SUMMARY NOTES OF THE AUGUST 7, 2013 MEETING OF THE ROOT RIVER WATERSHED RESTORATION PLAN ADVISORY GROUP

INTRODUCTION

The August 7, 2013, meeting of the Root River Watershed Restoration Plan Advisory Group was convened at Franklin City Hall at 9:03 a.m. The meeting was called to order by Susan Greenfield, Executive Director of the Root-Pike Watershed Initiative Network (Root-Pike WIN). Attendance was taken by circulating a sign-in sheet.

In attendance at the meeting were the following individuals:

Advisory Group Members	
Susan Greenfield, Co-Chair	Executive Director, Root-Pike Watershed Initiative Network
Jeff Martinka, Co-Chair	Executive Director, Southeastern Wisconsin Watersheds Trust, Inc. (Sweet Water)
Michael G. Hahn, Secretary	Chief Environmental Engineer, Southeastern Wisconsin Regional Planning Commission
Joseph E. Boxhorn	Senior Planner, Southeastern Wisconsin Regional Planning Commission
Allison Chernouski	Root-Pike Watershed Initiative Network
Thomas Friedel	Administrator, City of Racine
Laura L. Kletti	Principal Engineer, Southeastern Wisconsin Regional Planning Commission
Michael A. Luba	NR Basin Supervisor, Wisconsin Department of Natural Resources
Christopher Magruder	Community Environmental Liaison, Milwaukee Metropolitan Sewerage District
Matthew T. Magruder	Systems Data Technician, Milwaukee Metropolitan Sewerage District
Mike Marek	Milwaukee Area Land Conservancy
Wendy McCalvy	Board of Directors, Caledonia Conservancy
Monte G. Osterman	Supervisor, Racine County Board of Supervisors
Julia Robson	Milwaukee County Parks
Brian Russert	Natural Areas Coordinator, Milwaukee County Parks and University of Wisconsin-Extension
Chad Sampson	County Conservationist, Racine County
Kurt O. Thomsen	KOT Environmental Consulting, Inc.
Andrew D. Yencha	Natural Resources Educator, University of Wisconsin-Extension
Guests	
Robert Smage	Root-Pike Watershed Initiative Network

Ms. Greenfield welcomed the attendees to the meeting and thanked them for their participation. She noted that the draft chapters to be reviewed were sent to the Group by electronic mail.

REVIEW OF SUMMARY NOTES FROM MAY 1, 2013, MEETING OF THE ROOT RIVER WATERSHED RESTORATION PLAN ADVISORY GROUP

At Ms. Greenfield's request Mr. Hahn addressed the summary notes from the May 1, 2013, meeting of the Advisory Group. He said that later in the meeting, prior to discussion of issues related to Horlick dam, he would review Exhibit H of the summary notes, "Summary of the June 13, 2013, Wisconsin Department of Natural Resources/Southeastern Wisconsin Regional Planning Commission Staff Meeting to Discuss Issues Related to Fish Passage in Streams and Rivers Tributary to Lake Michigan."

No questions or comments were offered on the summary notes, and they were approved by consensus of the Advisory Group.

REVIEW OF PARTIAL PRELIMINARY DRAFT CHAPTER IV, "CHARACTERIZATION OF THE WATERSHED," OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 316 (CAPR NO. 316), *"A RESTORATION PLAN FOR THE ROOT RIVER WATERSHED"*

Mr. Hahn provided a brief overview of the topics to be covered during the meeting, and he noted that development of Chapter IV, "Characterization of the Watershed," is an ongoing process that would continue for the near future as additional information becomes available and is incorporated and as text is drafted for the habitat focus area.

Mr. Hahn asked Mr. Boxhorn to begin the review "Mussels" subsection of the "Biological Conditions of the Root River Watershed" section of the partial preliminary draft of Chapter IV.

Mr. Boxhorn mentioned that the SEWRPC field crew collecting stream data along Hoods Creek for the watershed restoration plan had found mussels in the Creek. Ms. Greenfield asked if those mussels were inventoried, and she noted that Jason Dare would be inventorying mussels in some Root River tributaries along with streams in the Pike River watershed. Mr. Boxhorn said the SEWRPC staff did not specifically inventory the mussels they found, and Hoods Creek would be a good stream for Mr. Dare to check.

Mr. Magruder asked if the mussels could be classified based on their levels of tolerance to contaminants. Mr. Boxhorn replied that he was not aware of levels of tolerance having been determined.

