HINKSON CREEK COLLABORATIVE ADAPTIVE MANAGEMENT
ACTION TEAM Meeting Minutes
July 15, 2016
9:00 am
MU General Services Building 194b

Action Team Members Present: Erin Keys, Tom Wellman, Nicki Fuemmeler, Bill Florea, Ted Haeussler, Jon White, Melissa Scheperle
Staff Present: Kori Thompson, Lynne Hooper
Others: Cody Luebbering (Geosyntec)

1. CALL TO ORDER
   The meeting was called to order by Erin Keys at 8:58 a.m.

2. APPROVAL OF MINUTES FROM LAST MEETING- June minutes were approved

3. AGENDA ITEMS
   - Stakeholder or Science Team Updates
     - The Riparian Subcommittee met and the map provided by the County was reviewed. The topics of discussion also included the science behind the riparian buffer proposals and other BMPs. The subcommittee focus will be on areas downstream of Rock Quarry and on identifying priority areas. Stream restoration will be a priority followed by improving existing buffers. The subcommittee suggested looking at tributaries as well. There was also discussion on reforesting properities that are currently publicly owned.
     - The Science Strategy was added to the agenda and discussed. (See attached handout for comments)
   - Actions Updates
     - Level Spreader Update – Tom will remove the first wood slat from the level spreader and might carve a little of the second slat. The level loggers still need to be installed. The installation of time lapse cameras was also discussed.
   - Action Proposals
     - Stephens College Bioretention
   - Project List Update
     - All proposed City projects in watershed – Tom and the University still need to add a couple of projects to the list
     - Overall Speadsheet – Erin is still working on completing the spreadsheet.
   - Regulatory Update
     - Cody gave a brief overview of the CWC meeting regarding the additional descriptions added to the CAFO regulations.
     - DNR has approved the biodegradation procedure.
     - Water quality trading framework is being developed. Deadline of August 24th.
     - Multidischarge Variance (MDV) to address lagoons has be proposed to EPA.

4. ANNOUNCEMENTS / COMMENTS
   - Stakeholder Meeting will be August 1st at MU EHS Research Park Development Building
   - The next Science Team meeting will be held July 25th.

- MS4 Permit became effective June 1st.

5. AGENDA ITEMS FOR NEXT MEETING – August 19th
   - Trash BMP
   - Ann & Walnut

6. ADJOURN Meeting adjourned at 10:00 a.m.

Hinkson Creek CAM Science Strategy
Working Draft 7/12/16

Purpose of this Document

This document is meant to provide a summary of the current state of knowledge of Hinkson Creek, some of the major scientific questions yet to be resolved and the challenges in addressing those uncertainties. It also explains why an active discussion and implementation of science is necessary to support the goals of the Hinkson Creek stakeholders and those they represent.

The ultimate goals of the Hinkson CAM process are to restore Hinkson Creek to fully supporting all designated uses and to then maintain those uses. These paired goals depend fundamentally on adding to our understanding of the processes at work in the watershed through the application of scientific knowledge and technique. Thus, the science team defines its primary roles as defining potential factors contributing to the impairment and determining the efficacy of actions that would improve water quality conditions in Hinkson Creek.

This document is also important at this specific time as the CAM process moves forward. Many of the original stakeholders, action team and science team members took part in a one day training session on the CAM process and critical elements of that process. While the stakeholders have periodically revisited some of the foundational elements of this process, new participants and the passage of time will undoubtedly cause some loss of the context for the role of science in the process.

The Collaborative Adaptive Management (CAM) process is fundamentally based in science as it acknowledges the significant uncertainties or unknowns about this complex system and the need to reduce those uncertainties to provide the greatest opportunity for success. As the CAM process reaches maturity and some information has been derived from the invertebrate monitoring and physical habitat assessment, this is an appropriate time to review the state of understanding, review the most pressing scientific questions and examine the role of science in the process.

A science-driven CAM process is important to the chances of improving water quality and habitat In Hinkson Creek because science and the understanding that it provides guide good decision-making. In complex systems, choosing a solution may improve one or more characteristics of the stream, but not be able to provide the benefits needed to reach the end goal. Biological systems are incredibly complex and only by examining many aspects can one support making the best decisions possible.

Background

Hinkson Creek flows from rural Boone County through the City of Columbia to Perche Creek just upstream of its confluence with the Missouri River. Hinkson Creek was listed as impaired for two separate reasons (Figure 1). Hinkson Creek does not support the "protection of aquatic life" designated use as specified in Missouri's Water Quality Standards though no pollutant has been identified that accounts for this assessment. Parts of Hinkson Creek are also listed as impaired for bacteria as measured in the creek.

