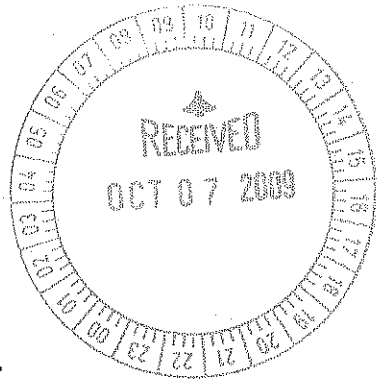
CAPITAL PAVING INC.

P.O. Box 815, Guelph, Ontario N1H 6L8

COPY

October 2, 2009

Grand River Conservation Authority
400 Clyde Rd.
P.O Box 729
Cambridge, ON N1R 5W6



Attention: **Melissa Larion, B.E.S, M.A**
Resource Planner

RE: **Response to GRCA Comments**
Capital Paving Inc. – Montrose Pit
Part of Lots 71, 74 & 75 Concession G.C.T
Township of Woolwich, Region of Waterloo

Dear Ms. Larion,

On July 18, 2008, Capital submitted an application to the Ministry of Natural Resources for a *Category 1; Class A – Pit Below the Water Table* under the *Aggregate Resources Act* for the above noted property.

On May 4, 2009, Capital received a letter from the MNR stating that the Ministry no longer has any remaining concerns with this application.

Capital received written comments from the GRCA on October 17, 2008 during the 45-day Notification and Consultation period.

Following a site visit on January 23, 2009 with representatives from the GRCA, MNR, Groundwater Science Corp., Stantec Consulting Ltd. and Capital, Capital and its Consulting team submitted technical responses to the GRCA on March 2, 2009.

Capital subsequently received a letter from the GRCA on June 25, 2009 with comments that required additional responses and clarification. This letter serves as a response to those comments raised by the GRCA. Please find attached with this letter, technical responses prepared by Capital's consultants, Groundwater Science Corp. and Stantec Consulting Ltd. that addresses each comment in detail.

We trust that the responses enclosed with this letter will satisfy the remaining concerns of the GRCA regarding this licence application. The GRCA's prompt review of the enclosed information would be greatly appreciated.

Should you have any questions or concerns, please do not hesitate to contact me at (519) 822 – 4511 or email at glourenco@capitalpaving.on.ca

Yours truly,

CAPITAL PAVNG INC.

George Lourenco
Resources Manager

Encls. Technical Response letter dated October 1, 2009 (Groundwater Science Corp.)

Technical Response letter dated October 2, 2009 (Stantec Consulting Ltd.)

CC. Diane Schwier, Ministry of Natural Resources
Jeremy Vink, Township of Woolwich
Brenna MacKinnon, Region of Waterloo

E.C. Glenn Harrington, HarringtonMacAvan Ltd.(Formerly Harrington & Hoyle Ltd.)
Bernie Janssen, HarringtonMacAvan Ltd.(Formerly Harrington & Hoyle Ltd.)
Andrew Pentney, Groundwater Science Corp.
Dan Eusebi, Stantec Consulting Ltd.

Groundwater Science Corp.

24 Erb Street East
Waterloo, ON N2J 1L6
Phone: (519) 746-6916
Fax: (519) 884-5996

October 1, 2009

Mr. Nick Toth
Capital Paving Inc.
P.O. Box 815,
Guelph, Ontario
N1H 6L8

Dear Mr. Toth:

RE: Technical Response
Grand River Conservation Authority Letter dated June 25, 2009
Capital Paving Inc. Proposed Montrose Pit.

As requested, this letter provides a technical response to the groundwater related comments provided by the Grand River Conservation Authority (GRCA) in the letter dated June 25, 2009 regarding the Aggregate Resource Act Licence application for the proposed Montrose Pit. Specifically, this response addresses GRCA Engineering Comment No. 1 and Terrestrial Comments No. 1 and 5. Stantec is providing additional response to GRCA comments related to ecological issues.

This response refers to some additional work completed at the site, including the installation of two new drive-point piezometers to assess and monitor conditions within the wetland area between the site and the Grand River, and, on-going water level monitoring. The location of the additional drive-point piezometers (DP5 and DP6) are shown on the attached Figure 1. A summary with the updated water level monitoring data is also included with this letter.

Engineering Comments

1. *Groundwater Monitoring Data, Extraction Plan and Pond Volume.*

An updated monitoring summary is attached to this letter for reference. The Establish Groundwater Table at the site for the purposes of the Site Plan was developed in accordance with Ministry of Natural Resources (MNR) Policy. The Established Groundwater Table for the Site Plan is based on the observed December 2006 water table elevations at 9 monitoring well and drive-point piezometer locations distributed across the site. The December 2006 measurements correspond to a time of seasonal high based on the over 1.5 years of monitoring data available at that time. Subsequent monitoring has confirmed that Established Groundwater Table elevation is appropriate as the basis for the extraction and rehabilitation plan.

For example, at locations BH2, BH4, BH8, DP1, DP2 and DP2 the December 2006 levels are either the highest observed to date or within 6 cm of the highest levels observed to date. At BH6 the December 2006 level has only been exceeded 3 times (out of 34 measurements) and by a maximum of 18 cm. Location BH7 is at the proposed below water table extraction area, and although the water level at this location has been observed to be higher on occasion than measured in December 2006, this does not affect the Site Plan significantly. In addition, although the water level at DP4 has also been observed to occasionally be higher than measured in December 2006, the ground surface at DP4 is proposed to be raised as part of the rehabilitation plan.

Overall, we have compared the water table elevations as shown in the January 23, 2009 memo to the proposed rehabilitation plan to return the site to agricultural use. These water table conditions do not necessitate a change to the Site Plan in proposed above water table extraction areas or near the proposed small pond. The plan does include some water table control in the eastern portion of the site, similar to the installation of a tile drain system, therefore final grades in this area reflect the control elevations that are to be achieved.

With respect to pond volume calculations, in the projection (Stantec February 2009) the assumed water table elevation at the pond was 321.7 mAMSL. This level was exceeded at BH7 for a short period in April 2008 due to the extreme wet conditions at that time (as reflected in the January 23, 2009 memo). The conditions shown in the memo represent a short-lived extreme situation that was used for illustrative purposes as part of the groundwater impact assessment regarding wetlands. The monitoring summary included with this letter indicates that the groundwater level have not "continued to rise" since that time, but have fluctuated within a normal range. For the majority of the monitoring period water levels at BH7 are well below 321.7 mAMSL. Stantec will provide additional comment regarding pond storage capacity.

Terrestrial Comments

1. *Wetland Hydrology and Impacts.*

The impact on the wetland hydrology was assessed based on the effect the extraction could have on water inputs to the wetlands. If no significant change, and no negative change, in water inputs would be caused by the extraction, then no effect on wetland hydrology (or hydroperiod, function, soils, etc.) would be expected. As stated in the impact assessments, no significant change in groundwater inputs to the wetlands is expected.

As stated in our response, the long-term impact of the proposed extraction is a slight increase in recharge. In order to quantify this in more detail, we provide the following assessment. Referring to the March 2008 Hydrogeologic Assessment report (page 18), existing groundwater recharge at the site is expected to contribute 3.3 L/s to the shallow flow system that flows toward the wetland system along the Grand River. This wetland is approximately 8.59 ha in size (Stantec, April 2008 report, page 5.1), therefore each square metre of wetland could receive at a maximum approximately 0.039 milliliters per second (mL/s) of water due to recharge at the site. However, not all of this water will contribute to the wetland, some will move directly to the river. Only that portion of the shallow groundwater flow system at or near surface (i.e. at the water table) would be available to the wetland.

As stated in the Hydrogeologic Assessment report (page 21), recharge at the site is expected to increase. Based on the site area, a post-rehabilitation recharge contribution of 4.7 L/s to the shallow groundwater flow system would be expected. This equates to a total maximum contribution of 0.055 mL/s to each square metre of the wetland edge (an increase of 0.016 mL/s). As noted previously, only a small portion of this water would actually contribute to the wetland. Therefore, as stated in our February 4, 2009 letter:

> *No significant changes are expected to the overall water table system supporting the Grand River and associated wetlands, and, the northern creek. In addition, the long-term impact associated with the overall extraction is a small net increase in local recharge. Although the overall increase in recharge volume is likely minor with respect to the discharge volume at the wetlands, creek and river; the long-term impact can be considered beneficial, potentially leading to a more sustained level of discharge during extreme dry periods.*

The increase is minor at best, however does not represent a negative increase, and could be considered a very slight benefit. In addition, the increase in water volume is so small that no measurable change to groundwater levels are expected. The objective of maintaining or increasing groundwater recharge at a site as part of proposed development is often used by review agencies as criteria for wetland protection.

In order to ensure impacts do not occur, a revised monitoring program is being proposed, as outlined later in this letter. Proposed revisions to the monitoring program include new drive-point locations DP5 and DP6 within the Grand River wetland system. We note that based on monitoring completed to date, the water table is below ground surface at these locations, however may be expected to rise to ground surface in the spring. As noted within the impact assessment no changes to groundwater table elevations are expected within this area, however monitoring data will be in place to ensure conditions at the wetlands remain within existing ranges

5. *Monitoring Program, Trigger Levels, Contingency Plan.*

Based on agency requests to date, although no impacts are predicted or expected, we propose the following revised monitoring program, mitigation measures and contingency plan:

Groundwater Monitoring Program

Extraction Phases 1 to 4:

- Quarterly water level measurements will be obtained at all monitoring locations (BH2, BH4, BH6, BH7, BH8, DP1, DP2, DP3, DP5 and DP6) as accessible.
- The monitoring data will be summarized in an annual report submitted to MNR, GRCA and the Township.

