SERVICING AND STORMWATER MANAGEMENT REPORT

PROPSOED WAREHOUSE
2360 BRISTOL CIRCLE
OAKVILLE, ON

PREPARED FOR:
KANEFF GROUP
8501 MISSISSAUGA ROAD
BRAMPTON, ON L6Y 5G8

DATE: JUNE 2023

PROJECT NO. 231423

PREPARED BY HUSSON
200 CACHET WOODS COURT, SUITE 204
MARKHAM, ON L6C 0Z8
GENERAL@HUSSON.CA

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1.0 INTRODUCTION

The purpose of this report is to provide detailed design information related to the stormwater management (SWM) plan and servicing design for the proposed new Warehouse at 2360 Bristol Circle in Oakville, Ontario. This report will demonstrate the measures that will be undertaken to deal with storm and sanitary drainage, and water servicing for the site.

The site is located at the northwest corner of Bristol Circle and Brighton Road in the Town of Oakville. There is an existing office building located on the site. The site area is 1.20ha. **Figure 1** shows the site location.

Site Development Plan A 1.0, prepared by Pearce McClusky Architects, shows the proposed development. It is proposed to construct a 2,880m^2 warehouse on the vacant portion at the southeast corner and associated landscape and parking areas. The building will be industrial and include truck loading bays along the south side of the buildings.

The servicing and stormwater management plan has been designed to meet the requirements of the Town of Oakville. The following materials were referenced in the preparation of this report.

- Winston Industrial Business Park Guidelines for Preparation of Stormwater Management Report (Winston Park SWM Guidelines), provided by the Town (refer to **Appendix A**).
- The Stormwater Management Planning and Design Manual (MECP Guidelines), prepared by the Ministry of the Environment, Conservation and Parks, March 2003.
- The Erosion & Sediment Control Guideline for Urban Construction, prepared by the Greater Golden Horseshoe Area Conservation Authorities (GGHA CA), December 2006.

2.0 STORMWATER DESIGN

2.1 Design Criteria

The stormwater management criteria is outlined in the Winston Park SWM Guidelines.

- Runoff from the 5-year storm should be limited to 100 litres/sec/hectare, based on the 4-hour Chicago Distribution.
- Runoff from the 100-year storm should be limited to 200 litres/sec/hectare, based on the 4-hour Chicago Distribution.
- Drainage is to be self-contained unless a communal facility is feasible. The development has been almost entirely built out, therefore, a communal facility would not be practical at this stage.
- Overland flow is to be directed to a safe outlet without negatively impacting neighbouring properties.
- The system should have redundancy if possible.

HUSSON
ENGINEERING + MANAGEMENT
P 905.709.5825
200 CACHET WOODS COURT, SUITE 204
MARKHAM, ON L6C 0Z8
HUSSON.CA

LEGEND

FIGURE 1
2360 BRISTOL CIRCLE
SITE LOCATION

DATE: JUNE 2023 SCALE: N.T.S. PROJECT: 231423

- Outlet control devices will be located in a manhole at the property line. The control device shall be installed on the upstream side of the manhole. The controlled device is standardized, being comprised of a two-plate bolted design with minimum 75mm square diamond shape opening.
- No area ponding of the 5-year storm is allowed on any paved area with the exception of depressed loading dock areas where it should be kept to a minimum. Ponding over the 5-year storm shall be limited to remote parking areas only, not driveways or access ways.
- Hydrology modelling is to be completed with Otthymo/Interhymo computer model.
- On-site water quality facilities must be clearly defined. The Town will accept oil/grit separators only where no other available measure to control water quality can be obtained.
- An emergency overland flow rate must be designed to convey stormwater to a safe outlet. Avoid fire routes where major ponding or overland flows are proposed.

2.2 Major and Minor System Drainage

2.2.1 Existing Drainage

The Grading & Servicing Plan for the existing site was prepared by Cosburn Patterson Mather Limited (CPM) in 1999. The plan is provided in **Appendix A**. The existing drainage on the site and on the adjacent roads is shown on **Figure 2** and summarized below:

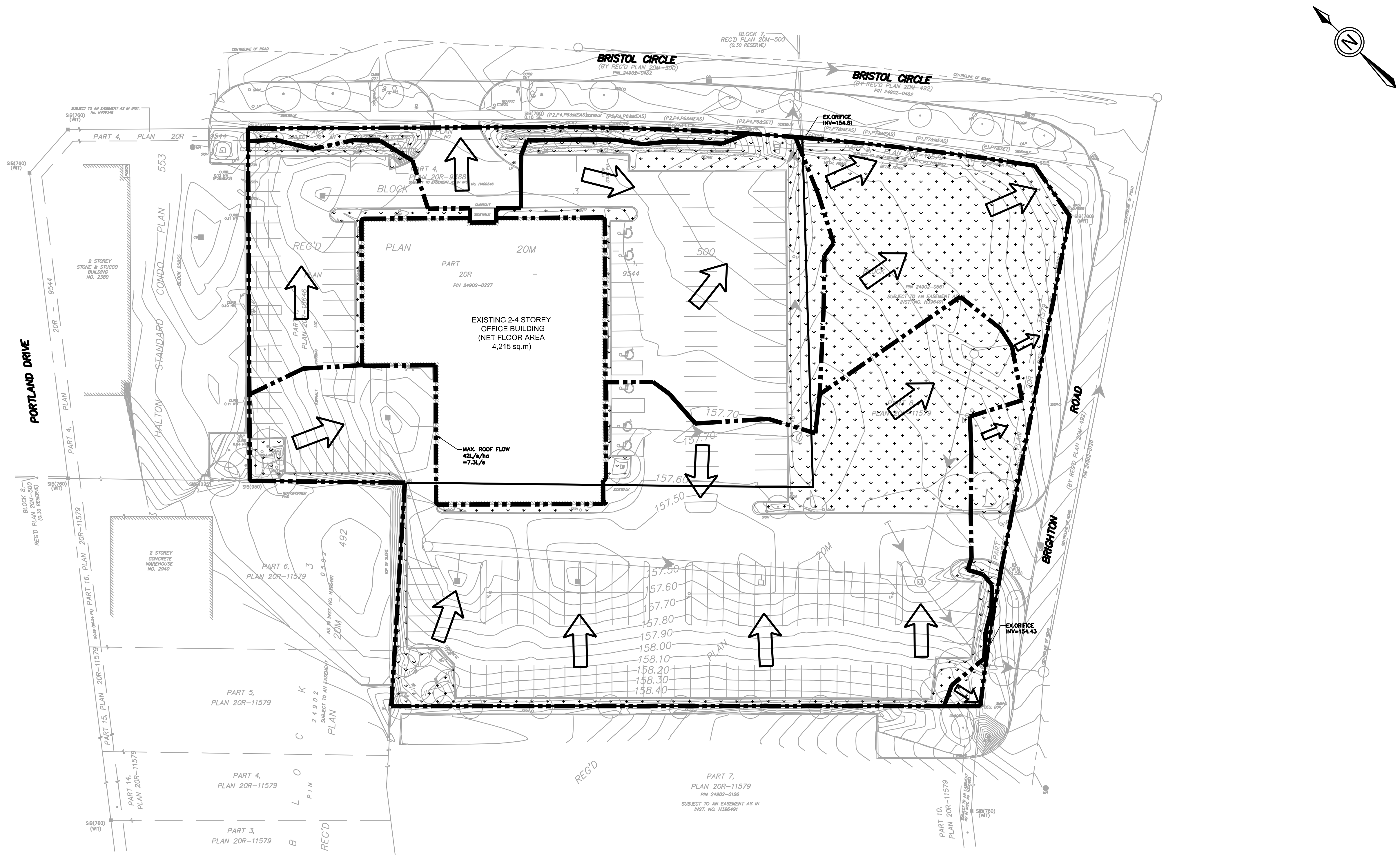
- There is a 525mm diameter storm sewer on Bristol Circle, draining from west to east across the frontage of the site.
- There is a storm sewer on Brighton Road, draining south to north across the frontage of the site.
- There are two storm service connections to the site; and 450mm connected to the Brighton Road storm sewer and one connected to the Bristol Storm sewer. Each service connection has a 125mm x 125mm diamond shaped orifice control.

The site has saw-toothed grading with drainage directed to on-site catchbasins. Surplus storage is provided in two oversized pipes; a 1200mm diameter sewer upstream of the Brighton outlet and a 1350mm dimeter sewer upstream of the Bristol outlet. The existing storm drainage is shown on **Figure 2**.

2.2.1 Minor System Design

As discussed above, two existing sewer outlets to the site; one to Bristol Circle and one to Brighton Road. Storm sewer systems have been designed to convey the 5-year runoff from the subject lands to these storm sewer connection points. The proposed grading design consists of sawtoothed grading through the parking lot with water ponding above the catchbasins. With this type of design, the majority of the 100-year storm will be captured in the minor (storm sewer) system. Details of the on-site ponding are provided in **Section 2.3**.

The existing oversized storm sewer connected to Bristol Circle is located under the proposed building and will be removed. The new storm sewer, west of the building will not need to be oversized based on the proposed controls, as discussed in Section 2.3.



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Symbol	Description
100m² / 100	CATCHMENT AREA / CATCHMENT ID
(arrow)	OVERLAND FLOW DIRECTION
(dash-dot line)	CATCHMENT BOUNDARY
(dotted hatch)	PERVIOUS AREA

FIGURE 2
2360 BRISTOL CIRCLE
EXISTING SWM PLAN

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As well, the Town does not permit surface ponding within the fire route in the 100-year event. The fire route is located above the 100-year ponding elevation within each catchment. Further, the Town has requested that the minor system will not surcharge above the catchbasin top elevations within the fire route during the 100-year storm. The catchbasins have been located outside of the fire route and will overtop the curb before there is any significant ponding within the fire route.

Drawing SW2 shows the proposed storm sewer system design and the storm sewer design sheet for the site can be referenced in **Appendix B**.

An analysis was completed to ensure that the on-site catchbasins have capacity for the 5-year design storm, to limit surface ponding during frequent events. MTO Design Chart 4.19: Inlet Capacity at a Sag was referenced to determine the inlet capacity of each catchbasin. The capacity was determined assuming 50 percent blockage. **Table 1** provides a summary of the inlet capacities for each catchbasin. Refer to **Figure 3** for the catchment areas and **Appendix B** for calculations.

Table 1. Catchbasin Inlet Capacity Summary

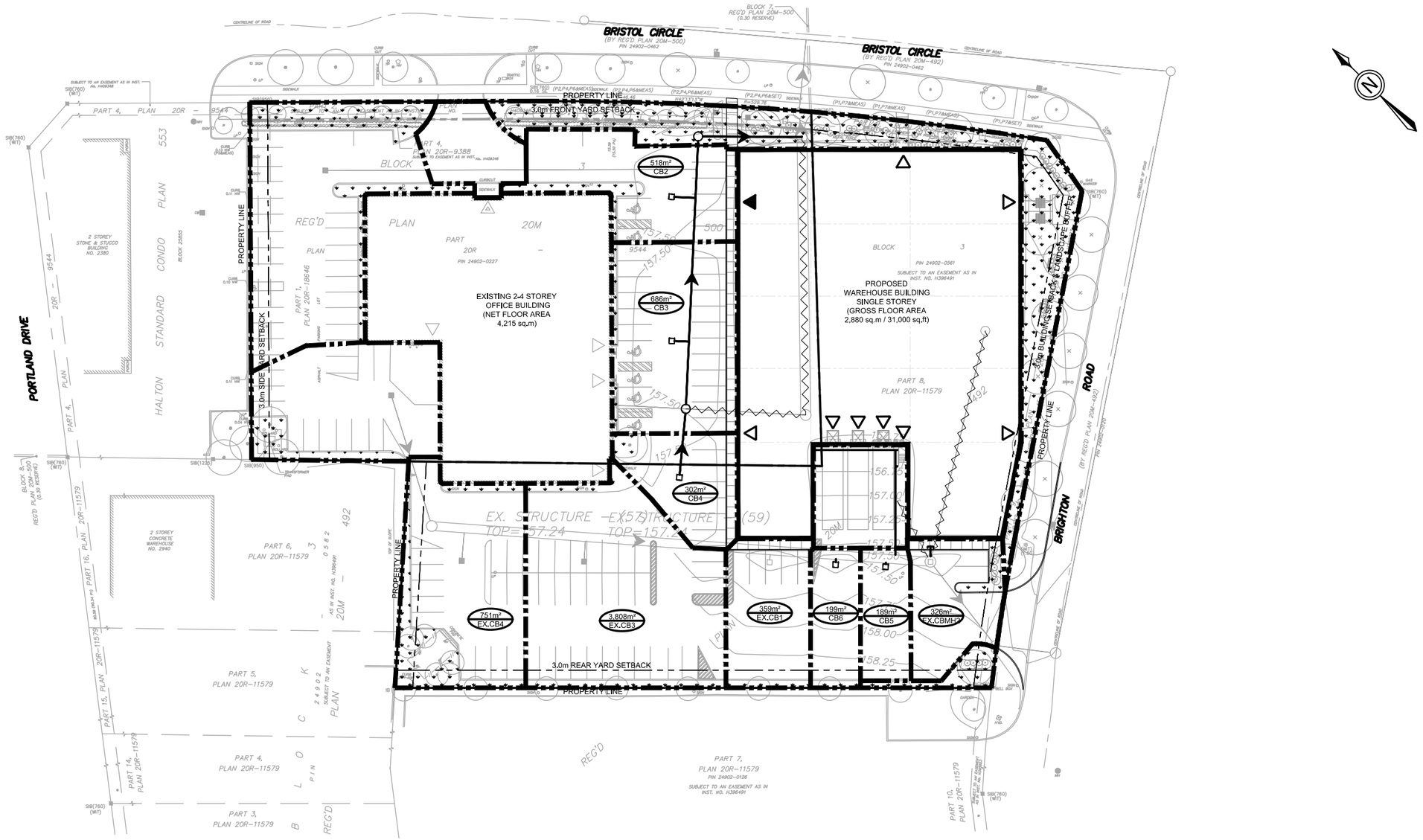
Catchbasin	Catchment Area (m^2)	5 Year Post-Development Peak Flow (L/s)	Depth (mm)	Inlet Capacity (With 50% blockage) (L/s)
CB2	518	14.8	250	90
CB3	686	19.6	250	90
CB4	302	8.6	180	71.5
CB5	189	5.4	70	12.5
CB6	199	5.7	70	12.5
EX.CB1	359	10.3	70	12.5
EX.CBMH2	326	9.3	70	12.5
EX.CB3	1063	30.4	260	93.5
EX.CB4	751	21.4	270	95

Therefore, all catchbasins will have capacity to accept the 5-year peak flow. Refer to detailed calculations in **Appendix A**.

Stormwater management controls will be provided to limit the release rate to each outlet, during the 5 and 100-year storm events, to the allowable site release rate. Details of the on-site stormwater management design are provided in **Section 2.3**.

2.2.2 Major System Design

In the event of a blockage, or a storm greater than the 100-year event, an emergency overland flow route has been incorporated into the design so that ponding above the new catchbasins does not exceed 0.25m. Note that there are existing catchbasins that will have up to 0.27m of ponding, but this is likely the result of settlement the time they were installed and could be adjusted as part of the site maintenance program.



