2 PARK CRESCENT
PROPOSED SEVERANCE

STORMWATER DRAINAGE BRIEF

Victoria Sanderson

January 16, 2023

PLAN • SURVEY • ENGINEER

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www.agm.on.ca

January 16, 2023

Municipality of Middlesex Centre
10227 Ilderton Road
Ilderton, ON N0M 2A0

Attention: **Fatehbir Singh, C.Tech, rcji**
Development Review Coordinator

Re: **2 Park Crescent Severance, Poplar Hill**
Stormwater Drainage Brief

This brief has been prepared to explain the stormwater drainage strategy for the proposed severance at 2 Park Crescent in Poplar Hill. The original property is located on the south side of Park Crescent, spanning from Poplar Hill Road to Currie Street. The severed lot will favour the north limit with access off Park Crescent and an external sideyard to Currie Street. The proposed severed lot area is 0.196ha. A single family dwelling and driveway are proposed for the lot to be severed (Figure 1).

Subsurface Soils

The Septic System Feasibility Report by EXP Services Inc. dated August 17, 2022 was used to confirm the subsurface soil types. It was determined that the subsurface soils on the site are "silty sand". These soils are known to have moderate infiltration potential. Parameters for analysis were assigned accordingly.

Existing Drainage

The lot to be severed (0.196ha) is currently made up of built up grass and has a split drainage flow pattern. Drainage from an upstream external area (0.029ha) consisting of a portion of the Park Crescent right-of-way is conveyed to the subject property.

Runoff generated by a 0.160ha area is conveyed in an easterly direction to the rear of the property and ultimately discharged to the Currie Court swale. Runoff from the remaining portion of the proposed severance and external area (0.065ha) drain in a westerly direction to the west property corner (Figure 2).

The peak runoff to the rear of the property during the 2 and 100 year storm events is 1.6 L/s and 8.3 L/s respectively. The peak runoff to the front of the property during the 2 and 100 year storm events is 2.3 L/s and 7.4 L/s respectively.

Proposed Drainage

The proposed dwelling and driveway will introduce impervious area to the property, resulting in an increase in runoff potential and the need for stormwater management controls. Since there is no fronting storm sewer, the stormwater management strategy for the property is to direct as much runoff as possible to a SWM facility designed to infiltrate as much stormwater as possible in an effort to reduce the amount of runoff leaving the property uncontrolled.

Controlled Drainage

The SWM facility will serve a 0.198ha area consisting of the proposed dwelling, the external area as well as a portion of the rear yard and side yards (Figure 3). Runoff will be conveyed through grassed swales to the proposed catchbasins at the rear of the property that will serve as the inlets for an exfiltration trench.

The SWM facility will utilize an exfiltration trench below grade. The trench will consist of 32.0m of perforated 450mm diameter pipe connected to a catchbasin at each end. The trench will be a minimum of 1.45m wide and 1.35m high, starting 0.6m below the invert of the pipe, complete with triple washed clear stone 50mm in diameter having a void ratio of at least 0.35 (Figure 5). The total trench storage will be 25.2m³. Above grade, the storage created by the swale will provide additional volume to contain storm events exceeding the capacity of the exfiltration trench. The grassed area storage will be 69.4m³ (Figure 4).

The infiltration test on the property conducted by EXP Services Inc. in the Septic System Feasibility Report, yielded an average percolation time of 12 min/cm. Based on the "LID Design guide, Appendix C" by the CVC and the TRCA dated 2010, a percolation time of 12 min/cm equates to an approximate field (unfactored) hydraulic conductivity of 0.0001 cm/s or 3.6 mm/hr. Using a safety factor of 3.5 applied to the approximate field hydraulic conductivity, the design (factored) hydraulic conductivity for the site is approximately 1.0 mm/hr.

With infiltration to the native soils occurring through the bottom of the trench and the sidewalls, the SWM facility's theoretical performance is as follows:

Table 1 –SWM Facility Performance

STORM EVENT	TRENCH STORAGE (m^3)	SURFACE STORAGE (m^3)	TOTAL STORAGE (m^3)	WATER ELEV. (m)	EXFILTRATED DISCHARGE (L/s)
2 YR	16.0	0	16	244.51	0.03
100 YR	25.2	22.8	48	246.25	0.05

The SWM facility is sufficiently sized to contain the minor system runoff in the trench and major system runoff on the surface for the tributary area. Storm events exceeding the capacity will engage the overland flow route to the east property corner of the site.

Uncontrolled Discharge

The remaining 0.027ha area of the severed lot, consisting of the rear yard adjacent to the southeast property line, will continue to be tributary to the Currie Court right-of-way swale. Runoff generated by this area will drain uncontrolled to the east discharging to the swale per the existing condition. The peak runoff to the Currie Court right-of-way swale during the 2 and 100 year storm events is 0.5 L/s and 2.5 L/s respectively. The reduction in tributary area by way of the grading design will reduce the post development flows entering the Currie Court swale to **less than** pre development levels.

Summary

The lot grading and SWM facility have been designed such that there will be no negative impact on adjacent lots. Peak flows will be reduced to below pre development levels for the storm events analyzed, up to and including the 100 year storm.

If you have any questions regarding this brief, please contact our office.

Regards,

Archibald, Gray & McKay Engineering Ltd.

Craig Colpaert
Engineer-in-Training

Lukas Grabowski, P.Eng.
Project Engineer

FIGURES

PARK CRESCENT

CURRIE COURT

MAILBOX

Aerial Wires

H.P.

B.PED.

J.B.

N44°09'30"E
4.540

N44°09'30"E

25.630

N44°09'30"E
8.463

IB(CD)

IBø
(SU)

SIB
(AGM)

SIB
(AGM)

PROPOSED
DRIVEWAY

28.727

150 Dia.

500 Dia.

500 Dia.

PROPOSED
BUILDING
ENVELOPE

EXISTING TWO
STOREY DWELLING
MUN#2
PARK CRESCENT

42.368

N46°09'30"W

28.727

SEVERANCE LINE

N46°09'30"W

PROPOSED
SEPTIC BED

300 Dia.

300 Dia.

300 Dia.

600 Dia.

800 Dia.

400 Dia.

500 Dia.

IB
(CD)

SIB
(CD)

N44°09'30"E

34.093

CB

CB

800 Dia.

800 Dia.

RETAINED
LOT

N46°09'30"W

21.886

500 Dia.

SEVERED LOT
AREA=0.196ha

150 Dia.

400 Dia.

100 Dia.

IBø
(SU)

46.069

N48°15'55"W
8.429

600 Dia.

600 Dia.

600 Dia.

500 Dia.

B.PED.

J.B.

SIB
(AGM)

Hedge

Hedge

Hedge

N43°53'30"E

29.850

SIB(AGM)

N43°53'30"E
8.473

PB
(CD)

NEIGHBOURING
RESIDENTIAL
PROPERTY

NEIGHBOURING
RESIDENTIAL
PROPERTY

FIGURE 1
PROPOSED DEVELOPMENT

SCALE 1:250
DATE: JANUARY 2023

ARCHIBALD, GRAY & McKAY
ENGINEERING LTD.
3514 WHITE OAK ROAD, LONDON, ON, N6E 2Z9
PHONE 519-685-5300 FAX 519-685-5303
EMAIL info@agm.on.ca WEB www.agm.on.ca
PLAN • SURVEY • ENGINEER

Plot date: Jan 13, 2023 G:\CLIENT\1430\6\CAD 2019\1430-6 SWM BASE.dwg

PARK CRESCENT

MAILBOX

EXISTING SIDEWALK

EXISTING ONE STOREY DWELLING MUN#118 DELAWARE STREET

2
0.065

1
0.160

LOCALIZED LOW POINT

LOCALIZED LOW POINT

REAR PROPERTY LINE

SHALLOW SWALE

NEIGHBOURING RESIDENTIAL PROPERTY

NEIGHBOURING RESIDENTIAL PROPERTY

CURRIE COURT

LEGEND

1
0.000

CATCHMENT ID

AREA SERVED IN HECTARES

EXISTING SWALE

DIRECTION OF SURFACE FLOW

CATCHMENT BOUNDARY

IMPERVIOUS AREA

PERVIOUS AREA

FIGURE 2
EXISTING DRAINAGE

SCALE 1:250
DATE:JANUARY 2023

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Plot date: Jan 13, 2023 G:\CLIENT\1430\6\CAD 2019\1430-6 SWM BASE.dwg

PARK CRESCENT

MAILBOX

Aerial Wires

B.PED.

H.P.

PROPOSED DRIVEWAY

PROPOSED BUILDING ENVELOPE

PROPOSED SEPTIC BED

EXISTING TWO STOREY DWELLING MUN#2 PARK CRESCENT

NEIGHBOURING RESIDENTIAL PROPERTY

101
0.198

102
0.027

CB

150 Dia.
500 Dia.
400 Dia.
300 Dia.
600 Dia.
800 Dia.
100 Dia.

CURRIE COURT

LEGEND

- CATCHMENT ID / AREA SERVED IN HECTARES (101 / 0.000)
- DIRECTION OF SURFACE FLOW
- PROPOSED SWALE
- PROPOSED OVERLAND FLOW ROUTE
- CATCHMENT BOUNDARY
- EXFILTRATION TRENCH AND PIPE
- IMPERVIOUS AREA
- PERVIOUS AREA

FIGURE 3
PROPOSED DRAINAGE

SCALE 1:250
DATE:JANUARY 2023

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Plot date: Jan 13, 2023 G:\CLIENT\1430\6\CAD 2019\1430-6 SWM BASE.dwg

46.26 46.70 46.80 46.80 46.51 46.65 46.75

PROPOSED SEPTIC BED

CURRIE COURT

46.12 46.40 46.25 46.63 46.63 46.40 46.63

BOTTOM OF TRENCH ELEV.=243.65

CB

T/G 46.10

46.19 46.11

PROPOSED EXFILTRATION TRENCH 32.60–450 ST–0.00%

CB

T/G 45.95

46.56

100 YEAR WATER ELEV.=246.25

(246.56) (246.56) (246.54)

+(246.45) +(246.39) +(246.43) (246.38)+

300 Dia. 600 Dia. 800 Dia. 400 Dia. 500 Dia. 800 Dia. 400 Dia. 500 Dia. 500 Dia. 50 Dia. 400 Dia. 100 Dia. 150 Dia. 600 Dia. 600 Dia. 600 Dia. 500 Dia.

B.PED. J.B.

Hedge Hedge Hedge

NOTE:
ADD 200 METRES TO OBTAIN GEODETIC DESIGN ELEVATIONS

LEGEND

- DIRECTION OF SURFACE FLOW
- PROPOSED SWALE
- PROPOSED OVERLAND FLOW ROUTE
- 00.00 — FINISHED GROUND ELEVATION
- × (000.00) — MATCH EXISTING ELEVATION
- T/G 00.00 — PROPOSED TOP OF GRATE ELEVATION
- CB — PROPOSED EXFILTRATION TRENCH AND PIPE

FIGURE 4
PROPOSED SWM FACILITY

SCALE 1:150
DATE:JANUARY 2023

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Plot date: Jan 13, 2023 G:\CLIENT\1430\6\CAD 2019\1430-6 SWM BASE.dwg

