Attachment-4 Summary of the Comprehensive Environmental Impact Study

1. Introduction

The Comprehensive Environmental Impact Study (CEIS) characterizes the existing conditions in the CMSP area (Phase 1 / 2) and provides an Impact Assessment and Management Plan (Phase 3) for the Preferred Community Structure. Four main environmental areas were studied and are summarized below:

2. Hydrology (Surface Water)

Phase 1 / 2 Characterization:

The purpose of assessing the surface water systems for urbanizing subwatersheds was to provide a better understanding of the factors which influence the amount and movement of water in the system, both under existing land use and proposed future land use conditions. Existing conditions were characterized by integrating background information, mapping and the observed flow and rainfall data from the 2016 to 2019 monitoring periods. By developing representative numerical models which reasonably predict seasonal and storm-based runoff response, the impacts of proposed future urbanization could be better quantified, thereby supporting the identification of appropriate strategies as part of integrated management plans. Through this process, a hydrologic model was developed (PCSWMM) that determines the peak flows, runoff volumes, infiltration and evaporation that occurs within the existing drainage system in the Clair-Maltby Secondary Plan area.

The Clair-Maltby Secondary Plan area is located at the headwaters of the Hanlon Creek and Mill Creek and is characterized by a significant number of the depressional features and a general lack of overland drainage routes and watercourses. Surface runoff is predominantly infiltrated or evaporated. In the broader secondary study area, each creek system annually infiltrates and evaporates 93 per cent to 98 per cent of the total precipitation. The remaining surface water (not infiltrated or evaporated) ends up as discharge/ runoff from the system, which for Hanlon Creek is 0.4 per cent and Mill Creek is 9 per cent. Each creek system exhibits high annual infiltration, due to the soil properties and the depressional features and greenways.

Phase 3 Implementation & Impact:

The hydrologic model (PCSWMM) was used to assess the hydrologic impacts from the updated Preferred Community Structure and from the Final Preferred Community Structure. Typical impacts from urbanization include additional runoff, less infiltration and higher peak flows. As noted, the Clair-Maltby Secondary Plan area is characterized by a significant number of depressional features, with certain features providing over 300 mm capture of runoff, which is greater than the Regional Storm (Hurricane Hazel) at 285 mm of precipitation.

To mimic the existing depressional features, a distributed approach was adopted by using low impact development (LID) best management practices (BMPs) capturing 20 mm runoff (reduced from 27 mm in the first impact assessment, to determine

recharge sensitivity to capture amount and to improve feasibility and reduce cost of implementing LID BMPs) and designated stormwater capture areas (SWCAs), for capturing and infiltrating the balance of the drainage not captured by the LID BMPs at source.

Hydrologic modelling comparing existing and post-development conditions indicated that peak flows (external to the Secondary Plan area) within Hanlon Creek and Mill Creek and along Maltby Road will be maintained at pre-development levels. In addition, the amount of water available for infiltration will largely match existing drainage conditions on a subwatershed basis. Furthermore, the supplemental analyses completed over the fall of 2020, provided an approach to maintain wetland water balances for the three largest ponds / wetland areas in the primary study area (i.e., Neumanns Pond, Halls Pond and Halligan's Pond) under post-development conditions. Based on the hydrologic modelling, stormwater management has been summarized as the following:

1. To provide stormwater management for the Clair-Maltby Secondary Plan area, it is recommended that distributed low impact development best management measures capturing 20 mm runoff be provided within both public and private lands, with the remaining drainage being conveyed to stormwater capture areas, sized to capture the Regional Storm. Stormwater capture areas are to have an overflow to existing depression areas, should the stormwater capture area storage capacity be fully used.
2. For small development areas (typically less than 5 ha), unless draining to Maltby Road, 20 mm capture will be required to provide water quality treatment
3. For small development areas (typically less than 5 ha), draining to Maltby Road, Regional Storm (285 mm) capture and control will be required, to mitigate impacts to properties located south of Maltby Road. Water quality controls will be required as per all of the development within Clair-Maltby.
4. For the Community Park, located adjacent to Halls Pond, distributed LID BMPs are to capture the 100 year storm event. The distributed LID BMPs are to replace a 100 year stormwater capture area, which would have been required for the park draining to Halls Pond. The rationale for using LID BMPs versus a SWCA is to prevent groundwater mounding and increases in the average Halls Pond water level.
5. The SWCA's for Subcatchments SW-42 and SW-61 should be located as per the recommendations of the Halls Pond Assessment (ref. Appendix H).
6. Infiltrative low impact development best management measures that receive runoff from paved surfaces will require pretreatment to protect groundwater quality.
7. A treatment train approach should be used to protect the stormwater capture areas' function of infiltration and to protect groundwater quality.
8. Surface and groundwater quality monitoring as discussed in this report, will be required to protect existing surface water and groundwater resources.
9. The City of Guelph should consider salt reduction and management measures recommended in the MESP and herein.