Normally, when a stream or other water body is listed as impaired, a Total Maximum Daily Load (TMDL) analysis is done to define the maximum pollutant load that will allow the stream to return to conditions fully compliant with its designated uses. This approach does not lend itself well to a situation where no specific pollutant has been identified.

In 2012, Boone County, the City of Columbia, the University of Missouri-Columbia, the US Environmental Protection Agency and the Missouri Department of Natural Resources jointly agreed to use a Collaborative Adaptive Management (CAM) approach to address water quality concerns in Hinkson Creek. CAM is a proven tool for use in complex systems with significant scientific unknowns as it expressly provides a framework for learning and putting new knowledge and understanding to use to solve complex challenges. While it has been used in biological restoration efforts, the Hinkson Creek CAM process is its first application to an impaired watershed in lieu of a TMDL.

As part of this agreement, a science team (team) was selected to provide advice to the stakeholder committee for the CAM process. This team often works closely with a group that represents the local government agencies, serving as an action team focused on engineering, chemical and biological approaches to improve water quality.

Four years into the CAM agreement, scientists have collected additional data and documented physical habitat conditions within the creek. The local partners have undertaken projects to improve water quality and the citizens of the Stakeholder Committee who recommend actions in the CAM process has grown in understanding and reached a number of decisions to move the CAM process and our understanding of Hinkson Creek forward. However, no improvement in its condition has been documented with a reasonable degree of certainty to date.

While this is a practical process rather than one with a mainly academic focus, effectively improving water quality and the biological community requires an investment in science in order to most effectively spend resource on solutions. Questions of impacts, complexity and scalability are central to finding good, cost effective solutions. These questions can only be addressed through a combination of measurement, modeling and hypothesis testing.

Conceptual Model

The science team developed a conceptual model for assessing Hinkson Creek (Figure 2). The need for a conceptual model is driven by two major scientific factors: the large uncertainty or lack of understanding of the watershed and the complexity of the multiple interactions that may influence the invertebrate community. It is also necessary to support wise decision-making by providing a context for assessing the potential impacts of any given action within the watershed meant to improve water quality and the viability of the biological community.

This model serves as a guide to thinking about the scientific aspects of the CAM process as well a touchstone for the team as it considers projects and actions within the watershed. The conceptual model is critical as it captures multiple potential stressors and makes the connection between cause, mechanism and effect(s) of the complex physical, biological, chemical and engineered aspects of the watershed. The model follows a simple form tracking from an action through the changes that it may cause within the watershed and how those changes will impact the species present in the creek. The model shown includes potential physical and chemical factors that could impact invertebrate species. The model can be adjusted to examine other aspects of the creek as well.

Note that many potential stressors can influence the biological community through a number of sometimes interrelated physical, chemical and biological mechanisms. The model reflects what is known or suspected based on understanding of this watershed and many watersheds that have been the subject of study. Urbanization has been shown to have a number of complex, interacting impacts of stream and many other impacts are likely, but not yet fully examined or defined.

The model also provides a basis for evaluating major areas of uncertainty for focus. By choosing CAM over a more traditional TMDL approach, the partners in this process acknowledged the large uncertainties in both science and success. The conceptual model provides a framework for examining the cause-mechanism-effect pathway because it explicitly provides a guide to those relationships while also supporting an examination of indirect effects, both positive and negative, that may accompany any action within the watershed.

Completed Projects and Projects in Progress

As part of the CAM agreement, the Department of Natural Resources agreed to a minimum of three years of invertebrate data collection and analysis at 11 sites within Hinkson Creek. These data are central to understanding the status of the creek relative to water quality standards. Invertebrate populations respond to a broad array of conditions and stressors and thus provide a fundamental measure of an important "response variable," one that reflects conditions, but does not, by itself, provide a lot of insight into the causes of the populations observed. These data show that Hinkson Creek is not fully meeting water quality standards, but suggest that parts of the creek are doing so and others are not far from doing so. These data suggest that Hinkson is far from a lost cause and that actions could be taken to improve the creek. The seasonal, annual and geographic variability seen in these data and their dependence on so many environmental parameters strongly support the use of CAM to address Hinkson Creek.

The conceptual model and knowledge of studies in other urbanizing watersheds led to the decision to recommend a 2-part habitat assessment to the stakeholder committee. The first part of the study used remotely sensed data to provide an overview of the fundamental physical parameters of the watershed. The second part was a detailed, field-based longitudinal assessment of Hinkson Creek that provided a wealth of data on the basic form and structure of the creek and its floodplain. This assessment provided a wealth of data and provides a fundamental basis for further study and for examining the creek at a finer scale. It also provides information necessary to understand the scalability of certain specific actions under consideration.

