SERVICING AND STORMWATER MANAGEMENT REPORT
PARK PLACE NORTH LANDS
NORTH AMERICAN (PARK PLACE) CORPORATION
CITY OF BARRIE

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

SERVICING AND
STORMWATER MANAGEMENT REPORT
PARK PLACE NORTH LANDS
CITY OF BARRIE

Prepared for: North American (Park Place) Corporation
c/o North American Development Group

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1.0 INTRODUCTION

Sabourin Kimble & Associates Ltd. has been retained by North American Development Group to carry out a functional servicing and stormwater management assessment of the Park Place North Lands which is bound by open space area and a tributary to the Lover's Creek to the south, Bayview Drive to the east, and the Barrie Medical Centre and Fedex Distribution Centre to the north, in the City of Barrie. The following report is in accordance with the guidelines set out in the approved *Stormwater Management Analysis and Preliminary Servicing Study* (PSS) prepared by Sabourin Kimble and Associates Ltd. for the Park Place Development dated July 2003 and updated December 2007. The stormwater management strategy for this site was previously approved as a part of the PSS, therefore this report has been prepared to confirm that the proposed revision to the subject site is still in keeping with these reports. Relevant excerpts from this report have been provided in Appendix E. This report also identifies how the property will be serviced and assesses whether the existing infrastructure surrounding the property is adequate to support the development.

2.0 STUDY AREA

As shown in Figure 1, the proposed Study Area is located within the Park Place North Lands, bound by open space area and the north tributary to the Lover's Creek to the south, Bayview Drive to the east, and the Barrie Medical Centre and Fedex Distribution Centre to the north. The proposed site plan consists of four industrial buildings and surface parking.

STUDY AREA

N.T.S.

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NO.
02:999	1

3.0 MUNICIPAL SERVICES

3.1 Site Grading

The existing grading of the subject site generally falls west to east. Existing grade elevations at the western property boundary are as high as 300.21 metres and fall to the east to as low as 279.99 metres along the limit of development.

As shown in Figure SG (back pocket), the site will be graded to accommodate the proposed industrial site plan. Preliminary finished floor elevations have been provided for all proposed buildings. The grading approach has been designed to satisfy current City of Barrie grading criteria, meet boundary conditions and respect drainage boundaries.

3.2 Storm Drainage

3.2.1 Existing Conditions

As shown in Figure SS (back pocket), there are no existing storm sewers located within the subject site. Existing overland drainage generally flows from the west to east. There is an existing site entrance to the Barrie Medical Centre north of the site, which is serviced by storm sewers which convey drainage to an existing site outlet to Big Bay Point Road.

3.2.2 Proposed Storm Servicing

Parking lots and landscape strips will contribute flow to a proposed storm sewer system and will be conveyed to the proposed SWM Pond B, ultimately to a previously approved outlet location to the north tributary of the Lover's Creek located south of the site. The proposed storm sewers have been appropriately sized to accept major and minor system flows from the entire subject site and design sheets can be found in Appendix A. The storm servicing concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.

3.3 Rooftop Drainage

3.3.1 Existing Conditions

As shown in Figure SS (back pocket), there are no existing RDC sewers located within the subject site.

3.3.2 Proposed Rooftop Servicing

As shown in Figure SS (back pocket), the site will be serviced by a proposed rooftop drainage collector system which will convey rooftop drainage in a perforated drainage system from the proposed buildings through the site and ultimately to the north tributary of Lovers Creek. The perforated storm sewer system will be designed to maintain contact with the underlying sand layer to promote active infiltration of the rooftop flows, which will be controlled to 20l/s/ha of roof. The proposed RDC sewers have been appropriately sized to accept the rooftop flows from the entire subject site and design sheets can be found in Appendix A. The rooftop drainage collector servicing concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.

3.4 Sanitary Drainage

3.4.1 Existing Conditions

As shown in Figure SS (back pocket), there are no sanitary sewers located within the subject site. An existing 250mm diameter sanitary sewer and manhole is located at the north property line, which drains north through the Barrie Medical Centre and ultimately outlets to the existing 600mm diameter municipal sanitary sewer located on Big Bay Point Road. The existing private and municipal sanitary sewers have sufficient capacity to accept flows from the subject site.

3.4.2 Proposed Sanitary Servicing

As shown in Figure SS (back pocket), the site will be serviced by a proposed sanitary sewer system, which will convey sanitary drainage from the proposed buildings through the site and ultimately to the existing sanitary sewer and manhole located at the north property limit. As previously mentioned, the sanitary flows will be conveyed north

through the Barrie Medical Centre site, which ultimately outlets to the existing trunk sanitary sewer located on Big Bay Point Road. The proposed sanitary sewers have been appropriately sized to accommodate the sanitary flows from the entire subject site and design sheets can be found in Appendix A. The sanitary servicing concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.

3.5 Water Supply

3.5.1 Existing Conditions

As shown in Figure SS (back pocket), there are no existing watermains located within the subject site. An existing 400mm diameter watermain is located on Bayview Drive and runs along the eastern property limit. Existing pressures and flows have been measured on Bayview Drive and will provide adequate boundary conditions to service the subject site.

3.5.2 Proposed Water System

As shown in Figure SS (back pocket), the site will be serviced with a combination of proposed fire and domestic watermains. Two connections can be made to the existing 400mm diameter watermain on Bayview Drive to maintain a looped system to ensure adequate pressure, volume and safety are available to the development. A water service supply and demand analysis will be completed to ensure adequate fire flow, pressure, and domestic water quality, utilizing results from fire flow tests. The water distribution concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.

4.0 STORMWATER MANAGEMENT CRITERIA

As the subject site falls within the original Park Place development site area, the associated stormwater management criteria for the proposed development are as specified by the Stormwater Management Analysis and Preliminary Servicing Study (PSS) for Park Place Development, 2007 prepared by Sabourin Kimble & Associates Ltd.. Excerpts from the PSS have been provided in Appendix E to reference these criteria.

4.1 Water Quality Control

On-site water quality controls must be provided which satisfy enhanced protection level (formerly level 1) constraints as outlined in the Ministry of Environment Stormwater Management Planning and Design Manual (March 2003).

4.2 Water Quantity Control

Sufficient quantity controls must be provided on-site such that pre-development peak flow rates at the downstream flow nodes are met or reduced under post-development conditions for all storms up to and including the 100-year storm event. As determined in the PSS, the 4 hour Chicago storm distribution should be used for this analysis as it produces the most conservative volume requirements

4.3 Erosion Control

The minimum LSRCA requirements state that the runoff generated by a 25mm storm be discharged over a 24 hour period. As per the originally approved PSS, there are no further erosion concerns for the receiving watercourse, therefore this is the minimum erosion control requirement for the subject site.

4.4 Water Budget

To maintain annual pre-development water balance under post development conditions it was determined that the runoff from building rooftops must be infiltrated as well as 5.3mm of runoff from parking lot areas.

5.0 PROPOSED STORMWATER MANAGEMENT DESIGN

5.1 Overall Stormwater Management Concept

Under post-development conditions, parking lots and landscape strips will contribute flow to the proposed storm sewer system which conveys flows to proposed SWM Pond B, and ultimately to a previously approved outlet location to the north tributary of the Lover's Creek located south of the site. The storm servicing concept is in keeping with the originally approved PSS report for the subject lands.

The discharge and storage volume requirements outlined in the following sections have been used to prepare the detailed design for Pond B. This report is prepared in conjunction with Figure SWM (back pocket) that show the pond details. SWM Pond B has been designed as a wet pond with a sediment forebay, permanent pool, infiltration basin, erosion control storage, and active storage. Per City of Barrie criteria for fenced facilities, the sloping above and below the permanent pool has been graded at 3:1 with a 7:1 shelf at the permanent pool elevation.

In accordance with the requirements outlined in the PSS, a perforated RDC sewer system will collect rooftop drainage and provide infiltration of clean water throughout the subject site. An overflow is provided at the SWM pond outfall.

5.2 Water Quality Control

Pond B will be constructed as a wet pond with more than sufficient permanent pool volume to satisfy the MOE enhanced level of protection (80% TSS removal) to provide appropriate quality control for the subject site. The resulting permanent pool requirement is summarized in Table 3. Detailed calculations can be found in Appendix B.

Table 1 - SWMF Facility Water Quality Volumes

Drainage Area (ha)	Percent Impervious (%)	Unit Volume (m^3/ha)	Permanent Pool Volume (m^3)	
			Required	Provided
7.70	85	210	1,617	2,349

5.3 Water Quantity Control

Target peak flows for Pond B discharge are based on meeting the existing conditions flow rates at the downstream flow node, NT2. The existing conditions peak flow rates must be met for the 2 through 100-year return period storm events. Quantity control is solely provided by the SWM pond. The stage-storage rating curve for the pond was calibrated using the Visual OTTHYMO hydrologic modeling program. Per the PSS, the rooftops have been modelled as uncontrolled.

In order to meet the flow targets at NT2, an orifice size of 110mm is required as the sole pond control. This orifice was used to generate a rating curve for the SWM pond, which determined the storage volumes required for each storm event. The results of the water quantity control modeling at the downstream end of the site are shown in Table 2. Modelling output and supporting calculations can be found in Appendix C.

Table 2 - Designed Quantity Control Release Rates

		Flow Node NT2		
Return Period	**Pond B Discharge (m^3/s)**	**Design (m^3/s)**	**Target (m^3/s)**	**Percent Difference**
2-year	0.019	0.554	0.557	-0.54
5-year	0.025	1.297	1.334	-2.77
10-year	0.026	1.516	1.756	-13.67
25-year	0.028	2.054	2.158	-4.82
50-year	0.028	2.266	2.383	-4.91
100-year	0.030	2.651	2.882	-8.02

As previously mentioned, a 110mm orifice will control all return period events at the permanent pool elevation of 279.50. Table 3 shows that the ponding elevations under each storm event are in compliance with the recommended MOE active storage fluctuation.

Table 3 - Pond Storage Volumes

Storm Event	Volume (m^3)	Ponding Elevation (m)	Flux (m)
Extended Detention	1,592	279.96	0.46
2-year	2,297	280.12	0.62
5-year	4,056	280.50	1.00
10-year	4,676	280.62	1.12
25-year	5,290	280.74	1.24
50-year	5,472	280.77	1.27
100-year	6,124	280.90	1.40

5.3.1 Outlet Structure and Emergency Conditions

Under emergency conditions, safe conveyance from the SWM Pond to the north tributary of Lovers Creek must be provided for the greater of the uncontrolled 100-year storm event and the Regional (Hazel) storm event. It was found that the uncontrolled 100-year generates the greater peak flow and was therefore used for the emergency conveyance system design. Since the SWM Pond is not adjacent to the watercourse and due to the gradient differential between the pond and Bayview Avenue, it is not possible to grade an emergency spillway from the pond through the parking lot without spilling towards Bayview Avenue. Alternatively, an emergency overflow structure and the outfall storm sewers from the SWM pond to the outfall have been designed to capture the uncontrolled 100-year peak flow and safely convey flows to the outfall. This sill elevation of this emergency overflow structure has been set above the 100-year ponding elevation so that it will not become active during normal operation. The opening size required on this structure has been calculated to be $4m^2$, which is the opening size required to pass the emergency peak flow rate while maintaining a minimum 0.3m freeboard to the top of pond, assuming that the grate is 50% blocked. All outlet structure calculations can be found in Appendix B.

5.3.2 Pond C Retrofit

As discussed, the quantity control requirements for Pond B are primarily driven by the LRCA's requirement to match post-development flow rates to pre-development levels at the downstream flow nodes. Currently, Pond C (formerly referred to as the interim pond) also outlets to the north tributary of Lovers Creek, upstream of the flow node "NT2". As-constructed, Pond C utilized the full

capacity of the flow rate requirements at flow node NT2, thereby leaving no additional capacity for the Pond B to come online. Therefore, Pond C will need to undergo a retrofit in order for Pond B to proceed. As both ponds are proposed to outlet to the same location, the sizing of Pond B and the Pond C retrofit have been designed concurrently with consideration of both the proposed north site plan and existing conditions of the Pond C to try and minimize the extent of work and disturbance required to complete the retrofit. The Pond C retrofit regrading plan was designed with minimal disturbance of the existing vegetation, which resulted in the grading revisions being limited to the north and east sides. The outlet structure will also need to be re-designed to meet flow targets at NT2, including an additional DICB outlet, and decommissioning the existing top parallel pipe to better control the discharge from the pond under all return periods events.

With the above changes to Pond C and the proposed Pond B sizing, the flows at NT2 are at or below the target flow rates. Table 4 shows the proposed north pond discharge rates, retrofitted interim pond discharge rates and ponding elevations, and the resultant flow rate at NT2.

Table 4 - Proposed Interim Pond Retrofit Discharge Summary

Storm Event	Pond C Maximum Storage Used (m^3)	Pond C Ponding Elevation (m)	Pond C Discharge Rate (m^3/s)	Pond B Outflow (m^3/s)	Flow at NT2 (m^3/s)	NT2 Target Flow (m^3/s)
2-year	4,270	284.05	0.08	0.019	0.554	0.557
5-year	5,682	284.32	0.41	0.025	1.297	1.334
10-year	6,575	284.49	0.44	0.026	1.516	1.756
25-year	7,081	284.58	0.78	0.028	2.054	2.158
50-year	7,226	284.61	0.89	0.028	2.266	2.383
100-year	7,791	284.70	1.02	0.030	2.651	2.882

5.4 Erosion Control

As established in the PSS, the minimum drawdown time of the extended detention volume in Pond B is 24 hours. Due to the required quantity control described previously, the orifice size of 110mm is required as the sole control. This results in an extended

detention drawdown time of 49 hours. Erosion control parameters are presented in Table 5, and detailed calculations can be found in Appendix B.

Table 5 - SWM Facility Erosion Control Parameters

Extended Detention Volume (m^3)	Extended Detention Ponding Elevation (m)	Orifice Diameter (mm)	Drawdown Time (hours)
1,592	279.96	110	49

5.5 Water Budget

In accordance with the water balance design parameters set out in the approved PSS, rooftop runoff will be collected, controlled, and discharged to a perforated RDC sewer. A connection will be made via a perforated PVC sewer to collect the rooftop drainage from each proposed building of the subject site to the proposed roof drain collector system, which ultimately discharges to the north tributary of Lovers Creek. As per the approved PSS, the roof discharge will be controlled to a maximum of 20 l/s/ha of roof. For the proposed development, this corresponds to a total flow of 107 l/s.

In addition to the perforated RDC system, an infiltration basis has been designed within the stormwater management pond that is sized to infiltrate a minimum of 5.3mm of runoff prior to any discharge from the stormwater management pond. This equates to a total infiltration volume of 408m^3. This is in accordance with the requirements outlined in the PSS. The minimum contact area in the SWM pond required to provide this infiltration volume is 211m^2, which has been provided for at the south limit of the main cell.

5.6 Phosphorus Budget

In accordance with the LSRCA's Phosphorus budget requirements as outlined in the approved PSS, best efforts have been established to minimize phosphorus loading under post-development conditions. Phosphorus removal has been provided by 3 methods:

- Perforated RDC system collecting drainage from the rooftop
- Wet detention ponds collecting drainage from the remainder of the site
- Infiltration basin within the SWM Pond (accounts for 3.7% of the total active pond volume)

Using the MOE Phosphorus Budget Tool, the pre-development and post-development phosphorus loadings were calculated. The pre-development loading rate was calculated based on an empty grassed area which yields a total phosphorus load of 2.22kg/yr. The post development loading rate was calculated based on high intensity – commercial, yielding a total phosphorus load of 23.71kg/yr. As established in the approved PSS, best management practices (BMP) have been designed to treat runoff from the site. Under mitigated post development conditions, the phosphorus loading rate is lowered to 6.17kg/year, an 74% annual reduction from the site. A detailed summary of the phosphorus budget can be found in Appendix B.

6.0 MAINTENANCE OF THE STORMWATER MANAGEMENT FACILITY

6.1 Inspection

Inspection is a preventative measure, which is recommended to ensure the facility functions as designed as part of the storm drainage conveyance system. It is important that the pond outlets are operational at all times to limit surcharging of the storm sewers upstream of the pond. Inspections should be made after every significant rainfall event to ensure the facility is functioning properly. The MOE SWMP manual suggests that it is anticipated an average of four inspections per year will be required but it is recommended that one per month be undertaken. The storm sewer inlets, the control manholes, the quality/quantity control orifice plates and emergency overflow structures should be inspected for obvious signs of blockage and/or damage.

6.2 Maintenance

Regular maintenance of the facility is important for proper operation. The control structures and overflow devices should be free of debris and blockages at all times. Typically, the removal of debris can be carried out manually, with a pick- up truck for haulage and disposal.

The time frame for sediment removal is based on accumulation rates identified in the Stormwater Management Facility Sediment Maintenance Guide (1999). Based on these guidelines, the cleanout frequency of Pond B would be approximately 70 years. Calculations in support of this are enclosed in Appendix B. The enclosed calculations assume that the contributing drainage area is completely developed and restored to a stable condition. It is recommended in the SWMP manual, however, that the accumulated sediments in the facility should be removed and disposed of a minimum of every 10 years.

Prior to disposal, a sample of the sediments should be sent to a testing lab to test for contaminants under the MOE Dredging and Lake fill Guidelines. If the sample contaminants exceed the guideline requirements, the sediment should be disposed of at a licensed facility. Otherwise, the sediment may be disposed of at any site undergoing a

filling operation. The SWMP manual also states that there have been no reported cases where the sediment has been classified as contaminated. Therefore, it is anticipated that consideration of disposal of the sediment at a licensed waste facility is not necessary. Typically, a backhoe and dump truck for the pond can carry out the sediment removal operation.

Since the pond is to be a wet pond, the seeded/planted areas of the pond should be left to grow naturally. Plantings within the pond have been designed based on their tolerance to water fluctuations/permanent pool zones and as such, all grade control structures (sediment forebay berm, overflow structures) must be maintained. If bare spots occur throughout the pond as a result of surface erosion or poor root development, reseeding/planting should be undertaken. Ideally, the reseeding should be done in the spring or late summer/fall. The following Table 6 summarizes maintenance activities, which are grouped according to the interval at which maintenance is expected to be required.

Table 6 - Maintenance Activities and Intervals

	Typical Interval	Location and Type of Maintenance
1.	On regular inspection cycle and after rainfall events (say monthly on average)	Inspect for clogging: • extended detention control • outlet control/overflow • storm sewer inlets
2.	Bi-Annually	• Cut grass and other vegetation on and adjacent to the access road and routes to pond inlets & outlets
3.	Annually	Remove litter from: • The site • The pools • The active storage area • Inspect Outlet Control Manholes
4.	Every 5 years	Vegetation maintenance (Aquatic, Shoreline fringe, Upland, and Flood fringe areas).
5.	Every 10 years	Drain pools, remove accumulated sediments, restore pond.

7.0 EROSION AND SEDIMENTATION CONTROLS

Sediment fence will be placed appropriately around the site and shall be installed, where possible, prior to all construction activities within the subject site, including underground sewer construction and building construction. Sedimentation control measures are to be installed and operational prior to any construction activity and are to remain in place until such time as the building is constructed and the site grading complete with established sod and plantings, subject to approval by the City Engineering Department. Sediment controls must be inspected on a regular basis and after every rainfall event.

Please refer to Figure SED (back pocket) for all erosion and sediment control details. A sediment pond has been provided in the ultimate pond location. Calculations demonstrating that it is sized appropriated based on the TRCA Erosion and Sediment Control Guidelines for Urban Construction (December 2006) criteria have been provided in Appendix D.

Repairs to sediment controls must be done in a timely manner to prevent sediment from entering the water and to prevent any off-site environmental impacts. The catchbasins should also be cleaned should they become laden with sediment during construction. Prior to assumption the entire storm system should be inspected and cleaned in order to ensure proper long-term function. All disturbed areas are to be reinstated to their original condition or better, as determined by the City engineering department.

8.0 CONCLUSIONS

Based on the findings of this Servicing and Stormwater Management Report, the following conclusions were reached:

- The subject lands will be developed for industrial use.
- The subject site has been designed in accordance with the guidelines set out in the approved Stormwater Management Analysis and Preliminary Servicing Study (PSS) prepared by Sabourin Kimble and Associates Ltd. for the Park Place Development dated July 2003 and updated December 2007.
- The site will be graded for industrial use, satisfying current City of Barrie grading criteria, meeting boundary conditions and respecting drainage boundaries.
- The site will be serviced by a proposed storm sewer system which will convey drainage to the south-east to proposed SWM Pond B. SWM Pond B provides 2-year to 100-year water quantity controls and MOE Enhanced Protection Level 1 quality control in addition to more than the minimum required 24 hour draw down of the 25mm storm event. The storm servicing concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.
- The site will be serviced by a proposed roof drainage collector (RDC) system which outlets to the north tributary of Lovers Creek. Rooftop drainage will be controlled to 20 l/s/ha of roof area and will be conveyed via a perforated sewer system for infiltration. The rooftop collector servicing concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.
- The development will be serviced by a proposed sanitary sewer system which outlets to an existing sanitary sewer located within the Barrie Medical Centre lands, and ultimately outlets to the existing trunk sanitary sewer on Big Bay Point Road. The sanitary servicing concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.
- The site will be serviced by a combination of fire and domestic watermains with connections to the existing water distribution system located along Bayview Avenue. A water service supply and demand analysis will be completed to

ensure adequate fire flow, pressure, and domestic water quality, utilizing results from fire flow tests. The water distribution concept is in keeping with the originally approved Stormwater Management Analysis and Preliminary Servicing Study for the subject lands.

