Conservation Halton

Planning & Watershed Management
905.336.1158 | Fax: 905.336.6684
2596 Britannia Road West
Burlington, Ontario L7P 0G3
conservationhalton.ca

January 26, 2021

BY EMAIL

Janice Hogg, Senior Planner
Region of Halton
Legislative and Planning Services
1151 Bronte Road
Oakville ON L6M 3L1
Janice.Hogg@halton.ca

AND

Gordon Dixon, Senior Planner
City of Burlington
426 Brant St., P.O. Box 5013
Burlington, ON L7R 3Z6
gordon.dickson@burlington.ca

Dear Janice Hogg and Gordon Dixon:

Re: 1st Submission JART Feedback for Nelson Aggregate – Burlington Quarry Extension
Part Lot 17 & 18, Concession 2 NDS and Part Lot 1 & 2, Concession 2, Burlington
Application under the *Aggregate Resources Act* for a Category 2, Class A Quarry
Regional Official Plan Amendment RQ61A
Burlington Official Plan Amendment 505-04/20
Conservation Halton File PQ 20

Conservation Halton (CH) has reviewed the following studies and drawings submitted in conjunction with the above noted applications:

- Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment, April 2020, prepared by Earthfx et al.
- Level 1 and 2 Natural Environment Technical Report, April 2020, prepared by Savanta
- Adaptive Management Plan, April 2020, prepared by Nelson Aggregates
- Burlington Quarry Extension Planning Report, April 2020, prepared by MHBC
- Financial Impact Study, April 2020, prepared by Nelson Aggregates
- Progressive & Final Rehabilitation/Monitoring Study, April 2020, prepared by MHBC
- Burlington Quarry Extension Surface Water Assessment, April 2020, prepared by Tatham Engineering
- Site drawings and notes package, April 2020, prepared by MHBC

CH feedback on the above noted reports are found in the attached Appendix A.

Conservation Halton is participating in the review of the proposed quarry expansion through the Region of Halton's JART process. The JART includes agency representation from the Region of Halton, City of Burlington, Niagara Escarpment Commission and Conservation Halton.

Please note that CH has not circulated these comments to the applicant, and we trust that the Town and Region will include them as part of your report.

We trust that these comments are of assistance. Should you have any questions, please contact the undersigned via email lsmith@hrca.on.ca or phone 905-336-1158 ext. 2235.

Yours truly,

Leah Smith MCIP, RPP
Manager, Environmental Planning

Encl. Appendix A: Conservation Halton's JART Feedback on First Submission

Cc (by email): Joe Nethery, Region of Halton
John Stuart, Niagara Escarpment Commission
Steven Strong, MNR Aurora District
Calinda Manning, MNR
Christopher Martin, MECP

Nelson Quarry Expansion (CH File PQ 20)

Appendix A: Conservation Halton's JART Feedback on First Submission

January 26, 2021

General Comment:

1. All studies should be coordinated and integrated. In particular, the findings of the Hydrogeologic and Hydrologic Impact Assessment, Surface Water Assessment and Level 1 and 2 Natural Environment Technical Report should inform each other and should be reviewed for consistency.

	Comments	Page / Section
Report/Date: Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment, April 2020 Author: Prepared by Earthfx et al.		
1.	It is reported 5 out of 22 wetlands receive a groundwater discharge (less than 3% of the total inflows). Is this based on monitoring or model results? What year does this represents? How does this relate to potentially wetlands already being impacted by existing quarry operations? High water table may not only provide minor inputs, but also prevent surface water from infiltration, and hence, extend the wetland hydroperiod. Loss of groundwater inputs can also have an impact on wetland water temperature and have impact on the amphibian breeding in the ponds. Has this been assessed?	Page 23 and 24, Executive summary
2.	It is reported the West Extension is next to a locally significant groundwater discharge area, which helps to mitigate the local effects of the excavation. Although it can limit the propagation of the drawdown away from the extraction, lowering of the groundwater levels due to extraction would reduce the amount of discharge in the locally significant groundwater discharge area and hence can be deemed a negative impact. Please address these potential negative impacts in the report.	Page 24, Executive summary
3.	Although, this section states this hydrogeological assessment has been completed in accordance with Terms of Reference for the Level 1 and 2 Hydrogeological and Hydrologic Impact Assessment of the Proposed Burlington Quarry Extension (February 2020), the TOR states that a 25-year baseline period would be simulated including dry year 2007, wet year 2008 and average conditions year 2009. It seems only 10-year period was simulated as baseline, which does not include the specified period 2007-2009. Please include a 25-year baseline period as proposed in the TOR.	Page 30, Section 1.3 Level 1/ Level 2 Study Components and Methodology
4.	To complete a surface water and groundwater impact assessment on the natural environment and private water supplies the baseline conditions scenario should represent unaltered conditions in terms of groundwater and surface water. The modelled current/ baseline scenario (2010 onwards) does not account for quarry impacts to date, i.e. what was the extent and impact of groundwater cone of depression, what were the changes to groundwater levels and vertical gradients, changes to surface water pattern and flows and surface and groundwater interactions?	Page 31, Section 1.3.2 Site Characterization and Baseline Scenario Analysis
5.	The proposed external catchment diversion along Colling Road should be discussed within the Impact Assessment, with modeling updated if necessary. Identify and address any uncertainty associated with completion of these works within the analysis and report.	Multiple
6.	It is reported in this section that data collected for previous studies (see below), have been incorporated into this assessment: • Investigation by Golder in support of a previously south quarry extension (Golder, 2004) • Additional hydrogeologic field studies of wetland/groundwater interaction (Golder, 2006) • An assessment of water budgets for individual wetlands in south extension area (Golder, 2007), and • A study of the shallow overburden (Golder, 2007) However, it seems limited data from these studies have been included in this report for the reviewer to understand quarry expansion impacts on the surface water and groundwater regimes and their interactions within the natural features. Please expand and clarify how previous data have been used in the report conclusions.	Page 36, Section 2.1 Previous Studies
7.	It is impossible to depict some of the monitors on Figure 3.4. Please provide a larger scale map clearly showing all the monitoring location.	Page 46, Figure 3.4 Well Locations – South Extension Area
8.	How was the subsurface conduit to model the disappearing stream segment represented in the model?	Page 103, Section 5.2.4 Weathered Bedrock/ Overburden Interface Aquifer
9.	It is noted that low and high limits of bulk hydraulic conductivities for Amabel Formation used in the model as presented in Table 5.1 are some of the lowest values reported by others. How do hydraulic conductivities used in the model compare to the on-site field investigation derived data? The use of a uniform hydraulic conductivity data may work well for the overall system response, but can you confirm if it is suited to represent local groundwater and surface water	Page 104, Section 5.2.5.1 Amabel Formation hydraulic Conductivity

