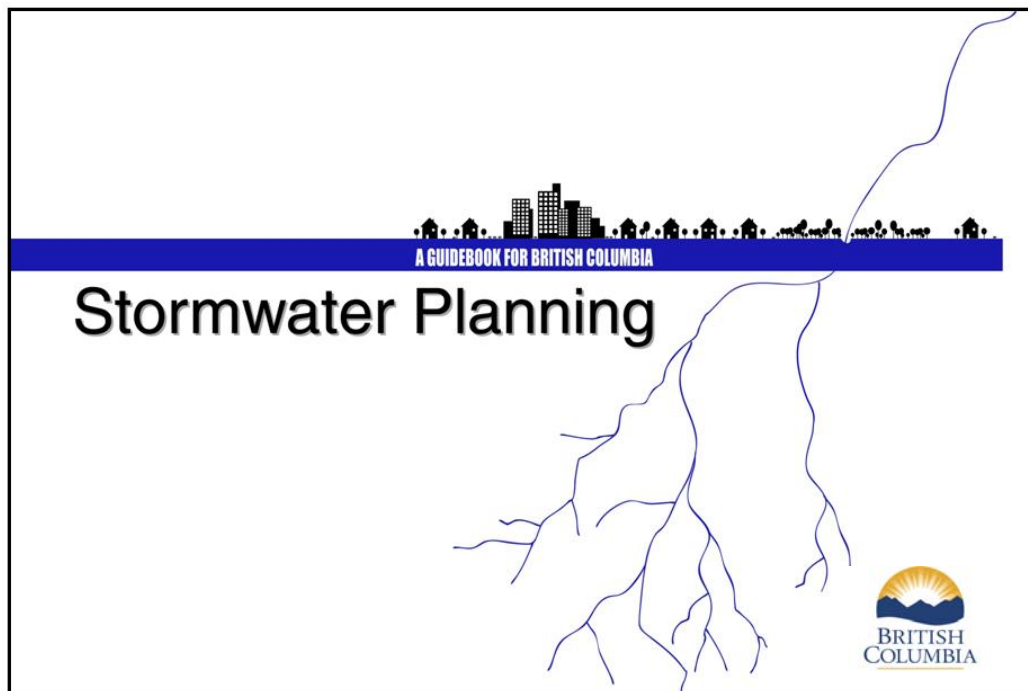


**Beyond the Guidebook: The New Business As Usual  
Create Liveable Communities & Protect Stream Health**

# **Rainwater Management: An Introduction to the Guidebook for British Columbia**



An initiative under the umbrella of the Water Sustainability Action Plan for British Columbia

# Rainwater Management: An Introduction to the Guidebook for British Columbia

## Preface

The purpose of this document is to provide the reader with a broad-brush picture of **Stormwater Planning: A Guidebook for British Columbia**, published in 2002. The emphasis is on core concepts. The desired outcome is that readers will be interested in learning more by delving into the Guidebook.

This document also provides a transition into the current **Beyond the Guidebook: The New Business As Usual** initiative that is intended to influence the greening of the built environment. Based on the experience gained and the lessons learned over the past six years, a key message is that what we believed to be unachievable a decade ago in terms of protecting stream health, may in fact now be within our grasp.

Ted van der Gulik, Chair  
Inter-Governmental Partnership  
&

John Finnie, Chair  
Convening for Action on Vancouver Island - CAVI

June 2008

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downloadable from [waterbalanc.ca](http://waterbalanc.ca)  
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# Rainwater Management: An Introduction to the Guidebook for British Columbia

## Context

Founded on British Columbia case study experience, and published by the Province in 2002, **Stormwater Planning: A Guidebook for British Columbia**<sup>1</sup> formalized a science-based understanding to set performance targets for reducing rainwater runoff volumes and rates. These targets represent the synthesis of biological and hydrological understanding.

The Guidebook was a direct outcome of the **SmartStorm Forum Series**<sup>2</sup> during the period 1998 through 2001. The SmartStorm Forum Series comprised events on Vancouver Island (Nanaimo), the Sunshine Coast (Sechelt), and Fraser Valley (Abbotsford and Pitt Meadows).

In turn, the Guidebook set in motion a chain of outcomes that has resulted in British Columbia being recognized internationally as a leader in implementing a natural systems approach to rainwater management in the urban environment. The Guidebook begat the web-based **Water Balance Model for British Columbia**<sup>3</sup> in 2003, which provided early credibility for the **Water Sustainability Action Plan for British Columbia**<sup>4</sup>, and also led to the formation of the **Green Infrastructure Partnership**<sup>5</sup> in 2003.

