July 24, 2024

SERVICING BRIEF

REZONING AND OCP AMENDMENT APPLICATION NO. CP100205 & RZ100808

Client: Ridgecrest Development Group
L&M Project No.: 1432-16

L&M Engineering Limited
1210 Fourth Avenue, Prince George, BC V2L 3J4
Phone: (250) 562-1977

Table of Contents

APPENDICIES: A – Proposed Site Plan
B – Water Modelling
C – Storm Modelling & Catchment Plan

1.0 INTRODUCTION

On behalf of Ridgecrest Development Group, L&M Engineering is pleased to provide you with this Servicing Brief for the subject property located at 8640 St. Lawrence Avenue. The property is currently split-zoned RS2: Single Residential, AG: Greenbelt, AF: Agriculture and Forestry. This Servicing Brief has been completed in support of Rezoning Application, RZ100808, and OCP Amendment Application, CP100205, for the subject property.

Ridgecrest Developments Group Inc. is proposing to rezone approximately 1.91ha of the property to RM5: Multiple Residential, to facilitate future multi-phased medium-high density multi-family development on the property. This phase of development would also include 10 single-family lots, adjacent to the proposed rezoning.

2.0 BACKGROUND DATA AND REPORTS

L&M Engineering has reviewed the following reports regarding the subject property:

- City of Prince George – 2017 Sanitary Sewer Services Master Plan – Prepared by AECOM;
- City of Prince George – 2014 Water Service Network Plan – Prepared by Opus Dayton Knight;
- City of Prince George – Vista Ridge Watermain Extension Design – Prepared by L&M Engineering;
- City of Prince George – Water Modelling Report WM000186 dated February 16, 2024;
- City of Prince George – Water Modelling Report WM000128 dated May 4, 2022
- City of Prince George – Development Services Department: Design Guidelines;
- L&M Engineering - Ospika South Neighbourhood Stormwater Management Plan dated: March 2013;
- Stanley Associates Engineering Ltd. – Heights Residential Subdivision As-builts dated: August 1979; and
- PG Map.

3.0 SITE TOPOGRAPHY & SITE ACCESS

A portion of the subject property along the projection of St. Lawrence Avenue was cleared during a previous phase of construction and the remaining portion of the property is vegetated. The topography of the property slopes from the west to the east at varying grades, from approximately 4-6%. The property is bordered by existing single-family dwellings to the north and east, and undeveloped land to the south and west. The property is bordered by the future Ospika Boulevard road dedication to the west. The site could be accessed from the west terminus of St. Lawrence Avenue.

4.0 DESIGN POPULATION

The design population of the subject property is calculated as follows:

- 10 Single-Family Lots
  - In July 2024, new density regulations were put in place to allow up to 4 dwellings on single-family/duplex zoned properties. It is not anticipated that every lot owner will construct a four-unit dwelling on single-family sized lots; however, it is reasonable to assume that the subdivision could average approximately 2 dwellings per lot.
  - Utilizing a factor of 3.2 people/dwelling (Southwest Sector – CoPG Design Guidelines – Table 2.10.1, yields a population of **64 people**.

- 1 Multi-Family Lot
  - The proposed lot area is 1.91ha
  - The maximum density (RM5) is 125 dwelling/ha
  - Using a factor of 3.2 people/dwelling (Southwest Sector – CoPG Design Guidelines – Table 2.10.1, yields a population of **764 people**.

- Total design population – **828 people**.

5.0 WATER DISTRIBUTION SYSTEM

5.1 Existing System

L&M Engineering reviewed the existing municipal water infrastructure in the vicinity of the subject development. The City's watermain network includes a 300mm diameter main on the Future Ospika Boulevard and a 200mm diameter main on St. Lawrence Avenue. A PRV also exists to the north of the subject property that was installed as part of the Vista Ridge Watermain Extension in 2023 and is not yet shown on PGMap.

The system is on the border of Pressure Zone 4 and 6A, located downstream of the PRV that was installed as part of the Vista Ridge Watermain Extension. CoPG Water Modelling Report WM000128 indicates that the PRV is set at 42psi.

5.2 Domestic Water Demands

The water demand has been calculated utilizing the rates published in the *City of Prince George Draft Design Guidelines*. Table 1 outlines the calculation of the water demand.

Table 1: Estimated Water Demand					
ADD (l/c/d)	475	CoPG Design Guidelines Section 3.1.3			
MDD Factor	3.1	CoPG Design Guidelines Section 3.1.4 Table 3.1.1			
PHD Factor	4.25	CoPG Design Guidelines Section 3.1.4 Table 3.1.1			
Location	**Population**	**ADD (L/s)**	**MDD (L/s)**	**PHD (L/s)**	**Node Elevation (m)**
St Lawrence Ave Extension	828	4.55	14.11	19.35	698.0

5.3 Fire Protection Demands

In addition to the domestic water demand, an allowance for fire protection must be made. The *City of Prince George Draft Design Guidelines* recommends minimum fire protection design flows based on land use. The recommended apartment/townhouse development design fire flow is 125L/s and 60L/s for single family residential.

The document *Water Supply for Public Fire Protection*, produced by the Fire Underwriters Survey, is the de-facto standard in Canada for establishing fire protection requirements in municipal waterworks system design. The document presents a fire flow estimate that accounts for factors such as building construction, total floor area, material combustibility, automatic sprinkling, building separation and occupancy, the design fire flows may require adjustments at the time of detailed design to ensure adequate design fire flow is utilized.

5.4 Water Modelling Results

L&M Engineering submitted design parameters to the City of Prince George for water modelling. The City's Water Model was analyzed under Average Day Demand (ADD), Maximum Day Demand (MDD) and Peak Hour Demand (PHD) conditions. Maximum Day conditions represent the highest recorded daily demand on the water system, and Peak Hour conditions represent the highest demand on the system over the course of a day.

The City produced a water modelling report (WM000186) and concluded that the existing infrastructure could provide the subject area with available fire flows of 143.24 L/s to 177.91 L/s and pressures of 41.60psi to 47.08psi during PHD.

The *CoPG Draft Design Guidelines* indicate that an apartment/townhouse development requires a fire flow of 125L/s and 60L/s for single family residential; therefore, the mains can provide sufficient flows for the subject property (Node 1 and 2). The CoPG Design Guidelines

recommend that the minimum system pressure during PHD conditions is 40psi; therefore, the water infrastructure can provide the required system pressure.

5.5 Proposed Water Servicing

The subject property could be adequately serviced using the existing water infrastructure with a 200mm diameter service installed for the multi-family lot and 25mm diameter services installed for each of the single-family lots.

Since the multi-family lot would be privately owned, the development would require an onsite backflow preventer and water meter. The onsite layout and backflow preventer/water meter should be determined at the detailed design stage.

6.0 SANITARY COLLECTION SYSTEM

6.1 Existing System

L&M Engineering reviewed the existing municipal sanitary infrastructure in the vicinity of the subject development. The surrounding City sanitary network includes a 200mm diameter main on St. Lawrence Avenue. This main flows east along St. Lawrence Avenue until it connects to a 450mm diameter trunk main at the intersection of St. Mary Crescent and St. Lawrence Avenue. The trunk main continues northeast to the Lansdowne Wastewater Treatment Center.

6.2 Sanitary Design Flows

The City of Prince George Draft Design Guidelines (Section 4.2) outlines the procedure to determine sanitary design flows. The estimated sanitary design flow calculation for the subject development is outlined in Table 2.

Table 2: Estimated Sewage Design Flow			
Variable	**Result**		**Notes**
Population	828	people	Refer to Section 4.0
Domestic Avg Daily per Capita	380	l/d	Refer to Section 4.2.2.6 CoPG Design Guidelines
Total Avg. Daily Flow	314640	l/d	= Population * Avg. Flow per Capita
Peak Factor	3.85		Harman Equation
Total Peak Design Flow (Qs)	1211364	l/d	=Total Avg. Daily Design Flow * Peak Factor
Total Peak Design Flow (Qs)	14.0	l/s	=Total Avg. Daily Design Flow * Peak Factor
Infiltration and Inflow			
Development Area	2.98	ha	
Infiltration Rate	11200	l/ha/d	Refer to section 4.2.2.4 (11,200 L/ha)
Infiltration (Qi)	33376	l/d	= Development Area x Infiltration Rate
Infiltration (Qi)	0.4	l/s	= Development Area x Infiltration Rate
Total Design Flow (Qs + Qi)	1244740	l/d	(Qs + Qi)
Total Design Flow (Qs + Qi)	**14.4**	l/s	(Qs + Qi)

6.3 Existing Capacity

L&M Engineering reviewed the *City of Prince George 2017 Sanitary Sewer Services Master Plan* and PGMap for information related to the capacity of the existing sanitary system.

The 2017 Sanitary Sewer Services Master Plan used the following criteria to determine if pipe upgrades are required:

- Local sewers (Peak Wet Weather Flow (PWWF)<40L/s) running more than 70% full (Q_{peak}/Q_{full} >0.7) were recommended for upgrade.
- Trunk sewers (PWWF≥40L/s) running more than 83.5% full (Q_{peak}/Q_{full}>0.835) were recommended for upgrade. This is approximately equivalent to 70% of the full pipe depth.

The 2017 Master Plan indicates that the sanitary flow for the subject development would flow through four sections of main that are outlined as long-term upgrades and two sections of main that are currently over capacity.

The four sections of main that are listed as part of the long-term upgrade projects are **O-10** – upsizing sewer upstream of the College Heights Siphon, **O-19** – twin the existing College Heights Siphon, **O-21** – upsizing sewer on Domano and Tent, and **O-23** – upsizing sewer on Southridge.

The two sections of main that are currently listed as overcapacity are AssetID: 8598 & 9086 and are located off Cowart Road, approximately 4km from the subject property. They are listed as part of the long-term upgrade project **O-19** in the *Master Plan*.

Based on the estimated maximum sanitary design flow of 14.4L/s, the development should not cause any sections of main from subject property to the Lansdowne Treatment Center to increase from sufficient capacity to overcapacity.

6.4 Proposed Sanitary Servicing

The subject development could tie in to the 200mm diameter sanitary main on St. Lawrence Avenue. A 200mm diameter service could be installed to service the multi-family lot and 100mm diameter services could be installed to service each single-family lot.

7.0 STORM WATER SYSTEM

7.1 Existing System

L&M Engineering reviewed the existing municipal storm infrastructure in the vicinity of the subject development. The City's storm network includes a 450mm diameter main on St. Lawrence Avenue that ties into a trunk main on Eastview Street. The trunk main proceeds southeast to an outlet that discharges into a ravine that runs into a City storm detention pond (PW255) located between Southridge Avenue and Vista Ridge Drive.

7.2 Storm Modelling

When the Ospika South Neighbourhood residential area was originally rezoned, a Stormwater Management Plan (SWMP) was produced by L&M Engineering to outline the catchment areas and determine future locations and sizes of storm detention ponds. The SWMP indicates that the development area will drain to the existing City storm detention pond (PW255). This plan remains the same, the only difference would be that the multi-family area that is being rezoned would generate a slightly higher runoff flow and volume due to the increased density of the development.

Multiple phases of development and changes to rainfall data have occurred since the Ospika South Neighbourhood Stormwater Management Plan was written in 2013 so we have reviewed the total area (Ospika South Neighbourhood) to ensure that the existing and proposed stormwater detention infrastructure still have the capacity to manage stormwater flows.

L&M Engineering completed HydroCAD modelling utilizing IDF Curves provided by the IDF_CC tool with a projection to factor in climate change (RCP 8.5 scenario).

As outlined in the modelling attached in Appendix C the existing and proposed stormwater infrastructure have enough capacity to handle up to a 10-year storm, including the full build out of the Ospika South Neighbourhood.

During storms greater than a 10-year return period, additional storm flows would not reach the piped storm network as the mains are sized for a 10-year storm. Instead, additional storm flows would be directed overland along City roads and through the natural drainage ravines. The 100-year overland flow path has been outlined in the Catchment Plan in Appendix C.

We have also outlined in the attached storm modelling that the Ridgecrest Development Group's other property (PID: 008-022-461) should not require any storm detention infrastructure to handle runoff from a 10-year storm event. Instead, the storm flows could be routed to the 900mm diameter CSP stub, on the east side of the property, that proceeds through St. Dennis Heights to an outfall and a natural ravine, which then flows into the east to the Fraser River.

This proposed option would reroute storm flows away from the ravine/road dedication between St. Patick Avenue and Domano Boulevard and no storm flows would be directed to the headwall (AssetID:62). This would reduce erosion in the ravine and potential sediment mobilization onto Domano Boulevard.

The 2013 SWMP outlines an additional pond within the greenbelt/ravine to reduce runoff from Area F. This pond could be moved outside of the ravine to the west side of the future Ospika Boulevard. The exact location/sizing of this pond should be determined during the development of Area F and Ospika Boulevard.

For detailed storm modelling and the Catchment Plan please refer to Appendix C.

7.3 Proposed Storm Servicing

The proposed plan to service the property with storm could be to install 100mm diameter storm services to each single-family lot. The multifamily lot could be serviced with a 375mm diameter service stubbed into the property. All services could connect to the storm main on St. Lawrence Avenue.

Storm flows from the subject development discharge into PW255, this pond is sufficiently sized so additionally detention infrastructure would not be necessary.

A temporary sediment basin could be installed at the west end of the development to manage runoff from the undeveloped lands to west of the development and on the multi-family lot until it is developed.

8.0 SUMMARY

The subject property could be serviced with water, sanitary, and storm utilizing existing City infrastructure and proposed extensions. The proposed 10 single family-lots and 1 multi-family lot could be serviced with 25mm diameter water services and a 200mm diameter water service, respectively. All these services could tie in to the existing main that was installed as part of the Vista Ridge Watermain Extension. 100mm diameter sanitary services could be installed for the single-family lots and a 200mm diameter sanitary service could be installed for the multi-family lot. These sanitary services could connect to the main along St. Lawrence Avenue. 100mm diameter storm services could be installed for the single-family lots and a 375mm diameter storm service could be installed to service the multi-family lot. The storm services could connect to the storm main on St. Lawrence Avenue. The existing and proposed storm infrastructure would have the capacity to service the proposed and future developments up to a 10-year storm and during a 100-year storm event runoff would flow along the road network and natural ravines.

9.0 CLOSURE

This Servicing Brief has been prepared for the City of Prince George and Ridgecrest Development Group as the intended users. Any use which a third party makes of this report or any reliance on or decisions made based on it are the responsibility of such third parties. L&M Engineering Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this study. The information and data contained within this document represent L&M Engineering Limited's professional judgement in accordance with the knowledge and information available to L&M Engineering Limited at the time of the report preparation. No warranty, expressed or implied, is made.

Sincerely,

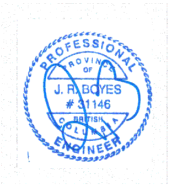
L&M ENGINEERING LTD

Prepared by:

Zachary Smith, EIT
Project Engineer

Reviewed by:

Jason Boyes, P.Eng.
Principal



2024-07-24

Permit to Practice No.: 1002375

Https://landmengineering-my.sharepoint.com/personal/zsmith_lmengineering_bc_ca/Documents/R-R.0 Servicing Brief - Rezoning and OCP Amendment Application No. CP100205 & RZ100808.docx

APPENDIX A

PROPOSED SITE PLAN

LEGAL DESCRIPTION
LOT 1 DL 1605
PL REM30683
PID: 005-287-391

EXISTING ZONING
RS2 (SINGLE RESIDENTIAL)
MIN FRONTAGE: 15.0m
MIN. AREA: 500m²
MAX. AREA: 0.2Ha

PROPOSED ZONING
RS2 – SINGLE RESIDENTIAL (LOTS 1-10)
RM3 – MULTIPLE RESIDENTIAL (LOT 11)

DEVELOPMENT AREA
2.98Ha. (7.37 acres)

SUBDIVISION YIELD
11 LOTS

NORTH

EXISTING PRV BUILDING

EXISTING SUBDIVISION

FUTURE SUBDIVISION

TEMPORARY TURNAROUND TO BE CONTAINED WITHIN STATUTORY RIGHT-OF-WAY

TEMPORARY SEDIMENT BASIN

EXISTING FIRE HYDRANT

FUTURE 37.0m ROAD DEDICATION

PROPOSED DEVELOPMENT BOUNDARY

FUTURE OSPIKA BOULEVARD

EX. 100mmø SAN

EX. 200mmø WATER MAIN

LOT 14 726m²

LOT 6 714m²

LOT 5 729m²

LOT 4 784m²

LOT 2 827m²

LOT 1 692m²

LOT 7 799m²

LOT 8 760m²

LOT 9 761m²

LOT 10 760m²

LOT 11 19158m²

PR. 25.00m ROAD DEDICATION

EX. 200mmø SANITARY MAIN

EX. 450mmø STORM MAIN

EX. 200mmø WATER MAIN

PROPOSED NEW SERVICES, (TYP.)

ST. LAWRENCE AVE

EX. 200mmø SAN
EX. 450mmø STM
EX. 200mmø WAT

EASTVIEW STREET

EXISTING ROAD DEDICATION TO BE CLOSED

EASTVIEW EXTENSION SUBDIVISION

204.47

67.04

40.08

151.89

I.P.

