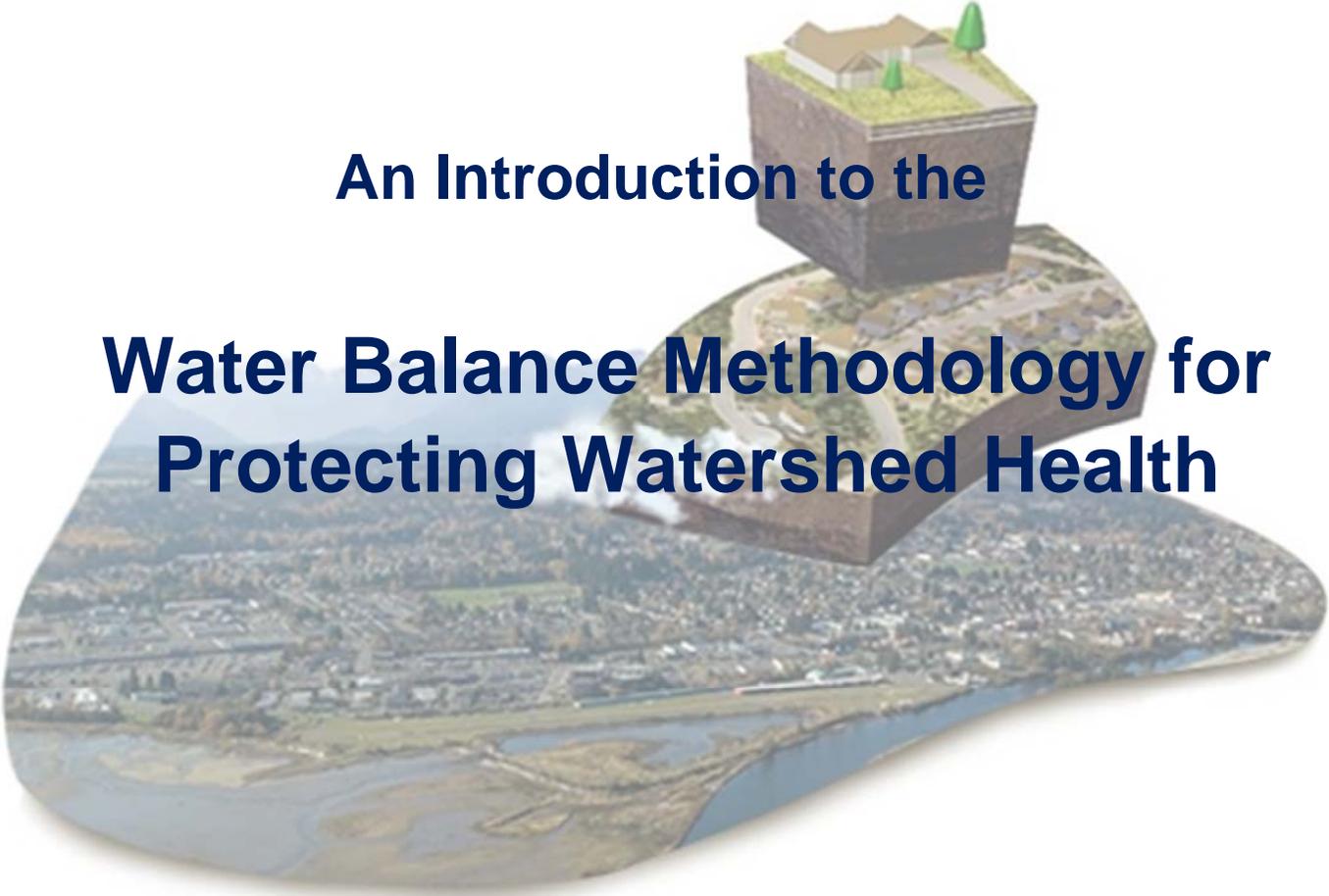




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**An Introduction to the  
Water Balance Methodology for  
Protecting Watershed Health**

Integrating the Site with the  
Watershed, Stream and Aquifer

April 2014

# **An Introduction to Water Balance Methodology for Protecting Watershed Health**

## Integrating the Site with the Watershed, Stream and Aquifer

### **Purpose**

Released in February 2014, the *Primer on Water Balance Methodology for Protecting Watershed Health* is primarily written for a technical audience, and provides the water resource practitioner with how-to-guidance for applying an analytical process to establish Watershed-based Targets that “mimic the Natural Water Balance”.

The purpose of this short-form document is to provide local government staff and others with a “what you need to know” overview of the Water Balance Methodology. The desired outcome is that this will facilitate informed decision-making that results in development and implementation of affordable and effective performance targets.

### **Guidance for Practitioners**

The water balance of a watershed is complex. It is also a topic which has suffered from descriptions that oversimplify the processes to such an extent that unintentional adverse consequences may be occurring as a result of application of commonly employed prescriptive practices. To address and rectify this issue of concern, the Primer:

- Reintroduces the practitioner to the complex hydrological processes and the analyses required to quantify how rainwater flows in a watershed.
- Provides the basic science and a basic knowledge needed to create an understanding of an individual watershed hydrology and the natural processes that affect the flow of rainwater from cloud to stream.
- Includes a discussion of the analysis of gauged and ungauged streams, flood frequency analysis, soil effects in undeveloped watersheds. It also includes an introduction into soil physics which

delves into the interaction of rainwater with the critical and hydrologically active shallow surface soils.

- Lays the foundation for the integration of watershed information into a system of analysis that allows a practitioner to describe how the streams in a watershed are impacted by urban development.

The utilization of standard engineering analyses is then extended to describe the operation of the infrastructure required to mitigate the impacts of changes to the Natural Water Balance.

### **Elements of an Integrated Design**

An integrated design for land development, rainwater management and groundwater recharge would balance the annual volume necessary for interflow storage with the annual volumes necessary to sustain the duration of interflow and allow infiltration to groundwater.

The results of the analyses allow estimation of watershed targets using proven analytic techniques which will provide a much greater degree of certainty than common prescriptive approaches based upon over simplified concepts.

Or put another way, the Water Balance Methodology provides a logical and straightforward way to assess potential impacts resulting from urban development; and analytically demonstrate the effectiveness of the methods proposed for preventing and/or mitigating those impacts.

### **How to Restore Watershed Function**

The Water Balance Methodology restores the hydrologic function of a natural watershed and incorporates these features and considerations:

- The interflow system would allow stored water to enter the stream from the shallow systems, rather than relying entirely upon groundwater discharge.

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## Integrating the Site with the Watershed, Stream and Aquifer

- The overflow rates would be controlled to prevent increased risks for flooding of properties downstream of any specific development.
- The flow to ground would be assessed using a sensitivity analysis combined with the storage size, area available for infiltration to groundwater, and controlled discharge rates.

### Three Pathways

The Water Balance Methodology recognizes three pathways that rainfall takes in travelling to a stream and the alterations which urban development cause and that require mitigation.

This means the resulting mitigation works will replicate the shallow soil storage and interflow conveyance system in order to mimic the natural watershed. This focus will allow mitigation of adverse impacts at the least possible cost.

### Performance Targets

The analyses identify three critical components in the mitigation infrastructure and which can be seen to be the watershed specific targets of:

1. **Retention Volume** expressed in terms of cubic metres per hectare ( $m^3$  per ha) of development area,
2. **Base Flow Release Rate** from retention expressed in terms of litres per second per hectare (Lps per ha), and
3. **Infiltration Area** for the retention facilities expressed in terms of square metres per ( $m^2$  per ha) of development area.

A graphic representation of the application of the three targets can be envisioned in the graphic opposite of a typical rain garden (Figure 1). Note how the three watershed targets can be readily identified in the different parts of this standard installation.

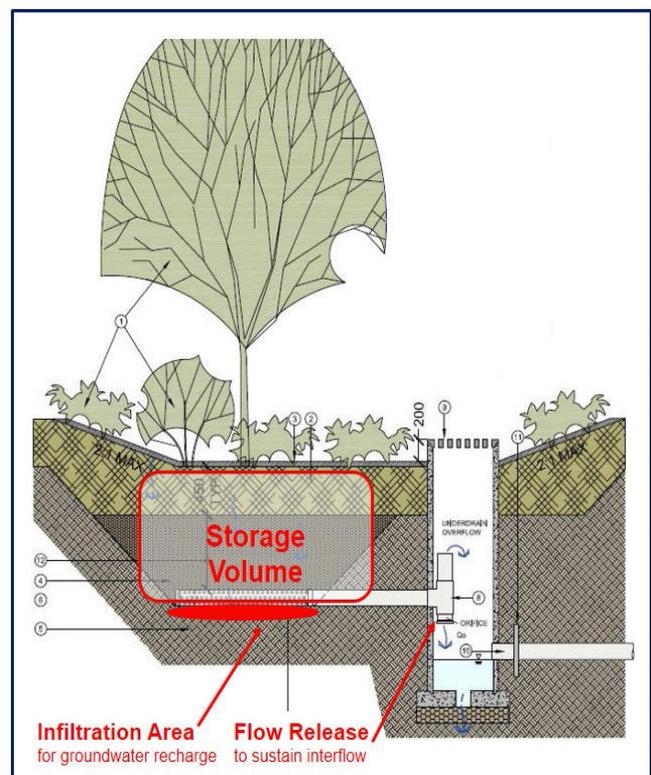


Image Source: Stormwater Source Control Design Guidelines 2012

Figure 1 – How Performance Targets for Storage, Infiltration and Flow Release are incorporated in a Rain Garden Design