Extraction Phases 5 to 8:

- Monthly water level measurements will be obtained at all monitoring locations (BH2, BH4, BH6, BH7, BH8, DP1, DP2, DP3, DP5 and DP6) as accessible.
- The monitoring data, including any threshold response or mitigation measures undertaken, will be summarized in an annual report submitted to MNR, GRCA and the Township.

Trigger Levels

- Prior to the installation of the water table control drain trigger levels for water level elevations at BH2, DP1, DP2 and DP3 be developed to the satisfaction of MNR, and GRCA.

Mitigation Measures and Contingency Plan

Private Well Interference:

- Where the Ministry of Natural Resources with the assistance of the Ministry of the Environment has determined that the operation of the pit has caused any well water to be adversely affected, the licensee shall, at the licensee's expense, either deepen the well or replace the well to ensure that historic water production quality standards are maintained for that well. If this pit operation has

caused a water supply problem, the licensee shall, at their expense, ensure a continuous supply of potable water to the affected landowner.

Changes Related to Water Table Control Drain:

The following Mitigation and Contingency Plan options are recommended for the site, to be implemented individually or in combination and on an as needed basis in consideration of the type and extent of trigger threshold exceedance:

a) Repeat monitoring event to confirm exceedance, increase monitoring frequency as appropriate.

b) Assess monitoring results, extraction history and/or climate data to determine if threshold exceedance is linked to on-site activities

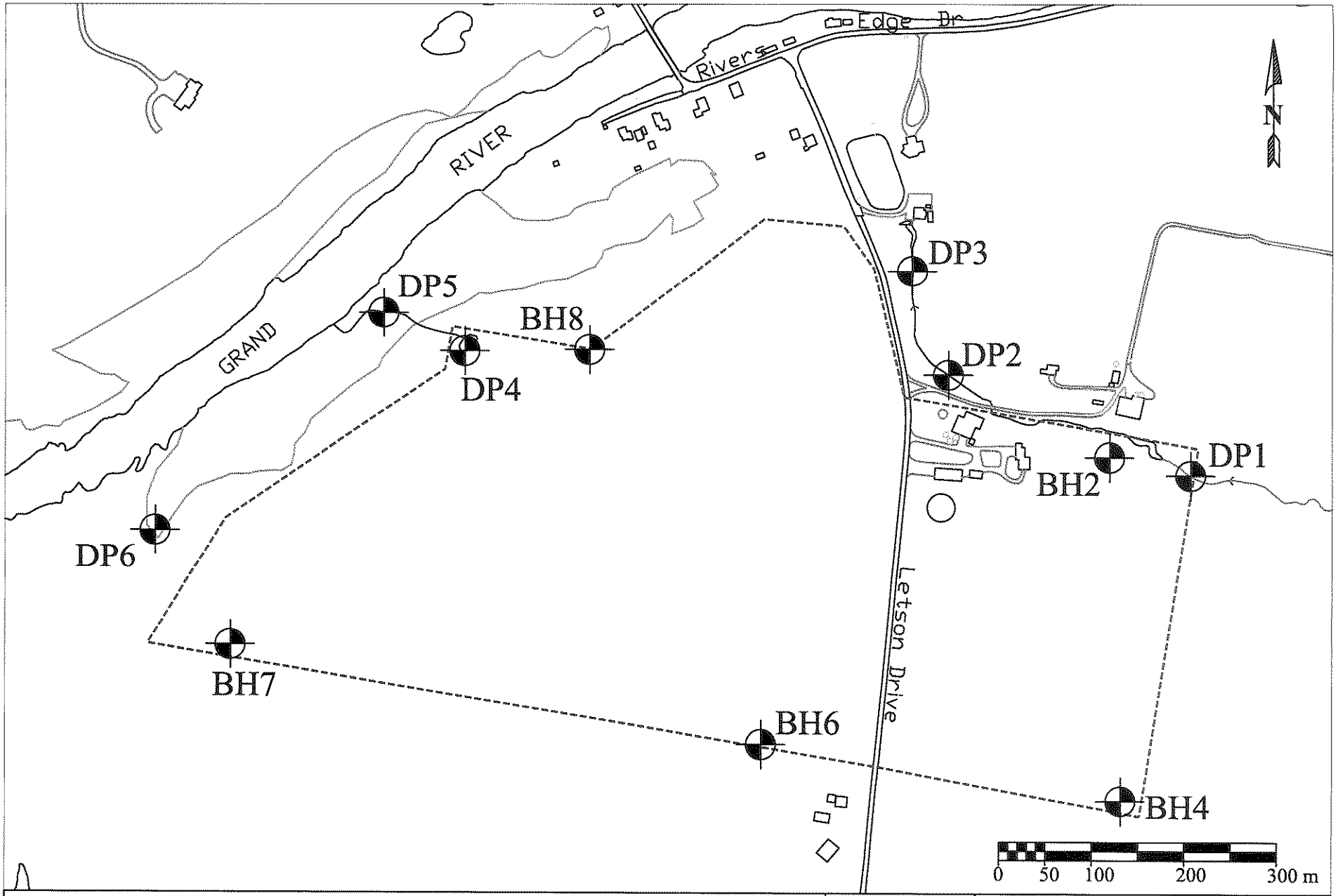
c) Stop, alter or reduce extraction or construction activities to allow groundwater system to equilibrate above threshold levels.

We trust that the responses provided address all of the GRCA comments. If you have any questions, or require further information, please do not hesitate to contact us.

Sincerely,

Andrew Pentney, P.Geo.
Hydrogeolgist

Cc: Bernie Janssen, Harrington and Hoyle Ltd.
Enclosed: Figure 1
Water Level Monitoring Update



Montrose Pit water level monitoring location

modified from: Site Plan (Harrington Hoyle Ltd.); and, 1,10,000 OBM Mapping

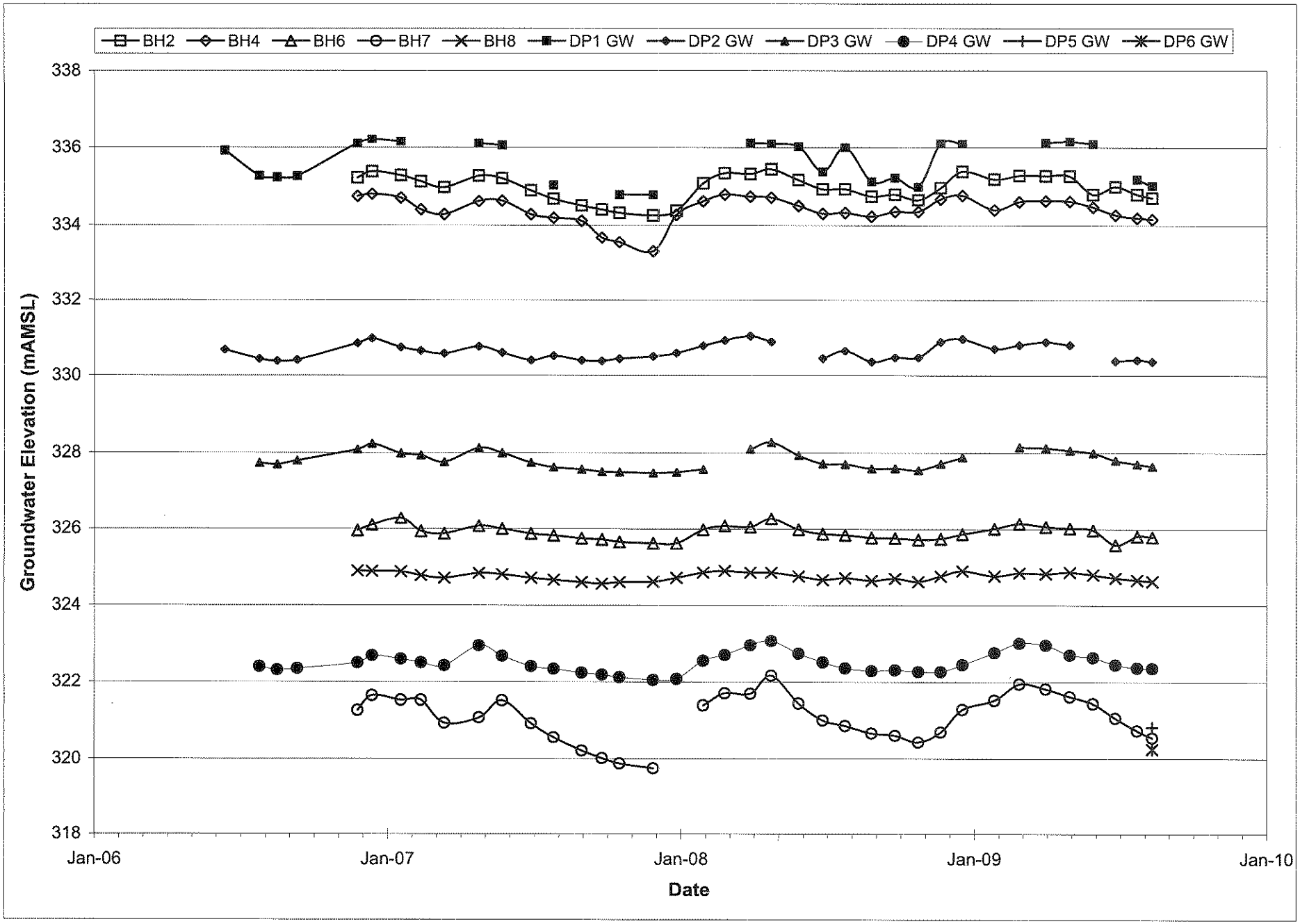
Scale: as shown
Date: September 2009

Hydrogeologic Assessment

Groundwater Science Corp.