HUSSON
ENGINEERING + MANAGEMENT
P 905.709.5825
200 CACHET WOODS COURT, SUITE 204
MARKHAM, ON L6C 0Z8
HUSSON.CA

LEGEND

100m² / CB0 — CATCHMENT AREA / CATCHBASIN ID

CATCHMENT BOUNDARY

PERVIOUS AREA

FIGURE 3
2360 BRISTOL CIRCLE
STORM DRAINAGE PLAN

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The emergency overland flow will be directed to Bristol Circle. Overland flow from the re-development area will be directed between the existing and proposed buildings to a low point near the northwest corner of the Warehouse building. The drainage from the parking area behind the existing building will drain along this route as well. There will be no changes to the drainage north and west of the existing building. Refer to **Drawing SW1** for the site grading.

2.3 Peak Flow Controls

Unit flow release rates have been set in the Winston Park SWM Guidelines. **Table 2** provides the allowable release rates from the site.

Table 2. Target Release Rates

Storm Event	Unit Release Rate (L/s/ha)	Catchment Area (ha)	Target Release Rate (L/s)
5-Year	100	1.20	120
100-Year	200	1.20	240

To meet the target release rates, it is proposed to use a combination of controlled flow roof drainage, oversized pipes and parking lot surface detention.

The existing site outlets, and controls will be maintained, such that there will be minimal change from the site to the receiving sewers.

2.3.1 Rooftop Storage

As per the CPM Servicing & Grading Plan, the existing building has controlled roof drainage with a controlled release rate of 42L/s/ha. Based on the roof area of 0.1736ha, a 100-year release rate of 0.0073m^3/s is assumed for this building.

The new warehouse building will be flat and capable of storing stormwater. The following is used in the design of the rooftop controls.

- There will be 10 roof drains, each with 2 weirs.
- The roof drains will be Zurn Z-105 (or equivalent), providing 10 gallons per minute flow per 25mm head.
- The maximum controlled flow depth will be 100mm.
- The rise from the roof drain to the parapet will be 100mm. Therefore, the storage volume is calculated based on conical storage (Area x Depth / 3).
- Relief scuppers will be installed at 125mm depth.
- The controlled flow drains will be installed with vandal proof screws.

Based on the above assumptions, **Table 3** provides the assumed storage-discharge for each building. Calculations for flow and storage are provided in **Appendix C**.

Table 3. Rooftop Storage

Building	Area (ha)	Number of Weirs	Controlled Flow Rate (L/s)	Storage Provided (m^3)	Drawdown Time (hours)
Warehouse	0.288	20	50.5	98	1.1

Refer to **Figure 4** for catchment locations.

Upon completion of each building construction, a certification letter will be required (signed and sealed by the design engineer) confirming that the building rooftop controls were constructed in accordance with the approved design.

2.3.2 Underground Pipe Storage

As noted above, the existing site was designed with 2 oversized storm sewers for stormwater storage. The one 1350mm diameter pipe will be located under the new building, and will be removed. The available storage, based on the proposed storm servicing design is provided in **Table 4**.

Table 4. Underground Storage Summary

Catchment	Pipe Storage (m^3)	MH Storage (m^3)	CB Storage (m^3)	Total Underground Storage (m^3)
102	6.7	8.4	1.3	16.4
103	99.5	24.7	2.1	126.2

The above volumes will be added to the surface storage volumes below to generate a storage-discharge curve for the hydrology modelling.

2.3.3 Surface Storage

Runoff can be stored in the depressions above the catchbasins in landscaped or parking areas. Surface storage will be limited to a maximum depth of 0.25m as described in Section 2.2.

Surface storage volumes are calculated in 0.05m increments above the trench drains and catchbasins. For Catchment 102, it is calculated from the lowest CB elevation of 157.25, and for Catchment 103 it is calculated from the trench drain elevation in the loading area of 156.55. **Table 5** provides a summary of the available surface storage for each catchment.

Table 5. Surface Storage Summary

Catchment	Lowest Elevation (m)	Overflow Elevation (m)	Surface Storage (m^3)
102	157.25	157.50	41
103	156.55	157.50	147

Both outlets will be controlled by the existing 125mm x 125mm diamond shaped orifice plates installed in the control manholes. **Table 6** provides a summary of the flow controls for each outlet.

Table 6. Orifice Control Summary

Catchment	HWL (m)	Invert (m)	Orifice Plate (mm)	Maximum Flow (L/s)
102	157.50	154.81	125x125	69
103	157.50	154.43	125x125	74

Refer to **Appendix D** for calculations of the storage-discharge for each catchment.

2.3.4 Uncontrolled Runoff

A portion of the site, including the driveway entrances and perimeter will not drain to the on-site catchbasins. These areas will drain overland to the adjacent municipal roads. These areas are identified as Catchment 101 on **Figure 3** and

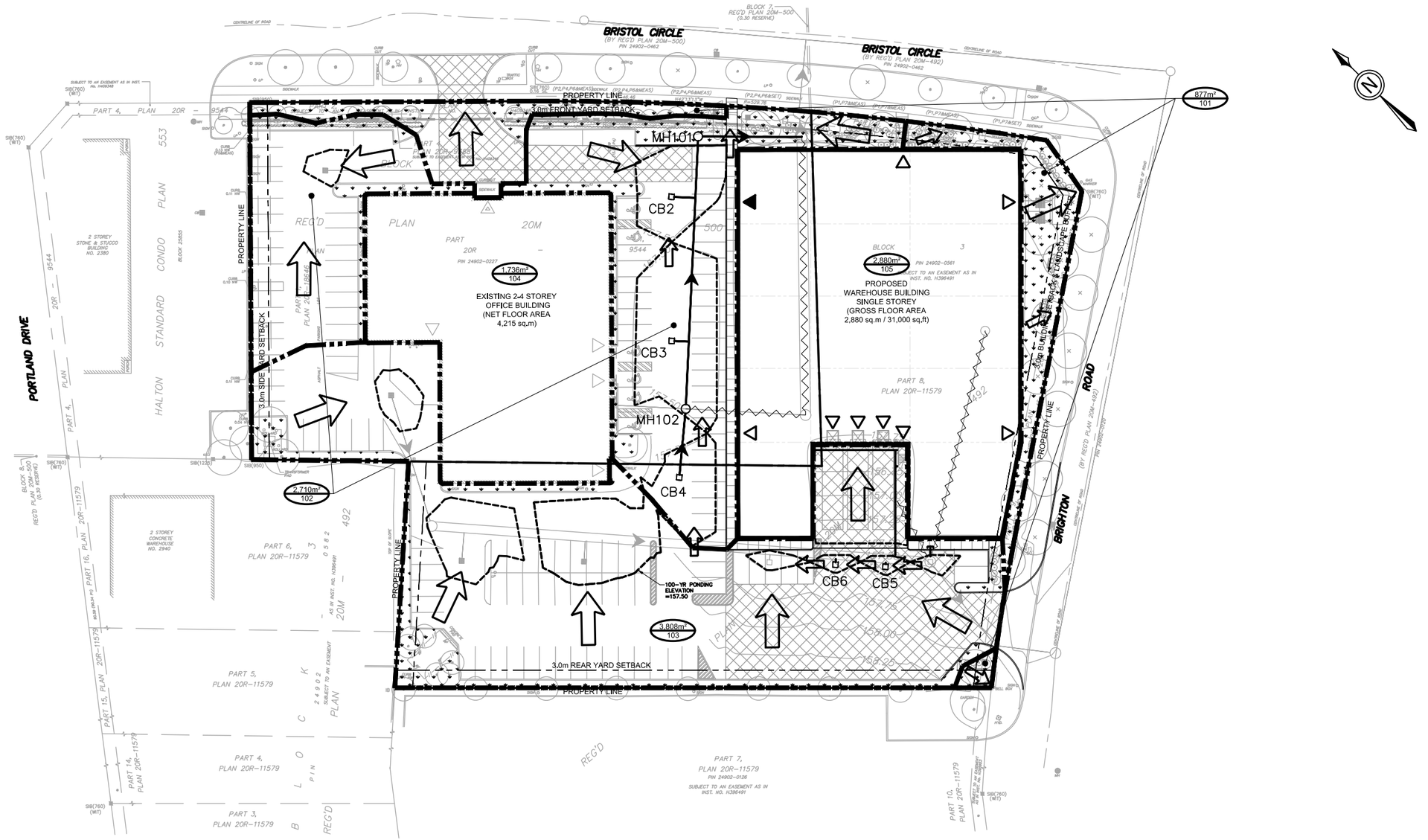
2.3.5 Hydrology Modelling

A Visual Otthymo 6 (VO6) model was prepared to simulate the post development site plan with the proposed controls in place. VO6 is a single event hydrology model that is based on unit hydrograph theory. The simulation for this site uses the StandHyd method for the primarily impervious catchments and Route Reservoir to simulate the surface and rooftop storage. **Table 7** provides a comparison of the required and provided storage volumes for each catchment.

Table 7. Storage Volume Summary

Catchment	Storage Provided (m^3)	Storage Required (m^3) 5-Year	Storage Required (m^3) 100-Year	100 Year Storage Depth (mm)
101	-	-	-	-
102	75	16	48	5
103	306	107	181	100
104 (Existing Roof)	N/A	53	91	N/A
105	98	55	98	100

Table 8 provides a comparison of the allowable and post-development peak flows. Refer to **Appendix E** for the post-development model output. As shown above, adequate storage is provided in each catchment. The 5-year storage will be contained underground and the maximum storage depth in the parking areas during the 100-year storm will be less than 250mm.



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P 905.709.5825
200 CACHET WOODS COURT, SUITE 204
MARKHAM, ON L6C 0Z8
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- 100m² / 100 — CATCHMENT AREA / CATCHMENT ID
- OVERLAND FLOW DIRECTION
- CATCHMENT BOUNDARY
- MAX PONDING
- PERVIOUS AREA

FIGURE 4
2360 BRISTOL CIRCLE
STORMWATER MANAGEMENT PLAN

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Table 8. Peak Flow Comparison

Outlet	5-Year Flow (L/s)	100-Year (L/s)
Uncontrolled	10	24
Bristol (Controlled)	55	68
Brighton (Controlled)	40	70
Total*	**92**	**158**
Target	**120**	**240**

*Flows calculated by addition of hydrographs, not peak flows.

Table 8 shows that the post development peak flows are less than the allowable flow for the full site. Since the orifice controls have not changed, the flows to each outlet will be generally the same as the existing development. Therefore, quantity controls from the site have been satisfied.

2.4 Quality Control

The proposed development consists of a new warehouse building and modifications to existing parking areas. Since roof drainage is generally considered clean, and there are no new parking areas, no new quality controls are proposed.

3.0 SANITARY SERVICING

The CPM Grading & Servicing Plan for the existing site was reviewed for the existing sanitary servicing. The existing sanitary sewers on the site and adjacent roads is summarized below:

- There is a 300mm diameter sanitary sewer on Bristol Circle, draining from west to east across the frontage of the site.
- There is a sanitary sewer on Brighton Road, draining south to north across the frontage of the site.
- The existing sanitary service to the site is 200mm diameter and is connected to the sewer on Brighton Road.

It is proposed to maintain the existing sanitary service connection. The on-site sanitary sewers will be re-aligned around the proposed building and a new connection will be extended to the warehouse building. The proposed servicing is shown on **Drawing SW2.**

The proposed development is light industrial which is generally consistent, or a lower use, compared with other uses in the area. Therefore, no capacity issues are anticipated.

4.0 WATER SERVICING

There is an existing 300mm diameter watermain located in the west boulevard of Brighton Road, across the site frontage. There is also a 400mm diameter watermain on Bristol Circle.

Water servicing for the existing building is provided from Bristol Circle.

It is proposed to provide a new water service connection to Brighton Road which will provide a 150mm fire and 100mm domestic service to the building. The water meter and backflow preventer will be provided in the building.

A new site fire hydrant will be required to meet the minimum distance of 45m to the fire department connection.

Refer to **Drawing SW2** for water servicing details.

5.0 EROSION AND SEDIMENT CONTROL

An erosion and sediment control plan, shown on **Drawing SW3,** has been prepared for the site. The plan has been prepared following the Erosion and Sediment Control Guidelines for Urban Construction (ESC Guidelines), prepared by The Greater Golden Horseshoe Area Conservation Authorities, December 2006. The plan has been designed to limit sediment and debris from leaving the site during all stages of construction.

5.1 Existing Site Condition

The existing site is developed with a grassed area over part of the proposed re-development area draining toward the adjacent roads. Overland flow is generally directed towards the southeast at an average grade of 2 percent. Based on the soils and gentle slopes across the site, there is a moderate potential for erosion from the site.

5.2 Erosion and Sediment Control Plan

The sediment control plan for this site consists of the following:

- A sediment control fence will be installed along the perimeter of the site where the grade will direct flows off-site.
- Site access will be limited to one entrance per phase of construction. A gravel access pad will be installed for staging of construction material and vehicles.
- Any mud tracked from the site should be swept immediately and a sweeper truck should be used as necessary to remove any additional debris.
- Trucks leaving the site should be covered with tarpaulin.
- During dry weather, above freezing construction periods, dust control measures including wetting the site and egress points should be implemented on an as needed basis.
- Once the storm sewer system has been constructed, catchbasin sediment control and protection devices will be installed and maintained until the site is ready to be paved.

Erosion measures will be in place prior to stripping topsoil from the site. A program will be in place to monitor and maintain the erosion and sediment controls. The sediment controls will be inspected by the Site Engineer and contractor:

- Once every 7 days and/or
- Within 24 hours following any significant rainfall event or snowmelt.

The inspection frequency can be extended to monthly inspections if there is no construction activity on-site.

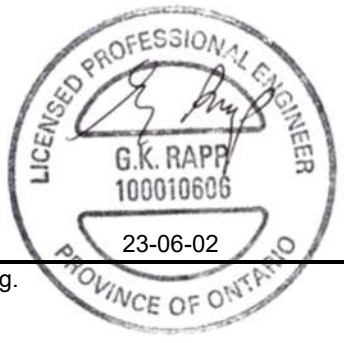
Proper construction sequencing will also help with erosion and sediment control. The following schedule is recommended:

1. Install sediment control fence and access road.
2. Install sediment control devices on existing catchbasins receiving runoff from areas to be disturbed during construction.
3. Install perimeter swales.
4. Rough grade site to subgrade elevations.
5. Install services and sediment control devices on new catchbasins.
6. Re-vegetate disturbed areas including lands left untouched for more than 30 days.
7. Remove sediment controls once the site has been 95 percent stabilized.

6.0 CONCLUSIONS

The storm drainage design for the site has been designed to meet the criteria outlined by the Town, MECP, and subdivision plan. The plan will consist of the following:

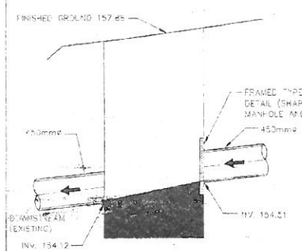
- A combination of rooftop, underground and surface storage, in conjunction with orifice plate controls will be used to limit peak runoff from the site to the 5- and 100-year target flows.
- There will be no surface ponding during the 5-year storm event.
- No new quality controls are proposed as there is no increase in surface parking area.
- An erosion and sediment control plan has been prepared to limit sediment and debris from leaving the site during construction.
- Water and sanitary services are available for the site. The existing sanitary service will be used and a new water service connection to the watermain on Brighton Road are proposed.



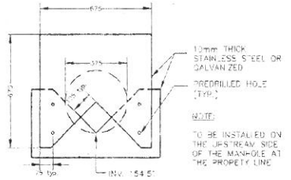
Greg Rapp, P.Eng.

APPENDIX A

BACKGROUND INFORMATION



MANHOLE 1 DETAIL (1200ø)
N.T.S.



INLET CONTROL DEVICE DETAIL
N.T.S.

