Lake Champlain Basin Program
Technical Advisory Committee meeting
Wednesday, October 2, 2024, 10:00 AM – 2:00 PM
Held in-person at the LCBP office with remote option

Approved TAC meeting summary

TAC Members: Jennifer Callahan, Bryan Dore, Laurie Earley, Michele Fafette, Peter Isles, Steve Kramer, Margaret Murphy, Bridget O'Brien, Andrew Schroth, Jamie Shanley, Daniel Tremblay

LCBP + Lake Champlain Staff: Elizabeth Lee, Meg Modley, Matthew Vaughan, Sonya Vogel, Sarita Croce, Erin Vennie-Vollrath, Kristen Balschunat, Tom Berry

Guests: Mark Henderson, Rose Stewart, Benjamin Jessup, Ismar Biberovic, Jens Kiesel, Dave Braun, Ellen Marsden, Lori Fisher, Rob Fiorentino

1. **Updates, announcements, public comments**
    - Margaret (VTFWD) kindly accepted to be the chair for the meeting in Neil's absence.
    - Peter (VTDEC): Lakes and Ponds will have a new supervisor, Oliver P.'s old position, so that will be nice to have that position filled. Cyanobacteria blooms are strong in Shelburne Pond, Lake Carmi, and up through the NE passage.
    - Jamie (USGS): USGS will install a gauge in Shoreham, VT, on the Lemon Fair River as part of a list being included in the NRCS CAP program. This will support Kristen Underwood's work. The Lamoille River was surveyed, modeled, and mapped by COMPASS with FEMA before the 2023/2024 floods. They have requested that USGS resurvey it after the July 2023 and 2024 flooding to see how things changed.
    - Laurie (USFWS): MNWR is working with LCBP and VTDEC to pull water chestnut in Gander Bay; there were over 50,000 rosettes. This is becoming a serious situation that needs more management. Ken Sturm from the refuge has taken photos and would like to address the situation. Brad Young will maybe be joining this afternoon, but he has taken a new job in WI beginning at the end of November. This will be a big loss for the region and the basin. Narrowing down a date in November (21st).
    - LCBP updates: Matt reminded folks that the CWHE research pre-proposal opportunity is now open for projects up to $400k until November 8th. We have CWHE implementation projects, 8 categories, that close October 3rd. The TAC meeting will be remote in November and then we'll try to be in-person in December. The focus of the December meeting will be to review the CWHE research pre-proposals.
        - Meg, AIS Updates: There was a positive detection of round goby eDNA in the upper Richelieu River, no fish in hand. More eDNA tests are being taken for northern Lake Champlain, no positive eDNA tests yet. There was one positive detection of round goby on lock C2, no other positive detections between lock C1 and C2. They are flushing and doing scheduled lockings at C2. We are

checking out habitat by Auger Lake which is stocked with Grass Carp, the outflow of that pond has been refortified, but we are monitoring for any detection of Grass Carp in outflow. We are coming to the end of the boat steward season, but with the warmer weather there have been a lot of people out on the Lake. We intercepted fanwort before entering Lake Champlain. Looks like native water marigolds are recovering.
    - Sonya: We are working on the initial development of a pre- and post-flood monitoring program and are reaching out to partners through TAC to help guide the work. If anyone has some input regarding the study, please contact Sonya (svogel@lcbp.org). Jamie asked about what happens with pre-flood sampling? Sonya noted that there will be baseline monitoring used to inform the study. It is important to create a suite of analytes for different flow conditions. Peter wondered if we would sample it in the lake or in the tributaries. Matt clarified that this study would focus on lake samples and is aimed to be responsive to the public questions that come in post flooding. LCBP staff will go out and do the sampling. Tom recommended that the lower tributaries be included in the study. For example, folks from the Intervale might have questions about flooding impacts on crops.
- Mark (UVM): We received funds through CHPE for habitat assessment and those funds will come directly to UVM to support long-term monitoring and water quality. The idea was to subcontract that out to LCBP. This is the first time I am talking to anyone about that. LCBP and UVM will set up a meeting to address that.
- Bridget sent in an update to share via Matt: State Toxicologist, Dr. Sarah Owen, is leaving state service. Her last day is October 18th. The job posting should be up soon, so send your toxicologist friends our way.