- The total annual phosphorus load will be reduced by 74% to 6.17 kg/year utilizing a perforated RDC system and a wet pond equipped an infiltration basin.
- During construction, adequate erosion and sedimentation controls must be provided in accordance with the City of Barrie and Lake Simcoe Region Conservation Authority guidelines

APPENDIX A

Design Sheets

PROJECT :	**Park Place North**
PROJECT NUMBER :	**02:999**
LOCATION:	**City of Barrie**
DATE :	**First Submission - April 2022**

Old Criteria

$I_{5YR} = \frac{1183.229}{(t + 12.036)^{0.833}}$

$I_{100YR} = \frac{2182.122}{(t + 14.443)^{0.841}}$

NOTES

New Criteria

$I_{5YR} = \frac{843.019}{(t + 4.582)^{0.763}}$

$I_{100YR} = \frac{1383.628}{(t + 4.905)^{0.754}}$

Designed By : RAM

SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS

5 YEAR AND 100 YEAR STORMS

			AREAS OF OVERLAND FLOW							AREAS WHERE 100 YEAR STORM IS CAPTURED						STORM SEWER DESIGN									
STREET	Upstream Manhole	Downstream Manhole	A at R=0.20 (ha)	A at R=0.90 (ha)	A x R this section	Acc. AR	t (min)	I (5yr) (mm/hr)	Q (5yr) (l/s)	A at R=0.20 (ha)	A at R=0.90 (ha)	A X R this section	Acc. AR	I (100yr) (mm/hr)	Q (100yr) (l/s)	**Total Acc. AR (Design)**	**Q (Design) (l/s)**	Pipe	Pipe (mm)	Grade (%)	Capacity (l/s)	Velocity (m/s)	Length (m)	Time (min)	Total Time (min)	% Capacity
STORMWATER MANAGEMENT POND A																									
	1	2	0.21	0.11	0.141	0.141	10.00	109.11	42.73	0.00	0.00	0.00	0.000	122.52	0.00	**0.14**	**42.73**	METRIC	300	1.50	118.43	1.68	90.00	0.90	10.90	36%
	2	3	0.20	0.12	0.148	0.289	10.90	104.26	83.70	0.00	0.00	0.00	0.000	119.30	0.00	**0.29**	**83.70**	METRIC	300	1.00	96.70	1.37	46.80	0.57	11.47	87%
	3	4	0.07	0.09	0.095	0.384	11.47	101.42	108.18	0.00	0.00	0.00	0.000	117.35	0.00	**0.38**	**108.18**	IMPERIAL	375	1.00	182.91	1.60	68.20	0.71	12.17	59%
	4	28	0.00	0.00	0.000	0.384	12.17	98.13	104.67	0.07	0.30	0.29	0.288	115.03	91.87	**0.67**	**196.54**	IMPERIAL	525	0.50	317.25	1.42	54.60	0.64	12.81	62%
	28	5	0.00	0.00	0.000	0.384	12.81	95.36	101.72	0.00	0.00	0.00	0.288	113.02	90.26	**0.67**	**191.98**	IMPERIAL	525	0.50	317.25	1.42	72.00	0.85	13.66	61%
	24	5	0.00	0.00	0.000	0.000	10.00	109.11	0.00	0.00	0.36	0.32	0.324	122.52	110.27	**0.32**	**110.27**	IMPERIAL	450	0.30	162.91	0.99	61.00	1.02	11.02	68%
	5	6	0.10	0.17	0.173	0.557	13.66	91.97	142.30	0.00	0.18	0.16	0.774	110.49	237.40	**1.33**	**379.70**	IMPERIAL	675	0.30	480.32	1.30	75.40	0.97	14.63	79%
	6	7	0.04	0.12	0.116	0.673	14.63	88.42	165.29	0.00	0.00	0.00	0.774	107.75	231.52	**1.45**	**396.81**	IMPERIAL	675	0.30	480.32	1.30	19.30	0.25	14.87	83%
	7	8	0.00	0.00	0.000	0.673	14.87	87.56	163.68	0.01	0.13	0.12	0.893	107.08	265.61	**1.57**	**429.29**	IMPERIAL	750	0.30	636.13	1.39	74.40	0.89	15.76	67%
	23	8	0.00	0.00	0.000	0.000	10.00	109.11	0.00	0.00	0.31	0.28	0.279	122.52	94.96	**0.28**	**94.96**	IMPERIAL	375	0.50	129.34	1.13	45.10	0.66	10.66	73%
	8	9	0.00	0.00	0.000	0.673	15.76	84.62	158.20	0.00	0.00	0.00	1.172	104.73	340.95	**1.85**	**499.15**	IMPERIAL	750	0.30	636.13	1.39	49.40	0.59	16.35	78%
	9	10	0.00	0.00	0.000	0.673	16.35	82.80	154.78	0.00	0.20	0.18	1.352	103.23	387.70	**2.03**	**542.48**	IMPERIAL	750	0.30	636.13	1.39	98.20	1.17	17.53	85%
	11	12	0.20	0.18	0.202	0.202	10.00	109.11	61.22	0.18	0.06	0.10	0.099	122.52	33.69	**0.30**	**94.91**	IMPERIAL	300	2.00	142.67	1.96	55.00	0.47	10.47	67%
	12	13	0.03	0.05	0.051	0.253	10.47	106.50	74.85	0.00	0.00	0.00	0.099	120.81	33.22	**0.35**	**108.07**	IMPERIAL	300	2.00	142.67	1.96	55.00	0.47	10.94	76%
	13	14	0.03	0.05	0.051	0.304	10.94	104.04	87.86	0.00	0.00	0.00	0.099	119.16	32.77	**0.40**	**120.62**	IMPERIAL	450	1.00	297.43	1.81	27.00	0.25	11.19	41%
	27	14	0.00	0.00	0.000	0.000	10.00	109.11	0.00	0.00	0.69	0.62	0.621	122.52	211.35	**0.62**	**211.35**	IMPERIAL	525	0.50	317.25	1.42	88.20	1.04	11.04	67%
	14	15	0.00	0.00	0.000	0.304	11.19	102.79	86.80	0.00	0.00	0.00	0.720	118.30	236.60	**1.02**	**323.40**	IMPERIAL	525	1.00	448.66	2.01	54.70	0.45	11.64	72%
	15	16	0.04	0.10	0.098	0.402	11.64	100.58	112.32	0.00	0.00	0.00	0.720	116.77	233.54	**1.12**	**345.86**	IMPERIAL	525	1.00	448.66	2.01	39.90	0.33	11.97	77%
	16	17	0.03	0.12	0.114	0.516	11.97	99.04	141.96	0.00	0.00	0.00	0.720	115.68	231.37	**1.24**	**373.34**	IMPERIAL	600	1.00	640.56	2.19	57.40	0.44	12.41	58%
	26	17	0.03	0.12	0.114	0.114	10.00	109.11	34.55	0.00	0.36	0.32	0.324	122.52	110.27	**0.44**	**144.82**	IMPERIAL	450	0.50	210.32	1.28	77.10	1.00	11.00	69%
	17	18	0.04	0.26	0.242	0.872	12.41	97.10	235.20	0.00	0.00	0.00	1.044	114.29	331.44	**1.92**	**566.64**	IMPERIAL	675	0.60	679.27	1.84	51.20	0.46	12.87	83%
	18	19	0.00	0.00	0.000	0.872	12.87	95.12	230.41	0.00	0.00	0.00	1.044	112.85	327.26	**1.92**	**557.67**	IMPERIAL	750	0.50	821.24	1.80	16.00	0.15	13.02	68%
	19	20	0.07	0.14	0.140	1.012	13.02	94.51	265.69	0.00	0.00	0.00	1.044	112.40	325.95	**2.06**	**591.63**	IMPERIAL	750	0.50	821.24	1.80	61.20	0.57	13.59	72%
	20	21	0.05	0.10	0.100	1.112	13.59	92.26	284.97	0.00	0.00	0.00	1.044	110.71	321.05	**2.16**	**606.02**	IMPERIAL	825	0.30	820.22	1.49	54.20	0.61	14.19	74%
	24N	25	0.00	0.00	0.000	0.000	10.00	109.11	0.00	0.00	0.48	0.43	0.432	122.52	147.03	**0.43**	**147.03**	IMPERIAL	525	0.30	245.74	1.10	90.00	1.36	11.36	60%
	25	21	0.00	0.00	0.000	0.000	11.36	101.91	0.00	0.00	0.49	0.44	0.873	117.70	285.41	**0.87**	**285.41**	IMPERIAL	600	0.30	350.85	1.20	90.00	1.25	12.61	81%
	21	22	0.00	0.13	0.117	1.229	14.19	89.97	307.14	0.00	0.00	0.00	1.917	108.96	580.21	**3.15**	**887.35**	IMPERIAL	900	0.30	1034.42	1.58	90.00	0.95	15.15	86%
	22	10	0.00	0.00	0.000	1.229	15.15	86.64	295.77	0.00	0.00	0.00	1.917	106.34	566.29	**3.15**	**862.06**	IMPERIAL	900	0.30	1034.42	1.58	15.50	0.16	15.31	83%
	10	HW1	0.00	0.00	0.000	1.902	17.53	79.42	419.62	0.00	0.23	0.21	3.476	100.40	969.46	**5.38**	**1389.08**	IMPERIAL	1200	0.30	2227.76	1.91	14.00	0.12	17.65	62%

PROJECT TITLE:	Park Place - North Lands
PROJECT No.:	02:999
CLIENT:	North American (Park Place) Corporation
ISSUED FOR:	First Submission April 2022

SANITARY SEWER DESIGN SHEET
CITY OF BARRIE

ENGINEER'S SEAL

PREPARED BY:

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

NOTES, STANDARDS AND DESIGN INPUT PARAMETERS

Densities (persons/unit):

Low Density Residential	3.13
Medium Density Residential	2.34
High Density Residential	1.67
Other	3.0
Unplanned Developable Land (persons/hectare)	125

Harmon Peaking Factor:

Maximum: 4.0
Minimum: 2.0
Formula: $K_H = 1 + \frac{14}{(4 + P)^{1/2}}$
where; K_H = Harmon Peaking Factor
P = Population in Thousands

Design Flows:

Residential Flow	225	L/person/day
Infiltration Flow	8.64	m^3/ha/day (0.10L/s/ha)
Commercial Flow	56	m^3/ha/day (28*peak of 2)
Floor Space Index	1	of gross lot area
Hotel Flow	225	L/bed space/day
Industrial Flow	100	m^3/ha/day (50*peak of 2)

Note: PVC pipe is manufactured in metric dimensions, therefore, the pipe diameter stated is used to calculate capacity and velocity. However, since concrete pipe is manufactured in imperial dimensions, standard imperial equivalent sizes for the diameter stated have been used to calculate capacity and velocity.

Infiltration Flow Applied to: Total Area

				RESIDENTIAL											COMMERCIAL				INSTITUTIONAL			INDUSTRIAL			EXTERNAL FLOWS		TOTAL AREA		INFILTRATION			PIPE DESIGN								
PROPERTY	**STREET**	**Upstream Manhole**	**Downstream Manhole**	**Section Area (ha)**	**Cummulative Area (ha)**	**Low Density Units**	**Medium Density Units**	**High Density Units**	**Other (specified above) Units**	**Unplanned Land (ha)**	**Section Population**	**Cummulative Population (thousands)**	**Harmon Peaking Factor**	**Residential Flow (L/s)**	**Section Area (ha)**	**Gross Floor Area (ha)**	**Cummulative Gross Floor Area (ha)**	**Commercial Flow (L/s)**	**Section Area (ha)**	**Cummulative Area (ha)**	**Institutional Flow (L/s)**	**Section Area (ha)**	**Cummulative Area (ha)**	**Industrial Flow (L/s)**	**Total External Flow (L/s)**	**Cumulative External Flow (L/s)**	**Total Section Area (ha)**	**Total Cummulative Area (ha)**	**Applicable Area (ha) (select above)**	**Infiltration Flow (L/s)**	**Total Design Flow (L/s)**	**Type**	**Pipe (mm)**	**Grade (%)**	**Capacity (l/s)**	**Length (m)**	**Velocity (m/s)**	**Down-stream Velocity (m/s)**	**Change in Velocity (m/s)**	**Capacity (%)**
	N/A	Plug 3	2A	0.00	0.00						0	0.000	4.00	**0.00**		0.00	0.00	**0.00**		0.00	**0.00**	1.02	1.02	**1.18**		**0.00**	1.02	1.02	1.02	**0.10**	**1.28**	PVC	200	2.00	46.38	20.6	1.48	1.48	0.00	3%
	N/A	2A	3A	2.12	2.12						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**		1.02	**1.18**		**0.00**	2.12	3.14	3.14	**0.31**	**1.49**	PVC	200	2.00	46.38	35.2	1.48	1.04	0.43	3%
	N/A	Plug 2	3A	0.00	0.00						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**	0.83	0.83	**0.96**		**0.00**	0.83	0.83	0.83	**0.08**	**1.04**	PVC	200	1.00	32.80	17.9	1.04	1.04	0.00	3%
	N/A	3A	4A	0.09	2.21						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**		1.85	**2.14**		**0.00**	0.09	4.06	4.06	**0.41**	**2.55**	PVC	200	1.00	32.80	35.9	1.04	0.74	0.31	8%
	N/A	4A	5A	0.18	2.39						0	0.000	4.00	**0.00**		0.00	0.00	**0.00**		0.00	**0.00**		1.85	**2.14**		**0.00**	0.18	4.24	4.24	**0.42**	**2.57**	PVC	200	0.50	23.19	39.4	0.74	0.74	0.00	11%
	N/A	5A	6A	0.61	3.00						0	0.000	4.00	**0.00**		0.00	0.00	**0.00**		0.00	**0.00**		1.85	**2.14**		**0.00**	0.61	4.85	4.85	**0.49**	**2.63**	PVC	200	0.50	23.19	56.6	0.74	1.04	0.31	11%
	N/A	6A	7A	0.16	3.16						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**		1.85	**2.14**		**0.00**	0.16	5.01	5.01	**0.50**	**2.64**	PVC	200	1.00	32.80	50.4	1.04	1.04	0.00	8%
	N/A	7A	8A	0.06	3.22						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**		1.85	**2.14**		**0.00**	0.06	5.07	5.07	**0.51**	**2.65**	PVC	200	1.00	32.80	19.0	1.04	0.74	0.31	8%
	N/A	8A	9A	0.12	3.34						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**		1.85	**2.14**		**0.00**	0.12	5.19	5.19	**0.52**	**2.66**	PVC	200	0.50	23.19	48.4	0.74	1.04	0.31	11%
	N/A	Plug 1	9A	0.00	0.00						0	0.000	4.00	**0.00**		0.00	0.00	**0.00**		0.00	**0.00**	1.40	1.40	**1.62**		**0.00**	1.40	1.40	1.40	**0.14**	**1.76**	PVC	200	1.00	32.80	13.2	1.04	1.04	0.00	5%
	N/A	9A	10A	3.72	7.06						0	0.000	4.00	**0.00**	0.00	0.00	0.00	**0.00**		0.00	**0.00**	0.00	3.25	**3.76**		**0.00**	3.72	10.31	10.31	**1.03**	**4.79**	PVC	200	1.00	32.80	89.2	1.04	0.74	0.31	15%
	N/A	Plug 4	10A	0.00	0.00						0	0.000	4.00	**0.00**		0.00	0.00	**0.00**		0.00	**0.00**	1.41	1.41	**1.63**		**0.00**	1.41	1.41	1.41	**0.14**	**1.77**	PVC	200	0.50	23.19	13.2	0.74	0.74	0.00	8%
	N/A	10A	North	0.00							0	0.000	4.00	**0.00**		0.00	0.00	**0.00**		0.00	**0.00**	0.00	4.66	**5.39**		**0.00**	0.00	11.72	11.72	**1.17**	**6.57**	PVC	200	0.50	23.19	13.2	0.74	N/A		28%

Park Place - North Lands
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First Submission April 2022

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

ROOFTOP DRAINAGE COLLECTOR SEWER DESIGN

			TOTAL DESIGN AREA		INDUSTRIAL			TOTAL FLOWS	PIPE DESIGN						
Street	Upstream Manhole	Downstream Manhole	Section Area (ha)	Cummulative Area (ha)	Rooftop Section Area (ha)	Cummulative Rooftop Area (ha)	Cummulative Rooftop Flow (l/s)	Cummulative Design Flow (l/s)	Pipe	Pipe Size (mm)	Grade (%)	Capacity (l/s)	Velocity (m/s)	Length	% Capacity
RDC															
	Plug 1	2B	1.02	1.02	1.020	1.020	20.40	20.40	IMPERIAL	250	1.00	62.04	1.22	21.1	32.88%
	2B	3B	0.00	1.02	0.000	1.020	20.40	20.40	IMPERIAL	250	0.50	43.87	0.87	66.1	46.50%
	3B	4B	0.00	1.02	0.000	1.020	20.40	20.40	IMPERIAL	250	0.50	43.87	0.87	71.3	46.50%
	Plug 2	4B	0.83	0.83	0.830	0.830	16.60	16.60	IMPERIAL	250	0.50	43.87	0.87	24.8	37.84%
	4B	5B	0.00	1.85	0.000	1.850	37.00	37.00	IMPERIAL	300	0.50	71.33	0.98	58.9	51.87%
	Plug 3	5B	1.39	1.39	1.390	1.390	27.80	27.80	IMPERIAL	250	1.00	62.04	1.22	6.7	44.81%
	5B	12B	0.00	3.24	0.000	3.240	64.80	64.80	IMPERIAL	375	0.50	129.34	1.13	70.0	50.10%
	12B	6B	0.00	3.24	0.000	3.240	64.80	64.80	IMPERIAL	375	0.50	129.34	1.13	70.0	50.10%
	Plug 4	6B	0.00	1.41	0.000	1.410	28.20	28.20	IMPERIAL	250	1.00	62.04	1.22	6.9	45.46%
	6B	7B	0.00	4.65	0.000	4.650	93.00	93.00	IMPERIAL	375	1.20	200.37	1.76	62.7	46.41%
	7B	HW 1	0.00	4.65	0.000	4.650	93.00	93.00	IMPERIAL	375	1.00	182.91	1.60	18.7	50.84%

APPENDIX B

SWM Design Calculations

02:999
Park Place North - Pond B
NORTH POND DESIGN SHEET

DRAINAGE AREA COMPOSITION			
LOCATION	**AREA (ha)**	**TIMP (%)**	**XIMP (%)**
Industrial	6.72	90%	90%
Pond	0.98	50%	50%
Weighted Total	**7.70**	**85%**	**85%**

PERMANENT POOL REQUIREMENTS

Type of Pond	Wet Pond
Protection Level	Level 1 - Enhanced

Using Table 3.2 in MOE *Stormwater Management Planning and Design Manual*			
Storage Volume (m^3/ha) for Impervious Level			
35%	55%	70%	85%
140	**190**	**225**	**250**

Unit Volume (m^3/ha) = $\frac{85\% - 70\%}{85\% - 70\}} (250 - 225) + 225$

= **250** m^3/ha

- 40 m^3/ha of extended detention

= **210** m^3/ha

Permanent Pool Storage Required = (**210** m^3/ha) × (**7.70** ha)

= **1,617** m^3

FOREBAY SIZING

Forebay Length

Dispersion Length (m) $= \frac{8Q}{d\,v_F}$ where;

Q: inlet pipe capacity (m^3/s)

Diameter	1200	mm
Slope	0.30%	
Capacity	**2.135**	m^3/s

V_F: desired forebay velocity 0.50 m/s

d: depth of forebay 2.00 m

= **17** **m**

Settling Length (m) $= \sqrt{\frac{rQ_Q}{V_S}}$ where;

Q_Q: quality control peak flow **0.030** m^3/s

r: forebay length to width ratio 1 :1

V_s: settling velocity 0.0003 m/s

= **10** **m**

Therefore, the provided forebay length of 43m is sufficient.

Forebay Weir / Conveyence Pipe		
Forebay Weir height, H	0.25	m
Forebay Weir Length, L	13.0	m

$Q_{CAP} = 1.67*L*H^{1.5}$

= **2.714** m^3/s

Q_{TOTAL} = **2.714** m^3/s which is greater than inlet capacity

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Park Place North - Pond B
NORTH POND STAGE - STORAGE

FOREBAY PERMANENT POOL					
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Volume (m^3)**	**Total Volume (m^3)**
277.5		**117**			**0**
	0.50		154	77	
278.00		190			77
	0.50		254	127	
278.50		318			204
	0.50		393	197	
279.00		467			401
	0.25		557	139	
279.25		646			540
	0.25		773	193	
279.50		899			**733**
MAIN CELL PERMANENT POOL					
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Volume (m^3)**	**Total Volume (m^3)**
277.5		**296**			0
	0.50		398	199	
278.00		500			199
	0.50		619	310	
278.50		737			509
	0.50		863	432	
279.00		989			941
	0.25		1,167	292	
279.25		1,344			1,233
	0.25		1,532	383	
279.50		1,720			1,616
TOTAL PERMANENT POOL VOLUME (m^3)		→			**2,349**
INFILTRATION GALLERY					
279.50		211			0
	0.25		234	59	
279.75		257			59
	0.21		273	57	
279.96		288			116
	0.04		298	12	
280.00		307			128
ACTIVE STORAGE					
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Volume (m^3)**	**Total Volume (m^3)**
279.5		2,830			**0**
	0.25		3,165	791	
279.75		3,499			791
	0.21		3,812	801	
279.96		4,125			1,592
	0.04		4,179	167	
280.00		4,232			1,759
	0.50		4,577	2,289	
280.50		4,922			4,048
	0.50		5,204	2,602	
281.00		5,486			6,650
	0.50		5,804	2,902	
281.50		6,122			9,552
	0.25		6,298	1,575	
281.75		6,474			11,127
TOTAL ACTIVE VOLUME (m^3)		→			**11,127**

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Park Place North - Pond B
NORTH POND PONDING ELEVATIONS

	Volume (m^3)		Elevation (m)
	Required	**Available**	
Permanent Pool	**1,617**	**2,349**	279.50

Chicago Storm Distribution

STORM EVENT	Volume (m^3)	Elevation (m)	Flux (m)
First Flush	**1,592**	279.96	**0.46**
2-year	**2,287**	280.12	**0.62**
5-year	**4,043**	280.50	**1.00**
10-year	**4,664**	280.62	**1.12**
25-year	**5,276**	280.74	**1.24**
50-year	**5,457**	280.77	**1.27**
100-year	**6,110**	280.90	**1.40**

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Park Place North - Pond B
NORTH POND EXTENDED DETENTION CALCULATIONS

Rainfall Depth =	25	mm	
Runoff Depth =	20.67	mm	*from VO3 Model, simulation #7*
Detention Time =	24	hr	

Runoff Volume (m^3) = Area x Runoff Depth
= **7.70 x 20.67**
= **1,592** m^3

Ponding Elevation =	**279.96**	m

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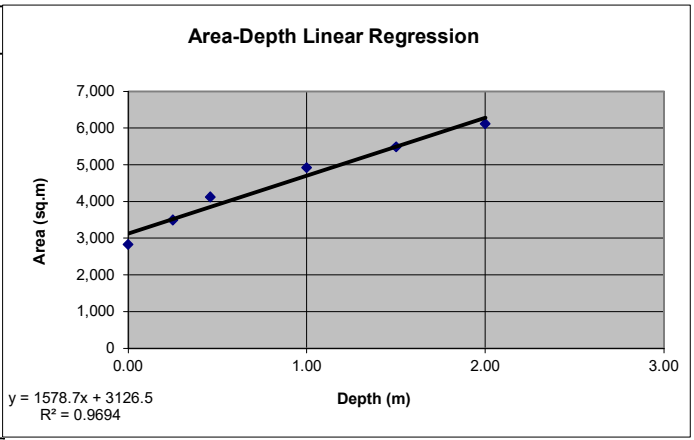
Park Place North - Pond B
NORTH POND EXTENDED DETENTION CALCULATIONS

Elevation (m)	Depth (m)	Area (m^2)
279.50	0.00	2,830
279.75	0.25	3,499
279.96	0.46	4,125
280.50	1.00	4,922
281.00	1.50	5,486
281.50	2.00	6,122



Using Equation 4.11 in MOE *Stormwater Management Planning and Design Manual*

$$t = \frac{0.66 C_2 h^{1.5} + 2 C_3 h^{0.5}}{2.75 Ao}$$

where:

C_2 =	1578.7	
h =	**0.46**	m
C_3 =	3126.5	
Ao =	**0.00950**	m^2
dia. Orifice =	**110**	mm

t = 174778
t = 49

$$Q_{peak} = CA\sqrt{2gh}$$

$$Q_{peak} = (0.62)(0.06306)\sqrt{2(9.81)(0.76)}$$

where:

C =	0.62	
h =	**0.46**	m
Ao =	**0.00950**	m^2
dia. Orifice =	**110**	mm

Q_{peak}= 0.0177

02:999
Park Place North - Pond B
Infiltration Calculations

Infiltration Depth (mm)	5.3
Infiltration Rate (m/hr)	0.2016

Infiltration Calculations			
POND	Area (ha)	Volume (m^3)	Rate (m^3/hr)
Commercial	6.720	356	15
Pond Block	0.980	52	2
B	7.700	408	17

Bottom Area of Trench Required: $A = \frac{1000\,V}{Pn\Delta t}$

Runoff Volume to be Infiltrated (V):	408	m^3
Percolation Rate (P):	201.6	mm/hr
Porosity of Storage Media (n):	0.4	
Retention Time (Δt):	24	hr
Bottom Area of Trench (A):	210.81	m^2

02:999
Park Place North - Pond B
NORTH POND OUTFLOW

Orifice Plates/Tubes	
Diameter (m)	**0.110**
Invert (m)	**279.50**
Sill Elevation (m)	
Sill @	P.Pool
Length (m)	N/A
Coefficient, C	0.62

$$Q = CA\sqrt{2gh}$$

Emergency Overflow	
Invert (m)	281.12
Area (m2)	2.00

*50% Blocked

Storm Event	Volume (m^3)	Elevation (m)	Orifice Plate Flow (m3/s)	Total Orifice Flow (m^3/s)	Overflow 50% Blocked	Total Outflow (m^3/s)
First Flush	**1,592**	**279.96**	0.017	0.017	0.00	0.017
2 Year	**2,287**	**280.12**	0.020	0.020	0.000	0.020
5 Year	**4,043**	**280.50**	0.025	0.025	0.000	0.025
10 Year	**4,664**	**280.62**	0.027	0.027	0.000	0.027
25 Year	**5,276**	**280.74**	0.028	0.028	0.000	0.028
50 Year	**5,457**	**280.77**	0.029	0.029	0.000	0.029
100 Year	**6,110**	**280.90**	0.030	0.030	0.000	0.030
Emergency		281.46	0.00	0.00	3.20	3.20

*Emergency Required Flow is equal the uncontrolled 100-year event as it is greater than both the Inlet Pipe Capacity and the Regional storm event

100 Year Uncontrolled:	2.622 (m^3/s)	(From proposed conditions VO3 model)
Inlet Pipe:	1.146 (m^3/s)	
Regional Uncontrolled Saturated:	1.100 (m^3/s)	

02:999
Park Place North - Pond B
NORTH POND STAGE-STORAGE-DISCHARGE

			OUTLET STRUCTURE(S)			Orifice Tube Flow								
						Emergency Pipe 1 Flow (825mm dia)		Emergency Pipe 2 Flow (1050mm dia)		Emergency DICB Grate Flow				
			Orifice Plate	*Erosion Control Orifice Plate*		Diameter (mm)	838	**Diameter (mm)**	1067	**Length (m)**	2.00			
			Diameter (mm)	*110*	**Total Controlled Flow**	Invert (m)	279.57	**Invert (m)**	279.57	**Width (m)**	2.00			
			Invert (m)	*279.50*		Length (m)	5.00	**Length (m)**	82.60	**Sill Elevation (m)**	281.12	**Total Emergency Flow**	**Total Combined Outflow (m^3/s)**	
			Sill (m)	*279.50*		Area (m2)	0.552	**Area (m2)**	0.894	**Area (m2)**	2.00			
						Coefficient, C	0.891	**Coefficient, C**	0.569	**Coefficient, C**	0.62			
	Elevation (m)	**Active Storage Volume**	**Stormwater Management Facility Outflow (m^3/s)**			**Emergency DICB Pipe 1 Flow (m^3/s)**		**Emergency DICB Pipe 2 Flow (m^3/s)**		**Emergency DICB Grate Flow (m^3/s)**				
Permanent Pool	**279.50**	**0**	0.000		**0.000**	0.000		0.000		0.000		**0.000**	**0.000**	
	279.75	**791**	0.012		**0.012**	0.000		0.000		0.000		**0.000**	**0.012**	
	280.00	**1,759**	0.017		**0.017**	0.000		0.000		0.000		**0.000**	**0.017**	
	280.25	**2,904**	0.022		**0.022**	0.000		0.000		0.000		**0.000**	**0.022**	
	280.50	**4,048**	0.025		**0.025**	0.000		0.000		0.000		**0.000**	**0.025**	
	280.75	**5,349**	0.029		**0.029**	0.000		0.000		0.000		**0.000**	**0.029**	
	281.00	**6,650**	0.031		**0.031**	0.000		0.000		0.000		**0.000**	**0.031**	
	281.10	**7,230**	0.032		**0.032**	0.000		0.000		0.000		**0.000**	**0.032**	
Emergency Overflow DICB Sill	**281.12**	**7,346**	0.033		**0.033**	0.000		0.000		0.000		**0.000**	**0.033**	
	281.20	**7,811**	0.033		**0.033**	2.397		2.359		1.554		**1.554**	**1.587**	
	281.30	**8,391**	0.034		**0.034**	2.494		2.465		2.330		**2.330**	**2.364**	
	281.40	**8,972**	0.035		**0.035**	2.588		2.566		2.906		**2.566**	**2.941**	
	281.46	**9,320**	0.036		**0.036**	2.642		2.624		3.203		**2.624**	**3.239**	
	281.50	**9,552**	0.036		**0.036**	2.678		2.663		3.386		**2.663**	**3.422**	
	281.60	**10,182**	0.037		**0.037**	2.765		2.756		3.805		**2.756**	**3.842**	
	281.70	**10,812**	0.038		**0.038**	2.850		2.847		4.183		**2.847**	**4.221**	
Top of Pond	**281.75**	**11,127**	0.039		**0.039**	2.891		2.891		4.360		**2.891**	**4.399**	

Orfice/Grate Flow Equation: $Q = CA\sqrt{2gh}$

Orifice flow equation is used for the emergency DICB grate as it is submerged when active.

Inlet Pipe Capacity: 1.146 (m^3/s)
100 Year Uncontrolled: 2.622 (m^3/s)
Regional : 1.100 (m^3/s)

= indicates the controlling factor in the emergency outflow structure when the grate is acting as an orifice and the outlet pipes are acting as an orifice tube.

= total area of grate assuming 50% blockage.

02:999
Park Place North - Pond B
Existing vs Proposed Peak Flow Rates at Downstream Flow Node

Storm Event	Pond B Outflow (cms)	Flow at NT2 (cms)	NT2 Target Flow (cms)	Percent Difference (%)
2-year	0.019	0.554	0.557	-0.54
5-year	0.025	1.297	1.334	-2.77
10-year	0.026	1.516	1.756	-13.67
25-year	0.028	2.054	2.158	-4.82
50-year	0.028	2.266	2.383	-4.91
100-year	0.030	2.651	2.882	-8.02

02:999
Park Place North - Pond B
NORTH POND PIPE CAPACITIES

100-Year Water level (m)	**280.90**
Permanent Pool (m)	**279.50**

Pipe	Diameter (mm)	Grade (%)	Upstream Invert (m)	Downstream Invert (m)	Length (m)	Velocity (m/s)	Q_{CAP} (m^3/s)	$Q_{100\text{-}YR}$ (m^3/s)
Reverse Slope	457	**-4.08%**	278.10	279.50	34.3	N/A	0.533	**0.030**
Emergency DICB	838	**0.40%**	279.57	279.55	5.0	1.716	0.946	**0.030**
Outlet Pipe	1067	**0.26%**	279.50	279.28	86.2	1.625	1.453	**0.030**

note: Q_{CAP} for reverse sloped pipe based on orifice flow through a pipe

note: Under emergency conditions, the outfall structure acts as an orifice tube. Refer to Stage Storage Discharge Calculation Sheet.

02:999
Park Place North - Pond B
NORTH POND SEDIMENT ACCUMULATION

Drainage Area	**7.70**	ha
% Impervious	**85%**	

Using Table iii in MOE *Storm Water Management Facility Sediment Maintenance Guide*			
Storage Volume (m^3/ha) for Impervious			
35%	55%	70%	85%
63	**98**	**124**	**150**

Unit Volume (m^3/ha) = $\left(\frac{85\% - 70\%}{85\% - 70\%}\right)(150 - 124) + 124$

= **150** m^3/ha

Minimum Permanent Pool Allowed = **150** m^3/ha X **7.70** ha

= **1,155** m^3

As designed Permanent Pool Volume = **2,349** m^3
Required Permanent Pool Volume = **1,617** m^3
Excess Permanent Pool Volume = **732** m^3

Total Sediment Capacity = **1,194** m^3

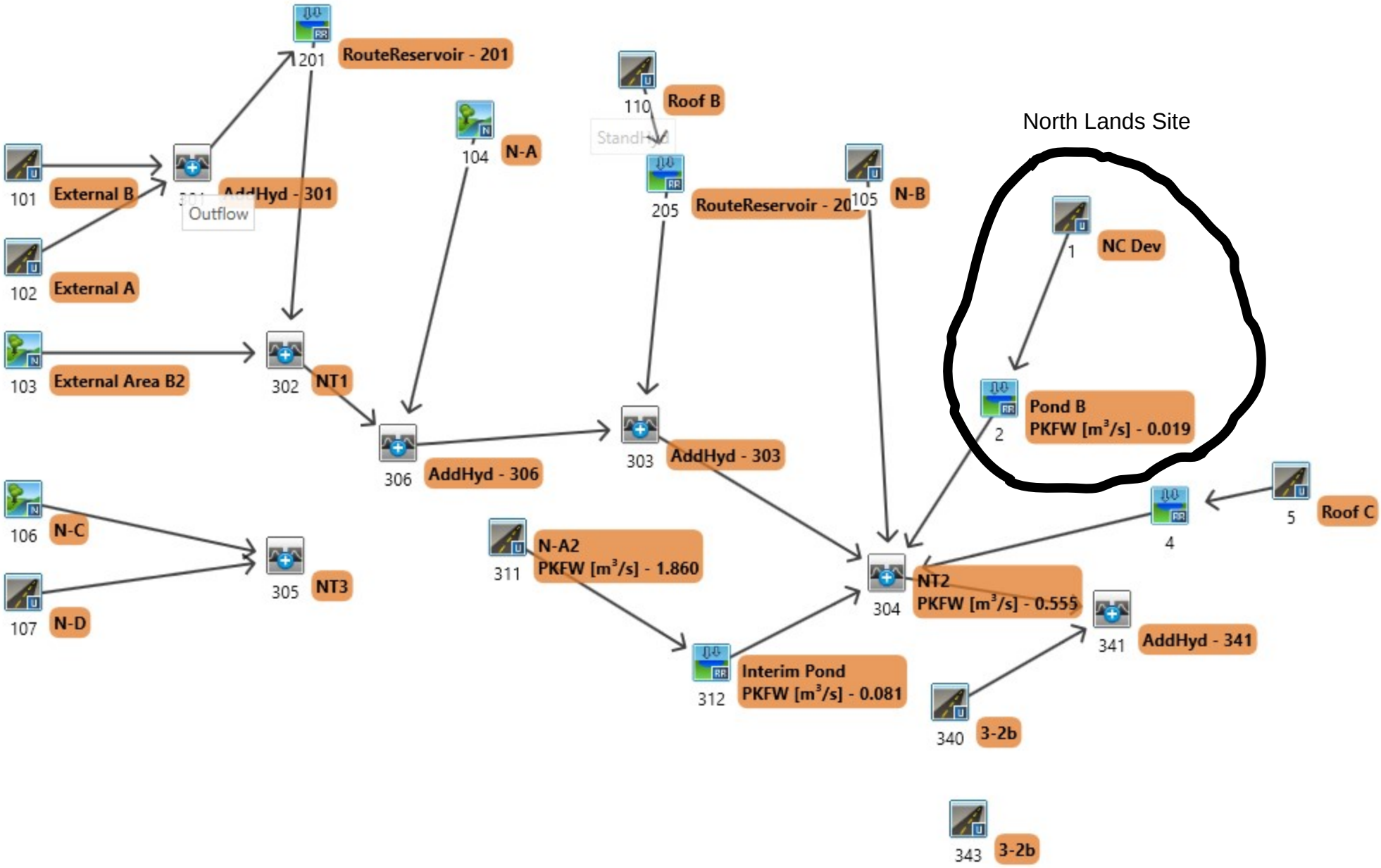
Annual Sediment Accumulation Rate = 2.26 m^3/ha
Annual Sediment Accumulation = **17** m^3

Required Cleanout Frequency = 70 Years

Minimum Cleanout Frequency of **10** Years is Recommended by the Stormwater Management Manual

APPENDIX C

Hydrology Modelling Output


North Lands Site
201
RouteReservoir - 201
110
Roof B
104
N-A
101
External B
Outflow
AddHyd - 301
205
RouteReservoir - 20
105
N-B
102
External A
1
NC Dev
103
External Area B2
302
NT1
2
Pond B
PKFW [m³/s] - 0.019
306
AddHyd - 306
303
AddHyd - 303
5
Roof C
106
N-C
4
311
N-A2
PKFW [m³/s] - 1.860
304
NT2
PKFW [m³/s] - 0.555
305
NT3
341
AddHyd - 341
107
N-D
312
Interim Pond
PKFW [m³/s] - 0.081
340
3-2b
343
3-2b

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       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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  Summary filename:
C:\Users\pcallaghan\AppData\Local\Civica\VH5\2ec0e8d4-75a3-4464-a264-206560201b7e\6
9f4f8be-1f80-4c9f-b064-59777c68fab0\s


DATE: 04/29/2022                          TIME: 11:49:53

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ********************************************
  ** SIMULATION : Run 01                     **
  ********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\pcallaghan\AppD
|                  |              ata\Local\Temp\
```

| | df8f5d1d-0f79-4d0f-9818-d533556f59a9\f269d3dd
| Ptotal= 38.14 mm | Comments: TWO YEAR STORM - FOUR HOUR CHICAGO - BAR

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.30	1.08	9.45	2.08	8.56	3.08	4.50
0.17	3.30	1.17	9.45	2.17	8.56	3.17	4.50
0.25	3.63	1.25	18.56	2.25	7.32	3.25	4.21
0.33	3.63	1.33	18.56	2.33	7.32	3.33	4.21
0.42	4.06	1.42	63.50	2.42	6.42	3.42	3.99
0.50	4.06	1.50	63.50	2.50	6.42	3.50	3.99
0.58	4.62	1.58	23.29	2.58	5.76	3.58	3.76
0.67	4.62	1.67	23.29	2.67	5.76	3.67	3.76
0.75	5.46	1.75	14.05	2.75	5.26	3.75	3.58
0.83	5.46	1.83	14.05	2.83	5.26	3.83	3.58
0.92	6.81	1.92	10.49	2.92	4.85	3.92	3.40
1.00	6.81	2.00	10.49	3.00	4.85	4.00	3.40

CALIB NASHYD (0106)	ID= 1 DT= 1.0 min	Area (ha)= 15.15	Curve Number (CN)= 49.0	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	U.H. Tp(hrs)= 0.20

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21

0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Unit Hyd Qpeak (cms)= 2.893

PEAK FLOW (cms)= 0.116 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 3.691
TOTAL RAINFALL (mm)= 38.138
RUNOFF COEFFICIENT = 0.097

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

CALIB		
STANDHYD (0107)	Area (ha)= 1.53	
ID= 1 DT= 1.0 min	Total Imp(%)= 79.00	Dir. Conn.(%)= 79.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.21	0.32
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	100.86	5.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99

0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	7.02	
over (min)	5.00	5.00	
Storage Coeff. (min)=	3.08 (ii)	4.51 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.30	0.24	
			TOTALS
PEAK FLOW (cms)=	0.20	0.01	0.204 (iii)
TIME TO PEAK (hrs)=	1.50	1.53	1.50
RUNOFF VOLUME (mm)=	37.14	5.31	30.45
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.97	0.14	0.80

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 54.0 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 (0305)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0106):	15.15	0.116	1.75	3.69
	+ ID2= 2 (0107):	1.53	0.204	1.50	30.45
	ID = 3 (0305):	16.68	0.260	1.53	6.14

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB NASHYD (0104)	Area (ha)= 10.79	Curve Number (CN)= 67.0
ID= 1 DT= 1.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.30	

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99

0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Unit Hyd Qpeak (cms)= 1.373

PEAK FLOW (cms)= 0.133 (i)
TIME TO PEAK (hrs)= 1.900
RUNOFF VOLUME (mm)= 6.940
TOTAL RAINFALL (mm)= 38.138
RUNOFF COEFFICIENT = 0.182

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

CALIB					
NASHYD (0103)	Area (ha)=	13.00	Curve Number (CN)=	74.0	
ID= 1 DT= 1.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	1.19			

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76

0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Unit Hyd Qpeak (cms)= 0.417

PEAK FLOW (cms)= 0.100 (i)
TIME TO PEAK (hrs)= 3.367
RUNOFF VOLUME (mm)= 8.973
TOTAL RAINFALL (mm)= 38.138
RUNOFF COEFFICIENT = 0.235

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

CALIB	
STANDHYD (0102)	Area (ha)= 9.37
ID= 1 DT= 1.0 min	Total Imp(%)= 72.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	6.75	2.62
Dep. Storage	(mm)=	1.50	1.50
Average Slope	(%)=	0.86	0.86
Length	(m)=	506.00	506.00
Mannings n	=	0.013	0.040

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58

0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	18.16	
over (min)	8.00	36.00	
Storage Coeff. (min)=	8.48 (ii)	35.94 (ii)	
Unit Hyd. Tpeak (min)=	8.00	36.00	
Unit Hyd. peak (cms)=	0.14	0.03	
			TOTALS
PEAK FLOW (cms)=	0.58	0.07	0.594 (iii)
TIME TO PEAK (hrs)=	1.57	2.17	1.57
RUNOFF VOLUME (mm)=	36.64	11.17	23.91
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.96	0.29	0.63

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 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.

CALIB	
STANDHYD (0101)	Area (ha)= 27.50
ID= 1 DT= 1.0 min	Total Imp(%)= 80.00 Dir. Conn.(%)= 50.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	22.00	5.50
Dep. Storage	(mm)=	1.50	1.50
Average Slope	(%)=	1.10	1.10
Length	(m)=	995.00	995.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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

0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58

0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	54.22	21.61	
over (min)	13.00	120.00	
Storage Coeff. (min)=	12.59 (ii)	119.77 (ii)	
Unit Hyd. Tpeak (min)=	13.00	120.00	
Unit Hyd. peak (cms)=	0.09	0.01	
			TOTALS
PEAK FLOW (cms)=	1.40	0.13	1.408 (iii)
TIME TO PEAK (hrs)=	1.65	3.85	1.65
RUNOFF VOLUME (mm)=	36.64	14.11	25.38
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.96	0.37	0.67

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 62.0 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 (0301)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0101):	27.50	1.408	1.65	25.38
+	ID2= 2 (0102):	9.37	0.594	1.57	23.91
	ID = 3 (0301):	36.87	1.947	1.62	25.00

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0201)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 1.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.2410	0.8929
	0.0070	0.0006	0.2750	1.3411

```
                          0.0190     0.0119   |   0.2880      1.5968
                          0.0350     0.0537   |   0.3560      1.9486
                          0.0520     0.1270   |   1.3590      2.5363
                          0.0970     0.4853   |   3.7440      3.1509
                          0.2180     0.6417   |   0.0000      0.0000

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0301)     36.870      1.947      1.62      25.00
   OUTFLOW: ID= 1 (  0201)     36.870      0.218      4.30      24.83

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.19
                  TIME SHIFT OF PEAK FLOW         (min)=161.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.6415

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--------------------
| ADD HYD  (  0302)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0103):    13.00   0.100     3.37     8.97
      + ID2= 2 (  0201):    36.87   0.218     4.30    24.83
        ================================================
        ID = 3 (  0302):    49.87   0.307     4.15    20.70

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

--------------------
| ADD HYD  (  0306)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0104):    10.79   0.133     1.90     6.94
      + ID2= 2 (  0302):    49.87   0.307     4.15    20.70
        ================================================
        ID = 3 (  0306):    60.66   0.347     4.03    18.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0110)|   Area    (ha)=   6.19
|ID= 1 DT= 1.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.13         0.06
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       0.50         2.00
     Length            (m)=     203.14        40.00
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Mannings n = 0.013 0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58

0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	11.85	
over (min)	6.00	8.00	
Storage Coeff. (min)=	5.77 (ii)	7.12 (ii)	
Unit Hyd. Tpeak (min)=	6.00	8.00	
Unit Hyd. peak (cms)=	0.19	0.15	
			TOTALS
PEAK FLOW (cms)=	0.87	0.00	0.874 (iii)
TIME TO PEAK (hrs)=	1.53	1.58	1.53
RUNOFF VOLUME (mm)=	37.14	8.60	36.85
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.97	0.23	0.97

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 68.0 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(0205)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 1.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1240	0.4776

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0110)	6.190	0.874	1.53	36.85
OUTFLOW: ID= 1 (0205)	6.190	0.048	4.07	34.89

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.50
TIME SHIFT OF PEAK FLOW (min)=152.00
MAXIMUM STORAGE USED (ha.m.)= 0.1853

ADD HYD (0303)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0205):	6.19	0.048	4.07	34.89
	+ ID2= 2 (0306):	60.66	0.347	4.03	18.25
	ID = 3 (0303):	66.85	0.395	4.03	19.79

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0105)	Area (ha)= 2.58
ID= 1 DT= 1.0 min	Total Imp(%)= 70.00 Dir. Conn.(%)= 70.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.80	0.77
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	131.07	5.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21

0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	7.02
over (min)	5.00	6.00
Storage Coeff. (min)=	3.60 (ii)	5.34 (ii)

Unit Hyd. Tpeak (min)=	5.00	6.00	
Unit Hyd. peak (cms)=	0.28	0.20	
			TOTALS
PEAK FLOW (cms)=	0.29	0.01	0.302 (iii)
TIME TO PEAK (hrs)=	1.52	1.55	1.52
RUNOFF VOLUME (mm)=	37.14	5.31	27.59
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.97	0.14	0.72

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 54.0 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.

