Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Surface Water

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response	JART Response
Report/Date: Surface Water Assessment, April 2020			**Author: Tatham Engineering**		
1.	Lacking details on groundwater monitor construction in or near surface water features. No monitor details or borehole logs in Appendices. Subsequent drive point information has been provided with no information on the soil units encountered.	General	Norbert M. Woerns		
2.	Only five wetlands of the 22 wetlands in the vicinity were instrumented with piezometers to assess vertical hydraulic gradients for water budget purposes. Water budget conclusions regarding the wetlands that have not been instrumented by Tatham therefore cannot be verified against measured data.	General	Norbert M. Woerns		
3.	Nelson Quarry obtained ECA from MECP in June 2017 that permits collection, transmission, treatment and off-site disposal of surface water and quarry water. Will the current PTTW and the ECA revised if the quarry expansions extend southward and westward?	General	City of Burlington		
4.	What is the rate at which Quarry Sump 0100 pumps water to the Colling Road roadside ditch? Will this rate be altered under the future conditions? If so, the conveyance features along Colling Road should be assessed for capacity and erosion potential.	General	City of Burlington		
5.	Similarly, will the pumping rate of Quarry Sump 0200 be maintained in compliance with the ECA? Is there an intention to apply for an amendment of the ECA which was issued in 2017?	General	City of Burlington		
6.	Did Nelson Quarry encounter a spill incident during any of the effluent monitoring periods?	General	City of Burlington		
7.	The surface water monitoring program has been implemented for the last 6 years. Were any of the public agencies (Conservation Halton, Region of Halton or the City of Burlington) involved in equipment installation and the review of the monitoring observations?	General	City of Burlington		
8.	What steps did the proponent take to ensure quality of the collected data from the monitoring stations? What QA/QC practices was in place to ensure proper functioning of the monitoring equipment. Were any outliers encountered?	General	City of Burlington		
9.	The Burlington Springs Golf and Country Club has constructed a weir structure which maintains water levels in the wetland, maintains flow downstream to a tributary of Willoughby Creek and diverts flow to a series of constructed irrigation ponds on the golf course via a diversion channel. Will this weir continue to exist under the future conditions or will its function be replicated through another structure?	General	City of Burlington		
10.	Could not locate monitoring station SW11A, SW12A, SW13A and SW16A on the drawings. Please make sure the monitoring station names are consistent in the report and the drawings.	General	City of Burlington		
11.	An assessment of the existing roadside ditches will be required to confirm enough capacity, or the existence of potential capacity to carry flow during design events.	General	City of Burlington		
12.	Will the new conveyance system which will carry external flows, and which will be located within Nelson property, replace the existing drainage channel that runs roughly parallel to Colling Road within the quarry?	General	City of Burlington		
13.	There are several drainage features within the existing quarry. Will those features undergo any changes and realignments after the extraction operations cease?	General	City of Burlington		

14.	Will the proposed new conveyance system along Colling Road only carry flow from S100 (84.0 hectares) or will the catchments S113 through S116 (a total of 58.0 hectares) also drain into the new conveyance feature.	General	City of Burlington		
15.	Will the proposed conveyance system along Colling Road only carry minor flows? How are the major flows proposed to be managed?	General	City of Burlington		
16.	In which direction does catchment S102 drain from the Colling Road and Cedar Springs Road intersection. Does it flow north along Cedar Springs Road towards tributary of Willoughby Creek or does it flow east directly towards Willoughby Creek?	General	City of Burlington		
17.	Is the Wetland 13201 a natural feature or has it formed as a result of the obstructed culvert? Does this wetland feature provide any critical hydrologic function?	General	City of Burlington		
18.	Thank you for confirming that the existing drainage patterns within Burlington will remain unchanged even if the quarry expands west and south.	General	City of Burlington		
19.	Will there be operations and maintenance staff to monitor quarry sumps after the extraction operations cease at Burlington quarry?	General	City of Burlington		
20.	Will the discharge from the two expansions follow the existing PTTW or is there a proposal to apply and obtain a separate PTTW and ECA.	General	City of Burlington		
21.	City requests to be circulated on any proposed changes to the configurations of the existing settling ponds.	General	City of Burlington		
22.	Please provide existing and proposed conditions Visual OTTHYMO 6 hydrologic model schematic.	General	City of Burlington		
23.	Extraction in the west extension will reduce the size of sub-catchment draining to wetlands as well as those draining to the municipal drainage systems. This indicates that the drainage will be redistributed during the post development conditions. Please confirm that the extra, redirected flow will be retained in the reconfigured pond and will not result in an increase of flow in a different direction.	General	City of Burlington		
24.	It is recommended that the proponent take another look at the proposed rehabilitation plan towards the end of the extraction operation and to make any modifications to the rehabilitation plan to accommodate any hydrologic changes encountered during the extraction period.	General	City of Burlington		
25.	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.	General	Conservation Halton		
26.	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.	General	Conservation Halton		
27.	The report should include analysis of pre-golf course/quarry conditions and speak to how the drainage patterns of the area may have been impacted as a result of the existing extraction operation. Part 2.2.1 of the NEP requires the consideration of single, multiple, or successive development that has occurred or is likely to occur. • The report should also clarify language used in reference to the existing water features on the golf course lands. If they are features that contribute to the water balance and hydrological system of the area, a broader analysis of the impact of removing them on key natural and key hydrologic features should be incorporated. Any link to the proposed rehabilitation plan should be focused on protecting or enhancing the function of key hydrologic features including any identified wetlands (Part 2.6.3, 2.7.3, 2.7.6 (d), 2.9.3 (d & e), 2.9.11 (a & b). • If the ponds are considered man-made and their function and impact on the surface/groundwater artificial, a broader analysis of cumulative impacts should be incorporated as this will be the second identifiable time that key hydrologic	General	Niagara Escarpment Commission		

