Memo

To: Matt Johnston, Urban Solutions
Amber Lindsay, Valery Homes

From: Matt Senior, Robert Zhang, and Ron Scheckenberger, Wood

Date: April 20, 2022

File: TPB188083

Re: **Browlands Development (870 Scenic Drive and 828 Sanatorium Road), Hamilton City File 25T-202008, ZAC-20-041, UHOPA-20-026**
Engineering Comment Responses (March 18, 2021)

Introduction and Overall Issues

We are in receipt of the comments provided by City Staff (133 pages, March 18, 2021) as provided by Urban Solutions (ref. e-mail Drennan-Senior, March 18, 2021). Wood has focused on the engineering specific comments, as provided on pages 71-81. We would note that many of these comments are duplicated at a later section of the summary (pages 98 to 106) and are therefore redundant.

We have also included responses to engineering and stormwater management specific comments from the Hamilton Conservation Authority (HCA) on pages 95-98.

The numbering below follows that of the initial set of comments. For clarification the City comment is italicized, and the response follows.

The following responses should be read in conjunction with Wood's revised Functional Servicing and Stormwater Management Report and drawing set (April 19, 2022).

Development Engineering

1. *Section 2.1 of the FSR & SWM indicates that there is an existing private sanitary drain that was conveying flows from the property to the north through the Escarpment. Due to the age, unknow conditions, maintenance and environmental issues this sewer is considered as not suitable to service the proposed development. Therefore, the proponent will be required to include in the engineering design and cost estimate schedule provision to abandon the existing sewer at the owner's cost. Our office agrees with the Consultant's recommendation to redirect the sanitary flows from the existing heritage building on the site to the sanitary sewer on Scenic Drive.*

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Noted. This service was considered for use on an interim basis to serve the Long & Bisby building however based on subsequent discussions with City staff this approach was understood to be not supportable. The majority of the existing sanitary sewer works would be removed as part of the proposed re-development, and any section up to the limits of the property (i.e. Sanatorium Road) would be removed or abandoned. Sections of sanitary sewer beyond that point would be on City property and thus assumed to be a City responsibility.

2. *The Consultant has identified constructability issues in Section 2.1.2.2 of the FSR & SWM related to the future sanitary sewer extension to service the east portion of the site that will be reviewed at the detailed design stage. We note that all works related to the extension of the existing sanitary sewer on Scenic Drive to service the proposed development are at 100% owner's cost.*

   This is presumably in reference to the crossing of the existing 750 mm (proposed 1050 mm) diameter storm sewer. Agree that this would need to be reviewed as part of detailed design. It was previously understood that the extension of the sanitary sewer on Scenic Drive would be at the developer's expense.

3. *The Consultant has identified in Section 2.1.2.3 of the FSR & SWM that there are existing capacity constrains in the existing sanitary sewer downstream of the site that preclude development of the property until upgrades on the existing sewer are completed.*

   3.1We would like to advise that section of the existing 375 mm dia. sanitary sewer from the existing manhole #HD14A063 at the west limit of the property, to HC14A033 at Goulding Avenue is going to be replaced with a 525mm dia sanitary sewer to address the existing capacity constrains and to provide for development of the subject property. The Consultant will be required to update the FSR & SWM to demonstrate that the future 525mm dia. sanitary sewer has sufficient capacity to support the proposed density within the draft plan lands. Furthermore, the proponent will be required to provide a cash payment for their share of the costs to upsize the existing sewer.

   It would be helpful to receive the design calculations for the external areas that were used to confirm a 525 mm diameter sanitary sewer upgrade was required. Updated sizing calculations based on Wood's understanding are included in the updated FSR\SWM report and demonstrate that the proposed pipe upgrade would be sufficient to also service the proposed development. The timing of the upgrade requires confirmation relative to the proposed timing of the Browlands development.

4. *It appears that the total equivalent population of 898 persons identified in Appendix D of the FSR & SWM, as per Part 8 of the OBC, is underestimated based on the number and type of the residential units for the future development. We advise that the MOECP design criteria governs*

the design of the municipal infrastructure. Therefore, we recommend that the capacity of the future 525mm dia. sanitary sewer be assessed by the Consultant based on the following assumptions: 3.5ppu for townhouse units, 2.0ppu for 1-bedroom, 2.7ppu for 2-bedroom for the multi storey building at 360l/day/capita and appropriate infiltration in accordance with the current City's development criteria.

This has been incorporated into the revised design calculations. Overall demands have been calculated using both the above noted approach and OBC.

Based on the updated calculations, it has been confirmed that the proposed 525 mm diameter sanitary sewer at the downstream limits would be sufficient. Sizing of other services has been re-confirmed and are included in the updated materials.

5. *The Consultant's proposal for twining of the existing municipal watermains on Scenic Drive discussed in Section 2.2 of the FSR & SWM is going to be further evaluated at the detailed design stage with objective to ensure that no extra municipal infrastructure is installed due to the long-term maintenance and capital cost issues. The Consultant will be required to run the water modeling servicing scenario to consider upsizing the existing 200mm municipal watermain on Scenic Drive to the west of San Pedro Drive to 300mm dia, watermain first. We would like to advise that any upgrades on the existing municipal system that are driven by the proposed development shall be paid for by the proponent as a condition of draft plan of subdivision approval.*

   Noted. In order to meet fire flow demand requirements for both the west and east sites, it is anticipated that an upsizing of the existing 150/200 mm diameter watermain along Scenic Drive is needed. Final confirmation of design extents to be completed at detailed design stage. Cost sharing for this upgrade should be discussed with the City of Hamilton, as this was not originally anticipated to be required to service the proposed development. We defer to Urban Solutions and Valery on cost sharing.

