

Memorandum

To	Susan Murphy, Mattamy Homes	Page	1
CC			
Subject	Cumulative Impact Assessment – Jock River Development		
From	Paul Frigon, AECOM		
Date	March 3, 2010	Project Number	60117455

We have completed a cumulative impact assessment of future development in the Jock River Watershed upstream of Eagleson Road, on peak flows in the Jock River. As detailed below, it is evident that there is no cumulative impact on peak flows in the Jock River from foreseeable development.

The ten (10) development areas, as identified by the RVCA, are located in **Figure 1** and detailed in **Figure 2**, for Richmond, and for the remaining nine areas in the attached **Appendix A**. It is assumed that the ten areas provide a reasonable estimate of potential urbanisation within the watershed. The hydrologic model for summer flow estimates, prepared for the Jock River Flood Risk Mapping Study (PSR Group/JFSA 2004), was used to assess both existing and future (developed) flows.

The comparison of existing and developed flows was achieved by modifying the Curve Numbers (CN) utilised in the hydrologic model for those catchments that contained proposed development. There was no stormwater management (SWM) component considered: the intent was to gain understanding of the magnitude and timing of development flows and their potential to impact downstream areas. The addition of SWM would reduce flow magnitude but potentially increase the duration of the reduced peak flow.

There was no modification to the Time to Peak (Tp) since development areas typically ranged between 2% and 15% of the total drainage area, in the given subcatchments, and it was assumed this small change in landuse would not impact the overall Tp.

The modified CN are found in **Table 1** and were developed by using area weighted averages for the existing CN and the CN for the proposed development. CN for existing conditions are found in **Table 2** extracted from the Hydrologic Study prepared for the Jock River Flood Risk Mapping Study: the CN identified for proposed development assumed, conservatively, that most rural lot sizes would be ¼ acre with a CN of 83 while lots within Richmond would be less than 1/8 acre with a CN of 90.

A review of the watershed boundaries determined for the hydrologic model and a review of the location of the proposed development (confirmed through detailed engineering analysis

in preparation of subdivision stormwater management plans) suggested that the drainage area of the watershed would have to be increased, as related to developments 4, 5 and 6. This was achieved by adding those development areas (87 ha in total) to the area of the subcatchment identified as JR_GWM ie, the Goodwood Marsh: so JR_GWM increased from 3074 ha to 3161 ha.

The review also identified that the 260 hectares of development in Richmond, as identified in **Figure 2**, would be split between the following catchments: VG_DR, SW_5, SW_6, FL_CK, and SW_5A1 in the following ratios: 51%, 14%, 9%, 14% and 12%.

The result from the modelling of existing and future landuses and their resultant 1:100 Year flows are summarised in **Table 3** and illustrated in **Figure 3** for several significant points along the Jock River. These points include: upstream of Richmond (N6), downstream of the Van Gaal Drain (VG_DR), downstream of Richmond at Eagleson Road (S_N5A) and at the outlet which is the confluence with the Rideau River (N1). As well, the peak flows from several subcatchments (s/c) in Richmond are reported. The modelling input and output are summarised in **Appendix B**.

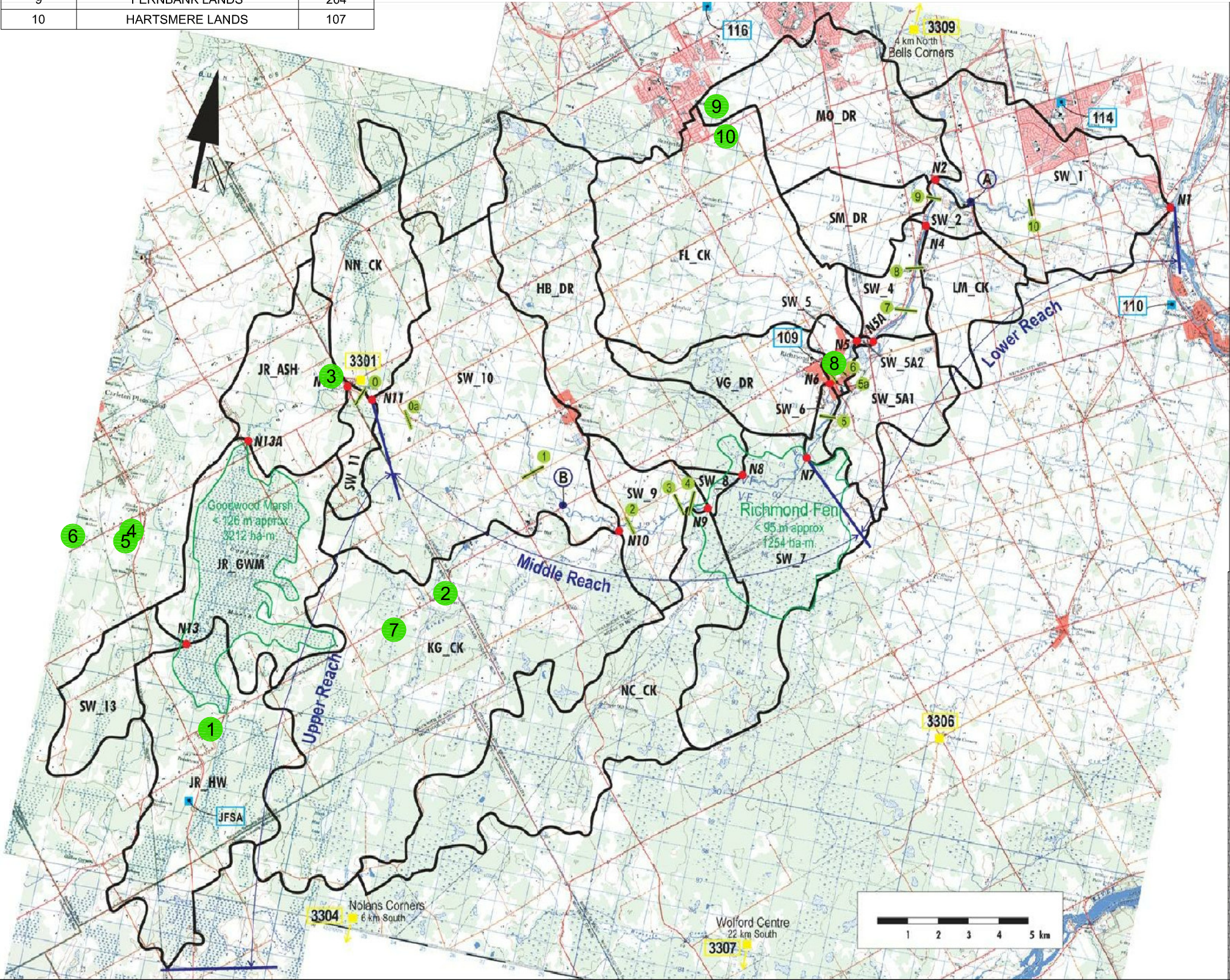
It is apparent that, given the Time to Peak assumptions in the model, coupled with routing characteristics including channel routing for various reaches and reservoir routing for Goodwood Marsh and the Richmond Fen, there are two major peaks in the system separated by approximately 30 hours.

The first peak is due to lands upstream of Richmond and occurs at roughly 60 hours into the 1:100 Year rainfall event. It is estimated at 60.3 m³/s, upstream of Richmond, for existing conditions and reflects peak flow and timing attenuation from the Goodwood Marsh and the Richmond Fen. This is illustrated in **Figure 3** by the hydrograph upstream (u/s) of Richmond. Review of the peak flow considering development, at this point in the system – 60.3m³/s, suggests that development upstream of Richmond has no impact on peak flows – see **Table 2** for peak flow estimates at node N6 upstream of Richmond.

The second peak occurs downstream of Richmond and is illustrated by review, in **Figure 3**, of the hydrograph at Eagleson Road (S_N5). The peak occurs at roughly 30 hours and is estimated at 88.6m³/s at this location under existing conditions. The hydrograph is heavily influenced by Flowing Creek (FL_CK) interaction with the rising limb of the flows from upstream of Richmond. Review of the peak flow considering development, at this point in the system, suggests that development through Richmond has little or no impact on peak flows: **Table 2** indicates an increase to 89.0m³/s under future conditions which is less than a 0.5% increase and well within the accuracy and limitations of the model and its current assumptions: for example, no SWM has been accounted for in the Mattamy development in Richmond (subcatchments VG_DR and SW_6).