CALIB
STANDHYD (0311)
ID= 1 DT= 1.0 min

Area (ha)= 15.68
Total Imp(%)= 84.00 Dir. Conn.(%)= 83.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	13.17	2.51
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	323.32	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21

0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	13.33
over (min)	6.00	11.00
Storage Coeff. (min)=	6.19 (ii)	10.58 (ii)
Unit Hyd. Tpeak (min)=	6.00	11.00

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     Unit Hyd. peak  (cms)=       0.18         0.11
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.82         0.06          1.860 (iii)
     TIME TO PEAK    (hrs)=       1.53         1.65           1.53
     RUNOFF VOLUME    (mm)=      37.14         9.04          32.36
     TOTAL RAINFALL   (mm)=      38.14        38.14          38.14
     RUNOFF COEFFICIENT   =       0.97         0.24           0.85


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  68.0    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(  0312)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  1.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                           0.0040     0.0000   |   0.4350      0.6452
                           0.0320     0.0808   |   0.4470      0.6609
                           0.0530     0.1727   |   0.4600      0.6725
                           0.0670     0.2860   |   0.7260      0.7015
                           0.0790     0.3993   |   0.9920      0.7363
                           0.0830     0.4464   |   1.0140      0.7769
                           0.3690     0.5301   |   1.1050      0.9508
                           0.4190     0.5720   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0311)     15.680      1.860      1.53      32.36
   OUTFLOW: ID= 1 (  0312)     15.680      0.081      4.10      31.85

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.37
                    TIME SHIFT OF PEAK FLOW         (min)=154.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.4270

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--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   7.70
|ID= 1 DT= 5.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  85.00
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                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       6.55         1.15
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
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     Length            (m)=     226.57        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      63.50         4.35
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       5.00 (ii)    9.23 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.21         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       1.04         0.01          1.048 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.58           1.50
     RUNOFF VOLUME    (mm)=      37.14         3.69          32.12
     TOTAL RAINFALL   (mm)=      38.14        38.14          38.14
     RUNOFF COEFFICIENT   =       0.97         0.10           0.84


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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(  0002)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
     **** WARNING : FIRST OUTFLOW IS NOT ZERO.
                           0.0120     0.0791   |   0.0290      0.5349
                           0.0170     0.1759   |   0.0310      0.6650
                           0.0220     0.2904   |   0.0320      0.7230
                           0.0250     0.4048   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0001)      7.700      1.048      1.50       32.12
   OUTFLOW: ID= 1 (  0002)      7.700      0.019      4.08       31.90

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.84
                    TIME SHIFT OF PEAK FLOW         (min)=155.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.2287

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--------------------
| CALIB            |
| STANDHYD (  0005)|   Area    (ha)=   6.19
|ID= 1 DT= 1.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
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                               IMPERVIOUS    PERVIOUS (i)
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Surface Area	(ha)=	6.13	0.06
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	0.50	2.00
Length	(m)=	203.14	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76

0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	11.85	
over (min)	6.00	8.00	
Storage Coeff. (min)=	5.77 (ii)	7.12 (ii)	
Unit Hyd. Tpeak (min)=	6.00	8.00	
Unit Hyd. peak (cms)=	0.19	0.15	
			TOTALS
PEAK FLOW (cms)=	0.87	0.00	0.874 (iii)
TIME TO PEAK (hrs)=	1.53	1.58	1.53
RUNOFF VOLUME (mm)=	37.14	8.60	36.85
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.97	0.23	0.97

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 68.0 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(0004)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.1018	0.4882

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                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0005)      6.190      0.874      1.53      36.85
   OUTFLOW: ID= 1 (  0004)      6.190      0.040      4.08      33.36

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.60
                  TIME SHIFT OF PEAK FLOW         (min)=153.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.1927

     **** WARNING : SELECTED ROUTING TIME STEP DENIED.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0304)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0105):     2.58   0.302     1.52    27.59
      + ID2= 2 (  0002):     7.70   0.019     4.08    31.90
        ================================================
        ID = 3 (  0304):    10.28   0.314     1.52    24.20

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

--------------------
| ADD HYD  (  0304)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0304):    10.28   0.314     1.52    24.20
      + ID2= 2 (  0303):    66.85   0.395     4.03    19.79
        ================================================
        ID = 1 (  0304):    77.12   0.434     4.00    20.38

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

--------------------
| ADD HYD  (  0304)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0304):    77.12   0.434     4.00    20.38
      + ID2= 2 (  0312):    15.68   0.081     4.10    31.85
        ================================================
        ID = 3 (  0304):    92.81   0.515     4.00    22.32

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

--------------------
| ADD HYD  (  0304)|
```

3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0304):	92.81	0.515	4.00	22.32
+ ID2= 2 (0004):	6.19	0.040	4.08	33.36
ID = 1 (0304):	99.00	0.555	4.00	23.01

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB STANDHYD (0340) ID= 1 DT= 1.0 min	Area (ha)= 33.00 Total Imp(%)= 90.00 Dir. Conn.(%)= 60.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	29.70	3.30
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	2.50	2.00
Length	(m)=	469.04	470.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 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
0.017	3.30	1.017	9.45	2.017	8.56	3.02	4.50
0.033	3.30	1.033	9.45	2.033	8.56	3.03	4.50
0.050	3.30	1.050	9.45	2.050	8.56	3.05	4.50
0.067	3.30	1.067	9.45	2.067	8.56	3.07	4.50
0.083	3.30	1.083	9.45	2.083	8.56	3.08	4.50
0.100	3.30	1.100	9.45	2.100	8.56	3.10	4.50
0.117	3.30	1.117	9.45	2.117	8.56	3.12	4.50
0.133	3.30	1.133	9.45	2.133	8.56	3.13	4.50
0.150	3.30	1.150	9.45	2.150	8.56	3.15	4.50
0.167	3.30	1.167	9.45	2.167	8.56	3.17	4.50
0.183	3.63	1.183	18.56	2.183	7.32	3.18	4.21
0.200	3.63	1.200	18.56	2.200	7.32	3.20	4.21
0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99

0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)=	63.50	39.32	
over (min)	6.00	51.00	
Storage Coeff. (min)=	5.88 (ii)	50.84 (ii)	
Unit Hyd. Tpeak (min)=	6.00	51.00	
Unit Hyd. peak (cms)=	0.19	0.02	
			TOTALS
PEAK FLOW (cms)=	2.81	0.20	2.835 (iii)
TIME TO PEAK (hrs)=	1.53	2.45	1.53
RUNOFF VOLUME (mm)=	37.14	13.73	27.77
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.97	0.36	0.73

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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  (  0341)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0304):    99.00   0.555     4.00    23.01
      + ID2= 2 (  0340):    33.00   2.835     1.53    27.77
        ================================================
        ID = 3 (  0341):   131.99   3.329     1.53    24.20

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0343)|   Area    (ha)=  33.00
|ID= 1 DT= 1.0 min |   Total Imp(%)=  90.00   Dir. Conn.(%)=  60.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      29.70         3.30
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       2.50         2.00
     Length            (m)=     469.04       100.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   1.0 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
     0.017    3.30 | 1.017    9.45 | 2.017    8.56 |  3.02    4.50
     0.033    3.30 | 1.033    9.45 | 2.033    8.56 |  3.03    4.50
     0.050    3.30 | 1.050    9.45 | 2.050    8.56 |  3.05    4.50
     0.067    3.30 | 1.067    9.45 | 2.067    8.56 |  3.07    4.50
     0.083    3.30 | 1.083    9.45 | 2.083    8.56 |  3.08    4.50
     0.100    3.30 | 1.100    9.45 | 2.100    8.56 |  3.10    4.50
     0.117    3.30 | 1.117    9.45 | 2.117    8.56 |  3.12    4.50
     0.133    3.30 | 1.133    9.45 | 2.133    8.56 |  3.13    4.50
     0.150    3.30 | 1.150    9.45 | 2.150    8.56 |  3.15    4.50
     0.167    3.30 | 1.167    9.45 | 2.167    8.56 |  3.17    4.50
     0.183    3.63 | 1.183   18.56 | 2.183    7.32 |  3.18    4.21
     0.200    3.63 | 1.200   18.56 | 2.200    7.32 |  3.20    4.21
```

0.217	3.63	1.217	18.56	2.217	7.32	3.22	4.21
0.233	3.63	1.233	18.56	2.233	7.32	3.23	4.21
0.250	3.63	1.250	18.56	2.250	7.32	3.25	4.21
0.267	3.63	1.267	18.56	2.267	7.32	3.27	4.21
0.283	3.63	1.283	18.56	2.283	7.32	3.28	4.21
0.300	3.63	1.300	18.56	2.300	7.32	3.30	4.21
0.317	3.63	1.317	18.56	2.317	7.32	3.32	4.21
0.333	3.63	1.333	18.56	2.333	7.32	3.33	4.21
0.350	4.06	1.350	63.50	2.350	6.42	3.35	3.99
0.367	4.06	1.367	63.50	2.367	6.42	3.37	3.99
0.383	4.06	1.383	63.50	2.383	6.42	3.38	3.99
0.400	4.06	1.400	63.50	2.400	6.42	3.40	3.99
0.417	4.06	1.417	63.50	2.417	6.42	3.42	3.99
0.433	4.06	1.433	63.50	2.433	6.42	3.43	3.99
0.450	4.06	1.450	63.50	2.450	6.42	3.45	3.99
0.467	4.06	1.467	63.50	2.467	6.42	3.47	3.99
0.483	4.06	1.483	63.50	2.483	6.42	3.48	3.99
0.500	4.06	1.500	63.50	2.500	6.42	3.50	3.99
0.517	4.62	1.517	23.29	2.517	5.76	3.52	3.76
0.533	4.62	1.533	23.29	2.533	5.76	3.53	3.76
0.550	4.62	1.550	23.29	2.550	5.76	3.55	3.76
0.567	4.62	1.567	23.29	2.567	5.76	3.57	3.76
0.583	4.62	1.583	23.29	2.583	5.76	3.58	3.76
0.600	4.62	1.600	23.29	2.600	5.76	3.60	3.76
0.617	4.62	1.617	23.29	2.617	5.76	3.62	3.76
0.633	4.62	1.633	23.29	2.633	5.76	3.63	3.76
0.650	4.62	1.650	23.29	2.650	5.76	3.65	3.76
0.667	4.62	1.667	23.29	2.667	5.76	3.67	3.76
0.683	5.46	1.683	14.05	2.683	5.26	3.68	3.58
0.700	5.46	1.700	14.05	2.700	5.26	3.70	3.58
0.717	5.46	1.717	14.05	2.717	5.26	3.72	3.58
0.733	5.46	1.733	14.05	2.733	5.26	3.73	3.58
0.750	5.46	1.750	14.05	2.750	5.26	3.75	3.58
0.767	5.46	1.767	14.05	2.767	5.26	3.77	3.58
0.783	5.46	1.783	14.05	2.783	5.26	3.78	3.58
0.800	5.46	1.800	14.05	2.800	5.26	3.80	3.58
0.817	5.46	1.817	14.05	2.817	5.26	3.82	3.58
0.833	5.46	1.833	14.05	2.833	5.26	3.83	3.58
0.850	6.81	1.850	10.49	2.850	4.85	3.85	3.40
0.867	6.81	1.867	10.49	2.867	4.85	3.87	3.40
0.883	6.81	1.883	10.49	2.883	4.85	3.88	3.40
0.900	6.81	1.900	10.49	2.900	4.85	3.90	3.40
0.917	6.81	1.917	10.49	2.917	4.85	3.92	3.40
0.933	6.81	1.933	10.49	2.933	4.85	3.93	3.40
0.950	6.81	1.950	10.49	2.950	4.85	3.95	3.40
0.967	6.81	1.967	10.49	2.967	4.85	3.97	3.40
0.983	6.81	1.983	10.49	2.983	4.85	3.98	3.40
1.000	6.81	2.000	10.49	3.000	4.85	4.00	3.40

Max.Eff.Inten.(mm/hr)= 63.50 139.18

over (min)	6.00	14.00	
Storage Coeff. (min)=	5.88 (ii)	13.05 (ii)	
Unit Hyd. Tpeak (min)=	6.00	14.00	
Unit Hyd. peak (cms)=	0.19	0.08	
			TOTALS
PEAK FLOW (cms)=	2.81	0.71	3.268 (iii)
TIME TO PEAK (hrs)=	1.53	1.70	1.55
RUNOFF VOLUME (mm)=	37.14	21.51	30.89
TOTAL RAINFALL (mm)=	38.14	38.14	38.14
RUNOFF COEFFICIENT =	0.97	0.56	0.81

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 69.0 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.

APPENDIX D

Erosion and Sediment Control Calculations

02:999
Park Place North Lands
SEDIMENT POND B
Stage-Storage

FOREBAY PERMANENT POOL					
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Volume (m^3)**	**Total Volume (m^3)**
277.5		**117**			**0**
	0.50		154	77	
278.00		190			77
	0.50		254	127	
278.50		318			204
	0.50		393	196	
279.00		467			400
	0.25		557	139	
279.25		646			539
	0.25		773	193	
279.50		899			**732**

MAIN CELL PERMANENT POOL					
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Volume (m^3)**	**Total Volume (m^3)**
277.5		**296**			0
	0.50		398	199	
278.00		500			199
	0.50		619	309	
278.50		737			508
	0.50		863	432	
279.00		989			940
	0.25		1,167	292	
279.25		1,344			1,231
	0.25		1,532	383	
279.50		1,720			1,614
				TOTAL PERMANENT POOL	**2,347**

ACTIVE VOLUMES					
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Volume (m^3)**	**Total Volume (m^3)**
279.5		2,830			**0**
	0.25		3,165	791	
279.75		3,499			791
	0.25		3,866	966	
280.00		4,232			1,758
	0.50		4,577	2,289	
280.50		4,922			4,046
	0.50		5,204	2,602	
281.00		5,486			6,648
	0.50		5,804	2,902	
281.50		6,122			9,550
	0.25		6,298	1,575	
281.75		6,474			11,125
				TOTAL ACTIVE STORAGE	**11,125**

Quality/Erosion Control Orifice Sizing			
7.7	ha	Drainage Area	
1,425	m^3	Permanent Pool Volume Required	=Area x 185 m^3/ha
963	m^3	Extended Detention Volume Required	=Area x 125 m^3/ha
2,387	m^3	Total Volume Required	
279.79	m	First Flush Elevation	
3,629	m^2	Area at First Flush Elevation	
35	hours	Extended Detention Drawdown Time	
0.004	m^2	Orifice Area	$A_O = \frac{2A_P}{Ct(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$
75	mm	Orifice Diameter	
0.003	m^3/s	Quality control peak flow	

APPENDIX E

Excerpts from Previous Studies

5.0 STORMWATER MANAGEMENT CRITERIA

The stormwater management criterion for the subject site was determined as a combination of site-specific constraints and criterion established by the Lake Simcoe Region Conservation Authority and/or the City of Barrie. The overall criterion for the design of the stormwater management system is outlined in the following sections.

5.1 Water Quality Control

Based on downstream aquatic habitat, on-site water quality controls must be provided, which satisfy enhanced protection level (formerly level 1) constraints as outlined in the Ministry of Environment Stormwater Management Planning and Design Manual (March 2003).

5.2 Erosion Control

The minimum Lake Simcoe Region Conservation Authority requirements state that the runoff generated by a 25mm storm be discharged over a 24-hour period. However, the Conservation Authority has identified that the south tributary of Lovers Creek is subject to erosion and an appropriate hydrologic model should be developed to assess downstream erosion potential and any necessary mitigation practices.

5.3 Water Balance

In order to maintain the recharge characteristics of this area, appropriate stormwater management works must be provided to maintain the annual pre-development water balance under post development conditions.

5.4 Water Quantity Control

The Lake Simcoe Region Conservation Authority requires that post development flows be controlled to pre-development levels for all storms up to, and including the 100 year storm event.

6.0 STORMWATER MANAGEMENT STRATEGY

6.1 Pre-development Hydrology

Existing Conditions
Quantity Targets

Using the Visual OTTHYMO hydrologic computer model, pre-development hydrographs were generated for both the north and south tributary of Lovers Creek through and downstream of the subject site.

As shown in Figure 4 (back pocket), the south tributary model includes a portion of the Barrie View Subdivision external area from west of Highway 400, the contributing area from the subject site, Bayview Drive, the existing Molson Centre and associated parking lots plus, a small portion of the South Barrie Business Park (external to the site outlet). Existing approved hydrologic models and associated stormwater management pond curves for the external areas and Molson Centre parking lots were input directly to the model. The pre-development hydrographs for the subject lands were generated utilizing the NASHYD command. Design parameters and supporting calculations for each of these areas plus a VO2 model schematic are provided in Appendix 'A'. City of Barrie 24-hour SCS and 4-hour Chicago rainfall distributions were input into the model and hydrographs were generated at the flow reporting locations shown in Figure 4. The resulting peak flows from each hydrograph are summarized in Table 1.

TABLE 1
Pre-Development Peak Flows
South Tributary

Storm	Peak Flow (m^3/sec)	
	24-hour SCS	4-hour Chicago
LOCATION ST-1		
2 Year	0.145	0.156
5 Year	0.180	0.264
10 Year	0.234	0.406
25 Year	0.346	0.564
50 Year	0.520	0.619
100 Year	0.684	0.770
LOCATION ST-2		
2 Year	0.704	0.525
5 Year	1.224	1.038
10 Year	1.627	1.354
25 Year	2.034	1.659
50 Year	2.415	1.863
100 Year	2.856	2.240
LOCATION ST-3		
2 Year	1.522	1.381
5 Year	2.187	2.952
10 Year	2.709	4.088
25 Year	3.843	5.293
50 Year	5.008	5.646
100 Year	6.296	6.619
LOCATION ST-4		
2 Year	0.148	0.143
5 Year	0.247	0.276
10 Year	0.320	0.338
25 Year	0.399	0.421
50 Year	0.486	0.455
100 Year	0.577	0.547
LOCATION ST-5		
2 Year	1.641	1.498
5 Year	2.361	3.227
10 Year	2.940	4.426
25 Year	4.242	5.712
50 Year	5.486	6.099
100 Year	6.865	7.164

As shown in Figure 4, the north tributary model includes a portion of the Barrie View Subdivision external area from west of Highway 400, the contributing area from the subject site and Bayview Drive. The north tributary outlets from the subject site at flow

reporting location NT-2. The north tributary model also includes the subject lands north of the north tributary which outlet at Big Bay Point Road via the storm sewer on Bayview Drive. These lands ultimately outlet to the north tributary further east through the Big Bay Point Road storm drainage system. The flow reporting location for these lands is identified as NT-3 and is considered in the stormwater management assessment.

There are also two (2) small drainage areas within the subject property east of Bayview Drive which ultimately outlet to the north tributary. As shown in Figure 4, there is a 1.2 hectare area immediately south of Churchill Drive and east of Bayview Drive which is tributary to the Churchill Drive roadside ditch. Drainage from this area contributes to the north tributary via the downstream roadside ditch system. The flow reporting location for these lands is identified as NT-4.

Immediately to the east and south of the above noted area is a 3.8 hectare drainage area which outlets to an existing industrial lot fronting onto Welham Road at the east limit of the study area. This existing lot is within the north tributary watershed area, however, a field reconnaissance identified that the existing lot exhibited poor drainage characteristics. These poor drainage characteristics would result in trapped drainage within the lot. The flow reporting location for these lands is identified as NT-5.

Similar to the south tributary model, the existing approved hydrologic models and associated stormwater management pond curves for the external lands were input directly into the model. The pre-development hydrographs for the subject lands were generated utilizing the NASHYD command and the design parameters and supporting calculations for these areas are summarized in Appendix 'A'. The resulting peak flows for the 24-hour SCS and 4-hour Chicago rainfall distributions at each flow reporting location are summarized in Table 2.

TABLE 2
Pre-Development Peak Flows
North Tributary

Storm	Peak Flow (m^3/sec)	
	24-hour SCS	4-hour Chicago
LOCATION NT-1		
2 Year	0.274	0.307
5 Year	0.467	0.518
10 Year	0.573	0.608
25 Year	0.687	0.703
50 Year	0.798	0.745
100 Year	1.054	1.056
LOCATION NT-2		
2 Year	0.804	0.557
5 Year	1.572	1.334
10 Year	2.205	1.756
25 Year	2.776	2.158
50 Year	3.359	2.383
100 Year	3.974	2.882
LOCATION NT-3 (Big Bay Point Road)		
2 Year	0.350	0.260
5 Year	0.635	0.483
10 Year	0.859	0.620
25 Year	1.070	0.733
50 Year	1.305	0.831
100 Year	1.557	1.015
LOCATION NT-4		
2 Year	0.005	0.004
5 Year	0.010	0.011
10 Year	0.015	0.015
25 Year	0.020	0.020
50 Year	0.025	0.021
100 Year	0.031	0.026
LOCATION NT-5		
2 Year	0.011	0.011
5 Year	0.024	0.031
10 Year	0.035	0.040
25 Year	0.048	0.051
50 Year	0.060	0.054
100 Year	0.074	0.066

Flows generated for the 24 hour SCS and the 4 hour Chicago storms utilized a 5 minute and 1 minute time step respectively. These time steps were utilized to help eliminate

storage coefficient warnings generated by the VO2 model. A copy of the pre-development hydrologic model input and output files are included on the enclosed CD.

Establishment that the 4 hour Chicago distribution should be used for pond design.

6.2 Design Storm Sensitivity Analysis

As shown in Tables 1 and 2 in the previous section, the 4-hour Chicago design storm generated flows that were consistently lower than those generated by the 24-hour SCS design storm. In order to determine which design storm to use, a "typical" development area, utilizing the coverage shown in the development concept, was modeled to determine, which storm would generate the largest required stormwater management facility volumes.

Assuming 100 year storm conditions, the Chicago storm generated a required storage volume, which was approximately twenty (20) percent greater than the volume generated by the SCS storm. Therefore, the 4-hour Chicago rainfall distribution was utilized for the stormwater management analysis.

6.3 Overall Stormwater Management Strategy

With the development of a commercial/industrial site of this size, it is often difficult to incorporate source or conveyance controls. However, the requirement to provide a water balance between post development and pre-development conditions has resulted in the proposal of a less conventional storm drainage/stormwater management system.

The water balance will be maintained by two (2) separate and unique systems. Firstly, all drainage from the rooftops will be controlled and collected by a separate storm system. The conveyance system will be perforated and will release controlled flows into the ground water regime. This will account for approximately thirty (30) percent of the yearly pre-development infiltration volume. Secondly, the remaining seventy (70) percent of the yearly pre-development infiltration volume will be provided by protected open space and dedicated infiltration facilities. The flow reaching the infiltration facilities will be pretreated by a water quality facility designed to provide an enhanced (formerly

Level 1) level of protection. Each pretreatment facility will also provide erosion control and water quantity controls. The details of each system operation are provided in the following sections.

As shown in Figure 5 (back pocket), stormwater management facilities will be constructed in two (2) separate locations to provide the necessary levels of control. Each facility will consist of a wet detention pond with an infiltration facility attached.

Pond A (south) will provide controls for the southern portion of the parking areas south of the north tributary to Lovers Creek and west of Bayview Drive, a 12.1 hectare external area from west of Highway 400 plus all of the lands east of Bayview Drive, south of Churchill Drive including the small areas which are currently within the north tributary drainage area and both of the Molson Centre expanded parking lots. The existing Molson Centre parking lot expansions are currently serviced by two (2) separate dry stormwater management ponds. These ponds will be replaced by the wet pond/infiltration capabilities of Pond A. The outlet from this facility will be directed to the south tributary of Lovers Creek via the existing outfall channel servicing the stormwater management pond for the south Molson Centre parking lot expansion.

The rooftop flows from the development area west of Bayview Drive will discharge to a perforated storm sewer system with two (2) different outlets. The perforated storm sewers servicing the bulk of this area will flow north and outlet to the north tributary. A small area of rooftops immediately north of Mapleview Drive will discharge to a perforated storm sewer which flows east and outlets to the south tributary of Lovers Creek.

Pond B (north) will provide controls for the remainder of the parking areas south of the north tributary and west of Bayview Drive plus the lands north of the north tributary. Due to grading constraints, the drainage area north of the north tributary will be split into two (2) sub-areas. For the bulk of this area the controlled rooftop flows discharge to a perforated storm sewer system, which outlets to the north tributary of Lovers Creek. The parking lot flows from this area discharge to pond B, which also outlets to the north tributary.

Rooftop and parking lot flows from an area immediately south of Big Bay Point Road will be controlled on-site through rooftop and parking lot controls and discharge to the existing sewer on Bayview Drive. Water quality control for this small area will be provided by an oil/grit separator (Stormscepter or equal).

Post development drainage areas to each tributary are summarized in a table included in Figure 5.

6.4 Water Balance

Determination of the required infiltration volumes.

6.4.1 General

The overall water balance for the entire site was calculated as part of a detailed soils investigation completed by Terraprobe. The water balance was completed on the average 10 year annual total rainfall from Environment Canada's Midhurst, Ontario station. Details and assumptions for the analysis are provided in the Terraprobe report.

Based on the Terraprobe evaluation, the average annual pre-development infiltration volume was calculated to be 193,305 cubic metres. Based on the requirement to match the average annual pre-development infiltration under post development conditions, the pre-development volume will be provided by a combination of infiltration from the rooftops, open space and central facilities. Assuming the coverage shown in the development concept, the required infiltration volumes are summarized in Table 3.

TABLE 3

Required Annual Infiltration Volumes

Coverage	Area (ha)	Annual Infiltration Volume (m^3)
Rooftops	13.4	63,181
Open Space	9.3	22,785
Parking Lots (Central Facilities)	50.8	107,339
	Total	193,305

A summary of the mass balance infiltration data as calculated by Terraprobe is enclosed in Appendix 'B'.

6.4.2 Rooftop Controls

As shown in section 6.4.1, the rooftops will provide approximately thirty percent (30%) of the required average annual infiltration volume. In order to discharge the rooftop runoff to the perforated storm sewer over an elongated period of time, it is proposed to implement rooftop runoff controls. Based on the provision of one (1) roof drain per 930 m^2 (10,000 ft^2) of roof and one (1) control weir per drain, rooftop controls will control the unit release rate to less than 20 *l*/sec/ha under 100 year storm conditions. This assumption was supported by the review of discharge rates for similar commercial/retail buildings in various municipalities. Table 4 provides a summary of that review.

TABLE 4

Controlled Rooftop Flow Rates

Municipality	Roof Area (ha)	Number of Roof Drains	100 Year Storm Controlled Flow (*l*/sec)	Unit Flow Contact (*l*/sec/ha)
Brampton	1.09	20	15.22	13.96
Kingston	0.91	18	11.52	12.66
Barrie	1.00	23	16.90	16.90
Collingwood	0.48	6	4.48	9.33
Sudbury	0.44	8	5.97	13.56

Therefore, based on the results shown in Table 4, it was assumed that the implementation of rooftop controls would control the unit release rate to 20 *l*/sec/ha of roof under 100 year storm conditions. The City of Barrie has also requested that the control rooftop flows be accounted for in the design of the central water quantity facilities by assuming that these flows do not infiltrate and are released to the downstream watercourse.

Establishment of 5.3mm of runoff as the target for parking lots.

6.4.3 Infiltration Facilities

The design of infiltration facilities is based on the required infiltration volume capacity per event, hydraulic conductivity of the soil and the resultant surface contact area.

In order to determine the required infiltration volume capacity per event, the 10 years of rainfall data was reviewed and recorded into the number of events within ranges of rainfall depth. The average number of events over the ten (10) year period within the selected rainfall depth range are summarized in Table 5.

TABLE 5

Average Number of Rainfall Events

Rainfall Depth Range (mm)	10 Year Average Total Number of Events/Year
<5	35
<6	40
<7	43
<8	47
<9	49
<10	51

Of note, it was calculated that the 10-year average total number of yearly rainfall events was seventy seven (77).

Based on the average number of rainfall events presented in Table 4, the required unit runoff volume available for infiltration per event was calculated as follows:

- Total yearly volume of infiltration required from parking lots. $107,339m^3$
- Assuming 40 rainfall events per year (< 6mm rain).
  Required infiltration volume per event. $2,683m^3$
- For 50.8 ha of parking lot/stormwater management ponds
  Required unit runoff depth to be infiltrated per event. 5.3mm

The detailed calculations in support of this runoff depth are provided in Appendix 'B'.

The water balance analysis identified that the soils within the study area have a hydraulic conductivity (i.e. infiltration capacity) of 180.0mm/hr. Assuming that the maximum of 5.3mm of runoff volume is provided over a 24-hour period, the infiltration basin contact area was calculated as the runoff volume rate over 24-hours divided by the soil infiltration rate. The infiltration basin contact areas are summarized in Table 6.

TABLE 6

Infiltration Basin Contact Areas

Basin	Parking Lot Drainage Area (ha)	Max. Volume to be Infiltrated (m^3)	Basin Inflow Rate (m^3 /hr)	Basin Contact Area (m^2)
Pond A				
Parking Lot & SWM	23.0	1220		
External	12.1	643		
Molson Parking Lot	7.0	371		
Total		2234	93	475
Pond B				
Parking Lot & SWM	26.6	1410	59	291

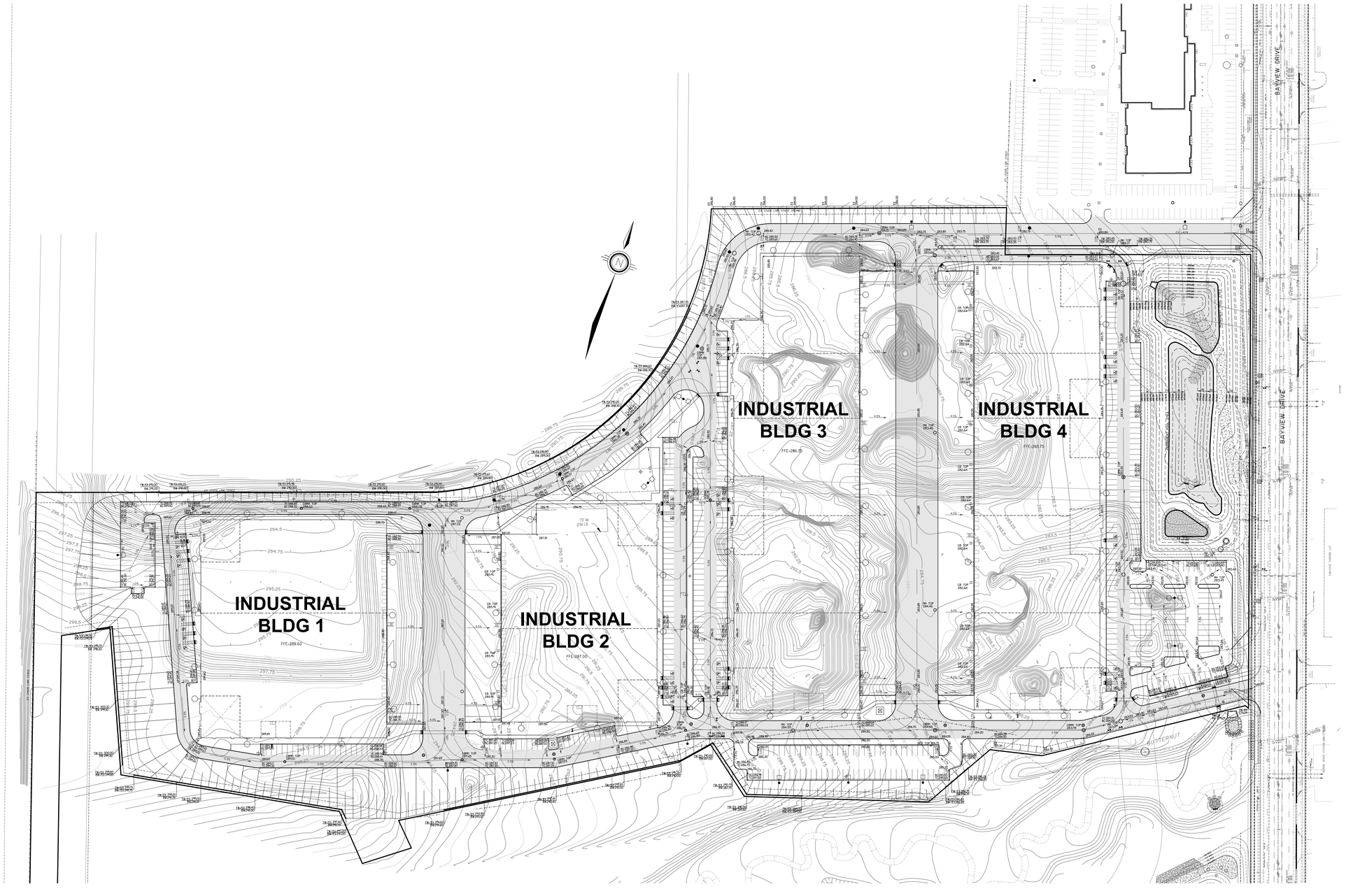
Basin A identifies an external area component, which is the tributary commercial lands from west of Highway 400 and the Molson Centre parking lots. This external area requirement is discussed in detail in the following section 6.4.4.

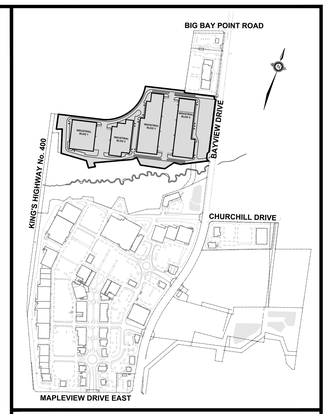
The basin contact areas shown in Table 6 were utilized in the design of the central stormwater management facilities described in section 6.5. Detailed calculations in support of the basin contact areas are provided in Appendix 'B'.

6.4.4 External Lands

As outlined in previous sections, external commercial lands (12.1ha) west of Highway 400 contribute controlled (water quantity only) flows to the south tributary on the subject site via a culvert under Highway 400. Immediately inside the west property line of the subject site, the external flows will be captured by the storm sewer system and conveyed to Stormwater Management Pond A. Similarly, storm runoff from the existing Molson Centre parking lot expansion (7.0 ha) will be captured and conveyed to Pond A. While these lands are not included in the water balance calculations, the infiltration facility at Pond A will be sized to also provide infiltration of 5.3 mm of runoff from these areas.

Back Pocket Figures





KEYMAP N.T.S.

LEGEND:

SWALE GRADE — SW 130.25
SWALE DRAINAGE
PROPOSED GRADE — 130.50
EXISTING GRADE — 131.53
EXISTING CONTOURS — 446
LG ARROW & SLOPE — 2.0%
PROPOSED SLOPE
HEAVY DUTY ASPHALT

NO.	REVISIONS	MARK VOID ALL COPIES PREVIOUS FINAL DATE	DATE (Y/M/D)	BY

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This drawing must be read in the context of all the other drawings which constitute the document.

SITE GRADING PLAN

SCALE: 1:750

PARK PLACE NORTH LANDS

HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

SITE SERVICING & SITE GRADING BY:

SKA SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS
110 OLD KINGSTON ROAD
AJAX, ONTARIO L1T 2Z9

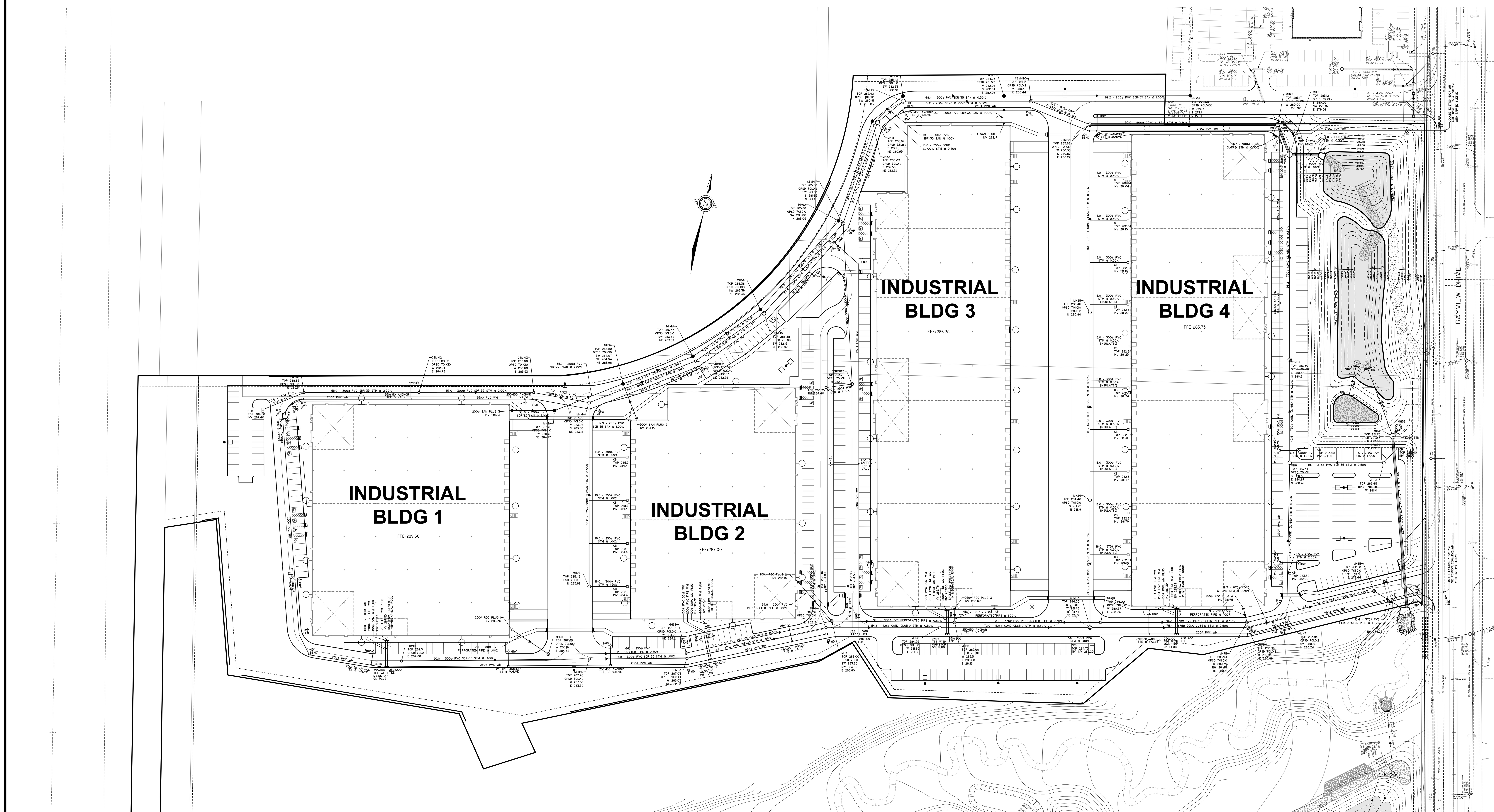
SKA PROJECT NO. 02:999

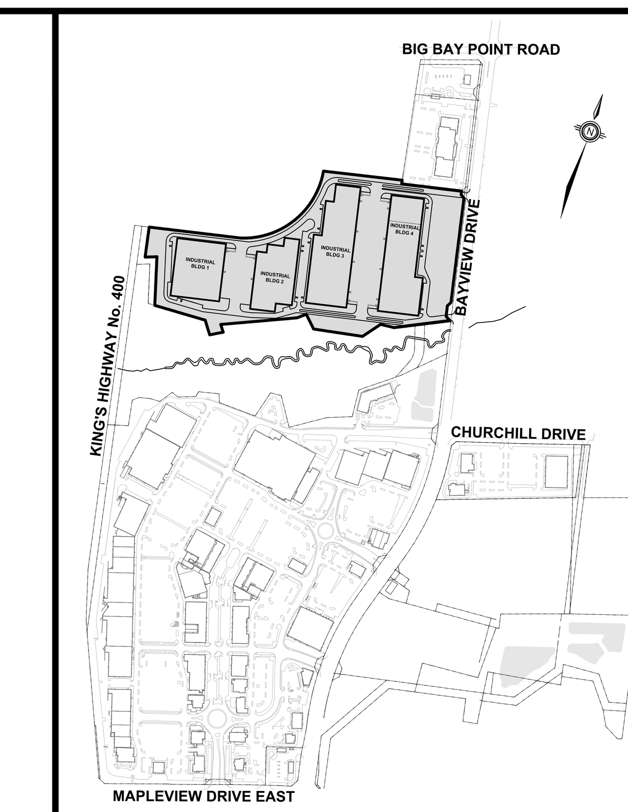
LICENSED PROFESSIONAL ENGINEER
M.A. GOLAKOWICH
100184446
29/04/22
PROVINCE OF ONTARIO

DRAWN BY	RAV
CHECKED BY	MAG
DATE	APRIL 29, 2022
ISSUED	APRIL 29, 2022

PROJECT NO. 02138.44

DWG. NO. SG





KEYMAP N.T.S.

LEGEND:

- CATCHBASIN
- DOUBLE CATCHBASIN
- CATCHBASIN MANHOLE
- DOUBLE CATCHBASIN MANHOLE
- STORM MANHOLE
- SANITARY MANHOLE
- RDC MANHOLE
- HYDRANT AND VALVE
- EX HYDRANT
- EXISTING SERVICES
- PROPOSED SERVICES
- CROSSING DATA

GENERAL NOTES

1. MEASUREMENTS

A. ALL DIMENSIONS ARE IN METRES, EXCEPT PIPE DIAMETERS, WHICH ARE IN MILLIMETRES, UNLESS SPECIFIED OTHERWISE.

2. GENERAL

A. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT CITY OF BARRIE STANDARD DRAWINGS (BSD) AND ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

B. ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY CITY OF BARRIE STANDARD DRAWINGS (BSD) AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

C. LOCATION OF EXISTING SERVICES ARE NOT GUARANTEED. THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.

D. A ROAD OCCUPANCY PERMIT IS REQUIRED FROM THE ENGINEERING DEPARTMENT PRIOR TO THE COMMENCEMENT OF WORK WITHIN ANY CITY RIGHT-OF-WAY.

E. A TOPSOIL PERMIT IS REQUIRED FROM THE ENGINEERING DEPARTMENT PRIOR TO THE COMMENCEMENT OF ANY EARTH WORKS ON THE SITE.

F. NATIVE MATERIAL, SUITABLE FOR BACKFILL, SHALL BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.

G. GRANULAR MATERIAL , USED FOR BACKFILL , SHALL BE PLACED IN LAYERS 150MM IN DEPTH MAXIMUM AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.

H. ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE CITY ENGINEERING DEPARTMENT.

I. ALL SILT CONTROL AND EROSION PROTECTION DEVICES ARE TO BE IN PLACE PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY ENGINEERING DEPARTMENT.

ROADS

A. BARRIER CURB TO COMPLY WITH OPSD 600.110.

B. SIDEWALKS TO COMPLY WITH OPSD-310.010 AND ARE TO BE 1.5 METRES WIDE.

MINIMUM THICKNESS AS FOLLOWS:
- RESIDENTIAL DRIVEWAY 150MM
- COMMERCIAL/INDUSTRIAL DRIVEWAY 200MM (REINFORCEMENT AS PER OPSD IF REQUIRED)
- WHEN NO DRIVEWAY IS PRESENT, 125MM.

