Mobilizing Efforts – Increasing Efficiency by Setting Realistic Boundaries

K. Bruce MacDonald

June 13-14 2013

Scoping the Lake Erie Drainage Basin –

The Big Picture – phosphorus

The Big Picture – water

Lessons from the Big Picture – mixing of concentrations

Targeting – the CEAP approach

Ontario considerations

Lake Erie – the Big Picture - Phosphorus

- *GLWQA target for phosphorus loading to Lake Erie – 11,000 tonnes/yr*
- *Total area of the Lake Erie Drainage Basin – 78,000 sq. km.*
- *Average phosphorus contribution per ha – 1.4 kg/ha*
- *From an agronomic standpoint –*
  - *Crop removal in harvest – 50-60 kg/ha P2O5 or 22-26 kg/ha P*
  - *Average P contribution per ha – 5-6% of crop removal*

Lake Erie – the Big Picture - Water

- *Lake Erie volume – 484 cubic km.*
- *Water retention/replacement time 2.6 yr*
- *Sources of water in Lake Erie according to the Ontario Farmer May, 2013*
  - *80% from upstream*
  - *10 % from precipitation*
  - *10% from the Lake Erie drainage basin*

Lake Erie – the Big Picture - Water

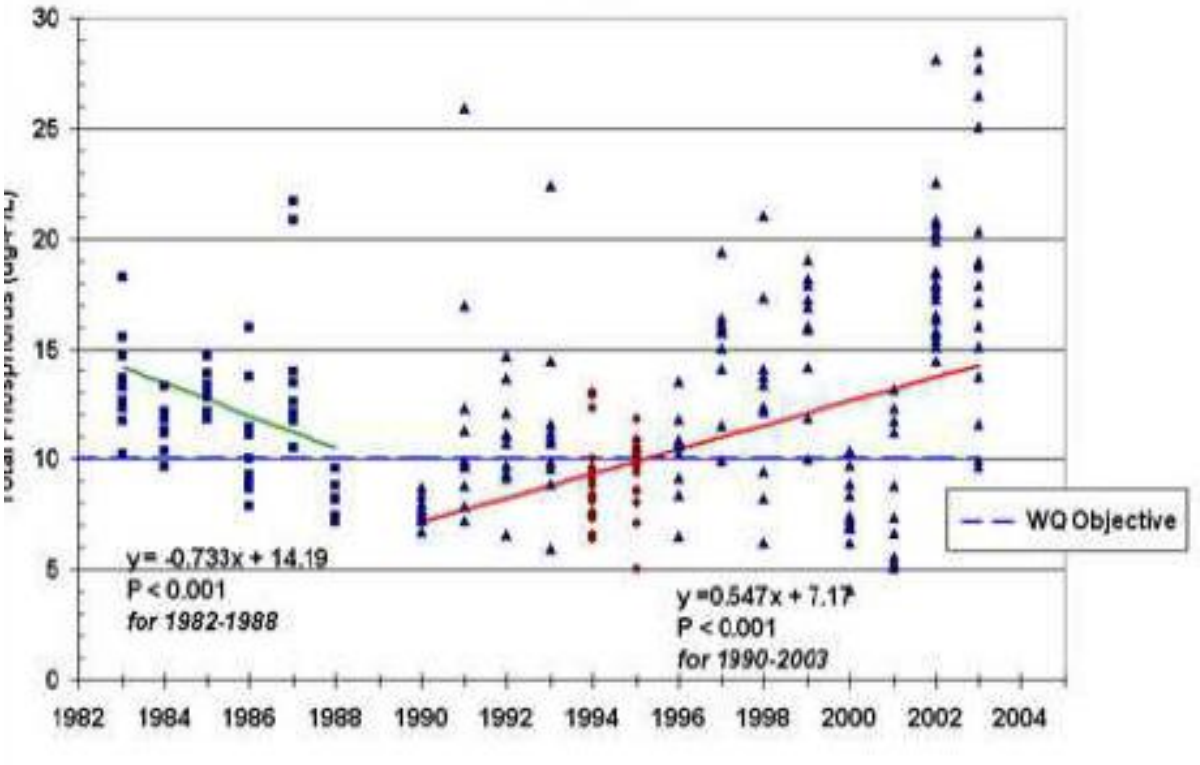
- *Annual Ontario Lake Erie Drainage Basin contribution*

*484 * 1/2.6 * 1/10 * 22800/78000 = 5.44 cubic km per year*

- *Annual Ontario Lake Erie Drainage Basin contribution = 1.12% of lake volume*
- *Per hectare contribution = 5.44/22800 = 240 mm per year per ha*
- *Average concentration of phosphorus lost 1.4 kg/240 mm/ha = 0.58 mg/l*

This average of 0.58 mg/l or 580 µg/l can be compared to the WBBE average of 750 µg/l total and 200 µg/l soluble

Lake Erie Monitoring

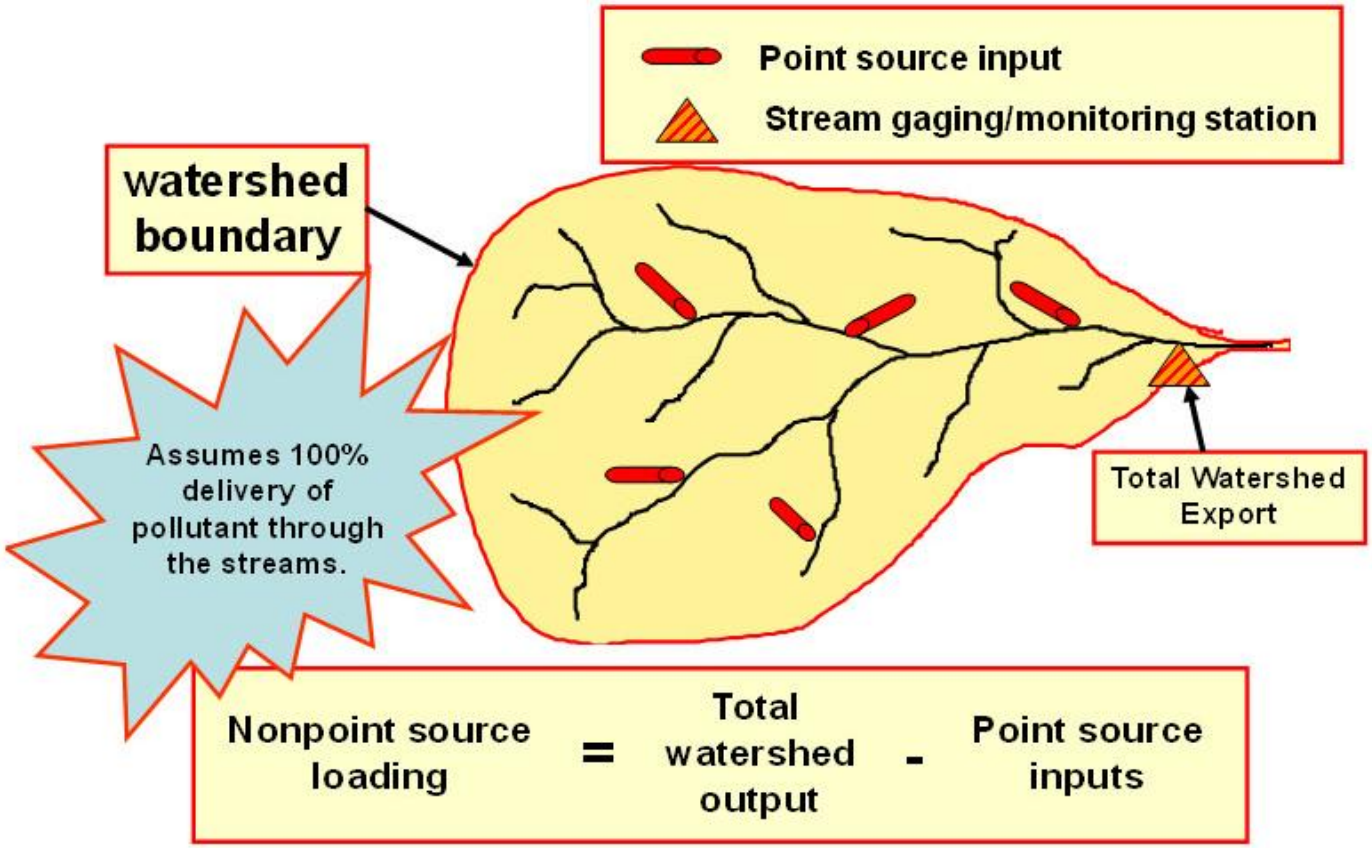


Lessons from the Big Picture – Mixing of Concentrations

Inflow P concentration µ/l from the Ontario Lake Erie Drainage Basin	Lake Erie P concentration µ/l after 1 year	Lake Erie P concentration µ/l after 10 years
200	17	35
100	16	24
50	15.4	18.7
5	14.9	13.9

(starting Lake Erie P concentration 15 µg/l)

Mixing Concentrations why does it matter



The CEAP Targeting Approach

- *Under treated acres were identified by an imbalance between the level of conservation treatment and the level of inherent vulnerability*
- *Not all acres require the same level of conservation treatment because of differences in inherent vulnerability due to soils and climate conditions*
- *Questions*
  - *How to assess inherent vulnerability*
  - *How to assess the level of conservation treatment*

Inherent vulnerability – Soil Runoff Potential

Soil Runoff Potential Rating	Soil Hydrologic Group A	Soil Hydrologic Group B	Soil Hydrologic Group C	Soil Hydrologic Group D
Low	All Soils	Slope <4	Slope < 2	Slope < 2; K factor < 0.28
Moderate		Slope >=4 and <=6; K factor < 0.32	Slope >= 2 and <= 6; K factor < 0.28	Slope < 2; K factor >= 0.28
Moderately High		Slope >=4 and <=6; K factor >= 0.32	Slope >= 2 and <= 6; K factor >= 0.28	Slope >= 2 and <= 4
High		Slope > 6	Slope > 4	Slope > 4

Assessing Conservation Practices for Phosphorus Management

- *Three components;*
  - *Structural practices (in field and edge of field),*
  - *tillage and residue management including estimates of gain or loss of soil organic carbon, and*
  - *nutrient management (rate, timing and placement)*
- *Each rated as L, M, MH and H;*
- *Two categories – slope <= 2 (uses tillage and nutrient management) and slope > 2 (uses all three components)*

The Targeting Matrix

	Conservation effects rating				
	High				
	Moderately High				Under
	Moderate			Under	Treated
	Low		Under	Treated	Areas
Inherent Vulnerability→ Rating (can be mapped!!)		Low	Moderate	Moderately High	High

The Serenity Prayer

God grant me the serenity to

- *Accept the things we can not change*
- *Courage to change those things that we can, and*
- *the wisdom to know the difference*

The Serenity Prayer – to improve Great Lakes Water Quality

- *Accept those things that you can not change – define them and make the case for change to those who can change them*
- *Change those things that you can change – document the design criteria and boundary conditions and measure to confirm the change*
- *Have the wisdom to know which is which*

Accept, Change, Wisdom to tell the difference

- *Farmers – **holistic approach – production, stewardship, environment;***
- *Researchers - **information and BMP development (reduction)***
- *KTT advisors – target – facilitate the flow of information (synthesis)*
- *Managers – within a focused set of objectives allocate resources, develop recommendations, regulations, and review information and submit requests and recommendations for change*
- *Policy makers – in response to a broad range of pressures develop high level goals and objectives, manage money and resources*

Accept (and refer), Change, Wisdom to tell the difference

- *Farmers – emerging problems and their need for information for viable decision making*
- *Researchers – boundary conditions what is included and **what is not** – need for new research approaches*
- *KTT advisors – need for appropriate kinds and levels of information for BMPs and targeting*
- *Managers - ??*
- *Policy makers - ??*

Gaps, Limitations and Challenges

- *BMPs have design criteria limitations e.g. if the capacity of a vegetative buffer is exceeded during storm periods or the non-growing season was it designed to handle the loading or should a different BMP have been chosen such as barrier of straw bales*
- *Farmers must operate in a holistic environment whereas researchers tend to deal with problems in a reductionist fashion*
- *Information gaps to target inherent vulnerability – sometimes it is easier to develop a model than to fix the information and data gaps*
- *Do the scoping math to confirm boundary conditions and expectations and follow through with measurement – then scale up – document and present both results*
- *Accept, Change and have the wisdom to tell the difference*

Conservation Effects – Structural and Annual Practices

- *In-Field Practices*
  - *Practices that control overland flow (terraces, contour buffer strips, contour farming, stripcropping, contour stripcropping), and*
  - *Practices that control concentrated flow (grassed waterways, grade stabilization structures, diversions and other structures for water control)*
- *Edge-of-field practices for buffering and filtering surface runoff before it leaves the field (riparian forest buffers, riparian herbaceous cover, filter strips, field borders)*

Conservation Effects – Structural and Annual Practices

Level of Treatment	In-Field – overland flow	In-Field – Concentrated flow	Edge-of-field practices	Rating
Low				1
Moderate	Either this	Or that		2
Moderately High	Either Both	Of these	Or this	3
High	Either this	Or that	And this	4

Conservation Effects – Levels of Residue and Tillage Management

Level of Treatment	Definition	Rating
Low	Conventional tillage; crop rotation is losing carbon	1
Moderate	Some crops have reduced tillage but tillage intensity exceeds criteria for mulch till or crop rotation is gaining SOC and tillage intensity exceeds mulch till criteria	2
Moderately High	Average annual tillage intensity meets criteria for mulch till or no-till and crop rotation is gaining SOC	3
High	All crops meet tillage intensity criteria for no-till or mulch till and crop rotation is gaining SOC	4

Conservation Effects – Phosphorus Management Levels

Level of Treatment	Definition	Rating
Low	All acres have excessive application rates over the crop rotation and inadequate method or timing of application for at least one crop in the rotation	1
Moderate	All phosphorus applications for all crops have appropriate time and method of application	2
Moderately High	Total phosphorus application rates (including manure) are less than 1.1 time the phosphorus in the crop yield for the rotation. No method or timing criteria applied	3
High	Total phosphorus application rates summed over all crops are less than 1.1 times the phosphorus in crop yields. All applications within 3 weeks before or 60 days after planting and all applications are incorporated or banded/spot/foliar	4

Conservation Treatment Levels – P Runoff Control

	Slope <= 2%	Slope > 2%
	Residue and Tillage Management and Phosphorus Management	Residue and Tillage Management, Phosphorus Management and In-field and Edge-of-Field practices
Rating		
Low	2-3	3,4,5
Moderate	4-5	6,7,8
Moderately High	6-7	9,10,11
High	8 (high for both)	12 (high for all three)