S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing and Stormwater Management Report

KING ASPHALT PLANT

North Service Road
City of Burlington

Prepared for:

KING PAVING &
CONSTRUCTION
COMPANY

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1 Introduction and Background

1.1 Overview

S. Llewellyn & Associates Limited has been retained by King Paving & Construction Company to provide Consulting Engineering services pertaining to the relocation of an asphalt mixing plant to the North Service Road in Burlington Ontario. The site is located approximately 1.2 km east of the interchange at Waterdown Road, west of existing Hickory, on the north side of the North Service Road, and south of the former Region of Halton Landfill (see Figure 1.1 for site location).

The proposed development consists of the relocation of Hickory Lane, currently located 250 m east of the site, the construction of a shared access from Hickory Lane to the existing landfill for the Region of Halton, the relocated asphalt plant, including bulk storage areas, asphalt production equipment and staff parking, a dry pond SWM facility and landscaped areas.

This report will provide detailed information about the proposed stormwater management and functional servicing schemes for this development. Please refer to the site engineering plans prepared by S. Llewellyn and Associates Limited for additional information.



Figure 1.1: Location of Proposed Development.

1.2 Background Information

The following documents were referenced in the preparation of this report:

Ref 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)

Ref 2: City of Burlington Standard Drawings (City of Burlington, March 2004)

Ref 3: Halton Region Water and Wastewater Linear Design Manual (Halton Region, May 2014)

Ref 4: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref 5: City of Burlington Stormwater Management Design Guidelines (May 2020)

Ref 6: Low Impact Development Stormwater Management Planning and Design Guide (2010)

Ref 7: Closed Burlington North Service Road Landfill Site, 2021 Annual Monitoring Report (March 31, 2022)

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2 Stormwater Management Criteria

Quality and Quantity Controls
The site is located within the Falcon Creek watershed and adjacent to Highway 403 and therefore stormwater quantity and quality controls are required to satisfy the criteria of Conservation Halton and the Ministry of Transportation (MTO). The following stormwater management (SWM) criteria will be applied to the site:

Quantity Control
The post-development stormwater discharge rate from the proposed site shall be controlled to the pre-development discharge rate for the 2-year to 100-year storm events as per MTO requirements.

Quality Control
The stormwater runoff from the proposed condition site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment) as per Conservation Halton criteria.

Erosion Control
Erosion and sediment control measures will be implemented following the standards of the Conservation Halton and City of Burlington criteria.

2.1 Pre-Development Conditions

The site is located on the north side of the North Service Road, between Waterdown and Hickory Lane, south of the former Region of Halton landfill. Situated within the Falcon Creek watershed with the Falcon Creek itself being 120 m west of the site. The site is bound on both the east and west sides by existing swales/ditches and low-lying wet areas that collect the overland flows before discharging to the roadside ditch along North Service Road and Falcon Creek.

The site is distinguished by an approximately 20.0m wide raised, manmade plateau topped with compacted granular fill, creating a peninsula above the surrounding area. The site also includes a granular access road located along the west boundary of the site, that is used by the Region of Halton Staff to monitor the existing leachate system for the former landfill. Existing vegetation includes scrub brush and grass, a significant woodland has been identified on the east and south side of the site. Refer to the Grading Plans prepared by S. Llewellyn and Associates Limited for further detail.

A single drainage area, Catchment 101, has been identified in the pre-development condition. The drainage area is bound to the north by the limits of the former landfill, the existing swales channels located to the west of the development, North Service Road to the south, and the existing property lines to the east, which includes the right of way for the new Hickory Lane. Refer to Table 2.1 for the catchment characteristics and Appendix A for the Pre-Development Storm Drainage Area Plan.

Table 2.1: Pre-Development Catchment Area 101 Characteristics

Characteristic	Value
Catchment Area	3.222 Ha
Impervious Area (Granular Surface)	0.771 Ha
Percentage of Impervious Coverage	24.0%
Runoff Coefficient (C_{imp}) for Impervious Area	0.85
Runoff Coefficient (C_{per}) for Pervious Area	0.10
Composite Runoff Coefficient (C_{site})	0.28

An analysis was performed for the pre-development conditions using the SWMHYMO hydrologic modelling program with the City of Burlington 2-year to 100-year design storm events (4-hour duration). See Appendix A for SWMHYMO input and output information.

Pre-development stormwater discharge rates are summarized in Table 2.2 for the 2, 5, 10, 25 and 100-Year events.

Table 2.2: Pre-Development Stormwater Discharge Rates (Catchment 101)

Storm Event	Discharge (m^3/s)	Storm Event	Discharge (m^3/s)
2-Year Event	0.152	25-Year Event	0.298
5-Year Event	0.205	50-Year Event	0.343
10-Year Event	0.242	100-Year Event	0.385

2.2 Post-Development Conditions

It is proposed to service the proposed asphalt plant with a combination of open ditches, a private storm sewer system, a proposed dry pond, and enhanced grassed swales designed and constructed as per the City of Burlington and Ministry of the Environment Standards. The relocated Hickory Lane will be serviced with roadside ditches out letting directly to the ditches on the north side of the North Service Road. Based on this servicing scenario, two drainage areas were identified, Catchment 201, representing the controlled runoff from the asphalt plant and the access road shared by King Paving & Construction Company the Region of Halton and Catchment 202 representing the uncontrolled runoff from the relocated Hickory Lane. The characteristics of the two catchment areas are summarized in Table 2.3 and Table 2.4, see Appendix A for the Post-Development Drainage Area Plan.

Table 2.3: Post-Development Characteristics of Catchment 201

Description	Area (Ha)	Percent of Total Catchment (%)	Runoff Coefficient (C)
Roof/Structures	0.067	2.8%	0.95
Asphalt/Concrete Area	0.592	24.9%	0.90
Recycled Asphalt Area (Material Storage Area)	0.693	29.1%	0.90
Granular Shoulders (adjacent to asphalt roads)	0.111	4.7%	0.85
Grassed/Landscaped Area	0.916	38.5%	0.25
TOTAL/COMPOSITE	**2.379**	**100%**	**0.65**
Total Impervious Area (Ha)	**1.463**		
% Impervious	**61.5%**		

Table 2.4: Post-Development Characteristics of Catchment 202

Description	Area (Ha)	Percent of Total Catchment (%)	Runoff Coefficient (C)
Asphalt/Concrete Area	0.173	20.6%	0.90
Granular Shoulders (adjacent to asphalt roads)	0.056	6.6%	0.85
Grassed/Landscaped Area	0.612	72.8%	0.25
TOTAL/COMPOSITE	**0.841**	**100%**	**0.42**
Total Impervious Area (Ha)	**0.229**		
% Impervious	**27.2%**		

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchments 201 utilizing a two-stage outlet structure within ditch inlet DI-3. The orifice structure consists of a 75mm diameter cored hole to discharge the volume from the 25mm storm event over a 24-to-48-hour period and the 2-year to 10-year storm event, and a 300mm diameter orifice pipe from ditch inlet DI-3 to manhole M12 to restrict the 25-year to 100-year design storms from the site to the pre-development discharge rates. Refer to the Site Servicing Plan for the outlet structure details.

With the installation of on-site quantity control measures for Catchments 201, it will be required to provide stormwater storage during storm events up to and including the 100-year event. To provide the required storage, a dry pond SWM Facility is proposed at the south end of the site. Refer to the Grading Plan prepared by S. Llewellyn and Associates Limited for the SWM facility details. The stage-storage-discharge characteristics can be

seen in Table 2.5 and Appendix A for details. Refer to Table 2.6 comparing the design parameters and minimum design criteria as per the Ministry of the Environment Stormwater Management Planning and Design Manual (March 2003).

As previously noted, discharge from Catchment 202 will not be controlled, so the discharge rate from Catchment 201 shall be over-controlled such that the combined discharge will not exceed the pre-development discharge rates.

Table 2.5: Proposed Condition Stage-Storage-Discharge

Description	Elevation (m)	Storage (m^3)	Total Discharge (m^3/s)
75mm Orifice Invert	115.45	0	0.0000
Bottom of Pond	115.45	0	0.0000
0.10m Ponding Depth	115.55	76	0.0047
0.20m Ponding	115.65	157	0.0081
0.30m Ponding	115.75	243	0.0104
0.40m Ponding	115.85	335	0.0123
Second Stage Inlet Sill Elevation	115.95	432	0.1666
0.60m Ponding	116.05	536	0.1886
0.70m Ponding	116.15	645	0.2079
0.80m Ponding	116.25	760	0.2252
0.90m Ponding	116.35	882	0.2412
1.00m Ponding	116.45	1009	0.2563
Weir Sill Elevation	116.50	1076	0.2636
1.20m Ponding	116.60	1213	0.2774
Top of Pond (1.35m Depth)	116.80	1507	0.3033

Table 2.6: Proposed Dry Pond Design Criteria

Design Objective	Minimum Criteria	Provided
Drainage Area	5 ha Smaller drainage areas may be considered (subject to minimum orifice sizing and reduced detention times) if the dry pond is part of a treatment train.	2.379 ha The proposed dry pond can service the smaller drainage area since it is a part of a treatment train system, and is subject to the minimum orifice size and therefore, reduced detention time.
Treatment Volume[1]	Minimum ($200m^3$/ha x 1.594ha) = 219 m^3	1507 m^3
Active Storage Detention Time	24 hours (12 hours if in conflict with minimum orifice size)	25 hours
Forebay	Minimum depth: 1m Sized to ensure non-erosive velocities leaving forebay	N/A
Length-to-Width Ratio	3:1	3:1
Depth	Maximum depth: 3m Mean depth: 1-2m	1.35m
Side Slopes	4:1 or flatter	4:1
Inlet	Minimum: 450mm	450mm & 675mm
Outlet	Minimum: 450mm outlet pipe If orifice control used, 75mm	Outlet structure comprised of a 75mm diameter orifice hole and a 300mm diameter orifice pipe.
Maintenance Access	Provided to approval of Municipality	Provided, see Site Grading and Servicing Plans for details.
Buffer	Minimum 3m, above maximum water level	Achieved

[1] As per Table 3.2, Ministry of the Environment Stormwater Management Planning and Design Manual (March 2003)

An analysis was performed on the Proposed Condition site using the SWMHYMO hydrologic modelling program to determine the required volume of stormwater storage required during the 2-year to 100-year City of Burlington design storms. A summary of the results for Catchment 201 and 202 can be found in Table 2.7. These combined post-development flows are compared to the allowable pre-development flows for Catchment 101 in Table 2.8. Detailed SWMHYMO input/output information can be found in Appendix A.

Table 2.7: Post-Development Stormwater Discharge Rates for Catchments 201 & 202

Storm Event	Catchment 201 (Uncontrolled) (m^3/s)	Catchment 201 (Controlled) (m^3/s)	Catchment 202 (Uncontrolled) (m^3/s)	Total Discharge (m^3/s)[1]
2-Year Storm	0.281	0.026	0.055	0.065
5-Year Storm	0.369	0.075	0.077	0.096
10-Year Storm	0.428	0.118	0.093	0.150
25-Year Storm	0.506	0.167	0.114	0.243
50-Year Storm	0.566	0.177	0.130	0.300
100-Year Storm	0.624	0.186	0.147	0.324

[1] Total Discharge = Catchment 201 Controlled + Catchment 202 Uncontrolled.

Table 2.8: Post-Development Discharge Rates vs Allowable Pre-Development Discharge Rate

Storm Event	Post-Development Discharge (Catchment 201+ 202) (m^3/s)	Allowable Discharge (Catchment 101) (m^3/s)	Reduction (%)
2-Year Storm	0.065	0.152	57%
5-Year Storm	0.096	0.205	53%
10-Year Storm	0.150	0.242	38%
25-Year Storm	0.243	0.298	18%
50-Year Storm	0.300	0.343	13%
100-Year Storm	0.324	0.385	16%

Based on the post-development discharge rates, stormwater storage is required for Catchment 201 as summarized in Table 2.9. These volumes can be accommodated within the proposed dry pond facility. The post-development flows will not exceed the allowable discharge rate in the 2 to 100-year design storms.

Table 2.9: Proposed Storage Requirements and Ponding Details

Storm Event	Required Storage Volume[1] (m^3)	Approximate Ponding Elevation (m)	Depth of Ponding (m)
2-Year Storm	343	115.86	0.41
5-Year Storm	374	115.89	0.44
10-Year Storm	402	115.92	0.47
25-Year Storm	435	115.95	0.50
50-Year Storm	480	116.00	0.55
100-Year Storm	527	116.04	0.59
Emergency Overflow Weir	1076	116.50	1.05
Top of Pond	---	116.80	1.35
[1]Storage Volumes have been rounded up to the nearest $1m^3$			

Water Quality Control

The proposed development is required to achieve an “Enhanced” (80% TSS removal) level of water quality protection. To achieve this criterion, discharge from Catchment 201 will be subject to treatment from enhanced swales, two HydroStorm or similar ETV approved oil/grit separators followed by the proposed stormwater management dry pond facility. Subsequently discharging to the East Ditch and ultimately to the existing roadside ditch on the North Service Road before crossing under Highway 403.

Quality control for the roadways within Catchment 201 will be provided by enhanced swales that direct runoff to the stormwater management dry pond. The swales were designed based on guidelines stated in the *MOE Stormwater Management Practices Planning and Design Manual* (Ref. 1) and *Low Impact Development Stormwater Management Planning and Design Guide* (Ref. 5) to provide effective stormwater quality control. The proposed ditches will be trapezoidal in shape, have side slopes of a maximum 3:1, a bottom width of 0.75m and a minimum depth of 0.40m. The ditches were analyzed to determine the worst-case scenario in terms of flow depth and velocity using the FlowMaster program developed by Bently Systems Inc. The FlowMaster summary reports have been included in Appendix A. The rainfall intensity for a 25mm Chicago storm event was generated using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates and can be found in Appendix A. Tables 2.10 and 2.11 summarize how the proposed enhanced swales were designed according to the recommended parameters to satisfy the quality control requirements.

Table 2.11 – Proposed Ditch Design Against Recommended Parameters Enhanced Swale 1		
Parameter	**Recommended**	**Designed**
Shape (cross-section)	Trapezoidal or Parabolic	Trapezoidal
Bottom Width	0.75 – 3.0 m	0.75 m
Longitudinal Slope	0.5% - 4.0%	4.0%
Max. Flow Depth	< 2/3 height of vegetation	0.04 m
Side Slopes	Max 2.5:1	3:1
Manning's n	0.027 – 0.050	0.035
Design Flow	4 hour, 25 mm Chicago storm event	4 hour, 25 mm Chicago storm event
Flow	≤ 0.15 m^3/s	Max. 0.02 m^3/s
Velocity	≤ 0.5 m/s	Max. 0.63 m/s

Table 2.22 – Proposed Ditch Design Against Recommended Parameters Enhanced Swale 2		
Parameter	**Recommended**	**Designed**
Shape (cross-section)	Trapezoidal or Parabolic	Trapezoidal
Bottom Width	0.75 – 3.0 m	0.75 m
Longitudinal Slope	0.5% - 4.0%	1.2%
Max. Flow Depth	< 2/3 height of vegetation	0.08 m
Side Slopes	Max 2.5:1	3:1
Manning's n	0.027 – 0.050	0.035
Design Flow	4 hour, 25 mm Chicago storm event	4 hour, 25 mm Chicago storm event
Flow	≤ 0.15 m^3/s	Max. 0.04 m^3/s
Velocity	≤ 0.5 m/s	Max. 0.51 m/s

Due to the minor exceedance in the designed velocity within the enhanced swales, rock check dams have been proposed within the swales. The rock check dams are spaced at 30m intervals such that the crest of the dam downstream is approximately at the same elevation as the toe of the dam upstream. These rock check dams will aid in improving the water polishing in the swale by reducing the channel's velocity. Furthermore, grass in the enhanced swales should be allowed to grow higher than 75mm to further enhance their water polishing effect.

The HydroStorm sizing software was used to determine the required size of the oil/grit separator units for the site. Rainfall data was taken from the Hamilton RBG rainfall gauge and the ETV Canada particle size distribution was used. It was determined that a HydroStorm HS10 will be required for runoff from the asphalt plant and access road and a HydroStorm HS6 will be required for the remainder of Catchment 201. See HydroStorm

unit sizing procedures in Appendix A for details. The HydroStorm unit has been certified under NJDEP for 50% removal credit, As such, the HS10 and HS6 have been designed to achieve an 'Enhanced' (80% TSS removal) level of stormwater quality control, but only credited for 50% TSS removal within the treatment train.

As part of the treatment train approach, the extended detention requirements for the dry pond were reviewed against the MOE requirements with the assumption that the dry pond could provide a minimum 60% TSS removal. The worksheet in Appendix A shows that for a Basic level of protection (60% TSS removal), approximately 321 m^3 of extended detention storage will be required. Based on the two-stage orifice structure providing quantity control for Catchment 201, this results in a drawdown time of 25 hours, which is an adequate draw down time.

The treatment train mechanisms for catchment 201 have been summarized in Table 2.9 below. In order to calculate the total TSS removal from the proposed development, the weighted average was used to calculate the cumulative TSS removal.

Table 2.6 - Proposed Condition Stormwater Treatment Train Catchment 201

Catchment 201 Drainage Area (Ha)	Treatment Train Mechanism #1 (% TSS Removal)	Treatment Train Mechanism #2 (% TSS Removal)	Treatment Train Mechanism #3 (% TSS Removal)	Total TSS Removal (%)[3]
2.379	Enhanced Swale (76%)[4]	HydroStorm Units (50%)[1]	Dry Pond (60%)[2]	95%

[1] The HydroStorm unit has been designed to achieve 80% TSS Removal. As per the ETV Standards, the HydroStorm unit is credited with only 50% TSS Removal.
[2] The dry pond has been conservatively assumed to achieve a 60% TSS Removal rate within the treatment train.
[3]Total TSS removal calculated using the following formula: R=A+B-[(AxB)/100], where R=total TSS removal rate, A=TSS removal rate for first mechanism, B=TSS removal rate for second mechanism
[4]TSS removal for Enhanced swales taken from the Low Impact Development Stormwater Management Planning and Design Guide Version 1.0 Dated 2010 by CVC and TRCA

As such, the weighted average of TSS Removal from the majority of the development area (Catchment 201) reveals that the treatment train approach will provide 95% TSS removal and meet the "Enhanced" (80% TSS removal) level of water quality protection.

Runoff from Catchment 202 will discharge to the existing east channel and the proposed and existing roadside ditches along Hickory Lane and the North Service Road. Rock check dams have been provided to encourage water polishing and it is recommended that proposed ditching be planted where feasible to further enhance the polishing effect of the roadside ditches.

This analysis determined the following:

- The post-development discharge rates will not exceed the existing condition discharge rates during the 2-year to 100-year storm events.
- Approximately 527 m^3 of stormwater storage is required for Catchment 201 during the 100-year event, which can be accommodated by the proposed dry and facility, having a volume of 1507.0 m^3.

- An “Enhanced” level of water quality protection can be achieved through the treatment train with the installation of an enhanced swales, HydroStorm units and the dry pond facility. The treatment train will provide a cumulative total of 95% TSS removal.

Erosion Control
The City of Burlington’s criteria is to retain the 25mm storm event and to release it over a 24-to-48-hour period. The drainage area of Catchment 201 is 2.379ha, which will generate approximately 280m^3 of runoff during the 25mm storm event. An analysis was completed using a two-stage orifice structure consisting of a 75mmø cored hole to discharge the volume from the 25mm design storm event over a 24-to-48-hour period, and a 300mmø orifice pipe to provide quantity control for the subject site. The analysis concluded the proposed 75mmø orifice plate resulted in a drawdown time of 23 hours. Given that the implementation of the 75mmø orifice is the smallest recommended orifice size, this drawdown time can be considered a best-efforts approach and will provide adequate erosion control for the proposed development.

Water Balance
As part of the stormwater management criteria for this development, 5mm of runoff volume from the site must be retained on-site as per City of Burlington Guidelines. To achieve this criterion, consideration was given to installing an infiltration gallery in order to capture and infiltrate storm water on site. However, a Geotechnical Investigation prepared by Landtek Ltd. Dated October 28, 2022 determined that shale bedrock was encountered at 115.79m, this elevation is 0.34m above the proposed bottom of SWM Pond at 115.45m. Furthermore, a Monitoring Report was completed by WSP (Ref.7) dated March 31, 2022 which indicates that high groundwater is present within the site. Therefore, an infiltration gallery will not be able to be constructed due to the proximity of the infiltration gallery to the shale underlying the site and high groundwater present within the site. Refer to Appendix E for Geotechnical Investigation.

2.3 Sediment and Erosion Control

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented as per City of Burington and Conservation Halton guidelines:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install silt fencing along the toe of proposed stockpiles;
- Install sediment control (i.e. silt sacks) in the proposed and nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system;
- Install a mud mat at the construction entrance of the site to reduce mud tracking and sediment leaving the site via construction traffic; and
- Stabilize all disturbed or landscaped areas and stockpiles with hydroseeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities and provisions:

- Inspecting the erosion and sediment controls before documenting and submitting associated reports to the governing municipality; and

- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

3 Storm Sewer Servicing

3.1 Existing Conditions

Under the current conditions, there is an existing channel flowing from the north toward the North Service Road adjacent to the site on both the east and west sides. Flows from these channels' outlet to the roadside ditches and low-lying areas located on the north side of the North Service Road. These combined flows continue east prior to discharging to Falcon Creek and crossing under Highway 403.

3.2 Proposed Storm Servicing and Capacity Analysis

It is proposed to collect stormwater through a private storm sewer system and open ditch system. The private storm sewer system will collect stormwater from the asphalt plant, discharging to the proposed dry pond SWM Facility where discharge rates will be controlled to pre-development levels prior to out letting to the existing east channel and North Service Road roadside ditches.

The private system will be designed to collect the minor or 5-year storm event, based on the City of Burlington Design storm with an overland flow route designed to direct larger events to the SWM facility. The exception to this design scheme will be the access road area where no overland flow route to the pond can be achieved. Therefore, in this area, it is proposed that total capture structures be employed to collect the major rain events up to the 100-year event in total capture structures and the flow conveyed via pipes designed for the 100-year event to the SWM facility. Refer to Appendix B for the storm sewer design sheet. All storm sewers and structures will be constructed as per the latest revision of the City Burlington Standards.

The open ditch system will be used to carry runoff from the proposed Hickory Lane and the shared access road, as well as convey flows from the existing east channel to the existing outlet to the roadside ditches located on the north side of the North Service Road. It is proposed to maintain much of the existing west channel with only minor grading required to facilitate the development.

4 Sanitary Sewer Servicing

4.1 Existing Conditions

There is an existing 150 mm diameter sanitary sewer owned and monitored by the Region of Halton as part of the leachate system for the former landfill. This sewer, located east of the development, flows from the north to an existing 250 mm diameter sanitary sewer in the north shoulder of the North Service Road.

4.2 Sanitary Demand

Sanitary discharge from the proposed development was estimated in accordance with Halton Region Water and Wastewater Linear Design Manual. As the asphalt plant is a special industrial use, average dry weather flows will be calculated using the anticipated staffing levels for the plant. Based on discussions with the owner, while in operation, the plant will require 5 full-time staff. Table 4.1 summarizes the sanitary sewer discharge rate from the proposed asphalt plant based on Unit Sewage Flows provided in Table 3.2 of the Halton Region Water and Wastewater Linear Design Manual Ref **3**).

Table 4.1: Post-Development Sanitary Sewer Discharge

Plant Population [A]	Unit Sewage Flow (l/day/person)[B]	Avg. Demand [C] (l/s)	Peaking Factor [D]	Infiltration [E] (l/s)	**Peak Flow [F] (l/s)**
5 persons	275	0.016	3.55	0.200	**0.256**

[A] The population is based on the operational requirements of the asphalt plant

[B] Unit sewage flow based on unit sewage flows for light industrial, converted to a per capita flow as follows; 34.375 / 125 = 0.275m^3/day/person or 275 l/day/person

[C] Average demand = 275 m^3/day/person x plant population

[D] Peaking Factor calculated with modified Harmon Formula = K_{av} x (1+(14/(4+$P^{0.5}$))) with P expressed in thousands and area of the asphalt plant (excluding load and material storage) = 0.27 ha, Min = 2.0

[E] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Site Area + Hickory Lane R.O.W. (0.70 ha)

[F] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

4.3 Proposed Sanitary Servicing and Capacity Analysis

It is proposed to discharge wastewater through a 200 mm diameter private sanitary sewer system which connects into the existing 250 mm diameter municipal sanitary sewer on The North Service Road via the existing manhole located 20.0 m west of the proposed Hickory Lane. The existing 250 mm sanitary will be extended to the centre of the proposed Hickory Lane. The Regional Servicing Agreement process will be required, for at a minimum, the extension of the existing 250 mm sanitary sewer within the North Service Road.

The minimum grade of the proposed 200 mm diameter private sanitary sewer will be 0.5%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.024 m^3/s (24

l/s). Therefore, the proposed 200 mm diameter sanitary sewer at 0.5% grade is adequately sized to service the proposed development.

The existing 250mmø sanitary sewer has a slope of 0.34%. At this slope, the existing 250mmø sanitary sewer has a free-flow capacity of 0.035 m^3/s (35 l/s). The subject site will contribute 0.256 l/s of additional flows to the existing 250mmø sanitary sewer on the north service road, representing 0.73% of the free-flow capacity of the existing 250mmø sanitary sewer. Therefore, the additional flows from the proposed development will have a negligible impact on the downstream sanitary sewers.

5 Domestic Water Usage

5.1 Existing Conditions

The existing municipal water distribution system consists of a 300 mm diameter watermain along the North Service Road with hydrants spaced an average of 95.0m apart along the north side of the North Service Road. It is understood that the Region of Halton has a major watermain upgrade program forecasted for the frontage of the proposed development. At this time, the impact and extent of the future watermain upgrade on North Service Road is unknown, but it is not anticipated to be a concern to this development.

5.2 Domestic Water Demand

Water demand for the proposed residential development has been estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual (Ref **3**). Table 5.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 5.1: Post-Development Domestic Water Demand

Population [A] (Persons)	Average Daily Demand [B] (l/s)	Max. Daily Peaking Factor [C]	Max. Hourly Peaking Factor [D]	**Max. Daily Demand [E] (l/s)**	**Max. Hourly Demand [F] (l/s)**
5	0.016	2.25	2.25	**0.036**	**0.036**

A Population = 1.60 persons/unit x 198 units + 90 persons/Ha x 0.02 Ha (refer to Table 2.0 in Ref. 3)
Average Daily Demand = 275 L/cap/day x Population

B Max. Daily Peaking Factor = 2.25 (refer to Section 2.4.2 of the Halton Region Water and Wastewater Linear Design Manual

C Max. Hourly Peaking Factor = 2.25 (refer to Table 2.2 in Section 2.4.2 of the Halton Region Water and Wastewater Linear Design Manual

D Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor

F Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

5.3 Fire Flow Demand

Fire flow demands for the development are governed by the Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020). Based on the current site plan, two buildings are proposed for the site, the Control Centre and the Motor Control Centre.

The motor control building is a 2-storey steel building (C=1.0). The control building is a 2-storey wood frame structure (C=1.5). A maximum exposure adjustment of 75% was assumed and maximum occupancy factor of 25% was applied representing a hazardous usage. Both of these factors are conservative assumptions.

The flow rate was determined in accordance with the Fire Underwriters Survey - 2020 Water Supply for Public Fire Protection. It has been determined that the required fire flow for the proposed development is **7,000 l/min (117 l/s)**. All fire flow calculations are preliminary and will be confirmed at the detail design stage, refer to Appendix C for the calculations and additional information.

The following hydrant flow test data for the closest municipal fire hydrants fronting the proposed development on North Service Road has been analysed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 5.2 summarizes the hydrant flow data for the fire hydrant in closest proximity to the proposed development. Data has been made available by Aquacom Contracting.

Table 5.2 – Hydrant Flow Data 1 (Aquacom Contracting)	
Location	North Service Road
Test Date	July 26, 2021
Static Pressure	71 psi
Residual Pressure During Test Flow (One Outlet)	67 psi
Residual Pressure During Test Flow (Two Outlets)	55 psi
Test Flow Rate (One Outlet)	1344 IGPM (101.83 l/s)
Test Flow Rate (One Outlet)	2014 IGPM (152.60 l/s)
Theoretical Flow @ 20 psi	**3766 IGPM (285.34 l/s)**

Based on the above, the theoretical maximum available flow rate from the flow data is **285.34 l/s**, while the maximum required fire flow for the proposed development is **117 l/s**.

Therefore, based on the above analysis the proposed water distribution system will have the capacity and pressure required to adequately service the subject land.

5.4 Proposed Water Servicing and Analysis

The proposed water servicing for the subject site consists of feeding off the existing 300 mm diameter PVC watermain provided on the North Service Road with a 200 mm diameter service. This 200 mm diameter water service has been designed to supply both domestic

and fire demands and will extend along Hickory Lane, entering the site from the south entrance and terminate south of the Control Center with a 200 mm to 150 mm reducer and a proposed hydrant. A 25 mm diameter domestic service is proposed to branch off the mainline and service the Control Center. An Environmental Opinion Letter was prepared by Landtek Ltd. Dated September 22, 2022 has determined the soil has a leachate influence as well as several MECP inorganic and organic exceedances. Due to the presence contaminates, it is proposed to construct 150mm to 200mm water services with ductile iron and the use of nitrite gaskets. This is to prevent pipe corrosion and containment leaching. Water services for the site have been designed and will be constructed according to the standards of the Region of Halton. Refer to Appendix E for Environmental Opinion Letter.

6 Conclusions and Recommendations

Based on the information provided herein, it is concluded that:

- The required Stormwater Management Criteria can be achieved for the proposed site.
- The site can be serviced by the extension of the existing sanitary sewers on the North Service Road but, further capacity analysis of the wastewater system is required by the Region of Halton to confirm capacity exists for this development.
- Water servicing is available via the existing 300 mm diameter watermain

Therefore, it is recommended that:

- The development will be graded and serviced in accordance with the Preliminary Grading Plan and Preliminary Site Servicing Plan, prepared by S. Llewellyn & Associates Limited upon confirmation of the available capacity within the municipal water and wastewater system;
- Erosion and sediment controls are installed as per the specifications of S. Llewellyn and Associates Limited; and
- The proposed sanitary, storm and water servicing system be installed as per the Site Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

S. LLEWELLYN & ASSOCIATES LIMITED



B.Henderson, C.Tech.

S. Frankovich , P.Eng.

APPENDIX A: STORMWATER MANAGEMENT

STORMWATER MANAGEMENT INFORMATION

S:\20036\WORKING_Current\20036- Topo.dwg

FORMER
LAND FILL

CORRIDOR

Ex. VACANT LANDS

EXISTING ROAD
SIDE DITCH

EAST CHANNEL

EXISTING GRANULAR PAD
AND ACCESS ROAD
AREA=0.771ha

101
3.222ha

WEST CHANNEL

10m SETBACK OF
SIGNIFICANT WOODLOT

Ex. HYDRO

LIMITS OF SIGNIFICANT WOOD LOT AS
STAKED BY GEOPROCESS

EXISTING BOX CULVERT
UNDER HIGHWAY 403

NORTH SERVICE ROAD

HIGHWAY # 403

LEGEND

101
3.022 ha

- CATCHMENT ID NUMBER
- CATCHMENT AREA
- CATCHMENT BOUNDARY
- LIMITS OF SIGNIFICANT WOODLOT
- EXISTING DITCH/CHANNEL

FIGURE 2.1
PRE-DEVELOPMENT CATCHMENT AREA PLAN
SCALE: 1:1500

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

5/22/2024 3:06:35 PM - Blair Henderson

S:\20036\WORKING_Current\20036-CATCHMENT FIGURES.dwg

FORMER LAND FILL

CORRIDOR

Ex. VACANT LANDS

EXISTING ROAD SIDE DITCH

NORTH SERVICE ROAD

HIGHWAY # 403

TRUCK ROUTE TO THE FORMER LANDFILL

EAST CHANNEL

SHARED ACCESS ROAD

SHARED ACCESS ROAD

202
0.841 ha
IMP. AREA=0.229 ha
% IMP. = 26.0 %

HICKORY LANE

ASPHALT LOADING AREA

201
2.379 ha
IMP. AREA=1.463ha
% IMP. = 61.5%

MATERIALS STORAGE

SWM FACILITY

ASPHALT PLANT

202
0.841 ha
IMP. AREA=0.229 ha
% IMP. = 27.2%

WEST CHANNEL

10m SETBACK OF SIGNIFICANT WOODLOT

RESURFACE ACCESS ROAD TO THE FORMER LANDFILL

Ex. HYDRO

LIMITS OF SIGNIFICANT WOOD LOT AS STAKED BY GEOPROCESS

EXISTING BOX CULVERT UNDER HIGHWAY 403

LEGEND

200
0.777 ha
CATCHMENT ID NUMBER
CATCHMENT AREA

CATCHMENT BOUNDARY

LIMITS OF SIGNIFICANT WOODLOT

EXISTING DITCH/CHANNEL

EXISTING DITCH/CHANNEL

ASPHALT PAVED SURFACES

RECYCLED ASPHALT SURFACES

GRANULAR SURFACES

CONCRETE SURFACE

DISTURBED LANDSCAPED AREAS

SWM FACILITY

FIGURE 2.2
POST-DEVELOPMENT CATCHMENT AREAS PLAN
SCALE: 1:1500

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CONSULTING ENGINEERS

Tel. (905) 631-6978
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email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

5/22/2024 3:11:32 PM — Blair Henderson

King Asphalt Plant
North Service Road, Burlington, Ontario

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CONSULTING ENGINEERS

STAGE-STORAGE-DISCHARGE CALCULATIONS

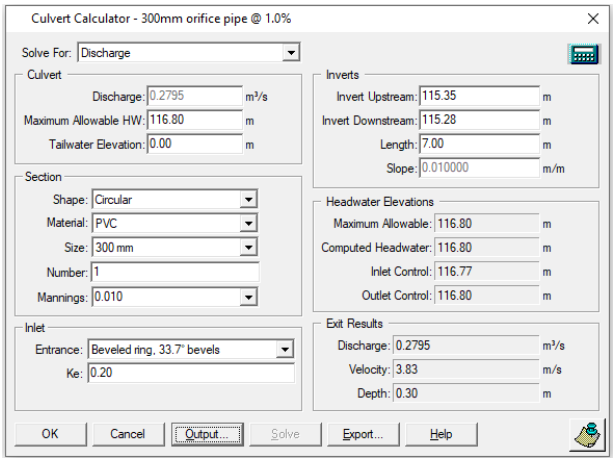
Outlet Device No. 1 (Quantity)		Outlet Device No. 2 (Quantity)	
Type:	Circular Orifice	Type:	Orifice Pipe
Diameter (mm)	**100**	Diameter (mm)	**300**
Area (m^2)	0.00785	Area (m^2)	0.07069
Invert Elev. (m)	115.45	Invert Elev. (m)	115.35
C/L Elev. (m)	115.50	C/L Elev. (m)	115.50
Disch. Coeff. (C_d)	0.6	Disch. Coeff. (C_d)	0.8
Discharge (Q) =	$C_d A (2 g H)^{0.5}$	Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1	Number of Orifices:	1

		SWM Pond Volumes					Outlet No. 1		Outlet No. 2		
	Elevation m	Area m^2	Incremental Volume from Pipes and Structures	Additional Incremental Underground	Additional Incremental Surface m^3	Cumulative Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s	H m	Discharge m^3/s	Total Discharge m^3/s
75mm Orifice Invert	115.45		0	0.0		0	0	0.000	0.0000	0.000	0.0000	0.0000
Bottom of Pond (Active Storage)	115.45		0	0.0		0	0	0.000	0.0000	0.000	0.0000	0.0000
0.10m Ponding	115.55		0	0.0		76	76	0.050	0.0047	0.000	0.0000	0.0047
0.20m Ponding	115.65		0	0.0		157	157	0.150	0.0081	0.000	0.0000	0.0081
0.30m Ponding	115.75		0	0.0		243	243	0.250	0.0104	0.000	0.0000	0.0104
0.40m Ponding	115.85		0	0.0		335	335	0.350	0.0123	0.000	0.0000	0.0123
Second Stage Inlet Sill Elevation	115.95		0	0.0		432	432	0.450	0.0140	0.450	0.1526	0.1666
0.60m Ponding	116.05		0	0.0		536	536	0.550	0.0155	0.550	0.1731	0.1886
0.70m Ponding	116.15		0	0.0		645	645	0.650	0.0168	0.650	0.1911	0.2079
0.80m Ponding	116.25		0	0.0		760	760	0.750	0.0181	0.750	0.2071	0.2252
0.90m Ponding	116.35		0	0.0		882	882	0.850	0.0192	0.850	0.2220	0.2412
1.00m Ponding	116.45		0	0.0		1009	1009	0.950	0.0203	0.950	0.2360	0.2563
Weir Sill Elevation	116.50		0	0.0		1076	1076	1.000	0.0209	1.000	0.2427	0.2636
1.20m Ponding	116.60		0	0.0		1213	1213	1.100	0.0219	1.100	0.2555	0.2774
Top of Pond (1.35m Depth)	116.80		0	0.0		1507	1507	1.300	0.0238	1.300	0.2795	0.3033

Rating Table Report
300mm orifice pipe @ 1.0%

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	115.95	116.80	0.01 m

HW Elev. (m)	Discharge (m³/s)
115.95	0.1526
115.96	0.1547
115.97	0.1569
115.98	0.1590
115.99	0.1611
116.00	0.1631
116.01	0.1652
116.02	0.1672
116.03	0.1692
116.04	0.1711
116.05	0.1731
116.06	0.1750
116.07	0.1769
116.08	0.1788
116.09	0.1806
116.10	0.1825
116.11	0.1843
116.12	0.1861
116.13	0.1878
116.14	0.1895
116.15	0.1911
116.16	0.1928
116.17	0.1944
116.18	0.1961
116.19	0.1977
116.20	0.1993
116.21	0.2009
116.22	0.2024
116.23	0.2040
116.24	0.2056
116.25	0.2071
116.26	0.2087
116.27	0.2102
116.28	0.2117
116.29	0.2132
116.30	0.2147
116.31	0.2162
116.32	0.2176
116.33	0.2191
116.34	0.2206
116.35	0.2220
116.36	0.2234
116.37	0.2249
116.38	0.2263
116.39	0.2277
116.40	0.2291
116.41	0.2305
116.42	0.2319
116.43	0.2332
116.44	0.2346
116.45	0.2360



Rating Table Report
300mm orifice pipe @ 1.0%

HW Elev. (m)	Discharge (m³/s)
116.46	0.2373
116.47	0.2387
116.48	0.2400
116.49	0.2413
116.50	0.2427
116.51	0.2440
116.52	0.2453
116.53	0.2466
116.54	0.2479
116.55	0.2492
116.56	0.2505
116.57	0.2517
116.58	0.2530
116.59	0.2543
116.60	0.2555
116.61	0.2568
116.62	0.2580
116.63	0.2593
116.64	0.2605
116.65	0.2617
116.66	0.2630
116.67	0.2642
116.68	0.2654
116.69	0.2666
116.70	0.2678
116.71	0.2690
116.72	0.2702
116.73	0.2714
116.74	0.2725
116.75	0.2737
116.76	0.2749
116.77	0.2761
116.78	0.2772
116.79	0.2784
116.80	0.2795

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MOE WATER QUALITY CONTROL REQUIREMENTS

MOE Table 3.2 Water Quality Storage Requirements based on Receiving Waters

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35%	55%	70%	85%
Enhanced 80% long-term S.S. removal	Infiltration	25	30	35	40
	Wetlands	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long term S.S. removal	Infiltration	20	20	25	30
	Wetlands	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. removal	Infiltration	20	20	20	20
	Wetlands	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Dry Pond (Continuous Flow	90	150	200	240

Total Drainage Area Serviced by SWM Facility = **2.379** **ha** *(Catchment 201)*
% Imperviousness = **61.5** %

Type of SWM Facility: **Dry Pond**
Protecton Level: **Basic (60%) - Treatment Train**

Unit Volume Requirments (per MOE Table 3.2) - Basis Dry Pond
Req'd Unit Volume = 171.66 m^3/ha
Extended Detention = 171.66 m^3/ha
Permanent Pool = m^3/ha

Storage Volume Requirements
Site Area to SWM = 2.379 ha
Extended Detention = ***408 m^3***
Permanent Pool = 0 m^3
Total = 408 m^3

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SWM Facility - Drawdown Calculations- Extended Detention

Drawdown Calculations based on the extended detention volume, as per MOE Standards

Pond drawdown time can be estimated using Equation 4.10
(MOEE SWMP Planning & Design Manual)

$$t = \frac{2A_p}{CA_o(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

t	= drawdown time in seconds	=	to be calculated	
Ap	= surface area of the pond (m^2)	=	**836**	(Avg. Surface Area between h_1 & h_2)
C	= discharge coefficient	=	0.60	
D	= diameter of controlling orifice (m)	=	**0.075**	
Ao	= cross-sectional area of orifice (m^2)	=	0.00442	
g	= acceleration due to gravity (m/s^2)	=	9.81	
	Orifice invert elevation (m)	=	***115.450***	
	Orifice centreline elevation (m)	=	***115.488***	
	Extended detention elevation (m)	=	***115.840***	
h_1	= starting water level above orifice (m)	=	0.3900	
h_2	= ending water level above orifice (m)	=	0.00	

t = 88914.44 seconds = **25 hours**

Project: 20036

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SWM Facility - Drawdown Calculations

Drawdown Calculations based on the 25mm event for Erosion Control as per City of Burlington Standards

Pond drawdown time can be estimated using Equation 4.10
(MOEE SWMP Planning & Design Manual)

$$t = \frac{2A_p}{CA_o(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

t	= drawdown time in seconds	=	to be calculated	
Ap	= surface area of the pond (m^2)	=	**832**	(Avg. Surface Area between h_1 & h_2)
C	= discharge coefficient	=	0.60	
D	= diameter of controlling orifice (m)	=	**0.075**	
Ao	= cross-sectional area of orifice (m^2)	=	0.00442	
g	= acceleration due to gravity (m/s^2)	=	9.81	
	Orifice invert elevation (m)	=	***115.450***	
	Orifice centreline elevation (m)	=	***115.488***	
	Extended detention elevation (m)	=	***115.790***	
h_1	= starting water level above orifice (m)	=	0.3400	
h_2	= ending water level above orifice (m)	=	0.00	

t = 82637.97 seconds = **23.0 hours**

Project: 20036

Worksheet for Trapezoidal Channel - Enhanced Swale 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.04000	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	0.75	m
Discharge	0.02	m³/s

Results

Normal Depth	0.04	m
Flow Area	0.04	m²
Wetted Perimeter	1.02	m
Hydraulic Radius	0.04	m
Top Width	1.01	m
Critical Depth	0.04	m
Critical Slope	0.03625	m/m
Velocity	0.63	m/s
Velocity Head	0.02	m
Specific Energy	0.06	m
Froude Number	1.05	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.04	m
Critical Depth	0.04	m
Channel Slope	0.04000	m/m

Worksheet for Trapezoidal Channel - Enhanced Swale 1

GVF Output Data

Critical Slope	0.03625	m/m

Worksheet for Trapezoidal Channel - Enhanced Swale 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01200	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	0.75	m
Discharge	0.04	m³/s

Results

Normal Depth	0.08	m
Flow Area	0.08	m²
Wetted Perimeter	1.28	m
Hydraulic Radius	0.07	m
Top Width	1.25	m
Critical Depth	0.06	m
Critical Slope	0.03292	m/m
Velocity	0.51	m/s
Velocity Head	0.01	m
Specific Energy	0.10	m
Froude Number	0.63	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.08	m
Critical Depth	0.06	m
Channel Slope	0.01200	m/m

Worksheet for Trapezoidal Channel - Enhanced Swale 2

GVF Output Data

Critical Slope	0.03292	m/m

SWMHYMO INPUT INFORMATION

```
00001> 2     Metric units
00002> *#*************************************************************************|
00003> *#  Project Name: KING ASPHALT PLANT
00004> *#                SOUTH SERVICE ROAD
00005> *#                BURLINGTON, ONTARIO
00006> *#  JOB NUMBER  : 20036
00007> *#       Date   : MAY 18, 2021
00008> *#    Revised   : APRIL, 2024
00009> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00010> *#       File   : 20036.DAT
00011> *#*************************************************************************|
00012> *
00013> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
00014>                     BURL_002.stm
00015> *
00016> READ STORM          STORM_FILENAME "STORM.001"
00017> *
00018> *#*************************************************************************|
00019> *#
00020> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00021> *#        ============================================
00022> *#
00023> **#************************************************************************|
00024> *# CATCHMENT 101 - Existing Condition (to North Service Road)
00025> *
00026> CALIB STANDHYD      ID=[1],NHYD=["101"], DT=[1](min), AREA=[3.222](ha),
00027>                     XIMP=[0.24], TIMP=[0.24], DWF=[0](cms), LOSS=[2],
00028>                     SCS curve number CN=[55],
00029>                     Pervious   surfaces: IAper=[2.50](mm), SLPP=[2.0](%),
00030>                                          LGP=[20.0](m), MNP=[0.25], SCP=[0](min)
00031>                     Impervious surfaces: IAimp=[1.00](mm), SLPI=[2.0](%),
00032>                                          LGI=[20.0](m), MNI=[0.025], SCI=[0](min
00033>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00034> *%-----------------|--------------------------------------------------------|
00035>
00036> *%-----------------|--------------------------------------------------------|
00037> *#
00038> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00039> *#        =============================================
00040> *#
00041> **#************************************************************************|
00042> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
00043> *
00044> CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[2.379](ha),
00045>                     XIMP=[0.615], TIMP=[0.615], DWF=[0](cms), LOSS=[2],
00046>                     SCS curve number CN=[55],
00047>                     Pervious   surfaces: IAper=[2.50](mm), SLPP=[5.0](%),
00048>                                          LGP=[20.0](m), MNP=[0.25], SCP=[0](min)
00049>                     Impervious surfaces: IAimp=[1.00](mm), SLPI=[5.0](%),
00050>                                          LGI=[10](m), MNI=[0.015], SCI=[0](min),
00051>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00052> *%-----------------|--------------------------------------------------------|
00053> *# ROUTE CATCHMENT 201 - Through SWM Controls
00054> *
00055> ROUTE RESERVOIR     IDout=[2],   NHYD=["201"],  IDin=[1],
00056>                     RDT=[1](min),
00057>                           TABLE of ( OUTFLOW-STORAGE ) values
00058>                                    (cms) - (ha-m)
00059>                                     0.0    , 0.0000
00060>                                     0.0047 , 0.0076
00061>                                     0.0081 , 0.0157
00062>                                     0.0104 , 0.0243
00063>                                     0.0123 , 0.0335
00064>                                     0.1666 , 0.0432
00065>                                     0.1886 , 0.0536
```

```
00066>                                      0.2079 , 0.0645
00067>                                      0.2252 , 0.0760
00068>                                      0.2412 , 0.0882
00069>                                      0.2563 , 0.1009
00070>                                      0.2636 , 0.1076
00071>                                      0.2774 , 0.1213
00072>                                      0.3033 , 0.1507
00073>                                      -1  ,  -1    (max twenty pts)
00074>                          IDovf=[3], NHYDovf=["OVF"]
00075> *%-----------------|-------------------------------------------------------|
00076> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
00077> *
00078> CALIB STANDHYD      ID=[4], NHYD=["202"], DT=[1](min), AREA=[0.841](ha),
00079>                     XIMP=[0.272], TIMP=[0.272], DWF=[0](cms), LOSS=[2],
00080>                     SCS curve number CN=[55],
00081>                     Pervious   surfaces: IAper=[2.50](mm), SLPP=[5.0](%),
00082>                                          LGP=[20.0](m), MNP=[0.025], SCP=[0](min
00083>                     Impervious surfaces: IAimp=[1.00](mm), SLPI=[5.0](%),
00084>                                          LGI=[5.0](m), MNI=[0.015], SCI=[0](min)
00085>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00086> *%-----------------|-------------------------------------------------------|
00087> *# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
00088> *
00089> ADD HYD             IDsum=[5], NHYD=["Total"], IDs to add=[+2+4]
00090> *%-----------------|-------------------------------------------------------|
00091> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00092> *
00093> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
00094>                     BURL_005.stm
00095> *
00096> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
00097>                     BURL_010.stm
00098> *
00099> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
00100>                     BURL_025.stm
00101> *
00102> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
00103>                     BURL_050.stm
00104> *
00105> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00106>                     BURL_100.stm
00107> *
00108> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[125]
00109>                     25MM.stm
00110> *
00111> *%-----------------|-------------------------------------------------------|
00112> FINISH
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00001> 2     Metric units
00002> *#*************************************************************************|
00003> *#  Project Name: KING ASPHALT PLANT
00004> *#                SOUTH SERVICE ROAD
00005> *#                BURLINGTON, ONTARIO
00006> *#  JOB NUMBER  : 20036
00007> *#       Date   : MAY 18, 2021
00008> *#    Revised   : AUGUST 04, 2021
00009> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00010> *#       File   : 20036.DAT
00011> *#*************************************************************************|
00012> *
00013> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
00014>                     25MM.STM
00015> *
00016> READ STORM          STORM_FILENAME "STORM.001"
00017> *
00018> *#*************************************************************************|
00019> *#
00020> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING FOR 25MM STORM EVENT
00021> *#        ==================================================================
00022> *#
00023> **#************************************************************************|
00024> *# CATCHMENT 201 - Enhanced Swale 1
00025> *
00026> CALIB STANDHYD      ID=[1], NHYD=["201-E1"], DT=[1](min), AREA=[0.2704](ha),
00027>                     XIMP=[0.55], TIMP=[0.55], DWF=[0](cms), LOSS=[2],
00028>                     SCS curve number CN=[55],
00029>                     Pervious   surfaces: IAper=[2.50](mm), SLPP=[5.0](%),
00030>                                          LGP=[20.0](m), MNP=[0.25], SCP=[0](min)
00031>                     Impervious surfaces: IAimp=[1.00](mm), SLPI=[5.0](%),
00032>                                          LGI=[10](m), MNI=[0.015], SCI=[0](min),
00033>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00034> *%-----------------|-------------------------------------------------------|
00035> *# CATCHMENT 201 - Enhanced Swale 2
00036> *
00037> CALIB STANDHYD      ID=[2], NHYD=["201-E2"], DT=[1](min), AREA=[0.7887](ha),
00038>                     XIMP=[0.32], TIMP=[0.32], DWF=[0](cms), LOSS=[2],
00039>                     SCS curve number CN=[55],
00040>                     Pervious   surfaces: IAper=[2.50](mm), SLPP=[5.0](%),
00041>                                          LGP=[20.0](m), MNP=[0.25], SCP=[0](min)
00042>                     Impervious surfaces: IAimp=[1.00](mm), SLPI=[5.0](%),
00043>                                          LGI=[10](m), MNI=[0.015], SCI=[0](min),
00044>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00045> *%-----------------|-------------------------------------------------------|
00046> **#***********************************************************************|
00047> *%-----------------|-------------------------------------------------------|
00048> FINISH
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SWMHYMO OUTPUT INFORMATION

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00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
00008>                                                          9   9  9   9   # 3902680
00009>          StormWater Management HYdrologic Model           999    999    =========
00010>
00011>  ********************************************************************************
00012>  ***************************** SWMHYMO Ver/4.05  ********************************
00013>  *********  A single event and continuous hydrologic simulation model  *********
00014>  *********     based on the principles of HYMO and its successors      *********
00015>  *********                   OTTHYMO-83 and OTTHYMO-89.                *********
00016>  ********************************************************************************
00017>  ******** Distributed by:  J.F. Sabourin and Associates Inc.           *********
00018>  *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019>  *********                  Gatineau, Quebec: (819) 243-6858           *********
00020>  *********                  E-Mail: swmhymo@jfsa.Com                   *********
00021>  ********************************************************************************
00022>
00023>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++++ Licensed user: S. Llewellyn & Associates Ltd                 +++++++++
00025>  +++++++++                 Burlington          SERIAL#:3902680        +++++++++
00026>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ********************************************************************************
00029>  *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030>  *********           Maximum value for ID numbers  :     10            *********
00031>  *********           Max. number of rainfall points: 105408            *********
00032>  *********           Max. number of flow points    : 105408            *********
00033>  ********************************************************************************
00034>
00035>
00036>  **********************   D E T A I L E D   O U T P U T   **********************
00037>  ********************************************************************************
00038>  *         DATE: 2024-05-21     TIME: 19:20:14     RUN COUNTER: 000821          *
00039>  ********************************************************************************
00040>  * Input   filename: T:\PROJECTS\20036\SWMHYMO\20036.dat                        *
00041>  * Output  filename: T:\PROJECTS\20036\SWMHYMO\20036.out                        *
00042>  * Summary filename: T:\PROJECTS\20036\SWMHYMO\20036.sum                        *
00043>  * User comments:                                                              *
00044>  * 1:_____________________________________________________________________     *
00045>  * 2:_____________________________________________________________________     *
00046>  * 3:_____________________________________________________________________     *
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001-----------------------------------------------------------------------
00051> *#*****************************************************************************|
00052> *#  Project Name: KING ASPHALT PLANT
00053> *#               SOUTH SERVICE ROAD
00054> *#               BURLINGTON, ONTARIO
00055> *#  JOB NUMBER  : 20036
00056> *#       Date   : MAY 18, 2021
00057> *#    Revised   : APRIL, 2024
00058> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00059> *#       File   : 20036.DAT
00060> *#*****************************************************************************|
00061> *
00062>   ** END OF RUN :   1
00063>
00064>  ********************************************************************************
00065>
00066>
00067>
00068>
00069>
00070> --------------------
00071> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
00072> --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
00073>     TZERO =   .00 hrs on        0
00074>     METOUT=   2 (output = METRIC)
00075>     NRUN  = 002
00076>     NSTORM=   1
00077>               #  1=BURL_002.stm
00078> --------------------------------------------------------------------------------
00079> 002:0002-----------------------------------------------------------------------
00080> *#*****************************************************************************|
00081> *#  Project Name: KING ASPHALT PLANT
00082> *#               SOUTH SERVICE ROAD
00083> *#               BURLINGTON, ONTARIO
00084> *#  JOB NUMBER  : 20036
00085> *#       Date   : MAY 18, 2021
00086> *#    Revised   : APRIL, 2024
00087> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00088> *#       File   : 20036.DAT
00089> *#*****************************************************************************|
00090> *
00091> --------------------------------------------------------------------------------
00092> 002:0002-----------------------------------------------------------------------
00093> *
00094> --------------------
00095> | READ STORM       |    Filename: 2-YR BURLINGTON CHICAGO STORM (4-HR DURA
00096> | Ptotal=  32.34 mm|    Comments: 2-YR BURLINGTON CHICAGO STORM (4-HR DURA
00097> --------------------
00098>                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00099>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00100>                 .17   2.193 |   1.17  17.083 |   2.17   5.221 |   3.17   2.635
00101>                 .33   2.511 |   1.33  68.163 |   2.33   4.444 |   3.33   2.448
00102>                 .50   2.955 |   1.50  22.413 |   2.50   3.884 |   3.50   2.289
00103>                 .67   3.627 |   1.67  11.979 |   2.67   3.459 |   3.67   2.151
00104>                 .83   4.775 |   1.83   8.270 |   2.83   3.126 |   3.83   2.031
00105>                1.00   7.239 |   2.00   6.374 |   3.00   2.857 |   4.00   1.925
00106>
00107> --------------------------------------------------------------------------------
00108> 002:0003-----------------------------------------------------------------------
00109> *
00110> *#*****************************************************************************|
00111> *#
00112> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00113> *#        ==============================================
00114> *#
00115> **#****************************************************************************|
00116> *# CATCHMENT 101 - Existing Condition (to North Service Road)
00117> *
00118> ----------------------
00119> | CALIB STANDHYD     |   Area    (ha)=    3.22
00120> | 01:101    DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
00121> ----------------------
00122>                              IMPERVIOUS    PERVIOUS (i)
00123>      Surface Area     (ha)=        .77         2.45
00124>      Dep. Storage     (mm)=       1.00         2.50
00125>      Average Slope     (%)=       2.00         2.00
00126>      Length            (m)=      20.00        20.00
00127>      Mannings n            =       .025         .250
00128>
00129>      Max.eff.Inten.(mm/hr)=      68.16         4.90
00130>                 over (min)        1.00        17.00
00131>      Storage Coeff.  (min)=       1.36 (ii)   16.92 (ii)
00132>      Unit Hyd. Tpeak (min)=       1.00        17.00
00133>      Unit Hyd. peak  (cms)=        .88          .07
00134>                                                          *TOTALS*
00135>      PEAK FLOW       (cms)=        .15          .02          .152 (iii)
00136>      TIME TO PEAK    (hrs)=       1.33         1.60         1.333
00137>      RUNOFF VOLUME    (mm)=      31.34         3.75        10.370
00138>      TOTAL RAINFALL   (mm)=      32.34        32.34        32.342
00139>      RUNOFF COEFFICIENT   =        .97          .12          .321
00140>
00141>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00142>            CN* =  55.0    Ia = Dep. Storage  (Above)
00143>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00144>            THAN THE STORAGE COEFFICIENT.
00145>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00146>
00147> --------------------------------------------------------------------------------
00148> 002:0004-----------------------------------------------------------------------
00149> *#
00150> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00151> *#        ==============================================
00152> *#
00153> **#****************************************************************************|
00154> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
00155> *
00156> ----------------------
00157> | CALIB STANDHYD     |   Area    (ha)=    2.38
00158> | 01:201    DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
00159> ----------------------
00160>                              IMPERVIOUS    PERVIOUS (i)
00161>      Surface Area     (ha)=       1.46          .92
00162>      Dep. Storage     (mm)=       1.00         2.50
00163>      Average Slope     (%)=       5.00         5.00
00164>      Length            (m)=      10.00        20.00
00165>      Mannings n            =       .015         .250
00166>
00167>      Max.eff.Inten.(mm/hr)=      68.16         5.54
00168>                 over (min)        1.00        12.00
00169>      Storage Coeff.  (min)=        .50 (ii)   11.75 (ii)
00170>      Unit Hyd. Tpeak (min)=       1.00        12.00
00171>      Unit Hyd. peak  (cms)=       1.47          .10
00172>                                                          *TOTALS*
00173>      PEAK FLOW       (cms)=        .28          .01          .281 (iii)
00174>      TIME TO PEAK    (hrs)=       1.30         1.52         1.333
00175>      RUNOFF VOLUME    (mm)=      31.34         3.75        20.718
00176>      TOTAL RAINFALL   (mm)=      32.34        32.34        32.342
00177>      RUNOFF COEFFICIENT   =        .97          .12          .641
00178>
00179>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00180>            CN* =  55.0    Ia = Dep. Storage  (Above)
00181>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00182>            THAN THE STORAGE COEFFICIENT.
00183>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00184>
00185> --------------------------------------------------------------------------------
00186> 002:0005-----------------------------------------------------------------------
00187> *# ROUTE CATCHMENT 201 - Through SWM Controls
00188> *
00189> ----------------------
00190> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00191> |  IN>01:(201   )    |
00192> | OUT<02:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
00193> ----------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
00194>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
00195>                             .000  .0000E+00     |     .208  .6450E-01
00196>                             .005  .7600E-02     |     .225  .7600E-01
00197>                             .008  .1570E-01     |     .241  .8820E-01
00198>                             .010  .2430E-01     |     .256  .1009E+00
00199>                             .012  .3350E-01     |     .264  .1076E+00
00200>                             .167  .4320E-01     |     .277  .1213E+00
00201>                             .189  .5360E-01     |     .303  .1507E+00
00202>
00203>      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
00204>      ---------------             (ha)     (cms)     (hrs)       (mm)
00205>      INFLOW >01: (201   )       2.38      .281     1.333     20.718
00206>      OUTFLOW<02: (201   )       2.38      .026     2.033     20.718
00207>     OVERFLOW<03: (OVF   )        .00      .000      .000       .000
00208>
00209>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00210>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00211>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00212>
00213>
00214>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.237
00215>                    TIME SHIFT OF PEAK FLOW         (min)=    42.00
00216>                    MAXIMUM  STORAGE   USED       (ha.m.)=.3436E-01
00217>
00218> --------------------------------------------------------------------------------
00219> 002:0006-----------------------------------------------------------------------
00220> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
00221> *
00222> ----------------------
00223> | CALIB STANDHYD     |   Area    (ha)=     .84
00224> | 04:202    DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
00225> ----------------------
00226>                              IMPERVIOUS    PERVIOUS (i)
00227>      Surface Area     (ha)=        .23          .61
00228>      Dep. Storage     (mm)=       1.00         2.50
00229>      Average Slope     (%)=       5.00         5.00
00230>      Length            (m)=      5.00        20.00
00231>      Mannings n            =       .015         .025
00232>
00233>      Max.eff.Inten.(mm/hr)=      68.16         8.27
00234>                 over (min)        1.00         3.00
00235>      Storage Coeff.  (min)=        .33 (ii)    2.74 (ii)
00236>      Unit Hyd. Tpeak (min)=       1.00         3.00
00237>      Unit Hyd. peak  (cms)=       1.62          .40
00238>                                                          *TOTALS*
00239>      PEAK FLOW       (cms)=        .04          .01          .055 (iii)
00240>      TIME TO PEAK    (hrs)=       1.25         1.35         1.333
00241>      RUNOFF VOLUME    (mm)=      31.34         3.75        11.253
00242>      TOTAL RAINFALL   (mm)=      32.34        32.34        32.342
00243>      RUNOFF COEFFICIENT   =        .97          .12          .348
00244>
00245>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00246>            CN* =  55.0    Ia = Dep. Storage  (Above)
00247>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00248>            THAN THE STORAGE COEFFICIENT.
00249>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00250>
00251> --------------------------------------------------------------------------------
00252> 002:0007-----------------------------------------------------------------------
00253> *# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
00254> *
00255> ------------------------
00256> | ADD HYD (Total     ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00257> ------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
00258>                        ID1 02:201          2.38      .026    2.03  20.72    .000
00259>                       +ID2 04:202           .84      .055    1.33  11.25    .000
00260>                        ========================================================
00261>                        SUM 05:Total        3.22      .065    1.33  18.25    .000
00262>
00263>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00264>
00265> --------------------------------------------------------------------------------
00266> 002:0008-----------------------------------------------------------------------
00267> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00268> *
00269>   ** END OF RUN :   4
00270>
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00271> ********************************************************************************
00272>
00273>
00274>
00275>
00276>
00277> --------------------
00278> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
00279> --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
00280>     TZERO =   .00 hrs on        0
00281>     METOUT=   2 (output = METRIC)
00282>     NRUN  = 005
00283>     NSTORM=   1
00284>              #  1=BURL_005.stm
00285> ------------------------------------------------------------------------------
00286> 005:0002----------------------------------------------------------------------
00287> *#*****************************************************************************|
00288> *#  Project Name: KING ASPHALT PLANT
00289> *#                SOUTH SERVICE ROAD
00290> *#                BURLINGTON, ONTARIO
00291> *#  JOB NUMBER  : 20036
00292> *#       Date   : MAY 18, 2021
00293> *#    Revised   : APRIL, 2024
00294> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00295> *#       File   : 20036.DAT
00296> *#*****************************************************************************|
00297> *
00298> ------------------------------------------------------------------------------
00299> 005:0002----------------------------------------------------------------------
00300> *
00301> --------------------
00302> | READ STORM       |    Filename: 5-YR BURLINGTON CHICAGO STORM (4-HR DURA
00303> | Ptotal=  41.70 mm|    Comments: 5-YR BURLINGTON CHICAGO STORM (4-HR DURA
00304> --------------------
00305>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00306>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00307>                .17   2.963 |   1.17  21.285 |   2.17   6.805 |   3.17   3.535
00308>                .33   3.374 |   1.33  88.094 |   2.33   5.834 |   3.33   3.293
00309>                .50   3.946 |   1.50  27.774 |   2.50   5.128 |   3.50   3.087
00310>                .67   4.803 |   1.67  15.072 |   2.67   4.590 |   3.67   2.908
00311>                .83   6.247 |   1.83  10.561 |   2.83   4.165 |   3.83   2.751
00312>               1.00   9.295 |   2.00   8.234 |   3.00   3.820 |   4.00   2.612
00313>
00314> ------------------------------------------------------------------------------
00315> 005:0003----------------------------------------------------------------------
00316> *
00317> *#*****************************************************************************|
00318> *#
00319> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00320> *#        ==============================================
00321> *#
00322> **#*****************************************************************************|
00323> *# CATCHMENT 101 - Existing Condition (to North Service Road)
00324> *
00325> ----------------------
00326> | CALIB STANDHYD     |   Area    (ha)=    3.22
00327> | 01:101    DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
00328> ----------------------
00329>                              IMPERVIOUS    PERVIOUS (i)
00330>      Surface Area     (ha)=        .77         2.45
00331>      Dep. Storage     (mm)=       1.00         2.50
00332>      Average Slope     (%)=       2.00         2.00
00333>      Length            (m)=      20.00        20.00
00334>      Mannings n            =       .025         .250
00335>
00336>      Max.eff.Inten.(mm/hr)=      88.09         9.09
00337>                    over (min)       1.00        13.00
00338>      Storage Coeff.  (min)=       1.23 (ii)   13.38 (ii)
00339>      Unit Hyd. Tpeak (min)=       1.00        13.00
00340>      Unit Hyd. peak  (cms)=        .95          .09
00341>                                                          *TOTALS*
00342>      PEAK FLOW       (cms)=        .19          .04          .205 (iii)
00343>      TIME TO PEAK    (hrs)=       1.33         1.53         1.333
00344>      RUNOFF VOLUME    (mm)=      40.70         6.22        14.494
00345>      TOTAL RAINFALL   (mm)=      41.70        41.70        41.696
00346>      RUNOFF COEFFICIENT   =        .98          .15          .348
00347>
00348>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00349>            CN* =  55.0    Ia = Dep. Storage  (Above)
00350>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00351>            THAN THE STORAGE COEFFICIENT.
00352>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00353>
00354> ------------------------------------------------------------------------------
00355> 005:0004----------------------------------------------------------------------
00356> *#
00357> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00358> *#        ==============================================
00359> *#
00360> **#*****************************************************************************|
00361> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
00362> *
00363> ----------------------
00364> | CALIB STANDHYD     |   Area    (ha)=    2.38
00365> | 01:201    DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
00366> ----------------------
00367>                              IMPERVIOUS    PERVIOUS (i)
00368>      Surface Area     (ha)=       1.46         .92
00369>      Dep. Storage     (mm)=       1.00        2.50
00370>      Average Slope     (%)=       5.00        5.00
00371>      Length            (m)=      10.00       20.00
00372>      Mannings n            =       .015         .250
00373>
00374>      Max.eff.Inten.(mm/hr)=      88.09       10.86
00375>                    over (min)       1.00        9.00
00376>      Storage Coeff.  (min)=        .45 (ii)    9.05 (ii)
00377>      Unit Hyd. Tpeak (min)=       1.00        9.00
00378>      Unit Hyd. peak  (cms)=       1.51         .13
00379>                                                          *TOTALS*
00380>      PEAK FLOW       (cms)=        .36         .02          .369 (iii)
00381>      TIME TO PEAK    (hrs)=       1.30        1.45         1.333
00382>      RUNOFF VOLUME    (mm)=      40.70        6.22        27.423
00383>      TOTAL RAINFALL   (mm)=      41.70       41.70        41.696
00384>      RUNOFF COEFFICIENT   =        .98         .15          .658
00385>
00386>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00387>            CN* =  55.0    Ia = Dep. Storage  (Above)
00388>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00389>            THAN THE STORAGE COEFFICIENT.
00390>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00391>
00392> ------------------------------------------------------------------------------
00393> 005:0005----------------------------------------------------------------------
00394> *# ROUTE CATCHMENT 201 - Through SWM Controls
00395> *
00396> ----------------------
00397> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00398> |  IN>01:(201    )   |
00399> | OUT<02:(201    )   |    =========  OUTLFOW STORAGE TABLE  =========
00400> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00401>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
00402>                              .000  .0000E+00    |     .208  .6450E-01
00403>                              .005  .7600E-02    |     .225  .7600E-01
00404>                              .008  .1570E-01    |     .241  .8820E-01
00405>                              .010  .2430E-01    |     .256  .1009E+00
00406>                              .012  .3350E-01    |     .264  .1076E+00
00407>                              .167  .4320E-01    |     .277  .1213E+00
00408>                              .189  .5360E-01    |     .303  .1507E+00
00409>
00410>      ROUTING RESULTS            AREA     QPEAK     TPEAK      R.V.
00411>      --------------------       (ha)     (cms)     (hrs)       (mm)
00412>      INFLOW >01: (201   )       2.38      .369     1.333     27.423
00413>      OUTFLOW<02: (201   )       2.38      .075     1.633     27.422
00414>     OVERFLOW<03: (OVF   )        .00      .000      .000       .000
00415>
00416>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00417>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00418>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00419>
00420>
00421>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   20.200
00422>                    TIME SHIFT OF PEAK FLOW          (min)=    18.00
00423>                    MAXIMUM  STORAGE   USED       (ha.m.)=.3741E-01
00424>
00425> ------------------------------------------------------------------------------
00426> 005:0006----------------------------------------------------------------------
00427> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
00428> *
00429> ----------------------
00430> | CALIB STANDHYD     |   Area    (ha)=     .84
00431> | 04:202    DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
00432> ----------------------
00433>                              IMPERVIOUS    PERVIOUS (i)
00434>      Surface Area     (ha)=        .23          .61
00435>      Dep. Storage     (mm)=       1.00         2.50
00436>      Average Slope     (%)=       5.00         5.00
00437>      Length            (m)=       5.00        20.00
00438>      Mannings n            =       .015         .025
00439>
00440>      Max.eff.Inten.(mm/hr)=      88.09        14.38
00441>                    over (min)       1.00         2.00
00442>      Storage Coeff.  (min)=        .30 (ii)    2.23 (ii)
00443>      Unit Hyd. Tpeak (min)=       1.00         2.00
00444>      Unit Hyd. peak  (cms)=       1.64          .52
00445>                                                          *TOTALS*
00446>      PEAK FLOW       (cms)=        .06          .02          .077 (iii)
00447>      TIME TO PEAK    (hrs)=       1.25         1.33         1.333
00448>      RUNOFF VOLUME    (mm)=      40.70         6.22        15.597
00449>      TOTAL RAINFALL   (mm)=      41.70        41.70        41.696
00450>      RUNOFF COEFFICIENT   =        .98          .15          .374
00451>
00452>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00453>            CN* =  55.0    Ia = Dep. Storage  (Above)
00454>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00455>            THAN THE STORAGE COEFFICIENT.
00456>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00457>
00458> ------------------------------------------------------------------------------
00459> 005:0007----------------------------------------------------------------------
00460> *# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
00461> *
00462> ------------------------
00463> | ADD HYD (Total     ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
00464> ------------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00465>                        ID1 02:201           2.38     .075    1.63  27.42    .000
00466>                       +ID2 04:202            .84     .077    1.33  15.60    .000
00467>                        ========================================================
00468>                        SUM 05:Total         3.22     .096    1.50  24.33    .000
00469>
00470>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00471>
00472> ------------------------------------------------------------------------------
00473> 005:0008----------------------------------------------------------------------
00474> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00475> *
00476> ------------------------------------------------------------------------------
00477> 005:0002----------------------------------------------------------------------
00478> *
00479>   ** END OF RUN :   9
00480>
00481> ********************************************************************************
00482>
00483>
00484>
00485>
00486>
00487> --------------------
00488> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
00489> --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
00490>     TZERO =   .00 hrs on        0
00491>     METOUT=   2 (output = METRIC)
00492>     NRUN  = 010
00493>     NSTORM=   1
00494>              #  1=BURL_010.stm
00495> ------------------------------------------------------------------------------
00496> 010:0002----------------------------------------------------------------------
00497> *#*****************************************************************************|
00498> *#  Project Name: KING ASPHALT PLANT
00499> *#                SOUTH SERVICE ROAD
00500> *#                BURLINGTON, ONTARIO
00501> *#  JOB NUMBER  : 20036
00502> *#       Date   : MAY 18, 2021
00503> *#    Revised   : APRIL, 2024
00504> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00505> *#       File   : 20036.DAT
00506> *#*****************************************************************************|
00507> *
00508> ------------------------------------------------------------------------------
00509> 010:0002----------------------------------------------------------------------
00510> *
00511> --------------------
00512> | READ STORM       |    Filename: 10-YR BURLINGTON CHICAGO STORM (4-HR DUR
00513> | Ptotal=  48.00 mm|    Comments: 10-YR BURLINGTON CHICAGO STORM (4-HR DUR
00514> --------------------
00515>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00516>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00517>                .17   3.423 |   1.17  24.501 |   2.17   7.852 |   3.17   4.083
00518>                .33   3.898 |   1.33 101.139 |   2.33   6.733 |   3.33   3.805
00519>                .50   4.558 |   1.50  31.955 |   2.50   5.920 |   3.50   3.567
00520>                .67   5.545 |   1.67  17.363 |   2.67   5.300 |   3.67   3.360
00521>                .83   7.210 |   1.83  12.175 |   2.83   4.810 |   3.83   3.179
00522>               1.00  10.719 |   2.00   9.497 |   3.00   4.413 |   4.00   3.019
00523>
00524> ------------------------------------------------------------------------------
00525> 010:0003----------------------------------------------------------------------
00526> *
00527> *#*****************************************************************************|
00528> *#
00529> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00530> *#        ==============================================
00531> *#
00532> **#*****************************************************************************|
00533> *# CATCHMENT 101 - Existing Condition (to North Service Road)
00534> *
00535> ----------------------
00536> | CALIB STANDHYD     |   Area    (ha)=    3.22
00537> | 01:101    DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
00538> ----------------------
00539>                              IMPERVIOUS    PERVIOUS (i)
00540>      Surface Area     (ha)=        .77         2.45
```

```
00541>      Dep. Storage     (mm)=       1.00         2.50
00542>      Average Slope     (%)=       2.00         2.00
00543>      Length            (m)=      20.00        20.00
00544>      Mannings n             =       .025         .250
00545>
00546>      Max.eff.Inten.(mm/hr)=     101.14        12.53
00547>                  over (min)        1.00        12.00
00548>      Storage Coeff.  (min)=       1.16 (ii)   11.85 (ii)
00549>      Unit Hyd. Tpeak (min)=       1.00        12.00
00550>      Unit Hyd. peak  (cms)=        .98          .10
00551>                                                          *TOTALS*
00552>      PEAK FLOW       (cms)=        .22          .06          .242 (iii)
00553>      TIME TO PEAK    (hrs)=       1.33         1.50         1.333
00554>      RUNOFF VOLUME    (mm)=      47.00         8.17        17.493
00555>      TOTAL RAINFALL   (mm)=      48.00        48.00        48.004
00556>      RUNOFF COEFFICIENT   =        .98          .17          .364
00557>
00558>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00559>            CN* =  55.0    Ia = Dep. Storage  (Above)
00560>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00561>            THAN THE STORAGE COEFFICIENT.
00562>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00563>
00564> ------------------------------------------------------------------------------
00565> 010:0004------------------------------------------------------------------------
00566> *#
00567> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00568> *#        ==============================================
00569> *#
00570> **#*************************************************************************|
00571> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
00572> *
00573>  ---------------------
00574> | CALIB STANDHYD     |   Area    (ha)=    2.38
00575> | 01:201     DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
00576>  ---------------------
00577>                              IMPERVIOUS    PERVIOUS (i)
00578>      Surface Area     (ha)=       1.46          .92
00579>      Dep. Storage     (mm)=       1.00         2.50
00580>      Average Slope     (%)=       5.00         5.00
00581>      Length            (m)=      10.00        20.00
00582>      Mannings n             =       .015         .250
00583>
00584>      Max.eff.Inten.(mm/hr)=     101.14        15.09
00585>                  over (min)        1.00         8.00
00586>      Storage Coeff.  (min)=        .43 (ii)    7.97 (ii)
00587>      Unit Hyd. Tpeak (min)=       1.00         8.00
00588>      Unit Hyd. peak  (cms)=       1.53          .14
00589>                                                          *TOTALS*
00590>      PEAK FLOW       (cms)=        .41          .03          .428 (iii)
00591>      TIME TO PEAK    (hrs)=       1.28         1.43         1.333
00592>      RUNOFF VOLUME    (mm)=      47.00         8.17        32.054
00593>      TOTAL RAINFALL   (mm)=      48.00        48.00        48.004
00594>      RUNOFF COEFFICIENT   =        .98          .17          .668
00595>
00596>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00597>            CN* =  55.0    Ia = Dep. Storage  (Above)
00598>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00599>            THAN THE STORAGE COEFFICIENT.
00600>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00601>
00602> ------------------------------------------------------------------------------
00603> 010:0005------------------------------------------------------------------------
00604> *# ROUTE CATCHMENT 201 - Through SWM Controls
00605> *
00606>  ---------------------
00607> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00608> |  IN>01:(201    )   |
00609> | OUT<02:(201    )   |    =========  OUTLFOW STORAGE TABLE  =========
00610>  ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00611>                             (cms)     (ha.m.)  |    (cms)    (ha.m.)
00612>                              .000  .0000E+00   |     .208  .6450E-01
00613>                              .005  .7600E-02   |     .225  .7600E-01
00614>                              .008  .1570E-01   |     .241  .8820E-01
00615>                              .010  .2430E-01   |     .256  .1009E+00
00616>                              .012  .3350E-01   |     .264  .1076E+00
00617>                              .167  .4320E-01   |     .277  .1213E+00
00618>                              .189  .5360E-01   |     .303  .1507E+00
00619>
00620>      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
00621>      ---------------            (ha)     (cms)     (hrs)       (mm)
00622>      INFLOW >01: (201    )       2.38      .428     1.333     32.054
00623>      OUTFLOW<02: (201    )       2.38      .118     1.517     32.054
00624>     OVERFLOW<03: (OVF    )        .00      .000      .000       .000
00625>
00626>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00627>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00628>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00629>
00630>
00631>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   27.511
00632>                     TIME SHIFT OF PEAK FLOW          (min)=   11.00
00633>                     MAXIMUM  STORAGE   USED       (ha.m.)=.4019E-01
00634>
00635> ------------------------------------------------------------------------------
00636> 010:0006------------------------------------------------------------------------
00637> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
00638> *
00639>  ---------------------
00640> | CALIB STANDHYD     |   Area    (ha)=     .84
00641> | 04:202     DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
00642>  ---------------------
00643>                              IMPERVIOUS    PERVIOUS (i)
00644>      Surface Area     (ha)=        .23          .61
00645>      Dep. Storage     (mm)=       1.00         2.50
00646>      Average Slope     (%)=       5.00         5.00
00647>      Length            (m)=       5.00        20.00
00648>      Mannings n             =       .015         .025
00649>
00650>      Max.eff.Inten.(mm/hr)=     101.14        18.90
00651>                  over (min)        1.00         2.00
00652>      Storage Coeff.  (min)=        .28 (ii)    2.01 (ii)
00653>      Unit Hyd. Tpeak (min)=       1.00         2.00
00654>      Unit Hyd. peak  (cms)=       1.65          .56
00655>                                                          *TOTALS*
00656>      PEAK FLOW       (cms)=        .06          .03          .093 (iii)
00657>      TIME TO PEAK    (hrs)=       1.25         1.33         1.333
00658>      RUNOFF VOLUME    (mm)=      47.00         8.17        18.736
00659>      TOTAL RAINFALL   (mm)=      48.00        48.00        48.004
00660>      RUNOFF COEFFICIENT   =        .98          .17          .390
00661>
00662>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00663>            CN* =  55.0    Ia = Dep. Storage  (Above)
00664>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00665>            THAN THE STORAGE COEFFICIENT.
00666>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00667>
00668> ------------------------------------------------------------------------------
00669> 010:0007------------------------------------------------------------------------
00670> *# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
00671> *
00672>  ----------------------
00673> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00674>  ----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
00675>                        ID1 02:201          2.38     .118    1.52  32.05    .000
00676>                       +ID2 04:202           .84     .093    1.33  18.74    .000
00677>                        ============================================================
00678>                        SUM 05:Total         3.22     .150    1.50  28.58    .000
00679>
00680>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00681>
00682> ------------------------------------------------------------------------------
00683> 010:0008------------------------------------------------------------------------
00684> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00685> *
00686> ------------------------------------------------------------------------------
00687> 010:0002------------------------------------------------------------------------
00688> *
00689> ------------------------------------------------------------------------------
00690> 010:0002------------------------------------------------------------------------
00691> *
00692>   ** END OF RUN :  24
00693>
00694> ******************************************************************************
00695>
00696>
00697>
00698>
00699>
00700>  --------------------
00701> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
00702>  --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
00703>     TZERO =   .00 hrs on        0
00704>     METOUT=   2 (output = METRIC)
00705>     NRUN  = 025
00706>     NSTORM=   1
00707>              #  1=BURL_025.stm
00708> ------------------------------------------------------------------------------
00709> 025:0002------------------------------------------------------------------------
00710> *#*************************************************************************|
00711> *#  Project Name: KING ASPHALT PLANT
00712> *#               SOUTH SERVICE ROAD
00713> *#               BURLINGTON, ONTARIO
00714> *#  JOB NUMBER  : 20036
00715> *#       Date   : MAY 18, 2021
00716> *#    Revised   : APRIL, 2024
00717> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00718> *#       File   : 20036.DAT
00719> *#*************************************************************************|
00720> *
00721> ------------------------------------------------------------------------------
00722> 025:0002------------------------------------------------------------------------
00723> *
00724>  --------------------
00725> | READ STORM       |    Filename: 25-YR BURLINGTON CHICAGO STORM (4-HR DUR
00726> | Ptotal=  56.03 mm|    Comments: 25-YR BURLINGTON CHICAGO STORM (4-HR DUR
00727>  --------------------
00728>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00729>               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00730>               .17   4.010 |   1.17  28.592 |   2.17   9.185 |   3.17   4.782
00731>               .33   4.566 |   1.33 117.720 |   2.33   7.879 |   3.33   4.457
00732>               .50   5.337 |   1.50  37.274 |   2.50   6.929 |   3.50   4.178
00733>               .67   6.491 |   1.67  20.279 |   2.67   6.204 |   3.67   3.937
00734>               .83   8.435 |   1.83  14.230 |   2.83   5.632 |   3.83   3.725
00735>              1.00  12.531 |   2.00  11.105 |   3.00   5.167 |   4.00   3.538
00736>
00737> ------------------------------------------------------------------------------
00738> 025:0003------------------------------------------------------------------------
00739> *
00740> *#*************************************************************************|
00741> *#
00742> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00743> *#        ==============================================
00744> *#
00745> **#*************************************************************************|
00746> *# CATCHMENT 101 - Existing Condition (to North Service Road)
00747> *
00748>  ---------------------
00749> | CALIB STANDHYD     |   Area    (ha)=    3.22
00750> | 01:101     DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
00751>  ---------------------
00752>                              IMPERVIOUS    PERVIOUS (i)
00753>      Surface Area     (ha)=        .77         2.45
00754>      Dep. Storage     (mm)=       1.00         2.50
00755>      Average Slope     (%)=       2.00         2.00
00756>      Length            (m)=      20.00        20.00
00757>      Mannings n             =       .025         .250
00758>
00759>      Max.eff.Inten.(mm/hr)=     117.72        18.69
00760>                  over (min)        1.00        10.00
00761>      Storage Coeff.  (min)=       1.10 (ii)   10.20 (ii)
00762>      Unit Hyd. Tpeak (min)=       1.00        10.00
00763>      Unit Hyd. peak  (cms)=       1.02          .11
00764>                                                          *TOTALS*
00765>      PEAK FLOW       (cms)=        .25          .08          .298 (iii)
00766>      TIME TO PEAK    (hrs)=       1.33         1.47         1.333
00767>      RUNOFF VOLUME    (mm)=      55.03        10.96        21.540
00768>      TOTAL RAINFALL   (mm)=      56.03        56.03        56.030
00769>      RUNOFF COEFFICIENT   =        .98          .20          .384
00770>
00771>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00772>            CN* =  55.0    Ia = Dep. Storage  (Above)
00773>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00774>            THAN THE STORAGE COEFFICIENT.
00775>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00776>
00777> ------------------------------------------------------------------------------
00778> 025:0004------------------------------------------------------------------------
00779> *#
00780> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00781> *#        ==============================================
00782> *#
00783> **#*************************************************************************|
00784> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
00785> *
00786>  ---------------------
00787> | CALIB STANDHYD     |   Area    (ha)=    2.38
00788> | 01:201     DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
00789>  ---------------------
00790>                              IMPERVIOUS    PERVIOUS (i)
00791>      Surface Area     (ha)=       1.46          .92
00792>      Dep. Storage     (mm)=       1.00         2.50
00793>      Average Slope     (%)=       5.00         5.00
00794>      Length            (m)=      10.00        20.00
00795>      Mannings n             =       .015         .250
00796>
00797>      Max.eff.Inten.(mm/hr)=     117.72        21.30
00798>                  over (min)        1.00         7.00
00799>      Storage Coeff.  (min)=        .40 (ii)    6.97 (ii)
00800>      Unit Hyd. Tpeak (min)=       1.00         7.00
00801>      Unit Hyd. peak  (cms)=       1.56          .16
00802>                                                          *TOTALS*
00803>      PEAK FLOW       (cms)=        .48          .04          .506 (iii)
00804>      TIME TO PEAK    (hrs)=       1.30         1.42         1.333
00805>      RUNOFF VOLUME    (mm)=      55.03        10.96        38.065
00806>      TOTAL RAINFALL   (mm)=      56.03        56.03        56.030
00807>      RUNOFF COEFFICIENT   =        .98          .20          .679
00808>
00809>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00810>            CN* =  55.0    Ia = Dep. Storage  (Above)
```

```
00811>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00812>            THAN THE STORAGE COEFFICIENT.
00813>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00814>
00815> ---------------------------------------------------------------------------
00816> 025:0005----------------------------------------------------------------------
00817> *# ROUTE CATCHMENT 201 - Through SWM Controls
00818> *
00819> ---------------------
00820> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
00821> |  IN>01:(201   )   |
00822> | OUT<02:(201   )   |    =========  OUTLFOW STORAGE TABLE  =========
00823> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00824>                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
00825>                             .000  .0000E+00    |     .208  .6450E-01
00826>                             .005  .7600E-02    |     .225  .7600E-01
00827>                             .008  .1570E-01    |     .241  .8820E-01
00828>                             .010  .2430E-01    |     .256  .1009E+00
00829>                             .012  .3350E-01    |     .264  .1076E+00
00830>                             .167  .4320E-01    |     .277  .1213E+00
00831>                             .189  .5360E-01    |     .303  .1507E+00
00832>
00833>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00834>     --------------------       (ha)     (cms)     (hrs)       (mm)
00835>     INFLOW >01: (201   )       2.38      .506     1.333     38.065
00836>     OUTFLOW<02: (201   )       2.38      .167     1.500     38.065
00837>    OVERFLOW<03: (OVF   )        .00      .000      .000       .000
00838>
00839>                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00840>                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00841>                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00842>
00843>
00844>                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   33.048
00845>                   TIME SHIFT OF PEAK FLOW         (min)=    10.00
00846>                   MAXIMUM  STORAGE   USED       (ha.m.)=.4356E-01
00847>
00848> ---------------------------------------------------------------------------
00849> 025:0006----------------------------------------------------------------------
00850> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
00851> *
00852> ---------------------
00853> | CALIB STANDHYD     |   Area    (ha)=      .84
00854> | 04:202    DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
00855> ---------------------
00856>                              IMPERVIOUS    PERVIOUS (i)
00857>      Surface Area     (ha)=        .23          .61
00858>      Dep. Storage     (mm)=       1.00         2.50
00859>      Average Slope     (%)=       5.00         5.00
00860>      Length            (m)=       5.00        20.00
00861>      Mannings n            =       .015         .025
00862>
00863>      Max.eff.Inten.(mm/hr)=     117.72        25.37
00864>                    over (min)       1.00         2.00
00865>      Storage Coeff.  (min)=       .27 (ii)    1.80 (ii)
00866>      Unit Hyd. Tpeak (min)=      1.00         2.00
00867>      Unit Hyd. peak  (cms)=      1.66          .60
00868>                                                          *TOTALS*
00869>      PEAK FLOW       (cms)=       .07          .04          .114 (iii)
00870>      TIME TO PEAK    (hrs)=      1.30         1.33         1.333
00871>      RUNOFF VOLUME    (mm)=     55.03        10.96        22.950
00872>      TOTAL RAINFALL   (mm)=     56.03        56.03        56.030
00873>      RUNOFF COEFFICIENT   =       .98          .20          .410
00874>
00875>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00876>            CN* =  55.0    Ia = Dep. Storage  (Above)
00877>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00878>            THAN THE STORAGE COEFFICIENT.
00879>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00880>
00881> ---------------------------------------------------------------------------
00882> 025:0007----------------------------------------------------------------------
00883> *# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
00884> *
00885> ------------------------
00886> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00887> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00888>                       ID1 02:201          2.38     .167    1.50  38.06    .000
00889>                      +ID2 04:202           .84     .114    1.33  22.95    .000
00890>                       ========================================================
00891>                       SUM 05:Total         3.22     .243    1.33  34.12    .000
00892>
00893>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00894>
00895> ---------------------------------------------------------------------------
00896> 025:0008----------------------------------------------------------------------
00897> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
00898> *
00899> ---------------------------------------------------------------------------
00900> 025:0002----------------------------------------------------------------------
00901> *
00902> ---------------------------------------------------------------------------
00903> 025:0002----------------------------------------------------------------------
00904> *
00905> ---------------------------------------------------------------------------
00906> 025:0002----------------------------------------------------------------------
00907> *
00908>   ** END OF RUN :  49
00909>
00910> ****************************************************************************
00911>
00912>
00913>
00914>
00915>
00916> --------------------
00917> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
00918> --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
00919>     TZERO =   .00 hrs on        0
00920>     METOUT=   2 (output = METRIC)
00921>     NRUN  = 050
00922>     NSTORM=   1
00923>            #  1=BURL_050.stm
00924> ---------------------------------------------------------------------------
00925> 050:0002----------------------------------------------------------------------
00926> *#*************************************************************************|
00927> *#  Project Name: KING ASPHALT PLANT
00928> *#               SOUTH SERVICE ROAD
00929> *#               BURLINGTON, ONTARIO
00930> *#  JOB NUMBER  : 20036
00931> *#       Date   : MAY 18, 2021
00932> *#    Revised   : APRIL, 2024
00933> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00934> *#       File   : 20036.DAT
00935> *#*************************************************************************|
00936> *
00937> ---------------------------------------------------------------------------
00938> 050:0002----------------------------------------------------------------------
00939> *
00940> --------------------
00941> | READ STORM       |    Filename: 50-YR BURLINGTON CHICAGO STORM (4-HR DUR
00942> | Ptotal=  61.96 mm|    Comments: 50-YR BURLINGTON CHICAGO STORM (4-HR DUR
00943> --------------------
00944>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00945>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00946>                .17   4.451 |   1.17  31.613 |   2.17  10.180 |   3.17   5.306
00947>                .33   5.067 |   1.33 129.819 |   2.33   8.734 |   3.33   4.946
00948>                .50   5.921 |   1.50  41.194 |   2.50   7.683 |   3.50   4.637
00949>                .67   7.198 |   1.67  22.439 |   2.67   6.881 |   3.67   4.369
00950>                .83   9.350 |   1.83  15.757 |   2.83   6.247 |   3.83   4.135
00951>               1.00  13.879 |   2.00  12.303 |   3.00   5.733 |   4.00   3.927
00952>
00953> ---------------------------------------------------------------------------
00954> 050:0003----------------------------------------------------------------------
00955> *
00956> *#*************************************************************************|
00957> *#
00958> *#         PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00959> *#         ==============================================
00960> *#
00961> **#************************************************************************|
00962> *# CATCHMENT 101 - Existing Condition (to North Service Road)
00963> *
00964> ---------------------
00965> | CALIB STANDHYD     |   Area    (ha)=    3.22
00966> | 01:101    DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
00967> ---------------------
00968>                              IMPERVIOUS    PERVIOUS (i)
00969>      Surface Area     (ha)=        .77         2.45
00970>      Dep. Storage     (mm)=       1.00         2.50
00971>      Average Slope     (%)=       2.00         2.00
00972>      Length            (m)=      20.00        20.00
00973>      Mannings n            =       .025         .250
00974>
00975>      Max.eff.Inten.(mm/hr)=     129.82        23.76
00976>                    over (min)       1.00         9.00
00977>      Storage Coeff.  (min)=       1.05 (ii)    9.33 (ii)
00978>      Unit Hyd. Tpeak (min)=       1.00         9.00
00979>      Unit Hyd. peak  (cms)=       1.04          .12
00980>                                                          *TOTALS*
00981>      PEAK FLOW       (cms)=        .28          .10          .343 (iii)
00982>      TIME TO PEAK    (hrs)=       1.33         1.45         1.333
00983>      RUNOFF VOLUME    (mm)=      60.96        13.23        24.684
00984>      TOTAL RAINFALL   (mm)=      61.96        61.96        61.962
00985>      RUNOFF COEFFICIENT   =        .98          .21          .398
00986>
00987>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00988>            CN* =  55.0    Ia = Dep. Storage  (Above)
00989>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00990>            THAN THE STORAGE COEFFICIENT.
00991>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00992>
00993> ---------------------------------------------------------------------------
00994> 050:0004----------------------------------------------------------------------
00995> *#
00996> *#         POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00997> *#         ===============================================
00998> *#
00999> **#************************************************************************|
01000> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
01001> *
01002> ---------------------
01003> | CALIB STANDHYD     |   Area    (ha)=    2.38
01004> | 01:201    DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
01005> ---------------------
01006>                              IMPERVIOUS    PERVIOUS (i)
01007>      Surface Area     (ha)=       1.46          .92
01008>      Dep. Storage     (mm)=       1.00         2.50
01009>      Average Slope     (%)=       5.00         5.00
01010>      Length            (m)=      10.00        20.00
01011>      Mannings n            =       .015         .250
01012>
01013>      Max.eff.Inten.(mm/hr)=     129.82        26.80
01014>                    over (min)       1.00         6.00
01015>      Storage Coeff.  (min)=        .39 (ii)    6.38 (ii)
01016>      Unit Hyd. Tpeak (min)=       1.00         6.00
01017>      Unit Hyd. peak  (cms)=       1.57          .18
01018>                                                          *TOTALS*
01019>      PEAK FLOW       (cms)=        .53          .05          .566 (iii)
01020>      TIME TO PEAK    (hrs)=       1.28         1.40         1.333
01021>      RUNOFF VOLUME    (mm)=      60.96        13.23        42.585
01022>      TOTAL RAINFALL   (mm)=      61.96        61.96        61.962
01023>      RUNOFF COEFFICIENT   =        .98          .21          .687
01024>
01025>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01026>            CN* =  55.0    Ia = Dep. Storage  (Above)
01027>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01028>            THAN THE STORAGE COEFFICIENT.
01029>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01030>
01031> ---------------------------------------------------------------------------
01032> 050:0005----------------------------------------------------------------------
01033> *# ROUTE CATCHMENT 201 - Through SWM Controls
01034> *
01035> ---------------------
01036> | ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
01037> |  IN>01:(201   )   |
01038> | OUT<02:(201   )   |    =========  OUTLFOW STORAGE TABLE  =========
01039> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01040>                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
01041>                             .000  .0000E+00    |     .208  .6450E-01
01042>                             .005  .7600E-02    |     .225  .7600E-01
01043>                             .008  .1570E-01    |     .241  .8820E-01
01044>                             .010  .2430E-01    |     .256  .1009E+00
01045>                             .012  .3350E-01    |     .264  .1076E+00
01046>                             .167  .4320E-01    |     .277  .1213E+00
01047>                             .189  .5360E-01    |     .303  .1507E+00
01048>
01049>     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01050>     --------------------       (ha)     (cms)     (hrs)       (mm)
01051>     INFLOW >01: (201   )       2.38      .566     1.333     42.585
01052>     OUTFLOW<02: (201   )       2.38      .177     1.500     42.584
01053>    OVERFLOW<03: (OVF   )        .00      .000      .000       .000
01054>
01055>                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01056>                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
01057>                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
01058>
01059>
01060>                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   31.209
01061>                   TIME SHIFT OF PEAK FLOW         (min)=    10.00
01062>                   MAXIMUM  STORAGE   USED       (ha.m.)=.4801E-01
01063>
01064> ---------------------------------------------------------------------------
01065> 050:0006----------------------------------------------------------------------
01066> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
01067> *
01068> ---------------------
01069> | CALIB STANDHYD     |   Area    (ha)=     .84
01070> | 04:202    DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
01071> ---------------------
01072>                              IMPERVIOUS    PERVIOUS (i)
01073>      Surface Area     (ha)=        .23          .61
01074>      Dep. Storage     (mm)=       1.00         2.50
01075>      Average Slope     (%)=       5.00         5.00
01076>      Length            (m)=       5.00        20.00
01077>      Mannings n            =       .015         .025
01078>
01079>      Max.eff.Inten.(mm/hr)=     129.82        30.58
01080>                    over (min)       1.00         2.00
```

```
      Storage Coeff.  (min)=        .26 (ii)    1.68 (ii)
      Unit Hyd. Tpeak (min)=       1.00         2.00
      Unit Hyd. peak  (cms)=       1.66          .62
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .08          .05          .130 (iii)
      TIME TO PEAK    (hrs)=       1.25         1.33         1.333
      RUNOFF VOLUME    (mm)=      60.96        13.23        26.212
      TOTAL RAINFALL   (mm)=      61.96        61.96        61.962
      RUNOFF COEFFICIENT   =        .98          .21          .423

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  55.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0007--------------------------------------------------------------------------
*# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
*
------------------------
| ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 02:201          2.38     .177    1.50  42.58    .000
                       +ID2 04:202           .84     .130    1.33  26.21    .000
                        ==========================================================
                        SUM 05:Total         3.22     .300    1.33  38.31    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0008--------------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002--------------------------------------------------------------------------
*
 ** END OF RUN :  99

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

```
--------------------
| START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
    TZERO =   .00 hrs on     0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=BURL_100.stm
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: KING ASPHALT PLANT
*#               SOUTH SERVICE ROAD
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 20036
*#       Date   : MAY 18, 2021
*#    Revised   : APRIL, 2024
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20036.DAT
*#*************************************************************************|
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 100-YR BURLINGTON CHICAGO STORM (4-HR DU
| Ptotal=  67.72 mm|    Comments: 100-YR BURLINGTON CHICAGO STORM (4-HR DU
--------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .17   4.865 |   1.17  34.553 |   2.17  11.126 |   3.17   5.800
                .33   5.538 |   1.33 141.892 |   2.33   9.547 |   3.33   5.406
                .50   6.472 |   1.50  45.024 |   2.50   8.397 |   3.50   5.068
                .67   7.868 |   1.67  24.526 |   2.67   7.521 |   3.67   4.776
                .83  10.219 |   1.83  17.223 |   2.83   6.828 |   3.83   4.519
               1.00  15.170 |   2.00  13.447 |   3.00   6.266 |   4.00   4.292

--------------------------------------------------------------------------------
100:0003--------------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#************************************************************************|
*# CATCHMENT 101 - Existing Condition (to North Service Road)
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=    3.22
| 01:101    DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .77         2.45
      Dep. Storage     (mm)=       1.00         2.50
      Average Slope     (%)=       2.00         2.00
      Length            (m)=      20.00        20.00
      Mannings n            =       .025         .250

      Max.eff.Inten.(mm/hr)=     141.89        28.23
                 over (min)        1.00         9.00
      Storage Coeff.  (min)=       1.02 (ii)    8.74 (ii)
      Unit Hyd. Tpeak (min)=       1.00         9.00
      Unit Hyd. peak  (cms)=       1.06          .13
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .30          .13          .385 (iii)
      TIME TO PEAK    (hrs)=       1.33         1.45         1.333
      RUNOFF VOLUME    (mm)=      66.72        15.58        27.855
      TOTAL RAINFALL   (mm)=      67.72        67.72        67.724
      RUNOFF COEFFICIENT   =        .99          .23          .411

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  55.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0004--------------------------------------------------------------------------
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#************************************************************************|
*# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.38
| 01:201    DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.46          .92
      Dep. Storage     (mm)=       1.00         2.50
      Average Slope     (%)=       5.00         5.00
      Length            (m)=      10.00        20.00
      Mannings n            =       .015         .250

      Max.eff.Inten.(mm/hr)=     141.89        31.75
                 over (min)        1.00         6.00
      Storage Coeff.  (min)=        .38 (ii)    5.97 (ii)
      Unit Hyd. Tpeak (min)=       1.00         6.00
      Unit Hyd. peak  (cms)=       1.58          .19
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .58          .06          .624 (iii)
      TIME TO PEAK    (hrs)=       1.28         1.38         1.333
      RUNOFF VOLUME    (mm)=      66.72        15.58        47.034
      TOTAL RAINFALL   (mm)=      67.72        67.72        67.724
      RUNOFF COEFFICIENT   =        .99          .23          .694

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  55.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0005--------------------------------------------------------------------------
*# ROUTE CATCHMENT 201 - Through SWM Controls
*
----------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>01:(201    )   |
| OUT<02:(201    )   |    =========  OUTFLOW STORAGE TABLE  =========
----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00    |     .208  .6450E-01
                             .005  .7600E-02    |     .225  .7600E-01
                             .008  .1570E-01    |     .241  .8820E-01
                             .010  .2430E-01    |     .256  .1009E+00
                             .012  .3350E-01    |     .264  .1076E+00
                             .167  .4320E-01    |     .277  .1213E+00
                             .189  .5360E-01    |     .303  .1507E+00

      ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
      ---------------             (ha)     (cms)     (hrs)       (mm)
      INFLOW >01: (201   )       2.38      .624     1.333     47.034
      OUTFLOW<02: (201   )       2.38      .186     1.500     47.034
     OVERFLOW<03: (OVF   )        .00      .000      .000      .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   29.893
                    TIME SHIFT OF PEAK FLOW          (min)=    10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.5271E-01

--------------------------------------------------------------------------------
100:0006--------------------------------------------------------------------------
*# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .84
| 04:202    DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
----------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=        .23          .61
      Dep. Storage     (mm)=       1.00         2.50
      Average Slope     (%)=       5.00         5.00
      Length            (m)=       5.00        20.00
      Mannings n            =       .015         .025

      Max.eff.Inten.(mm/hr)=     141.89        36.12
                 over (min)        1.00         2.00
      Storage Coeff.  (min)=        .25 (ii)    1.58 (ii)
      Unit Hyd. Tpeak (min)=       1.00         2.00
      Unit Hyd. peak  (cms)=       1.67          .64
                                                          *TOTALS*
      PEAK FLOW       (cms)=        .09          .06          .147 (iii)
      TIME TO PEAK    (hrs)=       1.25         1.33         1.333
      RUNOFF VOLUME    (mm)=      66.72        15.58        29.492
      TOTAL RAINFALL   (mm)=      67.72        67.72        67.724
      RUNOFF COEFFICIENT   =        .99          .23          .435

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  55.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0007--------------------------------------------------------------------------
*# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
*
------------------------
| ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
-----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
                        ID1 02:201          2.38     .186    1.50  47.03    .000
                       +ID2 04:202           .84     .147    1.33  29.49    .000
                        ==========================================================
                        SUM 05:Total         3.22     .324    1.33  42.45    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0008--------------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002--------------------------------------------------------------------------
*
  ** END OF RUN : 124
```

```
01351> ********************************************************************************
01352>
01353>
01354>
01355>
01356>
01357> --------------------
01358> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
01359> --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
01360>     TZERO =   .00 hrs on      0
01361>     METOUT=  2 (output = METRIC)
01362>     NRUN  = 125
01363>     NSTORM=   1
01364>              #  1=25MM.stm
01365> ------------------------------------------------------------------------------
01366> 125:0002-------------------------------------------------------------------------
01367> *#*****************************************************************************|
01368> *#  Project Name: KING ASPHALT PLANT
01369> *#                SOUTH SERVICE ROAD
01370> *#                BURLINGTON, ONTARIO
01371> *#  JOB NUMBER  : 20036
01372> *#      Date    : MAY 18, 2021
01373> *#    Revised   : APRIL, 2024
01374> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01375> *#      File    : 20036.DAT
01376> *#*****************************************************************************|
01377> *
01378> ------------------------------------------------------------------------------
01379> 125:0002-------------------------------------------------------------------------
01380> *
01381> --------------------
01382> | READ STORM       |    Filename: 25mm 4-HOUR (A=555 B=5.89 C=0.813)
01383> | Ptotal=  25.27 mm|    Comments: 25mm 4-HOUR (A=555 B=5.89 C=0.813)
01384> --------------------
01385>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01386>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01387>                .17   1.491 |   1.17  13.390 |   2.17   3.748 |   3.17   1.810
01388>                .33   1.720 |   1.33  58.584 |   2.33   3.156 |   3.33   1.675
01389>                .50   2.045 |   1.50  17.849 |   2.50   2.734 |   3.50   1.560
01390>                .67   2.542 |   1.67   9.118 |   2.67   2.417 |   3.67   1.460
01391>                .83   3.408 |   1.83   6.129 |   2.83   2.170 |   3.83   1.374
01392>               1.00   5.319 |   2.00   4.638 |   3.00   1.973 |   4.00   1.299
01393>
01394> ------------------------------------------------------------------------------
01395> 125:0003-------------------------------------------------------------------------
01396> *
01397> *#*****************************************************************************|
01398> *#
01399> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01400> *#        ==============================================
01401> *#
01402> **#****************************************************************************|
01403> *# CATCHMENT 101 - Existing Condition (to North Service Road)
01404> *
01405> ----------------------
01406> | CALIB STANDHYD     |   Area    (ha)=    3.22
01407> | 01:101    DT= 1.00 |   Total Imp(%)=   24.00   Dir. Conn.(%)=   24.00
01408> ----------------------
01409>                              IMPERVIOUS    PERVIOUS (i)
01410>      Surface Area     (ha)=        .77         2.45
01411>      Dep. Storage     (mm)=       1.00         2.50
01412>      Average Slope     (%)=       2.00         2.00
01413>      Length            (m)=      20.00        20.00
01414>      Mannings n            =       .025         .250
01415>
01416>      Max.eff.Inten.(mm/hr)=      58.58         3.03
01417>                    over (min)        1.00        20.00
01418>      Storage Coeff.  (min)=       1.45 (ii)   20.31 (ii)
01419>      Unit Hyd. Tpeak (min)=       1.00        20.00
01420>      Unit Hyd. peak  (cms)=        .85          .06
01421>                                                        *TOTALS*
01422>      PEAK FLOW       (cms)=        .13          .01          .128 (iii)
01423>      TIME TO PEAK    (hrs)=       1.33         1.67         1.333
01424>      RUNOFF VOLUME    (mm)=      24.27         2.25         7.533
01425>      TOTAL RAINFALL   (mm)=      25.27        25.27        25.268
01426>      RUNOFF COEFFICIENT   =        .96          .09          .298
01427>
01428>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01429>            CN* =  55.0    Ia = Dep. Storage  (Above)
01430>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01431>            THAN THE STORAGE COEFFICIENT.
01432>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01433>
01434> ------------------------------------------------------------------------------
01435> 125:0004-------------------------------------------------------------------------
01436> *#
01437> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01438> *#        ===============================================
01439> *#
01440> **#****************************************************************************|
01441> *# CATCHMENT 201 - Proposed Condition (Controlled to North Service Road)
01442> *
01443> ----------------------
01444> | CALIB STANDHYD     |   Area    (ha)=    2.38
01445> | 01:201    DT= 1.00 |   Total Imp(%)=   61.50   Dir. Conn.(%)=   61.50
01446> ----------------------
01447>                              IMPERVIOUS    PERVIOUS (i)
01448>      Surface Area     (ha)=       1.46          .92
01449>      Dep. Storage     (mm)=       1.00         2.50
01450>      Average Slope     (%)=       5.00         5.00
01451>      Length            (m)=      10.00        20.00
01452>      Mannings n            =       .015         .250
01453>
01454>      Max.eff.Inten.(mm/hr)=      58.58         3.41
01455>                    over (min)        1.00        14.00
01456>      Storage Coeff.  (min)=        .53 (ii)   14.20 (ii)
01457>      Unit Hyd. Tpeak (min)=       1.00        14.00
01458>      Unit Hyd. peak  (cms)=       1.44          .08
01459>                                                        *TOTALS*
01460>      PEAK FLOW       (cms)=        .24          .01          .240 (iii)
01461>      TIME TO PEAK    (hrs)=       1.30         1.55         1.333
01462>      RUNOFF VOLUME    (mm)=      24.27         2.25        15.790
01463>      TOTAL RAINFALL   (mm)=      25.27        25.27        25.268
01464>      RUNOFF COEFFICIENT   =        .96          .09          .625
01465>
01466>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01467>            CN* =  55.0    Ia = Dep. Storage  (Above)
01468>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01469>            THAN THE STORAGE COEFFICIENT.
01470>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01471>
01472> ------------------------------------------------------------------------------
01473> 125:0005-------------------------------------------------------------------------
01474> *# ROUTE CATCHMENT 201 - Through SWM Controls
01475> *
01476> ----------------------
01477> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01478> |  IN>01:(201    )   |
01479> | OUT<02:(201    )   |    =========  OUTLFOW STORAGE TABLE  =========
01480> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01481>                             (cms)    (ha.m.)   |    (cms)    (ha.m.)
01482>                              .000  .0000E+00    |     .208  .6450E-01
01483>                              .005  .7600E-02    |     .225  .7600E-01
01484>                              .008  .1570E-01    |     .241  .8820E-01
01485>                              .010  .2430E-01    |     .256  .1009E+00
01486>                              .012  .3350E-01    |     .264  .1076E+00
01487>                              .167  .4320E-01    |     .277  .1213E+00
01488>                              .189  .5360E-01    |     .303  .1507E+00
01489>
01490>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01491>      --------------------       (ha)     (cms)     (hrs)       (mm)
01492>      INFLOW >01: (201   )       2.38      .240     1.333     15.790
01493>      OUTFLOW<02: (201   )       2.38      .011     2.667     15.790
01494>     OVERFLOW<03: (OVF   )        .00      .000      .000       .000
01495>
01496>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01497>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
01498>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
01499>
01500>
01501>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    4.653
01502>                    TIME SHIFT OF PEAK FLOW          (min)=    80.00
01503>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2797E-01
01504>
01505> ------------------------------------------------------------------------------
01506> 125:0006-------------------------------------------------------------------------
01507> *# CATCHMENT 202 - Proposed Condition (Uncontrolled to North Service Road)
01508> *
01509> ----------------------
01510> | CALIB STANDHYD     |   Area    (ha)=     .84
01511> | 04:202    DT= 1.00 |   Total Imp(%)=   27.20   Dir. Conn.(%)=   27.20
01512> ----------------------
01513>                              IMPERVIOUS    PERVIOUS (i)
01514>      Surface Area     (ha)=        .23          .61
01515>      Dep. Storage     (mm)=       1.00         2.50
01516>      Average Slope     (%)=       5.00         5.00
01517>      Length            (m)=       5.00        20.00
01518>      Mannings n            =       .015         .025
01519>
01520>      Max.eff.Inten.(mm/hr)=      58.58         5.64
01521>                    over (min)        1.00         3.00
01522>      Storage Coeff.  (min)=        .35 (ii)    3.16 (ii)
01523>      Unit Hyd. Tpeak (min)=       1.00         3.00
01524>      Unit Hyd. peak  (cms)=       1.60          .36
01525>                                                        *TOTALS*
01526>      PEAK FLOW       (cms)=        .04          .01          .044 (iii)
01527>      TIME TO PEAK    (hrs)=       1.27         1.35         1.333
01528>      RUNOFF VOLUME    (mm)=      24.27         2.25         8.237
01529>      TOTAL RAINFALL   (mm)=      25.27        25.27        25.268
01530>      RUNOFF COEFFICIENT   =        .96          .09          .326
01531>
01532>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01533>            CN* =  55.0    Ia = Dep. Storage  (Above)
01534>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01535>            THAN THE STORAGE COEFFICIENT.
01536>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01537>
01538> ------------------------------------------------------------------------------
01539> 125:0007-------------------------------------------------------------------------
01540> *# Add flows from CATCHMENT 201 and 202 Total Post-Development Flows)
01541> *
01542> ------------------------
01543> | ADD HYD (Total     ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
01544> ------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
01545>                      ID1 02:201            2.38      .011    2.67  15.79    .000
01546>                     +ID2 04:202             .84      .044    1.33   8.24    .000
01547>                      ========================================================
01548>                      SUM 05:Total          3.22      .053    1.33  13.82    .000
01549>
01550>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01551>
01552> ------------------------------------------------------------------------------
01553> 125:0008-------------------------------------------------------------------------
01554> * RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
01555> *
01556> ------------------------------------------------------------------------------
01557> 125:0002-------------------------------------------------------------------------
01558> *
01559> ------------------------------------------------------------------------------
01560> 125:0002-------------------------------------------------------------------------
01561> *
01562> ------------------------------------------------------------------------------
01563> 125:0002-------------------------------------------------------------------------
01564> *
01565> ------------------------------------------------------------------------------
01566> 125:0002-------------------------------------------------------------------------
01567> *
01568> ------------------------------------------------------------------------------
01569> 125:0002-------------------------------------------------------------------------
01570> *
01571> ------------------------------------------------------------------------------
01572> 125:0002-------------------------------------------------------------------------
01573> *
01574>       FINISH
01575> ------------------------------------------------------------------------------
01576> ********************************************************************************
01577>      WARNINGS / ERRORS / NOTES
01578>      -------------------------
01579>    Simulation ended on 2024-05-21     at 19:20:16
01580> ================================================================================
01581>
01582>
```

```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
00008>                                                          9   9  9   9   # 3902680
00009>         StormWater Management HYdrologic Model            999    999    =========
00010>
00011>  ********************************************************************************
00012>  ***************************** SWMHYMO Ver/4.05  ********************************
00013>  *********  A single event and continuous hydrologic simulation model  *********
00014>  *********     based on the principles of HYMO and its successors      *********
00015>  *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
00016>  ********************************************************************************
00017>  ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
00018>  *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019>  *********                  Gatineau, Quebec: (819) 243-6858           *********
00020>  *********                  E-Mail: swmhymo@jfsa.Com                   *********
00021>  ********************************************************************************
00022>
00023>  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++++ Licensed user: S. Llewellyn & Associates Ltd                +++++++++
00025>  +++++++++                Burlington           SERIAL#:3902680        +++++++++
00026>  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ********************************************************************************
00029>  *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
00030>  *********           Maximum value for ID numbers  :     10            *********
00031>  *********           Max. number of rainfall points: 105408            *********
00032>  *********           Max. number of flow points    : 105408            *********
00033>  ********************************************************************************
00034>
00035>
00036>  **********************   D E T A I L E D   O U T P U T   **********************
00037>  ********************************************************************************
00038>  *         DATE: 2024-05-09     TIME: 14:18:58     RUN COUNTER: 000817         *
00039>  ********************************************************************************
00040>  * Input   filename: T:\PROJECTS\20036\SWMHYMO\20036_25.dat                     *
00041>  * Output  filename: T:\PROJECTS\20036\SWMHYMO\20036_25.out                     *
00042>  * Summary filename: T:\PROJECTS\20036\SWMHYMO\20036_25.sum                     *
00043>  * User comments:                                                              *
00044>  * 1:_____________________________________________________________________________*
00045>  * 2:_____________________________________________________________________________*
00046>  * 3:_____________________________________________________________________________*
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001-----------------------------------------------------------------------
00051> *#*****************************************************************************|
00052> *#  Project Name: KING ASPHALT PLANT
00053> *#                SOUTH SERVICE ROAD
00054> *#                BURLINGTON, ONTARIO
00055> *#  JOB NUMBER  : 20036
00056> *#       Date   : MAY 18, 2021
00057> *#    Revised   : AUGUST 04, 2021
00058> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00059> *#       File   : 20036.DAT
00060> *#*****************************************************************************|
00061> *
00062>   ** END OF RUN :   1
00063>
00064> ********************************************************************************
00065>
```

```
00066>
00067>
00068>
00069>
00070> --------------------
00071> | START            |  Project  dir.: T:\PROJECTS\20036\SWMHYMO\
00072> --------------------  Rainfall dir.: T:\PROJECTS\20036\SWMHYMO\
00073>     TZERO =   .00 hrs on        0
00074>     METOUT=   2 (output = METRIC)
00075>     NRUN  = 002
00076>     NSTORM=   1
00077>            #  1=25MM.STM
00078> ------------------------------------------------------------------------------
00079> 002:0002--------------------------------------------------------------------------
00080> *#*************************************************************************|
00081> *#  Project Name: KING ASPHALT PLANT
00082> *#                SOUTH SERVICE ROAD
00083> *#                BURLINGTON, ONTARIO
00084> *#  JOB NUMBER  : 20036
00085> *#       Date   : MAY 18, 2021
00086> *#    Revised   : AUGUST 04, 2021
00087> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00088> *#       File   : 20036.DAT
00089> *#*************************************************************************|
00090> *
00091> ------------------------------------------------------------------------------
00092> 002:0002--------------------------------------------------------------------------
00093> *
00094> --------------------
00095> | READ STORM       |    Filename: 25mm 4-HOUR (A=555 B=5.89 C=0.813)
00096> | Ptotal=  25.27 mm|    Comments: 25mm 4-HOUR (A=555 B=5.89 C=0.813)
00097> --------------------
00098>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00099>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00100>                .17   1.491 |   1.17  13.390 |   2.17   3.748 |   3.17   1.810
00101>                .33   1.720 |   1.33  58.584 |   2.33   3.156 |   3.33   1.675
00102>                .50   2.045 |   1.50  17.849 |   2.50   2.734 |   3.50   1.560
00103>                .67   2.542 |   1.67   9.118 |   2.67   2.417 |   3.67   1.460
00104>                .83   3.408 |   1.83   6.129 |   2.83   2.170 |   3.83   1.374
00105>               1.00   5.319 |   2.00   4.638 |   3.00   1.973 |   4.00   1.299
00106>
00107> ------------------------------------------------------------------------------
00108> 002:0003--------------------------------------------------------------------------
00109> *
00110> *#*************************************************************************|
00111> *#
00112> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING FOR 25MM STORM EVENT
00113> *#        ==================================================================
00114> *#
00115> **#************************************************************************|
00116> *# CATCHMENT 201 - Enhanced Swale 1
00117> *
00118> ----------------------
00119> | CALIB STANDHYD     |   Area    (ha)=     .27
00120> | 01:201-E1 DT= 1.00 |   Total Imp(%)=   55.00   Dir. Conn.(%)=   55.00
00121> ----------------------
00122>                                IMPERVIOUS    PERVIOUS (i)
00123>      Surface Area     (ha)=        .15           .12
00124>      Dep. Storage     (mm)=       1.00          2.50
00125>      Average Slope     (%)=       5.00          5.00
00126>      Length            (m)=      10.00         20.00
00127>      Mannings n             =       .015          .250
00128>
00129>      Max.eff.Inten.(mm/hr)=      58.58          3.41
00130>                 over (min)        1.00         14.00
```

