	Quaternary	200	800	160000	debris	no	yes	yes	single	gentle	vegetated		
KR-019	Kiskatinaw	BC 86047 no 80	KR 25/26	3	6	13	Shale	600	1600	960000	intact	yes	yes	no	complex	gentle	vegetated		
KR-020	Kiskatinaw	BC 86047 no 79	KR 33	3	2	338	Shale	400	800	320000	debris	yes	no	yes	single	gentle	vegetated		
KR-021	Kiskatinaw	BC 86047 no 79	KR 31	4	3	334	Shale	300	200	60000	no	yes	no	yes	complex	gentle	vegetated		
KR-022	Kiskatinaw	BC 86047 no 79	KR 30	3	2	331	Shale	500	900	450000	debris	yes	no	no	single	gentle	covered		
McL-001	Maurice	BC 86047 no 61	PR-T15L 2	2	2	29	Quaternary	500	600	300000	debris	no	yes	yes	single	gentle	vegetated		
McL-002	Maurice	BC 86047 no 61	PR-T15L 2	3	2	5	Quaternary	400	800	320000	debris	no	yes	yes	single	gentle	vegetated		
McL-003	Maurice	BC 86047 no 61	PR-T15L 3/4	3	3	21	Quaternary	500	1200	600000	debris	yes	no	no	complex	gentle	covered		
McR-001	Maurice	BC 86047 no 61	PR-T15R 2	3	2	171	Quaternary	250	800	200000	debris	no	yes	yes	complex	gentle	vegetated		
McR-002	Maurice	BC 86047 no 61	PR-T15R 3	2	2	211	Quaternary	200	500	100000	debris	no	partial	yes	single	gentle	vegetated		
McR-004	Maurice	BC 86047 no 61	PR-T15R 5	3	3	206	Quaternary	600	800	480000	no	yes	yes	yes	single	steep	good		
McR-005	Maurice	BC 86047 no 61	PR-T15R 5	3	3	253	Quaternary	400	1000	400000	no	yes	no	yes	single	steep	good		
ML-001	Moberly	BC 86047 no 130	ML 1	2	6	145	Shale	800	1600	1280000	intact	no	yes	yes	complex	steep	good		excellent slide
ML-002	Moberly	BC 86047 no 130	ML 2	3	6	152	Shale	500	600	300000	intact	yes	eroded	gullied	single	steep	muted		
ML-003	Moberly	BC 86047 no 130	ML 5	4	6	124	Shale	400	300	120000	intact	no	eroded	gullied	single	steep	muted		
ML-004	Moberly	BC 86047 no 130	ML 6	3	3	146	Shale	300	400	120000	no	no	eroded	gullied	single	steep	muted		
ML-005	Moberly	BC 86047 no 130	ML 6	4	3	136	Shale	400	400	160000	no	yes	yes	yes	single	steep	good		
ML-006	Moberly	BC 86047 no 130	ML 7	3	6	156	Shale	400	400	160000	intact	yes	eroded	yes	single	steep	muted		
ML-007	Moberly	BC 86047 no 130	ML 10	4	2	183	Shale	250	300	75000	debris	yes	partial	yes	complex	steep	muted		
ML-008	Moberly	BC 86047 no 130	ML 10	2	6	239	Shale	700	1000	700000	intact	yes	yes	yes	single	steep	good		
ML-009	Moberly	BC 86047 no 129	ML 11	3	6	204	Shale	750	1200	900000	intact	yes	yes	gullied	complex	gentle	good		L.Peace failures producing debris apron at base of scarp,
ML-010	Moberly	BC 86047 no 129	ML 11	3	8	175	Quaternary	900	900	810000	no	yes	no	gullied	complex	steep	good		L.Peace failures producing debris apron at base of scarp,
ML-012	Moberly	BC 86047 no 129	ML 12	3	6	168	Quaternary	900	1200	1080000	intact	yes	yes	yes	complex	gentle	good		L.Peace failures producing debris apron at base of scarp,
ML-014	Moberly	BC 86047 no 129	ML 13	3	8	210	Quaternary	600	1000	600000	debris	yes	partial	yes	complex	gentle	vegetated		L.Peace failures producing debris apron at base of scarp,
ML-015	Moberly	BC 86047 no 129	ML 14	3	8	173	Quaternary	1300	1400	1820000	intact	yes	yes	no	complex	gentle	vegetated		

ML-016	Moberly	BC 86047 no 129	ML 15	3	6	184	Shale	700	2200	1540000	intact	yes	yes	yes	complex	steep	good		
ML-017	Moberly	BC 86047 no 128	ML 15	3	6	190	Shale	800	400	320000	intact	yes	yes	yes	single	steep	good		
ML-018	Moberly	BC 86047 no 128	ML 18	4	6	138	Shale	200	600	120000	intact	no	yes	gullied	complex	steep	old		
ML-019	Moberly	BC 86047 no 128	ML 18	4	6	165	Shale	300	650	195000	intact	no	yes	yes	single	steep	good		
ML-020	Moberly	BC 86047 no 128	ML 21	3	6	139	Shale	300	900	270000	intact	no	yes	yes	complex	steep	vegetated		
ML-021	Moberly	BC 86047 no 128	ML 25	3	4	184	Quaternary	800	300	240000	no	no	yes	no	single	steep	good		
ML-022	Moberly	BC 86047 no 127	ML 25	4	3	138	Quaternary	400	500	200000	no	no	yes	yes	single	steep	good		
ML-024	Moberly	BC 86047 no 127	ML 28	4	6	148	Shale	350	400	140000	intact	no	yes	yes	single	steep	good		
ML-025	Moberly	BC 86047 no 127	ML 29	3	3	143	Shale	600	900	540000	no	no	yes	yes	single	steep	good		
ML-026	Moberly	BC 86047 no 127	ML 30	3	6	135	Shale	500	700	350000	intact	no	yes	yes	single	steep	good		
ML-027	Moberly	BC 86047 no 127	ML 36	3	6	172	Shale	600	400	240000	intact	no	yes	yes	single	steep	good		
ML-029	Moberly	BC 86047 no 127	ML 36	3	3	140	Quaternary	600	400	240000	no	yes	yes	yes	single	steep	good		
ML-030	Moberly	BC 86047 no 127	ML 37	4	3	138	Shale	500	600	300000	no	no	yes	yes	single	steep	good		
ML-040	Moberly	BC 86047 no 67	ML 54	4	3	166	Quaternary	200	2000	400000	no	no	yes	no	complex	gentle	vegetated	ML-48	
ML-041	Moberly	BC 86047 no 67	ML 55	2	3	168	Quaternary	50	200	10000	no	no	no	yes	single	steep	good		
ML-042	Moberly	BC 86047 no 67	ML 55	3	3	140	Quaternary	300	600	180000	no	no	yes	gullied	single	steep	vegetated		
ML-043	Moberly	BC 86047 no 67	ML 55	2	3	153	Quaternary	50	250	12500	no	no	no	yes	single	gentle	good		
ML-044	Moberly	BC 86047 no 67	ML 57	2	3	175	Quaternary	50	500	25000	no	no	no	yes	single	steep	good		
ML-045	Moberly	BC 86047 no 67	ML 60	4	3	217	Quaternary	150	400	60000	no	no	no	no	single	steep	vegetated		
ML-046	Moberly	BC 86047 no 66	ML 61	2	3	212	Quaternary	100	200	20000	no	no	eroded	yes	single	steep	good		
ML-047	Moberly	BC 86047 no 66	ML 62	2	3	181	Quaternary	50	300	15000	no	no	eroded	yes	single	steep	good		
ML-048	Moberly	BC 86047 no 66	ML 70	3	3	158	Quaternary	200	400	80000	no	no	yes	gullied	single	steep	good		
ML-049	Moberly	BC 86047 no 67	ML 55	4	3	144	Quaternary	300	1100	330000	no	no	yes	no	complex	gentle	vegetated		
MR-001	Moberly	BC 86047 no 130	MR 2	4	6	330	shale	300	700	210000	intact	no	no	yes	complex	steep	vegetated		
MR-002	Moberly	BC 86047 no 130	MR 2	4	6	326	shale	400	800	320000	intact	no	yes	yes	single	steep	vegetated		
MR-003	Moberly	BC 86047 no 130	MR 3	2	6	296	shale	600	300	180000	intact	no	yes	no	single	gentle	vegetated		
MR-004	Moberly	BC 86047 no 130	MR 4	3	6	324	shale	500	600	300000	intact	no	no	no	single	gentle	vegetated		fully recessed
MR-005	Moberly	BC 86047 no 130	MR 4	3	6	325	shale	500	700	350000	intact	no	no	no	complex	steep	vegetated		fully recessed
MR-006	Moberly	BC 86047 no 130	MR-T1R 1	2	6	253	shale	500	500	250000	intact	no	yes	yes	single	steep	good		
MR-007	Moberly	BC 86047 no 130	MR-T1R 1	3	6	225	shale	500	1000	500000	intact	no	yes	yes	complex	steep	good		
MR-008	Moberly	BC 86047 no 130	MR-T1L 3	3	6	37	shale	300	800	240000	intact	no	no	no	complex	gentle	vegetated		fully recessed
MR-010	Moberly	BC 86047 no 130	MR 5	4	6	321	shale	400	900	360000	intact	yes	partial	no	complex	steep	vegetated		fully recessed
MR-011	Moberly	BC 86047 no 130	MR 6	3	6	302	shale	400	300	120000	intact	no	yes	yes	complex	steep	good		
MR-013	Moberly	BC 86047 no 130	MR 8	4	6	343	shale	500	500	250000	intact	no	yes	no	complex	steep	old		
MR-014	Moberly	BC 86047 no 130	MR 11	4	6	12	shale	900	900	810000	intact	no	yes	yes	single	steep	vegetated		
MR-015	Moberly	BC 86047 no 129	MR 12	3	8	314	Quaternary	600	1400	840000	no	yes	no	no	complex	gentle	vegetated		
MR-016	Moberly	BC 86047 no 129	MR 13	3	8	78	Quaternary	400	1100	440000	no	yes	no	no	complex	gentle	vegetated		
MR-017	Moberly	BC 86047 no 129	MR 14	3	6	38	shale	800	1000	800000	intact	no	no	no	single	steep	vegetated		
MR-018	Moberly	BC 86047 no 129	MR 15	3	6	18	shale	850	750	637500	intact	yes	no	no	complex	steep	vegetated		
MR-019	Moberly	BC 86047 no 129	MR 16	3	6	359	shale	550	800	440000	intact	no	yes	no	single	steep	vegetated		
MR-020	Moberly	BC 86047 no 129	MR-T2R 1	3	6	323	shale	600	800	480000	intact	no	yes	yes	single	steep	vegetated		
MR-021	Moberly	BC 86047 no 129	MR-T2R 2	3	6	261	shale	500	300	150000	intact	no	no	no	single	gentle	vegetated		
MR-022	Moberly	BC 86047 no 129	MR-T2L 1	3	6	110	shale	600	900	540000	intact	no	yes	yes	single	steep	good		
MR-023	Moberly	BC 86047 no 129	MR-T2L 1	3	6	114	shale	300	400	120000	intact	no	yes	yes	single	steep	good		
MR-024	Moberly	BC 86047 no 129	MR 17	4	6	45	shale	400	400	160000	intact	no	yes	yes	single	steep	good		
MR-025	Moberly	BC 86047 no 129	MR 17	4	6	24	shale	800	2000	1600000	intact	no	yes	yes	complex	steep	good		
MR-026	Moberly	BC 86047 no 129	MR 18	4	6	343	shale	400	800	320000	intact	no	yes	no	single	gentle	vegetated		
MR-027	Moberly	BC 86047 no 129	MR 21	3	6	8	shale	600	1800	1080000	intact	no	yes	yes	single	steep	vegetated		
MR-028	Moberly	BC 86047 no 128	MR 22	4	6	332	shale	400	850	340000	intact	yes	yes	yes	complex	steep	covered		
MR-029	Moberly	BC 86047 no 128	MR 25	2	6	323	shale	250	300	75000	intact	no	yes	yes	single	steep	good		
MR-030	Moberly	BC 86047 no 128	MR 28	4	6	330	shale	300	300	90000	intact	no	yes	yes	single	steep	good		
MR-031	Moberly	BC 86047 no 128	MR 28	4	6	340	shale	400	800	320000	intact	no	no	yes	complex	gentle	vegetated		
MR-033	Moberly	BC 86047 no 127	MR 30	4	6	338	shale	600	1200	720000	intact	no	no	yes	single	steep	covered		
MR-034	Moberly	BC 86047 no 127	MR 31	4	3	321	shale	500	600	300000	no	no	yes	yes	single	steep	covered		
MR-035	Moberly	BC 86047 no 127	MR 32	4	3	314	shale	600	600	360000	no	no	yes	yes	single	steep	covered		
MR-036	Moberly	BC 86047 no 127	MR 33	4	6	288	shale	400	800	320000	intact	no	yes	yes	single	steep	covered		
MR-037	Moberly	BC 86047 no 99	MR 34	3	6	332	shale	350	1300	455000	intact	no	yes	no	single	gentle	covered		
MR-038	Moberly	BC 86047 no 100	MR 37	4	6	337	shale	500	400	200000	intact	no	yes	yes	single	steep	good		
MR-039	Moberly	BC 86047 no 100	MR 39/40	4	6	310	shale	500	1400	700000	intact	no	yes	no	complex	gentle	vegetated		
MR-040	Moberly	BC 86047 no 100	MR 47	4	3	348	Quaternary	400	1600	640000	no	no	yes	no	complex	gentle	vegetated		
MR-041	Moberly	BC 86047 no 67	MR 47	4	3	323	Quaternary	300	1000	300000	no	no	yes	no	single	gentle	vegetated		
MR-042	Moberly	BC 86047 no 67	MR 48	3	3	318	Quaternary	300	700	210000	no	no	no	no	single	gentle	vegetated		
MR-043	Moberly	BC 86047 no 67	MR 50	3	7	355	Quaternary	400	700	280000	no	no	yes	no	single	gentle	vegetated		
MR-044	Moberly	BC 86047 no 67	MR 51	3	7	329	Quaternary	500	800	400000	debris	no	yes	no	single	gentle	vegetated		
MR-045	Moberly	BC 86047 no 66	MR 67	4	3	231	Quaternary	300	600	180000	no	no	no	yes	single	gentle	vegetated		
MR-046	Moberly	BC 86047 no 66	MR 71	2	3	28	Quaternary	100	400	40000	no	no	no	yes	complex	gentle	good		
MR-047	Moberly	BC 86047 no 100	MR 35	4	3	31	Quaternary	200	400	80000	no	no	no	no	single	gentle	vegetated		
MR-048	Moberly	BC 86047 no 128	MR 28	3	4	332	Quaternary	500	200	100000	no	yes	yes	yes	complex	gentle	vegetated		
MR-049	Moberly	BC 86047 no 128	MR 28	3	4	316	Quaternary	700	200	140000	no	yes	yes	yes	single	gentle	vegetated		
MR-050	Moberly	BC 86047 no 128	MR 28	3	4	317	Quaternary	500	250	125000	no	yes	yes	yes	single	gentle	vegetated		

MR-051	Moberly	BC 86047 no 127	MR 20	3	3	57	Quaternary	400	350	140000	no	yes	no	yes	single	steep	vegetated		
MR-052	Moberly	BC 86047 no 129	MR-T2L 2	3	6	113	shale	500	550	275000	intact	no	no	no	complex	steep	good		
MR-053	Moberly	BC 86047 no 129	MR-T2L 2	3	3	109	Quaternary	400	600	240000	no	yes	no	no	complex	gentle	vegetated		
MR-054	Moberly	BC 86047 no 129	MR-T2L 3	3	6	109	Quaternary	300	600	180000	intact	yes	no	no	complex	steep	vegetated		
MR-055	Moberly	BC 86047 no 129	MR-T2L 3	2	2	88	Quaternary	150	800	120000	debris	yes	yes	yes	complex	gentle	good		
MR-056	Moberly	BC 86047 no 129	MR-T2R 3	1	5	310	Quaternary	350	100	35000	intact	yes	yes	yes	single	gentle	vegetated		
MR-057	Moberly	BC 86047 no 129	MR-T2R 3	3	6	302	shale	400	1000	400000	intact	yes	no	yes	single	steep	vegetated		
PiL-001	Pine	BC 86047 no 94	PiL 4	5	6	162	Quaternary	400	1400	560000	intact	no	yes	gullied	complex	steep	muted		Railway failures
PiL-002	Pine	BC 86047 no 94	PiL 5	5	6	237	shale	500	600	300000	intact	yes	eroded	gullied	complex	steep	muted		Railway failures,intact scarp as well
PiL-003	Pine	BC 86047 no 94	PiL 5	5	6	224	shale	600	600	360000	intact	yes	eroded	gullied	complex	steep	muted		Railway failures
PiL-004	Pine	BC 86047 no 94	PiL 6	5	6	200	shale	1000	800	800000	intact	yes	eroded	gullied	complex	steep	muted		Railway failures
PiL-005	Pine	BC 86047 no 94	PiL 6	5	6	160	shale	700	500	350000	intact	no	yes	yes	complex	steep	good		
PiL-007	Pine	BC 86047 no 95	PiL 6/7/8	4	6	129	shale	800	2600	2080000	intact	yes	no	yes	complex	steep	muted		
PiL-008	Pine	BC 86047 no 95	PiL 9	3	6	148	shale	500	900	450000	intact	yes	eroded	yes	single	steep	muted		
PiL-009	Pine	BC 86047 no 95	Pil 12	3	3	132	Quaternary	400	600	240000	no	yes	no	gullied	single	steep	vegetated		
PiL-010	Pine	BC 86047 no 95	PiL 13-16	3	6	117	shale	500	900	450000	intact	yes	yes	no	complex	gentle	vegetated		
PiL-011	Pine	BC 86047 no 95	PiL 13-16	3	6	116	shale	550	500	275000	intact	no	yes	yes	complex	steep	old		
PiL-012	Pine	BC 86047 no 96	PiL 17	4	6	158	shale	800	1600	1280000	intact	yes	yes	yes	complex	steep	muted		
PiL-013	Pine	BC 86047 no 96	PiL 18	3	6	190	shale	600	500	300000	intact	no	yes	yes	single	steep	muted		
PiL-014	Pine	BC 86047 no 96	PiL 18	3	6	132	shale	800	700	560000	intact	no	yes	yes	single	steep	muted		
PiL-015	Pine	BC 86047 no 96	PiL 18	3	4	240	Quaternary	1000	75	75000	no	yes	yes	yes	single	gentle	vegetated		
PiL-016	Pine	BC 86047 no 96	PiL 19	3	6	210	shale	600	1600	960000	intact	yes	partial	yes	complex	steep	good		
PiL-017	Pine	BC 86047 no 96	PiL 19	3	6	142	shale	800	1000	800000	intact	yes	yes	yes	single	steep	good		
PiL-018	Pine	BC 86047 no 96	PiL 20	3	4	140	Quaternary	1600	500	800000	no	yes	no	yes	complex	gentle	vegetated		
PiL-019	Pine	BC 86047 no 96	PiL 20	4	6	140	shale	1000	2000	2000000	intact	yes	yes	no	complex	gentle	vegetated		translational
PiL-020	Pine	BC 86047 no 71	PiL 20	4	6	130	shale	1200	2000	2400000	intact	yes	yes	yes	complex	steep	vegetated		
PiL-021	Pine	BC 86047 no 71	PiL 20	4	6	334	shale	600	500	300000	intact	yes	yes	yes	complex	steep	muted		
PiL-022	Pine	BC 86047 no 71	PiL 22	3	6	232	shale	400	850	340000	intact	yes	no	no	complex	gentle	vegetated		
PiL-023	Pine	BC 86047 no 71	PiL 23	3	6	72	shale	400	650	260000	intact	yes	no	no	complex	gentle	vegetated		
PiL-024	Pine	BC 86047 no 71	PiL 24	3	6	151	shale	400	1000	400000	intact	yes	eroded	yes	complex	steep	muted		
PiL-025	Pine	BC 86047 no 71	PiL 24	3	6	154	shale	600	400	240000	intact	yes	eroded	yes	single	steep	muted		
PiL-026	Pine	BC 86047 no 71	PiL 25	4	6	140	shale	900	2200	1980000	intact	no	yes	gullied	complex	steep	old		
PiL-027	Pine	BC 86047 no 71	PiL 25	3	3	139	Quaternary	1000	400	400000	no	no	yes	no	single	steep	good		
PiL-028	Pine	BC 86047 no 71	PiL 25/26	4	6	166	shale	600	1100	660000	intact	yes	yes	yes	complex	steep	muted		
PiL-029	Pine	BC 86047 no 70	PiL 26/27	3	4	189	Quaternary	700	1400	980000	no	yes	yes	no	complex	gentle	good		
PiL-030	Pine	BC 86047 no 70	PiL 27	4	6	183	shale	1000	1100	1100000	intact	yes	yes	no	complex	steep	muted		
PiL-031	Pine	BC 86047 no 70	PiL 33	3	3	214	Quaternary	300	650	195000	no	no	no	no	single	steep	vegetated		
PiL-032	Pine	BC 86047 no 70	PiL 35	4	3	115	Quaternary	500	3200	1600000	no	yes	yes	yes	complex	steep	covered		
PiL-034	Pine	BC 86047 no 70	PiL 37/38	3	3	183	shale	200	600	120000	no	no	yes	yes	complex	steep	vegetated		
PiL-035	Pine	BC 86047 no 69	PiL 40	3	6	170	shale	600	700	420000	intact	yes	yes	yes	single	steep	good		
PiL-037	Pine	BC 86047 no 69	PiL 40	3	6	154	shale	800	1800	1440000	intact	no	yes	yes	complex	steep	good		
PiL-038	Pine	BC 86047 no 69	PiL 41	3	3	160	shale	400	150	60000	no	no	yes	yes	single	steep	good		
PiL-039	Pine	BC 86047 no 69	PiL 41	3	3	156	shale	300	350	105000	debris	no	yes	yes	single	steep	good		
PiL-040	Pine	BC 86047 no 69	PiL 43	3	6	151	shale	700	600	420000	intact	no	yes	yes	single	steep	good		
PiL-041	Pine	BC 86047 no 69	PiL 44	3	2	197	shale	400	1000	400000	debris	no	yes	yes	single	steep	good		
PiL-042	Pine	BC 86047 no 69	PiL 46	3	7	60	Quaternary	500	700	350000	debris	no	no	yes	single	gentle	vegetated		
PiL-043	Pine	BC 86047 no 69	PiL 47/48	3	5	122	Quaternary	800	1400	1120000	no	no	no	no	complex	steep	vegetated		
PiL-044	Pine	BC 86047 no 69	PiL-T1L 1	3	6	194	shale	400	1200	480000	intact	no	yes	yes	single	steep	good		
PiL-045	Pine	BC 86047 no 69	PiL-T1L 2	3	3	165	shale	600	4600	2760000	no	yes	no	yes	complex	steep	muted		
PiL-046	Pine	BC 86047 no 69	PiL-T1R 1	3	7	345	shale	500	4000	2000000	intact	no	yes	no	complex	gentle	covered		
PiL-047	Pine	BC 86047 no 69	PiL 49	4	6	98	Quaternary	700	1000	700000	intact	no	yes	no	complex	gentle	covered		
PiR-001	Pine	BC 86047 no 94	PiR 1	4	6	17	shale	900	1600	1440000	intact	no	yes	no	complex	gentle	vegetated		
PiR-002	Pine	BC 86047 no 94	PiR 1	3	6	351	Quaternary	1000	600	600000	intact	no	yes	no	single	gentle	vegetated		
PiR-003	Pine	BC 86047 no 94	PiR 2	3	6	0	Quaternary	1600	1000	1600000	intact	yes	yes	yes	single	steep	vegetated		
PiR-004	Pine	BC 86047 no 94	PiR 3	2	6	359	Quaternary	1100	900	990000	intact	yes	yes	yes	complex	steep	good		
PiR-005	Pine	BC 86047 no 94	PiR 3	1	6	28	Quaternary	600	1000	600000	intact	yes	yes	yes	single	steep	good		
PiR-006	Pine	BC 86047 no 94	ScR 1	3	2	302	Quaternary	950	800	760000	debris	yes	yes	no	single	gentle	good		
PiR-007	Pine	BC 86047 no 94	ScR 1	3	2	277	Quaternary	1300	2450	3185000	debris	yes	yes	no	complex	gentle	good		
PiR-008	Pine	BC 86047 no 94	ScL 1	3	6	106	Quaternary	800	1500	1200000	intact	no	yes	yes	complex	steep	good		
PiR-009	Pine	BC 86047 no 94	ScL 1	3	6	137	Quaternary	600	800	480000	intact	no	yes	yes	single	steep	good		
PiR-010	Pine	BC 86047 no 94	ScL 2	2	6	164	Quaternary	600	700	420000	intact	yes	yes	yes	complex	steep	muted		
PiR-011	Pine	BC 86047 no 94	ScL 3	3	3	190	Quaternary	250	600	150000	no	no	yes	yes	complex	steep	vegetated		
PiR-012	Pine	BC 86047 no 94	ScL 2	2	2	120	Quaternary	350	550	192500	debris	no	yes	debris	single	gentle	vegetated		
PiR-013	Pine	BC 86047 no 94	ScL 5	3	2	124	Quaternary	700	600	420000	debris	no	yes	gullied	single	steep	vegetated		
PiR-014	Pine	BC 86047 no 94	PiR 4	3	6	14	shale	800	1300	1040000	intact	yes	no	no	complex	steep	vegetated		has larger low mobility flow within slide mass
PiR-015	Pine	BC 86047 no 94	PiR 5	1	2	17	shale	400	600	240000	debris	yes	yes	yes	complex	steep	vegetated		
PiR-016	Pine	BC 86047 no 94	PiR 5	3	6	5	shale	1200	900	1080000	intact	yes	yes	yes	single	gentle	vegetated		
PiR-017	Pine	BC 86047 no 94	PiR 5	4	7	359	shale	1500	800	1200000	intact	yes	yes	yes	single	gentle	vegetated		
PiR-018	Pine	BC 86047 no 95	PiR 6	3	6	337	shale	?	?		intact	no	yes	yes	complex	steep	vegetated		

