Minutes from Lake Carmi Coordination Team Meeting
Thursday, February 25, 2021 @ 4:00 PM

1. **Introductions**

- See Last Page for a list of meeting participants
- Rob Evans (FWC) acknowledged of town select board members (Yvon Dandurand and Pete Magnant) who are stepping down. Also support from legislature, during a zoom meeting outside of legislative season. Legislators asked questions, good conversations, including continued refinement of Lake in Crisis and $50,000 to support. Tucker has knocked it across the park in terms of receiving grants, including water quality monitoring work
- Oliver Pierson (DEC) gave presentation on aeration system during Franklin information meeting last week (town meeting), stating that 2020 included challenging weather. Aeration season had an early snafu, which affected internal loading. Good news with federal and state support of BMPs in watershed as well as all the partners involved.

2. **Presentation from VDH on cyanobacteria health impacts / toxicity issues**
   Sarah Vose, VDH *(Note: Presentation attached to the Minutes)*
   - Overall Goal of VDH's work with cyanobacteria is to protect people at greatest risk - drinking water and contact during recreation. In general VDH recommends – When in doubt stay out!
   - ALS brought up as topic of interest: lots of theories to understand cause of ALS that are not genetic. Includes head injuries, occupation. A Dartmouth neurologist published papers postulated about link between ALS and CB. This is based on spatial clustering. It's a hypothesis and would need more in-depth research to show a causal relationship.
   - Discussion:
     - Oliver – Our monitoring results indicate that that majority of CB blooms do not produce toxins.
     - Rob – interest based on VPR report about study about clusters associated with CB blooms. How do we stay abreast of research findings?
     - Sarah -clustering studies created an expected number of ALS. But this isn't a reportable disease. So, needed to estimate numbers of cases. Didn't interview people with ALS. DVH does read every research paper. She couldn't participate in VPR story because of time spent on COVID. She talked about weakness of studies to date. Aerosol studies being done in Vermont. IN Florida, seen near ocean, where oceans can aerosolize water easily.
     - Andrea Englehart – drinking water taken from lake, is that considered untreated?
     - Sarah – depends on treatment train. If it follows DEC rules, it should take out of toxins. She remembers that 2017 was date of rules, and DEC wouldn't know what people were using before that time as it wasn't tracked and so couldn't reach out.
     - Diane Larose – concerned about aerosol from Ocean having CB toxins. Brother-in-law lives on North end of lake, and has liver disease, and knows of others around lake who have ALS. Would request that aerosol be tested for CB toxins. Would hot water tanks worsen it, especially when goes through shower. Worried about impacts of CB.
     - Sarah – Lots of unknowns. Know that minerals in water, can aerosolize during showering.
     - Pete – get message that we should stay out of waters when bloom but would like to know more about impacts of aerosols.

- Oliver – if some lake water by passes home treatment systems and goes straight to shower, may want to change.
- Diane – most get water from town for drinking, but then draw from lake for other uses.
- Oliver – can investigate and continue to discuss in future.

