Plan to Develop Consensus for Dam Modification and Channel Enhancement at Fullersburg Woods

Version 1

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DRSCW

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Project Overview

State EPA evaluations of Salt Creek have found that the waterway fails to meet the goals of the 1972 Clean Water Act (CWA), the primary federal law in the United States governing water pollution. Principally the state has found that the totality of the Salt Creek mainstem fails to meet the aquatic life goal of the CWA Act (Illinois EPA 2016). In response to this, the State has recommended tighter controls on wastewater inputs and is increasingly scrutinizing county and municipal storm water programs.

Total Maximum Daily Loads (TMDL) aimed at improving Dissolved Oxygen (DO) and lowering chlorides (road salts) in Salt Creek were approved in 2004 (CH2M Hill 2004). The DO TMDLs called for lowering inputs of selected pollutants from public wastewater plants and the modification of dams on the waterways. There were, however, a number of fatal flaws in the DO model and the State consented to working with local governments to improve the TMDL. Rebuilding the analysis was organized by the DuPage River Salt Creek Workgroup (DRSCW) who initiated a monitoring program for documenting that would incorporate stream conditions and logged wastewater inputs for populating the model.

Figure 1. Project area showing Fullersburg dam and its impoundment. An impoundment is an artificial pond or lake caused by a restriction of flow on a waterway.

The new data set allowed the updated model to be calibrated and validated against observed in – stream data and achieved a high level of agreement between the two (HDR 2009). The calibrated model was then used to model various alternatives that might affect DO. The modeled alternatives included artificial aeration, elimination of wastewater pollutants, dredging and dam modification. Modeled results identified dam modification as the most efficient intervention, promising more benefits than other options, at a lower cost. Dredging and aeration were both found to be expensive, offered a lower certainty of improving DO and failed to address the non-DO issues present on the waterway at all. The wastewater

loading reduction or elimination option to meet the DO standard, at an estimated capital cost of $487,000,000, is the alternative currently being considered by the State and is seen as the "do nothing" alterative. While this scenario extends beyond the levels of available technology, simulating the removal of all wastewater pollutants contributing to low DO while maintaining flow, low DO upstream of the dam remained. That is to say that despite exceeding the level of treatment called for by the TMDLs the problem would not be resolved. The updated model for the East Branch DuPage River suggested that removing the Churchill Woods dam in Glen Ellyn would help resolve low DO. The Churchill Woods dam modification was completed in 2012 and biological response upstream of the site has been better than anticipated (MBI 2001, 2014).

Carried out parallel to the DO modeling effort was a thorough basin assessment measuring aquatic life at over 50 locations throughout the Salt Creek watershed (MBI 2008, 2012, 2015). There were three surveys which measured fish and insect biodiversity using the same protocols as Illinois EPA, but at a much higher resolution. The survey, executed in 2007, 2010 and 2013, identified the Fullersburg Woods dam as the basin's major constraint on aquatic life (MBI 2008, 2012, 2015). Large drops in fish and insect biodiversity were found upstream of the dam in all survey years, demonstrating persistence of the distortion under various basin conditions. In all three survey years the best physical (habitat) and biological (aquatic life) conditions in the basin were found downstream of the dam. Also, in all three surveys the chemistry of the stream was essentially identical both upstream and downstream of the dam. Therefore, the evidence indicated that the fish diversity is constrained by the presence of the physical barrier itself, meaning a number of fish species present downstream of the dam were entirely absent upstream of the dam. Insects were constrained by poor water quality, sedimentation and flooded habitat associated with the dam's impoundment. Similar distortions or aquatic communities upstream of dams have been noted on the East and West Branch DuPage Rivers, elsewhere in Illinois and throughout the nation (MBI 2008). Locally and nationally dam removal and modification has been used as an effective means to meet environmental law and improve river health.

Modification of the dam to allow fish passage and elimination of the impoundment would allow upstream conditions to move into a similar physical and biological condition as the downstream segment. **Economic, environmental and aesthetic analyses showed that modifying the existing dam was by far the most efficient option, promising more benefits than the other options, at a lower cost.** Based on these facts, the DRSCW elected to move forward with the removal or modification of the dams and remove their impoundments within the study areas.

In 2015 the DRSCW successfully negotiated with State and Federal regulators phased implementation of additional regulations for Publicly Owned Wastewater Treatment Plants (POTWs) in return for executing an adaptive management program to improve biodiversity. As a result of these negotiations, priority projects focused on improving aquatic biodiversity were included in all POTW permits within the study area. The projects were carefully targeted to maximize outcomes for aquatic biodiversity and include a set of indicators to track and evaluate outcomes. Funding for the program is provided by area permit holders for whom the program offers increased gains in aquatic biodiversity while reducing compliance costs over the next decade. The list of priority projects includes removal or modification of Fawell dam, Oak Meadows dam, Arrow Road dam and Fullersburg Woods dam. The Oak Meadows dam was successfully removed in late 2015 and evaluations of environmental improvement will start in 2017.

The modification of Fullersburg Woods dam is scheduled for 2022. The project will meet local agencies' obligations related to TMDLs, POTW permits and is an essential step towards long term compliance with State mandates for aquatic life. The dam is owned by the Forest Preserve District of DuPage County and the project may generate a high level of public interest. The DRSCW wishes to design a project that achieves multiple objectives and maximizes community benefits. This project to allow fish passage and eliminate the impoundment may take multiple forms ranging from full dam removal to partial dam reconstruction that is period-consistent with Graue Mill or maintaining a water cascade over the dam.

The **DuPage River Salt Creek Workgroup**, is a coalition of municipalities, publicly-owned wastewater treatment plants, environmental organizations and professional firms, dedicated to ensuring the long-term health of local waterways by using sound science based on empirical data to enact viable restoration projects. DRSCW's membership is listed Appendix A.

Figure 2. Fullersburg Woods dam looking north. The dewatering gate is visible on the north side (far bank).

History of Fullersburg Woods dam

Fullersburg Woods dam is located on Salt Creek adjacent to Graue Mill in the Fullersburg Woods Forest Preserve in the Village of Oak Brook. The dam is owned by the Forest Preserve District of DuPage County (FPDDC).

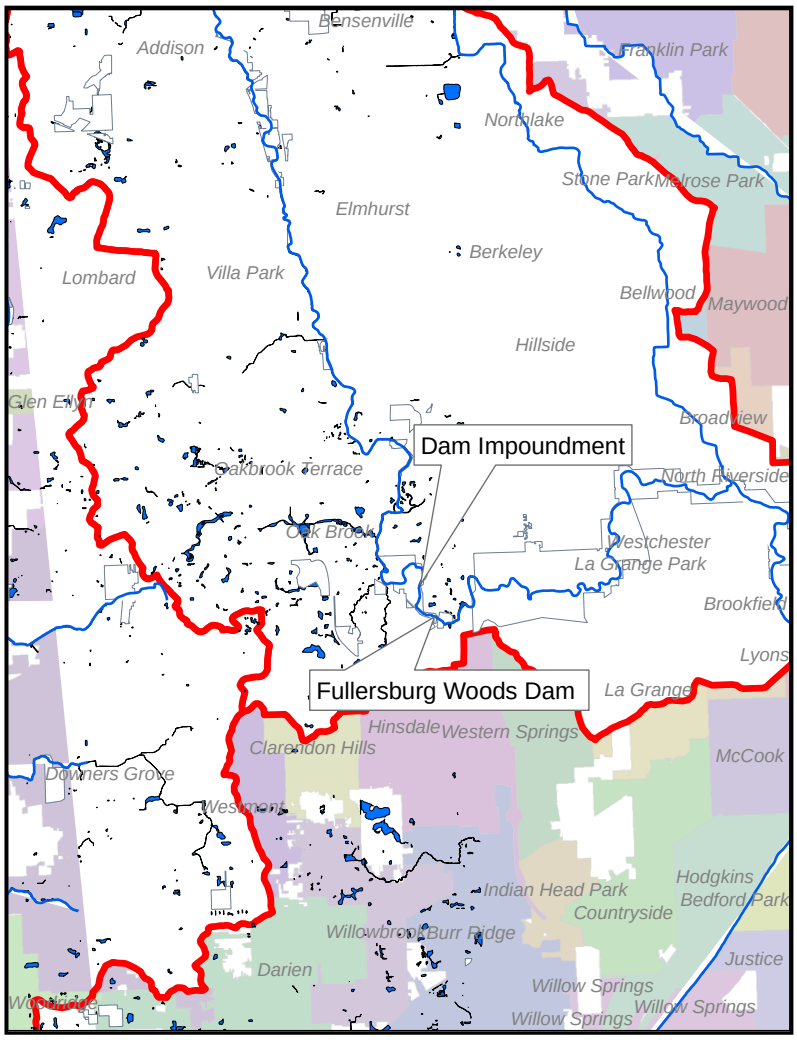


Figure 3. Project site location in southeastern DuPage County.

The original brush wood dam was constructed in the 1830s but lasted only a few years before being destroyed (ASME 1981). It was replaced with a log dam in 1844, which in turn was replaced by a plank and crib dam in 1879. The latter was washed away in 1916. No documentation describing the construction of the brush, log or plank and crib dams have been located by the DRSCW as of the writing of this document.

The site was purchased by the Forest Preserve District of DuPage County in 1933 and in 1934 the Civilian Conservation Corps built the concrete dam that exists at the site today. The dam has a crest length of 132 ft. (40.3 m) and stands 6.2 ft. (1.9 m) high. The purpose of its construction was to generate power. A side stream mill race is also present, which houses the wheel at Graue Mill; however, flow is no longer used to power the wheel. In 1991, the Forest Preserve District retained Harza Engineering Company to design a dewatering gate, which was built on the north side of the dam, to allow periodic drawdown for maintenance and inspection.

The adjacent historic mill was originally constructed in 1852; like the dam, the mill was rebuilt by the Civilian Conservation Corps in 1934 (ASME 1981). The impoundment created by the dam spans 16 acres and is approximately 3,900 linear feet in length.

The Forest Preserve District of DuPage County has extensive accounting of the current structure of the dam, which is summarized below from a 1991 Maintenance Plan (HDR 2009):

- Concrete Spillway: The concrete wall is 3' thick supported by a 23' wide concrete footing. A 9' sheet pile wall is installed 9.5' upstream of the concrete footing. The walls key into the earthen abutments on both sides. A 10' long concrete stilling basin prevents erosion on the downstream side of the dam

- Earthen Abutments: both abutments are built on a 19' thick layer of hard clay overlain by 10' of dense sand, 3' of hard clay, and finally 6' of topsoil on the North abutment, or 5' of topsoil over 2 feet of dense silt on the South. Tests for seepage conducted by Harza were negative for both abutments.

- Millrace Channel and Sluice Gate: the Mill Race is 10' wide by 210' long and houses the 18' wheel used at Graue Mill. Water control is provided by a sluice gate. Little if any capacity for dewatering exists in this channel. Dewatering Slide Gates: Three 7'w x 4'h stainless steel slide gates comprise the dewatering portion of the dam. The gates are housed in a reinforced concrete structure located on the North side of the dam.

Together the dam and Mill are an important piece of local history and the surrounding communities' cultural identity. Families explore the area on hot summer days. School kids visit on field trips. Brides and grooms have their wedding photos taken with the waterfall in the background.

Because of these personal and cultural connections, the proposal to modify the dam has generated a high-level of public interest. Residents are concerned that modifications will detract from the historical nature of the site. They are also worried that modifications will make the site unattractive and not worth visiting. In the end, community members are concerned that their special place will change for the worse.

The DRSCW wishes to design a project that achieves all of the environmental and economic objectives, while maximizing community benefits. Engineers, planners and community representatives have the ability and resources to modify the dam in a thoughtful way that is consistent with Graue Mill history and the area's charming feel. In addition, the modification project could include other changes to the area—like interactive exhibits—that make the site even more accessible and enjoyable for all residents.

Gathering Public Input

Due to the public's personal connection to the dam and adjacent Graue Mill, there has been strong opposition to any modification (See Appendix B for public comments regarding the dam modification in 2009). The DuPage River Salt Creek Workgroup has tasked Bluestem Communications, a nonprofit communications organization, with developing a public outreach and communications plan to ensure that all residents and organizations have an opportunity to voice concerns, share ideas and help determine the areas final design.

As previous public engagement efforts on water quality issues have shown, talking about the project with just engineering plans and scientific facts will not provide residents with the opportunity to truly engage. Additionally, the project design team must better understand which engineering solutions will most accurately meet both the environmental and cultural goals. Community feedback must provide the project team with input on what form the dam modification should take.

The communication team will utilize a very specific, tried and true method for researching and developing education, outreach and behavior change campaigns. The communication team will combine **research**, **public outreach, values-based communications** and **social marketing strategies** in a system that gets to the root of the community's concerns and the project's goals.

The communications and outreach approach will be divided into three phases. Phase 1 will focus on internal research and planning. This phase will take place over three weeks and will help the communications team identify audiences to target for input, how to reach those audiences and the goals of the public opinion research. The communications team will produce a literature review of existing public opinion research and similar dam modification projects and an implementation plan.

Phase 2 is the public opinion research and input process and will take about 12 weeks to complete. In this phase, the communications team will focus on gathering public opinion information and public input on the dam modification project. This information will be gathered via a targeted online survey and a series of two to three town hall meetings. Both the survey and the town hall meetings could ask the public for general opinions on dam modification as well as their specific feelings towards the Fullersburg Woods dam. This process would also seek design input from the public by engaging town hall meeting attendees in design charrettes. By the end of this phase, the communications team will produce a final report of all research results, including data, analysis and messaging and outreach recommendations, and a collection of proposed design solutions, including renderings.

A communications strategy and message will be created during phase 3. The communications strategy will determine how the DRSCW will build support for dam modification and effectively communicate the benefits and final design of the modified dam. The strategy will come with a messaging document that contains compelling language to be used in all educational materials.

The initial communications and outreach process for the Fullersburg Woods dam modification project will span approximately 21 weeks. The information gathered from this process will help the DRSCW decide on a publicly-supported design for the modified dam and communicate the progress of the project to the public over the subsequent years.

The DRSCW and the communications team are committed to an open and transparent process through which all residents and organizations will have the opportunity to ask questions, voice concerns and provide input on what the Fullersburg Woods dam project should look like. The DRSCW anticipates that the public engagement process will begin in early 2017.

Plan to Develop Consensus for Dam Modification and Channel Enhancement at Fullersburg Woods

Project Background

The State of Illinois has found that Salt Creek does not meet state water quality standards for dissolved oxygen (DO, see Appendix C for relevant water quality criteria) or state thresholds for fish and aquatic insect biodiversity (Illinois EPA 2016). Monitoring and modeling of Salt Creek DO levels found that the lowest levels were in the impoundment upstream of the Fullersburg Woods dam (HDR 2009). Three biological surveys showed a large decrease in fish biodiversity upstream of the dam (MBI 2008, 2012, 2015).

Due to the significant ecological declines associated with the Fullersburg Woods dam, the DuPage River Salt Creek Workgroup (DRSCW) is advocating to modify the dam in order to eliminate the impoundment and create fish passage. This option is the most effective at increasing DO levels, allowing fish passage and improving aquatic habitat. Other options, such as dredging, in-stream aeration and treatment cost more and do not achieve all of the desired effects. Dam modification could come in multiple forms, including crest reduction (making the dam lower), a partial removal (removing part of the dam to allow fish passage), or full removal with a partial rebuilt version of the original dam.

Figure 4. Northern Pike caught downstream of the Fullersburg Woods dam. The species is entirely absent from the river north of the dam.

The **Fullersburg Woods Dam Modification and Channel Enhancement Project** aims to reduce or eliminate the dissolved oxygen impairment in the Fullersburg Woods dam impoundment, improve channel physical conditions and raise fish and aquatic insect biodiversity in the 1.5 miles of river north of the dam.

Public opposition to dam modification has been strong. The DRSCW has tasked Bluestem Communications with developing a public outreach and communications plan to increase support for dam modification and help determine the dam's final design.

Project Objectives and the Project Partners

The Fullersburg Woods Dam Modification and Channel Enhancement Project objectives are to reduce or eliminate the dissolved oxygen impairment in the Fullersburg Woods dam impoundment, improve physical channel conditions and raise fish and aquatic insect biodiversity in the 1.5 miles of river north of the dam. The ecological enhancement of the site with the corresponding improvement of Index of Biological Integrity scores is considered essential to project success; they are the basis for regulation of area wastewater and stormwater permits.

The project meets both the mission and purpose of the property owner (DuPage County Forest Preserve District) and the Project Sponsor (the DRSCW):

The Forest Preserve District of DuPage County- Mission
To acquire and hold lands containing forests, prairies, wetlands, and associated plant communities or lands capable of being restored to such natural conditions for the purpose of protecting and preserving the flora, fauna and scenic beauty for the education, pleasure and recreation of its citizens.

The Forest Preserve District of DuPage County- Purpose
To acquire, preserve, protect and restore the natural resources in DuPage County while providing opportunities for people to connect with nature.

DuPage River Salt Creek Workgroup (DRSCW) - Mission
The mission of the DRSCW is to bring together a diverse coalition of stakeholders to work together to preserve and enhance water quality and stream resource quality in the East Branch DuPage River, West Branch DuPage River, Salt Creek and their tributaries.

About Bluestem Communications

Bluestem Communications, a nonprofit organization, has 21 years of experience building creative communications campaigns to protect North America's most precious land and water resources. Since 1995, the organization has earned a reputation in the environmental community as a leader in the field of values-based communications and research-based message development. Bluestem uses public opinion and other research to inform messages that speak to widely held cultural values and prominent public concerns. The organization's primary task is to meaningfully engage people and motivate them to act by making the connection between the environment, their daily lives and their basic values. Bluestem does this by 1) developing communication approaches and campaigns that motivate more people to protect the environment and 2) by building strategic communications capacity within other environmental and conservation organizations.

Communication Approach for Plan Development

To improve ecological conditions in Salt Creek, the dams within it must be modified. Dam modification will improve dissolved oxygen levels and benefit fish populations. Fullersburg Woods dam is one of Salt Creek's dams that needs modification. To ensure that the Fullersburg Woods dam modification project is successful, the communication team will work with the community to determine the most acceptable dam modification approach. Through this process, the communication team will also educate the public, local media and decision makers about the importance of this type of project, culminating in broad public support. To accomplish these two complementary goals, the communications team will follow a three-step approach:

Phase 1: Internal Research and Planning

3 weeks

To develop a communications campaign that engages and inspires audiences surrounding Salt Creek to support modification to the Fullersburg Woods dam, project team members must understand their values, knowledge and current behaviors. They must also determine which form of the modified dam is strongly supported by the public. There are many ways to gather this information. The communication team has decided to use two approaches to gather this public opinion research, explained in Phase 2 below.

This brief planning process will help determine audiences, goals for the public opinion research and the resources available from all involved organizations. During this time, the communications team will also conduct a literature review of existing public opinion research and similar dam modification projects that might be relevant to this project. The review will cover research conducted in these targeted municipalities, similar populations and river issues broadly. During this initial stage, the communications team will cast a wide net for any existing studies or research that might be helpful.

Phase 2: Public Opinion Research and Input Process

12 weeks

Understanding what a targeted audience thinks, knows and feels about an issue is critical to designing an effective engagement campaign. Public opinion research can identify audience values; current opinions; current knowledge; history of experience with the creek; motivators; ideal language to use; and language to avoid, all correlated to demographic data. Most important, this phase will also gather input that will directly influence the final design of project.

The public opinion research and input process will include two methods to ensure that everyone who wants to will have the ability to participate.

<u>Method 1: Surveys</u>

Surveys will be developed and distributed by members of the DRSCW and any partners. There can be both an electronic version of the survey (in SurveyMonkey) and a designed printed version, depending on member preferences. The target audience and the method of survey distribution will be determined by members of the DRSCW and the literature review. Audiences could be determined by zip code or neighborhood, membership in select groups (i.e. kayakers) and interest in community issues (as indicated in their subscription to municipal listservs, etc.). The survey could be mailed to residents, emailed to

community listservs, emailed to select groups, shared on social media and promoted through newspapers and websites.

Introductory text will explain the project and encourage people to provide their input to help determine the final form of the dam modification. While survey questions will be determined by the work group members based on the results of the literature review, questions may ask the resident about their location, values associated with Salt Creek and their community, current behaviors along or within Salt Creek and the Fullersburg Woods dam, concern for problems caused by dams, and their opinion on how the Fullersburg Woods dam should be modified.

Method 2: Public meetings

Interactive public meetings can provide valuable feedback on proposed plans. Key community members need to be heard in order to lend support to a project. A third party facilitator will facilitate these meetings in order to ensure that people are heard and the needed feedback is provided. The third party facilitator will incorporate interactive activities into the meeting in order to gather specific feedback while ensuring fair audience participation. These small group interactive activities also prevent town hall meetings from becoming one-way lectures or unproductive ranting sessions.

The meetings will also incorporate an interactive design component. This may be in the form of design charrettes. Participants will be asked to be creative and provide suggestions on what they would like the modified dam to look like.

During the interactive meetings, participants will have the opportunity to visit two stations. The first station might gather attendees' opinions on Salt Creek and Fullersburg Woods dam and its modification. The other station could be the design charrette. They will spend about 25 minutes at each one. The facilitator will let them know when 25 minutes are up and advise them to switch. One member from the communications team will be assigned to each station. That person's job is to facilitate. They will explain the instructions, ask the questions, spur discussion and take notes on the conversation/comments people have that do not get recorded on the flipcharts or printouts. That person will answer questions if they can, but will not take up time giving long answers. Instead, they will write the question down so it can be fully answered at a later time.

The results of the distributed survey will influence the questions asked at the public meetings. Information from both public opinion options will be combined and will guide all communications recommendations. The feasibility of the design suggestions will be determined by the Project Design Team.

In the end of Phase 2, the public opinion research from all the possible outlets described above will be combined into a report that has both the data and analysis of the data, along with recommendations. The results will be plotted on maps wherever possible. The research report will be shared with the DRSCW and other partners at an in-person meeting. At the in-person meeting the project team will present several design options that were gathered from the input process. The cost, impact and likelihood of public approval will be presented for each option. The design option chosen will determine the scope of the dam modification project.

Phase 3: Develop Communications Strategy and Messages

8 weeks

A complete communications strategy shows communicators how to reach goals. For this project, the communications strategy will guide the DRSCW through a public communications process aimed at building support for dam modification and showcasing the benefits and eventual design that the dam modification will take.

Strategy components include measureable campaign objectives that are SMART—Specific, Measurable, Achievable, Realistic and Time-bound, an analysis of the public's perceived barriers and benefits to dam modification and recommended pathways to reach audiences. The strategy document will include suggested activities to reach the chosen audience(s) and ultimately becomes a work plan for implementing the campaign. Activities could include a social media campaign, advertising buys in targeted media and markets and/or the development of a project website. The strategy document will also include a recommended timeline for campaign implementation.

Messages answer key questions with compelling language, tailored to each audience: What is the fundamental problem we want to solve? What is the solution? What are the benefits of this solution? The messages will be based on the public opinion research and the audience analysis created during Phase 2. Each message will contain the component parts (problem, solution, audience, audience values, audience concerns and audience ask) and a full-text document with compelling language. Both the component parts and the full text will be used for all materials.

Bluestem will develop the communications strategy and message with partners during two planning meetings.

The final message document and designed materials will be presented to interested partners at a workshop training session. The training will include a discussion of the communications goals, messages and tips for how messages and materials can be used to tell a cohesive story. By the end of the training all partners should be on board with the coordinated activities of the campaign and its messages.

Preliminary Communications and Outreach Schedule

Week of:	1/8	1/15	1/22	1/29	2/5	2/12	2/19	2/26	3/5	3/12	3/19	3/26	4/2	4/9	4/16	4/23	4/30	5/7	5/14	5/21	5/28	6/4	6/11
Phase 1																							
Planning																							
Literature review																							
Conference call																							
Phase 2																							
Survey drafts																							
Survey distribution and analysis																							
Public meetings																							
Final report and designs																							
Report meeting																							
Phase 3																							
Communications Strategy																							
Message																							
Materials																							
Training																							

Figure 5. Preliminary Communications and Outreach Schedule

Technical Justification for the Project

The State of Illinois found Salt Creek does not meet state water quality standards for dissolved oxygen (DO) or state thresholds for fish and aquatic insect biodiversity (Illinois EPA 2016).

Intensive DO monitoring and modeling confirmed that violations of DO water quality standards occur in Salt Creek (HDR 2009). Figure 4 shows a validated model run based on 2007 data. Dams with significant impoundments are illustrated by the vertical grey lines. The model predicted that the lowest DO on the river system would be found in the Fullersburg Woods dam impoundment. Since the creation of the model, DO monitoring on Salt Creek continues to support the modeled predictions and the original conclusions.

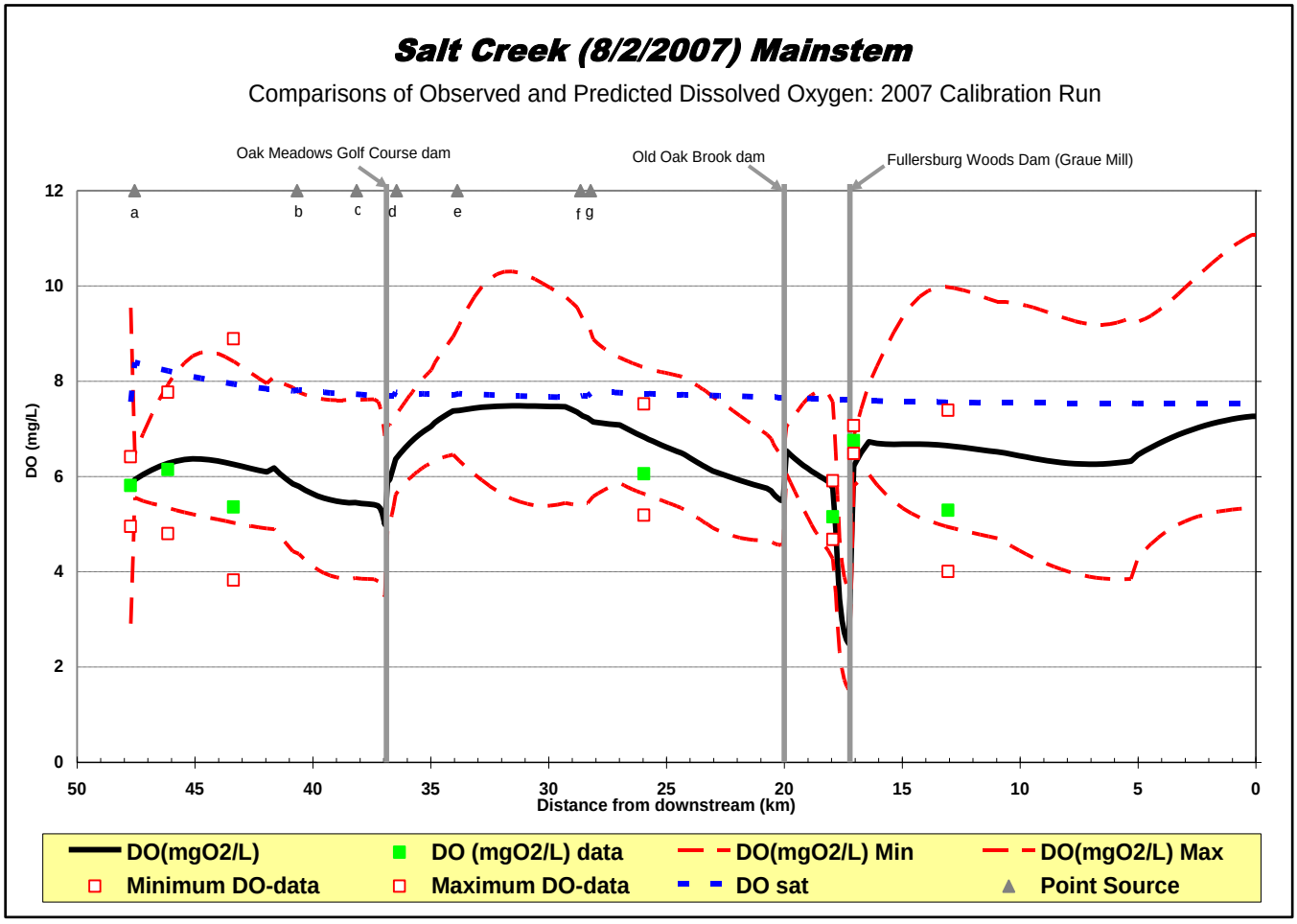


Figure 6. Calibration Run for Salt Creek DO based on data gathered in 2007. Model showed excellent agreement between observed (DO (mgO2/L) data and maximum, minimum DO (gO2/L)) and modeled data.

Locally funded biological surveys carried out in 2007, 2010 and 2013 confirmed the State's finding that the river does not support biodiversity to the levels set by state law (MBI 2008, 2012, 2015). Fish and insect biodiversity is measured by IBI (Index of Biological Integrity), which allocates a single numeric score to fish (FIBI) and insect (MIBI) populations based on the diversity and numbers of native species found at the site.

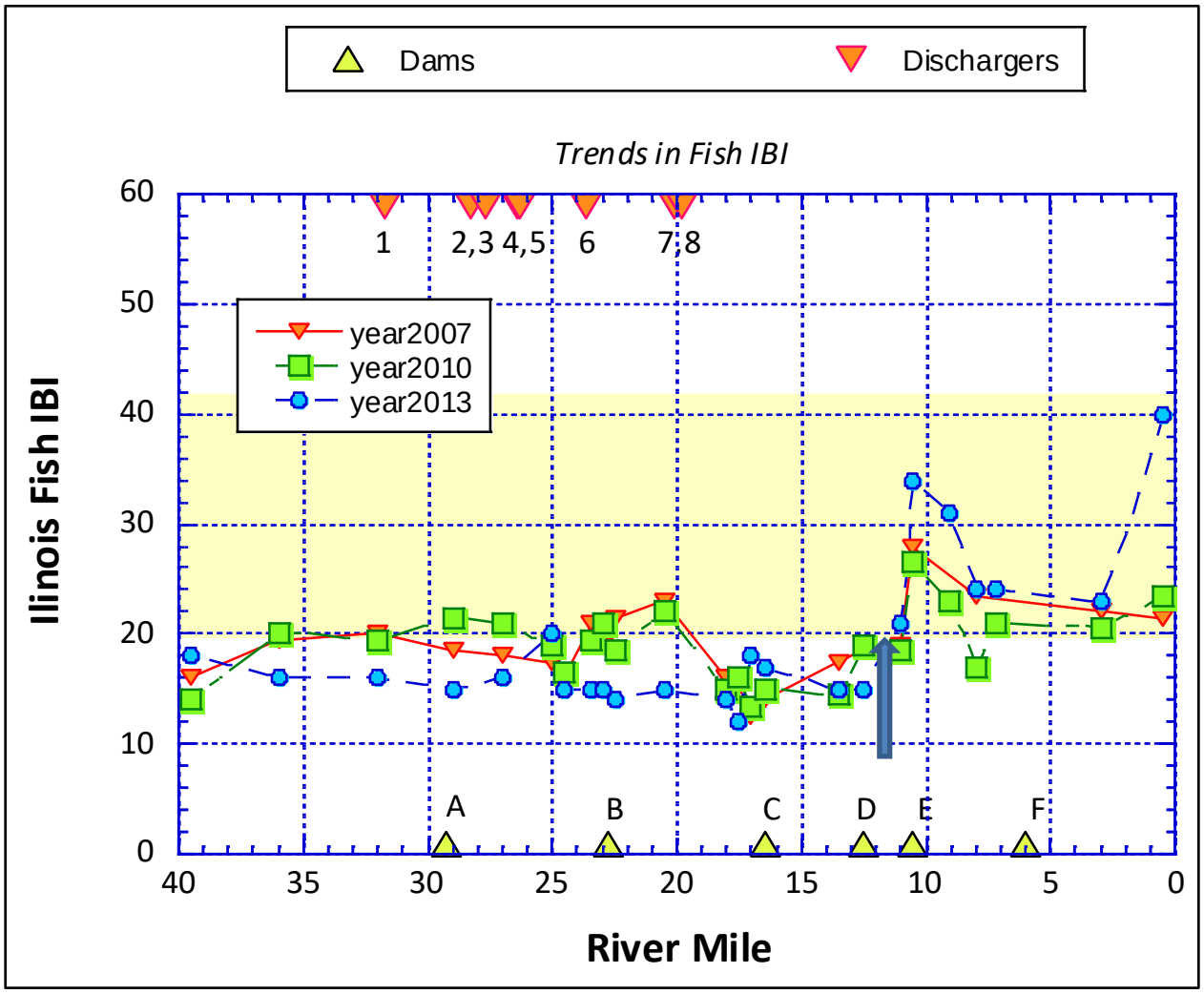


Figure 7. Fish IBI on Salt Creek for years 2007, 2010 & 2013. Fullersburg Woods dam is shown by a blue arrow.

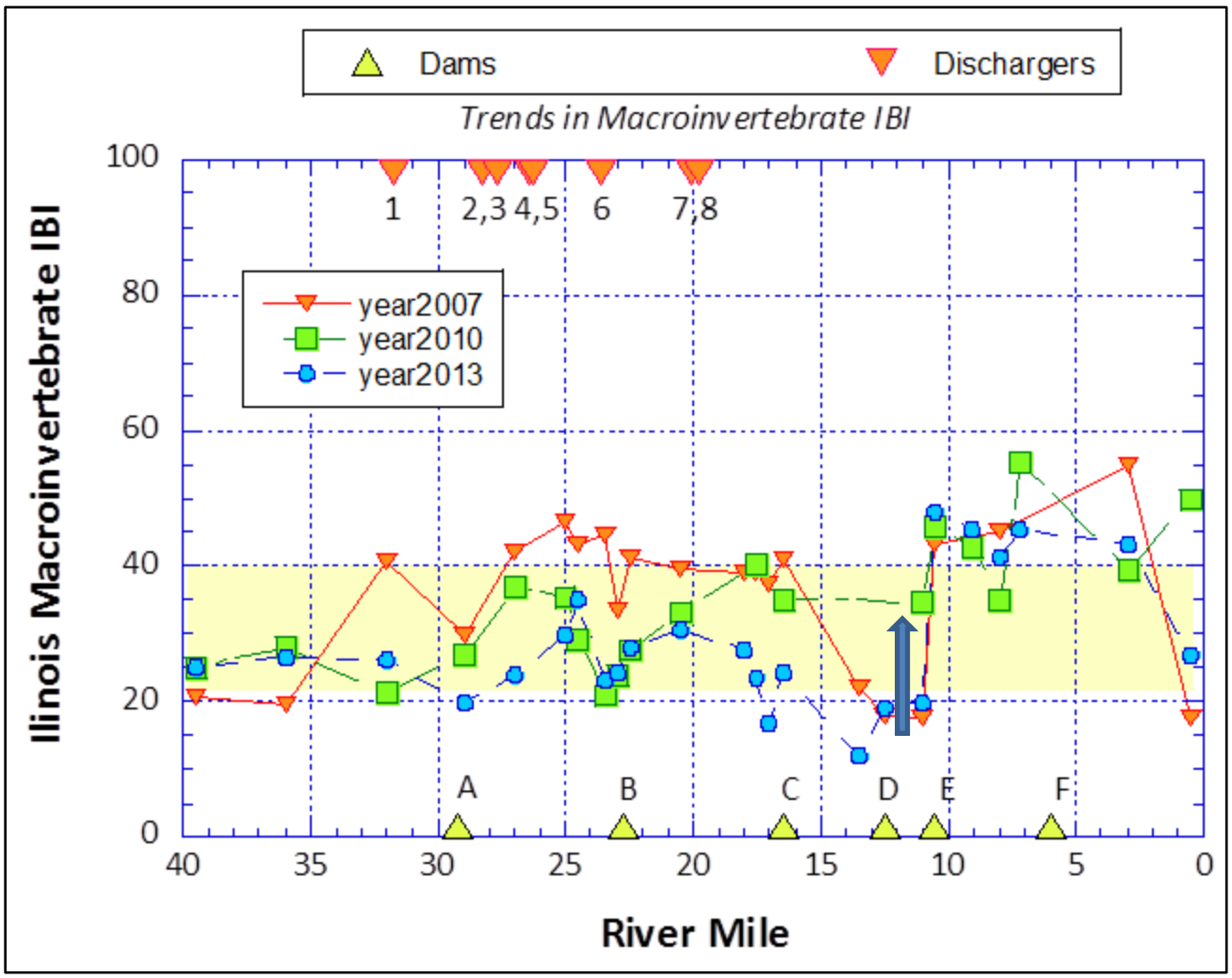


Figure 8. MIBI for Salt Creek 2007, 2009 & 2013. The sites at river miles 11, 12 and 13 were not sampled in 2013 due to high water. Fullersburg Woods dam is shown by a blue arrow.

BLACKSIDE DARTER
EMERALD SHINER
JOHNNY DARTER
NORTHERN PIKE
ROCK BASS

Table 1. Fish species present in Salt Creek, but absent north of the dam.

Figure 6 shows a large decrease in fish biodiversity as we move upstream of the dam. The fall in fish populations is primarily due to the dam's presence, a physical barrier to fish passage. Five (5) native river fish species are absent upstream of the dam, see table 1. Suitable habitat conditions exist upstream of the dam, so their complete absence from approximately 29 mainstem river miles upstream can only be explained by the presence of the physical barrier at river mile 10.7. However, the physical barrier should not preclude the presence of aquatic insects (measured by macroinvertebrate IBI or MIBI) which can move over barriers during their winged adult phases of their life cycles. The decline in MIBI in the two miles upstream of the dam is explained by low DO and the poor physical conditions created by the impoundment, principally the flooding of habitat, and river bed gravels covered by silt. This observation suggests that even stocking the upstream area with the absent fish species would be unsuccessful.

Sediment at Site

Sediment volume was studied in 2008 when eight cross sections were taken above the Fullersburg Woods dam (HDR 2009). There was generally 1-2' of deposition along the channel margins with often little to no deposition in the thalweg, or deepest part, of the channel. The lack of material in the thalweg is likely due to the impact of a dredging project accomplished in the late 1990s. The channel regains its natural thalweg of coarse material approximately 1200' upstream of the dam. The material that is being transported by the stream is depositing in a point bar just downstream of the bend into the Fullersburg Woods property.

Evaluation of Options to Improve Stream Resource Quality

Preferred Option	Cost (2016 values)	Fix DO Conditions	Allow Fish Passage	Improve Habitat	Improve Insect Scores
Dam Modification Partial removal	$2,222,405 to $3,746,493	✓	✓	✓	✓
Other Options Investigated	**Cost (2016 values)**	**Fix DO Conditions**	**Allow Fish Passage**	**Improve Habitat**	**Improve Insect Scores**
Eliminate oxygen demanding point source pollutants [1]	$486,673,387				
Air based in-stream aeration [2]	$2,936,628	✓			
High purity oxygen addition	$2,509,084	✓			
Dredging impoundment	$7,400,000 (biannual)	Not modeled			

[1] Based on achieving zero oxygen demanding pollutant discharge. All plants retrofitted with membrane bioreactors and polished with granular activated carbon. Given the variation in these costs and the persistence of predicted minimum DO below 5.0 mg/L in the Fullersburg Woods impoundment, no estimate of operating costs was made. Annual M&O costs are likely to be significant.
[2] Based on two (2) units.

Table 2. Investigation of alternatives for management of the Fullersburg Woods dam and impoundment.

In 2007 the DRSCW created a Project Team to oversee the development of the model and evaluation of alternatives. Five alternatives were investigated: POTW upgrades to eliminate oxygen-demanding compounds from upstream wastewater inputs; dam modification; two iterations of water column aeration; and dredging the impoundment to reduce sediment (table 2). Dam modification was selected by the DRSCW Project team as it was the only scenario that hit all of the project objectives, had acceptable costs and did not require ongoing maintenance.

Concepts for Dam Modification Alternatives

Both nationwide and locally dam modification has been shown an efficient tool to meet environmental law and improve stream health. A summary of local dam modifications carried out to improve stream resource quality is given in Appendix D. Given both the scale of the environmental impact of the Fullersburg Woods dam and its social context the DRSCW initially looked at several options for modifying it. These are summarized, along with their estimated costs, in table 3. A brief description of each type of modification is also supplied below.

Type of Dam Modification	Estimated Cost (2016 values)	DO Improvement	Fish Passage	Impoundment Habitat Improvement	Maintain Flow in Raceway
Full removal	$2,222,405	✓	✓	✓	✓
Partial removal	$2,222,405	✓	✓	✓	✓
Partial removal while maintained cascade	$3,135,804	✓	✓	✓	✓
Partial removal additional enhancements	$3,746,493	✓	✓	✓	✓

Table 3. Options for dam modification. Adapted from the DO Feasibility Study for Salt Creek 2009

Full Removal – This is one of the cheapest options and it obtains all output targets. Under this scenario the impoundment would be eliminated and the river width would narrow to widths observed upstream and downstream of the current impoundment. However, the association of the dam with Graue Mill means the dam has a historical component and a strong local interest in its preservation. Full dam removal was **not** the first choice of the project team.

Partial Removal – Estimated to be approximately the same cost as the full dam removal. Partial removal involves removing approximately 60ft of the current structure to allow drawdown of impoundment and full fish passage. The part of the dam that would likely be removed would be on the north bank and would include the drawdown gates and part of the dam wall. However more than half of the dam would remain. Under this scenario the impoundment would be eliminated and the river width would narrow to widths observed upstream and downstream of the current impoundment (see figure 8).

Partial Removal with Cascade Maintained - The same as partial removal but with a pumping mechanism and dam crest modifications that would maintain flow over the dam and the cascade on the dam's downstream face. Cost reflects the addition of the design, capital and running of such an operation for 20 years.

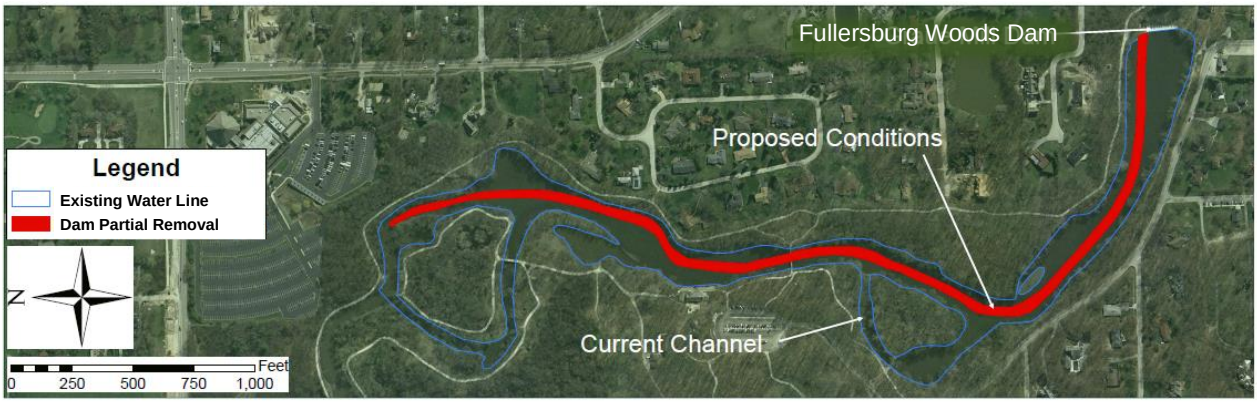
Partial Removal with Cascade and Additional Enhancements – An further enhanced version of the partial removal. This option follows the details outlined in the Partial Removal option with cascade, but with additional considerations that would maintain—or improve—the aesthetic attributes of the site. Possibilities include, construction of a historically accurate partial dam consistent with the period of the mill building, and a riffle drop down to create a water feature at the site of the modification and a canoe launch at the site. Under this scenario the impoundment would be eliminated and the river system would narrow to widths observed upstream and downstream (see figure 8).

Concepts for Channel Modification

All modification scenarios involve lowering or eliminating the upstream impoundment. Under full removal or partial breech, the stream will narrow from an average of 110' to approximately 80' and the mean water elevation would fall, considerably in some areas. This drop in water elevation and narrowing of the channel (see figure 8) will create multiple favorable outcomes for stream health. Assessments of the impoundment (MBI 2012) have found that it lacks gravel substrates, riffles and pools and meanders, all of these are related to some degree to the impounded nature of the site. Such features are not uncommon in the sections of river downstream in Cook County portions of the lower Salt Creek and have been linked to healthy aquatic communities by numerous studies. DO is also affected by the physical nature of the site (sediment and impounded geometry increases oxygen demand and decreases reaeration rates). All of these factors would be improved to some degree by draining the impoundment.

Dissolved Oxygen- Increase levels of dissolved oxygen as sediment oxygen demand and algae levels are decreased and reaeration rates go up. This general hypothesis is supported by the DO model produced for the reach and empirical evidence from local dam modifications.

Fullersburg Woods Dam, Partial Removal Option



Current conditions at dam before partial removal.

Current reservoir before partial removal, looking upstream.

Dam after proposed partial removal.

Reservoir after proposed partial removal looking upstream.

Figure 9. Draw down in Salt Creek following partial removal of the dam.

River Bed conditions – Cobble and gravel beds have higher habitat value as they support better and more diverse aquatic populations than mud dominated stream beds. Mapping of stream beds on the main stem of Salt Creek has shown that the river has a mean value as low as 12 (with 1 being completely mud dominated and 20 being completely gravel dominated) and as high as 18, the impoundment had a value of 2 signifying a poor quality silt covered bed. This level of sedimentation exists upstream of the dam because of the lack

of velocities necessary to transport silt fines over the top of the dam meaning they become deposited inside the impoundment. Modification of the dam will allow velocities to exist in the footprint of the impoundment that will minimize on-going sediment deposition and create conditions conducive to the construction of gravel bed sections.

Figure 10. Constructed riffle at Churchill Woods, Glen Ellyn on the East Branch DuPage River.

Riffles and runs – Related to river bed conditions, this is a rocky shoal or sandbar lying near the water's surface. These channel forms have been identified as being essential components of a healthy river system. Riffles are vital breeding and feeding areas for aquatic life and increase aeration rates (increase DO). A modified dam environment would both reveal existing, currently submerged, riffles and would allow the construction of additional riffles where needed (figure 9).

Figure 11. Constructed riffle pool sequence on the West Branch DuPage River.

Pools – Deeper slower flowing areas, usually found in relation to riffles. Pools are vital shelter areas for aquatic life. A modified dam environment would possibly reveal existing, currently submerged, pools and would allow the construction of additional riffles where needed (figure 10).

Meanders - a bend in a sinuous watercourse, often occurring in series. This sinuosity means that velocity varies both across the channel and along the length of the channel. Meanders may be exposed by the falling water levels; they may be built or they may be induced passively (figure 11).

Figure 12. Construction of meander on the West Branch DuPage River.

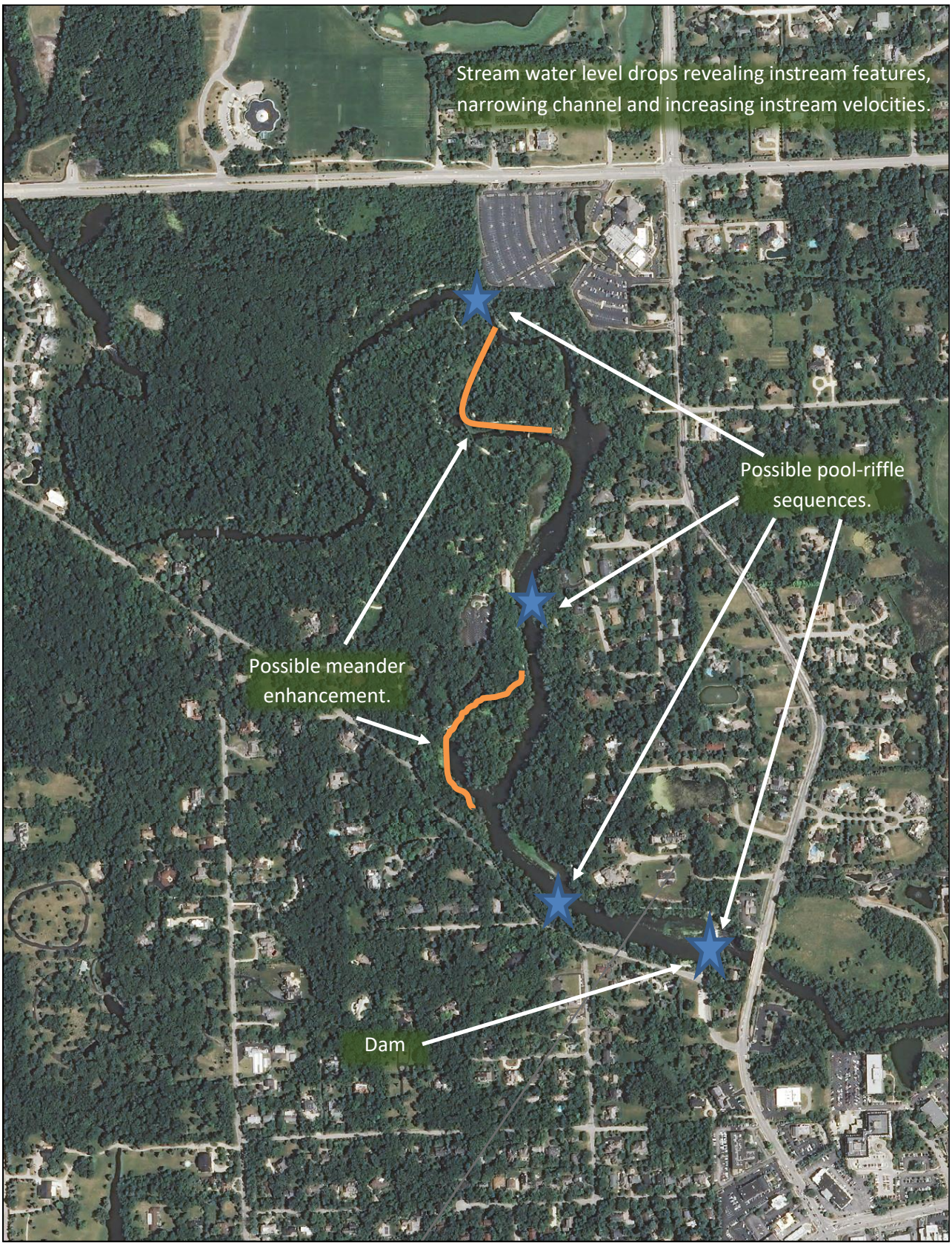


Figure 13. Mockup of possible in channel design following drawdown of the impoundment.

Appendix A. DRSCW 2016 Members

Agency Members

Village of Addison
Village of Arlington Heights
City of Aurora
Village of Bartlett
Village of Bensenville
Village of Bloomingdale
Village of Bolingbrook
Village of Carol Stream
Village of Clarendon Hills
Village of Downers Grove
Downers Grove Sanitary District
DuPage County
City of Elmhurst
Village of Glen Ellyn
Glenbard Wastewater Authority
Village of Glendale Heights
Village of Hanover Park
Village of Hinsdale
Village of Hoffman Estates
Village of Itasca
Village of Lisle
Village of Lombard
Metropolitan Water Reclamation District of Greater Chicago
City of Naperville
City of Northlake
Village of Oak Brook
City of Oakbrook Terrace
Village of Roselle
Salt Creek Sanitary District
Village of Schaumburg
Village of Villa Park
City of Warrenville
City of West Chicago
Village of Westchester
Village of Western Springs
Village of Westmont
City of Wheaton
Wheaton Sanitary District

Associate Members

AECOM
Arcadis US Inc.
Baxter & Woodman, Inc.
Black & Veatch
Carollo Engineers
CDM Smith
Christopher B. Burke Engineering, Inc.
Clark Dietz
Donohue and Associates
DuPage County Health Department
Elmhurst-Chicago Stone Company
Engineering Resource Associates
Forest Preserve District of DuPage County
Geosyntec Consultants
HDR Inc.
Hey and Associates, Inc.
HR Green, Inc.
Huff & Huff, Inc.
Illinois Department of Transportation
Illinois State Toll Highway Authority
Inter-Fluve, Inc.
K-Tech Specialty Coatings, Inc.
Lisle Township Highway Department
Monroe Truck Equipment
Naperville Park District
Naperville Township Road District
Prairie Rivers Network
RHMG Engineers, Inc.
RJN Group
Robinson Engineering
Ruekert Mielke
Salt Creek Watershed Network
Sierra Club, River Prairie Group
Strand Associates, Inc.
Suburban Laboratories, Inc.
The Conservation Foundation
The Morton Arboretum
Trotter and Associates

City of Winfield
City of Wood Dale
Village of Woodridge
V3 Companies
Walter E. Deuchler Associates, Inc
WellSpring Environmental Products
York Township Highway Dept.

Appendix B. Summary of comments made during public meeting outlining the findings and recommendations of the DO Study Report for Salt Creek.

Meeting 1. 7.30 PM Oak Brook Village Hall. 03.18.2009. Number of attendees 44

Comments: (*Italicized are hosts answers*)

Two solutions were proposed, the second was not clear.

1. *Bridging or ramping*
2. *Partial Breach - water not over the top of the dam unless auxiliary pumping*

Will there be a concrete apron installed with the breaching option?

There would be a natural scour pool. There would not be an apron installed, perhaps there would be buttressing of the dam.

Scour pool is a bad term; it implies sediment in my backyard.

Erosion cannot increase under the regulations.

What was the cost of dredging when completed previously?

$500,000-600,000 in 1995 dollars

Can aeration be created any other way?

Bridging, riffles and artificial aeration

Can riffles be used upstream of the dam?

No, a change in elevation is needed; it can't be done in a flooded area

What would the bridging option look like?

The crest would go down, ramp created on the downstream side.

Would there be water flowing over the dam?

Yes, but part of the dam would have to be removed to achieve the DO standard, the fall would be smaller than at present.

What would it look like upstream in the bridging option?

Look at diagram – pink shows where the water level would be if the crest was decreased by one foot. The aqua shows two feet. The yellow shows three feet. The channel will narrow with the bridging option.

Committee member is disappointed with the context, the colors are bad, the slides are different, the committee met four times and they had not seen this graphic. Gates were put in at the dam to make it a

flood control structure. When the gates are open the upstream channel recedes to 35 feet wide, can't see it from Spring Road. Vegetation will impede the flow of water when flooding.

Under no circumstances will any part of this project make flooding worse. Trees slowing down flow so offsetting increased storage. Bath tub example. The reservoir will be empty so additional capacity is created.

If the sediment decomposing take DO will dredging help?

Sediment is constantly being added and even a fine layer will trigger oxygen consumption. No re-aeration in pool.

Treatment plants add sediment at storm time.

Treatment plants have constant flows. If we do activity and do not meet the DO goal, IEPA will come back and say do more, this is not an attempt to draw attention away from POTWs.

There was a request for three dimensional models.

That would be cost prohibitive and would not add to the understanding of the problems or potential solutions.

How does the mill race continue to flow if the dam is taken down three feet? If the dewatering gates are open the raceway is dry.

There are a number of ways to accomplish this, how it will be accomplished exactly hasn't been decided. Needs to be discussed with mill operators. It can, and should be, engineered to continue to flow.

Are there any threatened or endangered species at the site? If there are no threatened and endangered species, it's not that critical of a problem.

No, there have not been any threatened or endangered species identified on site because the habitat and water chemistry are so degraded that they cannot support threatened or endangered species. The habitat will not support even common species.

Concerned because the character of the mill area will be changed, lose the beauty of the area – artists, photographers, families come. There are 20,000 visitors a year. This is the only place where we have a historic dam that dates back to the 1830s.

The Clean Water Act does not allow for exemptions, we are looking for a balance between the history and water quality improvements.

How can the historic integrity of the site be maintained if water does not flow over the dam?
Where is EPA? What can we do? Who do we contact beyond this meeting?

IEPA's solution is to go to treatment plants, but that costs money and won't meet the stated environmental goals. We would still have impairment on the waterway even under optimal plant upgrades. We have two options, dam modification and aeration. We discarded aeration because it doesn't solve the habitat problems and it is expensive. Aeration scenarios were examined, four different options that resulted in the following 1) very expensive equipment 2) costly maintenance

3) no one to maintain and operate 4) where to locate the equipment. If ever the treatment plant put out drinking water quality effluent, the problem will still not be solved.

What about the two bridges above the dam?

It was clarified that the question was referring to additional dams shown above Graue Mill. Oak Meadows is owned by the Forest Preserve District and will be addressed – likely removed. The Old Oak Brook dam is not causing a major problem. We have taken the worst problem on the waterway and made it a priority project. Then we will monitor to see if the problem is solved.

Are we going to destroy Graue Mill so we can take of one mile of Salt Creek?

All indicators show that area at Graue Mill is one of the largest water quality problems on Salt Creek.

I live downstream, what will happen to the water? There's quite a bit of flooding now.

The dam creates no storage so both options will cause no increase in flooding. The DuPage County Ordinance does not allow for an increase in flooding.

Do dewatering gates exist at the dam?

Yes.

Can we open the bridge and see if it improves DO?

It was noted that the question refers to the dewatering gates, not a bridge. The Forest Preserve District operates the gates and has said that they are insufficient to dewater the impoundment. They clog with woody debris. The Forest Preserve District does not want to routinely clean the gates. The dewatering gates have approximately half the capacity of what is being proposed. Option should be examined more closely and had come up at the DRSCW working committee on DO

Neither option for altering the dam will preserve the historical aspect. The aesthetics will be destroyed. Wedding parties are there every weekend. Painters paint the waterfall. The water flowing over the dam is an aeration system. He's appalled that we have a government that is worried about marginal affects.

To us, and a number of other groups such issues are not small but essential. Environmental agencies will sue if the solutions do not have enough of an environmental effect.

Commenter has been on the Salt Creek Committee. She was the Vice Chair of the DuPage County Stormwater Commission. She was around for the flood of 1987. The DuPage County Stormwater Committee is the only one licensed by the Corps of Engineers to operate on their behalf. They would lose that if they allowed flooding to be exacerbated downstream. It's important for residents to negotiate out a good answer. IEPA answers to USEPA, they hold all the cards. We need to collaborate to come up with a reasonable solution.

In Person Comments

- If water flow in raceway can be maintained, project look like fair compromises
- Presenter knows nothing of history and is biased

- It is understood that area upstream is essentially dead (devoid of life)
- Previous skepticism of project largely assuaged
- Very interesting presentation
- Maintaining flow in raceway is key

Comment Box:

- Fishable/swimmable?
- It won't help to alleviate the sediment problems or remove the dams if the dumping of raw sewage continues in Fullersburg Woods from the Hinsdale Sanitary Sewers (Flagg Creek POTW).

Meeting 2. 7.30 PM Oak Brook Village Hall. 03.31.2009. Number of attendees 60
Comments:

Speaker from the Fullersburg Homeowners Association 550 homes, personal observations. Moved here with wife 58 years ago. His home was built in 1874, one of the only structures here that is that old including the dam, the York grocery store. He thinks this is heritage vs. fish. He doesn't know where the swimming concept came from. He is an environmentalist, but you have to draw the line somewhere. Oakbrook is the jewel of DuPage County. It has eight historical buildings. He doesn't know the distinction between a creek or a river. The creek is an essential part of the character of Oakbrook. The vegetation will grow up and encroach and the creek will disappear visually. Are we here to support the fish downstream? Solution is to reexamine dredging in phases and discovery. There is no doubt that we could get grants. If dredging doesn't meet the criteria perhaps breaching. He wants to start group. Has to be a compromise. Last report said Salt Creek meets the DO standard and he thought DO problem was from Addison Creek. Certainly wouldn't want this to wind up in litigation, but don't rule it out.

What body has ultimate authority? Who would execute project

This is convoluted in Illinois. Property lines go out to the middle of Salt Creek in Elmhurst and would have to get property rights. IEPA is responsible for water quality. IDNR is responsible for fish and animals. In this case there is one property owner – the Forest Preserve District, project cannot happen without their consent. What will happen is that the DRSCW will do the data collection, hire a design consultant through grants, hand over the project to DuPage County Stormwater because they have the resources and knowledge to implement the project.

What is the authority of the Village of Oak Brook?

Answer by Village Trustee - the Village has no authority. If the residents say that don't want any change the Village can make a formal statement to the Forest Preserve District, the DRSCW, the IEPA.

Wouldn't the work require a construction permit from the Village because it's within the Village limits?

Not aware of how permitting would function

What agency is requiring the Forest Preserve District to do this?

IEPA is requiring water quality improvements. The best way to advance to those improvements is to reduce the size of the impoundment.

Last meeting, it was indicated another dam upstream of Graue Mill would be removed or breached. Wouldn't it be prudent to do that first?

We are trying to get the biggest bang for our buck. We are discussing removing the dam at Oak Meadows with Forest Preserve District. Old Oak Brook dam is not that big of a DO problem because it has a small impoundment.

What about flooding, salt, parking lot runoff?

NPDES Phase II addresses stormwater. The program is in its 6th year. It changes how stormwater is treated. Silt fence, grassy swales, are Best Management Practices (BMPs), which are required to be implemented in communities to treat stormwater runoff. Stormwater is the second biggest problem in Salt Creek. The DRSCW has been very active in chloride education and is also looking at stormwater.

Russ Strand from Robin Hood Ranch: Report says Salt Creek is an effluent dominated stream, what does that mean?

Salt Creek is dominated, approximately 85%, by wastewater effluent at low flow conditions, (when it's not raining). This starts at the Egan plant in Schaumburg and goes all the way to Elmhurst.

What is a combined sewer overflow (CSO)?

Every community has a sewer collection system. A CSO is storm and sanitary sewers in one system. Elmhurst and Oak Brook have separate sanitary sewers which go to the treatment plant. The storm sewer goes directly to the river. In a CSO, all flow goes to the plant and is fully treated for up to the 10-year storm event. For the 10-year storm event and above, the flow bypasses part of the treatment plant, after it is treated through gravity and separation. A 10-year event or greater is very diluted.

What is a sanitary sewer overflow (SSO)? Flagg Creek POTW example

An SSO should never happen, it's a violation of the Clean Water Act. It happens when the sanitary collection system is overwhelmed. It consists of very diluted material, but it is illegal.

He has picked up material in Fullersburg Woods. Syringes, etc.

This information was shared with the Forest Preserve District and Flagg Creek Sanitary District after the last meeting. It could be many things, such as a sewer blockage or collapse.

He'd like to see these things fixed before we talk about taking out the dam.

Agreed

Do you have any flexibility or judgment in this issue? The fact that you want to turn this into a swamp is offensive to me. Why are we returning this is the mosquitoes? You used models, the global warming model from 20 years ago are wrong. Models can say whatever you want them to say.

The Clean Water Act does not have exemptions. Our flexibility is how we can implement these things. We've thought about merging what was done at the Kent dam with breaching, that was a flexible approach.

On mosquitoes the situation is quite the reverse, mosquitoes love low DO and still water – the impoundment is more desirable than a moving river. Also in free flowing conditions more fish are available to consume mosquito larvae. Yes, models can say what you want it to say. They have also proven powerful tools for predicting events. On top of the model, we have three years of continuous DO monitoring. All other parameters were directly sampled – habitat, fish, macro invertebrates. Once again the goal is water quality not a certain action.

How much does the impoundment have to be reduced by to meet minimum DO standard?

Look at the display boards in the back of the room. This is the kind of flexibility we have – if we reduce the hydraulic head of the dam by 2.5 feet, the river will draw down by 3 feet, not sure what the area of the impoundment would be, but this would meet the DO standard.

Can residents participate in the committee?

Tom Richardson said that he is a resident of Oak Brook and a member of the committee, as wills Joe Rush from the Fullersburg Woods Association, Karen Bushy from Graue Mill, and another Oak Brook resident.

So far the DRSCW has confirmed that there is a water quality problem. We're not rushing to provide any solutions, there is much more time for community input.

Has there been any consideration of the change in property values? Where the bridge goes over the creek, the creek is 90 feet wide and will be reduced to 20-40 feet. The creek is hard to see. Vegetation and trees will further hide it.

The Forest Preserve District will be a major partner and they will have to look at the management plan. Will provide information on property values

Everyone keeps saying this is not a dam issue, it is a dam issue. The dam has been there since the 1850's. The perspective given is always from the south side of the creek looking away from the mill, the mill would sit without any water around it and would look very unnatural. This is human habitat and we need to look at the human side of the story. Partial removal will destroy what the dam is. The mill was a site on the underground railroad.

The dam was built to control water, to regulate flow. If you open up the dam, how will you control erosion downstream?

The dam was not built for flood control or erosion control. Flood levels and erosion cannot change under the current permitting system. The dam was built as a hydraulic battery.

It was said before that the dewatering gates were not enough, that 60 feet of the dam would have to be removed and that the dewatering gates are only 25-30 feet. We don't need an all or nothing approach.

We should strategically place a bunch of rocks upstream and open the gates from Monday through Thursday. Close the gates for the weekend.

This may be done as a demonstration and to gather further data. In the long term, it is not feasible because the capacity is not there and the Forest Preserve District does not want to clean the dewatering gates frequently.

The Forest Preserve District works for the taxpayers.
What about the ducks, geese and the one heron?

Better habitat will bring more birds. We currently have puddle ducks. There will be more herons because they are fishermen.

If the stream is effluent dominated, what are our native fish species?

16th and Spring Road is the location of the first native flow. Upstream of that it was stormwater. The Des Plaines has always had a constant flow. The fish migrated upstream.

26 villages are contributing (to the DRSCW), what is the total amount of the bill (for the Salt Creek DO study)?

$300,000 for all the studies on Salt Creek.

Proposal to dredge and let the creek go down, open the flood gates and when the sludge dries out use front loaders to put it on Forest Preserve District land. Dredge down to clay. It will be cheaper. A million dollars will be used, there are lots of millionaires in this room, about half. We're not talking about that much money.

My understanding is that the mill would be shut down part of the time, and the wheel would only turn part of the time. When I come under the bridge in my costume, it's like Brigadoon. Kids do change in their heads. It's a wonderful place for schools; they come to Robert Crowne and Graue Mill. Those who work there love it.

The wheel will turn under all scenarios.

Comment Box:

- This is a public issue. Water quality affects everyone. It's not just fish – it's also habitat. All over the U.S. dam removal is occurring – in every case all aspects of the water are improving. Oak Brook Village has no legal authority over the removal or change in the dam.
- I have been a life-long fisherman, and an avid Salt Creek fisherman for the past half-decade and what bothers me is how many local residents claim this dam removal issue is about "Heritage vs. Fish". I wholeheartedly disagree. I take pride in being able to catch big Pike and Walleyes from my own backyard rather than travel to some foreign or out of state destination…It is about removing Salt Creek's nickname as "sewer ditch" and cleaning up our own backyards.
- Remember, Salt Creek was once incredibly impaired and unusable a few decades ago with no fish …clean-up and restoration is still not over yet. The more we sit and wait on this dam at Graue Mill to continue crumbling and killing further aquatic life at its upstream and downstream sections, the more power it will take to make significant improvements to the creek's overall water quality and environmental sustainability.

Appendix C. Description of Dissolved Oxygen and Illinois Standards

Dissolved oxygen refers to the level of free oxygen present in water or other liquids. It is an essential parameter for aquatic live as it is the fraction of oxygen available in the water column for respiration. Dissolved oxygen enters water through the air or as a byproduct of plant respiration. From the air, oxygen can slowly diffuse into the water column across the water's surface or be captured when the water is agitated by wind, waterfalls or rapids. One can imagine that free oxygen molecules dissolve in water much the way salt or sugar does when it is stirred. A dissolved oxygen level that is or too low can harm aquatic life and affect water quality.

State law in Illinois says that General use waters must maintain dissolved oxygen concentrations at or above:

1) During the period of March through July,

- A) 5.0 mg/L at any time; and
- B) 6.0 mg/L as a daily mean averaged over 7 days.

2) During the period of August through February,

- A) 3.5 mg/L at any time;
- B) 4.0 mg/L as a daily minimum averaged over 7 days; and
- C) 5.5 mg/L as a daily mean averaged over 30 days.

Appendix D. Dam Removal Projects in DuPage County and Neighboring Counties

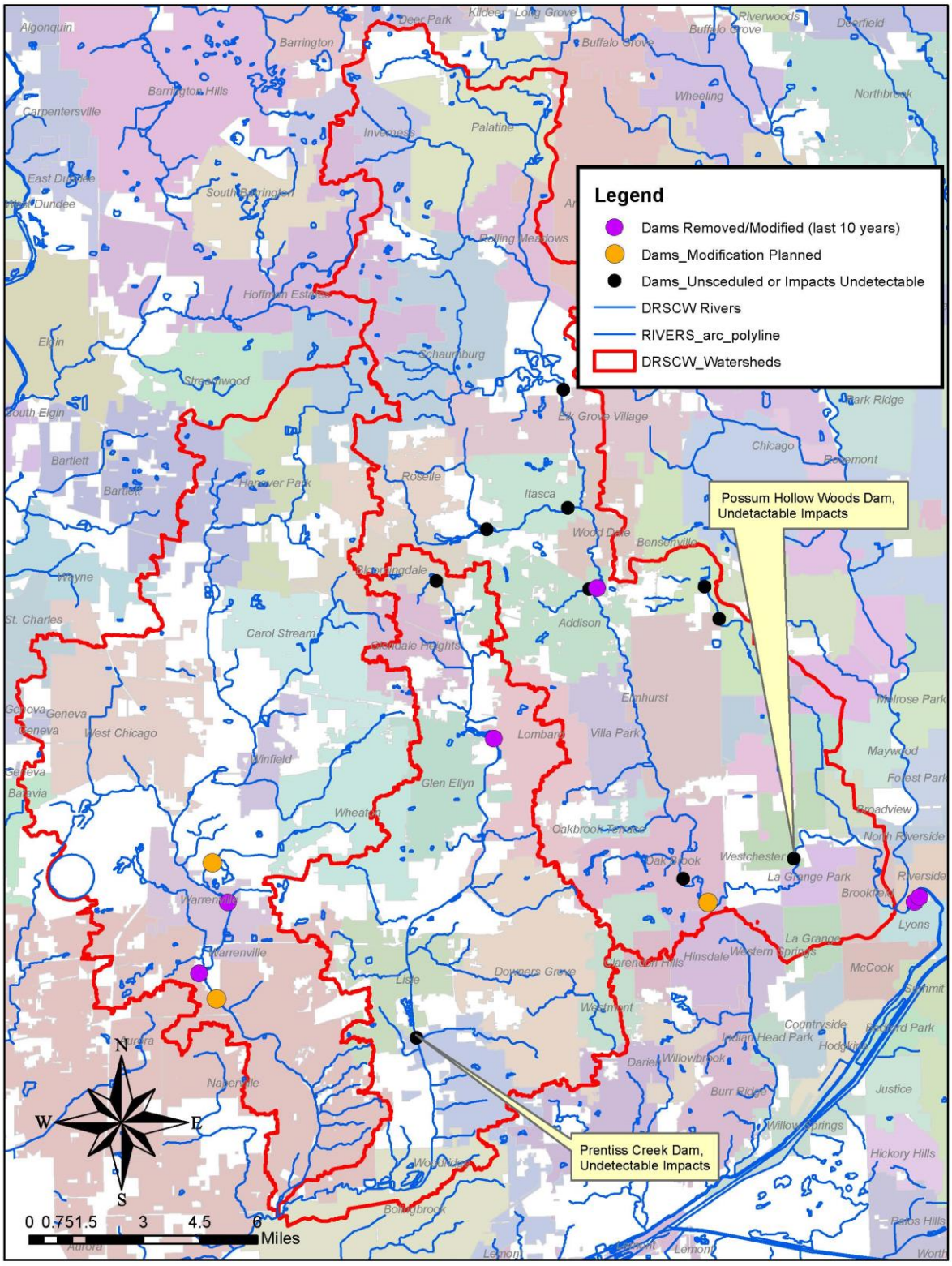
Nationwide, dam removal has shown itself to be a cost effective means of working towards water resource quality and biological improvements. During the last decade, in DuPage County and neighboring Cook County, six low head dams were removed or modified, including 3 in Salt Creek system. Dams removed in the Salt Creek system near the Fullersburg Woods dam include the Oak Meadows dam in Addison on Salt Creek (removed in 2015, upstream of the Fullersburg Woods dam) and the Hofmann and Fairbank dams in Riverside on the Des Plaines River (removed in 2012, downstream of the Fullersburg Woods dam), immediately downstream of that river's confluence with Salt Creek (see map 1).

In addition to the Fullersburg Woods dam, an additional 3 dams located in DuPage and Will Counties are scheduled for modification or removal in area wastewater permits. A list of removed dams and dams scheduled for modification/removal are summarized below in table 1 below.

Dam	Waterway	Municipality	Watershed	Project Type	Project Status
Churchill Lake Dam	East Branch DPR	Glen Ellyn	East Branch DuPage River	Modification	Completed
Oak Meadows Golf Course Dam	Salt Creek	Addison	Salt Creek	Removal	Completed
Warrenville Dam	West Branch DPR	Warrenville	West Branch DuPage River	Modification	Completed
McDowell Grove Dam	West Branch	Naperville	West Branch DuPage River	Removal	Completed
Hofmann Dam	Des Plaines	Riverside	Des Plaines River	Removal	Completed
Fairbank Dam	Des Plaines	Riverside	Des Plaines River	Removal	Completed
Fullersburg Woods Dam	Salt Creek	Oak Brook	Salt Creek	Modification	Scheduled
Fawell Dam	West Branch	Naperville	West Branch DuPage River	Modification (for fish passage)	Scheduled
Arrow Road Dam	Spring Brook, West Branch	Wheaton	West Branch DuPage River	Removal	Scheduled
Hammel Woods Dam[1]	DuPage River	Shorewood	DuPage River	Removal	Scheduled

Table 1. Dams in DuPage County and neighboring counties removed or scheduled for removal or modification.

[1] Not shown on map 1. Lies to the south of mapped area.



Map 1. Dam environmental improvement projects in proximity to the project area.

All dams in the list above classified as “scheduled” have funding for design, permitting and modification construction.

The dams already modified or removed can provide stakeholders with a reference for post-project conditions. The Warrenville Dam, for example, also had an historic side channel. Images of pre and post project dam removals at Warrenville Dam and Oak Meadows Dam sites are shown in Figure 1-4.

Figure 1. Warrenville dam pre- removal.

Figure 2. Warrenville dam post-removal. Removal of the dam moved habitat scores from 62 to 69.5 (2006 and 2012 surveys respectively) and increased annual monthly DO by >1 mg/l.

Figure 3. Oak Meadows dam pre-removal. The dam was built by Elmhurst Country Club to provide a source of irrigation water for the golf course. The spillway was approximately 3 feet high and 75 feet wide. The impoundment was approximately 4, 500 linear feet in length and covered approximately six acres. Low dissolved oxygen, low aquatic biodiversity habitat scores were observed in the impoundment area.

Figure 4. Oak Meadows dam post-removal (below). The removal eliminated the impoundment allowing the construction of functioning gravel runs (riffle type structures) and the grading and revegetating of the banks upstream of the former dam. The lowering of water levels and the habitat enhancements are predicted to increase the biodiversity of aquatic communities. Data gathering to assess impacts will begin in 2017. NOTE. Picture taken before the planting of graded banks had time to mature.

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