# Evolution

## Stormwater Management Report

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**PREPARED FOR:** Evolution Land

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# 1.0 Introduction

This report has been prepared by ISL Engineering and Land Services Ltd. (ISL Engineering) on behalf of the landowner, to provide a comprehensive understanding of the stormwater management requirements and considerations for the proposed development. Evolution Lands Claresholm (the subject property / proposed new development) is located south of 39 Avenue W and West of Highway 2 in Claresholm, Alberta. Legally described as part of SE ¼ Section 23-12-27-4. It covers roughly 54 ha (133 ac)

The objective of this SWMR is to detail stormwater management criteria for the total site area (constructed in multiple phases) based on compliance with the Town of Claresholm Infrastructure Master Plan (2021). This high-level preliminary SWMR will act as the governing master drainage plan for the entire site during the pre-detailed design phase. This document outlines stormwater design criteria for the entire development ensuring all phases are in line with the overall master planning.

The stormwater management criteria for the site are based on adherence to the guidelines set forth in the Claresholm Infrastructure Master Plan (2021) and the following general requirements:

- Control preliminary site release rates to 2.5 L/s/ha for all lands within Town of Claresholm. For the proposed development, the preliminary release rate is calculated as 135.1 L/s
- Maintain an approximate unit storage of 800$m^3$/ha, and for the proposed development the preliminary storage requirement is an estimated 43,200 $m^3$
- Follow Best Management Practices.
- Minimize the transference of drainage issues from one location to another.
- Not burden downstream properties with increased flow rates resulting from development of the site.
- Ensure that the site does not restrict or redirect upstream runoff that would have otherwise naturally flowed through the site.

In addition to the Towns standards, stormwater design shall be based on the most recent editions of:

- Alberta Environment Standards & Guidelines for Municipal Waterworks, Wastewater & Storm Drainage Systems.
- Alberta Environment Stormwater Management Guidelines for the Province of Alberta.

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# 2.0 Site Description and Design Criteria

## 2.1 Study Area

The development site is a multi-phase development consisting of 12.85 ha. of commercial, 18.73 ha. of single family residential, 5.39 ha. of open space, 3.24 ha. of medium density multi-family, 1.10 ha. of townhouses, and includes 0.92 ha. for a private facility. Figure 2.1 shows the overall study area boundary and proposed site layout. The existing site has no stormwater management for runoff which currently discharges uncontrolled north-to-south across the property towards identified trap lows at the southeast of the property.

As part of the Town of Claresholm Infrastructure Master Plan (2021), Associated Engineering has identified a future storm system upgrade slated to run through the proposed development referred to as the “East Basin Bypass”. This forthcoming project is set to extend westward along the south side of 39 Ave W and is planned to divert southward along the shared property line, cutting through the golf course and the site. During the assessment of the existing site conditions, it became evident that the current ditch's path continues westward along 39 Ave W, extending beyond the shared property line and the proposed parcel. It then crosses southward over 39 Ave W through a culvert, channeling the flow into the golf course, ultimately leading to the Frog Creek Wetlands. The proposed project described as the “East Basin Bypass” and the current existing conditions of the drainage path are shown below in figures 1 and 2. As a result of the current conditions of the proposed East Basin Bypass and the expected feasibility of such a project, ISL recommends that the current drainage path remains in place through the completion of the development.

Drainage for this development consists of a dual drainage concept made up of a major and minor system. The minor system is comprised of an underground storm network (sewers, catch basins, and manholes) which collects overland flows from the major system (curb and gutter, lanes, walkways, swales, etc.). The major system also includes a stormwater management facility (SWMF) to manage peak runoff flows to the Frog Creek Drain. This SWMF is designed to provide controlled peak discharge rates, evaporation to reduce runoff volumes, and water quality treatment. Peak release rates for the SWMF outlets were ultimately stipulated by the Town of Claresholm Servicing Standards.

