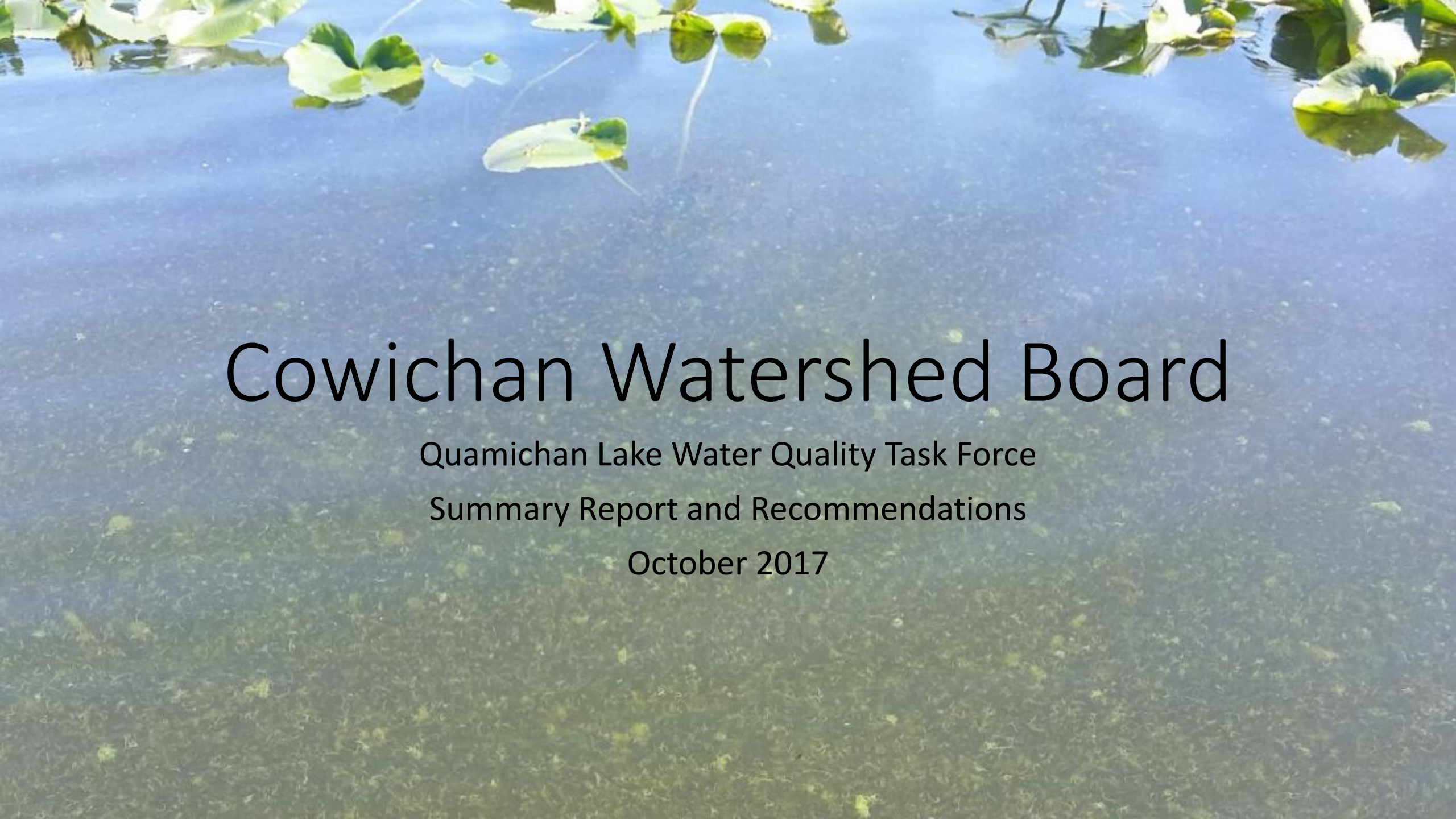


Cowichan Watershed Board

Quamichan Lake Water Quality Task Force

Summary Report and Recommendations

October 2017

Purpose of the Task Force Established December 2016

1. Recommend to the B.C. Government treatment strategies to improve water quality (e.g.. Eliminate blue green algae) and the long-term health of Quamichan Lake.
2. To identify specific strategies that North Cowichan and its partners can implement to reduce nutrient in Quamichan Lake

Members of Task Force

Mayor Jon Lefebure, Chair

Ken Ashley - B.Sc., M.Sc., M.A.Sc., Ph.D**. -** internationally recognized for his research in the design, operation and effects of hypolimnetic aeration systems, lake/reservoir fertilization, and stream/river enrichment.

James Cosh – FCPA, FCA – Founding Director of the Quamichan Watershed Stewardship Society

Dave Groves – BSA, MSA, PhD Biochemistry - Vice President, Sea Spring Salmon Farm Ltd. 1982-2008, Past Director and President, Cowichan Watershed Council

Tim Kulchyski – Resource Consultant and expert on the impact of development on cultural values and marine ecosystems.

Tom Rutherford - Executive Director of the Cowichan Watershed Board – 35 years experience with Fisheries Canada

Jen Woike – owner of Farmer Ben Eggs, member of the BC Egg Marketing Board, Provincial Chair for B.C. young Farmers Program

Quamichan Lake

- Largest lake in North Cowichan
- Drains 17.3 square kilometers
- 3.13 square kilometers
- Maximum depth – 7.9 meters
- Volume 13,770,000,000 liters
- Impacts thousands in the “South End” / Maple Bay Community

- Concern over algae blooms increased in the 1990’s
- Summary of Data Collected 1951 to 2005 prepared in 2006
- Quamichan Watershed Stewardship Society Established in 2008 (Quamichan Stewards)
- Phosphorus loading study completed in 2008
- Action plans developed in 2008 (Riparian planting and restoration started)
- Settling ponds on Gary Oak Preserve completed in 2013 by Quamichan Stewards
- Trout Refuge Aeration Project completed 2014 supported by North Cowichan, Rotary and Quamichan Stewards
- Rising temperatures in the lake and algae an increasing concern

TROUT REFUGE

Quamichan Lake, Duncan, BC

QUAMICHAN STEWARDS

Quamichan Lake has an excess of nutrient arriving in the runoff from the surrounding residential and agricultural development. That nutrient supports the growth of trout placed in the lake by the Freshwater Fisheries Society of BC and their food chain – crayfish, protozoa daphnia as well as algae. Towards the end of summer when the water is warm and the algae starts to die off the trout and their food chain are caught between water with low oxygen and that with too high a temperature. Without this refuge large numbers of trout and their food chain will die. The Quamichan Watershed Stewardship Society led the installation of the compressed air system and fine bubble diffusers that both cool and aerate the water. The refuge is the result of the support and collaboration of:

MUNICIPALITY OF NORTH Cowichan

Rotary Club of Duncan

TimberWest

Aquatech

Woodmere Strata Corporation

Project completed July 2015

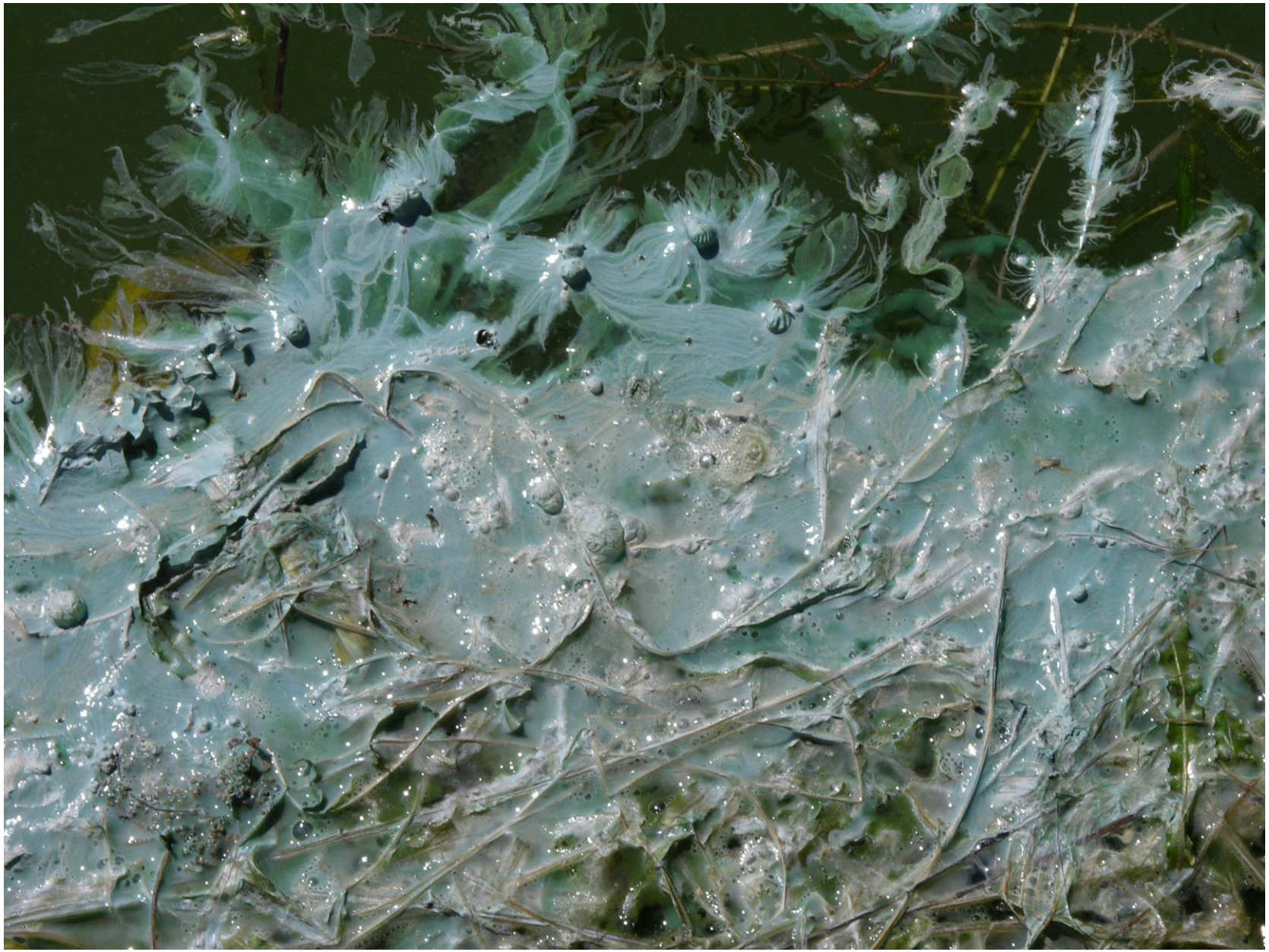
A Need to Take Action

Dr. Lyn Pascoe's dog, Austin, died a day after returning home with bright green algae from Quamicham Lake clinging to his legs. (Dr. Lyn Pascoe)

Toxic algae suspected in Cowichan-area dog deaths

At least 4 dogs died after swimming in or near algae-filled Quamichan Lake (CBC News Oct 28, 2016)

Blue Green Algae



Why is Algae a problem?

Algae or Sinobacteria can grow rapidly. Its cells contain **Toxins** that are released when the cells break down.

Toxins impact the liver of animals and humans

They can be fatal to dogs and are a serious risk to small children

The Government of Canada has issued guidelines for the monitoring of Toxins.

- Algae growth is tied to excess nutrient – particularly phosphorus.
- Phosphorus gets in the lake from the air and runoff streams.
- Phosphorus only leaves as part of plants or animals or as runoff.
- More phosphorus has come into Quamichan Lake than has left for many decades, resulting in a buildup of phosphorus on the bottom of the lake.
- Warm temperatures release phosphorus from the bottom of the lake.

Algae Blooms are now bigger, start earlier and occur later in the year than in the last decade.

Phosphorus in the water column in the lake has increased

From an average of .06 mg/L up to 2007 to .19 mg/L in the 2014/15 period

Phosphorus is increasing because:

1. More is released from the bottom in warmer temperatures
2. Farm practices have remained unchanged but there is a gradual increase in the non-farm activity
   - Disturbing the soils
   - Adding to the housing stock

Current inflow of phosphorus would replace all the phosphorus in the water column in a few years.

We have looked at : - How to get phosphorus out of the lake water.

- How to reduce how much phosphorus is getting into the lake

Remove Phosphorus from the Lake Water

1. Dredging - very expensive and very invasive
2. Harvesting Water Lilies – low phosphorus content
3. Harvesting Duck Weed – low phosphorus content and hard to grow and harvest
4. Skimming algae – high in phosphorus and being done elsewhere – **A possibility but need to develop a prototype**

Aeration

1. Speece cone oxygen injection – generally not used in shallow lakes but being tried elsewhere
2. Surface aerator – does not impact nutrient load
3. Bubble column aerator – generally best in deep lakes to promote turnover
4. Fine bubble aeration – used in fish farms, a possibility but expensive and would not reduce temperature or directly impact phosphorus.

Biological Treatment

1. Purchased bacteria concentrates – c/b $1 million per year
2. Generate our own bacteria to carry out the phosphorus – **A possibility**
3. Barley straw added to lake – requires too much straw and could increase the problem

Remove Phosphorus from the Lake Water

Agents to precipitate the phosphorus out of the water – all seen as too invasive and destructive to wildlife

1. Iron Oxide
2. Phoslock
3. Alum

Zeolite – not used elsewhere but could remove toxins – **worth watching developments from suppliers**

Ultrasound – expensive and could be counterproductive

Add Cold Water – reduce the release of phosphorus from the bottom, reduce lake temperature, allow fish to survive, increase flushing – **A possibility**

Improve the outlet – smooth flow of water takes out more phosphorus – **should be ongoing**

Where does the Phosphorus come from

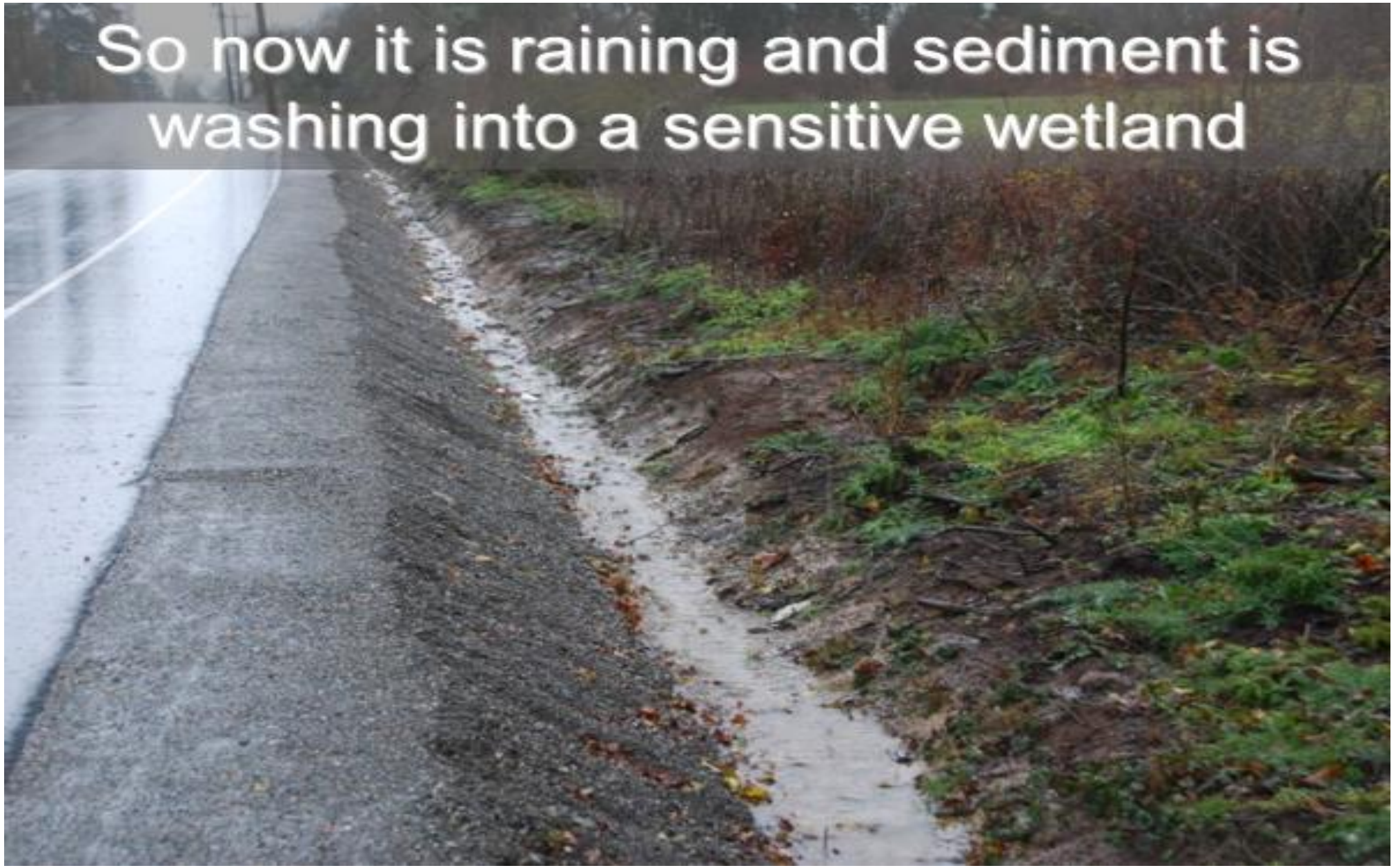
- Point Sources
  - Wastewater effluent
  - Feed lots
  - Storm sewers

  We do not have any big Point Sources of phosphorus
- Non-Point Sources
  - Runoff from agricultural land and pastures
  - Urban runoff
  - Septic leachate
  - Construction sites
  - Atmospheric deposits
  - Logging and larges scale soil disturbance

Our Challenge is reducing None-Point Runoff – each a small contributor but collectively providing the nutrient that grows the algae

Sources of nutrient and possible actions

1. Erosion from runoff creeks, ditches beside roads and channeled water draining large areas of development
    1. Review the maintenance practices that contribute to erosion i.e. cleaning all vegetation
    2. Add foliage and boulders to slow down the streams
2. Construction site management
    1. Change the timing of excavation and construction to the summer
    2. Do a better job of reducing runoff
3. Human Activity – garden and lawn fertilizer, hard surfaced paths and drives, lack of rainwater storage on site
    1. Some of this can be impacted by education.
    2. Could change zoning to reduce runoff from sites
4. Expansion of Sewered area – get more of the 750 septic tanks connected to sewers
    1. Be more active with sewer expansion
    2. Require septic inspections or assessments to ensure they are working
5. Farm Fields
    1. Addition of zeolite to animal feeds – reduces runoff and makes manure more efficient to use
    2. Using zeolite as a nutrient trap at the edge of fields
    3. Plant trees and shrubs at the edge of fields to trap nutrient
6. Zoning and regulatory changes
    1. Runoff management built in to zoning and building permits
    2. Charging for storm water runoff – combine stormwater with sewer utility
    3. Increase the use of row or town house development – reduce footprint and related soil disturbance and leave more room for runoff water treatment


So now it is raining and sediment is washing into a sensitive wetland

Monitoring and Measurement

1. The Government of Canada recommends monitoring for Cyanobacteria and Toxins in recreational waters. Since the toxins can have devastating effects, monitoring when they are suspected to be present would be prudent.

2. We will need baseline nutrient loads for key creeks and the lake and regular monitoring to see changes resulting from runoff reduction actions taken or poor runoff management not otherwise identified.

“What gets measured gets done”

In Search of Excellence by Tom Peters - one of the world's *Quality Gurus*

A final thought

The algae and cyanobacteria in the lake is a symptom of human development and habitation getting ahead of the ability of our environment to absorb the resulting runoff of nutrient. There is no "Silver Bullet" that reverses decades of neglect but concerted, persistent actions can start a trajectory of improvement.