FOCUS
Engineering - Geomatics - Planning

October 17, 2012

File No.: 060300016

Trish Morgan
Peace River Regional District
PO Box 810
1981 Alaska Avenue
Dawson Creek, BC
V1J 4H8

RE: **REMEDIAL OPTIONS REPORT**
PEACE RIVER LOOKOUT

Please find included in this submission, one (1) copy of the Remedial Options Report prepared by Focus Corporation and one (1) copy of the Preliminary Desktop Geotechnical Assessment for Proposed Lookout Upgrade prepared by Northern Geo Testing and Engineering Ltd.

If you have any questions or require clarification, please contact me at (250) 787-3150.

Sincerely,

FOCUS CORPORATION

BGarberg

Britney Garberg, E.I.T.
Focus Corporation
Fort St. John, BC

PEACE VALLEY LOOKOUT

REMEDIAL OPTIONS REPORT: A SUMMARY OF COMPLETED WORK AND SUGGESTED NEXT STEPS

Project number 060300016



Submitted to:
Peace River Regional District
PO Box 810
1981 Alaska Avenue
Dawson Creek, BC
V1G 4H8

Prepared by:
Focus Corporation
10716 100 Avenue
Fort St. John, BC
V1J 1Z3

October 2012

FOCUS

1.0 INTRODUCTION

Focus Corporation (FOCUS) has prepared this report for the Peace River Regional District (PRRD) as part of the proposal signed in September 2011. The information found in this report has been collected and summarized from the recently completed environmental and geotechnical studies. The report also provides cost estimates and next steps for remediation at the property. The cost estimates and recommendations in this report are to be used by the PRRD to determine if they will purchase the parcel of land and convert it to a regional park.

2.0 BACKGROUND

The PRRD is considering the purchase of a parcel of crown land where the Peace Valley Lookout is currently located (Slide 2.1). The intention is that the parcel be converted into a regional park. In considering the purchase, the PRRD is evaluating the property's potential for development and determining the possible costs to remediate any negative site issues. The following issues have been identified as part of this process:

- Is it feasible to convert the lookout into a regional park?
- Are there significant potential environmental issues?
- If a significant environmental issue does exist, what are the estimated costs to remediate it?
- Are there are any significant geotechnical issues with slope stability?
- If a significant geotechnical issue does exist, what are the estimated costs to remediate it?
- Pending the results of the environment and geotechnical investigations, is the development of the site as a park financially viable?

Slide 2.1: The current Peace Valley Lookout

To help answer these questions, the PRRD commissioned the following studies:

1) **Feasibility Study:** Focus completed a feasibility study in March 2010. Focus was awarded the project after the initial Request for Proposal from the PRRD that closed October 8, 2009.
2) **Stage One Preliminary Site Investigation (PSI) and Limited Stage Two PSI Studies.** Completed by Focus in March 2011 as part of the Preliminary Site Investigation Proposal that was dated February 28, 2011.
3) **Preliminary Desktop Geotechnical Assessment:** Completed in September of 2012 by Northern Geo Testing and Engineering Ltd.

The Feasibility Study was the first assignment completed. The study recommended that a geotechnical study, environmental assessment, and a drainage and runoff study be completed before the PRRD moves ahead with plans to purchase the parcel. Next, the Phase One and Limited Phase Two Preliminary Site Investigations (PSIs) were completed and a report was submitted to the PRRD. Lastly, Northern Geo Testing and Engineering Ltd. (Northern Geo) completed their Geotechnical investigation and finalized the report in September of 2012.

In addition to these studies, there has been work done by others at the site. In the fall of 2011, the Ministry of Transportation and Infrastructure (MoTI) did a significant amount of work on the site. They removed the existing household garbage, car hulks (old vehicles) and appliances that had been dumped at the site. MoTI also placed fill in some areas, installed rip rap, and hydro-seeded to help prevent further erosion (Slide 2.2a and 2.2b). (It is not known if these measures were engineered.) Finally, MoTI installed fencing near the edge of the bank, picnic tables, and a sign.

Slide 2.2a: MOTI has made some improvements to the site such as placing fill and rip rap.

Slide 2.2b: Rip rap installed in the drainage ditch to the left of the viewing area

The PRRD will use the summary and costs contained in this report to determine if the development of the park is financially viable.

3.0 REPORT OBJECTIVES:

The purpose of this report is to outline a remedial options action plan and the estimated costs for the site based on the results from the investigations. For the purposes of this report, we will focus on the preliminary site investigations, geotechnical study and results from site visits carried out since the PSIs were completed.

4.0 SUMMARIZED STUDY RESULTS:

This section summarizes the results of the studies completed on the site.

