Adaptive Management Plan
Proposed Burlington Quarry Extension, Nelson Aggregates Co.

Prepared for:

NELSON AGGREGATES

April 2020
Version 1.0

April 23, 2020

Nelson Aggregate Co.
2433 No. 2 Sideroad
Burlington, Ontario
L7P 0G8

Attention: Mr. Quinn Moyer, President

RE: Burlington Quarry Adaptive Management Plan (Version 1.0)

Dear Mr. Moyer,

Earthfx Incorporated, Savanta Inc. and Tatham Engineering Limited are pleased to provide Nelson Aggregates Co. with the Adaptive Management Plan (AMP) for the Proposed Burlington Quarry Extension. This is Version 1 of the AMP and has been prepared considering key findings and recommendations stipulated in the natural heritage, hydrological, and hydrogeological assessments completed in support of the proposed extraction plan.

All proposed monitoring locations, threshold values, methodologies, and mitigation strategies presented in this report are considered preliminary. It is recommended that the AMP (including threshold values and mitigation options) be finalized in consultation with the Ministry of Natural Resources and Forestry (MNRF), Conservation Halton (CA), the Ministry of the Environment, Conservation and Parks (MECP) and applicable commenting agencies.

Regards,

Dirk Kassenaar, M.Sc., P.Eng.
President, Eartfx Incorporated

Shannon Catton, MSc.
Branch Manager & Senior Ecologist, Savanta Inc.

Daniel Twigger, B.Sc.Eng., P.Eng.
Senior Engineer, Group Leader, Tatham Engineering Limited

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1. INTRODUCTION

The surface water and groundwater impact assessment for the proposed extension of the Burlington Quarry has relied on the results of a predictive fully integrated numerical groundwater and surface water flow model. The recommended groundwater and surface water monitoring programs and mitigation measures have been incorporated into the Burlington Quarry Preliminary Adaptive Management Plan (AMP). The overall monitoring program has been developed to allow for an evaluation of the local effects and facilitate insightful and strategic decision-making to mitigate unforeseen impacts resulting from quarry development. The goal is to operate the proposed Burlington Quarry extension without creating any adverse impacts to the natural environment or private domestic water supply wells through adaptive management.

All proposed monitoring locations, threshold values, methodologies, and mitigation strategies presented in this report are considered preliminary. It is recommended that the AMP (including threshold values and mitigation options) be finalized in consultation with the Ministry of Natural Resources and Forestry (MNRF), Conservation Halton (CA), the Ministry of the Environment, Conservation and Parks (MECP) and applicable commenting agencies.

1 PURPOSE OF THE ADAPTIVE MANAGEMENT PLAN

The purpose of the AMP is to provide Nelson Aggregates Co. (Nelson) with the information needed to verify that the quarry is operating without causing adverse impacts to the natural environment or private water supplies. The AMP establishes a process to monitor operations and implement mitigation strategies, if necessary, before any unforeseen impacts occur (Figure 1). The monitoring results will be reported to the MNRF, the principal reviewing/approval agency responsible for ensuring that the operator complies with the terms and conditions of the aggregate licence, including enforcing the contents of the AMP.

The AMP allows for strategic decision-making with respect to quarry operations so potential impacts to the natural environment can be fully assessed and mitigated prior to any adverse impact. To be effective, the AMP:

1. identifies receptors to be monitored during extraction, lake filling and for a period after final rehabilitation has been completed;
2. facilitates the collection of monitoring data from the natural environment so that it can be used to evaluate the environmental impact of the extension on the function of natural features;
3. allows for trend analyses to be completed which aids in the evaluation of threshold values and that, if thresholds are exceeded, will initiate action by Nelson so that mitigation can occur before any negative effects can occur;
4. establishes a link between Nelson, the public, stakeholders, and government agencies so that the monitoring data collected can be shared in a transparent and understandable manner;
5. defines the roles and responsibilities of Nelson, stakeholders, and governing agencies; and
6. outlines the reporting requirements under the AMP.

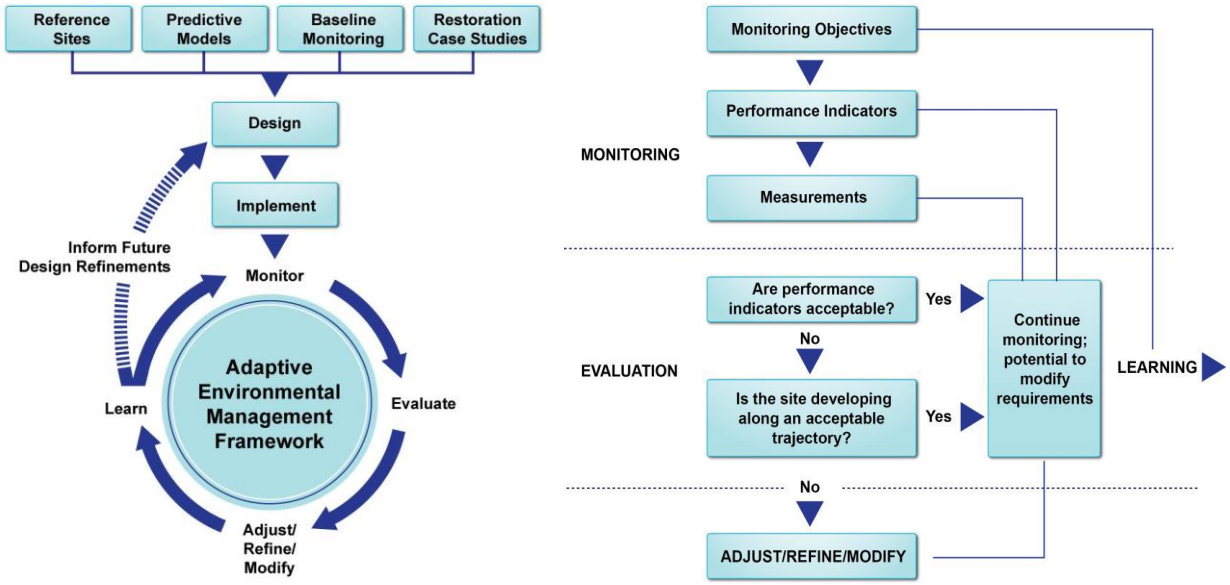

Figure 1: Adaptive Management Framework

2 OVERVIEW: BURLIGNTON QUARRY SITE DEVELOPMENT

The proposed extensions are situated directly to the south and west of the existing quarry and total 78.3 ha of licenced lands of which 50.2 ha are proposed for extraction. The subject lands are referred to as the South Extension and the West Extension (Figure 2).

2.1 South Extension

The proposed South Extension consists of a licenced area of 18.3 ha, of which 14.5 ha will be extracted. Extraction will occur in two (2) phases designed to assist final rehabilitation. Phase 1 will be completed in two stages: 1A covers approximately 1.4 ha and will take the quarry floor down approximately 9 m to an elevation of 271 masl. 1B will cover approximately 0.8 ha and step down one metre from 1A to an elevation of 270 masl. The final phase in the South Extension will cover the remaining 12.3 ha and will be extracted to a total depth of approximately 30 m to 252.5 masl. The drainages areas contributing to each wetland east and south of the south extension will remain undisturbed through extraction and rehabilitation.

It is anticipated that the extraction of aggregate and rehabilitation of the South Extension will take approximately 10 years. Once the material has been removed from Phase 1 and Phase 2, the area will be allowed to fill with groundwater and surface water, creating a lake. The final rehabilitation of this area will allow for a beach and shallow swimming area, along with a deep lake for public recreational use.

The integrated surface water/groundwater model predicts that the lake will fill to an elevation of 271 m. A water level control outlet is not proposed for the lake and the lake water level will fluctuate seasonally. A high-water level overflow weir will be graded into the south corner of the lake to ensure discharge from the lake during extremely rare storm events (less frequent than the 1:100-year storm) and freshets will drain to an appropriate outlet. Discharge from the overflow weir will drain overland into the wetland (wetland 13037) and to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek via the existing drainage channel connecting the two.

2.2 West Extension

The West Extension covers a proposed licenced area of 60.0 ha with a proposed extraction area of 35.7 ha. Extraction will occur in four (4) additional phases following the completion of Phase 1 and Phase 2. For all four (4) phases (Phase 3 through to Phase 6) extraction will occur down to a floor elevation of 252.5 masl. It is anticipated that extraction will be completed in the West Extension after 20 years. Progressive rehabilitation will be on-going with a final rehabilitation plan of a below grade/water recreational area, complete with park land, water features, and naturalized areas including wetland and woodland habitat.

Extraction in the west extension will alter the sub-catchments draining to each existing outlet and wetland. Dewatering post extraction will also lower groundwater levels surrounding the west extension.

Prior to the surrender of the Aggregate Resources Act licence, the licencee will provide, to the satisfaction of the MNRF, confirmation that any long-term monitoring, pumping, or mitigation will not result in a financial liability to the public. The final long-term water management system approved and regulated by the MECP under the Permit to Take Water (PTTW) and the Environmental Compliance Approval (ECA) will stipulate the mandatory groundwater and surface water monitoring program for the future landowner.

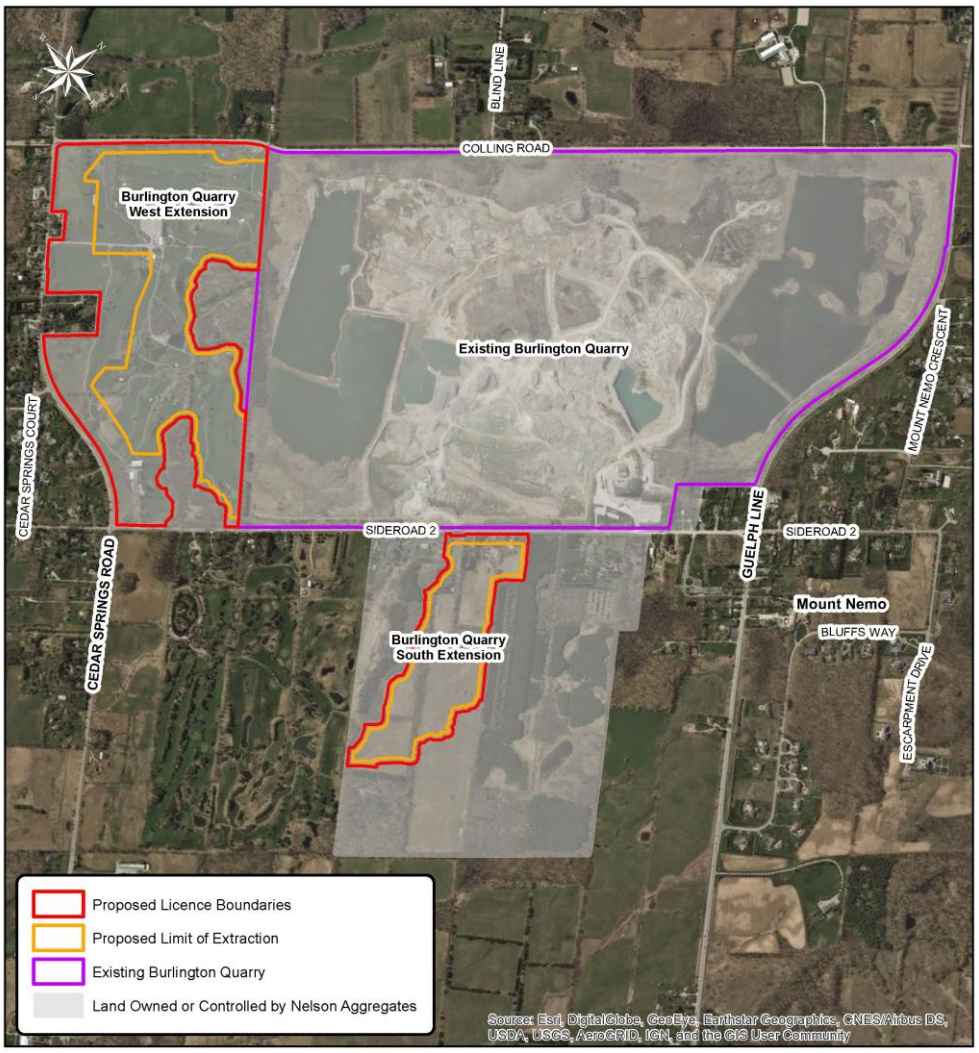

Figure 2: Burlington Quarry and Proposed Extension Areas

3 ADAPTIVE MANAGEMENT PLAN OUTLINE

The environmental management and monitoring of the Burlington Quarry is a multi-stakeholder task. Therefore, the roles and responsibilities of all regulatory agencies involved with the proposed extension are outlined below as well as the enforcement actions available to ensure the monitoring and mitigation measures, as may be required, are fully implemented over the life cycle of the quarry including rehabilitation.

