DILLON CONSULTING

Lakefront Heights Inc.

Official Plan and Zoning By-Law Amendments

Stormwater Management Report

Lakefront Heights Development

Windsor, Ontario

June 2024 – 21-2104

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1.0 Introduction

Dillon Consulting Limited (Dillon) has been retained by Lakefront Heights Inc. to prepare a Stormwater Management Report in support of its Official Plan (OPA) and Zoning By-law Amendments (ZBA) for its proposed development to the south of the existing Riverside Sportsman Club. As shown in **Figure 1,** the proposed development is located in the neighborhood of East Riverside, in the City of Windsor, north of Wyandotte Street East.

The proposed development area is approximately 1.66 ha and is currently vacant undeveloped land, with the exception of a concrete pad located at the northeast corner of the site. The proposed development consists of a combination of multi-storey and attached townhome style residential buildings. The site plan for the proposed development can be found in ***Appendix A***.

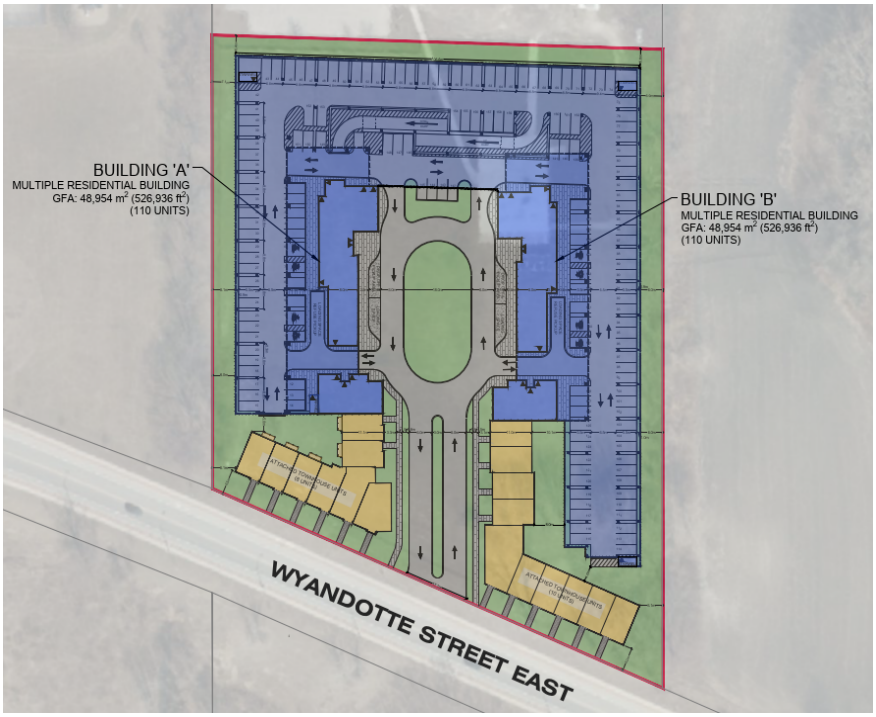


Figure 1: Proposed Development

1.1 Background

In 2018, Dillon completed a stormwater assessment study of the North Neighbourhood Development for the City of Windsor (the City). The details of the previously completed study can be found in the North Neighbourhood Development Storm Water Management Analysis Report (Dillon 2018). The current development was part of the ultimate future build out area considered in the 2018 study. As such, the currently proposed development was assessed to the North Neighbourhood Stormwater Management

Pond and the Wyandotte Street East Trunk Sewer.

1.2 Stormwater Management Design Criteria

Design criteria for the stormwater design and servicing were based on review of the following reference documents:

- Stormwater Management Planning and Design Manual (Ministry of the Environment [MECP], 2003);
- Windsor/Essex Region Stormwater Management Standards Manual (WERSMSM) (2018); and
- North Neighbourhood Stormwater Management Study (Dillon, 2018).

The corresponding criteria are described below.

1.2.1 Quantity Control

The proposed SWM plan is designed at a minimum to provide active storage volume for the 100-Year, 24 hour storm and the 100-Year, 4 hour storm.

1.2.1.1 Minor System Conveyance

The proposed site storm sewers are designed to accommodate the peak flows from the 5-Year design storm event.

1.2.1.2 Major System Conveyance

The proposed major system is designed to limit the maximum surface ponding depths on the proposed roadways to 0.30 m.

1.2.1.3 Climate Change Resiliency Assessment

The regional SWM facility is designed to accommodate the runoff generated from the Urban Stress Test design storm event without overtopping its banks.

1.2.2 Quality Control

On-site stormwater quality treatment will be provided using an oil-grit separator (OGS) positioned upstream of the outlet to the Wyandotte Street Trunk Storm Sewer. The OGS unit is designed to meet the Ministry of Environment, Conservation and Parks (MECP) design requirements for 70% TSS removal (normal level of protection). Additionally, the North Neighbourhood SWM facility (North Neighbourhood Pond) is designed to provide for a “Normal” Protection Level of water quality treatment to remove 70% of total suspended solids (TSS) from the proposed site runoff.

2.0 Existing Conditions

The subject property is currently vacant undeveloped land, with the exception of a concrete pad located at the northeast corner of the site. The site is bound by the Riverside Sportsman Club to the north, Wyandotte Street East to the south, and vacant land to the east and East End Park to the west.

2.1 Existing Drainage

Based on the available topographic information, runoff from the existing site generally travels south towards Wyandotte Street East as shallow surface flow. Flow from the site is entering the Wyandotte Street East Trunk Sewer where it ultimately discharges to the North Neighbourhood Pond. No external drainage areas contribute runoff to the site.

2.2 Site Soils

Based on the information presented on the Soil Map of Essex County, the site soils of the site consist of Clyde Clay and Colwood Fine Sandy Loam. These soils are classified in the Ontario Agricultural Atlas as Hydrologic Soil Group (HSG) D and C, respectively.

2.3 Tailwater Conditions

The impact of downstream tailwater conditions occurring against the site's stormwater management system was accounted for in this analysis. Head time-series were extracted from the North Neighbourhood Model for the 5-Year, 4 hour; 100-Year, 4 hour; 100-Year, 24 hour and UST events, for the node MH 6R4007. These time-series were then applied to the outfall node to represent tail water conditions.

The head time series used to simulate tailwater conditions for different storm events are shown below in **Figure 2**.

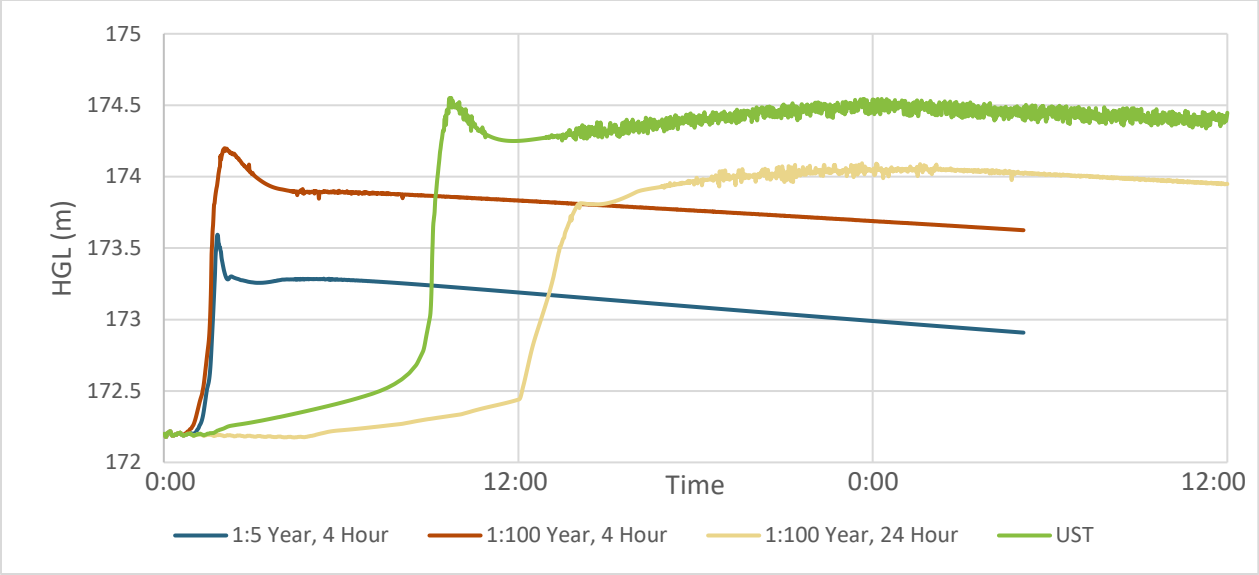


Figure 2: Tailwater time-series for various storm events

3.0 Proposed Condition Analysis

The proposed site development is 1.66 ha site area and consists of a combination of multi-storey and townhome residential buildings. All runoff from the proposed development is discharged to the North Neighbourhood Pond through the Wyandotte Street East Trunk Sewer. The site plan for the proposed development can be found in ***Appendix A***.

