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

October 29, 2012
File: 1049385/121510734

Attention: Andrew Giles, P.Eng
Brunello Estates
200 Barrington Street
Suite 202
Halifax, NS B3J 3K1

Reference: Construction Monitoring Report Year 1 – Annual Report

Dear Mr. Giles,

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 for Brunello Estates was carried out according to the monitoring plan described in the *Brunello Estates Water Quality Monitoring Plan* (Stantec 2011), this plan outlines a prescriptive monitoring program to assess the impacts of urban development on freshwater resources. Within the plan the basic water quality parameters are monitored every month with the exception being during the winter freeze-up (January to March) where one monitoring event takes place. Additional more specific parameters are monitored quarterly and semi-annually. This parameter list as well as schedule is provided below.

Table 1. Grouped listings of Chemical Parameters

Group 1	Group 2	Group 3
E.coli	**Group 1** parameters in addition to;	**Group 1 and 2** parameters in addition to;
Total Phosphorous	Potassium	Antimony
Total Suspended Solids	Sodium	Arsenic
Turbidity	Calcium	Barium
Colour	Magnesium	Beryllium
pH	Hardness as CaCO3	Bismuth
Conductivity	TDS	Boron
Dissolved Oxygen	Alkalinity as CaCO3	Cadmium
Air & Water Temperature	Bicarbonate as CaCO3	Chromium
Cloud Cover	Carbonate as CaCO3	Cobalt
Ice Depth	Sulphate	Lead
Date & Time	Reactive Silica	Molybdenum
	Nitrate-Nitrite	Nickel
	Ammonia	Selenium
	Turbidity	Silver
	Color	Strontium
	Total Organic Carbon	Thallium
	Iron	Tin
	Copper	Titanium
	Manganese	Uranium
	Zinc	Vanadium

Table 2. Schedule of Construction Sampling for Brunello Estate Water Bodies

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Group 2 (only one sampling event during winter construction phase)			Group 3	Group 1	Group 1	Group 1	Group 3	Group 1	Group 1	Group 2	Group 1

In addition to the water chemistry samples taken the following observations and water quality parameters were taken 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

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 (attached) illustrates the locations of the water quality monitoring stations on each stream.

LOCATION AND DATES OF SAMPLING

At the time of the sampling construction activities were 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 during the first year:

- June 21, 2011
- July 28, 2011
- August 28, 2011
- September 22, 2011
- October 9, 2011
- November 30, 2011
- December 21,2012 (Note: there was only one sampling event during the winter months of December – February)
- March 30, 2012
- April 26, 2012
- May 17, 2012

METEROLOGICAL CONDITIONS AND GENERAL OBSERVATIONS

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:

Year 1 1st Quarter

- June 21, 2011: Mostly Cloudy, 17°C, 3.2 mm of rain in the previous 48 hrs.
- July 28 2011: Mostly Cloudy, 19°C, Trace amounts of rain (<2mm) in the previous 48 hrs.

- August 28, 2011: Mostly Cloudy, 20°C, Trace amounts of rain (<2mm) in the previous 48 hrs.

Year 1 2nd Quarter

- September 22, 2011: Mostly Cloudy, 20°C, No rain in the previous 48 hrs.
- October 9, 2011: Mostly Cloudy, 14°C, No rain in the previous 48 hrs.
- November 22, 2011: Mostly Cloudy, 13°C, No rain in the previous 48 hrs.

Year 1 3rd Quarter

- December 21, 2011: Mainly Clear, -2°C, Trace precipitation (<2mm) in the previous 48 hrs.

Year 1 4th Quarter

- March 30, 2012: Mostly Cloudy, 4°C, No rain in the previous 48 hrs.
- April 26, 2012: Mainly Clear, 14°C, 30 mm in the previous 48 hrs.
- May 17, 2012: Cloudy, 15°C, 10 mm in the previous 48 hrs.

General observations in water clarity and color indicated that the water in WC-7 at the time of the surveys was frequently observed to be tea-stained during sampling events with no unusual odors or sheens observed during any event. In addition, no sedimentation was visible during any of the site visits.

WATER QUALITY RESULTS

During Year 1 of monitoring WC-7 10 samples were collected, these samples were collected monthly with the exception of the 3rd quarter December to February where only one sample was collected due to winter conditions and stream freeze-up. The parameters from group 1 (Table 1 above) were sampled every event with group 2 and group 3 parameters sampled quarterly and semi-annually respectively. Table 3 lists the quarterly and annual means for each water quality parameter in group 1 as well as the mean of baseline samples collected in spring 2011 during prior to construction.

Table 3 Brunello Estates – Annual and Quarterly Construction Monitoring Means (Group 1 Parameters)

Watercourse 7	Year 1 – Q1 Mean[1]	Year 1 – Q2 Mean[1]	Year 1 – Q3 Results (1 Sample)	Year 1 – Q4 Mean[1]	Baseline Mean[1]	Year 1 – Annual Mean[1]
pH[2] (pH units)	4.81	4.96	4.89	5.12	*4.59*	**4.96**
Specific Conductivity[2] (µS/cm)	56	35	92	41	*55*	**52**

Total Phosphorous (µg/L)	48	47	29	39	*16*	**43**
Total Suspended Solids (mg/L)	2	2	1	2	*1*	**4**
Turbidity (NTU)	1.2	1.5	1.2	1.7	*2*	**1.4**
Color (TCU)	377	230	120	147	*189*	**238**
Dissolved Oxygen[2] (mg/L)	5.42	7.08	8.40	7.88	*7.20*	**6.95**
Dissolved Oxygen[2] (%)	53.9	66.8	67.0	72.9	*62.0*	**64.8**
E. coli[3] (MPN/100ml)	1	1	ND	18	*ND*	**2**

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

2 Measured In-situ

3 Geometric Mean utilized

NTU = Nephelometric Turbidity Units

TCU = True Color Units

The histographs of select water quality parameters (pH, conductivity, TSS, turbidity, total phosphorus and E.coli) are attached in Figures 1 through 6. Other parameters in group 1 such as water temperature and dissolved oxygen are not included in the graphical representations as they are diurnally variable and the single point in time sampling regime reduces the efficacy of graphical interpretation.

Where applicable the graphs indicate the parameter specific guideline value(s) for the Protection of Aquatic Life from the Canadian Council for the Ministers of the Environment (CCME FAL).

In addition to the monthly sampling of group 1 parameters, group 2 and 3 parameters (from table 1) were sampled quarterly and semi-annually, respectively. From the group 2 and 3 parameters the key water quality parameters were chosen based on the availability of CCME FAL guidelines, these parameters included:

- Dissolved chloride
- Nitrate
- Nitrite
- And total metals (Al, As, Cd, Cu, Fe, Pb, Ni, Se, Ag, Tl, Zn)

The following table indicates the number of samples, sample range, mean value, guideline value and the frequency of guideline exceedances for each parameter. This tabular representation was chosen over graphical representation as the number of samples for each parameter is limited to four or in certain cases two sampling events per year.

Table 4 Brunello Estates – Annual and Quarterly Construction Monitoring Means (Select Group 2 and Group 3 Parameters)

Watercourse 7	Number of Samples (n)	Sample Range	Year 1 – Annual Mean[1]	CCME FAL	Frequency of Guideline Exceedance

Dissolved Chloride (mg/L)	4	6 - 13	8	**120**	*0*
Nitrate (mg/L)	2	<0.05	<0.05	**13**	*0*
Nitrite (mg/L)	2	<0.01	<0.01	**0.6**	*0*
Aluminum (µg/L)	2	569 - 951	760	**100**	*1.0*
Arsenic (µg/L)	2	2.6 – 8.0	5.3	**5**	*0.5*
Cadmium (µg/L)	2	0.039 – 0.133	0.086	**0.017**	*1.0*
Copper (µg/L)	4	<2.0	<2.0	**2**	*0*
Iron (µg/L)	4	407 – 1600	825	**300**	*1.0*
Lead (µg/L)	2	1.20 – 2.58	1.89	**1**	*1.0*
Nickel (µg/L)	2	<2.0	<2.0	**25**	*0*
Selenium (µg/L)	2	<1.0	<1.0	**1**	*0*
Silver (µg/L)	2	<0.10	<0.10	**0.1**	*0*
Thallium (µg/L)	2	<0.10	<0.10	**0.8**	*0*
Zinc (µg/L)	4	<5.0 – 8.8	6.8	**30**	*0*

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

The most frequently exceeded water quality parameters included: Aluminum, Cadmium, Iron and Lead. Of these parameters Aluminum, Cadmium and Iron also exceeded guideline limits during the baseline monitoring.

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. The lowest pH (4.75) was recorded in August and November while the highest pH (5.47) was recorded in April (Figure 1, attached). These conditions are similar to those recorded during the baseline sampling events and representative of wetland drainage channels located 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.

It is typical of urban streams in watersheds subject to development to contain relatively higher salt concentrations than would be expected for a similar stream in a less developed watershed. The drainage area upstream of WC-7 monitoring location is for the majority currently undeveloped. Highway 103 passes immediately downstream of the monitoring location and salt inputs from this roadway appeared to have influenced water quality during the December monitoring event. The influence of road salts was assessed for WC-7 using conductivity. In an 2009 report by In-situ Inc it was determined that specific conductivity and chloride are positively correlated (In-situ Inc, 2009), the report indicated that chloride concentrations in the Minnesota study watershed were equivalent to 14-21 percent of specific conductivity in µS/cm. Within the first year of monitoring there were four events where conductivity and chloride were simultaneously measured the ratio of chloride to specific conductivity was determined to be 0.19 ($r = 0.87$), this approximates the results of

the In-situ Inc. report. Within WC-7 during the first year of monitoring the conductivity varied from a low of 29 µS/cm in September to 92 µS/cm in December, this equates to an approximate chloride concentration range of 6 to 18 mg/L chloride which is below the CCME FAL guideline of 120 mg/L.

Water clarity and transparency of WC-7 were measured by observations and the concentrations of turbidity and total suspended solids (TSS) in the water sample. Turbidity is a measure of water clarity whereas 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. The turbidity and TSS concentrations in the baseline samples was low (mean = 1 mg/L) and continues to be low during the first year of monitoring (4 mg/L). These levels of sediment in the water column indicate 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 with a limit of 25 mg/L increase over background levels for effects lasting <24 hrs. This leads to interpreted long and short-term guideline concentrations for Brunello Estates of 6 mg/L and 26 mg/L, respectively for WC-7. Long-term TSS levels are below this guideline and similar to results noted during the baseline assessment.

Levels of nutrients, specifically phosphorous, found in WC-7 were slightly 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 annual mean 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 fourth quarter are elevated over baseline results.

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 three of ten samples during the 1st year of monitoring; the geometric mean of these results (assuming ND = 1) results in an annual mean of 2 CFU/100ml which is below the CCME recreational guidelines for freshwater set at 200 CFU/100ml.

SUMMARY

The results provided in this report represent the findings of the 1st year of monitoring for the construction monitoring program which occurred between June 2011 and May 2012. During this period water quality

remained similar to values observed during the baseline monitoring program though seasonal fluctuations in TSS, conductivity, Total phosphorus and E.coli were observed. 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, though some additional phosphorus was likely mobilized by upstream construction. This data report was created to provide Brunello Estates an annual review of the water quality monitoring program 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

In-Situ Inc, 2009. Real-time Conductivity Monitoring Estimates chloride levels in Minnesota Watershed.

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.

Reference: Construction Monitoring Report Year 1 – Annual Report

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 Matt Steeves, B.Sc. and reviewed by Robert Federico MPA. Should you have any questions, please do not hesitate to contact the undersigned or Sam Salley at (902) 468-7777.

Regards,

STANTEC CONSULTING LTD.

Matt Steeves
Aquatic Scientist
Tel: (902) 468-7777 Ext. 4687299
Fax: (902) 468-9009
matt.steeves@stantec.com

Attachment: Figure 1 - Water Quality Monitoring Locations
Figure 2 – 7 Annual Water Quality Results for WC-7
Annual Water Quality Results and Relevant Guidelines

c.

ms v:\1215\active\121510xxx\121510734\disciplines\water_quality_monitoring\reporting (construction monitoring)\brunello_construction_year1_annual.docx

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\ReportFigures\Fig_XX_Field_Delin_Streams_May2009.mxd