Figure 1: Montrose Pit Monitoring Locations

Capital Paving Inc. Proposed Montrose Pit



Captial Paving Inc.
Proposed Montrose Pit

Update : Water Level Hydrograph

Groundwater Science Corp.
Scoped Subwatershed Study

Date	Location / Water Level Elevation								
	BH2	BH4	BH6	BH7	BH8	DP1 GW	DP1 SW	DP2 GW	DP2 SW
TOC:	338.75	338.42	332.08	327.33	329.13	336.87	336.87	331.89	331.89
13-Jun-06	#N/A	#N/A	#N/A	#N/A	#N/A	335.92	336.05	330.68	330.98
26-Jul-06	#N/A	#N/A	#N/A	#N/A	#N/A	335.28	dry	330.44	330.98
17-Aug-06	#N/A	#N/A	#N/A	#N/A	#N/A	335.24	dry	330.38	330.98
11-Sep-06	#N/A	#N/A	#N/A	#N/A	#N/A	335.27	dry	330.41	330.98
25-Nov-06	335.23	334.75	325.96	321.27	324.91	336.11	336.12	330.86	331.03
13-Dec-06	335.39	334.81	326.10	321.65	324.90	336.22	336.26	330.99	331.09
18-Jan-07	335.29	334.71	326.28	321.53	324.89	336.16	336.22	330.75	331.01
12-Feb-07	335.13	334.40	325.94	321.53	324.79	fr	fr	330.65	330.96
13-Mar-07	334.98	334.28	325.88	320.94	324.72	fr	fr	330.58	330.95
25-Apr-07	335.28	334.62	326.07	321.08	324.85	336.11	336.11	330.77	330.98
24-May-07	335.21	334.63	326.00	321.52	324.82	336.06	336.09	330.60	330.95
29-Jun-07	334.90	334.28	325.88	320.93	324.72	#N/A	dry	330.40	330.95
27-Jul-07	334.68	334.19	325.83	320.56	324.67	335.04	dry	330.52	330.96
31-Aug-07	334.51	334.11	325.76	320.21	324.61	dry	dry	330.40	330.97
25-Sep-07	334.40	333.67	325.73	320.01	324.57	dry	dry	330.38	330.97
17-Oct-07	334.32	333.55	325.67	319.87	324.61	334.79	dry	330.44	330.97
28-Nov-07	334.25	333.31	325.64	319.74	324.62	334.79	dry	330.50	330.98
27-Dec-07	334.38	334.27	325.64	#N/A	324.73	fr	fr	330.59	330.97
29-Jan-08	335.09	334.62	325.99	321.40	324.87	fr	fr	330.79	330.99
25-Feb-08	335.35	334.80	326.08	321.71	324.91	fr	fr	330.94	331.04
28-Mar-08	335.33	334.74	326.05	321.70	324.87	336.12	336.12	331.05	330.95
23-Apr-08	335.45	334.72	326.27	322.17	324.87	336.10	336.09	330.90	331.05
27-May-08	335.17	334.50	325.99	321.45	324.77	336.02	336.05	#N/A	331.02
26-Jun-08	334.94	334.30	325.88	321.02	324.68	335.39	dry	330.45	331.00
24-Jul-08	334.94	334.33	325.85	320.87	324.73	336.00	336.05	330.65	331.02
26-Aug-08	334.75	334.23	325.79	320.68	324.66	335.14	dry	330.36	330.98
24-Sep-08	334.80	334.35	325.77	320.61	324.71	335.23	dry	330.48	330.98
23-Oct-08	334.66	334.35	325.74	320.43	324.63	335.00	dry	330.48	330.98
20-Nov-08	334.97	334.68	325.76	320.70	324.78	336.11	336.13	330.89	331.05
17-Dec-08	335.40	334.77	325.87	321.29	324.91	336.10	336.15	330.97	331.07
26-Jan-09	335.20	334.40	326.01	321.53	324.78	fr	fr	330.71	330.99
26-Feb-09	335.29	334.61	326.14	321.95	324.86	fr	fr	330.81	331.00
31-Mar-09	335.29	334.63	326.06	321.82	324.84	336.13	336.13	330.89	331.02
30-Apr-09	335.27	334.62	326.02	321.62	324.88	336.16	336.16	330.81	331.01
29-May-09	334.80	334.47	325.98	321.44	324.81	336.09	336.15	#N/A	330.99
26-Jun-09	335.00	334.27	325.60	321.07	324.73	#N/A	dry	330.38	330.97
23-Jul-09	334.80	334.19	325.82	320.74	324.67	335.19	dry	330.41	330.98
11-Aug-09	334.71	334.16	325.80	320.55	324.64	335.02	dry	330.36	330.97

Notes: GW = groundwater, SW = surface water
#N/A = not available, not yet installed, no measurement possible or none taken
fr = frozen

Date	Location / Water Level Elevation							
	DP3 GW	DP3 SW	DP4 GW	DP4 SW	DP5 GW	DP5 SW	DP6 GW	DP6 SW
TOC:	328.54	328.54	323.21	323.21	322.52	322.52	321.74	321.74
13-Jun-06	#N/A	#N/A	#N/A	322.49	#N/A	#N/A	#N/A	#N/A
26-Jul-06	327.73	327.53	322.40	322.39	#N/A	#N/A	#N/A	#N/A
17-Aug-06	327.69	327.53	322.31	322.31	#N/A	#N/A	#N/A	#N/A
11-Sep-06	327.79	327.56	322.35	322.33	#N/A	#N/A	#N/A	#N/A
25-Nov-06	328.08	327.62	322.50	322.52	#N/A	#N/A	#N/A	#N/A
13-Dec-06	328.23	327.74	322.69	322.68	#N/A	#N/A	#N/A	#N/A
18-Jan-07	327.98	327.64	322.60	322.57	#N/A	#N/A	#N/A	#N/A
12-Feb-07	327.93	327.57	322.51	322.51	#N/A	#N/A	#N/A	#N/A
13-Mar-07	327.76	327.56	322.43	322.41	#N/A	#N/A	#N/A	#N/A
25-Apr-07	328.12	327.59	322.96	322.94	#N/A	#N/A	#N/A	#N/A
24-May-07	327.99	327.54	322.68	322.66	#N/A	#N/A	#N/A	#N/A
29-Jun-07	327.74	327.53	322.41	322.39	#N/A	#N/A	#N/A	#N/A
27-Jul-07	327.62	327.53	322.34	322.32	#N/A	#N/A	#N/A	#N/A
31-Aug-07	327.56	327.54	322.24	322.24	#N/A	#N/A	#N/A	#N/A
25-Sep-07	327.52	327.52	322.17	dry	#N/A	#N/A	#N/A	#N/A
17-Oct-07	327.49	327.49	322.12	dry	#N/A	#N/A	#N/A	#N/A
28-Nov-07	327.47	327.49	322.05	dry	#N/A	#N/A	#N/A	#N/A
27-Dec-07	327.49	327.49	322.08	dry	#N/A	#N/A	#N/A	#N/A
29-Jan-08	327.56	327.53	322.56	322.58	#N/A	#N/A	#N/A	#N/A
25-Feb-08	fr	fr	322.71	322.69	#N/A	#N/A	#N/A	#N/A
28-Mar-08	328.09	327.61	322.97	322.97	#N/A	#N/A	#N/A	#N/A
23-Apr-08	328.27	327.59	323.08	310.21	#N/A	#N/A	#N/A	#N/A
27-May-08	327.93	327.57	322.75	322.73	#N/A	#N/A	#N/A	#N/A
26-Jun-08	327.71	327.54	322.52	322.53	#N/A	#N/A	#N/A	#N/A
24-Jul-08	327.70	327.56	322.36	322.38	#N/A	#N/A	#N/A	#N/A
26-Aug-08	327.59	327.53	322.29	322.33	#N/A	#N/A	#N/A	#N/A
24-Sep-08	327.59	327.53	322.31	322.33	#N/A	#N/A	#N/A	#N/A
23-Oct-08	327.54	327.55	322.27	322.28	#N/A	#N/A	#N/A	#N/A
20-Nov-08	327.71	327.64	322.27	322.29	#N/A	#N/A	#N/A	#N/A
17-Dec-08	327.88	327.68	322.45	322.48	#N/A	#N/A	#N/A	#N/A
26-Jan-09	fr	327.55	322.77	322.79	#N/A	#N/A	#N/A	#N/A
26-Feb-09	328.15	327.55	323.02	322.99	#N/A	#N/A	#N/A	#N/A
31-Mar-09	328.12	327.61	322.97	322.96	#N/A	#N/A	#N/A	#N/A
30-Apr-09	328.06	327.60	322.71	322.69	#N/A	#N/A	#N/A	#N/A
29-May-09	327.99	327.59	322.64	322.63	#N/A	#N/A	#N/A	#N/A
26-Jun-09	327.80	327.53	322.45	322.42	#N/A	#N/A	#N/A	#N/A
23-Jul-09	327.70	327.53	322.37	322.37	#N/A	#N/A	#N/A	#N/A
11-Aug-09	327.64	327.54	322.36	322.32	320.83	321.40	320.25	dry

Notes: GW = groundwater, SW = surface water
#N/A = not available, not yet installed, no measurement possible or none taken
fr = frozen DP5 and DP6 installed August 4, 2009

Stantec Consulting Ltd.
Suite 1 - 70 Southgate Drive
Guelph ON N1G 4P5
Tel: (519) 836-6050
Fax: (519) 836-2493

Stantec

October 2, 2009
File: 160960196

Capital Paving Inc.
P.O. Box 815
Guelph, Ontario
N1H 6L8

Attention: **Mr. Nick Toth**

Dear Mr. Toth:

Reference: **Capital Paving Inc., Montrose Pit**
Part of Lots 71, 74 & 75, Concession G.C.T.
Township of Woolwich, Region of Waterloo
GRCA Letter to Capital Paving (June 25, 2009)
Stantec Consulting Ltd. Technical Response

Stantec Consulting Ltd. (Stantec) is in receipt of the June 25, 2009 letter to Capital Paving Inc. (Capital), which provided additional technical comments from the Grand River Conservation Authority (GRCA) subsequent to earlier response letters provided by Groundwater Science Corp. and Stantec (letter from Groundwater Science Corp. dated February 24, 2009, letter from Stantec dated February 18, 2009, memo from Groundwater Science Corp. dated January 23, 2009) supporting the Category 1, Class "A" pit licence application for the above-referenced proposed development. We have prepared the following commentary to address the GRCA's stated concerns as they relate to the Natural Environment aspect of this project, as follows:

- Engineering Comments (#1and #2)
- Engineering Advisory Comments (# 1 and #2)
- Aquatic Resource Comments (GRCA satisfied)
- Terrestrial Resource Comments (#1 - #4)

ENGINEERING COMMENTS

GRCA Engineering Comment #1 (pg 2 of 4)

Response

Groundwater Science Corp. (GWS) has provided a detailed response with respect to comment #1 in the accompanying letter, GWS October 1, 2009.

In addition, Stantec provides information with respect to the statement in the GRCA letter *"the figures indicate spring 2008 groundwater elevations ranging from 0.3m to 1.5m higher then those of the fall 2007. This is unlikely to significantly change the pond's active storage capacity unless groundwater levels have continued to rise."*

Reference: Capital Paving Inc., Montrose Pit
Part of Lots 71, 74 & 75, Concession G.C.T.
Township of Woolwich, Region of Waterloo
GRCA Letter to Capital Paving (June 25, 2009)
Stantec Consulting Ltd. Technical Response

The groundwater level elevation assumed in Stantec's analysis (Feb. 18, 2009) was 321.7 masl (metres above sea level), based on the highest level recorded at borehole BH7 (321.65 masl). Since then water level at BH7 has been recorded on one occasion to be 322.17 masl (Apr. 23, 2008), and on two other occasions at 321.82 masl (Mar. 31, 2009) and 321.95 masl (Feb. 26, 2009). An assessment of the impact on active storage volumes using the 322.17 m reading indicates a reduction in available active storage volume of 4,000 m^3 over that previously proposed (from 43,000 m^3 to 39,000 m^3), or 9%.

The hydrologic model (SWMHYMO) created in support of the previous design package was revised to reflect the updated stage-storage relationship, with results as summarized in Table 1, below:

Table 1. Hydrologic Modeling Results

Event	Hydrologic Condition	Runoff Volume		Peak Storage Used	Spill Expected?	Drawdown Time to 'Normal' Water Level
		(mm)	(m^3)	(m^3)	(y/n)	(days)
100-yr, 3-hr	Unfrozen	35.9	16,460	15,410	n	8.1
	Frozen	55.8	25,590	24,160	n	11.1
100-yr, 24-hr	Unfrozen	54.9	25,160	20,350	n	9.8
	Frozen	80.5	38,880	30,640	n	13.1
Regional	Unfrozen	191.2	87,590	40,050	y	16.0

With reference to the analysis summarized in the previous submission and the summary table above, it is confirmed that the pond will continue to function as designed even if the groundwater table is at the highest recorded level. The runoff from all storm events, up to and including the 1:100-year return period, 24-hour duration, storm event occurring during frozen conditions, will be contained within the pond with no overtopping.

Updated stage-storage discharge information and hydrologic modeling is appended for reference.

GRCA Engineering Comment #2 (pg 3 of 4)

Response

Capital Paving has provided the new floodplain delineation and revised extraction limit in previous correspondence and these revisions will be reflected on the revised Site Plans.

GRCA Engineering Advisory Comments #3 (pg 3 of 4)

Response

The slopes steeper than 5:1 occur on the northwest portion of the site and are part of the replanting plan and are not intended to be farmed. Similarly a small area of 4:1 slope at Letson Drive, adjacent to the entrance of

Reference: **Capital Paving Inc., Montrose Pit**
Part of Lots 71, 74 & 75, Concession G.C.T.
Township of Woolwich, Region of Waterloo
GRCA Letter to Capital Paving (June 25, 2009)
Stantec Consulting Ltd. Technical Response

the existing farmstead is also not intended for farming. No slopes greater than 5:1 are intended to be used for agricultural crop production at this site.

GRCA Engineering Advisory Comments #4 (pg 3 of 4)

Response

The 1.0 m restoration depth to the high groundwater elevation has been reviewed by an agricultural specialist. The soils on site are a combination of St Jacob's loam, silty loam and Burford sandy loam or loam soil. The St. Jacob soil is well drained; consisting of 30-90 cm of loam or silt loam soil overlying outwash gravel and is noted to be Class 1 with no limiting factors. The Burford soil, which comprises the majority of the soil on site, is well drained and consists of 30 cm, or less, of sandy loam or loam soil overlying outwash gravel. It is classified in the The *Soils of Waterloo County; Report No. 44 of the Ontario Soil Survey* as 2 F/M soils with limiting factors including low fertility and low moisture holding capacity. The soil tends to be well drained and the agricultural capability is limited by droughtiness due to the low moisture holding capacity of the porous parent material. The decreases in depth of the sand and gravel between the rooting zone and the groundwater table during the growing season will improve the access of plants with deep feeder roots to the groundwater during the growing season. The rehabilitation of the to 1.0 m above the established water table is not anticipated to adversely affect the agricultural productivity of the land given the known conditions at the site and moisture holding capacity of the soil material.

TERRESTRIAL RESOURCE COMMENTS

GRCA Terrestrial Resource Comment #1 (pg 3 of 4)

Response

GWS has provided detailed information with respect to the assessment of water related impacts to the wetlands on site. In addition to these comments Stantec adds the following information.

The wetland communities immediately to the west of the Subject Property are described as a complex of coniferous and mixed swamps, including conifer swamp (SWC1-1); and white cedar-hardwood mineral mixed swamp (SWM1-1) vegetation types. Adjacent communities further from the Grand River include more upland communities: fresh-moist white cedar-hardwood forest (FOM7-2); fresh-moist white cedar coniferous forest (FOC4-1); and white cedar-black cherry cultural savannah (CUS1-4). The soils are noted to be generally mineral type soils, which indicates a connection to the groundwater. The water that supports these wetlands is interpreted to be generally from spring and fall flooding associated with the Grand River, and diffuse groundwater contributions.

The wetland resources in the study area have been identified and their character noted with respect to hydric conditions. Wetlands in the study area receive water at varying degrees from three possible sources:

- Incident precipitation;
- Surface water inputs; and
- Groundwater contributions.

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The proposed aggregate extraction at the Montrose pit will not affect the incident precipitation that falls directly on the features and, as such, will not affect this input of water to wetland areas.

As discussed in the impact assessment reports, there is no potential change in surface water input to the isolated wetland along the Northern Tributary associated with the proposed extraction.

Surface water contributions to the wetlands along the Grand River are associated with flooding of the river during snowmelt events and major rainfall events and potential overland flow inputs from the site to wetland features. Flooding of the Grand River will provide by far the largest contribution water. The proposed extraction will not affect this input of water to the wetlands. Given the gently sloped topography of the area, the underlying gravel soils, and the extensive upland forest area between the extraction area and the wetlands, there is no significant potential for regular surface water runoff from the site to reach the wetland. Any potential surface water contribution from the site to the wetlands under snowmelt or heavy precipitation will be minor compared to other inputs. In addition, after extraction, any potential reduction in overland flow from the site will be balanced by a corresponding increase in groundwater contribution (through increased recharge rates at the site). Therefore no significant change is expected in surface water availability or hydroperiod at these wetland areas due to the proposed extraction.

The groundwater analysis has demonstrated that there will be no anticipated changes in the groundwater regime that would adversely effect the hydric period currently offered via groundwater inputs to the west or south west, where the nearest wetland environments are found. The potential increase in recharge that may be expressed as a more sustained level of discharge during extreme dry periods, would not be considered to have a negative effect on the wetland flora. The wetland species found in the mineral environment are currently subject to a varying hydroperiods, and are relatively tolerant to a range of hydroperiods.The potential change would be minor, tending toward a wetting rather than a drying condition.