	functions of the golf course lands will have been altered. Coupled with better details on pre-golf course/quarry conditions, this analysis should drive proposed rehabilitation efforts.				
28.	It is noted that extraction will reduce the drainage area to wetlands 13200 & 13201 but that the area will be supplemented with water pumped from the quarry in order to maintain hydroperiods. • Is this proposed in perpetuity? Will flows to this wetland be protected through the proposed rehabilitation strategy? • NEC Staff would not agree that pumping water into a wetland to maintain its hydroperiod fundamentally protects or enhances the feature. This proposed approach should be sufficiently evaluated by a qualified ecology professional to ascertain any additional mitigation strategies required to maintain the wetlands beyond balancing hydroperiods.	General	Niagara Escarpment Commission		
29.	Additional details for the 'replica pond' along Collings Road are being sought. • How does shifting the current irrigation ponds and implementing a longer diversion channel maintain or enhance the key hydrologic functions of the site? • Mitigation methods suggest that "a portion" of wetland 13200's drainage area will be reinstated as part of the rehabilitation plan. As part of this it is identified that fill will be imported to raise grade in the area to original ground level. How much fill is required? Why is only 'a portion' being reinstated? Is some pumping still going to be required if the drainage area cannot be replicated? • New 'replica' ponds should be justified per Part 2.6.7 of the NEP (2017) that requires ponds be designed to avoid key natural and hydrologic features and shall be designed to be offline.	General	Niagara Escarpment Commission		
30.	The surface water assessment establishes surface water drainage conditions across the Burlington Quarry, South Extension, and West Extension lands to assess impacts from the proposed quarry extension and provides context to surface water hydrology and hydrogeology, which is directly linked to fish habitat impacts. This assessment was completed primarily through identification of existing drainage patterns, water balance, and event based hydrologic modelling. There is an overall lack of integration with the surface water report with regards to the 2020 NETR- this is primarily on the basis that the surface water discussion extends beyond the 120.0 metre limit of the extraction footprint.	General	Matrix Solutions Inc.		
31.	The surface water assessment acknowledges Willoughby Creek and West Arm as fish habitat, and that baseflows and water temperature are critical to the form and function of the watercourses from a natural heritage and fish spawning perspective. The proposed condition integrated surface water/groundwater analysis predicts a minor reduction in monthly streamflow due to the lowering of groundwater and suggests maintaining the discharge from the Quarry Sump 0100 to ensure that some reaches of Willoughby Creek does not run dry. Furthermore, it mentions that the predictive water/groundwater model predicts a measurable reduction in flow of the unnamed tributary of Lake Medad during operations and quarrying. For this reason, the surface water assessment report recommends that streamflow and water temperature thresholds be established from historic surface water monitoring completed in support of the proposed quarry extension. The rationale for future management of quarry water as is lacking in critical details such as "how does the hydroperiods function in terms of downstream fisheries". There is also no table or rationale illustrating how the reductions streamflow and lowering of groundwater as predicted by the groundwater models will be offset by pumping operations.	General	Matrix Solutions Inc.		
32.	Drainage to the South Extension is anticipated to be reduced in size as open extraction will intercept rainfall, groundwater, and surface runoff. To alleviate the	General	Matrix Solutions Inc.		

	reduced drainage, discharge to the West Arm from the Quarry Sump 0200 is proposed to continue throughout its operations in accordance with Nelson's Permit to Take Water (PTTW) and Environmental Compliance Approval (ECA) that will require an amendment to include the discharge from the south extension. For the West Extension, extraction activities will reduce the size of the sub catchments draining to several of its existing outlets. Extraction and quarry dewatering are predicted to lower groundwater levels surrounding the west extension within 350.0 metres of the extraction face. Similar to the West Arm discharges, discharge to the Colling Road roadside ditch and Willoughby Creek will be maintained from the Quarry Sump 0100 and is proposed to continue throughout the duration of quarry operations in accordance with Nelson's PTTW and ECA that will require an amendment to include the discharge from the west extension. The runoff regime to the discharge outlets requires further detail. For example, how is the reduced drainage from quarrying balanced by the pumping? As it is understood that the Assessment of impact to Willoughby Creek is based on computer simulations and not real field measurements to verify existing conditions, how is the flow to the downstream reaches validated? If the discharge regime is set to mimic existing conditions, how will this be operationalized in terms of pumping rate?				
33.	The other aspect of the surface water assessment that should be discussed is the water quality of the discharge waters. If the extraction were to continue to occur in phases, is the water quality of the discharge assumed to be the same? There is a possibility that excavation procedures including blasting may result in the release of contaminants. There is also a possibility that the Enbridge Pipeline which runs along Colling Road could be ruptured through blasting and could impact downstream fish habitat. The cumulative effects of the extraction with respect to water quality and quantity should be explained further in this section.	General	Matrix Solutions Inc.		
34.	The approved rehabilitation plan envisions that the existing Burlington Quarry will be rehabilitated into a lake upon completion of extraction activities, which will result in no further discharges to both Willoughby Creek and West Arm unless water levels in the lake rise in response to wet conditions. This scenario is anticipated to reduce or eliminate baseflows to these systems. As this scenario is considered a negative effect, a new proposed rehabilitation plan proposes rehabilitation of the west extension into a lake (mentioned originally as part of the adaptive management plan) but in the surface water management plan, this has been changed to a conversion of the lands to a landform suitable for recreational, natural heritage and water management purposes. This scenario also includes maintaining the long-term offsite discharge from Quarry Sump 0100 and Quarry Sump 0200 to the tributary of Willoughby Creek and West Arm as part of the new rehabilitation plan for the Burlington Quarry and West Extension. The discussion of continual pumping and controlled release of water coming from the lake should be explored further as there may be some benefit to having the lake discharge provide a more stable flow regime that is less susceptible to mechanical failure or disruptions. There is also a diversion from Colling Road that has been proposed and the resultant effects on downstream fisheries habitat along Willoughby Creek should also be discussed.	General	Matrix Solutions Inc.		
35.	Evolution and background details on the purpose and development of the Terms of Reference would be helpful to understand the context of the scope of the surface water assessment.	General	Wood Environment & Infrastructure Solutions		
36.	Rating Curve development is unclear; given the importance to corroborating modelling results this should be discussed in further detail including an indication of potential error bands.	General	Wood Environment & Infrastructure Solutions		

