TATHAM ENGINEERING

Enhancing our communities

16728 Highway 12, Midland

PRELIMINARY STORMWATER MANAGEMENT REPORT

U-Haul Co. Canada Ltd.

File 324816 | September 25, 2024

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PROVINCE OF ONTARIO

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Issue	Date	Description
1	September 25, 2024	First Submission

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by U-Haul Co. Canada Ltd. to prepare a Preliminary Stormwater Management (SWM) Report in support of a proposed development located at 16728 Highway 12 in the Town of Midland (Town). A Functional Servicing Report (FSR), Traffic Impact Brief (TIB) and Hydrogeological Assessment (Hydro-G) Report have been prepared by Tatham and are submitted under separate cover.

1.1 SITE DESCRIPTION

The overall development site is approximately 2.35 hectares in size and is located at 16728 Highway 12 within the Town of Midland. The property is bound by Prospect Boulevard to the south, an existing commercial hotel to the east, Highway 12 to the north, and an existing commercial automotive dealership to the west.

The property is located in the Wye River watershed which is within the jurisdiction of the Severn Sound Environmental Association (SSEA). The site location is illustrated on Figure 1 enclosed at the rear of this report for reference.

1.2 OBJECTIVES

The primary objective of this report is to demonstrate the proposed preliminary SWM plan will address potential adverse impacts the development may have on the local surface water features and water quality. This will be accomplished by evaluating the impacts of the development on the local drainage conditions and, where necessary, provide solutions to mitigate potential adverse impacts.

1.3 GUIDELINES AND BACKGROUND REPORTS

The proposed SWM Plan was developed recognizing the pertinent Municipal and Provincial guidelines on municipal design, water resources, and the environment, as well as the following publications:

- Town of Midland Engineering Development Design Standards, (2024);
- Design Criteria for Sewage Works, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approvals (MECP, 2022);
- Stormwater Management Planning and Design Manual, (Ministry of the Environment, 2003); and
- Drainage Management Manual, (Ministry of Transportation, 1995-1997).

1.4 PROPOSED DEVELOPMENT

The proposed development includes buildings consisting of the following:

- Building 'A' – a 3-storey, 3,348 m^2, mixed use building including self-storage, office and retail spaces; and
- Building 'B' – a 1-storey, 1,186 m^2 logistics building with the interior configured as one large open space 3-storeys in height.

In addition to the self-storage building, the site also includes an external storage unit area configured as four distinct groupings of storage units separated by access laneways. These storage units will be configured to allow surface drainage to flow beneath them without affecting their contents.

Building 'A' will reside along the west side of the property near the northern property limit while Building 'B' will also reside on the west side of the parcel, approximately 10.0 m south of the self-storage building. The external storage units will be located near the south-east corner of the property along with snow storage and a dry pond. The site plan also includes guest parking along the flanks of the buildings with truck share parking along the north and south lot limits, all of which will be accessed through a new site entrance to Prospect Boulevard. The existing site access to Highway 12 is to be removed.

2 Existing Drainage Conditions

Information relating to existing topography, ground cover, and drainage patterns was obtained through a review of available plans and base mapping. A detailed survey was completed by J.D.Barnes Ltd. O.L.S. on January 22, 2024. A Pre-Development Drainage Plan (Drawing DP-1) illustrating the existing drainage conditions across the site and in surrounding area is included as Figure 2. The existing drainage conditions are described as follows:

- Green Geotechnical Ltd. (2023) defines the subsurface conditions as approximately 0.2 m – 0.7 m of topsoil followed by silty sand with trace gravel. Ontario Soil Survey No. 29 (Simcoe County North) defines the site soils as Vasey sandy loam (Vasl);
- Groundwater on the site is generally deep with four of the five monitoring wells found to be dry during site visits on March 13 and July 29, 2024 as described in the Hydro-G report. One monitoring well in the southwest corner of the property identified groundwater at 3.3 m below ground surface during the March 13, 2024 site visit;
- The existing ground cover of the property is primarily trees with some open grass areas near the south-east corner;
- Existing topography of the site consists of an average grade of 6% in a west to east direction;
- All runoff from the site converges in the existing ditch near the southwest corner of Highway 12 and King Street; and
- All drainage from the site is ultimately conveyed to Georgian Bay via the Wye River.

2.1 EXISTING HYDROLOGY

The Rational Method has been used for the purpose of estimating existing peak flow rates. The interior site has been modelled as two catchments, (Catchment 101 and 102) with the external drainage areas expressed as three separate catchments (Catchment EXT-1, EXT-2, and EXT-3).

Catchment 101 is approximately 0.48 ha and is comprised mainly of unimproved areas such as grass, tress, and vegetation. An existing runoff coefficient (RC) of 0.20 is assigned in accordance with Town design standards and with reference table 1.07 of the Ministry of Transportation (MTO) Drainage Management Manual. Drainage within this catchment is conveyed north to the Highway 12 ditch.

Catchment 102 is approximately 1.87 ha and is comprised mainly of unimproved areas such as grass, trees, and vegetation with a corresponding RC of 0.20. Drainage within this catchment is conveyed south to the ditch along Prospect Boulevard.

External catchment EXT-1 is approximately 0.03 ha and consists of gravel and grassed areas from the adjacent property to the west and has a corresponding RC of 0.47. This external catchment is tributary to Catchment 102 along the west side yard property limit.

External catchment EXT-2 is approximately 0.04 ha and consists of gravel areas from the adjacent property to the west and has a corresponding RC of 0.60. This external catchment contributes to Catchment 102 along the west side yard property limit.

External catchment EXT-3 is approximately 0.03 ha and consists of gravel and grassed areas from the adjacent property to the west and has a corresponding RC of 0.47. This external catchment is tributary to Catchment 101 along the west side yard property limit.

All combined, the existing catchments represent an area of approximately 2.45 ha with a corresponding composite RC (CRC) of 0.21.

Supporting calculations for the Runoff Coefficients are provided in Appendix A.

Peak flows for the 1:2-year through 1:100-year return frequency design storms have been generated using the intensity-duration-frequency (IDF) parameters from the Town of Midland design standards. Peak flows for the entire site, which includes drainage to Highway 12, are summarized in Table 1. A separate column, extracting the portion of drainage conveyed directly to Highway 12, is also provided in Table 1 for comparison with post-development.

Supporting calculations are provided in Appendix B.

Table 1: Pre-Development –Peak Flow Summary

STORM	PEAK FLOW RATE (L/S)	
	Full Site	Highway 12 Only
1:2-year	61.6	17.3
1:5-year	81.2	22.7
1:10-year	94.3	26.4
1:25-year	121.8	34
1:50-year	148.3	41.3
1:100-year	169.8	47.3

3 Stormwater Management Plan

The proposed SWM Plan has been developed to address potential adverse impacts the development may have on the local surface water features and on surface water quality. This SWM Plan is subject to review and approval in support of Zoning By-Law and Official Plan amendments. The proposed SWM plan is outlined in the following sections and illustrated on the design drawings included in Appendix G.

3.1 DESIGN CRITERIA

Based on the background information collected and our analysis of this information, a clear understanding of the potential impacts, and required mitigating measures, were gained. The following design criteria are to be satisfied in the proposed SWM report:

- Post-development peak flow rates for the site must be controlled to pre-development rates to ensure no adverse impacts to downstream landowners. As such, water quantity controls will be provided to attenuate post-development peak flow rates to pre-development flow rates.
- Post-development peak flow rates for the portion of drainage conveyed directly to Highway 12 must also be controlled to pre-development rates to ensure no adverse impacts to the Highway corridor.
- Water quality controls are to be provided to satisfy the MECP SWM Planning and Design Manual. Primarily, this would apply to the proposed parking lot and front yard areas as drainage from rooftops is considered to be clean. As such, “Enhanced” Level 1 water quality treatment corresponding with 80% long-term total suspended solids (TSS) removal is proposed.
- Recognizing the site is located in a Significant Groundwater Recharge Area (SGRA) and quantity sensitive Wellhead Protection Area (WHPA), best efforts are proposed to minimize changes in water balance between pre and post-development conditions.
- A siltation and erosion control plan is required to prevent the migration of sediment off-site during construction activities.

3.2 PROPOSED STORMWATER MANAGEMENT PLAN

A post-Development Drainage Plan (Drawing DP-2) is enclosed as Figure 3 and illustrates the proposed drainage conditions.

As the proposed building and pavement surfaces will increase the CRC, on-site stormwater quantity controls are required to reduce post-development peak flow rates to existing rates. The post-development site is modelled as four drainage catchments (Catchment 201, 202, 203, and 204) alongside the external drainage catchments which are unchanged.

Calculations of the post-development runoff coefficients are provided in Appendix A.

3.2.1 Uncontrolled Areas

Catchment 203 consists of grassed areas and part of the proposed parking lot which drain towards Highway 12. Drainage within this catchment is conveyed to the Highway 12 ditch via proposed swales, grading of grassed areas promoting sheet flow and a curb outlet with asphalt spillway from the parking area to minimize erosion of the slope. The catchment area is 0.20 ha and has a CRC of 0.39. The area of this catchment has been configured to ensure post-development runoff matches pre-development rates from Catchment 101, thus eliminating need for quantity controls.

Calculations demonstrating a net reduction in peak flows conveyed directly toward Highway 12 are included in Appendix B and summarized in Table 2.

Table 2: Highway 12 - Post to Pre-Development –Peak Flow Summary

STORM	PEAK FLOW RATE (L/S)	
	Pre Development (Catchment 101 & EXT-3)	Post-Development (Catchment 203 & EXT-3)
1:2-year	17.3	16.7
1:5-year	22.7	21.9
1:10-year	26.4	25.3
1:25-year	34	32.6
1:50-year	41.3	39.6
1:100-year	47.3	45.3

Catchment 204 consists of a six-meter-wide strip of land along the east side of the property graded with 3:1 slopes to match existing grade at the property line. The catchment area is 0.17 ha and has a CRC of 0.20.

External drainage from Catchment EXT-3 will continue to drain through the site via Catchment 203 maintaining existing conditions.

3.2.2 Controlled Areas

Catchment 201 represents the balance of the proposed parking lot and the grassed areas nearest to Prospect Boulevard. The catchment has an area of 1.37 ha and a CRC of 0.76. Drainage within this catchment will be conveyed overland to a shallow swale behind the proposed snow storage area where it is then conveyed into an infiltration cell via two 450 mm diameter culverts. Additional detail on the infiltration cell is provided in Section 3.3. For less frequent storm events, an 8.5 m wide quantity weir is proposed in the berm between the swale and infiltration cell, ultimately allowing conveyance to the proposed dry pond.

Catchment 202 represents the building rooftops and grassed area on the west side of the property. The catchment has an area of 0.61 ha and a CRC of 0.77. Drainage from catchments 202 and EXT-2 will be conveyed to an infiltration cell proposed in the grassed area for quality treatment of runoff from the 25 mm storm event. Additional detail on the infiltration cell is provided in Section 3.3. For less frequent storm events, the walkway and asphalt area between the two buildings act as an overflow weir, conveying drainage to Catchment 201 and the dry pond via an overland flow route over the paved area.

Calculations of the weir and overland flows associated with on-site quantity conveyance are provided in Appendix C.

External drainage from Catchments EXT-1 and EXT-2 will continue to drain through the site via Catchments 201 and 202 respectively, maintaining existing conditions.

3.2.3 Quantity Controls and Storage

The Modified Rational Method was used to compute the uncontrolled post-development peak flows discharging from the proposed development and contributing external areas. Results of the hydrologic analysis of uncontrolled, post-development peak flows for the 1:2-year through 1:100-year return frequency design storms are summarized in Table 3 with supporting calculations provided in Appendix B.

Table 3: Post-Development – Uncontrolled Peak Flow Summary

STORM	PEAK FLOW RATE (L/s)		
	Catchment 201, 202, EXT-1 & EXT-2 (Uncontrolled)	Catchment 203, 204 and EXT-3 (Uncontrolled)	Total (Uncontrolled)
1:2-Year	334.3	21.4	355.7 *(61.6)*
1:5-Year	436.8	28.1	464.9 *(81.2)*
1:10-Year	505.5	32.6	538.1 *(94.3)*
1:25-Year	650.2	42.0	692.2 *(121.8)*
1:50-Year	785.0	51.0	836.0 *(148.3)*
1:100-Year	899.3	58.4	957.6 *(169.8)*

Note: (*169.8*) – Existing peak flow rate

Peak flow attenuation of the 1:2-year through 1:100-year return frequency design storms generated from Catchments 201 and 202 will be provided through storage of stormwater in the proposed dry pond and the eastern infiltration cell during infrequent events. For the purposes of quantity controls, water quality and infiltration cell volumes are excluded. A primary orifice control of 160 mm diameter is proposed in the outlet structure within the dry pond. The invert of the pipe conveying discharge from the control structure (perforated riser) is 215.29 m while the orifice control is proposed with preliminary centroid elevation of 215.38 m providing 10 mm of separation between the invert of the orifice and outlet pipe.

The dry pond will consist of 3:1 sidewall slopes configured with a maximum surface area of approximately 980.7 m^2. The channel and infiltration cell immediately upstream the dry pond have sidewalls graded with 3:1 slopes and a maximum surface area of approximately 632.6 m^2.

The base elevation of the dry pond is 215.30 m while the top of pond elevation is 217.10 m. The base elevation of the conveyance channel and infiltration cell meanwhile, is 216.50 m while the top elevation is also 217.10 m. At a maximum water surface elevation of 216.80, the combined areas provide storage for approximately 1,139 m^3 of runoff.

The Modified Rational Method was utilized to determine operating characteristics of the SWM system including flow rates, storage volumes and water surface elevations for the 1:2-year through 1:100-year return frequency design storms which are summarized in Table 4.

Supporting calculations and stage-storage-discharge tables are provided in Appendix D.

Table 4: Quantity Control - Operating Characteristics Summary

STORM	PEAK FLOW RATE (L/s)			STORAGE VOLUME (m^3)	WATER ELEVATION (m)
	Catchment 201, 202 and EXT-1, EXT-2 (Controlled)	Catchment 203, 204 and EXT-3 (Uncontrolled)	Total (Controlled)		
1:2-Year	39.5	21.4	60.9 *(61.6)* **0.7**	305	215.88
1:5-Year	46.0	28.1	74.1 *(81.2)* **7.1**	418	216.05
1:10-Year	49.7	32.6	82.3 *(94.3)* **12.0**	495	216.16
1:25-Year	56.5	42.0	98.5 *(121.8)* **23.3**	662	216.39
1:50-Year	61.0	51.0	112.0 *(148.3)* **36.4**	834	216.56
1:100-Year	63.9	58.4	122.2 *(169.8)* **47.5**	974	216.68

Note: (*169.8*) – Existing peak flow rate, **47.5 –** Difference in Post-Development and Existing flow.

Since the controlled post-development flows do not exceed the pre-development flows, the proposed stormwater system satisfies the quantity control requirements.

3.2.4 External Drainage

As previously noted, conveyance of uncontrolled surface drainage from external contributing catchments will generally be maintained post-development through grading design and establishment of swales to provide a positive outlet through the site. Existing grades will be matched along the perimeter of the site.

3.2.5 Emergency Flow Conveyance

For storms exceeding the 1:100-year event, or where partial blockage of the quantity control drains should occur, a proposed 15.0 m wide emergency overflow weir on the south side of the dry pond will be utilized to effectively convey stormwater off site. The overflow weir elevation of 216.80 m has been set above the 1:100-year design storm water level of 216.68 to ensure it is only active in emergency events. Located within the 0.3 m depth of freeboard at the top of the pond, the weir is capable of conveying the uncontrolled, post-development 1:100-year storm flow at a depth of approximately 0.13 m.

Calculations for the pond emergency overflow weir are included in Appendix D.

3.3 WATER QUALITY CONTROL

The proposed water quality treatment objective under the proposed condition will provide MECP enhanced level treatment corresponding to 80% TSS removal for on-site runoff.

Water quality control for the development will be provided via two infiltration cells, and LID practices consisting of grassed swales and roof leaders directed to pervious grass areas. While the dry pond is also anticipated to provide a measure of quality control, it has not been quantified due to anticipated low drawdown times.

3.3.1 Infiltration Cells

Two infiltration cells are proposed to treat direct runoff from Catchment 201 and 202 separately. Each cell was designed to provide a 48-hour drawdown time for the runoff volume generated by a 25 mm storm event, achieving 80% TSS removal in accordance with MECP and NVCA guidelines.

The infiltration cell treating catchment 202 has been proposed a minimum of 4.0 m from the building to mitigate interaction between the infiltrated water and footings of the building. The cell has a footprint of approximately 150 m^2 and underground storage depth of 2.10 m. The combined maximum storage volume provided when including surface storage is approximately 168.2 m^3, exceeding the maximum 125.00 m^3 storage required to infiltrate the 25 mm storm. The cell provides an infiltration rate of approximately 2.60 cubic meters per hour.

The infiltration cell treating catchment 201 has been proposed behind the snow storage area, with the proposed gently graded swale collecting and conveying drainage to the infiltration trench providing pre-treatment. The cell has an approximate footprint of 311.7 m^2 and underground storage depth of 2.10 m. The approximate maximum storage volume of 261.8 m^3 provided exceeds the required storage of 259.0 m^3 and provides an infiltration rate of 5.4 cubic meters per hour.

Supporting calculations relating to the infiltration cells are provided in Appendix E.

3.3.2 Low Impact Development Practices

Grassed swales have been specified in landscaped areas throughout the site including rear and side lot areas and behind the snow storage area to promote infiltration and to reduce post-development runoff. Roof leaders from the buildings will outlet at grade onto grassed areas draining directly into the infiltration cells to promote infiltration.

The above LID practices have been designed to promote infiltration at the site. They have been specified to complement the water quality and quantity functions of the dry SWM facility and infiltration cells, providing pre-treatment of runoff prior to infiltration.

3.3.3 Treatment Train Calculation Approach

As previously noted, a small area of the proposed parking surface in Catchment 203 is conveyed to the Highway 12 ditch, bypassing the proposed quality controls, however, is conveyed by grassed swales to an existing roadside ditch. The combined grassed swales and infiltration trench servicing Catchment 201 however, will exceed the 80% TSS removal requirement as they operate as a treatment train. When both catchments and their respective level of treatment are considered together however, an overall TSS removal of 80% for the site is achieved if the swales are considered to provide 36% TSS removal independently. Catchments 202 and 204 are excluded from the calculation as they consist of surface features which are considered to be clean, and not requiring water quality control.

Supporting calculations are provided in Appendix E.

3.4 WATER BUDGET

A preliminary water budget has been prepared using the Thornthwaite and Mather approach to determine water surplus after evapotranspiration and it should be noted the site is within a WHPA for municipal water quantity SGRA. Our following analysis is based on the Midland WPCP Climate Normal Data for 1997 – 2016 (Environment Canada).

Under existing conditions, the site has an infiltration factor of 0.6. Under post-development conditions, the area of pervious land cover will decrease, and the infiltration factor will also decrease to 0.5 due to the change in land cover from wooded to pasture. As such, the annual infiltration is estimated to decrease by 5,486 m^3 under the proposed conditions.

The proposed infiltration cells promoting water balance have similar composition with varying footprints, each one matching its respective catchment area. For Catchment 201, the cell design consists of 6.1 m wide, and 51.1 m long area and captures runoff from the most frequent storm events. Runoff from the less frequent storm events will drain to the dry pond via a channel.

The proposed cell for 202 is 2.5 m wide and 60.0 m long and captures runoff from the most frequent storm events with excess runoff overtopping a proposed weir into the parking lot.

Underlying the topsoil and sod for both cells is a 1.45 m thick layer of 19 mm clear stone over a 0.5 m thick layer of sand to provide filtration prior to infiltrating into native material. To prevent migration of fines into the clear stone component, the clear stone volume is wrapped in a permeable geotextile filter fabric.

The proposed infiltration cells further promote infiltration into the native soils, with potential to increase infiltration by 2,851 m^3 annually in comparison with existing figures.

Supporting calculations are provided in Appendix F.

4 Erosion Control and Grading

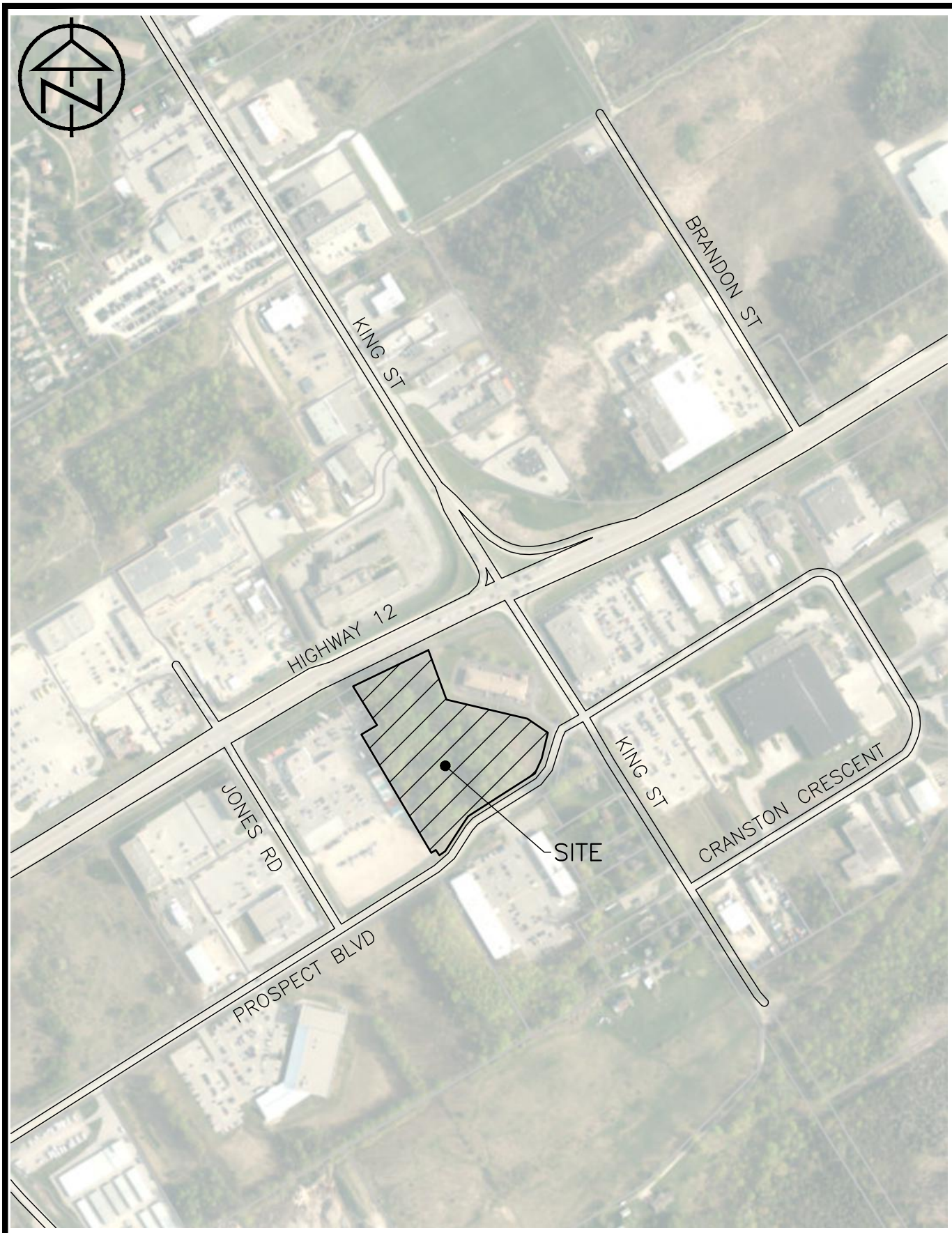
Siltation and erosion controls will be implemented for all construction activities, including removals, earthwork operations, service construction, building construction, paving and grading works. Details of the siltation and erosion controls are shown on the Erosion & Siltation Control Plan drawing (ESC-1) in Appendix G. A number of standard practices which will be implemented are summarized as follows:

- The disturbance area and activities will be minimized where possible;
- The smallest possible land area will be exposed for the shortest amount of time;
- Heavy duty silt control fences will be erected coincident with the property boundary prior to commencement of grading operations to control sediment movement;
- A stone mud mat will be implemented at the construction entrance;
- Catch basins on-site and downstream of the site will have grates wrapped in permeable geotextile to prevent migration of sediment into the storm sewers;
- Straw bale check dams will be installed in existing ditches and drainage features downstream of anticipated disturbance;
- Regular inspection of control measures shall be instituted and repairs made as necessary; and
- Promptly re-vegetating disturbed areas following completion of construction works within the site.

5 Summary

This report has been prepared to document the stormwater management plan recommended for the subject property as well as the applicable design criteria and proposed siltation and erosion controls. The preliminary SWM plan ensures the development can be constructed in accordance with all applicable municipal and provincial guidelines while minimizing the impact of the development on the local drainage systems. The SWM design criteria described in Section 3.1 of this report will be achieved and is summarized as follows:

- Post-development peak flow rates will be controlled to lower than existing flow rates for the 1:2-year through 1:100-year storm events. Water quantity controls will be provided via controlled discharge through a 160 mm diameter orifice plate combined with a dry pond.
- Post-development peak flow rates conveyed directly to Highway 12 will be maintained below existing flow rates through proposed grading.
- “Enhanced” Level 1 water quality controls corresponding to 80% TSS removal are provided through inclusion of infiltration cells grassed swales for pre-treatment.
- Best efforts have been provided to mitigate changes in water balance due to the proposed development achieving a surplus compared with pre-development condition. These measures include out letting roof drains onto pervious ground surfaces and two infiltration cells to promote infiltration into native soil.



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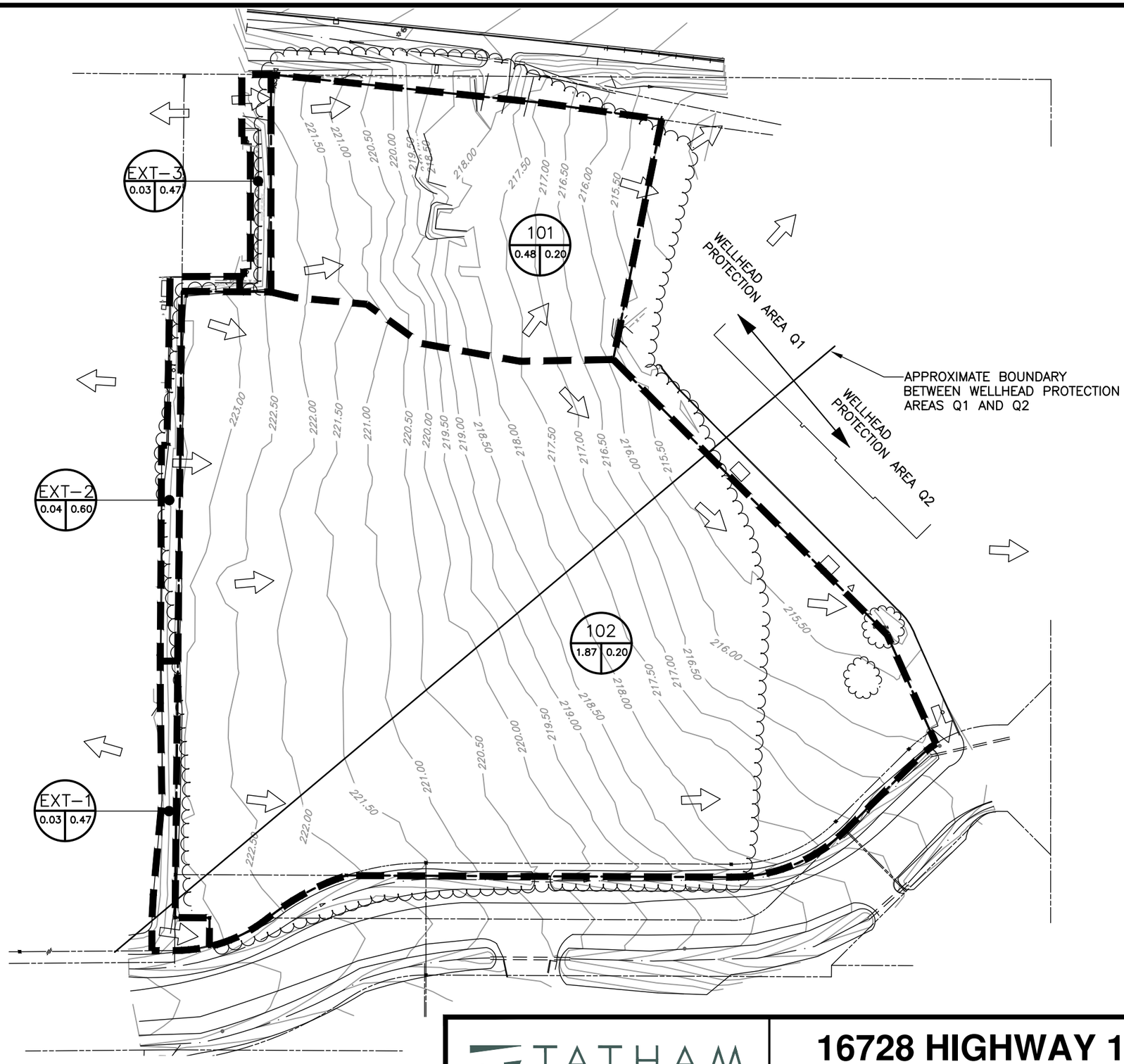
TOWN OF MIDLAND

DWG. No.
FIG. 1

SCALE: NTS	DATE: AUG. 2024	JOB NO. 324816

Drawing Name: 324816 – FIG–1.dwg, Plotted: Sep 17, 2024



LEGEND

- 221.00 — EXISTING CONTOURS
- EXISTING LOT LINES
- SUBJECT PROPERTY
- PRE–DEVELOPMENT DRAINAGE BOUNDARY
- 102 / 1.87 / 0.20 — CATCHMENT ID; RUNOFF COEFFICIENT; CATCHMENT AREA (ha)
- EXISTING CONDITIONS OVERLAND FLOW DIRECTION

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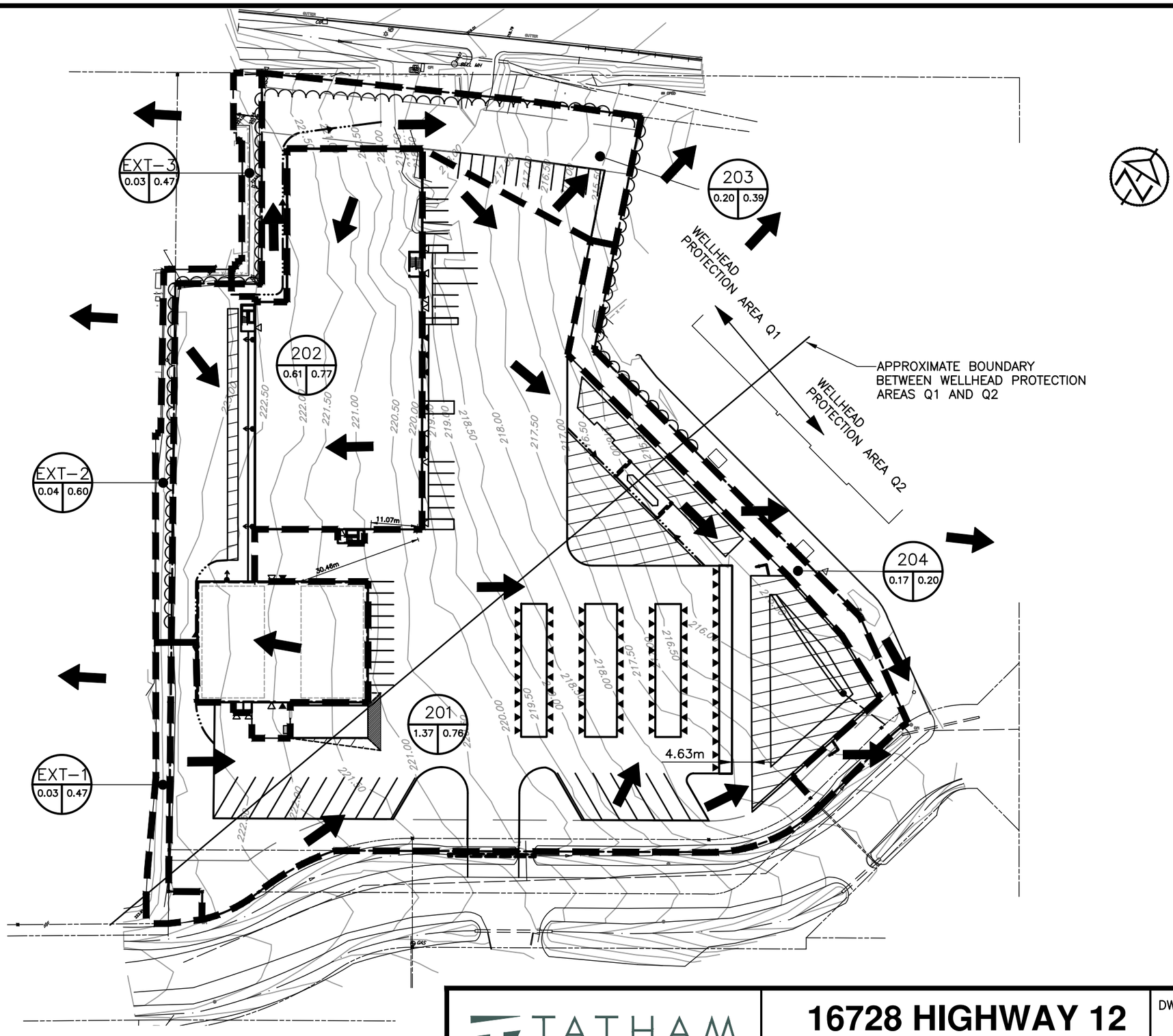
16728 HIGHWAY 12
PRE-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-1**

SCALE: 1:1000	DRAWN: JH	DATE: AUG/24	JOB NO. 324816

Drawing Name: 324816–DP–1.dwg Plotted: Sep 24, 2024



LEGEND

- 221.00 — EXISTING CONTOURS
- EXISTING LOT LINES
- SUBJECT PROPERTY
- PRE–DEVELOPMENT DRAINAGE BOUNDARY
- 201 / 1.37 / 0.75 — CATCHMENT ID, RUNOFF COEFFICIENT, CATCHMENT AREA (ha)
- PROPOSED CONDITIONS OVERLAND FLOW DIRECTION

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16728 HIGHWAY 12
POST-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-2**

SCALE: 1:1000	DRAWN: JH	DATE: AUG/24	JOB NO. 324816

Drawing Name: 324816–DP–1.dwg Plotted: Sep 24, 2024

Appendix A:
Composite Runoff Coefficients

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PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
		PAGE	1 OF 15

Pre-Development Condition

Catchment Parameters

Catchment ID:	EXT-1	Soil Symbol:	Vasl
Max Elev. (m):	224.50	Soil Series:	Vasey
Min Elev. (m):	223.41	Hydrologic Soils Group:	AB
Length (m):	4.50	Soil Texture:	Sand Loam
Slope (%):	24.22%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Gravel and Shoulders	0.40	0.60	0.60	0.020
Unimproved Areas	0.10	0.30	0.20	0.010

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.03
Composite Runoff Coefficient:	0.47

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	0.19	Proposed Time of Concentration (mins):	10.00

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PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
		PAGE	2 OF 15

Pre-Development Condition

Catchment Parameters

Catchment ID:	EXT-2	Soil Symbol:	Vasl
Max Elev. (m):	224.47	Soil Series:	Vasey
Min Elev. (m):	223.19	Hydrologic Soils Group:	AB
Length (m):	4.30	Soil Texture:	Sand Loam
Slope (%):	29.77%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Gravel and Shoulders	0.40	0.60	0.60	0.04

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.04
Composite Runoff Coefficient:	0.60

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	0.17	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Pre-Development Condition

Catchment Parameters

Catchment ID:	EXT-3	Soil Symbol:	Vasl
Max Elev. (m):	224.47	Soil Series:	Vasey
Min Elev. (m):	223.19	Hydrologic Soils Group:	AB
Length (m):	4.30	Soil Texture:	Sand Loam
Slope (%):	29.77%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient

Description	Min.	Max.	Proposed	Area (ha)
Gravel and Shoulders	0.40	0.60	0.60	0.02
Unimproved Areas	0.10	0.30	0.20	0.01

Rural Runoff Coefficient

Description	Suggested	Proposed	Area (ha)

Bare Rock Runoff Coefficient

Property Coverage (%)	Suggested	Proposed	Area (ha)

Total Area:	0.03
Composite Runoff Coefficient:	0.47

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	0.18	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Pre-Development Condition

Catchment Parameters

Catchment ID:	101	Soil Symbol:	Vasl
Max Elev. (m):	222.55	Soil Series:	Vasey
Min Elev. (m):	215.06	Hydrologic Soils Group:	AB
Length (m):	117.50	Soil Texture:	Sand Loam
Slope (%):	6.37%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient

Description	Min.	Max.	Proposed	Area (ha)
Unimproved Areas	0.10	0.30	0.20	0.48

Rural Runoff Coefficient

Description	Suggested	Proposed	Area (ha)

Bare Rock Runoff Coefficient

Property Coverage (%)	Suggested	Proposed	Area (ha)

Total Area:	0.48
Composite Runoff Coefficient:	0.20

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	17.26	Proposed Time of Concentration (mins):	17.25

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Pre-Development Condition

Catchment Parameters

Catchment ID:	102	Soil Symbol:	Vasl
Max Elev. (m):	223.36	Soil Series:	Vasey
Min Elev. (m):	215.20	Hydrologic Soils Group:	AB
Length (m):	219.30	Soil Texture:	Sand Loam
Slope (%):	3.72%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Unimproved Areas	0.10	0.30	0.20	1.87

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	1.87
Composite Runoff Coefficient:	0.20

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	28.16	Proposed Time of Concentration (mins):	28.15

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Pre-Development Condition

Catchment Parameters

Catchment ID:	Pre-Dev.	Soil Symbol:	Vasl
Max Elev. (m):	223.36	Soil Series:	Vasey
Min Elev. (m):	215.20	Hydrologic Soils Group:	AB
Length (m):	219.30	Soil Texture:	Sand Loam
Slope (%):	3.72%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient

Description	Min.	Max.	Proposed	Area (ha)
Unimproved Areas	0.10	0.30	0.20	2.37
Gravel and Shoulders	0.40	0.60	0.60	0.08

Rural Runoff Coefficient

Description	Suggested	Proposed	Area (ha)

Bare Rock Runoff Coefficient

Property Coverage (%)	Suggested	Proposed	Area (ha)

Total Area:	2.45
Composite Runoff Coefficient:	0.21

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	27.75	Proposed Time of Concentration (mins):	27.70

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	201	Soil Symbol:	Vasl
Max Elev. (m):	223.60	Soil Series:	Vasey
Min Elev. (m):	217.00	Hydrologic Soils Group:	AB
Length (m):	210.70	Soil Texture:	Sand Loam
Slope (%):	3.13%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Asphalt/Concrete Pavement	0.80	0.95	0.95	1.02
Lawns	0.10	0.15	0.20	0.35

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	1.37
Composite Runoff Coefficient:	0.76

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	9.26	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	202	Soil Symbol:	Vasl
Max Elev. (m):	223.97	Soil Series:	Vasey
Min Elev. (m):	219.68	Hydrologic Soils Group:	AB
Length (m):	68.00	Soil Texture:	Sand Loam
Slope (%):	6.31%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Lawns	0.10	0.15	0.20	0.15
Rooftops	0.70	0.95	0.95	0.45
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.01

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.61
Composite Runoff Coefficient:	0.77

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	2.82	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	203	Soil Symbol:	Vasl
Max Elev. (m):	223.15	Soil Series:	Vasey
Min Elev. (m):	215.10	Hydrologic Soils Group:	AB
Length (m):	124.00	Soil Texture:	Sand Loam
Slope (%):	6.49%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Lawns	0.10	0.15	0.20	0.15
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.05

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.20
Composite Runoff Coefficient:	0.39

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	13.95	Proposed Time of Concentration (mins):	14.15

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	204	Soil Symbol:	Vasl
Max Elev. (m):	217.00	Soil Series:	Vasey
Min Elev. (m):	215.20	Hydrologic Soils Group:	AB
Length (m):	7.80	Soil Texture:	Sand Loam
Slope (%):	23.08%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Lawns	0.15	0.20	0.20	0.17

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.17
Composite Runoff Coefficient:	0.20

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	2.91	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
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SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	203, 204 & EXT-3	Soil Symbol:	Vasl
Max Elev. (m):	223.15	Soil Series:	Vasey
Min Elev. (m):	215.10	Hydrologic Soils Group:	AB
Length (m):	124.00	Soil Texture:	Sand Loam
Slope (%):	6.49%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Unimproved Areas	0.10	0.30	0.20	0.33
Gravel and Shoulders	0.40	0.60	0.60	0.02
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.05

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.40
Composite Runoff Coefficient:	0.31

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	15.40	Proposed Time of Concentration (mins):	15.40

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	201,202, EXT-1 & EXT-2	Soil Symbol:	Vasl
Max Elev. (m):	223.00	Soil Series:	Vasey
Min Elev. (m):	215.00	Hydrologic Soils Group:	AB
Length (m):	148.00	Soil Texture:	Sand Loam
Slope (%):	5.41%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Asphalt/Concrete Pavement	0.80	0.95	0.95	1.03
Rooftops	0.70	0.95	0.95	0.45
Lawns	0.10	0.15	0.20	0.51
Gravel and Shoulders	0.40	0.60	0.60	0.06

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	2.05
Composite Runoff Coefficient:	0.75

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	5.60	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	EXT-2 & 202	Soil Symbol:	Vasl
Max Elev. (m):	223.00	Soil Series:	Vasey
Min Elev. (m):	215.00	Hydrologic Soils Group:	AB
Length (m):	148.00	Soil Texture:	Sand Loam
Slope (%):	5.41%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Gravel and Shoulders	0.40	0.60	0.60	0.04
Lawns	0.10	0.15	0.20	0.15
Rooftops	0.70	0.95	0.95	0.45
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.01

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.65
Composite Runoff Coefficient:	0.76

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	6.28	Proposed Time of Concentration (mins):	10.00

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	EXT-3 & 203	Soil Symbol:	Vasl
Max Elev. (m):	223.15	Soil Series:	Vasey
Min Elev. (m):	215.10	Hydrologic Soils Group:	AB
Length (m):	124.00	Soil Texture:	Sand Loam
Slope (%):	6.49%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Gravel and Shoulders	0.40	0.60	0.60	0.02
Unimproved Areas	0.10	0.30	0.20	0.01
Lawns	0.10	0.15	0.20	0.15
Asphalt/Concrete Pavement	0.80	0.95	0.95	0.05

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	0.23
Composite Runoff Coefficient:	0.40

Time of Concentration

Calculation Method:	Airport Method		
Time of Concentration (mins):	13.75	Proposed Time of Concentration (mins):	13.75

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Runoff Coefficient Calculations	NAME	JH
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Post-Development Condition

Catchment Parameters

Catchment ID:	Post-Total	Soil Symbol:	Vasl
Max Elev. (m):	223.00	Soil Series:	Vasey
Min Elev. (m):	215.00	Hydrologic Soils Group:	AB
Length (m):	148.00	Soil Texture:	Sand Loam
Slope (%):	5.41%	Runoff Coefficient Type:	1

