APPENDIX E
CULTURAL RESOURCE MANAGEMENT REPORT LETTER
(Nova Scotia Communities, Culture and Heritage, 2022)

Environmental Assessment Registration Document:
Middle River Pit Expansion
Middle River, Inverness County
Nova Scotia

NOVA SCOTIA

Communities, Culture & Heritage

1741 Brunswick Street
3rd Floor
P.O. Box 456
Halifax, NS
B3J 2R5

Tel: (902) 424-6475
Fax: (902) 424-0560

August 24, 2021

Emily Redden
Cultural Resource Management Group Limited
Ten Mile House
1519 Bedford Highway
Bedford, Nova Scotia
B4A 1E3

Dear Emily Redden:

RE: Heritage Research Permit Report
A2021NS046 – Middle River Quarry

We have received and reviewed the report on work conducted under the terms of Heritage Research Permit A2021NS046 for an archaeological resource impact assessment on the Middle River Quarry Project in Victoria County, Nova Scotia.

Dexter will be registering an Environmental Assessment with Nova Scotia Environment and Climate Change in order to expand an existing gravel pit located in Middle River, Victoria County. In order to determine the potential for encountering archaeological resources within the proposed development area Dexter retained the services of CRM Group. This ARIA consists of a background study, Mi'kmaw engagement and field reconnaissance.

The background study revealed the study area is within the greater Mi'kmaq Territory known as Unama'kik (a modified version of Mi'kma'ki, or Mi'kmaw Territory) and has been occupied by the Mi'kmaq peoples for thousands of years. The area contains numerous waterways and travel corridors, as well as resources important to the Mi'kmaw. Euro-Canadian occupation began in the mid 18th century and continues today.

The 2021 ARIA of the Middle River Pit study area consisted of engagement, a background study, and field reconnaissance of the property. It did not involve sub-surface testing. Portions of the Middle River Pit study area lie within 80 meters of McLeod Brook, and the northern portion of the study area represents a former floodplain associated with the watercourse. McLeod Brook, a lower tier watercourse, flows downslope from Highland drainage to the north into the more substantial Middle River to the west. Flooding of this generally non-navigable watercourse would be seasonal. Although terrain immediately south of the former flood plain is elevated, level and dry, it quickly begins sloping gently to the southeast - towards lower, wet areas. In comparison, the level plateau along the west side of the nearby Middle River would not have been flood prone, providing a consistently dry vantage point of the river valley. It is therefore likely that portage routes from the Bras d'Or Lake to the northwest side of the island would have favoured the west side of the river.

Man-made earthen berms along the south side of McLeod Brook are associated with efforts to protect the low-lying area from flooding, enabling its use as arable land. Evidence of field clearing, and fencing are apparent throughout the northern portion of the study area. Although early Scottish settlement is documented in the vicinity of the study area, no historic structures or cellar features were identified within the impact area. Additionally, the presence of extensive karst holes throughout the study area would have made the landscape difficult, if not dangerous, to live upon.

Based on this assessment of the study area and surrounding landscape, the background research, and field reconnaissance conducted by CRM Group it is determined that the study area property does not exhibit elevated potential for encountering either Mi'kmaq (both Pre-contact and historic) or Euro-Canadian archaeological resources.

Based on these results, CRM Group offers the following management recommendations for the study area:

1. It is recommended that the study area, as defined and depicted in this report, be cleared of any requirement for future archaeological investigation.

2. In the event that archaeological deposits or human remains are encountered during activities associated with the development of the Middle River Pit, all work in the associated area(s) should be halted and immediate contact made with Special Places (John Cormier, Coordinator: 902-424-6475).

CCH Staff agree with the recommendations and find the report acceptable as submitted. Please do not hesitate to contact me with any questions or concerns.

Sincerely,

John Cormier
Coordinator, Special Places

APPENDIX F
WATER BALANCE ASSESSMENT
(Consulting Hydrogeologist J. Fraser, 2023)

Environmental Assessment Registration Document:
Middle River Pit Expansion
Middle River, Inverness County
Nova Scotia

PROPOSED MIDDLE RIVER PIT EXPANSION

WATER BALANCE ASSESSMENT

Prepared by Mr. Jim Fraser, M.A.SC, P. Geo,

Date: April 3, 2023

1.0 INTRODUCTION

This document outlines the Water Balance Assessment undertaken for the proposed Middle River Pit Expansion Project, located off MacIntyre Road, Highway 30, Middle River, Victoria County, Nova Scotia. Dexter Construction Company Limited (Dexter) operates a Nova Scotia Environment and Climate Change (NSECC) approved pit of less than 4 hectares. The Pit serves as a strategic source of construction aggregate to support local construction and roadwork, as well as Nova Scotia Department of Public Works projects in the area. The existing 3.94-hecatre Pit is proposed to be expanded by 10.89-hectares to a maximum 14.83-hectares. The proposed pit expansion is intended to provide additional aggregate reserves to support the long-term sustainability of the site. It is anticipated that the rate of pit development will progress gradually, at a rate consistent with aggregate demand in the area and growth of the local market.

The water balance presented herein is an assessment of the estimated effects on surrounding surface water features resulting from the proposed quarry expansion. The methodology used for this Water Balance Assessment is consistent with the approach used recently to assess similar pit and quarry expansion projects undergoing Environmental Assessment.

For this water balance assessment four (4) site conditions were analyzed; existing (baseline) conditions, mid-life conditions, full development conditions, and reclaimed conditions. Existing conditions include a gravel covered pit area of approximately 3.94-hectares, which includes the pit slope, crusher set-up and stockpile areas, and portions of the site access road. Mid-development conditions consider the pit at mid-development of 9.29-hectares. Full development conditions consider the pit at full development of 14.83-hectares. Reclamation conditions are representative of the site upon removal of all construction equipment and buildings, after re-contouring, and following the re-introduction of vegetative cover over the Pit areas.

Progressive reclamation will occur throughout the development and operation phases of the pit, as per the established Reclamation Plan for the site. As the site is developed and aggregate reserves are depleted, disturbed areas no longer required for aggregate production or site related activities will be progressively rehabilitated. This includes using grubbing material originating onsite for site grading, slope construction, and re-vegetation efforts. Temporarily stockpiling, re-use of overburden, and establishment of vegetation is anticipated to simulate pre-development conditions. Areas that have been progressively rehabilitated would be expected to have reduced surface water runoff and increased infiltration, reflective of natural conditions in the area. This water balance assessment does not account for progressive reclamation, so the development scenarios presented represent the worst-case for each scenario with respect to runoff quantity.

The water balance was completed for (2) infiltration scenarios. The two infiltration scenarios represent the range of possible outcomes from existing/natural infiltration (most likely) to 100% impervious (worst case, no infiltration).

1.1 Data Collection

1.1.1 Geology

The Middle River Pit is situated on alluvial deposits consisting of gravel, sand and mud and is bedded at the base with finer materials at the top. The deposits were formed as streams and rivers retreated from

the last glaciers. Stream channels nearby are generally gravelly sand with sandy floodplains. Topography is flat or gently sloping river valley floodplains and sloping alluvial fans. The alluvial deposits are a major source of groundwater as well as a source of aggregate and are commonly utilized for pastureland. Flooding, high-water table, and poor drainage are limitations for use of the land for crop use and construction (Davis and Browne 1996). The site is located primarily on Hebert soils – stratified greyish brown gravelly sandy loams that are prone to drying and occur along river valleys. Topography ranges from level to undulating, but there are places where the gravel is coarser or has been deposited over rougher terrain, and rolling hummocky topography is common (Cann et al. 1963)

1.1.2 Topographic Data

The existing pit is in the Middle River Valley, which cuts through the broad region of hilly uplands known as the Cape Breton Hills that surround the Cape Breton Highlands. The pit is excavated in a raised alluvial gravel ridge, resulting in steep banks around the pit floor on the north and east and open on the west, where it meets the natural floodplain of Leonard MacLeod Brook. Surface water runoff from the existing pit and proposed expansion area will follow the local topography, flowing to the west to an unnamed watercourse and ultimately to Leonard MacLeod Brook.

A LiDAR digital elevation model (DEM) was prepared using available LiDAR data from the province. Catchment areas were manually determined using a 5-meter contour interval from the LiDAR DEM. A 2-meter contour interval from the LiDAR DEM was then used to validate and confirm the catchment areas.

1.1.3 Climate Data

Precipitation and temperature data were collected from the Baddeck Climate Station (1981-2010), which is located approximately 15 kilometers (km) from the Pit. Monthly lake evaporation data was obtained from the Environment Canada Truro Station (1981-2010). The Truro station is the closest climate station to the Project Site that collects lake evaporation data and is located approximately 205 km away from the Pit. Monthly potential evapotranspiration data was calculated using the Hamon equation (1961) (Lu, et al., 2005). The Hamon equation requires monthly average hours of daylight and monthly average temperature as input. Monthly average hours of daylight were calculated for the site using the Sunrise and Sunset Calculator (https://www.timeanddate.com/sun/, last accessed on April 3, 2023).

Table 1 -Climate Normal Data

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL
Temperature[1] (°C)	-5.4	-5.8	-2.3	3.2	9.0	13.9	18.1	18.5	14.6	8.9	3.8	-1.5	-
Precipitation[1] (mm)	155.0	125.6	128.6	125.8	104.0	104.8	97.5	107.2	127.8	137.1	155	166.3	1,535
Lake Evaporation[2] (mm)	0.0	0.0	0.0	0.0	89.9	102.0	117.8	96.1	69.0	40.3	0.0	0.0	515
PET[3] (mm)	0.0	0.0	0.0	33.5	53.6	76.1	95.9	90.8	64.3	39.6	25.0	0.0	479

[1] Values obtained from the Baddeck Climate Station

[2] Values obtained from the Truro Climate Station

[3] Potential Evapotranspiration was calculated using the Hamon equation (1961), Lu, et al., 2005)

2.0 METHODOLOGY

The water balance assessment for the Middle River Pit was prepared to assess predicted changes in local flow characteristics during an average year for four site conditions (existing / mid-development / full-development / reclaimed) and two infiltration scenarios (pervious/impervious). The methodology used for this water balance assessment is consistent with the approach used recently to assess similar quarry expansion projects undergoing Environmental Assessment.

2.1 Watershed Delineation

The area potentially affected by the proposed pit expansion involves two catchment areas, defined as Catchment 1 (unnamed watercourse) and Catchment 2 (unnamed pond).

Catchment 1 encompasses a total area of 22.6 ha, including a disturbed area associated with the existing pit of approximately 3.94 ha. Surface water in Catchment 1 flows to the southwest, discharging from the unnamed watercourse, ultimately flowing to Middle River Brook.

Catchment 2 encompasses a total area of 10.7 ha. Surface water in Catchment 2 flows to the south, discharging from the unnamed pond, ultimately flowing to Middle River Brook.

The proposed pit expansion area is wholly located within Catchment 1 and Catchment 2. An adjacent catchment area identified as Catchment 3 (Grants Pond) is located to the east of Catchment 1 and 2. The pit expansion will not enter this catchment area and as such, no changes within Catchment 3 are expected.

Pre and post catchment area delineations, boundary of existing pit operations, and the proposed pit expansion area are presented on **Figure 1 and Figure 2**.

2.2 Evaporation and Evapotranspiration Potential

Evaporation (E) describes the process of the return of moisture to the atmosphere from open water and land surfaces. Evapotranspiration (ET) is the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and transpiration from plants. The magnitude of evaporation and evapotranspiration over time is a function of the climate, soil, and vegetation in the area. Evaporation rates tend to peak in the summer months when temperatures are the highest, daylight hours are the longest, sun intensity is greatest, and the growing season is at its peak.

Lake evaporation (LE) is the amount of evaporation from an open body of water. In Atlantic Canada, the lake evaporation rate is greater than the standard evaporation rate because of the constant availability of water. Aerial imagery and field delineation from the Biophysical Assessment was used to determine water bodies and identified wetlands within the catchment areas.

Evapotranspiration rates were calculated using the Hamon equation (1961), which is based on average monthly temperatures and daylight hours. Potential evapotranspiration rates for the 4 months of January through March and December were set to zero due to low temperatures resulting in minimal potential for evapotranspiration. **Table 1** includes a summary of the potential evapotranspiration rates used as a water loss parameter in the water balance assessment.

2.3 Infiltration Factor

Water storage/infiltration has been estimated using the infiltration factors taken from Table 3.1 of the Ontario Ministry of Environment, Conservation and Parks (OMECP) Stormwater Management Planning and Design Manual (2003). Calculations using the OMECP Table 3.1 account for slope, soil types and vegetation cover when estimating the water holding capacity for an area. The slope, soil type, and vegetative cover within the catchment areas was used to determine the appropriate infiltration factor. Using this procedure, as outlined in Appendix 1 – Pit Water Balance Factors, other than the developed pit area, the catchment areas were determined to be flat to rolling land, with partial woodland, and sandy loam soil.

Two scenarios were assessed for the infiltration conditions during pit development phases; (1) an impervious pit floor where no infiltration occurred through the floor of the pit (due to the presence of the groundwater table near the existing pit floor (Dillon Consulting, 2022); and (2) a pervious pit floor consisting of similar infiltration capabilities as existing surficial soils (sandy loam soils). Due to the nature of the surficial soils and the presence of the groundwater table near the existing pit floor, it is unlikely that there will be greater infiltration at the floor of the pit than the existing surface. In this regard therefore, these two scenarios represent the maximum and minimum values for expected infiltration in the pit. These two scenarios provide a range of potential outcomes resulting from pit development. Infiltration factors for these scenarios were calculated using an area-ratio method.

Reclamation conditions were expected to be similar to pre-development conditions, with the exception of Flat Land (0.3) and Cultivated Land (0.1) in the area where the pit was located. An area-ratio method was applied to determine the appropriate infiltration factor for the slope and land use in the catchment areas.

