Case Nos. 09-031 and 09-032

ENVIRONMENTAL REVIEW TRIBUNAL

IN THE MATTER OF sections 38 to 48 of the *Environmental Bill of Rights, 1993*, S.O. 1993, c. 28, as amended, and section 34 of the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40, as amended;

AND IN THE MATTER OF an Application by the Sierra Club of Canada and the Greenspace Alliance of Canada's Capital for leave to appeal the decision of the Director under section 34 of the *Ontario Water Resources Act*, to issue Permit to Take Water No. 8130-7HNPVW dated April 27, 2009, to Findlay Creek Properties Ltd. and 1374537 Ontario Limited for the purposes of construction dewatering at Lot 18, 19 & 20, Concession IV, former Township of Gloucester, Ottawa, Ontario.

SIERRA CLUB OF CANADA
AND
GREENSPACE ALLIANCE OF CANADA'S CAPITAL

- and –

DIRECTOR, MINISTRY OF THE ENVIRONMENT

AFFIDAVIT OF ROBERT PUTZLOCHER
HYDROGEOLOGIST, WATER RESOURCES ASSESSMENT UNIT
MINISTRY OF THE ENVIRONMENT

(Sworn June 4, 2009)

I, **Robert Putzlocher**, of the City of Kingston, in the Province of Ontario, AFFIRM AND SAY AS FOLLOWS:

1. I am a Hydrogeologist with the Ministry of the Environment's Technical Support Section, Eastern Region. I have been so employed since February 14, 2001. In this capacity, I investigate and report on complex groundwater quality and quantity issues. I have provided technical reviews for a number of Permit to Take Water applications at the subject site. I have also attended the site on a number of occasions.

2. I am a licensed Professional Engineer in the Province of Ontario. In accordance with Subsection 3(2) of the Professional Geoscientists Act, I have the appropriate training and experience to engage in the practice of Professional Geoscience in the area of hydrogeology. I have a Bachelor's Degree in Environmental Engineering and a Master's Degree in Civil Engineering from Queen's University. The subject matter for my graduate degree was in the field of contaminant hydrogeology.

3. I have personal knowledge of the matters to which I depose in this affidavit. Where I do not have personal knowledge, I have indicated the source of my information and I believe such information to be true.

The Application

4. The application for the Permit to Take Water (PTTW) that is the subject of this review was received from Findlay Creek Properties Ltd. and 1374537 Ontario Limited ("the proponent") by the Ministry of the Environment on July 14, 2008. The Permit was required to authorize temporary water takings for the purposes of installing water and sewer servicing for all future stages of Findlay Creek Village subdivision on Lots 19 and 20, Concession V, former Township of Gloucester, now City of Ottawa. A copy of the application is set out at Tab 5 of the Respondents' Book of Documents.

5. A letter requesting an amendment to the application was received by the Ministry on August 29, 2008. This letter described two additional water takings that the proponent wished to have added to the original PTTW application. This was followed by another letter providing additional details and a formally amended application dated September 12, 2008. The additional takings were associated with works: 1) on the Findlay Creek Extension Area on the north and east sides of the Leitrim Wetland; and 2) on the Drainage Ditch Modification Area to the north and central portion of the property. The maximum pumping rates requested were: 1) 6,944 litres per minute or 10,000,000 litres per day; and 2) 2,083 litres per minute or 3,000,000 litres per day. These two letters are set out at Tabs 11 and 12 of the Respondents' Book of Documents.

6. The water takings described under the amendment are almost exclusively related to surface waters. It was the ground water takings associated with the intermittent dewatering of trench excavations that were my main focus and as that poses a potential impact to groundwater levels in the adjacent wetland. The surface water takings were reviewed by my colleague, Dana Cruikshank.

7. The application was considered a Category 3 application under the Ministry's Permit to Take Water Manual, requiring that hydrogeologic information submitted in support of the application be reviewed by Ministry of the Environment Technical Support Groundwater Unit staff.

8. The subject permit application was accompanied by a new hydrogeologic report entitled "Hydrogeological Evaluation in Support of an Application for a Permit to Take Water, Sewer Construction, Future Stages, Findlay Creek Village Subdivision, Ottawa (Gloucester), Ontario", dated July 2008 and prepared by Golder Associates Limited, which is set out at Tab 6 of the Respondents' Book of Documents.

9. In addition to the accompanying hydrogeological report, I reviewed the following documents in my review of the PTTW application:

   - "Groundwater Monitoring Report, Environmental Monitoring Program, October 2003 to March 2008, Findlay Creek Village, Ottawa, Ontario" dated April 2008 and prepared by Golder Associates Limited, which is set out in the Respondents' Book of Documents at Tab 7;

   - "Hydrogeological and Geotechnical Considerations, Pre-design of Stormwater Management Works, Leitrim Development Area, Gloucester, Ontario" dated August 1994 and prepared by Golder Associates Limited;

   - "Geotechnical and Hydrogeological Considerations, Final Design, Leitrim Stormwater Management Facilities, Gloucester,Ontario" dated April 2002 and prepared by Golder

Associates Limited;

- "Amendment to the Canadian Environmental Assessment Act, Environmental Screening Report for Revised Leitrim Stormwater Management Pond, Ottawa, Ontario" dated June 2005 and prepared by Golder Associates Limited;

