Water Budget Assessment

Terms of Reference

1. Description

A Water Budget Assessment uses the basic principles of hydrology and hydrogeology to identify the impacts of land use changes on the hydrologic cycle and post-development targets needed to mitigate those impacts.

2. Background

The City of Ottawa is underlain by extensive and predominantly shallow and vulnerable groundwater features. Across the City, there is also a vast network of surface water features including streams, rivers, lakes, and wetlands. These surface water and groundwater features provide drinking water for residents, sustain natural ecosystems and processes, and support agricultural, industrial, commercial, and recreational uses.

Our water resources are abundant, of variable health, and intrinsically interconnected. Development and land use changes can lead to significant, often irreversible, impacts to the prevailing watershed hydrology, hydrogeology and inherent water balance. Unmitigated disruption of the hydrologic cycle may change the fundamental health of watercourses and wetlands in developed areas, exacerbate watershed hazards associated with flooding and erosion, and impact the amount and quality of water that recharges our aquifers. This is increasingly important to address given the anticipated challenges resulting from a changing climate.

Understanding and maintaining watershed hydrologic functions during all stages of development planning in the City is necessary for environmental, social, and economic sustainability. It is critical to complete a thorough analysis of the existing water budget and potential impacts due to proposed land use changes. This analysis can then be used to define appropriate water budget targets, to be achieved through the design of the proposed development, to mitigate the impacts.

The Water Budget Assessment is a critical component of planning studies and development application studies. However, the specific role or objective for the Water Budget Assessment will vary at each level of study. The hierarchy of key planning and development studies and their relationships is demonstrated in Appendix A below.

3. When Required

Water Budget Assessments are required to support all subwatershed plans, environmental management plans (EMPs), updates to existing Master Drainage Plans, and master servicing studies. Water Budget Assessments must also be integrated with stormwater management plans prepared in support of EMPs, master servicing studies, and draft plans of subdivision.

While applications subject to site plan control are not normally required to prepare a formal Water Budget Assessment, they are required to address targets established by higher-level planning studies and must be accompanied by a stormwater management plan. There are circumstances where site plan control applications may be required to prepare Water Budget Assessments including sites with private servicing and / or proximity to hydrogeologically-sensitive areas (e.g., significant wetlands or other designated features).

The requirement for a Water Budget Assessment will be confirmed at the development pre-consultation meeting. The scope of a Water Budget Assessment will be determined through technical pre-consultation and a work plan since requirements can vary by project and site. For higher level planning studies such as subwatershed plans and EMPs, the scope of the Water Budget Assessment will be determined in that study's specific Terms of Reference.

4. Contents

A Water Budget Assessment will contain and / or address the points outlined in the planning study's specific Terms of Reference or as identified during the pre-consultation meeting and technical work plan. Failure to address the requirements identified in the pre-consultation meeting may result in the application being returned with limited review.

The Water Budget Assessment shall be integrated with stormwater management plans and analysis for the study area. The Water Budget Assessment shall consider and inform the development of recommendations for relevant stormwater management plans.

Objectives for Key Studies

General objectives for Water Budget Assessment prepared for key levels of study are as follows:

1. **Watershed and Subwatershed Studies:** Will be expected to focus on higher-level evaluations of existing and post-development water budgets and

potential impacts, as well as identify broad watershed and subwatershed mitigation objectives and criteria. Any targets set at this stage will consider what is feasible for mitigation at later planning stages, based on the geological and hydrogeological setting.

2. **Environmental Management Plan (EMP):** Will be expected to identify water balance impacts resulting from the planned development within the study area and to identify water budget targets. The identification of targets, suitable mitigation measures and assessment of their effectiveness, shall be achieved through integrated analysis with the stormwater management planning. Any additional mitigation work required downstream of outlets must also be identified. This objective also applies in cases where an existing Master Drainage Plan is being updated.
3. **Master Servicing Study:** Will be expected to identify functional implementation and planning of measures required to achieve post-development water budget targets as identified in the EMP.
4. **Servicing Studies for Draft Plan of Subdivision:** Will be required to implement mitigation measures and demonstrate that identified water budget targets have been met. Where targets have not been set, additional water budget analysis will be required to establish objectives and targets for the development.
5. **Applications Subject to Site Plan Control:** Will be required to address water budget targets established through an applicable subwatershed plan and / or EMP. Where targets have not been set, the application may be required to demonstrate that runoff volume controls have been implemented to the maximum extent possible to reduce or attenuate increased runoff volume.

Site plan control applications shall be accompanied by a stormwater management plan which demonstrates compliance with applicable recommendations, standards, or targets within subwatershed plans, EMPs, and water budgets. In cases where site plan control applications are required to prepare Water Budget Assessments (e.g., sites that are privately serviced, proximity to hydrogeologically-sensitive areas), the requirements shall be consistent with those identified for draft plan of subdivision applications in **Table 1**.