3. Update on in-lake monitoring data from 2020

A. **Andrew Schroth, UVM** will present the results of their 2020 lake carmi water quality monitoring work

B. **Oliver Pierson, DEC** will discuss TMDL progress as cited in the Carmi Clean Water Progress Report

A. UPDATE on INLAKE monitoring data.

- New platform with automatic sampler that UVM put into lake with DEC Grant. Led by Andrew Schroth, Ph.D.
- Andrew = presented on 2020 results (slides): More comprehensive monitoring and he will provide summary of finding to show how lake system has changed in response to aeration – measured at bottom to top of water column in deep trough in lake, also sediment samples to analysis P over time. Can then show how changes in water column and sediment chemistry relate. Could also look at meteorological data over 2 years to describe general precipitation pattern. Over course of study, had different patterns (2018-2020). 2020 – dry season with large rain events.
- Reviewed time series –
  - 2018 -before system, so natural system – where sustained stratified system until fall when cooling, leading to fall turnover (water mixes) – so bottom of lake has 0 oxygen during summer until mixing occurs.
  - In 2019 and 2020 – system turned over earlier in August. But in 2019 – sustained stratification because system failed early on but mixing happened when system began to work again.
  - In 2020, system turns on in late May, so lake was fully mixed. This was an advantage. There was a prolonged period where system was down again, and oxygen level declined again. When system came back on again, oxygen levels at bottom increases as system mixes.
- How it plays out regarding phosphorus concentration – Natural system – see large spikes of internal loading of P, when oxygen is low in sediment. In 2019, aeration limited internal loading; in 2020 saw decreased limited loading. Except ….. when this was a dry summer?
- Iron and Manganese measured and was similar to P, which supports that P is from internal loading.
- Measurement of CB algae – multiple blooms associated with weather? Limited extent of monitoring though - When bloom is bad all over lake, sensor detect it, but if bloom is around edge or concentrated in' other areas, wasn't detected.
- What triggered bloom in dry year of 2020? – anoxic because system failed, in early July – p builds up, then wind event, which mixes water column, bringing P from bottom to near surface where there's light, giving algae light and P, resulting in a bloom. Large storm pushed bloom down, but P still high.
- So system good to control internal P loading.
- UVM professor - Mindy Morales study – found that composition of phytoplankton much more diverse when system installed. During bloom, often few species dominate. But when well mixed than much more diverse population. Possibly with lower population of CB.

- Data (in real time) is presented here in quasi-real time.

B. PROGRESS AGAINST TMDL

- See existing presentation on this subject
- Installation of clean water projects expected to improve water quality. We can model P reduction benefit for now and compare against expected P reduction goal. Graph shows that way to go but have made progress. Presently at 43% of TMDL target, mostly due to P reduction from Agricultural BMPs.

C. DISCUSSION

- Oliver – Could be hopeful that by suppressing internal loading could offset external load. Will have to look at difficulty in measuring presence of shoreline blooms.
- John Tucci , EverBlue– if change in Dissolved oxygen in bottom, would that lead to huge P spike?
- Andrew – There could be a very thin layer of P at bottom, so if mixed, becomes dilute. SO if thicker layer, more enriched water column then, which could happen if anoxic condition lasts for long time. The study didn't measure thickness.
- John Tucci – any insight into anabaena being small population, but when stressed, comes to surface as localized slicks. Do we have to achieve perfection to reduce anabaena, to reduce blooms along shorelines? Where do we need to get Lake Carmi too, for both internal and external loading and can we do it.
- Oliver – we have been looking at CB species, and will continue.
- John (other) – make sense to move sensors closer to shoreline to learn more.
- Andrew – can't just move one. And focus is looking at Oxygen profile, which is better in deeper water. But other graduate student, who will be looking at European studies that use satellite imagery to collect spacial data. Maybe also have opportunity to use cheaper monitoring tools.
- Andrea – is internal loading same as legacy phosphorus? How much is from internal loading.
- Andrew – Yes. but can also include the phosphorus stored in soils due to fertilization. But he does see it as P accumulated in lakes from landuse practices over time. They are developing a model to measure legacy phosphorus. Can also see that during dry season, loading would be expected to be internal. Not the goal of his research, though.
- Oliver – we can also look at calculating external loads from tributaries. Lake bottom Sediment cores will also be studied that can help document long term P loading and help us understand that we may be dealing with legacy P for years to come.
- Pete – sediment samples: where collected and have they been tested for P?
- Ashton (Graduate student with Andrew) –Regarding sediment sampling: Took three samples once a month, May through Nov, near platform. He's working on getting results in lab, looking at getting some data over next two lakes.
- Andrew – The question of study: can related changes of P in sediment relate to water column chemistry data.
- Oliver – DEC providing money for monitoring this summer.

4. Update on the 2020 Carmi tributary monitoring data – Tucker Wehner, FWC

- Presentation on Tributary measurements of P concentrations 2020
- Five creeks and 10 sampling dates despite COVID and dry summer – with help from Pete B and Tucker and Karen Bates. We looked at dissolved P (DP), which is in water column and thought

to be more bioavailable. The other is Total P or TP that would include sediment bound P in water column.

