TATHAM ENGINEERING

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Blue Birch Development

FLOOD HAZARD STUDY

Insoho Developments Inc.

File 121295 | October 20, 2023

Document Control

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Issue	Date	Description
0	September 28, 2023	Draft for client review
1	October 20, 2023	Final Report

Document Contents

Tables

Appendices

1 Introduction

This report has been prepared in support of a residential development at Part Lot 25, Concession 4, in the Town of The Blue Mountains. This report summarizes the existing and proposed conditions hydrologic and hydraulic analysis completed to assess the flood hazards across the subject property. Additionally, this report also presents the proposed drainage improvements recommended as part of the development.

1.1 SITE DESCRIPTION

The subject property is approximately 10 ha in area and is bounded by existing residential lands to the east, Barclay Boulevard to the west, the Georgian Trail to the north, and residential lands fronting Hidden Lake Road and James Street to the south.

A watercourse, referred to as Watercourse 22, runs from southwest to northeast across the subject property. The watercourse crosses the Georgian trail via a 900 mm diameter CSP culvert and Highway 26 via a 1300 mm x 800 mm CSP culvert north of the subject property before draining into Georgian Bay.

Based on preliminary natural heritage constraints mapping completed by Birks Natural Heritage Consultants, the central portion of the property is identified as a wetland with little to no opportunity for development. As such, an area in the northwest corner of the property and an area in the southeast corner of the property at the west end of James Street have been identified as having potential for development.

1.2 OBJECTIVES AND DESIGN CRITERIA

The primary objective of this report is to assess the existing flood hazard conditions and establish the developable limits across the subject property. The existing and proposed flood hazards and mitigation measures will be analyzed and designed in accordance with the relevant Town, Grey Sauble Conservation Authority (GSCA) and Ministry of Natural Resources and Forestry (MNRF) standards and guidelines.

1.3 GUIDELINES AND BACKGROUND DOCUMENTS

This report was prepared recognizing the pertinent Conservation Authority and Municipal guidelines on water resources and the environment, including the following publications:

- *Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation Ontario Regulation 151/06*. Grey Sauble Conservation Authority (2010).

- *The Blue Mountains Engineering Standards*. Town of the Blue Mountains (2023).
- *Technical Guide*: *River & Stream Systems: Flooding Hazard Limit.* Ontario Ministry of Natural Resources and Forestry (2002).

2 Study Methodology

A hydrologic model has been created for the Watercourse 22 watershed using Visual OTTHYMO (VO) hydrologic modelling software. This hydrologic model has been used to calculate stream flow hydrographs to be entered into the hydraulic model to assess the existing and proposed condition flood hazards. Catchment hydrologic parameters have been calculated using soils information and land use data extracted from the latest available aerial imagery of the catchment areas.

Due to the nature of the large wetland storage area within the subject property, a 2D HEC-RAS hydraulic model was used to properly account for the significant storage volume provided in the wetland. The 2D hydraulic model is an unsteady flow model, meaning streamflow is represented as a time dependent hydrograph rather than the single instantaneous peak flow used for a conventional 1D hydraulic model. Conducting an unsteady 2D analysis allows the model to account for the effect of flood storage in the drainage system which can attenuate flows.

The 2D HEC-RAS hydraulic model was generated from a LiDAR Digital Elevation Model (DEM) for the study area and supplemented with topographic survey. The road crossing and trail culverts within the model area were included using topographic survey data. Manning's roughness coefficients were set throughout the study area based on existing land uses. The model's downstream conditions were set to reflect the Georgian Bay high water levels of 177.50 m and 177.90 m for the 1:100-year return frequency design storm and Regional Storm, respectively.

3 Existing Drainage Conditions

The subject property contains a wetland located on a small watercourse, referred to as Watercourse 22, which is in the Grey Sauble Conservation Authority (GSCA) Regulated Area. As a first step in our assessment, hydrologic and hydraulic modelling was completed to define the existing floodplain for Watercourse 22 through the subject property.

3.1 HYDROLOGIC ANALYSIS

A Visual OTTHYMO (VO6) hydrologic model was developed to quantify the runoff from the catchments draining to the wetland and Watercourse 22. The drainage patterns for this study area are illustrated on the Overall Drainage Plan (ODP-1) enclosed for reference. Using MTO IDF Curve data for the subject property, return frequency design storms were generated using the 4-hr Chicago and 6, 12, and 24-hour SCS design storm distributions. These design storms were all modeled in the VO model, and it was determined the 24-hour SCS design storm governs and hence results for this storm distribution are presented in addition to the Timmins Storm. A summary of the existing peak flows established through the VO analysis is provided in Table 1. Detailed model results for all design storms are provided in Appendix A for reference.

Table 1: Existing Condition Peak Flow Summary

STORM	PEAK FLOW AT POINTS OF INTEREST (m^3/s)			
	NODE 22104	NODE 22102	NODE 22103	NODE 22101
1:2-year	0.58	0.13	0.06	0.17
1:5-year	1.06	0.21	0.11	0.27
1:10-year	1.43	0.26	0.15	0.37
1:25-year	1.95	0.37	0.20	0.49
1:50-year	2.35	0.44	0.24	0.58
1:100-year	2.78	0.51	0.29	0.67
Regional (Timmins)	2.79	0.26	0.24	0.34

Hydrographs with peak flows as summarized in Table 1 were applied in the 2D HEC-RAS model at the locations shown on the Overall Drainage Plan (ODP-1) enclosed for reference.

3.2 HYDRAULIC ANALYSIS

As discussed, a combination of topographic survey information collected by Tatham and LIDAR DEM data was used to create the hydraulic model terrain. A detailed review of the topographic survey information and DEM did not reveal any significant discrepancies. Therefore, no datum adjustment to the DEM data was required. A combined terrain surface (topographic survey plus DEM) was created using AutoCAD Civil 3D software and imported into HEC-RAS. The terrain was modified in HEC-RAS to add buildings based on aerial imagery.

Model extents, mesh definition and boundary conditions were verified by running the model using the simplified Diffusion Wave equation set using the 1:100-year return frequency design storm and Regulatory (Timmins) storm hydrographs. The default computational mesh cell size was set as 4 m and breaklines were added along roads and channels to optimize the computational mesh. Road and trail crossing culverts were added per the topographic survey of the subject property.

3.2.1 Boundary Conditions

Boundary conditions and inflow data for the 2D hydraulic model were added as follows:

- A stage-hydrograph outflow boundary condition was added at Georgian Bay; and
- Flow hydrograph inflows were added at the locations illustrated on the Overall Drainage Plan (ODP-1) enclosed for reference.

3.2.2 Manning's Roughness Coefficient

Manning's roughness coefficients have been applied based on landcover information and aerial mapping of the study area. A summary of the existing Manning's roughness coefficients is provided in Table 2.

