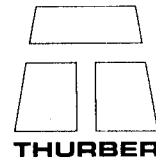


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November 7, 2003

Fraser Valley Regional District
8430 Cessna Drive
Chilliwack, BC
V2P 7K4

Attention: Mr. M. Rowlands, P.Eng.
Manager of Environmental Services

FVRD - INCOMING MAIL	
1450-56	
☐ Executive	☐ Finance
☐ Administration	☐ Community Services
☐ Planning	☐ Building
	☐ Recreation
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**EMERGENCY RESPONSE TO OCTOBER 16-18 DEBRIS FLOOD
AT 35900 DALE ROAD, HATZIC VALLEY**

Dear Sirs:

At your request on November 5, Thurber Engineering Ltd. (TEL) reviewed the effects of a recent debris at the above location in the Fraser Valley Regional District (FVRD). The site is at the foot of Dale Creek, one of 6 creeks now known to have generated debris floods or debris flows in residential areas on the east side of Hatzic Valley. The events occurred on or about October 16-18, 2003. This report is supplemental to one submitted to the FVRD on October 31.

The primary goal of our work is to determine if a residence at 35900 Dale Road, immediately below Sylvester Road, is exposed to continuing flood and debris hazards and particularly to recommend, if necessary, that the home should be temporarily vacated until further engineering assessment is conducted. We understand the owner contacted FVRD staff whilst TEL was evaluating hazards on 5 other creeks to the north.

We were also asked to assess broad landslide and flood hazard issues and to estimate approximate costs of required engineering and repair work. Our recommendations and estimates are provided in Section 3. Sections 1 and 2 give background information. The Creek is located on Figure 1; Figure 2 is a sketch map of the area.

We inspected the area and met the landowner on November 6. We have studied aerial photos of the area but no helicopter inspection was conducted.

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In light of our report findings, we recommend that the creek and its basin should be inspected and photographed from a helicopter as soon as possible.

The subject residence is in an inappropriate location with respect to creek flood and debris hazards. The recent adversities appear to have been generated by a combination of creek flooding and discharges from roadway ditches. We cannot yet sort out the relative importance of these sources but this can be done with further work. Debris has now filled the channel of Dale Creek. In our judgment, hydraulic investigation of the creek and clean-out of the channel are urgently required to protect the subject home if it is to be occupied.

Use of this report is subject to the enclosed Statement of General Conditions.

1. BACKGROUND

1.1 Area and Event Description

The Dale Creek event is reported to have occurred during a period of intense rain on late afternoon of October 17. Similar, but much larger events occurred on creeks to the north on the same day. The land owner reports that a Ministry of Transportation contractor was working on Sylvester Road apparently trying to control creek flood and ditch water just prior to the climactic flood event which washed out the outer (west) side of the road.

Creek and roadway debris descended the channel located immediately behind the subject residence (Figure 2). The creek flows along the base of Sylvester Road fill and is confined on its right (west) side by a low gravel dyke that protects the adjacent house from low magnitude creek floods. The subject house is constructed of cinder block. There is a wood frame outbuilding (a garage) just south of the house. The creek also flows along the side of the outbuilding. Most of the family (including 2 children) occupy the house; one child occupies the outbuilding.

The October 17 event filled the creek channel, breached the low dyke and allowed water, mud and debris to break out on each side of the house. Water and debris alarmed the residents. Up to about 0.6 m of sand, gravel and cobble debris was deposited on each side of the

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house. More debris ran down the channel and spread into a field to the south of the house. Much of the house area debris had been removed by the owners by the time we inspected the site.

Water and debris apparently caused nuisance damage but it also entered two house sub-floor vents on the north side of the house. This material apparently plugged the sub-floor area and may have caused some inside floor damage.

The flood did not destroy the old (but apparently plugged) Dale Creek culvert beneath the paved surface of Sylvester Road. The west side of the road appears to have been washed out by water that crossed the road just south of the culvert. Some of the water apparently originated in a north-flowing ditch along the east side of Sylvester Road and some turned onto the road from a gravel driveway that ascends the hill just south of Dale Creek. Thin soil along the uphill edge of the driveway was eroded to bedrock. It will be very important to determine the ditch water sources when considering remedial works.