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PiR-019	Pine	BC 86047 no 95	PiR 7	3	7	352	shale	?	?		no	no	yes	no	complex	gentle	vegetated		
PiR-020	Pine	BC 86047 no 95	PiR 7	3	6	5	shale	1200	550	660000	intact	no	eroded	no	complex	steep	good		
PiR-021	Pine	BC 86047 no 95	PiR 7	3	6	344	shale	1700	2000	3400000	intact	no	yes	yes	single	steep	good		
PiR-022	Pine	BC 86047 no 95	PiR 7	4	6	345	shale	1600	1400	2240000	intact	no	yes	yes	complex	steep	vegetated		
PiR-023	Pine	BC 86047 no 95	PiR 8	3	6	307	shale	1700	2400	4080000	intact	no	yes	gullied	single	steep	good		
PiR-024	Pine	BC 86047 no 96	PiR 9	3	5	281	Quaternary	800	700	560000	debris	yes	no	no	complex	gentle	vegetated		
PiR-025	Pine	BC 86047 no 96	PiR 10	3	5	27	Quaternary	1000	600	600000	debris	yes	no	no	complex	gentle	vegetated		
PiR-026	Pine	BC 86047 no 96	PiR 11	3	6	350	shale	900	1400	1260000	intact	yes	yes	yes	complex	steep	vegetated		
PiR-027	Pine	BC 86047 no 96	PiR 12/13	3	7	335	Quaternary	500	600	300000	intact	yes	yes	yes	complex	gentle	vegetated	PiR-10b	
PiR-028	Pine	BC 86047 no 96	PiR 14	3	6	10	shale	900	1300	1170000	intact	no	yes	yes	complex	steep	good		has smaller flows on mass
PiR-029	Pine	BC 86047 no 96	PiR 17	3	3	290	shale	600	1200	720000	debris	yes	no	no	complex	gentle	vegetated	PiR-30b	
PiR-030	Pine	BC 86047 no 96	PiR 16/17	3	2	53	shale	500	1000	500000	debris	yes	no	no	complex	gentle	vegetated		
PiR-031	Pine	BC 86047 no 96	PiR 21/22	3	6	309	shale	1000	2200	2200000	intact	yes	no	no	complex	gentle	vegetated		fully recessed
PiR-032	Pine	BC 86047 no 71	PiR 22	3	6	336	shale	900	700	630000	intact	yes	eroded	no	complex	gentle	vegetated		fully recessed
PiR-033	Pine	BC 86047 no 71	PiR 25	2	7	330	shale	1700	1200	2040000	intact	yes	yes	no	complex	gentle	vegetated		with paleoriver benches
PiR-034	Pine	BC 86047 no 71	PiR 25	4	7	334	Quaternary	1500	1200	1800000	debris	yes	yes	yes	single	gentle	vegetated		like flatrock
PiR-035	Pine	BC 86047 no 71	PiR 27/30	4	7	327	Quaternary	1000	1600	1600000	intact	no	no	no	complex	steep	vegetated		
PiR-036	Pine	BC 86047 no 71	PiR 23/24	4	7	13	Quaternary	1200	1600	1920000	intact	no	no	no	complex	gentle	vegetated	PiR-035b	
PiR-037	Pine	BC 86047 no 70	PiR 34	3	2	55	Quaternary	300	900	270000	debris	yes	no	no	complex	gentle	vegetated		
PiR-038	Pine	BC 86047 no 70	PiR 35	4	1	318	Quaternary	300	1200	360000	no	no	yes	yes	complex	steep	vegetated		
PiR-042	Pine	BC 86047 no 69	PiR 42	2	2	282	shale	700	800	560000	debris	yes	yes	yes	single	steep	good		
PiR-044	Pine	BC 86047 no 71	PiR 29	3	7	321	shale	1600	2300	3680000	intact	yes	no	no	single	gentle	vegetated		translational like flatrock
PiR-043	Pine	BC 86047 no 70	PiR 31/32	4	7	314	Quaternary	1500	2200	3300000	no	yes	yes	no	single	gentle	vegetated	PiR-44	
PiR-047	Pine	BC 86047 no 69	PiR-T1L 6	2	4	10	Quaternary	1400	600	840000	no	no	no	no	single	gentle	vegetated		
PiR-048	Pine	BC 86047 no 69	PiR-T1L 3	4	7	58	Quaternary	500	1200	600000	intact	yes	yes	no	complex	gentle	vegetated		
PiR-049	Pine	BC 86047 no 69	PiR-T1R 3	4	7	261	Quaternary	500	800	400000	no	yes	yes	no	complex	gentle	vegetated		
ScL-001	Septimus Ck	BC 86047 no 72	ScL 6	2	2	106	Shale	?	?		debris	yes	yes	yes	complex	steep	good		
ScL-002	Septimus Ck	BC 86047 no 72	ScL 12	3	2	117	Shale	1000	900	900000	debris	no	yes	no	single	gentle	vegetated		
ScL-003	Septimus Ck	BC 86047 no 72	ScL 13	3	6	121	Shale	800	900	720000	intact	yes	yes	yes	single	steep	vegetated		
ScL-004	Septimus Ck	BC 86047 no 72	ScL 14	4	6	162	Shale	600	800	480000	intact	no	yes	gullied	single	steep	good		
ScL-005	Septimus Ck	BC 86047 no 72	ScL 14	3	6	149	Shale	500	600	300000	intact	yes	yes	yes	single	steep	vegetated		
ScL-006	Septimus Ck	BC 86047 no 72	ScL 14	4	2	178	Shale	500	800	400000	debris	no	yes	gullied	complex	steep	vegetated		
ScL-007	Septimus Ck	BC 86047 no 72	ScL 14	4	6	183	Shale	500	600	300000	intact	no	yes	yes	single	steep	vegetated		
ScL-008	Septimus Ck	BC 86047 no 72	ScL 14	4	3	219	Shale	550	500	275000	no	no	yes	yes	single	steep	vegetated		
ScL-009	Septimus Ck	BC 86047 no 72	ScL 14	4	5	9	Quaternary	800	700	560000	no	no	yes	no	single	gentle	vegetated		
ScL-010	Septimus Ck	BC 86047 no 72	ScL 16	2	6	90	Shale	500	900	450000	intact	no	yes	yes	single	steep	good		
ScL-012	Septimus Ck	BC 86047 no 72	ScL 17	4	3	89	Shale	1200	1300	1560000	no	no	yes	yes	single	steep	vegetated		
ScL-013	Septimus Ck	BC 86047 no 72	ScL 17	2	6	146	Shale	400	400	160000	intact	yes	yes	no	single	steep	good		
ScL-014	Septimus Ck	BC 86047 no 72	ScL 17	2	6	126	Shale	200	500	100000	intact	no	no	yes	complex	steep	good		
ScL-015	Septimus Ck	BC 86047 no 72	ScL 18	4	6	215	Shale	400	900	360000	intact	no	yes	yes	single	steep	good		
ScL-016	Septimus Ck	BC 86047 no 72	ScL 18	4	2	216	Shale	500	400	200000	debris	no	yes	yes	single	steep	vegetated		
ScL-017	Septimus Ck	BC 86047 no 72	ScL 18	4	3	201	Shale	350	400	140000	no	no	yes	yes	single	steep	vegetated		
ScR-001	Septimus Ck	BC 86047 no 72	ScR 5a	3	7	320	Shale	1400	1800	2520000	debris	no	yes	yes	single	steep	vegetated		
ScR-002	Septimus Ck	BC 86047 no 72	ScR 6	3	2	310	Shale	1000	1200	1200000	debris	no	yes	no	complex	gentle	vegetated		
ScR-003	Septimus Ck	BC 86047 no 72	ScR 7	2	2	319	Shale	400	400	160000	debris	no	yes	no	single	gentle	covered		
ScR-004	Septimus Ck	BC 86047 no 72	ScR 7	3	2	298	Shale	500	300	150000	debris	no	yes	yes	single	steep	vegetated		
ScR-006	Septimus Ck	BC 86047 no 72	ScR 8	2	3	337	Quaternary	300	300	90000	no	yes	yes	yes	single	steep	good		
ScR-007	Septimus Ck	BC 86047 no 72	ScR 9	2	3	334	Quaternary	350	400	140000	no	yes	yes	yes	single	steep	good		
ScR-008	Septimus Ck	BC 86047 no 72	ScR 9	4	4	63	Quaternary	1600	500	800000	no	yes	yes	no	single	gentle	good		
ScR-009	Septimus Ck	BC 86047 no 72	ScR-T1R 1	3	6	299	Shale	1000	950	950000	intact	no	yes	no	complex	gentle	vegetated		
ScR-010	Septimus Ck	BC 86047 no 72	ScR-T1R 2	3	6	290	Shale	900	1400	1260000	intact	no	yes	no	single	steep	vegetated		
ScR-011	Septimus Ck	BC 86047 no 72	ScR-T1L 2	3	2	77	Shale	300	700	210000	debris	no	yes	yes	single	steep	vegetated		
ScR-012	Septimus Ck	BC 86047 no 72	ScR-T1L 1	3	6	61	Shale	500	600	300000	intact	no	yes	yes	single	steep	good		
ScR-013	Septimus Ck	BC 86047 no 72	ScR-T1L 1	2	2	98	Shale	500	500	250000	debris	no	yes	yes	single	gentle	good		
ScR-014	Septimus Ck	BC 86047 no 72	ScR-T1L 1	3	6	85	Shale	400	650	260000	intact	no	yes	yes	complex	gentle	vegetated		
ScR-015	Septimus Ck	BC 86047 no 72	ScR 9	4	5	325	Quaternary	900	3000	2700000	intact	no	yes	yes	complex	gentle	good		
									Total	151617500	m2								
									Area	151.6175	km2								

Appendix IV - Landslide Inventory

Table IV - 4 Beatton River East

Failure Name	River	Photo	River Segement	Activity	Failure Type	Probable Basal Failure Material	Length (m)	Width (m)	Area m2	Slide Aspect	Secondary Scarps	Over Scarp	Debris Apron	Defined Head Scarp	Single or Complex	Slope Angle	Feature Clarity	May Be Mapped As	Additional Comments
AL-001	Alces	BC 86047 no 87	AL-T1R 1	3	2	Shale	500	800	400000	125	debris	yes	no	yes	complex	steep	muted		2 parts, a 3 and a 2
AL-002	Alces	BC 86047 no 87	AL-T1R 2	3	2	Shale	400	400	160000	75	debris	yes	yes	yes	single	gentle	covered		
AL-003	Alces	BC 86047 no 87	AL-T1L 1	2	3	Shale	200	200	40000	232	no	yes	eroded	yes	single	steep	good		
AL-004	Alces	BC 86047 no 87	AL-T1L 2	3	2	Shale	300	400	120000	235	debris	yes	yes	yes	single	steep	covered		
AL-005	Alces	BC 86047 no 87	AL-T1R 4	3	2	Shale	200	700	140000	82	debris	no	yes	gullied	complex	steep	covered		
AL-006	Alces	BC 86047 no 87	AL-T1R 4	3	3	Shale	200	400	80000	137	no	no	yes	yes	single	steep	covered		
AL-007	Alces	BC 86047 no 87	AL 5	3	3	Shale	400	600	240000	265	no	yes	no	gullied	complex	steep	good		
AL-008	Alces	BC 86047 no 87	AL 10	3	2	Shale	400	500	200000	277	debris	yes	no	yes	single	steep	muted		
AL-009	Alces	BC 86047 no 87	AL-T2L 1	3	3	Shale	400	500	200000	294	no	yes	yes	gullied	single	steep	covered		
AL-010	Alces	BC 86047 no 87	AL-T2R 2	3	3	Shale	400	300	120000	107	no	yes	no	yes	single	gentle	good		
AL-011	Alces	BC 86047 no 87	AL 15/16	2	4	Quaternary	600	400	240000	183	no	yes	yes	yes	single	gentle	good		
AL-012	Alces	BC 86047 no 87	AL 18	2	4	Quaternary	700	100	70000	253	no	yes	yes	yes	complex	gentle	good		
AL-013	Alces	BC 86047 no 138	AL 19	2	3	Quaternary	500	300	150000	238	no	yes	yes	gullied	complex	steep	covered		
AL-014	Alces	BC 86047 no 138	AL 23	3	6	Shale	400	600	240000	233	intact	no	yes	yes	single	steep	good		
AL-015	Alces	BC 86047 no 138	AL 24	3	3	Shale	600	1300	780000	268	no	no	yes	yes	complex	steep	covered		
AL-016	Alces	BC 86047 no 138	AL 25	2	6	Shale	600	500	300000	274	intact	yes	yes	yes	single	steep	good		
AL-017	Alces	BC 86047 no 138	AL 25	3	6	Shale	400	400	160000	273	intact	no	no	no	complex	steep	covered		
AL-018	Alces	BC 86047 no 138	AL 25	2	2	Shale	400	500	200000	280	debris	no	yes	yes	single	steep	good		
AL-019	Alces	BC 86047 no 138	AL 28	3	3	Quaternary	400	500	200000	279	no	yes	no	no	single	gentle	vegetated		
AL-020	Alces	BC 86047 no 138	AL 29	3	6	Shale	400	400	160000	295	intact	yes	yes	yes	single	gentle	vegetated		
AL-021	Alces	BC 89047 no 147	AL 32	3	6	Shale	200	600	120000	320	intact	no	no	no	single	gentle	vegetated		
AL-022	Alces	BC 89047 no 147	AL 32	3	6	Shale	300	500	150000	263	intact	no	no	no	single	gentle	vegetated		
AL-023	Alces	BC 89047 no 147	AL 33	3	3	Quaternary	400	600	240000	304	no	no	no	no	complex	gentle	vegetated		
AL-024	Alces	BC 89047 no 147	AL 34	3	2	Quaternary	400	1100	440000	287	debris	no	no	no	single	gentle	vegetated		
AL-025	Alces	BC 86047 no 87	AL 3	3	2	Quaternary	600	200	120000	321	debris	yes	yes	gullied	single	steep	muted		
AL-026	Alces	BC 86047 no 87	AL 4	4	6	Shale	400	800	320000	215	intact	yes	no	yes	complex	steep	muted		
AL-027	Alces	BC 86047 no 87	AL 6	3	6	Shale	400	400	160000	273	intact	yes	no	yes	single	steep	vegetated		
AL-028	Alces	BC 86047 no 87	AL 8	3	6	Shale	600	600	360000	264	intact	yes	no	gullied	single	steep	vegetated		
AL-029	Alces	BC 86047 no 87	AL 9	4	6	Shale	500	300	150000	278	intact	yes	no	no	single	steep	vegetated		
AL-030	Alces	BC 86047 no 87	AL 18	3	6	Shale	400	500	200000	259	intact	no	yes	yes	single	steep	muted		
AL-031	Alces	BC 86047 no 87	AL 12	4	6	Shale	500	1500	750000	329	intact	yes	partial	yes	complex	steep	muted		
AL-032	Alces	BC 86047 no 87	AL 9	3	6	Shale	500	300	150000	239	intact	yes	no	yes	single	steep	muted		
AL-033	Alces	BC 86047 no 87	AL 4	3	5	Quaternary	600	300	180000	195	no	yes	yes	yes	single	steep	covered		
AL-034	Alces	BC 86047 no 87	AL 4	3	6	Shale	400	600	240000	203	intact	no	no	no	complex	steep	vegetated		
AL-035	Alces	BC 86047 no 87	AL-T1L 5	4	3	Shale	200	600	120000	258	no	yes	yes	no	single	gentle	vegetated		
AL-036	Alces	BC 86047 no 87	AL 1	4	1	Shale	400	600	240000	199	no	no	yes	yes	single	steep	good	AL-0	
AL-037	Alces	BC 89047 no 147	AL 34	3	6	Quaternary	400	1300	520000	162	intact	no	yes	no	complex	steep	vegetated	AL-25	
AL-038	Alces	BC 89047 no 147	AL 34	4	3	Quaternary	200	600	120000	311	no	no	no	no	complex	gentle	vegetated	AL-26	
AL-039	Alces	BC 86047 no 87	AL 8	3	6	Shale	400	400	160000	202	intact	no	no	yes	single	gentle	vegetated	AL-31	
AR-001	Alces	BC 86047 no 87	AR 1	3	3	Quaternary	400	1000	400000	53	no	yes	no	no	complex	gentle	vegetated		
AR-002	Alces	BC 86047 no 87	AR 2	3	3	Quaternary	500	1100	550000	24	no	yes	yes	yes	complex	gentle	vegetated		
AR-003	Alces	BC 86047 no 87	AR 5	2	6	Shale	500	600	300000	93	intact	no	no	no	complex	steep	covered		
AR-004	Alces	BC 86047 no 87	AR 7	3	2	Shale	400	600	240000	13	debris	yes	no	no	complex	steep	vegetated		
AR-005	Alces	BC 86047 no 87	AR 8	3	3	Shale	400	500	200000	41	no	yes	no	no	complex	steep	vegetated		
AR-006	Alces	BC 86047 no 87	AR 9	3	3	Shale	400	400	160000	69	no	yes	no	yes	single	steep	good		
AR-007	Alces	BC 86047 no 87	AR 10	3	3	Shale	400	300	120000	31	no	yes	no	no	single	gentle	vegetated		
AR-008	Alces	BC 86047 no 87	AR 10	3	6	Shale	500	350	175000	3	intact	no	no	yes	single	steep	vegetated		