Land Cover - MTO Drainage Management Manual (1997), Design Chart 1.07

Urban Runoff Coefficient				
Description	**Min.**	**Max.**	**Proposed**	**Area (ha)**
Asphalt/Concrete Pavement	0.80	0.95	0.95	1.08
Rooftops	0.70	0.95	0.95	0.45
Lawns	0.10	0.15	0.20	0.84
Gravel and Shoulders	0.40	0.60	0.60	0.08

Rural Runoff Coefficient			
Description	**Suggested**	**Proposed**	**Area (ha)**

Bare Rock Runoff Coefficient			
Property Coverage (%)	**Suggested**	**Proposed**	**Area (ha)**

Total Area:	2.45
Composite Runoff Coefficient:	0.68

Time of Concentration

Calculation Method:	Bransby-Williams Formula		
Time of Concentration (mins):	5.50	Proposed Time of Concentration (mins):	10.00

Appendix B: Modified Rational Method Calculations

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Modified Rational Method Calcs. Full Development Site	NAME	JH
		PAGE	1 OF 1

Municipality / IDF Curve Source:		Town of Midland			
Pre-Development		**Post-Development**	Controllable		Uncontrolled
Catchment ID:	Pre-Dev.	Catchment ID:	EXT-1,2 & 201,202		EXT-3 & 203,204
Catchment Area (ha):	2.45	Catchment Area (ha):	2.05		0.40
1:5-Year Runoff Coef:	0.21	1:5-Year Runoff Coef:	0.75		0.31
Time of Conc. (min):	27.7	Time of Conc. (min):	10.0		15.4

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
	B	6.75	7.50	7.97	8.30	9.00	9.04
	C	0.828	0.841	0.852	0.858	0.868	0.871
Pre-Dev.	i (mm/hr)	43.08	56.82	66.00	77.45	86.50	95.02
	C	0.21	0.21	0.21	0.23	0.25	0.26
Post-Dev. Controllable	i (mm/hr)	78.28	102.27	118.36	138.40	153.18	168.45
	C	0.75	0.75	0.75	0.83	0.90	0.94
Post-Dev. Un-controlled	i (mm/hr)	62.11	81.57	94.62	110.86	123.28	135.53
	C	0.31	0.31	0.31	0.34	0.37	0.39

Peak Flow Summary (L/s)

Storm	$Q_{Existing}$	$Q_{Uncontrolled}$	$Q_{Controllable}$	$Q_{Sub-Total}$	$Q_{Ex} - Q_{Sub}$	$Q_{Controls}$	Q_{Total}	$Q_{Ex} - Q_{Tot}$
2	61.6	21.4	334.3	355.7	-294.1	39.5	60.9	0.7
5	81.2	28.1	436.8	464.9	-383.7	46.0	74.1	7.1
10	94.3	32.6	505.5	538.1	-443.8	49.7	82.3	12.0
25	121.8	42.0	650.2	692.2	-570.4	56.5	98.5	23.3
50	148.3	51.0	785.0	836.0	-687.6	61.0	112.0	36.4
100	169.8	58.4	899.3	957.6	-787.9	63.9	122.2	47.5

Required Volume Summary (m^3)

Duration (min)	2	5	10	25	50	100	Time Step
75	304	416	491	653	817	948	5
80	**305**	417	493	656	822	954	
85	305	418	494	659	826	959	
90	304	**418**	494	661	829	963	
95	303	418	**495**	662	831	967	
100	303	418	494	662	833	969	
105	301	417	494	**662**	834	971	
110	300	416	493	662	834	973	
115	298	414	491	661	**834**	973	
120	297	412	490	660	834	**974**	
125	295	411	488	659	833	974	

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Modified Rational Method Calcs. Drainage to Highway 12	NAME	JN
		PAGE	1 OF 1

Municipality / IDF Curve Source:		Town of Midland			
Pre-Development		**Post-Development**	Controllable		Uncontrolled
Catchment ID:	Pre-Dev.	Catchment ID:	N/A		EXT-3 & 203
Catchment Area (ha):	0.51	Catchment Area (ha):	0.00		0.23
1:5-Year Runoff Coef:	0.21	1:5-Year Runoff Coef:	0.00		0.40
Time of Conc. (min):	17.3	Time of Conc. (min):	0.0		14.2

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
	B	6.75	7.50	7.97	8.30	9.00	9.04
	C	0.828	0.841	0.852	0.858	0.868	0.871
Pre-Dev.	i (mm/hr)	58.12	76.41	88.67	103.94	115.70	127.18
	C	0.21	0.21	0.21	0.23	0.25	0.26
Post-Dev. Controllable	i (mm/hr)	166.13	208.56	236.61	272.75	293.00	322.28
	C	0.00	0.00	0.00	0.00	0.00	0.00
Post-Dev. Un-controlled	i (mm/hr)	65.17	85.51	99.16	116.14	129.04	141.87
	C	0.40	0.40	0.40	0.44	0.48	0.50

Peak Flow Summary (L/s)

Storm	$Q_{Existing}$	$Q_{Uncontrolled}$	$Q_{Controllable}$	$Q_{Sub-Total}$	$Q_{Ex} - Q_{Sub}$	$Q_{Controls}$	Q_{Total}	$Q_{Ex} - Q_{Tot}$
2	17.3	16.7	0.0	16.7	0.6	0.0	16.7	0.6
5	22.7	21.9	0.0	21.9	0.9	0.0	21.9	0.9
10	26.4	25.3	0.0	25.3	1.0	0.0	25.3	1.0
25	34.0	32.6	0.0	32.6	1.4	0.0	32.6	1.4
50	41.3	39.6	0.0	39.6	1.7	0.0	39.6	1.7
100	47.3	45.3	0.0	45.3	2.0	0.0	45.3	2.0

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Modified Rational Method Calcs Peak Flow from Catch 202 to 201	NAME	JN
		PAGE	1 OF 1

Municipality / IDF Curve Source:		Town of Midland			
Pre-Development		**Post-Development**	Controllable		Uncontrolled
Catchment ID:	N/A	Catchment ID:	N/A		EXT-2 & 202
Catchment Area (ha):		Catchment Area (ha):			0.65
1:5-Year Runoff Coef:		1:5-Year Runoff Coef:			0.76
Time of Conc. (min):		Time of Conc. (min):			10.0

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
	B	6.75	7.50	7.97	8.30	9.00	9.04
	C	0.828	0.841	0.852	0.858	0.868	0.871
Pre-Dev.	i (mm/hr)	166.13	208.56	236.61	272.75	293.00	322.28
	C	0.00	0.00	0.00	0.00	0.00	0.00
Post-Dev. Controllable	i (mm/hr)	166.13	208.56	236.61	272.75	293.00	322.28
	C	0.00	0.00	0.00	0.00	0.00	0.00
Post-Dev. Un-controlled	i (mm/hr)	78.28	102.27	118.36	138.40	153.18	168.45
	C	0.76	0.76	0.76	0.84	0.91	0.95

Peak Flow Summary (L/s)

Storm	$Q_{Existing}$	$Q_{Uncontrolled}$	$Q_{Controllable}$	$Q_{Sub-Total}$	$Q_{Ex} - Q_{Sub}$	$Q_{Controls}$	Q_{Total}	$Q_{Ex} - Q_{Tot}$
2	0.0	107.4	0.0	107.4	-107.4	0.0	107.4	-107.4
5	0.0	140.3	0.0	140.3	-140.3	0.0	140.3	-140.3
10	0.0	162.4	0.0	162.4	-162.4	0.0	162.4	-162.4
25	0.0	208.9	0.0	208.9	-208.9	0.0	208.9	-208.9
50	0.0	252.2	0.0	252.2	-252.2	0.0	252.2	-252.2
100	0.0	288.9	0.0	288.9	-288.9	0.0	288.9	-288.9

Appendix C: Weir and Channel Flow Calculations

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Secondary Overflow Weir Flow - West	NAME	JH
		PAGE	1 OF 1

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	219.68
Overflow Weir Width, B (m):	1.0
Weir Crest Length, L (m):	0.2
Overflow Weir Material:	Concrete, Finished
ϵ (mm):	1
δ/L :	0.01722

	Left Flank	Right Flank
Grade (%):	6.0%	5.3%
Width (m):	2.5	2.9

$$\delta/_L \approx 0.001 + 0.2 \times (\epsilon/_L)^{0.5}$$

Source: Equation 10.57 for round-nosed broad-crested weirs
Frank M. White, *Fluid Mechanics Fifth Edition*, McGraw-Hill Companies Inc., New York, 2003.

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	288.90
Overflow Weir Base Elevation (m):	219.68
Structure T/G Elevation (m):	219.46
Required Weir Head (m):	0.153
C_d:	0.53
Qweir, (L/s):	288.90
Max Ponding Over T/G (m):	0.373
Weir Overflow Elevation (m):	219.83

$$C_d \approx 0.544 \times (1 - \frac{\delta/_L}{H/_L})^{3/2}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Note: for flow over flanks, H in Q_{weir} formula is "Required Weir Head" divided by 2.

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
219.68	0.00		0.00
219.69	0.01	0.35	4.26
219.70	0.02	0.44	12.91
219.71	0.03	0.47	24.26
219.72	0.04	0.49	37.79
219.73	0.05	0.50	53.17
219.74	0.06	0.51	70.21
219.75	0.07	0.51	88.77
219.76	0.08	0.52	108.72
219.77	0.09	0.52	129.98
219.78	0.10	0.52	152.46
219.80	0.12	0.53	200.88
219.82	0.14	0.53	253.55
219.84	0.16	0.53	310.15
219.86	0.18	0.53	370.44
219.88	0.20	0.53	434.19

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Overflow Channel Catchment 202 to 201	NAME	JH
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
10				
Event	A	B	C	Intensity (mm/hr)
1-Year				
2-Year	807.44	6.75	0.828	78.28
5-Year	1135.4	7.5	0.841	102.27
10-Year	1387	7.97	0.852	118.36
25-Year	1676.2	8.3	0.858	138.40
50-Year	1973.1	9	0.868	153.18
100-Year	2193.1	9.04	0.871	168.45

Peak Runoff Flow Rate

Area Name	EXT-2	202					
Area (ha)	0.04	0.61					
Runoff	0.60	0.77					
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							
2-Year	5.22	102.14					107.35
5-Year	6.82	133.45					140.26
10-Year	7.89	154.44					162.33
25-Year	10.15	198.65					208.80
50-Year	12.26	239.84					252.10
100-Year	14.04	274.75					289.56

Ditch Flows

Manning's n:	0.013
Ditch Slope:	2.00%
L. Side Slope 1:	15
R. Side Slope 1:	16
Base Width (m):	1

Calculate

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year							
2-Year	0.107	0.051	0.051	0.041	1.000	1.589	1.170
5-Year	0.140	0.058	0.058	0.053	1.000	1.816	1.259
10-Year	0.162	0.063	0.063	0.061	1.000	1.951	1.310
25-Year	0.209	0.071	0.071	0.078	1.000	2.204	1.401
50-Year	0.252	0.077	0.077	0.093	1.000	2.407	1.478
100-Year	0.290	0.083	0.083	0.106	1.000	2.570	1.533
Manual							

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	23-Aug-2024
SUBJECT	Secondary Overflow Weir Flow - East	NAME	JH
		PAGE	1 OF 1

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	217.11
Overflow Weir Width, B (m):	8.5
Weir Crest Length, L (m):	1.8
Overflow Weir Material:	Brickwork
ϵ (mm):	3.7
δ/L :	0.01007

	Left Flank	Right Flank
Grade (%):	33.0%	33.0%
Width (m):	0.5	0.5

$$\delta/_L \approx 0.001 + 0.2 \times (\epsilon/_L)^{0.5}$$

Source: Equation 10.57 for round-nosed broad-crested weirs
Frank M. White, *Fluid Mechanics Fifth Edition*, McGraw-Hill Companies Inc., New York, 2003.

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	899.30
Overflow Weir Base Elevation (m):	217.11
Structure T/G Elevation (m):	216.86
Required Weir Head (m):	0.171
C_d:	0.46
Qweir, (L/s):	899.30
Max Ponding Over T/G (m):	0.421
Weir Overflow Elevation (m):	217.28

$$C_d \approx 0.544 \times (1 - \frac{\delta/_L}{H/_L})^{3/2}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Note: for flow over flanks, H in Q_{weir} formula is "Required Weir Head" divided by 2.

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
217.11	0.00		0.00
217.12	0.01		0.00
217.13	0.02	0.02	2.66
217.14	0.03	0.14	21.47
217.15	0.04	0.22	51.06
217.16	0.05	0.28	88.30
217.17	0.06	0.32	131.83
217.18	0.07	0.35	180.86
217.19	0.08	0.37	234.81
217.20	0.09	0.39	293.28
217.21	0.10	0.40	355.93
217.23	0.12	0.43	492.80
217.25	0.14	0.44	643.76
217.27	0.16	0.45	807.62
217.29	0.18	0.46	983.42
217.31	0.20	0.47	1170.40

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Secondary Overflow Channel - Pond Inlet	NAME	JH
		PAGE	1 OF 1

Region/Municipality				
Midland				
T_C (in minutes)				
10				
Event	A	B	C	Intensity (mm/hr)
1-Year				
2-Year	807.44	6.75	0.828	78.28
5-Year	1135.4	7.5	0.841	102.27
10-Year	1387	7.97	0.852	118.36
25-Year	1676.2	8.3	0.858	138.40
50-Year	1973.1	9	0.868	153.18
100-Year	2193.1	9.04	0.871	168.45

Peak Runoff Flow Rate

Area Name	EXT-1	EXT-2	201	202			
Area (ha)	0.03	0.04	1.37	0.61			
Runoff	0.76	0.60	0.76	0.77			
Event	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_{Total}
1-Year							
2-Year	4.60	4.92	224.10	100.71			334.32
5-Year	6.01	6.42	292.80	131.58			436.81
10-Year	6.95	7.43	338.85	152.28			505.52
25-Year	8.94	9.56	435.86	195.87			650.24
50-Year	10.79	11.55	526.24	236.49			785.07
100-Year	12.37	13.23	602.82	270.90			899.32

Ditch Flows

Manning's n:	0.035
Ditch Slope:	0.60%
L. Side Slope 1:	3
R. Side Slope 1:	3
Base Width (m):	3

Calculate

Event	Q (m^3/s)	depth (m)	A_{Base} (m^2)	A_{Sides} (m^2)	P_{Base} (m)	P_{Sides} (m)	V (m/s)
1-Year							
2-Year	0.334	0.161	0.483	0.078	3.000	1.019	0.596
5-Year	0.437	0.188	0.564	0.106	3.000	1.189	0.652
10-Year	0.506	0.204	0.613	0.125	3.000	1.293	0.685
25-Year	0.650	0.236	0.708	0.167	3.000	1.492	0.743
50-Year	0.785	0.262	0.787	0.207	3.000	1.660	0.790
100-Year	0.899	0.283	0.850	0.241	3.000	1.791	0.825
Manual							

Appendix D: Stage Storage Discharge Calculations

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Orifice Flow	NAME	JH
		PAGE	1 OF 7

Orifice Parameters

Orifice Dia. (mm):	160
Orifice Centroid Elevation (m):	215.38
Orifice Invert Elevation (m):	215.30
Orifice Area (m^2):	0.02011
Orifice Coefficient (C):	0.63

$$Q_{Orifice} = CA(2gh)^{0.5}$$

$$Weir\ C_d = 0.555 + \frac{1}{110 \times (\frac{h}{d})} + 0.041 \times (\frac{h}{d})$$

$$Q_{Weir} = C_d \times [10.12 \times \left(\frac{h}{d}\right)^{1.975} - 2.66 \times \left(\frac{h}{d}\right)^{3.78}] \times d^{\frac{5}{2}}$$

Note: h and d in units of decimeters in the weir equations above.

Elevation (m)	h_{invert} (dm)	$h_{centroid}$ (m)	Weir C_d	Q_{Weir} (L/s)	$Q_{orifice}$ (L/s)	$Q_{Governing}$ (L/s)
215.30	0.00	0.00				0.00
215.35	0.50	0.00	0.60	1.90		1.90
215.38	0.80	0.00	0.59	4.58	0.00	4.58
215.41	1.10	0.03	0.60	8.08	9.72	8.08
215.46	1.60	0.08	0.61	14.62	15.87	15.87
215.51	2.10	0.13	0.62	19.70	20.23	20.23
215.56	2.60	0.18	0.63	19.77	23.80	23.80
215.66	3.60	0.28	0.65	0.00	29.69	29.69
215.76	4.60	0.38	0.68	0.00	34.59	34.59
215.86	5.60	0.48	0.70	0.00	38.87	38.87
215.96	6.60	0.58	0.73	0.00	42.73	42.73
216.06	7.60	0.68	0.75	0.00	46.27	46.27
216.16	8.60	0.78	0.78	0.00	49.55	49.55
216.26	9.60	0.88	0.80	0.00	52.63	52.63
216.36	10.60	0.98	0.83	0.00	55.54	55.54
216.41	11.10	1.03	0.84	0.00	56.94	56.94
216.51	12.10	1.13	0.87	0.00	59.64	59.64
216.61	13.10	1.23	0.89	0.00	62.23	62.23
216.66	13.60	1.28	0.90	0.00	63.48	63.48
216.71	14.10	1.33	0.92	0.00	64.71	64.71
216.75	14.50	1.37	0.93	0.00	65.67	65.67
216.80	15.00	1.42	0.94	0.00	66.86	66.86
216.85	15.50	1.47	0.95	0.00	68.03	68.03
216.90	16.00	1.52	0.97	0.00	69.17	69.17
216.95	16.50	1.57	0.98	0.00	70.30	70.30
217.00	17.00	1.62	0.99	0.00	71.41	71.41
217.05	17.50	1.67	1.00	0.00	72.51	72.51
217.10	18.00	1.72	1.02	0.00	73.58	73.58
217.13	18.30	1.75	1.02	0.00	74.22	74.22

Note: Q_{Weir} represents calculated weir flow across the bottom of the orifice plate prior to submergence and orifice flow shown in $Q_{Orifice}$

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Dry Pond Quantity Storage	NAME	JH
		PAGE	2 OF 7

Description	DRY POND	INFIL. CELL			
Base Elev. (m)	215.30	216.50			
Area (m^2)	442.88	342.50			
Pond Elev. (m)	217.10	217.10			
Pond Area (m^2)	980.67	632.60			
Pond Vol (m^3)	1281.19	292.53	0.00	0.00	0.00

Elevation (m)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Total Vol. (m^3)
215.30	442.88	0.00	0.00	0.00	0.00	0.00
215.35	457.82	0.00	0.00	0.00	0.00	22.52
215.38	466.78	0.00	0.00	0.00	0.00	36.39
215.41	475.74	0.00	0.00	0.00	0.00	50.52
215.46	490.68	0.00	0.00	0.00	0.00	74.69
215.51	505.62	0.00	0.00	0.00	0.00	99.59
215.56	520.56	0.00	0.00	0.00	0.00	125.25
215.66	550.44	0.00	0.00	0.00	0.00	178.80
215.76	580.32	0.00	0.00	0.00	0.00	235.33
215.86	610.19	0.00	0.00	0.00	0.00	294.86
215.96	640.07	0.00	0.00	0.00	0.00	357.37
216.06	669.95	0.00	0.00	0.00	0.00	422.87
216.16	699.82	0.00	0.00	0.00	0.00	491.36
216.26	729.70	0.00	0.00	0.00	0.00	562.84
216.36	759.58	0.00	0.00	0.00	0.00	637.30
216.41	774.52	0.00	0.00	0.00	0.00	675.66
216.51	804.39	347.33	0.00	0.00	0.00	771.97
216.61	834.27	395.68	0.00	0.00	0.00	891.05
216.66	849.21	419.86	0.00	0.00	0.00	953.53
216.71	864.15	444.04	0.00	0.00	0.00	1017.96
216.75	876.10	463.38	0.00	0.00	0.00	1070.91
216.80	891.04	487.55	0.00	0.00	0.00	1138.86
216.85	905.98	511.73	0.00	0.00	0.00	1208.77
216.90	920.92	535.90	0.00	0.00	0.00	1280.63
216.95	935.85	560.08	0.00	0.00	0.00	1354.45
217.00	950.79	584.25	0.00	0.00	0.00	1430.23
217.05	965.73	608.43	0.00	0.00	0.00	1507.96
217.10	980.67	632.60	0.00	0.00	0.00	1587.64
217.13	980.67	632.60	0.00	0.00	0.00	1587.64

Note: Q_{Weir} represents calculated weir flow across the bottom of the orifice plate prior to submergence and orifice flow shown in $Q_{Orifice}$

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Total Storage Summary	NAME	JH
		PAGE	3 OF 7

Elevation (m)	MH & CB (m^3)	Pipe (m^3)	Ditch (m^3)	Dry Pond (m^3)	Underground (m^3)	Total Vol. (m^3)
215.30	0.00	0.00	0.00	0.00	0.00	0.00
215.35	0.00	0.00	0.00	22.52	0.00	22.52
215.38	0.00	0.00	0.00	36.39	0.00	36.39
215.41	0.00	0.00	0.00	50.52	0.00	50.52
215.46	0.00	0.00	0.00	74.69	0.00	74.69
215.51	0.00	0.00	0.00	99.59	0.00	99.59
215.56	0.00	0.00	0.00	125.25	0.00	125.25
215.66	0.00	0.00	0.00	178.80	0.00	178.80
215.76	0.00	0.00	0.00	235.33	0.00	235.33
215.86	0.00	0.00	0.00	294.86	0.00	294.86
215.96	0.00	0.00	0.00	357.37	0.00	357.37
216.06	0.00	0.00	0.00	422.87	0.00	422.87
216.16	0.00	0.00	0.00	491.36	0.00	491.36
216.26	0.00	0.00	0.00	562.84	0.00	562.84
216.36	0.00	0.00	0.00	637.30	0.00	637.30
216.41	0.00	0.00	0.00	675.66	0.00	675.66
216.51	0.00	0.00	0.00	771.97	0.00	771.97
216.61	0.00	0.00	0.00	891.05	0.00	891.05
216.66	0.00	0.00	0.00	953.53	0.00	953.53
216.71	0.00	0.00	0.00	1017.96	0.00	1017.96
216.75	0.00	0.00	0.00	1070.91	0.00	1070.91
216.80	0.00	0.00	0.00	1138.86	0.00	1138.86
216.85	0.00	0.00	0.00	1208.77	0.00	1208.77
216.90	0.00	0.00	0.00	1280.63	0.00	1280.63
216.95	0.00	0.00	0.00	1354.45	0.00	1354.45
217.00	0.00	0.00	0.00	1430.23	0.00	1430.23
217.05	0.00	0.00	0.00	1507.96	0.00	1507.96
217.10	0.00	0.00	0.00	1587.64	0.00	1587.64
217.13	0.00	0.00	0.00	1587.64	0.00	1587.64

Note: Q_{Weir} represents calculated weir flow across the bottom of the orifice plate prior to submergence and orifice flow shown in $Q_{Orifice}$

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Overflow Weir Flow	NAME	JH
		PAGE	4 OF 7

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	216.80
Overflow Weir Width, B (m):	15.0
Weir Crest Length, L (m):	2.4
Overflow Weir Material:	Brickwork
ϵ (mm):	3.7
δ/L :	0.00885

$$C_d \approx 0.544 \times (1 - \frac{\delta/L}{H/L})^{3/2}$$

$$\delta/L \approx 0.001 + 0.2 \times (\epsilon/L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Source: Equation 10.57 for round-nosed broad-crested weirs
Frank M. White, *Fluid Mechanics Fifth Edition*, McGraw-Hill Companies Inc., New York, 2003.

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
215.30	0.00		0.00
215.35	0.00		0.00
215.38	0.00		0.00
215.41	0.00		0.00
215.46	0.00		0.00
215.51	0.00		0.00
215.56	0.00		0.00
215.66	0.00		0.00
215.76	0.00		0.00
215.86	0.00		0.00
215.96	0.00		0.00
216.06	0.00		0.00
216.16	0.00		0.00
216.26	0.00		0.00
216.36	0.00		0.00
216.41	0.00		0.00
216.51	0.00		0.00
216.61	0.00		0.00
216.66	0.00		0.00
216.71	0.00		0.00
216.75	0.00		0.00
216.80	0.00		0.00
216.85	0.05	0.24	124.65
216.90	0.10	0.38	564.92
216.95	0.15	0.43	1180.85
217.00	0.20	0.46	1931.66
217.05	0.25	0.48	2796.37
217.10	0.30	0.49	3761.58
217.13	0.33	0.49	4384.86

Note: Q_{Weir} represents calculated weir flow across the bottom of the orifice plate prior to submergence and orifice flow shown in $Q_{Orifice}$

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Overflow Weir Flow	NAME	JH
		PAGE	5 OF 7

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	899.3
Overflow Weir Base Elevation (m):	216.80
Structure T/G Elevation (m):	215.30
Required Weir Head (m):	0.129
C_d:	0.41
Qweir, (L/s):	899.3
Max Ponding Over T/G (m):	1.629
Weir Overflow Elevation (m):	216.93

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
216.80	0.00		0.00
216.82	0.02		0.00
216.84	0.04	0.17	65.67
216.86	0.06	0.28	195.03
216.88	0.08	0.34	364.04
216.90	0.10	0.38	564.92
216.92	0.12	0.41	793.22
216.94	0.14	0.43	1046.00
216.96	0.16	0.44	1321.06
216.98	0.18	0.45	1616.73
217.00	0.20	0.46	1931.66
217.02	0.22	0.47	2264.74
217.04	0.24	0.47	2615.03
217.06	0.26	0.48	2981.72
217.08	0.28	0.48	3364.11
217.10	0.30	0.49	3761.58

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Stage Storage Discharge	NAME	JH
		PAGE	6 OF 7

Stage Storage Discharge Table

Elevation (m)	$Q_{orifice}$ Prim. (L/s)	Q_{Weir} (L/s)	Q_{Total} (L/s)	Total Vol. (m^3)
215.30	0.00	0.00	0.00	0.00
215.35	1.90	0.00	1.90	22.52
215.38	4.58	0.00	4.58	36.39
215.41	8.08	0.00	8.08	50.52
215.46	15.87	0.00	15.87	74.69
215.51	20.23	0.00	20.23	99.59
215.56	23.80	0.00	23.80	125.25
215.66	29.69	0.00	29.69	178.80
215.76	34.59	0.00	34.59	235.33
215.86	38.87	0.00	38.87	294.86
215.96	42.73	0.00	42.73	357.37
216.06	46.27	0.00	46.27	422.87
216.16	49.55	0.00	49.55	491.36
216.26	52.63	0.00	52.63	562.84
216.36	55.54	0.00	55.54	637.30
216.41	56.94	0.00	56.94	675.66
216.51	59.64	0.00	59.64	771.97
216.61	62.23	0.00	62.23	891.05
216.66	63.48	0.00	63.48	953.53
216.71	64.71	0.00	64.71	1017.96
216.75	65.67	0.00	65.67	1070.91
216.80	66.86	0.00	66.86	1138.86
216.85	68.03	124.65	192.68	1208.77
216.90	69.17	564.92	634.09	1280.63
216.95	70.30	1180.85	1251.16	1354.45
217.00	71.41	1931.66	2003.07	1430.23
217.05	72.51	2796.37	2868.88	1507.96
217.10	73.58	3761.58	3835.16	1587.64
217.13	74.22	4384.86	4459.09	1587.64

Note: Q_{Weir} represents calculated weir flow across the bottom of the orifice plate prior to submergence and orifice flow shown in $Q_{Orifice}$

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	17-Sep-2024
SUBJECT	Stage Storage Discharge	NAME	JH
		PAGE	7 OF 7

Discharge Summary - Modified Rational Method

Storm Event	Control Flow (L/s)	Storage (m^3)	Depth (m)	Elevation (m)
1:2-year	39.5	305	0.58	215.88
1:5-year	46.0	418	0.75	216.05
1:10-year	49.7	495	0.86	216.16
1:25-year	56.5	662	1.09	216.39
1:50-year	61.0	834	1.26	216.56
1:100-year	63.9	974	1.38	216.68

Appendix E:
Water Quality Controls

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Infiltration Trench Volume (202)	NAME	JH
		PAGE	1 OF 2

Native Soil Characteristics

Texture Class:	Sandy Loam	Ontario AG Maps and Geotechnical Reports
Hydraulic Conductivity, (cm/hr):	2.18	- (Table 10.4 - NVCA SWM Technical Guide)
Percolation Time, (min/cm):	9.76	- (Interpolated per Table 7.1 - NVCA SWM Technical Guide)
Infiltration Rate, (mm/hr):	61.48	- (Table 7.1 - NVCA SWM Technical Guide)
Ratio of Mean Measured Infiltration:	1.1 to 4.0	- Estimate - Table 7.2 - NVCA SWM Technical Guide)
Safety Factor:	3.5	- Estimate - Table 7.2 - NVCA SWM Technical Guide)
Revised Infiltration Rate, (mm/hr):	17.57	>= 15 mm/hr - Underdrain Not Required.

Required Storage Volume - MECP Quality Control

Design Area, (ha):	0.65	
Imperviousness, (%):	77%	
MECP Protection Level:	Enhanced, 80% TSS Removal	
Storage Volume, (m^3/ha):	37.4	
Storage Volume, (m^3):	24.31	

Required Storage Volume - 25 mm Storm Runoff from Impervious Surfaces

Impervious Surface Area (ha):	0.50	
Storage Volume (m^3):	125.00	

Infiltration Footprint for Minimum 48-hour Drawdown Time

i (mm/hr):	17.57	- Infiltration Rate of Native Soil
i (m/hr):	0.018	- Infiltration Rate of Native Soil
T_{D25mm}, (hr):	48.00	- Desired Drawdown Time
V_{25mm}, (m^3):	125.00	- Volume to be infiltrated
Q_i (m^3/hr) = V_{25mm}/T_{D25mm} =	2.60	- Required Infiltration Rate for Desired Drawdown
A_f (m^2) = Q_i/i =	148.22	- Footprint of Infiltration Basin
Void Ratio, (%):	40%	- Void Ratio of Infiltration Gallery
D, (m):	2.11	- Required Depth of Infiltration Gallery

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Infiltration Trench Volume (202)	NAME	JH
		PAGE	2 OF 2

Proposed Infiltration Trenches

Infiltration Trench

Width of Infiltration Trench, (m):	2.50
Length Iniltration Trench, (m):	60.00
Infiltration Trench Footprint, (m^2):	150.00
Elevation of Weir Discharge, (m):	219.68
Invert Elevation at Low Point, (m):	219.46
Slope of Banks, (%):	33.33%
Surface Storage Volume, (m^3):	42.17
Depth of Topsoil and Sod, (m):	0.15
Depth of Permeable Backfill, (mm):	0.00
Depth of Clear Stone Layer, (m):	1.45
Depth of Sand Layer, (m):	0.50
Combined Underground Depth, (m):	2.10
Void Ratio, (%):	40%
Storage Volume, (m^3):	126.00
Trench Base Elevation, (m):	217.36

Combined Storage

Max. Storage Required, (m^3):	125.00
Combined Storage Provided, (m^3):	168.17

Therefore, the proposed trenches have sufficient capacity for the design storage.

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Infiltration Trench Volume (201)	NAME	JH
		PAGE	1 OF 2

Native Soil Characteristics

Texture Class:	Sandy Loam	Ontario AG Maps and Geotechnical Reports
Hydraulic Conductivity, (cm/hr):	2.18	- (Table 10.4 - NVCA SWM Technical Guide)
Percolation Time, (min/cm):	9.76	- (Interpolated per Table 7.1 - NVCA SWM Technical Guide)
Infiltration Rate, (mm/hr):	61.48	- (Table 7.1 - NVCA SWM Technical Guide)
Ratio of Mean Measured Infiltration:	1.1 to 4.0	- Estimate - Table 7.2 - NVCA SWM Technical Guide)
Safety Factor:	3.5	- Estimate - Table 7.2 - NVCA SWM Technical Guide)
Revised Infiltration Rate, (mm/hr):	17.57	>= 15 mm/hr - Underdrain Not Required.

Required Storage Volume - MECP Quality Control

Design Area, (ha):	1.40	
Imperviousness, (%):	74%	
MECP Protection Level:	Enhanced, 80% TSS Removal	
Storage Volume, (m^3/ha):	36.4	
Storage Volume, (m^3):	50.96	

Required Storage Volume - 25 mm Storm Runoff from Impervious Surfaces

Impervious Surface Area (ha):	1.04	
Storage Volume (m^3):	259.00	

Infiltration Footprint for Minimum 48-hour Drawdown Time

i (mm/hr):	17.57	- Infiltration Rate of Native Soil
i (m/hr):	0.018	- Infiltration Rate of Native Soil
T_{D25mm}, (hr):	48.00	- Desired Drawdown Time
V_{25mm}, (m^3):	259.00	- Volume to be infiltrated
Q_i (m^3/hr) = V_{25mm}/T_{D25mm} =	5.40	- Required Infiltration Rate for Desired Drawdown
A_f (m^2) = Q_i/i =	307.10	- Footprint of Infiltration Basin
Void Ratio, (%):	40%	- Void Ratio of Infiltration Gallery
D, (m):	2.11	- Required Depth of Infiltration Gallery

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Infiltration Trench Volume (201)	NAME	JH
		PAGE	2 OF 2

Proposed Infiltration Trenches

Infiltration Trench

Width of Infiltration Trench, (m):	6.10
Length Iniltration Trench, (m):	51.10
Infiltration Trench Footprint, (m^2):	311.71
Elevation of Weir Discharge, (m):	216.50
Invert Elevation at Low Point, (m):	216.50
Slope of Banks, (%):	33.33%
Surface Storage Volume, (m^3):	0.00
Depth of Topsoil and Sod, (m):	0.15
Depth of Permeable Backfill, (mm):	0.00
Depth of Clear Stone Layer, (m):	1.45
Depth of Sand Layer, (m):	0.50
Combined Underground Depth, (m):	2.10
Void Ratio, (%):	40%
Storage Volume, (m^3):	261.84
Trench Base Elevation, (m):	214.40

Combined Storage

Max. Storage Required, (m^3):	259.00
Combined Storage Provided, (m^3):	261.84

Therefore, the proposed trenches have sufficient capacity for the design storage.

TATHAM ENGINEERING

PROJECT	16728 Highway 12, Midland U-Haul Development	FILE	324816
		DATE	18-Sep-2024
SUBJECT	Water Quality Treatment Train Catchments with Paved Areas	NAME	JN
		PAGE	1 OF 1

Water Quality Treatment Train Calculation

Catchment Label: 201, 203, EXT-1 & EXT-3

Total Drainage Area, (ha): 1.63

Catchment Imperviousness, (%): 66.9% (weighted average)

Treatment Control		Target TSS Removal	Actual Area (ha)	Actual TSS Removal
Pre-Treatment	Grass Swales	36.0%	1.63	36.0%
Primary Treatment	Infiltration Trench	80.0%	1.40	68.7%
				0.0%

TSS Removal = $1 - ((1 - R_1) \times (1 - R_2) \times (1 - R_3))$

Where:

R_1: % TSS Removal by Pre-Treatment

R_2: % TSS Removal by Primary Treatment

R_3: % TSS Removal by Optional Treatment

TSS Removal (Primary Controls) = 80.0%

TSS Removal (Incl. Secondary Controls): 80.0%

Notes:

TSS = Total Suspended Solids.

Appendix F:
Water Budget Calculations

TATHAM ENGINEERING

Water Budget
Climate Normal Data

Project Details

16728 Highway 12, Midland	324816

Prepared By

JH	18-Sep-2024

Water Budget Details

Methodology	Thornthwaite Method
Climate Data & Source	Midland WPCP
	Climate Normal Data for 1997 to 2016 (Environment Canada)
Thornthwaite Coefficient	1.095

Month	Temp (°C)	Precip (mm)	Heat Index	PET (mm)	Daylight Factor	Adjusted PET (mm)	AET (mm)	Surplus (mm)	Deficit (mm)
Jan.	-8.5	109.8	0.0	0.0	0.77	0.0	0.0	109.8	0.0
Feb.	-6.4	69.9	0.0	0.0	0.87	0.0	0.0	69.9	0.0
Mar.	-1.9	65.7	0.0	0.0	1.00	0.0	0.0	65.7	0.0
Apr.	5.8	65.1	1.3	28.8	1.12	32.4	32.4	32.7	0.0
May	12.2	92.8	3.9	73.7	1.23	90.9	90.9	1.9	0.0
Jun.	18.1	89.5	7.0	114.9	1.29	148.2	89.5	0.0	58.7
Jul.	20.8	72.7	8.7	135.3	1.26	170.7	72.7	0.0	98.0
Aug.	19.9	77.9	8.1	119.1	1.17	138.8	77.9	0.0	60.9
Sep.	15.9	99.1	5.8	80.6	1.04	84.1	84.1	15.0	0.0
Oct.	9.3	90.1	2.6	40.7	0.92	37.2	37.2	52.9	0.0
Nov.	3.2	103.6	0.5	10.7	0.80	8.6	8.6	95.0	0.0
Dec.	-3.1	104.4	0.0	0.0	0.74	0.0	0.0	104.4	0.0
Total	**-**	**1041**	**37.7**	**603.8**	**-**	**710.9**	**493.3**	**547.3**	**217.7**

Additional Notes

PET = Potential Evapotranspiration; AET = Actual Evapotranspiration

Equations

$PET = 16\left(\frac{L}{12}\right)\left(\frac{N}{30}\right)\left(\frac{10T_d}{I}\right)^{\alpha}$ Where

PET is the estimated potential evapotranspiration (mm/month)

T_d is the average daily temperature (degrees Celsius; if this is negative, use 0) of the month being calculated

N is the number of days in the month being calculated

L is the average day length (hours) of the month being calculated

$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$

$I = \sum_{i=1}^{12}\left(\frac{T_{m_i}}{5}\right)^{1.514}$ is a heat index which depends on the 12 monthly mean temperatures T_{m_i}.[1]

TATHAM ENGINEERING

Water Budget

Pre and Post Development Comparison

Project Details

16728 Highway 12, Midland	324816

Prepared By

JH	Sep-24

Pre-Development Catchment Details

Area (ha)	2.45
Pervious Area (ha)	2.37
Impervious Area (ha)	0.08

Post Development Catchment Details

Area (ha)	2.45
Pervious Area (ha)	0.84
Impervious Area (ha)	1.61

Infiltration Factor

Infiltration Factor	Pre-Development		Post Development	
	Pervious	Impervious	Pervious	Impervious
Topography	0.100	0.0	0.100	0.0
Soil	0.300	0.0	0.300	0.0
Land Cover	0.200	0.0	0.100	0.0
Infiltration Factor	0.600	0.0	0.500	0.0

Water Budget

Water Budget	Pervious	Impervious	Total	Pervious	Impervious	Total
Water Surplus (m^3)	12,972	438	13,409	4,598	8,812	13,409
Infiltration (m^3)	7,783	0	7,783	2,299	0	2,299
Runoff (m^3)	5,189	438	5,626	2,299	8,812	11,111
Reduction in Infiltration Volume (m^3)						**5,484**

Additional Notes

Infiltration Factors

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

(Stormwater Planning and Design Manual. MOE, 2003.)

TATHAM ENGINEERING

Water Budget

Mitigation Measures
LID Design

Project Details

16728 Highway 12, Midland	324816

Prepared By

JH	Sep-24

LID Design Details

LID Measure	Infiltration Trench
LID Impervious Drainage Area (ha)	1.54
Number of LIDs	1
Void Ratio	0.4
Footprint of LID (m^2)	461.70
Depth of LID (m)	2.10
Storage Volume Required (m^3)	113.8
Volume Required / LID (m^3)	113.79
Volume Provided / LID (m^3)	387.83
Volume Provided (m^3)	387.83
Design Precipitation Depth (mm)	25.2
Annual Volume Captured (mm)	676.5
Annual Volume Captured excluding Evapotransiration (m^3)	10,419
Annual Volume Captured after Evapotranspiration (m^3)	8,335

Additional Notes

TATHAM ENGINEERING

Water Budget
Summary

Project Details

16728 Highway 12, Midland	324816

Prepared By

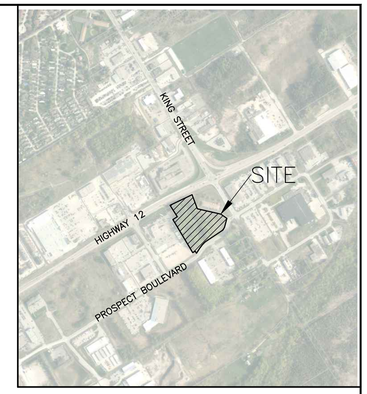
JH	Sep-24

Summary

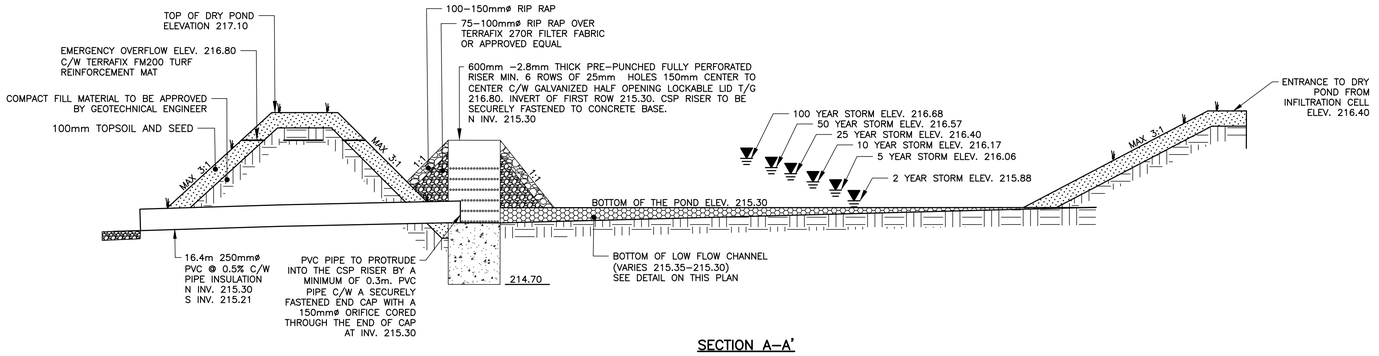
Existing Infiltration (m^3)	7,783
Proposed Infiltration (m^3) - No Mitigtation	2,299
Infiltration Deficit Prior to Mitigation (m^3)	-5,484
Proposed Infiltration Measures	
[ ] Increase Topsoil Depth	
[x] Infiltration LID	
[ ] Impervious Area Routed Over Pervious Area	
Mitigation - Increase Topsoil Reduction in Pervious Runoff (m^3)	0
Mitigation Measure - Implementing LID (m^3)	8,335
Mitigation Measure - Impervious Area Routed over Pervious Area (m^3)	0
Infiltration Surplus after Mitigation (m^3)	2,851

Additional Notes

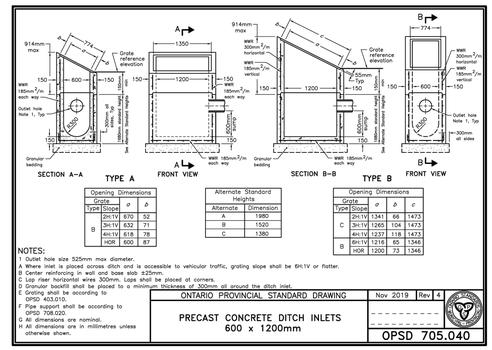
Appendix G:
Design Drawings



KEY PLAN



SECTION A–A'
NTS



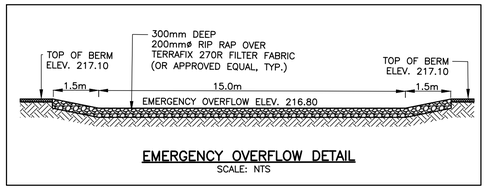
Opening Dimensions				
Grate Type	Slope	a	b	
B	2H:1V	670	52	
	3H:1V	632	71	
	4H:1V	618	78	
	HOR	600	87	

Alternate Standard Heights	
Alternate	Dimension
A	1980
B	1520
C	1380

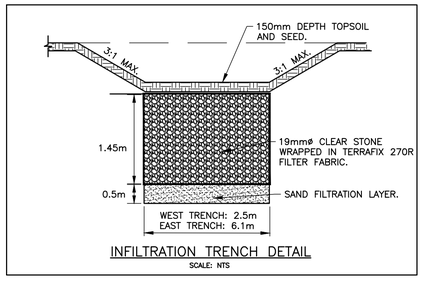
Opening Dimensions				
Grate Type	Slope	a	b	c
C	2H:1V	1341	66	1473
	3H:1V	1265	104	1473
	4H:1V	1237	118	1473
B	6H:1V	1216	65	1346
	HOR	1200	73	1346

NOTES:
A Outlet hole size 525mm max diameter.
A Where inlet is placed across ditch and is accessible to vehicular traffic, grating slope shall be 6H:1V or flatter.
B Center reinforcing in wall and base slab ø25mm.
C Lap riser horizontal wires 300mm. Laps shall be placed at corners.
D Granular backfill shall be placed to a minimum thickness of 300mm all around the ditch inlet.
E Grating shall be according to OPSD 403.010.
F Pipe support shall be according to OPSD 708.020.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

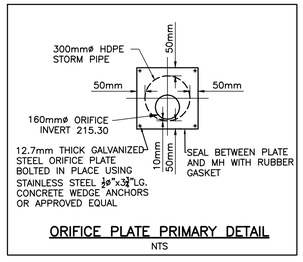
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2019	Rev 4
PRECAST CONCRETE DITCH INLETS 600 x 1200mm		
	OPSD 705.040	



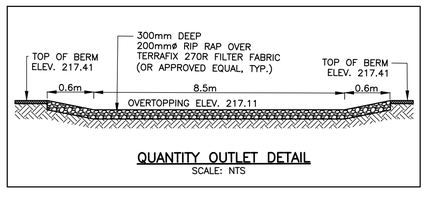
EMERGENCY OVERFLOW DETAIL
SCALE: NTS



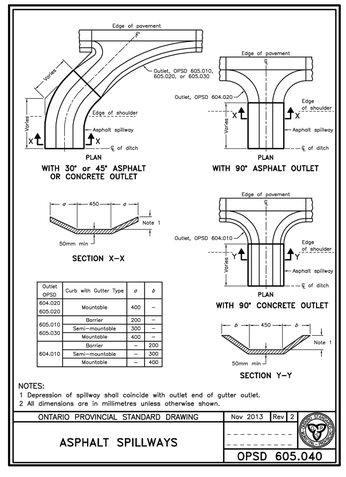
INFILTRATION TRENCH DETAIL
SCALE: NTS



ORIFICE PLATE PRIMARY DETAIL
NTS



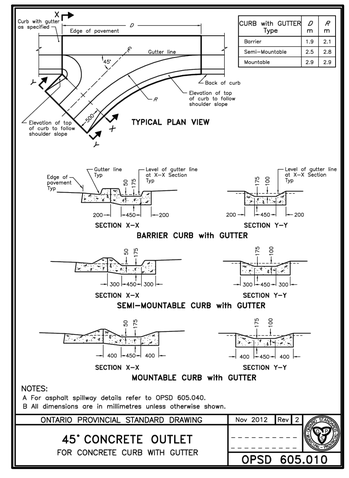
QUANTITY OUTLET DETAIL
SCALE: NTS



Outlet OPSD	Curb with Gutter Type	a	b
604.020 605.020	Mountable	400	–
605.010 605.020	Barrier	200	–
	Semi–mountable	300	–
	Mountable	400	–
604.010	Barrier	–	200
	Semi–mountable	–	300
	Mountable	–	400

NOTES:
1 Depression of spillway shall coincide with outlet end of gutter outlet.
2 All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 2
ASPHALT SPILLWAYS		
	OPSD 605.040	



CURB with GUTTER Type	D m	R m
Barrier	1.9	2.1
Semi–Mountable	2.5	2.8
Mountable	2.9	2.9

NOTES:
A For asphalt spillway details refer to OPSD 605.040.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
45° CONCRETE OUTLET FOR CONCRETE CURB WITH GUTTER		
	OPSD 605.010	

BENCHMARKS

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM CGVD28:78 AND ARE DERIVED FROM BENCH MARK No. 00820038041 HAVING A PUBLISHED ELEVATION OF 222.025 METRES.

NOTES

LEGAL AND TOPOGRAPHIC INFORMATION FROM 'PLAN OF SURVEY OF PART OF THE NORTH HALF OF LOT 100 CONCESSION 1 (EAST OF PENETANGUISHENE ROAD) GEOGRAPHIC TOWNSHIP OF TAY NOW IN THE TOWN OF MIDLAND COUNTY OF SIMCOE' PREPARED BY J. D. BARNES LIMITED DATED: 01/22/2023

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 2024

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Sept. 25, 2024
PROVINCE OF ONTARIO

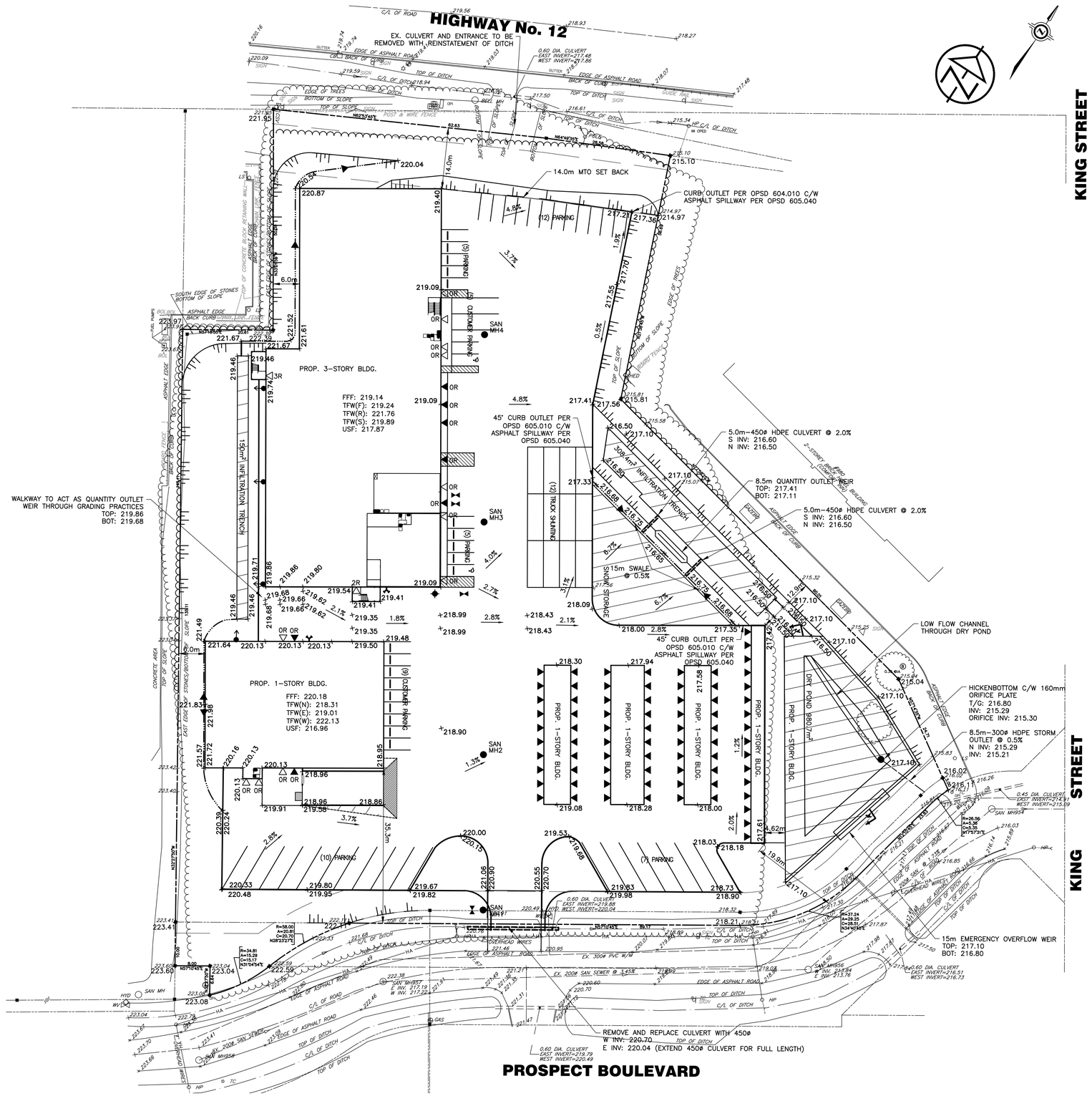
16728 HIGHWAY 12
(PART OF THE NORTH HALF OF LOT 100 CONCESSION 1)
TOWN OF MIDLAND

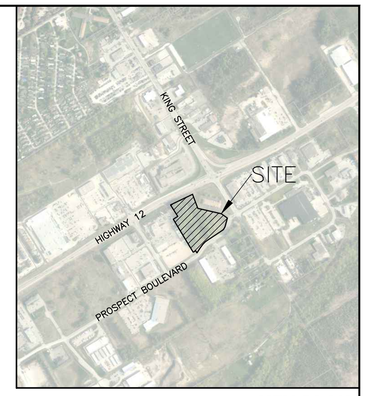
NOTES AND DETAILS

TATHAM ENGINEERING

DESIGN: JH	FILE: 324816	DWG:
DRAWN: JH	DATE: AUG. 2024	**DET-1**
CHECK: JN	SCALE: 1:500	

Drawing Name: 324816–DET–1.dwg, Plotted: Sep 25, 2024





KEY PLAN

LEGEND

217.50	PROPOSED GROUND ELEVATION
221.50	EXISTING GROUND ELEVATION
	PROPERTY LINE
	EXISTING DITCH
STM MH	FUTURE STORM SEWER
	FUTURE STORM MH
CB	FUTURE STORM CB
1.9%	PROPOSED OVERLAND FLOW DIRECTION
OGS	PROPOSED MH C/W OGS UNIT
221.00	EXISTING CONTOURS
WV	PROPOSED WATER VALVE
HYD	PROPOSED HYDRANT & VALVE
HYD	EXISTING HYDRANT
	PROPOSED CULVERT
	POTENTIAL ROOF DRAIN
	FIRE DEPARTMENT CONNECTION

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

BENCHMARKS

ELEVATIONS SHOWN ON THIS PLAN ARE RELATED TO GEODETIC DATUM CGVD28:78 AND ARE DERIVED FROM BENCH MARK No. 00820038041 HAVING A PUBLISHED ELEVATION OF 222.025 METRES.

NOTES

LEGAL AND TOPOGRAPHIC INFORMATION FROM 'PLAN OF SURVEY OF PART OF THE NORTH HALF OF LOT 100 CONCESSION 1 (EAST OF PENETANGUISHENE ROAD) GEOGRAPHIC TOWNSHIP OF TAY NOW IN THE TOWN OF MIDLAND COUNTY OF SIMCOE' PREPARED BY J. D. BARNES LIMITED DATED: 01/22/2023

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 2024

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Sept. 25, 2024
324816
PROVINCE OF ONTARIO

16728 HIGHWAY 12

(PART OF THE NORTH HALF OF LOT 100 CONCESSION 1)

TOWN OF MIDLAND

LOT GRADING PLAN

TATHAM ENGINEERING

DESIGN: JH	FILE: 324816	DWG:	LG.1
DRAWN: JH	DATE: AUG. 2024		
CHECK: JN	SCALE: 1:500		

Drawing Name: 324816-LG01.dwg, Plotted: Sep 25, 2024

LEGEND

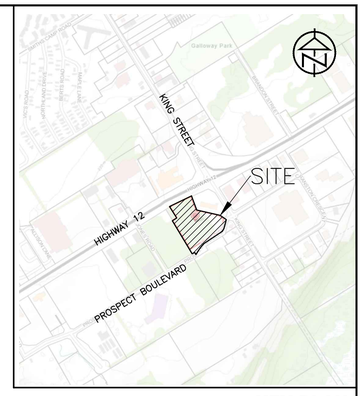
- SILT/TREE PROTECTION FENCE OPSD 219.131
- SBCD — STRAW BALE FLOW CHECK DAM OPSD 219.180
- RCD — PERMANENT ROCK CHECK DAM OPSD 219.211
- STONE MUD MAT
- CATCH BASIN FILTER

SILTATION AND EROSION CONTROL NOTES

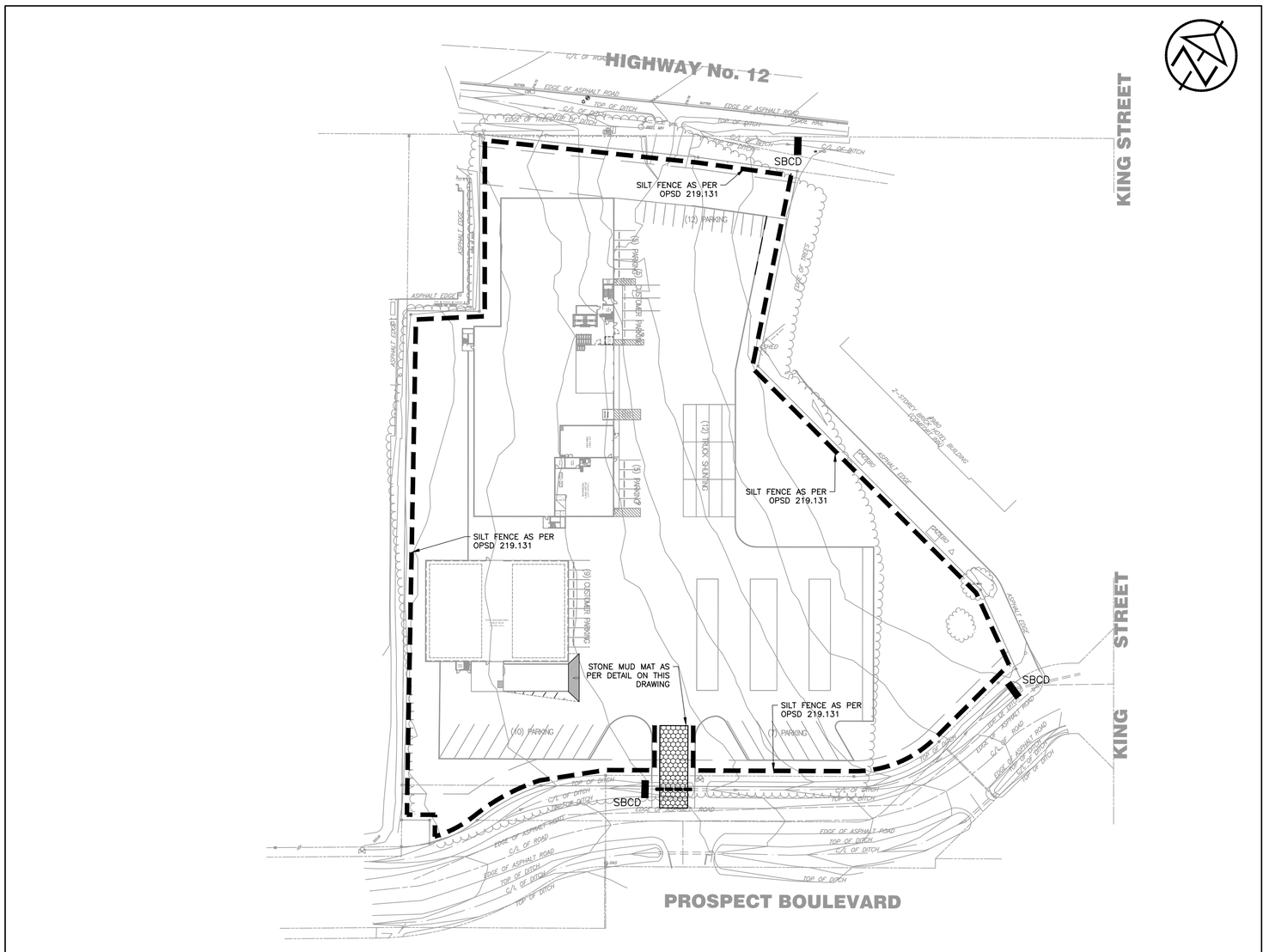
1. ALL SILTATION AND EROSION CONTROL MEASURES TO BE IN PLACE PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO INSTALL AND MAINTAIN SILTATION CONTROL DEVICES AT LOCATIONS SHOWN, OR AS DIRECTED BY THE CONTRACT ADMINISTRATOR IF ADDITIONAL CONTROLS ARE DEEMED NECESSARY.
3. CONTRACTOR TO ARRANGE PRE-CONSTRUCTION MEETING WITH CONTRACT ADMINISTRATOR IMMEDIATELY AFTER PLACING ALL SILTATION CONTROL DEVICES.
4. SILTATION CONTROL DEVICES TO BE INSPECTED BY CONTRACTOR WEEKLY AND AFTER EACH RAINFALL. REPAIRS TO SILTATION CONTROL DEVICES TO BE COMPLETED PROMPTLY WHEN REQUIRED.
5. THE CONTRACT ADMINISTRATOR WILL INSPECT THE SEDIMENT AND EROSION CONTROL MEASURES PERIODICALLY, AND AFTER EACH MAJOR STORM EVENT. THE CONTRACT ADMINISTRATOR WILL NOTIFY THE CONTRACTOR OF CORRECTIVE ACTIONS REQUIRED AS SOON AS DEFICIENCIES ARE NOTED. THE CONTRACTOR MAINTAINS ULTIMATE RESPONSIBILITY TO ENSURE PROPER SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED AND MAINTAINED. ALL DEFICIENCIES AND CORRECTIVE MEASURES WILL BE DOCUMENTED BY THE CONTRACTOR IN A WEEKLY INSPECTION REPORT. A COPY OF THE WEEKLY INSPECTION REPORT WILL BE PROVIDED TO THE CONTRACT ADMINISTRATOR.
6. CONTRACTOR TO REMOVE SILTATION CONTROL DEVICES ONLY AFTER ALL PAVING IS COMPLETED AND VEGETATION HAS STABILIZED.
7. ALL SILT FENCE PER OPSD 219.131 (SEE DETAIL ON THIS DRAWING) .

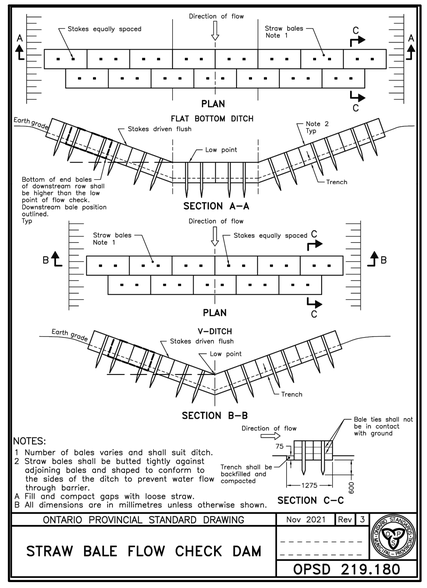
CONSTRUCTION ENTRANCE NOTES

1. CONSTRUCT AND MAINTAIN CONSTRUCTION ENTRANCE AS SHOWN AND IN ACCORDANCE WITH O.P.S.D. 301.020.
2. ALL CONSTRUCTION VEHICLES TO ACCESS THE SITE USING THE DESIGNATED CONSTRUCTION ENTRANCE.
3. CONTRACTOR TO INSTALL AND MAINTAIN STONE MUD MAT AS DETAILED.
4. REMOVE TOPSOIL (WHERE APPLICABLE) BEFORE INSTALLING CONSTRUCTION ENTRANCE.
5. PROMPTLY REMOVE ANY MUD OR DUST WHICH IS TRANSPORTED BEYOND THE STONE MUD MAT TO MAINTAIN EXISTING ROAD DRIVING CONDITION.
6. ENTRANCE RADII TO BE MINIMUM 8.0m.

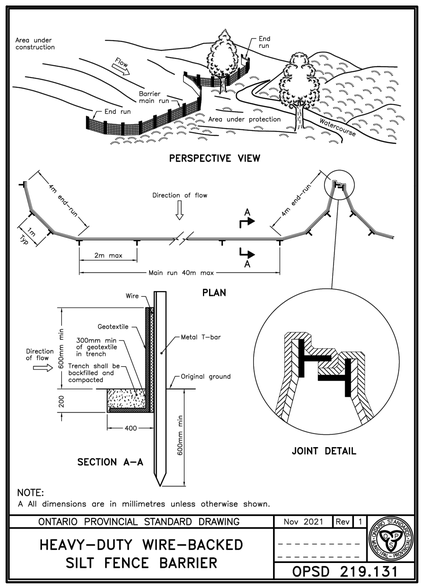


KEY PLAN

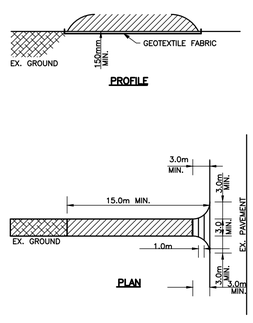




ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
STRAW BALE FLOW CHECK DAM		OPSD 219.180



ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 1
HEAVY–DUTY WIRE–BACKED SILT FENCE BARRIER		OPSD 219.131



STONE SIZE

THE STONE PAD SHALL BE A MIN. 150mm THICK. USE 50#mm STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 10m FROM ADJACENT ROAD & 150mm# STONE FOR REMAINDER OF STONE PAD.

LENGTH

AS REQUIRED BUT NOT LESS THAN 15m (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 10m MIN. LENGTH WOULD APPLY).

WIDTH

3m MIN. BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.

GEOTEXTILE FABRIC

(TERRAFIX 270R OR EQUAL) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

SURFACE WATER

ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.

MAINTENANCE

THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE STONE MAT IS TO BE FULLY REPLACED.

WASHING

WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

STONE MUD MAT DETAIL
SCALE: NTS

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No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	AUG. 2024

ENGINEER STAMP

LICENCED PROFESSIONAL ENGINEER — J. A. NEMISZ — 100181826 — Sept. 25, 2024 — 324816 — PROVINCE OF ONTARIO

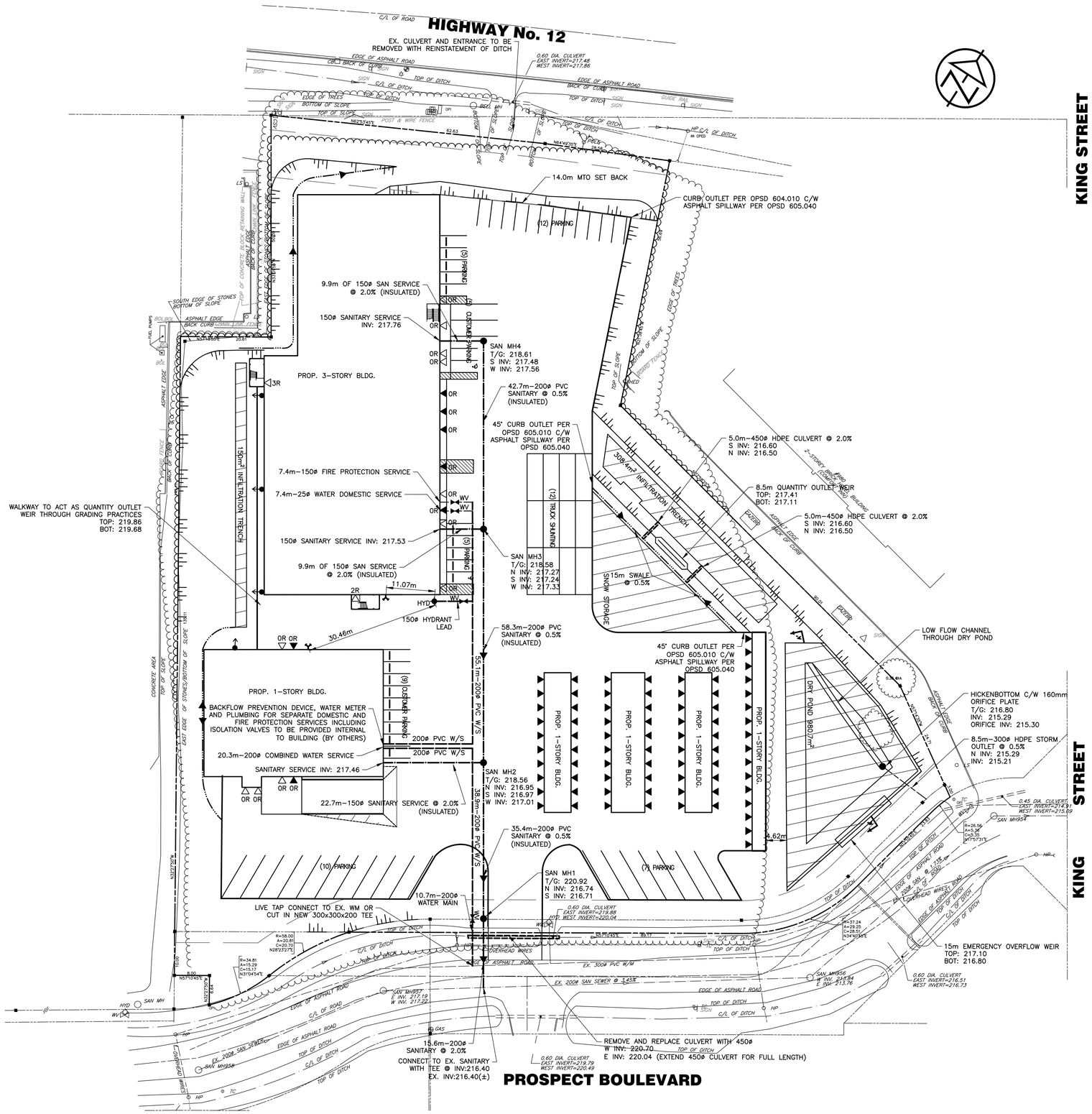
16728 HIGHWAY 12
(PART OF THE NORTH HALF OF LOT 100 CONCESSION 1)
TOWN OF MIDLAND

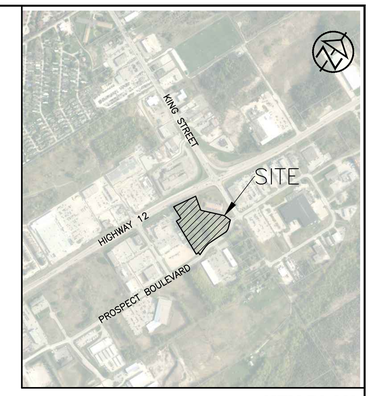
EROSION & SILTATION CONTROL PLAN

TATHAM ENGINEERING

DESIGN: JH/MPO	FILE: 324816	DWG: ESC-1
DRAWN: JH/MPO	DATE: AUG. 2024	
CHECK: JN	SCALE: 1:750	

Drawing Name: 324816-SC-1.dwg, Plotted: Sep 25, 2024





KEY PLAN

LEGEND

- PROPERTY LINE
- EXISTING DITCH
- EXISTING STORM SEWER
- STM MH — EXISTING STORM MH
- CB — EXISTING STORM CB
- 200ø SAN — PROPOSED SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- 450ø STM — PROPOSED STORM SEWER/ SIZE/ DIRECTION OF FLOW
- 150ø WATERMAIN — WATERMAIN/SIZE
- PROPOSED SANITARY SERVICE
- PROPOSED WATER SERVICE
- PROPOSED DITCH
- SAN MH2 — PROPOSED SANITARY MANHOLE/ NUMBER
- STM MH2 — PROPOSED STORM MANHOLE/ NUMBER
- HYD & WV — PROPOSED HYDRANT & WATER VALVE
- WV — PROPOSED WATER VALVE
- CSV — PROPOSED WATER CURB STOP
- POTENTIAL ROOF DRAIN
- ENTRANCE/EXIT – VEHICULAR
- ENTRANCE/EXIT – PEDESTRIAN
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- FIRE DEPARTMENT CONNECTION

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ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER — J. A. NEMISZ 100181826 — Sept. 25, 2024 — PROVINCE OF ONTARIO

16728 HIGHWAY 12
(PART OF THE NORTH HALF OF LOT 100 CONCESSION 1)
TOWN OF MIDLAND

TATHAM ENGINEERING

GENERAL SERVICING PLAN

DESIGN: JH/WL	FILE: 324816	DWG:	GS.1
DRAWN: JH/WL	DATE: AUG. 2024		
CHECK: JN	SCALE: 1:500		

Drawing Name: 324816-SS01.dwg, Plotted: Sep 25, 2024