STORMWATER and WETLANDS

An Review for Non-Engineers and Engineers

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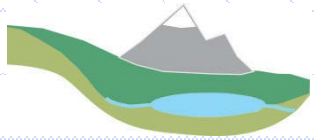
January 29, 2015

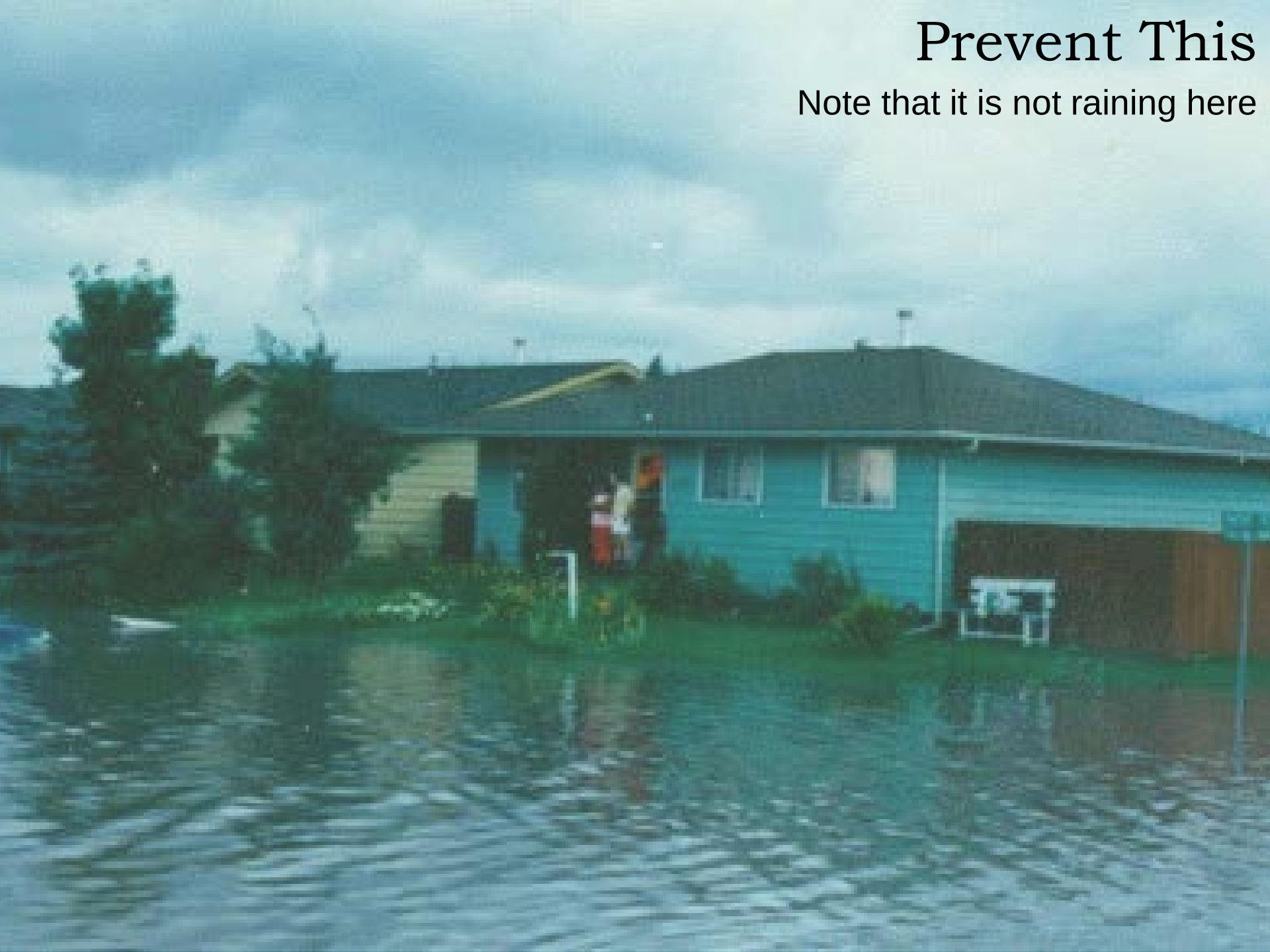


Why SWM Ponds?

- Pre = Post discharges (and volumes)
- No adverse impacts from your activities
- No increase in downstream flooding
- No decrease in water quality
- No habitat damage
- Used for a source of water
- Reduce downstream pipe sizing
- Ponds do what a pipes do not

Prevent This

Note that it is not raining here



Trends

- Multiple objectives
  - Discharge rate control
  - Water quality improvement
  - Volume reduction
  - Aquatic habitat
  - Social amenity
  - Recreation opportunity

INTEGRATING WETLANDS

Important to understand the implications

Question

Is a wetland part of the drainage system?

