

# **SITE SERVICING AND STORMWATER MANAGEMENT REPORT**

**WHELAN TRUCKING  
158 CARDEVCO ROAD, OTTAWA**



## **PREPARED FOR**

**WHELAN TRUCK REPAIR  
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## REVISIONS & SUBMISSIONS

| Revision # | Comments                                 | Date             |
|------------|--|------------------|
| 00         | 60% Design Issued for Review and Comment | December 2, 2022 |
|            |  |                  |
|            |  |                  |

## EXECUTIVE SUMMARY

Shade Group Inc. (SGI) was retained by Pri-Tec Construction Ltd. (Pri-Tec) on behalf of Whelan Truck Repair to provide civil engineering design services pertaining to the proposed development at 158 Cardevco Road, Ottawa. The development is understood to include construction of an addition to the existing structure which is to consist of a new 50' by 100' pre-engineered building that is to be connected to the existing 50' by 100' structure by way of a new 14' x 100' breezeway.

The subject property is located at 158 Cardevco Road; approximately 400m north of Richardson Side Road and approximately 300m west of Carp Road. The site is located within a development adopted by way of Plan of Subdivision known as the Cardevco Industrial Park. Cardevco Industrial Park was adopted by Plan of Subdivision 4M-356.

The primary objective of this report is to provide stormwater management details in accordance with the recommendations and guidelines provided by the Ministry of the Environment, Conservation and Parks (MECP), the City of Ottawa and the Mississippi Valley Conservation Authority (MVCA). As this property is encompassed within a formerly adopted Plan of Subdivision, this report has also been prepared in reference to the specifications as outlined in the Subdivision Agreement for 4M-356, as applicable.

The site is rural in nature and serviced by private well and septic. For further information pertaining to the well and septic, and any changes (if applicable) required to these to accommodate the development, refer to the Hydrogeological Report prepared by others. (This report was not available to SGI at the time of this report).

The site has been designed to restrict post-development peak flow rates for the 2-, 5- and 10-year storm to the 2-year pre-development level; and the 100-year post-development peak flow rate has been controlled to the 10-year pre-development level.

The proposed stormwater management system is to be comprised of clearstone filled trenches along much of the perimeter of the site. These trenches are intended to intercept overland sheet flow, offer particle filtration through the clearstone, offer groundwater recharge opportunity through infiltration, and offer temporary retention storage for runoff. There are two trench networks which are each to be equipped with an outlet control structure comprised of an 178mm orifice, that will outlet to the Cardevco Road roadside ditch. This system is anticipated to provide both quantity and quality control for the site.

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## 1.0 INTRODUCTION

Shade Group Inc. (SGI) was retained by Pri-Tec Construction Ltd. (Pri-Tec) on behalf of Whelan Truck Repair to provide civil engineering design services pertaining to the proposed development at 158 Cardevco Road, Ottawa. The development is understood to include construction of an addition to the existing structure which is to consist of a new 50' by 100' pre-engineered building that is to be connected to the existing 50' by 100' structure by way of a new 14' x 100' breezeway. We understand that the proposed development is subject to Site Plan Control under the *Planning Act*.

This report reflects a 60% design submission, intended to outline the general intent of the proposed civil engineering design for the subject property. Pending input from approval agency staff, additional details and cross-sections are expected to be provided as part of the next design submission.

## 2.0 OBJECTIVE

SGI was retained to prepare the civil engineering design works associated with the subject property. Our scope of work included preparation of the following:

- Servicing, Grading and Drainage Plan (**Appendix H**);
- Site Servicing & Stormwater Management Report.

The primary objective of this report is to provide stormwater management details in accordance with the recommendations and guidelines provided by the Ministry of the Environment, Conservation and Parks (MECP), the City of Ottawa and the Mississippi Valley Conservation Authority (MVCA). As this property is encompassed within a formerly adopted Plan of Subdivision, this report has also been prepared in reference to the specifications as outlined in the Subdivision Agreement for 4M-356 (as applicable).

## 3.0 BACKGROUND INFORMATION

The following guides, standards and supporting reports were referenced in the preparation of this report:

### 3.1 GUIDELINES & STANDARDS & WATERSHED STUDIES

- **City of Ottawa Sewer Design Guidelines**, Second Edition, City of Ottawa, October 2012;
- **Technical Bulletin ISDTB-2014-01**, City of Ottawa, February 5, 2014;
- **Technical Bulletin PIDTB-2016-01**, City of Ottawa, September 6, 2016;
- **Stormwater Management Planning and Design Manual**, Ministry of the Environment, March 2003;

- **Interpretation Bulletin: Ontario Ministry of Environment and Climate Change Expectations Re: Stormwater Management**, Ministry of the Environment and Climate Change (Now Ministry of the Environment, Conservation and Parks), February 2015;
- **Carp River Watershed/Subwatershed Study**, Robinson Consultants Inc., December 2004;
- **Huntley Creek 2017 Catchment Report**, Mississippi Valley Conservation Authority, 2017.

### 3.2 SUPPORTING STUDIES

- **Geotechnical Investigation** Proposed Building Addition 158 Cardevco Road, Paterson Group, June 2, 2022.

### 3.3 OTHER

- **Pre-application Consultation Meeting Notes**, City File No PC2022-0012, February 11, 2022;
- **Preliminary Structural Engineering Drawing Package**, S0-S8, Daido Group Inc, November 14, 2021;
- **Site Plan + Architectural Drawing Package**, A0-A6, Chris A. Leggett Architect Inc, November 12, 2021;
- Former **Site Plan**, Pri-Tec Construction Ltd., January 1991;
- **Subdivision Agreement**, November 15, 1982;
- **Site Grading Plan Cardevco Industrial Park**, R. W. Connelly Associates Ltd, March 1990 (Drawing No. 88-1370-SGP);
- **Input from Pri-Tec Staff**.

## 4.0 PROJECT DESCRIPTION

The subject property is located at 158 Cardevco Road; approximately 400m north of Richardson Side Road and approximately 300m west of Carp Road. The site is located within a development adopted by Plan of Subdivision and is known as the Cardevco Industrial Park. Cardevco Industrial Park was adopted by Plan of Subdivision 4M-356.

The legal description of the subject property is Part of Block 11, Registered Plan 4M-356. The PIN for the subject property is 04536-0142.

The property is a corner lot and is bounded by Cardevco Road to the north and west; a (currently) vacant gravel storage yard to the south (154 Cardevco Road); and R&R Auto Repairs to the east (164 Cardevco Road). The subdivision is comprised of rural industrial lots; including R&R Auto Repairs, Akman Construction, Harris Rebar, Virtucom Metals, Carp and Cardevco West End Self Storage; just to name a few.

The subdivision is rural in nature, with roadside ditches used for stormwater conveyance, and each lot is on private well and septic. There are no public services (sewer or water).

An aerial photograph of the subject property has been provided in Figure 1, while a Location Plan is available in **Appendix A**.



Figure 1: Map of subject property location. Source: GeoOttawa (accessed 2022-10-25)

#### 4.1 SITE TOPOGRAPHY

A topographic survey was completed by Annis, O'Sullivan, Vollebekk Ltd. on July 12, 2022 and supplied SGI by Pri-Tec for preparation of the civil engineering design.

The subject property ranges in elevation from approximately 117.00m to 117.20m at the property line adjacent Cardevco Road, to approximately 118.00m at the highest point of the property adjacent the existing structure. The existing structure is located at the highpoint of the property, with runoff directed away in either a southwesterly or northeasterly manner towards the surrounding ditches. These drainage patterns are consistent with the Site Grading Plan for the Cardevco Industrial Park (R.W. Connelly Associates Ltd, March 1990).

#### 4.2 RECEIVING WATERSHED

The entirety of the property drains either indirectly (by way of a side yard swale located along the northeast property boundary) or directly (via overland sheet flow) to the Cardevco Road roadside ditch. The Cardevco Road roadside ditch flows in a north and easterly manner from the subject property – outletting to the roadside ditch at Carp Road.

The subject property is located within the subwatershed of Huntley Creek, which is a tributary to the Carp River.



### **4.3 SOURCE PROTECTION**

The subject property is located within an Intake Protection Zone 3 within a Groundwater Recharge Area. The property is also identified as located within a Highly Vulnerable Aquifer. (Source Protection Information Atlas, Ministry of the Environment, Conservation and Parks).

### **4.4 SUBSURFACE CONDITIONS**

A geotechnical investigation was performed by Paterson Group. As part of their works, three test pits were advanced on the site.

The Geotechnical Investigation Report describes the subsurface conditions as *“2 to 2.2m thick fill layer underlain by a native silty sand deposit. The fill material was generally observed to consist of compact to very dense brown silty sand with gravel, crushed stone, brick fragments, asphalt and concrete....A compact, brown native silty sand with gravel and traces of cobbles was encountered underlying the fill.”*

Practical refusal is noted as being approximately 2.1-3.1m below grade on inferred bedrock surface. (Geotechnical Investigation, Section 4.2, Paterson Group, June 2022)

Groundwater infiltration was noted at depths of approximately 1.6 to 1.8m. (Geotechnical Investigation, Section 4.3, Paterson Group, June 2022).

## **5.0 SITE SERVICING**

### **5.1 WATER SUPPLY**

The existing site is serviced by an existing private well located at the south corner of the site. For more information pertaining to the water supply, please refer to the Hydrogeological Report prepared by others (a copy of the report was not available at the time of this report).