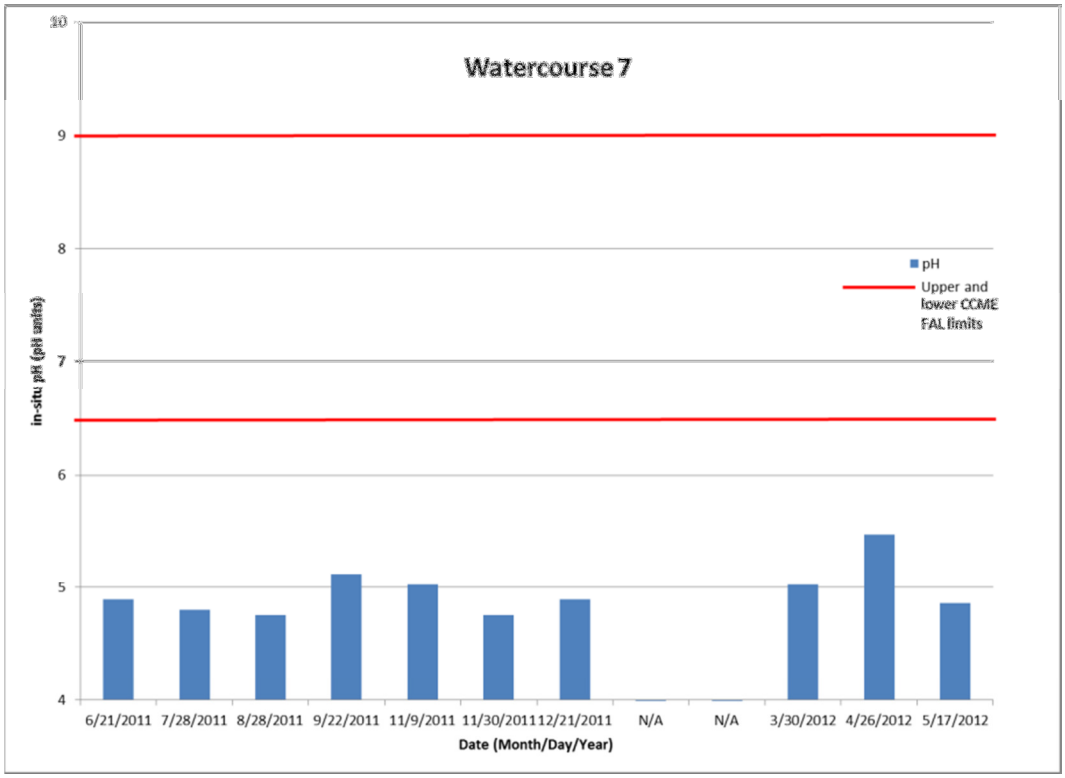

Figure 2 pH at WC-7 from June 2011 to May 2012

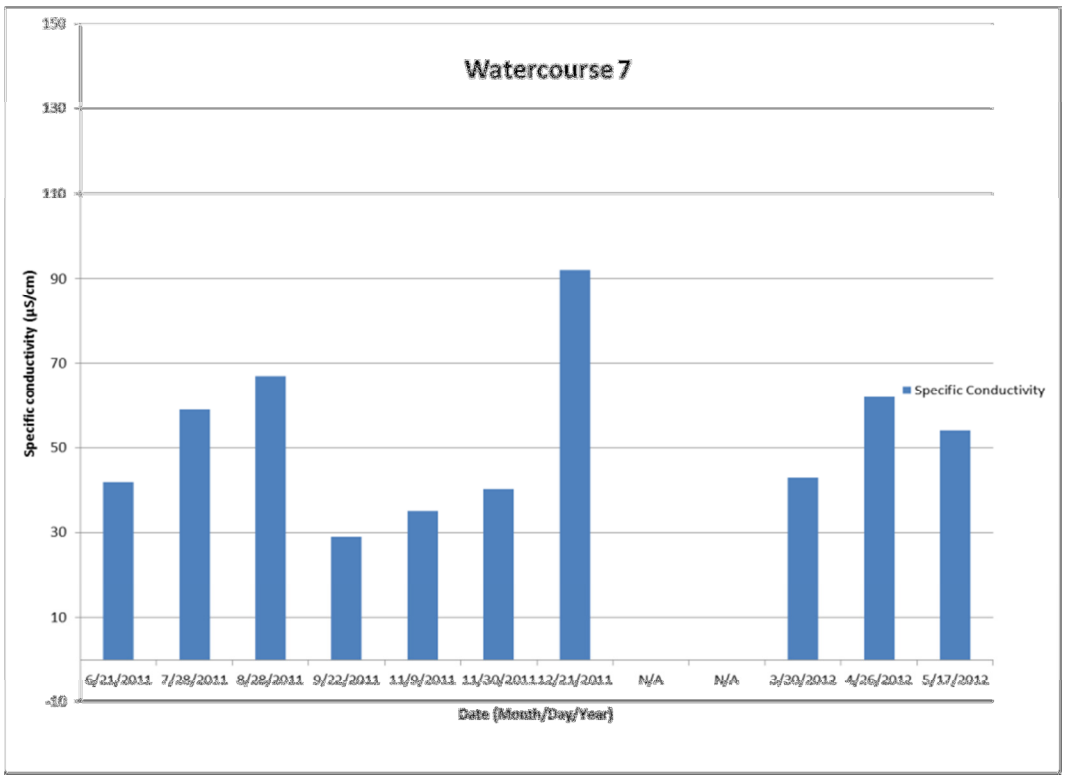

Figure 3 Specific conductivity at WC-7 from June 2011 to May 2012

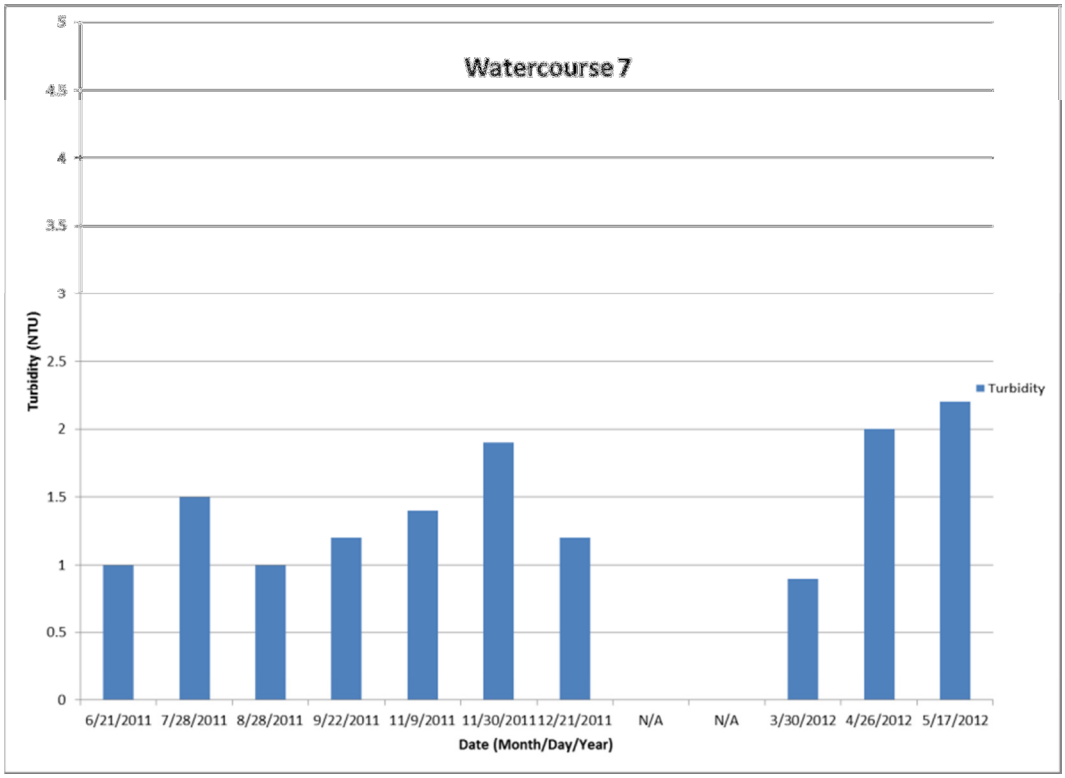

Figure 4 Turbidity at WC-7 from June 2011 to May 2012

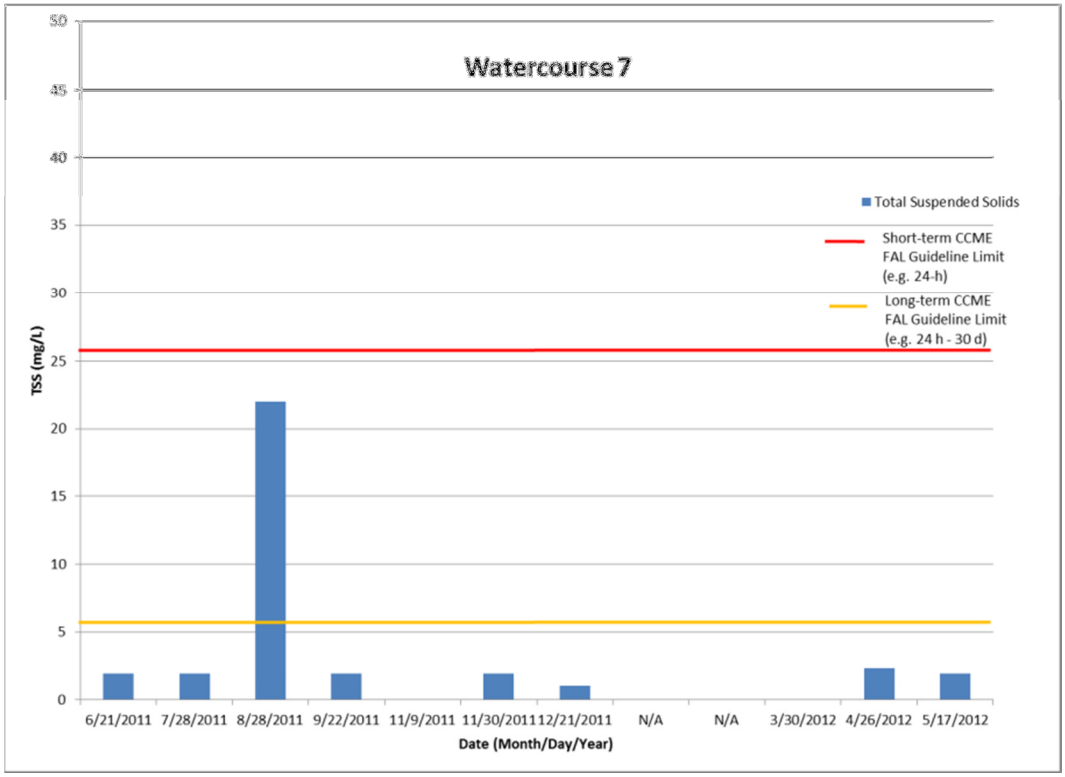

Figure 5 TSS at WC-7 from June 2011 to May 2012

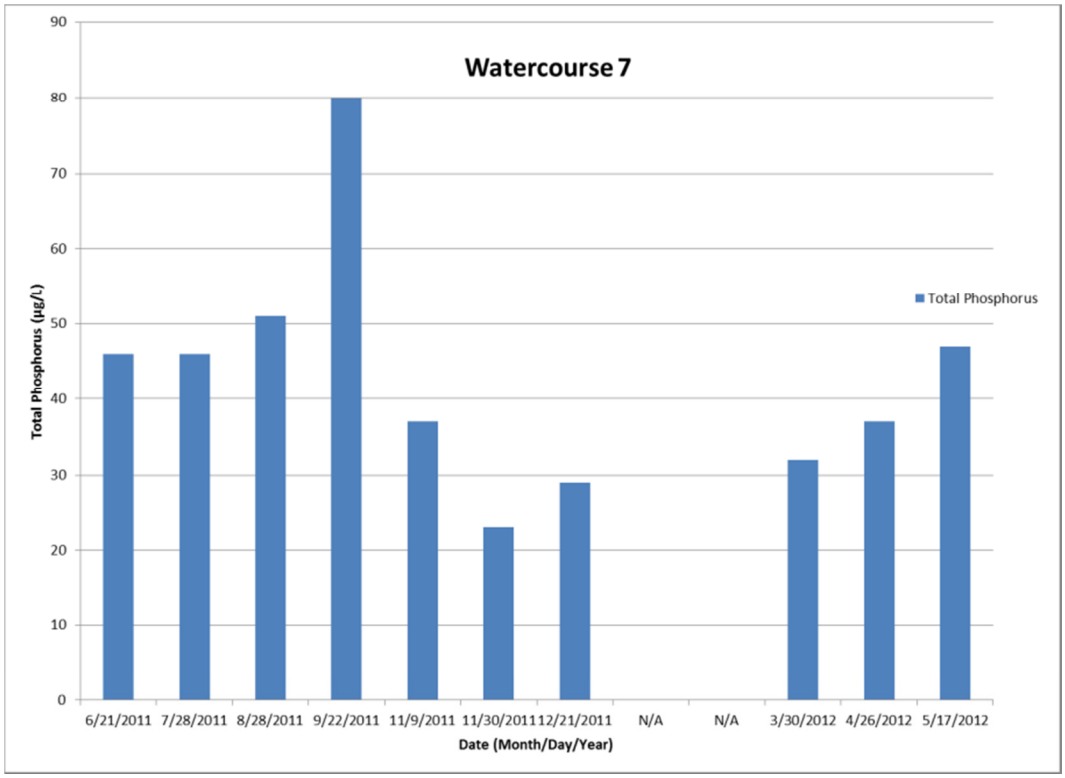

Figure 6 TP at WC-7 from June 2011 to May 2012

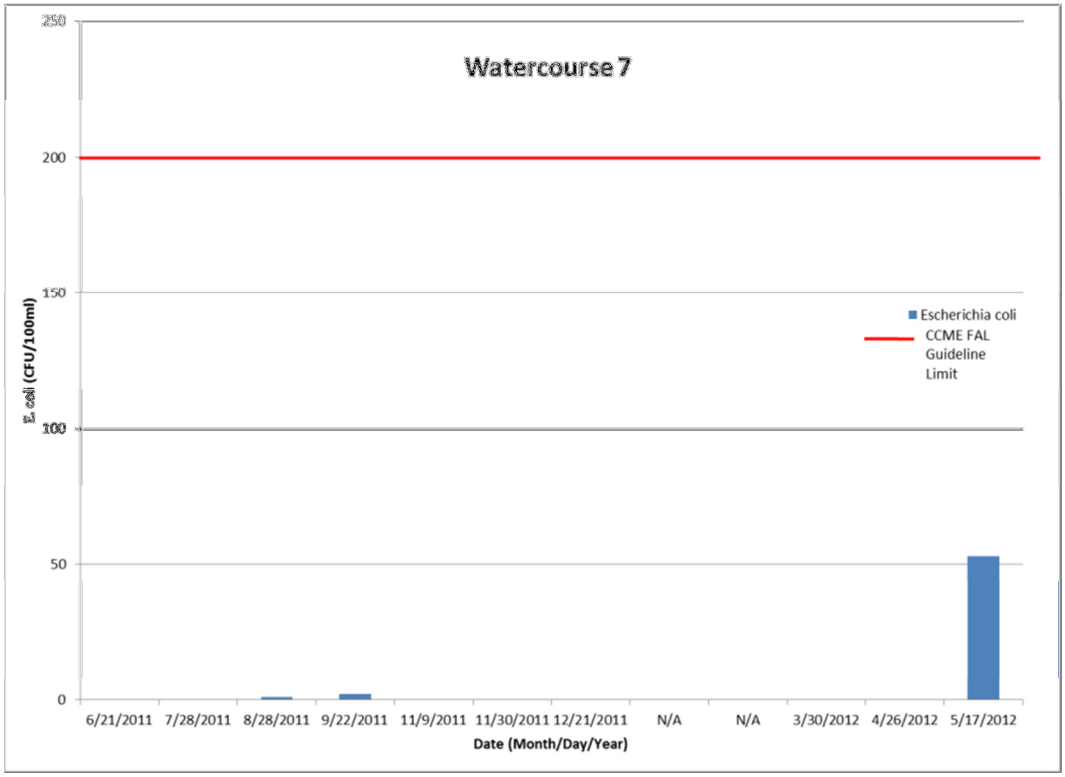

Figure 7 E.coli at WC-7 from June 2011 to May 2012

Table 1: Brunello Estates Water Chemistry (General Chemistry)

RESULTS OF ANALYSES OF WATER			Watercourse #7												CCME FWAL
Sampling Period			Year 1 - First Quarter			Year 1 - Second Quarter			Year 1 - Third Quarter			Year 1 - Forth Quarter			
Sampling Month			Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Guidelines