At the time of our inspection, the old Dale Creek culvert had been removed and a larger concrete culvert installed. Ditches had been re-excavated along the east side of Sylvester Road and the road fill had been rebuilt. As noted above, the downstream creek channel is filled with debris. The subject house and its adjacent creek are very sensitive to creek behaviour, including the effects of Sylvester Road drainage works. This sensitivity is a direct consequence of the unfortunate house location.

1.2 Dale Creek Hazards

Dale Creek is shown on Figure 1. It originates in a valley head some 800 m in elevation above Sylvester Road. Available topographic maps indicate that it follows a linear, 850 m long path above Sylvester Road. Contour measurements indicate that the average channel gradient is about 14° horizontal. As noted in Section 1, we did not inspect the creek and its upper basin so we do not know the magnitude of debris activity that originated there.

The Dale Creek flood was preceded by a week or so of heavy rain. There was probably no snow on mountain slopes but antecedent rainfall

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conditioned adverse ground and surface water regimes on the highest mountain slopes so landslides and floods occurred during a final period of extreme rainfall. The estimated return periods of antecedent and triggering rain falls are unknown at this time but they probably exceeded 100 years.

1987 aerial photos in TEL's library (BC 87084 70-71) indicate that there was activity (erosion or debris deposition) on the upper branches of the creek. A portion of the basin rim was clear cut and there was a small patch clear cut in the lower basin north of the creek. The lower channel was forested but we interpret it to be incised in old debris fan material. In the field, we noted that a debris fan appears to radiate south to north, around the subject house on the Hatzic Valley floor. The fan is not clearly shown on the small scale aerial photos.

Recent events show the subject house is exposed to creek flow and debris floods. Our map and photo observations suggest that it may also be exposed to an unacceptable risk from higher energy debris flows. To some degree, this issue may be clarified by helicopter observations. This effort should also document any development activity along the lower creek above Sylvester Road.

In our judgment, the Dale Creek channel system is now heavily surcharged with sediment and it will need immediate and detailed creek hydraulic maintenance in anticipation of pending winter and longer term creek flows.

2. REMEDIAL WORK DESIGN AND CONSTRUCTION

2.1 General

In general, we recommend that Dale Creek channels and flood ways be rebuilt or restored to allow transport and deposition of new debris and flood water during the coming winter.

2.2 Anticipated Work Requirements

In our judgment, detailed Dale Creek remediation work (like other areas to the north) will require acquisition of large scale topographic mapping (e.g. 1:2,500 scale with 2 m contours). The work will also require field

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survey and geologic mapping of the mountain slope, creek channel and surrounding area with helicopter support.

Pending winter weather is likely to preclude intensive field investigation on high and very steep mountain slopes. However, considering the vulnerability of the subject residence, we recommend that detailed follow-up work be given very high priority.

In our judgment, creek and debris hazards in the subject area would have been identified by overview and detailed engineering and geoscience studies prior to the recent occurrences. We recommend that follow-up engineering work be conducted by BC professional engineers and geoscientists with training or experience in:

- Creek hydraulics and river engineering
- Landslide hazard and risk assessment with particular reference to debris flows
- Forest road deactivation and steep land reclamation work.

If old forestry works on the upper slopes are implicated in hazard initiation, in our judgment, the works should be investigated as soon as possible because winter snow and rain may degrade evidence for the actual timing and relative importance of logging-related hazard occurrences. This work will also be important to gauge the need for road deactivation and land reclamation work to limit downstream risks.

We suggest that immediately required work may cost at least \$40,000, including helicopter charges. As noted above, we recommend this work channel maintenance and house protection recommendations be given a high priority.

We cannot estimate costs of required remedial work until we conduct a helicopter inspection. However, we estimate that costs will be a minimum of \$175,000.

3. RECOMMENDATION FOR PUBLIC HEALTH AND SAFETY

There are a number of uncertainties about the origin and magnitude of Dale Creek floods and possible debris flows. At this time, we recommend that the subject house be vacated at least until a more

Continued.....