Table 2: Existing Manning's Roughness Coefficients Summary

LANDCOVER TYPE	MANNING'S ROUGHNESS COEFFICIENT
Water	0.025
Impervious Area	0.017
Cultivated	0.040
Wetlands	0.085
Lawns	0.035
Forest	0.120
Roads	0.017

3.2.3 Hydraulic Model Results

The final model scenarios were analyzed using the SWE-ELM equation set and adaptive time step control for all return frequency design storms and the Regional (Timmins) Storm. Calculated peak flows at key locations throughout the study area are summarized in Table 3 and the key locations are illustrated on the Overall Drainage Plan (ODP-1) enclosed for reference.

Table 3: Summary of Existing Peak Flows at Key Locations

POINT OF INTEREST	PEAK FLOW (m^3/s)	
	1:100-YEAR	TIMMINS
Southern Inflow (POI-1)	2.78	2.79
Georgian Trail Culvert (POI-2)	0.49	1.06
Highway 26 Culvert (POI-3)	0.79	1.18

As shown in Table 3, the wetland on the lower portion of the subject property provides notable peak flow attenuation for both the 1:100-year return frequency design storm and the Timmins Storm. The existing flood limits under the 1:100-year return frequency design storm and the Timmins Storm are illustrated on the Flood Hazard Plans (Drawings FH-1 and FH-2) enclosed in Appendix B for reference.

4 Proposed Drainage Conditions

The proposed development includes a developable area of approximately 0.85 ha in the northwest corner of the property which will be accessed from Barclay Boulevard, and a developable area of approximately 0.41 ha in the southeast corner of the property which will be accessed from James Street.

The existing conditions hydrologic and hydraulic models were updated with the proposed development plan to produce the proposed conditions models.

4.1 RECOMMENDED DRAINAGE IMPROVEMENTS

As part of the proposed development, drainage improvements are proposed to regularize the floodplain and flood proof the development.

The proposed improvements include:

- filling a portion of the floodplain to regularize the floodplain (and consequently the developable limits);
- providing an offsetting cut (removing fill from the floodplain) to compensate for floodplain storage lost due to fill placement;
- raising the grade in the developable area;
- constructing an interceptor swale at the south limit of the southern developable area; and
- improving the drainage channel west of the southern developable area.

The proposed drainage improvements are illustrated on the Flood Hazard Plans (Drawings FH-1 and FH-2) enclosed for reference.

4.2 PROPOSED CONDITIONS HYDRAULIC ANALYSIS

The existing conditions hydraulic model was updated with the proposed site grading and drainage improvements to create a proposed conditions hydraulic model. The proposed conditions model was used to verify the proposed development will not adversely impact flood conditions on adjacent properties, or floodplain storage, as well as to establish the minimum lot and building elevations.

The proposed conditions hydraulic model results are summarized in Tables 4, 5 and 6 and illustrated on the Flood Hazard Plans (Drawings FH-1 and FH-2) enclosed. The existing and proposed conditions peak flows at the key points of interest are summarized in Table 4.

Table 4: Summary of Existing and Proposed Peak Flows at Key Locations

POINT OF INTEREST	EXISTING PEAK FLOW (m^3/s)		PROPOSED PEAK FLOW (m^3/s)	
	1:100-YEAR	TIMMINS	1:100-YEAR	TIMMINS
Southern Inflow (POI-1)	2.78	2.79	2.78	2.79
Georgian Trail Culvert (POI-2)	0.49	1.06	0.47	1.06
Highway 26 Culvert (POI-3)	0.79	1.18	0.77	1.18

As illustrated in Table 4, under proposed conditions the peak flows at each point of interest match existing conditions or are slightly less and the proposed development will not impact the peak flow attenuation provided on the subject property.

Water levels at key locations across the subject property under existing and proposed conditions are summarized in Table 5 and the key locations are illustrated on the Flood Hazard Plans (Drawings FH-1 and FH-2) enclosed in Appendix B for reference.

Table 5: Summary of Existing and Proposed Water Levels

KEY LOCATION	EXISTING WATER LEVEL (m)		PROPOSED WATER LEVEL (m)	
	1:100-YEAR	TIMMINS	1:100-YEAR	TIMMINS
A	185.19	185.19	184.87	184.87
B	182.55	182.55	182.28	182.28
C	181.77	182.05	181.76	182.04
D	181.76	182.04	181.76	182.04
E	181.76	182.04	181.76	182.04

As per Table 5, the maximum water levels under proposed conditions for both the 1:100-year return frequency design storm and the Regional (Timmins) Storm are maintained at or lower than existing conditions levels. Pursuant to the identified maximum water level under the Regional Storm and considering the elevation of the Georgian Trail, the recommended lowest opening and/or apron elevation for any proposed structures in the northern developable area is 183.00 m. For structures in the southern developable area the recommended lowest opening and/or

apron elevation is 184.50 m. Additional grading details are provided on the Site Grading Plans (Drawings SG01 and SG02) enclosed for reference.

As previously mentioned, the lower portion of the subject property contains a wetland which provides notable peak flow attenuation for flows in Watercourse 22. The upper portion of the subject property provides negligible flow attenuation as it is steeply sloped with an average gradient of approximately 8% in the watercourse. The proposed development plan includes a cut area southeast of the proposed developable area in the lower portion of the subject property to offset floodplain storage lost due to the placement of fill in the floodplain and raising grades in the developable area. The existing and proposed flood storage volume provided in the lower portion of the subject property are summarized in Table 6 at 0.30 m increments in water elevation. The lowest elevation in the wetland is approximately 181.30 m.

Table 6: Summary of Existing and Proposed Flood Storage Volumes

WATER ELEVATION (m)	EXISTING STORAGE VOLUME (m^3)	PROPOSED STORAGE VOLUME (m^3)
181.44	2,563	2,544
181.74	15,250	15,581
182.04	34,420	34,501