- "Baseline Monitoring Program, Groundwater And Surface Water Regimes, Leitrim Development Area, City of Gloucester, Ontario" dated May 1999 and prepared by Golder Associates Limited;

- "Geotechnical Investigation, Proposed Stormwater Management Pond East of Bank Street and North of Blais Road, Findlay Creek Village Development, Ottawa, Ontario" dated March 2006 and prepared by Golder Associates Limited;

- "Hydrogeological Investigation, Leitrim Village Lands, Gloucester, Ontario" dated October 1990 and prepared by Golder Associates Limited;

- Ontario Municipal Board Decision/Order No: 1675: IN THE MATTER OF Subsection 34(19) of the Planning Act, R.S.O. 1990, c.P. 13, as amended Decision dated June 18, 2007 and delivered by Board Member M.C. Denhez, which is set out in the Respondents' Book of Documents at Tab 18;

- Letter entitled "Response to Ministry of Environment Comments, Category 3 Permit to Take Water Application, Future Stages of Findlay Creek Village Subdivision, Ottawa, Ontario" dated December 16, 2008 and prepared by Golder Associates Limited, which is set out in the Respondents' Book of Documents at Tab 16;

- Letter entitled "Response to Ministry of Natural Resources Comments, Category 3 Permit to Take Water Application, Future Stages of Findlay Creek Village Subdivision, Ottawa, Ontario" dated December 16, 2008 and prepared by Golder Associates Limited, which is set out in the Respondents' Book of Documents at Tab 17;

- Letter entitled "RE: Revised Groundwater Monitoring Report, Environmental Monitoring Program, Findlay Creek Village, Ottawa, Ontario" dated April 18, 2008 and prepared by Golder Associates Limited;

- Letter entitled "Permit to Take Water Monitoring Program, Future Stages of Findlay Creek Village Subdivision, Ottawa, Ontario" dated February 27, 2009 and prepared by Golder Associates, which is set out in the Respondents' Book of Documents at Tab 19;

- Letter entitled "Response of Environment Canada to Environmental Petition No. 100 by Mr. Albert Dugal under the Auditor General Act, CONCERNS ABOUT THE proposed Leitrim External Storm Sewer System, Located in the former City of Gloucester" dated May 20, 2004 and originally signed by David Anderson, Federal Minister of the Environment;

- Letter entitled "Minister's Response: Fisheries and Oceans Canada" dated June 15, 2004 and originally signed by Geoff Regan, Federal Minister of Fisheries and Oceans;

- Letter entitled "Minister's Response: Health Canada" dated June 14, 2004 and originally signed by Geoff Regan, Federal Minister of Fisheries and Oceans;

- Letter entitled "Minister's Response: Natural Resources Canada" dated June 11, 2004 and originally signed by George Anderson, Deputy Minister, Natural Resources Canada;

- Letter entitled "Minister's Response: Transport Canada" dated June 1, 2004 and originally signed by Tony Valeri, Federal Minister of Transport;

- Letter entitled "RE: Provision of Additional Information, Applications for Permits to Take Water for Phase 2 Construction Dewatering and Completion of Findlay Creek Extension Construction, Findlay Creek Development, City of Ottawa" dated February

12, 2008 and prepared by Golder Associates Limited;

- Memorandum entitled "Findlay Creek Village Subdivision Long-term Application, Comments on Golder Associates Response to MOE Concerns" dated December 28, 2008 and prepared by Dana Cruikshank, MOE Surface Water Reviewer;

- Letter entitled "RE: Application for Permit to Take Water, Findlay Creek Properties Ltd., Lots 19 and 20 Concession IV, City of Ottawa (Gloucester)" dated February 6, 2009 and prepared by Sarah Nugent, Water Resources Coordinator, Kemptville District;

- "Environmental Management Plan, Leitrim External Storm System, City of Ottawa" dated March 2003 and prepared by Cumming Cockburn Limited and Golder Associates Limited;

- Paper entitled "Aquifer contamination and restoration at the Gloucester Landfill, Ontario, Canada" from Proceedings of the Symposium held during the Third IAHS Scientific Assembly, Baltimore, MD, May 1989, IAHS Publ. no. 185, 1989;

- Minutes of the Leitrim Monitoring Technical Advisory Committee (TAC) meetings held on: January 24, 2007; March 3, 2007; April 26, 2007; September 26, 2007; December 10, 2007; March 3, 2008; June 16, 2008; September 24, 2008; January 14, 2009;

- 'Submission for Permit To Take Water' by Linda McCaffrey Q.C. on behalf of Greenspace Alliance of Canada's Capital and The Sierra Club of Canada, (received September 8, 2008);

- Minutes 'Submission for Permit To Take Water' by Linda McCaffrey Q.C. on behalf of Greenspace Alliance of Canada's Capital and The Sierra Club of Canada, (dated October 16, 2008), which is set out in the Applicants' Leave to Appeal submission at Tab 34.

10. Furthermore, each time a short-term application was submitted in the past, it was accompanied by a hydrogeologic report providing technical information pertaining to the characteristics of the site and the taking. As part of my review of the subject permit, I reviewed each of these reports for the respective prior permits. These reports were available for the subject Permit application and my review considered them where relevant. My concern in particular was the locations of the previous takings, the predicted radius of influence, and the actual impact on groundwater elevations as measured at monitoring wells.