3.1 Proposed Condition Hydrologic Assessment

Sub catchment attributes for the proposed development model were selected based on the ERCA SWM standard and are summarized in **Table 1** below. Additional details of the modelling parameters and other model details for proposed conditions are provided in ***Appendix B***.

Table 1: Post Development Sub-Catchment Parameters for the Site

Attribute	Development
Land Use	Residential
Area (ha)	1.66
Flow Length[1] (m)	155
Imperviousness (%)	90
Slope (%)	1.5
Manning's n Impervious	0.013
Manning's n Pervious	0.24
Depression Storage Impervious (mm)	2.5
Depression Storage Pervious (mm)	7.5
Soil Capillary Suction Head (mm)[2]	215
Hydraulic Conductivity (mm/hr)[2]	1.15
Initial Soil Moisture Deficit (frac.)[2]	0.235

[1]*Maximum flow path to outlet*
[2]*Weighted average for soil type C &D*

3.2 Allowable Release Rate

The subject development lands were assessed to the Wyandotte Street East Trunk Sewer in the 2018 North Neighbourhood Study. In the 2018 report, the development lands were included with an

imperviousness percentage of 37% flowing unrestricted through overland flow to the Wyandotte Street East Trunk Sewer.

As such, the allowable release rate of the proposed site was estimated considering a percentage imperviousness of 37% in the modelling analysis. The estimated maximum allowable stormwater release rate for the development site is 160 L/s. This flow represents the 5-Year, 4 hour design storm event, peak flow rate from the development site using a 37% imperviousness for the site.

In order to prevent any adverse impacts on the downstream system due to the proposed development, the maximum flow rate from the site is expected to be maintained at or below the allowable release rate for all events up to and including the 100-Year event.

3.3 Preliminary SWM Strategy

A preliminary SWM strategy was developed to manage the runoff from the proposed site. The proposed strategy includes:

- An on-site storm sewer to convey the minor flows from all storms up to and including 5-Year design storm event;
- Catchbasin pre-treatment measures to capture oil and suspended sediment at the source;
- An oil/grit separator to provide water quality treatment;
- A gravity outlet with a flap gate to discharge the proposed site runoff to the Wyandotte Street East Trunk Sewer under high tailwater conditions; and
- On-site temporary stormwater storage to attenuate the peak discharges.

3.4 Storm Sewer Design

The proposed site storm sewers are designed to convey the site runoff to the Wyandotte Street East Trunk Sewer by gravity. The storm sewers are designed to accommodate the peak discharges from the 5-Year storm event. The peak discharge from the proposed storm sewer to the Wyandotte Street East Trunk Sewer is restricted by an orifice that limits the site discharge to the allowable release rate of 160 L/s.

3.5 Quantity Control

Stormwater storage on site is proposed by a combination of underground storage and above ground storage at catch-basin (CB) locations. A 750 mm diameter pipe and 230 mm circular orifice is proposed from the site to the outlet node (6R4007) to restrict the flow within the allowable rate.

The parking lot areas will be graded to include local sags at catch basin locations to allow for surface ponding during large storm events. Storage in the storm sewers and sewer structures has been taken into account in this analysis and incorporated into the stage-storage curve used to simulate on-site storage in the model.

The proposed condition model was simulated for different storm events. A summary of the release rates and the on-site storage volumes for various storm event simulations is provided in **Table 2.**

Table 2: Onsite Storage Depth, Storage Volume and Release for Various Storms

Storm Type	Release Rate (L/s)	Storage Volume (m^3)
5-Year, 4 hour Chicago	130	390
100-Year, 4 hour Chicago	160	670
100-Year, 24 hour SCS Type-II	120	390
Urban Stress Test	120	990

Shown in **Table 2,** it is observed that the release rates for all simulated storm events is within the allowable limit of 160 L/s. It is also observed in the 100-Year, 4 hour storm (Chicago) event is the governing 100-Year return period event regarding storage requirements. The maximum volume of storm water estimated to be stored on-site is 670 m^3, during the governing 100-Year simulation. The details of the model inputs and outputs are provided in ***Appendix B*.**

The Urban Stress Test (UST) storm event was also simulated to account for impacts of climate change. The estimated storage volume during the UST event simulation, shown in **Table 2**, is 990 m^3, which is higher than the maximum estimated volume during the governing 100-Year simulation.

The maximum depth of storage on-site during the 100-year and UST events will be confirmed during detailed design stage.

The flow from the site is conveyed via a 750 mm diameter conduit to the outfall (6R3879) of the Wyandotte Street East Trunk Sewer. Additionally, a 230 mm circular orifice is required to restrict the flow within the allowable limit.

3.6 Quality Control

Water quality treatment is provided by a multi-component approach that includes:

- Pre-treatment measures in the proposed site catch basins to capture TSS; and
- An oil/grit separator (OGS) to meet the design TSS removal rate.

Pre-treatment devices will be selected during detailed design but must be designed to convey flows under freezing conditions. The site will require an OGS unit to meet Normal Protection Level water quality treatment to remove 70% TSS from the proposed site runoff. The FD-5HC model supplied by ADS, or approved equivalent is recommended for this site. The details of this OGS sizing is provided in ***Appendix C*.**

3.7 Downstream Capacity Analysis

The PCSWMM model developed as part of the North Neighbourhood Stormwater Management Study (Dillon, 2018) was utilized to determine upstream and downstream impacts on the Wyandotte Street East Trunk Sewer. The model was simulated using the 5-Year, 4 hour; 100-Year 4 hour; 100-Year 24 hour and the UST design storm events, with and without the inflow from the proposed development. Comparing the HGL through the Wyandotte Street East Trunk Sewer, there was no observed increase in HGLs during the storm events.

This is understood to be because the flows from the proposed development are relatively small in comparison to the peak flows in the larger Wyandotte Street East Trunk Sewer.

Therefore, it was concluded that the release rate from the proposed site is not expected to have a significant impact on the receiving sewer system. Profiles of the Wyandotte Street East Trunk Sewer showing the HGL, with and without the new development inflow, are included in ***Appendix D*.**

4.0 Conclusions

The stormwater management design for the proposed development meets the established SWM criteria for the overall site, and no negative impacts due to the site development are anticipated in the existing system.

Based on the analysis performed, the conclusions are listed as follows:

- The allowable release rate for this proposed development is estimated to be 160 L/s. This is based on a 5-Year year pre-development release from the development area, assuming a pre-development percentage imperviousness of 37% for the site.
- A 750 mm diameter circular pipe and 230 mm diameter circular orifice is proposed at the outlet to provide flow restriction for maintaining outflow within the allowable release rate.
- Approximately 390 m^3 of underground storage is required to restrict flow from the site to the allowable release while maintaining the HGL below the road elevation for storms up to and including the 5-Year event.
- On-site storage volume of 670 m^3 is required for the 100-Year event to restrict flows from the site to the allowable release rate without surface ponding exceeding 0.30 m.
- From the outlet capacity assessment analysis, no significant change in HGLs in the Wyandotte Street East Trunk Sewer, downstream of the development, is observed. Therefore, no negative impact to the hydraulic conditions of the downstream municipal sewer is expected due to the proposed development.

This report is respectfully submitted for review and approval. Should you have any questions, we would be pleased to discuss the results of our evaluation in further detail.

