

July 18, 2023  
WE: 23037

Mr. Oliver Beaudin, P.Eng.  
Water Resources Engineer  
Valdor Engineering Inc.  
741 Rowntree Dairy Road, Suite 2,  
Woodbridge, Ontario  
L4L 5T9

Dear Mr. Beaudin:

**Re: Vargas Properties Inc.  
Millbrook East Fluvial Geomorphic Opinion**

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Water's Edge undertook an evaluation of a proposed crossing of an unnamed tributary within the above noted development. This memo provides a summary of our geomorphic opinion on the crossing with recommendations for implementation.

Further to the information provided via email previously, we undertook a cursory evaluation of site conditions and the tributary that flows through the site. Reviewed information included:

- Site grading plan;
- Aerial photography; and.
- HEC RAS mapping.

A proposed road will be crossing the existing watercourse and Valdor has noted that no other alterations are proposed within the 30 m watercourse buffer or erosion hazard limit. The crossing will consist of a 23 metre long 4 m wide by 1.5 m high concrete box culvert. HEC-RAS modelling has demonstrated that the proposed culvert will adequate flood conveyance capacity (and adequate conveyance would also be available with a smaller 2.4-metre wide box culvert). The SWM pond outlet pipe will discharge from the downstream wingwall of the culvert.

Encroachment within the stream corridor can result in impacts to watercourse/channel morphology due to changes in natural valley/watercourse configuration, active filling within the valley, channelization and concentration of stream, flow through the proposed concrete culvert, narrowing of the natural meander belt width, and possible changes to erosion and flooding hazard limits upstream and downstream of the crossing.

Our examination of the site suggested that the channel bankfull ranged from 1.5 to 2 metres in width. As such a 4-metre wide box would provide a reasonable width for the channel to pass through. From a geomorphic perspective, the 4-metre wide culvert would allow some local channel movement, sediment transport, and natural flow characteristics. This would not be possible with a smaller culvert or a twin box solution. Even though these options may reduce erosion and stream velocities, they would not allow for a normal range of physical processes associated with a natural stream. A 4-metre culvert would allow the creation of a bankfull bench within the structure.

Based on Valdor's HEC-RAS analysis for the previously-proposed 2.4 m wide culvert, there was a slight increase in the Regional flow velocity of 0.5 m/s (from 2.04 m/s to 2.51 m/s) immediately downstream of the culvert, with no significant velocity changes elsewhere along the watercourse. It is expected that the velocity increase will be further reduced with a 4.0 m wide culvert.

With the exception of the areas immediately upstream and downstream of the proposed culvert, it is not anticipated that there will be changes to the meander belt width because there are no other alterations within the watercourse setback.

We also envision that there will be no impacts to the downstream erosion hazard limit or flooding hazards because there will be no change to the meander belt width and stream hydrology with the proposed Stormwater Management strategy.

**Conclusions and Recommendations:**

Based on the above assessment, we conclude that the proposed culvert will not adversely impact the existing watercourse. To ensure that there are no impacts, we recommend the following:

- 1 A bankfull bench should be established within culvert to promote natural stream processes;
- 2 The proposed box culvert should be embedded by 0.30 metres to further promote natural stream processes, aquatic habitat, and fish passage;
- 3 SWM controls are to be implemented that ensure that post-development peak flows will not exceed the pre-development peak flows for the 2- to 100-year events and that there will be no increase in flows or the flooding hazard due to this development;
- 4 Energy dissipation and/or erosion protection is required for the SWM outlet to be located in the culvert wingwall to ensure that the existing creek is not impacted by the discharge; and,
- 5 A final design for these works, including a final geomorphic assessment and design, be prepared during the detailed design stage.

Thank you for the opportunity to work with you on this project. Should you have any comments or questions, please do not hesitate to contact us.

Respectfully submitted,



Ed Gazendam, Ph.D., P.Eng.,  
President, Sr. Fluvial Geomorphologist  
Water's Edge Environmental Solutions Team Ltd.