37.	The Colling Rd. diversion seems central to future management of quarry water; additional background and status on this proposal is required including the potential for a back-up strategy in the event this is not ultimately feasible.	General	Wood Environment & Infrastructure Solutions		
38.	Cross-references to the Hydrogeological Assessment reporting should be minimized and relevant text supporting the findings/recommendations in the Surface Water reporting should be extracted and repeated in the Surface Water reporting for completeness.	General	Wood Environment & Infrastructure Solutions		
39.	Rationale as to why runoff parameters to wetlands were not adjusted for the wetland results calibration (validation) should be provided. Further, the methodology to establishing wetland “storage correction factors” should be expanded upon as this is a key aspect of validating the model’s performance.	General	Wood Environment & Infrastructure Solutions		
40.	Why was the hydrologic modelling conducted with a simplistic SCS event-based technique rather than a more detailed continuous modelling approach?	General	Wood Environment & Infrastructure Solutions		
41.	The integration of the natural systems feature characteristics and their water needs is not well established. The form and function of these features should be elaborated on and better connected to the results interpretation.	General	Wood Environment & Infrastructure Solutions		
42.	The reporting states that there was an iterative process used to refine the Site Plan however no details are provided; documentation of this process should be included in the reporting.	General	Wood Environment & Infrastructure Solutions		
43.	Details of impacts during remediation when the lake is filling are not provided; these need to be documented and considered in the assessment of impacts to surrounding systems.	General	Wood Environment & Infrastructure Solutions		
44.	The study is understood to have been guided by the TOR developed for the Level 1 and 2 Hydrogeologic and Hydrologic Assessment; these are dated Feb 2020 and the submitted report is April 2020. While it is acknowledged that considerable work occurred for several years prior to the submission of the subject reporting, the authors should consider adding a section which outlines how the TOR evolved, what was their purpose and how the reporting has met the requirements of the TOR, including any deviations.	Page 1 Section 1	Wood Environment & Infrastructure Solutions		
45.	The text indicates that the "objective" of the study is to "establish the existing form and function of the surface water features on-site and in the surrounding area and determine if the proposed quarry extension will have an adverse impact …". As noted in several of the comments that follow, the study tends to focus on water balance and hydroperiod as the only markers for impacts to wetlands and outlet receivers. Form and function are not explicitly integrated into the assessment as this requires input and support from the natural ecology study. As such, there is a need to further and more directly integrate the understanding of impacts from an ecological perspective to further inform and guide the overall water management strategy.	Page 2 Section 1.1	Wood Environment & Infrastructure Solutions		
46.	Were the monitoring locations advanced by Nelson reviewed and approved by the regulators/agencies either before or after installation? Also, what was the basis for establishing the locations of the gauges in the surrounding area?	Pages 5-7 Sections 2-2.1	Wood Environment & Infrastructure Solutions		
47.	The report states that there are two (2) additional wetlands (within the west extension area) which were to be monitored this spring (2020); have these data been collected and if so do they have any impact on recommendations for water management?	Page 7 Section 2	Wood Environment & Infrastructure Solutions		

48.	The report indicates that the monitoring period was established as six (6) years; as Tatham is aware not all gauges have 6 years of data with some only having 2 years and others no data (i.e. those proposed for this past spring). Can Tatham comment as to how the lack of a full (6-year) and consistent monitoring period for all gauges affects the findings? Further, has each monitoring year been reviewed in terms of its relationship to climatic norms? This is important when reviewing the results at gauges with different monitoring periods.	Page 7 Section 2.1	Wood Environment & Infrastructure Solutions		
49.	Rating curves at each gauge site were noted to be developed by Tatham however no details have been provided. How many data points have been collected at each site and how many reflect storm conditions vs. non-storm conditions? Further has there been any effort to corroborate the water levels to flows using theoretical hydraulics of the local reaches?	Page 7 Section 2.1	Wood Environment & Infrastructure Solutions		
50.	The reports states that monitoring at all sites was to continue beyond the September 15, 2019 period selected as the end of reporting. Can Tatham verify that all gauges have continued and that the data from these gauges will be used to support decision-making in the future?	Page 7 Section 2.1	Wood Environment & Infrastructure Solutions		
51.	'Streamflow monitoring location SW1 was established in July 2015 and is located in the weir pond (wetland 13202) downstream of the Quarry Sump 0100 discharge. SW1 measures the flow through the weir structure to the tributary of Willoughby Creek downstream. The quarry discharge occurs year-round, maintaining sufficient water depth and flow at SW1 to prevent freezing of the pressure transducer during the winter months. As such, the continuously recording pressure transducer typically remains installed year-round to capture the flows at the upstream end of the tributary of Willoughby Creek.' Is the flow to the irrigation ponds separate from or is that included in SW1 flow to the Tributary to Willoughby Creek? Does the flow in SW1 also include the 2.0 litres/second diversion through the head box diversion from the weir?	Page 9 Monitoring Location SW1 1st Paragraph	Norbert M. Woerns		
52.	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	Conservation Halton		
53.	Add label for Monitoring Location SW-9 to drawing.	Section 2.1.2. Streamflow Monitoring, Grindstone Creek Watershed, Dwg. SW-1	Conservation Halton		
54.	What was the protocol for the manual in-situ measurements taken at the 38 locations surrounding the existing quarry? Was there an inter-event time? Were they always dry periods or also wet periods? Were results adjusted for actual antecedent conditions?	Page 19 Section 2.1.4	Wood Environment & Infrastructure Solutions		
55.	Remove/correct references to Wetland 13036.	Page 24 Section 2.2.5. Wetland Hydroperiod Monitoring, Monitoring	Conservation Halton		