The Technical Review

11. I was assigned by the Director, Peter Taylor, to conduct a technical review of the groundwater aspects of the proposed water taking. This involved evaluating water takings from subsurface excavations listed as the first source in the permit application. Other sources listed in the permit application are considered surface water takings and are evaluated by Mr. Cruikshank. As required by Ontario Regulation 387/04, my review considered the potential impacts of the proposed groundwater withdrawal to: the existing use of groundwater; groundwater availability; the interaction of groundwater and surface water; and the natural function of the ecosystem.

12. The only known existing use of groundwater in the area is for drinking water purposes. Most of the area is serviced by municipal water. However, a number of private wells within a radius of approximately 500 metres were identified from the Ministry of the Environment Water Well Record database. The nature of the proposed taking, dewatering of trenches, is from shallow aquifers. It is not expected that groundwater wells would be adversely impacted from this type of taking. The Ministry has not received any complaints from neighbouring well owners of adverse impacts to their wells since construction commenced in 2003.

13. Similarly, as there are few other users of groundwater in the area, and because of the intermittent nature of the proposed taking, there is no reason to believe that the availability

of groundwater would be adversely affected.

14. The third factor that must be taken into consideration under O. Reg. 387/04 for groundwater takings, the natural function of the ecosystem, required significant technical review because the property on which the taking is to occur is adjacent to the Leitrim wetland which is a provincially significant wetland (PSW).

15. I began by identifying the potential impacts to groundwater elevations in the area. This included assessing the influences to groundwater levels in the wetland from works conducted under previous permits and evaluating the proponent's interpretation of potential influences from groundwater takings associated with the development of future stages.

16. The future stages refer to areas of new residential development to be constructed in the subdivision. These were indicated in Figure 2 of the application and are listed as: northwestern future stage; southwestern future stage; central future stage; northeastern future stage; and southeastern future stage. Figure 2 also shows that the future stages represent approximately 50 percent of the development as a whole - half of the residential area has been serviced, constructed, and occupied. Figure 2 is set out at page 22 of the application, set out at Tab 5 of the Respondents' Book of Documents.

17. With the exception of the northwestern future stage, each of the new areas will be serviced by municipal water, sewer and stormwater systems. The northwest future stage of development refers only to the installation of a watermain connection to Leitrim Road.

18. Trench excavations are required for the installation of these services. It is routine construction practice that groundwater control (dewatering) is performed where necessary in order to ensure the trenches remain dry to allow for associated work within the trenches to be carried out. The application states that trench excavations at future stage sites will average 9 metres in length and 4 metres in width with an average depth of 4 metres. Dewatering will occur where needed on a temporary and sequential basis along the alignment of service trenches.

19. The PTTW application requests a maximum pumping rate of 11,820 litres per minute or 17,020,800 litres per day. This amount was based on previous maximum dewatering requirements at the site. It is standard practice for Permit applicants to apply for the maximum rates that could potentially be required for dewatering at a site.

20. It is a common misperception that water takings authorized under a PTTW will be at the maximum rate for the full term of the Permit. In fact, for this type of dewatering activity, the maximum allowable rate may never be achieved and pumping occurs for as little time as possible – often only a fraction of the term. However, due to the unpredictability of when pumping may be required, it is not practical to limit the pumping. Therefore, the maximum amount is authorized for any given day.

Analysis of Previous Takings and Monitoring Results

21. The Environmental Management Plan that was developed as part of the DFO approval first issued in 2003 for the Findlay Creek reconstruction project at the site requires on-going monitoring of groundwater and surface water in and around the PSW. With respect to groundwater monitoring, there are a total of 16 monitoring wells at 11 separate locations. Groundwater monitoring at these wells was initiated in the fall of 2003. Each monitoring well is equipped with a data logger that records groundwater elevations on an hourly basis. Results are typically downloaded and reviewed monthly during periods when water taking is not occurring.

22. Previous PTTW's have required that the frequency of monitoring data collection and review be increased to bi-weekly (every two weeks) during periods when construction dewatering is taking place.

23. The document "Groundwater Monitoring Report, Environmental Monitoring Program, October 2003 to March 2008, Findlay Creek Village, Ottawa, Ontario" provides and interprets the results of the ongoing monitoring groundwater program at the site. The report is set out at Tab 7 of the Respondents' Book of Documents.

24. This report was submitted to the Leitrim Monitoring Technical Advisory Committee in April, 2008. The data and interpretations contained in the report were reviewed and accepted by all agencies on that committee which included: Environment Canada, Federal Department of Fisheries and Oceans, Ontario Ministry of Natural Resources, City of Ottawa, South Nation Conservation Authority, and Ontario Ministry of the Environment.

25. The letter entitled "Response to Ministry of Environment Comments, Category 3 Permit to Take Water Application, Future Stages of Findlay Creek Village Subdivision, Ottawa, Ontario" presents additional monitoring data to the end of October, 2008. This letter is set out at Tab 16 of the Respondents' Book of Documents.

