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GEOTECHNICAL FIELD REVIEW / SITE INSTRUCTION

Project No: 0907-40

Project: Geotechnical Assessment

Project Address: 360 Arbutus Ave – Duncan, BC

Date: December 18, 2023

Client: Somenos Construction

Contact: Darcy Beaveridge

Email: darcy@somenosconstruction.com

Drainage Assessment

As requested, we visited the referenced site on November 17, 2023, to review the existing drainage conditions within the residential property. We understand that water ingress of the residence had occurred during extreme rainfall due to the existing drainage infrastructure deficiencies and that improvements of the drainage installations are desired to be completed in conjunction with the proposed home renovations. The site is designated as being within Development Permit Areas 3 & 4 within the Municipality of North Cowichan's (MoNC) Official Community Plan (OCP - DPA-3 Natural Environment; DPA-4 Hazard Lands). Accordingly, professional review is required for such drainage modifications in accordance with the bylaw. Our associated observations, comments, and recommendations in this regard are contained herein. The MoNC is an authorized user of this report and may rely on this information when considering the approval. Our work has been carried out in accordance with, and is subject to, the accepted Terms of Engagement.

The site is located within the northeastern portion of Maple Bay and generally bounded by similar residential lots to the east and west, Arbutus Road to the north, and the shoreline of Maple Bay to the south. The site is gently to moderately sloped within the upper portions and undulates downward from the roadway to the shoreline, and the existing residence is situated adjacent to a steep small scale rock slope along the shore. The terrain is mostly bedrock controlled (metavolcanic formation) and soils where present are typically a veneer of organics or rocky fills around the building.

Currently, the drainage configuration consists of an existing 450 mm diameter culvert that extends below Arbutus Road and discharges into an open top culvert section that conveys to a separate concrete culvert that extends below the shared driveway access. This flow continues through an open bedrock control channel and conveys to a small existing area drain situated behind a rock and mortar retaining wall alongside the driveway. Below the sloped concrete driveway exists California drains, and a small roadside style catch basin that is inferred to collect and discharged down to a 200 mm diameter corrugated steel culvert which extends below the existing residence. This pipe, along with other perimeter drain and roof drain readers, appears to discharge within the open area undercarriage of the building atop gravelly soils. Evidence of flow and erosion was noted below this outlet and such then extends just beyond the building and down a small slope and into the foreshore area.

We consider the existing drainage is close to the end of its design life. Furthermore, the severe storm event that occurred in November 2021 is expected to have exceeded the system capacity and resulted in local water ingress on the high side of the building.

We have completed hydrology analysis of the upslope catchment area and consider that the flow influence during storm periods ranging between 100-200 year return would generally reach or exceed the capacity of the 450 mm diameter culvert at the road. We therefore consider that new installations to collect and convey this flow sufficiently should be designed to similar sizing as a 450 mm diameter infrastructure. The small catch-basin behind the rock and mortar wall could be replaced with a 1.2 m diameter catch-basin with a 450 mm pipe trenched through the driveway to join with a similar arrangement in the area of the existing catch-basin near the house. The replacement driveway should be graded as much as practicable to direct flow towards the new lower catch-basin.

The catch-basins should include a dome grate lid for protection against clogging from organic debris. The outlet from the chambers would extend as a 450 mm diameter PVC culvert, with the daylighting length consisting of an HDPE pipe that would continue beyond the underside of the building and discharge atop the boulder and bedrock surface at the foreshore. Additional tertiary drains consisting of similar California drain arrangement should be included in a

The above does not constitute approval to proceed with the noted work if such is perceived to be an extra to a Contract, or if the work requires approvals/permits from approving authorities.

similar area as the existing, and those flows (along with any roof leaders as required) could be conveyed into the lower 1.2 diameter manhole section.

Furthermore, we understand that the perimeter joist of the building will be subject to exposure to remove backfill influence for that area and we consider that a small step back and inclusion of a drop down cultured block wall with a gravel bordering at a lower elevation at least 200 millimeters below the top of the concrete foundation would be appropriate to maintain any collateral flows that may overtop these areas and therefore be conveyed around the building and away from the building frame. Additionally, we observed that the concrete culvert section that conveys flow under the shared driveway was half full of sediment and therefore has reduced conveyance, and should be cleaned out and all existing and new drain installations maintained on an annual basis.

The installation of the lower catch basin and outlet pipe is anticipated to require replacement of a stacked boulder retaining wall and therefore this area along with the overall installation particulars should be reviewed by Ryzuk during the construction for field review and site instructions as such.

We can provide further details on this design upon request and expect that the driveway grading would need to be adjusted marginally to accommodate this design. We also understand that the environmental consultant will be providing their commentary with respect to the allowance for discharging the collected stormwater load at the foreshore from their review.

We consider the proposed drainage improvements would be feasible from a geotechnical perspective while maintaining conformance with the requirements of the DPA. The pipe installations should be completed by a qualified plumber and include MMCD conformant materials.