Review and approve summary of previous TAC meeting

Motion: To approve the summary from the September 2024 TAC meeting
By: Jenn Callahan
Second: Peter Isles
Vote: All in favor
Abstentions: Laurie Earley, Rob Fiorentino

2. Workplan review: Lake Sturgeon population size and structure within Lake Champlain: implications for management of an endangered species (Dr. Mark Henderson, UVM)

- Mark will work with Margaret and Ben on the project. Others that have contributed include Ellen Marsden, Jaren Homola, and Lee Simard. Lake Sturgeon populations have historically been spread across the Midwest US. Populations have been declining and distribution restricting. Current estimates are that populations are at 1% of what they have been previously. As a result, there is a decline in the genetic diversity of the species, and increased extirpation. Genetic studies show that there is a structure of metapopulations of Lake Sturgeon. A metapopulation spawns together, not a huge amount of genetic diversity here due to intermixing. This not only occurs on the large

scale (i.e. in the Great Lakes), but this also happens on a finer scale (i.e. St. Lawrence R.). In Lake Champlain, we have four historic spawning locations (Otter, Lamoille, Winooski, Missisquoi) and we assume that Lake Sturgeon returns to the same places to spawn each year. Izzo 2022 estimated ~93 - 131 Lake Sturgeon are spawning in the Winooski River each year. There is still a lot of uncertainty about the size and structure of the population.

- The purpose of this study is to assess population structure and quantify the effective population size of Lake Sturgeon in Lake Champlain. Initial field and lab work will include collection of genetic samples, extraction of DNA, and genomic sequencing. Followed by the analysis of population structure and estimation of effective population size.
    - Task 2.1: Collect genetic samples. Sample from all historic spawning sites (except Winooski, since there are >70 genetic samples from the Winooski). Will capture sturgeon using gillnets, take a fin clip for DNA analyses, and give the fish an acoustic tag.
    - Task 2.2: Extract DNA from the fin clips (Qiagen DNeasy Blood and Tissue Kit).
    - Take 2.3: Genomic sequencing. RAD-seq will separate sections of the DNA into pieces which will help us identify how populations are unique. Sturgeon are polyploids, they get four copies of alleles from each parent, which makes it difficult to identify where the alleles come from. Samples will be done in Ben M-Q's lab at MI State U.
    - Task 2.4 & 2.5: Population structure analysis.
    - Tasks 3.1 & 3.2: Estimating effective population size, a measurement of the rate of evolutionary change. Gives a proxy for the history of how the genomes of fish have changed through time. How has effective population size changed over time? Where are the bottlenecks, where is genetic diversity changing? This way the project will both look at the current and historical population diversity of the Lake Champlain Lake Sturgeon population.
- Outcome: Estimation of the population size, understanding of the population structure, data that can contribute to the larger Great Lakes Lake Sturgeon work, and the development of a genotyping panel to estimate true population abundances in Lake Champlain and Great Lakes.

Questions & Discussion

- Margaret: The sample size is going to be challenging, will require more effort than has been used in the past. I wouldn't discount the Winooski; it would be useful to get more samples to supplement existing ones. Lamoille is similar to Winooski, so it will be important to focus on the Lamoille too to compare it to Winooski. Missisquoi is going to be tough (we've only been able to tag ~10 over three years). Same difficulty with Otter Creek (this concern was echoed by Laurie online).
    - Mark: We are planning to build a team for this work, including hiring two lab techs, a PhD student, and an undergrad student to help with this work. New lab technicians will hopefully be hired in the spring and then again in the fall. The plan will be to have two full crews: your (Margaret) crew and a UVM crew.
    - Margaret: If you can address these questions, I think this is exactly the type of work I've wanted to see.