		Location SW16A (Wetland 13037)			
56.	The report states that a single drivepoint piezometer was installed adjacent to each wetland to monitor shallow groundwater to assist in baseline monitoring. Can Tatham advise as to the rationale for only having a single gauge and what the potential for up and downgradient variation may be and how this may affect the baseline conditions? Based on more common industry practices, wetlands are typically instrumented with multiple gauges to improve the understanding of groundwater/surface water interactions in complex settings.	Page 25 Section 2.3	Wood Environment & Infrastructure Solutions		
57.	Water quality samples were collected from selected surface water monitoring sites for 2018 and 2019 and tested for a limited suite of parameters (TSS, pH and Conductivity); can Tatham advise how these sites were selected and the sampling period determined and why only 3 parameters were tested? Further there seems to be limited interpretation of these data in terms of physical characterization - how is this information being used?	Page 26 Section 2.4	Wood Environment & Infrastructure Solutions		
58.	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	Conservation Halton		
59.	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	Conservation Halton		
60.	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	Conservation Halton		

		Conditions - Rehabilitation			
61.	Can the source and vintage of the topographic and aerial mapping be provided? Further there is reference to field survey - can this report provide documentation on the extent and purpose of the field survey?	Page 27 Section 3.1	Wood Environment & Infrastructure Solutions		
62.	Has Tatham compared drainage area mapping with that available through other sources? i.e. CH, MNRF, etc. This would be beneficial to assist in a comparative verification of the mapping.	Page 27 Section 3.1	Wood Environment & Infrastructure Solutions		
63.	The accuracy of the survey data used should be included within the document. LiDAR data with a +/- 0.1 metre 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	Conservation Halton		
64.	Section 3.1.1 (Page 28 of 601) “As part of ongoing operations within the existing Burlington Quarry, Nelson is exploring options to divert this external drainage from northwest of Colling Road directly to the discharge location of Quarry Sump 0100; preventing the runoff from entering the existing quarry. This would include the construction of a conveyance system (a culvert, ditch or combination of the two) alongside Colling Road within Nelson’s property between Blind Line and the quarries existing discharge location (Quarry sump 0100). With this in place, the external runoff would drain to its existing outlet, the tributary of Willoughby Creek, without entering the active quarry operation. This will reduce the surface water management requirements of the active operation.” Please provide more information about the proposed conveyance system along Colling Road between Blind Line and the weir pond (wetland 13202) which will carry external flows bypassing the active quarry operations.	Page 28 Section 3.1.1	City of Burlington		
65.	Report states that Nelson is exploring options to divert drainage external to the quarry along Colling Rd. This alternative/option is cited in subsequent sections of the reporting as a core requirement of the mitigation strategy. Can Tatham provide additional details on what Nelson has done to "explore" this alternative? Has the City of Burlington been contacted in terms of potential influence on roadway drainage? Has CH been contacted in terms of transferred impacts? Have neighbours been contacted? Have there been any earlier analyses and or design proposals?	Page 28 Section 3.1.1	Wood Environment & Infrastructure Solutions		
66.	The south extension is discussed in terms of drainage area which discharges to the West Arm (36.0 hectares). There is also reference to a further drainage area draining overland into wetlands which are part of the East Arm however no drainage area is provided? Can Tatham advise?	Page 28 Section 3.1.2	Wood Environment & Infrastructure Solutions		
67.	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	Conservation Halton		
68.	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	Conservation Halton		
69.	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	Conservation Halton		

70.	Section 3.2.3 West Extension (Page 30) “It is noted, the drainage systems, specifically roadside ditches, downstream of the culvert crossings Cedar Springs Road are poorly defined or nonexistent. It is expected that any surface runoff draining through the culverts will either, evaporate, infiltrate or drain overland following the topographic low through the road allowance or across private property to the Medad Valley and Willoughby Creek.” Further investigation is needed to determine the baseline conditions in order to understand the flow regime.	Page 30 Section 3.2.2	City of Burlington		
71.	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	Conservation Halton		
72.	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	Conservation Halton		
73.	The Water Balance Calibration section provides details on the approach and suggests that there was a topographic survey - can details of this survey be provided? Also the calculations have been reported daily and monthly; it is also suggested that these be considered/assessed at a seasonal time period. It should also be noted that there are numerous cross-references in this section and others to the Level 1 and 2 Hydrolgeological Assessment; for completeness and readability it is suggested that relevant details be repeated in this document to improve the flow of content.	Page 34 Section 3.2.4	Wood Environment & Infrastructure Solutions		
74.	Given that only 4 years of data have been used for model performance review it is respectfully suggested that the analysis be re-titled to "Water Balance Validation" as 4 years of data would be considered insufficient for the purpose of model "calibration".	Page 34 Section 3.2.4	Wood Environment & Infrastructure Solutions		
75.	This section indicates that the basis for the calibration (validation) was founded on the wetland discharge parameters rather than any of the runoff generating parameters. Tatham states that this is due to a review of the results which suggests this approach was "reasonable and did not warrant adjustment". Further it is unclear as to how the "correction factors" were established, along with the storage discharge curves and the "broad crested weir equation". Wetland discharge relationships are inherently complex and it is unclear as to how these have been represented accurately. Can Tatham offer more details?	Page 34 Section 3.2.4	Wood Environment & Infrastructure Solutions		
76.	The differences between observed and modelled hydroperiods ranges between 7 and 10 days - has the Nelson Team's ecological specialists weighed in on the adequacy of this predictive range?	Page 35 Section 3.2.5	Wood Environment & Infrastructure Solutions		
77.	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	Conservation Halton		
78.	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	Conservation Halton		