AR-009	Alces	BC 86047 no 87	AR 14	4	6	Shale	600	1000	600000	49	intact	no	no	no	complex	gentle	vegetated		
AR-010	Alces	BC 86047 no 138	AR 17	3	3	Shale	300	700	210000	153	no	no	yes	gullied	single	steep	good		
AR-011	Alces	BC 86047 no 138	AR 19	3	3	Shale	200	700	140000	288	no	no	yes	yes	single	gentle	vegetated		
AR-012	Alces	BC 86047 no 138	AR 20	3	3	Shale	250	750	187500	109	no	no	yes	yes	single	steep	covered		
AR-013	Alces	BC 86047 no 138	AR 22	3	3	Shale	400	400	160000	48	no	yes	no	gullied	single	steep	good		
AR-014	Alces	BC 86047 no 138	AR 22	3	3	Shale	400	350	140000	38	no	yes	yes	gullied	single	steep	covered		
AR-015	Alces	BC 86047 no 138	AR 22	3	3	Shale	200	100	20000	54	no	yes	yes	yes	single	steep	good		
AR-016	Alces	BC 86047 no 138	AR-T1R 1	2	3	Shale	300	600	180000	289	no	yes	yes	yes	complex	steep	covered		
AR-017	Alces	BC 86047 no 138	AR-T1R 2	3	3	Quaternary	300	600	180000	127	no	no	yes	no	complex	gentle	covered		
AR-018	Alces	BC 86047 no 138	AR-T1L 3	3	3	Quaternary	200	500	100000	145	no	no	yes	yes	complex	gentle	covered		
AR-019	Alces	BC 86047 no 138	AR 23	2	4	Quaternary	600	100	60000	49	no	yes	yes	yes	single	gentle	good		
AR-020	Alces	BC 86047 no 138	AR 23	3	6	Shale	300	600	180000	40	intact	no	no	no	single	steep	covered		
AR-021	Alces	BC 86047 no 138	AR-T2R 1	3	6	Shale	500	1800	900000	43	intact	no	no	no	complex	steep	vegetated		
AR-022	Alces	BC 86047 no 138	AR-T2R 4	3	6	Shale	300	400	120000	82	intact	no	no	no	complex	steep	vegetated		
AR-023	Alces	BC 86047 no 138	AR-T2L 6	3	3	Shale	200	400	80000	220	no	no	no	gullied	complex	steep	muted		
AR-024	Alces	BC 86047 no 138	AR-T2L 4	3	3	Shale	300	500	150000	234	no	no	yes	yes	complex	steep	muted		
AR-025	Alces	BC 86047 no 138	AR-T2L 1	3	2	Shale	200	300	60000	203	debris	no	yes	gullied	single	steep	muted		
AR-026	Alces	BC 86047 no 138	AR-T2L 1	3	3	Shale	200	400	80000	232	no	no	no	gullied	single	steep	muted		
AR-027	Alces	BC 86047 no 138	AR-T2L 1	3	3	Shale	300	400	120000	221	no	no	yes	yes	single	steep	good		
AR-028	Alces	BC 86047 no 138	AR-T2L 3	3	3	Shale	100	300	30000	231	no	no	yes	yes	single	steep	good		
AR-029	Alces	BC 86047 no 138	AR 26	2	6	Shale	300	800	240000	103	intact	yes	eroded	yes	complex	steep	good		8 above
AR-030	Alces	BC 86047 no 138	AR 26	3	3	Quaternary	200	500	100000	120	no	no	yes	yes	single	steep	good		
AR-031	Alces	BC 86047 no 138	AR 24	3	6	Shale	500	2600	1300000	91	intact	no	yes	gullied	complex	steep	vegetated		
AR-032	Alces	BC 86047 no 147	AR 31	4	3	Quaternary	300	600	180000	123	no	no	yes	no	single	gentle	vegetated		
AR-033	Alces	BC 86047 no 147	AR 32	5	2	Quaternary	300	600	180000	126	debris	no	yes	yes	single	steep	modified		road
AR-034	Alces	BC 86047 no 147	AR 35	3	6	Quaternary	200	700	140000	152	intact	yes	yes	no	single	gentle	vegetated		
AR-035	Alces	BC 86047 no 147	AR 36	4	3	Quaternary	200	700	140000	121	no	no	yes	no	single	gentle	vegetated		road
AR-036	Alces	BC 86047 no 147	AR-T3R 1	3	2	Quaternary	200	600	120000	36	debris	no	yes	no	single	gentle	vegetated		
AR-037	Alces	BC 86075 no 10	AR 44	3	3	Quaternary	200	1200	240000	55	no	no	yes	no	complex	gentle	vegetated	AR 48	
AR-038	Alces	BC 86047 no 147	AR-T3R 1	3	2	Quaternary	400	600	240000	108	debris	no	yes	no	single	gentle	vegetated		
AR-039	Alces	BC 86047 no 147	AR-T3R 2	3	2	Quaternary	200	600	120000	110	debris	no	yes	yes	single	gentle	vegetated		
AR-040	Alces	BC 86047 no 147	AR-T3R 2	3	3	Quaternary	200	600	120000	77	no	no	yes	no	single	steep	covered		
AR-041	Alces	BC 86047 no 147	AR-T3R 3	3	3	Quaternary	100	1000	100000	77	no	no	yes	yes	complex	steep	covered		
AR-042	Alces	BC 86047 no 147	AR 37	5	3	Quaternary	500	800	400000	168	no	yes	yes	yes	complex	steep	muted		
AR-043	Alces	BC 86075 no 10	AR 43	3	3	Quaternary	300	800	240000	7	no	no	yes	no	single	gentle	vegetated	AR 49	
AR-044	Alces	BC 86047 no 147	AR 38	3	2	Quaternary	400	800	320000	98	debris	no	no	no	complex	gentle	vegetated		
AR-045	Alces	BC 86047 no 147	AR 39	2	2	Quaternary	200	150	30000	140	debris	yes	yes	yes	single	steep	good		
AR-046	Alces	BC 86047 no 147	AR 39/40	3	2	Quaternary	300	1200	360000	138	debris	no	yes	no	complex	gentle	good		high translational
AR-047	Alces	BC 86075 no 10	AR 45/46	2	2	Quaternary	300	2800	840000	69	debris	no	yes	no	complex	gentle	vegetated		high translational
AR-048	Alces	BC 86047 no 87	AR 6	3	2	Shale	600	800	480000	61	debris	yes	no	yes	complex	steep	muted		debris from 8's rest on competent lower bed
AR-049	Alces	BC 86047 no 87	AR 7	3	6	Shale	400	600	240000	24	intact	yes	yes	yes	complex	steep	muted		
AR-050	Alces	BC 86047 no 138	AR 16	3	6	Shale	500	500	250000	257	intact	no	yes	gullied	single	gentle	vegetated		fully recessed rotational
AR-051	Alces	BC 86047 no 138	AR 18	3	6	Shale	400	1000	400000	32	intact	yes	yes	yes	complex	steep	vegetated		
AR-052	Alces	BC 86047 no 147	AR 30	3	3	Quaternary	300	500	150000	81	no	yes	yes	no	single	gentle	vegetated		
AR-053	Alces	BC 86047 no 147	AR 32	4	3	Quaternary	300	600	180000	36	no	no	no	yes	single	gentle	vegetated	AR 51	
AR-054	Alces	BC 86047 no 147	AR-T3L 2	3	3	Quaternary	200	900	180000	18	no	no	yes	yes	complex	gentle	vegetated	AR 50	
AR-055	Alces	BC 86047 no 138	AR 10	3	6	Shale	600	400	240000	175	intact	no	yes	no	single	steep	covered		
DL-001	Doig	BC 86075 no 62	DL 3	3	3	Shale	300	500	150000	356	no	no	yes	gullied	single	steep	good		in canyon
DL-002	Doig	BC 86075 no 62	DL 8	3	3	Shale	250	450	112500	355	no	no	no	yes	single	gentle	good		
DL-003	Doig	BC 86075 no 62	DL 8	3	6	Shale	400	1100	440000	345	intact	yes	no	no	single	complex	vegetated		
DL-004	Doig	BC 86075 no 62	DL 13	3	3	Shale	400	500	200000	18	no	yes	eroded	yes	single	steep	covered		
DL-005	Doig	BC 86075 no 62	DL 15	3	6	Shale	600	900	540000	271	intact	no	no	no	single	gentle	vegetated		
DL-006	Doig	BC 86075 no 62	DL 15	3	6	Shale	500	500	250000	273	intact	yes	yes	yes	single	steep	vegetated		
DL-007	Doig	BC 86075 no 62	DL 16	3	6	Shale	700	600	420000	313	intact	yes	no	no	complex	gentle	vegetated		fully regressed

DL-008	Doig	BC 86075 no 62	DL 16	2	6	Shale	1000	400	400000	118	intact	no	yes	yes	single	gentle	vegetated		still has good back scarp
DL-009	Doig	BC 86075 no 62	DL 16	3	6	Shale	700	600	420000	137	intact	yes	yes	no	single	gentle	vegetated		
DL-010	Doig	BC 86075 no 62	DL 18	3	6	Shale	400	1500	600000	143	intact	no	yes	no	complex	gentle	vegetated		
DL-011	Siphon Ck	BC 86074 no 255	DL-T1L 1	2	7	Quaternary	300	1000	300000	3	debris	yes	yes	yes	single	gentle	vegetated		
DL-012	Doig	BC 86074 no 255	DL 24	2	6	Shale	300	400	120000	21	intact	no	yes	yes	complex	steep	good		recent activity near south
DL-013	Doig	BC 86074 no 255	DL 24	4	6	Shale	500	1000	500000	290	intact	no	yes	gullied	single	steep	vegetated		
DL-014	Doig	BC 86074 no 255	DL 26/27	4	7	Quaternary	350	700	245000	299	debris	yes	no	no	complex	gentle	vegetated		
DL-015	Doig	BC 86074 no 255	DL 27	2	6	Shale	100	200	20000	14	intact	no	yes	yes	single	steep	good		
DL-016	Doig	BC 86074 no 255	DL 29	4	6	Quaternary	400	400	160000	339	intact	yes	yes	yes	single	gentle	vegetated		
DL-017	Doig	BC 86074 no 255	DL 31	2	6	Shale	150	300	45000	10	intact	yes	yes	yes	single	steep	good		
DL-018	Doig	BC 86074 no 255	DL 32	3	3	Quaternary	200	400	80000	260	no	no	no	no	single	gentle	vegetated		
DL-019	Doig	BC 86074 no 255	DL 35	3	6	Quaternary	200	600	120000	312	intact	no	no	no	complex	gentle	vegetated		
DL-020	Doig	BC 86074 no 255	DL 36	3	6	Quaternary	400	400	160000	285	intact	no	no	no	complex	gentle	vegetated		
DL-021	Doig	BC 86074 no 255	OL 1	3	6	Quaternary	400	1000	400000	318	intact	no	no	no	complex	gentle	vegetated		
DL-022	Doig	BC 86074 no 255	OR 2	3	2	Quaternary	400	400	160000	164	debris	no	no	no	complex	gentle	vegetated		
DL-023	Doig	BC 86074 no 255	OR 1	3	6	Quaternary	150	500	75000	201	intact	no	no	no	single	gentle	vegetated		
DL-024	Doig	BC 86074 no 255	DL 37	3	6	Quaternary	200	1000	200000	196	intact	no	yes	no	single	gentle	vegetated		
DL-025	Doig	BC 86074 no 255	DL 38	2	2	Quaternary	100	400	40000	280	debris	no	no	yes	single	steep	good		
DL-028	Doig	BC 86074 no 255	DL 33	3	6	Quaternary	200	1200	240000	310	intact	no	yes	yes	single	gentle	vegetated		
DL-029	Doig	BC 86075 no 62	DL 14	3	6	Shale	500	800	400000	315	intact	yes	yes	yes	single	gentle	vegetated		
DL-026	Siphon Ck	BC 86074 no 255	DL-T1L 1	2	7	Quaternary	300	1200	360000	98	debris	no	yes	yes	complex	gentle	vegetated	DL-30	
DL-027	La Guarde	BC 86074 no 255	DL-T1L 2	3	6	Shale	200	500	100000	357	intact	yes	yes	yes	single	gentle	vegetated	DL-31	
DL-032	Doig	BC 86075 no 62	DL 17	3	6	Quaternary	350	800	280000	151	intact	no	yes	yes	single	gentle	good	DL-28	
DR-001	Doig	BC 86075 no 62	DR 6	3	2	Shale	500	1000	500000	145	debris	yes	no	no	complex	gentle	vegetated		high translational component
DR-002	Doig	BC 86075 no 62	DR 6	2	6	Shale	600	300	180000	147	intact	no	yes	no	single	steep	vegetated		low mobility flow
DR-003	Doig	BC 86075 no 62	DR 7	3	6	Shale	600	800	480000	150	intact	yes	eroded	no	single	steep	vegetated		
DR-004	Doig	BC 86075 no 62	DR 8	4	6	Shale	500	1200	600000	97	intact	no	no	no	complex	gentle	vegetated		full recession of slide/river bank
DR-005	Doig	BC 86075 no 62	DR 9	3	6	Shale	400	400	160000	70	intact	no	yes	no	complex	gentle	good		couple of slides together
DR-006	Doig	BC 86075 no 62	DR 9	3	6	Shale	500	500	250000	101	intact	yes	yes	yes	single	steep	good		
DR-008	Doig	BC 86075 no 62	DR 12	3	3	Shale	500	600	300000	174	no	yes	yes	yes	single	steep	vegetated		meander
DR-010	Doig	BC 86074 no 255	DR 30	2	6	Shale	200	300	60000	175	intact	no	yes	yes	single	steep	good		
DR-011	Doig	BC 86074 no 255	DR 37	1	2	Quaternary	100	300	30000	150	debris	no	eroded	yes	single	steep	good		
DR-012	Doig	BC 86074 no 255	DR 39	3	3	Quaternary	200	600	120000	21	no	no	yes	no	single	gentle	vegetated		
DR-013	Doig	BC 86074 no 255	DR 39	2	3	Quaternary	100	200	20000	177	no	no	eroded	yes	single	steep	good		
DR-014	Doig	BC 86074 no 255	DR 41	3	3	Quaternary	300	1200	360000	60	no	no	no	no	complex	gentle	vegetated		
DR-015	Doig	BC 86075 no 62	DR 10	2	8	Quaternary	100	1000	100000	130	no	yes	no	yes	complex	gentle	vegetated		
								Total	33010000		m2								
								Area	33.01		km2								

Appendix IV - Landslide Inventory
Table IV - 5 Halfway River West

Failure Name	River	Photo	River Segement	Activity	Failure Type	Slide Aspect	Probable Basal Failure Material	Length (m)	Width (m)	Area m2	Secondary Scarps	Over Scarp	Debris Apron	Defined Head Scarp	Single or Complex	Slope Angle	Feature Clarity	May Be Mapped As	Additional Comments
CL-001	Cameron	BC 86075 no 28	CL 1/2	3	6	260	Shale	1200	2000	2400000	intact	no	yes	yes	complex	gentle	vegetated		
CL-002	Cameron	BC 86075 no 28	CL 3/4	3	6	275	Shale	500	1400	700000	intact	no	yes	no	complex	gentle	vegetated		
CL-003	Cameron	BC 86075 no 28	CL 4/5	3	5	301	Quaternary	1600	2200	3520000	intact	no	yes	no	complex	gentle	vegetated		
CL-004	Cameron	BC 86075 no 28	CL 5	4	3	212	Shale	300	600	180000	no	yes	yes	yes	single	steep	good		
CL-005	Cameron	BC 86075 no 28	CL 4	4	3	274	Shale	500	600	300000	no	yes	yes	yes	single	steep	good		
CL-006	Cameron	BC 86075 no 28	CL 5	4	3	210	Shale	600	600	360000	no	yes	yes	yes	single	steep	vegetated		
CL-007	Cameron	BC 86075 no 50	CL7	3	3	228	Shale	1800	1200	2160000	no	yes	yes	yes	complex	steep	vegetated		
CL-008	Cameron	BC 86075 no 50	CL8	3	2	258	Shale	1100	1000	1100000	debris	yes	yes	yes	complex	steep	vegetated		
CL-009	Cameron	BC 86075 no 50	CL9	4	3	250	Shale	900	1200	1080000	no	yes	yes	no	complex	gentle	vegetated		
CL-010	Cameron	BC 86075 no 50	CL-T1L 1	3	3	255	Shale	300	400	120000	no	yes	no	no	single	gentle	vegetated		
CL-011	Cameron	BC 86075 no 50	CL-T1L 1	3	6	271	Quaternary	400	2400	960000	intact	no	yes	no	complex	steep	vegetated		
CL-012	Cameron	BC 86075 no 50	CL-T1R 1	3	6	95	Quaternary	500	2000	1000000	intact	no	no	yes	complex	steep	vegetated		
CL-013	Cameron	BC 86075 no 50	CL-T1L 3	3	3	202	Shale	150	600	90000	no	no	yes	yes	single	steep	good		
CL-014	Cameron	BC 86075 no 50	CL-T1L 3	3	6	273	Quaternary	300	900	270000	intact	no	yes	yes	complex	steep	vegetated		
CL-015	Cameron	BC 86075 no 50	CL-T1L 4	3	2	270	Quaternary	400	1000	400000	debris	no	yes	no	complex	gentle	vegetated		
CL-016	Cameron	BC 86075 no 50	CL-T1R 3	3	2	96	Quaternary	400	1200	480000	debris	no	yes	no	complex	gentle	vegetated		
CL-017	Cameron	BC 86075 no 50	CL-T1R 3	3	3	93	Quaternary	400	1000	400000	no	no	yes	no	complex	gentle	vegetated		
CL-018	Cameron	BC 86075 no 50	CL 11	2	2	213	Shale	800	800	640000	debris	yes	yes	yes	single	steep	good		
CL-019	Cameron	BC 86075 no 50	CL 12	2	6	279	Shale	1200	1200	1440000	intact	yes	yes	yes	complex	steep	good		
CL-020	Cameron	BC 86075 no 50	CL 12	2	6	242	Shale	700	500	350000	intact	yes	yes	yes	single	steep	good		
CL-021	Cameron	BC 86075 no 50	CL 13	2	3	238	Quaternary	600	400	240000	no	yes	yes	yes	single	steep	good		
CL-022	Cameron	BC 86075 no 50	CL 13	3	3	229	Shale	600	400	240000	no	no	yes	yes	single	steep	good		
CL-023	Cameron	BC 86075 no 152	CL 15	4	3	218	Quaternary	500	1600	800000	no	no	yes	yes	complex	steep	old		
CL-024	Cameron	BC 86075 no 152	CL 16	4	6	243	Quaternary	500	300	150000	intact	yes	eroded	no	single	steep	good		
CL-025	Cameron	BC 86075 no 152	CL 16	3	2	226	Quaternary	900	500	450000	debris	yes	yes	yes	single	steep	vegetated		
CL-026	Cameron	BC 86075 no 152	CL 17	2	2	170	Shale	200	1100	220000	debris	no	yes	yes	single	steep	vegetated		
CL-027	Cameron	BC 86075 no 152	CL 19	3	3	289	Shale	150	700	105000	no	no	no	no	single	gentle	vegetated		
CL-028	Cameron	BC 86075 no 153	CL 20	4	3	256	Quaternary	300	600	180000	no	no	no	no	single	gentle	vegetated		
CL-029	Cameron	BC 86075 no 153	CL 22	4	5	185	Quaternary	1300	1200	1560000	no	no	yes	no	complex	gentle	vegetated		
CL-030	Cameron	BC 86075 no 153	CL 26	4	3	192	Quaternary	200	400	80000	no	no	yes	yes	single	steep	good		
CL-031	Cameron	BC 86075 no 28	CL 3	3	4	277	Quaternary	1600	1200	1920000	no	no	yes	no	single	gentle	good		
CL-032	Cameron	BC 86075 no 28	CL 4	4	6	149	Shale	800	1400	1120000	intact	no	yes	yes	single	steep	good		
CL-033	Cameron	BC 86075 no 28	CL 4	4	2	196	Shale	700	500	350000	debris	no	yes	yes	single	gentle	good		
CL-034	Cameron	BC 86075 no 152	CL 14	4	3	256	Quaternary	400	1200	480000	no	no	yes	no	complex	gentle	vegetated	CL 32	
CR-001	Cameron	BC 86075 no 28	CR 1	3	6	133	Quaternary	500	600	300000	intact	no	yes	yes	single	steep	good		
CR-002	Cameron	BC 86075 no 28	CR 2	3	6	107	Quaternary	700	800	560000	intact	no	yes	yes	single	steep	good		
CR-003	Cameron	BC 86075 no 28	CR 3	3	6	82	Quaternary	700	600	420000	debris	no	yes	yes	single	steep	vegetated		
CR-004	Cameron	BC 86075 no 28	CR 5	3	3	40	Shale	500	800	400000	no	no	yes	yes	single	steep	muted		
CR-005	Cameron	BC 86075 no 50	CR 7	4	3	105	Shale	300	700	210000	no	no	no	no	single	gentle	vegetated		
CR-006	Cameron	BC 86075 no 50	CR 8	4	3	73	Shale	300	800	240000	no	no	yes	yes	single	steep	vegetated		
CR-007	Cameron	BC 86075 no 50	CR 11	3	2	55	Quaternary	500	1200	600000	debris	no	no	no	complex	gentle	vegetated		
CR-008	Cameron	BC 86075 no 50	CR 16	3	2	85	Quaternary	400	1300	520000	debris	no	yes	gullied	complex	steep	vegetated		
CR-009	Cameron	BC 86075 no 50	CR 16	3	3	74	Shale	500	600	300000	no	yes	yes	no	single	steep	vegetated		
CR-010	Cameron	BC 86075 no 50	CR 17	3	3	57	Shale	300	700	210000	no	no	yes	gullied	single	steep	vegetated		
CR-011	Cameron	BC 86075 no 152	CR 20	3	6	62	Shale	400	800	320000	intact	no	yes	gullied	single	steep	vegetated		
CR-012	Cameron	BC 86075 no 152	CR 21	3	3	33	Shale	300	1400	420000	no	no	yes	gullied	complex	gentle	vegetated		
CR-013	Cameron	BC 86075 no 152	CR 21	3	2	10	Quaternary	250	300	75000	debris	no	eroded	yes	single	steep	vegetated		
CR-014	Cameron	BC 86075 no 152	CR 22	4	2	6	Quaternary	400	400	160000	debris	no	yes	no	single	steep	vegetated		
CR-015	Cameron	BC 86075 no 152	CR 23	4	6	29	Quaternary	500	1300	650000	intact	no	no	no	complex	gentle	vegetated		
CR-016	Cameron	BC 86075 no 153	CR 26	4	3	49	Quaternary	300	1100	330000	no	no	eroded	no	complex	gentle	vegetated		
CR-017	Cameron	BC 86075 no 153	CR 28	3	2	72	Quaternary	200	700	140000	debris	no	eroded	no	complex	gentle	vegetated		