In conclusion, the proposed pit poses no threat to the continued existence of the wetland features and the flora and fauna found therein.

GRCA Terrestrial Resource Comment #2 (pg 3 of 4)

Response

As noted above, there are no water related impacts to the wetland associated with the location of the pond and effects to water regimes. Ecologically, the pond is anticipated to be a complementary feature that will offer benefits. A pond of this nature would undoubtedly create additional habitat and breeding areas for amphibians, odonates and birds, and may be a source of food for avian fauna and mammals that feed on lower order species. This habitat feature would add to and complement the local wildlife diversity, and this is considered to be positive, with respect to the effect on the existing wetland area. There are no ecological aspects of the pond that would realistically be perceived as having a negative effect on the existing natural heritage features.

The proposed pond will be planted with trees and shrubs on the northwest, west and south sides, as illustrated on the Site Plans. The pond will be very shallow along its margins (<1 m). The intent of the design is to allow for natural colonization of the shallow aquatic margins as time progresses. As is typical with many ponds and depressions created in the rural landscape in this region, wetland species will invariably establish themselves and create a dynamic wetland margin.

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GRCA Terrestrial Resource Comment #3 (pg 3 of 4)

Response

It is agreed that the criteria for identifying provincially significant features is outlined in MNR's Natural Heritage Reference Manual (NHRM). The significance of all on-site or near-site features has been assessed using this manual. It is the responsibility of the MNR to determine and assess the significance of wetland features in an area. Stantec has been engaged with the MNR in the review of the wetlands in the immediate vicinity of the study area, as well as the Scoped Subwatershed Study area. Stantec has designated those features appropriately, in accordance with the information provided by the MNR that included a site review of the area with the MNR. Notwithstanding the current non- provincially significant designation of the wetlands found in the immediate vicinity of the Subject Property, and as suggested in the GRCA letter, the Montrose Pit proposal avoids the wetlands and has assigned appropriate setback from the wetland edge. As discussed in detail, the wetland features have also been protected from indirect hydrologic and hydrogeological impacts. The wetland edges have been marked by Stantec and electronically surveyed using GPS. The boundary has been included on the revised Site Plans, and has been adopted as part of this Application (see also response to item #4 below). Wetland edges are greater than 30 m from the extraction limits, and are buffered by existing wooded areas.

The extraction limit has been revised to further address top of slope comments in the northwest corner of the site. It should be noted that this slope has been reviewed and is not considered to be an erosive slope. The revision is reflected on the revised Site Plans.

The design of the proposal provides for a 1 m setback from the dripline of the retained forest edge. In the northwest corner, where development will affect the woodland edge by removing two protrusions and straightening the edge, the woodland effect will be mitigated by re-establishing the woodland edge in that location with a 10 m replanting plan occurring over a 130 m portion of the northwest corner of the site. This would result in an overall increase in the woodland in this area that is consistent with the intent of maintaining or increasing woodland cover in the Region and Watershed, and is considered a reasonable mitigative approach.

GRCA Terrestrial Resource Comment #4 (pg 4 of 4)

Response

As noted above, wetland edges are greater than 30 m from the extraction limits, and are buffered by existing wooded areas. In addition, as stated in the Site Plan's Technical Recommendations *"Prior to stripping and operations in any phase, the wetland and woodland limits will be flagged by a qualified person. The Ministry of Natural Resources and Conservation Authority will be notified, should they wish to confirm the wetland boundaries".*

CLOSING

Detailed information concerning the local hydrology is present in the Groundwater Science Corp report and reflects the geological information and groundwater data gathered over three years of investigation. Assessment of effects presented in the natural environment report are determined through dialogue with the hydrogeologist and in consideration of water resource information and associated potential effects on natural heritage features.

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Stantec Consulting Ltd. Technical Response

Stantec Consulting Ltd. respectfully provides the foregoing response comments for the GRCA's consideration with regard to the proposed development. We trust this addresses the concerns expressed by the GRCA, however, should there be additional questions please do not hesitate to contact the undersigned at your convenience.

Sincerely,

STANTEC CONSULTING LTD.

Daniel Eusebi, BES
Senior Environmental Planner
Tel: (519) 836-6050, ext. 234
Fax: (519) 836-2493
dan.eusebi@stantec.com

Att: Revised Stage-storage-discharge analysis of proposed pond
SWMHYMO modeling (input and output files)

c.c. Bernie Janssen, Harrington & Hoyle Ltd.
Andrew Pentney, Groundwater Science Corp.

als w:\active\60960196\correspondence_agency\grca\stantec\2009-10-02_let-grca_stantec-ne-response.doc

Montrose Pit - Proposed Pond
Facility Design Calculations

Elevation (m)	Pond Area (m^2)	Interval Volume (m^3)	Cumulative Volume (m^3)	Active Storage Depth (m)	Active Storage Volume (m^3)	Pond Elevation above Grand River (m)	Discharge through Exfiltration (m^3/s)	Discharge over Weir (m^3/s)	Drawdown Time (hrs)	Parameters
320.00	1800									Groundwater Table
320.25	2325	516	516			0.25				322.17
320.50	2850	647	1163			0.50				Conductivity of Sand and Gravel Layer
320.75	3375	778	1941			0.75				0.0005 m/s
321.00	3900	909	2850			1.00				Length of Exfiltrating Reach
321.25	5095	1124	3974			1.25				170 m
321.50	6290	1423	5398			1.50				Water Level at Grand River
321.75	7485	1722	7119			1.75				320 m
322.00	8680	2021	9140			2.00				Water Table Slope
322.25	10420	2388	11528	0.08	764	2.25	0.0068		31.2	1 m/m
322.50	12160	2823	14350	0.33	3587	2.50	0.0280		66.7	Regional Overflow Weir
322.75	13900	3258	17608	0.58	6844	2.75	0.0493		105.3	Weir Invert / Weir Length
323.00	15640	3693	21300	0.83	10537	3.00	0.0705		146.8	324.00 / 170
323.25	22080	4715	26015	1.08	15252	3.25	0.0918		192.9	Weir Coeff. / Left Side Slope
323.50	28520	6325	32340	1.33	21577	3.50	0.1130		245.9	1.70 / (H:V) (?:1)
323.75	34960	7935	40275	1.58	29512	3.75	0.1343		307.0	Manning's 'n' / 10.0
324.00	41400	9545	49820	1.83	39057	4.00	0.1555		376.7	0.04 / Right Side Slope
324.25	47840	11155	60975	2.08	50212	4.25	0.1768	48.4	455.6	Channel Slope (%) / (H:V) (?:1)
										1.00 / 10.0

Weir Equation Used (Manning's): $Q = 1/n \cdot A \cdot R_h^{2/3} \cdot S^{1/2}$, where

n = Manning's coefficient, set at 0.03

A = cross-sectional flow area over the weir (m^2)

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: Capital Paving - Montrose Pit
00004> *#  Date        : January 26, 2009
00005> *#  Revised     : October 1, 2009
00006> *#  Modeller    : S Robertson
00007> *#  Company     : Stantec Consulting Ltd. (Kitchener)
00008> *#  License #   : 4730904
00009> *#*************************************************************************
00010> START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
00011> *%                     ["Wat10Dyr.3hr"] <--storm filename, one per line for NSTORM
00012> *%--------------------|---------------------------------------------------|
00013> READ STORM             STORM_FILENAME=["Storm.001"]
00014> *%--------------------|---------------------------------------------------|
00015> *#*************************************************************************
00016> *# Proposed Conditions (unfrozen)
00017> *#*************************************************************************
00018> *#
00019> *# Soil Type A based on hydrogeological characteristics identified in the
00020> *# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
00021> *# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
00022> *# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
00023> *# Therefore, use CN=65 under AMC II conditions
00024> *# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
00025> *#                                      typ.vel = 1ft/s, Tp = 0.6*Tc
00026> *#
00027> DESIGN NASHYD         ID=[2], NHYD=[200], DT=[5]min, AREA=[45.8](ha),
00028>                       DWF=[0](cms), CN/C=[65], TP=[0.82]hrs,
00029>                       RAINFALL=[  ,  ,  ,  ,  ](mm/hr), END=-1
00030> *%--------------------|---------------------------------------------------|
00031> *#
00032> *# Route through proposed ponding area
00033> *#
00034> ROUTE RESERVOIR       IDout=[3],   NHYD=[300],  IDin=[2],
00035>                       RDT=[5 ](min),
00036>                             TABLE of ( OUTFLOW-STORAGE ) values
00037>                                      (cms) - (ha-m)
00038>                                    [   0.0 ,  0.0 ]
00039>                                    [ 0.007 , 0.0764]
00040>                                    [ 0.028 , 0.3587]
00041>                                    [ 0.069 , 0.6844]
00042>                                    [ 0.071 , 1.0537]
00043>                                    [ 0.092 , 1.5252]
00044>                                    [ 0.113 , 2.1577]
00045>                                    [ 0.134 , 2.9512]
00046>                                    [ 0.155 , 3.9057]
00047>                                    [ 48.58 , 5.0212]
00048>                                    [   -1  ,   -1  ]  (max twenty pts)
00049>                             IDovf=[   ], NHYDovf=[   ]
00050> *%--------------------|---------------------------------------------------|
00051> *#*************************************************************************
00052> *# Proposed Conditions (frozen)
00053> *#*************************************************************************
00054> *#
00055> *# Soil Type A based on hydrogeological characteristics identified in the
00056> *# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
00057> *# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
00058> *# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
00059> *# Therefore, use CN=65 under AMC II conditions
00060> *# Use AMC III conditions to reflect frozen conditions, therefore CN = 82
00061> *# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
00062> *#                                      typ.vel = 1ft/s, Tp = 0.6*Tc
00063> *#
00064> DESIGN NASHYD         ID=[2], NHYD=[200], DT=[5]min, AREA=[45.8](ha),
00065>                       DWF=[0](cms), CN/C=[82], TP=[0.82]hrs,
00066>                       RAINFALL=[  ,  ,  ,  ,  ](mm/hr), END=-1
00067> *%--------------------|---------------------------------------------------|
00068> *#
00069> *# Route through proposed ponding area
00070> *#
00071> ROUTE RESERVOIR       IDout=[3],   NHYD=[300],  IDin=[2],
00072>                       RDT=[5 ](min),
00073>                             TABLE of ( OUTFLOW-STORAGE ) values
00074>                                      (cms) - (ha-m)
00075>                                      (cms) - (ha-m)
00076>                                    [   0.0 ,  0.0 ]
00077>                                    [ 0.007 , 0.0764]
00078>                                    [ 0.028 , 0.3587]
00079>                                    [ 0.069 , 0.6844]
00080>                                    [ 0.071 , 1.0537]
00081>                                    [ 0.092 , 1.5252]
00082>                                    [ 0.113 , 2.1577]
00083>                                    [ 0.134 , 2.9512]
00084>                                    [ 0.155 , 3.9057]
00085>                                    [ 48.58 , 5.0212]
00086>                                    [   -1  ,   -1  ]  (max twenty pts)
00087>                             IDovf=[   ], NHYDovf=[   ]
00088> *%--------------------|---------------------------------------------------|
00089> START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[3],  NRUN=[2]
00090> *%                     ["24SCS100.stm"] <--storm filename, one per line for NSTORM
00091> *%--------------------|---------------------------------------------------|
00092> START                 TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
00093> *%                     ["huzhaz48.stm"] <--storm filename, one per line for NSTORM
00094> *%--------------------|---------------------------------------------------|
00095> FINISH
00096>
00097>
00098>
00099>
00100>
00101>
```

