Saturday Morning Live For 6/01/2013

"We're Live-We're About Liberty-We're Focused on You!"

❖ *call-in to comment or participate @ 676-5464 (KGMI)* ***8:05 am***

On the Show Today:

DOE Stormwater Diversion Systems:

Dave Onkels (Planning Commissioner) and Perry Eskridge (Realtors Assoc. Lawyer), are invited to talk about the science, costs and impacts of this program if implemented in Whatcom County

1. How will the new stormwater regulations in the Lake Whatcom watershed affect property owners in the watershed? **(Enormous cost, little benefit to the lake.)**

2. How much phosphorus will be removed from the stormwater contribution to the lake by these new regulations if all the lots are developed? **(117#)**

3. How does that compare to the phosphorus contribution to the lake from the Middle Fork diversion to the lake by the City of Bellingham? **(It pales.)**

5. How much phosphorus is in the water diverted to the lake, according to DOE? **(200 kg., or 660 lb.)**

6. What does the city of Bellingham, in the person of Clare Fogelsang, have to say about the effect of that diversion into the lake? Why does he say that the diversion water's phosphorus content is not a threat or a contribution of bioavailable phosphorus to the lake? **(It settles into the sediments and is not available to affect lake water quality.)**

7. Where do stormwater flows from Sudden Valley arrive in the lake? **(basin 3.)**

7. If phosphorus contributions to the lake from the diversion from the Middle Fork, by way of Anderson Creek, are not a threat to the lake, since they are delivered into basin 3, why are flows from Sudden Valley, delivered into the same basin, a threat? **(That's for the City of Bellingham and the Department of Ecology to answer.)**

8. What will the the per-lot costs of the stormwater regulation proposed for the watershed be? **(One local engineer estimates $40,000.)**

How much phosphorus will that remove from the lake? **(The Parametrix P wash-off calculations: .11 # of P per year per acre from original forested conditions, and .28 # of P per year for developed properties. The difference is .17 # of P year. A quarter-acre lot would then produce an additional .04# per year compared to the original forested condition. If the required BMP's cost $40,000 for that lot, the cost of avoided P wash-off is $1,000,000 per pound.)**

9. What is the TMDL? **(It is the total maximum daily load of a pollutant, which is, in the case of Lake Whatcom, Phosphorus.)**

10. Why is this important? **(Lake Whatcom is a phosphorus-limited lake, for nutrients, so that calculated limit of phosphorus is critical for lake health.)**

11. Why is elevated phosphorus in the stormwater that flows into Lake Whatcom a problem? **(It [illegible] of algae.)**

12. What h[illegible] **(They consu[illegible] decompose.**

13. What i[illegible] **when the la[illegible] volume bec[illegible] something [illegible] the year du[illegible]**

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Fall. This occurs in the hypolimnia of basins one and two, and only for that period.)

14. What happens next? **(Every year, the lake de-stratifies, and the oxygen levels in the bottom of the lake are restored to original levels.)**

15. Is this process limited to Lake Whatcom? **(No!, It occurs in every lake. It is most pronounced in lakes with relatively shallow and rounded bathymetric profiles, such as those in basins one and two of Lake Whatcom.) (Dave explains.)**

16. What is the recent trend of lake water quality parameters in the lake? **(Dave recites data from the Institute for Watershed Studies at Huxley College for the Environment.)** Those data suggest that lake water quality is improving.

17. How long is water resident in the lake? **(At least six years.)**

18. What does that say about the effect of water-quality BMP's **(Govt.-speak for investments in facilities to improve water quality)** in terms of short-term water quality improvements**? (Not only is water resident in the lake for at least six years, it is subject to significant inter-basin mixing as the result of seiches [storm-driven waves] during the winter months when the lake is not stratified. I think a long time horizon for observed water-quality improvements should be adopted accompanied by continued investments in phosphorus-reducing BMOP's by Whatcom County and the City of Bellingham. Recent reports by the Institute suggest increasing lake water quality.)**

19. What is your opinion of property purchases by the City of Bellingham as a method of reducing phosphorus contributions to the lake? **(I'm amused by the futility. Present stormwater regulations require no net increase in phosphorus compared to the original forested condition as a result of development. If the City really believes that its regulations work in this manner, it is better to leave the land in the development pool at no net increase, than to remove it and to shift the cost of Lake Remediation to taxpayers out of the watershed. This might be, in an atmosphere of flakey land use regulation, the one most impacted by first-order thinking and least mindful of the externalities, the unintended consequences, of the regulation. These purchases benefit the lake not at all, and in fact deprive the effort to improve lake water quality of the tax revenue to accomplish the task.)**

Common Cents: (revised by me)

The growth of all powers, lawmaking, managerial and judiciary, in the same hands, whether of one, a few, or many, and whether genetic, self-appointed, or elective, may justly be said the very definition of tyranny.

I believe there are more examples of the taking of the freedom of the people by gradual and silent advances of those in power, than by violent and sudden seizure…This threat needs to be wisely defended against.

~ James Madison

Local areas were "the cleverest brainchild ever planned by the intelligence of man for the perfect use of self-government, and for its preservation.

~ Thomas Jefferson

Huxley Report (1)

Lake Whatcom Water Quality Summary Report
March 18, 2013

1. This report summarizes the preliminary data collected for the Lake Whatcom monitoring project from January through mid-March 2013. The YSI profiles are plotting in Figures 1–5; water quality data are plotted in Figures 6–65; stormwater hydrographs and sampling points are plotted in Figures 66–68. The water quality figures show results from January 1994–present to provide a frame of reference for the current data.

2. The lake was sampled on February 7 & 14, 2013. All sites were unstratified, and dissolved oxygen, pH, and conductivity concentrations were essentially uniform throughout the water column.

3. Alkalinity and turbidity concentrations were low at all sites and depths, which is a typical winter pattern for Lake Whatcom.

4. Ammonium, soluble phosphate, and total phosphorus concentrations were low and nitrate/nitrite concentrations were high, which is a typical winter pattern for Lake Whatcom.

5. The chlorophyll concentrations were relatively low at all sites and depths except the Intake, where the near-surface concentration was about twice as high (3.11 μg/L) as it was at other depths in the water column (1.4–1.7 μg/L).

6. The plankton counts were dominated by Chrysophyta (diatoms, *Dinobryon*, and other golden algae), which is a typical winter patterns for Lake Whatcom. Chlorophyta (green algae) were abundant at Site 1 but in very low densities at the other sites.

7. Coliform counts were low ($\leq$10 cfu/100 mL) at all sites.

8. The provisional Austin Creek and Smith Creek hydrographs are not available because IWS is converting to a new software program to calculate stream discharge.

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Huxley Report (2)

9. Beginning in 2013, monthly creek monitoring will be conducted in alternate years. The next scheduled creek sampling will be in January 2014.

10. Stormwater samples were collected in Brannian, Anderson, and Austin Creeks on the following dates:

Brannian Creek	Anderson Creek	Austin Creek
Jan 23–24	Jan 23–24	–
Jan 29–30	Jan 29–30	Jan 29–31
Feb 28–Mar 2	Feb 28–Mar 2	Feb 28–Mar 2
Mar 12–15	Mar 12–15	Mar 12–15

Figures 66–68 show provisional flows (cfs) and sampling points for events through March 2, 2013. The March 12–15 data are not yet available for plotting.

FACTS FROM THE FIELD

This is interesting, and there is a bit of reinvention of the wheel here, but what I found is offered for your consideration.

David Onkels
April, 2012 *(updated version March, 2013)*

Proposed Chapter 20.51 Lake Whatcom Watershed Overlay District

From the TMDL study (Overview)
"...Lake Whatcom was placed on the 303(d) list of impaired water bodies in 1998. The decision was made because in the basin closest to Bellingham (Basin 1) the rate at which oxygen levels declined in the bottom of the lake in the summer had increased over time. This information indicated that oxygen levels were below natural levels."

I argue that this listing was made because DOE asserted, without foundation, that the rate at which oxygen declined had increased. This measure is not presently used by most researchers. In addition, the Entranco study (1999 and 2002) contains data that appears to contradict the finding of increase in hypolimnetic oxygen depletion rate (HODR), and, in fact, includes a graph that demonstrates no trend in HODR. (Figure 18 on Page 42 of the Entranco report).