Date		dd/mm/yy	6/21/2011	7/28/2011	8/28/2011	9/22/2011	11/9/2011	11/30/2011	12/21/2011	N/A	N/A	3/30/2012	4/26/2012	5/17/2012	
Calculated Parameters	**Units**	**RDL**													
Anion Sum	me/L	N/A	-	-	0.250	-	-	0.240	-	-	-	0.210	0.360	-	
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	ND	-	-	ND	-	-	-	ND	ND	-	
Calculated TDS	mg/L	1	-	-	24	-	-	21	-	-	-	17	27	-	
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	ND	-	-	ND	-	-	-	ND	ND	-	
Cation Sum	me/L	N/A	-	-	0.460	-	-	0.310	-	-	-	0.310	0.460	-	
Hardness (CaCO3)	mg/L	1	-	-	6	-	-	4	-	-	-	3.8	5	-	
Ion Balance (% Difference)	%	N/A	-	-	29.6	-	-	12.7	-	-	-	19.2	12.2	-	
Langelier Index (@ 20C)	N/A		-	-	NC	-	-	NC	-	-	-	NC	NC	-	
Langelier Index (@ 4C)	N/A		-	-	NC	-	-	NC	-	-	-	NC	NC	-	
Nitrate (N)	mg/L	0.05	-	-	ND	-	-	-	-	-	-	-	ND	-	13
Saturation pH (@ 20C)	N/A		-	-	NC	-	-	NC	-	-	-	NC	NC	-	