- Michele: Are Sturgeon stocked? Apparently not. When I see this the low numbers are shocking... have you considered taking Sturgeon and relocating them to a new region to improve genetic diversity?
    - Mark: I would be hesitant to do that. You want to keep the native genetics as much as possible before introducing non-native genetics. Native genetics tend to be the strongest (natural selection).
    - Margaret: This is one of the few native populations left. LC has chosen to wait to understand the existing populations before stocking.
- Michele: Since there are so few spawning locations, are there any monitoring efforts for protecting these areas?
    - Margaret: It is an endangered species so there is signage, education, and it's discouraged among fishers.
    - Michele: Does signage work effectively in the spawning habitat?
    - Margaret: Unsure of how effective it is. Anglers tend to be aware of the importance of fish populations and are careful.
    - Mark: We also don't know exactly where on the rivers that they spawn.
- Tom: Where is the Lake Sturgeon that is in captivity at The Echo Center from?
    - Ellen: I believe they are from the Wisconsin Lab.
- Tom: The technique of using a gillnet to capture can be harmful to other fish. Are Lake Sturgeon more resilient?
    - Margaret: Yes. But it requires care and temperature monitoring.
- Tom: Is there a sturgeon population in the Richelieu River?
    - No.
    - Margaret: There were some early genetic studies in Lake Champlain and the populations here are most closely related to the St. Lawrence River populations but are still genetically distinct.
- Ellen: Mark, have you considered taking samples of eggs?
    - Mark: Yes, but it is not viable due to the ratio of DNA to non-DNA in the eggs. I don't have more info there, but basically, it's not possible.
    - Margaret: Could we hatch them out?
    - Mark: Maybe, it's really good to look into that as an option.
- Jamie: What do you mean by effective population?
    - Mark: There are lots of things that go into that estimate. With genetics, it is the number of spawners that come back and reproduce with each other, which then determines the number of samples you get. It gives a general estimate of genetic diversity in a population.
    - Margaret: It is the number of successful spawners, or those that will contribute to genetic diversity.
- Rob: Given that the population has decreased significantly, and habitats have been altered, is there potential for spawning locations on the NY side? If so, should we look into that?
    - Margaret: Yes.
    - Mark: I wouldn't go as far as to say that it isn't possible, but there is no documentation of historical spawning on the NY side. eDNA would be the way to look into this and see if it is happening.
- Rob: Do we know if Brad's eDNA work tested for Lake Sturgeon? I think we wouldn't have missed that had it been happening, but it's a cheap way to check if we haven't yet.

    - Mark: Fish from the VT side sometimes move over to the NY side.
    - Laurie: I checked, and we had one positive Lake Sturgeon hit, and it was in the Winooski.
    - Rob: Maybe it's a time thing.
- Laurie: The sample size is my biggest concern, helpful that there are historical samples from the Winooski. Increase sampling scope as much as you can!

Motion: To approve the workplan
By: Jenn Callahan
Second: Peter Isles
Vote: all in favor

3. Workplan review: Could American eel predation be a natural control for sea lamprey populations? (Dr. Rose Stewart, UVM)