### **5.2 SANITARY SERVICING**

The site is serviced by an existing private septic system located along the northwest side of the existing building. For more information pertaining to the septic system, please refer to the Hydrogeological Report prepared by others (a copy of the report was not available at the time of this report).

## **6.0 UTILITIES**

The site is understood to be serviced by overhead utilities as well as natural gas. No changes to utilities or services are proposed as part of the proposed addition. Any servicing extensions would be handled internally as part of the build; with design to be provided by the electrical or mechanical designer (i.e. by others), as applicable.

## 7.0 GRADING AND DRAINAGE

A Site Servicing, Grading and Drainage Plan has been prepared as part of the scope of work undertaken by SGI. The Site Servicing, Grading and Drainage Plan includes such details as existing and proposed spot elevations; overland flow routes; location of existing well and septic; location of proposed stormwater measures, etc. A copy of the plan has been provided in **Appendix H**.

## 8.0 STORMWATER MANAGEMENT DESIGN

### 8.1 METHODOLOGY

The stormwater peak flow calculations were completed using the Rational Method.

$$Q = 2.78CIA$$

Where

|   |   |                            |
|---|---|----------------------------|
| Q | = | Flow Rate (L/s)            |
| C | = | Runoff coefficient         |
| I | = | Rainfall intensity (mm/hr) |
| A | = | Drainage area (ha)         |

The use of the Rational Method is permitted per the City of Ottawa Sewer Design Guidelines – as the subject development is less than 40 hectares (City Guidelines - Section 3.5.1.1).

### 8.2 DESIGN CRITERIA AND CONSTRAINTS

Stormwater design criteria have been established in reference to current design practices as outlined in the City of Ottawa Sewer Design Guidelines, through consultation with City of Ottawa Staff (pre-application consultation, February 2022), through input from the Mississippi Valley Conservation Authority (pre-consultation completed by others), and through specifications provided by the client (Pri-Tec).

#### 8.2.1 QUANTITY CONTROL

- Post-development peak flow conditions for the 2, 5 and 10-year storm events have been controlled to not exceed the 2-year pre-development peak flow rate;
- The 100-year post-development peak flow rate has been restricted to not exceed the 10-year pre-development peak flow rate (Pri-Tec);
  - *It's worth noting that design to a 10-year storm event is consistent with the design standards as used to size the roadside ditches under the Subdivision Agreement for the subdivision; and consistent with design practices used on nearby adjacent projects (e.g. Akman Construction, 127 Cardevco Road, Site Servicing and Stormwater Management Report, November 1, 2021).*
- Peak flow rates have been calculated using a time of concentration ( $T_c$ ) of 10 minutes (City of Ottawa – Section 5.4.5.2);

- Pre-development conditions have been determined using the smaller of a runoff coefficient of 0.5 or the actual site runoff coefficient (City of Ottawa – Section 8.3.7.3).

#### 8.2.2 QUALITY CONTROL

- The site has been designed to ensure a minimum 80% Total Suspended Solids (TSS) removal rate (pre-application consultation, February 2022).

#### 8.2.3 RUNOFF COEFFICIENTS

The following coefficients were used to develop a weighted runoff coefficient for each area in post-development conditions:

|                      |      |
|----------------------|------|
| Paved and Roof Areas | 0.90 |
| Grass                | 0.20 |
| Off-Site Areas       | 0.50 |
| Gravel Surfaces      | 0.60 |

The runoff coefficients have been increased by 25% for the 100-year storm (up to a maximum value of C=1.0), as per City of Ottawa Sewer Design Guidelines, Section 5.4.5.2.1.

#### 8.2.4 TIME OF CONCENTRATION

The time of concentration used to calculate peak flow rates was 10 minutes as per City of Ottawa Sewer Design Guidelines, Section 5.4.5.2 (*“an inlet time of 10 minutes is to be used for all land uses and lot grading configurations”*).

#### 8.2.5 RAINFALL INTENSITY

Rainfall intensities were derived from City of Ottawa Sewer Design Guidelines (City Guidelines - Section 5.4.2), where

$$\text{2-Year Intensity} = 732.951 / (\text{Time in min} + 6.199)^{0.810}$$

$$\text{5-Year Intensity} = 998.071 / (\text{Time in min} + 6.053)^{0.814}$$

$$\text{10-Year Intensity} = 1174.184 / (\text{Time in min} + 6.014)^{0.816}$$

$$\text{100-Year intensity} = 1735.688 / (\text{Time in min} + 6.014)^{0.820}$$

### **8.3 PRE-DEVELOPMENT DRAINAGE PATTERNS**

Under pre-development conditions the site has been assessed as a single drainage area measuring approximately 0.56 hectares. The majority of the site consists of impervious or relatively impervious (gravel) surfaces. A small grass area on-site is located at the northwest corner, encompassing the existing septic system. The property houses an approximately 466m<sup>2</sup> building that includes truck and auto repair shop bays and a small office.

The existing building is located at the highest point of the property at an elevation of approximately 118.00. Runoff is conveyed by overland sheet flow in a north, west or easterly direction, towards the Cardevco Road roadside ditch.

Under pre-development conditions, the site has a calculated runoff coefficient of 0.59; however as per the City Design Standards (Section 8.3.7.3), a runoff coefficient of 0.50 was used to calculate the pre-development allowable release rates.

Under pre-development conditions, the property is estimated to have peak flow rates of 60 L/s, 81 L/s and 95 L/s for the 2-, 5- and 10-year storm events respectively.

A Pre-Development Drainage Area Plan and associated calculations have been enclosed in **Appendix B**.

## **8.4 POST-DEVELOPMENT DRAINAGE PATTERNS**

Under post-development conditions, the site has been split into three sub-drainage areas: B1, B2 and B3.

Post-development drainage area B1 encompasses the southern half of the property; part of the existing structure, and approximately half of the new proposed addition. Runoff from B1 is to be conveyed by overland sheet flow towards a proposed stormwater retention trench along the perimeter of the site. B1 encompasses an area of approximately 0.25 hectares and has a weighted runoff coefficient of approximately 0.62 (2-10 year) and 0.75 (100-year). The peak flow rate under uncontrolled post-development conditions is estimated to be 33 L/s, 44 L/s, 52 L/s and 91 L/s for the 2-, 5-, 10- and 100-year storm events respectively.

Post-development drainage area B2 encompasses the northern half of the property; part of the existing structure, and approximately half of the new proposed addition. Runoff from B2 is to be conveyed by overland sheet flow towards a proposed stormwater retention trench along the perimeter of the site. B2 encompasses an area of approximately 0.25 hectares and has a weighted runoff coefficient of approximately 0.62 (2-10 year) and 0.75 (100-year). The peak flow rate under uncontrolled post-development conditions is estimated to be 34 L/s, 46 L/s, 54 L/s and 95 L/s for the 2-, 5-, 10- and 100-year storm events respectively.

Post-development drainage area B3 encompasses a small section at the northwest corner and a stretch along the northeast length of the property, representing flow that would be uncontrolled and not captured within a stormwater facility. Runoff would flow uncontrolled via overland sheet flow, over grassed surfaces, towards the Cardevco Road roadside ditch. B3 encompasses a total area of approximately 0.06 hectares and has a weighted runoff coefficient of approximately 0.34 (2-10 year) and 0.40 (100-year). The peak flow rate under uncontrolled post-development conditions is estimated to be 4 L/s, 6 L/s, 7 L/s and 12 L/s for the 2-, 5-, 10- and 100-year storm events respectively.

A Post-Development Drainage Area Plan and associated calculations have been enclosed in **Appendix C**.

## 8.5 PEAK FLOW RESULTS

The following tables provide a summary of the peak flow results for both pre- and post-development (uncontrolled) conditions. These results can also be found in **Appendix B and C** along with their associated supporting calculations.

Table 1: Pre-development peak flow results

|                           |    |
|---------------------------|----|
| Peak Flow (L/s) - 2-Year  | 60 |
| Peak Flow (L/s) - 5-Year  | 81 |
| Peak Flow (L/s) - 10-Year | 95 |

Table 2: Post-development (uncontrolled) peak flow results

|                            | B1 | B2 | B3 |
|----------------------------|----|----|----|
| Peak Flow (L/s) - 2-Year   | 33 | 34 | 4  |
| Peak Flow (L/s) - 5-Year   | 44 | 46 | 6  |
| Peak Flow (L/s) - 10-Year  | 52 | 54 | 7  |
| Peak Flow (L/s) - 100-Year | 91 | 95 | 12 |

## 8.6 QUANTITY CONTROL

Quantity control measures have been proposed to limit post-development peak flow rates to either the 2-year (2-10-year post-development); or the 10-year (100-year post-development). This is proposed to be achieved through the implementation of a clearstone filled trench that would be constructed along most of the perimeter of the site.

### QUANTITY CONTROL B1

For post-development drainage area B1, the proposed trench would be approximately 108m in length; stretching along the west and south sides of the property. The proposed trench is to be 1.5m wide, and the bottom of the clearstone is to be at an elevation of 116.50m. The maximum allowable ponding depth has been designed as 117.10m (or 0.60m), based on the existing ground elevation along the southwest property limit. As the top of the trench would be constructed to generally match the existing ground elevations, the actual depth of the trench will vary; ranging from a minimum of 0.60m; to approximately 1.1m along the central south side of the property.