```
00131>      Storage Coeff.  (min)=        .53 (ii)   14.20 (ii)
00132>      Unit Hyd. Tpeak (min)=       1.00        14.00
00133>      Unit Hyd. peak  (cms)=       1.44          .08
00134>                                                        *TOTALS*
00135>      PEAK FLOW       (cms)=        .02          .00          .024 (iii)
00136>      TIME TO PEAK    (hrs)=       1.28         1.55         1.333
00137>      RUNOFF VOLUME    (mm)=      24.27         2.25        14.359
00138>      TOTAL RAINFALL   (mm)=      25.27        25.27        25.268
00139>      RUNOFF COEFFICIENT   =        .96          .09          .568
00140>
00141>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00142>            CN* =  55.0    Ia = Dep. Storage  (Above)
00143>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00144>            THAN THE STORAGE COEFFICIENT.
00145>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00146>
00147> ---------------------------------------------------------------------------
00148> 002:0004-----------------------------------------------------------------------
00149> *# CATCHMENT 201 - Enhanced Swale 2
00150> *
00151> ----------------------
00152> | CALIB STANDHYD     |   Area    (ha)=     .79
00153> | 02:201-E2 DT= 1.00 |   Total Imp(%)=   32.00   Dir. Conn.(%)=   32.00
00154> ----------------------
00155>                              IMPERVIOUS    PERVIOUS (i)
00156>      Surface Area     (ha)=        .25          .54
00157>      Dep. Storage     (mm)=       1.00         2.50
00158>      Average Slope     (%)=       5.00         5.00
00159>      Length            (m)=      10.00        20.00
00160>      Mannings n           =       .015         .250
00161>
00162>      Max.eff.Inten.(mm/hr)=      58.58         3.41
00163>                over (min)        1.00        14.00
00164>      Storage Coeff.  (min)=        .53 (ii)   14.20 (ii)
00165>      Unit Hyd. Tpeak (min)=       1.00        14.00
00166>      Unit Hyd. peak  (cms)=       1.44          .08
00167>                                                        *TOTALS*
00168>      PEAK FLOW       (cms)=        .04          .00          .042 (iii)
00169>      TIME TO PEAK    (hrs)=       1.30         1.55         1.333
00170>      RUNOFF VOLUME    (mm)=      24.27         2.25         9.294
00171>      TOTAL RAINFALL   (mm)=      25.27        25.27        25.268
00172>      RUNOFF COEFFICIENT   =        .96          .09          .368
00173>
00174>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00175>            CN* =  55.0    Ia = Dep. Storage  (Above)
00176>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00177>            THAN THE STORAGE COEFFICIENT.
00178>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00179>
00180> ---------------------------------------------------------------------------
00181> 002:0005-----------------------------------------------------------------------
00182> **#*************************************************************************|
00183>       FINISH
00184> ---------------------------------------------------------------------------
00185> ***************************************************************************
00186>      WARNINGS / ERRORS / NOTES
00187>      -------------------------
00188>    Simulation ended on 2024-05-09     at 14:18:58
00189> ===========================================================================
00190>
00191>
```

QUALITY CONTROL INFORMATION

Hydroworks Sizing Summary

East Channel & Shared Access Road

05-16-2024

Recommended Size: HydroStorm HS 6

A HydroStorm HS 6 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.7887 (ha) with an imperviousness of 32 % and Hamilton RBG, Ontario rainfall for the ETV Canada particle size distribution.

The recommended HydroStorm HS 6 treats 96 % of the annual runoff and provides 80 % annual TSS removal for the Hamilton RBG rainfall records and ETV Canada particle size distribution.

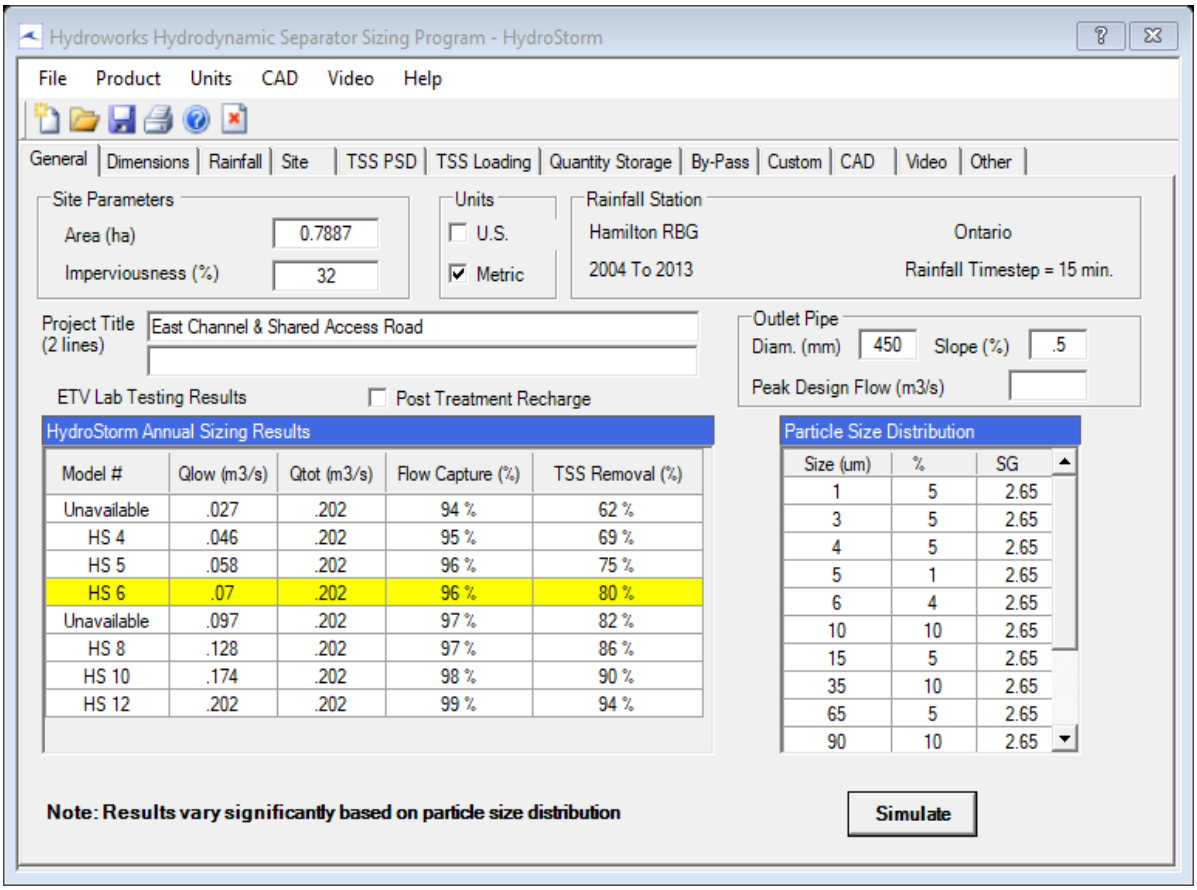
The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .2 (m3/s) for the given 450 (mm) pipe diameter at .5% slope. The headloss was calculated to be 85 (mm) based on a flow depth of 450 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

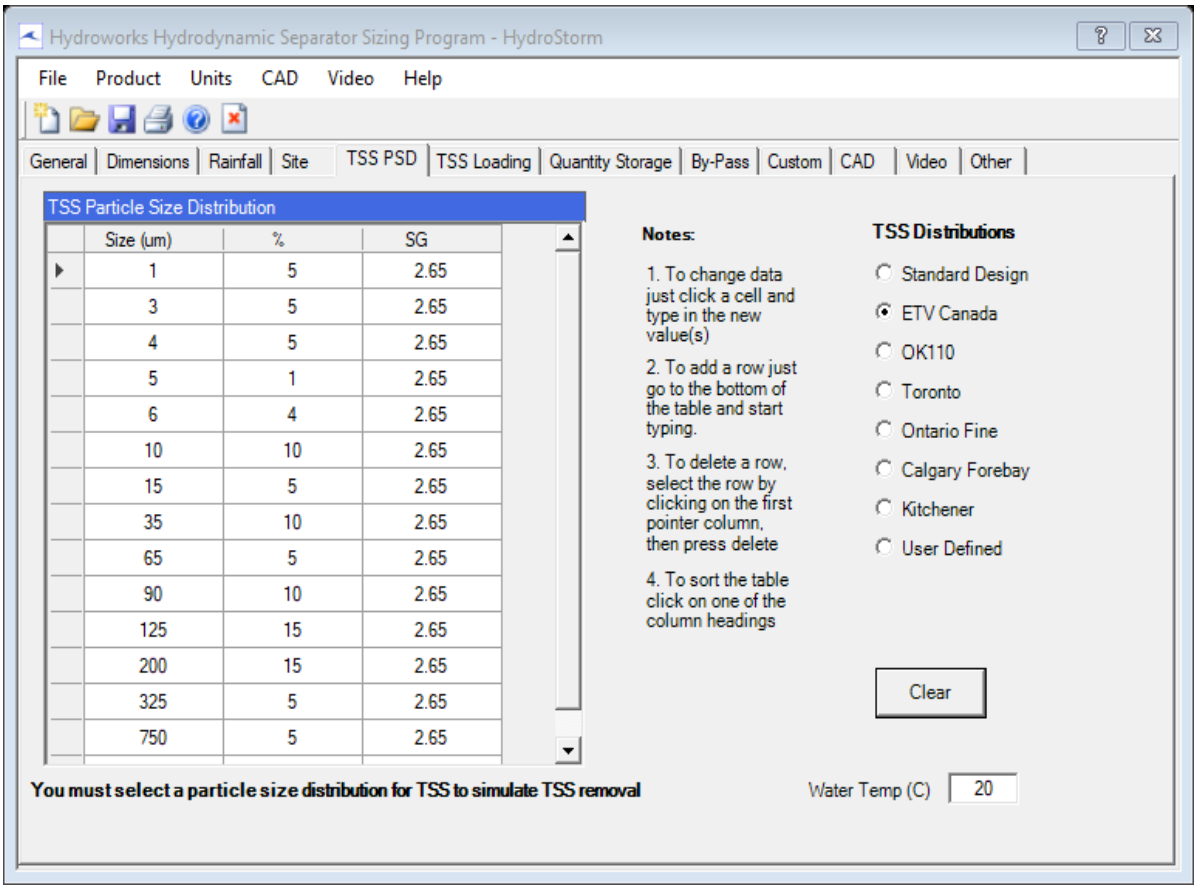
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

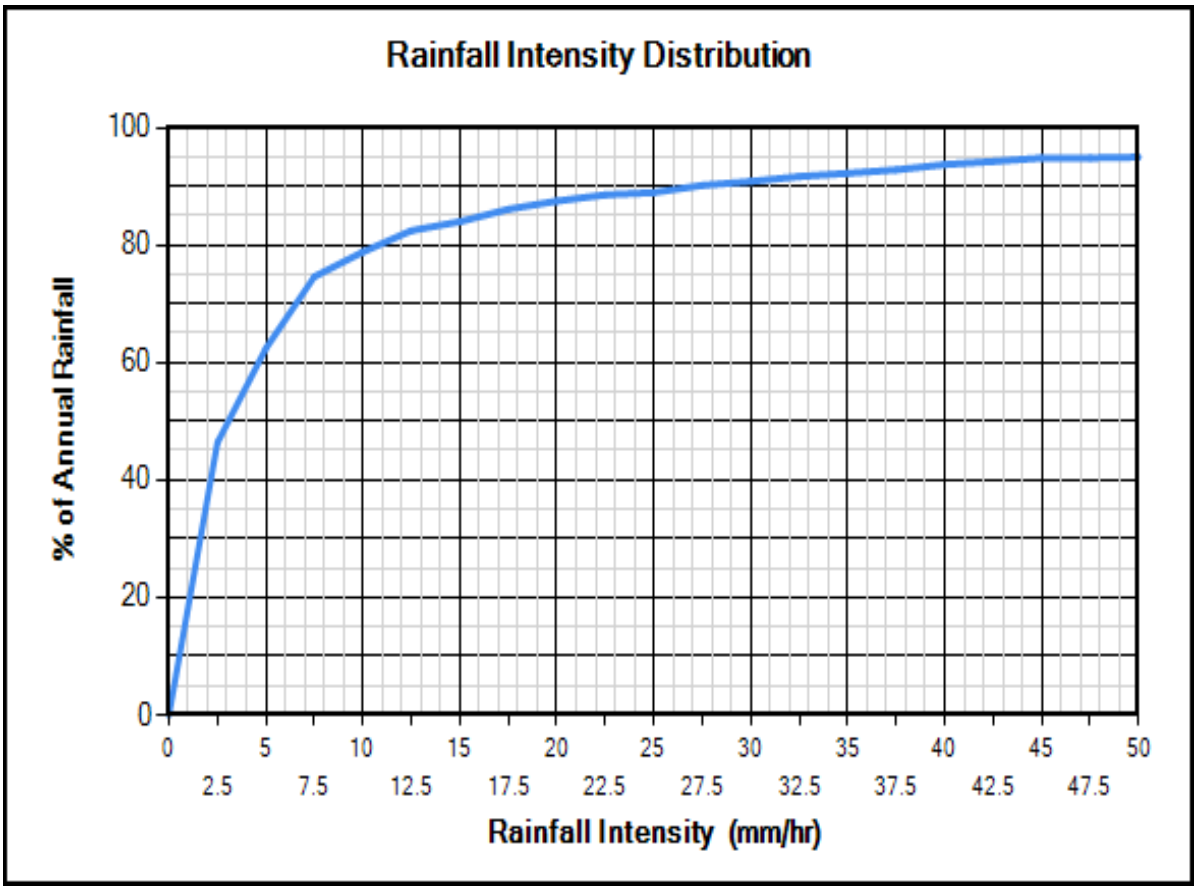
TSS Removal Sizing Summary



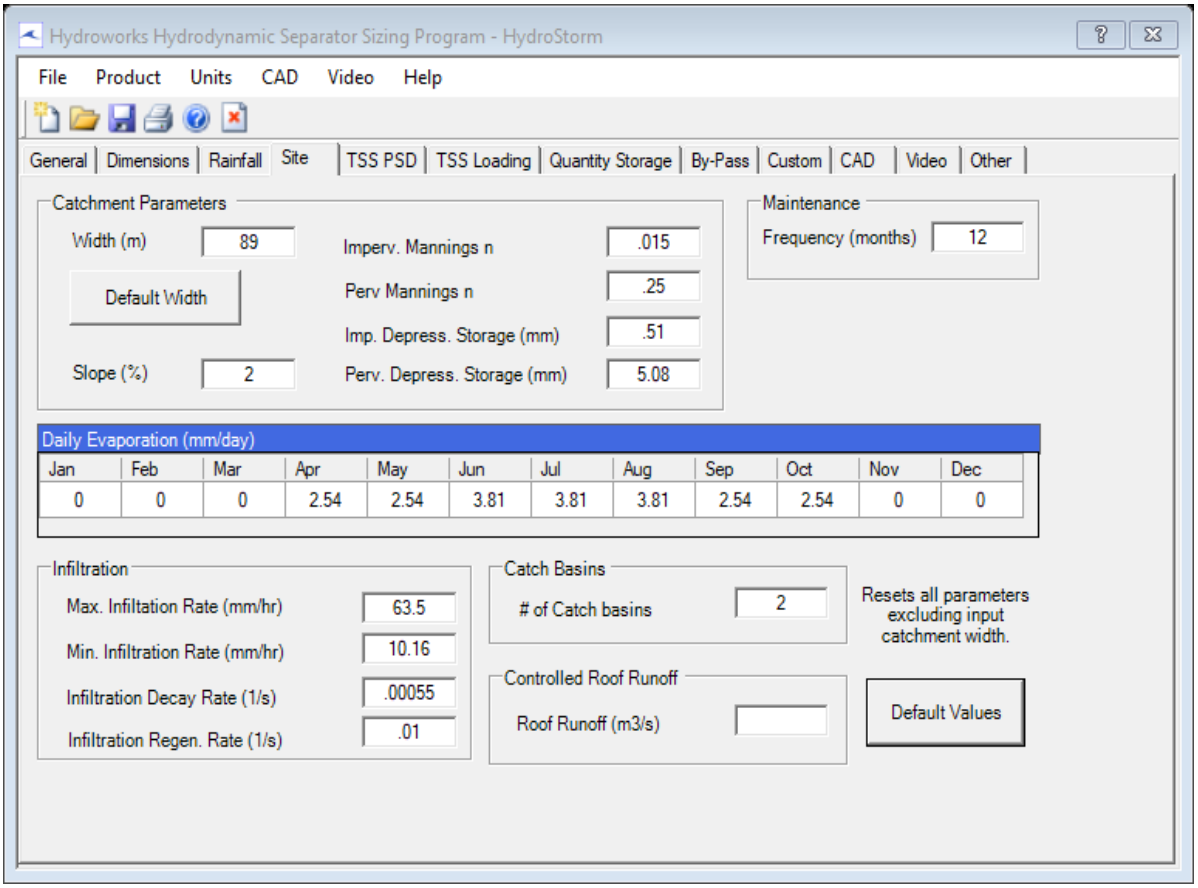
TSS Particle Size Distribution



Rainfall Station - Hamilton RBG, Ontario(2004 To 2013)



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

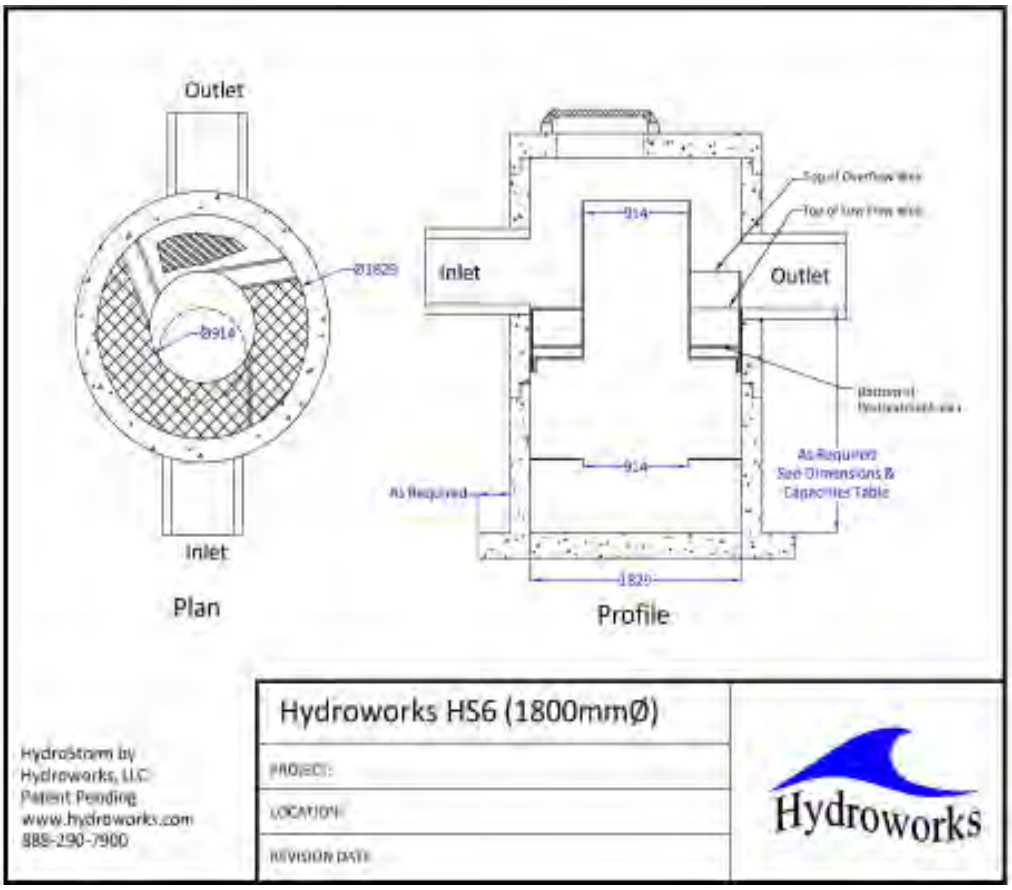
General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

Dimensions and Capacities

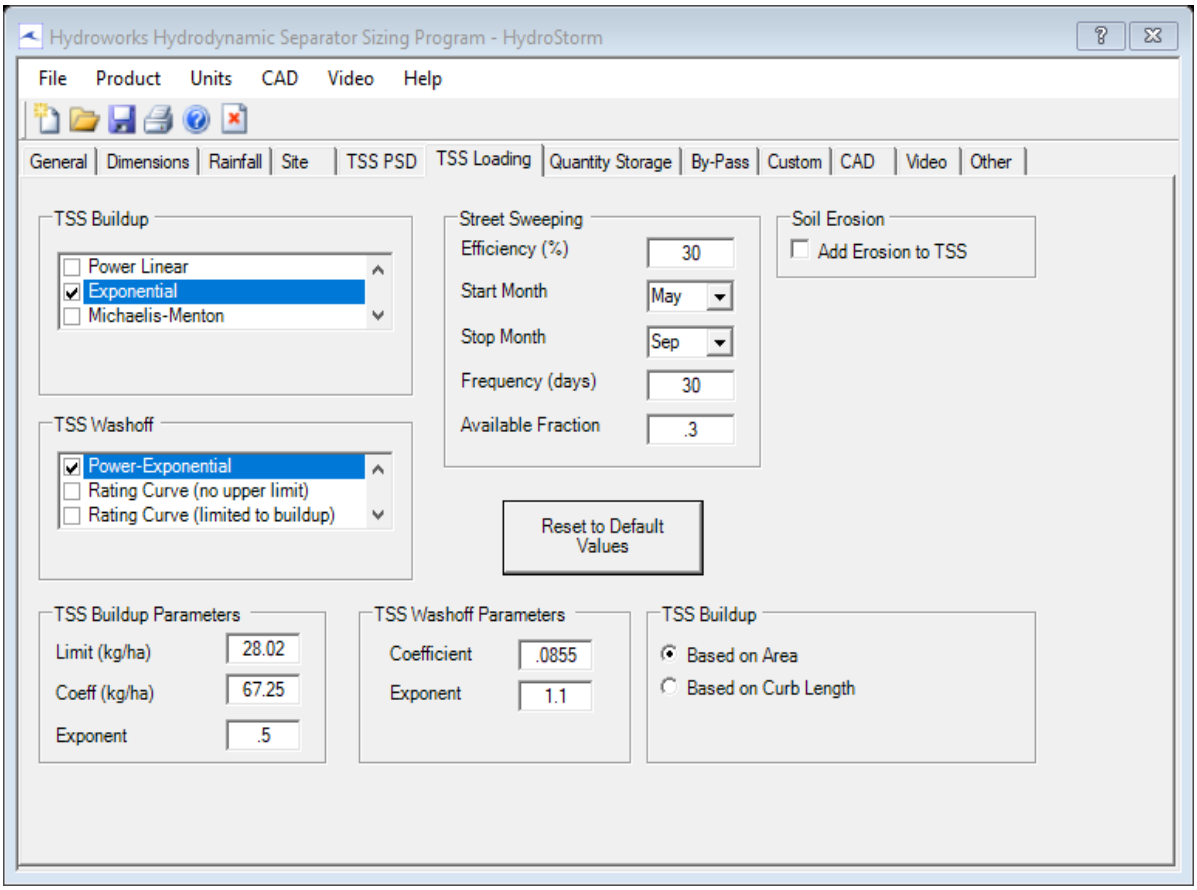
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

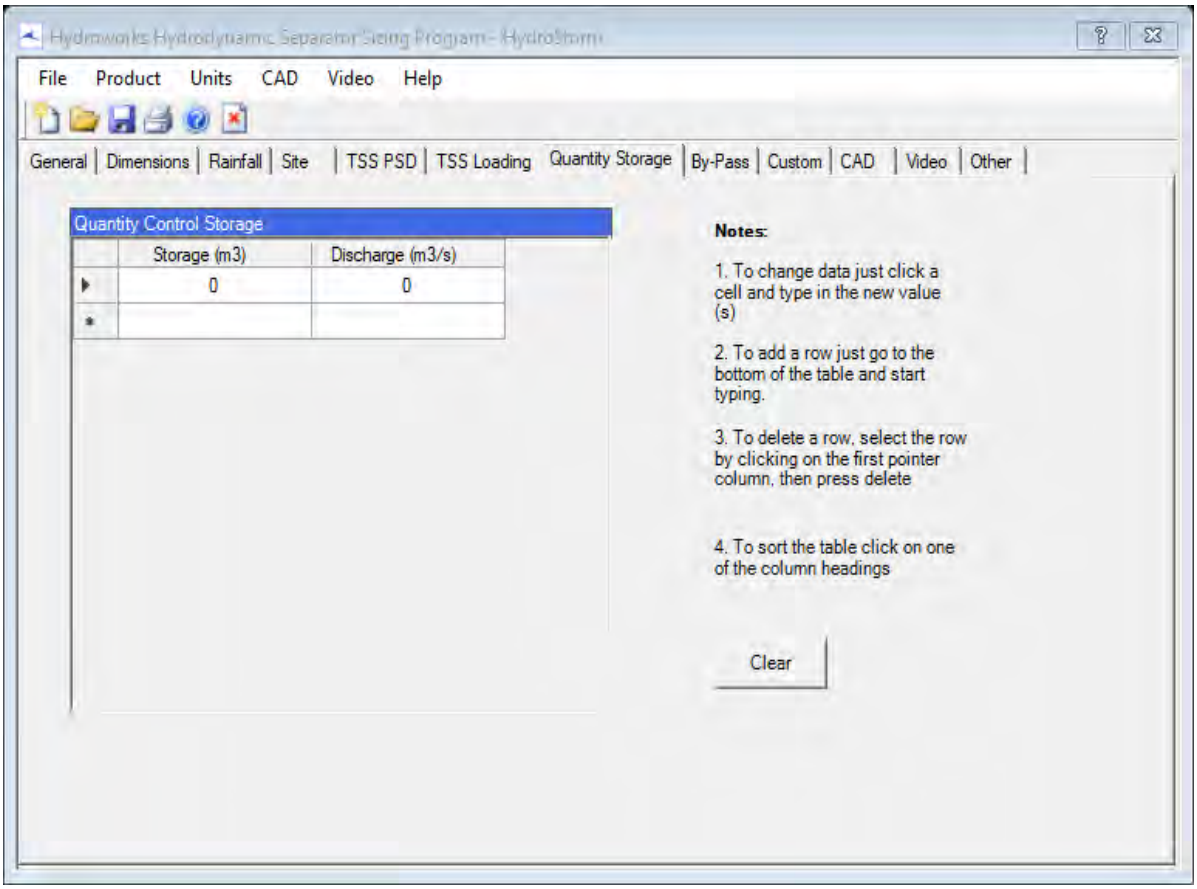
Generic HS 6 CAD Drawing



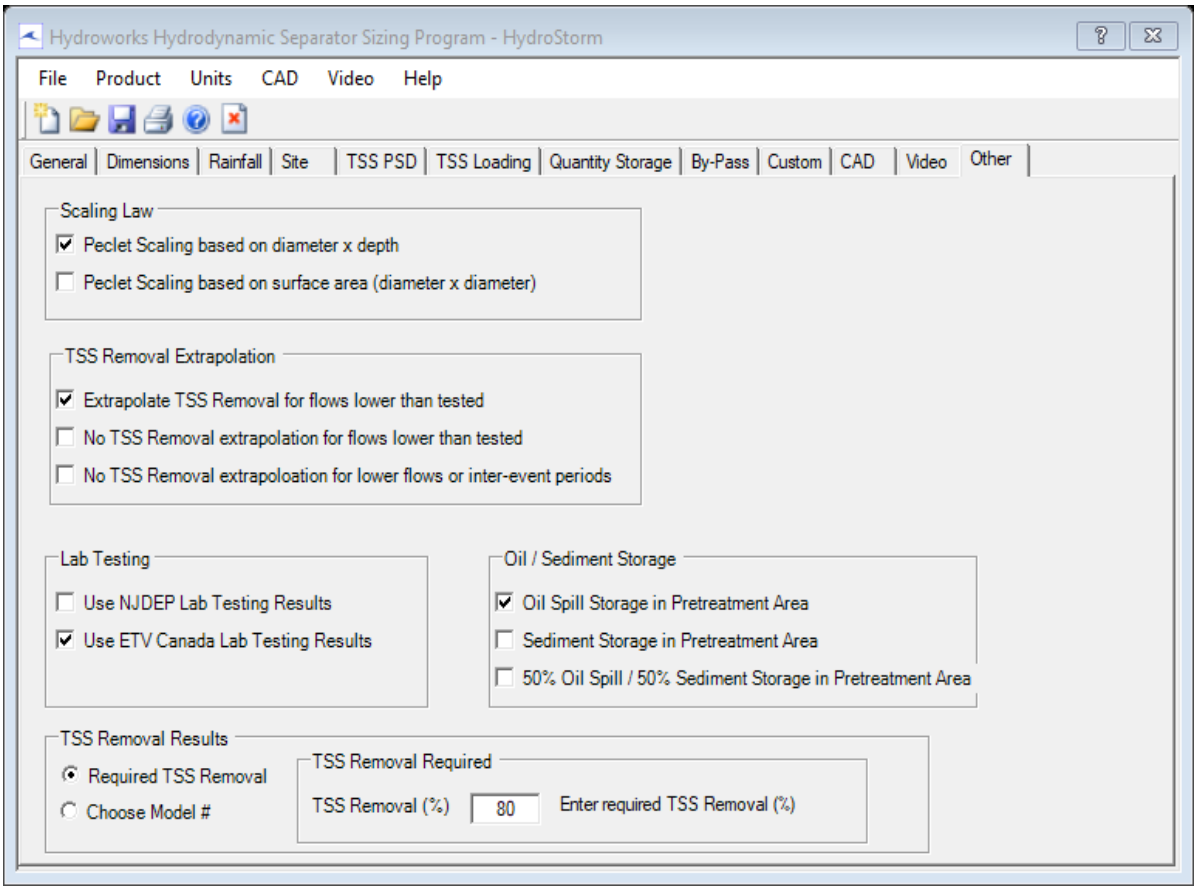
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

Hydroworks Sizing Program - Version 5.6
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1-800-290-7900
www.hydroworks.com

Hydroworks Sizing Summary

Asphalt Plant

05-16-2024

Recommended Size: HydroStorm HS 10

A HydroStorm HS 10 is recommended to provide 80 % annual TSS removal based on a drainage area of 1.088 (ha) with an imperviousness of 70 % and Hamilton RBG, Ontario rainfall for the ETV Canada particle size distribution.

The recommended HydroStorm HS 10 treats 98 % of the annual runoff and provides 82 % annual TSS removal for the Hamilton RBG rainfall records and ETV Canada particle size distribution.

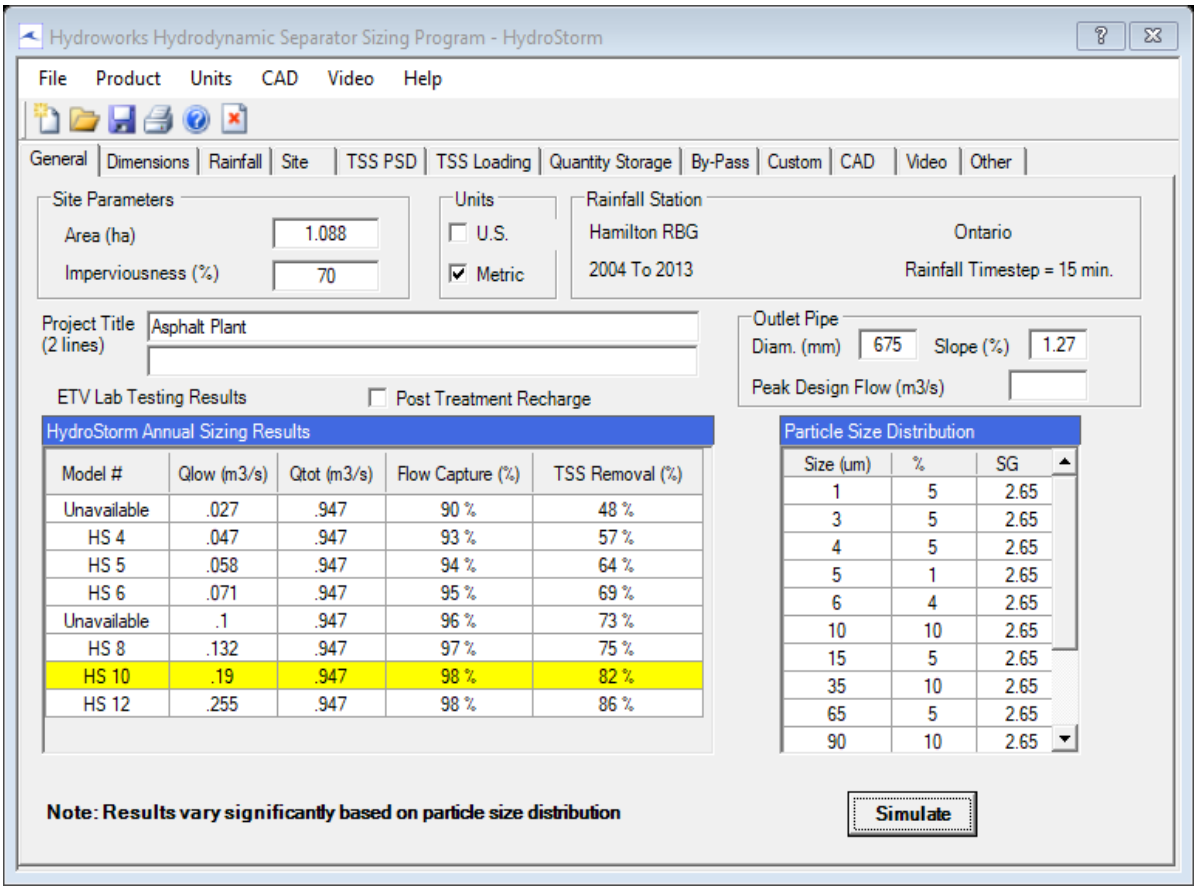
The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .95 (m3/s) for the given 675 (mm) pipe diameter at 1.3% slope. The headloss was calculated to be 372 (mm) based on a flow depth of 675 (mm) (full pipe flow).

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

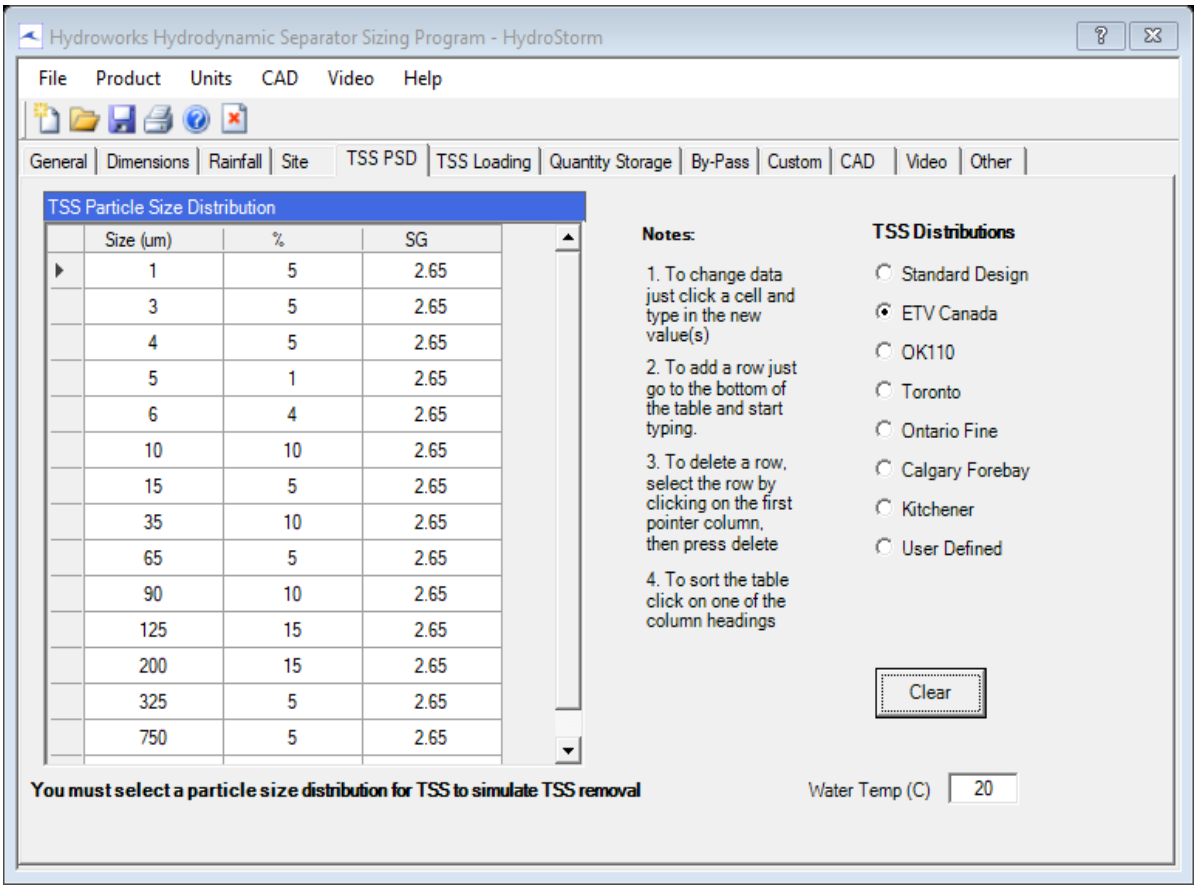
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroStorm .

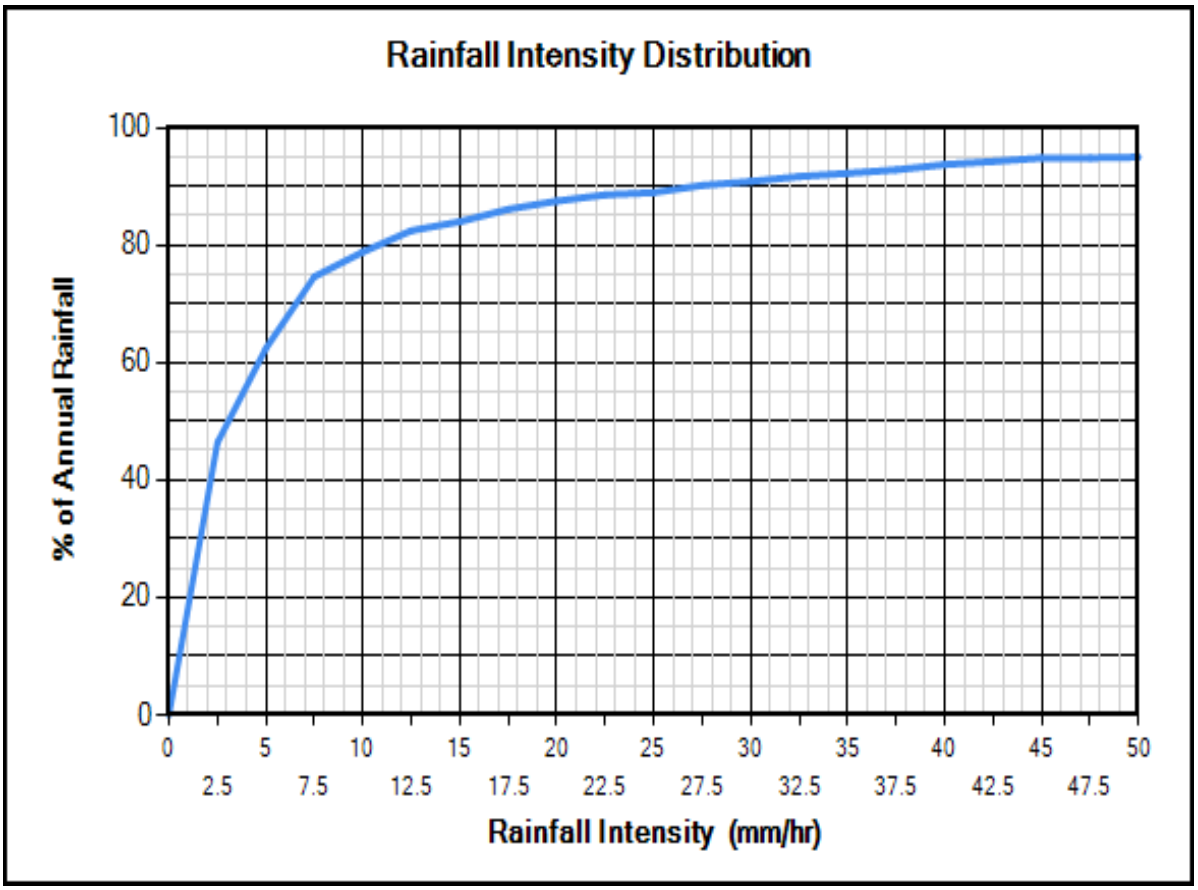
TSS Removal Sizing Summary



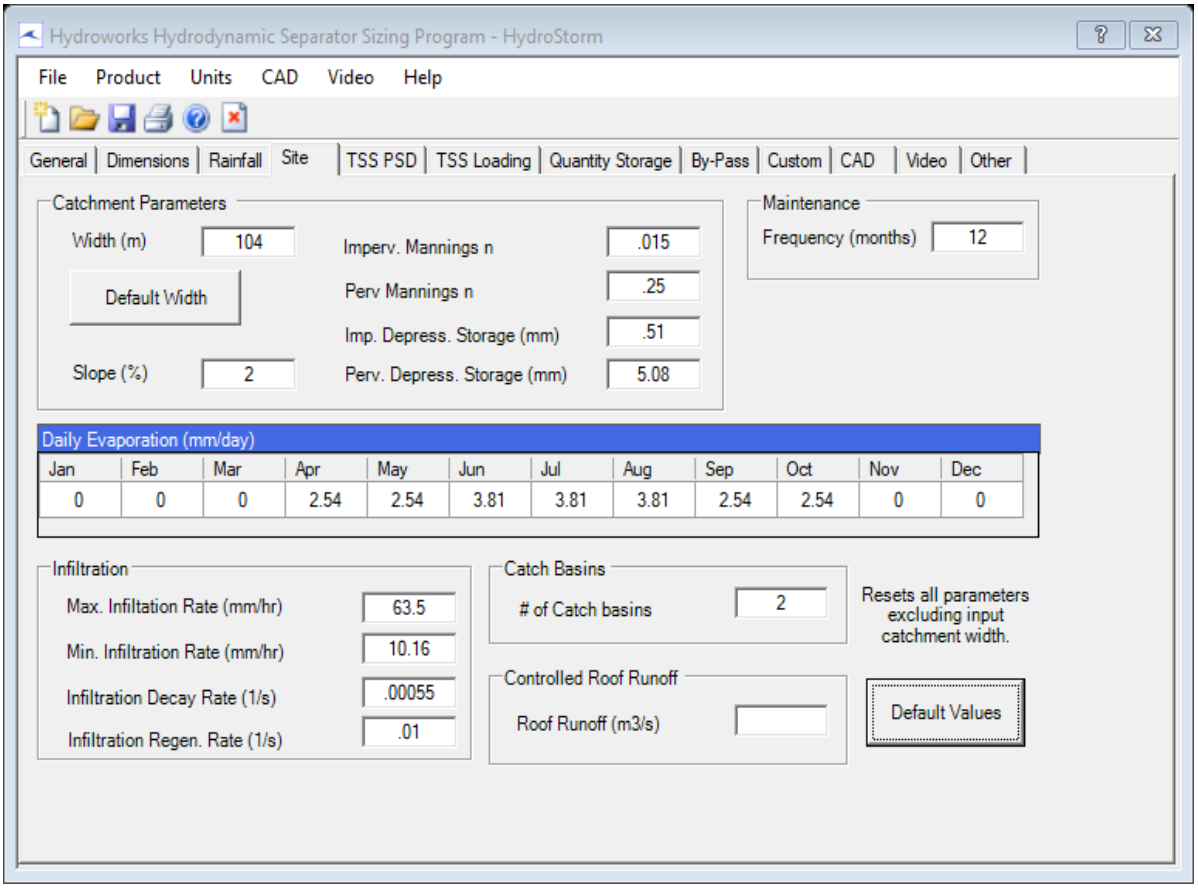
TSS Particle Size Distribution



Rainfall Station - Hamilton RBG, Ontario(2004 To 2013)



Site Physical Characteristics



Dimensions And Capacities

Hydroworks Hydrodynamic Separator Sizing Program - HydroStorm

File Product Units CAD Video Help

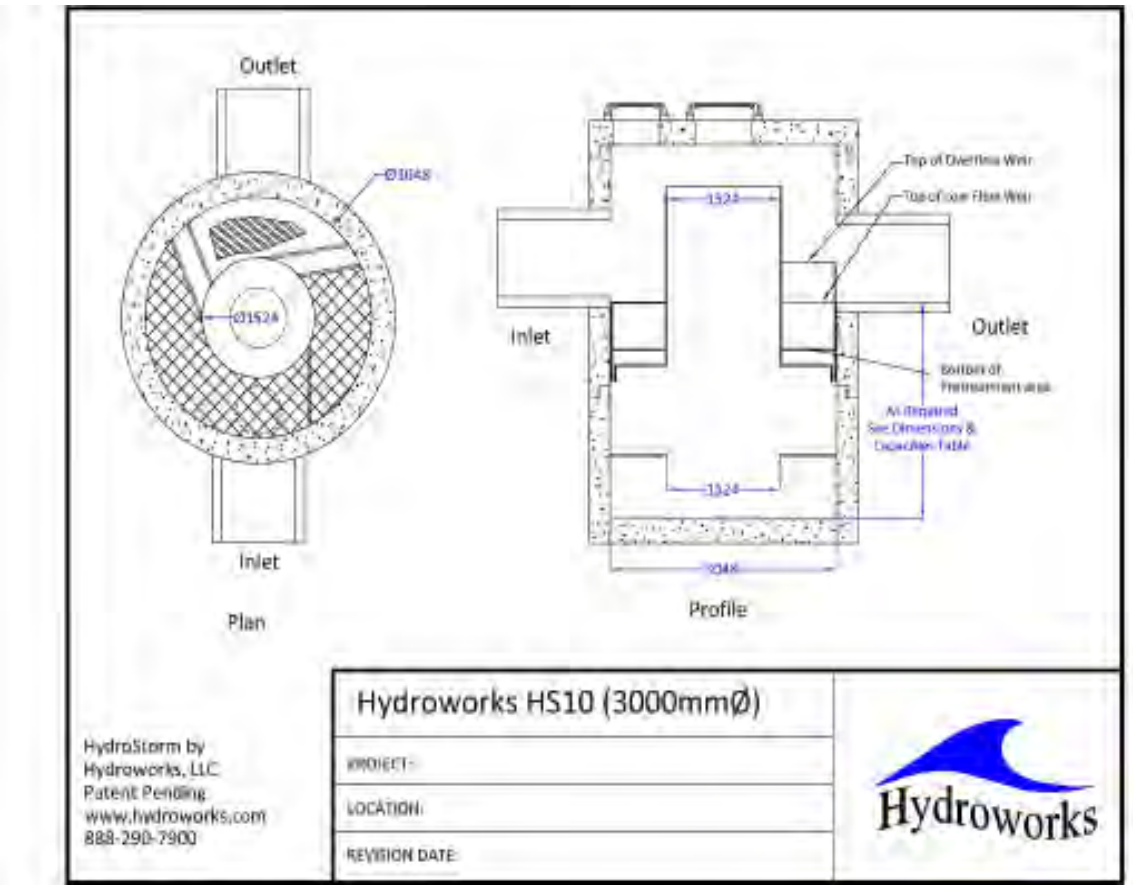
General | Dimensions | Rainfall | Site | TSS PSD | TSS Loading | Quantity Storage | By-Pass | Custom | CAD | Video | Other

Dimensions and Capacities

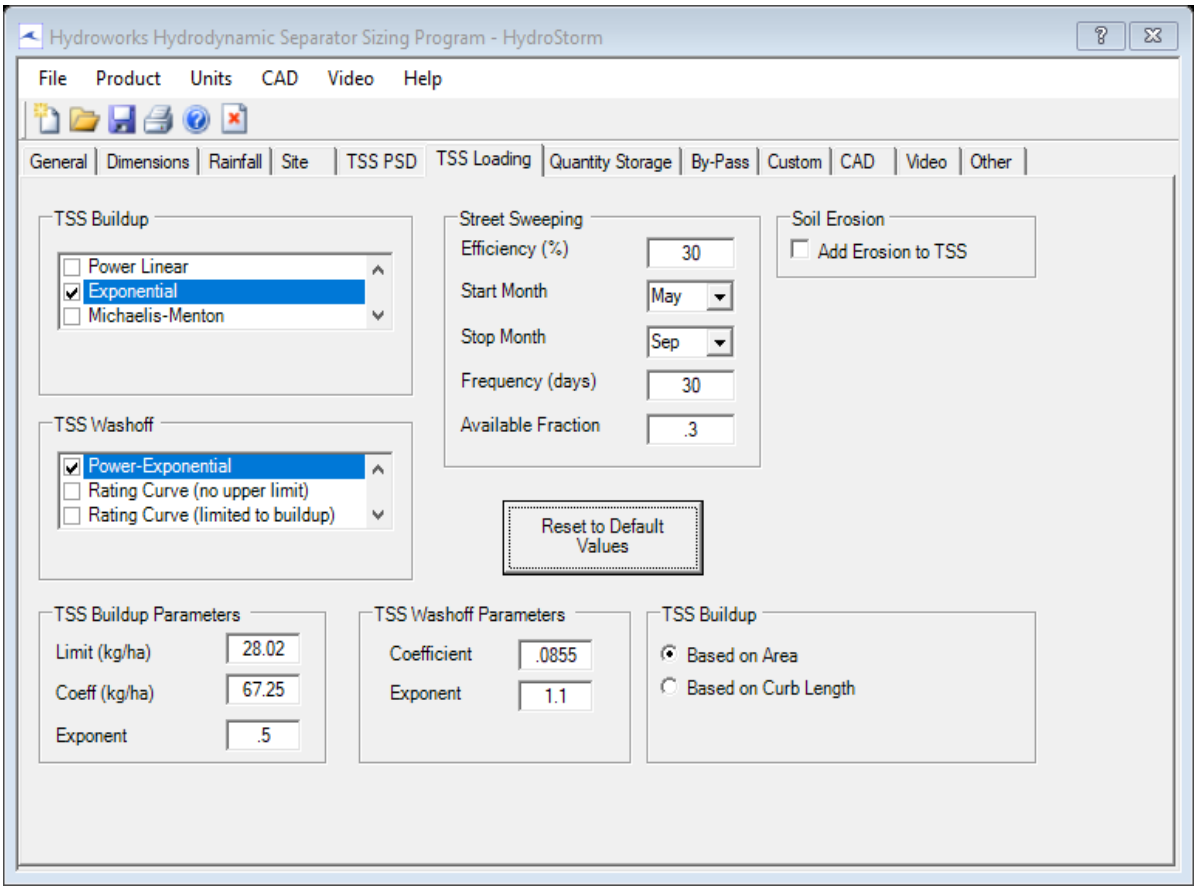
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 3	0.91	1.07	185	0.4	0.7
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

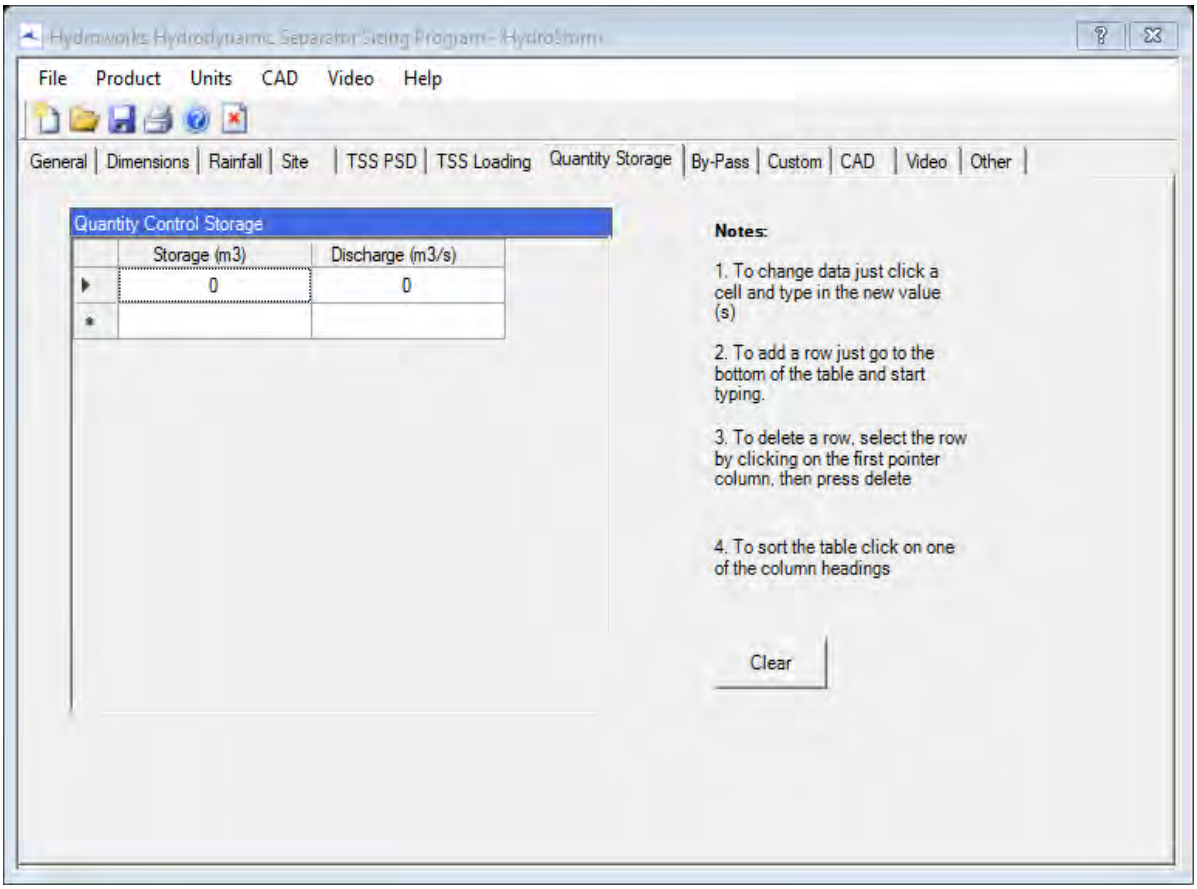
Generic HS 10 CAD Drawing



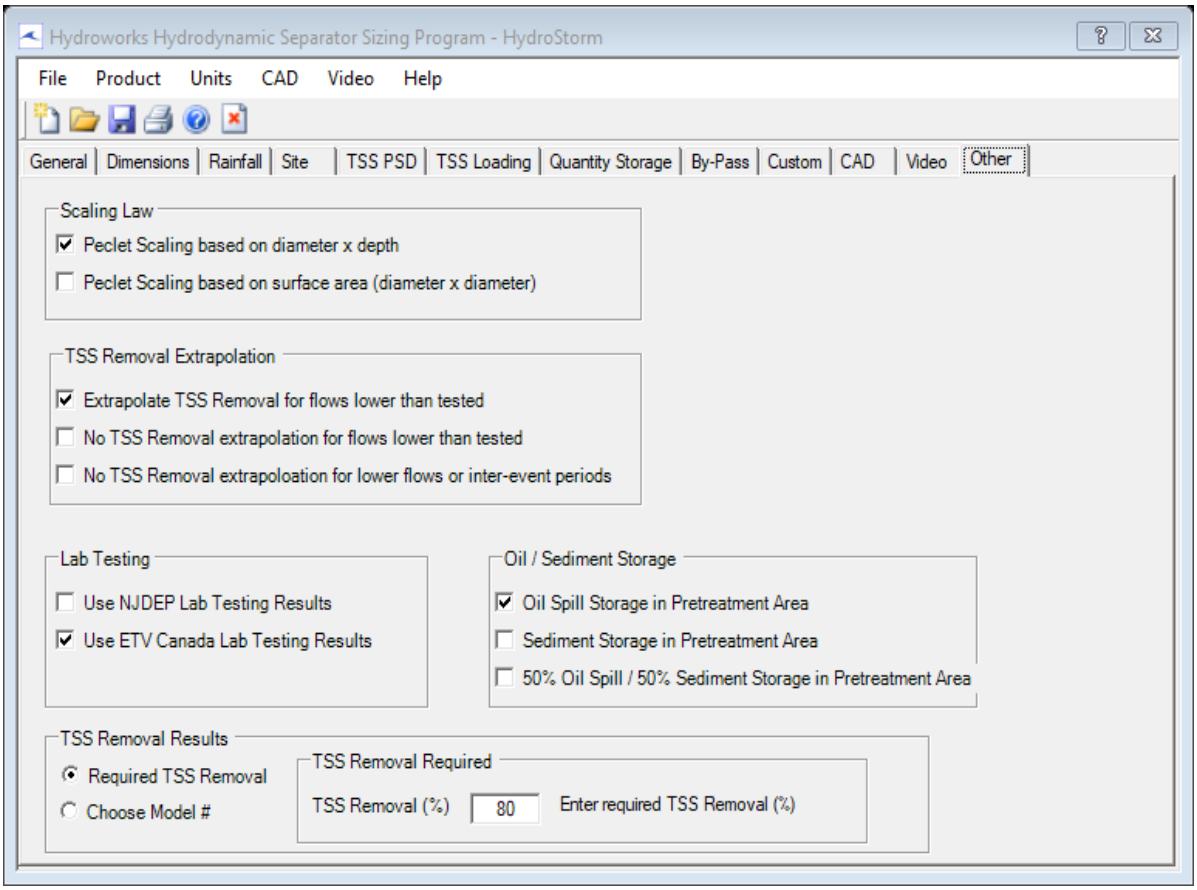
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

None

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www.hydroworks.com

APPENDIX B: STORM SEWER DESIGN INFORMATION

S:\20036\WORKING_Current\20036-STM DRAINAGE AREA.dwg

FORMER
LAND FILL

CORRIDOR

Ex. VACANT LANDS

HICKORY LANE

NORTH SERVICE ROAD

MH11 TO BE AN
OIL/GRIT SEPERATOR

ST1 0.07 ha
ST2 0.08 ha
ST3 0.08 ha
ST4 0.17 ha
ST5 0.09 ha
ST6 0.59 ha
ST7 0.11 ha
ST8 0.08 ha
ST9 0.789 ha

CB1
DI-1
DI-3
CBMH1
CBMH2
CBMH4
CBMH5
CBMH8
CBMH9
MH3
MH6
MH10
MH12
HW1
HW2

10m SETBACK OF
SIGNIFICANT WOODLOT

LIMITS OF SIGNIFICANT WOOD LOT AS
STAKED BY GEOPROCESS

Ex. HYDRO

LEGEND

ST1 / 0.77 ha — DRAINAGE AREA ID NUMBER / AREA

DRAINAGE AREA BOUNDARY

LIMITS OF SIGNIFICANT WOODLOT

FIGURE B.1
STORM DRAINAGE AREAS PLAN
SCALE: 1:1500

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

5/22/2024 3:13:22 PM — Blair Henderson

Project No. 20036
Sheet No. 1
Checked by:
Computed by: BH
Date: May 2024

CITY OF BURLINGTON

STORM SEWER DESIGN

Project: King Paving Asphalt Plant - North Service Raod

$$i = \frac{A}{(T+B)^C}$$

	100 Yr	*5 Yr*
A=	1281.34	802.04
B=	5.00	5.00
C=	0.761	0.764
n=	0.013	0.013

Area No.	Street Name	From MH	To MH	Area [ha]	C	A*C	Cumulative A*C	Time of Conc. [min]	Intensity [mm/hr]	Qpeak [m³/s]	Pipe Characteristcs					Travel Time [min]	Fraction Full [%]	Remarks
											Diameter [mm]	Slope [%]	Length [m]	Capacity [m³/s]	Velocity [m/s]			
Areas Draining to North SWM Facility Inlet																		
ST1		CB1	CBMH1	0.09	0.90	0.08	0.59	10.00	101.31	0.166	**375**	**1.82%**	**35.5**	0.247	2.16	0.27	67%	
ST2		CBMH1	CBMH2	0.08	0.90	0.07	0.66	10.27	99.92	0.184	**450**	**1.20%**	**25.5**	0.326	1.98	0.21	56%	
ST3		CBMH2	MH3	0.08	0.90	0.07	0.73	10.49	98.87	0.202	**450**	**3.50%**	**18.5**	0.556	3.39	0.09	36%	
---		MH3	CBMH4	0.00	0.90	0.00	0.73	10.58	98.43	0.201	**450**	**5.00%**	**14.5**	0.665	4.05	0.06	30%	
ST4		CBMH4	CBMH5	0.17	0.90	0.15	0.89	10.64	98.14	0.242	**450**	**1.00%**	**34.0**	0.297	1.81	0.31	81%	
ST5		CBMH5	MH6	0.09	0.90	0.08	0.97	10.95	96.66	0.260	**450**	**1.00%**	**13.5**	0.297	1.81	0.12	87%	
---		MH6	MH11	0.00	0.90	0.00	0.97	11.08	96.09	0.258	**450**	**1.00%**	**13.0**	0.297	1.81	0.12	87%	
								11.19										
ST6		DI.1	MH7	0.59	0.90	0.53	0.59	10.00	**163.18**	0.267	**525**	**1.00%**	**4.5**	0.449	2.01	0.04	60%	100-Yr Storm
---		MH7	CBMH8	0.00	0.90	0.00	0.59	10.04	**162.87**	0.267	**525**	**1.00%**	**60.5**	0.449	2.01	0.50	59%	100-Yr Storm
ST7		CBMH8	CBMH9	0.11	0.90	0.10	0.69	10.54	**158.85**	0.304	**525**	**1.00%**	**48.0**	0.449	2.01	0.40	68%	100-Yr Storm
---		CBMH9	MH10	0.08	0.90	0.07	0.76	10.94	**155.82**	0.329	**525**	**1.00%**	**16.5**	0.449	2.01	0.14	73%	100-Yr Storm
ST7		MH10	MH11	0.00	0.90	0.00	0.76	11.07	**154.80**	0.327	**525**	**1.00%**	**28.0**	0.449	2.01	0.23	73%	100-Yr Storm
---		MH11	HW1	0.00	0.00	0.00	1.73	11.31	**153.12**	0.735	**675**	**1.56%**	**5.5**	1.095	2.97	0.03	67%	100-Yr Storm
ST9		DI.2	MH13	0.79	0.46	0.36	0.36	10.00	**163.18**	0.164	**450**	**0.50%**	**31.0**	0.210	1.28	0.40	78%	100-Yr Storm
---		MH13	HW2	0.00	0.00	0.00	0.36	10.40	**159.92**	0.161	**450**	**0.50%**	**5.5**	0.210	1.28	0.07	77%	100-Yr Storm

APPENDIX C: FIRE FLOW CALCULATIONS

HYDRANT FLOW TEST RESULTS

AQUACOM CONTRACTING
81 Todd Road Suite 202 Georgetown Ont. L7G 4R8
(o) 905-467-5853 (C) 905-971-9956 (e) mark@aquacom.ca

SITE NAME	KING PAVING
TEST DATE TIME	MONDAY 26 JULY 2021 @ 900
SITE ADDRESS	NORTH SERVICE ROAD, BURLINGTON
TECHNICIANS	MARC COULTER & JEFF DAM
COMMENTS	MUNICIPAL HYDRANTS

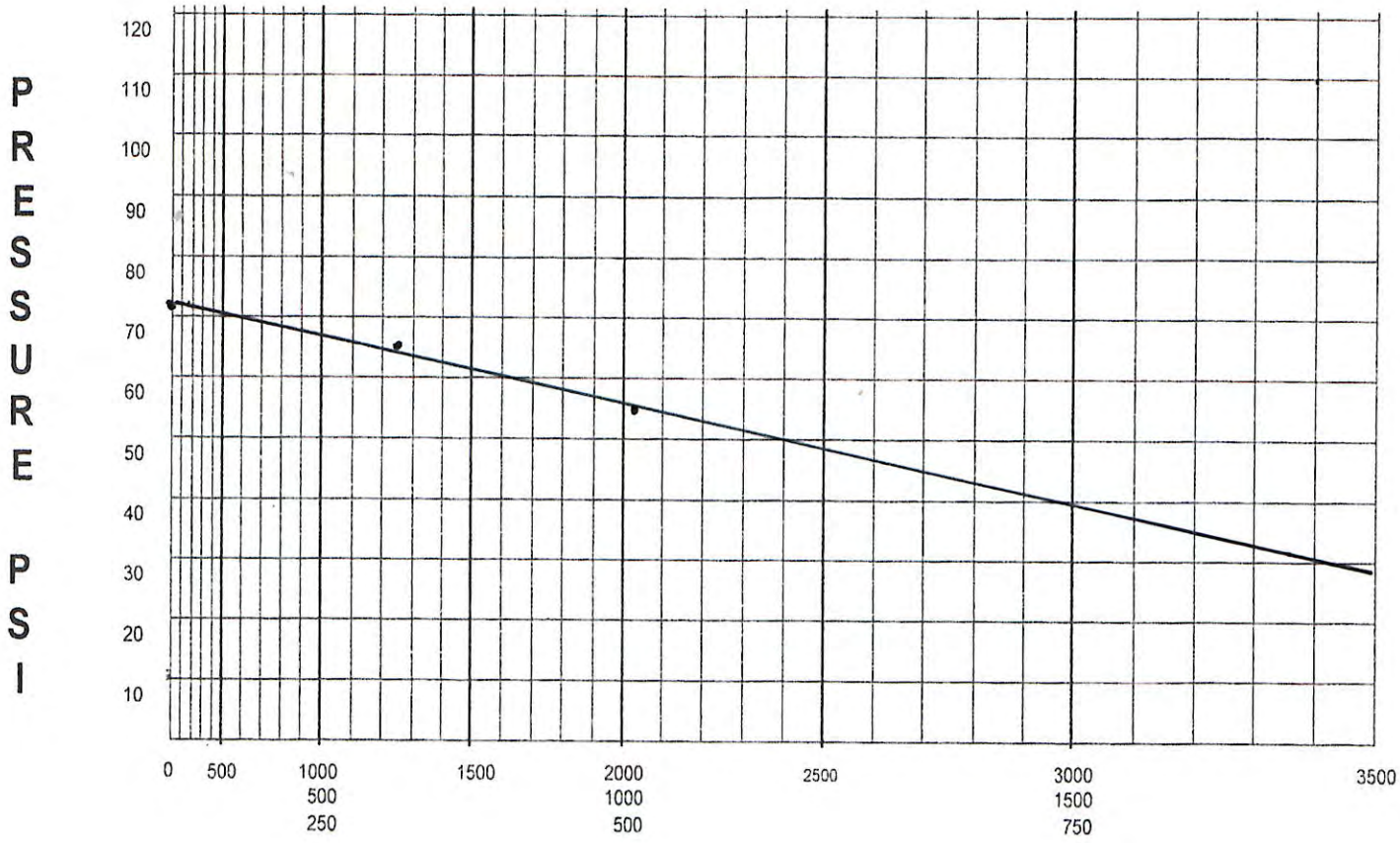
LOCATION OF FLOW HYDRANT

NSR 1ST WEST OF HICKORY LANE

LOCATION OF RESIDUAL HYDRANT

NSR 2ND WEST OF HICKORY LANE

# OUTLETS	SIZE INCHES	PITO PSI	FLOW USGPM	RESIDUAL PSI	STATIC PSI	PIPE DIA. MM
ONE	2.50	64	1344	67	71	300MM
TWO	2.50	36	2014	55		
		THEORETICAL	3766	20	TEST #	ONE
NOZZLE COEFF.		.90				



81 Todd Road Suite 202 Georgetown Ont. L7G 4R8

(o) 905-467-5853 (c) 905-971-9956 (e) mark@aquacom.ca

HYDRANT FLOW TEST REPORT

		HYDRANT MAKE	SEC. VALVE CONDITION	TECH.	TIME	STATIC PSI	PITO 1-2.50" PSI	FLOW 1-2.50" US GPM	RESIDUAL 1-2.50" PSI	PITO 2-2.50" PSI	FLOW 2-2.50" US GPM	RESIDUAL 2-2.50" PSI	COLOUR CODE
F1	NSR 1ST WEST OF HICKORY LANE	CV	OK/OPEN	MC			64	1344		36	2014		BLUE
R1	NSR 2ND WEST OF HICKORY LANE	CV	OK/OPEN	JD		71			67			55	
F2													
R2													
F3													
R3													
F4													
R4													
F5													
R5													

CUSTOMER	LOCATION	CONTACTS ON SITE
S LLEWELLYN & ASSOCIATES	NORTH SERVICE ROAD	REGION OF HALTON OPERATOR
KING PAVING	CITY OF BURLINGTON	

FIRE FLOW CALCULATIONS

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Project Number: **20036**
Project Name: **291 North Service Road, Burlington**
Date: **2024-05-10**

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 2020).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A} \qquad \textbf{(1)}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for Type V wood frame construction (structure essentially all combustible)
= 0.8 for Type IV-A mass timber construction (encapsulated mass timber)
= 0.9 for Type IV-B mass timber construction (rated mass timber)
= 1.0 for Type IV-C mass timber construction (ordinary mass timber)
= 1.5 for Type IV-D mass timber construction (un-rated mass timber)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

Building / Location	Building Area: Footprint Area (m^2)	Building Area: # of Storeys	Building Area: **Total GFA (m^2)**	Type of Construction	(1) *Fire Flow "F"*: (l/min)	(1) *Fire Flow "F"*: (l/s)	(2) *Occupancy*: %	(2) *Occupancy*: Adjustment (l/min)	(2) *Occupancy*: **Adjusted Fire Flow (l/min)**	(3) *Sprinkler*: %	(3) *Sprinkler*: Adjustment (l/min)	(4) *Exposure*: %	(4) *Exposure*: Adjustment (l/min)	**Final Adjusted Fire Flow**: **(l/min)**	**Final Adjusted Fire Flow**: **(l/s)**
Motor Control Building	**46.0**	**2**	**92**	**1.0**	2000	33.3	**25**	500.0	**2500.0**	**0**	0.0	50	1250.0	**4000**	**67**
Control Building	**81.0**	**2**	**162**	**1.5**	4000	66.7	**25**	1000.0	**5000.0**	**0**	0.0	45	2250.0	**7000**	**117**

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

Motor Control Bulding

Side	Exposure (m)	Charge (%)
North =	**0 to 3m**	**25**
South =	**> 30m**	**0**
East =	**0 to 3m**	**25**
West =	**> 30m**	**0**
Total Expoure =		***50***

Control Building

Side	Exposure (m)	Charge (%)
North =	**0 to 3m**	**25**
South =	**> 30m**	**0**
East =	**> 30m**	**0**
West =	**3.1m to 10m**	**20**
Total Expoure =		***45***

(4) Exposure

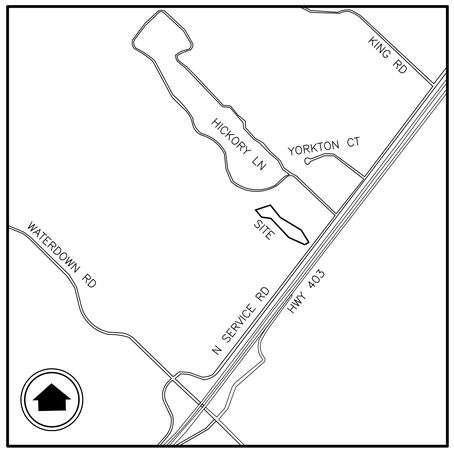
0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
> 30m	0%	exceed 75%

APPENDIX D: ENGINEERING DRAWINGS

KING PAVING & CONSTRUCTION COMPANY

PROPOSED ASPHALT PLANT

291 NORTH SERVICE ROAD
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.



DRAWING INDEX:

Sheet Number	Sheet Title
C–101	General Notes and Details
C–102	Site Layout Plan
C–103	Site Grading Plan – Sheet 1 of 4
C–104	Site Grading Plan – Sheet 2 of 4
C–105	Site Grading Plan – Sheet 3 of 4
C–106	Site Grading Plan – Sheet 4 of 4
C–107	Site Servicing Plan – Sheet 1 of 2
C–108	Site Servicing Plan – Sheet 2 of 2
C–109	Preliminary Road Widening Plan
C–110	Preliminary Plan and Profile

REISSUED FOR SITE PLAN APPROVAL- MAY 2024

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631–6978
website: www.sla.on.ca
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

GENERAL NOTES:

1. CONSTRUCTION OF ALL WATERMAIN SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE CITY OF BURLINGTON, THE REGIONAL MUNICIPALITY OF HALTON AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD). THE CITY AND THE REGION'S DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. ONTARIO PROVINCIAL STANDARD DRAWINGS TO BE READ IN CONJUNCTION WITH THE REGION OF HALTON REVISIONS.
3. RELOCATION OF EXISTING SERVICES AND/OR UTILITIES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
4. THE CONTRACTOR SHALL OBTAIN ALL PERMITS FOR CONSTRUCTION.
5. FOR ALL SEWERS AND WATERMAIN IN FILL SECTIONS, THE COMPACTION SHALL BE VERIFIED PRIOR TO LAYING OF PIPE.
6. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE REGIONAL ENGINEER, CITY OF BURLINGTON OR THE ENGINEER.
7. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% SPD.
8. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BT THE ENGINEER.
9. TREE PROTECTION PROCEDURES TO BE IMPLEMENTED IN ACCORDANCE WITH CITY OF BURLINGTON STANDARDS.
10. THESE PLANS ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SEALED BY THE ENGINEER AND INDICATED ISSUED FOR CONSTRUCTION ON THE DRAWING.
11. THESE PLANS ARE NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF S. LLEWELLYN AND ASSOCIATES LIMITED.
12. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS ARE FURNISHED AS THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS HE SEES FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR ITS ACCURACY AND /OR SUFFICIENCY. THE CONTRACTOR SHALL ASSUME LIABILITY FOR ANY DAMAGE TO EXISTING WORKS.
13. EXISTING TOPOGRAPHIC INFORMATION TAKEN FROM INFORMATION PROVIDED BY KING PAVING CONSTRUCTION COMPANY, DATED APRIL 2020 AND APPENDED WITH ADDITIONAL TOPOGRAPHIC AND LEGAL INFORMATION PROVIDED BY A.T. MCLAREN LIMITED, DATED JANUARY 2021, AND THE REGION OF HALTON.
14. SITE PLAN INFORMATION PROVIDED BY KING PAVING AND CONSTRUCTION COMPANY RECEIVED MAY 2024.
15. THESE PLANS TO BE READ IN CONJUNCTION WITH THE STORM WATER MANAGEMENT (SWM) REPORT PREPARED BY S. LLEWELLYN AND ASSOCIATES LIMITED, DATED MAY 2024.
16. THIS PLAN TO BE USED FOR SERVICING AND GRADING ONLY, FOR BUILDING LOCATION REFER TO TO THE SITE PLAN.
17. MUNICIPAL APPROVAL OF THESE DRAWINGS IS FOR MATERIAL AND COMPLIANCE WITH CITY OF BURLINGTON AND PROVINCIAL SPECIFICATIONS AND STANDARDS ONLY. APPROVAL AND INSPECTION OF THE WORKS BY THE CITY OF BURLINGTON STAFF DOES NOT CERTIFIY THE LINE AND GRADE OF THE WORKS NOR RELIEVE THE CONTRACTOR OF CERTIFICATION OF ALL WORKS BY THE OWNER'S ENGINEER.
18. ALTERNATE MATERIALS MAY BE ACCEPTABLE PROVIDED WRITTEN APPROVAL HAS FIRST BEEN OBTAINED FROM THE CITY OF BURLINGTON AND THE THE ENGINEER.
19. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S BONDED CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS NORMALLY REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS, BUT NOT LIMITED TO THE FOLLOWING:
   - ROAD CUT PERMITS
   - SEWER PERMITS
   - APPROACH APPROVAL PERMITS
   - RELOCATION OF SERVICES
   - COMMITTEE OF ADJUSTMENT
   - ENCROACHMENT AGREEMENTS
22. PRIOR TO CONSTRUCTION THE CONTRACTOR MUST:
   i. CHECK AND VERIFIY ALL DIMENSIONS AND EXISTING ELEVATIONS WHICH INCLUDE BUT ARE NOT LIMITED TO THE BENCHMARK ELEVATIONS, EXISTING SERVICE CONNECTIONS, EXISTING INVERTS AND REPORT FINDING IN WRITING TO THE ENGINEER.
   ii. OBTAIN ALL UTILITY LOCATES AND REQUIRED PERMITS AND LICENSES.
   iii. VERIFY ALL FINISHED FLOOR ELEVATIONS AND BASEMENT FLOOR ELEVATIONS WHICH MY APPEAR ON THESE PLANS COMPLY WITH THE FINAL ARCHITECTURAL DRAWINGS.
   iv. CONFIRM ALL DRAWINGS USED FOR CONSTRUCTION ARE OF THE MOST RECENT REVISION.
   v. NOTIFY THE ENGINEER OF THE PROPOSED CONSTRUCTION SCHEDULE FOR COORDINATION OF NECESSARY INSPECTIONS.
23. **THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING THE ENGINEER 48 HOURS PRIOR TO THE COMMENCING SITE WORKS TO ARRANGE FOR INSPECTION. THE ENGINEER SHALL DETERMINE THE EXTENT OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF THE UNDERGROUND SERVICE INSTALLATION AS MANDATED BY THE ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO MAKE SUITABLE ARRANGEMENTS FOR INSPECTION WILL LEAD TO POST CONSTRUCTION TESTING AND INSPECTION AS DETERMINED BY THE ENGINEER, THE COSTS OF WHICH INCLUDING ANY DELAYS IN CONSTRUCTION SHALL BE BOURNE BY THE CONTRACTOR. FULL PAYMENT FOR UN-INSPECTED WORKS MAY BE WITHHELD UNTIL THE COMPLETION OF THE POST CONSTRUCTION INSPECTION AND TESTING TO THE SATISFACTION OF THE ENGINEER.**
24. INSPECTION BY THE OWNER'S ENGINEER IS FOR CERTIFICATION AND GENERAL CONFORMANCE PURPOSES AND DOES NOT CERTIFY LINE AND GRADE OR IMPLY AN ASSURANCE OF QUALITY CONTROL. THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THE INSTALLATION OF THE WORKS TO PROPER LINE, GRADE AND QUALITY TO CURRENT INDUSTRY STANDARDS.
25. ANY UTILITY RELOCATIONS AND RESTORATIONS DUE TO THE DEVELOPMENT TO BE UNDERTAKEN AT THE EXPENSE OF THE OWNER/APPLICANT AND SHALL BE COORDINATED BY THE CONTRACTOR.
26. ALL RESTORATIONS AND RECONSTRUCTIONS SHALL BE TO COMPLETED TO MATCH EXISTING CONDITIONS OR BETTER AND ARE TO BE PERFORMED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF BURLINGTON.
27. SERVICING CONTRACTOR TO MAINTAIN A "CONFINED TRENCH CONDITION" IN ALL SEWER AND WATERMAIN INSTALLATION TRENCHES.
28. THE SITE SERVICING CONTRACTOR SHALL TERMINATE ALL SERVICES 1.0m FROM THE BUILDING FACE.
29. NO BLASTING WILL BE PERMITTED.

ROADWORKS:

1. APPROVED FILL, FREE OF DELETERIOUS AND ORGANIC MATERIAL AND BOULDERS SHALL BE COMPACTED TO A DRY DENSITY NOT LESS THAN 95% THAN THE STANDARD PROCTOR DENSITY. AFTER COMPACTION, SOIL DENSITY TESTS SHALL BE CONDUCTED TO ENSURE ADEQUATE COMPACTION AND STABILITY OF THE FILL AND TEST RESULTS SHALL BE SUBMITTED TO THE ENGINEER.
