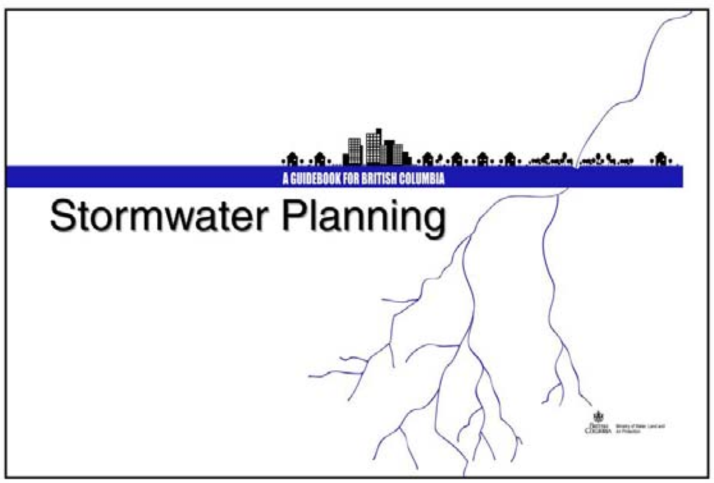
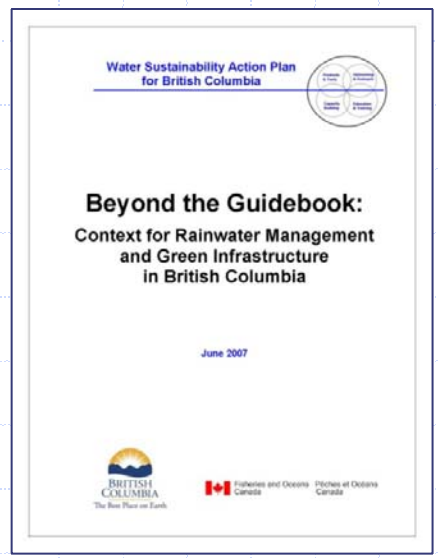
Beyond the Guidebook

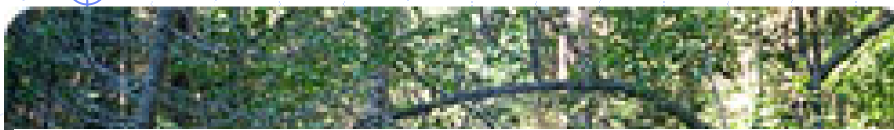
Why The Water Balance Model Powered by QUALHYMO





2002 → 2007

Goal

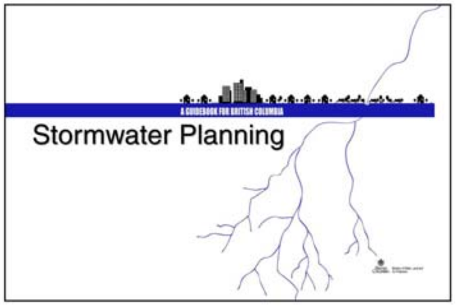


In a perfect world, no impact results from development

Presentation Outline

1. **Beyond the Guidebook Explained**
2. The science behind the Stream Health Methodology
3. So, what is QUALHYMO?
4. What integration of QUALHYMO and the Water Balance Model will achieve

Published in 2002, the Guidebook…



- Provides
  - Direction
  - Principles and objectives
  - Guidance on how to do integrated planning
- Introduced
  - Rainfall spectrum
  - The “retain, detain, convey” strategy
  - Water balance methodology
  - Performance targets
  - Adaptive management framework

Incorporating all the lessons we have learned to date...

Beyond the Guidebook connects the dots between source controls at the site scale and stream health protection at the watershed scale

Documented stream impacts date back to a 1973 research report

Effects of Urbanization on Stream Channels and Stream Flow, Thomas Hammer, 1973

- Streams are impacted by development
- Discharges and width increase
- The width of the buffer strip does not matter when pipes are used to discharge runoff directly into the stream

In 1996, Horner & May identified factors affecting stream health as...