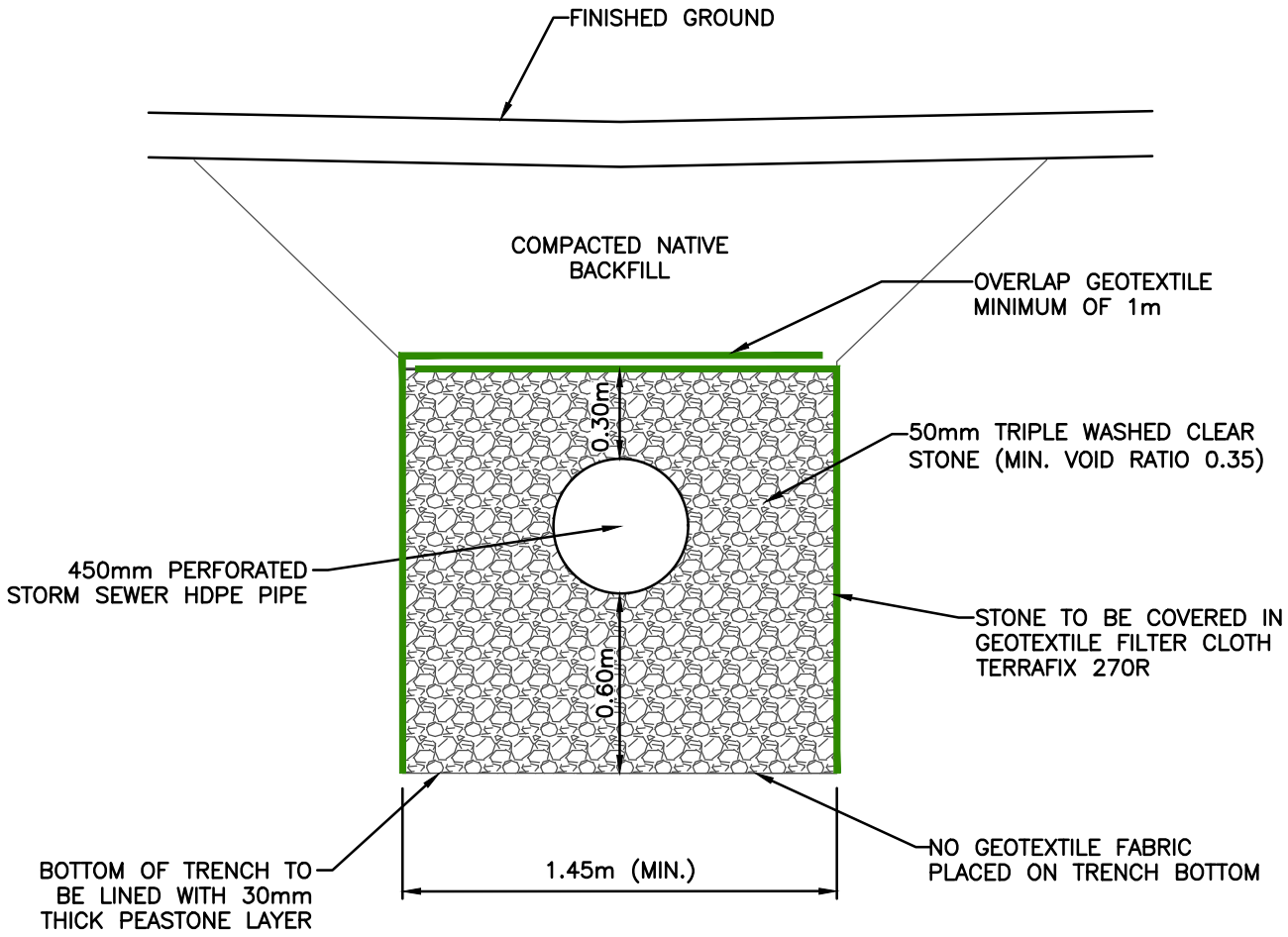

FIGURE 5
EXFILTRATION TRENCH DETAIL

SCALE 1:25
DATE: JANUARY 2023

AGM
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ARCHIBALD, GRAY & McKAY ENGINEERING LTD.
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Plot date: Jan 13, 2023 G:\CLIENT\1430\6\CAD 2019\1430-6 SWM BASE.dwg

APPENDIX A

Pre Development Calculation

SCS CURVE NUMBER DETERMINATION

Land Use		Hydrologic Soil Type				
		A	B	C	D	
Meadow	"Good Condition"	30	58	71	78	MTO
Woodlot	"Fair Condition"	36	60	73	79	MTO
Pasture	"Good Condition"	39	61	74	80	MTO
Crop	"Contoured in Good Condition"	65	75	82	86	MTO
Lawns	"Fair Condition"	49	69	79	84	USDA
Gravel		76	85	89	91	USDA
Impervious		98	98	98	98	MTO

United States Department of Agriculture, Part 630 Hydrology National Engineering Handbook, July 2004 (USDA)
MTO Drainage Management Manual, Design Chart 1.09 (MTO)

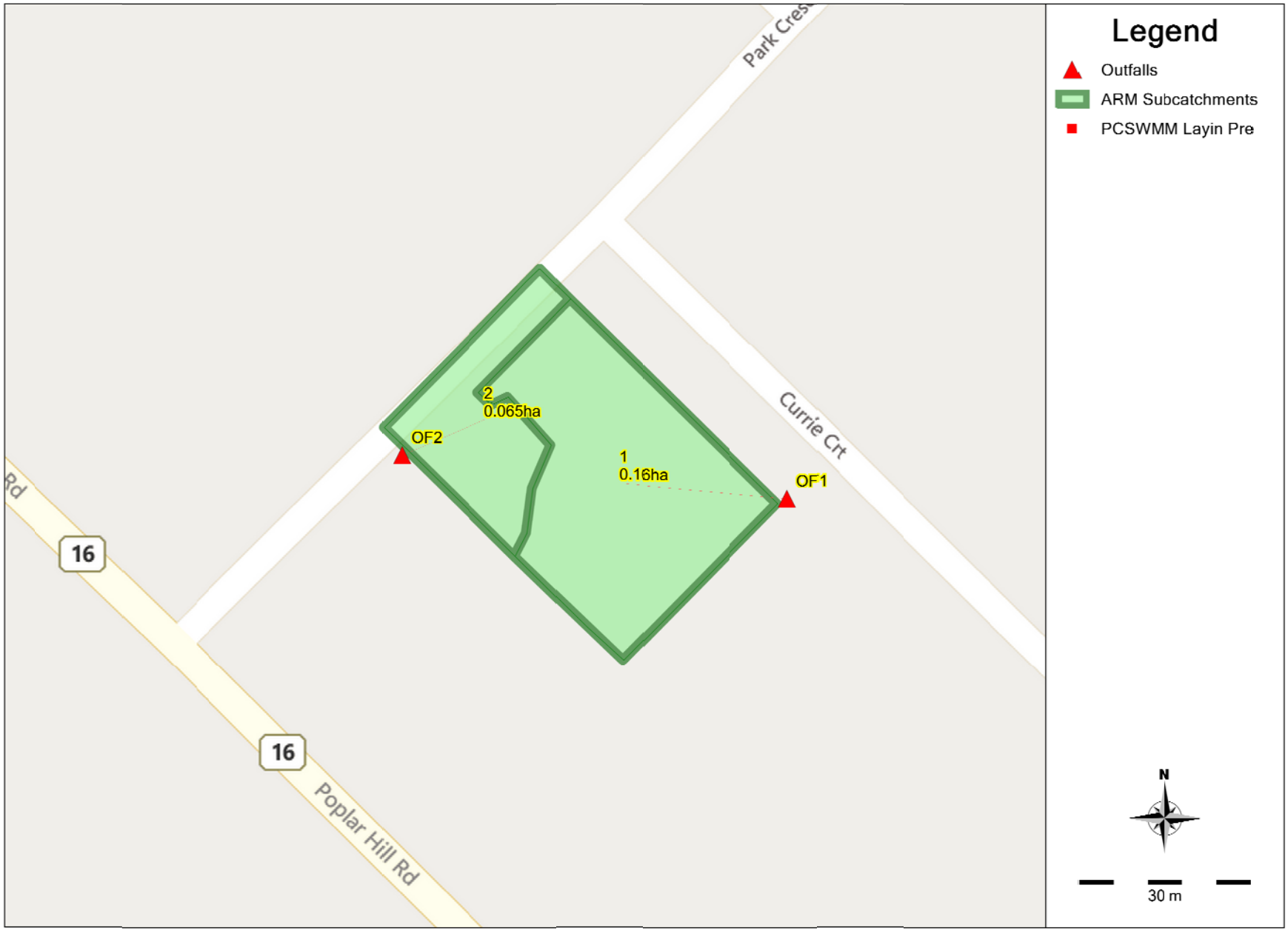
PRE DEVELOPMENT MODELING DATA (NASH HYDROGRAPH)

