Stantec Consulting Limited
40 Highfield Park Drive Suite 102
Dartmouth NS B3A 0A3
Tel: (902) 468-7777
Fax: (902) 468-9009

October 29, 2012
File:1049385/121510734

Brunello Estates
2000 Barrington Street
Suite 202
Halifax, NS B3J 3K1

Attention: Andrew Giles, P. Eng.

Dear Mr. Giles:

Reference: Reference: Construction Monitoring Report Year 2 – Q1

Brunello Estates has a proposed 18-hole golf course and residential development between Lakeside and Timberlea in Halifax, Nova Scotia, currently under construction. The property is bordered by Highways 3 and 103 (Figure 1). Further information regarding the development can be found at www.brunelloestates.com. All watercourses within the project area are identified and the associated fish habitat is described in the Aquatic Assessment report titled "Brunello Estates – Stream Assessments in Preparation for an Application for Watercourse Alteration" (Stantec 2009a). This report also includes baseline data on *in-situ* water quality and physical characteristics.

The Brunello Estates water quality monitoring plan was accepted by the Halifax Area Watershed Advisory Board (HWAB) in February 2012. The plan was based on information contained within the "Halifax Regional Municipality's Water Quality Monitoring Functional Plan" (Stantec 2009b). The Water Quality Monitoring Functional Plan (WQMFP) is one of a series of diverse functional plans mandated by the "HRM Regional Municipal Planning Strategy" (HRM 2006). Functional Plans are considered to be management guides considering the detailed elements of policy programming. Recognizing that "environmental features within a watershed all are connected and land-use activities in one part of the watershed can adversely affect quality and quantity of water in another", the Regional Municipal Planning Strategy (RMPS) in Policy E-18 identifies the need for the WQMFP to assist in the sustainable management land use and water resources.

SURVEY METHODOLOGY

The water quality monitoring was carried out according to the monitoring plan illustrated in the *Brunello Estates Water Quality Monitoring Plan* (Stantec 2011).

Sample locations were chosen based on the proximity of construction activities surrounding the watercourses, the identified habitat described in the aquatic assessment report (Stantec 2009a) and the connectivity of the watercourses to larger systems. In total six locations were chosen to be monitored all of which are streams or brooks (*ie*. Lotic systems). Three of the watercourses in the monitoring program drain into Governors Lake (WC 1,2 and 6), with two located along the western extent of the property flowing into Nine Mile River (WC-11 and WC-13). The remaining two watercourses (WC-4 and WC-7) are predominantly overland drainage connecting wetlands. Figure 1 illustrates the locations of the water quality monitoring stations on each stream.

LOCATION AND DATES OF SAMPLING

Construction activities are currently limited to the central portion of the development and as such interaction of the development with the freshwater environment is limited to the area upstream of WC-7. As such, water chemistry sampling occurred at WC-7 on the dates below:

- June 25, 2012
- July 18, 2012
- August 23, 2012

In addition to the water chemistry samples taken the following water quality parameters were measured in the field.

- Date and time
- pH
- Conductivity
- Dissolved oxygen
- Air temperature
- Water temperature
- Ice depth (Winter)
- Incidental wildlife sightings,
- Observations on water clarity and odour

RESULTS

Monitoring events were chosen to correspond with periods of weather typical to the season in which the monitoring occurred with periods of elevated rainfall and drought conditions avoided (if possible). Meteorological conditions observed prior to sample collection were as follows:

- June 25, 2012: Mostly Cloudy, 20°C, 8.3 mm in the previous 48 hrs.
- July 18, 2012: Mostly Cloudy, 22°C, 1.5 mm in the previous 48 hrs.
- August 23, 2012: Mainly Clear, 21°C, No Rain in the previous 48 hrs.

The water in WC-7 at the time of the surveys was observed to be tea-stained during all sampling events with no unusual odors observed during any event. In addition, no sedimentation was visible during any of the site visits.

Water Quality

The following Table summarizes the water quality measured in WC-7 during the first quarter of Year 2 of construction monitoring. All chemical analysis and field measurements not summarized below are included as an attachment with the relevant guidelines.