	interactions? Although a lot of field testing to obtain hydraulic conductivity data was done on and in vicinity of the site, instead of using them to refine the model and to represent local conditions, a uniform hydraulic conductivity values are used, please explain.	
10.	The representation of vertical fractures to connect the shallow and deeper systems by adjusting Kh/Kv anisotropy value to 1:1 of model Layer 5 and Layer 7 in 5% of model cells maybe a good fit for the overall regional groundwater conditions. This approach suggests that areas not underlain by the model cells where Kv/Kh anisotropy was not adjusted may be subject to reduced groundwater flux than areas where the adjustment was made. Considering the above, this approach may misrepresent groundwater and surface water interactions within streams and wetlands depending on the location of the zones with adjusted parameters. Please reconsider this approach.	Page 104, 105 Section 5.2.5.2 Anisotropy and Vertical Flow Patterns
11.	As per Figure 18.20 it appears that the cells with increased vertical hydraulic conductivity are not present within some 100metres of the edge of escarpment and within the Medad valley – please explain. Based on our experience the distribution of vertical fractures near the escarpment tends to be higher (halo effect).	Page 105, Figure 18.20 and Figure 18.21 Section 5.2.5.2 Anisotropy and vertical Flow Patterns
12.	It is suggested in the second paragraph of this section, based on Figure 5.12 which presents water levels in OW03-14C that quarry influence is less than 200 m from the quarry face. Based on other monitoring well results it seems that this may be true for this location only suggesting that the aquifer is not uniform, and which puts in question the use of uniform hydraulic conductivity values in model layers. Please reconsider the use of uniform hydraulic conductivity values in the model.	Page 106, Section 5.2.8, Layer 8: Lower Fracture Zone
13.	Monthly water level data were collected by Golder starting in 2003, and continuous data were collected in most wells from 2007 to 2013 and only starting again in October of 2018. Considering that the longest transient water level dataset is 2007 to 2013 why does the transient model run start at WY2010? It should be noted that the Level 1 and 2 Hydrologic and Hydrogeologic Assessment Terms of Reference proposes a 25 year simulation, and it specifically mentions years 2007, 2008 and 2009 as representative of dry, wet and average climate conditions, respectively.	Page 109, Section 5.3.1.2 Transient Water Level Data
14.	Area west of the quarry between the quarry and the Medad Valley is depicted on Figure 5.15 as having downward gradients, which suggests recharge conditions. Same figure identifies upward gradients within the Medad valley discharge conditions. If the west quarry is approved what would be the mechanism to guarantee the pre-extraction quantity of water is directed to support groundwater discharge function in Medad Valley and associated natural features?	Page 110, Figure 5.15 Section 5.3.2.1 Vertical Head Differences
15.	Figure 5.16 presents a 9 month water level hydrograph for OW03-30B, which is most likely impacted by the quarry operation in 2018/2019. Discussion of a long-term natural seasonal water level fluctuations should be supported by a long-term water level monitoring dataset for wells not impacted by the quarry operation.	Page 114, Section 5.3.3.1 Seasonal and Inter-annual Pattern
16.	A relationship between the distance of the extraction face and groundwater levels in the shallow bedrock and deep bedrock is documented in this section. Even at 1000 metres away from the extraction face the groundwater levels are not at pre-extraction levels (“nearly identical”). This summary is based on a discussion of groundwater levels at four locations only (OW03-15, OW03-21, MW03-09 and OW03-17). All available groundwater level data should be provided for this assessment.	Page 115, Section 5.3.3.2 Quarry Water Level Patterns
17.	It is clearly seen on the provided hydrographs that in the end of 2009 groundwater levels were already impacted by the quarry operation at 50, 300, 650 and 1050 metres away from the quarry face. The end of 2009 clearly cannot be used as the beginning of the transient model simulation used as a baseline scenario as it already shows impacts in groundwater conditions. Please update the baseline period.	Page 115, Section 5.3.3.2 Quarry Water Level Patterns
18.	Considering that groundwater zone of influence extends beyond 1000m away from the quarry face, if the ARA license is issued a follow up water well survey within at least 1000m of the quarry face should be carried out.	Page 118, Section 5.4.1 Private Water Wells
19.	It seems that total well depth was used to calculate available drawdown for private wells as presented in Table 5.3. At least 1.5 metres should be deducted from the well total depth to allow for pump setting and avoid pumping sediment. Also, private water well survey results are needed for this assessment as pump type (single jet, double jet vs submersible) may alter the available drawdown for a particular well.	Page 119, Section 5.4.1 Private Water Wells
20.	Topography-related Properties – The accuracy and extent of the drone survey data in the vicinity of the Quarry and expansion lands should be included within the document. LiDAR data with a +/- 0.1 m accuracy is available for purchase from Conservation Halton to improve the accuracy of the results, if necessary.	Page 129, Section 6.6, Parameter Assignment
21.	Paragraph five of this section explains that white areas on Figure 6.17 represent areas where groundwater discharge exceeds groundwater recharge. It should be noted that these areas coincide with wetland locations surrounding the proposed southern extension and south of the western extension area (wetland 13201), and abut the West Branch of Mount Nemo the tributary to Grindstone Creek. Considering that the baseline scenario represents partially	Page 135, Section 6.9 PRMS Submodel Outputs, Figure 6.17 Simulated

	impacted groundwater conditions the amount of groundwater discharge in these areas was potentially higher. How would groundwater discharge function be restored and maintained during extraction face moving closer to those features resulting in additional groundwater lowering?	annual net average groundwater recharge in mm/yr
22.	Based on the recharge map the area which is proposed for west quarry extension provides recharge which supports a number of downstream private water supplies and discharge within Medad Valley. This is also supported by provided cross sections on Figures 5.3 and 5.4. How would these conditions be maintained during and after extraction?	Page 139, Figure 6.17 Annual Net groundwater Recharge (mm/yr)
23.	The report should document which and how parameters in the PRMS sub-model were adjusted to calibrate the GSFLOW model.	Page 143, Section 6.11.1, GSFLOW Surface Water Streamflow Calibration
24.	Figure 6.19, Simulated and observed flow at SW10B for WY2019 - While the match of observed streamflow to the GSFLOW simulated flows is very good for 2019, the match for Fall 2018 is weak. Further discussion is required and refinements to the calibration may be required.	Pages 143-144, Section 6.11.1, GSFLOW Surface Water Streamflow Calibration
25.	To validate the GSFLOW model, hydrographs illustrating simulated and observed flows should be presented at a surface water monitoring location on each tributary.	Pages 143-144, Section 6.11.1, GSFLOW Surface Water Streamflow Calibration
26.	Please include OW03-15B observed and simulated water levels on Figure 6.24. The model overestimates deep groundwater conditions by some 1-2 m and at the same time underestimates the shallow groundwater levels by some 0.5-2 m without an explanation why and what it means in terms of surface and groundwater interactions. Please provide an explanation of surface and groundwater interactions at this location and any other location where the model does not simulate the observed data	Page 149, Section 6.11.3.1 Well within 100 m of the Quarry face
27.	Please provide a borehole logs for well nests OW03-21 and OW03-31. If well nest OW03-31 has a shallow installation, please provide the data. Please include OW03-21C simulated water levels on Figure 6.25. As presented on Figure 6.26, while the observed data in OW03-31A (deep bedrock) is consistently higher than OW03-31B (shallow bedrock), suggesting upward gradients, while the simulated water levels show consistently downward gradients. Considering OW03-31 is located next to a wetland and the model does not represent local conditions it poses a question if the model can be used to predict impacts on the wetland.	Page 150, Section 6.11.3.2 Well between 100 m and 800 m of the Quarry Face
28.	Please include OW03-29C observed and simulated water levels on Figure 6.27. Based on observed water level data in Figure 6.27 there is a reversal of vertical gradients to upwards in the fall, this is not represented in the model as the simulated water levels are consistently 0.5 to 1 m higher in the shallow bedrock – please explain.	Page 150, Section 6.11.3.3 Wells greater than 800 m from the Quarry Face
29.	It appears that there is a two to three-month lag between the observed and simulated data as presented on Figures 6.29 and 6.30 – please explain. It appears that MP16 is constructed in MNRF wetland 13037. As per Provincially Significant Grindstone Creek Headwaters Wetland Complex assessment, February 2007, Ontario Ministry of Natural Resources Aurora District this wetland also known as No. 12 was identified to be seepage-fed and contributing baseflows to Grindstone Creek.	Page 152, Section 6.11.4 Shallow Groundwater Calibration
30.	Please explain a two to four-month lag between observed and simulated water level results for MP5 and what it means in terms of using the model for predictive analysis.	Page 155, Section 6.11.5 Wetland and Pond Calibration
31.	The GSFLOW calibration section is lacking calibration to transient groundwater level data outside of the existing quarry zone of influence, especially to the west of the quarry. Please update the calibration accordingly.	Page 161, Section 6.11.8 GSFLOW Calibration Conclusions
32.	Figure 6.39 is confusing. It shows a loss of groundwater on annual basis at a rate of some 1000-2000m3/d, and groundwater ET losses in winter months at rates which are comparable to summer months – please clarify.	Page 164, Figure 6.39 Average monthly groundwater budget for the study area
33.	The proposed set of groundwater assessment points for “the Baseline and Scenario comparative analyses” at locations without observed data seems questionable. Please provide a justification of why these assessment points are representative of baseline conditions and why would it be appropriate to use them for comparative analyses.	Page 167, Section 7.2.4 Seasonal and Inter-annual Groundwater Levels
34.	Please provide digital, daily water levels, presented graphically (to depict the wetland hydroperiod) and summarize daily water balance analyses as average monthly water volumes presented in tabular format integrated in the report. Compare driest year, average and wettest year monthly water volumes to assess potential impact.	Page 179 Section 7.2.6 Wetland Water Budgets