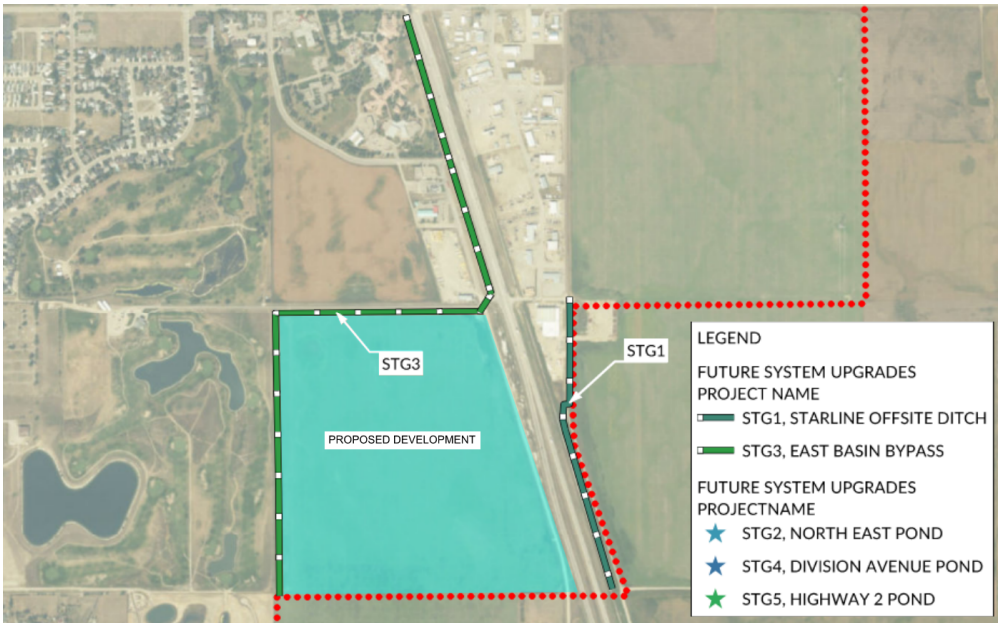


Figure 2.1: Proposed East Basin Bypass (Town of Claresholm Infrastructure Master Plan 2021)

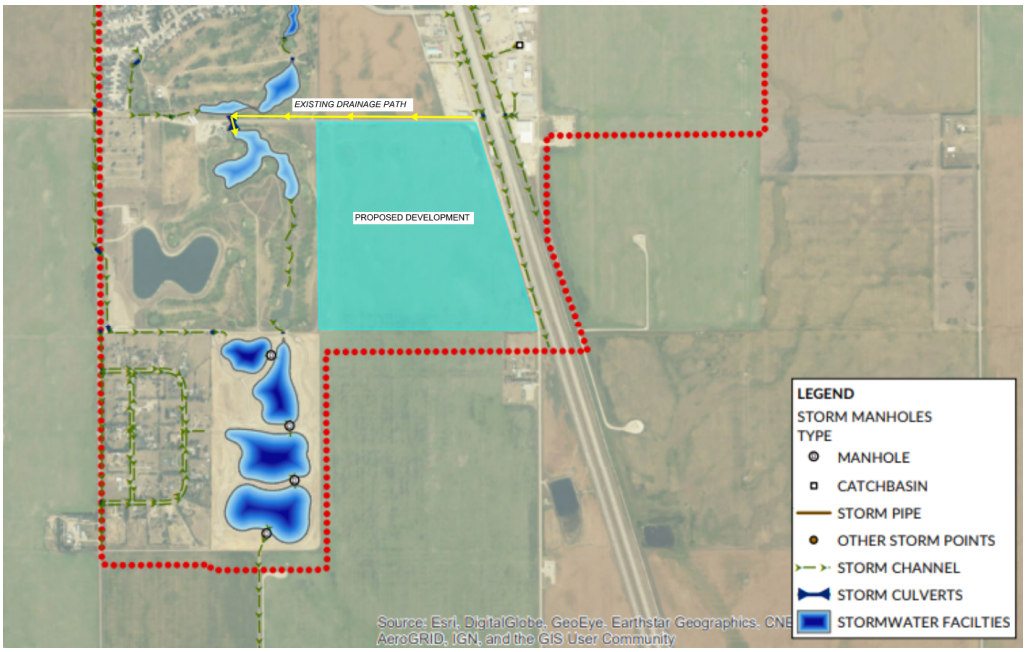


Figure 2.2: Existing Drainage Path Along North Side of 39 Ave. W

## 2.2 Design Objectives

The design objectives for this SWMR are generally governed by the following design manuals, guidelines, and industry bulletins:

- Town of Claresholm Infrastructure Master Plan (Associated Engineering, 2021).
- Stormwater Management and Design Manual (The City of Calgary Water Resources, 2011).
- Stormwater Management Guidelines for the Province of Alberta (AEP, 1999).