2. SUBGRADE TO BE PROOF ROLLED PRIOR TO PLACEMENT OF SUB BASE. UNSUITABLE MATERIAL TO BE REMOVED AND REPLACED WITH SELECT FILL OR GRANULAR "B" AND COMPACTED TO 98% SPD. GEOTECH ENGINEER TO CONFIRM THE VOLUME OF THE UNSUITABLE MATERIALS.
3. ASPHALTIC CONCRETE TO BE COMPACTED TO 97% MARSHALL DENSITY.
4. LANDSCAPED AREAS TO BE RESTORED WITH A MINIMUM 100mm OF SELECT TOPSOIL AND HYDRO SEEDED PER OPSS 804 TO THE SATISFACTION OF THE REGION OF HALTON.
5. MANHOLE FRAMES AND COVERS AND WATER VALVE BOXES SHALL BE SET FLUSH WITH BASE COURSE ASPHALT AND ADJUSTED TO FINAL GRADE AFTER INSTALLATION OF SURFACE ASPHALT AS PER CITY OF BURLINGTON STANDARD DRAWINGS S-130.
6. TRAFFIC CONTROL SHALL BE MAINTAINED AT ALL TIMES FOR WORKS ON EXISTING ROADWAYS TO THE SATISFACTION OF THE DIRECTOR OF ENGINEERING. THE EXPENSE FOR THE ERECTION OF SIGNS, DELINEATORS AND OTHER TRAFFIC CONTROL DEVICES SHALL BE BORNE BY THE CONTRACTOR.

GRADING NOTES

1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SODDED SLOPES (MIN. 3H TO 1V) AND/OR RETAINING WALLS AS SPECIFIED.
2. ALL RETAINING WALLS, WALKWAYS, CURBS, ETC., SHALL BE PLACED A MIN. OF 0.45m OFF THE PROPERTY LINE. ALL WALLS 1.0M OR HIGHER SHALL BE DESIGNED BY A P.ENG.
3. RETAINING WALLS 0.6m IN HEIGHT OR GREATER REQUIRE CONSTRUCTION OF A FENCE OR GUARD RAIL AT THE TOP OF THE REAR OF THE WALL. GUARDS FOR RETAINING WALLS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF EXTERIOR GUARDS AS CONTAINED IN THE ONTARIO BUILDING CODE.
4. TOP OF FOUNDATION WALLS FOR BUILDINGS SHALL BE 150mm (MIN) ABOVE FINISHED GRADE.
5. IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE DEVELOPMENT WHICH ARE NOT OWNED BY THE APPLICANT, THEN THE APPLICANT MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER TO ALLOW THE APPLICANT TO GRADE ON THE ADJACENT LANDS, OTHERWISE RETAINING WALLS MUST BE USED.
6. THE WRITTEN PERMISSION REQUIRED FROM THE ADJACENT LANDOWNER SHALL BE OBTAINED PRIOR TO ENTERING THE LANDS. SHOULD PERMISSION NOT BE OBTAINED OR IS WITHDRAWN PRIOR TO COMMENCING THE WORK, THEN THE APPLICANT SHALL LIMIT HIS ACTIVITIES TO THE LIMITS OF THE DEVELOPMENT SITE.
7. ANY CHANGES IN GRADES AND CATCH BASINS REQUIRE THE APPROVAL OF THE ENGINEERING CONSULTANT AND THE CITY'S MANAGER OF DEVELOPMENT ENGINEERING.

SILTATION AND EROSION CONTROL

1. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED.
2. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL AS DIRECTED AND TO THE SATISFACTION OF THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.
3. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER, THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.

SANITARY SEWERS:

1. CONSTRUCTION OF ALL WATERMAIN SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE REGION MUNICIPALITY OF HALTON AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD). THE REGIONS DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. SANITARY SEWERS SHALL BE PVC. PVC PIPE IS TO BE BELL AND SPIGOT AND COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35.
3. MINIMUM BEDDING REQUIREMENTS FOR ALL SANITARY SEWER MAINS AND RELATED CONNECTIONS IN A SINGLE TRENCH SHALL BE CLASS B GRANULAR BEDDING AS PER OPSD 802.010 UNLESS OTHERWISE NOTED.
4. SANITARY SEWER MANHOLES FRAME AND COVER AS PER OPSD 401.01.
5. ALL PVC LATERALS TO BE SDR 28 AND SHALL BE ANY COLOUR EXCEPT WHITE. MINIMUM SLOPE OF LATERAL TO BE 2.0%.
6. TAPPING AT EXISTING SANITARY MANHOLES SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
7. ALL SEWERS TO BE VIDEO INSPECTED.
8. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
9. ALL PVC SEWERS ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION. SANITARY SEWERS SHALL ALSO BE TESTED FOR LEAKAGE (LOW AIR PRESSURE). PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED.

STORM SEWERS:

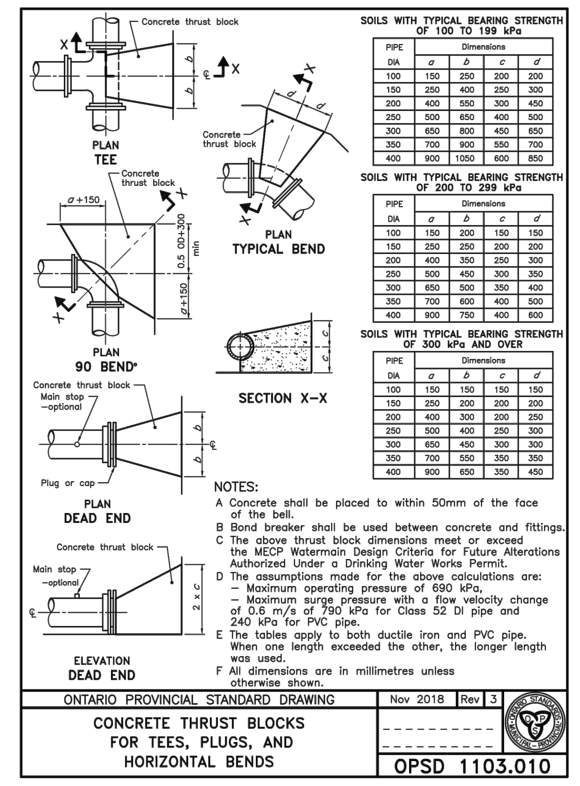
1. CONSTRUCTION OF ALL WATERMAIN SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE CITY OF BURLINGTON AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD). THE CITY'S DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. 250mm–525mm STORM SEWERS SHALL BE PVC, BELL AND SPIGOT AND SHALL COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35.
3. MINIMUM BEDDING REQUIREMENTS FOR ALL SINGLE STORM SEWER MAINS AND ALL RELATED CONNECTIONS SHALL BE HIGH PERFORMANCE CLEAR STONE (HL-8 GRADED) AS PER CITY OF BURLINGTON STANDARD DRAWINGS S-188.
4. STORM SEWER MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010. AND 701.011. FRAME AND COVER AS PER OPSD 401.01 TYPE A. FRAMES TO BE STAMPED "DANGER" AND "STORM".
5. CATCHBASINS SHALL BE IN ACCORDANCE WITH OPSD 705.010. CATCHBASIN MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010 AND 701.030 UNLESS OTHERWISE SPECIFIED. CATCHBASINS TO LOCATED WITHIN LANDSCAPED AREAS TO BE SUMPLESS. FRAME AND COVER FOR CATCHBASINS AND CATCHBASIN MANHOLES SHALL BE AS PER OPSD 400.100 (ROADS).
6. DOUBLE CATCH BASINS SHALL BE IN ACCORDANCE WITH OPSD 705.020 WITH 250mm DIA. LEAD. FRAMES AND COVERS TO BE OPSD 400.11 (ROADS) AND CITY OF BURLINGTON STD. S-176 (REAR YARDS). LEADS TO BE PVC SDR 35.
7. CATCH BASIN AND MANHOLE TOPS SHALL BE INITIALLY SET TO BASE COURSE ASPHALT ELEVATION AND ADJUSTED TO GRADE PRIOR TO PLACEMENT OF TOP LIFT OF ASPHALT.
8. ALL TRENCH EXCAVATIONS ARE TO BE BACKFILLED WITH SELECT NATIVE MATERIAL PLACED IN MAXIMUM 200mm LIFT THICKNESSES WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 95% SPD, UNLESS OTHERWISE SPECIFIED.
9. INVERTS OF ALL SWALES TO BE SODDED TO A MINIMUM WIDTH OF 3.0m. ALL OTHER DISTURBED AREAS TO BE TOPSOILED AND SEEDED. SOD SHALL BE #1 NURSERY LAID ON A MINIMUM OF 100mm OF TOPSOIL.
10. ALL SEWERS TO BE VIDEO INSPECTED.
11. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
12. ALL PVC SEWERS (SANITARY AND STORM) ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION. PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED.

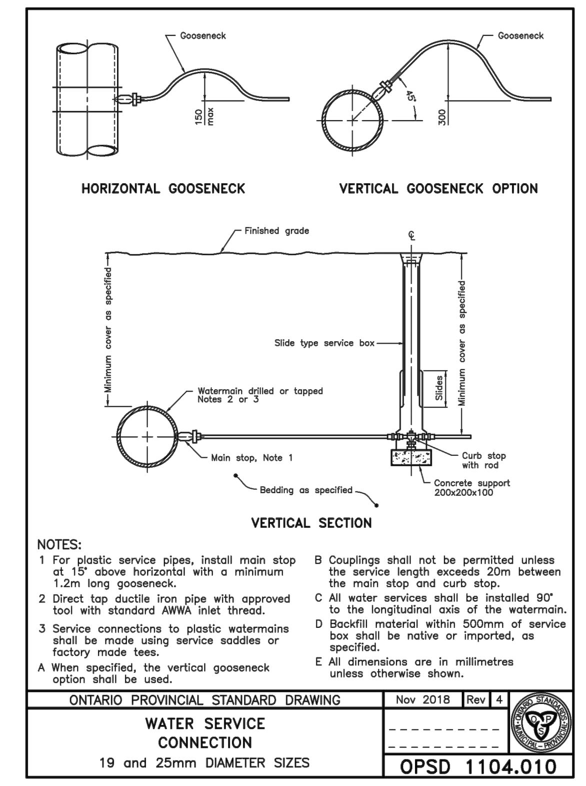
WATERMAINS:

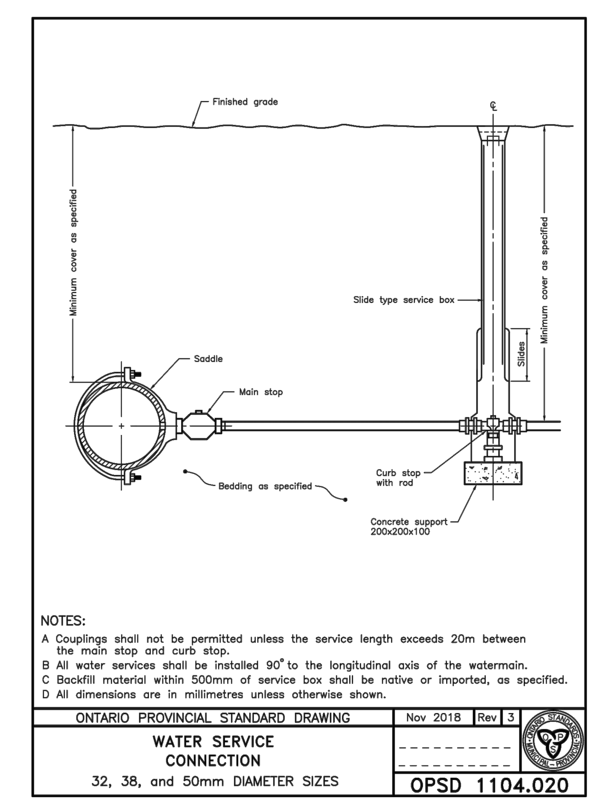
1. CONSTRUCTION OF ALL WATERMAIN SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE REGION MUNICIPALITY OF HALTON AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD). THE REGIONS DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. FLEXIBLE WATERMAIN PIPE UP TO 300mm DIAMETER TO BE P.V.C. DR-18 AND CONFORM TO A.W.W.A. C-900 WITH MECHANICAL JOINTS AS PER A.W.W.A. C-110, AND TO BE INSTALLED WITH A 10 GAUGE TRACER WIRE.
3. FLEXIBLE PIPE BEDDING TO BE OPSD 802.010 WITH COMPACTED GRANULAR B MATERIAL.
4. MINIMUM COVER TO BE 1.7m TO TOP OF PIPE.
5. DEFLECTION AT JOINTS NOT TO EXCEED 2.5 DEGREES AND SHALL BE EQUAL AT ALL JOINTS.
6. GATE VALVES AND BOXES FOR 150mm AND 250mm DIAMETER WATERMAINS AS PER A.W.W.A. STANDARD C-500 AND ARE TO OPEN TO THE LEFT (COUNTER CLOCKWISE).
7. HYDRANTS SHALL MEET THE REQUIREMENTS OF A.W.W.A. STANDARD C-502 AND SHALL BE SET IN ACCORDANCE WITH REGION OF HALTON, AND CITY OF BURLINGTON BUILDING DEPARTMENT STANDARDS, COMPLETE WITH STEAMER CONNECTIONS. THE 100mm STEAMER PORT SHALL FACE THE FIRE ROUTE AND SHALL BE UNOBSTRUCTED BY ANY PROPOSED LANDSCAPING.
8. ALL FITTINGS TO HAVE MECHANICAL RESTRAINTS THAT MEET UNI-B-13-92.
9. ALL TEMPORARY AND PERMANENT WATERMAIN PLUGS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH OPSD 1103.01.
10. TAPPING AT EXISTING WATERMAINS SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
11. ALL WATER CUSTOMERS SUPPLIED BY A WATERMAIN TO BE SHUT DOWN SHALL BE NOTIFIED BY THE CONTRACTOR AT LEAST 48 HOURS IN ADVANCE OF THE SHUT DOWN AS PER REGION OF HALTON SPECIFICATIONS. NOTIFICATION SHALL TAKE PLACE UNDER THE ENGINEER'S DIRECTION.
12. MINIMUM HORIZONTAL SEPERATION BETWEEN WATERMAINS (INCLUDING PRIVATE SERVICES) AND STORM AND SANITARY SEWERS SHALL BE 2.5m. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 150mm OVER AND 500mm UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
13. WATER SERVICE CONNECTIONS (25mm DIA. TYPE 'K' SOFT COPPER) AS PER OPSD 1104.01 AND OPSD 1104.02.

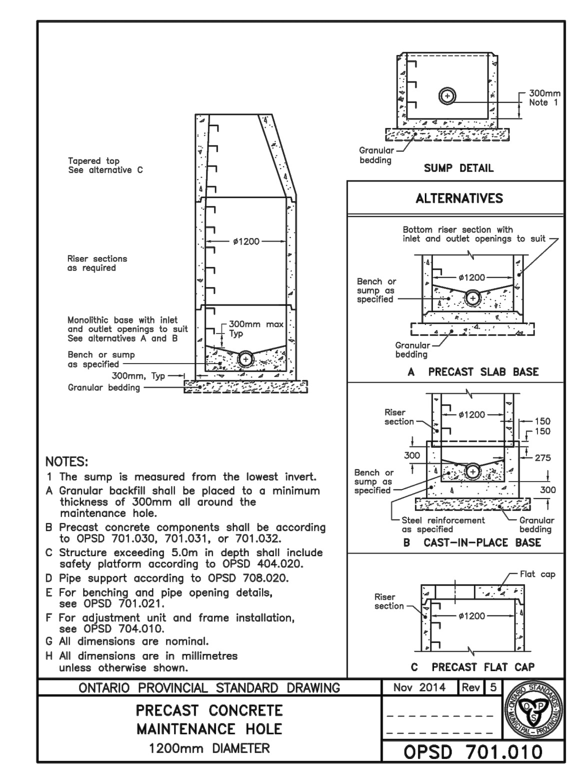
RESTORATIONS:

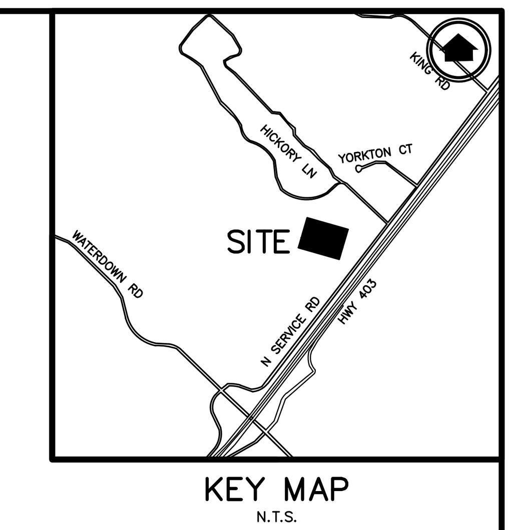
14. ALL TRENCH EXCAVATIONS WITHIN EXISTING ROAD ALLOWANCES SHALL BE AS BACKFILLED AS PER CITY OF BURLINGTON STANDARD DRAWING S-114 AND S-114A.
15. EXISTING PRIVATE FENCING IS TO BE MAINTAINED THROUGHOUT CONSTRUCTION. WHERE REMOVAL OR RELOCATION OF FENCING IS NECESSARY IT SHALL BE RESTORED OR REPLACED TO ORIGINAL CONDITIONS OR BETTER UNDER THE DIRECTION OF THE ENGINEER.
16. DAMAGED CURB, GUTTER AND SIDEWALK TO BE REPLACED WITH 28 MPa CONCRETE TO EXISTING CONDITIONS OR BETTER.
17. PAVEMENT SURFACE ON EXISTING NORTH SERVICE ROAD TO BE REPAIRED BY CONTRACTOR AT THEIR EXPENSE IF DAMAGED BY CONSTRUCTION TRAFFIC.



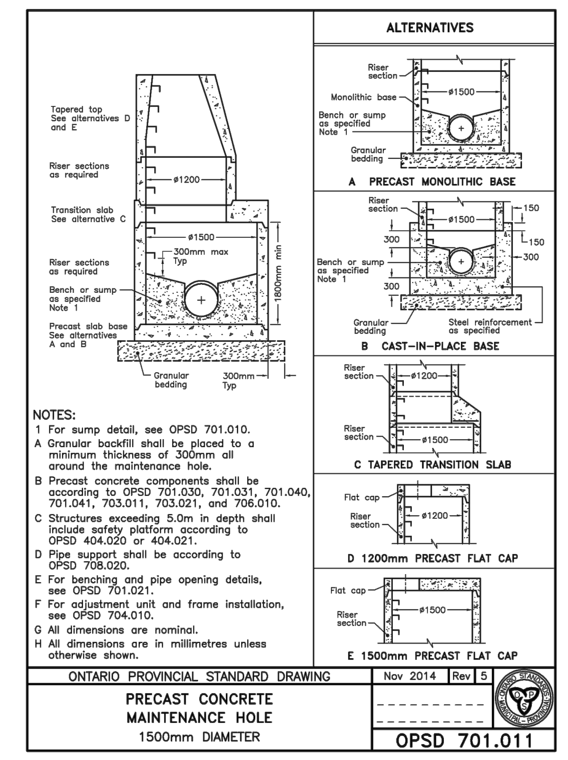


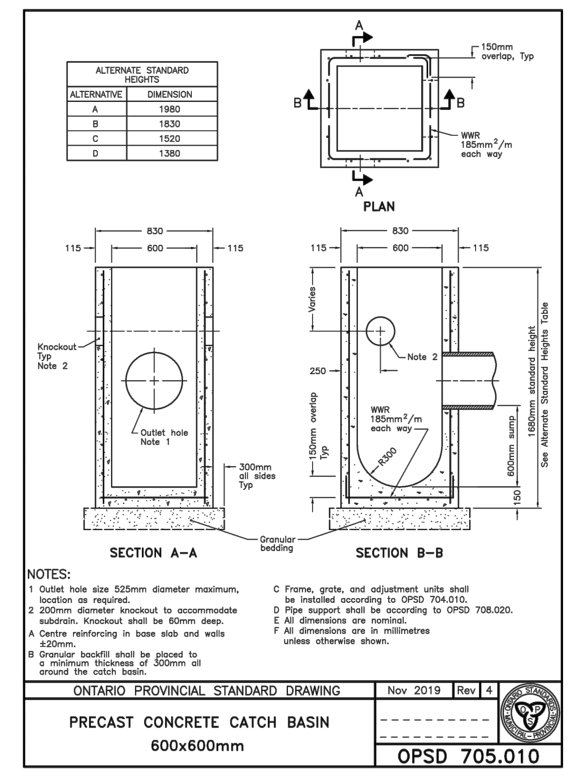


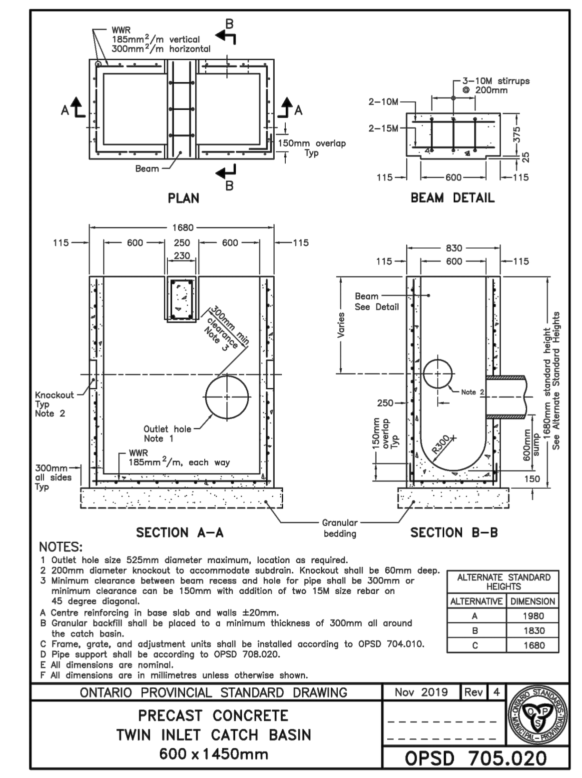


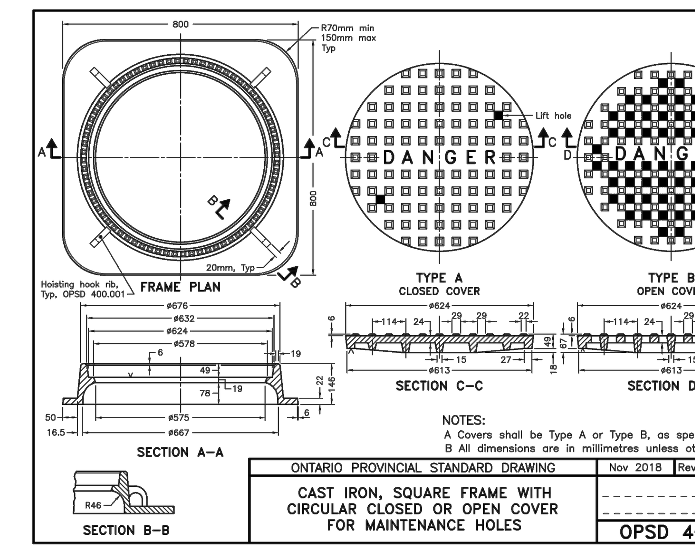


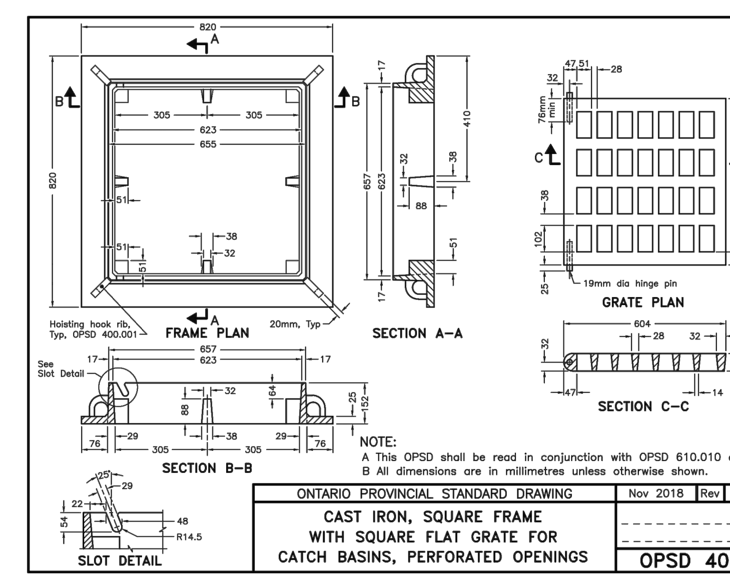
KEY MAP
N.T.S.

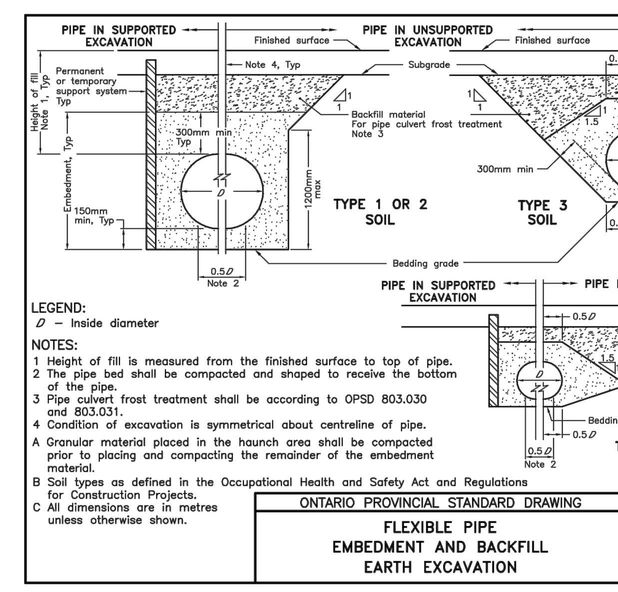


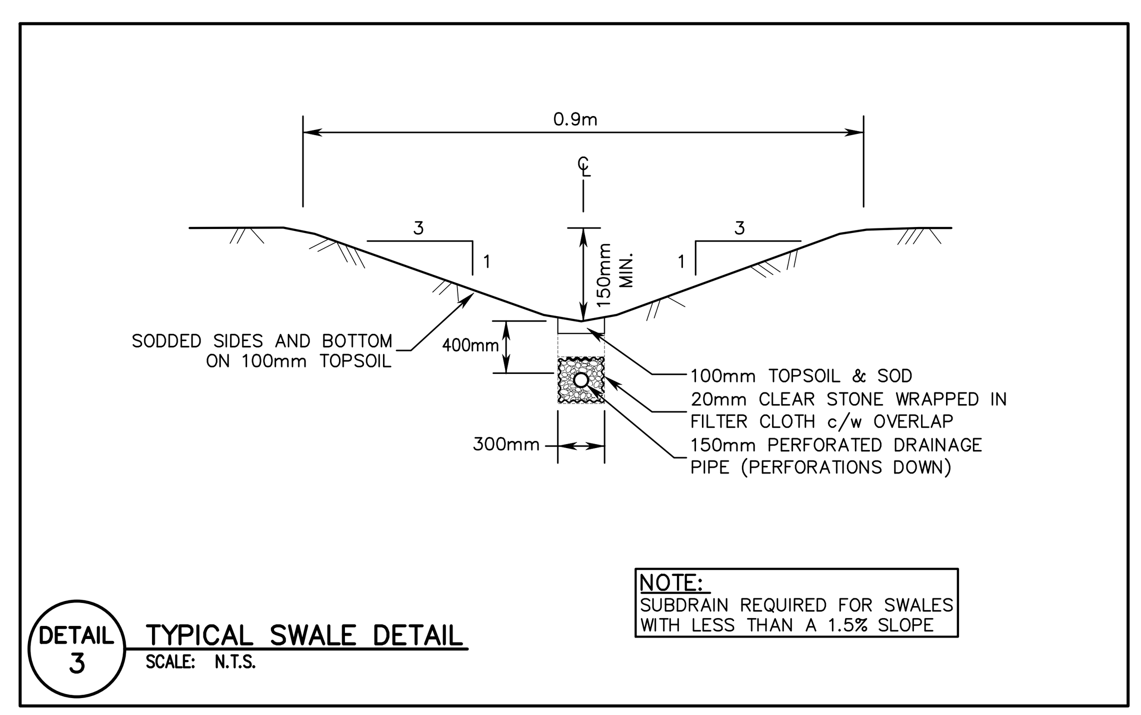




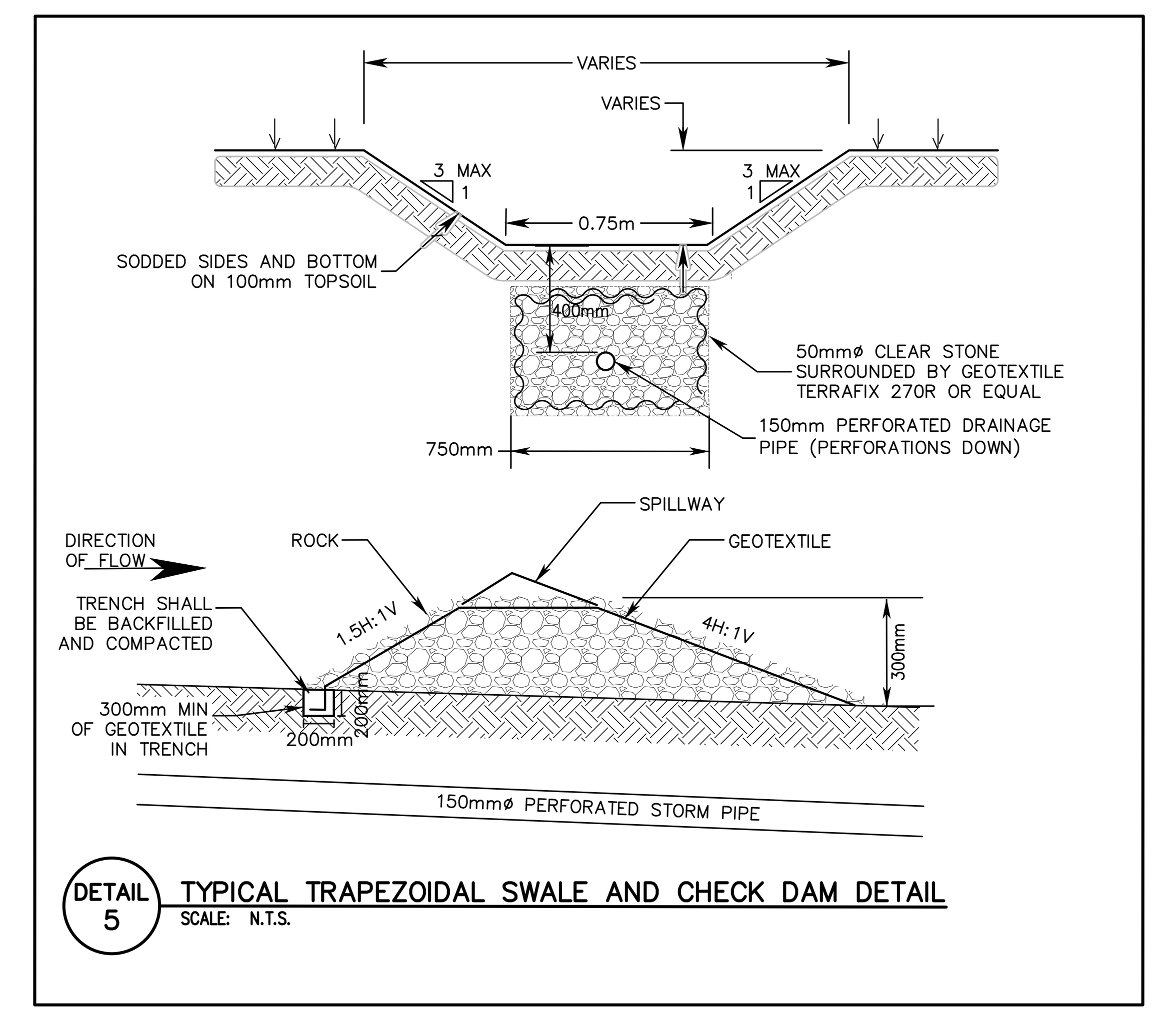








DETAIL 3 TYPICAL SWALE DETAIL
SCALE: N.T.S.



DETAIL 5 TYPICAL TRAPEZOIDAL SWALE AND CHECK DAM DETAIL
SCALE: N.T.S.

REGIONAL APPROVAL:
REGION DESIGN OF WATER &/OR WASTWATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANARDS & SPECIFICATIONS & LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED:________________ DATED: ________
INFRASTRUCTURE PLANNING & POLICY

The Applicant should be aware that the approval of the water system on private property is the responsibility of the Local Municipality. Regardless, the Applicant must ensure that the Region of Halton's standards and specifications are met. (The Water and Wastewater Linear Design Manual may be obtained thru the Data Management Group at 905-825-6032) Furthermore, all water quality tests must be completed to the Region of Halton's satisfaction, before the water supply can be turned on.

NOTES TO CONTRACTOR:
1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

NO.	DATE	BY	REVISIONS
7.0	MAY 2024	BH	REVISED PER UPDATED SITE PLAN
6.0	AUG. 2023	AS	REVISED PER DECEMBER 2021 COMMENTS
5.0	SEPT 2022	BH	ISSUED FOR HYDRO ONE REVIEW
4.0	MAY 2022	SD	AS PER ROAD WIDENING REQUIREMENTS
3.0	NOV. 2021	SJD	AS PER REVISED SITE LAYOUT PLAN

DESIGN	RB	CHK'D		DATE May 27, 2021
DRAWN	RB	CHK'D		

BENCH MARK NOTE:
UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

STAMP
LICENSED PROFESSIONAL ENGINEER
S.V. FRANKOVICH
5/22/2024
PROVINCE OF ONTARIO

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

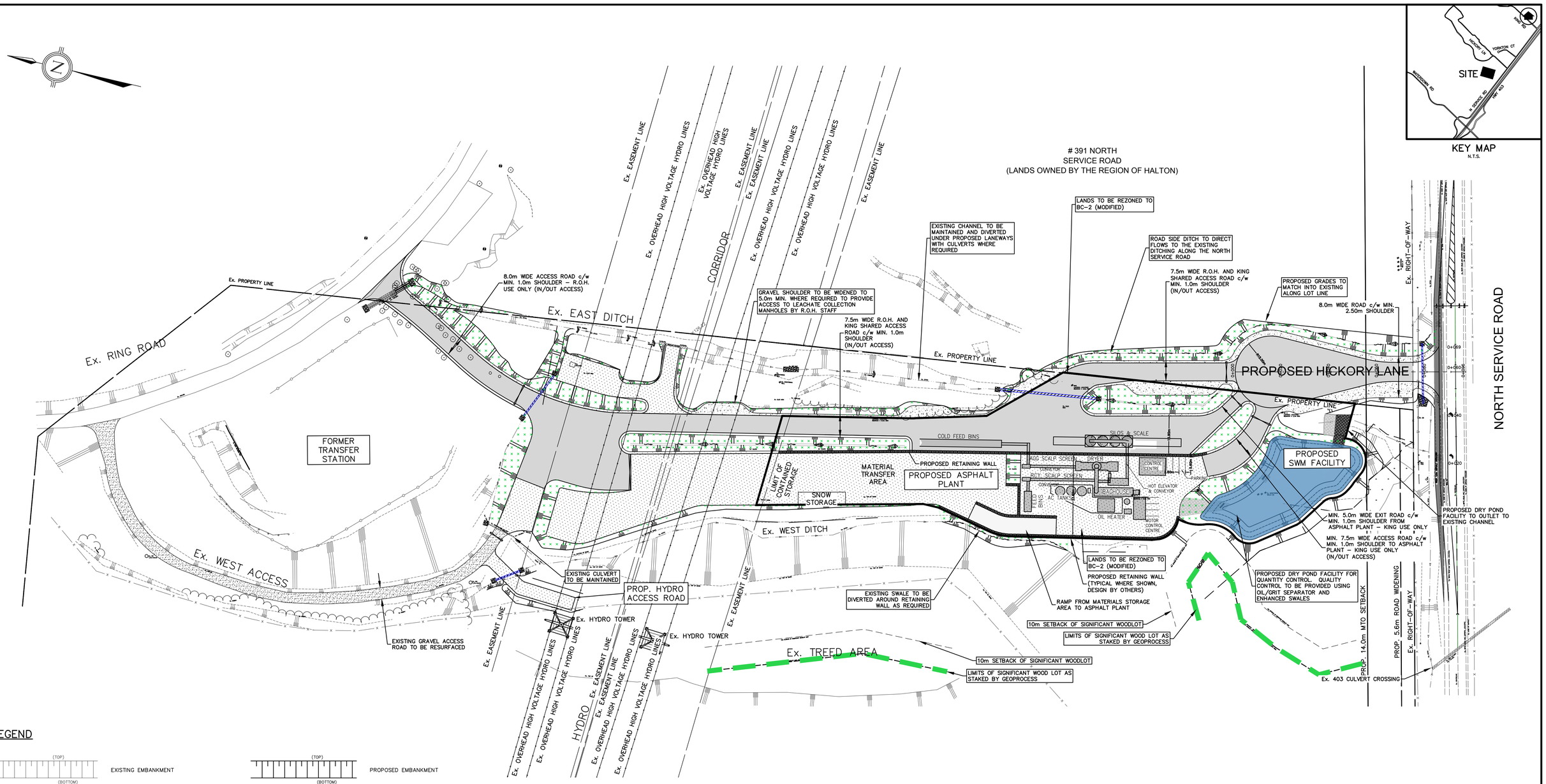
CLIENT
KING PAVING AND CONSTRUCTION COMPANY
3385 HARVESTER ROAD, BURLINGTON ONTARIO

PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
GENERAL NOTES AND DETAILS PLAN

PROJECT No. 20036
DRAWING No. C-101
SCALE

S:\20036\WORKING_Current\20036 – Title Sheet & General Notes.dwg
Plotted: May 22, 2024 3:34:23 PM By: Blair Henderson



LEGEND

- EXISTING EMBANKMENT
- EXISTING POST & WIRE FENCE
- EXISTING CHAIN LINK FENCE
- EXISTING HIGH VOLTAGE HYDRO LINES
- EXISTING OVERHEAD UTILITY LINES
- EXISTING DITCH/DRAINAGE CHANNEL
- EXISTING DRIPLINE/CANOPY LIMITS
- LIMITS OF SIGNIFICANT WOODLOT
- EXISTING RIP RAP
- PROPOSED EMBANKMENT
- PROPOSED GATE
- PROPOSED SWALE
- PROPOSED HDPE CULVERT, SIZE AS NOTED
- PROPOSED RETAINING WALL, TO BE DESIGNED BY OTHERS
- PROPOSED SWM POND AREA
- PROPOSED GRANULAR\RECYCLED ASPHALT SURFACE
- PROPOSED PAVED SURFACE
- PROPOSED LANDSCAPE AREA
- PROPOSED GRANULAR SHOULDERS
- PROPOSED RESURFACED GRANULAR ROAD
- PROPOSED CONCRETE PADS
- PROPOSED RIP RAP, SIZE AS NOTED

NOTES TO CONTRACTOR:

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DESIGN	RB	CHK'D		DATE
DRAWN	RB	CHK'D		May 27, 2021

BENCH MARK NOTE:
UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

STAMP
LICENSED PROFESSIONAL ENGINEER
S.V. FRANKOWICH
5/22/2024
PROVINCE OF ONTARIO

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT
KING PAVING AND CONSTRUCTION COMPANY
3385 HARVESTER ROAD, BURLINGTON ONTARIO

PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
OVERALL CONCEPT PLAN

PROJECT No. 20036
DRAWING No. C-102
SCALE 1:750 (0, 5, 15, 25, 50, 75)

S:\20036\WORKING_Current\20036-Overall Plans.dwg
Plotted: May 22, 2024 3:33:18 PM By: Blair Henderson

LEGEND

- EXISTING CONTOUR (0.50m INTERVAL)
- EXISTING GROUND ELEVATION
- EXISTING EMBANKMENT
- EXISTING POST & WIRE FENCE
- EXISTING CHAIN LINK FENCE
- EXISTING OVERHEAD HIGH VOLTAGE HYDRO LINES
- EXISTING OVERHEAD HYDRO/UTILITY LINES
- EXISTING DITCH/DRAINAGE CHANNEL
- EXISTING CONCRETE RETAINING WALL
- EXISTING GUIDERAIL
- EXISTING HYDRANT
- EXISTING MANHOLE
- EXISTING PEDESTAL/ ELECTRICAL BOX
- EXISTING HYDRO POLE
- EXISTING TREE/SHRUB
- EXISTING CULVERT
- EXISTING DRIPLINE/ CANOPY LIMITS
- LIMITS OF SIGNIFICANT WOODLOT
- EXISTING RIP RAP, SIZE AS NOTED
- EXISTING WET AREAS
- PROPOSED ELEVATION
  - EX = MATCH EXISTING ELEVATION
  - HP = HIGH POINT
  - TW = TOP OF WALL
  - BW = BOTTOM OF WALL
  - T/G = TOP OF GRATE
- PROPOSED EMBANKMENT
- PROPOSED SWALE/CHANNEL
- PROP. EMERGENCY OVERFLOW
- EX. OVERFLOW ROUTE
- DRAINAGE SPLIT
- PROPOSED BOSS 2000 CULVERT, SIZE AS NOTED
- PROPOSED RETAINING WALL, TO BE DESIGNED BY OTHERS
- PROPOSED STORM MANHOLE\ CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN\ DITCH INLET
- PROPOSED HEADWALL PER OPSD 804.030 c/w GRATE PER OPSD 804.050
- PROPOSED SANITARY MANHOLE
- PROPOSED WATER VALVE/ CURB STOP
- PROPOSED HYDRANT COMPLETE WITH BOLLARDS
- PROPOSED GATE
- PROPOSED ROCK CHECK DAM PER DETAIL

KEY MAP
N.T.S.

SITE
HWY 403
W. SERVICE RD
WATERCOURSE RD
YORKTON CT
MICHAEL LN

LIMIT OF ASPHALT PAVING
EXISTING TREES TO BE REMOVED AS REQUIRED
EXTEND EXISTING CULVERT TO TOE OF SLOPE. 3x7.0m-600mmø CULVERT INV.=±137.20 C/W 3.0mX2.0mX0.3m RIP RAP PAD 150mmø NOMINAL SIZE
Ex. RING ROAD
RE-ALIGN EXISTING CHANNEL AS REQUIRED
PROPOSED 3.0mX2.0mX0.3m RIP RAP PAD 150mmø NOMINAL SIZE TO BE INSTALLED ON WEST SIDE OF EXISTING CULVERT
Ex. CHAIN LINK FENCE
PROPOSED ACCESS ROAD TO BE PAVED
PAVED ASPHALT ACCESS ROAD (REGION OF HALTON)
AREA ADJACENT TO PAVED ROAD TO BE FINE GRADED AS REQUIRED TO ENSURE POSITIVE DRAINAGE
EXISTING TREES TO BE REMOVED AS REQUIRED
SLOPE TO BE RE-GRADED @ 3:1 AS REQUIRED.
EXISTING CHANNEL TO REMAIN
Ex. DITCH
Ex. GABION
Ex. HYDRO EASEMENT LINE
PROVIDE APRON AROUND EXISTING BUILDING TO PROMOTE POSITIVE DRAINAGE AWAY FROM STRUCTURE
Ex. BUILDING
Ex. ELEC BOSS
Ex. MH23 T/G=130.48 INV. 123.87±
Ex. MH22A T/G=128.64 INV. 123.79±
Ex. OVERHEAD HIGH VOLTAGE HYDRO LINES
PROP. 21.0m-600mmø BOSS 2000 CULVERT @ 11.5% C/W 2.0mX2.0mX0.3m RIP RAP PAD 150mmø NOMINAL SIZE W. INV. 130.45 E. INV. 128.05
MULTI-USE ACCESS (GRANULAR SURFACE) (REGION OF HALTON & HYDRO ONE)
Ex. EASEMENT LINE
Ex. MH22 T/G=125.79 INV. 122.06±
Ex. MONITORING WELL
Ex. ELEC BOX
Ex. DRIPLINE
Ex. RIP RAP
APPROXIMATE LIMIT OF EXISTING ROCK FILL
SLOPE TO MATCH EXISTING @ 3:1 AS REQUIRED.
ASPHALT ACCESS ROAD (SHARED)
PROP. ROCK CHECK DAM SPACED @ 30.0 INTERVALS (AS PER DETAIL) (TYP.)
PROP. TRAPEZOIDAL SWALE (AS PER DETAIL)
PROP. EDGE OF GRAVEL
Ex. GRAVEL
Ex. SWALE (TO BE RELOCATED)
PROPOSED GATE OPERATED BY REGION OF HALTON
SLOPE TO BE RE-GRADED AS REQUIRED. Ex. SWALE/DITCH INVERTS TO BE MAINTAINED
FORMER TRANSFER STATION
Ex. DITCH (TO REMAIN)
LIMIT OF ASPHALT PAVING
ACCESS ROAD (GRANULAR SURFACE) (REGION OF HALTON)
ASPHALT ACCESS RAMP (KING PAVING)
LIMIT OF ASPHALT PAVING
PROPOSED GATE
DRAINAGE SPLIT (TYP.)
MATERIALS STORAGE AREA (GRANULAR SURFACE)
LIMIT OF MATERIALS STORAGE AREA
Ex. EDGE OF GRAVEL
Ex. TOP OF BANK
Ex. BOTTOM OF BANK
Ex. DITCH
MATCH GRADES INTO Ex. ACCESS ROAD
EXISTING GRAVEL TO BE RESURFACED WITH RECYCLED ASPHALT/GRANULAR MATERIAL (REFER TO OVERALL PLANS FOR RESURFACING EXTENTS
PROPOSED 2.0mX2.0mX0.3m RIP RAP PAD 150mmø NOMINAL SIZE TO BE INSTALLED ON WEST SIDE OF EXISTING 300mmø CULVERT
EXISTING 300mmø CULVERT TO REMAIN
PROP. EDGE OF GRAVEL
Ex. HYDRO EASEMENT LINE

REFER TO DRAWING C-103

NOTES TO CONTRACTOR:

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2. CONFIRMATION OF EXISTING INVERTS
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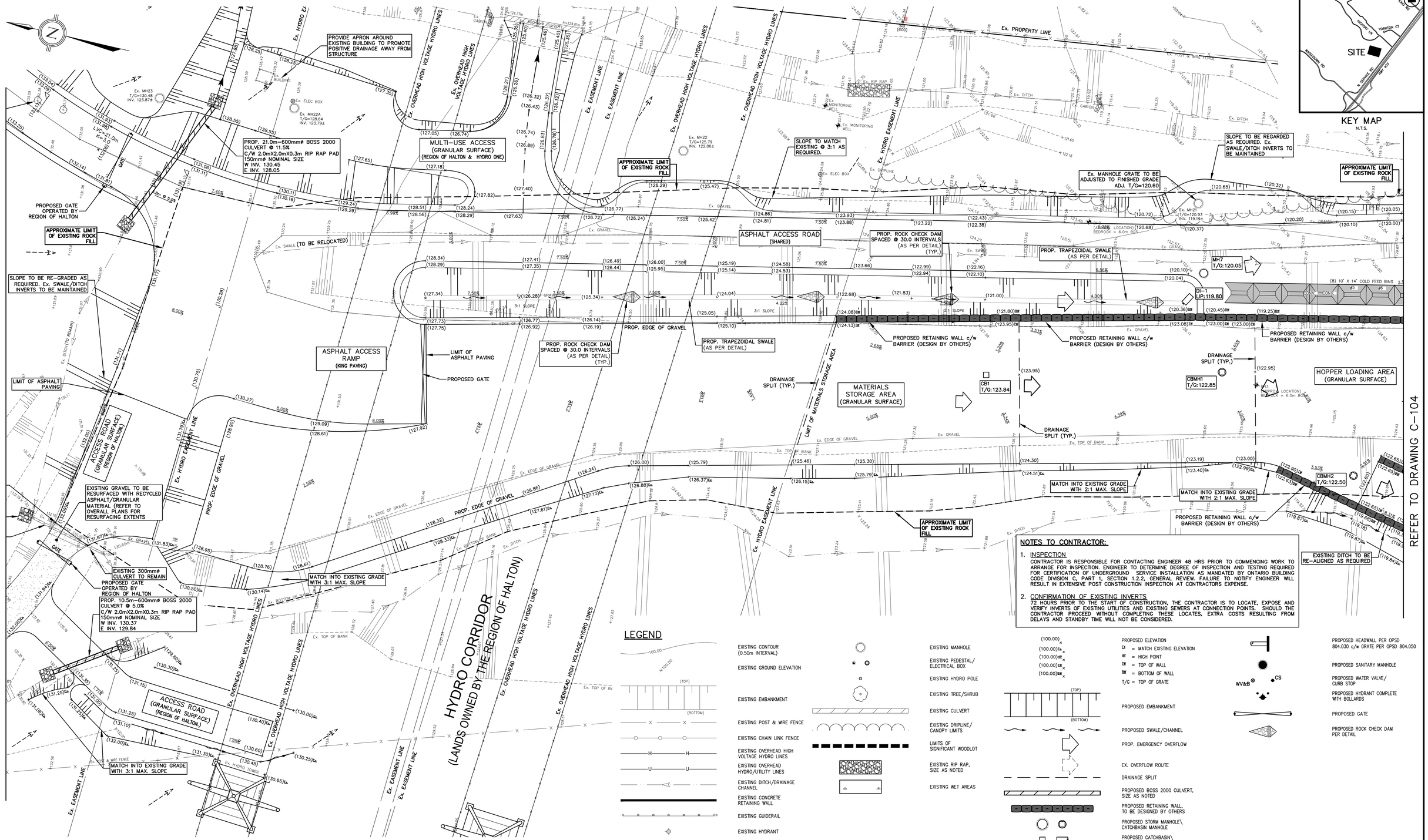
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3385 HARVESTER ROAD, BURLINGTON ONTARIO

PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
GRADING PLAN
SHEET 1 of 4

PROJECT No. 20036
DRAWING No. C-103
SCALE 1:250 (0, 5, 10, 15, 20, 25)

S:\20036\WORKING_Current\20036-Site Servicing and Grading.dwg
Plotted: May 22, 2024 2:50:10 PM By: Blair Henderson



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PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
GRADING PLAN
SHEET 2 of 4

PROJECT No. 20036
DRAWING No. C-104
SCALE 1:250 (0 5 10 15 20 25)

S:\20036\WORKING_Current\20036-Site Servicing and Grading.dwg
Plotted: May 22, 2024 2:50:17 PM By: Blair Henderson

391 NORTH SERVICE ROAD
(LANDS OWNED BY THE REGION OF HALTON)

KEY MAP
N.T.S.

SITE

PROPOSED HICKORY LANE

REFER TO DRAWING C-103

REFER TO DRAWING C-105

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- EXISTING POST & WIRE FENCE
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- EXISTING RIP RAP, SIZE AS NOTED
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PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
SITE GRADING PLAN
SHEET 3 of 4

PROJECT No. 20036
DRAWING No. C-105
SCALE 1:250

S:\20036\WORKING_Current\20036-Site Servicing and Grading.dwg
Plotted: May 22, 2024 2:50:33 PM By: Blair Henderson

391 NORTH SERVICE ROAD
(LANDS OWNED BY THE REGION OF HALTON)

PROPOSED HICKORY LANE

REFER TO DRAWING C-104

PROP. 25.0m–450mmø BOSS 2000. CULVERT @ 0.8% C/W 2.0mX2.0mX0.3m RIP RAP PAD 150mmø NOMINAL SIZE E INV. 114.40 W INV. 114.25

200mø TO EXISTING HICKORY LANE

SAWCUT, REMOVE & RESTORE EX. ASPHALT TO EX. CONDITION OR BETTER (AS PER CITY OF BURLINGTON STANDARDS S-114 & S-114-B)

PROPOSED GATE OPERATED BY KING PAVING CONSTRUCTION COMPANY AND THE REGION OF HALTON

PROPOSED GATES OPERATED BY KING PAVING & CONSTRUCTION COMPANY

Ex. PROPERTY LINE

ASPHALT ACCESS ROAD (SHARED)

84.41 @ 2.35%

MH2A T/G:116.92

MH3A T/G:116.90

MH1A T/G:115.21

DI-2 T/G:116.95

MH10 T/G:118.30

MH4A T/G:119.25

MH13 T/G:117.75

MH11 T/G:118.42

MH6 T/G:119.70

CBMH9 T/G:118.00

MH12 T/G:116.80

DI-3 T/G: 115.95 C/W OUTLET STRUCTURE (AS PER DETAIL 2)

PROP. HW2 (AS PER OPSD 804.030 & 804.050) INV. 115.66

PROP. HW1 (AS PER OPSD 804.030 & 804.050) INV. 115.66

200–300mø NOMINAL SIZE RIP–RAP SPILL MAT, 0.5m THICK OVER TERRAFIX 270R OR APPROVED ALTERNATIVE

200–300mø NOMINAL SIZE RIP–RAP SPILL MAT, 0.5m THICK OVER TERRAFIX 270R OR APPROVED ALTERNATIVE

EMERGENCY OVERFLOW WEIR

TOP OF POND ELEV.=116.80

TOP OF WEIR ELEV.=116.50

100-YR PONDING ELEV.=116.04

BOTTOM OF POND ELEV.=115.45

MAX PONDING ELEV. 116.50

PROP. 14.0m MTO SETBACK

PROP. 5.6m ROAD WIDENING

PROP. 2.0m ASPHALT SHOULDER

EX. HYDRO LINES TO BE RAISED TO SUIT PROPOSED GRADES (DESIGNED BY OTHERS)

NOTE:
SEE C-109 FOR PRELIMINARY ROAD WIDENING PLAN.

MATCH INTO EXISTING GRADE WITH 3:1 SLOPE

APPROXIMATE LIMIT OF EXISTING ROCK FILL

EXISTING DITCH TO BE REGRADED TO PROVIDE POSITIVE DRAINAGE

PROP. DRY POND (C/W GEOSYNTHETIC CLAY LINER)
TOP OF POND = 116.80m
BOTTOM OF POND = 115.45m
STORAGE VOLUME = 1507m³
100-YR REQ'D VOLUME = 527m³

Ex. MONITORING WELLS TO BE RELOCATED BY REGION OF HALTON FORCES

MATCH INTO EXISTING GRADE WITH 3:1 SLOPE

MATCH INTO EX. GRADES AT 10m WOODLOT SETBACK

PROPOSED RETAINING WALL c/w BARRIER (DESIGN BY OTHERS)

ASPHALT PLANT AREA (GRANULAR SURFACE)

LIMIT OF ASPHALT PAVING

HYD. SET c/w BOLLARDS

ASPHALT ENTRANCE

PROP. LANDSCAPED AREA

Ex. MONITORING WELLS (3)

Ex. MH18 T/G=115.53 N INV. 113.36± S INV. 113.32±

Ex. MH19 T/G=117.13 INV. 114.79±

Ex. MH17 T/G=115.28 INV. 113.72±

APPROX. LOCATION OF BEDROCK = 2.3m BGS

SWALE

PLACE WITH SD 701.010 (TYPE A). S MATERIAL ED OFFSITE T/G=117.65

PARKING

3:1 MAX

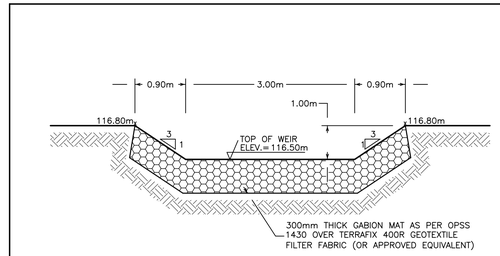