10. Phasing of stormwater management servicing as per the MESP recommendations.

3. Hydrogeology

Phase 1 / 2 Characterization:

A background review of existing hydrogeological data and documentation, including regional and local scale information was completed to provide a preliminary understanding of the local and regional hydrogeological setting. The conceptual understanding derived from existing information was used to inform the groundwater field programs and modelling for simulating existing and future conditions.

A groundwater field program was completed to support refinements to the understanding of groundwater function within the Secondary Plan area and the primary study area. This understanding under existing conditions provided support for the design of future land use plans to minimize potential impacts to the groundwater system function. In Phase 2 the conceptual model of existing groundwater flow system was represented in an integrated surface water and groundwater flow model (i.e., MIKESHE).

The MIKESHE model simulates all the relevant processes to represent existing and future conditions including rainfall, snow melt, runoff, infiltration, evapotranspiration, flow above and below the water table and ponding of water.

Based on the conceptual model and calibrated integrated model findings (i.e. water table, shallow and deep bedrock amounts) within in the Secondary Plan area, regional groundwater flow supports the following groundwater functions:

- Groundwater discharge to wetlands and headwaters in Mill Creek outside the Secondary Plan area.
- Groundwater discharge to wetland north of Halls Pond within the Secondary Plan area.
- Groundwater flow and discharge to Hanlon, Torrance, Mill Creeks
- Recharge to the water table, shallow (Guelph Formation) and deep (Gasport Formation) bedrock aquifers

The permeable nature of the surficial sediments, as well as the interconnected permeable properties throughout the overburden allows for significant infiltration, subsequent recharge to the water table (overburden aquifer) and shallow and deep bedrock aquifers. Groundwater flow tends to radiate out from the Secondary Plan area to contribute groundwater flow to the Mill Creek and Hanlon Creek subwatersheds.

Closed depressional features are shown to provide enhanced infiltration and recharge.

Water budget analyses of Neumann's Pond, Halls Pond and Halligan's Pond indicate these features are predominantly maintained by direct precipitation and minor overland flow contribution which reflects the lower groundwater levels near these wetland features. Groundwater discharge appears to be derived locally and during spring melt or longer-term precipitation events. Wetlands within the Secondary Plan area can exhibit perched conditions such as Neumann's Pond (i.e. unsaturated zone beneath the pond) or be connected to the water table such as Halls Pond, Halligan's

Pond (i.e. saturated zone beneath the pond) and other wetland/pond features within the Secondary Plan area (i.e. northwestern portion of Secondary Plan area).

Groundwater quality analysis indicates the overburden water consistently represents a calcium-magnesium carbonate system with no significant difference in most basic anions and cations between the shallow and deeper groundwater in the overburden monitoring wells. In addition, the basic anions and cations within the two Provincial Groundwater Monitoring Network (PGMN) bedrock wells appear to be like the overburden monitoring wells. Localized elevated levels of chloride and nitrate reflect potential quality degradation related to winter de-icing or agricultural applications.

There is limited to moderate groundwater quality protection within the overburden and shallow bedrock aquifers, respectively from potential contaminant sources, particularly related to those elements that are considered conservative (i.e. those that do not biodegrade or are not adsorbed such as chloride). The Vinemount aquitard provides greater protection for the deep bedrock aquifer (main source of municipal groundwater) by limiting the flux from the shallow to deep bedrock aquifer in the Secondary Plan area).

The thick overburden provides a degree of groundwater quality protection from potential contaminant sources particularly those species that are considered conservative (i.e. those that do not biodegrade or are not adsorbed such as chloride). The Vinemount aquitard provides greater protection for the municipal aquifer.

Phase 3 Implementation & Impact:

The conceptual understanding of groundwater flow conditions within the Secondary Plan area and primary study area was used to inform the location of future land use types found in the initial and updated community structure. This understanding also informed the development of a Stormwater Management (SWM) plan and associated low impact development best management practice (LID BMP) recommendations tailored to the unique biophysical context of the Clair-Maltby Secondary Plan area and to the Final Preferred Community Structure land use plan.

The unique SWM plan developed for this Secondary Plan area takes advantage of the high infiltration capacity of the soils and thick unsaturated zone to replicate the function of existing depressional features in the landscape which, outside of the protected NHS, are expected to be altered through grading for development. Additional depression storage depth has been incorporated into the development areas, outside of the NHS, to meet the established capture/infiltration targets and support an overall study area water balance. The SWCAs have been sized and located to receive excess runoff and infiltrate additional runoff during larger precipitation events, in excess of 20 mm, within the development area.

The future conditions scenario was simulated using the integrated surface water – groundwater model MIKE SHE model developed as part of the Phase 1 and 2 Existing Conditions Characterization. Future conditions were represented in the model for each iteration of the impact assessment to represent Initial, Updated and Final Preferred Community Structure land use and the SWM management approaches. In addition, MIKESHE was used to inform the more area-specific analyses undertaken for the Halls Pond catchment area associated with the Final Preferred Community Structure with the confirmed Community Park location. The

representation of the development area was updated to reflect changes in topography, imperviousness, changes in vegetation cover and proposed stormwater management practices. Additional depression storage was incorporated to all development areas. Source control LID capture of 20 mm was determined to be effective in the Final Preferred Community Structure, but values of 5 to 35 mm were simulated and assessed in the Final Preferred Community Structure simulations. Alternative source control capture volumes were evaluated but ultimately 20 mm was found to offer the best balance of impact mitigation and constructability. Stormwater volumes in excess of local depression storage were simulated to be routed to the centralized SWCAs consistent with the proposed SWM plan.

The impacts of the future conditions scenario and effectiveness of the LID BMPs and SWM measures were assessed by comparison to the existing conditions for the period of 2003-2017 for the updated and Final Preferred Community Structure (May 2019). The 15-year simulation period employed in iteration 2 and 3 (updated and final Preferred Community Structure) provided additional insight on long term impacts compared to the shorter simulation used in iteration 1 (based on the initial Preferred Community Structure, May 2018).

Overall, the modelling predicted that under the final Preferred Community Structure and the recommended LID BMPs and SWCAs, recharge is maintained with slight increases in recharge within the Secondary Plan area. While localized increases and decreases in groundwater recharge to the water table are predicted within the Secondary Plan area, the distributed detention storage in development areas and the additional capture capacity provided by the SWCAs are predicted to maintain or slightly increase recharge and maintain overall groundwater flow directions and recharge to shallow and deep bedrock aquifers by infiltrating water as close to source as possible. By maintaining groundwater flow, gradients and linkages between groundwater recharge and discharge areas are expected to be sustained under the updated and final Preferred Community Structure plan and the groundwater function is simulated to be maintained across the study area.

4. Surface Water Quality

Phase 1 / 2 Characterization:

The purpose of the water quality assessment was to characterize the water quality of the Clair-Maltby Secondary Plan area based on both available information from the associated subwatershed studies and data collected with respect to contaminant loadings under existing land use conditions. Under existing conditions, most of the surface water drains to depressional features including natural features (e.g., wetlands and woodlands). As such, surface water impacts from future land use changes could impact groundwater quality.

As part of the CEIS four-year monitoring program, surface water quality monitoring was conducted at key locations within the Clair-Maltby Secondary Plan area and beyond to characterize the surface water chemistry under existing land use conditions.

Based on the monitoring results, existing surface water quality within the Clair-Maltby Secondary Plan area and immediately downstream is generally of reasonable

quality, with exceedances to provincial and federal water quality guidelines in parameters linked primarily to agricultural and golf course land uses and roadway runoff.

Phase 3 Implementation & Impact:

The updated Preferred Community Structure land use plan (May 2019) includes a mix of densities of different land uses including residential, commercial, institutional (schools) and parks, as compared to the existing predominant agricultural land uses and golf course. As such, contaminant loadings typically associated with agriculture and golf courses are expected to be reduced, while contaminants associated with urbanization (e.g., from road runoff in particular) are expected to increase.

To help manage the water quality impacts of the urbanized land uses, drainage will be conveyed through a series of LID BMPs, with the overflow being directed towards SWCAs that will infiltrate the balance of the captured drainage. The foregoing approach is described in the following:

i. Apply a distributed approach for 20 mm capture within LID BMPs, 100 mm for Community Park.
ii. Separate 'clean' water (rooftop and landscaped areas runoff) from dirty water, with dirty water typically resulting from roadways and parking areas
iii. Apply water quality measures in series to protect the SWCA's function of infiltration
iv. LID BMP selection and locations to be determined based on land ownership, land use, development form and grading (public and private realm)
v. Reduce the use of salt through the City of Guelph Salt Management Plan; and through implementation of the recommendations provided by the Wood Team to the City for reducing infiltration of salt laden runoff, and
vi. LID BMPs and other stormwater quality management measures would need to be reviewed and refined through the planning process.

5. Natural Heritage

Phase 1 / 2 Characterization:

As part of Guelph's Natural Heritage Strategy, Natural Heritage System (NHS) mapping and policies were developed for the entire City, including the Clair-Maltby Secondary Plan area. These NHS policies and maps were included in the City's updated Official Plan in 2010, refined through the Ontario Municipal Board process, and finalized in June 2014. The purpose of the natural heritage work for this project was to confirm, refine and update the mapping as appropriate based on the most current and applicable policies, guidelines and information.

From a natural heritage perspective, the Clair-Maltby Secondary Plan area is unique in the City because it is dominated by the Paris Moraine which has no watercourses and hummocky topography that supports woodlands, wetlands and transitional habitats among lands that are currently being farmed.

As part of the Clair-Maltby Secondary Plan project, the natural heritage team was required to:

a) make refinements to the NHS mapping and characterization in the Secondary Plan area based on a combination of existing and new information collected, and current environmental legislation / policies / guidelines;

b) help design the Community Structure and Land Use Plan to avoid and minimize negative impacts to the NHS to the greatest extent possible while still accommodating the various Secondary Plan requirements; and

c) provide recommendations for avoiding, minimizing and managing impacts anticipated in relation to the final Community Structure and Land Use Plan, including identification of measures specifically tailored to the Clair-Maltby Secondary Plan area to protect, enhance and restore the unique natural heritage features and areas in the Secondary Plan area.

The results of the natural heritage work have resulted in a refined NHS consisting of the following components:

i. Significant Natural Areas including: Habitat for Provincially Endangered and Threatened species; Surface Water Features and Fish Habitat (warm water) plus 15 m minimum buffers; Provincially Significant Wetlands (PSWs) plus minimum 30 m buffers; Significant Woodlands plus minimum 10 m buffers; Significant Landform; and Confirmed Significant Wildlife Habitat (SWH) including Ecological Linkages; and Restoration Areas; and

ii. Natural Areas (mapped as an overlay) including: Other Wetlands plus 15 m buffers; Candidate SWH; Cultural Woodlands plus 10 m buffers; and Habitat of Significant Species.

Phase 3 Implementation & Impact:

The refined NHS confirmed through the CMSP study process is a well-connected system that occupies more than 45 per cent of the land base in the Clair-Maltby Secondary Plan area. "Environment first" strategies that influenced the development of the initial Preferred Community Structure (May 2018) have been carried forward into the updated Preferred Community Structure and land use plan including:

- Respecting the limits of the NHS by excluding all residential, commercial, institutional and industrial development from identified Significant Natural Areas, and their applicable minimum or established buffers;
- Keeping new municipal roads from crossing Significant Wetlands and Significant Woodlands, and generally limiting new road crossings of the NHS to the extent possible;

- Keeping the proposed trail network largely outside the NHS and along the outer edges of the NHS and limiting trail crossings of the NHS to connections required to accommodate connectivity for active transportation;
- Co-location of SWCAs with schools and parks to maximize infiltration in existing suitable locations to help sustain local hydrologic and hydrogeologic functions; and
- Placement of SWCAs, parks and schools adjacent to the NHS where possible to provide open spaces in the immediately adjacent lands, further "buffering" the NHS from more intensive residential and commercial land uses.

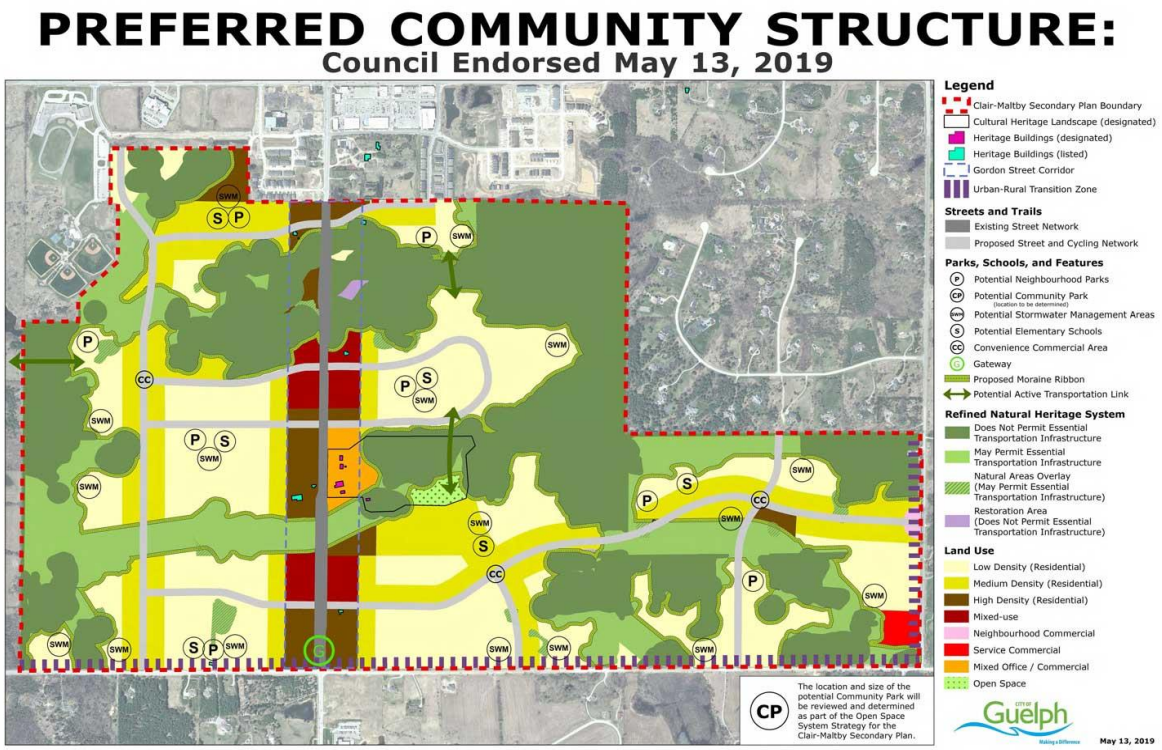
Although the strategies listed above are expected to help avoid and mitigate most major potential development-related impacts to the NHS, there are still some anticipated unavoidable impacts related to implementation of the updated Preferred Community Structure. The primary challenges to maintaining and enhancing existing NHS functions in the Clair-Maltby Secondary Plan area are expected to be related to:

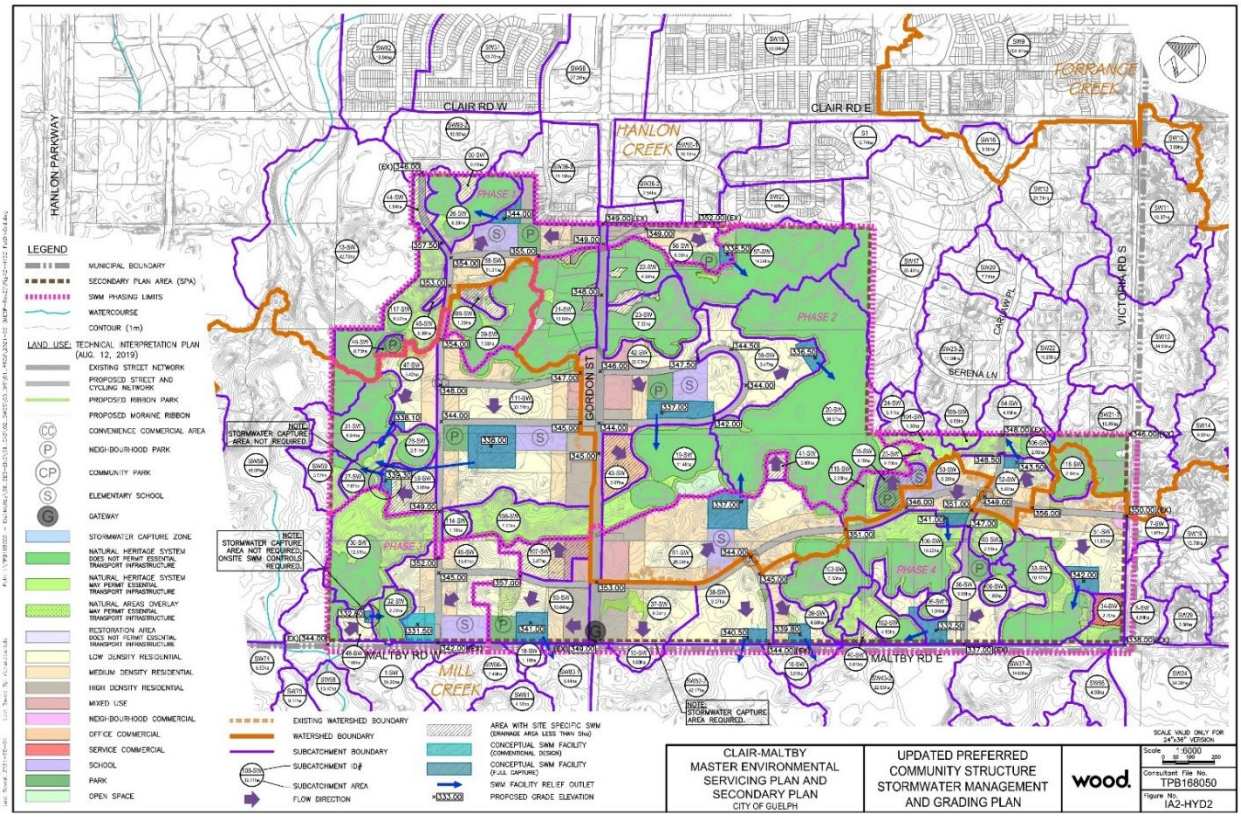
- Maintaining the local amphibian and reptile populations as human population density and traffic volumes increase;
- Effectively integrating the protected Significant Landform into the Clair-Maltby Secondary Plan area so that its visual uniqueness and hydrologic functions are maintained; and
- Protecting the NHS from encroachments associated with adjacent land uses while supporting community connectivity and access to nearby natural areas.

A series of recommendations to help avoid, minimize and manage potential negative impacts to the NHS at the Secondary Plan scale are included in this report. In addition, as part of the implementation of the Secondary Plan, site-specific impacts will need to be addressed, as part of area or site-specific studies undertaken as part of the subsequent development process (i.e., typically an Environmental Impact Study (EIS) or Environmental Assessment (EA) process).

The final Refined NHS included in this second iteration of the Phase 3 CEIS builds on the draft versions circulated for comment and input over the course of this project, and has provided the basis for the impact assessment and related mitigation and management recommendations in relation to the updated Preferred Community Structure (May 2019) and related Land Use Plan.

6. Figures


PREFERRED COMMUNITY STRUCTURE:
Council Endorsed May 13, 2019
Legend
Clair-Maltby Secondary Plan Boundary
Cultural Heritage Landscape (designated)
Heritage Buildings (designated)
Heritage Buildings (listed)
Gordon Street Corridor
Urban-Rural Transition Zone
Streets and Trails
Existing Street Network
Proposed Street and Cycling Network
Parks, Schools, and Features
Potential Neighbourhood Parks
Potential Community Park
Potential Stormwater Management Areas
Potential Elementary Schools
Convenience Commercial Area
Gateway
Proposed Moraine Ribbon
Potential Active Transportation Link
Refined Natural Heritage System
Does Not Permit Essential Transportation Infrastructure
May Permit Essential Transportation Infrastructure
Natural Areas Overlay (May Permit Essential Transportation Infrastructure)
Restoration Area (Does Not Permit Essential Transportation Infrastructure)
Land Use
Low Density (Residential)
Medium Density (Residential)
High Density (Residential)
Mixed-use
Neighbourhood Commercial
Service Commercial
Mixed Office / Commercial
Open Space
CP
The location and size of the potential Community Park will be reviewed and determined as part of the Open Space System Strategy for the Clair-Maltby Secondary Plan.
Guelph
May 13, 2019


CLAIR RD W
CLAIR RD E
HANLON PARKWAY
HANLON CREEK
TORRANCE CREEK
GORDON ST
VICTORIA RD S
SERENA LN
MALTBY RD W
MALTBY RD E
MILL CREEK
PHASE 1
PHASE 2
PHASE 3
PHASE 4
LEGEND
MUNICIPAL BOUNDARY
SECONDARY PLAN AREA (SPA)
SWM PHASING LIMITS
WATERCOURSE
CONTOUR (1m)
LAND USE: TECHNICAL INTERPRETATION PLAN (AUG. 12, 2019)
EXISTING STREET NETWORK
PROPOSED STREET AND CYCLING NETWORK
PROPOSED RIBBON PARK
PROPOSED MORAINE RIBBON
CONVENIENCE COMMERCIAL AREA
NEIGHBOURHOOD PARK
COMMUNITY PARK
ELEMENTARY SCHOOL
GATEWAY
STORMWATER CAPTURE ZONE
NATURAL HERITAGE SYSTEM DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
NATURAL HERITAGE SYSTEM MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
NATURAL AREAS OVERLAY MAY PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
RESTORATION AREA DOES NOT PERMIT ESSENTIAL TRANSPORT INFRASTRUCTURE
LOW DENSITY RESIDENTIAL
MEDIUM DENSITY RESIDENTIAL
HIGH DENSITY RESIDENTIAL
MIXED USE
NEIGHBOURHOOD COMMERCIAL
OFFICE COMMERCIAL
SERVICE COMMERCIAL
SCHOOL
PARK
OPEN SPACE
EXISTING WATERSHED BOUNDARY
WATERSHED BOUNDARY
SUBCATCHMENT BOUNDARY
SUBCATCHMENT ID#
SUBCATCHMENT AREA
FLOW DIRECTION
AREA WITH SITE SPECIFIC SWM (DRAINAGE AREA LESS THAN 5ha)
CONCEPTUAL SWM FACILITY (CONVENTIONAL DESIGN)
CONCEPTUAL SWM FACILITY (FULL CAPTURE)
SWM FACILITY RELIEF OUTLET
PROPOSED GRADE ELEVATION
NOTE: STORMWATER CAPTURE AREA NOT REQUIRED
NOTE: STORMWATER CAPTURE AREA NOT REQUIRED, ONSITE SWM CONTROLS REQUIRED
CLAIR-MALTBY MASTER ENVIRONMENTAL SERVICING PLAN AND SECONDARY PLAN
CITY OF GUELPH
UPDATED PREFERRED COMMUNITY STRUCTURE STORMWATER MANAGEMENT AND GRADING PLAN
wood.
Consultant File No. TPB168050
Figure No. IA2-HYD2