The MNRF is responsible for administering Ontario's aggregate resources under the Aggregate Resources Act (ARA). As such, the MNRF will be responsible for issuing and enforcing the aggregate licence issued for the proposed extraction under the ARA. Since the AMP will become a condition referenced on the approved ARA Site Plans, it will be enforceable under the licence until surrendered, thereby making the MNRF the regulatory agency responsible for the AMP. The MNRF shall enforce all conditions of the aggregate licence issued under the ARA. In the event of non-compliance, the MNRF has the authority to revoke the licence.

The MECP is responsible for administering the water of Ontario under the Ontario Water Resources Act (OWRA) and the Environmental Protection Act (EPA). Therefore, the MECP will be responsible for issuing and enforcing the conditions of the PTTW for the quarry dewatering under section 34 and 98 of the OWRA and Water Taking Regulation O. Reg. 387/04. The MECP will also be responsible for enforcing the conditions of the ECA for the treatment and discharge of quarry water as per Section 53 of the OWRA. All site instruments will be updated to permit the proposed quarry operations and mitigation options.

The Niagara Escarpment Commission (NEC) will be responsible for issuing and enforcing the Development Permit for the proposed extension under the Niagara Escarpment Planning and Development Act. NEC shall enforce all conditions of the Development Permit.

Nelson will be responsible for meeting the requirements set forth in the aggregate licence, PTTW, ECA, and Development Permit including coordinating the monitoring requirements set forth in the AMP and ensuring that the rehabilitation phase of the Burlington Quarry is completed.

4 DEVELOPMENT OF THE GROUNDWATER MONITORING PROGRAM

The intent of the groundwater monitoring program is to serve four (4) main purposes: These are listed as:

1. to determine the background quality and seasonal groundwater level fluctuations in the vicinity of the extraction activities;
2. to assess and characterize the quality and seasonal groundwater level fluctuations throughout the quarry operations and upon closure of the Burlington Quarry;
3. to assess whether unforeseen changes within the groundwater regime is occurring from the extraction of aggregate and quarry dewatering; and if they are
4. to determine presence of, and risk to, private well receptors of the unforeseen changes and if the implementation of mitigation measures is required to off-set the unforeseen changes in the groundwater regime.

Groundwater monitoring will not be used to assess potential impacts to surface water features form and function. Recent studies[1] have highlighted the difficulties of using groundwater drawdown thresholds for

[1]Drawdown ''Triggers'': A Misguided Strategy for Protecting Groundwater-Fed Streams and Springs, Currell, Vol. 54, No. 5–Groundwater–September-October 2016

monitoring and protection of groundwater-dependent ecosystems (springs and groundwater fed springs). In response, Nelson has proposed an alternative surface water monitoring and threshold strategy (Refer to Section 6).

4.1 On-Site Monitoring Wells

Based on the findings of the impact assessment, key sentry groundwater monitoring wells have been selected and incorporated into the long-term groundwater monitoring program. The groundwater monitoring program consists of water level and water quality monitoring. Water levels will be collected manually on a monthly basis as well as continuously with automatic water level transducers. The manual measurements are used to calibrate the continuous data, which allows for a comprehensive assessment of the water level responses and trends.

The groundwater monitoring network consists of well nests, which monitor discrete intervals in the bedrock aquifer, as well as, open holes, which are constructed to straddle water-bearing flow zones. Well nests have monitoring wells with either A or B following the well label (for example: MW03-1A and MW03-1B). The A monitor is constructed in the regionally extensive lower bedrock aquifer system found below the quarry floor elevation. The B monitor is constructed within the upper/middle dolostone unit that intersects the quarry extraction face.

Water quality sampling will be completed on a semi-annual basis. Parameters will include general water quality parameters, metals, major and minor ions and cations, and hydrocarbons (F1-F4 and VOCs).

4.2 Off-Site Domestic Water Wells

The MECP requires that all PTTW holders take the necessary actions to ensure residents and their water supplies are protected from potential impacts associated with the water takings at aggregate operations. To be proactive and to alleviate the complaint driven process, Nelson shall implement a voluntary domestic water well monitoring program to those residents located within 1 km of the Burlington Quarry extension lands. This program will be designed to act as an early warning system and would identify any potential adverse interference that may compromise the integrity of the domestic water supply.

A preliminary private door-to-door water well survey was completed by Nelson personnel and a Professional Geoscientist on July 29th and July 30th, 2019. The survey was completed for all residents located within 1 km of the proposed extension lands, including those located on both the north and south sides of Sideroad No. 1. In total, 156 homes were visited. The purpose of the water well survey was to collect baseline information on the local water use (quality and quantity) to ensure the sustained quality and quantity of the water supply and to discuss the proposed extension. If residents were not home, an information package was left at their front door. The package included an informative flier on the proposed application, details about the well monitoring program, and Nelson's contact information.

Of the 156 homes visited, only eleven (11) homeowners indicated that they were interested in participating in the monitoring program. Seven (7) of the eleven (11) private domestic water wells were accessible and, as a result, have been added to the current groundwater monitoring program (Figure 7).

If the ARA licence is issued, Nelson will be completing a follow-up door-to-door water well survey to inform residents that they are still able to participate in the program if interested. Furthermore, Nelson's website will have a page dedicated to the Private Well Monitoring Program, including details on the monitoring program. The website will also have a contact form that will allow a resident to schedule a

meeting with Nelson personnel and their Professional Geoscientist to discuss having their well added to the monitoring program.

A pre-construction monitoring program will be offered to residents within 1 km of the extension lands by a qualified well technician (as is required by law [Ontario Regulation 903, as amended]). This program is designed to establish baseline conditions of existing domestic water wells. Domestic water wells need to be determined case-by-case as the physical characteristics of each well will need to be evaluated and documented to provide an understanding of the current conditions, including water quality, well yield and the available drawdown.

This monitoring program will be completed only at locations where permission has been granted by the property owner. Furthermore, the domestic water wells, which will be incorporated into the AMP shall be constructed to comply with Ontario Regulation 903 (as amended).

4.3 Groundwater Impact Assessment Methodology

As discussed in Section 1, the AMP must identify potential receptors, outline the compliance monitoring program, as well as identify threshold values to assess and mitigate the potential impact to those receptors that may be impacted by the quarry development.

The impact assessment methodology has been developed for the initial 5 years of quarry operation. During these 5 years, Nelson will have only operated in the south extension and will have completed extraction from Phase 1 and will have partially extracted Phase 2. The area surrounding the south extension area has been monitored extensively for over 7 years. As a result, the awareness of how the groundwater regime behaves is enough to develop the assessment tools, such as threshold values and threshold trend analysis for the south extension.

The impact assessment methodology proposed for the Burlington Quarry extension involves both an evidence-based and a predicted-based approach to ensure that the complexity of fractured rock hydrogeology is addressed. The evidence-based approach requires a comprehensive understanding of the natural variability of groundwater elevations at key monitoring locations. This understanding requires several years of monitoring data that shows the groundwater systems natural response to varying climatic conditions, including how the aquifer responds during and following dry/drought conditions. The baseline conditions allow for an improved ability to identify unforeseen trends in water level data, that could be a result of the quarry operations.

The predictive-based approach relied upon the simulated water level drawdowns in the bedrock aquifers resulting from both climatic conditions and quarry dewatering. The predicted water levels during drought conditions represent a worst-case scenario that may be encountered during the initial phases of quarry operation (Phase 1 and 2).

A key component of the evidence-based groundwater monitoring program is the availability of background water level data that reports the natural conditions during quarry extraction.

4.3.1 Monitoring of Background Groundwater Conditions

To assist in the evaluation of the water levels measured as part of the groundwater monitoring program, a background monitoring well has been incorporated to the program. The background monitoring well is a domestic water well located north of the existing quarry at 2377 Collins Road (referred to as DW2; Figure

2). The purpose of this background monitoring well is to document the natural variability of the groundwater elevation fluctuations and trends under various future climatic conditions. This background monitoring well has shown to have no drawdown from the proposed quarry extension.

As discussed in the following sections, the impact assessment will be assessing short and long-term trends identified in the data. Being able to identify trends that are resulting from either prolonged climatic changes or those which are largely associated with aquifer dewatering are a fundamental component of the AMP. On-going monitoring data from DW2 will be used to represent the natural background conditions.

4.3.2 Comprehensive Groundwater Elevation Trend Analysis

Traditionally, AMPs have set seasonal site-specific trigger water level elevations at select sentry monitoring wells. These trigger values are determined based on the evaluation of baseline water level data and the predicted maximum extent of the cone of influence under full extraction limits. By defining the maximum extent of the cone of influence, trigger values are set that would activate mitigation measures if the observed values collected through the groundwater monitoring program are lower than predicted during set periods (seasonal triggers).

Trigger values set based on the traditional approach have caused numerous false positive trigger exceedances. The reasons for these exceedances include the oversimplification of the methodology to setting trigger values in a fractured rock environment (fundamental principles of how aquifers respond to abstraction), and more importantly the neglect to account for the full impact of climate change. Seasonal variability in groundwater level as well as season creep, which refers to observed changes in the timing of the seasons, have been widely observed in Ontario.

A key objective of the impact assessment methodology is to utilize the important concept of long-term trends from either prolonged climatic changes or those which are largely associated with aquifer dewatering. Prolonged climatic changes mean sustained periods of departure from "normal" precipitation amounts, for example droughts. These precipitation trends, when severe and lengthy, leave noticeable effects on groundwater levels. Short-term trends (seasonal) should also be evaluated. However, they should not cause a concern if an exceptionally dry year results in water levels that drop below a minimum reported or predicted water level.

Nelson will rely on the Seasonal Mann-Kendall Test to statistically interpret trend analysis of groundwater elevations at select sentry wells. The Nottawasaga Valley Conservation Authority has relied on the Seasonal Mann-Kendall Test to interpret Provincial Groundwater Monitoring Network (PGMN) groundwater levels after it was recognized that statistically definable results can be utilized to manage groundwater resources, assess drought conditions, evaluate the impact of human activities on groundwater and evaluate long-term groundwater trends.

The Seasonal Mann-Kendall Test considers the seasonality of the data series. This means that for monthly data with seasonality of 12 months, one will not try to find a trend in the overall series, but a trend from one of January to another, and from one February and another, and so on. The Seasonal Mann-Kendall test is established on the basis that the trend is cyclically varying in relation to the seasons of the year. It is used to analyse time series data for the possible existence of an upward or downward trend, at a significance level, while accounting for the effect of seasonality.

If a decreasing trend is determined by the results of the Seasonal Mann-Kendall Test, the trend will be analyzed using a Theil-Sen slope. The Theil-Sen test is also nonparametric and provides a more robust slope estimate than the least-squares method because outliers or extreme values in the time series affect it less. Therefore, this test provides an estimate of the true slope of an existing trend (as change per year). If the trend is decreasing, the date at which the water level is predicted to drop below a threshold of 5 m of available drawdown is calculated. If the trend is not decreasing, the test will conclude that the slope is not statistically decreasing. The slope of the trend line is used to make a conclusion on future groundwater conditions.

4.3.3 Proposed Groundwater Threshold Levels

A decreasing trend in local groundwater elevations that has been confirmed to be the result of quarry operations must be identified before a threshold value can be exceeded. Nelson proposes to rely upon the percentile method for establishing groundwater thresholds; the same method relied upon by the MECP for calculating threshold level for the Groundwater for the Ontario Low Water Response Plan.

For the standard statistical method, a percentile is a statistic that gives the relative standing of a numerical data point when compared to all other data points in a distribution. A percentile value ranges from 0 to 100. The value indicates the percentage of the data is equal to or below it.

The proposed thresholds have been calculated from the simulated water level elevations from the difference between the simulated average baseline water levels and the simulated drought water levels with Phase 1 and 2 extracted during a drought period. If the 0^{th} percentile equals the minimum water level simulated, the 10^{th} and 5^{th} percentile values will be relied upon for the threshold values. Level 1 Threshold conditions occur when the measured water level falls below the Threshold 1 value (10^{th} percentile) for a 15-day period. Level 2 conditions occur when the water level falls below the Threshold 2 value (5^{th} percentile) for a 15-day period. This statistical approach to reviewing and assessing the impacts associated with the quarry development meets the objectives of the AMP, which is to implement a system that allows for a comprehensive evaluation of how the groundwater regime behaves with quarry development and to identify unforeseen changes in this system that provides time to implement appropriate mitigation strategies to protect local water use.