Table 1 Brunello Estates – Year 2 First Quarter Construction Monitoring Results

Watercourse 7	June 25, 2012	July 18, 2012	August 23, 2012	Baseline Mean	Year 2 – Q1 Mean
pH[2] (pH units)	8.82	5.05	5.18	*4.59*	**6.35**
Specific Conductivity[2] (µS/cm)	93	109	46	*55*	**83**
Total Phosphorous (µg/L)	97	140	92	*16*	**110**
Total Suspended Solids (mg/L)	3.6	2.8	2.4	*1*	**2.9**
Dissolved Oxygen[2] (mg/L)	6.91	5.75	7.71	*7.20*	**6.79**
Dissolved Oxygen[2] (%)	70.1	62.7	84.5	*62.0*	**72.4**
E. coli (CFU/100ml)	ND	ND	8.0	*ND*	**3.0**

1 One half RDL value used for calculation of average where one or more samples were reported as non-detectable.

2 Measured In-situ

Discussion

The results of the water chemistry sampling and *in-situ* water quality measurements are discussed below in comparison to the relevant Canadian Council of the Ministers of the Environment (CCME) Guidelines for the Protection of Freshwater Aquatic Life (CCME FAL) and Recreational Water Quality Guidelines (RWQG).

Within WC-7 the pH ranges in the acidic; this is similar to conditions observed during the baseline sampling events and elsewhere within Nova Scotia. CCME FAL recommends a pH range of 6.5 to 9.5 pH units to maintain fish health. Low pH values reduce the ability of certain species to spawn and hinder tissue development in juveniles (CCME 2006). During baseline fish habitat assessments it was determined that no fish habitat was present within WC-7 and therefore the recommended CCME FAL pH range is utilized as a reference value. It should be noted that viable fish communities in Nova Scotia have been observed by Stantec personnel in pH levels similar to or more acidic than those measured in the watercourses of Brunello Estates.

Levels of nutrients found in WC-7 were elevated as compared to the baseline results. Nutrient accumulation will become evident initially through increased levels in water quality and subsequently through in-stream vegetation growth. In general, nutrients remain elevated for a greater period of time in lentic (still water) systems than for lotic (moving water) systems based on the reduced flushing rates of the former.

The trophic state of a body of water is a general measure of the nutrient accumulation within. The CCME *Canadian Guidance Framework for the Management of Freshwater Systems* has developed trophic levels based on ranges of phosphorous concentrations. A body of water is usually classified as being in one of four possible classes (*oligotrophic*, *mesotrophic, meso-eutrophic* or *eutrophic)* ranging from low to high trophic status. Watercourses with extreme trophic indices may also be considered *hyperoligotrophic* or *hypereutrophic*. Based on the fourth quarter results WC-7 can be classified as eutrophic . A eutrophic stream is one in which has reached the limit for nutrient input. The water is usually turbid with beds of submerged aquatic macrophytes; algae is likely present in the late summer leading to increased water turbidity. The levels of phosphorous within the stream during the first quarter of year two are elevated over baseline results.

Water clarity and transparency of the streams in Brunello Estates were measured by observations and the concentrations of total suspended solids (TSS) in the water sample. TSS is a direct measure of the weight of solids in the water; this parameter is predominantly used as a method to indicate the quantity of sediment in the water column. TSS in the baseline samples was low (mean = 1 mg/L) and continues to be low during the fourth quarter (mean = 2.9 mg/L); these levels of sediment in the water column indicates an aquatic environment with little sedimentation through erosion or other anthropogenic effects. CCME FAL recommend a maximum TSS increase of 5 mg/L over background levels for effects lasting longer than 30 days, this leads to an interpreted guideline concentration for Brunello Estates of 6 mg/L for WC-7. TSS levels are below this guideline and similar to results noted during the baseline assessment.

E.coli is a type of faecal bacteria commonly found in the intestinal tract of warm-blooded animals and is used as an assessment tool to identify fecal contamination. During the baseline monitoring *E.coli* concentrations within the streams of Brunello Estates development were low with detectable results measured solely in the streams adjacent to existing residential units (WC-1 and WC-4). The source of the *E.coli* measured in the three streams cannot be determined but could be attributed to wildlife, pets, or humans. As bacterial contamination has little effect on aquatic habitats the primary reason for monitoring is related to human health. *E. coli* was detected in one of three samples during the first quarter of year two; this positive result was reported as 8.0 CFU/100ml placing it at a level well below the CCME recreational guidelines for freshwater set at 200 CFU/100ml.