```
 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999     999  ==========
 S      W   W  MM MM  H   H   Y Y   MM MM  O   O      9   9   9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9   9   9  Ver. 4.02
     S  W W W  M   M  H   H    Y    M   M  O   O       9999    9999  July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO            9       9  ==========
                                                       9   9   9   9  # 4730904
      StormWater Management HYdrologic Model            999     999  ==========

 ************************************************************************
 ************************** SWMHYMO-99 Ver/4.02 *************************
 *******  A single event and continuous hydrologic simulation model  *******
 *******     based on the principles of HYMO and its successors      *******
 *******              OTTHYMO-83 and OTTHYMO-89.                     *******
 ************************************************************************
 *******  Distributed by:  J.F. Sabourin and Associates Inc.          *******
 *******                   Ottawa,  Ontario: (613) 727-5198           *******
 *******                   Gatineau, Quebec: (819) 243-6858           *******
 *******                   E-Mail: swmhymo@jfsa.Com                   *******
 ************************************************************************

 +------+ Licensed user: Stantec Consulting Ltd. (Kitchener)          +------+
 +------+                Kitchener            SERIAL#:4730904         +------+

 ************************************************************************
 *******          +++++ PROGRAM ARRAY DIMENSIONS +++++          *******
 *******          Maximum value for ID numbers  :    10         *******
 *******          Max. number of rainfall points:  15000        *******
 *******          Max. number of flow points    :  15000        *******
 ************************************************************************

 ********************   D E T A I L E D   O U T P U T   ********************
 ************************************************************************
          DATE: 2009-10-01       TIME: 16:47:58       RUN COUNTER: 000927
 ************************************************************************
 * Input   filename: C:\PROGRA~1\SWMHYMO\60196-2.dat                    *
 * Output  filename: C:\PROGRA~1\SWMHYMO\60196-2.out                    *
 * Summary filename: C:\PROGRA~1\SWMHYMO\60196-2.sum                    *
 * User comments:                                                       *
 * 1:_____________________________________________________________      *
 * 2:_____________________________________________________________      *
 * 3:_____________________________________________________________      *
 ************************************************************************

-----------------------------------------------------------------------------
001:0001-------------------------------------------------------------------
*************************************************************************
*#  Project Name: Capital Paving - Montrose Pit
*#  Date          : January 26, 2009
*#  Revised       : October 1, 2009
*#  Modeller      : S Robertson
*#  Company       : Stantec Consulting Ltd. (Kitchener)
*#  License #     : 4730904
*************************************************************************
 ----------------------
| START              |  Project  dir.: C:\PROGRA~1\SWMHYMO\
 --------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 001
    NSTORM=   1
            #  1=Wat100yr.3hr
-----------------------------------------------------------------------------
002:0002-------------------------------------------------------------------
 ----------------------
| READ STORM         |    Filename: C:\PROGRA~1\SWMHYMO\Wat100yr.3hr
| Ptotal=  91.85 mm  |    Comments: CHICAGO STORM - 100 yr - City of Waterlo
 ----------------------
                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                 .08   6.750 |    .83  26.104 |   1.58  31.091 |   2.33   7.531
                 .17   5.342 |    .92  38.248 |   1.67  24.585 |   2.42   6.815
                 .25   6.075 |   1.00  62.711 |   1.75  20.017 |   2.50   6.206
                 .33   6.989 |   1.08 325.868 |   1.83  16.677 |   2.58   5.684
                 .42   8.163 |   1.17 242.795 |   1.92  14.156 |   2.67   5.232
                 .50   9.707 |   1.25 141.915 |   2.00  12.202 |   2.75   4.838
                 .58  11.801 |   1.33  84.406 |   2.08  10.655 |   2.83   4.492
                 .67  14.757 |   1.42  56.548 |   2.17   9.406 |   2.92   4.186
                 .75  19.143 |   1.50  40.851 |   2.25   8.382 |   3.00   3.915
-----------------------------------------------------------------------------
003:0003-------------------------------------------------------------------
*************************************************************************
*# Proposed Conditions (unfrozen)
*************************************************************************
*#
*# Soil Type A based on hydrogeological characteristics identified in the
*# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
*# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
*# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
*# Therefore, use CN=65 under AMC II conditions
*# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
                                        typ.vel = 1ft/s, Tp = 0.6*Tc
*#
 ----------------------
| DESIGN NASHYD      |   Area     (ha)=   45.80   Curve Number    (CN)=65.00
| 02:000200 DT= 5.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=     .820

      Unit Hyd Qpeak  (cms)=     2.133

      PEAK FLOW       (cms)=     2.438 (i)
      TIME TO PEAK    (hrs)=     2.167
      RUNOFF VOLUME    (mm)=    35.944
      TOTAL RAINFALL   (mm)=    91.853
      RUNOFF COEFFICIENT   =      .391

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
004:0004-------------------------------------------------------------------
*#
*# Route through proposed ponding area
*#
 ----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  5.0 min.
|  IN>02:(000200)    |
| OUT<03:(000300)    |    ==========  OUTFLOW STORAGE TABLE  ==========
 --------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000   .0000E+00    |     .092   .1525E-01
                           .007   .7640E-01    |     .113   .2158E-01
                           .028   .3587E+00    |     .134   .2951E-01
                           .049   .6844E+00    |     .155   .3906E-01
                           .071   .1054E+01    |   48.580   .5021E+01

      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
      ---------------            (ha)     (cms)     (hrs)       (mm)
      INFLOW >02: (000200)      45.80     2.438     2.167     35.944
      OUTFLOW<03: (000300)      45.80      .093     5.000     35.944

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.795
                    TIME SHIFT OF PEAK FLOW          (min)=   170.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.1541E-01

-----------------------------------------------------------------------------
001:0005-------------------------------------------------------------------
*************************************************************************
*#*********************************************************************
*# Proposed Conditions (frozen)
*#*********************************************************************
*#
*# Soil Type A based on hydrogeological characteristics identified in the
*# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
*# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
*# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
*# Therefore, use CN=65 under AMC II conditions
*# Use AMC III conditions to reflect frozen conditions, therefore CN = 82
*# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
                                        typ.vel = 1ft/s, Tp = 0.6*Tc
*#
 ----------------------
| DESIGN NASHYD      |   Area     (ha)=   45.80   Curve Number    (CN)=82.00
| 02:000200 DT= 5.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=     .820

      Unit Hyd Qpeak  (cms)=     2.133

      PEAK FLOW       (cms)=     3.849 (i)
      TIME TO PEAK    (hrs)=     2.083
      RUNOFF VOLUME    (mm)=    55.874
      TOTAL RAINFALL   (mm)=    91.853
      RUNOFF COEFFICIENT   =      .608

      (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------
006:0006-------------------------------------------------------------------
*#
*# Route through proposed ponding area
*#
 ----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  5.0 min.
|  IN>02:(000200)    |
| OUT<03:(000300)    |    ==========  OUTFLOW STORAGE TABLE  ==========
 --------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           .000   .0000E+00    |     .092   .1525E-01
                           .007   .7640E-01    |     .113   .2158E-01
                           .028   .3587E+00    |     .134   .2951E-01
                           .049   .6844E+00    |     .155   .3906E-01
                           .071   .1054E+01    |   48.580   .5021E+01