4.3.4 Proposed Groundwater Mitigation Measures

As stipulated in the General Conditions of all Ontario Water Resource Act (OWRA) Section 34 Permit to Take Water (PTTW), if the taking of water is observed to cause any negative impact to groundwater supplies, the Permit Holder shall take such action necessary to make available to those affected, a supply equivalent in quantity and quality to their normal takings. If the permitted water taking at the Burlington Quarry causes permanent interference, Nelson shall restore the water supplies of those permanently affected. Nelson acknowledges and endorses this responsibility under Section 34 of the OWRA for the replacement of the water supply, which must be of equivalent quality and quantity. To ensure a cooperative and fair treatment with all concerned, Nelson will work diligently with their neighbours on these issues.

A key finding of the Level 1 and 2 Hydrogeological Assessment and Numerical Modelling (Earthfx et. al., 2020), is that the drawdown associated with the extension of the Burlington Quarry does not adversely impact the available drawdown in the regional bedrock aquifer found at an elevation beneath 252 masl (elevation of the quarry floor). The available drawdown is the distance between the static water level (either pre or post quarry development) and the top of the aquifer. Interference with available drawdown

can reduce the maximum yield of a well. It is generally accepted that 5 m of available drawdown is a safe available drawdown for domestic water wells constructed in bedrock aquifers.

The available drawdown at the private water wells is based on the well construction. If the well does not straddle the regional bedrock aquifer, available drawdown may be limited. Private wells are not always designed to obtain the maximum possible yield, but only an acceptable yield for domestic use. Nelson has determined the level of risk based on the total available drawdown for each well identified within the predicted area of influence. This information has been superimposed onto the model results showing available drawdown within the stratigraphic units, and the results show that wells can be deepened, if needed, to increase the available drawdown at each location. Data collected from existing domestic water wells along No. 2 Sideroad, which are within 80 m of the quarry, show that wells constructed in the hydrostratigraphy layer beneath the quarry floor (Layer 8) can meet peak domestic water demands with between 2 and 5 m of available drawdown.

The Seasonal Mann-Kendall Test will act as an early warning tool to identify any deviation from predicted water level trends and impacts. This test will be applied to private water wells where permission to monitor has been granted. However, the sentry wells are key locations to monitor trends and identify any unforeseen impacts before the influence is reported off-site. This approach limits the time required to complete traditional investigations that are triggered only if a specific water level threshold has been exceeded. Nelson will commence with planning the required compensation if unforeseen trends suggest off-site impacts will be greater than predicted and threaten the available drawdown in private wells. Compensation must be acceptable to the homeowner and the quarry operator and could include all or part of the costs associated with drilling of a new well, deepening a well, and abandonment of the old well.

In addition to providing a new private water supply well in a deeper aquifer system, Nelson will ensure that the quality of this source is equivalent or better than that of the well being replaced. Upon completion of the well construction, a comprehensive water quality analysis will be completed to characterize the water supply. If it is shown that the water quality has deteriorated from intercepting poor water quality at depth (for example increased chlorides and sulphates), the appropriate water treatment system will be purchased and installed.

The integrated surface water/groundwater model results predict groundwater mounding beneath the existing irrigation ponds in the West Extension. This groundwater mounding is generally maintained year-round by the diversion of quarry discharge into the irrigation ponds and raises groundwater levels in the area artificially. Through extraction, the irrigation ponds will be eliminated, and groundwater water levels will be lowered in the area. To replicate the existing artificial groundwater mounding produced by the irrigation ponds, a pond will be constructed outside the extraction area within the licence boundary between the extraction limit and Cedar Springs Road. The pond will be constructed at depths and elevations consistent with the existing irrigation ponds.

4.4 Groundwater Monitoring Network and Thresholds (Southern Extension)

4.4.1 Groundwater Monitoring Program

The effect the extension will have on the groundwater regime will be controlled by the depth, timing, and direction of extraction. Interference will be in part masked or, coupled by local climatic conditions. Key

groundwater monitoring locations that have over 7 years of water level data have been selected to act as the long-term sentry wells to ensure the influence on the groundwater regime is consistent with the predicted influence from quarry operations (Figure 3). The monitoring locations, well construction details, and predicted drawdown conditions during a drought period (expressed as water level elevation, simulated drawdown, and simulated available drawdown), are provided on Table 1.

Table 1: Monitoring Well Details (Southern Extension)

Borehole	Well ID	Survey Coordinates (NAD83)		Well Depth (m)	Simulated Water Levels (masl)	Simulated Drawdown (m)	Simulated Available Drawdown in Aquifer (m)
		Easting	Northing		Post-Extraction (Phase 1 and 2) During Extreme Drought Conditions		
M03-01	MW03-01A	590,635	4,805,092	24.4	256.34	12.20	5.7
	MW03-01B			14.1	259.54	9.63	
M03-07	MW03-07A	591,145	4,805,222	27.6	259.89	11.75	9.2
	MW03-07B			7.9	260.96	11.40	
M03-09	MW03-09A	590,963	4,805,320	30.7	253.95	16.41	4.1
	MW03-09B			9.4	254.50	16.15	
M03-14	OW03-14A	590,587	4,805,821	32.1	254.70	5.20	1.5
	OW03-14B			7.4	251.88	8.59	
M03-15	OW03-15A	590,389	4,805,517	25.6	254.57	5.35	2.8
	OW03-15B			10.2	258.40	4.59	
M03-17	OW03-17A	591,001	4,804,710	22.3	262.71	6.63	13.7
	OW03-17B			11.4	263.14	6.36	
M03-18	OW03-18A	591,469	4,805,367	31.1	262.25	9.13	11.2
	OW03-18B			17.6	262.88	9.06	
M03-19	OW03-19A	591,469	4,805,367	31.1	264.44	8.30	10.8
	OW03-19B			17.6	264.92	8.45	
M03-20	OW03-20A	591,168	4,805,650	26.1	262.08	9.57	9.0
	OW03-20B			8.9	262.75	9.70	
M03-28	OW03-28A	591,163	4,805,239	27.3	260.21	11.53	9.3
M03-29	OW03-29A	591,363	4,805,168	29.5	263.28	8.91	11.1
	OW03-29B			10.2	263.71	8.95	
M03-30	OW03-30A	590,933	4,805,878	24.3	260.08	7.85	6.8
	OW03-30B			8.5	260.08	8.55	

As discussed, it is generally accepted that 5 m of available drawdown is a safe available drawdown for domestic water wells constructed in bedrock aquifers. To identify potential groundwater receptors, domestic water wells that have less than 5 m of available drawdown have been plotted on Figure 4. The purple well symbols indicate wells that have less than 5 m of available drawdown based on the static water level recorded when the well was drilled, which indicates that these wells had limited available drawdown prior to the proposed aggregate extraction in Phases 1 and 2. The orange well symbols identify wells that have less than 5 m of available drawdown from the average simulated water level during the extraction of Phase 1 and Phase 2. The yellow symbols identify domestic water wells that are currently part of the on-going groundwater monitoring program.

A noteworthy finding of the model results is the simulated available drawdown in Layer 8 (lower aquifer) during drought conditions which will continue to have enough available drawdown to support private water supplies (i.e., > 5 m). Figure 4 shows contour intervals (shaded in green) that represent the available drawdown above the base of Layer 8 under drought conditions.

The groundwater monitoring wells are constructed within the Upper Bedrock Aquifer (Layer 6) and the Lower Bedrock Aquifer (Layer 8) of the numerical model. The wells constructed within Layer 6 are relied upon to assess the influence on the water-bearing fracture network that is intercepted by the quarry face.

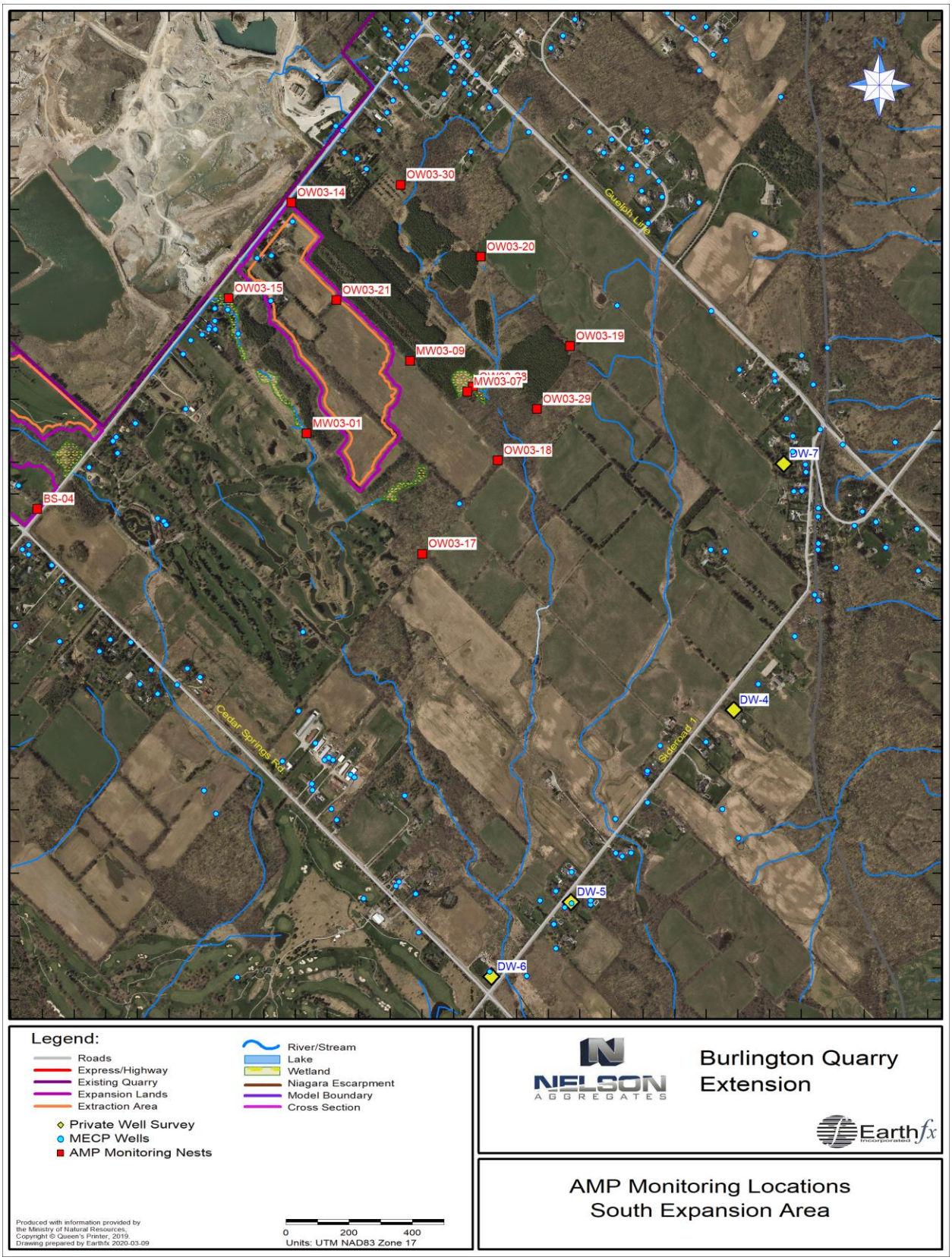

Figure 3: Groundwater Monitoring Network (Southern Extension)

