AECOM

Mattamy Homes Limited

Mattamy Homes – Richmond - Jock River Phosphorus Reduction Assessment

Prepared by: **AECOM**

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Revision Log

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1	JG	January 14, 2009	Draft for Discussion
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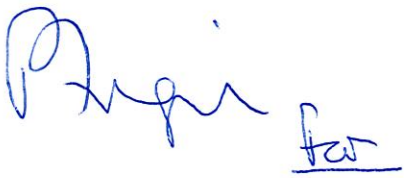	
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1. Introduction

Mattamy Homes proposed 155.5ha development is located within the Jock River Reach One Subwatershed, within the City of Ottawa and the community of Richmond, Ontario. The subwatershed and the area of development is generally identified in **Figure 1**.

This report analyzes the phosphorus loadings to the Jock River from the urbanization of agricultural land for the proposed development.

While phosphorus is an essential nutrient to aquatic plants and algae, when present in excess it can be harmful to fresh water aquatic ecosystems. Excess phosphorus increases plant and algae growth which produce organic mater that is digested by bacteria and other organisms, a process which uses significant amounts of oxygen and decreases the availability of oxygen for aquatic species.

There are three primary discharge sources of phosphorus to a receiving watercourse: point sources (industrial and municipal wastewater discharge), non-point sources (urban and agricultural stormwater runoff), and atmospheric deposition. A change in the non-point source, such as agricultural land use to urbanization, alters the net phosphorus loading to the watercourse.

The Jock River, based on phosphorus concentrations, has been classified as a Policy 2 watercourse by the Ontario Ministry of Environment (MOE); as such, post-development phosphorus loadings must be equivalent or less than pre-development loadings.

Typically, the urbanization of agricultural land reduces phosphorus loadings to the receiving watercourse; where this does not occur, a storm water management facility, designed in accordance the Ontario Ministry of Environment guidelines, can be used for quality control. The phosphorus removal efficiency of storm water management facilities in Ottawa has been found to be approximately 70% as stated in the *Jock River Reach One Subwatershed Study – Appendix H – Phosphorus Loading Analysis* (Stantec 2007) prepared for the City of Ottawa:

> "In Ontario, SWM facilities are designed according to MOE guidelines (MOE 2003). Monitoring reports of a number of SWM facilities in Ottawa show that phosphorus removal efficiency of such facilities are approximately 70%. Synthesis of monitoring studies conducted under the stormwater assessment monitoring and performance program report (SWAMP 2005) document results and findings of monitoring and analysis of performance of stormwater facilities in Southern Ontario. The results show that TP removal efficiency for the stormwater ponds is approximately 70% (67% winter, 74% summer). Hence 70% removal efficiency has been used in this report"

JOCK RIVER WATERSHED MANAGEMENT PLAN

MAP 3
REACHES

LEGEND

- WATERCOURSE
- WATERSHED BOUNDARY
- TOWNSHIP BOUNDARY
- HY — HYDRO LINE
- RAIL LINE
- ABANDONED RAIL LINE
- PRIMARY ROADS
- REACH BOUNDARY

OTTAWA
LANARK

STITTSVILLE
KANATA
CARLETON PLACE
Highway No. 7
Highway No. 15
ASHTON
Flewellyn Road
Fallowfield Road
Munster Road
Regional Road 6
Eagleson Road
Monaghan Drain
Jock River
Highway 416
Cedarview Road
Jockvale Road
BARRHAVEN
Woodroffe Ave
Rideau River
Barnsdale Road
Highway No. 16
Dwyer Hill Road
Ashton Station Road
BECKWITH
4
MUNSTER
3
2
1
Flowing Creek
Richmond Road
Twin Elm Road
Moodie Drive
RICHMOND
Franktown Road
Bankfield Road
PROSPECT
Kings Creek
FRANKTOWN
CP Rail
GILLIES CORNERS
North Mud Lake
Nichols Creek
MONTAGUE
CN Rail

Mattamy Homes: Richmond Area Development

Figure 1: Proposed Development Location

RIDEAU VALLEY CONSERVATION AUTHORITY

0 1000 2000 3000 4000 5000
METRES
SCALE 1:125,000

NOTE: The information conveyed by this map is regional in nature & is not suited for use in site specific evaluations.

2. Phosphorus Export Coefficients

The rate of phosphorus loading (kg/ha/yr) from non-point sources varies with land usage; typically, forested areas have the lowest phosphorus export coefficients, while corn fields have some of the highest. **Table 1** below outlines the phosphorus export coefficients used in the current analysis, these were extracted from the report *Jock River Reach One Subwatershed Study Final Report, Stantec Consulting Ltd (June 2007)* and from literature. Literature shows that corn and soy crops can have higher export coefficients ranging from 4.52 kg/ha/yr (Baker and Richards, 2002) to a more conservative 2.20 kg/ha/yr; the later was applied in this analysis.

Table 1.Phosphorus Export Coefficients

Type	P Export Coefficient (kg/ha/yr)
Row Crops	2.20[1]
Corn	2.20[1]
Soy	2.20[1]
Hay	1.08[1]
Fallow (Pasture)	0.20[2,3]
Urban Residential	1.00[3]
Agricultural (General)	0.60[3]

Notes: [1]*Montana Department of Environmental Quality (MDEQ), 2001*
[2]*Winter and Duthie, 2000 and Paterson et. al, 2006*
[3]*Stantec, Jock River Reach One Subwatershed Study, 2007:*

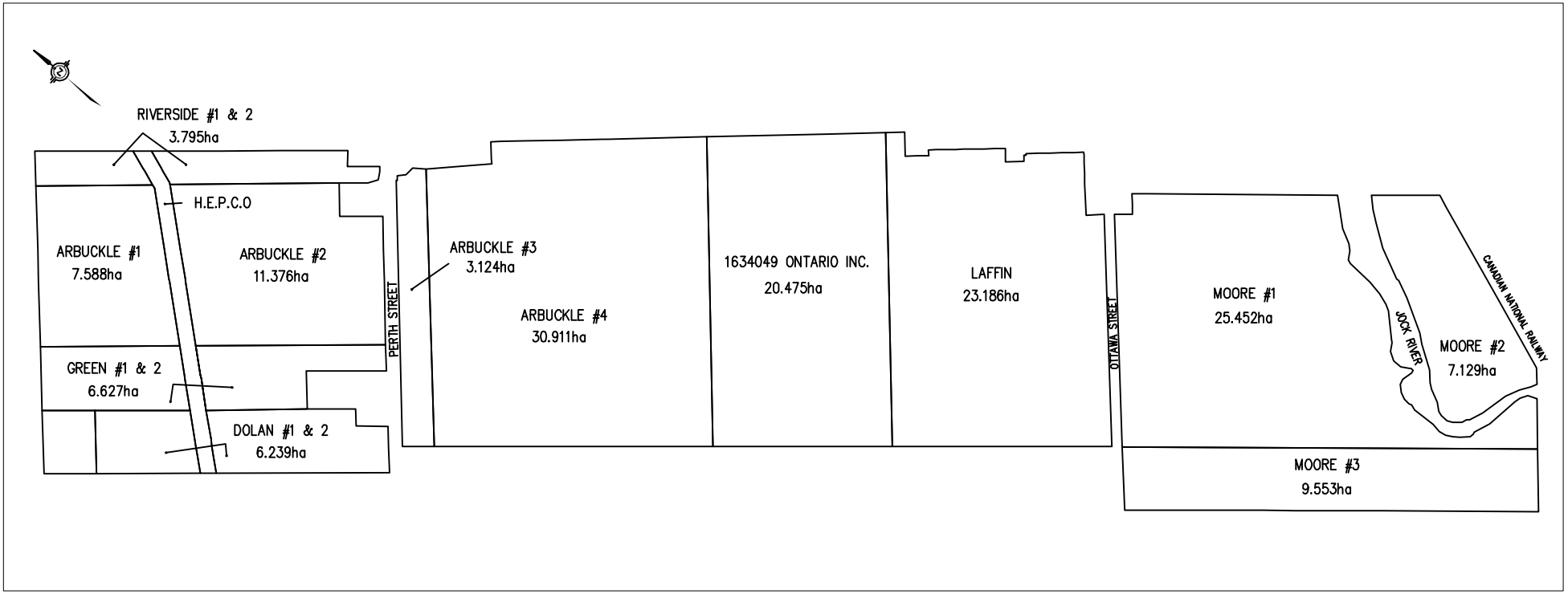
3. Landuse and Phosphorus Loading

The pre-development landuse conditions are primarily agricultural; post-development are urban residential .

3.1 Historical Pre-development Landuse

Ten (10) years of historical crop plantings were acquired from the majority of the landowners and these were analyzed to determine an average pre-development phosphorus export coefficient for various parcels of land to be urbanized, as shown in **Figure 2**. Results are tabulated in **Table 2**. No historical data was available for the remaining 15.7ha of properties; landuse was assumed to be general agricultural with a coefficient of 0.6 kg/ha/yr.

Richmond Area Ownership



Updated: July 12, 2007

Figure 2: Land Parcels for Development

Table 2: Historical Pre-development Landuse and Phosphorus Export Coefficient

Land	Arbuckle		16434049 Ontario Inc.		Laffin		Moore	
Area (ha):	53.0		20.5		23.2		43.1	
Year	Landuse	P Export Coefficient	Landuse	P Export Coefficient	Landuse	P Export Coefficient	Landuse	P Export Coefficient
2008	Row	2.2	Soy	2.2	Fallow	0.2	Fallow	0.2
2007	Row	2.2	Hay	1.08	Fallow	0.2	Fallow	0.2
2006	Row	2.2	Hay	1.08	Soy	2.2	Fallow	0.2
2005	Corn	2.2	Hay	1.08	Soy	2.2	Fallow	0.2
2004	Corn	2.2	Hay	1.08	Soy	2.2	Fallow	0.2
2003	Corn	2.2	Corn	2.2	Corn	2.2	Corn	2.2
2002	Corn	2.2	Corn	2.2	Corn	2.2	Corn	2.2
2001	Soy	2.2	Corn	2.2	Corn	2.2	Corn	2.2
2000	Soy	2.2	Hay	1.08	Hay	1.08	Corn	2.2
1999	Soy	2.2	Hay	1.08	Hay	1.08	Corn	2.2
Average:		**2.2**		**1.5**		**1.6**		**1.2**

3.2 Post-development Landuse

Post development landuse is entirely Urban Residential, an export coefficient of 1.0kg/ha/yr is used.

3.3 Calculation of Phosphorus Loading Pre and Post-development

Table 3 below estimates the total pre and post-development phosphorus loadings based on existing and proposed landuse and the appropriate phosphorus export coefficients.

Pre-development loadings were found to be **245kg/yr** based on the average export coefficients established for ten (ten) years of historical crops. **Post-development** loadings were found to be **155kg/yr** without the use of a stormwater management facility; with a stormwater management facility, the loading is reduced to **109kg/yr**.

4. Conclusions and Discussion

The post-development (155kg/yr) phosphorus loadings are 58% lower than pre-development (245kg/yr) levels, achieving the objectives for a Policy 2 watercourse. A stormwater management pond is not required for phosphorus removal, but may be required for other water quality/quantity control measures.

Table 3: Pre and Post-Development Total Phosphorus Loadings

Parcel	Pre-Development				Post-Development				
	Landuse	Area (ha)	P. Export Coef. (kg/ha/yr)	P. Total Loading (kg/yr)	Landuse	P. Export Coef. (kg/ha/yr)	P. Total Loading (kg/yr)	Removal Efficiency* (%)	Net P. Loading (kg/yr)
Arbuckle	Agriculture	53.0	2.2	117	Urban Residential	1.0	53	70	37
1634049 Ontario Inc.	Agriculture	20.5	1.5	31	Urban Residential	1.0	20	70	14
Laffin	Agriculture	23.2	1.6	37	Urban Residential	1.0	23	70	16
Moore S. of Ottawa Street	Agriculture (General)	42.1	1.2	51	Urban Residential	1.0	42	70	29
Other	Agriculture (General)	16.7	0.6	10	Urban Residential	1.0	17	70	12
Total		**155.5**		**245**			**155**		**109**

*Notes: *Typical removal efficiency of a stormwater management pond in Ottawa*

References

Montana Department of Environmental Quality (MDEQ) 2001. Draft Nutrient Management Plan and Total Maximum Daily Load for Flathead Lake, Montana.

Stantec Consultants Ltd (June 2007). Jock River Reach One Subwatershed Study and Barrhaven South Master Servicing Plan. Completed for the City of Ottawa.

Winter and Duthie (June, 2001). Export Coefficient Modeling to Assess Phosphorus Loading in and Urban Watershed. Journal of the American Water Resources Association, Vol. 36, Issue 5, pg 1053-1061.