6. *The Consultant has identified need of a municipal storm sewer to pick up the runoff collected by the existing catchbasins within Scenic Drive ROW that discharge onto the subject lands and to divert the runoff to the existing 750mm storm sewer in Section 2.3.1 of the FSR & SWM and preliminary Engineering plans. The existing 750mm storm sewer performs as the outlet for the existing SWM facility and is not sized to pick up additional flows to our understanding. Consultant shall provide additional discussion to clarify this issue.*

   There are two options in this case. Under the first option, the section of 750 mm diameter storm sewer from proposed MH29 to the new creek could be upsized to account for the additional flows from the new storm sewer. This option is presented on the updated submission and servicing plan (downstream section upsized to a 1050 mm storm sewer).

Under the second option, the new storm sewer could be kept separate with a second outfall directly to the watercourse. The first option is likely preferable to avoid duplicate infrastructure; this would also potentially be preferable given that the section of 750 mm diameter storm sewer also has the critical crossing of the sanitary sewer in the same location. However, this can be confirmed as part of detailed design and City preferences.

As part of the updated submission, Wood has developed a detailed hydrologic\hydraulic model (PCSWMM) of the area including the upstream SWM facility and 750 mm diameter storm sewer outlet. This modelling was used to assess the simulated 100-year storm flow and the combination of that flow and the proposed storm sewer on Scenic Drive; this resulted in the proposed 1050 mm diameter sizing.

6.1We note that the proposed low flow channel should pick up flows from the existing 750mm storm sewer to our understanding. Consultant to clarify.

Correct, the creek on the north side of Scenic Drive would continue to serve as the outlet from the existing 750 mm (proposed 1050 mm) diameter storm sewer.

7. *We would like to advise that at the detailed Engineering design stage, the Consultant will be required to revise the proposal to have the proposed storm outlets from the underground storage structures at MH17 to match the spring line of the existing outlet pipe, as a minimum, in accordance with the City's servicing criteria.*

   This can be reviewed further as part of detailed design, however this would likely necessitate reducing cover below typical minimums (1.2 m). We would note however that the currently proposed storage tank layout has been assessed in an integrated PCSWMM hydrologic\hydraulic model which has confirmed there are no issues with backwater impacts based on the proposed extents and grades.

8. *It appears that the preliminary grading proposal for the site to the east of the proposed roundabout conflicts with the existing drainage pattern. Refer to Figure 4 in the Engineering set. Consultant shall provide additional info to address this issue.*

   It is unclear what is being suggested here. Under existing conditions the area of the site in question drains largely to the woodlot to the north; under proposed conditions some of the area continues to drain in this direction with the remainder largely routed to a storage tank prior to discharge to the creek block. Further details are required to clarify the grading concern; please refer to the updated grading plans included with the current re-submission.

9. *The preliminary grading proposal shown on Figure 4 suggests that the major flows and emergency flow route from the proposed development on the east side of the creek are directed*

to Scenic Drive. We note that at the detailed design stage the Consultant will be required to demonstrate that the post-development runoff is self-contained within the private lands and directed to an adequate outlet being proposed realigned creek.

The on-site storm sewer system has been designed to a 100-year storm capacity. Any further overland flows to off-site areas (including Scenic Drive, to some degree) would only occur for storm events greater than this magnitude. There are minor areas which must drain towards Scenic Drive due to the need to match grades (i.e. driveway accesses).

For the balance of the site, best efforts have been made to provide overland flow routes away from Scenic Drive and towards the creek block or the escarpment.

10. *The Consultant objective to keep the footings of future underground parking structure at or above the existing bedrock elevation requires high retaining walls in proximity to the existing heritage building that may not be supported by the City's staff.*

    Please refer to the updated drawings as part of the current re-submission. Please confirm specific concerns with the proposed design; all works would be on private property. If there are specific heritage concerns those would need to be addressed by the team's cultural heritage consultant.

    10.1 We would like to note that if significant rock excavation is required to facilitate sitting of the future multi-storey buildings our office will require a study prepared by a qualified professional to address vibration impact on the Escarpment c/w adequate monitoring protocol due to the proximity to the brow of the escarpment. We note that if a such study is required it will be subject to a peer review at the proponent's cost.

    The design is premised on minimizing rock excavation to the extent possible, as per the preceding comment. Wood defers to Landtek (geotechnical) with respect to any potential additional required analyses.

11. *We have no clear understanding of the impact of the Consultant's proposal to raise the emergency spill way elevation at the brow from approximately 191.35m based on the existing topo to 191.60m. We note that the existing low-laying area within the subject lands performs as a SWM storage facility for the upstream catchment. Therefore, the Consultant should provide additional info to demonstrate that the post-development storage within the site and emergency spillway elevation are matching the predevelopment conditions. We advise that an easement in the City favour over the creek block will be required as a condition of the draft plan approval.*

    This proposed adjustment is assessed and detailed in the FSR/SWM report (Section 4). It is understood that the existing creek block is also an online flood control facility; the report

confirms that the proposed grading would continue to function as such and that storage is in fact increased as compared to existing conditions. An overflow spillway across the former Sanatorium Road is not advisable from a public safety perspective and also given the presence of a heritage stone wall on the north side of this location. As such, it is unlikely that there is an existing overflow spillway. As outlined in the report, a relief Ditch Inlet has been proposed to provide overflow relief in the event of a debris blockage or event greater than the Regional Storm (Regional Flood Elevation of 191.16 m, proposed ditch inlet relief at 191.30 m +\-). Spill over the proposed reconstructed road would occur at an elevation of approximately 192.00 m. We note that the lowest proposed building elevation is 192.50 m, building openings are higher.

The creek block is intended to remain in private ownership. Wood defers to Valery and Urban Solutions over the need for an easement for the City on the creek block.

12. *Detailed comments on Section 4, Stormwater Management, of the FSR & SWM provided by the Infrastructure Planning staff are included in this document.*

Noted.

13. *Development Engineering staff offers the following info that may impact the timing of the City's approvals for consideration by the proponent and further discussions with the City staff.*

13.1 As noted above there is a capital project initiated by the City to upsize the existing 375mm sanitary sewer on Scenic Drive, from the west limit of the subject lands to Goulding Avenue, including the road improvements works from Chateau Crescent to Upper Paradise Road. The works within the municipal right-of-way that are driven by the proposed development are expected to be paid for by the proponent including but not limited to upgrades of the existing watermain, extension of the sanitary sewer, installation of roundabout, curbing, storm sewer, sidewalk c/w street lighting, multi-use trail etc. could be included as a part of the City contract. However, it is expected that the proponent retain services of qualified Consultants and obtain Form 1 watermain approval by the City, the MOECP approval for the proposed municipal sewers and the detailed design of the proposed roundabout and street light design at 100% their cost and prior to tendering of the capital project works by the City.

Need to confirm cost-sharing requirements (what amount is actually based on the new development) and also timing for these works. Watermain requirements also require confirmation, since no watermain replacement was proposed in the section referred to.

13.2 The Development Engineering staff may recommend 'H' provision to be placed over the subject lands under the proposed Zoning By-law amendment to ensure that the required upgrades on the municipal infrastructure to support the proposed development are completed

and proponent has provided payment to the City for their share of the works prior to issuance of the building permits.

Understood, as per previous comments.

14. *We would like to advise that our office has no objection on the proponent's proposal to close off and purchase the lands of Sanatorium Road right-of-way to the north of Scenic Drive subject to providing a 5.0m wide Block on the proposed draft plan of subdivision to facilitate public access to the brow. The said block is to provide for installation of a 3.0m wide walkway from Scenic Drive to the brow of the Niagara Escarpment within the creek block. In addition, we note that the proponent will be required to install walkway within the open space block at 100% their cost and to the City satisfaction.*

    Understood. The details of the walkway/trailway through the creek block would need to be confirmed as part of the subsequent detailed design effort and require confirmation from Valery and Urban Solutions.

Infrastructure Planning

1. *Table 4.4.4 and 4.4.5: Please provide supporting model files/outputs in support of the post development flows from the subject site.*

    PCSWMM (hydrology and SWM) and HEC-RAS (open channel hydraulics) modelling files can be provided.

2. *Paragraph 2, Page 24: It is mentioned that impermeable liner for the wet pond may be required. Please provide supporting design details of the proposed pond liner including groundwater table information. Please verify and conform the depth of the pond as per Geotechnical study recommendations.*

    We note that a wet pond is no longer proposed in the subject location; an open bottom underground storage chamber is now proposed, consistent with comments received from HCA staff.

3. *OGS design calculations should be stamped by a Professional Engineer. Additional design measures should be considered in addition to the proposed OGS to achieve required TSS removal ('Leve 1' /80% TSS removal).*

    OGS Sizing calculations are supplied by the manufacturer, not Wood. Wood will review with manufacturers if they can provide stamping. We note that OGS units are verified separately through the ETV program. We would suggest if required, this be deferred to detailed design.

As outlined in Section 4 of the report, the intent is to apply the OGS units for pre-treatment, and then use the "isolator row" within the sub-surface chambers as part of a treatment train approach to achieve overall treatment of 80%.

4. *Page 8 and page 28: Cost sharing for the proposed storm sewer on Scenic Drive (east of Sanatroium Road) - The existing overland drainages from Scenic Drive (east of Sanatorium Road) drains overland through existing Sanatorium road to the Creek. However, the proposed development proposes to eliminate the existing Sanatorium road (north of Scenic Drive) which currently provides the overland conveyance for flows from Scenic Drive (east of Sanatorium road); in absence of Sanatorium road/overland flow route, storm drainage from Scenic Drive is proposed to be captured and conveyed to the Creek through storm sewer on Scenic Drive. Therefore, proposed storm sewers on Scenic Drive should be constructed to accommodate entire drainages at proponent's cost; There will not be any City share for any cost for proposed storm sewer on Scenic Drive (east of Sanatoirum Road)*

   Wood defers to Valery and Urban Solutions as to whether or not further discussions are required regarding cost sharing. However, Wood notes that only a very small drainage area was previously being conveyed across Scenic Drive (a portion of the grassed frontage of Columbia College) and is being collected by the new storm sewer system. The majority of the need for the new storm sewer system is due to the proposed roadway urbanization to meet City standards. Further, public drainage is not typically drained through private property; the proposed design addresses this concern.

5. *Page 10 (paragraph 1): Creek block slide slope 3:1 proposed; however, we recommend a flatter slope (4:1)*

   3H:1V is a typically accepted stable slope and is supported by the geotechnical assessment. 4H:1V side slopes would likely not be feasible within the creek block, given the need to preserve the meander belt width at the toe of slope and stormwater management measures above. The proposed re-design of the creek block preserves existing grades to the extent possible, however some 3H;1V slope grades are proposed to tie-in in to existing grades.

6. *Page 10 (paragraph1), Page 11 (last paragraph) Page 17 (paragraph 1): meander belt width 30 m (determined by Geo Morphix) mentioned; please show/label the meander belt width/ creek block width on the grading plan.*

   The meander belt width is presented in the fluvial geomorphology materials and drawings; refer to those submissions.

Please provide cross sections through the Creek showing water levels for low flow (to be determined based on erosive event) and high flow (to be determined based on design storm events: 2-100 year storm and regional storm) channel.

Cross-sections are presented in Drawing 7 of the current re-submission. HEC-RAS modelled cross-sections with return period flows are included in Appendix G of the updated FSR\SWM Report.

Please provide a 4m wide creek maintenance access road on both sides of the proposed realigned creek. These access roads should be set at a minimum of 0.3 m above the emergency spillway elevation (191.60 m) near downstream culvert at Sanatorium road. The cross section should show maintenance access road.

Flat graded areas which could serve as maintenance access roads are located on both sides at the limits of the creek block; refer to the updated grading plans for details.

7. *Please submit functional design of the realigned creek which should show low and high flow channel considering the existing soil (bed rock) and groundwater condition.*

Channel design details are included in the fluvial geomorphology materials. A borehole location plan is included in the materials in Appendix C. Based on a review of the available data, the proposed reconstructed channel will be above bedrock throughout except for the most downstream section. BH5 indicates a bedrock elevation above the proposed channel invert however it is unknown whether or not this is a localized issue as bedrock elevations can vary spatially.

The nearest monitoring wells to the creek block (MW6 and 7) indicate groundwater between 3.3 and 4.3 m below ground surface. Refer to Appendix C for further details (Landtek).

8. *Table 4.4.5 shows post and predevelopment flow comparison to the Creek from the subject site. However, the report did not provide any discussions related to downstream erosion assessment in the Creek. Please review. In this connection, the report should demonstrate that the predevelopment water balance and erosion below escarpment is maintained in the post development such that the predevelopment hydrology is maintained in the downstream as much as possible in the post development conditions.*

As discussed in the report, the erosion risk to the downstream receiver was assessed as part of the "Sanatorium Road Realignment Flood and Erosion Impact Assessment" (Dillon, 2010). That assessment specifically considered the impacts of the development site and concluded that if post to pre peak flow control was implemented, there would be no adverse impacts to

the downstream receiver. The current FSR/SWM report has demonstrated that SWM controls can be implemented, consistent with this requirement, which should satisfy this requirement.

The proposed sub-surface chambers have been proposed to be implemented with open bottoms to promote infiltration and reduce site runoff volume, as per HCA comments.

9. *Please provide existing and proposed conditions stage-storage-discharge table for the Creek to demonstrate water level, corresponding volume and discharge for all storm events (2-100 year) including regional storm event.*

   Rating curves and storage calculations for the online flood control facility are provided in Appendix G of the report and also presented in Section 4 of the report for the 2-100 year and Regional Storm event.

10. *Section 4.3.2/section 4.4.2: Please discuss where is the existing conditions drainage outlet for the woodlots (where the flows drain to from the wood lots). Also, please confirm if the drainage outlet for the woodlots remains the same in the post development conditions.*

    The woodlot appears to eventually drain over the Niagara Escarpment. No changes to the woodlot itself are proposed as part of the proposed works. The intent is to maintain post to pre peak flows to the woodlot as requested by the ecology team. The proposed discharges would actually be consistently less than existing flows as discussed in Section 4 of the report.

11. *Table 4.4.5: Tabulated results suggests that 2 year and 5 year post development flows are increased towards wood lots. Please confirm that there will not be any erosion impact in the downstream of the woodlot (below escarpment).*

    All post-development flows to the east woodlot are maintained below pre-development flows in the currently proposed approach (including the 2 and 5-year storms) as presented in Section 4 of the updated report.

12. *By the comparing existing conditions drainage area plan prepared by AJ Clarke (digital page 59 of 292) with proposed grading and storm servicing plans (Figure 3 to 6) it appears that drainage from existing sub-catchment 230 is diverted from woodlot to the creek. However, the report did not discuss how the predevelopment water balance/hydrologic regime for the woodlots will be maintained.*

    Under pre-development conditions subcatchment 230, with an area of 1.77 ha (AJ Clarke) represents drainage to the east woodlot. Under proposed conditions a portion of this area continues to drain to the woodlot; this includes a portion of the developed site (SITE09 – 0.20 ha) and the remaining undeveloped portion of the catchment (SITE10 – 0.50 ha), for a

total of 0.70 ha. The remaining area is directed to storage tank #3 and then discharged to the creek block.

This is discussed in the report; the intent is to maintain post to pre peak flows to the woodlot, as per the request of the ecology group to support hydrophilic plants in this area. This would be via the proposed bioswale on the east side of the site. This is balanced against the requirement to not increase peak flows to the site. If a closer match to pre-development drainage conditions is required, additional site flows can be directed to the woodlot.

13. *Section 4.4.2.4: Servicing plan shows there are two outlets proposed to the woodlots; however, stormwater quality treatment through bioswale is proposed for only at one outlet location. Please clarify how the stormwater quality treatment will be provided at other outlet location. Report should provide functional design of the bioswale.*

    The other outlet to the woodlot represents all grassed and pervious area and does not require quality treatment. A typical bioswale design is included in Appendix G. This would be refined as part of subsequent detailed design.

14. *Culvert outlet at Sanatorium road at downstream of the Creek: Digital Page 219 (appendix F) of 292 shows the existing and proposed culvert rating curve based on current Wood study; however, it is not clarified whether the stage-storage-discharge information presented are based on hydrologic/ hydraulic model. Please provide model files with the report.*

    The storage scenarios for the creek are outlined in the report (Section 4). A stage-discharge relationship was based on a combination of orifice and weir flow equations, matching to the MTO nomograph for culverts under inlet control; details are provided in Appendix G. Stage-storage relationships have been developed separately based on the HEC-RAS hydraulic models for the creek block under these respective scenarios; this is also discussed in Section 4 of the report with details provided in Appendix G. Modelling files will be provided with the submission.

