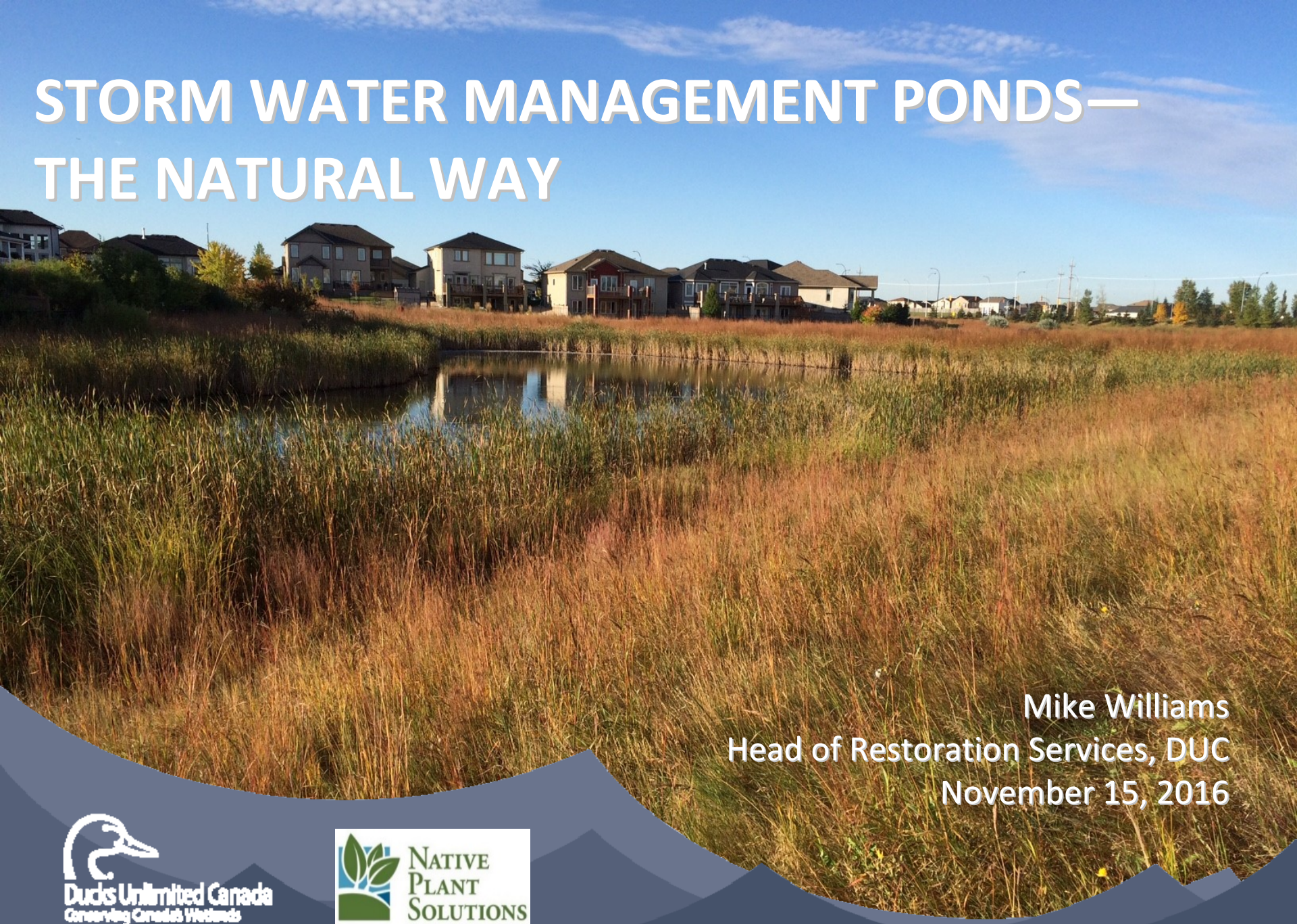
STORM WATER MANAGEMENT PONDS— THE NATURAL WAY



Mike Williams
Head of Restoration Services, DUC
November 15, 2016

Ducks Unlimited Canada
Conserving Canada's Wetlands

Native Plant Solutions

Storm Water Management Ponds – The Natural Way

- What is a “naturalized” storm water pond?
- Why naturalize?
- Conventional vs. naturalized wet ponds
  - Design
  - Construction and maintenance costs
  - Nutrient removal