C. NATIVE SUBGRADE SHALL HAVE A CROSSFALL OF 3% AND THE MATERIAL SHALL BE APPROVED BY A SOILS CONSULTANT AND IS SUBJECT TO APPROVAL BY THE DIRECTOR OF ENGINEERING.

D. NATIVE SUBGRADE TO BE COMPACTED TO MINIMUM 95% STANDARD PROCTOR MAXIMUM DRY DENSITY AND SHALL BE PROOF ROLLED.

E. GRADE AND CROSS FALL ADJUSTMENT OF MAINTENANCE HOLE AND CATCH BASIN FRAMES WILL BE MADE USING PRODUCTS SPECIFICALLY MANUFACTURED FOR THAT PURPOSE. THE TOP ADJUSTMENT UNIT OF ALL CATCH BASIN AND MAINTENANCE HOLES SHALL BE RUBBER.

F. ADJUSTMENT UNITS MUST BE CERTIFIED TO MEET ALL PERTINENT OPSD, CSA, ASTM AND MTO-DSM LIST, OR OTHER INDUSTRY GUIDELINES FOR MATERIALS, PERFORMANCE AND USE AS APPLICABLE.

G. ADJUSTMENT UNITS AND JOINTS WILL BE SEALED AND OR PARGED IN COMPLIANCE WITH MANUFACTURERS SPECIFICATIONS AND GUIDELINES.

H. MORTAR IS USED FOR LEVELING OF PRECAST UNITS ONLY. THE THICKNESS OF MORTAR WILL BE 10MM TO FILL ALL VOIDS CREATED BY IRREGULARITIES IN THE PRECAST UNITS TO ENSURE AN EVEN SURFACE ONLY.

I. NON-COMPRESSIBLE BACK FILL WILL BE USED DURING REBUILDING, ADJUSTING, OR ANY OTHER APPLICABLE CATCH BASIN OR MAINTENANCE HOLE WORKS.

J. PAVEMENT STRUCTURES

PARKING LOT PAVEMENT STRUCTURE
- 40MM HL3 SURFACE COURSE ASPHALIC CONCRETE
- 50MM HL8 BASE COURSE ASPHALIC CONCRETE
- 150MM GRANULAR 'A' OR 19MM CRUSHER RUN LIMESTONE AS BASE COURSE
- 200MM GRANULAR 'B' OR 50MM CRUSHER RUN LIMESTONE AS SUBBASE COURSE

DRIVEWAY/FIRE ROUTE PAVEMENT STRUCTURE
- 40MM HL3 SURFACE COURSE ASPHALIC CONCRETE
- 65MM HL8 BASE COURSE ASPHALIC CONCRETE
- 150MM GRANULAR 'A' OR 19MM CRUSHER RUN LIMESTONE AS BASE COURSE
- 350MM GRANULAR 'B' OR 50MM CRUSHER RUN LIMESTONE AS SUBBASE COURSE

SANITARY SEWERS

A. SEWERS SHALL BE CONSTRUCTED WITH BEDDINGS AS PER OPSD-802.010, (GRAN. 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD-802.030 OR 802.031 CLASS B (GRAN. 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING.

B. MAXIMUM DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY C.S.A., O.P.S. OR MANUFACTURERS RECOMMENDED SPECIFICATIONS.

C. PVC, CONCRETE AND PROFILE WALL PVC SEWERS SHALL HAVE RUBBER GASKET TYPE JOINTS AND SHALL BE CERTIFIED TO CONFORM TO ALL APPLICABLE CURRENT C.S.A. SPECIFICATIONS.

D. CONCRETE SANITARY SEWERS SHALL HAVE A MINIMUM STRENGTH OF 50 N/M/MM CONFORMING TO CSA STANDARD A257.2-1982, CLASS 50-D (PREVIOUSLY C.S.A. STANDARD A257.2-1974, CLASS II).

E. MAINTENANCE HOLES TOPS (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACE. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD-N2.

F. ALL CONNECTIONS TO NEW SANITARY MAINS SHALL BE PRE-MANUFACTURED, FABRICATED TEES. CONNECTIONS TO EXISTING SANITARY SEWER SHALL BE MADE WITH APPROVED FACTORY MADE TEES OR INSERTA-TEES IN STRICT ACCORDANCE TO MANUFACTURES GUIDELINES. SANITARY DROP STRUCTURES TO BE AS PER OPSD 1003.020.

G. CONTRACTOR TO PROVIDE COMPLETE SANITARY SEWER VIDEO REPORT UPON COMPLETION.

STORM SEWERS

A. ALL STORM SEWERS SHALL BE CONCRETE PIPE PER A.S.T.M. C76-IV OR C14-ES OR PVC PIPE PER A.S.T.M 03034-74 SDR 35 SPEC. ALL STORM SEWERS SHALL BE CONSTRUCTED WITH BEDDING AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD 802.030 OR 802.031 CLASS B (GRANULAR 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING. ALL MANHOLES SHALL BE 1200mm PRECAST CONCRETE AS PER OPSD STANDARD 701.01 UNLESS OTHERWISE NOTED. ALL CATCHBASIN AND CATCHBASIN MANHOLES SHALL HAVE A MINIMUM 0.30m SUMP AND BE PROVIDED WITH A FRAME AND COVER PER MUNICIPAL STANDARDS.

B. THE SERVICE CONNECTION MANHOLES FOR STORM SEWER SERVICES INSTALLED AT STREETLINE SHALL BE BENCHED BY THE CONTRACTOR TO THE SATISFACTION OF THE GOVERNING AUTHORITY.

C. ALL DOUBLE AND SINGLE CATCHBASINS SHALL BE INSTALLED PER OPSD STANDARDS 705.01 AND 705.02 RESPECTIVELY. ALL CONNECTIONS TO THE MAINLINE SEWERS SHALL BE MADE PER OPSD 705.01, (OPTIONAL SUB DRAINS) THREE 3.0m LONG PVC SUB-DRAINS SHALL BE INSTALLED RADIALLY AT ALL SITE CATCHBASINS, DOUBLE CATCHBASINS AND CATCHBASIN MANHOLES. SUBDRAINS SHALL BE PRE-WRAPPED WITH GEOTEXTILE FILTER FABRIC AND INSTALLED 0.30m BELOW SUBGRADE ELEVATION SURROUNDED BY ACCEPTABLE GRANULAR FILTER MEDIUM.

D. ALL CATCHBASINS AND MANHOLES TO RECEIVE GRANULAR BACKFILL TO A MINIMUM THICKNESS OF 300mm. GRANULARS TO BE WRAPPED IN GEOTEXTILE FABRIC TO A DEPTH OF 1 m FROM UNDERSIDE OF ASPHALT SURFACE DOWNWARDS TO PREVENT INFILTRATION OF FINE SOIL INTO GRANULAR BACKFILL.

E. CONTRACTOR TO PROVIDE COMPLETE STORM SEWER VIDEO REPORT UPON COMPLETION.

STORM MANAGEMENT LINER SPECIFICATIONS

A. THE EARTH FILL SOILS TO BE USED FOR THE CONSTRUCTION OF THE LINER MUST CONTAIN MINIMUM OF 40 PERCENT OF THE MATERIAL FINER THAN 0.08MM (I.E., PASSING NO. 200 SIEVE) AND A MINIMUM 15 PERCENT FINER THAN 0.002MM (CLAY SIZE) PARTICLES BY WEIGHT. THE EARTH FILL SOILS MUST BE FREE FROM ORGANIC AND TOPSOIL INCLUSIONS. THE FILL COMPOSITION SHOULD BE PERIODICALLY SAMPLED AND TESTED DURING EXCAVATION OF THE POND BASE.

B. THE AREAS BENEATH SLOPE FILL OR POND BASE SHOULD BE STRIPPED TO REMOVE ALL ORGANIC SOILS AND VEGETATION. THE EXPOSED SUBGRADE SHOULD BE PROOF-ROLLED AND INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER TO CONFIRM THE FOUNDING CONDITIONS. ANY LOOSE, SOFT OR OTHERWISE DELETERIOUS MATERIALS MUST BE REMOVED TO THEIR FULL EXTENT AND REPLACED WITH COMPACTED ENGINEERED FILL UNDER THE DIRECTION OF A QUALIFIED GEOTECHNICAL ENGINEER. THE SUBGRADE SURFACE SHOULD BE COMPACTED TO AT LEAST 98 PERCENT STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).

C. ANY COBBLES OR BOULDERS GREATER THAN 50MM IN SIZE SHOULD BE EXCLUDED FROM THE LINER FILL AND 100MM FROM THE BERM FILL MATERIALS, AS SHOULD ANY EARTH FILL SOILS CONTAINING EXCESSIVE AMOUNTS OF SAND OR SILT.

D. THE LINER FILL MATERIALS SHOULD BE PLACED IN LIFTS NOT EXCEEDING 150MM THICKNESS. THE TOTAL THICKNESS OF THE COMPACTED CLAY LINER MUST BE NO LESS THAN 1000MM. THE FILL SHOULD BE PLACED AND COMPACTED UNDER THE FULL-TIME SUPERVISION OF QUALIFIED GEOTECHNICAL PERSONNEL.

E. ALL LINER FILL MATERIALS SHOULD BE PLACED AND MECHANICALLY COMPACTED WITH A HEAVY ROLLER TO A MINIMUM OF 98 PERCENT OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. THE LINER FILL MATERIALS SHALL BE PLACED AND COMPACTED AT A WATER CONTENT OF BETWEEN 2 PERCENT TO 4 PERCENT WET OF OPTIMUM. EARTH FILL MATERIALS SHOULD NOT CONTAIN ANY FROZEN MATERIALS IF THE CONSTRUCTION PROCEEDS UNDER WINTER CONDITIONS.

F. THE FINAL SLOPE SURFACE AND ALL BARE OR EXPOSED AREAS (WHERE APPLICABLE) ARE TO BE PROVIDED WITH SUITABLE GROUND COVER OR EROSION PROTECTION. THE SLOPE SURFACE SHOULD BE PROVIDED WITH A THIN LAYER OF TOPSOIL (MINIMUM 100MM THICK) AND IT SHOULD BE HYDRO-SEEDED WITH A GRASS MIXTURE AND MULCH. ALTERNATIVELY, STAKED SOD COULD BE USED.

G. IF SEEDED, DURING THE FIRST 2 TO 3 YEARS THE SURFACE COVER OF TOPSOIL AND SEEDING MAY REQUIRE PERIODIC MAINTENANCE ON SLOPES, DUE TO SURFACE EROSION UNTIL THE VEGETATION BECOMES WELL ESTABLISHED. IF SEEDED, IT IS RECOMMENDED THAT EROSION NETTING BE STAKED ON THE OUTSIDE SLOPE (WHERE APPLICABLE) FOR EROSION PROTECTION (AND INSIDE SLOPE WHICH IS ABOVE WATER LEVEL).

WATERMAIN

A. CONTRACTOR SHALL INFORM THE CITY OF BARRIE ENGINEERING DEPARTMENT A MINIMUM OF 48 HOURS IN ADVANCE OF THEIR INTENTIONS TO WORK.

B. OPERATION OF FIRE HYDRANTS AND VALVES ON POTABLE WATER BY OTHER THAN ENGINEERING DEPARTMENT IS PROHIBITED BY BY-LAW 1-88 AS AMENDED BY BY-LAW 99-290. THE CITY WILL SWAB, PRESSURE TEST, CHLORINATE AND FLUSH ALL NEW WATERMAINS.

C. MINIMUM COVER OVER WATERMAIN TO BE 1.7M. THE MINIMUM HORIZONTAL SEPARATION BETWEEN WATERMAIN AND SEWERS TO BE 2.5M. WHERE WATERMAIN CONFLICTS WITH SEWER PIPES, DEFLECT WATERMAIN HORIZONTALLY OR VERTICALLY WHILE PROVIDING A MINIMUM OF 0.5M CLEARANCE BETWEEN WATERMAIN AND SEWERS. MAINTAIN MINIMUM DEPTH OF COVER AT ALL TIMES.

D. 1) WATERMAIN SHALL BE CONSTRUCTED WITH BEDDINGS AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD 802.030 OR 802.031 CLASS 'B' (GRANULAR 'A' BEDDING MATERIAL, GRANULAR 'A' OR SELECT NATIVE COVER MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING, OR
× ALTERNATIVE EMBEDMENT MATERIAL - SAND MEETING GRADATION REQUIREMENTS OF OPS 1004.05.05 COMPACTED TO 95% PROCTOR DENSITY. GEOTECHNICAL CERTIFICATION OF MATERIAL AND COMPACTION TESTING MUST BE PROVIDED EVERY 150 METRES. THE COMPACTION TESTING MUST INCLUDE THE ENTIRE EMBEDMENT ENVELOPE (HAUNCHES, BEDDING AND TOP OF PIPE).

D. 2) COPPER WATER MAINS AND SERVICES 19MM TO 50MM IN DIAMETER SHALL BE EMBEDDED IN SAND 100MM ABOVE AND BELOW TO CONFORM TO OPSD 1004.05.05.

E. CONCRETE THRUST BLOCKS ARE TO BE INSTALLED AT ALL TEES, BENDS, HYDRANTS, END OF MAINS AND CONNECTIONS 100MM AND LARGER AS PER OPSD 1103.010 AND 1103.020. RESTRAINING DEVICES MAY BE REQUIRED IN ADDITION TO STANDARD CONCRETE THRUST BLOCKING WHERE SOIL CONDITIONS WARRANT.

G. RESTRAINING WILL BE REQUIRED ON ALL FIRE HYDRANTS.

H. NEW WATERMAINS TO BE PVC DR18 CL150, OR DUCTILE IRON CL52.

I. TRACING WIRE (£12 TWU STRANDED COPPER) TO BE INSTALLED ON THE TOTAL LENGTH OF ALL NON-METALLIC WATERMAIN AND BROUGHT UP AT EACH HYDRANT AND CONNECTED TO FLANGE BOLT.

J. CONTRACTOR TO INSTALL CHLORINATION TAIL JUST BEHIND TAPPING VALVE TO FACILITATE CHLORINATING SERVICE, TO BE REMOVED AFTER TESTING.

K. ALL SERVICE PIPE MATERIAL MUST BE DUCTILE IRON FROM THE RESTRAINING FLANGE TO A MINIMUM OF 3 METRES OUTSIDE THE FOUNDATION REFER TO DSD-61.

L. WATER WILL NOT BE AVAILABLE UNTIL SERVICES HAVE BEEN SAMPLED AND PASSES FOR BACTERIOLOGICAL COMPLIANCE.

M. WATERMETER TO BE PLACED WITHIN THE MECHANICAL ROOM AS PER CITY OF BARRIE STANDARD BSD-58.

N. FIRE HYDRANT TO BE INSTALLED AS PER CITY OF BARRIE STANDARD BSD-50, REVISED ON 01/15/08.

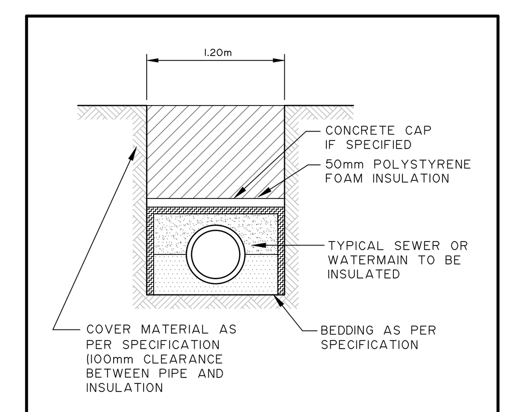
O. FIRE HYDRANT WITHIN THE SITE TO BE COLOURED AS RED.

P. 1500MM DIAMETER WATER VALVE CHAMBER TO BE PLACED AT THE PROPERTY LINE AS PER OPSD 1101.010 AND OPSD 1101.011.

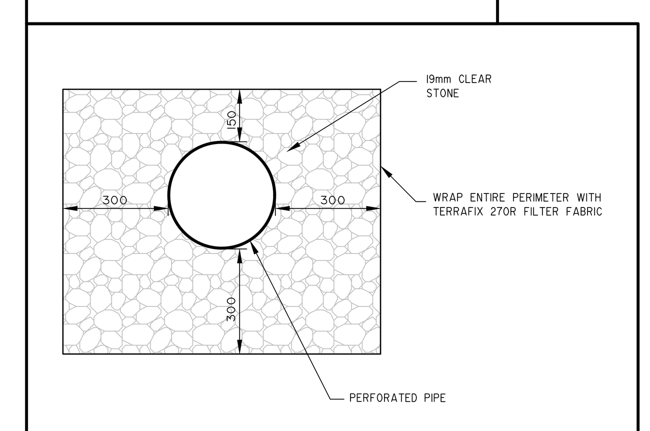
Q. ALL DOMESTIC WATER SERVICES TO BUILDINGS TO HAVE CURB STOP AND BOX OUTSIDE EACH BUILDING.

VERTICAL CONTROL MONUMENTS

A. BENCH MARK NO.: 03120030030
DESCRIPTION: BARRIE MOLSON CENTRE- 555 BAYVIEW DRIVE
THE VERTICAL CONTROL MONUMENT IS SET FLUSH IN THE CONCRETE FOUNDATION TO BUILDING VENTILATION SHAFT AT THE SOUTHEAST CORNER OF THE BARRIE MOLSON CENTRE. THE TABLET IS 230mm BELOW THE TOP OF THE FOUNDATION SHAFT WALL AND 110mm WEST OF THE EAST SIDE OF THE SOUTHEAST CORNER OF THE VENTILATION SHAFT WALL.
ELEVATION: 287.040



PIPE INSULATION DETAIL
NTS



PERFORATED PIPE BEDDING DETAIL
NTS

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SITE SERVICING PLAN

SCALE: 1:750

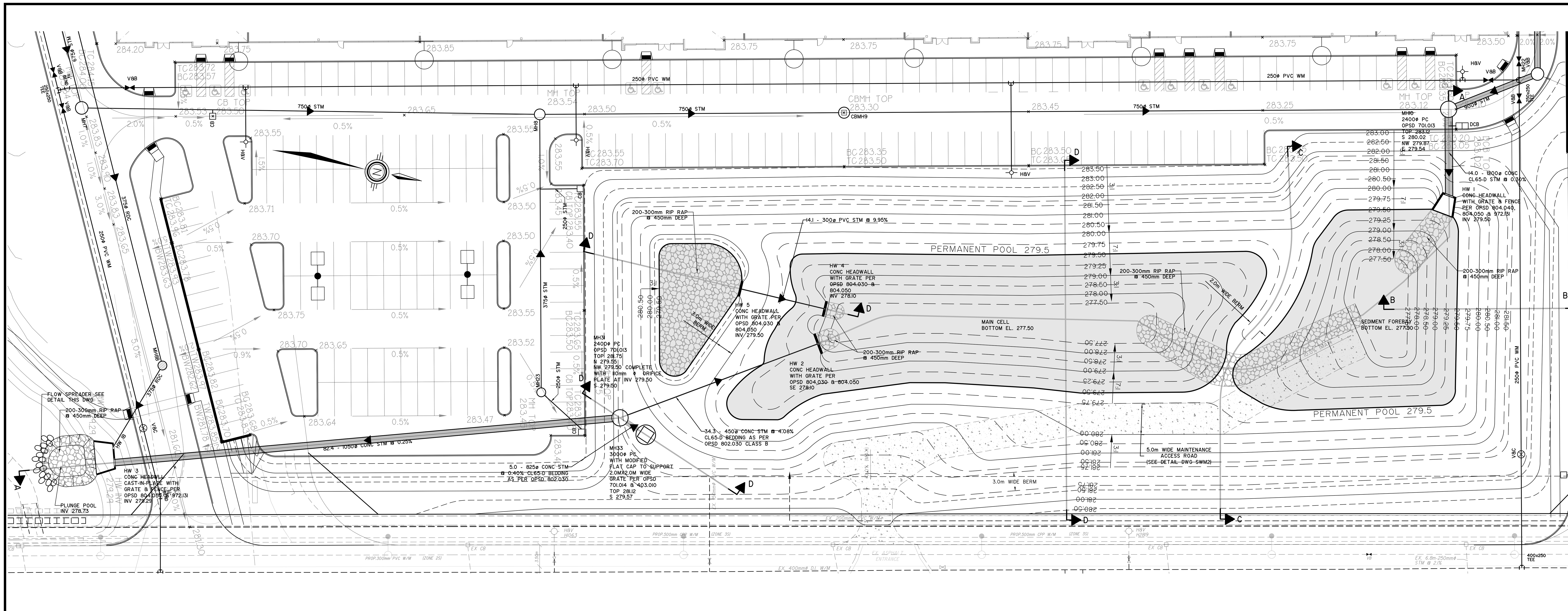
PARK PLACE NORTH LANDS

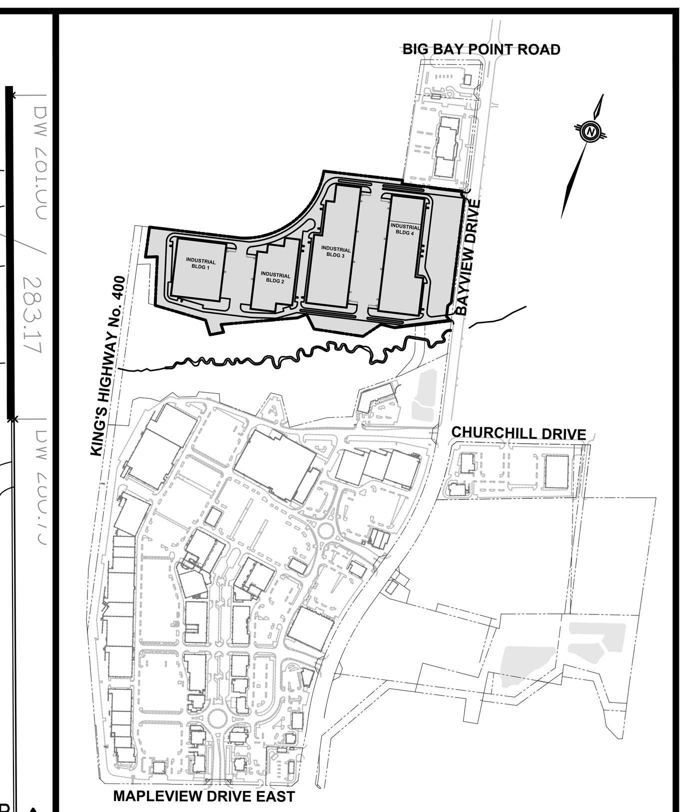
HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