15. *Sub-catchment names on Table 4.4.2 should be consistent with Figure 11 (Table 4.4.2 mentions S02 but Figure 11 shows S02A for the same 1.09 ha area).*

    This has been addressed in the current re-submission, subcatchment labels have been revised.

16. *Please show sub-catchment S08 (1.39 ha) on Figure 11 as per Table 4.4.2.*

    Subcatchment labels have been re-named and revised in the current resubmission.

17. *Stage-storage-discharge Tables – Appendix F (digital page 221 of 292): Please show stages in terms of elevations on the stage-storage-discharge tables for the proposed wet pond, underground storage tanks to confirm the facility footprints and backwater conditions.*

    These tables are included in Appendix G of the updated report. Note that the rating curves for the storage tanks are preliminary and would be confirmed as part of subsequent detailed design depending on the manufacturer selected. In addition, the modelled surface areas differ from the approximate surface areas presented on the drawings (larger), given that sub-surface storage tanks with aggregate are not fully open (i.e. pore space in aggregate).

18. *Please provide stage-storage-discharge rating table for the proposed wet pond at 0.1 m incremental height by identifying the stage/storage/discharge for different storm events (2 to 100 year and regional storm events).*

    A wet pond is no longer proposed; it has been replaced by a sub-surface storage tank. The rating curves for each of the tanks including expected levels for the 2–100-year storm events are included in Appendix G.

19. *Please review and confirm an ECA requirement from MECP for the proposed wet pond and underground storage tank.*

    A wet pond is no longer proposed. We would assume an ECA would be required for the storage tanks, and oil/grit separator units (direct submission to Approval Branch with City approval).

20. *We recommend the proponent will be responsible to maintain the Creek including downstream the culvert at Sanatorium Road; however, an easement should be provided in favour of the City.*

    We understand that the creek block will be private property. We defer to Valery and Urban Solutions as to the need for an easement for the City given this.

21. *A 4 m maintenance access Road around the Creek should be provided and to be shown on the cross section on the drawing as per comment no. 6 above.*

    Further to comment 6, flat graded areas which could serve as maintenance access roads are located on both sides at the limits of the creek block; refer to the updated grading plans for details.

Figure 3 (Functional site grading plan)

22. *Please provide cross section through the pond (across the entire creek block up to the east bank) in both directions (north-south; east-west) showing side slopes, inlets, outlets and water level for different storm events.*

    Refer to Drawing 7 for cross-sections through the proposed creek block. Typical water levels for different storm events are summarized in the report and included as part of the HEC-RAS model output in Appendix G.

23. *Units parallel to Scenic Drive: current grading plan suggests proposed rear elevation of the townhouse house units are lower than the front. Please demonstrate how the drainages from the rear of townhouse units will be captured. We do not support any uncontrolled flows from the rear of townhouse units to Scenic Drive.*

    Correct. It is not feasible to have the rear-yards of these properties drain internally given the need to match grades on Scenic Drive without retaining walls. The proposed drainage in this case represents the minor grassed area only; roofs would be directed to the internal drainage system.

    Please review and confirm that the emergency spillway for the internal roads on both condo sites towards the creek, not towards Scenic Drive. Please verify and confirm that overland drainages from Scenic Drive east of Sanatorium Road does not drain through Condo site at roundabout location.

    As noted in previous comments, the internal site storm sewer system is designed to a 100-year capacity. Only a portion of the flows above this event could potentially drain towards Scenic Drive. Best efforts have been made to direct overland flow routes for the site towards the creek block or escarpment, however tie-in grades (i.e. at driveway accesses) necessitate some areas to drain towards Scenic Drive. The drainage for Scenic Drive at the roundabout would require further review as part of the detailed design grading.

24. *The proposed grade along the development limit to the west should be set at a minimum of 0.3 m above the emergency spillway elevation 191.6 m near the downstream culvert (on existing Sanatorium Road).*

    A spillway over Sanatorium Road is not considered appropriate for public safety reasons. Based on the updated modelling included with the current submission, the Regional Storm elevation is now estimated to be 191.16 m. A relief ditch inlet is proposed above this elevation, at approximately 191.30 m. Spill across the reconstructed access road at the escarpment would occur at approximately 192.00 m (assuming complete blockage of all the previously

noted outlets). The lowest grade along the proposed building on the west side of the creek is approximately 192.50 m, along the east side the lowest elevation is 193.50 m (building edges – openings are higher still). Based on the preceding, freeboard requirements are easily met regardless.

Figure 5 (Functional Site Servicing Plan- West)

25. *Wet pond: Permanent pool elevation mentioned is 190 m which does not appear to be correct. Please review and confirm. The bottom invert of the pond should be set above the 100 year creek operating elevation. The pond emergency spillway invert elevation should be set at a minimum of 0.3 m above the spillway elevation 191.6 m at culvert location on Sanatorium road. The pond and perimeter berm should not be located within the emergency spillway elevation 191.6 m on Sanatorium Rd at the culvert outlet location.*

    A wet pond is no longer proposed; an underground storage tank is now proposed in the same location. Storage tank #3 (south-east) has been set above the 100-year water level. All other storage tanks discharge downstream of the online flood control facility structure and therefore are unaffected by creek tailwater\ponding levels. The storage tanks however have been verified through integration in the combined PCSWMM model and have been confirmed to function with tailwater levels from the culvert outlet.

    As noted in the response to Comment 24, a formal spillway over the former Sanatorium Road is not considered advisable from a public safety perspective, a relief ditch inlet has been proposed in the event water levels exceed the Regional Storm ponding elevation.

26. *Please consider erosion protection at the end of Headwalls HW1, HW2 and HW 4, HW21.*

    Noted, rip rap protection will be provided at all outlet headwalls.

27. *Please provide the following information regarding SWM detention unit #2, #3, #4: Please confirm and mention the proposed model of the underground storage (i.e ADS Stormtech Chamber as per Page 22 of the report); Please confirm on the drawing: foot print of the storage chamber based on stage-storage-discharge rating table; and top/bottom elevation considering Creek elevation to confirm the volume.*

    As a preliminary selection, the ADS Stormtech Chamber can be assumed however this would be confirmed as part of detailed design and tendering and consideration of alternative equivalent products. Estimated footprints are presented on Drawings 5 and 6, volumes and elevations are also noted on the servicing drawings and in the report (including Appendix G).

The storage tank inverts should be set at 0.3 m above the 100 year creek operating elevation. All pipes inverts from the below ground parking lot to the storage systems/pond/creek should be set at a minimum of 0.3 m above the emergency spillway elevation 191.6 m on Sanatorium road. Please mention that proposed underground chamber will have impermeable liner at the bottom.

As per comment 25, only storage tank #3 (south-east) outlets to the creek block and would be affected by ponding levels, and the elevation has been set above the 100-year ponding elevation. All other storage tanks outlet downstream of the control and would be unaffected by creek ponding; tailwater levels from the culvert outlet are accounted for in the PCSWMM modelling.

As per previous comments a spillway across Sanatorium Road is not considered feasible and a relief ditch inlet has been proposed above the Regional Storm elevation.

All underground storage chambers will have an open bottom to promote infiltration as requested by HCA staff.

28. *Please provide flow control details at MH 16 (for underground SWM detention unit #2) and at MH35 (for underground SWM detention unit #3) and Control structure details to confirm stage-storage-discharge rating and back water condition for 100 year level in the creek.*

    Rating curves are provided in the FSR/SWM report along with orifice outlet details (refer to Appendix G). Proposed orifice sizing and details are noted as well. Note that the orifices are physically modelled in the PCSWMM modelling. All of the underground storage chambers have been tested in an integrated PCSWMM to confirm tailwater conditions do not impact simulated function.

29. Wet pond: please provide flow control details at MH18 to justify footprint of the pond and adequacy of pond volume and outlet configuration considering backwater condition for 100 year water level in the creek

    Note that a wet pond is no longer proposed in this location, an underground storage chamber has been proposed instead. Adequate of storage tank sizing and tailwater conditions is as per previous comment responses.

30. *Please mention the proposed OGS model (EF 6) at OGS 1 and OGS 21 on the drawing (Figure 6) OGS design calculations should be stamped by a Professional Engineer. All OGS should be designed using treatment train design principle. Please note that City will give credit up to the maximum TSS removal efficiency obtained by the ETV test for the chosen OGS model. The design should consider additional measures to achieve the required TSS removal rate (Level 1).*

Preliminary proposed OGS unit sizes are noted on the servicing drawings (Drawings 5 and 6) and in the report. It is unclear what calculations would be stamped and by whom – the sizing software is proprietary to the vendor. Wood can inquire with the manufacturers regarding stamping but suggest this be deferred to detailed design. OGS sizing follows the ETV particle size distribution, and the proposed units are ETV certified.

As outlined in the FSR/SWM report, a treatment train approach is proposed: the OGS units would provide pre-treatment to the level calculated, with the balance of the water quality treatment provided by the "isolator row" technology (also ETV certified) in the subsurface storage chambers.

31. *Downstream culvert at the creek: Proposed 1500 culvert is proposed to be placed at an angle south of the front portion of the existing culvert. Please confirm stage-storage-discharge table for the Creek at 0.1 m incremental elevation under pre and post development conditions.*

The storage-discharge relationship for the creek corridor is provided in Appendix G. The modelling was completed using the 0.25 m increment version however a version at 0.10 m increments has been provided for the City's reference including a comparison indicating the curves are nearly identical as would be expected.

Please provide a table showing the outlet velocity (leaving the culvert) comparisons at different stages under pre and post development considerations. As the southern portion (south of proposed MH 17) existing culvert (1.63 m W× 1.12 m H) will be replaced by the proposed 1500 mm culvert (19 m @0.5 % slope) to replicate the online flood control storage in the realigned creek, therefore the remaining portion of the existing culvert should be replaced at owners cost and be maintained by the condo Corporation.

Given that the outlet section of culvert is to be maintained under proposed conditions, and peak flows are met or reduced under proposed conditions, velocities would be the same or lower under proposed conditions.

If the City requires that the balance of the culvert is replaced, this will require co-ordination with other City comments, in particular the need to maintain the existing stone wall above as a heritage feature (i.e. trenchless technologies for construction) and potential ecological impacts. This would require further discussion. In addition the culvert is a City asset on City property and thus a discussion on cost sharing for any potential replacement warrants discussion.

Figure 6 (Functional Site Servicing Plan- East)

32. *Wood Block: Please show erosion protection at end of the Internal storm service on the east side out letting to the Woodlot and on the west out letting to bioswale. All outlet to the woodlot should be labelled properly including end of treatment control/erosion protection.*

    Rip-rap protection for all storm sewer outfalls would be provided. Further details would be confirmed at the detailed design stage.