Saturation pH (@ 4C)	N/A		-	-	NC	-	-	NC	-	-	-	NC	NC	-	
Inorganics	**Units**														
Total Alkalinity (Total as CaCO3)	mg/L	5	-	-	ND	-	-	ND	-	-	-	ND	ND	-	
Dissolved Chloride (Cl)	mg/L	1	-	-	9	-	-	6	-	-	-	7.3	13	-	120
Colour	TCU	5	430	230	470	220	240	230	120	-	-	110	170	160	
Nitrate + Nitrite	mg/L	0.05	-	-	ND	-	-	1	-	-	-	0.059	ND	-	
Nitrite (N)	mg/L	0.01	-	-	ND	-	-	-	-	-	-	-	ND	-	0.06
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	ND	-	-	ND	-	-	-	ND	ND	-	69.7 - 153
Total Organic Carbon	mg/L	0.5	-	-	30	-	-	18	-	-	-	8.3	15	-	
Orthophosphate (P)	mg/L	0.01	-	-	0.02	-	-	0.01	-	-	-	0.014	0.016	-	
pH	pH	N/A	-	-	**4.76**	-	-	**4.67**	-	-	-	**4.69**	**4.67**	-	6.5 - 9.0
Total Phosphorus	µg/L	0.002	46	46	51	80.000	37	23	29	-	-	32	37	47	
Reactive Silica (SiO2)	mg/L	0.5	-	-	4.9	-	-	4.4	-	-	-	3.2	4	-	
Total Suspended Solids	mg/L	2	2	2	22	2	ND	2	1	-	-	ND	2.4	2	
