

BRAESIDE QUARRY

EXPANSION

HYDROLOGICAL INVESTIGATION

TOWNSHIP OF MCNAB/BRAESIDE

COUNTY OF RENFREW

October, 2007

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COUNTY OF RENFREW**

P/N 05-2033

October, 2007

Prepared by: Skelton, Brumwell & Associates Inc.
93 Bell Farm Road, Suite 107
Barrie, Ontario
L4M 5G1

Telephone: (705) 726-1141
FAX: (705) 726-0331
E-mail: mail@skeltonbrumwell.ca

Prepared for: Miller Group Inc.
A Division of Miller Paving Limited

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Environment Canada, Water Level and Streamflow Statistics -
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Ministry of the Environment, Water Quality Data Ontario Lakes and Streams 1979 -
Bonnechere and Muskrat Rivers

Ministry of Environment, Biophysical Performance
Standards for Aquatic Ecosystem Objectives

Ministry of the Environment, Certificate of Approval,
Industrial Sewage Works Number 6988-6VZJFB June 4 , 2007

APPENDIX E

Curriculum Vitae - Bernie Muncaster, M.Sc., B.Sc.

APPENDIX F

Curriculum Vitae - Jay Clark, P. Eng

**BRAESIDE QUARRY EXPANSION
HYDROLOGICAL INVESTIGATION
TOWNSHIP OF MCNAB/BRAESIDE**

P/N 05-2033

October, 2007

1.0 INTRODUCTION

Smiths Construction Company (A Division of Miller Group Inc.) wish to licence adjacent owned lands to the existing licenced Braeside Quarry for the proposed expansion. The property legal description is Part of Lots 16 & 17, Concession A, Geographic Township of McNab, Township of McNab/Braeside, County of Renfrew. It is generally located 3 km northwest of the Town of Braeside, 8 km northwest of the Town of Arnprior and 18 km southeast of the Town of Renfrew (Figure 1).

The existing 17.1 ha disturbed area has an actual drainage area of 31 ha. The ultimate quarry drainage area was delineated at 91.6 ha or about three (3) times the existing conditions. The ultimate extraction area would be expanded by about 4 times its original size to a new extracted area of 70.4 ha. About 62.3 ha or 47% of the total 132.7 ha licenced area will remain undeveloped to protect the significant wildlife on the subject property, provide a wildlife corridor at the southeast corner of the subject property and meet the Official Plan requirements of a 300 m setback between residences and extraction limits. Furthermore, plans to reduce extraction along Osborne Street will have a secondary effect of maintaining the existing Ryan Creek drainage area.

The proposed Quarry expansion is "L" shaped extending north (lot 17) and east (E1/2 Lot 16) of the existing licenced area, which is primarily located on the W1/2 Lot 16. It will be generally bound to the north by the back of residential lots fronting onto Golf Club Road, south by the unopened road allowance (Carmichael Sideroad), west by Osborne Street and east by the unopened road allowance at Concession A/B.

The existing quarry extraction floor is at about 135 masl or 6 m below grade, while the ultimate quarry finished floor elevation would be 125masl or 16 m below grade. The ultimate quarry floor elevation would be 5 m above the highest encountered water bearing zone in the confined aquifer, as identified in the Gorrell Resource Investigations (GRI) Hydrogeological Investigation.

Water ponds on the existing quarry floor in the spring, summer and fall requiring seasonal de-watering operations. The de-watering systems draw surface water from the quarry sump and pump it up the quarry face and discharge at grade into a sediment basin (section 3.1). Surface water passes through a rock check dam and then overland through a heavily forested area founded on fractured bedrock to the Usborne Street roadside ditch. It flows westerly off-site via the Usborne Street culvert crossing, being conveyed by roadside ditching southerly along Campbell Drive and then westerly along Carmichael sideroad where it empties into Ryan Creek.

The outlet to Ryan Creek is about 2.2 km upstream of it's confluence with Dochart Creek. The Ministry of Natural Resources historic data has identified Dochart and Ryan Creeks as cold water systems.

The primary purpose of the Hydrological Investigation is to assess the impact of the ultimate quarry de-watering operations on Ryan Creek. Field investigations of Ryan Creek at the discharge point will be completed to identify stream channel hydraulics, morphological characteristics, riparian vegetation and spot temperature measurement. It will examine current and ultimate quarry de-watering operations by reviewing current pump records and estimate the average annual water surplus.

Critical aquatic habitat factors for a water course include water velocity, depth and temperature. Therefore preparation of a rating curve for the Ryan Creek will allow evaluation of changes in creek hydraulics. Investigation of de-watering operations on creek flow will determine monthly impacts on water temperature, channel velocity and depth of flow. The Report will propose a monitoring plan and contingency plan which would be implemented to mitigate potential impacts.

2.0 HYDROLOGIC CHARACTERISTICS

The Proposed Quarry precipitation, evapotranspiration, water surplus, topography, soil conditions, vegetative cover, infiltration and runoff characteristics are as follows:

2.1 Precipitation

The Miller Braeside Quarry is in a rural area and does not have site specific climatic data. Therefore four (4) surrounding Canadian Climate Stations within the same isohyetal region (Appendix A) as the site were assessed. Precipitation data from Canadian Climate Normals 1971-2000 were available from Environment Canada on their web at www.climate.weatheroffice.ec.gc.ca. The average annual precipitation for Arnprior Grandon, Claybank and Renfrew Ontario and Shawville Quebec was 801 mm, 814 mm, 812 mm and 906mm, respectively. The closest Climate Station at Claybank is just west of Arnprior Ontario about 6.7 km from the quarry. Thus it was selected to represent the site historical precipitation (Appendix A).

Canadian Climate Normals and Yearly Data Reports for the period from 1971 to 2000 are available for the Claybank Ontario Climatic Station. The Mean Monthly Precipitation for the 30 year period varied from highs of 84.5 mm in August to a low of 55.1 mm in January. The Mean Annual values for the 30 year period were 814 mm/yr of Precipitation, 199 mm/yr of Snowfall and 615 mm/yr of Rainfall as shown in Appendix A.

Current precipitation data was not available on the web for the above four (4) Canadian Climate Stations. Precipitation for this period required the used of the Ottawa MacDonald-Cartier International Airport Ontario Station (Appendix A).

2.2 Evapotranspiration

Three Methods including the Thornthwaite, Lowry-Johnson and Isoline Map Methods were used to evaluate evapotranspiration.

The Thornthwaite Equation $U = 1.6 \times \text{SUM}(10t/TE)^{0.9916}$ calculates the evapotranspiration, where: t - mean monthly temperature (°F)

TE - Annual Heat Index

U - Evapotranspiration (cm)

The Lowry-Johnson Equation $U = 0.000156H + 0.8$ calculates evapotranspiration, where:

H - Degree Days above 32°F

U - Evapotranspiration (Ft)

The Thornthwaite, and Lowry-Johnson Methods resulted in Evapotranspiration values of 535 mm and 507 mm, respectively. The Southern Ontario Mean Annual Actual Evapotranspiration Isoline Map (Appendix A) was interpolated to estimate site evapotranspiration at 20.5 inches or 521 mm. The average Evapotranspiration for the three (3) methods was 521 mm showing good agreement and verification for choosing the Isoline Map Method. Therefore Evapotranspiration was set at 521 mm/yr.

2.3 Water Surplus

Annual Water Surplus for the proposed Quarry is the differential between average annual Precipitation (814 mm) and Evapotranspiration (521mm). Therefore the estimated Annual Water Surplus is 293 mm. Quarry de-watering volumes should be consistent with the quarry drainage area multiplied by the annual water surplus.

2.4 Infiltration Factor

The Ministry of the Environment determination of the Infiltration factor equals the sum of topography, soil and vegetative factors. The overland flow topography, soils and vegetative cover characteristics were evaluated as outlined in the Hydrologic Cycle Component Values found in Appendix A.

2.4.1 Topography

The bench land has an average gradient varying from 1 to 2 % or 10 to 20 m/km. It has a topographic classification between (28m to 47 m/km) and (2.8m to 4.7 m/km) with associated topographic factors I_f of 0.1 and 0.2, respectively . Therefore, the topographic factor I_f is estimated to be 0.15.

2.4.2 Soil

The bench land soil series is classified as Renfrew (G.W.) as outlined in the Ontario Soil Survey Report No. 30. It is dominantly fine textured soil consisting of lacustrine silt loam and clay. The Ministry of Transportation and Communications (MTC) Drainage Manual Chart H2-6A identifies the hydrologic soil group as a Type C soil.

Its soil classification is between tight clay and medium combinations of loam and clay with associated soil factors S_f of 0.1 and 0.2, respectively. Therefore, the soil factor S_f is equal to 0.15.

2.4.3 Vegetative Cover

The bench land vegetative cover is forested with an associated cover factor C_f of 0.2. Therefore the cover factor C_f is equal to 0.2.

2.5 Infiltration

Infiltration is the product of the Infiltration factor I_f multiplied by 293 mm, the Water Surplus. The Infiltration factor I_f is determined by summing the above noted factors for topography, soil and cover were $I_f = T_f + S_f + C_f = 0.15 + 0.15 + 0.2 = 0.5$. This relates to infiltration from the overburden estimated at 146.5 mm.

The Hydrogeological Investigation found the significant water bearing zone in the confined aquifer to be 5 m below the proposed quarry floor at 125 masl. Therefore the confined aquifer would have a negligible impact on de-watering operations.

2.6 Runoff

Runoff is the sum of Water Surplus (293 mm) minus Infiltration (146.5 mm). Therefore Runoff equals 146.5 mm.

3.0 FIELD INVESTIGATIONS

Four (4) site visits were undertaken at the Miller Braeside Quarry and surrounding lands. The subject property boundary and surrounding four (4) surface water resources are delineated in relation to the site north shown in Figure 2. A local marsh or swamp land is located on private lands southeast of the property; the unnamed drain head waters are found immediately northwest of the subject lands;

the Ottawa River is located east of the property; and Ryan Creek is found west of the quarry boundary.

The quarry de-watering operation consists of internal ditches leading to a sump below the quarry floor and pump systems to discharge surface water to drain the quarry. The pump discharge outlets to a sediment basin on top of the quarry, prior to flowing via gravity overland through a heavily treed area and then off site. The pump systems are also used to supply water for quarry dust suppression. A gate valve is manually closed to divert flow to the water truck fill station (Photo 1).

De-watering flows off site via a roadside culvert and is then conveyed via roadside ditching and culverts discharging to Ryan Creek. The surface water flows westerly off site via the 450 mm dia Corrugated Steel Pipe (CSP) Culvert crossing Usborne Street, then southerly along the Campbell Drive roadside ditching for about 650 m, then westerly via the 800 mm dia CSP Culvert crossing Campbell Drive and along Carmichael Sideroad ditching for approximately 330 m out letting to Ryan Creek, immediately upstream of the 2,740 mm dia CSP Culvert.

The purpose and findings of each site visit is as follows:

3.1 Site Visit #1

The first site visit on April 17, 2007 was completed during a de-watering operation of extensive ponding within the quarry (Photo 1). Pump Records (Appendix B) identify the de-watering period from April 16 to 20, 2007 with a pump duration of 12 hrs/day at a rate of 8,550 Lpm (2,260 Usgpm).

The purpose of the field work was to delineate the two de-watering pump systems, trace it's gravity flow route to the discharge point at Ryan Creek, inspect sediment and erosion control measures and document surface water turbidity.

A diesel powered portable 8" trash pump was being used for quarry de-watering in the spring and fall. The pump was located above and adjacent to the 27 m wide by 24 m long by 6 m deep sump. It's suction line consisting of 11 m of 200 mm dia rubber hose runs from the sump to the pump. The discharge line including valves and fittings consisting of 13.6 m of 200 mm dia rubber hose and 78.6 m of 300 mm dia welded CSP culvert, runs from the pump to the sediment basin at the top of the quarry.



Photo 1 - Dewatering Operation

Miller Braeside Quarry
Hydrologic Report

Photo Page 1

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April 17, 2007



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A small submersible pump was being used for quarry de-watering in the summer. The pump was submerged about 4 m into the sump. The pump twin discharge lines each including valves and fittings consisting of 97 m of 100 mm dia galvite rigid steel conduit, runs from the pump to the sediment basin at the top of the quarry. One line is for primary use with the other for backup.

All pump discharge lines run westerly to the top of the quarry out letting into a rock cut “v” shaped sediment basin 18 m long with a 4 m top wide and a depth varying from 1.4 m to 2.0 m (Photo 2) encompassing a riprap check dam 4 m long with a 5 m top width and a 2 m height (Photo 3), prior to discharging via an outlet channel (Photo 4). The rock cut outlet channel is 33 m long with a 5 m top width and it’s depth varies from an initial 2 m to 0 m at the end. It runs northerly discharging at the surface, then flows about 200 m overland through mature forest in a westerly direction towards Usborne Street.

Quarry de-watering is intercepted by the Usborne Street north side ditch. It outlets westerly off-site via a 450 mm dia CSP culvert crossing Usborne Street (Photo 5). The flow is then conveyed southerly along Campbell Drive north side ditching for approximately 650 m (Photos 6 & 7), out letting to Carmichael Sideroad via a 800 mm dia CSP culvert (Photo 8). Then the flow is directed westerly along Carmichael Sideroad ditching for about 330 m to Ryan Creek (Photo 9), immediately up stream of the 2,740 mm dia Structural Plate Corrugated Steel Pipe (SPCSP) culvert.

The field investigation did not identify any sediment and erosion problems due to de-watering operations, as exhibited by photographs 1 to 5 inclusive. The surface water within the quarry floor, the sump, the sediment basin including rock check dam, the 450 CSP culvert inlet at Usborne Street and grassed roadside ditching which outlets to Ryan Creek was very clear and void of any turbidity, while Ryan Creek which has a bare silty clay bed and banks contained extremely turbid surface water.



Photo 2 - Pump Discharge to Sediment Basin



Photo 4 - Outlet Channel immediately downstream of Sediment Basin



Photo 3 - RipRap Check Dam at Sediment Basin Outlet



Photo 5 - 450 mm Dia CSP at Usborne Street

Source: Site photos taken by Jay Clark and Kyle Fleming (SBA) 2007.

Miller Braeside Quarry
Hydrologic Report

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April 17, 2007



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Photo 6 - Campbell Drive Roadside Ditch west of Usborne Street



Photo 8 - 900 mm Dia CSP at Campbell Drive immediately north of Carmichael Sideroad




Photo 7 - Campbell Drive Roadside Ditch north of Carmichael Sideroad



Photo 9 - Carmichael Sideroad Ditch from Campbell Drive west to Ryan Creek (Background)

Source: Site photos taken by Jay Clark and Kyle Fleming (SBA) 2007.

<p>Miller Braeside Quarry Hydrologic Report</p>	
<p>Photo Page 3</p>	
<p>P/N 05-2033</p>	<p>June 12, 2007</p>
	<p>Skelton Brumwell & ASSOCIATES INC.</p>
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3.2 Site Visit #2

The second site visit on April 24 and 25, 2007 was conducted between de-watering operations and ponding was minimal within the quarry. Pump Records (Appendix B) identify the de-watering period from April 23 to 27, 2007 with a pump duration varying from 12 hr/day to 7.5 hr/day at a rate of 8,550 Lpm (2,260 USgpm).

The purpose of the field investigation was to:

- take spot measurements of water temperature at the de-watering sump, 450 mm dia CSP culvert crossing Usborne Street just east of Campbell Drive , 2,740 mm dia SPCSP culvert at Carmichael Sideroad crossing Ryan Creek and 7,620mm x 4,240 mm SPCSPA culvert at Campbell Drive crossing Dochart Creek;
- take field measurements to determine the flow rate through the 2,740 mm dia SPCSP culvert at Carmichael Sideroad crossing Ryan Creek and the channel cross section immediately upstream of the culvert crossing and the 7,620 mm x 4,240 mm culvert at Campbell Drive crossing Dochart Creek;
- inspect sediment and erosion control measures; and
- document surface water turbidity.

Groundwater temperatures in the aquifer upper 100 m are expected to be 1-2°C greater than the mean annual air temperature. The Site mean annual air temperature is approximately 6°C. Therefore site groundwater would range from about 7 to 8°C. The water temperature at the Usborne Street 450 mm dia CSP was 8°C, which suggests its source could primarily be groundwater fed. This is confirmed by the Hydrogeological Investigation's documented static water level of the nearest well, TW3. It is 130-131 masl, which corresponds to the surface elevation of the 450mm CSP.

The water temperature at the culverts crossing of Carmichael Sideroad on Ryan Creek and Campbell Drive on Dochart Creek was 9°C and 11°C, respectively. This would also indicate that Ryan and Dochart Creeks have sources of groundwater consistent with cold water systems.

Surface water temperatures at the de-watering sump were 13.5°C at the surface and 9.5°C at a depth of 4 m below surface. The sump's average water temperature is 11.5°C or 3.5°C above the water temperature at Usborne Street.

The culvert at the Carmichael Sideroad crossing Ryan Creek is shown in Photo 10. Its diameter measured 2,740 mm rather than 2,700 mm which defines it as a structural plate corrugated steel pipe (SPCSP). It has a length of 20.7 m and a change in elevation of 0.5 m from its inlet to outlet. The culvert had an average flow depth of 0.6 m, a flow area of 0.96 m², a velocity of approximately 0.6 m/s and a flow rate of 0.58 m³/s or 580 Lps.

The culvert at the Campbell Drive crossing Dochart Creek is shown in Photo 11. The culvert is a 7,620 mm x 4,240 mm structural plate corrugated steel pipe arch (SPCSPA) about 34.8 m long. The culvert outlet had an average flow depth of 0.2 m, a flow area of 0.88 m², an average surface water velocity of approximately 0.8 m/s and a flow rate of 0.70 m³/s or 700 Lps.

The Ryan Creek cross-sectional area immediately upstream of the Carmichael Sideroad 2,740 mm dia SPCSP culvert at the electric fence line is located on Figure 3 and shown in Photo 12. It was measured at 1m horizontal intervals. The distance from top of bank to top of bank was 7 m and the bank full maximum depth was 1.5 m. The present hydraulic conditions had a water surface width of 6 m, maximum depth to creek invert of 0.7 m, cross sectional area of 2.93 m², average velocity of 0.2 m/s and a flow rate of 0.59 m³/s or 590 Lps. The creek water flowing within the silty clay channel was highly turbid.

The field investigation did not identify any sediment and erosion problems due to de-watering operations. The surface water within the sump and internal channels, the sediment basin including rock check dam, the 450 CSP culvert inlet at Usborne Street and grassed roadside ditching which outlets to Ryan Creek was very clear and void of any turbidity.

3.3 Site Visit #3

The third site visit was conducted on June 11 and 12, 2007. Pump Records (Appendix B) identify the de-watering period from June 11 to 15, 2007 with a pump duration varying from 2.8 hr/day to 0.1 hr/day at a rate of 2,176 (575 Usgpm). Previous de-watering operations had drawn the sump down



Photo 10 - Ryan Creek 2,740mm Dia SPCSP at Carmichael Sideroad



Photo 11 - Dochart Creek - 7,620 mm X 4,240 mm SPCSPA at Cambell Drive

Miller Braeside Quarry
Hydrologic Report

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P/N 05-2033

April 25, 2007



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Photo 12 - Ryan Creek looking upstream of 2,740 mm Dia SPCSP at Carmichael Sideroad



Photo 14 - Unnamed Drain looking upstream of 600 mm Dia CSP at Golf Club Road



Photo 13 - Ryan Creek looking downstream of 2,740 mm Dia SPCSP at Carmichael Sideroad



Photo 15 - Unnamed Drain looking downstream of 600 mm Dia CSP at Golf Club Road

Miller Braeside Quarry
Hydrologic Report

Photo Page 5

P/N 05-2033

June 12, 2007



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to a 6m depth with no ponding within the quarry. During the day water was pumped from the sump into a water truck and then spread on the interior roads for dust suppression.

The purpose of the field work was to identify the manufacturer's name and serial number for the de-watering pumps listed in the 2006 Water Taking Records; investigate the adjacent unnamed drain that out lets to Rhoddys Bay; develop the thermocline for the sump, re-measure water temperature along the de-watering system route to Ryan Creek including Dochart Creek and measure a channel cross section downstream of the Carmichael Sideroad crossing Ryan Creek; and inspect sediment and erosion control measures and document surface water turbidity.

The downstream channel cross-section is located in Figure 3 and shown in Photo 13. Its distance from top of bank to top of bank was 4 m and the bank full maximum depth was 0.4 m. The present hydraulic conditions had a water surface width of 1.3 m, maximum depth to creek invert of 0.7 m, average velocity of 0.28 m/s, cross sectional area of 0.72 m² and a flow rate of 0.20 m³/s or 200L/s. The creek water within the silty clay channel was highly turbid.

We were informed by the quarry manager, Mr. Jason Roessner that the small submersible and larger portable trash pumps were failing and had been replaced. The small submersible pump was removed from site for repairs and was found to need replacement. The large portable trash pump had reached it's life expectancy and was abandoned off site with other scrap metal. A new larger submersible pump was purchased with installation in June of 2007 to replace these two pumps.

The dismantled original small submersible pump was at the Smith Construction Company workshop in Arnprior. The name plate listed a 2.4 hp, 3490 rpm, 9.8 A, 27 kg Flygt Submersible Pump with the serial numbers 2066.171-0060099 and 2066.171-0507.

The old portable 8" trash pump had a raised WAB10 in the pump cast iron body, but no name plate was found. We were thus unable to identify the manufacturer and serial number. It was powered by a General Motors Company diesel drive without a serial plate. The quarry mechanic, Mr. Dean Roessner was also unable to identify the pump manufacturer but his records showed the diesel engine drive to be a 90 hp.

The new submersible pump was purchased through Franklin Empire on March 13, 2007. Mr. Dan Adams of Franklin Empire confirmed that the new de-watering pump was a 10 hp Berkeley submersible turbine pump, model no. 8T-550.

The Unnamed Drain located northwest of the site crosses Golf Club Road through a 600 mm dia CSP culvert about 400 m northeast of Osborne Street. The Drain passes through rural residential lands south of Golf Club Road (Photo 14) and cultivated agricultural and forested lands north of Golf Club Road (Photo 15). The Drain was not flowing immediately upstream and downstream of Golf Club Road.

Spot measurements of surface water temperature were taken at the 450 mm dia CSP culvert crossing Osborne Street just east of Campbell Drive, 2,740 mm dia SPCSP culvert at Ryan Creek crossing Carmichael Sideroad, 7,620mm x 4,240 mm SPCSPA culvert at Dochart Creek crossing Campbell Drive (Table 7) and at 1m depth intervals within the sump (Table 8). Field measurements were completed to determine the hydraulic capacity of Ryan Creek immediately down stream of the 2,740 mm dia SPCSP culvert crossing Carmichael Sideroad.

The field investigation did not identify any sediment and erosion problems due to de-watering operations, as exhibited by photographs 7 to 9 inclusive. The surface water within the sump and internal channels, the sediment basin including the rock check dam, the 450 CSP culvert inlet at Osborne Street and grassed roadside ditching which outlets to Ryan Creek was very clear and void of any turbidity. While Ryan Creek flow was highly turbid surface water as shown in Photo 12 and 13.

3.4 Site Visit # 4

The fourth site visit was conducted on August 21, 2007 to monitor off-site discharge between de-watering operations. The purpose of the field work was to determine the Ryan Creek flowrate and to calibrate the flow rate leaving the site that is associated with de-watering operations; and re-measure the sump water thermocline, collect spot measurements for water temperature along the de-watering system route from the 450 mm dia CSP at Osborne Street to the outlet at Ryan Creek including Dochart Creek; and inspect sediment and erosion control measures and document surface water turbidity.

The sump water depth had decreased from 6 m (June 11) to 3 m (August 21) due primarily to evaporation and dust suppression operations. The roadside ditching along Usborne Street, Campbell Drive and Carmichael Sideroad were all dry. Ryan Creek flow rate was so low that it was flowing through the granular bedding of the 2,640 mm dia culvert crossing Carmichael Sideroad.

The Ryan Creek flow rate was measured at the downstream channel cross-section located in Figure 3. The present hydraulic conditions had a water surface width of 0.45 m, maximum depth to creek invert of 0.05 m, average velocity of 0.2 m/s, cross sectional area of 0.02 m² and a flow rate of 0.004 m³/s or 4L/s. The creek water within the silty clay channel was not turbid due to extreme drought conditions.

Surface water temperatures were measured in the morning at the de-watering sump. It was consistently 20.0°C from the surface to the invert at a depth of 3 m below surface. The air temperature was 16°C when the sump water thermocline was measured.

Surface water temperatures at Ryan and Dochart Creeks were both 14.5°C and the air temperature was 18°C.

The quarry operations at the time of our site visit included rock drilling and aggregate production. The aggregate operation included a field trailer, large loader, portable crusher and screening equipment including conveyors distributing the product, fuel tanker and water trucks (Photo 16 & 17). A drill rig and blasting crew was setting up on top of the east face for a blast scheduled for the next day (Photo 17 background).

The field investigation did not identify any sediment and erosion problems due to drought flow conditions. The surface water within the sump was clear, the sediment basin including rock check dam was dry with no accumulation of sediment, the 450 CSP culvert inlet at Usborne Street and grassed roadside ditching which outlets to Ryan Creek were dry.

4.0 DE-WATERING OPERATIONS

The quarry de-watering operations consist of internal drainage ditches, a sump and pump(s) within the quarry floor, with forcemain(s) to the top of the quarry out letting to a sediment basin prior to surface discharge via gravity flow. The internal rock cut ditch directs surface runoff within the quarry



Photo 16 - Aggregate Production



Photo 17 - Aggregate Production and Rock Drilling

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floor to an 6 m deep sump. The sump water is discharged to the top of quarry via sump pump(s) and forcemain(s). The forcemain(s) outlet to a rock cut basin complete with a rip rap check dam for sediment control before discharging as gravity flow at grade. The gravity flow follows the natural topography westerly through a mature forest on flat lands with a thin clay loam soil over eroded and fractured bedrock to roadside ditching at Usborne Street.

Surface water flows off site via roadside culverts and ditching, discharging to Ryan Creek. The surface water is discharged westerly off site via the 450 mm dia CSP Culvert crossing Usborne Street, then southerly along the Campbell Drive roadside ditching for about 650m, then westerly via the 800 mm dia CSP Culvert crossing Campbell Drive and along Carmichael Sideroad ditching for approximately 330 m out letting to Ryan Creek immediately upstream of the 2,740 mm dia CSP Culvert crossing Carmichael Sideroad.

4.1 Pumping Systems

Until June of 2007, two (2) pumping systems were in operation. Annual Water Taking Records delineated daily pump run times on a spreadsheet with the calculation of daily and monthly pumped volumes based on assumed pump capacities. The 2006 Water Taking Records identify the maximum pump capacity at 8,550 LPM which is in compliance with the combined capacity of 10,000 LPM listed in the PTTW 0035-6T8HMJ (Appendix B).

The de-watering pumps are located in a rock cut sump below the 125 masl quarry floor. It 's dimensions are 27 m by 24 m by about 6 m deep. This relates to a relatively small storage volume of 3,900 m³ when compared to the average spring snow melt and rainfall volume from December 1 to April 1 of 77,500 m³. The spring time runoff results in extensive flooding of the quarry floor until de-watering is initiated in the beginning of April. The sump provides storage for a 25mm summer storm event. This requires pumping to coincide shortly after rainfall events. The secondary function of the sump is to provide water supply for aggregate production and dust suppression on internal roads.

The two (2) pumping systems consisted of the following:

The smallest pump was a 2.4 hp Flygt BIBO 2066.171 Submersible Pump with a 75 mm (3") discharge and maximum capacity of 946 LPM (250 USGPM). The Technical specification including

motor rating and performance curve for the 230V, 60 Hz, 1 Phase, 3490 rpm pump are attached in Appendix B. The twin 100 mm dia Galvite hot dipped galvanized rigid steel conduit forcemain was 97 m long . The valves and fittings equivalent length was calculated to be 45.6 m plus the 97 m of straight pipe sums for a total length of 142.6 m. The forcemain static head was 10.3 m consisting of a 4.5 m vertical lift from the pump invert to the top of sump and an additional vertical lift of 5.8 m from the quarry floor to the top of grade.

Iterative calculations for pump capacity and forcemain friction head were completed and compared to the pump performance curve capacity and total dynamic head (TDH), to determine the actual pump capacity. A 130 USgpm pump capacity resulted in a friction head of 1.9m plus the 10.3 m static head totalled 12.2 m TDH. This matched the pump performance curve for 130 USgpm and a total dynamic head TDH of 12.2 m. Therefore the actual pump capacity was determined to be 130 USgpm. The 2006 Water Taking Record mistakenly listed the pump discharge diameter as 100 mm (4") rather than 75 mm (3") and the capacity at 2,160 LPM (571 USgpm) rather than 492 LPM (130 USgpm).

The largest pump is a 90 hp diesel engine drive vertical positioned centrifugal pump with an 200 mm (8") discharge and suction. The portable trash pump is very old and has no manufacturers marking or serial number. The non standard forcemain consisted of a combination of 24.6 m of 200 mm dia flexible rubber hose and 78.6 m of welded 300 mm dia CSP culvert sections. The valves and fittings equivalent length was calculated to be 129.5 m plus the 103.2 m of straight pipe sums for a total length of 232.7 m. The total friction head was 1.6 m at the suction line and 46.4 m at the discharge line. The static head was 13.8 m consisting of 8.0 m vertical lift of suction and 5.8 m vertical lift of discharge. The pump TDH was 59.8m at a capacity of 8,550 LPM (2,259 USgpm).

The 2006 Water Taking Record (Appendix B) shows de-watering was completed in April, May, June, July, August, September, October and November of 2006. The 75 mm (3") submersible pump was in operation during the spring and summer. It's pump run times were as follows: April (83.5 hr), May (83hrs), June (344.5 hr), July (377.5 hr), August (66 hr) and September (79 hr). The 200 mm (8") pump was in operation during the spring and fall. It's pump run times were as follows: April (131.5 hr), September (24 hr), October (18 hr) and November (48 hr).