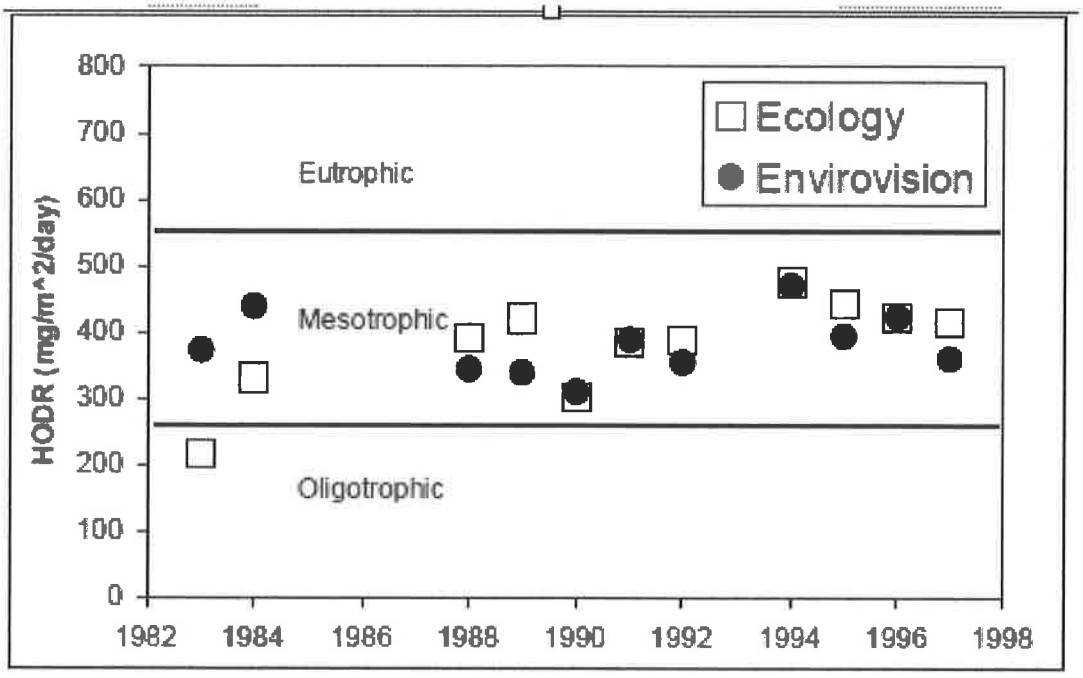

Figure 18
Comparison of HODR Rates Estimated by Ecology and Envirovision in Basin 1

The following graph, from a Department of Ecology Report titled, "Dissolved Oxygen in Lake Whatcom", appears to me to demonstrate no clear trend, the opinion of the authors notwithstanding.

Specifically, the Entranco study details differences between HODR rates as found by Ecology and those found by Envirovision. Entranco states, "The HODR over the 9-year period since 1988 are stable and show no trend."

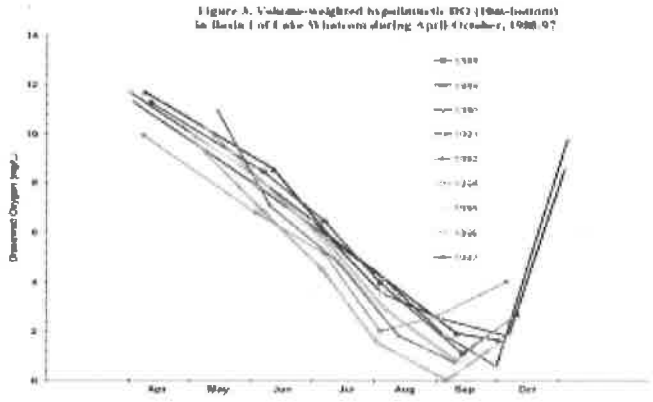

Figure 1: Volume-weighted hypolimnetic DO in Basin 1 of Lk Whatcom; Apr-Oct, 1988-97 (click image to link to original doc.

My opinion is that the use of "natural" in reference to oxygen levels is subjective, and might be replaced by "optimum" or "desired." Certainly, dissolved oxygen (DO) in the hypolimnion in September and October is going to be reduced, as it always has been. The "natural" is always going to tend to decrease.

