

STAFF REPORT

To: RVCA Board of Directors

**Prepared by: Ferdous Ahmed, Ph.D, P.Eng.,
Senior Water Resources Engineer
&
Bruce A. Reid, P.Eng., Director,
Watershed Science and Engineering Services**

Subject: Van Gaal Drain Flood Plain Mapping – Final Report

Date: December 8, 2009

Recommendations:

1. That this report be received by the Board
2. That the RVCA accept the JFSA report dated November, 2009 and accompanying flood Plain mapping as having fulfilled the terms of reference of the project.
3. That the RVCA accept the JFSA report dated November 2009 and accompanying flood plain mapping as representing the best available information regarding flooding hazards in the Van Gaal Drain watershed.
4. That the information provided in the JFSA report and accompanying flood plain mapping be used by the RVCA when participating in the municipal land planning and development approval process, and when exercising its powers and responsibilities under Ontario Regulation 174/06.

The Assignment

The Van Gaal Drain Floodplain Mapping Project in the Village of Richmond, initiated in 2008, is now complete. The firm of J. F. Sabourin and Associates, Water Resources and Environmental Consultants (JFSA), was commissioned in October 2008 to undertake the hydrologic analysis, hydraulic modeling and flood line mapping work. JFSA submitted their final report and mapping to RVCA on November 27, 2009. They are accessible on the RVCA website at:

http://www.rvca.ca/watershed/Richmond_New_Mapping/index.html

Communications with the Community and other Stakeholders

JFSA submitted their draft report and flood line maps to the RVCA on September 2, 2009. Through September and October the findings of the study have been made available to directly affected landowners and the public at large, as follows:

- September 10, 2009: a meeting with affected landowners was arranged to inform them of the work done, the draft final report and maps – 19 landowners attended in addition to the Ward Councillor, City staff, RVCA staff and JFSA personnel
- September 12, 2008: a public open house arranged as part of the Richmond CDP process; RVCA staff were in attendance with the draft flood plain information
- October 8, 2009: another meeting with the affected landowners was arranged by the Ward Councillor – RVCA staff made a presentation on the mapping status and answered questions
- RVCA staff attended two meetings of the Steering Committee for the Richmond CDP study to provide updates on the status of the flood plain mapping project
- copies of the draft final report and maps, received by RVCA on September 2, 2009, were made available to all landowners and other stakeholders on an as requested basis
- numerous questions and queries were answered though telephone, mail, emails, meetings and site visits
- several field visits/meetings were conducted in response to landowner queries
- a listing of questions, comments and issues raised by various stakeholders and RVCA's responses to them is available on RVCA's website at:
http://www.rvca.ca/watershed/Richmond_New_Mapping/index.html

Some adjustments to hydrologic modeling inputs and corresponding changes in estimated 1:100 year water surface elevations were made in response to some of the comments and questions raised during and after the public information sessions. The hydrologic modeling adjustments are discussed in a supplementary letter report submitted by JFSA on November 17, 2009.

Changes on the Landscape during the Flood Plain Mapping Process

After the draft flood plain maps were released for public review and comment, earthworks were undertaken on the overbanks of the Van Gaal Drain upstream of Perth Street on lands identified in the draft mapping as being susceptible to shallow depth flooding under 1:100 year flood conditions. Earth berms were installed along both sides of the Drain, apparently with the objective of ensuring that any flows exceeding the bankfull capacity of the Drain will be confined to a narrower corridor than the flood plain that is depicted in the draft mapping. The earthworks were undertaken on lands that are not currently subject to the RVCA's regulation and did not need prior approval from RVCA. In the case of the berm installed on the west side of the Drain (observing a 30 metre setback from the watercourse), the landowner did first contact the RVCA to convey his intentions and to ascertain if approvals would be needed. In the case of the berm installed on the east side of the Drain (very close to the top of bank), the RVCA was informed of the berm's installation after the fact.

The proponents of the earthworks were advised that RVCA may be prepared to recognize these site alterations and take them into account in further revisions of the flood plain mapping, but only after it has been satisfactorily demonstrated that:

- the earthworks do not adversely affect the interests of adjacent landowners; preliminary analysis by RVCA staff indicates that the berms will cause a small, but measurable increase in water surface elevations over a 900 metre length of the Drain; the maximum increase in the estimated 1:100 water surface elevation attributable to the berms is 12 centimetres (at cross-section 1922)
- the loss of flood plain storage volume resulting from the confinement of flow to a narrower flood plain will not have adverse downstream consequences
- there is no pending litigation under the City's Drainage By-law in respect of the changes that have been made
- the berms will perform as effective barriers under 1:100 year flood conditions, in terms of their permeability, ability to withstand hydrostatic pressure, and resistance to erosion

In the meantime, the flood plain mapping should proceed to completion and adoption as though the lands behind the berms remain susceptible to flooding to the extent that the ground elevations are below the estimated 1:100 year water surface elevations.

Remedial Flood Level/Flood Damage Reduction Measures

No existing residential structures are in the flood susceptible areas identified by this study. No existing public roads were found to be flood susceptible.

There are numerous residential structures located just outside the mapped flood plain limits, some with portions of their lots being inundated under 1:100 year flood conditions. Whether these structures or their contents are susceptible to damages under 1:100 year (or more frequent) flood conditions depends on the design of the structures and their foundations, and whether or not their foundation drainage systems will be compromised when overbank flooding occurs. The grading of these lots, as shown in the base mapping, appears to be such that there should be no direct entry of surface water into the structures for 1:100 year and more frequent floods on either the Van Gaal Drain or the Jock River. Accordingly there is no perceived need for remedial measures to reduce flood damage potential associated with existing developments.

However, if the flood susceptibility of undeveloped lands along the Van Gaal Drain is to some degree attributable to man-made obstructions along the creek (e.g. undersized culverts or bridge crossings, weirs, or channel encroachments), or by historical changes to (enlargement of) the contributing drainage area, then remedial measures to mitigate the impacts and restore flood levels and flood lines back to their "natural" positions might be considered.

The hydraulic analysis undertaken within this study has shown that existing culverts on Fowler, Fortune and Perth Street do affect the estimated 1:100 year water surface profile to a degree that is typical of all road crossings. Some energy losses associated with flow constriction and expansion at the entrance and exit of the culvert and friction losses within the conduit are unavoidable. The energy losses at these culverts are not excessive. The Fowler Street and Fortune Street culverts have negligible effects on the water surface profile for the governing scenario on the Van Gaal Drain downstream of Perth Street – when the Jock River is at its 1:100 year level. At the Perth Street culvert - which is less affected by Jock River levels - the analysis indicates that the upstream water surface elevation for the 1:100 year Van Gaal Drain flow could be reduced by only 0.04 metres by improving the efficiency of the culvert inlet. This difference in water level is small relative to the estimating error that is inherent in the water surface profile calculations, so culvert adjustments are not considered to be warranted.

Similarly, channelization of the watercourse will have no significant effect on water levels in the Jock River to Perth Street reach, since the dominant flood condition in the reach is set up by backwater effects from the Jock River water level when at its peak 1:100 year spring snowmelt flow.

Widening of the channel in selected sections of the watercourse between Perth Street and Garvin Road (beyond the channel width that is specified for the municipal drain) might have some localized effect on 1:100 year water surface elevations, by increasing the bankfull capacity of the channel, since there is some gradient in water surface profile through this reach with the present channel configuration. Channelization schemes can have downstream consequences due to reduction in flood plain storage volumes and changes in the routing of the flood hydrograph as it passes through the channelized reach. The effectiveness and potential adverse consequences would need to be investigated. Modelling of hypothetical channelization schemes has not been undertaken, as doing so is beyond the scope of the present study.

It appears that the contributing drainage area for the Van Gaal Drain has increased in size (compared to its natural, undisturbed drainage area) as a result of the historical evolution of drainage works in the agricultural areas to the north and east of the study area, as well as the drainage systems that serve parts of the Village. The existing network of rural drainage ditches cuts across the natural grade of the landscape, pulling more runoff towards the Van Gaal Drain than would otherwise be the case. The present analysis has shown that in two locations on the main branch of the Drain, the 1:100 year flow exceeds bankfull capacity and water will tend to “spill” as shallow overland flow from the Van Gaal Drain catchment (as presently defined) into the adjacent Hamilton Drain or Flowing Creek catchments. The flood lines on the Van Gaal Drain are based on a conservative assumption that the “spill” magnitude is insignificant relative to the total flow in the Drain. If a suitable route to a sufficient alternate outlet for the overland flow leaving the Van Gaal Drain were to be identified and maintained, a reduction in the Van Gaal Drain design flows below the spill sections could be warranted [note: this would not change the flood lines downstream of Perth Street which are governed by 1:100 year conditions on the Jock River]. The issue of providing designated overland flow routes for runoff events that exceed bankfull flow capacities should be examined within the context of a master drainage plan or subwatershed plan for the entire Village and its surroundings, dealing with the potential inter-connectedness of the various catchments when extreme rain or snowmelt events occur.

Guidance for Land Use/Development Planning and Administration of RVCA Regulations

Upon the formal acceptance of the final report and mapping, as recommended herein, the mapping should be referred to by RVCA as defining areas that are subject to flood hazards along the Van Gaal Drain corridor. The mapping should be used by the RVCA in revisions to the Regulation Limit Mapping referred to in Section 12 of Ontario Regulation 174/06, and by the City of Ottawa in the process of updating its Official Plan and Zoning Schedules.

The following policies should be applied in the planning and design of future development in three specific zones of the study area:

1. Lands within the 1:100 year flood lines:

Land use and development plans must be consistent with the Natural Hazards policies (Section 3.1) of the Provincial Policy Statement issued under Section 3 of the *Planning Act*, and compliant with the requirements of the RVCA’s local policies for the administration of Regulations under Section 28 of the *Conservation Authorities Act* (O.Reg. 174/06).

2. Lands that are outside of the 1:100 year flood lines, adjacent to “spill sections”:

Two spill areas are identified in the mapping. At these locations, overland flow during extreme rainfall or snowmelt events will spill from the Van Gaal Drain catchment toward the adjacent catchments (Hamilton Drain or Flowing Creek). There are two options for the management of this overland flow:

Option 1

- raise the grades adjacent to the spill sections so as to create an effective barrier for the overland flow spilling from the Van Gaal Drain catchment
- no change to flood lines would be required since they are already based on a conservative assumption that the entire flow is carried down the Van Gaal Drain to Perth Street.

Option 2

- Provide an adequate conveyance route for the overland flow spilling from the Van Gaal Drain to a suitable outlet via the Hamilton Drain or Flowing Creek drainage systems; if a formally created and maintained conveyance route is established through a more comprehensive Master Drainage Plan or subwatershed planning process for the Village, an adjustment to the Van Gaal Drain flood lines upstream of Perth Street might be warranted if the “spill” is significant relative to the total Van Gaal Drain flow; this overland flow route would be designed to convey flow only during wet weather events of a certain magnitude and frequency, and would otherwise be dry and usable for other purposes such as recreational pathways and pedestrian linkages.

3. Lands that are Upstream of the Study Limits

For Study Limits that are identified at or beyond the presently defined limits of the Village of Richmond (at Garvin Road and Joys Side Road) - if at some time land use changes or developments are proposed adjacent to the watercourses, it will be necessary to undertake further hydrologic and hydraulic analyses to determine the extent of flood hazard areas beyond (upstream of) the study limit

For the Study Limit on the “Moore Branch” of the proposed Arbuckle Drain – the study limit is drawn at a point on the local surface drain which is considered to be the extent of “backwater effects” associated with 1:100 year flood events on the Jock River or Van Gaal/Arbuckle Drain. The design of developments in this portion of the study area must provide adequate routes for the continued conveyance of “external” flows that originate west of Joys Side Road, towards the Van Gaal/Arbuckle Drains.

Flood Plain Mapping Amendments

The end products generated through this project are:

1. the Flood Plain Mapping Report
2. the Flood Plain Mapping
3. input and output files for the SWMMHYMO and HEC-RAS simulations

The report and maps have been made available to the public on the RVCA web site. The hydrologic and hydraulic modeling files will be made available to anyone who wishes to obtain them, subject to acceptance of the standard “terms of use” that apply to the release of RVCA data and information.

Site specific amendments to any RVCA flood risk mapping (i.e. the delineation of the flood lines), after its being formally approved for use by the RVCA Board of Directors, may be warranted from time to time in the following circumstances:

- when a development proposal within the identified flood plain is approved under the prevailing regulations and has been completed in accordance with the permit, resulting in a change in the grades on the property from those depicted in the flood risk mapping
- when accurate site specific information has been brought to the attention of the Authority and allows for a more precise delineation of the flood hazard area than was possible based on the topographic base mapping used for the flood risk delineation

When amendments are warranted, the delineation of the flood line will be adjusted by RVCA's Watershed Science and Engineering Services. Revisions to the mapping will be carefully documented (including notations on the map indicating the site of the adjustment, with cross-referencing to notes on file, explaining the technical basis of the adjustment).

In the case of this particular flood plain mapping project, future amendments to the mapping may also be warranted in these specific circumstances:

- 1) to recognize the presence of earth berms that were constructed prior to RVCA formal adoption of the flood line mapping, if the conditions outlined previously in the report are met (four bullet points at the top of page 4), and
- 2) to take into account a reduction in the 1:100 flow in the main channel of the Van Gaal Drain that would result from the establishment of a dedicated overland flow route for flood waters that "spill" from its watershed when flows exceed bankfull capacity.

Ferdous Ahmed, P.Eng.
Senior Water Resources Engineer

Bruce Reid, P.Eng., Director
Watershed Science & Engineering Services