Ms. McCalvy inquired if mussels could be an indicator species of water quality, specifically relative to a possible return flow of treated City of Waukesha wastewater to the Root River. Mr. Boxhorn said that stream insects and macroinvertebrates might be better indicators, but he noted that, hypothetically, if a lack of juvenile mussels were observed, that could indicate recent water quality problems.

Ms. Greenfield asked what Mr. Dare's overall conclusions were regarding mussels in the River. Mr. Boxhorn said that because Mr. Dare found many mussels, it could be concluded that water quality in the river was sufficiently good to support large mussel populations. He added that Mr. Dare's study is a good start on characterization of mussels in the River, and that future comparative data would be helpful for further characterization. Ms. Greenfield said that Mr. Dare's report recommends future monitoring of mussels, and she noted that it would be helpful if the SEWRPC staff could share their ideas on which tributaries should be sampled in the future and when the sampling should occur. Mr. Boxhorn said that the time of the next monitoring of mussels should be related to their life cycle, and Hoods Creek and Tess Corners Creek would be good candidates for mussel sampling.

> [Secretary's Note: The SEWRPC staff contacted WDNR regarding information related to mussel sampling protocols, but had not received a response as of the date of these summary notes.]

Mr. Marek asked if there was information available on the number of generations of mussels in the River. Mr. Boxhorn replied that such a determination would require collecting live samples (which he noted is illegal) and counting growth rings, and he said he was not aware of any such study being done. Mr. Marek asked how successfully mussels were reproducing in the River. Mr. Boxhorn said that when the River was surveyed in the 1970s, three live, native mussel species were identified, and Mr. Dare's recent survey identified seven live species. He noted that part of the reason for the recent identification of more species could be the greater effort for Mr. Dare's survey relative to that in the 1970s.

Upon completion of the discussion regarding mussels, Mr. Hahn reviewed the "Flooding (Racine County)" section of the partial preliminary draft of Chapter IV. He reminded the Advisory Group that the watershed restoration plan was addressing flooding problems in Racine County at the request of the County, and he said that the plan would not address Milwaukee County flooding problems in detail because those are being addressed separately through watercourse system planning work conducted by the Milwaukee Metropolitan Sewerage District.

He noted that the fourth full paragraph on page 7 referred to both the "Town of Raymond Drainage District" and the "Raymond Stormwater Utility District." He asked the Advisory Group for verification whether those references were correct.

[Secretary's Note: Mr. Hahn reviewed the paragraph with Christopher Stamborski of R. A. Smith National consulting engineers, the Town Engineer. The following paragraph replaces the paragraph in the draft:

"In 2009, the Town of Raymond conducted an evaluation of the 3 Mile Road crossing over the East Branch Root River Canal. The evaluation indicated that the crossing is impassable anytime two or more inches of rain falls and this was identified as the highest priority flooding problem to be addressed by the Town. The evaluation included a floodplain impact study of raising the road and providing additional high water culverts. This study concluded that these actions would have no impact on the floodplain. Between 2009 and 2011, the Raymond Stormwater Utility District conducted three projects along the mainstem of the Root River, the Root River Canal, and the East and West Branches of the Canal. In each of these projects, woody and nonwoody debris were removed from streams and dead, dying, and leaning trees that were located within 30 feet of the ordinary high water mark of the streams were removed. Projects were conducted along the Root River Canal between 5 Mile Road and 8 Mile Road in 2009, the East Branch Root River Canal and the Root River Canal between 3 Mile Road and 5 Mile Road in 2010, and the mainstem of the Root River from 43rd Street to the north town line in 2011."

The changes to the original paragraph involved removing references to the "Town of Raymond Drainage District" or replacing such references with the "Town of Raymond."]

With respect to the subsections on historical and more recent flooding on pages 7 and 8, Mr. Hahn said that while five floods reported for the 34-year period from 1940 through 1973 as compared to 41 flood events reported by the National Climatic Data Center (NCDC) from 1990 to 2013, the increase in the number of floods was not necessarily an indication of a proportional increase in flood activity since the level of effort for systematic flood reporting had increased since 1990. Mr. Osterman asked if Mr. Hahn was claiming no relationship between the earlier (1940 through 1973) and later (1990 to 2013) time periods, and he asked if increased land development was not also a cause of more floods. Mr. Hahn said that more systematic flood reporting contributed to the increase in number of reported floods as did development and climate change. Ms. Greenfield asked for clarification as to whether Mr. Hahn was saying that based on the historical record, the frequency of flooding had increased and climate change is influencing that. Mr. Hahn replied that that is a reasonable statement, that it is necessary to take a long-term perspective to reach such conclusions, and that there have been more intense large rain storms in recent years than in the past.