- Yes, the point of discharge is FROM the wetland
- No, the point of discharge is TO the wetland

Very important to understand the consequence of the answer to this question

No – not part of engineered systems

- May receive treated water from pipes
- May receive attenuated flows
- Environmental standards apply
- Use “non-standard” engineering analyses that provide the necessary results
- May be impacted but this can be properly assessed and mitigated

Yes – a part of engineered systems

- Part of the Drainage system
- Used for storage
- Used for TREATMENT
- Use typical engineering standards
- Environmental values will be IMPARED

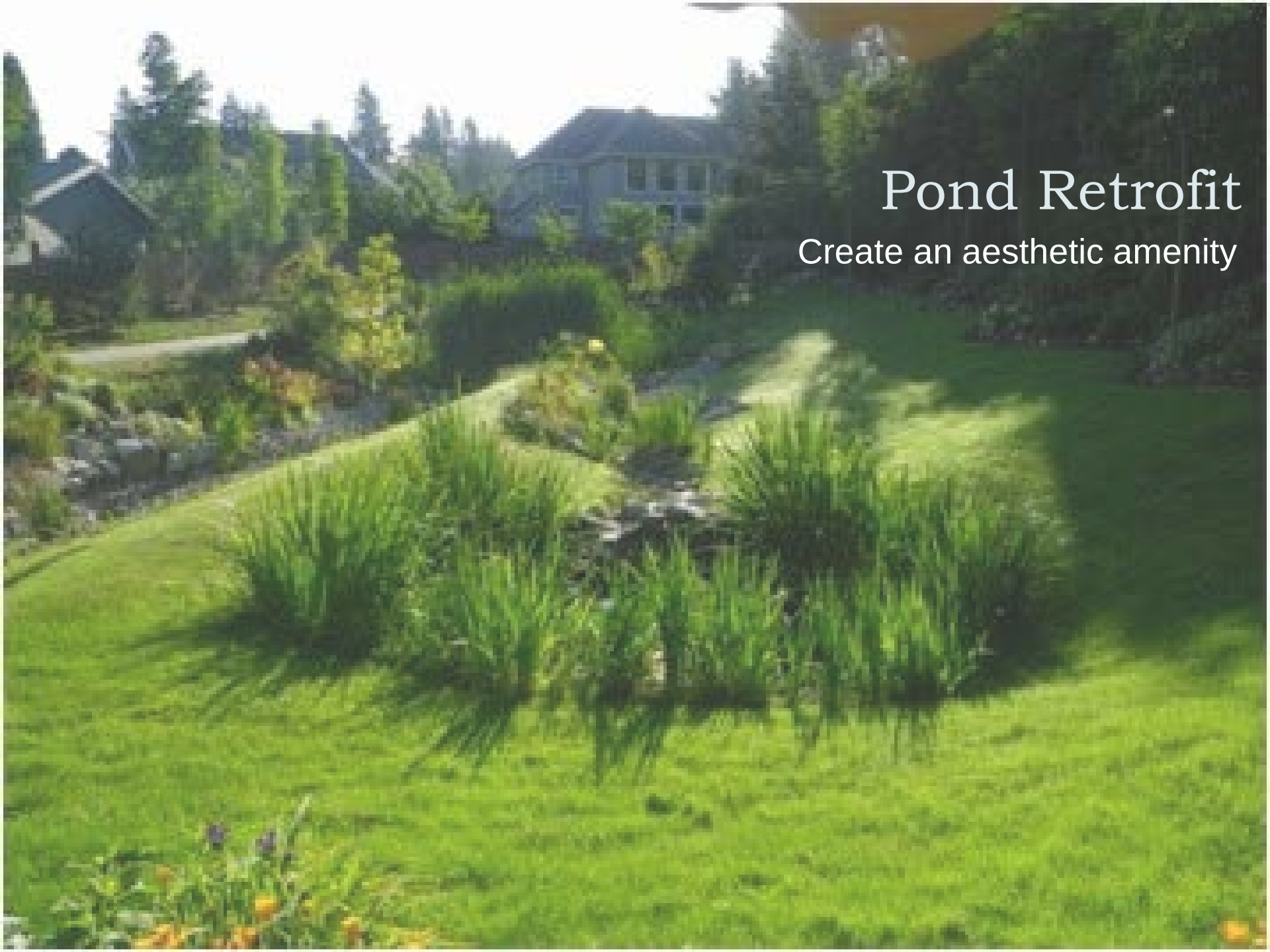
Storm Ponds

Wet Pond

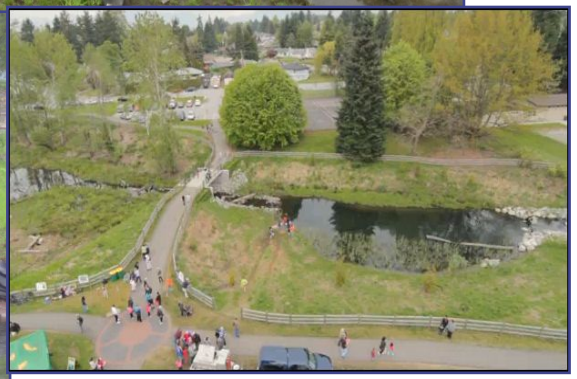
Dry Pond

Water Quality Pond

Multi-use Dry Pond


Pond Retrofit
Create an aesthetic amenity

Pond Features



Retrofit Pond With Multiple Objectives

Larger than the minimum for engineered purposes

DESIGN CONSIDERATIONS

Details, details, details, ...

Exposed Structures

- Safety
- Aesthetics
- Siting

Structures - Below Water

- Unseen
- No attraction to kids
- Floatables trapped
- No trash racks
- No erosion controls
- Below ice levels

Structure Options

- Large number of alternatives

  (1 + number of engineers involved)
- All have good and bad features
- Selection of features depends upon
  - Local conditions
  - Local rules
  - Safety
  - Redundancy

Cross Section

- Large number of alternatives
  (each jurisdiction has a rule)
- Selection of configuration
  - Local conditions
  - Local rules
  - Safety
- Beware of steep side slopes

ENGINEERS ASSUMPTIONS

Language Lesson For Non Engineers

Assumption 1 - Standards

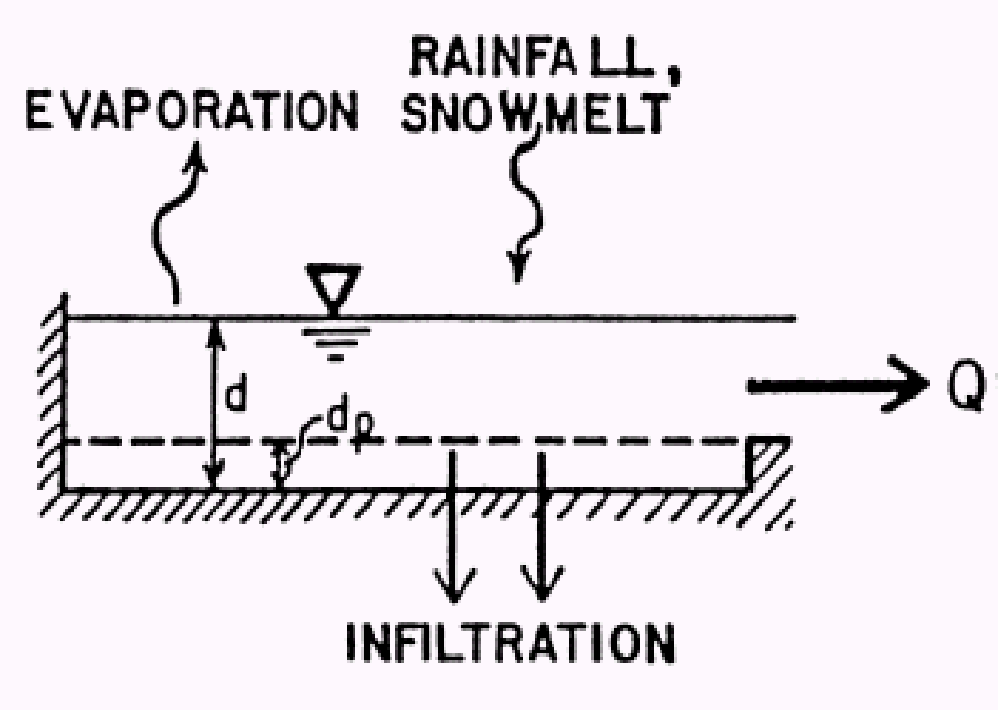
Engineering standards apply to all projects

- Design standards applied to pipes will be applied to wetlands
- Design standards are created to assure similar results for each analysis and sizing for every project

Assumption 2 - Runoff

All discharges are from surface runoff

- Subsurface flows and groundwater are not important to pipe design – see Assumption 1



Source USEPA SWMM Manual

Assumption 3 – Design Storm

Use a “Design Storm” rather than real rain

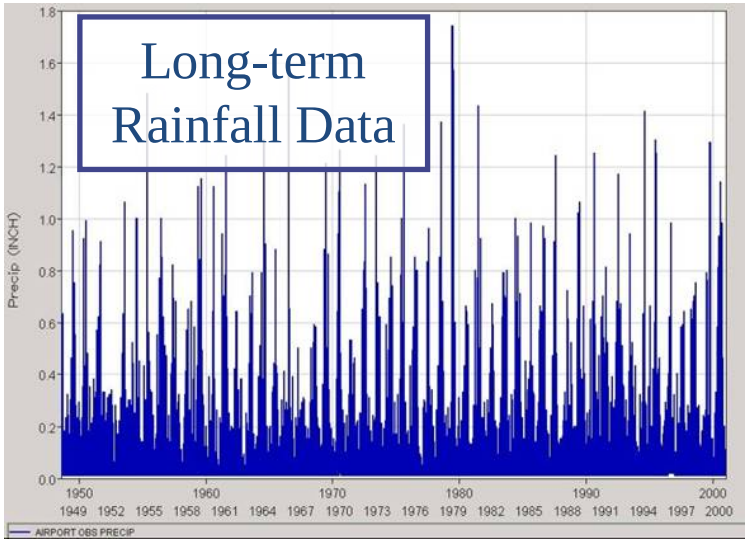
- Design storms are hypothetical
  - they do not really exist
  - you will never see one fall from the sky
- Duration from 30 minutes to 24 hours.
  - Does this describe last week’s rainfall?

Design Storm Decisions

- Choice of rainfall duration
  - Depends on size & response characteristics of watershed (e.g., anywhere from 1 to 120 hr)
- Choice of rainfall volume
  - Affects detention facility design/performance
- Choice of rainfall intensity and distribution
  - Affects collection system design/performance
- Choice of antecedent moisture conditions; tidal/river boundary; initial lake levels; etc.

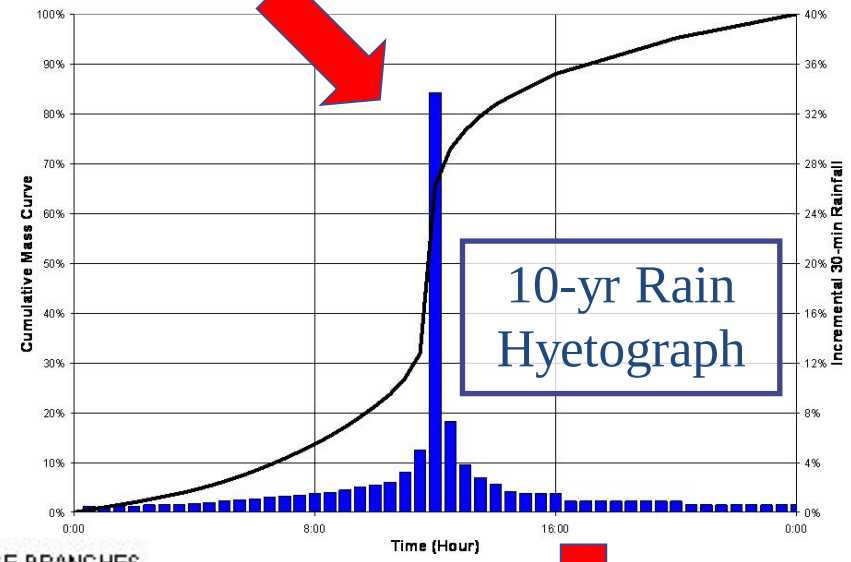
...on & on... So many options, **MUST SIMPLIFY**

Design Storm Approach



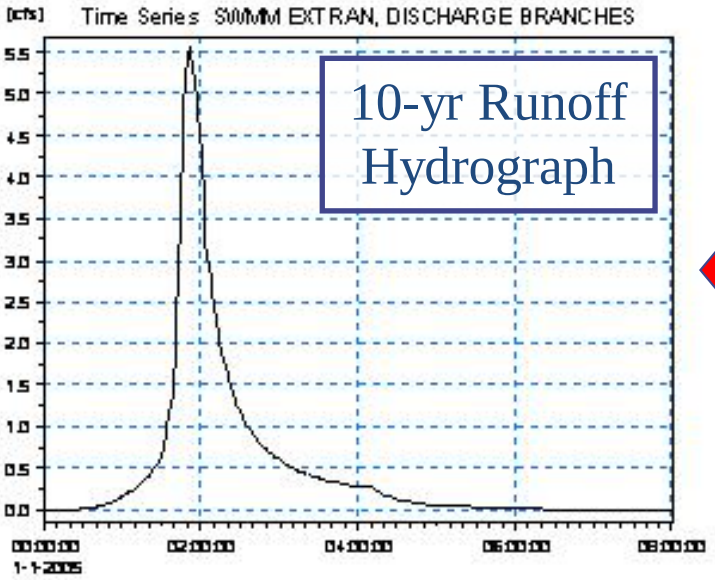
Long-term Rainfall Data

Statistical Analysis

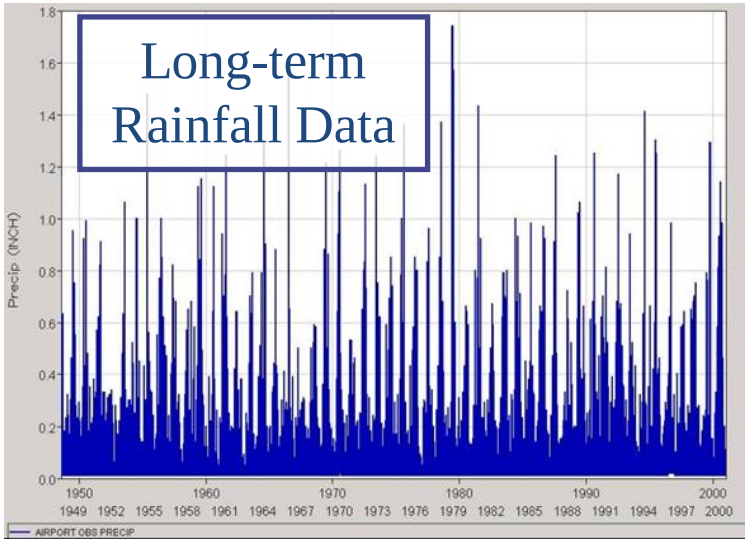


10-yr Rain Hyetograph

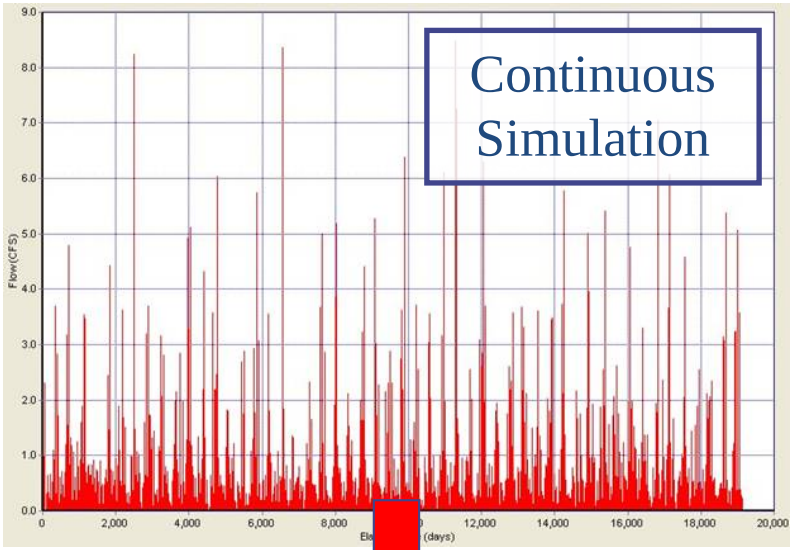
Stormwater Model



10-yr Runoff Hydrograph

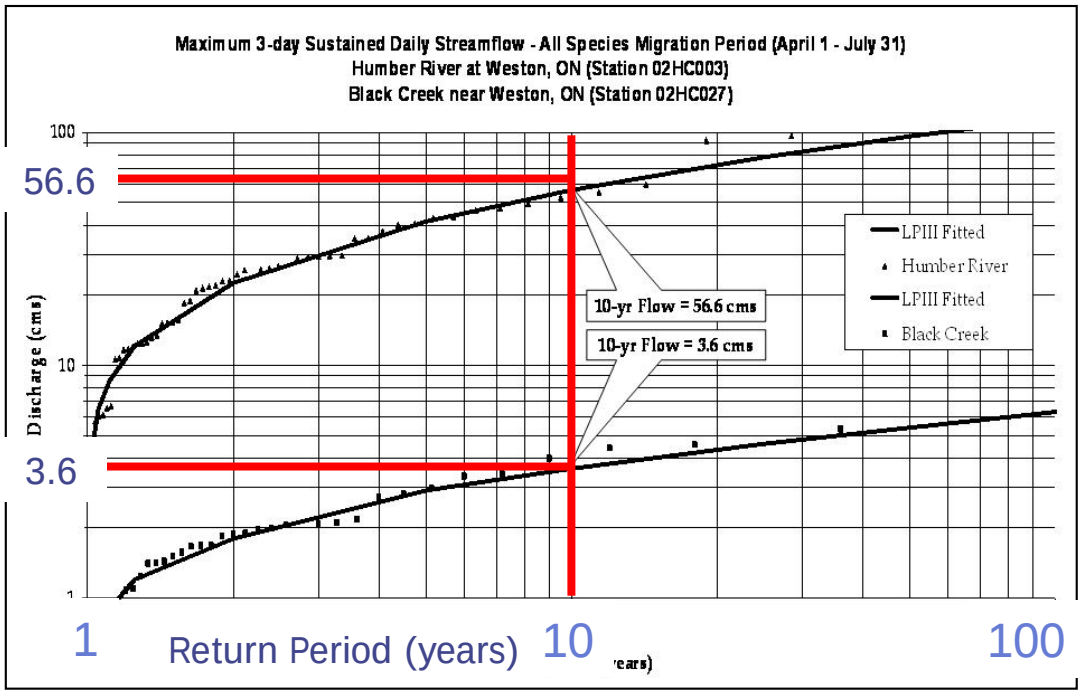


Stormwater
Model



Statistical
Analysis

Continuous Simulation



Assumption 4 - Frequency

- Return Period of the Design Storm is equal to the Return Period of the flood event
  - This is not true but this assumption will provide:
    - Uniform answers for each project
    - Pipe sizes which prevent flooding in urban areas
  - Will NOT address environmental issues

Assumption 5 - Operation

Pond is empty before the storm and pond empties before next storm

- Not valid due to
  - Multi-day events, and
  - Back to back storms

Solution:

- Longer design storms, or
- Continuous simulation

Solution to Assumptions

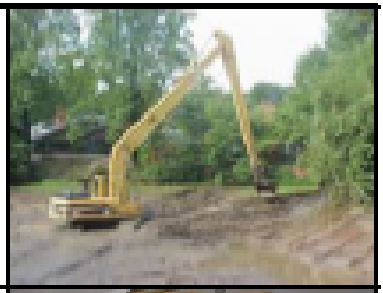
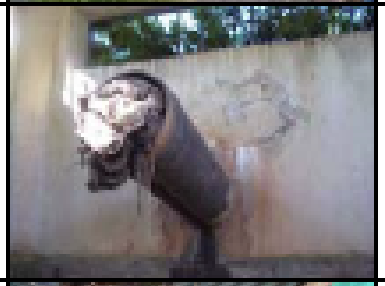
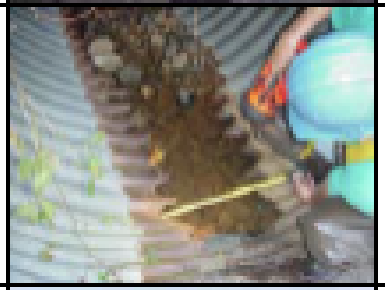
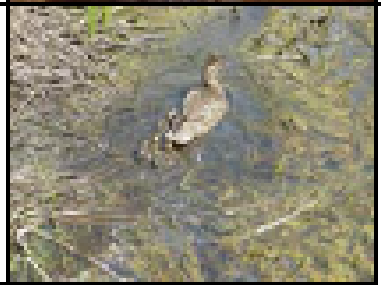
- Use continuous simulation
- Use the Water Balance Methodology

http://waterbucket.ca/wp-content/uploads/2012/05/Primer-on-Water-Balance-Methodology-for-Protecting-Watershed-Health_February-2014.pdf

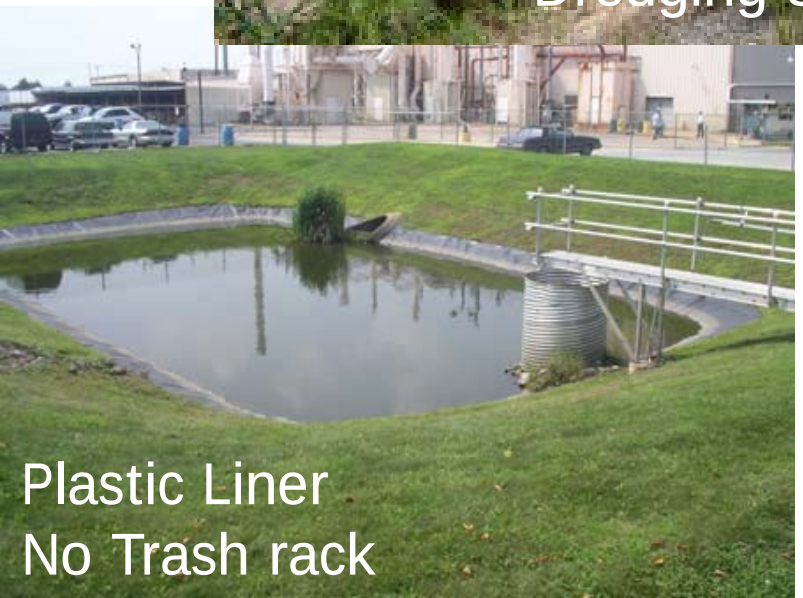
MAINTENANCE

Yes it is required

Top Concerns

Permanent Pool		Dredging and Muck Removal	
Clogging		Access	
Pipe Repairs		Mechanical Components	
Vegetation Management		Nuisance Issues	

Common Maintenance Items



Sediment

Sediment Inflows (watershed washoff)

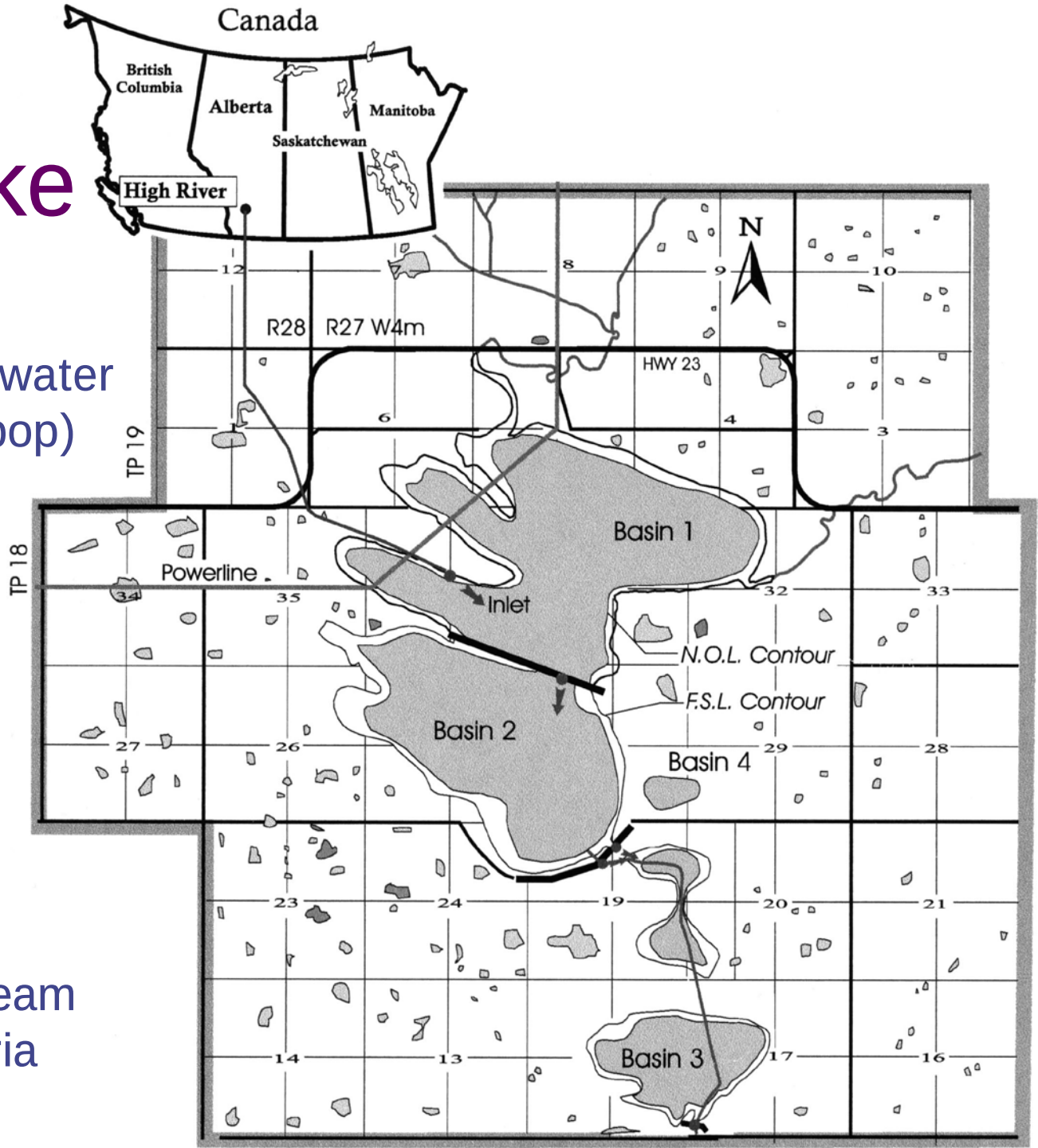
Type of Land Use	Sediment Yield (tonnes/ha/yr)
Natural Forest	0.66
Agricultural	0.11 to 2.2
Urban Construction	1.8 - 73.5
Stable Watershed	0.039 to 0.367
Urban Areas	0.10 to 0.61

Sediment from construction is a BIG problem

Frank Lake

1,246-ha (3,079-acre)
Receives treated wastewater
- High River (13,000 pop)
- Cargil Meats

Biologists seem to like it as a wetland
Often violates downstream receiving water criteria



Researcher's Comment

In regard to Frank Lake and the diversity of published opinions

"The public should no more trust bureaucrats to assess their own environmental work that they should trust third-graders to design their own report cards"

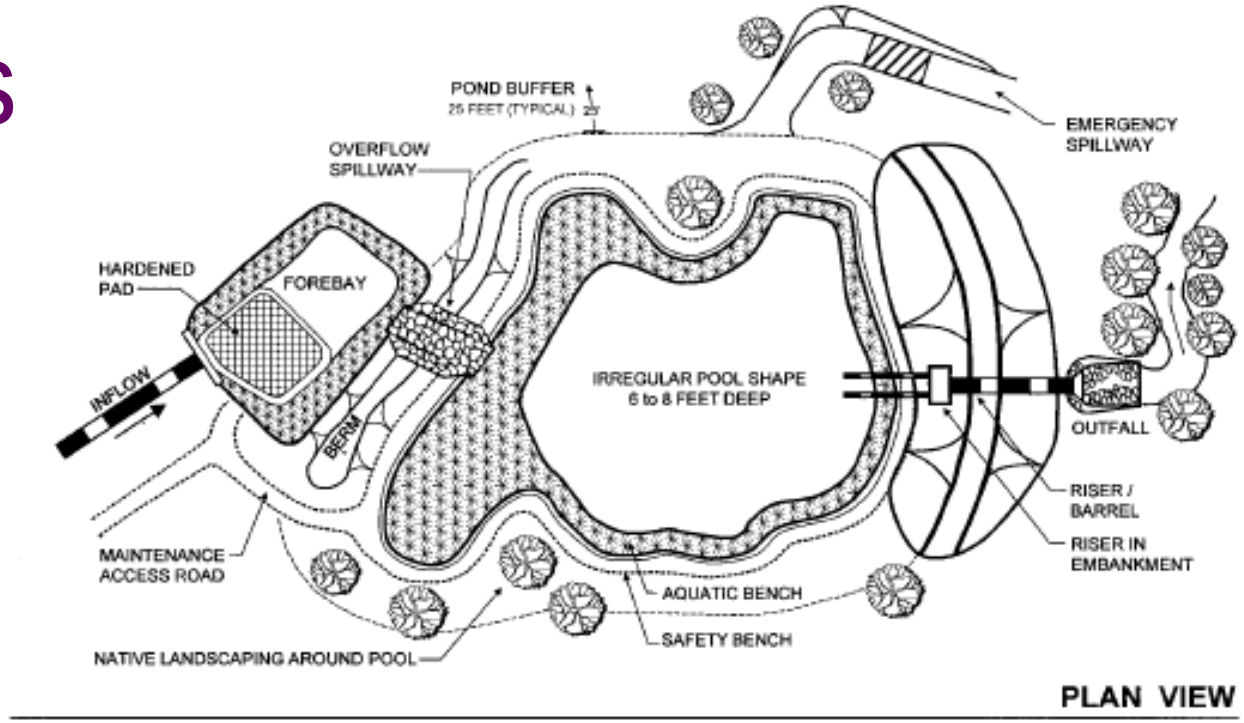
-- Andrew Nikiforuk "The Nasty Game"

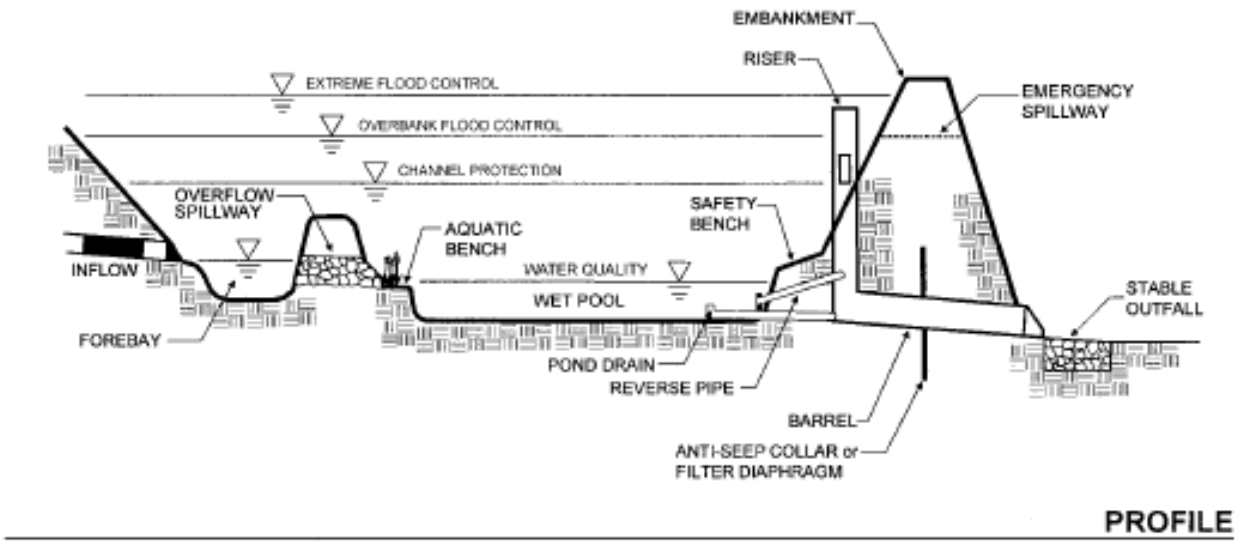
LANDSCAPE PLANNING

What does it look like?

Developer's View

Engineer's View





QUESTIONS?

Simple stuff, right?

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