In conclusion, a simplistic approach has been used to identify the cumulative impact of development on peak flows in the Jock River watershed. Given the size of the watershed and the relatively small amount of development in the foreseeable future, it is apparent that there is no impact from anticipated development on Jock River flows.

LOCATION #	DEVELOPMENT NAME	AREA (Ha)
1	FRANKTOWN	106
2	PROSPECT	129
3	ASHTON	54
4	RICHARDSON	26
5	AMT GROUP	22
6	HAY FAMILY DEVELOPMENTS	15
7	1343791 ONTARIO LTD.	32
8	VILLAGE OF RICHMOND	413
9	FERNBANK LANDS	204
10	HARTSMERE LANDS	107



1 LOCATION NUMBER
VACANT DEVELOPMENT

Legend:

- Watershed
- Bogs (Reservoir)
- Nodes
- Flow gauges
- Rain gauges
- Snow course stations
- River Cross-Sections (based on topo. maps)
- River Cross-Sections adjusted with field data
- Reaches limits

Flow gauges ID

- A 02LA007- Jock River near Richmond
- B Jock River at Franktown Rd

Rain gauges ID

- 109 Richmond
- 110 Manotick
- 114 Barrhaven
- 116 Maple Grove
- JFSA JFSA Inc, Temporary Rain Gauge 2003

Snow course stations ID

- 3301 Ashton
- 3304 Nolans Corners
- 3306 Pierces Corners
- 3307 Bells Corners
- 3309 Wolford Centre

Client:



Project:

Jock River Flood
Plain Mapping Study

Title:

Watershed Delineation



J.F. Sabourin & Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
OTTAWA (613) 727-5199
Gatineau (819) 243-6858

Ref. File: Base Map Jock River B.cdr

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CLIENT:

MATTAMY HOMES

PROJECT:

RICHMOND

DRAWING:

VACANT DEVELOPMENT
LANDS IN BECKWITH AND
OTTAWA UPSTREAM OF
EAGLESON ROAD

DRAWN BY:

S.A.E.

CHECKED BY:

S.A.E.

PROJECT No.:

60117455

DESIGNED BY:

APPROVED BY:

DRAWING No.

SCALE:

N.T.S.

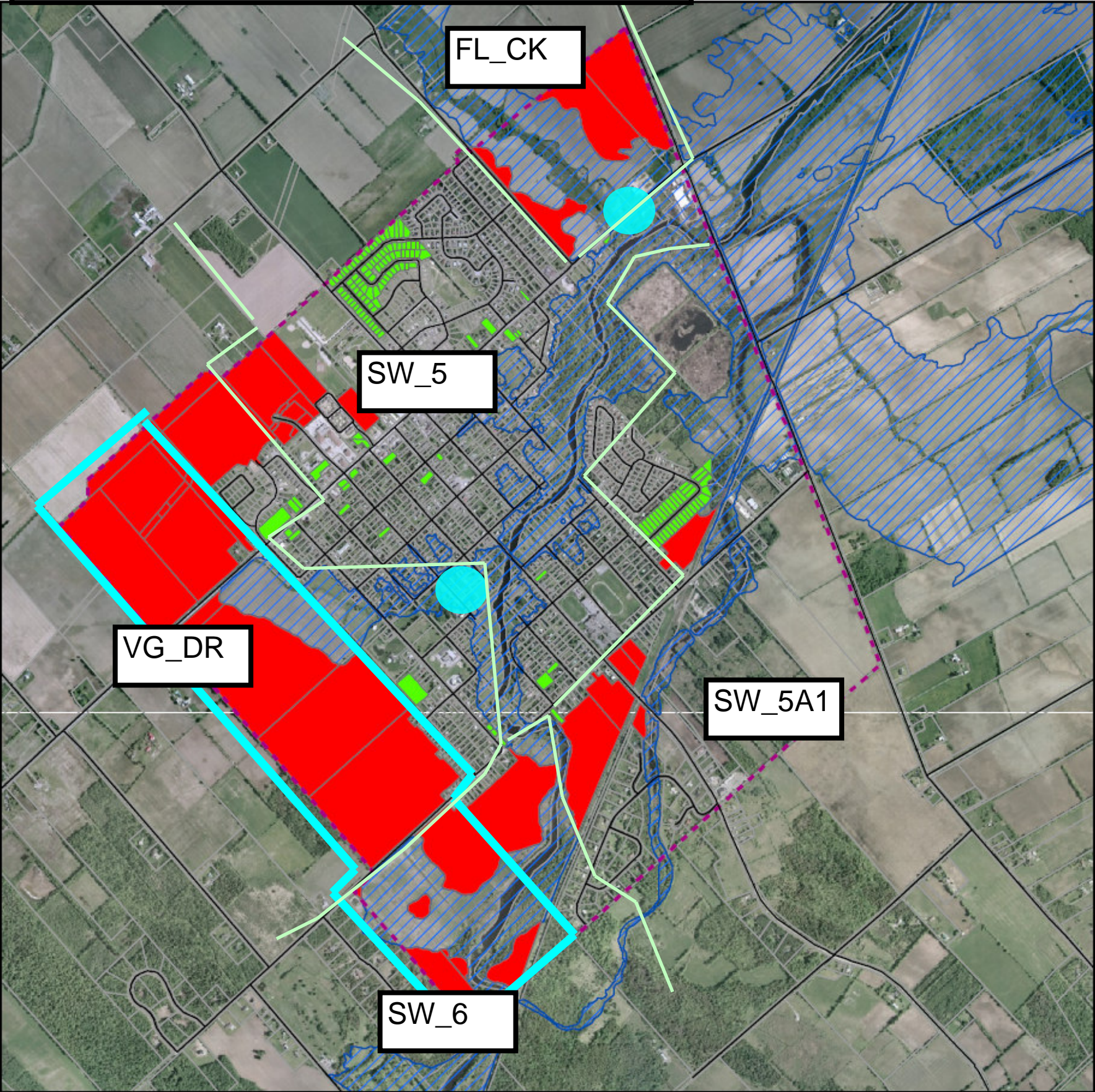
DATE:

Jan, 2010

Fig. 1

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Figure 2
Development in Richmond



0 250 500 1,000
Meters

Legend

- Infill Parcels
- Larger Parcels
- Floodplain

Figure 3 1:100 Year Hydrographs for selected catchments and locations on the Jock River

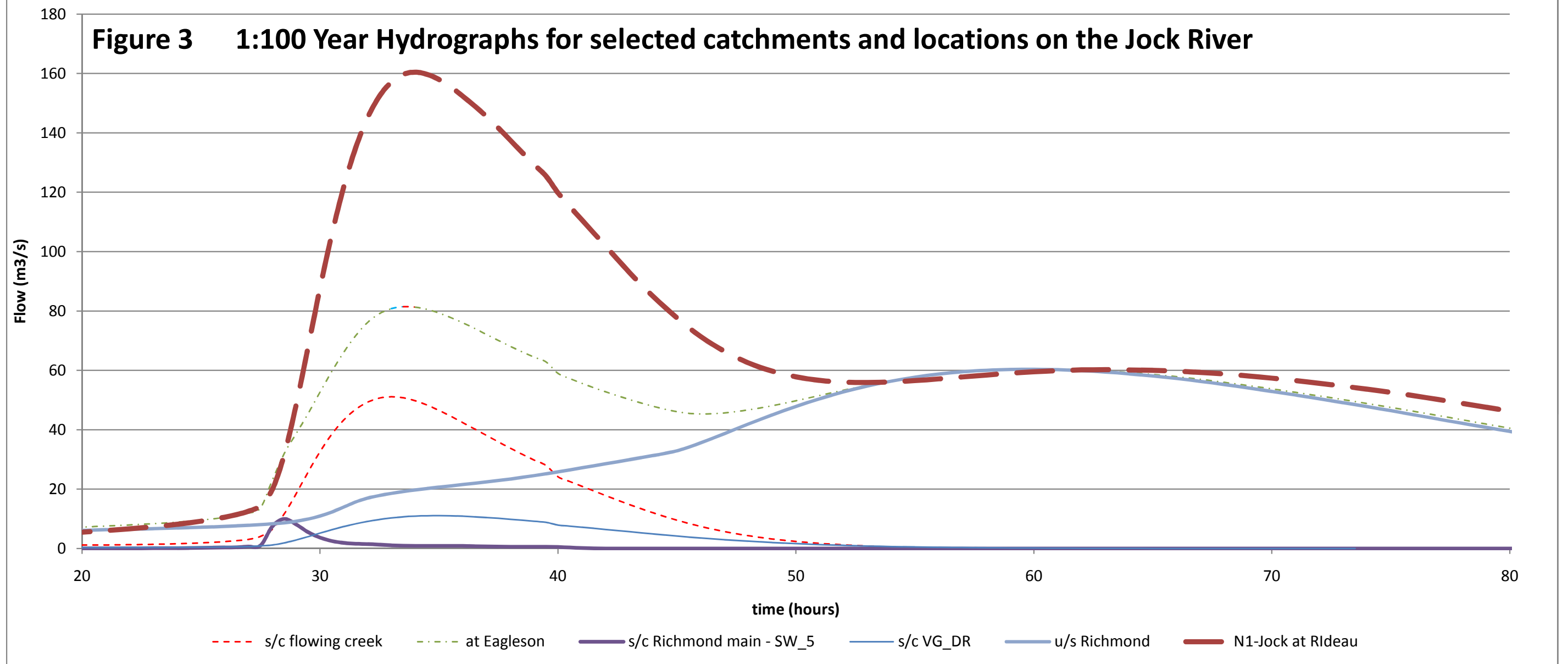


Table 1: CN determination based on future development							
development				sub-catchment			
location	area (ha)	CN	id	area (ha)	CN	revised CN	
1	106	83	JR_HW	3680	64	64.5	
2	129	83	KG_CK	8376	66	66.3	
7	32	83	KG_CK				
3	54	83	JR_ASH	1781	72	72.3	
4	26	83	JR_GWM	3161	55	55.8	
5	22	83	JR_GWM				
6	39	83	JR_GWM				
8d	36	90	SW_5	224	77	79.1	
8c	132	90	VG_DR	1332	72	73.8	
10	107	83	FL_CK	4945	74	74.6	
9	204	83	FL_CK				
8a	36	90	FL_CK				
8e	24.0	90	SW_6	165	67	70.3	
8b	30	90	SW_5A1	1412	75	75.3	
In Richmond				% of remaining	remaining		
			development	development area (ha)			
8a	FL_CK		14%	36			
8b	SW_5A1		12%	30			
8c	VG_DR		51%	132			
8d	SW_5		14%	36			
8e	SW_6		9%	24			
		TOTAL	100%	258			
				(From Figure 2)			

Table 2: 1:100 Year Peak Flow Comparisons - Selected Locations - Existing and Future Conditions							
	Location	Existing		Future			
		peak (m3/s)	time (hrs)	peak (m3/s)	time (hrs)		
	u/s Richmond (N6)	60.3	60:00:00	60.3	60:00:00		
	s/c SW-6	1.5	33:00:00	1.6	32:30:00		
	s/c VG_DR	10.6	35:00:00	10.9	35:00:00		
	s/c SW_5	9.3	28:30:00	10.0	28:30:00		
	s/c FL_CK	51.1	33:00:00	51.1	33:00:00		
	d/s Eagleson (S_N5A)	88.6	34:30:00	89.0	34:30:00		
	Confluence with Rideau (N1)	158.3	34:00:00	158.8	34:00:00		

APPENDIX A
Location of Future Development
Jock River Watershed
Drainage Areas
Upstream of Eagleson Road

APPENDIX B

Hydrologic Model

Input and Output files