


Centre for Water Resources Studies  
At Dalhousie University  
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## Water Sustainability & the Water Balance Model: Advancing Inter-Provincial Partnerships

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Water Sustainability Action Plan for British Columbia



## Think Outside the Pipe!

Key Message:  
Return Rainwater Runoff to Natural Pathways

# from Stormwater Management to Rainwater Management

## From TRADITIONAL to

- Drainage Systems
- Reactive (Solve Problems)
- Engineer-Driven
- Protect Property
- Pipe and Convey
- Limited Consultation
- Local Government Ownership
- Extreme Storm Focus
- Peak Flow Thinking!

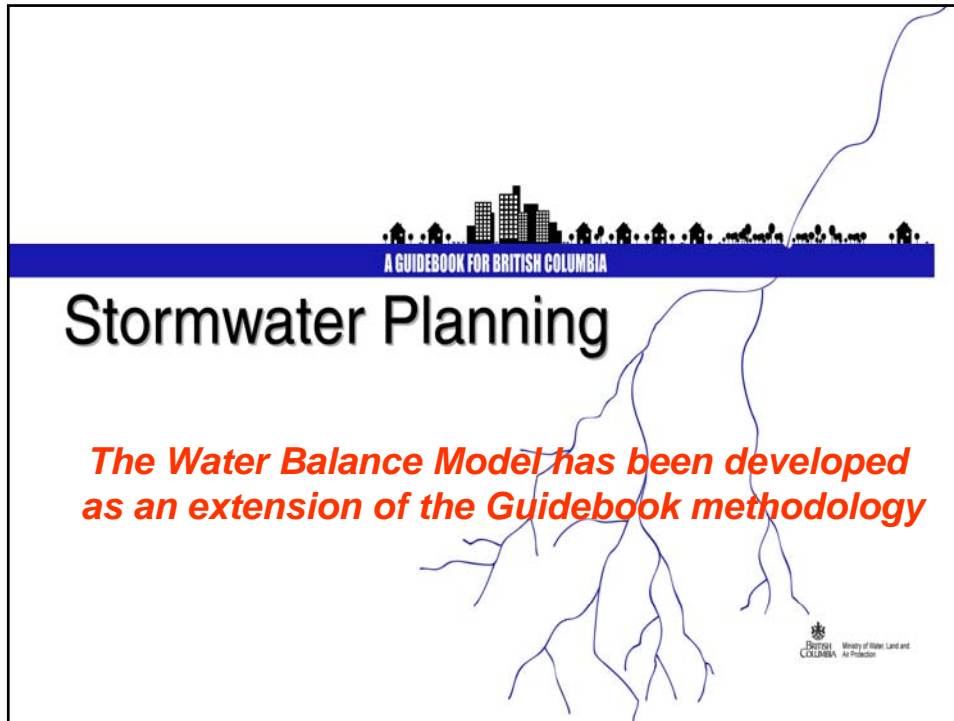


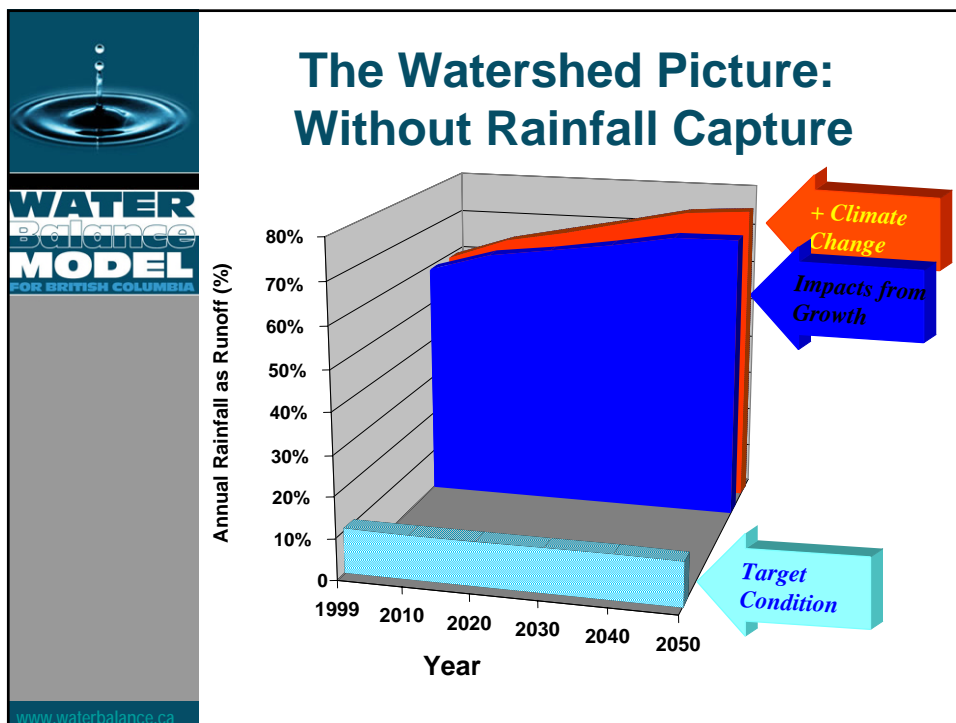
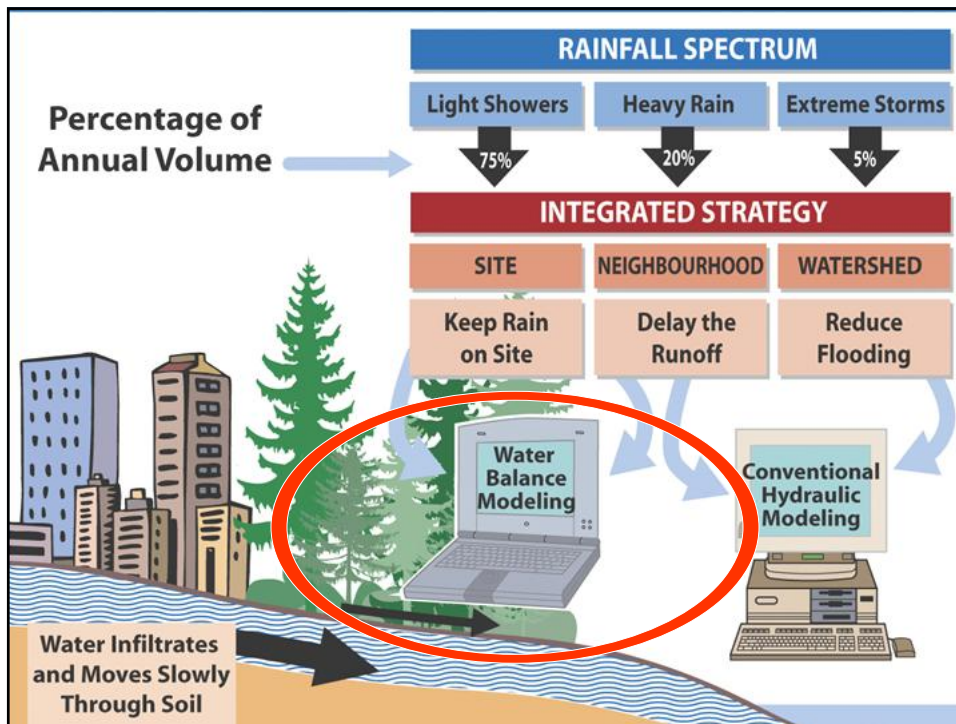
## INTEGRATED:

- Ecosystems
- Proactive (Prevent Problems)
- Interdisciplinary Team-Driven
- Protect Property *and* Habitat
- Mimic Natural Processes
- Extensive Consultation
- Partnerships with Others
- Rainwater Integrated with Land Use
- Volume-Based Thinking!

## Mind Map

- 1. Provincial Guidebook**
- 2. Changing Paradigms**
- 3. The Science**
- 4. Action Plan Context**
- 5. Model Evolution**
- 6. Designing With Nature**





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Andy Reese

**“Do you know where you really are in the shifting paradigms of stormwater management?”**

1. Run it in Ditches
2. Run it in Pipes
3. Run it in Stormwater Pipes
4. Keep it from Stormwater Pipes
5. Well, Just Don't Cause Flooding
6. Oh, and Don't Pollute Either
7. It's the Ecology, Stupid
8. Water is Water is Watershed
9. Green and Bear It

**10. Build the Vision, Create the Legacy**

### Municipal Storm Water Management



Thomas N. Debo  
Andrew J. Reese



## Building a Vision & Creating a Legacy

- **Issue:** How We Manage Population Growth
- **Impact:** Growth Resulting in Urban Densification (Land Constraints; Smaller Lots)
- **Sustainability:** *Means Design with Nature*
- **Built Environment:** We Can Improve It
- **Natural Environment:** We Can Protect It
- **Cumulative Benefits:** Accrue Over Time
- **Outcome:** Sustain Community Livability

## Drainage Planning in BC Has Been Evolving Over the Decades

- 1960s: Pipe and Remove
- 1970s: Detain Peak Flows
- 1980s: Reactive Mitigation
- 1990s: Stream Stewardship  
(Proactive Management)
- 2000s: Rainwater Management  
(Sharing a Vision)

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## IMPACT OF CHANGES IN HYDROLOGY ON WATERCOURSE EROSION AND BASE FLOW RELATIONSHIPS (WITHOUT BEST MANAGEMENT PRACTICES)

### Why Manage Volume

**Erosion**

**Sedimentation**

The Mean Annual Flood (MAF) is the 'channel-forming event'

When the MAF increases, the channel erodes to convey the additional volume

A consequence of channel instability is habitat degradation

**INCREASING URBANIZATION (NO BEST MANAGEMENT PRACTICES)**

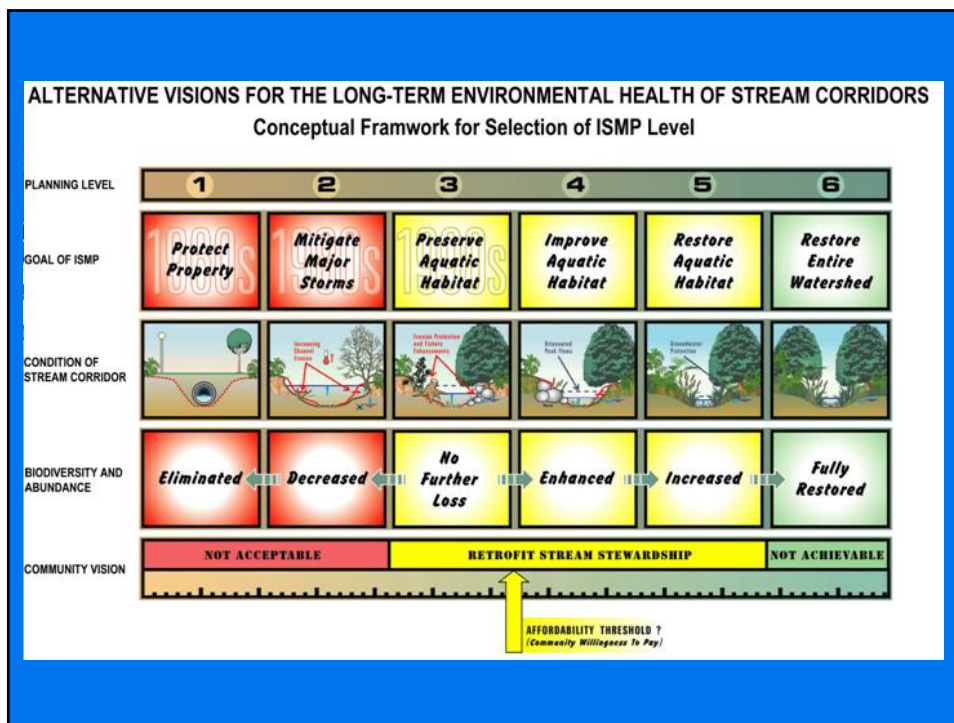
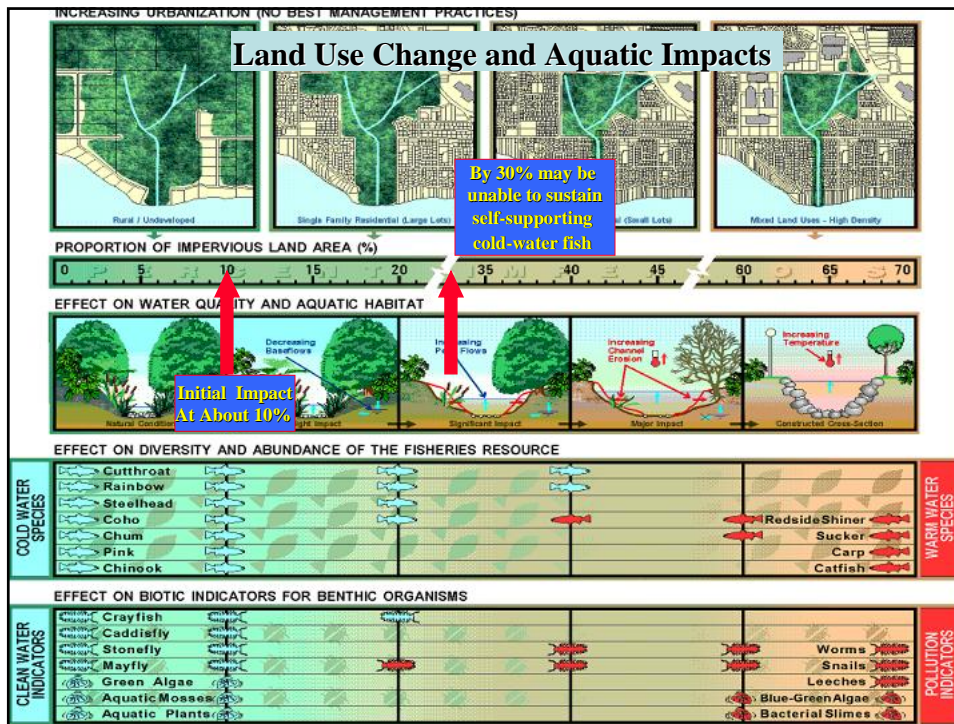
PROPORTION OF IMPERVIOUS LAND AREA (%)

EFFECT ON TYPICAL YEAR HYDROGRAPH

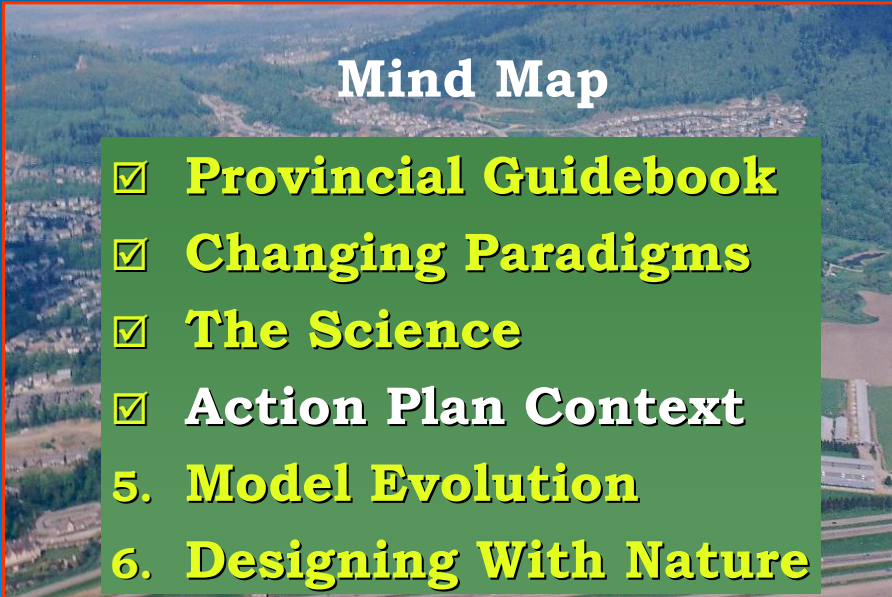
EFFECT ON WATERCOURSE EROSION

NUMBER OF STORM EVENTS AT OR ABOVE PREDEVELOPMENT MEAN ANNUAL FLOOD

RATIO OF MEAN ANNUAL FLOOD TO WINTER BASE FLOW








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## The Water Balance Model is the result of a Building Block Process:


**WATER**  
Balance  
**MODEL**  
FOR BRITISH COLUMBIA

Stormwater Planning:  
A Guidebook for British Columbia

GVRD Report on Stormwater  
Source Control Evaluation

Chilliwack Policy & Design Manual  
for Surface Water Management

*UniverCity:*  
The Sustainable Community at the  
Top of Burnaby Mountain



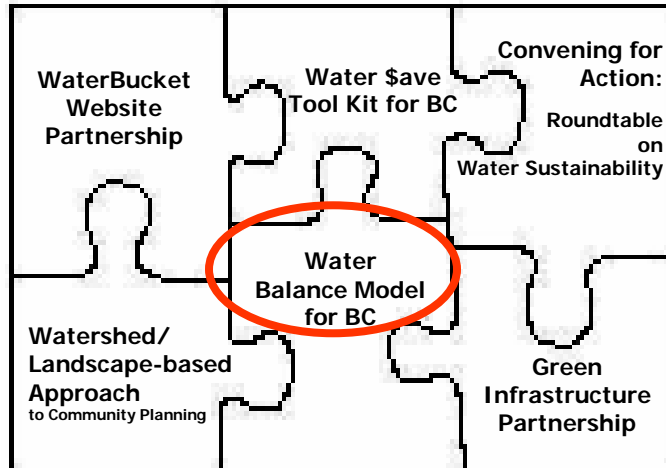
[www.waterbalance.ca](http://www.waterbalance.ca)



**WATER  
balance  
MODEL**  
FOR BRITISH COLUMBIA

[www.waterbalance.ca](http://www.waterbalance.ca)

...and is also the centrepiece of the  
**Water Sustainability Action Plan for  
British Columbia:**



## The Water Sustainability Action Plan for BC....

... provides a partnership umbrella for  
implementing water stewardship and  
sustainable community design *on-the-ground*



*waterbucket.ca* is the communication vehicle for the Action Plan




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## 6. Designing With Nature

BRITISH COLUMBIA

**Partners**



City of Chilliwack

Visit  
City of Chilliwack

**Events**

Jun 2005


Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4		
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Add an event

**Poll**

A poll is not available

Home About this Site



**TRY THE MODEL**


1. Enter the area of your site, add existing soil conditions, and land use information.
2. Create a graph of rainwater volume summaries and see how well your site performs.
3. Add a Green Roof or a Rain Garden or similar rainwater source control and compare before and after results.

**Key Message:**  
Anybody with a computer and internet connection can access the model

primary purpose is to provide province-wide guidelines for the maintenance of environmental values .....More

[www.waterbalance.ca](http://www.waterbalance.ca)

Adapting the Australian Experience

WSUD: 

BASIC PROCEDURES FOR SOURCE CONTROL OF STORMWATER

**Organizations**

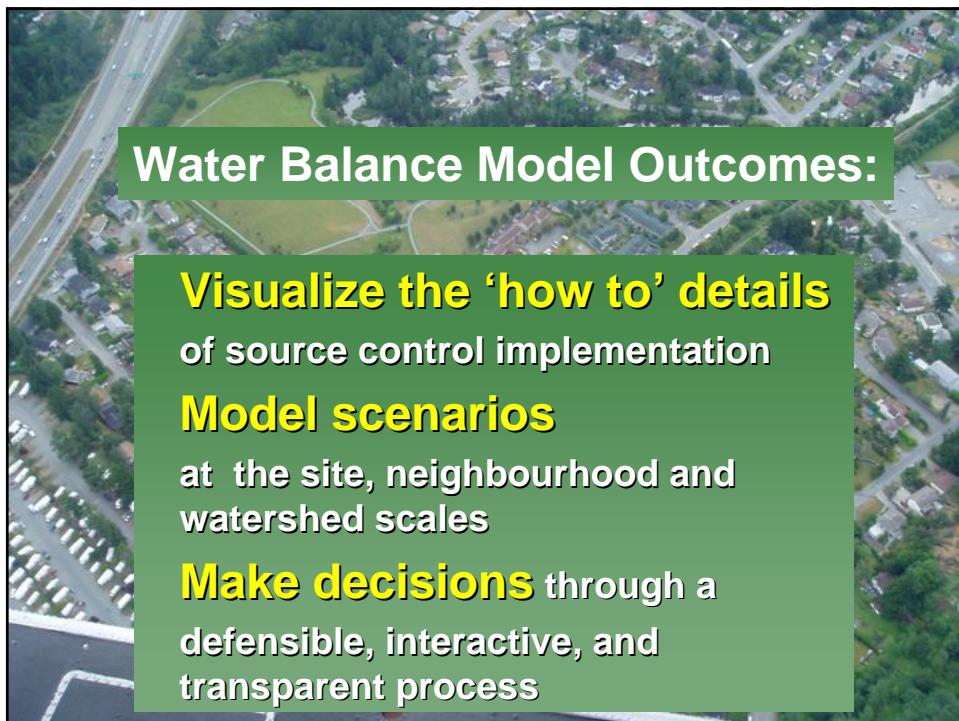
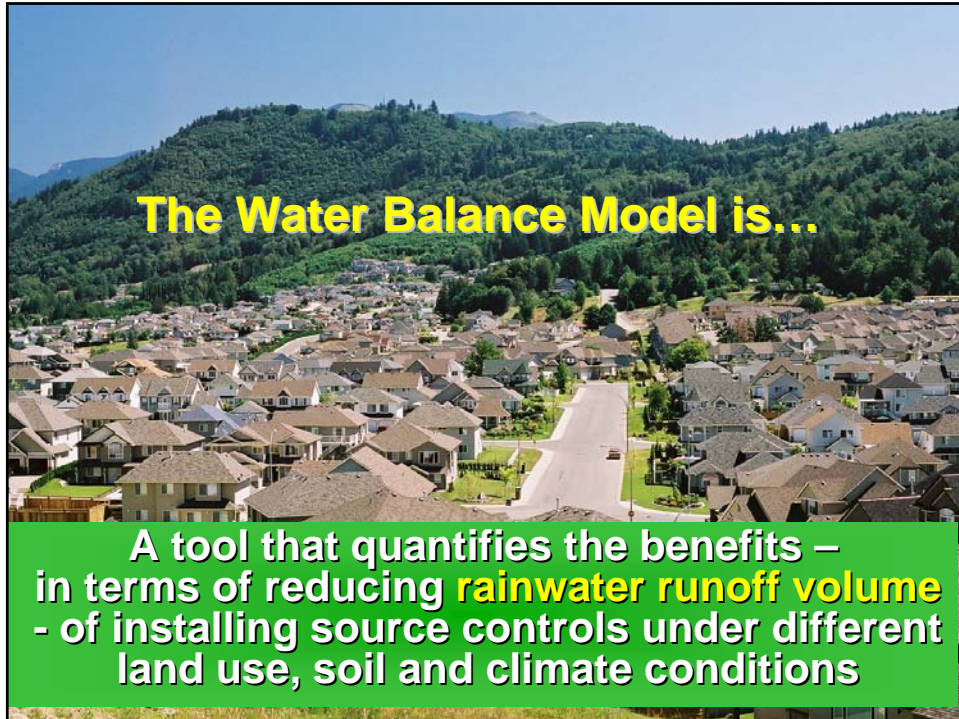
Recent Additions...

[British Columbia Ground Water Association](#)

[Canadian Water Resources Association](#)

The Canadian Water Resources Association is a national organization of individuals and organizations interested in the management of Canada's water resources. The membership of the Association is composed of private and public sector water resource professionals including managers, administrators, scientists, academics, students and users. It has branch organizations in eight provinces and members throughout Canada and beyond.

[Watershed Report Card](#)

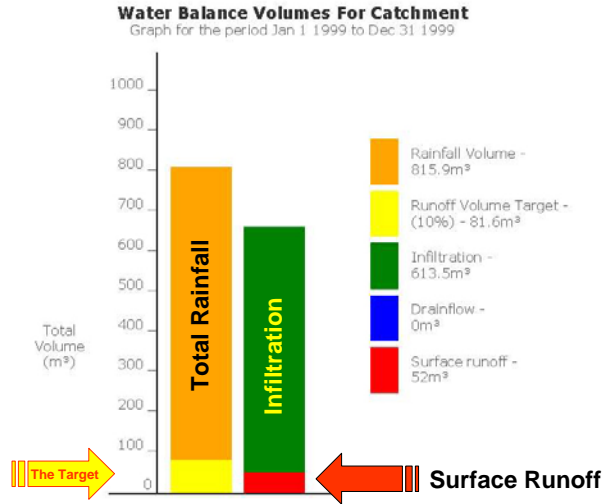




**WATER**  
Balance  
**MODEL**  
FOR BRITISH COLUMBIA

www.waterbalance.ca

## It enables users to test the achievability of Performance Targets



**WATER**  
Balance  
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## Inter-Governmental Partnership: Vision

To promote changes in land development practices so that:

- The built environment will preserve and/or restore the natural water balance over time
- Performance targets will be achieved for rainwater runoff volume and flow rate reduction at the source, *where rain falls*



## Inter-Governmental Partnership: Key Partnerships

Real Estate Foundation of BC  
Urban Development Institute  
BC Water and Waste Association  
APEGBC



[www.waterbalance.ca](http://www.waterbalance.ca)



Having an Internet-accessible tool:

- Increases opportunities to promote widespread use
- Results in greater need to provide training in its use



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*Balance*  
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## Inter-Governmental Partnership: Outreach & Continuing Education Program

The program has comprised sessions for:

- Elected Officials
- Local Government Staff
- Development Community
- Municipal Advisory Committees
- Community Stewardship Groups
- Professional Associations

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## **‘Design with Nature’ Means:**

- Develop compact, complete communities
- Increase transportation options
- Reduce the loads on water, waste and energy systems
- Protect and restore urban greenspace
- Strive for a lighter ‘hydrologic footprint’
- Achieve higher levels of stream protection



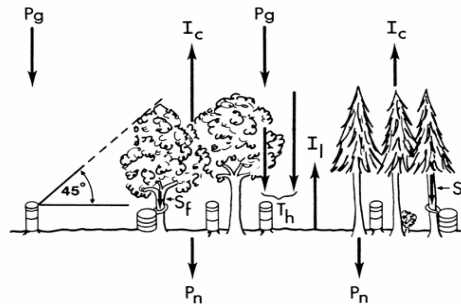
**How Water Moves Through Soil**



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A **Tree Canopy Module** has been developed through a 3-way partnership with the **University of British Columbia** and the **Urban Forest Research Center** at the University of California (Davis)



Interception total  $I = I_c + I_u$   
The amount reaching the forest floor  $= T_n + S_f$   
Interception by canopy (overstory + understory)  $I_c = P_g - T_n - S_f$   
Net precipitation  $P_n = T_n + S_f - I_u$

## Water Balance Model promotes Integration of Perspectives

- **Planners:** Tool for Better Use of Space
- **Engineers:** Tool for Pre-Design
- **Landscape Architects:** Tool for Green Solutions
- **Ecologists:** Tool for Watershed Function
- **Educators:** Tool for Social Marketing



## Simplifying the Technical Language!

### Basic Source Control Types:

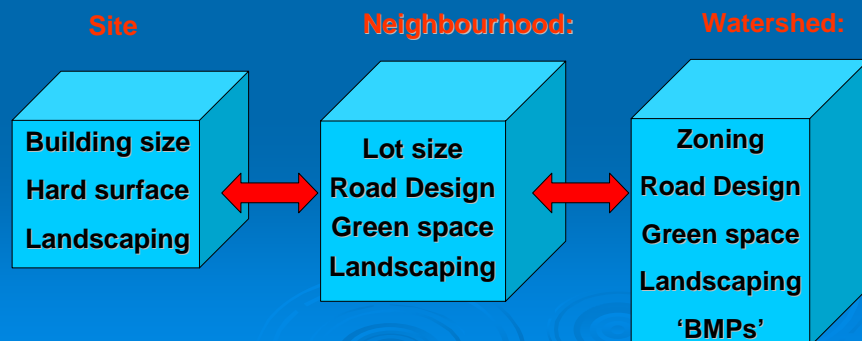
- Absorbent Landscape
- Rain Gardens
- Infiltration Swales
- Pervious Paving
- Green Roof

[www.waterbalance.ca](http://www.waterbalance.ca)

## How the Water Balance Model can be used to make better decisions:

- **Local Governments** - when communicating with the public
- **Planners and Engineers** – when setting performance targets
- **Developers and their Consultants** - when testing scenarios
- **Environmental Agencies** - when monitoring watershed health

## Key Message: Integrate Actions at Three Scales: Improve Site Practices to Enhance Community Livability



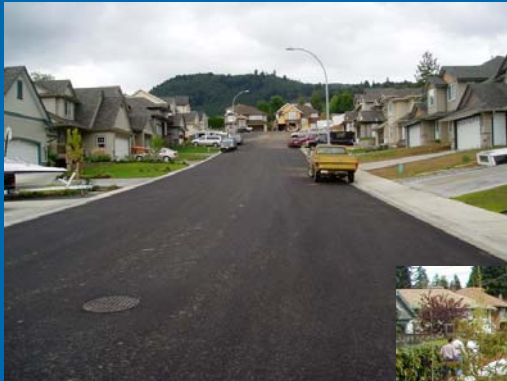


### Chiliwack's Landscaping Requirements Can Also Accommodate Infiltration

Land Use Little area is needed for source control infiltration. The galleries can be installed under landscape or asphalt parking.	Percentage of Land Needed for Infiltration	
	Deep Infiltration Systems	Shallow Infiltration Systems
<b>Commercial / Industrial</b>	2.5%	6.7%
<b>Institutional</b>	2.2%	5.3%
<b>Residential – Low Density</b>	1.4%	3.1%
<b>Residential – Medium/High Density</b>	2.3%	6.3%







**Livability and Streetscape Design:  
We Have Choices:  
An Example**

**Will Streets Be  
Sterile and Uninviting,  
Or Green and Inviting?**



City of Seattle  
Street Edge Alternatives Program



**WATER  
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**Coming Next Year.....**

**Integration with QUALHYMO**

will provide engineers with “one-stop shopping” for:

**Rainwater Storage Routing**

**Water Quality**

**Stream Erosion**

**Drainage Area Flow Routing**

**Snowmelt Runoff**