The first de-watering period for 2006 occurs in April. We assume from pump records that water surplus for Dec 1, 2005 to April 30, 2006 would be pumped during April of 2006. April records list

the 200 mm (8") pump capacity at 8,550 LPM (2,259 USgpm) and pump time at 131.5 hr; and after correction for the 3" Flygt submersible pump capacity at 492 LPM (130 USgpm) and pump time at 83.5 hr. The water surplus volume of 78,430,000 L results in the 8" pump capacity being within 9 % of the listed capacity, providing verification.

Precipitation data from Environment Canada for 2006 is limited to only 8 months, from January to July and September. The 200 mm (8") pump was primarily in operation in April (131.5 hr) and to a lesser extent in September (24 hr), October (18 hr) and November (48 hr) of 2006. Therefore the 200 mm (8") centrifugal pump capacity could not be accurately calibrated to match water surplus until the remaining unpublished monthly precipitation for September, October and November of 2006 are released.

From June of 2007, one (1) pumping system has been in operation. The original 2.4 hp Flygt Submersible Pump and twin 100 mm dia forcemain has been abandoned; and the 90 hp diesel engine drive portable trash pump has been replaced with a 10 hp Berkeley 8T-550 Submersible Turbine Pump with an electronic flow meter, while retaining the original forcemain. During pump operation the electronic flow meter was fluctuating between 2,157 LPM (570 USgpm) and 2,195 LPM (580 USgpm).

The static head was 13.8 m consisting of an 8 m vertical lift from the pump invert to the top of sump and an additional vertical lift of 5.8 m from the quarry floor to the top of grade. The friction head for 2,176 LPM (575 USgpm) was 3.8m and the addition of 13.8 m of static head totalled 17.6 m TDH.

The 10 hp Berkeley 8T-550 pump performance curve has a capacity of 2,176 LPM (575 USgpm) at a TDH of 17.8 m showing good agreement with calculations and thus verified the flow meter readings (Appendix B).

4.2 De-watering Volumes

The submitted 2006 Water Taking Records were revised as discussed above in section 4.1 to reflect the corrected pumping capacities. The monthly and annual pumped volumes for the existing quarry in 2006 plus ultimate quarry development are shown in Table 1.

The April 2006 annual pumped volume was verified against estimated water surplus volumes for December 1, 2005 to April 30, 2006. However, calibration of the pump capacity should be completed

when Environment Canada publishes the remaining monthly precipitation data for 2006, to ensure data reliability. Environment Canada has only published climate up to July 2006 plus September 2006.

Environment Canada on-line climate data for 2006 did not include the four (4) historical climate stations in Section 2.1. Therefore the Ottawa MacDonald Cartier International Airport, Ontario station was used to gauge the site 2006 precipitation variation from the normal. The total precipitation from December 1, 2005 to July 31 plus September 2006 was 819.6 mm or 34 % above the average precipitation value of 611.5 mm for this period (Appendix C).

Table 1 - Revised 2006 Water Taking Records

Month	75mm (3") Submersible Pump Monthly Volume m³	200mm (8") Portable Trash Pump Monthly Volume m³	2006 Total Monthly Volume m³ (%)	Projected Ultimate Quarry Total Monthly Volume m³ (%)
Jan.	0	0	0	0
Feb.	0	0	0	0
Mar.	0	0	0	0
Apr.	2,465	67,460	69,925 (51.6)	138,488 (51.6)
May	2,450	0	2,450 (1.8)	4,831 (1.8)
June	10,170	0	10,170 (7.5)	20,129 (7.5)
July	11,144	0	11,144 (8.2)	22,008 (8.2)
Aug.	1,948	0	1,948 (1.4)	3,757 (1.4)
Sept.	2,332	12,312	14,644 (10.8)	28,986 (10.8)
Oct.	0	615	615 (0.5)	1,342 (0.5)
Nov.	0	24,624	24,624 (18.2)	48,847 (18.2)
Dec.	0	0	0	0
Total	30,509	105,011	135,520 (100.0)	268,388 (100.0)

The Total Annual Pumped Volume for 2006 was 135,520 m³ compared to the predicted average year volume of 90,830 m³ which is 49 % greater. Total Precipitation for nine of the 12 months shows an increase of 34 % from the average. We shall complete our evaluation, once Environment Canada monthly precipitation data is available for August, October and November 2006.

The de-watering operation identifies that about 80% of discharge occurs during the spring and fall wet weather periods and 20 % during the summer thunder storm period. The summer de-watering operations are the critical period when creek flows are low and water temperatures are high. Therefore thermal impact assessment will be generally limited to the summer period.

The average annual water surplus is the sum of average annual precipitation (814 mm) minus average annual evapotranspiration (521 mm) totalling 293 mm. Therefore the average water surplus volume for the existing quarry is the sum of 0.293 m multiplied by the drainage area 310,000 m² equalling 90,830 m³.

The ultimate quarry drainage area is estimated to be 91.6 ha or 3 times the existing conditions. The ultimate drainage area (916,000 m²) multiplied by the estimated annual water surplus (0.293 m) equals to an ultimate annual de-watering pumped volume of 268,388 m³. The 2006 total monthly pumped volume as a percentage of annual flow was used to pro-rate the ultimate annual de-watering pumped volume for each individual month, as outlined in Table 1.

4.3 Off Site Discharge

The de-watering forcemain(s) outlet to a rock basin with a rip rap check dam for sediment control prior to discharging overland via gravity flow. The gravity flow follows the natural topography westerly through a mature forest on flat lands with a thin clay loam soil cover over eroded and fractured bedrock to roadside ditching at Osborne Street.

The overland flow topography, soils and vegetative cover characteristics were categorized as outlined in the Hydrologic Cycle Component Values found in Appendix A. Then the infiltration factor was determined by summing the factors for topography, soils and cover. The topographic gradient varies from 1 to 2 percent and has an average infiltration value of 0.15. The soil is Renfrew grey wooded clay loam classified as a hydrologic soil group 'C' having an infiltration factor of 0.15. The mature forest

cover has an infiltration factor of 0.2. The estimated total infiltration factor is 0.5, therefore 50% would infiltrate to groundwater and 50% would flow as surface water off site.

The quarry manager, Jason Roessner has observed that pumped water takes about 24 hours to travel overland from the sediment basin to the outlet culvert at Usborne Street (~230 m), over the course of which it exhibits substantial infiltration. He had no quantitative measurements but agrees that he observes that about half of the pumped water infiltrates into large open fractures within the eroded bedrock.

The estimated monthly 2006 and Ultimate Quarry Off Site Discharge volumes are shown in Table 2.

Table 2 - Quarry Off Site Discharge

Month	Days	2006 Monthly Volume m ³	2006 Maximum Daily Off Site Discharge m ³ /s (USgpm)	Ultimate Quarry Monthly Volume m ³	Ultimate Quarry Maximum Daily Off Site Discharge m ³ /s (USgpm)
Jan.	31	0	0		0
Feb.	28	0	0		0
Mar.	31	0	0		0
Apr.	30	34,963	0.072(1,130)	143,348	0.055(863)
May	31	1,225	0.004(65)	5,023	0.018(288)
June	30	5,085	0.004(65)	20,849	0.018(288)
July	31	5,572	0.004(65)	22,845	0.018(288)
Aug.	31	974	0.004(65)	3,993	0.018(288)
Sept.	30	7,322	0.072(1,130)	30,020	0.055(863)
Oct.	31	308	0.072(1,130)	1,263	0.055(863)
Nov.	30	12,312	0.072(1,130)	50,479	0.055(863)
Dec.	31	0	0		0
Annual		67,761	N/A	134,194	N/A

4.4 Off Site Conveyance

The off site conveyance route leaves the site via a 450 mm CSP crossing Usborne Street, then flows south along Campbell Drive ditching, through an 800 mm CSP crossing Campbell Drive, then west along Carmichael Sideroad ditching to Ryan Creek.

The first site visit on April 17, 2007 was completed during a de-watering operation. De-watering was being undertaken with the original 8" portable trash pump which had a capacity of 0.14 m³/s (8,550 Lpm). The off site discharge was estimated to be 0.07 m³/s or half the pump capacity (see Section 4.3). Photographs of the Usborne Street roadside ditch (Photo 18) show ponding of water and Campbell Drive roadside ditch (Photo 19) show minor erosion. Evidence of roadway flooding was encountered during off site discharge at Usborne Street to the outlet at Ryan Creek via the Carmichael Sideroad ditch on April 19, 2007 by Gorrell Resource Investigations. This was due to heavy rainfall and the high capacity (8,550 Lpm) pump that has been replaced with the new low capacity (2,176 Lpm) pump.

Quarry production is not operational until May 15 when half load season restrictions on roads have ended. This spring's April pumping was completed at 8,550 Lpm (2,259 Usgpm) within 131.5 hrs. However, it could have been undertaken within 1,080 hrs (45 days) at a reduced pump rate of 1,041 Lpm to lessen potential roadway flooding. This pump rate was multiplied by the increased drainage area factor 3, to estimate the potential ultimate spring pump rate of 3,123 Lpm (825 Usgpm). This ultimate spring pump rate will result in an off site discharge rate of 1,562 Lpm or 0.026 m³/s.

We have assessed the capacity of off site flow conveyance via culverts and roadside ditching to ensure that discharge from present and future de-watering operations do not result in flooding. The MTO Drainage Management Manual was utilized to determine the capacities of the 450 mm dia CSP culvert crossing Usborne Street, the Campbell Drive roadside ditch, 900 mm dia CSP culvert crossing Campbell Drive and the Carmichael Sideroad ditch, as follows:

4.4.1 Usborne Street Culvert Capacity

The culvert inlet control capacity was determined by the Ministry of Transportation of Ontario MTO Chart 2.32.(Appendix C) given a projecting inlet, a culvert diameter D of 0.45 m and headwater to diameter HW/D ratio of 0.85. The culvert capacity is 0.12 m³/s under inlet control conditions with a headwater HW of 0.39 m.



Photo 18 - Usborne Street Roadside Ditch looking southeast from "T" intersection with Campbell Drive.



Photo 19 - Campbell Drive Roadside Ditch looking south from the "T" intersection with Usborne Street.

Source: Site photos taken by Jay Clark and Kyle Fleming (SBA) 2007.

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The culvert outlet control capacity was determined by MTO Chart 2.35 (Appendix C). The 14 m culvert has a projecting inlet with an entrance loss coefficient of 0.9. The ditch inlet is skewed about 70 degrees from the culvert alignment resulting in a skewed length of 40 m and given a capacity of 0.12 m³/s, it's headloss H is 0.28 m. Critical depth was 0.23 m as determined by MTO Chart 2.37 (Appendix C). The length slope of 0.28m was the product of the 14m length multiplied by the surveyed slope of 0.02m/m. The culvert capacity is 0.12 m³/s under outlet control conditions with a headwater HW of 0.45 m, as determined by MTC Form D4-1 (Appendix C).

Outlet Control conditions are the governing headwater HW at 0.45 m. The 450 mm dia CSP culvert has a full flow capacity 0.12 m³/s or about four (4) times the estimated maximum ultimate de-watering off site discharge value of 0.026 m³/s providing ample freeboard allowance for stormwater runoff. Therefore ultimate de-watering operations will not flood Osborne Street.

4.4.2 Campbell Drive Ditch Capacity

The roadside ditch is a grass lined channel and the Manning's roughness coefficient 'n' was set at 0.030. The ditch front and back slopes vary from 2:1 to 3:1, the average ditch bottom is 0.6 m wide, the depth is 1.0 m and the minimum ditch gradient between Osborne Street and Carmichael Sideroad is 0.013m/m. A Manning's Channel computer program (Appendix C) was utilized to determine the bank full capacity of 7.6 m³/s. It far exceeds the estimated maximum ultimate de-watering off site discharge value of 0.026 m³/s with extensive freeboard allowance for stormwater runoff. Therefore ultimate de-watering operations will not flood Campbell Drive.

4.4.3 Campbell Drive Culvert Capacity

The culvert inlet control capacity was determined by the Ministry of Transportation of Ontario MTO Chart 2.32.(Appendix C). The culvert capacity is 0.52 m³/s under inlet control conditions given a projecting inlet, a culvert diameter D of 0.80 m and headwater HW of 0.69 m.

The culvert outlet control capacity was determined by MTO Chart 2.35 (Appendix C). The culvert has a projecting inlet with an entrance loss coefficient of 0.9. The ditch inlet is skewed about 70 degrees from the culvert alignment resulting in a skewed length of 51 m and given a capacity of 0.52 m³, it's headloss H is 0.40 m. Critical depth was 0.46 m as determined by MTO Chart 2.37 (Appendix C). The length slope of 0.39 m was the product of the 17.6 m length and surveyed slope

of 0.022 m/m. The culvert capacity is 0.52 m³/s under outlet control conditions with a headwater HW of 0.81 m, as determined by MTC Form D4-1 (Appendix C).

Outlet Control conditions are the governing headwater HW at 0.81 m. The 800 mm dia CSP culvert has a full flow capacity 0.52 m³/s or 20 times the estimated maximum dewatering off site discharge value of 0.026 m³/s providing a large freeboard allowance for stormwater runoff. Therefore ultimate de-watering operations will not flood Campbell Drive.

4.4.4 Carmichael Sideroad Ditch Capacity

The roadside ditch is primarily a grass lined channel with a short section of riprap lined ditch immediately upstream of Ryan Creek. The Manning's roughness coefficient 'n' for grass ditching was set at 0.030. The ditch front and back slopes vary from 2:1 to 3:1, the average ditch bottom is 0.6 m wide, the depth is 1.2 m and the minimum ditch gradient between Campbell Drive and Ryan Creek is 0.031 m/m. A Manning's Channel computer program (Appendix C) was utilized to determine the bank full capacity of 11.7 m³/s. It greatly exceeds the estimated maximum ultimate de-watering off site discharge value of 0.026 m³/s with extensive freeboard allowance for stormwater runoff. Therefore ultimate de-watering operations will not flood Carmichael Sideroad.

4.4.5 County of Renfrew Contact

Mr. Steve Boland, C.E.T.; the Manager of Road Maintenance for the County of Renfrew (613-732-4353 ext 405) was contacted on September 20, 2007. Mr. Boland stated that infrequent springtime flooding has occurred on Renfrew County Road 3 (Usborne St.) just east of the 'T' intersection with Campbell Drive. He noted that the primary cause of road flooding along the shoulder was due to the culvert being blocked with snow and ice.

4.4.6 Township of McNab/Braeside Contact

Mr. Brian Box, the Road Superintendent for the Township (613-623-6222) was contacted on September 20, 2007. He was aware of the infrequent flooding of Usborne Street as identified by the County of Renfrew. Mr. Box noted that Miller Paving Ltd had previously installed riprap along the Carmichael Sideroad ditch immediately upstream of Ryan Creek, at their own expense to remediate ditch erosion.

5.0 SUB-WATERSHED AREAS

The ultimate quarry drainage area, surrounding four (4) sub-watershed areas and associated drainage area reductions are shown in Figure 4. A local marsh or swamp land is located about 100 m from the southeast corner of the property; the head waters of an unnamed drain run within 50 m of the northwest corner of the subject lands; the Ottawa River runs southerly and parallel to the C P Rail line approximately 900 m east of the property boundary; and Ryan Creek runs parallel to Osborne Street at a 600 m offset west of the quarry boundary.

The MNR Natural Areas & Significant Features Map 2.1 completed for the County of Renfrew Development and Property Department was reviewed. It identified sensitive areas of concern, and water courses that are either cold water permanent or intermittent. Then the four (4) surface water resources were assessed for potential impacts from the proposed quarry due to reduced runoff and base flow, as discussed below:

5.1 Local Marsh or Swamp Land

There is a marsh or swamp located on private land adjacent to the southeast corner of the subject property, on Lot 15, Concession B, Geographic Township of McNab, Township of McNab/Braeside, County of Renfrew. The Official Plan identifies it as a sensitive area of concern. The drainage area is approximately 77 ha of which 0.8 ha or $\pm 1\%$ would be utilized for the proposed quarry expansion. Therefore potential impacts from the proposed expansion due to reduced runoff and base flow would be negligible.

5.2 Unnamed Drain

The Unnamed Drain head waters are located northwest of the subject property. The drain flows in a northerly and then northeasterly direction to Rhoddys Bay. It is identified as an intermittent cold water drain by MNR.

The drain crosses Golf Club Road via a 600 mm dia CSP culvert about 3 km upstream of its outlet to Rhoddys Bay. The drain passes through rural residential lands south of Golf Club Road and cultivated agricultural and forested lands north of Golf Club Road. Its drainage area is about 312 ha of which 7.8 ha or $\pm 2\%$ would be contained within the proposed quarry extraction. Therefore potential impacts from the proposed expansion due to reduced runoff and base flow would be negligible.

5.3 Ottawa River

The Ottawa River is a very large river running southerly and parallel to the CP Rail. It is located approximately 900 m east of the property boundary. County of Renfrew mapping has identified the Ottawa River as a cold water river.

Environment Canada lists the drainage areas for only five (5) of the thirteen Ottawa River gauge stations. The closest upstream station is approximately 160 km from site at Des Joachims 02KA002 with a gross drainage area of 5,750,000 ha. The closest downstream station is about 15 km from site at Chats Falls 02KF009 with a gross drainage area of 8,960,000 ha. The proposed quarry extraction limits would reduce the drainage area by about 67.5 ha or 0.001%. Therefore potential impacts from the proposed quarry due to reduced runoff and base flow would be negligible.

5.4 Ryan Creek

Ryan Creek runs southeasterly of the proposed quarry and parallel to Osborne Street at a 600 m offset. It is a tributary of Dochart Creek and both creeks are identified by MNR as a cold water systems. The drainage area immediately upstream of the Carmichael Sideroad crossing is approximately 1,175 ha of which 10 ha or less than 1% is located on site between Osborne Street and the existing quarry. The portion of it's drainage area located on the subject property will not be extracted nullifying any potential impacts due to reduced runoff and base flow.

Potential quarry de-watering impacts on the Ryan Creek cold water fishery were assessed to ensure no harmful alteration to aquatic life and habitat. The following assessment verifies surface water features, identifies the stream classification, characterizes stream discharge, evaluates fluctuations in water level and influences on seasonal thermal regime.

5.4.1 Surface Water Features and Stream Classification

Ryan Creek at the Carmichael Sideroad has a bare earth creek bed. The channel substrate consists of very soft to firm silty clay and its clay banks are steep and eroding. The creek bed roughness compares to dredged channels having considerable bed roughness with eroding side slopes. Its thalweg shifts from side to side owing to changes in cross sectional shape. Obstructions such as depositional point bars with few mid channel bars occupy about 35 percent of the cross-sectional area.

Stream Classification criteria used by Rosgen is based on measurable morphological features. The Ryan Creek valley reach 1 km upstream to 2 km downstream of Carmichael Sideroad was selected for morphologic measurement. The 1:10,000 Ontario Base Mapping (OBM) was utilized to delineate the sinuosity at 1.7 and designate slight channel confinement. Field measurements determined the creek gradient at 0.1 % and bank full width to depth ratio is 5, and soil sampling identified the channel material dominant particle size as silty clay. Therefore this reach of the Ryan Creek is a C5 stream type, which does not reflect Brook Trout habitat.

5.4.2 Rating Curve

The guide for selecting Manning's roughness coefficients for natural channels was utilized to estimate Manning's Coefficient (n) for Ryan Creek. It identifies the characteristics for estimating the base (n_b) and adjustments for degree of irregularity (n₁), variation in cross-section (n₂), effect of obstructions (n₃) and vegetation (n₄) before multiplying by the adjustment for meander (m). The formula used to estimate the channel roughness coefficient n for Ryan Creek is as follows:

$$\begin{aligned} n &= (n_b + n_1 + n_2 + n_3 + n_4) m \\ &= (0.030 + 0.010 + 0.015 + 0.025 + 0) \times 1.3 \\ &= 0.104 \end{aligned}$$

Ryan Creek cross-section had a measured maximum depth of 0.7 m and velocity of 0.19 m/s; calculated discharge Q of 0.54 m³/s, flow area of 2.93 m², hydraulic gradient (S) of 0.001 m/m, wetted perimeter (WP) of 6.2 m and hydraulic radius (R) of 0.47. Manning's equation was used to estimate the roughness coefficient 'n' as follows:

$$\begin{aligned} n &= 1/V \times R^{2/3} \times S^{1/2} \\ &= 0.101 \end{aligned}$$

Both the guide to selecting Manning's Coefficient (n) and the calculated Manning's (n) from field measurements showed good agreement.

The 2,740 mm SPCSP culvert crossing at the Carmichael Sideroad had a measured velocity of 0.58 m/s; calculated flow depth of 0.6 m, and flow area of 0.96 m². The estimated culvert flow rate Q was 0.56 m³/s or 560 L/s.

The above noted culvert flow rate was within 4 percent of the Ryan Creek cross-section flow rate providing verification of our channel parameters for manning's equation. Then a rating curve for the Ryan Creek cross-section up to bank full capacity was completed, as shown in Table 3 below.

Table 3 - Ryan Creek Rating Curve

Stage	Top Width	Flow Area	Wetted Perimeter	Hydraulic Radius	Flowrate	Flowrate	Velocity
(m)	(m)	(m ²)	(m)	(m)	(m ³ /s)	(L/s)	(m/s)
0.1	1.5	0.19	1.5	0.13	0.01	20	0.08
0.2	3.66	0.45	3.94	0.11	0.03	30	0.07
0.3	4.3	0.85	4.34	0.2	0.09	90	0.1
0.4	4.8	1.3	4.88	0.27	0.17	170	0.13
0.5	5.3	1.8	5.42	0.33	0.26	260	0.15
0.6	5.65	2.35	5.82	0.4	0.39	390	0.17
0.7	6	2.93	6.2	0.47	0.54	540	0.19
0.8	6.13	3.54	6.44	0.55	0.72	720	0.2
0.9	6.25	4.16	6.67	0.62	0.92	920	0.22
1	6.38	4.84	6.91	0.7	1.16	1160	0.24
1.1	6.5	5.43	7.14	0.76	1.38	1380	0.25
1.2	6.63	6.09	7.38	0.83	1.64	1640	0.27
1.3	6.75	6.76	7.62	0.89	1.9	1900	0.28
1.4	6.88	7.44	7.85	0.95	2.19	2190	0.42
1.5	7	8.13	8.09	1	2.47	2470	0.3

5.4.3 Pro-rating Flow

Ryan Creek is within the Southern Ontario Drainage Index Sub- Sub Division 02KC as shown on Department of the Environment, Water Resource Branch Fig. 9 (Appendix D). It is a small ungauged watercourse and requires flow being estimated from a gauged watercourse within the same hydrologic region. Streamflow data is available for three (3) gauge stations within Drainage Index Sub- Sub Division 02KC.

The Bonnechere River Stream Gauge Station 02KC009 near Castleford Road is located about 10 km from the site. It has a drainage area of 2,380 km² and mean monthly discharge records for an 83 year period. The Indian River Stream Gauge Station 02KC014 near Pembroke is about 66 km from site. This station has a drainage area of 443 km² and 16 years of mean monthly discharge records. The Muskrat River Stream Gauge Station 02KC015 near Pembroke is located about 63 km from site. It has a drainage area of 688 km² and mean monthly discharge records for a 9 year period.

Statistical analysis of historical September mean discharges were completed for the three stations. The minimum acceptable years of record calculated for the Bonnechere River, Indian River and Muskrat River stations were 19 years, 28 years and 47 years, respectively. The Indian River and Muskrat River stations were statistically inaccurate due to too short a period record. Therefore these two stations were excluded from further consideration.

The Historical September mean discharges for Stream Gauge Station 02KC009 on Bonnechere River were found to have a sufficient length of record. Therefore Stream Gauge Station 02KC009 was selected to pro-rate flow data for Ryan Creek.

Discharge from Bonnechere River Gauge Station 02KC009 (Appendix D) was pro-rated to estimate the Ryan Creek discharge using the area reduction formula. The Bonnechere River station drainage area (2,380 km²) and mean April discharge (56.1 m³/s); and the Ryan Creek site drainage area (12 km²) and April 24, 2007 field measured discharge (0.54 m³/s) were inputted into the area reduction formula, to calculate 0.87 for the 'c' exponential coefficient listed below.

$$Q_{\text{site}} = Q_{\text{station}} \times (A_{\text{site}} / A_{\text{station}})^c$$

The Bonnechere River statistics for extremes of monthly mean and daily discharges for the period of January 1921 to December 2004 were reviewed. The minimum monthly mean discharge occurring on September 2002 was 1.35 m³/s; and the minimum daily discharge occurring on September 29, 1991 was 0.292 m³/s (Appendix D). Then the Ryan Creek minimum monthly mean discharge (0.135 m³/s) and minimum daily discharge (0.029 m³/s) were estimated using the area reduction formula listed above.

5.4.3.1 Mean and Median Monthly and Annual Discharge

The statistical data for the Bonnechere River Station 02KC009 in Appendix D was pro-rated as discussed above to estimate mean and median monthly and annual discharge (Table 4). The Ryan Creek June 11, 2007 measured flow rate of 200 L/s confirmed the pro-rated monthly flow.

August, September and October are the three months with lowest flow rates ranging from 80 L/s to 68 L/s. The rating curve for Ryan Creek shows associated channel velocities of approximately 0.09 m/s to 0.1 m/s and associated pool depths of 0.28 m and 0.26 m, respectively. This does not meet the average minimum summer pool depth of 0.5 m for Brook Trout.

Table 4 - Ryan Creek Pro-rated Flow

Discharge (L/s)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
mean monthly	123	129	235	561	457	201	97	73	68	80	112	131	189 MAF
median monthly	110	114	215	541	415	175	83	64	63	66	77	103	181

5.4.4 Mean Monthly Air Temperature

The mean month air temperature was only available for Arnprior, Ontario as shown in Table 5. June, July and August are the three months with the highest air temperature, which will increase the surface water temperatures on Ryan Creek.

Table 5 - Mean Monthly Air Temperature

Air Temp (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
Daily Avg	-12	-10	-3	5.3	13	18	21	19	14	7.8	0.8	-7	5.6

5.4.5 Threshold Flow

The aquatic habitat within Ryan Creek will be under the most stress in August when the mean monthly flow rate is the lowest and air temperature is only 6 % below hottest daily average in July.

Small streams require a portion of the flow to be allocated for the protection of the aquatic ecosystem.

The approach to preserving the aquatic ecosystem includes setting a threshold flow. Hydrologic

Methods evaluate flow to determine a threshold flow below which no taking would be permitted for a specific creek location (see Gartner Lee, Best Practices for Assessing Water Taking Proposals, Nov 2002). These methods recognize that flow fluctuates over time and the aquatic ecosystem has evolved to handle these variations.

The following methods were incorporated to evaluate Threshold representing good habitat conditions. The Tennant Method specifies flows greater than 30 % of the Mean Annual Flow (MAF) or 57 Lps. The Montana-Tennant Method specifies flow greater than 40 % of MAF or 76 Lps from April to September. The Aquatic Baseflow Method specifies flow greater than the August median or 64 Lps. The average threshold flow rate for the above three methods was 66 Lps and the Aquatic Baseflow Method was within 3 % of this value. Therefore the Aquatic Baseflow method was utilized to estimate the Threshold flow at 64 Lps.

The de-watering operation may benefit fisheries during drought periods by increasing creek flow for up to 5 day periods with maximum pump durations of 12 hr/day after rainfall events.

5.4.6 De-watering Thermal Impact Assessment

The previous summer time pump rate of 492 Lpm (130 Usgpm) was multiplied by 3 (the increased drainage area factor) to estimate the potential ultimate summer pump rate at 1,476 Lpm (390 Usgpm). Actual thermal impacts were assessed at the new pump rate of 2,176 Lpm (575 Usgpm) which relates to an off site discharge rate of 1,088 Lpm or 18 L/s (section 4.3).

The MOE has biophysical performance standards for aquatic ecosystem objectives (Appendix D). Ryan Creek is recognized by MOE as a cold water fishery, although it does not exhibit brook trout habitat. The report uses Brook Trout habitat objectives as a benchmark to ensure cautious evaluation of thermal impacts.

The associated aquatic thresholds for Brook Trout are 22 °C for maximum annual water temperature, less than 20 mg/L for average annual total suspended solids (TSS) and greater than 5 mg/L for dissolved oxygen (DO). Therefore de-watering impacts on Ryan Creek fisheries must ensure that MOE thresholds for Brook Trout are not exceeded.

Total suspended solids recording is presently required by the Certificate of Approval, Industrial Sewage Works Number 6988-6VJFB (Appendix D), and quarry de-watering discharge does not reduce dissolved oxygen, therefore only thermal impacts will be assessed in this report.

Historical MOE Water Quality data identifies water temperature for the Bonnechere River Stream Gauge 02KC009 and Muskrat River Stations 02KC015 (Appendix D). Table 6 summarizes water temperatures for these cold water fisheries within the same Drainage Sub-Sub Division 2KC as Ryan Creek in comparison to air temperatures. Both Bonnechere and Muskrat River have less than half the allowable TSS, and almost double the minimum DO . However, water temperatures for August were within 1 to 2 °C of the water temperature threshold for Brook Trout.

Table 6 - Mean Monthly Air Temperatures and Daily River Water Temperature, TSS and DO

Sample Date dd/mm/yy	Air Temp (°C)	Bonnechere River Water			Muskrat River Water		
		Temp (°C)	TTS (mg/L)	DO (mg/L)	Temp (°C)	TTS (mg/L)	DO (mg/L)
26/04/79	5.3	11.4	9	13	13	9	10.6
31/05/79	13	13.8	5	8.8	14	5	9.1
30/08/79	19.4	21	2	10	20	3	8.9
27/09/79	14.3	NA	3	NA	NA	2	NA
25/10/79	7.8	9	4	10.2	9.9	8	9.9

The surface water temperature at various locations along roadside ditching measured between de-watering operations, are summarized in Table 7. Ryan Creek temperatures were consistently 2 °C below Dochart Creek for April and June. The morning air temperature increased by 7 °C from 21 °C on April 24 to 28 °C on June 11, 2007. Surface water temperature also increased by 7 °C from April 24 to June 11, 2007. Water temperatures at Usborne Street consistently increased by 1 °C along the roadside ditching prior to out letting at Ryan Creek. The August 21 air temperature was 18 °C which is 1.4 °C below normal and Ryan and Dochart Creek temperatures were both 14.5 °C.

Table 7 - Summary of Drainage System Air and Water Temperatures

Location	Apr. 24/07		Jun. 11/07		Aug. 21/07	
	Air (°C)	Water (°C)	Air (°C)	Water (°C)	Air (°C)	Water (°C)
Usborne St. 450 mm CSP inlet	7	8	21	15	18	N/A*
Campbell Dr. 800 mm CSP inlet	7	8	21	15	18	N/A*
Carmichael Sdrd 2740 mm SPCSP on Ryan Creek	7	9	21	16	18	14.5
Campbell Drive 4240 mm SPCSPA on Dochart Creek	7	11	21	18	18	14.5

Note: * no surface water flow

The de-watering sump water temperatures are summarized in Table 8. From April 24 to June 11, 2007 the water temperature increased by 10.5 °C at the surface, 8.5 °C at a 4m depth and 10 °C on average. The August sump water temperatures were constant at 20 °C.

Table 8 - Sump Water Temperatures

De-watering Sump Depth (m)	Water Temperature (°C)		
	Apr. 24/04	Jun. 11/07	Aug. 21/07
0	13.5	24	20
1		23	20
2		22	20
3		20	20
4	9.5	19	
5		16.5	
6		16	

The Ryan Creek June flow rate was 200 Lps and the water temperature was 16 °C. De-watering operations changed to a new 575 USgpm (36 Lps) submersible turbine pump. The pumped water flows overland through a heavily treed area covering weathered bedrock. Discharge off site is

estimated to be 18 Lps or half the pump rate due to an estimated infiltration factor of 0.5. The pump is installed at the sump invert and the average water temperature was calculated to be 20.1 °C. The sump water temperature will increase by 1 °C to a temperature of 21.1 °C as it flows along the roadside ditching to Ryan Creek.

The diurnal water temperature variation was estimated at 2.5 to 4 °C. Therefore the morning water temperatures were increased by 2/3 of 4 °C or 2.5 °C to estimate maximum daily temperatures.

The June de-watering thermal impact on Ryan Creek was evaluated using a mass balance equation to determine the water temperature of Ryan creek after pumping, as follows:

$$\begin{aligned}
 T_{\text{RYAN}} &= \frac{[Q_{\text{RYAN}} \times T_{\text{RYAN}}] + [Q_{\text{DISCH}} \times T_{\text{DISCH}}]}{[Q_{\text{RYAN}} + Q_{\text{DISCH}}]} \\
 &= \frac{[200 \text{ Lps} \times (16.0 \text{ °C} + 2.5 \text{ °C})] + [18 \text{ Lps} \times (21.1 \text{ °C} + 2.5 \text{ °C})]}{[200 \text{ Lps} + 18 \text{ Lps}]} \\
 &= 18.9 \text{ °C}
 \end{aligned}$$

The maximum surface water temperature is estimated to increase from 18.5 °C to 18.9 °C or by 2%. The estimated maximum daily temperature of 18.9 °C is 3.1 °C below 22 °C, the maximum annual water temperature threshold.

The Ryan Creek August 21, 2007 flow rate was an extreme drought condition. It measured only 4 Lps compared to the estimated threshold flow rate of 64 Lps. It is also only 5 % of the predicted mean monthly August flow rate of 73 Lps. The water temperature was 14.5 °C due to cooler than average air temperatures. We have assumed the water temperature to be 17.0 °C, which is the June water temperature plus 1.0 °C (the increase in mean monthly air temperature from June to August).

The estimated Ryan Creek threshold flow (August Median) of 64 Lps was used for evaluating potential de-watering thermal impacts, as it is a more reasonable limit than drought flow. De-watering operations changed to a new 575 USgpm (36 Lps) submersible turbine pump. The pumped water flows overland through a heavily forested area founded on open fractures within weathered bedrock. Discharge off site is estimated to be 18 Lps or half the pump rate due to an estimated

infiltration factor of 0.5. The pump is installed at the sump invert and the average water temperature was estimated to be 21.1 °C or 1 °C above the June average water temperature of 20.1 °C. The sump water temperature will increase by 1 °C to 22.1 °C as it flows along the roadside ditching to Ryan Creek.

This diurnal water temperature variation was accounted for by adding 2.5 °C to the morning temperature to estimate the maximum temperature.

The August de-watering thermal impact on Ryan Creek was also evaluated using a mass balance equation.

$$\begin{aligned}
 T_{\text{RYAN}} &= \frac{[Q_{\text{RYAN}} \times T_{\text{RYAN}}] + [Q_{\text{DISCH}} \times T_{\text{DISCH}}]}{[Q_{\text{RYAN}} + Q_{\text{DISCH}}]} \\
 &= \frac{[64 \text{ Lps} \times (17.0 \text{ °C} + 2.5 \text{ °C})] + [18 \text{ Lps} \times (22.1 \text{ °C} + 2.5 \text{ °C})]}{[64 \text{ Lps} + 18 \text{ Lps}]} \\
 &= 20.6 \text{ °C}
 \end{aligned}$$

The maximum surface water temperature would increase from 19.5 °C to 20.6 °C or by 6 %. The estimated maximum daily temperature of 20.6 °C is 1.4 °C below the maximum annual water temperature threshold.

Existing thermal impacts from de-watering operations at 575 Usgpm (36 Lps) were not found to reach the maximum annual water temperature threshold. The ultimate summertime de-watering will be limited to 575 Usgpm (36 Lps). Therefore Ultimate Quarry Operations will not result in harmful alteration or destruction of fish and aquatic habitat.

The existing heavily treed area between the sediment basin and the Usborne Street outlet provides a shaded reach for discharge waters. This treed area should be maintained in the future for protection against thermal enhancement.

5.4.7 Ministry of Natural Resources Contact

Ms. Tania Baker, a Biologist at the Ontario Ministry of Natural Resources Pembroke District Office was contacted on August 23, 2007. She had no historical record of any fish kills on Ryan Creek associated with the Braeside Quarry de-watering operation or on Dochart Creek. Ms. Baker noted that this did not necessarily mean that fish kills could not have occurred.

We noted that the site has been operated as a quarry since the early 1970's and any fish kill problems should have been identified if they existed over the last 35 years. This is consistent with our evaluation that the de-watering operations would not be harmful to fish and aquatic habitat.

5.4.8 Muncaster Environmental Planning Inc. Consultation

Mr. Bernie Muncaster, a Biologist and Principal with Muncaster Environmental Planning Inc. was consulted with regard to aquatic ecosystem aspects of the report. He reviewed and approved the monitoring and contingency plans. Mr. Muncaster's curriculum vitae is enclosed in Appendix E.

5.4.9 Monitoring Plan

Surface water thermal impact monitoring should be completed for de-watering operations by a qualified professional. It should be undertaken at the following locations:

- 1) The 450 mm CSP culvert crossing Usborne Street
- 2) The Carmichael Sideroad ditch immediately upstream of Ryan Creek
- 3) The Ryan Creek cross section immediately upstream of the 2,740 mm SPCSP culvert crossing Carmichael Sideroad.

The monitoring frequency should be biweekly from July 1 to September 15 for a total of five (5) events a year. The monitoring should include the following field measurements, hydraulic calculations and documentation:

- 1) Measurement of culvert flow depth plus ditch and creek flow cross sectional area.

- 2) Measurement of flow velocity at six-tenths depth below the surface, at increments representative of each flow area for the culvert, ditch and creek with a digital flow meter.
- 3) Calculation of culvert flow cross sectional area plus culvert, ditch and creek flow rates.
- 4) Measurement of water temperature at the culvert, ditch and creek between 3:30 and 4:30 p.m. to obtain maximum day temperatures.
- 5) Written documentation of the above noted field measurements and hydraulic calculations.

A Mass Balance equation should be employed to evaluate water temperature impacts after each monitoring event as described in Section 5.4.6 and then compared to 22 °C, the maximum annual water temperature for Brook Trout (Appendix D). The resultant thermal impact assessment including the mass balance equation will be documented in a written report. The report will include the following assessment and mitigation requirements:

- 1) If the resultant Ryan Creek temperature is below 21.5 °C, no action is required.
- 2) If the resultant Ryan Creek temperature is 21.5 °C or above then the Contingency Plan (Section 5.4.10) should be triggered.
- 3) If the resultant Ryan Creek temperature is 22 °C or above then the MOE shall be notified in writing.

Written documentation listed above for the five (5) monitoring events outlining monitoring locations, field measurements, hydraulic calculations, resultant Ryan Creek temperatures and any MOE correspondence with regard to non compliance events should be compiled and made available upon request from the MOE as an annual report.

Monitoring and recording of dissolved oxygen (DO) is not required as quarry de-watering discharge does not reduce DO in Ryan Creek. Typical industries that cause decreased DO in streams from discharge are forest harvesting, pulp mills, agriculture and sewage treatment plants.

Monitoring and recording of total suspended solids (TSS) is a present requirement of the Certificate of Approval, Industrial Sewage Works Number 6988-6VZJFB (Appendix D).

In summary a revised Monitoring Plan should:

- 1) Confirm that quarry de-watering does not result in thermal degradation of the aquatic ecosystem for Brook Trout.
- 2) Ensure that Ryan Creek water temperature does not exceed 22 °C, the Brook Trout threshold for temperature.
- 3) Affirm any significant deviations between measured and predicted thermal impacts.
- 4) Trigger contingency measures if unacceptable thermal impacts to Ryan Creek result in water temperatures greater than 21.5 °C.

5.4.10 Contingency Plan

The contingency plan will safeguard the aquatic ecosystem's maximum annual water temperature by increasing the monitoring frequency from bi-weekly to daily, restrict the pumping duration from 24 hours to 12 hours daily and reducing pump capacity or stopping pumping if required.

Pump capacity reduction would require the installation of a check valve on the pump discharge line immediately upgradient of the electronic flow meter. The check valve could be incrementally closed to lower pump capacity to readings on the flow meter.

If the resultant Ryan Creek temperature reaches 21.5 °C then the following action should be taken:

- 1) The daily de-watering duration should be restricted to 12 hours from 8 p.m. to 8 a.m. with reduced pump capacity to lessen thermal enhancement.
- 2) Daily field measurements should be taken to determine compliance with 22 °C the maximum annual water temperature.

- 3) If the resultant Ryan Creek temperature reaches or exceeds 22 °C, de-watering operations should immediately cease until daily field measurements show that water temperature in the sump and creek is reduced to acceptable theoretical limits (as determined by mass balance equation). Written notification to MOE of non compliance should be provided the same day.
- 4) If the resultant Ryan Creek temperature drops below 21.5 °C, then standard de-watering operations may resume with field measurements being taken for the next day to confirm compliance.

5.5 Sediment and Erosion Control Measures

The field investigation undertaken on April 17, 2007 during a de-watering operation did not identify any sediment and erosion problems as exhibited by photographs 1 to 5 inclusive (Section 3.1). The surface water was very clear in the sump, sediment basin, the 450 CSP culvert inlet at Osborne Street and along roadside ditching to Ryan Creek. Additional field investigations completed between de-watering operations showed no sediment accumulation within the dry sediment basin or sump.

The ultimate quarry de-watering operation may result in extended pumping periods which could potentially increase erosion off site. Therefore, sediment and erosion control on site should be improved by installing rock check dams at three (3) locations equally spaced along the northerly outlet channel, immediately downstream of the existing check dam at the sediment basin outlet. This would slow the flow velocity in the outlet channel to minimize potential downstream erosion and capture any sediment that may pass through the sediment basin.

5.5.1 Sediment and Erosion Control Plan

The Sediment and Erosion Control Plan should incorporate monthly inspection and cleaning, if required, to remove silt from the sediment basin and from any check dams. The Quarry floor sump and internal channels should also be inspected and cleaned if required to remove silt during dry weather periods when the water is drawn down.

6.0 SUMMARY

1. The quarry development proposes an extraction area of 70.4 ha of the 132.7 ha licenced area. It will retain site natural lands to protect the alvar and provide a wildlife corridor.
2. The Claybank Climate Station is within the same isohyetal area and 6.7 km from site. It's average annual precipitation of 814 mm was utilized to estimate site conditions.
3. The Southern Ontario Mean Annual Actual Evapotranspiration isolines were interpolated for the site location. The estimated site Annual Evapotranspiration was 521 mm.
4. The Hydrogeological Investigation found the new quarry floor at 125 masl to be 5 m above the significant water bearing zone in the confined aquifer.
5. The annual quarry Water Balance is summarized as follows:

Precipitation	-	814 mm/yr
Evapotranspiration	-	<u>521 mm/yr</u>
Water Surplus	-	293 mm/yr
Infiltration	-	146.5 mm/yr
Runoff	-	146.5 mm/yr

6. An Annual Water Surplus of 293 mm/yr and the Quarry Expansion Drainage Area of 91.6 ha were used to estimate the ultimate annual de-watering volume of 268,388 m³.
7. The Miller Braeside Quarry 2006 Water Taking Record mistakenly listed the submersible pump discharge size at 4" and capacity at 2,160 LPM rather than 3" and 492 LPM, respectively; the 8" pump rate of 8,550 LPM was found to be 9 % lower than the April de-watered volume showing general agreement.
8. The original 3" Flygt Submersible Pump (492 Lpm) and 8" Portable Trash Pump (8,550 Lpm) have been replaced with one 6" Berkeley Submersible Turbine 8T-550 10Hp Pump (2,176 Lpm) for de-watering operations.

9. The previous summertime pump rate was calculated to be 492 Lpm. It was multiplied by 3 or the ratio of increased drainage area to estimate the ultimate summertime pump rate of 1,476 Lpm. Thermal impacts were assessed at the new pump rate of 2,176 Lpm to be conservative (section 5.4.6).
10. Existing ditch and culvert capacities were found to be sufficient when compared to runoff associated with the ultimate springtime pump rate of 3,123 Lpm or 0.052 m³/s (section 4.4).
11. The Aquatic Baseflow Method specifies threshold flow greater than the August median or 64 Lps to preserve the aquatic ecosystem. It was within 3% of the average value for the three methods used to calculate threshold flow. Therefore, the Aquatic Baseflow method was utilized to estimate the Threshold flow for Ryan Creek .
12. The Maximum Thermal Impact on Ryan Creek due to ultimate de-watering operations is expected to occur in August. It is calculated to result in an estimated water temperature of 20.6 °C or 1.4 °C below 22 °C the maximum annual water temperature threshold.
13. The Ontario Ministry of Natural Resources Pembroke District Office has no record of any fish kills on Ryan or Dochart Creeks associated with the Braeside Quarry de-watering operation. The site has been operated as a quarry since the early 1970's and any problems should have been identified if they existed over the last 35 years.
14. Ryan Creek's morphological characteristics define it as a C5 stream type using the Rosgen Stream Classification System. The Ryan Creek reach at the Carmichael Sideroad crossing appears to be a marginal cold water habitat due to clay substrate, minimal in-stream cover and highly turbid waters.
15. Mr. Bernie Muncaster of Muncaster Environmental Planning Inc., Principal and Biologist, was consulted. He reviewed and approved monitoring and contingency plans prior to finalizing the report.

16. Infrequent roadway flooding of Usborne Street east of Campbell Drive due to culvert blockage with ice and snow has been documented by County of Renfrew and the Township of McNab/Braeside.
17. April 19, 2007 roadway flooding of Campbell Drive and Carmichael Sideroad was identified by Gorrell Resource Investigations during de-watering operations with the now abandoned 8" high capacity pump.

7.0 CONCLUSIONS

1. The deep bedrock aquifer would have a negligible impact on de-watering operations.
2. The quarry expansion will result in a negligible reduction in the drainage area (runoff and base flow) of the Local Marsh or Swamp Land, Unnamed Drain, Ottawa River and Ryan Creek.
3. The ultimate quarry de-watering operations will not result in harmful alteration or destruction of fish and aquatic habitat.
4. The ultimate off site discharge from de-watering operations will not result in local or County road flooding. Quarry staff should provide inspection and maintenance to keep the 450 mm CSP flowing during snow and ice pack conditions.

8.0 RECOMMENDATIONS

1. Verify total annual pumped volume for 2006 after Environment Canada publishes the complete monthly climate data report for 2006, to confirm estimated water surplus.
2. Implement the Sediment and Control Measures Plan for the quarry de-watering system (section 5.5.1).
3. Implement the Monitoring Plan as per section 5.4.9 to measure the flow rate and water temperature of Ryan Creek and de-watering discharge on a biweekly basis from July 1 to September 15 to confirm compliance with the Brook Trout maximum annual water temperature objective of 22 °C.

4. Install a ball valve on the pump discharge line behind the flow meter to facilitate reducing pump capacity.
5. Monitoring events in non compliance with the aquatic ecosystem objective (Item 3) would trigger Contingency Measures (section 5.4.10).
6. Install three (3) evenly spaced riprap check dams within the outlet channel to decrease potential erosion and siltation from leaving the site.
7. The Industrial Sewage Works Number 6988-6VZJFB should be revised to incorporate the proposed surface water monitoring and contingency plans, when the quarry expansion has been approved.
8. Limit de-watering operations in July, August and September to 2,160 Lpm (New 10 hp Berkeley 8T-550 Submersible Turbine Pump) to minimize any potential impacts on Ryan Creek fisheries and aquatic habitat.
9. Inspect and maintain the 450 mm CSP culvert crossing Usborne Street before pumping commences in April, to ensure that no blockage of snow and ice exists during any springtime de-watering operation mitigating any potential roadway flooding.
10. Maintain the existing heavily treed area between the sediment basin and the Usborne Street outlet for protection against thermal enhancement.

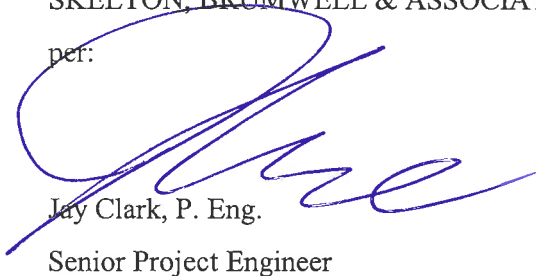
9.0 QUALIFICATIONS AND EXPERIENCE

The Aggregate Resources Provincial Standards for Category 2 Application, 2.2.10 requires that each report state the qualifications and experience of the individual that prepared the report. The Hydrological Investigation was prepared by Jay Clark, P. Eng. of Skelton Brumwell & Associates Inc. Mr. Clark has provided Expert Testimony with regard to Hydrological Investigations for numerous Pit and Quarry Licence Applications at Ontario Municipal Board Hearings. The curriculum vitae for Jay Clark, P. Eng. is enclosed in Appendix F.

All of which is respectfully submitted,

SKELTON, BRUMWELL & ASSOCIATES INC.

per:



Jay Clark, P. Eng.
Senior Project Engineer



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APPENDIX A

Hydrologic Cycle Component Values

Ontario Isohyetal Map - 2 Year 1 Hour Rainfall (mm)

**Canadian Climate Normals and Yearly Data Reports 1971 to 2000
- Claybank, Ontario
- Ottawa MacDonald-Cartier Int'l A, Ontario**

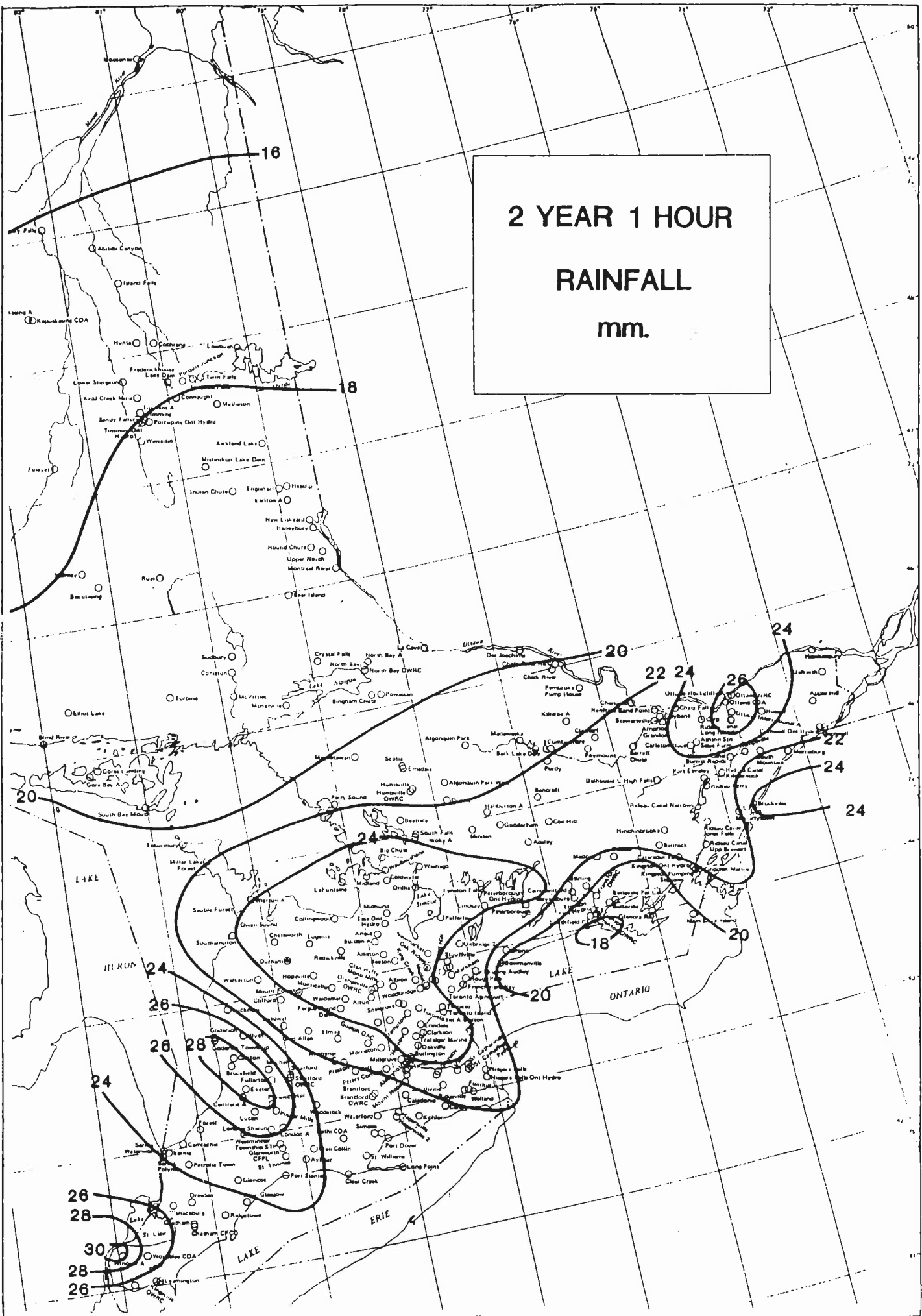
Monthly Climate Data Report 2006 - Ottawa Int'l A, Ontario

Southern Ontario Mean Annual Actual Evapotranspiration Isoline Map (in)

Table 3.1: Hydrologic Cycle Component Values

	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo-transpiration mm	Runoff mm	Infiltration* mm																								
Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)																														
Fine Sand	50	A	940	515	149	276																								
Fine Sandy Loam	75	B	940	525	187	228																								
Silt Loam	125	C	940	536	222	182																								
Clay Loam	100	CD	940	531	245	164																								
Clay	75	D	940	525	270	145																								
Moderately Rooted Crops (corn and cereal grains)																														
Fine Sand	75	A	940	525	125	291																								
Fine Sandy Loam	150	B	940	539	160	241																								
Silt Loam	200	C	940	543	199	199																								
Clay Loam	200	CD	940	543	218	179																								
Clay	150	D	940	539	241	160																								
Pasture and Shrubs																														
Fine Sand	100	A	940	531	102	307																								
Fine Sandy Loam	150	B	940	539	140	261																								
Silt Loam	250	C	940	546	177	217																								
Clay Loam	250	CD	940	546	197	197																								
Clay	200	D	940	543	218	179																								
Mature Forests																														
Fine Sand	250	A	940	546	79	315																								
Fine Sandy Loam	300	B	940	548	118	274																								
Silt Loam	400	C	940	550	156	234																								
Clay Loam	400	CD	940	550	176	215																								
Clay	350	D	940	549	196	196																								
<p>Notes: Hydrologic Soil Group A represents soils with low runoff potential and Soil Group D represents soils with high runoff potential. The evapotranspiration values are for mature vegetation. Streamflow is composed of baseflow and runoff.</p> <p><i>* This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.</i></p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top;"><u>Topography</u></td> <td>Flat Land, average slope < 0.6 m/km</td> <td style="text-align: right;">0.3</td> </tr> <tr> <td></td> <td>Rolling Land, average slope 2.8 m to 3.8 m/km</td> <td style="text-align: right;">0.2</td> </tr> <tr> <td></td> <td>Hilly Land, average slope 28 m to 47 m/km</td> <td style="text-align: right;">0.1</td> </tr> <tr> <td style="vertical-align: top;"><u>Soils</u></td> <td>Tight impervious clay</td> <td style="text-align: right;">0.1</td> </tr> <tr> <td></td> <td>Medium combinations of clay and loam</td> <td style="text-align: right;">0.2</td> </tr> <tr> <td></td> <td>Open Sandy loam</td> <td style="text-align: right;">0.4</td> </tr> <tr> <td style="vertical-align: top;"><u>Cover</u></td> <td>Cultivated Land</td> <td style="text-align: right;">0.1</td> </tr> <tr> <td></td> <td>Woodland</td> <td style="text-align: right;">0.2</td> </tr> </table>							<u>Topography</u>	Flat Land, average slope < 0.6 m/km	0.3		Rolling Land, average slope 2.8 m to 3.8 m/km	0.2		Hilly Land, average slope 28 m to 47 m/km	0.1	<u>Soils</u>	Tight impervious clay	0.1		Medium combinations of clay and loam	0.2		Open Sandy loam	0.4	<u>Cover</u>	Cultivated Land	0.1		Woodland	0.2
<u>Topography</u>	Flat Land, average slope < 0.6 m/km	0.3																												
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<u>Cover</u>	Cultivated Land	0.1																												
	Woodland	0.2																												

2 YEAR 1 HOUR
RAINFALL
mm.



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The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

[NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.]

**CLAYBANK
ONTARIO****Latitude:** 45° 25' N**Longitude:** 76° 24' W**Elevation:** 106.70 m**Climate ID:** 6101555**WMO ID:****TC ID:**

Precipitation:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Rainfall (mm)	11.3	12.6	30.6	53.2	72.3	75	68.9	84.5	68.8	70.1	47.4	20.4	614.9	C
Snowfall (cm)	43.8	44.1	32.2	5.5	0.3	0	0	0	0	2.4	17.4	53.3	198.9	C
Precipitation (mm)	55.1	56.7	62.7	58.6	72.6	75	68.9	84.5	68.8	72.5	64.7	73.7	813.7	C
Extreme Daily Rainfall (mm)	22.5	33	42	39.1	45.7	49	60.2	74	55	59.5	43.2	31.5		
Date (yyyy/dd)	1993/04	1985/23	1980/21	1973/27	1976/19	1967/24	1986/25	1990/28	1989/22	1979/05	1972/08	1969/10		
Extreme Daily Snowfall (cm)	38.1	30	27.9	25.4	12.7	0	0	0	0	10.2	33	33		
Date (yyyy/dd)	1966/30	1984/28+	1962/12	1970/02	1963/10	1962/01+	1961/03+	1961/01+	1961/28+	1965/27+	1987/25	1973/20		
Extreme Daily Precipitation (mm)	38.1	33	42	39.1	45.7	49	60.2	74	55	59.5	43.2	33		
Date (yyyy/dd)	1966/30	1985/23	1980/21	1973/27	1976/19	1967/24	1986/25	1990/28	1989/22	1979/05	1972/08	1973/20		
Extreme Snow Depth (cm)	36	105	121	7	0	0	0	0	0	6	33	31		
Date (yyyy/dd)	1994/31	1993/28	1993/31	1990/12	1983/01+	1983/01+	1983/01+	1983/01+	1983/01+	1992/21	1987/25	1984/07		
Days with Rainfall:														
>= 0.2 mm	2.3	2	5.7	9.9	13	12.3	10.6	11.5	12.7	12.5	10	3.7	106.2	C
>= 5 mm	0.82	0.79	2	4	4.7	4.7	4.1	4.8	4.7	4.7	2.8	1.4	39.4	C
>= 10 mm	0.32	0.42	0.91	1.6	2.5	2.7	2.4	2.5	2.1	2.1	1.4	0.83	19.7	C
>= 25 mm	0	0.08	0.22	0.17	0.3	0.42	0.42	0.67	0.3	0.26	0.15	0	3	C
Days With Snowfall:														
>= 0.2 cm	10.7	8.7	6	1.5	0.09	0	0	0	0	0.65	3.6	10.2	41.4	C
>= 5 cm	3.5	3.5	2.8	0.42	0.04	0	0	0	0	0.17	1.3	4.3	15.9	C
>= 10 cm	1.1	1.2	0.96	0.13	0	0	0	0	0	0.09	0.55	1.7	5.6	C
>= 25 cm	0	0.17	0.04	0	0	0	0	0	0	0.05	0.17	0.43		C
Days with Precipitation:														
>= 0.2 mm	12.3	10.2	11	11.2	13	12.3	10.6	11.5	12.7	13	13	13.2	143.9	C
>= 5 mm	4.4	4.2	4.7	4.3	4.7	4.7	4.1	4.8	4.7	4.7	4.3	5.6	55.3	C
>= 10 mm	1.5	1.7	1.9	1.8	2.5	2.7	2.4	2.5	2.1	2.2	2	2.5	25.6	C
>= 25 mm	0	0.25	0.3	0.17	0.3	0.42	0.42	0.67	0.3	0.26	0.2	0.17	3.5	C

Important Notices

Created : 2002-06-21

Modified : 2004-02-25

Reviewed : 2004-02-25

Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.htmlThe Green Lane™,
Environment Canada's World Wide Web Site.**Canada**

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Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

OTTAWA MACDONALD-CARTIER INT'L A *
ONTARIO

Latitude: 45° 19' N

Longitude: 75° 40' W

Elevation: 114.00 m

Climate ID: 6106000

WMO ID: 71628

TC ID: YOW

* This station meets WMO standards for temperature and precipitation.

