

FUNCTIONAL SERVICING REPORT

**WATERSAND CONSTRUCTION C/O DG GROUP
PHASE 1 SALEM SECONDARY PLAN**

PROPOSED RESIDENTIAL DEVELOPMENT

CITY OF BARRIE

PROJECT 4278

OCTOBER 2016



SCHAEFFERS
CONSULTING ENGINEERS

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1 INTRODUCTION

1.1 Study Objectives and Location

The objective of this report is to provide a servicing plan for the proposed residential development that will guide future detailed engineering designs.

The subject site was previously analyzed as part of the *Subwatershed Impact Study (SIS), Salem Annexed Lands, City of Barrie completed by Schaeffers Consulting Engineers* dated September 2016. The Salem Secondary Plan (SSP) lands are bound by Salem Road to the north, Hurontario Road to the east, County Road 27 to the west and the southern boundary is a mid concession line south of McKay Road between Simcoe County Road 27 to the west and Huronia Road as shown in **Figure 1.1**. The southern boundary is also the municipal boundary between City of Barrie and Town of Innisfil.

The Salem Annexed lands are to be developed in three phases, with each phase can be developed in stages. The subject site is part of Phase plan as described in the SIS. The subject site is bound by Mackay Road to the north, Highway 400 to the east, and a future development phase to the west as illustrated on **Figure 1.1** and **Figure 1.2**. The total area of the Salem Annexed lands is approximately 1,484 ha, while the portion currently considered for development, and discussed in this report, makes up 124 ha of that total area.

The subject lands fall along the jurisdictional boundary of the of the Nottawasaga Valley Conservation Authority (NVCA) and the Lake Simcoe Region Conservation Authority (LSRCA), which is also the watershed boundary between Lover's Creek (LSRCA) and Thornton Creek (NVCA).

The following sections of this report provide strategic information regarding the stormwater management (SWM), water supply and sanitary servicing for the subject lands. The information will be provided while ensuring compatibility with the existing storm, sanitary and water supply services.

1.2 Proposed Development Plan and Population

It is proposed to construct a residential subdivision. There are five access points from McKay Road West and two from Veteran's Drive as shown on **Figure 1.2**. The proposed development has a total developable area of approximately 124 ha. Approximately 1,443 residential units are proposed (1047 singles and 396 townhouses) with an estimated population of 4,200 persons based on a population density of 3.13 ppu for single and 2.34 ppu for townhouses., as per City of Barrie design criteria. Additionally there is commercial, institutional and industrial lands proposed.

1.3 Existing Site Conditions

A review of existing site conditions was carried out using available topographic mapping, air photography, and previous studies. Salem lands surround the divide of the Lake Simcoe and Nottawasaga River Watersheds, and represent the headwater drainage area for three subwatersheds: Lovers Creek (Lake Simcoe Watershed) and,

Thornton Creek (Nottawasaga River Watershed).

The landscape throughout the study area generally slopes towards the above-mentioned creeks and respective surrounding areas. Lovers Creek generally drains in an easterly direction and ultimately into Lake Simcoe. The Thornton Creek generally conveys flow in southerly direction towards the Nottawasaga River and Bear Creek drains to northwest, also contributing to the Nottawasaga River. The current land cover and land use is a mix of agricultural, forested and open space areas with isolated residential pockets and some minor urban developments.

According to the Soil Survey of Simcoe County Report (1962), the predominant soil types throughout this study area are Tioga and Bondhead Sandy Loams. The Tioga and Bondhead Sandy Loams are classified as soils with good drainage. The topography varies from gently smooth to irregular steeply sloping. The stoniness is characterized as stone-free to moderately stony. The local geology monitoring completed by R.J. Burnside confirmed that the study area consists of silty to sandy glacial till with areas of glaciofluvial ice-contact stratified sediments of sand and gravel.

Currently, agriculture is the predominant land use, especially within the Lovers Creek sub-watershed, with some estate residential lots and minor developments. Thornton Creek subwatershed area remains predominantly undeveloped. Significant natural heritage features, including woodlots and wetlands are found throughout all two subwatersheds.

WATERSAND RESIDENTIAL SUBDIVISION
SALEM COMMUNITY DEVELOPMENT AREA
CITY OF BARRIE

LEGEND



SUBJECT SITE



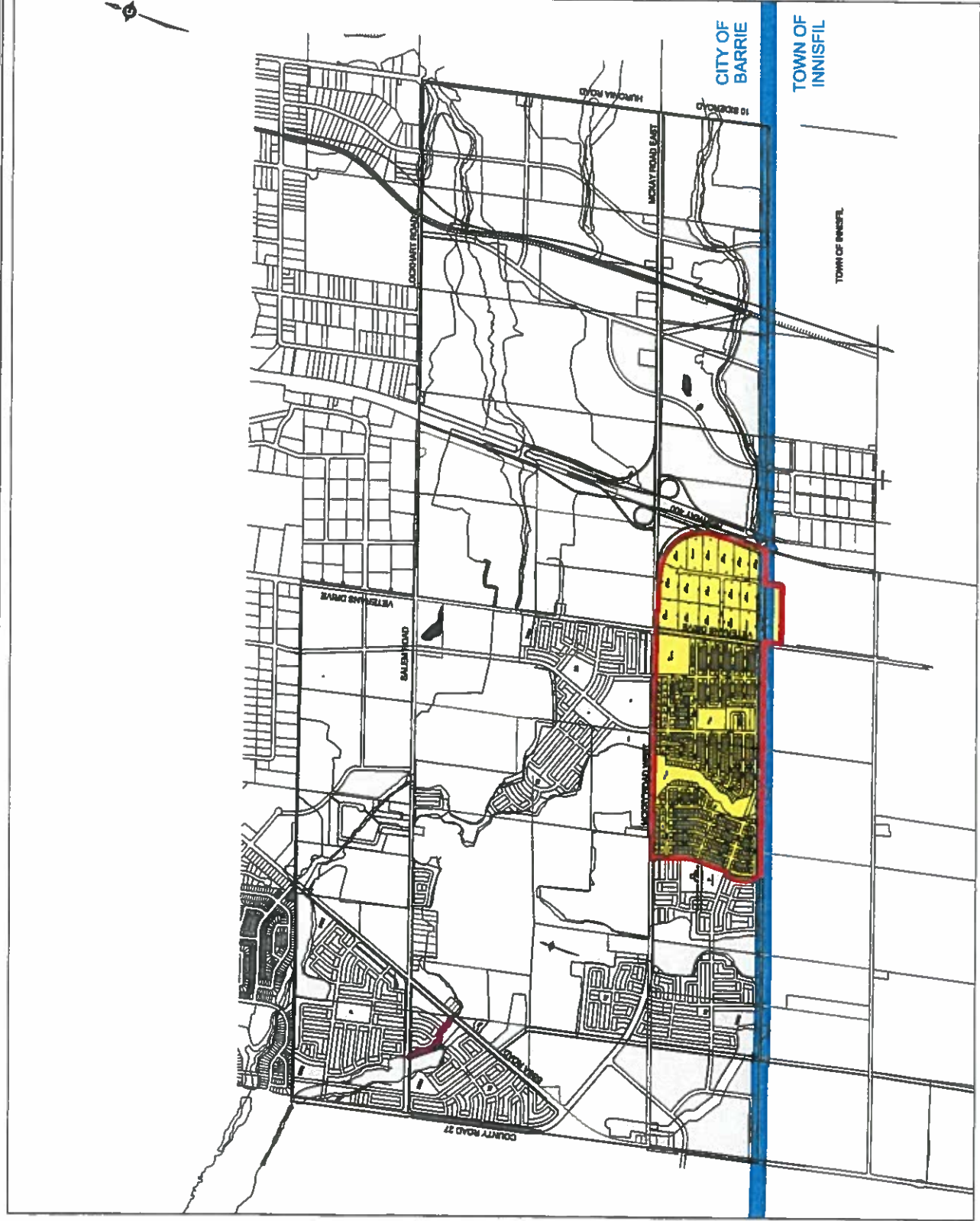
SECONDARY DEVELOPMENT
PLAN BOUNDARY

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FIGURE 1.1
LOCATION PLAN

2015-2778 OCTOBER 2015 SCALE: N.T.S.



LEGEND

SUBJECT SITE

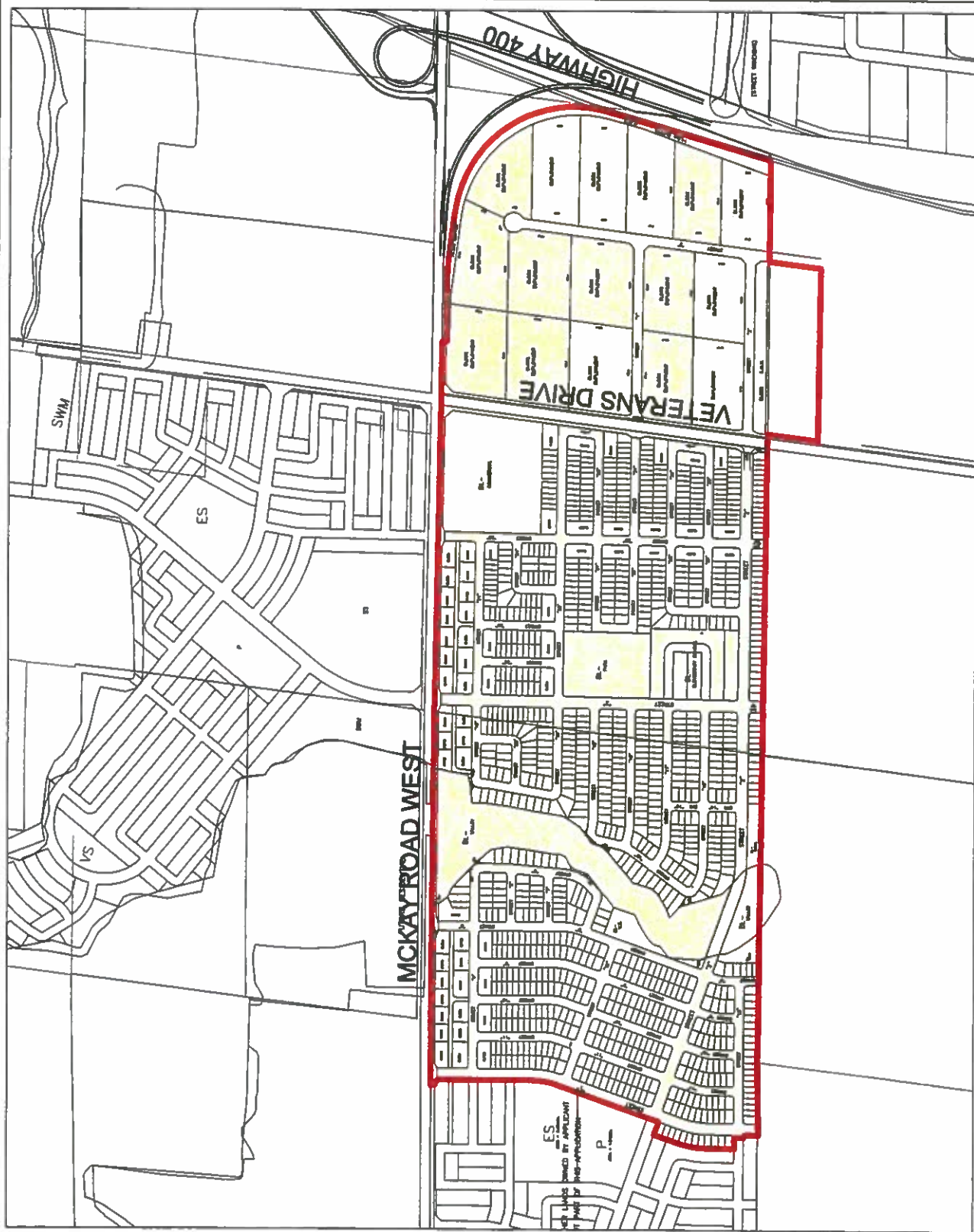
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FIGURE 1.2
DEVELOPMENT PLAN

2015-4278 OCTOBER 2016 SCALE: N.T.S.



2 STORMWATER MANAGEMENT

2.1 Existing Storm Infrastructure

There is no existing stormwater infrastructure in the vicinity of the subject site. Under pre-development the majority of the site drains towards Thornton Creek, while a portion at the east drains towards Lover's Creek shown in **Figures 2.1**.

2.2 Stormwater Design Criteria

Major SWM controls related to the Study Area have been established following the project team discussions with the City of Barrie, LSRCA and NVCA staff. Some specific requirements were adopted through additional consultation with the Conservation Authorities, as per their current technical guidelines.

In general, the SWM design criteria and requirements follow the City of Barrie's Stormwater Management Policies and Design Guildlines (2009). Where deemed necessary, the MOE's Stormwater Management Planning and Design (SWMPD) Manual (2003) will be applied as a minimum.

The following summarizes the general design criteria applicable to the stormwater conveyance system within the Salem lands development:

- Water quality control should be Level One (enhanced);
- At minimum, the removal of 80% of the annual Total Phosphorus (TP) load from all impervious surfaces is required for new development.
- Water quantity control should be 100-year storm post- to pre- development;
- Urban drainage systems (curb/gutter/storm sewers) are preferred by the City of Barrie;
- Major drainage system should be designed to accommodate runoff exceeding the capacity of the minor system for flows up to the 100-year return frequency. The major system should be contained within road allowances, swales, drainage channels, designated blocks and ponds;
- Minor drainage system should be designed for the 5-year storm event using the Rational Method and City of Barrie IDF curves;
- Generally, the obvert of storm sewers is to be placed 1.5 m below the finished grade at the centerline of the road or at a minimum 1.0 m below the dwelling basement floor elevation. Where foundation drainage is provided by sump pumps the minimum cover should be no less than 1.2 m. Foundation and weeping tile drains are to be drained by gravity to the storm sewers wherever possible;

The following summarizes general design criteria for the proposed SWM facilities:

- Where possible, the facilities should be adjacent to open space areas or natural systems including proposed linkage corridors and watercourses;
- The drainage area to the facilities should be limited to a maximum of 40 to 80 ha;

- The facilities should be designed as off-line wet ponds in accordance with the MOE's requirements for "enhanced" protection level for the receiving watercourse;
- The facilities should be designed in accordance with the MOE requirements for the length to width ratio to mitigate the thermal impacts of urban storm runoff;
- The required permanent storage should be determined by extrapolating values from Table 3.2 from the MOE's Design Manual (2003), based on the imperviousness level of the contributing drainage area and subtracting 40 m³/ha required for extended detention storage;
- The required storage volume for erosion control (i.e. extended detention) should be based on an impervious hectare basis and flow control rate for the development area as summarized in Table 4.4.8: Stormwater Management Erosion Control Requirements – Traditional SWM of DSWMMP
- The required storage volume necessary to mitigate impacts on peak flow rates (flooding) should be based on the flood control characteristics as summarized in Table 4.4.13: Stormwater Management Flood Control Requirements of DSWMMP.
- The permanent pool in the proposed wet ponds should be no greater than 2.0 m in depth. The active storage volume should have a maximum fluctuation of 1.5 m to 2.0 m.
- The SWM facilities should include a reverse grade bottom draw outlet structure, sediment forebay, outlet plunge pool, emergency overflow spillway and maintenance access route. The outlet channel from the facilities should be designed with a riffle structure to assist in aerating the SWM effluent before it reaches the receiving watercourse.
- Thermal mitigation practices such as cooling trenches, deeper permanent pools, reversed slope pond outlets should be considered for all SWM facilities. Shading of open water areas by maximizing canopy and enhancement of riparian vegetation between the facility outlet and the receiving watercourse should be implemented for each facility.
- Alternative on-site control SWM measures may be considered for developments with a contributing drainage area less than 5.0 ha.
- Infiltration should be promoted through the use of LID measures throughout the development area. Recharging water quality must be acceptable such that local water wells are not impacted in accordance with the Ontario Drinking Water Quality Standards.
- Consideration should be given to the implementation of LID measures to maximize SWM at the site level: on-site capture of the first 25 mm rainfall for infiltration; 48 hour release of 25 mm storm event for erosion control; and post-to-pre Phosphorus loading for Lovers Creek Watershed as per LSPP area.

2.3 Total Phosphorous Reduction Criteria

As the subject site is split between LSRCA and NVCA jurisdictions, the following criteria are to be applied:

- The target within LSRCA jurisdiction is established based on LSRCA Technical Guidelines for Storm Management Submissions, Dated June 8, 2016. According to this guideline, by comparing the total Phosphorus load (TP) and application of feasible mitigation measures, the SWM plan should demonstrate that the removal of 80% of the annual Total Phosphorus (TP) load from all major development areas are achieved.
- The target within this jurisdiction is established based on NVCA Stormwater Technical Guide, Dated December, 2013. NVCA prefers that at all new developments TP load at post development stage is reduced by 20% from that of predevelopment. However, NVCA recognizes that in some circumstances, this target cannot be achieved and therefore, at least, NVCA requires that the TP load at post development stage matches with that of pre development.

2.4 Proposed Stormwater Management Scheme

It is proposed to provide stormwater quality and quantity control for the subject site through the use of end-of-pipe stormwater management ponds. As per the SIS for the Salem Annex Lands, three SWM ponds (referred to as SWM Pond A, B and M) have been proposed to service the subject site as shown in **Figure 2.2**.

SWM Ponds A and B are proposed to discharge to Thornton Creek. SWM Pond M is proposed to be located on the east side of Veterans Drive and discharge to Lovers Creek. The following section provides preliminary design details for the SWM Ponds.

There are two low areas near the middle of the subdivision, adjacent to McKay Road, as shown on Figure 2.2, which cannot drain by gravity to the proposed SWM Ponds. LID measures are proposed in these two areas to provide water quantity and quality control, before discharging directly to Thornton Creek.

2.5 SWM Pond Design

The purpose of this section is to demonstrate that the proposed SWM facilities are designed to provide sufficient stormwater quality, quantity, and erosion control in accordance with the City of Barrie, LSRCA, NVCA and MOECC requirements.

The SWM facilities have been planned with the following objectives in mind:

- Ensure Enhanced (Level 1) water quality protection;
- Use water quantity control as per pre-development flow rates;
- Ensure erosion control;
- Ensure phosphorous loading reduction;
- Achieve water balance objectives.

As per the SIS report, in general the 6 and 24 hour SCS storms generally required the largest pond volumes.

The following tables present a summary of parameters for each proposed SWM wet pond and are organized by watershed. The drainage areas provided in the tables include the pond block areas.

The following sections provide a brief summary of these ponds. Preliminary Pond design drawings are provided in Appendix A.

2.5.1 SWM Pond A

SWM Pond A is proposed to be located at south boundary of the Salem lands, east of Thornton Creek and west of Veterans Drive, within Phase 1. The majority of the Pond A block is located within Innisfil lands owned by DG Group. The location of Pond A is shown on Figure 2.2 and is generally consistent with the DSWMMP.

The proposed catchment for Pond A is 31.55 ha in area and generally consists of a residential land use with a park and school block. As per discussions with the NVCA, Pond A has been sized to provide quality, quantity and erosion control. Quantity control criteria was based on pre-development target rates.

The SIS recommended, that in addition to the SWM Pond, an outlet swale be proposed to provide the required total phosphorous reduction as per applicable criteria.

A summary of Pond A design features are provided in Table 2.1. Further details are provided in Appendix A.

2.5.2 SWM Pond B

SWM Pond B straddles the southern boundary limit on the west side of the Thornton Creek within Phase 1. A portion of the pond block is located within Innisfil lands owned by DG Group. The location of Pond B is shown on Figure 2.2 and is generally consistent with the DSWMMP.

The proposed catchment for Pond B is approximately 22.97 ha in area and generally consists of a residential land use. As per discussions with the NVCA, Pond B has been sized to provide quality, quantity and erosion control.

The SIS recommended, that in addition to the SWM Pond water quality treatment, an outlet swale be proposed to provide the required total phosphorous reduction as per applicable criteria

A summary of Pond B design features are provided in Table 2.1. Further details are provided in Appendix A.

2.5.3 SWM Pond M

SWM Pond M is a proposed wet facility located within the Lovers Creek watershed, on the east side of Veterans Drive within DG Group owned lands in the Town of Innisfil as shown on Figure 2.2.

The proposed catchment area for Pond M generally consists of a mix of residential, commercial, and employment lands. The western portion of the catchment area was previously part of the Thornton Creek

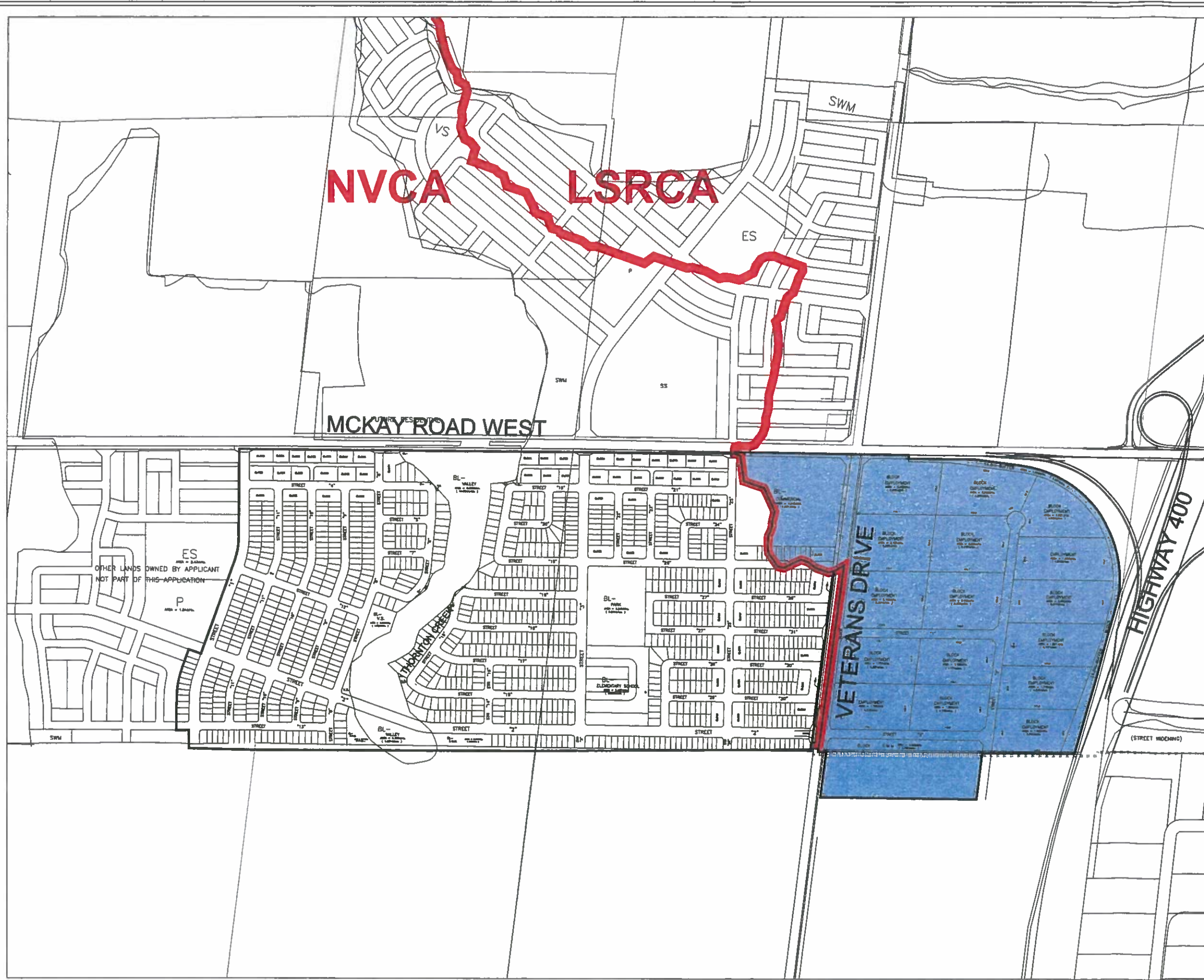
watershed. The pre-development release rates are based on the portion of the catchment area within the Lovers Creek watershed. The proposed SWM was designed to provide quantity control, as well as quality and erosion control.

The SIS recommended, that in addition to the SWM Pond, an outlet swale be proposed to provide the required total phosphorous reduction as per applicable criteria

Table 2.1 provides a summary of the storage requirements. Additional details are provided in Appendix A, including preliminary design drawings.

Table 2.1: Summary of Proposed SWM Facilities

Parameter	Stormwater Management Facility		
	A	B	M
SIS Area (ha)	527	5254	1421
Drainage Area (ha)	31.55	22.97	67.17
Impervious Area (%)	60	60	76
Permanent Storage (m ³)	5,100	3,700	13,400
Extended Detention Storage (m ³)	4,700	3,450	12,800
100 Year Storm Storage (Required) (m ³)	15,500	11,500	50,000
Peak Extended Detention Flow (m ³ /s)	0.082	0.060	0.222
Governing Storm	SCS 6hr	SCS 6hr	SCS 24hr
100 Year Target Release Rate (m ³ /s)	1.244	0.934	1.491

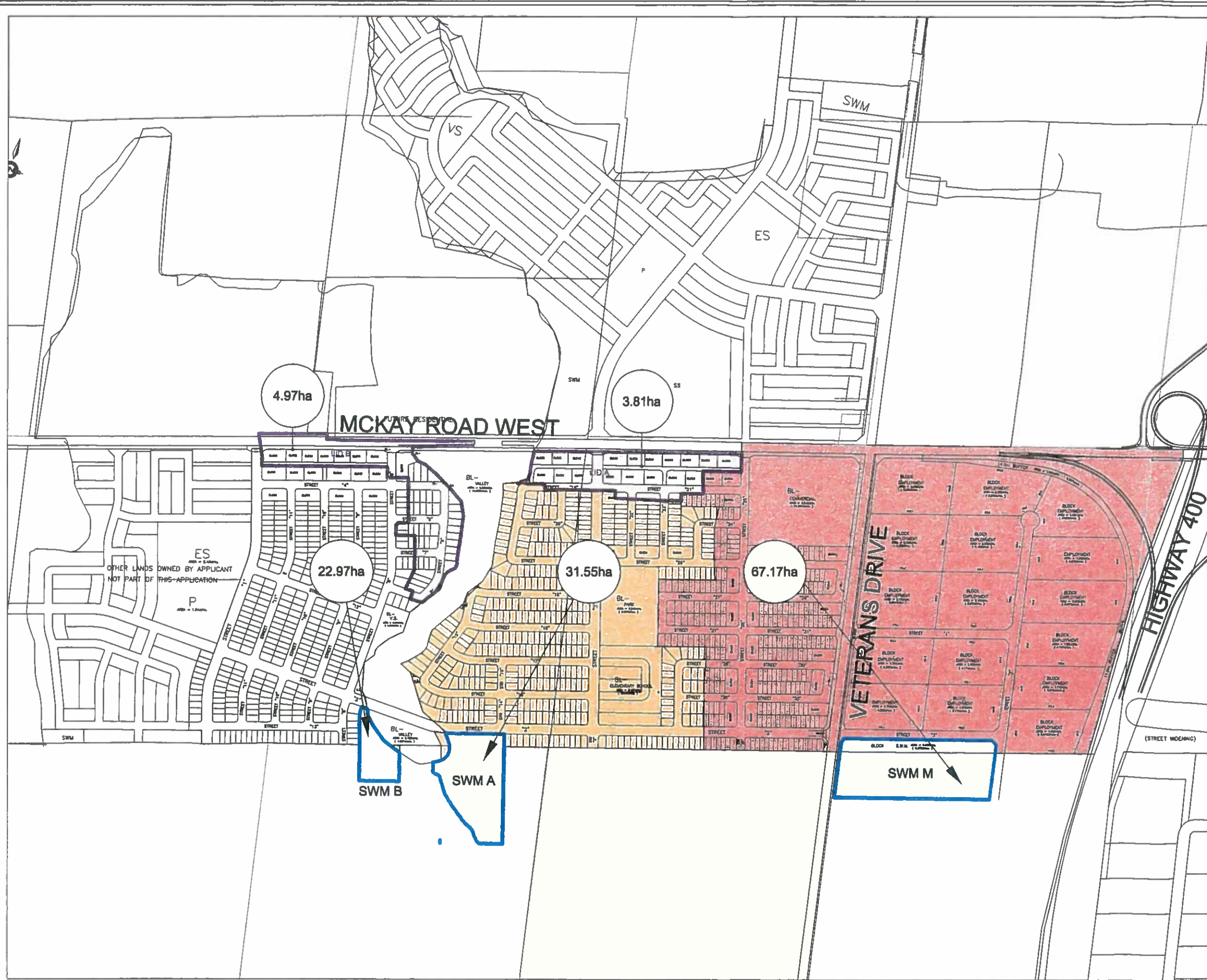


WATERSAND RESIDENTIAL SUBDIVISION
SALEM COMMUNITY DEVELOPMENT AREA
CITY OF BARRIE

- LEGEND
- TRIBUTARY TO THORNTON CREEK (NVCA)
 - TRIBUTARY TO LOVER'S CREEK (LSRCA)

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FIGURE 2.1
PRE-DEVELOPMENT DRAINAGE AREA



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SALEM COMMUNITY DEVELOPMENT AREA
CITY OF BARRIE

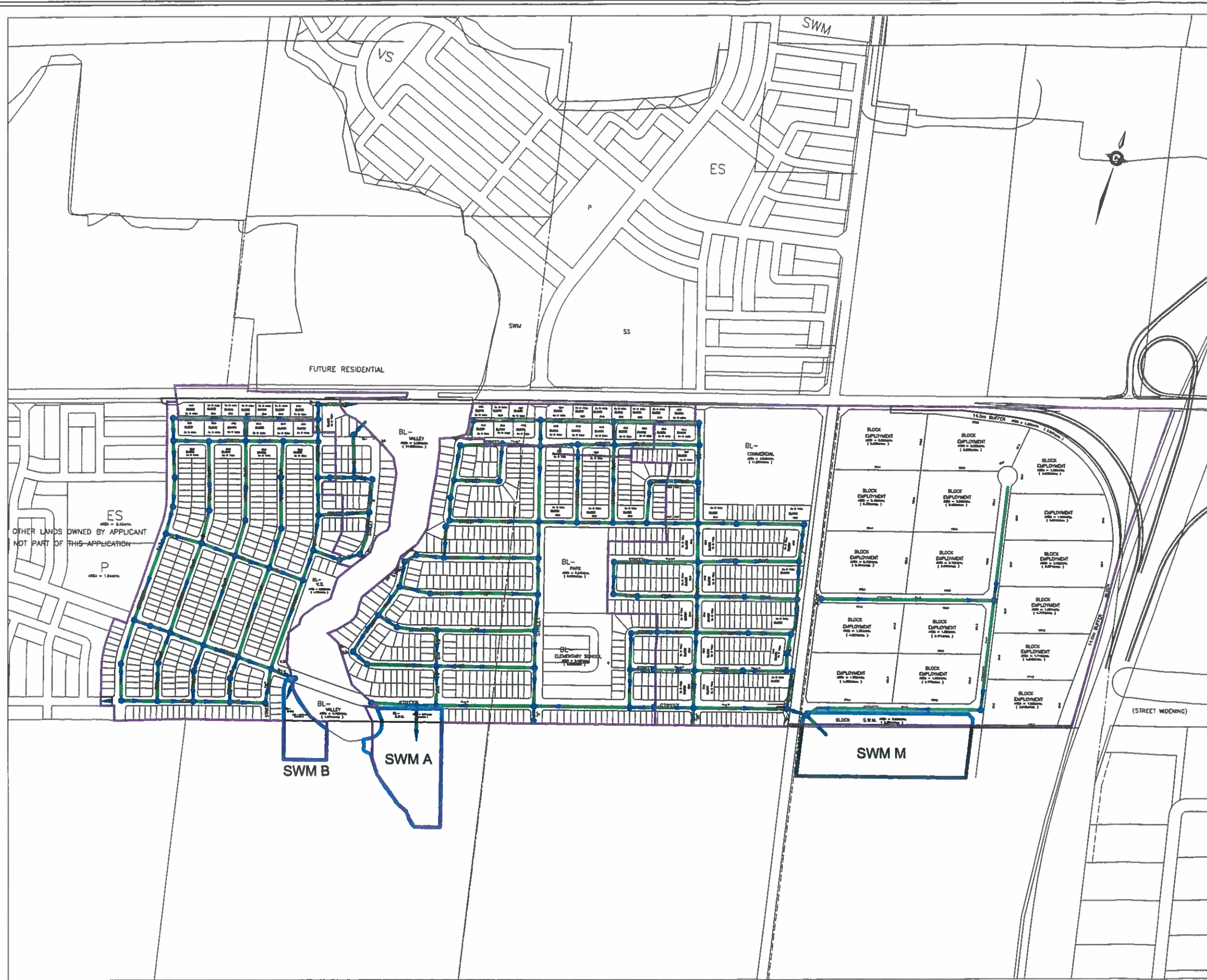
LEGEND

- POTENTIAL SWM FACILITY
- POTENTIAL AREAS DRAINING TO LID
- SWM POND A TRIBUTARY AREA
- SWM POND B TRIBUTARY AREA
- SWM POND C TRIBUTARY AREA
- SWM POND M TRIBUTARY AREA

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FIGURE 2.2
SWM POND & LID AREAS
SALEM SECONDARY PLAN - MASTER PLAN

Stephen McKeown
W:\2016\4278\Drawings\2016-10-07-4278-Servicing.dwg



WATERSAND RESIDENTIAL SUBDIVISION
SALEM COMMUNITY DEVELOPMENT AREA
CITY OF BARRIE

LEGEND

-  SUBJECT SITE
-  PROPOSED STORM SEWERS
-  PROPOSED SWM TRIBUTARY BOUNDARY
-  PROPOSED SWM PONDS

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FIGURE 2.3
STORMWATER SERVICING PLAN
SALEM SECONDARY PLAN - MASTER PLAN

2.5.4 Flows to SWM Pond

For the subject site, the minor system will convey stormwater runoff from storms up to and including the 5 year design storm to the SWM Ponds. Stormwater runoff in excess of the minor system up to the flows generated from the 100 year storm event will be conveyed via the major system and controlled by the SWM Pond. The proposed stormwater infrastructure is illustrated in **Figure 2.3**.

2.6 Low Impact Development

As noted earlier in the report, the Salem development lands lay within the LSRCA and NVCA regulatory limits. LSCRA encourage and support the use of LID techniques to achieve quality and quantity control objectives based on the best management practices. It should be noted that the LID measures should be used as part of a treatment train approach. Furthermore, besides reducing Total Suspended Solids (TSS), some LID techniques can also be used to reduce phosphorous loading as per LSRCA guidelines and objectives of the Lake Simcoe Protection Plan.

Figure 2.2 has identified two areas (LID A and LID B) within the Thornton Creek watershed that, due to grading constraints, cannot drain to the proposed SWM Ponds. LID A has an area of 3.81 ha and LID B has an area of 4.97 ha. Quantity and quality control for these areas is proposed to be provided through the use of underground superpipe storage and oil grit separators. Preliminary calculations show a required storage volume of 1450 m³ for LID A and 1850 m³ for LID B.

3 SANITARY SERVICING

The wastewater servicing plan for SSP lands was initially addressed in the Barrie's Wastewater Collection Master Plan (WCMP) for Intensification Areas and Annexed Lands, prepared by AMEC (October 2013).

3.1 Existing Sanitary Servicing

There is no existing sanitary infrastructure within the vicinity of the site.

As per the SIS, sanitary servicing for the subject site will be provided by the future McKay Road trunk sewer.

3.2 Sanitary Design Criteria

As per the City of Barrie's Design Criteria for sewers, the following guidelines were used in the design calculations for the sanitary sewers:

- A sewage flow rate of 225 L/cap/day for residential;
- 28 L/ha/day for commercial and institutional;
- 35 L/ha/day for industrial;
- An infiltration rate (extraneous flow) of 0.1 L/sec/ha;
- Peaking Factor: based on Babbitt Peaking (as agreed upon with City staff);
- Population Density of 3.13 ppu for low density and 2.34 ppu for medium density;
- Maximum velocity shall not be greater than 3.0 m/s with pipe flowing full;
- Minimum velocity shall not be less than 0.6 m/s at actual flow, and
- Minimum pipe diameter of 200mm (as agreed with City in areas where cleaning velocity cannot be achieved).

3.3 Proposed Sanitary Servicing Plan

As per the SIS for the Salem Annexed Lands, an interim and ultimate sanitary servicing plan was developed. The following details the servicing during Stage 1, Stage 2 and the ultimate servicing plan:

3.3.1 Phase 1- Stage 1

Servicing for Phase 1, Stage 1 is proposed to be provided through construction of a trunk sewer on McKay Drive, a temporary pumping station at the intersection of McKay Road and Veterans Drive, and a gravity sewer on Veterans Drive.

The interim servicing scheme will utilize spare capacity of the existing sewerage system servicing the population within the previous urban boundaries of the City until the McKay/Huron Sanitary Trunk Sewer can be commissioned. This interim servicing scheme will be used only while the first stage of Phase 1 development is being constructed as shown on Figure 3.1.

3.3.2 Phase 1 – Stage 2

As per Figure 3.2, there is an area at the southwest of the subject site that cannot drain by gravity to McKay Road. A permanent pumping station is proposed west of the site. The low lying area identified in Figure 3.2 will drain by a proposed gravity sewer to the proposed pump station. The flows will then be pumped up to a proposed gravity sewer which connects to the McKay/Hurononia trunk sewer.

3.3.3 Ultimate Servicing

Under ultimate conditions, the temporary pump station at the intersection of McKay Road and Veterans Drive will be decommissioned. The McKay/Hurononia Trunk Sewer on McKay Drive will be extended to Huronia Road and then north on Huronia Road to connect with the existing sanitary system as shown on Figure 3.3.

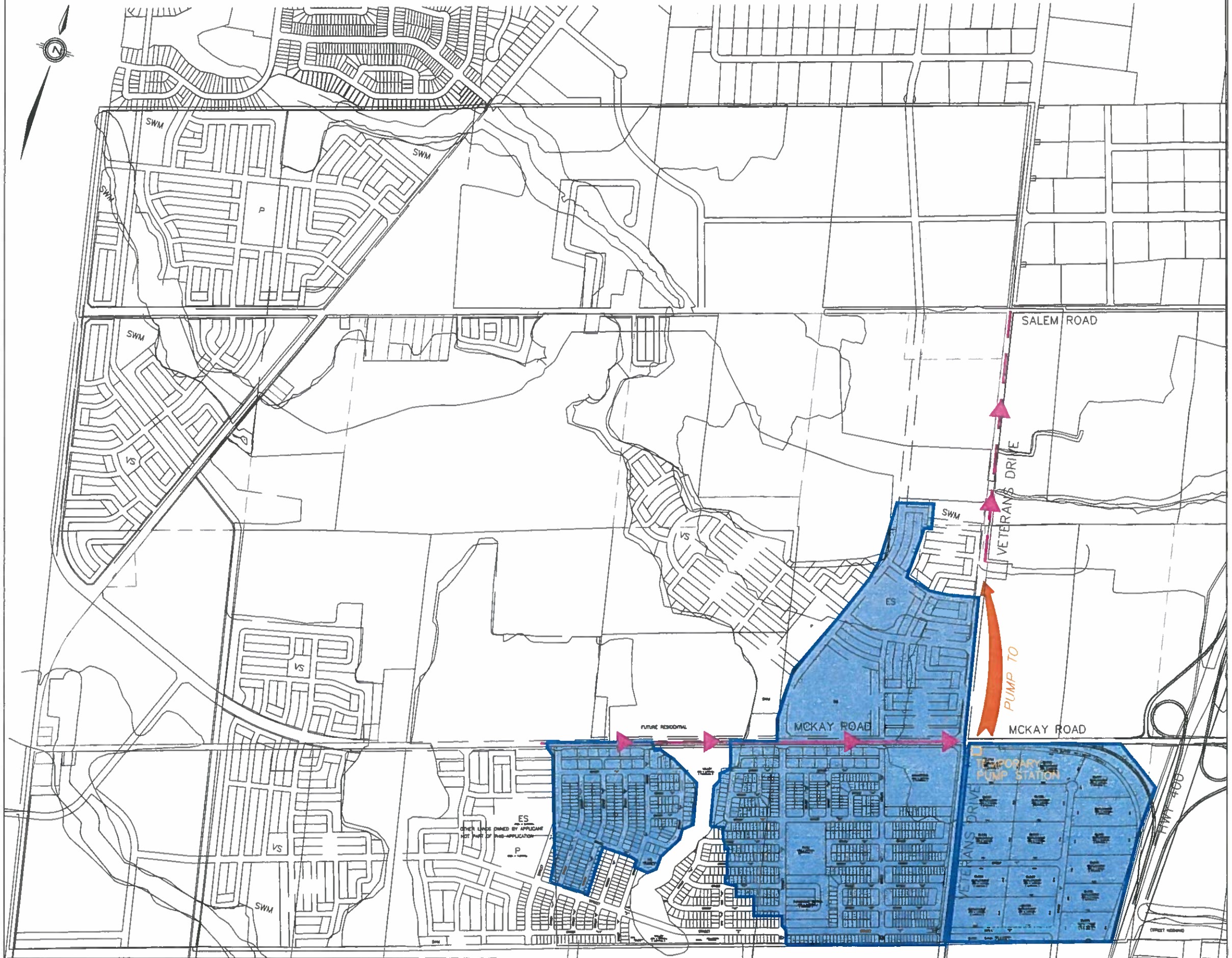
Estimate sanitary demands are presented below in Table 3.1 and sanitary calculations are provided in Appendix B.

Table 3.1 - Sanitary Servicing Requirements

Land Use	Average Demand (L/s)	Peaking Factor	Infiltration (L/s)	Total Peak Flow (L/s)
Residential	10.95	3.75 *	4.57	45.65
Institutional	0.79	2	0.24	1.82
Commercial	1.47	2	0.45	3.40
Industrial	14.50	3	3.58	47.09
Total				97.95

* Based on Babbitt Peaking Factor equation

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SALEM COMMUNITY DEVELOPMENT AREA CITY OF BARRIE

LEGEND

-  MCKAY / HURON IA TRUNK SAN. SEWER
(BUILT AT STAGE 1 OF PHASE 1)
-  SAN. SEWER ON VETERANS DRIVE
(BUILT AT STAGE 1 OF PHASE 1)
-  TRIBUTARY AREA IN PHASE 1
(WEST OF HWY 400) DRAINING TO THE
TEMP. PUMP STATION AT
THE INTERIM STAGE

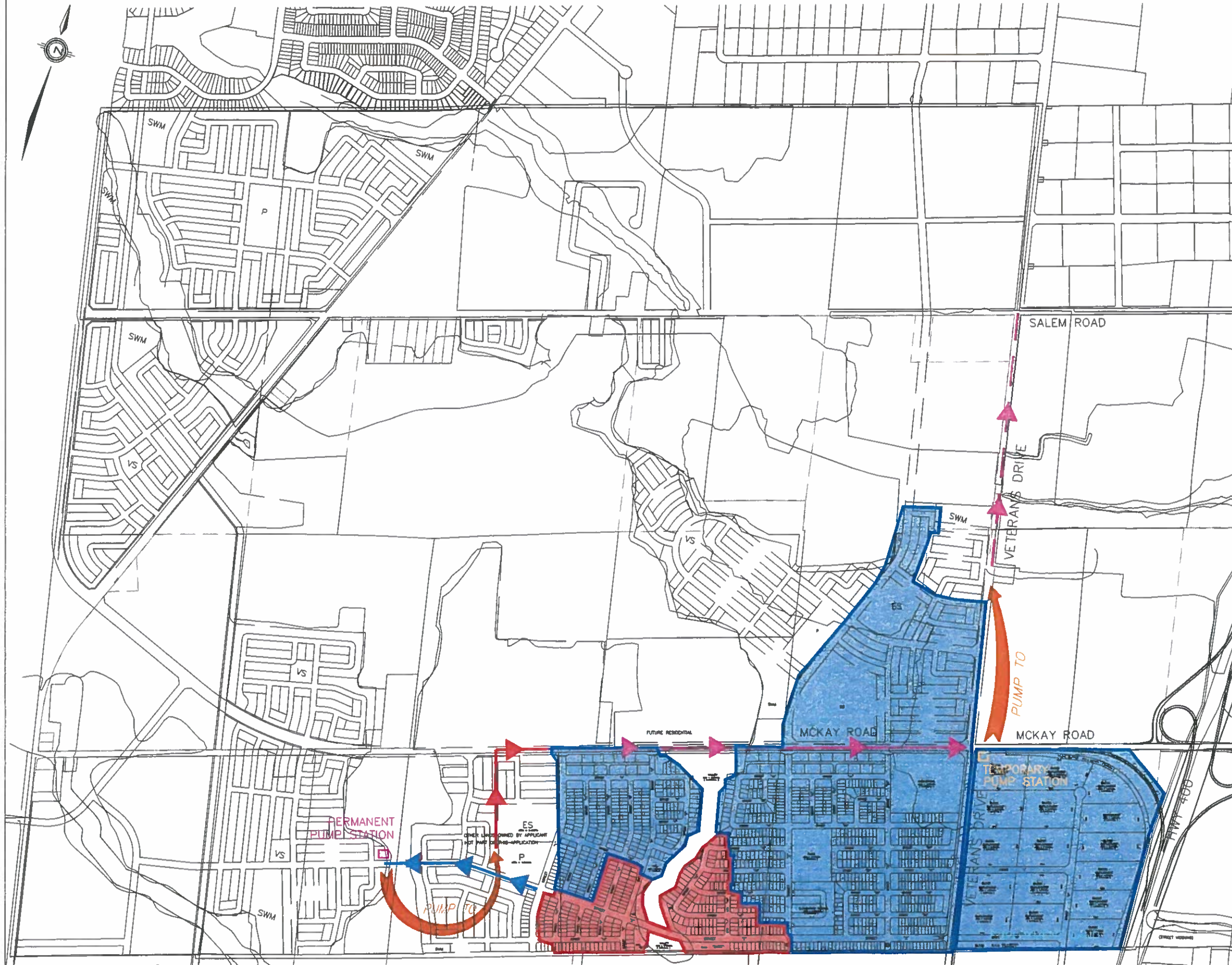
NOTES:

1. INSTALL SAN. SEWER ON VETERANS DRIVE TO SALEM ROAD.
2. INSTALL TEMPORARY PS INSIDE EMPLOYMENT LAND AND PUMP TO EXTENDED SEWER ON VETERAN'S DRIVE.
3. INSTALL PERMANENT GRAVITY SANITARY SEWER ALONG MCKAY ROAD FROM TEMPORARY PS TO THE WEST.

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FIGURE 3.1
PHASE 1 (STAGE 1)
SANITARY SERVICING



SALEM COMMUNITY DEVELOPMENT AREA CITY OF BARRIE

LEGEND

-  MCKAY / HURON LA TRUNK SAN. SEWER
(BUILT AT STAGE 1 OF PHASE 1)
-  SAN. SEWER ON VETERANS DRIVE
(BUILT AT STAGE 1 OF PHASE 1)
-  TRUNK SAN. SEWER
(BUILT AT STAGE 2 OF PHASE 1)
-  LOCAL SAN. SEWER IN PHASE 2 AND 3
(BUILT AT STAGE 2 OF PHASE 1)
-  TRIBUTARY AREA IN PHASE 1
(WEST OF HWY 400) DRAINING TO THE
TEMP. PUMP STATION AT
THE INTERIM STAGE
-  TRIBUTARY AREA IN PHASE 1
(WEST OF HWY 400) DRAINING TO THE
PERMANENT PUMP STATION

NOTES:

1. INSTALL A PORTION OF GRAVITY SEWER
IN PHASE 2.
2. INSTALL PERMANENT PS AND PUMP TO
GRAVITY SEWER ON A LOCAL ROAD IN
PHASE 2.
3. INSTALL A COLLECTOR SEWER FROM
PHASE 1 (STAGE 2) TO PERMANENT
PUMP STATION.



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FIGURE 3.2
PHASE 1 (STAGE 2)
SANITARY SERVICING

SALEM COMMUNITY DEVELOPMENT AREA CITY OF BARRIE

LEGEND

-  MCKAY / HURONIA TRUNK SAN. SEWER
(BUILT AT STAGE 1 OF PHASE 1)
-  SAN. SEWER ON VETERANS DRIVE
(BUILT AT STAGE 1 OF PHASE 1)
-  TRUNK SAN. SEWER
(BUILT AT STAGE 2 OF PHASE 1)
-  LOCAL SAN. SEWER IN PHASE 2 AND 3
(BUILT AT STAGE 2 OF PHASE 1)
-  MCKAY / HURONIA TRUNK SAN. SEWER
-  TRIBUTARY AREA A (WEST OF HWY 400)
DRAINING TO MCKAY TRUNK SAN. SEWER
BY GRAVITY AT THE ULTIMATE STAGE.
-  TRIBUTARY AREA A IN PHASE 1
(WEST OF HWY 400) DRAINING TO THE
PERMANENT PUMP STATION
-  TRIBUTARY AREA A OF PHASE 2, 3 AND
POST 2031 (WEST OF HWY 400) DRAINING
TO THE PERMANENT PUMP STATION

NOTES:

1. INSTALL ULTIMATE GRAVITY
SEWER (HURONIA TRUNK SEWER)
AND ABANDON TEMPORARY PS
AND DIVERT SEWERS TO THE
ULTIMATE GRAVITY SEWER AS PER
SSP MASTER SERVICING PLAN.

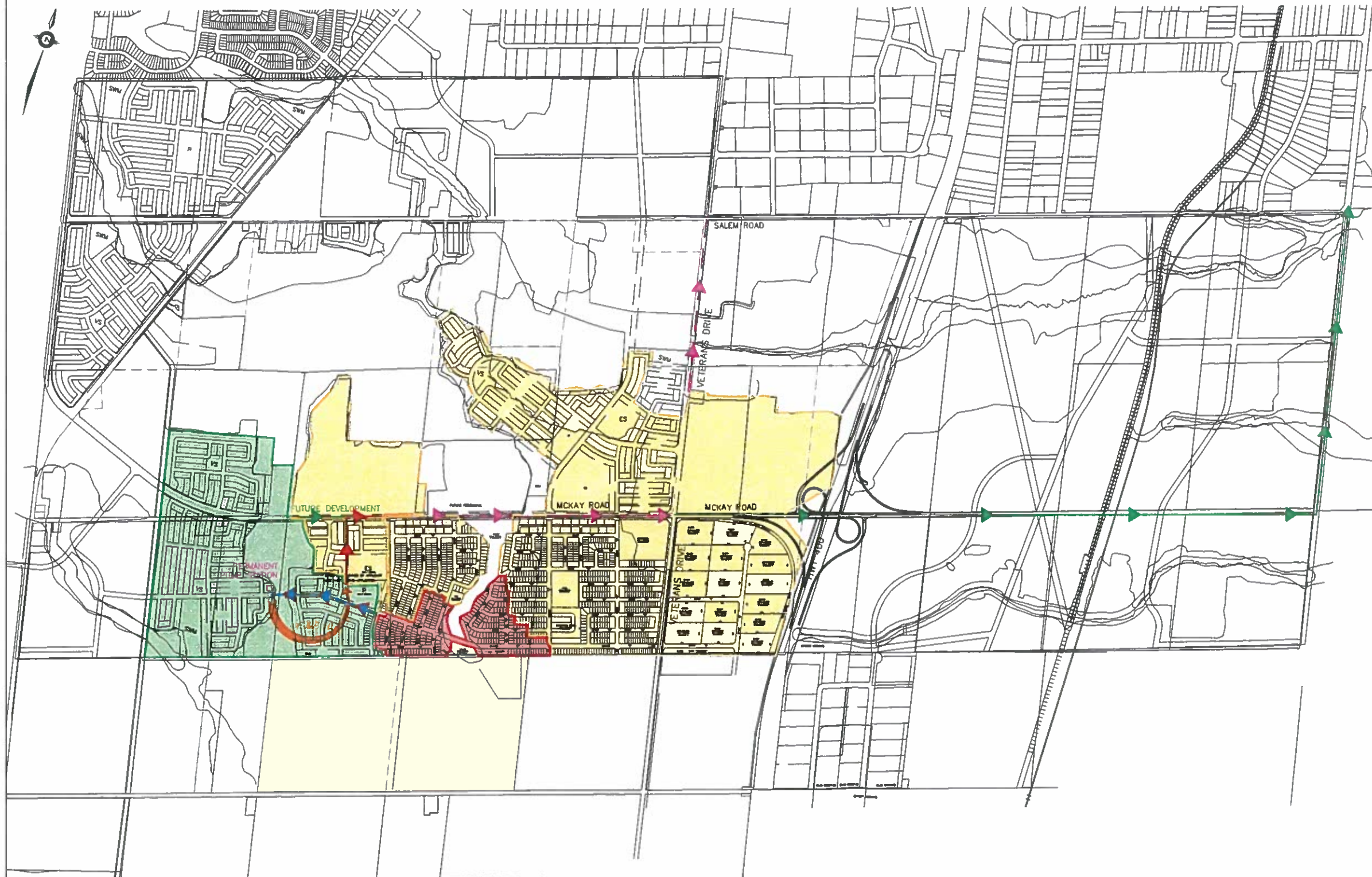


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FIGURE 3.3
ULTIMATE PHASES
SANITARY SERVICING



4 WATER SUPPLY SERVICING

A conceptual municipal water servicing plan for the SSP lands was proposed in the City of Barrie Water Storage and Distribution Master Plan for Intensification Areas and Annexed Lands (AMEC Report), prepared by AMEC (October 2013).

Currently, the City of Barrie has five pressure districts:

- District 1 (HWL = 281.2 meters above sea level (masl)) (PD1)
- District 2 North (324.09 masl) (PD2N)
- District 3 North (347 masl) (PD3N)
- District 2 South (308 masl) (PD2S)
- District 3 South (350.2 masl) (PD3S)

The subject lands fall entirely within PD3S. The existing topography is known for the site, where the lowest elevation is in the southeast corner of the site at 265 masl, and the highest is 313.5 masl occurring in the central region of the subject land. In general the SSP lands have a fall from west to east.

4.1 Existing Water Supply Servicing

There is currently no distribution system within the vicinity of the subject lands. Just north of the Salem Road, still in PD3S, are two pump stations and the Maplevue reservoir storage facility that services the pre-annexation area. There are also key tie-in points identified, all at the border of the SSP land, they consist of:

- A 300mm diameter main running on Veterans Drive between Salem Road and King Street,
- A 500mm diameter main running on Veterans Drive between King Street and Maplevue Drive, this main connects to the Maplevue Reservoir.

4.2 Water Supply Servicing Design Criteria

The following design criteria will be utilized in the design of the subject lands land water distribution system:

- Average residential daily demand of 270 L per capita per day, 28 m³/ha·day for institutional and commercial land use, and 35 m³/ha·day for industrial;
- Peaking factors are as follows: Maximum Daily Flow = 2.0, Minimum Hour Flow = 0.4, Peak Hour Flow = 4.13
- Fire flow demands: 76 L/s for residential, 114 L/s for institutional and commercial, 152 L/s for industrial and all flows must arrive with a minimum pressure of 140 kPa
- Allowable pressure range under operating conditions (peak hour – min hour) shall be within 275kPa – 700kPa. The prescribed maximum pipe velocity is 1.5m/s.

The Hazen-Williams “C” values are listed below:

Pipe Diameter (mm)	Hazen-Williams Coefficient
150	100
200 – 250	110
300 – 600	120
675 and larger	130

4.3 Proposed Water Supply Servicing Plan

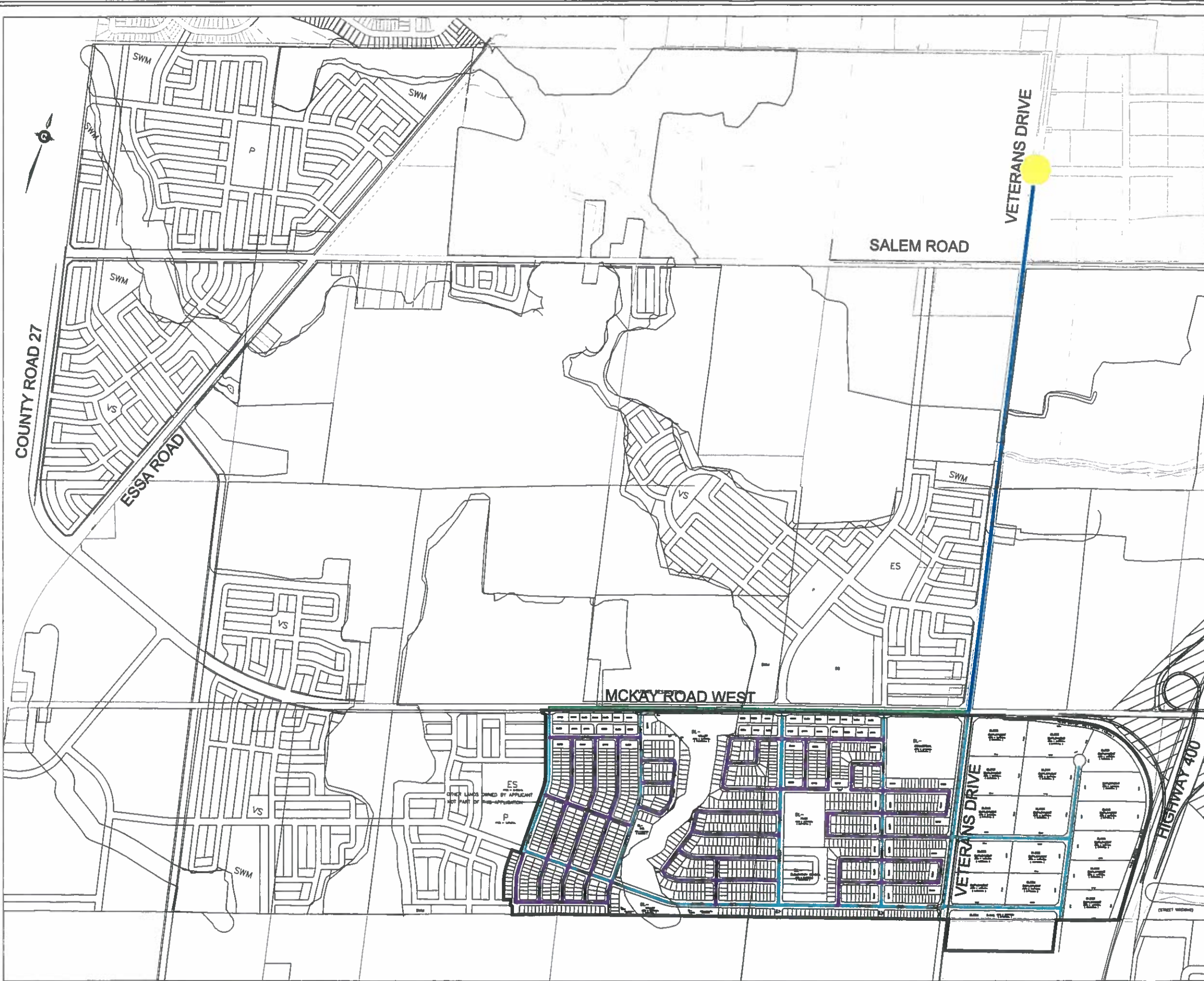
The SIS presented a water distribution network during Phase 1 of the Salem Secondary Plan (see Figure 7.2 in Appendix C). The proposed development will connect to the existing watermain on Veterans Drive, north of Salem Road as shown on Figure 4.1. A 500mm watermain is proposed to extend from the existing connection, south on Veterans Drive, to McKay Road and a 400mm extending along McKay Road. For the subject site, a looping watermain network is proposed with connections to the proposed McKay Road and Veterans Drive watermains.

The expected domestic supply and fire flow demands are summarized in Table 4.1, with detailed calculations provided in Appendix C.

Table 4.1 - Water Supply Demand

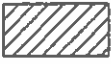
Land Use	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hourly Demand (L/s)	Fire Flow (L/s)
Residential	13.14	26.28	59.26	76.00
Commercial/Institutional	2.26	4.52	9.33	114.00
Industrial	14.50	29.00	59.89	152.00

From the information we have procured for this project, water supply constraints are not expected.



WATERSAND RESIDENTIAL SUBDIVISION
SALEM COMMUNITY DEVELOPMENT AREA
CITY OF BARRIE

LEGEND

-  SUBJECT SITE
-  HIGHWAY / INTERCHANGE
-  200mmØ WATERMAIN
-  300mmØ WATERMAIN
-  400mmØ WATERMAIN
-  500mmØ WATERMAIN
-  CONNECTION TO EXISTING WATERMAIN

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FIGURE 4.1
WATER SUPPLY

5 CONCLUSIONS

This Functional Servicing Report presents a municipal servicing scheme for the proposed Watersand subdivision located within the Salem Annexed Lands in the City of Barrie.

The pre-development drainage is split between Lover's Creek and Thornton Creek watersheds. Three SWM Ponds are proposed to provide water quantity and quality control. Low impact development techniques are recommended in low lying areas that cannot gravity drain to the SWM Ponds.

The wastewater servicing plan for SSP lands was initially addressed in the Barrie's Wastewater Collection Master Plan (WCMP) for Intensification Areas and Annexed Lands, prepared by AMEC (October 2013). An interim and ultimate sanitary servicing plan is proposed for the subject site.

The site is located in Pressure District PD3S. The proposed development will connect to the existing watermain on Veterans Drive, north of Salem Road as shown on Figure 4.1. A 500mm watermain is proposed to extend from the existing connection, south on Veterans Drive, to McKay Road and a 400mm extending along McKay Road. For the subject site, a looping watermain network is proposed with connections to the proposed McKay Road and Veterans Drive watermains. No water supply constraints are expected.

Respectfully Submitted,

SCHAEFFER & ASSOCIATES LTD.

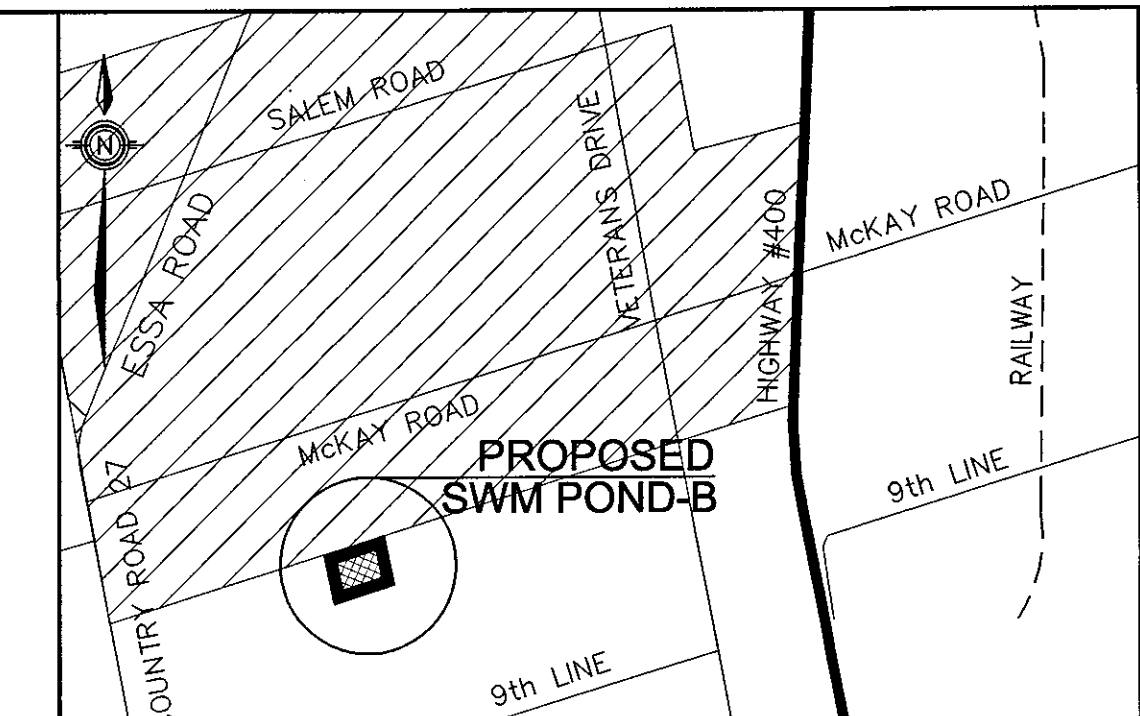
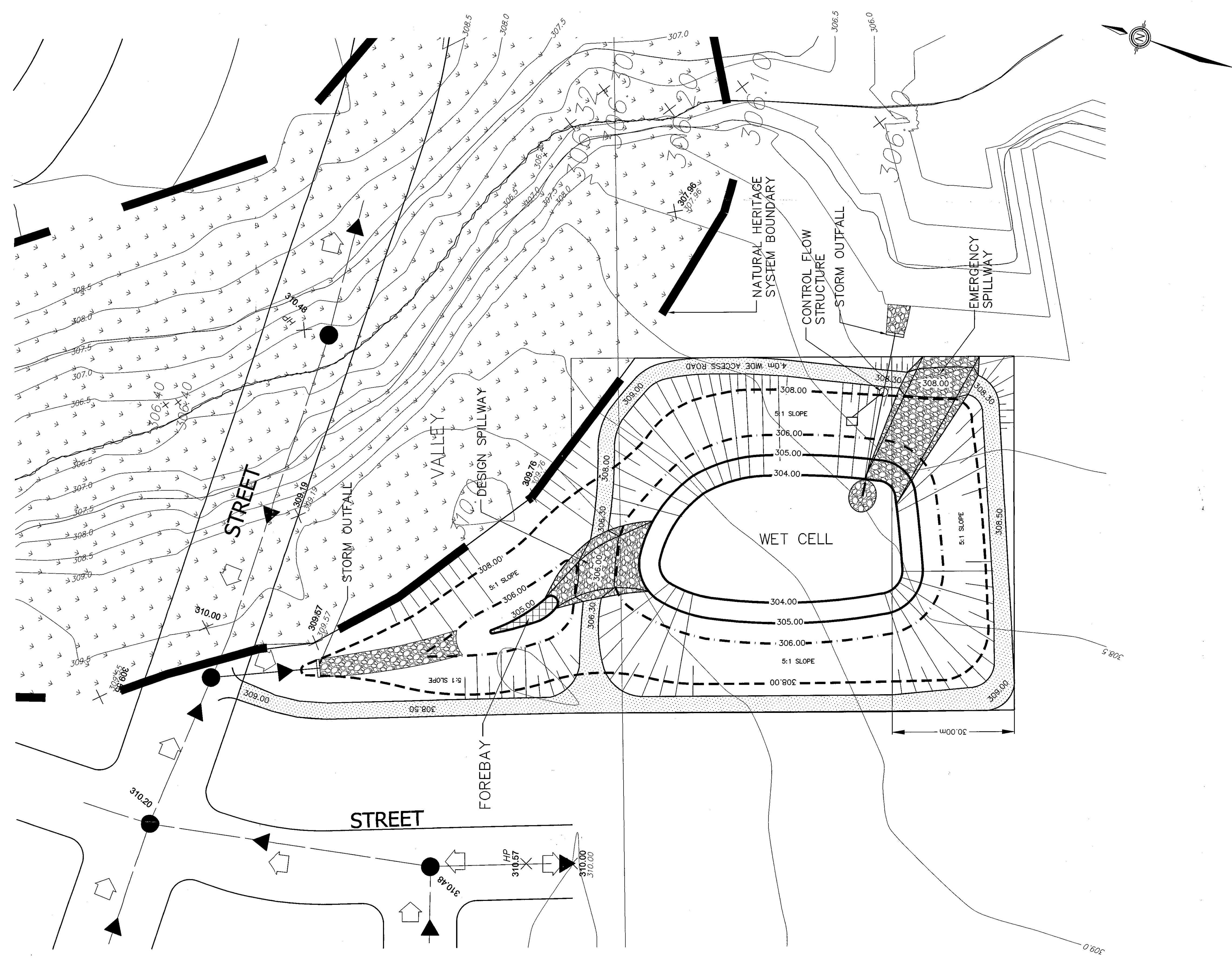
Stephen Monteith, P.Eng.
Water Resources Engineer

Appendix A

Stormwater Management

Visual Otthymo Modeling

SWM POND A



LEGEND

- 309.51 x DENOTES PROPOSED ELEVATION
- 306.20 x DENOTES EXISTING ELEVATION
- 308.5 - - - DENOTES EXISTING CONTOUR
- ◀ DENOTES OVERLAND FLOW
- - - - - DENOTES 100 YR. WATER LEVEL
- . - . - . - DENOTES PERMANENT POOL LEVEL
- DENOTES PROPOSED POND CONTOUR LINE

POND STATISTICS

TOP OF POND ELEV.	308.50
BOTTOM OF POND ELEV.	304.00
NWL ELEV.	306.00
100YR. ELEV.	308.00
MAX. ELEV.	4.00m
PERMANENT POOL VOLUME	5,500m ³
ACTIVE STORAGE VOLUME	11,500m ³
CONCEPTUAL SWM BLOCK AREA	1.20ha.

No.	REVISIONS	DATE	APPROVED

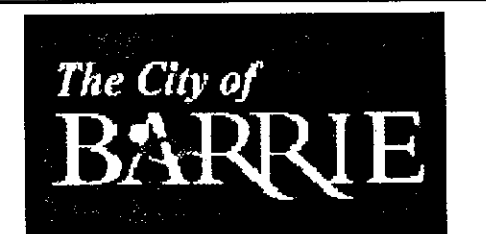


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SCHAEFFER & ASSOCIATES LTD.

SALEM LANDOWNERS GROUP

PROPOSED SWM POND-B



DESIGN	A.B.O.	SCALE	PROJ. No. 2015-4074
DRAWN	R.M.M.	CHECKED	DWG. No.
DATE:		SHEET No.	

Barrie Annex Lands
WATER QUALITY REQUIREMENT CALCULATIONS
SWM Pond A

Table: Water Quality Storage Requirements Based on Receiving Waters

Protection Level	SWMP Type	Storage Volume (m ³ /ha) for Impervious Level					
		0%	35%	55%	70%	85%	100%
Level 1	Wet Pond	53	140	190	225	250	275

* For wet ponds, all of the storage, except for 40 m³/ha represents the permanent pool volume.
The 40 m³/ha represents extended detention storage.

POND A

Input:

Estimated Imperviousness = 60%
Area = 31.55 ha
Level of Protection: 1
SWMP Type : Wet Pond

Calculation:

Total Storage Volume Required = 202 m³/ha → 6,363 m³
Permanent Pool Volume = 162 m³/ha → 5,101 m³
Active Storage Volume = 40 m³/ha → 1,262 m³

Erosion Control:

Input Area = 31.55 ha
R.V = 25 mm
Draw Down Time = 24 hrs

Calculations:

Storage = 4,733 m³
Average Outflow = 0.055 m³/s
Peak Outflow = 0.082 m³/s

Note: Estimated at 1.5 times Average Outflow

Provide 4733 m3 for erosion control.

PRE-DEVELOPMENT MODELLING

*** SIMULATION NUMBER: 1 ***

MASS STORM		Filename:	C:\Users\mkamran\AppData\Local\Temp\9462fefb-ba93-490d-bc8e-7f1e2b1e2b1e\SCS II 6H 2YR
Total= 42.30 mm		Comments:	SCS II 6H 2YR

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	1.69	1.75	4.23	3.25	9.31	4.75	2.54		
0.50	1.69	2.00	4.23	3.50	9.31	5.00	2.54		
0.75	2.54	2.25	5.08	3.75	4.23	5.25	1.69		
1.00	2.54	2.50	5.08	4.00	4.23	5.50	1.69		
1.25	2.54	2.75	25.38	4.25	3.38	5.75	1.69		
1.50	2.54	3.00	65.99	4.50	3.38	6.00	1.69		

CALIB					
NASHYD	(	0136)			
ID= 1	DT=	5.0 min			
	Area	(ha)	=	31.55	Curve Number (CN) = 58.0
	Ia	(mm)	=	5.00	# of Linear Res. (N) = 3.00
	U.H.	Tp (hrs)	=	0.98	

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

----- TRANSFORMED HYETOGRAPH -----					
TIME	RAIN	TIME	TIME	RAIN	TIME
hrs	mm/hr	hrs	mm/hr	mm/hr	hrs
0.083	1.69	1.583	4.23	3.083	9.31
0.167	1.69	1.667	4.23	3.167	9.31
0.250	1.69	1.750	4.23	3.250	9.31
0.333	1.69	1.833	4.23	3.333	9.31
0.417	1.69	1.917	4.23	3.417	9.31
0.500	1.69	2.000	4.23	3.500	9.31
0.583	2.54	2.083	5.08	3.583	4.23
0.667	2.54	2.167	5.08	3.667	4.23
0.750	2.54	2.250	5.08	3.750	4.23
0.833	2.54	2.333	5.08	3.833	4.23
0.917	2.54	2.417	5.08	3.917	4.23
1.000	2.54	2.500	5.08	4.000	4.23
1.083	2.54	2.583	25.38	4.083	3.38
1.167	2.54	2.667	25.38	4.167	3.38
1.250	2.54	2.750	25.38	4.250	3.38
1.333	2.54	2.833	65.99	4.333	3.38
1.417	2.54	2.917	65.99	4.417	3.38
1.500	2.54	3.000	65.99	4.500	3.38
					6.00

Unit Hyd Opeak (cms) = 1.230

PEAK FLOW	(cms) =	0.210 (i)
TIME TO PEAK	(hrs) =	4.083
RUNOFF VOLUME	(mm) =	6.289
TOTAL RAINFALL	(mm) =	42.300
RUNOFF COEFFICIENT	=	0.149

 Pond A Trib Area AREA [ha] - 31.550 136 PKFW [m³/s] - 0.210	 SCHAEFFERS CONSULTING ENGINEERS	Visual OTTHYNO™ Schematic SWM Pond Tributary Area ALLOWABLE RELEASE PRE-DEVELOPMENT (SCS Type II DESIGN STORM)	Job #: 4278	Date: October 2016
--	--	--	--------------------	---------------------------

**VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond A Pre-Development – SCS Type II Design Storm**

DATE: October 2016

TIME TO PEAK	{hrs} =	4.083
RUNOFF VOLUME	{mm} =	12.457
TOTAL RAINFALL	{mm} =	59.500
RUNOFF COEFFICIENT	=	0.209

RUNOFF VOLUME	(mm) =	12.457
TOTAL RAINFALL	(mm) =	59.500
RUNOFF COEFFICIENT	=	0.209

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

```

*** SIMULATION NUMBER: 2 ***

```

MASS STORM	Filename: C:\Users\nkamran\AppData\Local\Temp\9462fefb-ba93-490d-bcf6-cbd7e00bf5f1\ecs528ce5
	Comments: SCS II 6H SYR
Protol= 59.50 mm	

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME		RAIN		TIME		RAIN		TIME		RAIN	
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	2.38	1.75	5.95	3.25	13.09	4.75	3.57	3.25	13.09	4.75	3.57
0.50	2.38	2.00	5.95	3.50	13.09	5.00	3.57	3.50	13.09	5.00	3.57
0.75	3.57	2.25	7.14	3.75	5.95	5.25	2.38	3.75	5.95	5.25	2.38
1.00	3.57	2.50	7.14	4.00	5.95	5.50	2.38	4.00	5.95	5.50	2.38
1.25	3.57	2.75	35.70	4.25	4.76	5.75	2.38	4.25	4.76	5.75	2.38
1.50	3.57	3.00	92.82	4.50	4.76	6.00	2.38	4.50	4.76	6.00	2.38

NASHYD	(0136)	Area	(ha) =	31.55	Curve Number	(CN) =	58.0
ID= 1	DT= 5.0 min	Ia	(mm) =	5.00	# of Linear Res.	(N) =	3.00
		U.H.	TP(hrs) =	0.90			

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

TRANSFORMED HYETOGRAPH

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.38	1.583	5.95	3.083	13.09	4.58	3.57	4.58	3.57
0.167	2.38	1.667	5.95	3.167	13.09	4.67	3.57	4.67	3.57
0.250	2.38	1.750	5.95	3.250	13.09	4.75	3.57	4.75	3.57
0.333	2.38	1.833	5.95	3.333	13.09	4.83	3.57	4.83	3.57
0.417	2.38	1.917	5.95	3.417	13.09	4.92	3.57	4.92	3.57
0.500	2.38	2.000	5.95	3.500	13.09	5.00	3.57	5.00	3.57
0.583	3.57	2.083	7.14	3.583	5.95	5.08	2.38	5.08	2.38
0.667	3.57	2.167	7.14	3.667	5.95	5.17	2.38	5.17	2.38
0.750	3.57	2.250	7.14	3.750	5.95	5.25	2.38	5.25	2.38
0.833	3.57	2.333	7.14	3.833	5.95	5.33	2.38	5.33	2.38
0.917	3.57	2.417	7.14	3.917	5.95	5.42	2.38	5.42	2.38
1.000	3.57	2.500	7.14	4.000	5.95	5.50	2.38	5.50	2.38
0.083	3.57	2.583	35.70	4.083	4.76	5.58	2.38	5.58	2.38
0.167	3.57	2.667	35.70	4.167	4.76	5.67	2.38	5.67	2.38
0.250	3.57	2.750	35.70	4.250	4.76	5.75	2.38	5.75	2.38
0.333	3.57	2.833	92.82	4.333	4.76	5.83	2.38	5.83	2.38
0.417	3.57	2.917	92.82	4.417	4.76	5.92	2.38	5.92	2.38
0.500	3.57	3.000	92.82	4.500	4.76	6.00	2.38	6.00	2.38

Unit Hyd Opeak (cms) = 1.230

PEAK FLOW
(cms) = 0.421 (i)

*** SIMULATION NUMBER: 3 ***

MASS STORM

File name: C:\Users\nkamran\AppData\Local\Temp\9462fefb-ba93-490d-bcf6-cbd7e00b5f51\ec528ce5

Comments: SCS II 6H 10YR

Protal= 70.80 mm

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	2.83	1.75	7.08	3.25	15.58	4.75	4.25		
0.50	2.83	2.00	7.08	3.50	15.58	5.00	4.25		
0.75	4.25	2.25	8.50	3.75	7.08	5.25	2.83		
1.00	4.25	2.50	8.50	4.00	7.08	5.50	2.83		
1.25	4.25	2.75	42.48	4.25	5.66	5.75	2.83		
1.50	4.25	3.00	110.45	4.50	5.66	6.00	2.83		

CALIB	Area	(ha)	31.55	Curve Number	(CN) = 58.0
NASHDY	Ia	(mm)	5.00	# of Linear Res. (N)	= 3.00
ID-1 DT=	U.H.	Tp(hrs)	0.98		

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

TRANSFORMED HYETOGRAPH

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	2.63	1.583	7.08	3.083	15.58	4.58	4.25		
0.167	2.83	1.667	7.08	3.167	15.58	4.67	4.25		
0.250	2.83	1.750	7.08	3.250	15.58	4.75	4.25		
0.333	2.83	1.833	7.08	3.333	15.58	4.83	4.25		
0.417	2.83	1.917	7.08	3.417	15.58	4.92	4.25		
0.500	2.83	2.000	7.08	3.500	15.58	5.00	4.25		
0.583	4.25	2.083	8.50	3.583	7.08	5.08	2.83		
0.667	4.25	2.167	8.50	3.667	7.08	5.17	2.83		
0.750	4.25	2.250	8.50	3.750	7.08	5.25	2.83		
0.833	4.25	2.333	8.50	3.833	7.08	5.33	2.83		
0.917	4.25	2.417	8.50	3.917	7.08	5.42	2.83		
1.000	4.25	2.500	8.50	4.000	7.08	5.50	2.83		
1.083	4.25	2.583	42.48	4.083	5.66	5.58	2.83		
1.167	4.25	2.667	42.48	4.167	5.66	5.67	2.83		
1.250	4.25	2.750	42.48	4.250	5.66	5.75	2.83		
1.333	4.25	2.833	110.45	4.333	5.66	5.83	2.83		
1.417	4.25	2.917	110.45	4.417	5.66	5.92	2.83		
1.500	4.25	3.000	110.45	4.500	5.66	6.00	2.83		

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond A Pre-Development - SCS Type II Design Storm

DATE: October 2016

Unit Hyd Qpeak (cms) = 1.230
PEAK FLOW (cms) = 0.589 (1)
TIME TO PEAK (hrs) = 4.000
RUNOFF VOLUME (mm) = 17.337
TOTAL RAINFALL (mm) = 70.800
RUNOFF COEFFICIENT = 0.245

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

*** SIMULATION NUMBER: 4 ***

Filename: C:\Users\nkamran\AppData
ata\Local\Temp\9462fefb-ba93-490d-bcf6-cbd7e00b5f51\ec528ce5
Comments: SCS II 6H_25YR
Ptotal= 85.20 mm

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	3.41	1.75	8.52	3.25	18.74
0.50	3.41	2.00	8.52	3.50	18.74
0.75	5.11	2.25	10.22	3.75	8.52
1.00	5.11	2.50	10.22	4.00	8.52
1.25	5.11	2.75	51.12	4.25	6.82
1.50	5.11	3.00	132.91	4.50	6.82

CALIB (0136) Area (ha) = 31.55 Curve Number (CN) = 58.0
NASHYD (0136) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.98

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.41	1.583	8.52	3.083	18.75
0.167	3.41	1.667	8.52	3.167	18.74
0.250	3.41	1.750	8.52	3.250	18.74
0.333	3.41	1.833	8.52	3.333	18.74
0.417	3.41	1.917	8.52	3.417	18.74
0.500	3.41	2.000	8.52	3.500	18.74
0.583	5.11	2.083	10.22	3.583	8.52
0.667	5.11	2.167	10.22	3.667	8.52
0.750	5.11	2.250	10.22	3.750	8.52
0.833	5.11	2.333	10.22	3.833	8.52
0.917	5.11	2.417	10.22	3.917	8.52
1.000	5.11	2.500	10.22	4.000	8.52
1.083	5.11	2.583	51.12	4.083	6.82
1.167	5.11	2.667	51.12	4.167	6.82

1.250	5.11	2.750	51.12	4.250	6.82	5.75	3.41
1.333	5.11	2.833	132.91	4.333	6.82	5.83	3.41
1.417	5.11	2.917	132.91	4.417	6.82	5.92	3.41
1.500	5.11	3.000	132.91	4.500	6.82	6.00	3.41

Unit Hyd Qpeak (cms) = 1.230

PEAK FLOW (cms) = 0.833 (1)
TIME TO PEAK (hrs) = 4.000
RUNOFF VOLUME (mm) = 24.352
TOTAL RAINFALL (mm) = 85.200
RUNOFF COEFFICIENT = 0.286

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

*** SIMULATION NUMBER: 5 ***

Filename: C:\Users\nkamran\AppData
ata\Local\Temp\9462fefb-ba93-490d-bcf6-cbd7e00b5f51\ec528ce5
Comments: SCS II 6H_50YR
Ptotal= 95.90 mm

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	3.84	1.75	9.59	3.25	21.10
0.50	3.84	2.00	9.59	3.50	21.10
0.75	5.75	2.25	11.51	3.75	9.59
1.00	5.75	2.50	11.51	4.00	9.59
1.25	5.75	2.75	57.54	4.25	7.67
1.50	5.75	3.00	149.60	4.50	7.67

CALIB (0136) Area (ha) = 31.55 Curve Number (CN) = 58.0
NASHYD (0136) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.98

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.84	1.583	9.59	3.083	21.10
0.167	3.84	1.667	9.59	3.167	21.10
0.250	3.84	1.750	9.59	3.250	21.10
0.333	3.84	1.833	9.59	3.333	21.10
0.417	3.84	1.917	9.59	3.417	21.10
0.500	3.84	2.000	9.59	3.500	21.10
0.583	5.75	2.083	11.51	3.583	9.59
0.667	5.75	2.167	11.51	3.667	9.59
0.750	5.75	2.250	11.51	3.750	9.59
0.833	5.75	2.333	11.51	3.833	9.59

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN DATE: October 2016
SWM Pond A Pre-Development - SCS Type II Design Storm

0.917	5.75	2.417	11.51	3.917	9.59	5.42	3.84
1.000	5.75	2.500	11.51	4.000	9.59	5.50	3.84
1.083	5.75	2.583	57.54	4.083	7.67	5.58	3.84
1.167	5.75	2.667	57.54	4.167	7.67	5.67	3.84
1.250	5.75	2.750	57.54	4.250	7.67	5.75	3.84
1.333	5.75	2.833	149.60	4.333	7.67	5.83	3.84
1.417	5.75	2.917	149.60	4.417	7.67	5.92	3.84
1.500	5.75	3.000	149.60	4.500	7.67	6.00	3.84

Unit Hyd Qpeak (cms) = 1.230
PEAK FLOW (cms) = 1.033 (i)
TIME TO PEAK (hrs) = 4.000
RUNOFF VOLUME (mm) = 30.065
TOTAL RAINFALL (mm) = 95.900
RUNOFF COEFFICIENT = 0.314

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

** SIMULATION NUMBER: 6 **

File name: C:\Users\nkamran\AppData\Local\Temp\9462fefb-ba93-490d-bcf6-cbd7e00b5f51\ec528ce5
Comments: SCS II 6H_100YR
Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	4.26	1.75	10.65	3.25	23.43	4.75	6.39
0.50	4.26	2.00	10.65	3.50	23.43	5.00	6.39
0.75	6.39	2.25	12.78	3.75	10.65	5.25	4.26
1.00	6.39	2.50	12.78	4.00	10.65	5.50	4.26
1.25	6.39	2.75	63.90	4.25	8.52	5.75	4.26
1.50	6.39	3.00	166.14	4.50	8.52	6.00	4.26

CALIB (0136) Area (ha) = 31.55 Curve Number (CN) = 58.0
NASHVD (0136) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.98

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 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
0.083	4.26	1.583	10.65	3.083	23.43	4.58	6.39
0.167	4.26	1.667	10.65	3.167	23.43	4.67	6.39
0.250	4.26	1.750	10.65	3.250	23.43	4.75	6.39
0.333	4.26	1.833	10.65	3.333	23.43	4.83	6.39
0.417	4.26	1.917	10.65	3.417	23.43	4.92	6.39
0.500	4.26	2.000	10.65	3.500	23.43	5.00	6.39

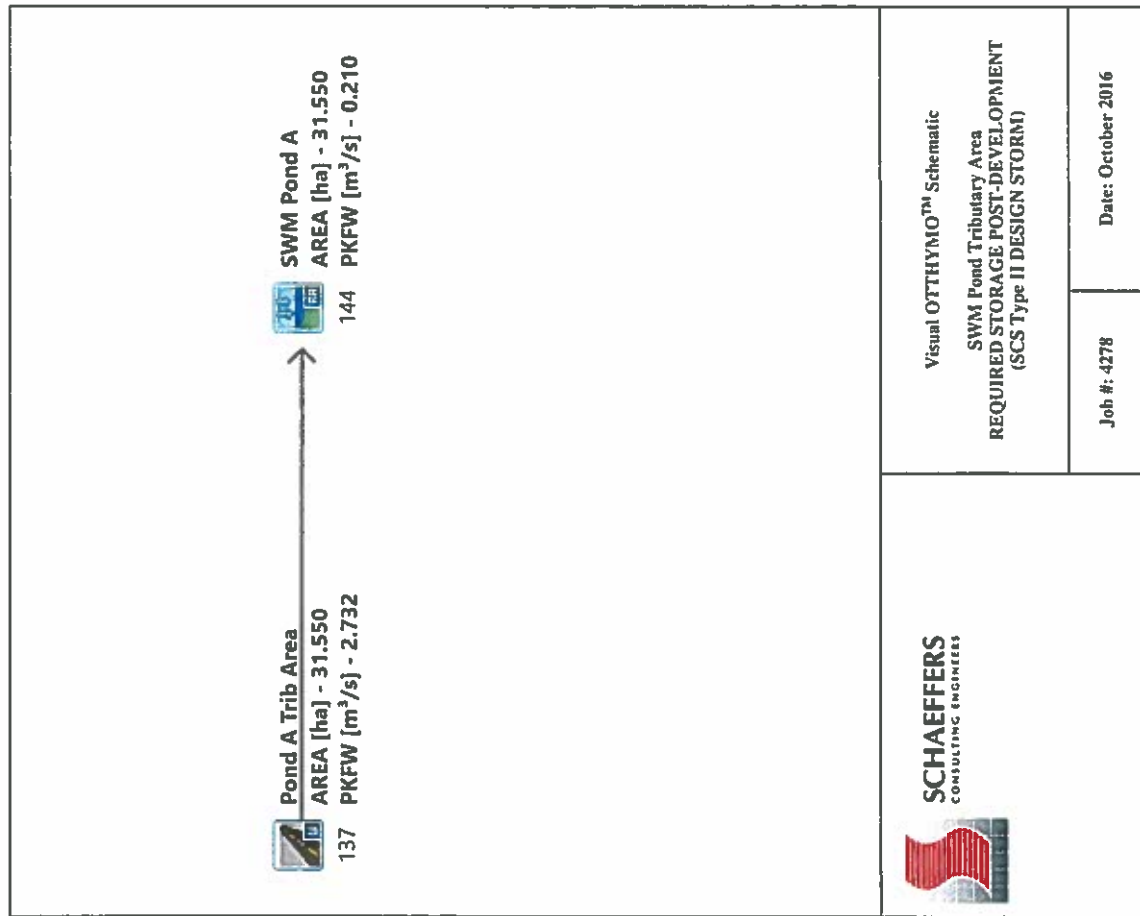
0.583	6.39	2.083	12.78	3.583	10.65	5.08	4.26
0.667	6.39	2.167	12.78	3.667	10.65	5.17	4.26
0.750	6.39	2.250	12.78	3.750	10.65	5.25	4.26
0.833	6.39	2.333	12.78	3.833	10.65	5.33	4.26
0.917	6.39	2.417	12.78	3.917	10.65	5.42	4.26
1.000	6.39	2.500	12.78	4.000	10.65	5.50	4.26
1.083	6.39	2.583	63.90	4.083	8.52	5.58	4.26
1.167	6.39	2.667	63.90	4.167	8.52	5.67	4.26
1.250	6.39	2.750	63.90	4.250	8.52	5.75	4.26
1.333	6.39	2.833	166.14	4.333	8.52	5.83	4.26
1.417	6.39	2.917	166.14	4.417	8.52	5.92	4.26
1.500	6.39	3.000	166.14	4.500	8.52	6.00	4.26

Unit Hyd Qpeak (cms) = 1.230
PEAK FLOW (cms) = 1.244 (i)
TIME TO PEAK (hrs) = 4.000
RUNOFF VOLUME (mm) = 36.094
TOTAL RAINFALL (mm) = 106.500
RUNOFF COEFFICIENT = 0.339

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



POST DEVELOPMENT MODELLING



** SIMULATION NUMBER: 1 **

CALIB	STANDHYD (0137)	Area (ha) = 31.55	Dir. Conn. (%) = 45.00
ID= 1	DT= 5.0 min	Total Imp (%) = 60.00	

Surface Area (ha) = 18.93	IMPERVIOUS	PERVIOUS (i)
Dep. Storage (mm) = 1.00		
Average Slope (%) = 2.00		
Length (m) = 458.62		
Mannings n = 0.013		
Max. Eff. Inten. (mm/hr) = 65.99		
Storage Coeff. (min) = 5.00		
Unit Hyd. Tpeak (min) = 6.11 (ii)		
Unit Hyd. Peak (cms) = 5.00		
PEAK FLOW (cms) = 2.46		
TIME TO PEAK (hrs) = 3.00		
RUNOFF VOLUME (mm) = 41.30		
TOTAL RAINFALL (mm) = 42.30		
RUNOFF COEFFICIENT = 0.98		

*****TOTALS*****

2.732 (iii)		
3.00		
23.92		
42.30		
0.57		

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0144)	OUTFLOW	STORAGE	OUTFLOW	STORAGE
IN= 2--> OUT= 1	(cms)	(ha.m.)	(cms)	(ha.m.)
DT= 5.0 min	0.0000	0.0000	0.8330	1.1767
	0.2100	0.5490	1.0330	1.3403
	0.4210	0.7948	1.2440	1.5050
	0.5890	0.9602	0.0000	0.0000

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
31.550	2.732	3.00	23.92
31.550	0.210	4.50	23.90

INFLOW : ID= 2 (0137)	PEAK FLOW REDUCTION (Qout/Qin) (%) = 7.69
OUTFLOW : ID= 1 (0144)	TIME SHIFT OF PEAK FLOW (min) = 90.00
	MAXIMUM STORAGE USED (ha.m.) = 0.5490

** SIMULATION NUMBER: 2 **

CALIB

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN SWM Pond A Post-Development – SCS Type II Design Storm

DATE: October 2016

STANDHYD (0137) | Area (ha)= 31.55 | Dir. Conn.(%)= 45.00
ID= 1 DT= 5.0 min | Total Imp(%)= 60.00

IMPERVIOUS		PERVIOUS (i)	
Surface Area (ha)=	18.93		12.62
Dep. Storage (mm)=	1.00		1.50
Average Slope (%)=	2.00		2.00
Length (m)=	458.62		40.00
Mannings n =	0.013		0.250
Max.Eff.Inten.(mm/hr)=	92.82		46.90
over (min)	5.00		15.00
Storage Coeff. (min)=	5.33 (ii)		14.89 (ii)
Unit Hyd. Tpeak (min)=	5.00		15.00
Unit Hyd. peak (cms)=	0.21		0.08
PEAK FLOW (cms)=	3.52		0.90
TIME TO PEAK (hrs)=	3.00		3.08
RUNOFF VOLUME (mm)=	58.50		17.75
TOTAL RAINFALL (mm)=	59.50		59.50
RUNOFF COEFFICIENT =	0.98		0.30

TOTALS 4.272 (iii)

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0144) |
IN= 2---> OUT= 1 |
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.8330	1.1767	
0.2100	0.5490	1.0330	1.3403	
0.4210	0.7948	1.2440	1.5050	
0.5890	0.9602	0.0000	0.0000	

AREA (ha) 31.550 4.272 3.00 36.09
QPEAK (cms) 0.421 4.00 36.07
TPEAK (hrs) 4.00
INFLOW : ID= 2 (0137) 31.550
OUTFLOW : ID= 1 (0144) 0.421

PEAK FLOW REDUCTION [Qout/Qin] (%) = 9.85
TIME SHIFT OF PEAK FLOW (min) = 60.00
MAXIMUM STORAGE USED (ha.m.) = 0.7948

*** SIMULATION NUMBER: 3 ***

CALIB
STANDHYD (0137) | Area (ha)= 31.55 | Dir. Conn.(%)= 45.00
ID= 1-DT= 5.0 min | Total Imp(%)= 60.00

IMPERVIOUS		PERVIOUS (i)	
Surface Area (ha)=	18.93		12.62

Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 458.62 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 110.45 63.05
over (min) 5.00 15.00
Storage Coeff. (min)= 4.97 (ii) 13.46 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.22 0.08

PEAK FLOW (cms)= 4.22 1.28
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 69.80 23.88
TOTAL RAINFALL (mm)= 70.80 70.80
RUNOFF COEFFICIENT = 0.99 0.34

TOTALS 5.300 (iii)

- ***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0144) |
IN= 2---> OUT= 1 |
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.8330	1.1767	
0.2100	0.5490	1.0330	1.3403	
0.4210	0.7948	1.2440	1.5050	
0.5890	0.9602	0.0000	0.0000	

AREA (ha) 31.550 5.300 3.00 44.54
QPEAK (cms) 0.589 3.83 44.52
TPEAK (hrs) 3.83
INFLOW : ID= 2 (0137) 31.550
OUTFLOW : ID= 1 (0144) 0.589

PEAK FLOW REDUCTION [Qout/Qin] (%) = 11.11
TIME SHIFT OF PEAK FLOW (min) = 50.00
MAXIMUM STORAGE USED (ha.m.) = 0.9602

*** SIMULATION NUMBER: 4 ***

CALIB
STANDHYD (0137) | Area (ha)= 31.55 | Dir. Conn.(%)= 45.00
ID= 1 DT= 5.0 min | Total Imp(%)= 60.00

IMPERVIOUS		PERVIOUS (i)	
Surface Area (ha)=	18.93		12.62
Dep. Storage (mm)=	1.00		1.50
Average Slope (%)=	2.00		2.00
Length (m)=	458.62		40.00
Mannings n =	0.013		0.250

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond A Post-Development - SCS Type II Design Storm

DATE: October 2016

Max. Eff. Inten. (mm/hr) = 132.91
over (min) = 15.00
Storage Coeff. (min) = 4.62 (ii)
Unit Hyd. Tpeak (min) = 5.00
Unit Hyd. peak (cms) = 0.22
PEAK FLOW (cms) = 5.11
TIME TO PEAK (hrs) = 1.83
RUNOFF VOLUME (mm) = 84.20
TOTAL RAINFALL (mm) = 85.20
RUNOFF COEFFICIENT = 0.99
TOTALS
6.679 (iii)
3.00
55.75
85.20
0.65

Unit Hyd. Tpeak (min) = 5.00
Unit Hyd. peak (cms) = 0.23
PEAK FLOW (cms) = 5.78
TIME TO PEAK (hrs) = 3.00
RUNOFF VOLUME (mm) = 94.90
TOTAL RAINFALL (mm) = 95.90
RUNOFF COEFFICIENT = 0.99
TOTALS
7.748 (iii)
3.00
64.33
95.90
0.67

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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.

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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 (0144)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.8330	1.1767	
0.2100	0.5490	1.0330	1.3403	
0.4210	0.7948	1.2440	1.5050	
0.5890	0.9602	0.0000	0.0000	
AREA (ha)		QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
31.550		6.679	3.00	55.75
31.550		0.832	3.75	55.73

INFLOW : ID= 2 (0137)
OUTFLOW: ID= 1 (0144)
PEAK FLOW REDUCTION (Qout/Qin) (%) = 12.46
TIME SHIFT OF PEAK FLOW (min) = 45.00
MAXIMUM STORAGE USED (ha.m.) = 1.1767

** SIMULATION NUMBER: 5 **

CALIB		STANDHYD (0137)		Area (ha) = 31.55	Total Imp (%) = 60.00	Dir. Conn. (%) = 45.00
ID= 1	DT= 5.0 min					
Surface Area (ha)	18.93	IMPERVIOUS				
Dep. Storage (mm)	1.00	PERVIOUS (i)				
Average Slope (%)	2.00	12.62				
Length (m)	458.62	1.50				
Mannings n	0.013	2.00				
Max. Eff. Inten. (mm/hr)	149.60	40.00				
over (min)	5.00	0.250				
Storage Coeff. (min)	4.40 (ii)	122.13				
		5.00				
		4.22 (ii)				
		10.74 (ii)				
		15.00				
		0.09				
		TOTALS 8.840 (iii)				

RESERVOIR (0144)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.8330	1.1767	
0.2100	0.5490	1.0330	1.3403	
0.4210	0.7948	1.2440	1.5050	
0.5890	0.9602	0.0000	0.0000	
AREA (ha)		QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
31.550		7.748	3.00	64.33
31.550		1.033	3.67	64.31

INFLOW : ID= 2 (0137)
OUTFLOW: ID= 1 (0144)
PEAK FLOW REDUCTION (Qout/Qin) (%) = 13.33
TIME SHIFT OF PEAK FLOW (min) = 40.00
MAXIMUM STORAGE USED (ha.m.) = 1.3403

** SIMULATION NUMBER: 6 **

CALIB		STANDHYD (0137)		Area (ha) = 31.55	Total Imp (%) = 60.00	Dir. Conn. (%) = 45.00
ID= 1	DT= 5.0 min					
Surface Area (ha)	18.93	IMPERVIOUS				
Dep. Storage (mm)	1.00	PERVIOUS (i)				
Average Slope (%)	2.00	12.62				
Length (m)	458.62	1.50				
Mannings n	0.013	2.00				
Max. Eff. Inten. (mm/hr)	166.14	40.00				
over (min)	5.00	0.250				
Storage Coeff. (min)	4.22 (ii)	122.13				
Unit Hyd. Tpeak (min)	5.00	15.00				
Unit Hyd. peak (cms)	0.24	10.74 (ii)				
PEAK FLOW (cms)	6.43	15.00				
		0.09				
		TOTALS 8.840 (iii)				

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE 1 SALEM SECONDARY PLAN
SWM Pond A Post-Development – SCS Type II Design Storm

DATE: October 2016

TIME TO PEAK (hrs) = 3.00 3.08 3.00
 RUNOFF VOLUME (mm) = 105.50 46.46 73.03
 TOTAL RAINFALL (mm) = 106.50 106.50 106.50
 RUNOFF COEFFICIENT = 0.99 0.44 0.69

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
 CN* = 58.0 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.

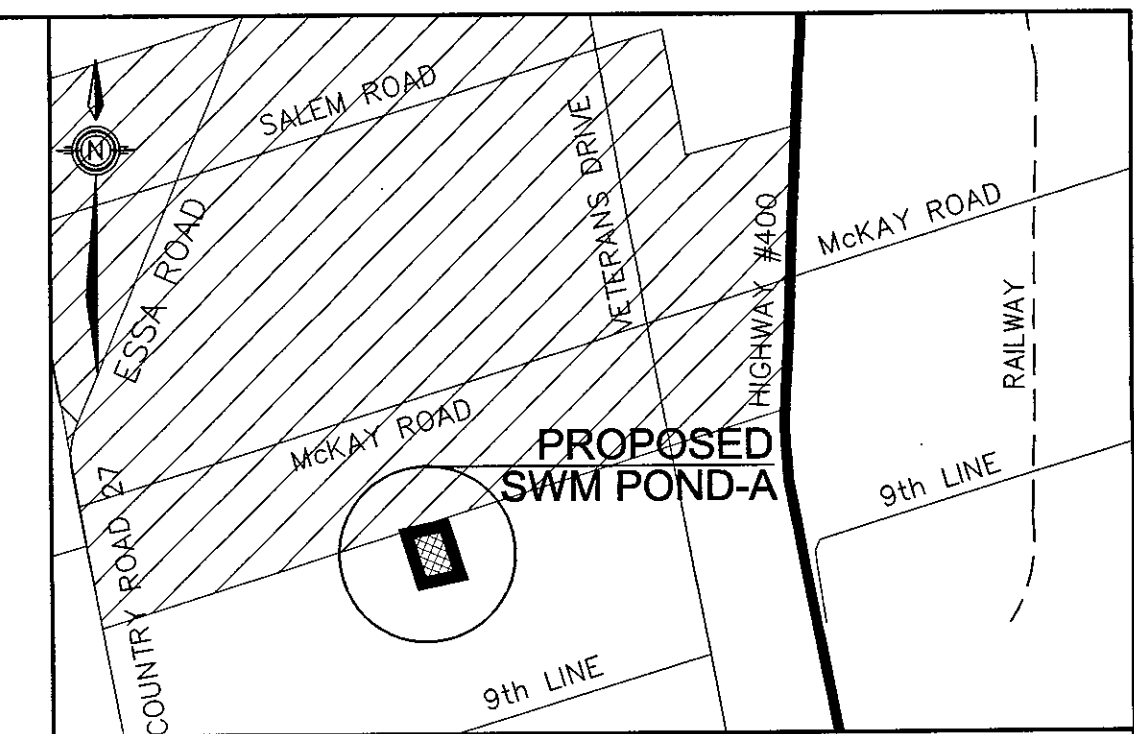
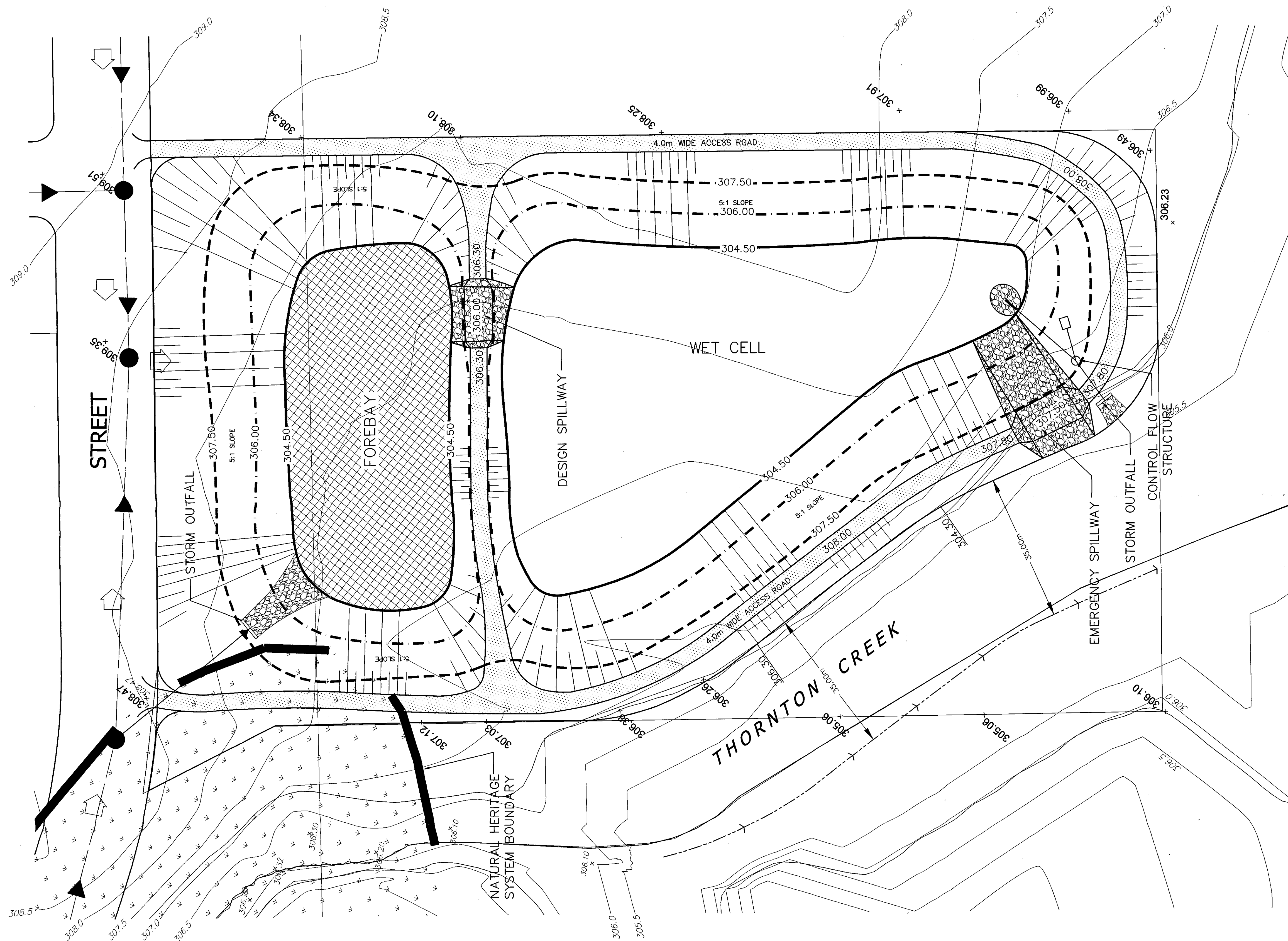
RESERVOIR (0144)
 IN= 2--> OUT= 1
 DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.8330	1.1767
0.2100	0.5490	1.0330	1.3403
0.4210	0.7948	1.2440	1.5050
0.5890	0.9602	0.0000	0.0000

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
31.550	8.840	3.00	73.03
31.550	1.243	3.67	73.00

PEAK FLOW REDUCTION [Qout/Qin] (%) = 14.06
 TIME SHIFT OF PEAK FLOW (min) = 40.00
 MAXIMUM STORAGE USED (ha.m.) = 1.5051

SWM POND B



KEY PLAN
N.T.S.

LEGEND

- 309.51 x DENOTES PROPOSED ELEVATION
- 306.20 x DENOTES EXISTING ELEVATION
- 308.5 — DENOTES EXISTING CONTOUR
- ◀ DENOTES OVERLAND FLOW
- DENOTES 100 YR. WATER LEVEL
- - - - - DENOTES PERMANENT POOL LEVEL
- DENOTES PROPOSED POND CONTOUR LINE

POND STATISTICS

TOP OF POND ELEV.	308.00
BOTTOM OF POND ELEV.	304.50
NWL ELEV.	306.00
100YR. ELEV.	307.50
MAX. ELEV.	3.00m
PERMANENT POOL VOLUME	18,000m ³
ACTIVE STORAGE VOLUME	24,000m ³
CONCEPTUAL SWM BLOCK AREA	3.35ha.

No.	REVISIONS	DATE	APPROVED

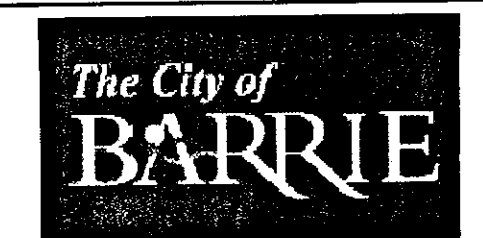


SCHAEFFERS
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design@schaeffers.com

SALEM LANDOWNERS GROUP

PROPOSED SWM POND-A



DESIGN	A.B.O.	SCALE	PROJ. No. 2015-4074
DRAWN	R.M.M.	CHECKED M.N.	DWG. No.
DATE:		SHEET No.	

Barrie Annex Lands
WATER QUALITY REQUIREMENT CALCULATIONS
SWM Pond B

Table: Water Quality Storage Requirements Based on Receiving Waters

Protection Level	SWMP Type	Storage Volume (m ³ /ha) for Impervious Level					
		0%	35%	55%	70%	85%	100%
Level 1	Wet Pond	53	140	190	225	250	275

* For wet ponds, all of the storage, except for 40 m³/ha represents the permanent pool volume.
The 40 m³/ha represents extended detention storage.

POND B

Input:

Estimated Imperviousness = 60%
Area = 22.97 ha
Level of Protection: 1
SWMP Type : Wet Pond

Calculation:

Total Storage Volume Required = 202 m³/ha → 4,632 m³
Permanent Pool Volume = 162 m³/ha → 3,713 m³
Active Storage Volume = 40 m³/ha → 919 m³

Erosion Control:

Input Area = 22.97 ha
R.V = 25 mm
Draw Down Time = 24 hrs

Calculations:

Storage = 3,446 m³
Average Outflow = 0.040 m³/s
Peak Outflow = 0.060 m³/s

Note: Estimated at 1.5 times Average Outflow

Provide 3446 m3 for erosion control.

PRE-DEVELOPMENT MODELLING

136

SCHAEFFERS
CONSULTING ENGINEERS



Visual OTTHYMO™ Schematic

**SWM Pond Tributary Area
ALLOWABLE RELEASE PRE-DEVELOPMENT
(SCS Type II DESIGN STORM)**

Job #: 4278

Date: October 2016

*** SIMULATION NUMBER: 1 ***

Filename: C:\Users\nkamran\AppData\Local\Temp\

Comments: SCS II 6H_2YR

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	1.69	1.75	4.23	3.25	9.31	4.75	2.54		
0.50	1.69	2.25	4.23	3.50	9.31	5.00	2.54		
0.75	2.54	2.50	5.08	3.75	4.23	5.25	1.69		
1.00	2.54	2.50	5.08	4.00	4.23	5.50	1.69		
1.25	2.54	2.75	25.38	4.25	3.38	5.75	1.69		
1.50	2.54	3.00	65.99	4.50	3.38	6.00	1.69		

	CALIB	(ha) =	22.97	Curve Number	(CN) = 56.0
	NASHVD { 0136)	Area		Ia	# of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min		Ia	(mm)= 5.00	U.H.	Tp(hrs)= 0.94

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

---- TRANSFORMED HYETOGRAPH ----									
TIME	RAIN	TIME	TIME	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	1.69	1.583	4.23	3.083	9.31	4.58	2.54		
0.167	1.69	1.667	4.23	3.167	9.31	4.67	2.54		
0.250	1.69	1.750	4.23	3.250	9.31	4.75	2.54		
0.333	1.69	1.833	4.23	3.333	9.31	4.83	2.54		
0.417	1.69	1.917	4.23	3.417	9.31	4.92	2.54		
0.500	1.69	2.000	4.23	3.500	9.31	5.00	2.54		
0.583	2.54	2.083	5.08	3.583	4.23	5.08	1.69		
0.667	2.54	2.167	5.08	3.667	4.23	5.17	1.69		
0.750	2.54	2.250	5.08	3.750	4.23	5.25	1.69		
0.833	2.54	2.333	5.08	3.833	4.23	5.33	1.69		
0.917	2.54	2.417	5.08	3.917	4.23	5.42	1.69		
1.000	2.54	2.500	5.08	4.000	4.23	5.50	1.69		
1.083	2.54	2.583	25.38	4.083	3.38	5.58	1.69		
1.167	2.54	2.667	25.38	4.167	3.38	5.67	1.69		
1.250	2.54	2.750	25.38	4.250	3.38	5.75	1.69		
1.333	2.54	2.833	65.99	4.333	3.38	5.83	1.69		
1.417	2.54	2.917	65.99	4.417	3.38	5.92	1.69		
1.500	2.54	3.000	65.99	4.500	3.38	6.00	1.69		

Unit Hyd Qpeak (cms) = 0.933

PEAK FLOW	(cms) =	0.157 (i)
TIME TO PEAK	(hrs) =	4.000
RUNOFF VOLUME	(mm) =	6.289
TOTAL RAINFALL	(mm) =	42.300
RUNOFF COEFFICIENT	=	0.149

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN SWM Pond B Pre-Development - SCS Type II Design Storm

DATE: October 2016

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

TIME TO PEAK (hrs) = 4.000
 RUNOFF VOLUME (mm) = 12.457
 TOTAL RAINFALL (mm) = 59.500
 RUNOFF COEFFICIENT = 0.209

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

 ** SIMULATION NUMBER: 2 **

 File name: C:\Users\nkamran\AppData
 ata\Local\Temp\7bd18649-8964-4ec4-ab26-db63a84b4a99\ec528ce5
 Comments: SCS II 6H_5YR
 Ptotal= 59.50 mm

Duration of storm = 6.00 hrs
 Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	2.38	1.75	5.95	3.25	13.09
0.50	2.38	2.00	5.95	3.50	13.09
0.75	3.57	2.25	7.14	3.75	5.95
1.00	3.57	2.50	7.14	4.00	5.95
1.25	3.57	2.75	35.70	4.25	4.76
1.50	3.57	3.00	92.82	4.50	4.76

 CALIB NASHYD (0136) Area (ha) = 22.97 Curve Number (CN) = 58.0
 ID= 1 DT= 5.0 min Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
 U.H. Tp (hrs) = 0.94

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.38	1.583	5.95	3.083	13.09
0.167	2.38	1.667	5.95	3.167	13.09
0.250	2.38	1.750	5.95	3.250	13.09
0.333	2.38	1.833	5.95	3.333	13.09
0.417	2.38	1.917	5.95	3.417	13.09
0.500	2.38	2.000	5.95	3.500	13.09
0.583	3.57	2.083	7.14	3.583	5.95
0.667	3.57	2.167	7.14	3.667	5.95
0.750	3.57	2.250	7.14	3.750	5.95
0.833	3.57	2.333	7.14	3.833	5.95
0.917	3.57	2.417	7.14	3.917	5.95
1.000	3.57	2.500	7.14	4.000	5.95
1.083	3.57	2.583	35.70	4.083	4.76
1.167	3.57	2.667	35.70	4.167	4.76
1.250	3.57	2.750	35.70	4.250	4.76
1.333	3.57	2.833	92.82	4.333	4.76
1.417	3.57	2.917	92.82	4.417	4.76
1.500	3.57	3.000	92.82	4.500	4.76

Unit Hyd Qpeak (cms) = 0.933
 PEAK FLOW (cms) = 0.316 (i)

 ** SIMULATION NUMBER: 3 **

 File name: C:\Users\nkamran\AppData
 ata\Local\Temp\7bd18649-8964-4ec4-ab26-db63a84b4a99\ec528ce5
 Comments: SCS II 6H_10YR
 Ptotal= 70.80 mm

Duration of storm = 6.00 hrs
 Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	2.83	1.75	7.08	3.25	15.58
0.50	2.83	2.00	7.08	3.50	15.58
0.75	4.25	2.25	8.50	3.75	7.08
1.00	4.25	2.50	8.50	4.00	7.08
1.25	4.25	2.75	42.48	4.25	5.66
1.50	4.25	3.00	110.45	4.50	5.66

 CALIB NASHYD (0136) Area (ha) = 22.97 Curve Number (CN) = 58.0
 ID= 1 DT= 5.0 min Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
 U.H. Tp (hrs) = 0.94

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.83	1.583	7.08	3.083	15.58
0.167	2.83	1.667	7.08	3.167	15.58
0.250	2.83	1.750	7.08	3.250	15.58
0.333	2.83	1.833	7.08	3.333	15.58
0.417	2.83	1.917	7.08	3.417	15.58
0.500	2.83	2.000	7.08	3.500	15.58
0.583	4.25	2.083	8.50	3.583	7.08
0.667	4.25	2.167	8.50	3.667	7.08
0.750	4.25	2.250	8.50	3.750	7.08
0.833	4.25	2.333	8.50	3.833	7.08
0.917	4.25	2.417	8.50	3.917	7.08
1.000	4.25	2.500	8.50	4.000	7.08
1.083	4.25	2.583	42.48	4.083	5.66
1.167	4.25	2.667	42.48	4.167	5.66
1.250	4.25	2.750	42.48	4.250	5.66
1.333	4.25	2.833	110.45	4.333	5.66
1.417	4.25	2.917	110.45	4.417	5.66
1.500	4.25	3.000	110.45	4.500	5.66

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond B Pre-Development - SCS Type II Design Storm

DATE: October 2016

Unit Hyd Qpeak (cms) = 0.933
PEAK FLOW (cms) = 0.443 (i)
TIME TO PEAK (hrs) = 4.000
RUNOFF VOLUME (mm) = 17.337
TOTAL RAINFALL (mm) = 70.800
RUNOFF COEFFICIENT = 0.245

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

** SIMULATION NUMBER: 4 **

MASS STORM
Filename: C:\Users\nkamran\AppData
ata\Local\Temp\
7bd18649-8964-4ec4-ab26-d63a84b4a99\ec528ce5
Ptotal= 85.20 mm
Comments: SCS II 6H_25YR

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	3.41	1.75	8.52	3.25	18.74	4.75	5.11
0.50	3.41	2.00	8.52	3.50	18.74	5.00	5.11
0.75	5.11	2.25	10.22	3.75	8.52	5.25	3.41
1.00	5.11	2.50	10.22	4.00	8.52	5.50	3.41
1.25	5.11	2.75	51.12	4.25	6.82	5.75	3.41
1.50	5.11	3.00	132.91	4.50	6.82	6.00	3.41

CALIB (0136) Area (ha) = 22.97 Curve Number (CN) = 58.0
NASHYD (0136) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.94

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

----- TRANSFORMED HYETOGRAPH -----							
TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.41	1.583	8.52	3.083	18.75	4.58	5.11
0.167	3.41	1.667	8.52	3.167	18.74	4.67	5.11
0.250	3.41	1.750	8.52	3.250	18.74	4.75	5.11
0.333	3.41	1.833	8.52	3.333	18.74	4.83	5.11
0.417	3.41	1.917	8.52	3.417	18.74	4.92	5.11
0.500	3.41	2.000	8.52	3.500	18.74	5.00	5.11
0.583	5.11	2.083	10.22	3.583	8.52	5.08	3.41
0.667	5.11	2.167	10.22	3.667	8.52	5.17	3.41
0.750	5.11	2.250	10.22	3.750	8.52	5.25	3.41
0.833	5.11	2.333	10.22	3.833	8.52	5.33	3.41
0.917	5.11	2.417	10.22	3.917	8.52	5.42	3.41
1.000	5.11	2.500	10.22	4.000	8.52	5.50	3.41
1.083	5.11	2.583	51.12	4.083	6.82	5.58	3.41
1.167	5.11	2.667	51.12	4.167	6.82	5.67	3.41

1.250 5.11 | 2.750 51.12 | 4.250 6.82 | 5.75 3.41
1.333 5.11 | 2.833 132.91 | 4.333 6.82 | 5.83 3.41
1.417 5.11 | 2.917 132.91 | 4.417 6.82 | 5.92 3.41
1.500 5.11 | 3.000 132.91 | 4.500 6.82 | 6.00 3.41

Unit Hyd Qpeak (cms) = 0.933

PEAK FLOW (cms) = 0.626 (i)
TIME TO PEAK (hrs) = 4.000
RUNOFF VOLUME (mm) = 24.352
TOTAL RAINFALL (mm) = 85.200
RUNOFF COEFFICIENT = 0.286

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

** SIMULATION NUMBER: 5 **

MASS STORM
Filename: C:\Users\nkamran\AppData
ata\Local\Temp\
7bd18649-8964-4ec4-ab26-d63a84b4a99\ec528ce5
Ptotal= 95.90 mm
Comments: SCS II 6H_50YR

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	3.84	1.75	9.59	3.25	21.10	4.75	5.75
0.50	3.84	2.00	9.59	3.50	21.10	5.00	5.75
0.75	5.75	2.25	11.51	3.75	9.59	5.25	3.84
1.00	5.75	2.50	11.51	4.00	9.59	5.50	3.84
1.25	5.75	2.75	57.54	4.25	7.67	5.75	3.84
1.50	5.75	3.00	149.60	4.50	7.67	6.00	3.84

CALIB (0136) Area (ha) = 22.97 Curve Number (CN) = 58.0
NASHYD (0136) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.94

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

----- TRANSFORMED HYETOGRAPH -----							
TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.84	1.583	9.59	3.083	21.10	4.58	5.75
0.167	3.84	1.667	9.59	3.167	21.10	4.67	5.75
0.250	3.84	1.750	9.59	3.250	21.10	4.75	5.75
0.333	3.84	1.833	9.59	3.333	21.10	4.83	5.75
0.417	3.84	1.917	9.59	3.417	21.10	4.92	5.75
0.500	3.84	2.000	9.59	3.500	21.10	5.00	5.75
0.583	5.75	2.083	11.51	3.583	9.59	5.08	3.84
0.667	5.75	2.167	11.51	3.667	9.59	5.17	3.84
0.750	5.75	2.250	11.51	3.750	9.59	5.25	3.84
0.833	5.75	2.333	11.51	3.833	9.59	5.33	3.84

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond B Pre-Development - SCS Type II Design Storm

DATE: October 2016

0.917	5.75	2.417	11.51	3.917	9.59	5.42	3.84
1.000	5.75	2.500	11.51	4.000	9.59	5.50	3.84
1.083	5.75	2.583	57.54	4.083	7.67	5.58	3.84
1.167	5.75	2.667	57.54	4.167	7.67	5.67	3.84
1.250	5.75	2.750	57.54	4.250	7.67	5.75	3.84
1.333	5.75	2.833	149.60	4.333	7.67	5.83	3.84
1.417	5.75	2.917	149.60	4.417	7.67	5.92	3.84
1.500	5.75	3.000	149.60	4.500	7.67	6.00	3.84

Unit Hyd Qpeak (cms) = 0.933

PEAK FLOW (cms) = 0.775 (i)

TIME TO PEAK (hrs) = 4.000

RUNOFF VOLUME (mm) = 30.065

TOTAL RAINFALL (mm) = 95.900

RUNOFF COEFFICIENT = 0.314

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

** SIMULATION NUMBER: 6 **

File name: C:\Users\nkamran\AppData
Local\Temp\7bd18649-8964-4ec4-ab26-d863a84b4a99\ec528ce5
Comments: SCS II 6H_100YR

Duration of storm = 6.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	4.26	1.75	10.65	3.25	23.43	4.75	6.39
0.50	4.26	2.00	10.65	3.50	23.43	5.00	6.39
0.75	6.39	2.25	12.78	3.75	10.65	5.25	4.26
1.00	6.39	2.50	12.78	4.00	10.65	5.50	4.26
1.25	6.39	2.75	63.90	4.25	8.52	5.75	4.26
1.50	6.39	3.00	166.14	4.50	8.52	6.00	4.26

CALIB (0136) Area (ha) = 22.97 Curve Number (CN) = 58.0
NASHVD (0136) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
ID= 1 DT= 5.0 min U.H. Tp (hrs) = 0.94

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 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
0.083	4.26	1.583	10.65	3.083	23.43	4.58	6.39
0.167	4.26	1.667	10.65	3.167	23.43	4.67	6.39
0.250	4.26	1.750	10.65	3.250	23.43	4.75	6.39
0.333	4.26	1.833	10.65	3.333	23.43	4.83	6.39
0.417	4.26	1.917	10.65	3.417	23.43	4.92	6.39
0.500	4.26	2.000	10.65	3.500	23.43	5.00	6.39

0.583	6.39	2.083	12.78	3.583	10.65	5.08	4.26
0.667	6.39	2.167	12.78	3.667	10.65	5.17	4.26
0.750	6.39	2.250	12.78	3.750	10.65	5.25	4.26
0.833	6.39	2.333	12.78	3.833	10.65	5.33	4.26
0.917	6.39	2.417	12.78	3.917	10.65	5.42	4.26
1.000	6.39	2.500	12.78	4.000	10.65	5.50	4.26
1.083	6.39	2.583	63.90	4.083	8.52	5.58	4.26
1.167	6.39	2.667	63.90	4.167	8.52	5.67	4.26
1.250	6.39	2.750	63.90	4.250	8.52	5.75	4.26
1.333	6.39	2.833	166.14	4.333	8.52	5.83	4.26
1.417	6.39	2.917	166.14	4.417	8.52	5.92	4.26
1.500	6.39	3.000	166.14	4.500	8.52	6.00	4.26

Unit Hyd Qpeak (cms) = 0.933

PEAK FLOW (cms) = 0.934 (i)

TIME TO PEAK (hrs) = 3.917

RUNOFF VOLUME (mm) = 36.093

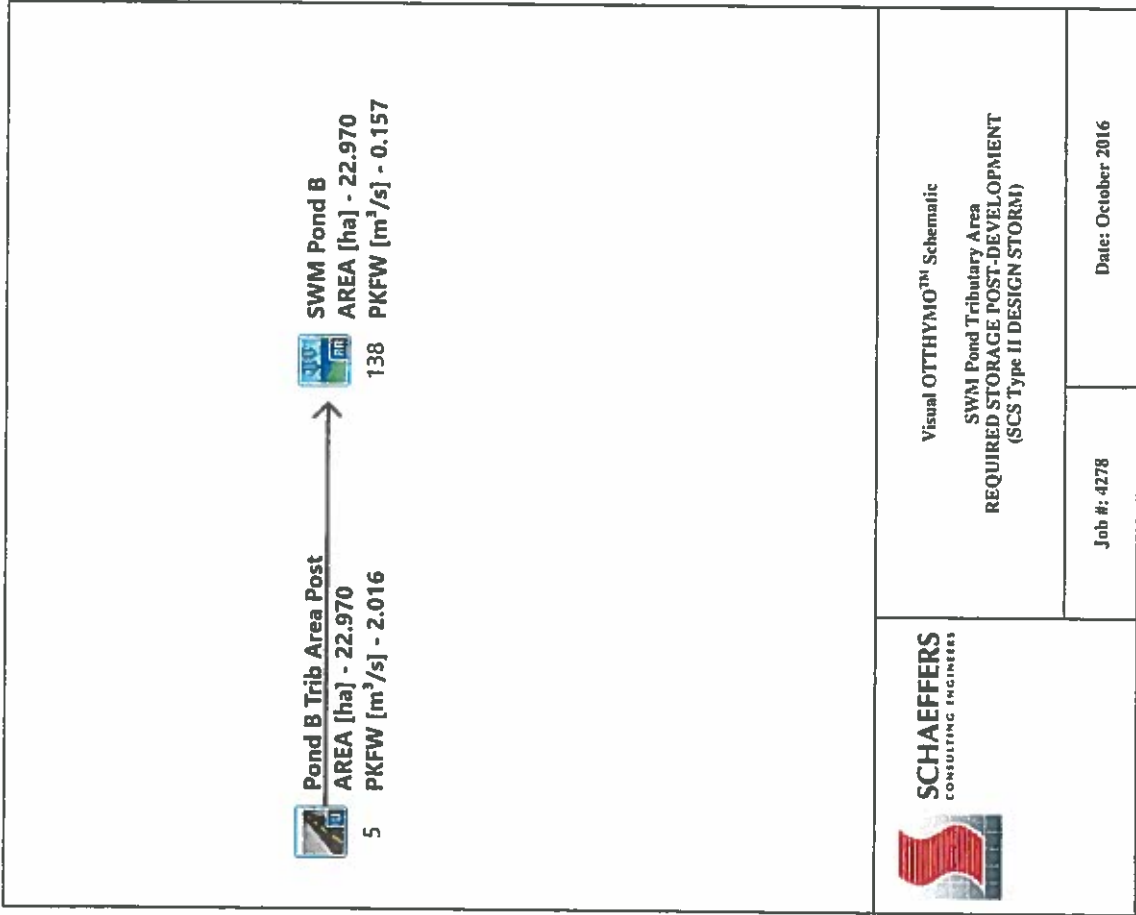
TOTAL RAINFALL (mm) = 106.500

RUNOFF COEFFICIENT = 0.339

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



POST DEVELOPMENT MODELLING



 ** SIMULATION NUMBER: 1 **

CALIB	Area (ha) = 22.97	Dir. Conn. (%) = 45.00
STANDHYD (0005)	Total Imp (%) = 60.00	
ID= 1 DT= 5.0 min		

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha) =	13.78	9.19
Dep. Storage (mm) =	1.00	1.50
Average Slope (%) =	2.00	2.00
Length (m) =	391.32	40.00
Manning's n =	0.013	0.250
Max.Eff.Inten.(mm/hr) =	65.99	23.23
Storage Coeff. (min) =	5.00	20.00
Unit Hyd. Tpeak (min) =	5.56 (ii)	18.21 (ii)
Unit Hyd. peak (cms) =	5.00	20.00
	0.20	0.06
PEAK FLOW (cms) =	1.81	0.31
TIME TO PEAK (hrs) =	3.00	3.17
RUNOFF VOLUME (mm) =	41.30	9.71
TOTAL RAINFALL (mm) =	42.30	42.30
RUNOFF COEFFICIENT =	0.98	0.23

TOTALS
 2.016 (iii)
 3.00
 23.92
 42.30
 0.57

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 58.0 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 (0138)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2--> OUT= 1	0.0000	0.0000	0.6260	0.8513
DT= 5.0 min	0.1570	0.3972	0.7750	0.9697
	0.3160	0.5750	0.9340	1.0889
	0.4430	0.6947	0.0000	0.0000

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0005)	22.970	2.016	23.92
OUTFLOW: ID= 1 (0138)	22.970	0.157	23.89

PEAK FLOW REDUCTION (Qout/Qin) (%) = 7.79
TIME SHIFT OF PEAK FLOW (min) = 85.00
MAXIMUM STORAGE USED (ha.m.) = 0.3972

 ** SIMULATION NUMBER: 2 **

CALIB

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN SWM Pond B Post-Development - SCS Type II Design Storm

DATE: October 2016

STANDHYD (0005) | Area (ha)= 22.97 | Total Imp(%)= 60.00 | Dir. Conn.(%)= 45.00
ID= 1 DT= 5.0 min

IMPERVIOUS PERVIOUS (i)

Surface Area (ha)= 13.78 9.19
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 391.32 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 92.82 46.90
over (min) 5.00 15.00
Storage Coeff. (min)= 4.85 (ii) 14.40 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.22 0.08

PEAK FLOW (cms)= 2.59 0.67
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 58.50 36.09
TOTAL RAINFALL (mm)= 59.50 59.50
RUNOFF COEFFICIENT = 0.98 0.30

TOTALS

3.146 (iii)

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

(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:

CN* = 58.0 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 (0138)

IN= 2---> OUT= 1

DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.6260	0.8513	
0.1570	0.3972	0.7750	0.9697	
0.3160	0.5750	0.9340	1.0889	
0.4430	0.6947	0.0000	0.0000	

INFLOW : ID= 2 (0005) 22.970 3.146 3.00 36.09
OUTFLOW: ID= 1 (0138) 22.970 0.316 3.92 36.06

PEAK FLOW REDUCTION [Qout/Qin] (%)= 10.04
TIME SHIFT OF PEAK FLOW (min)= 55.00
MAXIMUM STORAGE USED (ha.m.)= 0.5750

** SIMULATION NUMBER: 3 **

CALIB

STANDHYD (0005)

ID= 1 DT= 5.0 min

Area (ha)= 22.97
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)

Surface Area (ha)= 13.78 9.19
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 391.32 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 110.45 63.05
over (min) 5.00 15.00
Storage Coeff. (min)= 4.52 (ii) 13.01 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.23 0.08

PEAK FLOW (cms)= 3.10 0.95
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 69.80 23.88
TOTAL RAINFALL (mm)= 70.80 70.80
RUNOFF COEFFICIENT = 0.99 0.34

TOTALS

3.898 (iii)

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

(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:

CN* = 58.0 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 (0138)

IN= 2---> OUT= 1

DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.6260	0.8513	
0.1570	0.3972	0.7750	0.9697	
0.3160	0.5750	0.9340	1.0889	
0.4430	0.6947	0.0000	0.0000	

INFLOW : ID= 2 (0005) 22.970 3.898 3.00 44.54
OUTFLOW: ID= 1 (0138) 22.970 0.443 3.75 44.52

PEAK FLOW REDUCTION [Qout/Qin] (%)= 11.36
TIME SHIFT OF PEAK FLOW (min)= 45.00
MAXIMUM STORAGE USED (ha.m.)= 0.6947

** SIMULATION NUMBER: 4 **

CALIB

STANDHYD (0005)

ID= 1 DT= 5.0 min

Area (ha)= 22.97
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)

Surface Area (ha)= 13.78 9.19
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 391.32 40.00

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond B Post-Development - SCS Type II Design Storm

DATE: October 2016

Mannings n = 0.013 0.250
Max.Eff.Inten.(mm/hr)= 132.91 85.60
over (min) 15.00
Storage Coeff. (min)= 4.20 (ii) 11.71 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.24 0.09
PEAK FLOW (cms)= 3.75 1.35
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 84.20 32.47
TOTAL RAINFALL (mm)= 85.20 85.20
RUNOFF COEFFICIENT = 0.99 0.38
TOTALS
4.908 (iii)
55.75
85.20
0.65

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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 (0138)
IN= 2--> OUT= 1
DT= 5.0 min
OUTFLOW (cms) STORAGE (ha.m.)
0.0000 0.0000
0.1570 0.3972
0.3160 0.5750
0.4430 0.6947
AREA (ha) OPEAK (cms) TPEAK (hrs)
22.970 4.908 3.00
22.970 0.625 3.67
R.V. (mm)
55.75
55.72
INFLOW : ID= 2 (0005)
OUTFLOW: ID= 1 (0138)
PEAK FLOW REDUCTION [Qout/Qin] (%) = 12.74
TIME SHIFT OF PEAK FLOW (min) = 40.00
MAXIMUM STORAGE USED (ha.m.) = 0.8513

** SIMULATION NUMBER: 5 **

CALIB
STANDHYD (0005)
ID= 1 DT= 5.0 min
Area (ha) = 22.97
Total Imp (%) = 60.00 Dir. Conn. (%) = 45.00
IMPERVIOUS PVIOUS (i)
Surface Area (ha) = 13.78 9.19
Dep. Storage (mm) = 1.00 1.50
Average Slope (%) = 2.00 2.00
Length (m) = 391.32 40.00
Mannings n = 0.013 0.250
Max.Eff.Inten.(mm/hr)= 149.60 103.54
over (min) 5.00 15.00

Storage Coeff. (min)= 4.00 (ii) 10.97 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.24 0.09
PEAK FLOW (cms)= 4.23 1.69
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 94.90 39.32
TOTAL RAINFALL (mm)= 95.90 95.90
RUNOFF COEFFICIENT = 0.99 0.41
TOTALS
5.691 (iii)
3.00
64.33
95.90
0.67

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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 (0138)
IN= 2--> OUT= 1
DT= 5.0 min
OUTFLOW (cms) STORAGE (ha.m.)
0.0000 0.0000
0.1570 0.3972
0.3160 0.5750
0.4430 0.6947
AREA (ha) OPEAK (cms) TPEAK (hrs)
22.970 5.691 3.00
22.970 0.775 3.67
R.V. (mm)
64.33
64.31
INFLOW : ID= 2 (0005)
OUTFLOW: ID= 1 (0138)
PEAK FLOW REDUCTION [Qout/Qin] (%) = 13.61
TIME SHIFT OF PEAK FLOW (min) = 40.00
MAXIMUM STORAGE USED (ha.m.) = 0.9697

** SIMULATION NUMBER: 6 **

CALIB
STANDHYD (0005)
ID= 1 DT= 5.0 min
Area (ha) = 22.97
Total Imp (%) = 60.00 Dir. Conn. (%) = 45.00
IMPERVIOUS PVIOUS (i)
Surface Area (ha) = 13.78 9.19
Dep. Storage (mm) = 1.00 1.50
Average Slope (%) = 2.00 2.00
Length (m) = 391.32 40.00
Mannings n = 0.013 0.250
Max.Eff.Inten.(mm/hr)= 166.14 122.13
over (min) 5.00 15.00
Storage Coeff. (min)= 3.84 (ii) 10.36 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.25 0.09

TOTALS

PEAK FLOW (cms) = 4.71 2.04 6.490 (iii)
TIME TO PEAK (hrs) = 3.00 3.08 3.00
RUNOFF VOLUME (mm) = 105.50 46.46 73.03
TOTAL RAINFALL (mm) = 106.50 106.50 106.50
RUNOFF COEFFICIENT = 0.99 0.44 0.69

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

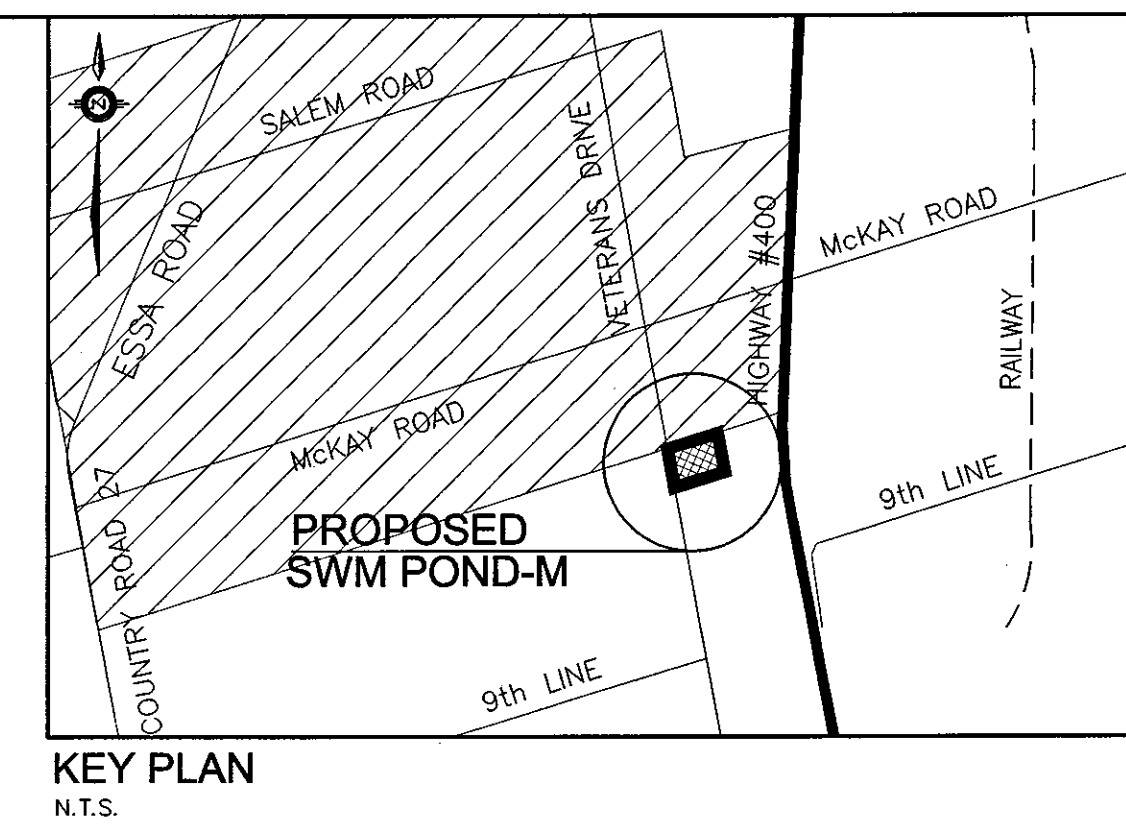
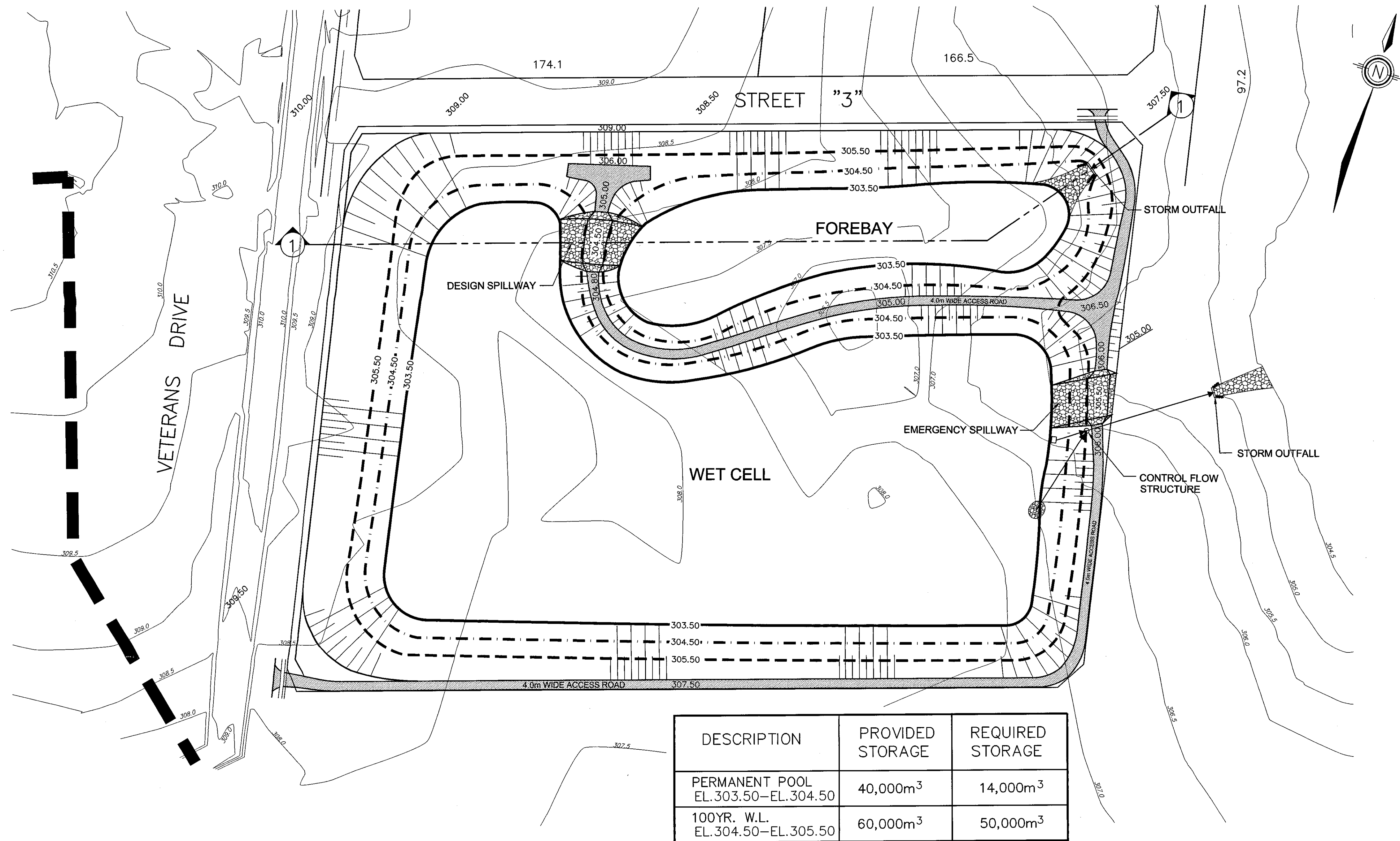
- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 Ia = Dep. Storage (Above)
- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
- (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR (0138)									
IN= 2--> OUT= 1									
DT= 5.0 min									

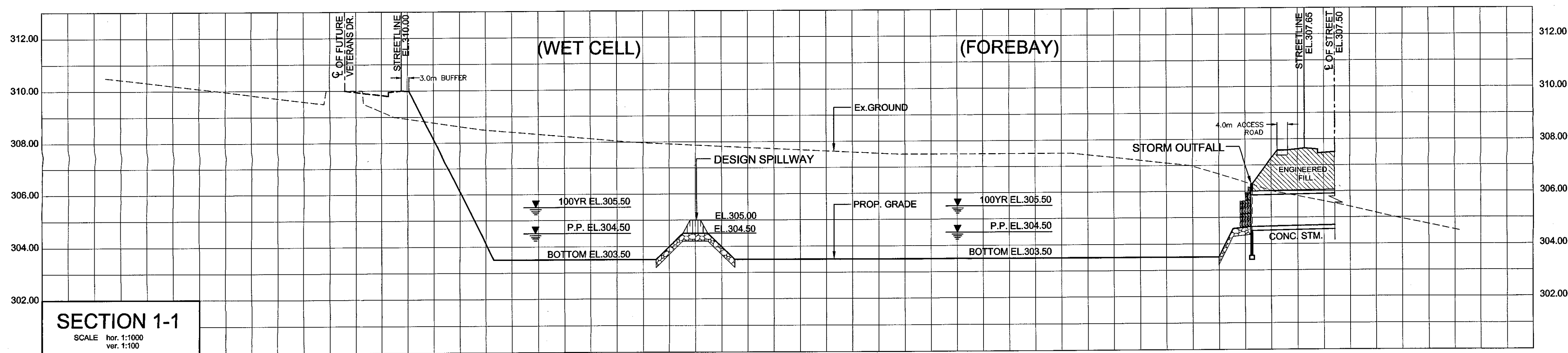
		OUTFLOW	STORAGE	OUTFLOW	STORAGE				
		(cms)	(ha.m.)	(cms)	(ha.m.)				
		0.0000	0.0000	0.6260	0.8513				
		0.1570	0.3972	0.7750	0.9697				
		0.3160	0.5750	0.9340	1.0889				
		0.4430	0.6947	0.0000	0.0000				
		AREA	QPEAK	TPEAK	R.V.				
		(ha)	(cms)	(hrs)	(mm)				
		22.970	6.490	3.00	73.03				
		22.970	0.932	3.67	73.00				

PEAK FLOW REDUCTION [Qout/Qin] (%)= 14.36									
TIME SHIFT OF PEAK FLOW (min)= 40.00									
MAXIMUM STORAGE USED (ha.m.)= 1.0889									

SWM POND M



DESCRIPTION	PROVIDED STORAGE	REQUIRED STORAGE
PERMANENT POOL EL.303.50-EL.304.50	40,000m ³	14,000m ³
100YR. W.L. EL.304.50-EL.305.50	60,000m ³	50,000m ³



No.	REVISIONS	DATE	APPROVED

SCHAEFFERS
CONSULTING ENGINEERS
6 Rossmore Drive, Concord,
Ontario L4K 4R3
Tel: (905) 738-6100
Fax: (905) 738-6875
E-mail:
design@schaeffers.com

WATERSAND CONSTRUCTION c/o D.G. GROUP

PROPOSED SWM POND-M

The City of BARRIE

DESIGN	A.B.O.	SCALE	PROJ. No. 2015-4278
DRAWN	R.M.M.	CHECKED	DWG. No.
DATE:		SHEET No.	

Barrie Annex Lands
WATER QUALITY REQUIREMENT CALCULATIONS
SWM Pond M

Table: Water Quality Storage Requirements Based on Receiving Waters

Protection Level	SWMP Type	Storage Volume (m ³ /ha) for Impervious Level					
		0%	35%	55%	70%	85%	100%
Level 1	Wet Pond	53	140	190	225	250	275

* For wet ponds, all of the storage, except for 40 m³/ha represents the permanent pool volume.
The 40 m³/ha represents extended detention storage.

POND M

Input:

Estimated Imperviousness = 76.16%
Area = 67.17 ha
Level of Protection: 1
SWMP Type : Wet Pond

Calculation:

Total Storage Volume Required = 239 m³/ha → 16,079 m³
Permanent Pool Volume = 199 m³/ha → 13,392 m³
Active Storage Volume = 40 m³/ha → 2,687 m³

Erosion Control:

Input Area = 67.17 ha
R.V = 25 mm
Draw Down Time = 24 hrs

Calculations:

Storage = 12,789 m³
Average Outflow = 0.148 m³/s
Peak Outflow = 0.222 m³/s

Note: Estimated at 1.5 times Average Outflow

Provide 12789 m3 for erosion control.



PRE-DEVELOPMENT MODELLING

** SIMULATION NUMBER: 1 **

File name: C:\Users\ankamran\AppData
Local\Temp\2191741b-22c3-4d38-bf97-21cde6e866f5\3775b4fe
Comments: SCS II 24H_2YR

Duration of storm = 24.00 hrs
Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.55	6.25	1.10	12.25	7.92	18.25	0.99
0.50	0.55	6.50	1.10	12.50	7.92	18.50	0.99
0.75	0.55	6.75	1.10	12.75	4.07	18.75	0.99
1.00	0.55	7.00	1.10	13.00	4.07	19.00	0.99
1.25	0.55	7.25	1.10	13.25	0.77	19.25	0.99
1.50	0.55	7.50	1.10	13.50	0.77	19.50	0.99
1.75	0.55	7.75	1.10	13.75	4.51	19.75	0.99
2.00	0.99	8.00	1.10	14.00	4.51	20.00	0.99
2.25	0.72	8.25	1.49	14.25	1.65	20.25	0.66
2.50	0.71	8.50	1.48	14.50	1.65	20.50	0.66
2.75	0.72	8.75	1.49	14.75	1.65	20.75	0.66
3.00	0.71	9.00	1.49	15.00	1.65	21.00	0.66
3.25	0.71	9.25	1.76	15.25	1.65	21.25	0.66
3.50	0.71	9.50	1.76	15.50	1.65	21.50	0.66
3.75	0.72	9.75	1.98	15.75	1.65	21.75	0.66
4.00	0.71	10.00	1.98	16.00	1.65	22.00	0.66
4.25	0.88	10.25	2.53	16.25	0.99	22.25	0.66
4.50	0.88	10.50	2.53	16.50	0.99	22.50	0.66
4.75	0.88	10.75	3.41	16.75	0.99	22.75	0.66
5.00	0.88	11.00	3.41	17.00	0.99	23.00	0.66
5.25	0.88	11.25	5.28	17.25	0.99	23.25	0.66
5.50	0.88	11.50	5.28	17.50	0.99	23.50	0.66
5.75	0.88	11.75	22.88	17.75	0.99	23.75	0.66
6.00	0.88	12.00	60.72	18.00	0.99	24.00	0.66

CALIB NASHYD (0136) Area (ha) = 51.45 Curve Number (CN) = 49.8
ID= 1 DT= 5.0 min Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
U.H. Tp (hrs) = 1.20

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.55	6.083	1.10	12.083	7.93	18.08	0.99
0.167	0.55	6.167	1.10	12.167	7.92	18.17	0.99
0.250	0.55	6.250	1.10	12.250	7.92	18.25	0.99
0.333	0.55	6.333	1.10	12.333	7.92	18.33	0.99
0.417	0.55	6.417	1.10	12.417	7.92	18.42	0.99
0.500	0.55	6.500	1.10	12.500	7.92	18.50	0.99
0.583	0.55	6.583	1.10	12.583	4.07	18.58	0.99
0.667	0.55	6.667	1.10	12.667	4.07	18.67	0.99



Pond M Pre-Dev Area
AREA [ha] - 51.450
136 PKFW [m³/s] - 0.271



SCHAEFFERS
CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic

SWM Pond Tributary Area
ALLOWABLE RELEASE PRE-DEVELOPMENT
(SCS Type II DESIGN STORM)

Job #: 4278

Date: October 2016

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond M Pre-Development - SCS Type II Design Storm

DATE: October 2016

0.750	0.55	6.750	1.10	12.750	4.07	18.75	0.99
0.833	0.55	6.833	1.10	12.833	4.07	18.83	0.99
0.917	0.55	6.917	1.10	12.917	4.07	18.92	0.99
1.000	0.55	7.000	1.10	13.000	4.07	19.00	0.99
1.083	0.55	7.083	1.10	13.083	0.77	19.08	0.99
1.167	0.55	7.167	1.10	13.167	0.77	19.17	0.99
1.250	0.55	7.250	1.10	13.250	0.77	19.25	0.99
1.333	0.55	7.333	1.10	13.333	0.77	19.33	0.99
1.417	0.55	7.417	1.10	13.417	0.77	19.42	0.99
1.500	0.55	7.500	1.10	13.500	0.77	19.50	0.99
1.583	0.55	7.583	1.10	13.583	4.51	19.58	0.99
1.667	0.55	7.667	1.10	13.667	4.51	19.67	0.99
1.750	0.55	7.750	1.10	13.750	4.51	19.75	0.99
1.833	0.99	7.833	1.10	13.833	4.51	19.83	0.99
1.917	0.99	7.917	1.10	13.917	4.51	19.92	0.99
2.000	0.99	8.000	1.10	14.000	4.51	20.00	0.99
2.083	0.72	8.083	1.49	14.083	1.65	20.08	0.66
2.167	0.72	8.167	1.49	14.167	1.65	20.17	0.66
2.250	0.72	8.250	1.49	14.250	1.65	20.25	0.66
2.333	0.71	8.333	1.48	14.333	1.65	20.33	0.66
2.417	0.71	8.417	1.48	14.417	1.65	20.42	0.66
2.500	0.71	8.500	1.48	14.500	1.65	20.50	0.66
2.583	0.72	8.583	1.49	14.583	1.65	20.58	0.66
2.667	0.72	8.667	1.49	14.667	1.65	20.67	0.66
2.750	0.72	8.750	1.49	14.750	1.65	20.75	0.66
2.833	0.71	8.833	1.49	14.833	1.65	20.83	0.66
2.917	0.71	8.917	1.49	14.917	1.65	20.92	0.66
3.000	0.71	9.000	1.49	15.000	1.65	21.00	0.66
3.083	0.71	9.083	1.76	15.083	1.65	21.08	0.66
3.167	0.71	9.167	1.76	15.167	1.65	21.17	0.66
3.250	0.71	9.250	1.76	15.250	1.65	21.25	0.66
3.333	0.71	9.333	1.76	15.333	1.65	21.33	0.66
3.417	0.71	9.417	1.76	15.417	1.65	21.42	0.66
3.500	0.71	9.500	1.76	15.500	1.65	21.50	0.66
3.583	0.72	9.583	1.98	15.583	1.65	21.58	0.66
3.667	0.72	9.667	1.98	15.667	1.65	21.67	0.66
3.750	0.72	9.750	1.98	15.750	1.65	21.75	0.66
3.833	0.71	9.833	1.98	15.833	1.65	21.83	0.66
3.917	0.71	9.917	1.98	15.917	1.65	21.92	0.66
4.000	0.71	10.000	1.98	16.000	1.65	22.00	0.66
4.083	0.88	10.083	2.53	16.083	0.99	22.08	0.66
4.167	0.88	10.167	2.53	16.167	0.99	22.17	0.66
4.250	0.88	10.250	2.53	16.250	0.99	22.25	0.66
4.333	0.88	10.333	2.53	16.333	0.99	22.33	0.66
4.417	0.88	10.417	2.53	16.417	0.99	22.42	0.66
4.500	0.88	10.500	2.53	16.500	0.99	22.50	0.66
4.583	0.88	10.583	3.41	16.583	0.99	22.58	0.66
4.667	0.88	10.667	3.41	16.667	0.99	22.67	0.66
4.750	0.88	10.750	3.41	16.750	0.99	22.75	0.66
4.833	0.88	10.833	3.41	16.833	0.99	22.83	0.66
4.917	0.88	10.917	3.41	16.917	0.99	22.92	0.66
5.000	0.88	11.000	3.41	17.000	0.99	23.00	0.66
5.083	0.88	11.083	5.28	17.083	0.99	23.08	0.66
5.167	0.88	11.167	5.28	17.167	0.99	23.17	0.66
5.250	0.88	11.250	5.28	17.250	0.99	23.25	0.66
5.333	0.88	11.333	5.28	17.333	0.99	23.33	0.66
5.417	0.88	11.417	5.28	17.417	0.99	23.42	0.66
5.500	0.88	11.500	5.28	17.500	0.99	23.50	0.66
5.583	0.88	11.583	22.88	17.583	0.99	23.58	0.66
5.667	0.88	11.667	22.88	17.667	0.99	23.67	0.66

Unit Hyd Qpeak (cms) = 1.638

PEAK FLOW (cms) = 0.271 (i)
TIME TO PEAK (hrs) = 13.250
RUNOFF VOLUME (mm) = 8.169
TOTAL RAINFALL (mm) = 55.000
RUNOFF COEFFICIENT = 0.149

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

*** SIMULATION NUMBER: 2 ***

File name: C:\Users\inkamran\AppData\Local\Temp\2191741B-22C3-4d38-bf97-21cde6e866f5\3775b4fe
Comments: SCS II 24H_5YR

Ptotal= 76.00 mm

Duration of storm = 24.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	0.76	6.25	1.52	12.25	10.94	18.25	1.37
0.50	0.76	6.50	1.52	12.50	10.94	18.50	1.37
0.75	0.76	6.75	1.52	12.75	5.62	18.75	1.37
1.00	0.76	7.00	1.52	13.00	5.62	19.00	1.37
1.25	0.76	7.25	1.52	13.25	1.06	19.25	1.37
1.50	0.76	7.50	1.52	13.50	1.06	19.50	1.37
1.75	0.76	7.75	1.52	13.75	6.23	19.75	1.37
2.00	1.37	8.00	1.52	14.00	6.23	20.00	1.37
2.25	0.99	8.25	2.05	14.25	2.28	20.25	0.91
2.50	0.99	8.50	2.05	14.50	2.28	20.50	0.91
2.75	0.99	8.75	2.05	14.75	2.28	20.75	0.91
3.00	0.99	9.00	2.05	15.00	2.28	21.00	0.91
3.25	0.99	9.25	2.43	15.25	2.28	21.25	0.91
3.50	0.99	9.50	2.43	15.50	2.28	21.50	0.91
3.75	0.99	9.75	2.74	15.75	2.28	21.75	0.91
4.00	0.99	10.00	2.74	16.00	2.28	22.00	0.91
4.25	1.22	10.25	3.50	16.25	1.37	22.25	0.91
4.50	1.22	10.50	3.50	16.50	1.37	22.50	0.91
4.75	1.22	10.75	4.71	16.75	1.37	22.75	0.91
5.00	1.22	11.00	4.71	17.00	1.37	23.00	0.91
5.25	1.22	11.25	7.30	17.25	1.37	23.25	0.91
5.50	1.22	11.50	7.30	17.50	1.37	23.50	0.91
5.75	1.22	11.75	31.62	17.75	1.37	23.75	0.91
6.00	1.22	12.00	83.90	18.00	1.37	24.00	0.91

CALIB (0136) Area (ha) = 51.45 Curve Number (CN) = 49.8
NASHVD (0136) ID= 1 DT= 5.0 min Ia (mm) = 5.00 # of Linear Res. (N) = 3.00

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond M Pre-Development - SCS Type II Design Storm

DATE: October 2016

U.H. Tp (hrs) = 1.20

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

TRANSFORMED HYETOGRAPH									
TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.76	6.083	1.52	12.083	10.95	18.08	1.37	24.08	1.37
0.167	0.76	6.167	1.52	12.167	10.94	18.17	1.37	24.17	1.37
0.250	0.76	6.250	1.52	12.250	10.94	18.25	1.37	24.25	1.37
0.333	0.76	6.333	1.52	12.333	10.94	18.33	1.37	24.33	1.37
0.417	0.76	6.417	1.52	12.417	10.94	18.42	1.37	24.42	1.37
0.500	0.76	6.500	1.52	12.500	10.94	18.50	1.37	24.50	1.37
0.583	0.76	6.583	1.52	12.583	5.62	18.58	1.37	24.58	1.37
0.667	0.76	6.667	1.52	12.667	5.62	18.67	1.37	24.67	1.37
0.750	0.76	6.750	1.52	12.750	5.62	18.75	1.37	24.75	1.37
0.833	0.76	6.833	1.52	12.833	5.62	18.83	1.37	24.83	1.37
0.917	0.76	6.917	1.52	12.917	5.62	18.92	1.37	24.92	1.37
1.000	0.76	7.000	1.52	13.000	5.62	19.00	1.37	25.00	1.37
1.083	0.76	7.083	1.52	13.083	1.06	19.08	1.37	25.08	1.37
1.167	0.76	7.167	1.52	13.167	1.06	19.17	1.37	25.17	1.37
1.250	0.76	7.250	1.52	13.250	1.06	19.25	1.37	25.25	1.37
1.333	0.76	7.333	1.52	13.333	1.06	19.33	1.37	25.33	1.37
1.417	0.76	7.417	1.52	13.417	1.06	19.42	1.37	25.42	1.37
1.500	0.76	7.500	1.52	13.500	1.06	19.50	1.37	25.50	1.37
1.583	0.76	7.583	1.52	13.583	6.23	19.58	1.37	25.58	1.37
1.667	0.76	7.667	1.52	13.667	6.23	19.67	1.37	25.67	1.37
1.750	0.76	7.750	1.52	13.750	6.23	19.75	1.37	25.75	1.37
1.833	1.37	7.833	1.52	13.833	6.23	19.83	1.37	25.83	1.37
1.917	1.37	7.917	1.52	13.917	6.23	19.92	1.37	25.92	1.37
2.000	1.37	8.000	1.52	14.000	6.23	20.00	1.37	26.00	1.37
2.083	0.99	8.083	2.05	14.083	2.28	20.08	0.91	26.08	0.91
2.167	0.99	8.167	2.05	14.167	2.28	20.17	0.91	26.17	0.91
2.250	0.99	8.250	2.05	14.250	2.28	20.25	0.91	26.25	0.91
2.333	0.99	8.333	2.05	14.333	2.28	20.33	0.91	26.33	0.91
2.417	0.99	8.417	2.05	14.417	2.28	20.42	0.91	26.42	0.91
2.500	0.99	8.500	2.05	14.500	2.28	20.50	0.91	26.50	0.91
2.583	0.99	8.583	2.05	14.583	2.28	20.58	0.91	26.58	0.91
2.667	0.99	8.667	2.05	14.667	2.28	20.67	0.91	26.67	0.91
2.750	0.99	8.750	2.05	14.750	2.28	20.75	0.91	26.75	0.91
2.833	0.99	8.833	2.05	14.833	2.28	20.83	0.91	26.83	0.91
2.917	0.99	8.917	2.05	14.917	2.28	20.92	0.91	26.92	0.91
3.000	0.99	9.000	2.05	15.000	2.28	21.00	0.91	27.00	0.91
3.083	0.99	9.083	2.43	15.083	2.28	21.08	0.91	27.08	0.91
3.167	0.99	9.167	2.43	15.167	2.28	21.17	0.91	27.17	0.91
3.250	0.99	9.250	2.43	15.250	2.28	21.25	0.91	27.25	0.91
3.333	0.99	9.333	2.43	15.333	2.28	21.33	0.91	27.33	0.91
3.417	0.99	9.417	2.43	15.417	2.28	21.42	0.91	27.42	0.91
3.500	0.99	9.500	2.43	15.500	2.28	21.50	0.91	27.50	0.91
3.583	0.99	9.583	2.74	15.583	2.28	21.58	0.91	27.58	0.91
3.667	0.99	9.667	2.74	15.667	2.28	21.67	0.91	27.67	0.91
3.750	0.99	9.750	2.74	15.750	2.28	21.75	0.91	27.75	0.91
3.833	0.99	9.833	2.74	15.833	2.28	21.83	0.91	27.83	0.91
3.917	0.99	9.917	2.74	15.917	2.28	21.92	0.91	27.92	0.91
4.000	0.99	10.000	2.74	16.000	2.28	22.00	0.91	28.00	0.91
4.083	1.22	10.083	3.50	16.083	1.37	22.08	0.91	28.08	0.91
4.167	1.22	10.167	3.50	16.167	1.37	22.17	0.91	28.17	0.91
4.250	1.22	10.250	3.50	16.250	1.37	22.25	0.91	28.25	0.91
4.333	1.22	10.333	3.50	16.333	1.37	22.33	0.91	28.33	0.91

Unit Hyd Qpeak (cms) = 1.638

PEAK FLOW (cms) = 0.520 (i)

TIME TO PEAK (hrs) = 13.250

RUNOFF VOLUME (mm) = 15.414

TOTAL RAINFALL (mm) = 76.000

RUNOFF COEFFICIENT = 0.203

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

*** SIMULATION NUMBER: 3 ***

File name: C:\Users\ankran\AppData\Local\Temp\

2191741b-22c3-4d38-bf97-21cde6e866f5\3775b4fe

Comments: SCS II 24H_10YR

Protal= 89.90 mm

Duration of storm = 24.00 hrs

Mass curve time step = 15.00 min

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	0.90	6.25	1.80	12.25	12.95	18.25	1.62	24.25	1.62
0.50	0.90	6.50	1.80	12.50	12.95	18.50	1.62	24.50	1.62
0.75	0.90	6.75	1.80	12.75	6.65	18.75	1.62	24.75	1.62
1.00	0.90	7.00	1.80	13.00	6.65	19.00	1.62	25.00	1.62
1.25	0.90	7.25	1.80	13.25	1.26	19.25	1.62	25.25	1.62
1.50	0.90	7.50	1.80	13.50	1.26	19.50	1.62	25.50	1.62
1.75	0.90	7.75	1.80	13.75	7.37	19.75	1.62	25.75	1.62
2.00	1.62	8.00	1.80	14.00	7.37	20.00	1.62	26.00	1.62
2.25	1.17	8.25	2.43	14.25	2.70	20.25	1.08	26.25	1.08
2.50	1.17	8.50	2.43	14.50	2.70	20.50	1.08	26.50	1.08
2.75	1.17	8.75	2.43	14.75	2.70	21.00	1.08	27.00	1.08
3.00	1.17	9.00	2.43	15.00	2.70	21.25	1.08	27.25	1.08
3.25	1.17	9.25	2.88	15.25	2.70	21.50	1.08	27.50	1.08
3.50	1.17	9.50	2.88	15.50	2.70	21.50	1.08	27.50	1.08

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond M Pre-Development - SCS Type II Design Storm

DATE: October 2016

3.75	1.17	9.75	3.24	15.75	2.70	21.75	1.08
4.00	1.17	10.00	3.24	16.00	2.70	22.00	1.08
4.25	1.17	10.25	4.14	16.25	1.62	22.25	1.08
4.50	1.44	10.50	4.14	16.50	1.62	22.50	1.08
4.75	1.44	10.75	5.57	16.75	1.62	22.75	1.08
5.00	1.44	11.00	5.57	17.00	1.62	23.00	1.08
5.25	1.44	11.25	8.63	17.25	1.62	23.25	1.08
5.50	1.44	11.50	8.63	17.50	1.62	23.50	1.08
5.75	1.44	11.75	37.40	17.75	1.62	23.75	1.08
6.00	1.44	12.00	99.25	18.00	1.62	24.00	1.08

CALIB (0136) Area (ha)= 51.45 Curve Number (CN)= 49.8
NASHYD (0136) Area (mm)= 5.00 # of Linear Res. (N)= 3.00
ID= 1 DT= 5.0 min U.H. Tp(hrs)= 1.20

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

--- TRANSFORMED HYETOGRAPH ---							
TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.90	6.083	12.96	18.08	1.62	18.08	1.62
0.167	0.90	6.167	1.80	12.167	12.95	18.17	1.62
0.250	0.90	6.250	1.80	12.250	12.95	18.25	1.62
0.333	0.90	6.333	1.80	12.333	12.95	18.33	1.62
0.417	0.90	6.417	1.80	12.417	12.95	18.42	1.62
0.500	0.90	6.500	1.80	12.500	12.95	18.50	1.62
0.583	0.90	6.583	1.80	12.583	6.65	18.58	1.62
0.667	0.90	6.667	1.80	12.667	6.65	18.67	1.62
0.750	0.90	6.750	1.80	12.750	6.65	18.75	1.62
0.833	0.90	6.833	1.80	12.833	6.65	18.83	1.62
0.917	0.90	6.917	1.80	12.917	6.65	18.92	1.62
1.000	0.90	7.000	1.80	13.000	6.65	19.00	1.62
1.083	0.90	7.083	1.80	13.083	1.26	19.08	1.62
1.167	0.90	7.167	1.80	13.167	1.26	19.17	1.62
1.250	0.90	7.250	1.80	13.250	1.26	19.25	1.62
1.333	0.90	7.333	1.80	13.333	1.26	19.33	1.62
1.417	0.90	7.417	1.80	13.417	1.26	19.42	1.62
1.500	0.90	7.500	1.80	13.500	1.26	19.50	1.62
1.583	0.90	7.583	1.80	13.583	7.37	19.58	1.62
1.667	0.90	7.667	1.80	13.667	7.37	19.67	1.62
1.750	0.90	7.750	1.80	13.750	7.37	19.75	1.62
1.833	1.62	7.833	1.80	13.833	7.37	19.83	1.62
1.917	1.62	7.917	1.80	13.917	7.37	19.92	1.62
2.000	1.62	8.000	1.80	14.000	7.37	20.00	1.62
2.083	1.17	8.083	2.43	14.083	2.70	20.08	1.08
2.167	1.17	8.167	2.43	14.167	2.70	20.17	1.08
2.250	1.17	8.250	2.43	14.250	2.70	20.25	1.08
2.333	1.17	8.333	2.43	14.333	2.70	20.33	1.08
2.417	1.17	8.417	2.43	14.417	2.70	20.42	1.08
2.500	1.17	8.500	2.43	14.500	2.70	20.50	1.08
2.583	1.17	8.583	2.43	14.583	2.70	20.58	1.08
2.667	1.17	8.667	2.43	14.667	2.70	20.67	1.08
2.750	1.17	8.750	2.43	14.750	2.70	20.75	1.08
2.833	1.17	8.833	2.43	14.833	2.70	20.83	1.08
2.917	1.17	8.917	2.43	14.917	2.70	20.92	1.08
3.000	1.17	9.000	2.43	15.000	2.70	21.00	1.08

3.083	1.17	9.083	2.88	15.083	2.70	21.08	1.08
3.167	1.17	9.167	2.88	15.167	2.70	21.17	1.08
3.250	1.17	9.250	2.88	15.250	2.70	21.25	1.08
3.333	1.17	9.333	2.88	15.333	2.70	21.33	1.08
3.417	1.17	9.417	2.88	15.417	2.70	21.42	1.08
3.500	1.17	9.500	2.88	15.500	2.70	21.50	1.08
3.583	1.17	9.583	3.24	15.583	2.70	21.58	1.08
3.667	1.17	9.667	3.24	15.667	2.70	21.67	1.08
3.750	1.17	9.750	3.24	15.750	2.70	21.75	1.08
3.833	1.17	9.833	3.24	15.833	2.70	21.83	1.08
3.917	1.17	9.917	3.24	15.917	2.70	21.92	1.08
4.000	1.17	10.000	3.24	16.000	2.70	22.00	1.08
4.083	1.44	10.083	4.14	16.083	1.62	22.08	1.08
4.167	1.44	10.167	4.14	16.167	1.62	22.17	1.08
4.250	1.44	10.250	4.14	16.250	1.62	22.25	1.08
4.333	1.44	10.333	4.14	16.333	1.62	22.33	1.08
4.417	1.44	10.417	4.14	16.417	1.62	22.42	1.08
4.500	1.44	10.500	4.14	16.500	1.62	22.50	1.08
4.583	1.44	10.583	5.57	16.583	1.62	22.58	1.08
4.667	1.44	10.667	5.57	16.667	1.62	22.67	1.08
4.750	1.44	10.750	5.57	16.750	1.62	22.75	1.08
4.833	1.44	10.833	5.57	16.833	1.62	22.83	1.08
4.917	1.44	10.917	5.57	16.917	1.62	22.92	1.08
5.000	1.44	11.000	5.57	17.000	1.62	23.00	1.08
5.083	1.44	11.083	8.63	17.083	1.62	23.08	1.08
5.167	1.44	11.167	8.63	17.167	1.62	23.17	1.08
5.250	1.44	11.250	8.63	17.250	1.62	23.25	1.08
5.333	1.44	11.333	8.63	17.333	1.62	23.33	1.08
5.417	1.44	11.417	8.63	17.417	1.62	23.42	1.08
5.500	1.44	11.500	8.63	17.500	1.62	23.50	1.08
5.583	1.44	11.583	37.40	17.583	1.62	23.58	1.08
5.667	1.44	11.667	37.40	17.667	1.62	23.67	1.08
5.750	1.44	11.750	37.40	17.750	1.62	23.75	1.08
5.833	1.44	11.833	99.24	17.833	1.62	23.83	1.08
5.917	1.44	11.917	99.25	17.917	1.62	23.92	1.08
6.000	1.44	12.000	99.25	18.000	1.62	24.00	1.08

Unit Hyd Opeak (cms) = 1.638

PEAK FLOW (cms) = 0.719 (i)
TIME TO PEAK (hrs) = 13.167
RUNOFF VOLUME (mm) = 21.142
TOTAL RAINFALL (mm) = 89.900
RUNOFF COEFFICIENT = 0.235

{i} PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

** SIMULATION NUMBER: 4 **

MASS STORM File name: C:\Users\nkaman\AppData\Local\Temp\

2191741b-22c3-4d38-bf97-21cde6e866f5\3775b4fe

Comments: Mass 24-Hour SCS Type II Design Storm

Protal=107.50 mm

Duration of storm = 24.00 hrs

Mass curve time step = 15.00 min

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond M Pre-Development - SCS Type II Design Storm

DATE: October 2016

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.25	1.08	6.25	2.15	12.25	15.48	18.25	1.93		
0.50	1.08	6.50	2.15	12.50	15.48	18.50	1.94		
0.75	1.08	6.75	2.15	12.75	7.95	18.75	1.93		
1.00	1.08	7.00	2.15	13.00	7.96	19.00	1.94		
1.25	1.08	7.25	2.15	13.25	1.50	19.25	1.93		
1.50	1.07	7.50	2.15	13.50	1.50	19.50	1.94		
1.75	1.08	7.75	2.15	13.75	8.82	19.75	1.93		
2.00	1.93	8.00	2.15	14.00	8.82	20.00	1.94		
2.25	1.40	8.25	2.90	14.25	3.22	20.25	1.29		
2.50	1.40	8.50	2.90	14.50	3.22	20.50	1.29		
2.75	1.40	8.75	2.90	14.75	3.22	20.75	1.29		
3.00	1.40	9.00	2.90	15.00	3.23	21.00	1.29		
3.25	1.40	9.25	3.44	15.25	3.22	21.25	1.29		
3.50	1.40	9.50	3.44	15.50	3.22	21.50	1.29		
3.75	1.40	9.75	3.87	15.75	3.22	21.75	1.29		
4.00	1.40	10.00	3.87	16.00	3.22	22.00	1.29		
4.25	1.72	10.25	4.95	16.25	1.94	22.25	1.29		
4.50	1.72	10.50	4.95	16.50	1.93	22.50	1.29		
4.75	1.72	10.75	6.67	16.75	1.93	22.75	1.29		
5.00	1.72	11.00	6.66	17.00	1.94	23.00	1.29		
5.25	1.72	11.25	10.32	17.25	1.93	23.25	1.29		
5.50	1.72	11.50	10.32	17.50	1.94	23.50	1.29		
5.75	1.72	11.75	44.72	17.75	1.93	23.75	1.29		
6.00	1.72	12.00	118.68	18.00	1.94	24.00	1.29		

CALIB (0136)
NASHYD (0136)
ID= 1 DT= 5.0 min
Area (ha)= 51.45 Curve Number (CN)= 49.8
Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
U.H. Tp (hrs)= 1.20

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.08	6.083	2.15	12.083	15.49	18.08	1.93
0.167	1.08	6.167	2.15	12.167	15.48	18.17	1.93
0.250	1.08	6.250	2.15	12.250	15.48	18.25	1.93
0.333	1.08	6.333	2.15	12.333	15.48	18.33	1.94
0.417	1.08	6.417	2.15	12.417	15.48	18.42	1.94
0.500	1.08	6.500	2.15	12.500	15.48	18.50	1.94
0.583	1.08	6.583	2.15	12.583	7.96	18.58	1.93
0.667	1.08	6.667	2.15	12.667	7.95	18.67	1.93
0.750	1.08	6.750	2.15	12.750	7.95	18.75	1.93
0.833	1.08	6.833	2.15	12.833	7.96	18.83	1.94
0.917	1.08	6.917	2.15	12.917	7.96	18.92	1.94
1.000	1.08	7.000	2.15	13.000	7.96	19.00	1.94
1.083	1.08	7.083	2.15	13.083	1.51	19.08	1.93
1.167	1.08	7.167	2.15	13.167	1.50	19.17	1.93
1.250	1.08	7.250	2.15	13.250	1.50	19.25	1.93
1.333	1.07	7.333	2.15	13.333	1.50	19.33	1.94
1.417	1.07	7.417	2.15	13.417	1.50	19.42	1.94
1.500	1.07	7.500	2.15	13.500	1.50	19.50	1.94
1.583	1.08	7.583	2.15	13.583	8.81	19.58	1.93
1.667	1.08	7.667	2.15	13.667	8.82	19.67	1.93

Unit Hyd Qpeak (cms) = 1.638
PEAK FLOW (cms) = 1.006 (i)
TIME TO PEAK (hrs) = 13.167
RUNOFF VOLUME (mm) = 29.303
TOTAL RAINFALL (mm) = 107.500
RUNOFF COEFFICIENT = 0.273

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
1.750	1.08	7.750	2.15	13.750	8.82	19.75	1.93		
1.833	1.93	7.833	2.15	13.833	8.82	19.83	1.94		
1.917	1.93	7.917	2.15	13.917	8.82	19.92	1.94		
2.000	1.93	8.000	2.15	14.000	8.82	20.00	1.93		
2.083	1.40	8.083	2.90	14.083	3.23	20.08	1.29		
2.167	1.40	8.167	2.90	14.167	3.22	20.17	1.29		
2.250	1.40	8.250	2.90	14.250	3.22	20.25	1.29		
2.333	1.40	8.333	2.90	14.333	3.22	20.33	1.29		
2.417	1.40	8.417	2.90	14.417	3.22	20.42	1.29		
2.500	1.40	8.500	2.90	14.500	3.22	20.50	1.29		
2.583	1.40	8.583	2.90	14.583	3.22	20.58	1.29		
2.667	1.40	8.667	2.90	14.667	3.22	20.67	1.29		
2.750	1.40	8.750	2.90	14.750	3.22	20.75	1.29		
2.833	1.40	8.833	2.90	14.833	3.23	20.83	1.29		
2.917	1.40	8.917	2.90	14.917	3.23	20.92	1.29		
3.000	1.40	9.000	2.90	15.000	3.23	21.00	1.29		
3.083	1.40	9.083	3.44	15.083	3.22	21.08	1.29		
3.167	1.40	9.167	3.44	15.167	3.22	21.17	1.29		
3.250	1.40	9.250	3.44	15.250	3.22	21.25	1.29		
3.333	1.40	9.333	3.44	15.333	3.22	21.33	1.29		
3.417	1.40	9.417	3.44	15.417	3.22	21.42	1.29		
3.500	1.40	9.500	3.44	15.500	3.22	21.50	1.29		
3.583	1.40	9.583	3.87	15.583	3.22	21.58	1.29		
3.667	1.40	9.667	3.87	15.667	3.22	21.67	1.29		
3.750	1.40	9.750	3.87	15.750	3.22	21.75	1.29		
3.833	1.40	9.833	3.87	15.833	3.22	21.83	1.29		
3.917	1.40	9.917	3.87	15.917	3.22	21.92	1.29		
4.000	1.40	10.000	3.87	16.000	3.22	22.00	1.29		
4.083	1.72	10.083	4.95	16.083	1.94	22.08	1.29		
4.167	1.72	10.167	4.95	16.167	1.94	22.17	1.29		
4.250	1.72	10.250	4.95	16.250	1.94	22.25	1.29		
4.333	1.72	10.333	4.95	16.333	1.93	22.33	1.29		
4.417	1.72	10.417	4.95	16.417	1.93	22.42	1.29		
4.500	1.72	10.500	4.95	16.500	1.93	22.50	1.29		
4.583	1.72	10.583	6.66	16.583	1.93	22.58	1.29		
4.667	1.72	10.667	6.67	16.667	1.93	22.67	1.29		
4.750	1.72	10.750	6.67	16.750	1.93	22.75	1.29		
4.833	1.72	10.833	6.66	16.833	1.94	22.83	1.29		
4.917	1.72	10.917	6.66	16.917	1.94	22.92	1.29		
5.000	1.72	11.000	6.66	17.000	1.94	23.00	1.29		
5.083	1.72	11.083	10.32	17.083	1.93	23.08	1.29		
5.167	1.72	11.167	10.32	17.167	1.93	23.17	1.29		
5.250	1.72	11.250	10.32	17.250	1.93	23.25	1.29		
5.333	1.72	11.333	10.32	17.333	1.94	23.33	1.29		
5.417	1.72	11.417	10.32	17.417	1.94	23.42	1.29		
5.500	1.72	11.500	10.32	17.500	1.94	23.50	1.29		
5.583	1.72	11.583	44.72	17.583	1.93	23.58	1.29		
5.667	1.72	11.667	44.72	17.667	1.93	23.67	1.29		
5.750	1.72	11.750	44.72	17.750	1.93	23.75	1.29		
5.833	1.72	11.833	118.67	17.833	1.94	23.83	1.29		
5.917	1.72	11.917	118.68	17.917	1.94	23.92	1.29		
6.000	1.72	12.000	118.68	18.000	1.94	24.00	1.29		

DATE: October 2016

** SIMULATION NUMBER: 5 **

Duration of storm = 24.00 hrs
Mass curve time step = 15.00 min

Area	51.45	Curve Number	(CN) = 49.8
Ia	(mm) = 5.00	# of Linear Res.	(N) = 3.00
U.H. Tp	(hrs) = 1.20		

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

TRANSFORMED HYETOGRAPH							
RAIN		TIME		RAIN		TIME	
mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs
1.21	6.083	2.41	12.083	17.37	18.08		
1.21	6.167	2.41	12.167	17.37	18.17		
1.21	6.250	2.41	12.250	17.37	18.25		
1.21	6.333	2.41	12.333	17.37	18.33		

9

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond M Pre-Development - SCS Type II Design Storm

DATE: October 2016

5.417	1.93	11.417	11.58	17.417	2.17	23.42	1.45
5.500	1.93	11.500	11.58	17.500	2.17	23.50	1.45
5.583	1.93	11.583	50.17	17.583	2.17	23.58	1.45
5.667	1.93	11.667	50.17	17.667	2.17	23.67	1.45
5.750	1.93	11.750	50.17	17.750	2.17	23.75	1.45
5.833	1.93	11.833	133.13	17.833	2.17	23.83	1.45
5.917	1.93	11.917	133.14	17.917	2.17	23.92	1.45
6.000	1.93	12.000	133.14	18.000	2.17	24.00	1.45

Unit Hyd Opeak (cms) = 1.638

PEAK FLOW (cms) = 1.241 (i)

TIME TO PEAK (hrs) = 13.167

RUNOFF VOLUME (mm) = 35.958

TOTAL RAINFALL (mm) = 120.600

RUNOFF COEFFICIENT = 0.298

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

** SIMULATION NUMBER: 6 **

File name: C:\Users\inkamran\AppData
ata\Local\Temp\2191741b-22c3-4d38-bf97-21cd6e6e86f5\3775b4fe
Comments: Mass 24-Hour SCS Type II Design Storm

Duration of storm = 24.00 hrs
Mass curve time step = 15.00 min

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.25	1.34	6.25	2.67	12.25	19.24	18.25	2.40
0.50	1.34	6.50	2.67	12.50	19.24	18.50	2.40
0.75	1.34	6.75	2.67	12.75	9.89	18.75	2.40
1.00	1.34	7.00	2.67	13.00	9.89	19.00	2.40
1.25	1.34	7.25	2.67	13.25	1.87	19.25	2.40
1.50	1.34	7.50	2.67	13.50	1.87	19.50	2.40
1.75	1.34	7.75	2.67	13.75	10.96	19.75	2.40
2.00	2.40	8.00	2.67	14.00	10.96	20.00	2.40
2.25	1.74	8.25	3.61	14.25	4.01	20.25	1.60
2.50	1.74	8.50	3.61	14.50	4.01	20.50	1.60
2.75	1.74	8.75	3.61	14.75	4.01	20.75	1.60
3.00	1.74	9.00	3.61	15.00	4.01	21.00	1.60
3.25	1.74	9.25	4.28	15.25	4.01	21.25	1.60
3.50	1.74	9.50	4.28	15.50	4.01	21.50	1.60
3.75	1.74	9.75	4.81	15.75	4.01	21.75	1.60
4.00	1.74	10.00	4.81	16.00	4.01	22.00	1.60
4.25	2.14	10.25	6.15	16.25	2.40	22.25	1.60
4.50	2.14	10.50	6.15	16.50	2.40	22.50	1.60
4.75	2.14	10.75	8.28	16.75	2.40	22.75	1.60
5.00	2.14	11.00	8.28	17.00	2.40	23.00	1.60
5.25	2.14	11.25	12.83	17.25	2.40	23.25	1.60
5.50	2.14	11.50	12.83	17.50	2.40	23.50	1.60
5.75	2.14	11.75	55.58	17.75	2.40	23.75	1.60
6.00	2.14	12.00	147.49	18.00	2.40	24.00	1.60

CALIB (0136)
NASHVD
ID= 1 DT= 5.0 min
U.H. Tp (hrs) = 1.20
Area (ha) = 51.45
Curve Number (CN) = 49.8
of Linear Res. (N) = 3.00

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

----- TRANSFORMED HYETOGRAPH -----									
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	1.34	6.083	2.67	12.083	19.25	18.08	2.40		
0.167	1.34	6.167	2.67	12.167	19.24	18.17	2.40		
0.250	1.34	6.250	2.67	12.250	19.24	18.25	2.40		
0.333	1.34	6.333	2.67	12.333	19.24	18.33	2.40		
0.417	1.34	6.417	2.67	12.417	19.24	18.42	2.40		
0.500	1.34	6.500	2.67	12.500	19.24	18.50	2.40		
0.583	1.34	6.583	2.67	12.583	9.89	18.58	2.40		
0.667	1.34	6.667	2.67	12.667	9.89	18.67	2.40		
0.750	1.34	6.750	2.67	12.750	9.89	18.75	2.40		
0.833	1.34	6.833	2.67	12.833	9.89	18.83	2.40		
0.917	1.34	6.917	2.67	12.917	9.89	18.92	2.40		
1.000	1.34	7.000	2.67	13.000	9.89	19.00	2.40		
1.083	1.34	7.083	2.67	13.083	1.87	19.08	2.40		
1.167	1.34	7.167	2.67	13.167	1.87	19.17	2.40		
1.250	1.34	7.250	2.67	13.250	1.87	19.25	2.40		
1.333	1.34	7.333	2.67	13.333	1.87	19.33	2.40		
1.417	1.34	7.417	2.67	13.417	1.87	19.42	2.40		
1.500	1.34	7.500	2.67	13.500	1.87	19.50	2.40		
1.583	1.34	7.583	2.67	13.583	10.95	19.58	2.40		
1.667	1.34	7.667	2.67	13.667	10.96	19.67	2.40		
1.750	1.34	7.750	2.67	13.750	10.96	19.75	2.40		
1.833	2.40	7.833	2.67	13.833	10.96	19.83	2.40		
1.917	2.40	7.917	2.67	13.917	10.96	19.92	2.40		
2.000	2.40	8.000	2.67	14.000	10.96	20.00	2.40		
2.083	1.74	8.083	3.61	14.083	4.01	20.08	1.60		
2.167	1.74	8.167	3.61	14.167	4.01	20.17	1.60		
2.250	1.74	8.250	3.61	14.250	4.01	20.25	1.60		
2.333	1.74	8.333	3.61	14.333	4.01	20.33	1.60		
2.417	1.74	8.417	3.61	14.417	4.01	20.42	1.60		
2.500	1.74	8.500	3.61	14.500	4.01	20.50	1.60		
2.583	1.74	8.583	3.61	14.583	4.01	20.58	1.60		
2.667	1.74	8.667	3.61	14.667	4.01	20.67	1.60		
2.750	1.74	8.750	3.61	14.750	4.01	20.75	1.60		
2.833	1.74	8.833	3.61	14.833	4.01	20.83	1.60		
2.917	1.74	8.917	3.61	14.917	4.01	20.92	1.60		
3.000	1.74	9.000	3.61	15.000	4.01	21.00	1.60		
3.083	1.74	9.083	4.28	15.083	4.01	21.08	1.60		
3.167	1.74	9.167	4.28	15.167	4.01	21.17	1.60		
3.250	1.74	9.250	4.28	15.250	4.01	21.25	1.60		
3.333	1.74	9.333	4.28	15.333	4.01	21.33	1.60		
3.417	1.74	9.417	4.28	15.417	4.01	21.42	1.60		
3.500	1.74	9.500	4.28	15.500	4.01	21.50	1.60		
3.583	1.74	9.583	4.81	15.583	4.01	21.58	1.60		
3.667	1.74	9.667	4.81	15.667	4.01	21.67	1.60		
3.750	1.74	9.750	4.81	15.750	4.01	21.75	1.60		
3.833	1.74	9.833	4.81	15.833	4.01	21.83	1.60		
3.917	1.74	9.917	4.81	15.917	4.01	21.92	1.60		
4.000	1.74	10.000	4.81	16.000	4.01	22.00	1.60		

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
SWM Pond M Pre-Development – SCS Type II Design Storm

DATE: October 2016

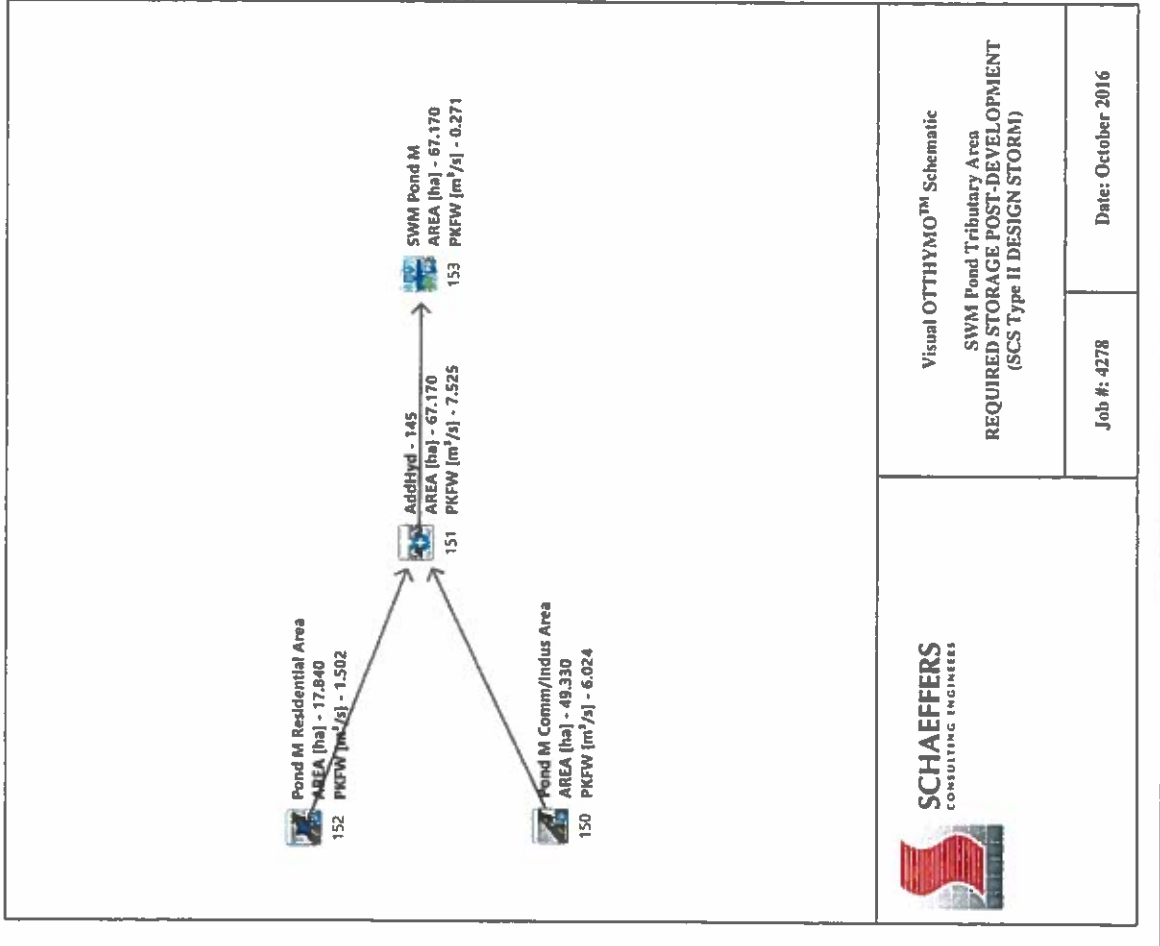
4.083	2.14	10.083	6.15	16.083	2.41	22.08	1.60
4.167	2.14	10.167	6.15	16.167	2.40	22.17	1.60
4.250	2.14	10.250	6.15	16.250	2.40	22.25	1.60
4.333	2.14	10.333	6.15	16.333	2.40	22.33	1.60
4.417	2.14	10.417	6.15	16.417	2.40	22.42	1.60
4.500	2.14	10.500	6.15	16.500	2.40	22.50	1.60
4.583	2.14	10.583	8.28	16.583	2.40	22.58	1.60
4.667	2.14	10.667	8.28	16.667	2.40	22.67	1.60
4.750	2.14	10.750	8.28	16.750	2.40	22.75	1.60
4.833	2.14	10.833	8.28	16.833	2.40	22.83	1.60
4.917	2.14	10.917	8.28	16.917	2.40	22.92	1.60
5.000	2.14	11.000	8.28	17.000	2.40	23.00	1.60
5.083	2.14	11.083	12.83	17.083	2.40	23.08	1.60
5.167	2.14	11.167	12.83	17.167	2.40	23.17	1.60
5.250	2.14	11.250	12.83	17.250	2.40	23.25	1.60
5.333	2.14	11.333	12.83	17.333	2.40	23.33	1.60
5.417	2.14	11.417	12.83	17.417	2.40	23.42	1.60
5.500	2.14	11.500	12.83	17.500	2.40	23.50	1.60
5.583	2.14	11.583	55.57	17.583	2.40	23.58	1.60
5.667	2.14	11.667	55.58	17.667	2.40	23.67	1.60
5.750	2.14	11.750	55.58	17.750	2.40	23.75	1.60
5.833	2.14	11.833	147.48	17.833	2.40	23.83	1.60
5.917	2.14	11.917	147.49	17.917	2.40	23.92	1.60
6.000	2.14	12.000	147.49	18.000	2.40	24.00	1.60

Unit Hyd Qpeak (cms) = 1.638

PEAK FLOW (cms) = 1.491 (i)
TIME TO PEAK (hrs) = 13.167
RUNOFF VOLUME (mm) = 42.996
TOTAL RAINFALL (mm) = 133.600
RUNOFF COEFFICIENT = 0.322

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

POST DEVELOPMENT MODELLING



***** ** SIMULATION NUMBER: 1 ** *****		***** ** SIMULATION NUMBER: 1 ** *****	
----- CALIB STANDHYD (0150) ID= 1 DT= 5.0 min -----		----- CALIB STANDHYD (0152) ID= 1 DT= 5.0 min -----	
Area (ha) = 49.33 Total Imp(%) = 82.00 Dir. Conn.(%) = 82.00		Area (ha) = 17.84 Total Imp(%) = 60.00 Dir. Conn.(%) = 45.00	
-----		-----	
IMPERVIOUS		IMPERVIOUS	
Surface Area (ha) = 40.45		Surface Area (ha) = 10.70	
Dep. Storage (mm) = 1.00		Dep. Storage (mm) = 1.00	
Average Slope (%) = 1.00		Average Slope (%) = 2.00	
Length (m) = 573.47		Length (m) = 344.87	
Mannings n = 0.013		Mannings n = 0.013	
Max.Eff. Inten. (mm/hr) = 60.72		Max.Eff. Inten. (mm/hr) = 60.72	
over (min) = 10.00		over (min) = 5.00	
Storage Coeff. (min) = 8.89 (ii)		Storage Coeff. (min) = 5.32 (ii)	
Unit Hyd. Tpeak (min) = 10.00		Unit Hyd. Tpeak (min) = 5.00	
Unit Hyd. peak (cms) = 0.12		Unit Hyd. peak (cms) = 0.21	
PEAK FLOW (cms) = 5.59		PEAK FLOW (cms) = 1.30	
TIME TO PEAK (hrs) = 12.00		TIME TO PEAK (hrs) = 12.00	
RUNOFF VOLUME (mm) = 54.00		RUNOFF VOLUME (mm) = 54.00	
TOTAL RAINFALL (mm) = 55.00		TOTAL RAINFALL (mm) = 55.00	
RUNOFF COEFFICIENT = 0.98		RUNOFF COEFFICIENT = 0.98	
TOTALS		*TOTALS*	
6.024 (iii)		1.502 (iii)	
12.00		12.00	
46.09		32.82	
55.00		55.00	
0.84		0.60	

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
 F_o (mm/hr) = 50.00 K (1/hr) = 2.00
 F_c (mm/hr) = 7.50 Cum.Inf. (mm) = 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN SWM Pond M Post-Development - SCS Type II Design Storm

DATE: October 2016

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0150):	49.33	6.024	12.00	46.09
+ ID2= 2 (0152):	17.84	1.502	12.00	32.82
ID = 3 (0151):	67.17	7.525	12.00	42.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0153)	OUTFLOW	STORAGE	OUTFLOW	STORAGE	R.V.
IN= 2--> OUT= 1	(cms)	(ha.m.)	(cms)	(ha.m.)	(mm)
DT= 5.0 min	0.0000	0.0000	1.0060	3.9939	
	0.2710	2.0221	1.2410	4.4895	
	0.5200	2.8060	1.4910	4.9785	
	0.7190	3.3239	2.0000	6.0000	
INFLOW : ID= 2 (0151)	67.170	7.525	12.00	42.56	
OUTFLOW: ID= 1 (0153)	67.170	0.271	14.50	42.54	
PEAK FLOW REDUCTION [Qout/Qin] (%) = 3.60					
TIME SHIFT OF PEAK FLOW (min)=150.00					
MAXIMUM STORAGE USED (ha.m.)= 2.0221					

***** SIMULATION NUMBER: 2 **

CALIB	Area	ha	Imp (%)	Dir. Conn. (%)
STANDHYD (0150)	67.17	49.33	82.00	82.00
ID= 1 DT= 5.0 min				

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	40.45
Dep. Storage (mm)=	1.00
Average Slope (%)=	2.00
Length (m)=	573.47
Mannings n =	0.013
Max.Eff.Inten.(mm/hr)=	83.90
over (min)=	10.00
Storage Coeff. (min)=	7.82 (ii)
Unit Hyd. Tpeak (min)=	10.00

Unit Hyd. peak (cms)=	0.13	0.09
PEAK FLOW (cms)=	8.02	1.12
TIME TO PEAK (hrs)=	12.00	12.08
RUNOFF VOLUME (mm)=	75.00	20.95
TOTAL RAINFALL (mm)=	76.00	76.00
RUNOFF COEFFICIENT =	0.99	0.28
TOTALS		
	9.018 (iii)	12.00
	65.27	76.00
	0.86	

- (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 50.00 K (1/hr)= 2.00
Fc (mm/hr)= 7.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	Area	ha	Imp (%)	Dir. Conn. (%)
STANDHYD (0152)	67.17	17.84	60.00	45.00
ID= 1 DT= 5.0 min				

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	10.70
Dep. Storage (mm)=	1.00
Average Slope (%)=	2.00
Length (m)=	344.87
Mannings n =	0.013
Max.Eff.Inten.(mm/hr)=	83.90
over (min)=	5.00
Storage Coeff. (min)=	4.68 (ii)
Unit Hyd. Tpeak (min)=	5.00
Unit Hyd. peak (cms)=	0.22
PEAK FLOW (cms)=	1.82
TIME TO PEAK (hrs)=	12.00
RUNOFF VOLUME (mm)=	75.00
TOTAL RAINFALL (mm)=	76.00
RUNOFF COEFFICIENT =	0.99
TOTALS	
	2.320 (iii)
	12.00
	48.54
	76.00
	0.64

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0150):	49.33	9.018	12.00	65.27
+ ID2= 2 (0152):	17.84	2.320	12.00	48.54
ID = 3 (0151):	67.17	11.338	12.00	60.83

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NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0153)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0060	3.9939
0.2710	2.0221	1.2410	4.4895
0.5200	2.8060	1.4910	4.9785
0.7190	3.3239	2.0000	6.0000

PEAK FLOW REDUCTION (Qout/Qin) (%) = 4.57
TIME SHIFT OF PEAK FLOW (min) = 135.00
MAXIMUM STORAGE USED (ha.m.) = 2.8060

SIMULATION NUMBER: 3 **

CALIB
STANDHYD (0150)
ID= 1 DT= 5.0 min

Area (ha) = 49.33
Total Imp (%) = 82.00 Dir. Conn. (%) = 82.00

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha) = 40.45	8.88
Dep. Storage (mm) = 1.00	1.50
Average Slope (%) = 1.00	2.00
Length (m) = 573.47	40.00
Mannings n = 0.013	0.250
Max.Eff.Inten. (mm/hr) over (min) = 99.25	89.07
Storage Coeff. (min) = 5.00	15.00
Unit Hyd. Tpeak (min) = 7.31 (ii)	11.17 (ii)
Unit Hyd. peak (cms) = 5.00	15.00
	0.09

PEAK FLOW (cms) = 10.21	1.47	11.552 (iii)
TIME TO PEAK (hrs) = 12.00	12.08	12.00
RUNOFF VOLUME (mm) = 88.90	28.98	78.11
TOTAL RAINFALL (mm) = 89.90	89.90	89.90
RUNOFF COEFFICIENT = 0.99	0.32	0.87

TOTALS

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr) = 50.00 K (1/hr) = 2.00
Fc (mm/hr) = 7.50 Cum. Inf. (mm) = 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0152)
ID= 1 DT= 5.0 min

Area (ha) = 17.84
Total Imp (%) = 60.00 Dir. Conn. (%) = 45.00

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha) = 10.70	7.14
Dep. Storage (mm) = 1.00	1.50
Average Slope (%) = 2.00	2.00
Length (m) = 344.87	40.00
Mannings n = 0.013	0.250
Max.Eff.Inten. (mm/hr) over (min) = 99.25	64.20
Storage Coeff. (min) = 5.00	15.00
Unit Hyd. Tpeak (min) = 4.37 (ii)	12.80 (ii)
Unit Hyd. peak (cms) = 5.00	15.00
	0.08

PEAK FLOW (cms) = 2.17 0.79
TIME TO PEAK (hrs) = 12.00 12.08
RUNOFF VOLUME (mm) = 88.90 35.43
TOTAL RAINFALL (mm) = 89.90 89.90
RUNOFF COEFFICIENT = 0.99 0.39
TOTALS
2.861 (iii)
12.00
59.49
89.90
0.66

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151)
1 + 2 = 3

AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
ID1= 1 (0150) : 49.33 11.552 12.00 78.11
+ ID2= 2 (0152) : 17.84 2.861 12.00 59.49
ID = 3 (0151) : 67.17 14.413 12.00 73.17

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0153)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.0060	3.9939
0.2710	2.0221	1.2410	4.4895
0.5200	2.8060	1.4910	4.9785
0.7190	3.3239	2.0000	6.0000

AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
INFLOW : ID= 2 (0151) 67.170 14.413 12.00 73.17
OUTFLOW: ID= 1 (0153) 67.170 0.719 13.08 73.13

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TIME TO PEAK	(hrs) =	12.00	12.08	12.00
RUNOFF VOLUME	(mm) =	106.50	47.14	73.85
TOTAL RAINFALL	(mm) =	107.50	107.50	107.50
RUNOFF COEFFICIENT	=	0.99	0.44	0.69

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

(i) CN PROCEDURE SELECTED FOR PREVIOUS LOSSES:
CN* = 58.0 1a = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANT.

ADD HYD (0151)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R. V. (mm)
1 + 2 = 3	49.33	14.138	12.00	94.27
ID1= 1 (0150)				
+ ID2= 2 (0152)	17.84	3.581	12.00	73.95
ID = 3 (0151)	67.17	17.719	12.00	88.95

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
RESERVOIR( 0153)
IN= 2---> OUT= 1
DT= 5.0 min
```

INFLOW : ID= 2 (0151)	67.170	17.719	12.00	88.85
OUTFLOW : ID= 1 (0153)	67.170	1.004	13.088	88.81

PEAK FLOW	REDUCTION	$[Q_{out}/Q_{in}] (\%) =$	5.67
TIME SHIFT OF PEAK FLOW		(min) =	65.00
MAXIMUM STORAGE USED		(ha.m.) =	3.9939

CALIB		STANDHYD (0150)		Area		(ha) = 49.33	
ID= 1		DT= 5.0 min		Total		Imp(%) = 82.00	
						Dir. Conn.(%) = 82.00	
				IMPERVIOUS		PERVIOUS (i)	
Surface Area				(ha) =		40.45	
Dep. Storage				(mm) =		1.00	
Average Slope				(%) =		1.00	
Length				(m) =		573.47	
						40.00	

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Mannings n = 0.013 0.250
Max.Eff.Inten.(mm/hr)= 133.14 125.03
over (min)
Storage Coeff. (min)= 5.00 10.00
Unit Hyd. Tpeak (min)= 6.50 (ii) 9.93 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. Tpeak (cms)= 0.18 0.11

TOTALS
16.368 (iii)
12.00
106.42
120.60
0.88

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 50.00 K (1/hr)= 2.00
Fc (mm/hr)= 7.50 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0152) Area (ha)= 17.84
ID= 1 DT= 5.0 min Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 10.70 7.14
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 344.87 40.00
Mannings n = 0.013 0.250
Max.Eff.Inten.(mm/hr)= 133.14 102.18
over (min)
Storage Coeff. (min)= 3.89 (ii) 10.89 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. Tpeak (cms)= 0.25 0.09

TOTALS
4.138 (iii)
12.00
84.83
120.60
0.70

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151) | AREA QPEAK TPEAK R.V.
1 + 2 = 3

ID1= 1 (0150): 49.33 16.368 12.00 106.42
+ ID2= 2 (0152): 17.84 4.138 12.00 84.83
ID = 3 (0151): 67.17 20.506 12.00 100.69

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0153)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.0060	3.9939
0.2710	2.0221	1.2410	4.4895
0.5200	2.8060	1.4910	4.9785
0.7190	3.3239	2.0000	6.0000

INFLOW : ID= 2 (0151) 67.170 20.506 12.00 100.69
OUTFLOW: ID= 1 (0153) 67.170 1.240 13.00 100.65

PEAK FLOW REDUCTION [Qout/Qin] (%) = 6.04
TIME SHIFT OF PEAK FLOW (min) = 60.00
MAXIMUM STORAGE USED (ha.m.) = 4.4895

***** SIMULATION NUMBER: 6 *****

CALIB STANDHYD (0150) Area (ha)= 49.33
ID= 1 DT= 5.0 min Total Imp(%)= 82.00 Dir. Conn.(%)= 82.00

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)= 40.45	8.88
Dep. Storage (mm)= 1.00	1.50
Average Slope (%)= 1.00	2.00
Length (m)= 573.47	40.00
Mannings n = 0.013	0.250
Max.Eff.Inten.(mm/hr)= 147.49	139.65
over (min)= 5.00	10.00
Storage Coeff. (min)= 6.24 (ii)	9.53 (ii)
Unit Hyd. Tpeak (min)= 5.00	10.00
Unit Hyd. Tpeak (cms)= 0.19	0.12

TOTALS
18.317 (iii)
12.00
118.53
133.60
0.89

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 50.00 K (1/hr)= 2.00
Fc (mm/hr)= 7.50 Cum.Inf. (mm)= 0.00

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- (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
 (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	Area (ha)=	17.84	Dir. Conn. (%)=	45.00
STANDHYD (0152)	Total Imp (%)=	60.00		
ID= 1 DT= 5.0 min				
	IMPERVIOUS	PERVIOUS (i)		
Surface Area (ha)=	10.70	7.14		
Dep. Storage (mm)=	1.00	1.50		
Average Slope (%)=	2.00	2.00		
Length (m)=	344.87	40.00		
Mannings n =	0.013	0.250		
Max.Eff.Inten.(mm/hr)=	147.49	119.41		
over (min)	5.00	15.00		
Storage Coeff. (min)=	3.73 (ii)	10.31 (ii)		
Unit Hyd. Tpeak (min)=	5.00	15.00		
Unit Hyd. peak (cms)=	0.25	0.09		
PEAK FLOW (cms)=	3.25	1.61		
TIME TO PEAK (hrs)=	12.00	12.08		
RUNOFF VOLUME (mm)=	132.60	65.94		
TOTAL RAINFALL (mm)=	133.60	133.60		
RUNOFF COEFFICIENT =	0.99	0.49		
			TOTALS	
				4.706 (iii)
				12.00
				95.94
				133.60
				0.72

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 58.0 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 (0151)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0150):	49.33	18.317	12.00	118.53
+ ID2= 2 (0152):	17.84	4.706	12.00	95.94
ID = 3 (0151):	67.17	23.023	12.00	112.53

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0153)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2----> OUT= 1				
DT= 5.0 min				
	0.0000	0.0000	1.0060	3.9939
	0.2710	2.0221	1.2410	4.4895
	0.5200	2.8060	1.4910	4.9785
	0.7190	3.3239	2.0000	6.0000

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
67.170	23.023	12.00	112.53
67.170	1.490	13.00	112.49

PEAK FLOW REDUCTION [Qout/Qin] (%) = 6.47
 TIME SHIFT OF PEAK FLOW (min) = 60.00
 MAXIMUM STORAGE USED (ha.m.) = 4.9785

LID A AREA

PRE-DEVELOPMENT MODELLING



North Area of Pond A Pre AREA [ha] - 3.810 149 PKFW [m³/s] - 0.059



Visual OTTHYMO™ Schematic
 Land North of Pond A Tributary Area
 ALLOWABLE RELEASE PRE-DEVELOPMENT
 (SCS Type II DESIGN STORM)

Date: October 2016

Job #: 4278

 ** SIMULATION NUMBER: 1 **

 CALIB (0149) Area (ha) = 3.81 Curve Number (CN) = 58.0
 NASHVD (0149) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
 ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.30

Unit Hyd Qpeak (cms) = 0.485
 PEAK FLOW (cms) = 0.059 (i)
 TIME TO PEAK (hrs) = 3.167
 RUNOFF VOLUME (mm) = 6.286
 TOTAL RAINFALL (mm) = 42.300
 RUNOFF COEFFICIENT = 0.149

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

 ** SIMULATION NUMBER: 2 **

 CALIB (0149) Area (ha) = 3.81 Curve Number (CN) = 58.0
 NASHVD (0149) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
 ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.30

Unit Hyd Qpeak (cms) = 0.485
 PEAK FLOW (cms) = 0.119 (i)
 TIME TO PEAK (hrs) = 3.167
 RUNOFF VOLUME (mm) = 12.452
 TOTAL RAINFALL (mm) = 59.500
 RUNOFF COEFFICIENT = 0.209

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

 ** SIMULATION NUMBER: 3 **

 CALIB (0149) Area (ha) = 3.81 Curve Number (CN) = 58.0
 NASHVD (0149) Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
 ID= 1 DT= 5.0 min U.H. Tp(hrs) = 0.30

Unit Hyd Qpeak (cms) = 0.485
 PEAK FLOW (cms) = 0.167 (i)
 TIME TO PEAK (hrs) = 3.167
 RUNOFF VOLUME (mm) = 17.330
 TOTAL RAINFALL (mm) = 70.800
 RUNOFF COEFFICIENT = 0.245

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

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Land North of Pond A Pre-Development – SCS Type II Design Storm

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** SIMULATION NUMBER: 4 **

| CALIB |
| NASHVD (0149) | Area (ha) = 3.81 Curve Number (CN) = 58.0
| ID= 1 DT= 5.0 min | Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
U.H. Tp (hrs) = 0.30

Unit Hyd Qpeak (cms) = 0.485

PEAK FLOW (cms) = 0.236 (i)
TIME TO PEAK (hrs) = 3.167
RUNOFF VOLUME (mm) = 24.342
TOTAL RAINFALL (mm) = 85.200
RUNOFF COEFFICIENT = 0.286

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

** SIMULATION NUMBER: 5 **

| CALIB |
| NASHVD (0149) | Area (ha) = 3.81 Curve Number (CN) = 58.0
| ID= 1 DT= 5.0 min | Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
U.H. Tp (hrs) = 0.30

Unit Hyd Qpeak (cms) = 0.485

PEAK FLOW (cms) = 0.293 (i)
TIME TO PEAK (hrs) = 3.167
RUNOFF VOLUME (mm) = 30.053
TOTAL RAINFALL (mm) = 95.900
RUNOFF COEFFICIENT = 0.313

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

** SIMULATION NUMBER: 6 **

| CALIB |
| NASHVD (0149) | Area (ha) = 3.81 Curve Number (CN) = 58.0
| ID= 1 DT= 5.0 min | Ia (mm) = 5.00 # of Linear Res. (N) = 3.00
U.H. Tp (hrs) = 0.30

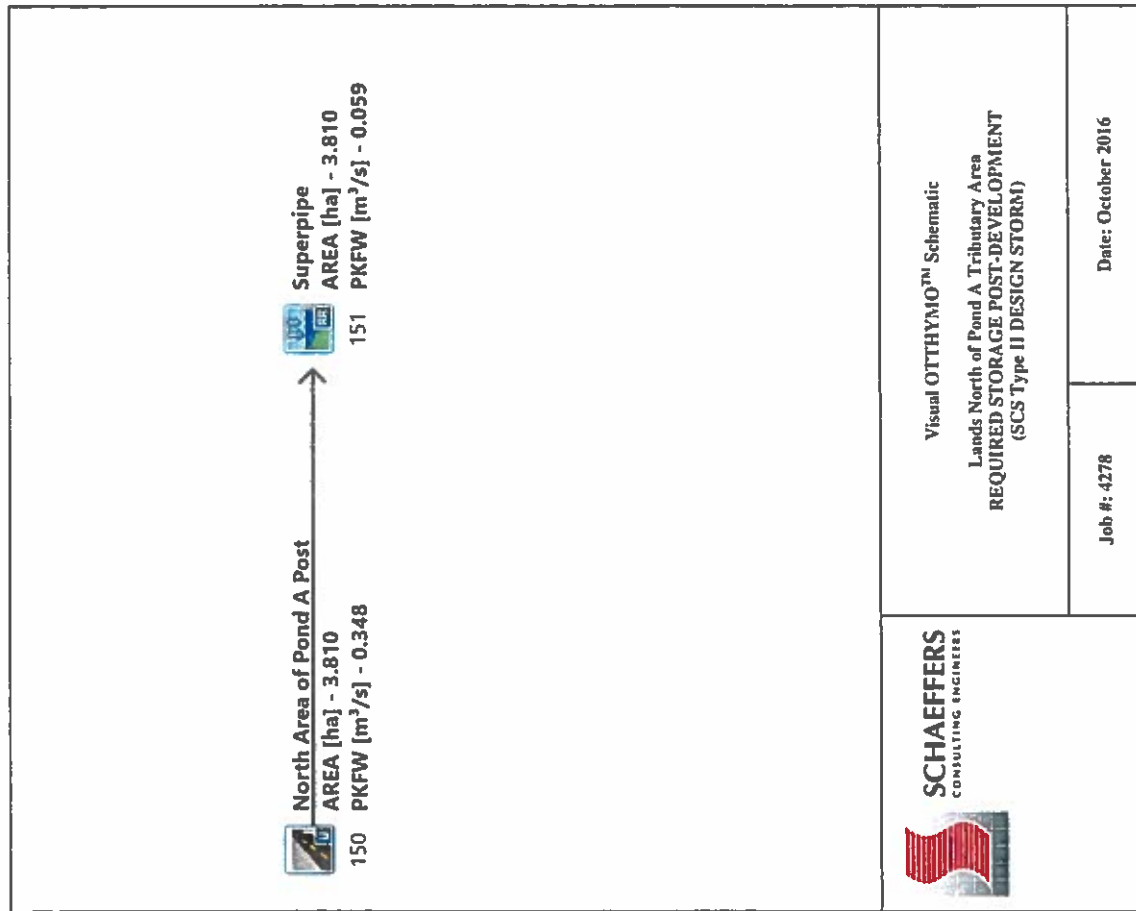
Unit Hyd Qpeak (cms) = 0.485

PEAK FLOW (cms) = 0.354 (i)
TIME TO PEAK (hrs) = 3.167
RUNOFF VOLUME (mm) = 36.080
TOTAL RAINFALL (mm) = 106.500
RUNOFF COEFFICIENT = 0.339

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



POST DEVELOPMENT MODELLING



 ** SIMULATION NUMBER: 1 **

CALIB	Area (ha) = 3.81	Dir. Conn. (%) = 45.00
STANDHYD (0150)	Total Imp (%) = 60.00	
ID= 1 DT= 5.0 min		
	IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha) = 2.29	1.52
Dep. Storage	(mm) = 1.00	1.50
Average Slope	(%) = 2.00	2.00
Length	(m) = 159.37	40.00
Mannings n	= 0.013	0.250
Max. Eff. Inten. (mm/hr) =	65.99	23.23
over (min)	5.00	20.00
Storage Coeff. (min) =	3.24 (ii)	15.90 (ii)
Unit Hyd. Tpeak (min) =	5.00	20.00
Unit Hyd. peak (cms) =	0.27	0.07
PEAK FLOW (cms) =	0.31	0.05
TIME TO PEAK (hrs) =	3.00	3.17
RUNOFF VOLUME (mm) =	41.30	9.71
TOTAL RAINFALL (mm) =	42.30	42.30
RUNOFF COEFFICIENT =	0.98	0.23
		TOTALS
		0.348 (iii)

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 58.0 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 (0151)
 IN= 2--> OUT= 1
 DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.2360	0.1095
0.0590	0.0523	0.2930	0.1243
0.1190	0.0744	0.3540	0.1389
0.1670	0.0888	0.0000	0.0000
AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3.810	0.348	3.00	23.92
3.810	0.059	3.58	23.86

PEAK FLOW REDUCTION [Qout/Qin] (%) = 16.90
 TIME SHIFT OF PEAK FLOW (min) = 35.00
 MAXIMUM STORAGE USED (ha.m.) = 0.0523

 ** SIMULATION NUMBER: 2 **

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DATE: October 2016

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CALIB
STANDHYD (0150)
ID= 1 DT= 5.0 min | Area (ha)= 3.81
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 2.29 1.52
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 159.37 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 92.82 46.90
over (min) 5.00 15.00
Storage Coeff. (min)= 2.83 (ii) 12.38 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.28 0.08

PEAK FLOW (cms)= 0.44 0.12
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 58.50 17.75
TOTAL RAINFALL (mm)= 59.50 59.50
RUNOFF COEFFICIENT = 0.98 0.30

TOTALS
0.541 (iii)
3.00
36.09
59.50
0.61

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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 (0151)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.2360	0.1095
0.0590	0.0523	0.2930	0.1243
0.1190	0.0744	0.3540	0.1389
0.1670	0.0888	0.0000	0.0000

AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
3.810 0.541 3.00 36.09
3.810 0.119 3.42 36.03

INFLOW : ID= 2 (0150)
OUTFLOW: ID= 1 (0151)

PEAK FLOW REDUCTION [Qout/Qin] (%) = 21.99
TIME SHIFT OF PEAK FLOW (min) = 25.00
MAXIMUM STORAGE USED (ha.m.) = 0.0744

CALIB
STANDHYD (0150)
ID= 1 DT= 5.0 min | Area (ha)= 3.81
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 2.29 1.52
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 159.37 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 110.45 63.05
over (min) 5.00 15.00
Storage Coeff. (min)= 2.64 (ii) 11.13 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.29 0.09

PEAK FLOW (cms)= 0.52 0.17
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 69.80 23.88
TOTAL RAINFALL (mm)= 70.80 70.80
RUNOFF COEFFICIENT = 0.99 0.34

TOTALS
0.668 (iii)
3.00
44.54
70.80
0.63

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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 (0151)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.2360	0.1095
0.0590	0.0523	0.2930	0.1243
0.1190	0.0744	0.3540	0.1389
0.1670	0.0888	0.0000	0.0000

AREA QPEAK TPEAK R.V.
(ha) (cms) (hrs) (mm)
3.810 0.668 3.00 44.54
3.810 0.167 3.33 44.49

INFLOW : ID= 2 (0150)
OUTFLOW: ID= 1 (0151)

PEAK FLOW REDUCTION [Qout/Qin] (%) = 24.98
TIME SHIFT OF PEAK FLOW (min) = 20.00
MAXIMUM STORAGE USED (ha.m.) = 0.0888

CALIB
STANDHYD (0150)
ID= 1 DT= 5.0 min | Area (ha)= 3.81
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 2.29 1.52
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
 Lands North of Pond A Post-Development -- SCS Type II Design Storm

DATE: October 2016

Length (m) = 159.37 40.00
 Mannings n = 0.013 0.250
 Max. Eff. Inten. (mm/hr) = 132.91 85.60
 over (min) 10.00
 Storage Coeff. (min) = 2.45 (ii) 9.96 (ii)
 Unit Hyd. Tpeak (min) = 5.00 10.00
 Unit Hyd. peak (cms) = 0.30 0.11
 PEAK FLOW (cms) = 0.63 0.25
 TIME TO PEAK (hrs) = 3.00 3.00
 RUNOFF VOLUME (mm) = 84.20 32.47
 TOTAL RAINFALL (mm) = 85.20 85.20
 RUNOFF COEFFICIENT = 0.99 0.38

TOTALS
 0.882 (iii)
 3.00
 55.75
 85.20
 0.65

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

(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
 CN* = 58.0 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 (0151)
 IN= 2---> OUT= 1
 DT= 5.0 min
 OUTFLOW (cms) STORAGE (ha.m.)
 0.0000 0.0000 0.2360 0.1095
 0.0590 0.0523 0.2930 0.1243
 0.1190 0.0744 0.3540 0.1389
 0.1670 0.0888 0.0000 0.0000
 AREA QPEAK TPEAK R.V.
 (ha) (cms) (hrs) (mm)
 INFLOW : ID= 2 (0150) 3.810 0.882 3.00 55.75
 OUTFLOW : ID= 1 (0151) 3.810 0.235 3.25 55.69

PEAK FLOW REDUCTION [Qout/Qin] (%) = 26.64
 TIME SHIFT OF PEAK FLOW (min) = 15.00
 MAXIMUM STORAGE USED (ha.m.) = 0.1095

 ** SIMULATION NUMBER: 5 **

CALIB
 STANDHYD (0150)
 ID= 1 DT= 5.0 min Area (ha) = 3.81
 Total Imp (%) = 60.00 Dir. Conn. (%) = 45.00
 IMPERVIOUS PVIOUS (i)
 Surface Area (ha) = 2.29 1.52
 Dep. Storage (mm) = 1.00 1.50
 Average Slope (%) = 2.00 2.00
 Length (m) = 159.37 40.00
 Mannings n = 0.013 0.250
 Max. Eff. Inten. (mm/hr) = 149.60 103.54

over (min) 10.00
 Storage Coeff. (min) = 2.34 (ii) 9.30 (ii)
 Unit Hyd. Tpeak (min) = 5.00 10.00
 Unit Hyd. peak (cms) = 0.30 0.12
 PEAK FLOW (cms) = 0.71 0.31
 TIME TO PEAK (hrs) = 3.00 3.00
 RUNOFF VOLUME (mm) = 94.90 39.32
 TOTAL RAINFALL (mm) = 95.90 95.90
 RUNOFF COEFFICIENT = 0.99 0.41

TOTALS
 1.025 (iii)
 3.00
 64.33
 95.90
 0.67

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

(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
 CN* = 58.0 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 (0151)
 IN= 2---> OUT= 1
 DT= 5.0 min
 OUTFLOW (cms) STORAGE (ha.m.)
 0.0000 0.0000 0.2360 0.1095
 0.0590 0.0523 0.2930 0.1243
 0.1190 0.0744 0.3540 0.1389
 0.1670 0.0888 0.0000 0.0000
 AREA QPEAK TPEAK R.V.
 (ha) (cms) (hrs) (mm)
 INFLOW : ID= 2 (0150) 3.810 1.025 3.00 64.33
 OUTFLOW : ID= 1 (0151) 3.810 0.291 3.17 64.27

PEAK FLOW REDUCTION [Qout/Qin] (%) = 28.42
 TIME SHIFT OF PEAK FLOW (min) = 10.00
 MAXIMUM STORAGE USED (ha.m.) = 0.1243

 ** SIMULATION NUMBER: 6 **

CALIB
 STANDHYD (0150)
 ID= 1 DT= 5.0 min Area (ha) = 3.81
 Total Imp (%) = 60.00 Dir. Conn. (%) = 45.00
 IMPERVIOUS PVIOUS (i)
 Surface Area (ha) = 2.29 1.52
 Dep. Storage (mm) = 1.00 1.50
 Average Slope (%) = 2.00 2.00
 Length (m) = 159.37 40.00
 Mannings n = 0.013 0.250
 Max. Eff. Inten. (mm/hr) = 166.14 122.13
 over (min) 10.00
 Storage Coeff. (min) = 2.24 (ii) 8.76 (ii)
 Unit Hyd. Tpeak (min) = 5.00 10.00
 Unit Hyd. peak (cms) = 0.30 0.12

PEAK FLOW	(cms)	0.79	0.38	1.171 (iii)
TIME TO PEAK	(hrs)	3.00	3.00	3.00
RUNOFF VOLUME	(mm)	105.50	46.46	73.02
TOTAL RAINFALL	(mm)	106.50	106.50	106.50
RUNOFF COEFFICIENT		0.99	0.44	0.69

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151)				
IN= 2--> OUT= 1				
DT= 5.0 min				
OUTFLOW	STORAGE	OUTFLOW	STORAGE	
(cms)	(ha.m.)	(cms)	(ha.m.)	
0.0000	0.0000	0.2360	0.1095	
0.0590	0.0523	0.2930	0.1243	
0.1190	0.0744	0.3540	0.1389	
0.1670	0.0888	0.0000	0.0000	
AREA	QPEAK	TPEAK	R.V.	
(ha)	(cms)	(hrs)	(mm)	
3.810	1.171	3.00	73.02	
3.810	0.353	3.17	72.97	
PEAK FLOW REDUCTION [Qout/Qin] (%) = 30.18				
TIME SHIFT OF PEAK FLOW (min) = 10.00				
MAXIMUM STORAGE USED (ha.m.) = 0.1389				

LID B AREA



PRE-DEVELOPMENT MODELLING



North Area of Pond B Pre
AREA [ha] - 4.970
150 PKFW [m^3/s] - 0.076



SCHAEFFERS
CONSULTING ENGINEERS

Visual OTTHYMO™ Schematic

Land North of Pond B Tributary Area
ALLOWABLE RELEASE PRE-DEVELOPMENT
(SCS Type II DESIGN STORM)

Job #: 4278

Date: October 2016

** SIMULATION NUMBER: 1 **

CALIB									
NASHYD	(	0150)		Area	(ha)	=	4.97	Curve Number	(CN) = 58.0
ID=	1	DT=	5.0 min	Ia	(mm)	=	5.00	# of Linear Res. (N)	= 3.00
				U.H. Tp	(hrs)	=	0.30		

Unit Hyd Qpeak (cms) = 0.633
PEAK FLOW (cms) = 0.076 (1)
TIME TO PEAK (hrs) = 3.167
RUNOFF VOLUME (mm) = 6.286
TOTAL RAINFALL (mm) = 42.300
RUNOFF COEFFICIENT = 0.149

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

** SIMULATION NUMBER: 2 **

CALIB									
NASHYD	(	0150)		Area	(ha)	=	4.97	Curve Number	(CN) = 58.0
ID=	1	DT=	5.0 min	Ia	(mm)	=	5.00	# of Linear Res. (N)	= 3.00
				U.H. Tp	(hrs)	=	0.30		

Unit Hyd Qpeak (cms) = 0.633
PEAK FLOW (cms) = 0.155 (1)
TIME TO PEAK (hrs) = 3.167
RUNOFF VOLUME (mm) = 12.453
TOTAL RAINFALL (mm) = 59.500
RUNOFF COEFFICIENT = 0.209

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

** SIMULATION NUMBER: 3 **

CALIB									
NASHYD	(	0150)		Area	(ha)	=	4.97	Curve Number	(CN) = 58.0
ID=	1	DT=	5.0 min	Ia	(mm)	=	5.00	# of Linear Res. (N)	= 3.00
				U.H. Tp	(hrs)	=	0.30		

Unit Hyd Qpeak (cms) = 0.633
PEAK FLOW (cms) = 0.217 (1)
TIME TO PEAK (hrs) = 3.167
RUNOFF VOLUME (mm) = 17.330
TOTAL RAINFALL (mm) = 70.800
RUNOFF COEFFICIENT = 0.245

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

** SIMULATION NUMBER: 4 **

| CALIB |
| NASHYD (0150) | Area (ha)= 4.97 Curve Number (CN)= 58.0
| ID= 1 DT= 5.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
|-----| U.H. Tp (hrs)= 0.30
Unit Hyd Qpeak (cms)= 0.633
PEAK FLOW (cms)= 0.308 (i)
TIME TO PEAK (hrs)= 3.167
RUNOFF VOLUME (mm)= 24.342
TOTAL RAINFALL (mm)= 85.200
RUNOFF COEFFICIENT = 0.286
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

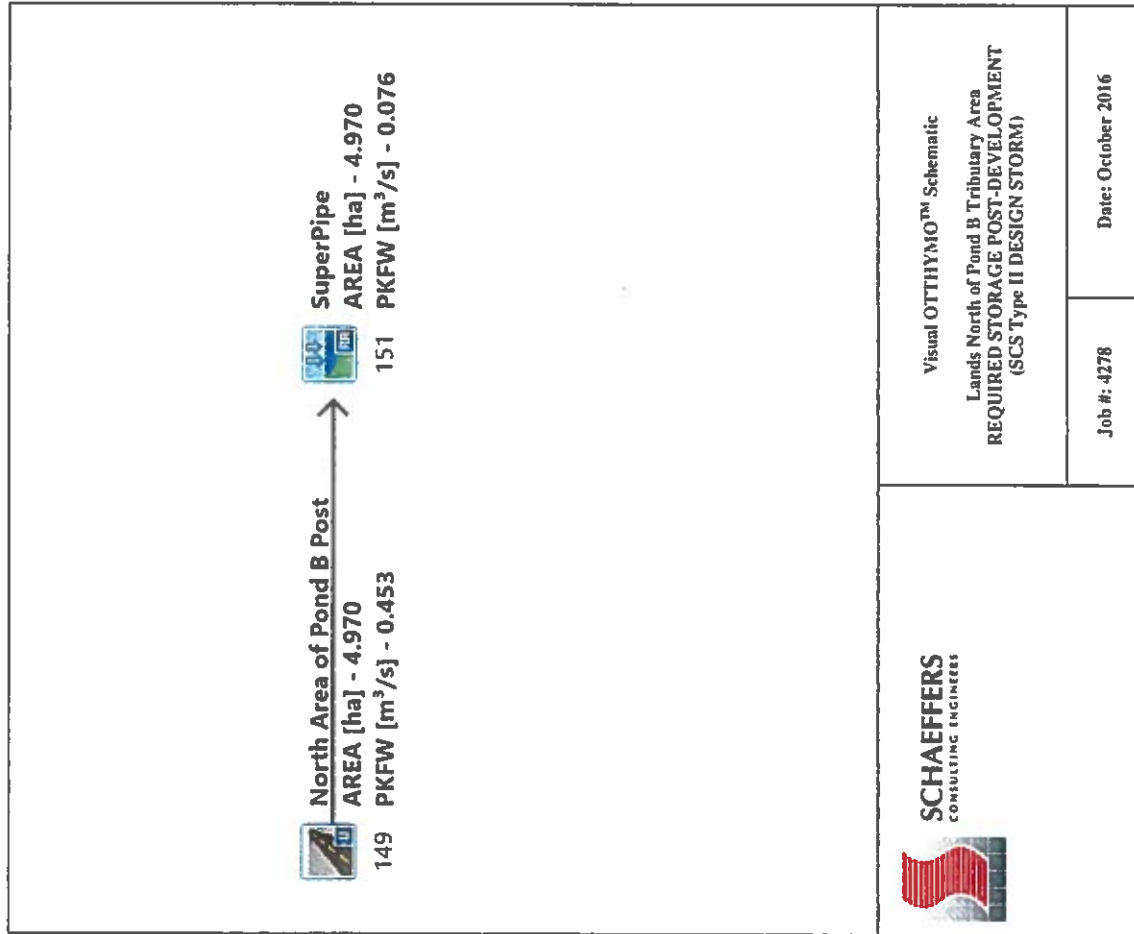
** SIMULATION NUMBER: 5 **

| CALIB |
| NASHYD (0150) | Area (ha)= 4.97 Curve Number (CN)= 58.0
| ID= 1 DT= 5.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
|-----| U.H. Tp (hrs)= 0.30
Unit Hyd Qpeak (cms)= 0.633
PEAK FLOW (cms)= 0.382 (i)
TIME TO PEAK (hrs)= 3.167
RUNOFF VOLUME (mm)= 30.053
TOTAL RAINFALL (mm)= 95.900
RUNOFF COEFFICIENT = 0.313
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

** SIMULATION NUMBER: 6 **

| CALIB |
| NASHYD (0150) | Area (ha)= 4.97 Curve Number (CN)= 58.0
| ID= 1 DT= 5.0 min | Ia (mm)= 5.00 # of Linear Res. (N)= 3.00
|-----| U.H. Tp (hrs)= 0.30
Unit Hyd Qpeak (cms)= 0.633
PEAK FLOW (cms)= 0.461 (i)
TIME TO PEAK (hrs)= 3.167
RUNOFF VOLUME (mm)= 36.080
TOTAL RAINFALL (mm)= 106.500
RUNOFF COEFFICIENT = 0.339
(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

POST DEVELOPMENT MODELLING



 ** SIMULATION NUMBER: 1 **

CALIB
 STANDHYD (0149) | Area (ha) = 4.97
 ID= 1 DT= 5.0 min | Total Imp(%) = 60.00 Dir. Conn.(%) = 45.00

IMPERVIOUS		PERVIOUS (i)	
Surface Area (ha)	2.98		1.99
Dep. Storage (mm)	1.00		1.50
Average Slope (%)	2.00		2.00
Length (m)	182.03		40.00
Mannings n	0.013		0.250
Max. Eff. Inten. (mm/hr)	65.99		23.23
Storage Coeff. (min)	5.00		20.00
Unit Hyd. Tpeak (min)	3.51 (ii)		16.16 (ii)
Unit Hyd. peak (cms)	5.00		20.00
	0.26		0.06
PEAK FLOW (cms)	0.41		0.07
TIME TO PEAK (hrs)	3.00		3.17
RUNOFF VOLUME (mm)	41.30		9.71
TOTAL RAINFALL (mm)	42.30		42.30
RUNOFF COEFFICIENT	0.98		0.23

TOTALS
 0.453 (iii)
 3.00
 23.92
 42.30
 0.57

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 58.0 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 (0151) |
 IN= 2---> OUT= 1
 DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.3080	0.1404
0.0760	0.0684	0.3820	0.1618
0.1550	0.0971	0.4610	0.1811
0.2170	0.1159	0.0000	0.0000

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
4.970	0.453	3.00	23.92
4.970	0.076	3.58	23.88

PEAK FLOW REDUCTION [Qout/Qin] (%) = 16.76
 TIME SHIFT OF PEAK FLOW (min) = 35.00
 MAXIMUM STORAGE USED (ha.m.) = 0.0684

 ** SIMULATION NUMBER: 2 **

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
Lands North of Pond B Post-Development – SCS Type II Design Storm

DATE: October 2016

CALIB
STANDHYD (0149)
ID= 1 DT= 5.0 min
Area (ha)= 4.97
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 2.98 1.99
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 182.03 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 92.82 46.90
over (min) 5.00 15.00
Storage Coeff. (min)= 3.06 (ii) 12.62 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.27 0.08

PEAK FLOW (cms)= 0.57 0.15
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 58.50 17.75
TOTAL RAINFALL (mm)= 59.50 59.50
RUNOFF COEFFICIENT = 0.98 0.30

TOTALS
0.703 (iii)
3.00
36.09
59.50
0.61

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.3080	0.1404	
0.0760	0.0684	0.3820	0.1618	
0.1550	0.0971	0.4610	0.1811	
0.2170	0.1159	0.0000	0.0000	

AREA QPEAK TPEAK
(ha) (cms) (hrs)
4.970 0.703 3.00
INFLOW : ID= 2 (0149)
OUTFLOW: ID= 1 (0151)

PEAK FLOW REDUCTION [Qout/Qin] (%)= 22.05
TIME SHIFT OF PEAK FLOW (min)= 25.00
MAXIMUM STORAGE USED (ha.m.)= 0.0971

** SIMULATION NUMBER: 3 **

CALIB
STANDHYD (0149)
ID= 1 DT= 5.0 min
Area (ha)= 4.97
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 2.98 1.99
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00
Length (m)= 182.03 40.00
Mannings n = 0.013 0.250

Max.Eff.Inten.(mm/hr)= 110.45 63.05
over (min) 5.00 15.00
Storage Coeff. (min)= 2.86 (ii) 11.34 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.28 0.09

PEAK FLOW (cms)= 0.68 0.22
TIME TO PEAK (hrs)= 3.00 3.08
RUNOFF VOLUME (mm)= 69.80 23.88
TOTAL RAINFALL (mm)= 70.80 70.80
RUNOFF COEFFICIENT = 0.99 0.34

TOTALS
0.869 (iii)
3.00
44.54
70.80
0.63

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 58.0 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 (0151)
IN= 2--> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
0.0000	0.0000	0.3080	0.1404	
0.0760	0.0684	0.3820	0.1618	
0.1550	0.0971	0.4610	0.1811	
0.2170	0.1159	0.0000	0.0000	

AREA QPEAK TPEAK
(ha) (cms) (hrs)
4.970 0.869 3.00
INFLOW : ID= 2 (0149)
OUTFLOW: ID= 1 (0151)

PEAK FLOW REDUCTION [Qout/Qin] (%)= 24.98
TIME SHIFT OF PEAK FLOW (min)= 20.00
MAXIMUM STORAGE USED (ha.m.)= 0.1159

** SIMULATION NUMBER: 4 **

CALIB
STANDHYD (0149)
ID= 1 DT= 5.0 min
Area (ha)= 4.97
Total Imp(%)= 60.00 Dir. Conn.(%)= 45.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 2.98 1.99
Dep. Storage (mm)= 1.00 1.50
Average Slope (%)= 2.00 2.00

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN Lands North of Pond B Post-Development – SCS Type II Design Storm

DATE: October 2016

Length (m) = 182.03 40.00
Mannings n = 0.013 0.250
Max.Eff.Inten.(mm/hr) = 132.91 85.60
Storage Coeff. over (min) = 5.00 15.00
Unit Hyd. Tpeak (min) = 2.65 (ii) 10.16 (ii)
Unit Hyd. Tpeak (min) = 5.00 15.00
Unit Hyd. Tpeak (cms) = 0.29 0.10
PEAK FLOW (cms) = 0.82 0.31
TIME TO PEAK (hrs) = 3.00 3.08
RUNOFF VOLUME (mm) = 84.20 32.47
TOTAL RAINFALL (mm) = 85.20 85.20
RUNOFF COEFFICIENT = 0.99 0.38

TOTALS
1.091 (iii)
3.00
55.75
85.20
0.65

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

(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:

CN* = 58.0 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(0151)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
IN= 2--> OUT= 1	0.0000	0.0000	0.3080	0.1404	
DT= 5.0 min	0.0760	0.0684	0.3820	0.1618	
	0.1550	0.0971	0.4610	0.1811	
	0.2170	0.1159	0.0000	0.0000	
AREA (ha)	4.970	4.970	3.00	55.75	
QPEAK (cms)	1.091	0.307	3.25	55.70	
TPEAK (hrs)					

PEAK FLOW REDUCTION [Qout/Qin] (%) = 28.13
TIME SHIFT OF PEAK FLOW (min) = 15.00
MAXIMUM STORAGE USED (ha.m.) = 0.1404

** SIMULATION NUMBER: 5 **

CALIB	STANDHYD (0149)	Area (ha) = 4.97	Dir. Conn. (%) = 45.00
ID= 1 DT= 5.0 min	Total Imp (%) = 60.00		
Surface Area (ha) = 2.98	IMPERVIOUS	PERVIOUS (i)	
Dep. Storage (mm) = 1.00			
Average Slope (%) = 2.00			
Length (m) = 182.03			
Mannings n = 0.013			
Max.Eff.Inten.(mm/hr) = 149.60			103.54

Storage Coeff. over (min) = 5.00 10.00
Unit Hyd. Tpeak (min) = 2.53 (ii) 9.49 (ii)
Unit Hyd. Tpeak (cms) = 0.29 0.12
PEAK FLOW (cms) = 0.93 0.41
TIME TO PEAK (hrs) = 3.00 3.00
RUNOFF VOLUME (mm) = 94.90 39.32
TOTAL RAINFALL (mm) = 95.90 95.90
RUNOFF COEFFICIENT = 0.99 0.41

TOTALS
1.333 (iii)
3.00
64.33
95.90
0.67

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

(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:

CN* = 58.0 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(0151)	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)	R.V. (mm)
IN= 2--> OUT= 1	0.0000	0.0000	0.3080	0.1404	
DT= 5.0 min	0.0760	0.0684	0.3820	0.1618	
	0.1550	0.0971	0.4610	0.1811	
	0.2170	0.1159	0.0000	0.0000	
AREA (ha)	4.970	4.970	3.00	64.33	
QPEAK (cms)	1.333	0.380	3.17	64.29	
TPEAK (hrs)					

PEAK FLOW REDUCTION [Qout/Qin] (%) = 28.51
TIME SHIFT OF PEAK FLOW (min) = 10.00
MAXIMUM STORAGE USED (ha.m.) = 0.1618

** SIMULATION NUMBER: 6 **

CALIB	STANDHYD (0149)	Area (ha) = 4.97	Dir. Conn. (%) = 45.00
ID= 1 DT= 5.0 min	Total Imp (%) = 60.00		
Surface Area (ha) = 2.98	IMPERVIOUS	PERVIOUS (i)	
Dep. Storage (mm) = 1.00			
Average Slope (%) = 2.00			
Length (m) = 182.03			
Mannings n = 0.013			
Max.Eff.Inten.(mm/hr) = 166.14			122.13
Storage Coeff. over (min) = 5.00			10.00
Unit Hyd. Tpeak (min) = 2.43 (ii)			8.94 (ii)
Unit Hyd. Tpeak (cms) = 5.00			10.00
Unit Hyd. Tpeak (cms) = 0.30			0.12

VISUAL OTTHYMO OUTPUT: WATERSAND CONSTRUCTION C/O DG GROUP PHASE I SALEM SECONDARY PLAN
Lands North of Pond B Post-Development – SCS Type II Design Storm

DATE: October 2016

PEAK FLOW (cms) = 1.03 0.49
TIME TO PEAK (hrs) = 3.00 3.00
RUNOFF VOLUME (mm) = 105.50 46.46
TOTAL RAINFALL (mm) = 106.50 106.50
RUNOFF COEFFICIENT = 0.99 0.44

TOTALS
1.523 (iii)
3.00
73.02
106.50
0.69

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

- (i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 58.0 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 (0151)
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.3080	0.1404
0.0760	0.0684	0.3820	0.1618
0.1550	0.0971	0.4610	0.1811
0.2170	0.1159	0.0000	0.0000

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
4.970	1.523	3.00	73.02
4.970	0.460	3.17	72.98

PEAK FLOW REDUCTION (Qout/Qin) (%) = 30.19
TIME SHIFT OF PEAK FLOW (min) = 10.00
MAXIMUM STORAGE USED (ha.m.) = 0.1811

Appendix B

Sanitary Servicing

Sanitary Flow Calculation

Project: Watersand

Project No: 4278

Infiltration Rate: 0.1 L/ha/s
Generation Rate: 225 L/person/day
Institutional/Commercial Rate: 28 m³/ha/day
Industrial Rate: 35 m³/ha/day

Estimated Site Discharge

Land Use	Units	Population	Babbitt Peaking Factor	Flow (L/s) **	Infiltration (L/s)	Total PeakFlow (L/s)
Residential	1443	4204	3.75	41.07	4.571	45.65

Land Use	Area (ha)	Population	Peaking Factor	Flow (L/s) **	Infiltration (L/s)	Total PeakFlow (L/s)
Institutional	2.43	n/a	2.00	1.58	0.243	1.82
Commercial	4.54	n/a	2.00	2.94	0.454	3.40
Industrial	35.80	n/a	3.00	43.51	3.580	47.09

Total Flow =	97.95
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*As per City of Barrie Design Guidelines

**Based on 225 L/person/d, as per City of Barrie Guidelines

Appendix C

Water Supply Servicing

Water Supply Calculation

Project: Watersand

Project No: 4278

Fire Protection:	4600.00 L/s
Average Daily Demand:	270 L/capita/day
Commercial/Institutional Avg Day Demand:	28 m ³ /ha/day
Industrial Avg Day Demand:	35 m ³ /ha/day
Commercial/Institutional Area:	6.97 ha
Industrial Area:	35.8 ha

Average Daily Demand

Land Use	Population	Average Day Demand (l/s)‡
Residential	4204	13.14
Comm/Inst	n/a	2.26
Industrial	n/a	14.50

Max Daily Demand

Land Use	Population	Peaking Factor	Average Day Demand (L/s)‡
Residential	4204	2.0	26.28
Comm/Inst	n/a	2.0	4.52
Industrial	n/a	2.0	29.00

Peak Hour Demand

Land Use	Population	Peaking Factor	Average Day Demand (L/s)‡
Residential	4204	4.1	54.26
Comm/Inst	n/a	4.1	9.33
Industrial	n/a	4.1	59.89

Max Day + Fire Flow

Land Use	Average Day Demand (L/s)‡	Max. Hour Demand Peaking Factor†	Max Hour Demand (L/s)	Max Day Demand Peaking Factor†	Max Day Demand (L/s)	Fire Flow (L/s)†	Total Flow (L/s)
Total	29.90	3.0	123.48	2.00	59.80	4600	4660

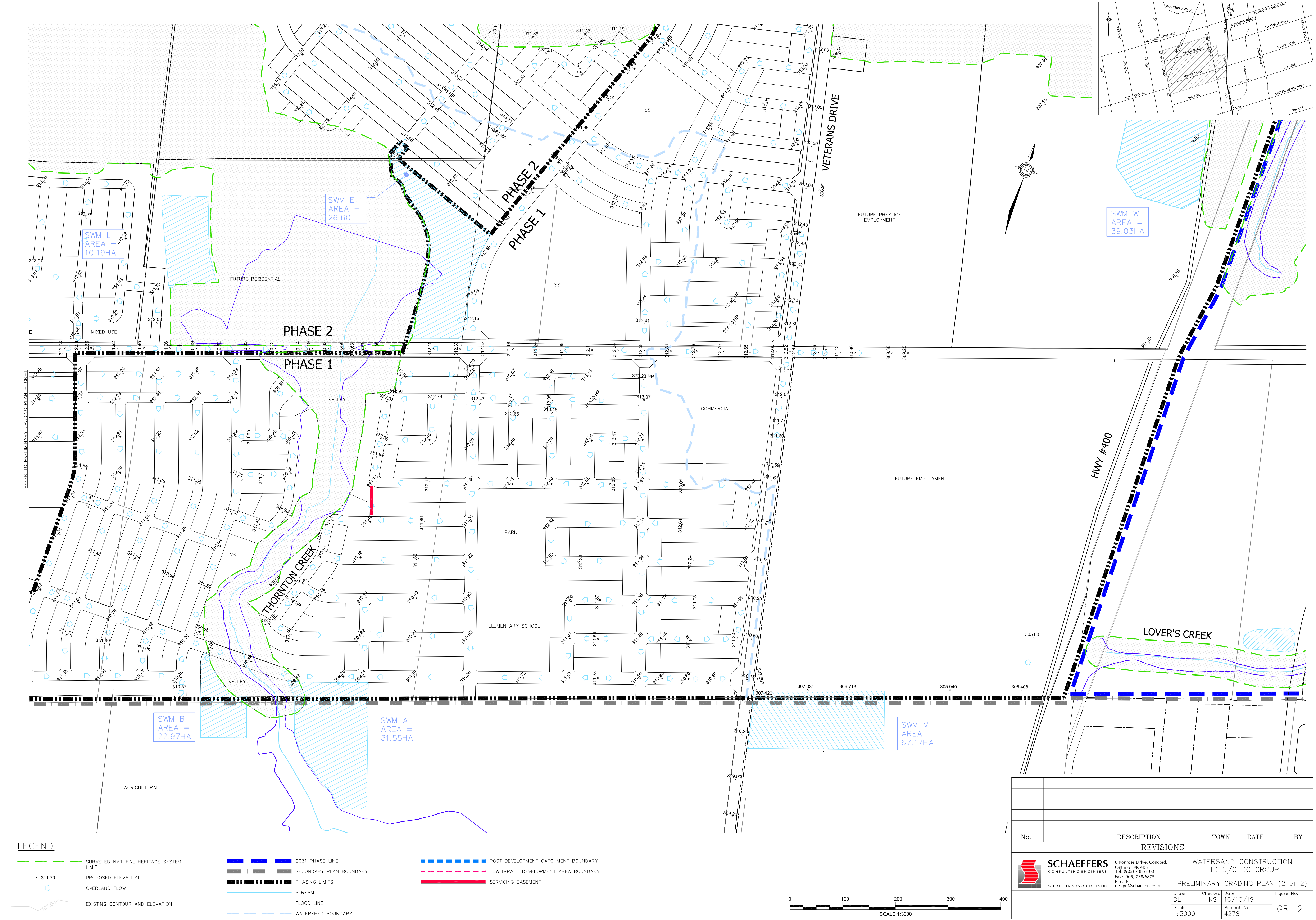
† As per City of Barrie Design Guidelines

‡ Based on 270 L/c/d, as per City of Barrie Design Guidelines

Appendix D

Preliminary Grading Plans





No.	DESCRIPTION		TOWN	DATE	BY
REVISIONS					
 SCHAEFFERS CONSULTING ENGINEERS SCHAEFFER & ASSOCIATES LTD.		6 Ronrose Drive, Concord, Ontario L4K 4R3 Tel: (905) 738-6100 Fax: (905) 738-6875 E-mail: design@schaeffers.com			
		WATERSAND CONSTRUCTION LTD C/O DG GROUP			
		PRELIMINARY GRADING PLAN (2 of 2)			
		Drawn DL	Checked KS	Date 16/10/19	Figure No.
		Scale 1: 3000	Project No. 4278		GR-2