Yours sincerely,

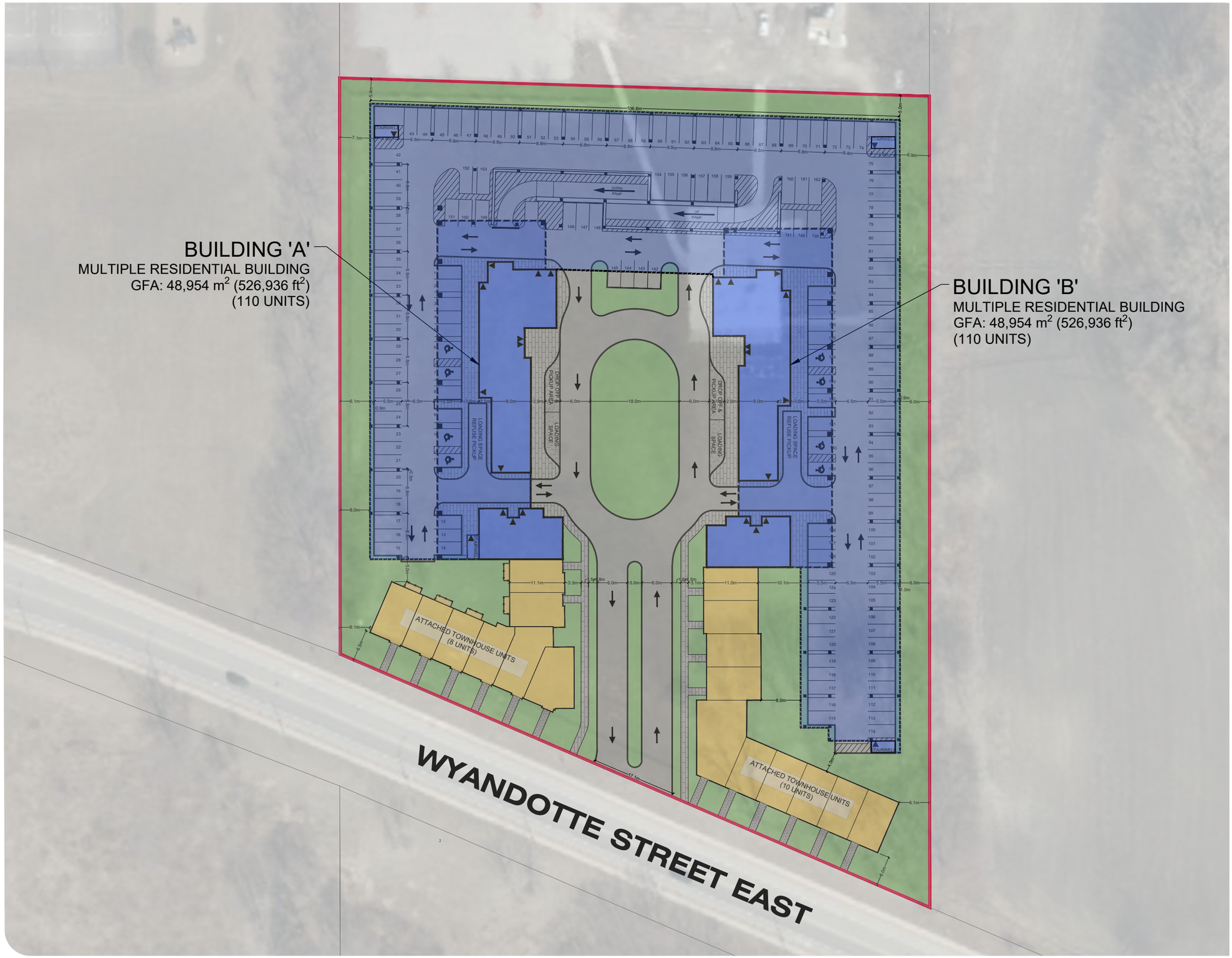
DILLON CONSULTING LIMITED

Aakash Bagchi, P.Eng. M.Eng.,
Water Resources Engineer

Saranya Jeyalakshmi
Water Resources Designer

Appendix A

Lakefront Heights Concept Plan



LAKEFRONT HEIGHTS INC.
LAKEFRONT HEIGHTS DEVELOPMENT
PLANNING JUSTIFICATION REPORT
CONCEPTUAL DEVELOPMENT PLAN
GROUND FLOOR - PARKING LAYOUT
FIGURE 4 (a)

- SUBJECT AREA (±1.66 ha / 4.11 ac)
- PROPOSED LANDSCAPE
- PROPOSED MULTI-UNIT RESIDENTIAL TOWERS
- PROPOSED TOWNHOME ATTACHED STYLE UNITS
- PROPOSED SIDEWALK
- PROPOSED PAVEMENT

SITE DATA MATRIX

	ZONING PROVISIONS	REQUIRED	PROVIDED
1	PROJECT DESCRIPTION	N/A	RESIDENTIAL
2	ZONING DESIGNATION	RD3.3	SITE SPECIFIC RD3.3
3	LAND USE	N/A	RESIDENTIAL
4	MAJOR OCCUPANCY(S)	N/A	RESIDENTIAL
5	PERMITTED USES	MULTIPLE DWELLING	MULTIPLE DWELLING
6	MINIMUM SITE AREA	11,680m²	16,633m²
7	BUILDING AREA (GROUND FLOOR FOOTPRINT)	N/A	9,314.5m²
8	TOTAL UNITS	N/A	238
9	LOT COVERAGE	35%	56%*
10	MINIMUM LOT WIDTH	45.0m	129.4m
11	MAXIMUM BUILDING HEIGHT	24.0m	44.0m*
12	MINIMUM FRONT YARD DEPTH	N/A	6.0m
13	MINIMUM REAR YARD DEPTH	N/A	5.0m
14	MINIMUM SIDE YARD DEPTH	N/A	6.0m
15	REQUIRED SPACES - STANDARD	289	307
16	REQUIRED SPACES - ACCESSIBLE	8 (4 TYPE A AND 4 TYPE B)	16 (8 TYPE A & 8 TYPE B)
17	REQUIRED SPACES - VISITOR (15%)	44	48
18	PARKING SPACES - TOTAL	297	323
19	GROUND FLOOR PARKING	N/A	162
20	SECOND FLOOR PARKING	N/A	161
21	BICYCLE SPACES	18	23
22	LOADING SPACES	4	4
23	LANDSCAPED AREA - SOFT	N/A	4,871m²
24	LANDSCAPED AREA - HARD	N/A	1,159m²
25	LANDSCAPED AREA - TOTAL	35%	6,030m² (36.2%)
26	DWELLING UNITS PER HECTARE	180	144

* REQUIRES SITE SPECIFIC ZONING BY-LAW AMENDMENT

SCALE : 1:750

SOURCE: COUNTY OF ESSEX
AERIAL PHOTOGRAPHY (2021)

MAP/DRAWING INFORMATION
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY. ALL DIMENSIONS AND BOUNDARY INFORMATION SHOULD BE VERIFIED BY AN O.L.S PRIOR TO CONSTRUCTION.

CREATED BY: SNP
CHECKED BY: MAM
DESIGNED BY: SNP

File Location:
c:\pw working directory\projects 2021\32mam\dms32529\21-2104 -sportsman club - site plan.dwg
June, 14, 2024 9:39 AM