      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
      ---------------            (ha)     (cms)     (hrs)       (mm)
      INFLOW >02: (000200)      45.80     3.849     2.083     55.874
      OUTFLOW<03: (000300)      45.80      .120     5.083     55.873

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.114
                    TIME SHIFT OF PEAK FLOW          (min)=   180.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.2416E-01

-----------------------------------------------------------------------------
007:0007-------------------------------------------------------------------
   ** END OF RUN :   1
*************************************************************************
```

```
 ----------------------
| START              |  Project  dir.: C:\PROGRA~1\SWMHYMO\
 --------------------  Rainfall dir.: C:\PROGRA~1\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
            #  1=24SCS100.stm
-----------------------------------------------------------------------------
002:0002-------------------------------------------------------------------
*************************************************************************
*#  Project Name: Capital Paving - Montrose Pit
*#  Date          : January 26, 2009
*#  Revised       : October 1, 2009
*#  Modeller      : S Robertson
*#  Company       : Stantec Consulting Ltd. (Kitchener)
*#  License #     : 4730904
*************************************************************************
-----------------------------------------------------------------------------
002:0002-------------------------------------------------------------------
 ----------------------
| READ STORM         |    Filename: C:\PROGRA~1\SWMHYMO\24SCS100.stm
| Ptotal= 119.90 mm  |    Comments: SCS-II 24H 100 WATERLOO
 ----------------------
                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                 .50   1.270 |   6.50   2.160 |  12.50  17.240 |  18.50   2.660
                1.00   1.320 |   7.00   2.330 |  13.00   8.940 |  19.00   1.920
                1.50   1.340 |   7.50   2.520 |  13.50   6.350 |  19.50   1.800
                2.00   1.410 |   8.00   2.730 |  14.00   4.560 |  20.00   1.750
                2.50   1.460 |   8.50   3.060 |  14.50   4.020 |  20.50   1.650
                3.00   1.510 |   9.00   3.350 |  15.00   3.790 |  21.00   1.560
                3.50   1.610 |   9.50   3.790 |  15.50   3.310 |  21.50   1.560
                4.00   1.650 |  10.00   4.390 |  16.00   3.000 |  22.00   1.390
                4.50   1.730 |  10.50   5.610 |  16.50   2.710 |  22.50   1.410
                5.00   1.850 |  11.00   7.410 |  17.00   2.520 |  23.00   1.340
                5.50   1.920 |  11.50  11.960 |  17.50   2.300 |  23.50   1.320
                6.00   2.040 |  12.00  91.180 |  18.00   2.180 |  24.00   1.270
-----------------------------------------------------------------------------
003:0003-------------------------------------------------------------------
*************************************************************************
*#*********************************************************************
*# Proposed Conditions (unfrozen)
*#*********************************************************************
*#
*# Soil Type A based on hydrogeological characteristics identified in the
*# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
*# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
*# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
*# Therefore, use CN=65 under AMC II conditions
*# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
                                        typ.vel = 1ft/s, Tp = 0.6*Tc
*#
 ----------------------
| DESIGN NASHYD      |   Area     (ha)=   45.80   Curve Number    (CN)=65.00
| 02:000200 DT= 5.00 |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
 --------------------   U.H. Tp(hrs)=     .820

      Unit Hyd Qpeak  (cms)=     2.133

      PEAK FLOW       (cms)=     2.283 (i)
      TIME TO PEAK    (hrs)=    12.667
      RUNOFF VOLUME    (mm)=    54.935
      TOTAL RAINFALL   (mm)=   119.895
      RUNOFF COEFFICIENT   =      .458
```

```

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 002:0004------------------------------------------------------------------------
 *#
 *# Route through proposed ponding area
 *#
 -----------------------
 | ROUTE RESERVOIR     |     Requested routing time step =  5.0 min.
 |  IN>02:(000200)     |
 | OUT<03:(000300)     |     =========  OUTLFOW STORAGE TABLE  =========
 -----------------------     OUTFLOW     STORAGE   |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)    |   (cms)     (ha.m.)
                               .000   .0000E+00    |      .092  .1525E+01
                               .007   .7640E-01    |      .113  .2158E+01
                               .028   .3587E+00    |      .134  .2951E+01
                               .049   .6844E+00    |      .155  .3906E+01
                               .071   .1054E+01    |    48.580  .5021E+01

     ROUTING RESULTS              AREA     QPEAK     TPEAK        R.V.
     -----------------------      (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (000200)        45.80     2.263    12.667      54.935
     OUTFLOW<03: (000300)        45.80      .109    24.417      54.934

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.814
                  TIME SHIFT OF PEAK FLOW          (min)=   705.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=.2035E-01

 --------------------------------------------------------------------------------
 002:0005------------------------------------------------------------------------
 *#******************************************************************************
 *# Proposed Conditions (frozen)
 *#******************************************************************************
 *#
 *# Soil Type A based on hydrogeological characteristics identified in the
 *# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
 *# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
 *# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
 *# Therefore, use CN=65 under AMC II conditions
 *# Use AMC III conditions to reflect frozen conditions, therefore CN = 82
 *# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
 *#                                      typ.vel = 1ft/s, Tp = 0.6*Tc
 *#
 -----------------------
 | DESIGN NASHYD       |   Area     (ha)=   45.80   Curve Number   (CN)=82.00
 | 02:000200 DT= 5.00  |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
 -----------------------   U.H. Tp(hrs)=     .820

     Unit Hyd Qpeak  (cms)=    2.133

     PEAK FLOW        (cms)=    3.422 (i)
     TIME TO PEAK     (hrs)=   12.667
     RUNOFF VOLUME     (mm)=   80.490
     TOTAL RAINFALL    (mm)=  119.895
     RUNOFF COEFFICIENT   =      .671

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 002:0006------------------------------------------------------------------------
 *#
 *# Route through proposed ponding area
 *#
 -----------------------
 | ROUTE RESERVOIR     |     Requested routing time step =  5.0 min.
 |  IN>02:(000200)     |
 | OUT<03:(000300)     |     =========  OUTLFOW STORAGE TABLE  =========
 -----------------------     OUTFLOW     STORAGE   |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)    |   (cms)     (ha.m.)
                               .000   .0000E+00    |      .092  .1525E+01
                               .007   .7640E-01    |      .113  .2158E+01
                               .028   .3587E+00    |      .134  .2951E+01
                               .049   .6844E+00    |      .155  .3906E+01
                               .071   .1054E+01    |    48.580  .5021E+01

     ROUTING RESULTS              AREA     QPEAK     TPEAK        R.V.
     -----------------------      (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (000200)        45.80     3.422    12.667      80.490
     OUTFLOW<03: (000300)        45.80      .136    24.417      80.489

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    3.988
                  TIME SHIFT OF PEAK FLOW          (min)=   705.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=.3064E+01

 --------------------------------------------------------------------------------
 002:0007------------------------------------------------------------------------
 --------------------------------------------------------------------------------
 002:0002------------------------------------------------------------------------
   ** END OF RUN :    2

