CW500 Block Assessment
Beech Creek

- TimberWest Forest Corp. -

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Block Assessment of WF500 Beech Creek

TimberWest Forest Corp.

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Prepared for:

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1. Executive Summary

Block CF500 located on Beech Creek, a tributary to Comox Lake was inspected on June 22nd, 2007 at the request of Mr. Stuart Macpherson, Executive Director of the PMFLC. Block CW500 is located on Managed Forest Land owned by TimberWest Forest Corporation. Riparian tree retention and channel bank stability were assessed along Beech Creek within the Block due to concerns about harvesting within the riparian area. A professional opinion with respect to the potential for, and magnitude of, downstream impacts to water quality and fish habitat is provided.

Fisheries and Water Resources:

Although no fish sampling was conducted during the June 22nd site inspection, TimberWest staff stated that resident trout are present at the site. Beech Creek is also within the Comox Lake Community Watershed.

Tree Retention:

The Block was logged in 2005. Trees were hand-felled and then yarded with a helicopter. The left bank (left when facing downstream) was completely logged and no trees were retained in the riparian area. The Council Regulation requires that a minimum of 20 trees be retained adjacent to the stream channel for every 100 meters of stream length. These trees must have a diameter of at least 30 cm and be representative of the pre-harvest stand with respect to size distribution and species mix. A stump count conducted by TimberWest staff indicates that there were a sufficient number of trees prior to harvesting that could have been left to meet the retention requirements.

Stream Bank Stability:

The stream has a semi-alluvial channel with non-erodable banks. Large woody debris (LWD) in the channel has formed two log jams and these log jams are acting to store sediment (gravel and cobble) in the stream channel. It is concluded that the removal of streamside trees did not destabilize the channel banks and that future bank destabilization (increased bank erosion) is not expected in the future.

Impacts to Fish Habitat and Water Quality

It is concluded that fish habitat and water quality within the Block were not measurably affected during or since logging. The future consequence of riparian harvesting, however, is difficult to predict. There has been a reduction in the amount of large wood that can enter the stream channel until riparian trees grow back (approx. 100 years). The two log jams in the Block are acting to provide both rearing and spawning habitat. It is possible that trees retained on the right bank during past logging, combined with upstream sources of LWD, will provide sufficient LWD to maintain the current channel characteristics.

Alternatively, if the riparian harvesting within the Block has reduced the source of LWD so that the log jams are lost, or become less substantial, then there may be a loss of spawning and rearing habitat. It is concluded, however, that this loss would not be significant when considered within a watershed context. Finally, it is concluded that harvesting the riparian area in the Block did not

result in measurable impacts to downstream water quality or fish habitat, and that future impacts are not anticipated.

2. Introduction

This report summarizes the results of an assessment of harvest block CW500 on Managed Forest Land owned by TimberWest Forest Corporation. This area will be referred to as the "Block" in this report. The Block is adjacent to Beech Creek which flows directly into Comox Lake, approximately 17 kilometers southwest of the Town of Courtenay on Vancouver Island.

The assessment was conducted at the request of Mr. Stuart Macpherson, Executive Director of the PMFLC. I visited the Block on June 22nd, 2007 with Mr. John Phillips, Manager, Forestry Programs for TimberWest, and Mr. Gary Lawson, Operations Planner for TimberWest.

The purpose of the Block assessment was to:

1. assess the streamside tree retention with respect to compliance with PMFLC regulatory requirements;
2. assess the stability of the stream banks where harvesting had occurred; and
3. provide written comments on any potential fish habitat protection concerns or water quality implications for the Comox Lake Community Watershed.

3. Block Layout and General Site Description

The Block is located on a south-facing slope on the north side of Comox Lake. The area of the Beech Creek watershed is 1,660 hectares and is located in Managed Forests 8 and 65 (TimberWest Site Review Summary dated June 8, 2007). The clearcut area of the Block is 5.2 ha and harvesting occurred during 2005 (Figure 1).