Fraser Valley Regional District

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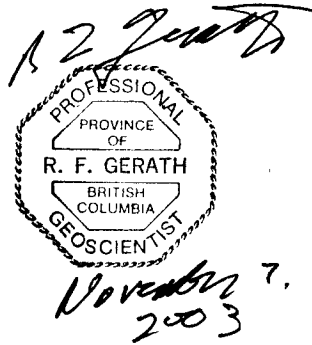
November 7, 2003

detailed hazard and risk assessment is conducted and after the Dale Creek channel and flood ways are restored to allow transport and deposition of new debris and the flood water during the coming winter.

We trust this information meets your present needs. Please do not hesitate to contact us if you have any questions.

Yours very truly,
Thurber Engineering Ltd.
D. Smith, P.Eng.
Review Engineer


Robert F. Gerath, P.Geo.
Engineering Geologist and Associate



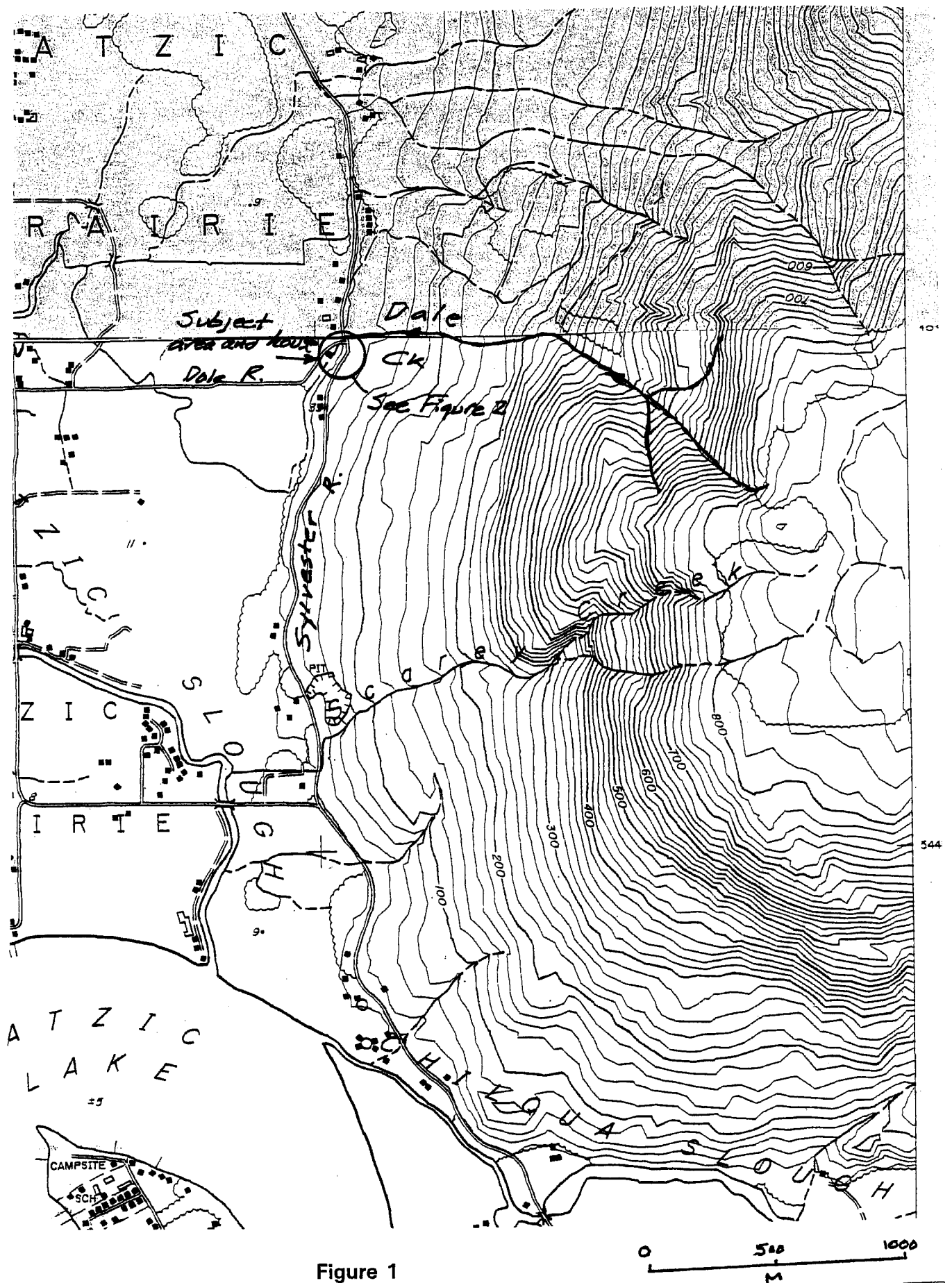