26. These documents display, in graphical format, the continuous groundwater elevations as recorded at the 16 monitoring wells for the time period October, 2003 to October, 2008. The charts also indicate four time periods when construction dewatering was occurring and provide total monthly and average monthly precipitation as measured at a nearby weather station. The charts are figures 7 to 13 of the "groundwater monitoring report, environmental monitoring program October 2003 to March 2008." which is at Tab 7 of the Respondents' Book of Documents, and in Attachment 3, figures 1 to 6 in the letter titled "Response to Ministry of Environment comments, category 3 PTTW, future stages" which is set out at Tab 16 of the Respondents' Book of Documents.

27. In my review of these data, I made the following observations:
    a) Drops in groundwater elevations occurred simultaneously in all monitoring wells for periods of time within the following periods of construction dewatering: January 2004 to May 2004; January 2005 to June 2005; and September 2005 to December 2006.

    b) The magnitude and duration of these elevation drops varied significantly ranging from an approximate maximum of 3 metres at BH03-5, BH03-6, and BH08a to an approximate maximum of 0.25 metres at BH03-1 and BH03-2.

c) Elevation drops were generally greater in bedrock intervals than in overburden intervals and greater in monitoring wells near the eastern edge of the PSW than in those near the western portion.

d) The duration of elevation drops varied from a matter of days to periods of up to 8 weeks.

e) During times of construction dewatering, groundwater elevations dropped below the trigger levels that had been set in the environmental monitoring plan required by the DFO authorization and remained below for lengthy periods in BH03-5, BH03-6, BH03-7a, BH03-7b, BH03-8a, BH03-8b, BH03-9a, BH03-9b, BH97-2a, and BH97-2b.

f) Lesser drops in groundwater elevations occurred both during construction periods and during times when no construction dewatering was taking place.

g) There was no evidence of any groundwater elevation lowering during the last period of construction dewatering in May and June of 2008.

h) Variations in groundwater elevations appeared to be loosely correlated with total monthly precipitation values.

i) In comparing groundwater elevations from the preconstruction period of October 2003 to those at the end of the reported period in October 2008, I found:

- In BH03-1 groundwater elevation was at approximately the same level in 2003 and in 2008
- In BH03-2 groundwater elevation was higher in 2008 than in 2003 by approximately 0.2 metres
- In BH03-3 groundwater elevation was higher in 2008 than in 2003 by

approximately 0.25 metres

- In BH03-4 groundwater elevation was higher in 2008 than in 2003 by approximately 0.1 metres
- In BH03-5 groundwater elevation was higher in 2008 than in 2003 by approximately 0.25 metres
- In BH03-6 groundwater elevation was higher in 2008 than in 2003 by approximately 0.5 metres
- In BH03-7a groundwater elevation was at approximately the same level in 2003 and in 2008
- In BH03-7b groundwater elevation was at approximately the same level in 2003 and in 2008
- In BH03-8a groundwater elevations elevation was lower in 2008 than in 2003 by approximately 0.4 metres
- In BH03-8b groundwater elevation was higher in 2008 than in 2003 by approximately 0.5 metres
- In BH03-9a groundwater elevation was at approximately the same level in 2003 and in 2008
- In BH03-9b groundwater elevation was at approximately the same level in 2003 and in 2008
- In BH97-2a groundwater elevation was lower in 2008 than in 2003 by approximately 0.5 metres
- In BH97-2b groundwater elevation was lower in 2008 than in 2003 by approximately 0.5 metres

j) In comparing groundwater elevations at the end of significant periods of construction dewatering in October 2006 to those at the end of the reported period in October 2008, I found that although there was significant seasonal fluctuations, very little, if any, overall change in groundwater elevations had taken place in any wells other than BH03-1. This well monitoring well is located within the bank of an excavation and is scheduled to be replaced as detailed in paragraph # 50 below.

k) Groundwater elevation at BH03-1 was lower in October 2008 than in October 2006, however as noted above in (i) there was no overall change from the elevation measured in the pre-construction period.

28. The application makes the statement that 'after the cessation of pumping, water levels recover immediately'. I noted the water level data as displayed in the charts was not discrete enough with respect to time in order to substantiate the statement. Therefore I requested that the proponent provide data with an expanded time sequence for significant drawdown and recovery periods in order that the response could be observed more closely.

29. The proponent provided graphs with an expanded time scale for events when temporary groundwater level lowering was associated with construction dewatering. These included charts for overburden monitoring wells 03-5 and 03-6 during winter 2005; for bedrock/overburden monitoring well pair 03-7a/03-7b during winter 2004; and, for bedrock/overburden monitoring well pair 03-9a/03-9b during winter 2005. Evaluation of this data indicated that recovery to the trigger level occurred in 6 days for MW 03-5 and 03-6; about 3 days in 03-7a and 03-7b; and, 2 days and 5 days in MW 03-9a and 03-9b, respectively.

30. A review of these data indicate that, as stated in the PTTW application, the groundwater levels began to rise very quickly after pumping stopped although recovery to trigger elevations took several days.

31. I noted that several significant water level variations occurred in the period between June and October 2007. This was evident at most monitoring wells other than BH03-1 and BH03-2. Therefore I requested that the proponent provide a detailed analysis of these events which considers daily precipitation and construction activities at the site.