35.	Figures 7.20 and 7.21 show groundwater discharge to the soil zone under wetlands and streams and discharge to streams, respectively. Some of these areas are within less than 200 m of the proposed south extraction. How would these functions be maintained during and after extraction?	Page 183, 184 Figure 7.20 and 7.21
36.	Wetland 9 (13014) water balance summary shows no groundwater discharge, however based on Figure 6.26, at OW03-21 there are documented upward gradients between the deep and shallow bedrock. Please provide hydrograph of all available monitoring data for OW03-30, OW03-31, MW03-08, MW03-10 and MW03-11 located in and around Wetland 9.	Page 186, Figure 7.23
37.	To evaluate the results of the wetland water balance results please submit all available water level monitoring data in and around the wetlands.	Pages 186 – 189, Figures 7.24 – 7.30
38.	It is stated that from a hydrogeological perspective the proposed west quarry extension is located in a favorable area due to the Medad Valley which is “a locally significant groundwater discharge area” which reduces the amount of inter-seasonal water level fluctuations. The Medad Valley is downstream of the proposed extension and although it is a hydraulic boundary which reduces the amount of water level fluctuations, a reduction of flow towards it would be considered a direct negative impact on this feature. Furthermore, most of the proposed west quarry extension is upgradient of numerous private water supplies, an area which provides recharge to the underlying aquifer. Since most of this area would be extracted causing groundwater lowering due to quarry cone of influence and reducing the upgradient area providing recharge for the private water supplies, an infiltration pond had to be proposed to mitigate the impacts, feasibility of which is uncertain (please see comments below, re: Page 226, Section 8.6.1 Infiltration Pond).	Page 191 and 192, Section 8.3 Level 2 Assessment Overview
39.	A more robust discussion of the anticipated changes in stream flows should be provided. At a minimum, the analysis should include: • Maximum changes in stream flow rates for each tributary/flow node (in addition to the change in average stream flow rates provided). • Percentage change in average and maximum stream flow rates. • Any change in the duration of no flow or baseflow periods. • Simulated stream hydrographs and analysis for Willoughby Tributary immediately downstream of Collings Road.	Pages 193 - 302, Section 8.4, Model Evaluation of Extraction Phases
40.	Detailed water budget for wetland figures should include baseline and proposed values to facilitate reviews.	Pages 193 - 302, Section 8.4, Model Evaluation of Extraction Phases
41.	Table 8.3, Scenario Summary – The climate data periods used to analyse extraction scenarios are not consistent. Explanation and justification for the start and end dates should be provided.	Page 196, Section 8.4.1, Model Evaluation of Extraction Phases, Scenario Summary
42.	Wetland 21 (13201) is considered compromised due to the road and culvert, and its water budget is not considered representative of future conditions. There is also minor groundwater discharge to the wetland. Please confirm how changes to this wetland will be assessed and mitigated. The NETR identifies this wetland as adjacent to a rare vegetation community and this should be considered when assessing impacts.	Page 212 Section 8.5.4 P12 Wetland Water Budgets
43.	Phases P34, P3456, RHB1 - The report suggests that water is not discharged to the tributary of Mt. Nemo Creek during these phases, while other reports indicate the discharge from Quarry Sump Q200 will continue through these phases and will potentially increase. Analysis should be consistent with proposed mitigation plan and the modeling updated as necessary.	Page 225, Section 8.6, Scenario P34; Page 230, Scenario P3456; Page 260, Section 8.8, Scenario RHB1
44.	Scenario P34 assumes that extraction in Phase 1 and 2 is complete and the water levels filled to the natural conditions. How long will it take for P12 to fill to the natural conditions? Unless P12 is filled before extraction commences in P34 the proposed approached does not represent cumulative impacts.	Page 225 Section 8.6 Scenario P34
45.	The proposed infiltration pond (as shown on Figure 8.38) does not match the pond shape on the submitted site plans. The pond on the site plans does not have a spur parallel to Cedar Springs Road in the northwest corner of the site. The grades on the site plans suggest that the spur cannot be constructed as shown on Figure 8.38. Please clarify.	Page 226, Section 8.6.1 Infiltration Pond
46.	Is the proposed infiltration pond an appropriate measure to mitigate impacts on private water supplies? The proposed infiltration pond would make most, if not all downstream wells, categorized as groundwater under direct influence of surface water (GUDI wells). Although, the proposed infiltration pond could be used as a measure to mitigate impacts on the NHS (Medad Valley), assuming that the pre-extraction groundwater heads could be maintained, considering private water supplies exist downstream of the proposed pond, how would the construction of the ponds be carried out to ensure ample and good quality of water is available for downgradient groundwater users? What measures would be implemented to ensure that water quality meets ODWQS? How would the pond be constructed to ensure continued infiltration: it is stated in the report that wetlands are	Page 226, Section 8.6.1 Infiltration Pond