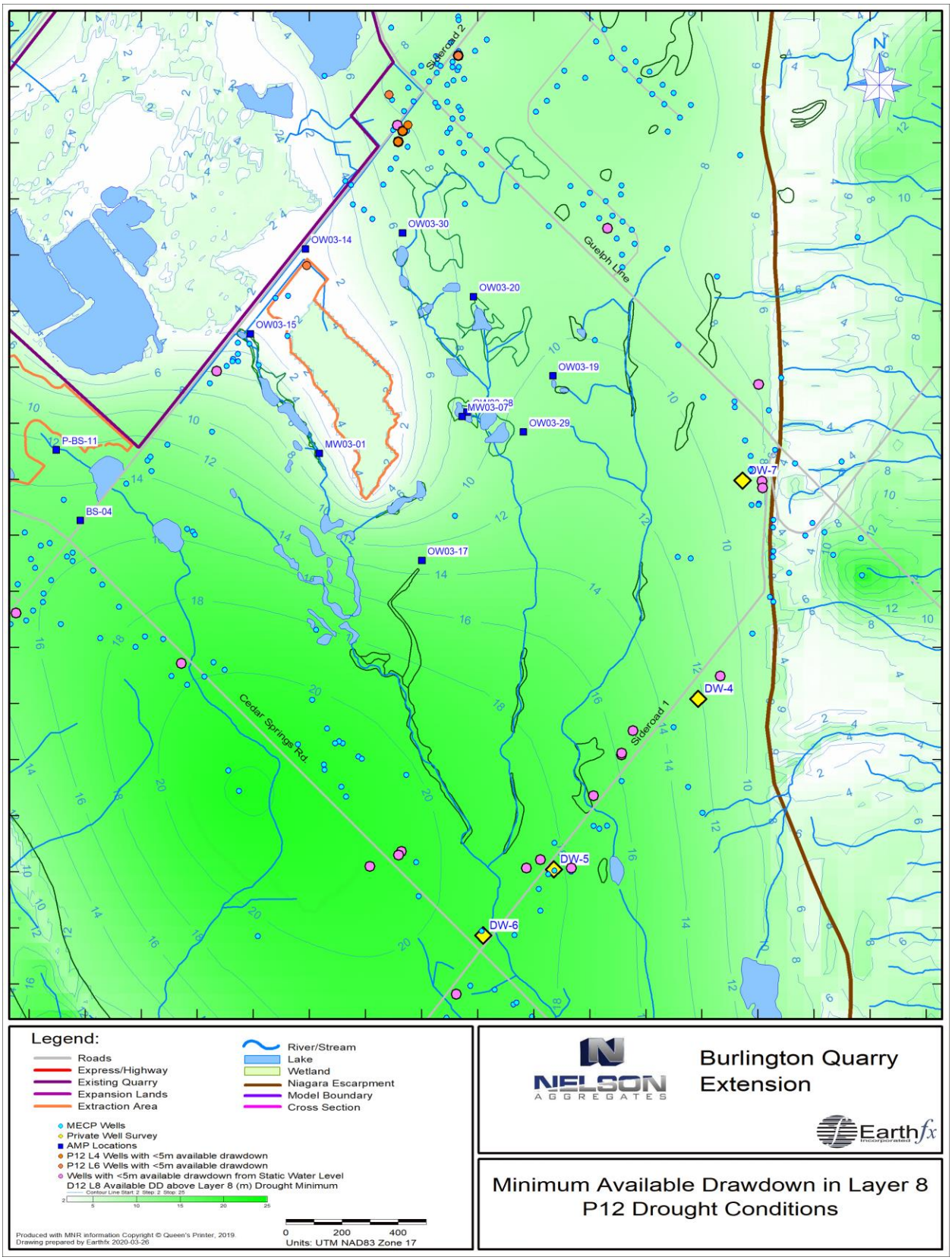

Figure 4: Available Drawdown (Southern Extension)

The wells constructed in Layer 8 monitor the aquifer unit beneath the quarry floor to ensure that there will be an available drawdown of at least 5 m, which would be utilized as a potable water supply if private water wells need to be deepened.

The simulated available drawdown in the regional bedrock aquifer (Layer 8) at the on-site groundwater monitoring wells show that, except for MW03-9, OW03-14, and OW03-15, the available drawdown remains above 5 m. OW03-14, and OW03-15 are located between the existing quarry and the proposed extension
to the south along No. 2 Sideroad. The closest receptor (private water well) is located approximately 120 m to the west of OW03-15, and currently has 4.6 m of available drawdown. Model results show that the aquifer will have approximately 5 m of available drawdown. Therefore, mitigation options are available, if required. MW03-9 is located immediately adjacent to the quarry face and therefore a greater drawdown in anticipated.

4.4.2 Groundwater Thresholds

Preliminary groundwater threshold values have been assigned to key Sentry Wells that are located outside of the extraction area. As discussed, these threshold values represent the 10th and 5th percentile of the water levels simulated under the 2016 drought conditions with the southern extension fully extracted (Phase 1 and 2 complete) and no rehabilitation.

Level 1 Threshold conditions occur when the measured water level falls below the Threshold 1 value (10th percentile) for a 15-day period. Level 2 conditions occur when the water level falls below the Threshold 2 value (5th percentile) for a 15-day period. These threshold levels are set as early warning water level elevations were the cumulative influence of drought conditions and quarry dewatering have lowered the water levels to an early warning threshold, where local private wells (adjacent to or in close proximity to the quarry) may start to notice a decrease in well yield.

Table 2: Groundwater Threshold Values

Well ID	Water Level Elevation (masl)		
	Simulated Min	Level 1 Threshold Value (10%)	Level 2 Threshold Value (5%)
MW03-01A	257.88	258.08	257.97
MW03-07A	262.40	263.26	262.75
OW03-14A	256.46	256.69	256.56
OW03-15A	255.60	255.69	255.64
OW03-17A	264.13	264.81	264.42
OW03-19A	267.10	268.36	267.64
OW03-20A	265.72	266.68	266.08
OW03-28A	262.74	263.63	263.11
OW03-29A	265.67	266.85	266.18
OW03-30A	263.70	264.42	263.92

The response to a Level 1 Threshold condition, would prompt Nelson to:

- mail out a letter to all residents located within 1 km of the southern extension lands informing them of the low water levels;
- notify the SLC, MECP and MNR in writing; and
- post a notice on the Nelson website.

The letter mailed to the residents shall include the estimated drawdown anticipated in their private water supply well based on simulated results along with Nelson's contact information. It will be requested that Nelson be notified immediately if the residents have noticed any change in the water quality or quantity. A licenced water well technician will preform an investigation on any wells located within 1 km, where a change has been reported. The results will be compared to background conditions, if available. If an impact to the resident's water supply has occurred as a result of the quarry operations, Nelson will immediately replace the private water supply with a deeper bedrock well.

The process will be repeated if a Level 2 Threshold condition is met. In addition to a second mail out letter, Nelson will attempt to notify the residents in person; and post a notification of the local groundwater conditions in the local news outlets. Instructions to contact Nelson if anyone has experienced any issues with their water supply within 1 km of the quarry will be outlined.

4.5 Groundwater Monitoring Network and Thresholds (Western Extension)

4.5.1 Drilling of Groundwater Sentry Wells

In response to the lack of current interest from the residents who reside along Cedar Springs Road to have their private water well monitored, Nelson will be supplementing the existing groundwater monitoring program on the western extension lands. The sentry well drilling program will be completed within the first year of extraction (Phase 1). Drilling and well construction will occur at 4 locations along Cedar Springs Road (Figure 5). At each location, two wells will be drilled:

- one (1) to the depth of the quarry floor (252 masl); and
- one (1) drilled to the lower aquifer unit (~244 masl).

These wells will be constructed as water wells (cased into the upper bedrock) and left as an open hole through the dolostone units. The intent of this construction is to mimic / understand the behavior in the adjacent water supply wells which are constructed above and below the base of the quarry floor.

These wells will be added to the on-going groundwater monitoring program. At least 8-years of baseline data will be collected during Phases 1 and 2 of extraction which will be used to assess seasonal fluctuations prior any influence from the quarry operations. The setting of the trend analysis techniques and trigger mechanisms will be defined between year 8 and 9 in consultation with the review agencies.

4.5.2 Groundwater Monitoring Program

The monitoring locations, well construction details, and predicted drawdown conditions during a drought period (expressed as water level elevation, simulated drawdown, and simulated available drawdown), are provided in Table 3. Groundwater monitoring at several monitoring wells on the West Extension commenced in 2018 and 2019. The monitoring of water levels and water quality shall continue for the duration of this AMP. Data collected will represent background conditions for as long as Phases 3-6 remain undisturbed.

The simulated available drawdown in the regional bedrock aquifer (Layer 8) at the on-site groundwater monitoring wells show that, except for BS-03, BH-05, and BS-07, the available drawdown remains above 5 m. BS-03, BH-05, and BS-07 are located within the proposed extraction footprint and therefore will see the most impact. Model results show that the aquifer will have approximately 5 m of available drawdown. Therefore, mitigation options are available, if required.

Table 3: Monitoring Well Details (Western Extension)

Borehole	Well ID	Survey Coordinates (NAD83)		Well Depth (m)	Simulated Water Levels (masl)	Simulated Drawdown (m)	Available Drawdown in Aquifer (m)
		Easting	Northing		Post-Extraction (Phase 3-6) During Drought Conditions		
BS-01	BS-01A	588,765	4,805,342	18.50	258.43	6.71	5.9
	BS-01B			15.20	257.90	3.41	
BS-02	BS-02A	589,421	4,805,342	23.1	262.72	10.08	7.7
	BS-02B			18.9	263.63	6.25	
BS-03	BS-03A	589,368	4,805,298	18.8	262.34	12.27	1.7
	BS-03B			12.8	263.64	13.44	
BS-04	BS-04A	589,777	4,804,855	24.5	264.07	7.61	11.9
	BS-04B			19.9	264.90	5.91	
BS-05	BS-05A	589,015	4,805,462	24.3	261.05	11.43	2.5
	BS-05B			18.2	261.65	12.45	
BH-07	BS-07	589,363	4,805,271	25.0	262.31	12.47	2.1
P-BS-08	P-BS-08A	589,072	4,805,879	Well to be drilled and constructed during the extraction of Phase 1			
	P-BS-08B						
P-BS-09	P-BS-09A	588,907	4,805,284				
	P-BS-09B						
P-BS-10	P-BS-10A	589,233	4,805,066				
	P-BS-10B						
P-BS-11	P-BS-11A	589,968	4,805,104				
	P-BS-11B						

4.5.3 Groundwater Thresholds

The extraction of the proposed West Extension (Phase 3 through to 6) is scheduled to commence approximately 10-years following the issuance of the ARA licence. No groundwater thresholds are proposed until enough groundwater monitoring data is collected to establish baseline conditions. The groundwater monitoring program outlined in Section 4.5.2, shall commence before the extraction begins in Phase 1. Once there is enough seasonal water level data and the behavior of the groundwater response in the vicinity of the West Extension is understood enough to develop the assessment tools, threshold values will be assigned, and threshold trend analysis will be then completed. These values must be defined and approved by the MNRF before extraction commences in the West Extension.

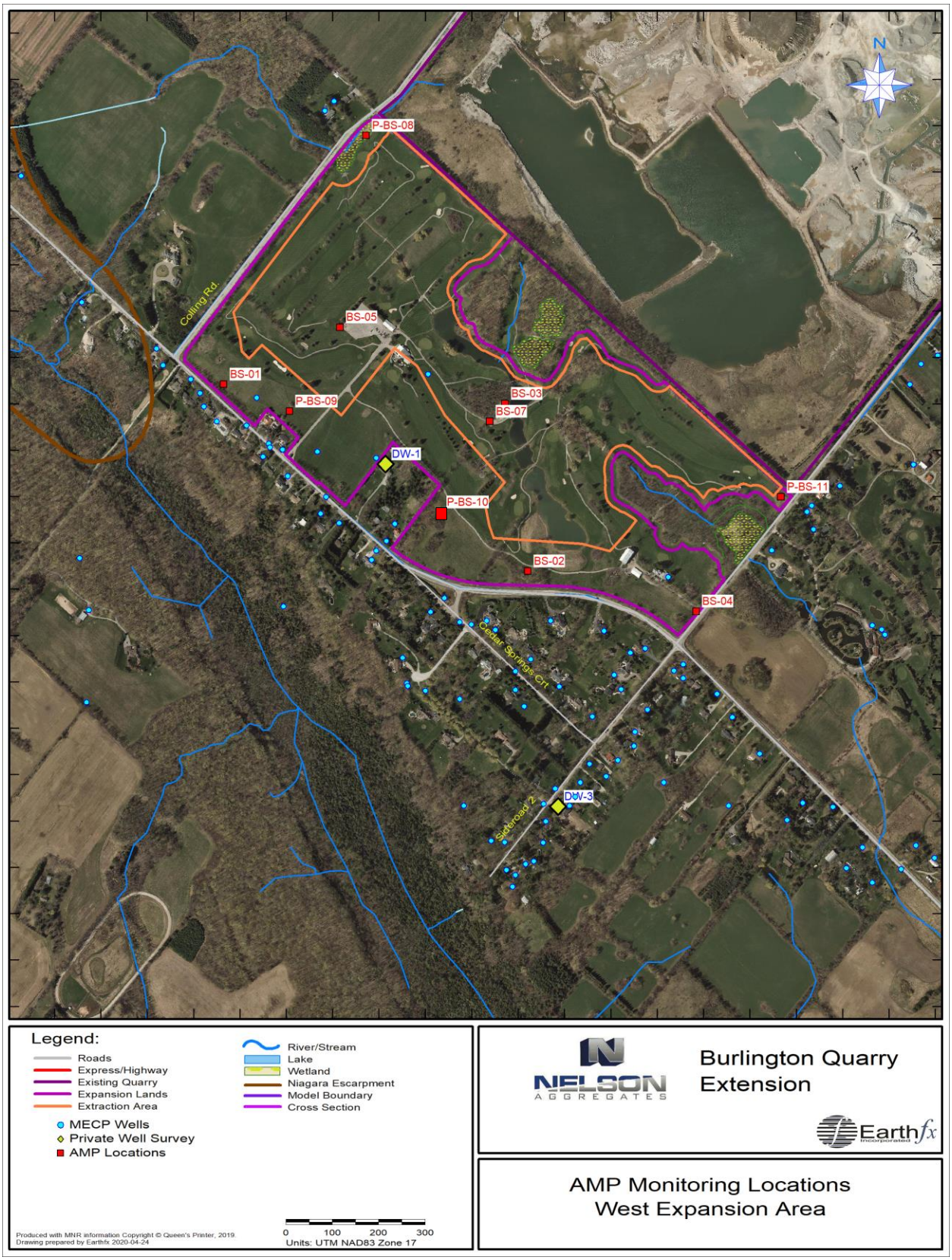

Figure 5: Groundwater Monitoring Locations (West Extension)

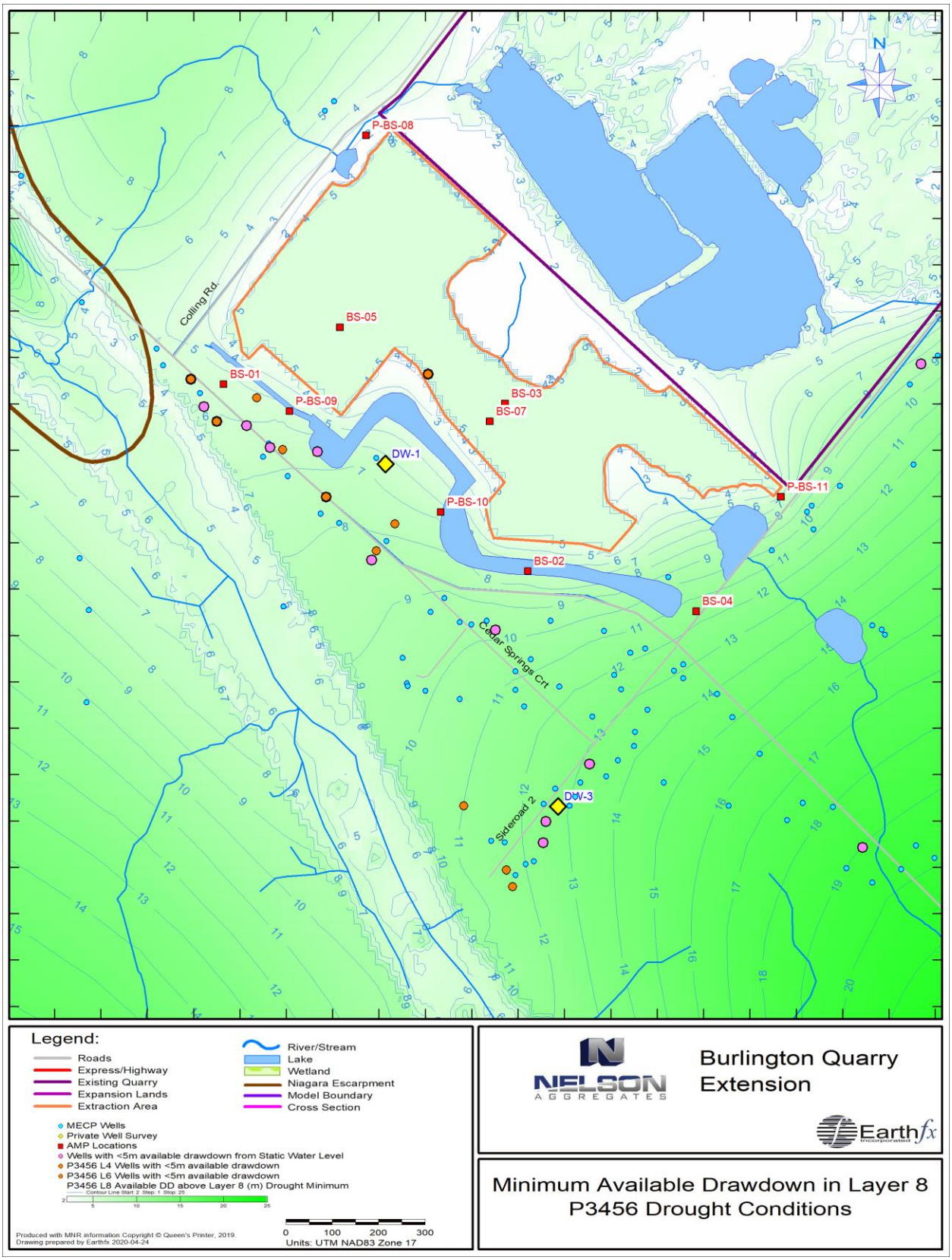

Figure 6: Available Drawdown (West Extension)

4.6 Water Well Interference Complaint Protocol

The Nelson Well Interference Complaint process is provided on Nelson's website.

https://www.nelsonaggregate.com/copy-of-licensing-1

If a water well complaint is received by the licencee, the following actions will be taken:

- The licencee will notify MNRF and MECP of the complaint.
- The licencee will contact a well contractor in the event of a well malfunction and residents will be provided a temporary water supply within 24 hours, if the issue cannot be easily determined and rectified.
- The well contractor will contact the resident with the supply issue and rectify the problem as expediently as possible, provided landowner authorization of the work. If the issue raised by the landowner is related to loss of water supply, the licencee will have a consultant/contractor determine the likely causes of the loss of water supply, which can result from a number of factors, including pump failure (owner's expense), extended overuse of the well (owner's expense) or lowering of the water level in the well from potential quarry interference (licencee expense). This assessment process will be carried out at the expense of the licencee and the results provided to the homeowner.
- If it has been determined that the quarry caused the water supply interference, the quarry shall continue to supply water at the licencee's expense until the problem is rectified. The following mitigation measures shall be considered, and the appropriate measure(s) implemented at the expense of the licencee:
    - adjust pump pressure;
    - lowering of the pump to take advantage of existing water storage within the well;
    - deepening of the well to increase the available water column;
    - widening of the well to increase the available storage of water;
    - relocation of the well to another area on the property;
    - drilling multiple wells; and
    - only at the request of a landowner would a cistern be installed.

If the issue raised by the land owner is related to water quality, the licencee will have a consultant/contractor determine the likely causes of the change in water quality, and review monitoring results at the quarry and background monitoring results from the baseline well survey to determine if there is any potential correlation with the quarry. If it has been determined that the quarry caused a water quality issue, the quarry shall continue to supply water at the licencee's expense until the problem is rectified. The licencee shall be responsible for restoring the water supply by replacing the well or providing a water treatment system. Only at the request of a landowner would a cistern be supplied. The licencee is responsible for the expense to restore the water quality.

5 DEVELOPMENT OF THE SURFACE WATER MONITORING PROGRAM

5.1 Existing Surface Water Monitoring Program

A surface water monitoring program has been developed and implemented over the past six (6) years to establish existing baseline conditions for the surface water features on-site and in the surrounding area. The surface water monitoring program includes streamflow, wetland hydroperiod, and shallow groundwater continuously recording monitoring locations and quarterly manual in-situ streamflow measurements and water quality sampling. The surface water monitoring locations are illustrated on the Surface Water Monitoring Locations Plan (Drawing SW-1) enclosed and are summarized in the following tables.

Table 4: Existing Streamflow Monitoring Locations

Monitoring Location	Northing	Easting	Watershed
SW1	4805833	589015	Bronte Creek
SW2	4806693	587340	Bronte Creek
SW6	4805071	590629	Grindstone Creek
SW7	4805441	588320	Bronte Creek
SW9	4805317	591235	Grindstone Creek
SW10	4803358	591283	Grindstone Creek
SW14	4804107	589227	Bronte Creek
SW15	4806484	589550	Bronte Creek
SW21	4803072	593686	Shoreacres Creek
SW22	4803267	593833	Shoreacres Creek
SW23	4803520	594087	Shoreacres Creek
SW24	4803691	594181	Shoreacres Creek
SW25	4804324	594708	Shoreacres Creek
SW26	4804448	594803	Shoreacres Creek
SW28	4803823	591609	Grindstone Creek
SW29	4804364	590180	Grindstone Creek
SW30	4809849	589826	Bronte Creek
SW31	4809367	592092	Bronte Creek
SW34	4806102	594154	Appleby Creek
SW35	4805699	594624	Appleby Creek

Table 5: Existing Wetland Hydroperiod / Shallow Groundwater Monitoring Locations

Monitoring Location	Northing	Easting	Wetland
SW5	4805331	591477	13031
SW11	4805245	591177	13027
SW12	4805393	591127	13022
SW13	4805707	590935	13016
SW16	4804900	590889	13037

The existing wetland hydroperiod and shallow groundwater monitoring locations are differentiated by the naming convention A and B, respectively. For example, SW5A represents the wetland hydroperiod monitoring location in wetland 13031 while SW5B represents the shallow groundwater monitoring in this wetland.

Table 6: Existing Water Quality Sampling Summary

Water Sampling Locations	Sampling Frequency	Parameters
SW1, SW2, SW6, SW10, SW14, SW15, SW24, SW28, SW29, SW30, SW31, SW32, SW35	Quarterly	Dissolved Organic Carbon, Ammonia, Alkalinity, BOD, COD, Conductivity, Total Hardness, Total Metals, Turbidity, Total Dissolved Solids, Total Suspended Solids, pH, Carbonate, Bicarbonate

In addition to the streamflow monitoring locations identified in Table 1, quarterly manual in-situ streamflow measurements are collected from 38 locations surrounding the existing Burlington Quarry (SW3 and M1 through M37). Also, the Natural Environment Technical Report (NETR) completed in support of the proposed extension identified two additional wetlands within the west extension area. Wetland hydroperiod and shallow groundwater monitoring stations will be established in the wetlands in the spring of 2020.

Streamflow monitoring locations have been established on-site and in the surrounding area to establish existing baseline conditions for the various watercourses in the area. A continuously recording pressure transducer measuring water level and water temperature and a water level staff gauge has been installed in each watercourse at each streamflow monitoring location. Manual in-situ streamflow measurements are collected monthly at each streamflow monitoring location along with a staff gauge water level measurement and temperature reading. Rating curves (streamflow versus water level) have been developed for each streamflow monitoring location from the collected field measurements allowing streamflow to be calculated from the continuously recorded water level data. The field measurements are also used to calibrate the continuously recording pressure transducer data.

Wetland hydroperiod monitoring locations have been established on-site and in the surrounding area to establish existing baseline conditions for the various wetlands in the area. A continuously recording pressure transducer measuring water level and water temperature and a water level staff gauge has been installed in each wetland at each wetland hydroperiod monitoring location. Staff gauge water level measurements and temperature readings are collected monthly at each wetland hydroperiod monitoring

location. The field measurements are used to calibrate the continuously recording pressure transducer data.

In 2018, shallow groundwater monitoring locations were established next to each wetland hydroperiod monitoring location to establish existing baseline conditions to help understand the surface water/ groundwater interactions in each wetland. A continuously recording pressure transducer measuring water level and water temperature has been installed in a drive point well in each wetland at each shallow groundwater monitoring location. Manual in-situ water level measurements are collected monthly at each shallow groundwater monitoring location. The field measurements are used to calibrate the continuously recording pressure transducer data.

Quarterly water quality samples were collected from select surface water monitoring locations in 2018 and 2019 to establish baseline water quality at each location. Samples were collected October 24, 2018, April 24, 2019, June 19, 2019 and September 25, 2019 from 13 total streamflow and manual in-situ streamflow monitoring locations.

5.2 Proposed Surface Water Monitoring Program

Moving forward, the current surface water monitoring program, with the additions noted previously, will be undertaken throughout the duration of the approvals process of the proposed quarry extension to gather additional baseline data. It is anticipated that the surface water monitoring program may be adjusted (monitoring locations added and/or removed) during the approvals process through consultation with the requisite approval agencies.

If the proposed extension is approved, surface water monitoring will continue during the operational lifespan of the quarry to:

- Monitor streamflow, wetland hydroperiods and surface and groundwater interactions during operations and upon closure of the Burlington Quarry;
- Assess potential unforeseen changes and impacts to the surface water and natural heritage features on-site and in the surrounding area resulting from extraction and dewatering of the quarry; and
- Establish the cause of any potential unforeseen changes and impacts to the surface water and natural heritage features and determine if mitigation is required to address the changes/impacts.

Through the work completed to date in support of the proposed quarry extension; specifically this Surface Water Assessment, the integrated surface water/groundwater model and Natural Environment Technical Report (NETR); key receptors, model and water balance calibration sites, waterbodies and natural heritage features have been identified considering potential impacts. The surface water monitoring locations associated with these key features form the suggested post approvals surface water monitoring program for the operational lifespan of the quarry. The post approvals surface water monitoring program recommended for the proposed quarry extension is outlined in Section 7 of this report.

5.3 Surface Water Thresholds

Surface water thresholds will be assigned to the surface water monitoring locations associated with key receptors, calibration points, and surface water and natural heritage features. The surface water thresholds will be assigned to identify potential unforeseen changes and impacts to the surface water and

natural heritage features as a result of extraction and quarry dewatering. Its recommended that the thresholds be established from the available surface water monitoring data and water balance and integrated surface water/groundwater model results. The thresholds will be established to identify deviations from historic trends and ranges that have the potential to adversely impact the surface water and natural heritage features on-site and in the surrounding area. The streamflow, wetland hydroperiod and water quality thresholds are described in the following sections.

5.3.1 Streamflow and Water Temperature Thresholds

Nelson is currently authorized to withdraw water from Quarry Sump 0100 and 0200 at rates of 4,090 L/minute (5,889,600 L/day) and 945 L/minute (1,360,800 L/day), respectively in accordance with Schedule "A" of Permit to Take Water No. 96-P-3009. Water taken from Quarry Sump 0100 is discharged northwest to the roadside ditch along Colling Road which drains into a tributary of Willoughby Creek north of Colling Road. Water taken from Quarry Sump 0200 is discharged southeast across No. 2 Sideroad to the upstream end of the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The monitoring data collected to date shows the tributary of Willoughby Creek and West Arm depend on the quarry discharge for much of their flow.

In addition to specifying the maximum allowable water taking rates and volumes, PTTW No. 96-P-3009 requires Nelson to:

- Measure, record and submit the quantities of water taken daily to the Ministry;
- Notify the Ministry of any complaints arising from the water taking; and
- Address any negative impacts caused by the water taking.

As long as Nelson withdraws water from the quarry sumps, they will be required to adhere to the conditions of their PTTW including those listed above.

Following several significant rain events, a temporary amendment to the PTTW was issued by the Ministry of the Environment and Energy August 13, 2014 increasing the maximum water taking from Quarry Sump 0100 to 8,200 L/minute. The amendment expired September 30, 2014 and the quarry has operated under the authority of PTTW No. 96-P-3009 since. It is recommended that Nelson seek to permanently increase the maximum allowable discharge rate from Quarry Sump 0100. It is recommended that a seasonal or varied (based on weather conditions and rainfall) allowable discharge rate(s) be established to provide Nelson with more operational flexibility to actively manage water on-site and allow discharge off-site when downstream channel capacities permit. Whether Nelson seeks to increase the maximum allowable discharge or not, they will have to adhere to the terms and conditions of the their current or any future PTTW for the operational lifespan of the quarry.

Willoughby Creek and the West Arm have been identified as fish habitat. Baseflow and water temperature are critical to the form and function of the watercourses from a natural heritage, habitat and spawning perspective. Also, the predictive integrated surface water groundwater model predicts a measurable reduction in flow to the unnamed tributary of Lake Medad at monitoring location SW29 during operations due to extraction and quarry dewatering. As such, streamflow and water temperature thresholds will be established for these watercourses.

Its recommended that streamflow and water temperature thresholds be established from the results of the historic surface water monitoring completed in support of the proposed quarry extension. Specifically, seasonal baseflows and maximum seasonal water temperatures should be established for each watercourse from the available surface water monitoring data. It is anticipated that the streamflow and water temperature thresholds may be refined as additional baseline monitoring data is collected during the approvals process, prior to extraction, through consultation with the requisite approval agencies. To set initial targets, preliminary streamflow and water temperature thresholds recommended for the proposed quarry extension are outlined in the following table:

Table 7: Streamflow and Water Temperature Thresholds

Monitoring Location (Watercourse)	Minimum Baseflow Threshold (L/s)			Water Temperature Threshold (°C)		
	Spring	Summer	Fall	Spring	Summer	Fall
SW1 (Tributary of Willoughby Creek)	2	2	2	20	30	28
SW2 (Willoughby Creek)	25	15	10	23	26	25
SW6 (West Arm of the West Branch of Mount Nemo Tributary)	2	0	1	28	29	28
SW10 (West Arm of the West Branch of Mount Nemo Tributary)	6	4	4	28	29	28
SW29 (Tributary of Medad Lake)	0.5	0	0	20	30	28

Note: Spring – March through May; Summer – June through August; Fall – September through November

Currently, a minimum baseflow of 2 L/s must be maintained to the upstream end of the tributary of Willoughby Creek as specified in PTTW No. 00-P-3072 issued to BSGCC. To maintain the baseflow in the tributary of Willoughby Creek, a continuous quarry discharge is required. Similarly, to maintain baseflow year-round in the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek discharge from Quarry Sump 0200 is required.

The predictive integrated surface water groundwater model predicts a measurable reduction in flow to the unnamed tributary of Lake Medad at monitoring location SW29 during operations due to extraction and quarry dewatering. Mitigation measures have been developed as part of the quarries surface water management plan to supplement wetland 13201 (SW36) feeding the unnamed tributary with quarry water to maintain its hydroperiod and consequently baseflows in the tributary. Mitigation is discussed in Section 6.4.

If the streamflow drops below the baseflow stipulated in the previous table, the applicable mitigation measure(s) described in Section 6.4 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. Similarly, if a water temperature measured in the watercourse exceeds the water temperature threshold stipulated in the previous table for three consecutive days, the applicable mitigation measure(s) described in Section 6.4 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.

5.3.2 Wetland Hydroperiod Thresholds

The wetlands bordering the south extension (outside the licence boundary) and within the west extension licence boundary (outside the extraction area) have been identified as natural heritage features, specifically significant wetlands. The wetland hydroperiod and water temperature are critical to the form and function of the wetland from a natural heritage, habitat and breeding perspective. As such, wetland hydroperiod thresholds will be established for the key significant wetlands.

Its recommended that the wetland hydroperiod thresholds be established from the results of the historic surface water monitoring, existing condition water balance and integrated surface water groundwater model completed in support of the proposed quarry extension. Specifically, dates when the wetlands must remain wet should be established from the monitoring data and water balance and integrated surface water groundwater model results. It is anticipated that the wetland hydroperiod thresholds may be refined as additional baseline monitoring data is collected during the approvals process, prior to extraction, through consultation with the requisite approval agencies. Preliminary wetland hydroperiod thresholds recommended for the proposed quarry extension are outlined in the following table:

Table 8: Wetland Hydroperiod Thresholds

Monitoring Location (Wetland)	Monitored Hydroperiod (5 Year Period)	Water Balance Hydroperiod (20 Year Period)	Spring Hydroperiod Threshold
SW11 (13027)	May 19th (2015)	May 3rd (2001)	April 26th
SW12 (13022)	May 11th (2015)	April 27th (2015)	April 20th
SW13 (13016)	May 16th (2015)	May 7th (1999)	May 1st
SW16 (13037)	July 5th (2019)	May 25th (2012)	May 18th
SW36 (13021)	TBD	TBD	TBD
SW37 (13020)	TBD	TBD	TBD

If the wetland water level drops to zero at a monitoring location (0.0 m water level staff gauge reading) before the hydroperiod threshold stipulated in the previous table, the applicable mitigation measure(s) described in Section 6.4 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.

Maintaining a standing pool of water in each wetland during its historic hydroperiod is critical to the form and function of the wetland from a natural heritage, habitat and breeding perspective. The species living and breeding in these wetlands rely on the standing pool of water for a period each spring. As such, the hydroperiod threshold represents the earliest date at which the standing pool of water reaches a depth of 0.0 m at the wetland monitoring locations as defined by the historic surface water monitoring data and predictive water balance and integrated surface water/groundwater model.

It is noted that the permanent pool in each wetland was generally not re-established prior to the wetland hydroperiod monitoring device being removed mid-December to prevent freezing. The results of the wetland hydroperiod monitoring, existing condition water balance and integrated surface

water/groundwater model show that the re-establishment of the permanent pool each fall/winter is highly dependent on rainfall and snowmelt and can occur between the beginning of November to mid-February. As such, a fall hydroperiod threshold has not been established for each wetland. The need for a fall hydroperiod threshold will be re-evaluated as additional baseline monitoring data is collected during the approvals process, prior to extraction, through consultation with the requisite approval agencies.

The overall catchment area draining to each wetland (wetlands 13031, 13027, 13022, 13016, and 13037) adjacent to the south extension will not be altered through extraction. The integrated surface water groundwater model predicts groundwater drawdown beneath each wetland during operations due to extraction and quarry dewatering. However, adverse impacts are not predicted to the wetlands as a result of the groundwater drawdown as the wetlands are generally perched with little (less than 1.8% of the total inflow to the wetland) to no groundwater contribution during the year. The wetland hydroperiod thresholds for these wetlands have been specified to ensure no unforeseen adverse impacts occur as a result of extraction and/or quarry dewatering.

The overall catchment area draining to wetlands 13200 and 13201 (wetland monitoring locations SW36 and 37) will be reduced as part of extraction in Phases 3 through 6. Also, the integrated surface water groundwater model predicts groundwater drawdown beneath each wetland during operations due to extraction and quarry dewatering. Mitigation measures have been developed as part of the quarries surface water management plan to supplement these wetlands with quarry water to maintain their hydroperiod. Mitigation is discussed in Section 6.4.

Wetland hydroperiod and shallow groundwater monitoring stations will be established in the two additional wetlands in the spring of 2020. The wetland hydroperiod thresholds for these two wetlands will be developed from the monitoring data collected moving forward and the results of the existing conditions water balance and integrated surface water groundwater model.

5.3.3 Water Quality Thresholds

As a condition of the quarries ECA, grab samples must be collected from the discharge pipe of Quarry Sump 0100 and 0200 monthly and quarterly (once every three months) during operations. Monthly and quarterly samples are collected from the discharge pipe of each sump and analyzed for a specified set of parameters (the monthly and quarterly sample parameters differ). As the quarry discharge will continue through extension, sampling is expected to continue long-term during operations as specified in the ECA or modified by the Director of the MECP. The following effluent limits have been established for off-site discharge:

Table 9: Environmental Compliance Approval Effluent Limits

Parameter	Concentration Limit (mg/l)
Total Suspended Solids (TSS)	25
Oil and Grease	15
pH	6.5 – 8.5 (inclusive)

Non-compliance is deemed to have occurred when the concentration of any parameter listed from any single grab sample exceeds the maximum concentration limit specified or when a single pH measurement falls outside the indicated range.

A settling pond constructed at surface is required as part of Phase 1 and 2 extraction to manage precipitation and intercepted groundwater until sufficient extraction has occurred and a sump has been constructed in the Phase 2 quarry floor. To dewater the extraction area, water will be pumped to the settling pond for treatment prior to discharge to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Once the quarry sump has been constructed, it will provide treatment and water from the sump will be pumped directly to the West Arm. It is recommended that this discharge adhere to the Environmental Compliance Approval Effluent Limits described above.

Downstream of each quarry discharge location (SW2 and SW10), water quality thresholds will be established to identify impacts on the water quality of the surface water features resulting from the quarry discharge. 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.

To date, four (4) samples have been collected from each water sampling location. Additional samples will be collected to establish suitable maximum and minimum concentration limits. As such, the water quality thresholds will be confirmed during the approvals process, prior to extraction in the extension areas, through consultation with the requisite approval agencies as additional water quality data is obtained.

5.4 Surface Water Mitigation

Mitigation measures for the potential surface water impacts identified through the predictive water balance and integrated surface water/groundwater model have been developed. The mitigation measures include maintaining the existing off-site discharge locations, adjusting quarry discharge rates, and supplementing wetlands with water from the quarry sumps to maintain wetland hydroperiod. These mitigation measures have been incorporated into the surface water management strategy for the proposed extension. Specifically, the mitigation measures proposed are summarized in the following paragraphs.

The integrated surface water/groundwater model results predict groundwater mounding beneath the existing irrigation ponds on the Burlington Springs Golf and Country Club (BSGCC) property. This groundwater mounding raises groundwater levels in the area artificially and is generally maintained year-round by the diversion of quarry discharge into the irrigation ponds. Through extraction, the irrigation ponds will be eliminated, and groundwater water levels will be lowered in the area. To replicate the artificial groundwater mounding produced by the existing irrigation ponds and supplement the groundwater recharge in the area, a pond will be constructed within the licence boundary, outside the extraction area, between the extraction limit and Cedar Springs Road during operations. The pond will be constructed at depths and elevations consistent with the existing irrigation ponds. The pond will remain post extraction as part of the rehabilitation of the site.

As discussed, Quarry Sump 0100 discharges to the roadside ditch along Colling Road which drains southwest to wetland 13202 (weir pond) located in the northeast corner of the west extension lands. A weir structure and diversion channel maintain flow to the irrigation ponds on the golf course. The diversion channel will be eliminated through extraction and will be replaced by a diversion pipe proposed to divert a portion of the quarry discharge to the proposed pond between the extraction limit and Cedar Springs Road. The diversion pipe will consist of an adequately sized culvert installed between Colling Road/Cedar Springs road and the extraction limit. The diversion pipe will divert flow to the proposed pond in a similar manner and elevation as the existing diversion channel. The diversion pipe will be installed during operations and remain in place post extraction as part of the rehabilitation of the site.