CR-018	Cameron	BC 86075 no 153	CR 29	3	7	347	Quaternary	400	800	320000	no	yes	no	no	single	gentle	vegetated		
CR-019	Cameron	BC 86075 no 28	CR 1	3	7	83	Quaternary	600	600	360000	debris	no	yes	yes	single	steep	good		
CR-020	Cameron	BC 86075 no 153	CR 25	4	3	30	Quaternary	200	1800	360000	no	no	no	no	complex	gentle	vegetated		
CR-021	Cameron	BC 86075 no 153	CR 24	4	3	69	Quaternary	300	1700	510000	no	no	no	no	complex	gentle	vegetated		
CR-022	Cameron	BC 86075 no 50	CR 9/10	3	6	60	Quaternary	400	1500	600000	intact	no	yes	no	single	steep	vegetated	CR-20	
FcL-001	Farrell Ck	BC 86047 no 122	FcL 9	4	3	96	Quaternary	100	300	30000	no	no	no	no	complex	gentle	vegetated		
FcL-002	Farrell Ck	BC 86047 no 122	FcL 3	4	8	246	Quaternary	600	300	180000	no	yes	yes	yes	single	steep	muted		
FcL-003	Farrell Ck	BC 86047 no 122	FcL 6	3	6	102	Shale	300	300	90000	intact	yes	yes	yes	single	steep	muted		
FcL-004	Farrell Ck	BC 86047 no 122	FcL 18	2	3	240	Quaternary	100	500	50000	no	no	yes	no	single	gentle	muted		
FcL-005	Farrell Ck	BC 86047 no 122	FcL 4	3	8	265	Quaternary	400	800	320000	no	yes	yes	yes	complex	gentle	good		
FcL-006	Farrell Ck	BC 86047 no 122	FcL 2	3	8	293	Quaternary	500	1200	600000	no	yes	yes	yes	complex	gentle	vegetated		
FcL-007	Farrell Ck	BC 86047 no 122	FcL 2	4	8	322	Quaternary	500	2400	1200000	no	yes	yes	gullied	complex	steep	vegetated		
FcL-008	Farrell Ck	BC 86047 no 122	FcL 10	3	3	306	Shale	400	500	200000	no	no	yes	gullied	complex	steep	vegetated		
FcL-009	Farrell Ck	BC 86047 no 122	FcL 11	3	5	267	Quaternary	350	300	105000	no	yes	yes	no	single	steep	vegetated		
FcL-010	Farrell Ck	BC 86047 no 122	FcL 12	3	5	268	Quaternary	500	200	100000	no	yes	yes	no	single	gentle	vegetated		
FcL-011	Farrell Ck	BC 86047 no 122	FcL 2	4	6	297	Shale	700	800	560000	intact	yes	yes	yes	complex	steep	vegetated		
FcL-012	Farrell Ck	BC 86047 no 106	FcL 1	3	6	298	Shale	600	500	300000	intact	no	yes	yes	complex	steep	good		
FcR-001	Farrell Ck	BC 86047 no 122	FcR 5	3	6	110	Shale	500	400	200000	intact	no	yes	yes	single	steep	muted		
FcR-002	Farrell Ck	BC 86047 no 122	FcR 7	4	7	124	Shale	400	1300	520000	debris	no	yes	yes	complex	steep	muted		
FcR-003	Farrell Ck	BC 86047 no 122	FcR 9	4	8	130	Quaternary	600	400	240000	no	yes	yes	yes	complex	steep	good		
FcR-004	Farrell Ck	BC 86047 no 122	FcR 10	2	8	65	Quaternary	300	300	90000	no	yes	yes	yes	complex	steep	good		
FcR-005	Farrell Ck	BC 86047 no 122	FcR 12	3	3	117	Shale	400	900	360000	no	no	yes	gullied	single	steep	muted		
FcR-006	Farrell Ck	BC 86047 no 122	FcR 12	4	3	99	Shale	500	500	250000	no	no	yes	gullied	single	steep	vegetated		
FcR-007	Farrell Ck	BC 86047 no 122	FcR 14	4	3	94	Quaternary	250	400	100000	no	no	yes	yes	single	steep	muted		
FcR-008	Farrell Ck	BC 86047 no 122	FcR 15	2	3	125	Quaternary	200	800	160000	no	no	no	yes	single	gentle	muted		
FcR-009	Farrell Ck	BC 86047 no 122	FcR 16	2	3	111	Quaternary	250	800	200000	no	no	no	no	single	gentle	good		
FcR-010	Farrell Ck	BC 86047 no 122	FcR 17	2	3	125	Quaternary	250	600	150000	no	no	no	no	single	gentle	good		
FcR-011	Farrell Ck	BC 86047 no 122	FcR-T2L 1	4	3	159	Quaternary	200	600	120000	no	no	yes	yes	single	steep	vegetated		
FcR-012	Farrell Ck	BC 86047 no 106	FcR 2	2	2	111	Quaternary	700	700	490000	debris	yes	yes	yes	single	gentle	good	FcR-19	
FcR-013	Farrell Ck	BC 86047 no 122	FcR 2	3	6	125	Shale	800	600	480000	intact	no	yes	yes	single	steep	vegetated		
FcR-014	Farrell Ck	BC 86047 no 122	FcR 2	4	2	136	Quaternary	600	600	360000	debris	no	yes	gullied	single	steep	vegetated		
FcR-015	Farrell Ck	BC 86047 no 122	FcR-T1L 1	3	6	156	Shale	400	600	240000	intact	no	yes	yes	single	steep	good		
FcR-016	Farrell Ck	BC 86047 no 122	FcR 12	3	3	64	Shale	500	400	200000	no	no	yes	no	single	steep	muted		
FcR-017	Farrell Ck	BC 86047 no 122	FcR 9	3	6	261	Quaternary	400	300	120000	intact	no	yes	yes	single	gentle	good		
FcR-018	Farrell Ck	BC 86047 no 106	FcR 5	3	3	181	Quaternary	150	400	60000	no	yes	yes	yes	single	gentle	good		
GBL-001	Ground Birch	BC 86075 no 30	GBL 1	3	3	153	Quaternary	200	1800	360000	debris	no	yes	yes	complex	gentle	vegetated		
GBL-002	Ground Birch	BC 86075 no 30	GBL 2/3	3	6	253	Quaternary	300	900	270000	intact	no	yes	no	complex	gentle	vegetated		
GBL-003	Ground Birch	BC 86075 no 30	GBL 4	4	6	278	Quaternary	400	500	200000	intact	no	yes	no	single	gentle	vegetated		
GBL-004	Ground Birch	BC 86075 no 30	GBL 5	3	2	87	Shale	500	800	400000	debris	no	yes	yes	single	steep	vegetated		
GBL-005	Ground Birch	BC 86075 no 30	GBL 7	3	1	142	Shale	100	500	50000	no	no	no	yes	single	steep	vegetated		
GBL-006	Ground Birch	BC 86075 no 30	GBL 9	3	3	205	Shale	100	400	40000	no	no	no	yes	single	steep	good		
GBL-007	Ground Birch	BC 86075 no 30	GBL 10	4	3	210	Shale	200	700	140000	intact	no	yes	no	complex	steep	vegetated		
GBL-008	Ground Birch	BC 86075 no 30	GBL 14	3	3	155	Shale	300	600	180000	no	no	yes	yes	single	steep	vegetated		
GBL-009	Ground Birch	BC 86075 no 30	GBL 15	3	7	143	Shale	?	?		no	no	no	no	complex	gentle	vegetated		
GBL-010	Ground Birch	BC 86075 no 30	GBL 4	4	6	57	Quaternary	350	900	315000	intact	no	no	no	complex	steep	vegetated		
GBL-011	Ground Birch	BC 86075 no 30	GBL 3	3	3	81	Shale	400	1100	440000	debris	no	yes	yes	single	gentle	vegetated		
GBL-012	Ground Birch	BC 86075 no 30	GBL 5	3	3	56	Shale	400	500	200000	no	no	yes	yes	single	gentle	vegetated		
GBL-013	Ground Birch	BC 86075 no 30	?	4	3	175	Quaternary	300	600	180000	no	no	yes	no	single	gentle	vegetated		
GBL-014	Ground Birch	BC 86075 no 30	?	4	3	118	Quaternary	400	400	160000	no	no	yes	no	single	gentle	vegetated		
GBR-001	Ground Birch	BC 86075 no 30	GBR 1	3	5	335	Quaternary	200	1600	320000	debris	no	yes	no	complex	gentle	vegetated		
GBR-002	Ground Birch	BC 86075 no 30	GBR 2	3	3	270	Quaternary	400	1100	440000	no	yes	no	no	single	gentle	vegetated		
GBR-003	Ground Birch	BC 86075 no 30	GBR 5	3	6	325	Shale	400	700	280000	intact	yes	yes	gullied	single	steep	vegetated		
GBR-004	Ground Birch	BC 86075 no 30	GBR 6	3	7	293	Quaternary	150	1000	150000	debris	no	no	no	complex	gentle	vegetated		

GBR-005	Ground Birch	BC 86075 no 30	GBR 10	3	3	101	Quaternary	100	1200	120000	debris	no	no	no	complex	gentle	vegetated		
GBR-006	Ground Birch	BC 86075 no 30	GBR 11	3	3	60	Quaternary	300	500	150000	no	yes	no	no	single	gentle	vegetated		
GBR-007	Ground Birch	BC 86075 no 30	GBR 12	3	3	1	Quaternary	200	400	80000	no	yes	no	yes	single	steep	good		
GBR-008	Ground Birch	BC 86075 no 30	GBR 14	2	2	330	Quaternary	300	2000	600000	debris	no	yes	yes	complex	gentle	good		
GBR-009	Ground Birch	BC 86075 no 30	GBR 2	4	5	42	Quaternary	300	700	210000	debris	no	yes	no	single	gentle	vegetated		
GBR-010	Ground Birch	BC 86075 no 30	GBR 11	3	3	349	Quaternary	250	300	75000	no	no	yes	no	single	gentle	vegetated		
GBR-011	Ground Birch	BC 86075 no 30	?	4	3	327	Quaternary	200	300	60000	no	yes	yes	no	single	gentle	vegetated		
GBR-012	Ground Birch	BC 86075 no 30	?	3	6	7	Shale	300	700	210000	intact	yes	yes	no	single	steep	good		
GBR-013	Ground Birch	BC 86075 no 30	?	3	6	248	Shale	300	600	180000	intact	yes	yes	no	single	steep	good		
HL-001	Halfway	BC 86047 no 124	HL 3	4	6	191	Quaternary	500	500	250000	intact	yes	yes	gullied	single	steep	good		
HL-002	Halfway	BC 86047 no 124	HL 3	4	6	188	Quaternary	400	400	160000	intact	yes	yes	yes	single	steep	good		
HL-003	Halfway	BC 86047 no 124	HL 3	3	6	205	Quaternary	400	400	160000	intact	yes	no	yes	single	steep	muted		
HL-004	Halfway	BC 86047 no 124	HL 4	4	6	247	Quaternary	350	400	140000	intact	yes	no	yes	single	steep	muted		
HL-005	Halfway	BC 86075 no 28	HL 25	3	3	225	Quaternary	200	400	80000	no	yes	no	yes	single	gentle	vegetated	HL-54(2nd Rev)	
HL-006	Halfway	BC 86047 no 124	HL 6	3	6	212	Quaternary	600	600	360000	intact	no	yes	yes	complex	steep	good		
HL-007	Halfway	BC 86047 no 124	HL 6	3	2	166	Quaternary	400	1200	480000	debris	no	yes	yes	complex	steep	old		react. In debris
HL-009	Halfway	BC 86047 no 124	HL 9	4	3	189	Quaternary	200	200	40000	no	yes	eroded	yes	single	steep	muted		
HL-010	Halfway	BC 86047 no 124	HL 10	3	6	140	Quaternary	1100	1600	1760000	intact	yes	yes	yes	complex	steep	vegetated		
HL-011	Halfway	BC 86047 no 124	HL 11	4	6	166	Quaternary	700	1400	980000	intact	no	yes	yes	complex	steep	vegetated		
HL-013	Halfway	BC 86047 no 123	HL 11	3	6	162	Quaternary	1500	900	1350000	intact	yes	no	yes	single	gentle	good		has L.Peace Clay complex above
HL-015	Halfway	BC 86047 no 123	HL 12	4	5	179	Quaternary	200	800	160000	no	no	no	yes	complex	steep	vegetated		
HL-016	Halfway	BC 86047 no 123	HL 14	3	6	222	Shale	500	800	400000	intact	yes	yes	yes	single	steep	muted		
HL-017	Halfway	BC 86047 no 123	HL 15	4	1	298	Shale	400	900	360000	no	no	yes	yes	single	steep	vegetated		
HL-018	Halfway	BC 86047 no 162	HL 16	3	7	283	Shale	500	650	325000	intact	yes	yes	yes	single	steep	covered		translational
HL-019	Halfway	BC 86047 no 162	HL 16	4	3	275	Shale	400	400	160000	no	yes	yes	gullied	single	steep	vegetated		
HL-020	Halfway	BC 86047 no 162	HL 17	4	2	254	Shale	1000	2000	2000000	debris	no	yes	yes	complex	steep	good		
HL-021	Halfway	BC 86047 no 162	HL 17	2	8	223	Quaternary	800	500	400000	debris	yes	yes	yes	single	gentle	good		
HL-022	Halfway	BC 86047 no 162	HL 19	3	8	298	Quaternary	600	600	360000	debris	yes	yes	yes	single	gentle	vegetated		
HL-023	Halfway	BC 86047 no 162	HL 19	4	8	241	Quaternary	300	900	270000	no	yes	yes	yes	complex	gentle	muted		
HL-024	Halfway	BC 86047 no 162	HL 20	2	3	289	Shale	400	1000	400000	no	yes	yes	yes	complex	steep	muted		
HL-025	Halfway	BC 86047 no 162	HL 20	4	3	242	Shale	900	1700	1530000	debris	no	yes	no	complex	steep	muted		
HL-026	Halfway	BC 86047 no 162	HL 21	3	8	245	Quaternary	600	200	120000	intact	yes	yes	yes	single	gentle	good		
HL-027	Halfway	BC 86047 no 162	HL 21	4	3	243	Quaternary	600	300	180000	no	yes	eroded	yes	single	steep	muted		
HL-028	Halfway	BC 86075 no 28	HL 21	4	3	241	Quaternary	600	1000	600000	no	yes	yes	yes	complex	gentle	vegetated		
HL-029	Halfway	BC 86075 no 28	HL 21	2	3	232	Quaternary	500	400	200000	no	yes	yes	yes	single	gentle	good		
HL-030	Halfway	BC 86075 no 28	HL 21	2	3	248	Quaternary	600	250	150000	no	yes	yes	yes	single	steep	good		
HL-031	Halfway	BC 86075 no 28	HL 21	4	3	220	Quaternary	600	750	450000	no	no	yes	yes	single	gentle	vegetated		
HL-032	Halfway	BC 86075 no 28	HL 21	4	3	249	Quaternary	600	1000	600000	no	yes	yes	yes	complex	gentle	vegetated		
HL-033	Halfway	BC 86075 no 28	HL 22	3	6	242	Shale	800	2000	1600000	intact	no	yes	gullied	complex	steep	good		
HL-034	Halfway	BC 86075 no 28	HL 23	3	3	200	Quaternary	400	900	360000	no	yes	no	no	complex	steep	vegetated		
HL-035	Halfway	BC 86075 no 28	HL 23	3	3	160	Shale	550	400	220000	no	no	yes	yes	single	steep	vegetated		
HL-036	Halfway	BC 86075 no 28	HL 24	3	3	202	Shale	500	800	400000	no	yes	yes	no	complex	steep	vegetated		
HL-037	Halfway	BC 86075 no 28	HL 24	3	6	206	Quaternary	500	450	225000	intact	yes	yes	yes	complex	steep	vegetated		
HL-038	Halfway	BC 86075 no 28	HL 24	3	6	213	Quaternary	600	1000	600000	intact	yes	yes	no	single	gentle	vegetated		
HL-039	Halfway	BC 86075 no 28	HL 25	3	3	253	Quaternary	900	700	630000	no	yes	yes	yes	single	gentle	good		
HL-040	Halfway	BC 86075 no 28	HL 26	4	6	224	Quaternary	700	1000	700000	intact	yes	yes	yes	complex	gentle	vegetated		
HL-041	Halfway	BC 86075 no 30	HL 26	4	3	191	Quaternary	350	300	105000	no	no	yes	yes	single	steep	muted		
HL-042	Halfway	BC 86075 no 50	HL 28	4	5	104	Quaternary	500	400	200000	no	no	yes	no	single	gentle	vegetated		
HL-043	Halfway	BC 86075 no 50	HL 28	4	5	95	Quaternary	600	700	420000	no	no	yes	no	complex	gentle	vegetated		
HL-044	Halfway	BC 86075 no 50	HL 18	3	3	95	Quaternary	200	600	120000	no	no	yes	no	single	gentle	vegetated		
HL-045	Halfway	BC 86075 no 50	HL 29	3	3	265	Quaternary	300	1000	300000	no	no	yes	no	complex	gentle	vegetated		
HL-046	Halfway	BC 86075 no 50	HL 29	4	3	250	Quaternary	800	800	640000	debris	no	yes	no	complex	gentle	vegetated		
HL-047	Halfway	BC 86075 no 50	HL 28	4	5	173	Quaternary	500	400	200000	no	no	yes	no	single	gentle	vegetated		
HL-048	Halfway	BC 86075 no 49	HL 30	4	3	210	Quaternary	500	1600	800000	no	yes	eroded	yes	complex	gentle	muted		
HL-049	Halfway	BC 86075 no 49	HL 31	4	6	215	Quaternary	600	1400	840000	intact	no	yes	yes	single	steep	muted		
HL-050	Halfway	BC 86075 no 49	HL 32	4	5	89	Quaternary	600	2300	1380000	no	no	yes	no	complex	gentle	vegetated		
HL-051	Halfway	BC 86075 no 49	HL 32	4	5	199	Quaternary	900	900	810000	no	no	yes	no	complex	gentle	vegetated		

HL-052	Halfway	BC 86075 no 154	HL 34	4	5	179	Quaternary	700	1200	840000	no	no	yes	yes	complex	gentle	vegetated		
HL-053	Halfway	BC 86075 no 154	HL 35	4	5	163	Quaternary	900	1300	1170000	debris	no	yes	yes	complex	gentle	vegetated		
HL-054	Halfway	BC 86047 no 124	HL 6	3	6	190	Quaternary	500	350	175000	intact	no	yes	yes	single	steep	good		
HL-055	Halfway	BC 86047 no 124	HL 25	4	3	267	Quaternary	600	900	540000	no	yes	no	yes	single	gentle	vegetated		
HL-056	Halfway	BC 86047 no 124	HL 27	4	3	249	Quaternary	350	1500	525000	no	yes	yes	yes	complex	gentle	vegetated		
HL-057	Halfway	BC 86075 no 50	HL 29	4	3	234	Quaternary	400	1400	560000	no	no	yes	no	complex	gentle	vegetated		
HL-058	Halfway	BC 86075 no 50	HL 17	3	3	231	Quaternary	150	900	135000	no	no	yes	no	single	gentle	vegetated		
HR-001	Halfway	BC 86047 no 124	HR 2	4	6	56	Quaternary	400	1300	520000	intact	no	yes	gullied	complex	steep	vegetated		
HR-002	Halfway	BC 86047 no 124	HR 2	2	4	72	Quaternary	600	300	180000	no	yes	yes	yes	single	steep	good		
HR-003	Halfway	BC 86047 no 124	HR 3	3	6	60	Quaternary	500	1000	500000	intact	no	yes	gullied	complex	steep	vegetated		
HR-004	Halfway	BC 86047 no 124	HR 4	4	6	12	Quaternary	600	600	360000	intact	no	yes	yes	single	steep	vegetated		
HR-005	Halfway	BC 86047 no 124	HR 5	3	3	30	Quaternary	700	700	490000	no	yes	yes	no	single	gentle	vegetated		
HR-006	Halfway	BC 86047 no 124	HR 6	3	3	78	Quaternary	600	450	270000	no	no	yes	yes	complex	steep	vegetated		
HR-007	Halfway	BC 86047 no 124	HR 7	4	6	331	Quaternary	1000	1200	1200000	intact	yes	yes	no	complex	gentle	vegetated		
HR-008	Halfway	BC 86047 no 124	HR 8	3	6	3	Quaternary	800	1400	1120000	intact	yes	yes	gullied	complex	steep	vegetated		
HR-009	Halfway	BC 86047 no 123	HR 8/9	4	6	356	Quaternary	800	1400	1120000	intact	yes	yes	gullied	complex	steep	vegetated		
HR-010	Halfway	BC 86047 no 123	HR 10	3	2	308	Quaternary	550	900	495000	debris	yes	yes	yes	single	steep	vegetated		
HR-011	Halfway	BC 86047 no 123	HR 10	2	2	19	Shale	900	700	630000	no	yes	yes	yes	single	gentle	good		upper 8's
HR-012	Halfway	BC 86047 no 123	HR 10	3	6	51	Shale	1600	400	640000	no	no	eroded	yes	complex	gentle	vegetated		
HR-013	Halfway	BC 86047 no 123	HR 11	4	3	39	Shale	700	1000	700000	debris	no	yes	no	single	steep	vegetated		
HR-014	Halfway	BC 86047 no 123	HR 13	3	2	149	Shale	600	500	300000	debris	no	yes	yes	single	steep	good		
HR-015	Halfway	BC 86047 no 123	HR 14	3	2	136	Shale	700	1300	910000	debris	no	yes	yes	single	steep	good		
HR-016	Halfway	BC 86047 no 162	HR 15	4	2	112	Shale	700	1200	840000	no	no	yes	gullied	single	steep	covered		
HR-017	Halfway	BC 86047 no 162	HR 16/17	3	2	61	Shale	1000	4000	4000000	debris	no	partial	yes	complex	steep	vegetated		ponding, long so high translational
HR-018	Halfway	BC 86047 no 162	HR 18	3	2	104	Shale	800	500	400000	debris	yes	yes	yes	single	steep	vegetated		
HR-019	Halfway	BC 86047 no 162	HR 19	3	2	84	Shale	900	2400	2160000	debris	no	no	yes	complex	gentle	vegetated		
HR-020	Halfway	BC 86047 no 162	HR 20	2	3	62	Shale	400	1000	400000	no	yes	no	yes	single	steep	covered		
HR-021	Halfway	BC 86075 no 28	HR 22	3	3	60	Shale	500	900	450000	no	yes	eroded	no	single	steep	muted		
HR-022	Halfway	BC 86075 no 28	HR 22	3	3	50	Shale	500	500	250000	no	yes	eroded	yes	single	steep	muted		
HR-023	Halfway	BC 86075 no 28	HR-T1R 1	3	7	310	Quaternary	1500	400	600000	no	no	yes	yes	complex	steep	vegetated		
HR-024	Halfway	BC 86075 no 28	HR-T1L 1	3	3	130	Shale	1400	300	420000	debris	no	yes	yes	complex	steep	vegetated		
HR-025	Halfway	BC 86075 no 28	HR 23	3	3	80	Shale	400	800	320000	no	yes	eroded	yes	single	steep	good		
HR-026	Halfway	BC 86075 no 28	HR 23	3	4	76	Quaternary	700	400	280000	no	yes	eroded	no	single	gentle	vegetated		
HR-027	Halfway	BC 86075 no 28	HR 25	4	2	40	Quaternary	700	700	490000	debris	yes	yes	yes	single	steep	vegetated		
HR-028	Halfway	BC 86075 no 28	HR 25	4	3	14	Quaternary	600	500	300000	no	yes	yes	no	complex	steep	vegetated		
HR-029	Halfway	BC 86075 no 28	HR 25/26	4	3	349	Quaternary	800	2000	1600000	no	yes	yes	no	complex	steep	vegetated		
HR-030	Halfway	BC 86075 no 28	HR 27	4	3	34	Quaternary	5000	2000	10000000	no	yes	no	no	complex	steep	vegetated		
HR-031	Halfway	BC 86075 no 28	HR 27	3	5	23	Quaternary	800	200	160000	no	yes	yes	no	single	gentle	vegetated		
HR-032	Halfway	BC 86075 no 30	HR 29	4	5	65	Quaternary	600	2400	1440000	no	yes	yes	no	complex	gentle	vegetated		
HR-033	Halfway	BC 86075 no 30	HR 30	3	6	42	Shale	200	1200	240000	intact	no	yes	yes	complex	steep	muted		
HR-034	Halfway	BC 86075 no 30	HR 30	3	6	43	Shale	400	500	200000	intact	yes	yes	yes	complex	steep	covered		
HR-035	Halfway	BC 86075 no 50	HR 30	3	3	55	Shale	400	600	240000	no	no	yes	yes	single	steep	vegetated		
HR-036	Halfway	BC 86075 no 50	HR 30	3	4	56	Quaternary	500	300	150000	no	yes	yes	no	single	gentle	vegetated		
HR-037	Halfway	BC 86075 no 50	HR 34	4	3	83	Quaternary	400	1500	600000	no	no	no	no	complex	steep	vegetated		
HR-038	Halfway	BC 86075 no 49	HR 34	4	3	29	Quaternary	400	1200	480000	no	no	no	yes	complex	steep	vegetated		
HR-039	Halfway	BC 86075 no 49	HR 35	4	3	356	Quaternary	500	1000	500000	no	no	yes	no	complex	steep	vegetated		
HR-040	Halfway	BC 86075 no 49	HR 35	4	3	20	Quaternary	600	600	360000	no	no	no	no	complex	steep	vegetated		
HR-041	Halfway	BC 86075 no 49	HR 36	4	3	2	Quaternary	400	900	360000	no	yes	yes	no	single	gentle	vegetated		
HR-042	Halfway	BC 86047 no 124	HR 5	3	6	41	Quaternary	300	400	120000	intact	no	partial	yes	single	steep	covered		
HR-043	Halfway	BC 86075 no 28	HR 28	4	3	50	Quaternary	600	1600	960000	no	yes	yes	no	complex	gentle	vegetated		
HR-044	Halfway	BC 86075 no 49	HR 35	4	3	15	Quaternary	300	1400	420000	no	yes	no	no	complex	gentle	vegetated		
HR-045	Halfway	BC 86075 no 49	HR 35	4	3	79	Quaternary	200	400	80000	no	yes	no	no	complex	gentle	vegetated		
HR-046	Halfway	BC 86075 no 49	HR 37	4	3	104	Quaternary	200	1000	200000	no	yes	no	no	complex	gentle	vegetated		
HR-047	Halfway	BC 86075 no 49	HR 39/40/41	4	3	1	Quaternary	300	3200	960000	no	yes	no	no	complex	gentle	vegetated		
HR-048	Halfway	BC 86075 no 28	HR 24	4	3	38	Quaternary	600	1200	720000	no	no	yes	yes	complex	gentle	vegetated		
								117.05	192	116790000	m2	Total							
									Area	116.79	km2	Area							