DILLON CONSULTING

PROJECT: 21-2104
STATUS: DRAFT
DATE: 12/06/2024

Appendix B

Modelling Input and Output Reports

Model Schematic

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

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

START_DATE           10/13/2022
START_TIME           00:00:00
REPORT_START_DATE    10/13/2022
REPORT_START_TIME    00:00:00
END_DATE             10/14/2022
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         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
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              6
```

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

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
100Y4hr_Chicago  INTENSITY 0:15     1.0      TIMESERIES 100Y4hr_Chicago
100YrSCS         INTENSITY 2:00     1.0      TIMESERIES 100YrSCS
5Y4hr_Chicago    INTENSITY 0:15     1.0      TIMESERIES 5Y4hr_Chicago
UST              INTENSITY 0:15     1.0      TIMESERIES UST

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- ----------------
SM1              5Y4hr_Chicago    SMS1             1.66     90       107.097  1.5      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
SM1              0.013      0.24       2.5        7.5        0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
SM1              215        1.15       0.235      0          0

[JUNCTIONS]
;;Name           Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
SMMH1            173.524    1.976      0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
SMOF1            171.755    TIMESERIES TW_5YR_4Hr_NorthNeighbourHood NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap    Psi
Ksat     IMD
```

```
;;-------------- -------- ---------- ---------- ---------- -------------------------- -------- --------
-------- --------
SMS1             173.524  1.976      0          TABULAR    Storage                       0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow   MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ---------- ---------
-
SMC1             SMMH1            SMOF1            10         0.013      173.524    173.324    0          0

[ORIFICES]
;;Name           From Node        To Node          Type         Offset     Qcoeff     Gated    CloseTime
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- ----------
SMO1             SMS1             SMMH1            SIDE         173.524    0.65       NO       0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
SMC1             CIRCULAR     0.565            0          0          0          1
SMO1             CIRCULAR     0.23             0          0          0

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
SMC1             0          0          0          YES        0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
Storage          Storage    0          570
Storage                     0.675      570
Storage                     0.676      0.7
Storage                     1.676      0.7
Storage                     1.976      4500

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
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100Y4hr_Chicago             0:15       4.87
100Y4hr_Chicago             0:30       6.36
100Y4hr_Chicago             0:45       9.19
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100Y4hr_Chicago	1:45	32.45
100Y4hr_Chicago	2:00	17.25
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100Y4hr_Chicago	3:00	5.71
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100Y4hr_Chicago	3:30	4.28
100Y4hr_Chicago	3:45	3.81
100Y4hr_Chicago	4:00	0
100YrSCS	0:00	0
100YrSCS	2:00	1.08
100YrSCS	4:00	1.62
100YrSCS	6:00	1.62
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100YrSCS	10:00	3.24
100YrSCS	12:00	25.92
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100YrSCS	16:00	3.24
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100YrSCS	22:00	1.62
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Too many data points (2160 in total).

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Too many data points (2160 in total).

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TW_UST_NorthNeighbourhood 7/7/2017   0:09       172.208679
TW_UST_NorthNeighbourhood 7/7/2017   0:10       172.210159
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......
Too many data points (2160 in total).

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UST                          0:45       2.46
UST                          1:00       2.48
UST                          1:15       2.51
UST                          1:30       2.53
UST                          1:45       2.55
UST                          2:00       2.58
UST                          2:15       2.61
UST                          2:30       2.64
UST                          2:45       2.67
UST                          3:00       2.71
UST                          3:15       2.74
UST                          3:30       2.79
UST                          3:45       2.83
UST                          4:00       2.88
UST                          4:15       2.94
UST                          4:30       3
UST                          4:45       3.07
UST                          5:00       3.15
```

UST	5:15	3.23
UST	5:30	3.33
UST	5:45	3.45
UST	6:00	3.59
UST	6:15	3.75
UST	6:30	3.94
UST	6:45	4.18
UST	7:00	4.49
UST	7:15	4.89
UST	7:30	5.43
UST	7:45	6.2
UST	8:00	7.41
UST	8:15	9.56
UST	8:30	14.29
UST	8:45	32.01
UST	9:00	145.13
UST	9:15	48.51
UST	9:30	23.13
UST	9:45	15.08
UST	10:00	11.35
UST	10:15	9.23
UST	10:30	7.88
UST	10:45	6.94
UST	11:00	6.25
UST	11:15	5.73
UST	11:30	5.32
UST	11:45	4.99
UST	12:00	4.72
UST	12:15	4.49
UST	12:30	4.29
UST	12:45	4.12
UST	13:00	3.98
UST	13:15	3.85
UST	13:30	3.74
UST	13:45	3.63
UST	14:00	3.54
UST	14:15	3.46
UST	14:30	3.39
UST	14:45	3.32
UST	15:00	3.26
UST	15:15	3.2

```
UST                     15:30      3.15
UST                     15:45      3.1
UST                     16:00      3.05
UST                     16:15      3.01
UST                     16:30      2.97
UST                     16:45      2.93
UST                     17:00      2.9
UST                     17:15      2.87
UST                     17:30      2.84
UST                     17:45      2.81
UST                     18:00      2.78
UST                     18:15      2.76
UST                     18:30      2.73
UST                     18:45      2.71
UST                     19:00      2.69
UST                     19:15      2.67
UST                     19:30      2.65
UST                     19:45      2.63
UST                     20:00      2.61
UST                     20:15      2.59
UST                     20:30      2.57
UST                     20:45      2.56
UST                     21:00      2.54
UST                     21:15      2.53
UST                     21:30      2.51
UST                     21:45      2.5
UST                     22:00      2.49
UST                     22:15      2.47
UST                     22:30      2.46
UST                     22:45      2.45
UST                     23:00      2.44
UST                     23:15      2.43
UST                     23:30      2.42
UST                     23:45      2.41

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

```
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       342302.36655     4688537.6191     342475.84645     4688730.7109
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
SMMH1            342456.582         4688564.669
SMOF1            342457.961         4688556.396
SMS1             342448.335         4688573.265

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

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
SM1              342310.252         4688705.953
SM1              342436.212         4688721.934
SM1              342459.906         4688562.512
SM1              342328.134         4688594.746
SM1              342310.252         4688705.953

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

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


*************
Element Count
*************
Number of rain gages ...... 4
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


*****************
Raingage Summary
*****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100Y4hr_Chicago      100Y4hr_Chicago             INTENSITY   15 min.
100YrSCS             100YrSCS                    INTENSITY  120 min.
5Y4hr_Chicago        5Y4hr_Chicago               INTENSITY   15 min.
UST                  UST                         INTENSITY   15 min.


*********************
Subcatchment Summary
*********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
SM1                         1.66    107.10     90.00    1.5000 5Y4hr_Chicago        SMS1


************
Node Summary
************
                                       Invert      Max.    Ponded    External
Name                 Type                Elev.     Depth      Area    Inflow
```

SMMH1	JUNCTION	173.52	1.98	0.0
SMOF1	OUTFALL	171.75	2.13	0.0
SMS1	STORAGE	173.52	1.98	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
SMC1	SMMH1	SMOF1	CONDUIT	10.0	2.0004	0.0130
SMO1	SMS1	SMMH1	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
SMC1	CIRCULAR	0.56	0.25	0.14	0.56	1	739.87

****
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
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/13/2022 00:00:00
Ending Date .............. 10/14/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.082	49.475
Evaporation Loss	0.000	0.000
Infiltration Loss	0.005	2.863
Surface Runoff	0.074	44.643
Final Storage	0.004	2.255
Continuity Error (%)	-0.577	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.074	0.741
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.074	0.738
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         0.002
  Continuity Error (%) .....         0.008


  ***************************
  Time-Step Critical Elements
  ***************************
  Link SMC1 (23.69%)


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


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     2.28 sec
  Average Time Step           :     4.57 sec
  Maximum Time Step           :     5.00 sec
  Percent in Steady State     :    -0.00
  Average Iterations per Step :     2.00
  Percent Not Converging      :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :    84.63 %
      3.155 -  1.991 sec      :    15.37 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------------
-------------
                           Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
```

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Coeff LPS
SM1	49.48	0.00	0.00	2.86	42.51	2.13	44.64	0.74	389.54 0.902

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
SMMH1	JUNCTION	0.03	0.16	173.69	0 01:54	0.16
SMOF1	OUTFALL	1.04	1.04	172.80	0 00:00	1.04
SMS1	STORAGE	0.10	1.35	174.87	0 01:54	1.29

****
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
SMMH1	JUNCTION	0.00	130.51	0 01:54	0	0.738	0.000
SMOF1	OUTFALL	0.00	130.80	0 01:54	0	0.738	0.000
SMS1	STORAGE	389.54	389.54	0 01:45	0.741	0.741	0.008

****
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
SMS1	0.057	5	0	0	0.386	36	0 01:54	130.51

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
SMOF1	96.46	13.88	130.80	0.738
System	96.46	13.88	130.80	0.738

****
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
SMC1	CONDUIT	130.80	0	01:54	2.23	0.18	0.28
SMO1	ORIFICE	130.51	0	01:54			1.00

****
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
SMC1	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Nov 18 16:37:14 2022
Analysis ended on: Fri Nov 18 16:37:14 2022
Total elapsed time: < 1 sec

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


*************
Element Count
*************
Number of rain gages ...... 4
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


*****************
Raingage Summary
*****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100Y4hr_Chicago      100Y4hr_Chicago             INTENSITY   15 min.
100YrSCS             100YrSCS                    INTENSITY  120 min.
5Y4hr_Chicago        5Y4hr_Chicago               INTENSITY   15 min.
UST                  UST                         INTENSITY   15 min.


*********************
Subcatchment Summary
*********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
S1                          1.66    107.10     90.00    1.5000 100Y4hr_Chicago      1


************
Node Summary
************
                                       Invert      Max.    Ponded    External
Name                 Type                Elev.     Depth      Area    Inflow
```

2	JUNCTION	173.52	1.98	0.0
3	OUTFALL	171.75	2.13	0.0
1	STORAGE	173.52	1.98	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	2	3	CONDUIT	10.0	2.0004	0.0130
1	1	2	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	0.56	0.25	0.14	0.56	1	739.87

****
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
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/13/2022 00:00:00
Ending Date .............. 10/14/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.135	81.588
Evaporation Loss	0.000	0.000
Infiltration Loss	0.005	3.079
Surface Runoff	0.127	76.709
Final Storage	0.004	2.255
Continuity Error (%)	-0.558	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.127	1.272
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.125	1.248
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         0.006
  Continuity Error (%) .....         1.430


  ***************************
  Time-Step Critical Elements
  ***************************
  Link 2 (20.27%)


  *******************************
  Highest Flow Instability Indexes
  *******************************
  Link 1 (50)


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.04 sec
  Average Time Step           :     4.59 sec
  Maximum Time Step           :     5.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.00
  Percent Not Converging      :     0.02
  Time Step Frequencies       :
      5.000 -  3.155 sec      :    89.01 %
      3.155 -  1.991 sec      :    10.99 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------------
-------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
```

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Coeff LPS
S1	81.59	0.00	0.00	3.08	71.57	5.14	76.71	1.27	651.88	0.940

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
2	JUNCTION	0.04	0.21	173.73	0 01:39	0.18
3	OUTFALL	1.78	1.78	173.53	0 00:00	1.78
1	STORAGE	0.25	1.87	175.40	0 02:00	1.87

****
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
2	JUNCTION	0.00	155.68	0 02:00	0	1.25	-0.002
3	OUTFALL	0.00	166.39	0 01:39	0	1.25	0.000
1	STORAGE	651.88	651.88	0 01:45	1.27	1.27	1.462

****
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
1	0.094	9	0	0	0.672	63	0 02:00	155.68

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
3	60.09	39.09	166.39	1.248
System	60.09	39.09	166.39	1.248

****
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
2	CONDUIT	166.39	0	01:39	2.14	0.22	0.37
1	ORIFICE	155.68	0	02:00			1.00

****
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
2	1.00	0.00	0.00	0.00	0.85	0.15	0.00	0.00	0.35	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Nov 18 16:37:36 2022
Analysis ended on: Fri Nov 18 16:37:37 2022
Total elapsed time: 00:00:01

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


*************
Element Count
*************
Number of rain gages ...... 4
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


*****************
Raingage Summary
*****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100Y4hr_Chicago      100Y4hr_Chicago             INTENSITY   15 min.
100YrSCS             100YrSCS                    INTENSITY  120 min.
5Y4hr_Chicago        5Y4hr_Chicago               INTENSITY   15 min.
UST                  UST                         INTENSITY   15 min.


*********************
Subcatchment Summary
*********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
S1                          1.66    107.10     90.00    1.5000 100YrSCS             1


************
Node Summary
************
                                       Invert      Max.    Ponded    External
Name                 Type                Elev.     Depth      Area    Inflow
```

2	JUNCTION	173.52	1.98	0.0
3	OUTFALL	171.75	2.13	0.0
1	STORAGE	173.52	1.98	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	2	3	CONDUIT	10.0	2.0004	0.0130
1	1	2	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	0.56	0.25	0.14	0.56	1	739.87

****
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
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/13/2022 00:00:00
Ending Date .............. 10/14/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.176	105.840
Evaporation Loss	0.000	0.000
Infiltration Loss	0.009	5.373
Surface Runoff	0.161	97.227
Final Storage	0.006	3.364
Continuity Error (%)	-0.117	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.161	1.613
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.137	1.367
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000

```
  Initial Stored Volume ....         0.000         0.001
  Final Stored Volume ......         0.025         0.246
  Continuity Error (%) .....         0.086


  ***************************
  Time-Step Critical Elements
  ***************************
  Link 2 (63.81%)


  *******************************
  Highest Flow Instability Indexes
  *******************************
  Link 1 (13)


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.34 sec
  Average Time Step           :     3.59 sec
  Maximum Time Step           :     5.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.15
  Percent Not Converging      :     0.00
  Time Step Frequencies       :
      5.000 -  3.155 sec      :    36.19 %
      3.155 -  1.991 sec      :    63.81 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------
-------------
                            Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
```

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Runoff LPS	Coeff
S1	105.84	0.00	0.00	5.37	92.42	4.81	97.23	1.61	117.91	0.919

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
2	JUNCTION	0.31	0.44	173.97	0 12:44	0.43
3	OUTFALL	2.19	2.19	173.95	0 00:00	2.19
1	STORAGE	0.42	1.39	174.92	0 14:00	1.39

****
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
2	JUNCTION	0.00	117.91	0 14:00	0	1.37	0.038
3	OUTFALL	0.00	117.91	0 14:00	0	1.37	0.000
1	STORAGE	117.91	117.91	0 14:00	1.61	1.61	0.117

****
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
1	0.206	19	0	0	0.386	36	0 14:00	117.91

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
3	63.86	33.82	117.91	1.367
System	63.86	33.82	117.91	1.367

****
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
2	CONDUIT	117.91	0	14:00	0.51	0.16	0.89
1	ORIFICE	117.91	0	14:00			1.00

****
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
2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
2	0.01	0.01	24.00	0.01	0.01

Analysis begun on: Fri Nov 18 16:38:06 2022
Analysis ended on: Fri Nov 18 16:38:06 2022
Total elapsed time: < 1 sec

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


*************
Element Count
*************
Number of rain gages ...... 4
Number of subcatchments ... 1
Number of nodes ........... 3
Number of links ........... 2
Number of pollutants ...... 0
Number of land uses ....... 0


*****************
Raingage Summary
*****************
                                                 Data       Recording
Name                 Data Source                 Type       Interval
------------------------------------------------------------------------
100Y4hr_Chicago      100Y4hr_Chicago             INTENSITY   15 min.
100YrSCS             100YrSCS                    INTENSITY  120 min.
5Y4hr_Chicago        5Y4hr_Chicago               INTENSITY   15 min.
UST                  UST                         INTENSITY   15 min.


*********************
Subcatchment Summary
*********************
Name                        Area     Width   %Imperv    %Slope Rain Gage            Outlet
-----------------------------------------------------------------------------------------------
S1                          1.66    107.10     90.00    1.5000 UST                  1


************
Node Summary
************
                                       Invert      Max.    Ponded    External
Name                 Type                Elev.     Depth      Area    Inflow
```

2	JUNCTION	173.52	1.98	0.0
3	OUTFALL	171.75	2.13	0.0
1	STORAGE	173.52	1.98	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
2	2	3	CONDUIT	10.0	2.0004	0.0130
1	1	2	ORIFICE			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
2	CIRCULAR	0.56	0.25	0.14	0.56	1	739.87

****
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
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/13/2022 00:00:00
Ending Date .............. 10/14/2022 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.249	149.985
Evaporation Loss	0.000	0.000
Infiltration Loss	0.011	6.509
Surface Runoff	0.233	140.077
Final Storage	0.007	3.942
Continuity Error (%)	-0.362	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.232	2.324
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.193	1.935
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000

```
  Initial Stored Volume ....         0.000         0.001
  Final Stored Volume ......         0.039         0.388
  Continuity Error (%) .....         0.110


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


  *******************************
  Highest Flow Instability Indexes
  *******************************
  Link 1 (14)


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     4.50 sec
  Average Time Step           :     5.00 sec
  Maximum Time Step           :     5.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     2.29
  Percent Not Converging      :     0.03
  Time Step Frequencies       :
      5.000 -  3.155 sec      :   100.00 %
      3.155 -  1.991 sec      :     0.00 %
      1.991 -  1.256 sec      :     0.00 %
      1.256 -  0.792 sec      :     0.00 %
      0.792 -  0.500 sec      :     0.00 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ---------------------------------------------------------------------------------------------------------------
-------------
                           Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
```

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Runoff LPS	Coeff
S1	149.98	0.00	0.00	6.51	132.33	7.74	140.08	2.33	659.75	0.934

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
2	JUNCTION	0.68	0.95	174.47	0 08:34	0.93
3	OUTFALL	2.69	2.69	174.45	0 00:00	2.69
1	STORAGE	0.81	1.96	175.48	0 09:41	1.96

****
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
2	JUNCTION	0.00	121.44	0 09:41	0	1.94	0.085
3	OUTFALL	0.00	121.44	0 09:41	0	1.93	0.000
1	STORAGE	659.75	659.75	0 09:15	2.32	2.32	0.094

****
Node Surcharge Summary

****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
2	JUNCTION	15.99	0.383	1.028

****
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
1	0.338	32	0	0	0.986	93	0 09:41	121.44

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
3	64.27	34.84	121.44	1.935

System 64.27 34.84 121.44 1.935

****
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
2	CONDUIT	121.44	0	09:41	0.48	0.16	1.00
1	ORIFICE	121.44	0	09:41			1.00

****
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
2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
2	15.99	15.99	24.00	0.01	0.01

Analysis begun on: Fri Nov 18 16:37:55 2022

Analysis ended on: Fri Nov 18 16:37:55 2022
Total elapsed time: < 1 sec

Appendix C

Details of OGS Unit

ADS OGS Sizing Summary

Project Name: Riverside Sportsman Club Development

Consulting Engineer: Dillon Consulting

Location: Windsor, ON

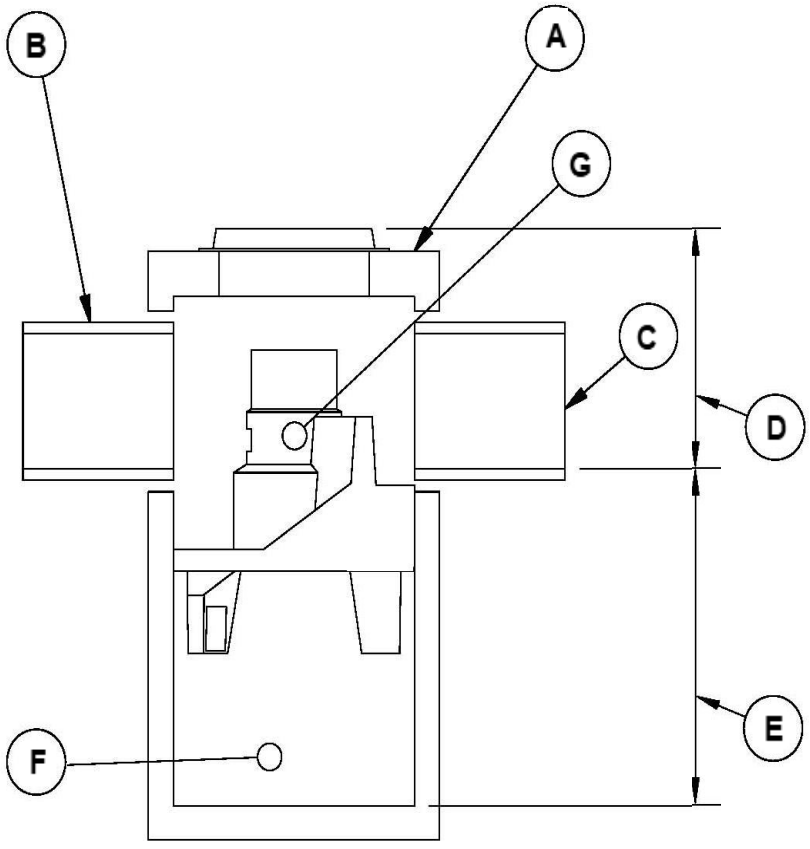
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

Treatment Requirements		
Treatment Goal:	Normal (MOE)	
Selected Parameters:	70% TSS	90% Volume
Selected Unit:	**FD-5HC**	

Site Details	
Site Area:	1.66 ha
% Impervious:	90%
Rational C:	0.84
Rainfall Station:	Windsor, ONT
Particle Size Distribution:	Fine
Peak Flowrate:	160 L/s

Summary of Results		
Model	**TSS Removal**	**Volume Treated**
FD-4HC	59.0%	>90%
FD-5HC	72.0%	>90%
FD-6HC	79.0%	>90%
FD-8HC	84.0%	>90%
FD-10HC	87.0%	>90%

FD-5HC Specification	
Unit Diameter (A):	1,500 mm
Inlet Pipe Diameter (B):	300 mm
Outlet Pipe Diameter (C):	300 mm
Height, T/G to Outlet Invert (D):	2000 mm
Height, Outlet Invert to Sump (E):	1780 mm
Sediment Storage Capacity (F):	1.29 m³
Oil Storage Capacity (G):	1,135 L
Recommended Sediment Depth for Maintenance:	475 mm
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	566 L/s



Site Elevations:	
Rim Elevation:	100.00
Inlet Pipe Elevation:	98.00
Outlet Pipe Elevation:	98.00

Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.

Project Name:	Riverside Sportsman Club Development
Consulting Engineer:	Dillon Consulting
Location:	Windsor, ON

Net Annual Removal Efficiency Summary: FD-5HC

Rainfall Intensity[(1)]	Rational Equation Flowrate	Surface Loading Rate	Fraction of Rainfall[(1)]	FD-5HC Removal Efficiency	Weighted Net-Annual Removal Efficiency
mm/hr	L/s	L/min/m^2	%	%	%
3.00	11.6	395	13.2%	87%	11.4%
4.00	15.5	526	9.6%	84%	8.1%
5.00	19.4	658	7.5%	83%	6.2%
6.00	23.2	789	6.0%	81%	4.9%
7.00	27.1	921	4.8%	80%	3.8%
8.00	31.0	1052	4.1%	79%	3.2%
9.00	34.9	1184	3.6%	78%	2.8%
10.00	38.7	1315	3.2%	78%	2.5%
11.00	42.6	1447	2.8%	77%	2.2%
12.00	46.5	1578	2.5%	76%	1.9%
15.00	58.1	1973	6.6%	75%	4.9%
20.00	77.5	2630	8.3%	73%	6.0%
25.00	96.8	3288	5.8%	71%	4.1%
30.00	116.2	3945	4.6%	70%	3.2%
35.00	135.6	4603	3.8%	69%	2.6%
40.00	154.9	5260	2.9%	68%	2.0%
45.00	174.3	5918	2.4%	67%	1.6%
50.00	193.7	6576	1.8%	0%	0.0%
65.00	251.8	8548	6.6%	0%	0.0%
				Total Net Annual Removal Efficiency:	71.6%
				Total Runoff Volume Treated:	99.9%

Notes:

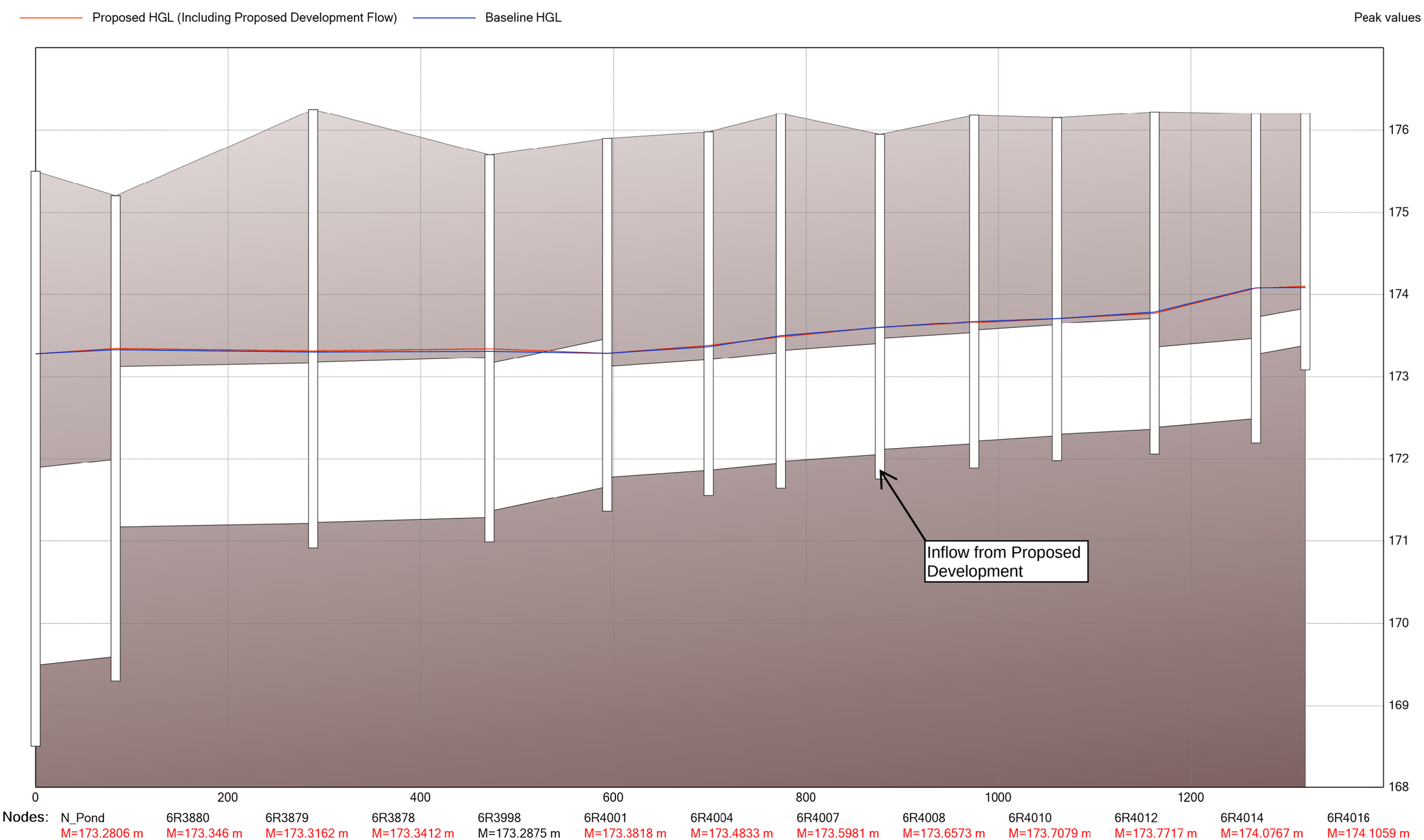
(1) Based on Windsor/Essex Region Stormwater Manual 2018, Table 3.4.1.5

(2) Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution

Appendix D

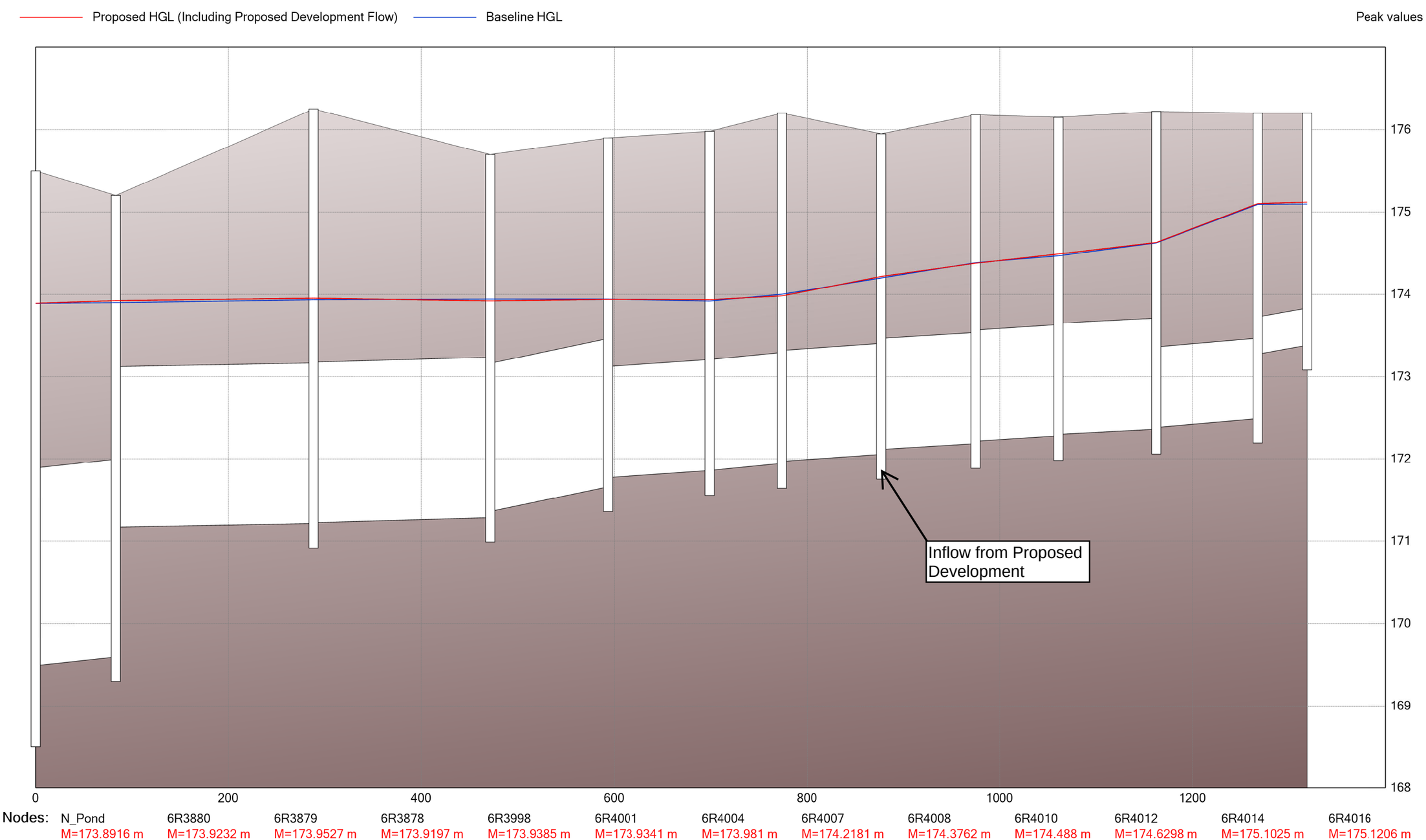
Wyandotte Street East Trunk Sewer Profile Comparison

Wyandotte Street East Trunk Sewer HGL Profile Comparison (1:5 year 4 hour)