The trench is proposed to be equipped with an outlet control structure comprised of an orifice outlet measuring 178mm, which will result in temporary ponding behind the outlet (within the trench); and offer control of peak flow rates. The proposed orifice is to outlet to the Cardevco Road roadside ditch. Given the noted soil conditions as described in Section 4.4, it is anticipated that this trench will also offer the opportunity for infiltration; further reducing the post-development peak flows from those that have been calculated. As infiltration rates were not available at the time of this report, the rate of infiltration has not been incorporated into the

design, and instead, it has been assumed that the only available outflow would be by way of the orifice. This approach is considered conservative.

### QUANTITY CONTROL B2

For post-development drainage area B2, the proposed trench would be approximately 104m in length; stretching along the north and east sides of the property. The proposed trench is to be 1.5m wide, and the bottom of the clearstone is to be at an elevation of 116.35m. The maximum allowable ponding depth has been designed as 116.95m (or 0.60m), based on a low point along the northeast property limit. As the top of the trench would be constructed to generally match the existing ground elevations, the actual depth of the trench will vary; ranging from a minimum of 0.60m; to approximately 1.1m along the central northwest side of the property.

The trench is proposed to be equipped with an outlet control structure comprised of an orifice outlet measuring 178mm, which will result in temporary ponding behind the outlet (within the trench); and offer control of peak flow rates. The proposed orifice is to outlet to the Cardevco Road roadside ditch. Given the noted soil conditions as described in Section 4.4, it is anticipated that this trench will also offer the opportunity for infiltration; further reducing the post-development peak flows from those that have been calculated. As infiltration rates were not available at the time of this report, the rate of infiltration has not been incorporated into the design, and instead, it has been assumed that the only available outflow would be by way of the orifice. This approach is considered conservative.

### SUMMARY – CONTROLLED PEAK FLOW RATES

The following table provides a summary of the peak flow results under post-development controlled conditions. These results can also be found in **Appendix D**.

*Table 3: Post-development (controlled) peak flow results*

|                            | B1<br>Controlled | B2<br>Controlled | B3<br>Uncontrolled | Total<br>Outflow | Pre/<br>Allowable | Δ * |
|----------------------------|------------------|------------------|--------------------|------------------|-------------------|-----|
| Peak Flow (L/s) - 2-Year   | 16               | 18               | 4                  | 38               | 60                | -22 |
| Peak Flow (L/s) - 5-Year   | 22               | 23               | 6                  | 51               | 60                | -8  |
| Peak Flow (L/s) - 10-Year  | 26               | 27               | 7                  | 60               | 60                | 0   |
| Peak Flow (L/s) - 100-Year | 41               | 42               | 12                 | 95               | 95                | 0   |

## 8.7 QUALITY CONTROL

The employment of Best Management Practices (BMPs) serves as the primary method of quality control for the site. Stormwater BMPs are present at the conveyance and end-of-pipe levels.

The proposed clearstone filled trenches will offer a means of temporary storage (end-of-pipe) and conveyance. Runoff is to enter the trenches through overland sheet flow, where water will percolate down through the clearstone. Given the retention storage, these trenches will offer an opportunity for particle settlement, filtration, and groundwater recharge through infiltration.

Calculations pertaining to the quality control storage volumes as per MECP Table 3.2 have been provided in **Appendix E**. The storage volumes required per Table 3.2 are anticipated to be approximately 22m<sup>3</sup> for the site; while approximately 38m<sup>3</sup> of quality storage volume is available per MECP Equation 4.17.

## 8.8 DOWNSTREAM SYSTEM REVIEW

A review of the receiving Cardevco Road roadside ditch has been completed as part of this report and the results have been enclosed in **Appendix F**. In summary, based on the existing cross-section of the ditch as surveyed in front of 164 Cardevco Road, and an assumed runoff coefficient of 0.50 for the upstream properties, the available capacity of the roadside ditch is greater than the anticipated 100-year peak flow rate of the upstream contributing area.

## 9.0 CONCLUSIONS

### 9.1 SERVICES (WATER + SANITARY)

The site will continue to be serviced by private on-site well and septic.

### 9.2 UTILITIES

The site is understood to be serviced by overhead utilities as well as natural gas. No changes to utilities or services are proposed as part of the proposed addition.

### 9.3 STORMWATER MANAGEMENT

The site is proposed to address stormwater management quantity and quality objectives through the implementation of clearstone filled trenches constructed along the majority of the perimeter of the site. The trenches are designed as two systems, with two outlets, each to be comprised of a 178mm diameter orifice opening that will restrict post-development peak flow rates to pre-development levels.

Quality control objectives are expected to be achieved through the same trenches, by way of percolation through the clearstone and the settlement of particles during the temporary storage that results due to the restricted outlet.

### 9.4 GRADING AND DRAINAGE

Grading and drainage changes are anticipated to be minimal given this is an existing developed site. Grading has been limited to that as required to accommodate the proposed addition. A copy of the Grading and Drainage Plan has been enclosed in **Appendix H**. The engineering design drawings have been prepared in reference to a Site Plan prepared by others. For ease of reference, a copy of the Site Plan has been enclosed in **Appendix G**.

## 10.0 CLOSING

This report is submitted for consideration in support of the proposed Site Plan Control Application for the subject property noted herein.

Should you have any questions or concerns, please do not hesitate to contact the undersigned at your earliest convenience.

**Monica Shade, P. Eng.**

**Shade Group Inc.**

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## 11.0 LIMITATIONS

This report was prepared exclusively for Pri-Tec Construction Limited and Whelan Truck Repair in support of the proposed Site Plan Approval Application associated with the proposed building addition at 158 Cardevco Road, Ottawa. This report has been prepared to review, assess and provide recommendation relating to stormwater management on the site, in conformance with the guidelines from the Ministry of the Environment, Conservation and Parks, the City of Ottawa, and the Subdivision Agreement associated with the development in which the site is located.

This report has been prepared in reference to information and data prepared by others, including those reports as outlined in Section 3.0 of this Report. Conclusions, calculations and assessments have been made in this report in reliance to the information provided by others (Section 3.0); no field measurements or conformance testing has been performed to confirm the results concluded by others.

Any reliance on this report by a third party is strictly prohibited. This report reflects Shade Group Inc.'s professional judgement with respect to the scope, schedule and other limitations as noted in this document. The opinions formed in this report are based on data, conditions and information that was existing at the time of the document preparation.

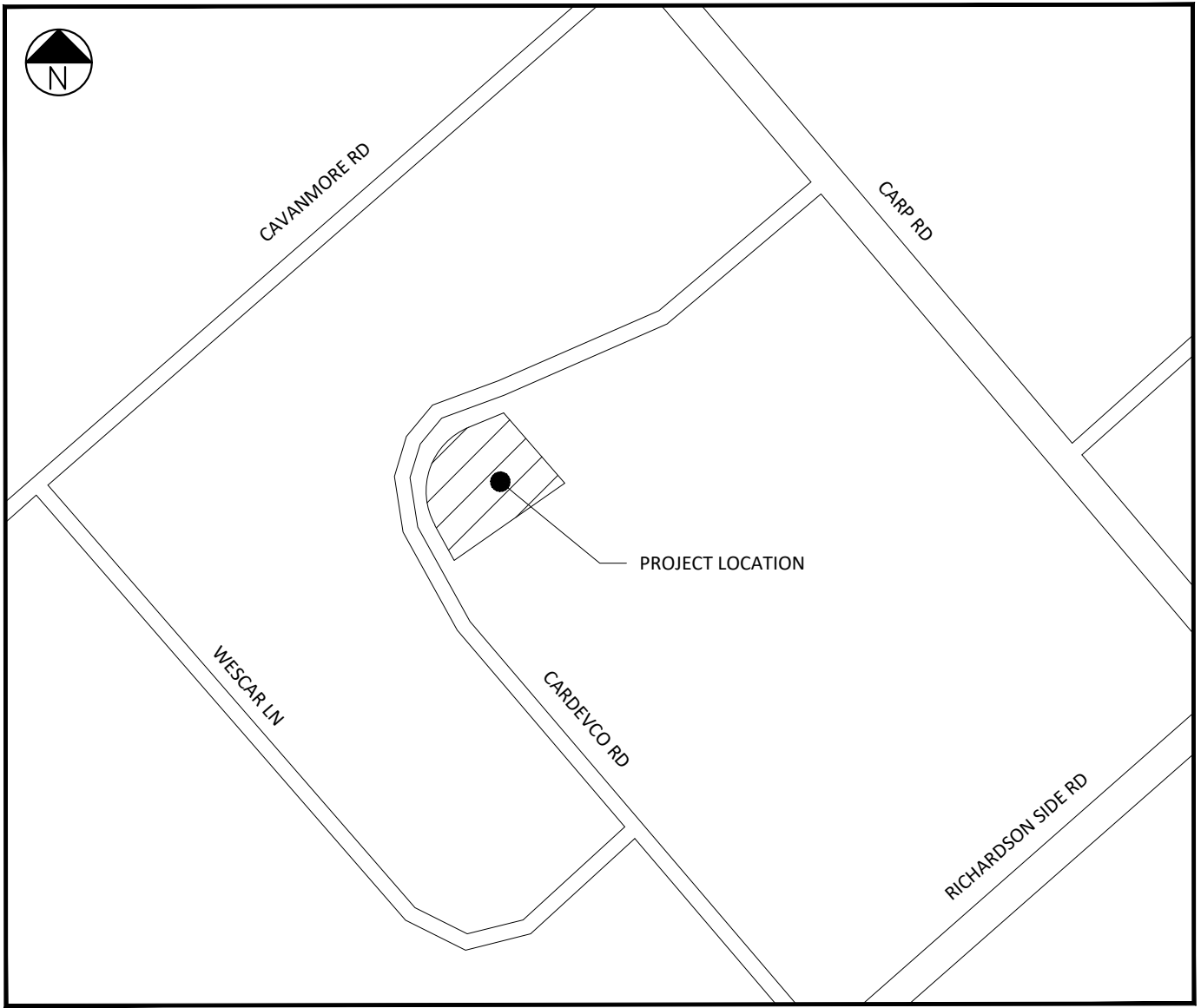
The findings, conclusions and recommendations of this report are only valid as of the date of this report. No assurance can be made with respect to the changes in site conditions following the date of this report. If additional information is discovered or becomes available Shade Group Inc. shall be contacted to review and re-evaluate the conclusions presented; and provide amendments, if required.

Any use which a third party makes of this document remains the responsibility and liability of such third party. Shade Group Inc. shall not be responsible for damages of any kind suffered by a third party as a result of decisions made or actions taken based on the findings of this report.

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## **APPENDIX A**

### **LOCATION PLAN**



LOCATION PLAN  
N.T.S.

158 CARDEVCO ROAD  
WHELAN TRUCK REPAIR

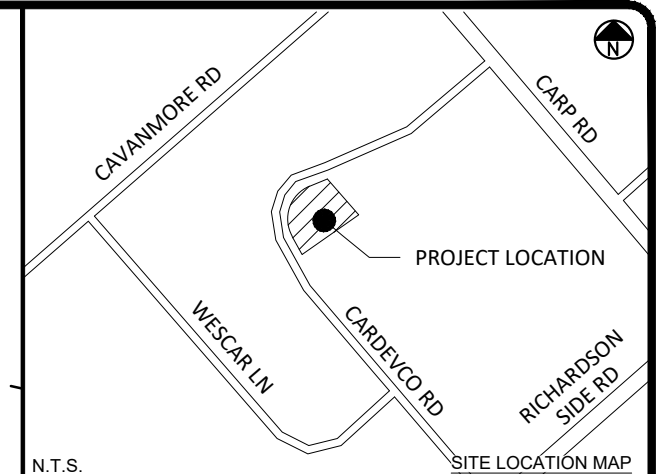
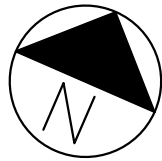
PROPOSED ADDITION

**SHADE**  
**GROUP** INC

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## **APPENDIX B**

### **PRE-DEVELOPMENT DRAINAGE PLAN & CALCULATIONS**



N.T.S.

SCALE BAR

0 10 25m

ALL DIMENSIONS ARE IN METRES. DO NOT SCALE DRAWING

|                  |           |
|------------------|-----------|
| <u>PAGE SIZE</u> | 11" x 17" |
|------------------|-----------|

SCALE 1:500








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**SHADE**  
**GROUP** INC.

### LEGEND

- |   |                     |
|---|---------------------|
|  | PROPERTY LINE       |
|  | EASEMENT            |
|  | EX. CENTERLINE      |
|  | EX. EDGE OF ASPHALT |
|  | EX. EDGE OF GRAVEL  |
|  | EX. OVERHEAD WIRES  |
|  | EX. WELL            |

- 
- PRE-DEVELOPMENT  
OVERLAND FLOW ROUTE

|      |                              |             |
|------|------------------------------|-------------|
|      |                              |             |
|      |                              |             |
| 00   | 60% DESIGN ISSUED FOR REVIEW | DEC 2, 2022 |
| REV. | DESCRIPTION                  | DATE        |

|                 |                                       |
|-----------------|---------------------------------------|
| CLIENT          | WHELAN TRUCKING                       |
| PROJECT ADDRESS | 158 CARDEVCO ROAD<br>CARP, ON K0A 1L0 |
| PROJECT TITLE   | PROPOSED BUILDING ADDITION            |
| DRAWING TITLE   | PRE-DEVELOPMENT DRAINAGE<br>PLAN      |

## Stormwater Management Calculations

### Whelan Trucking Pre-Development

#### Pre-Development - Runoff Coefficient

|   | Area ID     |
|---|-------------|
|   | A1          |
| Total Area (m <sup>2</sup> )            | 5598        |
| Grass (m <sup>2</sup> )                 | 586         |
| Runoff Coefficient (C)                  | 0.20        |
| Gravel (m <sup>2</sup> )                | 4415        |
| Runoff Coefficient (C)                  | 0.60        |
| Asphalt/Roof (m <sup>2</sup> )          | 596         |
| Runoff Coefficient (C)                  | 0.90        |
| <b>Weighted Runoff Coefficient (C)*</b> | <b>0.59</b> |

*\*Pre-development conditions will be determined using the smaller of a runoff coefficient of 0.5 or the actual site runoff coefficient (City of Ottawa – Section 8.3.7.3)*

Therefor the pre-development conditions will be calculated using a runoff coefficient of 0.5.

#### Post-Development - Peak Flow

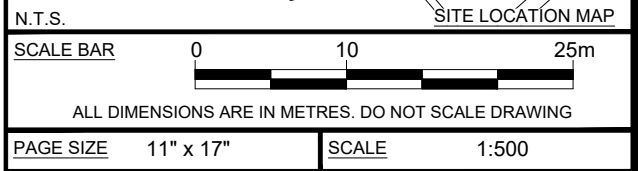
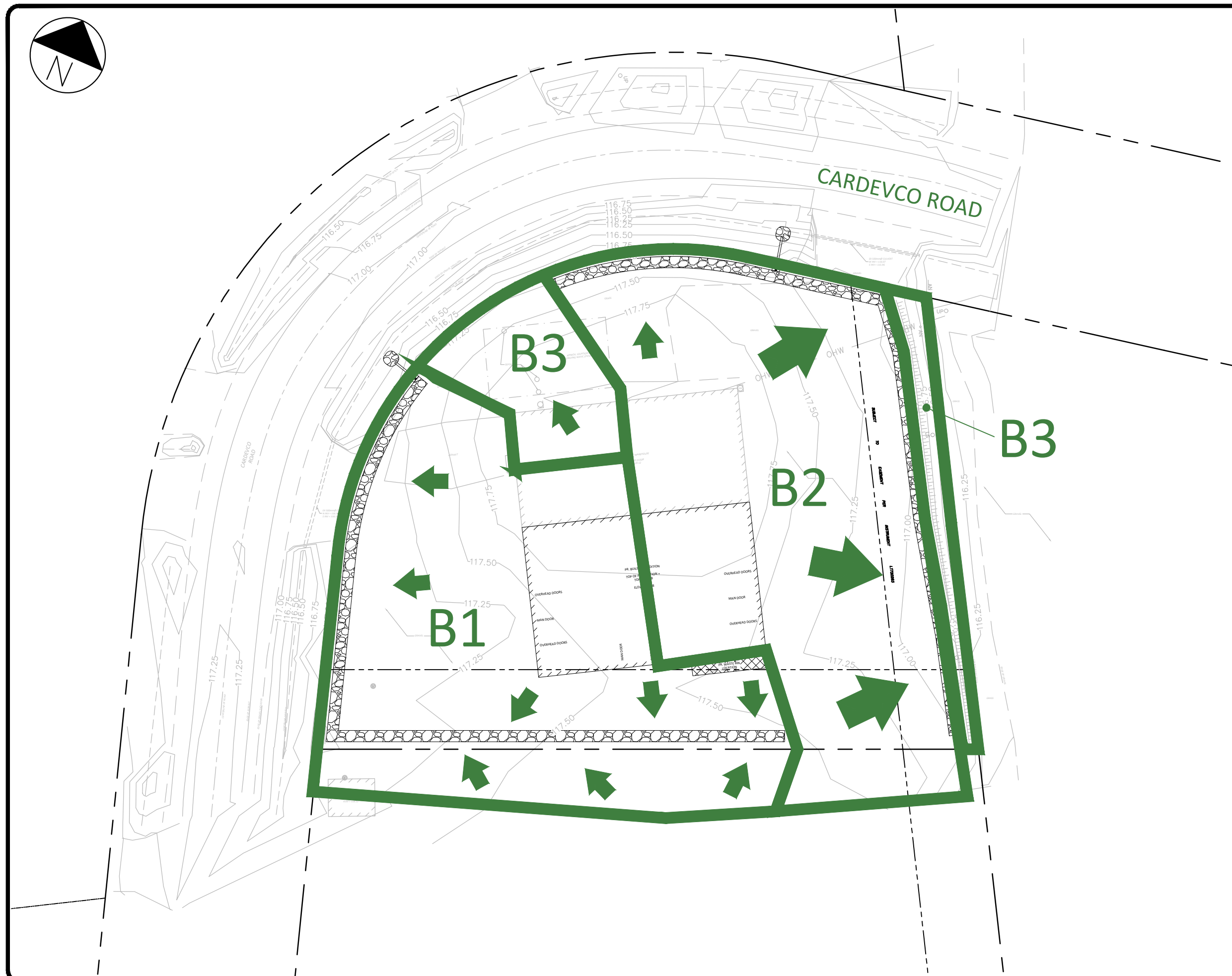
|                                 | Area ID |
|---------------------------------|---------|
|                                 | B1      |
| Weighted Runoff Coefficient (C) | 0.50    |
| Total Area (ha)                 | 0.56    |
| Time of Concentration (min)     | 10      |
| Intensity (mm/hr) - 2-Year      | 77      |
| Intensity (mm/hr) - 5-Year      | 104     |
| Intensity (mm/hr) - 10-Year     | 122     |
| Peak Flow (L/s) - 2-Year        | 60      |
| Peak Flow (L/s) - 5-Year        | 81      |
| Peak Flow (L/s) - 10-Year       | 95      |