Appendix IV - Landslide Inventory

Table IV - 6 Halfway River to Beatton River

Failure Name	River	Photo	River Segement	Activity	Failure Type	Probable Basal Failure Material	Slide Aspect	Length (m)	Width (m)	Area m²	Secondary Scarps	Over Scarp	Debris Apron	Defined Head Scarp	Single or Complex	Slope Angle	Feature Clarity	May Be Mapped As	Additional Comments
BBL-001	Blueberry	BC 86074 no 234	BBL 7	3	6	Quaternary	326	300	500	150000	intact	yes	no	yes	single	steep	good		
BBL-002	Blueberry	BC 86074 no 234	BBL 3/4	3	6	Quaternary	167	400	500	200000	intact	no	yes	no	single	gentle	good		
BBL-003	Blueberry	BC 86074 no 234	BBL 4	3	6	Quaternary	117	300	600	180000	intact	no	no	no	single	gentle	good		
BBL-004	Blueberry	BC 86074 no 234	BBL 5	2	6	Quaternary	193	300	400	120000	intact	no	yes	yes	single	steep	good		
BBL-005	Blueberry	BC 86074 no 234	BBL 11/12	3	6	Quaternary	222	200	1000	200000	intact	no	yes	yes	complex	steep	good		
BBL-006	Blueberry	BC 86074 no 234	BBL 12	3	3	Quaternary	172	400	400	160000	no	no	no	no	single	gentle	vegetated		
BBL-007	Umbach ck	BC 86074 no 234	BBL-T2L 1	3	2	Quaternary	257	400	700	280000	debris	no	no	no	single	gentle	vegetated		
BBL-008	Umbach ck	BC 86074 no 236	BBL-T2R 2	3	2	Quaternary	5	300	1000	300000	debris	no	yes	yes	complex	gentle	vegetated		
BBL-009	Blueberry	BC 86074 no 236	BBL 20	2	2	Quaternary	129	300	600	180000	debris	no	yes	yes	single	steep	good		
BBL-010	Blueberry	BC 86074 no 236	BBL 30	2	2	Quaternary	192	200	1000	200000	debris	no	yes	no	single	gentle	old		
BBL-011	Blueberry	BC 86075 no 144	BBL 56	3	2	Quaternary	184	300	800	240000	debris	no	yes	no	single	gentle	good		
BBL-012	Blueberry	BC 86075 no 144	BBL 57	3	3	Quaternary	169	200	700	140000	no	no	yes	no	single	gentle	good		
BBL-013	Blueberry	BC 86074 no 236	BBL 26	2	2	Quaternary	317	100	400	40000	debris	no	yes	yes	single	gentle	good		
BBL-014	Blueberry	BC 86075 no 142	BBL 66	4	2	Quaternary	193	100	800	80000	debris	no	yes	no	single	gentle	vegetated		
BBL-015	Blueberry	BC 86074 no 234	BBL 12	3	3	Quaternary	226	150	350	52500	no	no	no	no	single	gentle	vegetated		
BBL-016	Blueberry	BC 86074 no 236	BBL 21	3	2	Quaternary	98	200	600	120000	debris	no	yes	no	single	gentle	vegetated	BBL 14	
BBL-017	Blueberry	BC 86074 no 236	BBL 17	2	2	Quaternary	170	200	800	160000	debris	yes	yes	yes	single	steep	good	BBL 15	
BBR-001	Blueberry	BC 86074 no 237	BBR 31	3	3	Quaternary	342	100	700	70000	no	yes	yes	yes	complex	gentle	good		
BBR-002	Blueberry	BC 86074 no 237	BBR 32	2	2	Quaternary	10	150	800	120000	debris	no	yes	yes	single	gentle	good		
BBR-003	Blueberry	BC 86074 no 234	BBR 5	3	7	Quaternary	359	400	1400	560000	intact	no	yes	no	complex	steep	good		
BBR-004	Blueberry	BC 86074 no 234	BBR 6	3	6	Quaternary	147	200	600	120000	intact	no	yes	yes	single	steep	vegetated		
BBR-005	Blueberry	BC 86074 no 234	BBR 7	3	6	Quaternary	47	400	1000	400000	intact	no	yes	yes	single	steep	vegetated		
BBR-006	Blueberry	BC 86074 no 235	BBR 3	3	7	Quaternary	22	500	1200	600000	intact	yes	yes	yes	complex	gentle	good	BBR 17	
BBR-007	Blueberry	BC 86074 no 234	BBR 10	3	3	Quaternary	280	300	600	180000	no	no	yes	yes	single	gentle	vegetated		
BBR-008	Blueberry	BC 86074 no 234	BBR 11	3	6	Quaternary	336	300	800	240000	intact	no	yes	yes	complex	steep	good		
BBR-009	Blueberry	BC 86074 no 234	BBR 12	3	6	Quaternary	5	500	1200	600000	intact	no	no	yes	complex	steep	vegetated		
BBR-010	Blueberry	BC 86074 no 234	BBR 15	3	2	Quaternary	320	300	500	150000	debris	no	yes	yes	single	steep	vegetated		
BBR-011	Blueberry	BC 86074 no 234	BBR 17	4	6	Quaternary	350	500	600	300000	intact	no	yes	no	single	gentle	vegetated		
BBR-012	Blueberry	BC 86074 no 236	BBR 19	3	7	Quaternary	308	300	600	180000	no	no	no	no	single	gentle	vegetated		
BBR-013	Blueberry	BC 86074 no 236	BBR 20	3	2	Quaternary	338	400	1100	440000	debris	no	yes	yes	complex	steep	good		
BBR-014	Blueberry	BC 86074 no 236	BBR 26	3	2	Quaternary	320	300	800	240000	debris	no	no	no	single	gentle	vegetated		
BBR-015	Blueberry	BC 86074 no 237	BBR 34	3	3	Quaternary	321	150	1000	150000	no	yes	yes	yes	single	gentle	vegetated		
BBR-016	Blueberry	BC 86074 no 237	BBR 33	3	3	Quaternary	278	100	450	45000	no	yes	yes	yes	single	gentle	vegetated		
CcL-001	Red Ck	BC 86047 no 159	RcL 2	3	6	Shale	245	500	500	250000	intact	no	yes	yes	single	steep	muted		
CcL-002	Red Ck	BC 86047 no 159	RcL 2	3	6	Shale	269	600	500	300000	intact	no	yes	yes	single	steep	muted		
CcL-003	Red Ck	BC 86047 no 159	RcL-T1L 1	3	6	Shale	340	600	1300	780000	intact	no	no	no	complex	gentle	vegetated		
CcL-004	Red Ck	BC 86047 no 159	RcL-T1R 1	3	7	Shale	187	400	1400	560000	debris	no	yes	yes	complex	steep	good		
CcL-005	Red Ck	BC 86047 no 159	RcL 6	3	6	Shale	283	500	1200	600000	intact	no	yes	no	complex	steep	covered		
CcL-006	Red Ck	BC 86047 no 159	RcL 6	3	6	Shale	282	800	3200	2560000	intact	no	yes	no	complex	steep	vegetated		
CcL-007	Red Ck	BC 86047 no 159	RcR 6	3	6	Shale	99	600	1600	960000	intact	no	no	no	complex	gentle	vegetated		
CcL-008	Red Ck	BC 86047 no 159	RcR 5	3	7	Shale	109	800	1100	880000	intact	yes	no	no	complex	gentle	vegetated		
CcL-009	Red Ck	BC 86047 no 159	RcR 5	3	2	Shale	102	500	1600	800000	debris	no	yes	yes	complex	steep	good		
CcL-010	Red Ck	BC 86047 no 159	RcR-T1L 1	3	2	Shale	228	400	900	360000	debris	no	yes	yes	single	steep	good		
CcL-011	Red Ck	BC 86047 no 159	RcR-T2L 2	2	2	Shale	245	300	600	180000	debris	no	yes	yes	single	steep	good		
CcL-012	Cache Ck	BC 86047 no 159	CcL 1	3	6	Quaternary	195	550	1300	715000	intact	yes	yes	yes	complex	steep	good		
CcL-013	Cache Ck	BC 86047 no 159	CcL 6	3	6	Quaternary	162	400	600	240000	intact	yes	yes	yes	complex	steep	good		
CcL-014	Cache Ck	BC 86047 no 159	CcL 7	2	6	Quaternary	175	600	1000	600000	intact	yes	yes	yes	complex	steep	good		
CcL-015	Cache Ck	BC 86047 no 159	CcL 9	3	6	Quaternary	185	500	1100	550000	intact	yes	yes	yes	complex	steep	vegetated		
CcL-016	Cache Ck	BC 86047 no 159	CcL 9	3	6	Quaternary	196	400	600	240000	intact	no	yes	yes	complex	steep	vegetated		
CcL-017	Cache Ck	BC 86047 no 159	CcL 13	3	6	Quaternary	130	400	400	160000	intact	no	yes	yes	single	steep	vegetated		
CcL-018	Cache Ck	BC 86047 no 159	CcL 18	3	3	Shale	157	400	1000	400000	no	no	yes	yes	complex	steep	vegetated		
CcL-019	Red Ck	BC 86047 no 159	RcL 6	3	6	Quaternary	295	500	700	350000	intact	no	no	no	complex	gentle	vegetated		
CcL-020	Red Ck	BC 86047 no 159	RcL 7	3	6	Quaternary	300	500	800	400000	intact	no	no	no	complex	gentle	vegetated		
CcL-021	Red Ck	BC 86047 no 159	RcR 7	3	6	Shale	99	500	900	450000	intact	no	yes	no	complex	gentle	vegetated		
CcL-022	N.Cache Ck	BC 86047 no 159	CcL-T1L 3/4	4	2	Quaternary	121	350	1200	420000	debris	no	yes	yes	complex	steep	vegetated		
CcL-023	Cache Ck	BC 86047 no 159	CcL-30	3	2	Quaternary	201	300	1200	360000	debris	no	yes	yes	complex	gentle	good		
CcL-024	N.Cache Ck	BC 86047 no 159	CcL-T1L 7	3	7	Shale	289	?	?		debris	no	yes	yes	complex	gentle	good		
CcL-025	N.Cache Ck	BC 86047 no 159	CcL-T1R 2	3	2	Quaternary	103	400	800	320000	debris	no	yes	yes	single	steep	good		
CcL-026	N.Cache Ck	BC 86047 no 159	CcL-T1R 3	3	2	Quaternary	116	350	1400	490000	debris	no	yes	yes	single	gentle	good		
CcL-027	N.Cache Ck	BC 86047 no 159	CcL-T1R 4	3	2	Quaternary	95	300	1000	300000	debris	no	yes	no	single	gentle	good		
CcL-028	Cache Ck	BC 86047 no 159	CcL 31	3	3	Quaternary	222	300	600	180000	no	no	yes	yes	complex	steep	good		
CcL-029	Cache Ck	BC 86047 no 159	CcL 32	3	2	Quaternary	189	300	350	105000	debris	no	yes	yes	complex	steep	good		

CcL-030	Cache Ck	BC 86047 no 159	CcL 32	3	2	Quaternary	231	350	600	210000	debris	no	yes	yes	complex	steep	covered		
CcL-031	Cache Ck	BC 86047 no 159	CcL 26/27	3	3	Quaternary	343	500	1200	600000	no	yes	no	yes	complex	gentle	good		
CcL-032	N.Cache Ck	BC 86047 no 159	CcL 29	3	3	Shale	250	300	500	150000	no	no	yes	yes	single	steep	good		
CcL-033	N.Cache Ck	BC 86047 no 159	CcL-T1R 3	3	3	Shale	305	300	600	180000	no	no	yes	no	single	gentle	good		
CcL-034	N.Cache Ck	BC 86047 no 159	CcL-T1R 2	3	3	Shale	60	300	500	150000	no	no	yes	no	single	gentle	vegetated		
CcL-035	N.Cache Ck	BC 86047 no 159	CcL-T1L 4	4	3	Quaternary	258	300	900	270000	no	no	yes	no	single	gentle	vegetated		
CcL-036	N.Cache Ck	BC 86047 no 159	CcL-T1L 9/10	3	3	Quaternary	269	250	2000	500000	no	no	yes	no	complex	gentle	vegetated		
CcL-037	N.Cache Ck	BC 86047 no 159	CcL-T1R 4/5/6	3	3	Quaternary	93	250	1700	425000	no	no	yes	no	complex	gentle	vegetated		
CcL-038	N.Cache Ck	BC 86047 no 159	CcL-T1L 4	3	2	Quaternary	273	300	700	210000	debris	no	yes	yes	single	gentle	good		
CcL-039	N.Cache Ck	BC 86047 no 159	CcL-T1L 3	3	6	Quaternary	243	350	700	245000	intact	no	yes	yes	single	gentle	good		
CcL-040	Cache Ck	BC 86047 no 162	CcL 37	3	3	Quaternary	196	350	1000	350000	no	no	yes	yes	complex	steep	good		
CcL-041	Red Ck	BC 86075 no 024	RcL 14	3	2	Quaternary	264	300	500	150000	debris	no	yes	no	single	gentle	vegetated		
CcL-042	Red Ck	BC 86075 no 024	RcR 12	3	6	Quaternary	77	300	1200	360000	intact	no	yes	no	complex	gentle	vegetated		
CcL-043	Red Ck	BC 86075 no 024	RcR 10	3	3	Quaternary	61	250	800	200000	no	no	yes	no	complex	gentle	vegetated		
CcL-044	Red Ck	BC 86075 no 024	RcR 9	3	6	Shale	96	300	1200	360000	intact	no	no	yes	single	steep	vegetated		
CcL-045	Red Ck	BC 86075 no 024	RcL 12	3	6	Shale	273	300	1400	420000	intact	no	no	yes	complex	steep	vegetated		
CcL-046	Red Ck	BC 86075 no 024	RcR 9	3	4	Quaternary	63	400	300	120000	no	no	yes	no	single	steep	good		
CcL-047	Red Ck	BC 86075 no 024	RcR 9	2	5	Quaternary	47	500	200	100000	no	no	yes	no	single	steep	good		
CcL-048	Red Ck	BC 86075 no 024	RcL 11	3	3	Shale	160	300	800	240000	no	yes	yes	yes	complex	steep	good		
CcL-049	Cache Ck	BC 86047 no 161	CcL 25	3	6	Quaternary	257	200	900	180000	intact	no	yes	yes	complex	steep	good		
CcL-050	Cache Ck	BC 86047 no 161	CcL 21	3	3	Shale	245	400	600	240000	no	no	yes	yes	single	steep	good		
CcL-051	Red Ck	BC 86075 no 024	RcL 10	2	2	Shale	269	300	500	150000	debris	no	yes	yes	single	steep	good	CcL-25	
CcL-052	Red Ck	BC 86075 no 024	RcR 8	2	6	Shale	99	500	900	450000	intact	no	yes	no	single	steep	good	CcL-26	
CcL-053	Red Ck	BC 86075 no 024	RcR-T2R2	3	7	Shale	62	400	1600	640000	no	yes	no	no	complex	gentle	good	CcL-27	
CcL-054	Red Ck	BC 86047 no 159	RcL 1	3	6	Shale	204	600	500	300000	intact	no	yes	yes	single	steep	good	CcL-16	
CcL-055	Red Ck	BC 86047 no 159	RcL-6	2	5	Quaternary	264	500	300	150000	no	yes	yes	yes	single	gentle	good	CcL-5b	
CcL-056	Cache Ck	BC 86047 no 159	CcL 18	3	3	Shale	142	400	1000	400000	no	no	yes	yes	complex	steep	vegetated	CcL-18b	
CcR-001	Cache Ck	BC 86047 no 159	CcR 2	2	1	Shale	4	400	600	240000	intact	no	yes	gullied	single	steep	covered		
CcR-002	Cache Ck	BC 86047 no 159	CcR 20	3	7	Quaternary	87	400	1000	400000	debris	no	yes	yes	complex	steep	good		
CcR-003	Cache Ck	BC 86047 no 159	CcR 19	3	7	Quaternary	177	600	2100	1260000	debris	no	yes	yes	complex	steep	good		
CcR-004	Cache Ck	BC 86047 no 159	CcR 18	3	2	Quaternary	118	350	900	315000	debris	no	yes	yes	complex	steep	good		
CcR-005	Cache Ck	BC 86047 no 159	CcR 19	3	2	Quaternary	165	350	400	140000	debris	no	yes	yes	single	steep	good		
CcR-006	Cache Ck	BC 86047 no 159	CcR 21	2	2	Quaternary	46	300	300	90000	debris	no	yes	yes	single	steep	good		
CcR-007	Cache Ck	BC 86047 no 159	CcR 22	3	3	Quaternary	4	300	700	210000	no	yes	yes	yes	single	steep	covered		
CcR-008	Cache Ck	BC 86047 no 159	CcR 23	3	7	Shale	35	300	1000	300000	debris	no	yes	no	single	gentle	covered		
CcR-009	Cache Ck	BC 86047 no 162	CcR 24	3	3	Shale	28	300	1400	420000	no	no	yes	no	complex	steep	covered		
CcR-010	Cache Ck	BC 86047 no 161	CcR 16	3	6	Quaternary	85	400	1200	480000	intact	no	yes	yes	complex	steep	good		
CcR-011	Cache Ck	BC 86047 no 160	CcR 3	3	6	Quaternary	5	500	1400	700000	intact	no	yes	yes	complex	steep	good		
CcR-012	Cache Ck	BC 86047 no 160	CcR 2	3	6	Quaternary	355	500	1100	550000	intact	no	yes	yes	complex	steep	good		
SJL-001	St. Johns Ck	BC 86047 no 154	SJCL 1	3	6	Shale	168	400	600	240000	intact	no	yes	yes	single	steep	good		
SJL-002	St. Johns Ck	BC 86047 no 154	SJCL 1	3	6	Shale	203	500	900	450000	intact	yes	yes	yes	complex	steep	good		
SJL-003	St. Johns Ck	BC 86047 no 154	SJCL 2	2	6	Shale	239	600	600	360000	intact	no	yes	yes	single	steep	good		
SJL-004	St. Johns Ck	BC 86047 no 154	SJCL 2/3	3	6	Shale	270	800	1500	1200000	intact	no	yes	yes	single	steep	good		
SJL-005	St. Johns Ck	BC 86047 no 154	SJCL 6	3	6	Shale	175	400	700	280000	intact	yes	yes	yes	complex	steep	good		
SJL-006	St. Johns Ck	BC 86047 no 154	SJCL 7	3	6	Shale	199	500	450	225000	intact	no	yes	no	complex	steep	good		
SJL-007	St. Johns Ck	BC 86047 no 154	SJCL 8	3	6	Shale	193	350	500	175000	intact	no	yes	no	single	steep	good		
SJL-008	St. Johns Ck	BC 86047 no 154	SJCL 9	3	6	Shale	210	400	1200	480000	intact	no	yes	yes	single	steep	good		
SJL-009	St. Johns Ck	BC 86047 no 154	SJCL 9	3	2	Shale	210	300	600	180000	debris	no	yes	yes	single	steep	good		
SJL-010	St. Johns Ck	BC 86047 no 154	SJCL 10	3	3	Quaternary	227	200	600	120000	no	yes	no	yes	single	steep	good		
SJL-011	St. Johns Ck	BC 86047 no 154	SJCL 11	3	3	Shale	201	500	800	400000	no	no	yes	yes	single	steep	good		
SJL-012	St. Johns Ck	BC 86047 no 154	SJCL 12	2	6	Shale	243	400	800	320000	intact	no	yes	yes	single	steep	good		
SJL-013	St. Johns Ck	BC 86047 no 154	SJCL 13	3	2	Shale	261	300	1200	360000	debris	no	no	no	complex	gentle	vegetated		
SJL-014	St. Johns Ck	BC 86047 no 154	SJCL 13/14	3	6	Shale	248	400	2200	880000	intact	no	no	no	complex	gentle	vegetated		
SJL-015	St. Johns Ck	BC 86047 no 154	SJCL 6	2	6	Shale	180	550	300	165000	intact	no	yes	yes	single	steep	good		
SJL-016	St. Johns Ck	BC 86047 no 154	SJCL 15	2	2	Quaternary	146	300	400	120000	debris	no	yes	yes	single	gentle	good		
SJR-001	St. Johns Ck	BC 86047 no 154	SJCR 2	2	3	Shale	102	300	400	120000	debris	no	yes	yes	single	gentle	good		
SJR-002	St. Johns Ck	BC 86047 no 154	SJCR 1	3	7	Shale	7	1100	900	990000	intact	no	yes	yes	complex	gentle	vegetated		graben structure - translational
SJR-003	St. Johns Ck	BC 86047 no 154	SJCR 1	3	7	Shale	26	900	800	720000	intact	no	no	no	complex	gentle	vegetated		
SJR-004	St. Johns Ck	BC 86047 no 154	SJCR -T1R 1	3	7	Shale	343	600	1400	840000	debris	no	yes	yes	complex	steep	good		translational failure
SJR-005	St. Johns Ck	BC 86047 no 154	SJCR -T1R 1/2	3	7	Shale	16	800	2900	2320000	debris	no	yes	yes	complex	steep	good		translational failure
SJR-006	St. Johns Ck	BC 86047 no 154	SJCR-T1L 1	3	6	Shale	165	500	2300	1150000	intact	no	eroded	yes	complex	steep	good		
SJR-007	St. Johns Ck	BC 86047 no 154	SJCR 2	3	7	Shale	59	900	700	630000	debris	yes	yes	yes	single	steep	good		
SJR-008	St. Johns Ck	BC 86047 no 154	SJCR 3	5	7	Shale	27	1000	2000	2000000	debris	yes	yes	yes	single	steep	modified		
SJR-009	St. Johns Ck	BC 86047 no 154	SJCR 4	2	7	Shale	37	700	1000	700000	debris	yes	yes	no	single	steep	vegetated		
SJR-010	St. Johns Ck	BC 86047 no 154	SJCR 4	3	7	Shale	44	900	800	720000	intact	no	yes	no	single	steep	good		
SJR-011	St. Johns Ck	BC 86047 no 154	SJCR 5	3	7	Shale	88	500	1400	700000	debris	yes	yes	yes	single	steep	good		
SJR-012	St. Johns Ck	BC 86047 no 154	SJCR 6	3	7	Shale	83	800	2000	1600000	debris	no	no	no	complex	gentle	vegetated		
SJR-013	St. Johns Ck	BC 86047 no 154	SJCR 6	3	3	Shale	63	300	400	120000	intact	no	yes	yes	single	steep	vegetated		
									Total	53127500	m2								
									Area	53.13	km2								

APPENDIX V

Landslide Inventory Analysis Results

Appendix V - Inventory Analysis Results

Table V - 1 Activity (Divisions)