This assessment is an excellent example of the role of science in the CAM process because it provides a basis for additional scientific assessment and a practical tool for use in planning and executing future actions and was completed in a very reasonable timeframe and modest cost to meet the desire of the stakeholders to both learn and act toward their goal. This work was proposed by the science team after consultation with the action team and unanimously supported by the stakeholders after minor changes to address questions raised by the two groups.

The action team proposed the installation of a level spreader at a site under city ownership in the Hinkson Creek floodplain near the bottom of a catchment. The science team then worked with the action team to design a monitoring plan and to provide a cost estimate for the monitoring. This proposal was then explained to and approved by the stakeholders as an action that would provide a water quality benefit and could, if successful, be implemented on a scale that might provide a tool to make a measurable difference in water quality.

Most recently, a plan for improving the condition of the riparian corridor was approved. This effort should be guided by careful examination of the area immediately along the creek and into tributaries because connectivity between the floodplain and the creek has been compromised in places and riparian forests effectively function to provide water quality benefits only where this connection exists. Incisement of Hinkson Creek and some of its tributaries mean that much of the run-off by-passes the riparian areas reducing the effectiveness of forested or other buffer strips.

A wide range of other actions are also occurring in the basin, but have not been brought under the CAM process and are often not being monitored to provide scientific measurements of efficacy. In fact, many of these actions do not lend themselves to cost-effective monitoring because of the influence of non-controllable variables that may have a larger impact of any measurable quantity. It should be possible to model many of these impacts, but that approach has not yet been employed on a significant scale in this process.

Key Remaining Questions (Potential Scientific Priorities)

Habitat

The physical habitat assessment and subsequent observations show longitudinal variations in habitat and sediment distribution and size. However, these represent only a snapshot of the stream and do not address stream dynamics and sediment transport as a function of time, flow, etc. Major questions include: the role of habitat alteration on the species, the role of fine sediment and its transport, the potential influence of the Missouri River on Hinkson Creek and the efficacy of actions to improve habitat and water quality.

To determine the rates of transport and ultimately tie source to transport and impacts, a repeated set of observations is needed. These can be divided into three types of study.

The simpler of the two would require repeat visits to a pre-determined set of sites repeatedly at regular intervals to track the motion of sediment, particularly fine sediment, through the system. This work could be done, after a brief training, by undergraduate students, Stream Team volunteers or other members of the public. Repeated simple measurements or photographs would document change.

To look backward, the city or county could ask citizens to share past photographs of Hinkson Creek where the data and location of the photograph are known. These photos would provide a longer term view of changes in Hinkson Creek to show local changes, but have the disadvantage of being somewhat randomly selected and thus not providing the level of detail or of specific sites needed moving forward.

The third study would be to actively measure the movement of materials downstream. This study would provide the greatest depth of information on flow conditions and the movement of fine sediment, but would require higher levels of skill and a much greater time commitment to oversee data collection and analysis.

The last question under this category is how and the extent to which backwatering from the Missouri River influences the lower parts of Hinkson Creek. This question is just beginning to be assessed using data from both streams and the LiDAR data for elevations. Once the extent of this influence is understood, a second round of inquiry will try to determine what impact this would be expected to have on invertebrate habitat and populations.

Chemical Pollutants

Chemicals may not only kill individuals, but can reduce the ability of species to reproduce through a number of mechanisms. Chloride has been shown in a number of studies to impact aquatic species and the removal of the MoDOT salt storage facility is likely to help water quality downstream of that point. However, every major chemical has multiple sources with the watershed and it is likely that a complex combination of these chemicals is having impacts.

Chemical sampling of major constituents (chloride, dissolved oxygen, phosphorus) in addition to pH and temperature is needed at least at a survey level to determine possible stressors in Hinkson Creek. Initial data were collected and are becoming available through the work of Jason Hubbart and his students, but those data are not sufficient to determine the details of any significant chemical impact on Hinkson Creek and its biological community.

In addition, poly-aromatic hydrocarbons and other storm drainage related chemicals may be introduced after moderate to large storm events and may explain some of the invertebrate population variations as the department protocol specifically examines species with differing levels of tolerance for pollutants.