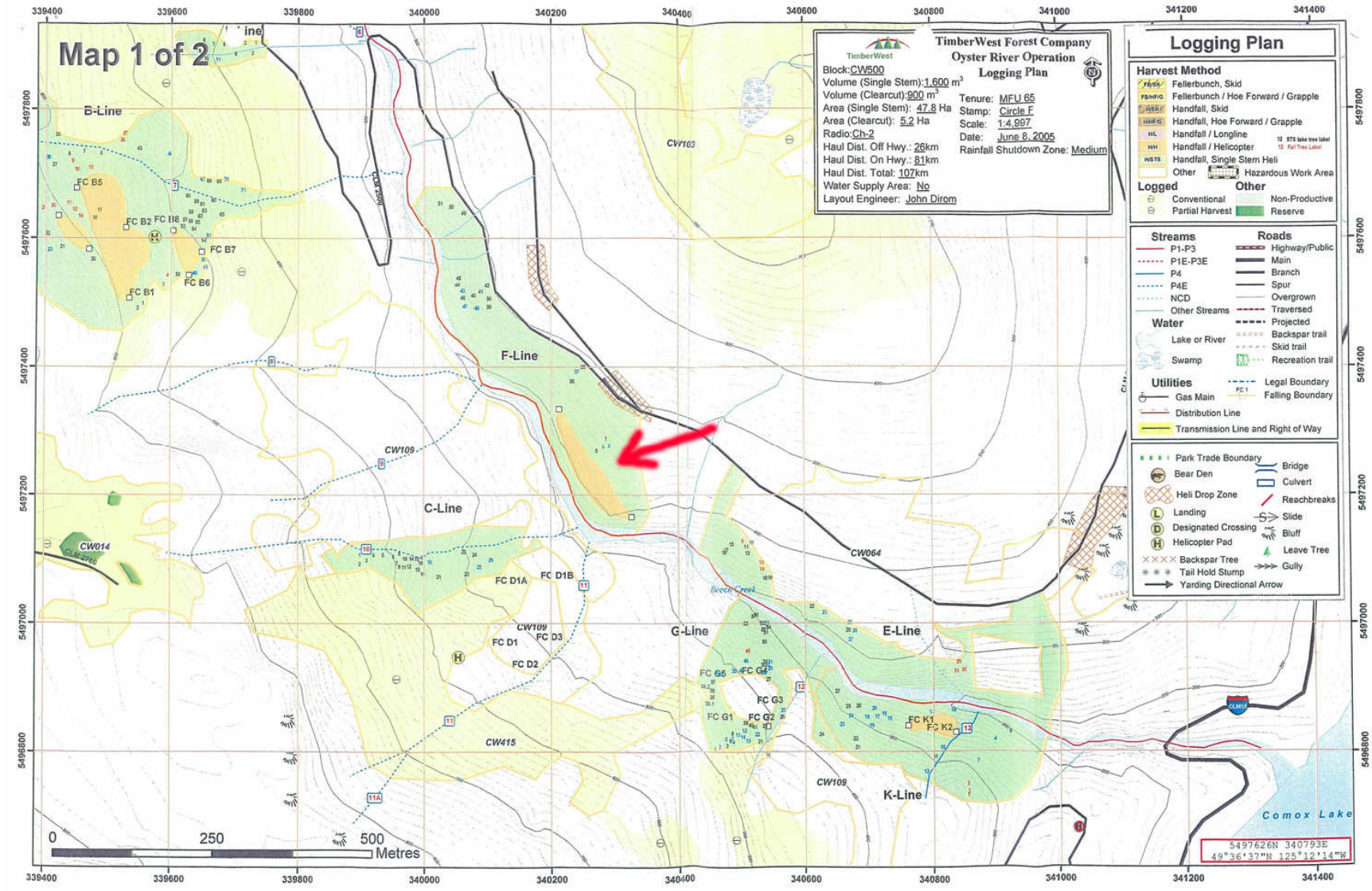
The Block was hand-felled and aerially yarded with a helicopter. It is my understanding that helicopter yarding was used due to concern for building and using a road on the steep slopes within the Block. Slopes within the Block range from approximately 45% to 90%.