Sheet	Total Slides	Activity =1		Activity =2		Activity =3		Activity =4		Activity =5	
Peace River	465	9	1.9%	54	11.6%	283	60.9%	107	23.0%	12	2.6%
Beatton River	407	17	4.2%	62	15.2%	248	60.9%	77	18.9%	3	0.7%
Southern Tributaries	255	3	1.2%	29	11.4%	140	54.9%	78	30.6%	5	2.0%
Beatton River - East	137	1	0.7%	23	16.8%	97	70.8%	14	10.2%	2	1.5%
Halfway River - West	216	0	0.0%	19	8.8%	109	50.5%	88	40.7%	0	0.0%
Halfway River to Beatton River	130	0	0.0%	20	15.4%	105	80.8%	4	3.1%	1	0.8%
Total	1610	30	1.9%	207	12.9%	982	61.0%	368	22.9%	23	1.4%

Appendix V - Inventory Analysis Results

Table V - 2 Landslide Type (Divisions)

Sheet	Total Slides	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	465	2	0.5%	53	13.0%	105	25.8%	2	0.5%	1	0.2%	216	53.1%	24	5.9%	4	1.0%
Beatton River	407	3	0.6%	43	9.2%	83	17.8%	14	3.0%	12	2.6%	279	60.0%	29	6.2%	2	0.4%
Southern Tributaries	255	1	0.4%	32	12.5%	62	24.3%	9	3.5%	6	2.4%	118	46.3%	22	8.6%	5	2.0%
Beatton River - East	137	2	0.9%	27	12.5%	97	44.9%	4	1.9%	16	7.4%	53	24.5%	7	3.2%	10	4.6%
Halfway River - West	216	1	0.8%	32	24.6%	27	20.8%	1	0.8%	2	1.5%	47	36.2%	20	15.4%	0	0.0%
Halfway River to Beatton River	130	1	0.7%	23	16.8%	49	35.8%	3	2.2%	1	0.7%	56	40.9%	3	2.2%	1	0.7%
Total	1610	10	0.6%	210	13.0%	423	26.3%	33	2.0%	38	2.4%	769	47.8%	105	6.5%	22	1.4%

Appendix V - Inventory Analysis Results

Table V - 3 Landslide Distribution (Divisions)

Sheet	Total Slides	Percentage of Total	Total Kilometers Measured	Percent km's	Slide / Km ratio	Area Covered Km^2	Percent Area	Km^2 / Slide Ratio
Peace River	465	28.9%	256	20.30%	1.82	258.92	33.8%	0.56
Beatton River	407	25.3%	254	20.14%	1.60	151.98	19.9%	0.37
Southern Tributaries	255	15.8%	200	15.86%	1.28	151.62	19.8%	0.59
Beatton River East	137	8.5%	194	15.38%	0.71	33.01	4.3%	0.24
Halfway River West	216	13.4%	263	20.86%	0.82	116.79	15.3%	0.54
Halfway River to Beatton River	130	8.1%	94	7.45%	1.38	53.13	6.9%	0.41
Total	1610	100.00%	1261	100.00%	1.28	765.45	100.0%	0.48

Appendix V - Inventory Analysis Results

Table V - 4 Basal Failure Plane Material (Divisions)

Sheet	Total Slides	Shale		Quaternary	
Peace River	465	184	39.6%	281	60.4%
Beatton River	407	142	34.9%	265	65.1%
Southern Tributaries	255	164	64.3%	91	35.7%
Beatton River East	137	83	60.6%	54	39.4%
Halfway River West	216	74	34.3%	142	65.7%
Halfway River to Beatton River	130	56	43.1%	74	56.9%
Total	1610	703	43.7%	907	56.3%

Appendix V - Inventory Analysis Results

Table V - 5 Slide Aspect (Divisions)

Sheet	Total Slides	0-30		30-60		60-90		90-120		120-150		150-180	
Peace River	465	34	7.3%	27	5.8%	29	6.2%	36	7.7%	44	9.5%	49	10.5%
Beatton River	407	28	6.9%	43	10.6%	31	7.6%	34	8.4%	40	9.8%	35	8.6%
Southern Tributaries	255	22	8.6%	10	3.9%	11	4.3%	15	5.9%	36	14.1%	34	13.3%
Beatton River East	137	12	8.8%	15	10.9%	10	7.3%	13	9.5%	16	11.7%	10	7.3%
Halfway River West	216	17	7.9%	25	11.6%	23	10.6%	21	9.7%	14	6.5%	14	6.5%
Halfway River to Beatton River	130	12	9.2%	8	6.2%	9	6.9%	14	10.8%	6	4.6%	14	10.8%
Total	1610	125	7.8%	128	8.0%	113	7.0%	133	8.3%	156	9.7%	156	9.7%

Sheet	Total Slides	180-210		210-240		240-270		270-300		300-330		330-360	
Peace River	465	54	11.6%	49	10.5%	34	7.3%	31	6.7%	51	11.0%	27	5.8%
Beatton River	407	30	7.4%	42	10.3%	41	10.1%	29	7.1%	35	8.6%	19	4.7%
Southern Tributaries	255	22	8.6%	16	6.3%	8	3.1%	13	5.1%	34	13.3%	34	13.3%
Beatton River East	137	8	5.8%	11	8.0%	9	6.6%	18	13.1%	10	7.3%	5	3.6%
Halfway River West	216	19	8.8%	19	8.8%	32	14.8%	17	7.9%	8	3.7%	7	3.2%
Halfway River to Beatton River	130	18	13.8%	7	5.4%	17	13.1%	9	6.9%	7	5.4%	9	6.9%
Total	1610	151	9.4%	144	8.9%	141	8.8%	117	7.3%	145	9.0%	101	6.3%

Appendix V - Inventory Analysis Results

Table V - 6 Generalized Slide Aspect (Divisions)

Sheet	Total Slides	North Facing (330 - 30)			East Facing (60 - 120)			South Facing (150 - 210)			West Facing (240 - 300)	
Peace River	465	61	13.1%		43	10.6%		31	7.6%		34	8.4%
Beatton River	407	47	11.5%		27	5.8%		29	6.2%		36	7.7%
Southern Tributaries	255	56	22.0%		10	3.9%		11	4.3%		15	5.9%
Beatton River East	137	17	12.4%		8	6.2%		9	6.9%		14	10.8%
Halfway River West	216	24	11.1%		15	10.9%		10	7.3%		13	9.5%
Halfway River to Beatton River	130	21	16.2%		25	11.6%		23	10.6%		21	9.7%
Total	1610	226	14.0%		128	8.0%		113	7.0%		133	8.3%

Appendix V - Inventory Analysis Results

Table V - 7 Activity - Area (Divisions)

Sheet	Total Area (km^2)	Activity 1 - Km^2		Activity 2 - Km^2		Activity 3 - Km^2		Activity 4 - Km^2		Activity 5 - Km^2	
Peace River	258.92	1.0	0.4%	19.9	7.7%	134.4	51.9%	98.4	38.0%	5.2	2.0%
Beatton River	151.98	4.3	2.8%	19.1	12.6%	104.6	68.9%	22.8	15.0%	1.1	0.7%
Southern Tributaries	151.62	0.9	0.6%	9.8	6.4%	86.0	56.7%	52.6	34.7%	2.4	1.6%
Beatton River East	33.01	0.0	0.1%	4.3	13.0%	23.8	72.1%	4.3	13.0%	0.6	1.8%
Halfway River West	116.79	0.0	0.0%	7.0	6.0%	54.1	46.3%	55.7	47.7%	0.0	0.0%
Halfway River to Beatton River	53.13	0.0	0.0%	4.6	8.6%	45.5	85.6%	1.1	2.0%	2.0	3.8%
Total	765.45	6.3	0.8%	64.6	8.4%	448.4	58.6%	235.0	30.7%	11.2	1.5%

Appendix V - Inventory Analysis Results

Table V - 8 Landslide Type - Area (Divisions)

Sheet	Total Area Km^2	Type 1 - Km^2		Type 2 - Km^2		Type 3 - Km^2		Type 4 - Km^2		Type 5 - Km^2		Type 6 - Km^2		Type 7 - Km^2		Type 8 - Km^2	
Peace River	258.92	1.22	0.5%	13.24	5.1%	22.79	8.8%	3.98	1.5%	4.18	1.6%	173.28	66.9%	39.15	15.1%	1.09	0.42%
Beatton River	151.98	0.38	0.3%	21.75	14.3%	23.02	15.1%	0.95	0.6%	0.27	0.2%	84.59	55.7%	20.14	13.2%	0.88	0.58%
Southern Tributaries	151.62	0.36	0.2%	13.86	9.1%	18.16	12.0%	4.10	2.7%	5.58	3.7%	79.01	52.1%	26.04	17.2%	4.51	2.97%
Beatton River East	33.01	0.24	0.7%	5.50	16.7%	8.87	26.9%	0.37	1.1%	0.18	0.5%	16.85	51.0%	0.91	2.7%	0.10	0.30%
Halfway River West	116.79	0.41	0.4%	19.69	16.9%	45.11	38.6%	2.53	2.2%	12.60	10.8%	30.41	26.0%	2.28	1.9%	3.78	3.24%
Halfway River to Beatton River	53.13	0.24	0.5%	7.81	14.7%	6.47	12.2%	0.12	0.2%	0.25	0.5%	21.64	40.7%	16.60	31.2%	0.00	0.00%
Total	764.3	2.85	0.4%	81.85	10.7%	124.4	16.3%	12.05	1.6%	23.05	3.0%	405.8	53.1%	105.1	13.8%	10.36	1.36%

Appendix V - Inventory Analysis Results

Table V -9 Activity - Landslide Type

Sheet	Activity =1																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	9	0	0.0%	2	22.2%	1	11.1%	0	0.0%	0	0.0%	5	55.6%	1	11.1%	0	0.0%
Beatton River	17	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	16	94.1%	1	5.9%	0	0.0%
Southern Tributaries	3	0	0.0%	1	33.3%	0	0.0%	0	0.0%	1	33.3%	1	33.3%	0	0.0%	0	0.0%
Beatton River - East	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River - West	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River to Beatton River	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	30	0	0.0%	4	13.3%	1	3.3%	0	0.0%	1	3.3%	22	73.3%	2	6.7%	0	0.0%

Sheet	Activity =2																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	54	0	0.0%	10	18.5%	12	22.2%	2	3.7%	3	5.6%	25	46.3%	2	3.7%	0	0.0%
Beatton River	62	0	0.0%	12	19.4%	9	14.5%	1	1.6%	0	0.0%	37	59.7%	2	3.2%	1	1.6%
Southern Tributaries	29	0	0.0%	9	31.0%	8	27.6%	1	3.4%	0	0.0%	10	34.5%	1	3.4%	0	0.0%
Beatton River - East	23	0	0.0%	4	17.4%	4	17.4%	3	13.0%	0	0.0%	9	39.1%	2	8.7%	1	4.3%
Halfway River - West	19	0	0.0%	5	26.3%	9	47.4%	1	5.3%	0	0.0%	2	10.5%	0	0.0%	2	10.5%
Halfway River to Beatton River	20	1	5.0%	9	45.0%	1	5.0%	0	0.0%	2	10.0%	6	30.0%	1	5.0%	0	0.0%
Total	207	1	0.5%	49	23.7%	43	20.8%	8	3.9%	5	2.4%	89	43.0%	8	3.9%	4	1.9%

Sheet	Activity =3																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	283	1	0.4%	23	8.1%	55	19.4%	12	4.2%	5	1.8%	165	58.3%	20	7.1%	2	0.7%
Beatton River	248	0	0.0%	31	12.5%	66	26.6%	1	0.4%	1	0.4%	130	52.4%	17	6.9%	2	0.8%
Southern Tributaries	140	0	0.0%	16	11.4%	29	20.7%	7	5.0%	3	2.1%	69	49.3%	11	7.9%	5	3.6%
Beatton River - East	97	0	0.0%	17	17.5%	39	40.2%	0	0.0%	1	1.0%	40	41.2%	0	0.0%	0	0.0%
Halfway River - West	109	1	0.9%	16	14.7%	39	35.8%	3	2.8%	5	4.6%	35	32.1%	6	5.5%	4	3.7%
Halfway River to Beatton River	105	0	0.0%	21	20.0%	25	23.8%	1	1.0%	0	0.0%	40	38.1%	18	17.1%	0	0.0%
Total	982	2	0.2%	124	12.6%	253	25.8%	24	2.4%	15	1.5%	479	48.8%	72	7.3%	13	1.3%

Sheet	Activity =4																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	107	2	1.9%	8	7.5%	13	12.1%	0	0.0%	3	2.8%	75	70.1%	6	5.6%	0	0.0%
Beatton River	77	2	2.6%	10	13.0%	30	39.0%	0	0.0%	0	0.0%	30	39.0%	4	5.2%	1	1.3%
Southern Tributaries	78	1	1.3%	6	7.7%	25	32.1%	1	1.3%	2	2.6%	33	42.3%	10	12.8%	0	0.0%
Beatton River - East	14	1	7.1%	0	0.0%	5	35.7%	0	0.0%	0	0.0%	7	50.0%	1	7.1%	0	0.0%
Halfway River - West	88	1	1.1%	6	6.8%	49	55.7%	0	0.0%	11	12.5%	16	18.2%	1	1.1%	4	4.5%
Halfway River to Beatton River	4	0	0.0%	2	50.0%	1	25.0%	0	0.0%	0	0.0%	1	25.0%	0	0.0%	0	0.0%
Total	368	7	1.9%	32	8.7%	123	33.4%	1	0.3%	16	4.3%	162	44.0%	22	6.0%	5	1.4%

Sheet	Activity =5																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	12	0	0.0%	0	0.0%	2	16.7%	0	0.0%	1	8.3%	9	75.0%	0	0.0%	0	0.0%
Beatton River	3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	3	100.0%	0	0.0%	0	0.0%
Southern Tributaries	5	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	100.0%	0	0.0%	0	0.0%
Beatton River - East	2	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River - West	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River to Beatton River	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Total	23	0	0.0%	1	4.3%	3	13.0%	0	0.0%	1	4.3%	17	73.9%	1	4.3%	0	0.0%

Appendix V - Inventory Analysis Results

Table V -10 Activity - Material

Sheet	Activity =1					Activity =2				
	Total	Shale		Quaternary		Total	Shale		Quaternary	
Peace River	9	4	44.4%	5	55.6%	54	26	48.1%	28	51.9%
Beatton River	17	3	17.6%	14	82.4%	62	23	37.1%	39	62.9%
Southern Tributaries	3	1	33.3%	2	66.7%	29	13	44.8%	16	55.2%
Beatton River - East	1	0	0.0%	1	100.0%	23	12	52.2%	11	47.8%
Halfway River - West	0	0	0.0%	0	0.0%	19	7	36.8%	12	63.2%
Halfway River to Beatton River	0	0	0.0%	0	0.0%	20	9	45.0%	11	55.0%
Total	30	8	26.7%	22	73.3%	207	90	43.5%	117	56.5%

Sheet	Activity =3					Activity =4				
	Total	Shale		Quaternary		Total	Shale		Quaternary	
Peace River	283	116	41.0%	167	59.0%	107	35	32.7%	72	67.3%
Beatton River	248	96	38.7%	152	61.3%	77	23	29.9%	54	70.1%
Southern Tributaries	140	93	66.4%	47	33.6%	78	53	67.9%	25	32.1%
Beatton River - East	97	63	64.9%	34	35.1%	14	8	57.1%	6	42.9%
Halfway River - West	109	49	45.0%	60	55.0%	88	18	20.5%	70	79.5%
Halfway River to Beatton River	105	46	43.8%	59	56.2%	4	0	0.0%	4	100.0%
Total	982	463	47.1%	519	52.9%	368	137	37.2%	231	62.8%

Sheet	Activity =5				
	Total	Shale		Quaternary	
Peace River	12	3	25.0%	9	75.0%
Beatton River	3	2	66.7%	1	33.3%
Southern Tributaries	5	4	80.0%	1	20.0%
Beatton River - East	2	0	0.0%	2	100.0%
Halfway River - West	0	0	0.0%	0	0.0%
Halfway River to Beatton River	1	1	100.0%	0	0.0%
Total	23	10	43.5%	13	56.5%

Appendix V - Inventory Analysis Results

Table V - 11 Activity - Aspect

Sheet	Activity 1									Activity 2								
	Total	North (330-30)		(East) 60-120		(South) 150-210		West (240-300)		Total	North (330-30)		(East) 60-120		(South) 150-210		West (240-300)	
Peace River	9	3	33.3%	2	22.2%	3	33.3%	2	22.2%	54	4	7.4%	11	20.4%	11	20.4%	10	18.5%
Beatton River	17	4	23.5%	2	11.8%	0	0.0%	2	11.8%	62	11	17.7%	9	14.5%	12	19.4%	8	12.9%
Southern Tributaries	3	2	66.7%	0	0.0%	0	0.0%	0	0.0%	29	6	20.7%	6	20.7%	5	17.2%	3	10.3%
Beatton River - East	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	23	4	17.4%	5	21.7%	3	13.0%	5	21.7%
Halfway River - West	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	19	1	5.3%	5	26.3%	1	5.3%	4	21.1%
Halfway River to Beatton River	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	20	2	10.0%	2	10.0%	5	25.0%	4	20.0%
Total	30	9	30.0%	4	13.3%	3	10.0%	4	13.3%	207	28	13.5%	38	18.4%	37	17.9%	34	16.4%

Sheet	Activity 3									Activity 4								
	Total	North (330-30)		(East) 60-120		(South) 150-210		West (240-300)		Total	North (330-30)		(East) 60-120		(South) 150-210		West (240-300)	
Peace River	283	30	10.6%	47	16.6%	61	21.6%	45	15.9%	107	21	19.6%	4	3.7%	26	24.3%	8	7.5%
Beatton River	248	32	12.9%	40	16.1%	42	16.9%	45	18.1%	77	3	3.9%	16	20.8%	10	13.0%	16	20.8%
Southern Tributaries	140	28	20.0%	16	11.4%	33	23.6%	14	10.0%	78	19	24.4%	4	5.1%	15	19.2%	4	5.1%
Beatton River - East	97	12	12.4%	17	17.5%	13	13.4%	18	18.6%	14	1	7.1%	1	7.1%	1	7.1%	4	28.6%
Halfway River - West	109	9	8.3%	24	22.0%	14	12.8%	25	22.9%	88	14	15.9%	15	17.0%	18	20.5%	20	22.7%
Halfway River to Beatton River	105	17	16.2%	21	20.0%	26	24.8%	21	20.0%	4	1	25.0%	0	0.0%	1	25.0%	1	25.0%
Total	982	128	13.0%	165	16.8%	189	19.2%	168	17.1%	368	59	16.0%	40	10.9%	71	19.3%	53	14.4%

Sheet	Activity 5								
	Total	North (330-30)		(East) 60-120		(South) 150-210		West (240-300)	
Peace River	12	1	8.3%	1	8.3%	0	0.0%	5	41.7%
Beatton River	3	0	0.0%	0	0.0%	2	66.7%	0	0.0%
Southern Tributaries	5	0	0.0%	0	3.0%	3	60.0%	0	0.0%
Beatton River - East	2	0	0.0%	0	0.0%	1	50.0%	0	0.0%
Halfway River - West	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River to Beatton River	1	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Total	23	2	8.7%	1	4.3%	6	26.1%	5	21.7%

Appendix V - Inventory Analysis Results

Table V - 12 Landslide Type - Activity

Sheet	Total	Landslide Type 1 Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	3	0	0.0%	0	0.0%	1	33.3%	2	66.7%	0	0.0%
Beatton River	2	0	0.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%
Southern Tributaries	1	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Beatton River - East	1	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Halfway River - West	2	0	0.0%	0	0.0%	1	50.0%	1	50.0%	0	0.0%
Halfway River to Beatton River	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Total	10	0	0.0%	1	10.0%	2	20.0%	7	70.0%	0	0.0%

Sheet	Total	Landslide Type 2 Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	43	2	4.7%	10	23.3%	23	53.5%	8	18.6%	0	0.0%
Beatton River	53	0	0.0%	12	22.6%	31	58.5%	10	18.9%	0	0.0%
Southern Tributaries	32	1	3.1%	9	28.1%	16	50.0%	6	18.8%	0	0.0%
Beatton River - East	23	1	4.3%	4	17.4%	17	73.9%	0	0.0%	1	4.3%
Halfway River - West	27	0	0.0%	5	18.5%	16	59.3%	6	22.2%	0	0.0%
Halfway River to Beatton River	32	0	0.0%	9	28.1%	21	65.6%	2	6.3%	0	0.0%
Total	210	4	1.9%	49	23.3%	124	59.0%	32	15.2%	1	0.5%

Sheet	Total	Landslide Type 3 Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	83	1	1.2%	12	14.5%	55	66.3%	13	15.7%	2	2.4%
Beatton River	105	0	0.0%	9	8.6%	66	62.9%	30	28.6%	0	0.0%
Southern Tributaries	62	0	0.0%	8	12.9%	29	46.8%	25	40.3%	0	0.0%
Beatton River - East	49	0	0.0%	4	8.2%	39	79.6%	5	10.2%	1	2.0%
Halfway River - West	97	0	0.0%	9	9.3%	39	40.2%	49	50.5%	0	0.0%
Halfway River to Beatton River	27	0	0.0%	1	3.7%	25	92.6%	1	3.7%	0	0.0%
Total	423	1	0.2%	43	10.2%	253	59.8%	123	29.1%	3	0.7%

Sheet	Total	Landslide Type 4 Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	14	0	0.0%	2	14.3%	12	85.7%	0	0.0%	0	0.0%
Beatton River	2	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%
Southern Tributaries	9	0	0.0%	1	11.1%	7	77.8%	1	11.1%	0	0.0%
Beatton River - East	3	0	0.0%	3	100.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River - West	4	0	0.0%	1	25.0%	3	75.0%	0	0.0%	0	0.0%
Halfway River to Beatton River	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Total	33	0	0.0%	8	24.2%	24	72.7%	1	3.0%	0	0.0%

Sheet	Landslide Type 5										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	12	0	0.0%	3	25.0%	5	41.7%	3	25.0%	1	8.3%
Beatton River	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Southern Tributaries	6	1	16.7%	0	0.0%	3	50.0%	2	33.3%	0	0.0%
Beatton River - East	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Halfway River - West	16	0	0.0%	0	0.0%	5	31.3%	11	68.8%	0	0.0%
Halfway River to Beatton River	2	0	0.0%	2	100.0%	0	0.0%	0	0.0%	0	0.0%
Total	38	1	2.6%	5	13.2%	15	39.5%	16	42.1%	1	2.6%

Sheet	Landslide Type 6										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	279	5	1.8%	25	9.0%	165	59.1%	75	26.9%	9	3.2%
Beatton River	216	16	7.4%	37	17.1%	130	60.2%	30	13.9%	3	1.4%
Southern Tributaries	118	1	0.8%	10	8.5%	69	58.5%	33	28.0%	5	4.2%
Beatton River - East	56	0	0.0%	9	16.1%	40	71.4%	7	12.5%	0	0.0%
Halfway River - West	53	0	0.0%	2	3.8%	35	66.0%	16	30.2%	0	0.0%
Halfway River to Beatton River	47	0	0.0%	6	12.8%	40	85.1%	1	2.1%	0	0.0%
Total	769	22	2.9%	89	11.6%	479	62.3%	162	21.1%	17	2.2%

Sheet	Landslide Type 7										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	29	1	3.4%	2	6.9%	20	69.0%	6	20.7%	0	0.0%
Beatton River	24	1	4.2%	2	8.3%	17	70.8%	4	16.7%	0	0.0%
Southern Tributaries	22	0	0.0%	1	4.5%	11	50.0%	10	45.5%	0	0.0%
Beatton River - East	3	0	0.0%	2	66.7%	0	0.0%	1	33.3%	0	0.0%
Halfway River - West	7	0	0.0%	0	0.0%	6	85.7%	1	14.3%	0	0.0%
Halfway River to Beatton River	20	0	0.0%	1	5.0%	18	90.0%	0	0.0%	1	5.0%
Total	105	2	1.9%	8	7.6%	72	68.6%	22	21.0%	1	1.0%

Sheet	Landslide Type 8										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	2	0	0.0%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Beatton River	4	0	0.0%	1	25.0%	2	50.0%	1	25.0%	0	0.0%
Southern Tributaries	5	0	0.0%	0	0.0%	5	100.0%	0	0.0%	0	0.0%
Beatton River - East	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River - West	10	0	0.0%	2	20.0%	4	40.0%	4	40.0%	0	0.0%
Halfway River to Beatton River	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	22	0	0.0%	4	18.2%	13	59.1%	5	22.7%	0	0.0%

Appendix V - Inventory Analysis Results

Table V -13 Type - Material

Sheet	Type =1					Type = 2					Type = 3					Type = 4				
	Total	Shale		Quaternary		Total	Shale		Quaternary		Total	Shale		Quaternary		Total	Shale		Quaternary	
Peace River	3	0	0.0%	3	100.0%	43	17	39.5%	26	60.5%	83	23	27.7%	60	72.3%	14	0	0.0%	14	100.0%
Beatton River	2	2	100.0%	0	0.0%	53	23	43.4%	30	56.6%	105	25	23.8%	80	76.2%	2	0	0.0%	2	100.0%
Southern Tributaries	1	0	0.0%	1	100.0%	32	18	56.3%	14	43.8%	62	28	45.2%	34	54.8%	9	0	0.0%	9	100.0%
Beatton River - East	1	1	100.0%	0	0.0%	23	10	43.5%	13	56.5%	49	26	53.1%	23	46.9%	3	0	0.0%	3	100.0%
Halfway River - West	2	2	100.0%	0	0.0%	27	13	48.1%	14	51.9%	97	36	37.1%	61	62.9%	4	0	0.0%	4	100.0%
Halfway River to Beatton River	1	1	100.0%	0	0.0%	32	6	18.8%	26	81.3%	27	11	40.7%	16	59.3%	1	0	0.0%	1	100.0%
Total	10	6	60.0%	4	40.0%	210	87	41.4%	123	58.6%	423	149	35.2%	274	64.8%	33	0	0.0%	33	100.0%

Sheet	Type = 5					Type = 6					Type = 7					Type = 8				
	Total	Shale		Quaternary		Total	Shale		Quaternary		Total	Shale		Quaternary		Total	Shale		Quaternary	
Peace River	12	0	0.0%	12	100.0%	279	121	43.4%	158	56.6%	29	23	79.3%	6	20.7%	2	0	0.0%	2	100.0%
Beatton River	1	0	0.0%	1	100.0%	216	82	38.0%	134	62.0%	24	13	54.2%	11	45.8%	4	0	0.0%	4	100.0%
Southern Tributaries	6	0	0.0%	6	100.0%	118	107	90.7%	11	9.3%	22	11	50.0%	11	50.0%	5	0	0.0%	5	100.0%
Beatton River - East	1	0	0.0%	1	100.0%	56	46	82.1%	10	17.9%	3	0	0.0%	3	100.0%	1	0	0.0%	1	100.0%
Halfway River - West	16	0	0.0%	16	100.0%	53	20	37.7%	33	62.3%	7	3	42.9%	4	57.1%	10	0	0.0%	10	100.0%
Halfway River to Beatton River	2	0	0.0%	2	100.0%	47	23	48.9%	24	51.1%	20	15	75.0%	5	25.0%	0	0	0.0%	0	0.0%
Total	38	0	0.0%	38	100.0%	769	399	51.9%	370	48.1%	105	65	61.9%	40	38.1%	22	0	0.0%	22	100.0%

Appendix V - Inventory Analysis Results
Table V -14 Landslide Type - Aspect

Sheet	Landslide Type 1								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Beatton River	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Southern Tributaries	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Beatton River - East	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Halfway River - West	1	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Halfway River to Beatton River	1	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Total	5	1	20.0%	0	0.0%	3	60.0%	1	20.0%

Sheet	Landslide Type 2								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	27	6	22.2%	4	14.8%	7	25.9%	10	37.0%
Beatton River	36	5	13.9%	8	22.2%	14	38.9%	9	25.0%
Southern Tributaries	24	7	29.2%	7	29.2%	5	20.8%	5	20.8%
Beatton River - East	18	1	5.6%	7	38.9%	2	11.1%	8	44.4%
Halfway River - West	18	3	16.7%	9	50.0%	3	16.7%	3	16.7%
Halfway River to Beatton River	23	3	13.0%	6	26.1%	8	34.8%	6	26.1%
Total	146	25	17.1%	41	28.1%	39	26.7%	41	28.1%

Sheet	Landslide Type 3								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	56	4	7.1%	19	33.9%	19	33.9%	14	25.0%
Beatton River	72	9	12.5%	18	25.0%	22	30.6%	23	31.9%
Southern Tributaries	37	9	24.3%	3	8.1%	21	56.8%	4	10.8%
Beatton River - East	26	7	26.9%	7	26.9%	4	15.4%	8	30.8%
Halfway River - West	68	12	17.6%	21	30.9%	16	23.5%	19	27.9%
Halfway River to Beatton River	20	4	20.0%	4	20.0%	6	30.0%	6	30.0%
Total	279	45	16.1%	72	25.8%	88	31.5%	74	26.5%

Sheet	Landslide Type 4								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	10	3	30.0%	0	0.0%	6	60.0%	1	10.0%
Beatton River	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Southern Tributaries	5	2	40.0%	1	20.0%	2	40.0%	0	0.0%
Beatton River - East	2	0	0.0%	0	0.0%	1	50.0%	1	50.0%
Halfway River - West	3	0	0.0%	2	66.7%	0	0.0%	1	33.3%
Halfway River to Beatton River	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Total	21	5	23.8%	4	19.0%	9	42.9%	3	14.3%

Sheet	Landslide Type 5								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	3	1	33.3%	0	0.0%	1	33.3%	1	33.3%
Beatton River	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Southern Tributaries	3	2	66.7%	0	3.0%	0	0.0%	1	33.3%
Beatton River - East	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%
Halfway River - West	14	2	0.0%	4	0.0%	6	0.0%	2	0.0%
Halfway River to Beatton River	1	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Total	23	5	21.7%	5	21.7%	8	34.8%	5	21.7%

Sheet	Landslide Type 6								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	177	36	20.3%	40	22.6%	65	36.7%	36	20.3%
Beatton River	128	27	21.1%	35	27.3%	30	23.4%	36	28.1%
Southern Tributaries	73	28	38.4%	12	16.4%	25	34.2%	8	11.0%
Beatton River - East	38	8	21.1%	8	21.1%	9	23.7%	13	34.2%
Halfway River - West	35	6	17.1%	6	17.1%	8	22.9%	15	42.9%
Halfway River to Beatton River	41	6	14.6%	7	17.1%	16	39.0%	12	29.3%
Total	492	111	22.6%	108	22.0%	153	31.1%	120	24.4%

Sheet	Landslide Type 7								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	16	8	50.0%	1	6.3%	4	25.0%	3	18.8%
Beatton River	16	9	56.3%	5	31.3%	1	6.3%	1	6.3%
Southern Tributaries	12	7	58.3%	2	16.7%	0	0.0%	3	25.0%
Beatton River - East	3	1	33.3%	1	33.3%	0	0.0%	1	33.3%
Halfway River - West	4	1	25.0%	1	25.0%	0	0.0%	2	50.0%
Halfway River to Beatton River	15	7	46.7%	5	33.3%	2	13.3%	1	6.7%
Total	66	33	50.0%	15	22.7%	7	10.6%	11	16.7%

Sheet	Landslide Type 8								
	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	2	1	50.0%	1	50.0%	0	0.0%	0	0.0%
Beatton River	1	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Southern Tributaries	4	0	0.0%	1	25.0%	3	75.0%	0	0.0%
Beatton River - East	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Halfway River - West	7	0	0.0%	1	14.3%	0	0.0%	6	85.7%
Halfway River to Beatton River	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	14	1	7.1%	3	21.4%	3	21.4%	7	50.0%

Appendix V - Inventory Analysis Results

Table V -15 Material - Activity

Sheet	Material	Total	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5
Peace River	**Shale**	**184**	**2.2%**	**14.1%**	**63.0%**	**19.0%**	**1.6%**
	Quaternary	281	1.8%	10.0%	59.4%	25.6%	3.2%
Beatton River	**Shale**	**142**	**2.0%**	**15.6%**	**65.3%**	**15.6%**	**1.4%**
	Quaternary	265	5.4%	0.2%	58.5%	20.8%	0.4%
Southern Tributaries	**Shale**	**164**	**0.6%**	**7.9%**	**56.7%**	**32.3%**	**2.4%**
	Quaternary	91	2.2%	17.6%	51.6%	27.5%	1.1%
Beatton River East	**Shale**	**83**	**0.0%**	**14.5%**	**75.9%**	**9.6%**	**0.0%**
	Quaternary	54	1.9%	20.4%	63.0%	11.1%	3.7%
Halfway River West	**Shale**	**74**	**0.0%**	**9.5%**	**66.2%**	**24.3%**	**0.0%**
	Quaternary	142	0.0%	8.5%	42.3%	49.3%	0.0%
Halfway River to Beatton River	**Shale**	**56**	**0.0%**	**16.1%**	**82.1%**	**0.0%**	**1.8%**
	Quaternary	74	0.0%	14.9%	79.7%	5.4%	0.0%
Total	**Shale**	**703**	**1.1%**	**12.8%**	**65.9%**	**19.5%**	**1.4%**
	Quaternary	907	2.4%	13.0%	57.5%	25.6%	1.4%

Appendix V - Inventory Analysis Results

Table V -16 Material - Landslide Type

Sheet	Material	Total	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8
Peace River	Shale	184	0.0%	9.2%	12.5%	0.0%	0.0%	65.8%	12.5%	0.0%
	Quaternary	281	1.1%	9.3%	21.4%	5.0%	4.3%	56.2%	2.1%	0.7%
Beatton River	Shale	142	1.4%	16.2%	16.9%	0.0%	0.0%	56.3%	9.2%	0.0%
	Quaternary	265	0.0%	11.6%	30.6%	0.8%	0.4%	50.8%	4.3%	1.6%
Southern Tributaries	Shale	164	0.0%	11.0%	17.1%	0.0%	0.0%	65.2%	6.7%	0.0%
	Quaternary	91	1.1%	15.4%	37.4%	9.9%	6.6%	12.1%	12.1%	5.5%
Beatton River East	Shale	83	1.2%	12.0%	31.3%	0.0%	0.0%	55.4%	0.0%	0.0%
	Quaternary	54	0.0%	24.1%	42.6%	5.6%	1.9%	18.5%	5.6%	1.9%
Halfway River West	Shale	74	2.7%	17.6%	48.6%	0.0%	0.0%	27.0%	4.1%	0.0%
	Quaternary	142	0.0%	9.9%	43.0%	2.8%	11.3%	23.2%	2.8%	7.0%
Halfway River to Beatton River	Shale	56	1.8%	10.7%	19.6%	0.0%	0.0%	41.1%	26.8%	0.0%
	Quaternary	74	0.0%	35.1%	21.6%	1.4%	2.7%	32.4%	6.8%	0.0%
Total	Shale	703	0.9%	12.4%	21.1%	0.0%	0.0%	56.5%	9.2%	0.0%
	Quaternary	907	0.4%	13.6%	30.3%	3.7%	4.2%	40.7%	4.4%	2.4%

Appendix V - Inventory Analysis Results

Table V - 17 Material - Aspect

Sheet	Material	Total	North Facing (330-30)		East Facing (60-120)		South Facing (150-210)		West Facing (240-300)	
Peace River	**Shale**	**184**	**28**	**15.2%**	**23**	**12.50%**	**38**	**20.7%**	**29**	**15.8%**
	Quaternary	281	31	11.0%	42	14.95%	65	23.1%	36	12.8%
Beatton River	**Shale**	**142**	**13**	**9.2%**	**24**	**16.90%**	**22**	**15.5%**	**30**	**21.1%**
	Quaternary	265	34	12.8%	41	15.47%	43	16.2%	40	15.1%
Southern Tributaries	**Shale**	**164**	**35**	**21.3%**	**16**	**9.76%**	**37**	**22.6%**	**14**	**8.5%**
	Quaternary	91	20	22.0%	10	10.99%	19	20.9%	7	7.7%
Beatton River East	**Shale**	**83**	**11**	**13.3%**	**14**	**16.87%**	**8**	**9.6%**	**20**	**24.1%**
	Quaternary	54	6	11.1%	9	16.67%	10	18.5%	9	16.7%
Halfway River West	**Shale**	**74**	**2**	**2.7%**	**17**	**22.97%**	**10**	**13.5%**	**19**	**25.7%**
	Quaternary	142	22	15.5%	27	19.01%	23	16.2%	30	21.1%
Halfway River to Beatton River	**Shale**	**56**	**8**	**14.3%**	**11**	**19.64%**	**14**	**25.0%**	**14**	**25.0%**
	Quaternary	74	13	17.6%	12	16.22%	18	24.3%	12	16.2%
Total	**Shale**	**703**	**97**	**13.8%**	**105**	**14.94%**	**129**	**18.3%**	**126**	**17.9%**
	Quaternary	907	126	13.9%	141	15.55%	178	19.6%	134	14.8%

Appendix V - Inventory Analysis Results

Table V - 18 Aspect - Activity

Sheet	North Facing (330-30)										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	59	3	5.1%	4	6.8%	30	50.8%	21	35.6%	1	1.7%
Beatton River	50	4	8.0%	11	22.0%	32	64.0%	3	6.0%	0	0.0%
Southern Tributaries	55	2	3.6%	6	10.9%	28	50.9%	19	34.5%	0	0.0%
Beatton River - East	17	0	0.0%	4	23.5%	12	70.6%	1	5.9%	0	0.0%
Halfway River - West	24	0	0.0%	1	4.2%	9	37.5%	14	58.3%	0	0.0%
Halfway River to Beatton River	21	0	0.0%	2	9.5%	17	81.0%	1	4.8%	1	4.8%
Total	226	9	4.0%	28	12.4%	128	56.6%	59	26.1%	2	0.9%

Sheet	East Facing (60-120)										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	65	2	3.1%	11	16.9%	47	72.3%	4	6.2%	1	1.5%
Beatton River	67	2	3.0%	9	13.4%	40	59.7%	16	23.9%	0	0.0%
Southern Tributaries	26	0	0.0%	6	23.1%	16	61.5%	4	15.4%	0	0.0%
Beatton River - East	23	0	0.0%	5	21.7%	17	73.9%	1	4.3%	0	0.0%
Halfway River - West	44	0	0.0%	5	11.4%	24	54.5%	15	34.1%	0	0.0%
Halfway River to Beatton River	23	0	0.0%	2	8.7%	21	91.3%	0	0.0%	0	0.0%
Total	248	4	1.6%	38	15.3%	165	66.5%	40	16.1%	1	0.4%

Sheet	South Facing (150-210)										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	101	3	3.0%	11	10.9%	61	60.4%	26	25.7%	0	0.0%
Beatton River	66	0	0.0%	12	18.2%	42	63.6%	10	15.2%	2	3.0%
Southern Tributaries	56	0	0.0%	5	8.9%	33	58.9%	15	26.8%	3	5.4%
Beatton River - East	18	0	0.0%	3	16.7%	13	72.2%	1	5.6%	1	5.6%
Halfway River - West	33	0	0.0%	1	3.0%	14	42.4%	18	54.5%	0	0.0%
Halfway River to Beatton River	32	0	0.0%	5	15.6%	26	81.3%	1	3.1%	0	0.0%
Total	306	3	1.0%	37	12.1%	189	61.8%	71	23.2%	6	2.0%

Sheet	West Facing (240-300)										
	Total	Activity 1		Activity 2		Activity 3		Activity 4		Activity 5	
Peace River	70	2	2.9%	10	14.3%	45	64.3%	8	11.4%	5	7.1%
Beatton River	71	2	2.8%	8	11.3%	45	63.4%	16	22.5%	0	0.0%
Southern Tributaries	21	0	0.0%	3	14.3%	14	66.7%	4	19.0%	0	0.0%
Beatton River - East	27	0	0.0%	5	18.5%	18	66.7%	4	14.8%	0	0.0%
Halfway River - West	49	0	0.0%	4	8.2%	25	51.0%	20	40.8%	0	0.0%
Halfway River to Beatton River	26	0	0.0%	4	15.4%	21	80.8%	1	3.8%	0	0.0%
Total	264	4	1.5%	34	12.9%	168	63.6%	53	20.1%	5	1.9%

Appendix V - Inventory Analysis Results

Table V - 19 Aspect - Landslide Type

Sheet	North Facing (330 - 30)																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	59	0	0.0%	6	10.2%	4	6.8%	3	5.1%	1	1.7%	36	61.0%	8	13.6%	1	1.7%
Beatton River	50	0	0.0%	5	10.0%	9	18.0%	0	0.0%	0	0.0%	27	54.0%	9	18.0%	0	0.0%
Southern Tributaries	55	0	0.0%	7	12.7%	9	16.4%	2	3.6%	2	3.6%	28	50.9%	7	12.7%	0	0.0%
Beatton River - East	17	0	0.0%	1	5.9%	7	41.2%	0	0.0%	0	0.0%	8	47.1%	1	5.9%	0	0.0%
Halfway River - West	27	0	0.0%	3	11.1%	12	44.4%	2	7.4%	2	7.4%	6	22.2%	1	3.7%	1	3.7%
Halfway River to Beatton River	23	1	4.3%	3	13.0%	4	17.4%	0	0.0%	0	0.0%	6	26.1%	7	30.4%	2	8.7%
Total	231	1	0.4%	25	10.8%	45	19.5%	7	3.0%	5	2.2%	111	48.1%	33	14.3%	4	1.7%

Sheet	East Facing (60 - 120)																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	66	0	0.0%	4	6.1%	19	28.8%	0	0.0%	1	1.5%	40	60.6%	1	1.5%	1	1.5%
Beatton River	67	0	0.0%	8	11.9%	18	26.9%	0	0.0%	1	1.5%	35	52.2%	5	7.5%	0	0.0%
Southern Tributaries	26	0	0.0%	7	26.9%	3	11.5%	1	3.8%	0	0.0%	12	46.2%	2	7.7%	1	3.8%
Beatton River - East	23	0	0.0%	7	30.4%	7	30.4%	0	0.0%	0	0.0%	8	34.8%	1	4.3%	0	0.0%
Halfway River - West	44	0	0.0%	9	20.5%	21	47.7%	2	4.5%	4	9.1%	6	13.6%	1	2.3%	1	2.3%
Halfway River to Beatton River	62	0	0.0%	6	9.7%	4	6.5%	1	1.6%	4	6.5%	7	11.3%	5	8.1%	35	56.5%
Total	288	0	0.0%	41	14.2%	72	25.0%	4	1.4%	10	3.5%	108	37.5%	15	5.2%	38	13.2%

Sheet	South Facing (150 - 210)																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	103	1	1.0%	7	6.8%	19	18.4%	6	5.8%	1	1.0%	65	63.1%	4	3.9%	0	0.0%
Beatton River	65	1	1.5%	14	21.5%	22	33.8%	0	0.0%	0	0.0%	27	41.5%	1	1.5%	0	0.0%
Southern Tributaries	58	1	1.7%	5	8.6%	21	36.2%	2	3.4%	1	1.7%	25	43.1%	0	0.0%	3	5.2%
Beatton River - East	18	1	5.6%	2	11.1%	4	22.2%	1	5.6%	1	5.6%	9	50.0%	0	0.0%	0	0.0%
Halfway River - West	35	0	0.0%	3	8.6%	16	45.7%	2	5.7%	6	17.1%	8	22.9%	0	0.0%	0	0.0%
Halfway River to Beatton River	38	0	0.0%	8	21.1%	6	15.8%	0	0.0%	6	15.8%	16	42.1%	2	5.3%	0	0.0%
Total	317	4	1.3%	39	12.3%	88	27.8%	11	3.5%	15	4.7%	150	47.3%	7	2.2%	3	0.9%

Sheet	West Facing (240 - 300)																
	Total	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8	
Peace River	65	0	0.0%	10	15.4%	14	21.5%	1	1.5%	1	1.5%	36	55.4%	3	4.6%	0	0.0%
Beatton River	71	0	0.0%	9	12.7%	23	32.4%	0	0.0%	0	0.0%	36	50.7%	1	1.4%	2	2.8%
Southern Tributaries	22	0	0.0%	5	22.7%	4	18.2%	1	4.5%	1	4.5%	8	36.4%	3	13.6%	0	0.0%
Beatton River - East	31	0	0.0%	8	25.8%	8	25.8%	1	3.2%	0	0.0%	13	41.9%	1	3.2%	0	0.0%
Halfway River - West	49	1	2.0%	3	6.1%	19	38.8%	1	2.0%	2	4.1%	15	30.6%	2	4.1%	6	12.2%
Halfway River to Beatton River	28	1	3.6%	6	21.4%	6	21.4%	1	3.6%	1	3.6%	12	42.9%	1	3.6%	0	0.0%
Total	266	2	0.8%	41	15.4%	74	27.8%	5	1.9%	5	1.9%	120	45.1%	11	4.1%	8	3.0%

Appendix V - Inventory Analysis Results

Table V - 20 Aspect - Material

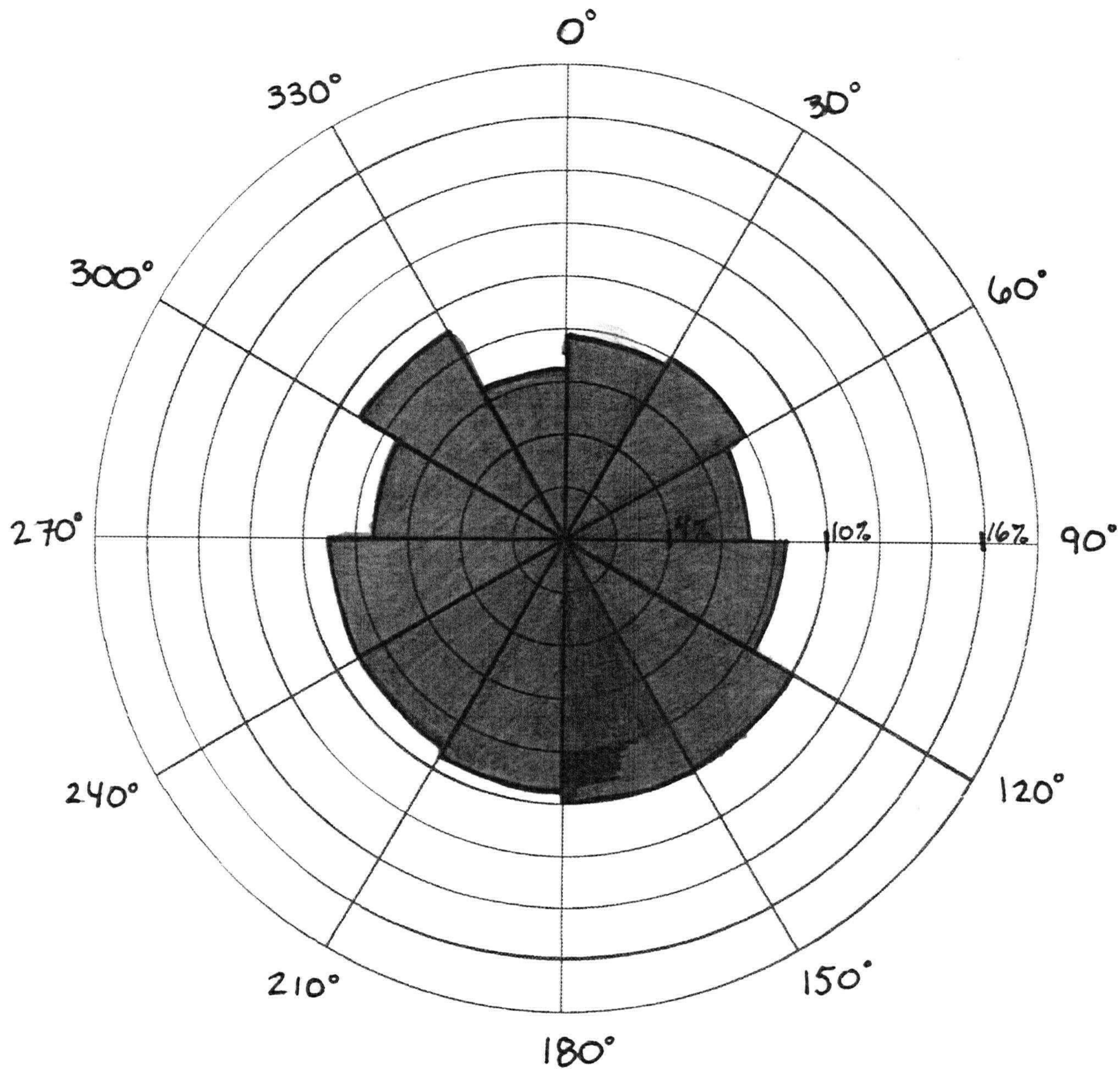
Sheet	North Facing (330 - 30)					East Facing (60 - 120)				
	Total	Shale		Quaternary		Total	Shale		Quaternary	
Peace River	61	28	45.9%	31	50.8%	65	23	35.4%	42	64.6%
Beatton River	47	13	27.7%	34	72.3%	65	24	36.9%	41	63.1%
Southern Tributaries	56	35	62.5%	20	35.7%	26	16	61.5%	10	38.5%
Beatton River - East	17	11	64.7%	6	35.3%	23	14	60.9%	9	39.1%
Halfway River - West	24	2	8.3%	22	91.7%	44	17	38.6%	27	61.4%
Halfway River to Beatton River	21	8	38.1%	13	61.9%	23	11	47.8%	12	52.2%
Total	226	97	42.9%	126	55.8%	246	105	42.7%	141	57.3%

Sheet	South Facing (150 - 210)					West Facing (240 - 300)				
	Total	Shale		Quaternary		Total	Shale		Quaternary	
Peace River	103	38	36.9%	65	63.1%	65	29	44.6%	36	55.4%
Beatton River	65	22	33.8%	43	66.2%	70	30	42.9%	40	57.1%
Southern Tributaries	56	37	66.1%	19	33.9%	21	14	66.7%	7	33.3%
Beatton River - East	18	8	44.4%	10	55.6%	27	20	74.1%	9	33.3%
Halfway River - West	33	10	30.3%	23	69.7%	49	19	38.8%	30	61.2%
Halfway River to Beatton River	32	14	43.8%	18	56.3%	26	14	53.8%	12	46.2%
Total	307	129	42.0%	178	58.0%	258	126	48.8%	134	51.9%

APPENDIX VI

Slide Aspect Rosette Diagrams

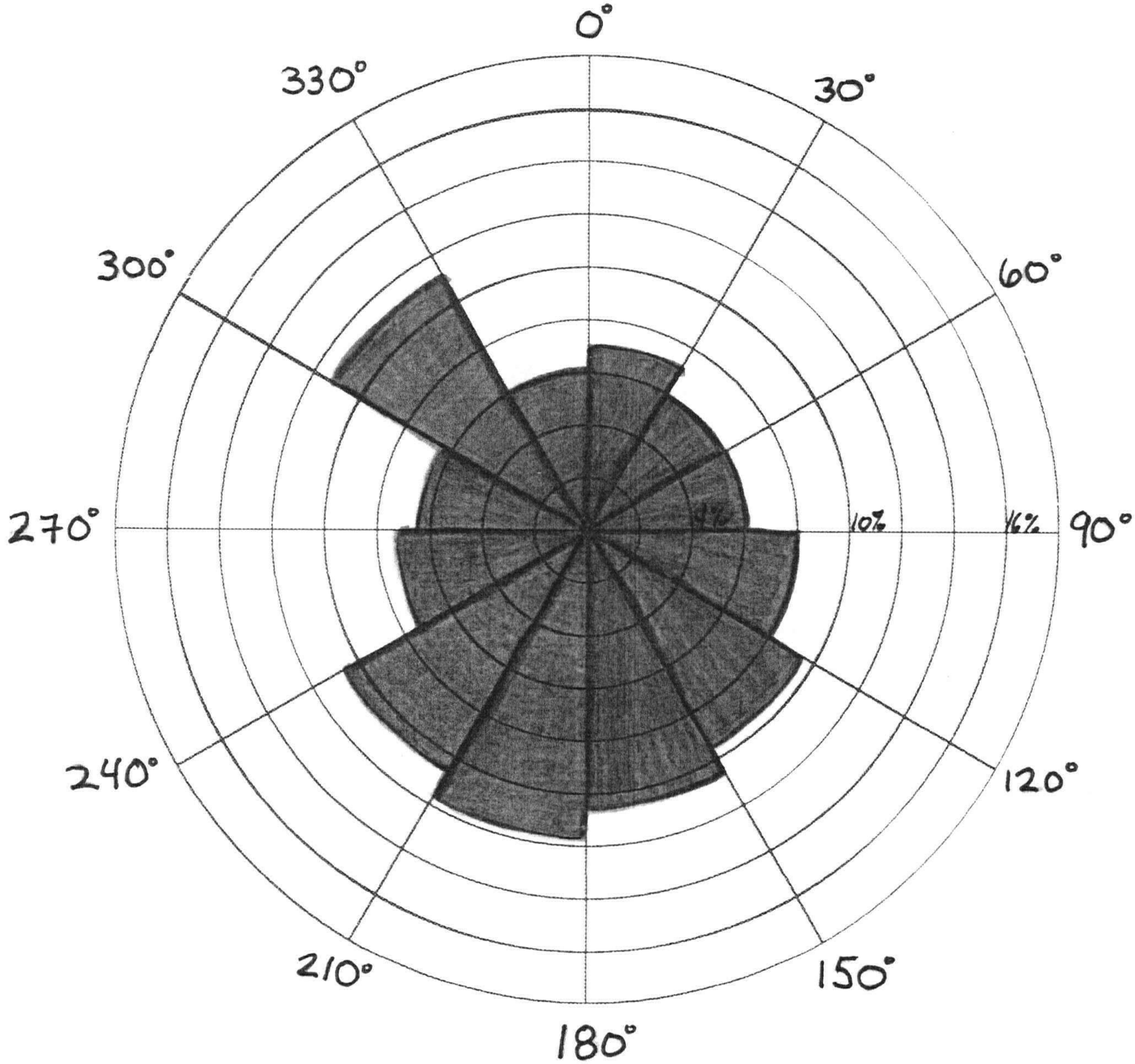
Charlie Lake Mapsheet (94A)
Landslide Aspect (2%)
1610 Failures



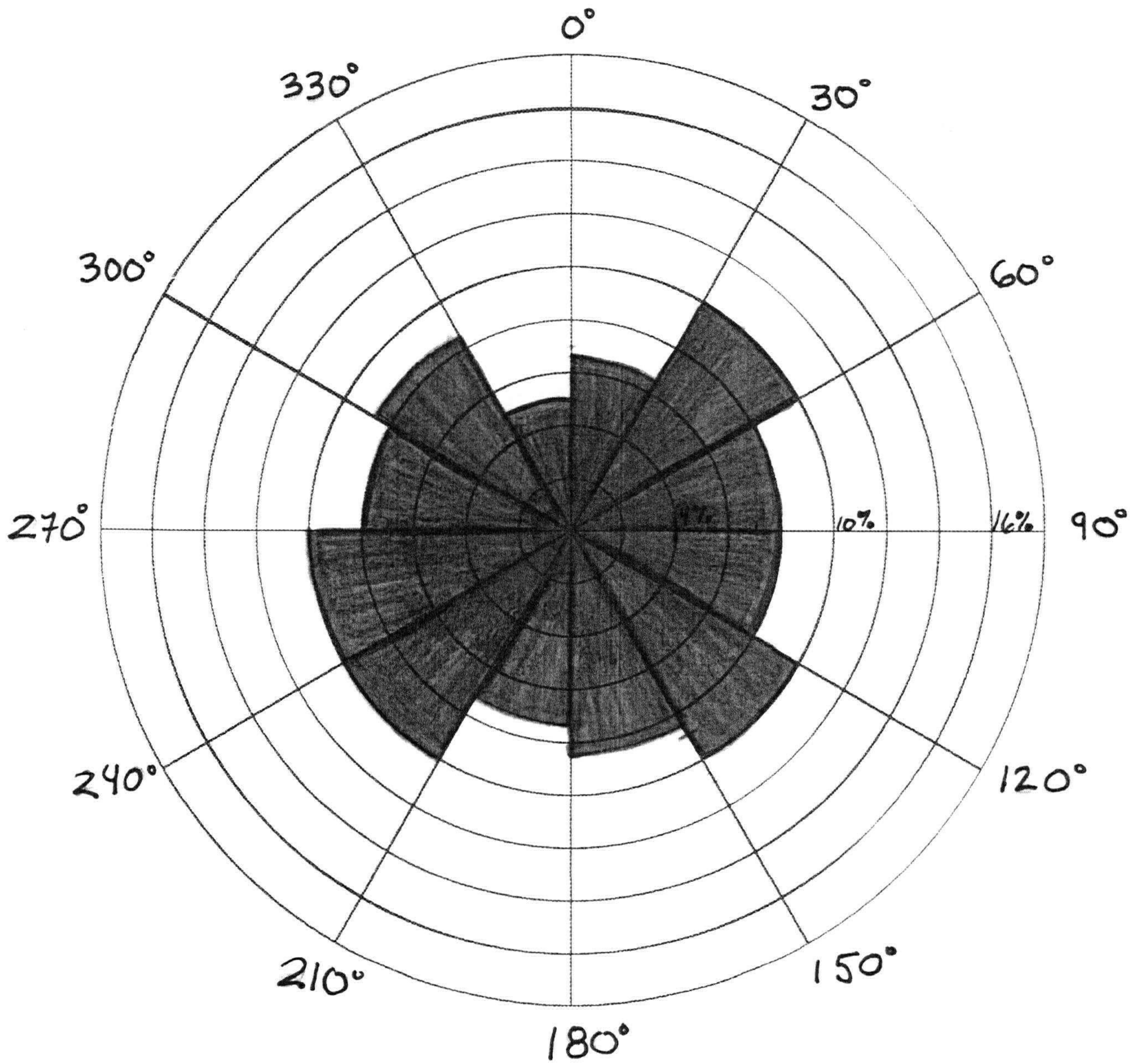
Peace River Division

Landslide Aspect (2% incr.)

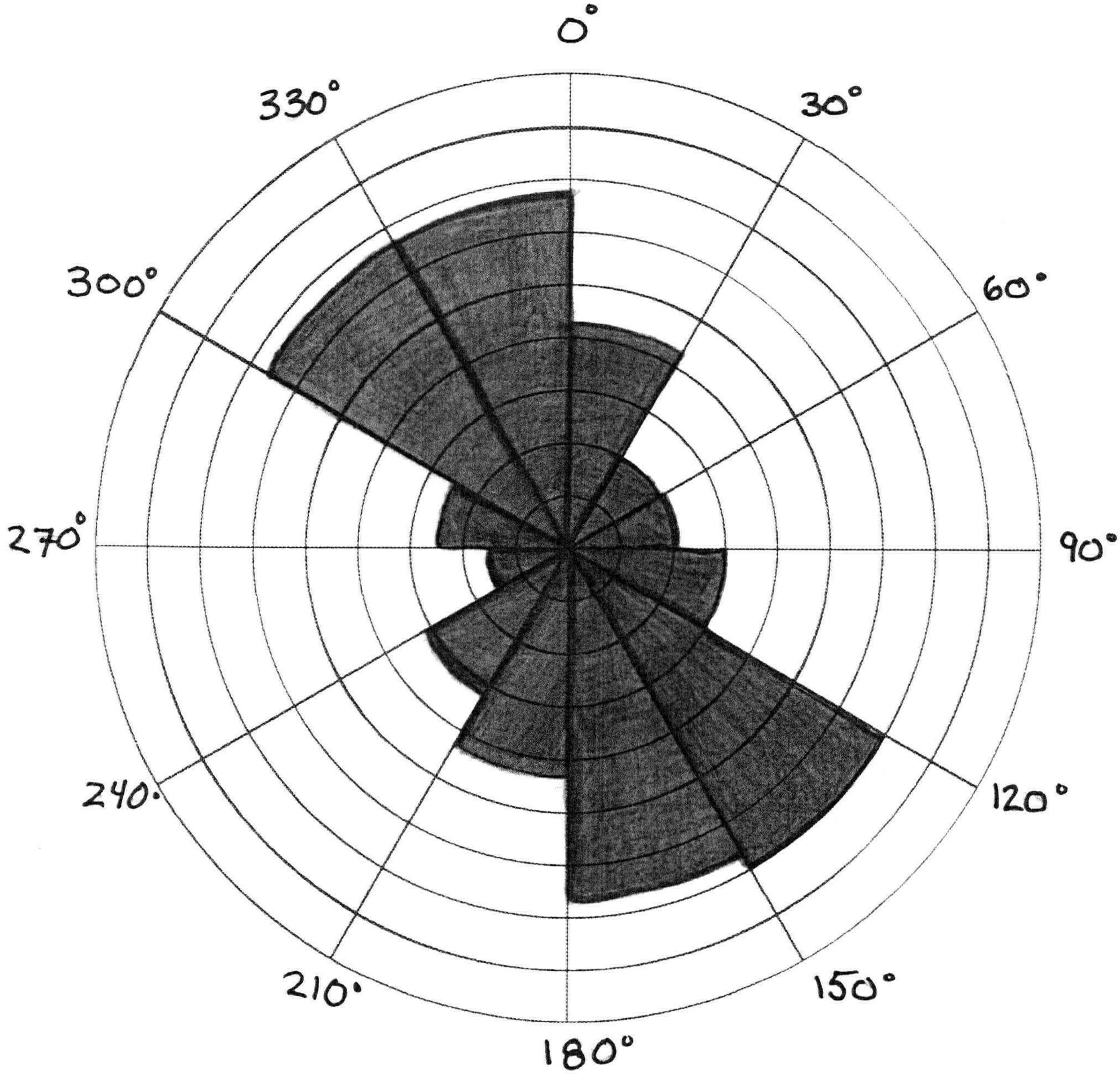
465 Failures



Beatton River Division
Landslide Aspect (2% incr.)
407 Failures



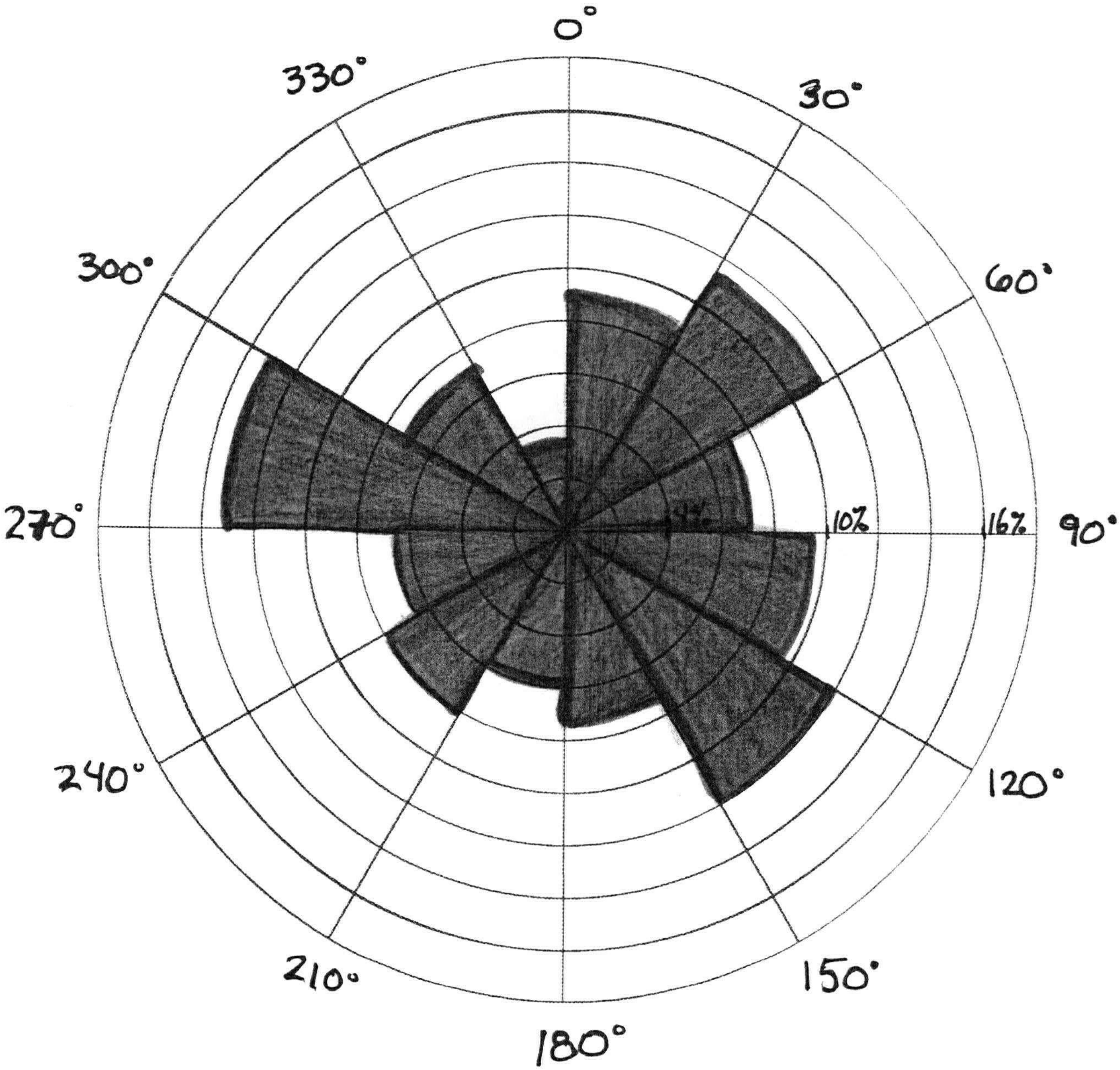
Southern Tributaries - Division
Landslide Aspect (2% incr.)
255 Failures



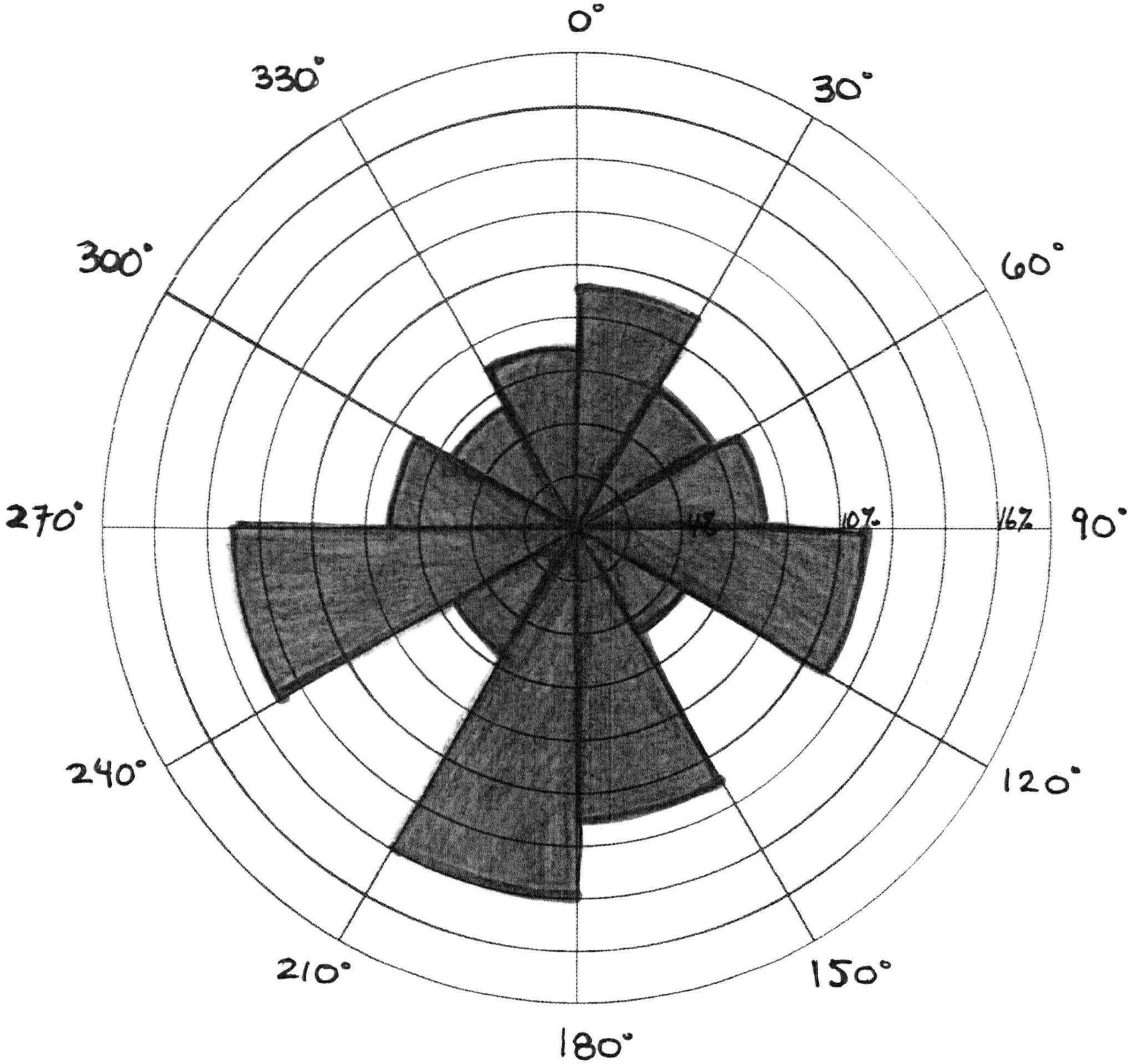
Beatton River - East Division

Landslide Aspect (2% incr.)

137 Failures



Halfway River to Beatton River Division
Landslide Aspect (2% incr.)
130 Failures



Halfway River-West Division
Landslide Aspect (2% incr.)
216 Failures