SUMMARY

The results provided in this report represent the findings of the first quarter of Year 2 for the construction monitoring program which occurred between June and August 2012. During this period, water quality remained similar to values observed during the baseline monitoring program. Total phosphorous was observed to have increased over the baseline results which may be due to natural variation through weather patterns and seasonality differences between the two monitoring periods. This data report was created to provide Brunello Estates a brief overview of the water quality observed during the previous quarter as compared to the baseline results.

References

Clair, T.A., Dennis, I.F.,Scruton, D.A., Gilliss, M. *Freshwater acidification research in Atlantic Canada: a review of results and predictions for the future*. Accessed in May 2011, at http://www.nrcresearchpress.com/toc/er/15/NA

Canadian Council of Ministers of the Environment, 2004. *Canadian Water Quality Guidelines for the Protection of Aquatic Life.*

Canadian Council of Ministers of the Environment, 2004. *Phosphorous: Canadian Guidance Framework for the Management of Freshwater Systems*

Halifax Regional Municipality, 2011. *Seasonal Water Quality Sampling Program*. As accessed in May 2011 at: http://www.halifax.ca/environment/lakesandrivers.html#SeasonalSampling

Nova Scotia Environment, 2011. *Water Quality Dataset.*

CLOSING

We trust that this report meets the requirements pertaining to the development agreement between Nine Mile River Investments and HRM for the project known as Brunello Estates. Stantec is open to comments and suggestions regarding this study, and appreciates any feedback from local watershed advisory boards.

This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report and the referenced documents. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a fourth party, or any reliance on decisions made based upon it, are the responsibility of such fourth parties. Stantec Consulting, Ltd. (Stantec) accepts no responsibility for damages, if any, suffered by any fourth party as a result of decisions made or actions taken based on this report.

Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report were assumed by Stantec to be accurate. Conclusions presented in this report should not be construed as legal advice.

This report represents the best professional judgment of Stantec personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report was prepared by Michael McLean and reviewed by Sam Salley. Should you have any questions, please do not hesitate to contact the undersigned or Sam Salley at (902) 468-7777.

Sincerely,

STANTEC CONSULTING LIMITED

Original Signed

Michael McLean
Environmental Scientist
Tel: (902) 468-7777
[redacted]

Attachment: Figure 1 – Water Quality Monitoring Locations
Water Quality Results and Relevant Guidelines

AUTHOR: C.Shupe	DATE: January 27, 2010	BRUNELLO ESTATES	FIGURE NO.: Figure 2
APPROVED BY: H. Aubrey	SCALE: 1:10,000	**Sampling Locations for Brunello Estantes Water Quality Monitoring Plan.**	
	COORDINATE SYSTEM: UTM NAD 83 ZONE 20		Stantec

X:\Projects\NovaScotia\104xxxx\1049385_Brunello_Estates\Mapping\MXD\Report\Figures\Fig_XX_Field_Delin_Streams_May2009.mxd

Table 1: Brunello Estates Water Chemistry (General Chemistry)

RESULTS OF ANALYSES OF WATER			Watercourse #7													CCME FWAL
Sampling Period			Year 2 - First Quarter			Year 2 - Second Quarter			Year 2 - Third Quarter			Year 2 - Forth Quarter				
Date		dd/mm/yyyy	6/25/2012	7/18/2012	8/23/2012											Guidelines
Calculated Parameters	**Units**	**RDL**														
Anion Sum	me/L	N/A	-	-	0.270											
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1.0	-	-	ND											
Calculated TDS	mg/L	1.0	-	-	28.0											
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.0	-	-	ND											
Cation Sum	me/L	N/A	-	-	0.480											
Hardness (CaCO3)	mg/L	1.0	-	-	6.6											
Ion Balance (% Difference)	%	N/A	-	-	28.0											
Langelier Index (@ 20C)	N/A		-	-	NC											
Langelier Index (@ 4C)	N/A		-	-	NC											
Nitrate (N)	mg/L	0.050	-	-	ND											13
Saturation pH (@ 20C)	N/A		-	-	NC											
Saturation pH (@ 4C)	N/A		-	-	NC											
Inorganics	**Units**															
Total Alkalinity (Total as CaCO3)	mg/L	5.0	-	-	ND											
Dissolved Chloride (Cl)	mg/L	1.0	-	-	9.3											120
Colour	TCU	50	-	-	390											
Nitrate + Nitrite	mg/L	0.050	-	-	ND											
Nitrite (N)	mg/L	0.010	-	-	ND											0.06
Nitrogen (Ammonia Nitrogen)	mg/L	0.050	-	-	ND											69.7 - 153
Total Organic Carbon	mg/L	5.0	-	-	21											
Orthophosphate (P)	mg/L	0.010	-	-	0.056											
pH	pH	N/A	-	-	**4.97**											6.5 - 9.0
Total Phosphorus	mg/L	0.002	0.097	0.14	0.092											
Reactive Silica (SiO2)	mg/L	0.50	-	-	7.5											
Total Suspended Solids	mg/L	2.0	3.6	2.8	2.4											
Dissolved Sulphate (SO4)	mg/L	2.0	-	-	ND											
Turbidity	NTU	0.10	-	-	1.0											
Conductivity	uS/cm	1.0	-	-	47											
Microbiological	**Units**															
Escherichia coli	CFU/100mL	1.0	ND	ND	8.0											200
Field Measurements	**Units**															
Water Temperature	℃	0.01	15.75	19.5	19.82											
pH	pH	0.01	8.82	**5.05**	**5.18**											6.5 - 9.0
Specific Conductivity	µS/cm	1	93	109	46											
Dissolved Oxygen	mg/L	0.01	6.91	5.75	7.71											5.5 Minimum
Dissolved Oxygen	%	0.1	70.1	62.7	84.5											
Total Dissolved Solids	g/L	0.001	0.064	0,071	0.028											
Air Temperature	℃	1	20	22	21											

Values in bold exceed CCME FAL/Recreational guidelines

Table 2: Brunello Estates Water Chemistry (Metals)

RESULTS OF ANALYSES OF WATER			Watercourse #7												CCME FWAL
Sampling Period			Year 2 - First Quarter			Year 2 - Second Quarter			Year 2 - Third Quarter			Year 2 - Forth Quarter			
Date		dd/mm/yyyy	6/25/2012	7/18/2012	8/23/2012										Guidelines
Calculated Parameters	Units	RDL													
Total Aluminum (Al)	ug/L	5.0	-	-	**734**										100
Total Antimony (Sb)	ug/L	1.0	-	-	ND										
Total Arsenic (As)	ug/L	1.0	-	-	**6.5**										5
Total Barium (Ba)	ug/L	1.0	-	-	8.7										
Total Beryllium (Be)	ug/L	1.0	-	-	ND										
Total Bismuth (Bi)	ug/L	2.0	-	-	ND										
Total Boron (B)	ug/L	50	-	-	ND										
Total Cadmium (Cd)	ug/L	0.017	-	-	**0.534**										0.017
Total Calcium (Ca)	ug/L	100	-	-	1590										
Total Chromium (Cr)	ug/L	1.0	-	-	ND										
Total Cobalt (Co)	ug/L	0.40	-	-	0.77										
Total Copper (Cu)	ug/L	2.0	-	-	**9.3**										2
Total Iron (Fe)	ug/L	50	-	-	**2100**										300
Total Lead (Pb)	ug/L	0.50	-	-	**1.84**										1
Total Magnesium (Mg)	ug/L	100	-	-	646										
Total Manganese (Mn)	ug/L	2.0	-	-	108										
Total Molybdenum (Mo)	ug/L	2.0	-	-	ND										
Total Nickel (Ni)	ug/L	2.0	-	-	ND										25
Total Phosphorus (P)	ug/L	100	-	-	130										
Total Potassium (K)	ug/L	100	-	-	1140										
Total Selenium (Se)	ug/L	1.0	-	-	ND										1
Total Silver (Ag)	ug/L	0.10	-	-	ND										0.1
Total Sodium (Na)	ug/L	100	-	-	5400										
Total Strontium (Sr)	ug/L	2.0	-	-	8.7										
Total Thallium (Tl)	ug/L	0.10	-	-	ND										0.8
Total Tin (Sn)	ug/L	2.0	-	-	ND										
Total Titanium (Ti)	ug/L	2.0	-	-	10.2										
Total Uranium (U)	ug/L	0.10	-	-	0.73										
Total Vanadium (V)	ug/L	2.0	-	-	ND										
Total Zinc (Zn)	ug/L	5.0	-	-	12.2										30

Values in bold exceed CCME FAL guidelines