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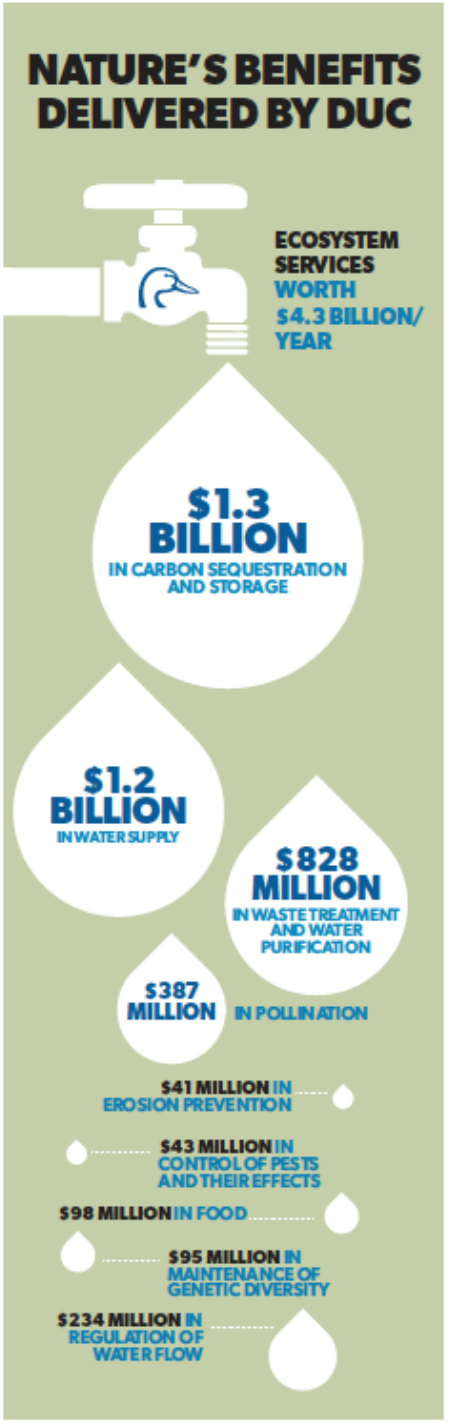
DUC is committed to **science-based** conservation. Wetlands provide a wide array of vital economic and ecological benefits in addition to waterfowl habitat.

This has driven much of our research in understanding these 'other' values.



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Conventional Wet Ponds: Existing Challenges

- Poor water quality
- Turbidity
- Excess algae growth
- Invasive species
- Intensive upland management of grassed areas
- Grazing geese
- Community concerns

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Dry Ponds: Challenges for Operation and Maintenance

- Regulate flow and help to reduce sediments, but does little to alleviate water quality concerns
- Plant establishment and weed species
- More intensive upland management
- Mosquito factories

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What is a “naturalized” storm water management pond?

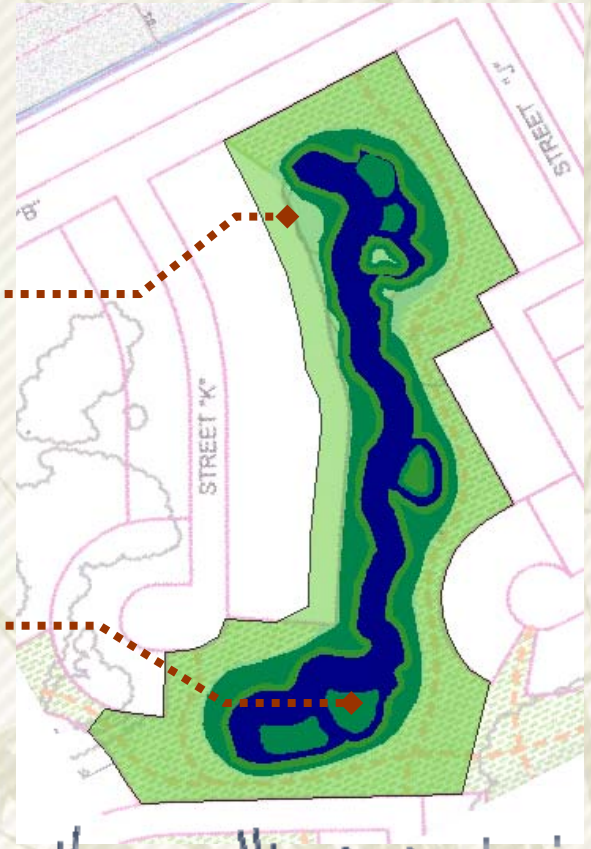
Naturalized storm water ponds are not wetlands, rather they are storm water basins that contain naturalized (wetland) elements in order to improve water quality

‘Naturalized’ SWMP Concept and Design:

Emergent Vegetation and Native Grass Uplands

Native Upland Buffer Strips intercept excess nutrients before they enter waterways

Wet Meadow and Emergent Wetland Vegetation in the pond helps to improve water quality



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Why “Naturalize”?