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 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. The discharge of water, both rate and quantity, will be controlled by the control valve operated by Nelson staff during operations. The bottom draw outlet and outlet pipe complete with a control valve will remain post extraction as part of the rehabilitation of the site. Monitoring of the wetland hydroperiod and discharge of water, both rate and quantity, to the wetland as required to maintain the wetland hydroperiod will be the responsibility of the operating authority of Mount Nemo Park after the licence has been surrendered.

Extraction will also reduce the drainage area to wetland 13200 located northeast of the existing irrigation ponds within the BSGCC property. 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. Quarry water will be pumped from Quarry Sump 0100 directly into the wetland at specified rates and volumes to maintain the wetland hydroperiod. As part of the rehabilitation of the west extension, fill will be imported into the west extension to raise the grade around the wetland to original ground level, reinstating the wetlands drainage area. The portion of the wetland's drainage area reinstated through rehabilitation will be graded to drain overland into the wetland and will be planted with trees mimicking existing conditions.

Additional mitigative measures for potential streamflow, wetland hydroperiod, water temperature and water quality impacts resulting from extraction and/or quarry dewatering are as follows:

- If a streamflow threshold is triggered, the quarry discharge off-site will be reviewed, and the discharge rates adjusted (within the permissible discharge rates specified in Nelson's PTTW) to satisfy the specified baseflow thresholds.
- If a maximum streamflow temperature threshold is triggered, the quarry discharge off-site will be reduced to reduce the discharges influence on the water temperature in the receiving watercourse. Consequently, the depth of water in the quarry sump and settling ponds will increase reducing the temperature of the water discharged off-site. In addition, the pump intake located in the quarry sump will be reviewed to ensure it is drawing off bottom where water temperatures are lowest in the water column.

- If a wetland hydroperiod threshold is triggered, the wetland will be supplemented with water from a quarry sump. Water will be pumped from the quarry sump to the wetland as required to maintain a standing pool of water in the wetland until the hydroperiod threshold date passes. Water quality samples will be collected from the discharge to confirm the water quality adheres to the effluent limits specified in the quarries ECA.
- If the effluent limits in the quarry discharge are exceeded in any individual grab sample collected, Nelson will collect a second sample to verify the results of the original sample and report the exceedance to the MECP in accordance with the reporting requirements of their ECA. If the second sample confirms the results of the first, the quarry sump and settling pond will be reviewed and the necessary modifications will be made to address the effluent limits.
- If the water quality thresholds are triggered in any individual grab sample collected, a second sample will be collected to verify the results of the original sample and a sample will be collected from the upstream quarry discharge. In addition, the quarry discharge off-site will be reduced to limit the discharges influence on the water quality of the receiving watercourse. If the second sample confirms the results of the first, the quarry sump and settling pond will be reviewed and the necessary modifications will be made to address the effluent limits.

To ensure the potential impacts on each wetland can be mitigated expeditiously, Nelson will maintain a pump(s) and a sufficient length of hose on-site to pump water from the quarry sump to the impacted wetland. A pump(s) and sufficient hose will remain on-site to feed the wetlands east and south of the south extension and the two wetlands within the west extension licence boundary. To identify an adverse impact on a wetland, the wetland hydroperiod monitoring frequency will be increase to weekly starting March 1st each year until the spring hydroperiod threshold date has passed.

The protocol for mitigating and investigating potential impacts identified by thresholds being triggered is as follows:

- The approved mitigation plan outlined in this Adaptive Management Plan will be implemented by Nelson.
- The MNRF and MECP will be notified within 48 hours of the trigger being discovered;
- For water quality triggers, a second sample will be collected to confirm the results of the first sample;
- The cause of the trigger will be investigated;
- If the investigation determines the trigger was caused by extraction and/or quarry dewatering, the mitigation measures implemented will remain in place until the trigger is resolved;
- If the investigation determines the trigger was not caused by extraction and/or quarry dewatering, the mitigation measures implemented will cease and operations will return to normal following approval from the MNRF and MECP; and
- The MNRF and the MECP will be advised of the results of the investigation and of the plan moving forward for approval.

6 JEFFERSON SALAMANDER BREEDING PONDS

Although the Natural Environment Technical Report has confirmed the wetlands within 120 m of the proposed extraction areas are not considered suitable Jefferson Salamander habitat due to the established wetland hydroperiods, there are two breeding ponds located on the property immediately

south of the South Extension. Wetland 13032 (Woodland Vernal Pool) is located approximately 550 m from the proposed extraction area. The south pond (Wetland Vernal Pool), referred as Pond 1, is about 410 m from the proposed extraction area.

Typically, permission to monitor off-site surface water features is granted by the property owner to ensure the on-going protection of the features form and function. However, permission to monitor the two off-site ponds has not been granted. Even without permission, the protection of the Jefferson Salamander breeding ponds will be achieved. To maintain suitable breeding conditions, wetlands need to hold water long enough to support salamander development but also need to dry-out in the later summer months (August). This requires that both surface water hydrology and groundwater contributions are not disrupted, altered or diminished.

An important improvement to the proposed South Extension is that all surface water catchment areas will be maintained. This coupled with the lack of hydraulic connectivity between the surface water and groundwater regimes, ensures that the habitat will be unaffected. The following sections provide a detailed discussion on the two off-site breeding ponds and proposed monitoring and mitigation plans.

6.1 MNRF Wetland 13032

Wetland 13032 is reported by the MNRF to provide Jefferson Salamander breeding habitat. This feature is located approximately 550 m from the extraction boundary. Perched approximately 8 m above the water table, the surface water feature is hydraulically isolated from the groundwater regime. Although minor drawdown is predicted beneath Wetland 13032, further lowering of the regional water table will not increase the vertical hydraulic gradient between the surface water and groundwater systems. Seepage from the wetland is independent of head in the aquifer due to perched conditions. Therefore, there are no mechanisms to disrupt, alter or diminish surface water or groundwater contributions to this feature.

The field measurement of pond level recession confirms that the model correctly simulates the hydrologic processes and pond water budget. The spring recession is a relatively good time to evaluate the pond function, for the dominant loss processes in a perched wetland are evapotranspiration and leakage to groundwater. The wetland fills in the spring with snowmelt, rainfall and runoff. Water levels gradually decline over the summer through evapotranspiration and vertical leakage of water down to the water table. Both the long-term monitoring record and the long-term simulations confirm that this wetland is fully disconnected from the groundwater system. No groundwater inflows are observed or simulated into this wetland. The field observations and model simulations confirm that seasonal and inter-annual changes in the water table have no impact on the wetland. The wetland responds only to local climate-driven processes.

Although no impacts to wetland 13202 are predicted, a monitoring station will be established in the wetland to confirm the results of the model simulations if granted permission by the landowner to do so. If permission is not granted, a monitoring program will be developed through consultation with the approval agencies to monitor the wetlands in the surrounding area to evaluate for potential impacts to wetland 13032.

If adverse impacts are anticipated through the long-term monitoring program from the quarry operations, the mitigation response is to cease dewatering of Phase 1 and 2.

6.2 MNRF Wetland 13034/13035 Complex

Pond 1 is a small wetland that is part of the wetland 13034/13035 complex and is reported by the MNRF to provide Jefferson Salamander breeding habitat. Pre and post extraction water balance results indicate that there will be a small change in the groundwater inflows and outflows to the feature. A net reduction in groundwater inflow of approximately 1.3% to 0.0% of the overall inputs is estimated. An increase in the outflow from the wetland into groundwater system (infiltration) 2.5% to 5.8% is estimated.

Monitoring location SW11A was established in October 2014 to monitor the hydroperiod and water temperatures in wetland 13027. Wetland 13027 is located east of the south extension upstream of the wetland 13034 and 13035 at the northern extent of the wetland complex. A detailed water balance of Wetland 13027 shows that extraction will decrease groundwater inflow by 0.8 m^3/day (about 1.3 % of the total inflow to the wetland) and increase groundwater outflow by 4.6 m^3/day (3.3% of the total outflow from the wetland). Although limited influence is predicted on the surface water feature, a viable mitigation strategy has been developed to supplement the flow into the wetland during operations as required (refer to Section 5.4).

7 COMPLIANCE MONITORING AND ASSESSMENT

7.1 Groundwater Monitoring Program

7.1.1 On-Site Groundwater Monitoring Program

The groundwater monitoring program is outlined in Table 10 and Table 11. Locations are shown on Figure 7.

Table 10: On-Site Groundwater Monitoring and Evaluation Program

Extraction Area	Borehole	Well ID	Water Level Monitoring		Water Quality Sampling		Analysis	
			Monthly Manual	Continuous (4-hour frequency)	Semi-Annual	Annual	Trend Analysis	Threshold Value (masl)
Southern Extraction Area	M03-01	MW03-01A	X	X	X		X	258.08
		MW03-01B	X	X	X	X	X	NVR
	M03-07	MW03-07A	X	X	X		X	263.26
		MW03-07B	X	X	X	X	X	NVR
	M03-09	MW03-09A	X	X	X			NVR
		MW03-09B	X	X	X	X		NVR
	M03-14	OW03-14A	X	X	X		X	256.69
		OW03-14B	X	X	X	X	X	NVR
	M03-15	OW03-15A	X	X	X		X	255.69
		OW03-15B	X	X	X	X	X	NVR
	M03-17	OW03-17A	X	X	X		X	264.81
		OW03-17B	X	X	X	X	X	NVR
	M03-19	OW03-19A	X	X	X		X	268.36
		OW03-19B	X	X	X	X	X	NVR
	M03-20	OW03-20A	X	X	X		X	266.68
		OW03-20B	X	X	X	X	X	NVR
	M03-21	OW03-21A	X	X	X			NVR
		OW03-21B	X	X	X	X		NVR
	M03-28	OW03-28A	X	X	X		X	263.63
		OW03-28B	X	X	X	X	X	NVR
	M03-29	OW03-29A	X	X	X		X	266.85
		OW03-29B	X	X	X	X	X	NVR
	M03-30	OW03-30A	X	X	X		X	264.42
		OW03-30B	X	X	X	X	X	NVR
Western Extraction Area	BS-01	BS-01A	X		X		X	TBD
		BS-01B	X	X	X	X	X	TBD
	BS-02	BS-02A	X		X		X	TBD
		BS-02B	X	X	X	X	X	TBD
	BS-03	BS-03A	X		X		X	TBD
		BS-03B	X	X	X	X	X	TBD
	BS-04	BS-04A	X		X		X	TBD
		BS-04B	X	X	X	X	X	TBD
	BS-05	BS-05A	X		X		X	TBD
		BS-05B	X	X	X	X	X	TBD
	BH-07	BS-07	X		X		X	TBD
Proposed West Extension	P-MW-08	P-BS-08	X	X	X	X	X	TBD
	P-MW-09	P-BS-09	X	X	X	X	X	TBD
	P-MW-10	P-BS-10	X	X	X	X	X	TBD
	P-MW-11	P-BS-11	X	X	X	X	X	TBD

NVR = No value required (shallow well)
TBD = value to be determined before extraction commences from Western Extension