FH

LEGEND

SUBJECT AREA BOUNDARY

EXISTING

- EX. LEGAL LINE
- EX. LEGAL R.O.W. & EASEMENT
- EX. SANITARY & MANHOLE
- EX. SANITARY FORCE MAIN
- EX. STORM & MANHOLE
- EX. SINGLE & DOUBLE CATCHBASIN c/w CB LEADS
- EX. CATCHBASIN MANHOLE
- EX. CULVERT
- EX. FIRE HYDRANT & VALVE ASSEMBLY
- EX. WATERMAIN & VALVE
- EX. BLOW-OFF ASSEMBLY
- EX. CURB STOP
- EX. ROAD & SIDEWALK
- EX. ROAD SIGN(s)
- EX. SHOULDER
- EX. TOP OF SLOPE
- EX. TOE OF SLOPE
- EX. DITCH or SWALE
- EX. FENCE
- EX. OVERHEAD LINES
- EX. UNDERGROUND LINES
- EX. POWER POLE & ANCHOR
- EX. GAS MAIN

PROPOSED

- PR. LEGAL LINE
- PR. LEGAL R.O.W. & EASEMENT
- PR. SANITARY & MANHOLE
- PR. STORM & MANHOLE
- PR. SINGLE & DOUBLE CATCHBASIN c/w CB LEADS
- PR. CATCHBASIN MANHOLE
- PR. CULVERT
- PR. DITCH or SWALE
- PR. FIRE HYDRANT & VALVE ASSEMBLY
- PR. WATERMAIN & VALVE
- PR. GRAVEL SHOULDER
- PR. ASPHALT
- PR. CURB & SIDEWALK
- PR. ROAD SIGN(s)
- RS2 - SINGLE RESIDENTIAL
- RM3 - MULTIPLE RESIDENTIAL

NO.	DATE (D/M/Y)	REVISION	BY
2	05/09/24	LOT LAYOUT REVISED	AM
1	4/15/24	REVISED ZONING BOUNDARY	MM

NOT FOR CONSTRUCTION

L&M ENGINEERING LIMITED

CITY OF PRINCE GEORGE
Development Services

CONSULTANTS PROJECT No.: 1432-17
DRAWN: MM
CHECKED: JRB
ENGINEER: JRB
DATE: OCT 2023
SCALES: FULL 1:500
SCALES: HALF 1:1000

RIDGECREST DEVELOPMENT GROUP
ST LAWRENCE AVE EXTENSION

11 LOT SUBDIVISION
SUBDIVISION APPLICATION PLAN

DRAWING No.
SAP

0 15 30 Meters

G:\Jobs Files\1400\1432 - 657180 BC Ltd - Mo Golam\17 - St Lawrence 11 Lot subdivision\00 - Planning\03 - Application\02 - Design\01 - CAD Files\C3D24 - 1432-17 SAP BASE.dwg

APPENDIX B

WATER MODELLING

CITY OF PRINCE GEORGE
Infrastructure and Public Works

1100 Patricia Boulevard, Prince George, BC V2L 3V9
Telephone (250) 561-7511 Fax (250) 612-5603

MEMO

To: **Zachary Smith**
L&M Engineering Limited
zsmith@lmengineering.bc.ca

From: **Alex Childs**
250-614-7807
Alex.Childs@princegeorge.ca

Date: **February 16, 2023**

Subject: **WM000186 Water Modelling for 8640 St Lawrence Avenue PID: 005-287-391**
Total number of pages (including this sheet): 10 Original WILL NOT follow by mail.

Zachary Smith,

Water modelling has been carried out for 8640 St Lawrence Avenue PID: 005-287-391 as requested by yourself via the attached email sent January 30, 2024. The scenario has been evaluated with the Vista Ridge watermain connector and PRV station as per IFC drawings sealed October 18, 2022. The model analysis has been completed with an assumed PRV outlet pressure of 42 psi. Please note that the City has not yet calibrated this station, so the final outlet pressure may vary.

The results of the modelling are outlined in Table 1. The design fire flow at all nodes meets the City guidelines of 125l/s with a residual pressure of 20psi for multi-family development.

Table 1: Modelling Scenarios for 8640 St Lawrence Avenue PID: 005-287-391

Node	Modelling Node #	Node Elevation (m)	Pressure During ADD	Pressure During PHD	Design Fire Flow During MDD
Node 1	1764	702.00	45.29 PSI	41.60 PSI	143.24 l/s
Node 2	1770	698.00	50.98 PSI	47.08 PSI	177.91 l/s
Node 3	1766	691.00	60.96 PSI	57.30 PSI	125.66 l/s
Node 4	1765	689.00	59.54 PSI	55.88 PSI	125.66 l/s
Node 5	4501	689.00	63.80 PSI	60.15 PSI	152.91 l/s
Hydrant 2532 (main)	1771	695.00	55.27 PSI	51.35 PSI	146.22 l/s

Keep in mind that the values provided are at the proposed main and any losses within the service connections must be considered by the designer.

If you have any questions please contact the undersigned.

Modelling has been carried out using the most recent version of the City's water model, analyzed under Average Day Demands (ADD), Maximum Day Demands (MDD), and Peak Hour Demands (PHD). Average Day represents the expected average demand over the entire year. Maximum Day represents the average demand during the expected highest demand day of the year. Peak Hour represents the expected highest single-hour average demand with a 3-year return period. Fire Flows given are Design Fire Flows, representing the highest flow that can be drawn from a hydrant under Maximum Day Demand, without reducing pressure at any point in the network below 20 PSI.

Regards,

Prepared by
Alex Childs, P.Eng,
Development Engineer

Reviewed by
Al Clark, P.Eng.
City Engineer

CC: Jon LaFontaine, Utilities Manager
Mandy Stanker, Manager Development Services

From:	Zachary Smith
To:	devserv
Cc:	Mo Golam; Jason Boyes; Tanner Fjellstrom; Childs, Alex
Subject:	Water Modelling Request - 8640 St Lawrence Avenue
Date:	Tuesday, January 30, 2024 3:06:52 PM
Attachments:	1035-101 - Issued for Construction - October 17 2022.pdf Water Modelling - 8640 St Lawrence Avenue.pdf

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To whom this may concern,

L&M Engineering would like to request water modelling for a proposed development at 8640 St. Lawrence Avenue. The proposed development would consist of 35 single-family lots and 1 multi-family lot.

The existing mains in the surrounding area are all 200mm diameter, except for the main from PW842 to the PRV and ~58m of main installed from the PRV to the stub near Node 1 (installed as part of the Vista Ridge Watermain Extension). Attached with this email are the design drawings for the Vista Ridge Watermain Extension that should be included in the model.

All proposed mains should also be modelled as 200mm diameter.

Also attached with this email is a marked-up PDF that outlines the estimated demands and node locations. Can you please model the following scenarios:

1. Pressure during ADD scenario (All Nodes).
2. Pressure during PHD scenario (All Nodes).
3. Available Fire Flow during MDD scenario (All nodes & CoPG fire hydrant AssetID: 2532. Please include a hydrant curve for all nodes)

Please feel free to give me a call with any questions.

Sincerely,

Zachary Smith, EIT
Project Engineer
L&M Engineering Limited
1210 4th Avenue
Prince George, BC V2L3J4
Work: 250-562-1977 (Ext 113)
Cell: 250-617-8365

Map Title

Table 1: Estimated Water Demand					
ADD (l/c/d)	475	CoP G Design Guidelines Section 3.1.3			
MDD Factor	3.1	CoP G Design Guidelines Section 3.1.4 Table 3.1.1			
PHD Factor	4.25	CoP G Design Guidelines Section 3.1.4 Table 3.1.1			
Location	**Population**	**ADD (L/s)**	**MDD (L/s)**	**PHD (L/s)**	**Node Elevation (m)**
Node 1	N/A	N/A	N/A	N/A	702.0
Node 2	742	4.08	12.65	17.34	698.0
Node 3	35	0.19	0.60	0.82	691.0
Node 4	38	0.21	0.65	0.89	692.0
Node 5	N/A	N/A	N/A	N/A	689.0

640m to 500mm diameter main near PW824 (300mm dia.)

PRV

58m (300mm dia.)