Since the parcel had been used as a landfill in the past, the soils, groundwater and surface water were assessed for contamination. The following identifies the testing results of the Preliminary Site Investigations:

- Property has been used for dumping of municipal waste and abandoned vehicles for years. The potential for environmental impairment to the property from illegal dumping is to be considered moderate.
- In British Columbia, contamination limits are based on the type of land use. There are six different land use categories identified in the British Columbia Contaminated Sites Regulation. FOCUS considers Agricultural Land Use (AL) and Parks Land Use (PL) to be applicable to the property based on existing and proposed land use. Standards based on this land use designation were used in the environmental assessment.
- All concentrations of BTEXS, VPH, VOCs, EPHs, PAHs, LEPH and HEPH and/or metals from the twelve soil samples were found to be below the acceptable CSR AL and PL Standards.

  Therefore, it was determined that the buried landfill waste, cars, and appliances did not have a significant negative impact on the soils, ground water, or surface water.

In addition to the soils and groundwater testing that was conducted, two site visits were completed in May of 2012. The site visit conducted on May 18, 2012 noted that there was some erosion along the south-east bank at the existing fence line (Slide 3.1). The May 31st follow-up visit noted that this same location had continued to slump. Enough soil movement had occurred that two fence posts were hanging in the air as the bank was no longer there to support them. In that area, the bank looked very unstable, and with more precipitation, the bank will continue to slump, leaving more of the fence unsupported. The fence has since been repaired and moved back into a stable ground area.

Slide 3.1: Bank erosion had left two fence posts unsupported

Along other areas of the bank, there is evidence of significant surface erosion where surface water has created concentrated flow paths along the bank. Although MoTI has hydro-seeded and installed rip rap, it is too early to tell if these measures will be effective enough to prevent further erosion and slumping.

It was also noted during these two site visits that while the visible surface garbage had been cleaned up, there are still some vehicles and appliances at the bottom of the slope, adjacent to the river, although not visible from the top of the lookout (Slide 3.2). This may not be the case in the fall when the leaves are gone, and the sight-lines are opened up.

Slide 3.2: Car hulks and old appliances can be found at the bottom of the slope.

Northern Geo completed their investigation of the site in September. Focus worked with the consultant to establish a survey grid for the set-up of their slope monitoring study. Once a month, Focus surveyed these points and provided the results to Northern Geo for their investigation. Northern Geo's report identified a low risk of danger to public due to a slide. They also reported that the recent earthflow and movement observed was mostly likely due to erosion of loose soil dumped in an uncontrolled manner. The extent of the movement is likely only shallow to moderately deep.

5.0 CONCLUSIONS:

Based on these results, FOCUS recommends the following actions to improve the site:

a. Clean-up and Disposal of Car Hulks and Appliances:

MoTI has removed the vehicles and appliances within visible sight lines. There are still some existing vehicles and appliances at the base of the bank, but they are not visible from behind the fence at the lookout. At this time, it is not deemed essential to remove this surface garbage on account of aesthetics or environmental reasons. (A fence and rip rap have been installed which will likely prevent further dumping

of waste off the lookout as vehicles can no longer access the bank.) It would be at the PRRD discretion as to whether they wish to remove the large items or not. Estimated costs to undertake this optional action can be found in Table 5.1.

b. Clean-up of Surface Garbage (litter):

The only visible garbage on the site is litter that has been deposited since MoTI completed their work. FOCUS recommends cleaning up the litter that has been left on the site since MoTI complete their work. (i.e.: fast food and beverage containers). This could be completed as part of a scheduled maintenance plan including maintenance of picnic tables, signs, and the clean-up for garbage that accumulates on site. A clean, well-respected site helps to deter others from littering or vandalizing. Costs to undertake the clean-up and disposal of garbage, maintain picnic tables, and signs can be found in Table 5.1.

c. Installation of Garbage Bins:

It is recommended that the PRRD install garbage receptacles at the site. Costs to install garbage receptacles can be found in Table 5.1.

d. Preventative Plan

FOCUS recommends that monitoring of the site take place. If the garbage issue persists, a further measure that could be taken involves installing one or two fake cameras around the site and assign stating the area is being monitored by a surveillance camera. This has been known to encourage people to clean-up after themselves. It will also help to limit the amount of vandalism that could occur on site. Costs to undertake a long term monitoring program consisting of monthly site visits can be found in Table 5.1.

e. Drainage Study to Prevent Further Surface Erosion

The major geotechnical concern for this site is drainage and surface erosion. It is our recommendation that the PRRD completes a surface erosion and drainage study and report. From this a storm water management plan should be implemented so that runoff does not continue to flow over the banks causing erosion and

further slumping. An estimate of the cost to complete a storm water drainage study and management plan can be found in Table 5.1.

f. Geotechnical Recommendations:

Due to the potential for slide movement to occur, is it is recommended that annual monitoring of slope movement be implemented. As per Northern Geo's report, it is recommended that staff from PRRD monitor the slope (take photographs) monthly for visual changes. If changes are noted, it is recommended to seek Geotechnical advice. This task could be incorporated into the monthly maintenance plan.

To ensure public safety, it is recommended that the current fence be maintained and signs be installed warning the public of the potential for slides to occur. If additional shallow slides occur, a setback of the fence should be provided to maintain the stability of the fence.

Table 5.1

Item Description	Cost
a. Removal of remaining car hulks and appliances at bottom of slope (optional)	$25,000
b. Site maintenance program (including clean-up of litter, maintenance of tables, and signs)	$8,000 (annually)
c. Installation of bins	$5,000
d. Monthly monitoring for litter and vandalism prevention	$6,000 (annually)
e. Drainage study	$7,000
f. Geotechnical monitoring	$3,000 (annually unless combined with maintenance visits)

6.0 NEXT STEPS

After reviewing the results of the site Investigations and geotechnical reports, Focus does not see any significant issues at the lookout location. There is, however, one last action that should be undertaken prior to concluding the feasibility review of the parcel:

1. Focus recommends completing the drainage study before the purchase of the land. By completing this study, the PRRD will have estimated costs to mitigate the surface runoff issues that are still affecting the slope.

7.0 Closing

We trust this short report has summarized the results of work completed for the site and provides relevant information regarding the potential purchase of the lookout. We are more than happy to discuss these results in further detail with you at any time and expand on the remediation suggestions, estimated costs and next steps.

Sincerely,
FOCUS CORPORATION

Britney Garberg, EIT
Project Engineer

Pam Astbury, P. Eng.
Senior Review

September 25, 2012

Northern Geo File No: NG820

Focus Surveys
10716 100TH Avenue
Fort St. John, BC
V1J 1Z3

Attention: Mr. Graham McCoubrey,

Re: Preliminary Desktop Geotechnical Assessment for Proposed Lookout Upgrade
Peace River Valley
Approximately LSD SW 1/4-19-083-18 W6M
100th Street, Fort St. John, BC

1.0 INTRODUCTION

Northern Geo Testing & Engineering Ltd. (Northern Geo) presents herein the results of our preliminary desktop geotechnical engineering study for the proposed developments at the Peace River Lookout, located approximately at LSD SW 1/4-19-083-18 W6M in Fort St. John, BC. This report provides a summary of the geotechnical conditions based upon review of available literature and based upon observations made during our ground-based visual assessment, and provides a summary of our comments and recommendations related to the proposed developments. Attachments to this report include a regional map and four ground-based photos. This report has been prepared for use by the Peace River Regional District (PRRD), and any third party decisions based upon this report are the responsibility of that third party.

1.1 General

At the request of Mr. Graham McCoubrey of Focus Corporation (Focus), Northern Geo has undertaken a preliminary desktop geotechnical assessment to evaluate the overall stability of the existing lookout in light of the new developments and upgrades proposed by the PRRD. The general location of the existing lookout is south of the southernmost end of 100th Street, south of the Fort St. John, BC city limit at the crest of the Peace River valley slope. Road access to the existing lookout is south from the Alaska Highway via 100th Street from Fort St. John, to the crest of the valley slope at the end of the existing gravel road. The area that was assessed and which is discussed below is shown on Figure 1 and Photos 1 and 4 (all attached at the end of this report).

The preliminary desktop geotechnical assessment consisted of visual observation of the terrain from the ground, a literature and map search of available geological and geotechnical information, a review of survey monitoring data provided by Focus, and a review of historical aerial photography of the area. Other investigations, including geotechnical drilling, reviews of other parts of the proposed developments,

soil sampling and stability modelling were not undertaken and were outside of the scope of the current geotechnical assessment.

The purposes of the preliminary desktop geotechnical assessment of the existing Peace River lookout were to provide geotechnical discussion and input into the following:

1. Evaluation of slope stability conditions based upon a visual assessment conducted on-site and upon available geological and geotechnical information.

2. The overall geotechnical feasibility of undertaking improvements and developments at the above noted location.

3. Identification of potential geotechnical and/or geological concerns in the above noted area that might preclude the construction of the proposed site developments.

4. Further geotechnical investigations if required.

1.2 Background & Methodology

On August 16, 2011, a preliminary ground-based visual geotechnical assessment of the existing lookout area was conducted on site to determine the general geotechnical conditions at the site, to determine the locations for an array of survey monitoring points, and to assess prior land use and previous earthworks/other improvements that have been ongoing at the site. A follow-up field visit to the site was undertaken on August 9, 2012 to review some of the improvements that had been undertaken during the spring and summer of 2012, and to assess changes in the stability conditions of several slide areas around the perimeter of the lookout area.

A review of available mapping and published regional geological information was also undertaken following the field work to supplement the field observations. Further historical data was obtained by reviewing stereographical aerial photographs in the archives at Front Counter BC in Fort St. John (photography from 1976, 1990 and 2005). A historical geotechnical report written in 1986 by Aquaterre Consultants Inc. was also reviewed to help determine the extent of previous geotechnical work in the area.