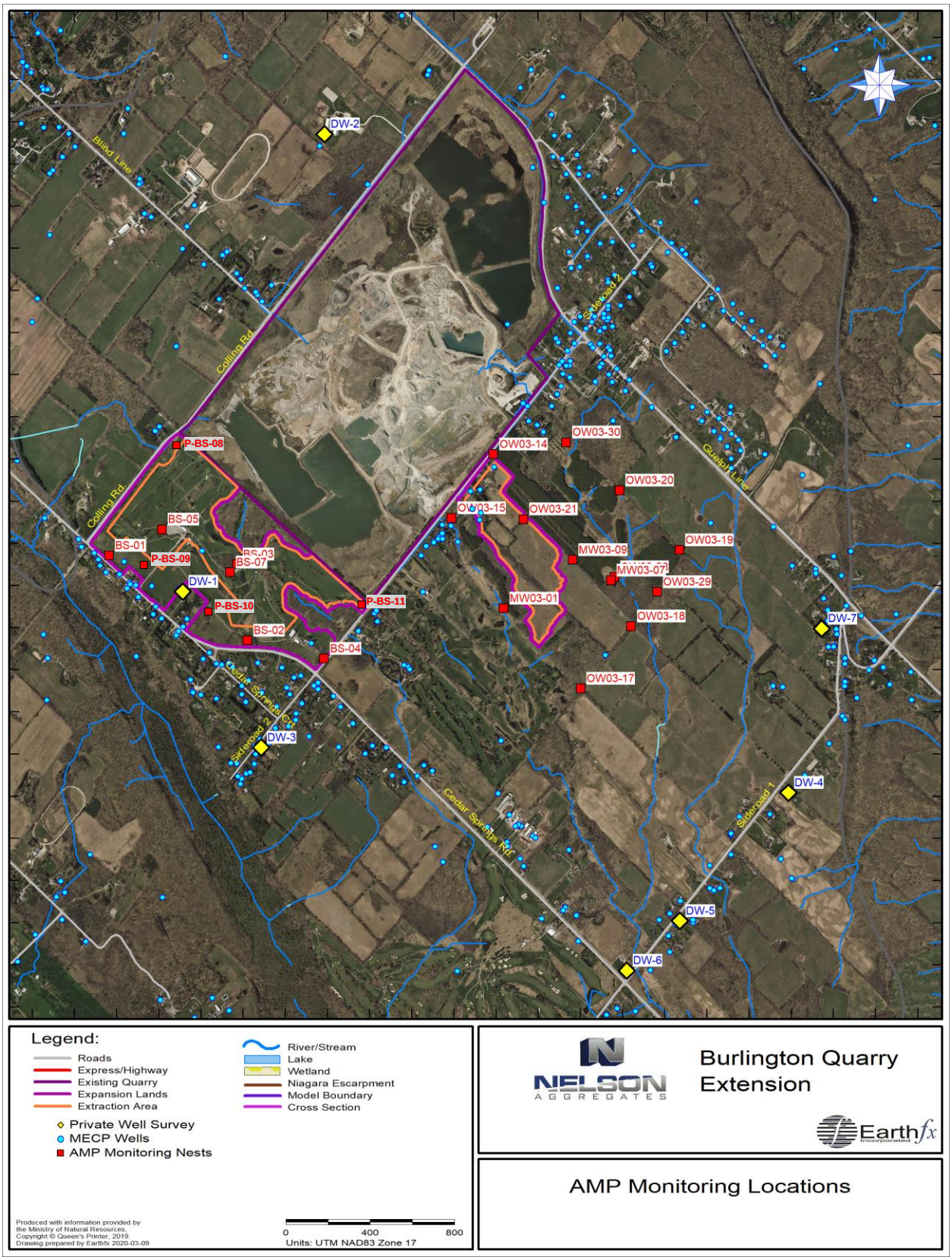

Figure 7: AMP Groundwater Monitoring Locations

Table 11: Groundwater Quality Parameters

Water Quality Sampling Frequency	Parameters
Semi-Annual	pH, Conductivity, Alkalinity, Hardness, Bicarbonate, Total Phosphorus, Metals (Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Cobalt, Copper, Lead, Iron, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Sodium, Silver, Strontium, Sulfur, Thallium, Thorium, Tin, Titanium, Tungsten, Uranium, Vanadium, Zinc),
Annual	Petroleum Hydrocarbons (BTEX, F1-F4)

7.1.2 Private Water Well Monitoring

The Private Well Monitoring Program includes the collection of water quality samples and water levels, like the on-site monitoring program outlined in Section 7.1.1. Similarly, the impact assessment on each well will include a trend analysis and threshold value. The current domestic water well monitoring locations are provided in Table 12.

Each domestic well that becomes a part of the groundwater monitoring program will be assigned independent threshold values, which will be based on the well construction details and the proximity to the proposed extraction face.

Nelson will continue efforts to expand the domestic water well monitoring network. It is anticipated that the residents will become increasingly more interested in having their potable water supply monitored if the aggregate licence is issued.

Table 12: Private Monitoring Well Locations

Borehole	MECP Well ID	Survey Coordinates (NAD83)	
		Easting	Northing
DW-1	28-03833	589114	4805170
DW-2	na	589786	4807340
DW-3	7276141	589486	4804431
DW-4	na	591987	4804216
DW-5	2800063	591472	4803608
DW-6	na	591220	4803372
DW-7	na	590916	4806143

7.2 Surface Water Monitoring Program

Surface water monitoring will continue during the operational lifespan of the quarry. The post approvals surface water monitoring program recommended for the proposed quarry extension is outlined in the following tables.

Table 13: Post Approvals Streamflow Monitoring Locations

Monitoring Location	Northing	Easting	Watershed
SW1	4805833	589015	Bronte Creek
SW2	4806693	587340	Bronte Creek
SW6	4805071	590629	Grindstone Creek
SW7	4805441	588320	Bronte Creek
SW9	4805317	591235	Grindstone Creek
SW10	4803358	591283	Grindstone Creek
SW14	4804107	589227	Bronte Creek
SW15	4806484	589550	Bronte Creek
SW24	4803691	594181	Shoreacres Creek
SW28	4803823	591609	Grindstone Creek
SW29	4804364	590180	Grindstone Creek
SW30	4809849	589826	Bronte Creek
SW31	4809367	592092	Bronte Creek
SW35	4805699	594624	Appleby Creek

Table 14: Post Approvals Wetland Hydroperiod / Shallow Groundwater Monitoring Locations

Monitoring Location	Northing	Easting	Wetland
SW5	4805331	591477	13031
SW11	4805245	591177	13027
SW12	4805393	591127	13022
SW13	4805707	590935	13016
SW16	4804900	590889	13037
SW36	To be Established Spring 2020		13021
SW37	To be Established Spring 2020		13020

As previously discussed, the Natural Environment Technical Report (NETR) completed in support of the proposed extension identified two additional wetlands within the west extension area. Wetland hydroperiod and shallow groundwater monitoring stations will be established in the wetlands in the spring

of 2020. These two additional monitoring locations are identified as SW36 and SW37 in the previous tables.

It is recommended that the surface water monitoring associated with the south extension, specifically Phases 1 and 2, continue throughout extraction and post extraction for a period of two years following rehabilitation of the south extension. Similarly, it is recommended that the surface water monitoring associated with the west extension, specifically Phases 3 through 6, continue throughout extraction until the licence is surrendered. The only exceptions to this are the surface water monitoring that occurs at SW6 and SW36. Monitoring at SW6 should continue for the duration of extraction in all six Phases until the licence is surrendered. Monitoring at SW36 should continue long-term or until a long-term discharge protocol for the release of water into wetland 13201 has been developed to maintain the wetland hydroperiod. During Phases 3 through 6 of extraction, a long-term discharge protocol will be developed by Nelson to aid the operating authority of the Mount Nemo Park with the release of water into wetland 13201 after the licence is surrendered.

To identify an adverse impact on a wetland, the wetland hydroperiod monitoring frequency will be increased to weekly starting March 1st each year until the spring hydroperiod threshold date presented in Section 6.4 has passed. Also, weekly site visits should be conducted to surface water monitoring location SW29 from March 1st until the spring hydroperiod threshold date specified for SW36 to confirm the baseflows in the unnamed tributary of Lake Medad are maintained.

Water quality sampling is also recommended during the operational lifespan of the quarry to assess the effectiveness of the quarries surface water management system in treating the quarry water prior to off-site discharge and assess the impacts the off-site discharge has on the water quality of the surface water features. The recommended post approvals water quality sampling is detailed in the following table.

Table 15: Post Approvals Water Quality Sampling Summary

Water Sampling Locations	Sampling Frequency	Parameters
SW1, SW2, SW6, SW10, SW14, SW24, SW28, SW29, SW30, SW31, SW35	Quarterly	Dissolved Organic Carbon, Ammonia, Alkalinity, BOD, COD, Conductivity, Total Hardness, Total Metals, Turbidity, Total Dissolved Solids, Total Suspended Solids, pH, Carbonate, Bicarbonate

In addition to the water quality sampling prescribed above, Environmental Compliance Approval Number 5203-AN6NGV issued by the Ministry of the Environment and Climate Change specifies an effluent monitoring program Nelson must conduct to confirm the effluent discharge from the quarry remains in compliance with the concentration limits stipulated within the ECA. The ECA requires monthly and quarterly (once every three months) effluent grab samples be collected from the two off-site discharges and analyzed for a variety of parameters to confirm compliance. In addition, quarterly field temperature monitoring is required at the various key points of interest downstream of the Quarry Sump 0100 discharge location to assess seasonal impacts. The effluent monitoring program as stipulated will remain in place moving forward unless modified by the Director of the Ministry of the Environment, Conservation and Parks (MECP).

Nelson is authorized to withdraw water from the quarry sumps in accordance with Permit to Take Water No. 96-P-3009. As per the conditions of their PTTW, Nelson is responsible to measure, record and submit

the quantities of water taken daily to the Ministry, notify the Ministry of any complaints arising from the water taking, and address any adverse impacts caused by the water taking. As long as Nelson withdraws water from the quarry sumps, they will be required to adhere to the conditions of their PTTW.

After the property is rehabilitated and the licence is surrendered, off-site discharge is proposed continue from Quarry Sump 0100 and 0200 in accordance with the conditions of Nelson's ECA and PTTW to maintain the quarry lake water levels and baseflows in the tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Prior to surrender of the Aggregate Resources Act Licence, the Licencee will provide to the satisfaction of the MNRF, confirmation that long-term monitoring, pumping or mitigation will not result in financial liability to the public.

7.3 Post-Extraction Monitoring Program

The proposed groundwater and surface water monitoring programs discussed above shall continue through the rehabilitation phases. The proposed South Extension groundwater and surface water monitoring programs will continue for two years after it has been determined that the quarry has reached final rehabilitation (creation of the lake feature) and a new groundwater equilibrium as been reached. Since the proposed West Extension will remain dewatered for final rehabilitation, the groundwater and surface water monitoring programs shall continue until rehabilitation has been completed and drawdown associated with the water management system has reached an equilibrium state.

The existing quarry operation continues to pump discharge water, accumulated through surface runoff, direct precipitation and intercepted groundwater, from Sumps 0100 and 0200 to the Unnamed Tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary, respectively. Current approvals for the existing quarry will stop the water discharge pumping at both locations once extraction is complete, which would have a negative impact on and associated fish habitat in both watercourses. The proposed revised rehabilitation plan recommends that the dewatering and pumping should continue at the same locations and in the same manner to ensure there are no negative impacts to any of the hydrological features that rely on this water input. This will result in long-term enhancements to downstream fish habitat compared to the existing approved post-extraction water management plan.

8 REPORTING REQUIREMENTS

Reporting will be used to provide the reviewers/agencies with interpretations of the data collected and make recommendations to modify the monitoring programs, as required. Annual reports detailing the results of the monitoring program will be provided to the MNRF, MECP, Halton Region, Halton Conservation, and the City of Burlington by a Qualified Person (QP).

The annual reports are intended to document the results of the monitoring program and any mitigation measures that were undertaken during the previous year. Annual reporting will involve data compilation, presentation and evaluation of the performance monitoring data, including the trend analysis. The reports will determine if the AMP is effectively monitoring the site conditions.

The first annual report should be completed by June 30 of the year following the sinking cut in Phase 1A and every June 30 for each subsequent year. All annual reports will include a discussion on:

- The quarry's influence on the bedrock groundwater system, specifically describing the progression of the cone of influence;
- The effect on the wetland feature including an assessment of the hydroperiod;

- The effect on the surface water system (streams and creeks); and
- The effect on local private wells that have agreed to participate in the Private Well Monitoring Program.

Subject to approval from MNRF, the AMP shall be updated between year 3 and 5 of extraction. Annual reports can be used to provide recommendations for changes to the AMP programs, should they be necessary based on observed results, but changes can only be implemented with approval from MNRF. Annual reports shall be used to make changes to the following aspects so that the AMP reflects the quarry condition at that time:

- Details of the monitoring program (i.e. protocols for data collection - frequency, location, and/or method);
- Trigger values used by the AMP; and/or
- Mitigation measures used to prevent impacts.

Annual monitoring reports will serve as stand-alone documents that report and interpret the results of that year's monitoring activities relative to historical data and report on the effectiveness of the AMP's monitoring programs and trigger levels.

9 ADAPTIVE MANAGEMENT IMPLEMENTATION AND REVIEW TIMELINE

To ensure that the AMP provides a clear understanding of the implementation and review timelines, the following tasks and schedule are provided in Table AA. It is recommended that the AMP be reviewed in detail and updated every five (5) years. The objective of the 5-year timeline is to ensure that the AMP is current and has been developed to focus on assessing potential impacts to the natural environment and private water wells in relation to the current quarry operations.

	Task	Timeline
1.	Commence recommended monitoring program	within at least one month following the issue of the ARA licence
2.	Drill and construct proposed Sentry Wells (West Extension)	Within at least one year following the issue of the ARA Licence
3.	First SLC meeting	Before stripping of topsoil from southern extension lands occurs
4.	Annual Reports	Due June 30th of the following year after sink cut for the Southern Extension
5.	First potential revision of the AMP	After 3-years of extraction from the Southern Extension lands
6.	Official Review of the AMP	The 5th year of extraction from the Southern Extension lands