- Our general practice with storm water management has been to move water off the land as fast as possible
- Due to water quality issues that are now widespread across Canada, we should really consider changing our storm water management approach to one of: “Improve then Move”

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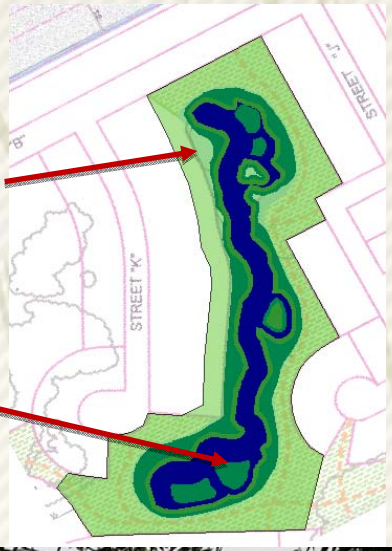
Why naturalize?

- Economically viable – can be retrofitted to existing SWP's or combined with LID
- Deter urban geese
- Improved aesthetics
- **Lower maintenance costs**
- **Improved water quality**



Conventional SWP Design

Naturalized SWP Design

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The Transition to Naturalization …

Water fountains

Naturalization of uplands

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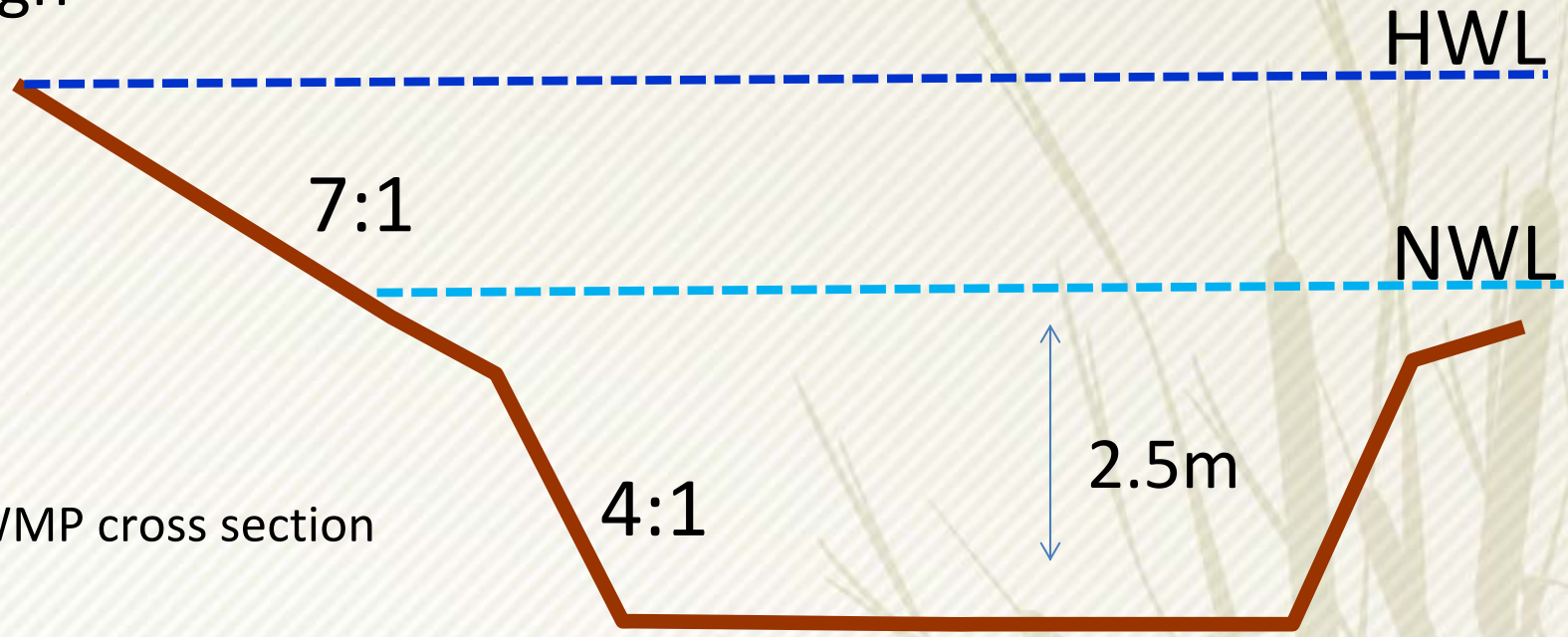
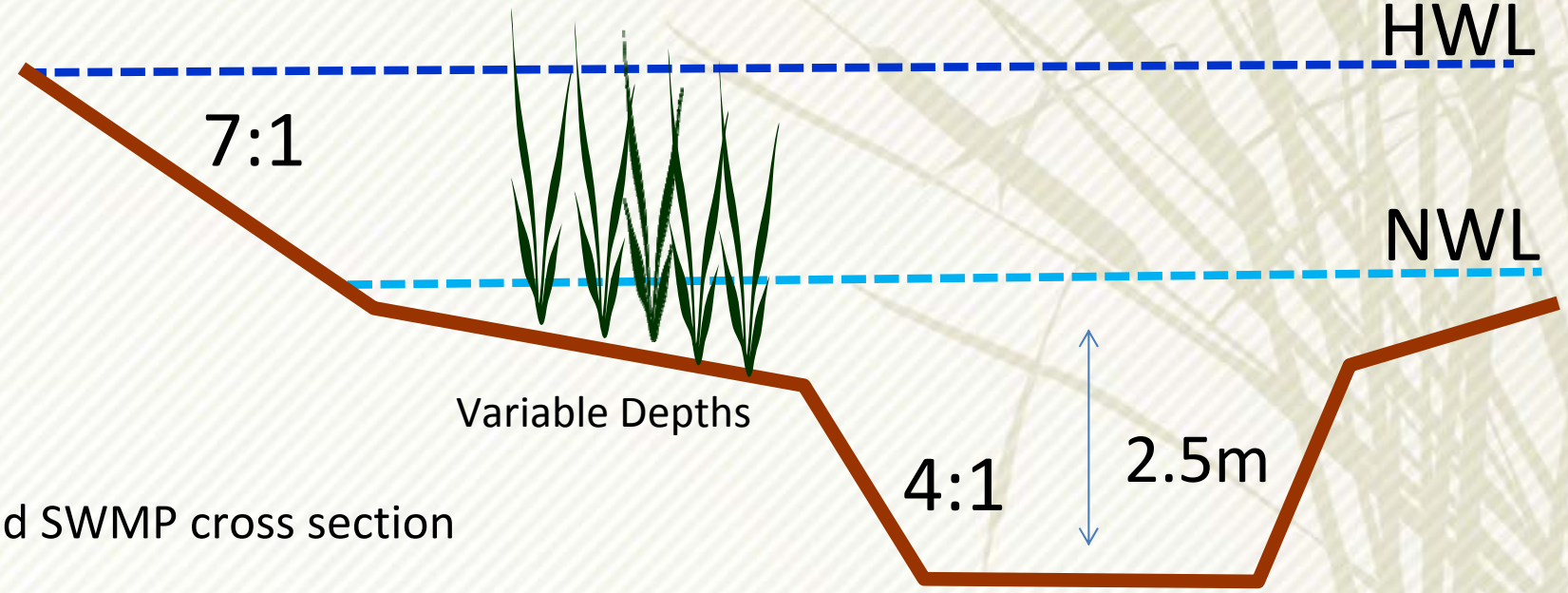
Pond design



Traditional SWMP cross section



Naturalized SWMP cross section

NATIVE PLANT SOLUTIONS

Construction:

Variable depths adjacent to central channel

NATIVE PLANT SOLUTIONS

Integrated Approach:

Topsoil protection, Erosion and Weed Control, Soil placement, Cover crops, Wildlife control

NATIVE PLANT SOLUTIONS

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Topsoil protection, Erosion and Weed Control, Soil placement, Cover crops, Wildlife control

Creating a New Environment: Retro-Fitting Existing Ponds

Summer 2008

Summer 2011

Upland Native Plantings:

- Emphasis on diversity
- Nutrient intercept (buffer) strip with native grass/forb cover
- Reduced maintenance costs
- Fewer invasive species

Upland management – prescribed burns

Prescribed Burn, June 2014

Creating a New Environment: Retro-Fitting Existing Ponds
Sterling Lyon Parkway, Winnipeg

June 2014 → August 2014

Pond Construction Cost Comparison

16,900m^2 HWL; 9500m^2 NWL (2.35 acres)

Traditional Storm Water Pond

- **Construction Costs:**
  - Design and professional services $56,640
  - Pond Excavation $316,620
  - Granite rock, geotextile & excavation $146,575
  - Boat Ramp $30,000
- **Planting Costs:**
  - Sod & 4'' screened soil $88,800
- **Initial Maintenance Costs (3 years):**
  - Mowing lawn grass $9000
  - Weed control
  - Litter management

TOTAL $647,635

Naturalized Storm Water Pond

- **Construction Costs:**
  - Design fee $16,450
  - Pond excavation $279,000
- **Wetland Revegetation:**
  - Continuous and planting divots $11,805
  - Placement of wetland growth medium $9,500
  - Plant extraction, hauling, placement $37,800
  - Emergent zone and wet meadow seed $3,800
- **Native Grass Establishment:**
  - Upland/Bufferstrip topsoil placement $29,600
  - Upland/Bufferstrip peat amendments $22,200
  - Bufferstrip native grass seeding $37,000
  - Erosion Control $10,500
- **Initial Maintenance Costs (3 years):**
  - Goose deterrence activities $24,000
  - Weed control $4,500
  - Wetland commissioning $15,000
  - Post-establishment maintenance $4,440
  - Professional services $15,000

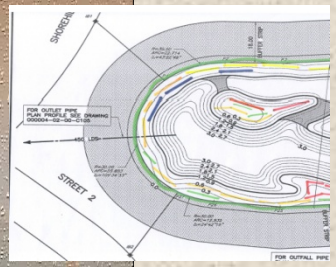
TOTAL $520,595

Annual Pond Maintenance Cost Comparison: City of Winnipeg

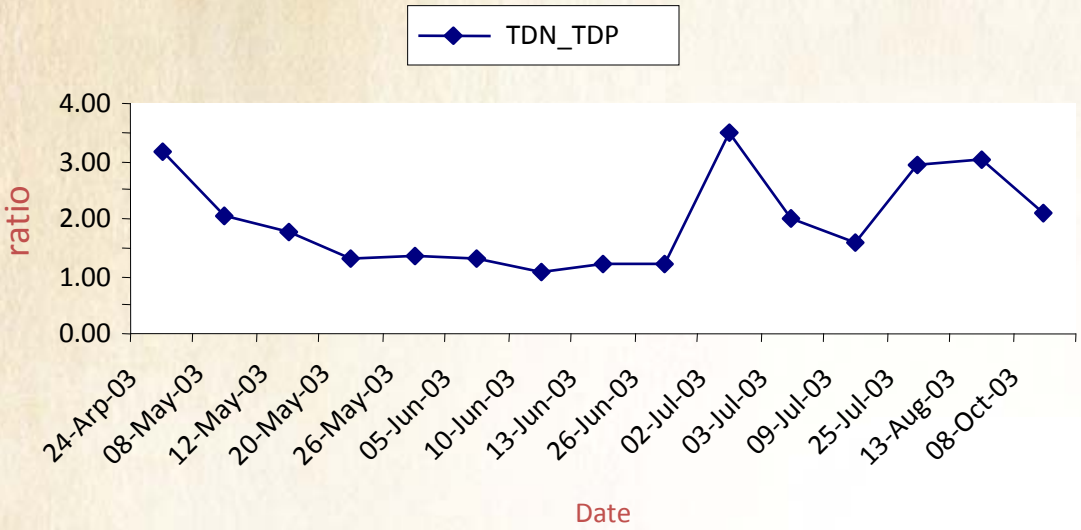
Activity	Traditional Storm water Pond	Naturalized Storm water Pond
Upland vegetation maintenance	$320/ha, 10x/year *Equates to $3200/ha/yr*	$6500/ha every 5 years (i.e. upland native grass burn) *Equates to $1300/ha/yr*
Remove shoreline debris	$300/year	n/a
Remove floating debris	$300/year	n/a
Herbicide weed control Aquatic weed harvesting	$1000/ha, 1-3x/year* $1,200/ha + $350, 1-3x/year*	n/a n/a
Shoreline vegetation maintenance	$0.18/m shoreline every 5 years	n/a
Inlet/outlet pipe maintenance	$500/year	$500/year
Revetment replacement	$8000 every 25 years	n/a
Operation, technical & maintenance support	$300/year	$300/year
TOTAL ANNUAL COST	***$10,048 / ha/yr***	***$2,100 / ha/yr***

Pond maintenance cost comparison was obtained from SEG Engineering (January, 2006) Report on 'Proposed wetland stormwater retention basins capital and life cycle cost comparison.', prepared for the city of Winnipeg; * - frequency of weed control and harvesting – City of Winnipeg

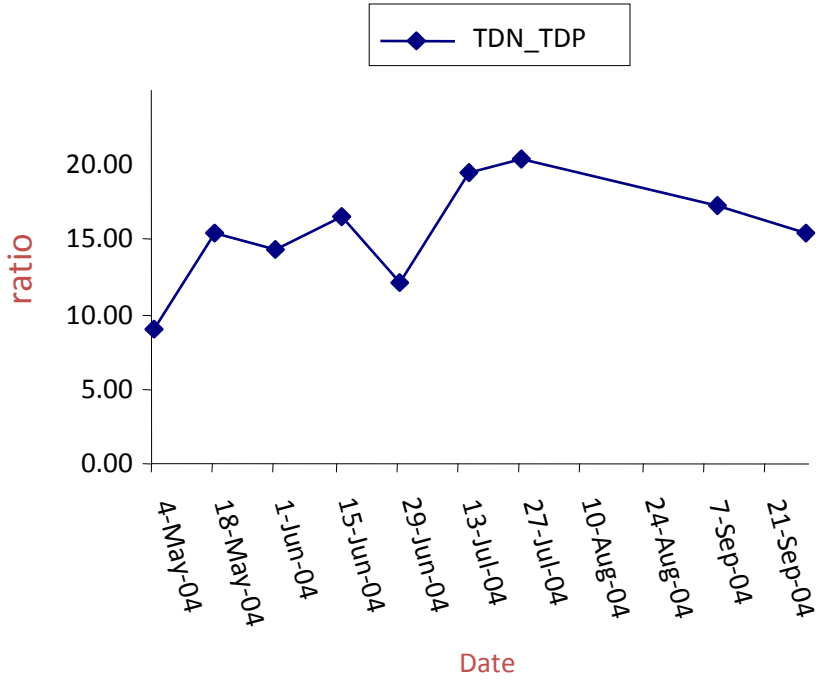
Comparison of traditional vs naturalized systems: Water quality



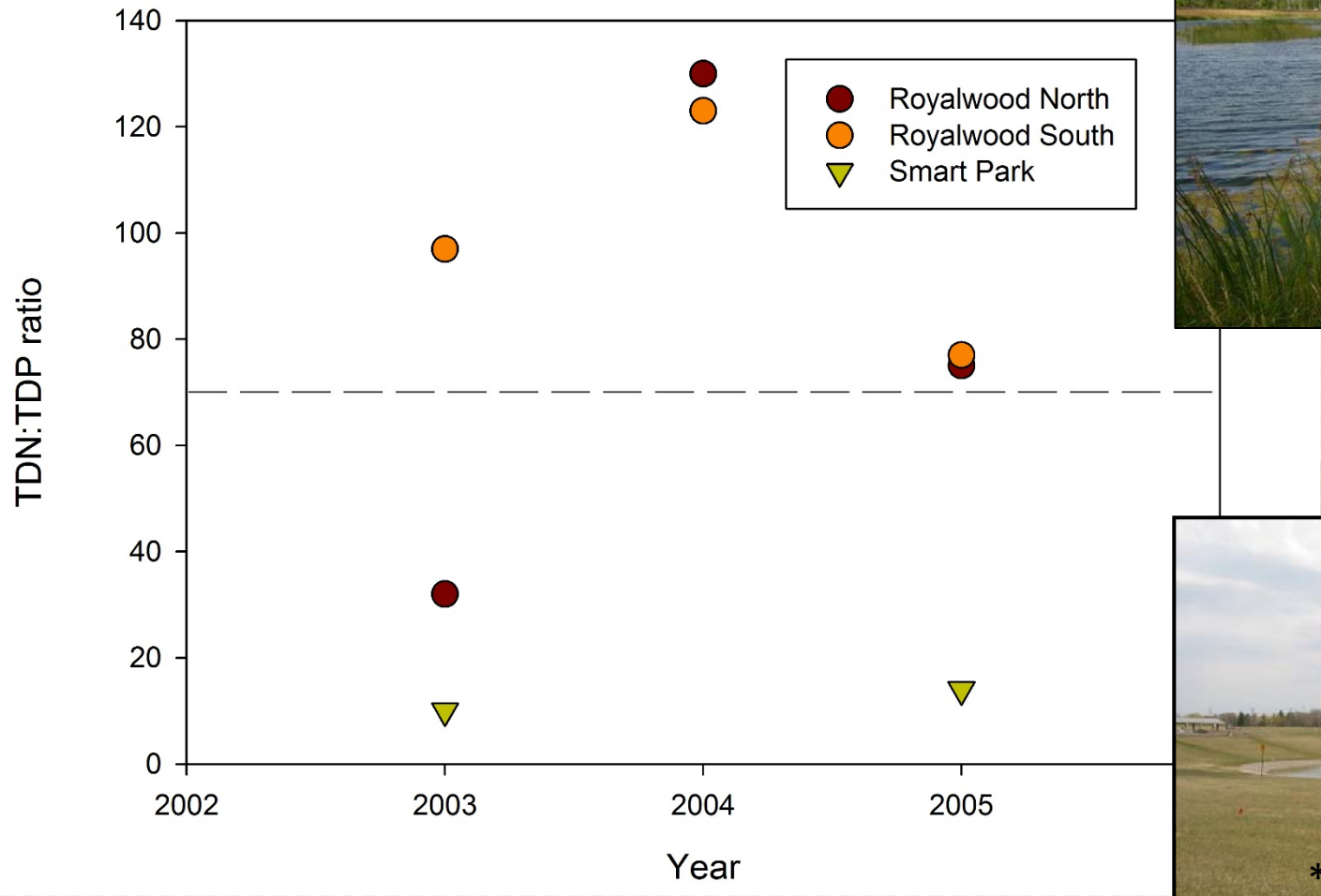
Smart Park Pond - U of M – Traditional Storm Water Pond



Royalwood South Pond – Naturalized



- N:P ratio in the Smart Park Pond never rose above 4:1 in 2003 and 2004
- Ratio of N:P maintained itself near 20:1 for most of the summer in Royalwood Ponds
- Dissolved phosphorous levels (TDP) were 30X higher in the Smart Park Pond than in Royalwood Ponds


TDN:TDP ratio
140
120
100
80
60
40
20
0
2002
2003
2004
2005
Year
Royalwood North
Royalwood South
Smart Park

* Naturalized *

* Conventional *

Low N:P ratio (4:1 = nitrogen limited ,Smart Park)

- Leads to increased growth of phytoplankton algae and a reduction of water clarity
- Often results in a predominance of cyanobacteria and an increase in algal toxins within the system
- Increased incidence of anoxia and fish kills

High N:P ratio (20:1 = phosphorus limited, Royalwood)

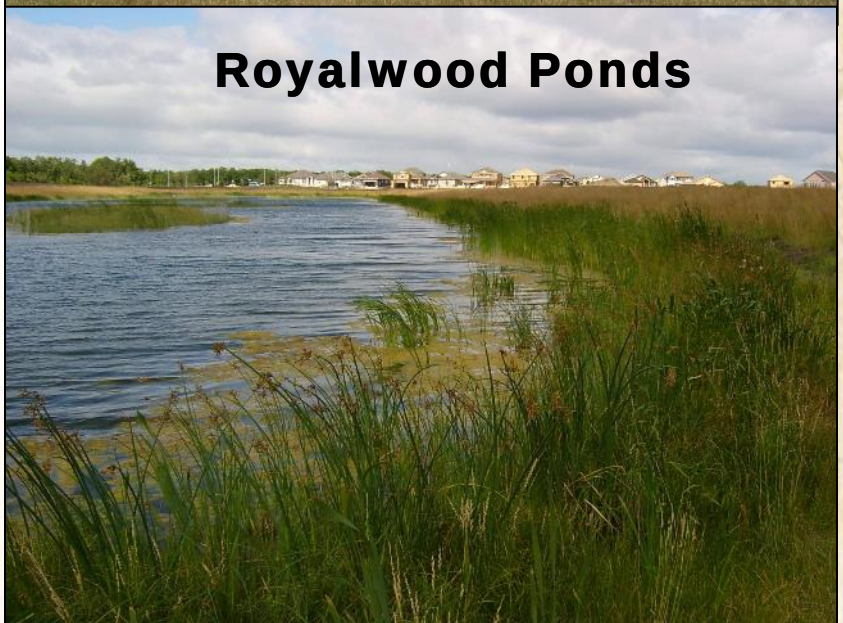
- Increased growth of wetland plants and healthy algal mats
- Improved water clarity and nutrient pooling within the system
- Accelerated levels of plant growth and decomposition leading to a greater requirement for phosphorous uptake and sequestration within the pond system

Algae: The Good and the Bad

- Phytoplankton biomass in the Smart Park Pond was heavily dominated by blue-green algae
- Overall, algal biomass was 18 times greater in the Smart Park Pond than the average for the Royal wood Pond
- Blue-green nitrogen fixers were 2200 times greater in the Smart Park Pond

Algae: The Good and the Bad

- Phytoplankton biomass in the Smart Park Pond was heavily dominated by blue-green algae
- Overall, algal biomass was 44 times greater in the Smart Park Pond than the average for the Royalwood Pond (4th year operation)
- Blue-green nitrogen fixers were over 4400 times greater in the Smart Park Pond



Property Value Comparison: Winnipeg, MB

Development	On Pond	House Area (ft^2)	Property Taxes ($)	Selling Price ($)	Price per Square Foot ($)
Royalwood	Y	1849	7337	779,900	421
Royalwood	N	1264	4207	369,000	291
Sage Creek	Y	1816	6500	769,900	423
Sage Creek	N	1737	4437	399,900	230
Bridgwater	Y	2353	9614	959,000	407
Bridgwater	N	2306	7348	749,900	325

Winnipeg

- Poor water quality, turbidity, excess algae, invasive species, grazing geese, maintenance costs

- Began to change direction in 2002
- Since then, more than 80 naturalized stormwater ponds have been constructed
- 100% of all ponds are now the naturalized design (2015)

Many jurisdictions have provided design standards/recommendations for constructed wetland stormwater systems.

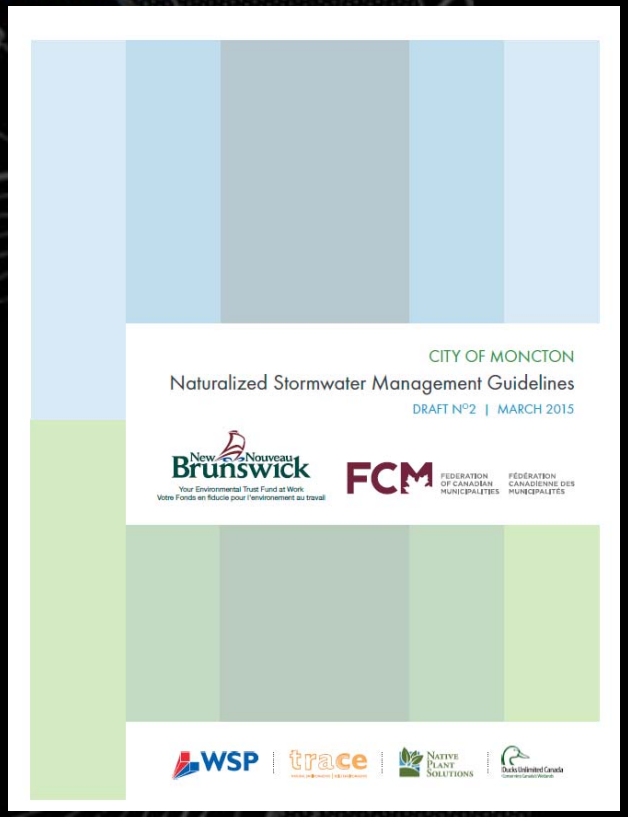
- Calgary
- Edmonton
- Saskatoon

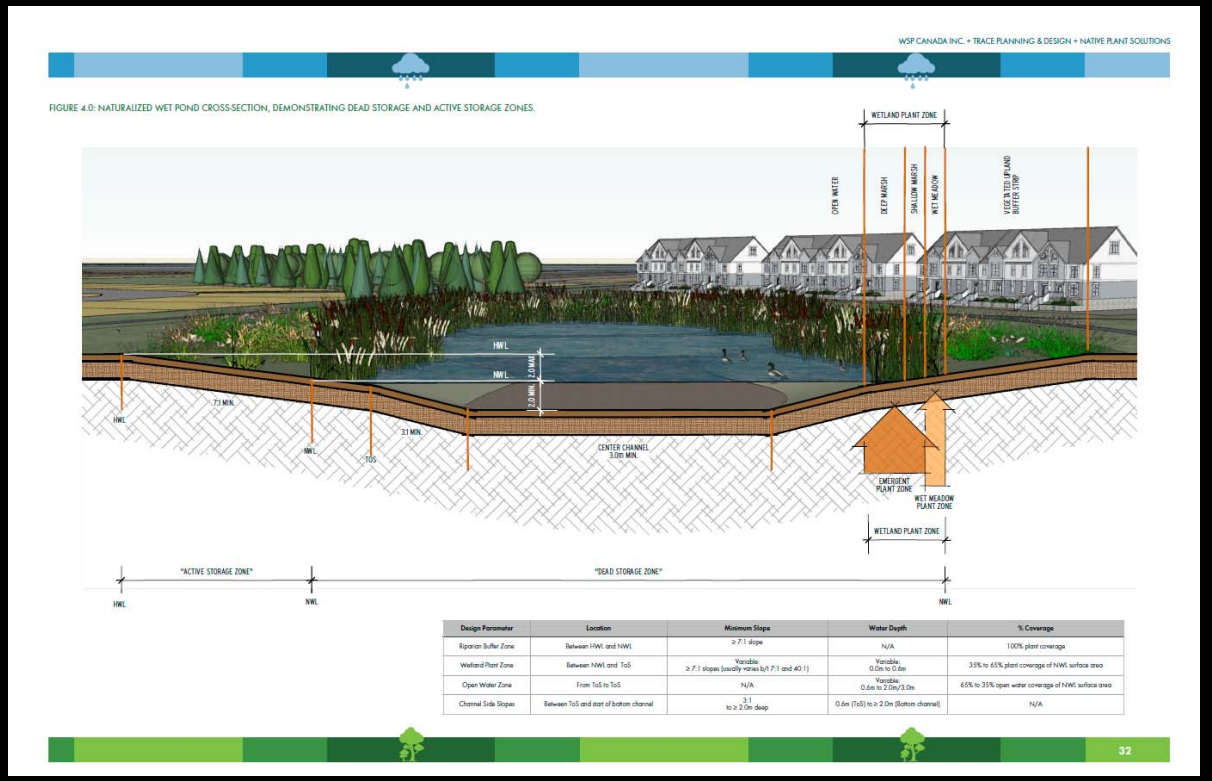
In Winnipeg/Moncton they are defined as Naturalized Stormwater Ponds.

- Winnipeg
- Moncton (Summer 2015)

Moncton

Naturalized Stormwater Management Guidelines





THANK YOU!

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