Conservation Halton Guidelines for Wetland Water Balance Assessments

Draft

December 2023

Conservation Halton

CONSERVATION HALTON GUIDELINES

Conservation Halton (CH) protects, manages, and enhances the area within its jurisdiction through the delivery of a range of programs and services, including mandatory programs and services related to managing the risks associated with natural hazards. In the planning and development process, CH exercises its roles and responsibilities in accordance with Section 21.1 of the *Conservation Authorities Act* and Ontario Regulation 686/21, including as:

- A regulatory agency under Section 28 of the *Conservation Authorities Act*;
- A body with delegated responsibility to represent the Provincial interest and ensure that development applications are consistent with the natural hazards policies of the Provincial Policy Statement (PPS), but not including those policies related to hazardous forest types for wildland fire;
- A public commenting body under the *Planning Act, Clean Water Act* and other Acts and Provincial Plans;
- A resource management agency operating on a local watershed basis; and
- A landowner in the watershed.

CH's Planning and Regulations staff (i.e., environmental planners, regulations officers, planning ecologists, water resource engineers, technologists, and hydrogeologists) work together on interdisciplinary teams to deliver timely and comprehensive reviews and advice to provincial agencies, municipalities, and landowners across CH's jurisdiction.

Section 28 (1) of the *Conservation Authorities Act* allows conservation authorities to make regulations to protect life and property from natural hazards. CH's regulation is Ontario Regulation 162/06. Under Ontario Regulation 162/06, CH regulates:

- All development in or adjacent to river or stream valleys, wetlands, and surrounding lands where development could interfere with the hydrologic function of the wetland, Lake Ontario shorelines, and hazardous lands such as karst and any prescribed allowances;
- Alterations to a river, creek, stream, or watercourse; and
- Interference with wetlands.

Permission is required from CH for undertaking the above noted works within regulated areas. CH's Board-approved Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document outlines the policies and technical requirements which must be met before permission may be granted. As part of a CH permit application, an applicant must demonstrate that CH's Board-approved policies and technical standards can be met.

CH also provides technical advice and support to its municipal partners on planning and development applications where it relates to CH's mandatory programs and services, as well as a public commenting body and a resources management agency.

These Guidelines provide clear expectations regarding the criteria and approaches that are acceptable to CH and are used by staff to assess the technical merits of a wetland water balance assessment for works proposed in CH regulated areas. Applicants proposing works should follow these Guidelines when preparing plans to be submitted as part of a CH permit application. By doing so, more efficient, and consistent reviews, fewer resubmissions, and faster approvals are anticipated.

These Guidelines are specific to CH and do not replace or supersede any other federal, provincial, or municipal requirement.

OBJECTIVE	The purpose of the **Guidelines for Wetland Water Balance Assessments** is to: • **Identify Conservation Halton's (CH's)** requirements for and outline the key expectations for a Wetland Water Balance Assessments
APPLICATION & USE	Applies to all Wetland Water Balance Assessments submissions associated with Ontario Regulation 686/21, 596/22 and 162/06 permit applications. These Guidelines have been developed for: • **Qualified professionals** such as hydrogeologists, engineers and ecologists tasked with preparing wetland water balance assessments. • **CH** staff to assess the technical merits of a Wetland Water Balance Assessment and to facilitate quicker and more consistent reviews.
ADDITIONAL REFERENCE MATERIALS (to be read in conjunction with this document)	• Ontario Regulation 686/21: Mandatory Programs and Services, 2021 • Ontario Regulation 162/02, Halton Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses, 2006 ((last amended, November 26, 2020) • Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning, November 2020 • Conservation Halton Guidelines for Stormwater Management Engineering Submissions, 2021 • Requirements for completion of hydrogeological studies to facilitate Conservation Halton's reviews
VERSION	**Version 1.0** This version of the Guidelines for Wetland Water Balance Assessments was presented and approved by the CH Board of Directors on DATE, YEAR. The Guidelines may be updated from time to time. For more information, visit https://www.conservationhalton.ca/policies-and-guidelines or call 905-336-1158.

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Section 1 Introduction

Wetlands are critical ecosystems that provide important ecological, hydrological, and socio-economic benefits or services. They help reduce downstream flooding and erosion by absorbing rainfall, snow melt, and surface water runoff, then slowly releasing the water directly to watercourses or infiltrating the water into the ground, recharging groundwater. Riparian wetlands within floodplains provide storage for flood waters, reducing flow rates and velocities. Wetlands also play a vital role in sustaining healthy watersheds by providing habitat and food for wildlife, fish, and plants, sustaining biodiversity, and maintaining natural cycles (carbon, water).

The purpose of the Guidelines for Wetland Water Balance Assessments is to:

- Identify Conservation Halton's (CH's) requirements and expectations for a Wetland Water Balance Assessment.

A Wetland Water Balance Assessment is undertaken when development is proposed adjacent to areas that may interfere or alter the wetland catchment area, to help determine potential impacts on the hydrological function of a wetland as well as the appropriate mitigation measures. An Assessment serves as a tool to quantify the existing hydrological functions of a wetland through collection and analyses of baseline data to characterize existing conditions and identify sensitive hydroperiod(s) to compare to a post development scenario. It is used to assess the potential short-term and long-term impacts to a wetland resulting from land-use changes.