**Max Allowable Outflow**

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## **APPENDIX C**

### **POST-DEVELOPMENT DRAINAGE PLAN & CALCULATIONS**



| <u>LEGEND</u>   |   |
|---|---|
|  | PROPERTY LINE                           |
|  | EASEMENT                                |
|  | EX. CENTERLINE                          |
|  | EX. EDGE OF ASPHALT                     |
|  | EX. EDGE OF GRAVEL                      |
|  | EX. OVERHEAD WIRES                      |
|  | EX. WELL                                |
|  | POST-DEVELOPMENT<br>OVERLAND FLOW ROUTE |

|      |                              |             |
|------|------------------------------|-------------|
|      |                              |             |
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|                 |                                       |
|-----------------|---------------------------------------|
|                 |                                       |
| CLIENT          | WHELAN TRUCKING                       |
| PROJECT ADDRESS | 158 CARDEVCO ROAD<br>CARP, ON K0A 1L0 |
| PROJECT TITLE   | PROPOSED BUILDING ADDITION            |
| DRAWING TITLE   | POST-DEVELOPMENT DRAINAGE<br>PLAN     |



## Stormwater Management Calculations

### Whelan Trucking

### Post-Development

#### Post-Development - Runoff Coefficient

|  | Area ID     |             |             |             |             |             |
|--|-------------|-------------|-------------|-------------|-------------|-------------|
|  | B1          |             | B2          |             | B3          |             |
|  | 2-10 Year   | 100-Year    | 2-10 Year   | 100-Year    | 2-10 Year   | 100-Year    |
| Total Area (m <sup>2</sup> )           | 2460        |             | 2542        |             | 596         |             |
| Grass (m <sup>2</sup> )                | 166         |             | 218         |             | 479         |             |
| Runoff Coefficient (C)                 | 0.20        | 0.25        | 0.20        | 0.25        | 0.20        | 0.25        |
| Gravel (m <sup>2</sup> )               | 1248        |             | 1600        |             | 0           |             |
| Runoff Coefficient (C)                 | 0.60        | 0.75        | 0.60        | 0.75        | 0.60        | 0.75        |
| Offsite Area (m <sup>2</sup> )         | 492         |             | 184         |             | 0           |             |
| Runoff Coefficient (C)                 | 0.50        | 0.63        | 0.50        | 0.63        | 0.50        | 0.63        |
| Asphalt/Roof (m <sup>2</sup> )         | 554         |             | 540         |             | 117         |             |
| Runoff Coefficient (C)                 | 0.90        | 1.00        | 0.90        | 1.00        | 0.90        | 1.00        |
| <b>Weighted Runoff Coefficient (C)</b> | <b>0.62</b> | <b>0.75</b> | <b>0.62</b> | <b>0.75</b> | <b>0.34</b> | <b>0.40</b> |

#### Post-Development - Peak Flow - Input Data

|                                 | Area ID   |          |           |          |           |          |
|---------------------------------|-----------|----------|-----------|----------|-----------|----------|
|                                 | B1        |          | B2        |          | B3        |          |
|                                 | 2-10 Year | 100-Year | 2-10 Year | 100-Year | 2-10 Year | 100-Year |
| Weighted Runoff Coefficient (C) | 0.62      | 0.75     | 0.62      | 0.75     | 0.34      | 0.40     |
| Total Area (ha)                 | 0.25      |          | 0.25      |          | 0.06      |          |
| Time of Concentration (min)     | 10        |          | 10        |          | 10        |          |
| Intensity (mm/hr) - 2-Year      | 77        |          | 77        |          | 77        |          |
| Intensity (mm/hr) - 5-Year      | 104       |          | 104       |          | 104       |          |
| Intensity (mm/hr) - 10-Year     | 122       |          | 122       |          | 122       |          |
| Intensity (mm/hr) - 100-Year    | 179       |          | 179       |          | 179       |          |

#### Post-Development - Peak Flow - Results

|                            | B1 | B2 | B3 |
|----------------------------|----|----|----|
| Peak Flow (L/s) - 2-Year   | 33 | 34 | 4  |
| Peak Flow (L/s) - 5-Year   | 44 | 46 | 6  |
| Peak Flow (L/s) - 10-Year  | 52 | 54 | 7  |
| Peak Flow (L/s) - 100-Year | 91 | 95 | 12 |

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## APPENDIX D

### QUANTITY CONTROL CALCULATIONS

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Quantity Control Summary**

**Pre-Development - Peak Flow**

|                           |    |                              |
|---------------------------|----|------------------------------|
| Peak Flow (L/s) - 2-Year  | 60 | <b>Max Allowable Outflow</b> |
| Peak Flow (L/s) - 5-Year  | 81 |                              |
| Peak Flow (L/s) - 10-Year | 95 |                              |

**Post-Development - Peak Flow**

**Uncontrollable Flow**

|                            |           |
|----------------------------|-----------|
|                            | <b>B3</b> |
| Peak Flow (L/s) - 2-Year   | 4         |
| Peak Flow (L/s) - 5-Year   | 6         |
| Peak Flow (L/s) - 10-Year  | 7         |
| Peak Flow (L/s) - 100-Year | 12        |

**Controllable Flow**  
**(Without Restriction)**

|                            |              |
|----------------------------|--------------|
|                            | <b>B1+B2</b> |
| Peak Flow (L/s) - 2-Year   | 66           |
| Peak Flow (L/s) - 5-Year   | 90           |
| Peak Flow (L/s) - 10-Year  | 106          |
| Peak Flow (L/s) - 100-Year | 186          |

**Controlled Flow**  
**(With Restriction)**

|                            | <b>B1 Contrld</b> | <b>B2 Contrld</b> | <b>B3 Unctrld</b> | <b>Total Outflow</b> | <b>Pre/Allowable</b> | <b>Δ *</b> |
|----------------------------|-------------------|-------------------|-------------------|----------------------|----------------------|------------|
| Peak Flow (L/s) - 2-Year   | 16                | 18                | 4                 | 38                   | 60                   | -22        |
| Peak Flow (L/s) - 5-Year   | 22                | 23                | 6                 | 51                   | 60                   | -8         |
| Peak Flow (L/s) - 10-Year  | 26                | 27                | 7                 | 60                   | 60                   | 0          |
| Peak Flow (L/s) - 100-Year | 41                | 42                | 12                | 95                   | 95                   | 0          |

\*A negative number suggests the post-development peak flow is less than pre-development or allowable levels for the applicable storm event.

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Storage Requirements - B1**

**2-Year Storm Event**

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 77                | 33         | 16                       | 16                           | 10   |
| 15       | 62                | 26         | 16                       | 10                           | 9  |
| 20       | 52                | 22         | 16                       | 6                            | 7  |
| 25       | 45                | 19         | 16                       | 3                            | 4  |
| 40       | 33                | 14         | 16                       | -2                           | -6   |
| 55       | 26                | 11         | 16                       | -5                           | -17  |
| 70       | 22                | 9          | 16                       | -7                           | -30  |
| 85       | 19                | 8          | 16                       | -8                           | -42  |
| 100      | 17                | 7          | 16                       | -9                           | -55  |
| 115      | 15                | 6          | 16                       | -10                          | -69  |

|  |    |
|--|----|
| <b>Peak Storage Requirement - 2-Year (m<sup>3</sup>)</b> | 10 |
|--|----|

**5-Year Storm Event**

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 104               | 44         | 22                       | 22                           | 13   |
| 15       | 84                | 35         | 22                       | 13                           | 12   |
| 20       | 70                | 30         | 22                       | 8                            | 9  |
| 25       | 61                | 26         | 22                       | 4                            | 6  |
| 40       | 44                | 19         | 22                       | -3                           | -8   |
| 55       | 35                | 15         | 22                       | -7                           | -24  |
| 70       | 29                | 12         | 22                       | -10                          | -40  |
| 85       | 25                | 11         | 22                       | -11                          | -57  |
| 100      | 22                | 10         | 22                       | -13                          | -75  |
| 115      | 20                | 9          | 22                       | -13                          | -93  |

|  |    |
|--|----|
| <b>Peak Storage Requirement - 5-Year (m<sup>3</sup>)</b> | 13 |
|--|----|

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Storage Requirements - B1**

**10-Year Storm Event**

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 122               | 52         | 26                       | 26                           | 16   |
| 15       | 98                | 42         | 26                       | 16                           | 14   |
| 20       | 82                | 35         | 26                       | 9                            | 11   |
| 25       | 71                | 30         | 26                       | 5                            | 7  |
| 40       | 52                | 22         | 26                       | -4                           | -9   |
| 55       | 41                | 17         | 26                       | -8                           | -27  |
| 70       | 34                | 15         | 26                       | -11                          | -47  |
| 85       | 30                | 13         | 26                       | -13                          | -67  |
| 100      | 26                | 11         | 26                       | -15                          | -88  |
| 115      | 23                | 10         | 26                       | -16                          | -109   |

|   |           |
|---|-----------|
| <b>Peak Storage Requirement - 10-Year (m<sup>3</sup>)</b> | <b>16</b> |
|---|-----------|