Ms. Greenfield said that over time, despite actions to 1) map floodplains, 2) keep development out of those floodplains, and 3) keep stormwater runoff onsite, severe flooding impacts are still occurring, and she indicated that large-scale loss of wetlands is also contributing to those flood impacts. She concluded by asking if floodplain boundaries are being redrawn. Mr. Hahn answered that SEWRPC works continually to update floodplain

information. He said that the recent Federal Emergency Management Agency (FEMA) Map Modernization program resulted in some updated floodplain studies, but in many cases its main product was simply a digital representation of previously-mapped floodplain boundaries. He continued, noting that the ongoing FEMA Risk Mapping, Assessment, and Planning (RiskMAP) program should produce some updated floodplain studies. He said that SEWRPC is currently involved in updating floodplain maps throughout Milwaukee County and along streams flowing into Milwaukee County under a program funded by the Milwaukee County Automated Mapping and Land Information System (MCAMLIS) Steering Committee, MMSD, and SEWRPC.

[Secretary's Note: Under the MCAMLIS/MMSD/SEWRPC floodplain mapping effort, SEWRPC is currently focusing on mapping floodplains along streams in the Root River watershed that flow into Milwaukee County, or are located in Milwaukee County. In addition, because of the need to develop a well-calibrated model, the hydrologic model for development of flood flows under that study covers the entire Root River watershed, including the areas within Racine County. The development of that model will facilitate updated floodplain mapping of the Root River and tributaries in Racine County. It is possible, but not certain, that updating of Root River floodplains under the FEMA RiskMAP program may begin in the next few years. SEWRPC will keep abreast of developments relative to the Root River watershed and will make updated floodplain information available for incorporation under the Risk MAP program.]

Mr. Hahn went on to explain that the National Oceanic and Atmospheric Administration (NOAA) recently published Atlas 14, Volume 8, Version 2.0, *Precipitation-Frequency Atlas of the United States–Midwestern States,* June 2013. He said that the Wisconsin portion of that study was funded by the Wisconsin Departments of Natural Resources and Transportation and SEWRPC. He said that compared to previous Federal and SEWRPC regional precipitation-frequency studies, the precipitation depths for the less frequent events and durations of several days or less increased somewhat under the new NOAA study, but the depths for less frequent events and longer durations increased substantially. He noted that the science of climate change is evolving and that it is now becoming possible to model the potential effects of climate change on a local level, but the state of the art has still not evolved to the point where we can confidently predict local climate change effects.

Mr. Osterman asked that the annual flood probabilities in Table IV-FLOOD-1 be explained.

[Secretary's Note: The following footnote was added at the end of the "Annual Flood Probability (percent)" column heading in Table IV-FLOOD-1:

"The one-percent-annual-probability flood has a 1 percent chance of occurring in any given year. That flood is also sometimes referred to as the 100-year recurrence interval flood. The two-percent-annual-probability flood has a 2 percent chance of occurring in any given year (50-year recurrence interval flood). The 10-percent-annual-probability flood has a 10 percent chance of occurring in any given year (10-year recurrence interval flood). The flood probability in percent is equal to 100 divided by the recurrence interval in years. As an example, the annual probability of the 50-year flood is 100/50 = 2 percent."]

Mr. Magruder asked whether the cost of emergency services during a flood was included in the estimates of flood damages set forth in Table IV-FLOOD-1. Mr. Hahn replied that it was through application of a generalized adjustment factor that also addresses other indirect damages/costs during a flood such as traffic detours.

REVIEW OF PORTION OF SUMMARY NOTES FROM MAY 1, 2013, ADVISORY GROUP MEETING ADDRESSING WDNR/SEWRPC MEETING TO DISCUSS FISH PASSAGE ISSUES

As noted previously, review of the part of the summary notes from the May 1, 2013, meeting that address fish passage issues was deferred because such a review would be a logical lead-in to the overall discussion of issues related to the Horlick dam. Mr. Hahn noted the reference on page 8 of the May 1, 2013, meeting summary notes to a proposed meeting between the staffs of the Wisconsin Department of Natural Resources (WDNR) and SEWRPC to discuss issues related to dam removal, invasive species, and viral hemorrhagic septicemia. He then reviewed Exhibit H of the May 1, 2013, summary notes, "Summary of the June 13, 2013, Wisconsin Department of Natural Resources/Southeastern Wisconsin Regional Planning Commission Staff Meeting to Discuss Issues Related to Fish Passage in Streams and Rivers Tributary to Lake Michigan." He thanked Mike Luba and Craig Helker, both of the WDNR staff, for arranging the meeting, and he noted that the notes from the WDNR/SEWRPC meeting would be included as Appendix G in the Root River watershed restoration plan report.