Runoff volumes for this water balance were assumed to equal the total precipitation less the potential evapotranspiration, lake evaporation, and infiltration. Infiltration includes groundwater recharge and groundwater that contributes to surface water resources as baseflow. This Water Balance Assessment does not distinguish between the two, and as such groundwater recharge was not included in this water balance assessment. The proposed pit expansion is not planned to enter the groundwater table, and overall is not anticipated to significantly impact or alter groundwater. If future pit operations are required to enter the water table, a hydrological study will be prepared to assess potential impacts to groundwater, and prior approval from NSECC will be obtained.

3.0 WATER BALANCE ANALYSIS

3.1 Catchment Area 1 (Unnamed Watercourse)

The existing pit conditions include a 3.94-hectare pit located within a larger 22.6-hectare catchment area. The existing pit is proposed to be expanded to a maximum of 14.83-ha. The expanded pit will increase the size of Catchment Area 1 by 0.9 hectares. Surface water runoff from the existing pit and proposed expansion area will follow the local topography, ultimately flowing to the southwest towards Leonard McLeod Brook. **Table 2** summarizes the details of the Water Balance Assessment for Catchment 1 under the four development scenarios considered (existing / mid-development / full-development / reclaimed) and two infiltration (pervious / impervious) scenarios.

Table 2 – Water Balance – Middle River Pit Catchment Area 1

Quarry Catchment Area	Area *(ha)*	Available Water *(m^3)*	Lake Evaporation *(m^3)*	PET *(m^3)*	Infiltration *(m^3)*	Runoff *(m^3)*	Change in Infiltration from Existing Conditions	Change in Runoff from Existing Conditions
Existing Conditions: Impervious Pit Floor	22.6	346,842	1,133	107,164	110,955	127,590	-	-
Quarry Mid-Development: Impervious Pit Floor	23.4	359,120	1,133	110,995	103,884	143,107	-6.4%	12.2%
Quarry Full Development: Impervious Pit Floor	23.4	359,120	1,133	110,995	92,189	154,802	-16.9%	21.3%
Existing Conditions: Pervious Pit Floor	22.6	346,842	1,133	107,164	117,193	121,352	-	-
Quarry Mid-Development: Pervious Pit Floor	23.4	359,120	1,133	110,995	118,593	128,399	1.2%	5.8%
Quarry Full Development: Pervious Pit Floor	23.4	359,120	1,133	110,995	115,669	131,322	-1.3%	8.2%
Quarry Reclamation: Pervious Pit Floor	23.4	359,120	1,133	110,995	111,146	135,845	-5.2%	11.9%

Based on the results of the Water Balance Assessment it is estimated that the change in infiltration from Existing Conditions ranges between –16.9% (Full-Development, Impervious Pit Floor) to 1.2% (Mid-Development, Pervious Pit Floor). It is estimated that the change in runoff from Existing Conditions ranges from 5.8% (Mid-Development, Pervious Pit Floor) to 21.3% (Full Development, Impervious Pit Floor).

3.2 Catchment Area 2 (Unnamed Pond)

The expanded pit will reduce the size of Catchment Area 2 by 0.9 hectares. **Table 3** summarizes the details of the Water Balance Assessment for Catchment 2 under the four development scenarios considered (existing / mid-development / full-development / reclaimed) and two infiltration (pervious / impervious) scenarios.

Table 3 – Water Balance – Middle River Pit Catchment Area 2

Quarry Catchment Area	Area *(ha)*	Available Water *(m^3)*	Lake Evaporation *(m^3)*	PET *(m^3)*	Infiltration *(m^3)*	Runoff *(m^3)*	Change in Infiltration from Existing Conditions	Change in Runoff from Existing Conditions
Existing Conditions: Impervious Pit Floor	10.7	164,213	10,173	41,779	56,130	56,130	-	-
Quarry Mid-Development: Impervious Pit Floor	9.8	150,401	10,173	37,469	51,379	51,379	-8.5%	-8.5%
Quarry Full Development: Impervious Pit Floor	9.8	150,401	10,173	37,469	51,379	51,379	-8.5%	-8.5%
Existing Conditions: Pervious Pit Floor	10.7	164,213	10,173	41,779	56,130	56,130	-	-
Quarry Mid-Development: Pervious Pit Floor	9.8	150,401	10,173	37,469	51,379	51,379	-8.5%	-8.5%
Quarry Full Development: Pervious Pit Floor	9.8	150,401	10,173	37,469	51,379	51,379	-8.5%	-8.5%
Quarry Reclamation: Pervious Pit Floor	9.8	150,401	10,173	37,469	51,379	51,379	-8.5%	-8.5%

Based on the results of the Water Balance Assessment it is estimated that the change in infiltration from Existing Conditions will be –8.5% under all scenarios. It is estimated that the change in runoff from Existing Conditions will be -8.5% under all scenarios.

4.0 SUMMARY

The Middle River Pit Water Balance Assessment was prepared to estimate changes in surface water flow and assess the potential impact of the proposed pit expansion on the local hydrological regime. The methodology used for this water balance assessment is consistent with the approach used recently to assess similar quarry expansion projects undergoing Environmental Assessment.

The Water Balance Assessment estimates that the Catchment 1 (unnamed watercourse) change in infiltration from Existing Conditions ranges between –16.9% (Full-Development, Impervious Pit Floor) to 1.2% (Mid-Development, Pervious Pit Floor). It is estimated that the change in runoff from Existing Conditions ranges from 5.8% (Mid-Development, Pervious Pit Floor) to 21.3% (Full Development, Impervious Pit Floor). Any increase in flow will be gradual, aligned with the incremental development of the site. Surface and groundwater monitoring programs will be established as part of the Industrial Approval process to ensure that any estimated changes to the hydrological regime will be identified, and appropriate mitigation can be applied.

The Water Balance Assessment estimates that the Catchment 2 (unnamed pond) change in infiltration from Existing Conditions will be –8.5% under all scenarios. It is estimated that the change in runoff from Existing Conditions will be -8.5% under all scenarios. These estimated changes are minimal and within the anticipated range of seasonal variance.

Based on the results of the Water Balance Assessment it is anticipated that the proposed pit expansion will have a negligible impact on the local hydrological regime.

The results of the Water Balance Assessment will be used to form the basis of further analysis and design of surface water management infrastructure at the Pit in the future. It is anticipated that conditions of any Environmental Assessment approval issued for the proposed quarry expansion will require a detailed surface water monitoring plan, groundwater monitoring plan, erosion and sediment control plan, and stormwater management plan. These items will be developed following Environmental Assessment approval for the project, as part of the subsequent Industrial Approval amendment process. The water management and monitoring plans will be used to validate the findings of the water balance assessment.

5.0 CONCLUSION

The Middle River Pit Water Balance Assessment was prepared to estimate changes in surface water flow and assess the potential impact of the proposed quarry expansion on the local hydrological regime. The methodology used for this water balance assessment is consistent with the approach used recently to assess similar pit and quarry expansion projects undergoing Environmental Assessment.

The estimated changes in runoff and infiltration are minimal and mostly within the anticipated range of seasonal variance. Based on the results of the water balance assessment it is anticipated that the proposed quarry expansion will have a negligible impact on the local hydrological regime. Water management and monitoring plans will be implemented as part of the Industrial Approval process to validate the findings of the water balance assessment.

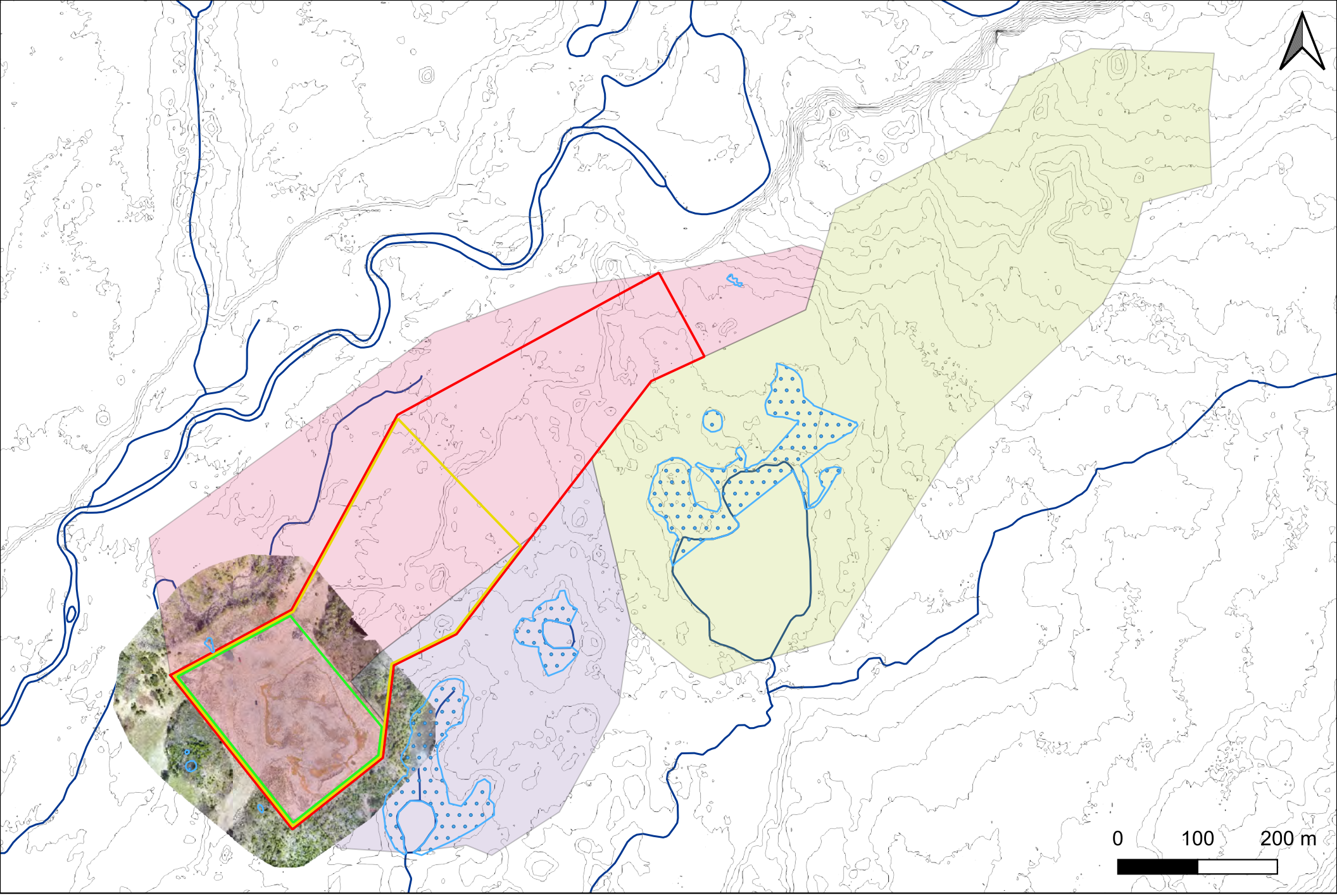
6.0 REFERENCES

GHD Consultants “Water Balance Analysis for the Proposed Dexter Quarry Located in Sheet Harbour, Nova Scotia”.

Lu et al. (2005). “A Comparison of Six Potential Evapotranspiration Methods for Regional Use in the Southeastern United States”. Journal of the American Water Resources Association, 41, 621-633.

Ontario Ministry of the Environment. (2003). Stormwater Management Planning and Design Manual.

Climate Normal Data (Data taken from Baddeck Big Falls and Truro Environment Canada Stations).



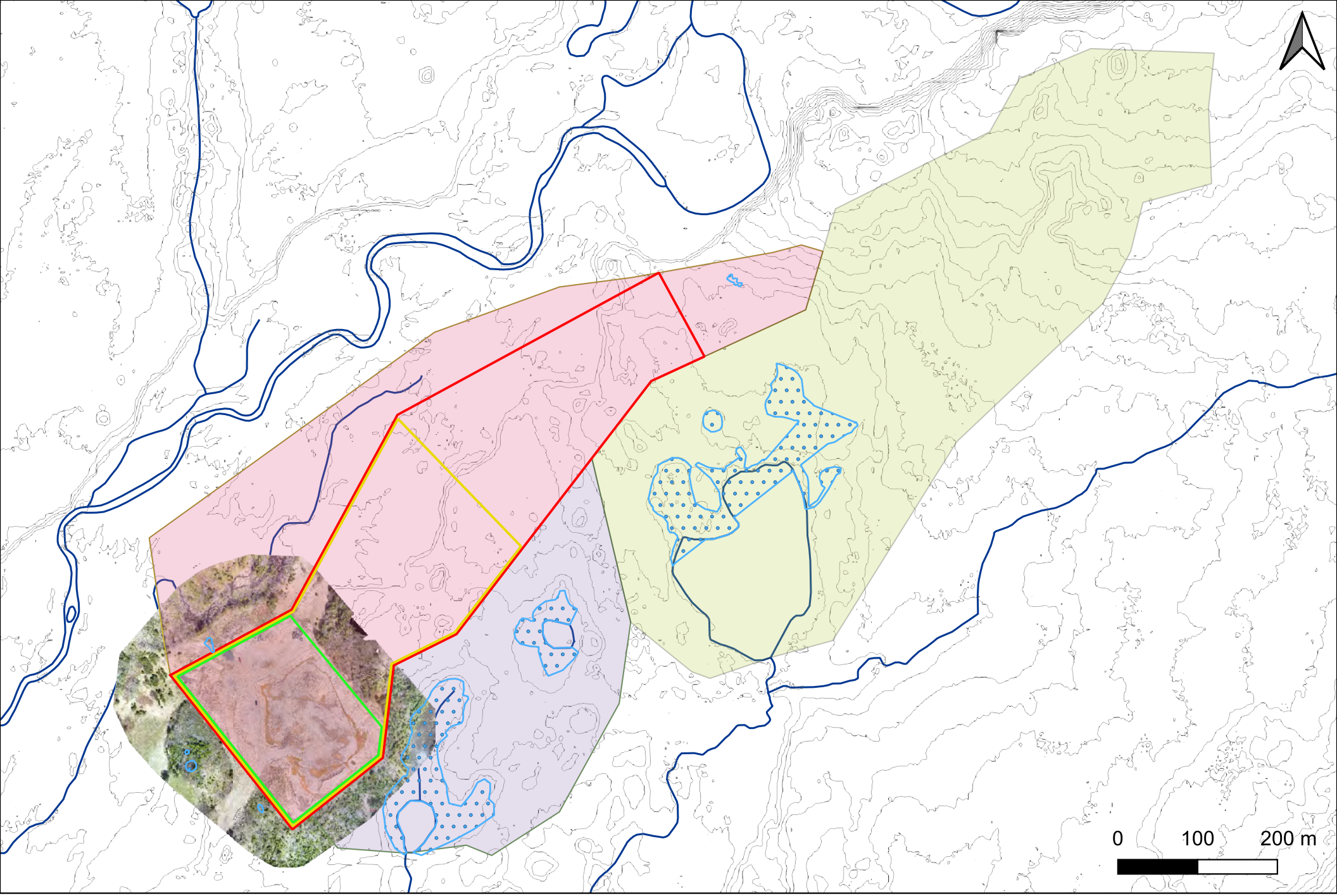
Middle River Pit
Catchment Areas - Pre-Expansion

Sketch Date: April 3, 2023

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

Legend

- Surveyed Wetlands
- Watercourses (1:10,000)
- Existing Operations Footprint (3.94 ha)
- Mid-Life Footprint (9.29 ha)
- End-Life Footprint (14.83 ha)
- Catchment 1 (Unnamed Watercourse) (22.6 ha)
- Catchment 2 (Unnamed Pond) (10.7 ha)
- Catchment 3 (Grants Pond) (27.2 ha)



Middle River Pit
Catchment Areas - Post-Expansion

Sketch Date: April 3, 2023

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

Legend

- Surveyed Wetlands
- Watercourses (1:10,000)
- Existing Operations Footprint (3.94 ha)
- Mid-Life Footprint (9.29 ha)
- End-Life Footprint (14.83 ha)
- Catchment 1 (Unnamed Watercourse) (23.4 ha)
- Catchment 2 (Unnamed Pond) (9.8 ha)
- Catchment 3 (Grants Pond) (27.2 ha)

Middle River Pit Water Balance Factors

Catchment	Development Stage	Scenario	Total Catchment Area m^2	Total Pit Area in Catchment m^2	Land Area[1]		Topography[2]			Cover				Soils			Total Infiltration Factor
					Open Water Bodies & Wetlands m^2	Land Area m^2	Pit *(flat land)* m^2	Other Slope *(rolling land)* m^2	Area - Ratio Infiltration Factor	Pit m^2	Roads *(impervious)* m^2	Forested *(partial woodland)* m^2	Area - Ratio Infiltration Factor	Quarry m^2	Sandy Loam Soil m^2	Area - Ratio Infiltration Factor	
Catchment 1 (Unnamed Watercourse)	Existing Conditons	Impervious Quarry Floor	226,000	39,400	2,200	223,800	39,400	186,600	0.22	39,400	0	186,600	0.12	39,400	186,600	0.12	0.465
Catchment 1 (Unnamed Watercourse)	Quarry Mid-Development	Impervious Quarry Floor	234,000	92,900	2,200	231,800	92,900	141,100	0.24	92,900	0	141,100	0.09	92,900	141,100	0.09	0.421
Catchment 1 (Unnamed Watercourse)	Quarry Full Development	Impervious Quarry Floor	234,000	148,300	2,200	231,800	148,300	85,700	0.26	148,300	0	85,700	0.05	148,300	85,700	0.05	0.373
Catchment 1 (Unnamed Watercourse)	Existing Conditons	Pervious Quarry Floor	226,000	39,400	2,200	223,800	39,400	186,600	0.22	39,400	0	186,600	0.12	39,400	186,600	0.15	0.491
Catchment 1 (Unnamed Watercourse)	Quarry Mid-Development	Pervious Quarry Floor	234,000	92,900	2,200	231,800	92,900	141,100	0.24	92,900	0	141,100	0.09	92,900	141,100	0.15	0.480
Catchment 1 (Unnamed Watercourse)	Quarry Full Development	Pervious Quarry Floor	234,000	148,300	2,200	231,800	148,300	85,700	0.26	148,300	0	85,700	0.05	148,300	85,700	0.15	0.468
Catchment 1 (Unnamed Watercourse)	Quarry Reclamation	Pervious Quarry Floor	234,000	148,300	2,200	231,800	148,300	85,700	0.26	148,300	0	85,700	0.04	148,300	85,700	0.15	0.450
Catchment 2 (Unnamed Pond)	Existing Conditons	Impervious Quarry Floor	107,000	0	19,750	87,250	0	107,000	0.20	0	0	107,000	0.15	0	107,000	0.15	0.500
Catchment 2 (Unnamed Pond)	Quarry Mid-Development	Impervious Quarry Floor	98,000	0	19,750	78,250	0	98,000	0.20	0	0	98,000	0.15	0	98,000	0.15	0.500
Catchment 2 (Unnamed Pond)	Quarry Full Development	Impervious Quarry Floor	98,000	0	19,750	78,250	0	98,000	0.20	0	0	98,000	0.15	0	98,000	0.15	0.500
Catchment 2 (Unnamed Pond)	Existing Conditons	Pervious Quarry Floor	107,000	0	19,750	87,250	0	107,000	0.20	0	0	107,000	0.15	0	107,000	0.15	0.500
Catchment 2 (Unnamed Pond)	Quarry Mid-Development	Pervious Quarry Floor	98,000	0	19,750	78,250	0	98,000	0.20	0	0	98,000	0.15	0	98,000	0.15	0.500
Catchment 2 (Unnamed Pond)	Quarry Full Development	Pervious Quarry Floor	98,000	0	19,750	78,250	0	98,000	0.20	0	0	98,000	0.15	0	98,000	0.15	0.500
Catchment 2 (Unnamed Pond)	Quarry Reclamation	Pervious Quarry Floor	98,000	0	19,750	78,250	0	98,000	0.20	0	0	98,000	0.15	0	98,000	0.15	0.500

Infiltration Factors[3]

Topography	
Flat Land (average slope <0.6 m/km)	0.3
Rolling Land (average slope 2.8 m/km to 3.8 m/km)	0.2
Hilly Land (average slope (28 m/km to 47m/km)	0.1
Soils	
Tight impervious clay	0.1
Sandy Loam Soil	0.15
Medium combinations of clay and loam	0.2
Open sandy loam	0.4
Cover	
Cultivated land	0.1
Partial Woodland	0.15
Woodland	0.2
Impervious	
Roads, etc.	0

Assumptions

Quarry floor slope = flat land

Forested area = partial woodland due to historic tree harvisting in the area

Soils = sandy loam soil

[1] Estimated using Google Earth Imagery

[2] Estimated using provincial 1:10,000 topography data

[3] Ontario Ministry of Environment, Conservation and Parks, SWM Planning and Design Manual

APPENDIX G
KARST SUMMARY REPORT
(Consulting Hydrogeologist J. Fraser, 2023)

Environmental Assessment Registration Document:
Middle River Pit Expansion
Middle River, Inverness County
Nova Scotia

PROPOSED MIDDLE RIVER PIT EXPANSION

Karst Investigation Summary Report

Prepared by Mr. Jim Fraser, M.A.SC, P. Geo,

Date: April 17, 2023

INTRODUCTION

This Middle River Pit Karst Investigation Summary Report is a summary of investigative work completed to identify the potential occurrence and risk of karst within the boundaries of the proposed Middle River Pit Expansion Project. The following documents were used to prepare this summary report.

1) Middle River Pit Initial Hydrogeological Investigation, Dillon Consulting, 2022,
2) Borehole & Monitoring Well Installation Program, Dexter, 2022, (attached) and
3) Draft Biophysical Assessment, Middle River Pit Expansion, Envirosphere, 2021.

This evaluation was deemed necessary based on the Nova Scotia Karst Risk Map produced by Service Nova Scotia and Internal Services, which indicates that the proposed Pit expansion area has a "High Risk" potential for Karst and possible sink hole development. The following sections of this document provide a summary of the karst related information for the site and presents associated Conclusions and Recommendations in concert with future development of the Pit.

BACKGROUND

Surficial Geology

The Middle River Pit is situated on alluvial deposits consisting of gravel, sand and mud and is bedded at the base with finer materials at the top. The deposits were formed as streams and rivers retreated from the last glaciers. Stream channels nearby are generally gravelly sand with sandy floodplains. Topography is flat or gently sloping river valley floodplains and sloping alluvial fans. The alluvial deposits are a major source of groundwater as well as a source of aggregate and are commonly utilized for pastureland. Flooding, high-water table, and poor drainage are limitations for use of the land for crop use and construction (Davis and Browne 1996). The site is located primarily on Hebert soils – stratified greyish brown gravelly sandy loams that are prone to drying and occur along river valleys. Topography ranges from level to undulating, but there are places where the gravel is coarser or has been deposited over rougher terrain, and rolling hummocky topography is common (Cann et al. 1963)

Bedrock Geology

Bedrock at the site is the carboniferous Windsor Group, consisting of thick sequences of massive red siltstones and shales, with thin beds of limestones, evaporites (mineral salts of seawater), gypsum and anhydrite (Giles and Boehner 2003). The Windsor Group is typically underlain by the older Horton Group consisting of sandstone and conglomerate. The study site is located on the Hood Island Formation and the undivided Lower Middle Windsor Group of the Windsor Group (Barr and White 2017).

DISCUSSION

An Initial Hydrogeological Investigation was completed by Dillon, and included the construction of five (5) test pits, which were converted to shallow monitoring wells to evaluate the subsurface surficial geology and to establish water table elevations. These monitoring wells indicated that the water table elevations at the existing pit ranged from a high of 36.65 to a low of 33.94 meters above sea level (masl). The report went on to state *"The water levels observed on the site are generally representative of the highest*

potential water levels as spring melt has occurred and rainfall was recorded in the days immediately prior to the first site visit".

A Borehole/Monitoring Well Installation Program was completed by Dexter personnel in 2022 to assess conditions at select locations around the proposed pit expansion area. A summary of findings is presented in Table 1 and a map showing borehole locations is attached.

Table 1: Borehole Summary

ID	Ground Elevation (masl)	Drilling Depth (m)	Borehole Depth (masl)	Depth Below Pit Floor (m)	Comments / Observations
MW-1	38.9	9.5	29.4	6.6	Gravel consistent with historic pit extraction. (No limestone or gypsum discovered)
MW-2	43.7	15.6	28.1	8.0	Gravel consistent with historic pit extraction. (No limestone or gypsum discovered)
MW-3	42.5	12.5	29.9	6.1	Gravel consistent with previous pit extraction to 10.5m depth. Limestone discovered at 10.5m depth / 31.9masl / 4.1m below pit floor). Limestone confirmed via in field acid test.
MW-4	46.6	15.9	30.7	5.3	Gravel consistent with historic pit extraction. (No limestone or gypsum discovered)
BH-5	40.1	15	25.1	10.9	Gravel consistent with historic pit extraction. (No limestone or gypsum discovered)
BH-6	44.6	15	29.6	6.5	Gravel consistent with historic pit extraction. (No limestone or gypsum discovered)

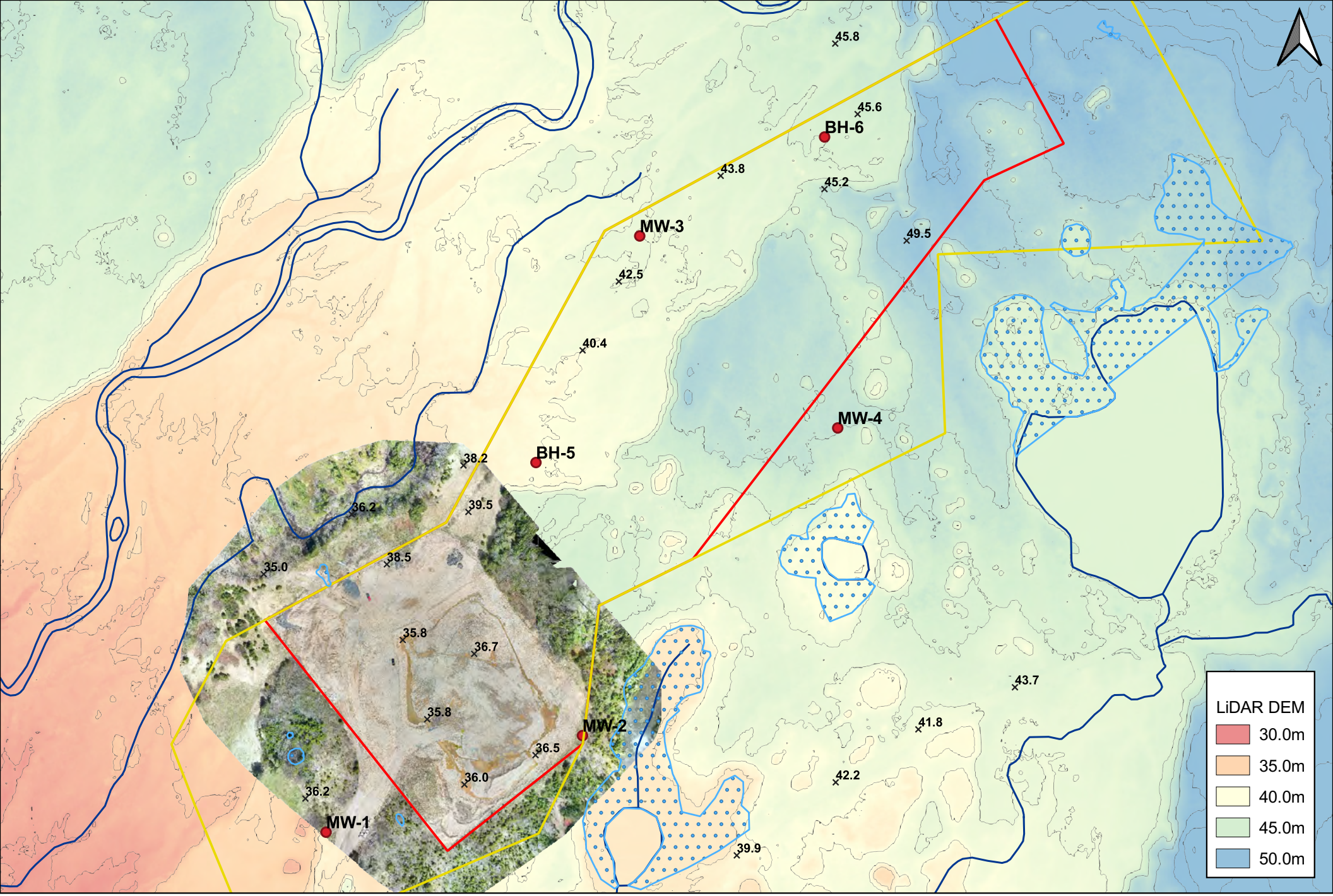
Analysis of the borehole information collected confirmed Dillon's findings regarding water table elevations. Gravel consistent with historic pit operations was encountered in all boreholes. Limestone or gypsum bedrock was not discovered in MW-1, MW-2, MW-4, BH-5, or BH-6. Limestone bedrock was encountered in Monitoring Well #3 at a depth of 10.5 m or an elevation of 31.9 masl. The boreholes indicate that there is a minimum of 4 meters of gravel overlying the bedrock below the current pit floor elevation, and excess of 6 meters of much of the proposed pit expansion area.