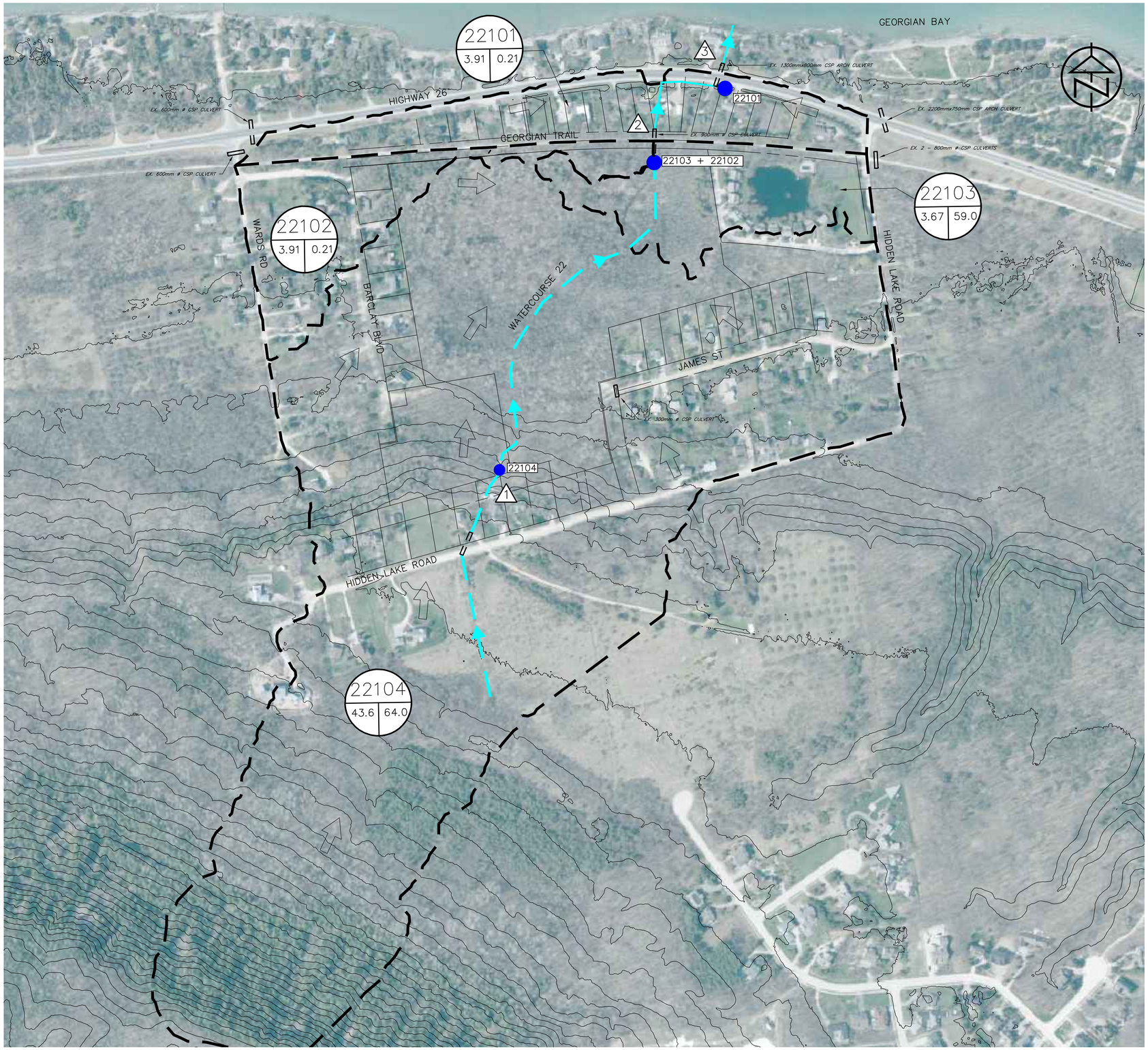
As shown in Table 6, the flood storage volumes provided under proposed conditions exceed the volumes provided under existing conditions at elevations 181.74 and 182.04 and are within 0.8% of the existing volume at elevation 181.44.

Given the results summarized in Tables 4, 5 and 6, it has been demonstrated that the proposed development will not adversely impact flooding conditions along Watercourse 22. The proposed development will be floodproofed through raised grading in the developable areas.

5 Summary

In support of the proposed development at Part Lot 25, Concession 4, in the Town of The Blue Mountains, an assessment of existing and proposed drainage conditions and flood hazards was completed, and flood mitigation measures were identified for the proposed development.

The assessment established the existing regulatory flood elevations for Watercourse 22 and the associated online wetland areas within the subject property. To floodproof the proposed developable areas and mitigate potential impacts on flood conditions, the grade throughout the developable areas will be raised, an area adjacent to the wetland will be cut to compensate for floodplain storage volume lost through the placement of fill, the drainage channel west of the southern developable area will be improved, and an interceptor swale will be constructed along the south limit of the southern developable area. Minimum opening/apron elevations of 183.00 and 184.50 are recommended for proposed structures in the northern and southern developable areas respectively. With these proposed measures, the proposed development will be safely floodproofed and will have not adversely impact flood conditions.



LEGEND

- EXISTING CULVERT CROSSING
- CATCHMENT BOUNDARY
- 396.00 EXISTING CONTOURS
- EXISTING LOT LINES
- EXISTING WATERCOURSE
- EXISTING OVERLAND FLOW DIRECTION
- 101 / 0.50 / 0.60 / 0.82 — CATCHMENT ID; EXISTING CN NUMBER/% IMPERVIOUS; PROPOSED CN NUMBER/% IMPERVIOUS; CATCHMENT AREA (ha)
- MODEL FLOW NODE
- 3 POINT OF INTEREST

BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE

ENGINEER STAMP

PART LOT 25, CONCESSION 4
TOWN OF BLUE MOUNTAINS

OVERALL DRAINAGE PLAN

TATHAM ENGINEERING

DESIGN: JM	FILE: 121295	DWG: ODP-1
DRAWN: GT	DATE: SEPTEMBER 2023	
CHECK: DRT	SCALE: 1:2500	

Drawing Name: 121295-ODP-1.dwg, Plotted: Sep 18, 2023

Appendix A:
Hydrologic Analysis

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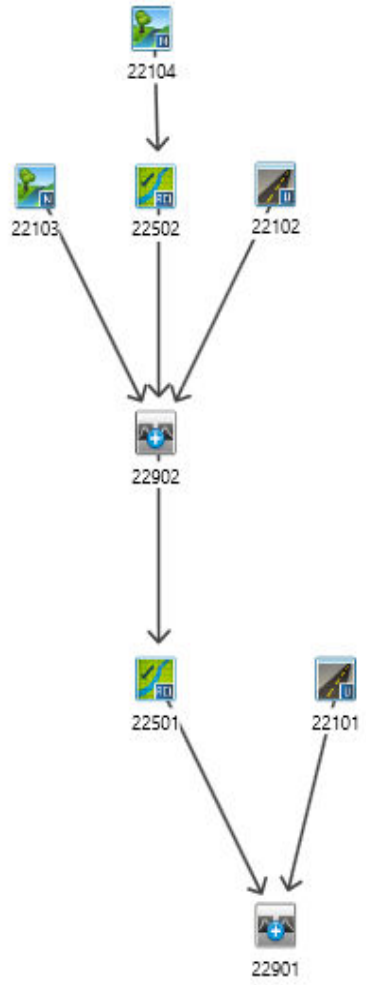
		DATE	2023.05.15
SUBJECT	VO Schematic	NAME	AAM
		PAGE	1 OF 1



NASHYD

ROUTE PIPE

DUHYD

STANDHYD

ROUTE CHANNEL

DIVERT HYD

ADDHYD

ROUTE RESERVOIR

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================================================================================
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       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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DATE: 09/18/2023                          TIME: 01:29:57

USER:



COMMENTS: _____________________________________________________________


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  ********************************************


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0.92	1.33	7.00	2.17	13.08	6.52	19.17	2.17
1.00	1.33	7.08	2.66	13.17	6.52	19.25	2.17
1.08	1.33	7.17	2.66	13.25	6.52	19.33	2.17
1.17	1.33	7.25	2.66	13.33	6.52	19.42	2.17
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1.33	1.33	7.42	2.66	13.50	6.52	19.58	2.17
1.42	1.33	7.50	2.66	13.58	5.07	19.67	2.17
1.50	1.33	7.58	2.66	13.67	5.07	19.75	2.17
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2.58	1.57	8.67	3.38	14.75	3.62	20.83	1.45
2.67	1.57	8.75	3.38	14.83	3.62	20.92	1.45
2.75	1.57	8.83	3.38	14.92	3.62	21.00	1.45
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Unit Hyd Qpeak (cms)= 3.315

PEAK FLOW (cms)= 2.783 (i)
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TOTAL RAINFALL (mm)= 120.770
RUNOFF COEFFICIENT = 0.406

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ROUTE CHN(22502)

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37.72	180.19	0.0600	
42.28	179.95	0.0600	
54.13	179.89	0.0600	
62.68	179.96	0.0600	
69.03	179.92	0.0600	
71.65	179.21	0.0600 /0.0350	Main Channel
72.04	178.88	0.0350	Main Channel
72.86	178.71	0.0350	Main Channel
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81.05	179.75	0.0600	
89.94	179.89	0.0600	
94.18	180.07	0.0600	
98.43	180.52	0.0600	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.09	178.81	.206E+02	0.0	0.41	7.68
0.18	178.90	.674E+02	0.3	0.71	4.43
0.27	178.99	.123E+03	0.6	0.98	3.19
0.36	179.08	.183E+03	1.2	1.20	2.61
0.45	179.17	.248E+03	1.8	1.39	2.26
0.55	179.27	.326E+03	2.8	1.61	1.95
0.65	179.36	.418E+03	4.0	1.78	1.76
0.74	179.46	.526E+03	5.3	1.91	1.64
0.84	179.56	.649E+03	6.9	2.02	1.56
0.94	179.65	.787E+03	8.8	2.10	1.50
1.03	179.75	.962E+03	10.7	2.10	1.49
1.13	179.85	.123E+04	13.1	2.01	1.56
1.23	179.94	.169E+04	15.8	1.77	1.78
1.32	180.04	.260E+04	21.0	1.52	2.06
1.42	180.14	.360E+04	28.1	1.47	2.13
1.52	180.23	.465E+04	36.5	1.48	2.12
1.61	180.33	.582E+04	46.3	1.50	2.10
1.71	180.43	.707E+04	58.5	1.56	2.01
1.81	180.52	.834E+04	72.3	1.63	1.92

	<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL

```
                              (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 2 ( 22104)   43.55     2.78   12.33  49.00      0.55      1.61
   OUTFLOW: ID= 1 ( 22502)   43.55     2.79   12.33  49.00      0.55      1.61



--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   ( 22103)|   Area    (ha)=   3.67   Curve Number   (CN)= 59.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   7.72   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.33

     Unit Hyd Qpeak  (cms)=   0.425

     PEAK FLOW       (cms)=   0.287 (i)
     TIME TO PEAK    (hrs)=  12.250
     RUNOFF VOLUME    (mm)=  44.128
     TOTAL RAINFALL   (mm)= 120.770
     RUNOFF COEFFICIENT   =   0.365

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD ( 22102)|   Area    (ha)=   3.91
|ID= 1 DT= 5.0 min |   Total Imp(%)=  20.80   Dir. Conn.(%)=  15.27
--------------------

                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.81         3.09
     Dep. Storage     (mm)=       2.00         5.08
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     161.37        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     147.82        59.22
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       2.91 (ii)   11.62 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.09
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.24         0.31          0.505 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.17          12.08
     RUNOFF VOLUME    (mm)=     118.77        38.09          50.40
     TOTAL RAINFALL   (mm)=     120.77       120.77         120.77
     RUNOFF COEFFICIENT   =       0.98         0.32           0.42

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
```

```
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 22902)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 22102):     3.91   0.505    12.08    50.40
      + ID2= 2 ( 22103):     3.67   0.287    12.25    44.13
        ================================================
        ID = 3 ( 22902):     7.58   0.704    12.08    47.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  ( 22902)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 ( 22902):     7.58   0.704    12.08    47.36
      + ID2= 2 ( 22502):    43.55   2.792    12.33    49.00
        ================================================
        ID = 1 ( 22902):    51.13   3.349    12.25    48.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN( 22501)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                  21.78        181.10        0.0600
                  29.52        180.31        0.0600
                  33.17        180.22        0.0600
                  34.85        180.27        0.0600
                  37.72        180.19        0.0600
                  42.28        179.95        0.0600
                  54.13        179.89        0.0600
                  62.68        179.96        0.0600
                  69.03        179.92        0.0600
                  71.65        179.21    0.0600 /0.0350  Main Channel
                  72.04        178.88        0.0350      Main Channel
```

72.86	178.71	0.0350	Main Channel
74.28	178.78	0.0350	Main Channel
74.99	178.85	0.0350	Main Channel
75.65	179.17	0.0350 /0.0600	Main Channel
78.05	179.66	0.0600	
81.05	179.75	0.0600	
89.94	179.89	0.0600	
94.18	180.07	0.0600	
98.43	180.52	0.0600	

<-------------------- TRAVEL TIME TABLE ---------------------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.09	178.81	.883E+01	0.1	0.62	2.19
0.18	178.90	.289E+02	0.4	1.07	1.26
0.27	178.99	.526E+02	1.0	1.48	0.91
0.36	179.08	.784E+02	1.8	1.82	0.74
0.45	179.17	.106E+03	2.8	2.10	0.64
0.55	179.27	.140E+03	4.2	2.43	0.55
0.65	179.36	.180E+03	6.0	2.69	0.50
0.74	179.46	.226E+03	8.0	2.88	0.47
0.84	179.56	.278E+03	10.5	3.04	0.44
0.94	179.65	.338E+03	13.2	3.17	0.43
1.03	179.75	.413E+03	16.2	3.17	0.42
1.13	179.85	.527E+03	19.8	3.04	0.44
1.23	179.94	.724E+03	23.9	2.67	0.51
1.32	180.04	.112E+04	31.7	2.30	0.59
1.42	180.14	.154E+04	42.4	2.22	0.61
1.52	180.23	.199E+04	55.1	2.24	0.60
1.61	180.33	.250E+04	69.7	2.26	0.60
1.71	180.43	.303E+04	88.2	2.35	0.57
1.81	180.52	.358E+04	108.9	2.46	0.55

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (22902)	51.13	3.35	12.25	48.75	0.49	2.22
OUTFLOW: ID= 1 (22501)	51.13	3.35	12.33	48.75	0.49	2.22

CALIB STANDHYD (22101) ID= 1 DT= 5.0 min	Area (ha)= 4.93 Total Imp(%)= 20.80 Dir. Conn.(%)= 15.27

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.03	3.91
Dep. Storage	(mm)=	2.00	6.43

```
     Average Slope     (%)=       5.00         2.00
     Length            (m)=     181.32        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     147.82        61.70
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       1.93 (ii)   10.49 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.31         0.09
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.31         0.42          0.670 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.17          12.08
     RUNOFF VOLUME    (mm)=     118.77        39.44          51.55
     TOTAL RAINFALL   (mm)=     120.77       120.77         120.77
     RUNOFF COEFFICIENT   =       0.98         0.33           0.43

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  52.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| ADD HYD  ( 22901)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 22101):     4.93   0.670    12.08    51.55
      + ID2= 2 ( 22501):    51.13   3.347    12.33    48.75
        ================================================
        ID = 3 ( 22901):    56.06   3.762    12.25    49.00

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2014)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
```

```
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\gtrombino\AppData\Local\Civica\VH5\db9a2f92-ba63-4ad9-8bdd-0915266138eb\5cc2b544-ba3b-4d0e-beb9-c52ba02546a2\sc
Summary filename:
C:\Users\gtrombino\AppData\Local\Civica\VH5\db9a2f92-ba63-4ad9-8bdd-0915266138eb\5cc2b544-ba3b-4d0e-beb9-c52ba02546a2\sc

DATE: 09/18/2023 TIME: 01:29:57

USER:

COMMENTS: _____

****
** SIMULATION : TIMMINS **
****

READ STORM	Filename: C:\Users\gtrombino\AppData\Local\Temp\a9f90f7b-888f-4faf-9fce-d1cdb6707147\b02ee3a1
Ptotal=193.00 mm	Comments: TIMMINS

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	15.00	3.00	3.00	6.00	43.00	9.00	13.00
0.25	15.00	3.25	3.00	6.25	43.00	9.25	13.00
0.50	15.00	3.50	3.00	6.50	43.00	9.50	13.00
0.75	15.00	3.75	3.00	6.75	43.00	9.75	13.00
1.00	20.00	4.00	5.00	7.00	20.00	10.00	13.00
1.25	20.00	4.25	5.00	7.25	20.00	10.25	13.00

1.50	20.00	4.50	5.00	7.50	20.00	10.50	13.00
1.75	20.00	4.75	5.00	7.75	20.00	10.75	13.00
2.00	10.00	5.00	20.00	8.00	23.00	11.00	8.00
2.25	10.00	5.25	20.00	8.25	23.00	11.25	8.00
2.50	10.00	5.50	20.00	8.50	23.00	11.50	8.00
2.75	10.00	5.75	20.00	8.75	23.00	11.75	8.00

CALIB			
NASHYD (22104)	Area (ha)=	43.55	Curve Number (CN)= 64.0
ID= 1 DT= 5.0 min	Ia (mm)=	8.73	# of Linear Res.(N)= 2.00
	U.H. Tp(hrs)=	0.34	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00

```
                2.500   10.00 | 5.500   20.00 | 8.500   23.00 | 11.50    8.00
                2.583   10.00 | 5.583   20.00 | 8.583   23.00 | 11.58    8.00
                2.667   10.00 | 5.667   20.00 | 8.667   23.00 | 11.67    8.00
                2.750   10.00 | 5.750   20.00 | 8.750   23.00 | 11.75    8.00
                2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
                2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
                3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Unit Hyd Qpeak  (cms)=   3.315

     PEAK FLOW       (cms)=   2.789 (i)
     TIME TO PEAK    (hrs)=   7.083
     RUNOFF VOLUME    (mm)= 103.275
     TOTAL RAINFALL   (mm)= 193.000
     RUNOFF COEFFICIENT   =   0.535

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| ROUTE CHN( 22502)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
               <------ DATA FOR SECTION (   1.1) ------>
               Distance      Elevation       Manning
                  21.78        181.10        0.0600
                  29.52        180.31        0.0600
                  33.17        180.22        0.0600
                  34.85        180.27        0.0600
                  37.72        180.19        0.0600
                  42.28        179.95        0.0600
                  54.13        179.89        0.0600
                  62.68        179.96        0.0600
                  69.03        179.92        0.0600
                  71.65        179.21    0.0600 /0.0350  Main Channel
                  72.04        178.88        0.0350      Main Channel
                  72.86        178.71        0.0350      Main Channel
                  74.28        178.78        0.0350      Main Channel
                  74.99        178.85        0.0350      Main Channel
                  75.65        179.17    0.0350 /0.0600  Main Channel
                  78.05        179.66        0.0600
                  81.05        179.75        0.0600
                  89.94        179.89        0.0600
                  94.18        180.07        0.0600
                  98.43        180.52        0.0600

      <---------------------- TRAVEL TIME TABLE ---------------------->
       DEPTH    ELEV      VOLUME    FLOW RATE    VELOCITY   TRAV.TIME
        (m)      (m)     (cu.m.)      (cms)        (m/s)      (min)
       0.09   178.81    .206E+02       0.0          0.41       7.68
```

0.18	178.90	.674E+02	0.3	0.71	4.43
0.27	178.99	.123E+03	0.6	0.98	3.19
0.36	179.08	.183E+03	1.2	1.20	2.61
0.45	179.17	.248E+03	1.8	1.39	2.26
0.55	179.27	.326E+03	2.8	1.61	1.95
0.65	179.36	.418E+03	4.0	1.78	1.76
0.74	179.46	.526E+03	5.3	1.91	1.64
0.84	179.56	.649E+03	6.9	2.02	1.56
0.94	179.65	.787E+03	8.8	2.10	1.50
1.03	179.75	.962E+03	10.7	2.10	1.49
1.13	179.85	.123E+04	13.1	2.01	1.56
1.23	179.94	.169E+04	15.8	1.77	1.78
1.32	180.04	.260E+04	21.0	1.52	2.06
1.42	180.14	.360E+04	28.1	1.47	2.13
1.52	180.23	.465E+04	36.5	1.48	2.12
1.61	180.33	.582E+04	46.3	1.50	2.10
1.71	180.43	.707E+04	58.5	1.56	2.01
1.81	180.52	.834E+04	72.3	1.63	1.92

		<---- hydrograph ---->			<-pipe / channel->	
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (22104)	43.55	2.79	7.08	103.28	0.55	1.61
OUTFLOW: ID= 1 (22502)	43.55	2.80	7.08	103.28	0.55	1.61

CALIB NASHYD (22103) ID= 1 DT= 5.0 min	Area (ha)= 3.67	Curve Number (CN)= 59.0
	Ia (mm)= 7.72	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.33	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00

0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Unit Hyd Qpeak (cms)= 0.425

PEAK FLOW (cms)= 0.239 (i)
TIME TO PEAK (hrs)= 7.083
RUNOFF VOLUME (mm)= 94.864
TOTAL RAINFALL (mm)= 193.000
RUNOFF COEFFICIENT = 0.492

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (22102)
ID= 1 DT= 5.0 min

Area (ha)= 3.91
Total Imp(%)= 20.80 Dir. Conn.(%)= 15.27

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.81	3.09
Dep. Storage	(mm)=	2.00	5.08
Average Slope	(%)=	1.00	2.00
Length	(m)=	161.37	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00
2.833	10.00	5.833	20.00	8.833	23.00	11.83	8.00
2.917	10.00	5.917	20.00	8.917	23.00	11.92	8.00
3.000	10.00	6.000	20.00	9.000	23.00	12.00	8.00

Max.Eff.Inten.(mm/hr)=	43.00	24.00	
over (min)	5.00	20.00	
Storage Coeff. (min)=	4.77 (ii)	17.26 (ii)	
Unit Hyd. Tpeak (min)=	5.00	20.00	
Unit Hyd. peak (cms)=	0.22	0.06	
			TOTALS
PEAK FLOW (cms)=	0.07	0.19	0.257 (iii)

```
     TIME TO PEAK    (hrs)=       6.92         7.08          7.00
     RUNOFF VOLUME    (mm)=     191.00        83.26         99.70
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.00
     RUNOFF COEFFICIENT   =       0.99         0.43          0.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  50.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  ( 22902)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 ( 22102):     3.91   0.257     7.00    99.70
     + ID2= 2 ( 22103):     3.67   0.239     7.08    94.86
       ================================================
       ID = 3 ( 22902):     7.58   0.496     7.00    97.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  ( 22902)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 3 ( 22902):     7.58   0.496     7.00    97.36
     + ID2= 2 ( 22502):    43.55   2.799     7.08   103.28
       ================================================
       ID = 1 ( 22902):    51.13   3.271     7.08   102.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| ROUTE CHN( 22501)|
| IN= 2---> OUT= 1 |     Routing time step (min)'=  5.00
--------------------
              <------ DATA FOR SECTION (   1.1) ------>
              Distance      Elevation       Manning
                 21.78        181.10        0.0600
                 29.52        180.31        0.0600
                 33.17        180.22        0.0600
                 34.85        180.27        0.0600
```

37.72	180.19	0.0600	
42.28	179.95	0.0600	
54.13	179.89	0.0600	
62.68	179.96	0.0600	
69.03	179.92	0.0600	
71.65	179.21	0.0600 /0.0350	Main Channel
72.04	178.88	0.0350	Main Channel
72.86	178.71	0.0350	Main Channel
74.28	178.78	0.0350	Main Channel
74.99	178.85	0.0350	Main Channel
75.65	179.17	0.0350 /0.0600	Main Channel
78.05	179.66	0.0600	
81.05	179.75	0.0600	
89.94	179.89	0.0600	
94.18	180.07	0.0600	
98.43	180.52	0.0600	

<---------- TRAVEL TIME TABLE ---------->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.09	178.81	.883E+01	0.1	0.62	2.19
0.18	178.90	.289E+02	0.4	1.07	1.26
0.27	178.99	.526E+02	1.0	1.48	0.91
0.36	179.08	.784E+02	1.8	1.82	0.74
0.45	179.17	.106E+03	2.8	2.10	0.64
0.55	179.27	.140E+03	4.2	2.43	0.55
0.65	179.36	.180E+03	6.0	2.69	0.50
0.74	179.46	.226E+03	8.0	2.88	0.47
0.84	179.56	.278E+03	10.5	3.04	0.44
0.94	179.65	.338E+03	13.2	3.17	0.43
1.03	179.75	.413E+03	16.2	3.17	0.42
1.13	179.85	.527E+03	19.8	3.04	0.44
1.23	179.94	.724E+03	23.9	2.67	0.51
1.32	180.04	.112E+04	31.7	2.30	0.59
1.42	180.14	.154E+04	42.4	2.22	0.61
1.52	180.23	.199E+04	55.1	2.24	0.60
1.61	180.33	.250E+04	69.7	2.26	0.60
1.71	180.43	.303E+04	88.2	2.35	0.57
1.81	180.52	.358E+04	108.9	2.46	0.55

		<---- hydrograph ---->			<-pipe / channel->	
	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (22902)	51.13	3.27	7.08	102.40	0.49	2.21
OUTFLOW: ID= 1 (22501)	51.13	3.28	7.08	102.40	0.49	2.21

CALIB	
STANDHYD (22101)	Area (ha)= 4.93
ID= 1 DT= 5.0 min	Total Imp(%)= 20.80 Dir. Conn.(%)= 15.27

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.03	3.91
Dep. Storage	(mm)=	2.00	6.43
Average Slope	(%)=	5.00	2.00
Length	(m)=	181.32	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	15.00	3.083	3.00	6.083	43.00	9.08	13.00
0.167	15.00	3.167	3.00	6.167	43.00	9.17	13.00
0.250	15.00	3.250	3.00	6.250	43.00	9.25	13.00
0.333	15.00	3.333	3.00	6.333	43.00	9.33	13.00
0.417	15.00	3.417	3.00	6.417	43.00	9.42	13.00
0.500	15.00	3.500	3.00	6.500	43.00	9.50	13.00
0.583	15.00	3.583	3.00	6.583	43.00	9.58	13.00
0.667	15.00	3.667	3.00	6.667	43.00	9.67	13.00
0.750	15.00	3.750	3.00	6.750	43.00	9.75	13.00
0.833	15.00	3.833	3.00	6.833	43.00	9.83	13.00
0.917	15.00	3.917	3.00	6.917	43.00	9.92	13.00
1.000	15.00	4.000	3.00	7.000	43.00	10.00	13.00
1.083	20.00	4.083	5.00	7.083	20.00	10.08	13.00
1.167	20.00	4.167	5.00	7.167	20.00	10.17	13.00
1.250	20.00	4.250	5.00	7.250	20.00	10.25	13.00
1.333	20.00	4.333	5.00	7.333	20.00	10.33	13.00
1.417	20.00	4.417	5.00	7.417	20.00	10.42	13.00
1.500	20.00	4.500	5.00	7.500	20.00	10.50	13.00
1.583	20.00	4.583	5.00	7.583	20.00	10.58	13.00
1.667	20.00	4.667	5.00	7.667	20.00	10.67	13.00
1.750	20.00	4.750	5.00	7.750	20.00	10.75	13.00
1.833	20.00	4.833	5.00	7.833	20.00	10.83	13.00
1.917	20.00	4.917	5.00	7.917	20.00	10.92	13.00
2.000	20.00	5.000	5.00	8.000	20.00	11.00	13.00
2.083	10.00	5.083	20.00	8.083	23.00	11.08	8.00
2.167	10.00	5.167	20.00	8.167	23.00	11.17	8.00
2.250	10.00	5.250	20.00	8.250	23.00	11.25	8.00
2.333	10.00	5.333	20.00	8.333	23.00	11.33	8.00
2.417	10.00	5.417	20.00	8.417	23.00	11.42	8.00
2.500	10.00	5.500	20.00	8.500	23.00	11.50	8.00
2.583	10.00	5.583	20.00	8.583	23.00	11.58	8.00
2.667	10.00	5.667	20.00	8.667	23.00	11.67	8.00
2.750	10.00	5.750	20.00	8.750	23.00	11.75	8.00

```
              2.833   10.00 | 5.833   20.00 | 8.833   23.00 | 11.83    8.00
              2.917   10.00 | 5.917   20.00 | 8.917   23.00 | 11.92    8.00
              3.000   10.00 | 6.000   20.00 | 9.000   23.00 | 12.00    8.00

     Max.Eff.Inten.(mm/hr)=      43.00        24.92
               over (min)        5.00        20.00
     Storage Coeff.  (min)=      3.16 (ii)   15.46 (ii)
     Unit Hyd. Tpeak (min)=      5.00        20.00
     Unit Hyd. peak  (cms)=      0.27         0.07
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.09         0.25          0.338 (iii)
     TIME TO PEAK    (hrs)=      6.75         7.00           7.00
     RUNOFF VOLUME    (mm)=    191.00        86.09         102.11
     TOTAL RAINFALL   (mm)=    193.00       193.00         193.00
     RUNOFF COEFFICIENT   =      0.99         0.45           0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  52.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  ( 22901)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 ( 22101):     4.93   0.338     7.00   102.11
      + ID2= 2 ( 22501):    51.13   3.278     7.08   102.40
        ================================================
        ID = 3 ( 22901):    56.06   3.576     7.08   102.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
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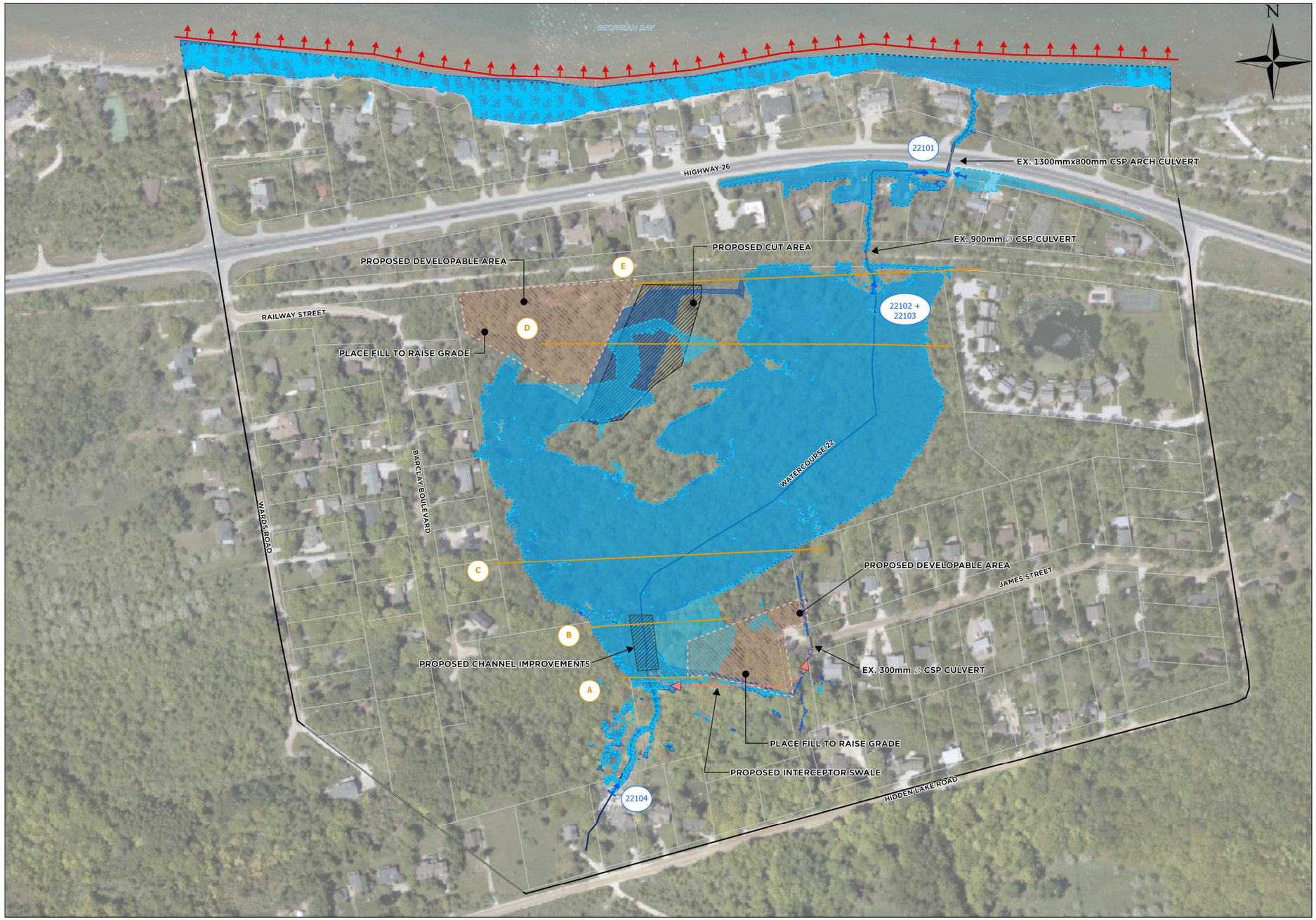
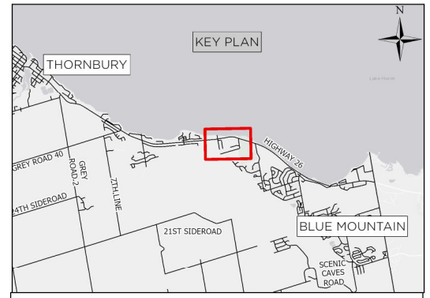
Appendix B:
Hydraulic Analysis





LEGEND

- MODEL INFLOW LOCATION
- MODEL OUTFLOW LOCATION
- EXISTING CULVERT
- WATERCOURSE
- MODEL EXTENT
- DEVELOPABLE AREAS
- CUT AREA/CHANNEL IMPROVEMENTS
- PROPOSED INTERSEPTOR SWALE
- KEY LOCATIONS
- EXISTING 100 YEAR FLOOD EXTENT
- PROPOSED 100 YEAR FLOOD EXTENT
- PROPOSED FILL AREA
- PROPERTY LINES

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

No.	REVISION DESCRIPTION	DATE
1.	FOR APPROVAL	SEPT. 2023

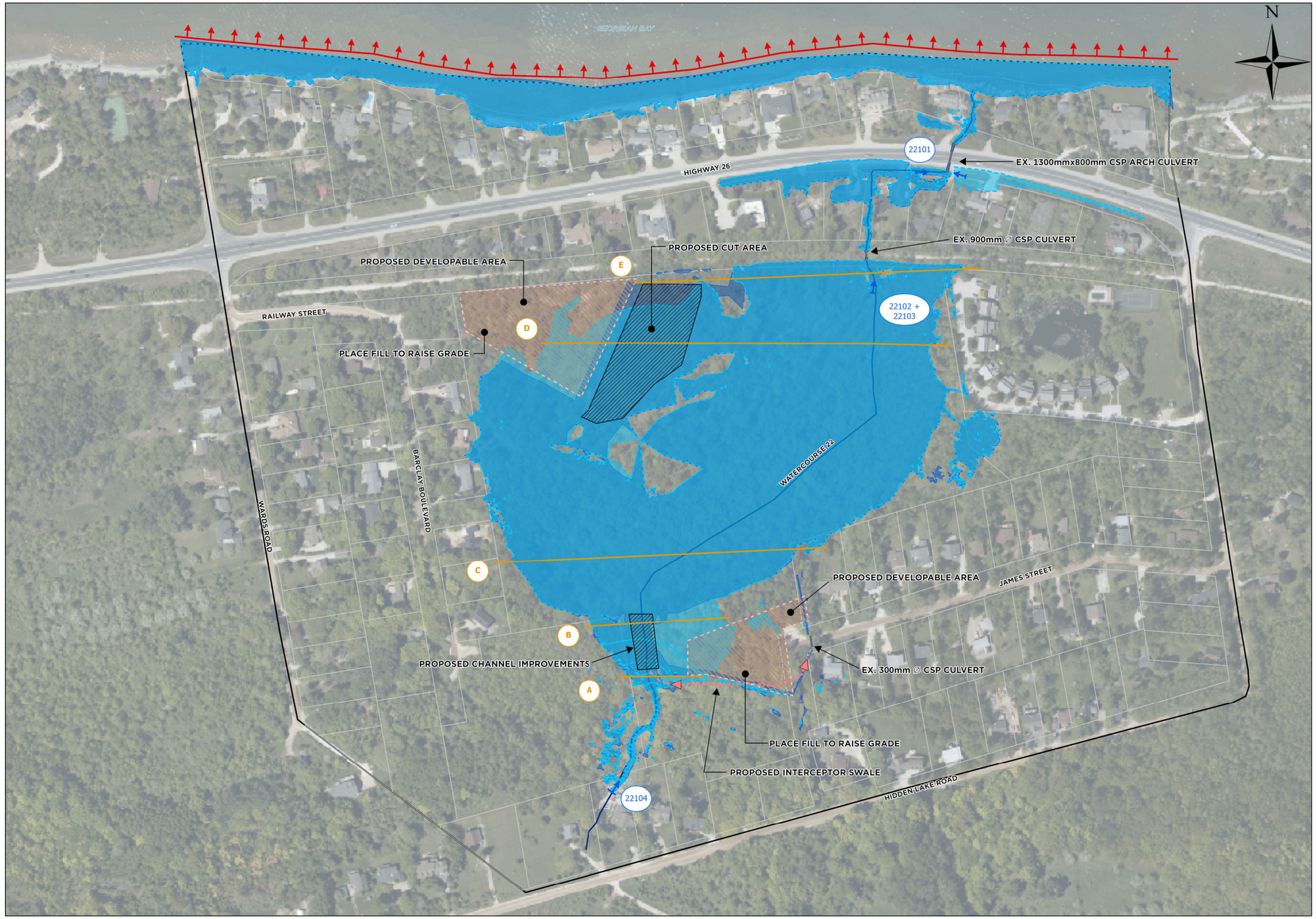
ENGINEERS STAMP

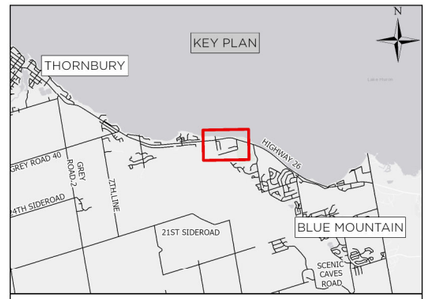
PART LOT 25, CONCESSION 4
TOWN OF BLUE MOUNTAINS

1:100-YEAR STORM
FLOOD HAZARD PLAN

TATHAM ENGINEERING

DESIGN:	AAM	FILE: 121295	DWG: FH-1
DRAWN:	CW	DATE: SEP. 2023	
CHECK:	JM/DRT	SCALE: 1:1,500	





LEGEND

- INFLOW
- OUTFLOW
- EXISTING CULVERT
- WATERCOURSE
- MODEL EXTENT
- DEVELOPABLE AREAS
- CUT AREA/CHANNEL IMPROVEMENTS
- PROPOSED INTERSEPTOR SWALE
- KEY LOCATIONS
- EXISTING REGIONAL FLOOD EXTENT
- PROPOSED REGIONAL FLOOD EXTENT
- PROPOSED FILL AREA
- PROPERTY LINES

NOTES:
1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

No.	REVISION DESCRIPTION	DATE
1.	FOR APPROVAL	SEPT. 2023

ENGINEERS STAMP

PARK LOT 25, CONCESSION 4
TOWN OF BLUE MOUNTAINS

REGIONAL (TIMMINS) STORM FLOOD HAZARD PLAN

TATHAM ENGINEERING

DESIGN:	AAM	FILE: 121295	DWG: FH-2
DRAWN:	CW	DATE: SEP. 2023	
CHECK:	JM/DRT	SCALE: 1:1,500	