The Beech Creek flows in a southerly direction (160°) and the average channel width was 14.6 m (measured at 5 locations with an optical rangefinder). The channel gradient within the Block was approximately 12%. Comox Lake is located just over a kilometre downstream of the Block. The length of riparian area harvested is approximately 200 m.

4. Fisheries Resource

No fish sampling was conducted during the June 22, 2007 site assessment and no fish were observed. It is my understanding, however, that resident trout are present in Beech Creek upstream of the Block (discussions with TimberWest staff). The 2007 Site Review Summary prepared by TimberWest states that fish inventories conducted by TimberWest show that a falls about a kilometre downstream of the Block prevents the upstream movement of anadromous salmonids.

Figure 1 CW500 Block Map. The red arrow points to the area of interest.



The Ministry of Environment Fisheries Information Summary System (FISS) contains very little information for Beech Creek (Watershed Code 920-553200-94200-47400). The database states only that the watershed supports cutthroat trout.

For the purposes of this assessment, it is assumed that Beech Creek has the potential to support resident trout adjacent to the Block.

5. Regulatory Requirements Around Streams

Regulatory requirements pertaining to streams are summarized below. Division 3 of the Private Managed Forest Land Council Regulation (Council Regulation) specifies the general requirements around all streams. Division 4 is applicable to streams that are fish streams, or are in a water supply area.

5.1. Division 3: General Requirements Around Streams

Of relevance to this report are:

1. Section 14 (2); and
2. Section 15 (described below).

5.1.1. Practices Concerning Access Structures Near Streams (Council Regulation Section 14 (2))

Section 14 (2) of the Council Regulation states that for all streams:

> An owner who constructs, deactivates or rehabilitates a road, landing, excavated or bladed skid trail or other similar access structure must ensure that the construction, deactivation or rehabilitation is carried out so as to meet the following:
>
> a. streams are maintained in their natural or existing courses;
> b. the structure does not become unstable to the extent that its instability contributes to landslide debris entering fish streams or streams in water supply areas; and
> c. excavated soil does not enter directly into streams.

5.1.2. Constraints on Activities near Streams (Council Regulation Section 15)

Section 15 of the Council Regulation states that for all streams:

> An owner who, adjacent to a stream, carries out timber harvesting or related activities, silviculture activities or road construction or deactivation activities must ensure that those activities meet all the following requirements:
>
> a. stream channel, banks and gully side walls are not destabilized or damaged;
> b. soil erosion into streams is minimized;

c. machine tracks within 5 m of the edge of the stream channel will not result in mineral soil exposure that leads to sedimentation, except at a stream crossing;
d. understory vegetation and non-commercial trees within 5 m of the edge of the stream channel are retained to the fullest extent possible unless
    i. they are a stream crossing
    ii. the area is to be subject to a planned fire,
    iii. the retention of the understory vegetation and non-commercial trees would result in
        A. damage to the stream bank
        B. damage to the stream channel, or
        C. sediment entering the stream, or
    iv. the disturbance of the understory vegetation and non-commercial trees would not result in
        A. harm to fish or fish habitat, or
        B. reduced water quality at water supply installations
e. accumulations of woody debris or slash in the stream channels do not result in
    i. harm to fish or fish habitat, or
    ii. reduced water quality at water supply installations.

5.2. Division 4: Specific Requirements for Fish Streams and Water Supply Areas

Division 4 of the PMFLCR specifies the number and distribution of trees that must be retained each side of fish streams, or streams in water supply areas. There are three categories of streams:

1. Streams less than 1.5 m in width;
2. Streams between 1.5 and 3.0 meters wide (Small Streams); and
3. Streams greater than 3.0 meters wide (Large Streams).