	perched, what would be done to ensure that the infiltration pond does not lose its intended functionality with time? How would water be prevented to flow back into the extraction zone? Monitoring, mitigation and contingency details should be provided to ensure that there is no water quantity and quality impacts on the downstream groundwater users in this area.	
47.	Scenario P3456 assumes that extraction in Phase 1 and 2 is complete and the water levels filled to the natural conditions. How long will it take for P12 to fill to the natural conditions? Unless P12 is filled before extraction commences in P3456 the proposed approached does not represent cumulative impacts.	Page 230 Section 8.7 Scenario P3456
48.	No changes to the water budget for Wetland 22 (13200) are suggested, as the wetland is perched and there is no change to its contributing area, however as noted in the Surface Water Assessment drawings DP-1 and DP-2, it appears that there will be changes to the catchment area of the wetland. Please discuss if these changes will impact the water budget for this wetland.	Page 242 Section 8.7.4 P3456 Wetland Water Budgets
49.	The impact assessment was done using a background scenario which represents altered conditions. As summarized in section 8.10.2, there is 2.0m of drawdown predicted up to 1000 m from the excavation, which suggest that the baseline conditions scenario does not document natural functions within surrounding wetlands and watercourses - please clarify.	Page 301, Section 8.10 Level 2 Impact Assessment Conclusions
50.	The groundwater monitoring program must include shallow monitoring wells including wells completed in overburden to understand full impact of the proposed extraction.	Page 303, Section 9.2 On-Site Monitoring Wells
51.	Staff support using private water wells to supplement monitoring and impact assessment, however, the efficacy of this monitoring “to act as an early warning system” as said in the first paragraph on page 304 is questionable. Especially, for the south extension area, where most of the proposed private wells for monitoring are more than 1 kilometer from the extraction zone (Figure 9.1). Monitoring wells between the extraction zone and groundwater receptors should be proposed to proactively assess impacts.	Page 303, Section 9.3 Off-Site Domestic Water Wells
52.	It is reported that the south extension area has been monitored extensively for 7 years. Considering most of the monitors were most likely impacted by present quarry operation during that time, how reliable is the data to establish baseline conditions?	Page 304, Section 9.4 Groundwater Impact Assessment Methodology
53.	Considering that private well referred to as DW2 is located within the present quarry zone of influence, it may not represent the natural variability of the groundwater elevation fluctuations as stated. How many years of DW2 monitoring data is available to date?	Page 305, Section 9.4.1 Monitoring of Background groundwater Conditions
54.	Please provide an example of the trend analysis. How often would this analysis be repeated based on actual measurements rather than simulated levels?	Page 305, Section 9.4.2 Comprehensive Groundwater Elevation Trend Analysis
55.	What groundwater mitigation measures would be implemented to mitigate impacts (if identified through monitoring) on the natural environment features? e.g. groundwater discharge to Medad Valley, wetlands and streams.	Page 307, Section 9.4.4 Proposed Groundwater Mitigation Measures
56.	A number of important monitors are not included in the monitoring program, e.g.: MW03-02, OW03-16 and MW next to it (based on Figure 3.4 cannot decipher what the MW number is), OW03-32, MW03-03, OW03-31, MW03-08, MW03-10. All monitoring well intervals should be monitored (including shallow either bedrock or overburden installations, which are usually designated C).	Page 308, Section 9.5.1 Groundwater Monitoring Program
57.	Provided thresholds in Table 9.2 assume that there are no impacts to the shallow zone. It seems, if the Level 1 and 2 Threshold conditions are met, a very similar response is proposed and there is no action proposed after reaching Threshold 1 to avoid Threshold 2. There is no action proposed to avoid reaching a minimum water level nor any action if it is reached or exceeded. Please revise to propose appropriate actions.	Page 313, Section 9.5.2 Groundwater Thresholds
58.	Please provide groundwater quality and quantity monitoring details. What would be the frequency of the trend analysis? Shallow monitoring wells and a number of wells listed in comment re Section 9.5.1 should be added to the monitoring program. Nitrite and nitrate should be added to water quality monitoring.	Page 319, Section 10.1.1 On-Site Groundwater Monitoring Program
59.	Include a summary of effects on watercourses in these sections.	Page 325; Sections 11.3.2.2 & 11.3.3.2, Wetlands and Surface Water Features
60.	Outline proposed pumping/discharge points for Rehabilitation Scenario 1.	Page 326; Section 11.3.4, Rehabilitation and Closure
61.	Please submit all borehole logs used for the assessment (Only 50 out of 100 reported borehole logs were provided).	Page 334, Section 15.1 Drilling Program

62.	Monitoring well packer test and slug test results for all tested wells should be provided (please provide location of MW18-1 and MW18-2 monitoring wells). On page 367, last paragraph of section 15.2.1 it is reported that the packer testing results are in section 11.1, but section 11.1 is an introduction to Summary and Conclusions. Borehole logs in section 15.1 for reported in section 15.2 packer tested wells do not show the information either.	Page 367, Section 15.2.1 Downhole Packer Testing
63.	Downhole geophysical results for all tested wells should be provided. Section 15.4 presents a summary of how the testing was carried out. Does section 15.4 include all results of geophysical logging?	Page 379, Section 15.4 Geophysical Logging
64.	Only hydrographs for monitoring wells proposed for the long-term monitoring are provided. All available groundwater level monitoring data should be included in the submission to help understand local conditions and measured progression of groundwater lowering due to quarry operations.	Page 389, Section 15.5 Groundwater Monitoring Program
65.	OW03-20 documented groundwater levels suggest upward gradients at this location suggesting groundwater discharge conditions. Please provide simulated data for all OW03-20 (A, B and C) intervals.	Page 392, Section 15.5
66.	OW03-28 documented groundwater levels suggest upward gradients at this location suggesting groundwater discharge conditions. Please provide simulated data for all OW03-28 (A, B and C) intervals.	Page 393, Section 15.5
67.	BS-01 through BS-05 reported groundwater level monitoring period is less than 1 year. Please extend the monitoring period to include the most recent data. Please include BS-06 and BS7 groundwater level data, borehole logs and location of these two wells.	Page 394-396, Section 15.5
68.	Please clarify for which wetlands field surveyed bathymetry data was used.	Page 486, Section 18.3.2 Lake and Wetland Representation
69.	Please explain why specific yield values for weathered and fractured zone hydrostratigraphic layers are so low (Weathered Amabel, Middle Amabel bedding plane fracture zone and Lower fracture zone)? They are an order of magnitude smaller than respective competent bedrock layers. As per section 5.2.4 Layer 4 may act as unconfined aquifer when specific yield rather than storage is used. It should be noted that this is also possible in lower layers closer to the extraction where water table drops significantly.	Page 492, Table 18.4 Final calibrated model parameter values
70.	Please include simulated and observed water levels for OW03-14B. It should be noted OW03-14A water levels are also constantly overestimated by some 1-2 m.	Page 533, Section 19.5.3 Wells within 100m of the Quarry Face
71.	Contrary to wells within 100 m of the extraction the model underestimates deep system groundwater levels by some 1-2.5 m, moreover, simulated water levels from model layer 7 or 8 should be presented and compared to MW03-09A. Shallow zone observed and simulated groundwater levels should be also included on this figure.	Page 535, Figure 5.25 Comparison of observed and simulated water levels at monitor MW03-09
72.	OW03-30 – observed groundwater levels in the deep and middle zones seem to be higher than simulated water levels. Simulated water levels from model layer 7 should be presented and compared to OW03-30A. Shallow zone groundwater OW03-30C observed and simulated water level data should be included.	Page 535 Figure 19.26 Comparison of observed and simulated water levels at monitor OW03-30
73.	The large difference between simulated and observed water levels in MW03-02 as presented on Figure 19.28 puts in question using the model to predict local conditions. Perhaps the difference between the observed and simulated water levels can be explained by heterogeneity of the bedrock aquifer. Has there been any hydraulic testing done on MW03-02 to identify local hydraulic properties of the aquifer? Please provide a borehole log for MW03-02. Please include MW03-02B observed and simulated data.	Page 537 Figure 19.28 Comparison of observed and simulated water levels at monitor MW03-02
74.	Considering MW03-01C is a shallow well (about 2 m deep), simulated water levels from an appropriate layer should be presented on Figure 19.28. Please include MW03-01B observed and simulated data.	Page 537 Figure 19.28 Comparison of observed and simulated water levels at monitor MW03-01
75.	Please explain a 2-3-month lag between the observed and simulated water levels at monitor OW03-17.	Page 538, Figure 19.30 Comparison of observed and simulated water levels at monitor OW03-17
76.	Please explain a couple month lag between observed and simulated water levels as visible on Figures 19.35, 19.38, 19.39, 19.40 and implications of using the model for predictive analysis. Please provide construction details of the mini-piezometers used in the assessment.	Page 540, Section 19.5.6 Shallow System Calibration (Mini-piezometers)

