

**CONFIDENTIAL DRAFT MINUTES  
COLLIERY DAMS TECHNICAL COMMITTEE  
FRIDAY, 2013-DEC-13 AT 10:30 A.M.  
BOARD ROOM, SERVICE & RESOURCE CENTRE, 411 DUNSMUIR STREET**

---

**PRESENT:**

*Colliery Dam Park Preservation Society:*

Leon Cake  
Geraldine Collins  
Lorne Gale  
Bill Heathcote  
Jeff Solomon

*Golder Associates:*

Herb Hawson, Director of Special Projects  
Bruce Downing, Principal  
Dr. Bill Roberds, Principal, Decision and Risk Analysis

*(Provincial) Dam Safety Section:*

Glen Davidson, Director, Water Management Branch  
Bruce O'Neill, Senior Dam Safety Engineer, Dam Safety Section

*City of Nanaimo:*

Toby Seward, Director, Social & Protective Services

Katherine Gordon, Facilitator  
Holly Pirozzini, Recording Secretary

---

1. Call to Order

The meeting was called to order at 10:40 a.m.

The facilitator asked all present to introduce themselves and she advised that Snuneymuxw First Nation (SFN) representatives were unable to attend today's meeting.

2. Presentations of Risk Assessment by Golder Associates

GA provided a PowerPoint presenting information from the Canadian Dam Association regarding dam safety; management of risk; traditional and probabilistic approaches to dam safety assessments; quantitative risk assessment; and the ALARP principle. **A copy of the presentation will be distributed to the Committee [done].** It was noted that financial, as well as safety issues are important aspects of risk assessment and evaluation of options, as the cost of some options is not always justified to bring risks below what may be necessary or acceptable.

**Agreed: To allow Colliery Dam Park Preservation Society (CDPPS) to record Dr. Bill Roberds' risk assessment presentation.**

Presentation by Dr. Bill Roberds, GA Principal, Decision and Risk Analysis, respecting a risk-assessment based approach to development of options for remediation of the Colliery Dams. **A copy of the presentation will be distributed to the Committee [done].** He stated that he will tour the Colliery Dams site after the meeting.

Discussion/Questions during presentation:

GA advised that although the Colliery Dams do not need to provide power or water, they must meet the minimum safety requirements. Safety requirements must be met; other design criteria are optional.

Dam Safety Section (DSS) noted that the latest addendum (concerning risk based dam safety assessments) to the Canadian Dam Association (CDA) Dam Safety Guidelines (2013) is new. DSS are becoming more familiar with quantifying realistic performance uncertainties under these new guidelines. This is a work in progress (the Dam Safety Regulations (which reference the CDA Guidelines) remain the DSS requirement), but the risk management approach appears to be a good one. Moving to a risk-based approach has advantages over the deterministic approach as it means designing to an acceptable standard that may be at a lower price.

Question: Will DSS accept a risk assessment approach for the Colliery Dams?

DSS responded "yes".

GA added that both governments and industry are moving slowly to accept this approach.

**Agreed: To entertain a request by CDPPS to present background information to the Committee that may be of assistance to Golder in its risk assessment work on the Colliery Dams.**

CDPPS provided copies of a *Research Package* to the Committee, including historical information on: previous extreme rainfall events (since 1921); copies of several newspaper articles respecting floods, dam breaks, emergency measures taken after torrential rains; hazard risk and vulnerability assessment update from the Regional District of Nanaimo; and a comparative of water volume of Nanaimo's dams and classification. **A copy was provided to the facilitator to pass onto Snuneymuxw representatives [done].**

CDPPS made the following comments:

- 1921 No. 2 Dam break was the most significant rain event. Records go back to 1890.
- 1955 the Middle Dam was opened up (hole blown into it) to release the pressure on the dam.
- 1958 significant rain event in Harewood.
- For each of above, flooding occurred.
- 1950s there was a fire that took away vegetation in the mountains which added to the risk of flooding.
- Only 5 deaths in Canada due to dam failure; only 1 death due to dam failure in BC. Occurred in 1912 in Union Bay. Langley Lake has 4 times the volume of both Chase River dams combined and there were 2,000 people living downstream.
- There are some direct comparisons with the Courtenay Dam; there was forewarning and the dam did breach.