## When it was published in 2002, the Guidebook ...

- Provided
  - Direction
  - Science-based principles and objectives
  - Guidance on how to do integrated planning
- Introduced these core concepts:
  - Rainfall spectrum
  - The “retain, detain, convey” integrated strategy
  - Water balance methodology
  - Performance targets
  - A “learn by doing” framework

## The Guidebook is Structured in Three Parts

The Guidebook is structured to meet the information needs of different audiences: from senior managers and elected officials...to those professional planning and engineering staff who are tasked with implementing early action...to land developers and the consulting community. To provide for this range of audiences, the Guidebook is organized in three parts:

- **Part A: Why → The Problem and Principles:** written for senior managers, elected officials and those wanting a general introduction to integrated rainwater management.
- **Part B: What → The Solutions:** written mainly for engineers and planners, this part provides examples of how to achieve integrated rainwater management at both planning and site levels.
- **Part C: How → The Process:** written for administrators and the complete range of stakeholders who will be involved in making the move from planning to action, this part defines roles, methods, means and timing for integrated rainwater management.

For readers who are new to integrated rainwater/stormwater management, **Part A** is required reading.

Readers looking for a sense of what integrated rainwater/stormwater management means on the ground will enjoy the examples in **Part B**.

Those wanting to start or fund an integrated rainwater/stormwater management plan or program will find organizational advice in **Part C**.

The overall objective of the Guidebook is to offer a **common sense, effective and affordable approach** to integrated rainwater/stormwater management.

## Scope of Each Part

### Part A - Why Integrated Rainwater/ Stormwater Management?

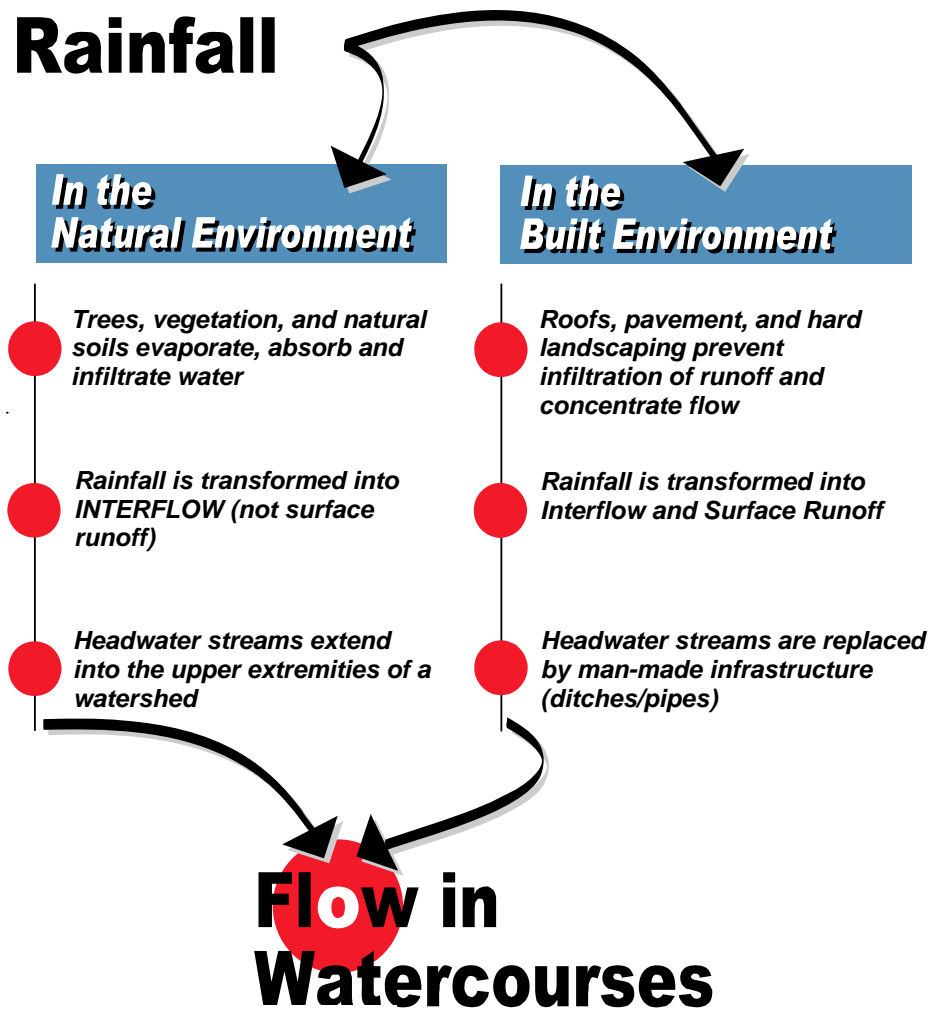
Part A identifies problems associated with traditional stormwater management and provides the rationale for a change from traditional to integrated rainwater/ stormwater management. Some guiding principles of integrated rainwater/ stormwater management are introduced.

Part A also builds a science-based understanding of how natural watersheds function and how this function is affected by land use change.

### Part B - Integrated Rainwater/ Stormwater Management Solutions

Part B outlines the scope and policy framework for integrated rainwater/ stormwater management, and presents a cost-effective methodology for developing rainwater/ stormwater solutions.

Integrated, or watershed-based, rainwater management recognizes the relationships between the natural environment and the built environment, and manages them as integrated components of the same watershed. Traditional drainage practice concentrated on peak flow rates and overlooked the importance of volume management. Integrated solutions manage both volume and flow rates.



## Part C – Moving from Planning to Action

Part C describes a process that will lead to better rainwater/stormwater management solutions.

The role and design of action plans are introduced to bring a clear focus to what needs to be done, with what priority, by whom, with related budgets.

Tips are provided on processes that produce timely and high-quality decisions.

Part C also provides guidance for organizing an administrative system and financing strategy for rainwater/stormwater management.

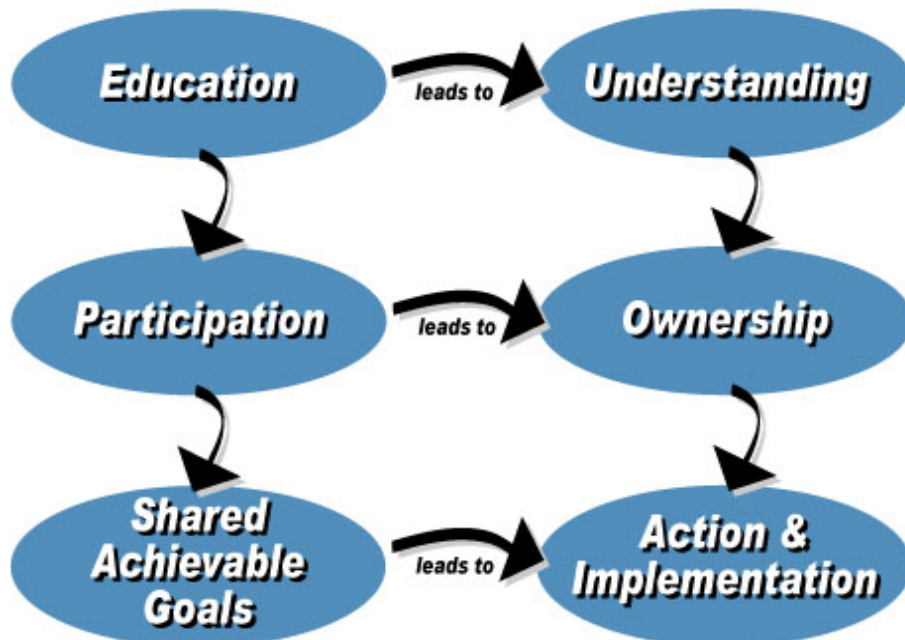
A final section on building consensus and implementing change describes how to develop a shared vision and overcome barriers to change.

**Building Consensus:** There are usually complex trade-offs involved in choosing the appropriate integrated solution. Many of the decisions about choice of solution require judgement – about public values and priorities, about the pace of change, and even about environmental conditions based on the currently available scientific information. Choices, especially, involve balance among competing objectives. The best way to find this balance is consensus.

The graphic below illustrates how education leads to implementation. The elements can be read in both the horizontal and vertical directions. Education leads to shared, achievable goals. In turn, these goals culminate in action and implementation.

Learning is a gradual process. Adults take in new information, reflect on it, blend it with their own experience, test it, and eventually apply it in making decisions.

# Building Consensus





## Managing the Rainfall Spectrum

The Guidebook formalized an *Integrated Strategy for Managing the Complete Spectrum of Rainfall Events* as the foundation for a "design with nature" approach to rainfall capture and runoff control.

The key to implementing the strategy is that most of the annual rain volume in British Columbia falls as *light showers*. Although daily rainfall amounts range from *light showers* to *heavy rain* to *extreme storms*, only a handful of long duration downpours occur in any year and extreme events are rare.

The Integrated Strategy is illustrated by the graphic below. This graphic encapsulates the Guidebook branding and is the defining image for the Guidebook.

The concepts and methodologies in the Guidebook were intended to stimulate a change in the mindset of practitioners and others, rather than cast in stone a set of prescriptive rules. A guiding principle is to design for the complete spectrum of rainfall events.

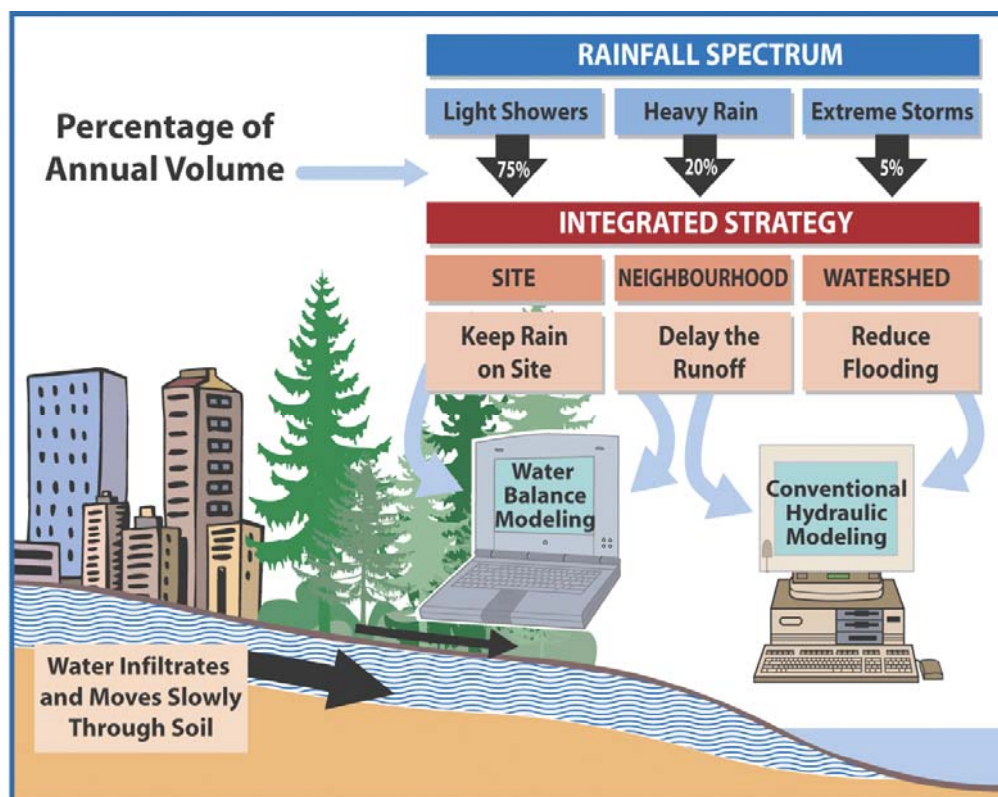
## Performance Targets

The Guidebook also introduced the concept of **Performance Targets**<sup>6</sup> to facilitate implementation of the **Integrated Strategy** for managing the complete rainfall spectrum. To create a mind-map for practitioners, the rainfall spectrum was defined in terms of three tiers, with each tier corresponding to a component of the integrated strategy, namely:

- **Rainfall Capture** - keep rain on site by means of 'rainfall capture' measures such as rain gardens and infiltration soakaways
- **Runoff Control** - delay overflow runoff by means of detention storage ponds which provide 'runoff control'
- **Flood Mitigation** - reduce flooding by providing sufficient hydraulic capacity to 'contain and convey'

Defining rainfall tiers simply enabled a systematic approach to data processing and identification of rainfall patterns, distributions and frequencies.

The Guidebook emphasizes that rainfall capture targets will depend on site and watershed-specific conditions.



## Adaptive Management

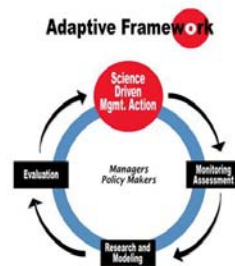
The Guidebook's premise that **land development and watershed protection can be compatible** represented a radical shift in thinking in 2002. The Guidebook recognized that local government has control over rainwater runoff volumes and rates through its infrastructure policies, practices and standards.

Prior to 2002, the lack of a science-based bridge meant there was a disconnect between policy objectives and site design practices. The Guidebook integrated breakthroughs in hydrological and biophysical understanding to bridge the gap between policy and site design.

The goal of **Adaptive Management**<sup>7</sup> is to learn from experience and constantly improve land development and rainwater management practices over time. This requires ongoing monitoring of demonstration projects to assess progress towards performance targets and the shared watershed vision.

Implicit in an adaptive management approach is recognition of the need to both **accept and manage risk** if the state-of-the-practice is to be advanced. Accepting risk opens the door to engineering creativity and resulting innovation.

The British Columbia Guidebook is a pioneer application in North America of 'adaptive management' in a local government setting, and reflects the understanding gained from a 1999 King County research project



Adaptive Management means we change direction when the science leads us to a better way



## Beyond the Guidebook

The Guidebook established the framework for rainfall capture and a performance target way-of-thinking and designing. The lasting impact of the Guidebook is that it changed how people view site development practices, and it got them thinking about how to change those practices for the better.

The Guidebook articulated a principle that performance targets at the watershed scale provide a starting point to guide the actions of local government in the right direction. An overarching objective is to translate those targets into appropriate site design criteria that then provide local government staff and developers with practical guidance for achieving the goal of stream protection.

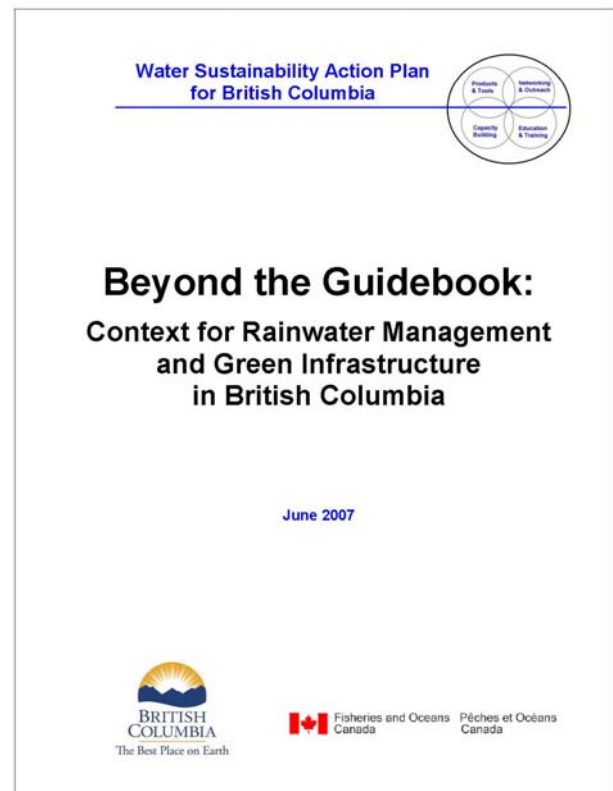
Now that practitioners are becoming comfortable with what 'rainfall capture' means in practice, local governments and the development community are in a position to turn their attention to what is an achievable outcome that makes sense and results in net environmental benefits at a watershed scale. **Beyond the Guidebook**<sup>8</sup> takes the Guidebook to the next level of evolution.

- *Beyond the Guidebook* is a runoff-based approach to urban drainage modeling that connects the dots between source control evaluation and stream health assessment. This approach is described as 'where science meets analysis' because **rainwater runoff volume management** is directly linked to **stream erosion** and **water quality**.
- The *Beyond the Guidebook* methodology allows practitioners to assess both site-level rainwater management measures AND flood relief projects so that they can develop a watershed approach that addresses stream protection and/or restoration. In the process, practitioners will view the watershed and its streams from a much more holistic perspective.

Through implementation of 'green infrastructure' policies and practices, the desired outcome in going *Beyond the Guidebook* is to apply what we have learned at the site scale over the past six years...so that we can truly protect and/or restore stream health in urban watersheds.

## The Guidebook's 'Build a Vision, Create a Legacy' paradigm means...

- Apply a science-based approach to create a shared vision of **achievable goals**
- Facilitate a **participatory decision process** to build stakeholder consensus and agree on expectations
- Obtain **commitment from everyone** to truly integrate RAINwater management with land development practices





## Developing and Implementing an Integrated Plan

In British Columbia, the term *Integrated Stormwater Management Plan* (ISMP) has gained widespread acceptance by local governments and the environmental agencies to describe a comprehensive approach to rainwater/stormwater planning.

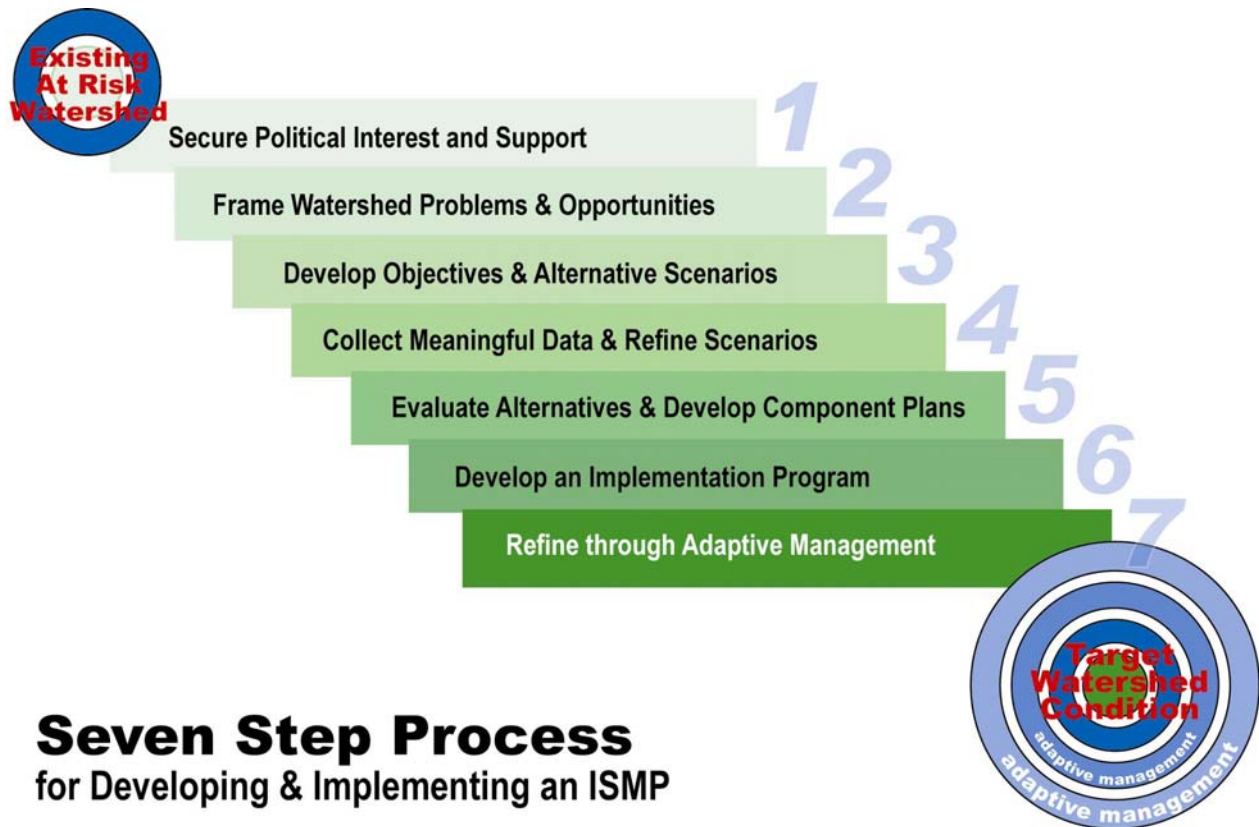
The purpose of an ISMP is to provide a clear picture of how to be proactive in applying land use planning tools to protect property and aquatic habitat, while at the same time accommodating land development and population growth.

Conventional 'flows-and-pipes' stormwater management is limited because it focuses only on the fast conveyance of the extreme storms and often creates substantial erosion and downstream flooding in receiving streams.

Similarly, a detention-based approach is only a partial solution because it allows the small storms that comprise the bulk of total rainfall volume to continue to create erosion and impacts on downstream aquatic ecosystems.

Neither of these approaches fully prevents the degradation of aquatic resources or flooding risks to property and public safety.

In contrast, the Guidebook approach is to eliminate the root cause of ecological and property impacts by designing for the complete spectrum of rainfall events. Solutions described in the Guidebook include conventional, detention, infiltration and re-use approaches for rainfall capture, runoff control and flood risk management.



## Greening of the Built Environment

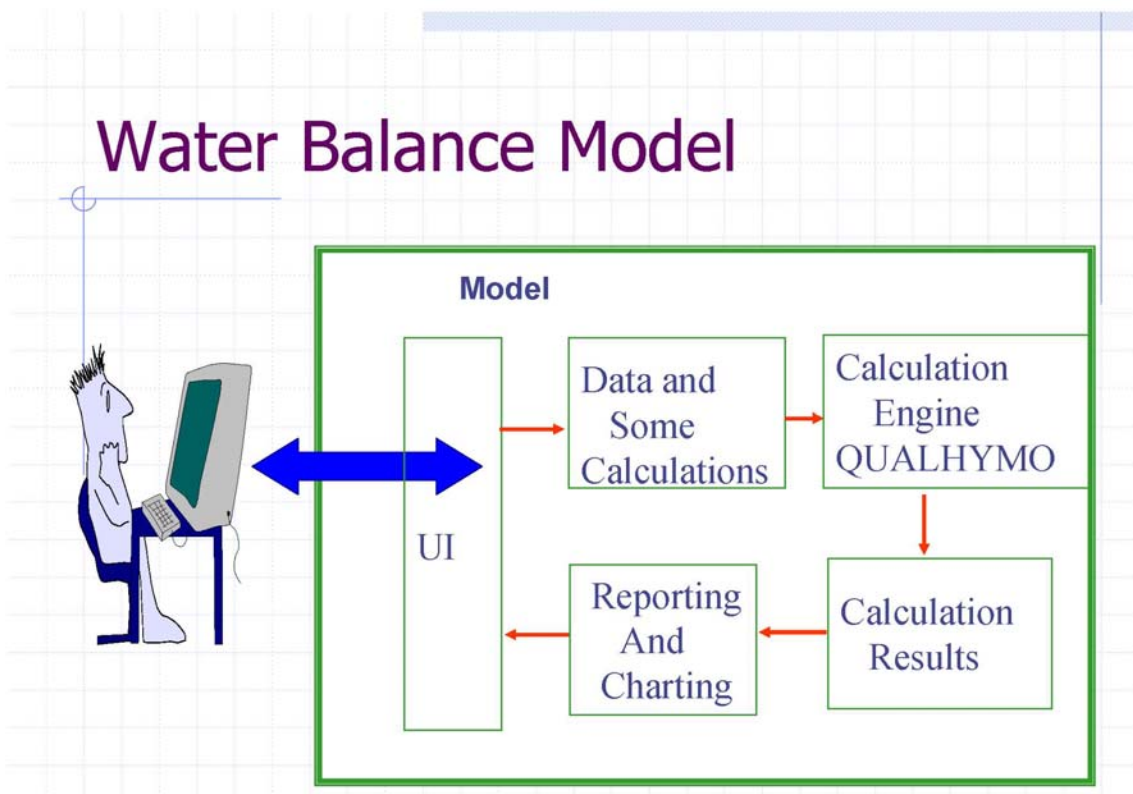
Two rainfall-runoff simulation models have been merged to create a single tool that integrates the site with the stream and watershed. The web-based **Water Balance Model for British Columbia** decision support tool was developed in 2003 as an extension of the Guidebook to promote rainfall capture, where rain falls. The new Water Balance Model integrates the powerful continuous hydrologic simulation capabilities of **QUALHYMO** (QUALity HYdrologic MOdel), while providing a standardized presentation of calculation results.

The tool demonstrates how to achieve a 'light hydrologic footprint'. The methodology embedded in the model enables a watershed target to be established; it also enables the user to assess how to meet the watershed target at the site scale. The significant benefit of the 'new Water Balance Model' is the resulting emphasis on strategy.

The 'new Water Balance Model' is a decision support and scenario modelling tool that is designed to bridge engineering and planning. The vision is that it will help communities create neighbourhoods that integrate both good planning and innovative engineering designs, for overall objectives of greater sustainability, such as:

- minimal environmental impacts,
- enhanced social values,
- economic stability, and
- recreational opportunities.

The 'new Water Balance Model' underpins **Beyond the Guidebook: The New Business As Usual<sup>9</sup>**, a provincial initiative to advance improved land use planning practices and to influence the greening of the built environment. Appendix A elaborates on this initiative.



**Appendix A**  
**Effective Municipal**  
**Rainwater/Stormwater Management**

## **Commentary on Effective Municipal Rainwater/Stormwater Management and Green Infrastructure to Achieve Watershed Health**

The *Local Government Act* vests the responsibility for drainage with municipalities, and British Columbia case law makes clear the responsibility of municipalities to manage runoff volume to prevent downstream impacts. An increasingly important corollary to that responsibility is the need to work from the regional down to the site scale, to maintain and advance watershed health to ensure that both water quantity and quality will be sustained to meet both ecosystem and human health needs.

The *Local Government Act* empowers municipalities with extensive and very specific tools to proactively manage the complete spectrum of rainfall events. These tools enable them to achieve watershed goals and objectives that are established under Integrated Stormwater Management Plan (ISMP) processes.

The Ministry of Community Services is the lead Ministry for rainwater management and green infrastructure; and has a mandate to leverage the Green Communities Project to advance implementation of green infrastructure province-wide. To influence the greening of the built environment, Ministry policy is that “*today’s expectations are tomorrow’s standards*”.

*Beyond the Guidebook: The New Business As Usual* (2007), (available at [www.waterbalance.ca](http://www.waterbalance.ca)), builds on *Stormwater Planning: A Guidebook for British Columbia* (2002) and provides key guidance to the new provincial approach. Validated through Metro Vancouver pilots, *Beyond the Guidebook* advances a performance target methodology for correlating green infrastructure effectiveness in protecting stream health. This initiative incorporates lessons learned over the past six years in order to help municipalities establish what performance targets makes sense at the site, catchment and watershed scales.

Now that prerequisite tools and resources exist, a key to success of ISMPs in meeting the goal of maintaining or improving watershed health as communities grow and redevelop will be the effective integration of rainwater management techniques and green infrastructure in land use planning, plus follow-through upon ISMP implementation, integrated from the regional down to the site scale.

Strategies for integrating drainage actions with other policy and actions, to be truly effective, include:

- Identification and protection of natural green infrastructure (green space and Environmental Sensitive Areas) that performs multiple services
- Reduction of watershed load through effective land use planning and urban containment
- Incorporation and retrofitting of engineered green infrastructure technologies into development plans
- Use of the *Water Balance Model powered by QUALHYMO* to set performance targets at the site, catchment and watershed scales
- Adjustment of bylaws and policies to support objectives and desired outcomes
- Plan performance monitoring and follow-up to adapt and adjust to lessons learned
- Budgeting that anticipates administrative and operations support

A desired outcome is to create neighbourhoods that integrate good planning and innovative engineering designs, for overall greater environmental, social and economic sustainability.



Through an integrated planning process, Table 1 below identifies actions that can be taken by municipalities to create liveable communities and protect stream health.

**Table 1 – Framework for Moving from Planning to Action**

Action	Level of Commitment
Complete and implement integrated rainwater/stormwater management plans that are <b>affordable and effective</b> in protecting Watershed Health	<ul style="list-style-type: none"> <li>Municipalities develop ISMPs that enable implementation of integrated strategies for greening the built environment; and include establishing watershed-specific runoff targets (for managing the complete rainfall spectrum) that make sense, meet multiple objectives, are affordable, and result in net environmental benefits at a watershed scale.</li> </ul>
	<ul style="list-style-type: none"> <li>Municipalities establish watershed targets that are characteristic of actual conditions in watersheds, recognizing that there will be different strategies for already developed versus partially developed watersheds</li> </ul>
	<ul style="list-style-type: none"> <li>Municipalities evaluate the acceptability of watershed-specific runoff targets on the basis of an evaluation framed by these three questions:               <ol style="list-style-type: none"> <li>1. What target will achieve the watershed health objective?</li> <li>2. What needs to be done to make the target achievable?</li> <li>3. Do the solutions meet the test of affordability and multiple objectives?</li> </ol> </li> </ul>
	<ul style="list-style-type: none"> <li>Municipalities implement green infrastructure solutions that result in effective rainfall management at the site, catchment and watershed scales.</li> </ul>
Embed ISMP strategies in neighbourhood concept plans	<ul style="list-style-type: none"> <li>Municipalities develop rainwater/stormwater and land use plans through an inter-departmental process that is collaborative and integrated.</li> <li>Municipalities provide guidance as to how watershed-specific targets can be met at the development scale.</li> </ul>

The **Water Balance Model powered by QUALHYMO** is a public domain, on-line decision support and scenario modeling tool for promoting rainwater management and stream health protection through implementation of "green" development practices. This tool demonstrates how to achieve a 'light hydrologic footprint', and will help build bridges between planners and engineers; and underpins *Beyond the Guidebook: The New Business As Usual*.

The methodology embedded in the *Water Balance Model powered by QUALHYMO* enables a watershed target to be established; it also enables the user to assess how to meet the watershed target at the site scale. Accompanying this commentary is a paper titled *Beyond the Guidebook: Establish Watershed-Specific Runoff Capture Performance Targets* that was released at the 2008 Water Balance Model Partners Forum.

Prepared by the Green Infrastructure Partnership  
with the support of the Inter-Governmental Partnership,  
March 2008

**Appendix B**  
**Resources downloadable**  
**from [waterbalance.ca](http://waterbalance.ca)**  
**and [waterbucket.ca](http://waterbucket.ca)**

## Resources downloadable from [waterbalance.ca](http://waterbalance.ca) and [waterbucket.ca](http://waterbucket.ca)

- **Stormwater Planning: A Guidebook for British Columbia**, published by the Province in 2002
- **Stormwater Source Control Design Guidelines 2005**, published by the Greater Vancouver Regional District in April 2005
- **Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia**, published by the Ministry of Environment in March 2006
- **The Green Infrastructure Guide: Issues, Implementation Strategies and Success Stories**, published by West Coast Environmental Law in 2007
- **Beyond the Guidebook: Context for Rainwater Management and Green Infrastructure in British Columbia**, jointly released by the Green Infrastructure Partnership and Inter-Governmental Partnership in June 2007
- **Integration of Rainwater Management & Green Infrastructure in British Columbia; The Province's Perspective**, presentation by Chris Jensen (Ministry of Community Services) at the Beyond the Guidebook Seminar in November 2007
- **Moving from Stormwater Management to RAINwater Management: A Federal Fisheries Perspective**, presentation by Corino Salomi (Fisheries & Oceans Canada) at the Beyond the Guidebook Seminar in November 2007
- **Beyond the Guidebook: Why the Water Balance Model Powered by QUALHYMO**, presentation by Jim Dumont (Engineering Applications Authority, QUALHYMO Integration Project Team) at the Beyond the Guidebook Seminar in November 2007
- **Beyond the Guidebook: Establish Watershed-Specific Runoff Capture Performance Targets**, released by the Inter-Governmental Partnership in February 2008

### These footnotes provide links to web resources referenced in this document:

From page 1:

<sup>1</sup> <http://www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html>

<sup>2</sup> <http://www.waterbucket.ca/gi/index.asp?sid=61&id=288&type=single>

<sup>3</sup> <http://www.waterbalance.ca/>

<sup>4</sup> [http://www.waterbucket.ca/cfa/index.asp?type=summary&section=Water\\_Sustainability\\_Action\\_Plan&sid=4](http://www.waterbucket.ca/cfa/index.asp?type=summary&section=Water_Sustainability_Action_Plan&sid=4)

<sup>5</sup> <http://www.waterbucket.ca/gi/index.asp?sid=5&id=13&type=single>

<sup>6</sup> <http://www.waterbucket.ca/rm/index.asp?sid=42&id=259&type=single>

From page 4:

<sup>7</sup> <http://www.waterbucket.ca/rm/index.asp?sid=16&id=332&type=single>

From page 5:

<sup>8</sup> <http://bc.waterbalance.ca/index.asp?type=single&section=Guidance%20Documents&sid=14&id=34>

From page 8:

<sup>9</sup> <http://bc.waterbalance.ca/index.asp?type=single&section=Events&sid=17&id=84>