	Comments	Page / Section
Report/Date: Level 1 and 2 Natural Environment Technical Report, April 2020 Author: Savanta		
1.	Not all of the natural heritage features that have the potential to be impacted are identified in the report. For example: • PSWs that are within the zone of influence of the proposed quarry but outside of the 120m adjacent lands are discussed only at a high level, though potential exists for impact as noted in the Hydrogeological and Hydrological Impact Assessment Report and the Surface Water Assessment. • Significant Wildlife Habitat (SWH) discussions did not include all of the identified SWH in the study area (e.g., FOD7-4, seeps and springs, amphibian movement corridors, etc.). • The extent of fish habitat on the site and within the zone of influence should be confirmed by DFO. • Connectivity across the landscape should be considered in more broader terms. Recommend revising the report to discuss all of the natural features that have the potential to be impacted by the proposed quarry and mitigation measures developed as appropriate.	General Comment
2.	Recommend expanding the applicable PPS policies to include those in the Policy 2.2 Water, given that some of these speak to natural heritage features and areas, and the connection to the water system.	Page 9 Section 2.1.1 Provincial Policy Statement
3.	Please discuss how the delay in the Headwater Drainage Feature (HDF) Assessment timing impacted the results of the assessment and provide additional mitigation as necessary. For example, the first round of the HDF Assessment was completed on April 18, 2019 with a temperature of 22 degrees, which is outside of the spring freshet of that year. The second round was completed outside of its typical period (June 3, 3019 vs Late April – May) and the last round was at the very end of the window as well (August 26, 2019 vs July-August).	Page 29 Section 4.3.1 Headwater Drainage Feature Assessment
4.	Please provide the number of surveys, location of sites and dates of the egg mass surveys.	Page 35 Section 5.2.4 Egg Mass Survey Results
5.	The report indicates that no amphibians were heard calling from ACC11 however wetland 13037 (PSW12) is identified as an amphibian breeding area in the MNRF Grindstone Creek Headwaters PSW evaluation. We recommend referencing the evaluation and discussing in the report.	Page 36 Section 5.2.5 Amphibian Call Count Survey Results
6.	Please note that the identified H2 is a regulated watercourse under Ontario Regulation 162/06 and not a headwater drainage feature as discussed in the report. Please revise the table accordingly.	Page 39 Section 5.3.1 Headwater Drainage Feature and Aquatic Habitat Results
7.	Once the additional hydroperiod information for the wetlands is complete, please revise and include an ecological interpretation of the data in this report. The data should be assessed from a dry, wet and average climate conditions perspective to ensure that proposed changes do not exacerbate natural dry conditions.	Page 46 Section 6.1.2 Significant Wetlands – 120 m Adjacent Lands
8.	The MNRF Grindstone Creek Headwaters PSW Evaluation notes that the larger wetland of the 13037 (PSW12) is seepage-fed and contains a seep that can be seen discharging to the surface, whereas the report indicates that this wetland is precipitation and surface runoff fed with groundwater contribution to be less than 2%. We recommend referencing the evaluation and discussing in the report.	Page 46 Section 6.1.2 Significant Wetlands – 120 m Adjacent Lands
9.	All of the PSWs within the zone of influence of the quarry should be discussed in this report, regardless if they are within the 120m adjacent lands. There are number of PSWs in the Grindstone Creek PSW Complex that may be impacted by the quarry that are not discussed in the report.	Page 46, Section 6.1.2 Significant Wetlands – 120 m Adjacent Lands
10.	Please confirm the source of water input for the SAS1 inclusion within the MAM2-2/SWT2-2.	Page 49 Section 6.1.3 Other Wetlands within the 120 m Adjacent Lands
11.	The significance and role of Woodland E relating to the RNHS should be expanded upon. Provide further analysis to confirm the functions and contributions of Woodland E for: • SWH (Eastern Wood-Pewee Habitat, Bat Maternity Roost Habitat); • Separation distance from Woodland D; • Overall connectivity/ linkage opportunities within the RNHS; and • Overall significance. It is recommended that detailed avoidance rationale be provided to reflect the role Woodland E plays within the larger RNHS and all associated impacts.	Page 53 Section 6.2.2. Halton Region Official Plan
12.	The FOD7-4 community is rare in the province and is therefore confirmed SWH, regardless of its frequency in Halton Region. The report should provide the full 30m buffer for this woodland, an impact assessment for this feature and mitigation measures developed as necessary.	Page 57 Section 6.4.1 SWH Assessment Summary, Table 19
13.	The Grindstone Creek Headwaters PSW Evaluation notes that a number of the wetlands adjacent to the proposed south extraction support amphibian breeding. Further discussion on the potential use of these wetlands by amphibians and	Page 57 Section 6.4.1

	potential SWH should be provided. We recommend referencing the evaluation and discussing in the report.	SWH Assessment Summary
14.	Confirmation from DFO is needed on the status of fish habitat on the site. Until this is confirmed, it is premature to state that no fish habitat is present.	Page 59 Section 6.6 Fish Habitat
15.	Recommend additional impact assessment as it pertains to fish habitat outside of the project footprint, given the potential impact to the water inputs to the offsite watercourses. Until such time that this occurs or direction from DFO is received, a precautionary approach should be taken.	Page 59 Section 6.6 Fish Habitat
16.	We recommend consultation with MECP regarding Species at Risk for this project to determine if the surveys and associated survey efforts are acceptable and to determine the current regulation limits for those identified.	Page 62 Section 6.7 Habitat of Endangered And Threatened Species
17.	Recommend that the general mitigation measures discuss the potential impacts associated with blasting. Currently blasting is discussed for wetlands, but as there are other natural heritage features present, this should be expanded to a general list.	Page 66 Section 7.1 General Mitigation Measures
18.	Without having access to the approved Spills Action Centre for the existing quarry, it is challenging to know if what is contained in it is appropriate for the proposed expansion. We recommend including this in the application.	Page 67 Section 7.1.2 Accidental Spills
19.	The location of the berm adjacent to the weir pond should be changed to 30m from the wetland, rather than 14m as currently proposed, to ensure the hydrologic and ecologic function of this pond is not impacted.	Page 68 Section 7.2.1 Wetlands
20.	For indirect water quality impacts, we recommend including turbidity in the assessment.	Page 68 Section 7.2.1 Wetlands
21.	More information has been requested with respect to the water balance assessment for the wetlands adjacent to the extraction areas. Please refer to comments on the Surface Water Assessment and the Level 1 and 2 Hydrogeologic and Hydrologic Impact Assessment. The Natural Environment Report should be revised to provide an ecological interpretation of those changes, as applicable.	Page 68 Section 7.2.1 Wetlands
22.	All of the wetlands that have the potential to be impacted by the quarry application should be discussed in this report. The zone of influence of the quarry is identified as 800m away and there is potential impact in those PSWs between 120m to 800m from the quarry. The Natural Environment Report should be revised to discuss all of the potential features impacted and mitigation measures discussed to ensure they are not impacted. This will ensure that all of the connections and linkages between the NHF, surface water features and groundwater features are identified.	Page 68 Section 7.2.1 Wetlands
23.	Please provide the details of the monitoring collected in the spring of 2020 wetlands 13200, 13201 and 13202.	Page 69 Section 7.2.1 Wetlands
24.	Is it suggested that the catchment areas of the wetlands to the east of the extraction will be maintained, however as noted in the Surface Water Assessment drawings DP-1 and DP-2, it appears that there will be changes to the catchment areas of the wetlands. Please confirm and revise as necessary.	Page 70 Section 7.2.1 Wetlands
25.	Please include a discussion on the potential impacts of reduced groundwater flows on the wetlands. For example, will less saturated soils lead to a great drawdown in water levels? Will there be impacts to the temperature of these wetlands from less groundwater and will this impact amphibian breeding?	Page 70 Section 7.2.1 Wetlands
26.	In the Hydrogeological Report, Wetland 21 (13201) is considered to be compromised due to the road and culvert, and its water budget is not considered representative of future conditions. Please confirm how changes to this wetland will be assessed and mitigated, especially as this wetland is adjacent to a rare vegetation community.	Page 70 Section 7.2.1 Wetlands
27.	The report indicates that bat maternity colonies in the study are not unique in the subject lands or even the landscape. The Significant Wildlife Habitat Mitigation Support Tool (2014), Index 12, states that Bat Maternity Colonies are critical to the survival of local bat populations and the loss of any site has significant impacts on bat populations. We recommend that this discussion be revised to reflect provincial policy and direction as it pertains to this type of SWH.	Page 72 Section 7.2.3 Significant Wildlife Habitat
28.	The Rare Vegetation Community FOD7-4 is not discussed in this section. As this is a confirmed SWH in the study area (confirmed in Table 19 as well) and as it may be impacted by the proposed quarry, this SWH should be discussed.	Page 72 Section 7.2.3 Significant Wildlife Habitat, Table 19
29.	FOD7-4 is not fully protected as it extends out past where the buffer is located. This SWH should be protected with a 30m just as the rest of the natural features are. Please revise.	Page 72 Section 7.2.3 Significant Wildlife Habitat. Figure 8a
30.	In addition to the SWH discussed, Amphibian Movement Corridors should be discussed as this is identified in Table 19 as present.	Page 74 Section 7.2.3 Significant Wildlife Habitat, Table 19
31.	The proposed settling pond outlet at the bank of the West Arm watercourse and associated longer term sump should be assessed in further detail so that the outlet does not impact the natural features present. Mitigation measures should be developed to limit impact, such as the use of a flow spreader to reduce bank erosion.	Page 76 Section 7.2.4 Fish Habitat
32.	Please confirm winter target numbers for baseflow upstream of Colling Road, as only spring, summer and fall are provided.	Page 77 Section 7.2.4 Fish Habitat
33.	The potential impact of a 3% reduction in groundwater in the creeks and wetlands as it relates to temperature changes has not been provided. Even a small	Page 80 Section 7.2.4