- Introduction and Background: Rose Stewart, Ellen Marsden, and Ben Marcy-Quay are all contributors to this work.
    - Work seeks to better understand if and when American Eels prey on Sea Lamprey. This could have many long-term effects on sea lamprey populations. Sea lamprey are abundant in Lake Champlain, wounding rates on salmonids are very high, so population control is currently being attempted and needs to improve.
    - We don't know if sea lamprey are native to Lake Champlain or not, but ultimately, they don't have enough controls on the population which is odd (especially if they are native). Sea lampreys are most at risk for predation during their larval phase.
    - Eels are a migratory species. Their species had difficulty passing Richelieu River dams, so their abundance was low in the 1960's. When these dams were removed, the population increased, and the 1970's population was considered large. Commercial eel fishery opened in 1982 and closed in 2002 which resulted in the population being greatly depleted. Stocking and the addition of fish ladders in the Richelieu River restocked the population. They feed on benthic foragers, macroinvertebrates, and sometimes larger things (maybe sea lamprey).
- Research Questions: Will eels predate upon lamprey in experimental conditions? Will eels predate on lamprey if alternative prey sources are available? Will eels prey on lamprey in the wild?
    - Experiment 1: Mesocosm experiment. A small population of eels will be added to tanks with lamprey in them, leaving them overnight to predate. The next day the team will see how many lampreys persist.
    - Experiment 2: Same set up, but the team will add multiple (eel) prey types to the tanks (crayfish or small bait fish).
    - Experiment 3: Team will go out at night to capture eels using electric fishing. Then the team will use gastric lavage to collect the eel's stomach content to be tested for the presence of lamprey DNA. This sampling will occur in the spring, summer, and fall. Aim for 120 eels (optimistic) from as many sites as possible.

- Outputs: Conference presentation(s), journal publication(s), information gathered regarding Sea Lamprey management strategies and American Eel conservation efforts, and the opportunity for student involvement and gained experiences.
- 2024 Pilot Study Summary:
    - Three cohorts of eels have been brought into the lab (46 eels) and were held for ~4 weeks. All eels were tagged with VIE, and there was 100% tag retention. The only mortalities were eels that escaped tanks.
    - Lamprey were collected by USFWS, approximately 80 that range in size. We learned that they want sediment to bury in. In trial tanks mimicking the above experiment 1 design, 5 lamprey were assumed to be consumed across 9 trials of 36 offered, or approximately 13% were consumed in 13 hours.
    - Trial with alternative prey showed that equal numbers of lamprey and alternative prey consumed.
    - In the field sampling trial 12 eels were successfully captured and have been sampled (lavage is successful). Samples have been frozen for later genetic analysis.

Discussion and Questions*:*

- Tom: USFWS have a treatment schedule for sea lamprey, have you thought about scheduling sampling for maximum abundance?
    - Rose: Yes, focusing on areas that are due for treatment in the fall, because we assume that the abundances are highest right before treatment.
- Tom: We know what depth lamprey prefers sediment wise, are you mimicking this in the lab?
    - Rose: Yes, we've found a good depth that keeps them happy and mimics wild conditions.
- Michele: Are you catching eels in the wild for lab testing?
    - Rose: Yes, but we are not concerned with whether they currently or have previously existed with lamprey in the wild.
- Michele: What is the hold time between capture and feeding? If they are starving, will eels eat lamprey out of desperation?
    - Rose: They are fasted for 7 days before experiments, and they don't get any food other than the potential prey that is provided. I am unwilling to keep them in the lab any longer than a month since they are only going to be fed the prey we provide them.
- Michele: Where are they kept in the lab?
    - Rose: There is a holding tank with lots of them, then they get moved from the holding tank to the experimental tanks. All are tagged and being monitored for individual tastes, when they are used, their size, etc.
- Peter: Are there other known predators of sea lamprey and what is their abundance?
    - Rose: The only known predators of lamprey are Lake Sturgeon, so this is a unique trial.
- Tom: Is there any value for collecting data from a saltwater tributary where eels are not monitored?

    - Margaret: We have work going on in the Connecticut River monitoring eel and lamprey populations out there.
    - Rose: Could be interesting in comparison to what we find in Lake Champlain!

Motion: To approve the workplan
By: Jenn Callahan
Second: Peter Isles
Vote: all in favor

4. Workplan review: Proactive Lake Assessment: Monitoring Benthic Cyanobacteria Blooms for Ecosystem and Public Health Protection in the LCB (Benjamin Jessup and Ismar Biberovic, Tetra Tech)

- Matt welcomed Ben and Ismar from Tetra Tech to review the workplan. Ismar is a former UVM undergraduate and graduate student (limnology). Ben has been working on diatoms and has started to work with cyanobacteria regarding bioassessment.
- Benthic Cyanobacteria Overview: Unlike their planktonic counterparts, benthic cyanobacteria grow attached to substrates in wetlands, littoral zones, and can grow in patches. They are found in a range of lakes with different water quality parameters. Difficult to identify and quantify because they are heterogenous across space.
    - Evident lack of understanding but we do know they can be harmful. Dog and cattle deaths have been reported in various lakes across the world.
    - Some species have been found in the region and may be toxic.
- Methods: There are no standardized monitoring efforts for benthic cyanobacteria in Lake Champlain. Plan to work with local volunteers on Lake Champlain and on inland lakes to increase the likelihood of finding benthic cyanobacteria. Any benthic cyanobacteria found will be tested for toxins. Methods for sampling for benthic cyanobacteria will be added into the existing monitoring program.
- Outcomes of this work: The project will increase the number of volunteers, create training and educational materials, develop and validate a systematic protocol for monitoring benthic cyanobacteria in Lake Champlain. Key partners will be LCC and UVM, VTDEC and NYSDEC, local watershed groups, etc.
- Tasks: Developing a QAPP, sampling protocol development and revision, training and outreach (UVM NR service learning class), Tetra Tech will distribute sampling gear to volunteers, site selection (may be able to identify certain lake characteristics that favor benthic cyanobacteria), sample collection (hope to extend sampling season into November), will sample for DNA and toxins in the water, and sample processing will be with GreenWater laboratories which has experience in benthic cyanobacteria sample analysis.
- Sample Processing: qPCR via 165 ribosomal RNA gene, and q PCR to quantify toxic gene copies. Water samples will be collected for anatoxin-a, sanitonix, cylindrospermopsin, and microcystin. Data analysis will be performed in 2 steps:
    - Summary of toxic genes and their presence
    - Exploration step to determine how well “on the ground” observations relate to toxin producing species/toxins & utilize compiled site data to revise the sampling protocol.

- Outputs: Technical reports, databases and associated files, and plain language documentation through ArcGIS story map.

Discussion and Questions:

- Matt started with a question about toxin analysis. What if a planktonic bloom occurs at the same time as a benthic bloom? It would be hard to differentiate between the two if they are co-occurring. Assuming the survey will include the visual observation of planktonic bloom.
    - We will have a number of questions that can be answered by a volunteer. Observations will include weather and water observations.
    - Matt: You will have to assign relative "weights" to the consideration of observations versus what is analyzed in the sample.
- Peter: Are you going to sample the actual material?
    - The proposal is for the material and the water as well. This can be determined when we develop the QAPP. We can sample the water before and after the water column is disturbed. We could also develop a cheap tool to sample water near or at the benthos mats. If the mat is right there and volunteers are comfortable sampling it then they can do that (keeping safety in mind).
    - Peter: Is there a project advisory committee built into the workplan?
    - Matt: Not built in explicitly.
    - Ben: We welcome anyone who can be involved in the process. We can build check-in points into the workplan. The TAC point people will be able to take a look at the QAPP. We can have other informal check-ins. Task deliverables will also come in as draft and then final. There will be different points when the TAC and look at deliverables. The project will be useless unless we have regular check-ins with folks on TAC and who are working in the field. Brian Duffy at NYSDEC is also really interested. Peter of course, and Bridget O'Brian.
- Peter: It might be useful to start to identify priorities for site selection so we can focus on volunteer needs?
    - Ismar/Ben: Yes, the intent is to incorporate literature data to develop target sites (roughly 100) and then we can keep incorporating lakes into the model where benthic mats have been found.
- Bridget: If the goal is for the volunteers to have a protocol for monitoring, are we missing pictures of benthic cyanobacterial mats and how dense it is in the protocol? How will that be worked into the sample protocol? What will volunteers be looking for? We will need to add a more systematic approach to assess the risks associated with the benthic cyanobacteria mats.
    - Ismar: Each time a mat is identified by a volunteer a photo of the mat will be taken. We do not know what they will look like. It might not look as straightforward as it does in some of the photographs in this presentation. If we better understand the conditions in which the mats might show up, then we can try to capture and share that. We will work hand in hand with LCC on the development of the survey.
    - Ben: We are unsure when we will encounter benthic mats and how frequently.
- Peter: I'm concerned about messaging and outreach related to benthic mats. We get bombarded with questions already about filamentous green algae. Please consider this

with the outreach. Please keep the messaging in line with the risk associated with the mats.
    - Bridget: Thanks, Peter, it especially concerns me with students developing messaging for towns.
    - Ben/Ismar: Outreach is expected to be done in the future with the PI's.
- Matt noted that collecting literature is considered secondary data and will need to be included in the QAPP.
    - Ben/Ismar: Mostly the students will help gather literature and funnel it to the PIs.
- Lori: We do share benthic species with volunteers, but we don't have clarity on what density and what might constitute generally safe, moderate, or high/concerning conditions. TAC + PAC input will be essential. Lori would like LCC to be on the PAC.

Motion: To approve the workplan by Margaret Murphy.
By: Jenn Callahan
Second: Peter Isles
Vote: all in favor

5. Workplan review: Phosphorus load estimation from direct drainages to the Northeast Arm of Lake Champlain (Dr. Jens Kiesel and Dave Braun, Stone Environmental)

- Matt introduced Jens and Dave from Stone Environmental. The project will be overseen by Jens Kiesel, Dave Braun, Michael Winchell, and Jody Stryker. The challenge being addressed in this work is that P is entering the northeast arm of Lake Champlain (NALC). P load from direct tributaries is not well characterized, and there are higher than expected P loads from small tributaries to South Lake A.
- Project objectives: To estimate the export of the target parameters TP, TDP, and TSS, measure flow rates, and develop a random forest model. The PAC will help guide sampling and modeling methods, data analysis, and other technical aspects of this project. At least one member will be based in QC.
- The first task will be monitoring NALC tributaries; we propose to monitor three ungauged tributaries to NALC. Backwater issues are apparent in many small streams near the mouth of Lake Champlain, which will need to be a consideration in site selection. The hope is to cooperate with PAC to choose sites and begin monitoring in spring 2025.
- Proposed sites:
    - Stone Bridge Brook at Beebe Hill Rd., Milton, VT: a good stream location upstream of a culvert. Was previously gauged by the USGS.
    - Mud Creek in Alburgh, VT: possible site of weir and beaver baffle, backwater influenced and has complex hydraulic conditions. There are a lot of problems but "we've got to do it" according to Dave, given the objectives of the project.
    - Unnamed tributary at 316 Maquam Shore Rd, Swanton, VT: good location downstream from a culvert, confined channel upstream (potential backwater from Lake Champlain). Owners seem amenable, alternate location selected if owners did not approve.
    - Unnamed tributary at 118 East Shore Rd, Grand Isle, VT: good site upstream of cascade and a confined channel with stable hydraulic control. You would need

permission for site access, but a less good backup option has been identified if needed.

- Field Methods: Traditional stream gauging for monitoring of NALC tributaries.
    - Matt: I was confused about the time-lapse camera.
    - Dave: It will take an hourly snapshot of the staff gauge.
- Field Methods Cont.: Monthly servicing on sensors and stations generally. Flow rates will be measured with manual discharge measurements (~ 10/ year) that will be used to develop a stage discharge relationship. Samples will be collected during an estimated 13 high and 4 low flow events each year.
- Models: P load estimation to NALC will be estimated using the machine learning model. The machine learning model requires a lot of data. We will first establish nationwide time series data including data collected from the USGS, NWQN, 22 Lake Champlain tributaries, Hastings et al., and data collected by this project. There will be QAQC for each gauge in the database. Then we will inform the model with the environmental characteristics upstream of the site and of the watershed as a whole. Characteristics include geology, climate, fertilizer data, land use, and vegetation.
    - Random Forest and Long-Short-Term-Memory Artificial Neural Network will be trained (10 years), validation (5 years), and testing (5 years). These models, once tested, will be used to estimate TP, TDP, and TSS loads for target sites. Then we can develop links between environmental variables and the loading of these parameters.
- Reporting: quarterly reports, final report, metric report, etc.

Discussion and Questions:

- Michele: I want to reiterate a requirement regarding the piece of equipment that is listed as a supply (SonTek). This is a piece of equipment according to EPA guidelines. Since this is over $10,000, it has larger requirements that will need to be delivered to LCBP and EPA. Also, once the project is completed, this piece of equipment will need to be disposed of according to EPA guidelines.
    - Matt: We've got it covered.
- Steve: Back to the SonTek device, are you monitoring four streams with pressure transducers? If so, why use the SonTek device in Mud Creek? What does this provide that pressure transducers don't?
    - Dave: We need a predictive variable (velocity) to produce reasonable flow estimates across the range of flows given backwater conditions. Three streams will be monitored with pressure transducers and one stream (Mud) will be supplemented with the velocity sensor to estimate flow rate.
    - Jamie: Are you going to do the velocity index method when you don't have backwater to see how the two measurements compare?
    - Dave: Yes, exactly/absolutely.
    - Matt: A study in itself.
    - Jamie: USGS approves the paired measurements!
- Peter: Regarding the model design, you are training the model with discharge, catchment characteristics, and chemistry. Are you trying to model discharge then chemistry, and then pair them to estimate loads?

    - Jens: We will use the meteorological data with catchment characteristics to predict stream flows. We will use the same data to calculate concentrations, then will calculate loads. We can't include everything in the training, so we plan to do a K-fol validation (basically we train the model three times and leave one gauge out each time) this way we can see the ungauged reference size.
- Matt (on behalf of Colette): Colette had some follow up questions. Will three streams be enough for the model? Will it work well, or is this just what is possible?
    - Jens: We will have lots of supplementary data from across the U.S. to use for the model. The three sites are valuable because they tell us how good our model is going to be.
- Matt: We need more information about the national data you will collect. How valuable is it since it will be down weighted in the model?
    - Jens: Machine learning models need the data, and they are capable of weighing datasets differently. So, if the dataset isn't that relevant, it will be down weighted. It won't harm to include more data than less.
- Jamie: Will the MLM use the TSS/turbidity to get at phosphorus concentrations? How will that work?
    - Jens: There are two different approaches; the random forest model will predict statistics of the time series (e.g. monthly maximum loads, annual max loads, etc.) and the LSTM will provide continuous time series data. For TSS/TP the two are related, but at this point I don't see using the LSTM to extrapolate TP from TSS, that would be if we have too few TP time series data points from other sources.
- Andrew: There is quite a bit of literature about gullies and farm fields that get wet and export huge loads of P into streams. Did you consider using a synoptic approach? I think missing agricultural fields would be a big loss for estimating loads into the Northeast Arm.
    - Dave: We wanted to figure out how to make the best datasets to validate the model. Short duration events in ephemeral channels can deliver large loads. A lot of the agricultural areas are channelized to a degree that are "ephemeral" and can't be gauged because they are so dynamic. Basically, yes you're right, but we have not included them yet.
    - Jens: When I queried the national database, the median size of sites was about 20 square km. So yes, there was a wide range of stream types to include.
    - Andrew: Would it be valuable to do synoptic samples around the perimeter to get a range of flow and samples?
    - Dave: I think we can't add more to this study, but that is something to be aware of.
    - Margaret: A recommendation would be to note that this is a limitation for the final report of this study.

Motion: To approve the workplan
By: Jenn Callahan
Second: Peter Isles
Vote: all in favor