2019 Water Quality Testing in the Merrymeeting Watershed

A. Monthly River Testing. Purpose: To continue to collect basic water quality values in designated portions of the Merrymeeting River (MMR) to build on historical values and validate/refine the Watershed Management Plan(WMP) models by conducting these tests throughout the entire year, especially through the winter months where current data is scarce.
    a. Each month (on the first Monday of the month) water samples will be collected to evaluate the following: Temperature(T), Dissolved oxygen (DO), total phosphorus (TP), specific conductivity (Cond), acidity(pH), turbidity(Tur), and cyanobacteria(phycocyanin concentration). Conductivity, pH and Turbidity=CPT.
    b. Locations: Marsh Pond outlet (New Durham), Main Street Dam (New Durham-Downing Pond outlet), Rt.28 Traffic circle (Alton), Rt.28 Coffin Brook (Alton), Rt.140 and MMR(Alton), and Rt.11 MMR at Alton Bay.
    c. Costs per test: TP=$12, CPT and phycocyanin are done at no charge by UNH; monthly charge to New Durham (ND)=$24 and monthly charge to Alton=$48. Twelve month total for ND=$288, for Alton=$576.
B. Monthly Phosphorus Loads at River sites. Purpose: To continue to document changes in flow and phosphorus load at designated sites along the MMR to refine the WMP models , look at variations associated with stormwater events and to monitor recovery after implementation of remediations (hatchery, stormwater, etc.).
    a. Each month, in association with the River Testing, stream gauge readings will be recorded and the flow calculated. Once flow and TP are known the Phosphorus load in pounds (or kilograms) per day will be recorded.
    b. Stream gauges must be installed and validated using detailed velocity/flow measurements under three different water flow conditions (low, medium and high flow conditions).
    c. Gauges will be placed at each of the river testing sites. Permission is being sought from NH DOT to mount the gauges directly on the bridge abutments.
    d. Costs for installation of the stream gauges is $30.50 per x7=$213.50. Volunteer time and equipment is already available. Validation of flow at each gauge will be contracted and a quote for this work is being solicited.
C. Testing Ponds in the MMR watershed. Purpose: To continue to monitor deep sites at critical locations throughout the MMR in order to assess the extent of oxygen depletion and phosphorus turnover from sediments and to record changes in these activities after remediations. In addition, chlorophyll-a and transparency will be recorded so that trophic status and assimilation capacity can be calculated. These sites will be extended into Alton in order to evaluate phosphorus turnover (internal loading) in Mill Pond, the effect of Mill pond drainage into the MMR, changes in these parameters after mitigation of phosphorus in Mill Pond. We will also collect data on changes in anoxic conditions, during a 24 hour daily cycle, along the bottom of Marsh and Jones Ponds and the effect this may have on internal loading of phosphorus. And finally, the status of cyanobacteria (type and numbers) will be determined monthly to provide safety information for recreational users and the concentrations of microcystins and other

known cyanotoxins will be retrospectively assayed. These tests will be performed once a month for 6 months beginning in May.

a. Sites chosen for these tests include: Marsh Pond, Jones Pond, Downing Pond, Wentworth Pond at Merrymeeting Meeting Marsh Wildlife Management Area at Traffic circle (Wentworth-Circle), Wentworth Pond at Alton Power Dam(Wentworth-Dam), Mill Pond.
b. Bathymetry was completed on Jones and Downing Ponds by NH DES in the past. Bathymetry has recently been completed on Mill Pond and Marsh Pond by NH DES at the request of the Cyanobacteria Mitigation Steering Committee (CMSC).
c. Bathymetry allows us to select the deep site in the ponds for future analysis. The two sites in Wentworth Pond will be determined by sounding these sites in May. Bathymetry also provides useful information for future sediment analyses.
d. At each site, water will be collected in the 0-3 Meter zone (0-3) and just above the sediment (deep). On the 0-3 sample the following tests are to be conducted: T, DO, TP, total nitrogen (TN), CPT, chlorophyll-a (C-a), transparency by Secchi disc (Trans), and cyanobacteria quantitation and toxin analysis. On the deep samples the following will be tested: T, DO, and TP.
e. In addition, two deep sites, Marsh and Jones Ponds, will be monitored using continuously recording water quality sondes in July or August for a 2week period of time recording T, pH, DO and Conductivity at the bottom (just above the sediment) of the deep sites. These sondes will be placed at the sites by the NH DES. This testing will be complemented by collecting T and DO readings every 0.5M from the surface to the bottom and sampling for TP at 0-3M and at the bottom. These complementary tests will be performed twice during the 2-week sonde residence time and include sampling each day at 6AM and again at 4PM. These tests will provide information concerning the changes in anoxia during the full 24 hour daily cycle and resulting changes in TP, information important in calculating the effect of internal loading from these sites.
f. Costs for the various tests include: TP and TN and chlorophyll-a= $12 each. CPT will be done by the Freshwater Biology Lab at UNH for no charge. Trans+DO+T are all done by instruments used at the sampling times (instruments on loan from UNH). Cyanobacteria quantitation will be done by F.Quimby with back-up from NH DES at no charge. Cyanobacteria toxins concentration will be done by NH DES at no charge. The total monthly charge for New Durham is $144. For the 6 month collection season it will be $864 plus $96 for complementary sonde testing=$960. The costs to Alton are $864.

