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FUNCTIONAL SERVICING REPORT

FOR THE

KANATA HIGHLANDS

RICHCRAFT GROUP OF COMPANIES

CITY OF OTTAWA

PROJECT NO.: 10-450

DECEMBER 20, 2016
REVISION 1, 1ST SUBMISSION

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1.0 INTRODUCTION

David Schaeffer Engineering Ltd. was retained by the Richcraft Group of Companies to prepare the following functional servicing report in support of a Draft Plan of Subdivision for their Kanata Highlands development area on the east side of Terry Fox Drive (TFD). It is noted that the subject land area has been previously referred to as the "Upper/Lower Baylis" or "Interstitial Lands" in reports and studies.

The Kanata Highlands development consists of 25.05 ha of vacant land within the former Municipality of Kanata and is located approximately 1.2 km north of Richardson Side Road on the east side of TFD. There are future residential development lands to the east and south of the site, as illustrated in ***Figure 1***.

This functional servicing report is provided to demonstrate that the site can be serviced in conformance with the design criteria of the City of Ottawa, background studies and general industry practice.

1.1 Existing Conditions

The subject property is a Greenfield Site within the Kanata community within the City of Ottawa, adjacent to TFD. The site is not currently serviced, however some municipal services as described in this report are available within the TFD right-of-way (ROW).

The site is subject to grade raise restrictions as noted in the geotechnical report prepared by Paterson Group. The maximum permissible grade raise is recommended at 1.5 m in areas where foundations will be bearing on the silty clay deposit.

1.2 Summary of Pre-consultation

There have been several pre-consultation meetings with City Staff and correspondence with the Mississippi Valley Conservation Authority regarding the overall Kanata Highlands servicing requirements.

1.3 Development Concept

The draft plan of subdivision has is presented on ***Figure 2***. The plan is comprised of single detached homes, townhomes, back-to-back townhomes, a park and open space.

The predicted populations currently associated with the development concept are described in ***Table 1*** below. The development is expected to proceed in phases, according to the landowner's preferred timing.

Table 1: Development Statistic Projections

Land Use	Total Area (ha)	Projected Residential Units	Residential Population per Unit *	Projected Population *
Medium Density Residential - Townhouses	5.32	224	2.7	605
Medium Density Residential - Back-to-Back Towns	0.60	52	2.7	141
Low Density Residential - Single Detached	5.94	159	3.4	541
Parks/Walkways	0.95			
Roads	5.22			
Open Space	7.02			
Total	**25.05**	**435**		**1287**

** NOTE: Population projections may differ from population estimates used in background Transportation Studies, Planning Rationale, and other studies. Population projection and residential population per unit values are based on City of Ottawa and Ministry of Environment and Climate Change guidelines for servicing demand calculations.*

1.4 Required Permits / Approvals

The City of Ottawa must approve detailed engineering design drawings and reports prior to construction of the municipal infrastructure identified in this report. This is expected to occur as part of the approval process for *Planning Act* applications.

The following additional approvals and permits listed in ***Table 2*** could be expected to be required prior to construction of the municipal infrastructure detailed herein. Please note that other permits and approvals may be required, as detailed in the other studies submitted as part of the *Planning Act* applications (e.g. *Tree Conservation Report, Phase 1 Environmental Site Assessment, etc.).*

Table 2: Potential Required Permits/Approvals

Agency	Permit/Approval Required	Trigger	Remarks
MVCA	Permit under Ontario Regulation 153/06, MVCA's Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation	Any ditches requiring closure due to development/grading. Any new connections to the Carp River.	Proposed land uses & municipal infrastructure require grading within the subject lands and may result in the closure of existing ditches. Construction of a new stormwater management pond will require a new outlet to the Carp River.
MOECC/ City of Ottawa	Environmental Compliance Approval (ECA)	Construction of new sanitary & storm sewers.	The MOECC is expected to review the storm sewer system and sanitary sewer system through the transfer of review program.
MOECC/ City of Ottawa	Environmental Compliance Approval (ECA)	Construction of oil & grit separators (OGS) or construction of new stormwater management facility (wet pond).	The MOECC is expected to review the stormwater management facility through the direct submission program.
MOECC	Permit to Take Water (PTTW)	Construction of proposed land uses (e.g. basements for residential homes) and services.	Pumping of groundwater and surface water may be required during construction, given groundwater conditions and proposed land uses/ municipal infrastructure.
City of Ottawa	MOE Form 1 – Record of Watermains Authorized as a Future Alteration	Construction of watermains.	The City of Ottawa is expected to review the watermains on behalf of the MOECC through the Form 1 – Record of Watermains Authorized as a Future Alteration.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

The following material has been reviewed in order to identify the constraints, which govern development within the subject site:

- Carp River Watershed / Subwatershed Study – Volume 1 – Main Report
  Robinson Consultants, December 2004
  (*Subwatershed Study*)

- Carp River Watershed / Subwatershed Study Modeling Analysis,
  Robinson Consultants, December 2005

- Sewer Design Guidelines,
  City of Ottawa, October 2012
  (City Standards)
    - Technical Bulletin ISD-2012-1
      City of Ottawa, January 31, 2012.
      *(*ISD-2012-1*)*

    - Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines - Sewer
      City of Ottawa, February 5, 2014
      (ITSB-2014-01)
    - Technical Bulletin PIEDTB-2016-01, Revisions to Ottawa Design Guidelines – Sewer
      City of Ottawa, September 6, 2016
      (PIEDTB-2016-01)
- Ottawa Design Guidelines – Water Distribution
  City of Ottawa, July 2010
  (Water Supply Guidelines)
    - Technical Bulletin ISD-2010-2
      City of Ottawa, December 15, 2010
      (ISDTB-2010-2)
    - Technical Bulletin ISDTB-2014-02
      City of Ottawa, May 27, 2014
      (ISDTB-2014-02)
- City of Ottawa Official Plan,
  adopted by Council 2003.
  (Official Plan)

- Stormwater Management Planning and Design Manual,
  Ministry of Environment, March 2003
  (*SWMP Design Manual)*
- Erosion & Sediment Control Guidelines for Urban Construction,
  Greater Golden Horseshoe Area Conservation Authorities*,* December 2006
  (E&S Guidelines)
- Kanata Lakes North Serviceability Study,
  IBI Group, June 2006
- Master Sanitary Servicing Plan, Kanata Lakes, Broughton and Interstitial Lands,
  Stantec Consulting Ltd., December 2007
  (Master Sanitary Servicing Plan)
- Pressure Zone 3W – Kanata North Potable Water Planning Study,
  Stantec Consulting Ltd., November 22, 2007
  (Water Planning Study)
- Preliminary Design for the Signature Ridge Pumping Station, Final Report
  R.V. Anderson Associates Limited, January 25, 2011
  (RVA Preliminary Design)
- Geotechnical Investigation, Kanata Highlands Phase 1 – Terry Fox Drive
  Paterson Group Consulting Engineers (PG2971), September 24, 2013
  (Geotechnical Report)
- Richardson Ridge Phase 4, Serviceability Report,
  IBI Group, August 2016
  (Richardson Ridge Phase 4 Serviceability Report)

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The proposed development is located within the City of Ottawa's water distribution Pressure Zone 3W. The northern sections of the 3W Zone are fed from the Campeau Drive Pumping Station while the Glen Cairn Pumping Station feeds the south. A 300 mm diameter watermain exists within the Terry Fox Drive right-of-way up to the south edge of the property boundary.

The existing watermains are shown on ***Figure 3.***

3.2 Water Supply Servicing Design

There is a proposed subdivision to the south of the subject property. Servicing for the neighbouring subdivision is outlined in the ***Richardson Ridge Phase 4 Serviceability***

Report prepared by *IBI Group*. The report describes that water servicing will be achieved through connections to the existing 300 mm watermain within Terry Fox Drive. As the development proposes a water demand in excess of ***50 m^3/day***, construction of a 150 mm diameter watermain is also proposed within Terry Fox Drive, extended to provide a redundant connection to the development. Please refer to ***Appendix A*** for an excerpt from the ***Richardson Ridge Phase 4 Serviceability Report***, showing the conceptual servicing plan.

It is anticipated that the applicant will enter into a cost sharing agreement with the property owner to the south to construct the proposed second watermain within Terry Fox Drive.

A summary of the ***Water Supply Guidelines*** employed in the preparation of the preliminary water demand estimate is presented in ***Table 3***.

Table 3: Water Supply Design Criteria

Design Parameter	Value
Residential Single Family	3.4 P/unit
Residential Semi-detached	2.7 P/unit
Residential Townhouse/Back-to-Back	2.7 P/unit
Residential Average Daily Demand	350 L/d/P
Residential Maximum Daily Demand	2.5 x Average Daily *
Residential Maximum Hourly	5.5 x Average Daily *
Commercial / Park Maximum Daily Demand	1.5 x Average Daily *
Commercial / Park Maximum Hourly	2.7 x Average Daily *
Commercial / Park w/ Splash Pad Demand	28,000 L/ha/d
Minimum Watermain Size	150 mm diameter
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During normal operating conditions desired operating pressure is within	350 kPa and 480 kPa
During normal operating conditions pressure must not drop below	275kPa
During normal operating conditions pressure must not exceed	552kPa
During fire flow operating pressure must not drop below	140kPa

Daily average based on Appendix 4-A from **Water Supply Guidelines*
*** Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons. City Guidelines used for populations greater than 500 persons.*
-Table updated to reflect ISD-2010-2

Water servicing for the subject site will be through the proposed property to the south. The 300 mm diameter watermain will be extended within Terry Fox Drive north to provide an additional connection along the west edge of the site. In order to ensure that minimum pressures are met throughout the development, it is recommended that the redundant connection within Terry Fox Drive be a 200 mm diameter watermain.

A 300 mm watermain is proposed through the site in accordance with the ***Kanata North Potable Water Planning Study***, prepared by *Stantec.* The 300mm watermain is extended to the east edge of the site where, in the future, a connection can be made to service proposed development east of the subject site. The remaining internal watermain network will be made up of 150 mm, 200 mm, 250 mm and 300 mm diameter watermains. The proposed watermains are presented in ***Figure 3***.

The proposed water supply demand and boundary conditions for the water servicing is presented in ***Table 4***. Water demands include calculated water demands for the subject site, in addition to, the water demand found in the ***Richardson Ridge Serviceability Report*** for the property to the south. Refer to ***Appendix A*** for detailed calculations of water demands.

Table 4: Water Demand and Boundary Conditions
Proposed Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition[2] Connection 1[3] (m H_2O / kPa)	
Average Daily Demand	496.6	66.8	655.3
Max Day + Fire Flow (250 L/s)	1,762.6 + 15,000= 16,762.6	40.0	392.4
Max Day + Fire Flow (184 L/s)	1,762.6 + 11,040= 12,762.6	48.5	475.8
Peak Hour	2,681.7	59.8	586.6

1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations. Water demand includes anticipated demand for neighboring property to the south, see ***Richardson Ridge Serviceability Report***
2) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence as per the ***Richardson Ridge Serviceability Report,*** assumed ground elevation equal to ***95.4m***.

The City of Ottawa was contacted to obtain updated boundary conditions associated with the estimated water demands; however, they were not received at the time of this publication. See ***Appendix A*** for boundary condition request correspondence. Boundary conditions, summarized in ***Table 4,*** were extracted from the ***Richardson Ridge Phase 4 Serviceability Report*****.** The pending boundary condition request results in an increase of ***240%*** in water demand compared to the original boundary condition request. Water distribution modeling and pressures summarized in this report are to be verified when updated boundary conditions are received.

The City of Ottawa provided both the anticipated minimum and maximum water pressures, as well as the estimated water pressure during fire flow summarized in ***Table 4***. Pressures at the proposed connection point during the Average Day and Peak Hour scenarios exceed the recommended operating pressures summarized in ***Table 3***. The available pressure for the fire flow demand is above the minimum pressure identified by the ***Water Supply Guidelines***.

All single detached homes are expected to conform to the City of Ottawa ***ISDTB-2014-02*** for fire flow, resulting in a maximum fire flow of ***10,000 L/min***.

In addition to single detached homes, the applicant has also contemplated back-to-back townhomes and traditional townhome units which would not conform to the described fire flow in ***ISDTB-2014-02***; therefore, the ***FUS*** method was used to estimate fire flow.

The following assumptions were assumed to estimate fire flow based on the ***FUS*** method:

- Type of construction – Wood Frame
- Occupancy type – Limited Combustibility
- Sprinkler Protection – Non-Sprinklered

The above assumptions result in a maximum estimated fire flow of approximately ***12,000L/min*** for back-to-back townhomes and traditional townhomes which would not conform to the ***ISDTB-2014-02.*** Actual building materials selected will affect the estimated flow and fire flow may change at the detailed design stage. See ***Appendix A*** for detailed FUS calculations.

3.2.1 Watermain Modeling

EPANet was used to determine pipe sizing and the availability of pressures throughout the system during average day demand, max day plus fire flow, and peak hour demands. The static model determines pressures based on the available head obtained from the boundary conditions provided by the City of Ottawa, as indicated in ***Table 4.***

The model utilizes the Hazen-Williams equation to determine pressure drop, while the pipe properties, including friction factors, have been selected in accordance with Table 4.4 of the ***Water Supply Guidelines***; refer to ***Appendix A*** for model parameters. The model was prepared to assess the available pressure at the finished first floor of each building as well as the pressures the watermain provided to fire hydrants during fire flow conditions.

The fire flows indicated in ***Table 5*** were used to model fire demands at each of the model nodes. Fire demands were determined for each node based on the proximity of building type (Single, Townhome, Back-to-Back) from the draft plan prepared by Annis, O'Sullivan Vollebekk Ltd., dated December 9, 2016. Refer to model schematics in ***Appendix A*** for node locations.

Table 5: Fire Demand and Minimum Pressure at Nodes

Node ID[1]		Fire Demand at Each Node (L/min)	Total Fire Demand (L/min)[2]	Critical Node ID[3]	Minimum Pressure at Critical Node (kPa)
Node 1	Node 2				
24	-	12000	12000	33	153.0
25	-	12000	12000	33	152.3
26	-	12000	12000	33	151.9
27	-	12000	12000	33	149.6
28	-	12000	12000	33	142.7
29	-	12000	12000	33	141.4
30	-	10000	10000	33	186.3
31	-	10000	10000	33	184.9
32	28	6000	12000	33	141.9
33	-	10000	10000	33	180.4
34	-	12000	12000	33	140.8
35	-	10000	10000	33	185.1
36	-	12000	12000	33	152.7
37	-	12000	12000	33	152.6
38	-	12000	12000	33	152.5
39	-	12000	12000	33	151.0
40	-	12000	12000	33	158.3
41	-	12000	12000	33	146.9
42	-	12000	12000	33	141.1
43	42	6000	12000	43	140.5
44	-	10000	10000	44	178.5
45	-	10000	10000	45	174.0
46	-	10000	10000	46	170.1
47	-	10000	10000	33	186.6
48	-	10000	10000	33	185.1
49	-	10000	10000	33	183.1
50	-	10000	10000	33	182.6
51	-	10000	10000	51	176.5
52	-	12000	12000	33	151.1

1) If more than one node is listed in this column, the total fire demand has been split equally at each node, refer to model schematics in ***Appendix B*** for node locations.
2) Demand based on ISDTB-2014-02 or the FUS estimated fire flow.
3) Critical node is the node with the lowest residual pressure. The critical node can be one of the nodes being analyzed for fire flow or a separate node with lower pressure.

As shown above, minimum pressures are maintained during the fire flow scenario. It is anticipated that to achieve adequate pressures at some locations, fire flow would be split equally between two hydrants. During detailed design, units that will require split flows to achieve adequate pressures will have a minimum of 2 fire hydrants located within ***90 m***, as per the ***OBC***.

In some cases lower pressures were observed at nodes not being directly modeled for fire flow, these nodes are referred to as the critical node and their residual pressures are summarized in ***Table 5*** above.

As shown above, minimum pressures are maintained during the fire flow scenario at all node locations. The lowest pressure was realized at the critical node 43, pressures for this scenario are summarized in ***Table 6*** below.

Table 6 summarizes the pressures during Average Day, Max Day + Fire Flow and Peak Hour.

Table 6: Model Simulation Output Summary

Node ID	Average Day (kPa)	Max Day + Fire Flow (kPa)	Peak Hour (kPa)
24	570.6	231.3	495
25	567.6	227.8	492
26	559.1	219.2	483.4
27	555.4	212.4	479.7
28	547.1	196.9	471.3
29	546	185.7	470.2
30	538.6	178.4	462.7
31	531.9	176.9	456.1
32	524.1	173.2	448.2
33	492.5	141.1	416.6
34	526.6	177.3	450.8
35	505.2	155.8	429.4
36	574	234.6	498.3
37	577.7	238.1	502.1
38	573.7	234	498.1
39	560.9	219.1	485.2
40	555.6	222.6	480.2
41	552	206.3	476.3
42	544.7	144.8	468.8
43	543.2	140.5	467.3
44	538.5	145.1	462.5
45	533.3	146.4	457.3
46	523.6	144.9	447.6
47	532.9	163.3	456.9
48	528.8	176.2	452.9
49	508.9	157.8	433.1
50	503.3	150.4	427.4
51	501.9	152.4	426
52	561.5	219.9	485.8
PARK	544.7	144.8	468.8

The recommended pressures from the ***Water Supply Guidelines*** shown in ***Table 3*** are respected during Peak Hour and minimum pressures are respected during Max Day + Fire Flow scenarios.

Pressures during Average Day conditions exceed the allowable pressure of ***552 kPa***; it is recommended that a pressure check be conducted during construction to determine if pressure controls are required.

The model predicted that water will flow in all areas of the system and no ‘dead’ zones were found.

3.3 Water Supply Conclusion

Water servicing is to be provided through connections to the neighbouring property to the south. An existing 300 mm and proposed 150 mm watermain within Terry Fox Drive will provide a redundant water connection to both developments. It is recommended that the redundant connection with Terry Fox Drive be a 200 mm diameter watermain.

Anticipated water demand under proposed conditions were submitted to the City of Ottawa for establishing boundary conditions; however, a response was not received at the time of this publication. Boundary conditions from the servicing report for the south property were used in the analysis and pressures found in this report are to be verified once updated boundary conditions are provided.

Modeling results indicate adequate fire flow and supply is available per the demands established with the City of Ottawa. Based on the modeling results, pressure reducing valves may be required and should be confirmed at the time of construction.

The proposed water supply design conforms to all relevant City of Ottawa Guidelines and Policies.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

There are three potential sanitary outlets for the Kanata Highlands development. The first two options are described in the ***Master Sanitary Servicing Plan*** prepared by *Stantec*.

(i) Option 1 is through the KLN development area which borders the eastern portion of the development.

(ii) Option 2 is to the existing Terry Fox Collector Sewer which conveys flows to the existing Signature Ridge Pumping Station (SRPS). The collector sewer is currently constructed along the east side of the Terry Fox Drive right-of-way (ROW) up to the Kanata Highlands southern property boundary.

(iii) Option 3 is to construct a new sanitary pump station and convey flows via a new forcemain to the Signature Ridge Pump Station.

A summary of existing available wastewater outlets is presented in ***Table 7***.

Table 7: Summary of Existing Available Wastewater Outlets

Outlet	Location
Signature Ridge PS	Didsbury Road at Terry Fox Drive
Kanata Lakes Trunk	Kimmins Court cul-de-sac

4.2 Wastewater Design and Outlet Constraints

The wastewater mains will be designed with the following design criteria, presented in ***Table 8***:

Table 8: Wastewater Design Criteria

Design Parameter	Value
Low Density Residential	3.4 p/unit
Medium Density Residential	2.7 p/unit
Peak Wastewater Generation per Person	350 L/p/d
Peaking Factor Applied	Harmon's Equation (2.0 min, 4.0 max)
Infiltration and Inflow Allowance	0.28 L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200 mm diameter
Minimum Manning's 'n'	0.013
Service Lateral Size	135 mm dia PVC SDR 28 with a minimum slope of 1.0%
Minimum Depth of Cover	2.0 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012.	

4.2.1 Kanata Lakes Trunk (via KLN Development Area)

The KLN outlet has been evaluated in the Master Sanitary Servicing Plan as receiving flows from the northern portion of the Kanata Highlands development (previously referred to as "Upper Baylis (Interstitial Lands)"). The study has evaluated flows based upon 15.67 ha of development area with a projected population of 1,377.4 (see ***Table 1.3.2*** excerpt from Stantec Master Sanitary Servicing Plan in ***Appendix B***). With the current refinement of the draft plan the new tributary area would equate to approximately 18.03 ha with an estimated population of 1287 (comprised of 159 single family homes and 276 townhomes).

The proposed KLN outlet could theoretically accept the projected flows, via gravity drainage, from the Highland development lands not accounted for in the TFD sanitary sewer. To achieve this, an outlet to the KLN lands would require the construction of sanitary sewers whose downward gradient (eastward) is contrary to a significant ground surface downward gradient (trending westward). In order to convey the sanitary flows via gravity, a required sewer invert of approximately 100.00 m would be needed at the lowest drainage point of the Kanata Highlands system based upon a preliminary grading design centerline of 101.60 m adjacent to TFD. Plan and profiles of the proposed trunk line through the KLN development were not available for review, however, an evaluation of the required invert at the Kanata Highlands eastern boundary estimates a minimum outlet elevation requirement of 97.99 m. A preliminary centerline of road elevation for the adjacent KLN roadway (see Kanata Lakes North Master Grading Plan 3433-LD drawing 5002 in ***Appendix B***) is at a high point of 112.00 m which results in a sewer that is approximately 14 meters deep.

Further evaluation of the proposed sanitary trunk line pipe slopes contained in the IBI Serviceability Study (2006), in conjunction with the Master Grading Plan, indicates that the pipe burial depths will range from 6.1 m up to the 14 m noted above. Ignoring the outlier high point elevation in the KLN development it is estimated that trunk sewers will be approximately 8.1 m deep on a weighted average in this gravity servicing scenario for the Highlands.

4.2.2 Terry Fox Collector Sewer

The TFD sewer is at the lower elevation (94.35 m) of the two alternative sewer outlets and could naturally accept drainage from all of the tributary area. However, the design of this sewer was established in previous servicing studies (previously referred to as “Lower Baylis (Interstitial Lands)”) and has accounted for only 2.26 ha of development area with a projected population of 198.7 (see Table 1.3.2 excerpt from Stantec Master Sanitary Servicing Plan, December 2007 in ***Appendix B***). The flows are conveyed to the SRPS where they are then ultimately pumped to the Kanata Lakes Trunk.

It is also noted in the ***Master Sanitary Servicing Plan*** that the hydraulic grade line (HGL) in the Terry Fox sanitary trunk sewer would surcharge to the surface at several points during emergency overflow conditions at the SRPS. Therefore the study further recommends that basements should not be permitted where the ground elevation is below 97.0 m.

As noted above, the TFD sewer was designed for capacity of the Lower Baylis (Interstitial Lands), which is part of the Kanata Highlands development. Refer to the Richardson Ridge - Terry Fox Drive Sanitary Sewer Tributary Areas Plan and Sanitary Sewer Design Sheet prepared by IBI Group on 2011/02/18, enclosed in ***Appendix B*** for reference. Based on the Terry Fox Drive Sanitary Sewer Design Sheet, the residual capacity is approximately 4 L/s.

The proposed flows to the Terry Fox Drive Sanitary Sewer form the Kanata Highlands is presented in ***Table 9***:

Table 9: Kanata Highlands Sanitary Flow Summary

	Area (ha)	Population	Peak Factor	Peak Flow (L/s)
Approved Terry Fox Sanitary Sewer Design	2.26	198.7	4.0	3.85
Current Proposal to Terry Fox Sanitary Sewer Design	18.3	1286	2.73	19.34

The Terry Fox Drive Sanitary Sewer Design Sheet has been updated for the current proposal to direct all of the Kanata Highlands to the TFD Sewer, enclosed in ***Appendix B*** for reference. The peak flow to the SRPS based on this is 84.23 L/s and the capacity of TFD sewer is 70.84 L/s. There is not sufficient residual capacity in the existing TFD Sanitary Sewer to service all of the Kanata Highlands development, when applying City of Ottawa Sewer Design Guidelines for peak design flows.

4.2.3 Signature Ridge Pumping Station

In January 2011 a *Preliminary Design* for upgrades to the SRPS was prepared by R.V. Anderson Associated Limited (RVA) which provided a comprehensive review of the Signature Ridge Pump Station’s configuration and the existing (in the 2011 timeframe) and future servicing areas. The RVA design report built on previous design flow verification analyses completed by CH2M Hill in March and June 2010. It is our understanding that Stantec used the RVA Preliminary Design as the basis for the SRPS upgrades that were undertaken in 2014. Further upgrades are proposed to accommodate future flows. The City’s ongoing flow monitoring program for the SRPS and associated infrastructure will ultimately confirm capacity for the Kanata Highlands.

4.3 Potential Future Sanitary Flows from West of Terry Fox Drive

A parcel of land on the west side of TFD (know municipally as 820 Huntmar Drive), across from the Highlands Phase 1 parcel, was previously identified as a candidate to be brought into the City’s Urban Boundary by way of an Ontario Municipal Board decision on Official Plan Amendment #76. The land was re-designated to ***Urban Expansion Study Area*** on Schedule B (Urban Policy Plan) of the City of Ottawa Official Plan (OP). The irregularly shaped parcel consists of 76.6 ha with a preliminary estimate of approximately 45 ha of developable area due to the presence of the Carp River floodplain (to be confirmed with the Conservation Authority). The site is located outside of the urban boundary as identified on Schedule A of the Official Plan with TFD being the divider.

4.4 Proposed Wastewater Servicing

The preferred sanitary servicing option for the Kanata Highlands is to construct a sanitary pump station on the Richcraft lands west of TFD, described in ***Section 4.3***. The pump station would service the subject Kanata Highlands property located on the east side of TFD and could also be designed to function as a future viable sanitary outlet for the Urban Expansion Study Area lands on the west side of TFD. The proposed pumping station would pump directly to outlet into the SRPS via a forcemain along TFD. The proposed sanitary servicing is depicted on ***Figure 4***.

4.5 Wastewater Servicing Conclusions

There are three options identified to service the Kanata Highlands: the Kanata Lakes Trunk, the Terry Fox Drive Collector Sewer and a new wastewater pump station on the west side of TFD. The preferred sanitary servicing option for the Kanata Highlands is to construct a sanitary pump station on the Richcraft Lands, west of TFD. The pumping station would pump directly to the SRPS via a forcemain along TFD. The City's ongoing flow monitoring program for the SRPS and associated infrastructure will ultimately confirm capacity for the Kanata Highlands.

The new sanitary pump station is preferred for the following reasons:

- Servicing all of the Kanata Highlands by gravity to the east through the KNL Lands would result in trunk sewers that are over 8.0 m deep on average (and significantly deeper in some areas). This depth of sewer would require an evaluation of the possibility of introducing high level sewers depending on the depth locations in relation to other relevant factors (e.g. width of ROW, subsurface conditions, etc);
- Lack of residual capacity in the existing TFD Collector Sewer to service all of the Kanata Highlands based on City of Ottawa peak design flow parameters; and
- Future flexibility is provided for the Richcraft Urban Expansion Study Area Lands on the west side of TFD as it will provide a viable sanitary outlet.

5.0 STORMWATER CONVEYANCE

5.1 Existing Conditions

The subject site falls within the study limits for the ***Carp River Watershed / Subwatershed Study.*** The Subwatershed Study sets out the existing flood lines, and the flood control requirements for all lands within the Subwatershed.

The Kanata Highlands development area drains in two directions, separated by a height of land in the north east portion of the site. As illustrated on ***Figure 5A*** and ***Figure 5B,*** the majority of the lands drain in a westerly direction towards the Carp River. The remaining lands in the north east portion of the site drain easterly towards the Goulbourn Forced Road ROW.

The existing site is comprised of treed areas and various pockets of rock outcrops.

5.2 Minor System

The Kanata Highlands will be serviced by a storm sewer system designed in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01).

The minor storm sewer system will be sized as follows:

- 2-year event for local streets;
- 5-year event for collector streets; and
- 10-year events for arterial roads

The storm sewers are sized using City of Ottawa IDF curves. Inlet control devices will be employed to ensure that storm flows entering the minor system are limited to the flows described above. A Hydraulic Grade Line (HGL) analysis will be completed and underside of footing elevations will be set at a minimum of 0.30 m above the HGL elevation during detailed design. The HGL must remain below the underside of building footing during the stress test event (100-year + 20%).

All storm flows will be treated for water quality, erosion, and quantity control as noted in the ***SWMP Manual.***

There are two storm servicing outlet options for Kanata Highlands. Option 1 and Option 2 are presented in ***Figure 5A*** and ***Figure 5B***, respectively. The description of the two options is as follows:

Option 1: New Stormwater Management (SWM) Facility

In this proposal, all of the Kanata Highlands are proposed to be serviced by a new SWM Facility on the west of Terry Fox Drive. Refer to the drainage areas and conceptual storm servicing for Option 1 on ***Figure 5A***.

Option 2: New Stormwater Management (SWM) Facility and Oil and Grit Separators

In this proposal, a portion of the Kanata Highlands are proposed to be serviced by a new SWM Facility on the west of Terry Fox Drive. A portion of the lands are proposed to be serviced by two oil and grit separators, located in the lands to the south. Refer to the ***Richardson Ridge Phase 4 Report*** for further details on the oil and grit separators. Refer to the drainage areas and conceptual storm servicing for Option 2 on ***Figure 5B***.

A summary of the relevant ***City Standards*** employed in the design of the proposed storm sewer system referred to as the minor system is presented in ***Table 10***:

Table 10: Storm Sewer Design Criteria

Design Parameter	Value
Minor System Design Return Period	2-Year (Local Streets), 5-Year (Collector Streets), 10-Year (Arterial Streets) – PIEDTB-2016-01
Major System Design Return Period	100-Year
Intensity Duration Frequency Curve (IDF) 5-year storm event. A = 998.071 B = 6.053 C = 0.814	$i = \frac{A}{(t_c + B)^C}$
Initial Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n'	0.013
Service Lateral Size	100 mm dia PVC SDR 28 with a minimum slope of 1.0%
Minimum Depth of Cover	2.0 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.8 m/s
Maximum Full Flowing Velocity	6.0 m/s
Clearance from 100-Year HGL to building opening	0.30 m
Extracted from Sections 5 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012	

5.3 Major System

Major system runoff in excess of the minor system and up to the 100-year event will be conveyed within the road allowances via a continuous overland flow route towards TFD. In accordance with City guidelines, the 100-year major flows at TFD will have to be captured and conveyed under TFD to avoid overland flows from crossing the collector roadway. The flows are then ultimately directed to the proposed SWM facility outside of the Carp River floodplain.

The major system is to be designed in accordance with the amendment to the storm sewer and stormwater management elements of the Ottawa Design Guidelines – Sewer (Technical Bulletin PIEDTB-2016-01).

- The maximum depth of flow on local and collector streets is 0.35 m during the 100-year event. The depth of flow may extend adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100 year + 20%). There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the nearest building envelope.
- Refer to ***Figure 5A*** and ***Figure 5B*** for a depiction of the major system flow design for the Kanata Highlands.

5.3.1 Water Quality Control

Water quality control targets for the proposed SWM facility were outlined by Doug Nuttall of the Mississippi Valley Conservation Authority (MVCA) via email correspondence (see ***Appendix C***). The targets are also discussed in Section 8.3.1.3 of the Subwatershed Study.

The recommended quality control objective for facilities discharging to the Carp River is a Level 2 (Normal Protection) control. This level of protection corresponds to a 70% total suspended solids (TSS) removal prior to discharging to the watercourse. The storage volumes required, based upon the chosen wet pond facility alternative, are dictated by Table 3.2 from the MOECC SWMP Design Manual.

As noted in the ***Richardson Ridge Phase 4 Report***, previous studies required Normal Protection (Level 2, 70% TSS removal). Due to the proximity to the Provincially Significant Wetland (PSW) south of Richardson Ridge, Enhanced Protection (Level 1, 80% TSS removal) will be provided by the oil and grit separators.

5.3.2 Water Quantity Control

Water quantity control targets of matching post-development flows to pre-development conditions (up to the 100-year event) were identified by Doug Nuttall in the correspondence previously referenced. This quantity target is also in accordance with the governing Subwatershed Study.

5.4 Stormwater Conveyance Conclusion

The storm sewers are to be designed per the City of Ottawa guidelines, including the amendment to the guidelines per Technical Bulletin PIEDTB-2016-01.

- There are two options for the storm sewer outlet: either the entire Kanata Highlands property is serviced by a new SWM facility on the west side of Terry Fox Drive or the storm servicing is split between a new SWM facility on the west side of Terry Fox Drive and two oil and grit separators located on the property to the south (Richardson Ridge, Phase 4);
- The storm flows will be treated for quality control, quantity control and erosion protection;
- The proposed SWM facility will be designed to provide quality control treatment to achieve a Normal Level of Protection (70% TSS removal per MOECC guidelines);
- The oil and grit separators have been designed to provide quality control treatment to achieve an Enhanced Level or Protection (80% TSS removal per MOECC guidelines) due to the proximity to the PSW, south of Richardson Ridge.
- A Hydraulic Grade Line (HGL) analysis will be completed and underside of footing elevations will be set at a minimum of 0.30 m above the 100-Year HGL elevation during detailed design. The HGL must remain below the underside of building footing during the stress test event (100-year + 20%).

6.0 SITE GRADING

6.1 Master Grading

The Kanata Highlands site is constrained by the existing topography to the north and east, future development to the south and Terry Fox Drive to the west.

Based upon the ***Geotechnical Investigation*** undertaken, the site is subject to a grade raise restriction of 1.5 m in areas where the underside of footings will be founded on existing silty clay deposits. The servicing and grading has been designed to minimize grade raises in these areas along with maintaining an appropriate balance between cut and fill for the subdivision.

There are two grading options, corresponding to the two storm servicing options. Grading Plan – Option 1 corresponds to the storm servicing design where all of Kanata Highlands is serviced by a new SWM facility, west of Terry Fox Drive. Grading Plan – Option 1 is presented on ***Figure 6A***. Grading Plan – Option 2 corresponds to the storm servicing design where the Kanata Highlands servicing is split between a new SWM Facility west of Terry Fox Drive and two oil and grit separators located on the property to the south. Grading Plan – Option 2 is presented on ***Figure 6B***.

The final grading plans will be forwarded to the geotechnical consultant for review and recommendations (especially in areas where grade raises may be of concern) at the detailed design stage. Final signoff for the Kanata Highlands detailed grading plans will be provided by the Geotechnical Engineer.

6.2 Grading Criteria

The following grading criteria and guidelines will be applied at the time of detailed design as per City of Ottawa Guidelines:

- Maximum slope in grassed areas between 2% and 5%;
- Grades in excess of 7% require terracing to a maximum of a 3:1 slope;
- Driveway grades between 2% and 6%;
- Drainage ditches and swales should have a minimum slope of 1.5%;
- Perforated pipe is required for swales less than 1.5% in slope;
- Swales are to be 0.15 m deep with 3:1 side slopes unless otherwise indicated on the drawings;

7.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosions losses is exaggerated during construction where the vegetation has been removed and the top layer of soil is disturbed.

Erosion and sediment controls will be implemented during construction. The following recommendations to the contractor will be included in contract documents.

- Limit extent of exposed soils at any given time;
- Re-vegetate exposed areas as soon as possible;
- Minimize the area to be cleared and grubbed;
- Protect exposed slopes with plastic or synthetic mulches;

- Install silt fence to prevent sediment from entering existing ditches;
- No refueling or cleaning of equipment near existing watercourses;
- Provide sediment traps and basins during dewatering;
- Install filter cloth between catch basins and frames;
- Installation of mud mats at construction accesses; and
- Plan construction at proper time to avoid flooding.

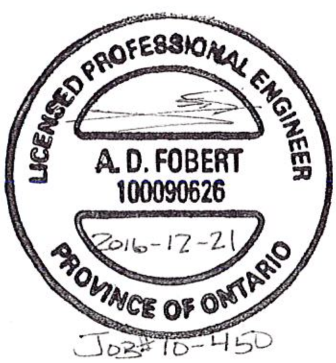
8.0 CONCLUSIONS AND RECOMMENDATIONS

The overall design summary for the Kanata Highlands development is as follows:

- The City of Ottawa has been pre-consulted regarding this application. Approvals will be required from the City of Ottawa, MOECC and MVCA.
- The proposed development is within the City's water distribution Pressure Zone 3W. Water servicing is to be provided through connections to the neighbouring property to the south. An existing 300 mm and proposed 150 mm watermain within Terry Fox Drive will provide a redundant water connection to both developments. Modeling results indicate adequate fire flow and supply is available per the demands established with the City of Ottawa. Based on the modeling results, pressure reducing valves may be required and should be confirmed at the time of construction. Boundary conditions from the servicing report for the south property were used in the analysis and pressures found in this report are to be verified once updated boundary conditions are provided. The proposed water supply design conforms to all relevant City of Ottawa Guidelines and Policies.
- Sanitary sewers are designed as per the City of Ottawa guidelines. There are three proposed sanitary options considered, with the preferred option being construction of a new sanitary pumping station to be located west of Terry Fox Drive. The sanitary pumping station flows will discharge to the Signature Ridge Pump Station via a proposed sanitary forcemain. This proposed servicing concept provides a viable servicing outlet for the Urban Expansion Study Area lands on the west side of TFD.
- Storm sewers are designed as per the City of Ottawa guidelines, including the amendment to the guidelines per Technical Bulletin PIEDTB-2016-01. Storm sewers will outlet to one of two storm servicing options. It is recommended that the Kanata Highlands outlet to a new SWM Facility west of TFD, outside the Carp River floodplain. The second option has the Kanata Highlands servicing split between a new SWM Facility west of TFD and two oil and grit separators located on the lands to the south (Richardson Ridge, Phase 4).

- The new SWM Facility will be designed to achieve the quality control target of 70% TSS removal (Normal Level of Protection) as well as controlling post-development flows to pre-development conditions. The oil and grit separators to the south are designed to achieve the quality control target of 80% TSS removal (Enhanced Level of Protection) due to the proximity to a PSW.
- A Hydraulic Grade Line (HGL) analysis will be completed and underside of footing elevations will be set at a minimum of 0.30 m above the 100-Year HGL elevation during detailed design. The HGL must remain below the underside of building footing during the stress test event (100-year + 20%).
- Servicing and grading has been designed as low as possible as the site is subject to a grade raise restriction of 1.5 m. The grading will be reviewed by the geotechnical engineer at the time of detailed design and provide recommendations.
- Erosion and sediment control measures will be implemented and maintained throughout construction. The Carp River will be protected from any negative impacts from construction.
- The design has been completed in general conformance with the City of Ottawa Design Guidelines and criteria presented in other background study documents.

Prepared by,
David Schaeffer Engineering Ltd.

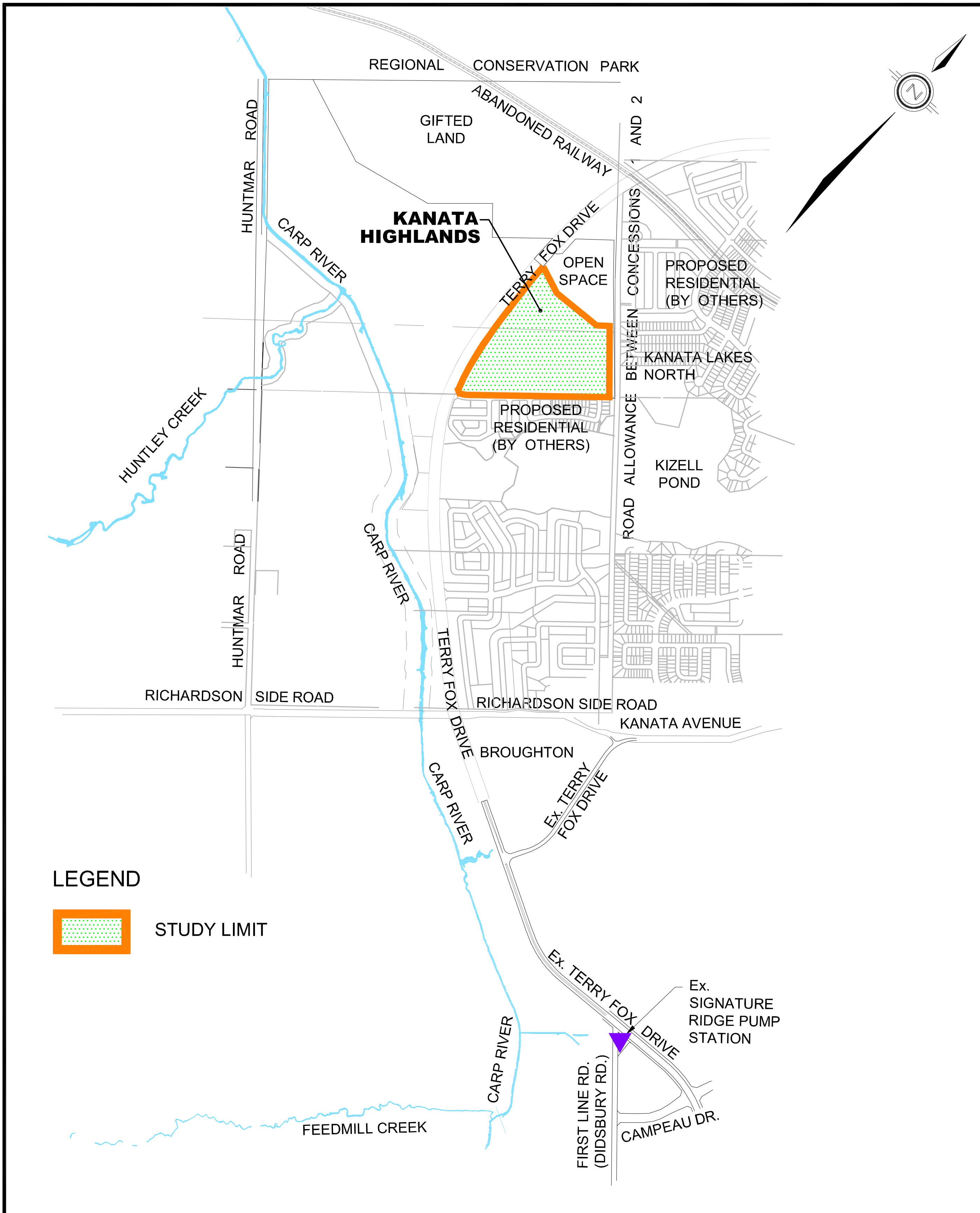


Per: Adam Fobert, P.Eng

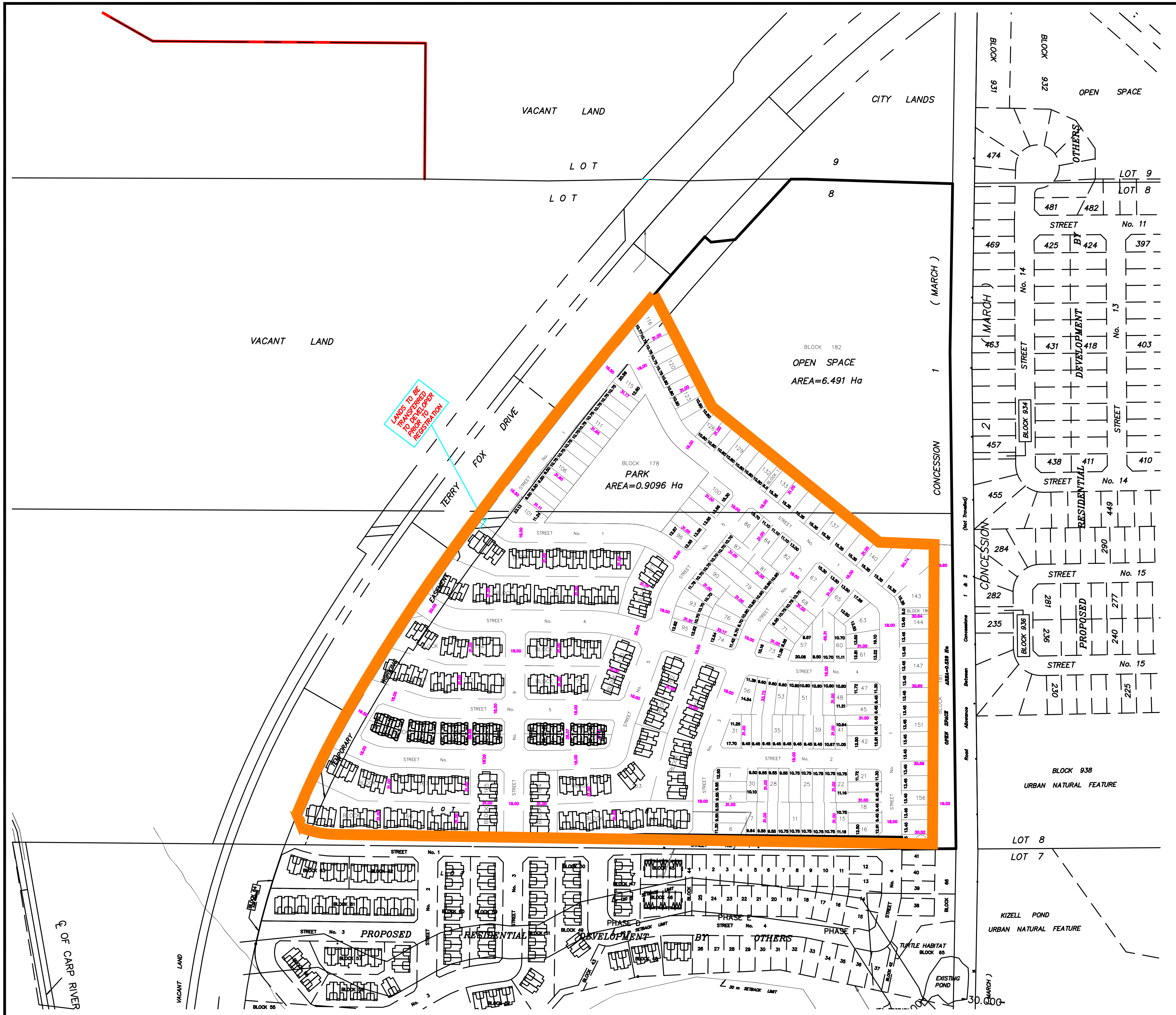
Prepared by,
David Schaeffer Engineering Ltd.

Per: Jennifer Ailey, P.Eng.

G:\Projects\10-450 Richcraft - Kanata Highlands\B_Design\B3_Reports\B3-2_Servicing (DSEL)\Functional Servicing Report\2016-12-20_450_Kanata-Highlands_FSR_DRAFT_ja.doc



KANATA HIGHLANDS	LOCATION PLAN	SCALE: 1:20000
DSEL david schaeffer engineering ltd	120 Iber Road, Unit 103 Stittsville, ON K2S 1E9 Tel. (613) 836-0856 Fax. (613) 836-7183 www.DSEL.ca	DATE: DECEMBER 2016 PROJECT No.: 10-450 FIGURE: 1



CONCEPT PLAN PREPARED BY ANNIS, O'SULLIVAN, VOLLEBEKK, LTD. DATED DECEMBER 09, 2016.

LEGEND

STUDY LIMIT

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david schaeffer engineering ltd
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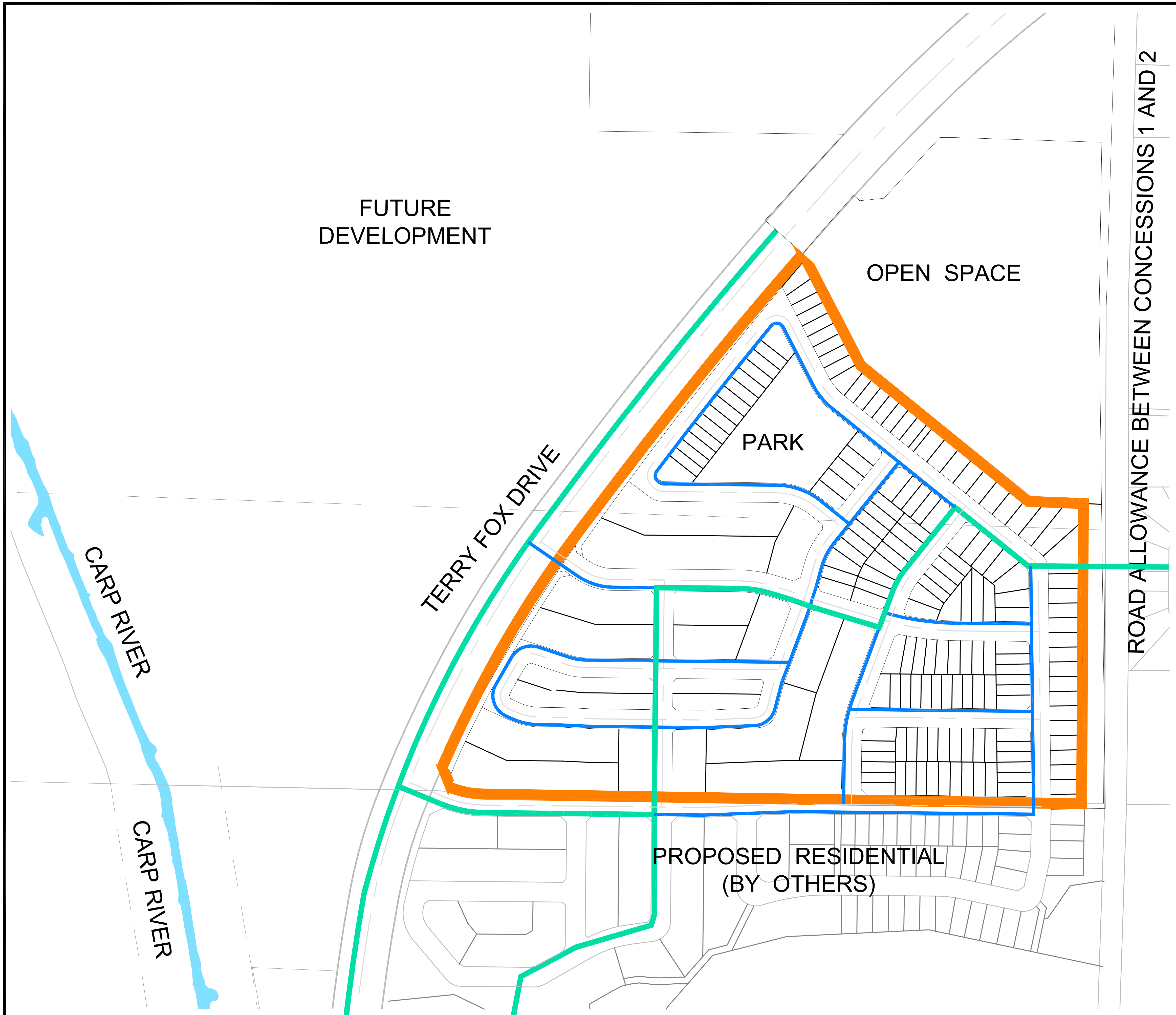
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

KANATA HIGHLANDS

CONCEPT PLAN

DRAWN BY:	DATE: DEC. 2016	CHECKED BY:
SCALE: 1:3500	PROJECT No. 10-450	FIGURE: 2



PROPOSED WATERMAIN SIZING OBTAINED FROM "PRESSURE ZONE 3W-KANATA NORTH POTABLE WATER PLANNING STUDY" PREPARED BY STANTEC CONSULTING LTD. ,DATED NOVEMBER 2007.

LEGEND

- LOCAL WATERMAIN
- 300Ø WATERMAIN
- STUDY LIMIT

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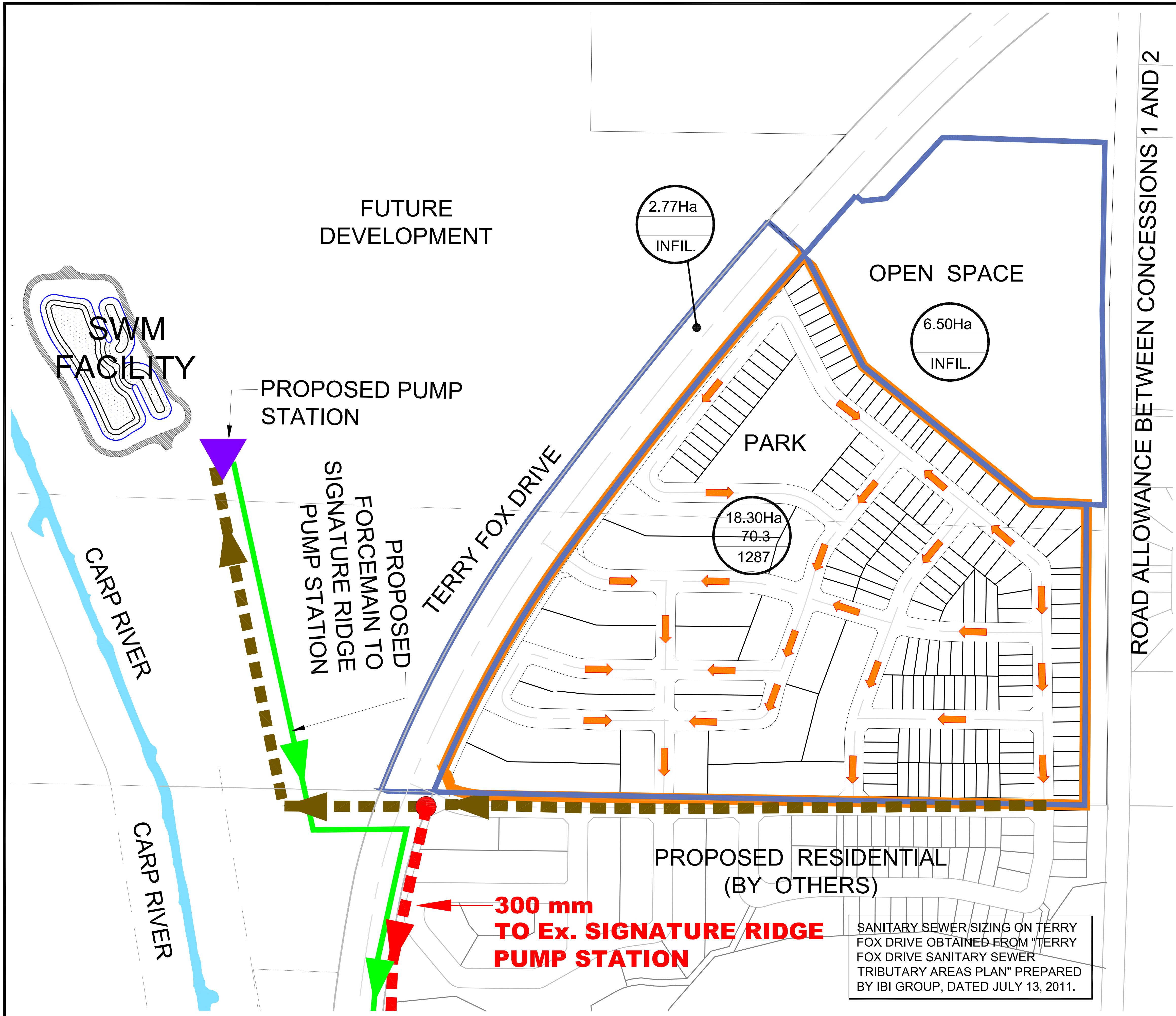
KANATA HIGHLANDS

CONCEPTUAL WATER DISTRIBUTION

DRAWN BY:	DATE: DEC. 2016	CHECKED BY:
SCALE: 1:3500	PROJECT No. 10-450	FIGURE: 3



UNIT TYPE	UNITS	P/UNITS	POPULATION
SINGLES	159	3.4	541
TOWNHOUSES	224	2.7	605
BACK TO BACKS	52	2.7	141
TOTAL	435		1287

LEGEND

- PROPOSED SANITARY FORCEMAIN
- PROPOSED SANITARY TRUNK
- PROPOSED SANITARY TRUNK (BY OTHERS)
- SANITARY SYSTEM FLOW DIRECTION
- SANITARY DRAINAGE AREA
- STUDY LIMIT
- PROPOSED SANITARY PUMP STATION
- 18.30Ha / 70.3 / 1287 — DRAINAGE AREA / AVERAGE DENSITY (PERSON/NET Ha) / POPULATION

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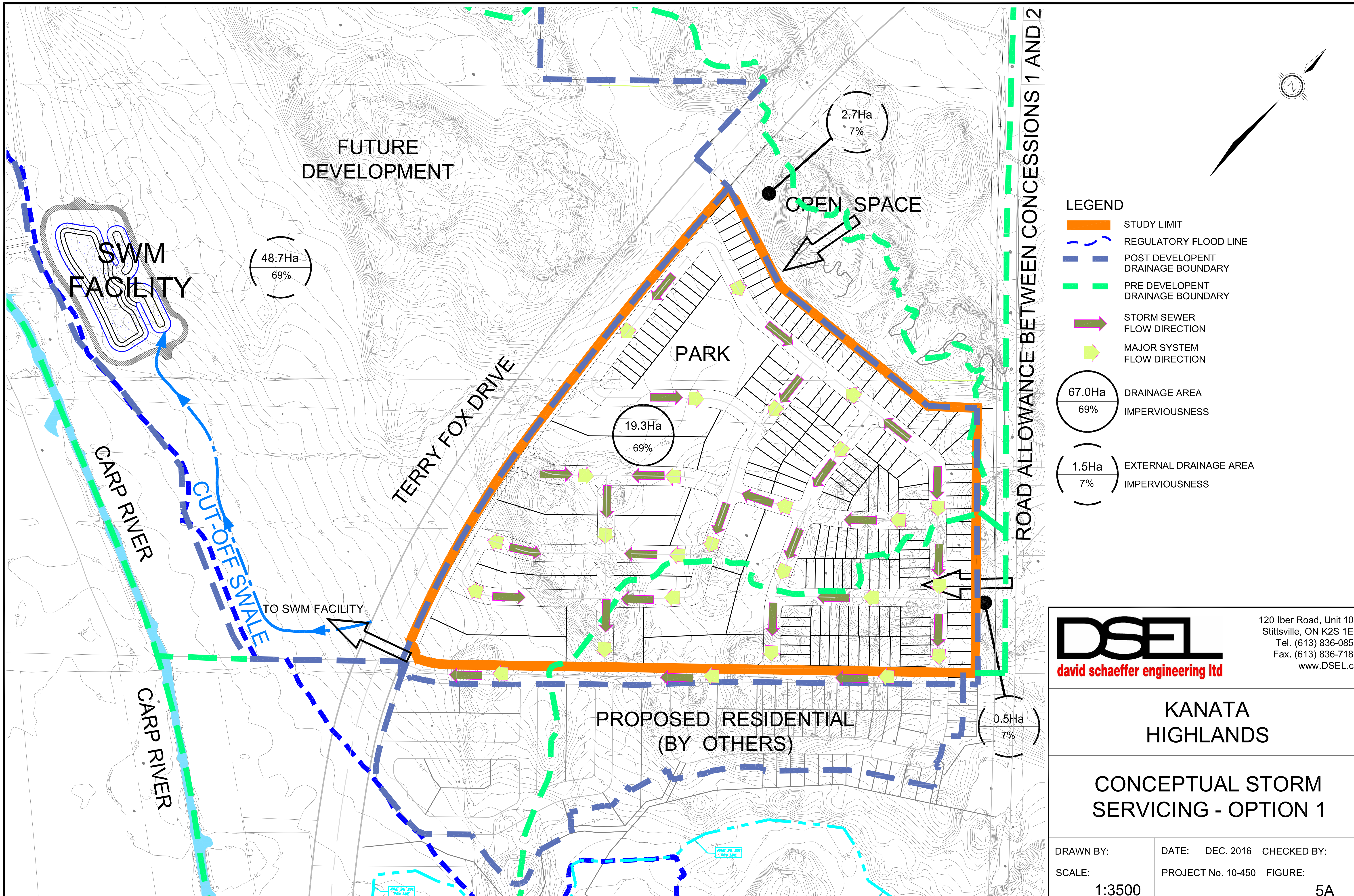
KANATA HIGHLANDS

CONCEPTUAL SANITARY SERVICING

DRAWN BY:	DATE: DEC. 2016	CHECKED BY:
SCALE: 1:3500	PROJECT No. 10-450	FIGURE: 4



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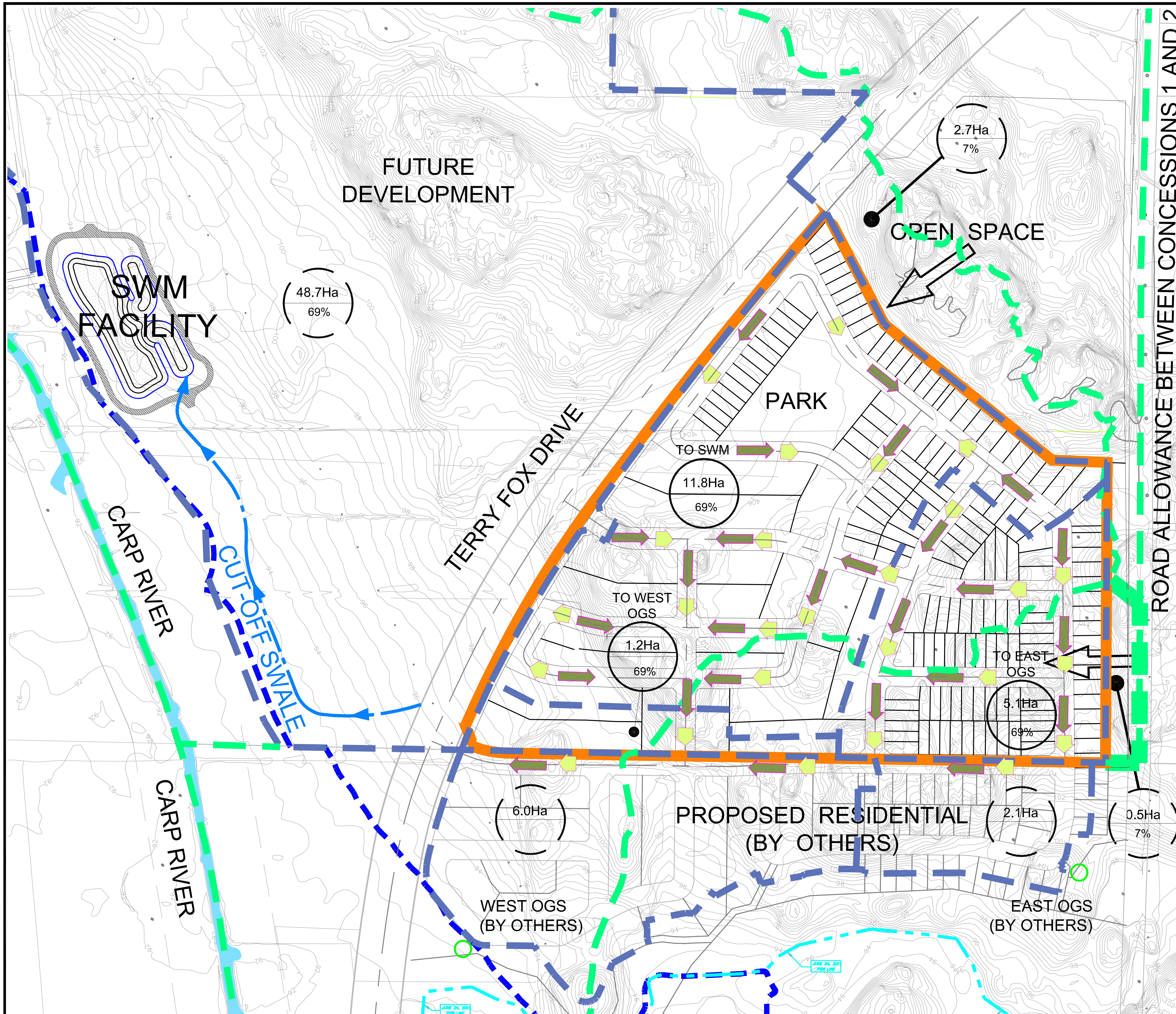
KANATA HIGHLANDS

CONCEPTUAL STORM SERVICING - OPTION 1

DRAWN BY:	DATE: DEC. 2016	CHECKED BY:
SCALE: 1:3500	PROJECT No. 10-450	FIGURE: 5A



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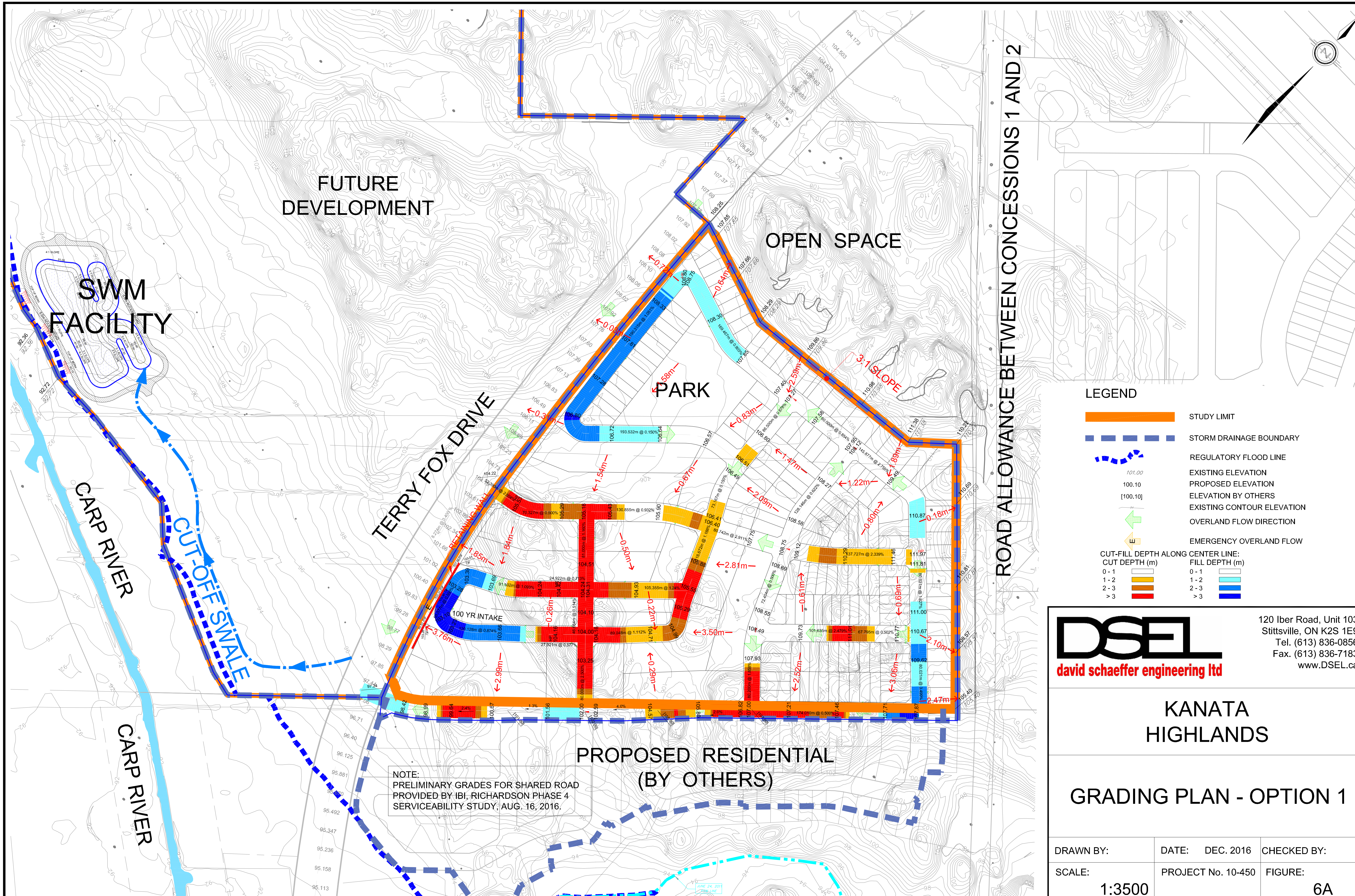
KANATA HIGHLANDS

CONCEPTUAL STORM SERVICING - OPTION 2

DRAWN BY:	DATE: DEC. 2016	CHECKED BY:
SCALE: 1:3500	PROJECT No. 10-450	FIGURE: 5B


FUTURE DEVELOPMENT
OPEN SPACE
SWM FACILITY
PARK
TERRY FOX DRIVE
CARP RIVER
CUT-OFF SWALE
CARP RIVER
RETAINING WALL
3:1 SLOPE
100 YR INTAKE
ROAD ALLOWANCE BETWEEN CONCESSIONS 1 AND 2
PROPOSED RESIDENTIAL (BY OTHERS)
NOTE:
PRELIMINARY GRADES FOR SHARED ROAD PROVIDED BY IBI, RICHARDSON PHASE 4 SERVICEABILITY STUDY, AUG. 16, 2016.
LEGEND
STUDY LIMIT
STORM DRAINAGE BOUNDARY
REGULATORY FLOOD LINE
101.00 EXISTING ELEVATION
100.10 PROPOSED ELEVATION
[100.10] ELEVATION BY OTHERS
EXISTING CONTOUR ELEVATION
OVERLAND FLOW DIRECTION
EMERGENCY OVERLAND FLOW
CUT-FILL DEPTH ALONG CENTER LINE:
CUT DEPTH (m)
FILL DEPTH (m)
0 - 1
1 - 2
2 - 3
> 3
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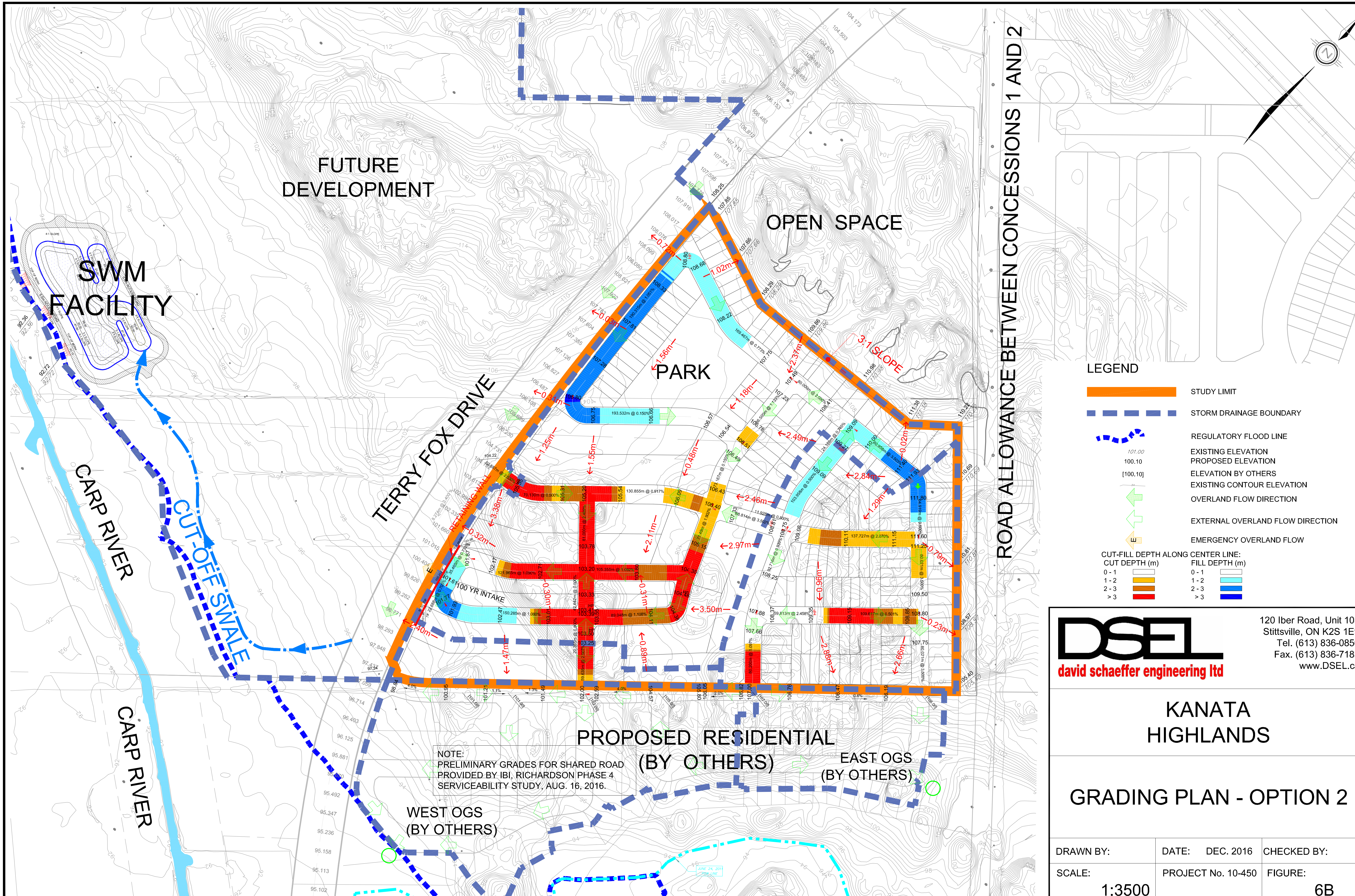
KANATA HIGHLANDS
GRADING PLAN - OPTION 1
DRAWN BY:
DATE: DEC. 2016
CHECKED BY:
SCALE: 1:3500
PROJECT No. 10-450
FIGURE: 6A



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KANATA HIGHLANDS

GRADING PLAN - OPTION 2

DRAWN BY:	DATE: DEC. 2016	CHECKED BY:
SCALE: 1:3500	PROJECT No. 10-450	FIGURE: 6B

APPENDIX A

WATER SUPPLY

Project Title

RICHARDSON RIDGE PHASE 4 SERVICEABILITY STUDY

Drawing Title

CONCEPTUAL SERVICING PLAN

Sheet No.

110

2016-08-16

BOUNDARY CONDITIONS EXTRACTED FROM RICHARDSON RIDGE SERVICEABILITY REPORT BY IBI GROUP (AUGUST 2016)

Boundary Conditions at Richardson Ridge.

Information Provided:

Date provided: 20 May 2016

For Residential and School	
Criteria	**Demand (L/s)**
Average Demand	2.56
Maximum Daily Demand	6.39
Peak Hourly Demand	14.07
Fire Flow Demand	250, 184
Maximum Daily + Fire Flow Demand	256.39, 190.39

Location:

BOUNDARY CONDITIONS EXTRACTED FROM RICHARDSON RIDGE SERVICEABILITY REPORT BY IBI GROUP (AUGUST 2016)

Results:

Connection-1:

Criteria	Head (m)	Pressure (psi)
Max HGL	162.2	94.2
PKHR	155.2	84.3
MXDY + Fire Flow (250 L/s)	135.4	56.0
MXDY + Fire Flow (184 L/s)	143.9	68.2

Note: The client requested BCs at two connections. Generally, the City does not provide boundary conditions beyond the existing watermain network. In this case, BC is provided for only one connection as there is no available information for the second connection.

Considerations:

1. According to the City of Ottawa Water Design Guidelines as well as the Ontario Building Code, the maximum pressure at any point within a distribution system shall not exceed 80 psi in occupied areas. In scenario-2, measures should be taken to try to reduce the residual pressure below 80 psi without the use of special pressure control equipment. In circumstances where the residual pressure cannot be reduced below 80 psi without the use of pressure control equipment, a pressure reducing valve (**PRV**) should be installed at site.
2. The site will not be permitted to develop more than 49 units until getting the second connection which will supply to the development as per Section 4.3.1 of the City's water design guidelines. The proponent must need to wait until availability of this second feed.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Steve Merrick

To: Robert Freel
Subject: RE: Kanata Highlands - Boundary Condition Request

From: Alison Gosling
Sent: December 16, 2016 10:18 AM
To: Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>
Cc: Robert Freel <RFreel@dsel.ca>
Subject: Kanata Highlands - Boundary Condition Request

Good morning Santhosh,

We would like to request water boundary conditions for Kanata Highlands – Phase 1 development using the following proposed development demands:

1. Location of Service / Street Number: 457 Terry Fox Drive

2. Type of development and the amount of fire flow required for the proposed development:

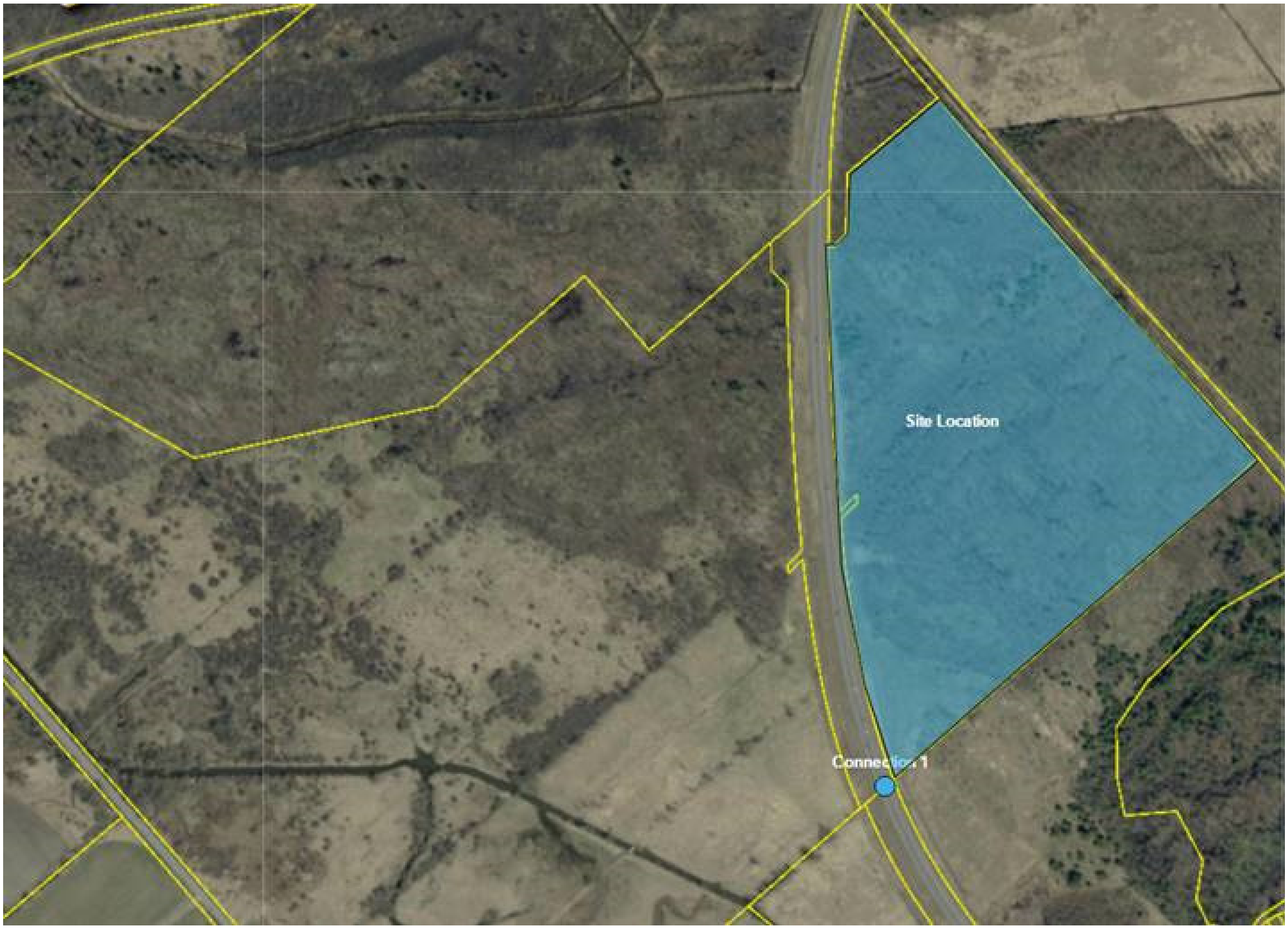
- The proposed Phased development is residential. Phase 1 proposes 159 Single homes and 276 townhomes/back-to-back units.
- It is anticipated that the development will have a connection from the existing 300 mm diameter watermain within Terry Fox Drive, as shown by the attached map.
- It is anticipated that a fire flow of 12,000 L/min will be required. In addition, we would also request the available fire flow at 140 kPa (20 psi).

3.

	L/min	L/s
Avg. Daily	330.5	5.51
Max Day	808.6	13.48
Peak Hour	1768.2	29.47

We understand that there is a development to the south of the subject site. Can you inquire with the modeling group to confirm if the boundary conditions will anticipate these demands?

It you have any questions please feel free to contact me.



Thanks,

Alison Gosling, E.I.T.
Project Coordinator / Junior Designer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext.542
fax: (613) 836-7183
email: agosling@DSEL.ca

Richcraft
Kanata Highlands Development
Proposed Site Conditions

Water Demand Design Flows per Unit Count
City of Ottawa - Water Distribution Guidelines, July 2010

DSEL

Domestic Demand

Type of Housing	Per / Unit	Units	Pop
Single Family	3.4	159	541
Semi-detached	2.7		0
Townhouse / Back-to-Back	2.7	276	746
Apartment			0
Bachelor	1.4		0
1 Bedroom	1.4		0
2 Bedroom	2.1		0
3 Bedroom	3.1		0
Average	1.8		0

	Pop	Avg. Daily		Max Day		Peak Hour	
		m^3/d	L/min	m^3/d	L/min	m^3/d	L/min
Total Domestic Demand	1287	450.5	312.8	1126.1	782.0	2477.5	1720.5

Institutional / Commercial / Industrial Demand

Property Type	Unit Rate		Units	Avg. Daily m^3/d	Avg. Daily L/min	Max Day m^3/d	Max Day L/min	Peak Hour m^3/d	Peak Hour L/min
Park	28,000.0	L/ha/d	0.9096	25.47	17.7	38.2	26.5	68.8	47.8
Office	75	L/9.3m^2/d		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Light	35,000	L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
Industrial - Heavy	55,000	L/gross ha/d		0.00	0.0	0.0	0.0	0.0	0.0
Total I/CI Demand Subject Site				25.5	17.7	38.2	26.5	68.8	47.8
Total Demand Subject Site				**475.9**	**330.5**	**1164.3**	**808.6**	**2546.2**	**1768.2**
Total Demand from Richardson Ridge Serviceability Report				239.3	166.1	598.3	415.2	1316.3	913.5
Total Demand Subject Site + Richardson Ridge				**715.2**	**496.6**	**1762.6**	**1223.8**	**3862.5**	**2681.7**

Fire Flow Estimation per Fire Underwriters Survey

Water Supply For Public Fire Protection - 1999

Fire Flow Required

1. Base Requirement

$F = 220C\sqrt{A}$ L/min *Where **F** is the fire flow, **C** is the Type of construction and **A** is the Total floor area*

Type of Construction: Wood Frame

C	1.5		*Type of Construction Coefficient per FUS Part II, Section 1*
A	589.0	m^2	*Total floor area based on FUS Part II section 1*

Fire Flow	8008.9	L/min	
	8000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Adjustments

2. Reduction for Occupancy Type

Limited Combustible	-15%
Fire Flow	**6800.0 L/min**

3. Reduction for Sprinkler Protection

Non-Sprinklered	0%
Reduction	**0 L/min**

4. Increase for Separation Distance

N	3.1m-10m	20%	
S	10.1m-20m	15%	
E	10.1m-20m	15%	
W	3.1m-10m	20%	
	% Increase	**70%**	*value not to exceed 75% per FUS Part II, Section 4*

Increase	**4760.0 L/min**

Total Fire Flow

Fire Flow	11560.0	L/min	*fire flow not to exceed 45,000 L/min nor be less than 2,000 L/min per FUS Section*
	12000.0	**L/min**	*rounded to the nearest 1,000 L/min*

Notes:
-Fire Underwriter Survey Calculates from Previously approved applications with applicant, fire flow to be confirmed when construction materials confirmed
-Calculations based on Fire Underwriters Survey - Part II

Minor Loss Coefficients

Fitting	Loss Coefficient
Globe valve, fully open	10
Angle Valve, fully open	5
Swing check valve, fully open	2.5
Gate valve, fully open	0.2
Short-radius elbow	0.9
Medium-radius elbow	0.8
Long-radius elbow	0.6
45 degree elbow	0.4
Closed return bend	2.2
Standard tee-flow through run	0.6
Standard tee- flow through branch	1.8
Square entrance	0.5
Exit	1

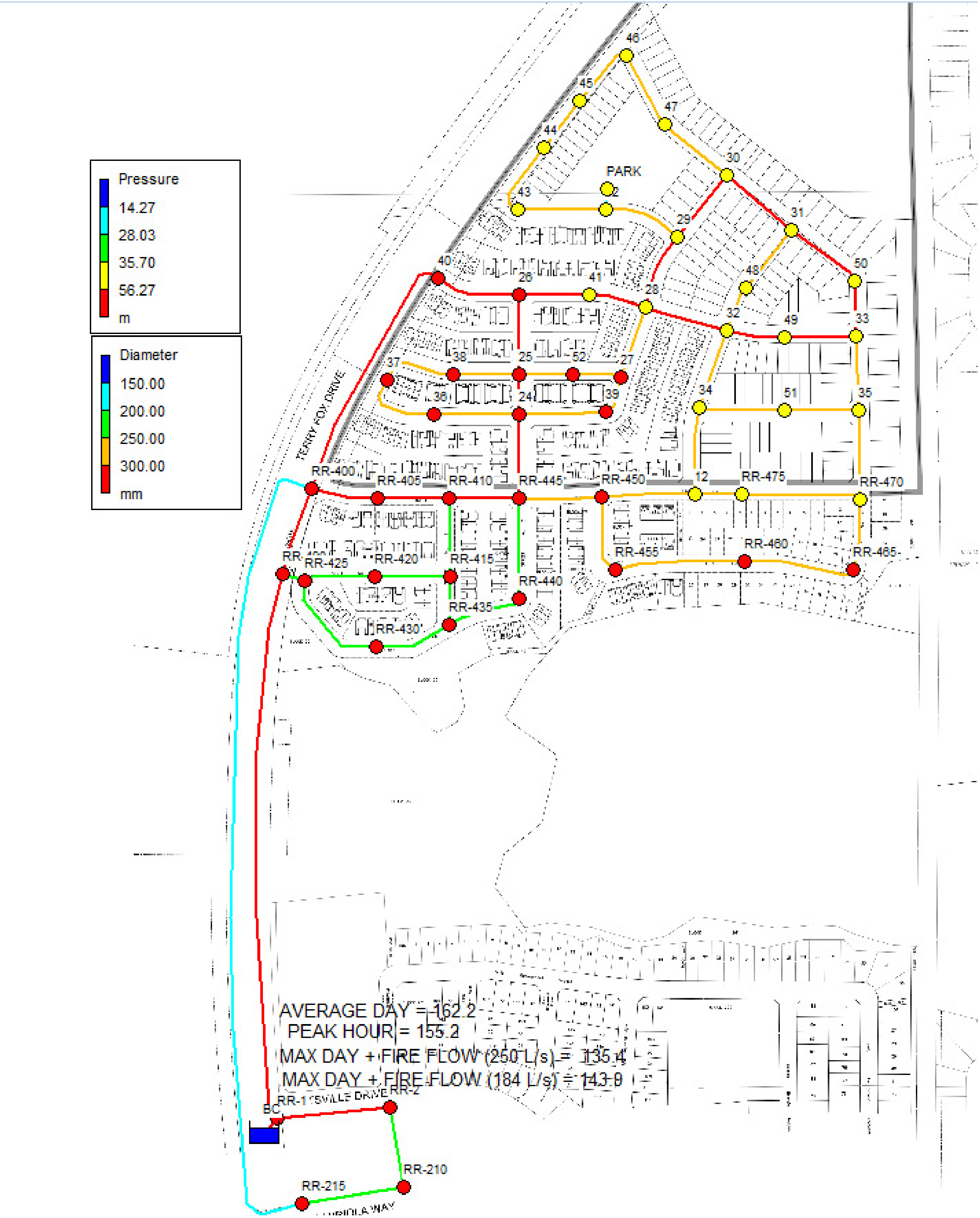
Pipe Diameter vs. "C"

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
Over 600	130

Node Pressures

Kpa	Pressure (Kpa)	Pressure (mm H_2O)
Max	552	56.3
Rec Max	480	49.0
Rec Min	350	35.7
Min	275	28.1

AVERAGE DAY SCHEMATIC



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******************************************************************
*                         E P A N E T                            *
*                 Hydraulic and Water Quality                    *
*                 Analysis for Pipe Networks                     *
*                        Version 2.0                             *
******************************************************************
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Input File: 2016-12-20_450_bnc.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	BC	RR-1	1	300
2	RR-1	RR-2	114.88	300
3	RR-2	RR-210	81.97	200
4	RR-210	RR-215	105.32	200
5	RR-1	RR-490	561.43	300
7	RR-490	RR-400	92.17	300
8	RR-400	RR-405	68.18	300
9	RR-405	RR-410	73.92	300
10	RR-410	RR-445	72.60	300
11	RR-445	RR-450	84.29	250
12	RR-450	12	95	250
13	12	RR-475	46.21	250
14	RR-475	RR-470	121.42	250
15	RR-470	RR-465	73.97	250
16	RR-465	RR-460	110	250
17	RR-460	RR-455	132.50	250
18	RR-455	RR-450	81.05	250
19	RR-410	RR-415	79.45	200
20	RR-445	RR-440	100.62	200
21	RR-490	RR-425	24.48	200
22	RR-425	RR-420	72.52	200
23	RR-420	RR-415	75.79	200
24	RR-425	RR-430	115.88	200
25	RR-430	RR-435	81.26	200
26	RR-415	RR-435	49.17	200
27	RR-435	RR-440	79.33	200
28	RR-445	24	85.82	300
29	24	25	40.68	300
30	25	26	82	300
35	27	28	76.12	250
36	28	29	79.64	300
37	29	30	80.50	300

39	28	32	65.29	300
40	30	31	86.0	300
42	33	35	74.02	250
43	12	34	89.32	250
44	34	32	82.83	250

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
48	35	RR-470	90.12	250
49	24	36	87.70	250
50	36	37	82.70	250
51	37	38	79.49	250
52	38	25	67.65	250
53	RR-215	RR-400	837.7	200
54	24	39	88.67	250
55	39	27	39.75	250
56	40	26	88.0	300
57	26	41	71.67	300
58	41	28	58.62	300
59	29	42	81.42	250
60	42	43	90.0	250
61	43	44	79.43	250
62	44	45	60.44	250
63	45	46	70.20	250
64	46	47	80.83	250
65	47	30	81.44	250
66	32	48	48.58	250
67	48	31	78.20	250
68	32	49	59.77	300
69	49	33	73.03	300
70	31	50	84.31	300
71	50	33	58.64	300
72	34	51	86.43	250
73	51	35	75.73	250
74	25	52	55.30	250
75	52	27	48.40	250
76	PARK	42	8	150
6	40	RR-400	264.90	300

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality

RR-2	0.10	162.20	63.70	0.00
RR-1	0.10	162.20	66.20	0.00
RR-210	0.15	162.20	63.95	0.00
RR-215	0.13	162.19	65.29	0.00
RR-490	0.00	162.17	64.97	0.00
RR-400	0.04	162.17	64.67	0.00
RR-405	0.09	162.17	60.67	0.00
RR-410	0.10	162.17	61.17	0.00
RR-445	0.09	162.17	60.17	0.00
RR-450	0.15	162.17	57.17	0.00
12	0.00	162.17	56.17	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
RR-475	0.12	162.17	55.17	0.00
RR-470	0.10	162.17	56.17	0.00
RR-465	0.14	162.17	58.17	0.00
RR-460	0.21	162.17	57.17	0.00
RR-455	0.32	162.17	56.67	0.00
RR-425	0.12	162.17	64.97	0.00
RR-420	0.18	162.17	62.97	0.00
RR-415	0.22	162.17	62.32	0.00
RR-430	0.10	162.17	64.92	0.00
RR-435	0.07	162.17	64.67	0.00
RR-440	0.24	162.17	63.42	0.00
24	0.18	162.17	58.17	0.00
25	0.18	162.17	57.86	0.00
26	0.18	162.17	56.99	0.00
27	0.18	162.17	56.62	0.00
28	0.18	162.17	55.77	0.00
29	0.18	162.17	55.66	0.00
30	0.18	162.17	54.90	0.00
31	0.18	162.17	54.22	0.00
32	0.18	162.17	53.42	0.00
33	0.18	162.17	50.20	0.00
34	0.18	162.17	53.68	0.00
35	0.18	162.17	51.50	0.00
36	0.18	162.17	58.51	0.00
37	0.18	162.17	58.89	0.00
38	0.18	162.17	58.48	0.00
39	0.18	162.17	57.18	0.00
40	0.18	162.17	56.64	0.00
41	0.18	162.17	56.27	0.00
42	0.18	162.17	55.53	0.00

43	0.18	162.17	55.37	0.00	
44	0.18	162.17	54.89	0.00	
45	0.18	162.17	54.36	0.00	
46	0.18	162.17	53.37	0.00	
47	0.18	162.17	54.32	0.00	
48	0.18	162.17	53.90	0.00	
49	0.18	162.17	51.88	0.00	
50	0.18	162.17	51.30	0.00	
51	0.18	162.17	51.16	0.00	
52	0.18	162.17	57.24	0.00	
PARK	0.30	162.17	55.53	0.00	
BC	-8.28	162.20	0.00	0.00	Reservoir

Page 4

Link Results:

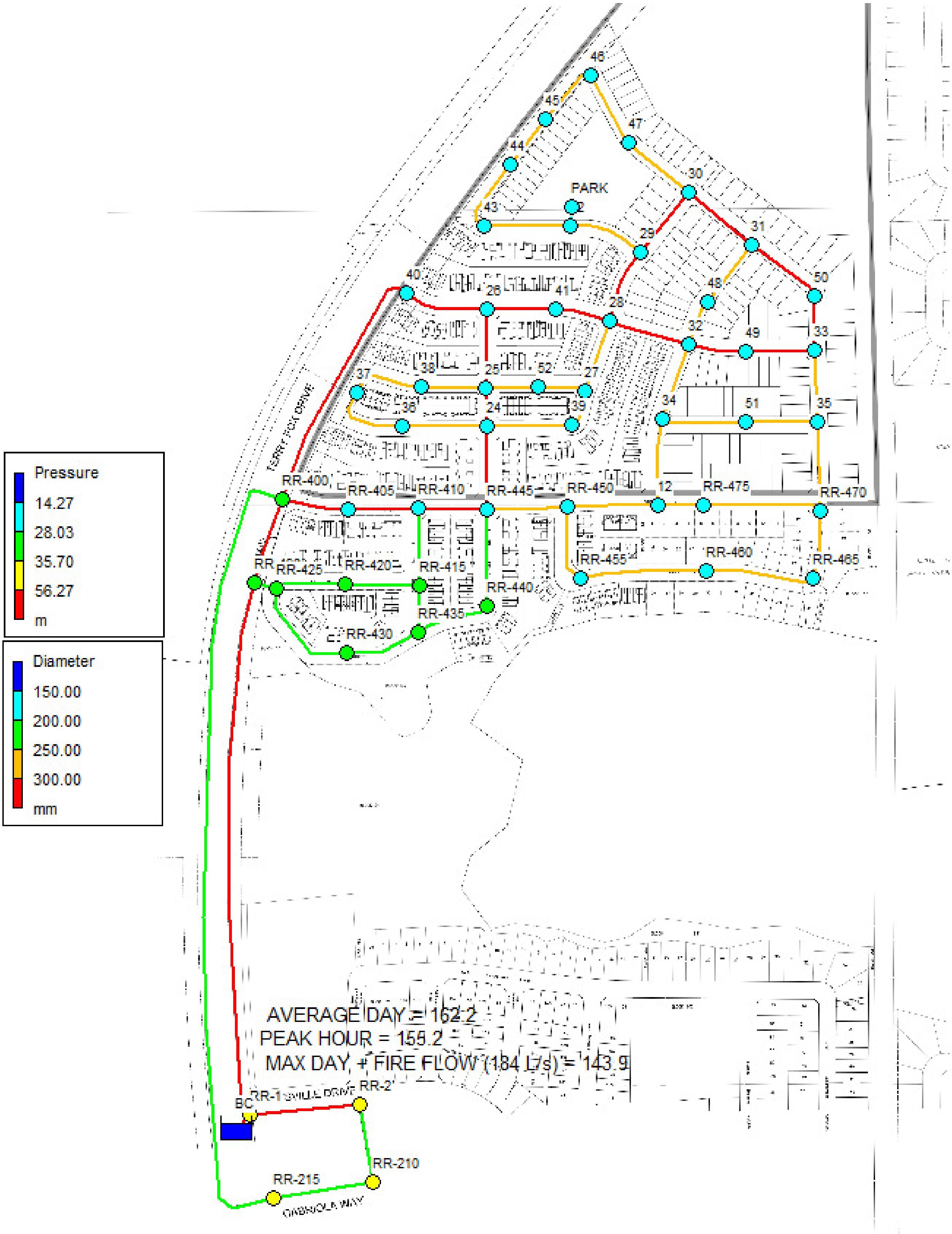
Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	8.28	0.12	0.48	Open
2	1.85	0.03	0.01	Open
3	1.75	0.06	0.04	Open
4	1.60	0.05	0.03	Open
5	6.34	0.09	0.05	Open
7	4.26	0.06	0.02	Open
8	3.01	0.04	0.01	Open
9	2.92	0.04	0.01	Open
10	3.35	0.05	0.02	Open
11	1.76	0.04	0.01	Open
12	0.84	0.02	0.00	Open
13	0.41	0.01	0.00	Open
14	0.29	0.01	0.00	Open
15	-0.09	0.00	0.00	Open
16	-0.23	0.00	0.00	Open
17	-0.44	0.01	0.00	Open
18	-0.76	0.02	0.00	Open
19	-0.52	0.02	0.00	Open
20	-0.63	0.02	0.01	Open
21	2.08	0.07	0.07	Open
22	1.06	0.03	0.02	Open
23	0.88	0.03	0.01	Open
24	0.90	0.03	0.01	Open
25	0.80	0.03	0.01	Open
26	0.14	0.00	0.00	Open
27	0.87	0.03	0.01	Open
28	2.13	0.03	0.01	Open
29	0.83	0.01	0.00	Open

30	-0.39	0.01	0.00	Open
35	1.08	0.02	0.01	Open
36	1.38	0.02	0.00	Open
37	0.44	0.01	0.00	Open
39	1.26	0.02	0.00	Open
40	-0.35	0.01	0.00	Open
42	-0.20	0.00	0.00	Open
43	0.43	0.01	0.00	Open
44	-0.02	0.00	0.00	Open
48	-0.28	0.01	0.00	Open
49	0.33	0.01	0.00	Open
50	0.15	0.00	0.00	Open
51	-0.03	0.00	0.00	Open
52	-0.21	0.00	0.00	Open
53	1.47	0.05	0.03	Open
54	0.79	0.02	0.00	Open
55	0.61	0.01	0.00	Open
56	2.49	0.04	0.01	Open
57	1.92	0.03	0.01	Open

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
58	1.74	0.02	0.00	Open
59	0.76	0.02	0.00	Open
60	0.28	0.01	0.00	Open
61	0.10	0.00	0.00	Open
62	-0.08	0.00	0.00	Open
63	-0.26	0.01	0.00	Open
64	-0.44	0.01	0.00	Open
65	-0.62	0.01	0.00	Open
66	0.47	0.01	0.00	Open
67	0.29	0.01	0.00	Open
68	0.59	0.01	0.00	Open
69	0.41	0.01	0.00	Open
70	-0.25	0.00	0.00	Open
71	-0.43	0.01	0.00	Open
72	0.28	0.01	0.00	Open
73	0.10	0.00	0.00	Open
74	0.83	0.02	0.00	Open
75	0.65	0.01	0.00	Open
76	-0.30	0.02	0.01	Open
6	-2.67	0.04	0.01	Open

MAX DAY + FIRE FLOW SCHEMATIC



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**********************************************************************
*                            E P A N E T                             *
*                    Hydraulic and Water Quality                     *
*                    Analysis for Pipe Networks                      *
*                           Version 2.0                              *
**********************************************************************
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Input File: 2016-12-20_450_bnc.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	BC	RR-1	1	300
2	RR-1	RR-2	114.88	300
3	RR-2	RR-210	81.97	200
4	RR-210	RR-215	105.32	200
5	RR-1	RR-490	561.43	300
7	RR-490	RR-400	92.17	300
8	RR-400	RR-405	68.18	300
9	RR-405	RR-410	73.92	300
10	RR-410	RR-445	72.60	300
11	RR-445	RR-450	84.29	250
12	RR-450	12	95	250
13	12	RR-475	46.21	250
14	RR-475	RR-470	121.42	250
15	RR-470	RR-465	73.97	250
16	RR-465	RR-460	110	250
17	RR-460	RR-455	132.50	250
18	RR-455	RR-450	81.05	250
19	RR-410	RR-415	79.45	200
20	RR-445	RR-440	100.62	200
21	RR-490	RR-425	24.48	200
22	RR-425	RR-420	72.52	200
23	RR-420	RR-415	75.79	200
24	RR-425	RR-430	115.88	200
25	RR-430	RR-435	81.26	200
26	RR-415	RR-435	49.17	200
27	RR-435	RR-440	79.33	200
28	RR-445	24	85.82	300
29	24	25	40.68	300
30	25	26	82	300
35	27	28	76.12	250
36	28	29	79.64	300
37	29	30	80.50	300

39	28	32	65.29	300
40	30	31	86.0	300
42	33	35	74.02	250
43	12	34	89.32	250
44	34	32	82.83	250

Page 2
Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
48	35	RR-470	90.12	250
49	24	36	87.70	250
50	36	37	82.70	250
51	37	38	79.49	250
52	38	25	67.65	250
53	RR-215	RR-400	837.7	200
54	24	39	88.67	250
55	39	27	39.75	250
56	40	26	88.0	300
57	26	41	71.67	300
58	41	28	58.62	300
59	29	42	81.42	250
60	42	43	90.0	250
61	43	44	79.43	250
62	44	45	60.44	250
63	45	46	70.20	250
64	46	47	80.83	250
65	47	30	81.44	250
66	32	48	48.58	250
67	48	31	78.20	250
68	32	49	59.77	300
69	49	33	73.03	300
70	31	50	84.31	300
71	50	33	58.64	300
72	34	51	86.43	250
73	51	35	75.73	250
74	25	52	55.30	250
75	52	27	48.40	250
76	PARK	42	8	150
6	40	RR-400	264.90	300

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality

RR-2	0.25	143.35	44.85	0.00
RR-1	0.25	143.57	47.57	0.00
RR-210	0.38	142.21	43.96	0.00
RR-215	0.33	140.77	43.87	0.00
RR-490	0.00	130.85	33.65	0.00
RR-400	0.10	129.71	32.21	0.00
RR-405	0.23	129.23	27.73	0.00
RR-410	0.25	128.78	27.78	0.00
RR-445	0.23	128.06	26.06	0.00
RR-450	0.38	127.24	22.24	0.00
12	0.00	126.81	20.81	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
RR-475	0.30	126.80	19.80	0.00
RR-470	0.25	126.76	20.76	0.00
RR-465	0.35	126.85	22.85	0.00
RR-460	0.52	126.97	21.97	0.00
RR-455	0.80	127.12	21.62	0.00
RR-425	0.30	130.14	32.94	0.00
RR-420	0.45	129.67	30.47	0.00
RR-415	0.55	129.17	29.32	0.00
RR-430	0.25	129.57	32.32	0.00
RR-435	0.17	129.17	31.67	0.00
RR-440	0.60	128.66	29.91	0.00
24	0.45	127.58	23.58	0.00
25	0.45	127.53	23.22	0.00
26	0.45	127.52	22.34	0.00
27	0.45	127.20	21.65	0.00
28	0.45	126.47	20.07	0.00
29	0.45	125.44	18.93	0.00
30	0.45	125.46	18.19	0.00
31	0.45	125.98	18.03	0.00
32	0.45	126.41	17.66	0.00
33	0.45	126.35	14.38	0.00
34	0.45	126.56	18.07	0.00
35	0.45	126.55	15.88	0.00
36	0.45	127.57	23.91	0.00
37	0.45	127.55	24.27	0.00
38	0.45	127.54	23.85	0.00
39	0.45	127.32	22.33	0.00
40	0.45	128.22	22.69	0.00
41	0.45	126.93	21.03	0.00
42	100.45	121.40	14.76	0.00

43	100.45	121.12	14.32	0.00	
44	0.45	122.07	14.79	0.00	
45	0.45	122.73	14.92	0.00	
46	0.45	123.57	14.77	0.00	
47	0.45	124.50	16.65	0.00	
48	0.45	126.23	17.96	0.00	
49	0.45	126.38	16.09	0.00	
50	0.45	126.20	15.33	0.00	
51	0.45	126.55	15.54	0.00	
52	0.45	127.35	22.42	0.00	
PARK	0.44	121.40	14.76	0.00	
BC	-220.42	143.90	0.00	0.00	Reservoir

Page 4
Link Results:

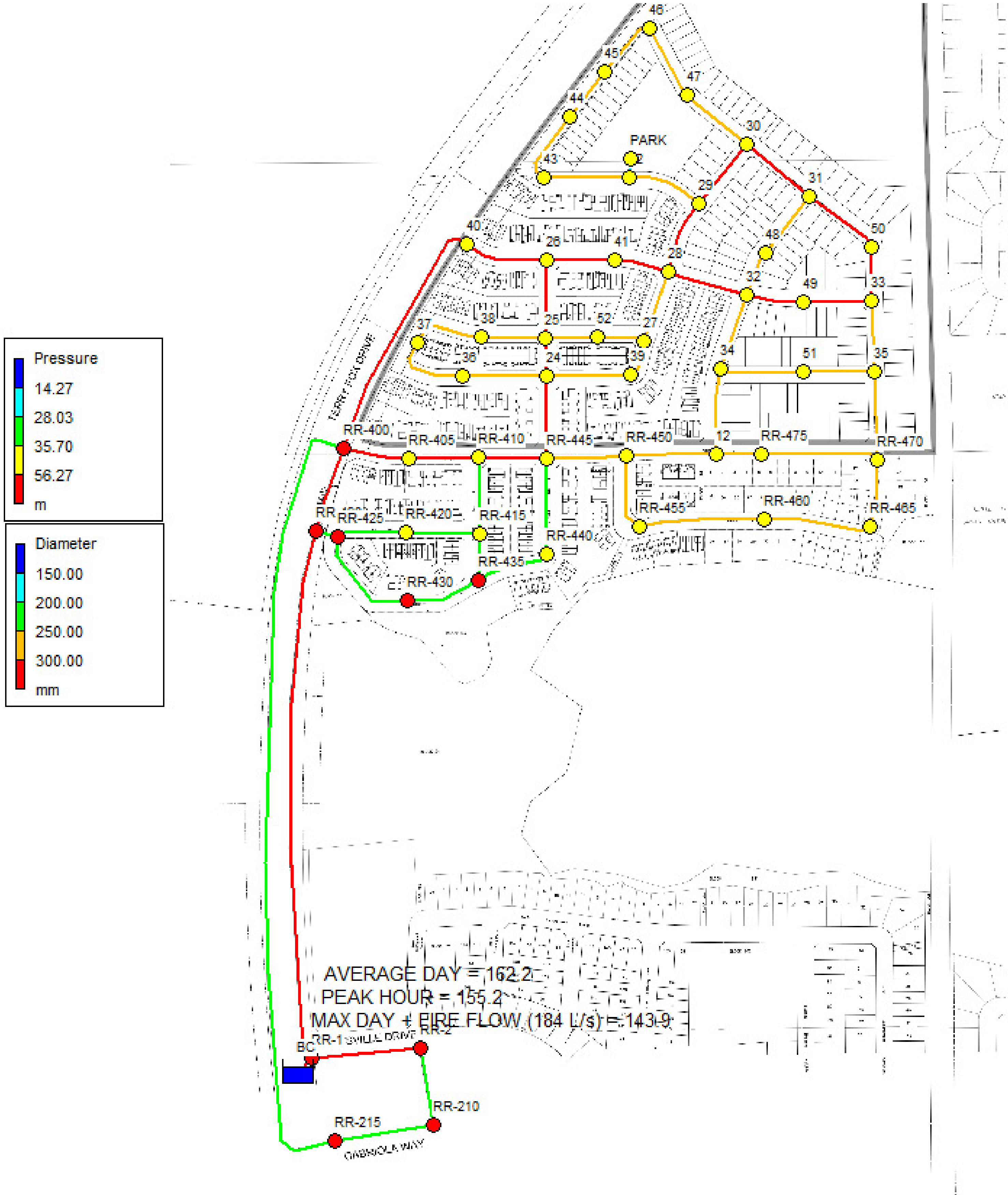
Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	220.42	3.12	329.39	Open
2	43.37	0.61	1.89	Open
3	43.12	1.37	13.99	Open
4	42.74	1.36	13.61	Open
5	176.80	2.50	22.66	Open
7	124.94	1.77	12.29	Open
8	85.39	1.21	7.09	Open
9	85.17	1.20	6.14	Open
10	108.27	1.53	9.95	Open
11	60.63	1.24	9.72	Open
12	39.95	0.81	4.46	Open
13	9.66	0.20	0.31	Open
14	9.36	0.19	0.28	Open
15	-18.63	0.38	1.11	Open
16	-18.98	0.39	1.13	Open
17	-19.50	0.40	1.14	Open
18	-20.30	0.41	1.41	Open
19	-23.35	0.74	4.97	Open
20	-26.19	0.83	5.98	Open
21	51.86	1.65	28.91	Open
22	27.40	0.87	6.49	Open
23	26.95	0.86	6.55	Open
24	24.16	0.77	4.96	Open
25	23.91	0.76	4.89	Open
26	3.05	0.10	0.11	Open
27	26.79	0.85	6.44	Open
28	73.60	1.04	5.51	Open
29	34.53	0.49	1.28	Open

30	8.15	0.12	0.08	Open
35	61.85	1.26	9.59	Open
36	119.70	1.69	12.97	Open
37	-16.04	0.23	0.28	Open
39	30.36	0.43	0.93	Open
40	-84.35	1.19	6.11	Open
42	-31.25	0.64	2.69	Open
43	30.29	0.62	2.85	Open
44	25.43	0.52	1.82	Open
48	-27.74	0.57	2.41	Open
49	7.37	0.15	0.20	Open
50	6.92	0.14	0.18	Open
51	6.47	0.13	0.14	Open
52	6.02	0.12	0.14	Open
53	42.42	1.35	13.20	Open
54	31.25	0.64	2.93	Open
55	30.80	0.63	3.11	Open
56	81.41	1.15	7.86	Open
57	89.12	1.26	8.28	Open

Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
58	88.67	1.25	7.88	Open
59	135.28	2.76	49.60	Open
60	34.39	0.70	3.11	Open
61	-66.06	1.35	11.96	Open
62	-66.51	1.35	10.93	Open
63	-66.96	1.36	12.02	Open
64	-67.41	1.37	11.44	Open
65	-67.86	1.38	11.81	Open
66	34.87	0.71	3.66	Open
67	34.42	0.70	3.14	Open
68	20.48	0.29	0.50	Open
69	20.03	0.28	0.41	Open
70	-50.38	0.71	2.58	Open
71	-50.83	0.72	2.49	Open
72	4.41	0.09	0.08	Open
73	3.96	0.08	0.06	Open
74	31.95	0.65	3.35	Open
75	31.50	0.64	3.02	Open
76	-0.44	0.03	0.01	Open
6	-81.86	1.16	5.66	Open

PEAK HOUR SCHEMATIC



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******************************************************************
*                         E P A N E T                            *
*                Hydraulic and Water Quality                     *
*                Analysis for Pipe Networks                      *
*                       Version 2.0                              *
******************************************************************
```

Input File: 2016-12-20_450_bnc.net

Link - Node Table:

Link ID	Start Node	End Node	Length m	Diameter mm
1	BC	RR-1	1	300
2	RR-1	RR-2	114.88	300
3	RR-2	RR-210	81.97	200
4	RR-210	RR-215	105.32	200
5	RR-1	RR-490	561.43	300
7	RR-490	RR-400	92.17	300
8	RR-400	RR-405	68.18	300
9	RR-405	RR-410	73.92	300
10	RR-410	RR-445	72.60	300
11	RR-445	RR-450	84.29	250
12	RR-450	12	95	250
13	12	RR-475	46.21	250
14	RR-475	RR-470	121.42	250
15	RR-470	RR-465	73.97	250
16	RR-465	RR-460	110	250
17	RR-460	RR-455	132.50	250
18	RR-455	RR-450	81.05	250
19	RR-410	RR-415	79.45	200
20	RR-445	RR-440	100.62	200
21	RR-490	RR-425	24.48	200
22	RR-425	RR-420	72.52	200
23	RR-420	RR-415	75.79	200
24	RR-425	RR-430	115.88	200
25	RR-430	RR-435	81.26	200
26	RR-415	RR-435	49.17	200
27	RR-435	RR-440	79.33	200
28	RR-445	24	85.82	300
29	24	25	40.68	300
30	25	26	82	300
35	27	28	76.12	250
36	28	29	79.64	300
37	29	30	80.50	300

39	28	32	65.29	300
40	30	31	86.0	300
42	33	35	74.02	250
43	12	34	89.32	250
44	34	32	82.83	250

Link - Node Table: (continued)

Link ID	Start Node	End Node	Length m	Diameter mm
48	35	RR-470	90.12	250
49	24	36	87.70	250
50	36	37	82.70	250
51	37	38	79.49	250
52	38	25	67.65	250
53	RR-215	RR-400	837.7	200
54	24	39	88.67	250
55	39	27	39.75	250
56	40	26	88.0	300
57	26	41	71.67	300
58	41	28	58.62	300
59	29	42	81.42	250
60	42	43	90.0	250
61	43	44	79.43	250
62	44	45	60.44	250
63	45	46	70.20	250
64	46	47	80.83	250
65	47	30	81.44	250
66	32	48	48.58	250
67	48	31	78.20	250
68	32	49	59.77	300
69	49	33	73.03	300
70	31	50	84.31	300
71	50	33	58.64	300
72	34	51	86.43	250
73	51	35	75.73	250
74	25	52	55.30	250
75	52	27	48.40	250
76	PARK	42	8	150
6	40	RR-400	264.90	300

Node Results:

Node ID	Demand LPS	Head m	Pressure m	Quality

RR-2	0.55	155.17	56.67	0.00
RR-1	0.55	155.19	59.19	0.00
RR-210	0.83	155.10	56.85	0.00
RR-215	0.71	155.03	58.13	0.00
RR-490	0.00	154.59	57.39	0.00
RR-400	0.22	154.54	57.04	0.00
RR-405	0.50	154.52	53.02	0.00
RR-410	0.55	154.50	53.50	0.00
RR-445	0.50	154.47	52.47	0.00
RR-450	0.83	154.45	49.45	0.00
12	0.00	154.44	48.44	0.00

Node Results: (continued)

Node ID	Demand LPS	Head m	Pressure m	Quality
RR-475	0.66	154.44	47.44	0.00
RR-470	0.55	154.44	48.44	0.00
RR-465	0.77	154.44	50.44	0.00
RR-460	1.15	154.44	49.44	0.00
RR-455	1.76	154.44	48.94	0.00
RR-425	0.66	154.55	57.35	0.00
RR-420	0.99	154.52	55.32	0.00
RR-415	1.21	154.50	54.65	0.00
RR-430	0.55	154.52	57.27	0.00
RR-435	0.38	154.50	57.00	0.00
RR-440	1.32	154.48	55.73	0.00
24	0.99	154.46	50.46	0.00
25	0.99	154.46	50.15	0.00
26	0.99	154.46	49.28	0.00
27	0.99	154.45	48.90	0.00
28	0.99	154.44	48.04	0.00
29	0.99	154.44	47.93	0.00
30	0.99	154.44	47.17	0.00
31	0.99	154.44	46.49	0.00
32	0.99	154.44	45.69	0.00
33	0.99	154.44	42.47	0.00
34	0.99	154.44	45.95	0.00
35	0.99	154.44	43.77	0.00
36	0.99	154.46	50.80	0.00
37	0.99	154.46	51.18	0.00
38	0.99	154.46	50.77	0.00
39	0.99	154.45	49.46	0.00
40	0.99	154.48	48.95	0.00
41	0.99	154.45	48.55	0.00
42	0.99	154.43	47.79	0.00

43	0.99	154.43	47.63	0.00	
44	0.99	154.43	47.15	0.00	
45	0.99	154.43	46.62	0.00	
46	0.99	154.43	45.63	0.00	
47	0.99	154.43	46.58	0.00	
48	0.99	154.44	46.17	0.00	
49	0.99	154.44	44.15	0.00	
50	0.99	154.44	43.57	0.00	
51	0.99	154.44	43.43	0.00	
52	0.99	154.45	49.52	0.00	
PARK	0.80	154.43	47.79	0.00	
BC	-44.74	155.20	0.00	0.00	Reservoir

Page 4
Link Results:

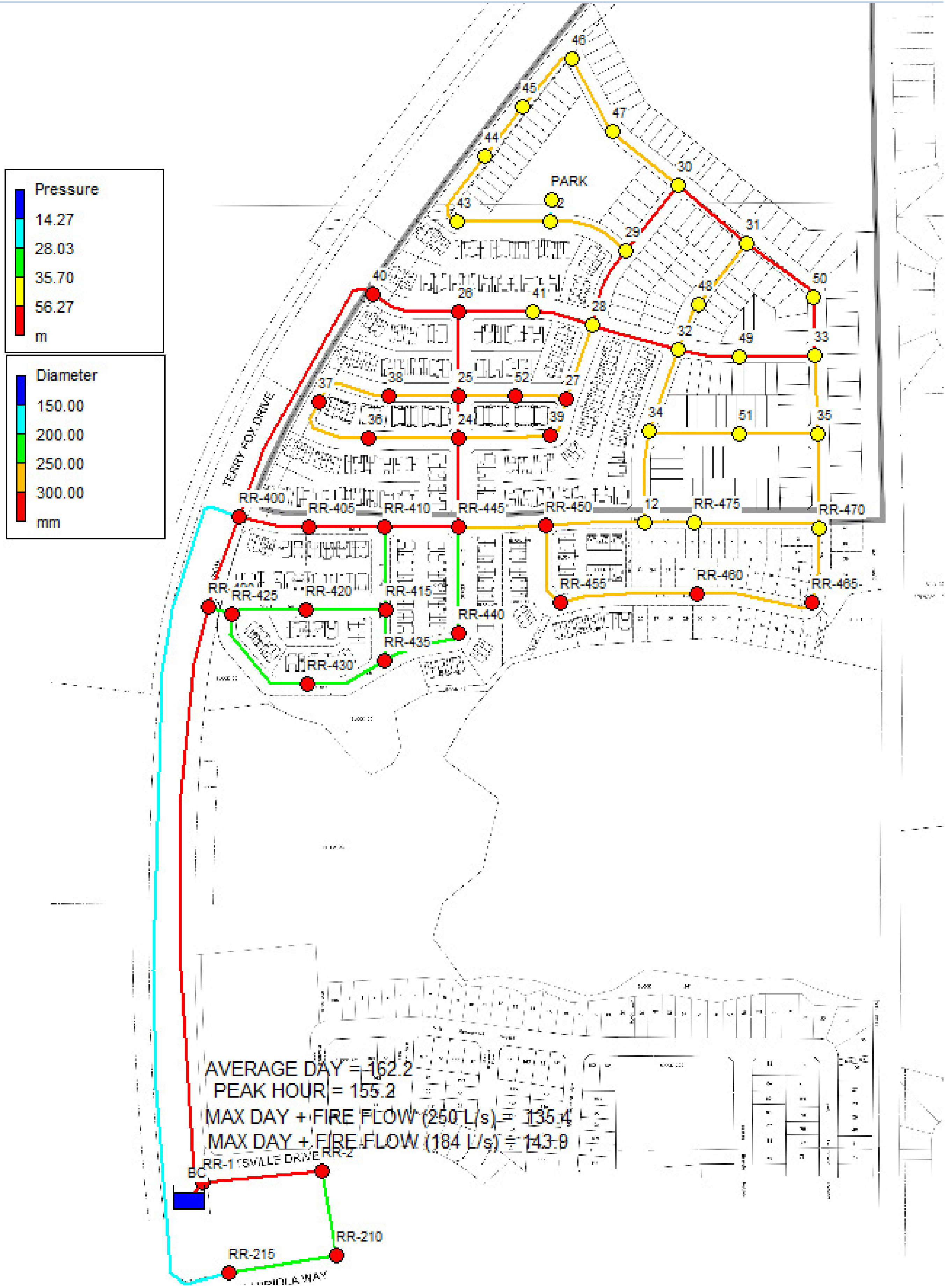
Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
1	44.74	0.63	13.92	Open
2	10.01	0.14	0.12	Open
3	9.46	0.30	0.83	Open
4	8.64	0.27	0.70	Open
5	34.18	0.48	1.07	Open
7	23.00	0.33	0.53	Open
8	16.32	0.23	0.32	Open
9	15.83	0.22	0.27	Open
10	18.01	0.25	0.35	Open
11	9.44	0.19	0.30	Open
12	4.51	0.09	0.08	Open
13	2.23	0.05	0.02	Open
14	1.57	0.03	0.01	Open
15	-0.42	0.01	0.00	Open
16	-1.19	0.02	0.01	Open
17	-2.35	0.05	0.02	Open
18	-4.11	0.08	0.07	Open
19	-2.74	0.09	0.09	Open
20	-3.33	0.11	0.13	Open
21	11.18	0.36	1.57	Open
22	5.70	0.18	0.35	Open
23	4.71	0.15	0.25	Open
24	4.82	0.15	0.25	Open
25	4.27	0.14	0.20	Open
26	0.77	0.02	0.01	Open
27	4.65	0.15	0.24	Open
28	11.40	0.16	0.16	Open
29	4.36	0.06	0.03	Open

30	-2.26	0.03	0.01	Open
35	5.74	0.12	0.11	Open
36	7.13	0.10	0.07	Open
37	2.55	0.04	0.01	Open
39	6.77	0.10	0.06	Open
40	-1.59	0.02	0.00	Open
42	-0.97	0.02	0.00	Open
43	2.28	0.05	0.02	Open
44	-0.22	0.00	0.00	Open
48	-1.44	0.03	0.01	Open
49	1.81	0.04	0.01	Open
50	0.82	0.02	0.00	Open
51	-0.17	0.00	0.00	Open
52	-1.16	0.02	0.01	Open
53	7.92	0.25	0.59	Open
54	4.24	0.09	0.07	Open
55	3.25	0.07	0.05	Open
56	13.39	0.19	0.25	Open
57	10.14	0.14	0.14	Open

Page 5
Link Results: (continued)

Link ID	Flow LPS	VelocityUnit m/s	Headloss m/km	Status
58	9.15	0.13	0.11	Open
59	3.59	0.07	0.05	Open
60	1.80	0.04	0.01	Open
61	0.81	0.02	0.00	Open
62	-0.18	0.00	0.00	Open
63	-1.17	0.02	0.01	Open
64	-2.16	0.04	0.02	Open
65	-3.15	0.06	0.04	Open
66	2.44	0.05	0.03	Open
67	1.45	0.03	0.01	Open
68	3.13	0.04	0.01	Open
69	2.14	0.03	0.01	Open
70	-1.13	0.02	0.00	Open
71	-2.12	0.03	0.01	Open
72	1.51	0.03	0.01	Open
73	0.52	0.01	0.00	Open
74	4.47	0.09	0.08	Open
75	3.48	0.07	0.05	Open
76	-0.80	0.05	0.04	Open
6	-14.38	0.20	0.22	Open

AVERAGE DAY SCHEMATIC



APPENDIX B

WASTEWATER SUPPLY

Table 1.3.1 City Suggested Population Density

Type	Percentage (%)	Density per Unit (ppl/unit)[A]	(Percentage x ppl/unit x 29 units/ha)
Singles/Semis	60	3.4	59.16
Apartments	10	1.8	5.22
Multiple Units (Townhouses/Stacked Townhouses)	30	2.7	23.49
SUM			**87.9 ppl/ha**

[A]Densities were taken from the City of Ottawa Sewer Design Guidelines.

Population and landuse values for the Interstitial Lands varied significantly between the different sources of information. As such, Table 1.3.2 is provided to present the information and source that was assumed most updated and applicable. For areas outside of the Interstitial/Broughton lands, the information from the City's IMP database was used in the hydraulic modeling as it represents the most recent data available from the City of Ottawa.

Table 1.3.2 Population & Landuses Sources.

ID	Location	Source	RES Area (ha)	COM/INST Area (ha)	IND Area (ha)	BUILDOUT Population	I/I Area (ha)
1	**Lower Baylis (Interstitial Lands)**	Stantec/Richcraft (August 2007)	2.26	na	na	198.7	2.26
2	**Upper Baylis (Interstitial Lands)**	Stantec/Richcraft (August 2007)	15.67	na	na	1377.4	15.67
3	**Richardson North (Interstitial Lands)**	IBI (July 2007)	11.8	na	na	1037.2	11.8
4	**Lower Richardson (Interstitial Lands)**	IBI (July 2007)	16.13	na	na	1417.8	16.13
5	**Upper Richardson (Interstitial Lands)**	IBI (July 2007)	24.36	na	na	2141.2	24.36
6	**Broughton Lands**	Novatech (May 2007)	17.21	1.5	na	893	18.71

	(Interstitial)						
7	**Terry Fox Right of Way**	Novatech (May 2007)	na	na	na	na	4.4
8	**Kanata Lakes (South of Kizell Pond)**	IBI (May 2007)	na	na	na	4753.1	106.8
9	**Kanata Lakes (North of Kizell Pond)**	IBI (June 2006)	na	na	na	9169.5	151.2
10	**Existing Contributing Lands SRPS (Heritage Hills + North HWY 417)**	IMP Database City of Ottawa (June 2007)	172.3	110.9	4.4	9543	310.4
11	**TBD[A]**	Assumed	2	na	na	175.8	2

[A]Represents approximate area south of Broughton Lands also slated to be developed.

This information was used to establish expected buildout flows from the Interstitial Lands, as well as to verify the effects of the Interstitial Lands development on the capacities of the SRPS, Main Street/Penfield and Kanata Lakes North sanitary infrastructure services.

NO.	DATE	BY	REVISION
1.	02:11:20		GENERAL REVISIONS
2.	02:11:26		REVISED AS PER NEW CONCEPT PLAN
3.	05:08:16		REVISED AS PER NEW CONCEPT PLAN
4.	06:02:14		REVISED AS PER NEW CONCEPT PLAN
5.	06:06:15		REVISED AS PER NEW CONCEPT PLAN

Legend:

(100.0) Proposed Centreline Profile Grade

Major Overland Flow Direction

Major Flow Outlet

DEVELOPMENT LIMITS

KNL DEVELOPMENTS INC.

Ottawa

CCL/IBI
Cumming Cockburn Limited
1770 WOODWARD DR., OTTAWA (613)225-1311

KANATA LAKES NORTH MASTER GRADING PLAN

SERVICEABILITY STUDY

SCALE:	1:5000		
DRAWN:	M.M.	DATE:	SEPT '02
DESIGN:	L.E.	DATE:	SEPT '02
CHECKED:	R.W.W.	DATE:	SEPT '02

PROJECT NO.	DRAWING NO.
3433-LD	5002

J:\IBI Engineering\CCL\0-CAD\cad\Land\3398-ld\FEB 2006\report-base.dwg Layout Name: 5002-GRADING Last Saved By: mmiline Oct 06, 2009 - 11:04am

SANITARY SEWER CALCULATION SHEET

PROJECT: **Richcraft Group of Companies**
LOCATION: **Kanata Highlands**
FILE REF: **10-450**
DATE: **20-Dec-16**

DESIGN PARAMETERS

Avg. Daily Flow Res.	350 L/p/d	Peak Fact Res. Per Harmons: Min = 2.0, Max =4.0		Infiltration / Inflow	0.28 L/s/ha
Avg. Daily Flow Comm	50,000 L/ha/d	Peak Fact. Comm.	1.5	Min. Pipe Velocity	0.60 m/s full flowing
Avg. Daily Flow Instit.	50,000 L/ha/d	Peak Fact. Instit.	1.5	Max. Pipe Velocity	3.00 m/s full flowing
Avg. Daily Flow Indust.	35,000 L/ha/d	Peak Fact. Indust. per MOE graph		Mannings N	0.013

DSEL

Location			Residential Area and Population										Commercial		Institutional		Industrial			Infiltration				Pipe Data							
Area ID	Up	Down	Area	Number of Units by type				Pop.	Cumulative		Peak. Fact.	Q_{res}	Area	Accu. Area	Area	Accu. Area	Area	Accu. Area	Q_{C+I+I}	Total Area	Accu. Area	Infiltration Flow	Total Flow	DIA	Slope	Length	$A_{hydraulic}$	R	Velocity	Q_{cap}	Q / Q full
			(ha)	Singles	Semis	Towns	Apts		Area (ha)	Pop.	(-)	(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(mm)	(%)	(m)	(m^2)	(m)	(m/s)	(L/s)	(-)
External Lands (Richcraft lower Baylis)			2.2600					198.7		198.7			0.00	0.00		0.00		0.00	0.0	2.26		0.00									
Future Development			9.010					692.0		692.0				0.00		0.00		0.00	0.0	9.01		0.00									
Terry Fox	1000A	1001A	0.350						11.62	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.35	11.62	3.25	17.08	304.8	0.19	74.82	0.073	0.076	0.60	43.97	0.3884
Terry Fox	1001A	1002A	0.330					0.0	11.970	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.33	11.95	3.35	17.17	304.8	0.19	70.46	0.073	0.076	0.60	43.97	0.3905
Terry Fox	1002A	1003A	0.420					0.0	12.390	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.42	12.37	3.46	17.29	304.8	0.19	92.77	0.073	0.076	0.60	43.97	0.3932
Terry Fox	1003A	1004A	0.560					0.0	12.950	890.7	3.83	13.83		0.00	0.00	0.00		0.00	0.0	0.56	12.93	3.62	17.45	304.8	0.19	120.00	0.073	0.076	0.60	43.97	0.3967
Terry Fox	1004A	1005A	0.270					0.0	13.220	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.27	13.20	3.70	17.52	304.8	0.19	59.80	0.073	0.076	0.60	43.97	0.3985
Terry Fox	1005A	1006A	0.470					0.0	13.690	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.47	13.67	3.83	17.65	304.8	0.19	103.52	0.073	0.076	0.60	43.97	0.4015
Terry Fox	1006A	1007A	0.330					0.0	14.020	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.33	14.00	3.92	17.75	304.8	0.19	71.15	0.073	0.076	0.60	43.97	0.4036
Terry Fox	1007A	1008A	0.190					0.0	14.210	890.7	3.83	13.83		0.00		0.00		0.00	0.0	0.19	14.19	3.97	17.80	381	0.19	42.96	0.114	0.095	0.70	79.73	0.2232
																0.00		0.00	0.0												
Phase 1C			2.980					125.8		125.8				0.00		0.00		0.00	0.0	2.98	2.98										
Phase 3A			3.280					173.2		173.2				0.00		0.00		0.00	0.0	3.28	3.28										
Phase 3C			2.160					446.2		446.2				0.00		0.00		0.00	0.0	2.16	2.16										
Phase 1C, 3A, 3C	stub	1008A						0.0		745.2	3.88	11.71		0.00		0.00		0.00	0.0	0.00	8.42	2.36	14.07	300	0.25	6.00	0.071	0.075	0.68	48.35	0.2909
																0.00		0.00	0.0												
Terry Fox	1008A	1009	0.320					0.0		1635.9	3.65	24.20		0.00		0.00		0.00	0.0	0.32	22.93	6.42	30.62	375	0.16	71.00	0.110	0.094	0.63	70.13	0.4366
Terry Fox	1009A	1010	0.460					0.0		1635.9	3.65	24.20		0.00		0.00		0.00	0.0	0.46	23.39	6.55	30.75	375	0.14	100.74	0.110	0.094	0.59	65.60	0.4687
																0.00		0.00	0.0												
Phase 2A	stub	1010						258.0		258	4.00	4.18		0.00		0.00		0.00	0.0	0.00	5.00	1.40	5.58	250	0.51	5.60	0.049	0.063	0.87	42.47	0.1314
																0.00		0.00	0.0												
Terry Fox	1010A	1011	0.35					0.0		1893.9	3.60	27.65		0.00		0.00		0.00	0.0	0.35	28.74	8.05	35.70	375	0.14	78.75	0.110	0.094	0.59	65.60	0.5442
																0.00		0.00	0.0												
Phase 2B	stub	1011	5.32					370.6		370.6	4.00	6.01		0.00		0.00		0.00	0.0	5.32	5.32	1.49	7.50	250	0.51	6.00	0.049	0.063	0.87	42.47	0.1766
																0.00		0.00	0.0												
Terry Fox	1011A	1012	0.54					0.0		2264.5	3.54	32.50		0.00		0.00		0.00	0.0	0.54	34.60	9.69	42.19	375	0.14	119.98	0.110	0.094	0.59	65.60	0.6431
Terry Fox	1012A	1013	0.35					0.0		2264.5	3.54	32.50		0.00		0.00		0.00	0.0	0.35	34.95	9.79	42.29	375	0.14	77.74	0.110	0.094	0.59	65.60	0.6446
Terry Fox	1013A	1014	0.34					0.0		2264.5	3.54	32.50		0.00		0.00		0.00	0.0	0.34	35.29	9.88	42.38	375	0.14	74.96	0.110	0.094	0.59	65.60	0.6461
Terry Fox	1014A	1015	0.35					0.0		2264.5	3.54	32.50		0.00		0.00		0.00	0.0	0.35	35.64	9.98	42.48	375	0.14	74.78	0.110	0.094	0.59	65.60	0.6476
																0.00		0.00	0.0												
Phase 1B	STUB	1015	5.02					190.4		190.4	4.00	3.09		0.00		0.00		0.00	0.0	5.02	5.02	1.41	4.50	200	6.46	4.80	0.031	0.050	2.65	83.36	0.0540
																0.00		0.00	0.0												
Terry Fox			0.43					0.0		2454.9	3.51	34.95		0.00		0.00		0.00	0.0	0.43	41.09	11.51	46.46	375	0.14	95.45	0.110	0.094	0.59	65.60	0.7082
Terry Fox			0.43					0.0		2454.9	3.51	34.95		0.00		0.00		0.00	0.0	0.43	41.52	11.63	46.58	375	0.14	95.45	0.110	0.094	0.59	65.60	0.7100
Terry Fox			0.47					0.0		2454.9	3.51	34.95		0.00		0.00		0.00	0.0	0.47	41.99	11.76	46.71	375	0.14	106.00	0.110	0.094	0.59	65.60	0.7120
Terry Fox			0.13					0.0		2454.9	3.51	34.95		0.00		0.00		0.00	0.0	0.13	42.12	11.79	46.75	350	0.6	42.61	0.096	0.088	1.17	112.99	0.4137
Terry Fox			0					0.0		2454.9	3.51	34.95		0.00		0.00		0.00	0.0	0.00	42.12	11.79	46.75	375	0.14	24.00	0.110	0.094	0.59	65.60	0.7126
																0.00		0.00	0.0												
Richardson Ph. 1D			*0.58*					*27.2*		*27.2*	*4.00*	*0.44*		*0.00*		*0.00*		*0.00*	*0.0*	*0.58*	*0.58*	*0.16*	*0.60*								
Broughton Residential			*13.81*					*1106.3*		*1106.3*	*3.77*	*16.90*		*0.00*		*0.00*		*0.00*	*0.0*	*13.81*	*13.81*	*3.87*	*20.77*								
Broughton Commercial								*0.0*		*0*	*4.00*	*0.00*	*1.2*	*1.20*		*0.00*		*0.00*	*1.0*	*1.20*	*1.20*	*0.34*	*1.38*								
Broughton Total										*1133.5*	*3.76*	*17.28*		*1.2*		*0.00*		*0.00*	*1.0*		*15.59*	*4.37*	*22.69*								
																0.00		*0.00*	*0.0*												
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*57.88*	*16.21*	*66.31*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9360*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*58.05*	*16.25*	*66.36*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9367*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*58.22*	*16.30*	*66.41*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9374*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*58.39*	*16.35*	*66.45*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9381*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*58.56*	*16.40*	*66.50*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9387*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*58.73*	*16.44*	*66.55*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9394*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*58.90*	*16.49*	*66.60*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9401*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*59.07*	*16.54*	*66.64*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9408*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*59.24*	*16.59*	*66.69*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9414*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*59.41*	*16.63*	*66.74*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9421*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*59.58*	*16.68*	*66.79*	*381*	*0.15*	*23.60*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9428*
Terry Fox			*0.17*					*0.0*		*3588.4*	*3.38*	*49.06*		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*59.75*	*16.73*	**66.83**	*381*	*0.15*	*11.40*	*0.114*	*0.095*	*0.62*	*70.84*	*0.9434*

DUPLICATE OF IBI'S "TERRY FOX DRIVE SANITARY SEWER DESIGN SHEET" project #11585 - 2011

Duplicate of original IBI design sheet which shows only the Lower Baylis lands going to the Signature Pump Station

SANITARY SEWER CALCULATION SHEET

PROJECT: **Richcraft Group of Companies**
LOCATION: **Kanata Highlands**
FILE REF: **10-450**
DATE: **20-Dec-16**

DESIGN PARAMETERS

Avg. Daily Flow Res.	350 L/p/d	300 Peak Fact Res. Per Harmons: Min = 2.0, Max =4.0		Infiltration / Inflow	0.28 L/s/ha
Avg. Daily Flow Comm	50,000 L/ha/d	Peak Fact. Comm.	1.5	Min. Pipe Velocity	0.60 m/s full flowing
Avg. Daily Flow Instit.	50,000 L/ha/d	Peak Fact. Instit.	1.5	Max. Pipe Velocity	3.00 m/s full flowing
Avg. Daily Flow Indust.	35,000 L/ha/d	Peak Fact. Indust. per MOE graph		Mannings N	0.013

DSEL

Location			Residential Area and Population										Commercial		Institutional		Industrial			Infiltration				Pipe Data								
Area ID	Up	Down	Area	Number of Units by type				Pop.	Cumulative		Peak.	Q_{res}	Area	Accu.	Area	Accu.	Area	Accu.	Q_{C+I+I}	Total	Accu.	Infiltration	Total	DIA	Slope	Length	$A_{hydraulic}$	R	Velocity	Q_{cap}	Q / Q full	
									Area	Pop.	Fact.			Area		Area		Area		Area	Area	Flow	Flow									Avail.
			(ha)	Singles	Semis	Towns	Apts		(ha)		(-)	(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(mm)	(%)	(m)	(m^2)	(m)	(m/s)	(L/s)	(-)	Capacity
Richcraft West Terry Fox			0.000					0.0	0.000	0.0	4.00	0.00		0.00		0.00		0.00	0.0	0.000	0.000	0.000	0.00									
External Lands (Richcraft Highlands)			**18.3000**	159		276		1286.0		1286.0				0.00		0.00		0.00	0.0	18.30		0.00										100.00%
Future Development			**9.010**					692.0		692.0				0.00		0.00		0.00	0.0	9.01		0.00										100.00%
Terry Fox	1000A	1001A	0.350						27.66	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.35	27.66	7.74	36.51	304.8	0.19	74.82	0.073	0.076	0.60	43.97	0.8302	16.98%
Terry Fox	1001A	1002A	0.330					0.0	28.010	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.33	27.99	7.84	36.60	304.8	0.19	70.46	0.073	0.076	0.60	43.97	0.8323	16.77%
Terry Fox	1002A	1003A	0.420					0.0	28.430	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.42	28.41	7.95	36.72	304.8	0.19	92.77	0.073	0.076	0.60	43.97	0.8350	16.50%
Terry Fox	1003A	1004A	0.560					0.0	28.990	1978.0	3.59	28.76		0.00	0.00	0.00		0.00	0.0	0.56	28.97	8.11	36.87	304.8	0.19	120.00	0.073	0.076	0.60	43.97	0.8385	16.15%
Terry Fox	1004A	1005A	0.270					0.0	29.260	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.27	29.24	8.19	36.95	304.8	0.19	59.80	0.073	0.076	0.60	43.97	0.8403	15.97%
Terry Fox	1005A	1006A	0.470					0.0	29.730	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.47	29.71	8.32	37.08	304.8	0.19	103.52	0.073	0.076	0.60	43.97	0.8433	15.67%
Terry Fox	1006A	1007A	0.330					0.0	30.060	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.33	30.04	8.41	37.17	304.8	0.19	71.15	0.073	0.076	0.60	43.97	0.8454	15.46%
Terry Fox	1007A	1008A	0.190					0.0	30.250	1978.0	3.59	28.76		0.00		0.00		0.00	0.0	0.19	30.23	8.46	37.23	381	0.19	42.96	0.114	0.095	0.70	79.73	0.4669	53.31%
																0.00		0.00	0.0													
Phase 1C			2.980					125.8		125.8				0.00		0.00		0.00	0.0	2.98	2.98											
Phase 3A			3.280					173.2		173.2				0.00		0.00		0.00	0.0	3.28	3.28											
Phase 3C			2.160					446.2		446.2				0.00		0.00		0.00	0.0	2.16	2.16											
Phase 1C, 3A, 3C	stub	1008A						0.0		745.2	3.88	11.71		0.00		0.00		0.00	0.0	0.00	8.42	2.36	14.07	300	0.25	6.00	0.071	0.075	0.68	48.35	0.2909	70.91%
																0.00		0.00	0.0													
Terry Fox	1008A	1009	0.320					0.0		2723.2	3.48	38.37		0.00		0.00		0.00	0.0	0.32	38.97	10.91	49.28	375	0.16	71.00	0.110	0.094	0.63	70.13	0.7026	29.74%
Terry Fox	1009A	1010	0.460					0.0		2723.2	3.48	38.37		0.00		0.00		0.00	0.0	0.46	39.43	11.04	49.41	375	0.14	100.74	0.110	0.094	0.59	65.60	0.7531	24.69%
																0.00		0.00	0.0													
Phase 2A	stub	1010						258.0		258	4.00	4.18		0.00		0.00		0.00	0.0	0.00	5.00	1.40	5.58	250	0.51	5.60	0.049	0.063	0.87	42.47	0.1314	86.86%
																0.00		0.00	0.0													
Terry Fox	1010A	1011	0.35					0.0		2981.2	3.44	41.60		0.00		0.00		0.00	0.0	0.35	44.78	12.54	54.14	375	0.14	78.75	0.110	0.094	0.59	65.60	0.8253	17.47%
																0.00		0.00	0.0													
Phase 2B	stub	1011	5.32					370.6		370.6	4.00	6.01		0.00		0.00		0.00	0.0	5.32	5.32	1.49	7.50	250	0.51	6.00	0.049	0.063	0.87	42.47	0.1766	82.34%
																0.00		0.00	0.0													
Terry Fox	1011A	1012	0.54					0.0		3351.8	3.40	46.18		0.00		0.00		0.00	0.0	0.54	50.64	14.18	60.36	381	0.14	119.98	0.114	0.095	0.60	68.44	0.8819	11.81%
Terry Fox	1012A	1013	0.35					0.0		3351.8	3.40	46.18		0.00		0.00		0.00	0.0	0.35	50.99	14.28	60.46	381	0.14	77.74	0.114	0.095	0.60	68.44	0.8834	11.66%
Terry Fox	1013A	1014	0.34					0.0		3351.8	3.40	46.18		0.00		0.00		0.00	0.0	0.34	51.33	14.37	60.55	381	0.14	74.96	0.114	0.095	0.60	68.44	0.8848	11.52%
Terry Fox	1014A	1015	0.35					0.0		3351.8	3.40	46.18		0.00		0.00		0.00	0.0	0.35	51.68	14.47	60.65	381	0.14	74.78	0.114	0.095	0.60	68.44	0.8862	11.38%
																0.00		0.00	0.0													
Phase 1B	STUB	1015	5.02					190.4		190.4	4.00	3.09		0.00		0.00		0.00	0.0	5.02	5.02	1.41	4.50	200	6.46	4.80	0.031	0.050	2.65	83.36	0.0540	94.60%
																0.00		0.00	0.0													
Terry Fox			0.43					0.0		3542.2	3.38	48.50		0.00		0.00		0.00	0.0	0.43	57.13	16.00	64.50	381	0.14	95.45	0.114	0.095	0.60	68.44	0.9424	5.76%
Terry Fox			0.43					0.0		3542.2	3.38	48.50		0.00		0.00		0.00	0.0	0.43	57.56	16.12	64.62	381	0.14	95.45	0.114	0.095	0.60	68.44	0.9442	5.58%
Terry Fox			0.47					0.0		3542.2	3.38	48.50		0.00		0.00		0.00	0.0	0.47	58.03	16.25	64.75	381	0.14	106.00	0.114	0.095	0.60	68.44	0.9461	5.39%
Terry Fox			0.13					0.0		3542.2	3.38	48.50		0.00		0.00		0.00	0.0	0.13	58.16	16.28	64.79	350	0.6	42.61	0.096	0.088	1.17	112.99	0.5734	42.66%
Terry Fox			0					0.0		3542.2	3.38	48.50		0.00		0.00		0.00	0.0	0.00	58.16	16.28	64.79	381	0.14	24.00	0.114	0.095	0.60	68.44	0.9466	5.34%
																0.00		0.00	0.0													
Richardson Ph. 1D			*0.58*					*27.2*		*27.2*	4.00	0.44		*0.00*		*0.00*		*0.00*	*0.0*	*0.58*	*0.58*	*0.16*	*0.60*									
Broughton Residential			*13.81*					*1106.3*		*1106.3*	3.77	16.90		*0.00*		*0.00*		*0.00*	*0.0*	*13.81*	*13.81*	*3.87*	*20.77*									
Broughton Commercial								*0.0*		*0*	4.00	0.00	*1.2*	*1.20*		*0.00*		*0.00*	*1.0*	*1.20*	*1.20*	*0.34*	*1.38*									
Broughton Total										*1133.5*	3.76	17.28		*1.2*		*0.00*		*0.00*	*1.0*		*15.59*	*4.37*	*22.69*									
																0.00		*0.00*	*0.0*													
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*73.92*	*20.70*	*83.71*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1817*	*-18.17%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*74.09*	*20.75*	*83.76*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1823*	*-18.23%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*74.26*	*20.79*	*83.81*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1830*	*-18.30%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*74.43*	*20.84*	*83.85*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1837*	*-18.37%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*74.60*	*20.89*	*83.90*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1844*	*-18.44%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*74.77*	*20.94*	*83.95*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1850*	*-18.50%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*74.94*	*20.98*	*84.00*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1857*	*-18.57%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*75.11*	*21.03*	*84.04*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1864*	*-18.64%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*75.28*	*21.08*	*84.09*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1871*	*-18.71%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*75.45*	*21.13*	*84.14*	*381*	*0.15*	*120.00*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1877*	*-18.77%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*75.62*	*21.17*	*84.19*	*381*	*0.15*	*23.60*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1884*	*-18.84%*
Terry Fox			*0.17*					*0.0*		*4675.7*	*3.27*	61.97		*1.2*		*0.00*		*0.00*	*1.0*	*0.17*	*75.79*	*21.22*	***84.23***	*381*	*0.15*	*11.40*	*0.114*	*0.095*	*0.62*	*70.84*	*1.1891*	*-18.91%*

Design sheet which reflects all of Kanata Highlands going to the Signature Pump Station via TFD Sewer

APPENDIX C

STORMWATER CONVEYANCE

450B1.4
Swm

Adam Fobert

From: Doug Nuttall <dnuttall@mvc.on.ca>
Sent: February-06-13 1:51 PM
To: afobert@dsel.ca
Subject: RE: Carp River Floodplain Mapping

I don't have the 2-year levels. Your surveyor would be able to pick up bankfull fairly easily, and the 1:2 year will be slightly higher than that. Based on the cross sections I have, I'd say it is slightly above 92.1m elevation at lot 9/10, and slightly above 92.2 at lot 7/8.

At lot line 7/8, the closest cross section upstream is 38950
At lot line 9/10, the closest cross section upstream is 37715

	SECNO	Q	CWSEL	VLOB	VROB	VCH
100	37715.000	59.80	93.15	.21	.17	1.11
50	37715.000	54.20	93.03	.21	.17	1.23
25	37715.000	42.50	92.92	.19	.14	1.17
10	37715.000	38.10	92.82	.18	.14	1.22
5	37715.000	35.40	92.75	.18	.13	1.26
*	37970.000	59.80	93.23	.16	.08	.81
*	37970.000	54.20	93.13	.14	.07	.81
*	37970.000	42.50	93.02	.11	.08	.72
*	37970.000	38.10	92.93	.11	.09	.70
*	37970.000	35.40	92.87	.10	.08	.68
*	38220.000	61.60	93.27	.11	.12	.41
*	38220.000	57.00	93.18	.11	.12	.43
*	38220.000	41.50	93.06	.08	.10	.37
*	38220.000	37.10	92.97	.08	.10	.38
*	38220.000	34.30	92.91	.08	.09	.38
	38450.000	40.40	93.28	.11	.08	.34
	38450.000	32.00	93.19	.10	.07	.30
	38450.000	24.30	93.06	.08	.06	.27
	38450.000	18.60	92.98	.07	.05	.22
	38450.000	17.20	92.92	.06	.05	.22
	38700.000	40.40	93.30	.11	.12	.39
	38700.000	32.00	93.20	.10	.10	.37
*	38700.000	24.30	93.08	.09	.09	.37
*	38700.000	18.60	92.99	.08	.08	.36
*	38700.000	17.20	92.93	.08	.08	.38
	38950.000	40.40	93.31	.12	.12	.40
	38950.000	32.00	93.22	.11	.10	.38
	38950.000	24.30	93.09	.10	.10	.39
	38950.000	18.60	93.00	.08	.08	.37
	38950.000	17.20	92.95	.08	.08	.39

70% TSS removal is required right now. After the Restoration Project is complete, there is an expectation that the fish community will be sufficiently enhanced that 80% TSS removal will be required, but that is currently conjecture. As you would be discharging downstream of the Restoration Project, you would have to match post- flows to pre- flows.

Yes, the Carp River Watershed/Subwatershed Study is the most up-to-date and complete document in place today. It has additional water quality treatment requirements that may apply here.

Greenland Engineering is the 'model keeper', and Don Moss at Greenland can be contacted to get the current HEC-RAS model. He's at dmoss@grnland.com

Douglas Nuttall, P.Eng.
Water Resources Engineer
Mississippi Valley Conservation

From: Adam Fobert [mailto:afobert@dsel.ca]
Sent: February-05-13 5:35 PM
To: 'Doug Nuttall'
Subject: RE: Carp River Floodplain Mapping

Hello Douglas,

Thank you for the cross-section information.

We should note that we are proposing a stormwater management pond on the western side of Terry Fox. As such we would like to confirm the following:

1) Water levels between lot line delineating Lots 7&8 and Lots 9&10. For all events from the 2-year to the 100-year. We require the 2-year water level to establish the pond's normal water level.
2) Release rate requirements: Quantity Control – Post development to Pre-Development Runoff rate?
3) Quality controls – Provide 80% TSS removal per MOE Enhanced?
4) Is the report 'Carp River Watershed / Subwatershet Study Modelling Analysis – Robinson Consultants, Dec 2005' the most current and accepted document?
5) Is an existing HEC-RAS model available for this area that our modellers (JFSA) can employ in the detailed design and modeling?

Thank you for your help. Feel free to call to discuss.

Adam Fobert, P.Eng.
Senior Design Engineer

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 203
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext.231

fax: (613) 836-7183
email: afobert@DSEL.ca

From: Doug Nuttall [mailto:dnuttall@mvc.on.ca]
Sent: February-04-13 4:49 PM
To: afobert@dsel.ca
Subject: RE: Carp River Floodplain Mapping

Your site is high and dry. The modelling I have in this location (where the Carp crosses the upstream side of Lot 9), which is section 38220.

	SECNO	Q	CWSEL	VLOB	VROB	VCH
*	38220.000	61.60	93.27	.11	.12	.41
*	38220.000	57.00	93.18	.11	.12	.43
*	38220.000	41.50	93.06	.08	.10	.37
*	38220.000	37.10	92.97	.08	.10	.38
*	38220.000	34.30	92.91	.08	.09	.38

This is the 1:100, 1:50, 1:25, 1:10, 1:5. This downstream of the confluence with Huntley Creek. The Regulation line is at 93.3m elevation.

From: Adam Fobert [mailto:afobert@dsel.ca]
Sent: February-04-13 2:42 PM
To: dnuttall@mvc.on.ca
Subject: Carp River Floodplain Mapping

Hello Douglas,

We met some time ago during Richcraft's pre-consultation with municipal staff regarding their Kanata Highlands project on Terry Fox. I've pasted a site location image below for convenience.

I'm in the process of gathering all the background information for this area, or at least ensuring that I have the most current information.

What information is considered latest and greatest for establishing water levels on the Carp River (2-year, through 100-year)? What is the current regulatory floodplain established on? I've attached the mapping that I have on file. I believe we need the next sheet down for this site. If this information is still current could you provide?

Thank you for your help.

Adam Fobert, P.Eng.
Senior Design Engineer

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