- 2009 RDN chart lists dam failure as being very rare along with volcano eruptions.
- Chase River Dams are amongst the smallest in Nanaimo, but are the only ones classified as extreme. Large Dams on Nanaimo River could flood Cedar and the Reserve if they failed.
- Night time population in the inundation area is 1883, but CDPPS has not received the City's source for this number. Requested this information 6 months ago. Believe this number is actually anywhere between half- to two-thirds.
- How much water would be left in the reservoirs if the dams were to collapse?
- There is no reason not to suspect that there is metal in the Middle Dam as there is metal sticking out of the wall and from the bedrock. 1 and ¼ inch piece of metal from the spillway of the Middle Dam was shown. Study showed that there is fortifying metal in the Low Dam. Middle Dam was never tested.

Q & A and discussion:

GA requested clarification of names of the dams due to confusion with Colliery Dams being referred to as Harewood 1 and 2. GA also noted that risk assessment looks at probabilities (the future) rather than simply relying on statistics (the past). Care has to be taken in assuming that what happened in the past will be what happens in the future.

**CoN will provide to the Committee: dam name clarification [already provided by CDPPS], sources of current population figures, the difference between day time and night time numbers (if any); and a topography map of the flood zone.**

Question: Will GA commence the risk assessment work dealing with the dams "as is"?  
GA responded that assessing the status quo will be beneficial to establish a base line and that remediation options and refinements will be added as they are developed by GA and the Technical Committee.

Question: Is there value in the recent determination that there is rebar in the Lower Dam?

GA responded that the Courtenay Dam failure in BC was .1g peak ground acceleration (PGA) at the site and the rebar in that concrete performed well at that time. Unsure whether there is steel in the Colliery Dams and there may be potential for it to crack, this would be a major rupture event. Need to factor this into the risk equation. When a basic model is created, then test it with scenarios and risk assessment with a range of possibilities. Unsure if ground penetrating radar (GPR) was used and whether the dams were cored?

Question: Could the new risk assessment affect the current classification of the dams?

GA responded that a risk assessment will indicate various levels of triggers in terms of magnitude of different events; the probability of failure goes up as the event size goes up and consequences will also differ. The risk assessment will give percentages with probabilities (i.e. 1 in 100,000). The design will be to achieve acceptable safety levels (as determined by the CDA Guidelines), understanding the risks.

DSS stated that even if the classification does not change, the risk assessment approach may end in reaching the same objective. DSS will be looking to Golder for an opinion as to how the proposed design will address the identified risks and meet required safety standards. Before changing the classification, DSS would need a rationale – e.g. new

information has emerged, or as in this case, a new approach is being used. DSS is open to considering this.

DSS also clarified that the Colliery Dams are not the only ones in BC with an extreme risk classification.

Question: What further studies or testing are needed next?

If more information is needed to augment the current inundation studies, Associated Engineering or NWH could be brought in to fill any gaps in information; GA needs to know the seismic response of the dams with an upgrade (e.g. how much buttressing is needed) and the response of the structures in different types of events. Need to know how much cracking might occur and what the downstream shell is made of (i.e. permeable material). Figure out the range of what would happen with overtopping, considering the spillway. The uncertainty is in what happens to the dam in a seismic event and how much damage this will lead to, what happens with overtopping occurring, and quantifying that relationship. The Middle Dam has already been overtopped. If there is a major sustained overtopping this will be a major event.

CDPPS stated that the effect of the downstream buttress is known now. GA responded that it is not completely known in fact.

Question: Will GA run both risk and design processes concurrently?

GA responded that they will proceed with the risk assessment based on the status quo and rehabilitation options that will change the status quo as needed. That work will take place more or less concurrently.

Facilitator – Can this work be achieved in time for the Committee to make its recommendations by Feb. 28, 2014?

GA responded that they will need to do a status quo assessment to gain insight of where problems are and then will do a final check on selected options using the risk assessment. GA will work to the Feb. target date.

CDPPS stated that engineers have identified the most possible way that the dams could fail (overtopping releases the wall and then will cause the Lower Dam to fail). The wall has a remote probability of .1g event or could possibly be in .2g event and approximately 150 loss of lives.