Dissolved Sulphate (SO4)	mg/L	2	-	-	ND	-	-	ND	-	-	-	ND	ND	-	
Turbidity	NTU	0.1	1	1.5	1.0	1.2	1.4	1.9	1.2	-	-	0.9	2.0	2.2	
Conductivity	uS/cm	1	-	-	44	-	-	37	-	-	-	42	61	-	
Microbiological	**Units**														
Escherichia coli	CFU/100mL		ND	ND	1	2	ND	ND	ND	-	-	ND	ND	53	200
Field Measurements	**Units**														
Water Temperature	℃	0.01	13.61	15.61	16.81	15.58	11.67	5.68	2.11	-	-	5.67	11.51	10.69	
pH	pH	0.01	**4.89**	**4.8**	**4.75**	**5.12**	**5.02**	**4.75**	**4.89**	-	-	**5.02**	**5.47**	**4.86**	6.5 - 9.0
Specific Conductivity	µS/cm	1	42	59	67	29	35	40	92	-	-	43	62	54	
Dissolved Oxygen	mg/L	0.01	6.21	**4.97**	**5.08**	8.47	6.48	6.3	8.4	-	-	6.23	8.8	8.6	5.5 Minimum
Dissolved Oxygen	%	0.1	59.7	50	51.8	85.2	59.8	55.5	67	-	-	60.1	81.1	77.6	
Total Dissolved Solids	g/L	0.001	0.027	0.038	0.043	0.084	0.029	0.031	0.109	-	-	0.028	0.038	0.035	
Air Temperature	℃	1	18	17	17	20	14	13	-2	-	-	8	14	15	

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 1 - First Quarter			Year 1 - Second Quarter			Year 1 - Third Quarter			Year 1 - Forth Quarter			
Sampling Month			Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Guidelines
Date		dd/mm/yy	6/21/2011	7/28/2011	8/28/2011	9/22/2011	11/9/2011	11/30/2011	12/21/2011	N/A	N/A	3/30/2012	4/26/2012	5/17/2012	
Calculated Parameters	Units	RDL													
Total Aluminum (Al)	ug/L	5.0	-	-	**951**	-	-	-	-	-	-	-	**569**	-	100
Total Antimony (Sb)	ug/L	1.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Arsenic (As)	ug/L	1.0	-	-	**8.0**	-	-	-	-	-	-	-	2.6	-	5
Total Barium (Ba)	ug/L	1.0	-	-	11.4	-	-	-	-	-	-	-	8.1	-	
Total Beryllium (Be)	ug/L	1.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Bismuth (Bi)	ug/L	2.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Boron (B)	ug/L	50	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Cadmium (Cd)	ug/L	0.017	-	-	**0.133**	-	-	-	-	-	-	-	**0.039**	-	0.017
Total Calcium (Ca)	ug/L	100	-	-	1540	-	-	926	-	-	-	886	1250	-	
Total Chromium (Cr)	ug/L	1.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Cobalt (Co)	ug/L	0.40	-	-	0.77	-	-	-	-	-	-	-	0.41	-	
Total Copper (Cu)	ug/L	2.0	-	-	ND	-	-	ND	-	-	-	ND	ND	-	2
Total Iron (Fe)	ug/L	50	-	-	**1600**	-	-	**726**	-	-	-	**407**	**568**	-	300
Total Lead (Pb)	ug/L	0.50	-	-	**2.58**	-	-	-	-	-	-	-	**1.2**	-	1
Total Magnesium (Mg)	ug/L	100	-	-	597	-	-	438	-	-	-	388	443	-	
Total Manganese (Mn)	ug/L	2.0	-	-	122	-	-	70.8	-	-	-	60.3	63	-	
Total Molybdenum (Mo)	ug/L	2.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Nickel (Ni)	ug/L	2.0	-	-	ND	-	-	-	-	-	-	-	ND	-	25
Total Phosphorus (P)	ug/L	100	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Potassium (K)	ug/L	100	-	-	1490	-	-	800	-	-	-	727	978	-	
Total Selenium (Se)	ug/L	1.0	-	-	ND	-	-	-	-	-	-	-	ND	-	1
Total Silver (Ag)	ug/L	0.10	-	-	ND	-	-	-	-	-	-	-	ND	-	0.1
Total Sodium (Na)	ug/L	100	-	-	5110	-	-	3580	-	-	-	4080	6860	-	
Total Strontium (Sr)	ug/L	2.0	-	-	7.5	-	-	-	-	-	-	-	6.1	-	
Total Thallium (Tl)	ug/L	0.10	-	-	ND	-	-	-	-	-	-	-	ND	-	0.8
Total Tin (Sn)	ug/L	2.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Titanium (Ti)	ug/L	2.0	-	-	10.6	-	-	-	-	-	-	-	5.2	-	
Total Uranium (U)	ug/L	0.10	-	-	1.02	-	-	-	-	-	-	-	0.67	-	
Total Vanadium (V)	ug/L	2.0	-	-	ND	-	-	-	-	-	-	-	ND	-	
Total Zinc (Zn)	ug/L	5.0	-	-	8.7	-	-	8.8	-	-	-	ND	7.1	-	30

Values in bold exceed CCME FAL guidelines