We trust the preceding is suitable for your current requirements. Please contact us if you have any questions or concerns.

Regards,
Ryzuk Geotechnical

Andrew Jackson, P.Geo., P.Eng.
Lead Geoscientist / Engineer

PTPN: 1002996

DRAINAGE DESIGN REVIEW

Company: Somenos Construction
Contact: Darcy Beaveridge
Email: darcy@somenosconstruction.com
Project Title: Geotechnical Assessment
Project Address: 360 Arbutus Avenue – Duncan, BC

Date: April 29, 2025
Project #: 0907-40

As requested, and further to our memorandum of December 18, 2023, we visited the referenced site on January 31, 2025, to review the drainage improvement concept and constraints for the property. Currently the residence is under renovation, and it is desired to resurface the driveway and install drainage improvements in the vicinity of the building in conjunction with the on-going work. This includes placement of surface armoring within the area adjacent to the shoreline to reduce the risk of erosion from storm drain discharge atop to soil surface, along with decreasing erosion due to wave action against the localized non-bedrock areas on the shoreline proximal to the existing structure. The site is designated as being within Development Permit Areas 3 & 4 within the Municipality of North Cowichan's (MoNC) Official Community Plan (OCP - DPA-3 Natural Environment; DPA-4 Hazard Lands). Accordingly, professional review is required for such drainage modifications in accordance with the bylaw. Our associated observations, comments, and recommendations in this regard are contained herein. The MoNC is an authorized user of this report and may rely on this information when considering the approval. Our work has been carried out in accordance with, and is subject to, the accepted Terms of Engagement.

We understand that the drainage concept would be similar to that described in our preliminary memo such that regrading of the driveway would direct the surface flows to be captured by an area drain system at the low area of the driveway, in conjunction with addressing a void adjacent to the building. A new 0.9 m (3') diameter concrete drop manhole barrel with a dome grate would be installed in the void area to receive the collected flow from the surface along with a California drain at the end of the driveway, and the roof leaders in the vicinity. The barrel would outfall to a 300 mm diameter pipe and would also include a separate 150 mm diameter overflow pipe set a few centimeters below the invert of the inlet pipes. Both pipes would then extend below the building and outfall at the surface within the area between the building and the shoreline.

As the surface within the vegetated areas in the vicinity of the shoreline may be subject to erosion in the long term due to scour from the drainage outlet, we recommend that coarse rock fill (riprap) be placed in the vicinity of the outlet and beyond as much as practicable to reduce this influence.

In addition, the local area of soil exposed along the shoreline adjacent to the drainage outfall could be treated with a similar armoring to reduce the erosion influence from wave action and reduce the rate of slope regression toward the adjacent building. We note that the size of rock

available (< 0.3 m dia.) may be subject to mobilization under severe wave action and may require future maintenance or replacement with larger rock (likely needed to be placed from a barge), or an alternative hard surface revetment at some future time.

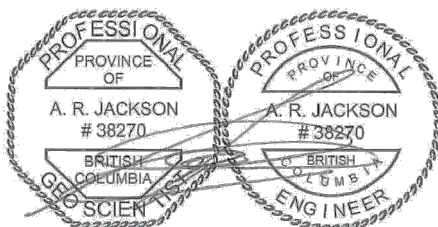
The shoreline in the adjacent areas to the small bay where soils are locally present is comprised primarily of steep bedrock slopes. Therefore, an attempt to stabilize the local soil area with soft soil based solutions would not be considered beneficial as resistance against wave action would be severely limited. That said, using the smaller riprap placed at the natural angle of repose of the particles (< 40 degrees) would provide a less reflective condition than large boulders or concrete revetments etc, and may allow for some degree of stabilizing vegetation to become established interstitially. Therefore such could be considered as an interim case between a soft slope and hard slope regime.

The attached drawing shows the proposed drainage concept and modifications for permit review purposes. We consider the proposed drainage improvements would be feasible from a geotechnical perspective while maintaining conformance with the requirements of the DPA. The pipe installations should be completed by a qualified plumber and include MMCD conformant materials and shoreline works subject to environmental consultant approval and applicable regulations.

We trust the preceding is suitable for your current requirements. Please contact us if you have any questions or concerns.