BENCHMARK NOTES:

ELEVATIONS HEREON ARE DERIVED FROM THE CITY OF MISSISSAUGA BENCHMARK NUMBER 826, ASSESSMENT AREA Z-25. A BRONZE CAP ON BRICK WALL AT THE NORTH-EAST CORNER OF WINSTON CHURCHILL BLVD. AND DUNDAS STREET WEST, 17.6m EAST OF CENTRELINE OF WINSTON CHURCHILL BLVD., SET VERTICALLY ON THE WEST FACE, 0.12m SOUTH OF THE NORTH-WEST CORNER, 0.3m ABOVE GRADE.
ELEVATION = 161.967 METRES.

LOCAL BENCHMARK No.1

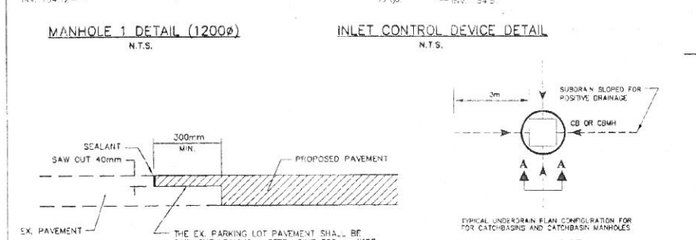
THE MOST WESTERLY CORNER OF CONCRETE PAD CONTAINING HYDRO JUNCTION BOX LOCATED AT THE MOST WESTERLY CORNER OF THE PARKING LOT.
ELEVATION = 158.57 METRES

LOCAL BENCHMARK No.2

FINISHED FLOOR OF EXISTING BUILDING, MAIN ENTRANCE THAT FACES NORTH TO BRISTOL CIRCLE.
ELEVATION = 157.72 METRES

GENERAL NOTES:

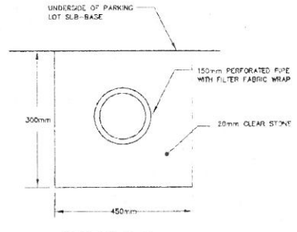
1. ALL WORK TO CONFORM WITH MINISTRY OF TRANSPORTATION OF ONTARIO, TOWN OF OAKVILLE, REGION OF HALTON, AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS AS THEY APPLY.
2. WATERMAIN SHALL BE POLYVINYL CHLORIDE (PVC) CLASS 150 DR 18 PIPE WITH GASKETED JOINTS UNLESS OTHERWISE SPECIFIED.
3. ALL WATERMAIN SHALL HAVE MINIMUM COVER OF 1.70m.
4. ALL WATERMAIN BEDDING SHALL BE AS PER OPSD 1102.02 CLASS 'B'.
5. ALL PLUGS, CAPS, TEES AND BENDS MUST BE MECHANICALLY RESTRAINED.
6. CONCRETE THRUST BLOCKS SHALL NOT BE USED.
7. ALL STORM MANHOLES TO BE AS PER OPSD 701.01 WITH GRATES AS PER OPSD 401.01,UNLESS OTHERWISE SPECIFIED (TYPE'B' TCP).
8. ALL CATCHBASIN MANHOLES TO BE AS PER OPSD 700.03
9. ALL CATCHBASINS TO BE PRECAST AS PER OPSD 705.02 WITH GRATES AS PER OPSD 400.02 UNLESS OTHERWISE SPECIFIED.
10. STORM SEWER PIPE BEDDING AS PER OPSD 802.03 TO BE CLASS 'B' BEDDING WITH NATIVE BACKFILL COMPACTED 98% STANDARD PROCTOR DENSITY.
11. ALL CONCRETE SEWER PIPES 525mm DIAMETER AND LARGER SHALL BE EQUAL TO C.S.A. A=257-2 REINFORCED CL. 500, 550, 1000, 1400 OR LATEST AMENDMENT UNLESS OTHERWISE NOTED.
12. ALL SINGLE CATCHBASIN LEADS TO BE 250mmø UNLESS OTHERWISE SPECIFIED. ALL CATCHBASIN LEADS TO BE A.S.T.M. D3034 PVC SDR-35.
13. ALL POLYVINYL CHLORIDE (PVC) SANITARY SEWER PIPES TO CONFORM TO A.S.T.M. 3034 UNLESS OTHERWISE NOTED.
14. ALL SANITARY MANHOLES TO BE AS PER OPSD STD. 1001.01 WITH GRATES AS PER OPSD 401.01,UNLESS OTHERWISE SPECIFIED (TYPE'A' TCP).
15. ALL SANITARY MANHOLES SERVING UP TO 300mm SEWER LINES SHALL BE BENCHED TO SPRINGLINE.
16. ALL MANHOLE AND CATCHBASIN EXCAVATIONS TO BE BACKFILLED WITH GRANULAR 'B' COMPACTED TO 98% STANDARD PROCTOR DENSITY.
17. "MODULOC" OR APPROVED MANHOLE AND CATCHBASIN ADJUSTERS TO BE USED IN LIEU OF BRICKING.
18. ALL GRANULAR BASE COURSE MATERIALS TO BE COMPACTED TO MIN. 98% SPD.
19. LIGHT DUTY ASPHALT TO BE CONSTRUCTED AS FOLLOWS:
    - 60mm HL-3 SURFACE ASPHALT COURSE
    - 100mm 20mm CRUSHER RUN LIMESTONE BASE COURSE (GRAN. 'A')
    - 250mm 50mm CRUSHER RUN LIMESTONE SUB-BASE (GRAN. 'B' TYPE II)
20. HEAVY DUTY ASPHALT TO BE CONSTRUCTED AS FOLLOWS :
    - 50mm HL-3 SURFACE ASPHALT COURSE
    - 70mm HL-8 BASE ASPHALT COURSE
    - 150mm 20mm CRUSHER RUN LIMESTONE BASE COURSE (GRAN. 'A')
    - 300mm 50mm CRUSHER RUN LIMESTONE SUB-BASE (GRAN. 'B' TYPE II)
21. ALL DISTURBED GRASSED AREAS TO BE RESTORED WITH100mm TOPSOIL & SOD
22. ALL BARRIER CURB ON SITE TO BE CONSTRUCTED AS PER OPSD 600.11.
23. FOR ALL CONSTRUCTION DETAILS NOT SHOWN ON PLANS, REFERENCE SHALL BE MADE TO THE ONTARIO PROVINCIAL STANDARD DRAWINGS.
24. WATER SERVICE CONNECTIONS TO BUILDING ENVELOPES SHALL BE 150mmø FOR FIRE SERVICE AND 100mmø FOR DOMESTIC SERVICE CONNECTION UNLESS OTHERWISE NOTED.
25. ALL UNUSED WATER AND WASTEWATER SERVICE CONNECTIONS SHALL BE DISCONNECTED AT THE MAINS.
26. MUNICIPAL WORKS DEPARTMENT OF THE TOWN OF OAKVILLE TO BE NOTIFIED FOR INSPECTIONS OF ALL WORKS WITHIN MUNICIPAL LANDS OR EASEMENTS.
27. THIS SITE INCORPORATES STORMWATER MANAGEMENT CONTROLS IN ACCORDANCE WITH COSBURN PATTERSON MATHER REPORT (STORMWATER MANAGEMENT REPORT MATTAMY OFFICE EXPANSION, DATED APRIL 1999). ALL BUILDING ROOF RUNOFF SHALL BE CONTROLLED TO A MAXIMUM 42 l/s/ha AT A MAXIMUM PONDING DEPTH OF 150mm.
28. FOR PAVEMENT, PARKING LOT, AND CURB LAYOUT, REFER TO SITE PLAN PREPARED BY JACKSON RYDER ARCHITECTS.
29. TOPOGRAPHIC SURVEY INFORMATION TAKEN FROM PLAN PREPARED BY J.D. BARNES SURVEYING LIMITED DATED MARCH 2, 1999.
30. THE EXISTENCE, LOCATION AND ELEVATION OF EX. UNDERGROUND SERVICES ARE NOT GUARANTEED AND THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION AND ELEVATION OF ALL SEWER, WATER AND GAS MAINS, SERVICES OR LINES, ELECTRIC LIGHT, POWER OR TELEPHONE CONDUITS OR OTHER SUCH STRUCTURES OR UTILITIES.
31. SNOW FENCE AND SILT CONTROL FENCE ARE TO BE INSTALLED PRIOR TO COMMENCING ANY SITE WORKS.
32. EXPOSED SURFACE FOLLOWING TOPSOIL STRIPPING SHALL BE COMPACTED TO A MINIMUM 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
33. ANY DELETERIOUS MATERIAL SHALL BE SUBEXCAVATED AND REPLACED WITH APPROVED COMPACTED MATERIAL.
34. ALL DISTURBED GRASSED AREAS TO BE RESTORED WITH SEED ON 100mm TOPSOIL.
35. FOR ALL CONSTRUCTION DETAILS NOT SHOWN ON PLANS, REFERENCE SHALL BE MADE TO THE TOWN OF OAKVILLE STANDARD DRAWINGS AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS.
36. FUTURE BUILDING PAD AREAS SHALL BE FINISHED WITH 100mm TOPSOIL AND SOD UNLESS OTHERWISE SPECIFIED.
37. REDUCTION OF 1200ø OSP TO 600ø AS PER MANUFACTURER'S SPECIFICATIONS
38. ROAD CUT PERMIT REQUIRED FROM PUBIC WORKS AND RESTORATION OF ROAD PER STD. 7-8



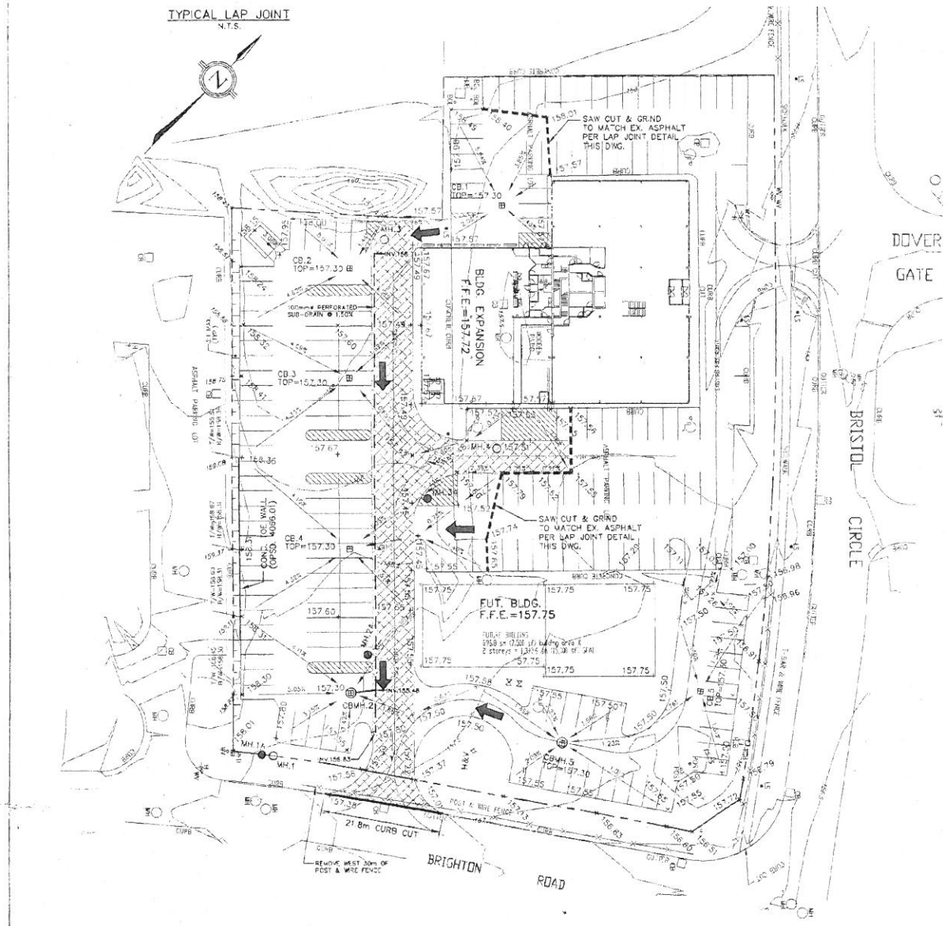
TYPICAL LAP JOINT
N.T.S.

TYPICAL UNDERDRAIN PLAN CONFIGURATION FOR 705 CATCHBASINS AND CATCHBASIN MANHOLES

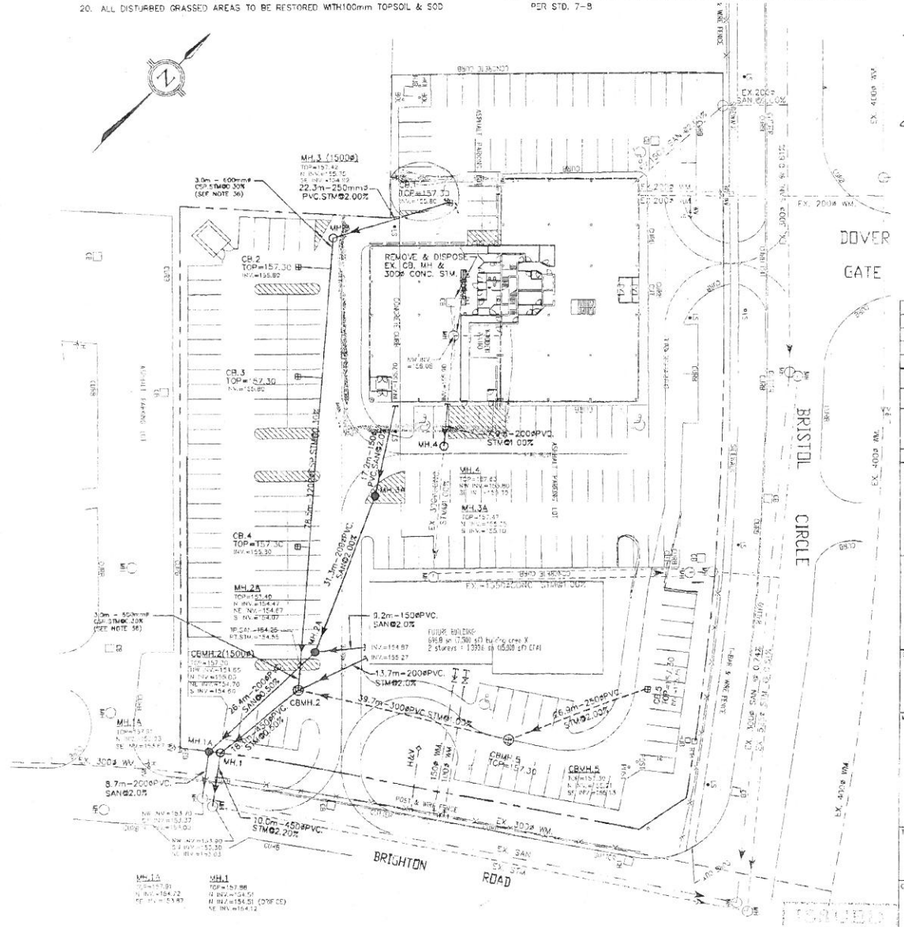
SUBDRAIN DETAIL
SCALE: N.T.S.



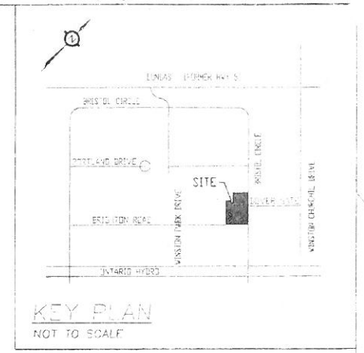
SECTION A-A
SCALE: N.T.S.