4:1 SLOPES

5:1 MAX

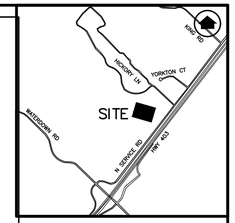
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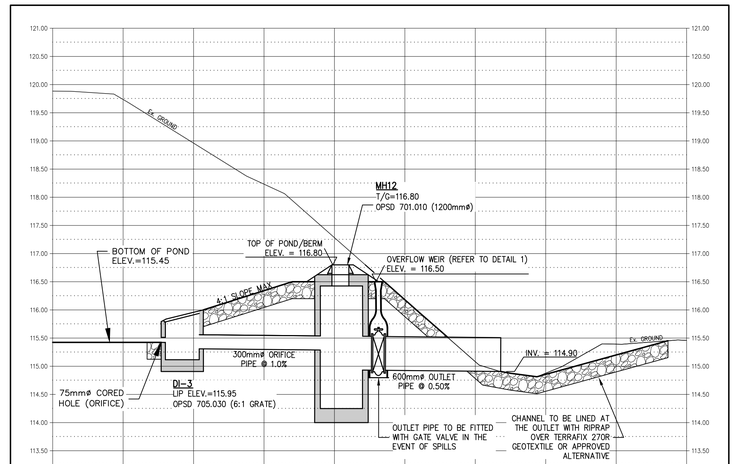
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DETAIL 1 — BROAD CRESTED OVERFLOW WEIR
SCALE: N.T.S.



KEY MAP
N.T.S.



DETAIL 2 — SWM FACILITY OUTLET DETAIL
SCALE: NTS

LEGEND

EXISTING CONTOUR (0.50m INTERVAL)
EXISTING GROUND ELEVATION
EXISTING EMBANKMENT
EXISTING POST & WIRE FENCE
EXISTING CHAIN LINK FENCE
EXISTING OVERHEAD HIGH VOLTAGE HYDRO LINES
EXISTING OVERHEAD HYDRO/UTILITY LINES
EXISTING DITCH/DRAINAGE CHANNEL
EXISTING CONCRETE RETAINING WALL
EXISTING GUIDERAIL
EXISTING HYDRANT

EXISTING MANHOLE
EXISTING PEDESTAL/ ELECTRICAL BOX
EXISTING HYDRO POLE
EXISTING TREE/SHRUB
EXISTING CULVERT
EXISTING DRIPLINE/ CANOPY LIMITS
LIMITS OF SIGNIFICANT WOODLOT
EXISTING RIP RAP, SIZE AS NOTED
EXISTING WET AREAS

PROPOSED ELEVATION
EX = MATCH EXISTING ELEVATION
HP = HIGH POINT
TW = TOP OF WALL
BW = BOTTOM OF WALL
T/G = TOP OF GRATE
PROPOSED EMBANKMENT
PROPOSED SWALE/CHANNEL
PROP. EMERGENCY OVERFLOW
EX. OVERFLOW ROUTE
DRAINAGE SPLIT
PROPOSED BOSS 2000 CULVERT, SIZE AS NOTED
PROPOSED RETAINING WALL, TO BE DESIGNED BY OTHERS
PROPOSED STORM MANHOLE\ CATCHBASIN MANHOLE
PROPOSED CATCHBASIN\ DITCH INLET

PROPOSED HEADWALL PER OPSD 804.030 c/w GRATE PER OPSD 804.050
PROPOSED SANITARY MANHOLE
PROPOSED WATER VALVE/ CURB STOP
PROPOSED HYDRANT COMPLETE WITH BOLLARDS
PROPOSED GATE
PROPOSED ROCK CHECK DAM PER DETAIL

NOTES TO CONTRACTOR:

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NO.	DATE	BY	REVISIONS
7.0	MAY 2024	BH	REVISED PER UPDATED SITE PLAN
6.0	AUG. 2023	AS	REVISED PER DECEMBER 2021 COMMENTS
5.0	SEPT 2022	BH	ISSUED FOR HYDRO ONE REVIEW
4.0	MAY 2022	SD	AS PER ROAD WIDENING REQUIREMENTS
3.0	NOV. 2021	SJD	AS PER REVISED SITE LAYOUT PLAN

DESIGN	RB	CHK'D		DATE May 27, 2021
DRAWN	RB	CHK'D		

BENCH MARK NOTE:
UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

STAMP
LICENSED PROFESSIONAL ENGINEER
S.V. FRANKOVICH
5/22/2024
PROVINCE OF ONTARIO

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

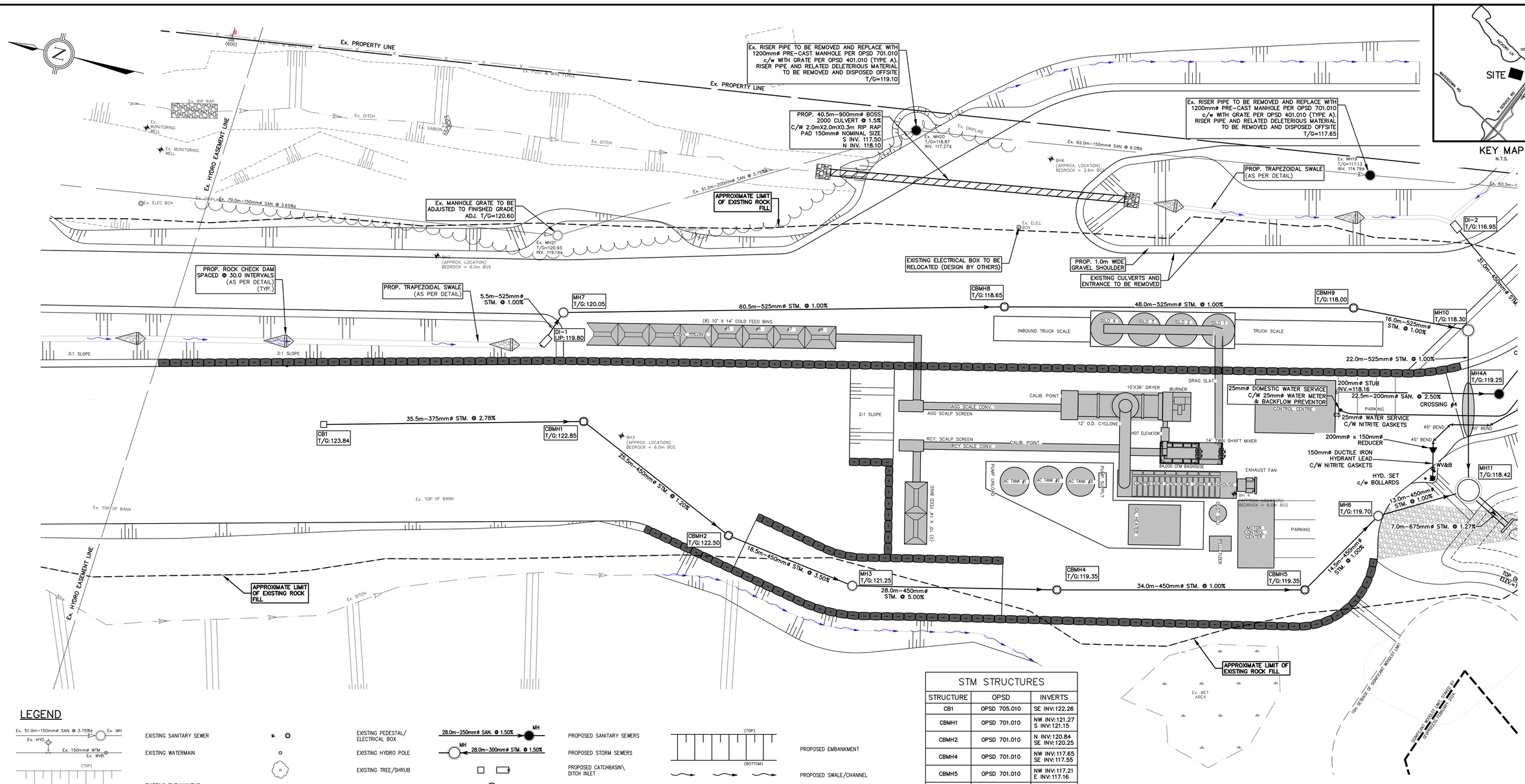
CLIENT
KING PAVING AND CONSTRUCTION COMPANY
3385 HARVESTER ROAD, BURLINGTON ONTARIO

PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
SITE GRADING PLAN
SHEET 4 of 4

PROJECT No. 20036
DRAWING No. C-106
SCALE 1:250

S:\20036\WORKING_Current\20036-Site Servicing and Grading.dwg
Plotted: May 22, 2024 2:50:44 PM By: Blair Henderson



KEY MAP
N.T.S.

LEGEND

- EXISTING SANITARY SEWER
- EXISTING WATERMAIN
- EXISTING EMBANKMENT
- EXISTING POST & WIRE FENCE
- EXISTING CHAIN LINK FENCE
- EXISTING OVERHEAD HIGH VOLTAGE HYDRO LINES
- EXISTING OVERHEAD HYDRO/UTILITY LINES
- EXISTING DITCH/DRAINAGE CHANNEL
- EXISTING CONCRETE RETAINING WALL
- EXISTING GUIDERAIL
- EXISTING PEDESTAL/ ELECTRICAL BOX
- EXISTING HYDRO POLE
- EXISTING TREE/SHRUB
- EXISTING CULVERT
- EXISTING DRIPLINE/ CANOPY LIMITS
- LIMITS OF SIGNIFICANT WOODLOT
- EXISTING RIP RAP, SIZE AS NOTED
- EXISTING WET AREAS
- PROPOSED SANITARY SEWERS
- PROPOSED STORM SEWERS
- PROPOSED CATCHBASIN\ DITCH INLET
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED HEADWALL PER OPSD 804.030 c/w GRATE PER OPSD 804.050
- PROPOSED WATERMAIN
- PROPOSED WATER VALVE/ CURB STOP
- PROPOSED HYDRANT COMPLETE WITH BOLLARDS
- PROPOSED BOSS 2000 CULVERT, SIZE AS NOTED
- PROPOSED EMBANKMENT
- PROPOSED SWALE/CHANNEL
- PROPOSED RETAINING WALL, TO BE DESIGNED BY OTHERS
- PROPOSED GATE
- PROPOSED ROCK CHECK DAM PER OPSD 219.210
- PROPOSED RIP RAP, SIZE AS NOTED

STM STRUCTURES

STRUCTURE	OPSD	INVERTS
CB1	OPSD 705.010	SE INV:122.26
CBMH1	OPSD 701.010	NW INV:121.27 S INV:121.15
CBMH2	OPSD 701.010	N INV:120.84 SE INV:120.25
CBMH4	OPSD 701.010	NW INV:117.65 SE INV:117.55
CBMH5	OPSD 701.010	NW INV:117.21 E INV:117.16
CBMH8	OPSD 701.010	SE INV:116.75 NW INV:116.93
CBMH9	OPSD 701.010	NW INV:116.27 SE INV:116.25
DI–1	DICB–1200X600	E INV:118.07
DI–2	DICB–1200X600	S INV:115.87
MH3	OPSD 701.010	NW INV:119.61 SE INV:119.05
MH6	OPSD 701.010	W INV:117.02 E INV:116.48
MH7	OPSD 701.010	W INV:118.02 SE INV:117.53
MH10	OPSD 701.011	NW INV:116.09 SW INV:116.03
MH11	HYDROSTORM HS10	NE INV:115.81 W INV:116.35 S INV:115.75
MH12	OPSD 701.010	SW INV:115.28 NE INV:114.97

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REGIONAL APPROVAL:
REGION DESIGN OF WATER &/OR WASTWATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANARDS & SPECIFICATIONS & LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED:_____ DATED: _____
INFRASTRUCTURE PLANNING & POLICY

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DESIGN	RB	CHK'D		DATE May 27, 2021
DRAWN	RB	CHK'D		

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INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

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ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

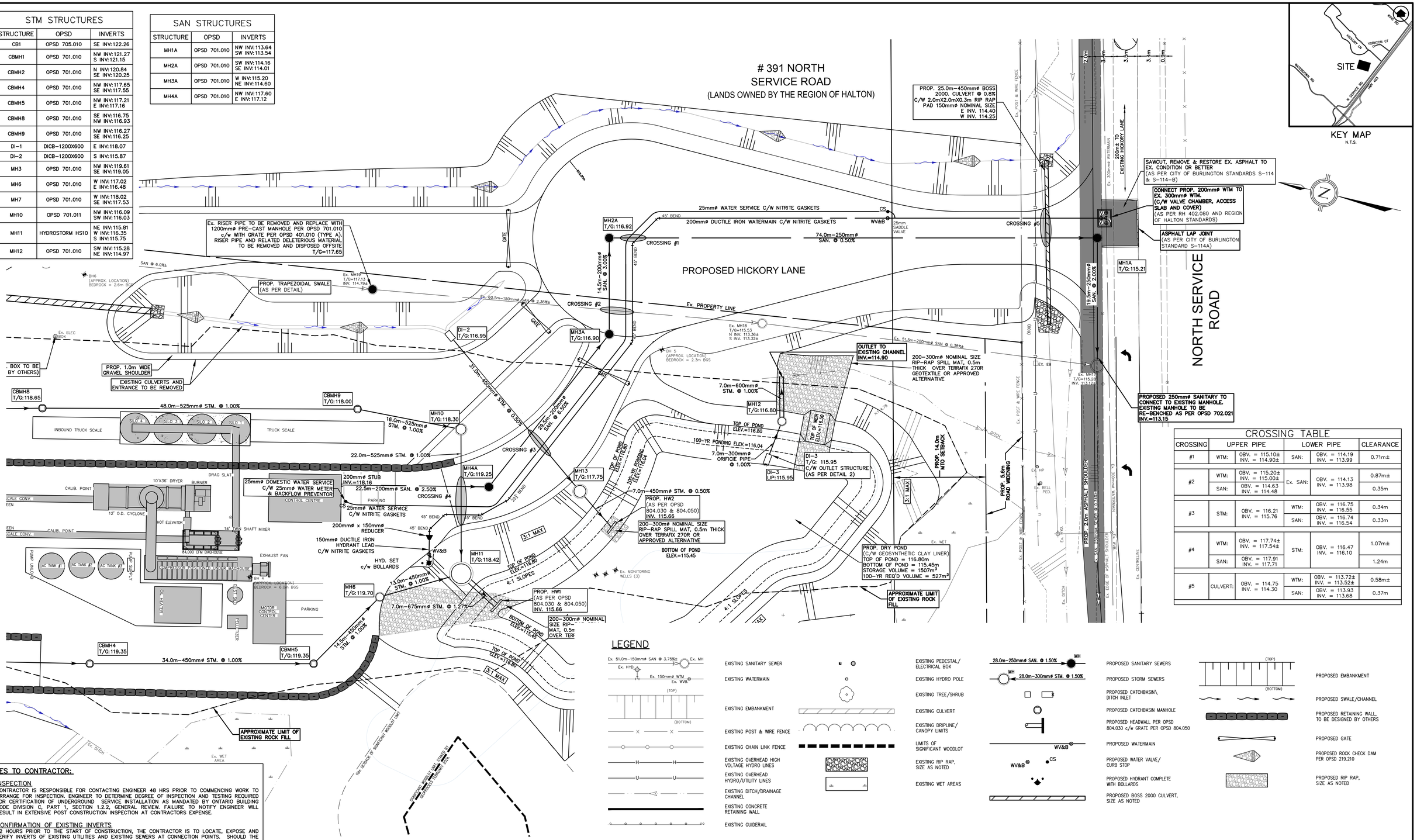
TITLE
SITE SERVICING PLAN
SHEET 1 of 2

PROJECT No. 20036
DRAWING No. C–107
SCALE 1:250 (0 5 10 15 20 25)

S:\20036\WORKING_Current\20036-Site Servicing and Grading.dwg
Plotted: May 22, 2024 2:50:53 PM By: Blair Henderson

STM STRUCTURES		
STRUCTURE	OPSD	INVERTS
CB1	OPSD 705.010	SE INV:122.26
CBMH1	OPSD 701.010	NW INV:121.27 S INV:121.15
CBMH2	OPSD 701.010	N INV:120.84 SE INV:120.25
CBMH4	OPSD 701.010	NW INV:117.65 SE INV:117.55
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MH7	OPSD 701.010	W INV:118.02 SE INV:117.53
MH10	OPSD 701.011	NW INV:116.09 SW INV:116.03
MH11	HYDROSTORM HS10	NE INV:115.81 W INV:116.35 S INV:115.75
MH12	OPSD 701.010	SW INV:115.28 NE INV:114.97

SAN STRUCTURES		
STRUCTURE	OPSD	INVERTS
MH1A	OPSD 701.010	NW INV:113.64 SW INV:113.54
MH2A	OPSD 701.010	SW INV:114.16 SE INV:114.01
MH3A	OPSD 701.010	W INV:115.20 NE INV:114.60
MH4A	OPSD 701.010	NW INV:117.60 E INV:117.12



CROSSING TABLE					
CROSSING	UPPER PIPE		LOWER PIPE		CLEARANCE
#1	WTM:	OBV. = 115.10± INV. = 114.90±	SAN:	OBV. = 114.19 INV. = 113.99	0.71m±
#2	WTM:	OBV. = 115.20± INV. = 115.00±	Ex. SAN:	OBV. = 114.13 INV. = 113.98	0.87m±
	SAN:	OBV. = 114.63 INV. = 114.48			0.35m
#3	STM:	OBV. = 116.21 INV. = 115.76	WTM:	OBV. = 116.75 INV. = 116.55	0.34m
			SAN:	OBV. = 116.74 INV. = 116.54	0.33m
#4	WTM:	OBV. = 117.74± INV. = 117.54±	STM:	OBV. = 116.47 INV. = 116.10	1.07m±
	SAN:	OBV. = 117.91 INV. = 117.71			1.24m
#5	CULVERT:	OBV. = 114.75 INV. = 114.30	WTM:	OBV. = 113.72± INV. = 113.52±	0.58m±
			SAN:	OBV. = 113.93 INV. = 113.68	0.37m

LEGEND

EXISTING SANITARY SEWER
EXISTING WATERMAIN
EXISTING EMBANKMENT
EXISTING POST & WIRE FENCE
EXISTING CHAIN LINK FENCE
EXISTING OVERHEAD HIGH VOLTAGE HYDRO LINES
EXISTING OVERHEAD HYDRO/UTILITY LINES
EXISTING DITCH/DRAINAGE CHANNEL
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EXISTING PEDESTAL/ ELECTRICAL BOX
EXISTING HYDRO POLE
EXISTING TREE/SHRUB
EXISTING CULVERT
EXISTING DRIPLINE/ CANOPY LIMITS
LIMITS OF SIGNIFICANT WOODLOT
EXISTING RIP RAP, SIZE AS NOTED
EXISTING WET AREAS
28.0m–250mmø SAN. @ 1.50%
28.0m–300mmø STM. @ 1.50%
PROPOSED SANITARY SEWERS
PROPOSED STORM SEWERS
PROPOSED CATCHBASIN\ DITCH INLET
PROPOSED CATCHBASIN MANHOLE
PROPOSED HEADWALL PER OPSD 804.030 c/w GRATE PER OPSD 804.050
PROPOSED WATERMAIN
PROPOSED WATER VALVE/ CURB STOP
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PROPOSED BOSS 2000 CULVERT, SIZE AS NOTED
(TOP)
(BOTTOM)
PROPOSED EMBANKMENT
PROPOSED SWALE/CHANNEL
PROPOSED RETAINING WALL, TO BE DESIGNED BY OTHERS
PROPOSED GATE
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DESIGN	RB	CHK'D		DATE
DRAWN	RB	CHK'D		May 27, 2021

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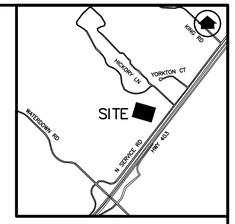
TITLE
SITE SERVICING PLAN
SHEET 2 of 2

PROJECT No. 20036
DRAWING No. C–108
SCALE 1:250

S:\20036\WORKING_Current\20036–Site Servicing and Grading.dwg
Plotted: May 22, 2024 2:51:05 PM By: Blair Henderson

LEGEND:

- PROPOSED ASPHALT
- [ ] LIMITS OF LINE PAINTING
- ×209.00 EXISTING GROUND ELEVATION
- ×(209.00) PROPOSED GROUND ELEVATION
- ×209.00EX PROPOSED ELEVATION TO MATCH EXISTING
- ×(209.00)SW PROPOSED SWALE ELEVATION
- ×[209.00] PROPOSED GROUND ELEVATION (BY OTHERS)
- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED STORM/SANITARY MANHOLE
- EXISTING DIRECTION OF DRAINAGE
- PROPOSED SWALE (AS PER DETAIL)
- PROPOSED ROAD RESTORATION



KEY MAP
N.T.S.

PROPOSED ASPHALT PLANT RELOCATION SITE

PROPOSED HICKORY LANE

PROPOSED VACANT LANDS

APPROXIMATE LIMIT OF EXISTING ROCK FILL

3:1 MAX

PROP. 14.0m MTO SETBACK

PROP. 5.6m ROAD WIDENING

EX. DITCH TO BE REGRADED TO PROVIDED POSITIVE DRAINAGE

MATCH 2.0m PROP. ASPHALT SHOULDER INTO EXISTING.

T/G TO BE ADJUSTED (AS PER CITY OF BURLINGTON STANDARDS).

PROP. 25.0m–450mmø BOSS 2000 CULVERT @ 0.8%
C/W 2.0mX2.0mX0.3m RIP RAP PAD 150mmø NOMINAL SIZE
E INV. 114.40
W INV. 114.25

PROP. 2.0m ASPHALT SHOULDER

PROP. 0.1m WHITE SOLID

PROP. 0.1m YELLOW SOLID

PROP. 0.1m WHITE DASHED

56.0m TAPER

30.0m STORAGE

200mø TO EXISTING HICKORY LANE

53.0m TAPER

TERMINATE PROP. 0.1m WHITE AT EX. WHITE LINE.

TERMINATE PROP. 0.1m YELLOW AT EX. YELLOW LINE.

NORTH SERVICE ROAD

NORTH SERVICE ROAD

NOTES TO CONTRACTOR:

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NO.	DATE	BY	REVISIONS
7.0	MAY 2024	BH	REVISED PER UPDATED SITE PLAN
6.0	AUG. 2023	AS	REVISED PER DECEMBER 2021 COMMENTS
5.0	SEPT 2022	BH	ISSUED FOR HYDRO ONE REVIEW
4.0	MAY 2022	SD	AS PER ROAD WIDENING REQUIREMENTS
3.0	NOV. 2021	SJD	AS PER REVISED SITE LAYOUT PLAN

DESIGN	RB	CHK'D		DATE
DRAWN	RB	CHK'D		May 27, 2021

BENCH MARK NOTE:
UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION

STAMP
LICENSED PROFESSIONAL ENGINEER
S.V. FRANKOVICH
5/22/2024
PROVINCE OF ONTARIO

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT
KING PAVING AND CONSTRUCTION COMPANY
3385 HARVESTER ROAD, BURLINGTON ONTARIO

PROJECT NAME
291 NORTH SERVICE ROAD
ASPHALT PLANT
BURLINGTON, ONTARIO
SITE PLAN No.: T.B.D.

TITLE
PRELIMINARY ROAD WIDENING PLAN

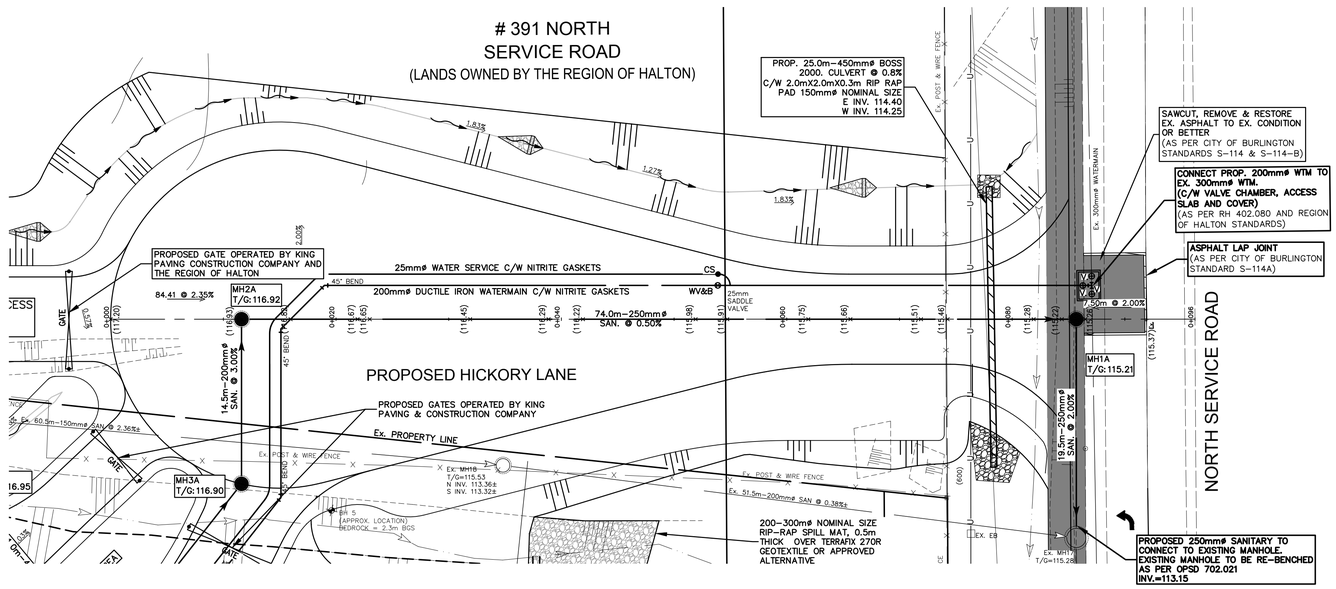
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DRAWING No. C-109
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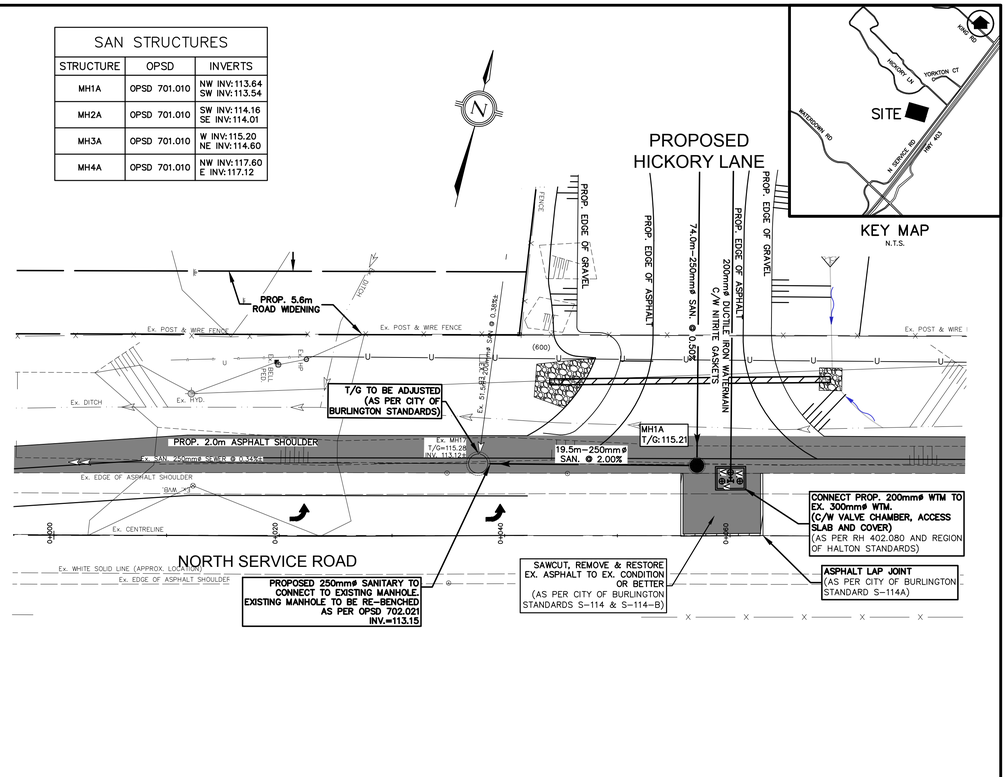
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NOTES TO CONTRACTOR:

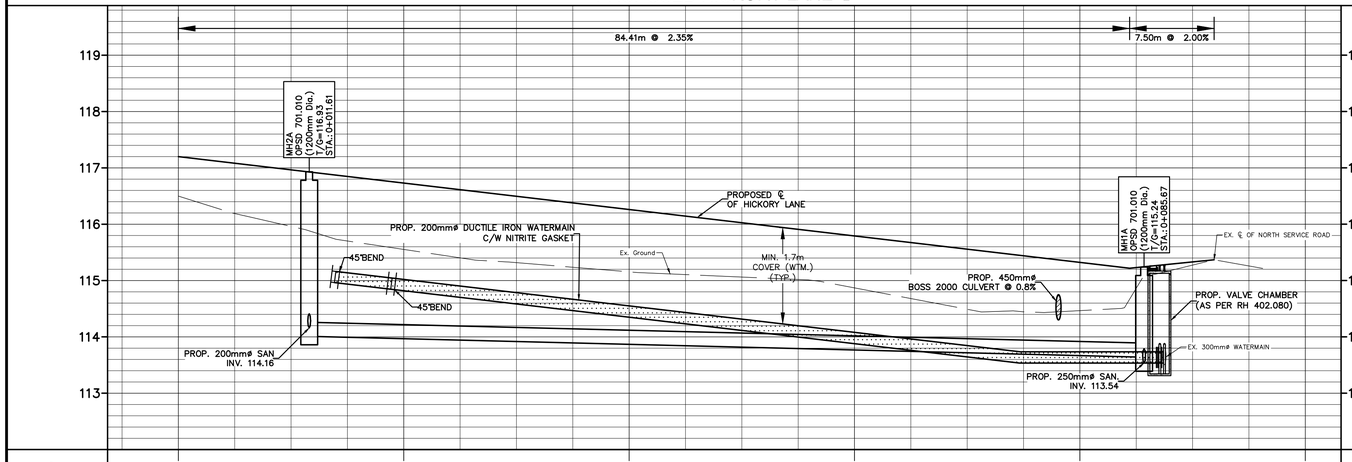
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SAN STRUCTURES		
STRUCTURE	OPSD	INVERTS
MH1A	OPSD 701.010	NW INV: 113.64 SW INV: 113.54
MH2A	OPSD 701.010	SW INV: 114.16 SE INV: 114.01
MH3A	OPSD 701.010	W INV: 115.20 NE INV: 114.60
MH4A	OPSD 701.010	NW INV: 117.60 E INV: 117.12



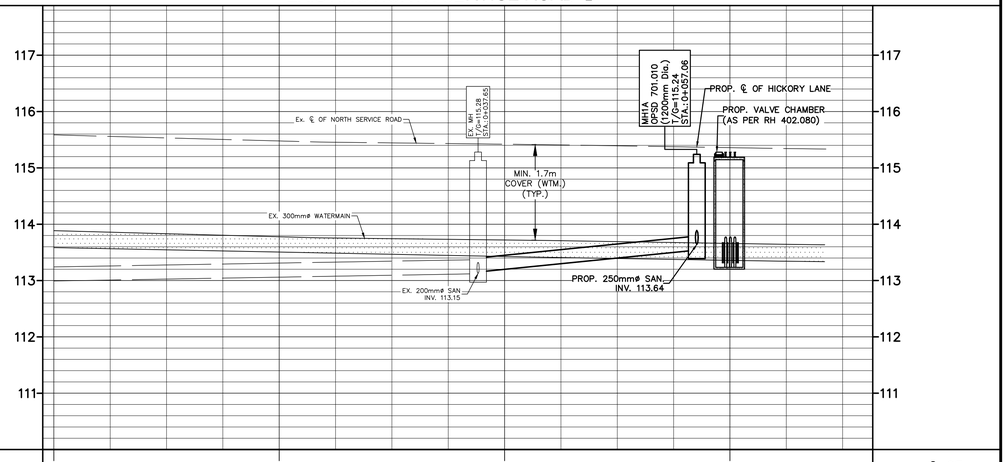


PROPOSED HICKORY LANE ℄



℄ OF ROAD GRADE	115.50 117.20	115.75 116.73	115.16 116.26	114.87 115.79	114.47 115.32
SANITARY SEWER	114.01	74.0m–250mmø PVC SDR 35 STM. @ 0.50% BEDDING PER OPSD 802.010 NATIVE BACKFILL			113.64
CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100

EXISTING NORTH SERVICE ROAD ℄



℄ OF ROAD GRADE	115.59	115.48	115.42	115.36
SANITARY SEWER	112.81	EX. 92.0m±–250mmø SAN. @ 0.34%±	113.12 113.15	19.5m–250mmø PVC SDR 35 STM. @ 2.00% BEDDING PER OPSD 802.010 NATIVE BACKFILL	113.54
CHAINAGE	0+000	0+020	0+040	0+060

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TITLE
PRELIMINARY PLAN AND PROFILE

PROJECT No. 20036
DRAWING No. C–110

SCALE
HORIZ. 1:250 0 2.5 5 12.5
VERT. 1:50 0 0.5 1 2.5

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Plotted: May 22, 2024 4:03:18 PM By: Blair Henderson

APPENDIX E: GEOTECHNICAL AND ENVIRONMENTAL REPORTS

LANDTEK LIMITED
Consulting Engineers

205 Nebo Road, Unit 4B
Hamilton, Ontario
L8W 2E1

Phone: 905-383-3733
engineering@landtek.ca
www.landtek.ca

October 28, 2022
File: 22298

King Paving & Construction Ltd.
% Solution Stream
1445 Caroline Street,
Burlington, Ontario
L7S 1H7

Attention: Mr. John Doyle, Managing Partner – Solution Stream

Dear Mr. Doyle,

Re: Geotechnical Investigation Letter Report
Proposed Asphalt Batching Plant, 291 North Service Road, Burlington, Ontario

Landtek Limited (herein "*Landtek*") is pleased to submit this updated Geotechnical Investigation letter report for the proposed new Asphalt Batching Plant at the site identified as civic address 291 North Service Road in Burlington, Ontario. Authorization to proceed with the work was received from Mr. John Hutter of King Paving & Construction Ltd. (herein "*King Paving*") on July 26, 2022.

Background

The proposed Asphalt Batching Plant is to be constructed and will include for a new access road, hoppers, material storage areas and a storm water management system. No subsurface structures or grade changes are anticipated, with all proposed structures understood to be of an at-grade construction.



A new turning lane is also proposed leading from North Service Road to the site.

The purpose of the investigation was to determine the subsurface soil and groundwater conditions underlying the site, and to provide design parameters recommendations with regards to foundations and floor slabs for the proposed structure and machinery.

The information provided by this letter report addresses the ground conditions and soil parameters required to assist the design of the new batching plant. The considerations and recommendations pertaining to the proposed turning lane to be constructed on North Service Road are provided under separate cover

This letter report has been prepared for the Client, their nominated engineers, designers, and project managers pertaining to the proposed Asphalt Batching Plant at 291 North Service Road in Burlington, Ontario. Further dissemination of this report is not permitted without Landtek's prior written approval. Further details of the limitations of this report are presented as Enclosure A.

Site Description and Topography

The site is located in Burlington, Ontario, is centered at approximate grid reference 592885, 4797135 (UTM 17T coordinates) and is currently a forested greenspace area, and formerly used as the Burlington North Service Road Landfill (now closed). The Geodetic elevation of the ground surface at the site ranges between approximately 118 m and 134 m. The site is approximately 60,260 m^2 (6.03 hectares) in plan area.

The site is bound to the south by North Service Road. Operations of the former landfill site and a current brickworks plant bound the site to the north, with dense vegetation and commercial properties bounding the site to the east and west.

Subsurface Characterization

Based on a review of the existing geological publication for the site area, Ontario Geological Survey (herein "*OGS*") Map 2509: "*Quaternary Geology of the Hamilton Area*", the native subsurface soil conditions in the vicinity of the site are anticipated to consist of clay and silt deposits of the Halton Till formation.

According to the OGS Map P2336 "*Paleozoic Geology of the Hamilton area*", the superficial geology is underlain by red shale of the Queenston Formation. Bedrock is anticipated at shallow depth beneath the site, in the order of approximately 4.0 m to 6.0 m below ground level.

Information provided by historical borehole records located in the vicinity of the site and held by the OGS, generally confirms the anticipated geological conditions beneath the site. Based on the data from records for Borehole ID 621749 located southwest of the site, the superficial soil profile confirms the presence of gravel and sand to 3.4 m, underlain by silt and clay till deposits to a depth of approximately 6.1 m. Red shale bedrock was encountered underlying the overburden soils at 6.1 m.

Fieldwork and Investigation Methodology

Fieldwork undertaken at the site by Landtek included clearance of underground services, borehole layout, borehole drilling, soil sampling, and field supervision. Of the seven boreholes proposed, a total of five (boreholes BH2 to BH6) were completed, with the remaining two boreholes located in inaccessible areas or in conflict with services at the site.

The five boreholes completed at the site drilled on September 29th, 2022 and were logged , sampled and backfilled under the supervision of a representative of Landtek using those standard symbols and terms defined in Enclosure B. The Borehole Location Plan, Drawing 22298-01, and associated borehole logs are provided in Enclosure C.

The boreholes were drilled using a Diedrich D-50 track-mounted drilling rig equipped with continuous flight, solid stem augers, and were advanced to depths of approximately 6.0 m below existing ground level. Standard Penetration Tests (SPT's) and split spoon samples were taken at frequent depth intervals during drilling.

All soil samples were transported to Landtek's in-house, Canadian Council of Independent Laboratories (CCIL) certified laboratory and visually examined to determine their classification. Moisture contents were carried out on all samples. No chemical laboratory testing was completed during this investigation.

Borehole locations were established on site by Landtek with reference to existing site structures and features. Depth related remarks for each borehole were made relative to the ground level at each respective borehole location.

Subsurface Conditions

<u>Organic Soils</u>

An approximately 75 mm thick layer of organic soil was encountered from ground surface at one location (borehole BH6). It should be noted that organic soil presence and thicknesses may vary across the site, and the thicknesses measured during this investigation may not be representative of the organic soil depths throughout the site area.

Granular Surface

A layer of granular materials was encountered from ground surface in all boreholes except borehole BH6. The granular material thicknesses range between approximately 125 mm and 150 mm. The granular materials comprise of sand and gravel with trace clay and silt and are generally brown and black in colour.

Fill Material

Fill materials comprising predominantly of silty clay was encountered in all boreholes underlying the topsoil and granular material and extends to depths of approximately 1.5 m to 6.0 m below existing ground level. The fill is red and brown in colour and contains variable fractions of silty sand, gravel, grey clay, asphalt pieces, red shale fragments, red brick fragments and sand.

SPT ''N'' values ranging from 4 to 37 were reported, indicating the fill to be of a poor to moderate level of compaction and are as expected for a fill material placed under uncontrolled conditions. Moisture content results of 3 % to 26 % were recorded within fill material samples collected during drilling.

The moisture content results are presented on the borehole logs in Appendix C.

Silty Clay Till

Native silty clay till was encountered in boreholes BH5 and BH6 underlying the fill materials and extends to depths of approximately 2.3 m to 2.6 m below existing ground level. The silty clay till includes traces of gravel and grey and red shale fragments.

SPT ''N'' values ranging between 13 and 31 were recorded, indicating the silty clay deposits to be of a stiff to hard, but generally stiff consistency. Moisture contents ranging from 12 % to 23 % were reported, which is as to be expected of a moist soil with silt and clay as primary constituents. The moisture content testing results are presented on the borehole logs in Enclosure C.

Bedrock

Red shale of the Queenston Formation was encountered underlying the existing fill materials and silty clay till deposits at depths between approximately 2.3 m (borehole BH5) and 6.0 m (boreholes BH1, BH2 and BH3) below existing ground level.

The shale is generally weak and highly to slightly weathered on initial contact, being recovered and behaving as a "*residual soil*" in the upper 1.0 m to 1.5 m and becoming more competent at depth. The shale bedrock can be classified as having a strength grade of R4 and being generally "*weak*" according to the Canadian Foundation Engineering Manual.

Though not encountered during this investigation, discontinuous green/grey and red siltstone layers are often encountered within the red shale and tend to be much sounder and harder than the shale strata. Occasional limestone seams may be also present within the bedrock horizon beneath the site, that also tend to be much sounder than the shale strata.

Groundwater

Groundwater was not encountered during the drilling process, with all boreholes remaining open to full drill depth and dry upon completion.

It should be noted that groundwater conditions and surface water flow conditions are expected to vary according to the time of year and seasonal precipitation levels. Water seepage is also expected from the transition zone between the existing fill materials and the native, fine-grained soils.

Engineering Considerations

Foundations in Native Strata

The existing fill materials and sporadic silty clay till deposits encountered in the boreholes are considered unsuitable as a bearing stratum due to the high risk of unacceptable settlements in the case of the fill materials, and the anticipated moderate loading of the proposed structures in the case of the silty clay till.

Consequently, the foundations for the proposed structures should be extended to the underlying, more competent native strata. On this basis and given the anticipated moderate loading of the

proposed plant structures, it is considered by Landtek that bearing conditions to support concrete footings (extended through '*trench and pour*' methodologies, if and where required) or piles (e.g., concrete caissons, driven piles etc.) for the proposed new Asphalt Batching Plant can be provided by the highly weathered shale.

Table 1 summarizes the recommended geotechnical reactions at the Serviceability Limit State (herein "*SLS*") and factored geotechnical resistances at the Ultimate Limit State (herein "*ULS*") for the native soils. It should be noted that the design parameters have been determined by Landtek for the design stage only.

Table 1: Recommended Limit State Foundation Design Values

Founding Depth Range	Founding Stratum	Foundation Design Value	
		SLS [1,2]	ULS [3,4]
1.5± to 2.5±	Silty Clay Till (where encountered)	150 kPa	225 kPa
2.5± to 6.0±	Highly Weathered Shale	500 kPa	750 kPa

Notes:
1. The National Building Code general safety criterion for the serviceability limit states is: SLS resistance ≥ effect of service loads.
2. Recommended SLS bearing values conform to Estimated Values based on soil types given in Tables K-8 and K-9 of the National Building Codes User's Guide.
3. The ULS resistance factor for shallow foundations is 0.5, as given in Table K-1 of the National Building Code User's Guide.
4. The National Building Code general safety criterion for the ultimate limit states is: factored ULS resistance ≥ effect of factored loads.

Where the bearing levels of the footings are at different design elevations, the footing base levels should be stepped along a line of 7V:10H, drawn upwards from the lowest footing, to avoid overlapping stresses.

Subsurface conditions can vary over relatively short distances and the subsurface conditions revealed at the test locations may not be representative of subsurface conditions across the site. Therefore, a Geotechnical Engineer should be engaged during construction to examine the exposed sub-soil quality and condition, and confirm the subsurface conditions are consistent with design assumptions. This is in compliance with field review requirements in the National Building Code, Volume 1, Clause 4.2.2.3.

Foundations on Engineered Fill

If engineered fill is required to support the proposed building or equipment foundations, it is considered by Landtek that such structures can be adequately supported by conventional strip or pad footings founded on the engineered earth fill for a geotechnical reaction at the SLS of 100 kPa, and a factored geotechnical resistance at the ULS of 150 kPa.

It should be noted that achieving the desired bearing capacities is very much dependent upon the nature and condition of the fill placed, the condition of the sub-grade upon which it is being placed, and the methods adopted for the placement and compaction of the fill materials. Particularly for granular fill material, it will be necessary to place a separation blanket across the subgrade prior to granular material placement to prevent material mixing and granular material loss into the finer-grained subgrade soils.

Where there is a requirement to raise the existing grade and generate the necessary founding subgrade, the engineered fill must be selected with care, then placed and compacted under strictly controlled conditions. The following recommendations are provided to address the selection of fill material as well as the placement and compaction of engineered fill.

- Processed imported granular material or consistent quality imported clean earth fill, can be considered for engineered fill provided the soil moisture content is within about 2 % of the optimum value of the material. Imported fill should meet the environmental requirements established for the site;
- Engineered fill should only be placed in an area that has been satisfactorily prepared by stripping all existing fill materials and organic soils, and proof rolling the exposed native subgrade soils with at least five passes of a minimum 10-ton static pad-foot steel drum type roller;

- Engineered fill should be placed in maximum 300 mm, loose lifts and compacted to a target value of 100 % Standard Proctor Maximum Dry Density (herein "*SPMDD*"). If placing during the winter period (i.e., November to March), the maximum lift thickness should be reduced to 200 mm;
- The placement and compaction of each lift should be monitored full time by Landtek, with in-place compaction determined using nuclear moisture/density testing equipment;
- Fill layers that do not meet the compaction requirements, or become wet or frozen, should not be approved for the placement of additional material; and,
- For engineered fill placement over large areas of varying elevation, the locations of quality control density tests should be recorded by total station survey.

As a precautionary measure and to mitigate cracking in building foundations, it is recommended that reinforcing steel be provided in footings on engineered fill, and at the top of poured concrete foundation walls. Two 15M bars (continuous) are recommended as a minimum for footing placement. The Structural Engineer should be consulted to confirm the design of such steel reinforcement.

Frost Susceptibility

The fine-grained, native soils encountered at shallow depths across the site should be considered sensitive to water and frost, and their physical and mechanical properties are dependent on in-situ moisture content. As such, the founding soils at the site are considered to have a moderate to high frost susceptibility, being classified as Frost Group "*F4*" (Table 13.1 of the "*Canadian Foundation Engineering Manual*", 4th Edition). However, the previously identified depths for foundations are considered to be below the maximum depth for frost penetration of 1.2 m in the Burlington area.

Should any re-grading be required as part of the proposed development and adjacent to the new structures, it will be important to ensure that the associated exterior footings will have a minimum of 1.2 m of soil cover, or equivalent suitable insulation, for frost protection.

Settlement Considerations

Based on the outline information provided for the nature of the proposed development of the site, it is anticipated that the loads to be applied to the native soils and residual soil of the red shale will be of a generally moderate intensity. As such, associated settlements are not expected to be significant. Therefore, the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate.

Seismic Design Consideration

Based on the soils conditions encountered, and in accordance with Table 4.1.8.4.A. of the current Ontario Building Code (herein "*OBC*"), the site is considered to be a 'D' Site Class for foundations seated within the native soils. The acceleration and velocity-based site coefficients, F_a and F_v, should be determined from Tables 4.1.8.4.B. and 4.1.8.4.C. respectively of the OBC for the above recommended Site Class. The seismic design data given in Table 1.2 of Supplementary Standard SB-1 in Volume 2 of the OBC, for selected Municipal locations, should be used to complete the seismic analysis.

Damp Proofing Considerations

Damp-proofing will not be required for at-grade structures. In the event that any subsurface or basement structures are included in the final design, then the subsurface areas should be damp proofed and comply with the OBC requirements.

As a minimum it is recommended that such a damp proofing system include a Delta Drainage Board or MiraDrain 2000 series product, or an approved alternative, along with an asphalt-based spray on wall coating.

Floor Slab Considerations

Based on the information provided to Landtek, it is anticipated that the floor slab subgrade will comprise of existing fill materials or (potentially) native silty clay till. The silty clay till will provide adequate support for standard floor slab construction.

For existing fill subgrade conditions, it is recommended that the existing fill materials are sub-excavated to approximately 1.0 m below the required subgrade or to native soils, whichever is shallower, and the required subgrade reinstated using select subgrade material placed per the "*General Backfill Considerations*" section of this letter report. The select subgrade material should be compacted to a target compaction of 100 % SPMDD, with no individual test below 98 % SPMDD.

The design of concrete slabs may be made on the basis of a value of modulus of sub-grade reaction of 15 MPa/m on the surface of any required engineered fill and 25 MPa/m for the native silty clay till.

It is recommended that a minimum 200 mm layer of clear 19 mm crushed quarried stone be used as the vapour barrier under the floor slab. The vapour barrier stone should meet the requirements of Ontario Provincial Standard Specifications (herein "*OPSS*") 1004 for 19 mm Type II clear stone. If a graded crushed stone is substituted for clear stone, the material should be limited to a maximum of 5 % fines (passing the 0.075 mm sieve).

The floor slab thickness should meet the specifications of the project based on anticipated floor loadings. The finished exterior ground surface should be sloped away from the building at a grade in the order of 2 %.

The concrete properties should meet the requirements of OPSS 1350. Contraction and isolation jointing practices should be in accordance with current Portland Cement Association recommendations, as given in the engineering bulletin "*Concrete Floors on Ground*", second edition, by R. E. Spears, and W. C. Panarese.

Excavation and Backfill Considerations

General Considerations

All temporary excavations and unbraced side slopes in the soils should conform to standards set out in the Occupational Health and Safety Act, Ontario Regulation 213/91 "*Construction Projects*" (herein "*OHSA*"). The subsurface soils to be encountered during excavation at the site are expected to behave as "*Type 3"* and "*Type 2*" materials according to the OHSA classification in Part III. Type 3 soils are characteristic of the "*fill material*" while the "… *generally stiff clayey silt till*" and "*highly weathered shale"* are considered Type 2 soils.

It should be possible to excavate the overburden soils and residual soil of the red shale with a hydraulic backhoe. Moist Type 2 and Type 3 soils are expected to be stable for short construction periods at slopes of approximately 45° to the horizontal (i.e., 1V:1H).

Consideration should be given to any existing trench excavations and associated backfill that may be present directly behind cut slopes within the native soils that may appear to be stable on first excavation. In these circumstances, slopes can suddenly slough or collapse due to the affects of the adjacent backfill. Consequently, for excavation conditions that cannot satisfy the OHSA requirements for unbraced 1H:1V side slopes, a trench box system should be used, or temporary shoring should be installed to maintain safe working conditions. This may be more applicable to service trench excavations, particularly when in close proximity to new or existing infrastructure.

It should be noted that the design of a temporary shoring system, should one be required, is the responsibility of the Contractor. Therefore, a specialist shoring contractor should be consulted to provide the most appropriate shoring type method and associated installation procedures. In any event, the shoring design should be based on the procedures outlined in the latest edition of the "*Canadian Foundation Engineering Manual*". It is also recommended that lateral and vertical movement of the shoring system be monitored during construction to ensure that movements are within the acceptable range.

Dewatering Consideration

Groundwater was not encountered during the investigation. This given, any localized groundwater seepages that may be encountered during excavation work should be able to be controlled by standard pumping equipment drawing from sumps at the base of the excavation.

Water seepage into open excavations is not expected to be a construction issue or be experienced to an extent that the project requires either registration under the Environmental Activity and Sector

Registry (herein "*EASR*") framework (i.e., exceeding 50,000 l/day but less than 400,000 l/day) or a Permit To Take Water (herein "*PTTW*") for amounts greater than 400,000 l/day.

General Backfill Considerations

Backfill next to foundation walls and in utility trenches should be selected to be compactable in narrow trench conditions. The native silty clay soils and residual soils of the red shale encountered at the site are expected to be reusable as trench backfill and backfill around the proposed structures on the site. Any variation in the moisture contents of the soils encountered may require selective separation of material to avoid the use of wet soil.

Site servicing trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. It is recommended that the target compaction specification for trench backfill be 97 % SPMDD with no individual test below 95 % SPMDD.

During inclement weather the native soils may become too wet to achieve satisfactory compaction. If construction is proposed for late in the year, a reduced level of trench compaction with a higher risk of future settlements is to be anticipated, and it is recommended that provisional contract quantities be established for the supply and placement of imported granular fill under such circumstances. The imported granular should meet the requirements of OPSS 1010 for Granular B Type I material as a minimum requirement.

Pavement Design Considerations

The proposed scope of paving works is anticipated to include for a new access road and all associated access points, turning areas and parking lots. The pavement structures are likely to comprise of both granular and asphaltic concrete surface finishes.

Based on the findings of the investigation, it is considered that though being of fill materials, the existing pavement structure subgrade is sufficiently stable to support a new pavement structure.

Landtek recommends that new asphalt and granular pavement structures should consist of the pavement layer thicknesses provided in Table 2 below. This pavement structure design thickness meets the minimum standards for an arterial-grade pavement for Corporation of the City of Burlington (herein "*City of Burlington*") design requirements.

Table 2: Recommended Minimum Pavement Structure Layer Thicknesses

Pavement Layer	Recommended Pavement Layer Thickness	
	Asphalt Pavement	Granular Pavement
Surface Course HL-3 HS Asphaltic Concrete	50 mm	-
Binder Course HDBC Asphaltic Concrete	80 mm	-
Granular Base OPSS 1010 Granular A	150 mm	200 mm
Granular Subbase OPSS 1010 Granular B Type II	350 mm	350 mm
Total Thickness	630 mm	550 mm

The above recommended pavement layer thicknesses are considered to yield a design life of 20 years, with first maintenance required after approximately seven to ten years.

Pavement Construction Considerations

Subgrade Preparation and Drainage

The overall performance of a pavement structure will greatly depend upon the support provided by the subgrades. A number of factors should be considered at the construction stages to ensure that an acceptable subgrade condition is developed and maintained:

- Any soft areas of notable deflection to the subgrade should be sub-excavated and replaced with a suitable backfill material approved by a qualified geotechnical engineer and compacted to 98 % of its Standard Proctor Maximum Dry Density (herein "*SPMDD*");
- The subgrade should be properly shaped, crowned and then proof-rolled under the full-time observation of a geotechnical representative of this office to delineate any soft areas which may require repair before placing the granular materials; and,
- Surface water should not be allowed to pond on the surface of or adjacent to the outside edges of any developed subgrade.

It is important to ensure that any necessary repairs are undertaken to the subgrades prior to pavement construction to avoid creating "*bathtub*" conditions in the subgrade that will ultimately translate through the overlying pavement structure.

This given, it is also recommended that subdrains and associated positive connections are installed along the full length of any asphalt pavement structure, and in accordance with the City of Burlington's Engineering Standards.

General Reconstruction Considerations

The following considerations should be maintained during paving:

- The requirements defined by OPSS 310 and OPSS.PROV.313 for the design and construction of lap joints between and transitions from existing and new asphaltic concrete pavements when connecting the new pavement construction to the existing pavements of adjacent roads;
- A tack coat should be applied to all contact surfaces prior to placing any hot mix asphalt layers or between asphaltic layers as per OPSS 308; and,
- The placing, spreading and rolling of the asphalt should be in accordance with current provincial standards or the City of Burlington's Engineering Standards.

Granular Base Course and Subbase

The granular base course materials should meet OPSS "*Granular A*" specifications. Quarried 19 mm limestone crushed to Granular A gradation specifications is recommended. Granular subbase material should meet OPSS "*Granular B Type II*" requirements for 100 % crushed quarried bedrock (50 mm crusher-run limestone).

Hot Mix Asphalt

The binder course and surface course asphalt should meet current specifications for HDBC and HL-3 HS respectively, as prescribed by the City of Burlington for commercial/industrial road pavements or, alternatively, OPSS 1150. The standard asphalt binder grade for the climate conditions in Burlington is PG 58-28.

Given the volume of commercial truck traffic is to be high, consideration may be given towards bumping up the binder grade to a higher PG grade of asphalt cement.

Compaction

Granular base course and subbase course fill material should be compacted to 100 % SPMDD. Hot mix asphalt should be compacted to the criteria set out by the City of Burlington's Engineering Standards.

Closure

The Limitations of Report, as stated in Enclosure A, are an integral part of this report.

Soil samples will be retained and stored by Landtek for a period of three months after the issuing of this letter report. The samples will be disposed of at the end of the three-month period unless a written request from the Client to extend the storage period is received.

We trust that this letter report is satisfactory for your purposes, and please do not hesitate to contact our office if you have any questions.

Yours sincerely,

LANDTEK LIMITED



James Dann, B.Eng. (Hons) ACSM
Manager, Geotechnical Projects

Ralph Di Cienzo, P.Eng.
Consulting Engineer

Attachments

Enclosure A: Limitations of Report
Enclosure B: Symbols and Terms Used in the Report
Classification of Soils for Engineering Purposes
Enclosure C: Drawing 22298-01 – Borehole Location Plan
Borehole Logs

ENCLOSURE A
LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the Boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the Boreholes.

The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of Boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Additionally, bedrock contact depths throughout the site may vary significantly from what was encountered at the exact borehole locations. Contractors bidding on the project, or undertaking construction on the site should make their own interpretation of the factual borehole information, and establish their own conclusions as to how the subsurface conditions may affect their work.

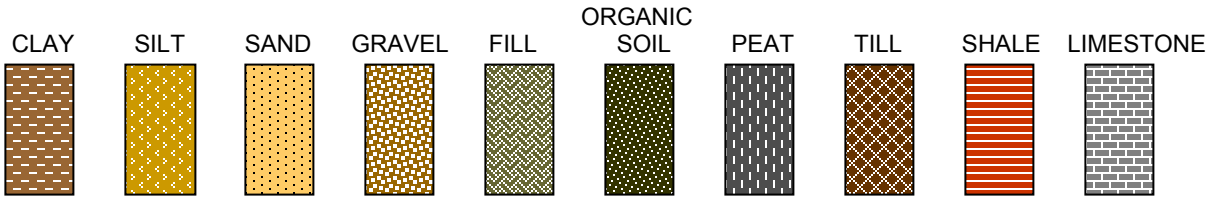
The survey elevations in the report were obtained by Landtek Limited or others, and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Landtek Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek Limited be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

ENCLOSURE B

SYMBOLS AND TERMS USED IN THE REPORT



RELATIVE PROPORTIONS

Term	Range
Trace	0 - 5%
A Little	5 – 15%
Some	15 – 30%
With	30 – 50%

CLASSIFICATION BY PARTICLE SIZE

Boulder ---------- > 200 mm
Cobble ---------- 80 mm – 200 mm
Gravel -
Coarse ---------- 19 mm – 80 mm
Fine ---------- 4.75 mm – 19 mm
Sand -
Coarse ---------- 4.75 mm – 2 mm
Medium -------- 2 mm – 0.425 mm
Fine ---------- 0.425 mm – 0.75 mm
Silt ---------- 0.075 mm – 0.002 mm
Clay ---------- < 0.002 mm

DENSITY OF NON-COHESIVE SOILS

Descriptive Term	Relative Density	Standard Penetration Test
Very Loose	0 – 15%	0 – 4 Blows Per 300 mm Penetration
Loose	15 – 35%	4 – 10 Blows Per 300 mm Penetration
Compact	35 – 65%	10 – 30 Blows Per 300 mm Penetration
Dense	65 – 85%	30 – 50 Blows Per 300 mm Penetration
Very Dense	85 – 100%	Over 50 Blows Per 300 mm Penetration

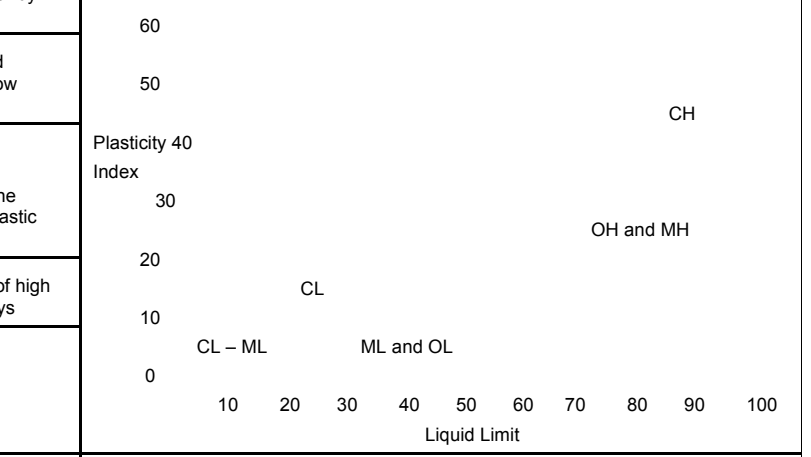
CONSISTENCY OF COHESIVE SOILS

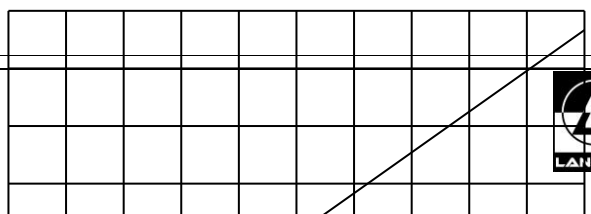
Descriptive Term	Undrained Shear Strength kPa (psf)	N Value Standard Penetration Test	Remarks
Very Soft	< 12 (< 250)	< 2	Can penetrate with fist
Soft	12 – 25 (250 – 500)	2 – 4	Can indent with fist
Firm	25 – 50 (500 –1000)	4 – 8	Can penetrate with thumb
Stiff	50 – 100 (1000 – 2000)	8 – 15	Can indent with thumb
Very Stiff	100 – 200 (2000 – 4000)	15 – 30	Can indent with thumb-nail
Hard	> 200 (> 4000)	> 30	Can indent with thumb-nail

Notes: 1. Relative density determined by standard laboratory tests.
2. N value – blows/300 mm penetration of a 623 N (140 Lb.) hammer falling 760 mm (30 in.) on a 50 mm O.D. split spoon soil sampler. The split spoon sampler is driven 450 mm (18 in.) or 610 mm (24 in.). The “N” value is the Standard Penetration Test (SPT) value and is normally taken as the number of blows to advance the sampler the last 300 mm.

ENCLOSURE B CONTINUED
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487 - 69 AND D 2488 – 69
(Unified Soil Classification System)

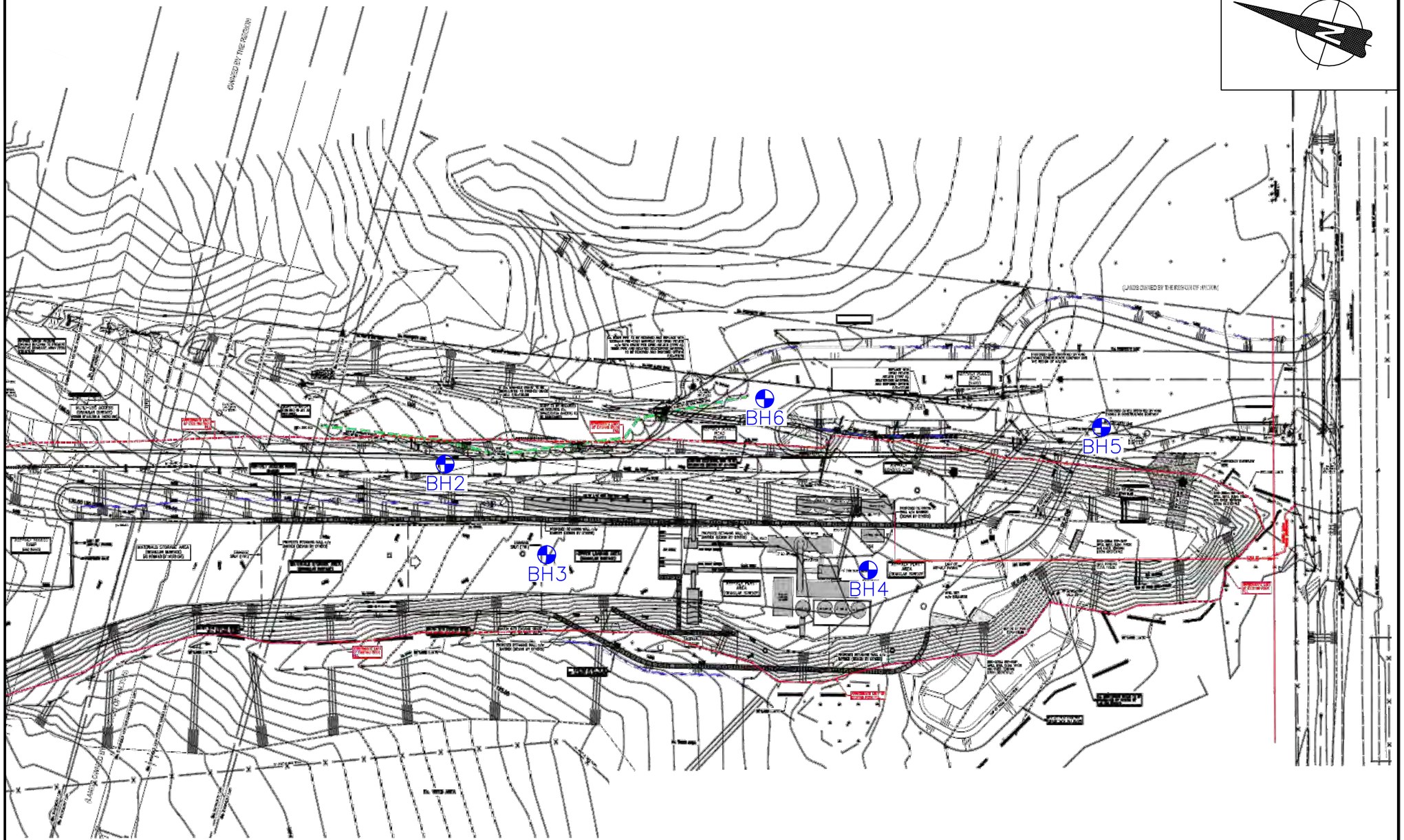
Major Divisions			Group Symbols	Typical Names	Classification Criteria		
Coarse-grained soils More than 50% retained on No. 200 sieve *	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve . . . . . GW, GP, SW, SP More than 12% pass No. 200 sieve . . . . . GM, GC, SM, SC 5 to 12% pass No.200 sieve . . . . . Borderline classifications requiring use of dual symbols	C_u=D60/D10 greater than 4; C_z = $(D30)^2$/(D10xD60) between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines		C_u=D60/D10 greater than 6; C_z = $(D30)^2$/ (D10xD60) between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with fines	SM	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils 50% or more passes No. 200 sieve *	Silts and clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	Plasticity Chart For classification of fine-grained soils and fine fraction of coarse-grained soils. Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols. Equation of A-line: PI=0.73 (LL-20)		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silts			
			OL	Organic silts and organic silts of low plasticity			
	Silts and clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity			
	Highly organic soils		Pt	Peat, much and other highly organic soils	* Based on the material passing the 3 in. (76mm) sieve.		





ENCLOSURE C

DRAWING 22298-01 – BOREHOLE LOCATION PLAN
BOREHOLE LOGS



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project location



Location plan an extract from burlington.maps.arcgis.com*

Legend:

Approximate location of boreholes 2 - 6 drilled by Landtek Limited on September 29th, 2022.

Notes:

Base drawing provided by S. LLewellyn & Associates Limited

revisions

#	date	revision/comment

client
King Paving & Construction Ltd.
% Solution Stream

municipality
The Corporation of the
City of Burlington

project
Geotechnical Investigation
291 North Service Road

sheet
Borehole Location Plan

date: October 25th, 2022
drawn: MDC
checked: JDC
project #: 22298
scale: NTS

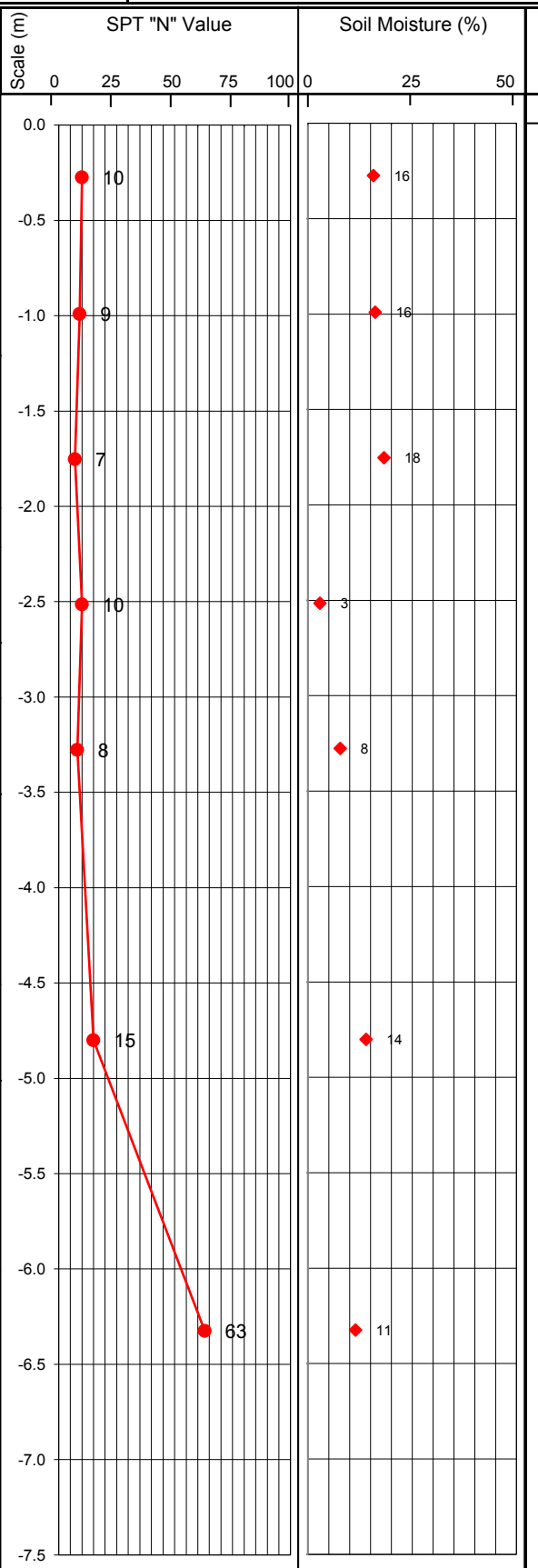
22298-01

LANDTEK LIMITED

BH 2

Project No.:	22298	Drill Date:	September 29, 2022
Project:	Proposed Asphalt Batching Plant Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	291 North Service Road, Burlington, Ontario	Datum:	Ground Surface

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Test Data
Ground Surface					
±125 mm of Sand and Gravel		0.0			
FILL: silty clay, trace grey clay. Brown and red, stiff, moist.		0.1	1	SS	
…trace asphalt pieces, trace red brick fragments.			2	SS	
…no asphalt pieces, no red brick fragments. Firm.			3	SS	
…trace gravel, trace sand. Stiff.			4	SS	
…firm to stiff.			5	SS	
…stiff to very stiff.			6	SS	
SHALE BEDROCK: highly weathered, red. Hard, dry. Residual soil.		6.0	7	SS	
BOREHOLE TERMINATED AT TARGET DEPTH		6.5			



GWL | Monitor Details

Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage was not encountered.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

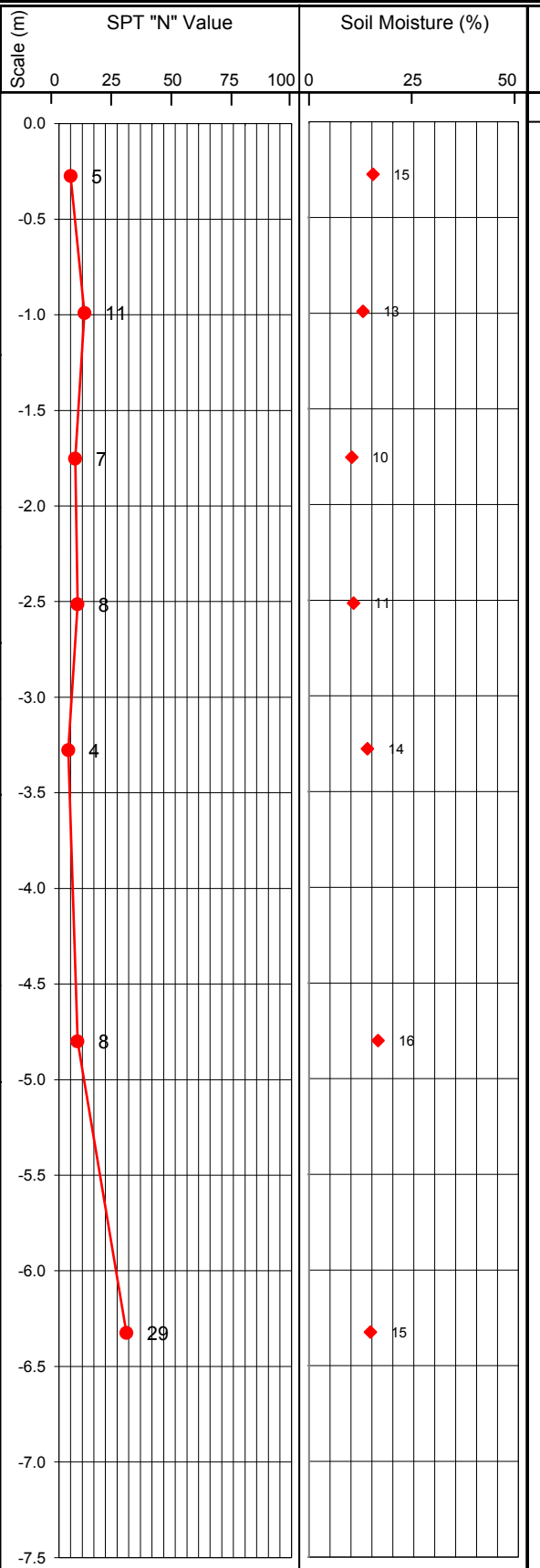
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LANDTEK LIMITED

BH 3

Project No.:	22298	Drill Date:	September 29, 2022
Project:	Proposed Asphalt Batching Plant Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	291 North Service Road, Burlington, Ontario	Datum:	Ground Surface

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface										
±125 mm of Sand and Gravel		0.0								
FILL: silty clay, trace grey clay. Red and brown, firm, moist.		0.1	1	SS						
…trace asphalt pieces, trace red brick fragments.			2	SS						
…no asphalt pieces. Firm.			3	SS						
…trace gravel, trace sand. Stiff.			4	SS						
…sand with silty clay, trace red shale fragments. Loose.			5	SS						
			6	SS						
SHALE BEDROCK: highly weathered, red. Hard, dry. Residual soil.		6.0	7	SS						
BOREHOLE TERMINATED AT TARGET DEPTH		6.5								



Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage was not encountered.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

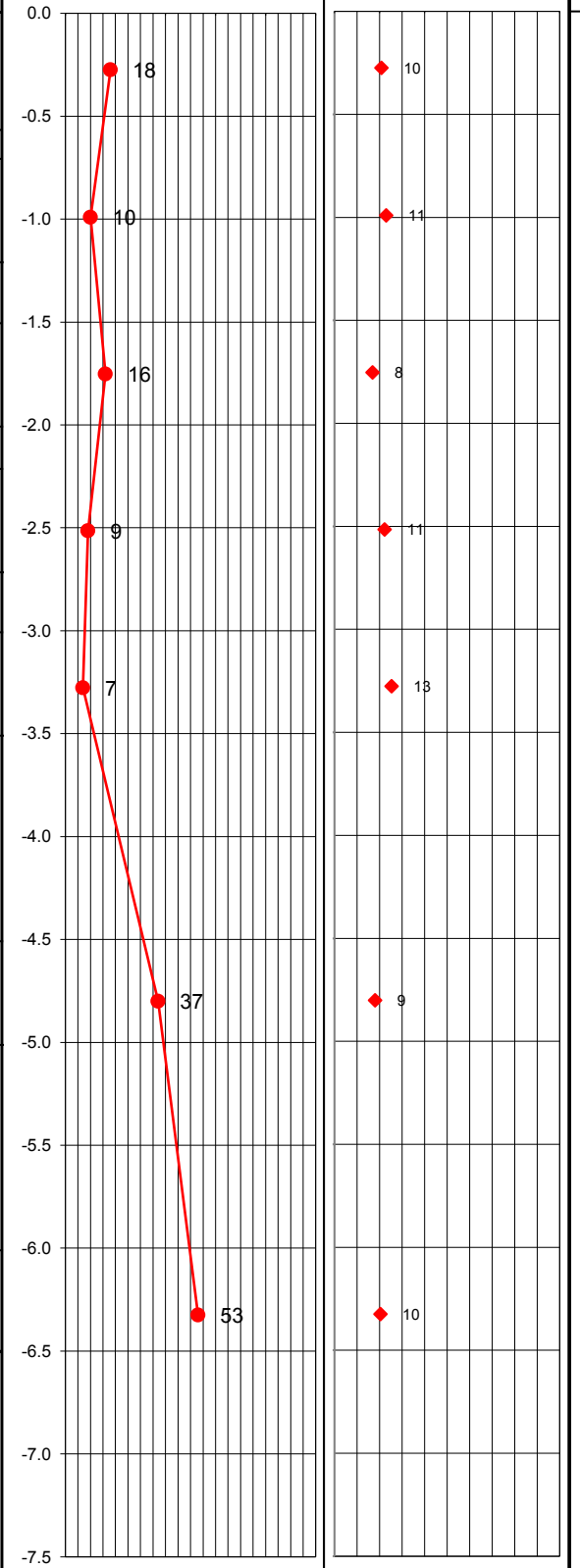
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LANDTEK LIMITED

BH 4

Project No.:	22298	Drill Date:	September 29, 2022
Project:	Proposed Asphalt Batching Plant Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	291 North Service Road, Burlington, Ontario	Datum:	Ground Surface

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface										
±150 mm of Sand and Gravel		0.0								
FILL: silty clay, some gravel. Grey, very stiff, moist.		0.2	1	SS		18	10			
…stiff.			2	SS		10	11			
…silty sand, trace silty clay. Very stiff.			3	SS		16	8			
…trace asphalt pieces. Stiff.			4	SS		9	11			
…silty clay. Red, firm.			5	SS		7	13			
…hard.			6	SS		37	9			
SHALE BEDROCK: highly weathered, red. Hard, dry. Residual soil.		6.0	7	SS		53	10			
BOREHOLE TERMINATED AT TARGET DEPTH		6.5								



Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage was not encountered.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

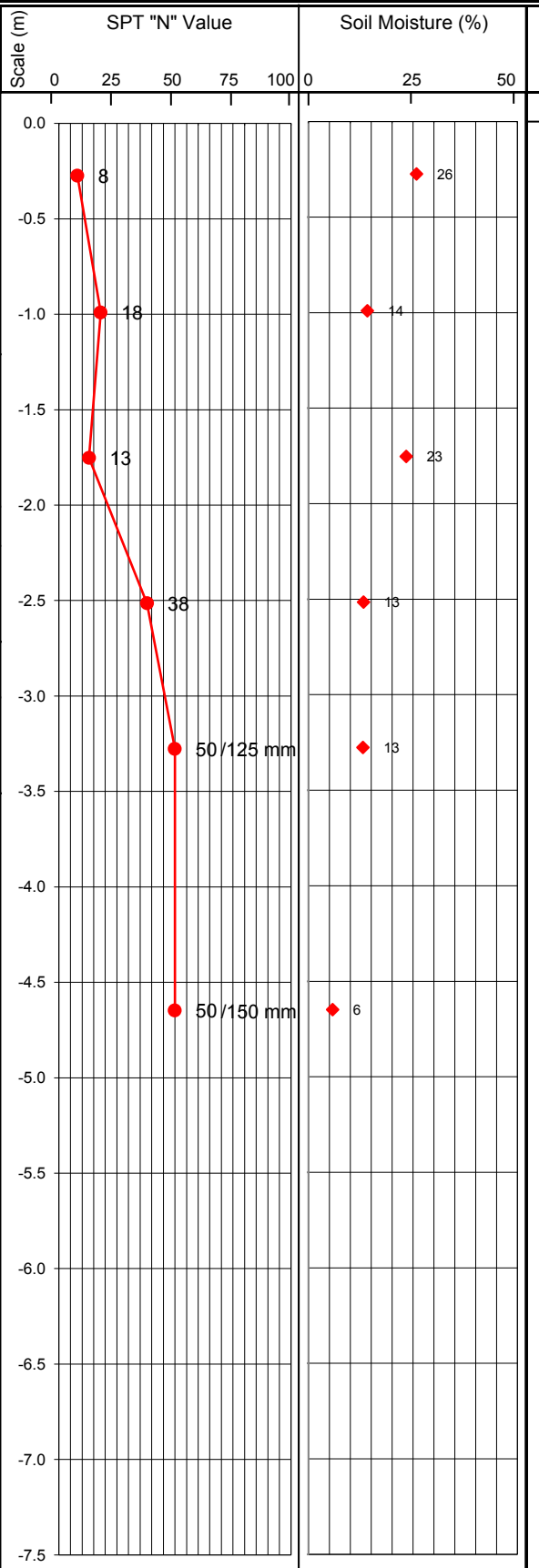
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LANDTEK LIMITED

BH 5

Project No.:	22298	Drill Date:	September 29, 2022
Project:	Proposed Asphalt Batching Plant Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	291 North Service Road, Burlington, Ontario	Datum:	Ground Surface

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface										
±150 mm of Sand and Gravel		0.0								
FILL: silty clay, trace grey clay. Brown and red, stiff, moist.		0.2	1	SS						
			2	SS						
SILTY CLAY TILL: trace gravel, trace grey clay fragments. Brown, stiff, moist. Possible Fill.		1.5	3	SS						
SHALE BEDROCK: highly weathered, grey. Hard, dry.		2.3	4	SS						
			5	SS						
…red.			6	SS						
BOREHOLE TERMINATED AT TARGET DEPTH		4.7								



Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage was not encountered.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

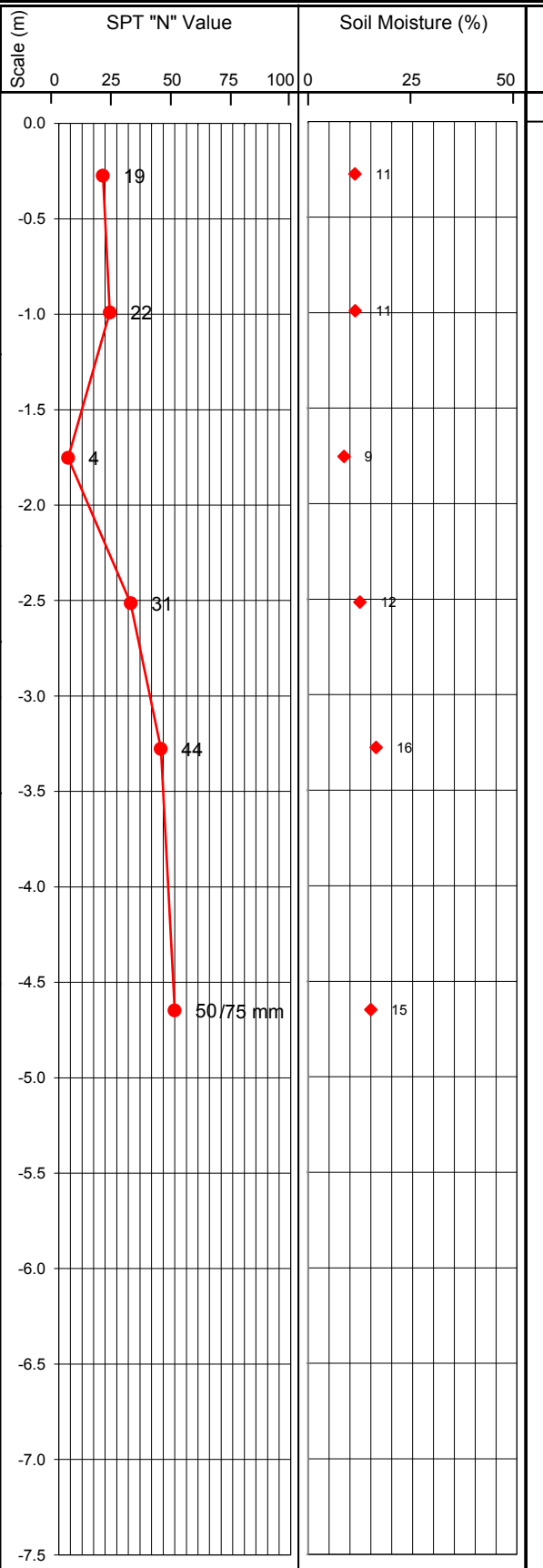
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LANDTEK LIMITED

BH 6

Project No.:	22298	Drill Date:	September 29, 2022
Project:	Proposed Asphalt Batching Plant Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	291 North Service Road, Burlington, Ontario	Datum:	Ground Surface

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Test Data
Ground Surface					
±75 mm of Topsoil		0.0			
FILL: silty clay, trace grey clay, trace gravel, trace red brick fragments. Red, very stiff, moist.		0.2	1	SS	
			2	SS	
…no red brick fragments. Soft to firm.			3	SS	
SILTY CLAY TILL: trace gravel, trace red shale fragments. Red, hard, dry to moist.		2.3	4	SS	
SHALE BEDROCK: highly weathered, red. Hard, dry.		2.6	5	SS	
			6	SS	
BOREHOLE TERMINATED AT TARGET DEPTH		4.7			



GWL | Monitor Details

Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage was not encountered.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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engineering@landteklimited.com
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September 22, 2022
File: 22298

King Paving & Construction Ltd.
1077 Howard Avenue
Burlington, Ontario
Via email: jahutter@kingpaving.com

Attention: Mr. John Hutter, VP Operations

Re: Environmental Opinion Letter – 291 North Service Road, Burlington, Ontario

INTRODUCTION

This letter was provided by Landtek Limited in response to a request on behalf of the Solution Stream at the direction of the City of Burlington. Based on the information provided to Landtek, it is understood that King Paving & Construction Ltd. concerning the development of 291 North Service Road in Burlington, Ontario for proposed industrial Use.

SCOPE OF WORK

Landtek conducted the following scope of work:

1. Completing the City of Burlington's Environmental Site Screening Questionnaire on behalf of the client.

2. Provide opinion by a Qualified Person (QP ESA) as defined by O.Reg. 153/04 concerning the proposed Site Development and the potential impact of methane from the historical land fill located to the west of the Site Development, based on the information provided to Landtek specifically in the report - Closed Burlington North Service Road Landfill Site – 2021 Annual Monitoring Report prepared by WSP dated March 31, 2022 for Halton Region (2021 Landfill Monitoring Report)

SITE DESCRIPTION

Based on information from Client, the Site development area is and irregular shaped approximately 2 ha of a larger parcel located to the south of the former landfill. The proposed development will be for King Paving's Asphalt batching facility. The development area is located to the south of Hydro One electrical transmission corridor adjacent to North Service Road, approximately 150 m from the southern extent of the closed Burlington Landfill, with the proposed development infrastructure approximately 200 m from the southern extent of the former landfill.

Geological Data and Groundwater

Geological and Hydrogeological information sources were reviewed to determine the nature of the subsurface strata on Site. The topography of the Site slopes to the south. The elevation of the Site is approximately 120 metres above sea level (masl). Surface drainage flows towards drainage ditches located along the south side of the Site which then discharges into ditches along North Service Road located along the south side of the property.

Based on a review of an existing geological publication for the site area, Ontario Geological Survey (OGS) Map 2509: "Quaternary Geology of the Hamilton Area", the site is underlain by a veneer of lacustrine and outwash sand deposits. These deposits generally comprise sands and silty sands. Underlying the sand deposits is clay or silt till, identified as a sequence of the Halton Till.

According to the OGS Map 2336 "Paleozoic Geology of the Hamilton Area", the superficial geology is underlain by red shale bedrock of the Queenston Formation. Previous geotechnical investigation undertaken in the vicinity of the site indicates that shale bedrock is at shallow depths beneath the site (i.e. less than 5 m below existing ground level).

Information provided by a large number of historical borehole records from within the vicinity of the site, and held by the OGS, generally confirms the anticipated geological conditions beneath the site. Based on the data from records for boreholes, located approximately 100 m of the site, the superficial soil profile confirms the presence of silt or clay till underlying sand deposits to a depth of approximately 5 m. Red shale bedrock is reported underlying the till deposits.

The nearest open water feature is Lake Ontario, located approximately 2.0 km south of the Site.

Closed Burlington N.S.R. Landfill Site – 2021 Annual Monitoring Report

Landtek was provided with the 2021 Landfill Monitoring Report. The Closed Burlington North Service Road Landfill Site (Site) is located on the northwestern side of the North Service Road and west of King Road. The landfill area covers an area of waste is approximately 34.5 ha. The landfill received waste from 1971 to December 1988, when the landfill was closed. A monitoring program with annual reporting has been in place since 1980 under Provisional Certificate of Approval A210102.

A leachate interceptor collection system has been located to the east, west and south side of landfill to control run-off from the landfill. The landfill volume is approximately 7 m above the leachate collection system.

Topography and local terrain slope in a southerly direction with flow toward the local watercourses. Regional groundwater flows in a southerly direction from higher elevations near the Escarpment toward Hamilton Harbour portion of Lake Ontario.

- Local shallow groundwater flow is influenced primarily by local terrain with flow toward the local watercourses.
- Local groundwater quality in the overburden and bedrock is naturally poor with some parameters exceeding the Ontario Drinking Water Quality Standards (ODWQS, MECP 2006 and updates).

- No groundwater users or water supply wells for domestic use adjacent to the Site. Landfill influences on groundwater quality are typically limited to areas immediately adjacent to and downgradient of the refuse.

Groundwater Monitoring and Quality

- Groundwater quality at the landfill property boundary monitors, particularly in the northeastern portion of the Site, indicate a leachate influence.
- Monitors located on the landfill property south and southwest of the refuse indicate that groundwater quality from is marginally influenced by landfill leachate.
- several inorganic parameter concentrations at the southern property boundary exceeded the Ministry of the Environment, Conservation and Parks (MECP) Guideline B-7 criteria for reasonable use in 2021.
- Organic parameters also exceeded the MECP Guideline B-7 criteria within on-site and property boundary monitors, including 1,4-dichlorobenzene, benzene, dichloromethane, and vinyl chloride.
- No leachate influences on surface water quality were observed in Falcon Creek adjacent to, and downgradient of, the former landfill.

Methane Gas

- Combustible gas (methane) concentrations adjacent to the eastern boundary of the landfill, on the Meridian Brick property, periodically exceed the lower explosive limit (LEL) for methane.
- A sentinel gas monitoring network is currently in place. The report stated no significant concentrations of combustible gas have been detected within the sentinel monitors to the south of the landfill.

CONCLUSIONS

Based on the information provided Landtek make the following conclusions:

- Methane gas/combustible gas are not considered to have an impact on the proposed buildings that will be constructed adjacent to North Service Road

- Methane gas should continue to be monitored on southeastern boundaries and within the proposed development.

Yours truly,

LANDTEK LIMITED

Paul Blunt, P. Eng. QP_{ESA}

Attachments: Statement of Limitations

Limitations of Report

This report was prepared for the sole use of the Client and authorized financial and mortgage institutions. It is intended to provide an evaluation of the current environmental conditions at the subject Site. Any use of this report, or decisions made based on it, by an unauthorized party, is the responsibility of the unauthorized party. Landtek Limited accepts no responsibility for damages of any type suffered by the unauthorized party as a result of actions or decisions made based on this report.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with customary principles and practices in the fields of environmental science and engineering with in the limited scope of work.

It should be noted that all surficial environmental assessments are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and Site evaluation. Subsurface conditions were not field investigated as part of this study and may differ from the conditions implied by the surficial observations. Additionally, the passage of time may result in a change in the environmental characteristics at this Site and surrounding properties. Landtek does not warrant against future operations or conditions, or against operations or conditions present of a type or at a location not investigated.

The conclusions and recommendations given in this report are based on information obtained from various sources noted and a visual examination of the Site. It is based on the conditions of the subject property at the time of the field investigation supplemented by a review of historical information to assess environmental conditions at the Site reported. Landtek Limited assumes that information provided by others is factual and accurate, and accepts no responsibility for any deficiency, misstatement, of inaccuracy in this report from information provided by others.

The primary direction of groundwater flow is assumed to follow topography, unless otherwise indicated by measurement of potentiometric surface or other quantifiable data.

Sampling and analysis of soil, groundwater, or other materials was not carried out as part of the scope of work. The findings of the assessment cannot be extended to reflect portions of the Site that were unavailable for direct observation by Landtek Limited.

This assessment should not be considered a comprehensive audit that eliminates all risks of encountering environmental problems. There is no warranty expressed or implied by this report concerning the status of the study Site.