DuPage/Salt Creek Special Conditions Report

March 31, 2020











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Introduction and Participation DuPage/Salt Creek Special Conditions Report March 31, 2020.

This report fulfills certain reporting requirements contained in DuPage River Salt Creek Workgroup's (DRSCW) and Lower DuPage River Watershed Coalition's (LDRWC) NPDES permits. These requirements are as provided in the DRSCW Special Conditions (Attachment 1) and the LDRWC Special Conditions (Attachment 2 – Note: As the LDWRC Special Conditions differ between permit holders, the Special Conditions for Bolingbrook STP#3 is included the Attachment as a representation of the Workgroup's Special Conditions Language.)

The Special Conditions are in the NPDES permits identified in Table 1 and Table 2. Listed permittees are required to ensure the completion of projects and activities set out in the Special Conditions, while a few other permittees are required to participate only in identified watershed level studies and the chloride reduction program. Table 1 identifies the status of funding for these activities by each permittee in the DRSCW and Table 2 identified the status of funding for these activities by each permittee in the LDRWC.

All listed permittees participate in the DRSCW and/or LDRWC and are working with other watershed members of the DRSCW and LDRWC to determine the most cost-effective means to remove dissolved oxygen (DO) and offensive condition impairments in the DRSCW watersheds.

The specific reporting requirements addressed herein include annual reporting on the progress of the projects listed in the Special Conditions, and certain baseline condition reporting for the Chloride Reduction Program. Map 1 and 2 show the locations of the physical projects to be realized under the special conditions.

Special Condition Permit Holder Forum

On December 6, 2019 a Special Conditions Permit Holder Forum for DRSCW and LDRWC Permit Holders was held at the Village of Lombard. The objective of the meeting was to provide an update on the status of nutrient regulation in Illinois; provide an overview of the findings of the Identification and Prioritization System (IPS) model and thresholds; and discuss future permit negotiations. The meeting agenda is included below.

8:30-8:40	Introductions
9:00-9:30	Nutrients –NSAC recommendations, 3 rd party agreements and expansions
	and NARPs (Deanna Doohaluk, The Conservation Foundation)
9:30-10:00	IPS Update and Nutrient Thresholds (Stephen McCracken, The
	Conservation Foundation)

9:30-9:45 Break
 9:45-11:00 Discussion on Upcoming Permit Negotiations (Nick Menninga, Downers Grove Sanitary District)

Table 1. Participation in the DRSCW Special Condition permit 2019-2020.

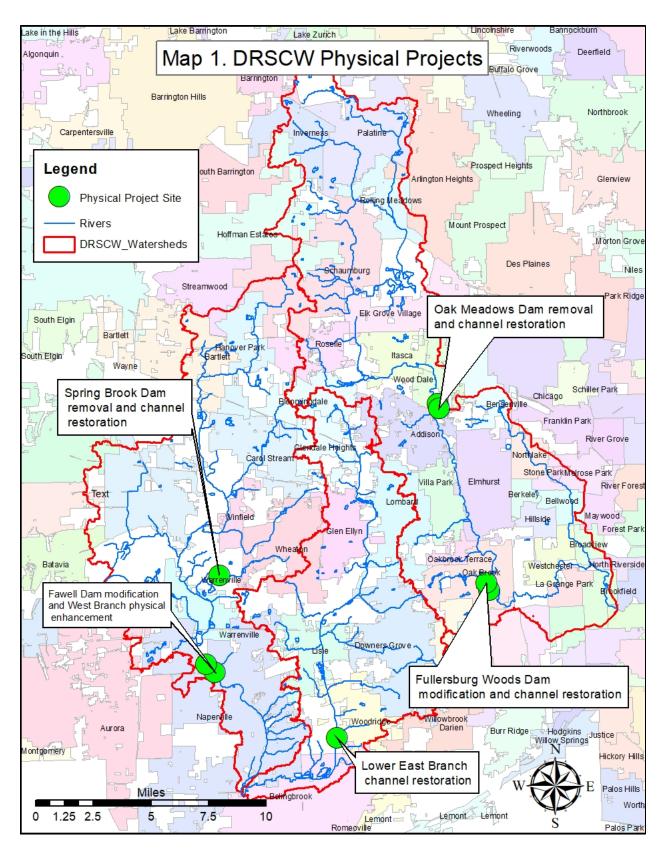
Addison North STP IL0033812 YES YES YES Addison South - AJ LaRocca IL0027367 YES YES YES Bartlett WWTP IL0027618 YES YES YES Bloomingdale-Reeves WRF IL0021130 YES YES YES Bolingbrook STP#1 IL0032689 YES YES YES Bolingbrook STP#2 IL0032735 YES YES YES Carol Stream WRC IL0026352 YES YES YES Downers Grove SD IL0028380 YES YES YES DuPage County Woodridge IL0031844 YES YES YES Elmhurst WWTP IL0028746 YES YES YES Glenbard WW Authority STP IL0021547 YES YES YES Glendale Heights STP IL0028967 YES YES YES Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) – Egan WRP IL0036340 YES YES YES Roselle-Devlin STP IL003637	POTW Owner/ Facility Name	NPDES No.	Membership Dues Paid 2019-2020	Assessment Paid for Paragraph 2 Table Project Funding*	Assessment Paid for Chloride Reduction/NIP/QUAL 2k/Trading Program
Bartlett WWTP	Addison North STP	IL0033812	YES	YES	YES
Bloomingdale-Reeves WRF	Addison South - AJ LaRocca	IL0027367	YES	YES	YES
Bolingbrook STP#1	Bartlett WWTP	IL0027618	YES	YES	YES
Bolingbrook STP#2	Bloomingdale-Reeves WRF	IL0021130	YES	YES	YES
Carol Stream WRC IL0026352 YES YES YES Downers Grove SD IL0028380 YES YES YES DuPage County Woodridge IL0031844 YES YES YES DuPage County Woodridge IL0028746 YES YES YES Elmhurst WWTP IL0028746 YES YES YES Glendard WW Authority STP IL0021547 YES YES YES Glendale Heights STP IL0028967 YES YES YES Hanover Park STP#1 IL0034479 YES YES YES Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) – Egan WRP IL0036340 YES YES YES MWRDGC – Hanover Park WRP IL0036137 YES YES YES Roselle-Devlin STP IL0030813 YES YES YES Roselle-J Botterman WWTF IL0048721 YES YES YES West Chicago Regional WWTF IL0023469 YES YES YES	Bolingbrook STP#1	IL0032689	YES	YES	YES
Downers Grove SD IL0028380 YES YES YES DuPage County Woodridge IL0031844 YES YES YES Elmhurst WWTP IL0028746 YES YES YES Glenbard WW Authority STP IL0021547 YES YES YES Glendale Heights STP IL0028967 YES YES YES Hanover Park STP#1 IL0034479 YES YES YES Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) – Egan WRP IL0036340 YES YES YES MWRDGC – Hanover Park WRP IL0036137 YES YES YES Roselle-Devlin STP IL0030813 YES YES YES Roselle-J Botterman WWTF IL0048721 YES YES YES West Chicago Regional WWTF IL0023469 YES YES YES	Bolingbrook STP#2	IL0032735	YES	YES	YES
DuPage County Woodridge Elmhurst WWTP IL0028746 Elmhurst WWTP IL0021547 IL0021547 IL0021547 IL0021547 IL0021547 IL0028967 IL0028967 IL0028967 IL0028967 IL0034479 IL0034479 IL0034479 IL0034479 IL0036340 IL0036340	Carol Stream WRC	IL0026352	YES	YES	YES
Elmhurst WWTP	Downers Grove SD	IL0028380	YES	YES	YES
Glenbard WW Authority STP Glendale Heights STP IL0021547 IL0028967 YES YES YES YES YES YES YES YE	DuPage County Woodridge	IL0031844	YES	YES	YES
STP IL0021547 YES YES YES YES Glendale Heights STP IL0028967 YES YES YES Hanover Park STP#1 IL0034479 YES YES YES Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) – Egan WRP MWRDGC – Hanover Park WRP IL0036137 YES YES YES Roselle-Devlin STP IL0030813 YES YES YES Roselle-J Botterman WWTF IL0048721 YES YES YES Salt Creek SD IL0030953 YES YES YES West Chicago Regional WWTF IL0023469 YES YES YES YES WWTF YES YES YES YES YES YES YES YES WWTF YES YE	Elmhurst WWTP	IL0028746	YES	YES	YES
Hanover Park STP#1 IL0034479 YES YES YES Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) – Egan WRP MWRDGC – Hanover Park WRP Roselle-Devlin STP Roselle-J Botterman WWTF Salt Creek SD West Chicago Regional WWTF IL0023469 YES YES YES YES YES YES YES YE	•	IL0021547	YES	YES	YES
Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) – Egan WRPIL0036340YESYESYESMWRDGC – Hanover Park WRPIL0036137YESYESYESRoselle-Devlin STPIL0030813YESYESYESRoselle-J Botterman WWTFIL0048721YESYESYESSalt Creek SDIL0030953YESYESYESWest Chicago Regional WWTFIL0023469YESYESYES	Glendale Heights STP	IL0028967	YES	YES	YES
Reclamation District of Greater Chicago (MWRDGC) – Egan WRP MWRDGC – Hanover Park WRP Roselle-Devlin STP Roselle-J Botterman WWTF Salt Creek SD West Chicago Regional WWTF IL0036340 YES	Hanover Park STP#1	IL0034479	YES	YES	YES
WRP IL0036137 YES YES YES Roselle-Devlin STP IL0030813 YES YES YES Roselle-J Botterman WWTF IL0048721 YES YES YES Salt Creek SD IL0030953 YES YES YES West Chicago Regional WWTF IL0023469 YES YES YES	Reclamation District of Greater Chicago	IL0036340	YES	YES	YES
Roselle-J Botterman WWTF		IL0036137	YES	YES	YES
Salt Creek SD IL0030953 YES YES YES West Chicago Regional WWTF IL0023469 YES YES YES	Roselle-Devlin STP	IL0030813	YES	YES	YES
West Chicago Regional NU023469 YES YES YES	Roselle-J Botterman WWTF	IL0048721	YES	YES	YES
WWTF ILUU23469 YES YES YES	Salt Creek SD	IL0030953	YES	YES	YES
Wheaton SD IL0031739 YES YES YES		IL0023469	YES	YES	YES
	Wheaton SD	IL0031739	YES	YES	YES
Wood Dale North STP IL0020061 YES YES YES	Wood Dale North STP	IL0020061	YES	YES	YES
Wood Dale South STP IL0034274 YES YES YES	Wood Dale South STP	IL0034274	YES	YES	YES
Bensenville South STP IL0021849 YES N/A YES	Bensenville South STP	IL0021849	YES	N/A	YES
Itasca STP IL0079073 YES N/A YES	Itasca STP	IL0079073	YES	N/A	YES

^{*}N/A means that the agency does not have that condition in their permit.

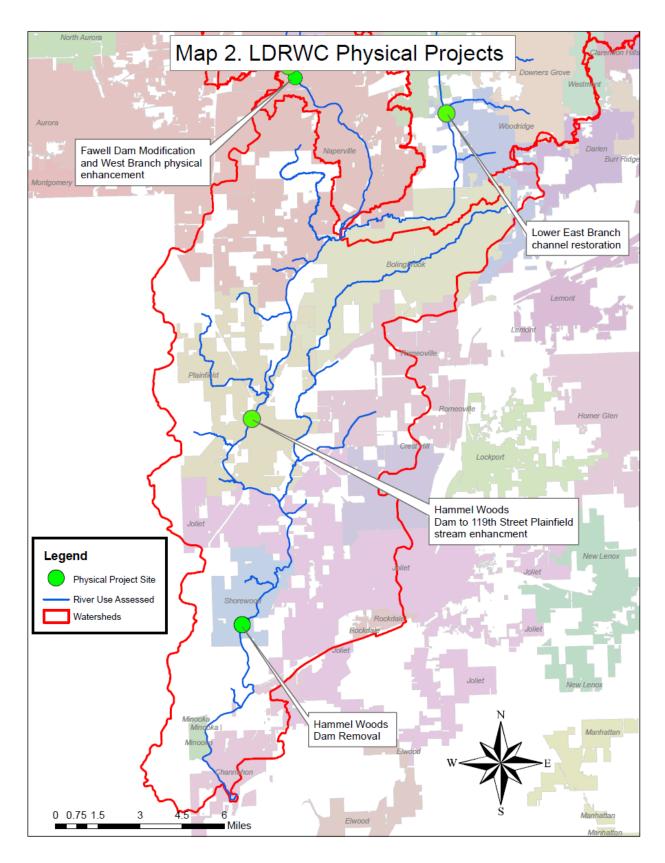
 Table 2. Participation in the LDRWC Special Condition Permit 2019-2020.

POTW Owner/ Facility Name	NPDES No.	Membership Dues Paid 2018-2019	Assessment Paid for Paragraph 2 Table Project Funding*	Assessment Paid for Chloride Reduction/NIP/QUAL 2k/Trading Program
Naperville Springbrook WRC	IL0034061	YES	YES	YES
Bolingbrook STP#3	IL0069744	YES	NO	NO
Plainfield STP	IL0074373	YES	N/A	YES
Joliet Aux Sable Plant	IL0076414	YES	N/A	YES
Crest Hill West STP	IL0021121	YES	N/A	YES
Minooka STP	IL0055913	YES	N/A	YES

^{*}N/A means that the agency does not have that condition in their permit.



Map 1. Map of DRSCW physical projects set out in the Special Condition.



Map 2. Map of the LDRWC physical projects set out in the Special Conditio

Chapter 1 Physical Projects

The Special Condition Paragraph 2 identifies stream restoration and dam modification projects that must be completed by the DRSCW and/or LDWRC. The current DRSCW Five-Year Financial Plan and the LDRWC Five-Year Financial Plan identifies project expenses and funds allocated for each of the physical projects. Map 1 shows the DRSCW physical projects covered in this section and Map 2 shows the LDRWC physical projects covered in this section.

1.1 Oak Meadows Dam Removal and Stream Restoration

- Special Condition Completion Date December 31, 2016 (dam removal), December 31, 2017 (stream restoration)
- Project Status Dam removal and stream restoration are complete. The post-project monitoring phase was completed in 2019. Future monitoring of the project area will be completed in conjunction with the bioassessment program. Salt Creek's next bioassessment is scheduled for 2021.

Summary of Results – Post project survey results: mean QHEI increased from 57.25 to 69.3 in 2017 to 70 in 2018 and 71.25 in 2019. Mean mIBI increased from 23.6 (based on 2013 data) to 33.2 in 2017 to 34.9 in 2018 and to 40.85 in 2019. Additionally, 13 of the 21 high value rheophilic taxa identified at the site were only identified post-project.

1.1.1. Site Description and Project Design

The 2016 Annual Report provided a site description and the design plan.

1.1.2. Project Implementation

The 2017 Annual Report detailed the project implementation.

1.1.3. Project Impact Evaluation

The DRSCW and Midwest Biodiversity Institute (MBI) developed a monitoring plan to assess the restoration work conducted by the Forest Preserve District of DuPage County (FPDDC) and DRSCW contractors at the Preserve at Oak Meadows restoration project site. Biological and habitat data from the previous watershed surveys conducted by MBI in Salt Creek prior to 2016 were used as the pre-restoration condition baseline. Post-restoration biological and habitat sampling added two new sites beginning in late August 2017 and continuing in 2018 and 2019 to assess project effectiveness. The post-restoration assessment included four biological monitoring sites with a fifth site located upstream at Lionwood Park (SC40) serving as an upstream control site that is typical of Salt Creek water quality and habitat and as representative of pre-restoration water quality conditions.

Habitat scores at the Oak Meadows project site were mostly fair during the pre-construction surveys (2007-2014) at SC34 and SC35 (SC35A and SC35B were not yet established). Silt or muck substrates, fair to poor development, and a stream channel recovering from channelization were among the 6-8 modified attributes consistently recorded at each site through 2014. The stream banks were lined with A-jacks and steel sheet piling and the riparian corridor was narrow and segregated from Salt Creek. The resulting poor instream habitat lacked root wads and root mats, coarse substrates, and riffles such that only 3-5 good attributes were recorded. The pre-restoration Oak Meadows project area had elevated ratios of modified good habitat attributes at each site which included at least one high and multiple moderate influence modified habitat attributes in 2007-14.

Post-restoration QHEI scores were higher at all four sites in the restoration area, but remained fair at the upstream control site (SC40). Now all four sites within the Preserve at Oak Meadows offer cobble/gravel riffles, deep runs, root wads, boulders and, other than SC35A, good to excellent channel morphology. Fine sediments are no longer the predominant substrates at any of the sites, the constructed riffles have low embeddedness, and the channel has recovered from historic modifications. Post-restoration surveys recorded no high influence modified attributes, fewer moderate influence modified attributes (3-4 down from 6-8), an increased number of good habitat attributes (7 up from 3-5), and lower modified good habitat ratios each of which is a distinct indication of improved habitat for aquatic life.

Ideally, these efforts were expected to first result in an increase in the diversity and abundance of macroinvertebrate populations associated with the enhanced habitat features. The expectations for fish are presently tempered by comparison given that their ingress to this reach is eliminated by downstream barriers (the Graue Mill and Old Oak Brook Dams at Fullersburg Woods) which was further documented in 2019. However, the 2019 survey yielded the highest MIwb scores ever recorded in the Oak Meadows project area and a signal of incremental improvement. The historically limited fish assemblage in Salt Creek plus remaining downstream barriers have blunted the potential improvements in the post-restoration fish assemblage for this project which is why the focus for the interim is on macroinvertebrate assemblage attributes.

Indicators of incremental improvement in the macroinvertebrate assemblage included using the occurrence of rheophilic taxa (i.e., taxa that prefer current) and/or taxa that prefer coarse, erosional substrates. Twenty-one (21) rheophilic taxa were identified and used to evaluate trends. The majority of these taxa were found only during post-project sampling and at the more riverine SC40 control site. Since the dam removal and habitat enhancement efforts were

completed in 2016, the presence of rheophilic taxa has increased substantially at the affected Salt Creek sites. Prior to construction, only eight (8) of the 21 rheophilic taxa were collected from project area sites and two (*Stenacron* and *Nectopsyche diarina*) were exclusive to the formerly impounded sites. Following construction, taxa richness within the group averaged nearly three (3) times the number found prior to construction (mean 7.8 vs. 2.75). In addition, the highest numbers at each project site were found post-construction. The net effect is that 13 new rheophilic taxa have appeared post-construction in the project area. Total taxa richness at the project sites was also the highest following construction when compared to pre-dam removal. The highest mIBI scores for each project site were also found during the most recent sampling in 2019. Project area scores now routinely meet or exceed the SC40 control and meet the Illinois mIBI biocriterion at all except the SC35 location.

The post-remediation increases in the abundance of rheophilic macroinvertebrate taxa in Salt Creek naturally corresponds with improved macroinvertebrate assemblage performance as measured by the mIBI. These positive indicators increased following dam removal and habitat enhancement. While the trend is not unexpected, it demonstrates the positive relationship between improved stream quality (as reflected by higher mIBI scores) and the physical attributes associated with free-flowing habitats such as shallower depths, increased current speed and habitat diversity, erosional (vs. depositional) substrate types and reduced siltation. It also points to the potential successes that can be achieved by carefully targeted and designed managerial interventions.

The full report on the pre-project and post-project macroinvertebrate, fish, and habitat assessments conducted at the Preserve at Oak Meadows can be found in Attachment 3: Biological and Habitat Assessment of Salt Creek, The Preserve at Oak Meadows (DuPage County, Illinois) 2007-2017.

1.2 Fawell Dam Modification

- Special Condition Listed Completion Date December 2018, Extended to December 2021
- Status In design and permitting phase.

The objective of the project is to raise the fish index of biological integrity scores (fIBI) above its current average of 18.5 for the three mainstem survey sites immediately upstream of the dam. To accomplish this, the original design approach focused on modifying the dam's primary spillway, which consists of three box culverts. In June 2018 the Dam's owner (DuPage County Division of Storm Water Management (DC SWM)) revealed that due to recent repairs to the dam structure they could no longer support direct structural modifications of the culvert system.

In response the project team, including the dam's owner, DC SWM, spent the last year reviewing alternative approaches to establishing fish passage at the dam which did not involve any proposed structural modifications. One new design approach suggested by the dam's owner focused on the installation of an inflatable low head weir structure downstream of the Fawell Dam structure. The intent was for this system to create a tailwater condition on the Dam's existing primary spillway that would result in hydraulic conditions favorable to fish passage. When the low head dam is in operation (inflated), a parallel fish ladder would allow fish to swim upstream into the upstream pool created by the inflatable low head dam. While this concept did not involve modifying the structure, the team did have a number of other concerns. Principally these were: 1) the ongoing cost and complexity of maintaining the inflatable dam and the systems to run it; and 2) ability to get fish into the bypass ladder and through the upstream pool.

A second option was raised by a staff member at the DuPage County Forest Preserve District (FPDDC) who had recently learned of a modular fish ladder system designed by BK Riverfish, LLC from Massachusetts. The system had successfully passed numerous small species at a fish passage barrier in Indiana. Historically fish ladders have often failed to pass the small bodied fish necessary to meet the IL fIBI threshold.

A BK Riverfish 2' X 2' system was installed at the Stockdale Dam in northeastern Indiana on the Eel River in August 2017. The results from 2018 monitoring indicate the passage of an estimated 60,000 fish comprised of 40 different species with sizes ranging from 1.5 inches up to 18 inches. Additionally, fish passage was observed at water depths as shallow as 5 inches up to the full 24-inch depth of the ladder system and the system performed at the relatively steep slope of 8%.

Given the unique modular design of the ladder system (Plate 1), the project team evaluated the possibility of installing the system directly into one of the Fawell Dam's culverts. This approach would not involve any structural modification, minimized instream impacts and the long-term maintenance associated with the downstream inflatable low head weir The project team performed system. agency/stakeholder coordination and initial hydraulic modeling to evaluate feasibility of this approach. The

Plate 1. Modular design of the BK Riverfish ladder



manufacturer of the fish ladder system visited the site (3/03/2020 -3/04/2020) and made a technical presentation to a collection of stakeholders regarding the design and effectiveness of the ladder system on the Eel River and how that could translate to successful fish passage at Fawell Dam.

See Plate 2 for photographs of sections of ladder (3/16 inch painted plate steel) being prepped for placement at the Eel River site. The proposal for Fawell would be in stainless steel. The modular nature of the construction is clearly visible. Plate 2 also shows the sections in place including the grill cover. Fish can be seen the system.





Several steps still need to be taken before committing to the concept. These include working through Fawell Dam specific design constraints (impact of downstream riffle, location of ladder entrance and exit, flood gate consideration, hydraulic impact, maintenance consideration, etc.) and then proceeding with securing permits from IDNR-OWR, USACE, and DuPage County. Depending on the permitting process and manufacturing lead time, the goal would be to install the system in late 2020.

The dam is a flood control structure operated by DuPage County Stormwater Management and must be fully functional as such post project.

1.2.1. Site Description

The 2017 Annual Report provided a site description.

1.2.2. Design Characteristics

Successful fish passage depends on variables such as water velocity, depth, distance between resting positions for the fish, and each fish's ability to swim against the current. The initial design

focused on lowering two of the dam's box culverts in order to achieve the desired water velocity and depth conditions at the dam. This was successful in a modeled environment but was judged unbuildable by the dam's owners.

The team is currently evaluating the design to evaluate the possibility of placing the BK Riverfish system into one of the side culverts of the dam. Velocity and depth must allow passage of the species listed in Table 3 (includes both species limited by Fawell Dam and species previewed as moving into the West Branch DuPage River following removal of the Hammel Woods dam, scheduled for Fall/Winter 2020/2021).

While the list of the species passed by the BK Riverfish system does not completely match the list of species targeted by the project, in all cases the system has passed members of Fawell species family. Data from the Eel River suggests an excellent positive relationship between the ability of one member of a species to pass, and other members of its family (Table 3). This appears to be true even when the size disparity among species is great. For example, the system has passed the American shad (30 inches long) and the blueback herring (13 inches long) have used the ladder, as well as for various families of catfish. The prototype has also passed 5 species of darters, with fish as small as 1.5 inches have used the Eel River ladder.

To finalize the design and allow construction the team's next steps will be:

- To discuss the Eel River fish passage results with the ecology staff at Manchester University.
- To design a removable section of ladder for the upstream dam face. This would allow the dam gate to fully close.
- Cost benefit analysis of the 2' X 2' versus 1' X 1' ladder designs.
- To review riffle height and talk to County staff about possibilities to lower it so as to reduce its tail water impacts.

To ensure fish passage, the project seeks to mimic as closely as possible the depth, velocity and distance requirements encountered by the target fish in an unmodified system during their spawning or migration periods (March – August). An optimal design would allow fish passage for all flows between the 10% and 95% exceedance levels during this migratory period. The flow duration analysis indicated that these target flows are between 42 and 397 cfs.

A literature review of appropriate target average velocity throughout the stream cross section suggested a target for northern pike and walleye of approximately 123 cm/s (4 ft/s), and an appropriate target average velocity for smallmouth bass, and white suckers of approximately 148 cm/s (4.9 ft/s). Smaller fish tend to be weaker swimmers; most will be able to take advantage of

Table 3. Species and families which have been documented as passing the BK Riverfish system

Fish Species	Downstream of Fawell Dam (RM 0.0-8.0)	Species Passed by BK Riverfish Ladder	Family Passed by BK Riverfish Ladder
Hornyhead chub	X ^{06,09,12}	Х	Х
Central stoneroller	X ^{76,83,06,09,12}	Х	Х
Bigmouth shiner	X ^{76,83,03}		Х
Blackstripe topminnow	X ^{03,12}		Х
Shorthead redhorse	X ⁰⁹		Х
Emerald shiner	X ^{76,09}		Х
Largescale stoneroller	X ⁰⁶		Х
Flathead catfish	X ₀₉		Х
Tadpole madtom	X ^{06.09}		Х
White perch	X ⁰⁹		Х
Rock bass	X ^{03,09,12}	Х	Х
Longear sunfish	X ⁰⁶	Х	Х
Shorewood Dam Specie	I S	1	
Grass Pickerel			
Yellow Bass			X
Pumpkinseed		Х	X
Slenderhead Darter			X
Log perch			Х

the lower velocities in the boundary layers adjacent to rocks that can be used as resting places behind and between rocks in natural stream. The exception is the black stripe top minnow, which may not be able to use the boundary layer near the stream bottom as it is a surface swimmer.

The project aims to have a minimum of 8 inches in the deepest water at any cross section. The team is currently reviewing if the revised plan can meet these requirements.

1.2.3. Permitting Requirements

Similar to the original design, the revised design approach will require a stormwater management certification demonstrating compliance with the DuPage County Countywide Stormwater Ordinance. The modification will likely require a new Dam Permit from the Illinois Department of Natural Resources – Office of Water Resources (IDNR-OWR). It is anticipated that a separate Floodway Construction permit will not be required by IDNR-OWR but will be reviewed as part of the County permitting process. Since Fawell Dam is a flood control facility with historical concerns regarding flooding upstream and downstream of the dam, the proposed design and permitting processes will focus on demonstrating that the proposed downstream improvements will not adversely impact flooding conditions.

In addition to the floodway/floodplain regulatory requirements, the proposed improvements will also need to comply with both the DuPage County and US Army Corps of Engineers (USACE) requirements associated with wetlands, Waters of the U.S., buffers, and sediment and erosion control. It is anticipated that the proposed improvements qualify for USACE Regional Permit (RP)5, Wetland and Stream Restoration and Enhancement, which also typically requires submittal of a Stormwater Pollution Prevention Plan (SWPPP) to Kane-DuPage Soil & Water Conservation District as part of the permitting process.

1.2.4. Design Progress Report

The upstream and the downstream ends of the design are under review:

Upstream end

The upstream section of the ladder will have a 60-degree left turn to remain along the wall upstream of the gate. The culvert on the upstream end needs a removable section to be designed and constructed to allow the culvert to be closed off for maintenance. BK Riverfish is currently modeling this section. Additionally, the upstream end would have the ability to be shut off during winter months (to eliminate winter debris entering the ladder).

Additionally, the team is looking at creating an instream debris screen to reduce waterborne material entering the ladder and to offset any increase in the culvert due to the presence of the ladder. DC SWM and DuPage County Public Works are responsible for removal of debris from the culvert system.

Downstream end

The problem here is getting fish to migrate to the ladder opening in the chaotic aquatic environment of the tail water of the culvert system. This is being investigated as a two-step process.

- Review the impacts of the downstream scour "riffle" on creating a backwater and the
 effects of lowering the riffle to below the level of the splash pad lip (670.4 +-). Modeling
 will be used to determine the depth of water that would come over the lip of the stilling
 basin as various "riffle" crest heights
- Review extending the ladder from the base of the culvert through the lip of the stilling basin (an additional 50 feet). This may allow the creation of flow of attraction by contrasting the flow through the ladder with the turbulent and shallow flow water over the lip.

Structural and Geotechnical Design Considerations

The use of anchors with a lower sheer strength than the construction materials of the culvert is being explored. This would prevent damage to the dam if the system was ripped off of the culvert wall.

Channel Management

An adaptive management plan for the upstream channel post modification was prepared for the original design and was previously under review by SWM (dam owner and operator) and the FPDDC (property owner). Since the new proposed design will no longer lower the dam's culverts, the upstream river reach will not change with respect to channel geomorphology. As such no upstream channel restoration improvements are proposed.

1.2.5. Project Impact Evaluation

Post project, both fIBI and fish taxa will be sampled upstream of the site and compared to historical data. The upstream and downstream sites will be sampled in 2020 as part of the DRSWC's rolling basin assessment.

There are several possibilities for additional instream monitoring for fish movement through the system which are being evaluated based on the new concept.

1.3 Spring Brook Restoration and Dam Removal (Spring Brook Phase 2)

- Special Condition Listed Completion Date December 2019
- Status Design and permitting are complete. Construction is 70% complete with reaches A and C being complete (see Map 3). Subject to weather conditions,

construction is estimated to be complete by end of September 2020. Delays were caused by the unusually wet weather encountered in 2019 and by the highly mobile sediments encountered in Reach C.

Objective – Based on the pre-project monitoring results the objective has been refined. These are shown in Table 4. Pre-project monitoring results were reported in detail in the 2019-20 report.

Table 4. Target QHEI, mIBI and fIBI scores generated from 2018 sampling

Parameter	All Monitoring Sites (5 sites)	Footprint proper sites (3 sites RM 0.75 -1.42)
QHEI	>54.8	> 52.5
MIBI	> 50.1	> 42.8
FIBI	> 19.4	> 17

The project is being managed by the Forest Preserve District of DuPage County (FPDDC); construction, permitting, and long-term monitoring is being funded by the FPDDC, the Illinois Tollway and the DRSCW.

1.3.1. Site Description and Project Design

The Phase 2 Project is located in unincorporated DuPage County in Blackwell Forest Preserve. The project footprint limits are entirely on FPDDC property. The project runs along Spring Brook #1. The downstream limit is approximately 400' downstream of the existing unnamed pedestrian bridge, which runs south from Mack Road and east of Williams Road. The upstream limit is Winfield Road. The project is immediately downstream of the Spring Brook #1 Stream and Wetland Restoration Project (Phase 1) constructed in 2015.

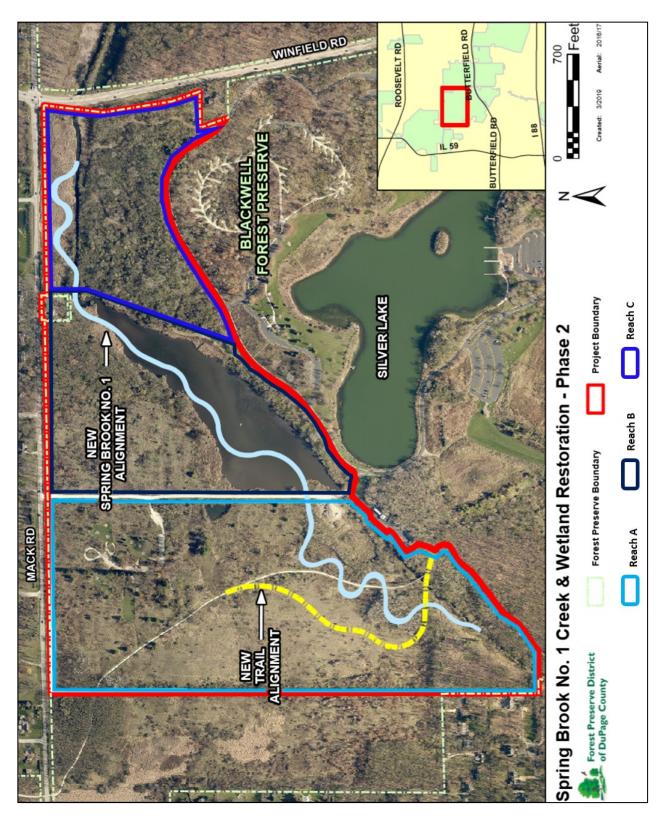
The 2018 Annual Report provided details on the Project's design in the section entitled Design Progress Report.

1.3.2. Design Characteristics

The 2017 Annual Report provided details on the Project's design characteristics in sections titled Existing Conditions and Proposed Conditions.

1.3.3. Permitting Requirements

All necessary project permits have been issued and received. The 2018 Annual Report provided details on the permits and their issuing agencies required for the project.



Map 3. Construction reaches of Spring Brook No.1 Creek & Wetland Restoration – Phase 2

1.3.4. Construction Progress Report

Following an extremely wet 2019 spring, construction on the new channel began in earnest in July 2019. Crews began work in "Reach A", the furthest-downstream one-third of the project. By September 2019, 2,254 linear feet of new stream was constructed including eight riffle sills and six pools (Plate 3). This section is complete.

In preparation of construction within "Reach B", the reach immediately upstream of the dam and within the footprint of the impoundment, crews began removing dam components in summer 2019. Issues with managing the fine particles that made up a large percentage of the deposited material sediment quickly became apparent.

The sediment that became suspended as result of the work did not settle as anticipated and inplace sediment control measures proved insufficient to the task. To prevent release of sediments the dam structure was re-installed and a new strategy conceived. After reviewing the situation, it was resolved to construct a temporary bypass channel around the impoundment. By diverting stream flow around the impoundment via this bypass channel, it was anticipated that the impoundment could be drawn down at a rate that would stop sediment from mobilizing while allowing work to continue. Permission for the bypass channel was received from the Army Corps of Engineers and DuPage County in November 2019. Excavation of the 2,500' long bypass began early in December and was completed early in 2020. In January 2020, while allowing the impoundment to draw down, construction began on "Reach C", the furthest upstream reach near the intersection of Mack and Winfield Roads. By the end of February 2020, Reach C was completed, resulting in 891 lineal feet of new stream channel with four riffle sills and three pools.

Sub-contractors also began their efforts to construct two new bridges beginning in November 2019. In January 2020, concrete beams for the service road bridge were set in place and the steel pedestrian bridge was set on its abutments. Bridge crews suspended operations for winter with approximately 75% of bridgework complete.

Unfortunately, the mild winter did not present ground conditions favorable for selective removal of non-desirable vegetation in the uplands surrounding the riparian corridor.

In anticipation of spring rains, the prime contractor will wait until summer 2020 to begin construction of the final stretch of Spring Brook, within Reach B, when conditions are expected to be drier.

Plate 3. Aerial image showing ongoing construction in Reach A. Image shows the pool riffle sequencing, root wads on the outside banks and stream re-meandering. The area disturbed by construction has since been planted.



1.3.5. Project Impact Evaluation

Pre-project monitoring was included in the 2018 Annual Report. No monitoring was conducted in 2019 due to on-going construction. Post-project monitoring will begin upon completion of the project with an expected start date of 2021. Additionally, the West Branch basin in which the project lies, will be covered by the 2020 DRSCW rolling basin assessment.

1.4 Fullersburg Woods Dam Modification Concept Plan Development

- Special Condition Listed Completion Date December 2016
- Status Complete (December 2016)

In December 2016, the DRSCW submitted the Fullersburg Woods Dam Modification Concept Plan to the IEPA. The 2017 Annual Report included details on the findings of the Fullersburg Woods Dam Modification Concept Plan.

1.5 Fullersburg Woods Dam Modification and Stream Restoration

- Special Condition Listed Completion Date December 2021
- Status Outreach and Education Campaign is ongoing (started 2017). Master Planning process is ongoing. Final Design/Construction scheduled for 2021-2023.

The project is on the Salt Creek mainstem; its objectives are to raise QHEI above its current score of 39.5, raise fIBI at the sites upstream of the dam above its current score of 19.0, raise mIBI above its current score of 17 for approximately 1.5 river miles and to improve dissolved oxygen in the impoundment, as compared to the 2007-2018 data set. The DRSCW will be collaborating with FPDDC and DuPage County Stormwater Management (DC SWM) on this project. DRSCW has budgeted \$4,975,000 for this project.

1.5.1 Site Description

The 2018 Annual Report provided details on the Project's site description.

1.5.2 Research and Public Outreach

Modification of the Fullersburg Woods (Graue Mill) dam will likely encounter significant public opposition. The concept plan prepared in 2016 included a framework for reaching out to stakeholders, listening to their concerns and soliciting feedback so that the final design proposal can incorporate features based on their input. In 2018, the DRSCW replaced its original outreach coordinator with Aileron Communications and updated the research and public outreach work plan. Below includes each task and work completed in 2019/2020.

Phase 1: Public Opinion Research

Task 1: Project Kickoff

Work was completed in 2018 and details on the work were included in the 2018 Annual Report.

Task 2: Survey Development

Work was completed in 2018 and details on the work were included in the 2018 Annual Report.

Task 3: Telephone Survey

Work was completed in 2018 and details on the work were included in the 2018 Annual Report.

Task 4: Online Survey

On Thursday, February 21, 2019, the online survey for the project went live at RestoreSaltCreek.org. The survey questions are nearly identical to the telephone survey. The online survey was conducted in January to March 2019. To facilitate dissemination of the survey to stakeholders and project collaborators, the DRSCW developed promotional materials for the survey. Items developed include a text, poster, and social media meme. All DRSCW members and identified project stakeholders received these materials via email.

The online survey found 92.6 percent of respondents would support modifying the dam to improve water quality, wildlife habitat and recreation. Meanwhile, 93.8 percent would support modifying the dam in order to save area taxpayers the estimated \$180 million alternative measures would cost. The online survey allowed respondents to write comments in addition to responding to survey questions, which provided some insight into community sentiment and helped us select participants to include in a focus group. The online survey was not a random sample, but was completed by individuals who saw social media posts about the survey and chose to participate— this self-selection bias likely accounts for the stronger support of the project in the online survey as compared to the telephone survey. Detail on the survey can be found in the 2018 Annual Report.

Task 5: In-depth Interviews/Focus Group

From January to March 2019, Aileron Communications conducted four one on one interviews with project stakeholders representing differing interests. Outline for the interviews is included in Attachment 5c. Interviewees included Steve Sinderson (paddler/angler on Salt Creek); David Carlin and Dan Wagner (Oak Brook Chamber of Commerce and Economic Development Partnership); Rus Strahan (Head Miller at Graue Mill), and Don Fuller (President of the Fullersburg Woods Historical Society). Aileron prepared a synopsis of each interview. Information learned from the interviews guided the framework development for a 6-8 person focus group held on April 3, 2019.

On April 3, 2019, seven area residents with a variety of opinions on the topic of dam modification participated in a 90-minute focus group. A moderator led a discussion on the importance of Salt Creek and Fullersburg Woods, water quality issues and opportunities, and potential options to modify the dam. Participants reacted to images of Graue Mill Dam and its impoundment, completed dam removals and renderings of the potential modifications of the Graue Mill Dam. The focus group discussion reinforced the public's concern for water quality, highlighted several ways the dam held social or historical significance, and identified potential options for outreach and communication around dam removal.

Task 6: Analysis, Strategy and Messaging

The opinion-gathering process revealed several key insights that should guide the workgroup's next steps. It's clear from survey data that the public supports the concept of dam modification. That support could change if the workgroup isn't perceived as dealing with the public in a fair and transparent way. Below are general recommendations for how the DRSCW should explain the dam modification project to the public:

Think beyond the dam — Rather than thinking only about removing a dam, the DRSCW should think in terms of creating a better forest preserve and a healthier, more valuable waterway. Recreation, wildlife, water quality, scenery and history are all considered important aspects of Graue Mill and Fullersburg Woods - communications around the project should address all of these topics.

Water quality issues don't begin or end at the Graue Mill Dam, so the DRSCW should make it clear that dam removal would be a key part of a broader, long-term project designed to improve the watershed for many years to come. If possible, tie in other efforts to reduce litter and runoff and encourage recreation in Salt Creek and support volunteer projects that could get more people involved in caring for the waterway.

Water quality is a top issue – Across the board, the public expressed strong support for improving water quality. The survey results align with other research the DRSCW and its partners have conducted that found local residents care deeply about clean water. The dam modification project should be framed as an effort that will improve water quality – and DRSCW should use facts and simple language to explain how dam modification will make Salt Creek better.

Use data to prove that dam modification will work – Providing data on the water quality benefits of removing the dam, and the public costs of inaction will be critical to making the public believe the dam modification will be successful. Also – case studies of other dam removal projects, and their effects on communities nearby and downstream, will be an important way to build public support.

Operation of the Graue Mill's waterwheel is a key motivator – The DRSCW goals include keeping the waterwheel operating. When interview and focus group participants understand this, their concerns decrease significantly. The DRSCW should clearly explain how the wheel can be kept in operation and design the project to make sure it delivers that result.

Use visuals to tell the story – Before and after images will be very important in helping the public understand what the project will change, and what it will maintain. Before beginning the outreach process, the workgroup should have renderings showing the millrace, waterwheel and dam. Images of algae blooms and sediment in the impoundment are also a powerful way to communicate the need to improve water quality and can be used to make the case for dam removal or modification.

As a focus group participant said after seeing renderings of dam removal at Graue Mill: "To me, the project now makes more sense, from a purely visual point. I can see there's a wetland space being created. It seems like the more natural approach..."

Build a coalition of supporters before going public – The DRSCW has a number of natural allies in this project, as confirmed by stakeholder interviews. Before any public outreach begins, the DRSCW should line up support from allies such as paddling and angling groups, the Oak Brook Chamber of Commerce or other business groups and environmental and conservation organizations. The DRSCW may want to adjust the project that will cement support from these allies.

The DRSCW could also coordinate with US EPA or other regulators to ensure that they clearly communicate the legal requirements for water quality. Wastewater Treatment Works should also be engaged to explain the efforts they have made to improve water quality and testify to the potential costs of additional upgrades.

Create a Role for Historic Preservation – The biggest risk in dam modification is altering what many consider a unique historic landmark for DuPage County. While the need to modify the dam is not negotiable, the DRSCW should find some areas where it can engage with and incorporate feedback from preservationists. The DRSCW could create an advisory body of people interested in the historic aspects of Graue Mill and possibly provide funding for this group to create signage, interpretive displays, programming or other features that highlight the historic significance of the site.

Be transparent and honest – The DRSCW's best strategy will be to provide clear and open communication throughout the project. Data shows that the majority of the public is already in support. The group should listen to feedback and be prepared to adjust plans based on public opposition, but also make it clear which decisions can and cannot be negotiated. Information on the project should be readily available and channels of communication should remain open all through the process.

Phase 2: Communications and Outreach

As the DRSCW move forward with the preparation of a Master Plan for Salt Creek at Fullersburg Woods (see Section 1.5.3 for more details) that includes modifying the Graue Mill Dam, the DRSCW has signed an additional contract with Aileron Communications to continue providing services during this phase of the project. Work in this phase includes communications and outreach efforts that would take place before the master plan is shared with the public, as well as communications strategy and support for public outreach on the master plan. These steps

would align support for the DRSCW's goals, increase the public's trust in the workgroup and help the public understand the importance of dam modification projects.

Task 1: Press Announcements and New Stories

Aileron will prepare two (2) press announcements and place news stories that will help the public understand the broader context of watershed restoration efforts and the benefits of dam modification. This effort will also help us build relationships between DRSCW and local media before the Fullersburg Woods plan is presented to the public.

This effort will help to create a foundation for later outreach efforts by:

- Helping the public understand the DRSCW and the impact of its work
- Explaining the benefits of dam modification projects and showing the impact of completed projects across the region
- Bringing positive attention to the Forest Preserve District of DuPage County and its work partnering with DRSCW

The first article was focused on water / habitat improvement following dam removal and restoration of the Oak Meadows dam site (See Section 1.1 for additional information on the project at the Preserve at Oak Meadows). This article was published by the Daily Herald on March 22, 2020. The second article will focus on the impact of dam removals in Northeast Illinois and is scheduled for release in early April 2020.

Task 2: Public Meetings Outreach and Support

As part of the Master Plan for Salt Creek at Fullersburg Woods (see Section 1.5.3 for more details), the DRSCW will host two (2) public Open Houses to present the master plan and solicit public comment. Aileron will provide support services to the DRSCW to prepare for the public engagement process by:

- Working with DRSCW and its engineering consultants to develop a clear public presentation on the plan to improve Fullersburg Woods and identify areas where public input will shape outcomes
- Contribute content for project fact sheets, web pages or other required materials
- Engage with DRSCW's network of stakeholders and partner organizations to ensure they understand the plan for Fullersburg Woods and the public outreach process
- Manage media inquiries related to the plan, share information with journalists and coordinate DRSCW responses as appropriate

Additionally, during public and after public meetings on the plan, Aileron will:

- Attend public meetings, manage media, and provide communications and logistical support
- Coordinate involvement of stakeholders and DRSCW partners
- Work with DRSCW and its engineering consultants to incorporate public feedback into a revised plan
- Manage media inquiries and coordinate DRSCW response to questions as appropriate

The public meetings are scheduled for:

- May 19, 2020 from 6-8pm: Central Park West, Oak Brook, Illinois
- May 20, 2020 from 6-8pm: Wilder Mansion, Elmhurst, Illinois

Details on the agenda, presentation, and exhibits are on-going and will be discussed in the 2020 Annual Report.

1.5.3 Design Progress Report

In June 2019, the DRSCW entered into a contract with AECOM Technical Services (AECOM) for the development of a Master Plan for Salt Creek at Fullersburg Woods. The scope of work for the Master Plan at Salt Creek at Fullersburg Woods and the work conducted to date is discussed below.

Task 1: Topographic and Bathymetric Survey

Task 1 includes the completion of a topographic field survey of the project area to locate substantial existing features and ground relief. For Task 1 and Task 2, the project area includes the Salt Creek corridor from York Road on the downstream end to 31st Street bridge on the upstream end. The project area also includes the Fullersburg Woods (Graue Mill) dam and the Old Oak Brook dam. During the survey activities, AECOM also conducted depth of refusal (DOR) measurements within the dam's impoundment to quantify impounded sediments volumes and identify approximate elevations and materials of pre-dam alluvium.

The topographic field survey and DOR measurements were completed in late July/early August 2019.

<u>Task 2: Wetlands/Waters of the United State (WOTUS) Assessment</u>

AECOM's subconsultant Applied Ecological Services (AES) completed a wetland and water delineation of the project area in accordance with the US Army Corps of Engineers (USACE) 1987 Wetland Delineation and the Midwest Regional Supplement for Wetland Delineations. DuPage County jurisdictional wetlands were also delineated and assessed. A wetland

delineation report has been submitted to the USACE and DC SWM. This report that includes a wetland delineation exhibit demarcating all wetlands and data collected, photos of representative locations, wetlands and soil maps, USACE data forms, an evaluation of the quality of on-site wetlands based upon Floristic Quality Index (FQI), location of adjacent off-site wetlands, calculation of buffer width and wildlife evaluation forms. Field confirmation of wetland boundaries and justification determination of the wetlands are expected in Spring 2020.

Threatened and Endangered Species and Historical Preservation Coordination has also been completed as part of Task 2.

Task 3: Sediment Sampling Analysis

Sediment sampling to provide a base understanding of the sediment quality of the impoundment located upstream of the Fullersburg Woods dam for planning purposes was conducted on July 16 –17, 2019. Sediment samples were taken at 18 locations, where silt, clay, and organic material depth is greater than or equal to 12 inches, two depths were sampled, the first depth to the first 12-inches of sediment and the second depth to the 12-24-inch depth. In total 31 samples were taken. The sediment samples were tested for the following parameters:

- Total Metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc;
- Toxicity Characteristic Leaching Procedure: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver;
- Polycyclic aromatic hydrocarbons (PAHs);
- Chemical Oxygen Demand (COD);
- Sediment Grain Size (hydrometer method);
- Total Organic Carbon (TOC);
- Polychlorinated Biphenyls (PCBs); and
- Pesticides: 4,4'DDD; 4,4'-DDE; dieldrin.

Analysis of the sediment data is ongoing and is expected to be completed by April 30, 2020. Final documents for Task 3 will include a comparison of all analytical results compared with background concentrations and applicable sediment and soil quality criteria. Additionally, if the collected samples are insufficient to characterize the soils within the impoundment, a sample plan will be created to collect the necessary additional data.

Task 4: Alternatives Analysis and Cost Estimates

As part of Task 4, design alternative for modification to the Fullersburg Woods dam will be evaluated for their viability to create fish passage and improve water quality in Salt Creek. Four

design alternatives were evaluated (see Attachment 4 for the renderings for each design option):

Alternative A: Complete dam removal: The dam is removed and replaced with a rock riffle. Final dimensions of the rock riffle are still to be determined but it is estimated the riffle will be 70 feet wide by 80-100 feet in length. The riffle will be designed so that velocities through the riffle will be sufficient to allow for fish passage. The existing impoundment is no longer present and this area will become floodplain/wetlands (this area is depicted as green on the drawing). The existing mill race will be cut off from the main channel so the final design will include alternatives for maintaining some water in the mill race (such as using potable water or pumping in stormwater) and options to turn the wheel (electric motor). The existing dewatering structure (east side of channel) will be removed. Modelling will have to be done to determine the regulatory conveyance impacts of the elevated area relative to the project. Alternative A will maximize both the fish passage and water quality objectives and will minimize cleaning of the mill race and future sediment management issues for the FPD.