Based on the results of the field investigation, it is noted that the site appears to be underlain by limestone, as opposed to gypsum. Limestone bedrock is less likely to be dissolved by groundwater movement and therefore has less potential to develop sink holes. This observation is validated in that no sink holes or karst related topography have been observed on the site during Dexter's past operations.

The Dillon Initial Hydrogeological Investigation determined that the floor of the existing pit is above the groundwater table. The proposed Middle River Pit Expansion Project is not expected to extract aggregate from below the groundwater table. Since both the existing pit and future expansion have no intention of excavating below the water table, groundwater table elevations around the pit are not expected to change significantly. As the Project is not anticipated to cause significant changes to the subsurface flow regime, it is expected that the proposed pit expansion will have negligible impact on potential future sink hole development.

CONCLUSIONS AND RECOMMENDATIONS

The Middle River Pit Expansion Project is expected to have negligible impact on sinkhole development, however, it is, nevertheless, prudent to monitor conditions as future work proceeds. This should be conducted in two (2) specific ways, firstly by routine monitoring of groundwater levels in the four (4) existing drilled monitoring wells and comparing this data to past water levels results, and secondly to perform regular visual inspections of the Pit and adjacent land to ensure that activities associated with aggregate extraction are not impacting the surrounding landscape.



Middle River Pit
Karst Investigation
Sketch Date: October 17, 2022
Drone Imagery: May 18, 2022

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

Legend

- EA Study Area
- Proposed Expansion Area (14.83ha)
- Borehole Locations
- Surveyed Spot Elevations
- Watercourses (1:10,000)
- Surveyed Wetlands

0 50 100 m

APPENDIX H
PUBLIC CONSULTATION DOCUMENTATION

Environmental Assessment Registration Document:
Middle River Pit Expansion
Middle River, Inverness County
Nova Scotia

January 29, 2021

Wagmatcook First Nation
P.O. Box 30001, 75 Humes Rear Road
Wagmatcook, NS
B0E 3N0

Attn: Chief Norman Bernard

Re: Middle River Pit Expansion Project, Victoria County
Class 1 Undertaking Under Section 9(1) of the Environmental Assessment Regulations

---

This letter is intended to provide early notification regarding the proposed Middle River Pit Expansion Project (the Project) that Dexter Construction Company Limited (Dexter) intends to register for Environmental Assessment in the fall of 2021, in accordance with Part IV of the *Environment Act*. Through this letter Dexter is seeking early engagement to identify and address potential First Nation's concerns regarding the Project.

Dexter currently operates an existing less than 4-hectare Nova Scotia Environment (NSE) approved aggregate pit located off MacIntyre Road, near Middle River, Victoria County, Nova Scotia. The existing pit has been seasonally operated since 2010 and is utilized periodically during the road construction season to provide construction aggregates for local projects as well as Nova Scotia Transportation and Infrastructure Renewal (NSTIR) projects in the area. It is the intent of Dexter to expand the existing pit to provide additional aggregate reserves to support local infrastructure needs in the future. Other than a proposed increase in the site operating footprint, future pit operations are not anticipated to change in scope or increase in frequency from past use.

Dexter and its environmental consultants are completing various desktop reviews and field studies in support of the Project. Cultural Resource Management Group Ltd. (CRM) has been contracted to undertake an Archaeological Resource Impact Assessment (ARIA) for the Project. The scope of the ARIA includes engaging the Kwilmu'lw Maw-klusuaqn Negotiation Office's Archaeological Research Division to request any information pertaining to traditional or historical Mi'kmaq use of the study area.

Attached is a plan showing the Study Area for this project. The nearest First Nation community to the Project is Wagmatcook First Nation which is located approximately 9 kilometers south of the existing pit.

Dexter will follow up with a second notification letter in the weeks leading up to Project registration with NSE. In the interim, we would be pleased to discuss this project in greater detail with you at your convenience. Please contact the undersigned if you would like to discuss further.

Sincerely,

DEXTER CONSTRUCTION COMPANY LIMITED

Gary Rudolph, P.Eng
Director of Aggregates

grudolph@dexter.ca
902-832-6346

Copy: Twila Gaudet, Director of Consultation, KMKNO
Gillian Fielding, Consultation Advisor, OAA


Middle River Pit
Legend
EA Study Area
Existing <4 Ha Permit Area
Upper Middle River
West Middle River
MacKenzie Pond
Middle River
Cabot Trail
Lower Middle River
Google Earth
Image © 2020 Maxar Technologies
Image © 2020 CNES / Airbus
N
2 km

MUNICIPAL ENTERPRISES LTD

June 9, 2023

Native Council of Nova Scotia
129 Truro Heights Road
Truro, Nova Scotia
B6L 1X2

Attn: Chief Lorraine Augustine

Re: Middle River Pit Expansion Project, Victoria County
Class 1 Undertaking Under Section 9(1) of the Environmental Assessment Regulations

---

Dexter Construction Company Limited (Dexter), an affiliated company of Municipal Enterprises Limited, operates many aggregate pits and quarries around the Province, including a Nova Scotia Environment and Climate Change (NSECC) approved, less than 4-hectare pit located off MacIntyre Road, in Middle River, Victoria County. The *Middle River Pit* is operated on a seasonal basis to support local construction projects in the area. This summer we intend to make application to expand the operating footprint of the existing pit beyond 4-hecatres. The expanded operating footprint will increase the available aggregate material and ensure that a long-term aggregate supply is available to support local project and infrastructure needs in the future.

We had previously advised of the proposed Project in January 2021, however operational needs and considerations delayed the initiative. We intend to officially register the Project for Environmental Assessment (EA) on or around June 28th, 2023. The application and review process will follow the Environmental Assessment (EA) Regulations, and includes engagement with First Nations, the local community, and various government stakeholders. As part of the registration process, we will be publishing a Notice in the paper to invite comments on the project.

The Public Notice accompanying the registration will appear in the Chronicle Herald and Cape Breton Post on the registration date (a copy of the draft Notice is attached). Hard copies of the EA Registration Document will be available for review at the Red Barn Gift Shop and Restaurant, Victoria County Municipal Office, and the local Nova Scotia Environment and Climate Change (NSECC) Regional Office in Sydney, Nova Scotia. An electronic copy of the document will also be available through the NSECC EA website (https://www.novascotia.ca/nse/ea/).

Following registration, comments regarding the Project can be forwarded to the NSECC EA Branch at EA@novascotia.ca.

In the interim, attached is a copy of the Project Summary with additional project details. If you are interested in learning more about the Project or the overall EA process, I would be pleased to meet with you to provide additional details. If you would like to schedule a meeting, please contact me at your convenience.

MUNICIPAL ENTERPRISES LTD

Sincerely,

MUNICIPAL ENTERPRISES LIMITED

Rhett Thompson, P.Eng
Environmental Engineer

rthompson@dexter.ca
902-718-9778

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

MIDDLE RIVER PIT EXPANSION PROJECT

KEY DETAILS

Existing NSE Industrial Approval: 2011-078985

Current NSE Approved Pit Footprint: 3.94-hectares

Anticipated Environmental Assessment Registration Date: June 28, 2023

Study Area: 23.9-hectares

Proposed Expansion Area: 14.83-hactares

Operating Schedule: Seasonal, when Dexter has a local project. No change in frequency or scope from past use.

PROJECT OVERVIEW

Municipal Enterprises Limited (MEL), the parent company of Dexter Construction Company Limited (Dexter), operates an existing Nova Scotia Environment and Climate Change (NSECC) approved aggregate pit at 71 MacIntyre Road, Middle River, Victoria County, Nova Scotia. The *Middle River Pit* has been an NSE approved pit for approximately 10-years and serves as an important source of construction aggregate for local and Nova Scotia Department of Public Works Projects (NSDPW) in the area.

The Pit is seasonally operated on an as needed basis to support local construction projects in the area (primarily highway work). When Dexter has a project in the area requiring use of the Pit, site activities will typically occur over a 4-6 week period. All equipment used at the site is portable in nature and is mobilized to the site when required. At the conclusion of site activities all equipment is removed from the pit.

Common pit activities include clearing of vegetation and grubbing of overburden, ripping and excavation of unconsolidated materials, crushing and stockpiling of various aggregate products, and loading and hauling of finished aggregate products.

If Dexter is unsuccessful in securing work in the area during the construction season, then the pit typically remains inactive. It is not uncommon for the site to be inactive for several years in between projects. During periods of inactivity the site is managed as a typical rural Nova Scotia pit, with periodic inspections to verify the integrity of safety and environmental controls.

Historic development of the site has resulted in the depletion of the aggregate deposit within the NSECC approved permit area. Dexter is proposing to expand the pit operating footprint to increase available aggregate material and ensure that a long-term aggregate supply is available to support local project and infrastructure needs in the future. Other than an increase in the total footprint of the site, site activities are not planned to increase in scope or frequency from past use.

Environmental studies associated with the proposed pit expansion have been undertaken by various consultants and include a review of publicly available data sources, a Biophysical and Socioeconomic Assessment (including botany surveys, bird surveys, wetland surveys, lichen surveys, water quality assessment, fish habitat assessment), and an Archaeological Resource Impact Assessment (ARIA).

If the proposed project is approved by NSECC, application will be made to amend the existing Industrial Approval for the site. As part of this subsequent approval process, Dexter will update environmental management and monitoring programs to reflect the scope of the proposed expansion.

MUNICIPAL ENTERPRISES LTD

June 9, 2023

Wagmatcook First Nation
P.O. Box 30001, 75 Humes Rear Road
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B0E 3N0

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MUNICIPAL ENTERPRISES LTD

Sincerely,

MUNICIPAL ENTERPRISES LIMITED

Rhett Thompson, P.Eng
Environmental Engineer

rthompson@dexter.ca
902-718-9778

Copy: Twila Gaudet, Director of Consultation, KMKNO
Melissa Slauenwhite, Consultation Advisor, Office of L'Nu Affairs

DEXTER
DEXTER CONSTRUCTION COMPANY LIMITED

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NOTICE

Registration of Undertaking
for Environmental Assessment
ENVIRONMENT ACT

This is to advise that on June 28, 2023, Municipal Enterprises Limited registered the Middle River Pit Expansion Project for environmental assessment, in accordance with Part IV of the *Environment Act.*

The purpose of the proposed undertaking is to expand an existing gravel pit located east of NS-Route 30, at 71 MacIntyre Road, Middle River, Victoria County, Nova Scotia. The existing pit has been in operation for approximately 15 years. The land associated with the expanded pit will occupy a maximum of 14.83 hectares, which includes the existing pit footprint. The expanded pit will support continued extraction and production of quality aggregate products used primarily in the road construction industry in Victoria County and Inverness County. It is expected that the continued use of the pit will be identical, or very similar, to historic use at the site. The project is anticipated to commence during the 2024 construction season with production volumes of approximately 25,000 tonnes per year during years in which the pit is active.

Copies of the environmental assessment registration information may be reviewed at the following locations:

- Red Barn Gift Shop and Restaurant, 2 Cabot Trail, Nyanza, NS
- Victoria County Municipal Office, 495 Chebucto Street, Baddeck, NS
- Nova Scotia Department of Environment and Climate Change, Regional Office: 1030 Upper Prince Street, Suite 2, Sydney, NS
- NSECC EA website (when available) https://www.novascotia.ca/nse/ea/

The public is invited to submit written comments to:

Environmental Assessment Branch,
Nova Scotia Environment and Climate Change
P.O. Box 442, Halifax, Nova Scotia B3J 2P8

on or before July 28, 2023 or contact the Department at 902-424-3600, 902-424-6925 (Fax), or e-mail at EA@novascotia.ca.

All comments received from the public consultation will be posted on the department's website for public viewing. In the case of an individual, the address, email and contact information will be removed before being placed on the website. By submitting your comments, you are consenting to the posting of your comments on the department's website.

Published by: Municipal Enterprises Limited, 927 Rocky Lake Dr, PO Box 48100, Bedford, NS, B4A 3Z2