33. *Please show functional design of the proposed bioswale on the drawing.*

    A typical bioswale design is included in Appendix G. This would be further refined as part of detailed design.

34. *Please use a different line style for the storm sewer vs. underground storage outline.*

    This has been revised.

35. *Storm outlet for storm sewers on Scenic Drive: Instead of connecting to the 750 mm culvert, proposed storm sewer on Scenic Drive should have a separate outlet to the Creek.*

    This requires confirmation/co-ordination with other City comments (Development Engineering Comment #6). Either a new outfall could be created or the downstream section of the 750 mm diameter storm sewer could be upgraded to account for the additional flow.

    Please show emergency flooding extent on Scenic drive west of Sanatorium road to convey the greater of uncontrolled 100-year post development flow or Regional event flow from the upstream drainages south of Scenic Drive. Please confirm any negative impacts on the proposed access across San Pedro Drive. Please confirm if spillway extent on Scenic Drive is in line with the proposed creek width north of Scenic Drive.

    Upstream areas drain to the water quality pond, which includes two storm sewer splitters to direct overflows to the box culvert crossing of Scenic Drive. Based on the PCSWMM modelling completed by Wood as part of the updated submission, the box culvert would be surcharged but not overtopped for either the 100-year or Regional Storm Event. Overland flow along Scenic Drive is minimal due to the areas diverted to the pond (the preliminary proposed storm sewer to the east of the crossing has also been sized for a 100-year storm). If further assessments are required, specific requirements will need to be discussed with City staff.

Figure 12 (Post Development Floodplain Mapping Plan)

36. Regional Flood line: please provide the relevant hydrologic and hydraulic model files/output.

Model files will be included with the updated submission.

37. Please show a cross section on the emergency spillway above the downstream culvert on Sanatorium Rd to demonstrate flooding extent, depth and flow velocity on the spillway.

As noted in previous comments, an emergency spillway is not proposed. This requires confirmation with City staff. Ponding extents in the channel block are included in the HEC-RAS model outputs in Appendix G.

Information Provided by Public Works:

Water Servicing Review

Regarding the memo of November 27, 2020 requesting comments on the proposal to permit the development of the lands at 801, 820, 828, 865 and 870 Scenic Drive in Hamilton:

- *The following document was reviewed as part of the submission:*
  - *Watermain Hydraulic Report (Wood., September 18, 2020)*

From the water servicing perspective, we have the following comments:

1. Water Demands:
- *Section 2.2 discusses populations but does not provide the actual flows. Please include the Average Day, max Day, and Peak Hour Flows for both the West side and the East side.*

2. Required Fire Flow:
- *The required fire flow for the development has been determined to be 150 L/s. This is acceptable.*

3. Hydraulic Analysis:
- *The boundary conditions do not discuss the pump conditions at the Kenilworth and Greenhill Pumping Stations. Typical operation is to have PMP-4 at Greenhill Ave. on all the time. If needed, PMP-1 at Greenhill will also turn on. In general, pumps at Kenilworth are off.*
- *All pumps at Woodward should be off.*
- *Pumps in PD 6 should be on (up to firm capacity) in order to maintain pressures in PD 6 while supplying the required flow and pressure in PD 5.*
- *Please use the 2021 scenario as existing and the 2031 scenario as future.*
- *If you would like to further discuss the boundary conditions/model, please contact Udo Ehrenberg (Udo.Ehrenberg@hamilton.ca)*

- *A detailed review of the hydraulic analysis has not been completed at this time, and will be completed after the boundary conditions have been coordinated.*

Average Day and Max Day and Peak hour flows were all provided in Appendix B of the previously submitted report. Additional details on the pump boundary conditions have been confirmed. An updated hydraulic modelling report has been included with the re-submission.

Sanitary Servicing

The following sanitary services are available: 375 mm sanitary sewer on the West side of the site on Scenic Dr.

1. *There is a capital project scheduled for construction in the future to replace the existing 375 mm sanitary sewer on Scenic Dr with a 525 mm sanitary sewer from manhole HD14A063 at the west limit of the property, to HC14A033 at Goulding Avenue. Completion of the 525 mm sewer project is required prior to approval of this application in order to prevent capacity constraints.*

   Understood, same comment is noted previously.

Minor Storm Drainage System

1. *There is an outfall to Chedoke Creek at the north end of the site, at Sanatorium Rd and the border of Chedoke Golf Course via a 900 mm storm sewer, as well as a dry pond through the middle of the site which collects flows from upstream of the site.*

   The outlet from the online flood control facility is not a 900 mm diameter storm sewer, but rather a 1.63 m W by 1.12 m H CSP arch.

2. *The applicant is suggesting that for the East site a City-owned storm sewer be constructed along Scenic Dr between the creek and Sanatorium Rd in order to capture flows from external areas and provide road drainage.*

   Correct. This would be for municipal ROW drainage only, a separate storm sewer on private property would be proposed to service the east half of the site and direct flows into the proposed stormwater control chambers. As noted previously external area drainage is minimal (minor grassed frontage of Columbia College) and this approach eliminates the drainage of public roads across private property.

3. *Clarification is required on the proposed City access and easements, as well as proposed ownership of existing storm assets, including the existing SWM facilities and culvert outlet to Chedoke Golf Course at Sanatorium.*

   Wood defers to Valery and Urban Solutions for input on this matter. However, it is understood that the existing property lines would generally delineate public from private assets, and that the creek block and proposed storage tanks would all be private property. It is assumed the portion of the outlet culvert on the access road and in the creek block would be private, however the portion downstream under the proposed trail and heritage wall would be publicly owned, however this may require confirmation.

Hamilton Conservation Authority

Stormwater Management and Servicing

Section 4.4.2.3 outlines that the HEC-HMS modeling determined that increased erosion is not an issue at the Escarpment. At the same time, the report outlines that the flood storage volume is expected to be increased (Section 4.4.1). Considering the flood volume will increase and, respectively, the storm water discharge time from the site will be extended, it is recommended that a qualified fluvial geomorphologist assess the proposed long-term erosion extent at the waterfall located immediately downstream of the road crossing and compare it to the existing long-term erosion potential.

The difference in flood storage volume for more frequent storm events (2 and 5-year storms) is nominal (refer to Table 4.3.5 in the updated report), given that the same dimensions of online flood control structure are proposed and that at lower flows creek block storage is similar. Based on the preceding it is considered unlikely that these minor differences would result in any impact to downstream erosion conditions. We defer to GeoMorphix for further comment if required.

If it is determined the proposed creek realignment will proceed, HCA notes further study will be required to demonstrate that the combination of the realigned channel and reconstructed Scenic Drive crossing is not a source of erosion at the Escarpment brow. If it is determined the erosion potential at the Escarpment brow will increase and have potential to encroach on the development, a geotechnical consultant would be required to assess the slope stability setback along the creek.

We are unclear as to what further study is required. As noted as part of the Sanatorium Road Class EA the proposed development with on-site SWM controls was assessed and it was determined that there would be no adverse impact to erosion further downstream or further upstream on the development, given that the creek block design considers the required meander belt width. No slope stability concerns in the revised design have been identified, all proposed slopes are 3H:1V or flatter. We defer to Landtek Limited for any further geotechnical or slope stability concerns.

HCA staff note the plans and drawings included do not identify the existing or proposed flood or erosion hazards, or indicate the width of the proposed creek block. A plan delineating the existing flood and erosion hazards in relation to the proposed development should be included with the submission.

The proposed flood hazard limit was indicated in the previously submitted materials and has been updated in the currently revised submission (refer to Drawing 10). The meander belt limit has been identified as 30 m, this is considered as part of the proposed design (refer to materials by GeoMorphix) in conjunction with preservation of a section of the existing channel.

The ultimate design should demonstrate that all new outfalls to the regulated watercourse are located above the bankfull elevation and away from the 100-year erosion hazard limit.

This is discussed in the updated FSR\SWM report. Only one new outfall to the watercourse is proposed (storage tank 3 – south-east side) which has been located above the 100-year water level and also assessed dynamically in a PCSWMM model which considers tailwater conditions on all proposed outfalls and storm sewers.

If filtration/infiltration quality control measures are proposed to achieve the required level of TSS removal, it should be demonstrated that storm water is not a potential source of shallow aquifer contamination.

Infiltration measures have been proposed as requested previously by HCA staff. All storage tanks would be pre-treated by oil/grit separators to reduce potential sources of contamination.

HCA staff note the Hydrogeologic Investigation (Landtek Ltd., September 8, 2020), indicates the potential for a significant change in site water balance. In Section 7.4.1, Maintenance of Groundwater Recharge, it is recommended the development maintain pre-development water balance and recharge at the site through storm water management design techniques. In reviewing the submission it is not clear how this has been addressed, and HCA suggests this should be addressed/clarified in the FSR.

As noted above, all proposed sub-surface storage chambers will incorporate an open bottom to promote infiltration and groundwater recharge. The previously proposed wet pond has also been replaced by a sub-surface storage chamber system to similarly promote infiltration. Given the high bedrock on the site it is suggested that groundwater recharge is likely fairly minimal, but the proposed measures will address this concern to the extent possible.

Ontario Regulation 161/06 under the Conservation Authorities Act

The central portion of the subject property is regulated by the HCA pursuant to Ontario Regulation 161/06 (HCA's Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) made under the Conservation Authorities Act, R.S.O. 1990. The regulated area is associated with a tributary of Chedoke Creek and associated flood and erosion hazards.

The development includes the proposed realignment of Chedoke Creek through the central portion of the property. As noted, this proposal has not been previously reviewed with HCA and the studies submitted in support of the application have not addressed HCA policies as they relate to proposed watercourse alterations. A site visit with HCA staff and further rational and assessment of the proposal is required. Given the proposed creek realignment and development within the regulated area a permit(s) will be required for site development.

A site visit was subsequently completed with HCA (July 16, 2021 – meeting minutes included with the updated FSR\SWM report) and HCA comments were e-mailed August 24, 2021 (also included in the updated FSR\SWM report). As per the previous comments, it is understood that a further rationale for the proposed channel re-alignment was required. This has been included in the updated FSR\SWM report (Table 3.1).

MNR/MMAH/CA Memorandum of Understanding – PPS Natural Hazards

Provincial natural hazard policies generally direct development to areas outside of hazardous lands. A plan to illustrate the flood and erosion hazards under existing and proposed conditions in relation to the proposed development should be submitted. All development will be required to be located outside of hazard limits, as they are ultimately determined. Given hazard limits have not been confirmed HCA staff suggest the natural hazard policies of the PPS have not been addressed.

The flood hazard limits were included in the previous submission and are again included in the current submission (refer to Drawing 10). The meander belt width of 30 m was confirmed by the fluvial geomorphologist and indicated in those materials (GeoMorphix). All proposed development is located beyond both of the previously noted hazard limits as outlined in the updated materials. With respect to the flood hazard, the lowest grade is > 1 m above the Regional Flood Level and buildings are located well beyond the typical HCA setback limits (>19 m on west bank, > 14 m on east bank).