56m to prv

Node 1

96m

Node 2

25m

St Lawrence Ave

AssetID: 2532

42m

Node 3

52m

88m

46m

Node 5

76m

Node 4

Graysheil Rd

Vista Ridge Dr

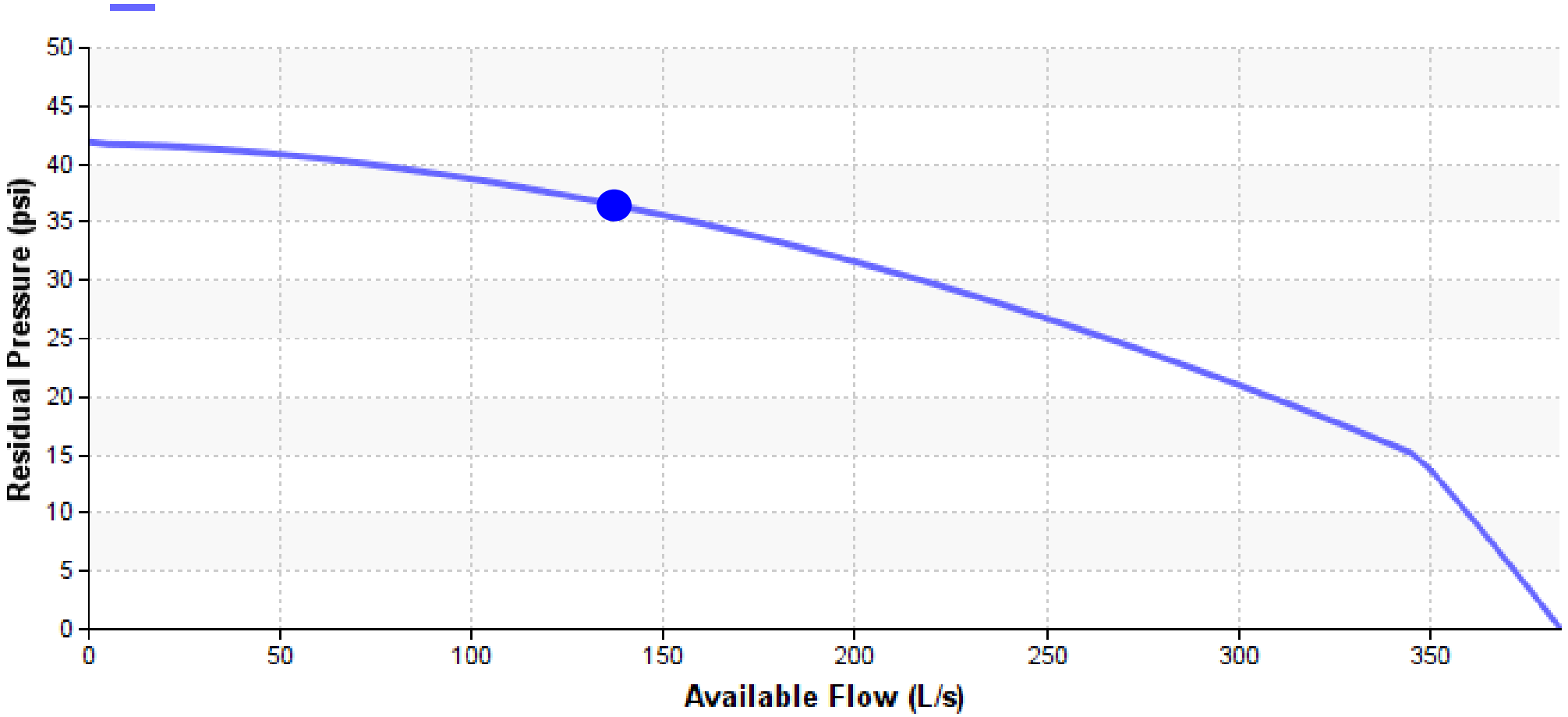
Proposed watermain

Main installed in 2023 - Vista Ridge Watermain Extension

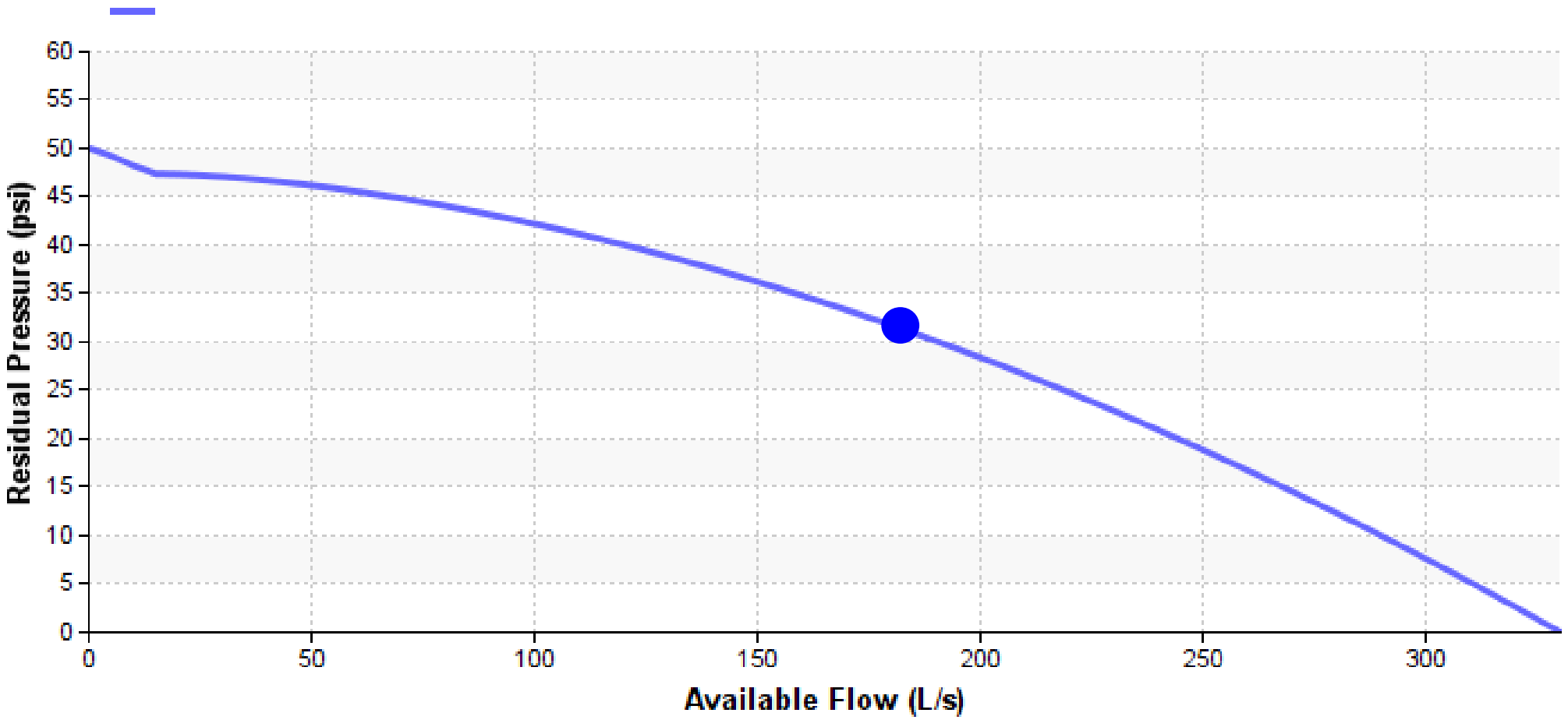
0 20 40 m

Printed: January 30, 2024 11:19

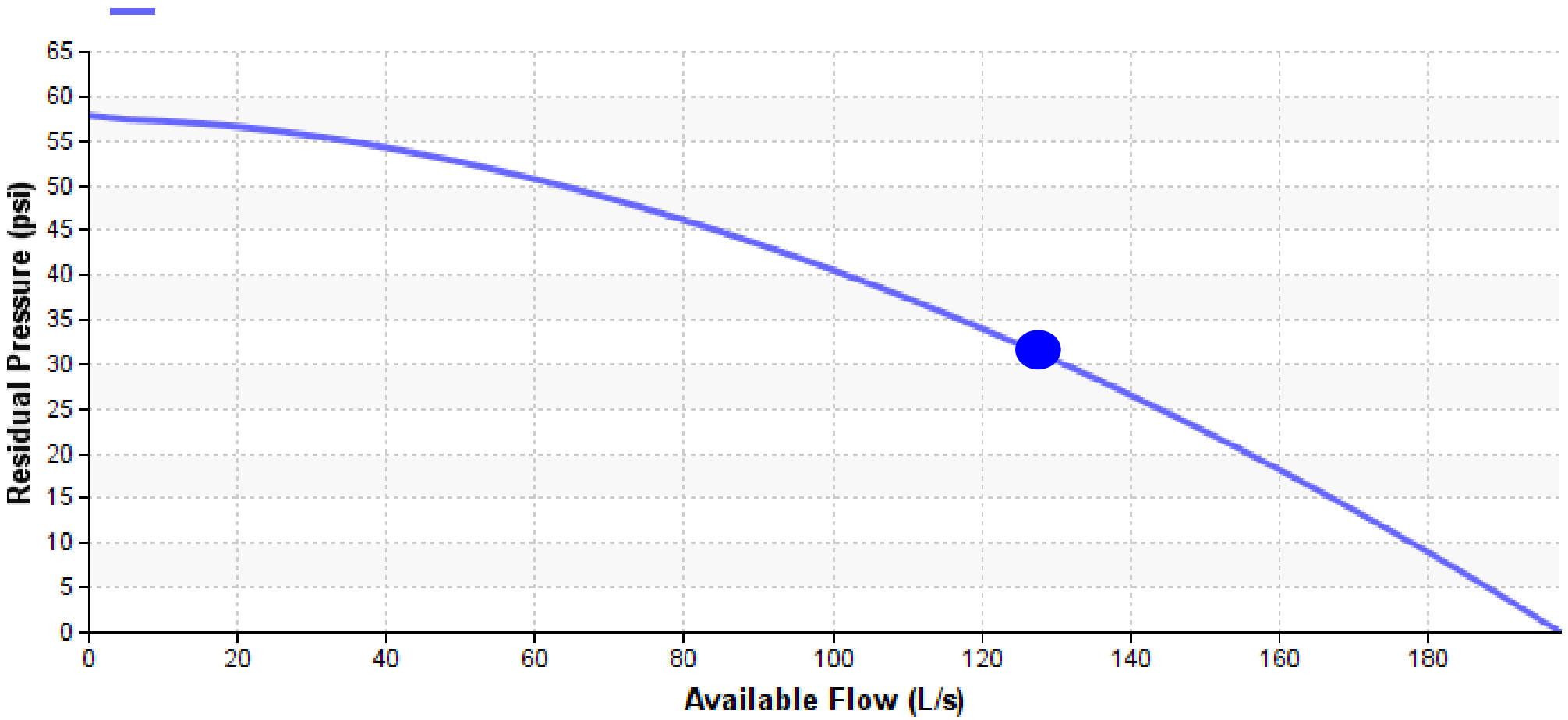
Hydrant Curve for Node 1



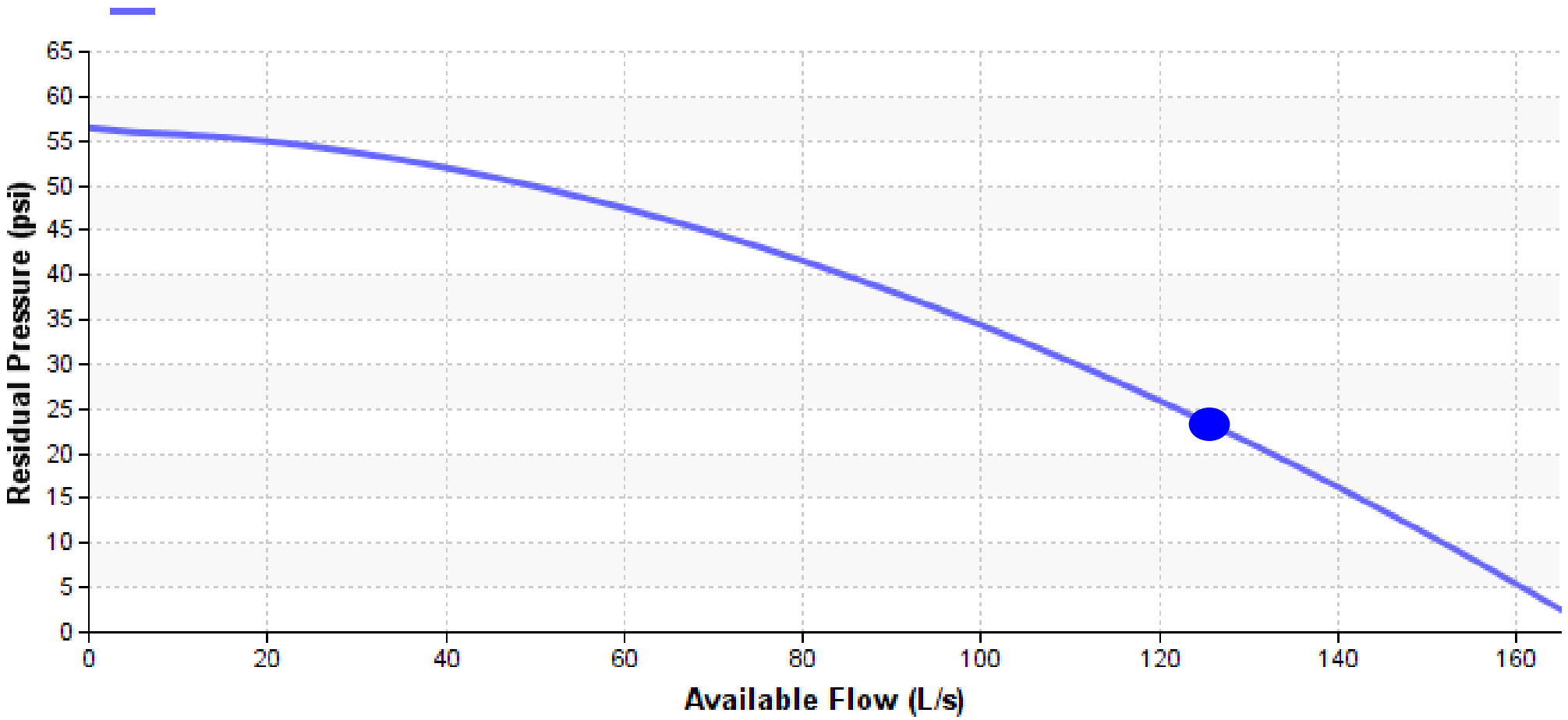
Hydrant Curve for Node 2



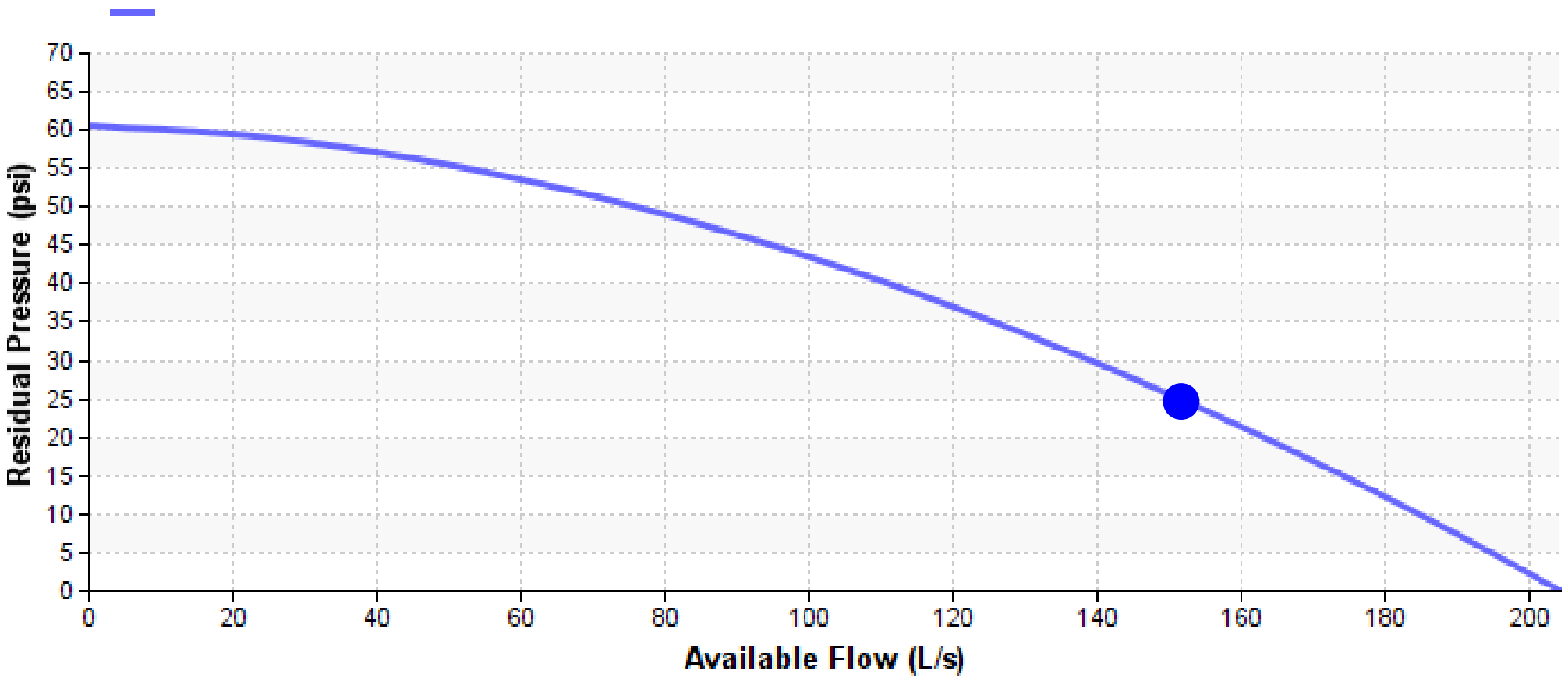
Hydrant Curve for Node 3



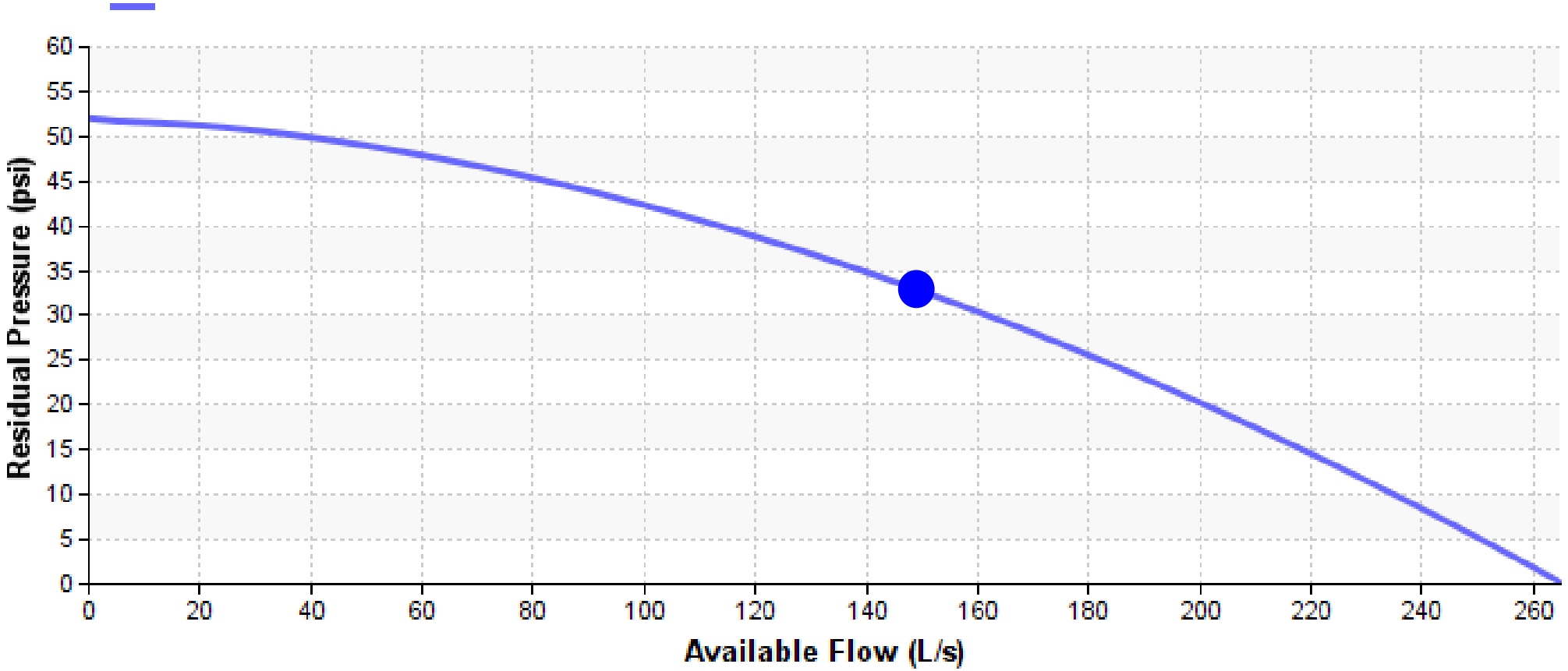
Hydrant Curve for Node 4



Hydrant Curve for Node 5

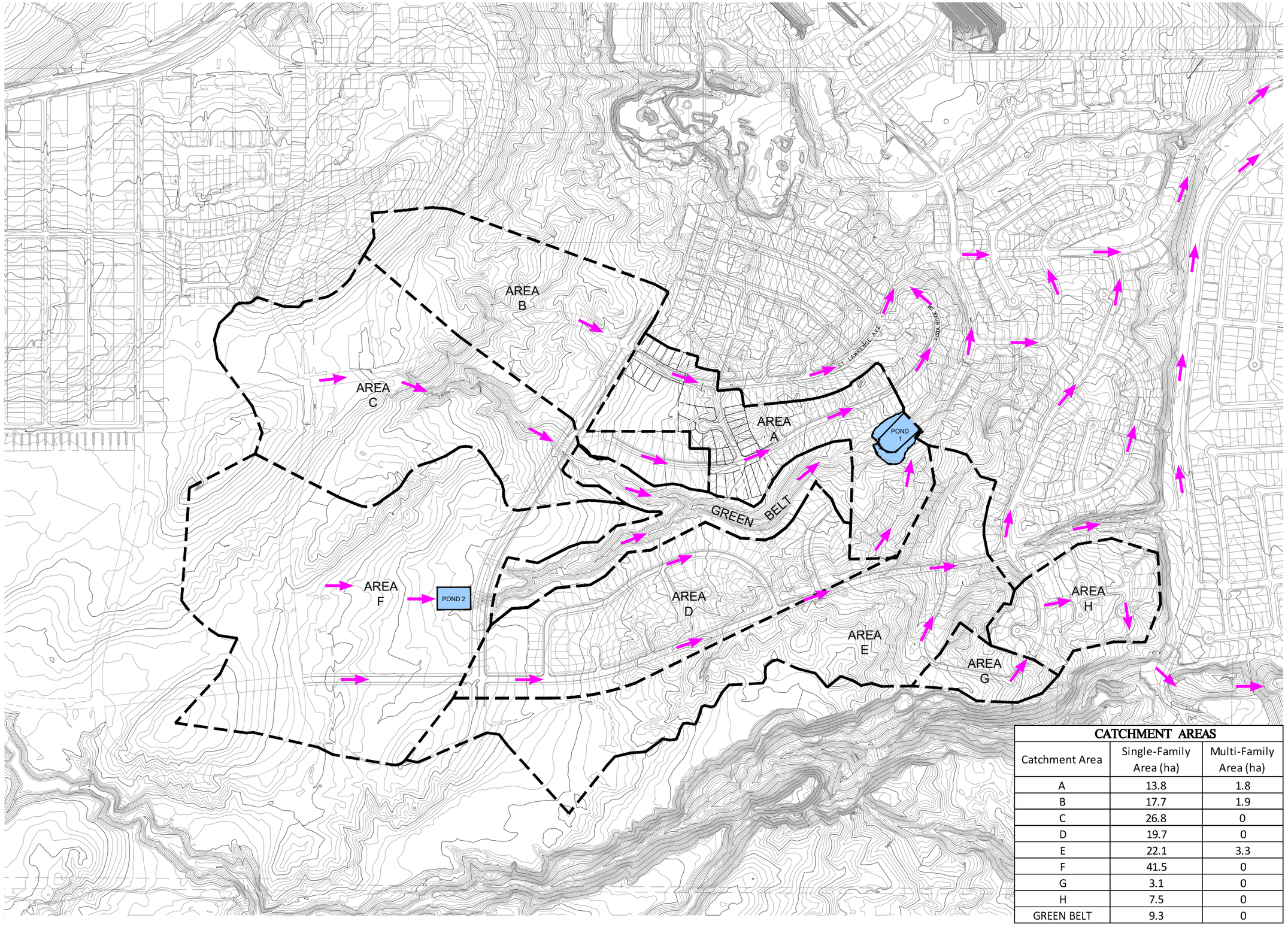


Hydrant Curve for Main at Hydrant 2532



APPENDIX C

STORM MODELLING & CATCHMENT PLAN



CATCHMENT AREAS

Catchment Area	Single-Family Area (ha)	Multi-Family Area (ha)
A	13.8	1.8
B	17.7	1.9
C	26.8	0
D	19.7	0
E	22.1	3.3
F	41.5	0
G	3.1	0
H	7.5	0
GREEN BELT	9.3	0

LEGEND

CATCHMENT BOUNDARY

100 YEAR OVERLAND FLOW PATH

NO.	DATE (D/M/Y)	REVISION	BY
–	–	–	–

NOT FOR CONSTRUCTION

L&M ENGINEERING LIMITED

CITY OF PRINCE GEORGE
Development Services

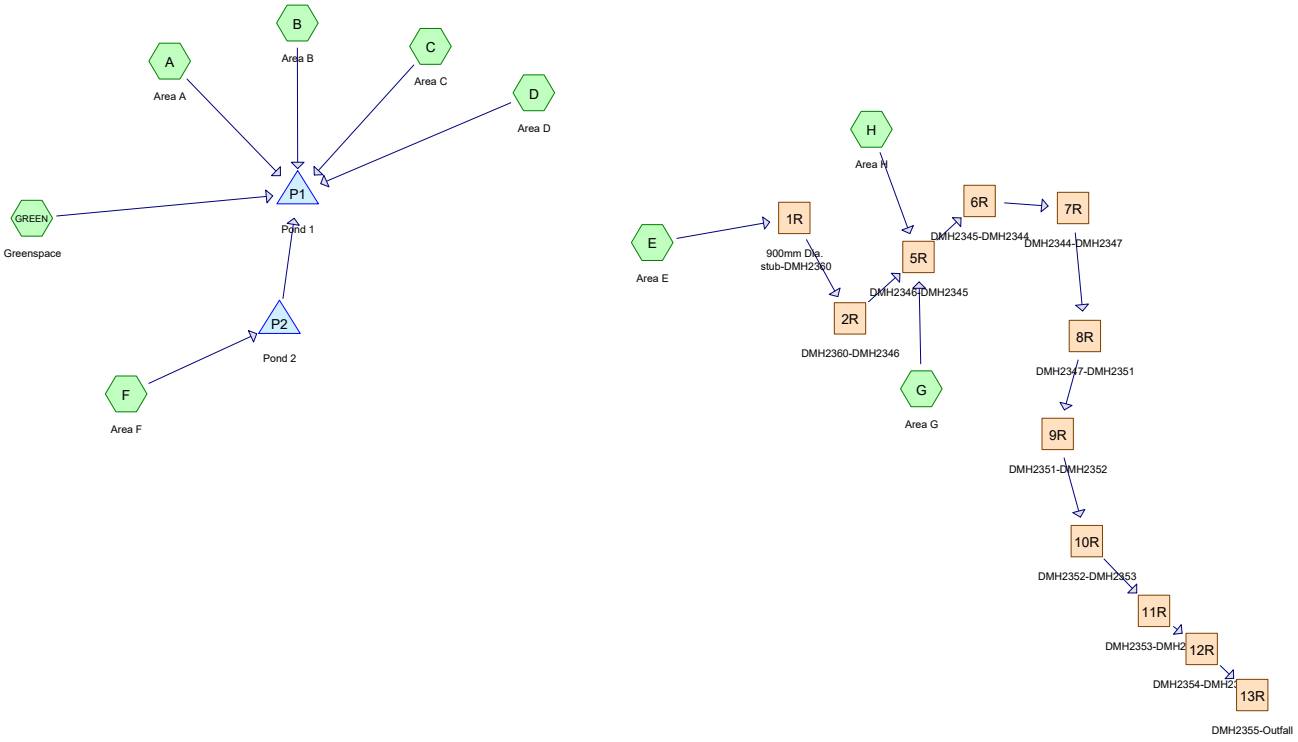
CONSULTANTS PROJECT No.:	1432-16
DRAWN:	NLW
CHECKED:	ZS
ENGINEER:	JRB
DATE:	28/02/2024
SCALES:	1:4000
SCALES:	

RIDGECREST DEVELOPMENT GROUP
ST. LAWRENCE AVENUE SUBDIVISION
STORM WATER MANAGEMENT CATCHMENT PLAN

DRAWING No.
CP

0 120 240 Meters

G:\Job Files\1400\1432 - 857180 BC Ltd - Mc Golden\16 - St Lawrence Ave Rezoning & 2 Lots SDV\05 - Storm Modelling\Catchment Boundaries1.dwg



Subcat Reach Pond Link

Routing Diagram for 1432 Overall HydroCAD
Prepared by L&M Engineering Limited, Printed 2024-07-24
HydroCAD® 10.20-2g s/n 03054 © 2022 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (hectares)	CN	Description (subcatchment-numbers)
7.5000	86	1/3 acre lots, 30% imp, HSG D (H)
150.5000	87	1/4 acre lots, 38% imp, HSG D (A, B, C, D, E, F, G)
3.7100	92	1/8 acre lots, 65% imp, HSG D (A, B)
7.5000	79	Woods/grass comb., Good, HSG D (GREEN)
169.2100	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
169.2100	HSG D	A, B, C, D, E, F, G, GREEN, H
0.0000	Other	
169.2100		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchme Numbers
0.0000	0.0000	0.0000	7.5000	0.0000	7.5000	1/3 acre lots, 30% imp	
0.0000	0.0000	0.0000	150.5000	0.0000	150.5000	1/4 acre lots, 38% imp	
0.0000	0.0000	0.0000	3.7100	0.0000	3.7100	1/8 acre lots, 65% imp	
0.0000	0.0000	0.0000	7.5000	0.0000	7.5000	Woods/grass comb., Good	
0.0000	**0.0000**	**0.0000**	**169.2100**	**0.0000**	**169.2100**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (meters)	Out-Invert (meters)	Length (meters)	Slope (m/m)	n	Width (mm)	Diam/Height (mm)	Inside-Fill (mm)
1	1R	652.817	652.457	35.00	0.0103	0.016	0	900	0
2	2R	652.426	651.793	65.92	0.0096	0.016	0	900	0
3	5R	651.701	649.833	79.50	0.0235	0.016	0	900	0
4	6R	649.770	648.930	20.00	0.0420	0.016	0	800	0
5	7R	648.885	644.640	96.47	0.0440	0.016	0	800	0
6	8R	644.626	644.129	21.50	0.0231	0.016	0	900	0
7	9R	644.129	643.315	26.97	0.0302	0.016	0	900	0
8	10R	643.314	642.125	42.00	0.0283	0.016	0	900	0
9	11R	642.059	637.144	49.50	0.0993	0.016	0	800	0
10	12R	637.015	622.927	41.00	0.3436	0.016	0	800	0
11	13R	622.928	622.142	13.50	0.0582	0.016	0	800	0
12	P1	667.000	666.700	30.00	0.0100	0.013	0	300	0
13	P2	696.000	695.800	10.00	0.0200	0.013	0	150	0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Area A Runoff Area=15.6000 ha 41.12% Impervious Runoff Depth>19 mm
Tc=15.0 min CN=88 Runoff=0.8339 m³/s 2.979 Ml

Subcatchment B: Area B Runoff Area=21.5100 ha 40.40% Impervious Runoff Depth>18 mm
Tc=15.0 min CN=87 Runoff=1.0353 m³/s 3.821 Ml

Subcatchment C: Area C Runoff Area=26.8000 ha 38.00% Impervious Runoff Depth>18 mm
Tc=20.0 min CN=87 Runoff=1.1126 m³/s 4.754 Ml

Subcatchment D: Area D Runoff Area=19.7000 ha 38.00% Impervious Runoff Depth>18 mm
Tc=15.0 min CN=87 Runoff=0.9482 m³/s 3.499 Ml

Subcatchment E: Area E Runoff Area=26.0000 ha 38.00% Impervious Runoff Depth>18 mm
Tc=15.0 min CN=87 Runoff=1.2515 m³/s 4.618 Ml

Subcatchment F: Area F Runoff Area=41.5000 ha 38.00% Impervious Runoff Depth>18 mm
Tc=20.0 min CN=87 Runoff=1.7229 m³/s 7.361 Ml

Subcatchment G: Area G Runoff Area=3.1000 ha 38.00% Impervious Runoff Depth>18 mm
Tc=10.0 min CN=87 Runoff=0.1751 m³/s 0.551 Ml

Subcatchment GREEN: Greenspace Runoff Area=7.5000 ha 0.00% Impervious Runoff Depth>9 mm
Tc=15.0 min CN=79 Runoff=0.1256 m³/s 0.708 Ml

Subcatchment H: Area H Runoff Area=7.5000 ha 30.00% Impervious Runoff Depth>17 mm
Tc=5.0 min CN=86 Runoff=0.4526 m³/s 1.241 Ml

Reach 1R: 900mm Dia. Avg. Flow Depth=0.63 m Max Vel=2.63 m/s Inflow=1.2515 m³/s 4.618 Ml
900 mm Round Pipe n=0.016 L=35.00 m S=0.0103 m/m Capacity=1.4917 m³/s Outflow=1.2460 m³/s 4.617 Ml

Reach 2R: DMH2360-DMH2346 Avg. Flow Depth=0.65 m Max Vel=2.55 m/s Inflow=1.2460 m³/s 4.617 Ml
900 mm Round Pipe n=0.016 L=65.92 m S=0.0096 m/m Capacity=1.4414 m³/s Outflow=1.2344 m³/s 4.614 Ml

Reach 5R: DMH2346-DMH2345 Avg. Flow Depth=0.55 m Max Vel=3.83 m/s Inflow=1.5752 m³/s 6.407 Ml
900 mm Round Pipe n=0.016 L=79.50 m S=0.0235 m/m Capacity=2.2547 m³/s Outflow=1.5680 m³/s 6.404 Ml

Reach 6R: DMH2345-DMH2344 Avg. Flow Depth=0.50 m Max Vel=4.76 m/s Inflow=1.5680 m³/s 6.404 Ml
800 mm Round Pipe n=0.016 L=20.00 m S=0.0420 m/m Capacity=2.2019 m³/s Outflow=1.5666 m³/s 6.404 Ml

Reach 7R: DMH2344-DMH2347 Avg. Flow Depth=0.49 m Max Vel=4.84 m/s Inflow=1.5666 m³/s 6.404 Ml
800 mm Round Pipe n=0.016 L=96.47 m S=0.0440 m/m Capacity=2.2538 m³/s Outflow=1.5605 m³/s 6.401 Ml

Reach 8R: DMH2347-DMH2351 Avg. Flow Depth=0.55 m Max Vel=3.80 m/s Inflow=1.5605 m³/s 6.401 Ml
900 mm Round Pipe n=0.016 L=21.50 m S=0.0231 m/m Capacity=2.2363 m³/s Outflow=1.5586 m³/s 6.400 Ml

Reach 9R: DMH2351-DMH2352 Avg. Flow Depth=0.51 m Max Vel=4.21 m/s Inflow=1.5586 m³/s 6.400 Ml
900 mm Round Pipe n=0.016 L=26.97 m S=0.0302 m/m Capacity=2.5553 m³/s Outflow=1.5563 m³/s 6.400 Ml

Reach 10R: DMH2352-DMH2353 Avg. Flow Depth=0.52 m Max Vel=4.11 m/s Inflow=1.5563 m³/s 6.400 Ml
900 mm Round Pipe n=0.016 L=42.00 m S=0.0283 m/m Capacity=2.4748 m³/s Outflow=1.5525 m³/s 6.398 Ml

Reach 11R: DMH2353-DMH2354 Avg. Flow Depth=0.38 m Max Vel=6.58 m/s Inflow=1.5525 m³/s 6.398 Ml
800 mm Round Pipe n=0.016 L=49.50 m S=0.0993 m/m Capacity=3.3855 m³/s Outflow=1.5496 m³/s 6.397 Ml

Reach 12R: DMH2354-DMH2355 Avg. Flow Depth=0.27 m Max Vel=10.35 m/s Inflow=1.5496 m³/s 6.397 Ml
800 mm Round Pipe n=0.016 L=41.00 m S=0.3436 m/m Capacity=6.2980 m³/s Outflow=1.5480 m³/s 6.397 Ml

Reach 13R: DMH2355-Outfall Avg. Flow Depth=0.45 m Max Vel=5.37 m/s Inflow=1.5480 m³/s 6.397 Ml
800 mm Round Pipe n=0.016 L=13.50 m S=0.0582 m/m Capacity=2.5925 m³/s Outflow=1.5469 m³/s 6.396 Ml

Pond P1: Pond 1 Peak Elev=670.111 m Storage=8,037.5 m³ Inflow=3.9921 m³/s 18.619 Ml
Primary=0.2459 m³/s 13.256 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.2459 m³/s 13.256 Ml

Pond P2: Pond 2 Peak Elev=698.049 m Storage=4,707.2 m³ Inflow=1.7229 m³/s 7.361 Ml
Primary=0.0521 m³/s 2.859 Ml Secondary=0.0000 m³/s 0.000 Ml Outflow=0.0521 m³/s 2.859 Ml

Total Runoff Area = 169.2100 ha Runoff Volume = 29.532 Ml Average Runoff Depth = 17 mm
63.45% Pervious = 107.3585 ha 36.55% Impervious = 61.8515 ha

Summary for Subcatchment A: Area A

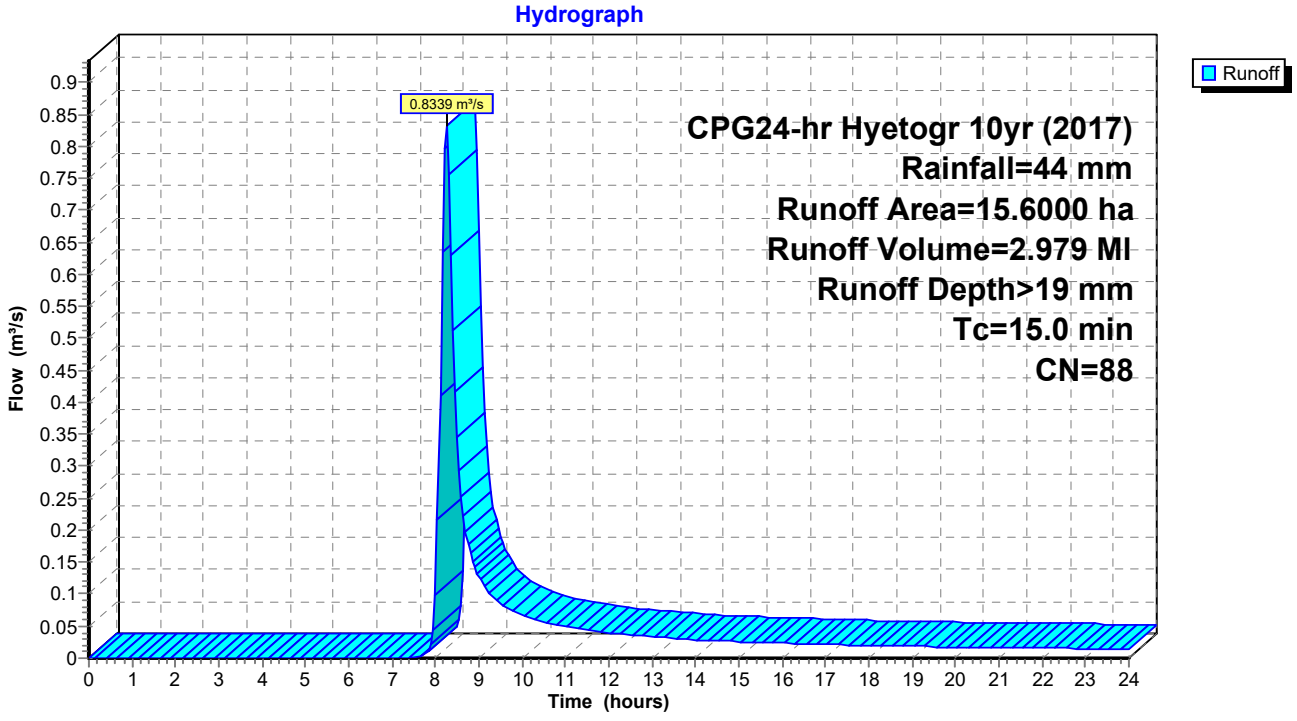
Runoff = 0.8339 m³/s @ 8.24 hrs, Volume= 2.979 Ml, Depth> 19 mm
Routed to Pond P1 : Pond 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
13.8000	87	1/4 acre lots, 38% imp, HSG D
1.8000	92	1/8 acre lots, 65% imp, HSG D
15.6000	88	Weighted Average
9.1860		58.88% Pervious Area
6.4140		41.12% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment A: Area A



Summary for Subcatchment B: Area B

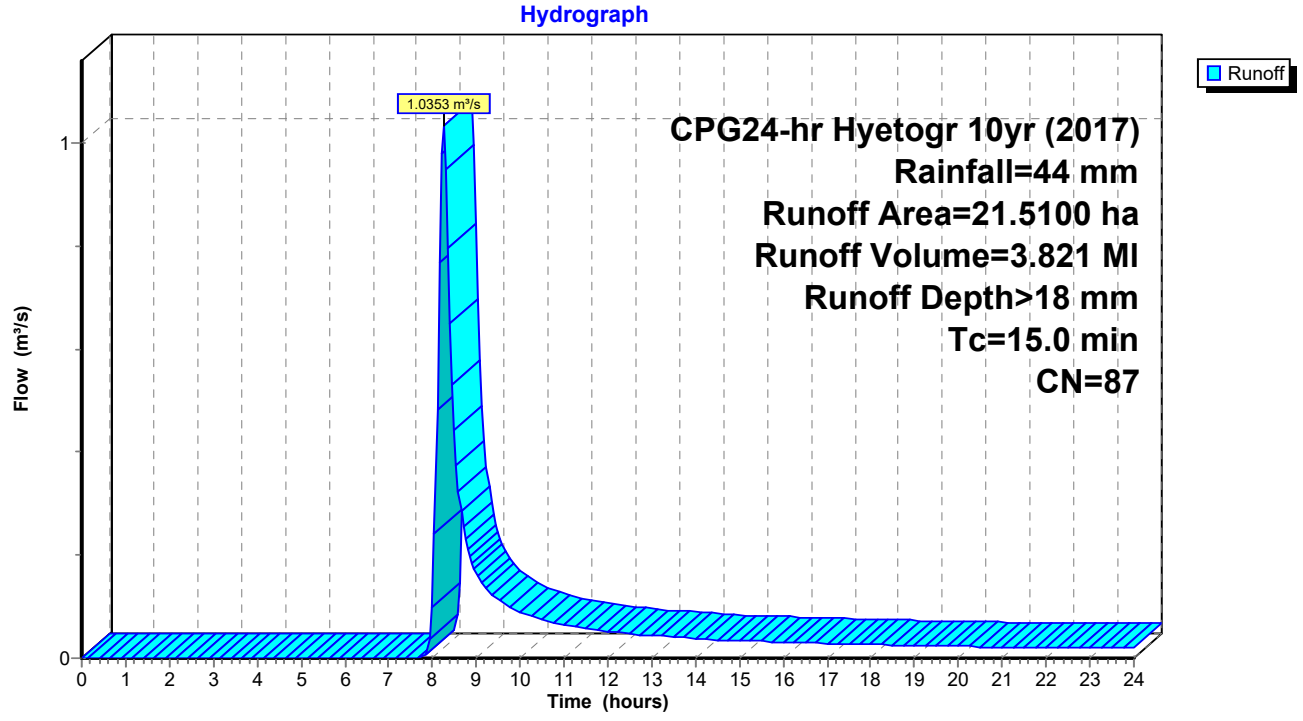
Runoff = 1.0353 m³/s @ 8.24 hrs, Volume= 3.821 Ml, Depth> 18 mm
Routed to Pond P1 : Pond 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
19.6000	87	1/4 acre lots, 38% imp, HSG D
1.9100	92	1/8 acre lots, 65% imp, HSG D
21.5100	87	Weighted Average
12.8205		59.60% Pervious Area
8.6895		40.40% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment B: Area B



Summary for Subcatchment C: Area C

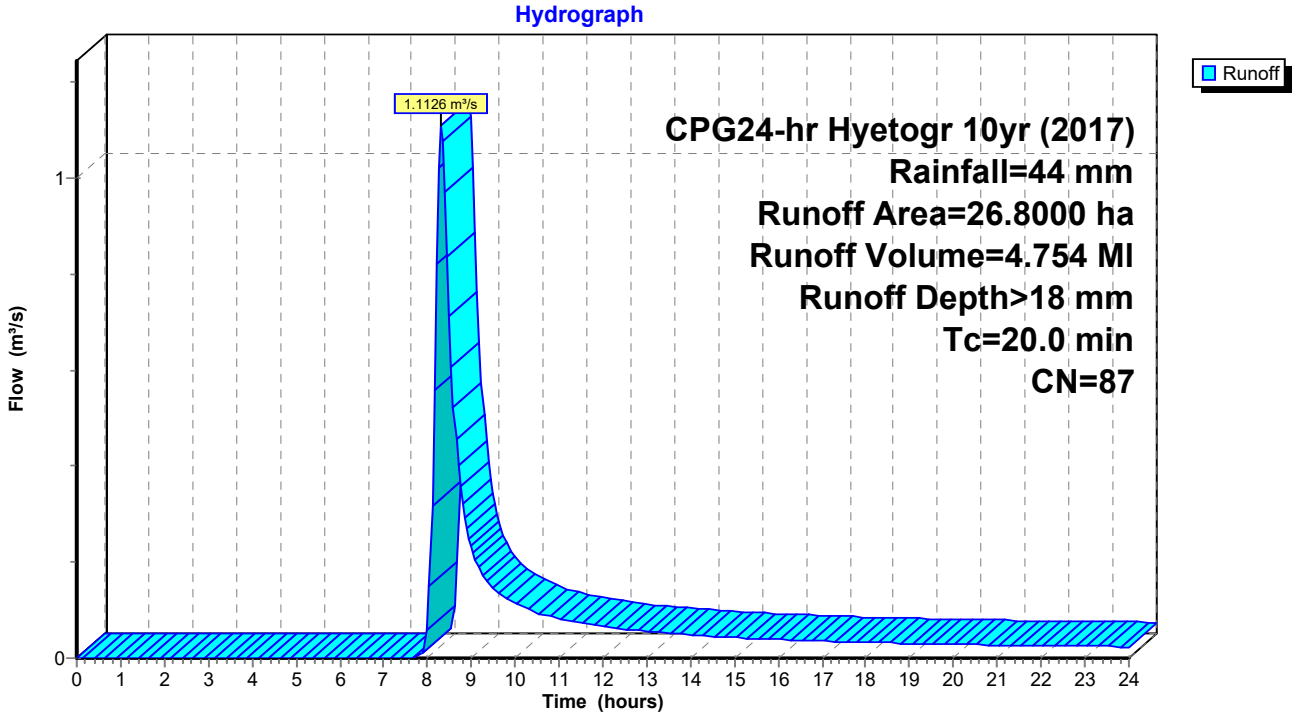
Runoff = 1.1126 m³/s @ 8.31 hrs, Volume= 4.754 Ml, Depth> 18 mm
Routed to Pond P1 : Pond 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
26.8000	87	1/4 acre lots, 38% imp, HSG D
16.6160		62.00% Pervious Area
10.1840		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment C: Area C