Beech Creek is both a fish stream and within a water supply area and therefore must be managed as a Large Stream since the average channel width is greater than 3 m (measured at 14.6 m). Regulatory tree retention requirements for a Large Stream are provided below:

5.2.1. Tree Retention Adjacent to Large Streams (Council Regulation, Section 18)

Section 18 requires that a minimum of 20 trees to be retained for every 100 m of stream length for streams that are at least 3 m wide (Large Streams). There is a hierarchy of selection preferences for these retained trees. The first preference is that the retained trees must:

1. be within 10 m of the edge of the stream;
2. be at least 30 cm in diameter;
3. be the same proportion of coniferous to deciduous as the pre-harvest stand;
4. be similar in the range of sizes as the pre-harvest stand; and
5. distributed as evenly as practicable along all of the 100 m length of stream.

If there are less than 20 trees within 10 m of the stream along the 100 m stream section there are three additional retention options described in Section 18.

6. Discussion and Conclusions

6.1. Streamside Tree Retention

No trees were retained adjacent to the left bank (facing downstream) of Beech Creek within Block CW500 (Photo 1). TimberWest has conducted and documented a detailed stump inventory and the results of this survey indicate that pre-harvest conditions would have allowed for a sufficient number of trees to be retained within 10 m of the stream channel (Photo 2).

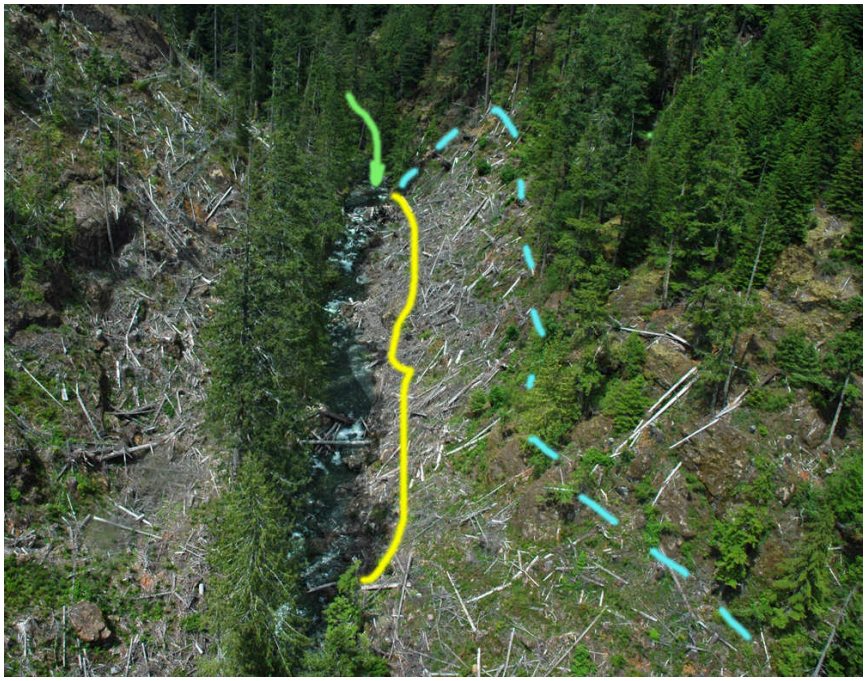


Photo 1 Aerial view of Block outlined with blue dotted line. The green arrow shows the direction of stream flow. The harvested left bank of Beech Creek is delineated with a yellow bracket.

Photo 2 Looking upstream Beech Creek at the harvested riparian area within the Block. The bank consists of large boulders and bedrock out-croppings.

6.2. Stream Bank Stability

Although trees growing on the channel banks were harvested along the left bank of Beech Creek there was very little evidence of stream bank instability. This section of the stream channel is confined by bedrock and large colluvial boulders (Photo 2 and 3).