Additionally, a review of survey data provided by Focus was also undertaken to assess the observed movements at specific locations around the perimeter of the existing lookout. Many of the survey points were destroyed during fall and/or winter of 2011/2012 due to other activities being undertaken on the site (including but not limited to dumping of loose soil and fill into the slide areas, snow clearing operations, installation of new fences and site grading), and therefore there are some gaps in the available survey information.

2.0 SITE CONDITIONS

2.1 Location and Topography

The proposed developments at the Peace River lookout are located south of the city of Fort St. John, and the lookout at the crest of the valley slope is situated on the south edge of a nearly flat to gently sloping upland plateau approximately 220m above the Peace River channel elevation. Figure 1 shows the existing lookout and Photos 1 and 4 show selected terrain features.

2.2 Geology

2.2.1 Bedrock Geology

Published regional geological information[1] indicates that the study area along the Peace River at the lookout area is underlain by shales of the Shaftesbury Formation. Also known as the Sully Formation, the bedrock consists of dark grey, sideritic (iron-rich) marine shales. The Sully Formation shales tend to weather recessively and are generally low strength, with interbedded high plastic and bentonitic clay layers. The high plastic clay layers form sliding surfaces for numerous very large deep-seated slides in many areas of northeastern British Columbia, particularly along the Peace River and its tributaries. The clay layers are typically located approximately 200 meters below the bottom of the overlying Dunvegan Formation. This depth interval is typical of the depth of the Peace River valley in the study area, and numerous large deep-seated slides have been documented in the area.

The Sully Formation shales are present under the lower to middle valley slopes and valley bottom areas along the Peace River near the existing lookout. Sully Formation shale typically weathers recessively and is, therefore, often not exposed. However, it can be observed in the deeply incised draws to the east of the lookout. Based upon the available stereographical aerial photographs, survey monitoring, and field observations, deep-seated movement related to the bedrock does not appear to have retrogressed to the existing lookout. However, deep-seated movement has occurred in many areas around and adjacent to the lookout, and therefore it is still considered to be a significant factor with respect to the terrain stability at the site. Further discussion of the stability conditions at the site is presented below.

[1] Stott, D.F., 1982. *Lower Cretaceous Fort St. John Group and Upper Cretaceous Dunvegan Formation of the Foothills and Plains of Alberta, British Columbia, District of Mackenzie and Yukon Territory.* Geological Survey of Canada, Bulletin 328.

2.2.2 Surficial Geology

The following descriptions of the surficial soils are based upon literature review, and upon the visual geotechnical assessment which included the following:

1. Visual reconnaissance of soil exposures in the area including small road cuts and eroded river/creek banks.
2. Previous work done in the surrounding area.
3. Published geological mapping[2].

The surficial soil deposits observed at the lookout area include the following (from youngest to oldest):

Glaciolacustrine sediments: in this area consisting of clay with some thin silt varves and layers, these materials were deposited in the standing water of a glacial lake that was present during and/or following the last glaciation in the area. These soils tend to be layered, and consist mainly of medium to high plastic, silty clay. In previous geotechnical drilling investigations along the Peace River several kilometers further downstream, and to the north in the City of Fort St. John, the glaciolacustrine materials have been found to extend for up to several tens of metres. The glaciolacustrine soils overlie and/or contain pockets of glacial till and/or boulders that have been dropped into the glaciolacustrine deposit from floating ice.

Glacial Till: consisting of a medium plastic clay matrix with variable quantities of sand, gravel and occasional boulders, the clay till occurs in the upland areas beneath or within the glaciolacustrine sediments. The clay till is typically denser than the glaciolacustrine sediments and contains larger quantities of gravel, cobbles and boulders.

Interglacial sands and gravels: deposited by flowing meltwater between episodes of glaciation, these include the sand and gravel accumulations observed at the ground surface to the east of the lookout where sand and gravel extraction has occurred in the past. These deposits generally underlie the glaciolacustrine deposits and tills, but further upstream along the Peace River, these deposits have been observed within the till deposits.

2.2.3 Geological Setting

The Peace River lookout is within the preglacial valley of the Peace River which, in some areas, was much broader than the present-day valley. In northeastern BC overall, the valleys of the Peace River and its tributaries (including the Moberly River, the Beatton River, the Pine River and others), appear to have undergone extensive erosion prior to the last glaciation, which left the valleys deeper but also wider than the current valleys. During the multiple ice advances and retreats of the last glaciation, these valleys have been partially backfilled by a combination of glacial till, glaciofluvial and glaciolacustrine sediments. The glacial till and other sediments have, in places, buried the bedrock surface and any preglacial and interglacial sediments under a significant thickness of overburden.

[2] Mathews, W.H, 1978. *Surficial Geology, Charlie Lake, Peace River District, British Columbia*; Geological Survey of Canada, Map 1460A.

During and following the final deglaciation in the area, fluvial erosion by the Peace River and its tributaries has removed part of the valley fill and locally exposed the bedrock at the edges of the preglacial valley. However, in many areas along the Peace River, the preglacial valley remains infilled with a substantial thickness of clay till and glaciolacustrine sediments with relatively thin deposits of modern alluvial sediments (sands and gravels) in the present-day valley bottom. Erosion of the valley fill materials, and in some cases the underlying shale bedrock by the Peace River, has caused widespread landslide activity along much of the Peace River valley.

3.0 GEOTECHNICAL OBSERVATIONS, DISCUSSION AND RECOMMENDATIONS

3.1 General

Figure 1 and Photos 1 and 4 show the location of the Peace River lookout that was observed in the field and reviewed in the available literature and aerial photography.

3.2 Stability

There were numerous locations around the perimeter of the existing lookout and at locations along the Peace River visible from the lookout where slope movements were taking place. In general, three types of slope failures were observed to be occurring, or have been documented in the area:

1. Very large, deep-seated, slow moving translational slides in the weak shale of the Sully Formation.

2. Shallow to moderately-deep translational slides in silty clay soils.

3. Earthflows.

The various types of slides and the geotechnical implications with respect to current and future improvements at the lookout are discussed in the following sections.

3.2.1 Deep Seated Instability

Large natural deep-seated translational slides in the bedrock of the Sully Formation are present in many of the valleys in the Fort St. John area. Similar post-glacial slides are common in northeastern British Columbia and are typically hundreds to thousands of years old. The slides are several hundreds of meters to a few kilometers long and extend from the valley bottom to the upland areas.

Based upon past investigation of deep-seated slides elsewhere along the Peace River which included the use of installed instrumentation, the near-horizontal high plastic clay beds sometimes found within the Sully Formation may form the basal failure surface. The slides typically retrogress back into the overlying sandstones and/or overburden sediments, producing tension cracks.

The deep-seated slides previously investigated in the area typically exhibited the following characteristics:

1. The slides were relatively deep-seated with maximum depths below the upper valley slopes of up to 200m or more. The toes and lower parts of the slides appeared to be close to or below the valley bottom or river elevation.

2. The slide crests usually extended a short distance back into the upland area. Tension cracks along the crests of the valley slopes indicated the approximate upper extent of the slides.

3. Within the slide masses, there were numerous features related to sliding activity including grabens (downdropped blocks), tension areas and side scarps, as well as smaller and shallower secondary slides. Many of the blocks within the deep-seated slides were very large and relatively intact, although they had been subject to appreciable translational movement.

4. The slides typically moved at slow rates (few to several mm/year to less than 1 m/year). However, during extended periods of unfavorable precipitation and/or rapid snow melt, similar deep-seated slides have been known to move up to several tens of meters in one day.

3.2.2 Shallow Translational Slides & Earthflows

Shallow to moderately deep-seated slope failures (shallow in comparison to the deep-seated slides) are also common along the Peace River, and active examples were visible extending up to the south edge of the lookout. These are typically translational slides with depths ranging from a few meters to perhaps 10 to 20 m, lateral extents of 20 to 100 m, and lengths of 50 to 100 m or more. The smaller translational slides typically move more rapidly than the larger deep-seated slides and movements in excess of 1 to 3 meters per year may occur, particularly during years of unfavorable precipitation. In extreme cases, some of the smaller translational slides may move several meters in a day.

Many of the shallow to moderately deep-seated slides occur as secondary slides within the deep-seated slide areas. Weakening of the soils due to the movement of the larger slides and appreciable groundwater seepage along the boundaries of the deep-seated slide blocks may be factors in the development of many of the smaller slides.

Earthflows are similar to the shallow translational slides except that more or less complete disruption of the overall soil fabric has occurred, resulting in a flowing soil mass, rather than slide blocks. Earthflows typically occur in wet soils containing considerable proportions of silt, clay and/or organic material. They generally tend to occur in areas where seepage has been significant or where surface water has been redirected to flow into areas of loose or disrupted soils. Evidence of recent earthflows was observed along the south, east and southeast sides of the lookout where it appeared that loose soils had been dumped into previous slide areas an uncontrolled manner. The dumped material had subsequently become weakened by rainfall runoff, and slid down the valley slope. The movement rates may be in the range of a few meters per week to several meters per day, depending upon rainfall amounts.

3.3 General Implications of Slides Relative to Lookout Improvements

As discussed in the foregoing, there are three types of sliding that are occurring, or have occurred, near or adjacent to the existing Peace River lookout. All three of these types of slides appear to have the potential to negatively impact the existing lookout area; however, from visual review of the site on the ground during the summers of 2011 and 2012, the slides appear to have affected only the perimeter of the site. Review of historical stereographical aerial photography[3] indicates that human activity has caused changes in the stability conditions around the south, east and southeast perimeters of the site due to uncontrolled dumping of loose/high moisture level soils and other debris, and changes have been made to the surface drainage conditions by ditching and road surface upgrades. This soil dumping and additional surface drainage appear to have caused accelerations in the movement and retrogression rates of the shallow to moderately deep slides and earthflow slides, as evidenced by open tension cracks and recent earthflows (see Photos 1 to 4), and the need to reconstruct the new chain-link fencing with an additional setback from the crest of the slope after slide activity had removed support from the fence foundations.

While a geotechnical report by others[4] has indicated that deep seated slides may have affected parts of the Old Fort Subdivision (located downslope from the existing lookout), and that this sliding could retrogress further upslope in future, at the time of this writing, the deep-seated sliding does not appear to have retrogressed upslope to the lookout area, based solely upon visual review of the site. Survey monitoring by Focus suggests that there has been some soil movement in the area between August 2011 and July of 2012; however, no clear conclusion can be drawn from the data to clearly indicate or preclude the occurrence of deep-seated movement during the time period that the survey monitoring was undertaken.

There is evidence of active shallow to moderately deep sliding and earthflows occurring around the perimeter of the site as shown in Photos 1 to 4. Survey monitoring by Focus appears to indicate that there are small movements occurring around the perimeter of the lookout, although the movements were only in the 1 to 2mm range. Therefore it is considered that while survey monitoring has probably detected the shallower movements, the dataset appears too small to draw definite conclusions, and hence surveying over a longer period of time may be necessary.

Based upon visual assessment, the active shallow to moderately deep-seated slides could, over time, retrogress further upslope and into the site if drainage conditions were subject to change, slope geometry were to change (due to dumping of more fill into the slides), or particularly if additional drainage were to be directed into the active slides. The deep seated sliding occurring regionally along the Peace River could, in theory, also retrogress onto the site in response to changes in the Peace River channel or in response to extreme weather events.

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[3] Front Counter British Columbia; 1976 - BC7836 Photo # 300/301; 1990 - 15BCB90002 Photo #66/67; 2005 - 15BCC05129 Photo # 50/51.

[4] Aquaterre Consultants Inc., 1986, *Hazard Assessment Report Old Fort Subdivision South of Fort St. John, British Columbia*; Peace River-Liard Regional District, File Number 85072.

In summary, there is the potential for slide movements to affect the site at some time in the future given its very close proximity to active sliding. Since slide activity usually occurs slowly, and since there are often signs of movement initiation in the form of changes in ground surface topography and/or tension cracks, the risk of slide activity at the lookout which could cause danger to the public is considered to be low, but it is definitely not zero. Therefore it is critical that PRRD must recognize that there is some inherent risk in further developing the lookout area, and by inviting additional people to visit the site.

In the interests of helping to improve public safety and for “due diligence” purposes, it is recommended that PRRD should continue some form of annual monitoring of the site, and appropriate signage should be posted along the access route and on the existing fences warning the public of the potential for slides at the site. As well, the fences should be maintained and set back as necessary if additional shallow slides occur which threaten to reduce that stability of the fence.

It is considered that the most effective and cost efficient type of monitoring for the site would be have experienced PRRD personnel visually monitor the site on a monthly basis, and to seek geotechnical advice if changes are noted. Additionally, PRRD may wish to consider the installation of permanent survey monitoring points that could be monitored annually to check for changes in the ground surface over the whole area of the site. Should annual survey monitoring show significant changes, then additional monitoring could be undertaken at shorter intervals, and/or ground investigations, possibly including geotechnical drilling and Slope Indicator installations could be considered. As discussed in previous correspondences, Slope Indicators are costly to install and monitor, and while they give very detailed movement data to significant depths, they only provide that data for a localized location, whereas survey monitoring can return data over a larger area at a reasonable cost. Further, Slope Indicator installations would be difficult to protect from damage and vandalism, which appears to be a consideration at this site. Should future survey monitoring show that movements in the lookout area are changing or increasing, or if additional developments are proposed for the site in the future, PRRD may wish to obtain additional geotechnical advice and possibly install Slope Indicators at specific locations.

4.0 CONCLUSION

The recommendations presented in the foregoing geotechnical report are based upon a geotechnical evaluation of the conditions observed during the site investigations noted, and which were undertaken at the request of Focus Surveys. If geotechnical conditions other than those described above are encountered during subsequent phases of the project, Northern Geo Testing and Engineering Ltd. should be notified and be given the opportunity to review the current recommendations and make revisions where necessary.

This geotechnical report has been prepared for the exclusive use of Focus Surveys, the Peace River Regional District and its representatives for specific application to the above-described study area. Any use of this report by others, or any reliance on or decisions made based upon it, are the responsibility of such third parties. Northern Geo Testing and Engineering Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based upon this geotechnical report. It has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

Respectfully submitted,

Northern Geo Testing and Engineering Ltd.

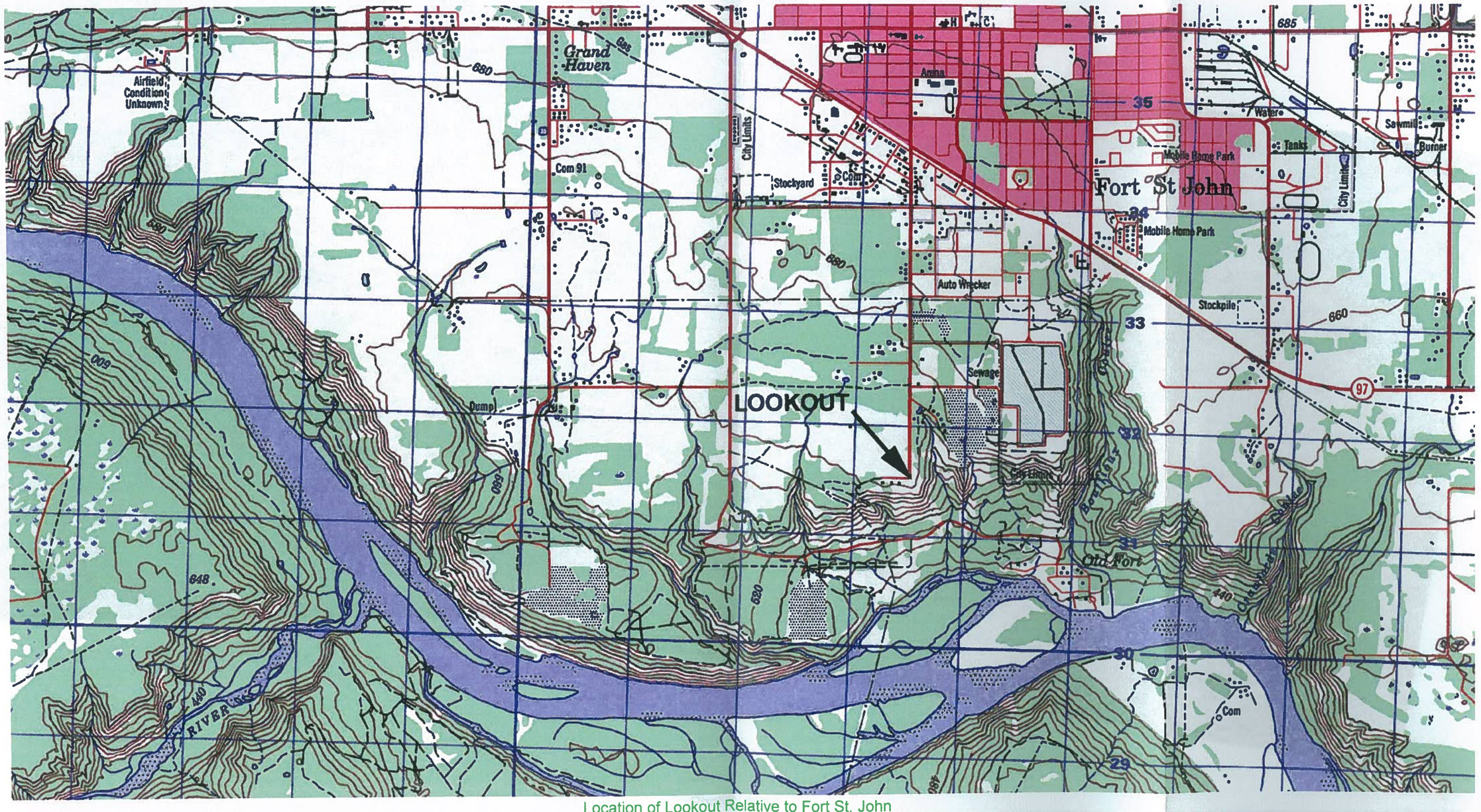
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. S. GRANDBERG
20575
25 Sep 2012

Per:

Dustin McDonald, P.Eng.
Geotechnical Engineer

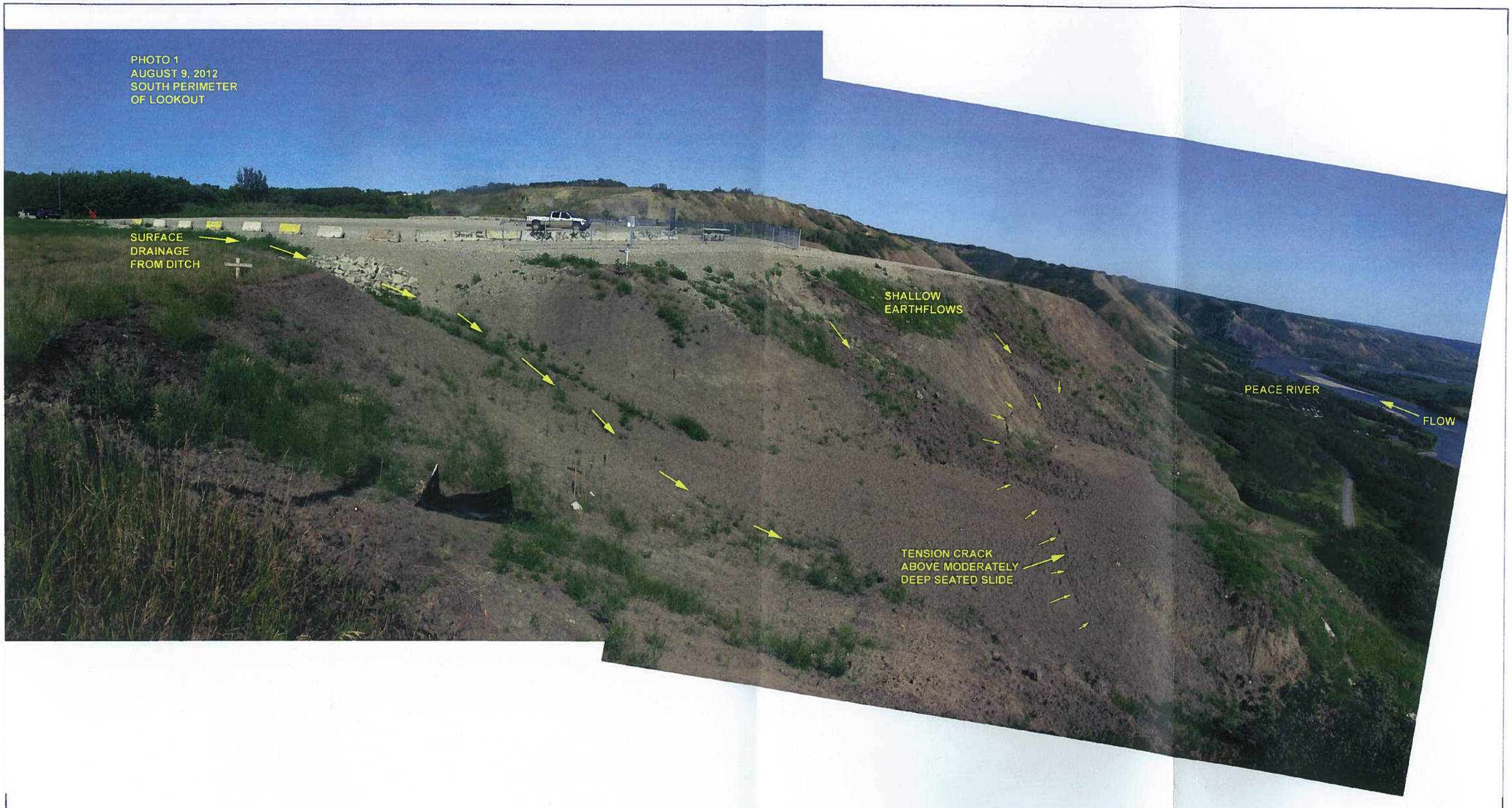
Darryl Grandberg, P.Eng.
Senior Geotechnical Engineer

Attachments: Figure 1
Photos 1 and 4



Location of Lookout Relative to Fort St. John

NORTHERN Geo Testing & Engineering Ltd. 250.261.6615	Client: Focus Corporation, 10716 100th Ave, Fort St. John, BC, V1J 1Z3	DWN BY: CD CHK'D BY: MR APP.: MR SCALE: NTS	Fort St. John Lookout	DATE: Sept 18, 2012 PROJECT NO.: NG820 REV. NO.: - FIGURE No.: FIGURE 1



Photograph 1

NORTHERN Geo Testing & Engineering Ltd. 250.261.6615	*Client* Focus Corporation 10716 100th Ave Fort St. John, BC V1J 1Z3	DWN BY: CD CHK'D BY: MR APP. MR SCALE NTS	Fort St. John Lookout	DATE: Sept 18, 2012 PROJECT NO: NG820 REV. NO.: - FIGURE No. FIGURE 2

Photograph 2

NORTHERN Geo Testing & Engineering Ltd
250.261.6615

Client

Focus Corporation
10716 100th Ave
Fort St. John, BC
V1J 1Z3

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APP:	MR
SCALE	NTS

Fort St. John Lookout

DATE:	Sept 18, 2012
PROJECT NO:	NG820
REV. NO.:	-
FIGURE No.	FIGURE 3

PHOTO 3
AUGUST 9, 2012
SOUTH PERIMETER
OF LOOKOUT

Photograph 3

NORTHERN Geo Testing & Engineering Ltd. 250.261.8615	*Client* Focus Corporation 10716 100th Ave Fort St. John, BC V1J 1Z3	DWN BY: CD CHK'D BY: MR APP: MR SCALE: NTS	Fort St. John Lookout	DATE: Sept 18, 2012 PROJECT NO: NG820 REV. NO.: - FIGURE No. FIGURE 4

Photograph 4

NORTHERN Geo Testing & Engineering Ltd 250.261.8815

Client

Focus Corporation
10716 100th Ave
Fort St. John, BC
V1J 1Z3

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DATE:	Sept 18, 2012
PROJECT NO:	NG820
REV. NO.:	-
FIGURE No.	FIGURE 5