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-10.8	-8.7	-2.5	5.7	13.4	18.3	20.9	19.5	14.3	7.8	1	-7.1	6	A
Standard Deviation	2.9	2.7	2.4	1.9	1.9	1.3	1.1	1.1	1.3	1.5	1.7	3.2	0.8	A
Daily Maximum (°C)	-6.1	-4.1	2.2	10.8	19.1	23.8	26.5	24.9	19.5	12.5	4.8	-3	10.9	A
Daily Minimum (°C)	-15.3	-13.3	-7.1	0.6	7.7	12.7	15.4	14.1	9.1	3	-2.8	-11.1	1.1	A
Extreme Maximum (°C)	12	12.4	26.7	31.1	32.8	36.1	36.7	37.8	35	27.8	23.9	16.3		
Date (yyyy/dd)	1996/19	2000/27	1946/29	1990/27	1944/31+	1941/27	1955/21+	1944/11+	1953/04	1946/07	1938/06	1982/03		
Extreme Minimum (°C)	-35.6	-36.1	-30.6	-16.7	-5.6	-0.1	5	2.6	-3	-7.8	-21.7	-34.4		
Date (yyyy/dd)	1957/15	1943/15	1950/03	1954/04	1966/07	1980/09	1946/15	1986/29	1980/29	1939/18+	1940/29	1942/20		
Precipitation:														
Rainfall (mm)	25.2	17.6	36.3	60.5	78.4	85	90.6	87.1	85.3	74.9	59.8	31.3	732	A
Snowfall (cm)	55.2	46	39.8	11	0.6	0	0	0	0	4.1	21.9	57.2	235.7	A
Precipitation (mm)	70.2	58.9	73.9	72.4	79	85	90.6	87.1	85.3	79.4	80.1	81.5	943.5	A
Average Snow Depth (cm)	27	32	23	2	0	0	0	0	0	0	2	14	8	A
Median Snow Depth (cm)	27	32	23	1	0	0	0	0	0	0	1	13	8	A
Snow Depth at Month-end (cm)	30	30	7	0	0	0	0	0	0	0	5	24	8	A
Extreme Daily Rainfall (mm)	33.6	40.4	44.2	42.4	42.9	66.6	69.6	66.7	80	76	46.2	36.3		
Date (yyyy/dd)	1995/15	1997/21	1980/21	1956/15	1943/25	1995/03	1967/09	1981/05	1942/09	1995/06	2000/26	1941/24		
Extreme Daily Snowfall (cm)	38.6	39.6	40.6	29.8	15	0	0	0	1.5	29.2	28.2	30.4		
Date (yyyy/dd)	1966/30	1954/16	1947/02	1993/01	1963/10	1939/01+	1939/01+	1939/01+	1946/30	1988/22	1987/25	1977/21		
Extreme Daily Precipitation (mm)	34	40.4	44.2	42.4	42.9	66.6	69.6	66.7	80	76	46.2	43.7		
Date (yyyy/dd)	1992/14	1997/21	1980/21	1956/15	1943/25	1995/03	1967/09	1981/05	1942/09	1995/06	2000/26	1973/09		
Extreme Snow Depth (cm)	77	119	135	58	10	0	0	0	0	20	42	68		
Date (yyyy/dd)	1979/26	1971/24	1993/14+	1971/01	1963/11	1955/01+	1955/01+	1955/01+	1955/01+	1997/27	1995/29	1995/17		
Days with Maximum Temperature:														
<= 0 °C	23.5	20.2	11.1	0.83	0	0	0	0	0	0	6	19.6	81.3	A
> 0 °C	7.5	8	19.9	29.2	31	30	31	31	30	31	24	11.4	284	A
> 10 °C	0.07	0.13	3.3	15.5	29.5	30	31	31	29.5	20.1	5.3	0.4	195.8	A
> 20 °C	0	0	0.17	2.5	12.7	24	29.7	27.5	13.2	2.6	0.03	0	112.3	A
> 30 °C	0	0	0	0.03	0.93	2.5	4.6	2.8	0.47	0	0	0	11.3	A
> 35 °C	0	0	0	0	0	0.03	0.1	0.03	0	0	0	0	0.16	A
Days with Minimum Temperature:														
> 0 °C	0.8	0.9	4.2	16.2	30.3	30	31	31	29.5	22.3	8.7	1.1	206	A
<= 2 °C	30.8	27.9	29.7	19.1	2.5	0.07	0	0	1.5	13.6	26	30.8	182	A
<= 0 °C	30.2	27.4	26.8	13.8	0.7	0.03	0	0	0.47	8.7	21.3	29.9	159.2	A
< -2 °C	29.4	26.1	22.5	7.8	0.13	0	0	0	0.07	3.5	15.2	27.5	132.2	A
< -10 °C	23.2	19.1	9.5	0.47	0	0	0	0	0	0	2.4	16.4	71	A
< -20 °C	9	5.1	0.62	0	0	0	0	0	0	0	0	3.8	18.4	A
< -30 °C	0.4	0.03	0	0	0	0	0	0	0	0	0	0.07	0.5	A
Days with Rainfall:														
>= 0.2 mm	4.5	3.9	7.1	10.1	12.8	12.2	11.6	11.1	12.7	12.6	10.4	5.8	114.7	A



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Monthly Data Report for 2006

Notes on Data Quality:

OTTAWA MACDONALD-CARTIER INT'L A ONTARIO

Latitude: 45° 19' N **Longitude:** 75° 40' W **Elevation:** 114.00 m
Climate ID: 6106000 **WMO ID:** 71628 **TC ID:** YOW

Month	Monthly Data Report for 2006										
	Mean Max T °C	Mean Te °C	Mean Min T °C	Extr Max T °C	Extr Min T °C	Total R mm	Total Sn cm	Total Pre mm	Snow Grnd La cm	Dir of Max 10's De	Spd of Max km/h
Jan	-1.6	-5.7	-9.7	8.3	-21.3	52.2	75.5	106.4	28	26E	70E
Feb	-3.7	-7.7	-11.7	5.2	-21.3	36.2	41.2	63.0	17	28E	69E
Mar	3.0	-1.4	-5.8	23.0	-18.0	25.4	1.2	25.8	0	24E	67E
Apr	13.3	7.3	1.2	23.3	-7.7	63.8	3.0	65.4	0	28E	59E
May	19.7	14.4	9.1	30.4	-1.9	114.6	0.0	114.6	0	29B	59B
Jun	24.0	18.7	13.3	31.3	6.8S	112.6	0.0	112.6	0	23E	50E
Jul	27.8	22.2	16.6	33.0S	13.1S	100.8	0.0	100.8	0	31*	65*
Aug											
Sep	19.1	14.1	9.1	26.8S	0.8	154.8	0.0	154.8	0	26E	76E
Oct											
Nov											
Dec											
Sum						M	M	M			
Avg	M	M	M								
Xtrm				M	M					M	M

Legend

[empty] = No data available
 M = Missing
 E = Estimated
 B = More than one occurrence and estimated
 * = The value displayed is based on incomplete data
 S = More than one occurrence
 T = Trace

Navigation Options

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Created : 2002-06-21
 Modified : 2004-01-26
 Reviewed : 2004-01-26
 Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html

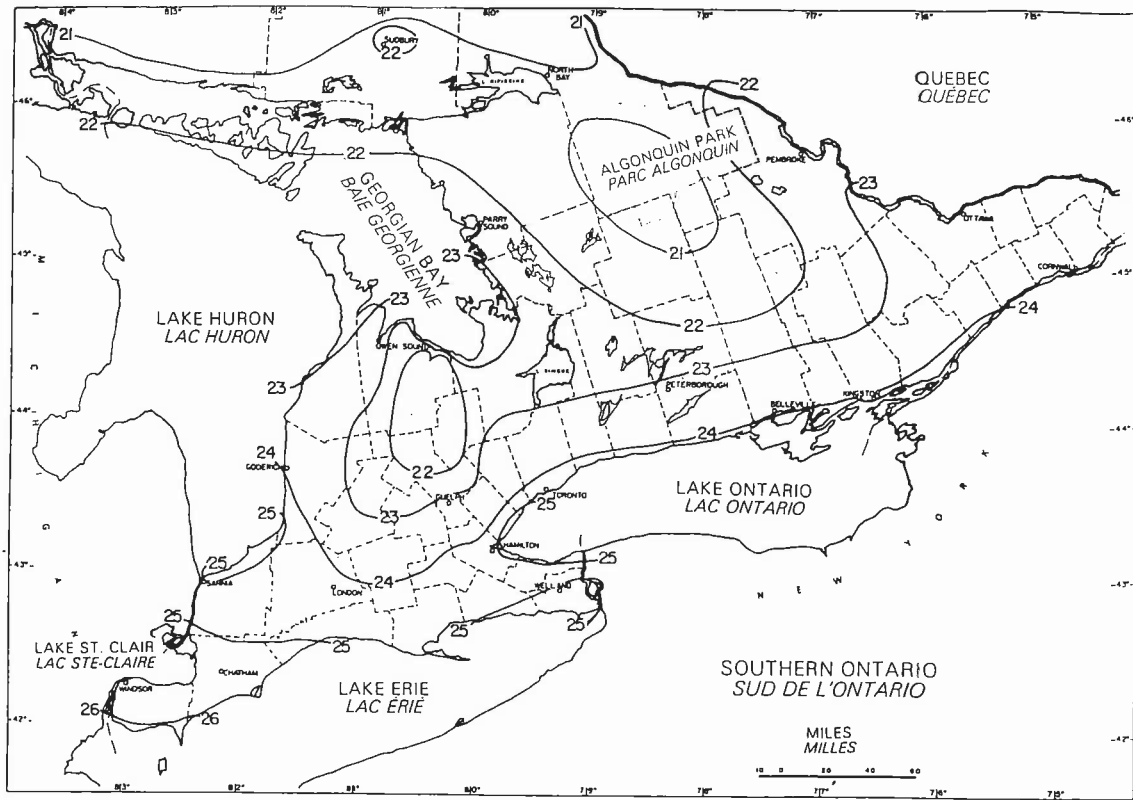


Figure 39

Mean annual potential evapotranspiration (inches)
Évapotranspiration potentielle annuelle moyenne (pouces)

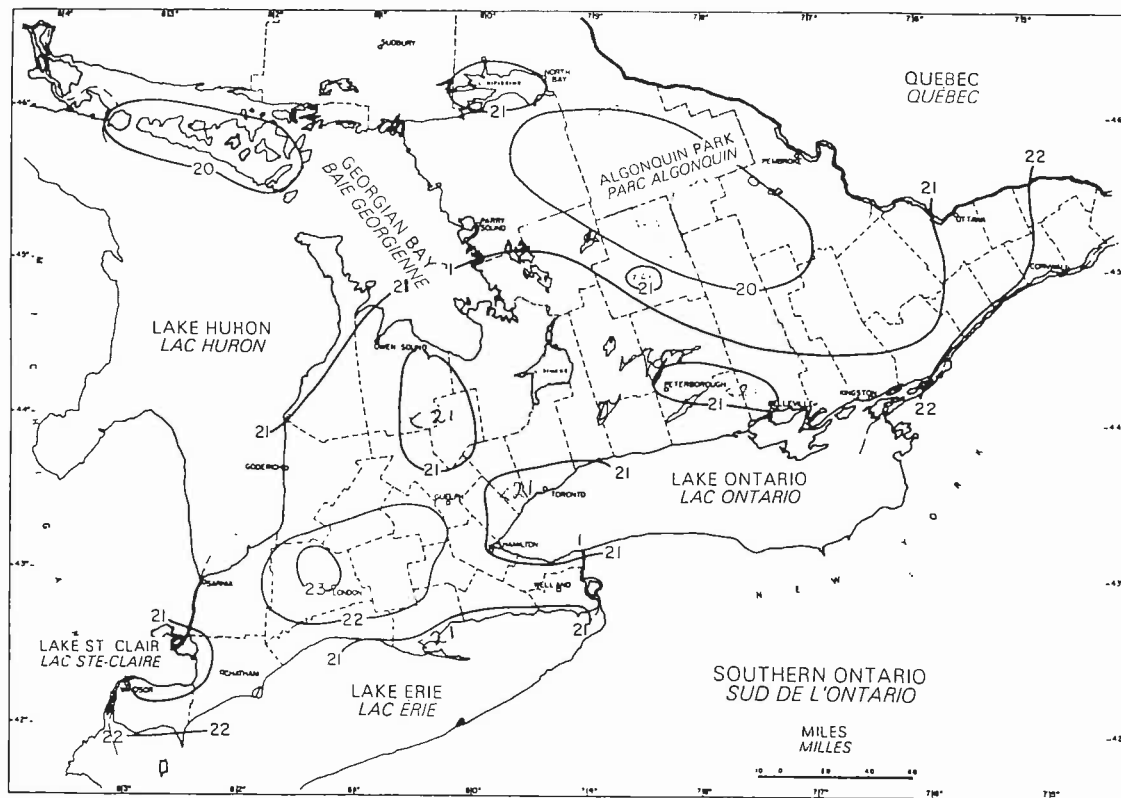


Figure 40

Mean annual actual evapotranspiration (inches) (4 inches storage)
Évapotranspiration réelle annuelle moyenne (pouces) (accumulation de 4 pouces)

APPENDIX B

Flygt ITT Industries, Submersible Pump 2066 Technical Specifications

Berkeley Pump Company, Submersible Turbine 8T-550 Performance Curve

Water Taking Records 2006 to August 2007

Amended Permit to Take Water 0035-6TBHMJ



Technical specification

Submersible pump B 2066, 60 Hz



Flygt



ITT Industries



BIBO 2066

Product

Submersible pump for dewatering building yards, draining water in flooded areas, and other similar applications. The pump can handle water containing relatively abrasive solids.

Denomination

Product code	2066.171
Installation	S
Impeller characteristics	MT, HT

Process data

Liquid temperature	max +40 °C
Liquid temperature-optional	max +70 °C max +90 °C
Depth of immersion	max 20 m
The pH of the pumped liquid	pH 5 - 8
Liquid density	max 1100 kg/m ³
Strainer hole size	7 mm x 21 mm

Motor data

Frequency	60 Hz
Insulation class	H (+180 °C)
Voltage variation	
- continuously running	max ± 5%
- intermittent running	max ± 10%
Voltage imbalance between phases	max 2%
No. of starts/hour	max 30

Cable

Direct-on-line SUBCAB®

4G1,5 mm ²
4G1,5+2x1,5 mm ²
4G2,5 mm ²
4G2,5+2x1,5 mm ²

Monitoring equipment

Thermal contacts opening temperature	125 °C
--------------------------------------	--------

Material

Impeller	Alloyed white cast iron
Wear parts	Nitrile rubber
Stator housing	Aluminium
Strainer	Steel
Shaft	Stainless steel
O-rings	Nitrile rubber

Mechanical face seals

Alternative	Inner seal	Outer seal
1	Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide	Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide

Surface Treatment

The pump is sprayed with one layer of aluminium paint. The top is sprayed with blue paint.

Weight

See dimensional drawing.

Option

Polyurethane-lined wear parts	POLY-LIFE®
Impeller (MT)	Stainless steel
Warm liquid version on request	
Starters	
Slim line version	
Slim line version with coupling B	
Plug contact 3-phase	
Other cables	
Zinc anodes	
Tandem connection	

Accessories

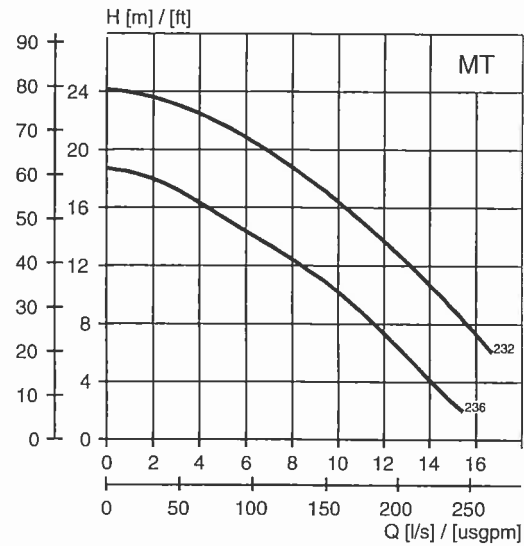
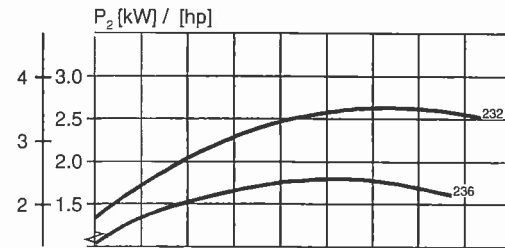
Adapters, hose connections and other mechanical accessories.

Electrical accessories such as pump controller, control panels, starters, monitoring relays, cables.

See separate booklet or www.flygt.com, for further information

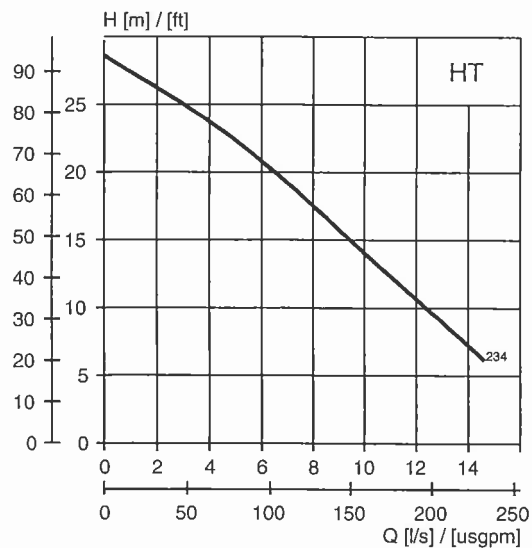
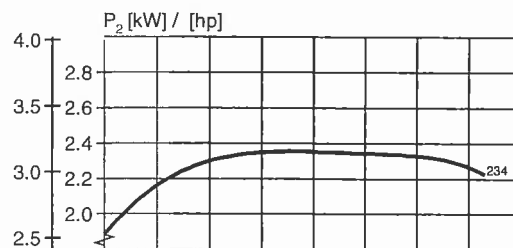
MT-Motor rating and performance curve

Curve/Impeller No	Rated Power, kW	Rated current, A	Starting current, A	Power factor $\cos \varphi$	Ex proof version available
460 V, 60 Hz, 3 ~, 3425 r/min					
232	2,7	4,7	26,0	0,92	No
236	2,7	4,7	26,0	0,92	No
230 V, 60 Hz, 1 ~, 3490 r/min					
236	1,8	9,8	33,0	0,99	No



HT-Motor rating and performance curve

Curve/Impeller No	Rated power, kW	Rated current, A	Starting current, A	Power factor $\cos \varphi$	Ex proof version available
460 V, 60 Hz, 3 ~, 3425 r/min					
234	2,7	4,7	26,0	0,92	No

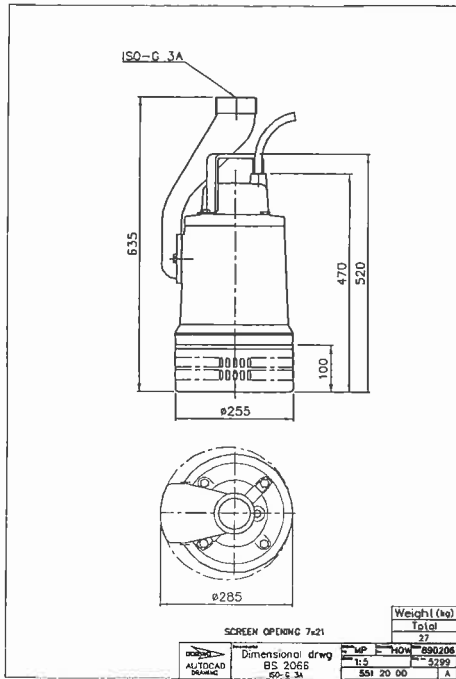


Dimensional drawing

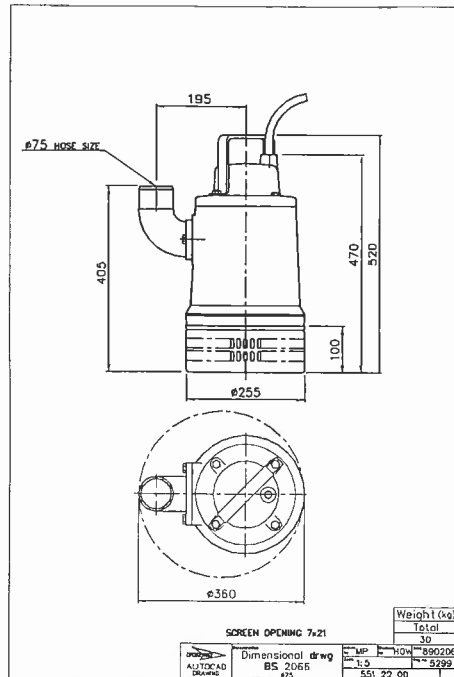
All drawings are available as Acrobat documents (.pdf) and AutoCad drawings (.dwg). Download the drawings from www.flygt.com or contact your ITT Flygt representative for more information.

All dimensions are in mm.

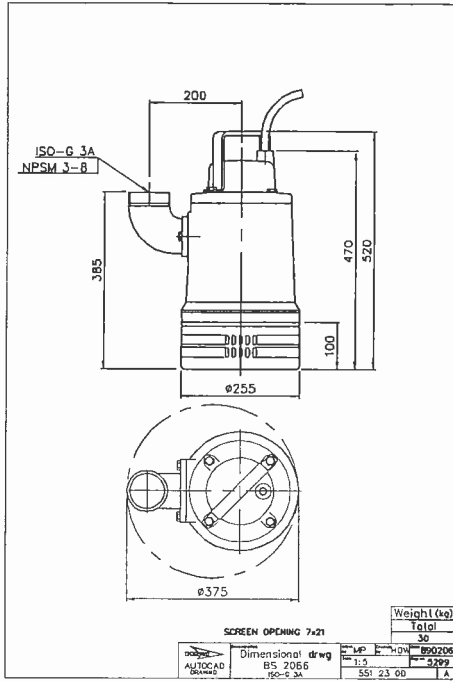
MT/HT, S-installation



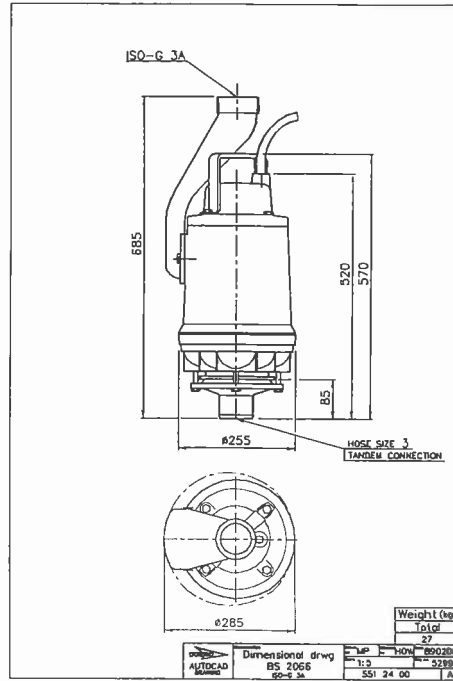
MT/HT, S-installation



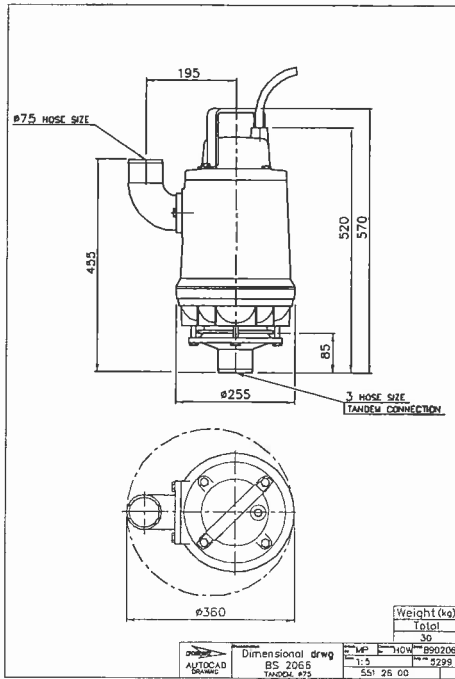
MT/HT, S-installation



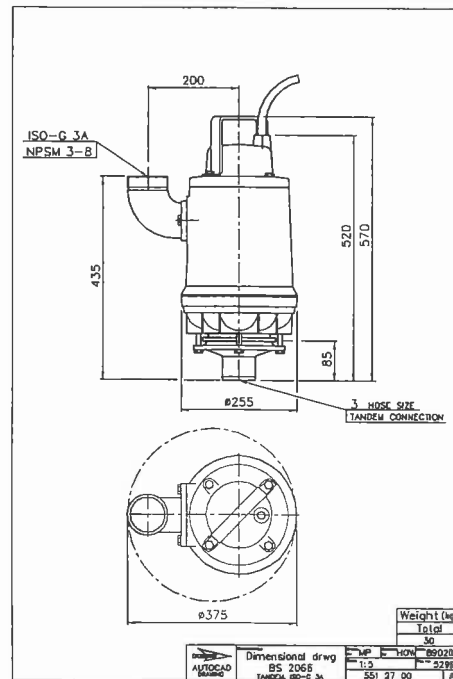
MT/HT, S-installation



MT/HT, S-installation



MT/HT, S-installation

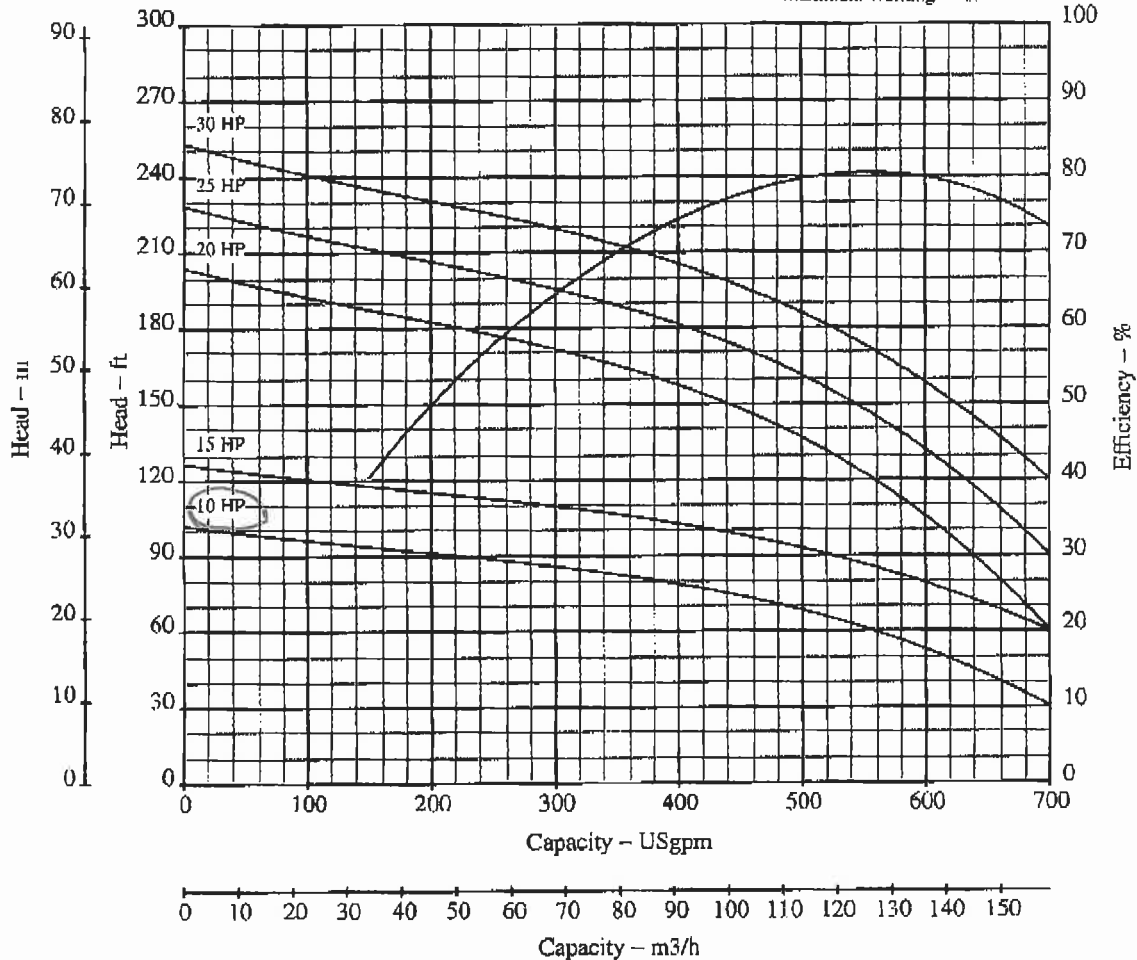




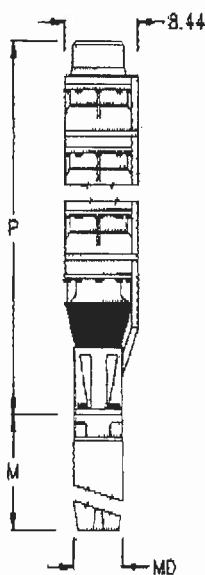
**SUBMERSIBLE
TURBINE**

8T-550

Nominal RPM: 3450
Based on Fresh Water @ 68 F.
Maximum Working Pressure: 485 PSI



OUTLINE DIMENSIONS / WEIGHTS



HP	stages	Motor size	P length	M* length	MD* dia.	Mtr. wt.	Pump wt.
10	1	6"	22.77	29.80	5.51	127	105
15	1	6"	22.77	30.40	5.51	130	105
20	2	6"	29.27	35.50	5.51	160	150
25	2	6"	29.27	47.20	5.51	224	150
30	2	6"	29.27	49.50	5.51	236	150

Note: dimensions = inches; weight = U.S. lbs.