32. The proponent provided charts of groundwater elevations and precipitation between May 1, 2007 and October 31, 2007 at monitoring wells MW03-3 and MW03-4; MW03-5 and MW03-6; and MW03-9a and MW03-9b with an enlarged time scale.

33. In reviewing these charts I noted a strong correlation between daily precipitation events and the rapid recovery of groundwater elevations. During this period only minimal dewatering of service trenches took place (less than 50,000 litres per day) and no PTTW was required for this purpose, although there was some surface dewatering of the Findlay Creek Extension Phase 1 occurring at the site.

34. Although not indicated by monthly precipitation displayed on the larger scale charts, I recalled anecdotally that this was a period of low precipitation. The local Conservation Authority was in a Level 2 Drought and dry wells were common in Eastern Ontario. I reviewed the hydrograph for the nearest Environment Canada stream monitoring station within the same watershed (Castor River at Kenmore) and noted that the streamflow during the summer and fall of 2007 was below normal. I also was aware of other watercourses where very low flow was recorded during the summer of 2007. At the time these occurrences were assumed to be related to long periods of low precipitation.

35. One of the comments received through the EBR process was also concerned with the significant groundwater level drops in the summer of 2007. Specifically, Dr. Topp concluded that the observed drawdowns during this time period were due to drainage and construction activities east of the wetland and not due to climatic conditions. This document is set out at Tab 20 of the Applicant's Leave to Appeal Application.

36. I had previously reviewed a report from Dr. Topp concerning water level impacts during the same period wherein it was concluded that there was a trend of declining water levels and that the trend would likely continue. The conclusions were based on in-situ permeability testing and on the measurement of groundwater elevations near the eastern fringe of the wetland on three occasions in May, June, and July of 2007. I noted that these measured water level elevations corresponded well with elevation data from BH03-7 and BH03-9 for the same dates. Both the independent measurement and the monitoring data showed a drop in water elevations of approximately 0.8 metres over the time period May 28 to July 18, 2007. However, the continuously recorded data showed that water levels in the monitoring

wells rose approximately 0.8 metres by the end of July, 2007 and continued to fluctuate for the remainder of the fall and then rose substantially (over 1.0 metre) by the middle of October, 2007. Dr. Topp's report is set out at Tab 20 of the Applicants' Leave to Appeal Application.

37. I disagreed with Dr. Topp's conclusion at the time because it was based on an extremely small set of observational data (3 points) over a period of approximately 7 weeks. The groundwater levels as measured daily had larger fluctuations than observed by Dr. Topp and continued to vary for a considerable period of time afterwards. The complete set of data to October, 2008 indicate that groundwater levels in the eastern fringe of the wetland returned to and remained at higher elevations since October, 2007. Again, no consistent trend of declining water levels had been noted by any of the agencies reviewing the groundwater monitoring report.

38. I reviewed Dr. Topp's comments on the current permit application which presented further analysis of the low groundwater levels in the summer of 2007. These comments again stated that observed low groundwater levels during this time period were due to drainage and construction activities east of the wetland and not due to climatic conditions.

39. The comments compared water levels in 2004 to those in 2007. The complete set of groundwater level monitoring data show similar groundwater level variations and overall decline between May and October in both 2004 and 2007, although the magnitude of water level lowering was greater in 2007 than in 2004. Dr. Topp concluded that the 10 month period (January to October) had identical precipitation in both 2004 and 2007 and therefore the difference in water level drops cannot be correlated with precipitation levels but were due to the impact of construction dewatering.

40. I considered these comments by reviewing the precipitation and water level data for 2004 and 2007. I also obtained precipitation data from the Environment Canada weather station at Ottawa Airport for 2008. In my analysis I found that the total precipitation for the 10 month period (Jan to Oct) was: 2004 – 728.1 mm, 2007 – 699.6, and 2008 – 844.4. Using

2004 as a reference, there was 4% less precipitation in 2007 and 15% more in 2008. I considered the precipitation in 2008 to be significantly greater and agreed that the 2004 and 2007 amounts were close to being the same.

41. I further considered that because, in general, much of spring freshet becomes runoff and/or discharge in the case of the wetland, precipitation in the period May to October would be more influential than that from January to April. The total precipitation for the 6 month period (May to Oct) was: 2004 – 528.0 mm, 2007 – 473.4, and 2008 – 520.4. Using 2004 as a reference, there was 11% less precipitation in 2007 and 1% less in 2008. In this case, the precipitation in 2008 can be considered the same while in 2007 there was a notably lesser amount of precipitation than in 2004.

42. I then considered the impact of these relative aggregate amounts (total for the period) of precipitation on groundwater levels as measured in the wetland. In every year from 2004 to 2008, groundwater levels showed significant variation and overall decline during the period May to October. As noted earlier, this occurred to a significantly larger degree in 2007 when compared to 2004. There was indeed less rainfall in the summer/fall of 2007 and of all years and in all monitoring wells, the summer/fall variation and decline was least apparent in 2008 – despite nearly identical rainfall in 2004 and 2008. I concluded that it was not possible to make a significant correlation between total precipitation over a six or 10 month span and the characteristic variation and decline of groundwater levels.

43. With respect to groundwater withdrawals, there was no groundwater pumping during the summer/fall of either 2004 or 2007 but there was groundwater withdrawal during that time period in 2008. The summer/fall groundwater level variation and decline was least apparent in 2008. The same characteristic variation and decline was recorded in monitoring wells 97-2a and 97-2b during the summer/fall of 1998 prior to development at the site.