Large scale applications (for example Subwatershed Studies, SISs/EIRs, EIA/EIS, etc.) or complex permit applications (such as subdivision applications, site plans and environmental assessments, etc.) may require a qualified professional prepare a Wetland Water Balance Assessment. Individual landowners proposing small scale works will be encouraged to adopt the principles in these guidelines in most cases, where possible, in lieu of preparing a Wetland Water Balance Assessment. Pre-consultation with CH is recommended to confirm study scope and requirements.

1.1 Guideline Overview

This document provides standardized steps to preparing a Wetland Water Balance Assessment. It should be used for large scale and for complex development applications to determine if there will be a negative impact on the hydrologic function of a wetland. Section 2 of the Guideline outlines the requirements for a full Wetland Water Balance Assessment, in the following six steps:

Step 1. Baseline Data Collection and Analysis

Step 2. Build the Existing Conditions Wetland Water Balance

Step 3. Establish Water Balance Goals and Targets

Step 4. Develop Proposed Conditions Water Balance and Comparing Pre-Development and Post-Development Conditions

Step 5. Develop Monitoring Plan

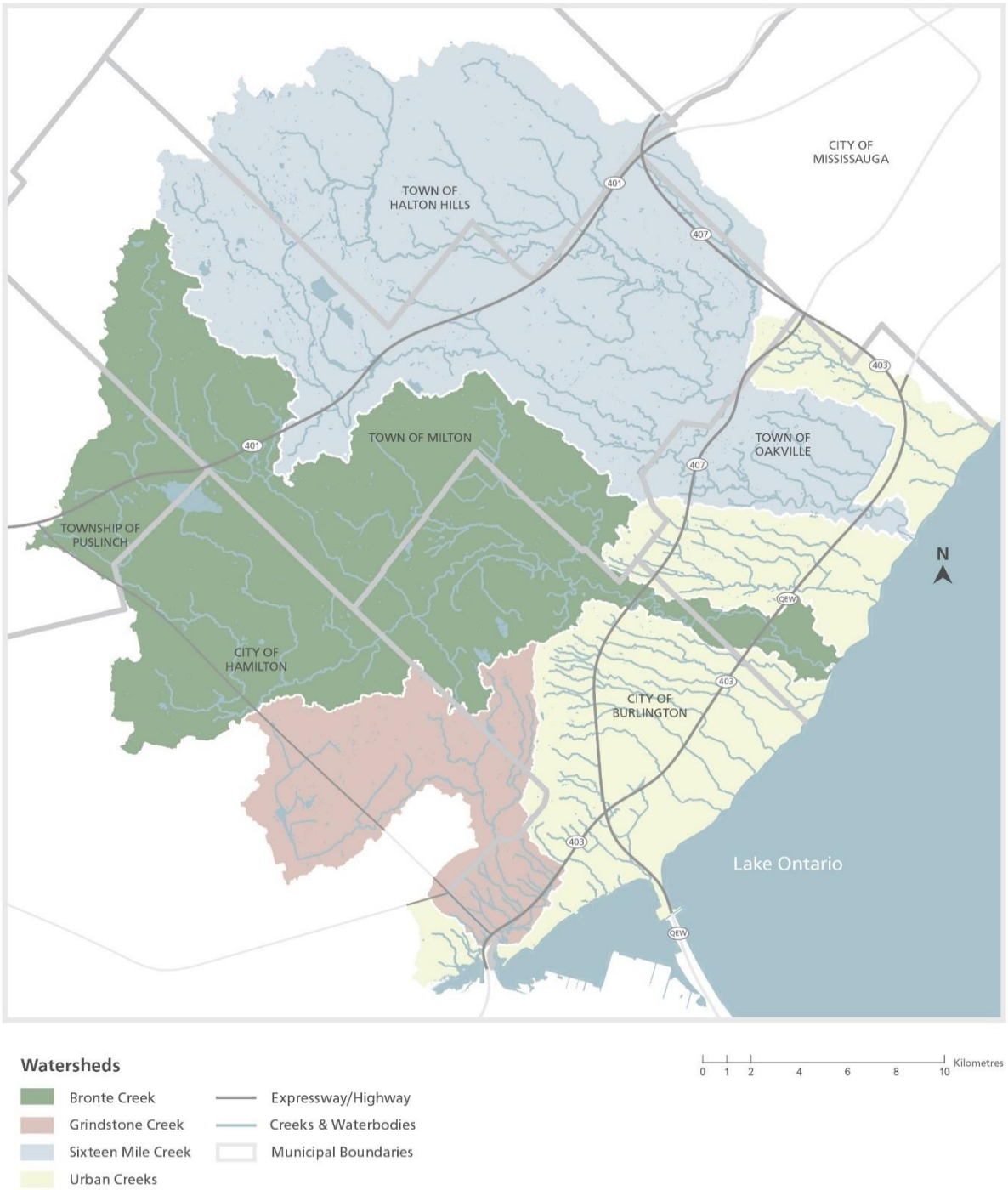
Step 6. Complete/Submit Report

In consultation with CH, the assessment may be scoped, recognizing the significance and sensitivity of individual wetlands and the scale of development proposed within the wetland catchment. Multiple developments within the same wetland catchment should undertake a comprehensive, coordinated Wetland Water Balance Assessment. Note that a Wetland Water Balance Assessment may also be part of a hydrologic evaluation. CH encourages pre-consultation to confirm study scope and requirements.

1.2 Conservation Halton's Role in Reviewing Wetland Water Balance Assessments

CH protects, manages, and enhances the area within its jurisdiction (see Figure 1-1) through a wide variety of programs and services, including the administration of regulations and the provision of planning services.

FIGURE 1-1: CONSERVATION HALTON WATERSHED



Under the Ontario Regulation 162/06 (O. Reg. 162/06), CH regulates:

- All development in or adjacent to river or stream valleys, wetlands, and surrounding lands where development could interfere with the hydrologic function of the wetland, Lake Ontario shorelines, or hazardous lands such as karst and any associated allowances.
- Alterations to a river, creek, stream, or watercourse; and
- Interference with wetlands.

Permission is required from CH for undertaking any development within regulated areas. “Development” means,

a) the construction, reconstruction, erection or placing of a building or structure of any kind,
b) any change to a building or structure that would have the effect of altering the use or potential use of the building or structure, increasing the size of the building or structure, or increasing the number of dwelling units in the building or structure,
c) site grading, or
d) the temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.

CH’s Board-approved *Policies and Guidelines for the Administration of Ontario Regulation 162/06* and Land Use Planning Policy Document (2020) outlines the policies and technical requirements which must be met before permission may be granted. As part of a CH permit application, an applicant must demonstrate that CH’s Board-approved policies and technical standards can be met to the satisfaction of CH.

CH also provides technical advice and support to its municipal partners on planning and development applications where it relates to CH’s mandatory programs and services, including those related to managing and understanding risks associated with natural hazards. O.Reg. 686/21 sets out that CAs are to act on behalf of the Province to ensure that decisions under the *Planning Act* are consistent with the natural hazard policies of the PPS (except hazardous forest types for wildfires). CAs are to review applications or other matters under the *Planning Act* and provide comments, technical support, or information to the responsible planning authority.

In addition, CH provides technical review services to municipalities related to the protection of wetlands, as part of the Planning Act/Niagara Escarpment development review/Environmental Assessment Act process, to ensure there will be no negative impacts on the hydrological function of a wetland.

CH’s review of Wetland Water Balance Assessments provides for a streamlined and integrated assessment of the merits of the proposal that is linked to both of CH’s roles and responsibilities.

The *Conservation Authorities Act* defines a wetland as an area that:

a) is seasonally or permanently covered by shallow water or has a water table close to or at its surface,
b) directly contributes to the hydrological function of a watershed through connection with a surface watercourse,
c) has hydric soils, the formation of which has been caused by the presence of abundant water, and
d) has vegetation dominated by hydrophytic plants or water tolerant plants, the dominance of which has been favored by the presence of abundant water.

but does not include periodically soaked or wet land that is used for agricultural purposes and no longer exhibits wetland characteristics.

Section 2 Steps to Prepare a Wetland Water Balance Assessment

The six steps to prepare a Wetland Water Balance Assessment within CH's watershed are discussed in the following section.

CH recommends a pre-consultation meeting prior to the submission of an application or initiating assessment to help establish effort, determine scope of work and terms of reference for the study. Scoping of work depends on the wetland sensitivity, proposed scale of the development, and wetland location on the landscape (tableland vs. riparian wetland).

The six steps are listed in the process map below and then described in detail.

Step 1 – Collect Baseline Data & Conduct Analysis

The first step in a wetland water balance is to collect and analyze the baseline data. The following outlines the components of this step:

- Delineate the surface water catchment of the wetland within the study area using topographic mapping. Determine contours within the wetland to the finest resolution feasible (e.g., 0.25 m or less). Determine contours within the external surface water catchment area to the appropriate level of detail for the size of the catchment area and nature of the proposed development.
- Conduct wetland bathymetry mapping, where appropriate (i.e., shallow marsh, swamps). Topographic contour mapping is considered an appropriate alternative (where 0.5m or finer resolution contours are available)
- Following a site reconnaissance and/or a desktop hydrogeological characterization of the area, assess the likelihood of groundwater and surface water interaction.
- Obtain local precipitation data from nearby gauges or install rain gauges if data is missing, to be confirmed with CH. To achieve a more accurate representation of the areal precipitation distribution, data from a network of stations or NEXRAD data can be used.
- Collect baseline data on wetland water levels and flow measurements (concentrated inflow and outflow locations) and groundwater flows on the subject property using staff gauges and/or piezometers with data loggers, continuously for a minimum of 12 months. Confirm with CH, the number, location and arrangement of instrumentation and methods of equipment installation. All data collected as part of the baseline assessment should be shared with CH in a graphical form and in either csv or delimited flat file format ready for upload to databases. Delineate the extent of the groundwater catchment, for wetlands with groundwater inputs.
- Map and describe each wetland vegetation unit using ELC (Ecological Land Classification) and/or OWES (Ontario Wetland Evaluation System) protocols. Depending on the size of the wetland and number of vegetation communities, it is possible that more than one community will be instrumented and monitored. Place instruments in locations which represent the dominant communities and avoid transition zones.
- Characterize the existing soils (using ELC protocols), land uses and drainage patterns within the wetland catchment.
- Measure depths of organic layers and depths to mottles and gley using a soil core or auger to ascertain vertical water level fluctuations. Observe and measure high water marks.
- Conduct detailed soils analysis within the wetland and its catchment to feed into the water balance model to characterize existing wetland conditions. Using field testing methods, determine soil characteristics, permeability estimates and perform:
    - Visual examination and description of shallow surficial soil and changes in lithology with depth.
    - Hydraulic testing for permeability such as percolation and/or infiltration tests at select sites within the wetland catchment, using acceptable methods. Distinct soils would require separate tests. Although grain size distribution analysis assists in identifying the soil constituents (clay, silt, sand, gravel) and soil type, it alone does not allow for accurate estimates of permeability of fine-grained till deposits that predominately occur within the watershed.
- See Appendix A for typical wetland water levels within CH's watershed. CH recommends using the graphs as a guide when formalizing data.

Step 2 – Build Existing Conditions Wetland Water Balance Model

Once the baseline data collection and analysis are complete in Step 1, Step 2 is to build the existing conditions wetland water balance. To characterize the wetland hydrologic function:

- Describe the water sources to the wetland.
- Quantify and compare the surface water inputs and outputs for the wetland.
- Describe the degree of groundwater interaction and fluctuation. How does the groundwater level respond to rainfall events?
- Quantify the volume of water the wetland can store. How does the water level vary seasonally and annually? Does the areal coverage of surface water vary seasonally or annually?
- Describe the wetland hydrology in dry and wet periods (seasonally dominant hydrological processes).
- Relate the above to observations of the wetland vegetation community and wildlife habitat distribution.

The Wetland Water Balance must quantify the elements of the water balance equation:

$$\Delta S = [P + G_i + S_i] - [ET + G_o + S_o]$$

Where:	ΔS	=	Change in storage over time
	P	=	Precipitation
	G_i	=	Groundwater inflow
	S_i	=	Surface Water inflow
	ET	=	Evapotranspiration
	G_o	=	Groundwater outflow
	S_o	=	Surface Water outflow

Each of the terms can be expressed as depth of water per unit time (L/T) or as volume of water per unit time (L^3/T). Obtain daily values or estimates for each component of the water balance, which may be summarized on weekly or monthly basis. Use 30 years of continuous climate data to account for variability of weather conditions.

Measured Observations

When reporting, clearly indicate the locations of all instruments used to characterize the hydrological regime. Plot the water level measurements on graphs, using unique lines for each staff gauge, monitoring well or piezometer. The resulting hydrographs should illustrate the wetland hydrological regime and give an idea of the patterns and processes (including groundwater interaction) that give the wetland its unique characteristics.

Modelling

Depending on wetland type, complexity, sensitivity, and proposed changes to the water balance elements, both a conceptual water balance model and more complex methods including continuous modelling may be required. The degree of groundwater-surface water interactions (relative contributions and timing) will factor into model selection.

Conceptual Model

Provide a description and/or conceptual diagram of the wetland that explains the water transfer mechanisms present and the substratum under the wetland. Outline/illustrate any seasonal variations to

the water transfer mechanisms separately. For complex wetlands consisting of multiple hydrological units, describe/illustrate separately each of the different hydrological units.

Continuous Hydrology Model

The seasonal pattern of wetland water level fluctuations is the main determinant for wetland flora and fauna communities. This seasonal pattern depends on the response of the catchment to rainfall events, snowmelt, and their cumulative effects. Use continuous simulation modeling approach to mimic the hydroperiod over a range of climatic conditions (dry, average, and wet weather conditions).

Using an approved continuous model, such as SWMM, HEC-HMS, HSPF, VO, PRMS, etc. and additional supporting analysis tools (e.g., Excel) as necessary, develop an Existing Conditions Water Balance. A groundwater numerical model is not a requirement for the wetland water balance at this time; however, the applicant may propose to use an integrated model such as MIKE SHE or GSFLOW. The understanding of groundwater/surface water interactions should inform the selection and set up of the appropriate numerical model.

- Describe sources for the model parameters, assumptions, and the potential range of error.
- Use monitoring data to inform model development and, if possible, for model calibration where technically appropriate. Validate calibrated models.
- Run long-term analysis (30-year record or greater is preferred) based on available climate data. Use daily data.
- Graphically display the modelled and observed results (simulated and observed water volumes and levels), ideally with the accompanying precipitation data.
- Present daily water levels graphically (to depict the wetland hydroperiod). Summarize daily water balance analyses as monthly average water volumes presented in tabular format. Consult with CH to determine if an alternate resolution is more appropriate.

Step 3 – Water Balance Goals and Targets

Once the existing conditions wetland water balance in Step 2 is built, then establish the water balance goals and targets to ensure there is no negative impact on the hydrological function:

- Maintain existing wetland hydrological functions, including extent, duration, timing, volume, and depth of water), maintaining consistency with targets and objectives determined through subwatershed studies, environmental implementation reports, subwatershed impact studies, etc.
- Include the requirements of the existing vegetation communities (e.g., marsh versus swamp vegetation) in developing thresholds of hydroperiod alteration. If there is any threshold alteration proposed, the assessment will need to include a detailed justification to ensure it is appropriate/ acceptable and demonstrate that there will be no negative impact to wetland form and function post development. Many factors play into hydroperiod alteration including, sensitivity of the wetland, rarity of the wetland function and contributions. Threshold alterations must be supported and approved by CH.

Prior to Step 4, CH recommends submitting the results of Steps 1 - 3 to CH for review and approval.

Step 4 – Proposed Conditions Water Balance and Compare Pre-development and Post-development Conditions

After establishing the target hydroperiod and thresholds of hydroperiod alteration in Step 3 and where using continuous modeling, reconfigure the continuous hydrologic model to reflect the post-development land use

condition, under both interim and ultimate conditions. Run long-term analysis for same period used in pre-development model.

A) If the pre-to-post development comparison shows that there <u>will not be</u> a negative impact to the wetland, no mitigation is required. Include the following within the assessment:

- Graphically display the pre-development, interim and ultimate condition results, based on the modeled analysis.
- Present comparison tables and graphs that show the changes caused by the proposed development (water volumes in tabular format and water levels displayed graphically).
- Provide discussion in the report about the comparison results; deviations from the pre-development conditions, in relation to the stated water balance goals, targets and thresholds; and implications for the ability of the wetland to sustain processes and functions. Provide maps which delineate the extent of flooding on a monthly/seasonal basis, overlaid on the vegetation communities, to further illustrate the results.

B) If the pre-to-post development comparison shows that there <u>will be</u> a negative impact to the wetland, mitigation measures will be required. Include the following within the assessment:

- Mitigation measures that are reflective of impacts identified to ensure maintenance of the pre-development hydrologic functions developed through collaboration between the modeller and an ecologist, and in consultation with CH.
- Updated modeling/long-term analysis using modified parameters to reflect the interim and ultimate land use condition with the proposed mitigation measures.
- Comparison tables and graphs (water volumes in tabular format and water levels graphically) incorporating the mitigation measures, with discussions relating these results to the stated water balance goals, targets, and thresholds. Provide maps which delineate the extent of flooding on a monthly/seasonal basis, overlain on the vegetation communities, to further illustrate the results.
- Include a summary table that outlines the existing and proposed wetland conditions (pre to post hydroperiod and associated mitigation measures). See Appendix B for an example of a typical summary table that clearly outlines the existing and proposed conditions.
- Mapped locations and extent of the proposed mitigation measures and any stormwater management facilities in relation to the wetland. Discuss the design of the proposed mitigation and how it connects to the natural feature.

Step 5 – Monitoring Plan

Though not always required, monitoring is often essential to ensure that the mitigation measures work and/or that the development is not impacting the wetland. Consult with CH to determine if monitoring is required and to confirm specific requirements.

The Monitoring Plan should:

- Discuss the baseline, during construction and post development monitoring necessary to determine the effectiveness of erosion and sediment control measures during construction period and mitigation measures and to assess the level and extent of negative impacts, if any, based on targets set in Step 3.
- Monitor parameters such as water depth, temperature, etc. continually during and post development. For water depth focus on dry/average/wet years to determine if data lines up with model.
- Include, but not be limited to, surveys of the vegetation community composition and distribution.

- Include an Adaptive Management Plan if established targets (Step 3) are exceeded or a deficit or excess water is observed to be negatively impacting the characteristics and functions of the wetland through the monitoring program. Mitigation considered in previous steps should be revised, and additional monitoring may be required. During construction activities, interim mitigation measures and triggers for action may be required that are separate from those identified in the post-development scenario.
- Extend 5-years post-development. Additional monitoring may be required depending on the scope and scale of the development and/or established through large scale studies (SWS SIS/EIS) (i.e., timing and duration of build-out).
- Require reporting to Conservation Halton at the end of years 1, 3 and 5 of a 5-year monitoring program, or as determined through consultation with Conservation Halton. It is noted that a monitoring program is typically associated with a Planning Act application, however consultation with Conservation Halton to determine monitoring effort will be needed.

The monitoring plan may be presented in a separate report; however, should be referenced in the Wetland Water Balance Assessment.

Step 6 – Reporting

The final Wetland Water Balance Assessment Report should:

- Synthesize the information gathered through the above steps.
- Provide comparison tables, graphs, and maps, as specified in the above steps, with discussion and justification for allowable hydroperiod alterations; and,
- Provide appendices containing summaries of models and calculations (including all the water balance components) as well as all field data sheets.
- Provide any models used for water balance with the application.
- Submit any water balance inputs and output data in digital format (delimited file format).

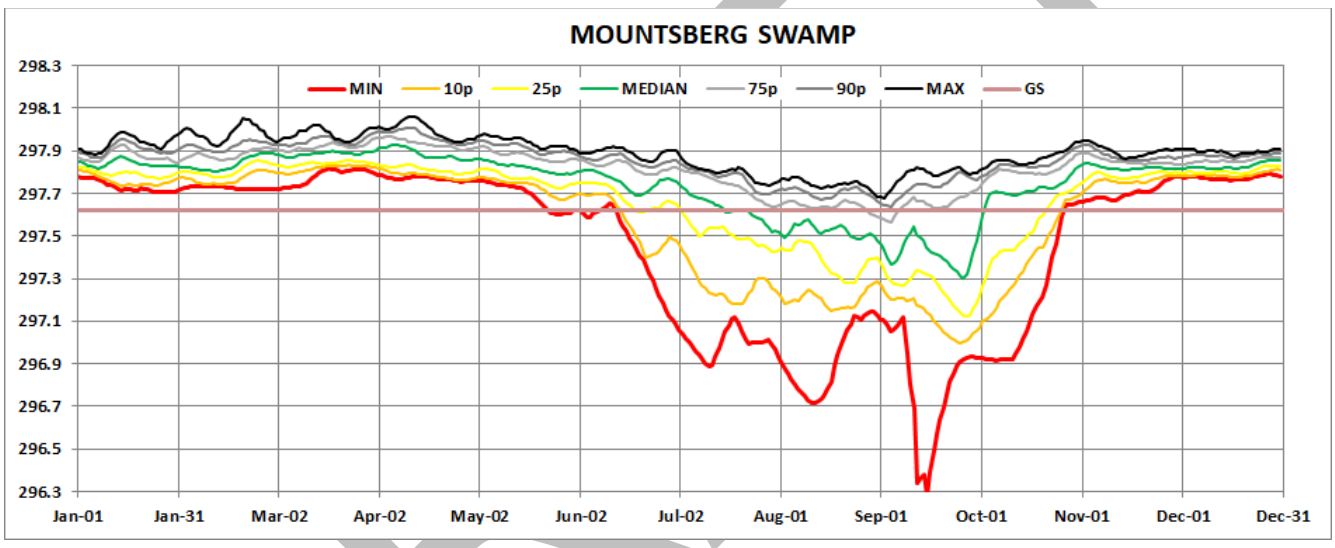
Once prepared, the report must be submitted to Conservation Halton for review and approval.

APPENDIX A

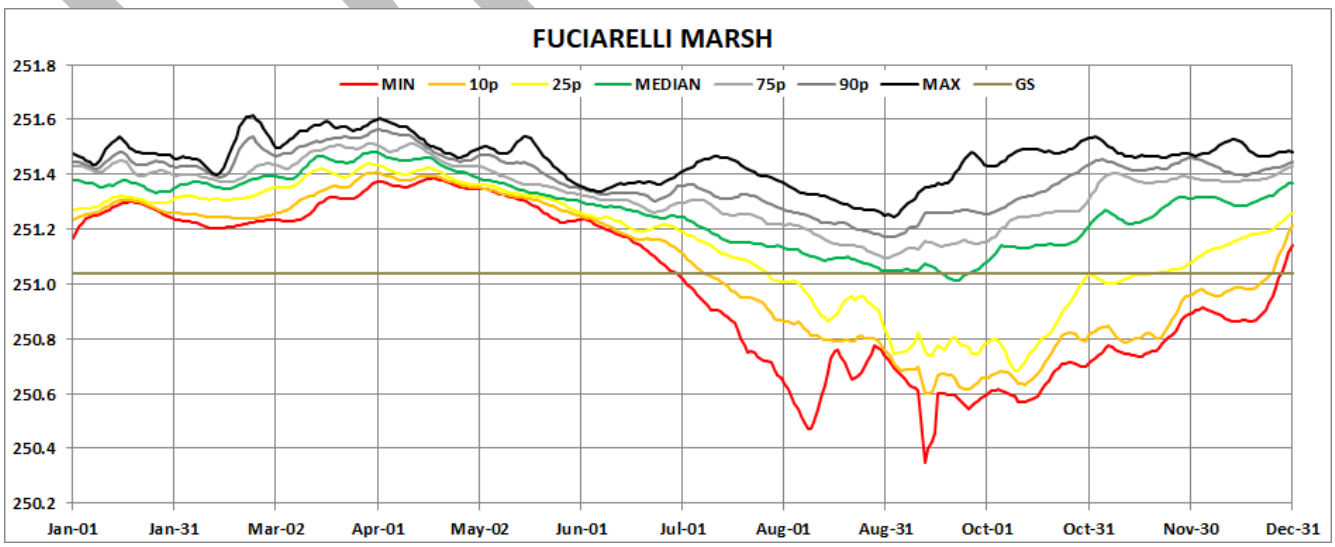
Typical Wetland Water Level Hydrographs within Conservation Halton's Watershed

The following hydrographs show seven day rolling average daily water level data collected over five to eleven years as part of CH's wetland monitoring project. The depicted water levels show a spectrum of wetland water levels between the minimum and maximum. The graphs show the minimum, 10 percentiles (level exceeded 90% of the time), 25 percentile, median, 75 percentile, 90 percentile, the maximum and ground surface at the instrumented location. As indicted within Step 1, CH recommends using the graphs as a guide when formalizing data. While these typical graphs show the water level spectrum minimum and maximum, it is median water level that is the target threshold when mitigation is being proposed both interim and post development.

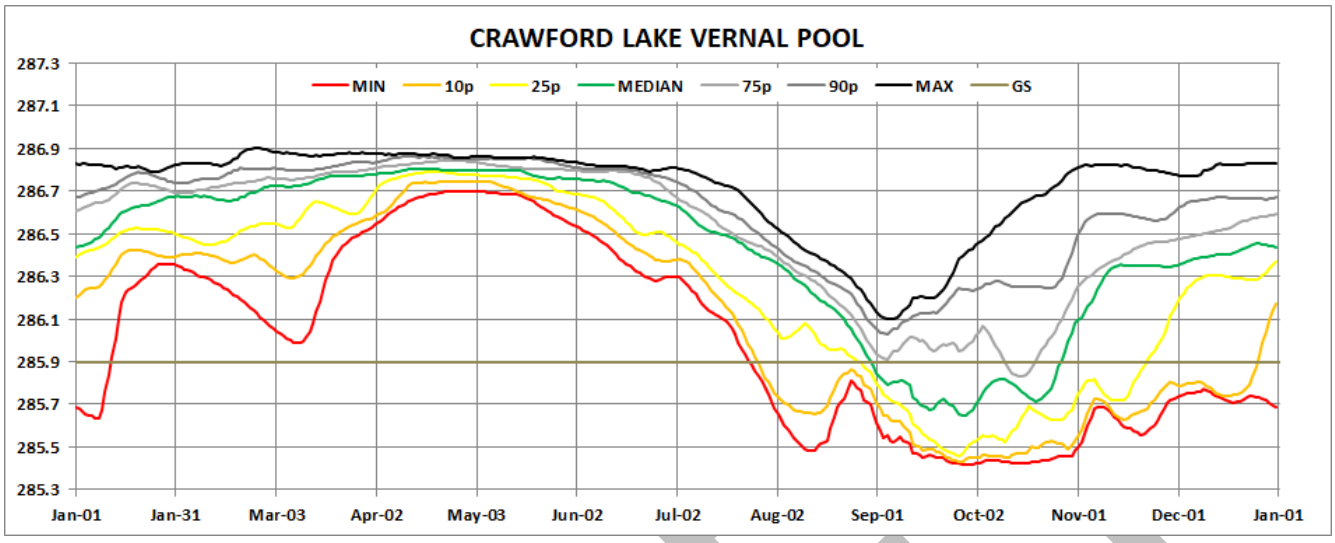
1. The Mountsberg swamp is a maple deciduous/moist white cedar swamp. The area is characterised by a shallow fractured dolostone bedrock, locally overlain by a silty sand to clayey silt till.



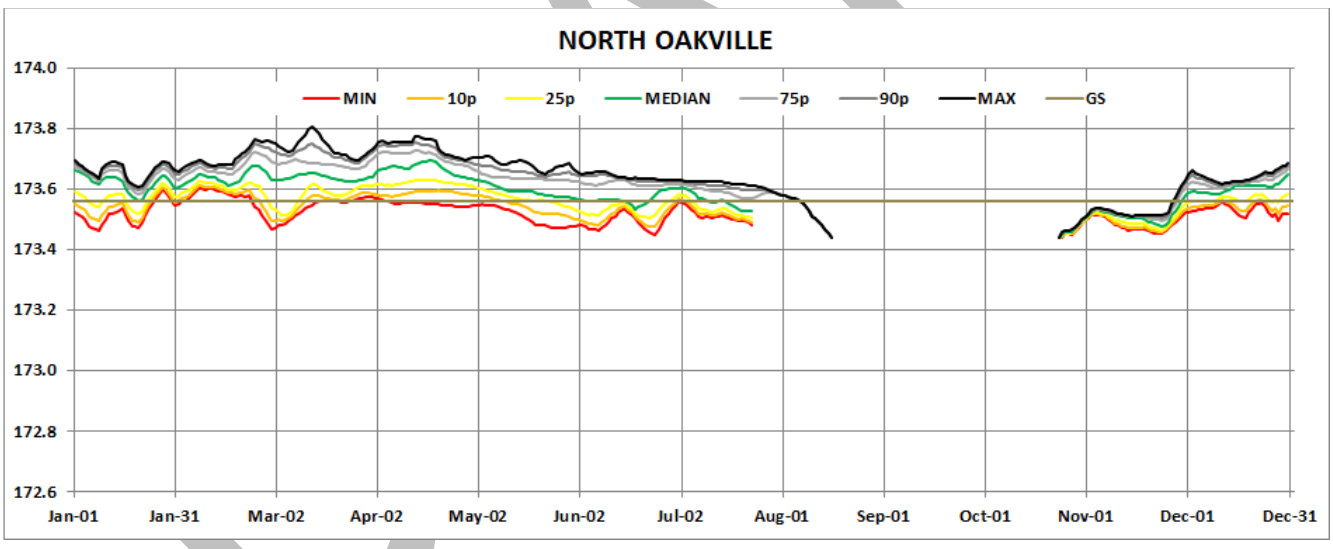
2. The Fuciarelli marsh is a cattail mineral shallow marsh. The wetland is located in an area of shallow fractured dolostone overlain by sands.



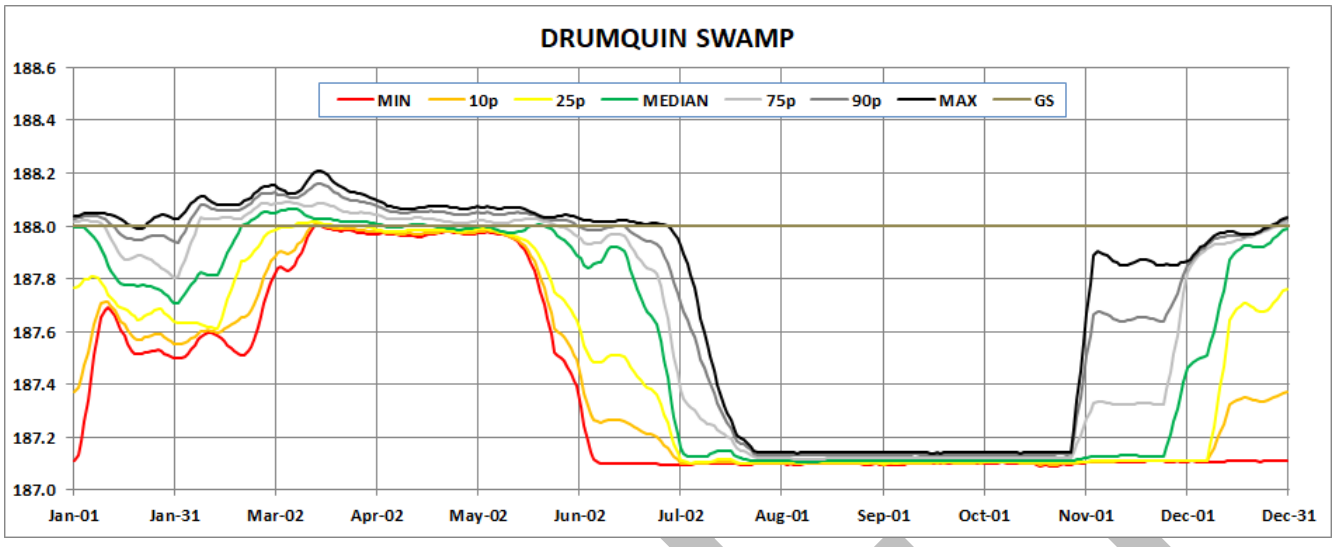
3. The Crawford Lake vernal pool is a vernal pool within a silver maple swamp. The wetland is located in an area of shallow dolostone bedrock and surrounded by bedrock at surface.



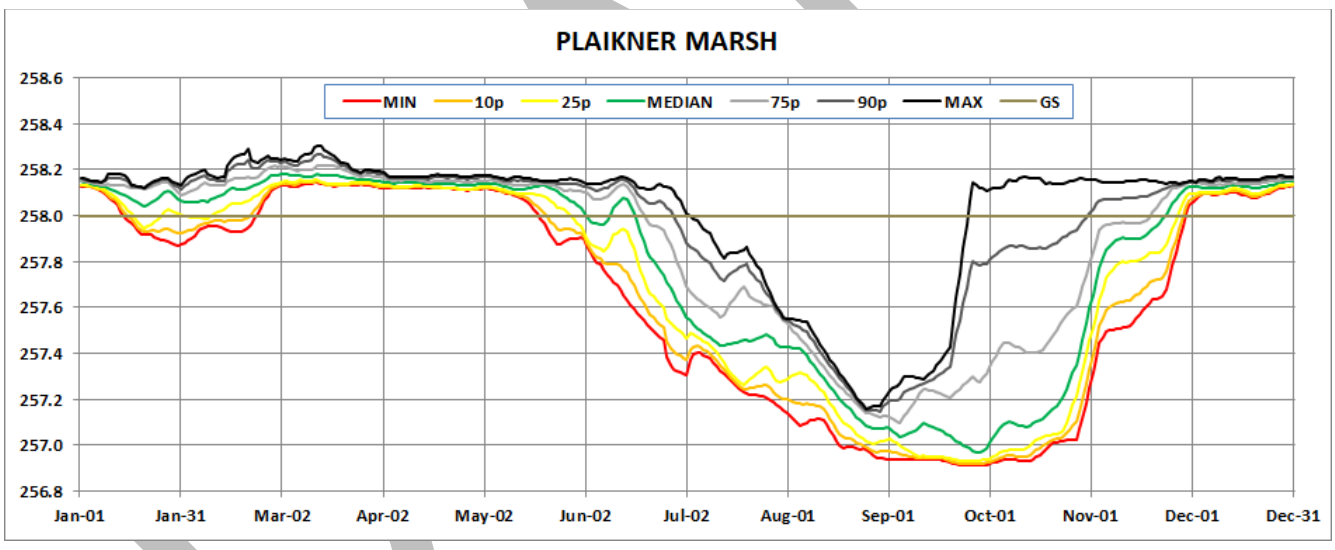
4. The North Oakville marsh is a broad-leaved sedge mineral shallow marsh. The wetland is located in an area of shallow fractured Ordovician shale overlain by Halton Till (silty clay).



5. The Drumquin swamp is a maple mineral deciduous swamp. The wetland is located in an area characterised by glacial lacustrine massive clays.



6. The Plaikner marsh is a reed-canary grass mineral meadow marsh. The wetland is located in an area characterised by silty clays at surface overlying outwash sand deposits.



APPENDIX B

Typical Summary Table

Below is an example of a summary table to include within the report to clearly indicate the wetland characteristics, existing/proposed conditions as well as any proposed mitigation measures to sustain wetland form and function pre to post development scenario, (if necessary).

	Feature Area (ha)	Catchment Area (ha)
Existing conditions		
Proposed conditions		
Proposed conditions with Mitigation		
Topography / Outlet conditions	• *Provide the outlet information (i.e., watercourse name)*	
Underlying Soils	• *Provide wetland soil type(s)*	
Wetland Type	• *Describe the type of wetland, vegetation community etc. include any supporting information from a larger study (SWS/SIS or EIA/EIS)*	
Hydrologic Input	• *Specify the inputs - surface/groundwater contributions*	
Recommended Mitigation Measures	• *Provide list of how the wetland hydroperiod will be maintained pre to post development conditions to ensure form and function is maintained*	