Figure 1
Dale Road, Dale Creek and Sylvester Road Area
Location Plan

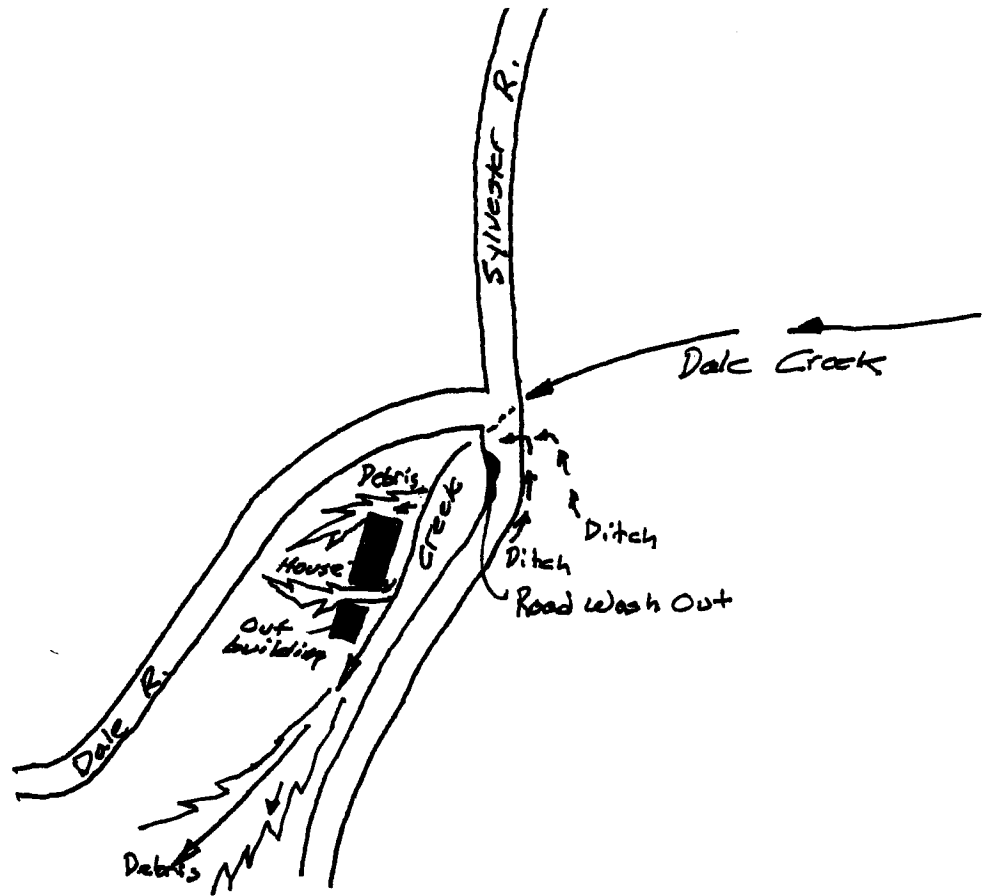


Figure 2

Sketch showing Dale Road, Dale Creek and Sylvester Road Area with road ditches, Sylvester Road washout, and debris tracks below the road and adjacent to subject house and out building. There is a low gravel dyke between the buildings and the lower creek. The dyke was breached by water and debris in the October 17 flood.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, findings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

(a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.