M* Maximum length (Pentair Motor)
MD* Motor diameter (Pentair Motor)

SPECIFICATIONS

Minimum Well I.D.	10.0 Inches
Minimum Submergence @ BEP (above inlet)	10.0 Feet
Capacity Range	250 - 660 GPM
Discharge	6" FNPT

See manufacturer's data for motor cooling requirements

SUPERSEDES

All Previous

Date 04/01/05

Section **8T**

Page 1.01

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 2,160 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES PUMPED
January 1, 2006	Dewatering/Fills Water Trucks		0.00
January 2, 2006			0.00
January 3, 2006			0.00
January 4, 2006			0.00
January 5, 2006			0.00
January 6, 2006			0.00
January 7, 2006			0.00
January 8, 2006			0.00
January 9, 2006			0.00
January 10, 2006			0.00
January 11, 2006			0.00
January 12, 2006			0.00
January 13, 2006			0.00
January 14, 2006			0.00
January 15, 2006			0.00
January 16, 2006			0.00
January 17, 2006			0.00
January 18, 2006			0.00
January 19, 2006			0.00
January 20, 2006			0.00
January 21, 2006			0.00
January 22, 2006			0.00
January 23, 2006			0.00
January 24, 2006			0.00
January 25, 2006			0.00
January 26, 2006			0.00
January 27, 2006			0.00
January 28, 2006			0.00
January 29, 2006			0.00
January 30, 2006			0.00
January 31, 2006			0.00
TOTAL			0.00

Smiths Construction, Division of Miller Paving
Braeside Quarry

WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8,550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES	TOTAL VOLUME
January 1, 2006	Discharge		0.00	0.00
January 2, 2006			0.00	0.00
January 3, 2006			0.00	0.00
January 4, 2006			0.00	0.00
January 5, 2006			0.00	0.00
January 6, 2006			0.00	0.00
January 7, 2006			0.00	0.00
January 8, 2006			0.00	0.00
January 9, 2006			0.00	0.00
January 10, 2006			0.00	0.00
January 11, 2006			0.00	0.00
January 12, 2006			0.00	0.00
January 13, 2006			0.00	0.00
January 14, 2006			0.00	0.00
January 15, 2006			0.00	0.00
January 16, 2006			0.00	0.00
January 17, 2006			0.00	0.00
January 18, 2006			0.00	0.00
January 19, 2006			0.00	0.00
January 20, 2006			0.00	0.00
January 21, 2006			0.00	0.00
January 22, 2006			0.00	0.00
January 23, 2006			0.00	0.00
January 24, 2006			0.00	0.00
January 25, 2006			0.00	0.00
January 26, 2006			0.00	0.00
January 27, 2006			0.00	0.00
January 28, 2006			0.00	0.00
January 29, 2006			0.00	0.00
January 30, 2006			0.00	0.00
January 31, 2006			0.00	0.00
TOTAL			0.00	0.00
			MONTH TOTAL	

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 2.160 LIT/MIN OR 129.600 LIT/HOUR	TOTAL DAILY LITRES PUMPED
March 1, 2006	Dewatering/Fills Water Trucks		0.00
March 2, 2006			0.00
March 3, 2006			0.00
March 4, 2006			0.00
March 5, 2006			0.00
March 6, 2006			0.00
March 7, 2006			0.00
March 8, 2006			0.00
March 9, 2006			0.00
March 10, 2006			0.00
March 11, 2006			0.00
March 12, 2006			0.00
March 13, 2006			0.00
March 14, 2006			0.00
March 15, 2006			0.00
March 16, 2006			0.00
March 17, 2006			0.00
March 18, 2006			0.00
March 19, 2006			0.00
March 20, 2006			0.00
March 21, 2006			0.00
March 22, 2006			0.00
March 23, 2006			0.00
March 24, 2006			0.00
March 25, 2006			0.00
March 26, 2006			0.00
March 27, 2006			0.00
March 28, 2006			0.00
March 29, 2006			0.00
March 30, 2006			0.00
March 31, 2006			0.00
TOTAL			0.00

Smiths Construction, Division of Miller Paving
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WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8,550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES	TOTAL VOLUME
March 1, 2006	Discharge		0.00	0.00
March 2, 2006			0.00	0.00
March 3, 2006			0.00	0.00
March 4, 2006			0.00	0.00
March 5, 2006			0.00	0.00
March 6, 2006			0.00	0.00
March 7, 2006			0.00	0.00
March 8, 2006			0.00	0.00
March 9, 2006			0.00	0.00
March 10, 2006			0.00	0.00
March 11, 2006			0.00	0.00
March 12, 2006			0.00	0.00
March 13, 2006			0.00	0.00
March 14, 2006			0.00	0.00
March 15, 2006			0.00	0.00
March 16, 2006			0.00	0.00
March 17, 2006			0.00	0.00
March 18, 2006			0.00	0.00
March 19, 2006			0.00	0.00
March 20, 2006			0.00	0.00
March 21, 2006			0.00	0.00
March 22, 2006			0.00	0.00
March 23, 2006			0.00	0.00
March 24, 2006			0.00	0.00
March 25, 2006			0.00	0.00
March 26, 2006			0.00	0.00
March 27, 2006			0.00	0.00
March 28, 2006			0.00	0.00
March 29, 2006			0.00	0.00
March 30, 2006			0.00	0.00
March 31, 2006			0.00	0.00
TOTAL				0.00
				MONTH TOTAL
				0.00

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 2,460 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES
April 1, 2006	Dewatering/Fills Water Trucks		0.00
April 2, 2006			0.00
April 3, 2006			0.00
April 4, 2006			0.00
April 5, 2006			0.00
April 6, 2006			0.00
April 7, 2006			0.00
April 8, 2006			0.00
April 9, 2006			0.00
April 10, 2006			0.00
April 11, 2006			0.00
April 12, 2006			0.00
April 13, 2006			0.00
April 14, 2006			0.00
April 15, 2006			0.00
April 16, 2006			0.00
April 17, 2006		18	2,332,800.00
April 18, 2006		24	3,110,400.00
April 19, 2006		17.5	2,268,000.00
April 20, 2006			0.00
April 21, 2006			0.00
April 22, 2006			0.00
April 23, 2006			0.00
April 24, 2006			0.00
April 25, 2006			0.00
April 26, 2006		6.5	842,400.00
April 27, 2006		17.5	2,268,000.00
April 28, 2006			0.00
April 29, 2006			0.00
April 30, 2006			0.00
		83.5 TOTAL	10,821,600.00

2,460,920

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WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8,550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES PUMPED	TOTAL VOLUME
April 1, 2006	Discharge		0.00	0.00
April 2, 2006			0.00	0.00
April 3, 2006		16	8,208,000.00	8,208,000.00
April 4, 2006		24	12,312,000.00	12,312,000.00
April 5, 2006		24	12,312,000.00	12,312,000.00
April 6, 2006		24	12,312,000.00	12,312,000.00
April 7, 2006		16	8,208,000.00	8,208,000.00
April 8, 2006			0.00	0.00
April 9, 2006			0.00	0.00
April 10, 2006		10	5,130,000.00	5,130,000.00
April 11, 2006		17.5	8,977,500.00	8,977,500.00
April 12, 2006			0.00	0.00
April 13, 2006			0.00	0.00
April 14, 2006			0.00	0.00
April 15, 2006			0.00	0.00
April 16, 2006			0.00	0.00
April 17, 2006			0.00	0.00
April 18, 2006			0.00	0.00
April 19, 2006			0.00	0.00
April 20, 2006			0.00	0.00
April 21, 2006			0.00	0.00
April 22, 2006			0.00	0.00
April 23, 2006			0.00	0.00
April 24, 2006			0.00	0.00
April 25, 2006			0.00	0.00
April 26, 2006			0.00	0.00
April 27, 2006			0.00	0.00
April 28, 2006			0.00	0.00
April 29, 2006			0.00	0.00
April 30, 2006			0.00	0.00
TOTAL			121.5	67,459,500.00
				MONTH TOTAL
				79,281,100.00

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 49 2460 LIT/Min or 129,600 LIT/Hr	TOTAL DAILY LITRES PUMPED	DATE
May 1, 2006	Dewatering/Fills Water Trucks		0.00	May 1, 2006
May 2, 2006			0.00	May 2, 2006
May 3, 2006			0.00	May 3, 2006
May 4, 2006		11.5	1,490,400.00	May 4, 2006
May 5, 2006	2 Loads (15,750 Lit/Load)		0.00	May 5, 2006
May 6, 2006			0.00	May 6, 2006
May 7, 2006			0.00	May 7, 2006
May 8, 2006	1 Load (15,750 Lit/Load)		0.00	May 8, 2006
May 9, 2006	2 Loads (15,750 Lit/Load)		0.00	May 9, 2006
May 10, 2006	1.5 Loads (15,750 Lit/Load)		0.00	May 10, 2006
May 11, 2006	.5 Load (7,875 Litres)		0.00	May 11, 2006
May 12, 2006	2.5 Loads (23,625 Litres)		0.00	May 12, 2006
May 13, 2006			0.00	May 13, 2006
May 14, 2006			0.00	May 14, 2006
May 15, 2006	3 Loads (15,750 Lit/Load)	18	2,332,800.00	May 15, 2006
May 16, 2006	2 Loads (15,750 Lit/Load)	17.5	2,268,000.00	May 16, 2006
May 17, 2006			0.00	May 17, 2006
May 18, 2006		17.5	2,268,000.00	May 18, 2006
May 19, 2006		18.5	2,397,600.00	May 19, 2006
May 20, 2006			0.00	May 20, 2006
May 21, 2006			0.00	May 21, 2006
May 22, 2006			0.00	May 22, 2006
May 23, 2006	1 Load (15,750 Lit/Load)		0.00	May 23, 2006
May 24, 2006	1 Load (15,750 Lit/Load)		0.00	May 24, 2006
May 25, 2006			0.00	May 25, 2006
May 26, 2006			0.00	May 26, 2006
May 27, 2006			0.00	May 27, 2006
May 28, 2006			0.00	May 28, 2006
May 29, 2006	2 Loads (15,750 Lit/Load)		0.00	May 29, 2006
May 30, 2006			0.00	May 30, 2006
May 31, 2006			0.00	May 31, 2006
83.0 TOTAL			10,756,800.00	

2,450,160

MAN 18/

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 129.600 LIT/HOUR	TOTAL DAILY LITRES	DATE
June 1, 2006	Dewatering/Fills Water Trucks	1 Load (15,750 Lit/Load)	0.00	June 1, 2006
June 2, 2006			0.00	June 2, 2006
June 3, 2006			0.00	June 3, 2006
June 4, 2006			0.00	June 4, 2006
June 5, 2006	3 Loads (15,750 Lit/Load)	18.5	2,397,600.00	June 5, 2006
June 6, 2006		24	3,110,400.00	June 6, 2006
June 7, 2006	2 Load (15,750 Lit/Load)	24	3,110,400.00	June 7, 2006
June 8, 2006		24	3,110,400.00	June 8, 2006
June 9, 2006	1 Load (15,750 Lit/Load)	17.5	2,268,000.00	June 9, 2006
June 10, 2006			0.00	June 10, 2006
June 11, 2006			0.00	June 11, 2006
June 12, 2006			0.00	June 12, 2006
June 13, 2006			0.00	June 13, 2006
June 14, 2006			0.00	June 14, 2006
June 15, 2006	1 Load (15,750 Lit/Load)		0.00	June 15, 2006
June 16, 2006			0.00	June 16, 2006
June 17, 2006			0.00	June 17, 2006
June 18, 2006			0.00	June 18, 2006
June 19, 2006		18.5	2,397,600.00	June 19, 2006
June 20, 2006	2 Load (15,750 Lit/Load)	18	2,332,800.00	June 20, 2006
June 21, 2006	6 Loads (15,750 Lit/Load)		0.00	June 21, 2006
June 22, 2006		17	2,203,200.00	June 22, 2006
June 23, 2006		24	3,110,400.00	June 23, 2006
June 24, 2006		24	3,110,400.00	June 24, 2006
June 25, 2006		24	3,110,400.00	June 25, 2006
June 26, 2006	4 Loads (15,750 Lit/Load)	24	3,110,400.00	June 26, 2006
June 27, 2006	1 Load (15,750 Lit/Load)	24	3,110,400.00	June 27, 2006
June 28, 2006	1 Load (15,750 Lit/Load)	24	3,110,400.00	June 28, 2006
June 29, 2006		24	3,110,400.00	June 29, 2006
June 30, 2006		15	1,944,000.00	June 30, 2006
			0.00	
			44,647,200.00	

344.5 TOTAL

10,169,640

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WATER TAKING RECORDS 2006

8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8,550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES PUMPED	TOTAL VOLUME	RAIN (mm)
Discharge		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	2,397,600.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	2,268,000.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	0.00	
		0.00	2,397,600.00	
		0.00	2,332,800.00	
		0.00	0.00	
		0.00	2,203,200.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	3,110,400.00	
		0.00	1,944,000.00	
		0.00	0.00	
		0.00	44,647,200.00	
TOTAL			MONTH TOTAL	RAIN TOTAL (mm)
				0.00

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 49.2 2460 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES
July 1, 2006	Dewatering/Fills Water Trucks		0.00
July 2, 2006			0.00
July 3, 2006			0.00
July 4, 2006		18.5	2,397,600.00
July 5, 2006		24	3,110,400.00
July 6, 2006		24	3,110,400.00
July 7, 2006		24	3,110,400.00
July 8, 2006		24	3,110,400.00
July 9, 2006		24	3,110,400.00
July 10, 2006		24	3,110,400.00
July 11, 2006		24	3,110,400.00
July 12, 2006		24	3,110,400.00
July 13, 2006		24	3,110,400.00
July 14, 2006		16	2,073,600.00
July 15, 2006			0.00
July 16, 2006			0.00
July 17, 2006			0.00
July 18, 2006		17.5	2,268,000.00
July 19, 2006	4 Loads (15,750 Lit/Load)	15	1,944,000.00
July 20, 2006			0.00
July 21, 2006			0.00
July 22, 2006			0.00
July 23, 2006			0.00
July 24, 2006			0.00
July 25, 2006			0.00
July 26, 2006			0.00
July 27, 2006	1 Load (15,750 Lit/Load)	16	2,073,600.00
July 28, 2006		24	3,110,400.00
July 29, 2006		24	3,110,400.00
July 30, 2006		24	3,110,400.00
July 31, 2006		6.5	842,400.00
		377.5 TOTAL	48,924,000.00

11,143,800

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WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8,550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES	TOTAL VOLUME
July 1, 2006	Discharge		0.00	0.00
July 2, 2006			0.00	0.00
July 3, 2006			0.00	0.00
July 4, 2006			0.00	2,397,600.00
July 5, 2006			0.00	3,110,400.00
July 6, 2006			0.00	3,110,400.00
July 7, 2006			0.00	3,110,400.00
July 8, 2006			0.00	3,110,400.00
July 9, 2006			0.00	3,110,400.00
July 10, 2006			0.00	3,110,400.00
July 11, 2006			0.00	3,110,400.00
July 12, 2006			0.00	3,110,400.00
July 13, 2006			0.00	3,110,400.00
July 14, 2006			0.00	2,073,600.00
July 15, 2006			0.00	0.00
July 16, 2006			0.00	0.00
July 17, 2006			0.00	0.00
July 18, 2006			0.00	2,268,000.00
July 19, 2006			0.00	1,944,000.00
July 20, 2006			0.00	0.00
July 21, 2006			0.00	0.00
July 22, 2006			0.00	0.00
July 23, 2006			0.00	0.00
July 24, 2006			0.00	0.00
July 25, 2006			0.00	0.00
July 26, 2006			0.00	0.00
July 27, 2006			0.00	2,073,600.00
July 28, 2006			0.00	3,110,400.00
July 29, 2006			0.00	3,110,400.00
July 30, 2006			0.00	3,110,400.00
July 31, 2006			0.00	842,400.00
TOTAL				48,924,000.00
				MONTH TOTAL

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 419 3,160 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES	DATE
August 1, 2006	Dewatering/Fills Water Trucks		0.00	August 1, 2006
August 2, 2006			0.00	August 2, 2006
August 3, 2006		7	907,200.00	August 3, 2006
August 4, 2006	1 Load (15,750 Lit/Load)		0.00	August 4, 2006
August 5, 2006			0.00	August 5, 2006
August 6, 2006			0.00	August 6, 2006
August 7, 2006			0.00	August 7, 2006
August 8, 2006			0.00	August 8, 2006
August 9, 2006			0.00	August 9, 2006
August 10, 2006			0.00	August 10, 2006
August 11, 2006			0.00	August 11, 2006
August 12, 2006			0.00	August 12, 2006
August 13, 2006			0.00	August 13, 2006
August 14, 2006			0.00	August 14, 2006
August 15, 2006			0.00	August 15, 2006
August 16, 2006	1 Load (15,750 Lit/Load)		0.00	August 16, 2006
August 17, 2006			0.00	August 17, 2006
August 18, 2006			0.00	August 18, 2006
August 19, 2006			0.00	August 19, 2006
August 20, 2006			0.00	August 20, 2006
August 21, 2006			0.00	August 21, 2006
August 22, 2006			0.00	August 22, 2006
August 23, 2006			0.00	August 23, 2006
August 24, 2006			0.00	August 24, 2006
August 25, 2006			0.00	August 25, 2006
August 26, 2006			0.00	August 26, 2006
August 27, 2006			0.00	August 27, 2006
August 28, 2006		17	2,203,200.00	August 28, 2006
August 29, 2006		24	3,110,400.00	August 29, 2006
August 30, 2006	1 Load (15,750 Lit/Load)	18	2,332,800.00	August 30, 2006
August 31, 2006		<u>66</u> TOTAL	<u>8,553,600.00</u>	August 31, 2006

1,948,320

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 2-160 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES
September 1, 2006	Dewatering/Fills Water Trucks		0.00
September 2, 2006			0.00
September 3, 2006			0.00
September 4, 2006			0.00
September 5, 2006			0.00
September 6, 2006			0.00
September 7, 2006			0.00
September 8, 2006			0.00
September 9, 2006			0.00
September 10, 2006			0.00
September 11, 2006		15	1,944,000.00
September 12, 2006		24	3,110,400.00
September 13, 2006		24	3,110,400.00
September 14, 2006		16	2,073,600.00
September 15, 2006			0.00
September 16, 2006			0.00
September 17, 2006			0.00
September 18, 2006			0.00
September 19, 2006			0.00
September 20, 2006			0.00
September 21, 2006			0.00
September 22, 2006			0.00
September 23, 2006			0.00
September 24, 2006			0.00
September 25, 2006			0.00
September 26, 2006			0.00
September 27, 2006			0.00
September 28, 2006			0.00
September 29, 2006			0.00
September 30, 2006			0.00
		79.0 TOTAL	10,238,400.00

2,332,080

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WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8.550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES	TOTAL VOLUME
September 1, 2006	Discharge		0.00	0.00
September 2, 2006			0.00	0.00
September 3, 2006			0.00	0.00
September 4, 2006			0.00	0.00
September 5, 2006			0.00	0.00
September 6, 2006			0.00	0.00
September 7, 2006			0.00	0.00
September 8, 2006			0.00	0.00
September 9, 2006			0.00	0.00
September 10, 2006			0.00	0.00
September 11, 2006			0.00	1,944,000.00
September 12, 2006			0.00	3,110,400.00
September 13, 2006			0.00	3,110,400.00
September 14, 2006			0.00	2,073,600.00
September 15, 2006			0.00	0.00
September 16, 2006			0.00	0.00
September 17, 2006			0.00	0.00
September 18, 2006			0.00	0.00
September 19, 2006			0.00	0.00
September 20, 2006			0.00	0.00
September 21, 2006			0.00	0.00
September 22, 2006			0.00	0.00
September 23, 2006			0.00	0.00
September 24, 2006			0.00	0.00
September 25, 2006			0.00	0.00
September 26, 2006		8	4,104,000.00	4,104,000.00
September 27, 2006		16	8,208,000.00	8,208,000.00
September 28, 2006			0.00	0.00
September 29, 2006			0.00	0.00
September 30, 2006			0.00	0.00
		TOTAL 24	12,312,000.00	22,550,400.00
				MONTH TOTAL

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 2,160 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES	DATE
October 1, 2006	Dewatering/Fills Water Trucks		0.00	October 1, 2006
October 2, 2006			0.00	October 2, 2006
October 3, 2006			0.00	October 3, 2006
October 4, 2006			0.00	October 4, 2006
October 5, 2006			0.00	October 5, 2006
October 6, 2006			0.00	October 6, 2006
October 7, 2006			0.00	October 7, 2006
October 8, 2006			0.00	October 8, 2006
October 9, 2006			0.00	October 9, 2006
October 10, 2006			0.00	October 10, 2006
October 11, 2006			0.00	October 11, 2006
October 12, 2006			0.00	October 12, 2006
October 13, 2006			0.00	October 13, 2006
October 14, 2006			0.00	October 14, 2006
October 15, 2006			0.00	October 15, 2006
October 16, 2006			0.00	October 16, 2006
October 17, 2006			0.00	October 17, 2006
October 18, 2006			0.00	October 18, 2006
October 19, 2006			0.00	October 19, 2006
October 20, 2006			0.00	October 20, 2006
October 21, 2006			0.00	October 21, 2006
October 22, 2006			0.00	October 22, 2006
October 23, 2006			0.00	October 23, 2006
October 24, 2006			0.00	October 24, 2006
October 25, 2006			0.00	October 25, 2006
October 26, 2006			0.00	October 26, 2006
October 27, 2006			0.00	October 27, 2006
October 28, 2006			0.00	October 28, 2006
October 29, 2006			0.00	October 29, 2006
October 30, 2006			0.00	October 30, 2006
October 31, 2006			0.00	October 31, 2006
TOTAL			0.00	

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 PUMP RUNNING	HOURS RUN AT VOLUME OF 2,160 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES
November 1, 2006	Dewatering/Fills Water Trucks		0.00
November 2, 2006			0.00
November 3, 2006			0.00
November 4, 2006			0.00
November 5, 2006			0.00
November 6, 2006			0.00
November 7, 2006			0.00
November 8, 2006			0.00
November 9, 2006			0.00
November 10, 2006			0.00
November 11, 2006			0.00
November 12, 2006			0.00
November 13, 2006			0.00
November 14, 2006			0.00
November 15, 2006			0.00
November 16, 2006			0.00
November 17, 2006			0.00
November 18, 2006			0.00
November 19, 2006			0.00
November 20, 2006			0.00
November 21, 2006			0.00
November 22, 2006			0.00
November 23, 2006			0.00
November 24, 2006			0.00
November 25, 2006			0.00
November 26, 2006			0.00
November 27, 2006			0.00
November 28, 2006			0.00
November 29, 2006			0.00
November 30, 2006			0.00
TOTAL			0.00

Smiths Construction, Division of Miller Paving
Braeside Quarry

WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8.550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES	TOTAL VOLUME
November 1, 2006	Discharge		0.00	0.00
November 2, 2006			0.00	0.00
November 3, 2006			0.00	0.00
November 4, 2006			0.00	0.00
November 5, 2006			0.00	0.00
November 6, 2006		7	3,591,000.00	3,591,000.00
November 7, 2006		12	6,156,000.00	6,156,000.00
November 8, 2006			0.00	0.00
November 9, 2006			0.00	0.00
November 10, 2006			0.00	0.00
November 11, 2006			0.00	0.00
November 12, 2006			0.00	0.00
November 13, 2006			0.00	0.00
November 14, 2006		15	7,695,000.00	7,695,000.00
November 15, 2006		5	2,565,000.00	2,565,000.00
November 16, 2006			0.00	0.00
November 17, 2006			0.00	0.00
November 18, 2006			0.00	0.00
November 19, 2006			0.00	0.00
November 20, 2006		9	4,617,000.00	4,617,000.00
November 21, 2006			0.00	0.00
November 22, 2006			0.00	0.00
November 23, 2006			0.00	0.00
November 24, 2006			0.00	0.00
November 25, 2006			0.00	0.00
November 26, 2006			0.00	0.00
November 27, 2006			0.00	0.00
November 28, 2006			0.00	0.00
November 29, 2006			0.00	0.00
November 30, 2006			0.00	0.00
TOTAL			48	24,624,000.00
				MONTH TOTAL

WATER TAKING RECORDS 2006

DATE	4" Submersible Pump 1 Pump Running	HOURS RUN AT VOLUME OF 2,160 LIT/MIN OR 129,600 LIT/HOUR	TOTAL DAILY LITRES PUMPED
December 1, 2006	Dewatering/Fills Water Trucks		0.00
December 2, 2006			0.00
December 3, 2006			0.00
December 4, 2006			0.00
December 5, 2006			0.00
December 6, 2006			0.00
December 7, 2006			0.00
December 8, 2006			0.00
December 9, 2006			0.00
December 10, 2006			0.00
December 11, 2006			0.00
December 12, 2006			0.00
December 13, 2006			0.00
December 14, 2006			0.00
December 15, 2006			0.00
December 16, 2006			0.00
December 17, 2006			0.00
December 18, 2006			0.00
December 19, 2006			0.00
December 20, 2006			0.00
December 21, 2006			0.00
December 22, 2006			0.00
December 23, 2006			0.00
December 24, 2006			0.00
December 25, 2006			0.00
December 26, 2006			0.00
December 27, 2006			0.00
December 28, 2006			0.00
December 29, 2006			0.00
December 30, 2006			0.00
December 31, 2006		TOTAL	0.00

Smiths Construction, Division of Miller Paving
Braeside Quarry

WATER TAKING RECORDS 2006

DATE	8" Pump 1 Pump Running	HOURS RUN AT VOLUME OF 8,550 LIT/MIN OR 513,000 LIT/HOUR	TOTAL DAILY LITRES	TOTAL VOLUME
December 1, 2006	Discharge		0.00	0.00
December 2, 2006			0.00	0.00
December 3, 2006			0.00	0.00
December 4, 2006			0.00	0.00
December 5, 2006			0.00	0.00
December 6, 2006			0.00	0.00
December 7, 2006			0.00	0.00
December 8, 2006			0.00	0.00
December 9, 2006			0.00	0.00
December 10, 2006			0.00	0.00
December 11, 2006			0.00	0.00
December 12, 2006			0.00	0.00
December 13, 2006			0.00	0.00
December 14, 2006			0.00	0.00
December 15, 2006			0.00	0.00
December 16, 2006			0.00	0.00
December 17, 2006			0.00	0.00
December 18, 2006			0.00	0.00
December 19, 2006			0.00	0.00
December 20, 2006			0.00	0.00
December 21, 2006			0.00	0.00
December 22, 2006			0.00	0.00
December 23, 2006			0.00	0.00
December 24, 2006			0.00	0.00
December 25, 2006			0.00	0.00
December 26, 2006			0.00	0.00
December 27, 2006			0.00	0.00
December 28, 2006			0.00	0.00
December 29, 2006			0.00	0.00
December 30, 2006			0.00	0.00
December 31, 2006			0.00	0.00
TOTAL			0.00	0.00
				MONTH TOTAL



Smiths Construction Company

276 Madawaska Blvd., P.O. Box 218

Arnprior, Ont. K7S 3H4

Phone: (613) 623-3144

Fax: (613) 623-8769

FACSIMILE TRANSMITTAL SHEET

TO:	Jay Clark	FAX NUMBER:	705-726-0331
COMPANY:	Skelton Brumwell	PHONE NUMBER:	705 726-1141
FROM:	Jason Roesner	DATE:	Sept 10/07
RE:	Braeside - Water Totals	NO. PAGES INCLUDING COVER:	(6)

URGENT
 FOR REVIEW
 PLEASE COMMENT
 PLEASE REPLY
 PLEASE RECYCLE

NOTES/COMMENTS:

REC'D by SBA		SEP 10 2007			
To	Initial	To	Initial		
GKB		ATG			
SWB		GLL			
BWB		BWM			
AJC		ADN			
JAC		TPP			
SLC		CJU			
PPD		TCW			
BDD		DJW			
JKF					
CJG					
cc:					
FILE:					

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Smiths Construction - Division of Miller Paving
Braeside Quarry

April 1, 2007				0	0
April 2, 2007				0	0
April 3, 2007				0	0
April 4, 2007				0	0
April 5, 2007				0	0
April 6, 2007				0	0
April 7, 2007				0	0
April 8, 2007				0	0
April 9, 2007				0	0
April 10, 2007	8.5		4,360,500		0
April 11, 2007	12		6,156,000		0
April 12, 2007	12		6,156,000		0
April 13, 2007	12		6,156,000		0
April 14, 2007			0		0
April 15, 2007			0		0
April 16, 2007	12		6,156,000		0
April 17, 2007	12		6,156,000		0
April 18, 2007	12		6,156,000		0
April 19, 2007	12		6,156,000		0
April 20, 2007	12		6,156,000		0
April 21, 2007			0		0
April 22, 2007			0		0
April 23, 2007	12		6,156,000		0
April 24, 2007	12		6,156,000		0
April 25, 2007	12		6,156,000		0
April 26, 2007	12		6,156,000		0
April 27, 2007	7.5		3,847,500		0
April 28, 2007			0		0
April 29, 2007			0		0
April 30, 2007			0		0
			0		0

Smiths Construction - Division of Miller Paving
Braeside Quarry

May 1, 2007				0	0
May 2, 2007				0	0
May 3, 2007				0	0
May 4, 2007				0	0
May 5, 2007				0	0
May 6, 2007				0	0
May 7, 2007				0	0
May 8, 2007				0	0
May 9, 2007				0	0
May 10, 2007				0	0
May 11, 2007				0	0
May 12, 2007				0	0
May 13, 2007				0	0
May 14, 2007				0	0
May 15, 2007				0	0
May 16, 2007				0	0
May 17, 2007	Started New Pump			0	0
May 18, 2007				0	0
May 19, 2007				0	0
May 20, 2007				0	0
May 21, 2007				0	0
May 22, 2007				0	0
May 23, 2007				0	0
May 24, 2007				0	3,500
May 25, 2007			1	0	0
May 26, 2007				0	0
May 27, 2007				0	0
May 28, 2007			2	0	7,000
May 29, 2007			4	0	14,000
May 30, 2007			4	0	14,000
May 31, 2007				0	0