I think that the authors of the "Total Maximum Daily Load," (TMDL) might have taken greater care in noting that the anoxia or reduced dissolved oxygen is primarily limited to the hypolimnia of Basins 1 and 2, and for only about three and a half months (at the most) of the year, and only in about .5% of the volume of the lake.

Interim data from the Institute for Watershed Studies indicate that DO levels for July and August 2011 in the hypolimnia of Basins 1 and 2 will be significantly higher than in immediately prior years. While this is not definitive, it is reason for caution in the implementation of land-use actions based on lake data.
http://ceratium.ietc.wwu.edu/IWS2/lakestudies/lakewhatcom/online_pdf/current.pdf

(The next two paragraphs are explanatory, based on bathymetry data from the Institute for Watershed Studies)

The hypolimnion volume of Basin 1 comprises (below 12 meters of depth, the bottom of the thermocline or metalimnion) only 0.35% of the volume of the lake and 16.58% of Basin 1, which in turn contains

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only 2.09% of the volume of the lake. The surface area of Basin 1 at 12 meters of depth is 3.63% of the area of the lake and 36.49% of the area of Basin 1.

The hypolimnion volume of Basin 2 comprises (below 15 meters of depth, the bottom of the thermocline or metalimnion) only 0.16% of the volume of the lake and 8.52% of the volume of Basin 2, which in turn contains 1.9% of the volume of the lake. The surface area of Basin 2 at 15 meters of depth is 2.36% of the area of the lake and 30.67% of the area of Basin 2.

I argue that the anoxic water comprises a small percentage of lake volume (0.51%), and that both **Basin 1 and 2 have relatively high area-to-volume ratios**, so that a "unit" of phosphorus (P) released from the sediments affects a disproportionately high volume of water. This conclusion is supported by almost all recent lake studies, but especially by Entranco (TECHNICAL REPORT, Water Quality Assessment/Conditions, LAKE WHATCOM STORMWATER PROGRAM 1999); prepared for Economic and Engineering Services Inc., and the Lake Whatcom Management team.

Here are excerpts from the abstract of a study that appears to support the argument: A study of thirty-eight oligotrophic lakes in central Quebec was conducted over a three year period to test the hypothesis that forest clear cutting and fires should be reflected in both higher nutrient export rates and ultimately in greater area hypolimnetic oxygen deficit rates (AHOD)..."However, no effect of clear cutting or forest fire on hypolimnetic oxygen consumption rates could be demonstrated as the result of a much greater and confounding variation in the effect of lake morphometry and the absence of information on the role of catchment-derived (Note: "Catchment" means "watershed.") organic matter on the AHOD. Consequently, only lake morphometry (hypolimnetic volume to hypolimnetic surface area ratio) served as a predictor of the AHOD...."

(Peter Douglas St. Onge, "The Effect of Clear-cut Logging and Forest Fires on Hypolimnetic Oxygen Depletion Rates in Remote Canadian Shield Lakes", A Thesis submitted to the Faculty of Graduate studies and research in partial fulfillment of the requirements for the Master of Science. July 2001)

The study results support my conclusion: Lake morphometry has a greater effect on AHOD (Areal hypolimnetic oxygen depletion) than does land use around the lake. In fact, for Basins 1 and 2, in a body of

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water such as Lake Whatcom, morphometry is destiny. That is not to say that phosphorus in stormwater flows into the lake from development surrounding the lake (especially in Basins 1 and 2) aren't a significant source of phosphorus in the water column of these basins, but it does support the argument that lake morphometry has a greater effect on phosphorus and low dissolved oxygen levels in the hypolimnion than does the pattern of land use in the watershed.

In support is this, from P. 58 of the TMDL: *"...little information is available about the effect of human activities on groundwater nutrient levels, and the amount of groundwater nutrients that would be present absent human contributions is unknown. The effect of future actions on groundwater levels is also uncertain. Measures to reduce phosphorus in surface tributaries may or may not affect groundwater phosphorus concentrations. The losses of phosphorus in the sediments as water enters the lake are also poorly understood. During the implementation of the TMDL, this may be a fruitful area for further investigation."*

I argue that this in-study language is insufficient to support the passage of land-use ordinances designed to control the flow of stormwater from the relatively small quantity of new development, since the findings of the TMDL are insufficient to find that the small stormwater flows from new development in the watershed mostly surrounding Basin 3 will adversely affect water quality in the lake, especially considering that the primary stormwater treatment strategies are infiltration and dispersion, both of which carry the risk of the injection of phosphorus into groundwater. As a consequence, this strategy is somewhat likely to result in violations of the Clean Water Act.

I argue, that if those phosphorus-rich stormwater flows don't reach groundwater then they are likely to find their way into preferential, or unsaturated zone flows, and to prematurely find their way into tributary streams and thereby directly into the lake. No measure of the quantity or phosphorus content of the resulting stormwater is available, but the implication of the language in the study is that the water will be somewhat depleted of DO and somewhat increased in P, as the result of adsorption from phosphorus-rich soils through which the water flows. Language in DOE material supports this scenario. The result of this would be lower DO and increased P in stormwater, exactly the opposite of what is desired for lake water quality.

I suggest that, where feasible, we design stormwater systems to deliver stormwater that is likely low in dissolved phosphorus from roof surfaces and other impervious surfaces likely to contain no significant phosphorus directly to the lake. My reasoning is that this water, mostly resulting from precipitation, is very high in DO and low in P: precisely the kind of flow that is beneficial to water quality in the lake. One criticism of this approach has been that leaves caught in gutters added to phosphorus levels in the resulting stormwater flows. It would be, in my opinion, a simple thing to design a study to determine if leaves caught in gutters resulted in stormwater flows containing higher levels of phosphorus.

One fact that is obvious is that pervious pavement is merely infiltration by another name, and trial installations of pervious concrete in the Silver Beach neighborhood have failed. (Anecdotally, calculations by a civil engineer who prefers to remain nameless indicate that stormwater from a major storm; given 40% pore space in the aggregate under the pavement would require more than ten inches of fill under the pervious pavement and take 1600 hours to infiltrate, in the Birch Bay area. Out-wash soils in the Lake Whatcom watershed have similar characteristics.) I'll be happy to provide his hand-written calculations.

I think that additional fate and transport study of phosphorus in the Lake Whatcom watershed should be conducted to better understand these processes. This sort of study is well-established for the study of contaminants (Phosphorus, in the case of Lake Whatcom).

No new study appears to exist,, although hydrologic simulation program Fortran (HSPF) contains a rudimentary fate and transport feature.

Fate refers to the forces of degradation and transformation as a substance moves through the environment. ***Transport*** refers to the way it moves through the environment. The reason I think that this study should be undertaken is that Ecology has limited knowledge about how Phosphorus moves through the environment at the present time. Lacking that knowledge, it has no basis for the encouragement of land-use regulations that purport to reduce phosphorus flows into the lake. There appears to be no science to link the regulation to the goal.

Lake and tributary monitoring is being conducted on an ongoing basis, with sampling frequency increasing and sampling locations also increasing in number. This should continue until the results form the

basis for the implementation of land-use regulations to reduce phosphorus loading in the lake.

Lake management techniques other than the stormwater management regulations which the Department of Ecology recommends for use are to be found here, in a Department of Ecology web page: "Lake restoration and management for algae"

Excerpts:
"A successful lake restoration program should strive to manage both external and internal nutrient sources."

"Controlling nutrient sources will not improve lake water quality immediately in many cases. Years may pass before lakes cleanse themselves of accumulated nutrient loads. For this reason, in-lake restoration techniques have been developed to accelerate recovery..."

"Please refer to the third edition of Restoration and Management of Lakes and Reservoirs, authored by G. Dennis Cooke, Eugene B. Welch, Spencer A. Peterson, and Stanley A. Nichols, 2005, for a comprehensive and scientific discussion of these and other lake management methods."

(Look here, by the way, for a diagram that demonstrates the names of the strata in the water in the lake.)

I suggest that a greater range of tools for lake management be implemented than have been to date, in order to achieve the goals of the TMDL. Land-use ordinances and stormwater best management practices (BMPs) will be insufficient.

In my opinion, the rights of property owners have been ignored by the failure to consider the management of internal nutrient sources and to consider the application of a wider range of funding sources to implement phosphorus management in Lake Whatcom. The implementation of the stormwater overlay may well result in myriad "takings" lawsuits against Whatcom County from property owners in Sudden Valley alone.

From the TMDL:

Recommendations
This report makes the following recommendation on how to develop and implement the TMDLs for Lake Whatcom and the 11 tributaries.
Dissolved oxygen and total phosphorus

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Pollutant allocations are recommended for total phosphorus and for developed acres as shown in Table 12.

- Final allocations and the *Summary Implementation Strategy* should be **developed collaboratively with local governments and citizens.**
- **Implementation should proceed, focusing on the approaches most readily implemented** to **reducing phosphorus loading.**
- **A basin-wide monitoring strategy should be developed to aid in adaptive implementation of the dissolved oxygen TMDL. The strategy should address monitoring of the lake, tributaries, and nutrient delivery from land uses, as well as the effectiveness of pollution-control strategies and practices.**
    - Types *of additional monitoring* and research that could potentially improve the watershed and lake models:
    - *Tributary loading during storm events*, including the deposition and re-suspension of
    - stream sediments and the impact of channel erosion.
- **Phosphorus uptake rates during infiltration of stormwater.**
- **Local inter-flow and groundwater phosphorus concentrations.**
- **Quantification of phosphorus deposition in sediments as groundwater passes though sediments and enters the water column. (Research proposed by Ecology to test procedures for measuring phosphorus attenuation [Pitz, 2008] may provide some information about what may be happening in Lake Whatcom.)**
    - In-stream processes that reduce phosphorus loading in tributaries.
    - Lake sediment phosphorus concentrations and exchange rates with the water column.
    - Loading from forested areas as a result of management practices and forest succession stages.
    - Changes in phosphorus delivery rates from developed lands as a result of different land-use and stormwater management practices.
    - Sensitivity analysis of key modeling parameters, such as wind-sheltering coefficient for the lake model, or infiltration rates for the watershed model.
    - *As implementation progresses, it may be desirable to refine the model by calibrating to smaller, more homogenous sub-basins if some basins are not responding to implementation as predicted by the current model.*
- **Modeling of the watershed and lake models using additional years of data, either as recalibration or for verification, could be helpful to improve and build confidence in the models.**
    - Improving the watershed and lake models based on new information is an appropriate ongoing task as part of implementation, although it should not be funded at the expense of phosphorus reduction efforts.
- **Bacteria**
    - Pollutant allocations are recommended for fecal coliform bacteria as shown in Table 14.
    - Monitoring results that identify elevated bacteria levels should trigger notification of public health authorities. Consideration of public exposure may help identify high priority locations for ongoing monitoring.

- **An *Implementation Strategy* should be developed collaboratively with local governments and citizens.**
    - NPDES (national pollutant discharge elimination system) permittees should agree to voluntarily extend relevant portions of their stormwater management plan to control non-point sources of bacteria. This would be to ensure more stringent limits are not needed on the NPDES regulated sources.
    - An effectiveness monitoring program should be developed to assess implementation of the bacteria TMDL

Finding:
Recent monitoring appears to find that bacteria levels in the lake are below action levels, with the exception of only a few tributaries at some times of the year, in which DNA testing might provide some illumination about the source of contamination.

In my opinion, the recommendations of the TMDL for additional study and monitoring should be implemented, and the results should be used to formulate public policy, land-use regulations, and ordinance language. To impose land-use ordinances based on the incomplete data and resulting conclusions about phosphorus flows into the lake contained in this study at the present time is premature.

In order to generate political support for lake management strategies, additional citizen input should be aggressively pursued to in the creation of "**• An *Implementation Strategy...*"**, (see above) possibly with the aid of notification by mail, email, or social media of affected property owners that include clear language about the probable effects on those property owners of proposed ordinance language.

NPDES permittees should agree to voluntarily extend relevant portions of their stormwater management plan to control non-point sources of bacteria."

I think it's pretty clear that NPDES permittees are going to find themselves under increasing scrutiny and **under increasing delineation and flow-measurement requirements**. The **permittees, both the City of Bellingham and Whatcom County,** *must* proceed immediately.

- David Onkels, Whatcom County Planning Commission