44. I concluded that it was not possible to make a significant correlation between groundwater withdrawals (in either individual or successive years) and the characteristic variation and decline of groundwater levels. As noted earlier, I found the strongest correlation to

groundwater level variations was with precipitation in a time frame of days. Water levels in the wetland appear to be affected primarily by distribution of rainfall over time - i.e., water levels respond quickly to large rainfall events and similarly diminish with periods of low precipitation.

45. I also reviewed comments provided by Dr. Topp with respect to the hydrogeologic characteristics of soils in the wetland south of Findlay Creek. In the summer of 2007, Dr. Topp conducted in-situ permeability testing of soils in and around the wetland. He reported that the soils underlying the western part of the wetland have a higher hydraulic conductivity that those in the eastern part. Specifically at three locations, the hydraulic conductivities of soils at depths up to 1.5 metres were found to be in the range of approximately 1 to 6 x 10^{-3} cm/sec. This was reported to be roughly 40 times higher than the hydraulic conductivity measured near the eastern limit of the wetland. This work was conducted just prior to the construction of the Findlay Creek extension to Albion Road. Dr. Topp concluded that any excavation in this area would result in rapid drainage (within months) of the wetland with extensive drawdown occurring to distances occurring to 100's of metres south into the wetland.

46. The three locations where Dr. Topp obtained the high hydraulic conductivity values are very close to established monitoring well pairs MW-01/02, MW-03/4, and MW-05/6 which are located along the northern edge of the wetland in the western portion of the site. These well pairs consist of two wells completed into the shallow overburden (3 to 4 metres) at distances of approximately 5 and 20 metres south of the north wetland boundary.

47. Since monitoring began in October 2003, these three well pairs have shown the least variation in groundwater levels. The Findlay Creek Extension Phase 1 was constructed in the fall of 2007 and involved the excavation of a channel along the northern edge of the wetland to a depth of approximately 1.5 metres below original ground surface.

48. The existing East-West ditch is located just north of the Findlay Creek extension. The depth of this channel is approximately the same as the Findlay Creek extension. With respect to

drainage, the Findlay Creek Extension is a replacement of the ditch. Once the DFO authorized upgrades are complete, the current flow through the ditch will be diverted to the Findlay Creek extension.

49. Continued monitoring indicates that groundwater levels at these three well pairs continue to be relatively stable (excepting MW-01) with no discernable impacts from the Findlay Creek extension. Groundwater levels at MW-2 through MW-6 were at slightly higher levels in October 2008 than prior to development in October 2003. This lead me to conclude that Dr. Topp's prediction of rapid water level lowering extending deep into the wetland was not valid.

50. After construction of the Findlay Creek extension, MW-01 was found to be located in the bank of the excavation. Water levels are impacted in this location and are no longer considered representative of water levels within the wetland. This monitoring well is scheduled to be replaced and reconstructed in a location 5 metres south of the extension. It is noted that water levels at MW-02 (approximately 20 metres south of the extension) do not show influence from the excavation.

51. In consideration of the above factors, I was satisfied with the conclusion that the decline in groundwater elevations during the period between June and October 2007 was attributable to seasonal low precipitation and not to water takings.

52. From consideration of the observations described in points 27 through 50 above, it was my opinion that:
    - temporary pumping for construction dewatering causes temporary lowering of groundwater elevations in the PSW
    - seasonal fluctuation of water levels caused by low precipitation are similar to lowerings caused by dewatering
    - the data does not show evidence of a trend of groundwater level lowering
    - previous works caused groundwater elevations to drop below trigger levels for periods of time

- the subject Permit should include conditions to enhance the monitoring, including increasing the rate of monitoring as water levels approach trigger values
- the subject Permit should not allow dewatering in bedrock when groundwater pumping causes levels to reach trigger values.

Expected Groundwater Impacts for Future Stage Development

53. The application provided an estimation of potential groundwater drawdown based on a distance-drawdown relationship developed from measurements at PSW monitoring wells during July 2006. This was at a time when pumping rates were at a maximum and close to the proposed maximum rate for future stage work.

54. Dewatering activity in July 2006 was for the construction of the deep stormwater trunk sewer extending toward Bank Street. The excavation for this construction was within highly permeable bedrock and amongst the deepest at the site. Table 1 of the application indicates that the maximum drawdown in PSW wells during this time was measured closest to the excavation in BH97-2A (1.3 metres).

55. The application provides a table (Section 4.3) listing the maximum anticipated drawdown in BH03-7A/B and BH03-9A/B during development of each future stage. According to this table the maximum drawdown is expected to be approximately 1.9 metres at BH03-9A during construction in the southeastern future stage.

56. I noted that for the purpose of drawdown estimation, drawdown was defined relative to the average groundwater elevation at the specific monitoring well as measured during the baseline and pre-berm conditions. Drawdown would more appropriately be described relative to groundwater elevations immediately prior to the dewatering period. In this respect I agreed with comments provided by Dr. Michel. Although the trigger groundwater elevations are not dependent on relative drawdown, the PTTW includes a condition to measure groundwater levels prior to the commencement of dewatering activity.

57. Dr. Topp commented that the methodology used for drawdown estimation contains fundamental analytical errors. Specifically, he states that the data used were lacking in quantification (pumping volume and precipitation) and that variances in certain data points from the prediction were considered valid.

58. I concurred with this determination. Modelling complex processes through empirical methods can produce only very rough estimates. A prediction derived from this method could either under or over estimate drawdown with a significant level of uncertainty. In comments submitted, Dr. Michel considered the drawdown estimates and speculated that future drawdown could potentially be twice that predicted

59. I considered that the predicted drawdowns were only rough estimates and conservative. That is because the observed and estimated drawdowns are based on conditions that are not likely to occur in future stage development (i.e., deep excavation through permeable bedrock at locations near the PSW). In reviewing servicing design, it is understood that all deep trunk sewers requiring bedrock excavation, with the exception of a short section in the future central stage, are already in-place.

60. The future development area nearest sensitive features of the wetland is the southeastern future stage. Subsurface conditions in this area consist of 3 to 4 metres of total overburden (sandy silt over till) overlying dolomitic bedrock. The large trunk sewer was constructed through the central part of this area in 2006. The lowest elevation of this sewer on site is 85.6 masl or approximately 7 metres below ground surface with excavation approximately 3 metres into bedrock. The deepest servicing yet to be installed is the sanitary sewer with a typical depth of 2.9 metres below ground surface. The trenching for this servicing will be primarily in the silty soils and glacial till, possibly just encountering the bedrock surface in localized spots. The requirement for dewatering is expected to be far below that needed for the trunk sewer installed in 2006.

61. Therefore it was my opinion that the drawdown in wetland wells associated with development in the southeastern future stage would be considerably less than that

experienced in 2006. I disagreed with Dr. Michel's suggestion that the dewatering could result in a 4 metre drawdown.

62. Trunk sewer construction and dewatering occurred in May and June 2008 under PTTW #1446-76SPH2. This work was in the area where bedrock excavation is expected to be required for future stage development. The maximum rate of dewatering (i.e. groundwater taking) under that PTTW was the same as that proposed for the subject Permit.

63. The application for PTTW #1446-76SPH2 included an estimation of maximum drawdown based on a distance-drawdown relationship developed from measurements at PSW monitoring wells during all periods of construction dewatering between 2004 and 2006. For this taking the report estimated that the drawdown at BH03-9 and BH03-7 would be on the order of 0.5 to 1.2 metres.

64. The charts of continuous groundwater elevation data indicate that, contrary to the estimation, construction dewatering during May and June 2008 did not result in any discernible drawdown in any monitoring well.

65. It is not necessarily the magnitude of drawdown that is important but rather the corresponding elevation to which groundwater is lowered and the duration of the lowering. This is dependent upon groundwater levels prior to dewatering.

66. Therefore, in my opinion, there is little risk that the proposed groundwater dewatering will have a lasting adverse impact on the water levels in the wetland. Nevertheless, it would be prudent for the Permit to have conditions which consider groundwater elevations prior to construction activities and which requires that groundwater dewatering ceases when levels fall to predetermined trigger levels.

Potential Impacts from the Area north of Findlay Creek

67. I considered received comments which expressed concerns about the potential impacts to the wetland from the lowering of water levels in the development area north of the Findlay

Creek extension during and following development.

68. Development of the area north of the Findlay Creek extension (southwest future stage) involves a grade raise of 1.2 to 1.7 metres above original ground surface. The depth of building footings would then be approximately 1.0 to 0.5 metres below original ground surface. Any drainage features (e.g., weeping tiles) will be at a relatively shallow depth and above existing drainage channels. I therefore considered the consultant's conclusion of no expected impact to groundwater levels in the wetland to be reasonable.

Baseline Groundwater Monitoring / Trigger Mechanisms

69. Groundwater elevation data from the time period prior to the issuance of PTTW's at the site are provided in the document "Groundwater Monitoring Report, Environmental Monitoring Program, October 2003 to March 2008". It is reported that manual groundwater levels were recorded at various monitors between 1990 and 1998 and that continuous data loggers were installed in a number of monitors during 1998. Data loggers were installed in all 16 monitoring wells in October 2003. The Monitoring Report is set out at Tab 7 of the Respondents' Book of Documents.

70. Construction of the berm which separates the PSW and the residential development began in the early part of 2004. The berm is a major feature of the approved Stormwater Management System for the site.

71. Although the time period before construction dewatering and berm is considered baseline, it is understood that works impacting groundwater at the site had been undertaken at a prior time (i.e., drainage ditching). It is my further understanding from Shaun Thompson, an ecologist at MNR, that the PSW had been experiencing changes for a considerable period before any groundwater monitoring occurred.

72. I reviewed the manually recorded groundwater elevation data contained in the groundwater monitoring report and other previous hydrogeologic reports. I determined that this data was

not of great value with respect to evaluating impacts from the proposed takings as it has been shown that groundwater levels vary considerably in the short term. This makes comparing 'snapshot' groundwater levels from different time periods difficult. Additionally, many of the locations where groundwater level data was measured no longer exist as monitoring locations. Therefore, due to the sporadic nature of this past data, I did not find it useful.

73. The baseline data is very limited and in this respect I agreed with comments provided by Dr. Michel and others. However as it is not possible to be provided with additional historic data, it was my opinion that the best groundwater level data for evaluation purposes is that which is available from the continuous data loggers in the current 16 monitoring wells. The continuous data provides a more reliable means of comparing groundwater trends than trying to compare sporadic data from a variety of different wells as recorded in historic reports.

74. My evaluation of the continuous monitoring data has been put forth in points 27 to 50 above.

75. The updated Environmental Management Plan developed for the DFO authorization identified certain trigger groundwater elevations at each monitoring location. These were developed by considering groundwater elevations recorded during the pre-berm and pre-dewatering periods up to December 2004. Trigger values were established at an elevation that was 0.1 metres less than the seasonal minimum groundwater levels recorded at each monitoring well.

76. The trigger values established in the EMP have been accepted by review agencies and have been adopted in previous PTTW's.

77. The proponent had suggested that for the subject permit application the trigger elevations could be lowered even less than the 0.1 below the mark described in paragraph 75 above based on groundwater elevations that have been observed during periods of no construction

dewatering over the past five years.

78. It is my opinion that it would be more precautionary if groundwater trigger elevations were to remain at the previous levels. More importantly, previous construction dewatering has resulted in the lowering of groundwater elevations below trigger values for periods of time and this should not be allowed to recur. Any permit issued must include conditions that will enhance the detection and response to groundwater elevations nearing the trigger elevations as previously identified.

79. Dr. Michel commented that the monitoring network appeared to be reduced by eliminating any monitoring points that have caused repeated trigger alarms in the past. I recommended that all 16 monitoring locations be incorporated into the groundwater monitoring program. The only location without an associated trigger level is at MW-10. This well is located outside of the wetland and adjacent to Findlay Creek.

80. I recommended to the Director that conditions to address the following issues be included in the PTTW:

- A record of all water takings be maintained, including the dates and times of water takings, the rates of pumping, and an estimated calculation of the total amounts of water pumped per day for each day that water is taken, for each source

- The Permit Holder shall maintain the 16 groundwater monitoring wells and associated data loggers in operating condition for the duration of the permit. These monitoring wells are identified as: 97-2A, 97-2B, 03-1, 03-2, 03-3, 03-4, 03-5, 03-6, 03-7A, 03-7B, 03-8A, 03-8B, 03-9A, 03-9B, 03-10A, and 03-10B.

- During periods when no groundwater takings for construction occur, the Permit Holder shall review the logged results of groundwater elevation monitoring from all groundwater monitoring wells on a monthly basis. Compiled results in graphical format shall be submitted to the Director in January and July of each year the permit is in effect.

- Prior to a construction period involving pumping from service trenches, the Permit Holder shall download and review groundwater elevations in the monitoring wells. If groundwater elevations are greater than 0.1 metres above the respective trigger elevations at all monitoring wells, data downloading and review during the construction period will occur at a bi-weekly (every two weeks) frequency. Trigger elevations for each monitoring well are to be as listed in the previous updated EMP.

- If at the pre-construction site visit groundwater elevations are equal to or less than 0.1 metres above the triggers at any monitoring well(s), data downloading and review will occur weekly at that/those monitoring well(s).

- If during data review, groundwater elevation at any monitoring well is observed to be equal to or less than 0.1 metres above the respective trigger, data downloading and review frequency will increase to weekly at that monitoring well. The frequency will remain as weekly until groundwater elevations are observed to be continually greater than 0.1 metres above the respective trigger elevations.

- If review of groundwater elevation data indicates that groundwater levels have fallen below trigger elevations at any monitoring well, groundwater taking at the site shall cease and the Director shall be notified. Groundwater taking shall not commence until groundwater elevations at all monitoring wells is equal to or greater than 0.1 metres above the respective trigger elevations.

- Notwithstanding the above conditions, groundwater taking at the site may resume if it can be demonstrated, to the satisfaction of the Director, that groundwater level lowering is not as a result of takings authorized by this permit and that continued taking will not interfere with groundwater level recovery.

81. My conclusion concerning the degree of groundwater level lowering associated with the proposed takings is any short-term lowering will likely be considerably less than that which

has previously been experienced at the site. The estimates provided by the proponent in the application represent conservative 'worst case' scenarios. The degree of expected groundwater level lowering is within the range of natural fluctuations of the wetland.

82. I am not qualified to provide a professional opinion on the matter of impact on the natural function of the ecosystem within the wetland. On this matter I defer to those agencies responsible for oversight of biological conditions within the wetland (i.e., the Ministry of Natural Resources and the South Nation Conservation Authority).

83. Through my participation in the Leitrim Monitoring Technical Advisory Committee, I am aware that all agencies had approved and accepted the vegetation photo-monitoring report and the comprehensive groundwater monitoring report. I am not aware of any significant concerns expressed by any of the agencies with respect to ecosystem impacts due to previous groundwater takings at the site.

AFFIRMED BEFORE ME at the City of Kingston in the Province of Ontario

this 4th day of June, 2009

Marie claire Suzanne Gervais
A Commissioner, etc.

Bob Putzlocher

Marie Claire Suzanne Gervais, a Commissioner, etc., Province of Ontario, for the Government of Ontario, Ministry of the Environment.
Expires October 22, 2011.