Such water quality sampling should try to capture different seasonal, run-off, flow, and longitudinal effects. Only after a basic survey can a more detailed, strategic set of questions with attendant monitoring be developed. Pollutant loading depends on sources and physical factors, including streamflow, providing a challenge to creating the best experiment design and implementation.

Bacteria

While much of the early focus for the CAM process has been on the invertebrate community and potential stressors, Hinkson Creek is also listed as impaired because of bacteria. The city and county have been coordinating for many years to take older lagoon-based wastewater treatment plants off line and connecting those subdivisions to the city sewer system. This should have a long-term impact on bacteria levels and is an excellent approach to addressing this impairment. However, other sources of bacteria are highly likely to exist in the watershed and should be quantified in order to create a sound long-term strategy for reducing bacteria to acceptable levels.

Investigations by the U.S. Geological Survey at state park beaches revealed a variety of sources and provided critical information as to the variability of bacterial levels based on a number of environmental factors and informed actions to reduce bacteria levels. The levels of bacteria were determined for all samples, which were frozen after the number of bacteria present was determined and then those samples with higher readings were analyzed to look at the species responsible for the bacteria. The technology to conduct source tracking of bacteria is rapidly advancing in terms of specificity and reduced cost.

The sources, fate and transport of bacteria have been studied extensively in other watersheds and similar studies would be highly beneficial in guiding the local partners toward approaches to reduce bacteria loading of Hinkson Creek. A similar approach to that used elsewhere could cost-effectively provide guidance to actions in the Hinkson Creek watershed. A well-designed monitoring protocol could provide a relatively quick overview of the sources of bacteria to Hinkson Creek. This would lead to both more detailed studies, where warranted, and suggest specific actions where a controllable source was found.

Efficacy of Actions

Monitoring or modeling of actions should accompany significant projects or small scale projects that may be widely replicable. Without monitoring data or modeling of impacts, it is likely that projects will be prioritized and located based on convenience rather than positive impacts on water quality and habitat.

Monitoring of individual actions poses challenges in many cases and should be carefully designed to minimize biases and external uncontrolled variables. In some cases, modelling, perhaps based on data collected under more ideal monitoring conditions, can provide a better estimate of the efficacy of an action or set of actions.

In addition, the scaling of project needed to accomplish the stakeholders' goals will remain unknown in the absence of data, potentially leading to extensive implementation of a particular solution that cannot make sufficient progress. Scaling of implementation and water quality impacts are each difficult, but each is needed to provide a greater level understanding to decision-making as well as adding to a greater level of certainty to the process.

Many projects are occurring within the watershed that could be expected to improve water quality. However, few of these have been monitored and thus their impacts can only be described subjectively (Need a better word here!).

Next Steps

This strategy was drafted with the purpose of sharing it with the action team and stakeholders to promote discussion of the science needed to support the CAM process. Interactions between those groups were frequent during the early stages of the process as all of us tried to build a common understanding of the watershed conditions and some of the factors to be considered when working on a complex system. The science team thinks that those discussions remain an integral part of the process and should be expanded to promote progress toward our shared goal.

Working with the other groups, the science team suggests that it is time to consider the next round of scientific questions to be asked from both the standpoint of the stakeholders and the scientists. They also suggest more thorough discussion of the actions underway and especially those planned to create the greatest chance of success.

Hinkson Creek

Collaborative Adaptive Management

Action Team Comments on Draft Science Strategy
July 25, 2016

"Background" First paragraph, second sentence:
The sentence suggests that it was listed for both things at the same time. Perhaps clarify.

"Background" Fifth paragraph, last sentence:
Perhaps add a sentence about the good scores. There may not be a reasonable degree of certainty about them or what they indicate, but it seems noteworthy.

"Completed Projects and Projects in Progress" in general:
There doesn't appear to be a mention of the flow and sediment study that is underway.

"Key Remaining Questions, Habitat" in general:
Is the fish study still relevant? Why or why not?

"Key Remaining Questions, Bacteria" in general:
The bacteria listing is, as of now, a separate issue. Including it in this strategy document may cause confusion among folks who read it but are not aware that no decision has been agreed upon to include it in CAM.

"Efficacy of Actions," first paragraph:
It is difficult for us to imagine bringing a project forward that can't be argued to have positive impacts on water quality. It is unclear what "convenience" means in this context, but we can't afford to spend limited time and money on actions that don't have benefits on water quality.

"Next Steps," in general:
Some goals or specific to-do items with a priority would be helpful. For instance, what are the top three science questions or information gaps, and why are they important?

"Next Steps," first paragraph:
The Action Team agrees that more joint meetings of the three teams would be useful; perhaps one or two per year, if not more.