SITE SERVICING & SITE GRADING BY:
SKA SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS
110 OLD KINGSTON ROAD
AJAX, ONTARIO L1T 2Z9
SKA PROJECT NO. 02:999

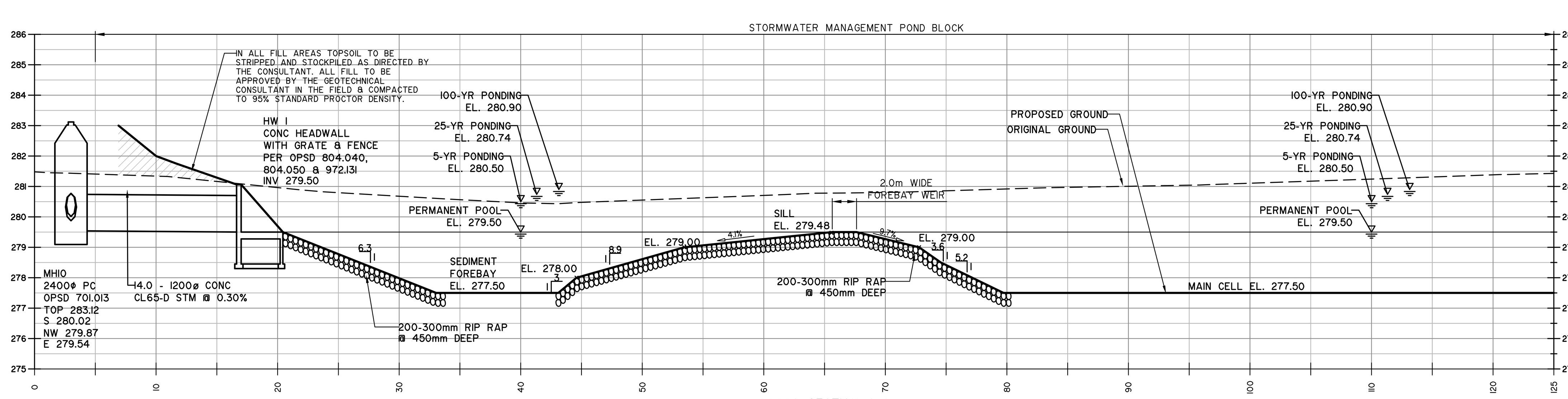
LICENSED PROFESSIONAL ENGINEER M.A. GOLAKOVICH 100164446 29/04/22 PROVINCE OF ONTARIO

DRAWN BY	RAV	PROJECT NO.	02138.44
CHECKED BY	MAG		
DATE	APRIL 29, 2022	DWG. NO.	SS
ISSUED	APRIL 29, 2022		

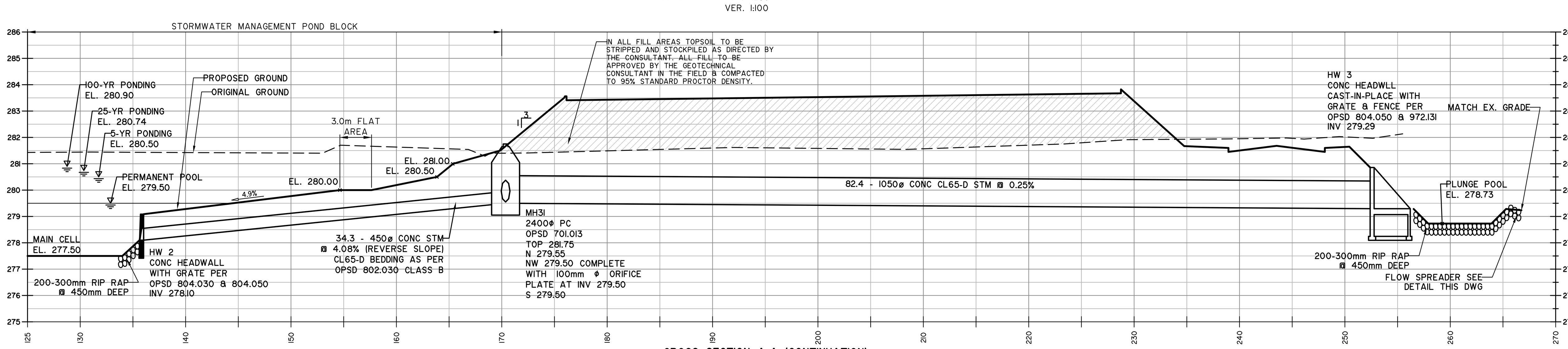




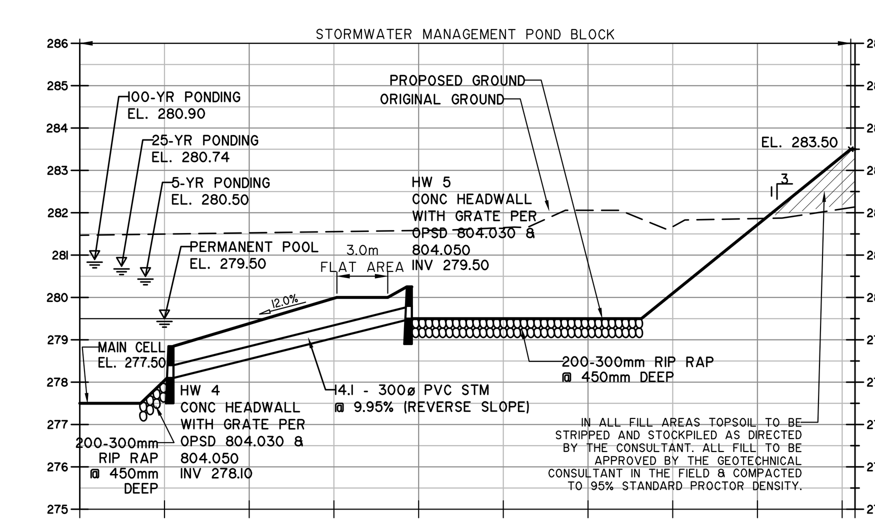
KEYMAP N.T.S.



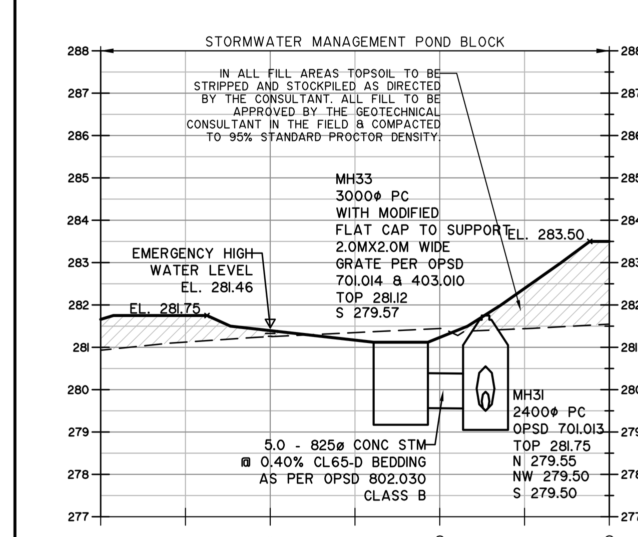
CROSS SECTION A-A
SCALE HOR. 1:250 VER. 1:100



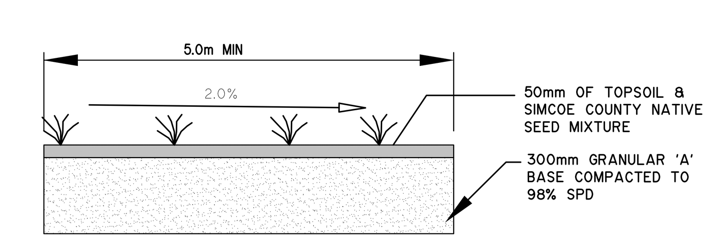
CROSS SECTION A-A (CONTINUATION)
SCALE HOR. 1:250 VER. 1:100



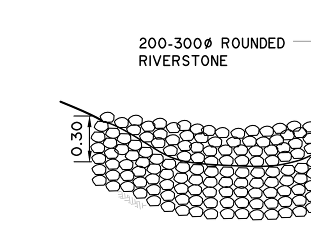
CROSS SECTION E-E
SCALE HOR. 1:250 VER. 1:100



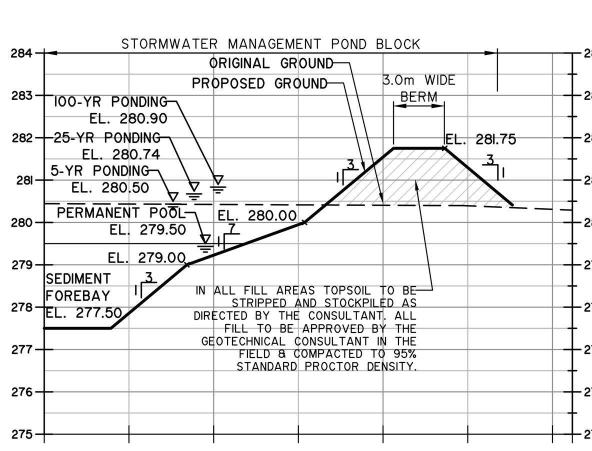
CROSS SECTION F-F
SCALE HOR. 1:250 VER. 1:100



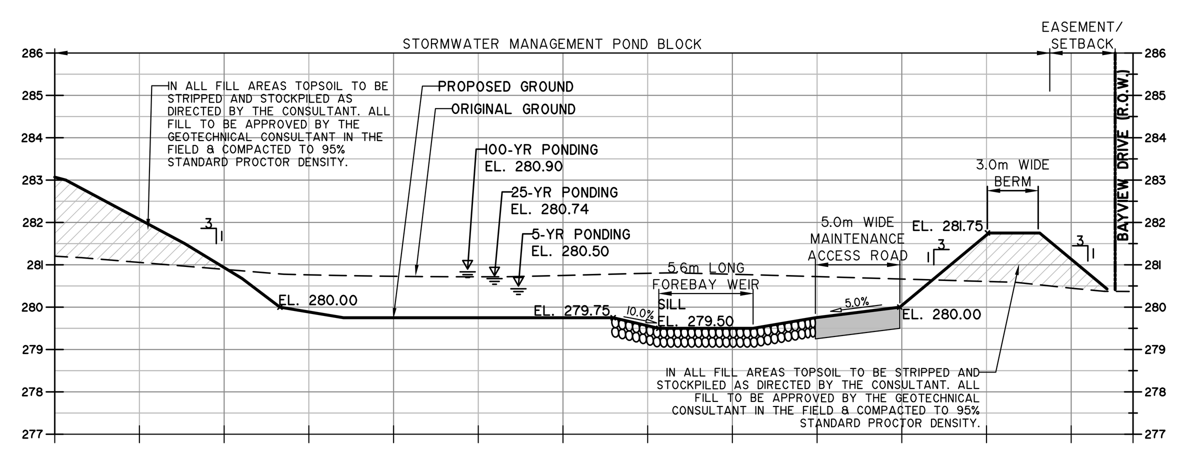
MAINTENANCE ACCESS ROAD
N.T.S.



RIVERSTONE FLOW SPREADER
N.T.S.



CROSS SECTION B-B
SCALE HOR. 1:250 VER. 1:100



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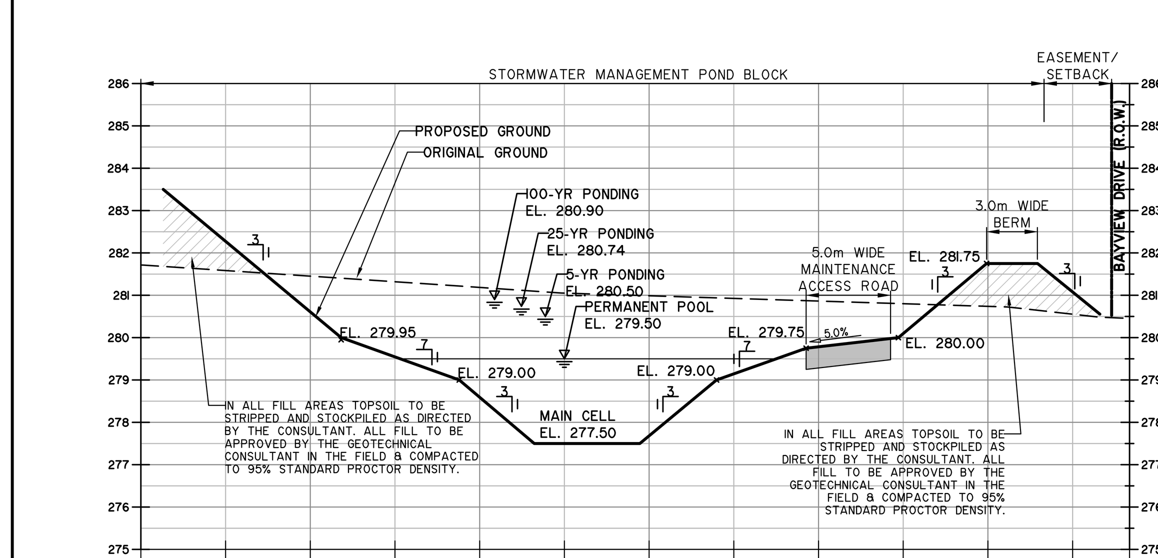

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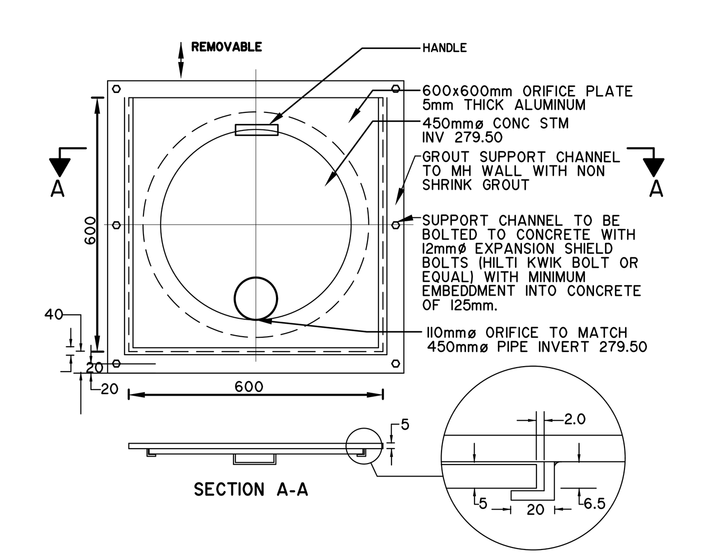

QUALITY CONTROL ORIFICE PLATE DETAIL TO BE INSTALLED IN MH
N.T.S

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STORMWATER MANAGEMENT POND AND DETAILS

SCALE: 1:250

PARK PLACE NORTH LANDS

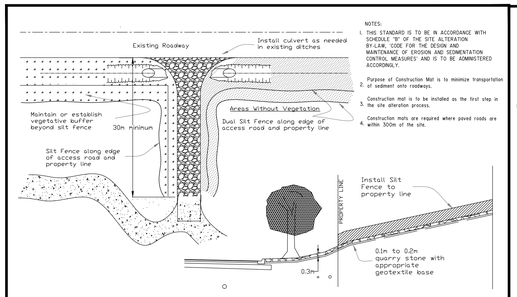
HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

SITE SERVICING & SITE GRADING BY:
SKA SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS
110 OLD KINGSTON ROAD
AJAX, ONTARIO L1T 2Z9

SKA PROJECT NO. 02:999

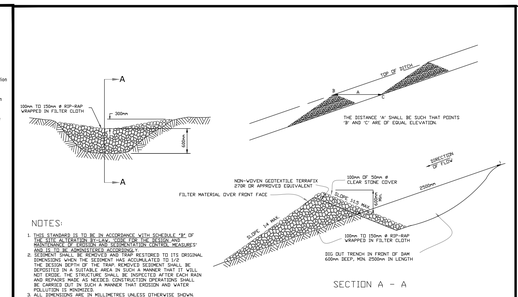
LICENSED PROFESSIONAL ENGINEER H. K. WALSH 100519045 29/04/22 PROVINCE OF ONTARIO

DRAWN BY	RAV	PROJECT NO.	02138.44
CHECKED BY	HKW		
DATE	APRIL 29, 2022	DWG. NO.	SWM
ISSUED	APRIL 29, 2022		



CITY OF BARRIE STANDARD					
CONSTRUCTION ENTRANCE MAT		1 Standardized Dimension Text J.S.			05.10.28
	NO.	REVISION	APR'D	DATE	

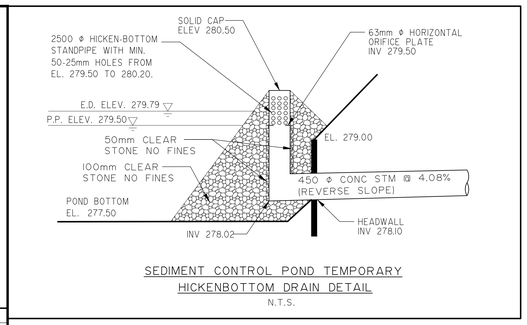
APR'D R.G.N. DATE: 04.03.16
DRAWN A.S.C. SCALE: N.T.S.
BSD-23D



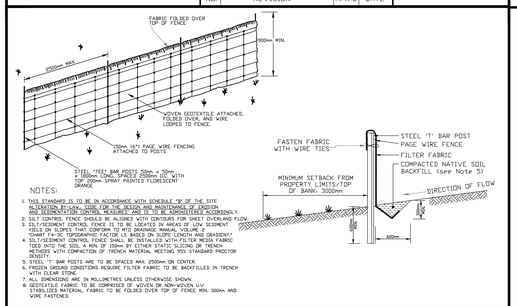
NOTES:
1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO BE ADMINISTERED ACCORDINGLY.
2. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO HALF THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE. ALL SEDIMENT SPILLED, DROPPED, WASHED OR BLOWN AND REPAIRS MADE AS NEEDED. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

CITY OF BARRIE STANDARD					
TYPICAL GRANULAR EROSION CONTROL DEVICE					
	2	MODIFICATIONS BY ENV. SER.			2004.04.06
	1	TRENCH ADDED AND FABRIC EXTENDED INTO IT	B.K.		2003.02.19
	NO.	REVISION	APR'D	DATE	

APR'D R.G.N. DATE: 04.03.16
DRAWN L.A.J. SCALE: N.T.S.
BSD-23B



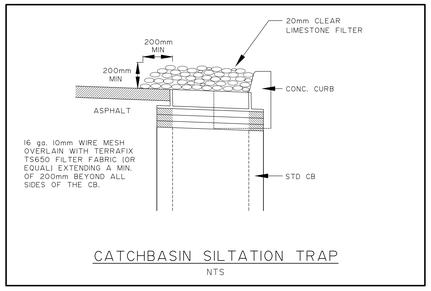
SEDIMENT CONTROL POND TEMPORARY HICKENBOTTOM DRAIN DETAIL
N.T.S.



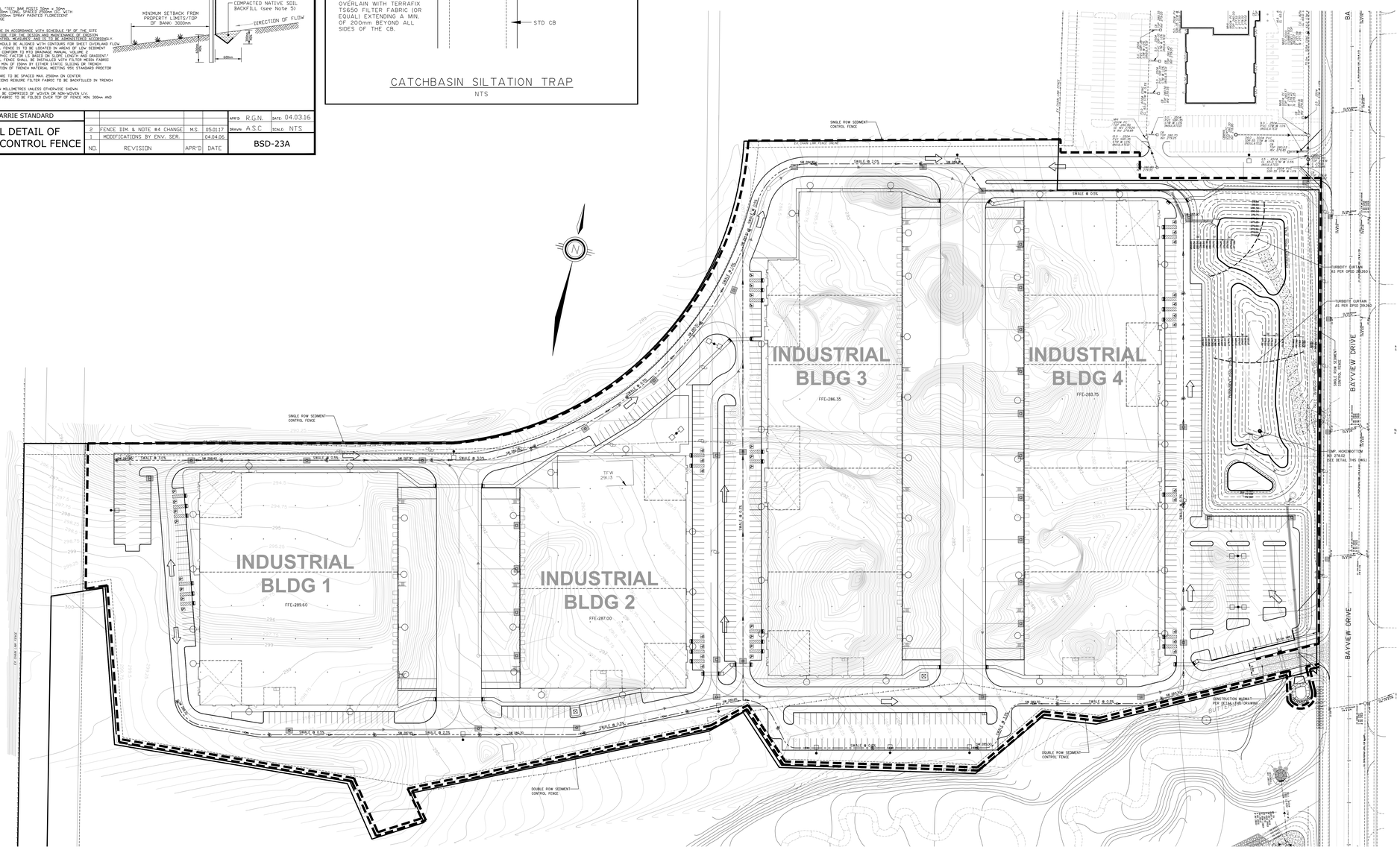
NOTES:
1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO BE ADMINISTERED ACCORDINGLY.
2. SILT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW.
3. SILT/SEDIMENT CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT TRANSPORT POTENTIAL. FENCE IS NOT TO BE USED WHERE THE "CHART 7.4-3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT."
4. SILT/SEDIMENT CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TIED INTO THE SOIL, A MIN. OF 150mm BY EITHER STATIC SLICING OR TRENCH METHOD WITH COMPACTION OF TRENCH MATERIAL MEETING 95% STANDARD PROCTOR DENSITY.
5. STEEL 'T' BAR POSTS ARE TO BE SPACED MAX. 2500mm ON CENTER.
6. FROZEN GROUND CONDITIONS REQUIRE FILTER FABRIC TO BE BACKFILLED IN TRENCH WITH CLEAR STONE.
7. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
8. GEOTEXTILE FABRIC TO BE COMPOSED OF WOVEN OR NON-WOVEN U.V. STABILIZED MATERIAL. FABRIC TO BE FOLDED OVER TOP OF FENCE MIN. 300mm AND WIRE FASTENED.

CITY OF BARRIE STANDARD					
TYPICAL DETAIL OF SILTATION CONTROL FENCE					
	2	FENCE DIM. & NOTE #4 CHANGE	M.S.		05.01.17
	1	MODIFICATIONS BY ENV. SER.			04.04.06
	NO.	REVISION	APR'D	DATE	

APR'D R.G.N. DATE: 04.03.16
DRAWN A.S.C. SCALE: N.T.S.
BSD-23A



CATCHBASIN SILTATION TRAP
NTS



SITE DATA TABLE:

ALTERATION AREA: 12.75 ha

EXISTING LAND USE: VACANT

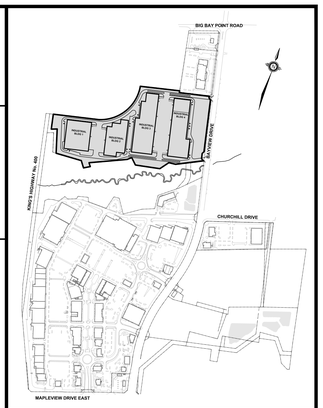
PREDOMINANT SOIL TYPE: SAND, SILT

SITE ALTERATION CERTIFICATION:

I HAVE REVIEWED THE PLANS FOR CONSTRUCTION OF THE PARK PLACE NORHT LANDS SITE PLAN LOCATED AT PARK PLACE IN BARRIE, ONTARIO AND HAVE PREPARED THIS PLAN TO INDICATE THE COMPATIBILITY OF THE PROPOSAL TO EXISTING ADJACENT PROPERTIES AND MUNICIPAL SERVICES. IT IS MY BELIEF THAT ADHERENCE TO THE PROPOSED GRADES AS SHOWN WILL PRODUCE ADEQUATE SURFACE DRAINAGE AND PROPER FACILITY OF MUNICIPAL SERVICES WITHOUT ANY DETRIMENTAL EFFECT TO THE EXISTING DRAINAGE PATTERNS OR ADJACENT PROPERTIES.

SCHEDULE OF WORKS:

1. ALL SILT CONTROL AND EROSION PROTECTION DEVICES ARE TO BE IN PLACE PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY ENGINEERING DEPARTMENT.SEDIMENT CONTROLS MUST BE INSPECTED ON A REGULAR BASIS AND AFTER EVERY RAINFALL EVENT.
2. REPAIRS TO SEDIMENT CONTROLS MUST BE DONE IN A TIMELY MANNER TO PREVENT SEDIMENT FROM ENTERING THE WATER AND TO PREVENT ANY OFF-SITE ENVIRONMENTAL IMPACTS.
3. ALL AREAS WHICH WILL REMAIN DISTURBED FOR MORE THAN THIRTY DAYS ARE REQUIRED TO BE STABILIZED AS PER THE LAKE SIMCOE CONSERVATION AUTHORITY.
4. ANY TOPSOIL STOCKPILES OR EARTH STOCKPILES TO BE SURROUNDED WITH SILTATION CONTROL FENCE AS PER CITY OF BARRIE STANDARDS.
5. ALL SEDIMENT CONTROL DEVICES TO REMAIN IN PLACE UNTIL SUCH TIME AS SPECIFIED BY THE CONSULTANT, CITY OF BARRIE AND THE LAKE SIMCOE REGION CONSERVATION AUTHORITY.
6. FREQUENT OBSERVATIONS OF CATCHBASINS SHOULD BE CONDUCTED.
7. ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE CITY ENGINEERING DEPARTMENT.
8. CONTRACTOR TO ENSURE ADEQUATE MUD-TRACKING MEASURES ARE IN PLACE PRIOR TO LEAVING THE SITE AT THE DEDICATED SITE ENTRANCE.



KEYMAP N.T.S.

LEGEND:

- SINGLE ROW SEDIMENT CONTROL FENCE AS PER DETAIL THIS DWG
- DOUBLE ROW SEDIMENT CONTROL FENCE AS PER DETAIL THIS DWG
- INTERCEPTOR SWALE GRADE (ie 3.0%)
- TEMPORARY INTERCEPTOR SWALE
- ROCK CHECK DAM
- MUDMAT AS PER DETAIL THIS DWG
- CATCHBASIN SILTATION TRAP
- OVERLAND FLOW

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EROSION SEDIMENT CONTROL PLAN

SCALE: 1:750

PARK PLACE NORTH LANDS

HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

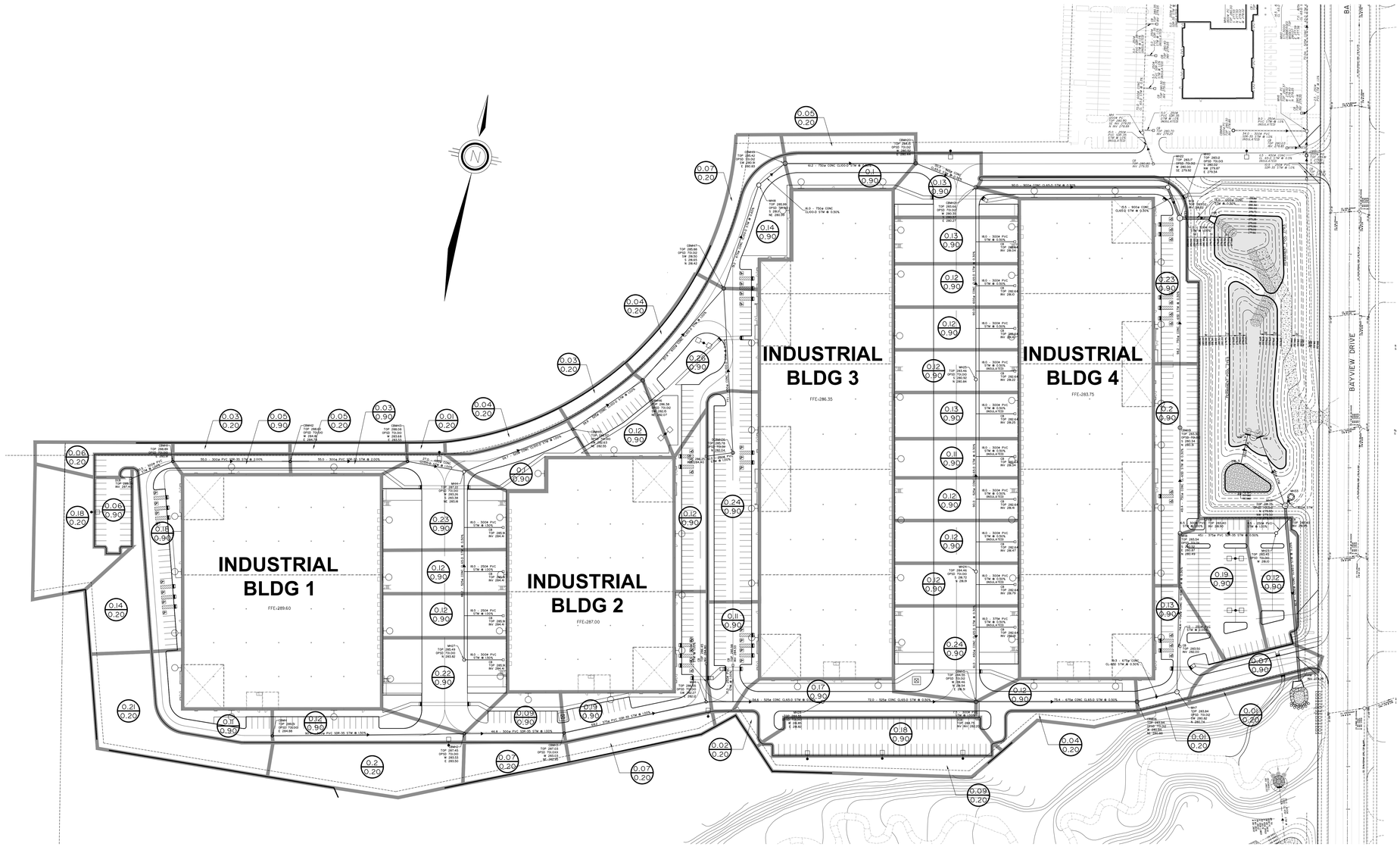
SITE SERVICING & SITE GRADING BY:

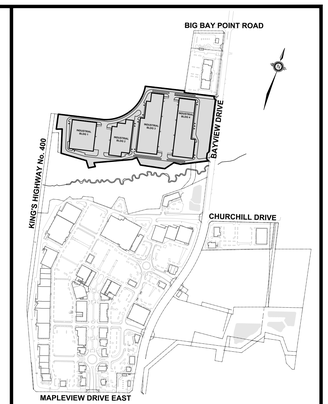
SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS
110 OLD KINGSTON ROAD
AJAX, ONTARIO L1T 2Z9
SKA PROJECT NO. 02:999

LICENSED PROFESSIONAL ENGINEER
M.A.GOLUBOWICH
100104446
29/04/22
PROVINCE OF ONTARIO

DRAWN BY	RAV
CHECKED BY	MAG
DATE	APRIL 29, 2022
ISSUED	APRIL 29, 2022

PROJECT NO.	02138.44
DWG. NO.	ESC





KEYMAP N.T.S.

LEGEND:

- CATCHBASIN
- DOUBLE CATCHBASIN
- CATCHBASIN MANHOLE
- DOUBLE CATCHBASIN MANHOLE
- STORM MANHOLE
- PROPOSED SERVICES
- STORM DRAINAGE BOUNDARY
- AREA IN HECTARES
- RUNOFF COEFFICIENT (0.99 / 0.45)
- HEAVY DUTY ASPHALT

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STORM DRAINAGE PLAN

SCALE: 1:750

PARK PLACE NORTH LANDS

HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

SITE SERVICING & SITE GRADING BY:

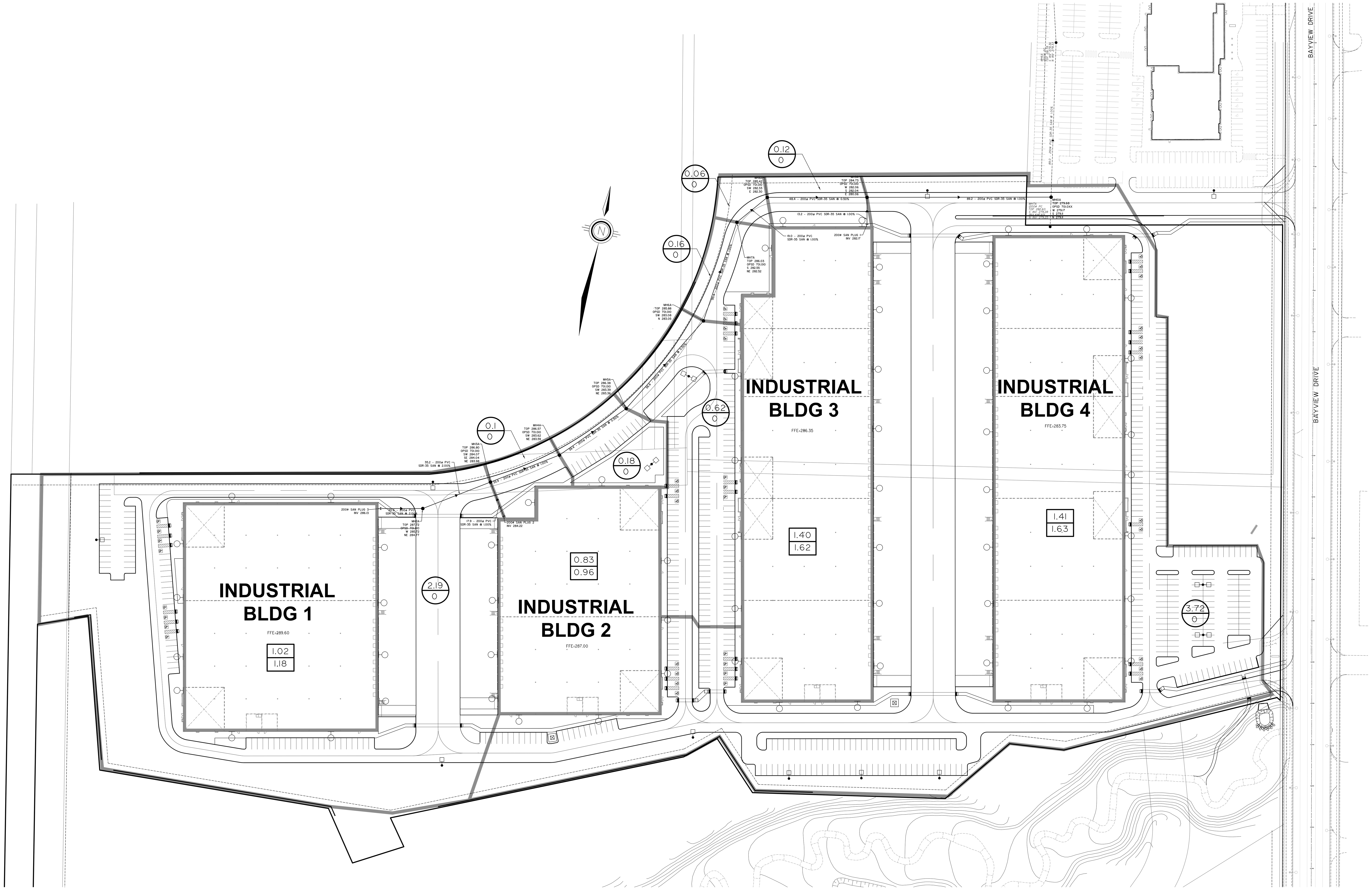
SKA SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS
110 OLD KINGSTON ROAD
AJAX, ONTARIO L1T 2Z9

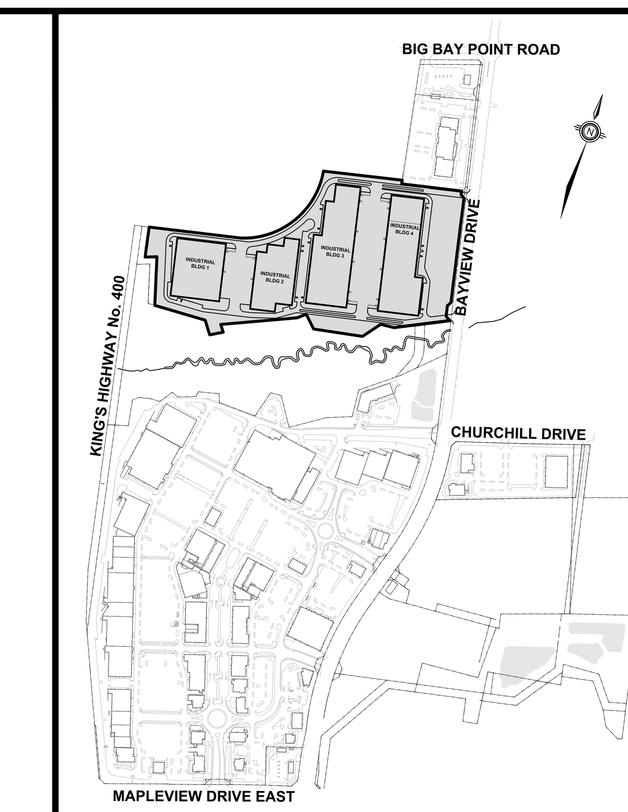
SKA PROJECT NO. 02:999

LICENSED PROFESSIONAL ENGINEER
M. A. GOLAKOVICH
100104446
29/04/22
PROVINCE OF ONTARIO

DRAWN BY	RAV
CHECKED BY	MAG
DATE	APRIL 29, 2022
ISSUED	APRIL 29, 2022

PROJECT NO. 02138.44
DWG. NO. STM





KEYMAP N.T.S.

LEGEND:

SANITARY MANHOLE	●
PROPOSED SERVICES	
SANITARY DRAINAGE BOUNDARY	
- AREA IN HECTARES - POPULATION	1.50 / 15
HEAVY DUTY ASPHALT	
INDUSTRIAL - AREA IN HECTARES - FLOW (L/S)	2.0 / 1.18

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SANITARY DRAINAGE PLAN

SCALE: 1:750

PARK PLACE NORTH LANDS
HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

SITE SERVICING & SITE GRADING BY:

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SKA PROJECT NO. 02:999

LICENSED PROFESSIONAL ENGINEER M.A. GOLAKOVICH 100104446 29/04/22 PROVINCE OF ONTARIO

DRAWN BY	RAV	PROJECT NO.	02138.44
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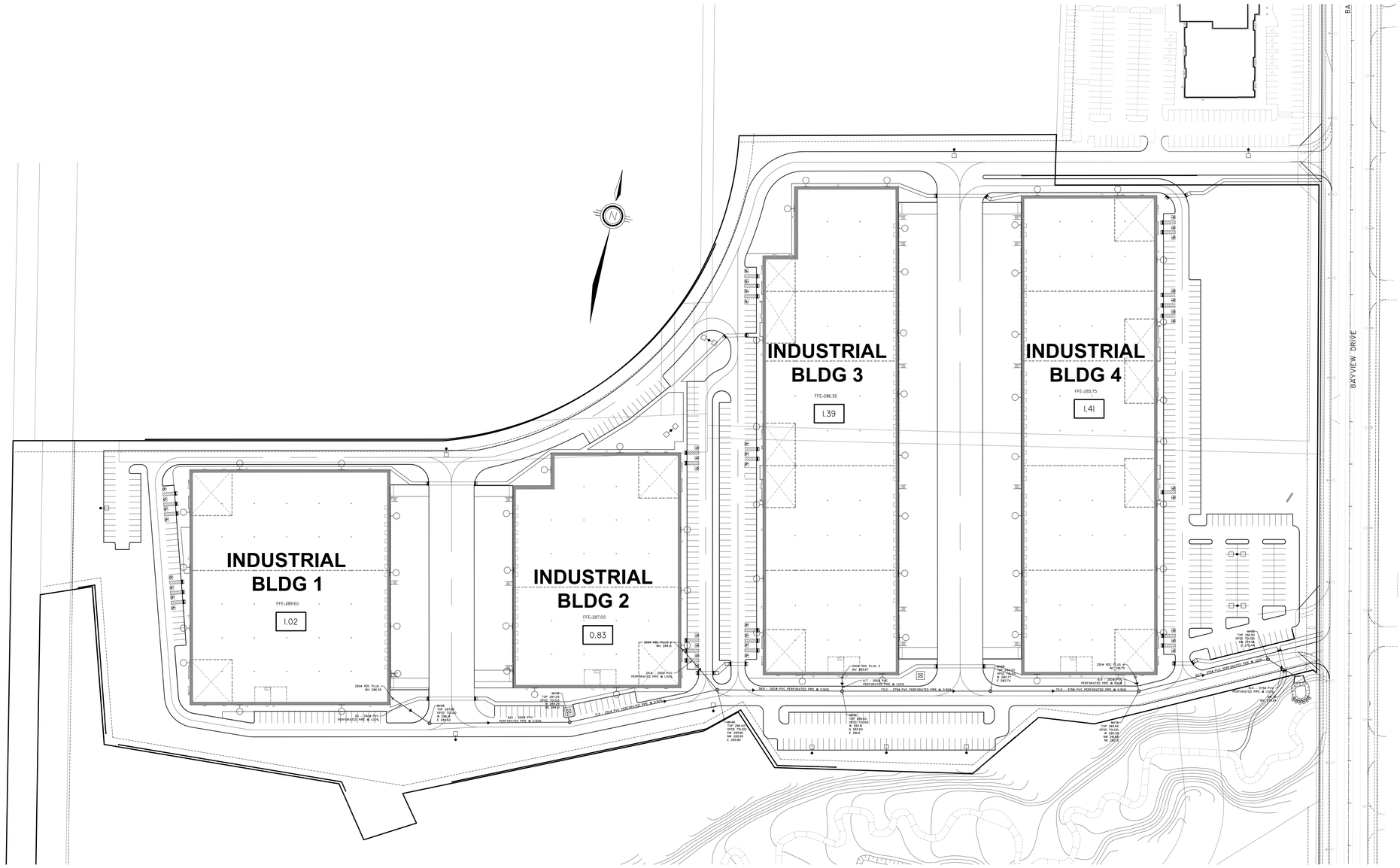
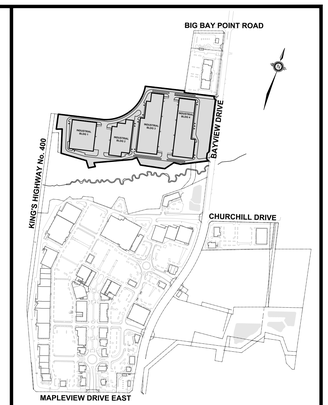
DATE	APRIL 29, 2022	DWG. NO.	SAN
ISSUED	APRIL 29, 2022		





KEYMAP N.T.S.

LEGEND:

- RDC MANHOLE
- PROPOSED SERVICES
- ROOFTOP DRAINAGE BOUNDARY
- AREA IN HECTARES — 1.50
- HEAVY DUTY ASPHALT

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ROOF DRAINAGE COLLECTOR PLAN

SCALE: 1:750

PARK PLACE NORTH LANDS

HWY 400 & MAPLEVIEW DRIVE E.
BARRIE, ONTARIO
FOR: NORTH AMERICAN

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SKA PROJECT NO. 02:999

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