SETON PORTAGE AREA INTEGRATED HYDROGEOMORPHIC RISK ASSESSMENT (2018) RESULTS

Frequently Asked Questions (FAQ)

What does hydrogeomorphology mean? What was actually studied?

Hydrogeomorphology is basically the study of how water and earth processes interact with each other. In terms of Seton Portage, the study examined how land movements such as debris flows and water movements such as freshet snow melt or torrential downpours might interact with each other in terms of generating a hazard to people and infrastructure in the Seton Portage area.

The Assessment studied the hydrogeomorphic hazards and risks, including risk to life, buildings, critical facilities, business activities, culturally significant sites, and critical infrastructure like roads, bridges, railway, power, and communication lines. For the purposes of the Assessment, hydrogeomorphic hazards are defined as hazards stemming from Bear/Pete's, Whitecap and Spider creeks and include floods, debris floods, debris flows and bank erosion on the Portage River (also known as the Seton River or Portage Creek). Additionally, hazards were assessed that could indirectly affect steep creek processes such as deep-seated landslides.

What area of Seton Portage was studied in the 2018 Assessment?

The study area included the drainages of the Whitecap, Bear, Pete's and Spider Creeks and a section of the Portage River (also known as Seton River or Portage Creek).

Why was the Seton Portage Area Integrated Hydrogeomorphic Risk Assessment completed?

An increase in debris flowing down from creeks after heavy rainfall events was observed by community members and field staff from the Ministry of Forests Lands and Natural Resource Operations and Rural Development (MFLNRORD), particularly after the 2009 wildfire on the slopes above Seton Portage. Debris flows following a localized thunderstorm in 2016 resulted in some properties being evacuated overnight. Community concern in conjunction with a written recommendation of further study by MFLNRORD geotechnical engineers prompted the Squamish-Lillooet Regional District (SLRD) and Tsal'alh to approach the provincial and federal governments for funding to complete this study.

What were the findings of the 2018 Assessment?

According to the BGC analysis, debris flow risks from Bear and Pete's creeks are much greater than risks from the other creeks at Seton Portage. Safety risk from Whitecap Creek was assessed as tolerable (note that there is one building at higher risk but there are plans to move it), and safety risk on Spider Creek was assessed as acceptable. Further study of Portage River was recommended.

The total number of buildings estimated to be affected (and suffer economic damage) for Bear and Pete's Creek is 134. An estimated 59 out of these 134 buildings also exceed the individual safety risk tolerance threshold criteria used for this Assessment; of these

buildings, 44 are on land within SLRD Area B and 15 are on Tsal'alh Reserve Lands. Buildings exceeding this safety risk threshold are subject to higher flow velocities and flow depths than buildings that only suffer economic damage. Higher flow velocities and flow depth mean a higher destructive potential.

How likely are these debris flow events to occur and what would be the impacts?

The following table shows the calculated size and frequency of projected future debris flow events. Debris from an event in the 10 to 30 year return period is estimated to reach properties below the Bear and Pete's Creek drainages, and debris from an event in the 30 to 100 year return period (and greater) is estimated to impact buildings on those properties, with increasing severity depending on the total volume of the debris flow event.

Table 4-1. Debris-flow magnitude for different return periods for Bear Creek.

Return Period (T) (years)	Annual Probability (1/T)	Max. Sediment Volume Estimate (m^3)	Debris Flow Peak Discharge (m^3/s)
10 to 30	0.1 to 0.03	11,000	30
30 to 100	0.03 to 0.01	70,000	220
100 to 300	0.01 to 0.003	150,000	480
300 to 1000	0.003 to 0.001	240,000	760
1000 to 3000	0.001 to 0.0003	320,000	1000

What does 'Return Period' mean?

The return period means the average time interval that passes between two events of a similar size. However, it does not mean that that number of years has to pass before another event occurs. For example, a 100-year return period does not mean that if an event happens in 2018 that the next one is due in the year 2118. One may think of it like this: Every 10th time that one works on a ladder, it falls over. That doesn't mean it can't fall over twice in a row, and one may not fall over for the next 30 jobs one does on the ladder. Two consecutive events (like the 2015 and 2016) debris flows on Bear and Pete's Creeks are a good example.

A 10-year return period means a 1 in 10 (10%) chance of occurring in any given year, a 100-year return period means a 1 in 100 (1%) chance of occurring in any given year so on. The 1 in 10 (0.1) or 1 in 100 etc. is also called frequency or annual probability. Return period and magnitude are correlated. The larger an event, the rarer it will be (i.e. the longer its return period).

Will climate change increase the risk of debris flows?

The Assessment concludes that climate change will likely affect both the frequency and the magnitude of future debris flow events, with changing weather patterns increasing the potential for heavy downpours that push debris downslope. Additionally, permafrost is likely present above 2100m in the watershed and rising temperatures would add to the debris load as rocks previously held together by ice are released as the ice melts. This would imply a higher frequency and possibly higher magnitude of land movement events in the future in the Bear and Pete's Creek drainage area.