**100-Year Storm Event**

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 179               | 91         | 41                       | 50                           | 30   |
| 15       | 143               | 73         | 41                       | 32                           | 29   |
| 30       | 92                | 47         | 41                       | 6                            | 11   |
| 45       | 69                | 35         | 41                       | -6                           | -15  |
| 60       | 56                | 29         | 41                       | -12                          | -44  |
| 75       | 47                | 24         | 41                       | -17                          | -75  |
| 90       | 41                | 21         | 41                       | -20                          | -107   |
| 105      | 36                | 19         | 41                       | -22                          | -140   |
| 120      | 33                | 17         | 41                       | -24                          | -173   |
| 135      | 30                | 15         | 41                       | -25                          | -206   |

|  |           |
|--|-----------|
| <b>Peak Storage Requirement - 100-Year (m<sup>3</sup>)</b> | <b>30</b> |
|--|-----------|

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Stage-Storage-Discharge - B1**

**Storage**

|  |        |
|--|--------|
| Minimum Bottom of Trench Elevation (m) | 116.50 |
| Trench Width (m)                       | 1.5    |
| Trench Length (m)                      | 108    |
| Porosity                               | 0.40   |

| Elevation (m) | Trench Depth (m) | Trench Volume (m <sup>3</sup> ) | Storage Volume (m <sup>3</sup> ) |          |
|---------------|------------------|---------------------------------|----------------------------------|----------|
| 116.50        | 0.00             | 0                               | 0                                |          |
| 116.60        | 0.10             | 16                              | 6                                |          |
| 116.65        | 0.15             | 24                              | 10                               | 2-Year   |
| 116.70        | 0.20             | 32                              | 13                               | 5-Year   |
| 116.74        | 0.24             | 39                              | 16                               | 10-Year  |
| 116.97        | 0.47             | 76                              | 30                               | 100-Year |
| 117.10        | 0.60             | 97                              | 39                               |          |

**Discharge through an Orifice**

$$Q = cA(2gh)^{1/2} \text{ (m}^3\text{/s)}$$

|                                |        |
|--------------------------------|--------|
| Invert Elevation (m)           | 116.50 |
| Centroid Elevation (m)         | 116.59 |
| Orifice Size (m)               | 0.178  |
| Orifice Area (m <sup>2</sup> ) | 0.025  |
| C                              | 0.60   |

| Elevation (m) | Head (m) | Q (l/s) |          |
|---------------|----------|---------|----------|
| 116.50        | 0.00     | 0       |          |
| 116.60        | 0.01     | 7       |          |
| 116.65        | 0.06     | 16      | 2-Year   |
| 116.70        | 0.11     | 22      | 5-Year   |
| 116.74        | 0.15     | 26      | 10-Year  |
| 116.97        | 0.38     | 41      | 100-Year |
| 117.10        | 0.51     | 47      |          |

Stormwater Management Calculations  
Whelan Trucking  
Stage-Storage-Dischage - B1

Stage-Storage-Discharge

| Elevation (m) | Storage Volume (m <sup>3</sup> ) | Q (l/s) |          |
|---------------|----------------------------------|---------|----------|
| 116.50        | 0                                | 0       |          |
| 116.60        | 6                                | 7       |          |
| 116.65        | 10                               | 16      | 2-Year   |
| 116.70        | 13                               | 22      | 5-Year   |
| 116.74        | 16                               | 26      | 10-Year  |
| 116.97        | 30                               | 41      | 100-Year |
| 117.10        | 39                               | 47      |          |

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Storage Requirements - B2**

**2-Year Storm Event**

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 77                | 34         | 18                       | 16.1                         | 9.7  |
| 15       | 62                | 27         | 18                       | 9.5                          | 8.6  |
| 20       | 52                | 23         | 18                       | 5.3                          | 6.3  |
| 25       | 45                | 20         | 18                       | 2.2                          | 3.4  |
| 40       | 33                | 14         | 18                       | -3.2                         | -7.6   |
| 55       | 26                | 12         | 18                       | -6.1                         | -20.2  |
| 70       | 22                | 10         | 18                       | -8.0                         | -33.6  |
| 85       | 19                | 8          | 18                       | -9.3                         | -47.4  |
| 100      | 17                | 7          | 18                       | -10.3                        | -61.6  |
| 115      | 15                | 7          | 18                       | -11.0                        | -75.9  |

|  |           |
|--|-----------|
| <b>Peak Storage Requirement - 2-Year (m<sup>3</sup>)</b> | <b>10</b> |
|--|-----------|

**5-Year Storm Event**

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 104               | 46         | 23                       | 22.3                         | 13.4   |
| 15       | 84                | 37         | 23                       | 13.3                         | 11.9   |
| 20       | 70                | 31         | 23                       | 7.4                          | 8.9  |
| 25       | 61                | 27         | 23                       | 3.3                          | 4.9  |
| 40       | 44                | 19         | 23                       | -4.0                         | -9.7   |
| 55       | 35                | 15         | 23                       | -8.0                         | -26.5  |
| 70       | 29                | 13         | 23                       | -10.6                        | -44.4  |
| 85       | 25                | 11         | 23                       | -12.3                        | -62.8  |
| 100      | 22                | 10         | 23                       | -13.6                        | -81.7  |
| 115      | 20                | 9          | 23                       | -14.6                        | -100.9                                       |

|  |           |
|--|-----------|
| <b>Peak Storage Requirement - 5-Year (m<sup>3</sup>)</b> | <b>13</b> |
|--|-----------|



## Stormwater Management Calculations

### Whelan Trucking

### Storage Requirements - B2

#### 10-Year Storm Event

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 122               | 54         | 27                       | 26.4                         | 16   |
| 15       | 98                | 43         | 27                       | 15.7                         | 14   |
| 20       | 82                | 36         | 27                       | 8.8                          | 11   |
| 25       | 71                | 31         | 27                       | 4.0                          | 6  |
| 40       | 52                | 23         | 27                       | -4.7                         | -11  |
| 55       | 41                | 18         | 27                       | -9.3                         | -31  |
| 70       | 34                | 15         | 27                       | -12.3                        | -52  |
| 85       | 30                | 13         | 27                       | -14.3                        | -73  |
| 100      | 26                | 11         | 27                       | -15.9                        | -95  |
| 115      | 23                | 10         | 27                       | -17.0                        | -118   |

|  |    |
|--|----|
| Peak Storage Requirement - 10-Year (m <sup>3</sup> ) | 16 |
|--|----|

#### 100-Year Storm Event

| Tc (min) | Intensity (mm/hr) | Flow (L/s) | Controlled Outflow (L/s) | Peak Flow to be Stored (L/s) | Volume of Storage Required (m <sup>3</sup> ) |
|----------|-------------------|------------|--------------------------|------------------------------|--|
| 10       | 179               | 95         | 42                       | 52.4                         | 31.4   |
| 15       | 143               | 76         | 42                       | 33.4                         | 30.1   |
| 20       | 120               | 64         | 42                       | 21.3                         | 25.5   |
| 30       | 92                | 49         | 42                       | 6.4                          | 11.5   |
| 45       | 69                | 37         | 42                       | -5.7                         | -15.5  |
| 60       | 56                | 30         | 42                       | -12.7                        | -45.8  |
| 75       | 47                | 25         | 42                       | -17.3                        | -77.9  |
| 90       | 41                | 22         | 42                       | -20.6                        | -111.1                                       |
| 105      | 36                | 19         | 42                       | -23.0                        | -145.1                                       |
| 120      | 33                | 17         | 42                       | -24.9                        | -179.6                                       |

|   |    |
|---|----|
| Peak Storage Requirement - 100-Year (m <sup>3</sup> ) | 31 |
|---|----|

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Stage-Storage-Dischage - B2**

**Storage**

|                                       |        |
|---------------------------------------|--------|
| <b>Bottom of Trench Elevation (m)</b> | 116.35 |
| <b>Trench Width (m)</b>               | 1.5    |
| <b>Trench Length (m)</b>              | 104    |
| <b>Porosity</b>                       | 0.40   |

| <b>Elevation (m)</b> | <b>Trench Depth (m)</b> | <b>Trench Volume (m<sup>3</sup>)</b> | <b>Storage Volume (m<sup>3</sup>)</b> |          |
|----------------------|-------------------------|--------------------------------------|---------------------------------------|----------|
| 116.35               | 0.00                    | 0                                    | 0                                     |          |
| 116.51               | 0.16                    | 25                                   | 10                                    | 2-Year   |
| 116.57               | 0.22                    | 34                                   | 13                                    | 5-Year   |
| 116.61               | 0.26                    | 41                                   | 16                                    | 10-Year  |
| 116.65               | 0.30                    | 47                                   | 19                                    |          |
| 116.85               | 0.50                    | 78                                   | 31                                    | 100-Year |
| 116.95               | 0.60                    | 94                                   | 37                                    |          |

**Discharge through an Orifice**

$$Q = cA(2gh)^{1/2} \text{ (m}^3\text{/s)}$$

|                                     |        |
|-------------------------------------|--------|
| <b>Invert Elevation (m)</b>         | 116.35 |
| <b>Centroid Elevation (m)</b>       | 116.44 |
| <b>Orifice Size (m)</b>             | 0.178  |
| <b>Orifice Area (m<sup>2</sup>)</b> | 0.025  |
| <b>C</b>                            | 0.60   |

| <b>Elevation (m)</b> | <b>Head (m)</b> | <b>Q (l/s)</b> |          |
|----------------------|-----------------|----------------|----------|
| 116.35               | 0.00            | 0              |          |
| 116.51               | 0.07            | 18             | 2-Year   |
| 116.57               | 0.13            | 23             | 5-Year   |
| 116.61               | 0.17            | 27             | 10-Year  |
| 116.65               | 0.21            | 30             |          |
| 116.85               | 0.41            | 42             | 100-Year |
| 116.95               | 0.51            | 47             |          |

Stormwater Management Calculations  
Whelan Trucking  
Stage-Storage-Dischage - B2

Stage-Storage-Discharge

| Elevation (m) | Storage Volume (m <sup>3</sup> ) | Q (l/s) |          |
|---------------|----------------------------------|---------|----------|
| 116.35        | 0                                | 0       |          |
| 116.51        | 10                               | 18      | 2-Year   |
| 116.57        | 13                               | 23      | 5-Year   |
| 116.61        | 16                               | 27      | 10-Year  |
| 116.65        | 19                               | 30      |          |
| 116.85        | 31                               | 42      | 100-Year |
| 116.95        | 37                               | 47      |          |

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## APPENDIX E

### QUALITY CONTROL CALCULATIONS

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Quality Control - B1**

|                                   | <b>B1</b> |
|-----------------------------------|-----------|
| Total Area (m <sup>2</sup> )      | 2460      |
| Impervious Area (m <sup>2</sup> ) | 2294      |
| % Impervious                      | 93%       |

\*\*For quality purposes - gravel area has been included in the impervious calculation in an effort to be conservative

Table 3.2 Water Quality Storage Requirements based on Receiving Waters

| <b>Storage Volume (m<sup>3</sup>/ha) for Impervious Levels</b> |            |            |            |
|--|------------|------------|------------|
| <b>35%</b>   | <b>55%</b> | <b>70%</b> | <b>85%</b> |
| <b>Normal - 70% TSS</b>  |            |            |            |
| 20   | 20         | 25         | 30         |
| <b>Enhanced - 80% TSS</b>                                      |            |            |            |
| 25   | 30         | 35         | 40         |

|   |                         |               |
|---|-------------------------|---------------|
| <b>Water Quality Storage Requirements</b> | 42.7 m <sup>3</sup> /ha | *Extropolated |
| <b>Area</b>                               | 0.25 ha                 |               |
| <b>Storage Requirements</b>               | 10.50 m <sup>3</sup>    |               |

**Storage Provided**

$$V = LWD \times n \times f$$

MECP Equation 4.17

|     |                   |                               |
|-----|-------------------|-------------------------------|
| V = | m <sup>3</sup>    | Volume of water in trench     |
| L = | 108 m             | Length of trench              |
| W = | 1.5 m             | Width of trench               |
| D = | 0.60 m            | Depth of water in trench      |
| n = | 0.4               | Void Space in Trench          |
| f = | 0.5               | Longevity Factor (Table 4.12) |
| V = | 19 m <sup>3</sup> |                               |

As the volume of storage provided exceeds the volume of storage required, the proposed design is expected to provided the required enhanced level of quality control.

**Stormwater Management Calculations**  
**Whelan Trucking**  
**Quality Control - B2**

|                                   | B2   |
|-----------------------------------|------|
| Total Area (m <sup>2</sup> )      | 2542 |
| Impervious Area (m <sup>2</sup> ) | 2324 |
| % Impervious                      | 91%  |

\*\*For quality purposes - gravel area has been included in the impervious calculation in an effort to be conservative

Table 3.2 Water Quality Storage Requirements based on Receiving Waters

| Storage Volume (m <sup>3</sup> /ha) for Impervious Levels |     |     |     |
|---|-----|-----|-----|
| 35%   | 55% | 70% | 85% |
| Normal - 70% TSS  |     |     |     |
| 20  | 20  | 25  | 30  |
| Enhanced - 80% TSS  |     |     |     |
| 25  | 30  | 35  | 40  |

|   |                       |               |
|---|-----------------------|---------------|
| <b>Water Quality Storage Requirements</b> | 42 m <sup>3</sup> /ha | *Extropolated |
| <b>Area</b>                               | 0.25 ha               |               |
| <b>Storage Requirements</b>               | 10.68 m <sup>3</sup>  |               |

**Storage Provided**

$$V = LWD \times n \times f$$

MECP Equation 4.17

|     |                   |                               |
|-----|-------------------|-------------------------------|
| V = | m <sup>3</sup>    | Volume of water in trench     |
| L = | 104 m             | Length of trench              |
| W = | 1.5 m             | Width of trench               |
| D = | 0.60 m            | Depth of water in trench      |
| n = | 0.4               | Void Space in Trench          |
| f = | 0.5               | Longevity Factor (Table 4.12) |
| V = | 19 m <sup>3</sup> |                               |

As the volume of storage provided exceeds the volume of storage required, the proposed design is expected to provided the required enhanced level of quality control.

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## **APPENDIX F**

### **DOWNSTREAM DITCH CAPACITY REVIEW**

## Downstream Ditch Capacity Review

### Whelan Trucking

#### Runoff Coefficient

|   |             |                           |
|---|-------------|---------------------------|
| Total Area (m <sup>2</sup> )            | 22092       |                           |
| Industrial Lots (m <sup>2</sup> )       | 17092       |                           |
| Runoff Coefficient (C)                  | 0.50        |                           |
| Road (m <sup>2</sup> )                  | 2000        | *500m x 4m wide           |
| Runoff Coefficient (C)                  | 0.90        |                           |
| Gravel Shoulder (m <sup>2</sup> )       | 750         | *500m x 1.5m wide         |
| Runoff Coefficient (C)                  | 0.60        |                           |
| Grass Lined Ditch (m <sup>2</sup> )     | 2250        | *500m x (10m - 4m - 1.5m) |
| Runoff Coefficient (C)                  | 0.20        |                           |
| <b>Weighted Runoff Coefficient (C)*</b> | <b>0.51</b> |                           |

#### Time of Concentration

|                            |    |     |                   |
|----------------------------|----|-----|-------------------|
| Overland Flow Length       | 57 | m   |                   |
| Overland Slope             | 2  | %   | (Assumed)         |
| Time of Concentration (Tc) | 12 | min | (Airport Formula) |

|                            |      |     |           |
|----------------------------|------|-----|-----------|
| Ditch Flow Length          | 500  | m   |           |
| Ditch Slope                | 0.5  | %   | (Assumed) |
| Velocity                   | 0.35 | m/s |           |
| Time of Concentration (Tc) | 24   | min |           |

|                      |           |            |  |
|----------------------|-----------|------------|--|
| <b>Cumulative Tc</b> | <b>36</b> | <b>min</b> |  |
|----------------------|-----------|------------|--|

#### Peak Flow

|                                 |            |   |
|---------------------------------|------------|---|
| Weighted Runoff Coefficient (C) | 0.51       |   |
| Total Area (ha)                 | 2.21       |   |
| Time of Concentration (min)     | 36         |   |
| Intensity (mm/hr) - 100-Year    | 82         |   |
| Peak Flow (L/s) - 100-Year      | <b>350</b> | *Includes restricted runoff rate for 158 Cardevco |



## Downstream Ditch Capacity Review Whelan Trucking

### Ditch Capacity - Front of 164 Cardevco Road

|                         |        |   |                                |
|-------------------------|--------|---|--------------------------------|
| Ditch Invert =          | 116.06 | m |                                |
| Edge of Shoulder Elev = | 116.82 | m |                                |
| Top of Slope Elev =     | 116.35 | m | *backslope at PL               |
| Max available ponding = | 0.29   | m | *Per backslope elevation at PL |
| Fore Slope =            | 21     | % |                                |
| Back Slope =            | 6      | % | *Calculated to PL              |

|                  |        |                |
|------------------|--------|----------------|
| Roughness Coeff  | 0.03   |                |
| Channel Slope    | 0.52   | %              |
| Area             | 0.92   | m <sup>2</sup> |
| Wetted Perimeter | 6.41   | m              |
| R                | 0.14   | m              |
| Q                | 610.67 | L/s            |

As the maximum available capacity of the ditch in front of 164 Cardevco Road is greater than the anticipated 100-year peak flow, capacity of the immediate downstream system is not anticipated to be a concern

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## **APPENDIX G**

SITE PLAN

(PREPARED BY OTHERS)



T.B.D.

[illegible]

1 SITE PLAN  
AO SCALE: 1 : 250

|     |                                |          |
|-----|--------------------------------|----------|
|     |                                |          |
|     |                                |          |
|     |                                |          |
|     |                                |          |
|     |                                |          |
| 2   | ISSUED TO ARCHITECT FOR REVIEW | 11/12/21 |
| 1   | ISSUED FOR CLIENT REVIEW       | 09/30/21 |
| NO. | ITEM                           | DATE     |

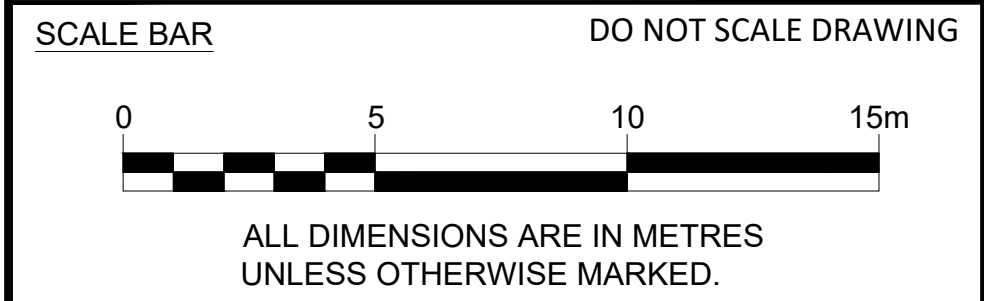
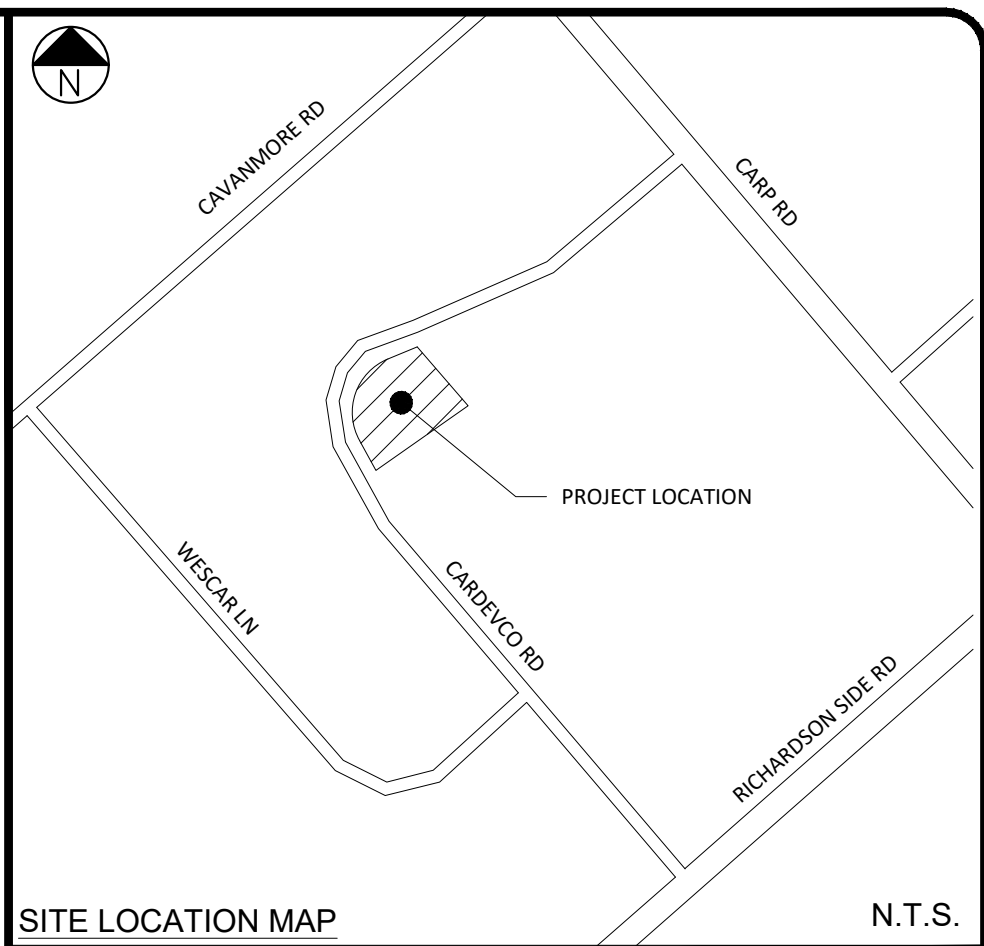
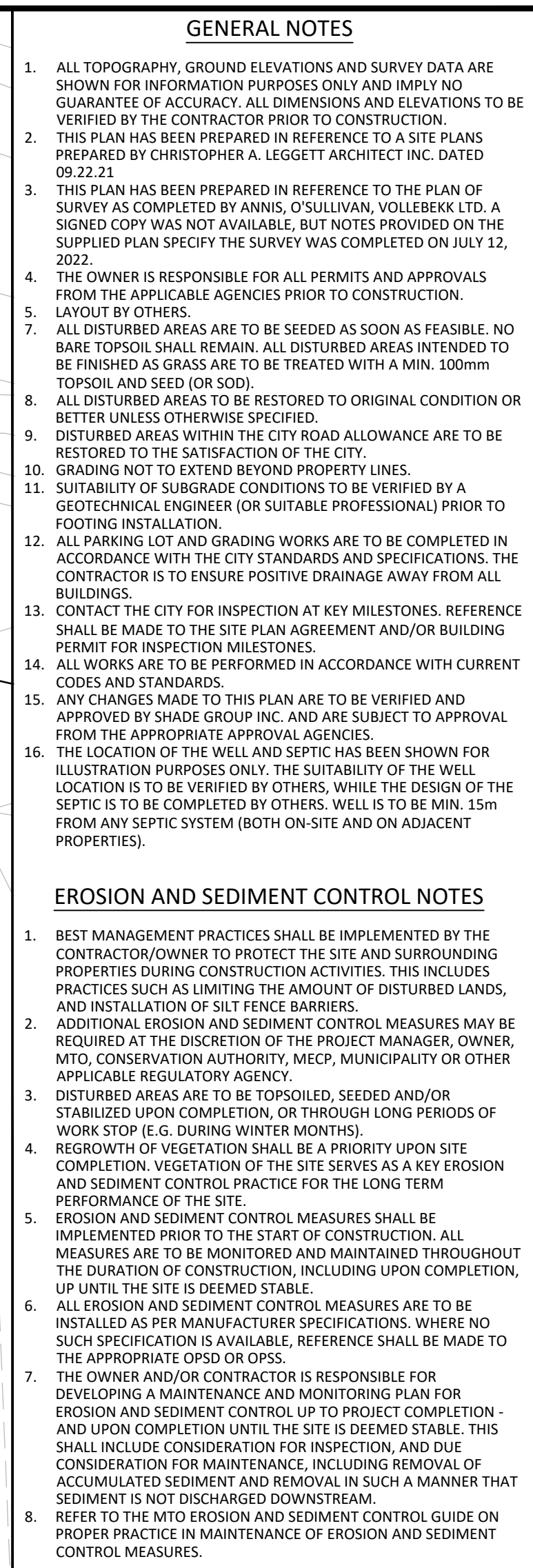
|             |           |                            |
|-------------|-----------|----------------------------|
| SCALE       | AS NOTED  | SHEET NO.<br><br><b>A0</b> |
| DRAWN BY    | SC        |                            |
| DATE        | 09.22.21  |                            |
| CHECKED BY  | CL        |                            |
| APPROVED BY | CL        |                            |
| PROJECT NO. | DH-221-32 |                            |

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## **APPENDIX H**

### **ENGINEERING DESIGN DRAWINGS**





|                  |           |              |       |
|------------------|-----------|--------------|-------|
| <u>PAGE SIZE</u> | 24" x 36" | <u>SCALE</u> | 1:150 |
|------------------|-----------|--------------|-------|

SHADE GROUP INC.  
PO BOX 1716  
ALMONTE, ON  
K0A 1A0

**SHADE**  
**GROUP** INC.

SITE BENCHMARK MAG NAIL AND WASHER IN UTILITY POLE ON  
NORTH SIDE OF CARDEVCO ROAD, DIRECTLY EAST  
OF ENTRANCE TO HARRIS REBAR.  
ELEVATION=117.72

**LEGEND**  
(IF APPLICABLE)

PROPERTY BOUNDARY  
EASEMENT  
EX. ROAD CENTRE LINE  
EX. EDGE OF ASPHALT  
EX. EDGE OF SHOULDER  
EX. DITCH  
EX. OVERHEAD UTILITIES  
EX. CONTOUR AND ELEVATION  
EX. BUILDING  
EX. SPOT ELEVATION  
EX. DRAINAGE DIRECTION & SLOPE  
EX. UTILITY POLE  
PR. BUILDING  
PR. DESIGN ELEVATION  
PR. DRAINAGE DIRECTION & SLOPE  
MATCH EXISTING SPOT ELEVATION  
LOT CORNER GRADES  
PR. STORMWATER TRENCH  
PR. OUTLET CONTROL STRUCTURE  
EXISTING  
PROPOSED

|               |   |             |
|---------------|---|-------------|
|               |   |             |
|               |   |             |
|               |   |             |
| 00            | 60% DESIGN ISSUED FOR REVIEW<br>AND COMMENT | DEC 2, 2022 |
| <b>REV. #</b> | <b>REVISION DESCRIPTION</b>                 | <b>DATE</b> |

STAMP

NOT FOR CONSTRUCTION

|               |  |
|---------------|--|
| PROJECT TITLE | WHELAN TRUCKING -<br>BUILDING ADDITION       |
| DRAWING TITLE | SITE SERVICING, GRADING<br>AND DRAINAGE PLAN |
| DRAWING NO.   | 1 OF 1                                       |