D. Mill Pond testing. Purpose: To evaluate the phosphorus load arising from Rt.11 stormwater drainage system in Alton Village and dumping into Mill Pond. Also, to evaluate whether or not a plume of water arising from the old town dump, beside Mill Pond, releases phosphorus into Mill Pond after a storm event.
    a. We will attempt to collect water for phosphorus analysis after a storm event from each culvert dumping water into Mill Pond. We will try to collect at the bank of Mill Pond and as it comes out of the culvert to see if more phosphorus is picked up from the eroded hillside. We will also photograph the culverts as they discharge and get GPS coordinates from each.

b. We will try to detect a change in the concentration of ions along the pond perimeter of Mill Pond after a storm event by dragging a conductivity probe behind a canoe and continuously recording the water specific conductivity . This will compare conductivity at the dump site with the rest of the perimeter of the pond. If a difference is seen, water samples, next to land at the dump, will be collected and compared to the average in Mill Pond proper.
c. Costs for 5 culverts taken twice and taken at the Mill Pond bank vs culvert opening amounts to 20 TP tests @ $12=$240. Conductivity testing will be done as part of the monthly testing in Mill Pond. Any additional phosphorus testing will be $12/test.

E. Testing Powder Mill Hatchery Interim Waste Water Septic System
   a. The NH Fish and Game Department (NH F&G) plans to construct a septic system on the present hatchery land as an interim measure until a new final Waste Water Treatment Facility can be placed into operation. This interim system will receive all vacuumed waste rather than dumping it into a settling pond.
   b. Together the NH F&G and NH DES will conduct an evaluation of the efficacy of this new system by collecting 24 hour composite samples from outfall 002 and evaluating them for total phosphorus and total nitrogen. Samples will be collected 5 times over a two week interval before the new septic system is brought on-line. This will be repeated after the system is on-line when again they will collect 24 hour composite samples 5 times over a 2 week inteval.
   c. All samples will be brought to the NH DES laboratory in Concord for analysis. No cost will be borne by either town.

F. Total financial commitment by town is:
   a. New Durham for 2019/20 is $1248.
   b. Alton for 2019/20 River and Pond testing is $1440. plus$240 for Mill Pond culverts and dump. Total is $1680.

G. Future testing:
   a. Now that we know that anoxic conditions exist above the sediments in Marsh and Jones ponds there is a high likelihood that internal loading of phosphorus takes place in these waterbodies (phosphorus leaves the sediment and enters the water column). Should this occur, the water may contain sufficient phosphorus to cause cyanobacteria blooms even after the hatchery waste water is remediated. So, it is important to know whether the phosphorus in the top 10 cm of the sediment is bound to iron or aluminum. Phosphorus bound to aluminum is permanently bound while iron will release phosphorus under anoxic conditions. This requires sediment coring and analysis. Most of the costs is in performing the analyses. Don Kretchmer estimates that for Marsh Pond a total of 8 sites should sampled and the estimated cost for this analysis is $7000. In all likelihood the sediment in Jones pond is like that of Marsh Pond since the hatchery's release of suspended solids is what has collected in the sediments of both ponds.
   b. However, we know nothing about Mill Pond. We now have bathymetry and we will find out this summer whether or not anoxia occurs along the bottom of this pond in the summer. If so, we will need sediment analysis of Mill Pond also, in order to determine how much phosphorus will be released under anoxic conditions and how best to prevent this from occurring.

c. Should the old town dump look like it is leaching phosphorus into the pond, consideration shall be given to boring several wells into the dump near its bank on Mill Pond where samples can be collected over time to better characterize the discharge. Don Kretchmer has some ideas about this.
d. One possibility for the high phosphorus concentrations existing in Marsh and Jones ponds deep sites during the summer months is that cold dense water from the hatchery sinks under the water column and settles in the deep sites of Marsh and Jones ponds. To rule this out a company may be hired to perform a dye test by injecting a fluorescent dye directly into outfall 002 at the hatchery and sampling the water column at the deep sites to see if the dye is concentrated at the bottom. A quote to perform this work is being sought. Sampling for dye concentration at Jones Pond will only be done if there is evidence for dye concentrating in Marsh Pond.