CATCHMENT NO.	AREA (ha)	SCS CURVE #	BASE FLOW (cms)	Initial Abstraction (mm)	Time of concentration (min)	Runoff Coef., C	Watershed Length, L (m)	Watershed Slope, (%)
1	0.160	60	0.000	5	27.4	0.20	55.0	0.5
2	0.065	60	0.000	4.4	15.9	0.33	40.0	1
	0.225				Airport Method			

Airport Method

$$T_C = \frac{3.26(1.1 - C)L^{0.5}}{S^{0.33}}$$

PCSWMM Input files


Legend
Outfalls
ARM Subcatchments
PCSWMM Layin Pre
Park Cres
Currie Crt
Poplar Hill Rd
16
16
Rd
2
0.065ha
1
0.16ha
OF2
OF1
N
30 m

```
[TITLE]
;;Project Title/Notes
1430-6

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/09/2023
START_TIME           00:00:00
REPORT_START_DATE    01/09/2023
REPORT_START_TIME    00:00:00
END_DATE             01/11/2023
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     NONE
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
SURCHARGE_METHOD     Slot
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
;Currie St ROW
OF1              246.35     FREE                        NO
;Park Cres. ROW
OF2              246.47     FREE                        NO

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       458217.30215     4761542.2564     458291.08685     4761551.0256
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OF1              458287.733         4761542.655
OF2              458220.656         4761550.627

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

PCSWMM Output files

2 Park Crescent
2 Year Pre Development Model Output

```
  ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406
  ---------------------------------------------------------

  This is a new version of ARM - your feedback and suggestions are solicited.
  Create a ticket, post on the PCSWMM feature request forum, or email us directly!

  Simulation start time:                  01/09/2023 00:00:00
  Simulation end time:                    01/10/2023 03:00:00
  Runoff wet weather time steps:          300 seconds
  Report time steps:                      60 seconds
  Number of data points:                  1621


  ******************************
  Unit Hydrographs Runoff Method
  ******************************

  ------------------------------------------------------------------------------------------------------------------------
----------------------------------------------
                                                                                  Area   Time of Concentration  Time to Peak
Time after Peak    Peak UH Flow    UH Depth
  Subcatchment         Runoff Method             Raingage                       (ha)   (min)                  (min)
(min)              (m³/s/mm)       (mm)
  ------------------------------------------------------------------------------------------------------------------------
----------------------------------------------
  1                    Nash IUH                  Chicago_3h_2year_2011MiddlesexCentreRainfallData 0.16   27.42
18.28           76.72               0.00079        0.996
  2                    Nash IUH                  Chicago_3h_2year_2011MiddlesexCentreRainfallData 0.065  15.88
10.59           44.41               0.00055        0.992


  *****************
  ARM Runoff Summary
  *****************

  ------------------------------------------------------------------------------------------------
                      Total       Total       Total       Total       Peak        Runoff
                      Precip      Losses      Runoff      Runoff      Runoff      Coeff
  Subcatchment        (mm)        (mm)        (mm)        10^6 ltr    LPS         (fraction)
  ------------------------------------------------------------------------------------------------
  1                   33.312      29.256      4.041       0.006       1.617       0.121
  2                   33.312      23.625      9.612       0.006       2.301       0.289



  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------
  1430-6


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 0
  Number of nodes ........... 2
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                Data Source                     Type       Interval
  ------------------------------------------------------------------------
  Chicago_3h_2year_2011MiddlesexCentreRainfallData Chicago_3h_2year_2011MiddlesexCentreRainfallData INTENSITY    5
min.


  ************
  Node Summary
  ************
                                     Invert      Max.    Ponded    External
  Name                Type            Elev.     Depth      Area    Inflow
  ------------------------------------------------------------------------
  OF1                 OUTFALL         246.35      0.00       0.0
  OF2                 OUTFALL         246.47      0.00       0.0


  ***********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ***********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Surcharge Method ......... SLOT
  Starting Date ............ 01/09/2023 00:00:00
  Ending Date .............. 01/10/2023 03:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00


  *************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  *************************     ---------     ---------
  Dry Weather Inflow .......          0.000         0.000
  Wet Weather Inflow .......          0.000         0.000
  Groundwater Inflow .......          0.000         0.000
  RDII Inflow ..............          0.000         0.000
  External Inflow ..........          0.001         0.013
  External Outflow .........          0.001         0.013
  Flooding Loss ............          0.000         0.000
  Evaporation Loss .........          0.000         0.000
  Exfiltration Loss ........          0.000         0.000
  Initial Stored Volume ....          0.000         0.000
  Final Stored Volume ......          0.000         0.000
  Continuity Error (%) .....          0.000


  Analysis begun on:  Thu Jan 12 13:02:13 2023
  Analysis ended on:  Thu Jan 12 13:02:13 2023
  Total elapsed time: < 1 sec
```

2 Park Crescent
100 Year Pre Development Model Output

```
  ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406
  ---------------------------------------------------------

  This is a new version of ARM - your feedback and suggestions are solicited.
  Create a ticket, post on the PCSWMM feature request forum, or email us directly!

  Simulation start time:                  01/09/2023 00:00:00
  Simulation end time:                    01/10/2023 03:00:00
  Runoff wet weather time steps:          300 seconds
  Report time steps:                      60 seconds
  Number of data points:                  1621


  ******************************
  Unit Hydrographs Runoff Method
  ******************************

  ------------------------------------------------------------------------------------------------------------------------
----------------------------------------------
                                                                                  Area   Time of Concentration  Time to Peak
Time after Peak    Peak UH Flow    UH Depth
  Subcatchment         Runoff Method             Raingage                       (ha)   (min)                  (min)
(min)              (m³/s/mm)       (mm)
  ------------------------------------------------------------------------------------------------------------------------
----------------------------------------------
  1                  Nash IUH                  Chicago_3h_100year_2011MiddlesexCentreRainfallData 0.16   27.42
18.28           76.72              0.00079        0.996
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10.59           44.41              0.00055        0.992


  ******************
  ARM Runoff Summary
  ******************

  ------------------------------------------------------------------------------------------
                      Total       Total       Total       Total       Peak        Runoff
                      Precip      Losses      Runoff      Runoff      Runoff      Coeff
  Subcatchment        (mm)        (mm)        (mm)        10^6 ltr    LPS         (fraction)
  ------------------------------------------------------------------------------------------
  1                   71.801      52.903      18.831      0.03        8.29        0.262
  2                   71.801      42.72       28.862      0.019       7.391       0.402



  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------
  1430-6


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 0
  Number of nodes ........... 2
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                Data Source                     Type       Interval
  ----------------------------------------------------------------------
  Chicago_3h_100year_2011MiddlesexCentreRainfallData Chicago_3h_100year_2011MiddlesexCentreRainfallData INTENSITY
5 min.


  ************
  Node Summary
  ************
                                     Invert      Max.    Ponded    External
  Name                Type            Elev.     Depth      Area    Inflow
  ----------------------------------------------------------------------
  OF1                 OUTFALL         246.35      0.00       0.0
  OF2                 OUTFALL         246.47      0.00       0.0



  ***********************************************************
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  based on results found at every computational time step,
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  ****************
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  Process Models:
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    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Surcharge Method ......... SLOT
  Starting Date ............ 01/09/2023 00:00:00
  Ending Date .............. 01/10/2023 03:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00


  *************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  *************************     ---------     ---------
  Dry Weather Inflow .......          0.000         0.000
  Wet Weather Inflow .......          0.000         0.000
  Groundwater Inflow .......          0.000         0.000
  RDII Inflow ..............          0.000         0.000
  External Inflow ..........          0.005         0.049
  External Outflow .........          0.005         0.049
  Flooding Loss ............          0.000         0.000
  Evaporation Loss .........          0.000         0.000
  Exfiltration Loss ........          0.000         0.000
  Initial Stored Volume ....          0.000         0.000
  Final Stored Volume ......          0.000         0.000
  Continuity Error (%) .....          0.000


  Analysis begun on:  Thu Jan 12 13:00:25 2023
  Analysis ended on:  Thu Jan 12 13:00:25 2023
  Total elapsed time: < 1 sec
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APPENDIX B

Post Development Model

SCS CURVE NUMBER DETERMINATION

Land Use		Hydrologic Soil Type				
		A	B	C	D	
Meadow	"Good Condition"	30	58	71	78	MTO
Woodlot	"Fair Condition"	36	60	73	79	MTO
Pasture	"Good Condition"	39	61	74	80	MTO
Crop	"Contoured in Good Condition"	65	75	82	86	MTO
Lawns	"Fair Condition"	49	69	79	84	USDA
Gravel		76	85	89	91	USDA
Impervious		98	98	98	98	MTO

United States Department of Agriculture, Part 630 Hydrology National Engineering Handbook, July 2004 (USDA)
MTO Drainage Management Manual, Design Chart 1.09 (MTO)

POST DEVELOPMENT MODELING DATA (NASH HYDROGRAPH)

CATCHMENT NO.	AREA (ha)	IMPERVIOUS (%)	SCS CURVE #	BASE FLOW (cms)	Initial Abstraction (mm)	Time of concentration (min)	Runoff Coef., C	Watershed Length, L (m)	Watershed Slope, (%)
101	0.198	13.7	60	0.000	4.6	22.3	0.30	73.0	1
102	0.027	0.0	60	0.000	5	8.3	0.20	8.0	1
	0.225					Airport Method			

Airport Method

$$T_C = \frac{3.26(1.1 - C)L^{0.5}}{S^{0.33}}$$

EXFILTRATION TRENCH AND SURFACE STORAGE
STAGE-STORAGE-DISCHARGE DATA

Elevation (m)	Depth (m)	Storage				Equvilent Incremental Area (PCSWMM)			Exfiltration Rate (L/s)	Description
		Stone (m^3)	Distribution Pipe (m^3)	Surface Storage (m^3)	Total Storage (m^3)	Incremental Area (m^2)	Incremental Storage (m^3)	Total Storage (m^3)		
243.650	0.000	0	0	0	0	16.2	0.0	0	0.01	Bottom of Trench
243.750	0.100	1.6	0	0	1.6	16.2	1.6	1.6	0.01	
243.850	0.200	3.2	0	0	3.2	16.2	1.6	3.2	0.02	
243.950	0.300	4.9	0	0	4.9	16.2	1.6	4.9	0.02	
244.050	0.400	6.5	0	0	6.5	16.2	1.6	6.5	0.02	
244.150	0.500	8.1	0	0	8.1	16.2	1.6	8.1	0.02	
244.250	0.600	9.7	0	0	9.7	16.2	1.6	9.7	0.03	Distribution Pipe Invert = 244.25
244.350	0.700	11.1	0.84	0	11.9	27.2	2.2	11.9	0.03	
244.450	0.800	12.2	2.19	0	14.4	22.8	2.5	14.4	0.03	2 Year Water Level = 244.51
244.550	0.900	13.4	3.60	0	17.0	28.2	2.5	17.0	0.03	
244.650	1.000	14.6	4.78	0	19.3	19.6	2.4	19.3	0.03	
244.700	1.050	15.3	5.09	0	20.4	20.9	1.0	20.4	0.04	
244.800	1.150	16.9	5.09	0	22.0	11.6	1.6	22.0	0.04	
244.900	1.250	18.5	5.09	0	23.6	20.9	1.6	23.6	0.04	
245.000	1.350	20.1	5.09	0	25.2	11.6	1.6	25.2	0.04	Top of Trench Elev. = 245.00
245.950	2.300	20.1	5.09	0	25.2	-11.6	0.0	25.2	0.05	Finished Ground = 245.95
246.050	2.400	20.1	5.09	0.62	25.9	24.0	0.6	25.9	0.05	
246.150	2.500	20.1	5.09	5.18	30.4	67.2	4.6	30.4	0.05	
246.250	2.600	20.1	5.09	21.52	46.8	259.6	16.3	46.8	0.05	100 Year Water Level = 246.25
246.380	2.730	20.1	5.09	69.41	94.6	477.2	47.9	94.6	0.05	Spillover Elev. = 246.38

Exfiltration Trench Components

GREEN Denotes PCSWMM Storage Unit Inputs

EXFILTRATION CALCULATIONS

Elevation (m)	Depth (m)	Through Bottom of Trench		Through Sidewalls of Trench		
		Hydraulic Gradient (m/m)	Exfiltration Rate (L/s)	Average Hyraulic Gradient (side slope)	Side Wall Surface Area (m^2)	Exfiltration Rate (L/s)
243.65	0.00	1.000	0.01289	1.000	0.0	0.00000
243.75	0.10	1.017	0.01311	1.008	6.4	0.00179
243.85	0.20	1.034	0.01332	1.017	12.8	0.00362
243.95	0.30	1.050	0.01354	1.025	19.2	0.00547
244.05	0.40	1.067	0.01376	1.034	25.6	0.00735
244.15	0.50	1.084	0.01397	1.042	32.0	0.00926
244.25	0.60	1.101	0.01419	1.050	38.4	0.01120
244.35	0.70	1.118	0.01441	1.059	44.8	0.01318
244.45	0.80	1.134	0.01462	1.067	51.2	0.01518
244.55	0.90	1.151	0.01484	1.076	57.6	0.01721
244.65	1.00	1.168	0.01506	1.084	64.0	0.01927
244.70	1.05	1.176	0.01516	1.088	67.2	0.02031
244.80	1.15	1.193	0.01538	1.097	73.6	0.02242
244.90	1.25	1.210	0.01560	1.105	80.0	0.02456
245.00	1.35	1.227	0.01581	1.113	86.4	0.02672
245.95	2.30	1.387	0.01787	1.193	86.4	0.02864
246.05	2.40	1.403	0.01809	1.202	86.4	0.02884
246.15	2.50	1.420	0.01830	1.210	86.4	0.02904
246.25	2.60	1.437	0.01852	1.218	86.4	0.02924
246.38	2.73	1.459	0.01880	1.229	86.4	0.02951

Exfiltration Trench Components

Groundwater Elevation =	237.700	m
Bottom of Trench Elevation =	243.650	m
Bottom of Trench Area =	46.4	sq.m.
Design Hydraulic Conductivity (k)=	1.0	mm/hr
Length of Trench=	32.00	m
Bottom Width=	1.45	m
Top of stone width=	1.45	m
Height of Stone=	1.35	m
Minimum Void Ratio=	0.35	
Side Slope=	0.00	
Distribution Pipe Invert=	244.250	m
Distribution Pipe Diameter=	0.450	m

Darcy's Law for Flow through Soil Media

$$Q = \mathbf{kIA}$$

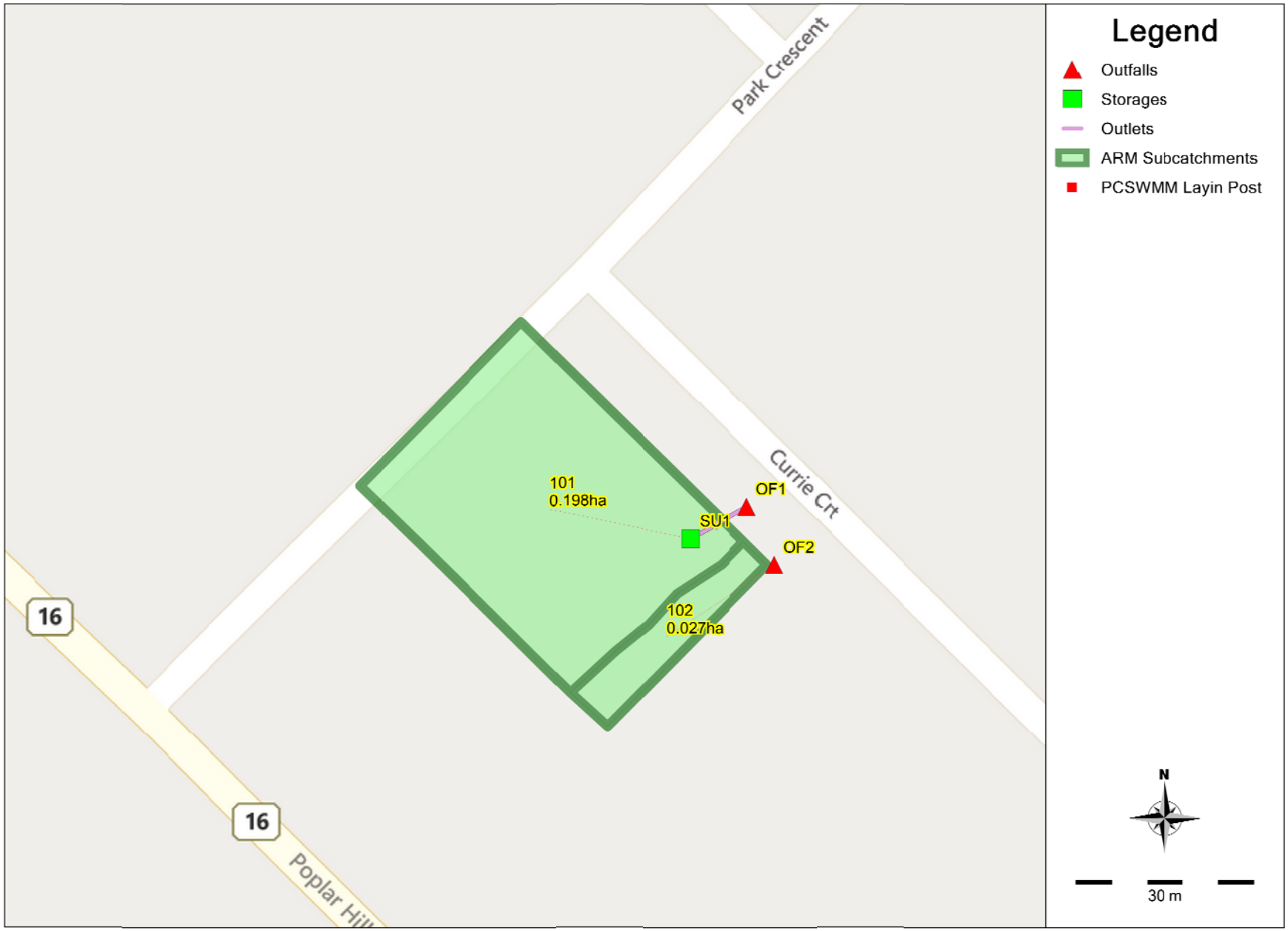
k, hydraulic conductivity
I, hydraulic gradient
A, area to travel through

Hydraulic Gradient Principals (I)

$$I = \frac{Head\ Differential\ across\ the\ soil\ media}{thickness\ of\ media}$$

$$I = \frac{Trench\ Water\ Elev\ -\ Groundwater\ Elev}{Trench\ Bottom\ Elev\ -\ Groundwater\ Elev}$$

PCSWMM Input files


Park Crescent
Currie Crt
16
16
Poplar Hill
101
0.198ha
SU1
OF1
OF2
102
0.027ha
Legend
Outfalls
Storages
Outlets
ARM Subcatchments
PCSWMM Layin Post
N
30 m

2 Park Crescent
Post Development Model Input

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           01/09/2023
START_TIME           00:00:00
REPORT_START_DATE    01/09/2023
REPORT_START_TIME    00:00:00
END_DATE             01/12/2023
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     NONE
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
SURCHARGE_METHOD     Slot
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
;Groundwater
OF1              237.7      FREE                        NO
OF2              246.35     FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------
-------- --------
;ExfiltrationTrench
SU1              243.65   2.73       0          TABULAR    ExfiltrationTrench             0      0

[OUTLETS]
;;Name           From Node        To Node          Offset     Type             QTable/Qcoeff    Qexpon     Gated
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ---------- --------
OL1              SU1              OF1              0          TABULAR/DEPTH    Exfiltratinggroundwater
NO

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Exfiltratinggroundwater Rating     0          0.0128889
Exfiltratinggroundwater            0.1        0.0148982
Exfiltratinggroundwater            0.2        0.0169374
Exfiltratinggroundwater            0.3        0.0190065
Exfiltratinggroundwater            0.4        0.0211055
Exfiltratinggroundwater            0.5        0.0232344
Exfiltratinggroundwater            0.6        0.0253931
Exfiltratinggroundwater            0.7        0.0275817
Exfiltratinggroundwater            0.8        0.0298002
Exfiltratinggroundwater            0.9        0.0320486
Exfiltratinggroundwater            1          0.0343268
Exfiltratinggroundwater            1.05       0.0354771
Exfiltratinggroundwater            1.15       0.0378002
Exfiltratinggroundwater            1.25       0.0401531
Exfiltratinggroundwater            1.35       0.0425359
Exfiltratinggroundwater            2.3        0.0465098
Exfiltratinggroundwater            2.4        0.0469281
Exfiltratinggroundwater            2.5        0.0473464
Exfiltratinggroundwater            2.6        0.0477647
Exfiltratinggroundwater            2.73       0.0483085

ExfiltrationTrench Storage    0          16.24
ExfiltrationTrench            0.1        16.24
ExfiltrationTrench            0.2        16.24
ExfiltrationTrench            0.3        16.24
ExfiltrationTrench            0.4        16.24
ExfiltrationTrench            0.5        16.24
ExfiltrationTrench            0.6        16.24
ExfiltrationTrench            0.7        27.19
ExfiltrationTrench            0.8        22.76
ExfiltrationTrench            0.9        28.17
ExfiltrationTrench            1          19.6
ExfiltrationTrench            1.05       20.92
ExfiltrationTrench            1.15       11.56
ExfiltrationTrench            1.25       20.92
ExfiltrationTrench            1.35       11.56
ExfiltrationTrench            2.3        -11.56
ExfiltrationTrench            2.4        23.96
ExfiltrationTrench            2.5        67.24
ExfiltrationTrench            2.6        259.56
ExfiltrationTrench            2.73       477.21

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       458261.7621      4761535.288      458288.4239      4761557.288
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
OF1              458282.615         4761551.579
OF2              458287.212         4761541.785
SU1              458272.974         4761546.288

[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

PCSWMM Output files

```
  ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406
  ---------------------------------------------------------

  This is a new version of ARM - your feedback and suggestions are solicited.
  Create a ticket, post on the PCSWMM feature request forum, or email us directly!

  Simulation start time:                  01/09/2023 00:00:00
  Simulation end time:                    01/13/2023 03:00:00
  Runoff wet weather time steps:          300 seconds
  Report time steps:                      60 seconds
  Number of data points:                  5941


  ******************************
  Unit Hydrographs Runoff Method
  ******************************

  ------------------------------------------------------------------------------------------------------------------------
-----------------------------------------
                                                                                  Area   Time of Concentration  Time to Peak
Time after Peak    Peak UH Flow    UH Depth
  Subcatchment         Runoff Method             Raingage                       (ha)   (min)                  (min)
(min)              (m³/s/mm)       (mm)
  ------------------------------------------------------------------------------------------------------------------------
-----------------------------------------
  101                  Nash IUH                  Chicago_3h_2year_2011MiddlesexCentreRainfallData 0.198  22.29
14.86           65.14                0.0012          0.997
  102                  Nash IUH                  Chicago_3h_2year_2011MiddlesexCentreRainfallData 0.027  8.3
5.53            24.47                0.00044         0.958


  ******************
  ARM Runoff Summary
  ******************

  ------------------------------------------------------------------------------------------
                      Total       Total       Total       Total       Peak        Runoff
                      Precip      Losses      Runoff      Runoff      Runoff      Coeff
  Subcatchment        (mm)        (mm)        (mm)        10^6 ltr    LPS         (fraction)
  ------------------------------------------------------------------------------------------
  101                 33.312      25.156      8.126       0.016       4.878       0.244
  102                 33.312      29.256      3.885       0.001       0.468       0.117


  WARNING ARM01: Computed UH depth for ARM subcatchment 102 is not unity. Consider reducing wet weather time step.

  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 0
  Number of nodes ........... 3
  Number of links ........... 1
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                Data Source                     Type       Interval
  ----------------------------------------------------------------------
  Chicago_3h_2year_2011MiddlesexCentreRainfallData Chicago_3h_2year_2011MiddlesexCentreRainfallData INTENSITY    5
min.


  *************
  Node Summary
  *************
                                      Invert      Max.    Ponded    External
  Name                Type             Elev.     Depth      Area    Inflow
  ----------------------------------------------------------------------
  OF1                 OUTFALL         237.70      0.00       0.0
  OF2                 OUTFALL         246.35      0.00       0.0
  SU1                 STORAGE         243.65      2.73       0.0


  *************
  Link Summary
  *************
  Name             From Node        To Node          Type            Length    %Slope Roughness
  ---------------------------------------------------------------------------------------------
  OL1              SU1              OF1              OUTLET


  *********************
  Cross Section Summary
  *********************
                                                  Full     Full     Hyd.     Max.   No. of     Full
  Conduit          Shape                Depth     Area     Rad.     Width  Barrels     Flow
  ---------------------------------------------------------------------------------------------


  ******************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ******************************************************

  ***************
  Analysis Options
  ***************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Flow Routing Method ...... DYNWAVE
  Surcharge Method ......... SLOT
  Starting Date ............ 01/09/2023 00:00:00
  Ending Date .............. 01/13/2023 03:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Routing Time Step ........ 1.00 sec
  Variable Time Step ....... YES
  Maximum Trials ........... 8
  Number of Threads ........ 1
  Head Tolerance ........... 0.001500 m


  *************************       Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  *************************     ---------     ---------
  Dry Weather Inflow .......          0.000         0.000
  Wet Weather Inflow .......          0.000         0.000
  Groundwater Inflow .......          0.000         0.000
  RDII Inflow ..............          0.000         0.000
  External Inflow ..........          0.002         0.017
  External Outflow .........          0.001         0.010
  Flooding Loss ............          0.000         0.000
  Evaporation Loss .........          0.000         0.000
  Exfiltration Loss ........          0.000         0.000
  Initial Stored Volume ....          0.000         0.000
  Final Stored Volume ......          0.001         0.007
  Continuity Error (%) .....          0.000


  **************************
  Time-Step Critical Elements
  **************************
  None


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.50 sec
  Average Time Step           :     1.00 sec
  Maximum Time Step           :     1.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.00
  Percent Not Converging      :     0.00
  Time Step Frequencies       :
      1.000 -  0.871 sec      :   100.00 %
      0.871 -  0.758 sec      :     0.00 %
      0.758 -  0.660 sec      :     0.00 %
      0.660 -  0.574 sec      :     0.00 %
      0.574 -  0.500 sec      :     0.00 %


  ******************
  Node Depth Summary
  ******************

  ------------------------------------------------------------------------------------------------------------------------
                                      Average  Maximum  Maximum  Time of Max     Reported
                                        Depth    Depth      HGL   Occurrence   Max Depth
  Node                Type            Meters   Meters   Meters  days hr:min       Meters
  ------------------------------------------------------------------------------------------------------------------------
  OF1                 OUTFALL           0.00     0.00   237.70    0  00:00         0.00
  OF2                 OUTFALL           0.00     0.00   246.35    0  00:00         0.00
  SU1                 STORAGE           0.64     0.86   244.51    0  03:45         0.86
```