- Tucker – shows graphs for visualization of data – found in many of brooks, high P about time of large storm based on Pete's memory. Could be that the lower TP levels outside of the large storms could be indicative of the BMP implementation.
- Oliver – DP/TP ratio is 70 to 90 percent, which is high. Could be due to drier season, with less sediment running off land scape. The higher DP could be from septic sites or agric. Fields. Less sediment, perhaps due to BMP implementation, but should look at source of DP.
- Andrea -camp close to Dickie Brook. The manure spreading had stopped but started up again. Perhaps interesting to see a correlation between when spreading happens and high P levels.
- Oliver – expecting that we can continue to fund sampling though LaRosa program. Need to compare to precipitation.
- Jeff – Dickie Brook field – manure applied via grass-land injected, late June or early July. Would be interesting to check correlation with P in brook and manure injection timing.

5. Update on Carmi aeration system performance in 2020 and plans for 2021 – John Tucci, Everblue Lakes

- John Tucci – disappointed with events that led to shut down of system (State Park). They turned down Evans Compressor to make sure that same problem didn't happen. The problem was difficult to understand and fix. Thought sizing of controller was adequate, but as systems worked overtime and drew more electricity then factored in engineering design, it failed. They then replaced controllers with next higher systems and electric upgraded to support the controllers, which took longer than expected because of COVID. Afterwards, saw perfect performance. They have bought an additional compressor and a controller so that there will be back up equipment just in case of subsequent problems.
- He thinks that turn on was just in time and would like to work with DEC and fisheries to turn on earlier, as lake is approaching target temperature. There was a lag period this year, where temperature increased by time, they could start system. They will also have crews ready to start as soon as lakes meets temperature threshhold.
- Oliver – Both temperature and oxygen thresholds need to be met and can talk about maximizing cushion of time.
- Andrew – their measurements can help.
- Oliver – DEC funding found to support EverBlue over next year. Will transfer ownership to town of Franklin for 2022, and continue to share in electricity costs with town.
- Pete – why 15 degree temperatures of lake important
- John – means that fry are big enough to deal with turbulence with aeration. With regard, to oxygen levels, want to make sure there's not even a day where sediments can release legacy P.

6. Lake Carmi Groundwater Study Progress Report – Jon Kim, Vermont Geological Survey

1) Physical Components
Surficial Geologic Map of the Lake Carmi Watershed is complete. This is important for understanding the distribution of porous and permeable deposits that may affect the flow of groundwater and surface water carrying phosphorous and nitrate to the lake. The Vermont Geological Survey website link is:

VG2021-1 Wright, S., 2021, Surficial Geology and Groundwater Hydrology of the Lake Carmi Watershed and Map Area A, Vermont: Vermont Geological Survey Open File Report VG2021-1, Scale 1:12,000,
Report, Plate 1 - Surficial Map with 3 cross-sections, Plate 2 - Overburden Thickness, Plate 3 - Infiltration Potential.

2) Chemical Components
Groundwater from 10 wells and surface water from 3 sites in the Lake Carmi watershed were submitted for chemical analysis at the Vermont DEC laboratory (VAEL). The analyses are not yet complete. Well owners will receive an explanatory letter and data sheet this spring. This is ~25% of the total water samples for the project. We will be sampling wells again in spring-summer 2021 and are again looking for volunteers within the Lake Carmi Watershed.

3) Shallow Monitoring Wells
A) Nine monitoring wells were installed around Lake Carmi in October 2020 under the direction of Grahame Bradley of DEC. The groundwater from these wells will be sampled by DEC during the spring-summer 2021 for chemical analysis.
B) A Middlebury College undergraduate and professor are analyzing the sediment cores from these monitoring wells for extractable phosphorous that could be transported by groundwater, as well as grain size and other chemical parameters.

4) A Review of Phosphorous and Nitrogen in Groundwater and Lakes
This Vermont Geological Survey Technical Report is a general overview of phosphorous and nitrogen in groundwater and lakes worldwide and gives context to the role that groundwater may play in phosphorous transport. See link below:
https://anrweb.vt.gov/PubDocs/DEC/GEO/TechReports/VGTR2020-2-Loewald,%20Ryan,%20and%20Kim,%20A%20Review%20of%20P%20and%20N%20in%20Groundwater%20and%20Lakes.pdf

- Will sample 15 more wells in spring, with data available in summer. They will be out this spring more water and looking for more volunteers for having their wells tested.
- Andrew – look at contribution of P.
- John = 25 wells comprehensive nutrient sampling – as well as sampling in tributary

7. Update on the results of Agricultural Extension work in the Lake Carmi Watershed in 2020 and plans for 2021 – Jeff Sanders, UVM

- Manure injector (MI)= goal of 700 acres, but in end got 600 acres. The 100 acres of hayland by Kane's Brook was missed because of weather, but it will be a high priority next year.
- Benefit of MI – Showed graph - use P index that is a tool to reflect risk to surface water when applying nutrients to soil. Factors in timing, soil, and crop type, and more. When graphing of P index, in Addison county, where fine soils can see MI has dramatic effect on P index, which can be related to sediment loss: Result is less P runoff, especially dissolved P. They have DEC funding for 2021. They do need to do some repairs in March and hope for increased use this year. COVID reduced use. But learned a lot and will use.
- UVM study with LCBP funding - A few farms feeding high quality forage to cows to reduce use of grain which translates to reduction of P in manure. Completed one full year of monitoring and in

process of drawing up recommendations to farmers, and then see what they will be able to adopt and why. From there, figure out what can be done to increase interest in changing feed.

- DEC grant is funding other projects in watershed, including acquiring land easements with help from Gund Institute, to help assess value of farmland for other purposes and potential to put it into environmentally benefit uses. One holdup from "farm prep" a software package that would do a lot of the assessment work. Working out some of the kinks right now and we should be hearing back shortly. One farmer is interested in using for their decision making.
- In last couple of months, agriculture has changes. Now a quota on milk, and price is low. One of main funding source is NRCS, and farmers are meeting their cap for federal money they can receive (to address farmstead problems and implement field BMPs). Farmers are looking to state funding to fill the gap. Jeff would like to see how best to use state funding.
- Oliver = different BMPs to address DP? although some from septic too,
- Jeff would like to look at watershed to see all potential sources. He is thinking one farmer will be able to address one possible source. If DP is the problem, that's where we need to head.
- Pete B – thank you for all the work that you have done, more so than ever before. FWC also interested in purchasing of farmland project that Gund Institute supporting.

8. Update on Private Roads Assessment – Amanda Holland, NRPC

- This winter conducted data analysis – in preparation to do road erosion inventory based on DEC's model, to understand what work could be accomplished if private roads and driveways remediated. Inventory work will be done this summer. They sent letter out to landowners, with ability to opt out. Five, including one large landowner did, which would reduce area by 18%. They will reach out again.
- Aiming to hold virtual workshop in May as to how to best manage roads. Will look to FWC to help publicize.
- Oliver, looking at 250 feet from lakeshore as distance from roads that would be hydrologically connected.
- Pete B. – didn't receive letters.
- Amanda – used Grand List, so perhaps just those people who owned the land.
- Rhonda Fletcher – owner on 39 Camp road and didn't receive letter.
- Or Vic Crossing road owner.
- Pete offered to help, by looking at list with them.

9. Discussion about Process to Update the Lake Carmi Crisis Response Plan / Critical Path Projects Section – Oliver Pierson, DEC

- Oliver – plan is out of date now, and so in collaboration with Partners, DEC will update.
- Categories of projects will remain same.
- Will look at what may have already happened, and what could happen.
- Could link up with timeline for Missisquoi Bay Tactical Basin Plan, where Lake Carmi is located.
- Thinking of subcommittees.
- This summer should have an update expected.

10. Next Steps

- Oliver will send out a save the date for a May meeting, if this is good timing to ensure campers can participate.
- Meeting Info and Minutes will be located on website.
- Big thank you to all. Look forward to BMP, better monitoring, more aeration, this summer. Hoping it will be a more normal summer.
- Pete – certainly appreciate.

Most meeting participants: