



Rainwater Management

Beyond the Guidebook

Summary

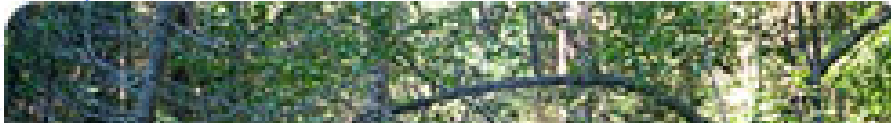
- ◆ Goal

- ◆ Guides

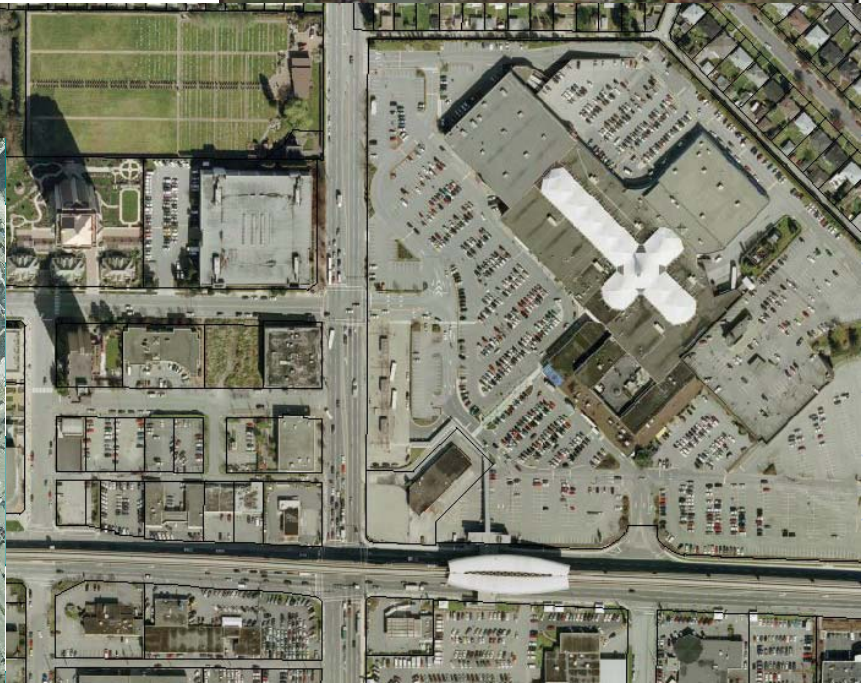
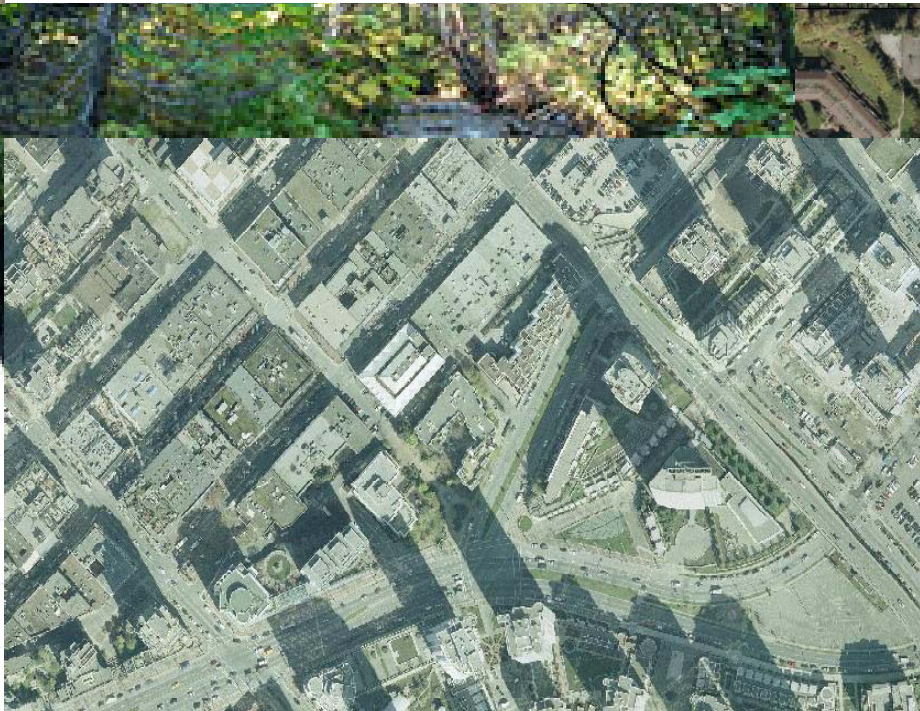
- ◆ Beyond the Guidebook

- The Water Balance Model
- New tools

Goal



No impact results from development



Guides

- ◆ Criteria have been documented in
 - Land Development Guidelines for the Protection of Aquatic Habitat, 1992
 - Stormwater Planning, A Guidebook for British Columbia, (2002)
 - Urban Stormwater Guidelines And Best Management Practices For Protection Of Fish And Fish Habitat, Draft Discussion Document, Revision 4, (Date ?)

Guidebook

◆ Guide – FOR SITE LEVEL

◆ Provides

- Direction
- Guidance on how to do SWM planning
- Design principles
- Outline of objectives

◆ Introduces

- Detain, Retain, Convey
- Mean Annual Storm (MAS)

DFO Guideline

- ◆ “Runoff will be modelled using continuous simulation”
- ◆ “Single event models are acceptable for preliminary sizing of BMP’s and conveyance systems if multiple event scenarios are modelled”

To Date

- ◆ Focus on rainfall
- ◆ Many documented issues with these methodologies
- ◆ Opportunity to follow DFO guidance
- ◆ “Go Beyond the Guidebook”

A New View

- ◆ A more scientific approach
- ◆ Clearly defined causes and effects
- ◆ Logical and easy to use
- ◆ Includes DFO wish and direction for continuous simulation
- ◆ Evaluate watersheds and the STREAM

Runoff Basis

- ◆ Flow duration for habitat availability
- ◆ Tractive force to measure erosion
- ◆ Sediment washoff for water quality
- ◆ Optimize systems to manage the impacts of the altered hydrologic cycle

Modelling Approach

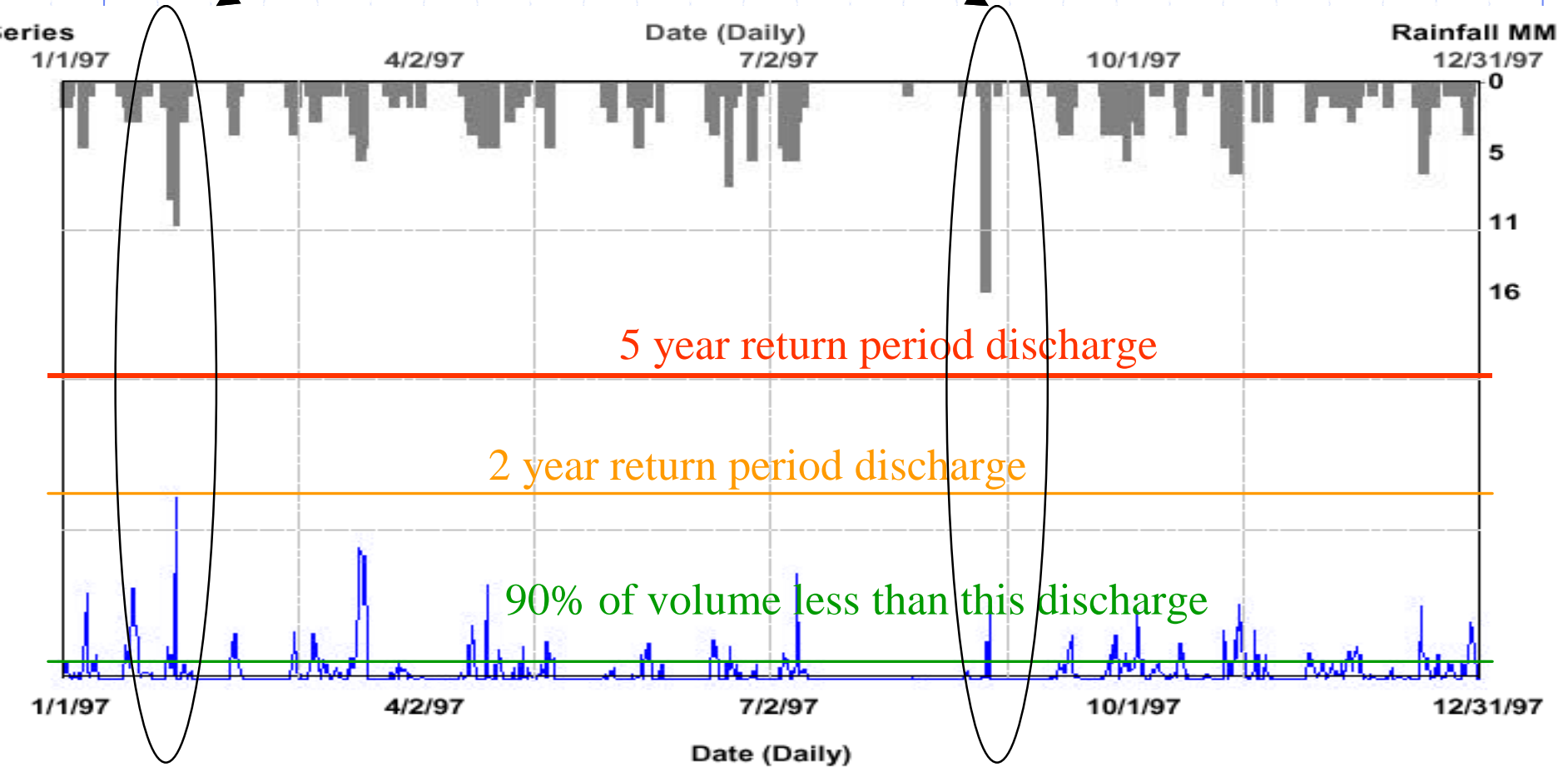
- ◆ Continuous simulation – Runoff Basis
- ◆ **Test** mitigation works **prior** to construction
- ◆ Can be used to assess stream impacts

Continuous Modelling

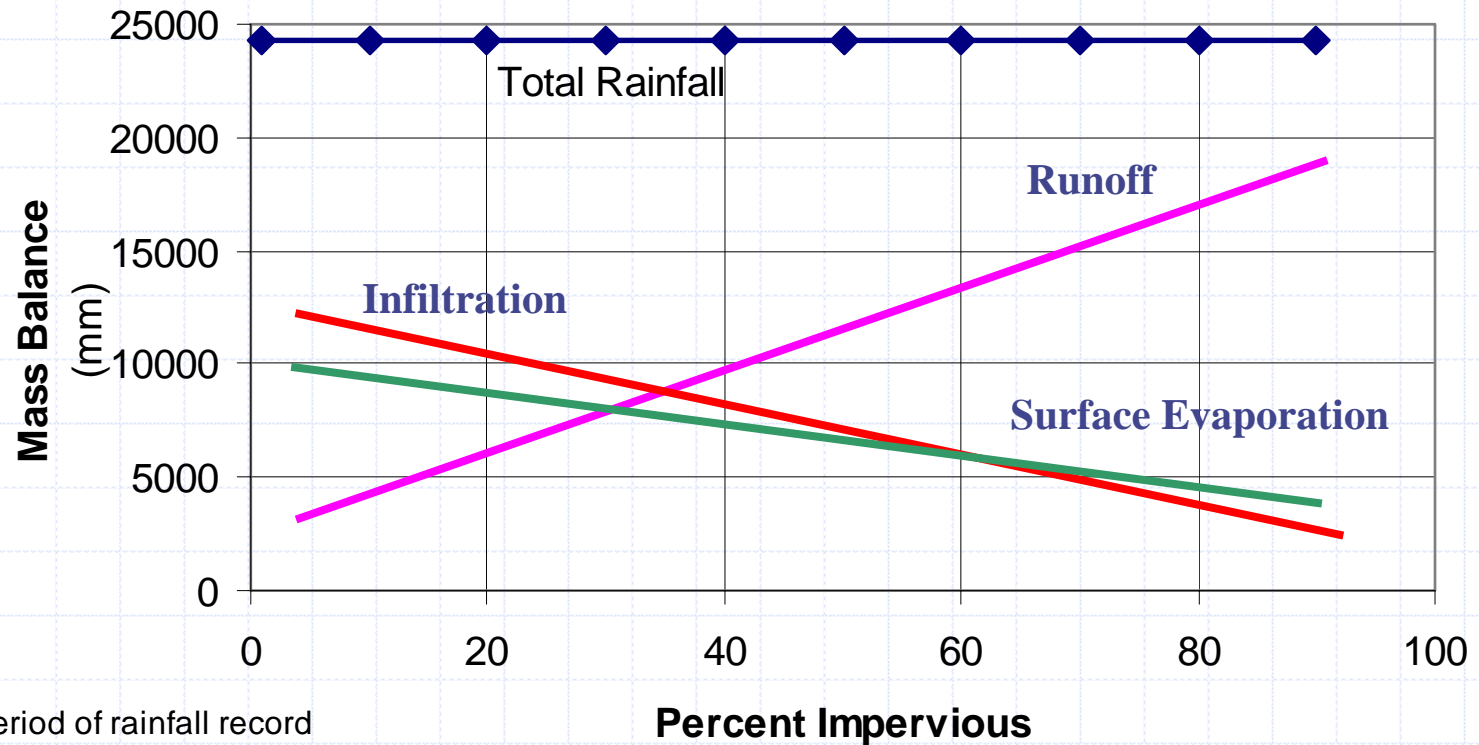
- ◆ Long regarded as too costly
- ◆ What is the issue / problem?
 - Modelling process is easy
 - Volume of information is large
 - Extracting and evaluating results can be difficult
- ◆ Solution – new information post processing methods and tools

Typical Year

Compare these two storm events



Hydrologic Change



Period of rainfall record
1982 through 1999

Percent Impervious

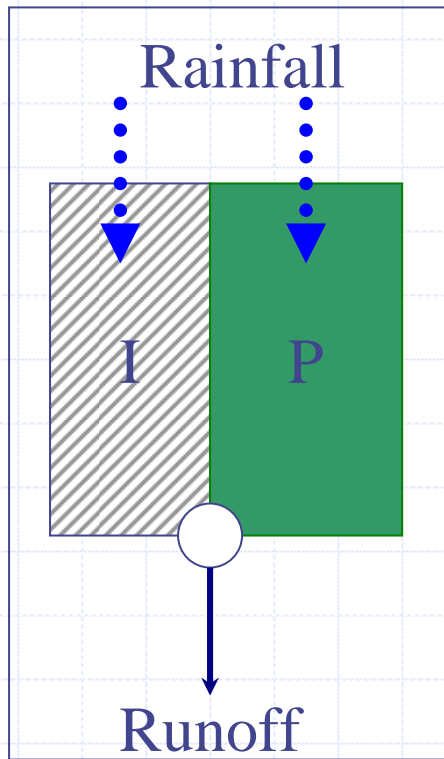
Duration of Discharge

- ◆ Critical to aquatic health
 - Durations are linked to stream health
- ◆ It can be measured and verified
- ◆ Computer simulations for duration of:
 - Flood discharges
 - Base flows
 - Fish habitat availability (depth vs duration)

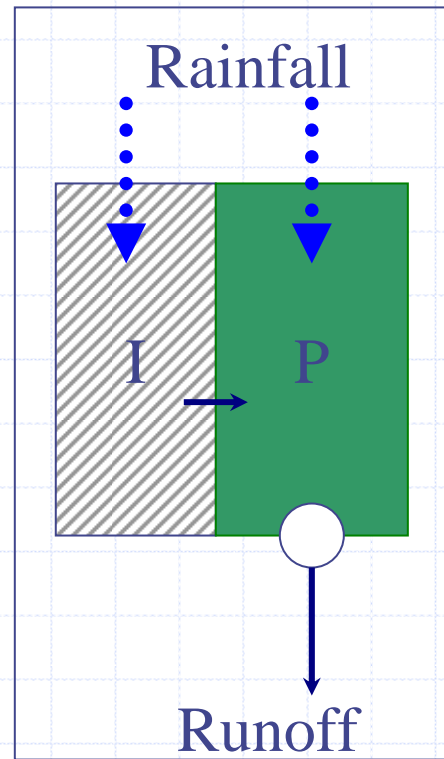
Beyond the Guidebook

- ◆ Where science meets analysis
- ◆ Where the WBM is going
 - Providing the new evaluation tools
- ◆ Evaluate
 - Site
 - Watershed
 - Stream

Model Surface Changes



Typical Model



Some Models

Surface Alterations can reduce runoff volumes.
Change:

- Imperviousness
- Surface roughness
- Infiltration rates
- Soil moisture reservoir

Existing WBM

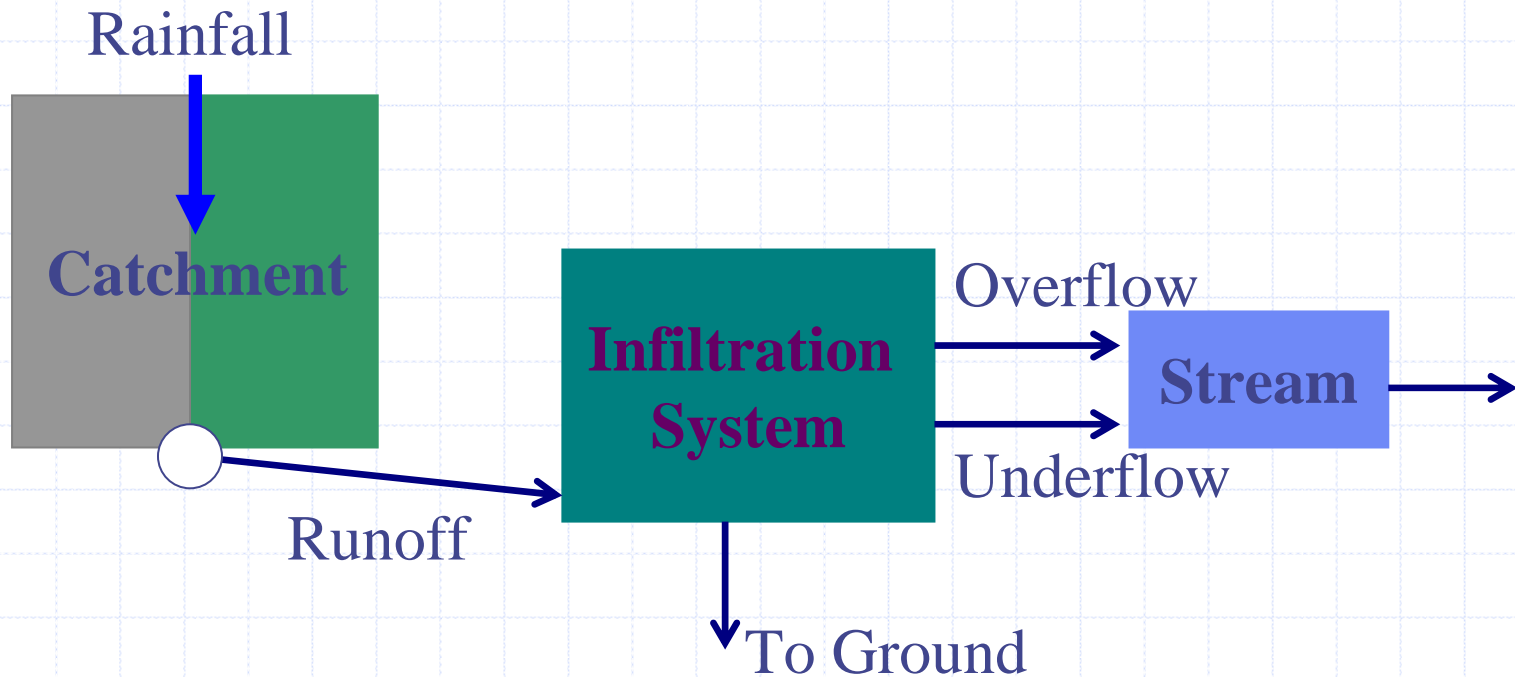
Surface Change BMP

◆ Absorbent Landscapes

- Tree cover density
- Increased top soil depth
- Porous pavement
- Green Roof – Typical
- Some infiltration swales – without storage

Infiltration Systems

- ◆ Happens after runoff occurs
- ◆ New WBM



Infiltration System BMP

- ◆ Capture surface runoff and STORE it
- ◆ Infiltration for volume reduction
 - Rain gardens
 - Infiltration swales with storage
 - ◆ Surface or subsurface storage
 - Infiltration ponds
 - Underground galleries

Analysis Results

- Beyond the Guidebook

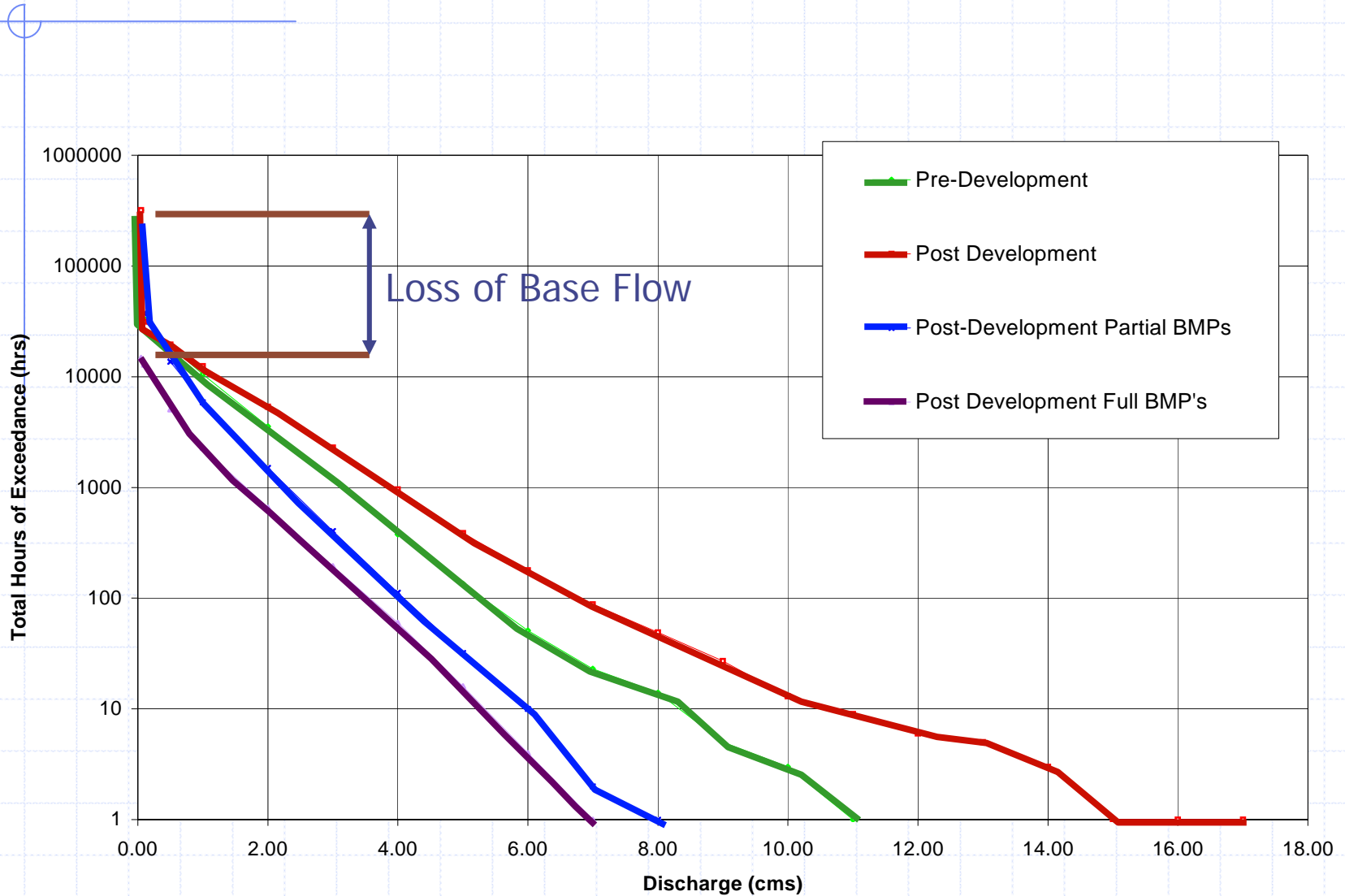
- ◆ Hydrologic Changes

- ◆ Flow Exceedance / Duration

- ◆ Potential Stream Erosion

- ◆ Stream Water Quality

Exceedance - Fergus Creek

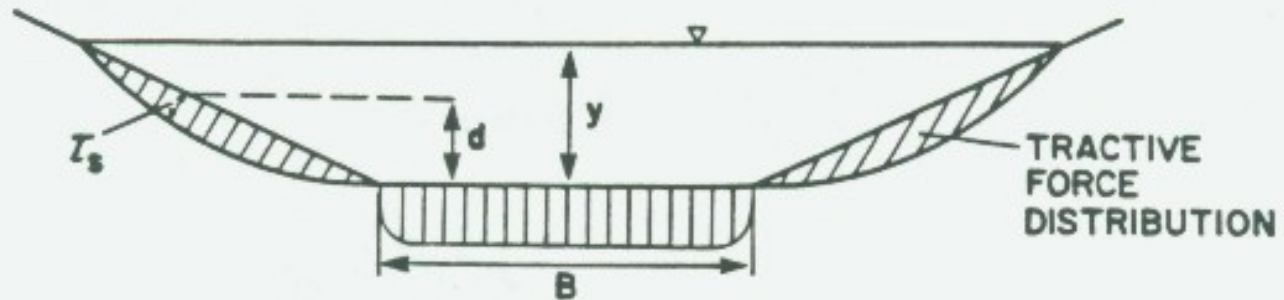


Stream Erosion



Tractive Force

Based upon Tractive Force calculations



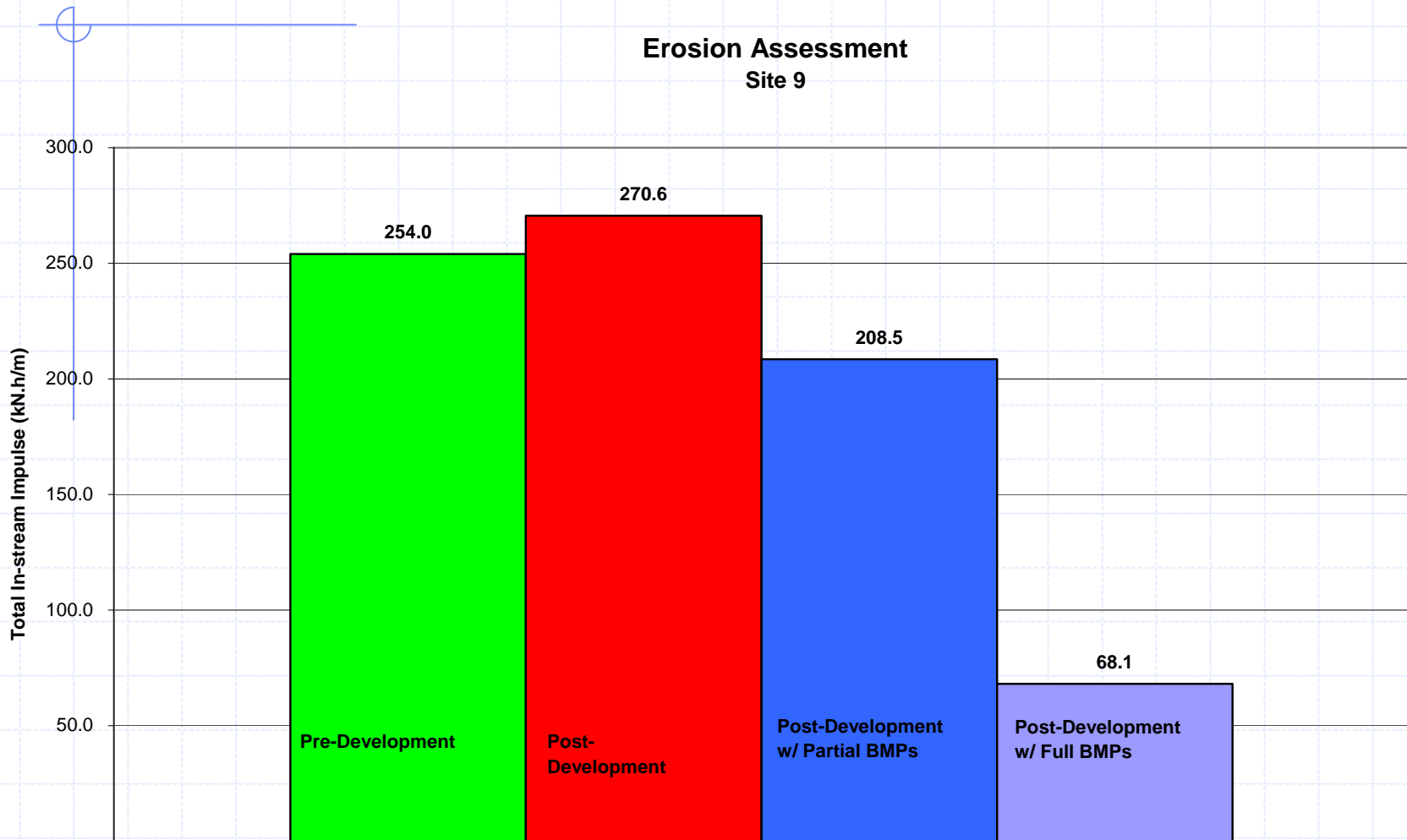
y = MAX. DEPTH

B = BED WIDTH

d = DEPTH

τ_s = TRACTIVE FORCE

Stream Erosion – Fergus Creek



Water Quality

- ◆ No consistent answer
- ◆ No consistent expectations
- ◆ Regulations vary greatly
- ◆ Suggest sediment and first order decay as surrogate measure

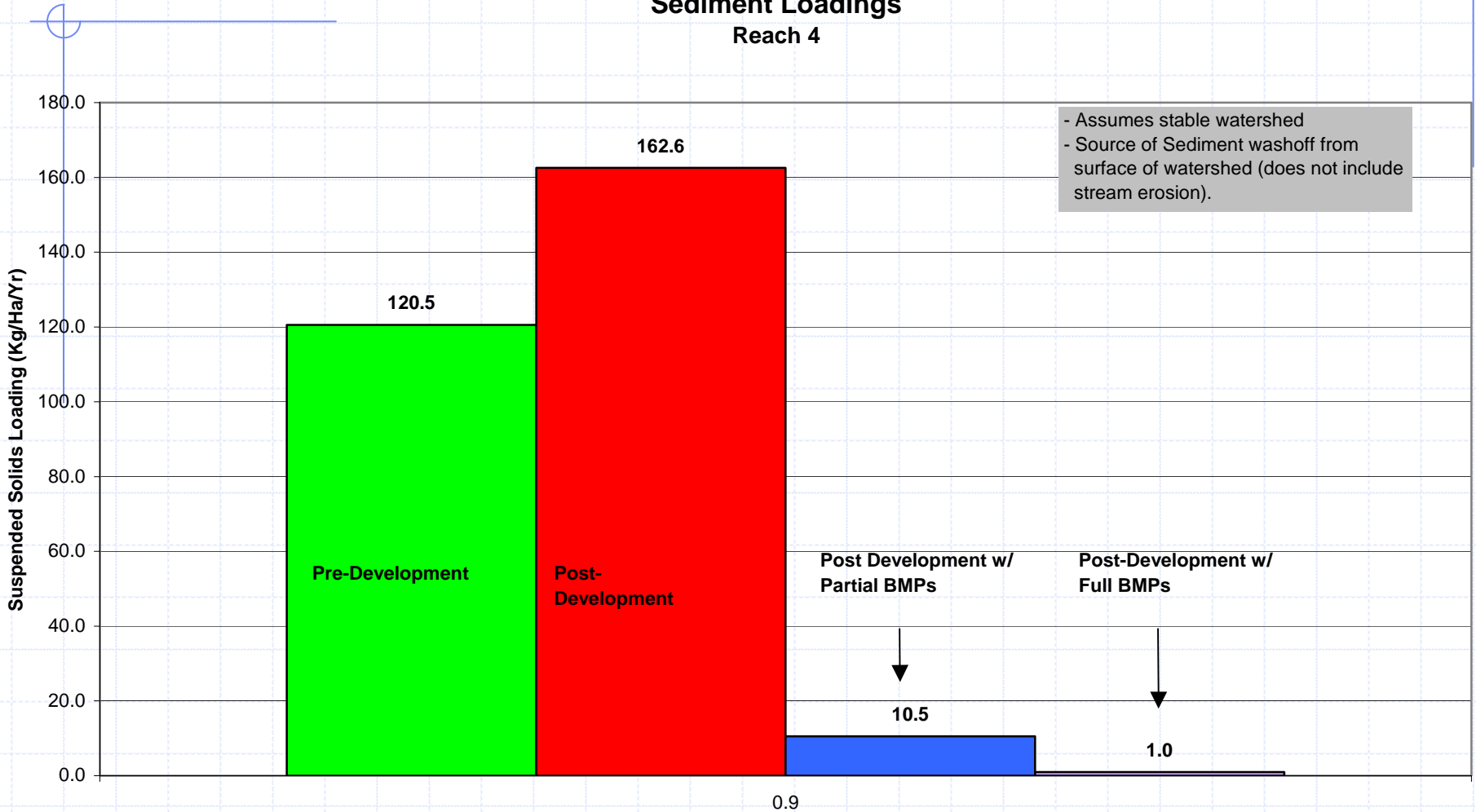
Sediment Supply

Sediment Supply

Type of Land Use	Sediment Yield (tonnes/ha/yr)
Natural Forest	0.66
Agricultural	0.11 to 2.2
Urban Construction	1.8 - 73.5
Stable Watershed	0.039 to 0.367
Urban Areas	0.10 to 0.61

Water Quality – Fergus Creek

Sediment Loadings Reach 4



Infiltration Systems

- ◆ **RUNOFF** Volume Reduction
 - Not rainfall reduction systems
- ◆ Many alternatives
- ◆ Need Assessment and Design tools
- ◆ WBM will provide the tools

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