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3358 Lakefield Road, Township of Selwyn, County of Peterborough

FUNCTIONAL SERVICING AND PRELIMINARY STORMWATER MANAGEMENT REPORT

Triple T Holdings Ltd.

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Issue	Date	Description
1	November 18, 2020	Final Report
2	June 29, 2023	Rev. Final Report
3	September 8, 2023	Rev. Final Report
4	September 15, 2023	Rev. Final Report

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1 Introduction

Tatham Engineering Limited (Tatham) was retained by Triple T Holdings Ltd. to prepare a Functional Servicing and Preliminary Stormwater Management (SWM) Report in support of a Draft Plan of Subdivision for a proposed development located in the Lakefield South Development Area (LSDA).

The preliminary servicing and SWM designs presented herein have been prepared in support of Zoning By-Law and Official Plan Amendment applications and a Draft Plan of Subdivision. The designs are based on extensive consultation with the Township of Selwyn (Township), County of Peterborough (County) and Otonabee Region Conservation Authority (ORCA) staff and are coordinated with other studies which have been prepared in conjunction with this report including: a planning rationale report, a geotechnical investigation, an environmental impact assessment, a stage 1 and 2 archaeological assessment, a traffic impact study, and a traffic impact study addendum report. A legal and detailed topographic survey have also been prepared for the site.

A pre-consultation meeting was held on March 8, 2018 at the County office. The Record of Pre-Consultation and relevant follow up email correspondence with the Township are attached in Appendix A. A follow up meeting between the Triple T Holdings Ltd., the Township and ORCA was held at the Township office on August 21, 2018. Key discussion points from the meeting are also attached in Appendix A.

1.1 SITE DESCRIPTION

The site consists of approximately 61.3 ha of undeveloped land located in the western portion of the LSDA in the Township of Selwyn, County of Peterborough. The site is bounded by Lakefield Road (County Road 29) and existing residential properties to the north and west, existing residential properties and undeveloped land located in the eastern portion of the LSDA to the east and existing rural residential properties and 7th Line to the south. Rays Creek bisects the western portion of the site and flows north from below Lakefield Road at the west limit of the site discharging across Lakefield Road at the north limit of the site. A key plan illustrating the site location is provided on the drawings included at the back of this report.

1.2 PROPOSED DEVELOPMENT

The proposed development consists of approximately 940 residential units comprised of townhouses (99), detached single family dwellings (255) and apartment units (586). Up to 4,000 m^2 of ground level neighbourhood commercial area is also proposed.

The proposed development will be constructed in approximately ten phases as illustrated on the Phasing Plan (Dwg. PH-1), attached at the back of this report.

The site will be serviced by the municipal watermain and sanitary sewers on Tower Road and Murray Street. Five SWM facilities are proposed to control and treat runoff from the future development upstream of the existing site outlets.

1.3 OBJECTIVES

The primary objectives of this report are to assess the feasibility of the proposed development with respect to servicing and SWM and to ensure satisfactory information is presented to demonstrate that the development can be graded and serviced in context with the overall LSDA and in accordance with the Township, County, Conservation Authority and the Ministry of the Environment, Conservation and Parks (MECP) design criteria.

1.4 GUIDELINES AND BACKGROUND REPORTS

This report was prepared recognizing municipal, provincial and agency guidelines and relevant background documents related to servicing and SWM including the following publications:

- Lakefield south Development Area – Servicing Capacity Analysis Technical Memo (D.M.Wills Associates, March 13, 2023);
- Water Subdivision & Development Requirements (Peterborough Utilities Commission, June 2020);
- Engineering Design Standards, Infrastructure Management Division (City of Peterborough, April 2019);
- Lakefield Sanitary Servicing upgrades Environmental Assessment (D.M.Wills Associates, June 2016);
- Hydrogeological Assessment Submissions, Conservation Authority Guidelines for Development Applications (2013);
- Ontario Building Code (2012);
- Lakefield South Retirement Community Stormwater Management Report (Cole Engineering, December 2011);
- Low Impact Development Stormwater Management Planning and Design Guide (CVC and TRCA, 2010);
- Lakefield South Retirement Community Servicing Options Report (D.M.Wills & Associates Ltd., April 2008);

- Design Guidelines for Drinking Water Systems (MECP, 2008);
- Design Guidelines for Sewage Works (MECP, 2008);
- The Ministry of Environment Stormwater Management Practices Planning and Design Manual (2003);
- Traffic Impact Assessment, Lakefield South Development Area (Dillon Consulting Ltd., 2003);
- Lakefield South Development Plan Infrastructure Assessment (D.M.Wills & Associates, August 2003); and
- Lakefield South Development Area Opportunities and Constraints Study (ORCA, April 2003.

The following background reports and documents pertaining to the site were also reviewed and have been submitted in conjunction with this report:

- Planning Justification Report – Lakefield South Plan of Subdivision, 3358 Lakefield Road (EcoVue Consulting Services Inc., November 2020, rev. July 2023);
- Tower Road Plan of Subdivision Environmental Impact Assessment (GHD Limited, October 20, 2020);
- Stage 1 and 2 Archaeological Assessment of 3358 Lakefield Road (Northeastern Archaeological Associates Ltd., June 2020);
- Lakefield South Subdivision Traffic Study Report, 3358 Lakefield Road (Tranplan Associates, March 2020);
- Traffic Impact Study Addendum Report, Tatham Engineering Limited, April 2023;
- Lakefield South Residential Development – Response to Stantec Recommendations and Comments re: Cambium's Geotechnical Reports for the Site (Cambium Inc, March 10, 2023);
- Geotechnical Investigation – 3358 Lakefield Road (Cambium Inc., September 18, 2020);
- Geotechnical Investigation – 2036 7th Line (Cambium Inc., March 14, 2017); and
- Geotechnical Investigation – 3358 Lakefield Road (Cambium Inc., January 23, 2017).

2 Background Information

Information regarding the existing topography, ground cover and drainage patterns was obtained through a review of relevant background studies, detailed topographic survey and base mapping and was confirmed during site visits.

2.1 SITE TOPOGRAPHY

A legal and detailed topographic survey of the site was completed by JBF Surveyors in December 2019. The survey information was used to confirm existing elevations, features, drainage conditions and outlets from the site. Drainage conditions for external areas draining into the site were confirmed using contour information available from the Land Information Ontario database and the County of Peterborough online GIS mapping.

Existing drainage conditions will be described in detail in Section 7.1.

2.2 GEOTECHNICAL

A geotechnical investigation was completed by Cambium Inc. on September 9 and 10, 2019 and documented in their report dated September 18, 2020.

The investigation included a subsurface exploration program by means of excavating 22 test pits dispersed throughout the site. All test pits ended upon refusal of unweathered limestone bedrock at depths ranging from 0.7 to 3.4 metres below ground surface (mbgs). Groundwater seepage was observed only in one test pit at 2.2 mbgs and all the other test pits were dry. The soil encountered in the test pits consisted of 0.2 m to 0.5 m of topsoil underlain with silty sand to sandy till soils which included traces of gravel and clay and occasional cobbles. Several of the test pits revealed a clay layer or a layer consisting of gravel with sand. Weathered bedrock interbedded in the sandy and silty material and having a maximum thickness of 1.2 m was encountered in approximately half of the test pits.

Additional geotechnical investigations for the site were completed by Cambium Inc. in January 2017 and March 2017 which included 14 additional test pits.

Based on the relatively shallow depth to bedrock, the preliminary grading design has been developed to minimize earth cut and fill and rock excavation.

A more detailed account of the existing soil characteristics can be found in the geotechnical investigation reports.

3 Water Supply and Distribution

The water supply to the site will be provided from the municipal water distribution system. The 300 mm diameter watermain at Tower Road is connected to a 300 mm diameter watermain at Lakefield road to the north and is capped adjacent to the elevated water storage tower to the south. The water tower provides reliable pressure and emergency water storage in the municipal water distribution system. The watermain on Lakefield Road is capped approximately 60 m west of Tower Road.

A connection to the existing 300 mm diameter watermain on Tower Road is proposed to service Phase 1. However, in accordance with Peterborough Utilities Commission Water Subdivision and Development Requirements (June 2020), no more than 50 units are to be constructed before a second redundant feed is provided. This is intended to minimize customer disruption during a watermain repair. We have consulted with the Township and confirm this same design guideline applies to development at the site.

A potential watermain connection exists, through the servicing block between Tower Road and Coyle Crescent to provide a redundant feed to Phase 1 and to enable construction of up to 50 units in Phase 2, in advance of extending the Murray Street watermain to Tower Road. However further review of the Township's water distribution model would need to be completed to confirm the broader effects of this connection.

The Murray Street watermain extension to Tower Road is required for the ultimate development of the AON lands as well as Phase 3 and subsequent phases of development within the site. Currently an existing 200 mm diameter watermain exists at the south limit of Murray Street.

Based on printouts of the Township's water system WaterCAD model provided by D.M. Wills Associates Limited on behalf of the Township, pressures of 65.2 psi, 65.1 psi and 65.0 psi are available at the south limit of Water Tower Road during average day, maximum day and peak hour scenarios respectively, thus confirming sufficient system flow and pressure is available to service the initial phases of development including Phases 1 and 2. The printouts are included in Appendix B.

Analysis of the existing water distribution system, considering the impacts of the proposed development, was completed by D.M.Wills, on behalf of the Township, and confirmed only minor impacts throughout the system during the average day, maximum day and peak hour scenarios. Regarding impacts to fire flow the results were varied however there are generally no areas of concern. A full account of the existing water distribution system review is available in the

Technical Memorandum completed by D.M.Wills dated March 13, 2023, which is included in Appendix B.

Notwithstanding the above, during the final design stage water demand calculations will be completed to confirm that the watermain sizes, pressures and velocities are in accordance with Peterborough Utilities Commission (PUC) and Ministry of the Environment, Conservation and Parks (MECP) guidelines during all phases of development. An internal WaterCAD model, will be prepared prior to the Murray Street watermain extension to confirm water system parameters under a looped water system configuration. The internal WaterCAD model will be provided to the Township to be incorporated into the Township's water distribution model in order to reconfirm the impacts of the proposed site demands on the overall water system and vis versa.

3.1 WATER SYSTEM DESIGN

The water system will be designed in accordance with PUC and MECP design criteria including but not limited to the following:

- Average per capita water consumption is estimated to be approximately 340 L/c/day as per the Lakefield Water Supply and Storage Facility – Class Environmental Assessment (Schedule B) Phase 1 and 2 Report (AECOM, 2010). For design purposes, a value of 450 L/c/day is recommended. For comparison purposes, MECP Design Guidelines recommends average daily domestic water demands of 270 to 450 L/c/day. Peaking factors are to be calculated in accordance with PUC and MECP guidelines;
- The minimum watermain size is 150 mm in diameter;
- The minimum depth of watermain and water services is 1.85 m, measured to the top of the pipe;
- Single family and townhouse units will be serviced with an individual 19 mm diameter water service whereas the size of the multi-residential building water services will be determined in the future when additional building details are known and water demands can be calculated for each. In both cases, the service connections will be terminated at the property line with a curb stop valve; and
- Maximum fire hydrant spacing of 150 m measured along the length of the watermain, to ensure a maximum hose length of 75 m to all buildings as per the PUC requirements.

The Preliminary Water Servicing Plan (Dwg. WM-1) illustrating the preliminary internal watermain layout, the potential connection to Coyle Crescent and the Murray Street watermain extension to Tower Road, is included at the back of this report.

4 Sanitary Sewer

The proposed sanitary collection system for the site will consist of internal gravity sewers, a temporary municipal sewage pumping station and, forcemain and a trunk sanitary sewer along the east side of Rays Creek.

4.1 BACKGROUND SEWAGE COLLECTION SYSTEM IMPROVEMENTS

Municipal sanitary system upgrades to accommodate future development in the LSDA are advancing in accordance with the preferred alternative of the Lakefield Sanitary System Upgrades Environmental Assessment (2016).

To date the George Street SPS has been replaced and now provides an initial firm rated pumping capacity of approximately 45 L/s (20 L/s allowed for from the LSDA). The George Street SPS design includes provisions for staged increases in capacity up to a future firm rated pumping capacity of approximately 85 L/s (60 L/s allowed for from the LSDA). In addition, a new gravity sewer extension from Bridge Street to George Street and Fraser Street which connects the LSDA to the upgraded George Street SPS has also been completed. This new gravity sewer is estimated to accommodate sanitary peak flows from the LSDA up to approximately 60 L/s.

Based on the background EA and considering the above system improvements as being completed, the municipal sanitary sewer infrastructure downstream of the LSDA will have an initial sewage flow capacity of approximately 20 L/s to accommodate initial development in the LSDA. Once peak sewage flows from the LSDA exceed 20 L/s, the following external improvements will be required:

- Replacement of portions of the existing gravity sanitary sewers upstream of the George Street SPS (George Street from Fraser Street to Clementi Street) when peak flows from the LSDA exceed approximately 20 L/s;
- Replacement of portions of existing gravity sewers downstream of the George Street forcemain discharge on Burnham Street (Water Street to Queen Street) and Queen Street (Burnham Street to Albert Street) when pumping capacity from the George Street SPS exceeds approximately 60 L/s or approximately 35 L/s from the LSDA;
- Replacement of portions of existing gravity sewers downstream of the George Street forcemain discharge on Albert Street (Queen Street to Regent Street), Regent Street (Albert Street to Duff Street) and Duff Street (Regent Street to Division Street(when the pumping capacity from the George Street SPS exceeds approximately 75 L/s or approximately 50 L/s from the LSDA;

- Upgrading of the Lakefield Wastewater Treatment Lagoons when the overall system average daily sewage flows approach 2,070 m^3/d or 90% of the plant rated capacity; and
- Upgrading of the Water Street SPS when overall system peak sanitary flows exceed approximately 87.5 L/s (current firm rated pumping capacity of Water Street SPS).

The Township is also planning to twin of the existing forcemain under the Otonabee River with a new 250 mm diameter forcemain to provide system redundancy however we note that this work is not specifically related to or triggered by future development with the LSDA.

Additional technical information and recommendations related to external infrastructure improvement recommendations and an up-to-date report on the available capacity in the existing sanitary collection system are included in the Technical Memorandum completed by D.M.Wills dated March 13, 2023, which is included in Appendix B.

4.2 PROPOSED SANITARY SERVICING FOR THE SITE

Based on consultations with the Township, the sewage collection system improvements described in Section 4.1, which are external to the site, and which are needed to support growth within the LSDA, will be completed by the Municipality only as development advances in the LSDA. Individual developers are responsible for constructing all sanitary sewers in the LSDA, including trunk sewers as well as any local sewage pumping stations. The preliminary sanitary servicing design for the site is therefore focussed on the proposed sanitary sewers which are located in the LSDA.

A 200 mm diameter sanitary sewer exists at the southern end of Tower Road at SAN MH 243 and flows north to Lakefield Road. The sewer increases to 300 mm in diameter at SAN MH 250, approximately 160 metres upstream (south) of Lakefield Road.

Due to the elevation and limited flow capacity in the 200 mm diameter sewer on Tower Road, a 375 mm diameter gravity sanitary sewer extending upstream from SAN MH 250 and generally following the Rays Creek alignment is proposed to service the western portion of the LSDA and the majority of the site.

Sewage design flow and peak flow calculations for the LSDA including the site area have been estimated based on information contained in the Lakefield Sanitary System Upgrades Environmental Assessment (June 2016). Specifically, average daily wastewater flows for the Lakefield wastewater system have historically been 25% higher than average daily demands of the drinking water system (which were determined to be 340 L/c/day). It is assumed that the 25% increase is due to extraneous flows. For design purposes, an average daily domestic sewage flow of 450 L/c/day has been used for the proposed residential development. For comparison, MECP Design Guidelines recommend a range of 225 to 450 L/c/day.

The estimated sewage design flows directed to the existing 200 mm diameter gravity sewer on Tower Road and the proposed 375 mm diameter gravity sewer along Rays Creek, from the total LSDA, are summarized in the following sections. For ease of review, the overall LSDA has been split into the five sewer catchment areas illustrated on the LSDA Sewer Catchment Area Plan (Dwg. S-1) included at the back of this report.

4.3 SEWAGE TO EXISTING 200 MM DIAMETER SEWER ON TOWER ROAD

Referring to Drawing S-1, the areas highlighted in red, yellow and purple illustrate sanitary catchment areas that are proposed to drain to the existing 200 mm diameter sanitary sewer on Tower Road at SAN MH 243.

The area in red is a portion of the site consisting of 29 townhouse units, 38 single family units and 184 apartment units. Sewage flow from this area is ultimately intended to drain east to a future sewage pumping station (SPS) located in close proximity to the Otonabee River, and pumped west to Tower Road via a forcemain, in accordance with the preferred alternative of the background EA. However, based on our understanding that the LSDA lands east of the site are not planned for development in the near future, sewage from the majority of the area in red will drain by gravity to a temporary SPS located at the east limit of the site. A small portion of the area in red fronting onto and near Tower Road is proposed to drain directly to the Tower Road gravity sewer. The temporary SPS will pump sewage west to the existing 200 mm diameter gravity sewer at the south end of Tower Road via a forcemain. If plans for development of the LSDA lands east of the site are advanced prior to construction of the temporary SPS, the sewage collection systems of both properties can be coordinated to drain by gravity to a permanent SPS located west of the Otonabee River.

The estimated peak flow from only the area in red is 13.6 L/s. Development of the majority of the area in pink is deferred until Phase 9 due to the significant cost of the temporary SPS and due to the uncertainty related to timing for development of the east portion of the LSDA which would eliminate the need for the temporary SPS.

An alternative gravity outlet exists for the catchment area draining to the temporary SPS, through the AON Inc. lands within the Murray Street road alignment and west along the north limit of the AON Inc. lands and ultimately discharging into the Tower Road gravity sewer at SAN MH 246. Initial consultation between Triple T Holdings and AON Inc. have occurred however further discussions are required to resolve whether the gravity sewer would be mutually beneficial to both parties. If it is determined to be feasible, it would eliminate the need for a temporary SPS and could result in the Phase 9 lands being developed in an earlier phase. The alternative option to service the Aon Inc. property and the Phase 9 lands is shown schematically on Drawings S-1 and SAN-1.

The area in yellow consists of the AON Inc. property and represents approximately 6.5 hectares of developable land. This Draft Approved development consists of 26 single family units, 200 apartment units, a retirement facility (including 126 long-term care beds) and a medical centre. Sewage from a portion of the AON Inc. property is proposed to connect into the existing sewer on Murray Street. Two options are provided in the Servicing Options Report prepared by D.M.Wills Associates Limited dated April 2008 including:

Option 1 – Service only half of the length of the proposed Murray Street extension by a gravity sewer draining to the north and the south half of the Murray Street extension by a temporary SPS.

Option 2 – Service only the lots serviceable by gravity and provide individual pumping systems for the apartment buildings and other proposed buildings not able to connect to the sanitary sewer by a gravity system. We assume that the south portion of the Murray Street extension would remain undeveloped until such time that the future lots could be serviced by a SPS station located in the LSDA.

Both Options 1 and 2 rely on pumping stations for the ultimate development of the AON Inc. site.

As indicated above, an alternative gravity outlet to Tower Road exists for all sewage from the AON Inc. property. Otherwise, the south portion of the AON Inc. property will drain south by gravity to a temporary SPS located within the site or a permanent SPS located on the adjacent lands east of the site to be pumped to the existing gravity sewer at the south limit of Tower Road. For the purposes of this study and for conservatism, all flows from the AON Inc. property are assumed to drain to the gravity sewer on Tower Road. The estimated peak flow from only the area in yellow is 16.3 L/s and the total flow has been included in our review of the existing Tower Road gravity sewer.

The area in purple is comprised of approximately 57.1 ha of currently undeveloped lands located in the east portion of the LSDA. Based on available background information contained in the County Official Plan, the future use of these lands will consist of 41.7 ha of low-density residential, 2.8 ha of recreational open space, 7.5 ha of environmental constraint area and 5.1 ha of site-specific policy area. We note that there is a new Draft County Official Plan (June 2022) that is pending approval by MMAH. However, since the new Draft Official Plan has not yet been approved, the sanitary flow calculations for lands located outside of the site and outside of the AON Inc. lands, are based on the currently approved official plan. The recreational open space and environmental constraint areas have been excluded from the sanitary design flow calculations. The site-specific policy area has been included as low-density residential area for the purposes of estimating sewage design flows however these design flows will need to be confirmed in the future once the land use has been confirmed. Sewage from the area in purple will drain by gravity from west to east to a permanent SPS located west of the Otonabee River where it will be pumped to the Tower Road gravity sewer. Ideally, the SPS would be designed for the entire east portion of the LSDA including a portion of the site and the AON Inc. property however this will depend on each individual landowner's timing for development. The estimated peak flow from only the area in purple is 48.7L/s.

The combined sewage peak flow that is directed to the 200 mm diameter gravity sewer at the south limit of Tower Road is 74.0 L/s. The existing capacity of the 200 mm diameter sewer between SAN MH 243 and SAN MH 250 is limited by the section of sewer pipe between SAN MH 246 and SAN MH 247 which has a pipe slope of 0.69%. The capacity of a 200 mm diameter sewer sloped at 0.69% (flowing 80% full) is 21.8 L/s.

Based on the above, the existing 200 mm diameter sanitary sewer between SAN MH 243 and SAN MH 250 is undersized to convey the ultimate development peak flow from the LSDA directed to it. However, the existing sewer has capacity to convey some initial development including the estimated peak flows from the site and the majority of the estimated flows from the AON Inc. property.

Recommendations regarding replacement of the existing Tower Road sanitary sewer are summarized in the Technical Memorandum completed by D.M.Wills dated March 13, 2023, which is included in Appendix B.

It is recommended that the timing for upsizing the Tower Road gravity sanitary sewer be resolved with the Township and that the proposed sewer be sized with sufficient capacity for the ultimate buildout of the LSDA.

4.4 SEWAGE TO PROPOSED 375 MM DIAMETER SEWER ALONG RAYS CREEK

Referring to Drawing S-1, the areas highlighted in blue and green illustrate sanitary catchment areas that are proposed to drain to the proposed 375 mm diameter Rays Creek gravity sewer.

The area in blue is a portion of the site development, consisting of 70 townhouse units, 217 single family units, 402 apartment units and up to 4,000 m^2 of ground floor commercial area. The sewage flow calculations exclude the recreational open space area. The estimated peak flow from the area in blue is 39.7 L/s.

The area in green is approximately 10.5 ha and is comprised of a combination of residential and commercial land uses and a recreational speed skating oval. Based on available background information contained in the current County Official Plan, the future use of these lands will consist of 2.6 ha of low-density residential area, 1.1 ha of neighbourhood commercial area, 2.1 ha of site-specific policy area and 0.1 ha of environmental constraint area. The site-specific policy area has been included as neighbourhood commercial area for the purposes of estimating sewage design flows however these design flows will need to be confirmed in the future once the land use has been confirmed. No sewage flows have been assigned for the environmental constraint area or the recreational open space area. The estimated peak flow from the area in green is 13.3 L/s.

The combined sewage peak flows from the areas in blue and green to the proposed 375 mm diameter Rays Creek gravity sewer is 52.4 L/s. The proposed 375 mm diameter sewer at a minimum slope of 0.4% will convey a maximum flow of 88.7 L/s at 80% capacity and therefore will have surplus capacity to convey sewage from the west portion of the LSDA.

The profile and alignment of the 375 mm diameter sewer along Rays Creek was resolved following extensive consultation with the Township and ORCA staff, whereby intrusion into the existing wetland has been minimized as much as possible without compromising the function of the sewer to service a large portion of the LSDA. During pre-consultations directionally drilling was suggested as a means to mitigate potential impacts of the sewer construction on the wetlands. However, from a constructability and long-term maintenance perspective, an open cut sewer installation is recommended due to the varying elevation of bedrock and the difficulty of being able to maintain a constant sewer profile at minimum grade where the drill head enters and exists bedrock. This will be reviewed in detail at the final design stage in consultation with ORCA and the Township. To mitigate impacts of the sewer construction on the wetlands, clay trench plugs are recommended at regular intervals. Rapid sewer construction is also recommended (7 am to 7 pm) and same day reinstatement of the surface material to reduce dewatering activities as much as possible.

The 375 mm diameter sewer will be constructed in phases, only as required to service development in the west portion of the LSDA.

4.5 SEWAGE TO EXISTING SEWERS DOWNSTREAM OF MH 250

The peak sewage design flow from the ultimate buildout of the LSDA to SAN MH 250 is approximately 120.6 L/s and is more than double the estimated peak flow for the LSDA calculated in the background EA of 60.0 L/s. Upon completion of the new gravity sewer extension from Bridge Street to George Street and Fraser Street, which will connect the LSDA to the new George Street SPS, up to 20.0 L/s of peak sewage flows from initial site development within the LSDA can be accommodated in the downstream municipal infrastructure. Once peak sewage flows from the LSDA exceed 20 L/s, additional downstream sanitary system improvements will be required.

Analysis of the existing sanitary sewage collection system, considering the impacts of the proposed development, was completed by D.M.Wills, on behalf of the Township, and provided existing infrastructure available capacity estimates for accommodating future development in the LSDA and provided recommendations for system improvements (including costing for each) to accommodate the ultimate buildout of the LSDA are various development milestones. A full account of the existing sanitary collection system review is available in the Technical Memorandum completed by D.M.Wills dated March 13, 2023, which is included in Appendix B.

It is recommended that sewage flows from the LSDA be monitored on a regular basis as development proceeds to properly plan for the critical downstream infrastructure improvements that are needed to support the ultimate buildout of the LSDA.

4.6 SANITARY DESIGN

The sanitary sewer system will be designed in accordance with MECP design criteria including but not limited to the following:

- An average daily domestic sewage flow of 450 L/c/day is to be used for residential development whereas MECP Design Guidelines recommend a range of 225 to 450 L/c/day. Average daily domestic sewage flow from the commercial uses is to be in accordance with the OBC. Peaking factors are to be calculated in accordance with MECP guidelines;
- Single family and townhouse lots will have individual 100 mm diameter services sloped at a minimum of 2.0%;
- Sanitary services to multi-residential blocks will be sized in the future when additional building details are known;
- Minimum sewer pipe size is 200 mm in diameter;
- Minimum pipe cover from centerline finished grade: 2.75 m;
- Minimum pipe slope of 0.5% for all local sewers and 1.0% for the first upstream leg. The 375 mm diameter Rays Creek sewer will be sloped at a minimum of 0.4% in accordance with MECP guidelines;
- Minimum velocity of 0.6 m/s; and
- Maximum velocity of 3.65 m/s.

The preliminary sewage design calculations are attached in Appendix C and the layout of the proposed sanitary sewer within the site is illustrated on Drawing SAN-1.

5 Internal Roadways and Transportation

A traffic impact assessment was completed for the Lakefield South Development area by Dillon Consulting Limited in 2003. A revised traffic study report was completed by Tranplan Associates in March 2020 and a traffic impact study addendum report was prepared by Tatham in June 2023 in response to comments on the revised traffic study report, received from the County and the Township. The revised analysis includes a comprehensive review of seven study intersections including five existing intersections and two new intersections. The revised traffic impact study by Tranplan and the addendum report by Tatham, which include conclusions and recommendations, have been submitted under separate cover.

The proposed internal roadways will consist of new local roads and collector roads. The new local roads will primarily provide direct access to the low-density residential uses and are proposed to follow a 20.0 m road cross section having an 8.5 m asphalt width which follows the City of Peterborough's Typical Local Road Cross Section. The new collector roads will provide north-south access to the adjacent County and Township road network and east-west access within the subdivision including connecting to the Murray Street and Clementi Street corridor to provide access to the core areas of the Village. The new collector roads are proposed to follow a 26.0 m wide road cross section having a 10.0 m asphalt width which follows the City of Peterborough's Typical 26.0 m wide Collector Road Cross Section.

Active transportation links consisting of typical 1.5 m wide concrete sidewalk and 2.5 m wide multi-use asphalt trails will be incorporated throughout the subdivision and will be connected to the internal sidewalk system along the collector roads and the existing sidewalks along Lakefield Road and Murray Street. Significant consultation between April and June 2023 occurred between Triple T and the Township and County to arrive at an active transportation concept that the Township and County will support. The active transportation concept drawing is attached at the back of this report and is intended to guide the detailed design of the future sidewalks and trails and their connections.

Based on the findings of the geotechnical investigation, the minimum pavement structure designs for the internal roadways and any other areas where truck traffic is anticipated will consist of the following:

- Surface course asphalt – 40 mm HL3 or HL4
- Binder course asphalt – 50 mm HL8
- Granular Base – 150 mm OPSS 1010 granular 'A'
- Granular Subbase – 400 mm OPSS 1010 granular 'B'

In the future, the internal roads will be assumed by the Township which will undertake routine maintenance and snow plowing.

6 Grading

The overall grading design matches existing ground elevations along the perimeter of the site and along the environmental constraint boundary. All site development is proposed outside of the Rays Creek floodplain. We have confirmed there are no existing ground slopes within the development boundary which exceed 3:1 (H:V) and therefore there are no steep slope erosion hazards. Internal road grading has been developed to ensure the majority of stormwater runoff is conveyed to the internal storm sewers which will be sized with capacity for flows generated by a 5-year return period storm event. The internal grading design also minimizes the amount of earth cut and fill and rock excavation while providing sufficient cover over proposed services and while directing stormwater runoff in excess of the storm sewer capacity to the SWM facilities.

The proposed development will be graded in a manner which will satisfy the following goals:

- Minimum road grade: 0.5%
- Maximum road grade: 5.0%
- Minimum lot grade: 2.0%
- Maximum lot grade: 5.0%
- Provide continuous road grades for overland flow conveyance
- Minimize the need for retaining walls
- Minimize the volume of earth to be moved and balance cut with fill on the site
- Minimize the need for rear lot catchbasins
- Achieve the SWM objectives required for the proposed development

Due to the shallow depth to bedrock, rock excavation will be required during servicing construction, primarily for the sanitary sewer installation. This can not be avoided without having to import a large volume of fill which was determined to be cost prohibitive. Due to the shallow depth to bedrock, slab on grade or raised basement type construction, should be considered within the individual building lots to reduce the need for rock excavation.

7 Stormwater Management

The primary objective of the preliminary SWM plan is to demonstrate that the proposed development will not adversely impact the hydrologic cycle and surface water runoff characteristics of the area. This will be accomplished by evaluating the effect of the development on local drainage conditions. Where necessary, solutions will be provided to mitigate any adverse impacts. Issues to be addressed and criteria to be met regarding drainage and SWM are summarized as follows:

- The site will be developed in accordance with all relevant Municipal, Provincial and Agency SWM criteria;
- MECP “Enhanced” treatment level water quality control will be provided, to ensure the development will have no negative impacts on the downstream receivers;
- All post development peak flows directed to each existing outlet will be reduced at or below existing condition peak flow rates during the 2-100-year design storm events based on 4-hour Chicago and 24-hour SCS Type II design storms;
- Existing condition annual infiltration volumes with the catchment area to each outlet are to be matched or increased in the proposed condition;
- Safe conveyance of storm flows from all storms up to and including the Regional (Timmins) Storm event; and
- Implementation of erosion and sediment control measures during and following construction until the ultimate build-out of the site to minimize erosion and sediment transport off-site.

The preliminary SWM plan was prepared recognizing provincial guidelines on water resources and the environment, including the following publications:

- Ministry of Municipal Affairs and Housing Provincial Policy Statement (2020);
- The Otonabee Region Conservation Authority (ORCA) Watershed Planning and Regulations Policy Manual (2012);
- Low Impact Development Stormwater Management Planning and Design Guide (CVC and TRCA, 2010);
- The Ministry of Environment (MOE) Stormwater Management Practices Planning and Design Manual (2003); and
- The Ministry of Natural Resources (MNR) Natural Hazard Technical Guide (2001).

7.1 EXISTING SITE DRAINAGE CONDITIONS

The existing topography, ground cover, and drainage patterns were obtained through a review of relevant background studies, available plans, base mapping, and site investigation. A detailed topographic survey of the site was completed by J.B. Fleguel Surveyors in December 2019 to confirm existing features and elevations.

The site consists primarily of cultivated agricultural field, lightly treed and wetland areas. Existing condition catchment areas within the site have been delineated based on four existing surface water outlets.

The SWM plan proposed herein has been developed to match existing condition peak flow rates at each surface water outlet. Portions of the site which have been identified as either floodplain, wetland or wetland buffer have been excluded from the existing (and proposed) condition catchment areas and hydrologic analysis as these areas are not developable and will remain undisturbed following development. Areas of the site which are located west of Rays Creek have also been excluded on the basis that only the lands east of Rays Creek are proposed for development at this time.

Outlet 1

The northern portion of the site (Outlet 1, Catchment 101 – 2.2 ha) drains overland to the northwest at an average grade of 3.8 % and discharges into an existing wetland located on the east side of Rays Creek. Rays Creek flows north across Lakefield Road via a 3.6 m wide by 1.2 m high concrete box culvert and discharges into Katchewanooka Lake/Otonabee River approximately 650 m north of Lakefield Road.

Outlet 2

The western portion of the site (Outlet 2, Catchment 102 – 12.0 ha) drains overland to the northwest at an average grade of 3.5 % and discharges into a wetland along the east side of Rays Creek.

Outlet 3

The southwest portion of the site (Outlet 3, Catchment 103 – 13.3 ha) drains overland to the southwest at an average grade of 1.6 % discharging into a wetland located east of Lakefield Road, north of 7th Line. Discharge from the wetland drains west across Lakefield Road via a concrete box culvert (approximately 0.9 m wide x 0.9 m high with 0.9 m diameter CSP culvert extensions on either side, and west into Rays Creek approximately 200 m west of Lakefield Road.

Significant consultation occurred between Triple T and ORCA regarding the potential to remove the portion of wetland within the southwest portion of the site at Outlet 3 and to compensate for the removed portion of wetland elsewhere within the overall site at a compensation ratio of 3:1. This would have allowed for a more efficient development plan. However, the preliminary SWM plan included herein preserves and protects the existing wetland feature within the site including an additional 15 m buffer.

Outlet 4

The east portion of the site (Outlet 4, Catchment 104 – 15.5 ha) drains overland to the east at an average grade of 1.6 % discharging into an intermittent tributary watercourse to the Otonabee River which is located on the adjacent property to the east.

The ultimate receiver of runoff from all outlets from the site is the Otonabee River.

An Existing Conditions Drainage Plan, Drawing DP-1, which depicts the existing condition drainage patterns, is included at the back of this report.

7.2 EXTERNAL DRAINAGE CONDITIONS

External drainage areas which drain into the developable portions of the site are described below. Safe conveyance of runoff from external drainage areas has been allowed for in the SWM plan included herein.

Catchment EXT-1 (3.2 ha), consisting of the rear portion of several rural residential lots fronting 7th Line, drains overland into Catchment 103 at an average grade of 2.5%. Runoff from this area combines with runoff from Catchment 103 and discharges into the existing wetland at Outlet 3.

Catchment EXT-2 (1.8 ha), also consisting of the rear portion of several rural residential lots fronting 7th Line, drains overland into Catchment 104 at an average grade of 1.3 %. Runoff from this area combines with runoff from Catchment 104 and drains to Outlet 4, discharging into the intermittent tributary to the Otonabee River.

Catchment EXT-3 (5.3 ha), consisting of the majority of the AON Inc. property drains overland to the northeast in the direction of the Otonabee River at an average grade of 2.1 %. Although runoff from this area does not drain into Catchment 104, it contributes runoff to Outlet 4. The AON Inc. property has the potential to drain into a centralized SWM facility located with Catchment 104 and on this basis, Catchment EXT-3 and PEXT-3 (proposed condition) has been included in the existing and proposed condition hydrologic analyses included herein.

Tower Road consist of a 26.0 m right-of-way and an 11.0 m wide road platform. It is fully urbanized from Lakefield Road to the elevated water storage tower. A storm sewer exists on the west side of the road ranging in size from 600 mm in diameter adjacent to the water tower to 900 mm in diameter where it outlets to an open ditch at an existing headwall located approximately 80 metres south of Lakefield Road. The ditch is located within the 26.0 m road allowance and flows north and west eventually discharging into Rays Creek immediately upstream of a 3.2 m x 1.2 m concrete box culvert at Lakefield Road. The contributing drainage area to the Tower Road storm system consists of Tower Road itself, Coyle Crescent, portions of Murray Street, and the west portion of both the AON Inc., and the Lakefield District Public School properties. The site area west of Tower Road is lower in elevation than the road and therefore drains away from Tower Road. On this basis, the drainage conditions within Tower Road and areas upstream are separated from the internal drainage and SWM plan for the site and have therefore been excluded from the existing and future condition hydrologic analyses included herein.

An Existing and Proposed Condition Drainage Plan, Drawings DP-1 and DP-2, which depict the external drainage conditions, is included at the back of this report.

7.3 EXISTING CONDITION HYDROLOGICAL ANALYSIS

A Visual Otthymo hydrologic model (VO6) has been developed to quantify the existing condition peak flows from the site and external areas.

The catchment delineations were completed based on the site area proposed for development, the environmental constraint boundaries and the limits of external drainage areas draining into the site. Land uses were established based on field reconnaissance and a review of online aerial photography. The land uses and soil information were used to establish the curve numbers (CN) and other catchment parameters used in the hydrologic model. The CN values were converted to modified CN values (CN*) for use in the Otthymo model. The time to peak values for the catchment areas were calculated using the Bransby Williams and Airport Methods for runoff coefficients “C” greater than and less than 0.4 respectively.

A summary of all catchment parameters established for the existing condition hydrologic model have been included in Appendix D.

Peak flows for storms up to and including the 100-year storm were calculated for the 4-hour Chicago and 24-hour SCS Type II design storms generated using the 2006 City of Peterborough Intensity-Duration-Frequency (IDF) Data (Peterborough Airport) as well as for the Regional (Timmins) Storm. Detailed calculations and Visual Otthymo modeling output are included in Appendix D with the results summarized below in Tables 1-4. The digital hydrologic model files are included in the digital link provided with this report.

Table 1: Existing Conditions Peak Flow Summary – Outlet 1

DESIGN STORM	CATCHMENT 101 2.2 ha (m^3/s)	
	CHI	SCS
25 mm	0.010	-
2-Year	0.020	0.041
5-Year	0.041	0.073
10-Year	0.058	0.097
25-Year	0.082	0.131
50-Year	0.103	0.157
100-Year	0.126	0.185
Regional Storm (Timmins)	0.220	

Table 2: Existing Conditions Peak Flow Summary – Outlet 2

DESIGN STORM	CATCHMENT 102 12.0 ha (m^3/s)	
	CHI	SCS
25 mm	0.050	-
2-Year	0.099	0.202
5-Year	0.203	0.359
10-Year	0.286	0.480
25-Year	0.410	0.648
50-Year	0.515	0.784
100-Year	0.628	0.924
Regional Storm (Timmins)	1.174	

Table 3: Existing Conditions Peak Flow Summary – Outlet 3

DESIGN STORM	CATCHMENT 103 13.3 ha (m^3/s)		CATCHMENT EXT-1 3.2 ha (m^3/s)		TOTAL OUTLET 3 16.5 ha (m^3/s)	
	CHI	SCS	CHI	SCS	CHI	SCS
25 mm	0.047	-	0.013	-	0.058	-
2-Year	0.088	0.156	0.025	0.048	0.109	0.197
5-Year	0.171	0.270	0.050	0.084	0.214	0.342
10-Year	0.236	0.357	0.070	0.113	0.296	0.453
25-Year	0.332	0.477	0.100	0.151	0.417	0.606
50-Year	0.413	0.573	0.125	0.183	0.520	0.729
100-Year	0.500	0.671	0.152	0.215	0.631	0.855
Regional Storm (Timmins)	1.106		0.303		1.394	

Table 4: Existing Conditions Peak Flow Summary – Outlet 4

DESIGN STORM	CATCHMENT 104 15.5 ha (m^3/s)		CATCHMENT EXT-2 1.8 ha (m^3/s)		CATCHMENT EXT-3 5.3 ha (m^3/s)		TOTAL OUTLET 4 22.6 ha (m^3/s)	
	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS
25 mm	0.063	-	0.008	-	0.025	-	0.095	-
2-Year	0.117	0.212	0.015	0.028	0.046	0.085	0.176	0.322
5-Year	0.229	0.368	0.029	0.048	0.090	0.148	0.344	0.557
10-Year	0.317	0.486	0.041	0.063	0.125	0.195	0.477	0.736
25-Year	0.446	0.649	0.057	0.085	0.176	0.261	0.671	0.983
50-Year	0.555	0.780	0.071	0.102	0.219	0.314	0.837	1.182
100-Year	0.672	0.915	0.086	0.119	0.266	0.368	1.014	1.387
Regional Storm (Timmins)	1.392		0.169		0.507		2.061	

7.4 STORMWATER MANAGEMENT ALTERNATIVES

The preliminary SWM plan is subject to the review and approval of the Township, County and ORCA. For intensive development SWM practices to provide both quantity and quality control of stormwater runoff are required. The MECP SWM design guidelines recommends using the following methods of stormwater management:

Lot Level Source Controls

Lot level controls include measures such as roof leader soak away pits, rear yard ponding areas, reduced grading, rear and side yard swales and other localized lot grading. Other methods of at-source stormwater management controls include Low impact development (LID) practices including rainwater harvesting, green roofs, roof downspout disconnection, infiltration trenches and chambers, vegetated filter strips and permeable pavement. These methods of stormwater control are beneficial since they reduce peak flows from storm events before being conveyed to the watershed. However, the above practices are site specific based on the existing soil conditions and require regular maintenance to be effective. Use of these practices is recommended but only to an extent that is achievable without requiring excessive maintenance.

Conveyance Controls

Infiltration trenches and perforated pipes are two examples of conveyance controls. Typically, these controls attempt to attenuate peak flows on route to the watershed by allowing the stormwater to infiltrate the existing soil. These methods of controlling stormwater are only effective if the soils have good drainage capabilities as the soil that exists onsite. Poor construction practices also reduce the effectiveness of these stormwater management controls. Conveyance controls should be evaluated further at the final design stage.

End-of-Pipe Facilities

End-of-pipe facilities are typically wet ponds, dry ponds or wetlands that control stormwater runoff from an entire development area. These facilities allow all stormwater to be retained and released at a rate equal to that of pre-development and can provide effective quality and quantity control of storm events. The major negative attributes of these facilities are that they require significant land area to provide the treatment controls thus the larger the development the greater the required pond size.

The preliminary SWM plan for the site includes two oil-grit-separators, two dry ponds and three wet ponds. These facilities will provide water quantity and quality control for the proposed development. Additional LID practices including increased topsoil depth combined with roof downspout disconnection, infiltration trenches , and enhanced grassed swales will be specified as required to match or increase the existing annual infiltration volume and to reduce the runoff volume directed to each outlet.

7.5 STORMWATER MANAGEMENT PLAN

The preliminary SWM plan for the site has been developed recognizing the SWM requirements for the site. The internal roadways will be constructed to a municipal road cross section standard with all minor system drainage from the roadways and the development areas being captured by a network of storm sewers sized to convey flow from the 5-year storm. Roads and overall lot grading will be constructed to follow the existing topography of the land as much as possible to maintain the pre-development drainage patterns, while still directing major flows overland to the SWM facilities.

The proposed condition drainage patterns are shown on Drawing DP-2.

Separate SWM plans have been developed for each outlet and are described below. LID practices, which will contribute towards maintaining the annual infiltration volume at the site and ensuring a treatment train approach to SWM will be specified upstream of each outlet. The details of the proposed LIDs will be resolved at the final design stage whereas sizing of end-of-pipe SWM facilities is provided herein to demonstrate adequate area has been provided within each SWM block.

Outlet 1

A dry SWM facility (SWMF 1) is proposed to provide water quantity control for runoff from Catchment 201 (2.2 ha). SWMF 1 will be designed to control all flows up to and including the 100-year storm such that the controlled peak flows from Catchment 201 are reduced at or below existing condition peak flow rates at Outlet 1. The water quality volume of SWMF 1 (described further in the Water Quality section below) will be released over a minimum of 24 hrs and will form part of the water quantity control volume. An emergency overflow will be incorporated into the pond design to safely convey all emergency flows directly to Rays Creek.

Since the drainage area of Catchment 201 is less than 5.0 ha, a wet pond cell to provide enhanced level water quality control is not feasible. An oil-grit separator is therefore proposed upstream of the dry pond cell to provide pre-treatment and MECP enhanced level water quality control. Additional LID type practices including infiltration galleries for infiltrating rooftop runoff will be analysed in detail at the final design stage in consideration of the detailed site grading and shallow depth of bedrock.

Outlet 2

The preliminary SWM plan for Outlet 2 includes a wet SWM facility (SWMF 2) which will provide water quality and quantity control for the western portion of the site including runoff from all of Catchment 202 (16.5 ha). SWMF 2 will be designed to control all flows up to and including the 100-year storm such that the controlled peak flows from Catchment 202 are reduced at or below existing condition peak flow rates at Outlet 2. A sediment forebay will be designed at each inlet and in accordance with MECP design criteria to provide pre-treatment. An emergency overflow will be incorporated into the pond design to safely convey all emergency flows to Rays Creek.

Outlet 3

The preliminary SWM plan for Outlet 3 includes a wet SWM facility (SWMF 3) and a small dry SWM facility in combination with an OGS (SWMF 5), each providing water quality and quantity control for the southwest portion of the site including runoff from Catchment 203 (5.4 ha), 205 (1.1 ha) and external area EXT-1 (3.2ha). SWMF 3 and SWMF 5 will be designed to control all flows up to and including the 100-year storm such that the combined controlled peak flows will be reduced at or below existing condition peak flows at Outlet 3. A sediment forebay will be designed at the wet pond storm sewer inlet in accordance with MECP design criteria to provide pre-treatment. The OGS will provide pre-treatment for the dry SWM pond. 24 hour extended detention will be provided within SWMF 3 for erosion control. Both facilities will be design with emergency overflows to safely convey all emergency flows to the receiving wetland.

A critical component of the SWM plan for Outlet 3 is to ensure the hydrologic conditions in the existing onsite wetland which is being maintained are generally maintained in the proposed condition. This will be accomplished by ensuring the 25 mm storm runoff volume from SWMF 3 which discharges into the upstream portion of the wetland matches or exceeds the existing 25 mm storm runoff volume to the existing wetland. This will be described in more detail in the sections to follow.

Outlet 4

The preliminary SWM plan for Outlet 4 includes a wet SWM facility (SWMF 4) which will provide water quality and quantity control for the eastern portion of the site as well as the future AON Inc. property. The SWMF 4 will control runoff from Catchments 204 (16.3 ha), EXT-2 (1.8 ha), and PEXT-3 (6.9 ha) and direct it to an intermittent watercourse at Outlet 4. Stormwater runoff will drain into the SWMF 4 via two inlets. A sediment forebay will be designed at each storm sewer inlet in accordance with MECP design criteria to provide pre-treatment. Sufficient water quantity control is provided in the pond to reduce post development peak flows during all storms up to and including the 100-year storm such that the proposed condition peak flows to Outlet 4 are reduced at or below existing condition peak flow rates. 24 hour extended detention will also be provided within SWMF 4 for erosion control. An emergency overflow will be incorporated into the pond design to safely convey all emergency flows from SWMF 4 to Outlet 4.

A proposed conditions drainage plan (Dwg. DP-2) illustrating details of all catchment areas and preliminary SWM Facility layouts (Dwgs. SWM-1 – SWM-5) providing preliminary details of each SWM facility, are included at the back of this report. It is noted that the SWM facility details provided are intended specifically to confirm SWM block sizing whereas additional details and calculations will be provided at the detailed design stage.

7.5.1 Internal Conveyance of External Drainage

Minor and major system drainage from external Catchments EXT-1 and EXT-2 will be captured by rear lot swales and rear lot catchbasins and will be safely conveyed to SWMF 3 and 4 respectively.

Treatment and control of runoff from Catchment PEXT-3, which includes all of the AON inc. property, has been allowed for in the sizing of SWMF 4 and runoff will be conveyed to the SWMF 4 via the minor and major storm drainage systems.

7.5.2 Emergency Overland Flow Route

Major system drainage, including runoff from storms greater than the 5-year storm, will be conveyed overland within the roadways to the proposed SWM facilities. Minimum 6.0 m wide drainage blocks between the roadways and the SWM facilities are provided for safe conveyance of emergency overland flows.

Hydraulic calculations confirming the conveyance routes within the proposed roadways and drainage easements are provided in Appendix D. Drawing DP-3, which illustrates the major storm drainage areas used in the conveyance calculations, is attached at the back of this report.

7.5.3 SWM Facility Design Criteria

The final design of the SWM facilities to service the site and external lands will consider the following:

- Sizing of the stormwater quantity control component of the facilities must ensure the post development peak runoff rates from the site are reduced at or below existing conditions and must be exclusive of the storage needed for the quality control component based on current MECP design guidelines;
- Sizing of the stormwater quality control component of the facilities must achieve “Enhanced” protection and erosion control at each outlet and thus the facilities must have water quality

control volumes as determined using Table 3.2 of the MECP SWM design guidelines. 24 hour extended detention of the 25 mm storm runoff volume must also be provided for erosion control for all contributing drainage areas larger than 2.0 ha;

- SWM facilities with permanent pools will be designed with bottom draw outlets to reduce thermal impacts to the downstream receivers;
- Sediment drying areas, located above the 2-year pond water level and sloped at a maximum of 10:1, are to be incorporated in the proposed wet pond grading designs to facility sediment removal in the future;
- Any overtopping of the SWM facilities during the regional storm event must be safely conveyed to the receiving drainage path;
- Optimization of suspended solids and heavy metal removal efficiencies by locating minor system inlets and SWM facility outlets as far apart as possible to prevent short circuiting;
- Optimize nutrient uptake potential and diversity of plantings to enhance local aquatic and wildlife habitats; and
- Consider operation and maintenance requirements and frequency and include as part of the design process.

7.5.4 Water Quantity Control

A hydrologic analysis of the post development condition was completed utilizing the single event Visual OTTHYMO Hydrologic Model. Peak flow rates for the 100-year storm events were calculated for the 4-hour Chicago and 24-hour SCS Type II design storms generated using City of Peterborough IDF data (Peterborough Airport) as well as for the Regional (Timmins) storm.

The catchment delineation for the contributing lands was completed utilizing the available topographic mapping and the Draft Plan of Subdivision prepared by J.B. Fleguel Surveyors. The total impervious (TIMP) and percent directly connected imperviousness for the single-family residential was assumed to be 55% and 45% respectively whereas 75% TIMP and 55% XIMP was assumed for medium density residential (townhouses) and 90% TIMP and 90% XIMP for higher density apartment building blocks. The impervious area calculations were determined in Civil 3D. A summary of all catchment parameters established for the post development hydrologic model have been included in Appendix D.

The time to peak values for the individual catchment areas were calculated using either the Bransby Williams and Airport Methods for runoff coefficient “C” values greater than and less than 0.4, respectively.

Post development peak flow rates at each outlet are shown in Tables 5-8 respectively and the results of the modelling are attached in Appendix D.

Table 5: Proposed Conditions Peak Flow Summary – Outlet 1

DESIGN STORM	CATCHMENT 201 2.2 ha UNCONTROLLED (m^3/s)		CATCHMENT 201 2.2 ha CONTROLLED (m^3/s)	
	CHI	SCS	CHI	SCS
25 mm	0.349	-	0.010 (0.010)	-
2-Year	0.350	0.292	0.018 (0.020)	0.026 (0.041)
5-Year	0.468	0.394	0.033 (0.041)	0.045 (0.073)
10-Year	0.547	0.462	0.044 (0.058)	0.059 (0.097)
25-Year	0.646	0.548	0.060 (0.082)	0.077 (0.131)
50-Year	0.720	0.614	0.073 (0.103)	0.092 (0.157)
100-Year	0.795	0.678	0.086 (0.126)	0.107 (0.185)
Regional Storm (Timmins)	0.253		-	

Notes: (0.010) refers to existing condition peak flow rate.

Table 6: Proposed Conditions Peak Flow Summary – Outlet 2

DESIGN STORM	CATCHMENT 202 16.5 ha UNCONTROLLED (m^3/s)		CATCHMENT 202 16.5 ha CONTROLLED (m^3/s)	
	CHI	SCS	CHI	SCS
25 mm	1.213	-	0.063 (0.050)	-
2-Year	1.378	1.322	0.087 (0.099)	0.107 (0.202)
5-Year	1.912	1.860	0.153 (0.203)	0.212 (0.359)
10-Year	2.273	2.336	0.214 (0.286)	0.298 (0.480)
25-Year	2.805	2.859	0.311 (0.410)	0.425 (0.648)
50-Year	3.180	3.265	0.399 (0.515)	0.532 (0.784)
100-Year	3.563	3.672	0.493 (0.628)	0.646 (0.924)
Regional Storm (Timmins)	1.862		-	

Notes: (0.050) refers to existing condition peak flow rate.

Table 7: Proposed Conditions Peak Flow Summary – Outlet 3

DESIGN STORM	CATCHMENT 203 + EXT-1 8.6 ha CONTROLLED (SWMF 3) (m^3/s)		CATCHMENT 205 1.1 ha CONTROLLED (SWMF 5) (m^3/s)		CATCHMENT 206 1.5 ha UNCONTROLLED (m^3/s)		TOTAL OUTLET 3 11.2 ha (m^3/s)	
	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS
25 mm	0.053	-	0.009	-	0.007	-	0.068 (0.058)	-
2-Year	0.075	0.095	0.012	0.014	0.013	0.025	0.098 (0.109)	0.129 (0.197)
5-Year	0.131	0.178	0.018	0.024	0.026	0.043	0.170 (0.214)	0.239 (0.342)
10-Year	0.181	0.242	0.026	0.033	0.036	0.057	0.237 (0.296)	0.325 (0.453)
25-Year	0.257	0.337	0.036	0.044	0.051	0.076	0.339 (0.417)	0.451 (0.606)
50-Year	0.325	0.417	0.044	0.055	0.063	0.091	0.427 (0.520)	0.558 (0.729)
100-Year	0.397	0.503	0.054	0.067	0.076	0.107	0.524 (0.631)	0.674 (0.855)
Regional Storm (Timmins)	-		-		0.143		1.185	

Notes: (0.058) refers to existing condition peak flow rate.

Table 8: Proposed Conditions Peak Flow Summary – Outlet 4

DESIGN STORM	CATCHMENT 204 16.3 ha UNCONTROLLED (m^3/s)		CATCHMENT EXT-2 1.8 ha (m^3/s)		CATCHMENT PEXT-3 6.9 ha (m^3/s)		TOTAL OUTLET 4 25.0 ha CONTROLLED (m^3/s)	
	CHI	SCS	CHI	SCS	CHI	SCS	CHI	SCS
25 mm	1.505	-	0.008	-	0.915	-	0.092 (0.095)	-
2-Year	1.699	1.540	0.015	0.028	0.931	0.789	0.149 (0.176)	0.215 (0.322)
5-Year	2.333	2.157	0.029	0.048	1.280	1.069	0.274 (0.344)	0.358 (0.557)
10-Year	2.761	2.569	0.041	0.063	1.505	1.321	0.358 (0.477)	0.508 (0.736)
25-Year	3.501	3.190	0.057	0.085	1.791	1.580	0.532 (0.671)	0.745 (0.983)
50-Year	3.963	3.615	0.071	0.102	2.006	1.778	0.693 (0.837)	0.933 (1.182)
100-Year	4.432	4.239	0.086	0.119	2.223	1.974	0.861 (1.014)	1.147 (1.387)
Regional Storm (Timmins)	1.862		0.169		0.798		2.827	

Notes: (0.095) refers to existing condition peak flow rate.

Preliminary stage-storage-discharge data was input into the "route reservoir" commands of the hydrologic model to confirm the quantity control storage requirements and corresponding land allocation for the SWM facility blocks are appropriate. Specific details relating to the pond outlet control structures will be determined at the final design stage.

SWMF 1 has approximately 1,353 m^3 of active storage including an additional 0.3 m of freeboard as illustrated on Drawing SWM-1, whereas 1,172 m^3 of active storage is required during the 100-year 24-hour SCS design storm.

SWMF 2 has approximately 7,796 m^3 of active storage including an additional 0.3 m of freeboard, whereas 6,817 m^3 of active storage is required during the 100-year 24-hour SCS design storm.

SWMF 3 has approximately 2,133 m^3 of active storage including an additional 0.3 m of freeboard, whereas 1,872 m^3 of active storage is required during the 100-year 24-hour SCS design storm.

SWMF 4 has approximately 11,125 m^3 of active storage including an additional 0.3 m of additional freeboard, whereas 10,955 m^3 of active storage is required during the 100-year 24-hour SCS design storm.

SWMF 5 has approximately 444 m^3 of active storage including an additional 0.3 m of additional freeboard, whereas 361 m^3 of active storage is required during the 100-year 24-hour SCS design storm.

A comparison of the post development peak flow summaries with the existing condition peak flow summaries confirms the proposed SWM plan will attenuate the 2-year through 100-year post development peak flows directed to each outlet at or below existing condition peak flow rates.

Preliminary stage-volume tables of each facility are included in Appendix D.

7.5.5 Water Quality Control

Water quality control for the development will be provided primarily within the proposed SWM facilities which have been designed to remove a minimum of 80% TSS prior to off-site discharge. An oil-grit-separator is also proposed upstream of SWMF 1 and SWMF 5 since on their own, both facilities only provide basic level water quality treatment.

Water quality control plans have been developed for each outlet and are described below. It is noted that the water quality control calculations and storage volumes provided within each SWM facility do not consider the additional water quality benefits of any upstream LID practices and thus are conservative as it relates to water quality treatment of runoff from the proposed development.

Outlet 1

Catchment 201 (2.2 ha) has an estimated imperviousness of 85%. As per MECP guidelines for dry ponds, 243.4 m^3/ha of water quality storage volume is required for basic treatment level (60% long-term TSS removal) and is to be released over a minimum of 24 hours. The corresponding water quality storage volume is 536 m^3 whereas SWMF 1 includes 1,353 m^3 of active storage volume. It is noted that the water quality storage volume will make up a portion of the water quantity control storage volume.

An oil-grit-separator, sized to provide MECP enhanced treatment of runoff (80% long-term TSS removal), will be proposed upstream of SWMF 1. OGS units are effective at providing water quality treatment for contributing areas less than 5.0 ha provided that they are maintained on a regular basis. Sizing details for the OGS will be provided at the final design stage.

Outlet 2

Catchment 202 (16.5 ha) has a total estimated imperviousness of 60%. As per MECP guidelines for wet ponds, 197.7 m^3/ha of which 157.7 m^3/ha is required for the permanent pool volume and the larger of 40 m^3/ha or the 25 mm runoff volume released over a minimum of 24 hours is required for extended detention. The corresponding permanent pool volume required for water quality control is 2,602 m^3 whereas 9,831 m^3 of permanent pool is provided in SWMF 2. The extended detention volume will make up a portion of the water quantity control storage volume.

Outlet 3

Catchment 203 + EXT1 (8.6 ha) have a weighted imperviousness of 38%. As per MECP guidelines for wet ponds, 148.4 m^3/ha of which 108.4 m^3/ha is required for the permanent pool volume and the larger of 40 m^3/ha or the 25 mm runoff volume released over a minimum of 24 hours is required for extended detention. The corresponding permanent pool volume required for water quality control is 933 m^3 whereas 2,185 m^3 of permanent pool is provided. The extended detention volume for the contributing area makes up a small portion of the water quantity control storage volume.

The contributing area to SWMF 5, 1.1 ha, is less than the minimum drainage area required to sustain a permanent pool in a typical wet pond. On this basis a dry SWM pond is proposed. As per MECP guidelines for dry ponds, 150 m^3/ha of water quality storage volume is required for basic treatment level (60% long-term TSS removal) and is to be released over a minimum of 24 hours. The corresponding water quality storage volume is 169 m^3 whereas SWMF 5 includes 444 m^3 of active storage volume. It is noted that the water quality storage volume will make up a portion of the water quantity control storage volume.

An oil-grit-separator, sized to provide MECP enhanced treatment of runoff (80% long-term TSS removal), will be proposed upstream of SWMF 5. OGS units are effective at providing water quality treatment for contributing areas less than 5.0 ha provided that they are maintained on a regular basis. Sizing details for the OGS will be provided at the final design stage.

Outlet 4

Catchment 204 + EXT2 + PEXT3 (25.0 ha) have an estimated imperviousness of 66%. As per MECP guidelines for wet ponds, 211.7 m^3/ha of which 171.7 m^3/ha is required for the permanent pool volume and the larger of 40 m^3/ha or the 25 mm runoff volume released over a minimum of 24 hours is required for extended detention. The corresponding permanent pool volume required for water quality control in the wet pond is 4,293 m^3 whereas 4,750 m^3 of permanent pool is provided. The extended detention volume for the contributing area makes up a small portion of the water quantity control storage volume.

The above calculations confirm the preliminary SWM plans at each outlet exceed the MECP requirements for water quality treatment.

7.5.6 Water Balance

An existing and proposed condition water balance for the contributing area to each outlet has been prepared in accordance with the Conservation Authority Guidelines for Hydrogeological Assessments, June 2013. The proposed condition was prepared with and without mitigation measures which at this early juncture includes increased topsoil depth combined with roof downspout disconnections which based on the CVC/TRCA LID manual have the effect of reducing annual runoff volume by 50% in areas having HSG ‘A’ and ‘B’ type soils.

Roof downspout disconnections on all single detached and townhouse dwellings have been considered and will have the effect of infiltrating approximately 24,636 m^3 of rooftop runoff from the overall site on an annual basis.

The results of the water balances are summarized in Table 9 below. Detailed water balance calculations are included in Appendix E.

Table 9: Water Balance Summary – Outlet 1,2,3,4

		OUTLET 1			OUTLET 2			OUTLET 3			OUTLET 4		
		Ex.	Pr.		Ex.	Pr.		Ex.	Pr.		Ex.	Pr.	
			W/O LID	With LID		W/O LID	With LID		W/O LID	With LID		W/O LID	With LID
Area	ha	2.20	2.20		12.0	16.5		16.5	11.2		22.6	25.0	
Precipitation	mm	855											
	m³	18,819	18,819		102,648	141,141		141,141	95,890		193,320	213,850	
Evapo-transpiration	mm	579	235		583	325		572	414		568	297	
	m³	12,737	5,160		69,957	53,617		94,378	46,416		128,358	74,138	
Infiltration	mm	124	16	16	123	55	134	128	93	138	129	48	74
	m³	2,737	357	357 (-87%)	14,711	9,082	22,153 (+51%)	21,043	10,435	15,499 (-26%)	29,233	12,087	18,588 (-36%)
Runoff	mm	152	605	605	150	475	396	156	348	303	158	511	485

As indicated in Table 9, additional infiltration measures within the contributing areas to outlets 1, 3 and 4 will be required as the total annual infiltration is shown to decrease by 87%, 26% and 36 % respectively. Rear yard catchbasins connected to perforated pipe systems is one example of an LID infiltration practice that will be evaluated during the final design stage to increase infiltration.

The annual infiltration within the contributing area to Outlet 2 is estimated to increase by 51% in the proposed condition and therefore does not require any further mitigation efforts.

7.5.7 Outlet 3 Wetland Hydrology

As described in Section 7.5 above, a critical component of the SWM plan for Outlet 3 is to ensure the hydrologic conditions in the existing onsite wetland, are generally maintained in the proposed condition. This has been confirmed by comparing the 25 mm storm runoff volume from Catchments 103 and EXT-1 to the existing wetland (2.7 mm or 442 m^3) to the 25 mm storm runoff volume from SWMF 3 (9.6 mm or 828 m^2) which demonstrates the existing wetland will receive sufficient surface water input to maintain its existing condition function. Additional hydrologic analysis confirming how the protected wetland feature will be supported by the proposed SWM plan will be provided at the detailed design stage however the work completed to date confirms that there are adequate surface water inputs available from SWMF 3.

8 Erosion and Sediment Control

Erosion and sediment control measures will be implemented for all construction activities within the development site including vegetation clearing, topsoil stripping, grading, and stockpiling of materials. The basic principles considered to minimize erosion and sedimentation and resultant negative environmental impacts include:

- All erosion control devices to be specified in accordance with MNR and OPSD guidelines;
- Silt control fences to be erected before the commencement of any grading operations to control sediment movement;
- A designated construction vehicle entrance(s) to Lakefield Road, with a stone mud mat to reduce off-site tracking of material;
- Temporary swales, temporary silt ponds, and check dams to be constructed to control runoff during construction by lowering velocities and promoting settling of particulates;
- All topsoil piles are to be surrounded with light duty silt fence and are to be seeded immediately upon completion of earthworks;
- Catchbasins will be fitted with filter fabric screens during construction activities, and cleaned out as required and prior to assumption of the works;
- Expose the smallest possible land area to erosion for the shortest possible time;
- Long term siltation and erosion control will be enhanced with a re-vegetation strategy for disturbed areas;
- Confine refuelling and servicing of equipment to areas well away from the drainage systems; and
- Regular inspection of control measures to be instituted through a monitoring and mitigation plan and repairs will be made as necessary. Bi-weekly inspections of the site erosion and sediment control should be completed.

A detailed erosion and sediment control plan will be prepared with the final engineering design of each phase of development.

9 Utilities

Peterborough Distribution Inc., Bell Canada, Nexicom and Enbridge have been contacted to confirm their capability to provide services to the site.

Hydro service is currently available on Lakefield Road however further consultation with Hydro One is required to confirm their existing infrastructure can be expanded to service the site. This will occur during final design of the initial phase of development.

Bell Canada has confirmed fibre-optic infrastructure will be available to service the proposed development.

Nexicom has confirmed cable, internet and telephone infrastructure is available in the area to service the proposed development.

Enbridge has confirmed gas is available along Lakefield Road and 7th Line. However, it is too early in the development process for Enbridge to confirm that gas will be available to service the proposed development. Further coordination is required with Enbridge to confirm that the existing gas infrastructure is sufficient to supply the proposed development.

Correspondence with each utility provider confirming the above information is included in Appendix F.

10 Summary

The servicing strategy presented for the proposed development demonstrates the site can be serviced to accommodate the 940 proposed residential units and up to 4,000 m^2 ground floor commercial uses.

The water supply for the site will be provided from the municipal water distribution system. The 300 mm diameter watermain on Tower Road is proposed to service the Phase 1 site development. However, in accordance with PUC and Township requirements, no more than 50 units are to be constructed before a second redundant feed is provided. The 200 mm diameter Murray Street watermain extension to Tower Road is required for the ultimate development of the AON Inc. property as well as Phase 2 and subsequent phases of development within the site. It is noted that a potential watermain connection exists, through the servicing block between Tower Road and Coyle Crescent to provide a redundant feed to Phase 1 and to enable construction of up to 50 units in Phase 2, in advance of extending the Murray Street watermain to Tower Road however further review of the water distribution model and consultation with the Township is required to confirm the broader effects of this connection.

The existing 200 mm diameter sanitary sewer on Tower Road is undersized to convey the ultimate development peak flow from the LSDA. However, the existing sewer has capacity to convey some initial development including estimated peak from approximately 9.4 ha of the site and the majority of the estimated flows from the AON Inc. property (6.5 ha). It is recommended that the timing for upsizing the Tower Road gravity sanitary sewer be resolved with the Township and that the proposed sewer be sized with sufficient capacity for the ultimate buildout of the LSDA. The sewage peak flows from the majority of the site including future development lands southwest of the site will drain by gravity to a proposed 375 mm diameter sewer located along Rays Creek on the east side and will discharge into the Tower Road gravity sanitary sewer approximately 160 metres south of Lakefield Road. The new gravity sewer extension from Bridge Street to George Street and Fraser Street by the Township, which provided a connection from the LSDA to the new George Street SPS, allows up to 20.0 L/s of peak sewage flows from initial site development within the LSDA. Once peak sewage flows from the LSDA exceed approximately 20 L/s, additional downstream sanitary system improvements, outside of the LSDA will be required.

Additional technical analysis and recommendations related to external water and wastewater infrastructure improvement recommendations have been advanced by the Township and are included in the Technical Memorandum completed by D.M.Wills dated March 13, 2023, which is included in Appendix B.

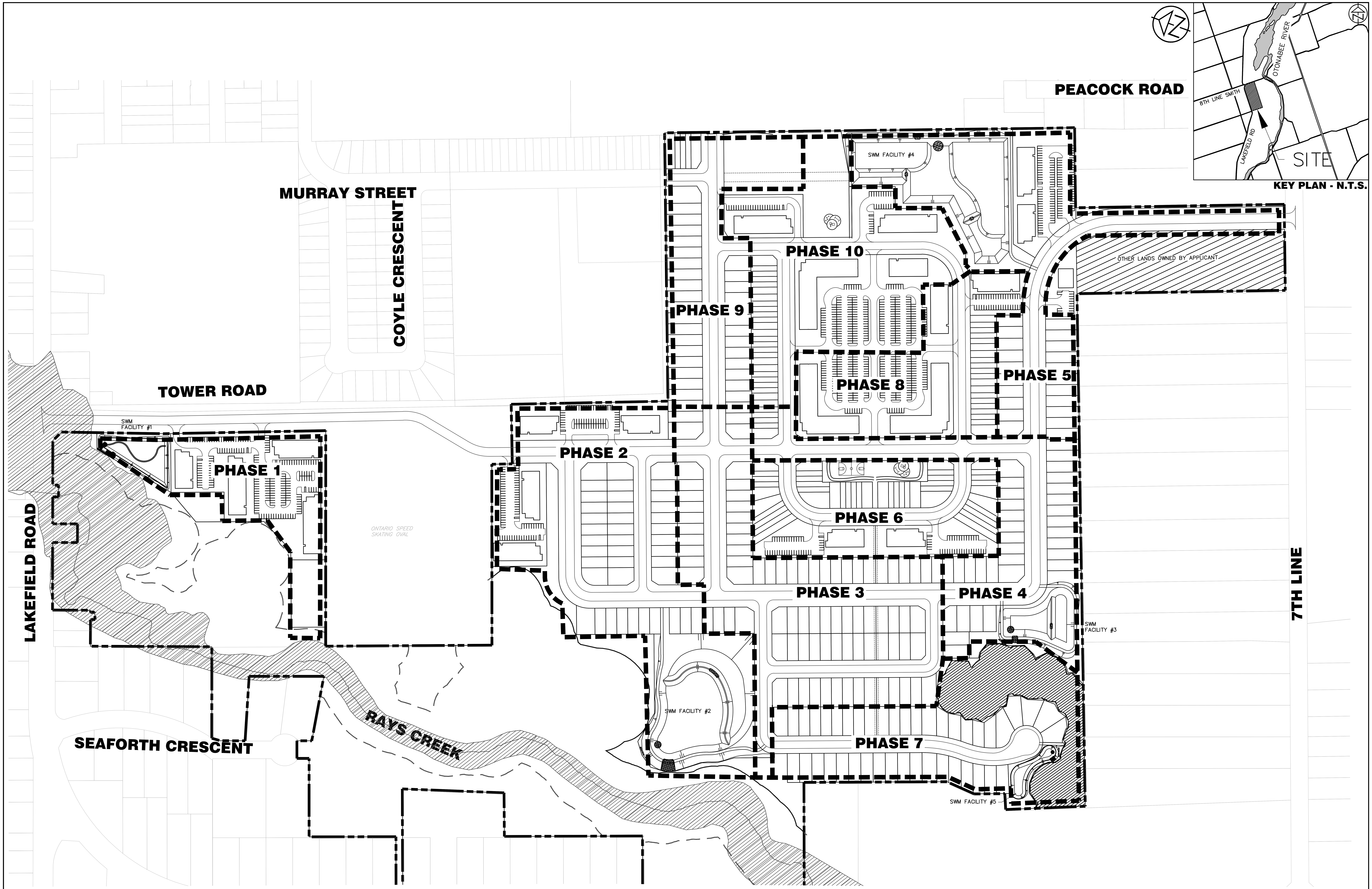
The preliminary SWM plan includes five SWM facilities including two dry SWM ponds (SWMF 1 and SWMF 5), and three wet SWM ponds (SWMF 2,3,4), each providing a combination of water quality and quantity controls at each existing drainage outlet from the site. An OGS is also proposed upstream of each of SWMF 1 and SWMF 5 to achieve the required water quality control criteria. LID practices will be designed at the final design stage as required in order to meet the water balance criteria for the site which includes matching or exceeding the existing annual infiltration volume within the contributing drainage area of each surface water outlet.

An existing and proposed condition water balance for the contributing area to each outlet has been prepared. LID practices are required within the contributing areas to Outlets 1, 3 and 4 to increase the annual post development infiltration volume to match or exceed the existing condition annual infiltration volume. The annual infiltration volume within the contributing area to Outlet 2 is estimated to increase in the proposed condition compared to the existing condition and therefore does not require any further mitigation efforts.

The proposed SWM plan for Outlet 3 ensures the hydrologic conditions in the existing onsite wetland, which is proposed to be protected, are generally maintained by ensuring the surface water inputs from SWMF 3 into the wetland during the 25 mm storm even match or exceed the existing condition surface water inputs. Additional hydrologic analysis confirming how the protected wetland feature will be supported by the proposed SWM plan will be provided at the detailed design stage, however, the work completed to date confirms that there is adequate surface water inputs available from SWMF 3.

The availability of existing utilities (hydro, telephone, cable, and gas) has been confirmed with each provider however further coordination is required and will be completed during the final design stage. Final utility designs will be completed as the project proceeds and plans are finalized.

In conclusion, the preliminary servicing and SWM design information included herein confirms the feasibility of the proposed development and thus is adequate to support the proposed Draft Plan of Subdivision.



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ENGINEER STAMP

3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

TATHAM ENGINEERING

PHASING PLAN

DESIGN: JA/HY	FILE: 517651	DWG:
DRAWN: HY	DATE: JULY 2020	**PH-1**
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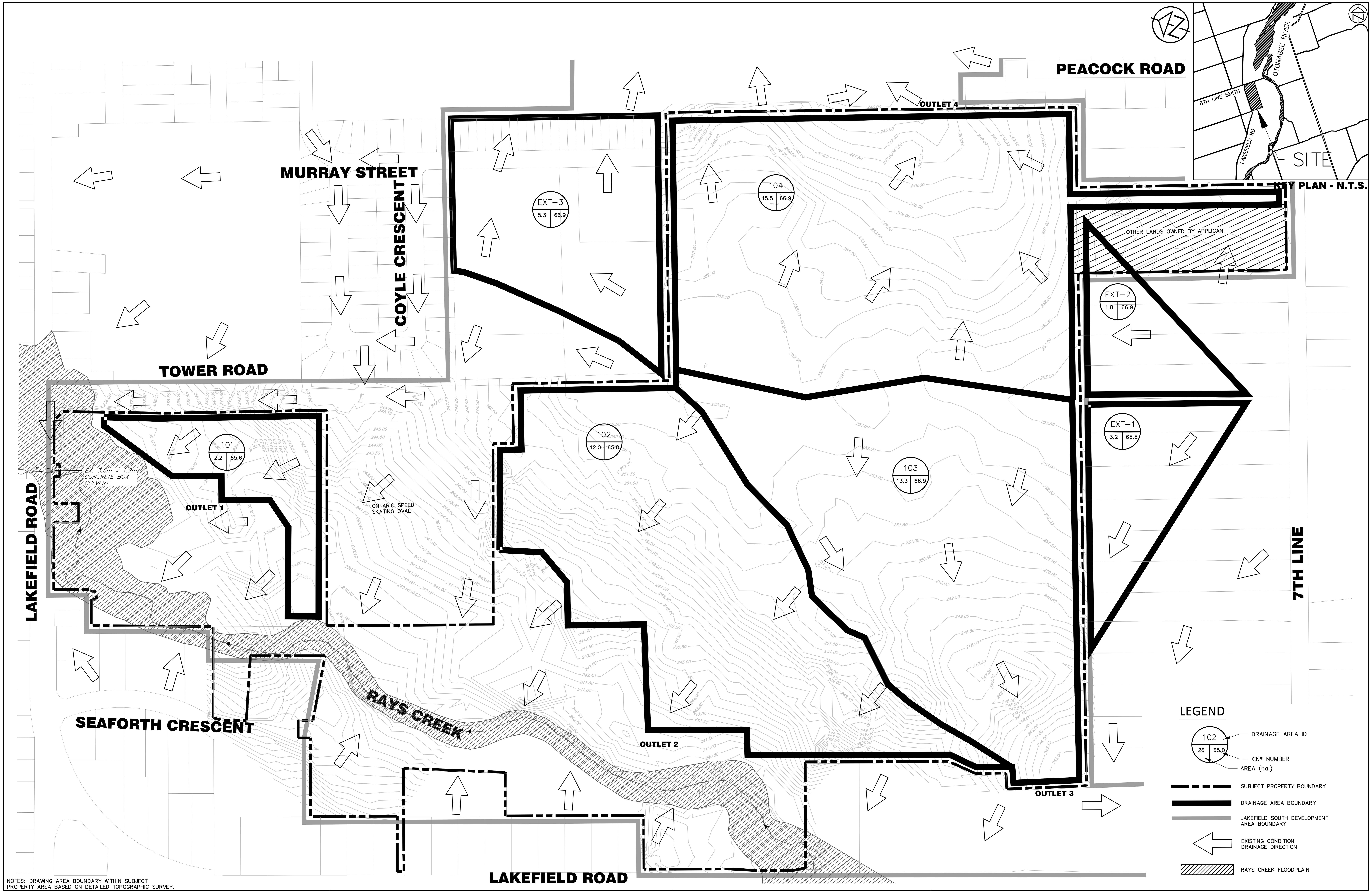

NOTES: DRAWING AREA BOUNDARY WITHIN SUBJECT PROPERTY AREA BASED ON DETAILED TOPOGRAPHIC SURVEY.

CONTOUR INFORMATION OBTAINED FROM LAND INFORMATION ONTARIO (LIO), PROVINCIAL DIGITAL ELEVATION MODEL.

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3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

EXISTING CONDITIONS
DRAINAGE PLAN

TATHAM ENGINEERING

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DRAWN: HY	DATE: JULY 2020	DP-1
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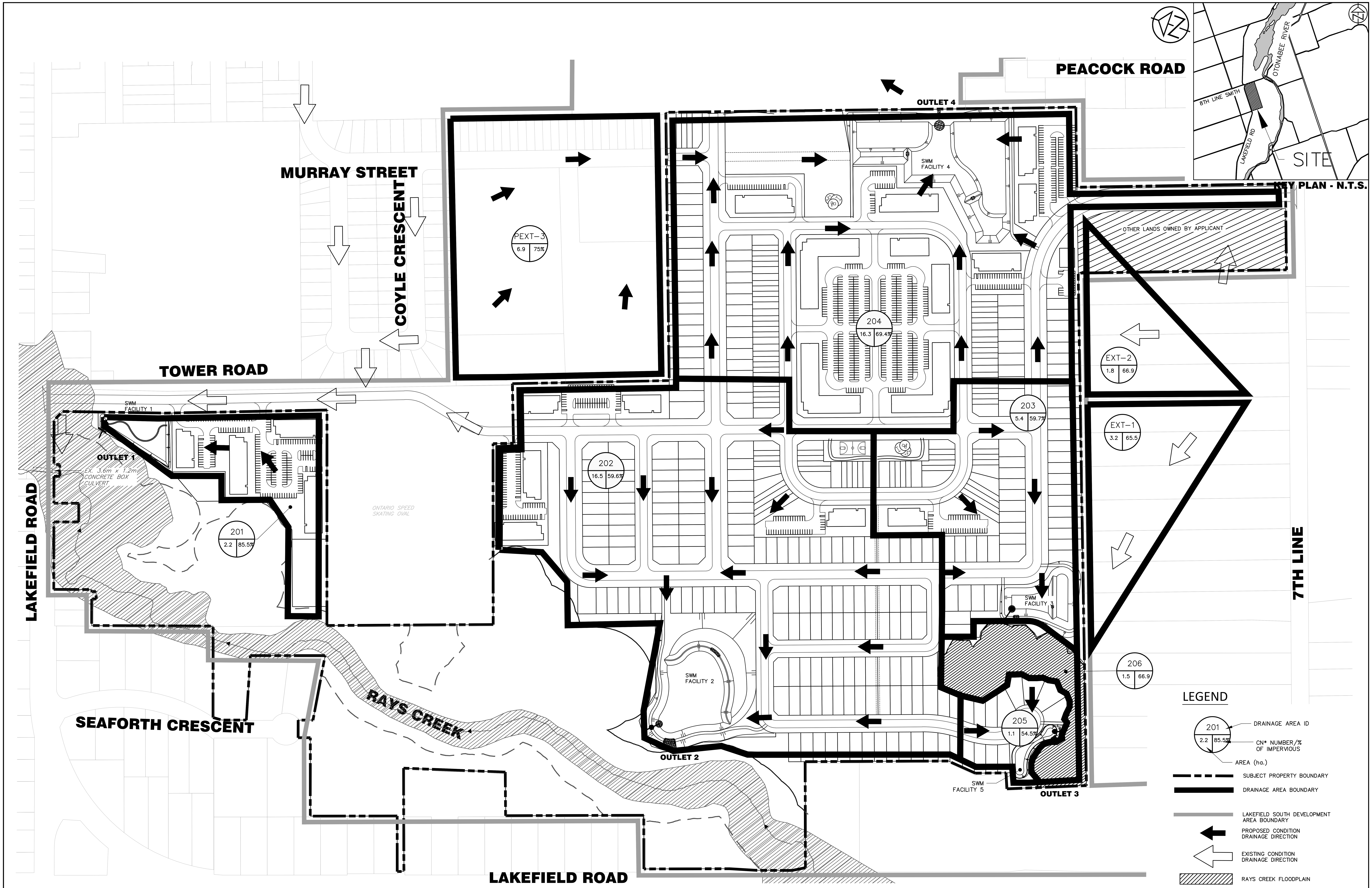

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3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

PROPOSED CONDITIONS DRAINAGE PLAN

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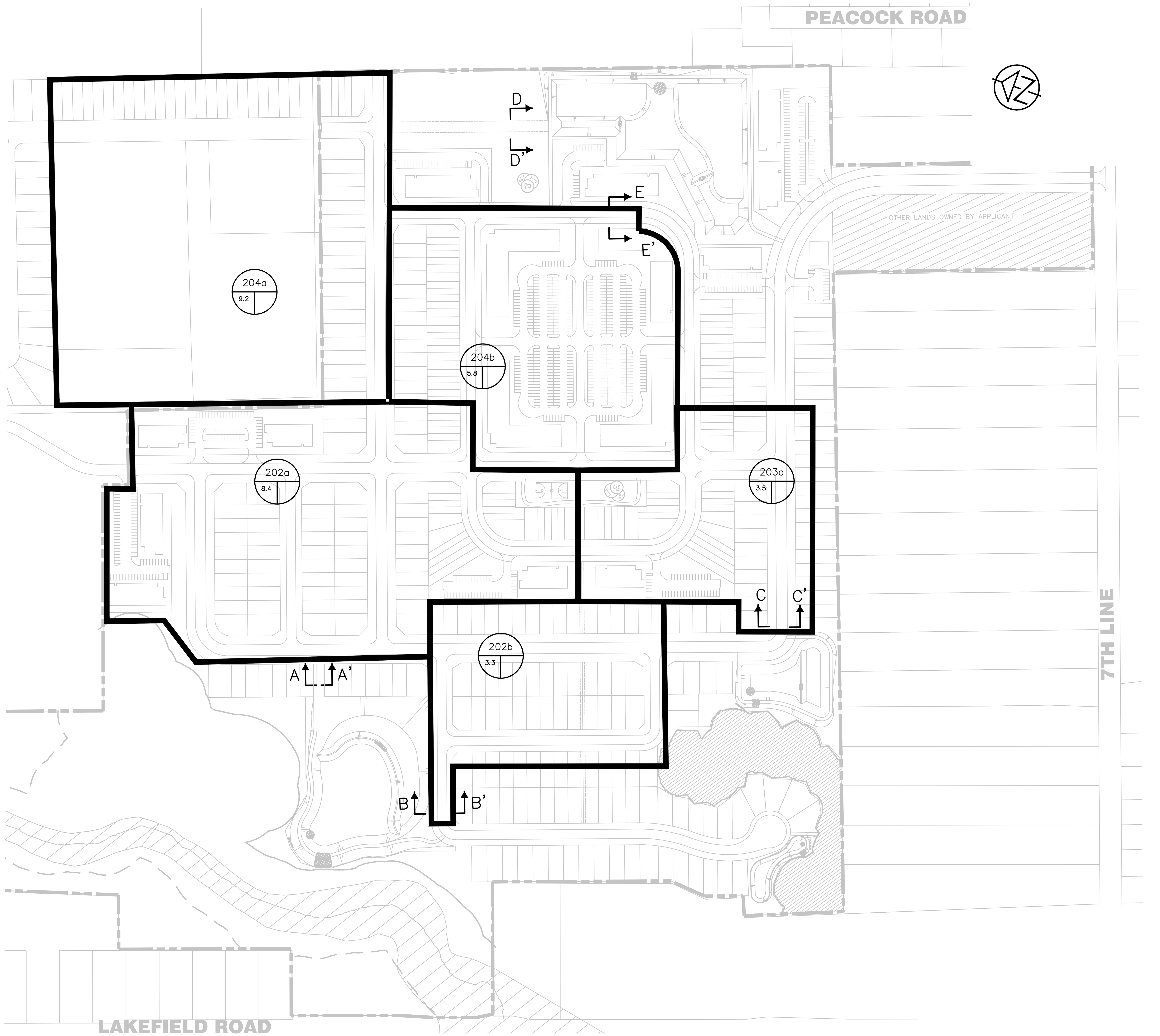
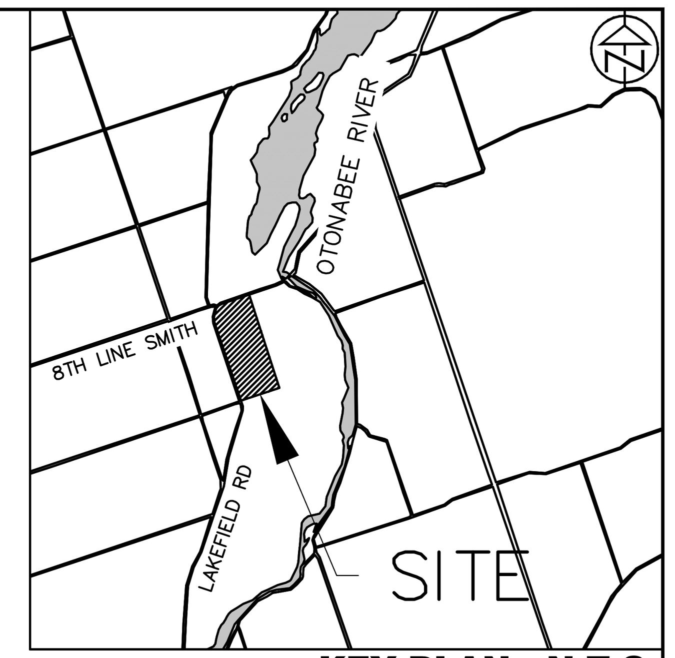
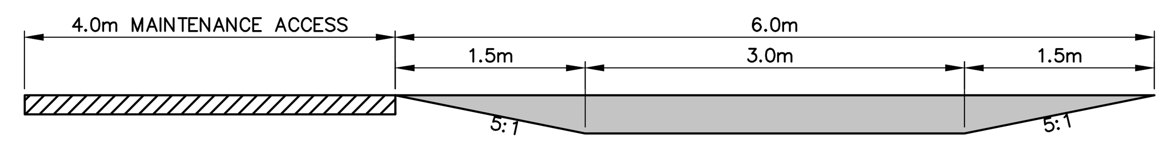
DRAWN: HY	DATE: JULY 2020	DP-2
CHECK: JA	SCALE:	





KEY PLAN - N.T.S.



SECTION A–A'
10.0m WIDE OVERLAND FLOW ROUTE
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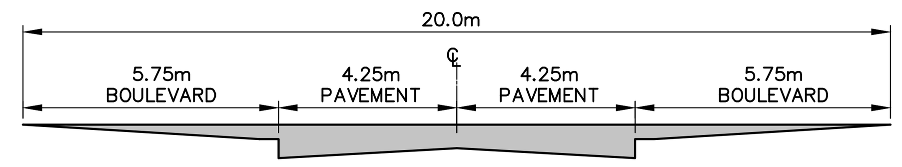

SECTION B–B', E–E'
20.0m LOCAL ROAD CROSS SECTION
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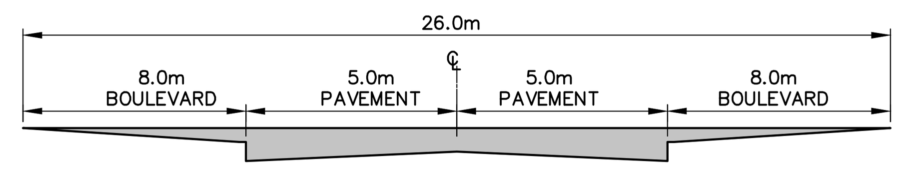

SECTION C–C'
26.0 COLLECTOR ROAD CROSS SECTION
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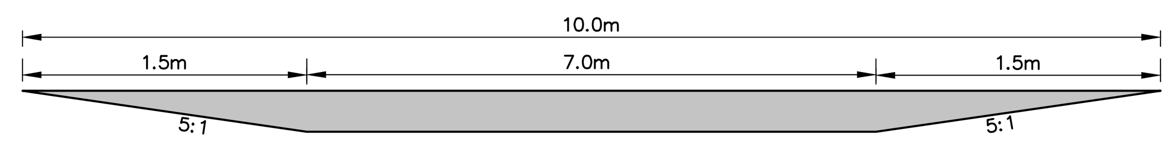
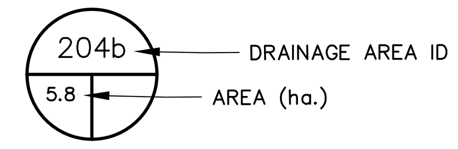


SECTION D–D'
WIDE DRAINAGE EASEMENT
SCALE: NTS

LEGEND



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3358 LAKEFIELD ROAD
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COUNTY OF PETERBOROUGH

TATHAM ENGINEERING

MAJOR STORM CONVEYANCE PLAN

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DRAWN: HY	DATE: JULY 2020	DP-3
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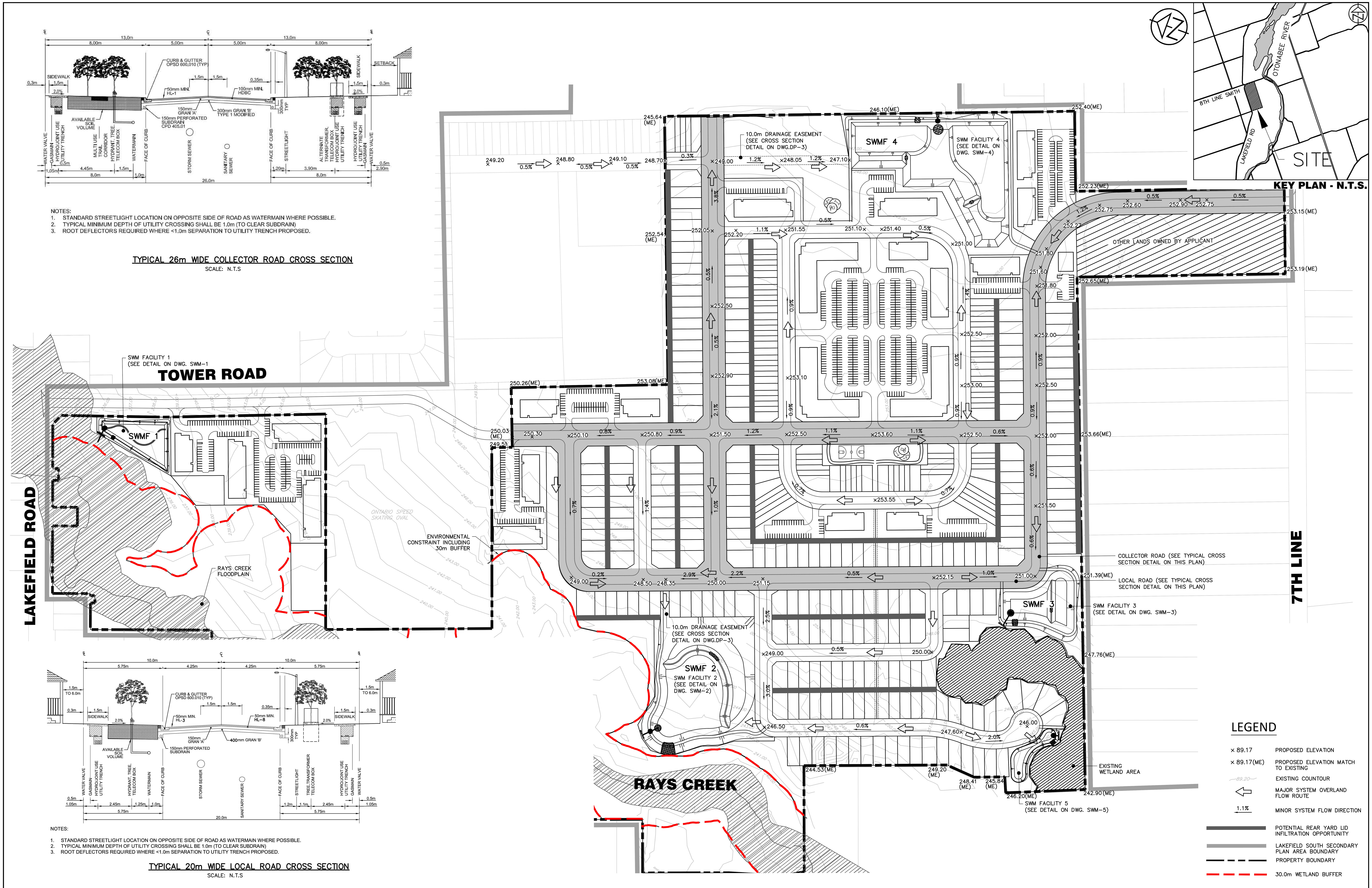

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3358 LAKEFIELD ROAD
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COUNTY OF PETERBOROUGH

PRELIMINARY SITE GRADING PLAN AND STORMWATER MANAGEMENT

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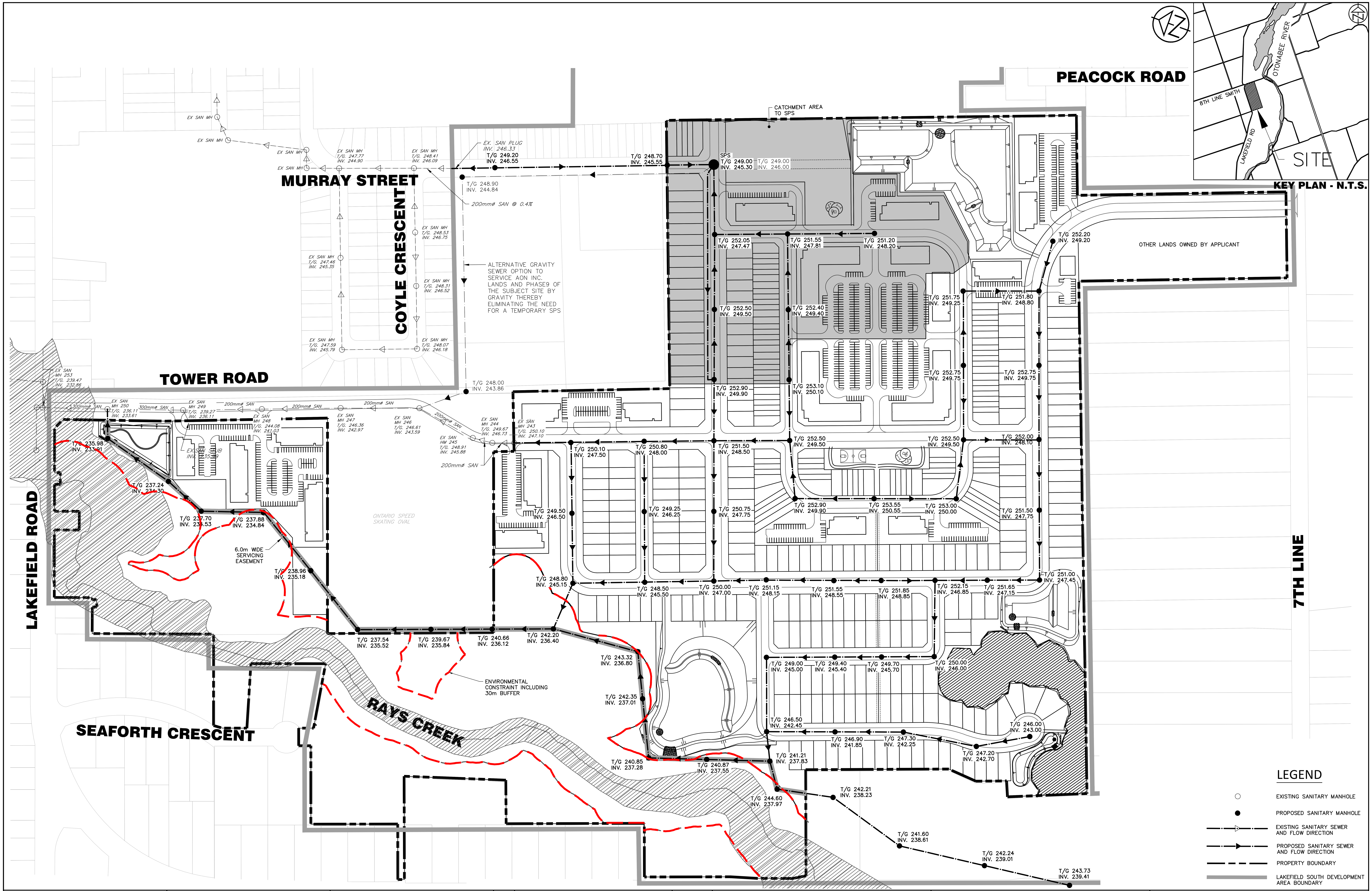

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COUNTY OF PETERBOROUGH

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PRELIMINARY SANITARY SERVICING PLAN

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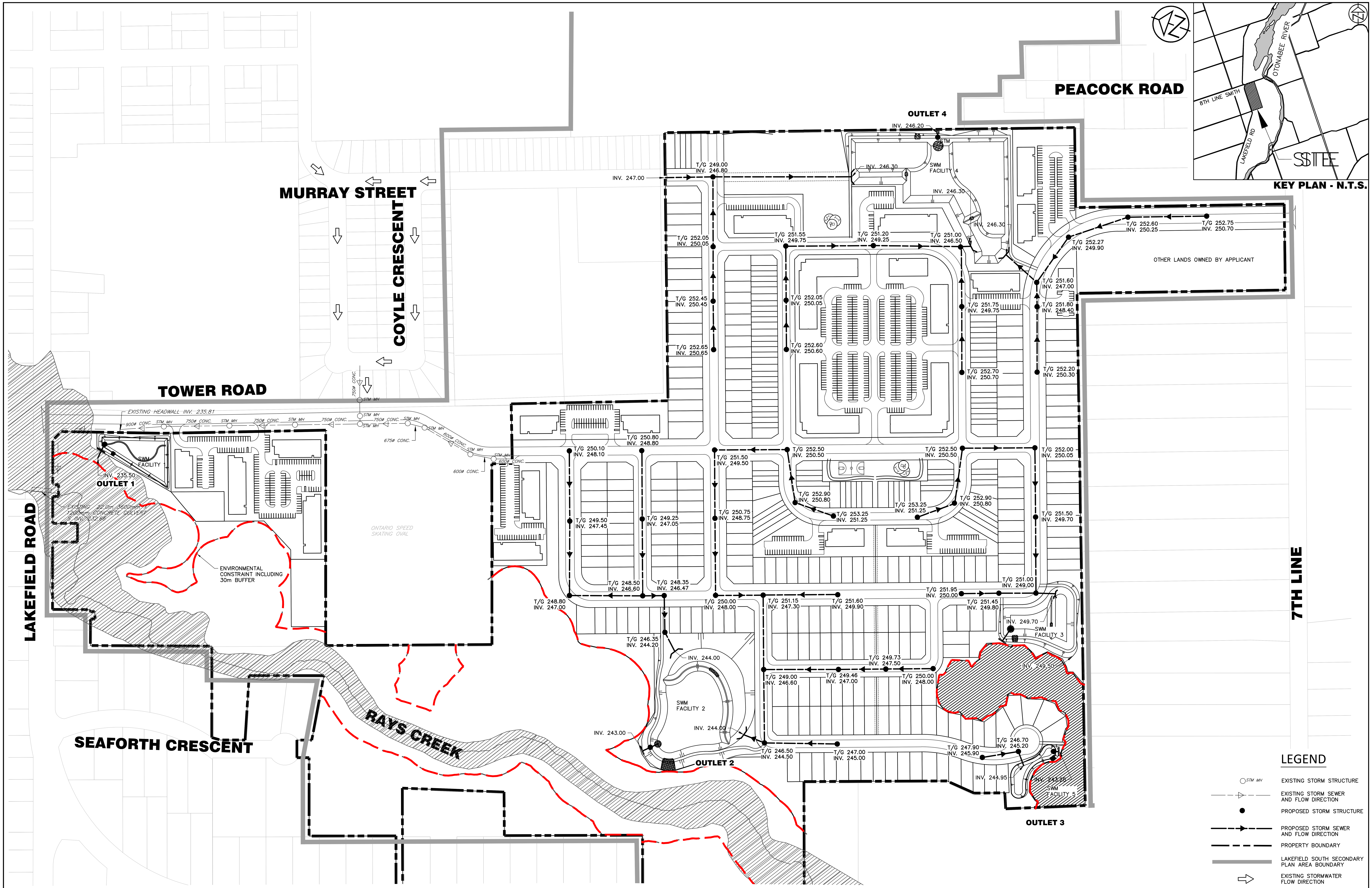

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PRELIMINARY STORM SERVICING PLAN

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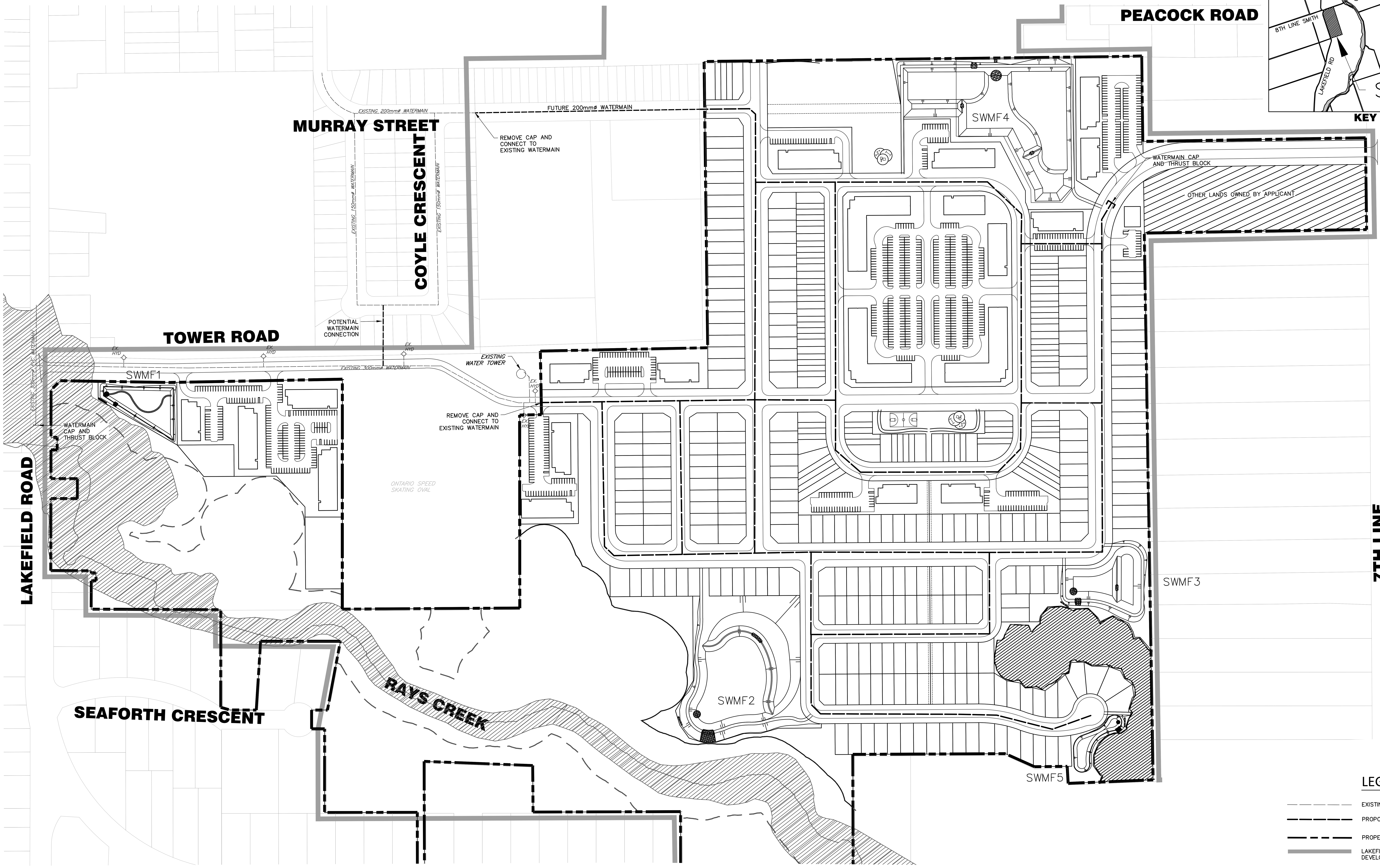

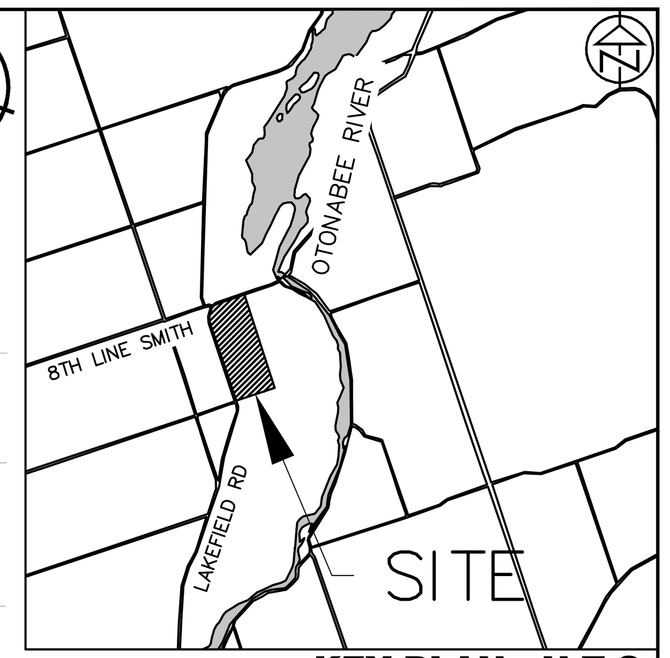

KEY PLAN - N.T.S.

LEGEND

- EXISTING WATERMAIN
- PROPOSED WATERMAIN
- PROPERTY BOUNDARY
- LAKEFIELD SOUTH DEVELOPMENT AREA BOUNDARY

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PRELIMINARY WATER SERVICING PLAN

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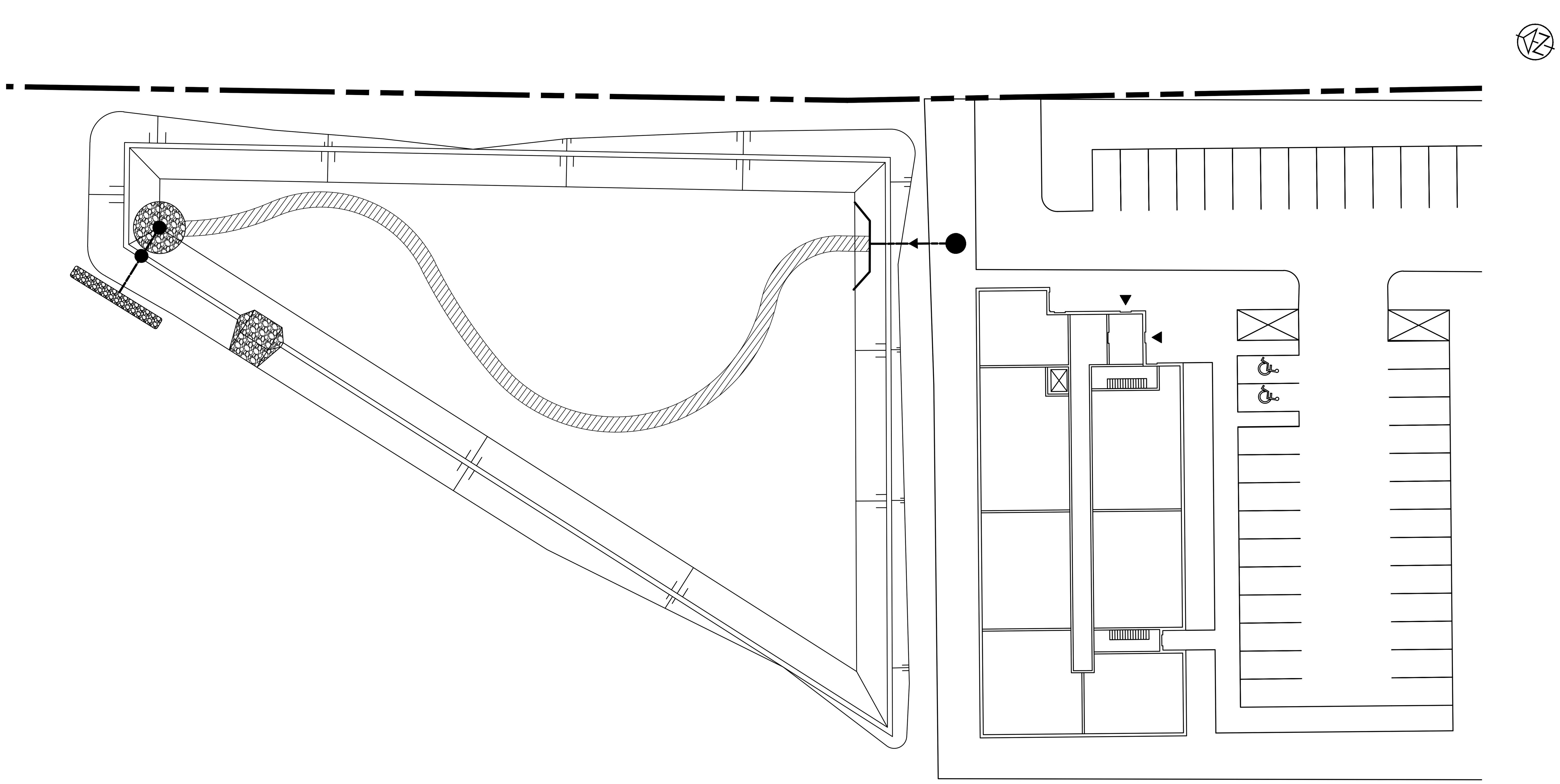

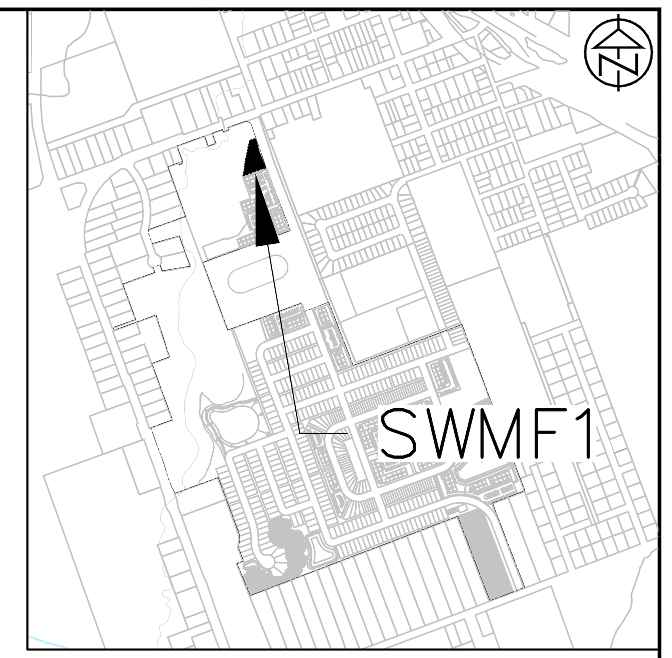

KEY PLAN N.T.S.

SWM FACILITY 1 PLAN VIEW (DRY POND)

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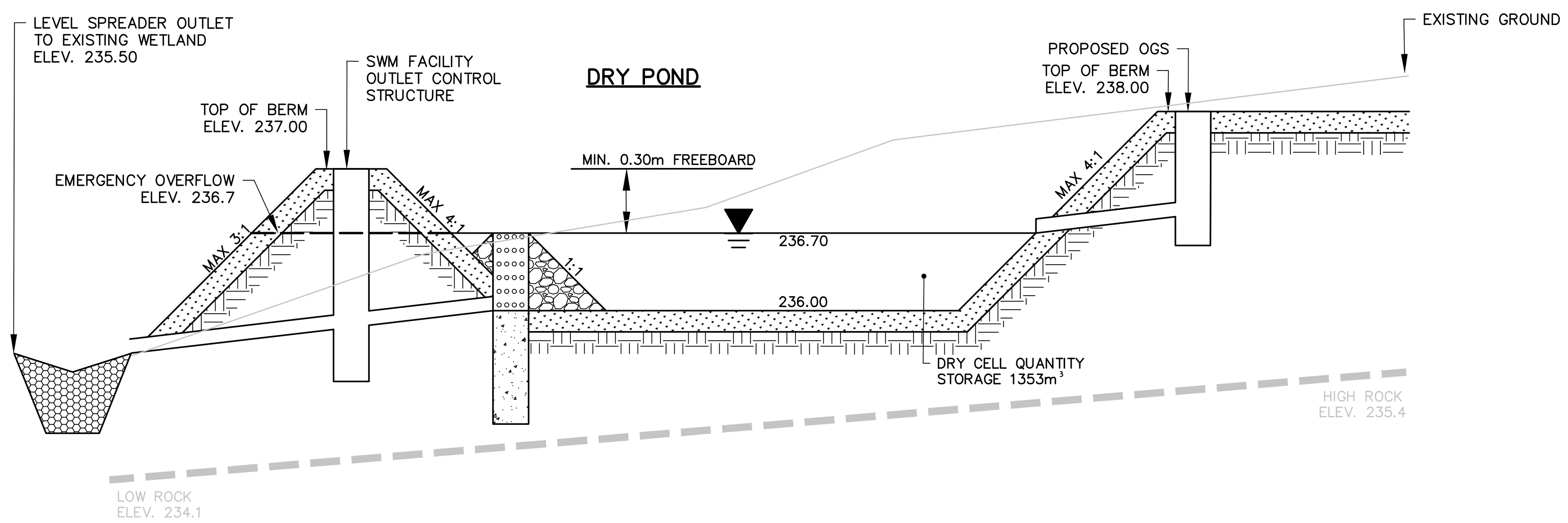

SWM FACILITY 1 PROFILE VIEW (DRY POND)

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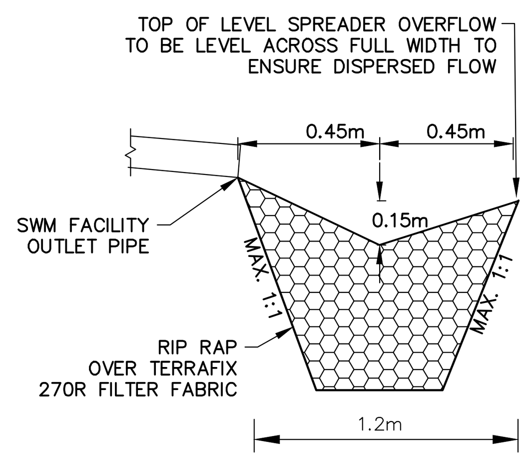

NOTE: ALL LEVEL SPREADER DIMENSIONS TO BE CONFIRMED DURING FINAL DESIGN.

TYPICAL LEVEL SPREADER DETAIL

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3358 LAKEFIELD ROAD
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COUNTY OF PETERBOROUGH

PRELIMINARY STORMWATER MANAGEMENT FACILITY 1

TATHAM ENGINEERING

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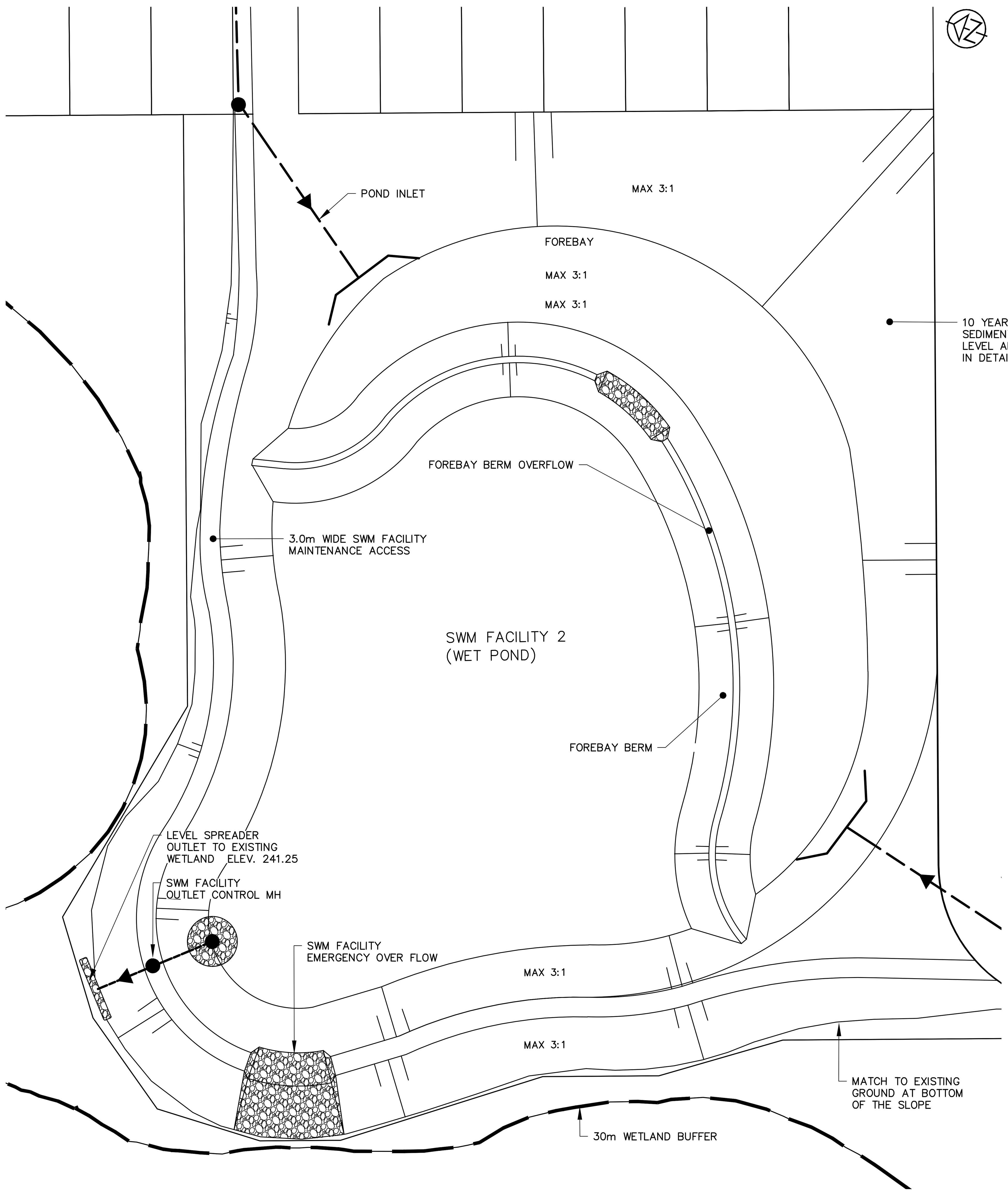

SWM FACILITY 2 PLAN VIEW(WET POND)

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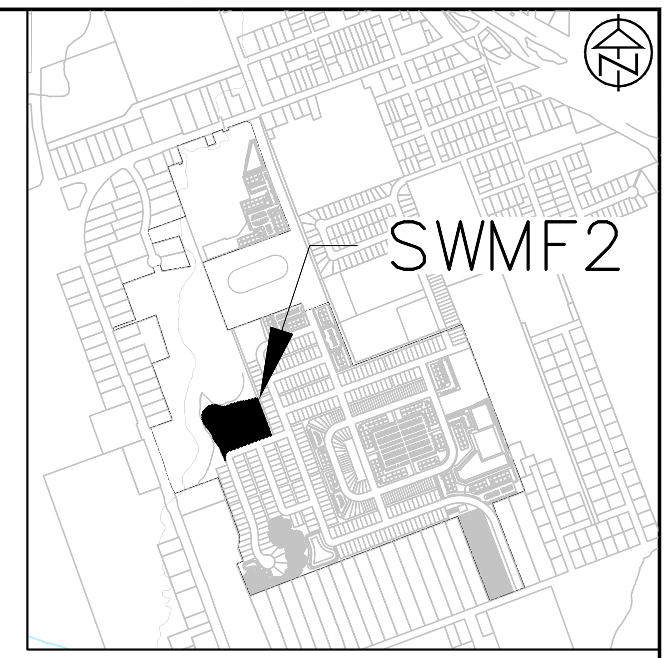

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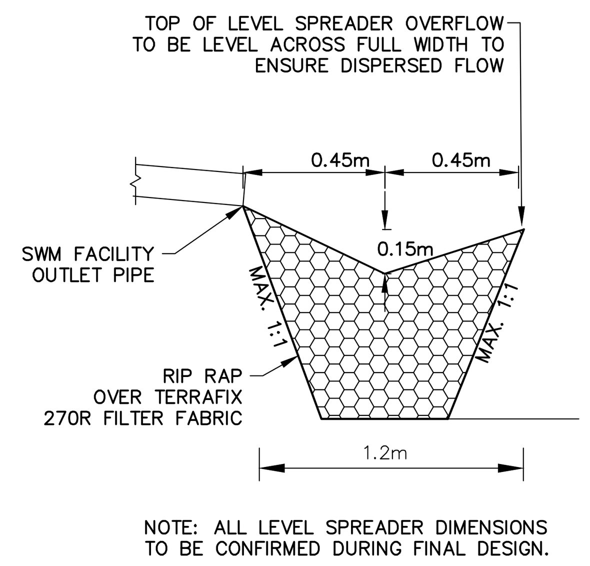

NOTE: ALL LEVEL SPREADER DIMENSIONS TO BE CONFIRMED DURING FINAL DESIGN.

TYPICAL LEVEL SPREADER DETAIL

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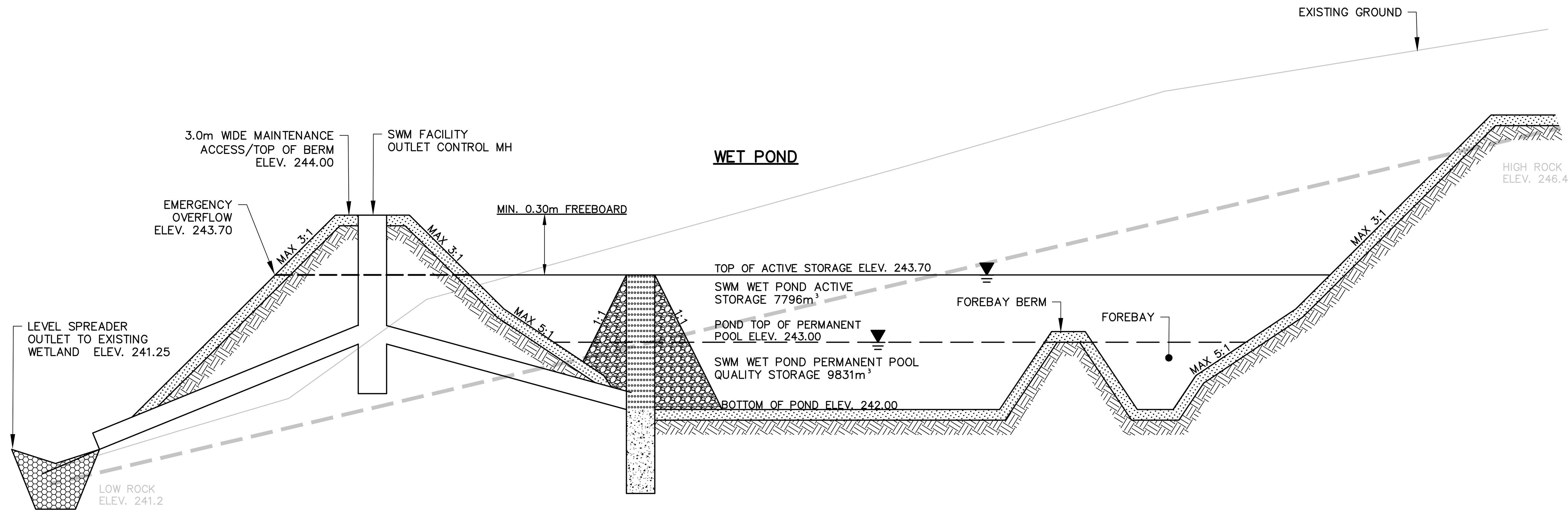

SWM FACILITY 2 PROFILE VIEW(WET POND)

SCALE: N.T.S

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ENGINEER STAMP

3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

PRELIMINARY STORMWATER MANAGEMENT FACILITY 2

TATHAM ENGINEERING

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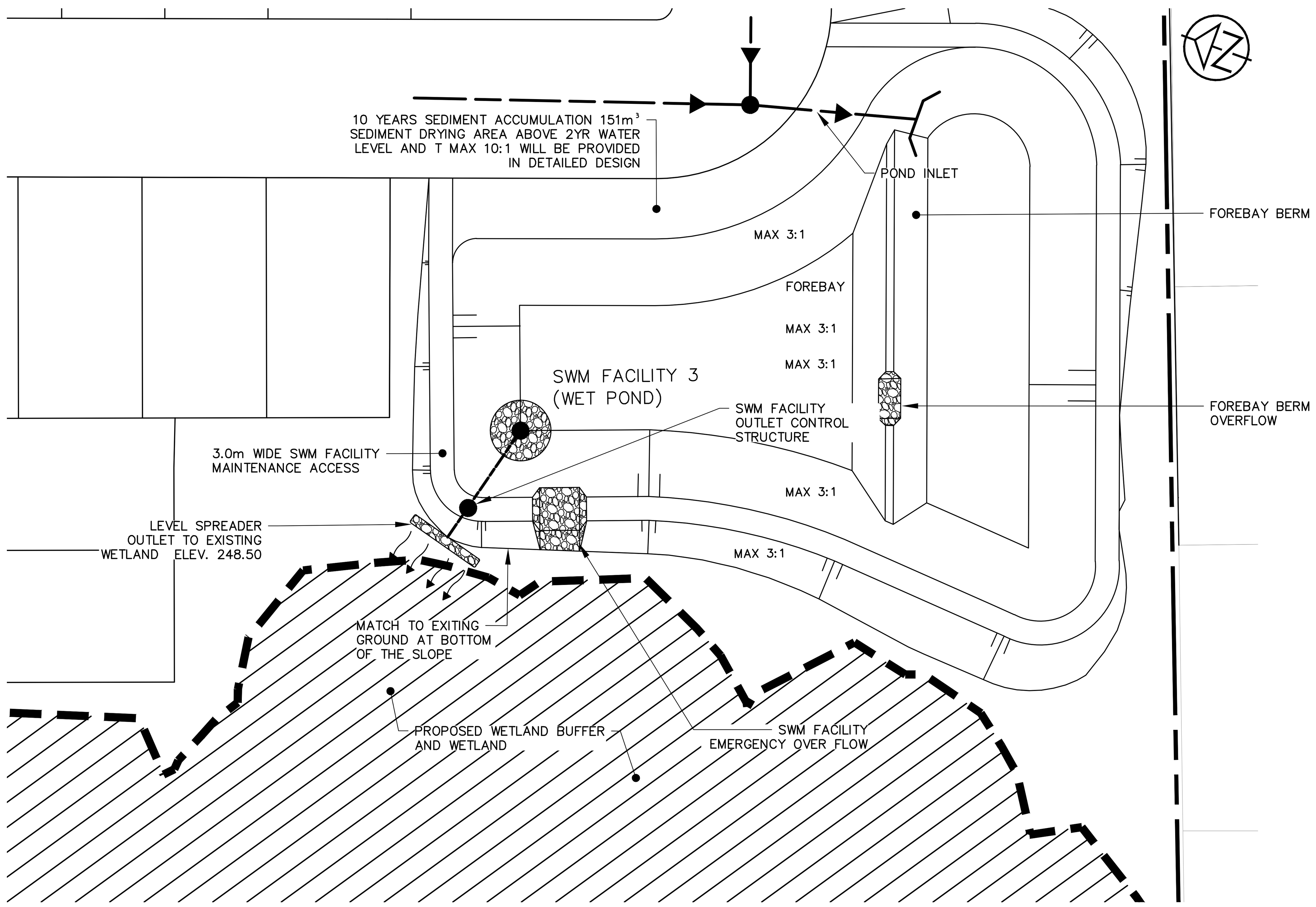
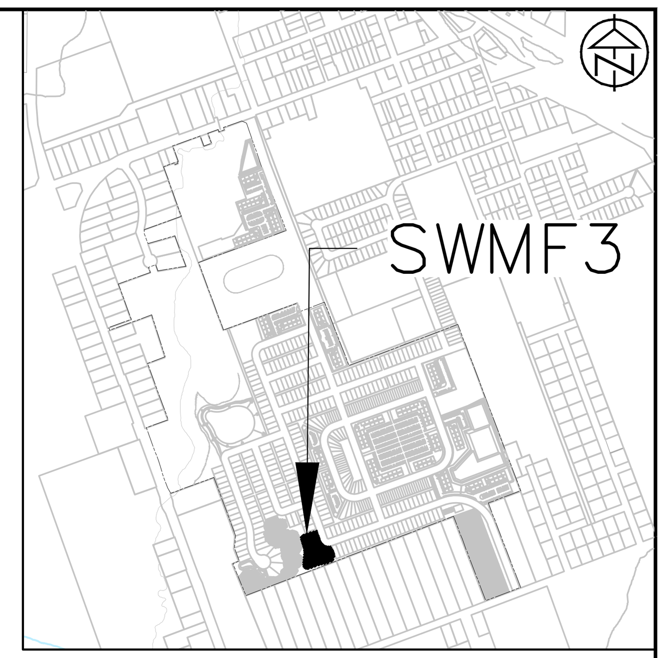
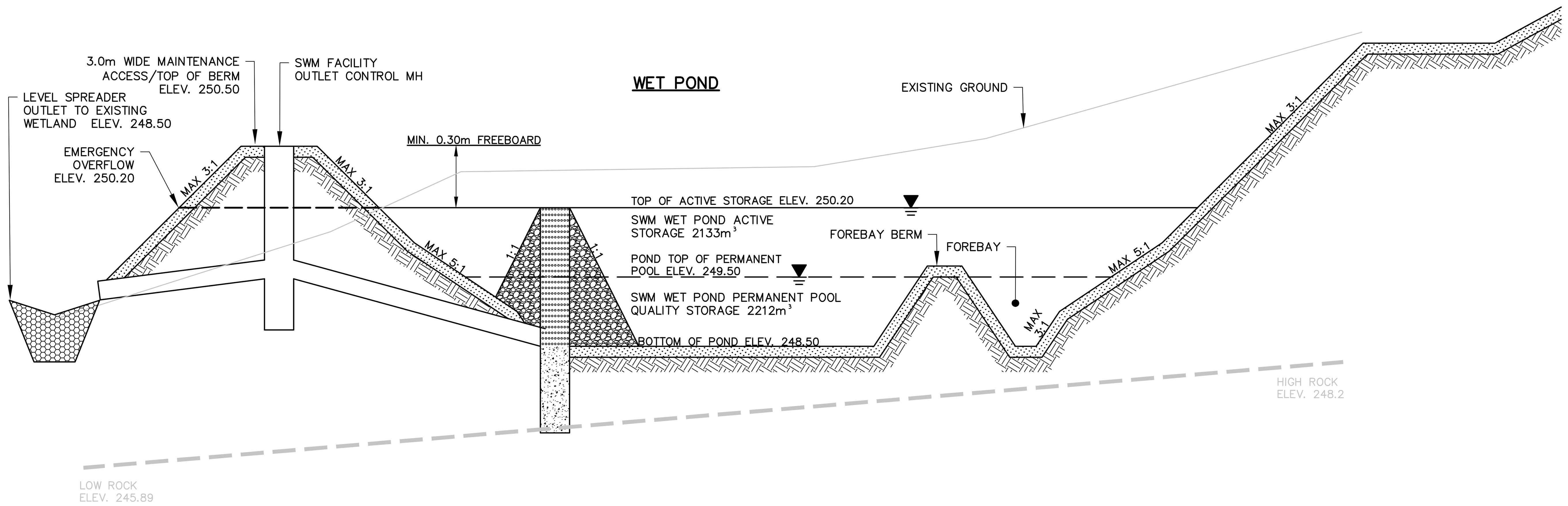


SWM FACILITY 3 PLAN VIEW (WET POND)

SCALE: 1:500

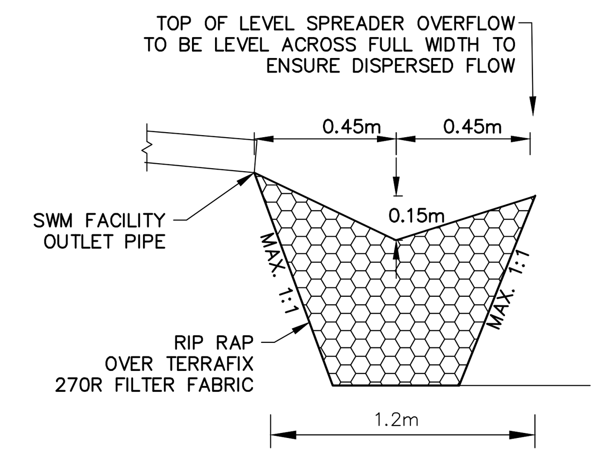


KEY PLAN N.T.S.



SWM FACILITY 3 PROFILE VIEW (WET POND)

SCALE: N.T.S



NOTE: ALL LEVEL SPREADER DIMENSIONS TO BE CONFIRMED DURING FINAL DESIGN.