GRADING PLAN – SCALE 1:500



SERVICING PLAN – SCALE 1:500



LEGEND:

- MH.1 — PROPOSED STORM SEWER
- MH.1C — PROPOSED STORMCEPTOR MANHOLE
- MH.1A — PROPOSED SANITARY SEWER
- CB.4 — CATCHBASIN
- DCB.2 — DOUBLE CATCHBASIN
- CBMH.2 — CATCHBASIN MANHOLE
- 150ø W.M. — PROPOSED WATERMAIN
- MV.B. — VALVE & BOX
- H.Y. — HYDRANT
- CURBED ISLAND
- PAINTED ISLAND
- 104.65 — PROPOSED GRADE
- 104.65 — EX. CONTOUR
- OVERLAND FLOW
- DRAINAGE DIRECTION
- HEAVY DUTY PAVEMENT

JAN 27 2005

No.	Date	By	REVISIONS
1	4/23/99	AGS	ISSUED FOR SITE PLAN APPROVAL

Design	GKR/AGS	Checked	DJFS	Date	APRIL 1999
Drawn	DS	Checked	AGS		

Scale: 1:500

APPROVALS

Municipal
APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO TOWN STANDARDS AND SPECIFICATIONS
SIGNED ____ DATE ____
DIRECTOR OF PLANNING SERVICES

Regional
DESIGN OF SANITARY & WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS & SPECIFICATIONS & LOCATION APPROVAL FROM AREA MUNICIPALITY
SIGNED ____ DATE ____
PLANNING AND PUBLIC WORKS DEPARTMENT

REFERENCES

FILE NOTES

STAMP: LICENSED PROFESSIONAL ENGINEER D. F. HUSSON PROVINCE OF ONTARIO

CONSULTANT
COSBURN PATTERSON MATHER LIMITED
CONSULTING ENGINEERS
7270 WOODBINE AVE, SUITE 300, MARKHAM, ONT. L3R 4B9
TELEPHONE: (905) 474-0455
FAX: (905) 474-9689

MUNICIPALITY
REGIONAL MUNICIPALITY OF HALTON
TOWN OF OAKVILLE

TITLE
MATTAMY OFFICE EXPANSION
GRADING & SERVICING PLAN

OWNER
MATTAMY HOMES LIMITED

MUNICIPAL FILE No. ____ REGIONAL FILE No. ____

CONTRACT No. 99835

TOPOGRAPHICAL AND SURVEY INFORMATION AS TAKEN FROM SURVEY PREPARED BY:

SURVEYING MAPPING
LAND INFORMATION SERVICES
J.D. BARNES LIMITED
OFFICE OF ORIGIN:
450 BRITANNIA ROAD EAST, SUITE 450B
MISSISSAUGA, ONTARIO L4Z 1X9
TEL. (905) 507-6767
FAX (905) 507-6977

DRAWN BY:	CHECKED BY:	REFERENCE NO.:
TS	AR	97-28-289-01-A

MARCH 8th, 1999 g:\72e28901\2e28901a.cgn

SURVEY NOTES:

SKETCH SHOWING

LOCATION OF TOPOGRAPHIC SURFACE FEATURES, ROADWAY DETAIL, AND SPOT ELEVATIONS

ELEVATION NOTES

ELEVATIONS HEREON ARE DERIVED FROM THE CITY OF MISSISSAUGA BENCHMARK NUMBER 625, ASSESSMENT AREA 2-25, A BRONZE CAP ON BRICK WALL AT THE NORTH-EAST CORNER OF WINSTON CHURCHILL BLVD. AND DUNDAS STREET WEST, 17.6m EAST OF CENTRELINE OF WINSTON CHURCHILL BLVD., SET VERTICALLY ON THE WEST FACE, 0.12m SOUTH OF THE NORTH-WEST CORNER, 0.37m ABOVE GRADE.
ELEVATION = 161.967 METRES.

LOCAL BENCHMARK No.1

THE MOST WESTERLY CORNER OF CONCRETE PAD CONTAINING HYDRO JUNCTION BOX LOCATED AT THE MOST WESTERLY CORNER OF THE PARKING LOT.
ELEVATION = 158.57 METRES

LOCAL BENCHMARK No.2

FINISHED FLOOR OF EXISTING BUILDING, MAIN ENTRANCE THAT FACES NORTH TO BRISTOL CIRCLE.
ELEVATION = 157.72 METRES

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT THE LOCAL BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THE RELATIVE ELEVATIONS AND DESCRIPTIONS AGREE WITH THE INFORMATION SHOWN ON THIS PLAN.

BEFORE DIGGING, UNDERGROUND SERVICES SHOULD BE LOCATED ON SITE BY THE RESPECTIVE AGENCIES.

METRIC DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

LEGEND

MH	DENOTES MANHOLE
CB	DENOTES SINGLE CATCHBASIN
LS	DENOTES LIGHT STANDARD
POST	DENOTES POST
BOL	DENOTES SAFETY POST
WV	DENOTES WATER VALVE
	DENOTES STAND PIPE
H	DENOTES FIRE HYDRANT
PED	DENOTES TELEPHONE PEDESTAL
HUB	DENOTES HYDRO JUNCTION BOX
BM	DENOTES LOCAL BENCHMARK

ALL CURB ELEVATIONS REPRESENT TOP OF CURB

CAUTION

THIS IS NOT A PLAN OF SURVEY AND SHALL NOT BE USED FOR TRANSACTION OR MORTGAGE PURPOSES.

THIS TOPOGRAPHIC SURVEY WAS COMPLETED ON MARCH 2nd, 1999

DATE

A. RICCAFORTE
ONTARIO LAND SURVEYOR

LEGAL DESCRIPTION OF SITE:
PARTS 1 & 2 OF BLOCK 3, REGISTERED PLAN 20M-500 AND PARTS 8 & 9 OF BLOCK 3, REGISTERED PLAN 20M-492
TOWN OF OAKVILLE,
REGIONAL MUNICIPALITY OF HALTON

0m 10 20 30 METRE
SCALE 1:300

NEW ASPHALT PAVING AS PER RECOMMENDATIONS OF GEOTECHNICAL INVESTIGATION BY G.K. BELL & ASSOCIATES LTD. DATED APRIL 1999

PARKING LOT PAVING
60mm ASPHALTIC CONCRETE HL3 - SURFACE TO 97% MARSHALL DENSITY
100mm OPSS GRANULAR 'A' - BASE TO 98% STANDARD PROCTOR MAXIMUM DRY DENSITY
250mm OPSS GRANULAR 'B' TYPE II - SUBBASE TO 98% STANDARD PROCTOR MAXIMUM DRY DENSITY
TOP 300 OF SUBGRADE TO 98% STANDARD PROCTOR DENSITY

TRUCK ACCESS PAVING, AT 7.6m WIDE FIRE ROUTE
50mm ASPHALTIC CONCRETE HL3 - SURFACE TO 97% MARSHALL DENSITY
70mm ASPHALTIC CONCRETE HL8 - BINDER TO 97% MARSHALL DENSITY
150mm OPSS GRANULAR 'A' - BASE TO 98% STANDARD PROCTOR MAXIMUM DRY DENSITY
300mm OPSS GRANULAR 'B' TYPE II - SUBBASE TO 98% STANDARD PROCTOR MAXIMUM DRY DENSITY
TOP 300 OF SUBGRADE TO 98% STANDARD PROCTOR DENSITY

PART 4 PLAN 20R-11579

PART 5 PLAN 20R-11579

PART 6 PLAN 20R-11579

PART 3 PLAN 20R-9544

PART 7 PLAN 20R-11579

PART 8 PLAN 20R-11579

PART 1 PLAN 20R-9544

PART 9 PLAN 20R-11579 SUBJECT TO EASEMENT AS IN LT 395923

BLOCK 3 R.P. 20M-492

BLOCK 3 R.P. 20M-500

BOLLARD DETAIL - BLRD ON PLAN
SCALE 1:50

15MØ X 1.0 (6.0 X 3/8") CONCRETE FILLED STEEL BOLLARD SET INTO 40MØ CONCRETE BASE. PAINTED HAZARD YELLOW

LOCAL NO.1 BENCHMARK

LOCAL No.2 BENCHMARK FINISHED FLOOR ELEVATION = 157.72m

BRISTOL CIRCLE

DOVER GATE

BRIGHTON ROAD

PORTLAND DRIVE

WINSTON CHURCHILL BLVD.

MATTAMY SITE

ONTARIO HYDRO

LOCATION PLAN [NTS]

SUBJECT TO EASEMENT AS IN LT 409346

SUBJECT TO EASEMENT AS IN LT 409334

No. 2360 4 STOREY GLASS FRONTED BUILDING

696.8 sm (7,500 sf) building area X 2 STOREY ADDITION

1,050.8 sm (11,311 sf) building area X 4 STOREY EXISTING

UNDEVELOPED AREA FOR FUTURE OFFICE BUILDING & PARKING

EXISTING ASPHALT PARKING LOT

REMOVE EXISTING ASPHALT, REGRADE, NEW ASPHALT PAVING

REMOVE POST & WIRE FENCE AT CURB CUT

TYPICAL LAP JOINT SEE COSBURN PATTERSON MATHER DRAWING

200 WIDE PAINTED STRIPES 300 APART TYPICAL

100 WIDE WHITE PAINTED LINES TYPICAL

RAMPED SIDEWALK

FIRE ROUTE

EXISTING SIAMESE CONNECTION

LANDSCAPE STRIP

FRONT YARD

REAR YARD

SIDE YARD

5M SIDE YARD

15M REAR YARD

3M LANDSCAPE STRIP

15M FRONT YARD

SITE PLAN DIMENSION POINT

EDGE OF ASPHALT - CURB SECTION

ROOFTOP SCREEN

NOTES:

1. FOR SITE SERVICING, GRADING AND DRAINAGE REFER TO GRADING & SERVICING PLAN 90835 SHEET 1 OF 1 COSBURN PATTERSON MATHER.

2. FOR LANDSCAPE AND PLANTING INFORMATION REFER TO LANDSCAPE MASTER PLAN, 1 OF 1 REYNOLDS + ASSOCIATES LANDSCAPE ARCHITECTS.

3. FOR MECHANICAL AND ELECTRICAL SITE INFORMATION REFER TO MECHANICAL AND ELECTRICAL SITE PLAN BY FRED JEWETT ENGINEERING LTD.

SITE STATISTICS - MAY 7, 1999

SITE AREA	12,611.1 sm	2.93 acres	100%
ASPHALT PAVING	6,380.1 sm	1.57 acres	52.3%
EXISTING OFFICES building area	1,050.8 sm	11,311 sf	
ADDITION building area	696.8 sm	7,500 sf	
TOTAL building area	1,747.6 sm	18,811 sf	14.5%
LANDSCAPED AREA	3,867.1 sm	0.96 acres	30.2%

EXISTING OFFICES GFA	3 only GF	35,751 sf	
ADDITION GFA	3 only GF	15,000 sf	
TOTAL GFA	4 only GF	50,751 sf	41.8%

EXISTING OFFICES LEASEABLE AREA 3,000 sm
ADDITION LEASEABLE AREA 1,254.8 sm
TOTAL LEASEABLE AREA 4,214 sm
PARKING REQUIRED @ 1 SPACE / 28 sm = 151 SPACES
PARKING PROVIDED INCL. 7 HC 178 SPACES

FRONT YARD AREA OF 1,240.6 sm / 4 = 310.2 sm LANDSCAPE REQUIRED
FRONT YARD LANDSCAPE PROVIDED = 436 sm
ALL OTHER YARDS TOTAL 6,993.9 sm / 10 = 699.4 sm LANDSCAPE REQUIRED
ALL OTHER YARDS LANDSCAPE PROVIDED = 1,399 sm

ZONING CLASSIFICATION: H6 SPECIAL PROVISION 424

DEC 1992 CLASSIFICATION:
3.2.2.5.2 GROUP C, UP TO 3 STOREYS, SPRINKLERED
WITH A 6s 2772 area NOT MORE THAN 3,600 sm
COMBUSTIBLE CONSTRUCTION PERMITTED CONSISTING OF WITH FLOOR, ROOF AND INTERIOR WALL AND SUPPORTING STRUCTURE TO HAVE A FIRE RESISTANCE RATING OF NOT LESS THAN 45 MIN.

PLOT DATE	JUNE 3, '99
DRAWN BY	J.STRAUM
SCALE	1:300
DRAWING NO.	9858-SP1
	A-0 9858

JACKSON RYDER
ARCHITECTS INCORPORATED
1114 LAKESHORE ROAD EAST
OAKVILLE, ONTARIO
L6J 1H2
OFFICE: 905-849-9500
FAX: 905-849-9397

ONTARIO ASSOCIATION OF ARCHITECTS 1999 LAW VOICE P MAT

ADDITION TO MATTAMY OFFICES
2360 BRISTOL CIRCLE

ARCHITECTURAL SITE PLAN

WINSTON INDUSTRIAL BUSINESS PARK GUIDELINES FOR PREPARATION OF STORMWATER MANAGEMENT REPORT

GENERAL

A Stormwater Management Study shall be prepared for each site plan application within the Winston Park Industrial Subdivision. A master overall stormwater computer model has been prepared by the firm of Thorburn Penny Limited on behalf of the original subdivider. This model included an intensified stormwater computer simulation for the entire park utilizing the original OTTHYMO Model. As part of the model, the Park utilizes a combination of a single detention pond facility and on-site detention areas. It was proposed that on-site storage be used to minimize the total stormwater flow from the Park. The individual Site Plan report must comply with the recommendations of the overall Stormwater Management Model, developed by Thorburn Penny Limited. All Stormwater Management Reports will be approved by Development Engineering staff with copies being reviewed by the Credit Valley Conservation Authority.

It should be noted that the following criteria shall act as a guideline only. Original and innovative approaches on a site specific basis will be considered. Each developer or his agent must submit a detailed study for his respective application.

In addition to stormwater quantity control, water quality control measures are also required for all sites. The type of control and release rates must be fully documented in the report for approval.

SITE GRADING PLANS

Site grading plans are the responsibility of the applicant's engineer, and shall be approved by this individual prior to any submission proceeding to the Town for review.

The detailed site grading shall comply with the overall subdivision grade control and shall not impede drainage from or direct drainage to the adjacent properties.

Provide a separate detailed site erosion and sedimentation control plan and schedule.

RUN-OFF REQUIREMENTS

Each site must comply with the following run-off requirements:

5 Year Town of Oakville

- Chicago 4 Hour Storm Distribution - 100 litres/sec/hectare - to minor system

100 Year Town of Oakville

- Chicago 4 Hour Storm Distribution - 200 litres/sec/hectare - net release limit

All design parameters are to conform to the Town of Oakville Department of Public Works Storm Drainage Policies and Criteria Manual, in addition to the Development Engineering Procedures and Guidelines Manual. Copies may be obtained by contacting the Planning Services Department at (905) 845-6601.

Design storm parameter information is attached to this document.

OTHER REQUIREMENTS

1. Each property shall be analyzed individually, and shall have, where possible, a self-contained drainage system, although the Town would encourage a communal detention storage facility in areas where it is appropriate.
2. Overland flow patterns shall be consigned to a safe outlet, without negatively impacting neighbouring lands.
3. The system should have redundancy if possible. (As an example, if a pipe system fails, there should be an alternate method of discharge to prevent flooding, without causing flood damage to proposed buildings or adjoining properties).
4. Outlet control devices will be located in a manhole at the property line. The control device shall be installed on the upstream side of the manhole. The controlled device is standardized, being comprised of a two plate bolted design with minimum 75mm square diamond shape opening (see detail at end of this document).
5. No area ponding of the 5 year storm is allowed on any paved area with the exception of depressed loading dock areas where it should be kept to a minimum. Ponding over the 5 year storm shall be limited to remote parking areas only, not driveways or access ways.

6. As-built drawings to be completed with OTTHYMO/INTERHYMO computer model diskette and submitted to the Town upon final completion of the development.
7. On-site water quality facilities must be clearly defined. The Town will accept "Stormcepter" manholes only if no other available measure to control water quality can be obtained.
8. An emergency overland flow rate must be designed to convey stormwater to a safe outlet. Avoid fire routes where major ponding or overland flows are proposed.

MODELLING REQUIREMENTS

Site Plans shall be modelled using OTTHYMO or INTERHYMO (latest version) for the 5 year and 100 year rainfall. Other models are discouraged, unless they are compatible with the overall master model, and will only be used after prior approval is obtained from the Development Engineering Section.

STORAGE TECHNIQUES

The following storage techniques, in order of preference, will be utilized:

1. Storage in swales and landscaped areas at locations approved by staff;
2. Roof top storage - the type of control device and release rate must be specified;
3. Paved area storage over and above the 5 year storm shall be allowed in remote areas of the site;
4. Underground storage in oversized pipes or vaults;
5. Maximum storage depth shall be 250mm on hard surfaces traversed by passenger vehicles and pedestrian movements, and 400mm shall be allowed in areas accessed by heavy vehicles only;
6. No "hard surface" ponding is to occur in the proximity of any building entry features.

SITE PLAN AGREEMENTS REGISTERED ON TITLE

The Town requires the following conditions being registered on title by way of Agreement:

1. Owners are responsible for maintenance of Stormwater Management Facilities and are responsible for any liabilities related to tampering;
2. Owner gives the Town the right to enter, inspect and repair Stormwater Management Facilities at the owner's expense, should the owner fail to do so.

REPORT OUTLINE

The report shall have, as a minimum, the following components:

1. Title page clearly defining site, consultant and date

2. Executive Summary

3. Section 1 - Introduction

A brief introduction describing:
- site location
- site size - contributing areas

4. Section 2 - Methodology

Any assumptions made and the method of analysis used

5. Section 3 - Storage Requirements

- type and description of storage (tanks, ponds, super pipe)

- Out Flow Hydrograph

- Detail outflow hydrograph, graphical and tabular
- 5 and 100 year maximum flow in litres/sec/hectares

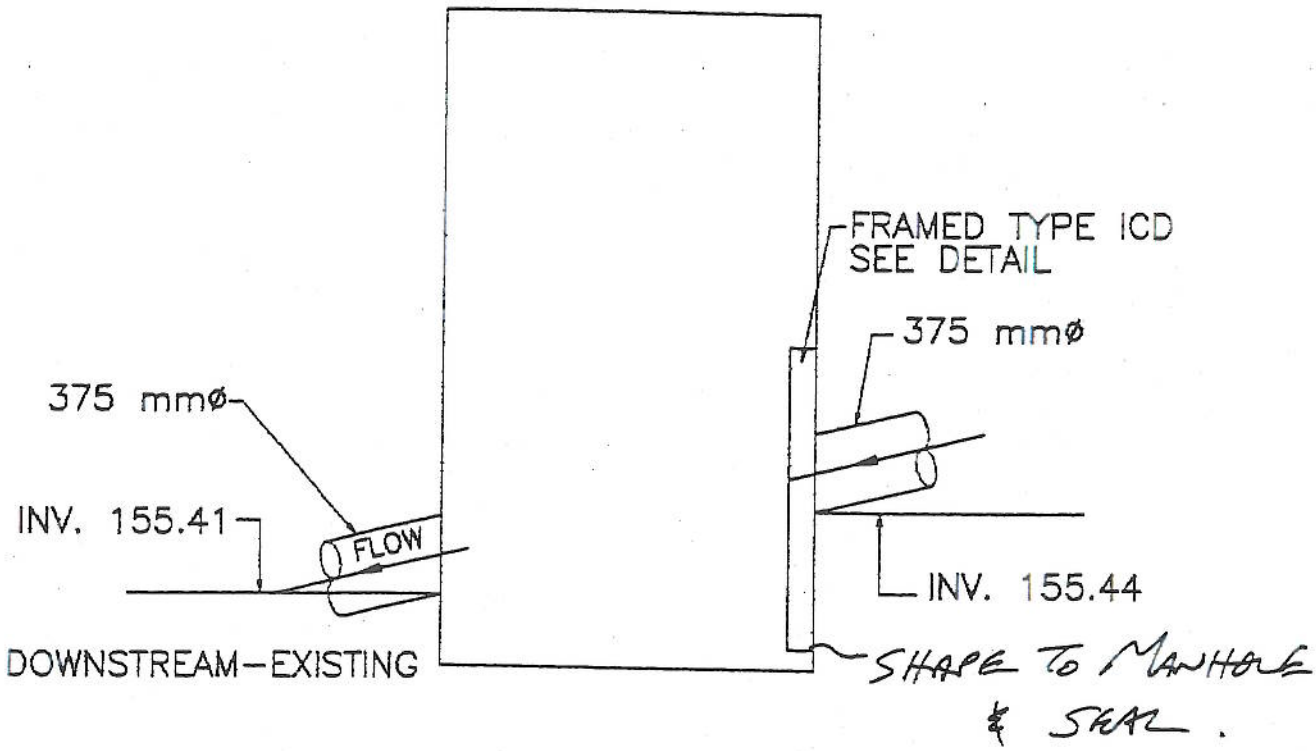
6. Section 4 - Water Quality Techniques

7. Section 5 - Summary
- Summarize storm water system

8. Appendix - Include complete input and output file for all
- Input parameters
- Include orifice calculations
- All construction or manufacturers' details

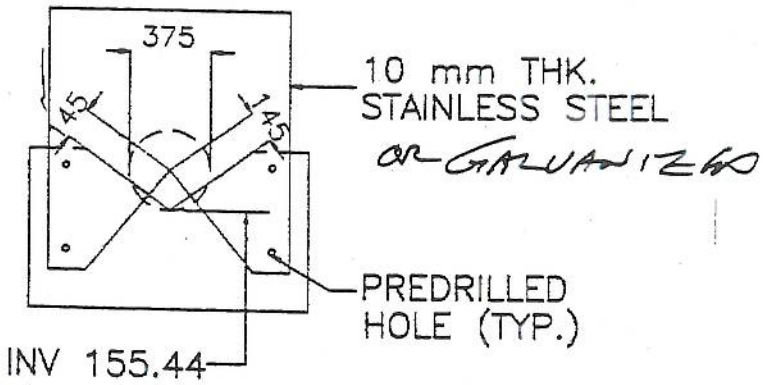
9. Diskette

10. Site Plan - A site plan will be prepared, including the following:
- Key Plan
- Location of:
- buildings
- property limits
- grassed and landscaped areas
- road right-of-ways
- paved areas
- drainage area
- contours, existing and proposed elevations
- area of ponding for 5 and 100 year storage
- location of water quality control features
- stamp or seal of Storm Water Management Designer/Engineer



MANHOLE AT PROPERTY LINE

N.T.S.



INLET CONTROL DEVICE DETAIL

N.T.S.

NOTE:
TO BE INSTALLED ON THE UPSTREAM SIDE OF THE MANHOLE AT THE PROPERTY LINE

NOTES

APPROVALS

Approval for each Site Plan applicant's Stormwater Report must be obtained from the Development Engineering Section prior to building permit issuance. Before approving the Stormwater Management Report, staff will confirm with the applicant's engineer that the lot grading has been approved by them. The report and appropriate plans will then accompany the formal site plan submission. Upon final site inspection clearance, a diskette combining the 5 year and 100 year OTTHYMO/INTERHYMO input and out files are required by the applicant.

Copies of the final site specific Stormwater Management Report shall be submitted as follows:

Credit Valley Conservation Authority	- one
Town of Oakville Development Services Department	- two

INQUIRIES

Town of Oakville

Mr. D. Bijsterveld, Planning Application Co-ordinator
(905) 845-6601, Ext. 3763

Mr. G. Trenkler, Development Technologist
(905) 845-6601, Ext. 3343

\Winston-SWM.DOC

APPENDIX B

STORM DRAINAGE CALCULATIONS

Storm Design Sheet
Town of Oakville

HUSSON

Rainfall Intensity = $\frac{A}{(Tc+B)^c}$

	5-Year	100-Year
A =	1170	2150
B =	5.8	5.7
c =	0.843	0.861

Project: 2360 Bristol Circle
Project No: 231423
Date: 23-May-23
Designed by: ZYX

Starting Tc = 10 min

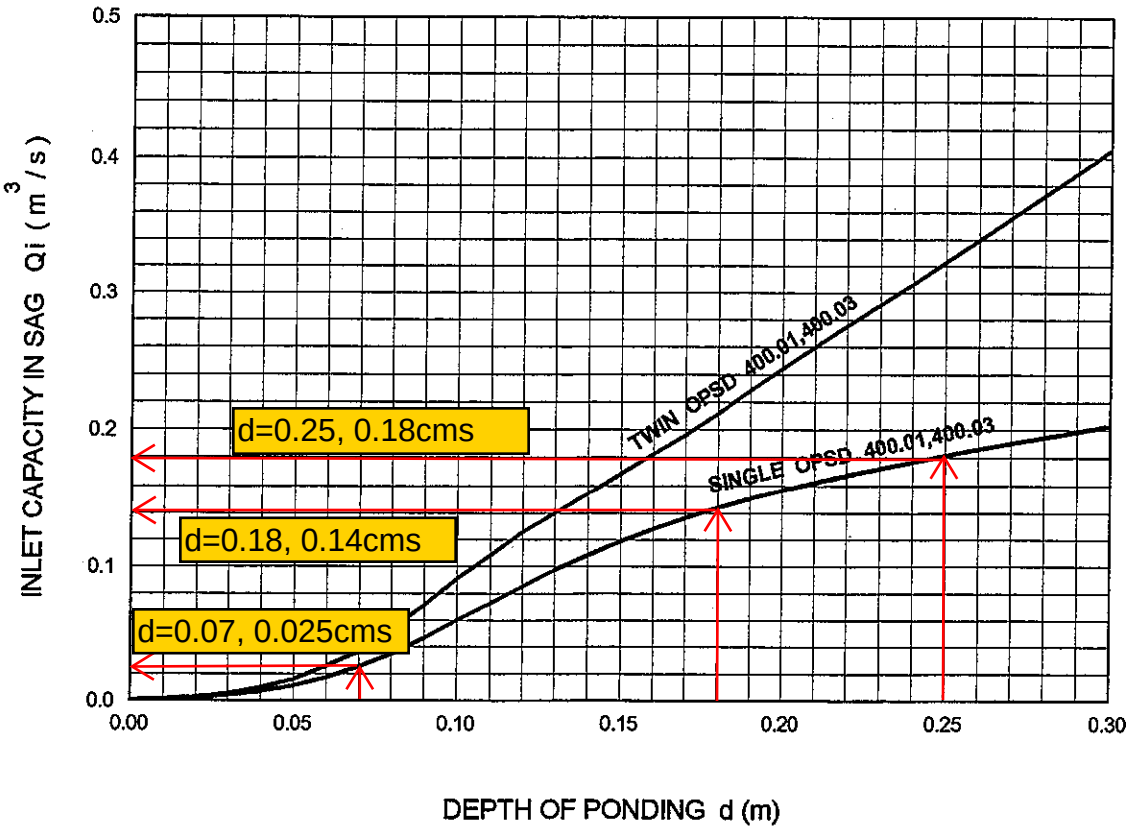
STREET	FROM MH	TO MH	5-YR AREA (ha)	5-YR RUNOFF COEFFICIENT "R"	5-YR "AR"	5-YR ACCUM. "AR"	5-YR RAINFALL INTENSITY (mm/hr)	5-YR ACCUM. FLOW (m3/s)	EXT or BLDG Area (ha)	EXT/BLDG FLOW RATE (l/s/ha)	EXT or BLDG FLOW (m3/s)	ACCUM. EXT/BLDG FLOW (m3/s)	Control Flow	Total Flow (m3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m3/s)	FULL FLOW VELOCITY (m/s)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONC. (min)
	EX.BLD	MH102					114.21		0.174	42.000	0.007	0.007	External	0.007	11.8	1.00	200	0.033	1.044	0.188	10.188
Site	MH102	MH101	0.28	0.82	0.23	0.23	113.08	0.072				0.007	5-yr	0.080	46.1	0.44	450	0.189	1.189	0.646	10.834
Site	MH101	EX. STM MH				0.23	109.37	0.070				0.007	5-yr	0.077	17.5	0.44	450	0.189	1.189	0.245	11.079
Site	EX.MH3	EX.CBMH2	0.33	0.82	0.27	0.27	114.21	0.086					5-yr	0.086	46.1	0.47	1200	2.671	2.363	0.325	10.325
Site	PROP.BLD	EX.CBMH2					114.21		1.000	50.500	0.051	0.051	External	0.051	11.8	2.00	250	0.084	1.713	0.114	10.114
Site	EX.CBMH2	EX.MH1	0.04	0.73	0.03	0.30	112.27	0.093				0.051	5-yr	0.144	46.1	0.90	450	0.270	1.701	0.452	10.777

Rational Method Calc.

Project:	541 Kipling Avenue	A:	1170.00
Project No.:	201118	B:	5.80
Municipality:	City of Toronto	C:	0.84
		Tc:	10.000

CATCH BASIN/ AREA DRAIN	DRAINAGE AREA (m^2)	RUNOFF COEFFICIENT (C)	5yr. INTENSITY @ Tc=10min (mm/hr)	5yr. FLOW (L/s)	Depth (mm)	Inlet Capacity (With 50% blockage) (L/s)*
CB2	518.0	0.90	114.2	14.8	250	90
CB3	686.0	0.90	114.2	19.6	250	90
CB4	302.0	0.90	114.2	8.6	180	71.5
CB5	189.0	0.90	114.2	5.4	70	12.5
CB6	199.0	0.90	114.2	5.7	70	12.5
EX.CB1	359.0	0.90	114.2	10.3	70	12.5
EX.CBMH2	326.0	0.90	114.2	9.3	70	12.5
EX.CB3	1063.0	0.90	114.2	30.4	260	93.5
EX.CB4	751.0	0.90	114.2	21.4	270	95
TOTAL	**4393.0**			**125.44**		

Design Chart 4.19: Inlet Capacity at Road Sag



APPENDIX C

CONTROLLED FLOW ROOF DRAINAGE DETAILS

Controlled Flow Roof Drains

Project:	2360 Bristol Circle		
Project No.:	231423		
Municipality:	Town of Oakville		
Building:	Warehouse		
Drain Type:	Zurn Z-105		
Number of Roof Drains:	10		
Max. Head (H)	4	inch	
	101.6	mm	
Flow per weir weir:	10	gpm	per inch of depth
	2.52	L/s	
Total Weirs:	20		
weirs per drain:	2.00		
Flow per drain	5.05	L/s	
Relief Scuppers:	125	mm	
Building Area (A)	0.288	ha	
Total Flow:	**50.5**	**L/s**	
Storage Estimate:	**98**	**m^3**	Estimate based on H x A / 3

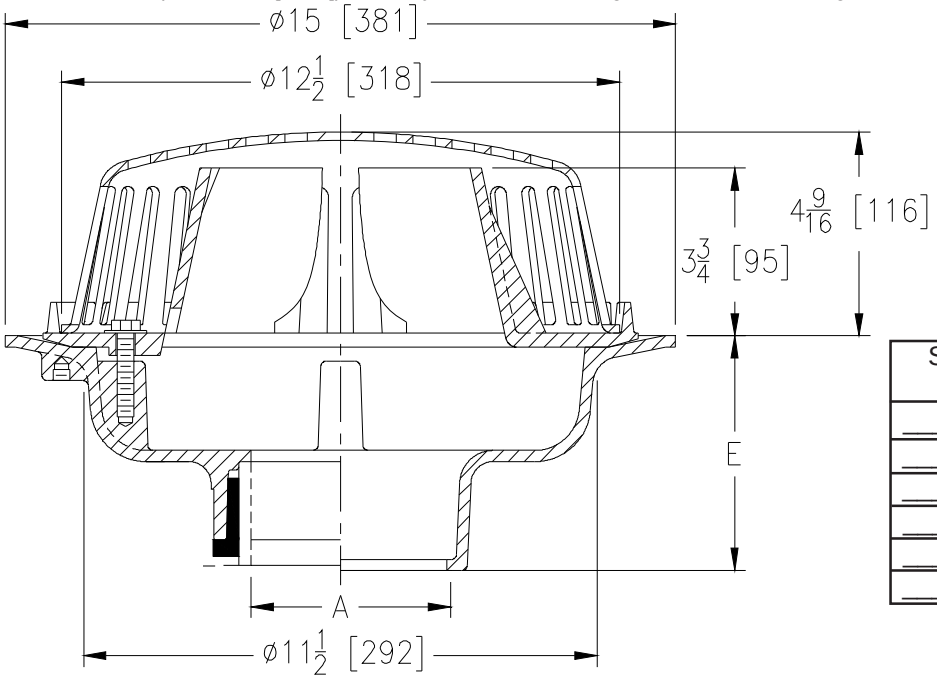
Z105

CONTROL-FLO ROOF DRAIN
W/ PARABOLIC WEIR

SPECIFICATION SHEET

TAG _____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



Specify Number of Notches in Weir	
___-N1	One Notch
___-N2	Two Notches
___-N3	Three Notches
___-N4	Four Notches
___-N5	Five Notches
___-N6	Six Notches

A- Pipe Size In.[mm]	Approx. Wt. Lbs. [kg]	Dome Open Area Sq. In. [cm²]
2,3,4 [51,76,102]	34 [15]	103 [665]

ENGINEERING SPECIFICATION: ZURN Z105
15" [381mm] Diameter Control-Flo roof drain for dead-level roof construction, Dura-Coated cast iron body, Control-Flo weir shall be linear functioning with integral membrane flashing clamp/gravel guard and Poly-Dome. All data shall be verified proportional to flow rates. Each notch will allow 10 GPM [LPM] of flow per 1" [25mm] of rain water build up above the drain.

OPTIONS (Check/specify appropriate options)

PIPE SIZE
3, 4 [76, 102]
2 , 3, 4 [51, 76, 102]
2 , 3, 4 [51, 76, 102]

(Specify size/type) **OUTLET**
_____ IC Inside Caulk
_____ NH No-Hub
_____ NL Neo-Loc

E BODY HT. DIM.
5-1/4 [133]
5-1/4 [133]
4-9/16 [116]

PREFIXES
_____ Z D.C.C.I. Body with Poly-Dome*
_____ ZA D.C.C.I. Body with Aluminum Dome
_____ ZC D.C.C.I. Body with Cast Iron Dome

SUFFIXES
_____ -C Underdeck Clamp
_____ -DP Top-Set® Deck Plate (Replaces both -C & -R)
_____ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)
_____ -EA Adjustable Extension Assembly 2-1/8 [54] thru 3-1/2 [89]
_____ -G Galvanized Cast Iron
_____ -R Roof Sump Receiver
_____ -TC Neo-Loc Test Cap Gasket (2,3,4 [51,76,102] NL Bottom Outlet Only)
_____ -VP Vandal Proof Secured Top
_____ -10 6 [152] High Parabolic Weir for Sloped Roof (ZC or ZA)

* Regularly furnished unless otherwise specified.

Zurn Industries, LLC | **Specification Drainage Operation**
1801 Pittsburgh Avenue, Erie, PA U.S.A. 16502 · Ph. 855-663-9876, Fax 814-454-7929
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 · Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

Rev. K
Date: 09/25/17
C.N. No. 137793
Prod. | Dwg. No. Z105

APPENDIX D

STORMWATER MANAGEMENT CALCULATIONS

Project:	2360 Bristol Circle
Project No.:	231423
Municipality:	Town of Oakville
Catchment:	102

Orifice Plate

Invert	154.81	m	@ MH101
Size	125	mm	
Co-efficient	0.62		
Area	0.0156	m^2	
Centroid	0.09	m	

Elevation	Area (m^2)	Incremental Storage (m^3)	Total Storage (m^3)	Head on Orifice (m)	Orifice Flow (m^3/s)
154.81	0	0.00	0.0	0.00	0.000
156.12	0	6.68	6.7	1.22	0.047
156.62	0	9.71	16.4	1.72	0.056
157.25	0	0.00	16.4	2.35	0.066
157.3	23	0.57	17.0	2.40	0.066
157.35	94	2.93	19.9	2.45	0.067
157.4	238	8.32	28.2	2.50	0.068
157.45	459	17.44	45.7	2.55	0.069
157.5	730	29.73	75.4	2.60	0.069

Pipe/Structure Storage Volumes

Project:	2360 Bristol Circle
Project No.:	231423
Municipality:	Town of Oakville
Catchment:	103

Pipe Storage

Diameter	Length	Storage Volume
150	0	0.00
200	0	0.00
250	81	3.98
300	0	0.00
375	0	0.00
450	17	2.70
525	0	0.00
600	0	0.00
675	0	0.00
750	0	0.00
825	0	0.00
900	0	0.00
975	0	0.00
1050	0	0.00
1200	0	0.00
1350	0	0.00
1500	0	0.00
1800	0	0.00

Total 6.68 m^3

Manhole Storage

Description	MH Inside Diam. (mm)	Invert (m)	Top Elev. (m)	Storage Depth (m)	Storage Volume (m^3)
EXMH	1200	154.81	157.50	2.69	3.04
MH101	1200	154.98	157.50	2.52	2.85
MH102	1200	155.27	157.47	2.20	2.49

Total 8.38 m^3

Catchbasin Storage

Description	CB Inside Dim. (mm)	Invert (m)	Top Elev. (m)	Storage Depth (m)	Storage Volume (m^3)
CB	600x600	94.55	95.40	0.85	0.31
CB	600x600	94.55	95.40	0.85	0.31
CB	600x600	94.55	95.40	0.85	0.31
CB	600x600	94.25	95.40	1.15	0.41

Total	1.33 m^3
Total Storage	16.4 m^3

Project:	2360 Bristol Circle
Project No.:	231423
Municipality:	Town of Oakville
Catchment:	103

Orifice Plate

Invert	154.43	m	@ MH101
Size	125	mm	
Co-efficient	0.62		
Area	0.0156	m^2	
Centroid	0.09	m	

Elevation	Area (m^2)	Incremental Storage (m^3)	Total Storage (m^3)	Head on Orifice (m)	Orifice Flow (m^3/s)
154.43	0	0.00	0.0	0.00	0.000
155.07	0	99.48	99.5	0.55	0.032
156.5	0	26.70	126.2	1.98	0.060
156.55	17	0.43	126.6	2.03	0.061
156.65	42	2.93	129.5	2.13	0.063
156.75	67	5.45	135.0	2.23	0.064
156.85	94	8.06	143.1	2.33	0.066
156.95	120	10.70	153.8	2.43	0.067
157	133	6.34	160.1	2.48	0.068
157.05	147	7.01	167.1	2.53	0.068
157.15	173	15.99	183.1	2.63	0.070
157.25	199	18.63	201.7	2.73	0.071
157.35	283	12.78	225.2	2.83	0.072
157.4	368	16.28	241.5	2.88	0.073
157.5	1178	42.39	306.0	2.98	0.074

Pipe/Structure Storage Volumes

Project:	2360 Bristol Circle
Project No.:	231423
Municipality:	Town of Oakville
Catchment:	103

Pipe Storage

Diameter	Length	Storage Volume
150	0	0.00
200	0	0.00
250	33	1.62
300	0	0.00
375	0	0.00
450	18	2.86
525	0	0.00
600	0	0.00
675	0	0.00
750	0	0.00
825	0	0.00
900	0	0.00
975	0	0.00
1050	0	0.00
1200	84	95.00

Total 99.48 m^3

Manhole Storage

Description	MH Inside Diam. (mm)	Invert (m)	Top Elev. (m)	Storage Depth (m)	Storage Volume (m^3)
MH101	2400	154.54	157.47	2.93	13.26
MH102	2400	154.94	157.46	2.52	11.40

Total 24.66 m^3

Catchbasin Storage

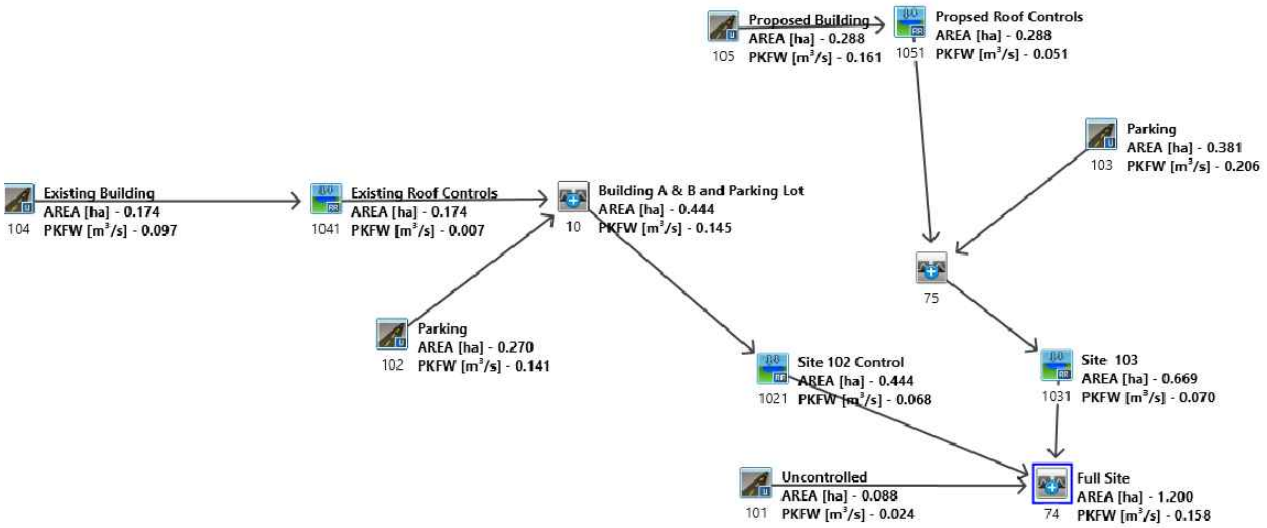
Description	CB Inside Dim. (mm)	Invert (m)	Top Elev. (m)	Storage Depth (m)	Storage Volume (m^3)
CB	600x600	155.87	157.25	1.38	0.50
CB	600x600	155.80	157.25	1.45	0.52
CB	600x600	155.80	157.25	1.45	0.52
CB	600x600	155.93	157.34	1.41	0.51

Total 2.05 m^3

Total Storage 126.2 m^3

APPENDIX E

HYDROLOGY MODELLING



HUSSON
ENGINEERING + MANAGEMENT
P 905.709.5825
200 CACHET WOODS COURT, SUITE 204
MARKHAM, ON L6C 0Z8
HUSSON.CA

FIGURE E1
2360 BRISTOL CIRCLE
VO6 POST DEVELOPMENT

DATE: JUNE 2023 SCALE: N.T.S. PROJECT: 231243

```
================================================================================================================
=====

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


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DATE: 06-01-2023                          TIME: 10:10:06

USER:


COMMENTS: _____________________________________________________________


----------------------------------------------------------------------------------------------------------------
-----
  ***********************************************
  ** SIMULATION : 100 Year Chicgo               **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2150.000
| Ptotal= 71.76 mm |                          B=   5.700
--------------------                          C=   0.861
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.93 |  0.83  200.80 |  1.67    9.50 |  2.50    4.68
                0.17    6.26 |  1.00   54.01 |  1.83    7.85 |  2.67    4.26
                0.33    8.66 |  1.17   25.55 |  2.00    6.70 |  2.83    3.91
                0.50   14.21 |  1.33   16.41 |  2.17    5.85 |
                0.67   39.75 |  1.50   12.04 |  2.33    5.19 |


------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0105)|   Area    (ha)=   0.29
|ID= 1 DT= 2.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.00
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      43.82         2.00
     Mannings n             =     0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.033    4.93 | 0.800   39.75 | 1.567   12.04 |  2.33    5.85
               0.067    4.93 | 0.833   39.75 | 1.600   12.04 |  2.37    5.19
               0.100    4.93 | 0.867  200.80 | 1.633   12.04 |  2.40    5.19
```

```
                0.133    4.93 | 0.900  200.80 | 1.667   12.04 |  2.43    5.19
                0.167    4.93 | 0.933  200.80 | 1.700    9.50 |  2.47    5.19
                0.200    6.26 | 0.967  200.80 | 1.733    9.50 |  2.50    5.19
                0.233    6.26 | 1.000  200.80 | 1.767    9.50 |  2.53    4.68
                0.267    6.26 | 1.033   54.01 | 1.800    9.50 |  2.57    4.68
                0.300    6.26 | 1.067   54.01 | 1.833    9.50 |  2.60    4.68
                0.333    6.26 | 1.100   54.01 | 1.867    7.85 |  2.63    4.68
                0.367    8.66 | 1.133   54.01 | 1.900    7.85 |  2.67    4.68
                0.400    8.66 | 1.167   54.01 | 1.933    7.85 |  2.70    4.26
                0.433    8.66 | 1.200   25.55 | 1.967    7.85 |  2.73    4.26
                0.467    8.66 | 1.233   25.55 | 2.000    7.85 |  2.77    4.26
                0.500    8.66 | 1.267   25.55 | 2.033    6.70 |  2.80    4.26
                0.533   14.21 | 1.300   25.55 | 2.067    6.70 |  2.83    4.26
                0.567   14.21 | 1.333   25.55 | 2.100    6.70 |  2.87    3.91
                0.600   14.21 | 1.367   16.41 | 2.133    6.70 |  2.90    3.91
                0.633   14.21 | 1.400   16.41 | 2.167    6.70 |  2.93    3.91
                0.667   14.21 | 1.433   16.41 | 2.200    5.85 |  2.97    3.91
                0.700   39.75 | 1.467   16.41 | 2.233    5.85 |  3.00    3.91
                0.733   39.75 | 1.500   16.41 | 2.267    5.85 |
                0.767   39.75 | 1.533   12.04 | 2.300    5.85 |

     Max.Eff.Inten.(mm/hr)=     200.80       193.98
               over (min)         5.00         2.00
     Storage Coeff.  (min)=       1.18 (ii)    1.32 (ii)
     Unit Hyd. Tpeak (min)=       4.00         2.00
     Unit Hyd. peak  (cms)=       0.49         0.66
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.00          0.161 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      70.76        65.43          70.70
     TOTAL RAINFALL   (mm)=      71.76        71.76          71.76
     RUNOFF COEFFICIENT   =       0.99         0.91           0.99

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  98.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1051)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.2300      0.0110
                           0.0510     0.0098   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0105)      0.288     0.161      1.00       70.70
   OUTFLOW: ID= 1 (  1051)      0.288     0.051      1.10       70.54

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 31.92
                  TIME SHIFT OF PEAK FLOW         (min)=  6.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0098

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0103)|   Area    (ha)=   0.38
|ID= 1 DT= 2.0 min |   Total Imp(%)=  91.00   Dir. Conn.(%)=  91.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.35         0.03
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      50.39         5.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.


                           ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.033    4.93 | 0.800   39.75 | 1.567   12.04 |  2.33    5.85
               0.067    4.93 | 0.833   39.75 | 1.600   12.04 |  2.37    5.19
               0.100    4.93 | 0.867  200.80 | 1.633   12.04 |  2.40    5.19
               0.133    4.93 | 0.900  200.80 | 1.667   12.04 |  2.43    5.19
               0.167    4.93 | 0.933  200.80 | 1.700    9.50 |  2.47    5.19
               0.200    6.26 | 0.967  200.80 | 1.733    9.50 |  2.50    5.19
```

```
                0.233    6.26 | 1.000  200.80 | 1.767    9.50 |  2.53    4.68
                0.267    6.26 | 1.033   54.01 | 1.800    9.50 |  2.57    4.68
                0.300    6.26 | 1.067   54.01 | 1.833    9.50 |  2.60    4.68
                0.333    6.26 | 1.100   54.01 | 1.867    7.85 |  2.63    4.68
                0.367    8.66 | 1.133   54.01 | 1.900    7.85 |  2.67    4.68
                0.400    8.66 | 1.167   54.01 | 1.933    7.85 |  2.70    4.26
                0.433    8.66 | 1.200   25.55 | 1.967    7.85 |  2.73    4.26
                0.467    8.66 | 1.233   25.55 | 2.000    7.85 |  2.77    4.26
                0.500    8.66 | 1.267   25.55 | 2.033    6.70 |  2.80    4.26
                0.533   14.21 | 1.300   25.55 | 2.067    6.70 |  2.83    4.26
                0.567   14.21 | 1.333   25.55 | 2.100    6.70 |  2.87    3.91
                0.600   14.21 | 1.367   16.41 | 2.133    6.70 |  2.90    3.91
                0.633   14.21 | 1.400   16.41 | 2.167    6.70 |  2.93    3.91
                0.667   14.21 | 1.433   16.41 | 2.200    5.85 |  2.97    3.91
                0.700   39.75 | 1.467   16.41 | 2.233    5.85 |  3.00    3.91
                0.733   39.75 | 1.500   16.41 | 2.267    5.85 |
                0.767   39.75 | 1.533   12.04 | 2.300    5.85 |

     Max.Eff.Inten.(mm/hr)=     200.80       110.38
               over (min)         5.00         2.00
     Storage Coeff.  (min)=       0.85 (ii)    1.45 (ii)
     Unit Hyd. Tpeak (min)=       4.00         2.00
     Unit Hyd. peak  (cms)=       0.53         0.64
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.19         0.01          0.206 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      70.76        39.94          67.99
     TOTAL RAINFALL   (mm)=      71.76        71.76          71.76
     RUNOFF COEFFICIENT   =       0.99         0.56           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    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  (  0075)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     0.38   0.206     1.00    67.99
      + ID2= 2 (  1051):     0.29   0.051     1.10    70.54
        ================================================
        ID = 3 (  0075):     0.67   0.248     1.00    69.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1031)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0680      0.0160
                          0.0320     0.0099   |   0.0680      0.0167
                          0.0600     0.0126   |   0.0700      0.0183
                          0.0610     0.0127   |   0.0710      0.0202
                          0.0630     0.0130   |   0.0720      0.0225
                          0.0640     0.0135   |   0.0730      0.0241
                          0.0660     0.0143   |   0.0740      0.0306
                          0.0670     0.0154   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0075)      0.669      0.248      1.00      69.09
   OUTFLOW: ID= 1 (  1031)      0.669      0.070      1.33      68.97

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 28.09
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0181

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0104)|   Area    (ha)=   0.17
|ID= 1 DT= 2.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.00
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
```

Length (m)=	34.06	5.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 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
0.033	4.93	0.800	39.75	1.567	12.04	2.33	5.85
0.067	4.93	0.833	39.75	1.600	12.04	2.37	5.19
0.100	4.93	0.867	200.80	1.633	12.04	2.40	5.19
0.133	4.93	0.900	200.80	1.667	12.04	2.43	5.19
0.167	4.93	0.933	200.80	1.700	9.50	2.47	5.19
0.200	6.26	0.967	200.80	1.733	9.50	2.50	5.19
0.233	6.26	1.000	200.80	1.767	9.50	2.53	4.68
0.267	6.26	1.033	54.01	1.800	9.50	2.57	4.68
0.300	6.26	1.067	54.01	1.833	9.50	2.60	4.68
0.333	6.26	1.100	54.01	1.867	7.85	2.63	4.68
0.367	8.66	1.133	54.01	1.900	7.85	2.67	4.68
0.400	8.66	1.167	54.01	1.933	7.85	2.70	4.26
0.433	8.66	1.200	25.55	1.967	7.85	2.73	4.26
0.467	8.66	1.233	25.55	2.000	7.85	2.77	4.26
0.500	8.66	1.267	25.55	2.033	6.70	2.80	4.26
0.533	14.21	1.300	25.55	2.067	6.70	2.83	4.26
0.567	14.21	1.333	25.55	2.100	6.70	2.87	3.91
0.600	14.21	1.367	16.41	2.133	6.70	2.90	3.91
0.633	14.21	1.400	16.41	2.167	6.70	2.93	3.91
0.667	14.21	1.433	16.41	2.200	5.85	2.97	3.91
0.700	39.75	1.467	16.41	2.233	5.85	3.00	3.91
0.733	39.75	1.500	16.41	2.267	5.85		
0.767	39.75	1.533	12.04	2.300	5.85		

			TOTALS
Max.Eff.Inten.(mm/hr)=	200.80	193.98	
over (min)	5.00	2.00	
Storage Coeff. (min)=	1.01 (ii)	1.26 (ii)	
Unit Hyd. Tpeak (min)=	4.00	2.00	
Unit Hyd. peak (cms)=	0.51	0.68	
PEAK FLOW (cms)=	0.10	0.00	0.097 (iii)
TIME TO PEAK (hrs)=	1.00	1.00	1.00
RUNOFF VOLUME (mm)=	70.76	65.43	70.71
TOTAL RAINFALL (mm)=	71.76	71.76	71.76
RUNOFF COEFFICIENT =	0.99	0.91	0.99

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 98.0 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.

RESERVOIR(1041) / IN= 2---> OUT= 1 / DT= 2.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.2700	0.0140
	0.0070	0.0095	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0104)	0.174	0.097	1.00	70.71
OUTFLOW: ID= 1 (1041)	0.174	0.007	1.53	68.74

PEAK FLOW REDUCTION [Qout/Qin](%)= 6.91
TIME SHIFT OF PEAK FLOW (min)= 32.00
MAXIMUM STORAGE USED (ha.m.)= 0.0091

CALIB / STANDHYD (0102) / ID= 1 DT= 2.0 min	Area (ha)= 0.27		
	Total Imp(%)= 80.00	Dir. Conn.(%)= 80.00	
		IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=		0.22	0.05
Dep. Storage (mm)=		1.00	5.00
Average Slope (%)=		4.00	2.00
Length (m)=		42.43	5.00
Mannings n =		0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 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
0.033	4.93	0.800	39.75	1.567	12.04	2.33	5.85
0.067	4.93	0.833	39.75	1.600	12.04	2.37	5.19
0.100	4.93	0.867	200.80	1.633	12.04	2.40	5.19
0.133	4.93	0.900	200.80	1.667	12.04	2.43	5.19
0.167	4.93	0.933	200.80	1.700	9.50	2.47	5.19
0.200	6.26	0.967	200.80	1.733	9.50	2.50	5.19
0.233	6.26	1.000	200.80	1.767	9.50	2.53	4.68
0.267	6.26	1.033	54.01	1.800	9.50	2.57	4.68
0.300	6.26	1.067	54.01	1.833	9.50	2.60	4.68
0.333	6.26	1.100	54.01	1.867	7.85	2.63	4.68
0.367	8.66	1.133	54.01	1.900	7.85	2.67	4.68
0.400	8.66	1.167	54.01	1.933	7.85	2.70	4.26
0.433	8.66	1.200	25.55	1.967	7.85	2.73	4.26
0.467	8.66	1.233	25.55	2.000	7.85	2.77	4.26
0.500	8.66	1.267	25.55	2.033	6.70	2.80	4.26
0.533	14.21	1.300	25.55	2.067	6.70	2.83	4.26
0.567	14.21	1.333	25.55	2.100	6.70	2.87	3.91
0.600	14.21	1.367	16.41	2.133	6.70	2.90	3.91
0.633	14.21	1.400	16.41	2.167	6.70	2.93	3.91
0.667	14.21	1.433	16.41	2.200	5.85	2.97	3.91
0.700	39.75	1.467	16.41	2.233	5.85	3.00	3.91
0.733	39.75	1.500	16.41	2.267	5.85		
0.767	39.75	1.533	12.04	2.300	5.85		

Max.Eff.Inten.(mm/hr)=	200.80	110.38		
over (min)	5.00	2.00		
Storage Coeff. (min)=	0.76 (ii)	1.64 (ii)		
Unit Hyd. Tpeak (min)=	4.00	2.00		
Unit Hyd. peak (cms)=	0.54	0.60		
			TOTALS	
PEAK FLOW (cms)=	0.12	0.02	0.141 (iii)	
TIME TO PEAK (hrs)=	1.00	1.00	1.00	
RUNOFF VOLUME (mm)=	70.76	39.94	64.60	
TOTAL RAINFALL (mm)=	71.76	71.76	71.76	
RUNOFF COEFFICIENT =	0.99	0.56	0.90	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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 (0010)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0102):		0.27	0.141	1.00	64.60
+ ID2= 2 (1041):		0.17	0.007	1.53	68.74
ID = 3 (0010):		0.44	0.145	1.00	66.22

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(1021)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 2.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0670	0.0020
	0.0470	0.0007	0.0680	0.0028
	0.0560	0.0016	0.0690	0.0075
	0.0660	0.0017	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0010)	0.444	0.145	1.00	66.22
OUTFLOW: ID= 1 (1021)	0.444	0.068	1.07	66.22

PEAK FLOW REDUCTION [Qout/Qin](%)= 47.08
TIME SHIFT OF PEAK FLOW (min)= 4.00
MAXIMUM STORAGE USED (ha.m.)= 0.0048

```
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.09
|ID= 1 DT= 2.0 min |   Total Imp(%)=  25.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.07
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      24.18        25.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 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
0.033	4.93	0.800	39.75	1.567	12.04	2.33	5.85
0.067	4.93	0.833	39.75	1.600	12.04	2.37	5.19
0.100	4.93	0.867	200.80	1.633	12.04	2.40	5.19
0.133	4.93	0.900	200.80	1.667	12.04	2.43	5.19
0.167	4.93	0.933	200.80	1.700	9.50	2.47	5.19
0.200	6.26	0.967	200.80	1.733	9.50	2.50	5.19
0.233	6.26	1.000	200.80	1.767	9.50	2.53	4.68
0.267	6.26	1.033	54.01	1.800	9.50	2.57	4.68
0.300	6.26	1.067	54.01	1.833	9.50	2.60	4.68
0.333	6.26	1.100	54.01	1.867	7.85	2.63	4.68
0.367	8.66	1.133	54.01	1.900	7.85	2.67	4.68
0.400	8.66	1.167	54.01	1.933	7.85	2.70	4.26
0.433	8.66	1.200	25.55	1.967	7.85	2.73	4.26
0.467	8.66	1.233	25.55	2.000	7.85	2.77	4.26
0.500	8.66	1.267	25.55	2.033	6.70	2.80	4.26
0.533	14.21	1.300	25.55	2.067	6.70	2.83	4.26
0.567	14.21	1.333	25.55	2.100	6.70	2.87	3.91
0.600	14.21	1.367	16.41	2.133	6.70	2.90	3.91
0.633	14.21	1.400	16.41	2.167	6.70	2.93	3.91
0.667	14.21	1.433	16.41	2.200	5.85	2.97	3.91
0.700	39.75	1.467	16.41	2.233	5.85	3.00	3.91
0.733	39.75	1.500	16.41	2.267	5.85		
0.767	39.75	1.533	12.04	2.300	5.85		

```
     Max.Eff.Inten.(mm/hr)=     200.80       110.38
               over (min)          5.00         8.00
     Storage Coeff.  (min)=       0.67 (ii)    6.92 (ii)
     Unit Hyd. Tpeak (min)=       4.00         8.00
     Unit Hyd. peak  (cms)=       0.55         0.15
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.01       0.024 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.07        1.00
     RUNOFF VOLUME    (mm)=      70.76        39.94       47.60
     TOTAL RAINFALL   (mm)=      71.76        71.76       71.76
     RUNOFF COEFFICIENT   =       0.99         0.56        0.66

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    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  (  0074)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)     (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     0.09   0.024     1.00    47.60
      + ID2= 2 (  1021):     0.44   0.068     1.07    66.22
        ==========================================================
        ID = 3 (  0074):     0.53   0.092     1.00    63.15

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

--------------------
| ADD HYD  (  0074)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)     (cms)    (hrs)     (mm)
        ID1= 3 (  0074):     0.53   0.092     1.00    63.15
      + ID2= 2 (  1031):     0.67   0.070     1.33    68.97
        ==========================================================
        ID = 1 (  0074):     1.20   0.158     1.03    66.39
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
--------------------------------------------------------------------------------
================================================================================================================
=====

       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
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                  *****  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\workstation\AppData\Local\Civica\VH5\d32691b7-9361-410b-808a-65824bdc2d5f
\f09a3238-6a58-454c-9412-0fff94beed06\
  Summary filename: C:\Users\workstation\AppData\Local\Civica\VH5\d32691b7-9361-410b-808a-65824bdc2d5f
\f09a3238-6a58-454c-9412-0fff94beed06\


DATE: 06-01-2023                          TIME: 10:10:06

USER:


COMMENTS: _____________________________________________________________

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  ***********************************************
  ** SIMULATION : 5 Year Chicgo                **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 838.490
| Ptotal= 43.99 mm |                          B=   3.750
--------------------                          C=   0.776
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  3.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    4.22 |  0.83  109.69 |  1.67    7.20 |  2.50    4.04
                0.17    5.14 |  1.00   30.02 |  1.83    6.17 |  2.67    3.74
                0.33    6.68 |  1.17   16.00 |  2.00    5.43 |  2.83    3.48
                0.50    9.94 |  1.33   11.18 |  2.17    4.86 |
                0.67   23.00 |  1.50    8.71 |  2.33    4.41 |


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0105)|   Area    (ha)=   0.29
|ID= 1 DT= 2.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.29         0.00
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      43.82         2.00
     Mannings n             =     0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.033    4.22 | 0.800   23.00 | 1.567    8.71 |  2.33    4.86
```

0.067	4.22	0.833	23.00	1.600	8.71	2.37	4.41
0.100	4.22	0.867	109.69	1.633	8.71	2.40	4.41
0.133	4.22	0.900	109.69	1.667	8.71	2.43	4.41
0.167	4.22	0.933	109.69	1.700	7.20	2.47	4.41
0.200	5.14	0.967	109.69	1.733	7.20	2.50	4.41
0.233	5.14	1.000	109.69	1.767	7.20	2.53	4.04
0.267	5.14	1.033	30.02	1.800	7.20	2.57	4.04
0.300	5.14	1.067	30.02	1.833	7.20	2.60	4.04
0.333	5.14	1.100	30.02	1.867	6.17	2.63	4.04
0.367	6.68	1.133	30.02	1.900	6.17	2.67	4.04
0.400	6.68	1.167	30.02	1.933	6.17	2.70	3.74
0.433	6.68	1.200	16.00	1.967	6.17	2.73	3.74
0.467	6.68	1.233	16.00	2.000	6.17	2.77	3.74
0.500	6.68	1.267	16.00	2.033	5.43	2.80	3.74
0.533	9.94	1.300	16.00	2.067	5.43	2.83	3.74
0.567	9.94	1.333	16.00	2.100	5.43	2.87	3.48
0.600	9.94	1.367	11.18	2.133	5.43	2.90	3.48
0.633	9.94	1.400	11.18	2.167	5.43	2.93	3.48
0.667	9.94	1.433	11.18	2.200	4.86	2.97	3.48
0.700	23.00	1.467	11.18	2.233	4.86	3.00	3.48
0.733	23.00	1.500	11.18	2.267	4.86		
0.767	23.00	1.533	8.71	2.300	4.86		

Max.Eff.Inten.(mm/hr)=	109.69	101.43	
over (min)	5.00	2.00	
Storage Coeff. (min)=	1.50 (ii)	1.68 (ii)	
Unit Hyd. Tpeak (min)=	4.00	2.00	
Unit Hyd. peak (cms)=	0.46	0.59	
			TOTALS
PEAK FLOW (cms)=	0.09	0.00	0.087 (iii)
TIME TO PEAK (hrs)=	1.00	1.00	1.00
RUNOFF VOLUME (mm)=	42.99	37.87	42.93
TOTAL RAINFALL (mm)=	43.99	43.99	43.99
RUNOFF COEFFICIENT =	0.98	0.86	0.98

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 98.0 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.

RESERVOIR(1051)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 2.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.2300	0.0110
	0.0510	0.0098	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0105)	0.288	0.087	1.00	42.93
OUTFLOW: ID= 1 (1051)	0.288	0.028	1.10	42.78

PEAK FLOW REDUCTION [Qout/Qin](%)= 32.48
TIME SHIFT OF PEAK FLOW (min)= 6.00
MAXIMUM STORAGE USED (ha.m.)= 0.0055

CALIB	
STANDHYD (0103)	Area (ha)= 0.38
ID= 1 DT= 2.0 min	Total Imp(%)= 91.00 Dir. Conn.(%)= 91.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.35	0.03
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	4.00	2.00
Length	(m)=	50.39	5.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 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
0.033	4.22	0.800	23.00	1.567	8.71	2.33	4.86
0.067	4.22	0.833	23.00	1.600	8.71	2.37	4.41
0.100	4.22	0.867	109.69	1.633	8.71	2.40	4.41
0.133	4.22	0.900	109.69	1.667	8.71	2.43	4.41

```
                0.167    4.22 | 0.933  109.69 | 1.700    7.20 |  2.47    4.41
                0.200    5.14 | 0.967  109.69 | 1.733    7.20 |  2.50    4.41
                0.233    5.14 | 1.000  109.69 | 1.767    7.20 |  2.53    4.04
                0.267    5.14 | 1.033   30.02 | 1.800    7.20 |  2.57    4.04
                0.300    5.14 | 1.067   30.02 | 1.833    7.20 |  2.60    4.04
                0.333    5.14 | 1.100   30.02 | 1.867    6.17 |  2.63    4.04
                0.367    6.68 | 1.133   30.02 | 1.900    6.17 |  2.67    4.04
                0.400    6.68 | 1.167   30.02 | 1.933    6.17 |  2.70    3.74
                0.433    6.68 | 1.200   16.00 | 1.967    6.17 |  2.73    3.74
                0.467    6.68 | 1.233   16.00 | 2.000    6.17 |  2.77    3.74
                0.500    6.68 | 1.267   16.00 | 2.033    5.43 |  2.80    3.74
                0.533    9.94 | 1.300   16.00 | 2.067    5.43 |  2.83    3.74
                0.567    9.94 | 1.333   16.00 | 2.100    5.43 |  2.87    3.48
                0.600    9.94 | 1.367   11.18 | 2.133    5.43 |  2.90    3.48
                0.633    9.94 | 1.400   11.18 | 2.167    5.43 |  2.93    3.48
                0.667    9.94 | 1.433   11.18 | 2.200    4.86 |  2.97    3.48
                0.700   23.00 | 1.467   11.18 | 2.233    4.86 |  3.00    3.48
                0.733   23.00 | 1.500   11.18 | 2.267    4.86 |
                0.767   23.00 | 1.533    8.71 | 2.300    4.86 |

     Max.Eff.Inten.(mm/hr)=     109.69        40.38
                over (min)        5.00         2.00
     Storage Coeff.  (min)=       1.08 (ii)    1.85 (ii)
     Unit Hyd. Tpeak (min)=       4.00         2.00
     Unit Hyd. peak  (cms)=       0.50         0.56
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.01          0.111 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      42.99        18.13          40.75
     TOTAL RAINFALL   (mm)=      43.99        43.99          43.99
     RUNOFF COEFFICIENT   =       0.98         0.41           0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  85.0    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  (  0075)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):     0.38   0.111     1.00    40.75
      + ID2= 2 (  1051):     0.29   0.028     1.10    42.78
        ==========================================================
        ID = 3 (  0075):     0.67   0.134     1.00    41.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  1031)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0680      0.0160
                          0.0320     0.0099   |   0.0680      0.0167
                          0.0600     0.0126   |   0.0700      0.0183
                          0.0610     0.0127   |   0.0710      0.0202
                          0.0630     0.0130   |   0.0720      0.0225
                          0.0640     0.0135   |   0.0730      0.0241
                          0.0660     0.0143   |   0.0740      0.0306
                          0.0670     0.0154   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0075)      0.669     0.134      1.00       41.62
   OUTFLOW: ID= 1 (  1031)      0.669     0.040      1.33       41.51

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 30.07
                  TIME SHIFT OF PEAK FLOW         (min)= 20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0107

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0104)|   Area    (ha)=   0.17
|ID= 1 DT= 2.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.17         0.00
```

```
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      34.06         5.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 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
0.033	4.22	0.800	23.00	1.567	8.71	2.33	4.86
0.067	4.22	0.833	23.00	1.600	8.71	2.37	4.41
0.100	4.22	0.867	109.69	1.633	8.71	2.40	4.41
0.133	4.22	0.900	109.69	1.667	8.71	2.43	4.41
0.167	4.22	0.933	109.69	1.700	7.20	2.47	4.41
0.200	5.14	0.967	109.69	1.733	7.20	2.50	4.41
0.233	5.14	1.000	109.69	1.767	7.20	2.53	4.04
0.267	5.14	1.033	30.02	1.800	7.20	2.57	4.04
0.300	5.14	1.067	30.02	1.833	7.20	2.60	4.04
0.333	5.14	1.100	30.02	1.867	6.17	2.63	4.04
0.367	6.68	1.133	30.02	1.900	6.17	2.67	4.04
0.400	6.68	1.167	30.02	1.933	6.17	2.70	3.74
0.433	6.68	1.200	16.00	1.967	6.17	2.73	3.74
0.467	6.68	1.233	16.00	2.000	6.17	2.77	3.74
0.500	6.68	1.267	16.00	2.033	5.43	2.80	3.74
0.533	9.94	1.300	16.00	2.067	5.43	2.83	3.74
0.567	9.94	1.333	16.00	2.100	5.43	2.87	3.48
0.600	9.94	1.367	11.18	2.133	5.43	2.90	3.48
0.633	9.94	1.400	11.18	2.167	5.43	2.93	3.48
0.667	9.94	1.433	11.18	2.200	4.86	2.97	3.48
0.700	23.00	1.467	11.18	2.233	4.86	3.00	3.48
0.733	23.00	1.500	11.18	2.267	4.86		
0.767	23.00	1.533	8.71	2.300	4.86		

```
     Max.Eff.Inten.(mm/hr)=     109.69       101.43
               over (min)          5.00         2.00
     Storage Coeff.  (min)=       1.29 (ii)    1.60 (ii)
     Unit Hyd. Tpeak (min)=       4.00         2.00
     Unit Hyd. peak  (cms)=       0.48         0.61
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.00          0.053 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      42.99        37.87          42.93
     TOTAL RAINFALL   (mm)=      43.99        43.99          43.99
     RUNOFF COEFFICIENT   =       0.98         0.86           0.98

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  98.0    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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--------------------
| RESERVOIR(  1041)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  2.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.2700      0.0140
                           0.0070     0.0095   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0104)      0.174     0.053      1.00       42.93
   OUTFLOW: ID= 1 (  1041)      0.174     0.004      1.70       40.95

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.32
                  TIME SHIFT OF PEAK FLOW         (min)= 42.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0053

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0102)|   Area    (ha)=   0.27
|ID= 1 DT= 2.0 min |   Total Imp(%)=  80.00   Dir. Conn.(%)=  80.00
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.22         0.05
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       4.00         2.00
     Length            (m)=      42.43         5.00
```

Mannings n = 0.013 0.250

NOTE: RAINFALL WAS TRANSFORMED TO 2.0 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
0.033	4.22	0.800	23.00	1.567	8.71	2.33	4.86
0.067	4.22	0.833	23.00	1.600	8.71	2.37	4.41
0.100	4.22	0.867	109.69	1.633	8.71	2.40	4.41
0.133	4.22	0.900	109.69	1.667	8.71	2.43	4.41
0.167	4.22	0.933	109.69	1.700	7.20	2.47	4.41
0.200	5.14	0.967	109.69	1.733	7.20	2.50	4.41
0.233	5.14	1.000	109.69	1.767	7.20	2.53	4.04
0.267	5.14	1.033	30.02	1.800	7.20	2.57	4.04
0.300	5.14	1.067	30.02	1.833	7.20	2.60	4.04
0.333	5.14	1.100	30.02	1.867	6.17	2.63	4.04
0.367	6.68	1.133	30.02	1.900	6.17	2.67	4.04
0.400	6.68	1.167	30.02	1.933	6.17	2.70	3.74
0.433	6.68	1.200	16.00	1.967	6.17	2.73	3.74
0.467	6.68	1.233	16.00	2.000	6.17	2.77	3.74
0.500	6.68	1.267	16.00	2.033	5.43	2.80	3.74
0.533	9.94	1.300	16.00	2.067	5.43	2.83	3.74
0.567	9.94	1.333	16.00	2.100	5.43	2.87	3.48
0.600	9.94	1.367	11.18	2.133	5.43	2.90	3.48
0.633	9.94	1.400	11.18	2.167	5.43	2.93	3.48
0.667	9.94	1.433	11.18	2.200	4.86	2.97	3.48
0.700	23.00	1.467	11.18	2.233	4.86	3.00	3.48
0.733	23.00	1.500	11.18	2.267	4.86		
0.767	23.00	1.533	8.71	2.300	4.86		

			TOTALS
Max.Eff.Inten.(mm/hr)=	109.69	40.38	
over (min)	5.00	4.00	
Storage Coeff. (min)=	0.97 (ii)	2.09 (ii)	
Unit Hyd. Tpeak (min)=	4.00	4.00	
Unit Hyd. peak (cms)=	0.52	0.40	
PEAK FLOW (cms)=	0.07	0.01	0.073 (iii)
TIME TO PEAK (hrs)=	1.00	1.00	1.00
RUNOFF VOLUME (mm)=	42.99	18.13	38.01
TOTAL RAINFALL (mm)=	43.99	43.99	43.99
RUNOFF COEFFICIENT =	0.98	0.41	0.86

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 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 (0010)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0102):		0.27	0.073	1.00	38.01
+ ID2= 2 (1041):		0.17	0.004	1.70	40.95
ID = 3 (0010):		0.44	0.075	1.00	39.16

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(1021)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 2.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0670	0.0020
	0.0470	0.0007	0.0680	0.0028
	0.0560	0.0016	0.0690	0.0075
	0.0660	0.0017	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0010)	0.444	0.075	1.00	39.16
OUTFLOW: ID= 1 (1021)	0.444	0.055	1.03	39.16

PEAK FLOW REDUCTION [Qout/Qin](%)= 73.52
TIME SHIFT OF PEAK FLOW (min)= 2.00
MAXIMUM STORAGE USED (ha.m.)= 0.0016

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--------------------
| CALIB            |
| STANDHYD (  0101)|   Area    (ha)=   0.09
|ID= 1 DT= 2.0 min |   Total Imp(%)=  25.00   Dir. Conn.(%)=  25.00
--------------------

                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.02         0.07
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      24.18        25.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   2.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.033    4.22 | 0.800   23.00 | 1.567    8.71 |  2.33    4.86
               0.067    4.22 | 0.833   23.00 | 1.600    8.71 |  2.37    4.41
               0.100    4.22 | 0.867  109.69 | 1.633    8.71 |  2.40    4.41
               0.133    4.22 | 0.900  109.69 | 1.667    8.71 |  2.43    4.41
               0.167    4.22 | 0.933  109.69 | 1.700    7.20 |  2.47    4.41
               0.200    5.14 | 0.967  109.69 | 1.733    7.20 |  2.50    4.41
               0.233    5.14 | 1.000  109.69 | 1.767    7.20 |  2.53    4.04
               0.267    5.14 | 1.033   30.02 | 1.800    7.20 |  2.57    4.04
               0.300    5.14 | 1.067   30.02 | 1.833    7.20 |  2.60    4.04
               0.333    5.14 | 1.100   30.02 | 1.867    6.17 |  2.63    4.04
               0.367    6.68 | 1.133   30.02 | 1.900    6.17 |  2.67    4.04
               0.400    6.68 | 1.167   30.02 | 1.933    6.17 |  2.70    3.74
               0.433    6.68 | 1.200   16.00 | 1.967    6.17 |  2.73    3.74
               0.467    6.68 | 1.233   16.00 | 2.000    6.17 |  2.77    3.74
               0.500    6.68 | 1.267   16.00 | 2.033    5.43 |  2.80    3.74
               0.533    9.94 | 1.300   16.00 | 2.067    5.43 |  2.83    3.74
               0.567    9.94 | 1.333   16.00 | 2.100    5.43 |  2.87    3.48
               0.600    9.94 | 1.367   11.18 | 2.133    5.43 |  2.90    3.48
               0.633    9.94 | 1.400   11.18 | 2.167    5.43 |  2.93    3.48
               0.667    9.94 | 1.433   11.18 | 2.200    4.86 |  2.97    3.48
               0.700   23.00 | 1.467   11.18 | 2.233    4.86 |  3.00    3.48
               0.733   23.00 | 1.500   11.18 | 2.267    4.86 |
               0.767   23.00 | 1.533    8.71 | 2.300    4.86 |

     Max.Eff.Inten.(mm/hr)=     109.69        40.38
               over (min)          5.00        10.00
     Storage Coeff.  (min)=       0.85 (ii)    8.81 (ii)
     Unit Hyd. Tpeak (min)=       4.00        10.00
     Unit Hyd. peak  (cms)=       0.53         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.13           1.00
     RUNOFF VOLUME    (mm)=      42.99        18.13          24.29
     TOTAL RAINFALL   (mm)=      43.99        43.99          43.99
     RUNOFF COEFFICIENT   =       0.98         0.41           0.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    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  (  0074)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)     (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     0.09   0.010     1.00    24.29
      + ID2= 2 (  1021):     0.44   0.055     1.03    39.16
        ================================================
        ID = 3 (  0074):     0.53   0.064     1.03    36.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
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--------------------
| ADD HYD  (  0074)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)     (cms)    (hrs)     (mm)
        ID1= 3 (  0074):     0.53   0.064     1.03    36.71
      + ID2= 2 (  1031):     0.67   0.040     1.33    41.51
        ================================================
```

```
        ID = 1 (  0074):     1.20   0.092     1.03    39.38

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