GA stated that they want to have a way of focusing their effort and options. Want to work internally to develop a continuum which recognizes the real situation of gradually increasing probability of failure with increasing severity of inputs (i.e. events like earthquakes and precipitation events), rather than the “all or nothing” approach inherent in deterministic analyses.

DSS stated that it is important to focus on the response of the dam and what can be done to fine-tune or test it.

Facilitator – When can we expect interim conclusions?

GA responded that they are working on seismic and stability analysis options, but more data may be required and more bore holes may need to be drilled. They hope to present recommendations at the next Technical Committee meeting. The project engineer will be away until January 13.

Question: Will GA carry on with their work while staff is away? GA responded "yes".

Facilitator – Can Bruce or Bill provide a substantial update to the Technical Committee while the project engineer is away? GA responded "yes".

GA stated that improved drawings and the following drilling locations are needed: 1) foundation and material in shell (both dams); 2) hydrogeology; and 3) the concrete core. Also, City permits for access to City lands.

CoN stated that City staff will work quickly with GA as this is a priority.

**Agreed: All parties will work together to expedite the drilling.**

CoN stated that Herold Engineering will be providing structural engineering for the wall performance as they have knowledge of this.

Facilitator – Reminded all members of the Committee about the importance of everyone being kept in the loop. She requested a summary of the drilling schedule that she can provide to the SFN.

GA advised that drilling will occur on the crest and in the spillway.

Facilitator – Can a meeting be scheduled the week of January 13, 2014, to discuss options and a meeting scheduled the following week to discuss the risk assessment model? **GA agreed to this.**

Question: Does GA now have all the information they need? GA responded "yes" Although noted additional new information to be obtained as already discussed.

**Agreed: GA will send information on drilling (both core and geotechnical) to all members of the Committee.**

CoN will discuss with Herold Engineering that the company they choose to do the sample drilling must avoid any damage to the core.

3. Context Discussion: review by Golder of documents received/questions

GA provided a PowerPoint presentation respecting initial thoughts on remediation of the Middle and Lower Dams based on review of the documentation received. **A copy of the presentation will be distributed to the Committee [done].** GA believes the risk assessment will guide the structural design for remediation.

GA stated that there are inconsistencies in information from EBA Engineering (2010) and that a lower level outlet found in the Lower Dam was concreted, but not in the Middle Dam. Uncertain how far in the concrete goes.

Question: Is the Lower Dam level spillway really 1/8 size of what it should be?

GA responded that probable maximum flood (PMF) estimates, by their nature, are conservative.

CDPPS stated that there has never been an overrun on the Lower Dam. There may be implications further down the line after this work is done.

GA stated that for spillway capacity, the probabilities of problems are different than for a PMF.

Question: Can the PMF be changed? GA responded “no”, it is an accepted process.

A discussion took place regarding probabilities of lives lost in different scenarios. CoN expressed concern that in considering risks, the likelihood of even one fatality could be considered unacceptable to the public. The Committee acknowledged that until the risk assessment is done and the options presented, they can only speculate. DSS noted that even if we designed for PMF and 1:10,000 standards, there is still always a risk of fatalities in an extreme event.

Question: Is it likely that construction of the Middle dam thickens from the top to the bottom of the dam?

GA responded that it is possible, but it would be beneficial to know how it was built. It was standing by itself for a period of time.

CDPPS stated that the fill was changed between 1950 and 1980.

CDPPS did have a diver check the Middle Dam, but does not have remarkable photos from an underwater assessment. **CDPPS will distribute underwater photos of the dams to Committee members.**

GA stated that the EBA Engineering report indicates:

- The spillway is on bedrock and there is some rock fill in the downstream shell.
- There is a possibly a concreted cap over a plug in the Middle Dam.
- There is a low level wooden box culvert with concrete at the inlet in the Middle Dam.

Facilitator – **If anyone has information about the Middle Dam being cut or a hole blown in the 1950s, please pass it onto GA.** CDPPS clarified this by referencing an EBA Report in 2009.