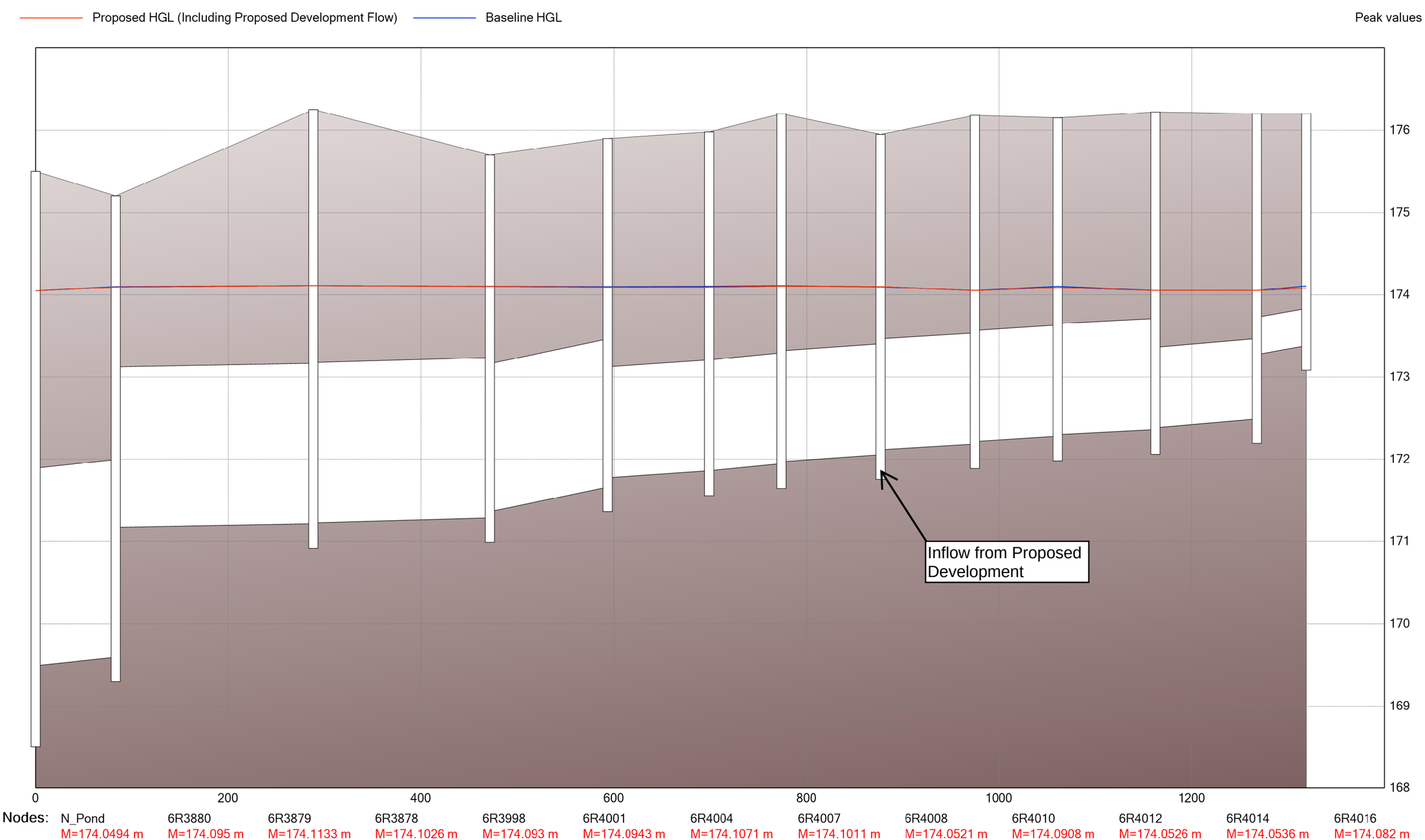
Nodes:	N_Pond	6R3880	6R3879	6R3878	6R3998	6R4001	6R4004	6R4007	6R4008	6R4010	6R4012	6R4014	6R4016
	M=173.2806 m	M=173.346 m	M=173.3162 m	M=173.3412 m	M=173.2875 m	M=173.3818 m	M=173.4833 m	M=173.5981 m	M=173.6573 m	M=173.7079 m	M=173.7717 m	M=174.0767 m	M=174.1059 m

Wyandotte Street East Trunk Sewer HGL Profile Comparison (1:100 year 4 hour)



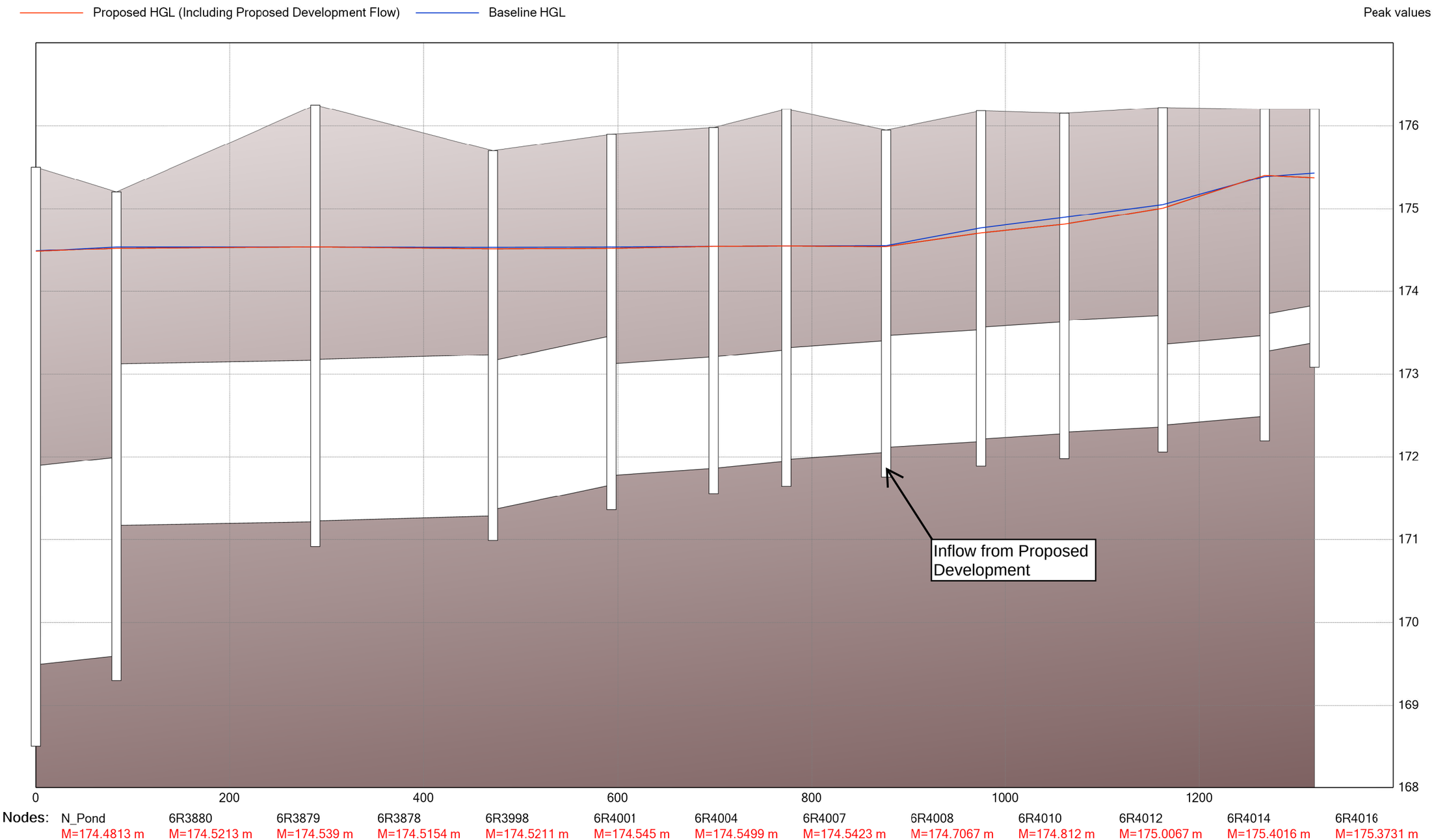
Nodes:	N_Pond	6R3880	6R3879	6R3878	6R3998	6R4001	6R4004	6R4007	6R4008	6R4010	6R4012	6R4014	6R4016
	M=173.8916 m	M=173.9232 m	M=173.9527 m	M=173.9197 m	M=173.9385 m	M=173.9341 m	M=173.981 m	M=174.2181 m	M=174.3762 m	M=174.488 m	M=174.6298 m	M=175.1025 m	M=175.1206 m

Wyandotte Street East Trunk Sewer HGL Profile Comparison (1:100 year 24 hour)



Nodes:	N_Pond	6R3880	6R3879	6R3878	6R3998	6R4001	6R4004	6R4007	6R4008	6R4010	6R4012	6R4014	6R4016
	M=174.0494 m	M=174.095 m	M=174.1133 m	M=174.1026 m	M=174.093 m	M=174.0943 m	M=174.1071 m	M=174.1011 m	M=174.0521 m	M=174.0908 m	M=174.0526 m	M=174.0536 m	M=174.082 m

Wyandotte Street East Trunk Sewer HGL Profile Comparison (UST)



Nodes:	N_Pond	6R3880	6R3879	6R3878	6R3998	6R4001	6R4004	6R4007	6R4008	6R4010	6R4012	6R4014	6R4016
	M=174.4813 m	M=174.5213 m	M=174.539 m	M=174.5154 m	M=174.5211 m	M=174.545 m	M=174.5499 m	M=174.5423 m	M=174.7067 m	M=174.812 m	M=175.0067 m	M=175.4016 m	M=175.3731 m