Photo 3 Looking upstream at the Beech Creek channel near the upstream limit of the Block. The channel is confined by bedrock on both sides.

The banks of Beach Creek are stable due to the nature of the bank material. I observed one area where some minor bank, or slope, slumping had occurred (Photo 4). This slumping was small (4 square meters), did not appear to be related to water scour since it was above the average highwater mark, and may have occurred during falling or yarding. Finally, it did not appear that further slumping or bank failure would occur.

Photo 4 Small (4 m^2) of bank/slope disturbance likely related to falling or yarding.

I walked the left bank of Beech Creek for the entire length of the Block and saw no evidence of bank instability at any of the sites I inspected. It is my opinion that the removal of trees growing on the edge of the stream bank will not result in a significant change in bank erosion during or since harvesting. It is my opinion that no measurable downstream impacts to water quality or fish habitat would have occurred.

6.3. Impacts to Downstream Water Quality and/or Fish Habitat

Determining the potential impacts to water quality and fish habitat downstream of the Block requires an understanding of how the section of the Beech Creek within the Block will be affected over the long term. The effects of riparian harvesting on stream channels can vary significantly depending on the channel type. This section of the report provides a very brief description of channel types as well as an opinion about the long term effects of riparian harvesting within the Block.

6.3.1. Channel Types

Streams can be classified by channel type. Knowing the stream channel type can help resource managers determine the potential effects of streamside harvesting and other logging-related activities. Channels are commonly classified as alluvial or non-alluvial. Alluvial channels flow through their own sediments which have been deposited under the contemporary flow regime. Alluvial streams have at least one bank consisting of erodible materials such as silt, sand, gravel or cobbles.

Alluvial streams can have a riffle-pool morphology and an identifiable floodplain with a channel migration zone. These channels can therefore change shape and location as a result of changing stream flow, bank erosion or sediment deposition. Alluvial channels are typically found in lower gradient streams. Riparian trees growing along alluvial channels play an important role in maintaining long term channel stability by helping to reduce the rate of bank erosion (roots growing in the bank, log jams, etc). This channel type is sensitive to logging-related disturbances such as the harvesting of riparian trees or the loss of large woody debris (LWD) consisting of fallen trees, logs, etc. from the channel. These channels are also sensitive to changes in both the rate of sediment delivery (e.g. landslides) or changes in streamflow due to harvesting, climate change, river regulation, etc.

Alluvial streams often contain highly productive fish habitat and LWD can be important for creating and maintaining channel structure such as scour pools and complex habitat features such as log jams.

Non-alluvial channels are confined by erosion resistant materials (such as fluvial terrace deposits, till, colluvium or bedrock) and may also be entrenched into the surrounding terrain. The channel bed consists of bedrock or coarse materials which are too large to be moved by the contemporary flow regime. These channels therefore tend to be laterally and vertically stable. Non-alluvial channels typically have a steep gradient and little or no erodible sediment may be stored in the channel. LWD's function in a non-alluvial channel is generally limited.

Recognizing a third channel type can help forestry and watershed managers. This third class of channel is referred to as semi-alluvial or partially alluvial. For the purpose of this report, a semi-alluvial channel is defined as a channel that has resistant channel banks and a sufficiently coarse channel bed where bank erosion or bed mobilization only occurs during infrequent sizeable flood events. In some cases, such as a bedrock canyon the banks may be non-erodible. Channel profiles are typically step-pool or cascade. The function of LWD in semi-alluvial channels varies depending on stream size and energy. LWD can play a critical role in sediment storage, particularly in situations where log jams span the channel. The bed material stored behind log jams can consist of sediment suitable for spawning. The availability of debris to form log jams and the long term stability of this material is therefore an important management consideration.

For the purposes of this report, the section of Beech Creek channel within the Block is classified as semi-alluvial. LWD is functioning to store sediment within the channel. There were two log jams within the Block section that were substantial enough to have sediment deposits upstream. Photo 5 and 6 show the two log jams. The log jam in Photo 5 is located at the downstream end of the Block. The Photo 6 log jam is at approximately mid-block.

Photo 5 Log jam at the downstream end of the Block. Sediment storage upstream of the jam.

Photo 6 Log jam in the middle of the Block with the sediment wedge just upstream (see Photo 7). Trees retained along the right bank during previous harvesting are visible on the left side of the photo.

6.3.2. Future Downstream Impacts to Water Quality and Fish Habitat

As stated in Section 6.2, it is my opinion that the current or future channel bank stability has not been significantly affected by the removal of trees growing on the edge of the stream bank. The long term effects of riparian harvesting on sediment storage within the channel, however, are harder to predict. The removal of the riparian trees means that LWD input to the channel from the right (east) bank within the Block has been eliminated for at least as long as it takes for large trees to grow back

(approx. 100 years). Trees were retained along the right (west) bank during recent harvesting on the west side of the Creek (Photo 6). These trees have the potential to provide some future LWD input to the stream. This LWD input may be sufficient to maintain sediment storage in the channel.

In addition to input from the right bank, LWD could be washed down from the upper watershed. It appears that the two existing log jams contain LWD that has been washed down from upstream reaches. It is therefore possible that sediment storage in the channel may continue over the long term if sufficient LWD is recruited from the right bank and upstream sources.

It is also possible that LWD recruitment may be insufficient to maintain the log jams. If so, the log jams will eventually fail as the wood rots. The log jams could fail over a period of years, or during a single flood event. If the log jams were to fail and LWD recruitment is insufficient to form new ones, sediment stored upstream of the log jams (Photo 7) will be flushed downstream.

Photo 7 Close up view of sediment stored by log jam. Log jam is located several meters downstream.

The loss of stored sediment would mean a reduction in potential spawning habitat. This, however, would probably not affect fish production since I doubt that spawning habitat is limiting in this section of Beach Creek. The log jams are likely utilized by rearing fish and the availability of rearing habitat, particularly during the winter, probably limits fish production in this section of the stream.

However, it is my opinion that the effect that this potential loss of rearing habitat may have on overall Beech Creek fish production is not significant for the following reasons:

1. Beech Creek is over 10 kilometers long and much of this habitat, which is mostly located upstream of the Block, is lower gradient and therefore probably more productive than the section of Beech Creek within the Block; and
2. the potential loss of the two log jams may not have a measurable effect on fish densities in the Block since fish will likely be washed down from upstream reaches on a continual basis.

Some nutrient input and shading was provided by the riparian trees prior to harvesting. This will be lost until trees grow back. In my opinion, this impact is not significant within the watershed context.

Finally, it is my opinion that downstream water quality and fish habitat will not be significantly affected if the log jams fail and the sediment that is currently stored in the channel is flushed downstream. This conclusion is based on the opinion that the volume of sediment stored upstream of the log jams is small in relation to the natural sediment transport in Beech Creek.

6.4. Remediation

No special remedial works are recommended. It is recommended, however, that TimberWest ensure that riparian trees grow back as quickly. The site has already been planted. The site should be inspected periodically as a priority to ensure that conifers reach free-to-grow status if this is not already planned.

7. Statement of Limitations

This report was prepared for the Private Managed Forest Land Council. The material in this report reflects Shawn Hamilton and Associates best judgment in light of the information available to us at the time of preparing this report. Conclusions and recommendations in this report are based on an analysis of the best available information and professional judgement that is subject to a degree of scientific uncertainty, and therefore cannot be used as absolute fact. Shawn Hamilton and Associates has made the findings and conclusions set out in this report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

The report author believes this report to be accurate. However, he cannot guarantee the completeness or accuracy of information supplied to him. Any use which a third party, other than the parties mentioned above, makes of this report, or any reliance on, or decisions to be made based on it, are the responsibility of such third parties. The author accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken.