Water and Land Tour of Lake Monticello's coves.

Water Tour

Land Tour

Coves full of sediment and leaves

- Polk Cove which has 4 docks without any boat access.
- Un-named cove between Benita and Leisure Court
- Un-named cove on Old Homestead Circle with one boat beached.
- Cove at 32 Possum Lane has a similar drainage problem as the head of Washington Cove.
- Cove at the end of Kingswood Road.

Jackson Cove

- Cove at the end of Xebec
- Cove between Amethyst and Jefferson
- Cove between Amethyst and Laguna
- Cove between Laguna and Mesquite
- Left side of Cove on Vine Ridge Road moving toward the head of the cove

Monroe Cove

- Un-named cove between Bella Vista and Barkley has 2 docks without boat access
- Cove between Amethyst and Laguna
- Cove between Ponderosa and Amethyst
- Cove between Finch and Condor

Washington Cove

- All coves in Washington Cove

Adams Cove

- Cove between Woodbridge and Chatam

What is *E. coli*?

- *Escherichia coli* (*E. coli*) is a bacterium commonly used as an indicator of water quality for freshwaters.

E. Coli in Water

- *E. coli*'s natural habitat is the intestinal tract of warm-blooded animals.

- Its presence in water indicates fecal contamination and the *potential* for waterborne disease.

What is the significance of *E.coli*?

- (Dufour 1984) demonstrated that *E. coli* concentrations are the best predictor of swimming-associated gastrointestinal illness.

What levels of *E.coli* are considered high for recreational waters?

- The EPA recommended recreational water quality standard for *E. coli* is based on two criteria:
- 1) a geometric mean of 126 organisms/100 ml based on several samples collected during dry weather conditions or
- 2) 235 organisms/100 ml for any single water sample (EPA 1986).

What levels of E.coli are considered high for recreational waters?

- The current EPA water quality standard for *E. coli* corresponds to approximately 8 gastrointestinal illnesses per 1000 swimmers (Dufour 1984). Virginia follows the current EPA water standards for recreational waters.

What levels of *E.coli* are considered high for recreational waters?

- States can adopt standards that are more restrictive than the current EPA standards.
- Vermont' standards are based on a threshold concentration of 77 organisms/100 ml water for any single sample.
- This corresponds to approximately 4 expected illnesses per 1000 swimmers (Dufour 1984).

Why *E. coli* is used for water quality testing?

- Mandatory water quality improvement programs, such as the U.S. Environmental Protection Agency (EPA) Total Maximum Daily Load, target *E. coli* concentrations in water.

Why is *E. coli* used for water quality testing?

- *E. coli* is also frequently used as the source identifier in microbial source tracking methods.
- The existence of various pathogenic *E. coli* (e.g.,enteropathogenic, enterotoxigenic, enterohemorragic *E. coli* strains) makes the choice of *E. coli* even more appropriate.

E.coli and Fecal coliform Indications

- Fecal coliform (FC) bacteria, and more recently *E. coli*, are indicators of fecal contamination and microbiological impairment of water quality.

Scientific Research
E. Coli & Sediments

- A literature review titled " *Escherichia Coli* and Fecal Coliforms in Freshwater and Estuarine Sediments" by Y. A. Pachepskya and D. R. Sheltona
- a USDA-ARS Environmental Microbial and Food Laboratory, Beltsville, MD, USA

Internet link to Research Study

- published in a peer review journal *Environmental Science and Technology* 41: 12, 1067 — 1110 in May 2011.
- To link to this Article: DOI: 10.1080/10643380903392718
- URL: http://dx.doi.org/10.1080/10643380903392718

What is the relationship between sediments and *E.coli*?

- In summary, this literature review makes the following points.

Summary Points

- It has been known for some time that substantial populations of fecal coliforms (FC) and *E. coli* are harbored in freshwater bottom sediments, bank soils, and beach sands.

Summary Points

- Geldreich (1970) stated that the water-sediment interface of a stream or lake bottom can serve as a reservoir for fecal pollution 'fallout' from overlying water.

Summary Points

- The relative importance of sediments as bacterial habitats and as a source of water-borne FC and *E. coli* has not been recognized until recently.

Summary Points

- A large number of publications have shown that in many cases the resuspension of sediment, rather than runoff from surrounding lands, can create elevated *E. coli* concentrations in water.

Summary Points

- This has far-reaching consequences for the detection, monitoring, and control of microbiological pollution of freshwater sources.

Summary Points

- As sediments may act as a reservoir for pathogens, it is important that they, too, be evaluated to determine if they pose a potential risk to human health (Donovan et al.,2008).

How does this affect water quality?

- The presence of bottom sediments containing large, unquantified reservoirs of fecal pollution introduces substantial uncertainty in detection, monitoring, and control of microbiological water quality and stream impairment.

How to reduce *E. coli*? A short term approach

Dredging

Dredging

- Dredging will remove the sediment along with the bacteria. Grimes et al. (1980)
- The bacteria will not live in the spoils area. (Grimes et al. 1980)

Dredging

- The dredging will stir up the sediments and the area being dredged should be closed to swimming during and after dredging.

How to reduce *E. coli*? A long term approach

- Most water conservation measures have the potential to decrease the sediment storage of pathogenic and indicator coliforms.

Methods to reduce sediment load

- Reduction of nutrient loads from agricultural and urban areas can decrease aquatic growth within impoundment areas, thereby reducing the potential for bacterial regrowth.

Methods to reduce sediment load

- Restoration of wetland and riparian zones may allow for infiltration of surface water runoff, thereby filtering out most bacteria by way of bank filtration.

Methods to reduce sediment load

- Implementing storm water runoff structures that promote infiltration and do not allow direct input of storm water to enter the steam may reduce bacteria levels by means of sediment filtration.

Methods to reduce sediment loads

- Reducing stream bank and streambed erosion may reduce bacteria concentrations during storm flows by minimizing the amount of sessile bacteria washed into the stream as the stream bank and streambed are eroded.

Importance of reducing sediment loads

- The explicit recognition of the importance of sediment as the pathogen bacteria reservoir makes imperative the development of treatments specifically aimed on the reduction of the pathogen concentrations in the sediment.

Importance of reducing sediment loads

- The efficiency of such treatments is evaluated by the changes of pathogen concentrations in water and sediment (Scholes, 2008).

Recommendations

- Make storm water management program similar to WEG report a priority
- Include in the water testing program sediment testing.

Recommendations

- Compost or remove leaves in spoils area.
- Implement a new drainage area for the spoils.

Recommendations

- Dredging the coves needs to be a priority.
- Increase efficiency of current dredging program to quickly clean the coves.

Recommendations

- Work with Aqua to perform E. coli testing on a regular basis from May 1 to Oct. 1 as described in the WEG report.

Sediments removed by Dredging

- 1998 and 1999 the major coves were dredged
- 11,683 cubic yards of sediment were removed

Sediments removed by Dredging

- Oct. 2009 to present
- Approximately 6,000 cubic yards have been removed.
- At the present rate it will take at least another 2 years to remove an additional 6,000 cubic yards.

Yearly Cost of Dredging

- The yearly costs of dredging include:
- $10,000.00 insurance
- $10,000.00 maintenance
- $39,000.00 salary
- $66,000.00 principle & interest

Yearly Cost of Dredging

- The costs for the program through 2013 will be approximately $126,000.00 per year.
- $20,000.00 /year is placed into the reserves.
- Over 5 years, the Lake Health fund has spent $730,000.00 for dredging.

Costs after 2013

- $60,000.00 /year is the cost after 2013.

Income from Dredging

- The original plan indicated that annual income would be $40,000.00 per year.
- Actual income since the program began in 2009 is $11,884.00