2 Park Crescent
2 Year Post Development Model Output

****

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.00	0.03	0 03:45	0	0.00935	0.000
OF2	OUTFALL	0.47	0.47	0 01:20	0.00105	0.00105	0.000
SU1	STORAGE	4.88	4.88	0 01:30	0.0161	0.0161	0.005

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.011	12	0	0	0.016	17	0 03:45	0.03

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	29.89	0.03	0.03	0.009
OF2	2.05	0.14	0.47	0.001
System	15.97	0.17	0.48	0.010

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OL1	DUMMY	0.03	0 03:45			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Jan 12 13:44:00 2023
Analysis ended on: Thu Jan 12 13:44:01 2023
Total elapsed time: 00:00:01

```
  ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406
  ---------------------------------------------------------

  This is a new version of ARM - your feedback and suggestions are solicited.
  Create a ticket, post on the PCSWMM feature request forum, or email us directly!

  Simulation start time:                  01/09/2023 00:00:00
  Simulation end time:                    01/17/2023 11:00:00
  Runoff wet weather time steps:          300 seconds
  Report time steps:                      60 seconds
  Number of data points:                  12181


  ******************************
  Unit Hydrographs Runoff Method
  ******************************

  ------------------------------------------------------------------------------------------------------------------------
-----------------------------------------
                                                                                  Area   Time of Concentration  Time to Peak
Time after Peak    Peak UH Flow    UH Depth
  Subcatchment         Runoff Method             Raingage                       (ha)   (min)                  (min)
(min)              (m³/s/mm)       (mm)
  ------------------------------------------------------------------------------------------------------------------------
-----------------------------------------
  101                  Nash IUH                  Chicago_3h_100year_2011MiddlesexCentreRainfallData 0.198  22.29
14.86           65.14                0.0012          0.997
  102                  Nash IUH                  Chicago_3h_100year_2011MiddlesexCentreRainfallData 0.027  8.3
5.53            24.47                0.00044         0.958


  ******************
  ARM Runoff Summary
  ******************

  ------------------------------------------------------------------------------------
                      Total       Total       Total       Total       Peak        Runoff
                      Precip      Losses      Runoff      Runoff      Runoff      Coeff
  Subcatchment        (mm)        (mm)        (mm)        10^6 ltr    LPS         (fraction)
  ------------------------------------------------------------------------------------
  101                 71.801      45.488      26.222      0.052       16.626      0.365
  102                 71.801      52.903      18.111      0.005       2.544       0.252


  WARNING ARM01: Computed UH depth for ARM subcatchment 102 is not unity. Consider reducing wet weather time step.
```

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 0
  Number of nodes ........... 3
  Number of links ........... 1
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                  Data       Recording
  Name                 Data Source                Type       Interval
  ----------------------------------------------------------------------
  Chicago_3h_100year_2011MiddlesexCentreRainfallData Chicago_3h_100year_2011MiddlesexCentreRainfallData INTENSITY
5 min.


  *************
  Node Summary
  *************
                                      Invert      Max.    Ponded    External
  Name                 Type            Elev.     Depth      Area    Inflow
  ----------------------------------------------------------------------
  OF1                  OUTFALL        237.70      0.00       0.0
  OF2                  OUTFALL        246.35      0.00       0.0
  SU1                  STORAGE        243.65      2.73       0.0


  *************
  Link Summary
  *************
  Name             From Node        To Node          Type            Length    %Slope Roughness
  ---------------------------------------------------------------------------------------------
  OL1              SU1              OF1              OUTLET


  *********************
  Cross Section Summary
  *********************
```

```
                                      Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape               Depth     Area     Rad.    Width  Barrels     Flow
-------------------------------------------------------------------------------------


***********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
***********************************************************

***************
Analysis Options
***************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... SLOT
Starting Date ............ 01/09/2023 00:00:00
Ending Date .............. 01/17/2023 11:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


*************************       Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.006         0.057
External Outflow .........         0.004         0.038
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.002         0.019
Continuity Error (%) .....         0.000


**************************
Time-Step Critical Elements
**************************
None


*********************************
Highest Flow Instability Indexes
*********************************
All links are stable.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.00 sec
Maximum Time Step           :     1.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00
Time Step Frequencies       :
    1.000 -  0.871 sec      :   100.00 %
    0.871 -  0.758 sec      :     0.00 %
    0.758 -  0.660 sec      :     0.00 %
    0.660 -  0.574 sec      :     0.00 %
    0.574 -  0.500 sec      :     0.00 %


******************
Node Depth Summary
******************

  ------------------------------------------------------------------------------------------
                                  Average  Maximum  Maximum  Time of Max     Reported
                                    Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type         Meters   Meters   Meters   days hr:min      Meters
  ------------------------------------------------------------------------------------------
OF1                  OUTFALL        0.00     0.00   237.70     0  00:00         0.00
OF2                  OUTFALL        0.00     0.00   246.35     0  00:00         0.00
SU1                  STORAGE        2.12     2.60   246.25     0  03:52         2.60
```

****

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.00	0.05	0 03:52	0	0.0327	0.000
OF2	OUTFALL	2.54	2.54	0 01:15	0.00489	0.00489	0.000
SU1	STORAGE	16.63	16.63	0 01:30	0.0519	0.0519	0.011

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
SU1	0.032	34	0	0	0.048	51	0 03:52	0.05

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	99.30	0.04	0.05	0.033
OF2	1.13	0.59	2.54	0.005
System	50.22	0.63	2.56	0.038

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
OL1	DUMMY	0.05	0 03:52			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Jan 13 10:23:48 2023
Analysis ended on: Fri Jan 13 10:23:49 2023
Total elapsed time: 00:00:01