- Changes in Hydrology
- Disturbance and/or Loss of the Riparian Corridor
- Degradation and/or Loss of Habitat within the Stream
- Deterioration of Water Quality

Real World Operation, Jones

Bioassessment of BMP Effectiveness in Mitigating Stormwater Impacts on Aquatic Biota, Jones, 1997

- Biological communities degraded below BMP’s as compared to reference watersheds
- No difference in BDI above or below BMP’s

Real World Operation, MacRae

Experience from Morphological Research on Canadian Streams, MacRae, 1997

- Stream channels below detention basins designed to control to 2 year discharges experienced accelerated erosion at 3 times the predevelopment rates
- Recommendation - Do not use this criteria to prevent erosion

Learn From Others

- Should we repeat mistakes of others?
- Or start where the others left off?
- We need
  - A new approach
  - One that has an analytical basis
  - Defines causes and effects

To Date

- Focus on rainfall
- No clearly defined connection to the stream and the environment
- Many documented problems
- Changing rules
- Assumptions of effectiveness

Assessment Needs

- Changes to stream geomorphology
- Engineers **must** understand the concept
- **Must** be quantifiable and reproducible
- **MUST** measure mitigation effectiveness
  - Mitigation systems **can** be analyzed
  - Alternatives **can** be compared

Analyses Needs

- How do things work?
- A tool to describe system operation
  - impacts and mitigation
- Must apply to
  - engineering
  - environment
- Minimize risk of failure

Results Needs

- To evaluate environmental impacts
- To design mitigation measures
- That is cost effective
- Provides an analytical basis
- Repeatable and verifiable results
- Ties engineering to the environment

A New View

- An analytical approach
- Clearly defines causes and effects
- Logical and easy to use
- Includes adaptive management

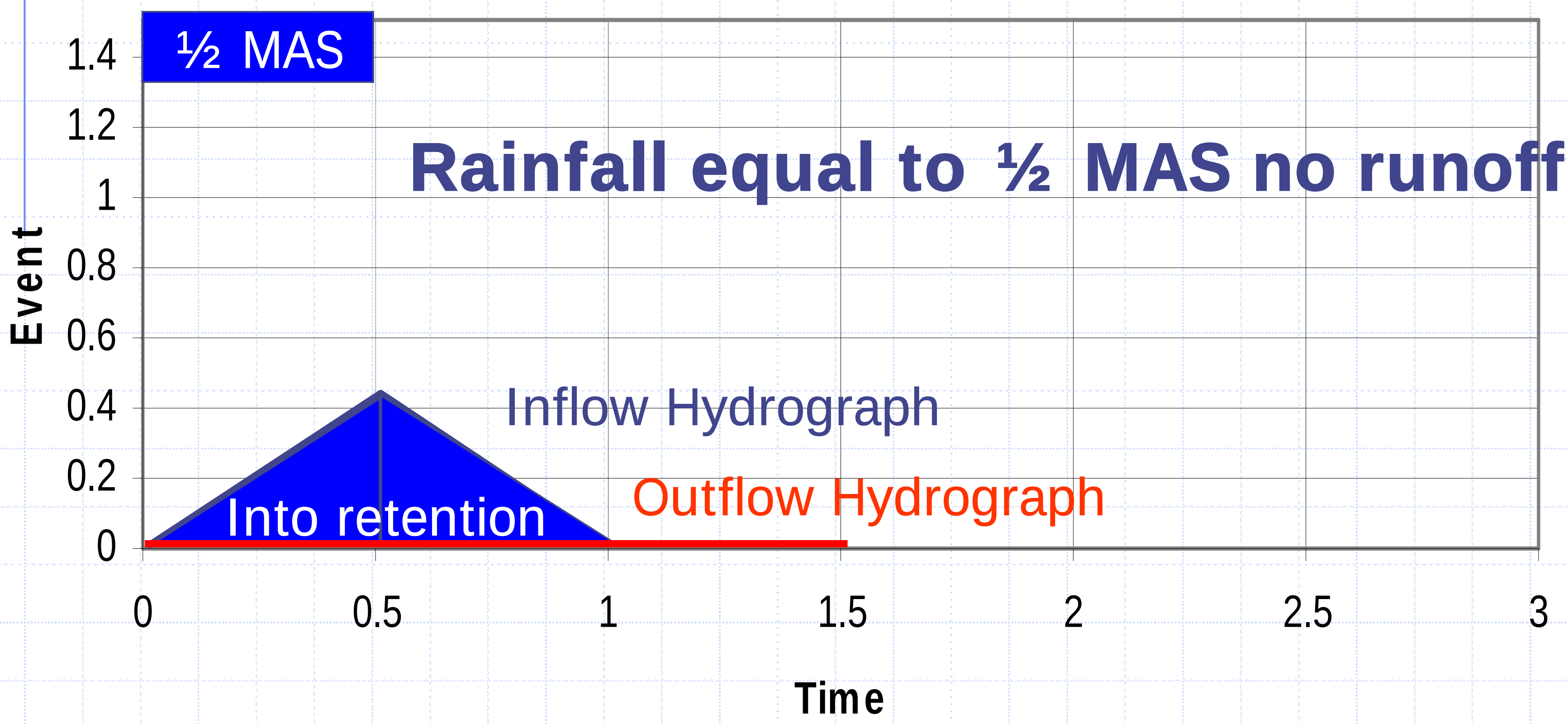
Design / Assessment Basis

- Two Paths that initially appear similar
- Rainfall Based
  - Control of a fixed volume, i.e. 30mm
  - Control of discharge rates
- Runoff Based
  - Address impacts on streams
  - Quantifiable and measurable