Water Budget Assessment Requirements

The standard components for Water Budget Assessments are summarized below. **Table 1** identifies the minimum requirements for a water budget assessment for

each study or plan. Water Budget Assessments may be exempt from specific components that have been adequately documented within a higher-level study.

Higher-level Studies: Be consistent with objectives and criteria or targets identified in existing Water Budget Assessments from relevant higher-level studies (e.g., subwatershed plan, EMP).

Water Budget Equation: Quantify the pre- and post-development components of the water budget equation, including precipitation, actual evapotranspiration, infiltration, runoff, and anthropogenic input and outputs.

Modelling: Characterize the existing condition and post-development condition groundwater and surface water flow systems and impacts of development by means of modelling.

Sensitive Features: Identify sensitive surface water and groundwater features that are present within the study area (or areas where further studies are needed) with the aim of setting and implementing appropriate targets to protect these sensitive features.

Water Budget Targets: Based on the analyses undertaken for the water budget equation, modelling and sensitive features, identify water budget targets to mitigate the expected impacts as a result of the development (e.g., runoff volume control, infiltration, recharge rates, filtration, evapotranspiration). The appropriate target(s) will depend on the type of system and the nature of any identified sensitive surface water and groundwater features.

Climate Change: Identify the expected changes to the water budget as a result of local projections related to climate change, and revise water budget targets where appropriate, or identify possible changes for mitigation measures.

Implementation: Contain an implementation plan demonstrating how post-development water budget targets will be met and identify any need for additional downstream mitigation measures or further studies. Mitigation measures shall be implemented in coordination with subsequent projects and development applications. The implementation plan shall also consider future climate conditions.

Monitoring: Provide a recommended approach for monitoring the effectiveness of water budget targets. The specific monitoring framework shall be established through the subwatershed plan and / or EMP.

Table 1. Minimum requirements for a Water Budget Assessment for key planning and development studies				
Minimum Requirements	**Subwatershed Plan**	**Environmental Management Plan[1]**	**Master Servicing Study**	**Draft Plan of Subdivision[2]**
Higher-level Studies	Yes	Yes	Yes	Yes
Water Budget Equation	Yes	Yes	TBD[3]	TBD[4]
Modelling	Yes	Yes	TBD[3]	TBD[4]
Sensitive Features	Yes	Yes	Yes	Yes
Water Budget Targets	Yes	Yes	TBD[3]	TBD[4]
Climate Change	Yes	Yes	TBD[3]	TBD[4]
Implementation	Yes	Yes	Yes	Yes
Monitoring	Yes	Yes	TBD[3]	No

[1]Also applies to updates to any existing Master Drainage Plans.
[2]Also applies to applications subject to site plan control, when required.
[3]May not be required if an EMP has been completed and requirement has been adequately addressed.
[4]May not apply where a target(s) has been identified by a higher-level study and is not being challenged by the proponent.

5. Evaluation Criteria

The Water Budget Assessment will be evaluated based on its compliance and conformity with applicable regulations, policy, and guidance documents, as well as any relevant planning and / or technical studies.

6. Roles and Responsibilities / Qualifications

A Water Budget Assessment must be prepared, signed, and sealed by a licensed Professional Engineer specializing in water resources, hydrology, and / or hydrogeology or by a licensed Professional Geoscientist specializing in hydrogeology. For many projects, both a water resources engineer, and a hydrogeologist will be required.

7. Submission Requirements

In addition to an electronic copy of the Water Budget Assessment report supplied in Adobe .PDF format, any supporting model files shall be included with the submission of the final report. The report shall be signed, and if applicable sealed, by the qualified professional who prepared the report.

8. Definition of Terms

Mitigation Measures: A process or engineered controls established to offset impacts or achieve water budget targets. For example, these may include low impact development-type controls (lot-level or conveyance), end of pipe controls, or downstream mitigation measures such as instream controls / improvements.

Water Budget Target: Specific, quantitative, spatially and temporally bounded benchmarks for measures that determine achievement of objectives. Depending on the specific system and results of water budget analysis, the objective for a water budget target may vary (e.g., infiltration, groundwater recharge, runoff volume control, attenuation, baseflow augmentation, filtration, evapotranspiration).

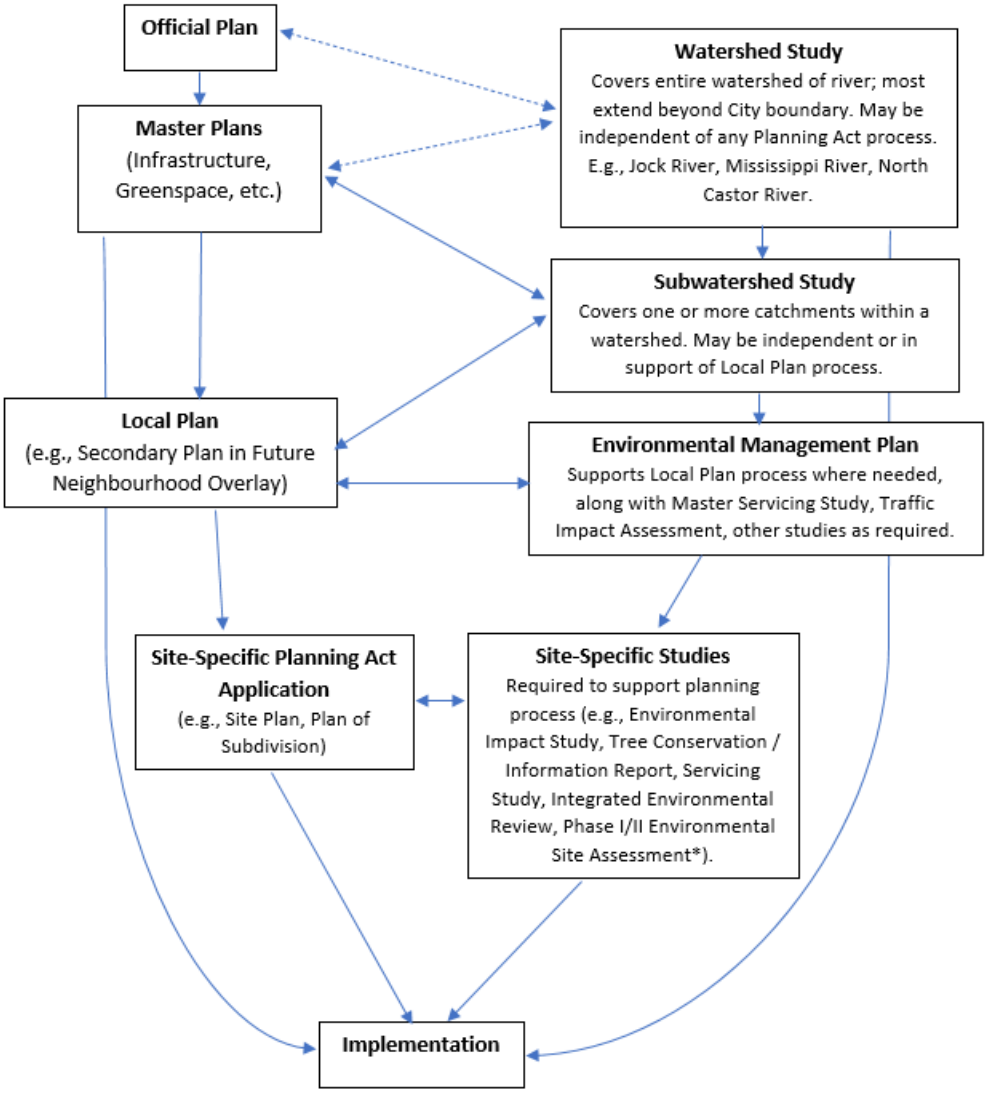
Water Budget / Water Balance: The accounting of inflow and outflow of water in a system according to the components of the hydrologic cycle. Water balance of an area over a period of time represents the way in which precipitation falling within that time period is partitioned between the processes of evaporation, transpiration, infiltration, and runoff, taking account of changes in water storage.

9. Additional References

The documents below provide additional, detailed information on the development and application of water budgets. These documents should be consulted and referenced to ensure that a consistent approach is taken with respect to the development of water budgets across the City of Ottawa.

- City of Ottawa and National Capital Commission. 2020. Climate Projections for the National Capital Region.
- Conservation Ontario. 2010. Integrated Watershed Management, Water Budget Overview.
- Ontario Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Publication #4329e.
- Ontario Ministry of the Environment. 2005. Water Budgets, Technical Paper #10, Oak Ridges Moraine Conservation Plan.
- Ontario Ministry of the Environment, Conservation and Parks. 2022. Low Impact Development Stormwater Management Guidance Manual. DRAFT.
- Thornthwaite, C.W., and Mather, J.R. 1957. Instructions and tables for computing potential evapotranspiration and the water balance. Centerton, N.J., Laboratory of Climatology, Publications in Climatology, v. 10, no. 3, p. 185-311.

10. Appendix A – Relationship between land use and environmental planning studies



* Phase I / II Environmental Site Assessments are used to identify potential contamination issues based on past uses / activities at a site. They are required for health and safety / liability purposes, not natural heritage protection. They may provide useful background information for environmental planning, however. Sites requiring extensive remediation may present additional challenges to the protection of trees and natural features.