In the Whitecap Creek area, climate change will likely result in a higher frequency of debris floods on Whitecap Creek combined with a moderate increase in debris flood magnitude. In absence of mitigation, this will result in more frequent road closures and potential damming events for the Portage River.

How many buildings are have been assessed as being at unacceptable risk from debris flows?

The total number of buildings estimated to be affected (and suffer economic damage) for Bear and Pete's Creek is 134. An estimated 59 out of these 134 buildings also exceed the individual safety risk tolerance threshold criteria used for this Assessment; of these buildings, 44 are on land within SLRD Electoral Area B, and 15 are on Tsal'alh Reserve Lands. Buildings exceeding this safety risk threshold are subject to higher flow velocities and flow depths than buildings that only suffer economic damage. Higher flow velocities and flow depth mean a higher destructive potential.

What were the recommendations of the 2018 Risk Assessment?

Engineered structural mitigation is possible and recommended by the Assessment, which identified mitigation on Bear and Pete's creeks as being a high priority. However, at an estimated capital cost of $7 - $8M, not including annual maintenance costs or the costs of clearing out debris after each debris flow event, securing the funding for structural mitigation will be a key area of focus moving forward.

The Assessment also recommended a number of non-structural mitigation options, including relocation, community education, emergency management planning, land use restrictions, and temporary evacuations during hazardous conditions such as heavy rainfall events. However, with the exception of relocation out of the area, none of these options would reduce the risks to a tolerable level without structural mitigation.

The Assessment also recommended that additional studies be considered to quantify the risk from certain hazards not included within the scope of the Assessment, including the risk from inland tsunamis that could potentially result from landslides into Anderson or Seton Lakes, and the risk from flooding and bank erosion along the Portage River through the Seton Portage area.

Who conducted the 2018 Assessment?

BGC Engineering Inc. (BGC) is an international consulting firm that provides professional services in applied earth sciences. BGC's practice was established in 1990, based on a specialized appreciation of the impacts of geology on engineered structures. This continues to be BGC's foundation today, enabling BGC to address a broad spectrum of engineering and environmental issues related to development in challenging terrain. More information at www.bgcengineering.ca

What should impacted property owners do?

Property owners should review the information provided and should read the 2018 risk assessment report in its entirety. They should attend the Community Information Meeting on April 16, 2018.

What are the SLRD and Tsal'alh doing about this matter?

The first step is to make the information available to all property owners as soon as possible. The SLRD and Tsal'alh will then host a community information session on April 16, 2018 with the geotechnical consultant to present the information, answer questions and discuss next steps as far as they are known at this time.

At this time, the two affected jurisdictions are reviewing the recommendations of the Seton Portage Integrated Hydrogeomorphic Assessment and considering next steps. While structural mitigation is possible and recommended by BGC, there is an estimated capital cost of $7 - $8M, not including annual maintenance costs or the costs of clearing out debris after each debris flow event. Both the SLRD and Tsal'alh are committed to ongoing discussions with Provincial and Federal agencies and ministries to advocate for

the safety of affected property owners and residents in the Seton Portage area.

What steps are being taken to mitigate the risk in the area? Can we build a debris flow barrier as has been built in other areas with this hazard?

Engineered structural mitigation is possible and recommended by the Assessment, which identified mitigation on Bear and Pete's creeks as being a high priority. However, the estimated capital cost is $7 – $8M not including annual maintenance costs or the costs of clearing out debris after each debris flow event, so funding will be a key area of focus.

The Assessment also recommended a number of non-structural mitigation options, including community education, emergency management planning, relocation, land use restriction and temporary evacuation during hazardous conditions such as heavy rainfall events. However, with the exception of relocation outside of the area, none of these options would reduce the risks to a tolerable level without structural mitigation.

What happens the next time we get a torrential downpour or sudden spring warming and snowmelt? Is there a plan?

In February 2018, Community Emergency Plans were approved by the SLRD Board for communities throughout the SLRD, including a plan for Seton Portage that includes evacuation protocols for a debris flow event. The Seton Portage Community Emergency Plan is available in the Report Directory on the SLRD website.

In addition to this plan, the SLRD has provided evacuation notification training and materials to the Seton Valley Volunteer Fire Department, and is also engaged in coordinated emergency management planning with the Tsal'alh Emergency Program Coordinator and Volunteer Fire Chief.

The Sk'il Mountain Community School is the designated Reception (evacuation) Centre in the event of people being displaced from their homes by a debris flow event.

Does this report mean that the 59 structures identified in the report are not safe to inhabit?

The Assessment has not made a recommendation to vacate the properties identified.

I'm confused about the risk. How worried should I be?

There are two parts to answering this question. One part is about how we as individuals self-assess risk and the second part is about how governments assess risk for citizens.

As individuals, we all have different levels of risk that we find acceptable for our families and ourselves. As individuals, we decide what constitutes acceptable risk in all areas of our life.

Governments, on the other hand, consider group risk and follow established laws, policy and professional best practice guidelines for the assessment of various hazards that may present a level of risk to citizens.