	reduction can alter the ecological function of these features and this should be assessed in the report. In addition, consider temperature changes from the proposed mitigation pond.	Fish Habitat
34.	Please discuss and quantify how the 4-6% reduction in runoff volume compares to a dry year and the potential impacts of this on the creeks and wetlands.	Page 80 Section 7.2.4 Fish Habitat
35.	We disagree with the justification provided with respect to the connectivity of the area. While the proposed expansion lands are currently in a non-natural state, there are limited barriers to obstruct the movement of species across the landscape. The connectivity that these lands currently provide would be lost based on the proposal. The diversity and connectivity of the overall Mount Nemo Plateau should be considered to ensure that the proposal does not restrict wildlife movement.	Page 80 Section 7.2.3
36.	A reduced buffer to some Significant Woodlands is proposed, however justification for this reduction is not included. As these woodlands are also supporting other natural features and functions, and as the site can accommodate full 30m buffers, this reduction is not supported.	Page 82 Section 8 Niagara Escarpment Plan
37.	As SWH is a Key Natural Heritage Feature, the vegetation protection zone should be 30m from these features. Please revise.	Page 82 Section 8 Niagara Escarpment Plan
38.	Please expand the SWH section to include the rare vegetation community FOD7-4 identified in the Level 1 Report. Discussion on how will be protected and any additional mitigation measures should be provided in addition to the SWH included in this section.	Page 84 Section 9 Regional Official Plan
39.	Cumulative impacts discussed in the report are limited. We recommend that this section be expanded upon to provide more detail and discussion on what the cumulative impacts of the proposed quarry might be. For example, the existing quarry began in the 1950s and has impacted the natural environment since then. If the existing quarry is continued to be used, rather than rehabilitated as originally planned, then this would result in longer, cumulative impacts on the area.	Page 86 Section 10 Regional Official Plan Guidelines – Aggregate Resources Reference Manual
40.	We recommend including the smaller portion of wetland 13037 on the ELC map as it is not identified.	Figure 3b
41.	Please discuss why amphibian monitoring was not conducted in the SWS3-2a/b communities in the western expansion area and the SWS/MAM2-2 associated with the West Arm. Table 2 notes that surface water in SWS3-3b was usually present in the spring as well as July and September. Should suitable habitat be present, then we recommend that amphibian monitoring occur.	Figure 4a Table 2
42.	We recommend that all of the hedgerows in the proposed extraction areas be assessed for potential bat habitat.	Figures 5a and 5b
43.	Please clarify why the FOD5-6 south of the proposed south extraction area was not assessed for bats. If suitable habitat is present, we recommend that this assessment occur.	Figure 5b
44.	Seeps were identified by the MNRF PSW evaluation in wetland 13037. This SWH should be considered as candidate and additional surveys done to determine the presence of these seeps.	Table 19
45.	Recommend that additional targeted surveys be undertaken to assess the potential for turtle habitat. We note that turtles have been known to use irrigation ponds and as there were limitations to being able to sample some of the deeper irrigation ponds, habitat may be present.	Table 19
46.	The table notes that monarchs were not observed during the insect surveys, however the CUM field sheets note four individuals on Sept 11 and 19. We recommend that host and feeding pollinating plant species be considered when developing restoration plans.	Table 19 and field sheets
47.	The ELC field notes are not complete as soils were not competed. Please discuss how this may impact the classification of the vegetation communities.	Field sheets
48.	Please include a more detailed discussion on net gain as per Halton Region's Aggregate Resources Reference Manual. Currently direction is to refer to the Site Plan and AMP, which does not give enough detail to ensure that net gain is achieved.	

	Comments **Report/Date: Adaptive Management Plan, April 2020** **Author: Nelson Aggregates**	**Page / Section**
1.	Staff recommends the Adaptive Management Plan be revisited and updated once significant issues with the Level 1 and Level 2 Natural Environment Technical Report, Surface Water Assessment, Phase 1 and 2 Hydrogeological and Hydrological Study, other reports and After Use have been resolved.	
2.	The Adaptive Management Plan (AMP) should identify securities to be posted by the applicant to protect the public agencies from financial liability for performance of the mitigation requirements and any on-going management over the long term, in the event the owner fails to do so.	
3.	The wetland AMP/monitoring program should be based on modelled baseline water levels within the wetlands, not just the hydroperiod start dates, in order to confirm if the proposed quarry activities impact the wetlands.	
4.	The AMP must consider all items listed in Section 4.11 of the Region's Aggregate Resource Reference Manual.	
5.	A private well at 2377 Colling Road is proposed to be used as background monitoring well. The well is located 350 metres away from the existing quarry and is potentially within the existing quarry zone of influence. How many years of data is available for this well? In addition to the above, a private well should not be used as a background monitoring well as there is no guarantee it will not be decommissioned during extraction due to, for example, property sale or changes	Section 4.3.1 Monitoring of Background Groundwater Conditions, page 7

	to water taking requirements on the property, Private well water taking can also change, which could impact the reliability of the groundwater level data.	

	Comments	Page / Section
Report/Date: Burlington Quarry Extension Planning Report, April 2020 Author: MHBC		
1.	The Planning Report should address the applicability of the *Conservation Authorities Act* and Conservation Halton's current regulation, Ontario Regulation 162/06, pre-, during and post-operation. Although areas licensed for aggregate extraction under the ARA are exempt from conservation authority permitting activities, Conservation Halton's regulation and regulatory policies are applicable prior to a license being granted and once a license is surrendered or revoked. Furthermore, any development proposed in Conservation Halton's regulated area, that is outside of the ARA licensed area, will require permission from Conservation Halton. Pursuant to Ontario Regulation 162/06, Conservation Halton regulates, all development in or adjacent to river or stream valleys, wetlands, shorelines or hazardous lands (including karst topography); alterations to a river, creek, stream or watercourse; and interference with wetlands. Conservation Halton's *Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* can be found at www.conservationhalton.ca	
2.	Section 8.0 (Description of Subject Site and On-Site Resources), Section 9.0 (Surrounding Land Uses and Mitigation/Monitoring Measures to Minimize Impacts (including Agricultural) and Section 10.0 (Surrounding Natural Heritage, Water Resources and Mitigation and Monitoring Requirements) of the Planning Report do not address natural hazards. Discussion of hazards should be addressed in these sections, where appropriate.	Sections 8, 9, 10 and 12.
3.	Section 12 (Policy Review) refers to hazardous lands and hazardous sites but does not refer to the natural hazard analysis completed as part of the Surface Water Assessment, or the karst investigation.	
4.	The policy review section refers to conclusions made in the Natural Environmental Technical Report, Surface Water Report and Hydrogeology Report in order to confirm that appropriate policy tests are being met (e.g. hazardous lands/sites, wetlands, significant wildlife habitat, endangered and threatened species, sensitive surface and groundwater features, etc.). The policy analysis in the PJR should be reviewed and updated accordingly, based on amendments to the technical reports that are required to address JART feedback.	Section 12

	Comments	Page / Section
Report/Date: Financial Impact Study, April 2020 Author: Nelson Aggregates		
1.	The Progressive and Final Rehabilitation Monitoring Study suggests the rehabilitated quarry lands, including water management system, be conveyed to Conservation Halton or another public agency. No formal discussion has taken place with Conservation Halton on future land ownership. How will the Licensee ensure that the long-term monitoring and pumping will not result in financial liability to the public? How will adequate securities be put in place? The Financial Impact Study should be revisited and refined once significant issues with all other reports and the after use have been resolved.	

	Comments	Page / Section
Report/Date: Progressive & Final Rehabilitation/Monitoring Study, April 2020 Author: MacNaughton Hermsen Britton Clarkson Planning Limited		
1.	Staff recommends the Progressive and Final Rehabilitation/Monitoring Study be revisited and updated once significant issues with the Level 1 and Level 2 Natural Environment Technical Report, Surface Water Assessment, Phase 1 and 2 Hydrogeological and Hydrological Study, other reports and After Use have been resolved.	
2.	Ecological monitoring should be undertaken to ensure that mitigation measures are working as proposed and to ensure that the quarry is not impacting the natural environment. As per the Region's Aggregate Resources Reference Manual, monitoring of the NHS should be included. Current monitoring of ecological features that may be impacted and mitigated for by the proposed development is not included. Recommend that this be incorporated into the report.	
3.	The report identifies Conservation Halton as a potential future landowner for the rehabilitated site. No formal discussion has taken place with Conservation Halton on future land ownership, and consideration for any future CH park land has no bearing on our review role as a member of the JART team.	

	Comments	Page / Section
Report/Date: Burlington Quarry Extension Surface Water Assessment, April 2020 Author: Tatham Engineering		
1.	Description of Monitoring Location SW31 in Section 2.1.1 does not match location shown on Drawing Dwg. SW-1. Update accordingly.	Page 12, Section 2.1.1, Streamflow Monitoring, Bronte Creek Watershed, & Dwg. SW-1
2.	Add label for Monitoring Location SW-9 to drawing.	Section 2.1.2, Streamflow Monitoring, Grindstone Creek

		Watershed, Dwg. SW-1
3.	Remove/correct references to Wetland 13036.	Page 24, Section 2.2.5, Wetland Hydroperiod Monitoring, Monitoring Location SW16A (Wetland 13037)
4.	The climate data for the impact assessments should be extended to a minimum of 20 years in keeping with the previously proposed duration and standard industry practices (2000 to 2019+, in conjunction with ongoing monitoring).	Pages 27 - 73, Sections 3, 4 & 5, Existing Conditions, Proposed Conditions - Operations, and Proposed Conditions - Rehabilitation
5.	Pre-quarry conditions should be described and evaluated, where feasible, to allow for comparison with existing and proposed conditions. The report should address cumulative impacts from quarrying operations and outline where a return to pre-quarry conditions would be preferable to existing conditions from a natural heritage and hazard perspective. Consultation with review agency staff is recommended.	Missing
6.	The study should demonstrate the proposed works will have no negative impacts on sediment transport (erosion and aggradation). The analysis should establish erosion threshold flow rates, and use continuous modeling to assess changes to the duration and frequency of exceedances as well as cumulative effective work and cumulative effective discharge.	Pages 27-44, Section 3, Existing Conditions
7.	Additional metrics should be used to provide a fulsome assessment of potential impacts to surface water features. At a minimum, the study should include at each key monitoring location (West Arm, East Arm, Willoughby Creek Tributary, Willoughby Creek (SW7 & SW14), Wetland 13201): • annual runoff volumes presented for each year (from Water Balance calculations as well as Integrated Surface Water Groundwater Model and/or continuous modeling) • monthly runoff volumes presented for each month (average, minimum and maximums; from Integrated Surface Water Groundwater Model and/or continuous modeling) • monthly average stream flows presented for each month (average, minimum and maximums; from Integrated Surface Water Groundwater Model and/or continuous modeling) • peak flow rates for event-based storm events (from event based hydrologic modeling) • duration and frequency of exceedances of the watercourse's erosion threshold (from continuous modeling) • cumulative effective work on the stream's beds and banks (from continuous modeling) • the watercourse's cumulative effective discharge (from continuous modeling) Additional metrics may be required, depending on the initial results and final water management strategy. Alternative metrics will be considered through consultation with the JART.	Pages 27-44, Section 3, Existing Conditions
8.	The accuracy of the survey data used should be included within the document. LiDAR data with a +/- 0.1 m accuracy is available for purchase from Conservation Halton to improve the accuracy of the results, if necessary.	Page 27, Section 3.1, Existing Drainage Patterns
9.	Grading details and invert elevations should be provided for the existing golf course weir pond, diversion channel and irrigation pond system to fully illustrate how the existing water management system functions.	Page 29-30, Section 3.1.3, West Extension
10.	In addition to the information provided in the Existing Condition Water Balance, the depth of water and bathymetry of the wetlands should be provided, in order to assess potential impacts to the wetlands. Changes in water depth should be provided in the interim and ultimate conditions as well.	Page 30 Section 3.2 Existing Condition Water Balance
11.	Please provide digital, daily water levels, presented graphically (to depict the wetland hydroperiod) and summarize daily water balance analyses as average monthly water volumes presented in tabular format integrated in the report. Compare driest year, average and wettest year monthly water volumes to assess potential impact.	Page 30 Section 3.2, Existing Condition Water Balance
12.	Parameter assumptions (e.g. soil water holding capacity, SCS curve numbers, etc.) and detailed calculations should be provided in a supporting appendix.	Pages 31-34, Sections 3.2.2 & 3.2.3, Existing Condition Water Balance, Daily and Monthly Water Balance Methodology
13.	The initial wetland volume, stage-discharge curve, storage correction factor and overflow correction factor for each wetland should be provided to illustrate the scale of adjustment used and support the validity of the water balance calibration.	Page 34, Section 3.2.4, Water Balance Calibration
14.	While the daily water balance is a reasonable predictor of the wetland hydroperiods in 2016 through 2018, the report should discuss the weaker agreement for 2015 and 2019.	Page 35, Section 3.2.5, Wetland Water Balance Results
15.	Staff have assumed the Key Points of Interest on this drawing coincide with the five outlet points outlined in Table 19. Please confirm within the report.	Page 38, Section 3.2.6, Existing Condition Water