Smiths Construction - Division of Miller Paving
Braeside Quarry

June 1, 2007			0	0	0
June 2, 2007			0		0
June 3, 2007			13,028,466		0
June 4, 2007	3,437,590		1,815,574		0
June 5, 2007	9,917,266		1,283,509		0
June 6, 2007	4,256,370		491,278		0
June 7, 2007	4,386,166		493,424		0
June 8, 2007	4,516,529		1,389,992		0
June 9, 2007			0		0
June 10, 2007			0		0
June 11, 2007	4,883,766	367,237	0	2.8 hr	0
June 12, 2007	4,970,175	86,409	0	0.8 hr	0
June 13, 2007	4,986,695	16,520	0	0.13 hr	0
June 14, 2007	5,000,875	14,180	0	0.11 hr	0
June 15, 2007	5,018,841	17,966	0	0.14 hr	0
June 16, 2007			0		0
June 17, 2007			0		0
June 18, 2007	5,021,162		0		0
June 19, 2007	5,039,719		0		0
June 20, 2007	5,158,224		0		0
June 21, 2007	5,173,984		0		0
June 22, 2007	5,174,425		0		0
June 23, 2007			0		0
June 24, 2007			0		0
June 25, 2007	5,177,382		0		0
June 26, 2007	5,196,786		0		0
June 27, 2007	5,216,248		0		0
June 28, 2007	5,235,826		0		0
June 29, 2007	5,249,774		0		0
June 30, 2007			0		0

**Smiths Construction - Division of Miller Paving
Braeside Quarry**

July 1, 2007		0
July 2, 2007		0
July 3, 2007	5,306,672	56,898 0
July 4, 2007	5,306,672	0 0
July 5, 2007	5,314,376	7,704 0
July 6, 2007		0
July 7, 2007		0
July 8, 2007		0
July 9, 2007	5,694,650	380,274 0
July 10, 2007	5,970,760	276,110 0
July 11, 2007	5,970,765	5 0
July 12, 2007	6,381,044	410,279 0
July 13, 2007	6,391,670	10,626 0
July 14, 2007		0
July 15, 2007		0
July 16, 2007	6,910,791	519,121 0
July 17, 2007	6,953,777	42,980 0
July 18, 2007	6,980,533	26,750 0
July 19, 2007	7,016,324	35,791 0
July 20, 2007	7,163,100	146,776 0
July 21, 2007		0
July 22, 2007		0
July 23, 2007	9,583,100	2,420,000 0
July 24, 2007	9,993,315	410,215 0
July 25, 2007	10,045,716	52,401 0
July 26, 2007	10,091,421	45,705 0
July 27, 2007		0
July 28, 2007		0
July 29, 2007		0
July 30, 2007	10,155,167	63,746 0
July 31, 2007	10,202,795	47,628 0

RAINFALL

7.8 mm

4,953,021 L

44%

2006
11,144,00 L

**Smiths Construction - Division of Miller Paving
Braeside Quarry**

August 1, 2007	10,222,825	20,030 0
August 2, 2007	10,276,630	53,805 0
August 3, 2007	10,330,435	53,805 0
August 4, 2007		0
August 5, 2007		0
August 6, 2007		0
August 7, 2007	10,357,337	26,902 0
August 8, 2007	10,384,240	26,903 0
August 9, 2007	10,460,861	76,621 0
August 10, 2007	10,488,469	27,608 0
August 11, 2007		0
August 12, 2007		0
August 13, 2007	10,502,273	13,804 0
August 14, 2007	10,516,077	13,804 0
August 15, 2007		0
August 16, 2007	10,571,567	55,490 0
August 17, 2007	10,584,652	13,085 0
August 18, 2007		0
August 19, 2007		0
August 20, 2007		0
August 21, 2007	10,611,717	27,065 0
August 22, 2007	10,647,095	35,378 0
August 23, 2007	10,658,733	11,638 0
August 24, 2007		0
August 25, 2007		0
August 26, 2007		0
August 27, 2007	11,176,944	518,211 0
August 28, 2007	11,192,529	15,585 0
August 29, 2007		0
August 30, 2007	11,739,190	546,661 0
August 31, 2007		0

1,536,395 L

79%

2006
1,948,000 L

Ministry of the Environment

Eastern Region
Technical Support Section
Water Resources
133 Dalton Ave
Kingston ON K7L 4X6
Fax: (613)548-6908
Telephone: (613) 549-4000

Ministère de l'Environnement

Direction régionale de l'Est
Bureau du district de Kingston
133 av Dalton
Kingston ON K7L 4X6
Télécopieur: (613)548-6908
Téléphone : (613) 549-4000



October 11, 2006

Miller Group Inc.
276 Madawaska Boulevard
Arnprior, Ontario
K7S 3H4

RE: Permit To Take Water 0035-6T8HMJ
Lot: 16, Concession: A
McNab-Braeside, County of Renfrew
Reference Number 6308-6SWJ57

Dear Sir/Madam:

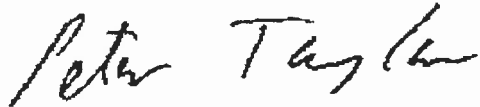
Please find attached Permit To Take Water 0035-6T8HMJ which authorizes the withdrawal of water in accordance with the application for this Permit To Take Water, dated February 4, 2005, and signed by Robert E. Bugden. This Permit cancels and replaces Permit 7406-6E4RXL, issued on July 20, 2005.

Permit 0035-6T8HMJ has been issued as a result of the identification of several administrative inconsistencies as well as information provided by your consultant, Jennifer Gorrell, Gorrell Resource Investigations, with respect to a reduction in the water taking from Source 2 (quarry discharge ditch). Since these changes are of an administrative nature or are environmentally insignificant (reducing the volume of water taken), the Ministry is not required to post a proposal notice for public comment on the Environmental Bill of Rights (EBR) registry. Furthermore, these changes are consistent with the details of the previous EBR proposal posting.

The new Water Taking and Transfer Regulation, O. Reg. 387/04 came into effect on January 1, 2005. It requires that Permit Holders track the volume of water they take daily and report these volumes to the Ministry the following year. Please ensure that you inform yourself of the monitoring and reporting requirements related to your permit. You can find additional information on the MOE web site at www.ene.gov.on.ca or by calling the nearest MOE office.

Take notice that in issuing this Permit To Take Water, terms and conditions pertaining to the taking of water and to the results of the taking have been imposed. The terms and conditions have been designed to allow for the development of water resources, while providing reasonable protection to existing water uses and users.

Yours truly,



Peter Taylor
Director, Section 34, Ontario Water Resources Act, R.S.O. 1990
Eastern Region

File Storage Number: P 0035 REN

c: Jennifer Gorrell, Gorrell Resource Investigations, RR 1, Oxford Mills, Ontario K0G 1S0



Ministry of the
Environment
Ministère de
l'Environnement

AMENDED PERMIT TO TAKE WATER
Surface and Ground Water
NUMBER 0035-6T8HMJ

Pursuant to Section 34 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

Miller Group Inc.
276 Madawaska Boulevard
Amprior, Ontario K7S 3H4
Canada

For the water taking from: Quarry Sump (Spring & Rainfall Event Pumping), Quarry Discharge Source, Quarry Closed-Loop Aggregate Washing System

Located at: Lot 16, Concession A
McNab-Braeside, County of Renfrew

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

- (a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34, OWRA.
- (b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.
- (c) "Ministry" means Ontario Ministry of the Environment.
- (d) "District Office" means the Ottawa District Office.
- (e) "Permit" means this Permit to Take Water No. 0035-6T8HMJ including its Schedules, if any, issued in accordance with Section 34 of the OWRA.
- (f) "Permit Holder" means Miller Group Inc..
- (g) "OWRA " means the *Ontario Water Resources Act*, R.S.O. 1990, c. O. 40, as amended.
- (h) "McNab-Braeside" means the former Geographic Township of McNab now located in the Township of McNab-Braeside.

10/16/06 10:14 AM 10100200709 SMITHS CONSTRUCTION → MILLER HEAD OFF 005/010

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

- 1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated February 4, 2005 and signed by Robert E. Bugden, and all Schedules included in this Permit.
- 1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.
- 1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.
- 1.4 This Permit is not transferable to another person.
- 1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.
- 1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.
- 1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections

The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act*, R.S.O. 1990, the *Pesticides Act*, R.S.O. 1990, or the *Safe Drinking Water Act*, S. O. 2002.

2.2 Other Approvals

The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act*, and the *Environmental Protection Act*, and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 Expiry

This Permit expires on **July 31, 2015**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes specified in Table A.

Table A

Source Number	Source Name/Description	Source	Permitted Purpose	Permitted Rate (Litres/Day)	Permitted Period (Days)	Permitted Volume (Litres)	Permitted Period (Months)	Permitted Volume (Litres)
1	Quarry Pump Springs, Rainfall Event Pumping	Pond Quarry	Pits and Quarries	Dewatering	7,000	24	10,080,000	18 387250 5036250
2	Quarry Discharge Source	Pond Quarry	Pits and Quarries	Dewatering	3,000	10	50,000	18 387250 5036250
3	Quarry Closed-Loop Aggregate Washing System	Pond Quarry	Aggregate Washing	Industrial	7,000	24	10,080,000	18 387250 5036250
						Total Taking:	10,080,000	

10,080,000

- 3.3 The Permit Holder shall ensure that the total combined taking from all three sources does not exceed the Total Taking indicated in Table A.
- 3.4 Notwithstanding Table A, the total annual water taking from Source 2 (Quarry Discharge Source) shall not exceed 2,000,000 litres.
- 3.5 Notwithstanding Table A, the water taking from Source 2 (Quarry Discharge Source) may also be used for the purposes of on-site dust control, local area construction projects and swimming pool filling.
- 3.6 Notwithstanding Table A, the locations of Sources 1, 2 and 3 may change within the quarry as it is developed.

4. Monitoring

- 4.1 The Permit Holder shall maintain a record of all water takings. This record shall include the dates and times of water takings, and the total measured amounts of water pumped per day for each day that water is taken under the authorization of this Permit. A separate record shall be maintained for each source. The Permit Holder shall keep all required records up to date and available at or near the site of the taking and shall produce the records immediately for inspection by a Provincial Officer upon his or her request. The total amounts of water pumped shall be measured using a calibrated flow meter and totalizer.
- 4.2 The Permit Holder shall establish a monitoring program, contingency plan, trigger mechanisms and water conservation measures based on the letter prepared by Gorrell Resource Investigations, dated July 8, 2005. The data collected under the monitoring program shall be analyzed and interpreted and summarized in an annual report. The Permit Holder shall keep all monitoring data and reports at or near the site of the taking and shall produce the data and reports immediately for inspection by a Provincial Officer upon his or her request.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Surface-Water Takings

The taking of water (including the taking of water into storage and the subsequent or simultaneous withdrawal from storage) shall be carried out in such a manner that streamflow is not stopped and is not reduced to a rate that will cause interference with downstream uses of water or with the natural functions of the stream.

For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

6. **Director May Amend Permit**

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act*, Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.
2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.
3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written notice served upon me, the Environmental Review Tribunal and the Environmental Commissioner, **Environmental Bill of Rights**, R.S.O. 1993, Chapter 28, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, as amended provides that the Notice requiring a hearing shall state:

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Permit to Take Water number;
6. The date of the Permit to Take Water;
7. The name of the Director;
8. The municipality within which the works are located;

This notice must be served upon:

The Secretary
Environmental Review Tribunal
2300 Yonge Street, Suite 1700
Toronto, Ontario M4P 1E4

AND

The Environmental Commissioner
1075 Bay Street
6th Floor, Suite 605
Toronto, Ontario M5S 2W5

AND

The Director, Section 34
Ministry of the Environment
133 Dalton Ave
Kingston ON K7L 4X6
Fax: (613)548-6908

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by telephone at (416) 314-4600

by fax at (416) 314-4506

by e-mail at www.ert.gov.on.ca

This instrument is subject to Section 38 of the **Environmental Bill of Rights** that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek to appeal for 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry, you can determine when the leave to appeal period ends.

This Permit cancels and replaces Permit Number 7406-6E4RXL, issued on 2005/07/20.

Dated at Kingston this 11th day of October, 2006.



Peter Taylor
Director, Section 34
Ontario Water Resources Act, R.S.O. 1990

Schedule A

This Schedule "A" forms part of Permit To Take Water 0035-6T8HMJ, dated October 11, 2006.

Letter prepared by Gorrell Resource Investigations, dated July 8, 2005 and signed by Jennifer B. Gorrell.

APPENDIX C

MTO Design Chart 2.32

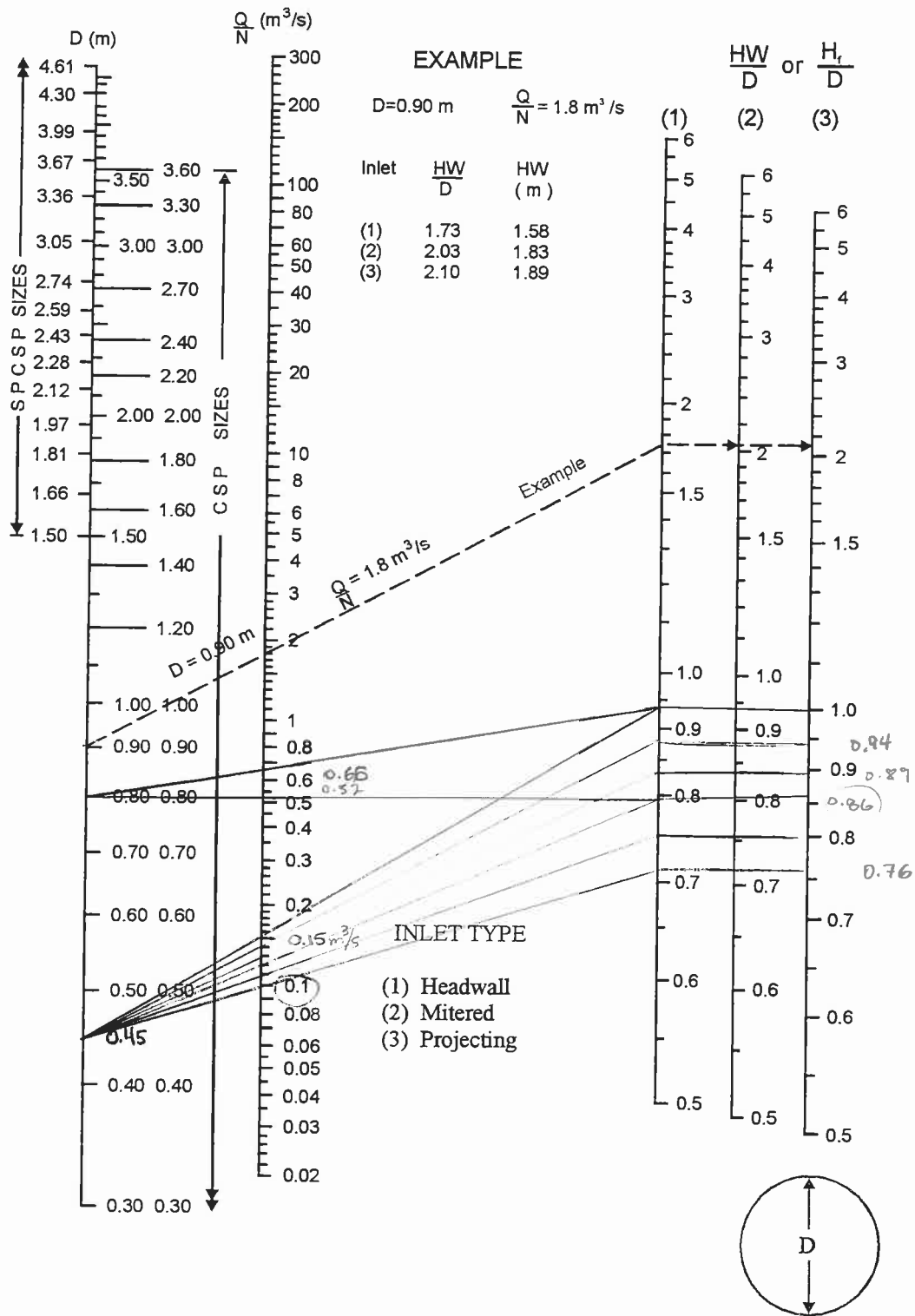
MTO Design Chart 2.35

MTO Design Chart 2.37

MTC Form D4-1

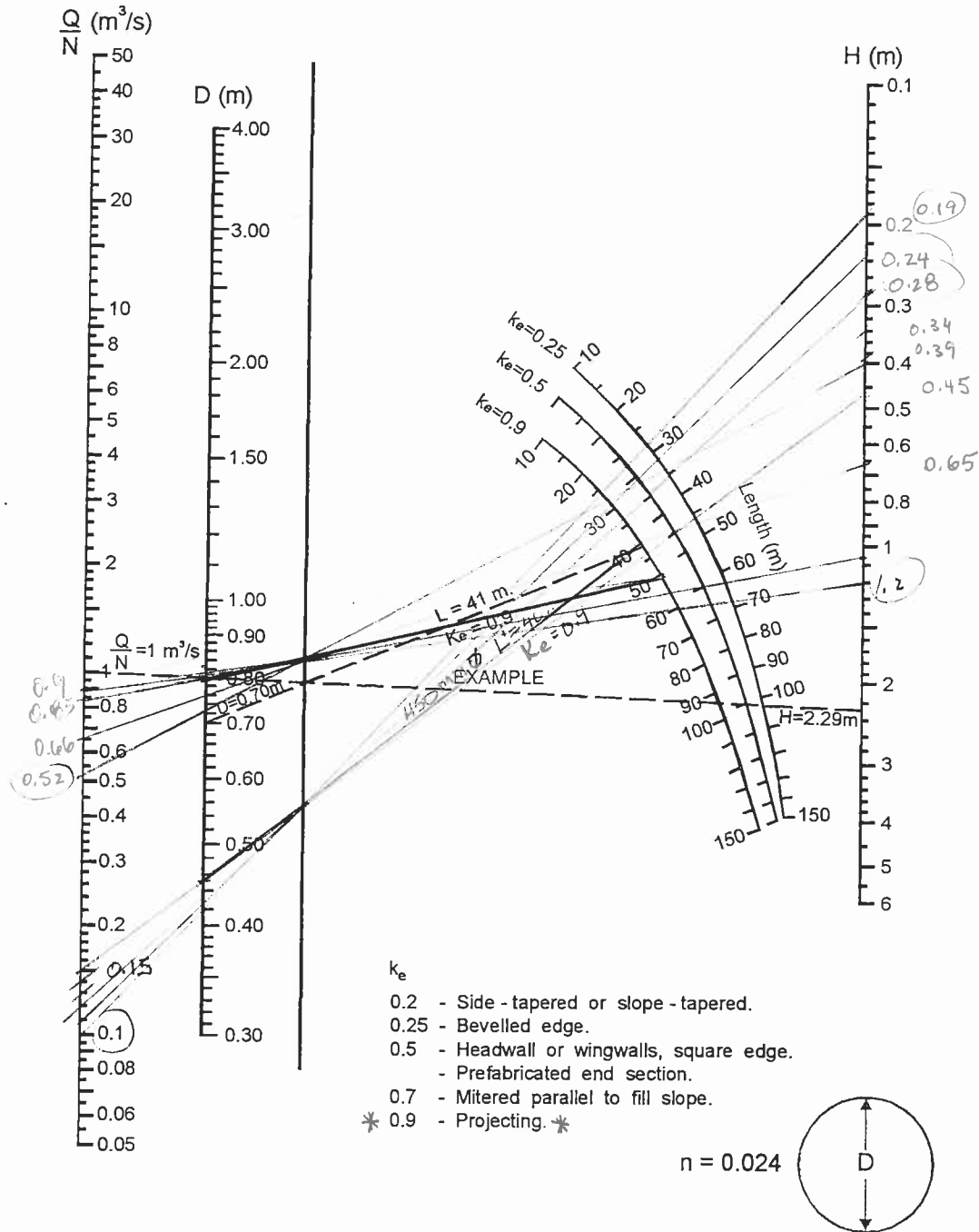
Manning's Channel Computer Program Printouts

Design Chart 2.32: Inlet Control: Circular CSP and SPCSP Culverts



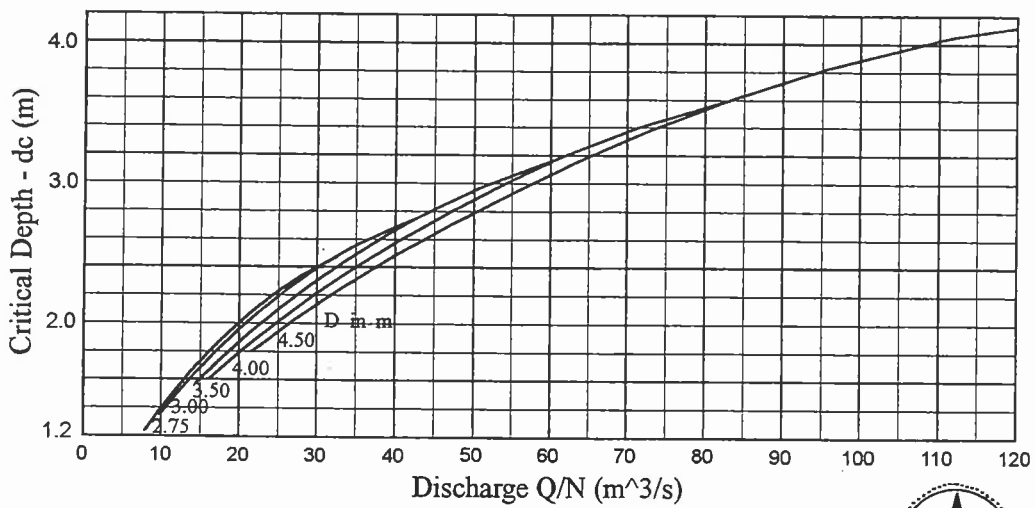
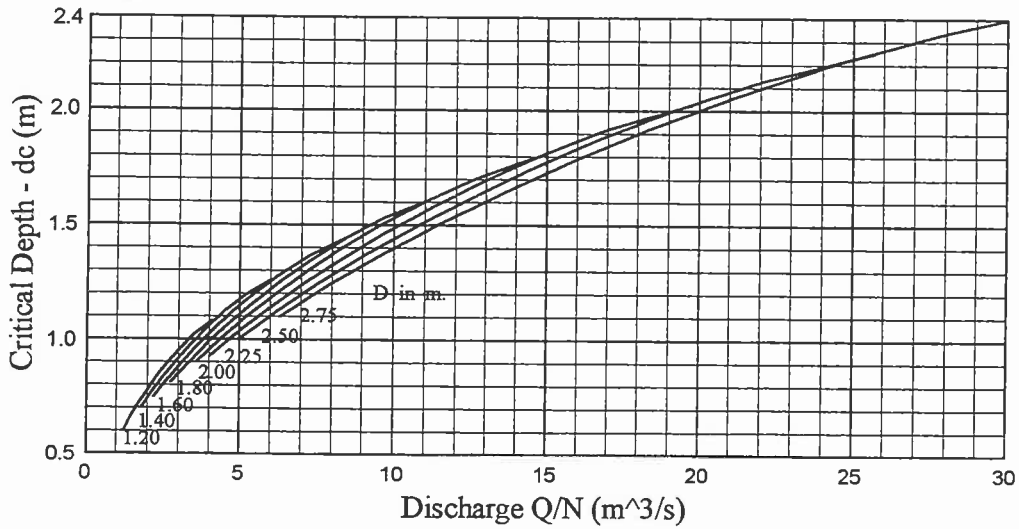
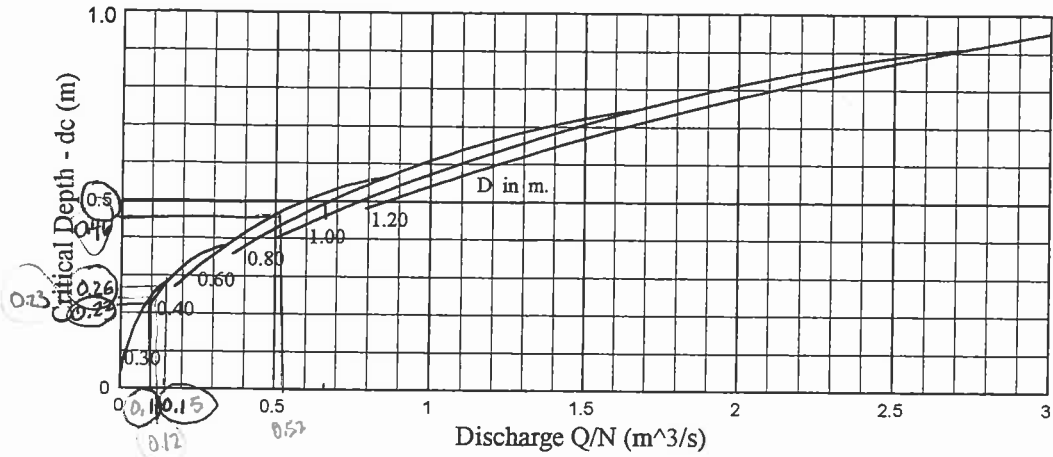
Source: Herr (1977)

Design Chart 2.35: Outlet Control: CSP Culvert - Flowing Full

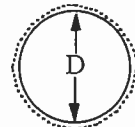


Source: Herr (1977)

Design Chart 2.37: Critical Depth Chart for Circular Pipes



$(d_c \geq D)$



Source: Herr (1977)

FORM D4-1 - (MTC FORM PH-D - 534) - CONVENTIONAL CULVERT DESIGN
(HAND CALCULATIONS)

STA.	DESIGN DATA				CULVERT DATA				INLET CONTROL				OUTLET CONTROL				GOVT. VEL.								
	Q m ² /s	d m	d ₀ m	AHW m	S m/m	L m	No.	Skew °	D or B x D m	N	A m ²	(E _{sch}) m ³ /m	Q (NB) m ³ /m	HW m	H m	d _c m	TW m	h ₀ m	LS m	HW m	V ₀ m/s				
1	2	3	4	5	6	7	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28
Usborne	0.15	0.40	0.05	0.45	70°	14	0.02	CSP	0.45	1	0.15	0.159	0.15	1	0.45	0.9	0.24	0.39	0.45	0.45	1.26	0.62	0.62		
Street																									
Campbell	0.66	0.8	0.00	0.8	70°	17.6	0.023	CSP	0.80	1	0.66	0.636	0.66	1	0.80	0.9	0.55	0.80	0.80	0.80	2.39	1.06	0.92		
Drive																									
Campbell	0.52	0.8	0.10	0.8	70°	17.6	0.022	CSP	0.80	1	0.52	0.636	0.52	0.80	0.9	0.40	0.46	0.63	0.80	0.80	0.39	1.81			
Street																									
Usborne	0.10	0.40	0.05	0.45	70°	14	0.02	CSP	0.45	1	0.10	0.159	0.10	0.76	0.74	0.19	0.22	0.34	0.45	0.45	0.20	0.36	0.36		
Street																									
Usborne	0.13	0.40	0.05	0.45	70°	14	0.02	CSP	0.45	1	0.13	0.159	0.13	0.89	0.40	0.34	0.24	0.39	0.45	0.45	0.20	0.51	0.51		
Street																									
Usborne	0.12	0.40	0.05	0.45	70°	14	0.02	CSP	0.45	1	0.12	0.159	0.14	0.85	0.39	0.9	0.28	0.23	0.35	0.45	0.20	0.45	0.45		
Street																									

11 No. of barrels.

12 From Form PH-D-533, col. 12.

13 Flood depth.

14 Embedment below channel invert.

15 Col. 3 + col. 4 + allowable bkwr.

16 Culvert slope, as applicable.

17 Culvert slope.

18 Chart D5-2A to G.

19 Chart D5-3A to F: (d_c > D).

20 Col. 3 + col. 4.

21 Col. 3 + col. 4.

22 Col. 7 x col. 8.

23 HW = col. 18 + col. 22 - col. 23.

24 HW = col. 18 + col. 22 - col. 23.

25 Chart D5-2A to G.

26 Outlet wll. If req'd (Subsec. 3.2.3.)

Refer to MTC Drainage Manual, Chapter D.

Note: Form is reduced from legal size.

MANNING CALCULATION FOR TRAPEZOIDAL CHANNELS - CAMPBELL DR.

A) Solve for Flow (Q)

N	0.030
DEPTH	1.000 m
SLOPE	1.3 %
SIDESLOPE	2.5 : 1
BOTTOM WIDTH	0.6 m
A	3.100 sq.m.
Wp	5.985 m
Rh	0.518 m
V	2.451 m/s
Q	7.599 cms

B) Solve for Slope (S)

Q	0.000 cms
N	0.000
DEPTH	0.000 m
SIDESLOPE	0 : 1
BOTTOM WIDTH	m
A	0.000 sq.m.
Wp	0.000 m
Rh	#VALUE! m
V	#VALUE! m/s
S	#VALUE! %

MANNING CALCULATION FOR TRAPEZOIDAL CHANNELS - CARMICHAEL SDRD

A) Solve for Flow (Q)

N	0.030
DEPTH	1.000 m
SLOPE	3.1 %
SIDESLOPE	2.5 : 1
BOTTOM WIDTH	0.6 m
A	3.100 sq.m.
Wp	5.985 m
Rh	0.518 m
V	3.785 m/s
Q	11.734 cms

B) Solve for Slope (S)

Q	0.000 cms
N	0.000
DEPTH	0.000 m
SIDESLOPE	0 : 1
BOTTOM WIDTH	m
A	0.000 sq.m.
Wp	0.000 m
Rh	#VALUE! m
V	#VALUE! m/s
S	#VALUE! %

APPENDIX D

**Department of the Environment, Water Resources Branch,
Fig.9 Southern Ontario Hydrometric Stations**

**Environment Canada, Water Level and Streamflow Statistics -
Bonnechere River near Castleford, Station 02KC009**

**Ministry of the Environment, Water Quality Data Ontario Lakes and Streams 1979 -
Bonnechere and Muskrat Rivers**

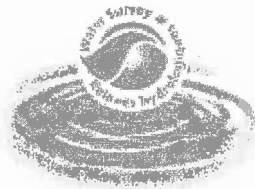
**Ministry of Environment, Biophysical Performance
Standards for Aquatic Ecosystem Objectives**

**Ministry of the Environment, Certificate of Approval,
Industrial Sewage Works Number 6988-6VZJFB June 4 , 2007**



Water Level and Streamflow Statistics

BONNECHERE RIVER NEAR CASTLEFORD



Water Survey of Canada
Burlington, Ontario

Station No. 02KC009
2380 km²

Select Station and click Refresh Data.
Click the "Go To ..." button to switch to the opposite parameter.

