THURBER ENGINEERING LTD.

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BC Ministry of Environment
Water Stewardship Division
2080-A Labieux Road
Nanaimo, BC V9T 6J9

Attention: John Baldwin, Dam Safety Officer

GARDOM POND DAM – NORTH PENDER ISLAND
PRELIMINARY GEOTECHNICAL ASSESSMENT OF WATER SUPPLY PIPES

Dear John:

1. INTRODUCTION AND SCOPE OF WORK

Thurber Engineering Ltd. (Thurber) has been retained by the Razor Point Improvement District (RPID) to provide geotechnical engineering services related to two existing water supply lines passing through Gardom Pond Dam on North Pender Island. The two 50 mm diameter poly pipes reportedly cross the dam crest at a depth of approximately 0.9 to 1.0 m below grade. On the downstream side of the crest they connect to a PVC header pipe that feeds the RPID water distribution system. A Dam Safety Review report was prepared for the facility by Ryzuk Geotechnical in August 2011. The report identified that a failure of these upper pipes could have "disastrous consequences" on the dam, and recommended that a full internal inspection of the water lines be carried out by a qualified professional.

The RPID approached Thurber for assistance in responding to geotechnical issues resulting from the recent dam safety review (DSR) pertaining to their water supply pipes. In a letter from your office (dated October 11, 2011) you provided a list of comments pertaining to Ryzuk's DSR report. Item 10 of the letter states: "Clarification required on shallow (depth of pipes from crest) location of upper pipes in embankment". Subsequent email correspondence with your office specified that clarification was requested with respect to impacts of the upper pipes on the safety of the dam (i.e., could these pipes cause a failure of the dam). If so, what action could be undertaken to address the matter.

2. DISCUSSION

The RPID water supply system utilizes water obtained from a pumped well upstream of the Gardom Pond Dam. The well water is pumped into two water supply tanks, also located upstream of the dam. A supply pipe is connected to each of the reservoirs, and crosses the dam crest before connecting to a common header pipe on the downstream face of the dam. As noted previously, the two water supply pipes cross through the dam at approximately 0.9 to 1.0 m depth. This is approximately the full supply level of the pond. Both pipes were installed in the same trench, and the pipes were reportedly bedded in sand.

We understand the original dam was constructed with a downstream slope angle of approximately 38° (2.6H to 1V) and a crest width of 2.4 m. However, additional fill was subsequently placed on the downstream slope to widen the crest to approximately 9 m. We understand this has resulted in a downstream embankment slope of approximately 1H to 1V, with steeper localized sections.

Some seepage along the pipe trench may occur during periods when the pond level is above the spillway elevation, although the gradients are not expected to be sufficient to cause piping of embankment materials through the dam. Seepage along the pipe trench or through a slow leak in the pipes during normal operating conditions could cause saturation of a localized portion of the downstream embankment, which could reduce the static factor of safety of the embankment.

However, likely the biggest impact the pipes could have on dam safety would be embankment erosion following the complete rupture of the pipes (e.g., following a failure of the oversteepened downstream slope). The Ryzuk DSR report states that there were no indications of instability on the downstream slope at the time of their site inspection. The report states that "the global stability of the dam is not at risk considering the normal and extreme loading conditions", but does indicate that considerable embankment deformations could occur during a seismic event. As noted on page 20 of the DSR report, these cracks/fissures could lead to internal erosion/piping of the dam, which could potentially lead to a breach of the dam. Earthquake induced deformations are not expected to be consistent across the width of the dam, but will be greatest near the downstream crest, where the embankment slope is already overly steep. The report also anticipated that the post-seismic movements could be significant and this could rupture the RPID water supply lines, resulting in the release of the water stored in the upstream water supply tanks. The injection of this water into the damaged embankment would not only greatly increase the potential for a dam breach, but would increase the speed at which such a failure would occur.

3. RECOMMENDATIONS

The RPID is aware of the above described potential safety impacts of the existing water supply pipes on Gardom Pond Dam. We understand the RPID is planning to relocate the pipes elsewhere (beyond the footprint of the dam) but that a new right of way first needs to be negotiated. This will take some time to accomplish. We also understand there is the possibility that the existing dam will be decommissioned (which would also require that the water lines be relocated). In the interim, the following measures have been proposed to improve dam safety.

- The installation of specialized seismic shutoff valves at each water supply tank outlet to automatically close during the event of a sufficiently large earthquake. The system utilizes a pre-programmed seismic controller that would actuate the motorized 50 mm ball valves. The RPID has received a quotation from a supplier in California (FLOLOC Products International).

- Excavation of the existing conduit trench to expose the 50 mm diameter pipes, remove the existing bedding sand along approximately a 2.4 m wide section and install approved low permeability fill (to form a seepage cut-off). Thurber would provide gradation

recommendations for the low permeability fill and carry out an inspection during the seepage cut-off installation.

The first measure noted above is intended to remove the potential for the water supply lines to contribute to a dam washout following an earthquake. However, a post-seismic piping failure could still occur through more conventional mechanisms (e.g., seepage of impounded water through fissures in the damaged embankment) as noted in the DSR report.

The second measure is intended to remove the preferential seepage path that is likely present at the top of the dam as a result of the installation of the two water supply lines. The proposed 2.4 m wide cut-off will match approximately with the original width of the dam crest prior to crest widening.

4. CLOSING

We understand the RPID desires you to provide your comments pertaining to the above proposed remediation measures. Could you also provide direction as to whether the proposed works would be considered "minor repairs" with respect to the Section 4 of the Dam Safety Regulation? In other words, would authorization under the Water Act be required to perform the above noted modifications?

Please call if you have any questions or require further information.

Yours truly,
Thurber Engineering Ltd.
Kevin Sterne, M.Sc., P.Eng.
Review Principal

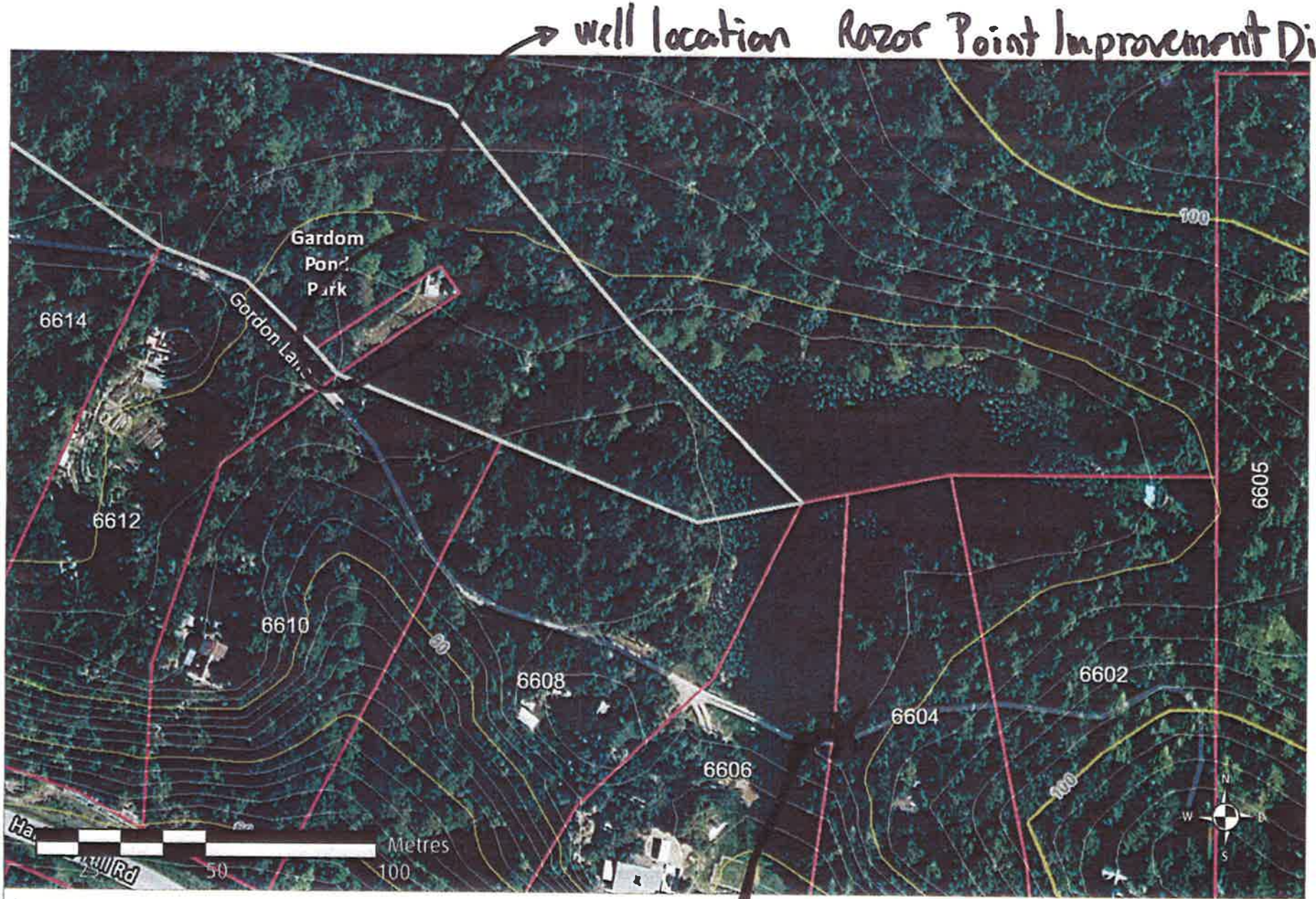
Jay McIntyre, M.A.Sc., P.Eng.
Geotechnical Engineer

Attachment

Copies to:

1. Riley Tate, RPID Trustee
2. Lynda Challis, RPID Chair, Board of Trustees
3. Joanne Munroe, RPID Trustee

2012-03-01



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Regional Community Atlas

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