TYPICAL LEVEL SPREADER DETAIL

SCALE: N.T.S

No.	REVISION DESCRIPTION	DATE
1.	2ND SUBMISSION FOR DPA	JUN 2023
2.	RE-SUBMISSION FOR DPA	SEPT 2023

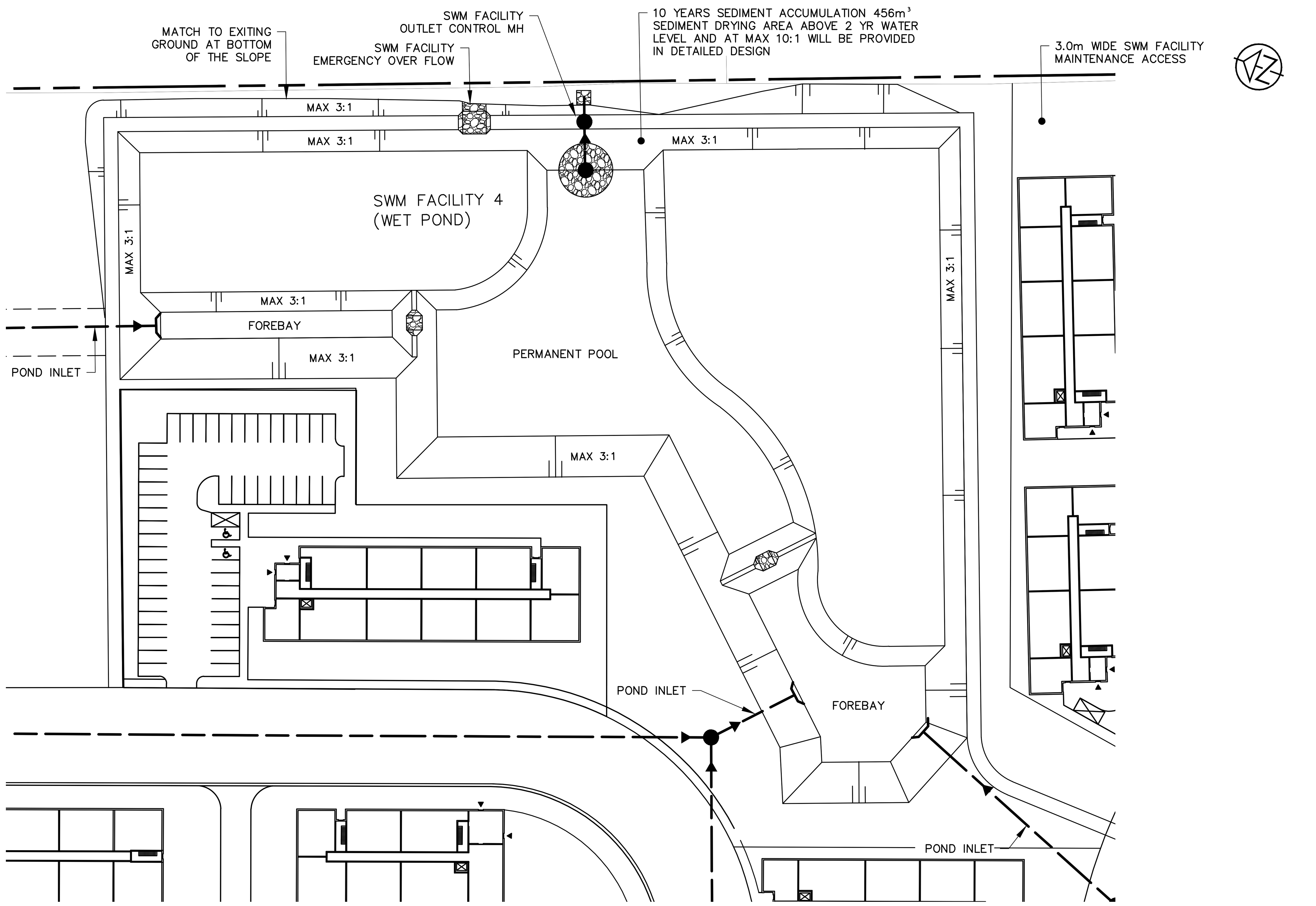
ENGINEER STAMP

3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

PRELIMINARY STORMWATER MANAGEMENT FACILITY 3

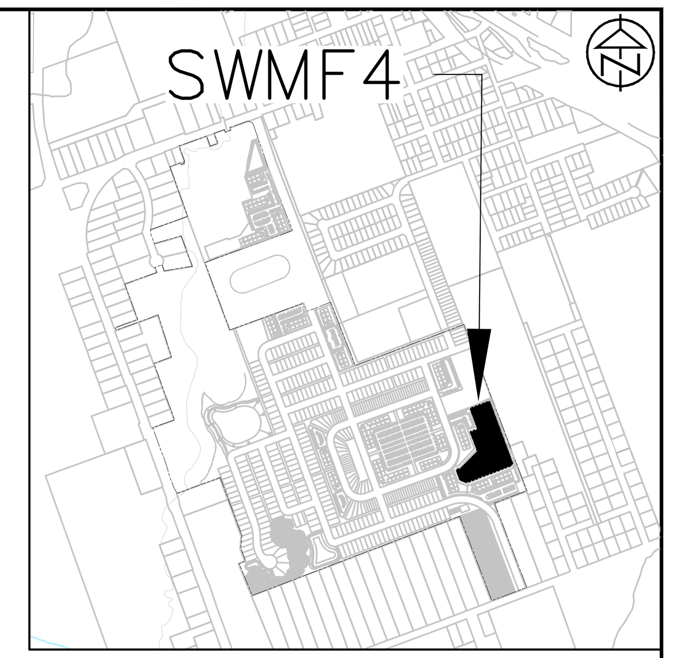
TATHAM ENGINEERING

DESIGN: JA/HY	FILE: 517651	DWG: SWM-3
DRAWN: HY	DATE: JULY 2020	
CHECK: JA	SCALE: 1:500	

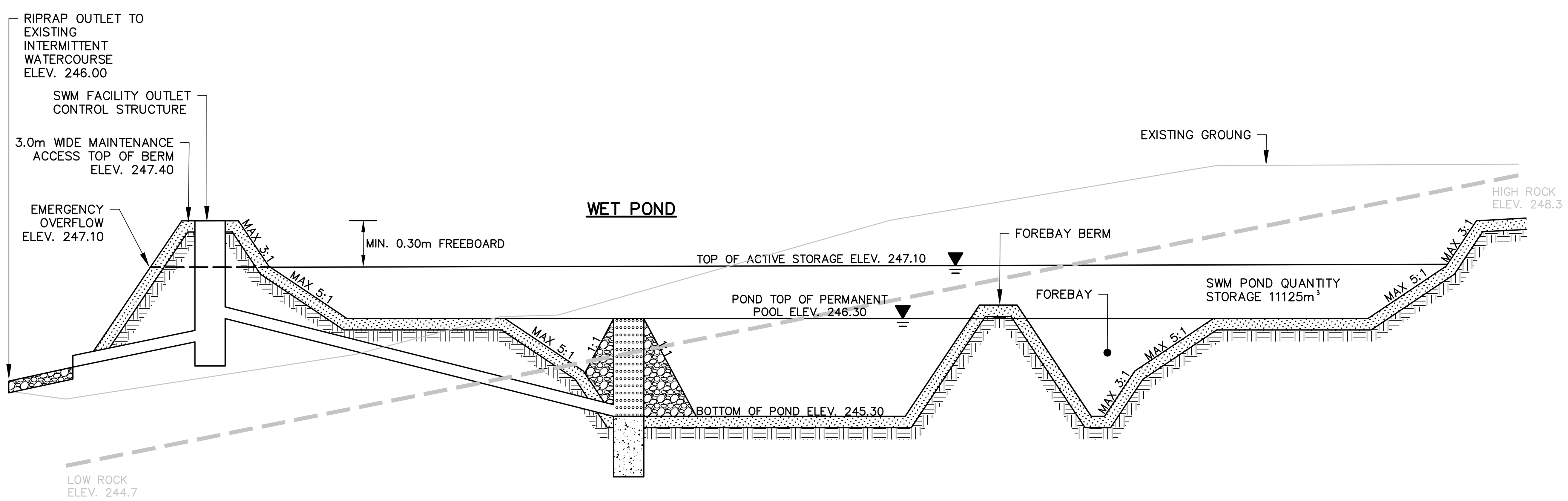


SWM FACILITY 4 PLAN VIEW (WET POND)

SCALE: 1:750



KEY PLAN N.T.S.



SWM FACILITY 4 (WET POND)

SCALE: N.T.S

No.	REVISION DESCRIPTION	DATE
1.	2ND SUBMISSION FOR DPA	JUN 2023
2.	RE-SUBMISSION FOR DPA	SEPT 2023

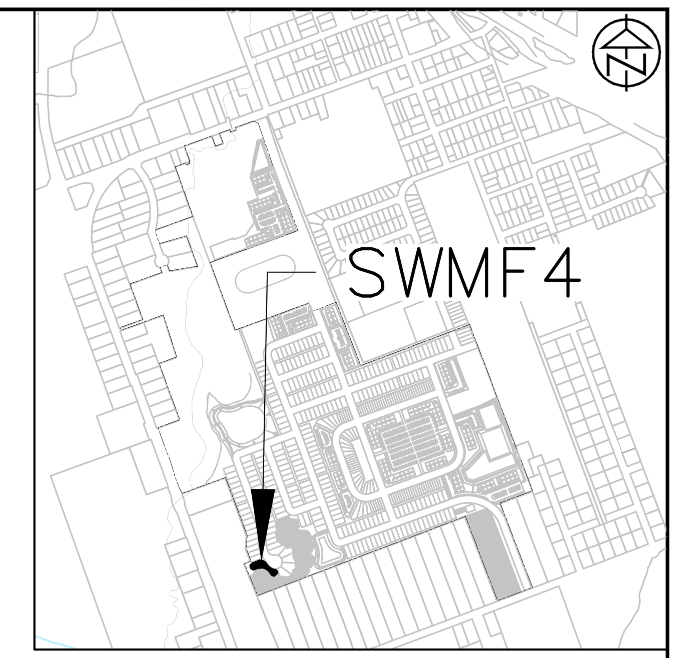
ENGINEER STAMP

3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

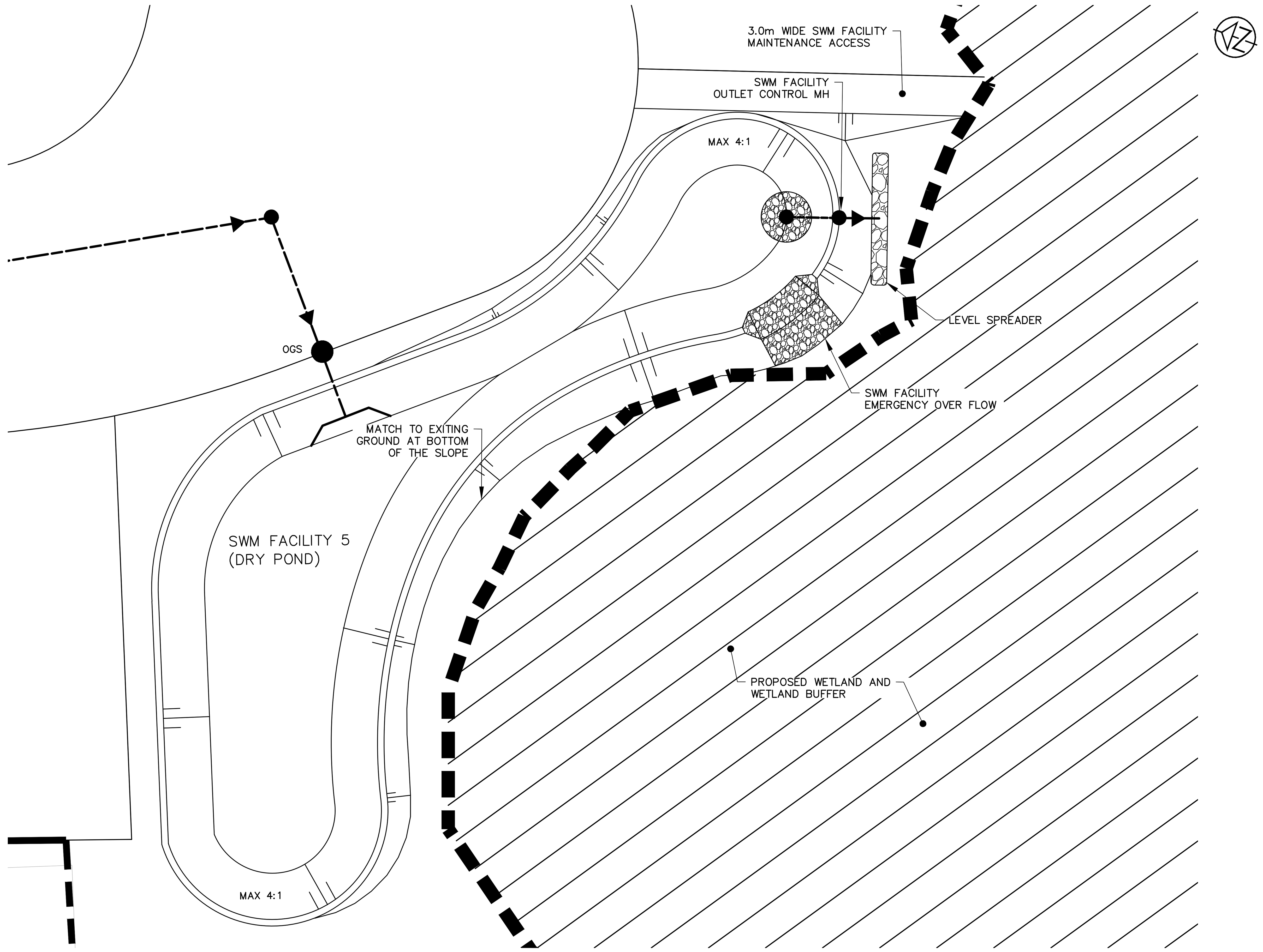
PRELIMINARY STORMWATER MANAGEMENT FACILITY 4

TATHAM ENGINEERING

DESIGN: JA/HY	FILE: 517651	DWG:
DRAWN: HY	DATE: JULY 2020	**SWM-4**
CHECK: JA	SCALE: 1:750	

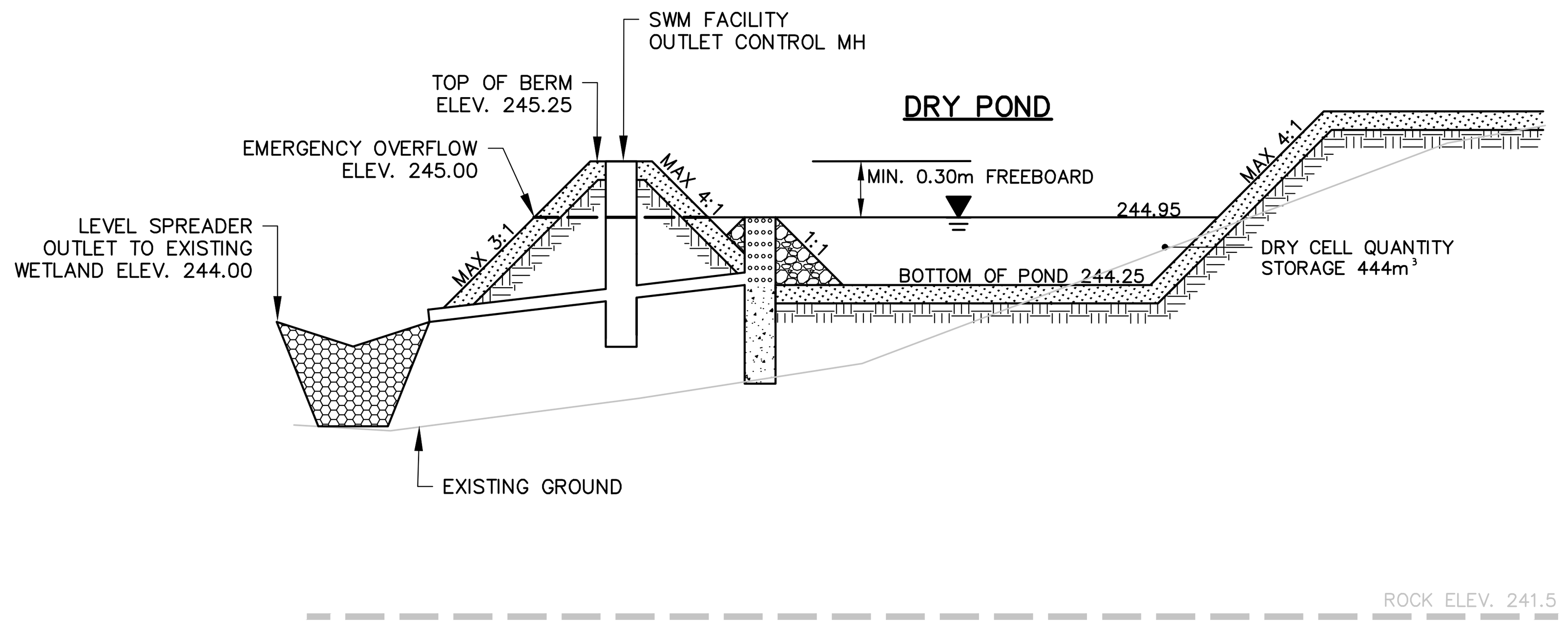


KEY PLAN N.T.S.



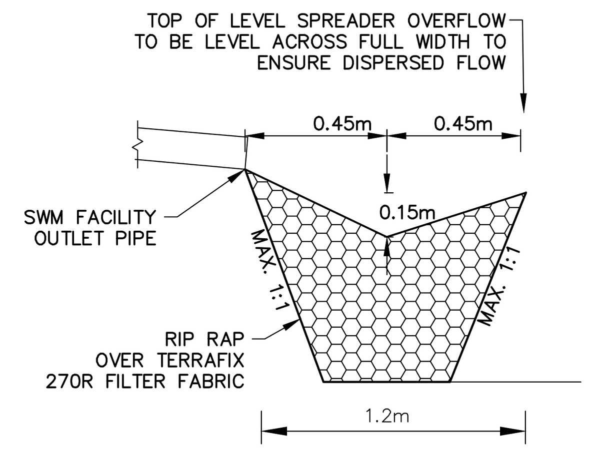
SWM FACILITY 5 PLAN VIEW (DRY POND)

SCALE: 1;250



SWM FACILITY 5 PROFILE VIEW (DRY POND)

SCALE: N.T.S



NOTE: ALL LEVEL SPREADER DIMENSIONS TO BE CONFIRMED DURING FINAL DESIGN.

TYPICAL LEVEL SPREADER DETAIL

SCALE: N.T.S

No.	REVISION DESCRIPTION	DATE
1.	2ND SUBMISSION FOR DPA	JUN 2023
2.	RE-SUBMISSION FOR DPA	SEPT 2023

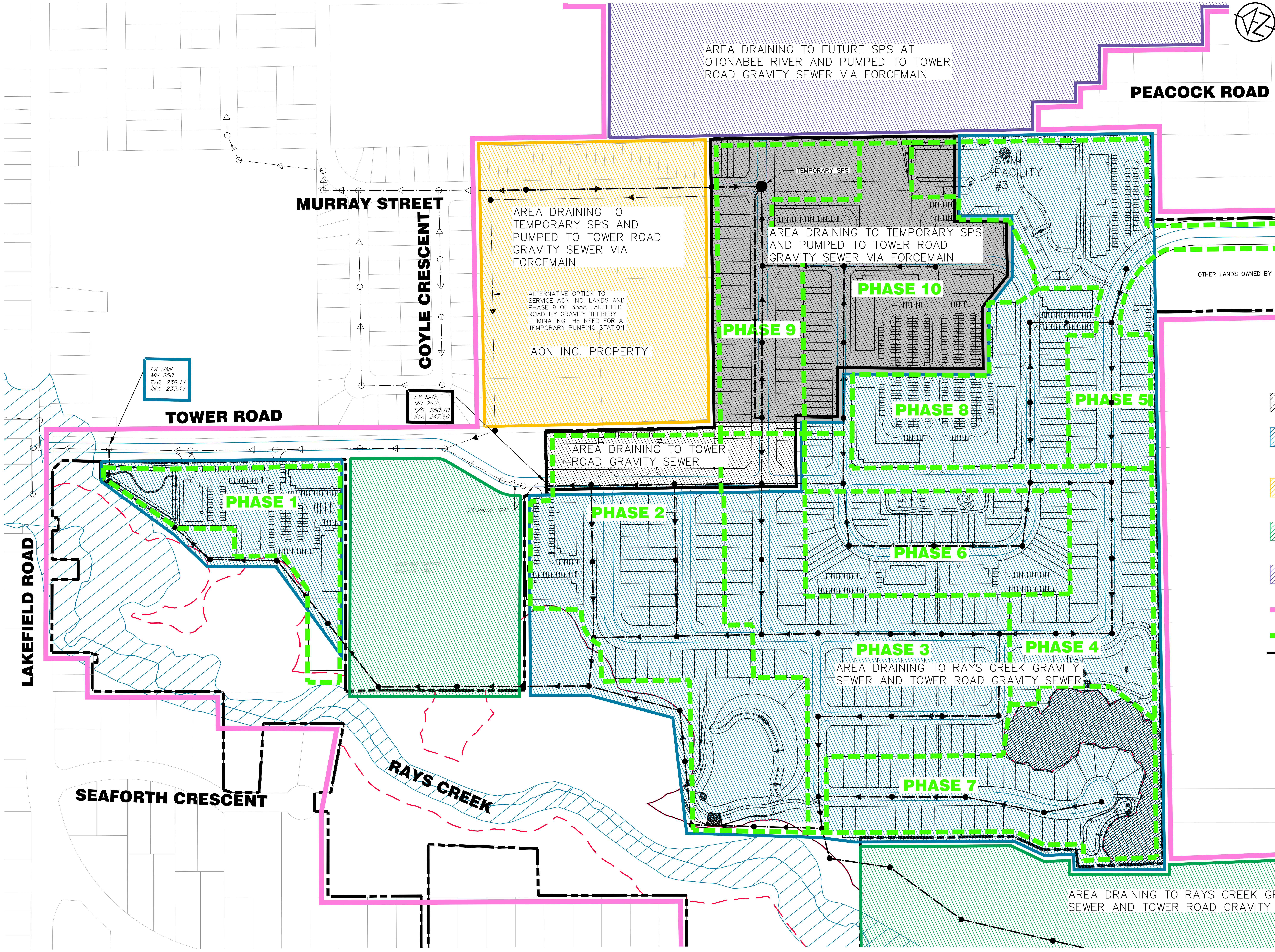
ENGINEER STAMP

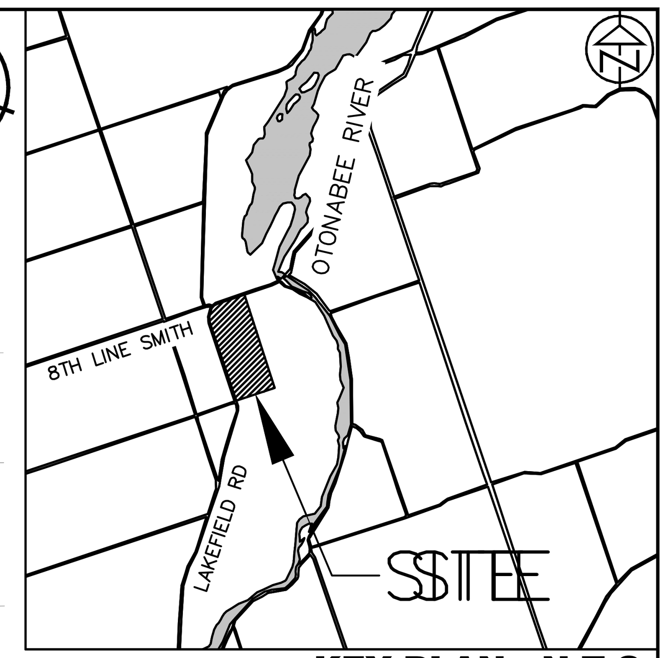
3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

PRELIMINARY STORMWATER MANAGEMENT FACILITY 5

TATHAM ENGINEERING

DESIGN: JA/HY	FILE: 517651	DWG:
DRAWN: HY	DATE: JULY 2020	**SWM-5**
CHECK: JA	SCALE: 1:250	





KEY PLAN - N.T.S.

29 TOWNHOUSE UNITS
38 SINGLE FAMILY UNITS
184 APARTMENT UNITS
TOTAL AREA= 9.4ha

70 TOWNHOUSE UNITS
217 SINGLE FAMILY UNITS
402 APARTMENT UNITS
4000m² OF COMMERCIAL SPACE
4.5ha OF RECREATION/OPEN SPACE
TOTAL AREA = 32.0ha

26 SINGLE FAMILY UNITS
200 APARTMENT UNITS
126 LTC BEDS
0.8ha MEDICAL CENTER/LAB
TOTAL AREA = 6.5ha

RESIDENTIAL AREA = 2.55ha
COMMERCIAL AREA = 3.2ha
ENVIRONMENTAL CONSTRAINT AREA = 0.1ha
TOTAL AREA= 10.5ha

RESIDENTIAL AREA = 41.7ha
RECREATION /OPEN SPACE AREA = 2.8ha
SITE SPECIFIC POLICY AREA = 5.1ha
ENVIRONMENTAL CONSTRAINT AREA = 7.5ha
TOTAL AREA= 57.1ha

LIMITS OF LAKEFIELD SOUTH DEVELOPMENT AREA

SITE PHASING BOUNDARY

SUBJECT PROPERTY BOUNDARY

DISCLAIMER AND COPYRIGHT

No.	REVISION DESCRIPTION	DATE
1.	2ND SUBMISSION FOR DPA	JUN 2023
2.	RE-SUBMISSION FOR DPA	SEPT 2023

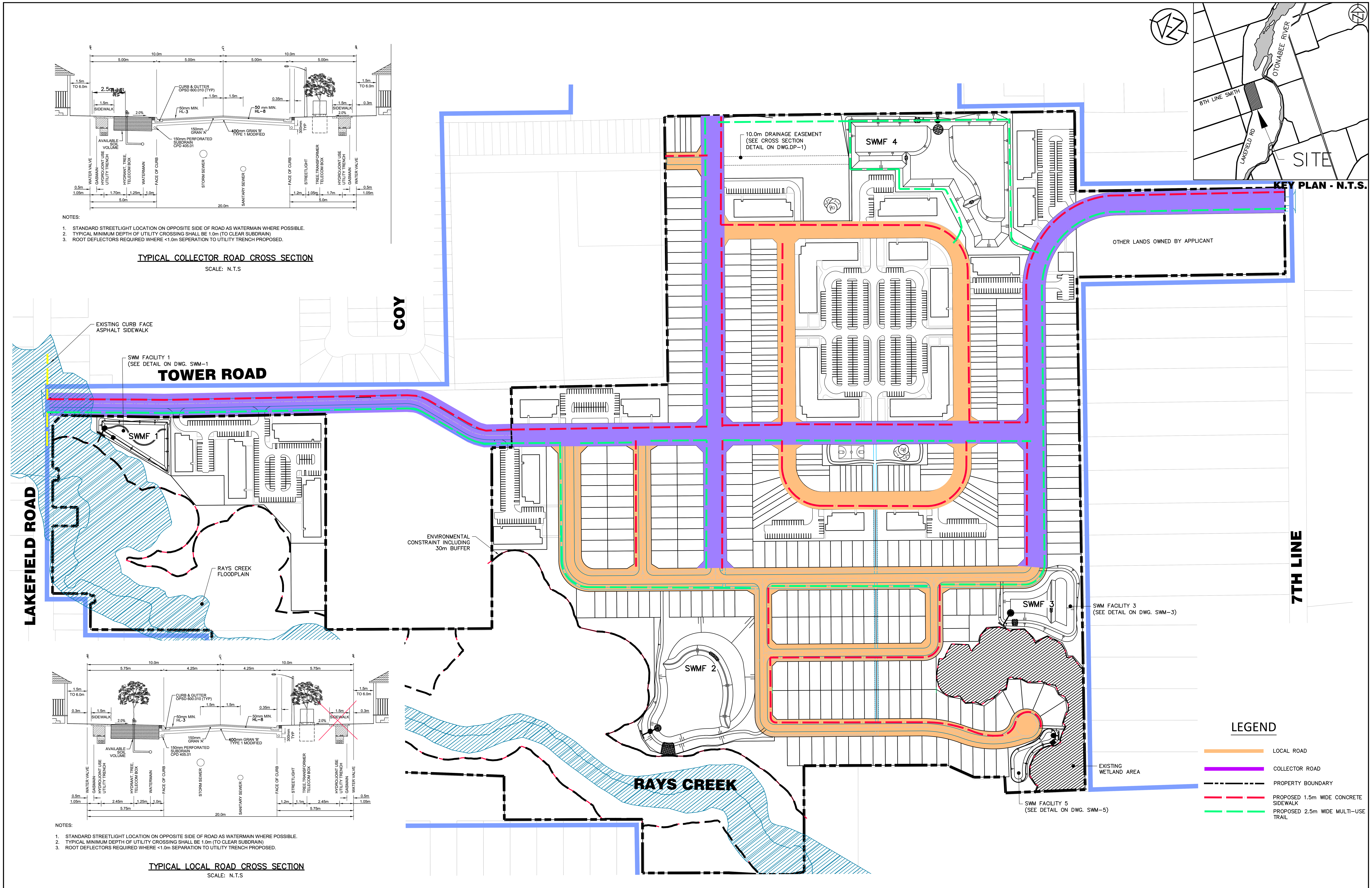
ENGINEER STAMP

3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

LSDA SEWER CATCHMENT AREA PLAN

TATHAM ENGINEERING

DESIGN: JA/HY	FILE: 517651	DWG: S-1
DRAWN: HY	DATE: JULY 2020	
CHECK: JA	SCALE:	



No.	REVISION DESCRIPTION	DATE
1.	2ND SUBMISSION FOR DPA	JUN 2023
2.	RE-SUBMISSION FOR DPA	SEPT 2023

ENGINEER STAMP

3358 LAKEFIELD ROAD
TOWNSHIP OF SELWYN
COUNTY OF PETERBOROUGH

ACTIVE TRANSPORTATION CONCEPT

TATHAM ENGINEERING

DESIGN: JA/HY	FILE: 517651	DWG: ATC
DRAWN: HY	DATE: JULY 2020	
CHECK: JA	SCALE:	

Appendix A: Record of Pre-Consultation Meeting and Background Correspondence

Record of Pre-Consultation

Prepared by the Peterborough County Planning Department

Name: Triple T Holdings Inc.

Agent: Jeremy Ash, C.C. Tatham
Heather Sadler, EcoVue

Lot: 26 & 27 **Concession:** 7

Municipality: Lakefield Ward
Township of Selwyn

Municipal Address: n/a

Roll No.(s) 151602000322407
151602000322400
151602000318700

Phone: 705-742-3338 (TTT)

Email: bill@tttholdings.com
jash@cctatham.com
hsadler@ecovueconsulting.com

Office Phone: 705-760-3053 (TTT)
705-876-8340 (EcoVue)

Communication Sent To: **Owner:** ☒ **Agent:** ☒

Meeting Date: 2018-03-08
Meeting Location: County Committee Room

Attendees:

Rob Lamarre, Manager of Building & Planning, Township of Selwyn
Jeannette Thompson, Planner, Township of Selwyn
Adam Tobin, Project Coordinator Water & Sewer, Township of Selwyn
Dylan Adams, Engineering Technician, Peterborough County
Doug Saccoccia, Assistant Manager Engineering & Design, Peterborough County of Peterborough
Jasmine Gibson, Planning Ecologist, ORCA
Neil MacFarlane, Engineering Technologist, ORCA
Alex Bradburn, Planning and Development Officer, ORCA
Beverly Hurford, Watershed Planner, ORCA
Caitlin Robinson, Planner, Peterborough County
Iain Mudd, Manager of Planning, Peterborough County
Matt Turner, TTT
Bill Turner, TTT
Jeremy Ash, C.C. Tatham
Heather Sadler, EcoVue

A copy of the complete Record of Pre-Consultation will be sent to all attendees ☒

Existing Parcel Description	
County O.P. Description	Settlement Area
Municipal O.P. Designation	Low Density Residential – Specific Policies (Section 6.3.3)
Municipal Zoning	Development (D) Zone
Area/Lot Dimensions	±43 ha (105 ac.)
Existing Use/Buildings	Vacant

Pre-consultation completed for:

☒ Plan of Subdivision (*Application submitted to County*)
☒ Plan of Condominium (*Application submitted to County)*
☒ Official Plan Amendment for
- ☐ County Official Plan *(Application submitted to County*)
- ☒ Local Component of County Official Plan *(Application submitted to County*)
- ☐ Municipal Official Plan (*Application submitted to Township*)

☒ Zoning By-law Amendment (*Application submitted to Township*)

Proposal Summary/Description:

- This is the second pre-consultation to discuss the development of the Lakefield South Lands by Triple T Holdings (TTT).
- Additional lands being considered as part of the overall development area.
- A more detailed conceptual plan and servicing plan was presented in advance of the meeting to facilitate discussion amongst the agencies.
- The proposal includes 849 units in total to be developed in phases as reflected in the Lakefield South Secondary Plan:

Phase 2A
- 156 units
  - 4 blocks for 30 unit, 3-storey apartment buildings = 120 units
  - 3 blocks for 12 unit, 3-storey apartment buildings = 36 units
- 1 block for green space
- 1 block for stormwater management facility

Phase 2B
- 140 units
  - 7 lots for luxury single detached dwellings – 7,641 m² lot size
  - 33 lots for single detached dwellings – 4,740 m² lot size
  - 2 block for 3-storey multi-use buildings = 40 units
  - 1 block for greenspace
  - 1 block two 30 unit, 3-storey apartment buildings = 60 units

Phase 3
- 553 units
  - 27 lots for luxury detached dwellings

- 174 units for single detached dwellings
- 2 blocks for four 30 unit, 3-storey apartment buildings = 120 units
- 7 blocks for nine 12 unit, 3-story apartment buildings = 108 units
- 3 blocks for four multi-use, 3-storey buildings = 80
- 5 blocks for 2 unit townhouses = 10 units
- 7 blocks for 4 unit townhouses = 28 units
- 2 blocks for 3 unit townhouses = 6 units
- 1 block for greenspace
- 1 block for stormwater facility

Discussion:

Topic	Action By
Density Calculations The Growth Plan, 2017 indicates that for upper-and single-tier municipalities in the outer ring of the Growth Plan, the minimum density target for designated greenfield areas contained in the applicable official plan that is approved and in effect as of July 1, 2017 will continue to apply until the next municipal comprehensive review (MCR) is approved and in effect (S.2.2.7.5) Greenfield targets for Peterborough County will be implemented on a phased-in approach with a density of **35 residents/jobs per hectare** being implemented immediately and that this number moves to 40 residents/jobs per hectare by 2015 (S.5.1.3.1, 15th bullet point). Specifically, within the low-density designation of Lakefield, the average density of residential development shall generally be 15 units per gross hectare Within the medium-density designation, the average density of residential development shall generally be 30 units per gross hectare. The maximum height and density of a low rise apartment permitted within the Medium Density Residential designation shall be three storeys and 50 dwelling units per net hectare respectively, provided that, where adjoining lands are designated Medium Density Residential. Please look at gross density and net density Gross density includes all land in the study area Net density is calculated on the portion of the developable area comprising private owned residential and employment lands	County currently in the process of a MCR - late 2019 for completion (estimate)

parcels, exclusive of all other land uses i.e. wetlands, SWM ponds, parks & open spaces and trails

Official Plan Amendment is required to recognize higher densities.

Traffic / Road Network
The Roads Plan for Lakefield in the County/Township Official Plan (Schedule "B1-1") identifies a proposed east-west collector road from County 29 (Lakefield Road) through the Phase 3 lands (see Schedule "B1-1" attached).

Traffic Study to be completed in support of development applications should review this intersection with the collector road to determine if the location of this intersection is appropriate.

Township to provide TTT with traffic study completed for Lakefield South secondary plan

Traffic Study to analyse all four intersections

1. Lakefield Road with Tower Road
2. 7th Line with new internal road at south east corner (traffic study should also look at the condition of 7th Line)
3. 7th Line with Lakefield Road
4. CR-29 and east-west proposed connection

Official Plan Amendment will be required to recognize any changes to the Road Plan (Schedule B1-1) as a result of traffic study findings i.e., 3 proposed collector roads (see Schedule B1-1 attached).

AON draft approved plan of subdivision includes extension of Murray Street. Layout for Phase 3 should include a connection to Murray St. Location of green space in Phase 3 may need to be reconsidered.

Neighbourhood Commercial
The County / Township Official Plan currently recognizes a 1 hectare site located at the south-west corner of Lakefield Road and 7th Line to permit a neighbourhood commercial centre to serve the daily needs of the Lakefield South Development Area.

TTT's proposal includes some mixed-use buildings incorporating ground floor retail.

A market analysis study will be required demonstrating the need for the ground floor retail. Study should build off existing market analysis completed for the Lakefield Secondary Plan. Show need for additional acreage. Demonstrate no impact to existing business area in Lakefield.

Township to provide TTT with market study completed for existing neighbourhood

	commercial location
EcoVue proposed the idea of having more flexible Official Plan policies to allow the area to evolve over time to support commercial/employment opportunities, higher densities, etc.	EcoVue to provide draft policies to County / Township for discussion
Rethink multi-use building located adjacent to existing low density residential along Peacock Road. Alternative location or speak to compatibility through scale, design, setbacks, etc.	
Servicing Concept The Lakefield South Development Area is premised on one stormwater management facility servicing the area.	
3 stormwater facilities are proposed for the development area, including one external facility	
ORCA raised potential slope and wetland issues associated with SWM facility #2. Concern regarding wetland disruption from the sanitary sewer alignment.	
C.C. Tatham advised that following environmental boundary does not work as the depth to bedrock is very shallow – all limestone. Looking for balance through compensation.	
Discussion around sewer line installation – open cut or directional drilling.	
C.C. Tatham advised that direction drilling would be difficult.	
ORCA has concerns around open cut installation within wetland complex. Utility policies of ORCA's policy manual say no site alteration in PSW.	ORCA to attend site with Niblett.
Need to resolve sewer line through PSW with ORCA and position of SWM facility #2.	C.C. Tatham
Location of SWM facility #2 off-site needs to be discussed with land owner. Township to initiate these discussions.	C.C. Tatham to provide Township with rationale / technical background work used to determine the

location for SWM facility #2

Geotechnical and/or Functional Servicing Study to incorporate a section that reviews the impact of the development on neighbouring well users. Speak to nature of wells adjacent to the development along 7th Line and Peacock Road

Archaeology
Stage 1 and 2 Study required
Stage 3 to be determined following recommendations in Stage 1 and 2 reports

Other:

- Updated study list attached
- Planning and Peer Review Reimbursement Agreement attached

Fees: A copy of the current Peterborough County Planning Fees schedule is attached with applicable Peterborough County planning fees emphasized (i.e. highlighted or circled). ☒

Other applicable fees should be confirmed through staff at the local Township, Conservation Authority and/or Peterborough Public Health.

***Record Completed By*: Caitlin Robinson**

⌦ **Please Note**: *Personal information contained on this form is collected under the authority of Section 29(2) of the Municipal Freedom of Information and Protection of Privacy Act, R.S.O. 1990, c.M.56 as amended and will be used to assist in the correct processing of the application. If you have any questions about the collection, use or disclosure of this information by the County of Peterborough, please contact the CAO or Clerk, County of Peterborough, 470 Water Street, Peterborough, Ontario K9H 3M3 (705-743-0380).*

Study Requirements for
Official Plan Amendments &
Subdivision/Condominium Developments

Updated - March 8, 2018

☒	Functional Servicing Report	
☒	Geotechnical Study	
☒	Storm Water Management Plan	
☒	Hydrogeological Study	Review impact of the development on neighbouring well users - incorporate a section into the Functional Servicing Report
☒	Market Analysis/Justification Study	Independent study, separate from the Planning Study
☒	Environmental Impact Study (EIS)	
☒	Archaeological Study	
☒	Planning Study/Analysis	
☐	Natural Resource Analysis (aggregates, mineral non-aggregates, forests, etc.)	
☐	Noise Impact Study	
☒	Traffic Study	
☐	Agricultural Land Usage Justification	
☒	Review of Impact on Municipal/Other Services – fire, waste disposal, school busing, road conditions, etc.	Incorporate into Planning Study
☒	Source Water Protection (if in Vulnerable Area, require RMO review – Terri Cox, Mark Majchrowski)	
☐	Phase 1 Environmental Site Assessment (generally for lands previously used for commercial and industrial uses)	
☐	Record of Site Condition (converting from a commercial/industrial use to a sensitive (agricultural, residential, parkland or institutional) use)	

☐	Minimum Distance Separation Calculation (where barns exist within 1 km) Include in Planning Study/Analysis)	
☒	Peer Review and Planning Reimbursement Agreement	$10,565.00 to cover costs associated with peer reviews of studies, advertising and

Recommended key agencies to contact:

☒ Township

☐ Trent Severn Waterway

☐ MTO

☒ Conservation Authority

☐ Health Unit

☒ First Nation

☒ Peterborough County Public Works Dept.

☐ Other: _____

Jeremy Ash - Re: FW: Lakefield South Development Area (CCTA Proj#517651)

From: Jeremy Ash
To: rlamarre@nexicom.net
Date: 6/15/2018 4:49 PM
Subject: Re: FW: Lakefield South Development Area (CCTA Proj#517651)
Cc: Jeannette Thompson; bill@tttholdings.com

Good Afternoon Rob.

Thank you for your time earlier this afternoon. I have summarized they key points of our discussion below in red.

Enjoy the weekend.

Jeremy

Jeremy Ash, B.Sc.Eng., P.Eng.
Manager - Ottawa Office
C.C. Tatham & Associates Ltd.
5335 Canotek Road, Unit 102
Ottawa, Ontario K1J 9L4
Tel: (613) 747-3636
Cell: (613) 716-6303
jash@cctatham.com
www.cctatham.com

>>> Rob Lamarre <rlamarre@nexicom.net> 6/13/2018 7:58 AM >>>

Hello Jeremy,

Please accept this further to our meeting earlier this year to discuss the TTT development proposed within the Lakefield South development Area (LSDA).

These comments are in addition to the Record of Pre-Consultation provided following our earlier meeting.

Following the meeting, you asked that the Township provide additional comment with respect to the following:

1) The approval process related to the municipal infrastructure (Municipal Class EA?).
2) Proposed storm water infrastructure on property not owned by the applicant.

3) Other issues

Infrastructure Approval Process

Approval of the infrastructure required to support the proposed development will not have to follow the Municipal Class Environmental Assessment process. It will be sufficient to manage the file through the typical Planning Approval process. The Municipal Class Environmental Assessment Manual does designate private sector developers as subject to the requirements of the EA Act if the private sector developer is proposing an undertaking of a type listed in Schedule C.

Schedule C projects are described as generally including the construction of new facilities and major expansion to existing facilities. Our review of your proposal with our consultant D. M. Wills resulted in their opinion that Schedule C does not include the activities proposed as part of the your development.

Regarding the costs for infrastructure designed and constructed by Triple T, which other land owners within the LSSPA will benefit from (i.e pipe oversizing, SWM control, road/ROW widening, etc.), Triple T would receive development charge credits for this work. The costs/credits will be jointly calculated by the Township and Triple T.

Storm Water Pond on property owned by someone other than the applicant

You have advised that the original storm water management design which was predicated on the construction of one large swm pond for the west watershed is not feasible. You have proposed the construction of a second pond on an adjacent property owned by a third party. If the need for the second pond can be substantiated, the Township would want assurance that the developer had obtained the right (ownership or otherwise) to develop that pond.

The Township will participate in a consultation process with the adjacent landowner to the west upon endorsing a revised SWM plan for the LSSPA and a preliminary SWM pond design on the adjacent lands. Triple T would participate in this consultation process also. A preliminary SWM report (by Triple T) would seem appropriate for review and approval by the Township and ORCA, following which consultation with the adjacent landowner would occur. It is not beneficial for Triple T to obtain ownership of any external land for construction of a pond to be transferred to the Township in the future.

Infrastructure through wetland

ORCA provided a very rigid response to the notion you advanced of bisecting a small portion of the existing wetland to accommodate a sanitary sewer. They were essentially unequivocal in stating that they would not permit any excavation even in light of your proposal to compensate. They advised that may permit directional boring. Jeannette and I spoke with our peers about their recent experience with the CA in relation to similar issues. They have run up against the very same responses. The CA has consistently prohibited any excavation within a wetland and our peers have not had any success getting them to deviate from that stand.

Work by Niblett Environmental related to the wetland boundary mapping is nearing completion. It will help inform our proposed sanitary sewer alignment. We will consult directly with ORCA to find middle ground on a sewer alignment that respects the wetland feature and function and meets the servicing requirements for the LSSPA.

I'm sorry it took as long as it did for us to get back to you, we wanted to speak with our consultant and other municipalities to get a clear understanding of the new realities as they relate to the protection of environmental features etc.

I'll leave it with you to propose the way forward. As always, we are open to coordinating meetings with commenting agencies, or our consultant. The ball is back in our court to start advancing the preliminary engineering design work.

An important note to consider would be the timing of the construction of the downstream sanitary main required to accommodate flows from you're the LSDA. We want to ensure that our efforts are appropriately coordinated. Noted. We can discuss this further upon completion of the preliminary engineering work which will include proposed sanitary design flows.

I look forward to hearing from you.

Robert Lamarre, MAATO, CBCO, CRBO
Manager of Building and Planning
The Corporation of The Township of Selwyn
(p) 705-292-9507 ext. 219
(f) 705-292-6491
Visit our website at www.selwyntownship.ca

Jeremy Ash - Lakefield South Secondary Plan Area - Sanitary Servicing Review Meeting Discussion Summary (CCTA Proj#517651)

From:	Jeremy Ash
To:	atobin@nexicom.net; bill@tttholdings.com; W H Turner; cellingwood@nib...
Date:	8/28/2018 12:58 PM
Subject:	Lakefield South Secondary Plan Area - Sanitary Servicing Review Meeting Discussion Summary (CCTA Proj#517651)

Good Afternoon.

As a follow up to our meeting on August 21, 2018, we provide the following summary of the key discussion points and our next steps:

1. CCTA provided a summary of the work completed since the last meeting on March 8, 2018 including: 1) Additional field work by Niblett to better understand the existing wetlands and boundaries, 2) Consultation with the Township which resolved that a typical planning approval process will be followed (as opposed to a municipal class EA) and that the Township will participate in a consultation process related to the external SWM facility (i.e located on lands not owned by Triple T) , 3) The cost for infrastructure oversizing (i.e pipe oversizing, road widening, SWM controls etc.) which would benefit other SPA land owners would be credited to Triple T by the Township in the form of development charge credits, 4) Review of three sanitary sewer collection alternatives including selecting the preferred alternative, 5) Revised servicing concept drawing showing road connectivity to the approved AON draft plan and adjustments to the development concept for the north parcel.

2. General discussion related to the preferred sanitary sewer profile and alignment including design and construction measures intended to mitigate impacts to the wetland including: open cut sewer installation in the outer 15 m of the wetland buffer (where required) however outside of the wetland buffer as much as possible, directional drilling below core wetland areas, clay trench plugs every 50 m within sensitive areas, rapid construction (7 am to 7 pm) to reduce dewatering as much as possible and same day reinstatement of surface material. ORCA mentioned TRCA's horizontal directional drill guidelines (which I now have) and these will be referenced in the development of a directional drilling plan at the construction stage.

3. Directional drilling is planned only in areas where the drill head will advance through rock. Open cut is preferred in all areas where the directional drill head would be expected to enter and exit rock since the design sewer profile would otherwise be difficult to maintain in these areas. The length of directional drilling has also been minimized to reduce construction costs. In areas where directional drilling is planned to occur, the Township will need to approve the construction method and be willing to accept some pipe deflection in the constructed sewer.

4. Minor adjustments to the sanitary sewer profile west of the north parcel were discussed and will be reflected on the preliminary design drawings and discussed in the EIS. Otherwise the group reached a consensus that the current alignment and planned mitigation efforts are generally appropriate to protect the adjacent wetland.

5. ORCA raised the potential for a steep slope erosion hazard along Rays Creek that needs to be reviewed. This will be evaluated as part of the preliminary engineering design.

6. The evaluation of the wetland and the discussed mitigation measures covered in the EIS will assume the wetland as PSW. This classification allows ORCA to review and interpret MNRFs PSW policies in-house and not require a subsequent circulation to the MNRF.

7. The location of SWM facility #3 is being reviewed by Niblett to determine if it is appropriate. The proposal to locate a SWM pond at this location is premised on it providing regular base flows to the defined watercourse downstream. Niblett will provide additional clarification on this topic in the coming weeks, prior to the development of the EIS and preliminary engineering documents.

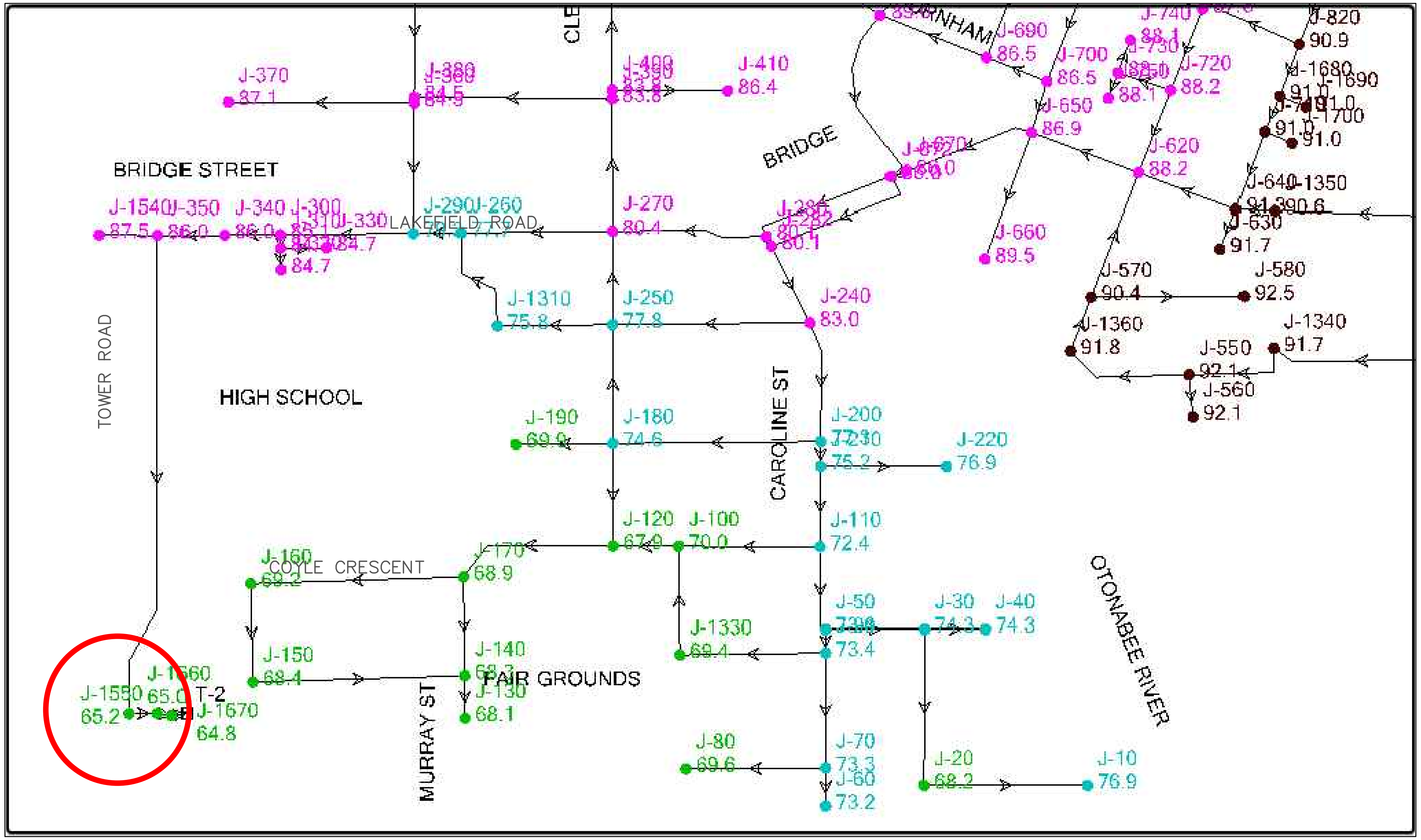
If you have any questions or inclusions/exclusions to the above, please 'reply all' to the group.

Thank you.

Jeremy

Jeremy Ash, B.Sc.Eng., P.Eng.
Manager - Ottawa Office
C.C. Tatham & Associates Ltd.
5335 Canotek Road, Unit 102
Ottawa, Ontario K1J 9L4
Tel: (613) 747-3636
Cell: (613) 716-6303
jash@cctatham.com
www.cctatham.com

Appendix B: Water System Information



USING 2013 MODEL DATA

Sketch No.

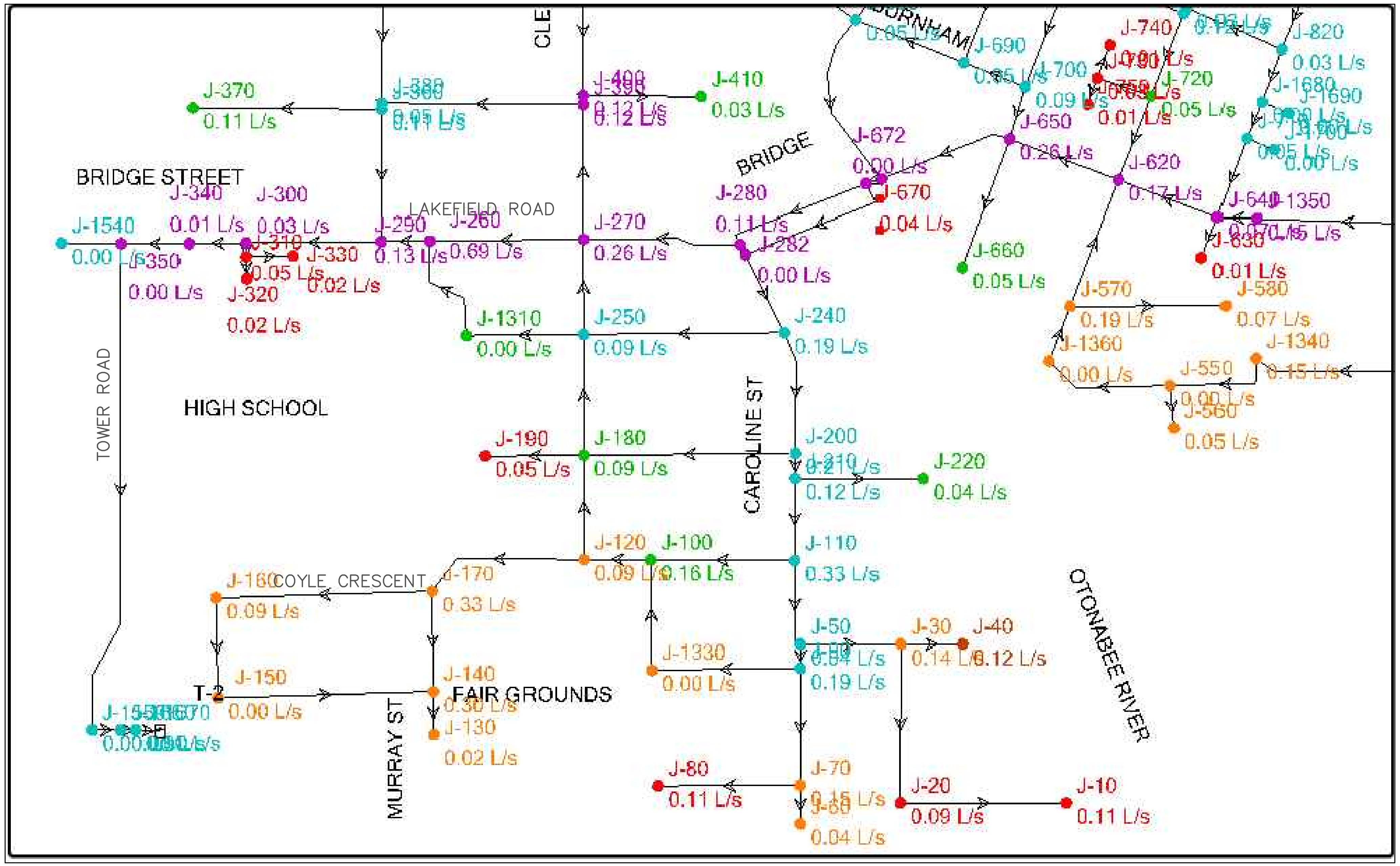
EXISTING
AVERAGE DAY PRESSURE
(lbs/In^2)

W I L L S

D.M. Wills Associates Limited
150 Jameson Drive
Peterborough, Ontario
Canada K9J 0B9

P. 705.742.2297
F. 705.741.3568
E. wills@dmwills.com

Drawn By CS	Scale NTS
	Plot Date FEBRUARY 2020
	Project No. 2918
Engineer RJ	Drawing File No. 2918_FIGURES



USING 2013 MODEL DATA

Sketch No.

EXISTING
AVERAGE DAY DEMAND

WILLS

D.M. Wills Associates Limited
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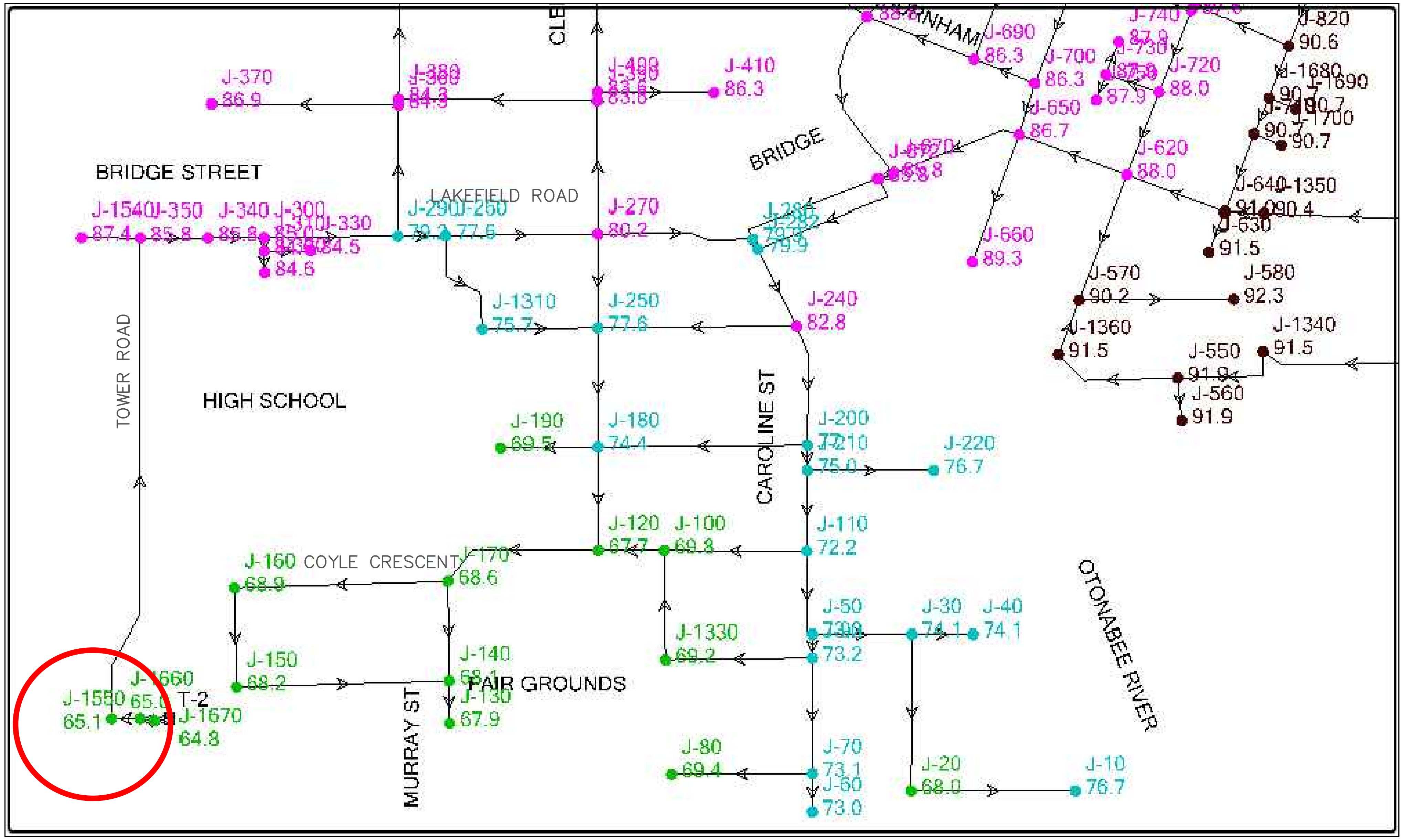
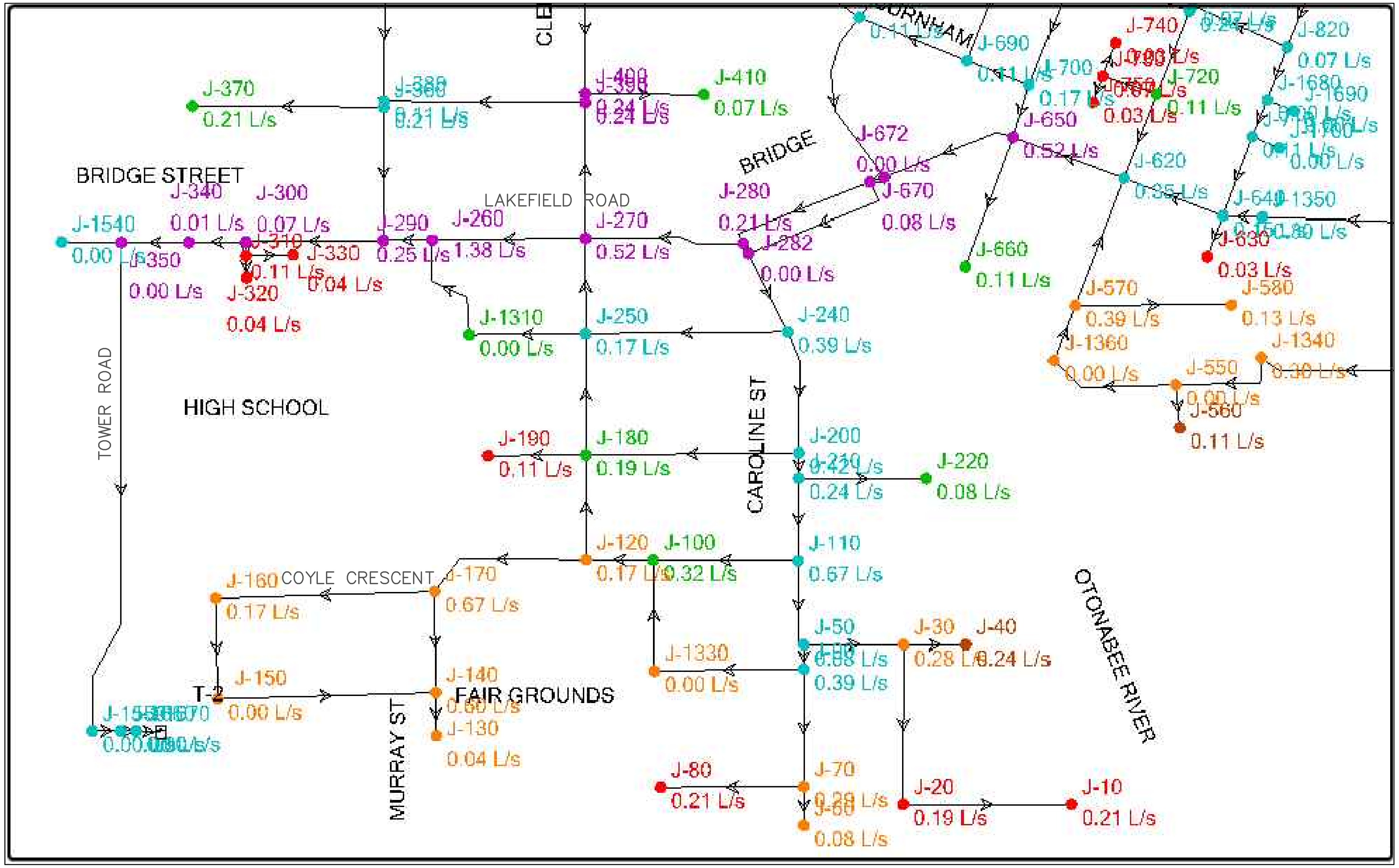
Drawn By	CS
Engineer	RJ
Scale	NTS
Plot Date	FEBRUARY 2020
Project No.	2918
Drawing File No.	2918_FIGURES



USING 2013 MODEL DATA

Sketch No. EXISTING MAXIMUM DAY PRESSURE (lbs/In^2)	D.M. Wills Associates Limited 150 Jameson Drive Peterborough, Ontario Canada K9J 0B9 P. 705.742.2297 F. 705.741.3568 E. wills@dmwills.com	Drawn By CS	Scale NTS
			Plot Date FEBRUARY 2020
			Project No. 2918
		Engineer RJ	Drawing File No. 2918_FIGURES



USING 2013 MODEL DATA

Sketch No.

EXISTING
MAXIMUM DAY DEMAND

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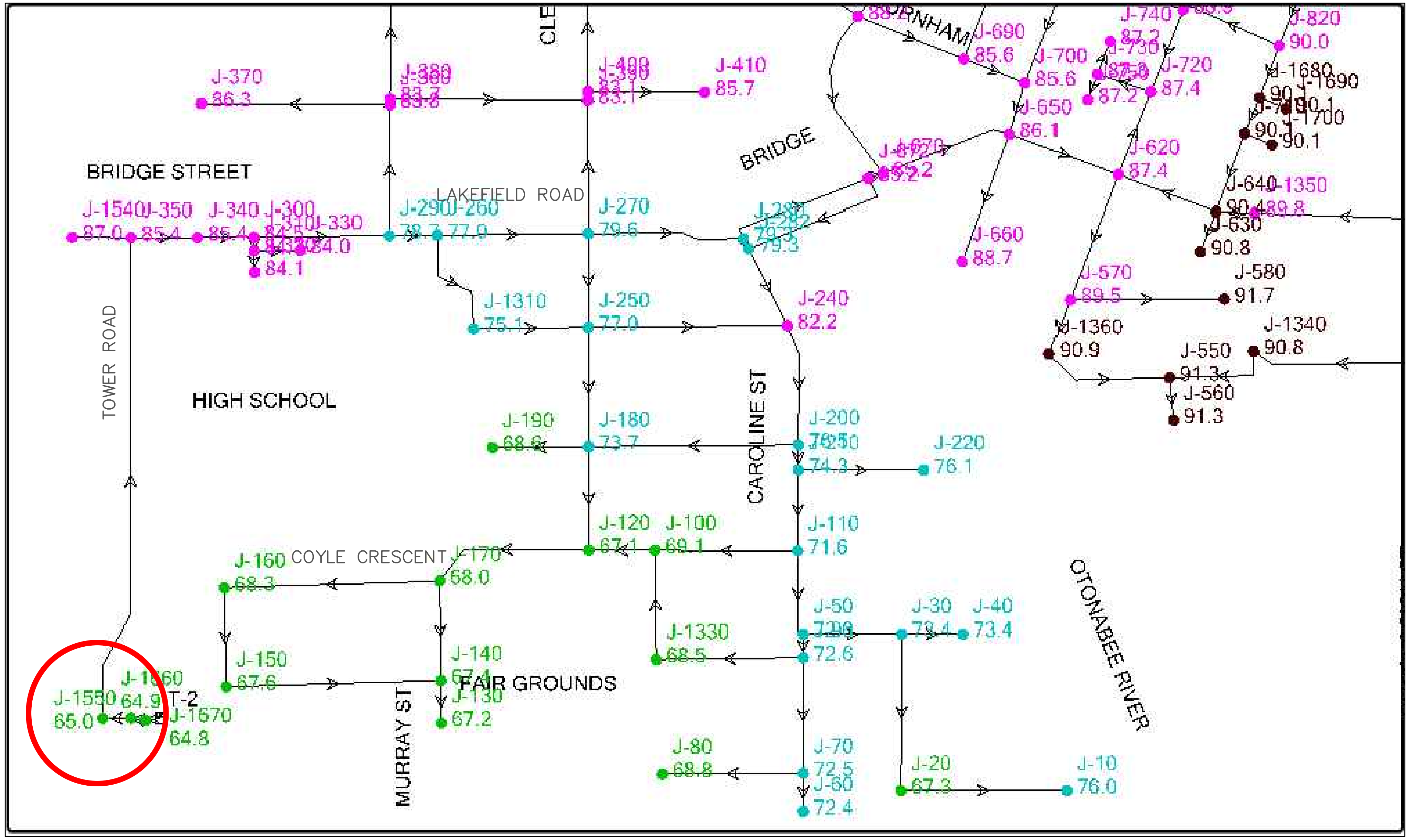
Drawn By: CS	Scale: NTS
	Plot Date: FEBRUARY 2020
	Project No.: 2918
Engineer: RJ	Drawing File No.: 2918_FIGURES



USING 2013 MODEL DATA

Sketch No.

EXISTING
PEAK HOUR PRESSURE
(lbs/In^2)

WILLS

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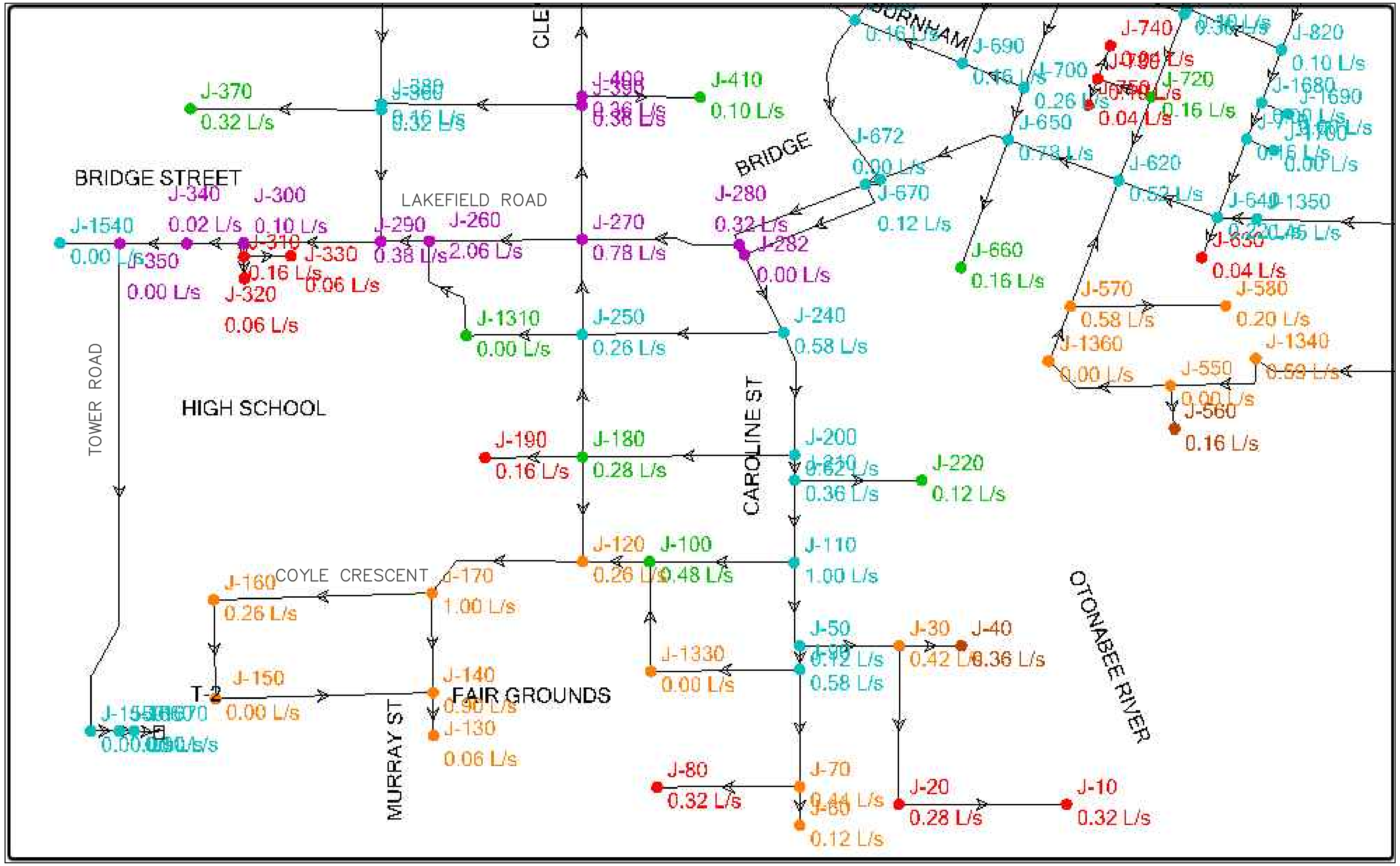
Drawn By CS	Scale NTS
	Plot Date FEBRUARY 2020
	Project No. 2918
Engineer RJ	Drawing File No. 2918_FIGURES



USING 2013 MODEL DATA

Sketch No.

EXISTING
PEAK HOUR DEMAND

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Plot Date	FEBRUARY 2020
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Drawing File No.	2918_FIGURES

WILLS

PARTNERS IN ENGINEERING, PLANNING & ENVIRONMENTAL SERVICES

March 13, 2023

Township of Selwyn
1310 Centre Line Road
Selwyn, ON
K9J 6X5

Attention: Lane Vance, Manager of Financial Services/Treasurer

Re: Lakefield South Development Area – Servicing Capacity Analysis Technical Memo – Triple T. Holdings Ltd. – Impacts to Committed Hydraulic Capacity (Phase 1 – Revision 2)
Township of Selwyn
D.M. Wills Project No. 22-20217

D.M. Wills Associates Limited (Wills) is pleased to submit our findings as it relates to the committed hydraulic capacity and how it relates to the proposed Triple T. Holdings and AON Inc. Developments.

This technical memo has been prepared using existing modelling and data, along with details regarding the proposed Lakefield South development, that are consistent with the following documents:

- 3358 Lakefield Road, Township of Selwyn, Functional Servicing & Preliminary Stormwater Management Report (FSR, Tatham Engineering, November 18, 2020)
- Lakefield Water Distribution System: Modelling and Assessment Report (Existing Model Report, Wills, April 2013)
- Lakefield Sanitary Servicing Upgrades, Schedule B – Municipal Class Environmental Assessment Phase 1 & 2 Report (Wills, 2016)
- George Street Sewage Pumping Station (Lakefield) Design Brief (Wills, 2017)
- WaterCAD v8i water distribution model, Scenarios: “Existing System Average Day 2013”, “Existing System Maximum Day 2013”, and “Existing System Peak Hour 2013”
- Annual Uncommitted Sewage and Water Reserve Capacity Report: Lakefield Systems, 2022 (Uncommitted Water Capacity Report)

1.0 Wastewater

A high level review has been completed based on a Draft Plan completed by EcoVue Consulting Services Inc. dated February 25, 2021.

Based on the above Draft Plan, the following units were identified:

	HD units	MD units	LD units
Phase 1	110	0	0
Phase 2	92	0	43
Phase 3	0	0	66
Phase 4	0	6	53
Phase 5	58	0	23
Phase 6	40	44	0
Phase 7	0	0	64
Phase 8	142	21	0
Phase 9	0	5	31
Phase 10	144	24	0
Totals	586	100	280

Based on the draft plan of the Proposed Triple T. Holdings. development, we calculated a population utilizing the following population densities:

- Low Density – 3.5 persons/per/unit
- Medium Density – 2.4 persons/per/unit
- High Density – 2.0 persons/per/unit

This provides a total of 966 units with an accumulated population of 2,392.

The following sections provide an overview of the potential impacts that the additional population may have on the existing water and wastewater infrastructure within the Village of Lakefield.

1.1 Lakefield Wastewater Sewage Lagoons:

The existing Lakefield Wastewater Sewage Lagoons have a rated capacity of **2,300 m³/d**, as per the Annual Uncommitted Sewage and Water Reserve

Capacity Report (November 2022). The average daily flow rate into the lagoons is **1,505 m³/d**. This leaves an available capacity of **795 m³/d**.

A review of the Annual Uncommitted Sewage and Water Reserve Capacity Report 2022 was completed to determine actual flows being generated vs. theoretical flows. Based on the findings of the report, a total of 1,688 units are connected to the Lakefield Wastewater System. (1505 m³/d/3545 persons = 0.4245 m3/c/d) This results in a calculated approximate 425 L/c/d, including extraneous flows into the system.

Flows calculated in the Tatham Engineering FSR assumed 450 L/c/d with an additional 0.28 L/s/ha for extraneous flows. This approach is considered to be too conservative to accurately determine timing of infrastructure upgrades and associated costs. It is Wills position that 450 L/c/d (which includes extraneous flows) is an appropriate and conservative analysis of future growth based on existing conditions identified in the report.

An analysis was performed calculating average daily flows considering the future flows generated by the Triple T. Proposed Development.

The analysis reveals the following:

Table 1 – Average Daily Flow

Population	Flow 450 L/c/d	Conversion to m³
2392	1,076,400 L/c/d	**1,075 m³/d**

Based on the calculation in **Table 1** the total flows following the full build-out of the Triple T. development (1,505 m³/d + 1,075 m³/d = **2,580 m³/d**), will exceed the rated capacity of the Lagoons by approximately 12%.

Assuming expansion of the Sewage Lagoons would be targeted at 90% rated capacity or **2,070 m³/d**, the residual capacity is **565 m³/d** (2,070 m³/d - 1,505 m³/d). Based on an average persons per unit of 2.50 and a flow generation of 450 L/s/d, approximately **502 units** could be accommodated in the existing Lagoon system.

It should be noted that the design and timing associated with the approvals from MOECP/ECA for the expansion of the Lagoons system should commence at 80% capacity or upon the addition of approximately **335 m³/d** (1,840 m3/d – 1,505 m3/d), equivalent to approximately **298 units.**

As per our proposal, Wills will need to engage a qualified Consulting Engineer to review expansion to the existing lagoon system.

Approaches to consider are:

- Utilization of the existing lagoon system with mechanical screening facility and modifications for enhanced ammonia removal (within the lagoons)
- Provisions of additional lagoons with mechanical screening and enhanced ammonia removal (within the lagoons)
- Utilization of the existing lagoon system with mechanical screening facility and provision of additional mechanical process

1.2 George Street Pumping Station:

The current capacity and planned expansion of the George Street Pumping Station are based on the information provided in the George Street Sewage Pumping Station Design Brief (Wills, 2017) and the Lakefield Sanitary Servicing Upgrades, Schedule B – Municipal Class Environmental Assessment Phase 1 & 2 Report (Wills, 2016)

This analysis assumes that all flows from the full build-out of both the proposed Triple T. development and the AON Inc. proposed development will be directed to the George Street SPS.

According to the George Street Sewage Pumping Station Design Brief (Wills, 2017, page 8), the current rated capacity of the SPS is approximately 45 L/s. According to the Lakefield Sanitary Servicing Upgrades EA (Wills, 2016, Page 27), the current peak flow to the station is estimated to be **24 L/s**. This leaves a residual capacity of approximately **21 L/s**. This would equate to approximately **430 units,** including a Harmon peaking factor of 3.75.

Based on the recommendations of the Lakefield Sanitary Servicing Upgrades EA, the SPS has been designed to accommodate staged increases up to **85 L/s** rated capacity.

Wills has completed a sanitary sewer design sheet based off the proposed building densities provided in the FSR for the proposed Triple T. Development prepared by Tatham. Considering a flow rate of 450 L/c/day, which includes contributions due to inflow and infiltration, a total peak flow of **43 L/s** is expected.

Flows generated by the Aon Inc. Proposed Development were calculated based on the unit count provided in the Tatham FSR. Peak flow generated by the AON Inc. Proposed Development is calculated to be approximately **14.6 L/s**.

Therefore, the proposed developments are expected to introduce an additional **57.6 L/s** additional flow to the George Street SPS. With consideration to the existing flow, this would total approximately **83 L/s** being directed to the George Street SPS, which would result in the George Street SPS running at **98% capacity**.

It is understood that further analysis is required in the next Phase of our study to identify capacity requirements of the George Street SPS. Flow monitoring of the SPS is recommended at 70% buildout to calculate real flow capacity checks. Design of the expansion of the George Street Pumping Station should commence at 80% capacity or **68 L/s**. As the SPS is currently accommodating 25 L/s, this would equate to approximately **41 L/s** residual capacity or **840 additional units** into the George Street SPS.

1.3 Water Street Pumping Station Upgrades:

According to the Lakefield Sanitary Servicing Upgrades EA (Wills, 2016, page 25) the station has a rated pumping capacity of **87.5 L/s** with two duty pumps operating and delivering sanitary flows to the lagoons through one forcemain. Currently the station is receiving approximately 60 L/s, leaving a residual capacity of approximately **27.5 L/s**. This would equate to approximately **563 units** available in the current condition.

The Lakefield Sanitary Servicing Upgrades EA (Wills, 2016) indicates the SPS has a twin forcemain and two duty pump system with one standby pump, the station would deliver approximately **126 L/s** with both duty pumps operating and pumping to separate forcemains. The Town has indicated that they will not support operating both forcemains concurrently.

Therefore, the following option was reviewed:

<u>Preferred Option:</u>

The Lakefield Sanitary Servicing Upgrades EA (Wills, 2016) states one of the existing forcemains has the capacity to accommodate a flow (pumping rate) of approximately **141 L/s** leaving a residual capacity of **81 L/s or**

approximately 1,659 units. We note that this upgrade would fall into a Schedule A+ Class EA.

It is considered that additional pumping capacity as dictated by growth and increased sanitary flows could be provided by replacing the existing pumps or by equipping the existing pumps with larger impellers. It is noted that, based on available information, the existing pumps are equipped with 290 mm diameter impellers but can accommodate impeller diameters up to 355 mm to suit increased flow and/or head requirements. The use of larger impellers may also require larger horsepower motors which will require further review of the adequacy of station electrical capacity (starters, standby generator, normal power system). Although, indications are that the three existing 45 kW pumps (2 duty + 1 standby) were occasionally operated simultaneously in the past to accommodate high flows with the original forcemain, so it is anticipated that the station would have electrical capacity to operate two 60 kW pumps (2 duty).

The Lakefield Sanitary Servicing Upgrades EA (Wills, 2016) confirms that the existing wet well is not considered a significant limitation to moderate increases to the SPS capacity.

1.3.1 Cost Considerations George Street SPS:

The Lakefield Sanitary Servicing Upgrades EA (Wills, 2016) provided cost estimates to upgrade the George Street SPS to **60 L/s** rated capacity and an additional cost to upgrade to **85 L/s**. The EA also recommended twinning of the forcemain with a 250 mm diameter forcemain leaving the existing 200 mm forecmain in place for redundancy. The cost identified in the EA for the 250 mm forcemain was $400,000.00 (2016). This cost has been indexed at 5% to 2025. The costs associated with upgrading capacity was indexed at 3% per year. We have revised indexing to 5% per year.

	Indexed to 5%
Upgrade to 60 L/s Rated Capacity	$100,000.00 (2026) - $125,000.00
Upgrade to 85 L/s Rated Capacity	$100,000.00 (2040) - $164,000.00
Total	**$289,000.00**

1.3.2 Cost Considerations Water Street SPS:

Estimated Cost to increase Water Street SPS capacity (2030)	**$320,000.00**

Timing of upgrades to the Sanitary Pump Stations will be reliant on the buildout of the Lakefield South Development Area.

Wills does not currently have in house expertise on the design of Pump Stations. The upgrades and associated cost to increase capacity at the Water Street SPS should be reviewed by a qualified consultant. The above cost was calculated by interpolating the cost associated with the upgrades of the George Street upgrades identified in the 2016 EA and indexed at 5% to the year 2030 and should be referenced as order of magnitude only.

1.4 Key Gravity Sewers:

As identified in the Lakefield Sanitary Servicing Upgrades EA (Wills, 2016), gravity sewers on George Street and sewers from the George Street SPS to the Water Street SPS will need to be upgraded.

We note that there is currently a discrepancy between the Township's GIS-based structure indentifiers and the values used in the Triple T. FSR prepared by Tatham. We suggest that the FSR be revised to reflect the Municipality's latest information. We have referenced all structures by the Township's GIS system, and **included the values in the FSR in (parentheses)**.

The Township has provided direction to proceed with an alternative servicing option to direct flows from the George Street SPS to the Water Street SPS via twin 250 mm forcemeains along Water Street.

1.5 Tower Road

MH 243 (MH 201)

Additional peak flows directed to Tower Road will be approximately an additional **57.6 L/s** considering the Triple T. Holdings and AON Inc. Proposed Developments. There are two connection points on Tower Road at MH 243 (MH 201) and MH 250 (MH 208) via Ray's Creek. Additional flows to MH 243 (MH 201) are as follows:

Triple T. Holdings	13.7 L/s
AON	16.3 L/s
Total	**30 L/s**

MH 250 (MH 208)

Additional flows directed to MH 250 (MH 208) are as follows:

Triple T. Holdings **30 L/s**

A capacity analysis was performed on the existing sewer between MH 243 (MH 201) and MH 253 (MH 212) on Tower Road. The section of sewer from MH 246 (MH 204) to MH 247 (MH 205) was identified in the Tathum FSR as a potential corncern with regards to a capacity constraint. Our review confirms this section of pipe to be the “bottleneck” within the Tower Road sanitary sewers.

Our findings are as follows:

- There is a significant capacity constraint on the sanitary sewer system on Tower Road at MH 246 (MH 204) to MH 247 (MH 205).
- Sanitary sewers from MH 246 (MH 204) to MH 250 (MH 208) will require upsizing from 200 mm to 300 mm diameter to accomodate the full buildout of the Proposed Triple T. Holdings and AON Inc. Proposed Developments.
- The existing 300 mm sanitary sewer from MH 250 (MH 208) to MH 253 (MH 212) @ 1.00% has capacity for 96.7 L/s and would be at 74% capacity (assuming 72 L/s) from MH 250 (MH 208) to MH 253 (MH 212) and therefore has sufficient capacity to accommodate the proposed developments to full build out.
- The existing capacity of the sanitary sewer on Tower Road could accommodate appoximately **480 units** in its existing condition.

1.5.1 Cost Considerations:

A review of the cost to upsize the sewers from MH 243 (MH 201) to MH 250 (MH 208) was completed. Our findings are as follows:

There is sufficient capacity to accommodate the proposed Triple T. Holdings and AON Inc. Properties from MH 243 (MH 201) to MH 246 (MH 204). MH 243 (MH 204) to MH 250 (MH 208) will require upsizing from 200 mm diameter to 300 mm diameter to accomadate the proposed developments.

Cost to remove and replace exist sanitary sewer **$370,000.00**

The cost estimate includes:

- Design and Approval of revised drawings
- Excavation and removal of existing 200 mm sanitary sewer and three 1200 mm manholes*
- Installation of 356.5 m of 300 mm sanitary sewer and three 200 mm manholes
- Backfill and restoration of Tower Road (assumes road constructed to base asphalt)

* Note: Recommend existing manholes be inspected to determine if they can be salvaged.

2.0 Forcemain

Currently the George Street SPS has capacity up to 45 L/s. Currently the pump station is receiving 24 L/s, leaving 21 L/s available. As stated above, the 250 mm forcemain would be required once the George Street SPS exceeds **75 L/s**. We understand that through construction of the George SPS, 20 m of 250 mm forcemain was installed for future connection. This was identified in the George Street SPS Design Brief prepared by Wills in July 2017.

As previously stated, an option to construct twin 250 mm forcemains from the George Street SPS Burnham Street to the Water Street SPS to avoid upsizing sanitary sewers on Burnham Street, Queen Street, Albert Street, Regent Street and Duff Street is the preferred option. This option requires an additional 550 m of twin 250 mm forcemains from the George Street SPS to the Water Street SPS.

2.1 Cost Considerations:

The cost associated with the above option would require the installation of approximately 150 m of 250 mm twinned forcemain crossing the Otonabee River plus 550 m of 250 mm twinned forcemain from the river crossing to the Water Street SPS.

Estimated cost of twinned forcemain (including river crossings): **$900,000.00**

3.0 Water Distribution System Modelling

Wills has been retained to review the impact of the proposed Lakefield South Development on the water distribution system throughout the Village of Lakefield. This analysis is completed in keeping with the recommendation within 3358 Lakefield Road, Township of Selwyn, Functional Servicing & Preliminary Stormwater Management Report (Tatham Engineering, November 18, 2020) that “further review of the Township’s water distribution model would need to be completed to confirm the broader effects of [an interim connection to Coyle Crescent]”.

The intention of this technical memo is to determine the impact, if any, that the proposed Lakefield South development may have on the function of the existing water distribution system. Particular attention was paid to changes in pressure during various design scenarios, and the available fire flow.

The assessment includes adjustments to the water demand values and selected pipe sizes / connections within the steady-state, hydraulic model. There were no changes to the model or technical design regarding:

- Source water supply; including water availability or delivery of water via pumps to the distribution system
- Water storage; including the function of any water tower or standpipe
- Water treatment; including free chlorine residual throughout the system

The model was run under average day, maximum day, peak hour, and fire flow demand scenarios. The review of the impacts to the system is based on a generalized comparison of the available pressure and flow at nodes throughout the system.

Two stages of development were considered in this analysis, as follows:

- Full buildout of Phase 1, temporary connection from Tower Road to Coyle Crescent to effectively loop Phase I, and partial buildout of Phase 2 up to 50 units (un-looped)

- Full buildout of all Phases, fully looped through a new connection to Murray Street

3.1 Water Demand, Treatment, and Storage Capacity

The adjustments to the water demand within the model were based on the recommendations and guidance within the previous Existing Model Report, the Uncommitted Water Capacity Report, and the FSR. The FSR noted that the previous EA Study by AECOM (2010) recommended a per-person demand of 340 L/c/day; however, for design purposes both the Ministry of the Environment, Conservation and Parks (MECP) maximum value of 450 L/c/day and the historical and current value of 400 L/c/day were considered. Based on the input of the previous reports, the following demand criteria were applied:

Table 2 – Water Demand Criteria

Criteria	Value
Persons / Unit	2.5
Demand (l/c/day)	400
Peaking Factor: Max Day	2.0
Peaking Factor: Peak Hour	3.0

The total demand for the Lakefield South development is based on the number of proposed units and the above assumptions. As discussed, two stages of development were considered in this assessment. A summary of the demand for each stage is provided in **Table 3 below.**

Table 3 – Water Demand Summary

Development Phase	Total Units[1]	Average Day Demand (L/s)
Stage 1 – Phase 1 and Phase 2 (50 Lots)		
Phase 1 (Looped)	110	1.27
Phase 2 (50 Lots, Un-Looped)	50	0.58
Stage 2 – All Phases		
Phase 1 (Looped)	110	1.27
Phase 2 – 10 (Looped)	856	9.9

Notes: 1 - Total Units represents the sum of all Residential, Township and Apartment Units, as counted per phase from Drawing DP1 (Ecovue, February 25, 2021); the sum equals the Site Statistic values in the table at the top-left.

According to the Uncommitted Water Capacity Report, on an average day the water distribution system draws and treats 1,419 m^3/d (raw water pumpage, 2019-2021). This value (equal to 16.4 L/s) is similar to the demand within the existing water distribution model, which is 17.9 L/s.

Based on a per capita usage of 400 L/c/day, which is in keeping with the Uncommitted Water Capacity Report, the proposed full build out of all phases of the development will increase the average day demand to 2,386 m^3/d.

A steady-state distribution model does not generally provide any guidance on the adequacy of the water storage systems or the capacity of water treatment plants. However, the Existing Model Report (Wills, 2013) provides information, drawn from an Environmental Assessment Study completed by AECOM in 2010, that is relevant to this investigation. The following tables are taken from Sections 1.2 through 1.4 of the Existing Model Report:

Lakefield Water Supply System Future Population and Water Demands

	2010	2020	2030
Equivalent Population*	3,680	4,710	6,030
Average Day Flow (m^3/d)*	1,251	1,600	2,050
Maximum Day Flow (m^3/d)*	2,500	3,200	4,100
Peak Hour Flow (m^3/d)	3,750	4,800	6,150

*From 2010 Class Environmental Assessment (Schedule B) Phase 1 and 2 Report

Lakefield Water Supply System Future Storage Requirements*

	2010	2020	2030
Fire Storage (m^3)	864	998	1,717
Equalization Storage (m^3)	625	800	1,025
Emergency Storage (m^3)	372	450	686
Total Storage (m^3)	1,861	2,248	3,428

*From 2010 Class Environmental Assessment (Schedule B) Phase 1 and 2 Report.

Based on the previous reports, the following observations are provided:

<u>With Respect to Water Treatment</u>

- The Lakefield South development includes an additional 2,415 persons. Based on a usage of 400 L/c/day, the average day demand in the model is expected to increase from 16.7 L/s (1,419 m^3/day) to 27.6 L/s (2,386 m^3/day). The Maximum Day Flow is expected to increase to 55.2 L/s (**4,773 m^3/day**). This is in excess of the anticipated 2030 demand values.
- According to Page 2 of the Existing Model Report, *"Where adequate treated water storage is available, the capacity of the treatment plant should generally **be at least equal to the maximum day demand** on the system with an allowance for in-plant usage."*
- According to Page 2 of the Existing Model Report, *"The Lakefield Water Supply System has a permitted capacity of 3,590 m^3/d. It is understood that the design of the 2003 upgrades to the Lakefield Water Treatment Plant (WTP), as outlined in the 2003 Design Report prepared by RAL Engineering, took into consideration the planned expansion of the plant to a **future capacity of 4,500 m^3/d.**"*
- According to the above information, the full build-out of the Lakefield South Lands will exceed the upgraded treatment capacity Lakefield Water Treatment Plant.
- It is estimated that approximately 624 units can be serviced by utilizing 90% of the future capacity. This is similar to the estimate within the Uncommitted Water Capacity Report, which suggests that 666 additional units can be serviced by the system.

<u>With Respect to Water Storage</u>

- The anticipated total water demands including the full buildout of the Lakefield South lands are (116%) of the projected 2030 demands.
- The calculations for required water storage are based on criteria for fire storage, equalization storage, and emergency storage, which do not necessarily scale directly with peak flow demand.
- Based on preliminary estimates, the theoretical storage for the population increase contemplated by the full build out of the development may be in the order of 3,638 m^3.

- According to Page 3 of the Existing Model Report, "*Available storage volumes…provided within the standpipe and elevated tank are approximately 800 m^3 and 2,630 m^3 respectively.*" The Water Model Report clarifies that the elevated water storage tank was commissioned in 2012 with a storage of 2,750 m^3. Therefore, the total available storage is therefore **3,550 m^3.**
- According to the above information, the full build-out of the Lakefield South Lands will be close to the capacity of the current Lakefield storage tower and standpipe.
- It is our understanding that water storage requirements are MECP recommendations and are not mandated. Additional consultation may be warranted to ensure the municipality is comfortable with the fire flow that will be provided upon full build-out. The storage volume above is based on 159 L/s for 3 hours.

3.2 Fire Flow Modelling

An additional scenario was assessed for each stage described above to determine the impact that the development may have on the available fire flow throughout the system. The fire flow was assessed in keeping with the Existing Model Report, which states that the model distribution system pressures should be maintained above 140 kPa (20 kpi) under maximum day plus fire flow conditions.

For the purposes of the Existing Model Report, a minimum fire flow of 33 L/s was considered adequate for the fire department to combat a single residential fire. The available fire flow was calculated using the fire flow analysis tool contained within the modelling software, in keeping with the Existing Model Report.

3.3 Modelling Assumptions

Two model stages were considered to assess the potential impact of the Lakefield South Development on the water distribution system. The adjustments to the model were made with the following assumptions:

- All new watermains were assumed to be 150 mm diameter, PVC pipes, with associated roughness 'c' values in keeping with the existing model.
- The elevations of the additional phases were generalized based on the highest proposed maintenance hole T/G elevation within the phase.

- The internal water distribution network was not modelled in detail. One watermain link was used to represent flow to and through the phases.
- The connection to Coyle Crescent was assumed to be temporary and was removed once the connection to Murray Street was established.

3.4 Summary of Impacts

3.4.1 Average Day, Maximum Day, and Peak Hour Pressure

In general, the addition of the Lakefield South development to the water distribution model had very little impact to the available pressure throughout the system during the Average Day, Max Day, and Peak Hour demand scenarios. There were no locations where pressures fell below 40 psi throughout the system; some nodes reduced slightly to less than 50 psi near Strickland Street, which may warrant closer attention. The most significant impact was observed at node J-130 (Murray Street), which is expected to experience a drop in pressure of approximately 2.2%, but remain within an appropriate range, under full-build conditions and during Peak Hour demand. A full comparison at each node is appended to this memo.

3.4.2 Available Fire Flow

The results of the Fire Flow assessment are somewhat diverse. The area in proximity to the proposed looping (Murray Street) is generally improved, which is reasonable given the additional flow path to these nodes.

There are some locations within the model where Fire Flow rates are reduced. The most significant reduction is at J-1850 and J-1550, where flow rates are reduced in the order of 20 L/s. However, these are locations with significantly high existing flow rates, so the results do not indicate a deficiency in the system. As a percentage of the existing flow rates, the reduction is in the order of 5%.

The most vulnerable locations within the model, dead end pipes with little fire flow available, showed very little difference as a result of the updates. For almost all locations where the fire flow is less than 50 L/s, the percentage reduction in fire flow was less than 1.0%

3.5 Water Distribution System Updates: 1991 - 2013

As part of the assessment of the water distribution system and model, Wills reviewed the status of various recommended improvements and upgrades, that may or may not have been implemented since they were recommended in previous technical reports. This audit of the 2013 water distribution model was completed with consideration to the following reports:

- Lakefield South Development Plan, Infrastructure Assessment Report (Wills, 2002)
- Village of Lakefield Water Distribution Lifeline Study (Wills, 1991)

While both reports reference various watermain improvements, the most comprehensive list is provided on Page 7-4 of the Water Distribution Lifeline Study (1991). **Table 4** and **Table 5** below summarize the recommended improvements, along with the current status in both the Township GIS records and the model:

Table 4 – Potential Historic Watermain Upgrades

Street Name	From	To	Diameter (GIS)	Diameter (Model)
George St.	Hunter St.	Clementi St.	200 mm	200 mm
Nassau St.	West End	Clementi St.	30 mm	30 mm
Katherine St.	Caroline St.	East End	150 mm	150 mm
Fraser St.	Smith St.	George St.	200 mm	200 mm
Rabbitt St.	Albert St.	Reid St.	200 mm (Part 30 mm)	200 mm (Part 30 mm)
Baptie Lane	Regent St.	Rabbitt St.	150 mm (Part 30 mm)	150 mm (Part 30 mm)
George St.	Fraser St.	West End	200 mm	200 mm

Table 5 – Potential Historic Watermain Loops

Street Name	From	To	Looped (GIS)	Looped (Model)
Braden St.	Simmons St.	Fitzgerald St.	No	No
River Cross	Trailer Park	Steward St.	No	No
Haugue Blvd.	George St.	D'eyncourt	No	No
Rabbitt St.	Baptie Ln.	Albert St.	Yes	Yes
Concession	Albert St.	Oxford St.	Yes	Yes
Albert St.	Concession	Rabbitt St.	Yes	Yes
Water St.	Bridge St.	Regent St.	No	No

Table 4 and **Table 5** demonstrate that all of the improvements that were considered in the previous technical studies are represented in the model in a manner that is consistent with the Township's GIS records.

3.6 Other Considerations

This assessment of the impact of the Lakefield South Development is based on the water distribution model that was completed as part of the 2013 Water Model Update study. We note that additional scenarios exist in our digital version of the model that may reflect changes in the distribution system since 2013. Since we do not have a formal submission or acceptance of any newer scenarios, we have relied on the 2013 information.

However, we believe that additional analysis may be warranted to ensure the model is 'up to date'. The key model updates that we recommend are as follows:

- The existing calibrated model does not include the Triple T. development near Strickland Street. We suggest that Tatham provide a final version of the water distribution system and associated demands for consideration in the overall water distribution model.
- The 2013 model reflects the use of the Strickland Street standpipe, which we understand has been taken in and out of service in the past. We recommend that a study be commissioned to examine the impact of the loss of this standpipe, prior to acceptance of this assessment.

- The 2013 model reflects a closed one-way valve on Rolliston Street, and no booster station. We understand that the booster station exists and has been taken in and out of service in the past. We recommend that a study be commissioned to examine the impact of this booster station, prior to acceptance of this assessment.

3.7 Conclusions

Wastewater Distribution:

The following tables are a summary of existing capacity of infrastructure and required upgrades with estimated costs:

Lagoon System

Existing Rated Capacity	Current Flow Rate	Residual Capacity	Equivalent # of Units	Estimated Cost of Upgrades
2,300 m^3/d	1,505 m^3/d	565 m^3/d @ 90% Capacity	500	
Required Upgrades				
Expansion of Existing Lagoon System				TBD

George Street SPS

Existing Rated Capacity	Current Flow Rate	Residual Capacity	Equivalent # of Units	Estimated Cost of Upgrades
42 L/s	25 L/s	15 L/s	330 units	
Required Upgrades				
Expand Capacity to 85 L/s		60 L/s	1,264 total units (98% capacity)	$290,000.00

Water Street SPS

Existing Rated Capacity	Current Flow Rate	Residual Capacity	Equivalent # of Units	Estimated Cost of Upgrades
87.5 L/s	60 L/s	27 L/s	592 units	
Required Upgrades				
Upgrade Pumps to Increase Capacity			1,777 units	$320,000.00

Tower Road Sanitary Sewers Upgrades

Existing Capacity – Constraint MH204-MH205	Current Available Capacity	Equivalent # of Units	Estimated Cost of Upgrades
21.76 L/s 0(80% capacity)	21.76 L/s 0(80% capacity)	480 units	
Required Upgrades			
Upsize Sanitary Sewers MH204-MH208			$370,000.00

Forcemain George Street SPS to Water Street SPS

Existing Capacity	Current Flow Rate	Residual Capacity	Equivalent # of Units	Estimated Cost of Upgrades
75 L/s	25 L/s	50 L/s	1,097 units	
Required Upgrades				
Twin 250mm Forcemains from George Street SPS to Water Street SPS	25 L/s	60 L/s	1,317 units (based on 100% capacity of George Street SPS)	*$900,000.00 (see note below)

* Note: A portion of which is to be included as part of the Water Street upgrades, currently under design at Wills.

Water Distribution:

The Lakefield South Water Model update is intended to provide a summary overview of the impacts that the development may have on the water distribution system throughout the Village of Lakefield.

The impacts to the pressure throughout the system during the Average Day, Max Day, and Peak Hour scenarios are minor. The impacts to fire flow are varied. In some cases, fire flow rates in the vicinity of Murray Street were improved as a result of the proposed looping. Some reductions were observed in locations with sufficiently high fire flow to accommodate the change. The vulnerable locations in the existing model were generally unchanged as a result of the proposed development.

The following tables are a summary of existing capacity of infrastructure and required upgrades:

Water Treatment Plant

Existing Conditions	Capacity m3/d	Anticipated Demand m3/d	Residual Capacity m3/d	Equivalent # of Units to 90% Cap
	3,590	2,838	752	624
Proposed Upgrades				
	4,500	4,773	-	-

Water Storage

Existing Conditions	Capacity m3	Anticipated Needs m3	Residual Capacity m3	Equivalent # of Units to 90% Cap
	3,550	2,248	1,302	-
Proposed Upgrades				
	3,550	3,638	-	-

Prior to acceptance of the findings of this assessment, we recommend that an additional study be commissioned to ensure that the model is up to date and reflects the current state of development and updated operation practices. Of particular importance is the non-function of the Strickland Street standpipe, which may still be operational in the water distribution model.

4.0 Closing

We trust this memo addresses the needs of the Township with respect to the impacts to the existing capacity of infrastructure with the inclusion of the Proposed Triple T. Holdings and AON Inc. Developments.

Respectfully Submitted,

Ken Smith, P.Eng.
Manager, Water Resources

PS/KS/jh

Statement of Limitations

This Stormwater Management Brief has been prepared by D.M. Wills Associates Limited on behalf of the Township of Selwyn.

The conclusions and recommendations in this letter are based on monitoring data and available background documentation and discussions with applicable agencies at the time of preparation.

The report is applicable only to the project described in the text, constructed substantially in accordance with the plans and details accompanying this report.

Any use which a third party makes of this report other than water distribution model update report for the subject area is the responsibility of such third parties. D.M. Wills Associates Limited accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or action taken based on using this report for purposes other than a water distribution model update report in the Township of Selwyn.

Appendix C:
Sanitary Design Calculations

Sewage Flow Calculations
Tatham File No. : 517651
Project : 3358 Lakefield Road
Date : August 30, 2023
Designed by : Guillaume Courtois

PROPOSED SEWAGE FLOW TO EX SAN MH 243

From Site

29 Townhouse Units (assumed 2 bedrooms, 2.4 people/unit)
= 450 L/c/day
= 450L * 29 units * 2.4 ppu
= 31,320 L/d (design flow)
= 0.36 L/s (design flow)

Estimated population: 70 (Assuming a population of 2.4 people/unit)

38 Single Family Units (assumed 3 bedrooms, 2.7 people/unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 38 units * 2.7 ppu
= 43,605 L/d (design flow)
= 0.50 L/s (design flow)

Estimated population: 103 (Assuming a population of 2.7 people/unit)

184 Apartment Units (assumed 2 people per unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 184 units * 2.0 ppu
= 165,600 L/d (design flow)
= 1.92 L/s (design flow)

Estimated population: 368 (Assuming a population of 2.0 people/unit)

Extraneous Flow
= 0.28 L/s/ha (as per Section A.1.9.e of the City of Peterborough Engineering Design Standards)
= 0.28 L/s * 9.4 ha (tributary area)
= 2.63 L/s

Sewage Flow From Site Only at SAN MH 243

Residential Design Flow:	2.78 L/s
Total Population:	541
Residential Peaking Factor (Harmon):	4.0
Residential Peak Flow:	11.0 L/s
Extraneous Flow:	2.6 L/s
Total Peak Flow:	13.6 L/s

From AON Inc. Property

26 Single Family Units (assumed 3 bedrooms, 2.7 people per unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 26 units * 2.7 ppu
= 31,590 L/d (design flow)
= 0.37 L/s (design flow)

Estimated population: 70.2 (Assuming a population of 2.7 people/unit)

200 Apartment Units (assumed 2 people per unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 200 units * 2.0 ppu
= 180,000 L/d (design flow)
= 2.08 L/s (design flow)

Estimated population: 400 (Assuming a population of 2.0 people/unit)

126 Long-Term Care (LTC) Beds
= 450 L per bed (as per OBC Table 8.2.1.3.B. Item 14.)
= 450 L * 126 beds
= 56,700 L/d (design flow)
= 0.66 L/s (design flow)

Estimated population: 126 (Assuming a population of 1 person/bed)

0.8 ha Medical Centre/Lab Lot Area
= 1.15 L/s/ha (as no information is available for the future building, Section A.1.9.b of the City of Peterborough Engineering Design Standards was used)
= 1.15 L/s * 0.8 ha
= 0.92 L/s (design flow)

Extraneous Flow
= 0.28 L/s/ha (as per Section A.1.9.e of the City of Peterborough Engineering Design Standards)
= 0.28 L/s * 6.5 ha (tributary area)
= 1.82 L/s

Sewage Flow From AON Inc. site to SAN MH 243

Residential Design Flow:	3.11 L/s
Total Population:	596.2
Residential Peaking Factor (Harmon):	3.9
Residential Peak Flow:	12.2 L/s
Commercial Design Flow:	0.9 L/s
Commercial Peaking Factor:	2.5 (As per Section A.1.9.b of the City of Peterborough Engineering Design Standards)
Commercial Peak Flow:	2.3 L/s
Extraneous Flow:	1.8 L/s
Total Peak Flow:	16.3 L/s

From LSDA lands Northeast of Site

46.8 ha Low Density Residential Area (includes 5.1 ha of site-specific policy area)
= 15 units/ha @ 2.7 people/unit (As no information is available for the future development, 15 units/ha was assumed for low density residential)

= 15 units * 46.8 ha
= 702 units
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 702 units * 2.7 ppu
= 852,930 L/d (design flow)
= 9.87 L/s (design flow)

Estimated population: 1896 (Assuming a population of 2.7 people/unit)

Extraneous Flow
= 0.28 L/s/ha (as per Section A.1.9.e of the City of Peterborough Engineering Design Standards)
= 0.28 L/s * 46.8 ha (tributary area)
= 13.1 L/s
Note: The calculations in this section exclude 2.8 ha recreation/open space area and a 7.5 ha environmental constraint area.

Sewage Flow From LSDA Lands Northeast of Site to SAN MH 243

Residential Design Flow:	9.9 L/s
Total Population:	1896
Residential Peaking Factor (Harmon):	3.6
Residential Peak Flow:	35.6 L/s
Extraneous Flow:	13.1 L/s
Total Peak Flow:	48.7 L/s

Total Combined Sewage Flow to SAN MH 243

Residential Design Flow:	15.8	L/s
Total Population:	3033.2	
Residential Peaking Factor (Harmon):	3.4	
Residential Peak Flow:	54.2	L/s
Commercial Design Flow:	0.9	L/s
Commercial Peaking Factor:	2.5	(As per Section A.1.9.b of the City of Peterborough Engineering Design Standards)
Commercial Peak Flow:	2.3	L/s
Extraneous Flow:	17.6	L/s
Total Combined Peak Flow:	74.0	L/s

The available sewer capacity between EX SAN MH 243 and EX SAN MH 250 is limited between SAN MH 246 and SAN MH 247 based on the existing pipe slope

from	to	length (m)	dia. (mm)	slope (%)	full capacity (L/s)	80% capacity (L/s)	velocity (full) (m/s)
EX SAN MH 246	EX SAN MH 247	90.0	200	0.69%	27.24	**21.80**	0.9

Manning's Coefficient (n) = 0.013

TATHAM ENGINEERING

Sewage Flow Calculations

Tatham File No. :	517651
Project :	3358 Lakefield Road
Date :	August 30, 2023
Designed by :	Guillaume Courtois

PROPOSED SEWAGE FLOW TO PROPOSED RAYS CREEK SANITARY SEWER

From Site

70 Townhouse Units (assumed 2 bedrooms, 2.4 people per unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 70 units * 2.4 ppu
= 75,600 L/d (design flow)
= 0.88 L/s (design flow)

Estimated population: 168 (Assuming a population of 2.4 people/unit)

217 Single Family Units (assumed 3 bedrooms, 2.7 people per unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 217 units * 2.7 ppu
= 263,655 L/d (design flow)
= 3.05 L/s (design flow)

Estimated population: 586 (Assuming a population of 2.7 people/unit)

402 Apartment Units (assumed 2 people per unit)
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 402 units * 2.0 ppu
= 361,800 L/d (design flow)
= 4.19 L/s (design flow)

Estimated population: 804 (Assuming a population of 2.0 people/unit)

4000 m^2 of Commercial Ground Floor Area
= 75 L per 9.3 m^2 of floor space (as per OBC Table 8.2.1.3.B. Item 15.b)
= (4000 m^2 / 9.3 m^2) * 75 L
= 32,258 L/d (design flow)
= 0.37 L/s (design flow)

Extraneous Flow
= 0.28 L/s/ha (as per Section A.1.9.e of the City of Peterborough Engineering Design Standards)
= 0.28 L/s * 32 ha (tributary area)
= 8.96 L/s

Note: The calculations in this section exclude the 4.5 ha speed skating oval property as it is currently designated as recreation/open space in the current Official Plan

Sewage Flow From the Site to Rays Creek Gravity Sewer

Residential Design Flow:	8.1 L/s
Total Population:	1558
Residential Peaking Factor (Harmon):	3.7
Residential Peak Flow:	29.8 L/s
Commercial Design Flow:	0.4 L/s
Commercial Peaking Factor:	2.5 (As per Section A.1.9.b of the City of Peterborough Engineering Design Standards)
Commercial Peak Flow:	0.9 L/s
Extraneous Flow:	9.0 L/s
<u>Total Peak Flow:</u>	39.7 L/s

From LSDA lands Southwest of Site

2.6 ha Low Density Residential Area
= 15 units/ha @ 2.7 people/unit (As no information is available for the future development, 15 units/ha was assumed for low density residential)

= 15 units * 2.6 ha
= 39 units
= 450 L/c/day (based on Lakefield Sanitary System Upgrades Class EA
= 450L * 39 units * 2.7 ppu
= 47,385 L/d (design flow)
= 0.55 L/s (design flow)

Estimated population: 106 (Assuming a population of 2.7 people/unit)

3.2 ha Neighbourhood Commercial Area
= 1.15 L/s/ha (as no information is available for the future development, Section A.1.9.b of the City of Peterborough Engineering Design Standards was used)
= 1.15 L/s * 3.2 ha
= 3.73 L/s (design flow)

Extraneous Flow
= 0.28 L/s/ha (as per Section A.1.9.e of the City of Peterborough Engineering Design Standards)
= 0.28 L/s * 5.9 ha (tributary area)
= 1.65 L/s

Note: The calculations in this section exclude a 0.2 ha environmental constraint area and the speed skating oval site.

Sewage Flow From LSDA lands Southwest of Site

Residential Design Flow:	0.5 L/s
Total Population:	106
Residential Peaking Factor (Harmon):	4.2
Residential Peak Flow:	2.3 L/s
Commercial Design Flow:	3.7 L/s
Commercial Peaking Factor:	2.5 (As per Section A.1.9.b of the City of Peterborough Engineering Design Standards)
Commercial Peak Flow:	9.3 L/s
Extraneous Flow:	1.7 L/s
<u>Total Peak Flow:</u>	13.3 L/s

Total Combined Sewage Flow to Rays Creek Sanitary Sewer

Residential Design Flow:	8.66 L/s
Total Population:	1664
Residential Peaking Factor (Harmon):	3.6
Residential Peak Flow:	31.6 L/s
Commercial Design Flow:	4.1 L/s
Commercial Peaking Factor:	2.5 (As per Section A.1.9.b of the City of Peterborough Engineering Design Standards)
Commercial Peak Flow:	10.2 L/s
Extraneous Flow:	10.6 L/s
Total Combined Peak Flow:	52.4 L/s

Proposed Rays Creek sanitary sewer capacity:

dia. (mm)	slope (%)	full capacity (L/s)	80% capacity (L/s)	velocity (full) (m/s)
375	0.40%	110.89	**88.7**	1.0

Manning's Coefficient (n) = 0.013
Minimum Velocity = 0.6 m/s
Maximum Velocity = 3.0 m/s

TATHAM ENGINEERING

Sewage Flow Calculations

Tatham File No. : 517651
Project : 3358 Lakefield Road
Date : August 30, 2023
Designed by : Guillaume Courtois

PROPOSED SEWAGE FLOW TO EX SAN MH 250

Residential Design Flow:	24.42 L/s
Total Population:	4698
Residential Peaking Factor (Harmon):	3.3
Residential Peak Flow:	79.9 L/s
Commercial Design Flow:	5.0 L/s
Commercial Peaking Factor:	2.5
Commercial Peak Flow:	12.5 L/s
Extraneous Flow:	28.2 L/s
Total Combined Peak Flow:	120.6 L/s

Available sewage capacity @ EX SAN MH 250:

from	to	length (m)	dia. (mm)	slope (%)	full capacity (L/s)	80% capacity (L/s)	velocity (full) (m/s)
EX SAN MH 250	EX SAN MH 253	74.0	300	1.00%	96.7	**77.4**	1.4

Manning's Coefficient (n) = 0.013

Appendix D: Stormwater Management

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Catchment EXT-1 **Area** 3.2 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	3.2	1	0.6	0.19	60	2.6	0.81	69	0	0	65	0	0	74	0	0	100	0	0	50	67.3
																									0
																									0
																									0
																									0
				Totals	3.2	1	0.6	0.19		2.6	0.81		0	0		0	0		0	0		0	0		67.3
																								CN*(AMC II)	65.5
																								CN*(AMC III)	81.4

Initial Abstraction	5.9 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	256.08	m
Minimum Catchment Elevation	247.49	m
Catchment length	340	m
Catchment Slope	2.5%	
Catchment Area	3.2	ha
Time of Concentration (Minutes)	**14.33**	
Time of Concentration (Hours)	**0.24**	
Time to Peak (2/3 x Time of Concentration)	**0.16**	

Time to Peak	**0.41 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	256.08	m
Minimum Catchment Elevation	247.49	m
Catchment length	340	m
Catchment Slope	3%	
Catchment Area	3.2	ha
Time of Concentration (Minutes)	**36.55**	
Time of Concentration (Hours)	**0.61**	
Time to Peak (2/3 x Time of Concentration)	**0.41**	

Runoff Coefficient	**0.27**

Landuse Type	Soil Series				
	OL	0	0	0	0
	2	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.25	#N/A	#N/A	#N/A	#N/A
Cultivated	0.35	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.27	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.27	#N/A	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Catchment EXT-2 **Area** 1.8 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	1.8	1	0	0	60	1.8	1	69	0	0	65	0	0	74	0.00	0	100	0	0	50	69.0
																									0
																									0
																									0
																									0
				Totals	1.8	1	0	0		1.8	1		0	0		0	0		0	0		0	0		69.0
																								CN*(AMC II)	66.9
																								CN*(AMC III)	82.3

Time of Concentration Calculations

Initial Abstraction	5.0 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	256.08	m
Minimum Catchment Elevation	252.57	m
Catchment length	275	m
Catchment Slope	1.3%	
Catchment Area	1.8	ha
Time of Concentration (Minutes)	**14.08**	
Time of Concentration (Hours)	**0.23**	
Time to Peak (2/3 x Time of Concentration)	**0.16**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	256.08	m
Minimum Catchment Elevation	252.57	m
Catchment length	275	m
Catchment Slope	1%	
Catchment Area	1.8	ha
Time of Concentration (Minutes)	**40.90**	
Time of Concentration (Hours)	**0.68**	
Time to Peak (2/3 x Time of Concentration)	**0.45**	

Time to Peak	0.45 hrs

Runoff Coefficient	0.28

Landuse Type	Soil Series				
	OL	0	0	0	0
	2	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.25	#N/A	#N/A	#N/A	#N/A
Cultivated	0.35	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.27	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.28	#N/A	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

Catchment EXT-3 **Area** 5.3 ha

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	2.9	0.55	0	0	60	2.90	1	69	0	0	65	0	0	74	0.00	0	100	0	0	50	69.0
EI	EMILY	B	Loam	2	2.4	0.45	0	0	60	2.40	1	69	0	0	65	0	0	74	0.00	0	100	0	0	50	69.0
																									0
																									0
																									0
				Totals	5.3	1	0	0		5.3	1		0	0		0	0		0	0		0	0		69.0
																								CN*(AMC II)	66.9
																								CN*(AMC III)	82.3

Initial Abstraction	5 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	245.8	m
Catchment length	337	m
Catchment Slope	2.1%	
Catchment Area	5.3	ha
Time of Concentration (Minutes)	**13.97**	
Time of Concentration (Hours)	**0.23**	
Time to Peak (2/3 x Time of Concentration)	**0.16**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	245.8	m
Catchment length	337	m
Catchment Slope	2%	
Catchment Area	5.3	ha
Time of Concentration (Minutes)	**38.20**	
Time of Concentration (Hours)	**0.64**	
Time to Peak (2/3 x Time of Concentration)	**0.42**	

Time to Peak	**0.42 hrs**

Runoff Coefficient	**0.28**

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.28	0.28	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Catchment EXT-3 **Area** 6.9 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	4.5	0.65	0	0	60	1.13	0.25	69	0	0	65	0	0	74	3.38	0.75	100	0	0	50	92.3
EI	EMILY	B	Loam	2	2.4	0.35	0	0	60	0.60	0.25	69	0	0	65	0	0	74	1.80	0.75	100	0	0	50	92.3
																									0
																									0
																									0
				Totals	6.9	1	0	0		1.73	0.25		0	0		0	0		5.18	0.75		0	0		92.3
																								CN*(AMC II)	93.1
																								CN*(AMC III)	96.9

Time of Concentration Calculations

Initial Abstraction	2.75 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	245.8	m
Catchment length	337	m
Catchment Slope	2%	
Catchment Area	6.9	ha
Time of Concentration (Minutes)	**13.60**	
Time of Concentration (Hours)	**0.23**	
Time to Peak (2/3 x Time of Concentration)	**0.15**	

Time to Peak	**0.15 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	245.8	m
Catchment length	337	m
Catchment Slope	2%	
Catchment Area	6.9	ha
Time of Concentration (Minutes)	**14.79**	
Time of Concentration (Hours)	**0.25**	
Time to Peak (2/3 x Time of Concentration)	**0.16**	

Runoff Coefficient	**0.78**

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.78	0.78	#N/A	#N/A	#N/A

Project:	3358 Lakefield Road Development
File No.:	517661
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Designed By:	HY
Checked By:	JA
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3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Catchment 101 **Area** 2.2 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	2.2	1	0.4	0.18	60	1.8	0.82	69	0	0	65	0	0	74	0	0	100	0	0	50	67.4
																									0
																									0
																									0
																									0
				Totals	2.2	1	0.4	0.18		1.8	0.82		0	0		0	0		0	0		0	0		67.4
																								CN*(AMC II)	65.6
																								CN*(AMC III)	81.4

Time of Concentration Calculations

Initial Abstraction	5.9 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	244.53	m
Minimum Catchment Elevation	235.27	m
Catchment length	244	m
Catchment Slope	3.8%	
Catchment Area	2.2	ha
Time of Concentration (Minutes)	**9.84**	
Time of Concentration (Hours)	**0.16**	
Time to Peak (2/3 x Time of Concentration)	**0.11**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	244.53	m
Minimum Catchment Elevation	235.27	m
Catchment length	244	m
Catchment Slope	4%	
Catchment Area	2.2	ha
Time of Concentration (Minutes)	**27.07**	
Time of Concentration (Hours)	**0.45**	
Time to Peak (2/3 x Time of Concentration)	**0.30**	

Time to Peak	**0.30 hrs**

Runoff Coefficient	**0.27**

Landuse Type	Soil Series				
	OL	0	0	0	0
	2	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.25	#N/A	#N/A	#N/A	#N/A
Cultivated	0.35	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.27	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.27	#N/A	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
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Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Rain Gauge: Peterborough Airport

Catchment 102 **Area** 12.0 ha

100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	12.0	1	3.1	0.26	60	8.9	0.74	69	0	0	65	0	0	74	0	0	100	0	0	50	66.7
																									0
																									0
																									0
																									0
				Totals	12.0	1	3.1	0.26		8.9	0.74		0	0		0	0		0	0		0	0		66.7
																								CN*(AMC II)	65.0
																								CN*(AMC III)	81.0

Initial Abstraction	6.3 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	243	m
Catchment length	282	m
Catchment Slope	3.5%	
Catchment Area	12.0	ha
Time of Concentration (Minutes)	**9.73**	
Time of Concentration (Hours)	**0.16**	
Time to Peak (2/3 x Time of Concentration)	**0.11**	

Time to Peak	0.33 hrs

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	243	m
Catchment length	282	m
Catchment Slope	4%	
Catchment Area	12	ha
Time of Concentration (Minutes)	**29.84**	
Time of Concentration (Hours)	**0.50**	
Time to Peak (2/3 x Time of Concentration)	**0.33**	

Runoff Coefficient	0.27

Landuse Type	Soil Series				
	OL	0	0	0	0
	2	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.25	#N/A	#N/A	#N/A	#N/A
Cultivated	0.35	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.27	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.27	#N/A	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
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Date:	Jun-23
Designed By:	HY
Checked By:	JA
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3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

Catchment 103 **Area** 13.3 ha

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	9.4	0.71	0	0	60	9.4	1	69	0	0	65	0	0	74	0	0	100	0	0	50	69
EI	EMILY	B	Loam	2	3.9	0.29	0	0	60	3.9	1	69	0	0	65	0	0	74	0	0	100	0	0	50	69
																									0
																									0
																									0
				Totals	13.3	1	0	0		13.3	1		0	0		0	0		0	0		0	0		69.0
																								CN*(AMC II)	66.9
																								CN*(AMC III)	82.3

Time of Concentration Calculations

Initial Abstraction	5 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	242.5	m
Catchment length	666	m
Catchment Slope	1.6%	
Catchment Area	13.3	ha
Time of Concentration (Minutes)	**26.76**	
Time of Concentration (Hours)	**0.45**	
Time to Peak (2/3 x Time of Concentration)	**0.30**	

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	242.5	m
Catchment length	666	m
Catchment Slope	2%	
Catchment Area	13.3	ha
Time of Concentration (Minutes)	**59.36**	
Time of Concentration (Hours)	**0.99**	
Time to Peak (2/3 x Time of Concentration)	**0.66**	

Time to Peak	**0.66 hrs**

Runoff Coefficient	**0.28**

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.28	0.28	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
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Designed By:	HY
Checked By:	JA
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3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

EXISITING CONDITION

Catchment 104 **Area** 15.5 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	11.6	0.75	0	0	60	11.6	1	69	0	0	65	0	0	74	0	0	100	0	0	50	69
EI	EMILY	B	Loam	2	3.9	0.25	0	0	60	3.9	1	69	0	0	65	0	0	74	0	0	100	0	0	50	69
																									0
																									0
																									0
				Totals	15.5	1	0	0		15.5	1		0	0		0	0		0	0		0	0		69.0
																								CN*(AMC II)	66.9
																								CN*(AMC III)	82.3

Time of Concentration Calculations

Initial Abstraction	5.0 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	246.2	m
Catchment length	426	m
Catchment Slope	1.6%	
Catchment Area	15.5	ha
Time of Concentration (Minutes)	**16.81**	
Time of Concentration (Hours)	**0.28**	
Time to Peak (2/3 x Time of Concentration)	**0.19**	

Time to Peak	**0.53 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253	m
Minimum Catchment Elevation	246.2	m
Catchment length	426	m
Catchment Slope	1.6%	
Catchment Area	15.5	ha
Time of Concentration (Minutes)	**47.28**	
Time of Concentration (Hours)	**0.79**	
Time to Peak (2/3 x Time of Concentration)	**0.53**	

Runoff Coefficient	**0.28**

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.28	0.28	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
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3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

PROPOSED CONDITION

Catchment 201 **Area** 2.2 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	2.2	1	0	0	60	0.02	0.01	69	0	0	65	0	0	74	1.88	0.85	100	0.3	0.14	50	92.9
																									0
																									0
																									0
																									0
				Totals	2.2	1	0	0		0.02	0.01		0	0		0	0		1.88	0.85		0.3	0.14		92.9
																								CN*(AMC II)	94.4
																								CN*(AMC III)	97.5

Time of Concentration Calculations

Initial Abstraction	3.4 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Wetland	12

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	241.5	m
Minimum Catchment Elevation	236	m
Catchment length	248	m
Catchment Slope	2%	
Catchment Area	2.2	ha
Time of Concentration (Minutes)	**11.14**	
Time of Concentration (Hours)	**0.19**	
Time to Peak (2/3 x Time of Concentration)	**0.12**	

Time to Peak	**0.12 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	241.5	m
Minimum Catchment Elevation	236	m
Catchment length	248	m
Catchment Slope	2%	
Catchment Area	2.2	ha
Time of Concentration (Minutes)	**11.01**	
Time of Concentration (Hours)	**0.18**	
Time to Peak (2/3 x Time of Concentration)	**0.12**	

Runoff Coefficient	**0.82**

Landuse Type	Soil Series				
	OL	0	0	0	0
	2	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.25	#N/A	#N/A	#N/A	#N/A
Cultivated	0.35	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.27	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.82	#N/A	#N/A	#N/A	#N/A

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Checked By:	JA
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3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

PROPOSED CONDITION

Catchment 202 **Area** 16.5 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	13.6	0.82	0	0	60	4.189	0.31	69	0	0	65	0	0	74	8.11	0.60	100	1.3	0.10	50	85.7
EI	EMILY	B	Loam	2	2.9	0.18	0	0	60	1.17	0.40361	69	0	0	65	0	0	74	1.73	0.60	100	0	0	50	87.5
																									0
																									0
																									0
				Totals	16.5	1	0	0		5.36	0.32		0	0		0	0		9.84	0.60		1.3	0.08		86.0
																								CN*(AMC II)	86.1
																								CN*(AMC III)	93.5

Initial Abstraction	3.8 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Wetland	12

Runoff Coefficient	0.66

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4			**For Runoff Coefficients less than 0.4**		
Bransby-Williams Formula			**Airport Method**		
Maximum Catchment Elevation	253.4	m	Maximum Catchment Elevation	253.4	m
Minimum Catchment Elevation	247	m	Minimum Catchment Elevation	247	m
Catchment length	476	m	Catchment length	476	m
Catchment Slope	1%		Catchment Slope	1%	
Catchment Area	16.5	ha	Catchment Area	16.5	ha
Time of Concentration (Minutes)	**19.32**		**Time of Concentration (Minutes)**	**28.29**	
Time of Concentration (Hours)	**0.32**		**Time of Concentration (Hours)**	**0.47**	
Time to Peak (2/3 x Time of Concentration)	**0.21**		**Time to Peak (2/3 x Time of Concentration)**	**0.31**	

Time to Peak	0.21 hrs

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.66	0.68	#N/A	#N/A	#N/A

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

PROPOSED CONDITION

Catchment 203 **Area** 5.4 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics Area	Catchment Soil Characteristics Percent	Forest/Woodland Area	Forest/Woodland Percent	Forest/Woodland CN	Pasture/Lawns Area	Pasture/Lawns Percent	Pasture/Lawns CN	Meadows Area	Meadows Percent	Meadows CN	Cultivated Area	Cultivated Percent	Cultivated CN	Impervious Area	Impervious Percent	Impervious CN	Wetland/Lakes/SWMF Area	Wetland/Lakes/SWMF Percent	Wetland/Lakes/SWMF CN	Average CN for Soil Type
OL	OTONABEE	B	Loam or Silt Loam	2	3.2	0.59	0	0	60	0.769	0.24	69	0	0	65	0	0	74	1.91	0.60	100	0.52	0.16	50	84.4
EI	EMILY	B	Loam	2	2.2	0.41	0	0	60	0.89	0.40	69	0	0	65	0	0	74	1.31	0.60	100	0	0.00	50	87.5
																									0
																									0
																									0
				Totals	5.4	1	0	0		1.66	0.31		0	0		0	0		3.23	0.60		0.52	0.10		85.7
																								CN*(AMC II)	85.9
																								CN*(AMC III)	93.3

Initial Abstraction	3.88 mm
Runoff Coefficient	0.66

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Wetland	12

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253.6	m
Minimum Catchment Elevation	251	m
Catchment length	350	m
Catchment Slope	1%	
Catchment Area	5.4	ha
Time of Concentration (Minutes)	**17.89**	
Time of Concentration (Hours)	**0.30**	
Time to Peak (2/3 x Time of Concentration)	**0.20**	

Time to Peak	**0.20 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253.6	m
Minimum Catchment Elevation	251	m
Catchment length	350	m
Catchment Slope	1%	
Catchment Area	5.4	ha
Time of Concentration (Minutes)	**29.74**	
Time of Concentration (Hours)	**0.50**	
Time to Peak (2/3 x Time of Concentration)	**0.33**	

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.64	0.68	#N/A	#N/A	#N/A

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

TATHAM ENGINEERING

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

PROPOSED CONDITION

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

Catchment 204 **Area** 16.3 ha

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	12.6	0.77	0	0	60	2.55	0.20	69	0	0	65	0	0	74	8.75	0.69	100	1.3	0.10	50	88.6
EI	EMILY	B	Loam	2	3.7	0.23	0	0	60	1.13	0.31	69	0	0	65	0	0	74	2.57	0.69	100	0	0	50	90.5
																									0
																									0
																									0
				Totals	16.3	1	0	0		3.68	0.23		0	0		0	0		11.32	0.69		1.3	0.08		89.0
																								CN*(AMC II)	89.7
																								CN*(AMC III)	95.2

Initial Abstraction	3.47558 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Wetland	12

Runoff Coefficient	0.73

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	253.1	m
Minimum Catchment Elevation	250.4	m
Catchment length	504	m
Catchment Slope	1%	
Catchment Area	16.3	ha
Time of Concentration (Minutes)	**24.62**	
Time of Concentration (Hours)	**0.41**	
Time to Peak (2/3 x Time of Concentration)	**0.27**	

Time to Peak	**0.27 hrs**

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	253.1	m
Minimum Catchment Elevation	250.4	m
Catchment length	504	m
Catchment Slope	1%	
Catchment Area	16.3	ha
Time of Concentration (Minutes)	**33.56**	
Time of Concentration (Hours)	**0.56**	
Time to Peak (2/3 x Time of Concentration)	**0.37**	

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.72	0.75	#N/A	#N/A	#N/A

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

PROPOSED CONDITION

Catchment 205 **Area** 1.13 ha

Rain Gauge: Peterborough Airport
100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	1.13	1.00	0	0	60	0.51	0.45	69	0	0	65	0	0	74	0.62	0.55	100	0	0.00	50	85.9
																									0
																									0
																									0
																									0
				Totals	1.13	1	0	0		0.51	0.45		0	0		0	0		0.62	0.55		0	0.00		85.9
																								CN*(AMC II)	88.9
																								CN*(AMC III)	94.9

Time of Concentration Calculations

Initial Abstraction	3.4 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Wetland	12

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	247.6	m
Minimum Catchment Elevation	246	m
Catchment length	80	m
Catchment Slope	2%	
Catchment Area	1.13	ha
Time of Concentration (Minutes)	**3.92**	
Time of Concentration (Hours)	**0.07**	
Time to Peak (2/3 x Time of Concentration)	**0.04**	

Time to Peak	0.04 hrs

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	247.6	m
Minimum Catchment Elevation	246	m
Catchment length	80	m
Catchment Slope	2%	
Catchment Area	1.13	ha
Time of Concentration (Minutes)	**10.55**	
Time of Concentration (Hours)	**0.18**	
Time to Peak (2/3 x Time of Concentration)	**0.12**	

Runoff Coefficient	0.65

Landuse Type	Soil Series				
	OL	0	0	0	0
	2	#N/A	#N/A	#N/A	#N/A
Forest/Woodland	0.25	#N/A	#N/A	#N/A	#N/A
Cultivated	0.35	#N/A	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	#N/A	#N/A	#N/A	#N/A
Impervious	0.95	#N/A	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	#N/A	#N/A	#N/A	#N/A
Meadows	0.27	#N/A	#N/A	#N/A	#N/A
Soil Series Total	0.65	#N/A	#N/A	#N/A	#N/A

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Hydrologic Parameters

3358 LAKEFIELD ROAD - CURVE NUMBER, INITIAL ABSTRACTION & TIME TO PEAK CALCULATIONS

PROPOSED CONDITION

Rain Gauge: Peterborough Airport

Catchment 206 **Area** 1.48 ha

100-yr 24hr SCS Rainfall Depth: 108.7 mm

WEIGHTED CN VALUE

Soil Series	Soil Series	Hydrologic Soil Group	Soil Texture	Runoff Coefficient Type	Catchment Soil Characteristics		Forest/Woodland			Pasture/Lawns			Meadows			Cultivated			Impervious			Wetland/Lakes/SWMF			Average CN for Soil Type
					Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
OL	OTONABEE	B	Loam or Silt Loam	2	1.31	0.89	0	0	60	1.31	1.00	69	0	0	65	0	0	74	0.00	0.00	100	0	0.00	50	69.0
EI	EMILY	B	Loam	2	0.17	0.11	0	0	60	0.17	1.00	69	0	0	65	0	0	74	0.00	0.00	100	0	0.00	50	69.0
																									0
																									0
																									0
				Totals	1.48	1	0	0		1.48	1.00		0	0		0	0		0.00	0.00		0	0.00		69.0
																								CN*(AMC II)	66.9
																								CN*(AMC III)	82.3

Time of Concentration Calculations

Initial Abstraction	5 mm

Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Wetland	12

For Runoff Coefficients greater than 0.4

Bransby-Williams Formula

Maximum Catchment Elevation	249	m
Minimum Catchment Elevation	243	m
Catchment length	295	m
Catchment Slope	2%	
Catchment Area	1.48	ha
Time of Concentration (Minutes)	**14.03**	
Time of Concentration (Hours)	**0.23**	
Time to Peak (2/3 x Time of Concentration)	**0.16**	

Time to Peak	0.40 hrs

For Runoff Coefficients less than 0.4

Airport Method

Maximum Catchment Elevation	249	m
Minimum Catchment Elevation	243	m
Catchment length	295	m
Catchment Slope	2%	
Catchment Area	1.48	ha
Time of Concentration (Minutes)	**36.32**	
Time of Concentration (Hours)	**0.61**	
Time to Peak (2/3 x Time of Concentration)	**0.40**	

Runoff Coefficient	0.28

Landuse Type	Soil Series				
	OL	EI	0	0	0
	2	2	#N/A	#N/A	#N/A
Forest/Woodland	0.25	0.25	#N/A	#N/A	#N/A
Cultivated	0.35	0.35	#N/A	#N/A	#N/A
Pasture/Lawn	0.28	0.28	#N/A	#N/A	#N/A
Impervious	0.95	0.95	#N/A	#N/A	#N/A
Wetland/Lake/SWMF	0.05	0.05	#N/A	#N/A	#N/A
Meadows	0.27	0.27	#N/A	#N/A	#N/A
Soil Series Total	0.28	0.28	#N/A	#N/A	#N/A

TATHAM ENGINEERING	Project :	3358 Lakefield Road Development
	File No.	517651
	Date:	Jun-23
	Designed By:	HY
	Checked By:	JA
	Subject:	Impervious Area Calculations

Impervious Area Calculations

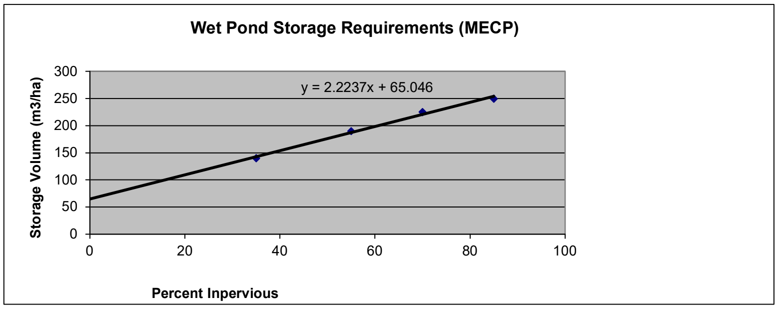
PEXT-3		
Total Area (ha)	6.90	
Future Development Area (ha)	6.90	
Impervious Area (ha)	5.18	(Assume 75% TIMP and 75% XIMP for future development)
Total % Impervious (TIMP)	75.0%	
Directly Connected Impervious (XIMP)	75.0%	
Pervious Area CN	69	

201		
Total Area (ha)	2.20	
High Density Residential (ha)	1.95	(Assume 90% TIMP and 90% XIMP over high density residential area)
SWM Pond (ha)	0.25	(Assume 50% TIMP and 50% XIMP over SWM pond area)
Impervious Area (ha)	1.9	
Total % Impervious (TIMP)	85.5%	
Directly Connected Impervious (XIMP)	85.5%	
Pervious Area CN	69	

202		
Total Area (ha)	16.50	
Low Density Residential (ha)	12.51	(Assume 55% TIMP and 45% XIMP over low density residential area)
Medium Density Residential (ha)	0.74	(Assume 75% TIMP and 55% XIMP over medium density residential area)
High Density Residential (ha)	1.95	(Assume 90% TIMP and 90% XIMP over high density residential area)
SWM Pond (ha)	1.30	(Assume 50% TIMP and 50% XIMP over SWM pond area)
Impervious Area (ha)	9.9	
Total % Impervious (TIMP)	59.6%	
Directly Connected Impervious (XIMP)	51.2%	
Pervious Area CN	69	

203		
Total Area (ha)	5.40	
Low Density Residential (ha)	3.76	(Assume 55% TIMP and 45% XIMP over low density residential area)
Medium Density Residential (ha)	0.74	(Assume 75% TIMP and 55% XIMP over medium density residential area)
High Density Residential (ha)	0.38	(Assume 90% TIMP and 90% XIMP over high density residential area)
Wetland (ha)	0.52	(Assume 50% TIMP and 50% XIMP over wetland area)
Impervious Area (ha)	3.2	
Total % Impervious (TIMP)	59.7%	
Directly Connected Impervious (XIMP)	50.0%	

TATHAM ENGINEERING	Project: 3358 Lakefield Road Development	Date: Jun-23
	File No.: 517651	Designed By: HY
	Subject: Wet SWM Pond Water Quality Calculations	Checked By: JA



MECP Water Quality Storage Volumes

Table 3.2 Values

% imp	Storage (m^3/ha)
35	140
55	190
70	225
85	250

(Enahnced 80% long-term TSS Removal)

SWMF 2 (Catchment 202)

Drainage Area (ha):	16.50	
% imp:	60%	
MECP Storage Volume Required (m^3/ha):	197.7	
Permanent Pool Storage Volume Required (m^3):	2601.5	
Extended Detention Storage Volume (m^3):	660.0	
25 mm Runoff Volume (m^3):	2322.7	
Permanent Pool Storage Volume Available (m^3):	9831	

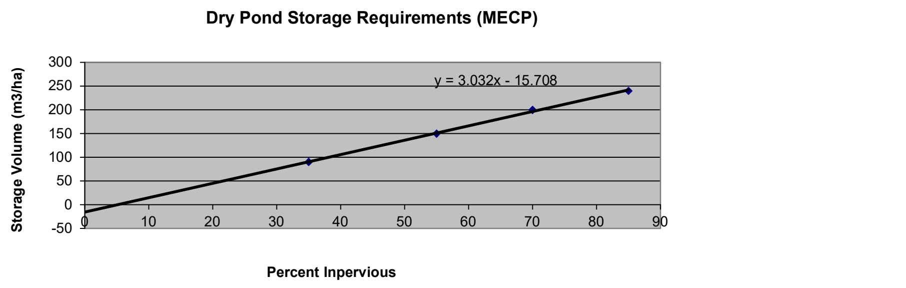
SWMF 3 (Catchment 203+EXT-1)

Drainage Area (ha):	8.60	(203+EXT1)
% imp:	38%	(Weighted AVG., 204 - 60%, EXT1 - 0%)
MECP Storage Volume Required (m^3/ha):	148.4	
Permanent Pool Storage Volume Required (m^3):	932.5	
Extended Detention Storage Volume (m^3):	344.0	
25 mm Runoff Volume (m^3):	830.2	
Permanent Pool Storage Volume Available (m^3):	2099	

SWM POND4 (Catchment 204+EXT2+PEXT3)

Drainage Area (ha):	25.00	(204+EXT2+PEXT3)
% imp:	66%	(Weighted AVG., 204 - 69%, EXT2 - 0%, PEXT-3 - 75%)
MECP Storage Volume Required (m^3/ha):	211.7	
Permanent Pool Storage Volume Required (m^3):	4293.3	
Extended Detention Storage Volume (m^3):	1000.0	
25 mm Runoff Volume (m^3):	4057.8	
Permanent Pool Storage Volume Available (m^3):	4750	

	Project:	3358 Lakefield Road Development	Date:	Jun-23
TATHAM ENGINEERING	File No.:	517651	Designed By:	HY
	Subject:	Dry Pond Water Quality Calculations	Checked By:	JA



MECP Water Quality Storage Volumes

Table 3.2 Values

% imp	Storage (m^3/ha)
35	90
55	150
70	200
85	240

(Basic 60% long-term TSS Removal)

SWMF 1 (Catchment 201)

Drainage Area (ha):	2.20	(Catchment 201)
% imp:	85%	
MECP Storage Volume Required (m^3/ha):	243.4	
MECP Storage Volume Required (m^3):	535.5	
25 mm Runoff Volume (m^3):	398.4	
Pond Storage Volume Available (m^3):	1353.1	

SWMF 5 (Catchment 205)

Drainage Area (ha):	1.13	(Catchment 205)
% imp:	55%	
MECP Storage Volume Required (m^3/ha):	149.6	
MECP Storage Volume Required (m^3):	169.0	
25 mm Runoff Volume (m^3):	204.6	
Pond Storage Volume Available (m^3):	444.0	

TATHAM ENGINEERING		
	Project :	3358 Lakefield Road Development
	File No.	517651
	Date:	Sep-23
	Designed By:	HY
	Checked By:	JA
	Subject:	Conveyance Calculations

20.0m Local Road Cross Section

Road minimum slope:	0.50%	
n of pavement	0.013	
n of boulevard:	0.035	
Pavement		
Area of flow A	1.98	m^2
Wetted perimeter Pw	9.326	m
Hydraulic Radius r=A/Pw	0.21	m
Hydraulic capacity Qp=(A x r^2/3 x s^1/2)/n	3.83	cm/s
Boulevard		
Area of flow A	0.638	m^2
Wetted perimeter Pw	11.206	m
Hydraulic Radius r=A/Pw	0.057	m
Hydraulic capacity Qp=(A x r^2/3 x s^1/2)/n	0.191	cm/s
Total Hydraulic capacity	4.024	cm/s

(based on max. depth of flow of 0.265 m at bottom of gutter and 0.18 m above CL)

26.0 m Collector Road Cross Section

Road minimum slope:	0.50%	
n of pavement	0.013	
n of boulevard:	0.035	
Pavement		
Area of flow A	2.519	m^2
Wetted perimeter Pw	9.997	m
Hydraulic Radius r=A/Pw	0.25	m
Hydraulic capacity Qp=(A x r^2/3 x s^1/2)/n	5.47	
Boulevard		
Area of flow A	1.328	m^2
Wetted perimeter Pw	16.004	m
Hydrolic Radius r=A/Pw	0.083	m
Hydrolic capacity Qp=(A x r^2/3 x s^1/2)/n	0.510	cm/s
Total Hydraulic capacity	5.976	cm/s

(based on max. depth of flow of 0.348 m at bottom of gutter and 0.21 m above CL)

10.0m wide drainage easement (6.0 m wide overland flow route)

Drainge easement width:	10.00	m
Drainge easement bottom width:	3.00	m
Drainge easement side slope	20.00%	
Minimum slope:	10.00%	
n of easement:	0.035	
Area of flow A	1.350	m^2
Wetted perimeter Pw	6.060	m
Hydraulic Radius r=A/Pw	0.223	m
Hydraulic capacity Qp=(A x r^2/3 x s^1/2)/n	4.482	cm/s

(based on max. depth of flow of 0.3 m within the easement)

10m wide drainage easement

Drainge easement width:	10.00	m
Drainge easement bottom width:	7.00	m
Drainge easement side slope	20.00%	
Minimum slope:	1.20%	
n of easement:	0.035	
Area of flow A	2.550	m^2
Wetted perimeter Pw	10.060	m
Hydraulic Radius r=A/Pw	0.253	m
Hydraulic capacity Qp=(A x r^2/3 x s^1/2)/n	3.197	cm/s

(based on max. depth of flow of 0.3 m within the easement)

Cross Section ID	Channel Category	Total Catchment Area (ha)	100 yr Storm Peak Flow (m^3/s)	Total Area Contributing (ha)^2	Pro-Rated Peak Flow (m^3/s)^2	Calc. Max. Flow Depth (m)
A-A'	10.0m wide drainage easement	16.5	3.67	8.4	2.21	0.21
B-B'	20.0 m Local Road Cross Section	16.5	3.67	3.3	1.10	0.15
C-C'	26.0 m Collector Road Cross Section	5.4	1.23	3.5	0.89	0.05
D-D'	20m wide drainage easement	23.2	6.21	9.2	3.10	0.30
E-E'	20.0 m Local Road Cross Section	23.2	6.21	5.8	2.20	0.21

Notes: 1. Overland flow path cross section locations are shown on DWG. DP-3.

TATHAM ENGINEERING	Project:	3358 Lakefield Road Development	Date:	Jun-23
	File No.:	517651	Designed By:	HY
	Subject:	Sediment Drying Volume Calculations	Checked By:	JA

Table 6.3: Annual Sediment Loadings

Catchment Imperviousness	Annual Loading (kg/ha)	Wet Density (kg/m³)	Annual Loading (m³/ha)
35%	770	1,230	0.6
55%	2,300	1,230	1.9
70%	3,495	1,230	2.8
85%	4,680	1,230	3.8

SWMF 2 (Catchment 202)

Drainage Area (ha):	16.50	
% imperviousness:	59.6%	
MECP Annual Sediment Volume Estimate (m^3/ha):	2.8	(MECP Table 6.3 above)
10 Years Sediment Accumultion(m^3):	462.0	

SWMF 3 (Catchment 203)

Drainage Area (ha):	5.40	
% imperviousness:	59.7%	
MECP Annual Sediment Volume Estimate (m^3/ha):	2.8	(MECP Table 6.3 above)
10 Years Sediment Accumultion(m^3):	151.2	

SWMF 4 (Catchment 204)

Drainage Area (ha):	16.30	
% imperviousness:	69.4%	
MECP Annual Sediment Volume Estimate (m^3/ha):	2.8	(MECP Table 6.3 above)
10 Years Sediment Accumultion(m^3):	456.4	

** Need 2576 of active storage during 100 yr SCS

TATHAM ENGINEERING	Project :	3358 Lakefield Road Development
	File No.	517651
	Date:	Jun-23
	Designed By:	HY
	Checked By:	JA
	Subject:	Pond Volume Table

SWM FACILITY 1 - DRY POND

Elevation	Depth	Increasing Area	Accum Area	Volume	Accum. Volume
(m)	(m)	(m^2)	(m^2)	(m^3)	(m^3)
236.00	0.00	0.00	1722.00	0.00	0.00
236.05	0.05	29.13	1751.13	86.8	86.8
236.10	0.10	29.37	1780.50	88.3	175.1
236.15	0.15	29.62	1810.12	89.8	264.9
236.20	0.20	29.86	1839.98	91.3	356.1
236.25	0.25	30.11	1870.09	92.8	448.9
236.30	0.30	30.35	1900.44	94.3	543.1
236.35	0.35	30.59	1931.03	95.8	638.9
236.40	0.40	30.84	1961.87	97.3	736.3
236.45	0.45	31.08	1992.96	98.9	835.1
236.50	0.50	31.33	2024.28	100.4	935.6
236.55	0.55	31.57	2055.86	102.0	1037.6
236.60	0.60	31.82	2087.67	103.6	1141.1
236.65	0.65	32.06	2119.73	105.2	1246.3
236.70	0.70	32.31	2152.04	106.8	1353.1
236.75	0.75	32.55	2184.59	108.4	1461.5
236.80	0.80	32.79	2217.38	110.0	1571.6
236.85	0.85	33.04	2250.42	111.7	1683.3
236.90	0.90	33.28	2283.70	113.4	1796.6
236.95	0.95	33.53	2317.23	115.0	1911.7
237.00	1.00	33.77	2351.00	116.7	2028.4

TATHAM ENGINEERING	Project :	3358 Lakefield Road Development
	File No.	517651
	Date:	Jun-23
	Designed By:	HY
	Checked By:	JA
	Subject:	Pond Volume Table

SWM FACILITY 2 - WET POND

Elevation	Depth	Increasing Area	Accum Area	Volume	Quality Volume	Quantity Volume
(m)	(m)	(m^2)	(m^2)	(m^3)	(m^3)	(m^3)
242.00	0.00	0.00	9095.00	0.00	0.00	0.0
242.05	0.05	71.88	9166.88	456.5	456.5	0.0
242.10	0.10	72.17	9239.05	460.1	916.7	0.0
242.15	0.15	72.45	9311.50	463.8	1380.5	0.0
242.20	0.20	72.73	9384.23	467.4	1847.8	0.0
242.25	0.25	73.01	9457.24	471.0	2318.9	0.0
242.30	0.30	73.30	9530.54	474.7	2793.6	0.0
242.35	0.35	73.58	9604.12	478.4	3271.9	0.0
242.40	0.40	73.86	9677.98	482.1	3754.0	0.0
242.45	0.45	74.15	9752.13	485.8	4239.7	0.0
242.50	0.50	74.43	9826.56	489.5	4729.2	0.0
242.55	0.55	74.71	9901.27	493.2	5222.4	0.0
242.60	0.60	74.99	9976.27	496.9	5719.3	0.0
242.65	0.65	75.28	10051.54	500.7	6220.0	0.0
242.70	0.70	75.56	10127.10	504.5	6724.5	0.0
242.75	0.75	75.84	10202.95	508.3	7232.8	0.0
242.80	0.80	76.13	10279.07	512.0	7744.8	0.0
242.85	0.85	76.41	10355.48	515.9	8260.7	0.0
242.90	0.90	76.69	10432.18	519.7	8780.4	0.0
242.95	0.95	76.98	10509.15	523.5	9303.9	0.0
243.00	1.00	77.26	10586.41	527.4	9831.3	0.0
243.05	1.05	77.54	10663.95	531.3	0.0	531.3
243.10	1.10	77.82	10741.78	535.1	0.0	1066.4
243.15	1.15	78.11	10819.88	539.0	0.0	1605.4
243.20	1.20	78.39	10898.27	543.0	0.0	2148.4
243.25	1.25	78.67	10976.95	546.9	0.0	2695.3
243.30	1.30	78.96	11055.90	550.8	0.0	3246.1
243.35	1.35	79.24	11135.14	554.8	0.0	3800.9
243.40	1.40	79.52	11214.67	558.7	0.0	4359.6
243.45	1.45	79.81	11294.47	562.7	0.0	4922.3
243.50	1.50	80.09	11374.56	566.7	0.0	5489.1
243.55	1.55	80.37	11454.93	570.7	0.0	6059.8
243.60	1.60	80.65	11535.58	574.8	0.0	6634.6
243.65	1.65	80.94	11616.52	578.8	0.0	7213.4
243.70	1.70	81.22	11697.74	582.9	0.0	7796.2
243.75	1.75	81.50	11779.24	586.9	0.0	8383.1
243.80	1.80	81.79	11861.03	591.0	0.0	8974.1
243.85	1.85	82.07	11943.10	595.1	0.0	9569.2
243.90	1.90	82.35	12025.45	599.2	0.0	10168.5
243.95	1.95	82.63	12108.08	603.3	0.0	10771.8
244.00	2.00	82.92	12191.00	607.5	0.0	11379.3

TATHAM ENGINEERING	Project :	3358 Lakefield Road Development
	File No.	517651
	Date:	Jun-23
	Designed By:	HY
	Checked By:	JA
	Subject:	Pond Volume Table

SWM FACILITY 3 - WET POND

Elevation	Depth	Increasing Area	Accum Area	Volume	Quality Volume	Quantity Volume
(m)	(m)	(m^2)	(m^2)	(m^3)	(m^3)	(m^3)
248.50	0.00	0.00	1773.00	0.00	0	0
248.55	0.05	40.97	1813.97	89.7	90	0
248.60	0.10	41.44	1855.41	91.7	181	0
248.65	0.15	41.91	1897.32	93.8	275	0
248.70	0.20	42.38	1939.70	95.9	371	0
248.75	0.25	42.85	1982.55	98.1	469	0
248.80	0.30	43.31	2025.86	100.2	569	0
248.85	0.35	43.78	2069.64	102.4	672	0
248.90	0.40	44.25	2113.89	104.6	776	0
248.95	0.45	44.72	2158.61	106.8	883	0
249.00	0.50	45.19	2203.79	109.1	992	0
249.05	0.55	45.65	2249.45	111.3	1104	0
249.10	0.60	46.12	2295.57	113.6	1217	0
249.15	0.65	46.59	2342.16	115.9	1333	0
249.20	0.70	47.06	2389.22	118.3	1451	0
249.25	0.75	47.53	2436.74	120.6	1572	0
249.30	0.80	47.99	2484.74	123.0	1695	0
249.35	0.85	48.46	2533.20	125.4	1821	0
249.40	0.90	48.93	2582.13	127.9	1948	0
249.45	0.95	49.40	2631.53	130.3	2079	0
249.50	1.00	49.87	2681.39	132.8	2212	0
249.55	1.05	50.33	2731.73	135.3	0	135
249.60	1.10	50.80	2782.53	137.9	0	273
249.65	1.15	51.27	2833.80	140.4	0	414
249.70	1.20	51.74	2885.54	143.0	0	557
249.75	1.25	52.21	2937.74	145.6	0	702
249.80	1.30	52.67	2990.42	148.2	0	850
249.85	1.35	53.14	3043.56	150.8	0	1001
249.90	1.40	53.61	3097.17	153.5	0	1155
249.95	1.45	54.08	3151.25	156.2	0	1311
250.00	1.50	54.55	3205.79	158.9	0	1470
250.05	1.55	55.01	3260.81	161.7	0	1632
250.10	1.60	55.48	3316.29	164.4	0	1796
250.15	1.65	55.95	3372.24	167.2	0	1963
250.20	1.70	56.42	3428.66	170.0	0	2133
250.25	1.75	56.89	3485.55	172.9	0	2306
250.30	1.80	57.35	3542.90	175.7	0	2482
250.35	1.85	57.82	3600.72	178.6	0	2660
250.40	1.90	58.29	3659.01	181.5	0	2842
250.45	1.95	58.76	3717.77	184.4	0	3026
250.50	2.00	59.23	3777.00	187.4	0	3214

Project :	3358 Lakefield Road Development
File No.	517651
Date:	Jun-23
Designed By:	HY
Checked By:	JA
Subject:	Pond Volume Table

SWM FACILITY 4 - WET POND

Elevation	Depth	Increasing Area	Accum Area	Volume	Quality Volume	Quantity Volume
(m)	(m)	(m^2)	(m^2)	(m^3)	(m^3)	(m^3)
245.30	0.00	0.00	3688.00	0	0	0
245.35	0.05	98.23	3786.23	187	187	0
245.40	0.10	99.53	3885.76	192	379	0
245.45	0.15	100.82	3986.58	197	575	0
245.50	0.20	102.11	4088.68	202	777	0
245.55	0.25	103.40	4192.08	207	984	0
245.60	0.30	104.69	4296.77	212	1197	0
245.65	0.35	105.98	4402.75	217	1414	0
245.70	0.40	107.27	4510.02	223	1637	0
245.75	0.45	108.56	4618.59	228	1865	0
245.80	0.50	109.85	4728.44	234	2099	0
245.85	0.55	111.15	4839.59	239	2338	0
245.90	0.60	112.44	4952.02	245	2583	0
245.95	0.65	113.73	5065.75	250	2833	0
246.00	0.70	115.02	5180.77	256	3089	0
246.05	0.75	116.31	5297.08	262	3351	0
246.10	0.80	117.60	5414.68	268	3619	0
246.15	0.85	118.89	5533.58	274	3893	0
246.20	0.90	120.18	5653.76	280	4172	0
246.25	0.95	121.47	5775.23	286	4458	0
246.30	1.00	122.77	5898.00	292	4750	0
246.30	1.00	7057.00	12955.00	0	4750	0
246.35	1.05	116.36	13071.36	651	4750	651
246.40	1.10	116.88	13188.23	656	4750	1307
246.45	1.15	117.40	13305.63	662	4750	1969
246.50	1.20	117.92	13423.55	668	4750	2638
246.55	1.25	118.44	13541.98	674	4750	3312
246.60	1.30	118.96	13660.94	680	4750	3992
246.65	1.35	119.48	13780.42	686	4750	4678
246.70	1.40	120.00	13900.41	692	4750	5370
246.75	1.45	120.52	14020.93	698	4750	6068
246.80	1.50	121.04	14141.97	704	4750	6772
246.85	1.55	121.56	14263.53	710	4750	7482
246.90	1.60	122.08	14385.61	716	4750	8198
246.95	1.65	122.60	14508.20	722	4750	8921
247.00	1.70	123.12	14631.32	728	4750	9649
247.05	1.75	123.64	14754.96	735	4750	10384
247.10	1.80	124.16	14879.12	741	4750	11125
247.15	1.85	124.68	15003.80	747	4750	11872
247.20	1.90	125.20	15129.00	753	4750	12625
247.25	1.95	125.72	15254.72	760	4750	13385
247.30	2.00	126.24	15380.96	766	4750	14151
247.35	2.05	126.76	15507.72	772	4750	14923
247.40	2.10	127.28	15635.00	779	4750	15701

TATHAM ENGINEERING	Project :	3358 Lakefield Road Development
	File No.	517651
	Date:	Jun-23
	Designed By:	HY
	Checked By:	JA
	Subject:	Pond Volume Table

SWM FACILITY 5 DRY POND

Elevation	Depth	Increasing Area	Accum Area	Volume	Accum. Volume
(m)	(m)	(m^2)	(m^2)	(m^3)	(m^3)
244.25	0.00	0.00	429.00	0.00	0.00
244.30	0.05	26.12	455.12	22.1	22.1
244.35	0.10	26.89	482.01	23.4	45.5
244.40	0.15	27.66	509.67	24.8	70.3
244.45	0.20	28.43	538.10	26.2	96.5
244.50	0.25	29.21	567.31	27.6	124.1
244.55	0.30	29.98	597.29	29.1	153.2
244.60	0.35	30.75	628.04	30.6	183.9
244.65	0.40	31.52	659.56	32.2	216.1
244.70	0.45	32.29	691.85	33.8	249.8
244.75	0.50	33.06	724.91	35.4	285.3
244.80	0.55	33.84	758.75	37.1	322.4
244.85	0.60	34.61	793.36	38.8	361.2
244.90	0.65	35.38	828.74	40.5	401.7
244.95	0.70	36.15	864.89	42.3	444.0
245.00	0.75	36.92	901.81	44.2	488.2
245.05	0.80	37.69	939.50	46.0	534.2
245.10	0.85	38.47	977.97	47.9	582.2
245.15	0.90	39.24	1017.21	49.9	632.0
245.20	0.95	40.01	1057.22	51.9	683.9
245.25	1.00	40.78	1098.00	53.9	737.8

```
PRE SCS
====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


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DATE: 06/29/2023                          TIME: 01:41:09

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 01-2yr SCS                **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.16 12.58  11.41 0.23   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.05 12.33  10.50 0.21   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.20 12.50  11.23  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.04 12.17  10.53 0.21   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.09 12.33  11.41 0.23   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.21 12.42  11.41 0.23   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.29 12.42  11.41  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.03 12.33  11.41 0.23   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.32 12.42  11.41  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
```

```
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.20 12.17  10.16 0.21   0.000
    [CN=65.0         ]
    [ N = 3.0:Tp 0.33]
*
==================================================================================
======================
```

```
       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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



```
                   *****  S U M M A R Y   O U T P U T  *****

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  Summary filename:
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9160-45a4-afd4-2583ba503821\scenario


DATE: 06/29/2023                           TIME: 01:41:10

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 02-5yr SCS                **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
```

```
                                     min      ha    '  cms   hrs      mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD          0003  1  5.0   13.30    0.27 12.58  19.39 0.30   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.66]
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD          0005  1  5.0    3.20    0.08 12.25  18.11 0.28   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.34 12.50  19.14  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD          0001  1  5.0    2.20    0.07 12.17  18.16 0.28   0.000
    [CN=65.6         ]
    [ N = 3.0:Tp 0.30]
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD          0007  1  5.0    5.30    0.15 12.33  19.39 0.30   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.42]
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD          0004  1  5.0   15.50    0.37 12.42  19.39 0.30   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.51 12.42  19.39  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD          0006  1  5.0    1.80    0.05 12.33  19.39 0.30   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.45]
*
```

```
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.56 12.42  19.39  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.36 12.17  17.62 0.27   0.000
    [CN=65.0         ]
    [ N = 3.0:Tp 0.33]
*
==================================================================================
======================
```

```
       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\abe3b33c-
5bf8-432d-9314-5cb926d9b482\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\abe3b33c-
5bf8-432d-9314-5cb926d9b482\scenario


DATE: 06/29/2023                          TIME: 01:41:10

USER:


COMMENTS: ____________________________________________________________


  ************************************************
```

```
  ** SIMULATION : Run 03-10yr SCS              **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB NASHYD          0003  1  5.0   13.30    0.36 12.58  25.39 0.34   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB NASHYD          0005  1  5.0    3.20    0.11 12.25  23.87 0.32   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.45 12.50  25.10  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB NASHYD          0001  1  5.0    2.20    0.10 12.17  23.93 0.32   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB NASHYD          0007  1  5.0    5.30    0.20 12.25  25.39 0.34   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB NASHYD          0004  1  5.0   15.50    0.49 12.42  25.39 0.34   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.67 12.42  25.39  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
```

```
 ** CALIB NASHYD         0006  1  5.0    1.80    0.06 12.33  25.39 0.34   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.45]
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.74 12.33  25.39  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.48 12.17  23.30 0.31   0.000
    [CN=65.0         ]
    [ N = 3.0:Tp 0.33]
*
=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\aa863043-
35d9-40c9-b9fc-a3e69d486c89\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\aa863043-
35d9-40c9-b9fc-a3e69d486c89\scenario


DATE: 06/29/2023                           TIME: 01:41:10

USER:
```

COMMENTS: ____

```
  **********************************************
  ** SIMULATION : Run 04-25yr SCS            **
  **********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.48 12.58  33.59 0.38   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.15 12.25  31.77 0.36   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.61 12.50  33.24  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.13 12.17  31.85 0.36   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.26 12.25  33.59 0.38   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.65 12.42  33.59 0.38   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.90 12.33  33.59  n/a   0.000
```

```
*
    MASS STORM                   15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.08 12.33  33.59 0.38   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.98 12.33  33.59  n/a   0.000
*
    MASS STORM                   15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.65 12.17  31.09 0.35   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
======================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\f42646d9-
cbf0-4b37-b920-faecce6a6b79\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\f42646d9-
cbf0-4b37-b920-faecce6a6b79\scenario


DATE: 06/29/2023                          TIME: 01:41:10
```

USER:

COMMENTS: ____

```
  **********************************************
  ** SIMULATION : Run 05-50yr SCS             **
  **********************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.57 12.58  40.16 0.41   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.18 12.25  38.13 0.39   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.73 12.50  39.76  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.16 12.17  38.22 0.39   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.31 12.25  40.15 0.41   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.78 12.42  40.15 0.41   0.000
```

```
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    1.08 12.33  40.15  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.10 12.33  40.15 0.41   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    1.18 12.33  40.15  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.78 12.17  37.37 0.38   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
 FINISH

====================================================================================
=======================

====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat
```

```
  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\ca029342-
19d0-4090-825d-c4a930d015a9\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\ca029342-
19d0-4090-825d-c4a930d015a9\scenario


DATE: 06/29/2023                          TIME: 01:41:10

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 06-100yr SCS              **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.67 12.58  46.88 0.43   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.22 12.25  44.66 0.41   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.85 12.50  46.45  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.19 12.17  44.76 0.41   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
```

```
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.37 12.25  46.88 0.43   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.91 12.42  46.88 0.43   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    1.27 12.33  46.88  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.12 12.33  46.88 0.43   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    1.39 12.33  46.88  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.92 12.17  43.83 0.40   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
```

Pre CHI
==

```
       V    V   I    SSSSS  U   U    A    L             (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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***** S U M M A R Y   O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

Output filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\bd85e30f-94ad-48d2-82fc-97ca82f049b9\scenario
Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\bd85e30f-94ad-48d2-82fc-97ca82f049b9\scenario

DATE: 06/29/2023 TIME: 01:41:41

USER:

COMMENTS: ____

```
  ************************************************
  ** SIMULATION : Run 01-25mm Storm             **
  ************************************************

  W/E COMMAND            HYD ID    DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.05  1.83   2.25 0.09   0.000
    [CN=65.0         ]
    [ N = 3.0:Tp 0.33]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.01  1.92   2.39 0.10   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.05  2.33   2.75 0.11   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.06  2.25   2.68  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.01  1.75   2.39 0.10   0.000
    [CN=65.6         ]
    [ N = 3.0:Tp 0.30]
*
```

```
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.01  2.00   2.75 0.11   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.02  1.92   2.75 0.11   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\28941494-d194-43c2-8862-1dfb8ed049c4\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.06  2.08   2.75 0.11   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.09  2.08   2.75  n/a   0.000
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.09  2.08   2.75  n/a   0.000
*
=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL
```

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\adff81b2-
e5ba-41c5-b2ad-6e91273d3861\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\adff81b2-
e5ba-41c5-b2ad-6e91273d3861\scenario


DATE: 06/29/2023                           TIME: 01:41:41

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 02-2yr Chicago            **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.10  1.75   4.39 0.13   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.02  1.92   4.59 0.14   0.000
```

```
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.09  2.25   5.13 0.16   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.11  2.17   5.03  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.02  1.75   4.61 0.14   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.01  1.92   5.13 0.16   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.05  1.92   5.13 0.16   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.12  2.00   5.13 0.16   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.16  2.00   5.13  n/a   0.000
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.18  2.00   5.13  n/a   0.000
*
==================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
```

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

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

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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\6242d562-
b9ca-4d6d-bd67-990ef20c76f0\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\6242d562-
b9ca-4d6d-bd67-990ef20c76f0\scenario


DATE: 06/29/2023                          TIME: 01:41:41

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 03-5yr Chicago            **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.20  1.75   8.56 0.19   0.000
    [CN=65.0         ]
    [ N = 3.0:Tp 0.33]
*
```

```
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.05  1.83   8.87 0.20   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.17  2.17   9.69 0.21   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.21  2.08   9.53  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.04  1.67   8.90 0.20   0.000
    [CN=65.6         ]
    [ N = 3.0:Tp 0.30]
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.03  1.92   9.69 0.21   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.09  1.83   9.69 0.21   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.42]
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.23  2.00   9.69 0.21   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.32  2.00   9.69  n/a   0.000
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.34  2.00   9.69  n/a   0.000
*
==================================================================================
=======================
```

```
      V    V   I    SSSSS  U   U    A    L             (v 6.1.2001)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\34023484-
5b0d-411d-ba0c-c89535593ab3\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\34023484-
5b0d-411d-ba0c-c89535593ab3\scenario


DATE: 06/29/2023                          TIME: 01:41:41

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 04-10yr Chicago           **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                10.0
    [ Ptot= 52.74 mm ]
*
```

```
 ** CALIB NASHYD         0002  1  5.0   12.00    0.29  1.75  11.77 0.22   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.07  1.83  12.15 0.23   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.24  2.17  13.14 0.25   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.30  2.08  12.95  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.06  1.67  12.18 0.23   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.04  1.92  13.14 0.25   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.12  1.83  13.14 0.25   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.32  2.00  13.14 0.25   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.44  2.00  13.14  n/a   0.000
*
```

```
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.48  1.92  13.14  n/a   0.000
*
==========================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\f0fcf338-
9ae4-4437-ad2c-f79a4cf6bd2b\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\f0fcf338-
9ae4-4437-ad2c-f79a4cf6bd2b\scenario


DATE: 06/29/2023                          TIME: 01:41:41

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 05-25yr Chicago           **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
```

```
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.41  1.75  16.55 0.26   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.10  1.83  17.01 0.27   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.33  2.17  18.25 0.29   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.42  2.08  18.01  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.08  1.67  17.06 0.27   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.06  1.92  18.24 0.29   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.18  1.83  18.25 0.29   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.45  2.00  18.25 0.29   0.000
    [CN=66.9          ]
```

```
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.61  1.92  18.25  n/a   0.000
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.67  1.92  18.25  n/a   0.000
*
 FINISH

=====================================================================================
=======================

=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\bdb2d9f6-
079f-432c-9eaa-1ccb04f64120\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\bdb2d9f6-
079f-432c-9eaa-1ccb04f64120\scenario


DATE: 06/29/2023                           TIME: 01:41:41

USER:


COMMENTS: ____________________________________________________________
```

```
 **********************************************
 ** SIMULATION : Run 06-50yr Chicago         **
 **********************************************

 W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha   '  cms   hrs     mm          cms

     START @  0.00 hrs
     --------------------
   CHIC STORM                 10.0
   [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0002  1  5.0   12.00    0.51  1.75  20.53 0.29   0.000
   [CN=65.0           ]
   [ N = 3.0:Tp 0.33]
*
   CHIC STORM                 10.0
   [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.12  1.83  21.06 0.30   0.000
   [CN=65.5           ]
   [ N = 3.0:Tp 0.41]
*
   CHIC STORM                 10.0
   [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0003  1  5.0   13.30    0.41  2.17  22.47 0.32   0.000
   [CN=66.9           ]
   [ N = 3.0:Tp 0.66]
*
   ADD [  0003+  0005]  0008  3  5.0   16.50    0.52  2.08  22.20  n/a   0.000
*
   CHIC STORM                 10.0
   [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.10  1.67  21.12 0.30   0.000
   [CN=65.6           ]
   [ N = 3.0:Tp 0.30]
*
   CHIC STORM                 10.0
   [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.07  1.92  22.47 0.32   0.000
   [CN=66.9           ]
   [ N = 3.0:Tp 0.45]
*
   CHIC STORM                 10.0
   [ Ptot= 70.55 mm ]
*
```

```
 ** CALIB NASHYD         0007  1  5.0    5.30    0.22  1.83  22.47 0.32   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.42]
*
    CHIC STORM                 10.0
    [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.55  2.00  22.47 0.32   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.77  1.92  22.47  n/a   0.000
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    0.84  1.92  22.47  n/a   0.000
*
=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

```

                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\3b371a02-
fcf2-4b78-bb7a-016ae11932c3\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\3b371a02-
fcf2-4b78-bb7a-016ae11932c3\scenario


DATE: 06/29/2023                           TIME: 01:41:41

USER:
```

COMMENTS: ____

```
  **********************************************
  ** SIMULATION : Run 07-100yr Chicago        **
  **********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD          0002  1  5.0   12.00    0.63  1.75  24.75 0.32   0.000
    [CN=65.0          ]
    [ N = 3.0:Tp 0.33]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD          0005  1  5.0    3.20    0.15  1.83  25.35 0.32   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD          0003  1  5.0   13.30    0.50  2.17  26.93 0.34   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0008  3  5.0   16.50    0.63  2.08  26.62  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD          0001  1  5.0    2.20    0.13  1.67  25.41 0.33   0.000
    [CN=65.6          ]
    [ N = 3.0:Tp 0.30]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD          0006  1  5.0    1.80    0.09  1.92  26.93 0.34   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
```

```
*
    CHIC STORM                10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.27  1.83  26.93 0.34   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.42]
*
    CHIC STORM                10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD         0004  1  5.0   15.50    0.67  2.00  26.93 0.34   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0009  3  5.0   20.80    0.93  1.92  26.93  n/a   0.000
*
    ADD [  0006+  0009]  0010  3  5.0   22.60    1.01  1.92  26.93  n/a   0.000
*
```

```
PRE TIMMINS
=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\8e2bcbc7-
a933-457f-812d-34fa3ba5909d\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\8e2bcbc7-
a933-457f-812d-34fa3ba5909d\scenario


DATE: 06/29/2023                          TIME: 01:42:08

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : 1_TIMMINS                     **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha  '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0001  1  5.0    2.20    0.22  8.00 142.75 0.74   0.000
    [CN=81.4         ]
    [ N = 3.0:Tp 0.30]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0007  1  5.0    5.30    0.51  8.08 145.66 0.75   0.000
    [CN=82.3         ]
    [ N = 3.0:Tp 0.42]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0004  1  5.0   15.50    1.39  8.17 145.67 0.75   0.000
    [CN=82.3         ]
    [ N = 3.0:Tp 0.53]
*
    ADD [  0004+  0007]  0050  3  5.0   20.80    1.89  8.17 145.66  n/a   0.000
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0006  1  5.0    1.80    0.17  8.08 145.66 0.75   0.000
    [CN=82.3         ]
    [ N = 3.0:Tp 0.45]
*
```

```
    ADD [  0050+  0006]  0048  3  5.0   22.60    2.06  8.17 145.66  n/a   0.000
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0002  1  5.0   12.00    1.17  8.00 141.50 0.73   0.000
    [CN=81.0         ]
    [ N = 3.0:Tp 0.33]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0005  1  5.0    3.20    0.30  8.08 142.79 0.74   0.000
    [CN=81.4         ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\49eb4ac6-9f87-4266-b11a-95f433206381\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0003  1  5.0   13.30    1.11  8.33 145.67 0.75   0.000
    [CN=82.3         ]
    [ N = 3.0:Tp 0.66]
*
    ADD [  0003+  0005]  0056  3  5.0   16.50    1.39  8.25 145.11  n/a   0.000
*
 FINISH

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

POST SCS
```
==========================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
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```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\27e40808-
3037-4043-83a0-78ff571b97da\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\27e40808-
3037-4043-83a0-78ff571b97da\scenario


DATE: 06/29/2023                          TIME: 01:42:39

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 01-2yr SCS                **
  ************************************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    MASS STORM                  15.0
    [ Ptot= 49.00 mm ]
*
 ** CALIB STANDHYD       0002  1   5.0   16.50    1.32 12.00  31.64 0.65   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1   5.0   16.50    0.11 13.08  31.60  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB STANDHYD       0001  1   5.0    2.20    0.29 12.00  42.99 0.88   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1   5.0    2.20    0.03 12.58  42.58  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB NASHYD         0008  1   5.0    1.80    0.03 12.33  11.41 0.23   0.000
    [CN=66.9           ]
    [ N = 3.0:Tp 0.45]
*
    MASS STORM                  15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB STANDHYD       0004  1   5.0   16.30    1.54 12.00  35.75 0.73   0.000
    [I%=64.0:S%= 2.00]
*
    MASS STORM                  15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB STANDHYD       0009  1   5.0    6.90    0.79 12.00  39.06 0.80   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3   5.0   23.20    2.33 12.00  36.73  n/a   0.000
*
    ADD [  0016+  0008]  0017  3   5.0   25.00    2.35 12.00  34.91  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1   5.0   25.00    0.21 13.00  34.88  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB NASHYD         0007  1   5.0    3.20    0.05 12.33  10.50 0.21   0.000
    [CN=65.5           ]
    [ N = 3.0:Tp 0.41]
```

```
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.45 12.00  31.43 0.64   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.48 12.00  23.64  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.09 12.75  23.62  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.02 12.25  11.41 0.23   0.000
    [CN=66.9           ]
    [ N = 3.0:Tp 0.40]
*
    MASS STORM                 15.0
    [ Ptot= 49.00 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.09 12.00  29.83 0.61   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.01 12.58  29.61  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.11 12.67  24.31  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.13 12.50  22.61  n/a   0.000
*
====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

```
                    *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\870fe1da-
38e6-4c1c-a32f-c8d35ed79b74\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\870fe1da-
38e6-4c1c-a32f-c8d35ed79b74\scenario


DATE: 06/29/2023                          TIME: 01:42:39

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 02-5yr SCS                 **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                 15.0
    [ Ptot= 65.00 mm ]
*
 ** CALIB STANDHYD       0002  1  5.0   16.50    1.86 12.00  44.44 0.68   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.21 12.92  44.40  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.39 12.00  57.93 0.89   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.04 12.50  57.52  n/a   0.000
*
    MASS STORM                 15.0
```

```
    [ Ptot= 65.00 mm ]
*
 *  CALIB NASHYD          0008  1  5.0    1.80    0.05 12.33  19.39 0.30   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB STANDHYD        0004  1  5.0   16.30    2.16 12.00  49.30 0.76   0.000
    [I%=64.0:S%= 2.00]
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB STANDHYD        0009  1  5.0    6.90    1.07 12.00  53.17 0.82   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    3.23 12.00  50.45  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    3.25 12.00  48.22  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.36 12.83  48.18  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB NASHYD          0007  1  5.0    3.20    0.08 12.25  18.11 0.28   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB STANDHYD        0003  1  5.0    5.40    0.65 12.00  44.21 0.68   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.70 12.00  34.50  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.18 12.58  34.48  n/a   0.000
*
    MASS STORM                  15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB NASHYD          0006  1  5.0    1.48    0.04 12.25  19.39 0.30   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
```

```
    MASS STORM                 15.0
    [ Ptot= 65.00 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.13 12.00  42.25 0.65   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.02 12.50  42.02  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.20 12.58  35.35  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.24 12.50  33.24  n/a   0.000
*
==================================================================================
======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\0c7d376d-
224b-4f70-95e0-2e39ad68d63d\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\0c7d376d-
224b-4f70-95e0-2e39ad68d63d\scenario


DATE: 06/29/2023                           TIME: 01:42:39

USER:
```

COMMENTS: ____

```
  ************************************************
  ** SIMULATION : Run 03-10yr SCS              **
  ************************************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min      ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 ** CALIB STANDHYD       0002  1  5.0   16.50    2.34 12.00  53.27 0.70   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.30 12.75  53.22  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.46 12.00  67.93 0.90   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.06 12.50  67.52  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB NASHYD         0008  1  5.0    1.80    0.06 12.33  25.39 0.34   0.000
    [CN=66.9           ]
    [ N = 3.0:Tp 0.45]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    2.57 12.00  58.54 0.77   0.000
    [I%=64.0:S%= 2.00]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    1.32 12.00  62.70 0.83   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    3.89 12.00  59.77  n/a   0.000
```

```
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    3.93 12.00  57.30  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.51 12.67  57.26  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.11 12.25  23.87 0.32   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.79 12.00  53.03 0.70   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.86 12.00  42.18  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.24 12.50  42.16  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.06 12.25  25.39 0.34   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.40]
*
    MASS STORM                 15.0
    [ Ptot= 75.60 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.16 12.00  50.86 0.67   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.03 12.50  50.63  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.28 12.50  43.14  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.32 12.42  40.80  n/a   0.000
*
==========================================================================================
=======================


       V    V   I    SSSSS  U    U    A    L              (v 6.1.2001)
       V    V   I    SS     U    U   A A   L
```

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

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

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***** S U M M A R Y   O U T P U T *****

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

Output filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\f857bf89-8bcb-4bcc-b945-ffcb035fa2e2\scenario
Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\f857bf89-8bcb-4bcc-b945-ffcb035fa2e2\scenario

DATE: 06/29/2023   TIME: 01:42:39

USER:

COMMENTS: ____

```
  ************************************************
  ** SIMULATION : Run 04-25yr SCS              **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 ** CALIB STANDHYD       0002  1  5.0   16.50    2.86 12.00  64.64 0.73   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
```

```
    OUTFLOW:             0011  1  5.0   16.50    0.42 12.67  64.59  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.55 12.00  80.57 0.91   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.08 12.33  80.15  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB NASHYD         0008  1  5.0    1.80    0.08 12.33  33.59 0.38   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    3.19 12.00  70.34 0.79   0.000
    [I%=64.0:S%= 2.00]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    1.58 12.00  74.81 0.84   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    4.77 12.00  71.67  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    4.82 12.00  68.93  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.75 12.58  68.90  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.15 12.25  31.77 0.36   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.96 12.00  64.40 0.72   0.000
    [I%=50.0:S%= 2.00]
*
```

```
    ADD [  0003+  0007]  0015  3  5.0    8.60    1.06 12.00  52.26  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.34 12.50  52.24  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.08 12.25  33.58 0.38   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.40]
*
    MASS STORM                 15.0
    [ Ptot= 88.90 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.20 12.00  61.99 0.70   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.04 12.42  61.77  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.38 12.50  53.35  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.45 12.42  50.74  n/a   0.000
*
 FINISH

=====================================================================================
=======================

=====================================================================================
=======================


      V    V   I   SSSSS  U   U    A    L              (v 6.1.2001)
      V    V   I   SS     U   U   A A   L
       V  V    I    SS    U   U  AAAAA  L
       V  V    I     SS   U   U  A   A  L
        VV     I   SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


```
                   *****  S U M M A R Y   O U T P U T  *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\7d3a9699-
2af9-4ca2-b94b-8a59b1a2fdc9\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\7d3a9699-
2af9-4ca2-b94b-8a59b1a2fdc9\scenario


DATE: 06/29/2023                          TIME: 01:42:39

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 05-50yr SCS               **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 ** CALIB STANDHYD       0002  1  5.0   16.50    3.26 12.00  73.36 0.74   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.53 12.58  73.32  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.61 12.00  90.13 0.91   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.09 12.25  89.71  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot= 98.90 mm ]
*
```

```
 *  CALIB NASHYD         0008  1  5.0    1.80    0.10 12.33  40.15 0.41   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    3.61 12.00  79.36 0.80   0.000
    [I%=64.0:S%= 2.00]
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    1.78 12.00  84.02 0.85   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    5.39 12.00  80.75  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    5.45 12.00  77.82  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.93 12.50  77.79  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.18 12.25  38.13 0.39   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    1.10 12.00  73.13 0.74   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    1.21 12.00  60.11  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.42 12.42  60.09  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.09 12.25  40.15 0.41   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
    MASS STORM                 15.0
    [ Ptot= 98.90 mm ]
```

```
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.22 12.00  70.56 0.71   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.05 12.33  70.34  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.47 12.42  61.28  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.56 12.33  58.49  n/a   0.000
*
=====================================================================================
=======================
```

```
       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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***** S U M M A R Y   O U T P U T *****

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

Output filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\902e5df6-343c-4033-a10e-d8c76af894b2\scenario

Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\902e5df6-343c-4033-a10e-d8c76af894b2\scenario

DATE: 06/29/2023   TIME: 01:42:39

USER:

COMMENTS: ____

```
  *********************************************
  ** SIMULATION : Run 06-100yr SCS           **
  *********************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    MASS STORM                15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB STANDHYD       0002  1  5.0   16.50    3.67 12.00  82.04 0.75   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.65 12.58  82.00  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.68 12.00  99.53 0.92   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.11 12.25  99.11  n/a   0.000
*
    MASS STORM                15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB NASHYD         0008  1  5.0    1.80    0.12 12.33  46.88 0.43   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    MASS STORM                15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    4.24 12.00  88.29 0.81   0.000
    [I%=64.0:S%= 2.00]
*
    MASS STORM                15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    1.97 12.00  93.12 0.86   0.000
    [I%=75.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    6.21 12.00  89.72  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    6.28 12.00  86.64  n/a   0.000
```

```
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    1.15 12.42  86.60  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.22 12.25  44.66 0.41   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    1.23 12.00  81.81 0.75   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    1.37 12.00  67.99  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.50 12.33  67.97  n/a   0.000
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.11 12.25  46.88 0.43   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
    MASS STORM                 15.0
    [ Ptot=108.70 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.27 12.00  79.10 0.73   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.07 12.25  78.87  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.57 12.33  69.23  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.67 12.33  66.28  n/a   0.000
*
```

POST CHI
===
=======================

```
       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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***** S U M M A R Y   O U T P U T *****

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

Output filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\d3c76390-15f5-4e0d-b213-1feeaecf2b1e\scenario
Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\d3c76390-15f5-4e0d-b213-1feeaecf2b1e\scenario

DATE: 06/29/2023   TIME: 01:42:58

USER:

COMMENTS: ____

```
  ************************************************
  ** SIMULATION : Run 01-25mm storm             **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 ** CALIB NASHYD         0008  1  5.0    1.80    0.01  2.00   2.75 0.11   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.45]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB STANDHYD       0009  1  5.0    6.90    0.92  1.33  18.75 0.75   0.000
    [I%=75.0:S%= 2.00]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB STANDHYD       0004  1  5.0   16.30    1.50  1.33  16.66 0.67   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    2.42  1.33  17.28  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    2.42  1.33  16.23  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.09  3.50  16.20  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.35  1.33  21.06 0.84   0.000
```

```
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.01  3.25  20.64  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.01  1.92   2.39 0.10   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.45  1.33  13.96 0.56   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.45  1.33   9.65  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.05  2.25   9.63  n/a   0.000
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.01  1.92   2.75 0.11   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
    READ STORM                  5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
```

```
    remark: 25 mm Rainfall Event

*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.10  1.33  13.05 0.52   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.01  2.25  12.83  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.06  2.25  10.00  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.07  2.08   9.04  n/a   0.000
*
    READ STORM                 5.0
    [ Ptot= 25.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\b5fa26d7-26cd-41c0-a729-495e90d6623d\97e22a62-587a-4
fb0-b63b-a92c279
    remark: 25 mm Rainfall Event

*
 *  CALIB STANDHYD       0002  1  5.0   16.50    1.21  1.33  14.12 0.56   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.06  3.33  14.08  n/a   0.000
*
 FINISH

===================================================================================
=======================

===================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

```
                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\0401e032-
ef38-4b18-99a4-d57d90638bd1\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\0401e032-
ef38-4b18-99a4-d57d90638bd1\scenario


DATE: 06/29/2023                           TIME: 01:42:57

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 02-2yr Chicago            **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm           cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    1.80    0.01  1.92   5.13 0.16   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    0.93  1.33  25.45 0.77   0.000
    [I%=75.0:S%= 2.00]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    1.70  1.33  22.88 0.69   0.000
    [I%=64.0:S%= 2.00]
*
```

```
    ADD [  0004+  0009]  0016  3  5.0   23.20    2.63  1.33  23.64  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    2.63  1.33  22.31  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.15  3.25  22.28  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.35  1.33  28.37 0.86   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.02  2.83  27.95  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.02  1.92   4.59 0.14   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.48  1.33  19.55 0.59   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.48  1.33  13.99  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.08  2.33  13.96  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.01  1.83   5.13 0.16   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.40]
*
    CHIC STORM                 10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.10  1.33  18.39 0.56   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.01  2.25  18.16  n/a   0.000
*
```

```
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.09  2.33  14.45  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.10  2.08  13.22  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 33.08 mm ]
*
 *  CALIB STANDHYD       0002  1  5.0   16.50    1.38  1.33  19.74 0.60   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.09  3.42  19.69  n/a   0.000
*
=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\9e20f463-
7723-4c9c-8383-f0feabff1135\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\9e20f463-
7723-4c9c-8383-f0feabff1135\scenario


DATE: 06/29/2023                          TIME: 01:42:57

USER:
```

COMMENTS: ____

```
  **********************************************
  ** SIMULATION : Run 03-5yr Chicago          **
  **********************************************

  W/E COMMAND              HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 ** CALIB NASHYD          0008  1  5.0    1.80    0.03  1.92   9.69 0.21   0.000
    [CN=66.9           ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB STANDHYD        0009  1  5.0    6.90    1.28  1.33  35.66 0.79   0.000
    [I%=75.0:S%= 2.00]
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB STANDHYD        0004  1  5.0   16.30    2.33  1.33  32.51 0.72   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]   0016  3  5.0   23.20    3.61  1.33  33.45  n/a   0.000
*
    ADD [  0016+  0008]   0017  3  5.0   25.00    3.62  1.33  31.74  n/a   0.000
*
 ** Reservoir
    OUTFLOW:              0014  1  5.0   25.00    0.27  2.75  31.70  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB STANDHYD        0001  1  5.0    2.20    0.47  1.33  39.37 0.87   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:              0010  1  5.0    2.20    0.03  2.42  38.95  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 45.08 mm ]
*
```

```
 *  CALIB NASHYD         0007  1  5.0    3.20    0.05  1.83   8.87 0.20   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.66  1.33  28.41 0.63   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.67  1.33  21.14  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.13  2.25  21.12  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.03  1.83   9.69 0.21   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.40]
*
    CHIC STORM                 10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.13  1.33  26.91 0.60   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.02  2.25  26.69  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.15  2.25  21.76  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.17  2.17  20.17  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 45.08 mm ]
*
 *  CALIB STANDHYD       0002  1  5.0   16.50    1.91  1.33  28.62 0.63   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.15  3.00  28.58  n/a   0.000
*
====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L             (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
```

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

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

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***** S U M M A R Y   O U T P U T *****

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\c524dc5b-
2c49-489d-b8e5-6ad65c74c8f7\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\c524dc5b-
2c49-489d-b8e5-6ad65c74c8f7\scenario


DATE: 06/29/2023                          TIME: 01:42:57

USER:


COMMENTS: ____________________________________________________________


  **********************************************
  ** SIMULATION : Run 04-10yr Chicago         **
  **********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min    ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    1.80    0.04  1.92  13.14 0.25   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.45]
*
```

```
    CHIC STORM                   10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB STANDHYD        0009  1  5.0     6.90    1.51  1.33  42.33 0.80   0.000
    [I%=75.0:S%= 2.00]
*
    CHIC STORM                   10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB STANDHYD        0004  1  5.0    16.30    2.76  1.33  38.87 0.74   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0    23.20    4.27  1.33  39.90  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0    25.00    4.27  1.33  37.97  n/a   0.000
*
 ** Reservoir
    OUTFLOW:              0014  1  5.0    25.00    0.36  2.67  37.94  n/a   0.000
*
    CHIC STORM                   10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB STANDHYD        0001  1  5.0     2.20    0.55  1.33  46.47 0.88   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:              0010  1  5.0     2.20    0.04  2.25  46.05  n/a   0.000
*
    CHIC STORM                   10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB NASHYD          0007  1  5.0     3.20    0.07  1.83  12.15 0.23   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                   10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB STANDHYD        0003  1  5.0     5.40    0.78  1.33  34.35 0.65   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0     8.60    0.79  1.33  26.09  n/a   0.000
*
 ** Reservoir
    OUTFLOW:              0012  1  5.0     8.60    0.18  2.17  26.06  n/a   0.000
*
    CHIC STORM                   10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB NASHYD          0006  1  5.0     1.48    0.04  1.83  13.14 0.25   0.000
```

```
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.16  1.33  32.66 0.62   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.03  2.08  32.44  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.21  2.17  26.80  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.24  2.08  25.00  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 52.74 mm ]
*
 *  CALIB STANDHYD       0002  1  5.0   16.50    2.27  1.33  34.57 0.66   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.21  2.75  34.53  n/a   0.000
*
====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


```
                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
```

```
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\a08b98d1-
5991-4dc4-b047-748421769c27\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\a08b98d1-
5991-4dc4-b047-748421769c27\scenario


DATE: 06/29/2023                          TIME: 01:42:57

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 05-25yr Chicago           **
  ************************************************

  W/E COMMAND             HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 ** CALIB NASHYD          0008  1  5.0    1.80    0.06  1.92  18.24 0.29   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB STANDHYD        0009  1  5.0    6.90    1.79  1.33  51.27 0.82   0.000
    [I%=75.0:S%= 2.00]
*
    CHIC STORM                 10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB STANDHYD        0004  1  5.0   16.30    3.50  1.33  47.47 0.76   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]   0016  3  5.0   23.20    5.29  1.33  48.60  n/a   0.000
*
    ADD [  0016+  0008]   0017  3  5.0   25.00    5.30  1.33  46.42  n/a   0.000
*
 ** Reservoir
    OUTFLOW:              0014  1  5.0   25.00    0.53  2.33  46.38  n/a   0.000
*
```

```
    CHIC STORM                   10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.65  1.33  55.93 0.89   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.06  2.17  55.52  n/a   0.000
*
    CHIC STORM                   10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.10  1.83  17.01 0.27   0.000
    [CN=65.5          ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                   10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    0.96  1.33  42.47 0.68   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.98  1.33  33.00  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.26  2.08  32.98  n/a   0.000
*
    CHIC STORM                   10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.05  1.83  18.24 0.29   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
    CHIC STORM                   10.0
    [ Ptot= 62.87 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.19  1.33  40.56 0.65   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.04  2.00  40.33  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.29  2.08  33.83  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.34  2.00  31.77  n/a   0.000
*
    CHIC STORM                   10.0
    [ Ptot= 62.87 mm ]
*
```

```
 *  CALIB STANDHYD       0002  1  5.0   16.50    2.81  1.33  42.70 0.68   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.31  2.50  42.66  n/a   0.000
*
=====================================================================================
=======================
```

```
       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

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```
                   *****  S U M M A R Y   O U T P U T  *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\99de1783-
e1ea-4481-8d11-b7c3fa805b21\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\99de1783-
e1ea-4481-8d11-b7c3fa805b21\scenario


DATE: 06/29/2023                          TIME: 01:42:57

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 06-50yr Chicago           **
  ************************************************
```

```
  W/E COMMAND              HYD ID   DT     AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                    min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                  10.0
    [ Ptot= 70.55 mm ]
*
 ** CALIB NASHYD         0008  1  5.0    1.80    0.07  1.92  22.47 0.32   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                  10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    2.01  1.33  58.14 0.82   0.000
    [I%=75.0:S%= 2.00]
*
    CHIC STORM                  10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    3.96  1.33  54.11 0.77   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    5.97  1.33  55.31  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    5.98  1.33  52.95  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.69  2.25  52.91  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.72  1.33  63.16 0.90   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.07  2.08  62.74  n/a   0.000
*
    CHIC STORM                  10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.12  1.83  21.06 0.30   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                  10.0
    [ Ptot= 70.55 mm ]
*
```

```
 *  CALIB STANDHYD       0003  1  5.0    5.40    1.08  1.33  48.80 0.69   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    1.11  1.33  38.48  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.32  2.00  38.46  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.06  1.83  22.47 0.32   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.40]
*
    CHIC STORM                 10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.22  1.33  46.72 0.66   0.000
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.04  2.00  46.50  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.37  2.00  39.39  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.43  2.00  37.16  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 70.55 mm ]
*
 *  CALIB STANDHYD       0002  1  5.0   16.50    3.18  1.33  49.03 0.69   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.40  2.42  48.99  n/a   0.000
*
====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L              (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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

```
       OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\cde98e27-
b337-495d-a08b-a74d858223a6\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\cde98e27-
b337-495d-a08b-a74d858223a6\scenario


DATE: 06/29/2023                          TIME: 01:42:58

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : Run 07-100yr Chicago          **
  ************************************************

  W/E COMMAND              HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    CHIC STORM                  10.0
    [ Ptot= 78.18 mm ]
*
 ** CALIB NASHYD          0008  1  5.0    1.80    0.09  1.92  26.93 0.34   0.000
    [CN=66.9          ]
    [ N = 3.0:Tp 0.45]
*
    CHIC STORM                  10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB STANDHYD       0009  1  5.0    6.90    2.22  1.33  65.03 0.83   0.000
    [I%=75.0:S%= 2.00]
*
    CHIC STORM                  10.0
```

```
    [ Ptot= 78.18 mm ]
*
 *  CALIB STANDHYD       0004  1  5.0   16.30    4.43  1.33  60.80 0.78   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    6.66  1.33  62.06  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    6.67  1.33  59.53  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0014  1  5.0   25.00    0.86  2.17  59.50  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.80  1.33  70.37 0.90   0.000
    [I%=86.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0010  1  5.0    2.20    0.09  2.08  69.96  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB NASHYD         0007  1  5.0    3.20    0.15  1.83  25.35 0.32   0.000
    [CN=65.5         ]
    [ N = 3.0:Tp 0.41]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB STANDHYD       0003  1  5.0    5.40    1.21  1.33  55.21 0.71   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    1.25  1.33  44.10  n/a   0.000
*
 ** Reservoir
    OUTFLOW:             0012  1  5.0    8.60    0.40  2.00  44.08  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB NASHYD         0006  1  5.0    1.48    0.08  1.83  26.93 0.34   0.000
    [CN=66.9         ]
    [ N = 3.0:Tp 0.40]
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.24  1.33  52.99 0.68   0.000
```

```
    [I%=46.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0013  1  5.0    1.13    0.05  1.92  52.77  n/a   0.000
*
    ADD [  0012+  0013]  0018  3  5.0    9.73    0.45  2.00  45.09  n/a   0.000
*
    ADD [  0018+  0006]  0018  1  5.0   11.21    0.52  1.92  42.69  n/a   0.000
*
    CHIC STORM                 10.0
    [ Ptot= 78.18 mm ]
*
 *  CALIB STANDHYD       0002  1  5.0   16.50    3.56  1.33  55.44 0.71   0.000
    [I%=51.0:S%= 2.00]
*
 ** Reservoir
    OUTFLOW:             0011  1  5.0   16.50    0.49  2.33  55.40  n/a   0.000
*
```

```
POST TIMMINS
=====================================================================================
=======================


       V    V   I    SSSSS  U   U    A    L             (v 6.1.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.1\VO2\voin.dat

  Output  filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\5592e8cd-
de27-44cb-98eb-790127cf9574\scenario
  Summary filename:
C:\Users\hyu\AppData\Local\Civica\VH5\e2c2d2be-418b-4c4d-a4c4-d228733f752c\5592e8cd-
de27-44cb-98eb-790127cf9574\scenario


DATE: 06/29/2023                          TIME: 01:45:53

USER:


COMMENTS: ____________________________________________________________


  ************************************************
  ** SIMULATION : 1_TIMMINS                     **
  ************************************************

  W/E COMMAND            HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                 min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
```

```
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0007  1  5.0    3.20    0.30  8.08 142.79 0.74   0.000
    [CN=81.4          ]
    [ N = 3.0:Tp 0.41]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB STANDHYD       0003  1  5.0    5.40    0.61  8.00 174.44 0.90   0.000
    [I%=50.0:S%= 2.00]
*
    ADD [  0003+  0007]  0015  3  5.0    8.60    0.91  8.00 162.66  n/a   0.000
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 ** CALIB NASHYD         0006  1  5.0    1.48    0.14  8.08 145.65 0.75   0.000
    [CN=82.3          ]
    [ N = 3.0:Tp 0.40]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 *  CALIB STANDHYD       0005  1  5.0    1.13    0.13  8.00 172.34 0.89   0.000
    [I%=46.0:S%= 2.00]
*
    ADD [  0015+  0005]  0018  3  5.0    9.73    1.04  8.00 163.78  n/a   0.000
*
```

```
    ADD [  0018+  0006]  0018  1  5.0   11.21    1.18  8.00 161.39  n/a   0.000
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 *  CALIB STANDHYD       0002  1  5.0   16.50    1.86  8.00 174.48 0.90   0.000
    [I%=51.0:S%= 2.00]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 *  CALIB NASHYD         0008  1  5.0    1.80    0.17  8.08 145.66 0.75   0.000
    [CN=82.3         ]
    [ N = 3.0:Tp 0.45]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 *  CALIB STANDHYD       0009  1  5.0    6.90    0.80  8.00 181.38 0.94   0.000
    [I%=75.0:S%= 2.00]
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 *  CALIB STANDHYD       0004  1  5.0   16.30    1.86  8.00 178.52 0.92   0.000
    [I%=64.0:S%= 2.00]
*
    ADD [  0004+  0009]  0016  3  5.0   23.20    2.66  8.00 179.37  n/a   0.000
*
    ADD [  0016+  0008]  0017  3  5.0   25.00    2.83  8.00 176.95  n/a   0.000
```

```
*
    READ STORM                 60.0
    [ Ptot=193.00 mm ]
    fname :
C:\Users\hyu\AppData\Local\Temp\5b52d987-0862-434c-aadd-1f9f19f4146d\5e4769b9-6f1e-4
c72-91b8-db63fa5
    remark: TIMMINS STORM

*
 *  CALIB STANDHYD       0001  1  5.0    2.20    0.25  8.00 181.50 0.94   0.000
    [I%=86.0:S%= 2.00]
*
 FINISH

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

Appendix E: Water Balance

TATHAM ENGINEERING	**Project:**	3358 Lakefield Road Development
	File No.:	517661
	Date:	Jun-23
	Designed By:	JA
	Checked By:	JA
	Subject:	Water Balance Calculations - OUTLET 1

Catchments:	101	
Average Soil Moisture Capacity (mm)	177	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 1 (ha)	2.20	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	Average Temperature (°C)	Precipitation (mm)	Heat Index	Average Daylight Hours	Number of Days in Month	Unadjusted PET (mm)	Daylight Factor	Adjusted PET (mm)	Accumulated Potential Water Loss (APWL) (mm)	Storage (S) (mm)	Change in Storage (ΔS) (mm)	AET (mm)	Water Surplus (mm)	Potential Infiltration (mm)	Potential Direct Surface Runoff (mm)
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	177	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	177	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	177	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	177	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	177	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	154	-24	103	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	96	-58	128	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	49	-47	124	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	62	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	104	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	177	73	7	6	3	3
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	177	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**579.0**	**276.4**	**124.4**	**152.0**

TOTAL WATER SURPLUS **276.4**

Note:
1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

TATHAM ENGINEERING	**Project:**	3358 Lakefield Road Development
	File No.:	517661
	Date:	Jun-23
	Designed By:	JA
	Checked By:	JA
	Subject:	Water Balance Calculations - OUTLET 1

Catchments:	201	
Average Soil Moisture Capacity (mm)	286	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 1 (ha)	2.20	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	Average Temperature (^{o}C)	Precipitation (mm)	Heat Index	Average Daylight Hours	Number of Days in Month	Unadjusted PET (mm)	Daylight Factor	Adjusted PET (mm)	Accumulated Potential Water Loss (APWL) (mm)	Storage (S) (mm)	Change in Storage (ΔS)	AET (mm)	Water Surplus (mm)	Potential Infiltration (mm)	Potential Direct Surface Runoff (mm)
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	286	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	286	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	286	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	286	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	286	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	262	-24	104	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	196	-66	137	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	130	-66	143	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	142	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	184	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	263	79	7	0	0	0
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	286	23	0	42	19	23
Total		**855.4**	**33.3**			**481.5**		**573.6**				**607.5**	**247.9**	**111.6**	**136.4**

TOTAL WATER SURPLUS **247.9**

Note:

1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

TATHAM ENGINEERING	**Project:**	3358 Lakefield Road Development
	File No.:	517661
	Date:	Jun-23
	Designed By:	JA
	Checked By:	JA
	Subject:	Water Balance Calculations - OUTLET 1

Catchment Designation	Pre-Development			Post-Development		
	Pervious	Impervious	Total	Pervious	Impervious	Total
Catchment Area Outlet 1 (ha)	**2.2**	**0.0**	**2.2**	**0.3**	**1.9**	**2.2**
Inflitration Factors						
Topography Infiltration Factor	0.10	-	-	0.10	-	-
Soil Infiltration Factor	0.30	-	-	0.30	-	-
Land Cover Infiltration Factor	0.15	-	-	0.15	-	-
MOE Infiltration Factor	0.55	-	-	0.55	-	-
Run-Off Coefficient	0.45	-	-	0.45	-	-
Runoff from Impervious Surfaces	0.00	0.80	-	0.00	0.80	-
Inputs						
Precipitation (mm/yr)	855.4	855.4	855.4	855.4	855.4	855.4
Run-on (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Other Inputs (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Inputs (mm/yr)	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Outputs						
Precipitation surplus (mm/yr)	276.4	684.3	276.4	247.9	684.3	620.8
Net surplus (mm/yr)	**276.4**	**684.3**	**276.4**	**247.9**	**684.3**	**620.8**
Evapotranspiration (mm/yr)	579.0	171.1	579.0	607.5	171.1	234.6
Infiltration (mm/yr)	124.4	0.0	124.4	111.6	0.0	16.2
Infiltration of Pervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Infiltration of Impervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	124.4	0.0	124.4	111.6	0.0	16.2
Run-off Pervious Areas (mm/yr)	152.0	0.0	152.0	136.4	0.0	19.8
Run-off Impervious Areas (mm/yr)	0.0	684.3	0.0	0.0	684.3	584.8
Total Run-off (mm/yr)	152.0	684.3	152.0	136.4	684.3	604.6
Total Outputs (mm/yr)	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Inputs						
Precipitation (m3/yr)	18,819	0	18,819	2,737	16,082	18,819
Run-on (m3/yr)	0	0	0	0	0	0
Other Inputs (m3/yr)	0	0	0	0	0	0
Total Inputs (m3/yr)	**18,819**	**0**	**18,819**	**2,737**	**16,082**	**18,819**
Outputs						
Precipitation surplus (m3/yr)	6,082	0	6,082	793	12,865	13,659
Net surplus (m3/yr)	6,082	**0**	6,082	793	12,865	13,659
Evapotranspiration (m3/yr)	12,737	0	12,737	1,944	3,216	5,160
Infiltration (m3/yr)	2,737	0	2,737	357	0	357
Infiltration of Pervious Runoff (m3/yr)	0	0	0	0	0	0
Infiltration of Impervious Runoff (m3/yr)	0	0	0	0	0	0
Total Infiltration (m3/yr)	2,737	0	2,737	357	0	357
Run-off Pervious Areas (m3/yr)	3,345	0	3,345	436	0	436
Run-off Impervious Areas (m3/yr)	0	0	0	0	12,865	12,865
Total Run-off (m3/yr)	3,345	0	3,345	436	12,865	13,302
Total Outputs (m3/yr)	18,819	0	18,819	2,737	16,082	18,819

Notes: 1. Evaporation from impervious areas was assumed to be 20% of precipitation and is within the acceptable range as per the Conservation Authority Guidelines for Hydrogeological Assessment Submissions (June, 2013)

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 2

Catchments:	102	
Average Soil Moisture Capacity (mm)	189	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 2 (ha)	12.00	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	Average Temperature (°C)	Precipitation (mm)	Heat Index	Average Daylight Hours	Number of Days in Month	Unadjusted PET (mm)	Daylight Factor	Adjusted PET (mm)	Accumulated Potential Water Loss (APWL) (mm)	Storage (S) (mm)	Change in Storage (ΔS) (mm)	AET (mm)	Water Surplus (mm)	Potential Infiltration (mm)	Potential Direct Surface Runoff (mm)
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	189	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	189	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	189	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	189	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	189	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	165	-24	104	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	106	-59	130	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	57	-49	126	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	70	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	112	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	189	77	7	2	1	1
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	189	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**583.0**	**272.4**	**122.6**	**149.8**

TOTAL WATER SURPLUS **272.4**

Note:
1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 2

Catchments:	202	
Average Soil Moisture Capacity (mm)	119	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 2 (ha)	16.50	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runonff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	Average Temperature (^{o}C)	Precipitation (mm)	Heat Index	Average Daylight Hours	Number of Days in Month	Unadjusted PET (mm)	Daylight Factor	Adjusted PET (mm)	Accumulated Potential Water Loss (APWL) (mm)	Storage (S) (mm)	Change in Storage (ΔS)	AET (mm)	Water Surplus (mm)	Potential Infiltration (mm)	Potential Direct Surface Runoff (mm)
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	119	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	119	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	119	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	119	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	119	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	96	-23	103	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	48	-49	119	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	18	-30	107	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	30	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	72	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	119	47	7	33	15	18
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	119	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**552.3**	**303.1**	**136.4**	**166.7**

TOTAL WATER SURPLUS **303.1**

Note:

1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 2

Catchment Designation	Pre-Development			Post-Development		
	Pervious	Impervious	Total	Pervious	Impervious	Total
Catchment Area Outlet 2 (ha)	**12.0**	**0.0**	**12.0**	**6.7**	**9.8**	**16.5**
Infiltration Factors						
Topography Infiltration Factor	0.10	-	-	0.10	-	-
Soil Infiltration Factor	0.30	-	-	0.30	-	-
Land Cover Infiltration Factor	0.15	-	-	0.15	-	-
MOE Infiltration Factor	0.55	-	-	0.55	-	-
Run-Off Coefficient	0.45	-	-	0.45	-	-
Runoff from Impervious Surfaces	0.00	0.80	-	0.00	0.80	-
Inputs						
Precipitation (mm/yr)	855.4	855.4	855.4	855.4	855.4	855.4
Run-on (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Other Inputs (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Inputs (mm/yr)	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Outputs						
Precipitation surplus (mm/yr)	272.4	684.3	272.4	303.1	684.3	530.4
Net surplus (mm/yr)	**272.4**	**684.3**	**272.4**	**303.1**	**684.3**	**530.4**
Evapotranspiration (mm/yr)	583.0	171.1	583.0	552.3	171.1	325.0
Infiltration (mm/yr)	122.6	0.0	122.6	136.4	0.0	55.0
Infiltration of Pervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Infiltration of Impervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	122.6	0.0	122.6	136.4	0.0	55.0
Run-off Pervious Areas (mm/yr)	149.8	0.0	149.8	166.7	0.0	67.3
Run-off Impervious Areas (mm/yr)	0.0	684.3	0.0	0.0	684.3	408.1
Total Run-off (mm/yr)	149.8	684.3	149.8	166.7	684.3	475.4
Total Outputs (mm/yr)	**855.40**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Inputs						
Precipitation (m3/yr)	102,648	0	102,648	56,965	84,176	141,141
Run-on (m3/yr)	0	0	0	0	0	0
Other Inputs (m3/yr)	0	0	0	0	0	0
Total Inputs (m3/yr)	**102,648**	**0**	**102,648**	**56,965**	**84,176**	**141,141**
Outputs						
Precipitation surplus (m3/yr)	32,691	0	32,691	20,183	67,341	87,524
Net surplus (m3/yr)	32,691	**0**	32,691	20,183	67,341	87,524
Evapotranspiration (m3/yr)	69,957	0	69,957	36,782	16,835	53,617
Infiltration (m3/yr)	14,711	0	14,711	9,082	0	9,082
Infiltration of Pervious Runoff (m3/yr)	0	0	0	0	0	0
Infiltration of Impervious Runoff (m3/yr)	0	0	0	0	0	0
Total Infiltration (m3/yr)	14,711	0	14,711	9,082	0	9,082
Run-off Pervious Areas (m3/yr)	17,980	0	17,980	11,101	0	11,101
Run-off Impervious Areas (m3/yr)	0	0	0	0	67,341	67,341
Total Run-off (m3/yr)	17,980	0	17,980	11,101	67,341	78,441
Total Outputs (m3/yr)	102,648.00	0.00	102,648.00	56,965.36	84,175.64	141,141.00

Notes: 1. Evaporation from impervious areas was assumed to be 20% of precipitation and is within the acceptable range as per the Conservation Authority Guidelines for Hydrogeological Assessment Submissions (June, 2013)

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 3

Catchments:	103, & EXT-1	
Average Soil Moisture Capacity (mm)	159	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 3 (ha)	16.50	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	Average Temperature (°C)	Precipitation (mm)	Heat Index	Average Daylight Hours	Number of Days in Month	Unadjusted PET (mm)	Daylight Factor	Adjusted PET (mm)	Accumulated Potential Water Loss (APWL) (mm)	Storage (S) (mm)	Change in Storage (ΔS) (mm)	AET (mm)	Water Surplus (mm)	Potential Infiltration (mm)	Potential Direct Surface Runoff (mm)
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	159	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	159	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	159	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	159	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	159	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	136	-23	103	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	81	-55	126	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	39	-42	119	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	51	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	93	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	159	66	7	13	6	7
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	159	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**572.0**	**283.4**	**127.5**	**155.9**

TOTAL WATER SURPLUS **283.4**

Note:

1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 3

Catchments:	203, EXT-1, 205, 206	
Average Soil Moisture Capacity (mm)	100	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 3 (ha)	11.21	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	**Average Temperature (°C)**	**Precipitation (mm)**	**Heat Index**	**Average Daylight Hours**	**Number of Days in Month**	**Unadjusted PET (mm)**	**Daylight Factor**	**Adjusted PET (mm)**	**Accumulated Potential Water Loss (APWL) (mm)**	**Storage (S) (mm)**	**Change in Storage (ΔS)**	**AET (mm)**	**Water Surplus (mm)**	**Potential Infiltration (mm)**	**Potential Direct Surface Runoff (mm)**
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	100	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	100	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	100	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	100	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	100	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	78	-22	102	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	34	-44	115	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	10	-23	100	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	23	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	65	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	100	35	7	44	20	24
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	100	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**540.7**	**314.7**	**141.6**	**173.1**

TOTAL WATER SURPLUS 314.7

Note:

1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 3

Catchment Designation	**Pre-Development**			**Post-Development**		
	Pervious	**Impervious**	**Total**	**Pervious**	**Impervious**	**Total**
Catchment Area Outlet 4 (ha)	**16.5**	**0.0**	**16.5**	**7.4**	**3.8**	**11.2**
Inflitration Factors						
Topography Infiltration Factor	0.10	-	-	0.10	-	-
Soil Infiltration Factor	0.30	-	-	0.30	-	-
Land Cover Infiltration Factor	0.15	-	-	0.15	-	-
MOE Infiltration Factor	0.55	-	-	0.55	-	-
Run-Off Coefficient	0.45	-	-	0.45	-	-
Runoff from Impervious Surfaces	0.00	0.80	-	0.00	0.80	-
Inputs						
Precipitation (mm/yr)	855.4	855.4	855.4	855.4	855.4	855.4
Run-on (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Other Inputs (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Inputs (mm/yr)	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Outputs						
Precipitation surplus (mm/yr)	283.4	684.3	283.4	314.7	684.3	441.3
Net surplus (mm/yr)	**283.4**	**684.3**	**283.4**	**314.7**	**684.3**	**441.3**
Evapotranspiration (mm/yr)	572.0	171.1	572.0	540.7	171.1	414.1
Infiltration (mm/yr)	127.5	0.0	127.5	141.6	0.0	93.1
Infiltration of Pervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Infiltration of Impervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	127.5	0.0	127.5	141.6	0.0	93.1
Run-off Pervious Areas (mm/yr)	155.9	0.0	155.9	173.1	0.0	113.8
Run-off Impervious Areas (mm/yr)	0.0	684.3	0.0	0.0	684.3	234.5
Total Run-off (mm/yr)	155.9	684.3	155.9	173.1	684.3	348.2
Total Outputs (mm/yr)	**855.40**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Inputs						
Precipitation (m3/yr)	141,141	0	141,141	63,034	32,856	95,890
Run-on (m3/yr)	0	0	0	0	0	0
Other Inputs (m3/yr)	0	0	0	0	0	0
Total Inputs (m3/yr)	**141,141**	**0**	**141,141**	**63,034**	**32,856**	**95,890**
Outputs						
Precipitation surplus (m3/yr)	46,763	0	46,763	23,189	26,285	49,474
Net surplus (m3/yr)	46,763	**0**	46,763	23,189	26,285	49,474
Evapotranspiration (m3/yr)	94,378	0	94,378	39,845	6,571	46,416
Infiltration (m3/yr)	21,043	0	21,043	10,435	0	10,435
Infiltration of Pervious Runoff (m3/yr)	0	0	0	0	0	0
Infiltration of Impervious Runoff (m3/yr)	0	0	0	0	0	0
Total Infiltration (m3/yr)	21,043	0	21,043	10,435	0	10,435
Run-off Pervious Areas (m3/yr)	25,720	0	25,720	12,754	0	12,754
Run-off Impervious Areas (m3/yr)	0	0	0	0	26,285	26,285
Total Run-off (m3/yr)	25,720	0	25,720	12,754	26,285	39,039
Total Outputs (m3/yr)	141,141.00	0.00	141,141.00	63,034.43	32,855.91	95,890.34

Notes: 1. Evaporation from impervious areas was assumed to be 20% of precipitation and is within the acceptable range as per the Conservation Authority Guidelines for Hydrogeological Assessment Submissions (June, 2013)

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 4

Catchments:	104, EXT-2, EXT-3	
Average Soil Moisture Capacity (mm)	150	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 4 (ha)	22.60	

Inflitration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	Average Temperature (^{o}C)	Precipitation (mm)	Heat Index	Average Daylight Hours	Number of Days in Month	Unadjusted PET (mm)	Daylight Factor	Adjusted PET (mm)	Accumulated Potential Water Loss (APWL) (mm)	Storage (S) (mm)	Change in Storage (ΔS) (mm)	AET (mm)	Water Surplus (mm)	Potential Infiltration (mm)	Potential Direct Surface Runoff (mm)
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	150	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	150	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	150	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	150	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	150	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	127	-23	103	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	73	-54	125	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	33	-39	116	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	46	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	88	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	150	62	7	17	8	9
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	150	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**568.0**	**287.4**	**129.3**	**158.1**

TOTAL WATER SURPLUS **287.4**

Note:

1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

TATHAM ENGINEERING

Project:	3358 Lakefield Road Development
File No.:	517661
Date:	Jun-23
Designed By:	JA
Checked By:	JA
Subject:	Water Balance Calculations - OUTLET 4

Catchments:	204, EXT-2, PEXT-3	
Average Soil Moisture Capacity (mm)	98	(MECP Table 3.1, HSG 'B')
Thornthwaite Coefficient	1.03	
Catchment Area Outlet 4 (ha)	25.00	

Infiltration Factors:

Topography Infiltration Factor	0.10
Soil Infiltration Factor	0.30
Land Cover Infiltration Factor	0.15
MECP Infiltration Factor	0.55
Average Runoff Factor	0.45
Runoff from Impervious Surfaces	0.80

Month	**Average Temperature (^{o}C)**	**Precipitation (mm)**	**Heat Index**	**Average Daylight Hours**	**Number of Days in Month**	**Unadjusted PET (mm)**	**Daylight Factor**	**Adjusted PET (mm)**	**Accumulated Potential Water Loss (APWL) (mm)**	**Storage (S) (mm)**	**Change in Storage (ΔS)**	**AET (mm)**	**Water Surplus (mm)**	**Potential Infiltration (mm)**	**Potential Direct Surface Runoff (mm)**
January	-8.5	57.4	0.0	9.3	31.0	0.0	0.8	0.0	0	98	0	0	57	26	32
February	-7.0	51.5	0.0	10.4	28.0	0.0	0.9	0.0	0	98	0	0	52	23	28
March	-1.8	56.1	0.0	11.9	31.0	0.0	1.0	0.0	0	98	0	0	56	25	31
April	5.9	68.6	1.3	13.4	30.0	28.8	1.1	32.2	0	98	0	32	36	16	20
May	12.1	81.5	3.8	14.7	31.0	60.3	1.2	76.6	0	98	0	77	5	2	3
June	17.0	79.9	6.4	15.4	30.0	85.6	1.3	110.0	-25	76	-22	102	0	0	0
July	19.6	70.6	7.9	15.1	31.0	99.1	1.3	128.9	-83	33	-44	114	0	0	0
August	18.3	77.0	7.1	14.0	31.0	92.3	1.2	111.1	-118	10	-23	100	0	0	0
September	13.9	85.3	4.7	12.5	30.0	69.6	1.0	72.6	-105	23	13	73	0	0	0
October	7.5	76.9	1.8	11.0	31.0	36.9	0.9	35.0	-63	65	42	35	0	0	0
November	1.9	86.4	0.2	9.7	30.0	9.0	0.8	7.2	0	98	34	7	45	20	25
December	-4.4	64.2	0.0	8.9	31.0	0.0	0.7	0.0	0	98	0	0	64	29	35
Total		**855.4**	**33.3**			**481.5**		**573.6**				**539.7**	**315.7**	**142.1**	**173.6**

TOTAL WATER SURPLUS 315.7

Note:

1) Source - Peterborough A Climate Normal Data for 1969 - 2006 (Environment Canada).
2) Thornthwaite method used to determine the potential Evapotranspiration.
3) PET - potential evapotranspiration; AET - actual evapotranspiration.

TATHAM ENGINEERING	**Project:**	3358 Lakefield Road Development
	File No.:	517661
	Date:	Jun-23
	Designed By:	JA
	Checked By:	JA
	Subject:	Water Balance Calculations - OUTLET 4

Catchment Designation	Pre-Development			Post-Development		
	Pervious	Impervious	Total	Pervious	Impervious	Total
Catchment Area Outlet 3 (ha)	**22.6**	**0.0**	**22.6**	**8.5**	**16.5**	**25.0**
Infiltration Factors						
Topography Infiltration Factor	0.10	-	-	0.10	-	-
Soil Infiltration Factor	0.30	-	-	0.30	-	-
Land Cover Infiltration Factor	0.15	-	-	0.15	-	-
MOE Infiltration Factor	0.55	-	-	0.55	-	-
Run-Off Coefficient	0.45	-	-	0.45	-	-
Runoff from Impervious Surfaces	0.00	0.80	-	0.00	0.80	-
Inputs						
Precipitation (mm/yr)	855.4	855.4	855.4	855.4	855.4	855.4
Run-on (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Other Inputs (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Inputs (mm/yr)	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Outputs						
Precipitation surplus (mm/yr)	287.4	684.3	287.4	315.7	684.3	558.8
Net surplus (mm/yr)	**287.4**	**684.3**	**287.4**	**315.7**	**684.3**	**558.8**
Evapotranspiration (mm/yr)	568.0	171.1	568.0	539.7	171.1	296.6
Infiltration (mm/yr)	129.3	0.0	129.3	142.1	0.0	48.3
Infiltration of Pervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Infiltration of Impervious Runoff (mm/yr)	0.0	0.0	0.0	0.0	0.0	0.0
Total Infiltration (mm/yr)	129.3	0.0	129.3	142.1	0.0	48.3
Run-off Pervious Areas (mm/yr)	158.1	0.0	158.1	173.6	0.0	59.1
Run-off Impervious Areas (mm/yr)	0.0	684.3	0.0	0.0	684.3	451.4
Total Run-off (mm/yr)	158.1	684.3	158.1	173.6	684.3	510.5
Total Outputs (mm/yr)	**855.40**	**855.4**	**855.4**	**855.4**	**855.4**	**855.4**
Inputs						
Precipitation (m3/yr)	193,320	0	193,320	72,786	141,064	213,850
Run-on (m3/yr)	0	0	0	0	0	0
Other Inputs (m3/yr)	0	0	0	0	0	0
Total Inputs (m3/yr)	**193,320**	**0**	**193,320**	**72,786**	**141,064**	**213,850**
Outputs						
Precipitation surplus (m3/yr)	64,962	0	64,962	26,861	112,851	139,712
Net surplus (m3/yr)	64,962	**0**	64,962	26,861	112,851	139,712
Evapotranspiration (m3/yr)	128,358	0	128,358	45,925	28,213	74,138
Infiltration (m3/yr)	29,233	0	29,233	12,087	0	12,087
Infiltration of Pervious Runoff (m3/yr)	0	0	0	0	0	0
Infiltration of Impervious Runoff (m3/yr)	0	0	0	0	0	0
Total Infiltration (m3/yr)	29,233	0	29,233	12,087	0	12,087
Run-off Pervious Areas (m3/yr)	35,729	0	35,729	14,773	0	14,773
Run-off Impervious Areas (m3/yr)	0	0	0	0	112,851	112,851
Total Run-off (m3/yr)	35,729	0	35,729	14,773	112,851	127,625
Total Outputs (m3/yr)	193,320.40	0.00	193,320.40	72,785.99	141,064.01	213,850.00

Notes: 1. Evaporation from impervious areas was assumed to be 20% of precipitation and is within the acceptable range as per the Conservation Authority Guidelines for Hydrogeological Assessment Submissions (June, 2013)

TATHAM ENGINEERING	**Project:**	3358 Lakefield Road Development
	File No.:	517661
	Date:	Jun-23
	Designed By:	JA
	Checked By:	JA
	Subject:	Water Balance Summary

Mitigation Techniques: 1. Direct rooftop areas from single detached and townhouses to pervious areas

Summary (Post Development)

	Outlet 1	Outlet 2	Outlet 3	Outlet 4
Inputs				
Precipitation (m3/yr)	18,819	141,141	95,890	213,850
Run-on (m3/yr)	0	0	0	0
Other Inputs (m3/yr)	0	0	0	0
Total Inputs (m3/yr)	18,819	141,141	95,890	213,850
Outputs				
Precipitation surplus (m3/yr)	13,659	87,524	49,474	139,712
Net surplus (m3/yr)	13,659	87,524	49,474	139,712
Evapotranspiration (m3/yr)	5,160	53,617	46,416	74,138
Pre-Development Infiltration (m^3/yr)	2,737	14,711	21,043	29,233
Post-Development Infiltration (m^3/yr)	357	9,082	10,435	12,087
Difference in Infiltration Pre to Post (%)	-87%	-38%	-50%	-59%
Number of rooftops	0	191	86	95
Area of rooftop Downspout Disconnects to Grass (m^2)	0	38,200	14,800	19,000
Roof Runoff (80% of precipitation) directed to grass (m/year)	0.68	0.68	0.68	0.68
Total Volume of Rooftop runoff (m^3/yr)	0	26,141	10,128	13,002
Infiltration of Runoff from Rooftop Disconnection (m^3/yr)	0	13,071	5,064	6,501
Total Infiltration Post Mitigation (m^3/yr)	357	22,153	15,499	18,588
Difference in Infiltration Pre to Post with mitigation (%)	-87%	51%	-26%	-36%
Total Run-off (m3/yr)	13,302	65,371	33,975	121,124
Total Outputs (m3/yr)	18,819	141,141	95,890	213,850

Notes

1.) The area of rooftops is assumed to be 200 m^2.

2.) Only single detached and townhouse units are considered in the roof downspout disconnection calculations.

3.) 50% of rooftop runoff infiltrates based on HSG 'B' type soils (CVC/TRCA LID Manual).

Appendix F: Utility Coordination Correspondence

Haoran Yu

From: Elchyson, Ryan <ryan.elchyson@bell.ca>
Sent: February-12-20 10:44 AM
To: Haoran Yu
Subject: RE: 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

Hi Haoran,

Bell have make sure fibre is available for this!

Thank you

Bell Canada
Ryan Elchyson
Access Network Co-ordinator
183 Hunter St W
Peterborough, ON
K9H 2L1
Office: (705) 876 2184
Cell: (705) 927 2872
Fax: (705) 748 9440
E-Mail: ryan.elchyson@bell.ca

From: Haoran Yu <hyu@tathameng.com>
Sent: February-11-20 11:37 AM
To: Cole Taylor <CTaylor@peterboroughutilities.ca>; Elchyson, Ryan <ryan.elchyson@bell.ca>; Wayne Millett <millett@nexicomgroup.net>; Vince Manzo <Vince.Manzo@enbridge.com>; corey.craney-twolan@canadapost.postescanada.ca
Cc: Jeremy Ash <jash@tathameng.com>; bill@tttholdings.com
Subject: [EXT]3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

Hello

On behalf of our Client, Triple T Holdings, we are confirming the availability of utilities for a planned development in Lakefield.

Please see the attached Site plan showing the multi-phased mixed use development located in the Lakefield South Secondary Plan Area. Currently, the total number of residential units is 977 which includes a mix of low and medium densities. The number of units is expected to change as the planning advances. Some ground-level commercial uses will also be incorporated. The development will be phased over a number of years however this will only be determined at a later stage. The preliminary civil engineering design is underway in support of zoning by-law and official plan amendments and a Draft Plan of Subdivision.

At this stage we want to confirm the availability of utilities to service this development and to have a very high-level idea of what expansions are likely to be required as development advances. We are not requesting preliminary designs. This will happen following approval of the initial planning applications and after the development phasing is resolved.

If you have any questions, please let me know,

Thanks

Haoran Yu
Civil Engineering Technologist
Tatham Engineering Limited
5335 Canotek Road, Unit 102 | Ottawa | Ontario | K1J 9L4
T 613-747-3636 x2120 | **C** 613-661-6399 | **E** Hyu@tathameng.com

In conjunction with our 30th year of operations, we are pleased to announce our new name **Tatham Engineering Limited** and website **tathameng.com**. Please update your records accordingly, including email addresses which have also changed.

Haoran Yu

From: Pam Gobby <Pam.Gobby@enbridge.com>
Sent: February-14-20 11:38 AM
To: Haoran Yu
Subject: FW: [External] 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)
Attachments: 517651-SP02-Layout1.pdf; ATT00001.htm

Good Morning Haoran Yu,

I am currently the Rep looking after Lakefield area. I have compared the site plan with our existing infrastructure map and we have gas along Lakefield Rd and 7th Line.

We will require gas mains through the area in question to service the future development.
We are not able to officially confirm gas is available for the project as it is too preliminary at this time, but it is good news that there is main surrounding the planned area.
Once the project is much further along, please send the below requirements to AreaPlanning40@Enbrige.com and you will be connected with the appropriate Rep. At that time, we will confirm that the existing infrastructure is sufficient for the loads requested and will advise of the required work to supply the development. If there are costs, they would be discussed once the below information is received. Please send the below information all together.

To proceed with a gas design please provide the following;

Completed Builder Information Form
CADD 2007 or earlier – Base, Deep Servicing, Hydro, site Plan
CADD 2007 or earlier – profiles for any culvert crossing
Site plan showing location of gas meters/ building wall elevations showing proposed gas meter locations
JUT detail if applicable
ROW for all streets within the site
Confirmation that the site to be serviced has been cleared on compliance with the SAR act – please provide any environmental comments
Civic addressing when available
Required gas installation timelines
1st closing date

Thank you,

Pam Gobby
Customer Connections, Field Rep

ENBRIDGE GAS INC.
TEL: 905-436-7027
1350 Thornton Rd S, Oshawa ON L1J8C4

enbridgegas.com
Integrity. Safety. Respect.

From: Vince Manzo
Sent: Tuesday, February 11, 2020 11:43 AM
To: Pam Gobby
Subject: Fwd: [External] 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

Hey Pam,
New future development in Lakefield for you.

Thanks
Vince

Begin forwarded message:

From: Haoran Yu <hyu@tathameng.com>
Date: February 11, 2020 at 11:37:18 AM EST
To: Cole Taylor <CTaylor@peterboroughutilities.ca>, "Elchyson, Ryan" <ryan.elchyson@bell.ca>, Wayne Millett <millett@nexicomgroup.net>, "Vince Manzo" <Vince.Manzo@enbridge.com>, "corey.craney-twolan@canadapost.postescanada.ca" <corey.craney-twolan@canadapost.postescanada.ca>
Cc: Jeremy Ash <jash@tathameng.com>, "bill@tttholdings.com" <bill@tttholdings.com>
Subject: [External] 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

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Haoran Yu

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Haoran Yu

From: Greg Conlin <gconlin@nexicomgroup.net>
Sent: February-12-20 3:04 PM
To: Haoran Yu
Cc: Tina Thornton
Subject: FW: 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)
Attachments: 517651-SP02-Layout1.pdf

Good Afternoon

We have cable, internet and phone facilities in the area and are interested to serve this new development.

Thanks

Greg

From: Wayne Millett <millett@nexicomgroup.net>
Sent: February 12, 2020 12:32 PM
To: Greg Conlin <gconlin@nexicomgroup.net>
Subject: FW: 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

Hi Greg,

Can you please run with this new subdivision.

Thanks
Wayne

From: Haoran Yu <hyu@tathameng.com>
Sent: Tuesday, February 11, 2020 11:37 AM
To: Cole Taylor <CTaylor@peterboroughutilities.ca>; Elchyson, Ryan <ryan.elchyson@bell.ca>; Wayne Millett <millett@nexicomgroup.net>; Vince Manzo <Vince.Manzo@enbridge.com>; corey.craney-twolan@canadapost.postescanada.ca
Cc: Jeremy Ash <jash@tathameng.com>; bill@tttholdings.com
Subject: 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

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Haoran Yu

From: Cole Taylor <CTaylor@peterboroughutilities.ca>
Sent: February-13-20 12:53 PM
To: Haoran Yu
Cc: Jeremy Ash; bill@tttholdings.com
Subject: Re: 3358 Lakefield Road Future Development Utility Coordination (Tatham Project# 517651)

Hello Haoran

We are just verifying through our GIS department the service territories boundary of PDI in Lakefield, preliminary review indicated most if not all of this development is in Hydro One territory and thus they get first opportunity to service the development.

If Hydro One could not service the project for some reason and was agreeable a service territory amendment would need to be agreed upon and filed with the Ontario Energy Board, You should confirm the availability of utilities and any limitations or expansion of such with Hydro One.

Once we have confirmed boundaries we will provide a copy of such.

Thanks

Cole Taylor, C.Tech
Senior Electrical Tech
705-748-9301 ext 1252

>>> Haoran Yu <hyu@tathameng.com> 2020-02-11 11:37 AM >>>
Hello

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