Summary for Subcatchment D: Area D

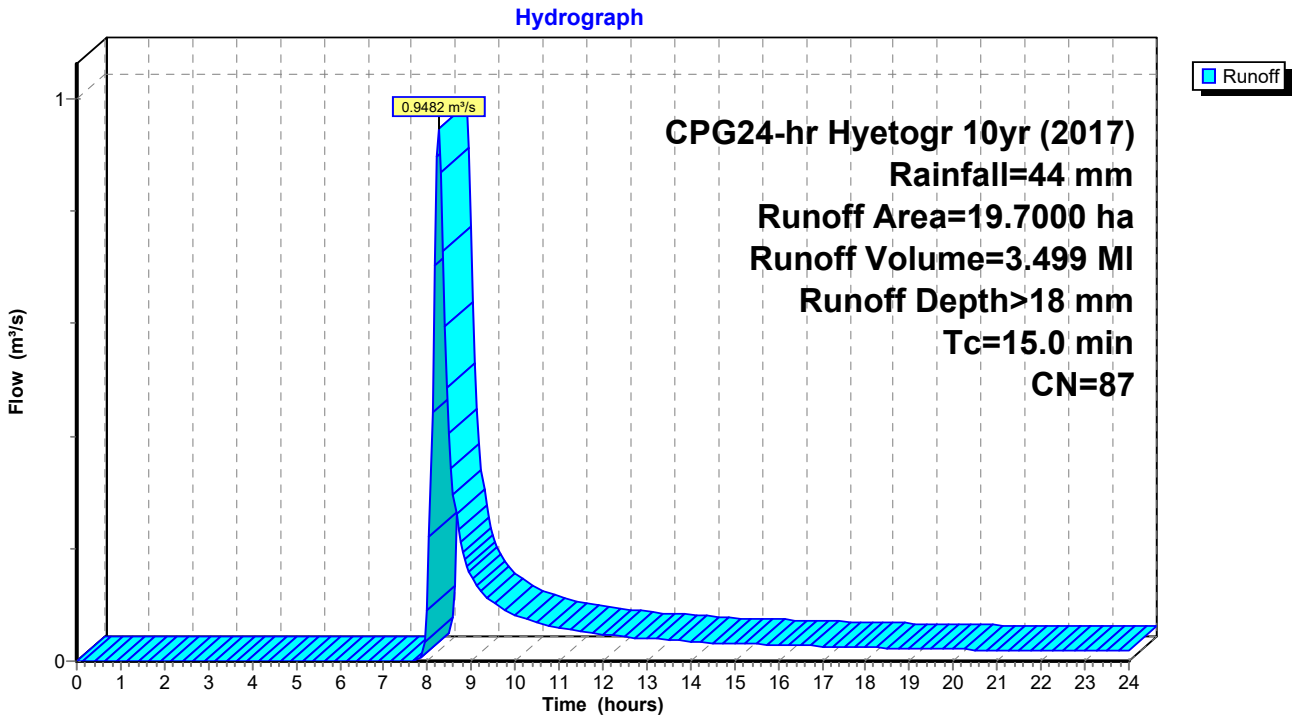
Runoff = 0.9482 m³/s @ 8.24 hrs, Volume= 3.499 Ml, Depth> 18 mm
Routed to Pond P1 : Pond 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
19.7000	87	1/4 acre lots, 38% imp, HSG D
12.2140		62.00% Pervious Area
7.4860		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment D: Area D



Summary for Subcatchment E: Area E

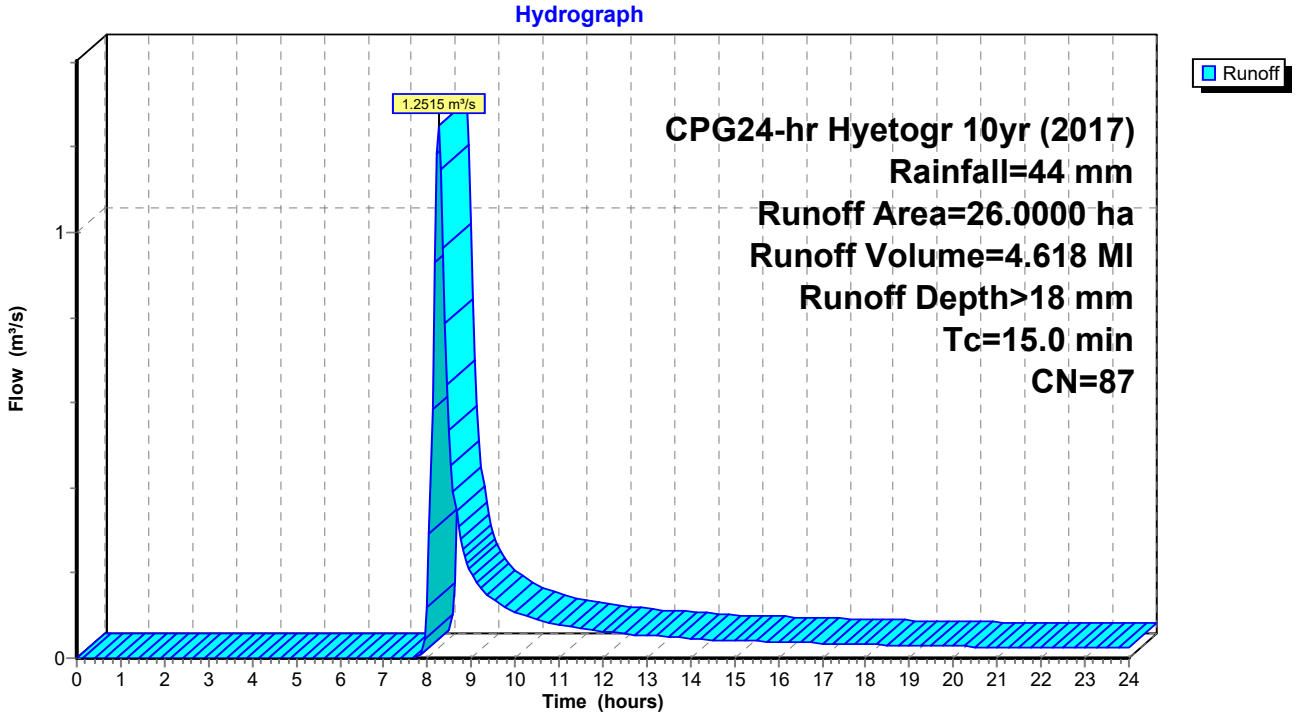
Runoff = 1.2515 m³/s @ 8.24 hrs, Volume= 4.618 Ml, Depth> 18 mm
Routed to Reach 1R : 900mm Dia. stub-DMH2360

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
26.0000	87	1/4 acre lots, 38% imp, HSG D
16.1200		62.00% Pervious Area
9.8800		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment E: Area E



Summary for Subcatchment F: Area F

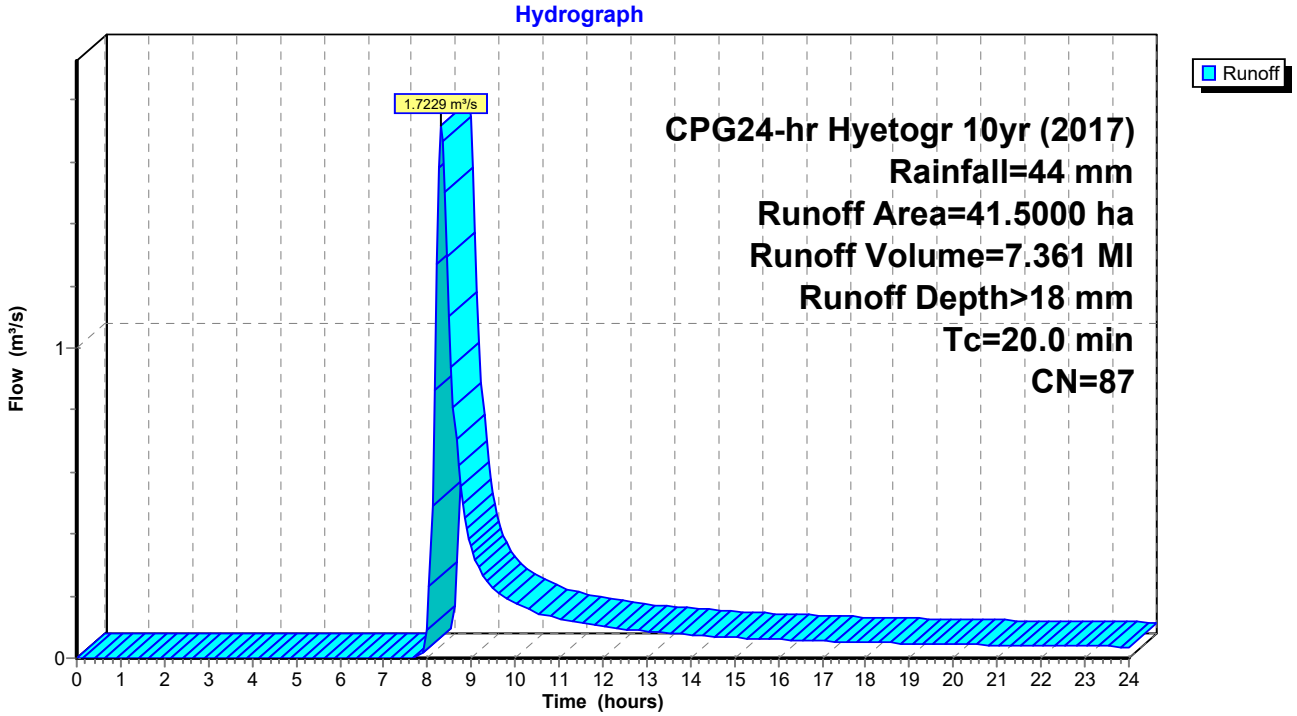
Runoff = 1.7229 m³/s @ 8.31 hrs, Volume= 7.361 Ml, Depth> 18 mm
Routed to Pond P2 : Pond 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
41.5000	87	1/4 acre lots, 38% imp, HSG D
25.7300		62.00% Pervious Area
15.7700		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
20.0					**Direct Entry,**

Subcatchment F: Area F



Summary for Subcatchment G: Area G

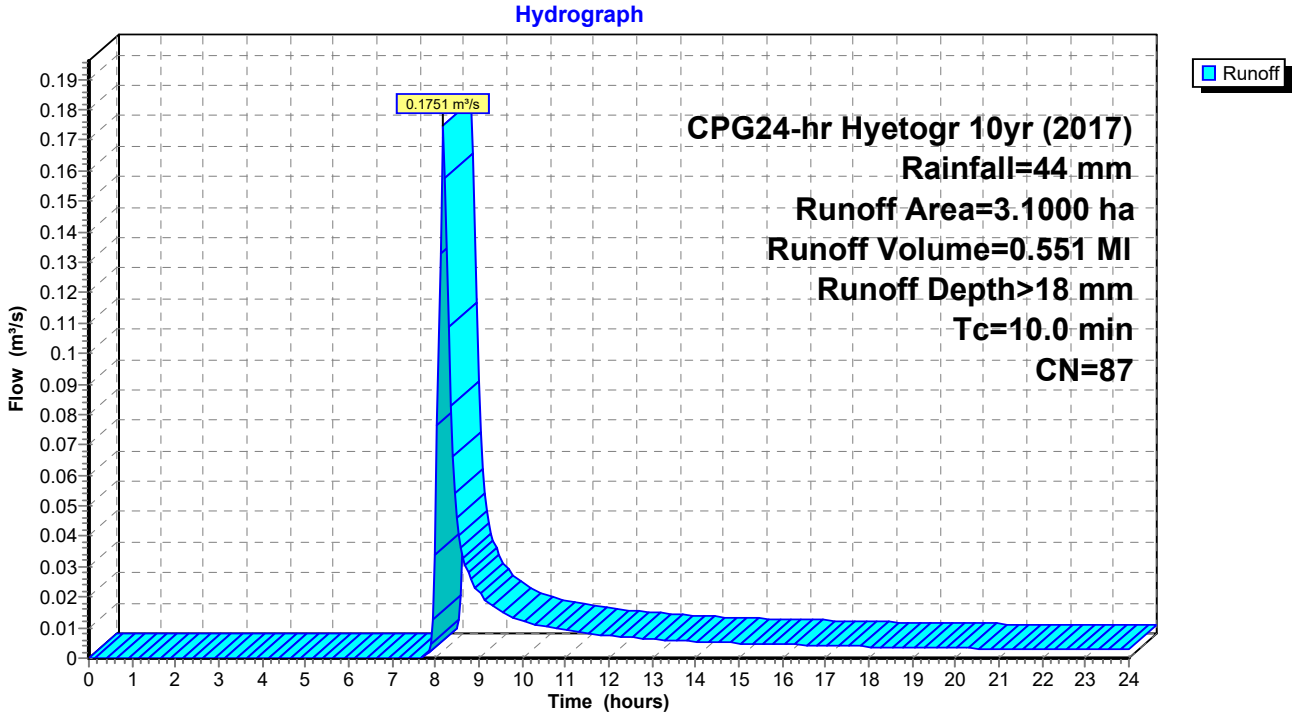
Runoff = 0.1751 m³/s @ 8.18 hrs, Volume= 0.551 Ml, Depth> 18 mm
Routed to Reach 5R : DMH2346-DMH2345

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
3.1000	87	1/4 acre lots, 38% imp, HSG D
1.9220		62.00% Pervious Area
1.1780		38.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment G: Area G



Summary for Subcatchment GREEN: Greenspace

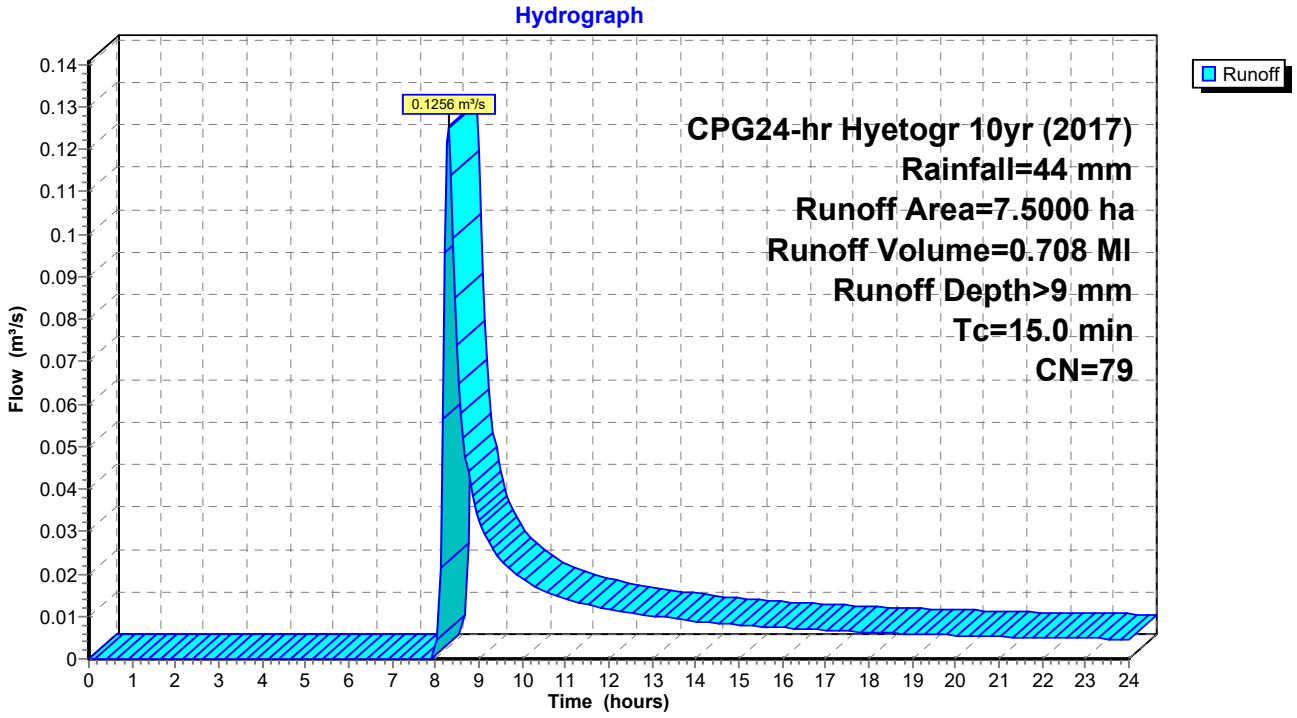
Runoff = 0.1256 m³/s @ 8.29 hrs, Volume= 0.708 Ml, Depth> 9 mm
Routed to Pond P1 : Pond 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
7.5000	79	Woods/grass comb., Good, HSG D
7.5000		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment GREEN: Greenspace