 ********************************************************************************





 -----------------------
 | START               |  Project  dir.: C:\PROGRA-1\SWMHYMO\
 -----------------------  Rainfall dir.: C:\PROGRA-1\SWMHYMO\
     TZERO =    .00 hrs on        0
     METOUT=    2 (output = METRIC)
     NRUN  = 003
     NSTORM=    1
            #  1=hurhaz48.stm
 --------------------------------------------------------------------------------
 003:0002------------------------------------------------------------------------
 *#******************************************************************************
 *#  Project Name: Capital Paving - Montrose Pit
 *#  Date         : January 26, 2009
 *#  Revised      : October 1, 2009
 *#  Modeller     : S Robertson
 *#  Company      : Stantec Consulting Ltd. (Kitchener)
 *#  License #    : 6730904
 *#******************************************************************************
 --------------------------------------------------------------------------------
 003:0002------------------------------------------------------------------------
 -----------------------
 | READ STORM          |     Filename: C:\PROGRA-1\SWMHYMO\hurhaz48.stm
 | Ptotal= 285.00 mm|        Comments: REGIONAL STORM
 -----------------------
                        TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                         hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                         .25   2.000 |  12.25   2.000 |  24.25   2.000 |  36.25   6.000
                         .50   2.000 |  12.50   2.000 |  24.50   2.000 |  36.50   6.000
                         .75   2.000 |  12.75   2.000 |  24.75   2.000 |  36.75   6.000
                        1.00   2.000 |  13.00   2.000 |  25.00   2.000 |  37.00   6.000
                        1.25   2.000 |  13.25   2.000 |  25.25   2.000 |  37.25   4.000
                        1.50   2.000 |  13.50   2.000 |  25.50   2.000 |  37.50   4.000
                        1.75   2.000 |  13.75   2.000 |  25.75   2.000 |  37.75   4.000
                        2.00   2.000 |  14.00   2.000 |  26.00   2.000 |  38.00   4.000
                        2.25   2.000 |  14.25   2.000 |  26.25   2.000 |  38.25   6.000
                        2.50   2.000 |  14.50   2.000 |  26.50   2.000 |  38.50   6.000
                        2.75   2.000 |  14.75   2.000 |  26.75   2.000 |  38.75   6.000
                        3.00   2.000 |  15.00   2.000 |  27.00   2.000 |  39.00   6.000
                        3.25   2.000 |  15.25   2.000 |  27.25   2.000 |  39.25  13.000
                        3.50   2.000 |  15.50   2.000 |  27.50   2.000 |  39.50  13.000
                        3.75   2.000 |  15.75   2.000 |  27.75   2.000 |  39.75  13.000
                        4.00   2.000 |  16.00   2.000 |  28.00   2.000 |  40.00  13.000
                        4.25   2.000 |  16.25   2.000 |  28.25   2.000 |  40.25  17.000
                        4.50   2.000 |  16.50   2.000 |  28.50   2.000 |  40.50  17.000
                        4.75   2.000 |  16.75   2.000 |  28.75   2.000 |  40.75  17.000
                        5.00   2.000 |  17.00   2.000 |  29.00   2.000 |  41.00  17.000
                        5.25   2.000 |  17.25   2.000 |  29.25   2.000 |  41.25  13.000
                        5.50   2.000 |  17.50   2.000 |  29.50   2.000 |  41.50  13.000
                        5.75   2.000 |  17.75   2.000 |  29.75   2.000 |  41.75  13.000
                        6.00   2.000 |  18.00   2.000 |  30.00   2.000 |  42.00  13.000
                        6.25   2.000 |  18.25   2.000 |  30.25   2.000 |  42.25  23.000
                        6.50   2.000 |  18.50   2.000 |  30.50   2.000 |  42.50  23.000
                        6.75   2.000 |  18.75   2.000 |  30.75   2.000 |  42.75  23.000
                        7.00   2.000 |  19.00   2.000 |  31.00   2.000 |  43.00  23.000
                        7.25   2.000 |  19.25   2.000 |  31.25   2.000 |  43.25  13.000
                        7.50   2.000 |  19.50   2.000 |  31.50   2.000 |  43.50  13.000
                        7.75   2.000 |  19.75   2.000 |  31.75   2.000 |  43.75  13.000
                        8.00   2.000 |  20.00   2.000 |  32.00   2.000 |  44.00  13.000
                        8.25   2.000 |  20.25   2.000 |  32.25   2.000 |  44.25  13.000
                        8.50   2.000 |  20.50   2.000 |  32.50   2.000 |  44.50  13.000
                        8.75   2.000 |  20.75   2.000 |  32.75   2.000 |  44.75  13.000
                        9.00   2.000 |  21.00   2.000 |  33.00   2.000 |  45.00  13.000
                        9.25   2.000 |  21.25   2.000 |  33.25   2.000 |  45.25  53.000
                        9.50   2.000 |  21.50   2.000 |  33.50   2.000 |  45.50  53.000
                        9.75   2.000 |  21.75   2.000 |  33.75   2.000 |  45.75  53.000
                       10.00   2.000 |  22.00   2.000 |  34.00   2.000 |  46.00  53.000
                       10.25   2.000 |  22.25   2.000 |  34.25   2.000 |  46.25  38.000
                       10.50   2.000 |  22.50   2.000 |  34.50   2.000 |  46.50  38.000
                       10.75   2.000 |  22.75   2.000 |  34.75   2.000 |  46.75  38.000
                       11.00   2.000 |  23.00   2.000 |  35.00   2.000 |  47.00  38.000
                       11.25   2.000 |  23.25   2.000 |  35.25   3.000 |  47.25  13.000
                       11.50   2.000 |  23.50   2.000 |  35.50   3.000 |  47.50  13.000
                       11.75   2.000 |  23.75   2.000 |  35.75   3.000 |  47.75  13.000
                       12.00   2.000 |  24.00   2.000 |  36.00   3.000 |  48.00  13.000

 --------------------------------------------------------------------------------
 003:0003------------------------------------------------------------------------
 *#******************************************************************************
 *# Proposed Conditions (unfrozen)
 *#******************************************************************************
 *#
 *# Soil Type A based on hydrogeological characteristics identified in the
 *# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
 *# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
 *# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
 *# Therefore, use CN=65 under AMC II conditions
 *# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
 *#                                      typ.vel = 1ft/s, Tp = 0.6*Tc
 *#
 -----------------------
 | DESIGN NASHYD       |   Area     (ha)=   45.80   Curve Number   (CN)=65.00
 | 02:000200 DT= 5.00  |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
 -----------------------   U.H. Tp(hrs)=     .820

     Unit Hyd Qpeak  (cms)=    2.133

     PEAK FLOW        (cms)=    4.459 (i)
     TIME TO PEAK     (hrs)=   47.000
     RUNOFF VOLUME     (mm)=  191.240
     TOTAL RAINFALL    (mm)=  285.000
     RUNOFF COEFFICIENT   =      .671

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 003:0004------------------------------------------------------------------------
 *#
 *# Route through proposed ponding area
 *#
 -----------------------
 | ROUTE RESERVOIR     |     Requested routing time step =  5.0 min.
 |  IN>02:(000200)     |
 | OUT<03:(000300)     |     =========  OUTLFOW STORAGE TABLE  =========
 -----------------------     OUTFLOW     STORAGE   |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)    |   (cms)     (ha.m.)
                               .000   .0000E+00    |      .092  .1525E+01
                               .007   .7640E-01    |      .113  .2158E+01
                               .028   .3587E+00    |      .134  .2951E+01
                               .049   .6844E+00    |      .155  .3906E+01
                               .071   .1054E+01    |    48.580  .5021E+01

     ROUTING RESULTS              AREA     QPEAK     TPEAK        R.V.
     -----------------------      (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (000200)        45.80     4.459    47.000     191.240
     OUTFLOW<03: (000300)        45.80     4.454    47.083     191.237

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   99.884
                  TIME SHIFT OF PEAK FLOW          (min)=     5.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=.4005E+01

 --------------------------------------------------------------------------------
 003:0005------------------------------------------------------------------------
 *#******************************************************************************
 *# Proposed Conditions (frozen)
 *#******************************************************************************
 *#
 *# Soil Type A based on hydrogeological characteristics identified in the
 *# hydrogeologic Assessment (Groundwater Science Corp.,March 2008)
 *# Drainage Area = 45.8 ha (40.2 internal, 5.65 ha external)
 *# Use CN of 67 for row crops (straight row) (42.8 ha) and 39 for pasture (3 ha)
 *# Therefore, use CN=65 under AMC II conditions
 *# Use AMC III conditions to reflect frozen conditions, therefore CN = 82
 *# Tp estimated using Upland Method with length = 1500m, slope = 1.3%,
 *#                                      typ.vel = 1ft/s, Tp = 0.6*Tc
 *#
 -----------------------
 | DESIGN NASHYD       |   Area     (ha)=   45.80   Curve Number   (CN)=82.00
 | 02:000200 DT= 5.00  |   Ia       (mm)=   1.500   # of Linear Res.(N)= 3.00
 -----------------------   U.H. Tp(hrs)=     .820

     Unit Hyd Qpeak  (cms)=    2.133

     PEAK FLOW        (cms)=    5.008 (i)
     TIME TO PEAK     (hrs)=   46.917
     RUNOFF VOLUME     (mm)=  236.907
     TOTAL RAINFALL    (mm)=  285.000
     RUNOFF COEFFICIENT   =      .831

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 --------------------------------------------------------------------------------
 003:0006------------------------------------------------------------------------
 *#
 *# Route through proposed ponding area
 *#
 -----------------------
 | ROUTE RESERVOIR     |     Requested routing time step =  5.0 min.
 |  IN>02:(000200)     |
 | OUT<03:(000300)     |     =========  OUTLFOW STORAGE TABLE  =========
 -----------------------     OUTFLOW     STORAGE   |  OUTFLOW    STORAGE
                              (cms)     (ha.m.)    |   (cms)     (ha.m.)
                               .000   .0000E+00    |      .092  .1525E+01
                               .007   .7640E-01    |      .113  .2158E+01
```

```
00541>                              .028  .3587E+00   |     .134  .2953E+01
00542>                              .049  .6844E+00   |     .155  .3906E+01
00543>                              .071  .1054E+01   |   48.580  .5021E+01
00544>
00545>      ROUTING RESULTS             AREA     QPEAK     TPEAK        R.V.
00546>      ---------------             (ha)     (cms)     (hrs)        (mm)
00547>      INFLOW >02: (000200)       45.80     5.008    46.917     236.957
00548>      OUTFLOW<03: (000300)       45.80     5.008    47.000     236.905
00549>
00550>                      PEAK   FLOW   REDUCTION [Qout/Qin](%)=    99.948
00551>                      TIME SHIFT OF PEAK FLOW          (min)=      5.00
00552>                      MAXIMUM  STORAGE   USED        (ha.m.)=.4017E+01
00553>
00554> ----------------------------------------------------------------------------
00555> 003:0007----------------------------------------------------------------------
00556> ----------------------------------------------------------------------------
00557> 003:0002----------------------------------------------------------------------
00558> ----------------------------------------------------------------------------
00559> 003:0002----------------------------------------------------------------------
00560>       FINISH
00561> ----------------------------------------------------------------------------
00562> ****************************************************************************
00563>      WARNINGS / ERRORS / NOTES
00564>      -------------------------
00565>    Simulation ended on 2009-10-01     at 16:47:58
00566> ****************************************************************************
00567>
00568>
```