		Water Balance Results & Dwg. DP-1			
79.	Table 19 results for some years indicate more runoff than precipitation (e.g. 2009). Can Tatham advise as to the rationale?	Page 38 Section 3.2.6	Wood Environment & Infrastructure Solutions		
80.	The surface-groundwater model has assumed the quarry discharge as fixed at 67.0 litres/second. It is questioned whether this assumption is valid and what the range of discharge rates are based on actual monitoring?	Page 39 Section 3.3	Wood Environment & Infrastructure Solutions		
81.	Are the flows reported in Table 20 based on the calibrated (validated) modelling?	Page 39 Section 3.3	Wood Environment & Infrastructure Solutions		
82.	'The portion of the quarry discharge assigned to Spring J is determined through numerical analysis within the integrated surface water groundwater model. The balance of the quarry discharge resurfaces at Spring K which drains to Willoughby Creek downstream of SW7.' There are no flow measurements of Spring J and K except for one occasion April 10, 2006 by Worthington, 2006. There are no field data to confirm flow conditions from these two springs and consequently flow from the tributary of Willoughby Creek which feeds these two springs. It is known that a minimum of 2.0 litres/second of pump discharge from quarry sump 100 is diverted to the tributary of Willoughby Creek but the total flow characteristics of quarry sump discharge into the tributary to Willoughby Creek are not known. It is also not known how much water is diverted from Sump 100 discharge to the existing irrigation ponds on the golf course property. An assessment of impact on this tributary therefore relies upon computer simulations in the absence of critical streamflow information and without the benefit of verification of existing conditions with field measurements.	Page 39 2nd Paragraph Section 3.3 Existing Condition Integrated Surface Water Groundwater Analysis	Norbert M. Woerns		
83.	Can a modelling schematic be provided for the OTTHYMO modelling?	Page 40 Section 3.4	Wood Environment & Infrastructure Solutions		
84.	For the surface water assessment for the hazard and erosion impact assessment why has a simplistic event based model been used rather than a more complex and comprehensive modelling approach (continuous simulation)? It is suggested that continuous modelling will provide a better and more representative result for the surface water flow regime, including sub-annual events. Further, the SCS CN methodology has been used for this assessment which again tends to be limiting and more black box in its methodology. Other time varying approaches for soil properties applied in long term continuous modelling are considered more accurate and superior to SCS and also eliminate bias when using design storm based methodologies.	Page 40 Section 3.4	Wood Environment & Infrastructure Solutions		
85.	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	Conservation Halton		

86.	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	Conservation Halton		
87.	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	Conservation Halton		
88.	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	Conservation Halton		
89.	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	Conservation Halton		
90.	It is noted that the MTO IDF has been selected - have these values been compared to local data available from the City of Burlington and CH?	Page 40 Section 3.4.3	Wood Environment & Infrastructure Solutions		
91.	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	Conservation Halton		
92.	It is noted that Table 21 reports on the SCS 24 hour distribution but unclear as to why that distribution has been reported rather than the Chicago 4 hour which is also noted to have been executed - please advise; also the timestep is not documented in this section - please advise and outline supporting rationale for its selection	Page 41 Section 3.4.3	Wood Environment & Infrastructure Solutions		
93.	Why was the quarry discharge not included in the event based results from Quarry Sumps 100 and 200?	Page 41 Section 3.4.3	Wood Environment & Infrastructure Solutions		

94.	The results of the event based hydrologic model during operation phase and in the post rehabilitation conditions remain the same. These both results are, however, quite different from the existing conditions hydrologic model results for all locations and for all design events. During the operations and under the rehabilitated conditions the West Arm, Weir Pond and Wetland 13201 flows are reduced, and the Burlington Quarry flows significantly increased as compared to the existing conditions. Please refer to Tables 21, 30, and 37. Were the review agencies previously made aware of the fluctuation in flows and is there any correspondence in this regard?	Tables 21, 30, and 37	City of Burlington		
95.	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	Conservation Halton		
96.	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 metre 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	Conservation Halton		
97.	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	Conservation Halton		
98.	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	Conservation Halton		
99.	Why was the flood hazard assessment restricted to the West Arm? Should not all outlets be examined for potential impacts due to the alteration of quarry surface water changes?	Page 42 Section 3.5.2	Wood Environment & Infrastructure Solutions		
100.	It is suggested that a Stream Morphologist be retained to review the erosion thresholds associated with the current predicted flow regime.	Page 43 Section 3.5.3	Wood Environment & Infrastructure Solutions		
101.	The supporting documentation required for the Existing Conditions modeling is also required for Proposed Conditions modeling.	Pages 45-73	Conservation Halton		

		Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation			
102.	Parameterization concerns identified for Existing Conditions should also be addressed within Proposed Conditions models.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton		
103.	Results are presented in different locations throughout the report. 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 and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton		
104.	Proposed Conditions should also document and consider impacts during north and south lake filling.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton		
105.	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 and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton		
106.	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 and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton		

107.	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 and Section 5. Proposed Conditions – Rehabilitation	Conservation Halton		
108.	Tatham references an "iterative" process to Site Plan development - for completeness and a more fulsome understanding of the process followed by the Nelson Team, can the iterative changes/adjustments be documented for the record?	Page 45 Section 4.1	Wood Environment & Infrastructure Solutions		
109.	Per earlier comment on section 3.1.1. pg 28 - can Nelson provide details on the process to-date on establishing a diversion along Colling Rd?	Page 46 Section 4.1.1	Wood Environment & Infrastructure Solutions		
110.	It is understood from Section 4.1.2 “South Extension” that a temporary settling pond will be constructed during the initial three years of extraction which will be ultimately replaced with a larger quarry sump that is proposed to maintain a discharge limit of 50.0 litres/second. Design details of both ponds, the temporary settling pond and quarry sump will be required at the design phase.	Section 4.1.2	City of Burlington		
111.	For the South extension it states that the quarry water is being treated at rates "set to mimic existing conditions"; can Tatham elaborate on how this is going to be operationalized?	Page 46 Section 4.1.2	Wood Environment & Infrastructure Solutions		
112.	Can Tatham provide additional details as to how the 50.0 litres/second was established as a limit for pumping? This approach assumes a rate but has there also been a check on volumes? To this end can calculations and assumptions be provided for the 1800.0 cubic metres settling pond sizing?	Page 46 Section 4.1.2	Wood Environment & Infrastructure Solutions		
113.	The report states that 5.0 hectares is a threshold condition for extraction which triggers implementation of a new sump; can Tatham provide details on this determination? Why 5.0 hectares?	Page 46 Section 4.1.2	Wood Environment & Infrastructure Solutions		
114.	What is the source of the 350.0 metre dimension from the face as a point of comparison?	Page 47 Section 4.1.3	Wood Environment & Infrastructure Solutions		
115.	As a means of mitigating impacts to off-site systems Tatham is proposing a "replica" pond. This appears to be a long linear feature extending approx. 3/4 of the distance between No. 2 SR to Colling Rd. From the available documentation it appears that there is no preliminary design for this feature, rather it is shown as a concept in plan form on the Site Plan, with basic sections only. Given the importance which Tatham places on this "replica" facility to service off-site systems and maintain overall water balance can Tatham provide additional design details to ensure that the facility as conceptualized is feasible, particularly in light of its length and the number of inlets and outlets.	Page 47 Section 4.1.3	Wood Environment & Infrastructure Solutions		
116.	It is postulated by Tatham that reducing flows to the roadside ditch and ultimately the Medad Valley and Willoughby Creek is positive for the function of the ditches however no comment is provided as to the potential environmental impact to the Medad Valley and Willoughby Creek - has this been assessed by Nelson's ecologist?	Pages 48-49 Section 4.1.3	Wood Environment & Infrastructure Solutions		
117.	Section 4.1.3 – “Extraction and quarry dewatering will also lower groundwater levels surrounding the west extension within 350 m of the extraction face. As such, a series	Section 4.1.3	City of Burlington		

	of mitigation measures are proposed to address any potential adverse impact that could result from extraction and quarry dewatering." Did the study team identify any of the potential adverse impacts? Mitigation measures must ensure that any identified impacts are satisfactorily addressed when the replica pond is constructed.				
118.	As suggested in Section 4.1.3, will the proposed replica pond exactly mimic the existing groundwater mounding? Location of the replica pond will essentially be different from the existing irrigation ponds which will result in the mounding being shifted. Will this impact the zone of influence of any wells in the surrounding area? Section 11.3.3.3 of the Burlington Quarry Extension Level 1/2 Assessment Report has further confirmed the impact to the private wells in the vicinity of West Expansion. What would be the strategy for implementing the mitigation measure of deepening the impacted wells?	Section 4.1.3	City of Burlington		
119.	All of the mitigation relies on the diversion of external flow along Colling Rd.; has Tatham considered a back-up or alternate strategy should this not be feasible or approved?	Page 49 Section 4.2	Wood Environment & Infrastructure Solutions		
120.	Can Tatham confirm the statement that all surface drainage catchments draining to the wetlands under assessment will not change in area or use over the course of the extraction and post extraction?	Page 50 Section 4.2.1	Wood Environment & Infrastructure Solutions		
121.	Tatham indicates that for 7 of the 10 years analysed the hydroperiod would be delayed 5 days or less; can Tatham indicate why the other 3 years have not been reported?	Page 50 Section 4.2.1	Wood Environment & Infrastructure Solutions		
122.	Further to above comments, it is noted 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 and Pages 70-71 Section 5.4.2. Outlet Water Balance Results	Conservation Halton		
123.	This section is understood to document the impacts to the runoff regime to the various outlets from the Quarry Study area; the last sentence in para. 2 in this section indicates that "if necessary, mitigation measures have been developed that could address potential impacts on the wetlands, ...". For clarity should this not refer to the "outlets" and further what would constitute the measure to indicate if mitigation is "necessary"? Can Tatham elaborate in this section?	Page 55 Section 4.2.2	Wood Environment & Infrastructure Solutions		
124.	Can Table 28 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Page 56 Section 4.2.2	Wood Environment & Infrastructure Solutions		
125.	Can Tatham provide details on how the system would be performing while the Lake is filling and how long this is predicted to take?	Page 56 Section 4.3	Wood Environment &		

			Infrastructure Solutions		
126.	Further to above comments, it is noted 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	Conservation Halton		
127.	'The Willoughby Creek watershed will be reduced in area at SW7 through extraction in the west extension. The overall watershed will be reduced by approximately 19 ha or 6% at SW7. As illustrated in the previous table, the proposed condition integrated surface water groundwater model predicts a minor reduction in Willoughby Creek average monthly streamflow through the Medad Valley due to the reduction in in watershed area, and consequently reduction in surface runoff, and the lowering of the groundwater table in the area through extraction and quarry dewatering. A reduction of 1.1 – 2.9 L/s is predicted at surface water monitoring location SW7. The reduction in streamflow is predicted to be greater in the fall, winter and spring (when more water is available in Willoughby Creek) and less during the summer months. The monitoring data collected to date shows a continuous baseflow of approximately 4 L/s in Willoughby Creek at SW7. However, the quarry discharge contributes to the baseflow at SW7 and it is expected that Willoughby Creek would run dry at SW7 if the quarry discharge were to cease. As proposed, the quarry discharge from Quarry Sump 0100 will be maintained during operations and long-term post rehabilitation. Maintaining the off-site discharge will maintain baseflows in Willoughby Creek downstream of its confluence with its tributary.' Why is it expected that Willoughby Creek at SW7 will dry up by stopping pumping into the creek? See Earthfx, page 252, 1st paragraph where the model shows a net reduction in seepage at SW7 of 2.1 litres/second from phases 3456 extraction. This represents over 50.0% of measured base flow of 4.0 litres/second at SW7. By turning off the pumps in rehabilitation scenario 2 (RHB2) the model shows increased surface water flows in adjacent creeks not currently receiving sump discharge from the quarry (see Earthfx Figure 8.106, page 284)). There does not appear to be a complete cost benefit analysis with respect to the two rehabilitation scenarios.	Page 58 2nd Paragraph Section 4.3 Proposed Condition Integrated Surface Water Groundwater Analysis	Norbert M. Woerns		
128.	Further to above comments, it is noted 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 and Pages 72-73 Section 5.6. Proposed Conditions (Rehabilitation) Event Based Hydrologic Analysis	Conservation Halton		

129.	Can Table 30 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Page 59 Section 4.4	Wood Environment & Infrastructure Solutions		
130.	'The predicted average lake water level (269.00 m) is below the existing sill elevation (269.08 m) of the weir structure constructed by the BSGCC in the weir pond (wetland 13202) which created the weir pond (wetland 13202), maintains water levels in the wetland and controls discharge to the tributary of Willoughby Creek and consequently Willoughby Creek. When the lake water level drops below an elevation of 269.08 m, gravity discharge to the tributary of Willoughby Creek will not occur. Also, the average water level in the weir pond (wetland 13202) is 269.27 m. The wetland water level will drop in response to the lake water levels and cessation of off-site discharge.' Have modifications to the weir been considered to maintain gravity flow to the Tributary to Willoughby Creek?	Page 61 Section 5.1, Approved Rehabilitation 3rd Paragraph	Norbert M. Woerns		
131.	'This is an important consideration as Willoughby Creek and the West Arm have been identified as fish habitat. Baseflow and water temperature are critical to the form and function of these watercourses from a natural heritage, habitat and spawning perspective. Rehabilitating the Burlington Quarry as approved will negatively impact Willoughby Creek and the West Arm as flows will be reduced and/or eliminated. Similarly, the weir pond (wetland 13202) and the wetland 13203 (located along the West Arm adjacent to the south extension) are currently identified as natural heritage features. These features are dependent on the quarry discharge to maintain their hydroperiod and may dry out under the approved rehabilitation plan.' Has drying out of features been established with supporting field evidence and analysis. The lack of understanding of the critical flow characteristics of the tributary of Willoughby Creek brings into question the validity of the conclusions regarding the impact from the quarry and quarry discharge on Willoughby Creek.	Page 61-62 Section 5.1, Approved Rehabilitation 4th Paragraph	Norbert M. Woerns		
132.	Section 5.2 makes reference to a new rehabilitation plan which proposes to convert the Burlington Quarry into a landform rather than a lake. Drawing 3 of the Site Plan set outlines the proposed rehabilitation for the west extension however no plan(s) are provided for the existing Burlington Quarry. In order to fully understand the drainage patterns and operations affecting surface water, a plan should be provided at this stage which illustrates the full rehabilitation plan, including the existing quarry.	Page 62 Section 5.2	Wood Environment & Infrastructure Solutions		
133.	Tatham references an "iterative" process to Site Plan development - for completeness and a more fulsome understanding can the iterative changes/adjustments be documented for the record?	Page 62 Section 5.3	Wood Environment & Infrastructure Solutions		
134.	This section describes long term water management objectives for the Quarry but does not provide any indication as to the overall water budget nor the needs for each of the proposed features requiring water. Can Tatham outline the water demands and associated tolerances for each element cited and also provide an indication of sustainability?	Page 63 Section 5.3.1	Wood Environment & Infrastructure Solutions		
135.	Tatham indicates that a water level control is not proposed for the lake - can the reason and rationale be provided? It is suggested that without some form of control adaptive management opportunities may be compromised	Page 63 Section 5.3.2	Wood Environment & Infrastructure Solutions		
136.	It is unclear if under the rehabilitated condition whether the water balance will change in the vicinity of the replica pond - can Tatham advise?	Page 64 Section 5.3.3	Wood Environment & Infrastructure Solutions		

137.	Tatham notes that a bottom draw outlet control will be maintained post extraction and monitoring of the wetland will be completed to maintain the hydroperiod; can Tatham advise on the triggers for adaptive management and the adjustments which may be required if those triggers are not met?	Page 64 Section 5.3.3	Wood Environment & Infrastructure Solutions		
138.	Can Table 36 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Page 71 Section 5.4.2	Wood Environment & Infrastructure Solutions		
139.	Can Table 37 be re-structured to include a comparison between existing and proposed peak flows at the respective outlets?	Page 73 Section 5.6	Wood Environment & Infrastructure Solutions		
140.	Revisit and revise the Surface Water Management Strategy in conjunction with addressing the feedback on the Surface Water Assessment and other supporting studies.	Pages 74-91 Section 6. Surface Water Management Strategy	Conservation Halton		
141.	Can Tatham provide a basis for the range in active storage requirements - i.e. 700,000.0 to 800,000.0 cubic metres?	Page 74 Section 6.1.1	Wood Environment & Infrastructure Solutions		
142.	Section 6.1.1 Burlington Quarry – “It is recommended that Nelson seek to permanently increase the maximum allowable discharge rate from Quarry Sump 0100. A permanent increase in the maximum allowable discharge rate is not mandatory, only recommended.” Will Nelson Aggregate implement this recommendation long term, under the operations and the rehabilitations scenarios?	Section 6.1.1	City of Burlington		
143.	For clarity can Tatham indicate which gauges were installed for this study and which will remain and which will be added post extraction? Suggest adding these details to Tables 38 and 39.	Page 79 Section 6.3	Wood Environment & Infrastructure Solutions		
144.	Can Tatham outline the elements of the adaptive management plan which will potentially be available to meet the environmental management goals?	Page 79 Section 6.3	Wood Environment & Infrastructure Solutions		
145.	Can Tatham describe the methodology proposed for Nelson to establish a long-term discharge protocol?	Page 81 Section 6.3	Wood Environment & Infrastructure Solutions		
146.	Surface water thresholds for wetland hydroperiod are proposed in this report (Section 6.4). It is noted on Page 86 that “If the wetland water level drops to zero at a monitoring location (0.0 water level staff gauge reading) before the hydroperiod threshold stipulated in the previous table, the applicable mitigation measures described in Section 6.5 are to be implemented while the cause of the potential impact is evaluated to determine if it has been caused by extraction and/or quarry dewatering.” These thresholds are therefore critical for maintaining wetland functions related to hydroperiod. The thresholds are not sufficiently conservative to protect the function of these ponds should the quarry affect their hydroperiod. Pond functions such as amphibian breeding rely on “good” years (years where water remains late into spring and summer) to make up for years where ponds dry up unusually early. The individual monitoring results for	Page 86 Section 6.4 and Tables 32-35 and 42	North-South Environmental Inc.		

	each wetland shown in Tables 32 to 35 show that these wetlands generally dry up in late spring or early summer, while the monitoring thresholds in Table 42 show thresholds in the early spring, generally the end of April or beginning of May. Wetlands that consistently dry up in early spring have low capacity to support amphibian breeding and other functions. Later thresholds should be established to ensure standing water is maintained for long enough to promote amphibian breeding and other functions. Wetland 13023 (the wetland immediately to the west of the south extension, which supports SWH for breeding amphibians as well as Painted Turtle), is not included in these analyses. The report should discuss monitoring and thresholds for this wetland, even though it is supported by quarry discharge.				
147.	Preliminary baseflow and temperature thresholds are recommended. Water quality thresholds for total suspended solids, pH, and oil and grease for discharge waters are part of the existing quarry Environmental Compliance Approval (ECA). Tatham recommended that these be maintained for the proposed expansion. No threshold or target water quality levels for the remaining water quality parameters included in the monitoring program, currently exist. 'Its recommended that the water quality thresholds be established from the results of the historic water quality sampling completed in support of the proposed quarry extension. Specifically, maximum and minimum concentration limits should be established from the sample results collected while considering the Provincial Water Quality Objectives (PWQO) and role water quality plays in the Natural Heritage Features.' (Tatham, page 88, 3rd paragraph.) No such recommendation has been made for groundwater quality parameters.	Page 88 3rd Paragraph	Norbert M. Woerns		
148.	'Extraction will reduce the drainage area to wetland 13201 northwest of No. 2 Sideroad forming the headwaters of the unnamed tributary of Lake Medad. Reducing the drainage area of the wetland has the potential to adversely impact the wetlands hydroperiod. As such, a mitigation strategy has been developed to supplement the flow into the wetland during operations as required. A bottom draw outlet will be constructed in the southeast corner of the proposed replica pond and an outlet pipe complete with a control valve will be installed to discharge water into the roadside ditch along No. 2 Sideroad feeding the wetland. The wetland hydroperiod will be monitored and water will be discharged to the wetland as required to maintain the wetland hydroperiod.' What are the threshold levels for the hydroperiod for this wetland?	Page 89 3rd Paragraph Section 6.5. Mitigation	Norbert M. Woerns		
149.	Mitigation measures are described with respect to meeting thresholds and triggering mitigation for streamflow, stream temperature, wetland hydroperiod, effluent limits, and water quality. Changes to surface water regime can change rapidly in response to precipitation events. How will the trigger levels be responded to and mitigative measures be implemented? The current monitoring program consists of continuous data logger recordings plus monthly manual flow measurements, quarterly water quality sampling, and weekly field visits to monitor wetland hydroperiods during the seasonal wetland hydroperiod.	Page 90 Section 6.5. Mitigation	Norbert M. Woerns		
150.	The City of Burlington expects Nelson Aggregates to implement the entire list of recommendations noted in Section 7 of the Surface Water Report.	Section 7	City of Burlington		
151.	Update recommendations and the summary as necessary to reflect any changes resulting from the above feedback.	Pages 92-95	Conservation Halton		

		Section 7. Recommendations and Section 8. Summary			
152.	Please add arrows on drawing DP-1 to show direction of flow in drainage channels.	Drawing DP-1	City of Burlington		
153.	Manual water level readings are shown on hydrographs in Appendix G. Appendix F summarizes manual shallow groundwater levels although it is not clear what the measuring point was and the significance of negative values.	Appendices F and G	Norbert M. Woerns		
154.	Water quality results are presented in Appendix H, however there is no discussion of water quality in the report with respect to drinking water quality standards. Infiltration of surface water is proposed to maintain down-gradient private well water supplies. Emphasis is focused upon the threshold values of selected parameters included in the Environmental Compliance Approval (ECA) for the existing quarry.	Appendix H	Norbert M. Woerns		