02KC009

REFRESH DATA

GO TO LEVELS

GRAPHS AND INFORMATION

PRINTABLE FORMAT

Navigation

New query

Other Links

Real-Time Data
Archived Data

In partnership with



Ontario

Monthly Extremes of Daily Discharges in m³/s for the Period January 1921 - December 2004

	Maximum Daily	Minimum Daily	
JAN	127 m ³ /sec on Jan 16, 1995	2.01 m ³ /sec on Jan 01, 1956	JAN
FEB	142 m ³ /sec on Feb 24, 1981	1.64 m ³ /sec on Feb 06, 1956	FEB
MAR	187 m ³ /sec on Mar 31, 1998	2.35 m ³ /sec on Mar 05, 1922	MAR
APR	286 m ³ /sec on Apr 06, 1928	4.90 m ³ /sec on Apr 05, 1965	APR
MAY	154 m ³ /sec on May 19, 1969	2.76 m ³ /sec on May 21, 1999	MAY
JUN	105 m ³ /sec on Jun 16, 2002	0.787 m ³ /sec on Jun 27, 1999	JUN
JUL	89.8 m ³ /sec on Jul 03, 1967	0.736 m ³ /sec on Jul 19, 1959	JUL
AUG	29.5 m ³ /sec on Aug 15, 1984	0.313 m ³ /sec on Aug 03, 1997	AUG
SEP	55.5 m ³ /sec on Sep 29, 1967	0.292 m ³ /sec on Sep 29, 1991	SEP
OCT	129 m ³ /sec on Oct 19, 1967	0.677 m ³ /sec on Oct 06, 2002	OCT
NOV	117 m ³ /sec on Nov 09, 1972	0.704 m ³ /sec on Nov 03, 2002	NOV
DEC	87.5 m ³ /sec on Dec 02, 1967	0.850 m ³ /sec on Dec 11, 1960	DEC
EXTREME	286 m ³ /sec on Apr 06, 1928	0.292 m ³ /sec on Sep 29, 1991	EXTREME

Extremes of Monthly Mean Discharges in m³/s for the Period January 1921 - December 2004

	Maximum Monthly Mean	Minimum Monthly Mean	
JAN	32.9 m ³ /sec in 1995	3.65 m ³ /sec in 1930	JAN
FEB	45.1 m ³ /sec in 1981	3.85 m ³ /sec in 1931	FEB
MAR	63.1 m ³ /sec in 1973	4.64 m ³ /sec in 1931	MAR
APR	123 m ³ /sec in 1928	12.3 m ³ /sec in 2003	APR
MAY	103 m ³ /sec in 1947	7.68 m ³ /sec in 1999	MAY

JUN	52.0 m ³ /sec in 1947	2.68 m ³ /sec in 1999	JUN
JUL	29.6 m ³ /sec* in 1967	2.77 m ³ /sec in 1999	JUL
AUG	20.0 m ³ /sec in 1927	1.71 m ³ /sec in 1999	AUG
SEP	23.8 m ³ /sec in 1981	1.35 m ³ /sec in 2002	SEP
OCT	50.9 m ³ /sec in 1967	2.11 m ³ /sec in 2002	OCT
NOV	56.7 m ³ /sec in 1967	2.99 m ³ /sec in 2002	NOV
DEC	41.7 m ³ /sec in 1928	3.91 m ³ /sec in 1929	DEC
EXTREME	123 m ³ /sec in 1928	1.35 m ³ /sec in 2002	EXTREME

Monthly Mean Discharges in m³/s for the Period January 1921 - December 2004

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	PERIOD	
1921	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.95	5.20	1.01	1921
1922	4.65	4.19	17.0	53.5	41.2	19.7	8.98	5.47	5.21	4.41	5.52	5.54	14.6	1922
1923	5.18	5.10	7.99	55.0	63.4	33.9	10.7	6.36	6.14	5.45	5.97	13.6	18.3	1923
1924	12.1	10.9	19.8	55.6	57.0	24.4	7.68	6.71	5.94	6.13	6.22	4.96	18.1	1924
1925	5.81	7.30	33.9	34.1	26.1	28.4	17.9	6.70	6.27	6.57	6.57	6.03	15.5	1925
1926	5.32	5.04	4.79	33.4	52.8	22.9	15.7	10.6	6.93	6.99	10.6	14.1	15.8	1926
1927	13.7	11.2	40.1	30.7	30.1	36.8	20.3	20.0	11.4	9.22	20.4	25.4	22.5	1927
1928	21.5	19.6	21.8	123	71.7	21.2	12.3	15.1	10.6	15.6	29.3	41.7	33.6	1928
1929	23.0	19.5	48.4	113	81.2	19.3	6.99	5.97	5.33	5.53	5.14	3.91	28.1	1929
1930	3.65	6.94	7.48	12.4	10.6	19.7	7.83	4.98	5.06	5.07	4.73	4.64	7.74	1930
1931	4.28	3.85	4.64	19.8	10.7	10.2	5.75	5.60	6.80	6.65	6.39	6.38	7.59	1931
1932	11.0	11.0	11.5	51.1	38.6	11.7	5.00	5.47	5.66	6.44	8.69	11.4	14.8	1932
1933	11.8	9.63	9.60	71.2	48.2	13.3	5.28	5.69	6.08	6.43	5.82	5.52	16.5	1933
1934	4.96	4.42	4.70	42.9	41.3	13.8	4.26	4.62	5.81	6.40	6.39	6.65	12.2	1934
1935	8.35	9.91	31.3	32.3	31.5	14.8	17.3	13.7	5.34	5.74	5.69	6.94	15.3	1935
1936	7.05	8.33	39.1	68.0	66.6	28.1	7.77	7.00	7.49	9.00	9.87	11.2	22.5	1936
1937	16.8	18.8	8.99	44.3	57.0	17.5	9.48	6.04	6.60	6.22	11.0	10.6	17.7	1937
1938	12.4	14.3	41.3	60.3	48.4	23.2	5.10	5.26	8.08	6.20	6.16	5.76	19.7	1938
1939	8.78	7.90	10.8	45.7	36.5	15.4	6.06	6.40	6.06	6.98	6.51	6.01	13.6	1939
1940	6.74	6.46	5.41	45.1	26.7	43.5	7.00	5.49	5.46	4.98	5.18	6.36	14.0	1940
1941	6.91	7.56	8.61	43.8	21.1	4.78	4.64	5.15	5.14	5.35	6.07	6.86	10.5	1941
1942	6.87	7.82	24.7	56.3	41.4	24.9	8.10	5.27	5.99	5.61	6.32	7.21	16.7	1942
1943	6.34	8.13	18.0	65.0	93.8	32.9	8.33	6.10	7.19	7.23	8.01	7.09	22.4	1943
1944	7.70	8.69	10.3	18.4	24.3	12.6	8.69	6.40	7.93	7.07	6.68	6.85	10.5	1944
1945	6.31	4.84	33.7	49.2	44.5	35.3	13.7	7.92	7.95	10.1	10.2	7.70	19.3	1945
1946	11.1	9.40	32.8	24.5	17.6	16.7	7.15	5.62	5.15	5.19	5.28	8.31	12.4	1946
1947	10.9	12.7	18.8	96.7	103	52.0	26.4	16.6	10.8	9.86	8.94	7.93	31.2	1947
1948	8.81	6.00	26.3	39.4	32.4	26.2	7.67	6.49	6.73	6.44	6.43	6.50	14.9	1948
1949	7.27	11.9	26.3	68.6	47.9	12.2	5.71	5.43	7.20	6.52	6.51	3.94	17.4	1949
1950	7.73	4.36	13.3	56.1	39.5	8.80	6.20	6.97	8.08	9.42	11.8	16.3	15.7	1950
1951	21.3	20.6	26.8	114	72.4	21.2	21.7	7.70	8.85	8.57	17.6	24.8	30.4	1951
1952	19.2	21.3	21.5	78.3	56.8	30.1	10.6	7.92	7.73	7.67	7.45	8.30	23.0	1952
1953	5.41	6.48	19.0	38.9	28.6	13.0	6.70	6.88	6.82	7.75	7.62	7.11	12.9	1953
1954	7.88	11.4	20.7	62.8	42.4	39.2	12.7	8.15	13.8	25.5	24.6	26.8	24.6	1954
1955	22.1	19.9	18.4	105	45.5	10.6	6.31	6.90	7.25	10.8	9.85	4.41	22.1	1955
1956	5.31	4.99	10.4	47.4	62.5	35.2	17.0	9.52	10.8	9.05	9.56	9.38	19.3	1956

1957	8.81	8.29	12.0	14.9	20.0	17.4	12.8	5.18	7.38	6.89	9.91	13.4	11.4	1957
1958	15.8	15.0	23.7	54.5	32.9	15.4	9.91	5.10	6.73	7.31	7.80	-----	16.5	1958
1959	-----	-----	-----	-----	29.9	10.9	4.59	5.89	5.58	7.21	11.8	-----	8.64	1959
1960	-----	-----	-----	-----	62.4	19.6	6.49	4.79	4.35	4.20	6.08	-----	9.19	1960
1961	-----	-----	-----	-----	-----	14.2	11.3	15.4	7.01	6.97	7.41	-----	5.40	1961
1962	-----	-----	-----	-----	-----	7.95	4.79	4.11	4.61	8.46	16.2	10.3	4.84	1962
1963	11.0	11.5	19.5	47.2	36.2	14.5	7.36	7.69	8.81	12.6	18.8	24.9	18.3	1963
1964	17.8	13.0	31.2	35.6	24.8	11.3	3.66	3.37	4.16	4.30	5.12	6.34	13.4	1964
1965	3.66	4.67	5.92	41.9	47.4	10.8	3.81	4.10	5.82	8.77	18.9	27.8	15.3	1965
1966	22.4	20.1	37.9	50.8	41.6	28.3	4.81	5.37	6.01	5.25	8.30	30.5	21.8	1966
1967	20.1	15.9	17.8	60.5	37.6	32.8	29.6	9.13	17.1	50.9	56.7	39.9	32.4	1967
1968	20.6	20.1	42.2	44.3	15.5	15.8	15.1	6.66	7.46	6.43	7.33	8.03	17.4	1968
1969	8.89	9.39	18.7	62.6	82.1	32.7	17.3	8.32	7.35	6.56	8.83	8.46	22.7	1969
1970	9.88	11.5	12.1	49.3	59.1	12.2	11.3	10.2	6.73	6.36	7.63	10.4	17.2	1970
1971	11.1	11.7	15.1	68.1	63.3	14.9	8.34	5.83	7.60	6.66	6.27	10.4	19.1	1971
1972	8.41	8.91	10.0	58.6	75.7	37.6	29.1	19.8	15.2	21.1	54.9	39.3	31.6	1972
1973	26.2	25.2	63.1	109	64.4	32.5	16.1	10.2	9.24	8.42	9.27	13.3	32.2	1973
1974	14.2	15.4	26.8	74.0	92.7	30.4	12.0	8.86	8.27	7.63	12.7	13.4	26.4	1974
1975	15.2	15.5	17.8	56.2	43.0	14.7	6.49	4.50	5.10	6.11	4.98	7.39	16.4	1975
1976	8.46	9.49	44.1	80.4	45.8	19.2	21.2	7.14	9.13	11.4	12.0	11.3	23.3	1976
1977	9.94	10.9	35.2	40.5	18.5	8.57	5.49	3.96	4.51	9.08	11.5	19.2	14.8	1977
1978	17.9	18.9	16.4	81.1	75.8	15.4	7.74	5.30	6.28	6.50	7.53	9.22	22.3	1978
1979	7.49	9.94	33.2	76.7	62.4	22.1	5.52	7.47	6.90	8.71	8.92	20.5	22.5	1979
1980	17.9	9.76	23.8	50.2	38.4	17.2	15.7	14.1	8.09	11.7	22.8	19.0	20.7	1980
1981	16.4	45.1	59.8	43.6	27.5	17.3	10.8	10.4	23.8	21.0	20.7	15.9	25.9	1981
1982	12.4	14.1	22.8	61.1	35.9	19.0	8.30	6.69	6.29	6.62	8.86	18.9	18.4	1982
1983	21.9	18.9	30.8	58.1	87.1	29.9	3.59	5.84	4.75	5.58	8.75	15.3	24.2	1983
1984	14.0	23.0	31.7	97.6	73.2	15.6	8.75	9.46	7.25	5.69	6.55	7.10	24.9	1984
1985	12.2	17.3	42.3	79.2	67.0	7.29	6.00	4.48	4.23	5.24	7.18	7.23	21.6	1985
1986	8.05	10.7	28.2	31.8	21.1	23.3	7.74	13.9	7.93	9.39	7.98	8.91	14.9	1986
1987	11.7	11.3	29.3	67.7	16.9	13.6	6.25	5.39	3.59	3.82	6.26	10.5	15.5	1987
1988	10.5	15.6	22.9	44.9	37.6	5.74	3.13	3.60	2.97	4.31	6.66	8.79	13.9	1988
1989	8.77	8.83	22.9	24.2	31.8	19.7	8.34	4.06	5.32	4.26	10.8	8.36	13.1	1989
1990	10.3	11.4	32.1	56.0	38.8	6.70	10.2	5.01	3.33	4.18	7.37	13.7	16.6	1990
1991	15.5	15.2	31.2	93.2	49.1	5.76	3.07	3.10	2.39	3.10	4.91	10.1	19.7	1991
1992	9.48	9.66	15.7	61.6	48.6	8.34	9.62	8.29	9.04	9.16	28.7	30.2	20.7	1992
1993	20.8	14.8	19.3	70.8	35.8	20.5	8.85	6.78	6.00	9.44	17.4	16.1	20.5	1993
1994	11.7	14.9	16.8	29.2	25.7	26.0	11.8	9.98	6.49	4.12	5.92	10.9	14.4	1994
1995	32.9	25.6	33.7	27.1	18.4	16.7	4.92	11.2	4.88	6.53	19.1	20.0	18.4	1995
1996	28.2	32.1	30.8	72.1	93.3	26.0	14.2	14.3	10.7	15.2	17.8	28.4	31.9	1996
1997	23.3	24.2	27.3	72.5	78.2	18.1	4.04	2.00	3.51	4.31	9.51	11.2	23.2	1997
1998	12.7	11.5	32.9	89.1	22.5	7.32	8.96	2.08	2.41	4.50	4.48	5.92	17.0	1998
1999	5.52	10.4	12.5	52.1	7.68	2.68	2.77	1.71	1.84	7.58	22.3	24.4	12.6	1999
2000	15.1	17.4	20.5	35.4	65.4	27.4	10.8	10.5	4.60	4.75	5.38	11.2	19.1	2000
2001	8.73	12.7	12.8	43.3	14.5	12.2	5.08	2.42	1.90	2.34	5.29	11.4	11.0	2001
2002	12.2	12.8	21.4	43.6	41.7	44.3	13.0	3.04	1.35	2.11	2.99	4.47	16.9	2002
2003	7.52	8.35	15.7	12.3	27.8	34.6	5.50	6.58	3.67	8.93	31.4	31.9	16.2	2003
2004	18.2	15.8	34.7	54.1	50.1	11.8	8.80	5.26	4.83	3.21	7.35	12.6	18.9	2004

Mean

Median

	<i>Mean</i> Monthly Discharge in m ³ /s	Median Discharge in m ³ /s	Lower Quartile in m ³ /s	Upper Quartile in m ³ /s	Cumulative Runoff Depth in mm	
JAN	12.3	11.0	7.52	16.4	12.38	JAN
FEB	12.9	11.4	8.33	15.8	23.96	FEB
MAR	23.5	21.5	13.3	31.7	52.15	MAR
APR	56.1	54.1	41.9	68.6	107.50	APR
MAY	45.7	41.6	28.2	62.5	156.57	MAY
JUN	20.1	17.5	12.2	27.4	178.54	JUN
JUL	9.73	8.30	5.71	12.0	190.27	JUL
AUG	7.29	6.40	5.18	8.32	197.07	AUG
SEP	6.82	6.29	5.10	7.93	204.27	SEP
OCT	8.04	6.57	5.35	8.93	211.27	OCT
NOV	11.2	7.72	6.26	11.7	219.85	NOV
DEC	13.1	10.3	6.88	16.0	237.89	DEC
PERIOD	18.9	18.1	14.9	22.5		PERIOD

Created: 2003-12-22
 Modified: 2006-10-12
 Reviewed: 2006-10-12

Important
 Notices

URL of this page:
[http://www.wsc.ec.gc.ca/staflo/index_e.cfm?
 cname=flow_monthly.cfm](http://www.wsc.ec.gc.ca/staflo/index_e.cfm?cname=flow_monthly.cfm)

The Green Lane™,
 Environment Canada's World Wide Web Site

Canada

B.O.W. / SITE: BONNECHERE RIVER
SAMPLE POINT: COUNTY ROAD 3 2 MILES EAST OF CASTLEFORD
STATION TYPE: RIVER FLOW GAUGE FED 02KCO09

MAJOR BASIN: GREAT LAKES
MINOR BASIN: OTTAWA RIVER
TERM STREAM: BONNECHERE RIVER

STATION ID: 18-3890-010-02

STORET CODE: 02
006
2905

STN NO: 10 LAT: LONG: U T M: 18 0378400.0 5041075.0 4 REGION: 04 MILEAGE: 0.50

Table with columns: SAMP DTE HOUR, STN, STN DIST, SAMP BRG, PU DEPTH, 934 SAMPLE NO, 901 SCD, 446 FLOW M3/S, 80 TOTAL COLIFORM MF/100ML, 83 BACKGRD COUNT MF/100ML, 81 FECAL COLIFORM MF/100ML, 84 M.F. ENTER. MF/100ML, 805 WATER TEMP. DEG C, 3 DISS. O2 MG/L, 1 5-DAY BOD MG/L. Includes data for samples 26-31, 30-31, 27-29, 25-10 and summary statistics.

Table with columns: SAMP DTE HOUR, STN, STN DIST, SAMP BRG, PU DEPTH, 33 TOTAL P MG/L, 34 FILTERED REACTIVE P MG/L, 19 FILTERED AMMONIA MG/L, 20 TOTAL KJELDAHL MG/L, 21 FILTERED NO2-N MG/L, 22 FILTERED NO3-N MG/L, 17 INRGNC N MG/L, 18 TOTAL ORGNC N MG/L, 23 TOTAL N MG/L, 6 SUSP. SOLIDS MG/L. Includes data for samples 26-31, 30-31, 27-29, 25-10 and summary statistics.

Table with columns: SAMP DTE HOUR, STN, STN DIST, SAMP BRG, PU DEPTH, 107 CALCUL D-SOLIDS MG/L, 14 COND. 25C UMHOS, 16 TURB. FORMAZIN UNITS, 56 CHLORIDE MG/L, 59 SULPHATE MG/L, 280 REACTIVE SILICATE SI MG/L, 95 ACIDITY PH 8.3 MG/L, 52 TOT ALK AT LAB MG/L, 55 PH AT LAB, 25 PHENOLS UG/L. Includes data for samples 26-31, 30-31, 27-29, 25-10 and summary statistics.

Table with columns: SAMP DTE HOUR, STN, STN DIST, SAMP BRG, PU DEPTH, 208 TOTAL IRON MG/L, 76 CALCUL HARDNESS MG/L, 72 TOTAL CALCIUM MG/L, 74 TOT. MAG NESIUM MG/L, 68 COLOUR HAZEN UNITS, 67 P155IUM K MG/L, 66 SODIUM I.A MG/L, 41 COO MG/L, 265 TOTAL ARSENIC MG/L, 235 TOTAL MERCURY UG/L. Includes data for samples 26-31, 30-31, 27-29, 25-10 and summary statistics.

Table with columns: SAMP DTE HOUR, STN, STN DIST, SAMP BRG, PU DEPTH, 203 TOTAL ALUMINUM MG/L, 221 TOTAL CHROMIUM MG/L, 225 TOTAL COPPER MG/L, 229 TOTAL LEAD MG/L, 15 TOTAL CADMIUM MG/L, 241 TOTAL ZINC MG/L, 201 TOTAL MN MG/L, 238 TOTAL NICKEL MG/L, 217 TOTAL COBALT MG/L, 272 AVAILBLE CYANIDE MG/L CN. Includes data for samples 26-31, 30-31, 27-29, 25-10 and summary statistics.

B.O.W. / SITE: MUSKRAT RIVER
SAMPLE POINT: HIGHWAY 17 BY PASS BRIDGE, PEMBROKE
STATION TYPE: RIVER FLOW GAUGE 02KCO14+015

MAJOR BASIN: GREAT LAKES
MINOR BASIN: OTTAWA RIVER
TERM STREAM: MUSKRAT RIVER

STATION ID: 18-4810-020-02

STORET CODE: 02
006
4210

STN NO: 20 LAT: LONG: U T M: 18 0335850.0 5076900 0 4 REGION: 04 MILEAGE: 0.20

Table with columns: SAMP DTE HOUR, STN, STN DIST, SAMP BRG, PU DEPTH, 934 SAMPLE NO, 901 SCD, 80 TOTAL COLIFORM MF/100ML, 83 BACKGRD COUNT MF/100ML, 81 FECAL COLIFORM MF/100ML, 84 M.F. ENTER. MF/100ML, 805 WATER TEMP. DEG C, 3 DISS. O2 MG/L, 1 5-DAY BOD MG/L, 33 TOTAL P MG/L. Includes data for samples 26-31, 30-31, 27-29, 25-10 and summary statistics.

Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives

AQUATIC ECOSYSTEM OBJECTIVE					
Aquatic Performance Standard	Brook Trout	Brook Trout Brown Trout	Brook Trout Brown Trout	Pike Darters Sunfish	Longnose Dace Brown Bullhead Brook Stickleback
HYDROLOGY					
• baseflow	• minimum 30% of average annual daily flow	• minimum 10-20% of average annual daily flow	• minimum 5% of average annual daily flow or sufficient to maintain isolated pools	• minimum 5% of average annual daily flow or sufficient to maintain isolated pools	• minimum to maintain isolated pools, may be < 5% of average annual daily flow
• bankfull frequency	• 1-2 times per year	• 1-2 times per year	• 1-2 times per year	• as required to protect downstream aquatic communities	• as required to protect downstream aquatic communities
CHANNEL MORPHOLOGY					
• average pool area as % of total surface area at low flow	• dynamically stable channels with 'natural' features	• dynamically stable channels with 'natural' features	• dynamically stable channels with 'natural' features	• dynamically stable channels with 'natural' features	• dynamically stable channels with 'natural' features
• average riffle area as % of total surface area at low flow	• > 12%	• > 12%	• > 10%	• > 4%	• > 4%
• average minimum summer pool depth	• 0.5 m	• 0.3 m	• 0.2 m	• generally > 5%	• may be < 5%
• bankfull width-to-depth ratio	• generally < 10	• generally 5-10	• generally 5-10	• generally 5-10	• no requirement

Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives (cont'd)

Aquatic Performance Standard		AQUATIC ECOSYSTEM OBJECTIVE			
	<input type="checkbox"/> Brook Trout <input type="checkbox"/> Brook Trout <input type="checkbox"/> Brook Trout <input type="checkbox"/> Brook Trout	<input type="checkbox"/> Brook Trout <input type="checkbox"/> Brown Trout	<input type="checkbox"/> Pike <input type="checkbox"/> Darters <input type="checkbox"/> Sunfish	<input type="checkbox"/> Longnose Dace <input type="checkbox"/> Brown Bullhead <input type="checkbox"/> Brook Stickleback	
IN-STREAM COVER	<ul style="list-style-type: none"> • minimum total in-stream cover 30-40% by surface area • woody debris presents up to 10% of surface area • minimum 15% of surface area with overhead cover • minimum 5% of surface area with overhead cover 	<ul style="list-style-type: none"> • minimum 10% of stream area during low flow • 10-20% of bottom of pool/backwater habitats covered by logs, vegetation, woody debris and boulder • cover at stream margins critical for juvenile fish 	<ul style="list-style-type: none"> • minimum 5% of stream area during low flow • 10% of bottom of pools/breakwaters covered by logs, vegetation, woody debris and boulder 	<ul style="list-style-type: none"> • minimum 5% of stream area during low flow • 5% of bottom of pools/backwaters covered by logs, vegetation, woody debris and boulder 	
SUBSTRATE	<ul style="list-style-type: none"> • well-sorted riffle zones • maximum 25% fines in spawning substrates • maximum 30% fines in riffle zones • upwelling conditions required • minimum 50% of riffles composed of cobble, rubble, small boulder 	<ul style="list-style-type: none"> • D50 in pools generally < 80 mm • fines in riffle zones moderate to low (< 50%) 	<ul style="list-style-type: none"> • D50 in pools generally < 40 mm • more fines in riffle zones, generally > 50% 	<ul style="list-style-type: none"> • no requirement 	

Table F.1: Biophysical Performance Standards for Aquatic Ecosystem Objectives (cont'd)

AQUATIC ECOSYSTEM OBJECTIVE			
Aquatic Performance Standard	□ Brook Trout	□ Brook Trout □ Brown Trout	□ Pike □ Darters □ Sunfish
RIPARIAN HABITAT	□ Longnose Dace □ Brown Bullhead □ Brook Stickleback		
• shaded during 1000-1400hr	• minimum 35%	• minimum 0% • maximum 50-75%	• minimum 0% • maximum 75%
• woody debris	• important component of in-stream cover and roughness	• important for roughness and refuge during peak flows	• woody debris less important
WATER QUALITY			
• maximum annual water temperature	22°C	30°C	31-35°C
• average annual total suspended solids (ppm)	< 20	< 150	< 400
• dissolved oxygen (ppm)	> 5	> 3-4	> 2
• spills	none	none	none
BARRIERS	• remove as feasible	• removal as feasible	• minimize as feasible
			• minimize as feasible



Ontario

Ministry of the Environment
Ministère de l'Environnement

CERTIFICATE OF APPROVAL
INDUSTRIAL SEWAGE WORKS
NUMBER 6988-6VZJFB
Issue Date: June 4, 2007

Miller Group Inc.
PO Box 4080 Stn Industrial Park
Markham, Ontario
L3R 9R8

Site Location: Braeside Quarry
Lot 16 and 17, Concession A
McNab-Braeside Township, County of Renfrew

You have applied in accordance with Section 53 of the Ontario Water Resources Act for approval of:

the establishment of sewage works for the collection, transmission, treatment and disposal of up to 116 litres per second of surface water and groundwater collecting within the confines of the quarry, consisting of the following:

- collection ditches in the quarry floor draining to the pumping sump;
- one (1) pumping sump measuring approximately 35 metres wide, 35 metres long and 8.5 metres deep, equipped with a two (2) submersible pumps, the first used during spring and rainfall events operating at up to 116 litres per second and the other used at other times operating at up to 50 litres per second, discharging to an existing on-site ditch that drains to the roadside ditch on the east side of County Road 3;
- all other controls, electrical equipment, instrumentation, piping, pumps, valves and appurtenances essential for the proper operation of the aforementioned sewage works;

all in accordance with the following submitted supporting documents:

1. Application for Approval of Industrial Sewage Works submitted by Bob Bugden of Miller Group Inc. dated March 9, 2006;
2. Permit to Take Water Application, Braeside Quarry, prepared by Gorrell Resource Investigations, dated March 2004; and
3. Letter and attachments dated March 26, 2007 from Jennifer Gorrell of Gorrell Resource Investigations to Randy Chin of the Ministry of the Environment.

For the purpose of this Certificate of Approval and the terms and conditions specified below, the following definitions apply:

"Certificate" means this entire certificate of approval document, issued in accordance with Section 53 of the *Ontario Water Resources Act* , and includes any schedules;

"Director" means any Ministry employee appointed by the Minister pursuant to section 5 of the *Ontario Water Resources Act* ;

"District Manager" means the District Manager of the Ottawa District Office of the Ministry;

"Ministry" means the Ontario Ministry of the Environment;

"Owner" means Miller Group Inc. and includes its successors and assignees; and

"works" means the sewage works described in the Owner's application, this certificate and in the supporting documentation referred to herein, to the extent approved by this certificate.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITION

(1) Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the works in accordance with the description given in this Certificate, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this Certificate.

(2) Where there is a conflict between a provision of any submitted document referred to in this Certificate and the Conditions of this Certificate, the Conditions in this Certificate shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

2. CHANGE OF OWNER

(1) The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within 30 days of the change occurring:

(a) change of Owner or operating authority, or both;

(b) change of address of Owner or operating authority or address of new owner or operating authority;

(c) change of partners where the Owner or operating authority is or at any time becomes a

partnership, and a copy of the most recent declaration filed under the *Partnerships Registration Act* ;

(d) change of name of the corporation where the Owner or operator is or at any time becomes a corporation, and a copy of the most current "Initial Notice or Notice of Change" (Form 1, 2 or 3 of O. Reg. 189, R.R.O. 1980, as amended from time to time), filed under the *Corporations Information Act* shall be included in the notification to the District Manager;

(2) In the event of any change in ownership of the works, the Owner shall notify in writing the succeeding owner of the existence of this certificate, and a copy of such notice shall be forwarded to the District Manager.

(3) The Owner shall ensure that all communications made pursuant to this condition will refer to this certificate's number.

3. OPERATIONS MANUAL

(1) The Owner shall prepare an operations manual prior to the commencement of operation of the sewage works, that includes, but not necessarily limited to, the following information:

(a) operating procedures for routine operation of the works;

(b) inspection programs, including frequency of inspection, for the works and the methods or tests employed to detect when maintenance is necessary;

(c) repair and maintenance programs, including the frequency of repair and maintenance for the works;

(d) contingency plans and procedures for dealing with potential spill, bypasses and any other abnormal situations and for notifying the District Manager; and

(e) complaint procedures for receiving and responding to public complaints.

(2) The Owner shall maintain the operations manual up to date through revisions undertaken from time to time and retain a copy at the location of the sewage works. Upon request, the Owner shall make the manual available for inspection and copying by Ministry personnel.

4. EFFLUENT OBJECTIVES

(1) The Owner shall use best efforts to design, construct and operate the works with the objective that the concentration of Total Suspended Solids does not exceed 10 milligrams per litre in the effluent from the works.

(2) The Owner shall include in all reports submitted in accordance with Condition 8 a summary of the efforts made and results achieved under this Condition.

5. EFFLUENT LIMITS

(1) The Owner shall design, construct and operate the works such that the concentration of Total Suspended Solids does not exceed 15 milligrams per litre in the effluent from the works.

(2) For the purposes of determining compliance with and enforcing subsection (1), non-compliance with respect to the Total Suspended Solids concentration limit is deemed to have occurred when any single sample analyzed for Total Suspended Solids is greater than the corresponding maximum concentration set out in subsection (1).

6. EFFLUENT - VISUAL OBSERVATIONS

Notwithstanding any other condition in this certificate, the Owner shall ensure that the effluent from the works is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen or foam on the receiving waters.

7. SURFACE WATER AND EFFLUENT MONITORING AND RECORDING

The Owner shall carry out the following monitoring program:

(1) All samples and measurements taken for the purposes of this certificate are to be taken at a time and in a location characteristic of the quality and quantity of the effluent stream over the time period being monitored.

(2) Samples shall be collected at Stations 1, 2, 3 and 4, as identified in subsection (4), and analyzed, at the sampling frequencies and using the sample type specified, for each parameter listed:

Table 1 - Surface Water and Effluent Quality Monitoring	
Frequency	Station 1: Once each week for the first six weeks of discharge and during the months of June, July and August and monthly thereafter Stations 2, 3 & 4: in accordance with subsection (5)
Sample Type	Grab
Parameters	Total Suspended Solids
Frequency	Station 1: Once each month during periods of discharge Stations 2, 3 & 4: in accordance with subsection (5)
Sample Type	Grab
Parameters	Alkalinity, DO (field), pH (field), Temperature (field), Conductivity (field), Total Dissolved Solids, Chloride, Nitrite, Nitrate, Sulphate, Total Kjeldahl Nitrogen, Total Ammonia, Hardness, 2-4 Dinitrotoluene and 2-6 Dinitrotoluene

(3) The methods and protocols for sampling, analysis, and recording shall conform, in order of precedence, to the methods and protocols specified in the following:

(a) the Ministry's publication "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" (August 1994), ISBN 0-7778-1880-9, as amended from time to time by more recently published editions; and

(b) the publication "Standard Methods for the Examination of Water and Wastewater" (17th edition) as amended from time to time by more recently published editions.

(4) The sampling locations identified in subsection (2) shall be as follows:

- Station 1: the discharge from the quarry – compliance point (SW2)
- Station 2: Carmichael Sideroad, upstream of the confluence of the roadside ditch and Ryans Creek
- Station 3: Ryans Creek, upstream of the confluence of roadside ditch and Ryans Creek (SW4)
- Station 4: Ryans Creek, downstream of the confluence of roadside ditch and Ryans Creek (SW6)

(5) Sampling Stations 2, 3 & 4 shall be sampled as follows:

- (i) 3 times each year during high flow conditions in the receiver with no discharge from the quarry;
- (ii) 3 times each year during low flow conditions in the receiver with no discharge from the quarry;
- (iii) 3 times each year during high flow conditions in the receiver with discharge from the quarry; and
- (iv) 3 times each year during low flow conditions in the receiver with discharge from the quarry.

(6) During each sampling, undertaken pursuant to subsection (5), the Owner shall undertake visual inspections of the conditions at Stations 1, 2, 3 and 4 and photographically record their observations.

(7) The Owner shall measure, record and calculate the flowrate from Station 1 daily and at Stations 2, 3 & 4 at the time of each sampling.

(8) Conductivity, Temperature and pH shall be measured and recorded in the field at the time of sampling. The concentration of un-ionized ammonia shall be calculated using the total ammonia concentration, pH and temperature using the methodology stipulated in "Ontario's Provincial Water Quality Objectives" dated July 1994, as amended, for ammonia (un-ionized).

(9) The measurement frequencies and listed parameters specified in subsection (2), in respect of any parameter are minimum requirements which may, after 12 months of monitoring in accordance with this Condition, be modified by the District Manager in writing from time to time.

(10) The Owner shall retain for a minimum of three (3) years from the date of their creation, all records

and information related to or resulting from the monitoring activities required by this certificate.

8. REPORTING

(1) One week prior to the start up of the operation of the works, the Owner shall notify the District Manager (in writing) of the pending start up date.

(2) The Owner shall report to the District Manager or designate, of any exceedence of any parameter specified in Conditions 5 and 6 orally, as soon as reasonably possible, and in writing within seven (7) days of the exceedence.

(3) In addition to the obligations under Part X of the *Environmental Protection Act*, the Owner shall, within 10 working days of the occurrence of a reportable spill, bypass or loss of any product, by product, intermediate product, oils, solvents, waste material or any other polluting substance into the environment, submit a full written report of the occurrence to the District Manager describing the cause and discovery of the spill or loss, clean-up and recovery measures taken, preventative measures to be taken and schedule of implementation.

(4) The Owner shall prepare and submit a performance report to the District Manager on an annual basis within ninety (90) days following the end of the period being reported upon. The reports shall contain, but shall not be limited to, the following information:

(a) a summary and interpretation of all monitoring data collected pursuant to Condition 7 and a comparison to the effluent limits outlined in Conditions 5 and 6 and the Provincial Water Quality Objective and/or Ontario Drinking Water Objective for the monitored parameter, including an overview of the success and adequacy of the sewage works. The report should provide an interpretation of the data as to the impact of the quarry discharge to the receiving stream with respect to water quality and quantity during periods of low and high flows and periods of discharge and no discharge;

(b) a description of any operating problems encountered and corrective actions taken;

(c) a summary of any effluent quality assurance or control measures undertaken in the reporting period; and

(d) a summary of the calibration and maintenance carried out on all effluent monitoring equipment; and

(e) a description of efforts made and results achieved in meeting the Effluent Objectives of Condition 4.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Certificate and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review.
2. Condition 2 is included to ensure that the Ministry records are kept accurate and current with respect to approved works and to ensure that subsequent owners of the works are made aware of the certificate and continue to operate the works in compliance with it.
3. Condition 3 is included to ensure that a comprehensive operations manual governing all significant areas of operation, maintenance and repair is prepared, implemented and kept up-to-date by the owner and made available to the Ministry. Such a manual is an integral part of the operation of the works. Its compilation and use should assist the owner in staff training, in proper plant operation and in identifying and planning for contingencies during possible abnormal conditions. The manual will also act as a benchmark for Ministry staff when reviewing the owner's operation of the work.
4. Condition 4 is imposed to establish non-enforceable effluent quality objectives which the owner is obligated to use best efforts to strive towards on an ongoing basis. These objectives are to be used as a mechanism to trigger corrective action proactively and voluntarily before environmental impairment occurs and before the compliance limits of Condition 5 are exceeded.
5. Conditions 5 and 6 are imposed to ensure that the effluent discharged from the works meets the Ministry's effluent quality requirements thus minimizing environmental impact on the receiver.
6. Condition 7 is included to require the owner to demonstrate on a continual basis that the quality of the effluent from the approved works is consistent with the effluent limits specified in the certificate and that the approved works does not cause any impairment to the receiving watercourse.
7. Condition 8 is included to provide a performance record for future references and to ensure that the Ministry is made aware of problems as they arise, so that the Ministry can work with the Owner in resolving the problems in a timely manner.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, as amended, you may by written notice served upon me and the Environmental Review Tribunal and in accordance with Section 47 of the Environmental Bill of Rights, S.O. 1993, Chapter 28, the Environmental Commissioner, within 15 days after receipt of this Notice, require a hearing by the Tribunal. The Environmental Commissioner will place notice of your appeal on the Environmental Registry. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, Chapter 0.40, provides that the Notice requiring the hearing shall state:

1. The portions of the approval or each term or condition in the approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The Certificate of Approval number;
6. The date of the Certificate of Approval;
7. The name of the Director;
8. The municipality within which the works are located;

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
2300 Yonge St., Suite 1700
P.O. Box 2382
Toronto, Ontario
M4P 1E4

AND

The Environmental Commissioner
1075 Bay Street, 6th Floor
Suite 605
Toronto, Ontario
M5S 2B1

AND

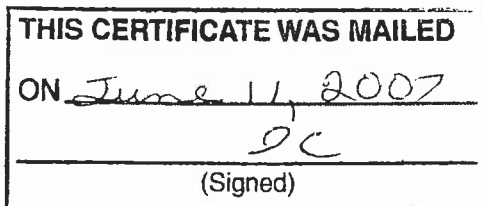
The Director
Section 53, *Ontario Water Resources Act*
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

* Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 314-4600, Fax: (416) 314-4506 or www.ert.gov.on.ca

This instrument is subject to Section 38 of the Environmental Bill of Rights, that allows residents of Ontario to seek leave to appeal the decision on this instrument. Residents of Ontario may seek leave to appeal within 15 days from the date this decision is placed on the Environmental Registry. By accessing the Environmental Registry at www.ene.gov.on.ca, you can determine when the leave to appeal period ends.

The above noted sewage works are approved under Section 53 of the Ontario Water Resources Act.

DATED AT TORONTO this 4th day of June, 2007



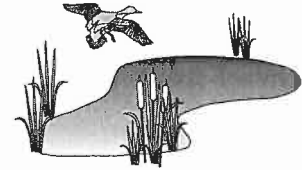
Mohamed Dhalla, P.Eng.
Director
Section 53, *Ontario Water Resources Act*

RC/

c: District Manager, MOE Ottawa
Jennifer B. Gorrell, P.Geo., P.Eng., Gorrell Resource Investigations ✓

APPENDIX E

Curriculum Vitae - Bernie Muncaster, M.Sc., B.Sc.



BERNIE W. MUNCASTER, M.Sc., B.Sc.

EDUCATION

M.Sc., Biology, University of Windsor, Area of Emphasis: Aquatic Toxicology, 1987
B.Sc. (Honours), Ecology, College of Biological Sciences, University of Guelph, 1984

POSITIONS HELD

2002-present: Muncaster Environmental Planning Inc., Principal
1995-2002: ESG International Inc., Regional Manager, Principal, Ottawa
1990-1995: Ecological Services for Planning Ltd/ESG International Inc., Project Manager, Guelph
1988-1990: B.A.R. Environmental Inc., Aquatic Biologist
1985-1988: Great Lakes Institute, University of Windsor, Graduate Student and Research Assistant
1984-1985: University of Guelph, Research Assistant, Department of Zoology
1980-1983: Biological Research Division, Ontario Hydro, Toronto; Department of Zoology, University of Guelph, Summer Technician Positions.

EXPERIENCE

Extensive project management experience of environmental assessments, watershed studies and route selection studies. These projects have involved giving evidence at the Ontario Municipal and Energy Boards, considerable agency interaction, obtaining approvals under the *Fisheries Act* and working jointly with consulting engineers, planners and members of other disciplines.

Certified as a *Fisheries Assessment Specialist* and *Fisheries Contract Specialist* by the Ministry of Transportation following the MTO/DFO/OMNR fisheries protocol.

Environmental Assessments and Monitoring for highways, residences, golf courses, quarries and pipelines

Monitoring of highway construction within sensitive habitats such as rivers and wetlands. For example, monitoring of Highway 28 at Paudash during replacement of the bridge structure over the Crowe River, sensitive coldwater habitat on Highway 60 between Douglas and Eganville, Highway 33 along Lake Ontario near Bath, and dozens of fish habitat watercourses during rehabilitation of Highway 417 east of Ottawa and Highway 7 west of Ottawa

Aquatic, wetland and terrestrial inventories, including fish surveys, impact assessments and production of environmental screening reports for proposed highway, regional and local road construction in eastern Ontario under the Class Environmental Assessment Process, including work in the City of Ottawa on Bank Street, Highway 417, Limebank Road, St. Joseph Blvd., Woodroffe Avenue, Hazeldean Road, Cleopatra Street and Terry Fox Drive, Clarence-Rockland on County Road 17, and City of Kingston on Wellington Street

Completion of Compensation Agreements under the Federal Fisheries Act where impairment to fish habitat was identified. The agreements were completed for highway reconstructions, watercourse realignments, installation of docks, utility crossings, public transit operations and residential developments

491 Buchanan Crescent, Ottawa, ON K1S 7B2

Tel (613) 748-3753 Fax (613) 748-6376

Fisheries assessment and stormwater quality surveys for MTO. Potential impacts and mitigation measures for the natural environment features from highway widening and bridge reconstructions were established. Inspections for the National Capital Commission and the City of Ottawa for breeding birds prior to removal of woody vegetation during the breeding bird period

Detailed fish habitat, breeding bird and terrestrial surveys of potential impacts on aquatic and riparian habitat through watercourse crossings and adjacent developments throughout Ontario, including infrastructure such as the South Nepean Collector. Projects involved agency correspondence, identification of mitigation measures and in many cases evidence provided to the Ontario Municipal and Energy Boards

Production of Preliminary Tree Preservation and Conservation Plans and Final Tree Studies for proposed developments as required in Official Plans

Four season ecological inventories for several public and private lands in the National Capital Region, including the upper portions of Monaghan Drain at Fernbank Road. Significant and sensitive habitats were identified. Developed mitigation plans for environmental features

Surveys of the wetland, terrestrial and aquatic environments for proposed residential developments using a four season's approach and the Ecological Land Classification methodology. Environmental constraints to development were classified, include core and secondary areas and linkages, and applied in the concept plans. Wildlife corridors connecting ESAs were identified as were other potential mitigation measures such as deer culverts, vegetation plantings to provide maximum benefit to wildlife, construction timing and stream restoration. Evidence provided to the Ontario Municipal and Environmental Assessment Boards

Evaluation of the impacts of proposed aggregate operations on cold water fisheries habitat

Production of Preliminary Tree Preservation and Conservation Plans and Final Tree Studies for proposed developments as required in Official Plans

Development of a turfgrass management plan for a tournament quality golf course

An Initial Environmental Evaluation of aggregate removal in Lake Superior on the aquatic habitat for the Federal Environmental Assessment Review Process

Route and Site Selections for Pipelines and Landfills

Route selection and environmental and socio-economic impacts assessments of proposed pipelines throughout Ontario, including crossings of the Ottawa River and St. Clair River. Approval obtained from National and Ontario Energy Boards, and evidence provided to the Ontario Energy Board

Evaluation of natural environment attributes of candidate areas for landfill operation as part of the Environmental Assessment Act

Delineation of wetland, aquatic and terrestrial features for proposed landfill expansions.

Development of Management Plans

The Kanata North, Sawmill Creek, McEwan Creek, Laurel Creek, Fletchers Creek, Centennial Creek and Grindstone Creek subwatershed studies identified core areas and linkages based on field surveys and reviews of existing information

The Urban Natural Areas Environmental Evaluation for the City of Ottawa

Wetland Management Plans for Shirleys Bay, Mer Bleue and the Greenboro Turtlehead Nature Area

Production of a Management Plan for the McKay Lake area

Management and Scientific Contributions to a Range of Technical Studies

Development of over fifteen Provincial Water Quality Guidelines for the Ontario Ministry of the Environment

Completion of detail Environmental Effects Monitoring for Pulp and Paper Mills in eastern Ontario,

including fish and benthic invertebrate sampling design and field work
Review of zebra mussel biology and their impacts on industrial operations
Referee of manuscripts for scientific journals

AWARDS

University of Windsor, Postgraduate Summer Scholarship, 1987

APPENDIX F

Curriculum Vitae - Jay Clark, P. Eng

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

EDUCATION

Bachelor of Science in Engineering
University of Guelph, 1980
Majored in Civil Engineering

Post Graduate Course
University of Alberta, 1982
640 River Engineering

Building Code Identification Number: 24240
On Site Sewage
General Legal/Process

**PROFESSIONAL
BACKGROUND**

Skelton, Brumwell & Associates Inc.
2004 to present - Senior Project Engineer

Senior Project Engineer responsible Urban Design projects reconstructing roadways, sewers and water mains; preparation of Environmental Study Master Plan Reports for multi-million dollar Water Distribution and Sewage Collection System Expansions, drainage investigations and on-site sewage treatment and disposal.

Henderson Paddon & Associates Ltd.
1998-2004 - Principal / Senior Environmental Engineer

Senior Engineer responsible for coordination of various municipal engineering projects undertaken by the firm. Specializing in Downtown Street & Street scape Reconstruction, Stormwater Management and Water Supply, Municipal Class Environmental Assessments and undertaking of a Major Slope Stabilization Project.

Henderson Paddon & Associates Ltd.
1989-1998 - Intermediate Environmental Engineer

Intermediate Project Engineer responsible for Master Drainage Study, Hydrologic Modelling, Stormwater Management Reports, Design and Contract Administration for flood way channelization, vertical drop structures and stormwater detention and sediment control ponds, and Inflow/Infiltration Studies of sanitary sewerage basins for municipalities.

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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**PROFESSIONAL
BACKGROUND**
cont'd

Gamsby and Mannerow Limited
1988-1989 - Project Engineer

Intermediate Project Engineer responsible for hydrologic computer modelling, stormwater management reports, on site sewage treatment and disposal system design, and an inflow/infiltration study of municipal sanitary sewerage basins.

MacLaren (Lavalan) Engineers
1986-1988 - Project Engineer

Project Engineer responsible for contract administration of the City of London Greenway Pollution Control Centre - Incinerator Ancillary Building, Expansion & Modification, Waste Activated Sludge Facilities Expansion and Renovations and Sludge Holding Tank and Modification.

Long Point Regional Conservation Authority
1984-1986 - Project Engineer responsible for flood and erosion projects

Credit Valley Conservation Authority
1983-1984 - Project Engineer responsible for flood and erosion projects

Associated Engineering Services Limited (Edmonton) AESL
1980-1983 - Engineer in Training responsible for stormwater and sewage projects

**MEMBERSHIP &
ASSOCIATIONS**

Professional Engineers of Ontario (designated as a Consulting Engineer)

KEY PROJECTS

URBAN DESIGN

City of Owen Sound - Street scape and Street Reconstruction of nine (9) blocks on 2nd Avenue East, 10th Street and 11th Street East-Project Manager for design, field survey pre-design work; supervise preparation of AutoCAD engineering drawings; construction supervision, processing of payment certificates, works replaced water mains, sanitary sewers and installed new storm sewers, street lighting, traffic signals and street scape. - \$7,000,000

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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URBAN DESIGN
cont'd

Town of Blue Mountains - Comprehensive Environmental Study Report for the Lora Bay, Clarksburg, Thornbury and Camperdown Service Areas Phase 2 Report. (Specifically the Water Distribution and Sewage Collection Systems - \$23,400,000)

Town of Blue Mountains - Georgian View Estates road reconstruction and new sanitary sewer design works. - \$800,000

Town of Blue Mountains - Combined Environmental Assessment Master Plan for Craigeith, Castle Glen and Osler Service Areas - Phase 2 Report (Specifically the Water Distribution and Sewage Collection Systems - \$21,600,000)

**EXPERT EVIDENCE
AND OPINION**

Miller Paving Ltd. - Surface Drainage Report in support of a Class "A" Licence and Testimony at OMB Hearing for the Lawrence (Durham) Pit

Miller Paving Ltd. - Surface Drainage Report in support of a Class "A" Licence and Testimony at OMB Hearing for the Batterman (Sullivan) Pit

Miller Paving Ltd. - Surface Drainage Report in support of a Class "A" Licence for the Sydenham Quarry Expansion

Miller Paving Ltd. - Hydrologic Report in support of a Class "A" Licence for the Graham (Minden Hills) Quarry Expansion of Wayside Quarry

Miller Paving Ltd. - Hydrological Investigation in support of a Class "A" Licence for the Braeside (McNab/Braeside) Quarry Expansion

Canadian Agra-Report for a civil suit Evaluating Engineering Design of a Large Subsurface Sewage System failure.

Euphrasia Township - Testimony at two (2) Niagara Escarpment Commission Hearings for the Kimberley-Amik-Talisman Water Supply Class Environmental Assessment (CEA) resulting in the Commission's rejection of staff planning recommendations and acceptance of the CEA for Kimberley-Amik-Talisman Water system.

Kettle Creek Conservation Authority - Testimony at the Mining and Lands Commission to prevent home construction within the Hurricane Hazel Flood way in the St Thomas area.

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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WATER WORKS

Township of Euphrasia - Class Environmental Assessment (CEA) for Kimberley-Amik-Talisman Water system with a capacity of 300,000 USgpd

Word of Life Fellowship Camp - Engineers Report O. Reg 505/02 recommending upgrade with green sand filters, ion exchangers, cartridge filters, hydropneumatic tanks primary U.V. disinfection, secondary sodium hypochlorite disinfection and appurtenances.

Ministry of Community, Family and Children's Services - Engineers Evaluation Report O. Reg 170/03 of the Durham Group Home water well supply and UV disinfection system.

Bucks Crossing Golf Course Irrigation Water Supply - drought flow assessment with 7 day low flow with a 20 year recurrence (7Q20) calculations utilizing Multiple Regression Analysis to justify Water Taking Permit Application for irrigation.

Osler Bluffs Ski Resort - assess water treatment upgrades to meet O. Reg. 170/03 for the Osler Pines, Angus and Osler view water facilities.

High County Springs water taking justification report including regression analysis of stream flow data to calculate frequency lines for annual monthly low flow and estimation of 7 day low flow with a 20 year recurrence (7Q20).

Loose Moose Magic Village Campground - Design WTP including 3 wells, submersible pumps, hydro pneumatic tanks, dual cartridge filtration, primary sodium hypochlorite disinfection, flow paced dual chemical feed pumps, raw and treated water turbine meters c/w 4-20 mA output and tricon transmitters, float valve c/w float mechanism in reservoir, 3 vertical turbine pumps c/w aquavar CPC (86 GPM), turbidity meter, chlorine/ph analyser, chessel data logger and EPANET 2 computerized hydraulic modelling of the water distribution system.

SEWAGE WORKS

City of Lloydminster, Alberta - Surge network analysis SURNAL computer simulation of transient flow conditions for sanitary force mains.

County of Parkland, Alberta - Final design for 9 km of 760 mm concrete sewer.

City of London - Fluid bed incinerator installation at Greenway Pollution Control Centre (295 t/d)

City of London - 230,000 l Gal steel plate sludge holding tank installation

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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SEWAGE WORKS
cont'd

County of Simcoe - Assess natural wastewater treatment systems for the Collingwood Landfill site including free water systems (FWS), subsurface flow systems (SFS) and peat sand filter (PSF) systems.

Bruce Packer's Ltd. - Assess treatment efficiency of a waste stabilization pond.

Laidlaw Waste Systems (Durham) Ltd. - Assess treatment feasibility of leachate treatment by spraying irrigation.

Berford Lake Water Quality Report - Assess proposed subdivision on-site secondary and tertiary sewage systems impacts on surface water and comparison with adjacent Albemarle Brook cold water fishery water quality.

Numerous Campgrounds - Fisherman's Cove (710 sites)/New Fairway Park (500 sites)/Ziontario and Word Of Life. Assess on-site secondary and tertiary sewage systems impacts on groundwater and surface water regimes.

STORM DRAINAGE

Alberta Environment - Spring Creek Basin Hydrology Study

Town of Stony Plain, Alberta - Master Drainage Study

Associated Engineering Services Limited - Preparation of the company users Manual for the Hydrologic Model HYMO

Alberta Environment - Deadfish Creek Diversion Project encompassing 7 km of channelization and earth embankment dams.

Long Point Conservation Authority - Flood line Mapping of Port Ryerse, Vittoria and Port Burwell

Laidlaw Waste Systems (Ottawa) Ltd landfill site - Drainage system including sediment control and three (3) groundwater recharge ponds.

Laidlaw Waste Systems (Newcastle)Ltd landfill site - Drainage report including peak flow attenuation pond design with plunge pool, drop inlet pipe principle spillway and riprap emergency spillway

Laidlaw Waste Systems (Sarnia) Ltd landfill site - Drainage report including peak flow attenuation pond design with plunge pool, drop inlet pipe principle spillway and riprap emergency spillway

**CURRICULUM
VITAE**

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John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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STORM DRAINAGE
cont'd

Laidlaw Waste Systems (Richmond) Ltd landfill site - drainage reports including peak flow attenuation pond design with plunge pool, drop inlet pipe principle spillway and riprap emergency spillway

Laidlaw Waste Systems (Sutcliffe) Ltd landfill site - drainage reports including peak flow attenuation pond design with plunge pool, drop inlet pipe principle spillway and riprap emergency spillway

City of Owen Sound - Design and Contract Administration for Stormwater Quality (Wetland) Pond to settle out colloidal particles; five (5) armour stone drop structures and flood way channelization; armour stone impact basin immediately upstream of twin concrete box culverts 2.4 m x 4.8 m; and two (2) peak flow attenuation ponds constructed within the Kenny Drain

City of Owen Sound - Class Environmental Assessment for Kenny Drain and West Branch Tributary of Telfer Creek. (The total estimated 1993 Project Cost was \$4,736,000.)

City of Owen Sound - Flood line Mapping of the Kenny Drain immediately d.s. of the Industrial Park to East Bayshore Rd

City of Owen Sound - Flood line Mapping of the Industrial Park on 16th Ave between 16th St and 23 rd St

Tim Horton's (Hepworth) - stormwater report addressing parking lot storage for post to pre development peak flow attenuation

Zehrs Food Plus (Owen Sound) - parking lot layout, storm sewer and manhole orifice controls, and roof top storage for post to pre development peak flow control

DAM EVALUATION

Shell Oil Canada, Swan Hills, Alberta - Complete hydrologic computer HYMO simulation to determine the Probable Maximum Flood by computing the inlet hydrograph, calculate principle spillway capacity with broad crest weir flow and estimate reservoir stage-storage, route the reservoir to determine the outlet hydrograph and determine allowable freeboard for each earth fill dam emergency spillway.

Town of Flesherton - Hydraulic Evaluation Report of the failing Mill Creek Dam spillway at Hwy #4 crossing (MTO Approval). Assess preliminary design proposal to remediate spillway with gabion basket drop structure by others, rejection of gabion structure due to high velocities and hydraulic analysis of armour stone drop structure and armour stone baffled chute drop

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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DAM EVALUATION

cont'd

structure alternatives, final design and contract administration of an armour stone baffled chute drop structure replacing the failing dam spillway.

Credit Valley Conservation Authority - Town of Orangeville Dam Water Balance Study. Installation and weekly monitoring of V - notch weirs at inlet streams and estimate inflow, weekly review of dam principle spillway outflow records, calculate weekly reservoir evaporation loss, measure reservoir levels and changes in storage volume. Substantial water loss to the permeable insitu soil and relief wells within the dam was quantified.

Grey Sauble Conservation Authority - Class Environmental Assessment for the Tara Dam Evaluation Study. Review of geo-technical report identifying dam failure mechanisms (overturning/sliding/bearing capacity/overtopping)and the natural environment survey report, identify piping as a failure mechanism by estimating the weighted creep ratio and factor of safety, hazard classification, risk assessment, review and correct HEC-2 modelling, utilize Rosgen stream morphology classification to determine fish habitat enhancement, complete preliminary design of earth fill dams with impervious core and cut-off wall and/or blanket and armour stone spillway, assess natural, social and economic impacts of river reinstatement, dam removal and replacement alternatives.

**EROSION CONTROL
PROJECTS**

Grey Sauble Conservation Authority - Report addressing Department of Fisheries and Oceans, concerns with realignment of the Beaver River at Thornbury and its impact on Mobile Bed Fluviology encompassing morphologic classification, assessing transport capacity, dynamic equilibrium, sediment transport and river regime.

City of Owen Sound - Class Environmental Assessment (CEA) for Park view Estates Gully Erosion Study (39 homes of 54 total at imminent risk). Assess natural, social and economic impacts of cut slope, fill slope and land acquisition alternatives. Complete Final Design of 2:1 granular 'B' Fill Slope with benching at 10 m vertical spacing including sub-surface drainage system, storm sewer and overflow channel. Site Supervision and Contract Administration (Total Construction Cost \$1,800,000)

Town of Thornbury - CEA for Beaver River Erosion Study (5 homes on Bruce Street at imminent risk) due to toe erosion from river. Assess natural, social and economic impacts of cut slope, fill slope and land acquisition

alternatives. Proposed remediation of near vertical banks by fill slope with river realignment and armour stone toe slope protection.

**CURRICULUM
VITAE**

SKELTON BRUMWELL & ASSOCIATES INC.

John Andrew (Jay) Clark, B.Sc. (Eng), P. Eng.
Senior Project Engineer

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**EROSION CONTROL
PROJECTS cont'd**

Laidlaw Waste Systems (Newcastle) - Report assessing annual erosion loss for continuous and non continuous (benching) uniform landfill slopes with recommended mid slope intercept drain and erosion control measures

City of Owen Sound - Kenny Drain Industrial Park final design of five (5) armour stone vertical drop structures and flood way channelization; diversion channel weir and low flow channel orifice structures, and armour stone impact basin immediately upstream of twin concrete box culverts 2.4 m x 4.8 m