Question: Is the width of the Lower Dam dimensions accurate? CDPPS stated that the width of the Lower Dam is said to be 77 m. May only be 50 m. or less. Measurement appears to be taken right to the spillway. The beach access was an addition by the Harewood Improvement area.

Question: Has it been surveyed? CDPPS responded that they have never seen a survey.

GA believes the Lower Dam may have been surveyed in 2010 by EBA Engineering, but will need to confirm the dimensions. Will be relying on Herold Engineering for assistance with information on design and construction of the dams (rebar, coring, reinforcement or dowels, condition/quality of concrete). Would like to be able to verify that the existing concrete core had reinforcement so could avoid adding a plastic concrete wall more in the

middle, instead of at the higher end of the dam. Could dewater to expose the concrete wall and put a membrane over it.

Question: Is dewatering (during construction) a possibility? CoN responded “yes”, but SFN may not want the dam dewatered and there may be concern about the effect this may have on the fish.

DSS commented that dewatering (as a means to mitigate flood risks to a dam) may not be effective in any event.

GA discussed initial conceptual ideas to increase the flood routing capacity:

- Allow overtopping of the dam.
- Increase spillway capacity (deepen spillway, but maintain reservoir levels with an Obermeyer weir).
- Lower level outlet or install a siphon.

Question: Does GA have experience in overtopping? GA responded “yes”.

Question: Is a lower level outlet realistic? Would you still end up with a gate? GA responded that the purpose is to be able to quickly drain the dam to make the dam safe in an event. Gates are not the safest option as they can jam in a power outage.

DSS stated that in critical spawning times, a lower level outlet would significantly benefit the fish to allow more water in when levels are too low.

CDPPS stated that a lower level outlet could allow for the release of water and cool the river. Very little flow and depth in the summer.

CDPPS believes that four 12 inch siphons would take approximately 2 days to pump water out. This is an alternative to a lower level outlet and it would work for maintenance.

GA discussed conceptual Design Options for the Middle Dam.

Question: What would this cost? CDPPS responded \$.5 million is the cost according to the EBA Engineering report.

CDPPS stated that the Lower Dam can sustain 1:3,000 so may not need to do anything.

GA stated that this event could still result in cracking of the core in the Lower Dam.

GA stated that an additional barrier could be installed in both dams for containment, if needed. A cutoff wall: slurry wall, plastic concrete and/or a liner could be added, but may be expensive options.

Facilitator – The Department of Fisheries and Oceans (DFO) has been kept involved in this issue since July. She met the new representative from DFO yesterday and he is very committed to this project. He is comfortable with an open-ended application to keep things moving along and he may be available to attend this Committee’s meeting in February, 2014.

Question: **Can DSS be provided with copies of today’s presentations?** The Committee agreed to this.

4. Review draft Minutes from 2013-Dec-05 and develop a public summary

The previous minutes were reviewed by the Committee and approved.

DSS requested a copy of the minutes from today's meeting.

Facilitator – The Committee will decide on this after they approve the draft minutes because they are confidential. DSS will be able to review their comments regardless; however, to make sure they are stated correctly. She stated that it was beneficial to have Dam Safety Section representatives attend today's meeting. **Agreed that DSS will come to future meetings.**

GA requested topography or digital ground model information. CDPPS provided a CD of some of this information (reservoir bathymetry) to GA at the meeting.

5. Next Steps/Action Plan

**Agreed next steps:**

- **Provide copies of all ppt presentations to the Committee [done].**
- **Develop a public summary from the Dec. 5 approved minutes [draft sent out Dec. 18].**
- **Distribute Draft Confidential minutes from today's meeting to the Committee, prior to Dec. 25.**
- **Confirm meeting dates in January, 2014 [done].**

Question: Is there a need for a public update before Christmas? No.

Facilitator - Discussed the communications strategy. Will schedule a meeting in early January to discuss. She requested that Committee Members email her in the meantime with any breaking news about this issue.

6. Next Meeting/ Scheduling of Meetings

**Agreed: Next tentative meeting dates will be Thursday, Jan. 16 and Wednesday, Jan. 22 from 10:30 a.m. – 3:30 p.m. [confirmed Jan, 21/22, times TBA.]**

7. Conclusion:

The meeting concluded at 4:00 p.m.