Specific design objectives for this site are as follows:

- The Minor (underground) portion of the storm system is to be designed based on a UARR 90 L/s/ha
- Major system, storm ponds, and overland flow are to be designed to safely handle a 1 in 100-year event without causing damage to private property or significant erosion damage.
- Site volume discharge is to reduce through onsite LID measures and evaporation from the SWMF.
- Trap low ponding depths are not to exceed 0.3 m.
- Flow rates are to be designed based on a defined allowable release rate of 2.5 L/s/ha
- Overland flow depths and velocities to meet AEP Depth vs. Velocity Criteria (Table 2.1).
- Provide a minimum 85% removal of Total Suspended Solid (TSS) for particle sizes greater than (or equal) to 75 µm for stormwater runoff leaving the site.

Table 2.1: Permissible Depth and Velocities of Overland Flow

| Water Velocity (m/s) | Permissible Depth (m) |
|---|---|
| 0.5 | 0.80 |
| 1.0 | 0.32 |
| 2.0 | 0.21 |
| 3.0 | 0.09 |

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# 3.0 Analysis and Methodology

## 3.1 Design Storm

Single event modelling is required for evaluating SWMF for caparison to the continuous simulation modeling with the more conservative of the two results governing the volumetric sizing. This method was utilized in the preliminary sizing of the stormwater management facility with regards to the planning and pond footprint. The following design storm is used for analysis of the proposed stormwater infrastructure:

1:100 year – 24-hour Chicago distribution design storm generated through PCSWMM design storm creator tool using IDF parameters for The City of Lethbridge (City of Lethbridge Engineering Standards 2021). The storm is used to evaluate required storage volumes for the proposed SWMF and trap lows as well as minor system sizing, due to proximity to storm ponds. By utilizing the Town of Claresholm's minimum design standard of a 1:100 year storm, a conservative result is produced for the stormwater management facility in the preliminary stage of planning. Once the detailed design phase of the development begins, a more thorough approach will be undertaken for the design and engineering of the stormwater management facilities including the use of computer modelling and water balance calculations.

### 3.1.1 Catchment Areas

The general catchment area information described in this section applies to all computer model simulations considered in this SWMR. As part of the Design Storm method as described in this section, a combined runoff coefficient is required for the analysis of surface runoff contributing to the SWMF storage volume. This is computed based on the proposed land-use designation for areas within the development as shown in figure 2.1, and uses the recommended minimum runoff coefficients denoted to each type of land use as outlined in the Town of Claresholm Servicing Standards (2017). A breakdown of the land-use areas and their corresponding runoff coefficients is included blow in table 3.1. The final weighted runoff coefficient for the catchment area is calculated by dividing the sum of the A*C column by the total area of the catchment – for the proposed development, a weighted runoff coefficient was calculated to be 0.691 for use in the design storm model.

Table 3.1: Combined Runoff Coefficient

| Land Use | Area (ha.) | Runoff Coefficient (100 yr) | A * C |
|---|---|---|---|
| Single Family | 21.04 | 0.6 | 12.624 |
| Multi Family | 3.02 | 0.8 | 2.416 |
| Commercial | 12.85 | 0.8 | 10.280 |
| Open Space | 5.59 | 0.3 | 1.677 |
| Asphalt | 9.09 | 0.95 | 8.636 |
| **SUM** | 51.59 | | 35.633 |

All other catchment parameters are provided in Appendix B, including City of Lethbridge Chicago Design Storm and full catchment calculation details.

## 3.2 Storage

A single stormwater management facility (wet ponds) is designed to control runoff volumes and peak rates to the values stipulated in Section 2.2. As this is strictly a high-level volume and footprint analysis, the following characteristics of the SWMF are based on an arbitrary datum elevation of 100 at normal water level (or dry pond bottom). Storm Pond characteristics are detailed in the Table 3.3 to Table 3.6.