Sincerely,

Ryzuk Geotechnical



2025-04-29

Andrew Jackson, P.Geo., P.Eng.
Lead Geoscientist / Engineer

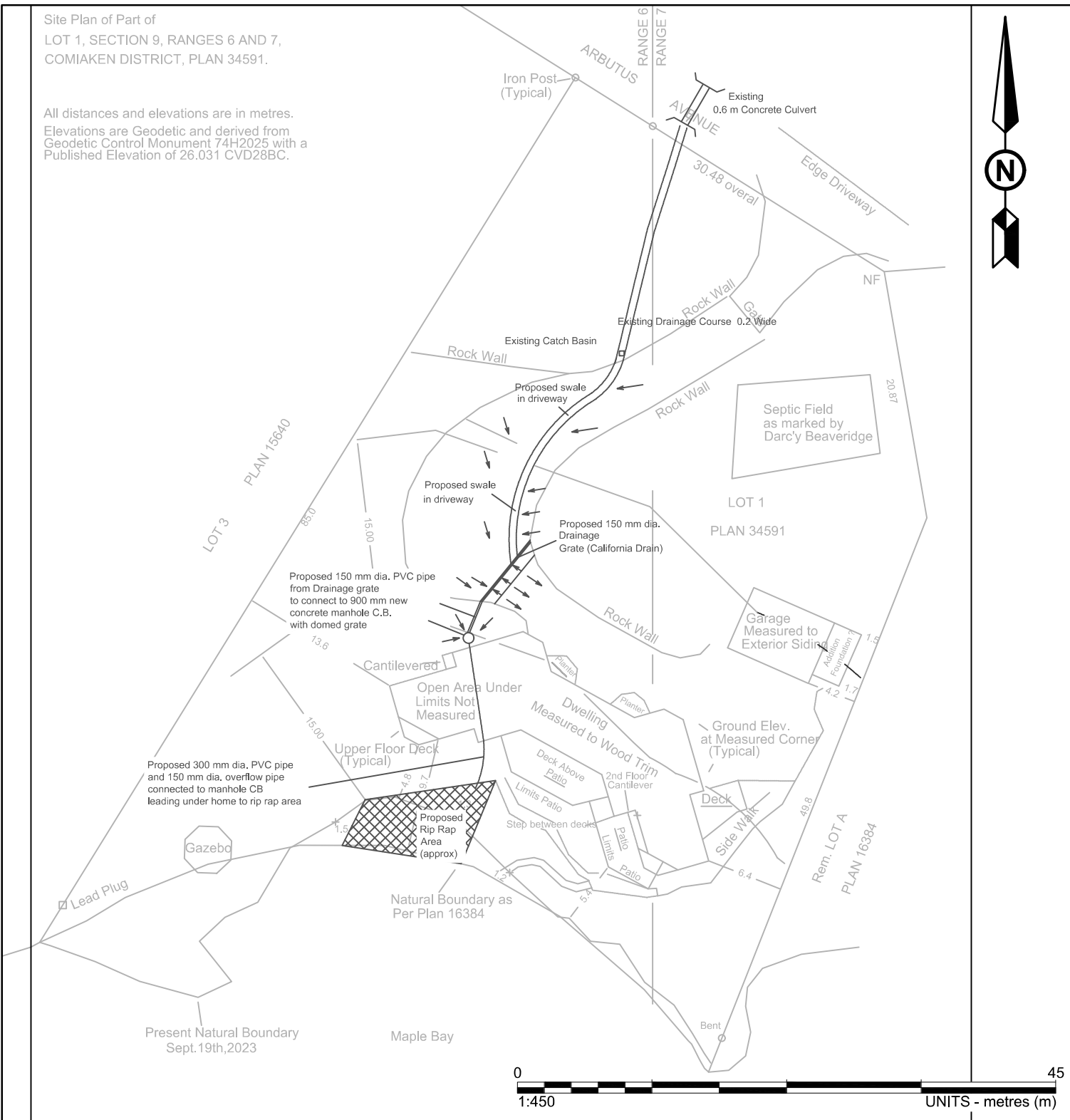
Permit to Practice Number: 1002996

Attachment – Proposed Drainage Plan

Distribution: Amanda Habkirk - Amanda.Habkirk@northcowichan.ca
Bianca Bodley - bianca@biophiliacollective.ca

Site Plan of Part of
 LOT 1, SECTION 9, RANGES 6 AND 7,
 COMIAKEN DISTRICT, PLAN 34591.

All distances and elevations are in metres.
 Elevations are Geodetic and derived from
 Geodetic Control Monument 74H2025 with a
 Published Elevation of 26.031 CVD28BC.



- NOTES**
1. This drawing is scaled for 8.5x11 sheet. Scales are approximate and should not be relied up on for layout.
 2. Site plan modified from Kenyon Wilson survey drawing provided by Somenos Construction with mark ups (Feb 2025).
 3. Drainage components to be installed by qualified plumber and in accordance with MMCD.
 4. Ryzuk to inspect drainage installations for design conformance.
 5. Field modification may be required pending Ryzuk review.

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		EOR/LEAD ARJ	PROJECT TITLE Geotechnical Assessment
		REVIEW	PROJECT ADDRESS 360 Arbutus Avenue - Duncan, BC.
		SCALE 1:450	DRAWING NAME PROPOSED DRAINAGE PLAN
		PROJECT No. 0907-40	SHEET No. 01 of 01
		DATE 2025/02/18	REVISION 00

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