Summary for Subcatchment H: Area H

[49] Hint: Tc<2dt may require smaller dt

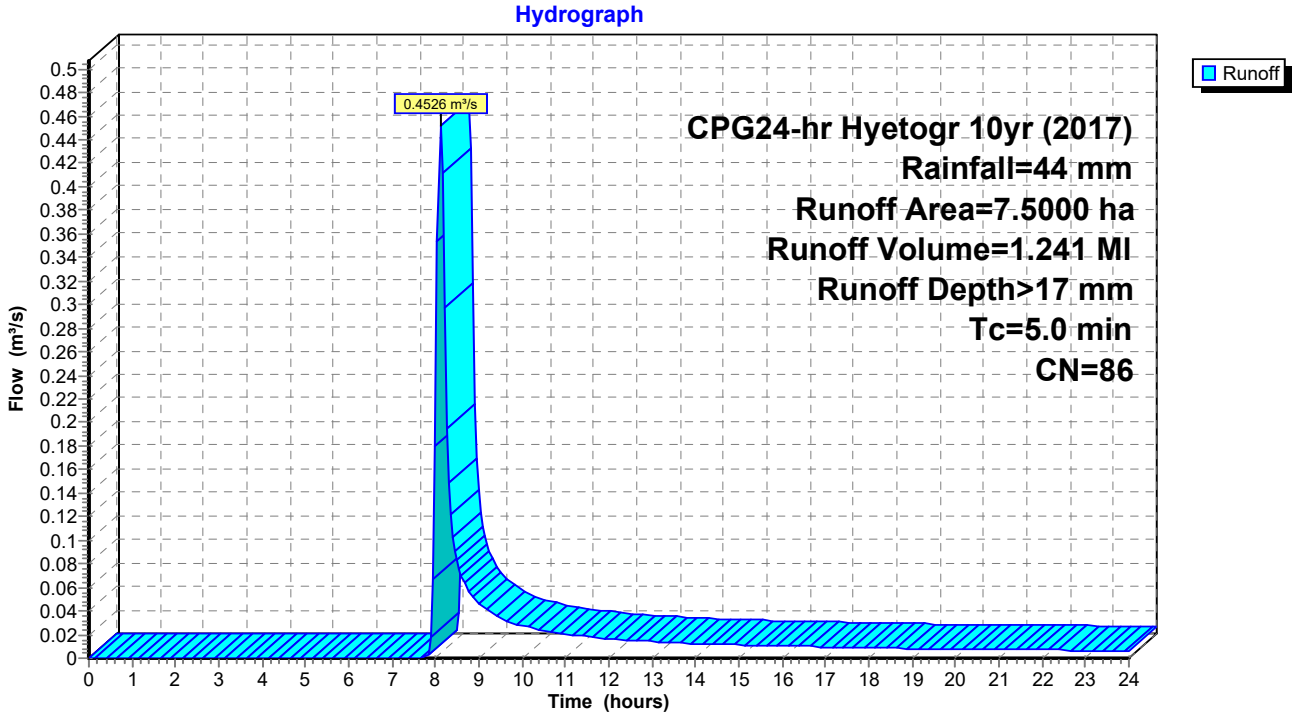
Runoff = 0.4526 m³/s @ 8.11 hrs, Volume= 1.241 Ml, Depth> 17 mm
Routed to Reach 5R : DMH2346-DMH2345

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
CPG24-hr Hyetogr 10yr (2017) Rainfall=44 mm

Area (ha)	CN	Description
7.5000	86	1/3 acre lots, 30% imp, HSG D
5.2500		70.00% Pervious Area
2.2500		30.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
5.0					**Direct Entry,**

Subcatchment H: Area H



Summary for Reach 1R: 900mm Dia. stub-DMH2360

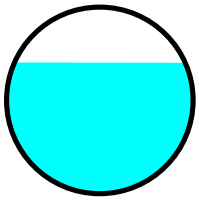
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 26.0000 ha, 38.00% Impervious, Inflow Depth > 18 mm
Inflow = 1.2515 m³/s @ 8.24 hrs, Volume= 4.618 Ml
Outflow = 1.2460 m³/s @ 8.25 hrs, Volume= 4.617 Ml, Atten= 0%, Lag= 0.4 min
Routed to Reach 2R : DMH2360-DMH2346

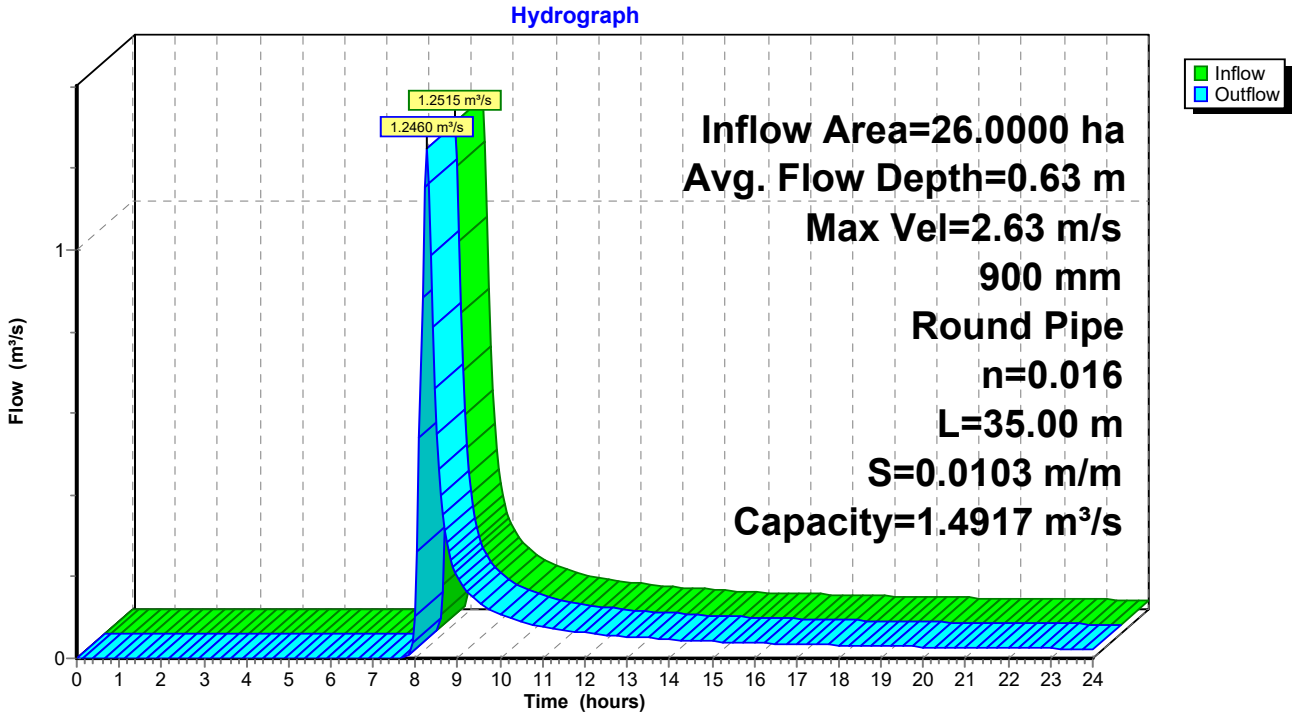
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.63 m/s, Min. Travel Time= 0.2 min
Avg. Velocity = 1.09 m/s, Avg. Travel Time= 0.5 min

Peak Storage= 16.7 m³ @ 8.25 hrs
Average Depth at Peak Storage= 0.63 m , Surface Width= 0.82 m
Bank-Full Depth= 0.90 m Flow Area= 0.64 m², Capacity= 1.4917 m³/s

900 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 35.00 m Slope= 0.0103 m/m
Inlet Invert= 652.817 m, Outlet Invert= 652.457 m



Reach 1R: 900mm Dia. stub-DMH2360



Summary for Reach 2R: DMH2360-DMH2346

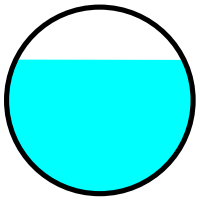
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 1R outlet invert by 0.614 m @ 8.25 hrs

Inflow Area = 26.0000 ha, 38.00% Impervious, Inflow Depth > 18 mm
Inflow = 1.2460 m³/s @ 8.25 hrs, Volume= 4.617 Ml
Outflow = 1.2344 m³/s @ 8.26 hrs, Volume= 4.614 Ml, Atten= 1%, Lag= 0.8 min
Routed to Reach 5R : DMH2346-DMH2345

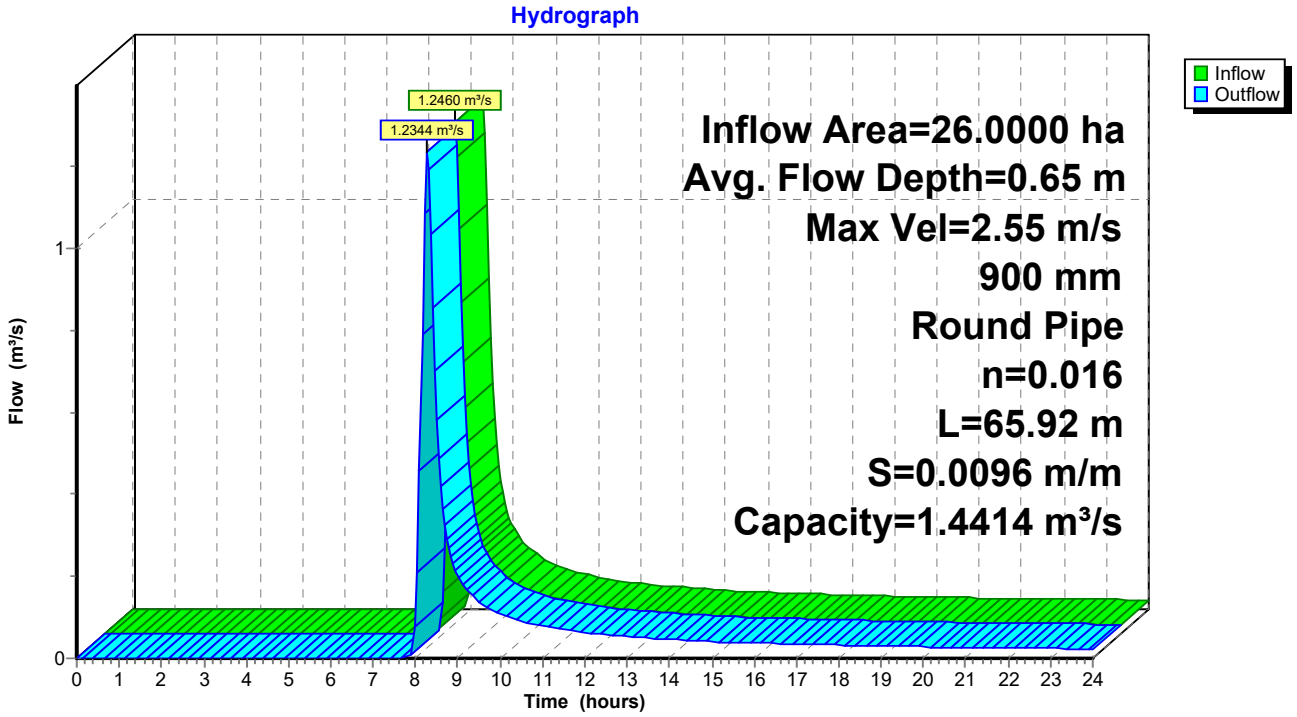
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.55 m/s, Min. Travel Time= 0.4 min
Avg. Velocity = 1.07 m/s, Avg. Travel Time= 1.0 min

Peak Storage= 32.2 m³ @ 8.26 hrs
Average Depth at Peak Storage= 0.65 m , Surface Width= 0.81 m
Bank-Full Depth= 0.90 m Flow Area= 0.64 m², Capacity= 1.4414 m³/s

900 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 65.92 m Slope= 0.0096 m/m
Inlet Invert= 652.426 m, Outlet Invert= 651.793 m



Reach 2R: DMH2360-DMH2346



Summary for Reach 5R: DMH2346-DMH2345

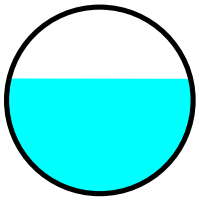
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 2R outlet invert by 0.461 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 18 mm
Inflow = 1.5752 m³/s @ 8.23 hrs, Volume= 6.407 Ml
Outflow = 1.5680 m³/s @ 8.24 hrs, Volume= 6.404 Ml, Atten= 0%, Lag= 0.7 min
Routed to Reach 6R : DMH2345-DMH2344

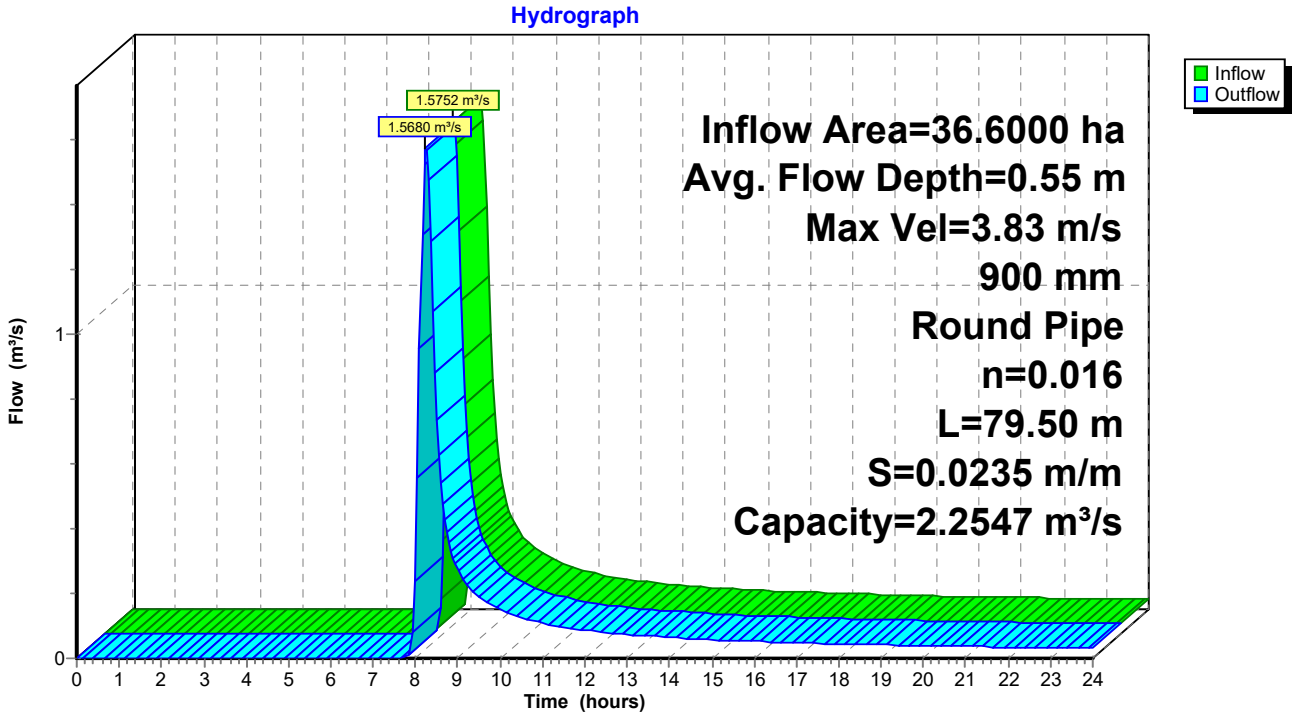
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.83 m/s, Min. Travel Time= 0.3 min
Avg. Velocity = 1.61 m/s, Avg. Travel Time= 0.8 min

Peak Storage= 32.7 m³ @ 8.23 hrs
Average Depth at Peak Storage= 0.55 m , Surface Width= 0.88 m
Bank-Full Depth= 0.90 m Flow Area= 0.64 m², Capacity= 2.2547 m³/s

900 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 79.50 m Slope= 0.0235 m/m
Inlet Invert= 651.701 m, Outlet Invert= 649.833 m



Reach 5R: DMH2346-DMH2345



Summary for Reach 6R: DMH2345-DMH2344

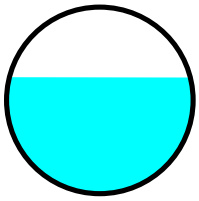
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 5R outlet invert by 0.436 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5680 m³/s @ 8.24 hrs, Volume= 6.404 Ml
Outflow = 1.5666 m³/s @ 8.24 hrs, Volume= 6.404 Ml, Atten= 0%, Lag= 0.1 min
Routed to Reach 7R : DMH2344-DMH2347

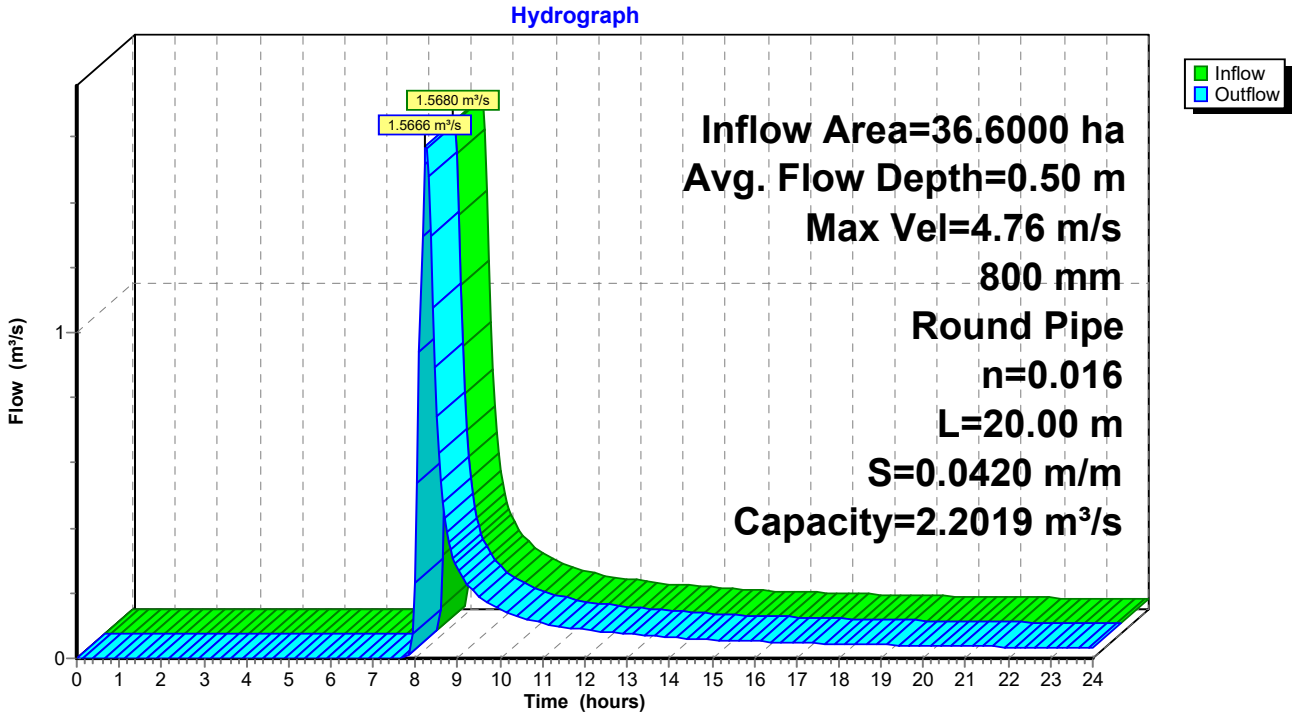
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.76 m/s, Min. Travel Time= 0.1 min
Avg. Velocity = 2.01 m/s, Avg. Travel Time= 0.2 min

Peak Storage= 6.6 m³ @ 8.24 hrs
Average Depth at Peak Storage= 0.50 m , Surface Width= 0.78 m
Bank-Full Depth= 0.80 m Flow Area= 0.50 m², Capacity= 2.2019 m³/s

800 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 20.00 m Slope= 0.0420 m/m
Inlet Invert= 649.770 m, Outlet Invert= 648.930 m



Reach 6R: DMH2345-DMH2344



Summary for Reach 7R: DMH2344-DMH2347

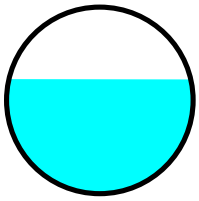
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 6R outlet invert by 0.446 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5666 m³/s @ 8.24 hrs, Volume= 6.404 Ml
Outflow = 1.5605 m³/s @ 8.25 hrs, Volume= 6.401 Ml, Atten= 0%, Lag= 0.6 min
Routed to Reach 8R : DMH2347-DMH2351

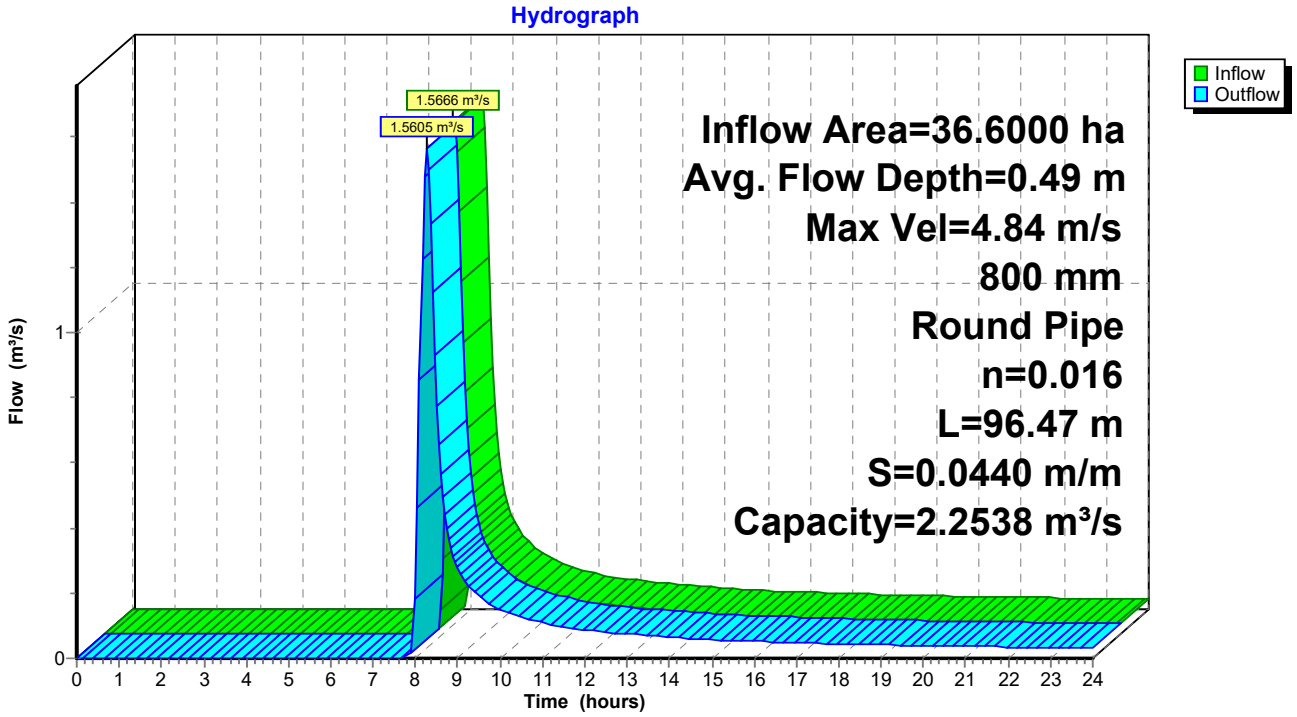
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.84 m/s, Min. Travel Time= 0.3 min
Avg. Velocity = 2.04 m/s, Avg. Travel Time= 0.8 min

Peak Storage= 31.2 m³ @ 8.25 hrs
Average Depth at Peak Storage= 0.49 m , Surface Width= 0.78 m
Bank-Full Depth= 0.80 m Flow Area= 0.50 m², Capacity= 2.2538 m³/s

800 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 96.47 m Slope= 0.0440 m/m
Inlet Invert= 648.885 m, Outlet Invert= 644.640 m



Reach 7R: DMH2344-DMH2347



Summary for Reach 8R: DMH2347-DMH2351

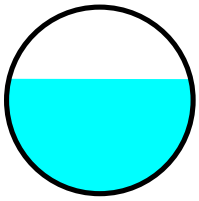
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 7R OUTLET depth by 0.051 m @ 8.30 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5605 m³/s @ 8.25 hrs, Volume= 6.401 Ml
Outflow = 1.5586 m³/s @ 8.26 hrs, Volume= 6.400 Ml, Atten= 0%, Lag= 0.2 min
Routed to Reach 9R : DMH2351-DMH2352

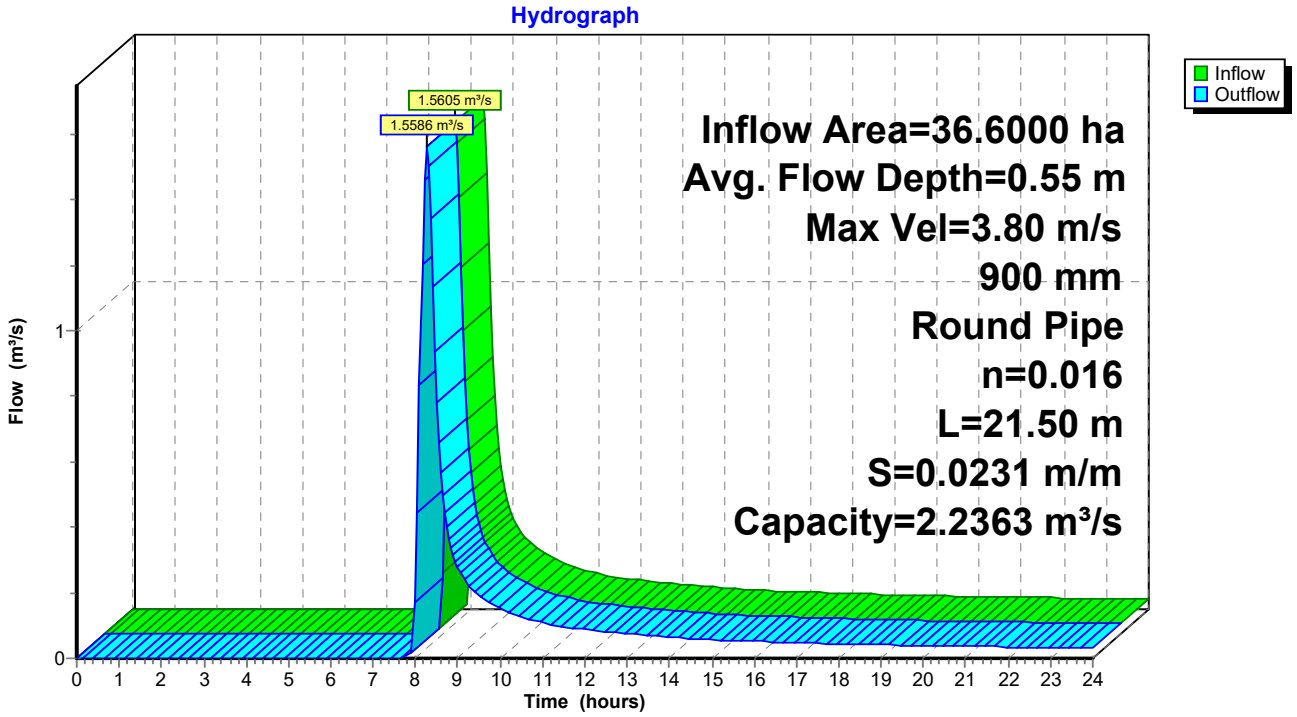
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.80 m/s, Min. Travel Time= 0.1 min
Avg. Velocity = 1.61 m/s, Avg. Travel Time= 0.2 min

Peak Storage= 8.8 m³ @ 8.26 hrs
Average Depth at Peak Storage= 0.55 m , Surface Width= 0.88 m
Bank-Full Depth= 0.90 m Flow Area= 0.64 m², Capacity= 2.2363 m³/s

900 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 21.50 m Slope= 0.0231 m/m
Inlet Invert= 644.626 m, Outlet Invert= 644.129 m



Reach 8R: DMH2347-DMH2351



Summary for Reach 9R: DMH2351-DMH2352

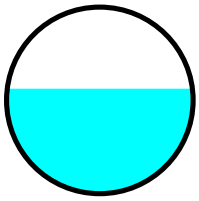
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 8R outlet invert by 0.507 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5586 m³/s @ 8.26 hrs, Volume= 6.400 Ml
Outflow = 1.5563 m³/s @ 8.26 hrs, Volume= 6.400 Ml, Atten= 0%, Lag= 0.2 min
Routed to Reach 10R : DMH2352-DMH2353

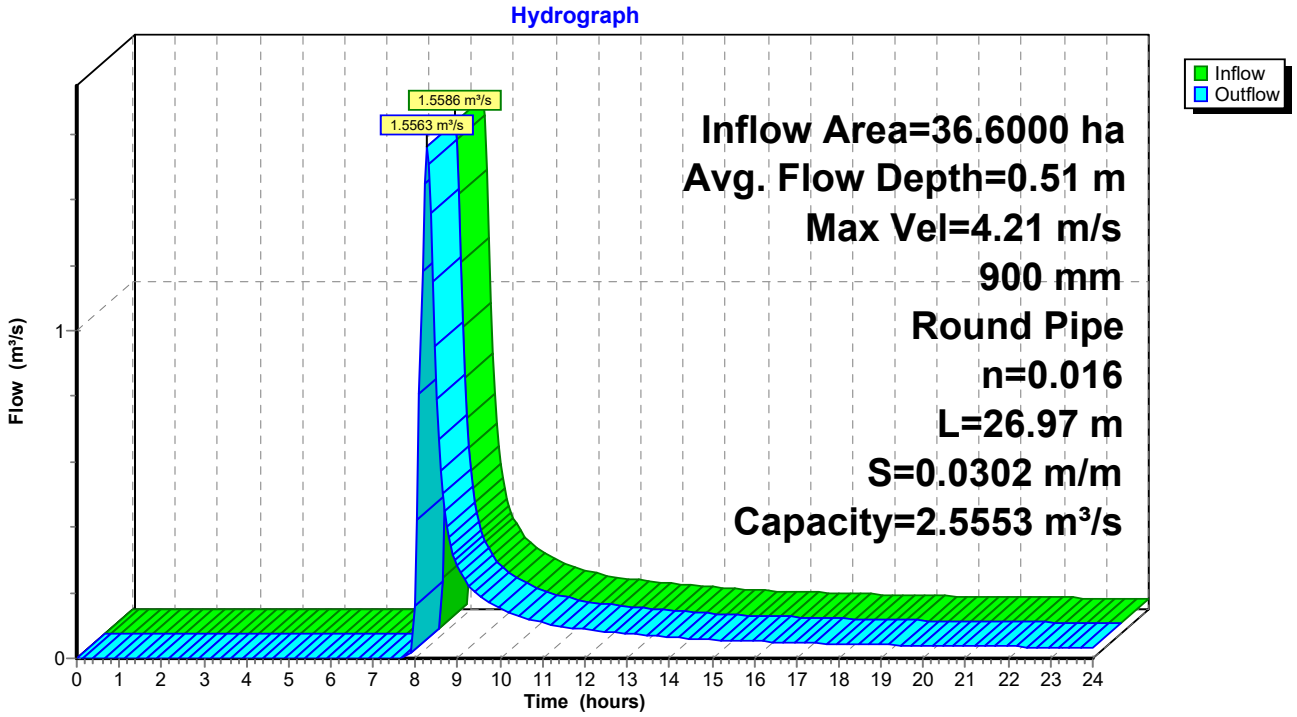
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.21 m/s, Min. Travel Time= 0.1 min
Avg. Velocity = 1.76 m/s, Avg. Travel Time= 0.3 min

Peak Storage= 10.0 m³ @ 8.26 hrs
Average Depth at Peak Storage= 0.51 m , Surface Width= 0.89 m
Bank-Full Depth= 0.90 m Flow Area= 0.64 m², Capacity= 2.5553 m³/s

900 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 26.97 m Slope= 0.0302 m/m
Inlet Invert= 644.129 m, Outlet Invert= 643.315 m



Reach 9R: DMH2351-DMH2352



Summary for Reach 10R: DMH2352-DMH2353

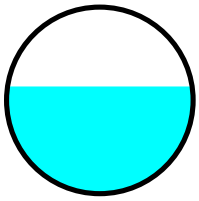
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 9R OUTLET depth by 0.011 m @ 8.35 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5563 m³/s @ 8.26 hrs, Volume= 6.400 Ml
Outflow = 1.5525 m³/s @ 8.26 hrs, Volume= 6.398 Ml, Atten= 0%, Lag= 0.3 min
Routed to Reach 11R : DMH2353-DMH2354

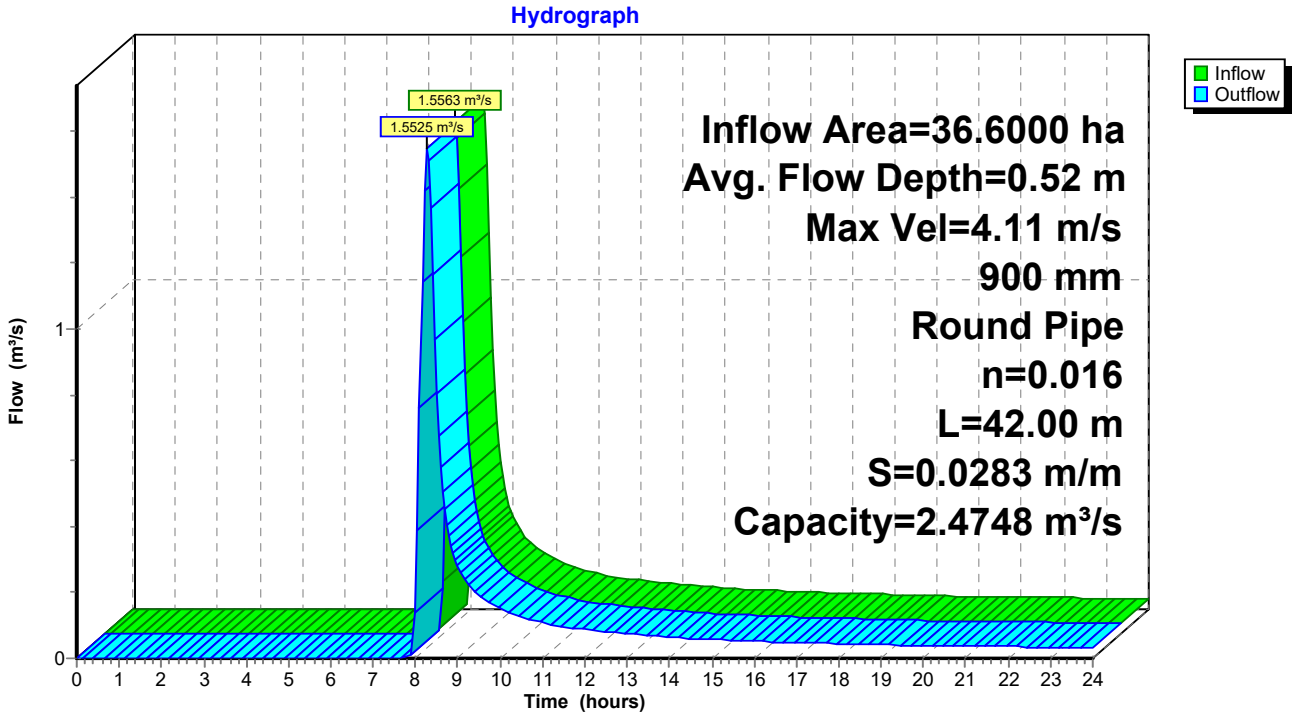
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.11 m/s, Min. Travel Time= 0.2 min
Avg. Velocity = 1.73 m/s, Avg. Travel Time= 0.4 min

Peak Storage= 15.9 m³ @ 8.26 hrs
Average Depth at Peak Storage= 0.52 m , Surface Width= 0.89 m
Bank-Full Depth= 0.90 m Flow Area= 0.64 m², Capacity= 2.4748 m³/s

900 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 42.00 m Slope= 0.0283 m/m
Inlet Invert= 643.314 m, Outlet Invert= 642.125 m



Reach 10R: DMH2352-DMH2353



Summary for Reach 11R: DMH2353-DMH2354

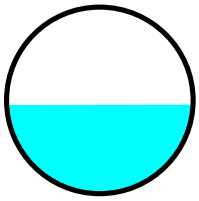
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 10R outlet invert by 0.313 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5525 m³/s @ 8.26 hrs, Volume= 6.398 Ml
Outflow = 1.5496 m³/s @ 8.27 hrs, Volume= 6.397 Ml, Atten= 0%, Lag= 0.2 min
Routed to Reach 12R : DMH2354-DMH2355

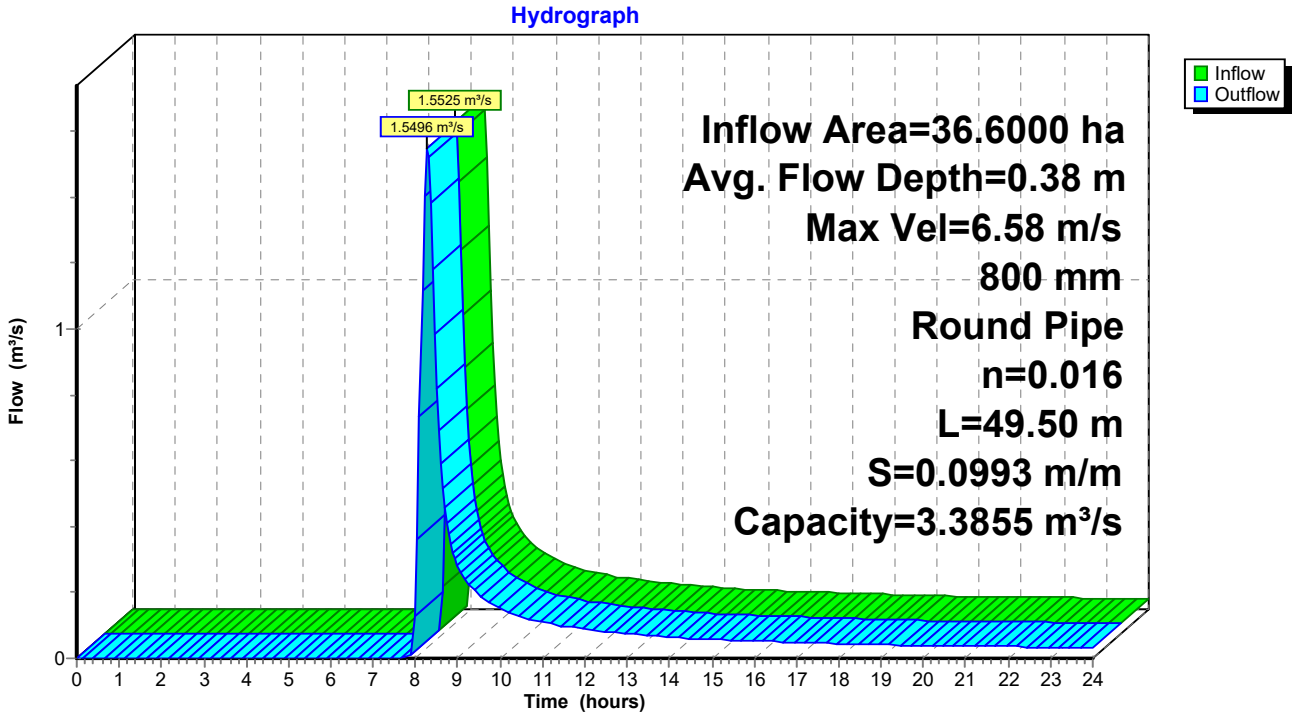
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.58 m/s, Min. Travel Time= 0.1 min
Avg. Velocity = 2.73 m/s, Avg. Travel Time= 0.3 min

Peak Storage= 11.7 m³ @ 8.27 hrs
Average Depth at Peak Storage= 0.38 m , Surface Width= 0.80 m
Bank-Full Depth= 0.80 m Flow Area= 0.50 m², Capacity= 3.3855 m³/s

800 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 49.50 m Slope= 0.0993 m/m
Inlet Invert= 642.059 m, Outlet Invert= 637.144 m



Reach 11R: DMH2353-DMH2354



Summary for Reach 12R: DMH2354-DMH2355

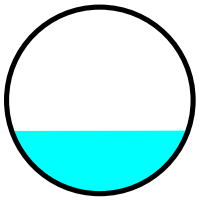
[52] Hint: Inlet/Outlet conditions not evaluated
[61] Hint: Exceeded Reach 11R outlet invert by 0.140 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5496 m³/s @ 8.27 hrs, Volume= 6.397 Ml
Outflow = 1.5480 m³/s @ 8.27 hrs, Volume= 6.397 Ml, Atten= 0%, Lag= 0.1 min
Routed to Reach 13R : DMH2355-Outfall

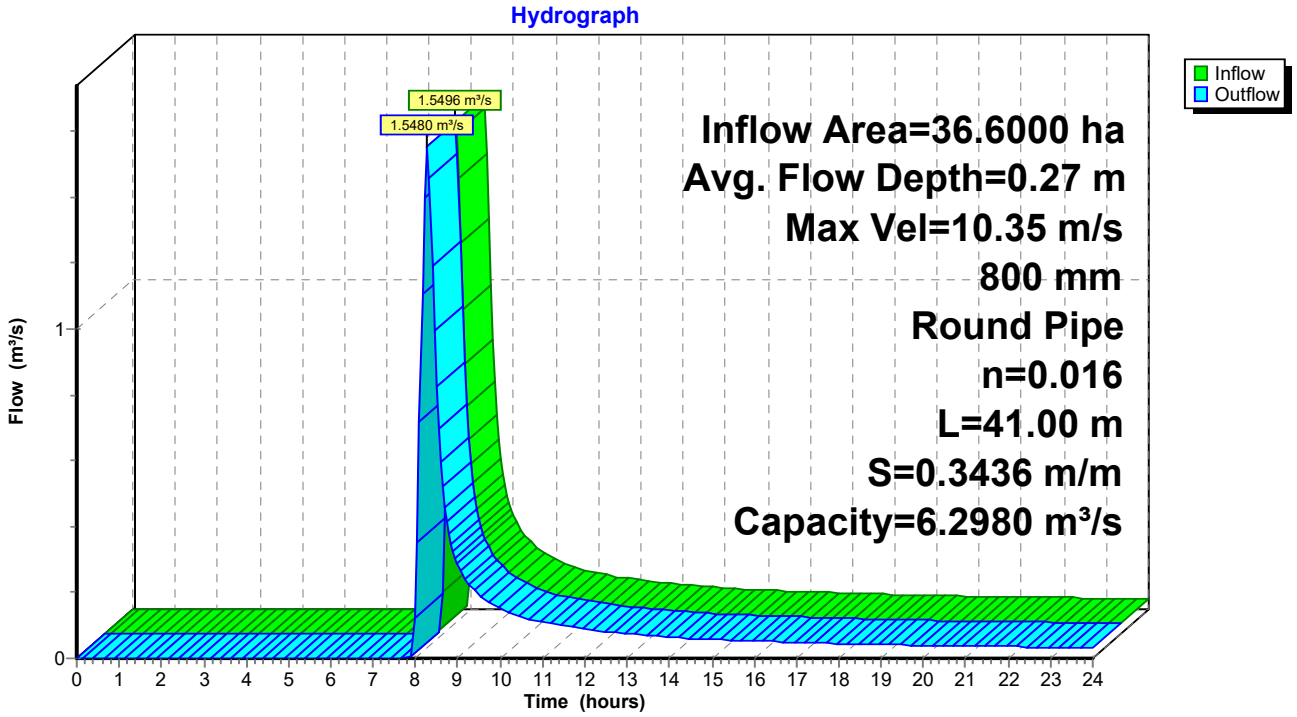
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.35 m/s, Min. Travel Time= 0.1 min
Avg. Velocity = 4.21 m/s, Avg. Travel Time= 0.2 min

Peak Storage= 6.1 m³ @ 8.27 hrs
Average Depth at Peak Storage= 0.27 m , Surface Width= 0.76 m
Bank-Full Depth= 0.80 m Flow Area= 0.50 m², Capacity= 6.2980 m³/s

800 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 41.00 m Slope= 0.3436 m/m
Inlet Invert= 637.015 m, Outlet Invert= 622.927 m



Reach 12R: DMH2354-DMH2355



Summary for Reach 13R: DMH2355-Outfall

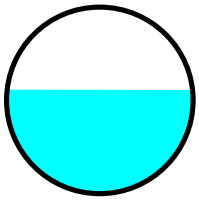
[52] Hint: Inlet/Outlet conditions not evaluated
[62] Hint: Exceeded Reach 12R OUTLET depth by 0.175 m @ 8.25 hrs

Inflow Area = 36.6000 ha, 36.36% Impervious, Inflow Depth > 17 mm
Inflow = 1.5480 m³/s @ 8.27 hrs, Volume= 6.397 Ml
Outflow = 1.5469 m³/s @ 8.27 hrs, Volume= 6.396 Ml, Atten= 0%, Lag= 0.1 min

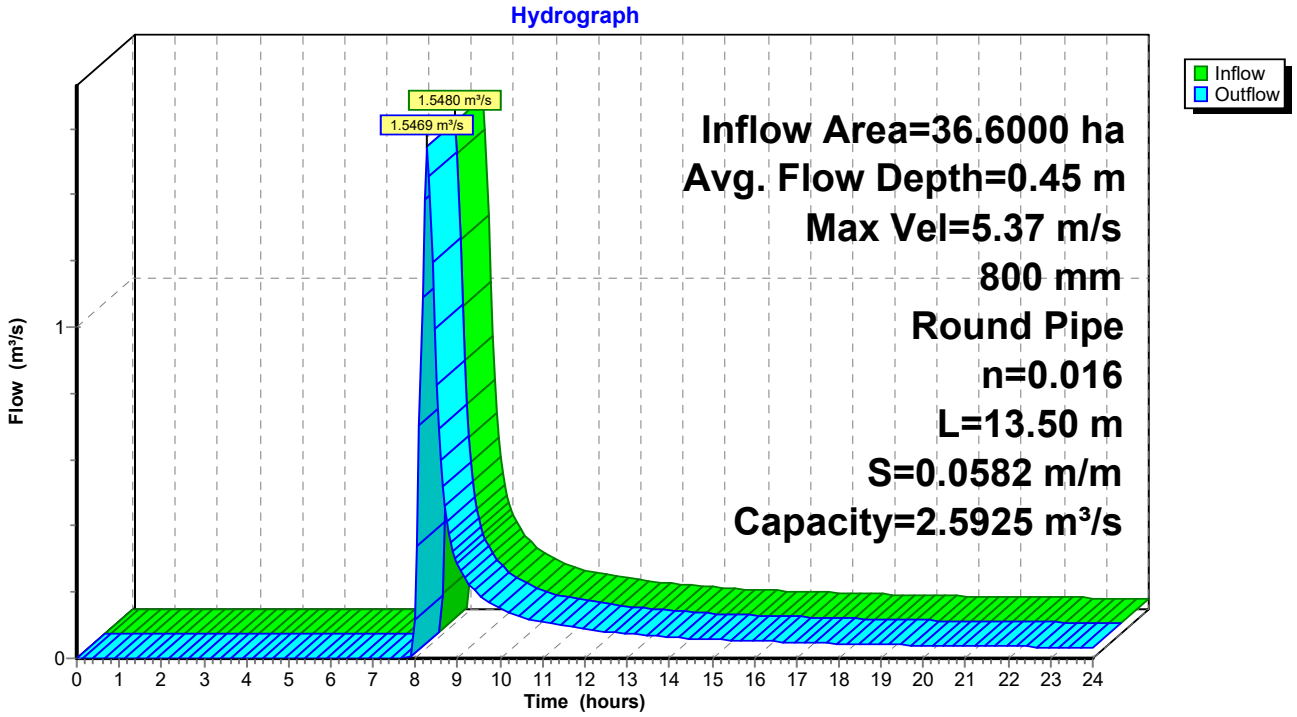
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.37 m/s, Min. Travel Time= 0.0 min
Avg. Velocity = 2.26 m/s, Avg. Travel Time= 0.1 min

Peak Storage= 3.9 m³ @ 8.27 hrs
Average Depth at Peak Storage= 0.45 m , Surface Width= 0.79 m
Bank-Full Depth= 0.80 m Flow Area= 0.50 m², Capacity= 2.5925 m³/s

800 mm Round Pipe
n= 0.016 Asphalt, rough
Length= 13.50 m Slope= 0.0582 m/m
Inlet Invert= 622.928 m, Outlet Invert= 622.142 m



Reach 13R: DMH2355-Outfall



Summary for Pond P1: Pond 1

Inflow Area = 132.6100 ha, 36.61% Impervious, Inflow Depth > 14 mm
Inflow = 3.9921 m³/s @ 8.26 hrs, Volume= 18.619 Ml
Outflow = 0.2459 m³/s @ 12.56 hrs, Volume= 13.256 Ml, Atten= 94%, Lag= 257.7 min
Primary = 0.2459 m³/s @ 12.56 hrs, Volume= 13.256 Ml
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 670.111 m @ 12.56 hrs Storage= 8,037.5 m³

Plug-Flow detention time= 375.1 min calculated for 13.229 Ml (71% of inflow)
Center-of-Mass det. time= 217.1 min (960.0 - 742.8)

Volume	Invert	Avail.Storage	Storage Description
#1	667.000 m	11,500.0 m³	**Custom Stage Data**Listed below

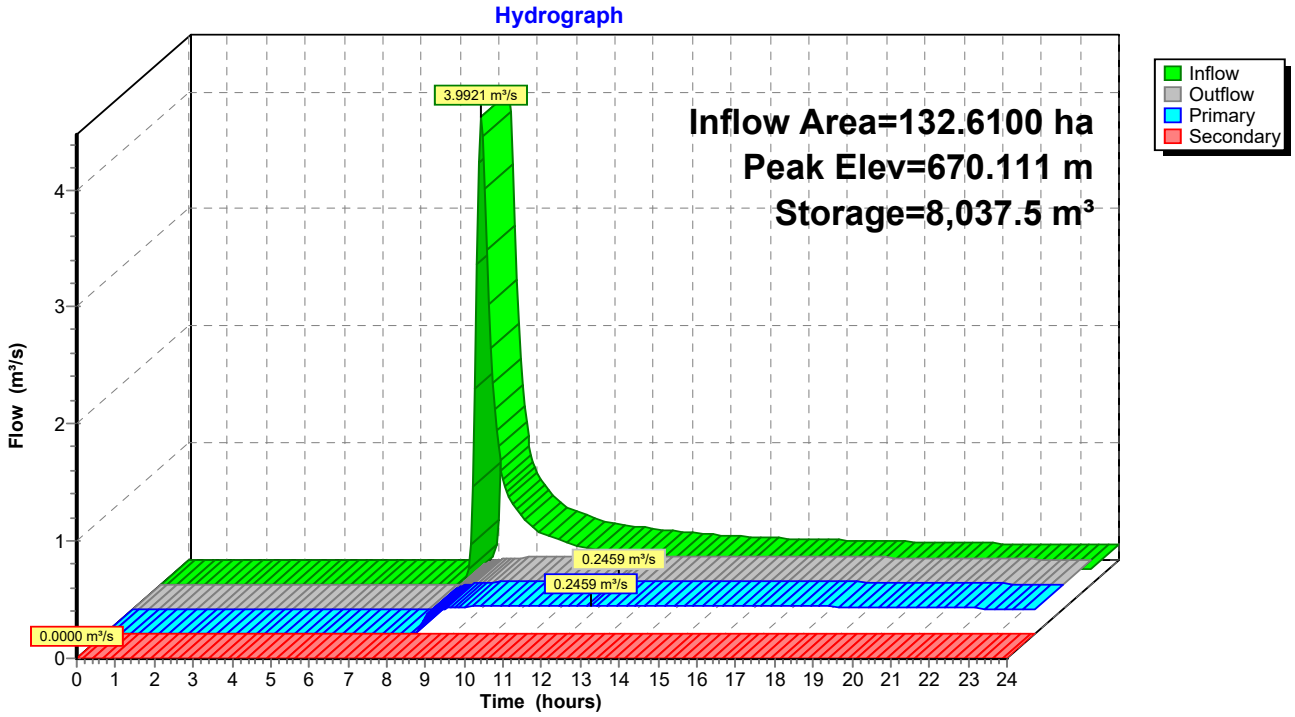
Elevation (meters)	Cum.Store (cubic-meters)
667.000	0.0
667.500	924.0
668.000	2,007.0
668.500	3,219.0
669.000	4,561.0
669.500	6,038.0
670.000	7,650.0
670.500	9,400.0
671.050	11,489.0
671.400	11,500.0

Device	Routing	Invert	Outlet Devices
#1	Primary	667.000 m	**300 mm Round Culvert** L= 30.00 m Ke= 0.900 Inlet / Outlet Invert= 667.000 m / 666.700 m S= 0.0100 m/m Cc= 0.900 n= 0.013, Flow Area= 0.071 m²
#2	Secondary	671.050 m	**45.0 deg x 5.00 m long x 0.60 m rise Sharp-Crested Vee/Trap Weir** Cv= 1.41 (C= 1.76)

Primary OutFlow Max=0.2459 m³/s @ 12.56 hrs HW=670.111 m (Free Discharge)
└**1=Culvert** (Barrel Controls 0.2459 m³/s @ 3.48 m/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=667.000 m (Free Discharge)
└**2=Sharp-Crested Vee/Trap Weir** (Controls 0.0000 m³/s)

Pond P1: Pond 1



Summary for Pond P2: Pond 2

[92] Warning: Device #2 is above defined storage

Inflow Area = 41.5000 ha, 38.00% Impervious, Inflow Depth > 18 mm
Inflow = 1.7229 m³/s @ 8.31 hrs, Volume= 7.361 Ml
Outflow = 0.0521 m³/s @ 17.65 hrs, Volume= 2.859 Ml, Atten= 97%, Lag= 560.6 min
Primary = 0.0521 m³/s @ 17.65 hrs, Volume= 2.859 Ml
Routed to Pond P1 : Pond 1
Secondary = 0.0000 m³/s @ 0.00 hrs, Volume= 0.000 Ml

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 698.049 m @ 17.65 hrs Storage= 4,707.2 m³

Plug-Flow detention time= 474.7 min calculated for 2.853 Ml (39% of inflow)
Center-of-Mass det. time= 278.1 min (979.3 - 701.2)

Volume	Invert	Avail.Storage	Storage Description
#1	696.000 m	11,489.0 m³	**Custom Stage Data**Listed below

Elevation (meters)	Cum.Store (cubic-meters)
696.000	0.0
696.500	924.0
697.000	2,007.0
697.500	3,219.0
698.000	4,561.0
698.500	6,038.0
699.000	7,650.0
699.500	9,400.0
700.000	11,489.0

Device	Routing	Invert	Outlet Devices
#1	Primary	696.000 m	**150 mm Round Culvert** L= 10.00 m Ke= 0.900 Inlet / Outlet Invert= 696.000 m / 695.800 m S= 0.0200 m/m Cc= 0.900 n= 0.013, Flow Area= 0.018 m²
#2	Secondary	700.000 m	**45.0 deg x 5.00 m long x 0.60 m rise Sharp-Crested Vee/Trap Weir** Cv= 1.41 (C= 1.76)

Primary OutFlow Max=0.0521 m³/s @ 17.65 hrs HW=698.049 m (Free Discharge)
1=Culvert (Inlet Controls 0.0521 m³/s @ 2.95 m/s)

Secondary OutFlow Max=0.0000 m³/s @ 0.00 hrs HW=696.000 m (Free Discharge)
2=Sharp-Crested Vee/Trap Weir (Controls 0.0000 m³/s)

Pond P2: Pond 2