Table 3.2: Common Characteristics of SWMF

| Parameter | Unit | Value |
|---|---|---|
| Bottom Elevation | m | 100 |
| Normal Water Level (NWL) | m | 100 |
| High Water Level (HWL) | m | 102.5 |
| Invert Elevation of Orifice in Control Structure | m | 100 |
| Invert Elevation of Overflow Weir in Control Structure | m | 100 |
| SWMF Depth Below NWL | m | 2.0 |
| Active SWMF Depth (NWL to HWL) | m | 2.5 |
| Freeboard Depth | m | 0.3 |

Table 3.3: SWMF Storage Volume and Area Relationship

| Water Depth Above NWL | Elevation | Storage Volume ($m^3$) | HWL Area ($m^2$) |
|---|---|---|---|
| 0 | 100 | 0 | - |
| 0.5 | 100.5 | 5,739.086 | 11,956.15 |
| 1 | 101 | 11,962.690 | 12,944.82 |
| 1.5 | 101.5 | 18,690.448 | 13,972.76 |
| 2 | 102 | 25,941.995 | 15,039.97 |
| 2.5 | 102.5 | 33,736.965 | 16,146.45 |
| 3 | 103 | 42,094.994 | **17,292.21** |

# 4.0 Results

## 4.1 Stormwater Management Facilities Volumetric Sizing

Model results were analyzed to quantify SWMF volumes to contain stormwater runoff on site and is summarized in the following section. Table 4.7 summarizes the volumetric sizing results for the SWMFs. As discussed in earlier sections the most conservative result of the various simulations governs the volumetric sizing. For the purposes of this high-level investigation, certain parameters were required to be estimated, such as bank sloping at 5:1. Additionally, calculations for the facility can be selected to include a 5m pathway around the SWMF; however, for this high-level report, only the HWL volumes and footprint are necessary to gain a general understanding of SWMF layout and area. For the proposed SWMF the volumetric storage and estimated footprint are summarized below in table 4.1.

Table 4.1: Design Storm Storage Requirements and HWL

| Storm | Required Storage ($m^3$) | HWL |
|---|---|---|
| 2 Year-24hr | 14245.53 | 101.100 |
| 5 Year-24hr | 19553.13 | 101.500 |
| 10 Year-24hr | 23054.25 | 101.800 |
| 25 Year-24hr | 27673.06 | 102.100 |
| 50 Year-24hr | 31046.26 | 102.300 |
| 100 Year-24hr | 42942.16 | 103.000 |

In the analysis of the pond storage and footprint, the storage has also been calculated relative to a conical shape. The conical shape consists of a pond bottom circular area and a larger area to denote the high-water level, with an additional allowance included in the interest of conservative design of a 0.3m freeboard with a side slope of 5:1, of which increases the footprint of the SWMF. Additionally, the area of the pond if it were to include a 5m pathway around the perimeter has been calculated as a potential option for planning purposes.

Table 4.2: SWMF Calculated Area Footprint

| Area Name | Area ($m^2$) | Radius (m) |
|---|---|---|
| A1 (BTM of NWL)= | **11006.74** | 59.19084 |
| A2 (HWL)= | **17292.21** | 74.19084 |
| A3 (Freeboard)= | **17998.51** | 75.69084 |
| A4 (5m pathway)= | **20454.94** | 80.69084 |

## 5.0 Summary of Findings, Conclusions, and Recommendations

This stormwater analysis is based on compliance with the Town of Claresholm Infrastructure Master Plan (2021) and Town of Claresholm Servicing Standards (2018). The scope and accuracy of the design and analysis for the study area is limited to the conditions considered herein. The main findings and recommendations from this analysis include:

- Control preliminary site release rates to 2.5 L/s/ha for all lands within Town of Claresholm. For the proposed development, the preliminary release rate is calculated as 135.1 L/s
- To maintain an approximate unit storage of 800$m^3$/ha, and for the proposed development the preliminary storage requirement is an estimated 43,200 $m^3$.
- Calculated storage volume from City of Lethbridge design storm affirms above estimated storage requirement at 4,300 $m^3$
- SWMF for the site is estimated to be adequate to contain runoff up to the 1:100-year storm event.
- Follow Best Management Practices.
- Minimize the transference of drainage issues from one location to another.
- Not burden downstream properties with increased flow rates resulting from development of the site.
- Ensure that the site does not restrict or redirect upstream runoff that would have otherwise naturally flowed through the site.

## 6.0 References

1. Town of Claresholm Infrastructure Master Plan (Associated Engineering, 2021)

2. City of Lethbridge Engineering Standards (City of Lethbridge, 2021)

2. Stormwater Management Guidelines for the Province of Alberta (Alberta Environmental Protection, 1999)

3. Stormwater Management and Design Manual (City of Calgary, 2011)