Alternative B: Partial dam crest removal: In Alternative B, the crest of the dam is reduced in height by approximately 50% to 2.5 feet and a rock ramp is added to the downstream face and channel for grade transition. The rock ramp includes rock arches. The riffle will be designed so that velocities through the riffle will be sufficient for fish passage but it is expected that there will be passage restrictions for more species than Alternative A through the ramp. There is limited dewatering of the existing impoundment so the existing DO and habitat issues in the impoundment will likely not improve with this alternative. Mill race is also disconnected from the main channel so the design options for the mill race discussed in Alternative A would also be applicable to Alternative B. The existing dewatering structure will be removed. There are also some long-term maintenance concerns with this alternative including debris becoming trapped in the rock arches. Alternative B will partially meet the fish passage goals but will not meet the water quality objectives for the project. The approach used in Alternative B is typically used in locations with high levels of contaminants in the sediment. In these situations, it becomes expensive to dispose of these sediments at a landfill as they cannot be left onsite. With this alternative, there is less need to remove sediments. Sediment analysis for Fullersburg Woods is still ongoing to determine if there will be a significant cost for sediment disposal at the site. Option B minimizes cleaning of the mill race but leaves future sediment management issues for the FPDDC.

Alternative C: Spillway Modification and Rock Fish Passage Channel: Alternative C is a partial dam removal. A portion of the dam will remain in place. This can be either on the east or west side of the channel (the rendering has the dam remaining on the east side). In the side where

the dam crest is lowered, a rock fish passage channel (fish ladder) will be constructed. A concrete wall would be necessary to divide the rock fish passage channel from the existing channel. The rock fish passage will be designed to get as close as possible to the velocities needed for fish passage. However, it will be challenging to reach lower velocities with this design. As the upstream end of the rock fish passage will be at the same elevation as the dam, there will be no change in the existing impoundment. The mill race will remain as it is in the existing conditions. Alternative C will have additional maintenance concerns/needs including maintenance of the dividing wall, cleaning out of the mill race, and the need for future degrading sediments from the impoundment. Alternative C will not meet the fish passage goals nor the water quality objectives for the project. Alternative C is typically used in conjunction with hydroelectric dams where the dam must remain in place but fish passage is a regulatory requirement. Experience for fish passage has shown results from mixed to poor. The FPDDC would continue to clean the race way and support any sediment management.

Alternative D: Spillway Modification and Rock Fish Passage Channel and Wood Crib Plank
Spillway: Alternative D is identical to Alternative C with the exception that instead of the
existing dam to remain (limestone), a crib and plank façade similar to what was on the 1800s
dam is added to the remaining portion of the dam. Alternative D will not meet the fish passage
goals nor the water quality objectives for the project. The FPDDC would continue to clean the
race way and support any sediment management.

Based on the results of the Alternatives Analysis, the DRSCW has focused its efforts on refining Alternative A. As part of this work, the Workgroup is exploring the impacts of Alternative A on the upstream channel and looking for additional opportunities for instream and streamside habitat improvements (riffle/pool creation, substrate installation, streambank stabilization, wetland creation, etc.). As part of this work, additional modeling and design work is being done on the channel around the island located in the northern portion of Fullersburg Woods. Historically, the main channel of Salt Creek flowed on the south side of the island. However, after the construction of the current dam in the 1930s, the main channel of Salt Creek was directed to the north side of the channel. As the property owner, FPDDC, is neutral on which channel (north or south) should be the main channel. The design will focus on allowing high flows to access both flow paths during flood stage and maintain enough flow in the secondary channel to maintain healthy wetland vegetation during low/normal flows. The proposed design will be presented to the public at the open houses scheduled for April 14 and 15, 2020 (see Section 1.5.2 for more information on the open houses).

In addition to design elements for the dam modification and stream channel restoration, the DRSCW is also identifying opportunities for the inclusion of low maintenance recreation and

educational elements in the final design of the project such as rock fishing areas, canoe launches, and educational signage.

Task 5: Coordination and Alternative Selection Meetings

Work in this task includes five (5) meetings between AECOM and the DRSCW. These meetings include a Project Kickoff (July 2020), two progress meetings to discuss the alternatives analysis (January 24, 2020 and February 4, 2020), a meeting to select the preferred alternative (March 11, 2020), and a meeting to present the Final Master Plan (to be held in April 2020).

This task also includes support by AECOM at the two public open houses scheduled for April 14, 2020 and April 15, 2020. Details on the open houses is found in Section 1.5.2.

Task 6: Pre-Application Meetings

Work included in this task includes initial coordination with the USACE, Illinois Department of Natural Resources (IDNR), Illinois Environmental Protection Agency (IEPA), DC SWM, and the FPDDC to discuss the critical aspects of the project. This will include wetland impacts, sediment management, safety issues, dewatering, functional uplift, water quality benefits, flood control, stormwater management and construction staging. Pre-Application Meetings are scheduled for spring/summer 2020.

Task 7: Master Plan for Salt Creek at Fullersburg Woods

The Master Plan for Salt Creek at Fullersburg Woods will include:

- A summary and findings of Tasks 1-5;
- Renderings prepared as part of Task 4 and additional renderings of the preferred alternatives as well as the stream corridor;
- A summary of all permits that will be required by the project;
- Anticipated application and processing fees;
- Estimate of permit review and issuance timeframes;
- Estimate for engineering fees to complete the Final Engineering Design and Permit; and
- Construction cost opinion

The intent of the Master Plan for Salt Creek at Fullersburg Woods will be to provide details and visuals on the work conducted as part of the master planning process in a manner that will allow the FPDDC to make decisions regarding its implementation at Fullersburg Woods. The Master Plan for Salt Creek at Fullersburg Woods is expected to be completed by April 30, 2020 with a presentation to the FPDDC Board of Commissioners in May 2020.

Task 8: Needs Analysis

Once the Master Plan for Salt Creek at Fullersburg Woods is finalized, AECOM will identify and detail all pertinent work items to be addressed under Final Engineering, Permitting, and Contract Preparation. Task 8 is scheduled to be completed in Spring/Summer 2020.

1.5.4 Project Impact Evaluation

Baseline data for the Fullersburg Woods Dam Modification project was completed in 2019. Map 4 depicts the locations of the samples collected by the DRSCW. Table 5 includes the results of the pre-project 2019 survey collected by the DRSCW. Figure 1 depicts the pre-project (2019) mIBI scores and Figure 2 depicts the pre-project (2019) fIBI scores at the site. It is also important to note that fish sampling found 24 species, including 21 native species, downstream of the dam but only 9 species with 7 native species upstream of the dam. These results highlight the need for fish passage through the Fullersburg Woods dam.

Table 5. flBI, mIBI, and QHEI baseline data collected in 2018 for the Fullersburg Woods Dam Modification

Site ID	River Mile	Drainage Area (sq mi)	fIBI	mIBI	QHEI	Attainment Status
Salt Creek 20	19					
SC56	12.5	107.0	17.0	14.6	44.5	Non-Poor
SC56a	12.2	109.7	15.0	27.6	42.5	Non-Poor
SC56b	11.7	113.5	16.0	N/A	53.5	Non-Poor
SC56c	11.3	113.6	15.0	28.5	57.0	Non-Poor
SC53	11.0	110.0	14.0	20.3	54.5	Non-Poor
SC53a	10.8	114.0	13.0	13.2	49.5	Non-Poor
SC52	10.5	112.0	30.0	47.4	72.0	Partial

Table 6. Color code to IBI scores depicted in Table 5

Legend: Biological Indicators		
Green	Good	
Yellow	Fair	
Red	Poor	
*	Significant departure from biocriterion	
NS	Nonsignificant departure from biocriterion	

Table 7. Color code to QHEI Scores in Table 5

Legend: QHEI		
	Excellent	
	Good	
	Fair	
	Poor	
	Very Poor	

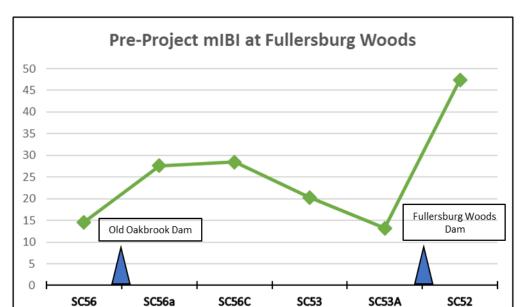
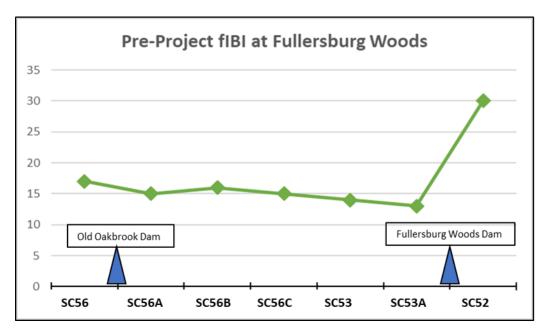


Figure 1. Pre-project (2019) mIBI scores at Fullersburg Woods

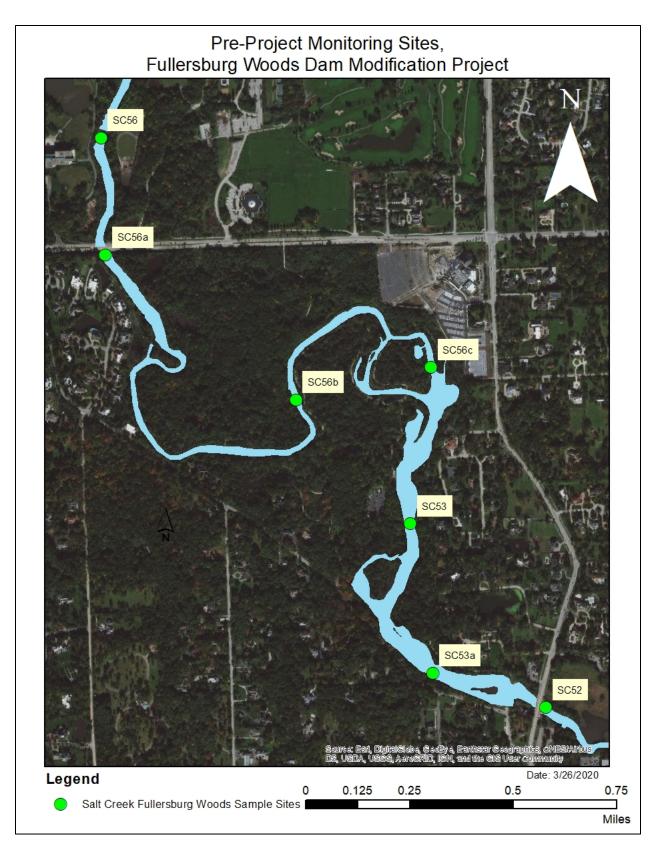
Figure 2. Pre-project (2019) fIBI scores at Fullersburg Woods



1.6 Southern West Branch Physical Improvement

- Special Condition Listed Completion Date December 2022
- Status Concepts are being developed along with the Fawell Dam Modification Plan.

The DRSCW budgeted \$1,465,071 for the period 2019 to 2021.



Map 4. Pre-project Monitoring Locations for the Fullersburg Woods Dam Modification Project

1.7 Southern East Branch Stream Enhancement

- Special Condition Listed Completion Date December 2023
- Status In planning

The DRSCW has budgeted \$2,500,000 for this project and anticipates expenditures in 2021-2023.

The 2017 Report provided details on the pre-project fieldwork conducted for the Project.

1.8. Hammel Woods Dam Modification

- Special Condition Listed Completion Date December 2023
- Status Designs are completed and permits were submitted in November 2019.
- The LDRWC budgeted \$600,000 for this project and anticipates expenditures in 2020-2021.

1.8.1 Site Description

The 2017 Annual Report provided a site description.

1.8.2 Design Characteristics

The 2017 Annual Report provided the design characteristics of the Project.

1.8.3 Permitting Requirements

The 2017 Annual Report provided details on the permitting requirements for the Project.

1.8.4 Design Progress Report

The Lower DuPage River Watershed Coalition approved a Memorandum of Understanding (MOU) with the Forest Preserve District of Will County (FPDWC) to fund the design and construction of this project. The FPDWC executed a contract with their consultant to complete the design and permitting phase of this project. The design consultant submitted permit applications in November 2019 to ACOE and IDNR. Bids for construction will go out this spring and construction will coincide with appropriate water level conditions for this project sometime in 2020.

1.8.5 Project Impact Evaluation

The LDRWC sampled bioassessment monitoring sites in 2012, 2015, and 2018 as part of the long-term Bioassessment Program. Sites sampled include above, below the dam, and within impoundment. In order to evaluate the success of the project, the LDRWC conducted additional

pre-project sampling at two additional sites within the impoundment in 2019 and will include those sites in addition to the regular bioassessment sites for post-project monitoring.

1.9 Hammel Woods Dam to 119th Street in Plainfield Stream Enhancement

- Special Condition Listed Completion Date December 2023
- Status in planning

The LDRWC has budgeted \$2,740,000.00 for this project and anticipated expenditures will be made from 2021-2023.

The 2017 Report provided details on the pre-project fieldwork conducted for the Project.

Chapter 2 Chloride Reduction Program

The Special Condition Paragraph 3 requires NPDES holder participation in a watershed Chloride Reduction Program either directly or through the DRSCW and/or LDRWC. This section summarizes the DRSCW and LDRWC Chloride Reduction Program activities in 2019/2020.

2.1 Technical Workshops

In 2007, the DRSCW held its first deicing workshop to highlight new deicing methods, NPDES water quality goals, and best management practices in order to reduce chlorides and costs. The workshops were held in collaboration with APWA Chicago Metro Chapter. The following year, the DRSCW added a second workshop that targeted contractors responsible for snow and ice management of parking lots and sidewalks into an annual rotation. Since 2007 the DRSCW has executed two workshops every year targeting personnel responsible for 1) public roads and 2) parking lots and sidewalks. The programs have provided training and resources for numerous attendees at various agencies. Additionally, in 2014, the DRSCW held a third workshop in collaboration with Monroe Truck Equipment which focused solely on equipment calibration. Calibrating equipment is an immediate, low-cost BMP that can be implemented without capital upgrades.

Plate 4. Demonstrations of equipment calibration at DRSCW Chloride Management Workshops.



During the reporting period April 1, 2019 to March 31, 2020, the DRSCW held three chloride reduction workshops.

On April 12, 2019, the DRSCW in conjunction with Fortin Consulting held a Level 2 Chloride Training. The clinic focused on the use of the WMAt (Winter Maintenance Assessment Tool) to review the organization's past, present, and future winter maintenance practices and create a series of reports for internal training, budgeting, and communicating with officials who fund maintenance work. Application of this tool will help an organization use less salt and apply it more efficiently. The DRSCW covered the costs for the clinic for all attendees. This is the first time this course was offered by the DRSCW as well as in the State of Illinois. The Level 2

Workshop was attended by 15 individuals representing 6 agencies/organizations including the Illinois State Highway Tollway Authority, DuPage County Department of Transportation, Fox Valley Park District, Village of Hanover Park, Good Samaritan Hospital and Robinson Engineering.

On October 24, 2019, the Public Roads Deicing Workshop was held at DuPage County DOT with the following agenda:

Place 5. DRSCW Public Road Deicing

7:00 – 7:30 Registration and Breakfast

7:30 – 7:35 Welcome and Housekeeping - *Jeff Pieroni, DuPage County Department of Transportation*

7:35 – 7:50 Trends in Chloride Water Quality and BMPs – *Stephen McCracken, DRSCW*

7:50 – 8:10 Chlorides and Your Agency's MS4 Permit – *Dan Bounds, Baxter & Woodman*

8:10 – 8:40 Direct Liquid Application, Ohio DOT Experience – *Darian Grant, Ohio DOT*

8:40 – 8:55 BREAK (includes exhibitor mic time)

8:55 – 9:55 Operations Hour – Ron Remmus, Village of Addison, Joe Mosher, Village of Hanover Park, Tom Ellis, Village of Lombard, TJ Countryman, Village of Schaumburg

9:55– 10:35 Equipment Calibration Methods and Procedures – *Zach Barnwell & Mike Taylor, Force America*

10:35 – 10:50 BREAK (includes exhibitor mic time)

10:50 – 11:20 Using Weather and Pavement Forecasts for Operation and Decision Support - *Leah Dailey, Iteris*

11:20 – 11:50 Ask a Chemist - Laura Fay, Western Transportation Institute – Montana State University

11:50 – 12:00 Wrap Up, Evaluations, Equipment Show

Attendance – 153 registered, 12 presenters/staff, 3 committee members/guests; 11 sponsors/exhibitors = 179 total. All participants received a certificate of attendance. Seventy-five (75) evaluation forms were completed by participants.

Thursday, October 24, 2019
7-00 am—12:00 pm
DuPage County Division of Transportation
140 N. County Farm Road—Mail Entrance
Wheaton, B. 60187

REGISTRATION OPENS AUGUST 2019
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Registration or or School Sch

Workshop brochure, 2019.

Plate 6. Photographs of the DRSCW Public Roads Deicing Workshop, 2019.





On October 17, 2019 the Parking Lots and Sidewalks Deicing Workshop was held at DuPage County DOT with the following agenda: Plate 7. DRSCW Parking Lots and Sidewalks

7:30 – 8:00 Registration & Breakfast

8:00 – 8:15 Ambient Conditions and Regulatory Update: Stephen McCracken, The Conservation Foundation/DRSCW

8:15 – 11:15 Information on developing efficient and costeffective snow fighting operations, appropriate product selection, equipment selection, application rates, equipment calibration, ambient conditions monitoring. Presenters: Carolyn Dindorf, Fortin Consulting and Chris Walsh, (former Public Works Director, City of Beloit, WI)

11:15 – 12:00 Test on Workshop Materials.

Attendance - 112 registrations, 4 presenters/staff, 5

exhibitors/staff = 89 total. All participants received a training certificate and participants who successfully completed the test are recognized on DuPage County Stormwater Management's Water Quality – Pollution Prevention/Good Housekeeping web page. The DRSCW received 97

program evaluations from participants.

Plate 8. Photographs from the DRSCW Parking Lots and Sidewalks Workshop, 2018 (2019 not available).

Deicing Workshop brochure, 2019. **SAVE THE DATE** 2019 Parking Lot & Sidewalk Workshop Thursday, October 17, 2019 7:30 am—12:30 pm DuPage County Division of Transp REGISTRATION OPENS AUGUST 2019

2-3

Lower DuPage River Watershed Coalition (LDRWC) in partnership with the Lower Des Plaines Watershed Group (LDWG) executed two chloride reduction workshops in the fall of 2019.

The Public Roads Deicing Workshop was held at the Village of New Lenox's Public Works Facility on October 16, 2019 with the following agenda:

7:30 am Registration and Breakfast

8:00 am Welcome/ Housekeeping, Shawn Vandenberg, Village of New Lenox

9:00 am Information on developing efficient and costeffective snow fighting operations, appropriate product selection, equipment selection, application rates, equipment calibration, ambient conditions monitoring. *Presenters:* Carolyn Dindorf, Fortin Consulting and Chris Walsh, (former Public Works Director, City of Beloit, WI)

11:30 am Test on Workshop Materials

12:15pm: Closing Remarks and Evaluations

Plate 9. LDRWC Public Roads Deicing Workshop brochure, 2019.



Attendance – 66 registered, 2 presenters, 2 staff, 7 exhibitors = 77 total. All participants received a certificate of attendance. Sixty evaluation forms were received from participants.

Plate 10. Photographs from the LDRWC Public Roads Deicing Workshop, 2019.



The Parking Lots and Sidewalks Deicing Workshop was held at the Village of New Lenox's Public Works Facility on October 15, 2019 with the following agenda:

7:30 am Registration and Breakfast

8:00 am Introduction of topic and the relevance to Will County, *Jennifer Hammer, The Conservation Foundation*

8:15 am Ambient conditions and regulatory update and information on developing efficient and cost-effective snow fighting operations, appropriate product selection, equipment selection, application rates, equipment calibration, ambient conditions monitoring. Presenters: *Carolyn Dindorf, Fortin Consulting and Chris Walsh*, (former Public Works Director, City of Beloit, WI)

11:30 am Test on workshop materials.

12:15 pm Closing Remarks and Evaluations

Plate 11. LDRWC Parking Lots & Sidewalk Workshop brochure, 2019



Attendance - 22 registrations, 2 presenters, 2 staff, 5 exhibitors = 31 total. All participants received a training certificate. The LDRWC received 21 program evaluations from participants.

Plate 12. Photographs from the LDRWC Parking Lots and Sidewalks Workshop, 2019.



Additionally, during this reporting period, the LDRWC shared seasonal outreach materials for members to use in residential outreach efforts. The materials were made available through their website www.dupagerivers.org/winter and through the Salt Smart Collaborative website at www.saltsmart.org. The LDRWC is one of the lead collaborators for SaltSmart.org. Materials included blog posts, newsletter articles, supporting social media graphics, a Salt Smart Infographic, plastic cups for spreading salt correctly and a bookmark with information for residents. A winter checklist was also included to assist communities in tracking the use of outreach materials for MS4 reporting. Both websites also advertise the winter deicing

workshops. The Salt Smart Collaborative website was also expanded to include more resources and information for residents, public road agencies and private deicing companies.

Plate 13. LDRWC Salt Smart Collaborative logo



Plate 14. LDRWC Salt Smart cups



Plate 15. Salt Smart infographic

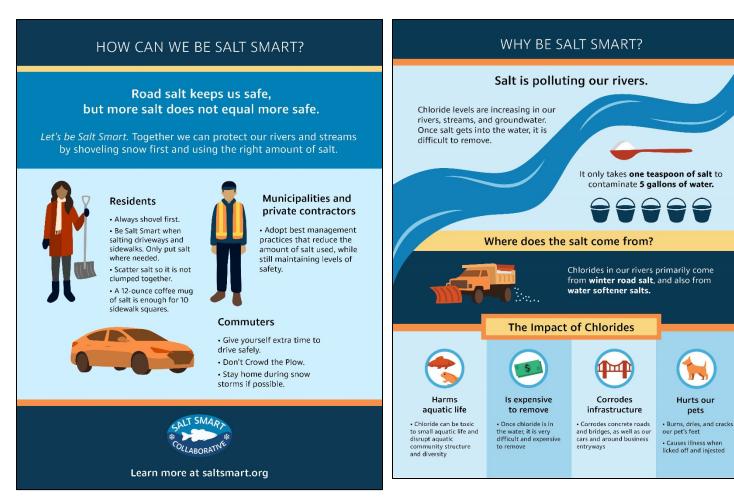


Plate 16. Salt Smart bookmark





Plate 17. Salt Smart social media posts













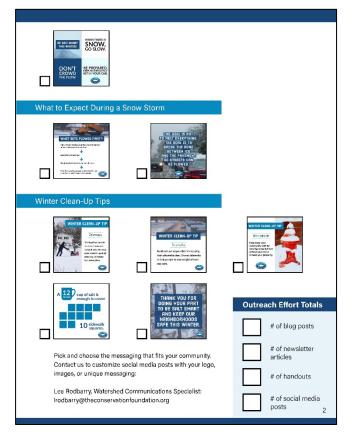






Plate 18. Winter campaign checklist





2.2 Tracking BMP Adoption

2.2.1 Chloride Questionnaire

The DRSCW has attempted to track adoption of sensible salting BMPs in the program area since 2007. Monitoring ambient chloride concentrations has proven an imperfect metric for tracking efficiency trends in winter salt use. Tracking target BMP adoption in the program area provides opportunities to evaluate the impacts of the chloride management workshops; identify material for future workshops and form suppositions about salt use per unit of service expended inside the program area relative to 2006 levels.

In 2007, 2010, 2012, 2014, 2016, and 2018 the DRSCW distributed a questionnaire to approximately 80 municipal highway operations and public works agencies to obtain information about deicing practices throughout the program area. Findings of the 2018 questionnaire were include in the 2018 Annual Report. A new questionnaire will be distributed in spring of 2020 and the results will be supplied in the 2020 Annual Report.

2.2.2 Ambient Impact Monitoring

DRSCW's Chloride Education and Reduction Program is performing an analysis to demonstrate an observable reduction in chloride loading within the water quality data collected since the beginning of program efforts. For over 10 years now, the program has been implementing numerous chloride reduction efforts, including:

- Annual Educational workshops (for public roads and parking lots/sidewalks)
- Equipment calibration training
- Product and chemical alternative summaries
- Information dissemination on Equipment and salt application advancements
- Information dissemination on salt usage, storage and deicing best management practices
- Example salt use policies and management plans

The goal of the ongoing analysis is to see if these efforts are resulting in a discernable reduction of chloride loading using the instream water quality data collected by DRSCW from 2009 to present. This is challenging, as there are many factors that affect the resulting water quality data, including variability in winter weather over the years (temperatures and precipitation levels), inconsistency in municipal salt application events across the DRSCW watershed areas, and inconsistency in the way events are defined and tracked by municipalities. The variability inherent in winter weather conditions and municipal application practices and record keeping does not allow the loading data to show the effect of reduction practices without accounting for it in some way.

The approach consists of using direct chloride sampling and analysis concentration data collected by the DRSCW during its rolling bioassessment program (summer), along with adjusted specific conductivity concentration data collected by the DRSCW (summer and winter), and USGS flow data to calculate loading (in pound per day) of chloride for each DRSCW watershed over the past decade. The loading data will then be adjusted or normalized to account for weighted variabilities in winter weather and salt application events. The data is being analyzed by individual watershed and separately for summer and winter periods each year. The hope is that once adjusted for variabilities, the loading data will better show the effect of the program's salt use reduction training and best management practices implementation by municipalities on ambient water quality.

As of the time of this report, the data has been organized by watershed and season, and water quality loadings have been calculated for the study period (Figure 3). The next analysis steps will be to QAQC the calculations, and develop methods for accounting for the variability in

temperatures and precipitation, municipal salt application events, and the way salt application events are defined and tracked. Adjustments will be performed using those methods, and the resulting loading trends will be presented in a future report. This analysis will provide an indication of the effectiveness of the DRSCW's chloride education and reduction efforts.

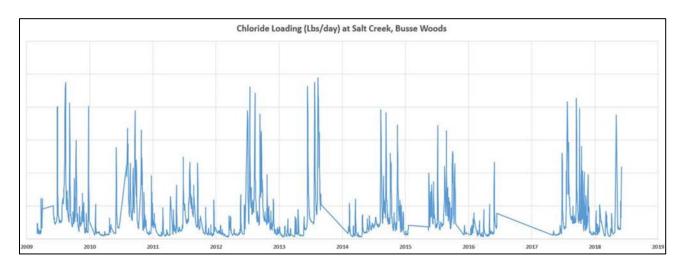
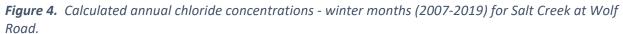


Figure 3. Chloride loading (Lbs/day) at Salt Creek, Busse Woods

2.3 Continuous Chloride Monitoring

Ambient monitoring of winter conductivity was carried out at 6 locations in the program area in 2018-2019 (4 sites monitored by the DRSCW and 2 sites monitored by MWRD). Conductivity is used to calculate chloride concentrations based on a relationship established by the DRSCW in 2007 and 2019 (so the data is referred to as calculated). Calculated Annual chloride concentrations for the winter months from 2006-2019 for the 6 sites are depicted in Figure 4-9.



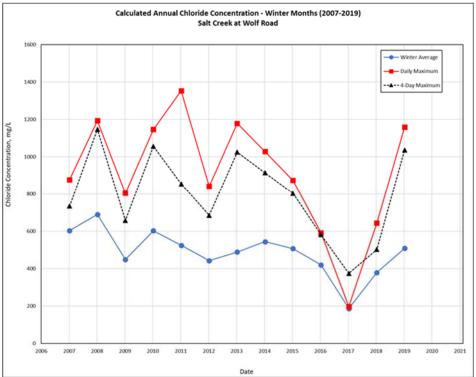


Figure 5. Calculated annual chloride concentrations - winter months (2008-2019) for Salt Creek at Busse Woods Main Dam.

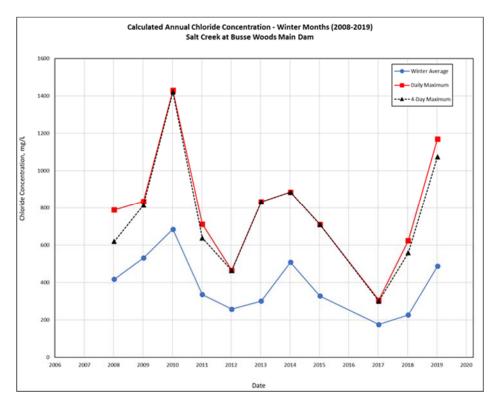


Figure 6. Calculated annual calculated chloride concentrations - winter months (2008-2019) for East Branch at Hobson Road.

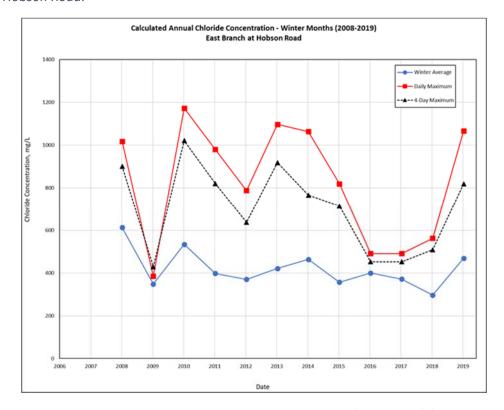


Figure 7. Calculated annual chloride concentrations - winter months (2006-2019) for East Branch at Army Trail Road.

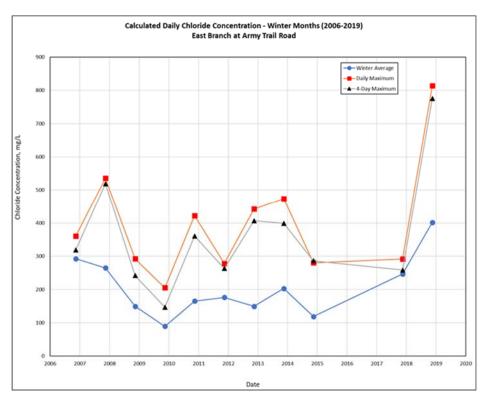


Figure 8. Calculated annual chloride concentrations - winter months (2018-2019) for West Branch at Bailey Road

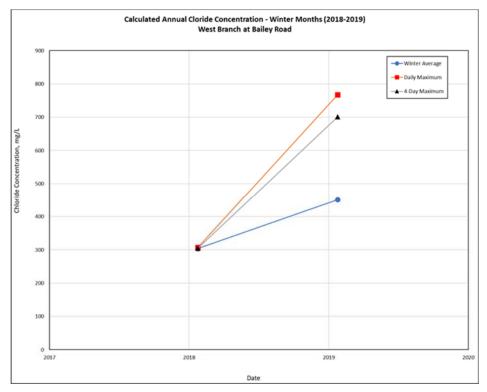
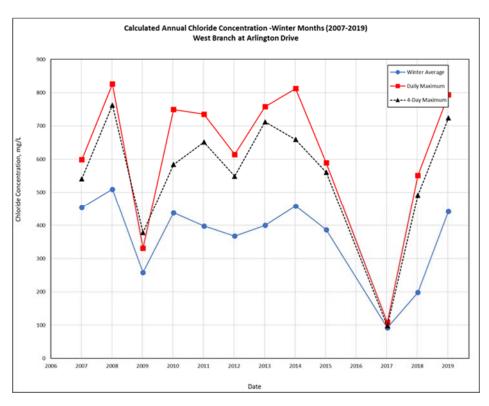


Figure 9. Calculated annual chloride concentrations - winter months (2007-2019) for West Branch at Arlington Road



Chapter 3 Nutrient Implementation Plan

The Special Condition Paragraph 10 requires NPDES holders in the DRSCW and LDRWC to develop a Nutrient Implementation Plan (NIP) for the watershed that identifies phosphorus input reductions by point source discharges, non-point source discharges and other measures necessary to remove DO and offensive condition impairments and meet the applicable dissolved oxygen criteria in 35 IL Adm. Code 302.206 and the narrative offensive aquatic algae criteria in 35 IL Adm. Code 302.203. Special Condition Paragraph 2 and Special Condition Paragraph 8.c. identify additional studies to be completed by the watershed workgroups. This section summarizes the DRSCW and LDRWC work in 2019/2020 on the studies.

3.1 IPS Model /Project Identification Study

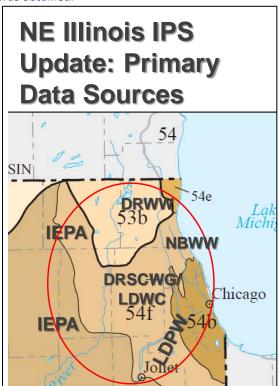
- Special Condition Listed Completion Date December 2018; Extended to July 31, 2020
- Status –Compilation of stressor data sets and stressor analysis is complete. The
 methodology, results, database, and a user manual all exist in draft and are under
 review. Due to the potential long-term impacts of some of the IPS model results, the
 DRSCW has requested extra time from IEPA to review the results.

3.1.1 Background on the IPS Model

The objective of this project is to update the DRSCW's Integrated Prioritization System model (IPS) and develop a new list of prioritized projects for both the DRSCW and LDRWC watersheds. The original IPS Model was developed by the DRSCW with its consultant (MBI) in 2010.

The updated IPS Model geographically covers the watersheds of Northeastern Illinois including the Upper Des Plaines River and tributaries (DuPage River, Salt Creek) in all or parts of DuPage, Cook, Will, and Lake Counties (Figure 10). Data from outlying watersheds including the Kishwaukee River, Kankakee River, and the Fox River were used in order to expand the stressor and response gradients. Qualifying data from more than 650 IEPA/IDNR, DRSCW, LDRWC, and the Des Plaines River Watershed Workgroup (DRWW) sites draining <350 sq. mi. were used in the analyses.

Figure 10. The Northeastern Illinois IPS study area showing level IV subregions and participating watershed groups and entities from which data was obtained.



This is a significant expansion over the original IPS 120 sites. A future effort will include sites >350 sq. mi.

Paired data supplied by these organizations included the dependent variables of fish, macro-invertebrates, habitat, and stressor variables including water quality and land use data (Table

8). This includes such data as road density, canopy cover, land cover and land use types which were used at various landscape scales. See the 2018 Annual Report for additional information on these data sources.

3.1.2 2020 IPS Update

The IPS is a framework that merges high resolution monitoring data and assessment results with water quality management goals and objectives in order to guide decision-making at regional and local watershed scales. The model is designed to provide accurate quantitative indicators (biological response measures and chemical, habitat and land use stressor measures) and data-driven tools to Watershed groups to guide and inform their restoration and protection efforts. Unlike modelling efforts that tend to focus on a very few parameters, the IPS examines

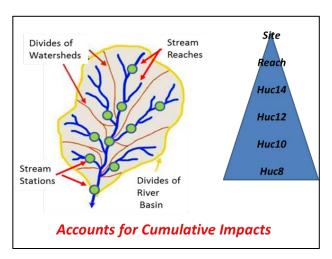
Table 8. Categories of stressor variables with corresponding parameters and indicators used to develop the stress/response relationships as part of the IPS Model development.

IPS Stressor Categories		
Physical habitat	QHEI and metrics, HydroQHEI, Watershed scale habitat	
Nutrients	TP, Nitrate, Max DO, DO Flux	
Organic Enrichment	DO, BOD, Total Ammonia, TKN	
Dissolved Materials	Chloride, Sulfate, Conductivity, TDS	
Suspended Materials	TSS, VSS, Turbidity	
Water Column Toxics	Metals, Organics	
Sediment Contaminants	PAH's, Metals, PCB's	
Catchment Land use	Impervious surface, Developed land uses, Road density	
Buffer Land use	Impervious surfaces, Developed land use, Road density	

many stressor variables including habitat and land use variables; thus, it provides a comprehensive view of the factors potentially limiting aquatic life.

The IPS Model includes analyses about the effects that chemical and physical variables have on the measured and potential condition of the biota and water quality at the site, reach, river, and watershed scales (Figure 11). The data used in the analyses was drawn from high resolution datasets collected at the local watershed scale of resolution (e.g., HUC 10-12). These datasets employed combined geometric (stratified-random) and targeted-intensive pollution surveys. This design was employed to determine the status of aquatic life at the same scale at which pollution sources are being managed and regulated within the NE Illinois watersheds. This design supplies the empirical data for resolving WQS attainability issues ahead of determining the extent and severity of WQS impairments. Importantly, compared to spatially less intense sampling designs, it provides data that can also address the influence of cumulative impacts on biological condition.

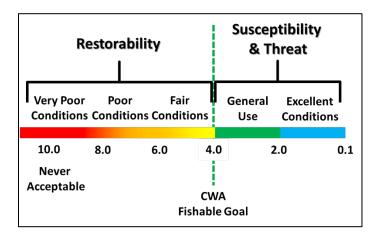
Figure 11. The fundamental role of spatial scale in the density and positioning of monitoring sites at the site, reach, and watershed levels for paired biological, physical, and habitat data used in the development of the IPS Model.



Like the original IPS, the updated model generates a Restorability Ranking for impaired sites, reaches, and watersheds and relates them to the primary limiting factors associated with impaired biota. This can then be used to design and prioritize where restoration actions are likely to be the most successful and support choosing the most appropriate restoration actions. The updated model also provides guidance on protecting high quality sites, reaches, and watersheds from further degradation.

Critically, the datasets for DuPage, Salt Creek, and the Upper Des Plaines consist of standardized "paired data". These data are comprised of biological indicator data (species, taxa, and IBI) that are spatially and temporally congruent with detailed habitat and water chemistry data. This allows for the development of more accurate and complete stressor relationships between the biological (i.e., the response) and the stressor data critical to determining the extent and severity of stream and river impairments and for developing stressor thresholds. Paired data from the IEPA/IDNR was also used to supplement the stressor analysis to increase the breadth of the stressor gradient (e.g., increased high quality sites) at a wider geographical scale.

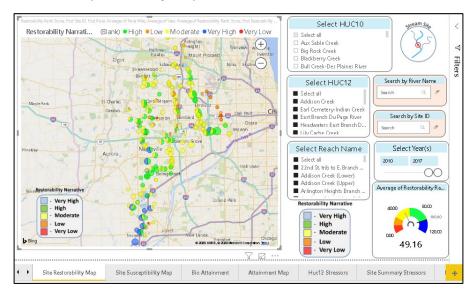
Figure 12. Schematic diagram of the 0-10 common scale for measuring condition and scaling stressors relative to the Illinois General aquatic life use and a narrative scale of quality and the relationship between restorability, susceptibility and threat.



For high quality sites that currently meet or exceed conditions considered to be in attainment, the updated IPS produces a Susceptibility and Threat ranking that can be used to develop protective actions for streams and their watersheds aimed at minimizing and eliminating the impact of increased or new stressors. Thus, measurement of biological condition and stressor conditions are used in a consistent and comparable manner that provides measures of restorability, susceptibility and threat (Figure 12).

Projects implemented under the original model pre- and post-project monitoring was used to establish the baseline, clarify stress/response relationships, evaluate and predict impacts, identify restoration actions, and improve the design of future actions based on the empirical testing of the methodology (adaptive management). The

Figure 13. Example page from the NE IL IPS illustrating the use of maps, tables, and charts to provide data for exploration in NE IL.



outputs provided by the IPS can be used for an array of watershed management applications and programs, regulatory and non-regulatory alike.

The first iteration of the IPS in 2010 was originally supported in Excel, but the inherent data and information storage and calculation demands made it difficult to maintain and also make it readily available to a wide spectrum of users. Without a mapping function and graphical interface, the original IPS was difficult to use. The updated version is housed in Microsoft Power BI. Power BI is a more promising analytics solution that is easy to develop (inward and outward facing dashboards of data, indicators, maps, graphs, photos, etc.) while making the underlying data and information readily available (Figure 13). Users can "drill down" from tools and indicators to the underlying data at the site level. Most importantly Power BI does not limit uses of the data to only the Power BI platform. Power BI allows users to export data and information from visualization tools (e.g., charts, tables, and maps) as summarized or from underlying data. Power BI is available free for the desktop version or for a fee with the advanced versions.

3.1.3 Key Steps in the IPS Methodology

Building a Comprehensive Watershed Database

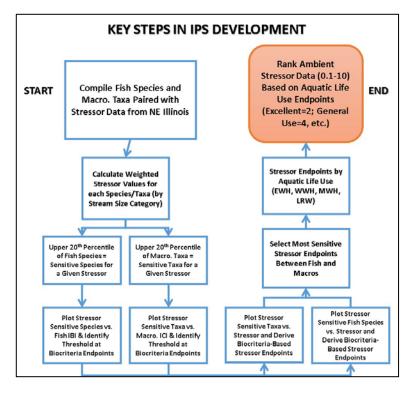
The paired datasets from the DRSCW, LDRWC, and DRWW, along with basin assessment datasets from IEPA/IDNR, were used to populate the IPS database. The dataset was complemented with detailed landscape data on canopy coverage, transportation surfaces, imperviousness and land use types. This produces an informative database that can be queried at the watershed, reach, and site-specific scales by various users who are focused on specific

water quality management issues. The watershed monitoring supported by the watershed groups is the first step towards an IPS framework (Figure 14) and was initiated first by the DRSCW in 2006 and then followed by the LDRWC in 2012 and DRWW in 2016. Two new groups, the North Branch Chicago River Watershed Workgroup (NBWW) and the Lower Des Plaines Watershed Group (LDWG) will also be incorporated in to the IPS framework in 2020 and beyond.

Causal Analysis

The initial identification of stressors associated with measured biological impairments relied on the combined use of the Illinois WQS, available regional analyses of stressor thresholds (not from Illinois), and the 2010 IPS for parameters that did not have criteria in the IL WQS. Water quality criteria are typically reliant on laboratory toxicity testing results for a wide enough range of species to develop protective criteria that are usually applied statewide. However, the effects of pollutants can vary by waterbody based on the sensitivity of the species that actually inhabit said waters. Also, water quality criteria

Figure 14. The key steps in the development of the IPS that initiate with the development of stressor relationships and indexing them to a common scale linked to narrative quality descriptions (excellent, good, fair, poor, and very poor



either simply do not exist for a wide range of stressors that are included in the IPS analyses or they have become outdated. It is therefore vital to account for the species likely to be resident in categories of waterbodies and effects from unaccounted for stressors to ensure that criteria or thresholds are protective but not exaggerated.

For many of the parameters that do not have aquatic life criteria (e.g., nutrients, habitat, bedded sediments, ionic strength parameters), application of a National or even statewide benchmark could likewise be either over or under protective of the aquatic resource. These are mostly "naturally occurring" constituents that may have optimum levels at sites, but when elevated (e.g., chloride) or depressed (e.g., habitat) can lead to aquatic life impairments. For such parameters, regionally derived thresholds can better account for differences among

stream and river typology (e.g., watershed size, gradient) and provide more robust thresholds than ones derived at too large a spatial scale (e.g., National, statewide) and that might not be appropriate for NE Illinois streams and rivers. The derivation of NE IL IPS thresholds reflects a modernization in linking biological impairments to causes and sources (Figure 14).

Following the identification of an impairment, the model helps to identify the responsible causes and sources. Adequate stressor analyses are important, in part due to the high costs of the traditional POTW/SSO and stormwater remediation solutions and the failure to account for ecological impacts. Rather than a stressor by stressor approach the IPS model uses a weight-of-evidence approach where multiple types of data (e.g., biological responses, water quality criteria or other benchmarks, habitat data, land use, etc.,) are used in a "stressor identification" process (SI) to identify associated causes/sources and their relative contributions to the

Table 9. Illinois fIBI and mIBI thresholds and ranges for each of the five narrative categories at which stressor thresholds were set using the WSV and stressor sensitive species approach.

Narrative	fIBI	mIBI
Excellent	<u>></u> 50	<u>></u> 73.0
Good (Attains General Use)	41.0-49.9	41.8-72.9
Fair	30.0-40.9	30.0-41.7
Poor	15.1-29.9	15.1-29.9
Very Poor	<u>≤</u> 15.0	<u><</u> 15.0

observed impairment.

The fIBI and mIBI are the key integrated multimeric indices that Illinois uses to measure attainment and non-attainment of aquatic life uses. These indices are designed to integrate the effects of all stressors, partly by having individual metrics that may respond along different parts of the stressor gradient or to different categories of stress (habitat, toxics, nutrients, dissolved solids, etc.).

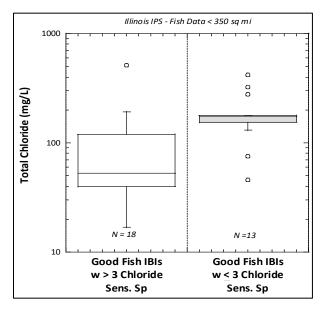
While the fish IBI and macroinvertebrate IBI have a

strong general relationship with aggregate stressors they are not the most discriminating way for gauging the most sensitive assemblage responses to specific stressors. To remedy this the IPS Model first identified suites of stressor sensitive fish species and macroinvertebrate taxa for individual stressors using ambient field data to calculate Weighted Stressor Values (WSVs, i.e., average stressor values weighted by the abundance of taxa or species) as more accurate measures of sensitivity. When ranked these yield Sensitive Species Distributions (SSD) which were, in turn, linked back to the fIBI or mIBI thresholds for each of five narrative categories (Table 9). The relationship between the results of the SSD and linkage back to the fIBI for chloride is illustrated in Figure 15. These thresholds are then used for conducting causal analyses as part of a watershed assessment (Figure 16).

A traditional toxicity-based water quality criterion is assumed to protect ~95 percent of the species in an assemblage. The IPS approach is designed to protect the species needed to support the Illinois General Use for aquatic life use and adding thresholds that are representative of the highest quality sites ("excellent" narrative category) and thresholds that

represent increasing departures from the General Use or good threshold. This provides a framework by which both attainment and impairment can be framed beyond a binary "pass-fail" assessment to a tiered approach. Other added advantages of this approach is that it controls for other conditions that commonly occur in the environment (e.g., temperature, other pollutants, etc.) and that many of the parameters most limiting to aguatic life today do not have water quality criteria (e.g., nutrients) or which are non-toxic in their mode of effect (bedded sediments, siltation, habitat, altered flow regime). This approach combines the strength of integrating multimetric indices (fIBI, mIBI) and species/taxa

Figure 15. Box-and-whisker plot showing the relationship between chloride sensitive fish species and the fIBI.

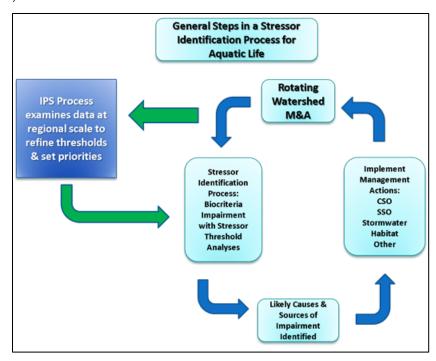


stressor-sensitivity inherent to a species-based SSD approach. It can also deal with the concept of use attainability that can be obscured by a binary framework and an identification of "excellent" or high-quality waters that may need greater levels of protection to maintain.

Least impacted reference conditions were the basis for deriving the IL General Use Fish IBI and macroinvertebrate mIBI thresholds. However least impacted reference sites may include some level of stress so the General Use stressor thresholds were controlled by defining stressor levels at the 75th percentile of the stressor levels at sites that achieve General Use IBI scores and have greater than the 25th percentile stressor-specific sensitive species/taxa associated with these sites. As was illustrated for chloride (Figure 6) this can account for situations where elevated chlorides may exist at sites with good fIBIs (and likely threaten the fIBI), but limit populations of chloride sensitive fish species. It can therefore offer a "safety factor" beyond the fIBI alone.

A key aspect of derivation of IPS thresholds is the ability to distinguish variables likely to be stronger causal stressors from ones that have less serious threshold exceedances and not likely responsible for an observed biological impairment. The IPS model accounted for varying strength of causal effects between stressors by calculating a strength of fit measure (FIT) between stressors and sensitive fish and/or macroinvertebrate taxa and conducting multivariate statistical analyses (random forest models) that provide inferences into the most important causal variables. These analyses were used to weight the IPS model assessment of responsible stressors. The results in the IPS model are designed to support the assignment of causes and sources of stressors at the site, reach, and watershed scales. Identification of

Figure 16. The key steps in a stressor identification process for aquatic life based on the implementation of a systematic approach to monitoring and assessment and a rotating watershed approach and its relationship to an IPS framework.



sources relies on strong local knowledge that lies with active watershed managers.

Additionally, the IPS model will grow more powerful over time as continued monitoring on a rotating watershed cycle provides feedback for the IPS model (Figure 16). Future monitoring efforts in NE IL will also add missing elements such as benthic chlorophyll, continuous D.O., more sediment PAH data in higher quality sites, and new generation pollutants that will allow for the refinement of the stressor analyses. Implementation of habitat restoration and other abatement actions should provide

some "un-layering" of complex multiple stressor impacts that may reveal other underlying stressor impacts.

3.1.4 Next Steps in IPS Modeling

The consortium of watershed workgroups is currently completing the following steps:

- Reviewing and testing the Power BI database and interface;
- Reviewing the results and editing the user manual and model narrative;
- Incorporating final results into ongoing program (NIP, physical projects, permit planning); and
- Generation of an updated list of priority projects.

3.2 QUAL2Kw Updates for East Branch and Salt Creek

- Special Condition Listed Completion Date December 2023
- Status On-going. The East Branch DuPage River and Salt Creek QUAL2Kw models are expected to be completed in 2020. The West Branch DuPage River and Lower DuPage River are scheduled for 2021. Model scenarios for all four (4) models will be also be completed in 2021.

The DRSCW budgeted \$183,000 for this effort and anticipates expenditures in 2019-2021. Additionally, the LDWRC has budgeted \$68,000 for this effort and anticipates expenditures in 2020-2021. Note: The Special Condition Permit language only requires the update of the existing QUAL2K models for Salt Creek and the East Branch DuPage River. The DRSCW and LDRWC have decided to pursue similar models for the West Branch DuPage River and Lower DuPage River to assist with the development of the NIP.

3.2.1 Data Collection

3.2.1.1 Continuous Dissolved Oxygen (DO) Sonde Network

In 2019, the DRSCW gathered continuous DO data via water quality sondes at three (3) sites on Salt Creek, five (5) sites on the East Branch DuPage River, and four (4) sites on the West Branch DuPage River that will be utilized in the calibration and verification of the updated QUAL2Kw models. The Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) also monitors two (2) additional locations on Salt Creek. Additionally, in 2019, the LDWRC maintained a sonde network of five (5) sondes on the Lower DuPage River. All sondes are deployed from May through October and collected DO, temperature, conductivity, and pH on an hourly basis.

3.2.1.2 Expanded Dissolved Oxygen Monitoring Program

As a means to collect additional data to support the calibration/validation of the QUAL2Kw models and to support the development of the NIP, in 2019, the DRSCW and LDWRC began their expanded DO Monitoring Program. This program is coordinated with the Bioassessment Program (see Table 10 for schedule). Sites sampled in the East Branch DuPage in 2019 are included in Table 11. It should be noted that four (4) sites in the East Branch DuPage River watershed were not able to be sampled due to high flows during the 2019 sampling period (EB07, EB30, EB31 and EB41). Sites in the other basins will be identified prior to the start of sampling for their designated year.

Table 10. Schedule for Expanded DO Monitoring

Basin	Expanded DO Monitoring Date
East Branch DuPage River	2019
West Branch DuPage River	2020
Salt Creek	2021
Lower DuPage River	2021

Table 11. Sites Monitored as Part of the Expanded DO Monitoring Program

Site Code	Site Name/Description	Latitude	Longitude
EB07	St Joseph Creek upstream of St Joseph Creek Road	-88.066105	41.799053
EB21	East Branch DuPage River behind Willowlake Apartments	-88.048586	41.898823
EB25	East Branch DuPage River upstream at Brookdale Road	-88.060411	41.93661
EB29	East Branch DuPage River at Sunnyside Park, Bloomingdale (upstream conditions)	-88.062479	41.941631
EB30	East Branch DuPage River 400 feet west of Valley Road	-88.042741	41.844856
EB31	East Branch upstream of Short Street	-88.079133	41.793944
EB33	East Branch DuPage River upstream of Pedestrian Bridge in the Green Valley FP	-88.067816	41.736857
EB34	East Branch DuPage River at Historic Trout Farm Park	-88.088376	41.712035
EB41	East Branch DuPage River downstream of Weber Road	-88.12797	41.7109

The sampling period for the Expanded DO Monitoring Project is late-June to the end of August in dry and low flow conditions (no rain a minimum of 72 hours prior to sampling). At each site, a sonde will be deployed for a minimum of 72 hours. Continuously monitored parameters include dissolved oxygen, temperature, pH, conductivity, turbidity, and chlorophyll A. The sondes will be placed in the thawab of the channel. The sondes will be set to record at 15-minute increments over the deployment period with their internal data-loggers. Composite water quality samples and sestonic algae sampling will be collected twice during the sonde deployment using sampling technique described in the IEPA Standard Operating Procedure for Stream Water Quality Sample Monitoring (DCN184). Samples will be analyzed for the constituents listed in Table 12. One (1) benthic algae sample will be collected at each site.

Table 12. Parameters Included in Expanded DO Monitoring Program

Parameter	Abbreviation	Frequency
5 Day Biological Oxygen Demand	BOD5	Twice per sampling period
5 Day Carbonaceous Biological	CBOD5	
Oxygen Demand		
Total Suspended Solids	TSS	
Volatile Suspended Solids	VSS	
Total Dissolved Solids	TDS	
Chloride	Chloride	
Conductivity	Cond.	
Total Organic Carbon	TOC	
Total Dissolved Carbon	TDC	
Ammonia	NH3	
Nitrite	NO2	
Nitrate	NO3	
Total Kjeldahl Nitrogen	TKN	
Total Phosphorus	TP	
Orthophosphate	Ortho-P	
Total Dissolved Phosphorus	TDP	
Chlorophyll A (sestonic)	Chol A	
Chlorophyll A (benthic)	Chl A (benthic)	Once Per Sampling Period

3.2.2 QUAL2Kw Modeling

In November 2019, the DRSCW and LDWRC entered into contract with Tetra Tech to update the existing QUAL2K models for the East Branch DuPage River and Salt Creek and to prepare water quality models for the West Branch DuPage River and the Lower DuPage River. The water quality model selected for all four (4) watersheds QUAL2Kw. The suite of QUAL models (most recently QUAL2K and QUAL2Kw) are a well-established modeling framework that is appropriate for steady-state (with diel variability) representation of critical condition DO and algal responses in flowing streams and run-of-river impoundments. The QUAL2Kw model improves upon the QUAL2K model in several ways, such as including hyporheic and surface transient storage zones and kinetics, variable options related to simulating sediment diagenesis, enhanced phytoplankton and bottom algae simulation and parameterization, options for a continuous dynamic modeling periods, and the built-in feature for automatic calibration using a genetic algorithm for parameter optimization 1. However, unlike QUAL2K, QUAL2Kw does not allow for multiple headwaters or branching, Transitioning an existing steady state QUAL2K model into the dynamic continuous QUAL2Kw environment would allow for more accurate simulation of existing conditions through the DuPage River and Salt Creek watersheds.

The scope of work for the water quality modeling and work conducted in 2019 is detailed below.

Task 1: Review of Existing and Identification of Data Needs

Publicly available data, information, and reports will be utilized for this project where applicable. This includes a suite of DRSCW/LDRWC data and reports, and IEPA TMDL reports. Additional information such as the original QUAL2K models, locations of flow and water quality monitoring sites, POTW discharges, and NPDES permit information will be used for model development as well. Other relevant data and information that may be used to enhance these modeling efforts may include remote sensing Light Detection and Ranging (LiDAR) data, regional groundwater reports, and regional watershed modeling efforts which may inform model setup and parameterization.

A review of all existing data and reports will be conducted. A crosswalk between QUAL2Kw inputs and available datasets will be generated. Potential data gaps and/or additional data needs will be identified and summarized in a memorandum. Included in this existing data review will be a thorough evaluation of existing model parameterization and whether simulated rates and kinetics fall within realistic parameter ranges or if there are resources available to better fine-tune this parameterization. Any additional publicly available data that may be utilized will be identified and assembled for model development.

Task 1 is on-going. Task 1 will be completed for the East Branch DuPage River and Salt Creek watersheds in 2020 and the West Branch DuPage River and Lower DuPage River watersheds in 2021.

Task 2A: Model Re-Calibration/Re-Validation for Salt Creek and East Branch DuPage Rivers

The existing QUAL2K models for Salt Creek and East Branch DuPage River will be updated and recalibrated in QUAL2Kw using the best available data. The updated QUAL2Kw models will be setup for dynamic continuous modeling periods based on the best available data across all model extents. The existing QUAL2K models have specific weaknesses that will be addressed, including the lack of instream nutrient calibration and validation, over-prediction of water temperature, and general over-prediction of DO concentrations. Dynamic continuous model simulation for these reaches will allow for a more robust representation of ambient warm weather stream conditions and will provide a better linkage between stressors and instream response variables. Both models will be recalibrated and revalidated based on the best available data related to hydraulics, physical channel properties, and water chemistry. The recalibrations will include model parameter adjustment where technically appropriate to improve these simulations. To the extent possible, recalibration will involve seeking the lowest possible relative error statistics between observed and simulated data.

Task 2 is on-going for the East Branch DuPage River model. Task 2 will be completed for the East Branch DuPage River and Salt Creek watersheds in 2020.

<u>Task 2B: Model Development, Calibration, and Validation for West Branch DuPage River and Lower DuPage River</u>

QUAL2Kw models will be developed, calibrated, and validated for the West Branch DuPage River and Lower DuPage River using existing data. QUAL2Kw model calibration and validation will include model parameter adjustment as technically appropriate. Both models will be calibrated and validated based on the best available data related to hydraulics, physical channel properties, and water chemistry. To the extent possible, recalibration will involve seeking the lowest possible relative error statistics between observed and simulated data and will employ the QUAL2Kw autocalibration feature as-needed to optimize model performance relative to a realistic range of parameter inputs.

Upstream model segments will be linked together for the Lower DuPage River by using model outputs from upstream QUAL2Kw simulation extents as inputs to the Lower QUAL2Kw mainstem model.

Task 2 will begin for the West Branch DuPage River and Lower DuPage River watersheds in 2021.

Task 3: Sensitivity Analysis

Uncertainty and sensitivity analyses will be conducted on all four (4) QUAL2Kw models using the add-in Monte Carlo simulation capability (YASAIw) which is publicly-available through the Washington Department of Ecology website and developed as a modification of the original YASAI add-in developed by Rutgers University. YASAIw will be used to identify which parameters have the greatest impact on key model calibration metrics such as DO, temperature, and nutrients. YASAIw will also be used to perform uncertainty analyses associated with water quality parameters and associated coefficients. The uncertainty analyses will provide histograms and probability density functions for each output variable. Key sensitive parameters with high uncertainty due to data availability and/or quality will be identified and may help pinpoint critical data and knowledge gaps. The sensitivity analysis will also provide information on the precision and levels of uncertainty present in the calibrated models, which are important input to decisionmakers.

Task 3 will be completed for the East Branch DuPage River and Salt Creek watersheds in 2020 and the West Branch DuPage River and Lower DuPage River watersheds in 2021.

Task 4: Model Scenarios

Using the refined and newly developed calibrated QUAL2Kw models, a scenario will be developed and/or refined to represent critical summer conditions (e.g., 7Q10 low flow conditions that occur during the dynamic continuous modeling period or other critical conditions to be determined in collaboration with DRSCW/LDRWC). The critical summer conditions simulation will serve as a baseline for evaluating potential management scenarios.

At least five (5) potential management scenarios will be modeled for each simulated reach related to nutrient load reductions, instream improvement projects, and potential dam modifications to improve water quality. DRSCW/LDRWC and Tetra Tech will work together through conference call brainstorming sessions to identify and select preferred management scenarios based on the results of previous tasks and prior modeling work within these watersheds. Options for the suite of management scenarios will be documented by Tetra Tech in a memorandum that includes level of effort estimates to help identify which scenarios are most appropriate and applicable to run.

Scenario results will be presented in a model application report including both tabular and graphic representation of all key instream water quality results. This model application report will be presented in a report which summarizes all work completed under Tasks 1-4.

Task 4 will be completed for all four (4) watersheds in 2021.

3.3 NPS Phosphorus Feasibility Analysis

- Special Condition Listed Completion Date December 2021
- Status In planning

The DRSCW budgeted \$183,610 for this effort and anticipates the majority of the expenditures in 2020-2021.

3.3.1 Consultant Roundtable

On July 24, 2018, the DRSCW held a consultant roundtable to discuss modeling and assessment options for nonpoint source pollution. Ten experts representing six consulting firms attended. Firms represented included Baxter and Woodman, Christopher Burke Engineering, Geosyntec Consultants, Hey and Associates, Strand Associates, and TetraTech. The 2-hour roundtable included discussions on the pros and cons of various nonpoint source and hydraulic/hydrologic models, siting and assessment of best management practices (BMPs), and identification of potential data gaps including chlorophyll A data that the DRSCW should consider addressing prior to any modeling efforts. The DRSCW will use information and guidance received at the roundtable as the foundation for their NPS Phosphorus Feasibility Analysis efforts in 2020.

3.3.2 Evaluation of Leaf Removal as a Means to Reduce Nutrient Concentrations and Loads in Urban Stormwater

In 2016, the DRSCW was a fiscal sponsor of work being conducted by William Selbig with the United States Geological Survey (USGS). The work was investigating use of leaf collection and street cleaning program as a means of reducing total and dissolved phosphorus and nitrogen in urban storm runoff in Madison, Wisconsin.

Results of the study indicated that loads of total and dissolved phosphorus were reduced by 84 and 83% (p < 0.05), and total and dissolved nitrogen by 74 and 71% (p < 0.05) with an active leaf removal program. Without leaf removal, 56% of the annual total phosphorus yield (winter excluded) was due to leaf litter in the fall compared to 16% with leaf removal. Despite significant reductions in load, total nitrogen showed only minor changes in fall yields without and with leaf removal at 19 and 16%, respectively. The majority of nutrient concentrations were in the dissolved fraction making source control through leaf removal one of the few treatment options available to environmental managers when reducing the amount of dissolved nutrients in urban runoff. Subsequently, the efficiency, frequency, and timing of leaf removal and street cleaning are the primary factors to consider when developing a leaf management program.

This research has been published in <u>Science of The Total Environment</u>, <u>Volume 571</u>, 15 November 2016, Pages 124-133

This research is being used by local and state officials to better understand the contribution of phosphorus to urban stormwater from leaf litter and to quantify reductions as a result of leaf collection. In Wisconsin, results of the research have been used to establish statewide phosphorus reduction credits for qualifying cities as a way to achieve phosphorus reduction goals identified in a TMDL.

Given that the USGS study found that leaf removal is one of the few treatment options available for reducing the amount of dissolved nutrients in stormwater, in 2020 the DRSCW/LDWRC will be collecting data on existing leaf litter and street sweeping programs within the DuPage River and Salt Creek watersheds. Using information learned from the USGS research and the DRSCW collected data, a best management fact sheet for leaf litter management will be developed.

3.4 Development of a Basin Wide Nutrient Trading Program

Special Condition 8.c. allows the DRSCW/LDWRC to develop and implement a trading program for the POTWs in the DuPage River and Salt Creek watersheds. The nutrient trading program will

allow for the re-allocation of phosphorus loadings between two or more POTWs in the DuPage River and Salt Creek watersheds as long as the following two conditions are met:

- The trade allocated loadings will not exceed the anticipated loading from the uniform application of the applicable 1.0 mg/L monthly average effluent limitation among the POTW permits in the DRSCW watersheds; and
- The trade allocated loadings also remove DO and offensive condition impairments and meet the applicable dissolved oxygen criteria in 35 IL Adm. Code 302.206 and the narrative offensive aquatic algae criteria in 35 IL Adm. Code 302.203.

Special Condition 8.c. also allows for the implementation of the nutrient trading program within the 10-year permit cycle by allowing the IEPA to modify the NPDES permits if the nutrient trading program meets the criteria detailed above.

In 2017, the DRSCW entered in to a contract with the team of Tetra Tech, Kieser & Associates, Abt Associates, and Earth & Water Group to lead the development of a basin wide nutrient trading program for the DuPage River and Salt Creek watersheds.

Estimated date of completion for the basin wide nutrient trading program is FY 2021-2022. Brief descriptions are described below of the project's original scope of work, the work completed between April 1, 2019 and March 31, 2020 by Task, and recommended modifications to the project's scope to reflect shifting priorities.

Phase I: Determining feasibility/viability of nutrient trading

Task 1: Project Kick-off and Schedule Analysis

This task was completed in 2017 and discussed in the 2017 Annual Report.

Task 2. Develop POTW Data Collection Checklist

This task was completed in 2017 and discussed in the 2017 Annual Report.

Task 3: Analyze and Define Eligibility Criteria

Eligibility criteria determine when, where, and what point and nonpoint sources are allowed to trade through the nutrient trading framework. This task will focus on analyzing and defining eligibility criteria for participating in trading, specifically baselines, geographic trading boundaries, and habitat project eligibility. In 2019-2020, work on eligibility criteria shifted away from point-to-point source trading among WWTPs due to ongoing discussions related to nutrient criteria and permit limits. Instead, this task has focused on the discussions and analysis related to stream restoration credits and equivalency factors, initiated under Task 5 in 2018.

Task 4: Analyze POTW Data and Fill Data Gaps

A memorandum drafted in 2017, documented missing data from that which was collected under Task 2. During 2018, the consultant team and DRSCW/LDRWC determined the reasons behind data gaps and determined how best to obtain that information. The DRSCW was able to acquire the majority of the missing data. In the case where data was not readily available, the consultant team's wastewater engineer cost experts used other valid, relevant data sources. During 2019, very limited work continued under this task, with a focus on wrapping up the analysis. The project team reviewed, revised, and resubmitted the master POTW data spreadsheet in response to a request from DRSCW and submitted a revised task memo in response to Project Committee feedback. Due to on-going discussions related to nutrient criteria and permit limits with IEPA, this task is sufficiently complete at this time until permit negotiations provide clarity on the direction and schedule of potential changes to permit limits.

Task 5: Develop/Analyze POTW Nutrient Reduction Costs

As reported in the 2018 Annual Report, the project team provided a technical memorandum for this task that shows the results of the preliminary supply and demand analysis that signifies that the opportunity for trading exists within and across subwatersheds. A more in-depth analysis of potential supply and demand to determine the number of possible bilateral trades to evaluate the viability of markets remains on hold due to ongoing discussions about nutrient criteria and permit limits.

Task 6: Evaluate PS-NPS and Stream Restoration Trading

As part of the DRSCW and LDRWC's efforts to meet negotiated permit requirements and provide an opportunity to achieve future permitting relief, the watershed workgroups are examining the potential for offsetting nutrient reductions by incentivizing stream restoration projects implemented by the POTWs. These include projects identified by the Identification and Prioritization System (IPS) Model (Section 3.1) that go above and beyond those currently listed in the Special Conditions Paragraph 2 of NPDES permits. The 2018 Annual Report described the preliminary analysis and conceptual approaches to stream restoration crediting efforts, programs, and methodologies used in other watersheds captured by the project team in a technical memorandum. In 2019, this task focused on developing a potential approach and analysis questions for developing a stream restoration crediting equivalency factor that could use DRSCW's IPS tool. Further work on this task remained somewhat on hold as MBI conducted IPS related work for DRSCW that will inform future analysis for this task.

Recommended Scope Modifications for 2020

Based on numerous discussions with DRSCW during 2019, the project team understands that the priority focus is on the development of a stream restoration crediting equivalency factor and approach for the duration of the project. To achieve this priority, the project team recommends modifications to the original Phase II project tasks focused on analyzing and developing appropriate market structures for a broad nutrient trading program.

The following Phase II tasks from the original scope would no longer be a priority at this time:

- Task 7: Develop Market Structure Recommendations
- Task 8: Prepare Nutrient Trading Framework, Guidelines and Templates
- Task 9: Prepare Nutrient Trading Program Final Report

Instead, the project will undertake the following tasks focused on further developing and piloting a stream restoration crediting equivalency factor and approach that maximizes use of DRSCW's IPS tool.

New Task 7. Use IPS Tool to Identify Site-Specific Stream Restoration Projects with Favorable Trade Ratios

The goal of this new task is to use the IPS tool to identify existing stream restoration projects that are most likely to yield favorable trade ratios, and to characterize the degree of confidence associated with these cases. The team will assess the prevalence of projects in the IPS tool where the ecological benefits of stream restoration are known with high confidence and the most favorable trade ratios are likely. This would involve a working session between the project team, MBI, and DRSCW to discuss further IPS tool updates, review relevant IPS components and supporting data, and collaborate on specific steps to conduct a trading scenario assessment. This task will help establish a minimum uncertainty threshold for a high restorability trade ratio.

New Task 8. Use IPS Tool to Identify Projects with Less Favorable Trade Ratios

The objective of this new task is to use the IPS tool to identify a range of existing stream restoration projects for which restoration benefits are less certain and to evaluate the primary reasons for this lower certainty. Less certainty in ecological benefits will have potential implications for less favorable trade ratios. This task will build off of the findings in new Task 7 to determine a minimum uncertainty threshold for this category of projects and assess the level of uncertainty in the context of a trade ratio. As feasible, this task will also assess the cost implications for crediting projects with higher, less favorable trade ratios.

New Task 9. Evaluate Alternative Approaches for Projects with Greatest Uncertainty

The objective of this new task is to evaluate whether there are benefits associated with using a quantitative probability-based Bayesian Network (BN) modeling approach for projects that have the greatest uncertainty using the rank-based system provided by IPS (i.e., projects identified in new Task 8). Implementing this task could result in a larger number of restoration projects with higher confidence in ecological benefits and more favorable trade ratios. The project team would work with DRSCW to determine if building a preliminary BN model for this category of uncertain projects is a worthwhile undertaking for purposes of comparison with Task 8 outcomes.

New Task 10. Estimate Phosphorus Reductions for Evaluated Projects to Improve Trade Ratios The objective of this new task is to improve trade ratios for stream restoration crediting by assessing potential phosphorus reductions associated with projects evaluated in Tasks 7-9. Reductions to be estimated using computational methods for physical project attributes that result in sediment, sediment-bound or soluble-P removal associated with project implementation.

New Task 11. Stream Restoration Crediting Approach Report

This task will summarize the findings and recommendations under Tasks 7-10 and outline an approach for piloting stream restoration crediting. The project team would present the task findings and approach to DRSCW, IEPA, and EAGs for discussion.

3.5 NIP Related Items

3.5.1 Chlorophyll A Sampling

The DRSCW bioassessment program began in 2007 with sampling in the West Branch DuPage River, East Branch DuPage River and Salt Creek watersheds. From 2009-2016, each watershed was sampled on a 3-year rotation beginning with the West Branch DuPage River watershed in 2006. Beginning in 2017, the watersheds will be sampled in a 4-year rotation to allow time for the report writing and program assessment. The LDWRC began in 2012 and is sampled every 3-years.

The DRSCW and LDWRC bioassessment program utilizes standardized biological, chemical, and physical monitoring and assessment techniques employed to meet three major objectives:

- determine the extent to which biological assemblages are impaired (using IEPA guidelines);
- 2) determine the categorical stressors and sources that are associated with those impairments; and,

3) add to the broader databases for the DuPage River and Salt Creek watersheds to track and understand changes through time in response to abatement actions or other influences.

The data collected as part of the bioassessment is processed, evaluated, and synthesized as a biological and water quality assessment of aquatic life use status. The assessments are directly comparable to previously conducted bioassessments such that trends in status can be examined and causes and sources of impairment can be confirmed, amended, or removed. A final report containing a summary of major findings and recommendations for future monitoring, follow-up investigations, and any immediate actions that are needed to resolve readily diagnosed impairments is prepared following each bioassessment. The bioassessment reports are posted on the DRSCW website at http://drscw.org/wp/bioassessment/. Data obtained from the bioassessments are a key source of data for all NIP projects discussed in Chapter 3.

In 2019, the DRSCW expanded its chemical monitoring to include sestonic chlorophyll A sampling beginning with the East Branch DuPage River. In order to support the development of the NIP, chlorophyll A sampling will be sampled as a nutrient parameter for all future bioassessments in the DRSCW and LDRWC watersheds.

ATTACHMENT 1

DRSCW Special Condition

DuPage/Salt Creek Special Condition XX.

- The Permittee shall participate in the DuPage River Salt Creek Workgroup (DRSCW). The
 Permittee shall work with other watershed members of the DRSCW to determine the most cost
 effective means to remove dissolved oxygen (DO) and offensive condition impairments in the
 DRSCW watersheds.
- 2. The Permittee shall ensure that the following projects and activities set out in the DRSCW Implementation Plan (April 16, 2015), are completed (either by the permittee or through the DRSCW) by the schedule dates set forth below; and that the short term objectives are achieved for each by the time frames identified below:

Project Name	Completion Date	Short Term Objectives	Long Term Objectives
Oak Meadows Golf Course dam removal	December 31, 2016	Improve DO	Improve fish passage
Oak Meadows Golf Course stream restoration	December 31. 2017	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi
Fawell Dam Modification	December 31, 2018	Modify dam to allow fish passage	Raise fiBi upstream
Spring Brook Restoration and dam removal	December 31, 2019	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi and fiBi
Fullersburg Woods dam modification concept plan development	December 31, 2016	Identify conceptual plan for dam modification and stream restoration	Build consensus among plan
Fullersburg Woods dam modification	December 31, 2021	Improve DO, improve aquatic habitat (QHEI)	Raise miBi and fiBi
Fullersburg Woods dam modification area stream restoration	December 31, 2022	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi and fiBi
Southern West Branch Physical Enhancement	December 31, 2022	Improve aquatic habitat (QHEI)	Raise miBi and fiBi
Southern East Branch Stream Enhancement	December 31, 2023	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi and fiBi

QUAL 2K East Branch and Salt Creek	December 31, 2023	Collect new baseline data and update model	Quantify improvements in watershed. Identify next round of projects for
NPS Phosphorus Feasibility Analysis	December 31, 2021	Assess NPS performance from reductions leaf litter and street sweeping	Reduce NPS contributions to lowest practical levels

- 3. The Permittee shall participate in implementation of a watershed Chloride Reduction Program, either directly or through the DRSCW. The program shall work to decrease DRSCW watershed public agency chloride application rates used for winter road safety, with the objective of decreasing watershed chloride loading. The Permittee shall submit an annual report on the annual implementation of the program identifying the practices deployed, chloride application rates, estimated reductions achieved, analyses of watershed chloride loads, precipitation, air temperature conditions and relative performance compared to a baseline condition. The report shall be provided to the Agency by March 31 of each year reflecting the Chloride Abatement Program performance for the preceding year (example: 2015-16 winter season report shall be submitted no later than March 31, 2017). The Permittee may work cooperatively with the DRSCW to prepare a single annual progress report that is common among DRSCW permittees.
- 4. The Permittee shall submit an annual progress report on the projects listed in the table of paragraph 2 above to the Agency by March 31 of each year. The report shall include project implementation progress. The Permittee may work cooperatively with the DRSCW to prepare a single annual progress report that is common among DRSCW permittees.
- 5. The Permittee shall develop a written Phosphorus Discharge Optimization Plan. In developing the plan, the Permittee shall evaluate a range of measures for reducing phosphorus discharges from the treatment plant, including possible source reduction measures, operational improvements, and minor low cost facility modifications that will optimize reductions in phosphorus discharges from the wastewater treatment facility. The permittee's evaluation shall include, but not necessarily be limited to, an evaluation of the following optimization measures:
 - a. WWTF influent reduction measures.
 - i. Evaluate the phosphorus reduction potential of users.
 - ii. Determine which sources have the greatest opportunity for reducing phosphorus (e.g., industrial, commercial, institutional, municipal, and others).
 - 1. Determine whether known sources (e.g., restaurant and food preparation) can adopt phosphorus minimization and water conservation plans.
 - 2. Evaluate implementation of local limits on influent sources of excessive phosphorus.

- b. WWTF effluent reduction measures.
 - Reduce phosphorus discharges by optimizing existing treatment processes without causing non-compliance with permit effluent limitations or adversely impacting stream health.
 - 1. Adjust the solids retention time for biological phosphorus removal.
 - 2. Adjust aeration rates to reduce DO and promote biological phosphorus removal.
 - 3. Change aeration settings in plug flow basins by turning off air or mixers at the inlet side of the basin system.
 - 4. Minimize impact on recycle streams by improving aeration within holding tanks.
 - 5. Adjust flow through existing basins to enhance biological nutrient removal.
 - 6. Increase volatile fatty acids for biological phosphorus removal.
- 6. Within 24 months of the effective date of this permit, the Permittee shall finalize the written Phosphorus Discharge Optimization Evaluation Plan and submit it to IEPA. The plan shall include a schedule for implementing all of the evaluated optimization measures that can practically be implemented and include a report that explains the basis for rejecting any measure that was deemed impractical. The schedule for implementing all practical measures shall be no longer than 36 months after the effective date of this permit. The Permittee shall implement the measures set forth in the Phosphorus Discharge Optimization Plan in accordance with the schedule set forth in that Plan. The Permittee shall modify the Plan to address any comments that it receives from IEPA and shall implement the modified plan in accordance with the schedule therein.

Annual progress reports on the optimization of the existing treatment facilities shall be submitted to the Agency by March 31 of each year beginning 24 months from the effective date of the permit.

7. The Permittee shall, within 24 months of the effective date of this permit, complete a feasibility study that evaluates the timeframe, and construction and O & M costs of reducing phosphorus levels in its discharge to a level consistently meeting a limit of 1 mg/L, 0.5 mg/L and 0.1 mg/L utilizing a range of treatment technologies including, but not necessarily limited to, biological phosphorus removal, chemical precipitation, or a combination of the two. The study shall evaluate the construction and O & M costs of the different treatment technologies for these limits on a monthly, seasonal, and annual average basis. For each technology and each phosphorus discharge level evaluated, the study shall also evaluate the amount by which the Permittee's typical household annual sewer rates would increase if the Permittee constructed and operated the specific type of technology to achieve the specific phosphorus discharge level. Within 24 months of the effective date of this Permit, the Permittee shall submit to the Agency and the DRSCW a written report summarizing the results of the study.

- 8. Total phosphorus in the effluent shall be limited as follows:
 - a. If the Permittee will use chemical precipitation to achieve the limit, the effluent limitation shall be 1.0 mg/L on a monthly average basis, effective 10 years after the effective date of this permit unless the Agency approves and reissues or modifies the permit to include an alternate phosphorus reduction program pursuant to paragraph c or d below that is fully implemented within 10 years of the effective date of this permit.
 - b. If the Permittee will primarily use biological phosphorus removal to achieve the limit, the effluent limitation shall be 1.0 mg/L monthly average to be effective 11 years after the effective date of this permit unless the Agency approves and reissues or modifies the permit to include an alternate phosphorus reduction program pursuant to paragraph c or d below that is fully implemented within 11 years of the effective date of this permit.
 - c. The Agency may modify this permit if the DRSCW has developed and implemented a trading program for POTWs in the DRSCW watersheds, providing for reallocation of allowed phosphorus loadings between two or more POTWs in the DRSCW watersheds, that delivers the same results of overall watershed phosphorus point-source reduction and loading anticipated from the uniform application of the applicable 1.0 mg/L monthly average effluent limitation among the POTW permits in the DRSCW watersheds and removes DO and offensive condition impairments and meet the applicable dissolved oxygen criteria in 35 IL Adm. Code 302.206 and the narrative offensive aquatic algae criteria in 35 IL Adm. Code 302.203.
 - d. The Agency may modify this permit if the DRSCW has demonstrated and implemented an alternate means of reducing watershed phosphorus loading to a comparable result within the timeframe of the schedule of this condition and removes DO and offensive condition impairments and meet the applicable dissolved oxygen criteria in 35 IL Adm. Code 302.206 and the narrative offensive aquatic algae criteria in 35 IL Adm. Code 302.203.
- 9. The Permittee shall monitor the wastewater effluent, consistent with the monitoring requirements on Page 2 of this permit, for total phosphorus, dissolved phosphorus, nitrate/nitrite, total Kjeldahl nitrogen (TKN), ammonia, total nitrogen (calculated), alkalinity and temperature at least once a month. The Permittee shall monitor the wastewater influent for total phosphorus and total nitrogen at least once a month. The results shall be submitted on NetDMRs to the Agency unless otherwise specified by the Agency.
- 10. The Permittee shall submit a Nutrient Implementation Plan (NIP) for the DRSCW watersheds that identifies phosphorus input reductions by point source discharges, non-point source discharges and other measures necessary to remove DO and offensive condition impairments and meet the applicable dissolved oxygen criteria in 35 IL Adm. Code 302.206 and the narrative offensive aquatic algae criteria in 35 IL Adm. Code 302.203. The NIP shall also include a schedule for implementation of the phosphorus input reductions and other measures. The Permittee may work cooperatively with the DRSCW to prepare a single NIP that is common among DRSCW permittees. The NIP shall be submitted to the Agency by December 31, 2023.

ATTACHMENT 2

LDRWC Special Conditions

Bolingbrook STP#3 Special Condition XX.

- The Permittee shall participate in the DuPage River Salt Creek Workgroup (DRSCW) and the Lower DuPage River Watershed Coalition (LDRWC). The Permittee shall work with other watershed members of the DRSCW and LDRWC to determine the most cost effective means to remove dissolved oxygen (DO) and offensive condition impairments in the DuPage River Salt Creek watershed.
- 2. The Permittee shall ensure that the following projects and activities set out in the DRSCW and LDRWC Implementation Plan (April 16, 2015), are completed (either by the permittee or through the DRSCW/LDRWC) by the schedule dates set forth below; and that the short term objectives are achieved for each by the time frames identified below. This condition may be modified to include additional projects due to participation in the Lower DuPage River Watershed Coalition.

Project Name	Completion Date	Short Term Objectives	Long Term Objectives
Oak Meadows Golf Course dam removal	December 31, 2016	Improve DO	Improve fish passage
IPS Tool/Project Identification Study	December 31, 2017	Improve DO	Improve fish passage
Oak Meadows Golf Course stream restoration	December 31. 2017	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi
Fawell Dam Modification	December 31, 2018	Modify dam to allow fish passage	Raise fiBi upstream
Hammel Woods Dam removal	December 31, 2019	Improve DO, reduce nuisance algae	Raise miBi and fiBi
Spring Brook Restoration and dam removal	December 31, 2019	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi and fiBi
Fullersburg Woods dam modification concept plan development	December 31, 2016	Identify conceptual plan for dam modification and stream restoration	Build consensus among plan
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Southern West Branch Physical Enhancement	December 31, 2022	Improve aquatic habitat (QHEI)	Raise miBi and fiBi

Southern East Branch Stream Enhancement	December 31, 2023	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi and fiBi
Hammel Woods Dam to 119 th Street in Plainfield Stream Enhancement	December 31, 2023	Improve aquatic habitat (QHEI), reduce inputs of nutrients and sediment	Raise miBi and fiBi
QUAL 2K East Branch and Salt Creek	December 31, 2023	Collect new baseline data and update model	Quantify improvements in watershed. Identify next round of projects for
NPS Phosphorus Feasibility Analysis	December 31, 2021	Assess NPS performance from reductions leaf litter and street sweeping	Reduce NPS contributions to lowest practical levels

- 3. The Permittee shall participate in implementation of a watershed Chloride Reduction Program, either directly or through the DRSCW/LDRWC. The program shall work to decrease DRSCW/LDRWC watershed public agency chloride application rates used for winter road safety, with the objective of decreasing watershed chloride loading. The Permittee shall submit an annual report on the annual implementation of the program identifying the practices deployed, chloride application rates, estimated reductions achieved, analyses of watershed chloride loads, precipitation, air temperature conditions and relative performance compared to a baseline condition. The report shall be provided to the Agency by March 31 of each year reflecting the Chloride Abatement Program performance for the preceding year (example: 2015-16 winter season report shall be submitted no later than March 31, 2017). The Permittee may work cooperatively with the DRSCW/LDRWC to prepare a single annual progress report that is common among DRSCW/LDRWC permittees.
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 - i. Evaluate the phosphorus reduction potential of users.
 - Determine which sources have the greatest opportunity for reducing phosphorus (e.g., industrial, commercial, institutional, municipal, and others).
 - 1. Determine whether known sources (e.g., restaurant and food preparation) can adopt phosphorus minimization and water conservation plans.
 - 2. Evaluate implementation of local limits on influent sources of excessive phosphorus.
- b. WWTF effluent reduction measures.
 - Reduce phosphorus discharges by optimizing existing treatment processes without causing non-compliance with permit effluent limitations or adversely impacting stream health.
 - 1. Adjust the solids retention time for biological phosphorus removal.
 - 2. Adjust aeration rates to reduce DO and promote biological phosphorus removal.
 - 3. Change aeration settings in plug flow basins by turning off air or mixers at the inlet side of the basin system.
 - 4. Minimize impact on recycle streams by improving aeration within holding tanks.
 - 5. Adjust flow through existing basins to enhance biological nutrient removal.
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- 6. Within 24 months of the effective date of this permit, the Permittee shall finalize the written Phosphorus Discharge Optimization Evaluation Plan and submit it to IEPA. The plan shall include a schedule for implementing all of the evaluated optimization measures that can practically be implemented and include a report that explains the basis for rejecting any measure that was deemed impractical. The schedule for implementing all practical measures shall be no longer than 36 months after the effective date of this permit. The Permittee shall implement the measures set forth in the Phosphorus Discharge Optimization Plan in accordance with the schedule set forth in that Plan. The Permittee shall modify the Plan to address any comments that it receives from IEPA and shall implement the modified plan in accordance with the schedule therein.

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monthly, seasonal, and annual average basis. For each technology and each phosphorus discharge level evaluated, the study shall also evaluate the amount by which the Permittee's typical household annual sewer rates would increase if the Permittee constructed and operated the specific type of technology to achieve the specific phosphorus discharge level. Within 24 months of the effective date of this Permit, the Permittee shall submit to the Agency and the DRSCW/LDRWC a written report summarizing the results of the study.

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 - d. The Agency may modify this permit if the DRSCW/LDRWC has demonstrated and implemented an alternate means of reducing watershed phosphorus loading to a comparable result within the timeframe of the schedule of this condition and removes DO and offensive condition impairments and meet the applicable dissolved oxygen criteria in 35 IL Adm. Code 302.206 and the narrative offensive aquatic algae criteria in 35 IL Adm. Code 302.203.
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ATTACHMENT 3

Biological and Habitat Assessment of Salt Creek,
The Preserve at Oak Meadows
(DuPage County, IL)
2007-2019





Biological and Habitat Assessment of Salt Creek: The Preserve at Oak Meadows (DuPage County, IL) 2007-19



Report citation:

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Biological and Habitat Assessment of Salt Creek: The Preserve at Oak Meadows 2007-19

DuPage County, Illinois

Technical Report MBI/2020-3-3

March 20, 2020

Prepared for:

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	fails GU poor

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Chris O. Yoder, MBI, served as the report editor and project manager and Matt Sarver was the primary report coordinator. Assistance with data management and analyses was provided by Vickie L. Gordon, Martin J. Knapp, Jack T. Freda, and Blair Prusha of MBI. Database management and advanced data analysis was provided by Edward T. Rankin and Vickie L. Gordon. Field crew leaders were Blair Prusha (macroinvertebrate assemblage) and Matthew A. Sarver (fish assemblage and habitat). Field sampling assistance was provided by Alex Roller-Knapp, Zachariah Alley, and Justin England. Logistical and administrative support at MBI was provided by Allison Boehler and Emily Frechette. Overall the Oak Meadows project management was directed by Stephen McCracken, Director of the DuPage River Salt Creek Workgroup and Watershed Manager, Deanna Doohaluk. We also recognize Preserve at Oak Meadows for assistance provided with the access to sampling sites.

FOREWORD

What is a Biological and Water Quality Survey?

A biological and water quality survey, or "bioassessment", is an interdisciplinary monitoring effort coordinated on a waterbody specific or watershed scale. This may involve a relatively simple setting focusing on one or two small streams, one or two principal stressors, and a handful of sampling sites or a much more complex effort including entire watersheds, multiple and overlapping stressors, and tens of sites. The Preserve at Oak Meadows (aka Oak Meadows) site on Salt Creek has been the subject of a significant instream restoration in addition to having sites positioned upstream and downstream for the larger watershed assessments of 2007, 2010, 2013, and 2016, the latter having only a single site due to the diversion of the mainstem flow into a temporary bypass channel during construction. Four sites were sampled on the intervening years beginning in 2014 and again in 2017, 2018, and 2019 in follow-up to the habitat restoration beginning in 2016. A common focus of all of the bioassessments is with determining the status of the Illinois General Use for aquatic life.

Scope of DRSCW Biological and Water Quality Assessments

The Midwest Biodiversity Institute (MBI) was contracted by the DuPage River Salt Creek Workgroup (DRSCW) in 2006 to develop a Biological and Water Quality Monitoring and Assessment Plan for West and Each Branches of the DuPage River within DuPage County and Salt Creek, parts of which are in Cook County. The Lower DuPage River in DuPage and Will Counties was added to the annual rotation in 2012. The Plan was incorporated into a Quality Assurance Project Plan (QAPP; DRSCW 2006) that was submitted to and approved by Illinois EPA. The spatial sampling design consists of an intensive pollution survey and geometric allocation of sites. This design was employed to fulfill multiple goals and objectives by determining the existing status of the biological assemblages and relationships to chemical, physical, and biological stressors. Targeted sites were positioned upstream and downstream from major discharges, other sources of potential pollution releases and contamination, and major tributaries to provide a "pollution profile" of the major mainstem streams and rivers. Sampling locations in the smaller tributaries were allocated by a geometric progression (i.e., panels) of drainage area to a "resolution" of 0.5-1.0 square miles. The major program objectives include:

- 1. Determine the aquatic life status of each sampling location in quantitative terms, i.e., not only if a waterbody is impaired, but the spatial extent and severity of the impairment and the respective departures from established criteria;
- 2. Determine the proximate stressors that correspond to observed impairments for the purpose of targeting appropriate management actions to those stressors; and,

3. Screen for any potential issues with use attainability.

To meet these objectives data was collected with methods that provide high quality results and in conformance with the practices of Illinois EPA (IEPA 2010a,b; 2011a-g; 2014a,b) and Illinois DNR (2010a,b) under a project QAPP approved by IEPA (DRSCW 2006).

Scope of the Salt Creek Preserve at Oak Meadows Assessment

Salt Creek flows 42.2 miles from western Cook County through DuPage County to its confluence with the Des Plaines River in southern Cook County. The Preserve at Oak Meadows occupies 1.2 miles of Salt Creek between river mile (RM) 22.3 and 23.5 near Addison, IL. Originally built in 1920 as a private country club, the golf course was purchased in 1985 by the Forest Preserve District of DuPage County (FPDDC) and renamed the Oak Meadows Golf Course (Whitten 2017). Constant spring flooding made several holes unplayable thus a renovation of the golf course in addition to the restoration of stream habitat in Salt Creek commenced in 2016. After completion of the project the Oak Meadows Golf Course became the 288 acre Preserve at Oak Meadows. Salt Creek is considered to be an impaired water by the Illinois EPA and a Total Maximum Daily Load (TMDL) was developed for copper, phosphorus, chloride, conductivity, and dissolved oxygen (D.O.). The TMDL recommended that D.O. concentrations are not to descend below 5.0 mg/L at any time or not below 6.0 mg/L for more than 16 hours in any 24



Figure 1. The FPDDC dam at RM 22.7 was removed in 2016 as part of the stream habitat restoration project at the Preserve at Oak Meadows.

consecutive hours (CH2M Hill 2004). Low D.O. levels can have negative effects on aquatic communities, limiting diversity through the exclusion of sensitive and intolerant species. The Oak Meadows Dam Removal and Stream Restoration project focused on improving instream habitat and increasing Qualitative Habitat Evaluation Index (QHEI) and the Macroinvertebrate Index of Biological Integrity (mIBI) scores through the addition of gravel

substrates, bank stabilization through bioengineered methods, removal of A-jacks and sheet piling bank stabilization, re-grading of banks, and the removal of a dam (Table 1; Figures 1 and 2; DRSCWG 2020). More than 30 acres of wetlands were installed to help handle flood waters from Salt Creek, trees removed from the golf course during construction were used to provide bank stabilization along outside bends and to provide habitat for fish, riffles were installed with cobble/gravel substrates to increase D.O. and provide better habitat for aquatic macroinvertebrates as well as various fish species (Table 1; DRSCW, 2019).

Table 1. A summary of the restoration subprojects completed at the Preserve at Oak Meadows restoration project in 2016 (from Table A2.1 from DRSCW Oak Meadows Dam Removal and Stream Project Summary). Shaded cells are direct restoration in the stream channel.

Restoration Practice	Units	Notes
Dam Removal	2	Improve D.O. and habitat values in impoundment
A-Jacks Removal	6,175 linear feet	Allow for increased bank habitat values
Sheet Pile Removal	1,190 linear feet	Allow for increased bank habitat values
Soil Lifts Installed	7,530 linear feet	Allow for increased bank habitat values
Bank Protection Fabric	13,740 sq. yds.	Erosion Control
Cobble Installed	9,400 Tons	Increased steam bed habitat values
Boulders Installed	105 Tons	Increased steam bed habitat values
Root Wads Installed	3,765 linear feet	Allow for increased bank habitat values
Riparian Enhancement	42.2 acres	Increased buffer/riparian habitat value
Other Restoration (including wetlands)	103 acres	Increased upland habitat value
Total wetlands (all)	38.2 acres	Increased habitat value

DRSCW and MBI developed a monitoring plan to assess the restoration work conducted by a FPDDC and DRSCW contractor. Biological and habitat data from the previous watershed surveys conducted by MBI in Salt Creek prior to 2016 were used as the pre-restoration condition baseline. Post-restoration biological and habitat sampling added two new sites beginning in late August 2017 and continuing in 2018 and 2019 to assess any trends. The biological sampling and analysis was done in conformance with Illinois EPA methods and conducted by qualified personnel.

STUDY AREA

Salt Creek at the Preserve at Oak Meadows drains 75.1 square miles of western Cook and eastern DuPage Counties, IL. The watershed is highly urbanized consisting mostly of residential communities and with several discharges of municipal wastewater. Spring Brook is the only major tributary to Salt Creek upstream from the Oak Meadows project area. The Wood Dale South Wastewater Treatment Plant (WWTP) is located at RM 23.1 within the restoration footprint, upstream from site SC35 and downstream from site SC34. The Oak Meadows project



Figure 2. The view (south) from the diversion dam at the upstream end of the project (near Elizabeth Drive) prior to flow being reintroduced to the engineered channel. The diversion channel is at the right of the project area. The restored river channel is on the left of the image with exposed gravel runs/beds and graded stream banks still under construction.

area included four biological monitoring sites with a fifth site located upstream at Lionwood Park (SC40) serving as an upstream control site that is typical of Salt Creek water quality and habitat and representative of pre-restoration conditions. One of the two D.O. "sag" points in the Salt Creek mainstem was determined by DRSCW to be caused by the FPDDC dam, which at that time was located at RM 22.7 (SC35A; Figure 2). The renovation construction took place from August 7, 2015 to December 2016 and included the removal of A-jacks, sheet pilings, and the FPDDC dam. Cobble riffles, boulders, woody debris, and root wads were installed in the stream channel during that time (Table 1).

METHODS

Fish, macroinvertebrates and qualitative habitat were sampled in Salt Creek by MBI personnel following IEPA and IDBNR methods. Project specific samples were collected twice for fish and once for macroinvertebrates at four sites (Figure 3) prior to the restoration project. Post-construction samples were collected one time per year for both fish and macroinvertebrates at five sites during the 2017-2019 post-construction follow-up period. Biological assemblages and habitat were sampled during the June 16-October 15 for fish and July 1-September 30 for macroinvertebrates during pre- and post-construction surveys. Elevated flows were avoided.

Habitat Methods

The QHEI (Rankin 1989, 1995; Ohio EPA 2006) was the primary aquatic habitat assessment

MBI



Figure 3. Locations sampled by MBI at the Preserve at Oak Meadows and the control site of SC40 at Lionwood Park. The yellow "pins" denote the sampling locations.

methodology used at each site. The protocol was accomplished as part of the fish assemblage method by the fish crew leader. The QHEI includes six categories of habitat that are important to the aquatic biota with a total scoring range of 0-100. QHEI scores of <a>\text{\geq}60 have generally been regarded as sufficient to support the General Use for aquatic life, while scores <45 indicate substantial deficiencies in habitat that can preclude attainment of the General Use. These rules-ofthumb have been altered by the NE IL IPS analyses (MBI 2020) and the newer thresholds were used herein to assess habitat quality. A QHEI matrix (Rankin 1995) showing the frequency of good and modified attributes was also used to evaluate the overall capacity of the stream habitat to support the General Use biocriteria at each site and to further delineate potential deficiencies in habitat that could be limiting to the aquatic assemblages.

Macroinvertebrate Methods

Macroinvertebrate methods followed the Illinois EPA multi-habitat method (IEPA 2011 a,b) at all sites. The IEPA multi-habitat method involves the selection of a sampling reach that has instream and riparian habitats representative of the assessment reach. Sampling was conducted during summer base flows and sites were absent of highly influential tributary streams, included the presence of one riffle/pool sequence or analog (i.e., run/bend meander or alternate point-bar sequence), and a length of at least 300 feet up to a

maximum distance of 800 feet. Macroinvertebrate collections were made with a D-frame dip net collecting from all available bank and bottom-zone habitat types within the sampling site. Conditions must be conducive to allow for the 11-transect habitat sampling method or to estimate, with reasonable accuracy, via visual or tactile cues, the amount of each of several bottom-zone and bank-zone habitat types. All sites were indexed with GPS coordinates at the beginning and end of sampling reach and site data was recorded on a standard field form. Multi-habitat macroinvertebrate samples were field preserved in 10% formalin and, upon delivery to the MBI lab in Hilliard, OH, the samples were transferred to 70% ethyl alcohol. Laboratory procedures followed the IEPA (2011c) methodology which requires the production of a 300-organism subsample from a gridded tray following an initial scan and pre-pick of large and/or rare taxa. Taxonomic resolution was at the lowest practicable resolution for the common macroinvertebrate assemblage groups such as mayflies, stoneflies, caddisflies,

midges, and crustaceans, which goes beyond the genus level minimum requirement of IEPA (2011d) and which supported certain analyses of the data. Calculation of the macroinvertebrate IBI (mIBI) adhered to the IEPA methodology by collapsing species level identifications to genera as the benchmark level of taxonomic resolution for mIBI scoring.

Fish Assemblage Methods

Fish were collected using an inflatable raft-mounted electrofishing apparatus. Pulsed D.C. current was produced by a Smith-Root 5.0 GPP unit powered by a 5 kW variable output generator. A 15.5 foot Wing raft was powered by a 25 H.P. 2-stroke outboard motor. The electrode array followed design specifications of the Ohio EPA (1989). Sampling distance for boat mounted electrofishing was 0.5 km of lineal shoreline that was intensively sampled through all available habitats in a downstream direction. A three person crew consisting of a fish crew leader and two field technicians conducted the sampling.

Captured fish were placed in an aerated live-well for processing at the end of each site. Samples from each site were processed by enumerating and recording weights of each species on a water resistant, standard field data sheet. The incidence of external anomalies was recorded and followed procedures outlined by Ohio EPA (1996, 2015) and refinements made by Sanders et al. (1999). Fish were released back into the water after they were identified to species, examined for external anomalies, and weighed in either batches or individually. Very early fish life stages (i.e., post-larval) were generally not included in the sample excepting for adults of very small species. All sites were marked with GPS coordinates (beginning, middle, and end of each sampling reach) and data was recorded on a standard field data sheet.

Fish required vouchering for laboratory identification. Vouchers specimens were preserved in a borax buffered 10% formalin solution and labeled by site number, date, and stream. Regional ichthyology keys were used including The Fishes of Illinois (Smith 1979) and updates available through the Illinois Natural History Survey (INHS). Scientific nomenclature followed Page et al. (2013). Vouchers were deposited at the Midwest Biodiversity Institute (MBI) in Hilliard, OH or the Ohio State University Museum of Biodiversity (OSUMB). The data was used to calculate the Illinois Fish Index of Biotic Integrity (fIBI; Smogor 2000, 2005) as the primary assessment of fish assemblage quality and the Modified Index of Well-Being (MIwb; Ohio EPA 1987) in addition to expressions of species richness and relative abundance.

Data Management

All data was managed by MBI in internal databases that permit ready access and analysis. Biological and habitat data is stored in a routine based on the Ohio ECOS format that MBI uses for all biological data management tasks. Biological data analysis included the calculation of the Illinois fish and macroinvertebrate IBIs for determining General Use aquatic life status and the accompanying data attributes to enhance the diagnosis of impairments. Habitat data was analyzed using the QHEI and also via a QHEI attributes matrix to aid in assessing habitat related impairments. Summaries of species/taxa relative abundance and QHEI metrics at each site and by sampling date are provided in Appendices A-C.

RESULTS

Habitat

Habitat scores at the Oak Meadows Project Site were mostly fair during the pre-construction surveys (2007-2014; Table 2) at SC34 and SC35 (SC35A and SC35B were not yet established). Silt or muck substrates, fair to poor development, and a stream channel recovering from channelization were among the consistently 6-8 modified attributes recorded at each site through 2014 (Table 2). The FPDDC dam at river mile 22.7 initially provided irrigation water to the Oak Meadows golf course and resulted in a 4,500 foot impoundment that precluded natural stream habitat feature such as riffles and runs at SC34, SC35 and the subsequently added sites SC35A and SC35B (MBI 2011). Banks were lined with A-jacks and steel sheet piling to prevent bank erosion, which offered poor habitat for aquatic assemblages. The riparian corridor was narrow and segregated from Salt Creek. Instream habitat lacked root wads and root mats, coarse substrates, and riffles such that only 3-5 good attributes were recorded. Fine substrates dominated the substrate and included sand, fine gravel, silt, and muck thus limiting the interstitial spaces between coarser substrates for aquatic organisms to use for cover and feeding. The pre-restoration Oak Meadows project area had elevated ratios of modified: good habitat attributes at each site which included at least one high and multiple moderate influence modified habitat attributes in 2007-14 (Table 2).

Post-restoration QHEI scores were higher at all four sites in the Preserve at Oak Meadows restoration area, but remained fair at the upstream control site (SC40; Table 2). The dam at RM 22.7 was removed to promote higher D.O. concentrations, restore connectivity in Salt Creek, and improve the availability of coarse substrates to aquatic communities and improve channel morphology by removing the impoundment. Artificial bank stabilization structures were also removed, banks were graded to allow Salt Creek to reconnect with the flood plain, the riparian corridor was widened and populated with native vegetation, root wads were installed along outside bends to provide better aquatic habitat and protect against bank erosion, and riffles consisting of coarse materials such as gravels and cobbles provide higher D.O. concentrations and habitat for aquatic communities through increased aeration. Post-restoration, all four sites within the Preserve at Oak Meadows now offer cobble/gravel riffles, deep runs, root wads, boulders and, other than SC35A, good to excellent channel morphology. Fine sediments are no longer the predominant substrates at any of the sites, the constructed riffles have low embeddedness, and the channel has recovered from historic channel modifications (Table 2). The downstream most site (SC35A) still lacks the sinuosity of the upstream sites, deep riffle/run complexes, and it retains moderate to heavy silt cover of the natural substrates. Despite these noted deficiencies at SC35A, the overall post-construction habitat in the Preserve at Oak Meadows is good and fully capable of supporting good quality aquatic assemblages. Postrestoration surveys have recorded no high influence modified attributes, fewer moderate influence modified attributes (3-4 down from 6-8), an increased number of good habitat attributes (7 up from 3-5), and lower modified:good habitat ratios (Table 2) each of which is a distinct indication of improved habitat for aquatic life.

Table 2. Qualitative Habitat Evaluation Index (QHEI) scores showing good and modified Habitat attributes at sites in the Salt Creek Oak Meadow study area from 2007 to 2019.

		Good Habitat Attributes High Influence Modified Attributes														ied			Mod	erat	e Infl	uen	ce M	odifi	ed A	Attrib	utes	3		Rat	tios			
Site ID	River Mile	онеі	No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	"Good" Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	< 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
	Salt Creek Oak Meadow Study Area - 2007																																	
SC40	24.5	64.5											5						0	•	•			•					•	•	•	6	0.00	1.20
SC34	23.5	56.5											5	•					1		•			•					•	•	•	5	0.20	1.20
SC35	23.0	46.5			ш						- 1:		3		•				2		-			•				•	•		•	5	0.67	2.33
2010	10451				Т		_				Salt	Cree		ik M	ead	ow S	Stud	y Ar		2010			П		П						ı			
SC40	24.5	57.8							_				4						0	•	•			•				•	•	•		6	0.00	1.50
SC34	23.5	50.5		-									4		•				1		•			•	•			-	-	•		7	0.25	2.00
SC35	23.0	55.5		_			_	_			C al+	Cree	5	ılı DA	ممط	0144	ام ر 40	Λ <i>-</i> -	0	2011	2			•				_	_	_		6	0.00	1.20
SC40	24.5	61.5									Juil	Cree	5	IK IVI	euu	JW S	otua _.	y Ar	0 - 2	2013												4	0.00	0.00
SC34	23.5	51.0								+			3						1									_	_	_	_	6	0.00	0.80 2.33
SC35	23.0	55.5											4		_				0									_			_	6	0.00	1.50
3033	25.0	33.3									Salt	Cree		ık M	eadi	ow ^e	Stud	v Ar		2014				_									0.00	1.50
SC34	23.5	54.0								T			4		•		1		1		•			•								6	0.25	1.75
SC35	23.0	60.5											5		-				0	•	•			•				•	•	•		6	0.00	1.20
Salt Creek Oak Meadow Study Area - 2017																						3.30												
SC40	24.5	64.5											6						0		•							•	•	•		4	0.00	0.67

Table 2. Qualitative Habitat Evaluation Index (QHEI) scores showing good and modified Habitat attributes at sites in the Salt Creek Oak Meadow study area from 2007 to 2019.

	area ji	om 200	7 10	2019	•									ı																				
			Good Habitat Attributes High Influence Modified Attributes														Moderate Influence Modified Attributes														tios			
Site ID	River Mile	ОНЕІ	No Channelization	Boulder, Cobble, Gravel	Silt Free	Good-Excellent Development	Moderate-High Sinuosity	Moderate-Extensive Cover	Fast Flow w Eddies	Little to No Embeddedness	Max Depth > 40 cm	No Riffle Embeddedness	"Good" Habitat Attributes	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse No Cover	Max Depths <40 cm	High Influence Poor Attributes	Recovering from Channelization	Mod-High Silt Cover	Sand Substrates (Boatable sites)	Hardpan Origin	Fair- Poor Development	Low Sinuosity	≤ 2 Cover Types	Intermittent Flow or Pools <20 cm	No Fast Current Types	Mod-Extensive Embeddedness	Mod-Extensive Riffle Embeddedness	No Riffle	Poor Habitat Attributes	Ratio of Poor (High) to Good	Ratio of Poor (All) to Good
SC34	23.5	67.0											6						0	•	•							•	•	•		5	0.00	0.83
SC35	23.0	69.5											7						0		•								•	•		3	0.00	0.43
SC35B	22.7	71.5											7						0		•							•		•		4	0.00	0.57
											Salt	Cred	ek Od	ık M	ead	ow S	Stud	y Ar	ea - 2	2018	3													
SC40	24.5	58.0											5						0	•	•			•				•	•	•		6	0.00	1.20
SC34	23.5	71.5											7						0		•								•	•		3	0.00	0.43
SC35	23.0	71.5											7						0		•								•	•		3	0.00	0.43
SC35B	22.8	71.5											7						0		•								•	•		3	0.00	0.43
SC35A	22.7	65.5				_							7						0		•			•					•	•		4	0.00	0.57
	T	l									Salt	Cred	ek Od	ık M	ead	ow S	Stud	y Ar	1	201		ı												
SC40	24.5	54.5											5						0	•	•			•			_	•	0	•		6	0.00	1.20
SC34	23.5	71.5				_							7_						0		•							•	•	•		4	0.00	0.57
SC35	23.0	74.0		_		_							7						0		•						_	•	•		\longrightarrow	3	0.00	0.43
SC35B	22.8	72.0				_							7						0		•							•	-		\longrightarrow	3	0.00	0.43
SC35A	22.7	67.5											6						0					•								6	0.00	1.00

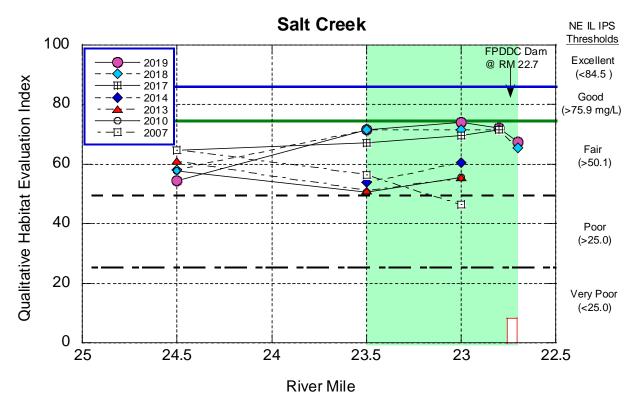


Figure 4. QHEI trends in the Salt Creek/Oak Meadows project area. Years 2007-2014 represent pre-restoration conditions and 2017-2019 represent post-restoration conditions. Green shading is the Preserve at Oak Meadows.

Macroinvertebrate Assemblage

Prior to the low-head dam removal and habitat enhancement efforts in the project area, the Oak Meadows reach of Salt Creek was impounded with sluggish flow and soft bottoms of silt, peat, and muck. Coarse substrates were rare or non-existent and those present were largely artificial and embedded by fine sediments (Figure 1). Dam removal, channel re-engineering, and the introduction of coarse substrates was accomplished in 2016, resulting in a shift in stream habitat from lentic to lotic conditions (i.e., from impounded to free-flowing). This resulted in increased current velocities, habitat heterogeneity, and reductions in fine sediments. Ideally, these efforts should also result in an increase in the diversity and abundance of macroinvertebrate populations associated with the enhanced habitat features. The expectations for fish are presently tempered by comparison given that their ingress to this reach is eliminated by downstream barriers (the Graue Mill and Old Oak Brook at Fullersburg Woods).

Since 2007, two sites in the Oak Meadows preserve (SC34 and SC35) have been surveyed for biological assemblages as part of the DRSCW basin assessment and both were negatively influenced by the aforementioned characteristics of the impoundment. As part of the post-remediation follow up monitoring, two new sites were added in the reconstructed channel (SC35A and SC35B) and sampled annually since 2017. Historic data from SC40, a free-flowing

site located approximately 1.5 miles upstream from the Project Site, was included for comparison as a control site.

In order to evaluate potential changes in macroinvertebrate performance, the occurrence of rheophilic taxa (i.e., taxa that prefer current) and/or taxa that prefer coarse, erosional substrates were parsed from the Salt Creek macroinvertebrate collection records. In order to simplify these trait references the entire group of taxa will be referred to as "rheophilic" in the remainder of the discussion. Comparisons were then made between the control and pre- and post-construction sites. Taxa were selected based on habitat classifications in the literature or professional observations based on 30+ years of stream macroinvertebrate assessment.

Twenty-one (21) rheophilic taxa were identified and used to evaluate for any trends (see Appendix Table B-1). While all of these taxa were found at one or more of the sites, the majority were found only during post-project sampling or from the more riverine SC40 control site. In fact, prior to construction, only eight (8) of the 21 rheophilic taxa were collected from project sites and two (*Stenacron* and *Nectopsyche diarina*) were exclusive to the formerly impounded sites. The net effect is that 13 new rheophilic taxa have appeared post-construction.

A description of the "Rheophilic" indicator taxa are as follows:

1) Three mayfly taxa:

- a) Baetis intercalaris, Baetis flavistriga The "small minnow mayflies" (Family Baetidae) are typically found in riffles and areas of swift current, often on firm, rocky substrates.
- b) Stenacron sp. A facultative genus (Family Heptageneiidae) that is typical of pools and sluggish current, but is included herein because the nymphs are typically found on the undersides of large, unembedded coarse substrates in flowing water.

2) Seven caddisfly taxa:

- a) Cheumatopsyche sp., Ceratopsyche morosa group, Hydropsyche simulans, Hydropsyche bidens or orrisi These filter-feeding larvae (family Hydropsychidae) inhabit riffles and runs where they construct nets and retreats on firm, rocky substrates or large pieces of stable woody debris. The larvae generally require at least minimal current velocities with Cheumatopsyche, a facultative and very common genus, tolerating the slowest current.
- b) Hydroptila sp. The "purse net" caddisfly (Family Hydroptilidae) is found in both lotic and lentic habitats (Wiggins 1996), but was included since it typically anchors its case to pieces of cobble and rubble as it grazes on attached filamentous algae. In the DuPage River/Salt Creek watersheds, cases have also been observed attached to macrophytes (mostly Elodea) which suggests it to be a marginal rheophilic indicator taxa. (Pupae level identifications taken to Family level were lumped with the generic ID for purposes of comparison).
- c) Nectopsyche diarina This "Longhorned Case Maker" caddisfly species is one of the few cited as current dependent (Glover 2004; Floyd 2004). In contrast, most others from the family Leptoceridae are found in lakes, ponds, or pooled areas of rivers and streams.

3) One beetle taxa:

- a) Stenelmis sp. A "riffle beetle" (Family Elmidae) commonly found in riffles and runs on coarse substrates.
- 4) Nine Dipteran (fly) taxa:
 - a) Simulium sp. These filter-feeding blackflies are relatively pollution tolerant, but typically attach themselves to coarse substrates in strong current.
 - b) Chironomidae: Seven rheobiotic midge taxa; Cricotopus (C.) trifascia, Rheocricotopus robacki, Thienemanniella xena, Microtendipes caelum, Polypedilum (Uresipedilum) flavum, and Rheotanytarsus sp. (Simpson and Bode, 1980) and Thienemanniella similis were selected. Among the group, Polypedilum (U.) flavum is considered the weakest indicator of current.
 - c) Hemerodromia sp. The most commonly encountered "dance fly" larvae is typically associated with erosional substrates and found in "the bottoms of swift streams" (Voshell 2002).

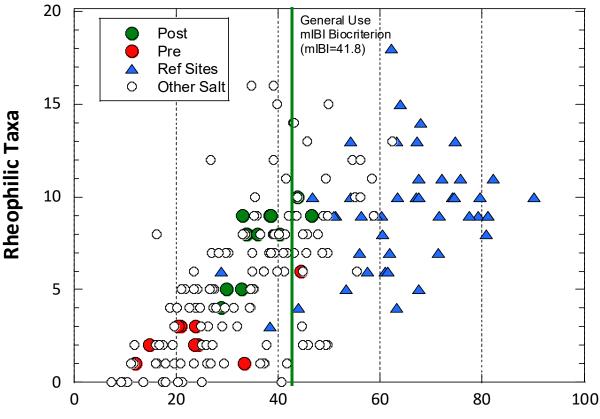
5) One snail taxa:

a) Elimia sp. – The "Pleurocerid" snail is most often found on top of rocky substrates in runs and riffles.

Since dam removal and habitat enhancement efforts were completed in 2016, the presence of rheophilic taxa has increased substantially at the affected Salt Creek sites (Appendix Table B-1). Following construction, taxa richness within the group averaged nearly three (3) times the number found prior to construction (mean 7.8 vs. 2.75). In addition, the highest numbers at each project site were found post-construction. Total taxa richness at the project sites was also highest following construction when compared to pre-dam removal. Both increases coincide with the shift from an impounded to a free-flowing condition and the commensurate habitat enhancements.

The post-remediation increases in the abundance of rheophilic taxa in Salt Creek naturally corresponds with improved macroinvertebrate assemblage performance as measured by the mIBI given that certain metrics are likewise improved. Figure 5 shows the positive relationship between mIBI scores and rheophilic taxa richness in Salt Creek at the control and project sites. The positive trend was also apparent at the Preserve at Oak Meadows project sites following dam removal and habitat enhancement (red vs. green circles). While the trend is not unexpected, it demonstrates the positive relationship between improved stream quality (as reflected by higher mIBI scores) and the physical attributes associated with free-flowing habitats such as shallower depths, increased current speed and habitat diversity, erosional (vs. depositional) substrate types and reduced siltation. Despite these improvements, Salt Creek mIBI scores still tend to fall below reference condition (blue triangles), a possible indication of the greater overall stressors on biological communities in the watershed.

Salt Creek Watershed and IPS Reference Sites



Macroinvertebrate Index of Biotic Integrity (mIBI)

Figure 5. Rheophilic taxa richness and mIBI scores from historical Salt Creek sites (open symbols), NE IL IPS reference sites (blue triangles), and pre (red symbols) and post remediation Oak Meadows sites (green symbols), 2007-2019.

Specific trends in Salt Creek mIBI scores from the project area sites were also plotted in Figure 5. With the exception of 2007, mIBI scores were consistently lower at the pre-construction project sites compared to the upstream control. Following construction (and with the exception of 2007), all mIBI scores were comparatively higher at the project sites. The highest mIBI scores for each project site were also found during the most recent sampling in 2019. Project area scores now routinely meet or exceed the SC40 control and meet the Illinois mIBI biocriterion at all except the SC35 location.

Regarding the control site at SC40, macroinvertebrate quality was much lower in 2016 compared to all other Salt Creek sites in the study reach. The 300 count sample contained only six (6) total taxa composed almost entirely of pollution tolerant sludge worms (Oligochaeta). A specific reason for the decline in 2016 quality is unknown, but the biological signatures point to one or more upstream pollution sources.

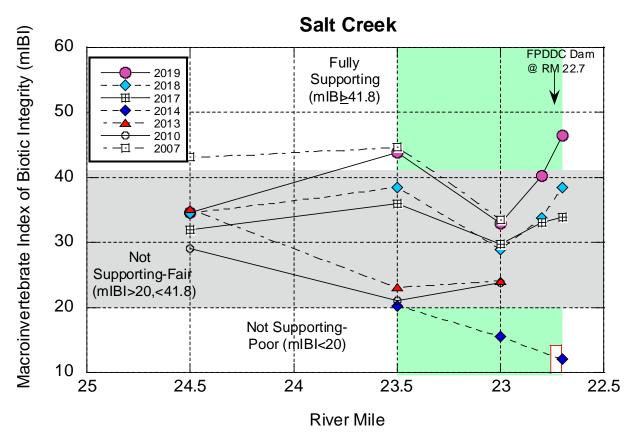


Figure 6. Macroinvertebrate Index of Biotic Integrity (mIBI) trends in the Salt Creek/Oak Meadows project area and the SC40 control at RM 24.5, 2007-2019.

Fish Assemblage

Fish were collected during two passes for the 2007, 2010, 2013, and 2016 watershed surveys while only one pass was conducted for the 2014 pre-construction and 2017-19 postconstruction surveys (Appendix A). The MIwb served as a supplemental assessment tool for assessing the overall quality of the fish assemblages. The MIwb can show improvement or declines in the fish assemblage with little or no accompanying change in fIBI scores (Ohio EPA 2015). The fIBI and MIwb scores for the pre-construction surveys are the average of two samples (Appendix A). Fish sampling was added to the Preserve at Oak Meadows restoration assessment to provide for a full community assessment, i.e., attainment of the General Use for aquatic life being based on both assemblages. Initially sampled in 2014 for only macroinvertebrates, fish were added at site SC35B in 2017 as the initial attempt to sample site SC35A (RM 22.7) was precluded by the failure of the electrofishing gear which resulted in an incomplete sample. Both SC35A and SC35B were sampled for fish in 2018 and 2019 (Table 3). Site SC40 was used as a control site that was indicative of Salt Creek riverine habitat conditions by offering a riffle, run, and pool complex, but with substrates comprised of sand and fine gravel as the predominant substrates. This site is also impacted by upstream pollution sources both point and nonpoint source in origin.

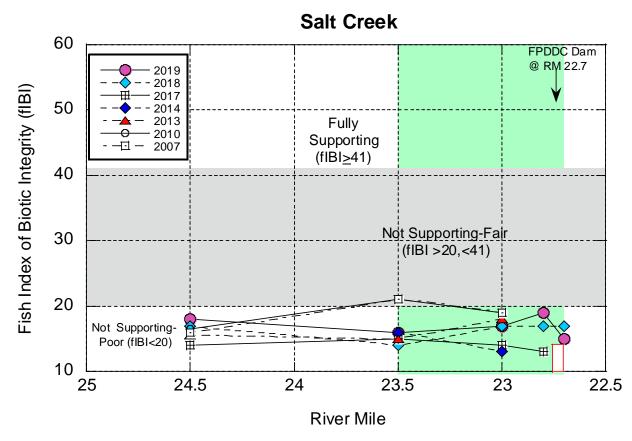


Figure 7. The number of fish species collected at each site in the Salt Creek/Oak Meadows project area including the control site (SC40 at RM 24.5). Green shaded area is the Preserve at Oak Meadows.

Oak Meadows pre-construction fIBI scores were generally poor and failed to meet the IEPA General Use biocriterion. The 2007 survey produced the highest fIBI score in the Oak Meadows project area with a fair rating at SC34 (Figure 7). Pre-construction species richness declined in each subsequent survey following the initial 2007 sampling events (Figure 8). Species such as the Bigmouth Shiner that were collected throughout Salt Creek only rarely occurred. During the 2007 survey 957 individuals were collected in Salt Creek, including eleven (11) individuals at Oak Meadows. The 2010 survey yielded 317 individuals in Salt Creek, with zero (0) individuals collected at Oak Meadows. Bigmouth Shiner numbers continued to decline in the 2013 and 2016 surveys with nine (9) and one (1) individual(s) collected in Salt Creek respectively and zero (0) in Oak Meadows. Other species including Pumpkinseed and Rock Bass have also declined throughout Salt Creek. A similar decline in species richness occurred at the control site (SC40) during the pre-restoration surveys where the habitat has remained consistently fair (Figure 7). The MIwb also declined from the initial survey in 2007 with each subsequent survey at Oak Meadows during the pre-restoration era (Figure 8). The total number of individuals present at each site were fewer in each subsequent survey and, on average, individuals were smaller in mass. Finer substrates persisted in each of the four pre-restoration surveys, but aquatic

River Mile

12

8

6

Modified Index of Wellbeing

Figure 8. The fIBI and MIwb at sites in the Oak Meadows project area. Years 2007-2014 represent prerestoration surveys and 2017-2019 represent post-restoration surveys.

River Mile

macrophytes, woody debris and deep pools were consistently available as cover for Centrarchidae, pool dwelling sucker and minnow species. The reduction in species richness was likely not habitat related, but once species are reduced or lost in the area, recolonization is impeded by downstream barriers. The lack of a diverse stream channel also prevented species like Hornyhead Chub, Logperch, Blackside Darter and Carmine Shiner from moving from areas of refuge to the Oak Meadows project area. The historically limited fish assemblage in Salt Creek plus remaining downstream barriers have blunted the potential improvements in the post-restoration fish assemblage for this project which is why the focus for the interim is on macroinvertebrate assemblage attributes.

Post-construction fIBI scores continued to fail the General Use designation biocriterion with poor scores in each of the three surveys (Table 4; Figure 8). In the subsequent surveys following the habitat improvements in Salt Creek and the riparian corridor, species richness has increased at each site located entirely within the Oak Meadows project site (SC34, SC35 and SC35B; Figure 7). The site SC35A has maintained 11 species in the most recent two surveys (2018 and 2019). The number of Bluegill, Spotfin Shiners, and Largemouth Bass individuals have increased, Largemouth Bass individuals are larger (Figure 9) and comprise a higher percentage of the total biomass at each site plus Walleye have been collected each year post-restoration (Table 3). The MIwb has shown incremental improvements at all sites in the Oak Meadows project area post-restoration. No increase in species richness, number of individuals or biomass was observed in the initial post-construction survey in 2017, but the 2019 survey yielded the highest MIwb scores ever recorded in the Oak Meadows project area (Figure 8). The deep riffles comprised of large gravel and cobble substrates offers better habitat for potential colonization by currently absent species such as Carmine Shiner, Hornyhead Chub, Logperch, Central Stoneroller, and Johnny Darter. All of these species have been previously collected in Salt Creek downstream from the Graue Mill Dam at Fullersburg Woods.

Table 3. The most abundant fish species by numbers (left column) and biomass (right column) at the Oak Meadows sites SC34 and SC35 in 2017-2019. Species are ordered by their prospective ranks at each site based on the 2019 results.

		SC3	34						SC3	4			
Cassias	201	.7	201	8	201	.9	Consins	20)17	20	018	20)19
Species	No. per Km	% by No.	No. per Km	% by No.	No. per Km	% by No.	Species	Kg per Km	% Biomass	Kg per Km	% Biomass	Kg per Km	% Biomass
Green Sunfish	32	15.4%	70	14.4%	204	24.9%	White Sucker	21.9	32.3%	48	15.6%	36.6	65.3%
Bluegill	68	32.7%	114	23.5%	142	17.3%	Common Carp	34.7	51.2%	232.1	75.3%	27.8	49.6%
Bluntnose Minnow	2	1.9%	34	7.0%	116	14.2%	Channel Catfish	-	-	5.2	1.7%	17	30.3%
Spotfin Shiner	-	-	26	5.4%	106	13.0%	Largemouth Bass	1.8	2.6%	9.6	3.1%	12	21.4%
Largemouth Bass	20	9.6%	64	13.2%	60	7.3%	Walleye	-	-	-	-	6.8	12.1%
Common Carp	16	7.7%	76	15.6%	56	6.8%	Green Sunfish	0.8	1.2%	1	0.3%	3.2	5.7%
White Sucker	36	17.3%	74	15.2%	46	5.6%	Bluegill	2.4	3.5%	4.4	1.4%	3	5.4%
Gizzard Shad	4	1.9%	6	1.2%	18	2.2%	Yellow Bullhead	0.6	0.9%	0.6	0.2%	1.3	2.3%
Blackstripe Topminnow	6	2.9%	2	0.4%	16	2.0%	Gizzard Shad	0.6	0.9%	2.8	0.9%	0.5	0.9%
Walleye	-	-	-	-	12	1.5%	Bluntnose Minnow	0.0	0.0%	0.2	0.1%	0.4	0.7%
		SC3	5						SC3	5			
Species	201	.7	201	8	201	.9	Species	20)17	20	018	20)19
эресіез	No. per Km	% by No.	No. per Km	% by No.	No. per Km	% by No.	Species	Kg per Km	% Biomass	Kg per Km	% Biomass	Kg per Km	% Biomass
Green Sunfish	58	27.4%	104	16.7%	176	51.6%	White Sucker	11.4	12.9%	28.6	18.8%	32.1	55.0%
Bluegill	52	24.5%	196	31.4%	130	38.1%	Common Carp	68.2	77.1%	106.9	70.4%	12.8	21.9%
Bluntnose Minnow	-	-	80	12.8%	90	26.4%	Largemouth Bass	3.8	4.3%	4.6	3.1%	8.2	14.0%
White Sucker	20	94.0%	40	6.4%	76	22.3%	Bluegill	1.8	2.0%	5.2	3.5%	2.3	3.9%
Largemouth Bass	10	47.0%	80	12.8%	56	16.4%	Green Sunfish	1.4	1.6%	2.6	1.7%	1.4	2.4%
Spotfin Shiner	-	-	20	3.2%	52	15.2%	Yellow Bullhead	1	1.1%	2.6	1.7%	1	1.7%
Common Carp	36	17.0%	52	8.3%	44	12.9%	Bluntnose Minnow	-	-	0.3	0.2%	0.2	0.3%
Yellow Bullhead	6	3.0%	16	2.6%	18	5.3%	Spotfin Shiner	-	-	0.1	0.1%	0.1	0.2%
Blackstripe Topminnow	6	3.0%	2	0.3%	14	4.1%	Bluegill x Green Sunfish	0.1	0.0%	0.3	0.2%	0.1	0.2%
Bluegill x Green Sunfish	2	1.0%	16	2.6%	10	2.9%	Yellow Bass	-	-	0.1	0.1%	0.1	0.2%





Figure 9. Largemouth Bass in the Oak Meadows project area have become more numerous and are larger due to increased woody debris and root wads for use as cover.

DISCUSSION

The status of the existing General Use designation was evaluated using the Illinois EPA biocriteria thresholds for the fish and macroinvertebrate IBIs that are outlined by Smogor (2000, 2005) and by (IEPA 2011c,d). Biological performance in Salt Creek at the Oak Meadows Project area and the control site failed to fully support the General Use during any of the pre- or post-restoration surveys. Macroinvertebrate assemblages improved incrementally in each year following restoration of the stream channel and met the General Use mIBI biocriterion in 2019 at SC35A and SC34 (Table 4). Fish assemblages continued to score poor and have not attained the fIBI biocriterion at any site during any survey. The poor performance of the fish assemblage precludes non-support-fair or full support at the few sites where the mIBI meets the General Use biocriterion. Despite little to no improvement in the fIBI, the MIwb has improved at three of the four sites in Oak Meadows with the highest scores being recorded in 2019 at each of the four sites (Table 4). The ability of the sites at Oak Meadows or any site upstream from the Graue Mill Dam are at a disadvantage to meet the General Use fIBI biocriterion due natural recolonization by fish species being blocked by that barrier (and possibly by the Old Oak Brook Dam, upstream of the Graue Mill dam). The full potential of the habitat improvements at Oak Meadows will not be realized until the removal of the dam.

The Preserve at Oak Meadows restoration project improved riparian habitat in Salt Creek through the removal of the A-jacks and steel sheet pilings, and regrading of stream banks as well as the installation of wetlands and native riparian vegetation. Instream improvements included the installation of root wads, cobble riffles, boulders, and the removal of the Oak Meadows dam. These habitat enhancements were substantial, with increases of nearly 20 QHEI points at SC34 and SC35 (Table 2). The number of modified attributes and the ratio of modified: good habitat attributes declined significantly at sites in the Oak Meadows project area following

Table 4. Aquatic life use attainment status at sites in the Preserve at Oak Meadows project area in 2007, 2010, 2013, 2014, and 2017-2019. Status at sites where only one assemblage group was available are noted in parentheses. Cell shading for flBI and mIBI: Green – meets General Use (GU) biocriterion; Yellow – fails GU fair; Orange – fails GU poor.

Site ID River Mile Drainage Area (sq. mi.) Fish IBI MIlwb mIBI QHEI Attaint State SC40 24.50 73.68 18.0 7.5 34.6 54.5 Non-P SC34 23.50 74.51 16.0 8.1 43.8 71.5 Non-P SC35 23.00 74.76 17.0 7.6 32.9 74.0 Non-P SC35B 22.80 74.96 19.0 8.2 40.2 72.0 Non-P SC35A 22.70 75.11 15.0 6.9 46.5 67.5 Non-P SC40 24.50 73.68 17.0 8.0 34.4 58 Non-P SC34 23.50 74.51 14.0 7.2 38.5 71.5 Non-P SC35 23.00 74.76 17.0 6.9 28.9 71.5 Non-P SC35 23.00 74.76 17.0 6.9 28.9 71.5 Non-P SC35A	
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SC35 23.00 74.76 18.0 6.6 24.1 55.5 Non-P	oor
Salt Creek 2010	
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SC34 23.50 74.51 21.0 6.7 21.0 50.5 Non-F	air
SC35 23.00 74.76 19.0 6.6 23.8 55.5 Non-P	oor
Salt Creek 2007	
SC40 24.50 73.68 16.0 6.0 43.2 64.5 Non-P	oor
SC34 23.50 74.51 21.0 7.9 44.6 56.5 Parti	al
SC35 23.00 74.76 19.0 7.1 33.5 46.5 Non-P	oor

restoration (Table 2). Similar post-restoration habitat scores were observed at the newly added sites SC35A and SC35B, surpassing the typical Salt Creek habitat exemplified by the control site (SC40; Table 2). Compared to the majority of Salt Creek, the work completed in the Oak Meadows project area is a significant improvement over recent conditions. Riffles are comprised of coarse substrates, woody debris is more substantial and of higher quality, pools are deeper, and lower embeddedness is prevalent at each Oak Meadows site.

Heterogeneous channel morphology created by the DRSCW sponsored project provides habitat for colonization by diverse aquatic assemblages. The constructed riffles add valuable habitat that has increased the incidence of rheophilic macroinvertebrate taxa. The riffles also provide habitat availability for sensitive fish species to occupy once impediments downstream are removed. The increase in rheophilic taxa corresponds to an increase in the mIBI within the Oak Meadows project area (Figure 5; Appendix B). The addition of stable woody debris provides cover for various sunfish species and offers breeding habitat for Spotfin Shiner (Pflieger 1965). Wetland habitats and backwaters provide refuge for young-of-year life stages and refuge for juveniles and adults during periods of elevated flow.

Overall the habitat improvements installed by the DRSCW sponsored project have resulted in improved mIBI and the QHEI scores in accordance with interim project goals. Even though fIBI scores have not improved above poor quality, the MIwb and an increase in species richness indicate that the restoration work has also benefited, albeit incrementally, the fish assemblage. Follow-up monitoring is recommended to monitor trends in the biological assemblages and with D.O. monitoring to determine improvements levels resulting from the installation of riffles and the removal of the Oak Meadows dam in accordance with the goals of the Salt Creek TMDL.

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APPENDIX A

Salt Creek Oak Meadows Project Fish Assemblage Data

MBI

Appendix Table A-1. Fish IBI results for data collected in the Salt Creek Oak Meadow study area.

									Nu	mber of				Per					
Site ID	River Mile	Туре	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Native species	Sunfish species		Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert- ivores	Rel.No. /(0.3km)		lodified lwb
	SALT	CREEK	C - (958	550)															
Year	r: 2007																		
SC41	25.00	A 08/0	05/2007	70.0	73.8	3	8(1)	4(4)	1(1)	0(0)	0(0)	2(2)	0(0)	50(4)	78(3)	0(0)	136 *	15.0	4.6
SC41	25.00	A 09/2	25/2007	70.0	73.8	3	14(3)	6(6)	1(1)	0(0)	0(0)	3(2)	0(0)	43(4)	68(4)	0(0)	816	20.0	7.1
SC40	24.50	A 08/0	05/2007	75.0	75.0	3	12(2)	4(4)	1(1)	0(0)	0(0)	3(2)	0(0)	50(4)	86(2)	0(0)	228	15.0	5.1
SC40	24.50	A 09/2	25/2007	75.0	75.0	3	12(2)	5(5)	1(1)	0(0)	1(1)	3(2)	0(0)	42(4)	89(2)	0(0)	1944	17.0	6.8
SC34	23.50	A 08/1	6/2007	76.0	75.3	3	16(3)	6(6)	1(1)	0(0)	1(1)	4(3)	0(0)	38(4)	87(2)	0(0)	766	20.0	8.0
SC34	23.50	A 09/2	26/2007	76.0	75.3	3	18(4)	6(6)	1(1)	0(0)	1(1)	5(3)	0(0)	39(4)	79(3)	0(0)	1594	22.0	7.9
SC35	23.00	A 08/1	6/2007	80.0	76.2	3	13(3)	5(5)	1(1)	0(0)	0(0)	3(2)	0(0)	46(4)	81(3)	0(0)	756	18.0	7.0
SC35	23.00	A 09/2	26/2007	80.0	76.2	3	15(3)	6(6)	1(1)	0(0)	0(0)	3(2)	0(0)	40(4)	74(4)	0(0)	1152	20.0	7.2
SC23	22.50	A 09/0	7/2007	84.0	77.1	3	15(3)	6(6)	1(1)	0(0)	1(1)	3(2)	0(0)	33(5)	64(5)	0(0)	856	23.0	6.9
SC23	22.50	A 09/2	27/2007	84.0	77.1	3	12(2)	6(6)	1(1)	0(0)	0(0)	2(2)	0(0)	42(4)	63(5)	0(0)	1094	20.0	7.5
SC39	20.50	A 09/0	06/2007	79.0	76.0	3	16(3)	6(6)	1(1)	0(0)	1(1)	4(3)	0(0)	38(4)	58(6)	0(0)	684	24.0	6.7
SC39	20.50	A 09/2	27/2007	79.0	76.0	3	13(3)	6(6)	1(1)	0(0)	0(0)	2(2)	0(0)	38(4)	55(6)	0(0)	898	22.0	6.5
Year	r: 2010																		
SC41	25.00	A 07/1	0/2010	70.0	73.8	3	10(2)	5(5)	1(1)	0(0)	0(0)	2(2)	0(0)	50(4)	77(3)	0(0)	256	17.0	5.1
SC41	25.00	A 10/0	01/2010	70.0	73.8	3	17(3)	5(5)	1(1)	0(0)	1(1)	4(3)	0(1)	41(4)	77(3)	0(0)	1608	21.0	8.2
SC40	24.50	A 07/1	1/2010	75.0	75.0	3	10(2)	4(4)	1(1)	0(0)	0(0)	2(2)	0(0)	50(4)	90(2)	0(0)	276	15.0	5.6
SC40	24.50	A 10/0	02/2010	75.0	75.0	3	14(3)	5(5)	1(1)	0(0)	0(0)	2(2)	1(1)	43(4)	89(2)	0(0)	1036	18.0	7.4
SC34	23.50	A 07/1	2/2010	76.0	75.3	3	14(3)	6(6)	1(1)	0(0)	0(0)	3(2)	0(0)	43(4)	81(3)	0(0)	234	19.0	5.4
SC34	23.50	A 09/3	80/2010	76.0	75.3	3	16(3)	6(6)	1(1)	0(0)	0(0)	3(2)	0(1)	44(4)	79(3)	0(0)	976	20.0	7.9
																			_

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

^{* - &}lt; 200 Total individuals in sample

^{** - &}lt; 50 Total individuals in sample

[•] One or more species excluded from IBI calculation.

Appendix Table A-1. Fish IBI results for data collected in the Salt Creek Oak Meadow study area.

									Nu	mber of				Perd					
Site ID	River Mile	Туре	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert- ivores	Rel.No. /(0.3km)	M IBI	/lodified lwb
SC35	23.00	A 07/1	2/2010	80.0	76.2	3	12(2)	6(6)	1(1)	0(0)	0(0)	3(2)	0(0)	42(4)	75(4)	0(0)	136 *	19.0	5.3
SC35	23.00	A 09/3	80/2010	80.0	76.2	3	15(3)	6(6)	2(2)	1(1)	1(1)	2(2)	1(1)	40(4)	79(3)	0(0)	668	23.0	7.9
SC23	22.50	A 07/0	09/2010	84.0	77.1	3	11(2)	4(4)	1(1)	0(0)	0(0)	2(2)	2(1)	45(4)	84(2)	0(0)	348	16.0	6.1
SC23	22.50	A 09/3	30/2010	84.0	77.1	3	15(3)	5(5)	1(1)	0(0)	0(0)	2(2)	1(1)	40(4)	62(5)	0(0)	1102	21.0	8.5
SC39	20.50	A 07/0	09/2010	79.0	76.0	3	13(3)	5(5)	1(1)	0(0)	0(0)	3(2)	1(1)	46(4)	87(2)	0(0)	204	18.0	5.8
SC39	20.50	A 10/0	01/2010	79.0	76.0	3	18(4)	6(6)	1(1)	0(0)	1(1)	5(3)	0(1)	44(4)	59(6)	0(0)	1448	26.0	7.7
Year	r: 2013																		
SC41	25.00	A 07/1	2/2013	70.0	73.8	3	16(3)	5(5)	1(1)	0(0)	1(1)	4(3)	0(1)	44(4)	87(2)	0(0)	548	20.0	7.6
SC41	25.00	A 08/3	31/2013	70.0	73.8	3	12(2)	4(4)	1(1)	0(0)	0(0)	3(2)	0(0)	50(4)	93(1)	0(0)	508	14.0	7.4
SC40	24.50	A 07/2	22/2013	75.0	75.0	3	11(2)	3(3)	1(1)	0(0)	0(0)	2(2)	1(1)	45(4)	89(2)	0(0)	266	15.0	6.9
SC40	24.50	A 09/1	0/2013	75.0	75.0	3	12(2)	5(5)	1(1)	0(0)	0(0)	1(1)	1(1)	33(5)	93(1)	0(0)	304	16.0	7.0
SC34	23.50	A 07/1	1/2013	76.0	75.3	3	11(2)	5(5)	1(1)	0(0)	0(0)	2(2)	0(0)	55(3)	86(2)	0(0)	332	15.0	6.2
SC34	23.50	A 09/0	06/2013	76.0	75.3	3	11(2)	5(5)	1(1)	0(0)	0(0)	1(1)	0(0)	55(3)	82(3)	0(0)	310	15.0	6.2
SC35	23.00	A 07/1	1/2013	80.0	76.2	3	10(2)	4(4)	1(1)	0(0)	0(0)	3(2)	0(0)	60(3)	76(3)	0(0)	178 *	15.0	6.7
SC35	23.00	A 09/0	06/2013	80.0	76.2	3	11(2)	4(4)	2(2)	1(1)	1(1)	2(2)	1(1)	45(4)	71(4)	0(0)	136 *	21.0	6.6
SC23	22.50	A 07/1	1/2013	84.0	77.1	3	12(2)	4(4)	1(1)	0(0)	0(0)	3(2)	0(0)	50(4)	96(1)	0(0)	366	14.0	6.5
SC23	22.50	A 09/0	09/2013	84.0	77.1	3	13(3)	4(4)	1(1)	0(0)	0(0)	2(2)	0(1)	46(4)	94(1)	0(0)	410	16.0	7.1
SC39	20.50	A 07/2	23/2013	79.0	76.0	3	11(2)	6(6)	0(0)	0(0)	0(0)	3(2)	0(0)	55(3)	91(2)	0(0)	288	15.0	5.1
SC39	20.50	A 09/0	01/2013	79.0	76.0	3	12(2)	5(5)	1(1)	0(0)	0(0)	3(2)	0(0)	58(3)	91(2)	0(0)	388	15.0	5.4
Year	r: 2014																		
SC34	23.50	A 10/1	4/2014	76.0	75.3	3	11(2)	5(5)	1(1)	0(0)	0(0)	2(2)	0(0)	55(3)	82(3)	0(0)	210	16.0	5.2

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

^{* - &}lt; 200 Total individuals in sample

^{** - &}lt; 50 Total individuals in sample

[•] One or more species excluded from IBI calculation.

Appendix Table B-1. Fish IBI results for data collected in the Salt Creek Oak Meadow study area.

									Nu	mber of				Per					
Site ID	River Mile	Туре	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	Tolerant Fish (as Species)	Generalist Feeders	Specialized Benthic Invert- ivores	Rel.No. /(0.3km)		lodified lwb_
SC35	23.00	A 10/	14/2014	80.0	76.2	3	8(1)	4(4)	1(1)	0(0)	0(0)	1(1)	0(0)	63(3)	83(3)	0(0)	150 *	13.0	5.3
Year	:: 2016	j																	
SC41	25.00	P 07/	04/2016	70.0	73.8	3	13(3)	5(5)	1(1)	0(0)	0(0)	3(2)	0(0)	38(4)	70(4)	0(0)	206	19.0	6.8
SC41	25.00	P 10/	04/2016	70.0	73.8	3	13(3)	5(5)	1(1)	0(0)	0(0)	2(2)	0(0)	46(4)	68(4)	0(0)	590	19.0	6.9
SC40	24.50	P 06/	29/2016	75.0	75.0	3	9(2)	3(3)	1(1)	0(0)	0(0)	3(2)	0(0)	78(2)	94(1)	0(0)	132 *	11.0	5.7
SC40	24.50	P 10/	04/2016	75.0	75.0	3	12(2)	4(4)	1(1)	0(0)	0(0)	3(2)	0(0)	50(4)	86(2)	0(0)	380	15.0	5.9
SC23	22.50	P 07/	04/2016	84.0	77.1	3	10(2)	3(3)	1(1)	0(0)	0(0)	3(2)	1(1)	70(2)	95(1)	0(0)	250	12.0	6.5
SC23	22.50	P 10/	04/2016	84.0	77.1	3	11(2)	5(5)	1(1)	0(0)	0(0)	2(2)	0(0)	55(3)	89(2)	0(0)	322	15.0	5.6
SC39	20.50	P 07/	03/2016	79.0	76.0	3	9(2)	4(4)	1(1)	0(0)	0(0)	2(2)	0(0)	56(3)	95(1)	0(0)	110 *	13.0	4.9
SC39	20.50	P 10/	04/2016	79.0	76.0	3	12(2)	5(5)	1(1)	0(0)	0(0)	3(2)	0(0)	58(3)	96(1)	0(0)	478	14.0	5.6
Year	:: 2017	,																	
SC23	24.50	P 08/	21/2017	75.0	77.1	3	9(2)	4(4)	1(1)	0(0)	0(0)	2(2)	0(0)	67(3)	91(2)	0(0)	276	14.0	7.1
SC23	23.50	P 08/	21/2017	76.0	77.1	3	11(2)	5(5)	1(1)	0(0)	0(0)	1(1)	0(0)	55(3)	80(3)	0(0)	208	15.0	6.3
SC23	23.00	P 08/	21/2017	80.0	77.1	3	10(2)	5(5)	1(1)	0(0)	0(0)	1(1)	0(0)	60(3)	88(2)	0(0)	212	14.0	5.9
SC23	22.70	P 08/	21/2017	84.0	77.1	3	8(1)	4(4)	1(1)	0(0)	0(0)	0(0)	3(1)	38(4)	86(2)	0(0)	116 *	13.0	6.7
Year	:: 2018	;																	
SC40	24.50	P 07/	24/2018	75.0	74.7	3	13(3)	5(5)	1(1)	0(0)	0(0)	3(2)	0(0)	46(4)	89(2)	0(0)	600	17.0	8.0
SC34	23.50	P 07/2	24/2018	76.0	74.9	3	12(2)	4(4)	1(1)	0(0)	0(0)	3(2)	0(0)	58(3)	85(2)	0(0)	486	14.0	7.2
SC35	23.00	P 07/2	24/2018	80.0	75.0	3	12(2)	5(5)	1(1)	0(0)	0(0)	3(2)	0(0)	50(4)	82(3)	0(0)	624	17.0	6.9
SC35A	22.70	P 07/	24/2018	84.0	75.0	3	13(3)	6(6)	1(1)	0(0)	0(0)	3(2)	0(0)	54(3)	88(2)	0(0)	620	17.0	7.2
SC35B	22.30	P 07/	24/2018	84.1	75.1	3	11(2)	5(5)	1(1)	0(0)	0(0)	2(2)	2(1)	55(3)	83(3)	0(0)	248	17.0	6.7
																			_

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

^{* - &}lt; 200 Total individuals in sample

^{** - &}lt; 50 Total individuals in sample

[•] One or more species excluded from IBI calculation.

Appendix Table A-1. Fish IBI results for data collected in the Salt Creek Oak Meadow study area.

									Nu	mber of				Per					
Site ID	River Mile	Туре	Date	DA sq mi	Wetted Width (ft)	IL IBI Reg.	Native species	Sunfish species	Sucker species	Intolerant species	Benthic Invert. species	Minnow species	Mineral Substrate Spawners	`	Generalist Feeders	Specialized Benthic Invert- ivores	Rel.No. /(0.3km)		lodified
Year	:: 2019)																	
SC40	24.50	P 09	/11/2019	75.0	74.7	3	12(2)	6(6)	1(1)	0(0)	0(0)	2(2)	0(1)	42(4)	92(2)	0(0)	706	18.0	7.5
SC34	23.50	P 09	/11/2019	76.0	74.9	3	13(3)	4(4)	1(1)	0(0)	0(0)	3(2)	1(1)	54(3)	88(2)	0(0)	818	16.0	8.1
SC35	23.00	P 09	/11/2019	80.0	75.0	3	13(3)	4(4)	1(1)	0(0)	0(0)	3(2)	0(1)	46(4)	87(2)	0(0)	682	17.0	7.6
SC35A	22.70	P 09	/11/2019	84.0	75.0	3	11(2)	4(4)	1(1)	0(0)	0(0)	2(2)	2(1)	55(3)	88(2)	0(0)	386	15.0	6.9
SC35B	22.30	P 09	/11/2019	84.1	77.1	3	14(3)	5(5)	1(1)	0(0)	0(0)	2(2)	3(1)	36(4)	82(3)	0(0)	424	19.0	8.2

na - Qualitative data, Modified Iwb not applicable.

X - IBI extrapolated

^{*} - < 200 Total individuals in sample

^{** - &}lt; 50 Total individuals in sample

[•] One or more species excluded from IBI calculation.

Appendix A-2: Midwest Biodiversity Institute Fish Species List - Grand Totals

Rivers: Salt Creek

Years: 2019

Numbe	er of Samples: 7	[Data So	urces:		99		Data Ty	pes:	Р	
Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	0		М		18	5.2	0.91	220	0.58	42.7
37-003	NORTHERN PIKE	Р		М	F	3	0.9	0.15	429	1.12	500.0
37-004	MUSKELLUNGE	Р		М	F	2	0.6	0.10	1315	3.44	2300.0
40-016	WHITE SUCKER	0	Т	S	W	49	14.0	2.47	3017	7.88	215.3
43-001	COMMON CARP	0	Т	М	G	140	40.0	7.07	20735	54.18	517.8
43-002	GOLDFISH	0	Т	М	G	22	6.3	1.11	533	1.39	84.7
43-003	GOLDEN SHINER	- 1	Т	М	N	6	1.7	0.30	18	0.05	10.8
43-004	HORNYHEAD CHUB	I	1	Ν	N	4	1.1	0.20	37	0.10	32.5
43-028	SPOTTAIL SHINER	I	Р	М	N	1	0.3	0.05	1	0.00	4.0
43-032	SPOTFIN SHINER	I		М	N	23	6.6	1.16	34	0.09	5.2
43-043	BLUNTNOSE MINNOW	0	Т	С	N	60	17.2	3.03	74	0.20	4.3
43-044	CENTRAL STONEROLLER	Н		Ν	N	3	0.9	0.15	20	0.05	23.3
43-045	COMMON CARP X GOLDFISH	0	Т		G	3	0.9	0.15	707	1.85	825.0
47-002	CHANNEL CATFISH			С	F	10	2.9	0.51	2666	6.97	932.5
47-004	YELLOW BULLHEAD	1	Т	С		10	2.9	0.51	437	1.14	153.0
47-006	BLACK BULLHEAD	1	Р	С		2	0.6	0.10	100	0.26	175.0
54-002	BLACKSTRIPE TOPMINNOW	1		М		23	6.6	1.16	6	0.02	0.9
74-006	YELLOW BASS	Р	Р	М		1	0.3	0.05	28	0.07	100.0
77-002	BLACK CRAPPIE	1		С	S	26	7.4	1.31	572	1.49	76.9
77-006	LARGEMOUTH BASS	С		С	F	145	41.5	7.32	2252	5.88	54.3
77-007	WARMOUTH SUNFISH	С		С	S	1	0.3	0.05	14	0.04	50.0
77-008	GREEN SUNFISH	1	Т	С	S	194	55.5	9.80	1169	3.06	21.0
77-009	BLUEGILL SUNFISH	1	Р	С	S	1079	308.6	54.49	1731	4.52	5.6
77-010	ORANGESPOTTED SUNFISH	1		С	S	52	14.9	2.63	143	0.37	9.6
77-013	PUMPKINSEED SUNFISH	1	Р	С	S	13	3.7	0.66	114	0.30	30.7
77-015	GREEN SF X BLUEGILL SF					20	5.7	1.01	233	0.61	40.7
80-002	WALLEYE	Р		S	F	6	1.7	0.30	1515	3.96	883.3
80-003	YELLOW PERCH			М		1	0.3	0.05	10	0.03	35.0
80-011	LOGPERCH	ı	М	S	D	1	0.3	0.05	10	0.03	35.0
80-014	JOHNNY DARTER	ı		С	D	1	0.3	0.05	0	0.00	1.0
87-001	ROUND GOBY				E	61	17.5	3.08	122	0.32	7.0

No Species: 31 Nat. Species: 26 Hybrids: 2 Total Counted: 1980 Total Rel. Wt.: 38273

A2 - 5 03/16/2020

Site ID: River: 95-850 Salt Creek RM: 10.50 Date: 08/30/2019

Time Fished: 2627 Distance: 0.500 Drainge (sq mi): 114.0 Depth: 0

Location: Dst. Grave Mills Dam

Lat: 41.82033 Long: -87.92612

Chasias											
Species Code:	Species Name:	Feed	Toler-	Breed	IBI	No.	Rel.	% by	Rel.	% by	Av.
	·	Guild	ance	Guild	Group	Fish	No.	No.	Wt.	Wt.	<u>Wt</u> .
37-003	NORTHERN PIKE	Р		М	F	3	6.0	0.81	7200	3.90	1200.0
37-004	MUSKELLUNGE	Р		М	F	2	4.0	0.54	13800	7.47	3450.0
40-016	WHITE SUCKER	0	Т	S	W	38	76.0	10.27	12520	6.78	164.7
43-001	COMMON CARP	0	Т	М	G	50	100.0	13.51	88800	48.07	888.0
43-002	GOLDFISH	0	Т	М	G	2	4.0	0.54	40	0.02	10.0
43-003	GOLDEN SHINER	1	Т	М	N	3	6.0	0.81	80	0.04	13.3
43-004	HORNYHEAD CHUB	- 1	I	Ν	Ν	4	8.0	1.08	260	0.14	32.5
43-028	SPOTTAIL SHINER	1	Р	М	N	1	2.0	0.27	8	0.00	4.0
43-032	SPOTFIN SHINER	1		М	N	14	28.0	3.78	140	0.08	5.0
43-043	BLUNTNOSE MINNOW	0	Т	С	Ν	4	8.0	1.08	14	0.01	1.7
43-044	CENTRAL STONEROLLER	Н		Ν	Ν	3	6.0	0.81	140	0.08	23.3
47-002	CHANNEL CATFISH			С	F	9	18.0	2.43	30200	16.35	1677.7
47-004	YELLOW BULLHEAD	1	Т	С		3	6.0	0.81	740	0.40	123.3
77-002	BLACK CRAPPIE	- 1		С	S	2	4.0	0.54	900	0.49	225.0
77-006	LARGEMOUTH BASS	С		С	F	36	72.0	9.73	12800	6.93	177.7
77-007	WARMOUTH SUNFISH	С		С	S	1	2.0	0.27	100	0.05	50.0
77-008	GREEN SUNFISH	1	Т	С	S	34	68.0	9.19	1400	0.76	20.5
77-009	BLUEGILL SUNFISH	1	Р	С	S	84	168.0	22.70	460	0.25	2.7
77-010	ORANGESPOTTED SUNFISH	1		С	S	2	4.0	0.54	20	0.01	5.0
77-015	GREEN SF X BLUEGILL SF					5	10.0	1.35	520	0.28	52.0
80-002	WALLEYE	Р		S	F	6	12.0	1.62	13600	7.36	1133.3
80-003	YELLOW PERCH			М		1	2.0	0.27	70	0.04	35.0
80-011	LOGPERCH	1	M	S	D	1	2.0	0.27	70	0.04	35.0
80-014	JOHNNY DARTER	1		С	D	1	2.0	0.27	2	0.00	1.0
87-001	ROUND GOBY				Е	61	122.0	16.49	860	0.47	7.0

No Species: 24 Nat. Species: 21 Hybrids: 1 Total Counted: 370 Total Rel. Wt.: 184744

IBI: 34.0 **Mlwb:** 9.1

A3 - 6 03/16/2020

Site ID: River: 95-850 Salt Creek RM: 10.80 Date: 08/28/2019

Time Fished: 2021 Distance: 0.500 Drainge (sq mi): 114.0 Depth: 0

Location: Ust. dam

Lat: 0.00000 Long: 0.00000

Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No Fisi		Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	0		М		1	11	22.0	3.72	1100	1.08	50.0
43-001	COMMON CARP	0	Т	М	G	1	19	38.0	6.42	82620	80.90	2174.2
43-002	GOLDFISH	0	Т	М	G	1	10	20.0	3.38	3840	3.76	192.0
43-043	BLUNTNOSE MINNOW	0	Т	С	N		6	12.0	2.03	30	0.03	2.5
77-002	BLACK CRAPPIE	1		С	S		9	18.0	3.04	700	0.69	38.8
77-006	LARGEMOUTH BASS	С		С	F	3	33	66.0	11.15	4840	4.74	73.3
77-008	GREEN SUNFISH	- 1	Т	С	S	2	28	56.0	9.46	940	0.92	16.7
77-009	BLUEGILL SUNFISH	1	Р	С	S	16	88	336.0	56.76	7800	7.64	23.2
77-010	ORANGESPOTTED SUNFISH	- 1		С	S	1	11	22.0	3.72	180	0.18	8.1
77-015	GREEN SF X BLUEGILL SF						1	2.0	0.34	80	0.08	40.0

No Species: 9 Nat. Species: 7 Hybrids: 1 Total Counted: 296 Total Rel. Wt.: 102130

IBI: 38.0 **Mlwb:** 6.7

A3 - 7 03/16/2020

Site ID: River: 95-850 Salt Creek RM: 11.00 Date: 08/28/2019

Time Fished: 2535 Distance: 0.500 Drainge (sq mi): 114.0 Depth: 0

Location: Dst. foot bridge Lat: 41.82554 Long: -87.93156

Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	0		М		4	8.0	0.93	1000	0.94	125.0
40-016	WHITE SUCKER	0	Т	S	W	2	4.0	0.47	4000	3.76	1000.0
43-001	COMMON CARP	0	Т	М	G	14	28.0	3.26	79000	74.33	2821.4
43-002	GOLDFISH	0	Т	М	G	1	2.0	0.23	100	0.09	50.0
43-043	BLUNTNOSE MINNOW	0	Т	С	Ν	8	16.0	1.86	100	0.09	6.2
47-004	YELLOW BULLHEAD	- 1	Т	С		1	2.0	0.23	800	0.75	400.0
54-002	BLACKSTRIPE TOPMINNOW	I		М		15	30.0	3.50	30	0.03	1.0
74-006	YELLOW BASS	Р	Р	М		1	2.0	0.23	200	0.19	100.0
77-002	BLACK CRAPPIE	- 1		С	S	6	12.0	1.40	700	0.66	58.3
77-006	LARGEMOUTH BASS	С		С	F	31	62.0	7.23	8700	8.19	140.3
77-008	GREEN SUNFISH	1	Т	С	S	49	98.0	11.42	2200	2.07	22.4
77-009	BLUEGILL SUNFISH	- 1	Р	С	S	289	578.0	67.37	8950	8.42	15.4
77-010	ORANGESPOTTED SUNFISH	1		С	S	5	10.0	1.17	100	0.09	10.0
77-015	GREEN SF X BLUEGILL SF					3	6.0	0.70	400	0.38	66.6

No Species: 13 Nat. Species: 11 Hybrids: 1 Total Counted: 429 Total Rel. Wt.: 106280

IBI: 38.0 **Mlwb:** 7.0

A3 - 8 03/16/2020

Site ID: River: 95-850 Salt Creek RM: 11.30 Date: 08/28/2019

Time Fished: 2430 Distance: 0.500 Drainge (sq mi): 113.6 Depth: 0

Location: Ust. foot bridge Lat: 0.00000 Long: 0.00000

Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
20-003	GIZZARD SHAD	0		М		3	6.0	1.05	200	0.33	33.3
40-016	WHITE SUCKER	0	Т	S	W	2	4.0	0.70	3000	5.01	750.0
43-001	COMMON CARP	0	Т	М	G	9	18.0	3.14	40700	67.95	2261.1
43-002	GOLDFISH	0	Т	М	G	5	10.0	1.74	1550	2.59	155.0
43-043	BLUNTNOSE MINNOW	0	Т	С	N	10	20.0	3.48	80	0.13	4.0
47-004	YELLOW BULLHEAD	1	Т	С		2	4.0	0.70	250	0.42	62.5
77-002	BLACK CRAPPIE	- 1		С	S	3	6.0	1.05	250	0.42	41.6
77-006	LARGEMOUTH BASS	С		С	F	28	56.0	9.76	4000	6.68	71.4
77-008	GREEN SUNFISH	- 1	Т	С	S	19	38.0	6.62	700	1.17	18.4
77-009	BLUEGILL SUNFISH	1	Р	С	S	194	388.0	67.60	8320	13.89	21.4
77-010	ORANGESPOTTED SUNFISH	1		С	S	3	6.0	1.05	100	0.17	16.6
77-013	PUMPKINSEED SUNFISH	- 1	Р	С	S	5	10.0	1.74	400	0.67	40.0
77-015	GREEN SF X BLUEGILL SF					4	8.0	1.39	350	0.58	43.7

No Species: 12 Nat. Species: 10 Hybrids: 1 Total Counted: 287 Total Rel. Wt.: 59900

IBI: 38.0 **Mlwb:** 6.8

A3 - 9 03/16/2020

Site ID: River: 95-850 Salt Creek RM: 11.70 Date: 08/28/2019

Time Fished: 2876 Distance: 0.500 Drainge (sq mi): 113.5 Depth: 0

Location: Dst. lowhead dam

Lat: 0.00000 Long: 0.00000

Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	0	Т	S	W	6	12.0	3.51	10000	7.81	833.3
43-001	COMMON CARP	0	Т	М	G	20	40.0	11.70	110400	86.26	2760.0
43-032	SPOTFIN SHINER	1		М	Ν	9	18.0	5.26	100	0.08	5.5
43-043	BLUNTNOSE MINNOW	0	Т	С	Ν	11	22.0	6.43	100	0.08	4.5
47-004	YELLOW BULLHEAD	1	Т	С		3	6.0	1.75	1000	0.78	166.6
54-002	BLACKSTRIPE TOPMINNOW	1		М		3	6.0	1.75	6	0.00	1.0
77-002	BLACK CRAPPIE	1		С	S	3	6.0	1.75	600	0.47	100.0
77-006	LARGEMOUTH BASS	С		С	F	6	12.0	3.51	350	0.27	29.1
77-008	GREEN SUNFISH	1	Т	С	S	44	88.0	25.73	2040	1.59	23.1
77-009	BLUEGILL SUNFISH	1	Р	С	S	52	104.0	30.41	3100	2.42	29.8
77-010	ORANGESPOTTED SUNFISH	1		С	S	13	26.0	7.60	250	0.20	9.6
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.58	40	0.03	20.0

No Species: 11 Nat. Species: 10 Hybrids: 1 Total Counted: 171 Total Rel. Wt.: 127986

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IBI: 28.0 **Mlwb:** 5.8

03/16/2020

Site ID: River: 95-850 Salt Creek RM: 12.20 Date: 08/30/2019

Time Fished: 2034 Distance: 0.500 Drainge (sq mi): 109.7 Depth: 0

Location: Dst. 31st street Lat: 0.00000 Long: 0.00000

Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
43-001	COMMON CARP	0	Т	М	G	2	8.0	1.71	19600	46.45	2450.0
43-002	GOLDFISH	0	Т	М	G	2	8.0	1.71	900	2.13	112.5
43-043	BLUNTNOSE MINNOW	0	Т	С	Ν	19	38.0	8.12	200	0.47	5.2
43-045	COMMON CARP X GOLDFISH	0	Т		G	2	4.0	0.85	7800	18.48	1950.0
47-004	YELLOW BULLHEAD	- 1	Т	С		1	2.0	0.43	550	1.30	275.0
47-006	BLACK BULLHEAD	- 1	Р	С		1	2.0	0.43	400	0.95	200.0
54-002	BLACKSTRIPE TOPMINNOW	- 1		М		5	10.0	2.14	8	0.02	8.0
77-002	BLACK CRAPPIE	- 1		С	S	1	2.0	0.43	50	0.12	25.0
77-006	LARGEMOUTH BASS	С		С	F	7	14.0	2.99	100	0.24	7.1
77-008	GREEN SUNFISH	- 1	Т	С	S	10	20.0	4.27	600	1.42	30.0
77-009	BLUEGILL SUNFISH	- 1	Р	С	S	164	328.0	70.09	11600	27.49	35.3
77-010	ORANGESPOTTED SUNFISH	- 1		С	S	13	26.0	5.56	250	0.59	9.6
77-013	PUMPKINSEED SUNFISH	- 1	Р	С	S	2	4.0	0.85	100	0.24	25.0
77-015	GREEN SF X BLUEGILL SF					1	2.0	0.43	40	0.09	20.0

No Species: 12 Nat. Species: 10 Hybrids: 2 Total Counted: 234 Total Rel. Wt.: 42198

IBI: 32.0 **Mlwb:** 6.5

Site ID: River: 95-850 Salt Creek RM: 12.50 Date: 08/30/2019

Time Fished: 2015 Distance: 0.500 Drainge (sq mi): 109.8 Depth: 0

Location: Dst. Golf course Lat: 0.00000 Long: 0.00000

Species Code:	Species Name:	Feed Guild	Toler- ance	Breed Guild	IBI Group	No. Fish	Rel. No.	% by No.	Rel. Wt.	% by Wt.	Av. Wt.
40-016	WHITE SUCKER	0	Т	S	W	1	2.0	0.52	1500	0.96	750.0
43-001	COMMON CARP	0	Т	М	G	24	48.0	12.44	141800	91.14	2954.1
43-003	GOLDEN SHINER	- 1	Т	М	Ν	3	6.0	1.55	50	0.03	8.3
43-043	BLUNTNOSE MINNOW	0	Т	С	Ν	2	4.0	1.04	6	0.00	1.5
43-045	COMMON CARP X GOLDFISH	0	Т		G	1	2.0	0.52	950	0.61	475.0
47-002	CHANNEL CATFISH			С	F	1	2.0	0.52	50	0.03	25.0
47-006	BLACK BULLHEAD	- 1	Р	С		1	2.0	0.52	300	0.19	150.0
77-002	BLACK CRAPPIE	1		С	S	2	4.0	1.04	950	0.61	237.5
77-006	LARGEMOUTH BASS	С		С	F	2	8.0	2.07	830	0.53	103.7
77-008	GREEN SUNFISH	1	Т	С	S	10	20.0	5.18	300	0.19	15.0
77-009	BLUEGILL SUNFISH	- 1	Р	С	S	128	256.0	66.32	8200	5.27	32.0
77-010	ORANGESPOTTED SUNFISH	1		С	S	5	10.0	2.59	100	0.06	10.0
77-013	PUMPKINSEED SUNFISH	- 1	Р	С	S	6	12.0	3.11	300	0.19	25.0
77-015	GREEN SF X BLUEGILL SF					5	10.0	2.59	250	0.16	25.0

No Species: 12 Nat. Species: 11 Hybrids: 2 Total Counted: 193 Total Rel. Wt.: 155586

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IBI: 34.0 **Mlwb:** 5.6

03/16/2020

APPENDIX B

Salt Creek Oak Meadows Project Macroinvertebrate Assemblage Data

Appendix Table B-1. Select macroinvertebrate taxa associated with stream current ("Rheophilic") and/or coarse substrates from Salt Creek stations SC40, 34, 35, 35B and 35A, 2007-19.

												Salt (Creek Mac	roinve	rtebra	te Site	S ^a											
						PRE-CO	NSTRU	CTION												POST-0	CONSTI	RUCTIO	ON					
		2007			2010			2013			201		2016			2017					2018 ¹					2019		
Таха	SC 40	SC 34	SC 35	SC 40	SC 34	SC 35	SC 40	SC 34	SC 35	SC 34	SC 35	SC 35	SC 40	SC 40	SC 34	SC 35	SC 35	SC 35	SC 40	SC 34	SC 35	SC 35	SC 35	SC 40	SC 34	SC 35	SC 35	SC 35
Mayflies																												
Baetis flavistriga																											X	
Baetis intercalaris	х					х									х	х	х	х	x*	х		Х	х	х	х		х	х
Stenacron sp					х																x**							х
Caddisflies																												
Cheumatopsyche sp	х	х		x	х	х	х		х	х				х	х	х	х	х	х	х	х	Х	х	х	х	Х	х	х
Ceratopsyche morosa grp.	х																											
Hydropsyche bidens or orris																				x								
Hydropsyche simulans															Х	X	X	X		x			X		Х			
Hydroptila sp (+	х	х	х				х																					
Hydroptilidae)	^	^	^				^	х									х			х		х	х	х	Х	х	х	х
Nectopsyche diarina		х													х	х					х	Х						
Beetles																												
Stenelmis sp	х			x			х							х	Х		X	X	х	x	X	X	X	х	Х	X	X	X
Diptera/flies																												
Simulium sp							х			х					х		х	х		х		Х	х		х		х	х
Cricotopus (C.) trifascia																						X	X				X	
Rheocricotopus robacki	х																X											
Thienemanniella similis																									Х			
Thienemanniella xena	х	х																							х			
Microtendipes caelum																		X										
Polypedilum flavum	х	х		x	х	х	х	Х	х	х	Х	х		x	х	х	x	х	Х	х	Х	Х	х		х	Х	х	х
Rheotanytarsus sp															Х		X	X		x		X			Х	X	X	
Hemerodromia sp	х	х									Х																	
Snails																												
Elimia sp																								X				X
# Rheophilic Indicators ^c	9	6	1	3	3	3	5	2	3	3	2	1	0	3	8	5	9	8	5	9	5	9	8	5	10	5	9	8
Pre/Post Avg. c, d		:	3.5			3		2	1.5		2						7.5				7	'.75				8	3.25	
Total Taxa ^c	26	40	24	29	21	23	33	24	27	24	32	24	6	30	27	31	23	23	32	33	34	31	27	39	40	31	30	30
Pre/Post Avg. c, d			32			22		2	26		27						26					31					25	

^a SC40 control site highlighted in blue

^b New, post-construction taxa records for project reach are noted in red

^c Highest number or highest averages for survey are highlighted in green

^d Pre and post construction at Project area sites (SC34,35,35B,35A)

^{*} Damaged, lone specimen but likely *Baetis*

^{**} Heptageneiidae; Early instar but Family includes Stenacron

Appendix Table B-2. Illinois Macroinvertebrate IBI metrics and values from the Oak Meadow Study area in Salt Creek.

			Drainage			Num	ber of			Perce	nt:	
River Mile	Site ID	Sample Date	Area (sq mi)	Sub- samp	Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	МВІ	Percent Scrapers	Percent EPT	MIBI
Salt Cre	ek (95-850))										
Year: 2	2007											
25.00	SC41	07/30/200	70.00	300	28(61.0)	2(40.0)	2(19.6)	5(55.6)	5.9(83.6)	9.0(30.4)	25.9(35.0)	46.5
24.50	SC40	07/30/200	75.00	300	24(52.0)	2(40.0)	2(19.6)	4(44.4)	5.9(83.6)	5.3(17.9)	32.9(44.5)	43.2
23.50	SC34	07/30/200	76.00	300	35(76.0)	1(20.0)	3(29.4)	5(55.6)	6.7(70.5)	14.5(49.0)	8.5(11.4)	44.6
23.00	SC35	07/30/200	80.00	300	22(48.0)	1(20.0)	1(9.8)	4(44.4)	6.9(67.2)	11.8(39.8)	3.8(5.1)	33.5
22.50	SC23	07/31/200	7 84.00	300	33(72.0)	2(40.0)	3(29.4)	3(33.3)	6.2(78.7)	1.9(6.5)	20.5(27.6)	41.1
20.50	SC39	07/31/200	79.00	300	30(65.0)	1(20.0)	3(29.4)	4(44.4)	6.1(80.3)	4.4(14.9)	16.0(21.7)	39.4
Year: 2	2010											
25.00	SC41	07/10/201	70.00	300	20(43.0)	1(20.0)	2(19.6)	0(0.0)	6.1(80.3)	3.2(10.8)	55.3(74.7)	35.5
24.50	SC40	07/11/201	75.00	300	24(52.0)	2(40.0)	1(9.8)	1(11.1)	7.2(62.3)	4.3(14.5)	10.3(13.9)	29.1
23.50	SC34	07/12/201	76.00	300	18(39.0)	0(0.0)	3(29.4)	0(0.0)	6.7(70.5)	1.3(4.5)	2.6(3.6)	21.0
23.00	SC35	07/12/201	80.00	300	19(41.0)	1(20.0)	2(19.6)	0(0.0)	6.8(68.9)	2.0(6.8)	7.7(10.4)	23.8
22.50	SC23	07/09/201	84.00	300	24(52.0)	2(40.0)	2(19.6)	0(0.0)	7.3(60.7)	4.1(13.8)	4.1(5.5)	27.4
20.50	SC39	07/09/201	79.00	300	22(48.0)	1(20.0)	2(19.6)	1(11.1)	6.4(75.4)	0.0(0.0)	10.5(14.2)	26.9
20.50	SC39	10/01/201	79.00	300	15(33.0)	2(40.0)	3(29.4)	0(0.0)	5.7(86.9)	10.8(36.6)	35.4(47.8)	39.1
Year: 2	2013											
25.00	SC41	07/12/201	70.00		25(54.0)	0(0.0)	2(19.6)	4(44.4)	6.3(77.1)	0.7(2.2)	8.2(11.1)	29.8
24.50	SC40	07/23/201	75.00		27(59.0)	2(40.0)	2(19.6)	2(22.2)	6.2(78.7)	2.8(9.4)	12.3(16.6)	35.1
23.50	SC34	07/11/201	76.00		27(59.0)	0(0.0)	2(19.6)	1(11.1)	7.1(63.9)	1.7(5.7)	2.2(3.0)	23.2
23.00	SC35	07/11/201	80.00		23(50.0)	1(20.0)	1(9.8)	0(0.0)	6.6(72.1)	4.4(14.9)	1.4(1.9)	24.1
22.50	SC23	07/11/201	84.00		30(65.0)	2(40.0)	1(9.8)	1(11.1)	7.0(65.6)	1.1(3.7)	0.8(1.1)	28.0
20.50	SC39	07/25/201	79.00		26(57.0)	1(20.0)	1(9.8)	2(22.2)	6.0(82.0)	5.7(19.4)	2.9(3.9)	30.6

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Appendix Table B-2. Illinois Macroinvertebrate IBI metrics and values from the Oak Meadow Study area in Salt Creek.

			Drainage			Numl	per of			Perce	ent:	
River Mile	Site ID	Sample Date	Area (sq mi)	Sub- samp	Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	MBI	Percent Scrapers	Percent EPT	МІВІ
Year: 2	014											
23.50	SC34	07/24/2014	76.00		20(43.0)	0(0.0)	1(9.8)	1(11.1)	6.9(67.2)	2.7(9.3)	0.9(1.2)	20.2
23.00	SC35	<mark>06/29/2014</mark>	80.00		26(57.0)	0(0.0)	0(0.0)	1(11.1)	8.7(37.7)	0.7(2.2)	0.3(0.4)	15.5
22.70	SC35A	<mark>06/29/2014</mark>	84.00		19(41.0)	0(0.0)	0(0.0)	0(0.0)	9.1(31.2)	3.6(12.3)	0.3(0.4)	12.1
Year: 2	016											
25.00	SC41	07/11/2016	70.00		27(59.0)	2(40.0)	1(9.8)	2(22.2)	6.2(78.7)	2.5(8.4)	28.0(37.9)	36.6
24.50	SC40	07/11/2016	75.00		6(13.0)	0(0.0)	1(9.8)	0(0.0)	9.6(23.0)	0.0(0.0)	4.6(6.2)	7.4
22.50	SC23	07/04/2016	84.00		23(50.0)	2(40.0)	0(0.0)	1(11.1)	9.1(31.2)	3.4(11.4)	3.4(4.6)	21.2
20.50	SC39	07/11/2016	79.00		24(52.0)	1(20.0)	0(0.0)	1(11.1)	6.6(72.1)	30.7(100)	3.6(4.9)	37.2
Year: 2	017											
24.50	SC40	08/21/2017	75.00		22(48.0)	2(40.0)	1(9.8)	1(11.1)	6.6(72.1)	0.7(2.5)	29.9(40.5)	32.0
23.50	SC34	08/21/2017	76.00		24(52.0)	2(40.0)	2(19.6)	1(11.1)	5.9(83.6)	1.7(5.8)	29.4(39.7)	36.0
23.00	SC35	08/21/2017	80.00		26(57.0)	1(20.0)	2(19.6)	2(22.2)	6.4(75.4)	0.0(0.0)	9.9(13.3)	29.7
22.80	SC35B	08/21/2017	75.10		21(46.0)	1(20.0)	2(19.6)	1(11.1)	5.9(83.6)	1.7(5.8)	33.8(45.7)	33.1
22.70	SC35A	08/21/2017	84.00		21(46.0)	1(20.0)	2(19.6)	0(0.0)	5.9(83.6)	0.7(2.3)	48.6(65.7)	33.9
Year: 2	018											
24.50	SC40	07/24/2018	75.00		26(57.0)	2(40.0)	2(19.6)	1(11.1)	5.2(95.1)	1.8(6.1)	9.1(12.2)	34.5
23.50	SC34	07/24/2018	76.00		29(63.0)	2(40.0)	2(19.6)	1(11.1)	5.8(85.3)	4.6(15.5)	26.1(35.2)	38.5
23.00	SC35	07/24/2018	80.00		26(57.0)	1(20.0)	2(19.6)	1(11.1)	5.8(85.3)	0.3(1.1)	6.3(8.5)	28.9
22.70	SC35A	07/24/2018	84.00		23(50.0)	1(20.0)	2(19.6)	1(11.1)	5.5(90.2)	3.5(12.0)	25.1(33.9)	33.8
22.30	SC35B	07/24/2018	84.11		25(54.0)	2(40.0)	2(19.6)	2(22.2)	5.7(86.9)	2.3(7.9)	28.3(38.2)	38.4
Year: 2	019											
24.50	SC40	09/11/2019	75.00		31(67.0)	2(40.0)	2(19.6)	2(22.2)	7.1(63.9)	6.1(20.6)	6.4(8.7)	34.6
23.50	SC34	09/11/2019	76.00		35(76.0)	2(40.0)	3(29.4)	2(22.2)	5.7(86.9)	7.1(24.1)	20.5(27.7)	43.8

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Appendix Table B-2. Illinois Macroinvertebrate IBI metrics and values from the Oak Meadow Study area in Salt Creek.

			Drainage			Numl	ber of			Perce	nt:	
River Mile	Site ID	Sample Date	Area (sq mi)	Sub- samp	Total Taxa	Coleoptera Taxa	Mayfly Taxa	Intolerant Taxa	МВІ	Percent Scrapers	Percent EPT	MIBI
23.00	SC35	09/11/2019	80.00		24(52.0)	2(40.0)	1(9.8)	1(11.1)	5.0(98.4)	3.6(12.1)	5.0(6.8)	32.9
22.70	SC35A	09/11/2019	84.00		27(59.0)	2(40.0)	3(29.4)	2(22.2)	5.2(95.1)	5.0(17.0)	46.6(63.0)	46.5
22.30	SC35B	09/11/2019	84.11		26(57.0)	1(20.0)	2(19.6)	2(22.2)	5.1(96.7)	3.7(12.6)	39.3(53.1)	40.2

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Appendix Table B-3. Macroinvertebrate taxa collected by MBI in the Salt Creek Fullersburg study area in 2019.

Site: Dst. Golf course Site ID: SC56

Sample:

Collection Date: 09/12/2019 River Code: 95-850 River: Salt Creek RM: 12.50

	ction Date: 09/12/2019	River C	oue. 9:	0-000	River: Salt C	геек	RM:	12.50
Taxa Code	Taxa	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp Tol.	Qt./QI.
01801	Turbellaria		6.0	1				
03600	Oligochaeta		10.0	273				
04660	Helobdella sp		8.0	3				
04901	Erpobdellidae		8.0	2				
06201	Hyalella azteca		4.0	42				
53800	Hydroptila sp	CA	2.0	1				
69400	Stenelmis sp	CO	7.0	1				
78655	Procladius (Holotanypus) sp		8.0	5				
79000	Tanypus sp		8.0	2				
82730	Chironomus (C.) decorus group		11.0	3				
83040	Dicrotendipes neomodestus		6.0	2				
84470	Polypedilum (P.) illinoense		6.0	4				
85625	Rheotanytarsus sp		6.0	1				
85800	Tanytarsus sp		7.0	2				
85821	Tanytarsus glabrescens group sp 7	,	7.0	1				
95100	Physella sp		9.0	1				
97601	Corbicula fluminea		4.0	1				
98600	Sphaerium sp		5.0	2				

No. Quantitative Taxa: 18 Total Taxa: 18

Number of Organisms: 347 mIBI: 14.60

Appendix Table B-3. Macroinvertebrate taxa collected by MBI in the Salt Creek Fullersburg study area in 2019.

Site: Dst. 31st street SC56a

Sample:

Colle	ction Date: 09/12/2019 Ri	ver C	ode: 9	5-850	River: Salt C	reek	RM:	
Taxa Code	Таха	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Taxa	Feed Grp Tol.	Q
)1801	Turbellaria		6.0	2				
3600	Oligochaeta		10.0	72				
4901	Erpobdellidae		8.0	1				
6201	Hyalella azteca		4.0	91				
21200	Calopteryx sp		4.0	1				
22001	Coenagrionidae		5.5	6				
2200	Cheumatopsyche sp	CA	6.0	1				
3800	Hydroptila sp	CA	2.0	7				
9400	Stenelmis sp	CO	7.0	2				
7120	Ablabesmyia mallochi		6.0	1				
7500	Conchapelopia sp		6.0	2				
77750	Hayesomyia senata or Thienemannimyia norena		5.0	4				
78655	Procladius (Holotanypus) sp		8.0	20				
80510	Cricotopus (Isocladius) sylvestris group	1	8.0	1				
31240	Nanocladius (N.) distinctus		3.0	1				
32730	Chironomus (C.) decorus group		11.0	2				
32820	Cryptochironomus sp		8.0	4				
32880	Cryptotendipes sp		6.0	1				
3040	Dicrotendipes neomodestus		6.0	17				
3300	Glyptotendipes (G.) sp		10.0	1				
3400	Harnischia sp		6.0	2				
34450	Polypedilum (Uresipedilum) flavum		6.0	13				
34470	Polypedilum (P.) illinoense		6.0	58				
35625	Rheotanytarsus sp		6.0	2				
85800	Tanytarsus sp		7.0	5				
85821	Tanytarsus glabrescens group sp 7		7.0	1				
85840	Tanytarsus sepp		7.0	2				
3200	Hydrobiidae		6.0	3				
7601	Corbicula fluminea		4.0	21				
8200	Pisidium sp		5.0	2				

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 346 mIBI: 27.59

Appendix Table B-3. Macroinvertebrate taxa collected by MBI in the Salt Creek Fullersburg study area in 2019.

Site: Ust. foot bridge

Sample:

Collec	ction Date: 09/12/2019 R	iver C	ode: 9	5-850	River: Salt Creek			RM:	11.30
Taxa Code	Таха	Taxa Grp	Tol.	Qt./QI.	Taxa Code	Таха	Feed Grp	Tol.	Qt./QI.
01801	Turbellaria		6.0	1					
03600	Oligochaeta		10.0	45					
04964	Erpobdella microstoma		8.0	3					
05800	Caecidotea sp		6.0	1					
06201	Hyalella azteca		4.0	187					
22001	Coenagrionidae		5.5	9					
22300	Argia sp		5.0	1					
53800	Hydroptila sp	CA	2.0	4					
59500	Oecetis sp	CA	5.0	1					
60900	Peltodytes sp	CO	99.9	1					
69400	Stenelmis sp	CO	7.0	2					
77120	Ablabesmyia mallochi		6.0	3					
77130	Ablabesmyia rhamphe group		6.0	2					
77355	Clinotanypus pinguis		6.0	1					
78655	Procladius (Holotanypus) sp		8.0	2					
80420	Cricotopus (C.) bicinctus		8.0	1					
80510	Cricotopus (Isocladius) sylvestris grou	р	8.0	1					
82141	Thienemanniella xena		2.0	1					
82730	Chironomus (C.) decorus group		11.0	3					
82820	Cryptochironomus sp		8.0	1					
83040	Dicrotendipes neomodestus		6.0	15					
83400	Harnischia sp		6.0	1					
84450	Polypedilum (Uresipedilum) flavum		6.0	1					
84470	Polypedilum (P.) illinoense		6.0	26					
85821	Tanytarsus glabrescens group sp 7		7.0	1					
85840	Tanytarsus sepp		7.0	2					
93200	Hydrobiidae		6.0	2					
95100	Physella sp		9.0	1					
97601	Corbicula fluminea		4.0	5					
98600	Sphaerium sp		5.0	1					

No. Quantitative Taxa: 30 Total Taxa: 30

Number of Organisms: 325 mIBI: 28.50

Appendix Table B-3. Macroinvertebrate taxa collected by MBI in the Salt Creek Fullersburg study area in 2019.

Site ID: SC53
Site: Dst. foot bridge

Sample:

Collec	ollection Date: 10/16/2019 River Code:			5-850	River: Salt Creek	oumpie.		RM:	11.0
Taxa Code	Таха	Taxa Grp	Tol.	Qt./Ql.	Taxa Code	Таха	Feed Grp	l Tol.	Qt./Ql.
01801	Turbellaria		6.0	1					
03600	Oligochaeta		10.0	235					
04601	Glossiphoniidae		8.0	4					
04666	Helobdella papillata		8.0	1					
04901	Erpobdellidae		8.0	2					
06201	Hyalella azteca		4.0	32					
08250	Orconectes (Procericambarus) rusticus		5.0	1					
21300	Hetaerina sp		3.0	1					
22300	Argia sp		5.0	1					
27000	Corduliidae or Libellulidae		0.0	1					
28705	Pachydiplax longipennis		8.0	1					
68700	Dubiraphia sp	CO	5.0	1					
69400	Stenelmis sp	CO	7.0	1					
78655	Procladius (Holotanypus) sp		8.0	15					
79000	Tanypus sp		8.0	4					
80510	Cricotopus (Isocladius) sylvestris group		8.0	4					
82820	Cryptochironomus sp		8.0	1					
82880	Cryptotendipes sp		6.0	3					
3040	Dicrotendipes neomodestus		6.0	1					
84470	Polypedilum (P.) illinoense		6.0	31					
84520	Polypedilum (Tripodura) halterale group)	6.0	1					
85625	Rheotanytarsus sp		6.0	2					
85800	Tanytarsus sp		7.0	1					
85821	Tanytarsus glabrescens group sp 7		7.0	2					
85840	Tanytarsus sepp		7.0	2					
93200	Hydrobiidae		6.0	3					
97601	Corbicula fluminea		4.0	1					

No. Quantitative Taxa: 27 Total Taxa: 27

Number of Organisms: 353 mIBI: 20.32

Appendix Table B-3. Macroinvertebrate taxa collected by MBI in the Salt Creek Fullersburg study area in 2019.

Site ID: SC53a Site: Ust. dam Sample: Collection Date: 10/16/2019 River Code: 95-850 River: Salt Creek RM: 10.80 Taxa Taxa Feed Taxa Code Taxa Tol. Qt./Ql. Code Taxa Grp Tol. Qt./QI. Grp 03600 Oligochaeta 10.0 202 4.0 107 06201 Hyalella azteca 5.0 16700 Tricorythodes sp 2 MA 21 22001 Coenagrionidae 5.5 99.9 1 43300 Ranatra sp 18 8.0 78655 Procladius (Holotanypus) sp 79000 Tanypus sp 8.0 1 82800 Cladopelma sp 6.0 1 83002 Dicrotendipes modestus 6.0 1 83300 Glyptotendipes (G.) sp 10.0 1 93200 Hydrobiidae 6.0 1 93900 Elimia sp 6.0 1 98600 Sphaerium sp 5.0 1

Number of Organisms: 358 mIBI: 13.22

Appendix Table B-3. Macroinvertebrate taxa collected by MBI in the Salt Creek Fullersburg study area in 2019.

Site ID: SC52 Site: Dst. Grave Mills Dam Sample: Collection Date: 10/16/2019 River Code: 95-850 River: Salt Creek RM: 10.50 Taxa Taxa Feed Taxa Code Taxa Tol. Qt./Ql. Code Taxa Grp Tol. Qt./QI. Grp 6.0 9 01801 Turbellaria 10.0 5 03600 Oligochaeta 05800 Caecidotea sp 6.0 1 06201 Hyalella azteca 4.0 70 5.0 30 16700 Tricorythodes sp MA 3.0 3 21300 Hetaerina sp 22001 Coenagrionidae 5.5 1 3 5.0 22300 Argia sp 52200 Cheumatopsyche sp CA 6.0 93 53800 Hydroptila sp CA 2.0 1 CO 7.0 3 69400 Stenelmis sp 2 6.0 74100 Simulium sp 80740 Eukiefferiella claripennis group 4.0 1 2 84470 Polypedilum (P.) illinoense 6.0 1 85625 Rheotanytarsus sp 6.0 6.0 98 93900 Elimia sp 97601 Corbicula fluminea 4.0 17 2 98600 Sphaerium sp 5.0

No. Quantitative Taxa: 18 Total Taxa: 18

Number of Organisms: 342 mIBI: 47.40

APPENDIX C

Salt Creek Oak Meadows Project Habitat Data

Appendix C-1. QHEI metric scores for sites in the Salt Creek Oak Meadow study area.

					QH	El Metri	cs:		
River Mile	QHEI	Substrate	eCover	Channel	Riparian	Pool	Riffle	Gradient & Score	Narrative
95850) 'ear:2007									
25.00	60.00	12.0	16.0	9.0	6.00	11.0	0.0	3.50 - (6)	Good
24.50	64.50	13.5	17.0	9.0	5.00	11.0	3.0	3.63 - (6)	Good
23.50	56.50	13.5	15.0	7.0	3.00	12.0	0.0	3.50 - (6)	Fair
23.00	46.50	6.5	16.0	7.0	4.00	7.0	0.0	3.50 - (6)	Fair
22.50	71.25	15.0	16.0	14.0	8.25	10.0	2.0	3.50 - (6)	Good
20.50	75.50	13.0	17.0	15.0	9.50	10.0	3.0	5.42 - (8)	Excellent
'ear:2010									
25.00	69.50	11.0	18.0	12.0	6.50	12.0	2.0	7.34 - (8)	Good
24.50	57.75	12.0	14.0	9.0	6.75	9.0	1.0	3.63 - (6)	Fair
23.50	50.50	6.0	13.0	8.0	3.50	10.0	2.0	6.55 - (8)	Fair
23.00	55.50	10.0	13.0	10.0	3.50	10.0	1.0	6.16 - (8)	Fair
22.50	66.75	11.0	15.0	14.0	6.75	11.0	1.0	5.70 - (8)	Good
20.50	67.75	12.0	15.0	15.0	7.75	11.0	1.0	4.95 - (6)	Good
'ear:2013									
25.00	67.50	11.0	15.0	13.0	5.50	11.0	4.0	7.34 - (8)	Good
24.50	61.50	12.5	13.0	11.0	6.00	10.0	3.0	3.63 - (6)	Good
23.50	51.00	7.0	15.0	9.0	3.00	9.0	0.0	6.55 - (8)	Fair
23.00	55.50	10.5	14.0	10.0	4.00	9.0	0.0	6.16 - (8)	Fair
22.50	67.00	11.0	16.0	12.0	8.00	10.0	2.0	5.70 - (8)	Good
20.50	67.75	11.0	15.0	13.0	8.75	11.0	3.0	4.95 - (6)	Good
/ear:2014									
23.50	54.00	6.0	14.0		3.00	10.0	2.0	6.55 - (8)	Fair
<mark>23.00</mark> ′ear:2016	60.50	11.0	14.0	12.0	3.50	10.0	2.0	6.16 - (8)	Good
25.00	61.00	11.0	16.0	8.0	7.00	10.0	1.0	7.34 - (8)	Good
24.50	55.50	6.0	16.0	9.0	6.50	11.0	1.0	3.63 - (6)	Fair
22.50	56.00	6.0	15.0	8.0	6.00	11.0	2.0	5.70 - (8)	Fair
20.50 'ear:2017	66.00	13.0	16.0	12.0	7.00	11.0	1.0	4.95 - (6)	Good
24.50	64.50	13.0	16.0	14.0	3.50	9.0	3.0	3.63 - (6)	Good
23.50	67.00	13.0	14.0	13.0	4.00	9.0	6.0	6.55 - (8)	Good
23.00	69.50	12.0	16.0	15.0	4.00	10.0	4.5	6.16 - (8)	Good
22.70	71.50	15.0	14.0	16.0	5.00	9.0	4.5	5.87 - (8)	Good
rear:2018									
24.50	58.00	12.0	15.0	11.5	4.50	8.0	1.0	3.63 - (6)	Fair

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Appendix C-1. QHEI metric scores for sites in the Salt Creek Oak Meadow study area.

					QH	El Metri	cs:		
River Mile	QHEI	Substrate	eCover	Channel	Riparian	Pool	Riffle	Gradient & Score	Narrative
(95850)									
Year:2018									
23.50	71.50	14.0	16.0	<mark>15.0</mark>	4.00	10.0	4.5	6.55 - (8)	Good
23.00	71.50	14.0	16.0	15.0	4.00	10.0	4.5	6.16 - (8)	Good
22.70	71.50	14.0	15.0	15.0	4.00	11.0	4.5	5.87 - (8)	Good
22.30	65.50	12.0	16.0	13.5	4.00	10.0	4.0	3.20 - (6)	Good
Year:2019									
24.50	54.50	10.0	15.0	11.5	5.00	6.0	1.0	3.63 - (6)	Fair
23.50	71.50	14.0	15.0	15.5	5.00	8.0	6.0	6.55 - (8)	Good
23.00	74.00	14.0	15.0	16.0	5.50	9.0	6.5	6.16 - (8)	Good
22.70	67.50	12.5	15.0	11.5	7.00	9.0	4.5	5.87 - (8)	Good
22.30	72.00	13.5	14.0	17.0	6.00	9.0	6.5	3.20 - (6)	Good

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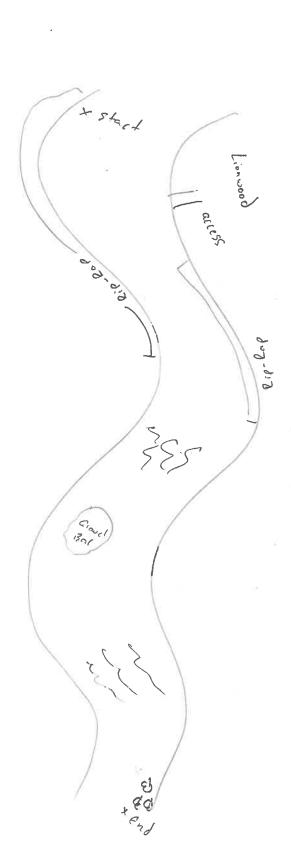
Qualitative Habitat Evaluation Index Field Sheet

OHEI	Score:	64
ALE!	ocure.	ツ

River Code: 95-850 RM: 24.5 Stream: Salt Creek	
Site Code: SC 46 Project Code: Sal Coly 19 Location: As Lion word Park	
Date: 9-11-19 Scorer: MAS Latitude: 41.94308 Longitude: ~87.96434	_
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
□ □-BLDR/SLBS [10] □ □ □ □ GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)	
☐ -SAND [6] ☐ -JIMESTONE [1] SILT: ☐ -SILT HEAVY [-2]	Substrate
□ -BOULDER [9] □ -BEDROCK [5] □ -TILLS [1] □ -SILT MODERATE [-1]	
□ -COBBLE [8] □ -DETRITUS [3] □ -WETLANDS [0] □ -SILT NORMAL [0]	10
☐ -ARTIFICIAL [0]	Max 20
□ -MUCK [2] □ -SILT [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	
-RIP/RAP[0] NESS: -MODERATE[-1]	
NUMBER OF SUBSTRATE TYPES: -4 or More [2] -4 CUSTRINE [0] -NORMAL [0]	
(High Quality Only, Score 5 or >)	
-COAL FINES [-2]	
COMMENTS:	
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or	
(Structure) TYPE: Score All That Occur check 2 and AVERAGE)	Cover
/ UNDERCUT BANKS [1] Z POOLS > 70 cm [2] OXBOWS, BACKWATERS [1]EXTENSIVE > 75% [11]	110
	1,2
3 SHALLOWS (IN SLOW WATER) [1] O BOULDERS [1] LOGS OR WOODY DEBRIS [1] -SPARSE 5 - 25% [3]	Max 20
OCTMATS [1] -NEARLY ABSENT < 5% [1]	•
COMMENTS:	
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY MODIFICATIONS / OTHER	
-HIGH [4] -SXCELLENT [7] -NONE [6] -HIGH [3] -SNAGGING -IMPOUNDMENT	Channel
-MODERATE [3] GOOD [5] GRECOVERED [4] -RELOCATION GREATE [2] -RELOCATION GREATE [3] -RELOCATION GREATE [4] -RELOCA	11.5
-LOW [2] -FAIR [3] -RECOVERING [3] -LOW [1] -CANOPY REMOVAL -LEVEED	
☐ -NONE [1] ☐ -POOR [1] ☐ -RECENT OR NO ☐ -DREDGING ☐ -BANK SHAPING RECOVERY [1] ☐ -ONE SIDE CHANNEL MODIFICATIONS	Max 20
RECOVERY [1] ☐-ONE SIDE CHANNEL MODIFICATIONS ☐ -IMPOUNDED [-1]	
COMMENTS:	
	_
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION BANK EROSION	
	Riparian
RIPARIAN WIDTH	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank)	Riparian
RIPARIAN WIDTH	
RIPARIAN WIDTH	6
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) -CONSERVATION TILLAGE [1] -NONE [1] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -RESIDENTIAL, PARK, NEW FIELD [1] -PENCED PASTURE [1] -MINING / CONSTRUCTION [0] SHAKE ROSION L R (Per Bank) L R (Per Bank) L R (Per Bank) -NONE [1] -NONE [1] -NONE PASTURE [1] -NONE PASTURE [1] -NONE PASTURE [1] -MINING / CONSTRUCTION [0] -NONE [0] -NONE PASTURE PASTURE [1] -NONE PASTURE PASTURE [1] -NONE PASTURE PASTURE [1] -NONE PASTURE PASTURE [1] -NONE PASTURE PASTURE PASTURE [1] -NONE PASTURE PAS	6
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -VERY NARROW 5 - 10m [2] -FENCED PASTURE [1] -MINING / CONSTRUCTION [0] -VERY NARROW < 5m [1] -NONE [0] COMMENTS: -SI POOL / GLIDE AND RIFFLE / RUN QUALITY MAX. DEPTH MORPHOLOGY MORPHOLOGY CURRENT VELOCITY (POOLS & RIFFLESI)	Max 10
RIPARIAN WIDTH	Max 10 Pool /
RIPARIAN WIDTH	Max 10
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current Max 12
RIPARIAN WIDTH	Max 10 Pool / Current Max 12
RIPARIAN WIDTH	Max 10 Pool / Current Max 12
RIPARIAN WIDTH	Pool / Current Max 12 Riffle / Run
RIPARIAN WIDTH	Pool / Current Max 12 Riffle / Run
RIPARIAN WIDTH	Pool / Current Max 12 Riffle / Run Max 8
RIPARIAN WIDTH	Pool / Current Max 12 Riffle / Run Max 8 Gradient
RIPARIAN WIDTH	Pool / Current Max 12 Riffle / Run Max 8 Gradient

Gradient: □ -Low □ -Moderate □ -High	Rating Rating (1-10)	Subjective Aesthetic	Lat / Long (X-Loc):	Lat / Long (End):	Lat / Long (Mid):	Lat / Long (Beg):	Is Sampling Reach Representative of the Stream? (Y/N)
		First Sampling Pass					ive of the Stream?
]	Gear:					? <u>Z</u>
Is there water close downstream Is Dry Channel mostly natural?	Is Stream Ephemeral (no pools, to)	Distance:	1				
Is there water close downstream? How far: Is Dry Channel mostly natural?	Is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water unstream? How far:	Water Clarity:		_			If Not. Explain:
	of only damp spots)?	Water Stage:					
		Canopy-% open:					
Other: Other Flow Alteration	Landfils Natural Dams	Suburban Impacts Mining Çhannelization Riparian Removal	Construction Urban Runoff	Livestock Silviculture	Agriculture	Impacts (Check All That Apply): None	Major Suspected Sources of

òtream Drawing:





	١.,
QHEI Score:	1

River Code: 95-850 RM: 23,5 Stream: Sal Circle	÷:
Site Code: SC34 Project Code: SoltOak In Location: Det Elizabeth Co	3
Date: 9-11-19 Scorer: MAS Latitude: 41,95188 Longitude: -87.78460	-
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
-GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)	Outratests
☐ ☐ -LIMESTONE [1] SILT: ☐ -SILT HEAVY [-2] ☐ ☐ -BOULDER [9] ☐ -BEDROCK [5] ☐ -TILLS [1] ☐ -SILT MODERATE [-1]	Substrate
	14.
	May 20
□ -HARDPAN [4] □ -ARTIFICIAL [0] □ -HARDPAN [0] □ -SILT FREE [1] □ -MUCK [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	Max 20
NUMBER OF SUBSTRATE TYPES: 4 or More [2] -LACUSTRINE [0] -NORMAL [0]	
(High Quality Only, Score 5 or >)	
COAL FINES [-2]	
COMMENTS:	-
2. INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or	_
(Structure) TYPE: Score All That Occur check 2 and AVERAGE) UNDERCUT BANKS [1] 3 POOLS > 70 cm [2] / OXBOWS, BACKWATERS [1] — EXTENSIVE > 75% [11]	Cover
UNDERCUT BANKS [1] 3 POOLS > 70 cm [2] / OXBOWS, BACKWATERS [1] - EXTENSIVE > 75% [11] - EXTENSIVE > 75% [11] - EXTENSIVE > 75% [7]	1/0
/ SHALLOWS (IN SLOW WATER) [1] 2 BOULDERS [1] 3 LOGS OR WOODY DEBRIS [1] -SPARSE 5 - 25% [3]	Max 20
O ROOTMATS [1]	, .
COMMENTS:	
3. CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY MODIFICATIONS / OTHER	
-HIGH [4]	Channel
` -MODERATE [3]	15.5
-LOW [2]PAIK [3]PAIK [3]PAIK [3]PAIK [4]PAIK [5]PAIK [4]PAIK [5]PAIK [5]	Max 20
RECOVERY [1] —-ONE SIDE CHANNEL MODIFICATIONS	
IMPOUNDED [-1]	
COMMENTS:	-0
4 RIPARIAN ZONE AND BANK FROSION (check ONE box PER bank or check 2 and AVERAGE per bank)	
4.1 RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	
L R (Per Bank) L R (Most Predominant Per Bank) L R L R (Per Bank)	
	Riparian
	Riparian /
	Riparian 5
-VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1]	
-VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -MINING / CONSTRUCTION [0]	6
-VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -MODERATE [2] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -HEAVY / SEVERE [1] -VERY NARROW 5 - 10m [2] -FENCED PASTURE [1] -MINING / CONSTRUCTION [0]	6
-VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -MINING / CONSTRUCTION [0]	6
-VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -FENCED PASTURE [1] -MINING / CONSTRUCTION [0] -WINING / CONSTRUCTION [0] -MINING / CONSTRUCTION [0] -M	6
-VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1] -NONE / LITTLE [3] -MODERATE [2] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -HEAVY / SEVERE [1] -VERY NARROW 5 - 10m [2] -FENCED PASTURE [1] -MINING / CONSTRUCTION [0]	6
	6
	Max 10 Pool / Current
	Max 10 Pool / Current
	Max 10 Pool / Current
VERY WIDE > 100m [5]	Max 10 Pool / Current
- VERY WIDE > 100m [5]	Max 10 Pool / Current
VERY WIDE > 100m [5]	Max 10 Pool / Current
VERY WIDE > 100m [5]	Max 10 Pool / Current
VERY WIDE > 100m [5]	Max 10 Pool / Current G Max 12
-VERY WIDE > 100m [5]	Max 10 Pool / Current Max 12 Riffle / Run
-VERY WIDE > 100m [5]	Max 10 Pool / Current G Max 12
VERY WIDE > 100m [5]	Max 10 Pool / Current Max 12 Riffle / Run
VERY WIDE > 100m [5]	Pool / Current Max 12 Riffle / Run Max 8
VERY WIDE > 100m [5]	Pool / Current Wax 12 Riffle / Run Max 8 Gradient
-VERY WIDE > 100m [5]	Pool / Current Max 12 Riffle / Run Max 8

Elizabeth Dr Stream Drawing: Is Sampling Reach Representative of the Stream? (Y/ N) ☐ -Low Lat / Long (Beg): _at / Long (Mid): .at / Long (End): /Long (X-Loc): Subjective Rating (1-10) aulf Cart Trail ☐ -Moderate Gradient: 4 Aesthetic □ -High Rating (1-10) 6 do First Sampling Pass 6 Gear 6 Back Is there water close downstream? How far: Is Dry Channel mostly natural? Is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far: 500 Distance If Not, Explain: Water Clarity Low Water Stage: 100 Canopy- % open: 35 Impacts (Check All That Apply): Major Suspected Sources of Urban Runoff CSOs CSOs Suburban Impacts Mining Channelization Riparian Removal Chandfills Natural Dams Can Flow Alteration Charf Flow Alteration Charf Flow Alteration Can Charf Flow Alteration Charf Flow Alteration Charf

diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools. small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very

Cart

Trail

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IV		Biodiversity Institute

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EI	Score:	14
ᄓ	Score:	' ' '

Site Code: SC 35 Project Code: Jalf Galc 19 Location: Dal Meodows Galf Course	
Date: 9-11-19 Scorer: MV-S Latitude: 41.94748 Longitude: -87.98233	_
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	=
TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
☐ ☐ -BLDR/SLBS [10] ☐ ☐ ☐ -GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)	
□ □ -Lg BOULD [10] □ □ □ -SAND [6] □ -SAND [6] □ -SILT: □ -SILT HEAVY [-2]	Substrate
□ □-BOULDER [9] □ □ □-BEDROCK [5] □ □ -TILLS [1] □ -SILT MODERATE [-1]	14
-COBBLE [8]WETLANDS [0]SILT NORMAL [0]	1, 1
☐ ☐ -HARDPAN [4] ☐ ☐ -ARTIFICIAL [0] ☐ -HARDPAN [0] ☐ -SILT FREE [1]	Max 20
□ □-MUCK [2] □ □ -SILT [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	
-RIP / RAP [0] NESS:	
NUMBER OF SUBSTRATE TYPES: 4 or More [2] - LACUSTRINE [0] - NORMAL [0] (High Quality Only, Score 5 or >) - 3 or Less [0] - SHALE [-1] - NONE [1]	
(High Quality Only, Score 5 or >) ☐ -3 or Less [0] ☐ -SHALE [-1] ☐ -NONE [1] ☐ -COAL FINES [-2]	
COMMENTS:	
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or	
(Structure) TYPE: Score All That Occur check 2 and AVERAGE) O UNDERCUT BANKS [1] 3 POOLS > 70 cm [2] / OXBOWS, BACKWATERS [1] -EXTENSIVE > 75% [11]	Cover
O UNDERCUT BANKS [1] 5 POOLS > 70 cm [2] / OXBOWS, BACKWATERS [1] - EXTENSIVE > 75% [11] O OVERHANGING VEGETATION [1] 3 ROOTWADS [1] 3 AQUATIC MACROPHYTES [1] MODERATE 25 - 75% [7]	(4)
2 SHALLOWS (IN SLOW WATER) [1] 2 BOULDERS [1] 3 LOGS OR WOODY DEBRIS [1] -SPARSE 5 - 25% [3]	Max 20
□ -NEARLY ABSENT < 5% [1]	
COMMENTS:	_0
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY MODIFICATIONS / OTHER ☐ -HIGH [4] — -EXCELLENT [7] ☐ -NONE [6] ☐ -HIGH [3] ☐ -SNAGGING ☐ -IMPOUNDMENT	Ohaaaal
-HIGH [4] -EXCELLENT [7] -NONE [6] -HIGH [3] -SNAGGING -IMPOUNDMENT -MODERATE [3] -MODERATE [3] -RELOCATION -ISLAND	Channel
- LOW [2] - FAIR [3] - RECOVERING [3] - LOW [1] - CANOPY REMOVAL - LEVEED	10
☐ -NONE [1] ☐ -POOR [1] ☐ -RECENT OR NO ☐ -DREDGING ☐ -BANK SHAPING	Max 20
RECOVERY [1]ONE SIDE CHANNEL MODIFICATIONS	
-IMPOUNDED [-1]	
COMMENTS:	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank)	_
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	_
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank)	Riparian
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION L R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank) L -VERY WIDE > 100m [5] -FOREST, SWAMP [3] -CONSERVATION TILLAGE [1]	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION L R (Per Bank) L R (Most Predominant Per Bank) Y R L R (Per Bank) VERY WIDE > 100m [5] FOREST, SWAMP [3] CONSERVATION TILLAGE [1] NONE / LITTLE [3] WIDE > 50m [4] SHRUB OR OLD FIELD [2] URBAN OR INDUSTRIAL [0] MODERATE [2]	35
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION L R (Per Bank) L R (Most Predominant Per Bank) Y R L R (Per Bank) L R (Per Bank) CONSERVATION TILLAGE [1] NONE / LITTLE [3] WIDE > 50m [4] SHRUB OR OLD FIELD [2] URBAN OR INDUSTRIAL [0] MODERATE [2] MODERATE 10 - 50m [3] RESIDENTIAL, PARK, NEW FIELD [1] OPEN PASTURE, ROWCROP [0] HEAVY / SEVERE [1]	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION L R (Per Bank) L R (Most Predominant Per Bank) Y R L R (Per Bank) VERY WIDE > 100m [5] FOREST, SWAMP [3] CONSERVATION TILLAGE [1] NONE / LITTLE [3] WIDE > 50m [4] SHRUB OR OLD FIELD [2] URBAN OR INDUSTRIAL [0] MODERATE [2]	35
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION L R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) L R (Per Bank) -NONE / LITTLE [3] -WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URBAN OR INDUSTRIAL [0] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1] -NARROW 5 - 10m [2] -FENCED PASTURE [1] -MINING / CONSTRUCTION [0]	35
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank) L R (Most Predominant Per Bank) L R (Per Bank) CONSERVATION TILLAGE [1] NONE [0]	35
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank) L R (Most Predominant Per Bank) L R (Per Bank	35
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank) L R (Most Predominant Per Bank) RIPARIAN WIDTH L R (Most Predominant Per Bank) RIPARIAN WIDTH L R (Most Predominant Per Bank) RIPARIAN WIDTH L R (Per Bank) L R (Per Bank) L R (Per Bank) RIPARIAN WIDTH RIPARIAN WIDTH L R (Per Bank) L R (Per Bank) L R (Per Bank) RIPARIAN WIDTH RIPARIAN WIDTH RIPARIAN WIDTH L R (Per Bank) RIPARIAN WIDTH NONE [1] -NONE [1]	мах 10
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Per Bank) L R (Most Predominant Per Bank) R (Per Bank) R	Max 10
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank) L R (Most Predominant Per Bank) RIPARIAN WIDTH L R (Most Predominant Per Bank) RIPARIAN WIDTH L R (Most Predominant Per Bank) RIPARIAN WIDTH L R (Per Bank) L R (Per Bank) L R (Per Bank) RIPARIAN WIDTH RIPARIAN WIDTH L R (Per Bank) L R (Per Bank) L R (Per Bank) RIPARIAN WIDTH RIPARIAN WIDTH RIPARIAN WIDTH L R (Per Bank) RIPARIAN WIDTH NONE [1] -NONE [1]	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current
RIPARIAN WIDTH	Max 10 Pool / Current C Max 12
RIPARIAN WIDTH	Pool / Current C Riffle / Run
RIPARIAN WIDTH	Pool / Current Max 12 Riffle / Run
RIPARIAN WIDTH	Pool / Current C Max 12 Riffle / Run Max 8
RIPARIAN WIDTH	Pool / Current C Riffle / Run
RIPARIAN WIDTH	Pool / Current C Max 12 Riffle / Run Max 8 Gradient
RPARIAN WIDTH	Pool / Current C Max 12 Riffle / Run Max 8
RPARIAN WIDTH	Pool / Current C Mex 12 Riffle / Run Max 8 Gradient

Stream Drawing:	Gradient: ☐ -Low ☐ -Moderate	Rating (1-10)	Subjective	Lat / Long (End): Lat / Long (X-Loc):	Lat / Long (Mid):	Is Sampling Reach I
White the state of		Yes/No	Aesthetic Gear: Sampling Pass			Is Sampling Reach Representative of the Stream? (Y/ N) Lat / Long (Beg):
The second of th	is there water obstream? How far: Is there water close downstream? How far: Is Dry Channel mostly natural?	Is Stream Ephemeral (no pools, totally dry of only damp spots)?	Distance: Water Clarity: Water Stage:			If Not, Explain:
Cart Bridge	Other: Other Flow Alteration	Landfills Natural Dams	Canopy- % open: Mining Channelization Riparian Removal	Livestock Silviculture Construction Urban Runoff CSOs	WWTP O	Major Suspeded Sources of Impacts (Check All That Apply): None ☐

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TWI C	Biodiversity
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I Coore	13.5
:I Score:	6

River Code: 45-850 RM: 22.7 Stream: Salt Create Site Code: \$\forall 35 A Project Code: \forall 40al (9 Location: Ust 1-290)	9: 8:
Date: 9-11-19 Scorer: MAS Latitude: 41,94114 Longitude: -87,98287	
1, SUBSTRATE Check ONLY Two Substrate TYPE BOXES; Estimate % percent	Substrate 1.2 Max 20
COMMENTS:	
AMOUNT: (Check ONLY one or check 2 and AVERAGE)	Cover
3. CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE) SINUOSITY	Channel \\.7 Max 20
4.] RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) RIVER RIGHT Looking Downstream RIVER RIGHT Looking Downstream RIVER RIGHT Looking Downstream BANK EROSION L R (Per Bank) L R (Per Bank)	Riparian Max 10
5.1 POOL / GLIDE AND RIFFLE / RUN QUALITY MAX. DEPTH	Pool / Current O\ Max 12
CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS -*Best Areas > 10cm [2] - MAX > 50 cm [2] / -STABLE (e.g., Cobble, Boulder) [2] -NONE [2] -Best Areas 5 - 10cm [1] - MAX < 50 cm [1] - MOD. STABLE (e.g., Large Gravel) [1] -LOW [1] -Best Areas < 5cm [0] - NORIFFLE but RUNS present [0] -NO RIFFLE but RUNS present [0] -EXTENSIVE [-1] COMMENTS:	Riffle / Run Max 8 Gradient
6.) GRADIENT (ft / mi): 5.87 DRAINAGE AREA (sq.mi.): 75 % POOL: % GLIDE: Gradient Score from Table 2 of Users Manual based on gradient and drainage area.	Max 10

Stream Drawing:	Lat / Long (Beg): Lat / Long (Mid): Lat / Long (Mid): Lat / Long (End): Lat / Long (End): Lat / Long (End): Lat / Long (End): Subjective
FI 33 8	ive of the Stream? (Y/ N) First Sampling Pass Yes/No O O O O O O O O O O O O O O O O O O
	If Not, Explain: If Not, Explain:
The state of the s	(b)
1-290 End	Major Suspected Sources of Impacts (Check All That Apply): None

small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools. quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very

760, 858	350.0	Midwest .
EWE	Co.	Biodiversity
MA BU		Institute

OHFI	Score:

ore:	1
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River Code: 95-850 RM: 22.3	Stream: Sal Creek		
Site Code: SC 35B Project Code: Salt Oalc 19	Location:	4 (2004 120	_
Date: 9-11-19 Scorer: MAS	Latitude: 41, 94424	Longitude:87.98213	= .
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % perc	ent		•
TYPE POOL RIFFLE	POOL RIFFLE SUBSTRATE ORIGIN	SUBSTRATE QUALITY	
☐ ☐ -BLDR/SLBS [10] ☐ ☐ ☐ -GRAVEL [7]	Check ONE (OR 2 & AVERA	AGE) Check ONE (OR 2 & AVERAGE)	
☐ ☐ -Lg BOULD [10] ☐ ☐ -SAND [6]	-LIMESTONE [1]	SILT: SILT HEAVY [-2]	Substrate
☐ -BOULDER [9] ☐ -BEDROCK [5]	TILLS [1]	-SILT MODERATE [-1]	45
☐ -COBBLE [8] ☐ -DETRITUS [3]	-WETLANDS [0]	☐ -SILT NORMAL [0]	13.5
-HARDPAN [4]	-HARDPAN [0]	SILT FREE [1]	Max 20
		EMBEDDED : -EXTENSIVE [-2]	Wax ZU
	,	NESS: MODERATE [-1]	
ANNAPED OF CURCURATE TYPES.			
NUMBER OF SUBSTRATE TYPES: 4 or More [2]	-LACUSTRINE [0]	-NORMAL [0]	
(High Quality Only, Score 5 or >)	-SHALE [-1]	NONE [1]	
COMMENTS:	COAL FINES [-2]		
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for in:	etructions)	AMOUNT: (Check ONLY one or	_
(Structure) TYPE: Score All That Occur	a distriby	check 2 and AVERAGE)	Cover
	O OXBOWS, BACKWATERS [1]	-EXTENSIVE > 75% [11]	
OVERHANGING VEGETATION [1] 3 ROOTWADS [1]	3 AQUATIC MACROPHYTES [1]	-MODERATE 25 - 75% [7]	14
SHALLOWS (IN SLOW WATER) [1] / BOULDERS [1]	3 LOGS OR WOODY DEBRIS [1]	-SPARSE 5 - 25% [3]	Max 20
ROOTMATS [1]		-NEARLY ABSENT < 5% [1]	HILDS ZO
COMMENTS:			
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2	and AVERAGE)		_
SINUOSITY DEVELOPMENT CHANNELIZAT	•	MODIFICATIONS / OTHER	
	✓ -HIGH [3]	□-SNAGGING □ -IMPOUNDMENT	Channel
☐ -MODERATE [3] ☐ -GOOD [5] ☐ -RECOVE	RED [4]	☑-RELOCATION ☐ -ISLAND	
☐ -LOW [2] ☐ -FAIR [3] ☐ -RECOVE	RING [3]LOW [1]	☐-CANOPY REMOVAL ☐ -LEVEED	17
□ -NONE [1] □ -POOR [1] □ -RECENT	OR NO	☐-DREDGING ☐ -BANK SHAPING	Max 20
REÇOVEI	RY [1]	☐-ONE SIDE CHANNEL MODIFICATIONS	
IMPOUN	DED [-1]		
COMMENTS:			
COMMENTS.			_
COMMENS.		ja ja	_
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che		River Right Looking Downstream	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL	ck 2 and AVERAGE per bank) ITY (PAST 100 Meter RIPARIAN)	River Right Looking Downstream BANK EROSION	_
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank)	Riparian
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank) U	ITY (PAST 100 Meter RIPARIAN) LR □ □ -CONSERVATION TILLAGE	BANK EROSION L R (Per Bank) E [1]	
4.] RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank) L R (Most Predominant Per Bank) — VERY WIDE > 100m [5] — -FOREST, SWAMP [3] — -WIDE > 50m [4] — -SHRUB OR OLD FIELD [2]	ITY (PAST 100 Meter RIPARIAN) LR □ □ -CONSERVATION TILLAGE □ □ -URBAN OR INDUSTRIAL [I	BANK EROSION L R (Per Bank) E[1]	Riparian
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R CONSERVATION TILLAGE URBAN OR INDUSTRIAL [I] FIELD [1] OPEN PASTURE, ROWCR	BANK EROSION L R (Per Bank) E [1]	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Most Predominant Per Bank) L R (Most Predominant Per Bank) — -FOREST, SWAMP [3] — -FOREST, SWAMP [3] — -WIDE > 50m [4] — -SHRUB OR OLD FIELD [2] — -MODERATE 10 - 50m [3] — -RESIDENTIAL, PARK, NEW — -NARROW 5 - 10m [2] — -FENCED PASTURE [1]	ITY (PAST 100 Meter RIPARIAN) LR □ □ -CONSERVATION TILLAGE □ □ -URBAN OR INDUSTRIAL [I	BANK EROSION L R (Per Bank) E [1]	0
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R CONSERVATION TILLAGE URBAN OR INDUSTRIAL [I] FIELD [1] OPEN PASTURE, ROWCR	BANK EROSION L R (Per Bank) E [1]	0
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Most Predominant Per Bank) L R (Most Predominant Per Bank) — -FOREST, SWAMP [3] — -FOREST, SWAMP [3] — -WIDE > 50m [4] — -SHRUB OR OLD FIELD [2] — -MODERATE 10 - 50m [3] — -RESIDENTIAL, PARK, NEW — -NARROW 5 - 10m [2] — -FENCED PASTURE [1]	ITY (PAST 100 Meter RIPARIAN) L R CONSERVATION TILLAGE URBAN OR INDUSTRIAL [I] FIELD [1] OPEN PASTURE, ROWCR	BANK EROSION L R (Per Bank) E [1]	0
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R CONSERVATION TILLAGE URBAN OR INDUSTRIAL [I] FIELD [1] OPEN PASTURE, ROWCR	BANK EROSION L R (Per Bank) E [1]	0
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R CONSERVATION TILLAGE UP - URBAN OR INDUSTRIAL [IIII] FIELD [1] - OPEN PASTURE, ROWCR UP - MINING / CONSTRUCTION	BANK EROSION L R (Per Bank) E[1]	0
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R CONSERVATION TILLAGE URBAN OR INDUSTRIAL [I] OPEN PASTURE, ROWCR UMARKAN OR INDUSTRIAL [I] COMMENT OF THE CONSTRUCTION	BANK EROSION L R (Per Bank) E [1]	Max 10
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I OPEN PASTURE, ROWCR - MINING / CONSTRUCTION - MINING / CONSTRUCTIO	BANK EROSION L R (Per Bank) E [1]	Max 10
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [IIII] FIELD [1] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - EDDIES [1]	BANK EROSION L R (Per Bank) E[1]	Max 10
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank) E [1]	Max 10 Pool / Current
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I FIELD [1] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - EDDIES [1] TH [1] - FAST [1] TH [0] - MODERATE [1]	BANK EROSION L R (Per Bank) E [1]	Max 10 Pool / Current
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN)	BANK EROSION L R (Per Bank) E [1]	Max 10 Pool / Current
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I FIELD [1] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - EDDIES [1] TH [1] - FAST [1] TH [0] - MODERATE [1]	BANK EROSION L R (Per Bank) E [1]	Max 10 Pool / Current
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN)	BANK EROSION L R (Per Bank) E [1]	Max 10 Pool / Current
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I FIELD [1] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - EDDIES [1] TH [1] - FAST [1] TH [0] - MODERATE [1] - NONE [-1]	BANK EROSION L R (Per Bank) E [1]	Max 10 Pool / Current Max 12
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I] FIELD [1] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - EDDIES [1] TH [1] - FAST [1] TH [0] - MODERATE [1] - NONE [-1]	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION - CURRENT VELOCITY (Check All TH [2] - FAST [1] TH [1] - FAST [1] TH [0] - NODERATE [1] - NONE [-1] CHECK 2 AND ADVERAGE RIFFLE / RUN SUBSTRATE	BANK EROSION L R (Per Bank) E[1]	Max 10 Pool / Current Max 12
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - FAST [1] TH [1] - FAST [1] TH [0] - NODERATE [1] - NONE [-1] CHECK 2 AND ADVERAGE RIFFLE / RUN SUBSTRATE - STABLE (e.g., Cobble, Boulder) [2]	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - FAST [1] TH [1] - FAST [1] TH [0] - NODERATE [1] - NONE [-1] CHECK 2 AND ADVERAGE RIFFLE / RUN SUBSTRATE - STABLE (e.g., Cobble, Boulder) [2]	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run Max 8
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run Max 8
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank)	Pool / Current C\ Max 12 Riffle / Run Max 8 Gradient
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	TY (PAST 100 Meter RIPARIAN) L R - CONSERVATION TILLAGE - URBAN OR INDUSTRIAL [I] - OPEN PASTURE, ROWCR - MINING / CONSTRUCTION - MINING / CONSTRUCTION CURRENT VELOCITY (Check All TH [2] - EDDIES [1] TH [1] - FAST [1] TH [0] - MODERATE [1] - NONE [-1] CHECK 2 AND ADVERAGE RIFFLE / RUN SUBSTRATE - STABLE (e.g., Cobble, Boulder) [2] - MOD. STABLE (e.g., Large Gravel) [1] - UNSTABLE (Fine Gravel, Sand) [0]	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run Max 8 Gradient
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or che RIPARIAN WIDTH FLOOD PLAIN QUAL L R (Per Bank) L R (Most Predominant Per Bank)	ITY (PAST 100 Meter RIPARIAN) L R	BANK EROSION L R (Per Bank) E[1]	Pool / Current Max 12 Riffle / Run Max 8 Gradient

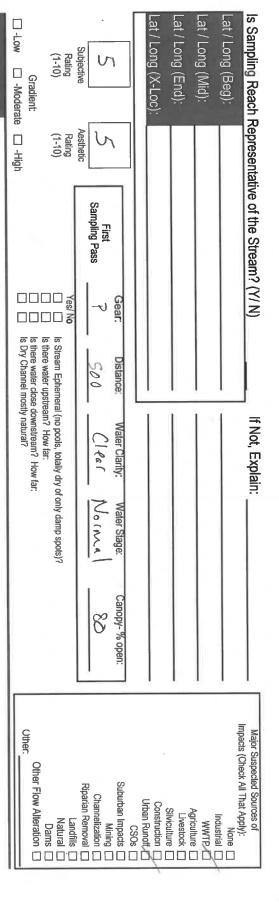
Stream Drawing:	Rating (1-10) Gradient: -Low -Moderate	Subjective	Lat / Long (End): Lat / Long (X-Loc):	Lat / Long (Beg): Lat / Long (Mid):	
5 5 5 5		First Sampling Pass		Is Sampling Reach Representative of the Stream? (Y/ N) Lat / Long (Beg): Lat / Long (Mid):	J
Sep Rep Od Hole	Yes/ No Yes/ No Is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far: Is there water close downstream? How far: Is Dry Channel mostly natural?	Sear: Distance: Water Clarity: Water Stage: Canopy-% open:		eam? (Y/ N) If Not, Explain:	
	Landfills ☐ Natural ☐ Dams ☐ Other Flow Alteration ☐ Other:	Suburban Impacts Mining Channelization Channelization Riparian Removal	Livestock Construction Cons	Major Suspected Sources or Impacts (Check All That Apply): None	Make Companded Courses of

quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools. small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very

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QHEI	Score:	1

River Code: 95-850 RM: 24.5 Stream: Salt Croek	
Site Code: 5C40 Project Code: Salt 18 Location: 9t Lion wood Par Congitude: -87.96735	= =
	=
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
□ □-BLDR/SLBS [10] □ □ □ □ GRAVEL [7] □ Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)	
- Lig BOULD [10] - SAND [6] - LIMESTONE [1] SILT: - SILT HEAVY [-2]	Substrate
□ □-BOULDER [9]	12
	L
□ □ -HARDPAN [4] □ □ -SILT FREE [1] □ □ -MUCK [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	Max 20
RIP/RAP[0] NESS: -MODERATE [-1]	
NUMBER OF SUBSTRATE TYPES:	
(High Quality Only, Score 5 or >)	
COMMENTS:	
COMMENTS: 2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or	<u> </u>
(Structure) TYPE Score All That Occur	Cover
3 UNDERCUT BANKS [1] / POOLS > 70 cm [2] OXBOWS, BACKWATERS [1] -EXTENSIVE > 75% [11]	6
/ OVERHANGING VEGETATION [1] / ROOTWADS [1] O AQUATIC MACROPHYTES [1] -MODERATE 25 - 75% [7]	12
2_ SHALLOWS (IN SLOW WATER) [1]	Max 20
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	-
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY MODIFICATIONS/OTHER	
☐-HIGH [4] ☐-EXCELLENT [7] ☐-NONE [6] ☐-HIGH [3] ☐-SNAGGING ☐-IMPOUNDMENT	Channel
-MODERATE [3] -GOOD [5] -RECOVERED [4] -MODERATE [2] -RELOCATION -ISLAND -LOW [2] -FAIR [3] -RECOVERING [3] -RECOVERING [3] -LOW [1] -CANOPY REMOVAL -LEVEED	11.5
☐ -LOW [2] ☐ -FAIR [3] ☐ -RECOVERING [3] ☐ -LOW [1] ☐ -CANOPY REMOVAL ☐ -LEVEED ☐ -NONE [1] ☐ -POOR [1] ☐ -RECENT OR NO ☐ -DREDGING ☐ -BANK SHAPING	Max 20
RECOVERY [1] —ONE SIDE CHANNEL MODIFICATIONS	INCK EU
-IMPOUNDED [-1]	
COMMENTS:	-
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	
L R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank)	Riparian
	1.5
☐ ☐ -WIDE > 50m [4] ☐ ☐ SHRUB OR OLD FIELD [2] ☐ ☐ -URBAN OR INDUSTRIAL [0] ☐ -MODERATE [2] ☐ ☐ -HEAVY / SEVERE [1]	Max 10
□ □ -NARROW 5 - 10m [2] □ -FENCED PASTURE [1] □ -MINING / CONSTRUCTION [0]	Max 10
□ -VERY NARROW < 5m [1]	•
OMMENTS:	- :
5.) POOL / GLIDE AND RIFFLE / RUN QUALITY	
MAX. DEPTH CURRENT VELOCITY (POOLS & RIFFLES!)	
(Check 1 ONLY!) (Check 1 or 2 & AVERAGE) (Check All That Apply) □ ,- 1m [6] -POOL WIDTH > RIFFLE WIDTH [2] □ -EDDIES [1] □ -TORRENTIAL [-1]	Pool /
☐ -1m [6] ☐ -POOL WIDTH > RIFFLE WIDTH [2] ☐ -EDDIES [1] ☐ -TORRENTIAL [-1] ☐ -0.7m [4] ☐ -POOL WIDTH = RIFFLE WIDTH [1] ☐ -FAST [1] ☐ -INTERSTITIAL [-1]	Current
-0.4 to 0.7m [2] -POOL WIDTH < RIFFLE WIDTH [0] -MODERATE [1] -INTERMITTENT [-2]	8
□ - 0.2 to 0.4m [1] □ -IMPOUNDED [-1] □ -SLOW [1] □ -VERY FAST [1]	Max 12
☐ -<0.2m [POOL = 0} ☐ -NONE [-1]	
COMMENTS:	
CHECK ONE OR CHECK 2 AND ADVERAGE	Riffle / Run
RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS	
-*Best Areas > 10cm [2] - MAX > 50 cm [2] - STABLE (e.g., Cobble, Boulder) [2] -NONE [2]	
Best Areas 5 - 10cm [1]	Max 8
-NO RIFFLE but RUNS present [0] -EXTENSIVE [-1]	Gradient
☐ -NO RIFFLE / NO RUN [Metric = 0]	J. J
COMMENTS.	
6.) GRADIENT (ft / mi): 3.63 DRAINAGE AREA (sq.mi.): 75 43.0 % POOL: %GLIDE: Gredient Score from Table 2 of Users Manual	(Q)
*Best areas must be large enough to support a population of riffle-obligate species % RIFFLE: % RUN: best on solder and drainage area.	Max 10



Stream Drawing:



quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools. Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very

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QHEI Score:

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River Code: 75-030 RM; 23.5 Stream:)alt Cree		
Site Code: S(34 Project Code: 591 18 Location: UST, Most in Oak Me	eadows Golf Course	
Date: 7-24-18 Scorer: MAS Latitude: 41.95187	Longitude: 87.98659	
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN	SUBSTRATE QUALITY AGE) Check ONE (OR 2 & AVERAGE)	
□ □-Lg BOULD [10] □ □ -LIMESTONE [1]	SILT:SILT HEAVY [-2]	Substrate
☐ ☐ -BOULDER [9] ☐ ☐ -BEDROCK [5] ☐ -TILLS [1]	-SILT MODERATE [-1]	1.0
COBBLE [8]	`☐ -SILT NORMAL [0]	19
-HARDPAN [4]	☐ -SILT FREE [1]	Max 20
□ -MUCK [2] □ -SANDSTONE [0] □ -RIP / RAP [0]	EMBEDDEDextensive [-2] NESS:MODERATE [-1]	
NUMBER OF SUBSTRATE TYPES: 4 or More [2] -LACUSTRINE [0]	-NORMAL [0]	
(High Quality Only, Score 5 or >) □ -3 or Less [0] □ -SHALE [-1]	□ -NONE [1]	
☐ -COAL FINES [-2]		
COMMENTS: 2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)	AMOUNT: (Check ONLY one or	
(Structure) TYPE: Score All That Occur	check 2 and AVERAGE)	Cover
/ UNDERCUT BANKS [1]	EXTENSIVE > 75% [11]	
O OVERHANGING VEGETATION [1] O ROOTWADS [1] 3 AQUATIC MACROPHYTES [1]	-MODERATE 25 - 75% [7]	16
/ SHALLOWS (IN SLOW WATER) [1] / BOULDERS [1] LOGS OR WOODY DEBRIS [1]	-SPARSE 5 - 25% [3]	Max 20
3 ROOTMATS [1] COMMENTS:	-NEARLY ABSENT < 5% [1]	
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)		
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY	MODIFICATIONS / OTHER	
☐ HIGH [4] ☐ EXCELLENT [7] ☐ -NONE [6] ☐ -HIGH [3]	□-SNAGGING □ -IMPOUNDMENT	Channel
-MODERATE [3] -GOOD [5] -RECOVERED [4] -MODERATE [2]	☐-RELOCATION ☐ -ISLAND	1.6
☐ -LOW [2] ☐ -FAIR [3] ☐ -RECOVERING [3] ☐ -LOW [1]	☐-CANOPY REMOVAL ☐ -LEVEED	15
☐ -NONE [1] ☐ -POOR [1] ☐ -RECENT OR NO RECOVERY [1]	☐-DREDGING ☐ -BANK SHAPING	Max 20
☐ -IMPOUNDED [-1]	ONE SIDE CHANNEL MODIFICATIONS	
COMMENTS:		
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) L R (Most Predominant Per Bank) L R	D]	Riparian Nax 10
EN DOOL (CLIDE AND DIETE E /DIN OLA ITY		
5.) POOL/GLIDE AND RIFFLE / RUN QUALITY MAX. DEPTH MORPHOLOGY CURRENT VELOCITY	(POOLS & RIFFLESI)	
	That Apply)	Poof /
-POOL WIDTH > RIFFLE WIDTH [2] -EDDIES [1]	☐ -TORRENTIAL [-1]	Current
-POOL WIDTH = RIFFLE WIDTH [1] -FAST [1]	☐ -INTERSTITIAL [-1]	10
□ - 0.4 to 0.7m [2] '□ -POOL WIDTH < RIFFLE WIDTH [0] MODERATE [1]	☐ -INTERMITTENT [-2]	1
- 0.2 to 0.4m [1] -IMPOUNDED [-1] -SLOW [1]	U-VERY FAST [1]	Max 12
☐ -0.2 to 0.4m [1] ☐ -IMPOUNDED [-1] ☐ -SLOW [1] ☐ -< 0.2m [POOL = 0) ☐ -NONE [-1] ☐ -NONE [-1]	LJ -VERY FAST [1]	Max 12
☐ -< 0.2m [POOL = 0] ☐ -NONE [-1]	LJ -VERY FAST [1]	Max 12
-< 0.2m [POOL = 0] COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE		Riffle / Run
☐ -< 0.2m [POOL = 0} COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE		Riffle / Run
- < 0.2m [POOL = 0] COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE - MAX > 50 cm [2] - STABLE (e.g., Cobble, Boulder) [2]	RIFFLE / RUN EMBEDDEDNESS □ -NONE [2]	Riffle / Run
☐ -< 0.2m [POOL = 0} COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE	RIFFLE / RUN EMBEDDEDNESS -NONE [2] -LOW [1]	Riffle / Run
-< 0.2m [POOL = 0} COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE -*Best Areas > 10cm [2] -*MAX > 50 cm [2] -*STABLE (e.g., Cobble, Boulder) [2] -*Best Areas 5 - 10cm [1] -*MAX < 50 cm [1] -*MOD. STABLE (e.g., Large Gravel) [1]	RIFFLE / RUN EMBEDDEDNESS -NONE [2] -LOW [1] -MODERATE [0]	Riffle / Run
- < 0.2m [POOL = 0} COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE - *Best Areas > 10cm [2] - MAX > 50 cm [2] - STABLE (e.g., Cobble, Boulder) [2] - Best Areas > 5cm [0] - NO RIFFLE but RUNS present [0] - NO RIFFLE / NO RUN [Metric = 0]	RIFFLE / RUN EMBEDDEDNESS - NONE [2] -LOW [1] -MODERATE [0]	Riffle / Run 以ら Max 8
-< 0.2m [POOL = 0} COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE - Best Areas > 10cm [2] - MAX > 50 cm [2] - STABLE (e.g., Cobble, Boulder) [2] - Best Areas 5 - 10cm [1] - Best Areas < 5cm [0] - NO RIFFLE but RUNS present [0] - NO RIFFLE / NO RUN [Metric = 0] COMMENTS:	RIFFLE / RUN EMBEDDEDNESS - NONE [2] -LOW [1] -MODERATE [0]	Riffle / Run A.S Max 8 Gradient
- < 0.2m [POOL = 0] COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE	RIFFLE / RUN EMBEDDEDNESS -NONE [2] -LOW [1] -MODERATE [0] -EXTENSIVE [-1]	Riffle / Run 以ら Max 8
-< 0.2m [POOL = 0} COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE - Best Areas > 10cm [2] - MAX > 50 cm [2] - STABLE (e.g., Cobble, Boulder) [2] - Best Areas 5 - 10cm [1] - Best Areas < 5cm [0] - NO RIFFLE but RUNS present [0] - NO RIFFLE / NO RUN [Metric = 0] COMMENTS:	RIFFLE / RUN EMBEDDEDNESS - NONE [2] -LOW [1] -MODERATE [0]	Riffle / Run A.S Max 8 Gradient

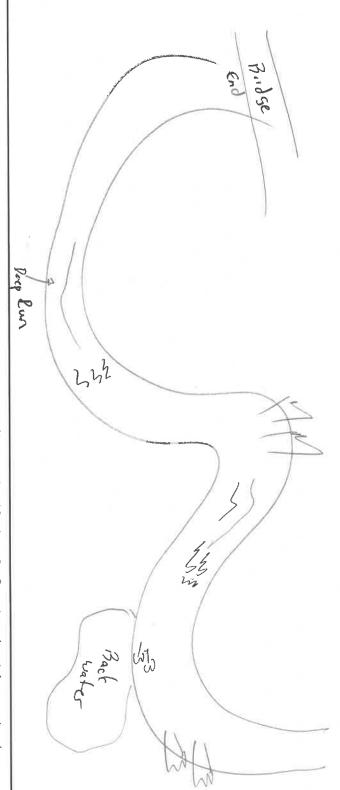
Stream Drawing:	adient:	Subjective	Lat / Long (End): Lat / Long (X-Loc):	Lat / Long (Mid):	Is Sampling Reach Representative of the Stream? (Y/ N) Lat / Long (Beg):
Fool Bridge	Rating (1-10)	Aesthetic			present
La B		First Sampling Pass			ative of the Stream
20		Gear:			1? (Y/ N)
	Is Stream Ephemeral (no pools, tol Is there water upstream? How far: Is there water close downstream? Is Dry Channel mostly natural?	Distance:			
	is Stream Ephemeral (no pools, totally dry of only damp spots)? is there water upstream? How far: is there water close downstream? How far: is there water close downstream? How far: is Dry Channel mostly natural?	Water Clarity:			If Not, Explain:
Eax Sac	of only damp spots)?	Water Stage:			
		Canopy-%open:			
Cro Cro	Landfills	Suburban Impacts Mining Channelization Ripanian Removal	Silviculture Construction Urban Runoff		Major Suspected Sources of Impacts (Check All That Apply):

N	8	Midwest Biodiversity
	No.	Institute

River Code: 95-850 RM: 23.00 Stream: Salt Creek	
Site Code: SC35 Project Code: SaH 18 Location: @ Oak Meadows Galf 19	-
Date: 7-24-18 Scorer: MAJ Latitude: 41,94746 Longitude: -87,98229	-
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY □ □ -BLDR/SLBS [10] □ □ -GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)	
☐ ☐ -BLDR/SLBS [10] ☐ GRAVEL [7] ☐ Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE) ☐ ☐ -Lg BOULD [10] ☐ -SAND [6] ☐ -LIMESTONE [1] SILT: ☐ -SILT HEAVY [-2]	Cubatasta
□ -BOULDER [9] □ -BEDROCK [5] □ -TILLS [1] □ -SILT MODERATE [-1]	Substrate
COBBLE [8]	14
☐ -HARDPAN [4] ☐ -ARTIFICIAL [0] ☐ -HARDPAN [0] ☐ -SILT FREE [1]	Max 20
□ -MUCK [2] □ -SILT [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	IVICA EU
-RIP/RAP[0] NESS: -MODERATE [-1]	
NUMBER OF SUBSTRATE TYPES: 4 or More [2] -LACUSTRINE [0] -NORMAL [0]	
(High Quality Only, Score 5 or >) ☐ -3 or Less [0] ☐ -SHALE [-1] ☐ -NONE [1]	
COMMENTS:	
COMMENTS:	=
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure) AMOUNT: (Check ONLY one or check 2 and AVERAGE)	Cover
O OVERHANGING VEGETATION [1] O ROOTWADS [1] Z AQUATIC MACROPHYTES [1] MODERATE 25 - 75% [7]	16
	Max 20
3 ROOTMATS [1] -NEARLY ABSENT < 5% [1]	
COMMENTS:	₽6
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY MODIFICATIONS / OTHER	
-HIGH [4] -EXCELLENT [7] -NONE [6] -IHIGH [3] -SNAGGING -IMPOUNDMENT	Channel
□ -MODERATE [3] □ -RECOVERED [4] □ -MODERATE [2] □ -RELOCATION □ -ISLAND	
☐ -LOW [2] ☐ -FAIR [3] ☐ -RECOVERING [3] ☐ -LOW [1] ☐ -CANOPY REMOVAL ☐ -LEVEED	15
□ -NONE [1] □ -POOR [1] □ -RECENT OR NO □-DREDGING □ -BANK SHAPING	Max 20
RECOVERY [1]ONE SIDE CHANNEL MODIFICATIONS -IMPOUNDED [-1]	
COMMENTS:	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	
L R (Per Bank) L R (Most Predominant Per Bank) L R L R (Per Bank)	Riparian
□ -VERY WIDE > 100m [5] □ -FOREST, SWAMP [3] □ -CONSERVATION TILLAGE [1] □ -NONE / LITTLE [3] □ -WIDE > 50m [4] □ -SHRUB OR OLD FIELD [2] □ -URBAN OR INDUSTRIAL [0] □ -WODERATE [2]	14
-MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -PEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1]	Max 10
□ -NARROW 5 - 10m [2] □ -FENCED PASTURE [1] □ -MINING / CONSTRUCTION [0]	THIRDY TO
VERY NARROW < 5m [1]	
	6
5.) POOL/GLIDE AND RIFFLE / RUN QUALITY	
MAX. DEPTH MORPHOLOGY CURRENT VELOCITY (POOLS & RIFFLESI)	
(Check 1 ONLYI) (Check 1 or 2 & AVERAGE) (Check All That Apply)	Pool /
-1m [6] -POOL WIDTH > RIFFLE WIDTH [2] -EDDIES [1] -TORRENTIAL [-1]	Current
-0.7m [4] -0.7m [4] -POOL WIDTH = RIFFLE WIDTH [1] -INTERSTITIAL [-1]	'D
- 0.4 to 0.7m [2] -POOL WIDTH < RIFFLE WIDTH [0] -MODERATE [1] -INTERMITTENT [-2]	10
☐ -0.2 to 0.4m [1] ☐ -IMPOUNDED [-1] ☐ -SLOW [1] ☐ -VERY FAST [1] ☐ -< 0.2m [POOL = 0] ☐ -NONE [-1]	Max 12
☐ -< 0.2m [POOL = 0] ☐ -NONE [-1] COMMENTS:	
	9,
CHECK ONE OR CHECK 2 AND ADVERAGE	Riffle / Run
RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS	4.5
-*Best Areas > 10cm [2] -MAX > 50 cm [2] -STABLE (e.g., Cobble, Boulder) [2] -NONE [2]	
-Best Areas 5 - 10cm [1] -MAX < 50 cm [1] -MOD. STABLE (e.g., Large Gravel) [1] -LOW [1] -UNSTABLE (Fine Gravel, Sand) [0] -MODERATE [0]	Max 8
-NO RIFFLE but RUNS present [0] -NO RIFFLE but RUNS present [0]	Gradient
-NO RIFFLE / NO RUN [Metric = 0]	
COMMENTS:	
6.) GRADIENT (ft/mi): 6.16 DRAINAGE AREA (sq.mi.): 74.8 % POOL: % GLIDE:	8
*Best areas must be large enough to support a population of riffle-obligate species % RIFFLE: % RUN: Gradient Score from Table 2 of Users Menuel based on gradient and drainage area.	Max 10

Rating Rating (1-10) (1-10) Gradient: -Low -Moderate -High	Subjective Aesthetic	Lat / Long (X-Loc):	Lat / Long (End):	Lat / Long (Mid):	Lat / Long (Beg):	Is Sampling Reach Representative of the Stream? (Y/ N)
	First Sampling Pass					ive of the Stream?
	Gear.					? (Y/ N)
Is Stream Ephemeral (no pools, to Is there water upstream? How far Is there water close downstream? Is Dry Channel mostly natural?	Distance:					
is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far: is there water close downstream? How far: is Dry Channel mostly natural?	Water Clarity:					If Not, Explain:
fonly damp spots)?	Water Stage:					
	Canopy-%open:					
Landfills \(\) Natural \(\) Dams \(\) Other Flow Alteration \(\) Other:	Suburban Impacts Suburban Impacts Chaining Channelization Channelization Riparian Removal	Construction Const	Livestock Silviculture	WWTP 2	Industrial [Major Suspected Sources of

Stream Drawing:





22.8

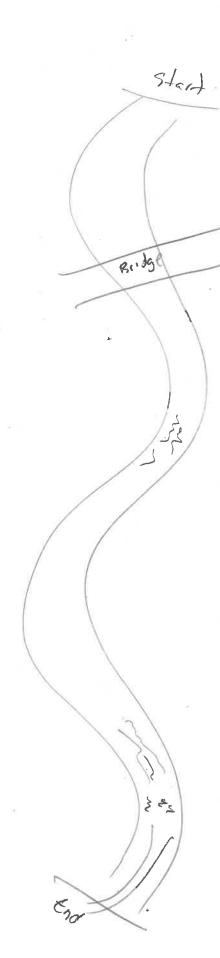
	١.
QHEI Score:	/

95-850 Salt Creek Stream: Site Code: 5c 35 8

Date: 7 - 24 + 18 S Galf Course Longitude: 87.98222 Salt 18 Project Code: Meadows Golf 11.94432 MAS Scorer: Latitude: 1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent RIFFLE SUBSTRATE ORIGIN POOL SUBSTRATE QUALITY ☐ ☐-BLDR/SLBS [10] GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE) ☐ -Lg BOULD [10] ☑ □ -SAND [6] ___ -LIMESTONE [1] ☐ -SILT HEAVY [-2] Substrate ☐ G-BOULDER [9] 🗹 -TILLS [1] SILT MODERATE [-1] ☐ ☐ -BEDROCK [5] ☐ ☐ -DETRITUS [3] COBBLE [8] ☐ -WETLANDS [0] ☐ -SILT NORMAL [0] -HARDPAN [0] ☐ HARDPAN [4] □ □ -ARTIFICIAL [0] ☐ -SILT FREE [1] Max 20 ☐ ☐ -MUCK [2] □ □ -SILT [2] □ -SANDSTONE [0] -RIP / RAP [0] NESS: -MODERATE [-1] NUMBER OF SUBSTRATE TYPES: 4 or More [2] -NORMAL [0] ☐ -LACUSTRINE [0] (High Quality Only, Score 5 or >) ☐ -3 or Less [0] ☐ -SHALE [-1] □ -NONE [1] -COAL FINES [-2] COMMENTS: 2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or TYPE: Score All That Occur (Structure) check 2 and AVERAGE) Cover 3 POOLS > 70 cm [2] 15 **UNDERCUT BANKS [1]** OXBOWS, BACKWATERS [1] ☐ -EXTENSIVÊ > 75% [11] **OVERHANGING VEGETATION [1]** _ROOTWADS [1] 2 AQUATIC MACROPHYTES [1] -MODERATE 25 - 75% [7] \triangle 3 LOGS OR WOODY DEBRIS [1] SHALLOWS (IN SLOW WATER) [1] / BOULDERS [1] -SPARSE 5 - 25% [3] Max 20 3 ROOTMATS[1] ☐ -NEARLY ABSENT < 5% [1]
</p> COMMENTS: 3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE) SINUOSITY DEVELOPMENT CHANNELIZATION **STABILTIY** MODIFICATIONS / OTHER -HIGH [4] -EXCELLENT [7] ☐ -HIGH [3] ☐ -NONE [6] ☐-SNAGGING ☐ -IMPOLINDMENT Channel ☐ -MODERATE [3] GOOD [5] -RECOVERED [4] MODERATE [2] __-RELOCATION -ISLAND ☐ -LOW [2] -FAIR [3] -RECOVERING [3] -LOW [1] ☐-CANOPY REMOVAL -LEVEED __ -POOR [1] -RECENT OR NO ☐ -NONE [1] -DREDGING □ -BANK SHAPING RECOVERY [1] T-ONE SIDE CHANNEL MODIFICATIONS ☐ -IMPOUNDED [-1] COMMENTS: River Right Looking Downstream 4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) **BANK EROSION** L R (Per Bank) L R (Most Predominant Per Bank) L R L R (Per Bank) Riparian ___ -VERY WIDE > 100m [5] ☐ -FOREST, SWAMP [3] □ □ -CONSERVATION TILLAGE [1] □ □ -NONE/LITTLE [3] ☐ -WIDE > 50m [4] ☐ -SHRUB OR OLD FIELD [2] ☐ URBAN OR INDUSTRIAL [0] -MODERATE [2] ☐ -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] ☐ ☐ -HEAVY / SEVERE [1] Max 10 ____ -NARROW 5 - 10m [2] ☐ ☐ -FENCED PASTURE [1] ☐ ☐ -MINING / CONSTRUCTION [0] ✓ VERY NARROW < 5m [1] □ -NONE [0] COMMENTS: 5.) POOL / GLIDE AND RIFFLE / RUN QUALITY MAX, DEPTH MORPHOLOGY CURRENT VELOCITY (POOLS & RIFFLES!) (Check J ONLY!) (Check 1 or 2 & AVERAGE) (Check All That Apply) Pool / -EDDIES [1] - 1m [6] -POOL WIDTH > RIFFLE WIDTH [2] ☐ -TORRENTIAL [-1] Current - 0.7m [4] -POOL WIDTH = RIFFLE WIDTH [1] ☐ -INTERSTITIAL [-1] -FAST [1] ___ - 0.4 to 0.7m [2] -POOL WIDTH < RIFFLE WIDTH [0] -MODERATE [1] ☐ -INTERMITTENT [-2] - 0.2 to 0.4m [1] ☐ -IMPOUNDED [-1] SLOW [1] -VERY FAST [1] Max 12 -< 0.2m [POOL = 0) □ -NONE [-1] COMMENTS: CHECK ONE OR CHECK 2 AND ADVERAGE Riffle / Run **RUN DEPTH** RIFFLE DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS A.5 -*Best Areas > 10cm [2] - MAX > 50 cm [2] -STABLE (e.g., Cobble, Boulder) [2] ☐ -NONE [2] ☐ -Best Areas 5 - 10cm [1] ☐ - MAX < 50 cm [1]</p> -MOD. STABLE (e.g., Large Gravel) [1] ☐ -LOW [1] Max 8 Best Areas < 5cm [0] ☐ -UNSTABLE (Fine Gravel, Sand) [0] -MODERATE (0) -NO RIFFLE but RUNS present [0] EXTENSIVE [-1] Gradient -NO RIFFLE / NO RUN [Metric = 0] 4 6.) GRADIENT (ft / mi): 5.87 DRAINAGE AREA (sq.mi.): 75.0 % POOI : % GLIDE: Gradient Score from Table 2 of Users based on gradient and drainage area. % RIFFLE: *Best areas must be large enough to support a population of riffle-obligate species % RUN: Max 10

Gradient: □ -Low □ -Moderate □ -High	Rating Rating (1-10)	Subjective Aesthetic	Lat / Long (X-Loc):	Lat / Long (End):	Lat / Long (Mid):	Lat / Long (Beg):	Is Sampling Reach Representative of the Stream? (Y/N)
		First Sampling Pass					tive of the Stream
	Yes/ No	Gear:					? (Y/N)
is there water close downstread is Dry Channel mostly natural?	Is Stream Ephemeral (no pools, to	Distance:				. Art	
is there water close downstream? How far. is Dry Channel mostly natural?	ls Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water unstream? How far:	Water Clarity:					If Not, Explain:
.1	of only damp spots)?	Water Stage:					
		Canopy- % open:					
Other Flow Alteration Uther:	Landfills U Natural O Dams O	Suburban Impacts Suburban Impacts Cannolization Channelization Removal	Construction Urban Runoff CSCs	Silviculture	Apriculture	None	Major Suspected Sources of

Stream Drawing:



22.7

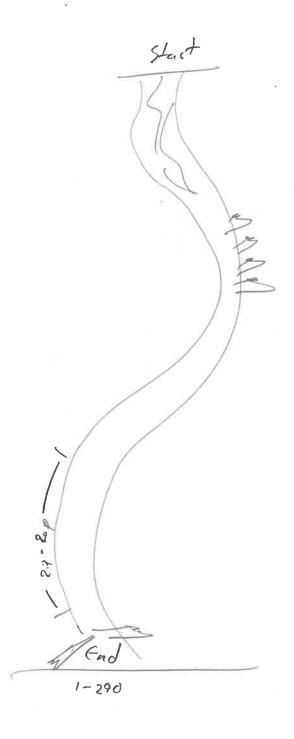


	,
QHEI Score:	B

Gualitative Habitat Evaluation Muex Field Sheet QHEI Score): \U^
River Code: 95-850 RM: -22.30 Stream: 3a Creek	
Site Code: SC 35 6 Project Code: Sql 18 Location: Upst. I - 290 Date: 7 - 24 - 18 Scorer: Maj Latitude: 1,24109 Longitude: - 87,98277	_
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
☐ ☐-BLDR/SLBS [10] ☐ ☐ ☐-GRAVEL [7] ☐ ☐ Check ONE (OR 2 & AVERAGE) ☐ Check ONE (OR 2 & AVERAGE)	
□ □-Lg BOULD [10] □ -LIMESTONE [1] SILT: □ -SILT HEAVY [-2]	Substrate
□ -BOULDER [9] □ -BEDROCK [5] □ -SILT MODERATE [-1]	
□ □-COBBLE [8] □ □ -DETRITUS [3] □ -WETLANDS [0] □ -SILT NORMAL [0]	12
□ □-HARDPAN [4] □ □ -ARTIFICIAL [0] □ -HARDPAN [0] □ -SILT FREE [1]	Max 20
□ □-MUCK[2] □ □ -SILT [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	
☐ -RIP / RAP [0] NESS: ☐-MODERATE [-1]	
NUMBER OF SUBSTRATE TYPES: 4 or More [2] LACUSTRINE [0] NORMAL [0]	
(High Quality Only, Score 5 or >) ☐ -3 or Less [0] ☐ -SHALE [-1] ☐ -NONE [1] ☐ -COAL FINES [-2]	
COMMENTS:	
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or	_
(Structure) TYPE: Score All That Occur check 2 and AVERAGE)	Cover
	16
Z SHALLOWS (IN SLOW WATER) [1] / BOULDERS [1] Z LOGS OR WOODY DEBRIS [1] SPARSE 5 - 25% [3]	Max 20
3 ROOTMATS [1] -NEARLY ABSENT < 5% [1]	IVIAX 20
COMMENTS:	_
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY MODIFICATIONS/OTHER	
-HIGH [4] -EXCELLENT [7] -NONE [6] -IHIGH [3] -SNAGGING -IMPOUNDMENT -MODERATE [3] -GOOD [5] -RECOVERED [4] -MODERATE [2] -RELOCATION -ISLAND	Channel
	13.5
□ -NONE [1] □ -POOR [1] □ -RECENT OR NO □-DREDGING □ -BANK SHAPING	Max 20
RECOVERY [1]ONE SIDE CHANNEL MODIFICATIONS	
COMMENTS:	
	£1
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	
L R (Per Bank) L R (Most Predominant Per Bank) L R L R (Per Bank)	Riparian
□ -VERY WIDE > 100m [5] □ -FOREST, SWAMP [3] □ -CONSERVATION TILLAGE [1] □ -NONE / LITTLE [3]	14
-WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -INBAN OR INDUSTRIAL [0] -MODERATE [2] -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPEN PASTURE, ROWCROP [0] -HEAVY / SEVERE [1]	Max 10
- NARROW 5 - 10m [2] - FENCED PASTURE [1] - MINING / CONSTRUCTION [0]	Max 10
ZÍ ZÍ-VERY NARROW < 5m [1]	
□□-NONE [0] COMMENTS:	_
EN POOL (OURS AND REST STRING OUR TO	
5.) POOL/GLIDE AND RIFFLE / RUN QUALITY MAX. DEPTH MORPHOLOGY CURRENT VELOCITY (POOLS & RIFFLES!)	
MAX_DEPTH MORPHOLOGY CURRENT VELOCITY (POOLS & RIFFLES!) (Check 1 On LY!) (Check 1 or 2 & AVERAGE) (Check All That Apply)	Pool /
✓ - 1m [6]	Current
-0.7m [4] -POOL WIDTH = RIFFLE WIDTH [1] -FAST [1] -INTERSTITIAL [-1]	
□ -0.4 to 0.7m [2] -POOL WIDTH < RIFFLE WIDTH [0] -INTERMITTENT [-2]	10
- 0.2 to 0.4m [1]IMPOUNDED [-1] - SLOW [1]VERY FAST [1]	Max 12
□ -< 0.2m [POOL = 0]	
VOIIIIIIIIII IV.	2.0
CHECK ONE OR CHECK 2 AND ADVERAGE	Riffle / Run
RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS	1/
-*Best Areas > 10cm [2] - MAX > 50 cm [2] - STABLE (e.g., Cobble, Boulder) [2] - NONE [2]	LX.
□ '-Best Areas 5 - 10cm [1] □ - MAX < 50 cm [1] □ '-MOD. STABLE (e.g., Large Gravel) [1] □ -LOW [1] □ -Best Areas < 5cm [0] □ -MODERATE [0]	Max 8
□ -NO RIFFLE but RUNS present [0] □ -NO	Gradient
□ -NO RIFFLE / NO RUN [Metric = 0]	GIGUIGII
COMMENTS:	
6.) GRADIENT (ft/mi): 3.2 DRAINAGE AREA (sq.mi.): 75.// % POOL: % GLIDE:	6
Best areas must be large enough to support a population of riffle-obligate species % RIFFLE: % RUN: Gradient Score from Table 2 of Users Manual based on gradient and drainage area.	Max 10

Rating Rating (1-10) (1-10) Gradient: Gradient: -Low -Moderate -High	e landient:		Lat / Long (End):	Lat / Long (Mid):	Lat / Long (Beg):	Is Sampling Reach Representative of the Stream? (Y/N)
	First Sampling Pass					ative of the Stream?
	Gear:					(Y/N)
Is Stream Ephemeral (no pools, to sthere water upstream? How far sthere water dose downstream? Is there water close downstream? Is Dry Channel mostly natural?	Distance:					
is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far: is there water close downstream? How far: is there water close downstream? How far: is Dry Channel mostly natural?	Water Clarity:					If Not, Explain:
of only damp spots)?	Water Stage:					
	Canopy-% open:					
Landfills Natural Natural Dams Dams Other Flow Alteration Cother.	Suburban Impacts Suburban Impacts Channelization Ch	Construction Urban Runoff	Agriculture Livestock	WWTP	Impacts (Check All That Apply): None	Major Suspected Sources of

Stream Drawing:



River Code: 95-850 Site Code: 96-850	RM: 24.5 Project Code: Solf 17	Stream: Location: 4 }		Park		
Date: 8-21-17	Scorer: MAS		6308	Longitude;	-87,98432	
1.) SUBSTRATE (Check ONLY Two TYPE POOL		•				
☐ ☐ BLDR/SLBS [10]	RIFFLE	POOL RIFFLE	SUBSTRATE ORIGIN	*	SUBSTRATE QUALITY	
	GRAVEL [7]		Check ONE (OR 2 & AV	ERAGE)	Check ONE (OR 2 & AVERAGE)	
☐ ☐ -Lg BOULD [10]	G -SAND [6]		[1]	SILT:	SILT HEAVY [-2]	Subst
☐ -COBBLE [8]			-TILLS [1]		SILT MODERATE [-1]	
	DETRITUS [3]		-WETLANDS [0]		SILT NORMAL [0]	13
			🗆 -HARDPAN [0]		SILT FREE [1]	Max
☐	[2]		C -SANDSTONE [0]	EMBEDDED		
AN IMPER OF CHROTOLET THEFE			RIP / RAP [0]	NESS:	-MODERATE [-1]	
NUMBER OF SUBSTRATE TYPES:	4 or More [2]		☐ -LACUSTRINE [0]	•	-NORMAL [0]	
(High Quality Only, Score 5 or >)	-3 or Less [0]		SHALE [-1]		☐ -NONE [1]	
COMMENTS:	/		COAL FINES [-2]			
2.) INSTREAM COVER (Give each co	iver type a score of 0 to 3: see back for	r inetractions\				
(Structure)	TYPE: Score All That Occur	insuucaona)			AMOUNT: (Check ONLY one or	
O UNDERCUT BANKS [1]	/ POOLS > 70 cm [2]		BACKWATERS [1]		check 2 and AVERAGE) -EXTENSIVE > 75% [11]	Cover
/ OVERHANGING VEGETATIO	N [1]/ROOTWADS [1]		MACROPHYTES (1)		-EXTENSIVE > 75% [11] -MODERATE 25 - 75% [7]	16
3 SHALLOWS (IN SLOW WATE	R) [1]/BOULDERS [1]		WOODY DEBRIS [1]		SPARSE 5 - 25% [3]	
/_ROOTMATS [1]	·—				-NEARLY ABSENT < 5% [1]	Max 20
COMMENTS:					_ version result	
3.) CHANNEL MORPHOLOGY: (Chec						
	LOPMENT CHANNELIZAT	. 2	BILTIY	MODIFICATIO	NS/OTHER	
	EXCELLENT [7] -NONE [6 GOOD [5] -RECOVE] -HIGH [3]	SNAGGI	C min portibilitati	Channe
	GOOD [5] ARECOVE		-MODERATE [2]	-RELOCA		11.
	OOR [1] -RECENT] -LOW [1]	CANOPY		14
— U.1	RECOVE			☐-DREDGI		Max 20
				ONE SID	E CHANNEL MODIFICATIONS	
	-IMPOUNI	DED (-1)				

TYPE POOL RIFFLE	POOL GRAVEL [7] FOOL POOL POOL	RIFFLE SUBSTRATE ORIGIN Check ONE (OR 2 & A' Check	SILT: SILT HEAVY [-2] SILT MODERATE [-1] -SILT NORMAL [0] -SILT FREE [1] EMBEDDED -SILT FREE [-1] EMBEDDED -SILT FREE [-1] -NORMAL [0] -NONE [1]	Substrat
OVERHANGING VEGETATION [1] SHALLOWS (IN SLOW WATER) [1] ROOTMATS [1] COMMENTS:	TYPE: Score All That Occur	OXBOWS, BACKWATERS [1] AQUATIC MACROPHYTES [1] LOGS OR WOODY DEBRIS [1]	AMOUNT: (Check ON check 2 and AVERAGE -EXTENSIVE > 75% [1 -MODERATE 25 - 75% -SPARSE 5 - 25% [3] -NEARLY ABSENT < 5	Cover [7]
3.) CHANNEL MORPHOLOGY: (Check ONLY SINUOSITY -HIGH [4] -MODERATE [3] -LOW [2] -NONE [1] COMMENTS:	IT <u>CHANNELIZATION</u> NT [7] □ -NONE [6]	ERAGE) STABILTIY	MODIFICATIONS / OTHER SNAGGINGIMPOURELOCATIONISLANICANOPY REMOVALLEVEEDREDGINGBANK:ONE SIDE CHANNEL MODIFICATIO	D 14 D Max 20
□ -VERY WIDE > 100m [5] □ -I □ -WIDE > 50m [4] □ -S □ -MODERATE 10 - 50m [3] □ -I	FLOOD PLAIN QUALITY (PAST 1 Nost Predominant Per Bank) FOREST, SWAMP [3] SHRUB OR OLD FIELD [2] RESIDENTIAL, PARK, NEW FIELD [1] ENCED PASTURE [1]	AVERAGE per bank) 100 Meter RIPARIAN L R CONSERVATION TILLAGE UP - URBAN OR INDUSTRIAL UP - OPEN PASTURE, ROWC	[0] — MODERATE [: ROP [0] — HEAVY/SEVI	Riparian 21 3.5
-1m[6]	MORPHOLOGY Check 1 or 2 & AVERAGE) OOL WIDTH > RIFFLE WIDTH [2] OOL WIDTH = RIFFLE WIDTH [1] OOL WIDTH < RIFFLE WIDTH [0] IPOUNDED [-1]		((POOLS & RIFFLESI) That Apply) -TORRENTIAL [-1] -INTERSTITIAL [-1] -INTERMITTENT [-2] -VERY FAST [1]	Pool / Current Max 12
	AX > 50 [2]	1.01 In own a new	RIFFLE / RUN EMBEDDEDNESS - NONE [2] - LOW [1] - MODERATE [0] - EXTENSIVE [-1]	Riffle / Run 3 Max 8 Gradient
7 . 1		POOL: % GLIDE: RIFFLE: % RUN:		Max 10

Major Suspected Sources of Impacts (Check All That Apply): None Industrial WWTP Agriculture Livestock Silviculture	Construction Urban Runoff COSOS COSO	Other:	Start
	Canopy-% open:		
	Water Stage:	only damp spois)?	
If Not, Explain:	Water Clarity:	Is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far. Is there water close downstream? How far: is Dry Channel mostly natural?	
	Distance:	Is Stream Ephemeral (no pools, totals there water upstream? How far. Is there water close downstream? Is Dry Channel mostly natural?	
1? (Y/ N)	Gear.	\$ 0000 \$	eiffle.
ive of the Stream	First Sampling Pass	3	3 446
epresentat		Aestredo Rating (1-10)	1
s Sampling Reach Representative of the Stream? -at / Long (Mid): -at / Long (End):	at / Long (X-Loc):	Subjective Rating (1-10) Gradient:	

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very quality; 3 = cover type of highest quality in moderate or greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large small amounts or if more common of marginal quality, 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

William Street	<u> </u>
Qualitative Habitat Evalu	nation Index Field Sheet QHEI Score: 64
River Code: 95-850 RM: 23.5 Stream: Salt (reet
Site Code: S34 Project Code: SH17 Location: P1	Elizabeta Dr.
Date: 9-21-17 Scorer: MAS Latitude: 41. SI	75 Longitude: -27.98636
GRAVEL [7] GRA	UBSTRATE ORIGIN heck ONE (OR 2 & AVERAGE) -LIMESTONE [1] SILT: -TILLS [1] -WETLANDS [0] -HARDPAN [0] -SANDSTONE [0] EMBEDDED -EXTENSIVE [-2] -RIP / RAP [0] NESS: -MODERATE [-1] -LACUSTRINE [0] -SHALE [-1] -NORMAL [0] -SHALE [-1]
COMMENTS:	-COAL FINES [-2]
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) (Structure)	ROPHYTES [1] -MODERATE 25 - 75% [7]
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE) SINUOSITY DEVELOPMENT -HIGH [4] -EXCELLENT [7] -NONE [6] -RECOVERED [4] -RECOVERING [3] -RECOVERING [3] -RECOVERING [3] -RECOVERY [1] -NONE [1]	GH [3] SNAGGING -IMPOUNDMENT Channel DERATE [2] -RELOCATION -ISLAND
-WIDE > 50m [4] -SHRUB OR OLD FIELD [2] -URI -MODERATE 10 - 50m [3] -RESIDENTIAL, PARK, NEW FIELD [1] -OPI	
EV BOOK (CURE MID DIFFLE / BUILDING	
(Check 1 ONLT1) (Check 1 or 2 & AVERAGE) -1m [6] -POOL WIDTH > RIFFLE WIDTH [2]	CURRENT VELOCITY

- 0.7m [4] - 0.4 to 0.7m [2] - 0.2 to 0.4m [1] - < 0.2m [POOL = 0] COMMENTS:	POOL WIDTH = R -POOL WIDTH < R -IMPOUNDED [-1]	IFFLE WIDTH [1] IFFLE WIDTH [0]	-FAS	T [1] DERATE [1] W [1]	☐ -INTERMITAL [-1] ☐ -INTERMITTENT [-2] ☐ -VERY FAST [1]		Curre 9 Max 1
RIFFLE DEPTH -*Best Areas > 10cm [2] -Best Areas 5 - 10cm [1] -Best Areas 5 - 5cm -NO Riffle but RUNS present [0] -NO RIFFLE / NO RUN [Metric: COMMENTS:	RUN DEPTH - MAX > 50 [2] - MAX < 50 [1]	(ONE OR CHECK 2 AND RIFFLE / RUN S - STABLE (e.g., - MOD. STABLE (FI	UBSTRATE	1) [1]	RIFFLE / RUN EMBEDDEDNESS	2	Riffie / R Max 8 Gradien
6.) GRADIENT (ft / mi): 6.55 D *Best areas must be large enough to support a p	_		OOL:	% GLIDE % RUN			Max 10

Impacts (Creek Au Triat Apply) None Industrial	Suburban Impacts Cook Cook Cook Cook Cook Cook Cook Coo	333
	Canopy- % open:	52
	Water Stage: \sum_6 r.m.a fonly damp spots)?	
	Distance: Water Clarity: Water Stage: Sco Moster Stage: Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water close downstream? How far: Is there water close downstream? How far:	
	Distance: Water Cla Score Score Stream Ephemeral (no pools, totals there water close downstream? How far: Is there water close downstream? Is there water close downstream?	
at / Long (End):	First Sampling Pass	
	Aesthelic Rating (1-10)	त्राम स्थाप प्रमाण
at / Long (Beg): -at / Long (Mid): -at / Long (End):	Subjective Rating (1-10) Gradient:	Stream Drawing:

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very quality; 3 = cover type of highest quality in moderate or greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

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OHEI	Score:	19.
44, 11771	90010.	LVK.

Piters Andre A P A P A P A	i Score: 6
Site Code: SC 2 S Project Code: S. 1 17 Landing M. 1	
Date: 9-21-17 Comm MA	
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
TVDE BOOK DIED S	
C CRUPE PE MAIL SUBSTRATE QUALITY	
CHECK ONE (OR 2 & AVERAGE)	
SILI HEAVY [2]	Substr
SILI MODERATE [-1]	.0
SILI NORMAL [0]	12
SILI PREE[1]	Max 2
NUMBER OF SUBSTRATE TYPES: 4 or More [2] - ACLISTRINE (0) NESS: C - MODERATE [-1]	
(Mich Quality Caby Second Seco	
- NONE[I]	
COMMENTS:COAL FINES [-2]	
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check ONLY one or	54.
(Structure) TYPE: Score All That Occur	0
UNDERCUI BANKS [1] SPOLS > 70 cm [2] OXBOWS, BACKWATERS [1]	Cover
O OVERTAINGING VEGE LATION [1] / ROOTWADS [1] AQUATIC MACROPHYTES [1] -MODERATE 25 - 75% [7]	16
SPARSE 5, 25% [3]	Max 20
	WILLY SU
OOMILITO.	
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE) SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY MODIFICATIONS (ATMER)	
HIGH IAI	
-SNAGGING IMPOUNDMENT	Channe
LOW [2] G-FAIR [3] G-PECOVERING [3] G-PECOVERING [3]	1
-NONE (1) -POOR (1) -PECENT OR NO	1/2
BANK SHAPING	Max 20
RECOVERY [1]ONE SIDE CHANNEL MODIFICATIONSIMPOUNDED [-1]	
COMMENTS:	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream	
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	
L R (Most Predominant Per Bank) L R L R (Per Bank)	Riparian
SHOUBORTE [2] - URBAN OR INDUSTRIAL [0] ADDERATE [2]	H
- TEAVY / SEVERE III	Max 10
☐ ☐-NARROW 5 - 10m [2] ☐ ☐ -FENCED PASTURE [1] ☐ ☐ -MINING / CONSTRUCTION [0] ☐ ☐ -MINING / CONSTRUCTION [0]	
□ □-NONE [0] COMMENTS:	
5.) POOL / GLIDE AND RIFFLE / RUN QUALITY	
MAX. DEPTH MORPHOLOGY CLIRRENT VELOCITY / POOL S & RIFET FOR	
(Check 1 or 2 & AVERAGE) (Check All That Apply)	D11
∠ - 1m [6]	Pool /
☐ -0.7m [4] ☐ -POOL WIDTH = RIFFLE WIDTH [1] ☐ -FAST [1] ☐ -INTERSTITIAL [-1]	Current
☐ -0.4 to 0.7 m [2]	10
☐ -0.2 to 0.4m [1] ☐ -IMPOUNDED [-1] ☐ -VERY FAST [1]	Max 12
☐ -< 0.2m [POOL ≈ 0]	WIGA 12
COMMENTS:	
A DE ALE ALE ALE ALE ALE ALE ALE ALE ALE AL	
CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RUN DEPTH RIFFLE / RUN SUBSTRATE	Riffle / Run
A *Bost Areas > 10cm (2) ANAY - FO (6)	15
	4.5
[] [] [] [] [] [] [] [] [] []	Max 8
MODERATE (U)	
-NO RIFFLE / NO RUN [Metric = 0]	Gradient
COMMENTS:	
6.) GRADIENT (ft/ml): 6.16 DRAINAGE AREA (sq.ml.): 74.8 % POOL: 6.16 % GLIDE:	- 8
*Part man must be large and the large and th	U
*Best areas must be large enough to support a population of riffle-obligate species % RIFFLE: % RUN:	Max 10

major Suspected Control major Suspected Control major Suspected Control major Suspected Construction major Suspected Construction major Suspected Construction major Suspected major Suspected Construction major Suspected major	Suburbar Chan Riparian	Landfills ☐ Natural ☐ Dams ☐ Other Flow Alteration ☐	27
if Not, Explain:	Gear: Distance: Water Clarity: Water Stage: Canopy-% open:	Yes/ No Is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far: Is there water close downstream? How far: Is Dry Channel mostly natural?	want want
s Sampling Reach Representative of the Stream? (Y/ N). at / Long (Beg): at / Long (End): at / Long (X-Loc):	First Sampling Pass	Subjective Aesthetic Rating Rating (1-10) (1-10) [Gradient:	Drawing:

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very quality; 3 = cover type of highest quality in moderate or greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.

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HEI Sco	ore:	71.	\$ Ĉ

QHEIS	core: 7
River Code: 95-850 RM: 22.8 Stream: Soc + Cree C	
Date: 8-21-17 Scorer: MA Location: Bug it Location: Date: 8-21-17 Scorer: MA Latitude: 4.7 250 Longitude: -87.98210	
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
TYPE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	
L] L-19 BOULD [10] [6] LIMESTONE [1] SILT:SILT HEAVY [-2]	Substrate
□ -BOULDER [9] □ -BEDROCK [5] □ -TILLS [1] □ -SILT MODERATE [-1]	
GOBBLE [8]	15
-SILI FREE[1]	Max 20
EMBEDDED 1 -EXTENSIVE [-2]	
NUMBER OF SUBSTRATE TYPES: 4 or More [2] -RIP / RAP [0] NESS: -MODERATE [-1] -LACUSTRINE [0] -NORMAL [0]	
(High Quality Only, Score 5 or >)	
COMMENTS:	
2) INSTREAM COVER (Give each cover have a cover of 0 to 2 core had to be at	
(Structure) TYPE: Score All That Occur	
OXBOWS, BACKWATERS [1] POOLS > 70 cm [2] OXBOWS, BACKWATERS [1] -EXTENSIVE > 75% [11]	Cover
2 SUALLONG (INCLUDING PLANCE) AQUATIC MACROPHYTES [1] AQUATIC MACROPHYTES [1]	14
POOTMATC (4)	Max 20
COMMENTS: -NEARLY ABSENT < 5% [1]	
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILITY MODIFICATIONS / OTHER -HIGH [4] -EXCELLENT [7] -NONE [6] -HIGH [3] -SANGGING	
MODERATE (3) GOOD (5) GOOD (6)	Channel
-RECOVERED [4]MODERATE [2]RELOCATIONISLANDSLANDFAIR [3]RECOVERING [3]LOW [1]CANOPY REMOVALLEVEED	16
□ -NONE [1] □ -POOR [1] □ -RECENT OR NO □ -BANK SHAPING	Max 20
RECOVERY [1]ONE SIDE CHANNEL MODIFICATIONSIMPOUNDED [-1]	
COMMENTS:	
AL DIRECTION OF THE PARTY OF TH	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) RIPARIAN WIDTH FLOOD PLAIN OILAL ITY (PAST 100 Motor PIPARIAN)	
L. R. (Per Bank) I. R. (Mart Predominant Box Bank) BANK EROSION	
□ -VERY WIDE > 100m [5] □ -FOREST, SWAMP [3] □ -CONSERVATION TILLAGE [1] □ -NONE / LITTLE [2]	Riparian
□ □-WIDE > 50m [4] □ □ -SHRUB OR OLD FIELD [2] □ □ -URBAN OR INDUSTRIAL [0] □ →MODERATE [2]	5
-MODERATE 10 - 50m [3] A RESIDENTIAL, PARK, NEW FIELD [1] - OPEN PASTURE, ROWCROP [0] - HEAVY / SEVERE [1]	Max 10
✓ ¬NARROW 5 - 10m [2]	
☐ ☐-NONE [0] COMMENTS:	
53 DOM (CLIDE AND DIFFLE ININIONALITY)	
5.) POOL / GLIDE AND RIFFLE / RUN QUALITY MAX. DEPTH MORPHOLOGY CURRENT VELOCITY (POOL & BIEFLESI)	
(Check 1 ONLYI) (Check 1 or 2 & AVERAGE) (Check All That Apply)	
☐ -POOL WIDTH > RIFFLE WIDTH [2] ☐ -EDDIÉS [1] ☐ -TORRENTIAL [-1]	Pool / Current
-0.7m [4]	
-0.4 to 0.7m [2] -POOL WIDTH < RIFFLE WIDTH [0] -MODERATE [1] -INTERMITTENT [-2] -0.2 to 0.4m [1] -MPOUNDED [-1] -SLOW [1] -JEPV FAST [1]	9
- 0.2 to 0.4 til [1] - WERY FAST [1] - VERY FAST [1] - VERY FAST [1] - NONE [-1]	Max 12
COMMENTS:	
CUECK AND	_
CHECK ONE OR CHECK 2 AND ADVERAGE RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS	Riffle / Run
- 'Best Areas > 10cm [2] - MAX > 50 [2] - STABLE (e.g., Cobble, Boulder) [2] - NONE [2]	45
- Best Areas 5 - 10cm [1] - MAX < 50 [1] - MOD. STABLE (e.g., Large Gravel) [1] - LOW [1]	Max 8
□ -Best Areas < 5cm □ -UNSTABLE (Fine Gravel, Sand) [0] □ -MODERATE [0] □ -NO Riffie but RUNS present [0]	-venera W
-NO RIFFLE / NO RUN [Metric = 0]	Gradient
COMMENTS:	
.) GRADIENT (ft/mi): 5.87 DRAINAGE AREA (sq.mi.): 75 % POOL: % GLIDE:	- 8
Best ereas must be large enough to support a population of riffie-obligate species % RIFFLE: % RUN:	Max 10
	IVIGA TU

Is Sampling Reach Representative of the Stream?	am? (Y/ N)		If Not, Explain:			Major Suspected Sources of Impacts (Check All That Apply):
Lat / Long (Beg):		. 1				Industrial Industrial
Lat / Long (Mid):						
Lat / Long (X-Loc):						
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy-% open:	CSOs C Suburban Impacts C Mining C Channelization C Riparian Removal
Subjective Aesthetic Rating Rating (1-10) (1-10) Gradient:		Is Stream Ephemei Is there water upsit Is there water close Is Dry Channel mo	Is Stream Ephemeral (no pools, totally dry of only damp spots)? Is there water upstream? How far. Is there water close downstream? How far: is Dry Channel mostly natural?	f only damp spots)?		Landfills Natural □ Dams □ Other Flow Alteration □ Other: \$\alpha \alpha
Drawing:						
		+	1	24		
35	\	ber				
3	/	1 5 la				
1	1	=/			1.	
Za) 25 /	mes
instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1	c: Each cover	type should reco	eive a score of bet	ween 0 and 3, who	ere; 0 = Cover type at	sent; 1 = cover type in very
small amounts or if more common of marginal quality; 2 = cover type pres			n moderate amoun mples of highest qu	its, but not of highe uality include, very	2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest r greater amounts. Examples of highest quality include, very large boulders in deep or fast water, larg	ent in moderate amounts, but not of highest quality or in small amounts of highest Examples of highest quality include, very large boulders in deep or fast water, large
diameter logs that are stable, well developed rootwads in deep / fast water, or deep, well-defined, functional pools.	otwads in deep	/ fast water, or	deep, well-defined	, functional pools.		

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ALC: NO DESCRIPTION OF THE PERSON OF THE PER	enstitute

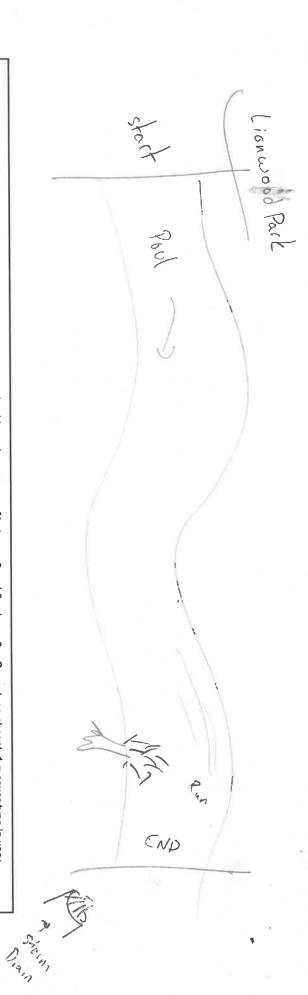
QHEI Score:

-	~	-
S, '	$\overline{}$.5
vγ	~	10

River Code: 15-150 RM: 24.5	
Site Code: So-40 Project Code: Soll	
Date: 6-29-16 Scorer: MMS	Latitude: 41, 96 295 Longitude: -87.98435
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Esti	timate % percent
TYPE POOL RIFFLE	POOL RIFFLE <u>SUBSTRATE ORIGIN</u> <u>SUBSTRATE QUALITY</u>
□ □-BLDR/SLBS [10] □ □ □ GRAVE	
☐ ☐ -Lg BOULD [10] ☐ ☐ -SAND [0	
☐ COBBLE [8]	
☐ ☐ -HARDPAN [4] ☐ ☐ -ARTIFIC	
☐ ☐ -MUCK [2] ☐ ☐ -SILT [2]	□ -SANDSTONE [0] EMBEDDED ☑ -EXTENSIVE [-2]
	-RIP / RAP [0] NESS: -MODERATE [-1]
NUMBER OF SUBSTRATE TYPES: 4 or Mor	ore [2]
(High Quality Only, Score 5 or >)	ss [0] •
	☐ -COAL FINES [-2]
COMMENTS:	
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see	se back for instructions) AMOUNT: (Check ONLY one or
(Structure) TYPE: Score All T	That Occur check 2 and AVERAGE) Co
UNDERCUT BANKS [1]	> 70 cm [2] OXBOWS, BACKWATERS [1] = -EXTENSIVE > 75% [11]
OVERHANGING VEGETATION [1] / ROOTW	
2 SHALLOWS (IN SLOW WATER) [1]	
/ ROOTMATS [1]	☐ -NEARLY ABSENT < 5% [1]
COMMENTS:	
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category	OR check 2 and AVERAGE)
	HANNELIZATION STABILTIY MODIFICATIONS / OTHER
☐ -HIGH [4] ☐ -EXCELLENT [7] ☐	☐ -NONE [6] ☐ -HIGH [3] ☐ -SNAGGING ☐ -IMPOUNDMENT Chai
	PECOVERED (II) AND EDATE (2) DELOCATION DELOCATION DELOCATION
☐ -LOW [2] ☐ -FAIR [3] ☐	2-RECOVERING [3]
☐ -NONE[1]	□ -RECENT OR NO □ -DREDGING □ -BANK SHAPING Max
,	RECOVERY [1] —ONE SIDE CHANNEL MODIFICATIONS
	☐ -IMPOUNDED [-1]
COMMENTS:	
	<u>≥</u>
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER RIPARIAN WIDTH L R (Per Bank) VERY WIDE > 100m [5] VERY WIDE > 50m [4] WIDE > 50m [4] MODERATE 10 - 50m [3] RESIDENTIAL, P.	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R (Per Bank) Ripa AP [3] — CONSERVATION TILLAGE [1] — NONE / LITTLE [3] 6 - 3 D FIELD [2] — JURBAN OR INDUSTRIAL [0] — MODERATE [2] Max PARK, NEW FIELD [1] — OPEN PASTURE, ROWCROP [0] — HEAVY / SEVERE [1] Max
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R (Per Bank) Ripa IP [3] - CONSERVATION TILLAGE [1] - NONE / LITTLE [3] 6 - A 0 FIELD [2] - URBAN OR INDUSTRIAL [0] - MODERATE [2] - MAX PARK, NEW FIELD [1] - OPEN PASTURE, ROWCROP [0] - HEAVY / SEVERE [1] Max
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) Int Per Bank) L R (Per Bank) Ripa IP [3]
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) Int Per Bank) L R (Per Bank) Ripa IP [3] - CONSERVATION TILLAGE [1] - NONE / LITTLE [3] FIELD [2] - URBAN OR INDUSTRIAL [0] - MODERATE [2] PARK, NEW FIELD [1] - OPEN PASTURE, ROWCROP [0] - HEAVY / SEVERE [1] Max LOGY - CURRENT VELOCITY (POOLS & RIFFLES!)
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R (Per Bank) Ripa MP [3] — -CONSERVATION TILLAGE [1] — -NONE / LITTLE [3]
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R (Per Bank) Ripa IP [3] — -CONSERVATION TILLAGE [1] — -NONE / LITTLE [3] 6 - 4 IP [2] — -URBAN OR INDUSTRIAL [0] — MODERATE [2] — Max PARK, NEW FIELD [1] — -OPEN PASTURE, ROWCROP [0] — -HEAVY / SEVERE [1] Max JRE [1] — MINING / CONSTRUCTION [0] — HEAVY / SEVERE [1] Max LOGY CURRENT VELOCITY (POOLS & RIFFLES!) AVERAGE) (Check All That Apply) Pool RIFFLE WIPTH [2] — -EDDIES [1] — -TORRENTIAL [-1] Curr
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) Interstit 100 Meter RIPARIAN) BANK EROSION Interstit 100 Meter RIPARIAN) Ripa Interstit 100 Meter RIPARIAN Ripa Rip
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) Intermit Per Bank) Inter
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) Intermit Per Bank) I. R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPAR(AN) BANK EROSION nt Per Bank
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank) L R
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPAR(AN) BANK EROSION nt Per Bank
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION nt Per Bank)
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION
RIPARIAN WIDTH	PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION

adient: -Moderate	Subjective Aesthetic	Lat / Long (X-Loc):	Lat / Long (Mid): Lat / Long (End):	Lat / Long (Beg):	Is Sampling Reach Representative of the Stream? (Y/ N)
ng O) +High	First Sampling Pass			ļ	sentative of the Stream?
	Gear:				(Y/N)
Is Stream Ephemeral (no pools, toll is there water upstream? How far: is there water close downstream? Is Dry Channel mostly natural?	Distance:				
is Stream Ephemeral (no pools, totally dry of only damp spots)? is there water upstream? How far: is there water close downstream? How far: is Dry Channel mostly natural?	Water Clarity: Poof	Some frash			If Not, Explain:
of only damp spots)?	Water Stage:	no oi Sheen			
	Canopy-% open:	3			
Landfills \(\) Natural \(\) Dams \(\) Dams \(\) Other Flow Alteration \(\) Other.	Suburban Impacts Suburban Impacts Channelization Riparian Removal	Construction Urban Runoff CSOs	Agriculture Livestock	Industrial	Major Suspected Sources of Impacts (Check All That Apply)

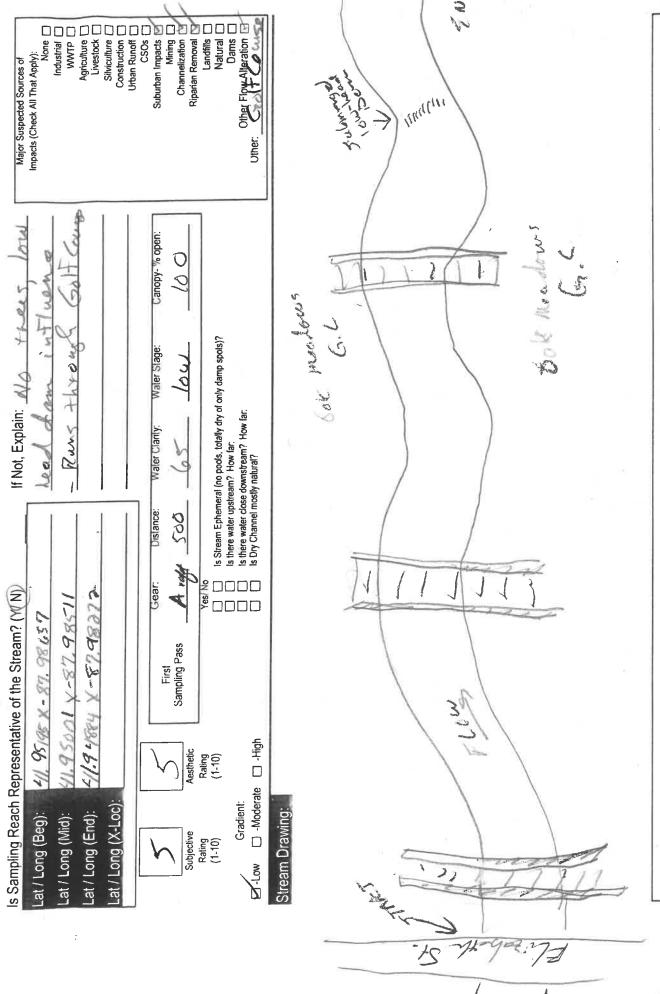
Stream Drawing:



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	1
QHEI Score:	3

THE WAS WELL WAS INSTITUTE		T. ICELICAL E.	aradion moon	(1 101d O1	WILLION	Ole.
River Code: 95 850		Stream:	Ja H	Chock		
Site Code: -34	Project Code: SALT 1			robeth	MU	
	Scorer:	- 4 4*	95195	Longitude:	-87.981657	_
	Two Substrate TYPE BOXES; Estimate					
TYPE POOL BLDR/SLBS [10]	L RIFFLE	POOL RIFFLE		(EDACE)	SUBSTRATE QUALITY	
☐ ☐ -Lg BOULD [10]	[7] (▼ -SAND [6]		Check ONE (OR 2 & A) -LIMESTONE [1]	-	Check ONE (OR 2 & AVERAGE)	
BOULDER [9]			-TILLS [1]	SILT:	SILT HEAVY [-2] SILT MODERATE [-1]	Substrate
COBBLE [8]	D-DETRITUS [3]	<u> </u>	-WETLANDS ID		SILT NORMAL [0]	2
☐ ☐ HARDPAN [4]	-ARTIFICIAL [0		-HARDPAN [0]		SILT FREE [1]	10
□ -MUCK [2]	-XIVII ICIAL [0]		-SANDSTONE [0]	EMBEDDED	-SILT FREE [1] -EXTENSIVE [-2]	Max 20
ES ES MOOR (2)			RIP / RAP [0]	NESS:	-MODERATE [-1]	
NUMBER OF SUBSTRATE TYPE	S:	******	-LACUSTRINE [0]		-NORMAL [0]	
(High Quality Only, Score 5 or >)	-3 or Less [0]		- SHALE [-1]		☐ -NONE [1]	
			COAL FINES [-2]			
COMMENTS:						
2.) INSTREAM COVER (Give each	th cover type a score of 0 to 3; see bac TYPE: Score All That Oc				AMOUNT: (Check ONLY one or	
UNDERCUT BANKS [1]	POOLS > 70 cm		, BACKWATERS [1]		check 2 and AVERAGE)	Cover
OVERHANGING VEGETA			MACROPHYTES [1]		-MODERATE 25 - 75% [7]	15
3 SHALLOWS (IN SLOW WA			WOODY DEBRIS [1]	•	-SPARSE 5 - 25% [3]	Max 20
ROOTMATS [1]					-NEARLY ABSENT < 5% [1]	
COMMENTS:	Charle ONLY and DED Cohone OD a	had 2 and AVEDACE				
	Check ONLY one PER Category OR c EVELOPMENT CHANNEL	·	ABILTIY	MODIFICATIO	ONS LOTHED	
	-EXCELLENT [7] -NON		☐ -HIGH [3]	SNAGG		Channel
MODERATE [3]	-GOOD (5)		MODERATE [2]	-BELOCA		
			☐ -LOW [1]	CANOP	_	191
□ -NONE [1]		ENT OR NO		DREDG		Max 20
		VERY [1] UNDED [-1]		TONE SIL	DE CHANNEL MODIFICATIONS .	
COMMENTS:		0.1020 [.]				
				M	H	_
	ROSION (check ONE box PER bank			River Rig	ht Looking Downstream	
RIPARIAN WIDTH L R (Per Bank)	L R (Most Predominant Per Ba	JALITY (PAST 100 Meter ank) L. R	RIPARIAN)		BANK EROSION L R (Per Bank)	
-VERY WIDE > 100m [5]	-FOREST, SWAMP [3]	•	-CONSERVATION TILLA	GE [1]	-NONE/LITTLE [3]	Riparian
☐ -WIDE > 50m [4]	HRUB OR OLD FIELD		-URBAN OR INDUSTRIA		MODERATE [2]	3
	RESIDENTIAL, PARK, N		-OPEN PASTURE, ROW		☐ -HEAVY/SEVERE [1]	Max 10
-NARROW 5 - 10m [2]	-FENCED PASTURE [1]		-MINING / CONSTRUCT	ON [0]		
☐ -VERY NARROW < 5m [1] ☐ NONE [0]	COMMENTS:					
E SE - HOUR [0]	OOMMENTO.					
5.) POOL / GLIDE AND RIFFLE / RL	JN QUALITY					
MAX, DEPTH	MORPHOLOGY		CURRENT VELOCITY		FFLES!)	
(Check 1 ONLY!)	(Check 1 or 2 & AVERAG	•	•	II That Apply)	~	Pool /
(2 - 1m [6] (1 - 0.7m [4]	-POOL WIDTH > RIFFLE V		-EDDIES [1] -EAST [1]	-TORREN	• •	Current
- 0.4 to 0.7m [2]	-POOL WIDTH < RIFFLE V		-MODERATE [1]	-INTERMI	* *	9
- 0.2 to 0.4m [1]	-IMPOUNDED [-1]		SLOW [1]	-VERY FA		Max 12
< 0.2m (POOL = 0)	• •		☐ -NONE [-1]			
COMMENTS:						_
	PUECK ONE (של ברובטה ש עייון איי	DACE			
RIFFLE DEPTH	RUN DEPTH .	R CHECK 2 AND ADVE		RIFFLE / RLIN F	EMBEDDEDNESS	Riffle / Run
Best Areas > 10cm (2)		-STABLE (e.g., Cobble		-NONE [2]	- MOED DE DITE DO	1
Besi Areas 5 - 10cm [1]		MOD. STABLE (e.g., I		-LOW [1]		Max 8
Best Areas < 5cm [0]		-UNSTABLE (Fine Gra		MODERA	TE [O]	
☐ NO RIFFLE but RUNS preser				-EXTENSIN	/E [-1]	Gradient
NO RIFFLE / NO RUN [Metric	; = 0]					
COMMENTS:	nii .	Option .				-0
.) GRADIENT (ft / mi): 6.52	DRAINAGE AREA (sq.mi.): 74,5	_	% GLIDE:		Manual based on gradent and drainage	0
Best areas must be large enough to support a	population of riffle-obligate species	% RIFFLE:	% RUN:		area.	Max 10



instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest

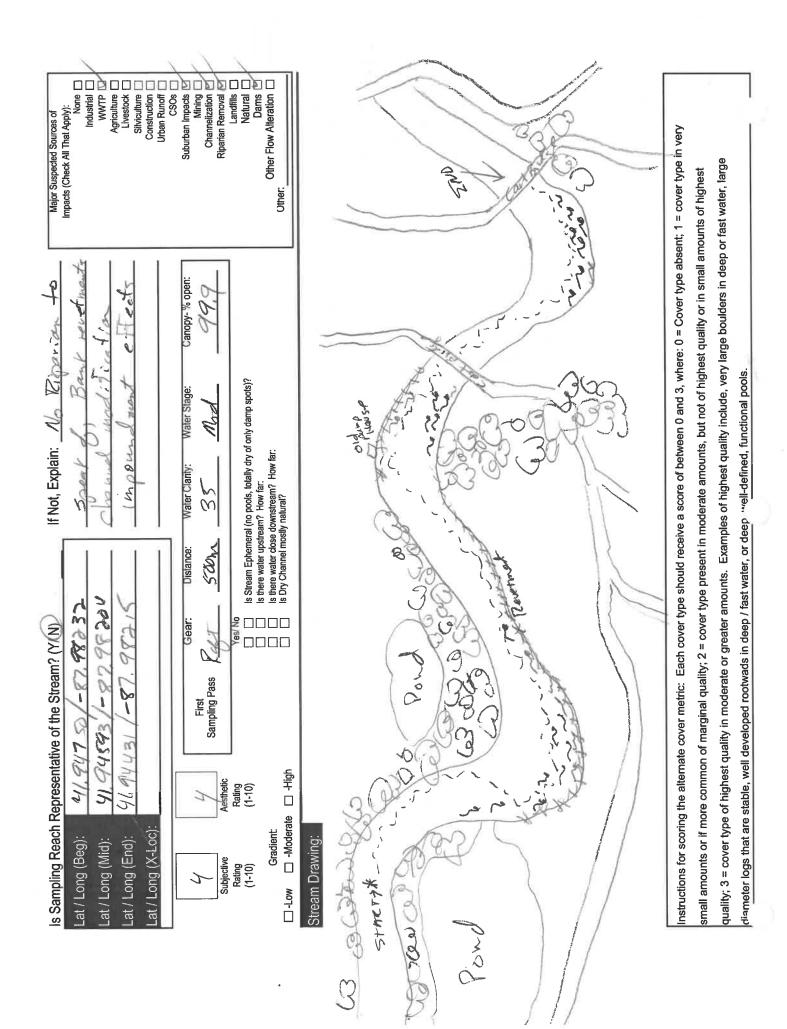




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QHEI	Score:	55,5	
GC III	00010.		

institute Qualitativo Flabitat Evaluation index Floid Officet	QHEI Score.
River Code: 95-850 RM: 23 Stream: 501+ Creak	~~
Site Code: Sc-35 Project Code: Scorer: Latitude: 41,94750 Longitude: ~97.98333	90
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	<u> </u>
TYPE POOL RIFFLE POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY	
☐ ☐-BLDR/SLBS [10] ☐ GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)	PAGE)
□ -Lg BOULD [10] □ -SAND [6] □ -LIMESTONE [1] SILT: □ -SILT HEAVY [-2]	Substrate
□ -BOULDER [9] □ -BEDROCK [5] □ -TILLS [1] □ -SILT MODERATE [-	41
☐ -COBBLE [8] ☐ -DETRITUS [3] ☐ -WETLANDS [0] ☐ -SILT NORMAL [0]	" [18]
☐ -HARDPAN [4] ☐ -ARTIFICIAL [0] ☐ -HARDPAN [0] ☐ -SILT FREE [1]	Max 20
□ -MUCK [2] □ -SILT [2] □ -SANDSTONE [0] EMBEDDED □ -EXTENSIVE [-2]	
NUMBER OF SUBSTRATE TYPES: ☐ 4 or More [2] ☐ -LACUSTRINE [0] ☐ -NORMAL [0]	
(High Quality Only, Score 5 or >) D-3 or Less [0] -SHALE [-1] -NONE [1]	
COMMENTS:	
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: (Check Of	NLY one or
(Structure) TYPE: Score All That Occur check 2 and AVERAG	
UNDERCUT BANKS [1] OXBOWS, BACKWATERS [1]EXTENSIVE > 75% [
2 OVERHANGING VEGETATION [1] ROOTWADS [1] 3 AQUATIC MACROPHYTES [1] MODERATE 25-75	
SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] SPARSE 5 - 25% [3] ROOTMATS [1] NEARLY ABSENT <	
COMMENTS:	3/0[1]
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY MODIFICATIONS OTHER	
	DUNDMENT Channel
☐ -MODERATE [3] ☐ -GOOD [5] ☐ -RECOVERED [4] ☐ MODERATE [2] ☐ -RELOCATION ☐ -ISLA ☐ -LOW [2] ☐ -FAIR [3] ☐ -RECOVERING [3] ☐ -LOW [1] ☐ -CANOPY REMOVAL ☐ -LEVE	11/ %
	K SHAPING Max 20
RECOVERY [1] Ne side Channel Modificat	
☐ -IMPOUNDED [-1]	
COMMENTS:	
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per bank) River Right Looking Downstream	AND THE PROPERTY OF THE PROPER
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) BANK EROSION	U"
L R (Per Bank) L R (Most Predominant Per Bank) L R (Per Bank)	Riparian
□ □-VERY WIDE > 100m [5] □ □ -FOREST, SWAMP [3] □ □ -CONSERVATION TILLAGE [1] □ □ -NONE / LIT	
□ □-WIDE > 50m [4] □ □ -SHBUB OR OLD FIELD [2] □ □ -URBAN OR INDUSTRIAL [0] □ -MODERATI	
☐ -MODERATE 10 - 50m [3] ☐ RESIDENTIAL, PARK, NEW FIELD [1] ☐ OPEN PASTURE, ROWCROP [0] ☐ HEAVY / SI ☐ NARROW 5 - 10m [2] ☐ FENCED PASTURE [1] ☐ MINING / CONSTRUCTION [0]	EVERE[1] Max 10
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	
NONE [0] COMMENTS:	
5.) POOL/GLIDE AND RIFFLE / RUN QUALITY	
MAX. DEPTH MORPHOLOGY CURRENT VELOCITY (POOLS & RIFFLES!) (Check 1 ONLY!) (Check 1 or 2 & AVERAGE) (Check All That Apply)	Deel /
-1m [6] -POOL WIDTH > RIFFLE WIDTH [2] -TORRENTIAL [-1]	Pool / Current
☐ -0.7m [4] ☐ -POOL WIDTH = RIFFLE WIDTH [1] ☐ -FAST [1] ☐ -INTERSTITIAL [-1]	, our our
☐ -0.4 to 0.7m [2] ☐ -POOL WIDTH < RIFFLE WIDTH [0] ☐ -MODERATE [1] ☐ -INTERMITTENT [-2]	Q
□ - 0.2 to 0.4m [1] □ -IMPOUNDED [-1] □ -SLOW [1] □ -VERY FAST [1]	Max 12
-< 0.2m [POOL = 0]	
COMMENTS:	
CHECK ONE OR CHECK 2 AND ADVERAGE	Riffle / Run
RIFFLE DEPTH RUN DEPTH RIFFLE / RUN SUBSTRATE RIFFLE / RUN EMBEDDEDNESS	
□ -*Best Areas > 10cm [2] - MAX > 50 [2] □ -STABLE (e.g., Cobble, Boulder) [2] □ -NONE [2]	1.0
-Best Areas 5 - 10cm [1] -MAX < 50 [1] -MOD. STABLE (e.g., Large Gravel) [1] -LOW [1]	Max 8
☐ -Bast Areas < 5cm ☐ -UNSTABLE (Fine Gravel, Sand) [0] ☐ -MODERATE [0] ☐ -NO Riffle but RUNS present [0] ☐ -EXTENSIVE [-1]	Condinat
□ -NO RIFFLE / NO RUN [Metric = 0]	Gradient
COMMENTS:	
6.) GRADIENT (ft/mi): 6.16 DRAINAGE AREA (sq.mi.): 7 1/2 8 % POOL: % GLIDE:	8
*Best areas must be large enough to support a population of riffle-obligate species % RIFFLE: % RUN:	Max 10
	Trimes 10

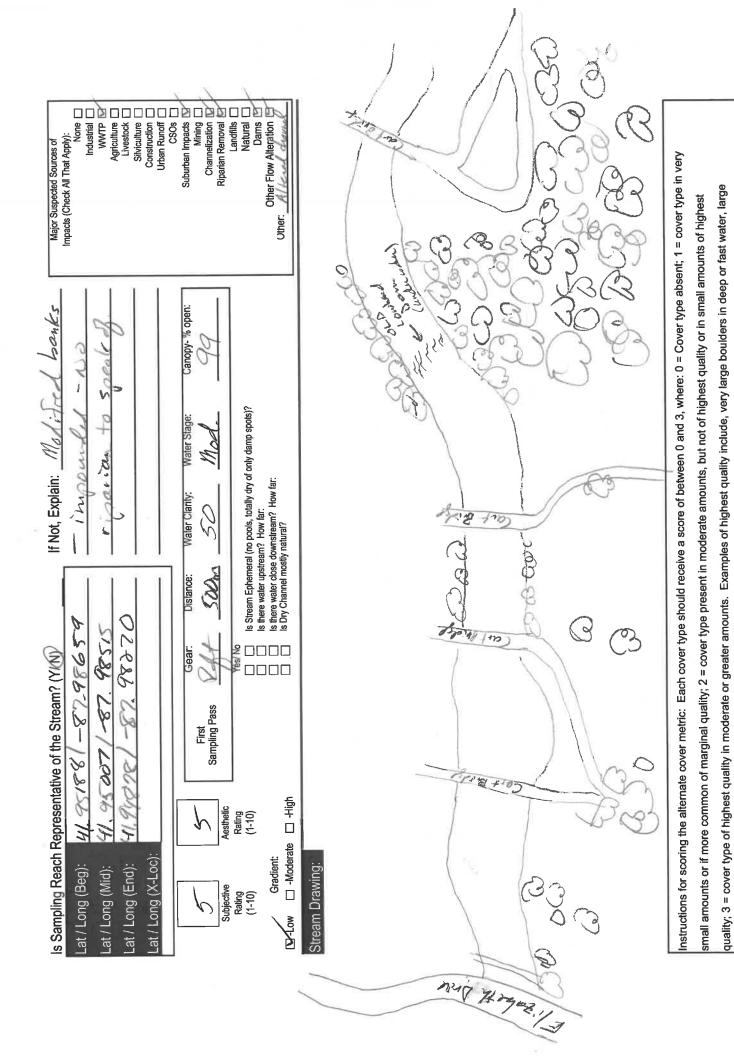






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Riediversity Qualitative Habitat Evaluat	ion Index Field Sheet QHEI Score: 50,
River Code: 95-850 RM: 23-5 Stream: Salt (reek
	Exisabethic & Street
Date: 1 - 12 10 Scorer: 41.9~1	18 Longitude: -87, 98659
1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % percent	
	STRATE ORIGIN SUBSTRATE QUALITY
	k ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE)
	-TILLS [1] SILT MODERATE [-1]
	-WETLANDS [0] □ -SILT NORMAL [0]
	-HARDPAN [0] □ -SILT FREE [1] Max 20
	-SANDSTONE [0] EMBEDDED ☑ -EXTENSIVE [-2]
	-RIP / RAP [0] NESS:MODERATE [-1]
NUMBER OF SUBSTRATE TYPES:	-LACUSTRINE [0]
(High Quality Only, Score 5 or >)	-SHALE [-1]
COMMENTO	-COAL FINES [-2]
COMMENTS:	AMAINE (OL. 1 CANA)
2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)	AMOUNT: (Check ONLY one or
(Structure) TYPE; Score All That Occur	check 2 and AVERAGE) Cover
UNDERCUT BANKS [1] 3 POOLS > 70 cm [2] OXBOWS, BACKW OVERHANGING VEGETATION [1] ROOTWADS [1] 3 AQUATIC MACRO	
3 SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOOD!	
ROOTMATS [1]	
COMMENTS:	☐ -NEARLY ABSENT < 5% [1]
3.) CHANNEL MORPHOLOGY: (Check ONLY one PER Category OR check 2 and AVERAGE)	
SINUOSITY DEVELOPMENT CHANNELIZATION STABILTIY	MODIFICATIONS / OTHER
HiGH [4]	
\cdot	SERVICE TO
□ LOW [2] □ -FAIR [3] □ -RECOVERING [3] □ -LOW	
□ -NONE [1] □ -RECENT OR NO	□-DREDGING □ -BANK SHAPING Max 20
RECOVERY [1]	ONE SIDE CHANNEL MODIFICATIONS
-iMPOUNDED [-1]	The other of the state mobile for more
COMMENTS:	
-	M M
4.) RIPARIAN ZONE AND BANK EROSION (check ONE box PER bank or check 2 and AVERAGE per ba	ank) River Right Looking Downstream
RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARI	
L R (Per Bank) L R (Most Predominant Per Bank) L R	L R (Per Bank) Riparian
VERY WIDE > 100m [5]FOREST, SWAMP [3]CON	SERVATION TILLAGE [1]
☐ -WIDE > 50m [4] ☐ -WRB/ SHRUB OR OLD FIELD [2] ☐ -URB/	AN OR INDUSTRIAL [0] -MODERATE [2]
	N PASTURE, ROWCROP [0]
□ □ →MARROW 5 - 10m [2] □ □ -FENCED PASTURE [1] □ -MINII	NG / CONSTRUCTION [0]
☑ _ VERY NARROW < 5m [1]	
NONE [0] COMMENTS:	
5.) POOL / GLIDE AND RIFFLE / RUN QUALITY	
	CURRENT VELOCITY (POOLS & RIFFLES!)
(Check *ONLY!) (Check 1 or 2 & AVERAGE)	(Check All That Apply) Pool /
✓ -1m [6]	-EDDIES [1] -TORRENTIAL [-1] Current

-HIGH [4]] -EXCELLENT [7]	NELIZATION NONE (6) RECOVERED (4) RECOVERING (3) RECENT OR NO ECOVERY (1) MPOUNDED (-1)	STABILTIY -HIGH [3] -MODERATE [2] -LOW [1]	MODIFICATIONS / OTHER SNAGGING IMPOUNDMENT FELOCATION ISLAND CANOPY REMOVAL ISLAND D-DREDGING ISLANK SHAPING ONE SIDE CHANNEL MODIFICATIONS	Channe Max 20
4.) RIPARIAN ZONE AND BANK E RIPARIAN WIDTH L R (Per Bank)		<u>N QUALITY (PAST 100</u> er Bank) 3] ELD [2] KK, NEW FIELD [1]		AL [0] AL [0] -MODERATE [2] CYCROP [0] -HEAVY / SEVERE [1]	Riparian 3.5 Max 10
5.) POOL / GLIDE AND RIFFLE / R MAX. DEPTH (Check * ONLY!) - 1m [6] - 0.7m [4] - 0.4 to 0.7m [2] - 0.2 to 0.4m [1] - < 0.2m {POOL = 0} COMMENTS:	MORPHOLOG (Check 1 or 2 & AVI -BOOL WIDTH > RIF -POOL WIDTH < RIF -POOL WIDTH < RIF -IMPOUNDED [-1]	FRAGE) FLE WIDTH [2] FLE WIDTH [1]		ITY (POOLS & RIFFLES!) All That Apply)	Pool / Current (A)
RIFFLE DEPTH -*Best Areas > 10cm [2] -Best Areas 5 - 10cm [1] -Best Areas < 5cm -NO Riffle but RUNS presen -NO RIFFLE / NO RUN [Met	RUN DEPTH M - MAX > 50 [2]	-MOD. STABLE (I	SUBSTRATE , Cobble, Boulder) [2] E (e.g., Large Gravel) [1] Fine Gravel, Sand) [0]	RIFFLE / RUIN EMBEDDEDNESS	Riffle / Ru Max 8 Gradient
6.) GRADIENT (ft / mi): 6,55 *Best areas must be large enough to support			POOL:		Max 10



diameter logs that are stable, well developed rootwads in deep / fast water, or deep "ell-defined, functional pools.

100	40.	Ĺ	11500
		V.	Biodiversity Institute
	-	=	

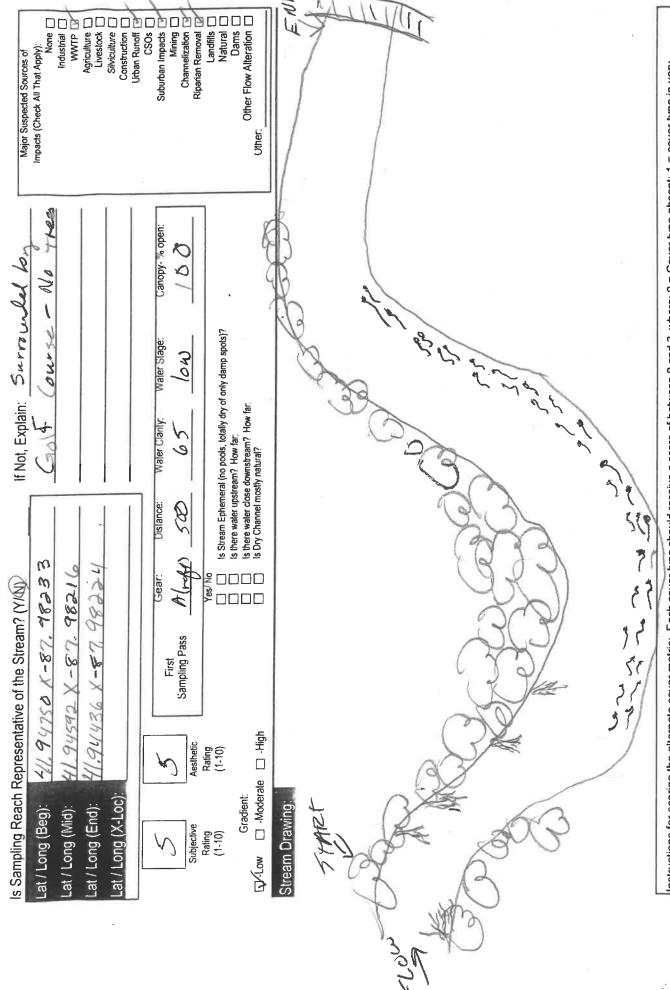
Best areas must be large enough to support a population of riffie-obligate species

River Code: \$ - 85		23.0	Stream:	valuation Index			QHEI Score:
Site Code: 3C-35	Project Code:	SALT B				when I Dan ?	sudf I
Date: 7-11-(3 Scorer:		Latitude: 4/1	2 2 2 2 1 2 2 2	Longitude:	C TO COST OF THE C	S Dear
1.) SUBSTRATE (Check ONLY	Two Substrate TVDE	POYES: Estimate %				01.100	3
IYPE PO		JOAES, ESIMBLE 76	POOL RIFFLI	E CHOCTDATE ODICIN		CUDOTDATE OUALITA	
☐ -BLDR/SLBS [10]		-GRAVEL [7]	POOL RIFFLI		(55105)	SUBSTRATE QUALITY	
				OHECK ONE (ON 2 & A	•	Check ONE (OR 2 & AVERAGE))
		-SAND [6]		LIMESTONE [1]	SILT:	SILT HEAVY [-2]	:
BOULDER [9]		-BEDROCK [5]		\		-SILT MODERATE [-1]	Ì
COBBLE [8]		-DETRITUS [3]		-WETLANDS [0]		SILT NORMAL [0]	Į
□ □-HARDPAN [4]		-ARTIFICIAL [0]		HARDPAN [0]		SILT FREE [1]	
ET INT-MOCK [2]	⊔ ⊔	-SILT [2]		SANDSTONE [0]		-EXTENSIVE [-2]	
IUMBER OF SUBSTRATE TYP		A a. Mara (2)		-RIP / RAP [0]	NESS:	-MODERATE [-1]	
		-4 or More [2]		-LACUSTRINE [0]		-NORMAL [0]	
High Quality Only, Score 5 or >	V	-3 or Less [0]		SHALE [-1]		□ -NONE [1]	
OMMENTS:				-COAL FINES [-2]			
INSTREAM COVER (Give ex	ach cover type a score	of 0 to 3; see back fo	r instructions)			AMOUNT: (Check ONLY or	ne or
(Structure)		core All That Occur	,			check 2 and AVERAGE)	w
UNDERCUT BANKS [1]		POOLS > 70 cm [2]		S, BACKWATERS [1]		- EXTENSIVE > 75% [11]	٢
OVERHANGING VEGET		ROOTWADS [1]		MACROPHYTES [1]		-MODERATE 25 - 75% [7]	
SHALLOWS (IN SLOW)	VATER) [1]	BOULDERS [1]	LOGS OF	R WOODY DEBRIS [1]		-SPARSE 5 - 25% [3]	
ROOTMATS [1] OMMENTS:						-NEARLY ABSENT < 5% [1]	
CHANNEL MORPHOLOGY:	(Check ONLY one DEL	Calenny OP shoot	2 and AVERAGE				
	DEVELOPMENT	CHANNELIZAT		ABILTIY	MODIFICATION	NS / OTHER	
	-EXCELLENT [7]	-NONE [6]			□-SNAGG		AENT (
	☐ -GOOD [5]	☐ -RE€OVE		-MODERATE [2]	☐-RELOCA		MENT (
		-RECOVE		row[1]	-CANOP		İ
☐ -NONE [1]	POOR [1]	-RECENT	OR NO		□-DREDGI		PING I
		RECOVER			ONE SIE	DE CHANNEL MODIFICATIONS	
MALIENTE.		-IMPOUNE	DED (-1)				
DMMENTS:							
RIPARIAN ZONE AND BANK	EROSION (check ON!	box PER bank or cl	heck 2 and AVERAC	SE per bank)	River Riot	nt Looking Downstream	
PARIAN WIDTH			TY (PAST 100 Mete		U	BANK EROSION	
R (Per Bank)		dominant Per Bank)	L R			L R (Per Bank)	Ri
VERY WIDE > 100m [5]	☐ ☐ -FOREST	, SWAMP [3]	. 🗆	CONSERVATION TILLAC	GE [1]	NONE / LITTLE [3]	
-WIDE > 50m [4]	-SHRUB			J -URBAN OR INDUSTRIAL		MODERATE [2]	
-MODERATE 10 - 50m [3]	V	ITIAL, PARK, NEW I		OPEN PASTURE, ROWC		☐ ☐ -HEAVY/SEVERE	[1] N
`	-FENCED	PASTURE [1]		-MINING / CONSTRUCTION	אנ [0]		
-very narrow < 5m [1]	COMMENTS:						
Tal store fol	COMMENTO.						
POOL / GLIDE AND RIFFLE / I	RUN QUALITY						
C. DEPTH	MO	RPHOLOGY		CURRENT VELOCITY	(POOLS & RIF	FLES!)	
eck 1 ONLY!)	(Check 1	or 2 & AVERAGE)		(Check All	That Apply)	•	P
1m [6]		OTH > RIFFLE WIDT		-EDDIES (1)	-TORREN	TIAL [-1]	Cı
0.7m [4]		OTH = RIFFLE WIDT		-EAST (1)	-INTERSTI		
0.4 to 0.7m [2]		OTH < RIFFLE WIDT	.H [0]	-MODERATE [1]	-INTERMIT		
- 0.2 to 0.4m [1]	-IMPOUND	ED [-1]		SLOW [1]	-VERY FAS	ST (1)	Ma
] - < 0.2m [POOL = 0]				NONE [-1]	-		
MAENTS.							
IMENTS:		CHECK ONE OR O	HECK 2 AND ADVE	RAGE		*****************	D:w.
IMENTS:			FFLE / RUN SUBST		RIFFLE / RUN F	MBEDDEDNESS	Riffle
	RUN DEPTH	PCI					
MENTS:	RUN DEPTH ☐ - MAX > 50		TABLE (e.g., Cobble	e, Boulder) (2)	-INDINE IZI		1 47
LE DEPTH		cm [2] 🗆 -S	TABLE (e.g., Cobble IOD. STABLE (e.g.,		☐ -NONE [2]		₹ M
LE DEPTH -*Best Areas > 10cm [2]	☐ - MAX > 50	cm [2]		Large Gravel) [1]			L. M.
LE DEPTH -*Best Areas > 10cm [2] -Best Areas 5 - 10cm [1]	- MAX > 50	cm [2]	IOD. STABLE (e.g.,	Large Gravel) [1] evel, Sand) [0]	FOM [1]	E (0)	M. Gra
LE DEPTH -*Best Areas > 10cm [2] -Best Areas 5 - 10cm [1] -Best Areas 5 - 5cm [0]	- MAX > 50 - MAX < 50	cm [2]	IOD. STABLE (e.g.,	Large Gravel) [1] evel, Sand) [0]	-LOW [1] -MODERAT	E (0)	

% RIFFLE:

% RUN:

Max 10



instructions for scoring the alternate cover metric. Each cover type should receive a score of between 0 and 3, where: 0 = Cover type absent; 1 = cover type in very quality; 3 = cover type of highest quality in moderate of greater amounts. Examples of highest quality include, very large boulders in deep or fast water, large small amounts or if more common of marginal quality; 2 = cover type present in moderate amounts, but not of highest quality or in small amounts of highest

diameter lane that are -4-61-

MBI Qualitative Habitat Evaluation Index Field Sheet QHEI Score: Stream: Location: (15 Tower Days at Ca. Date: (1/6 07) Latitude: Scorer: 41.94617 Longitude: 87 1] SUBSTRATE (Check ONLY Two SubstrateTYPE BOXES; Estimate % present **TYPE** POOL RIFFLE POOL RIFFLE SUBSTRATE ORIGIN SUBSTRATE QUALITY □ □-BLDR /SLBS[10] GRAVEL [7] Check ONE (OR 2 & AVERAGE) Check ONE (OR 2 & AVERAGE) □ □-Lg BOULD. [10] ☐ **2**-SAND [6] -LIMESTONE [1] SILT: U-SILT HEAVY [-2] □□-BOULDER [9] 👱 □ □-BEDROCK[5] TILLS [1] Substrate ET-SILT MODERATE [-1] □ □-COBBLE [8] □ □ DETRITUS[3] □ -WETLANDS[0] ☐-SILT NORMAL [0] DD-HARDPAN [4] - - ARTIFICIALIO □-HARDPAN [0] -SILT FREE [1] M D-MUCK [2] □ □-SILT [2] -SANDSTONE [0] EMBEDDED ☐-EXTENSIVE [-2] Max 20 RIP/RAP [0] MODERATE [-1] NESS: NUMBER OF SUBSTRATE TYPES: El-4 or More [2] -LACUSTRINE [0] -NORMAL [0] (High Quality Only, Score 5 or >) 2-3 or Less [0] -SHALE [-1] ☐-NONE [1] COMMENTS CI-COAL FINES [-2] 2] INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions) AMOUNT: Check ONLY One or Cover TYPE: Score All That Occur (Structure) check 2 and AVERAGE) 3 POOLS> 70 cm [2] UNDERCUT BANKS [1] OXBOWS, BACKWATERS [1] ☐ - EXTENSIVE > 75% [11] OVERHANGING VEGETATION [1] ROOTWADS [1] MODERATE 25-75% [7] ZAQUATIC MACROPHYTES [1] SHALLOWS (IN SLOW WATER) [1] BOULDERS [1] LOGS OR WOODY DEBRIS [1] □ - SPARSE 5-25% [3] Max 20 C ROOTMATS [1] COMMENTS: ☐ - NEARLY ABSENT < 5%[1] 3] CHANNEL MORPHOLOGY: (Check ONLY One PER Category OR check 2 and AVERAGE) SINUOSITY DEVELOPMENT **CHANNELIZATION** STABILITY Channel MODIFICATIONS/OTHER □ - HIGH [4] ☐ - EXCELLENT [7] ☐ - NONE [6] - HIGH [3] □ - SNAGGING IMPOUND. MODERATE [3] □ - GOOD [5] □ - RECOVERED [4] MODERATE [2] - RELOCATION □ - ISLANDS □ - LOW [2] □ - FAIR [3] ☐ - RECOVERING [3] □- LOW [1] CANOPY REMOVAL - LEVEED Max 20 ☐ - NONE [1] 9 - POOR [1] RECENT OR NO □ - DREDGING BANK SHAPING ONE SIDE CHANNEL MODIFICATIONS RECOVERY [1] □- IMPOUNDÉD [-1] COMMENTS: 4]. RIPARIAN ZONE AND BANK EROSION check ONE box per bank or check 2 and AVERAGE per bank) PRiver Right Looking Downstream P RIPARIAN WIDTH FLOOD PLAIN QUALITY (PAST 100 Meter RIPARIAN) **BANK EROSION** Riparian L R (Per.Bank) L R (Most Predominant Per Bank) L R (Per Bank)

D- VERY WIDE > 100m [5] D- WIDE > 50m [4] D- SHRUB OR OLD FIELD [2] D- MODERATE 10-50m [3] D- NARROW 5-10 m [2] D- VERY NARROW <5 m[1] Comments:	D-CONSERVATION TILLAGE [1] D-URBAN OR INDUSTRIAL [0] D-MODERATE [2] D [1] D-OPEN PASTURE, ROWCROP [0] D-HEAVY/SEVERE	
5.]POOL/GLIDE AND RIFFLE/RUN QUALITY MAX. DEPTH (Check 1 ONLY!) (Check 1 or 2 & AVERAGE) - 1m [6] - 0.7-1m [4] - 0.4-0.7m [2] - 0.2- 0.4m [1] - < 0.2m [POOL=0] COMMENTS:	CURRENT VELOCITY POOLS & RIFFLES!] (Check All That Apply) -EDDIES[1] -TORRENTIAL[-1] -FAST[1] -INTERSTITIAL[-1] MADDERATE [1] -INTERMITTENT[-2] SLOW [1] -VERY FAST[1]	Pool/ Current 7 Max 12
RIFFLE DEPTH RUN DEPTH RIF □ - Best Areas >10 cm [2] □ - MAX > 50 [2] □ STA □ - Best Areas 5-10 cm [1] □ - MAX < 50[1]	OR CHECK 2 AND AVERAGE FFLE/RUN SUBSTRATE RIFFLE/RUN EMBEDDEDNESS BLE (e.g., Cobble, Boulder) [2]	Riffle/Run Max 8 Gradient Max 10
* Best areas must be large enough to support a population of riffle-obligate species	%RIFFLE: %RUN:	Modified 6/01/2005

Short	Stream Drawing:	Subjective Rating (1-10) Gradient: (1-10
		Major Suspected Sources of Impacts (Check All That Apply): Impacts (Check All That Apply): Industrial Industri

Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, Where: 0 - Cover type absent; 1 - Cover type present in very small amounts or if more common of marginal quality; 2 - Cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 - Cover type of highest quality in moderate or greater amounts. Examples of highest quality include very large boulders in deep or fast water, large diameter logs that are stable, well developed roctwads in deep/fast water, or deep, well-defined, functional pools.

				Yes/No
Is Dry Channel Mostly Natural?	Is There Water Close Downstream? How Far:	ls there water upstream?	is Stream Ephemeral (no pools, totally dry or only damp spots)?	

MBI

The State Reents Ala Entered of New York Tours got Now 1-15 got Now 1 1-15 got No

	Qualitative Habit	at Evalua	tion Index	Field SI	heet QHE	El Score	: 56a5
River Code: 95 8	50 RM: 23.5 Stream	m: 5al4	Creak	-			
Station ID: 50.		on: Dst	Ilizab	eth	Drive		
	7 Scorer: On La		95/95		gitude: 8	7.9865	7
1] SUBSTRATE (Check	ONLY Two SubstrateTYPE I	BOXES; Estima	ate % present				-
			BSTRATE ORIGI		SUBSTRATE	QUALITY	
□ □-BLDR /SLBS[10]	TI- RAVEL [7]	7	ONE (OR 2 & AVE		Check ONE (OR		E)
Lg BOULD. [10] BOULDER [9]	D D SAND [6]	🖳	IMESTONE [1]	SILT:	- SILT HE		0.1.1.
DD-COBBLE [8]	D D-BEDROCK[5]		ILLS [1]		SILT MOD		Substrate
□□-HARDPAN [4]	- DETRITUS[3]		VETLANDS[0]		-SILT NOR		13.5
□ □-MUCK [2]	DD-SiLT [2]		ardpan [0] Andstone [0]	EMBEDDE	O -SILT FREE		الرما
			P/RAP [0]	NESS:	MODERAT	⊑ [-2] 'F [-1]	Max 20
NUMBER OF SUBSTRATE	TYPES: or More [2]		ACUSTRINE [0]	.112001	-NORMAL		
(High Quality Only, Score			HALE [-1]		-NONE [1		
COMMENTS			OAL FINES [-2]_			•	
2] INSTREAM COVER	(Give each cover type a score	e of 0 to 3; see	back for instruc	ctions)	AMOUNT: (Check	ONLY One	or _
(Structure)	TYPE: Score All Th				check 2 and AVE		Cover
UNDERCUT BANKS [1]	3 POOLS> 70 c		XBOWS, BACKWAT		- EXTENSIVE >		15
OVERHANGING VEGETA SHALLOWS (IN SLOW W			QUATIC MACROPH		- MODERATE		
addit.	MATER) [1] ZBOULDERS [1]]	OGS OR WOODY D		- SPARSE 5-25		Max 20
	LOGY: (Check ONLY One P	EP Category	NP abook 2 and		I - NEARLY ABSI	NT < 5%[1]	
	VELOPMENT CHANNELIZAT			MODIFICATIO			Channel
	EXCELLENT [7] D- NONE [6			- SNAGGIN		POUND.	
	GOOD [5] D - RECOVE		MODERATE [2]		ION 🗖 - ISL		7
	FAIR [3] D - BECOVE	RING [3] 🖽 - 1			REMOVAL 🗖 - LE		Max 20
☐ - NONE [1]	POOR [1] DY- RECENT			□ - DREDGIN	G ⊡ BA	NK SHAPING	Wax 20
	RECOVERY [1		4	d - ONE SIDE	CHANNEL MODII	TCATIONS	
COMMENTS:	- IMPOUND				^	Construction of the second	
4]. RIPARIAN ZONE ANI	D BANK EROSION check ONE	box per bank or	check 2 and AVE	ERAGE per ba			Downstream
RIPARIAN WIDTH L R (Per Bank)	L R (Most Predominant P	AIN QUALITY (<u>PAST 100 Meter</u> R	r RIPARIAN)		ROSION	Riparian
□ - VERY WIDE > 100m [ET	•	CONSERVATION	N THI LAGE (LR (Per	Bank) E/LITTLE [3]	
□ □ - WIDE > 50m [4]	DESHRUB OR OLD FIELD		-URBAN OR II			FRATE (2)	
□ □ - MODERATE 10-50m			-OPEN PASTU	RE,ROWCRO	P [O] D D-HEA	VY/SEVERE[1	Max 10
□ □ - NARROW 5-10 m [2]	☐ ☐-FENCED PASTURE [1]		-MINING/CON				2
DD - VERY NARROW <5 m	[1] Comments:						
NONE [0]							
E IDOOL (OL IDE AAID DU							
5.]POOL/GLIDE AND RI					. 		Pool/
MAX. DEPTH (Check 1 ONLY!)	MORPHOLOGY AChack 1 or 2 % AVEDA	OE/			LPOOLS & RIF	FLESI	Current
- >1m [6]	(Check 1 or 2 & AVERA	•	EDDIES[1]	Check All Ti			
□ - 0.7-1m [4]	-POOL WIDTH = RIFFLE WIDT		G-FAST[1]		ORRENTIAL[-1] ITERSTITIAL[-1]		[[4]]
□ - 0.4-0.7m [2]	□-POOL WIDTH < RIFFLE W. [0		MODERATE [TERMITTENT[-2]		Max 12
□ - 0.2-0.4m [1]	☐ -IMPQUNDED [-1]	1	□ -SLOW.[1]	=	ERY FAST[1]		
□ - < 0.2m [POOL=0]	COMMENTS:	1	☐-NONE [-1]		ent mortin		
			CK 2 AND AVE	ERAGE		F	Riffle/Run
RIFFLE DEPTH	RUN DEPTH		N SUBSTRATE		LE/RUN EMBEC		
☐ - Best Areas >10 cm [2]			.,Cobble, Bould		D - NONE [2		
☐ - Best Areas 5-10 cm[1]] ID- MAX < 50[1]		E (e.g.,Large G		- LOW [1]	·	Max 8
Best Areas < 5 cmNO RIFFLE [Metric=0]	1	DEFUNSTABLE (Fine Gravel,Sar	נטן (פר	- MODERAT		Gradient
COMMENTS	i e e e e e e e e e e e e e e e e e e e				ET - EXTENSIV	r [-1]	
							لعا
6] GRADIENT (ft/mi):	DRAINAGE AREA (sq	.mi.): 76	%POC	DL:] %GLIDE:		Max 10
. , _	port a population of riffle-obligate species		%RIFF		%RUN:		
areas must be large enough to site	ANNA E DODGIATION OF PITTA-INTIMATO ENGRICE						

	Stream Drawing:	Is Sampling Reach Repres Subjective Aesthetic Rating (1-10) Gradient: (1-10) Gradient: - High
Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, Where: 0 - Cover type absent; 1 - Cover type present in very small amounts or if more common of marginal quality; 2 - Cover type present in moderate amounts, but not of highest quality or in small amounts of highest quality; 3 - Cover type of highest quality in moderate or greater amounts. Examples of highest quality include very large boulders in deep or fast water, large diameter logs that are stable, well developed rootwads in deep/fast water, or deep, well-defined, functional pools.	Office of the state of the stat	Subjective Rating Rating Rating Gradient. (1-10) Gradient
is Stream Ephemeral (no pools, totally dry or only damp spots)? Is there water upstream? How Far:	Constant of the state of the st	Major Suspected Sources of Impacts (Check All That Apply): None Impacts (Check All That Apply): None Impacts I

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ν	87.JA	3.	223.1	

	Qualitative Habi	at Evalu	ation index	Field Sh	eet QHEISco	ore: 645
River Code: 95-8	56 RM: 24.50 Strea	m: Sal	A Charle			
	-1/10 Location		TRUING	PARE I	1	
Date: 8-5-07	Scorer: 314 La	4.	1.96304	Long	itude: 87.984	l clse
	ONLY Two SubstrateTYPE		nate % present		Mude. 8 7.489	47
			UBSTRATE ORIGIN	N	SUBSTRATE QUALIT	rv
□ □-BLDR /SLBS[10]			K ONE (OR 2 & AVE		Check ONE (OR 2 & AVE	
□ □-Lg BOULD. [10]	DM -SAND [6]		-LIMESTONE [1]		- SILT HEAVY [-2]	-
	□ □ BEDROCK[5]		TILLS [1]	OIL1.	SILT MODERATE	
□□-COBBLE [8]			-WETLANDS[0]		-SILT NORMAL [0]	,
🗖 🗖-HARDPAN [4]	ARTIFICIAL[0]		HARDPAN [0]		- SILT FREE [1]	113
□ □-MUCK [2] 🗸	D D-SILT [2]		SANDSTONE [0]	EMBEDDED	-EXTENSIVE [-2]	— (13.3)
				NESS:	MODERATE [-1]	Max 20
NUMBER OF SUBSTRATE			LACUSTRINE [0]		□ -NORMAL [0]	
(High Quality Only, Score	5 or >)		SHALE [-1]		-NONE [1]	
COMMENTS			OAL FINES [-2]		2.4	
2] INSTREAM COVER	(Give each cover type a scor	e of 0 to 3; se	e back for instruc	tions) AN	MOUNT: (Check ONLY (One or
(Structure)	TYPE: Score All TI	nat Occur			eck 2 and AVERAGE)	Cover
UNDERCUT BANKS [1]	<u>်</u> POOLS> 70 d	m [2] 📿	OXBOWS, BACKWAT		- EXTENSIVE > 75% [11	
3_OVERHANGING VEGETA	TION [1]ROOTWADS	[1] 🚁	AQUATIC MACROPH		- MODERATE 25-75%	
SHALLOWS (IN SLOW W		$\frac{2}{2}$	LOGS OR WOODY DE		- SPARSE 5-25% [3]	Max 20
	MMENTS:			0	- NEARLY ABSENT < 5%	[1]
	LOGY: (Check ONLY One F			AVERAGE)	
	/ELOPMENT CHANNELIZA		ABILITY A	MODIFICATION:	S/OTHER	Channel
	EXCELLENT [7] D- NONE [6	-		SNAGGING		
	GOOD [5] D- BECOVE		MODERATE [2]			191
	FAIR [3] ET - RECOVE				EMOVAL 🗖 - LEVEED	Max 20
☐ - NONE [1]	POOR [1] D - RECENT		_	- DREDGING	- BANK SHAP	
COMMENTS.	recovery [- Impouni			- ONE SIDE C	HANNEL MODIFICATION	S
AT PIDADIAN ZONE AND	and a most - most - most control of the state of the stat				Δ	
RIPARIAN WIDTH	D BANK EROSION(check ONI	E DOX per bank	or check 2 and AVE	RAGE per ban		ng Downstream
L R (Per Bank)	L R (Most Predominant F	Cor Ponk	(PAST 100 Meter	RIPARIAN)	BANK EROSION	Riparian
□ □ - VERY WIDE > 100m [!	FOREST, SWAMP [3-]	•	L R	NITHE ACE IS	L R (Per Bank)	
□ □ - WIDE > 50m [4]	☐ ☐ SHRUB OR OLD FIELD		□ □-CONSERVATIO □ □ -URBAN OR IN		MONE/LITTLE MODERATE [2	[13] [5]
MODERATE 10-50m			TI TI -ODEN PASTIE	DE BUMCBUD	[0] D -MODERATE [1	
□□-NARROW 5-10 m [2]	-FENCED PASTURE [1]		□ □-MINING/CONS			KE[1]
2 12 - VERY NARROW <5 m	[1] Comments:			o moc non to	1	
□ - NONE [0]	Commencs.					
5.JPOOL/GLIDE AND RIP	FLE/RUN QUALITY					DW
MAX. DEPTH	MORPHOLOGY		CURRENT	VELOCITY I	POOLS & RIFFLES!	Pool/ Current
(Check 1 ONLY!)	(Check 1 or 2 & AVERA	GE)		heck All Tha		Carrent
⊠ - >1m [6]	□-POOL WIDTH > RIFFLE WID		E -EDDIES[1]		RRENTIAL[-1]	111
🗖 - 0.7-1m [4]	POOL WIDTH = RIFFLE WID	TH [1]	121 FAST[1]		ERSTITIAL[-1]	
□ - 0.4-0.7m [2]	☐-POOL WIDTH < RIFFLE W. [0]	2 -MODERATE [1		ERMITTENT[-2]	Max 12
□ - 0.2- 0.4m [1]	☐ -IMPOUNDED [-1]		☑ -SLOW [1]		RY FAST[1]	
□ - < 0.2m [POOL=0]	COMMENTS:	1	☐ -NONE [-1]			
					·	D:#- 'D
		ONE OR CH	ECK 2 AND AVE	RAGE		Riffle/Run
RIFFLE DEPTH	RUN DEPTH		UN SUBSTRATE	RIFFL	E/RUN EMBEDDEDNES	s 7
Best Areas >10 cm [2]	₫- MAX > 50 [2]		g.,Cobble, Bould		☐ - NONE [2]	
Best Areas 5-10 cm[1]	□ - MAX < 50[1]		BLE (e.g.,Large Gr		□-/LOW [1]	Max 8
Best Areas < 5 cm		□ -UNSTABLE	(Fine Gravel, Sand	d) [0]	M- MODERATE [0]	Gradient
I - NO RIFFLE [Metric=0] COMMENTS					☐ - EXTENSIVE [-1]	
	<u> </u>					0
RI CHARLENT MILL. 3	53 DRAINAGE AREA (so	20	0/000		% OU IDE	Max 10
ין פראטובואו (תאווו): 🚣	UKAINAGE AREA (so	.mi.) ; 73			%GLIDE:	
Best areas must be large enough to sub-	port a papulation of riffie-obligate species		%RIFF	LE:	%RUN:	

Irving Pork Rol	
Stream Drawing: LI Now STMM STMM Instruction of by among of his weny rooth	Is Sampling Reach Representative of the Stream (Y/N). Subjective Rating (1-10) Gradient:
Instructions for scoring the alternate cover metric: Each cover type should receive a score of between 0 and 3, Where: 0 - Cover type absent; 1 - Cover type present in very small amounts or if more common of marginal quality; 2 - Cover type present in very small amounts, but not of highest quality or in small amounts of highest quality; 3 - Cover type of highest quality; 3 - Cover type dependent of highest quality; 3 - Cover type present in well-defined, functional pools.	
r metric: Each cover type should rece e absent; 1 - Cover type present in no quality; 2 - Cover type present in mo mall amounts of highest quality; 3 - I amounts. Examples of highest quality rige diameter logs that are stable, well-defined, functional pools.	ater Clarity: Water Stage: Jrements: Mean W/D Bankfull Max Ratio Depth Ratio Depth
	Canopy -% Open Imp
Yes/No Is Stream Ephemeral (no pools, totally dry or only damp spots)? Is there water upstream? How Far: Is There Water Close Downstream? How Far:	Major Suspected Sources of Impacts (Check All That Apply): None Industrial Impacts (Check All That Apply): None Impacts Impact

ATTACHMENT 4

Renderings for Proposed

Dam Modification at Graue Mill

(Fullersburg Woods)



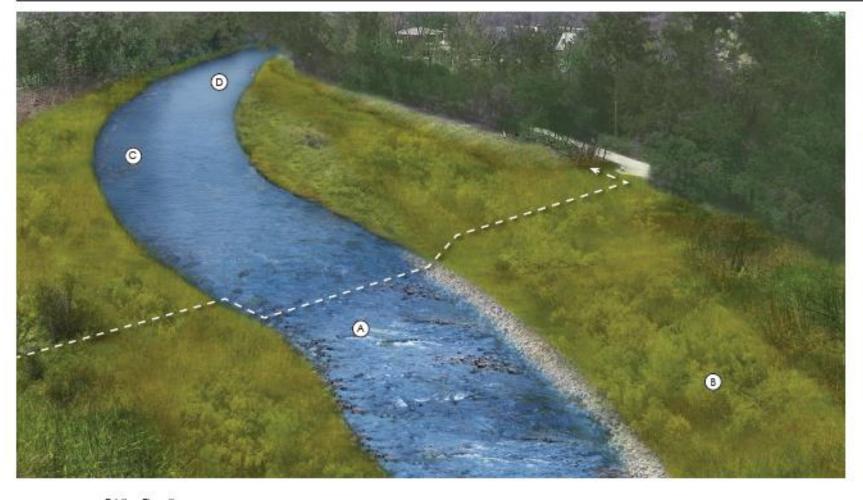
LEGEND

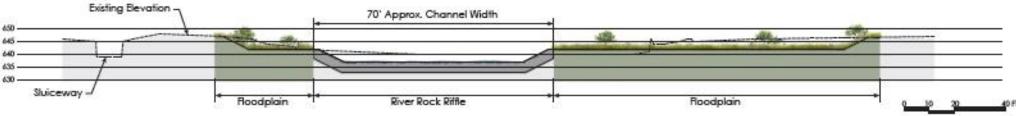
- (A) River Rock Riffle
- (B) Proposed Floodplain
- (C) Pool
- (D) Sluiceway
- (E) Proposed Channel



LEGEND

- (A) River Rock Riffle
- B Proposed Floodplain
- C Proposed Channel





Fullersburg Dam Alternatives

February 26, 2020 AECOM

LEGEND

© Pool

River Rock Riffle

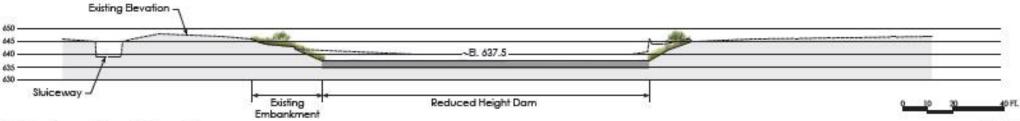
Proposed Floodplain

Proposed Channel



LEGEND

- (A) Reduced Height Dam
- B) Rock Ramp
- C Proposed Roodplain
- D Proposed Modified Pool



Fullersburg Dam Alternatives

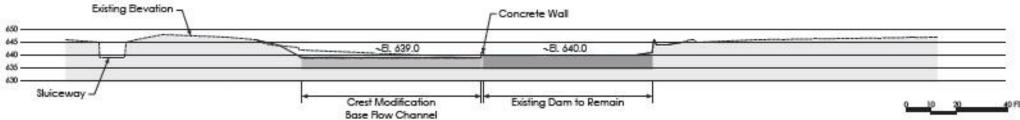
February 26, 2020 AECOM

Dam Modification -Option Spillway Modification – Add Passage



LEGEND

- (A) Existing Dam to Remain
- B Crest Modification Base Row Channel
- Spillway to Remain
- D Ponded Area Maintained
- (E) Concrete Wall



Fullersburg Dam Alternatives

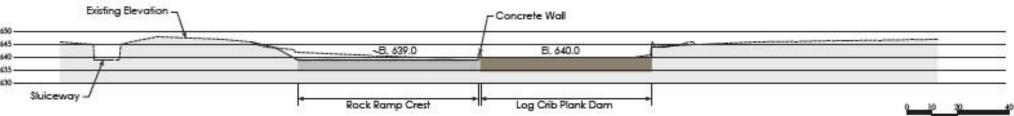
February 26, 2020 AECOM

Dam Modification -Option [& Wood Crib Plank Spillway Passage Channel

0

LEGEND

- (A) Log Crib Plank Dam
- (B) Rock Ramp Crest
- C Spillway to Remain
- D Ponded Area Maintained
- E Concrete Wall



Jam Modification – Salt Creek Channel Restoration