Rainfall Basis

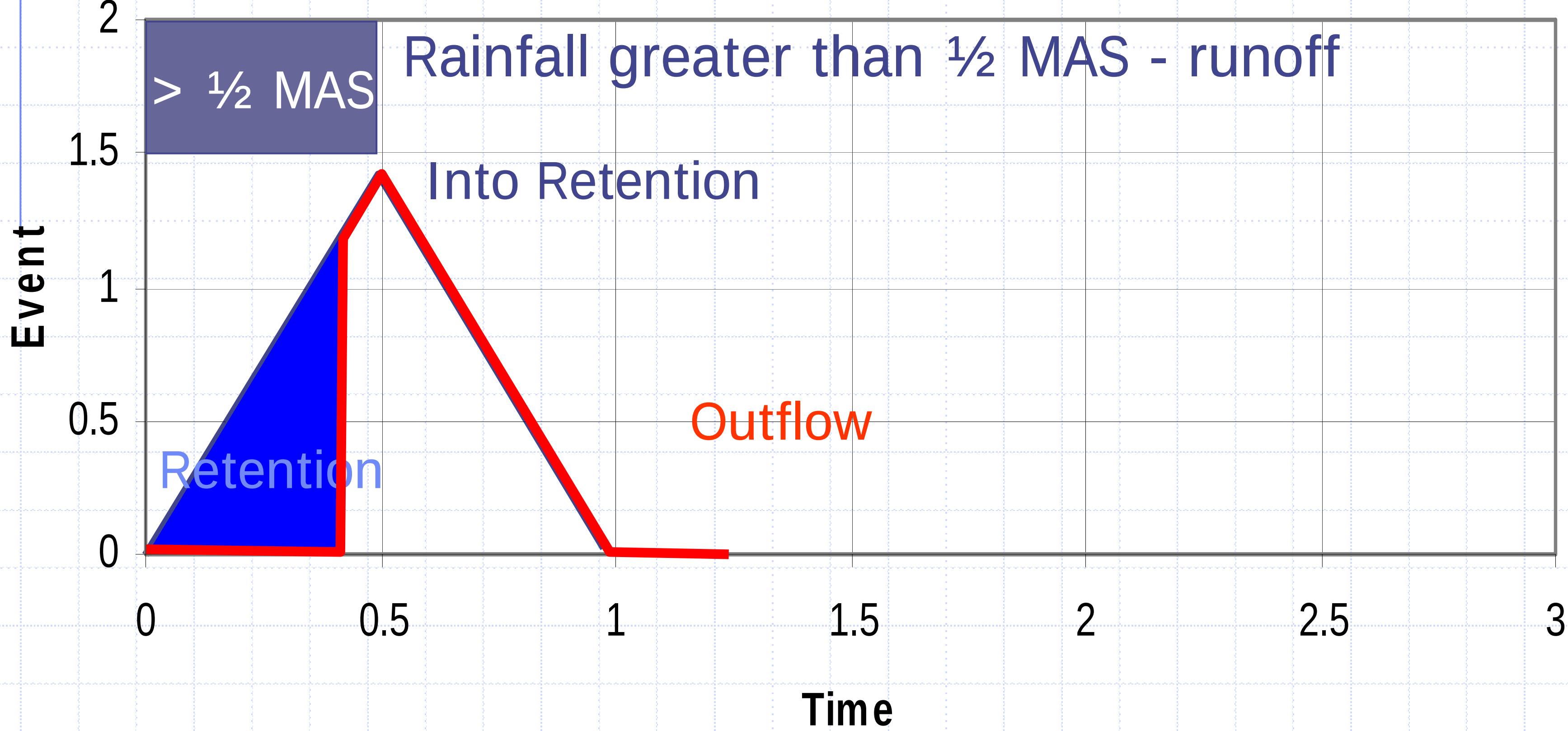
- Simple
- Capture volumes from impervious areas
  - Create some detention / infiltration
- Maintain predevelopment rates
  - Use design storms
  - Use retention ponds
- **Assume** (hope) it works to mitigate impacts
  - No way to test before construction

Does ½ Mean Annual Streamflow (MAS) Criterion Reduce Discharge?



More Rainfall

Events > ½ MAS: no decease in peak discharge



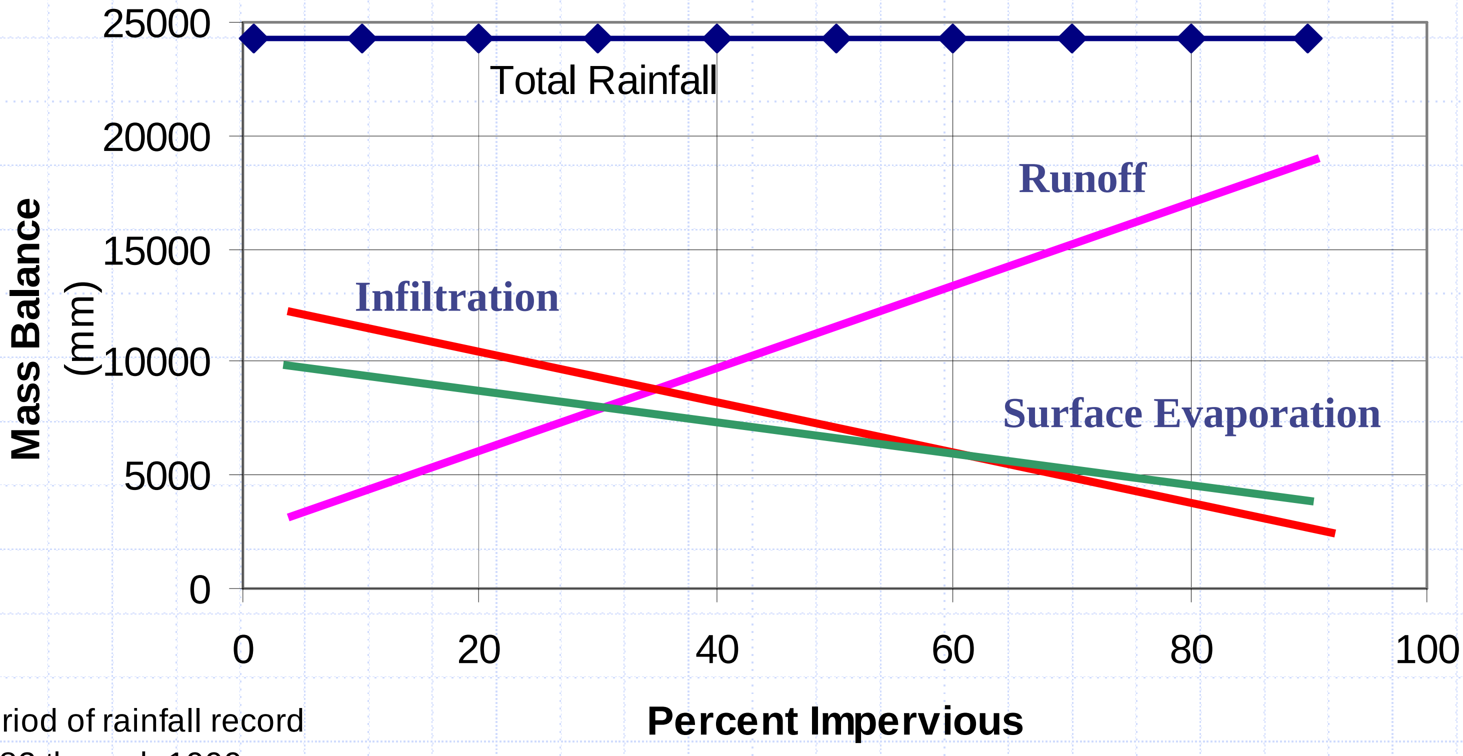
Runoff Basis

- Flow duration for habitat availability
- Tractive force to measure potential erosion
- Sediment washoff to evaluate water quality
- Optimize systems to manage the impacts of the altered hydrologic cycle
- **Test** mitigation works **prior** to construction

The science behind the Stream Health Methodology

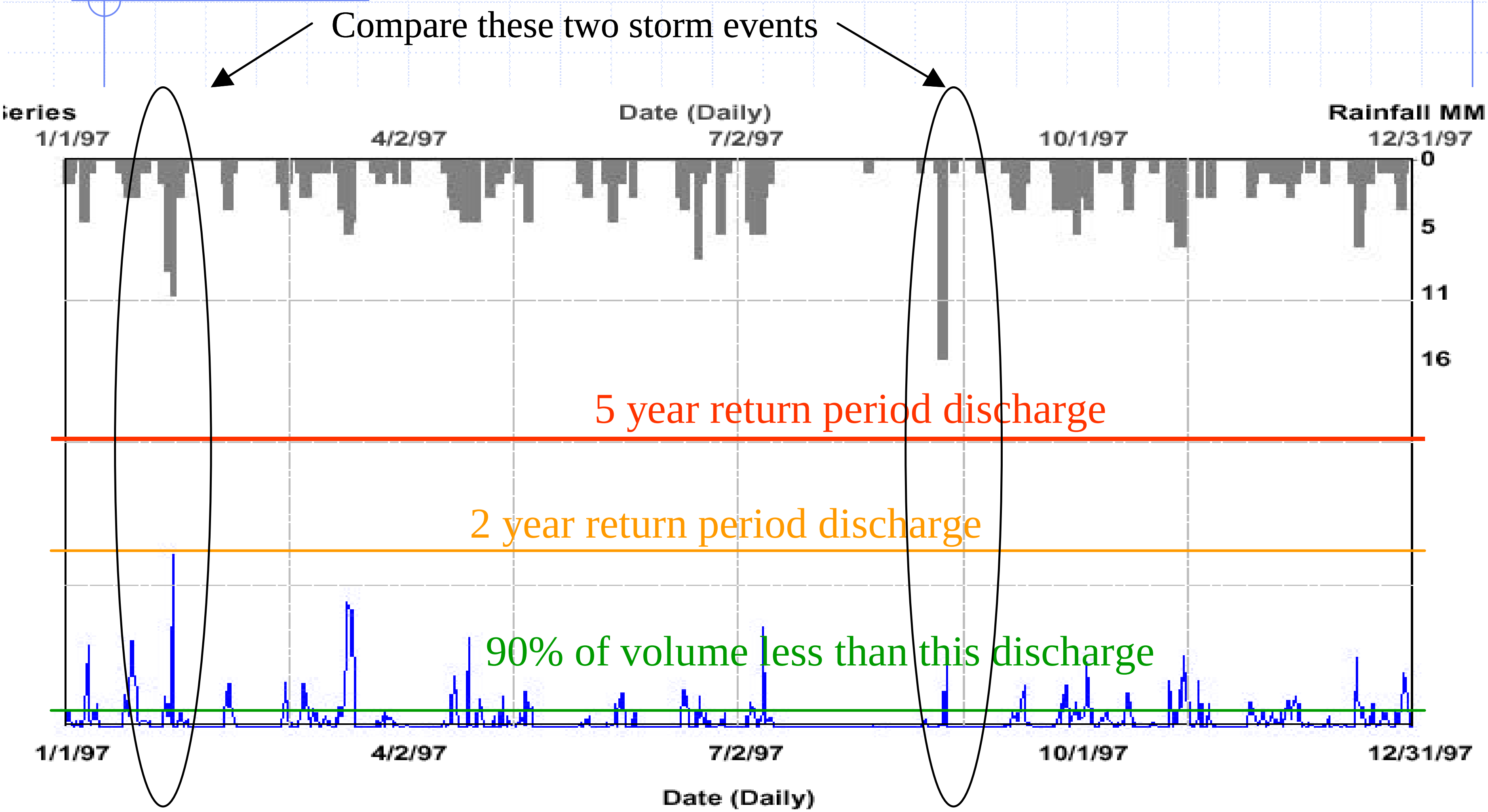
The basis for “Beyond the Guidebook”

Hydrologic Change



Period of rainfall record
1982 through 1999

Typical Year



The science-based stream health methodology at the heart of the

Water Balance MODEL Powered By QUALHYMO

picks up where others left off

So, what is QUALHYMO?

- A rainfall-runoff model developed by Dr. Charles Rowney for the Ontario Ministry of Environment in the 1980s
- The tool of choice in by experts in Ontario and Alberta

Why QUALHYMO

The strength of QUALHYMO resides in the ‘flow exceedance analysis’ which is key to correlating streamflow with impacts on stream health

It is also easy to apply

Duration of Discharge

- Critical to aquatic health
  - Discharge is 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)

Stream Erosion

- Calculate Stream Power
- Estimate potential Erosion
- Identify critical stream reaches for protection and enhancement
- Create watershed / stream specific plans

Water Quality

- What do we mean?
  - No consistent answer
  - No consistent expectations
  - Regulations vary greatly
- Models use sediment as a surrogate

What integration of QUALHYMO and the Water Balance Model will achieve

- Integrating the site with the watershed and the stream
  - Now, users will be able test alternative scenarios during planning in a watershed

In Part C, we will illustrate how the Stream Health Methodology has been applied to the Fergus Creek pilot to make informed land use decisions