		Balance, Outlet Water Balance Results & Dwg. DP-1
16.	The report should include the following: a. A schematic supporting the hydrologic model. b. A summary of the sources/rationale for the selected hydrologic parameter values. c. A table of all input parameters for each subcatchment. d. Hard copy of input and output files.	Pages 40-41 Section 3.4, Existing Condition Event Based Hydrologic Analysis
17.	MTO IDF data was not provided in Appendix L. Conservation Halton staff recommend City of Burlington IDF curves be compared to the MTO data, and the more appropriate values used and provided in the report.	Page 40, Section 3.4.1, Existing Condition Event Based Hydrologic Analysis, Climate Data
18.	Revisit drainage areas to ensure model and Existing Conditions Drainage Plan, DP-1 match.	Page 40, Section 3.4.2, Existing Condition Event Based Hydrologic Analysis, Methodology
19.	CN values used in the hydrologic model are low for the soil types in the subject area. Values used should be justified or revised accordingly. AMC III conditions should be used for the Regional Storm.	Page 40, Section 3.4.2, Existing Condition Event Based Hydrologic Analysis, Methodology
20.	As only the last 12 hours of the Regional Storm were modeled, the Initial Abstraction (Ia) rate used does not adequately account for saturated soil conditions and should be reduced.	Page 40, Section 3.4.2, Existing Condition Event Based Hydrologic Analysis, Methodology
21.	Revisit flow rates within Table 21, Existing Condition Hydrologic Model Results Summary, as they don't match the results within the digital VO6 model provided.	Pages 41, Section 3.4.3, Existing Condition Event Based Hydrologic Analysis, Hydrologic Model Results
22.	Explanation for the difference in the Regional Storm flow for the West Arm of the West Branch identified in Table 22 (as used in the hydraulic model) and from that provided in Table 21 (Section 3.4.3) should be provided, or the analysis updated accordingly.	Page 42, Section 3.5.2, Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation& Appendix M
23.	1) The accuracy and extent of the drone survey data in the vicinity of the Quarry and expansion lands should be included within the document, confirming it is sufficient to support hazard delineations in keeping with Provincial Guidelines. To improve the accuracy of the results, LiDAR data with a +/- 0.1 m accuracy is available from the Land Information Ontario Data Hub (https://geohub.lio.gov.on.ca/) , if necessary.	Page 42, Section 3.5.2, Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation& Appendix M
24.	The Natural Hazards Plan, Dwg NH-1 should include: • Source of topographical information including vertical datum. • Stamps and signatures of the qualified professional(s) responsible for the hazard delineation.	Dwg NH-1, Section 3.5.2, Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation
25.	Saturated soils (i.e. AMCIII conditions) should be assumed when modeling the Regional Storm using the last 12 hours of the Hurricane Hazel rainfall distribution. Modeling and the report should be updated accordingly.	Page 42, Section 3.5.2, Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation& Appendix M
26.	The supporting documentation required for the Existing Conditions modeling is also required for Proposed Conditions modeling.	Pages 45-73, Section 4, Proposed Conditions – Operations &

		Section 5, Proposed Conditions - Rehabilitation
27.	Parameterization concerns identified for Existing Conditions should also be addressed within Proposed Conditions models.	Pages 45-73, Section 4, Proposed Conditions – Operations & Section 5, Proposed Conditions - Rehabilitation
28.	Results are presented in different locations throughout the report. We recommend for each monitoring location a table for each metric, that summarizes results for pre-quarry (where applicable), existing, operational phases, and rehabilitation conditions.	Pages 45-73, Section 4, Proposed Conditions – Operations & Section 5, Proposed Conditions - Rehabilitation
29.	Proposed Conditions should also document and consider impacts during north and south lake filling.	Pages 45-73, Section 4, Proposed Conditions – Operations & Section 5, Proposed Conditions - Rehabilitation
30.	Quarry discharges and the Colling Road diversion are not applied consistently in the different analyses. Results should incorporate the proposed pumping regime with and without the proposed diversion at Colling Road.	Pages 45-73, Section 4, Proposed Conditions – Operations & Section 5, Proposed Conditions - Rehabilitation
31.	Results should be evaluated by the appropriate qualified professional (e.g. water resources engineer, ecologist, or fluvial geomorphologist).	Pages 45-73, Section 4, Proposed Conditions – Operations & Section 5, Proposed Conditions - Rehabilitation
32.	The depth of water and bathymetry of the wetlands should be provided for any interim phases and in the ultimate condition, in order to assess potential impacts to the wetlands.	Pages 45-73, Section 4, Proposed Conditions – Operations & Section 5, Proposed Conditions – Rehabilitation
33.	Further to above comments, we note specifically for Table 28, Proposed Condition (Operations) Outlet Water Balance Results Summary & Table 36, Proposed Condition (Rehabilitation) Outlet Water Balance Results Summary: a. Existing conditions should be presented in the same tables as Proposed conditions to facilitate reviews. b. Runoff volumes with mitigation measures (Quarry Sump Q100 & Q200 discharges) should be presented. Currently significant reductions in West Arm Runoff Volumes are indicated in the tables but proposed mitigation measures have not been included in the analysis. c. Significant increases in Weir Pond Runoff Volumes are predicted because of the proposed diversion of external runoff along Colling Road. An assessment of pre-Quarry conditions should be included in the report to support the claim this increase is reflective of a more natural streamflow hydrograph.	Page 54-56, Section 4.2.2, & Pages 70-71, Section 5.4.2, Outlet Water Balance Results
34.	Further to above comments, we note the ISWGA does not discuss the proposed diversion along Colling Road. Table 29, Proposed Condition Integrated Surface Water Groundwater Model Results may require revision.	Page 56, Section 4.3, Proposed Condition Integrated Surface Water Groundwater Analysis

35.	Further to above comments, we note specifically for Table 30, Proposed Condition (Operations) Hydrologic Model Results Summary & Table 37, Proposed Condition (Rehabilitation) Hydrologic Model Results Summary - a. Willoughby Creek Tributary on the downstream side of Colling Road should be included in as a point of interest in addition to or instead of the Weir Pond. Results both with and without the diversion of runoff along at Colling Road should be provided. b. For consistency, peak quarry sump discharge peak flow rates should be added to the peak flows provided in the tables.	Page 58-60, Section 4.4, Proposed Condition (Operations) Event Based Hydrologic Analysis & Pages 72-73, Section 5.6, Proposed Conditions (Rehabilitation) Event Based Hydrologic Analysis
36.	Revisit and revise the Surface Water Management Strategy in conjunction with addressing the feedback on the Surface Water Assessment and other supporting studies.	Section 6, Pages 74-91, Surface Water Management Strategy
37.	Update recommendations and the summary as necessary to reflect any changes resulting from the above feedback.	Section 7, Recommendations and Section 8, Summary, Pages 92-95

	Comments	**Page / Section**
Report/Date: Site drawing drawings and notes package, April 2020 **Author: MacNaughton Hermsen Britton Clarkson Planning Limited**		
1.	Drawings 2 and 3 indicate a 750 m long diversion pipe with zero slope from the Weir Pond to the newly constructed water feature closest to Cedar Springs Road. Proposed invert elevations are lower than the invert elevation of the existing control structure at the Weir Pond. Sufficient details on the entire existing and proposed water management system should be provided to demonstrate the proposed works will function as intended, including ensuring appropriate flow regimes to both discharge locations (i.e. to pond and to Willoughby Creek Tributary).	
2.	The Site Plan should also note that any development proposed in Conservation Halton's regulated area, that is outside of the ARA licensed area, will require permission from Conservation Halton. In addition, Conservation Halton should be contacted prior to submitting a permit application to confirm permit submission requirements.	