Mr. Osterman asked when the collapse of the salmon fishery in Lake Huron, which is referenced in Exhibit H of the May 1 summary notes, occurred. Mr. Magruder said that it occurred in the last decade.

Mr. Boxhorn mentioned that the dominance of zebra and quagga mussels in Lake Michigan has altered the food web. Currently most of the production in the Lake ends up as quagga mussel and *Cladophora* biomass instead of supporting forage for fish. He added that under these conditions, tributary streams might act as a source of organism to Lake Michigan and that improving fish migration from Lake Michigan to upstream areas in the Root River watershed presented an opportunity to restore the native fishery, including whitefish and northern pike. He said that the level of stocking of salmon in Lake Michigan has been reduced by both the States of Michigan and Wisconsin, and some salmon are reproducing in tributary rivers in Michigan.

Mr. Marek noted that 80 percent of the Lake Michigan native fish species require wetlands to reproduce, and many coastal wetlands have been lost. He said that salmon consume about four times the number of calories as do lake trout; therefore, salmon stocking reductions could lead to increases in native lake trout. Mr. Magruder responded that lake trout decline was caused by overfishing and parasites such as lamprey, and not by competition with salmon.

Ms. Greenfield said that wetland restoration in urban areas needs to be considered. Mr. Hahn said that urban restoration should be considered, but he noted that the Root River watershed has significant opportunities for wetland restoration in rural areas and those restorations can be accomplished on a larger scale than urban restorations.

[Secretary's Note: Native fish spawning opportunities could be provided through wetland restoration on agricultural land upstream of the dam, and those opportunities could be enhanced through connection of the watershed area upstream of Horlick dam with Lake Michigan, subject to Racine County's decision regarding the dam. Some spawning opportunities could also be achieved through wetland restoration in urban areas downstream from the dam.]

REVIEW OF PARTIAL PRELIMINARY DRAFT CHAPTER V, "DEVELOPMENT OF TARGETS AND ALTERNATIVE MEASURES," OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 316 (CAPR NO. 316), "*A RESTORATION PLAN FOR THE ROOT RIVER WATERSHED*"

Ms. Kletti began the review of the "Horlick Dam Alternatives" section of Chapter V.

[Secretary's Note: The Horlick dam presentation is attached as Exhibit A.]

Mr. Magruder asked whether the preliminary significant hazard rating for Horlick dam was based on the risk upstream or downstream of the dam. Ms. Kletti replied that the hazard rating is based on the downstream risk from dam failure. Ms. Greenfield asked what would happen if the dam were to fail. Ms. Kletti said that the County's dam failure analysis is currently being reviewed by WDNR and specifics regarding dam failure would not be known definitively until that review is complete. Mr. Hahn added that WDNR had indicated that the review might be complete in about six months and the final hazard rating would not be known until then.

There was some discussion regarding Map V-A which shows locations of private wells in the vicinity of the Horlick dam impoundment. It was decided that the SEWRPC staff would check into municipal requirements regarding wells in existence prior to provision of a Lake Michigan water supply. Mr. Hahn noted that, while the possible effects on private wells of changes to the Horlick dam impoundment were noted in the draft report because such effects might be an issue that would be raised during the consideration of options for the dam, the significance of that issue should not be overstated.

[Secretary's Note: This issue will be investigated by the SEWRPC staff.]

Mr. Magruder asked in salmon had been reported upstream of the dam. Mr. Boxhorn replied that none was reported in the data that he has reviewed. Mr. Luba noted that there have been problems with fish getting to the WDNR Root River Steelhead Facility during low flow periods.

There was also discussion of property ownership issues along the Horlick dam impoundment if the impoundment were reduced in size because of possible future modifications to the dam. Mr. Martinka asked whether the Horlick dam affects the River level up to STH 31. Ms. Kletti replied that it did. It was concluded that such ownership issues would have to be considered on a case-by-case basis when the County is considering what alternative to pursue regarding the dam.

Mr. Osterman inquired how much the level of the impoundment would be lowered if conceptual Alternative 1 were implemented for Horlick dam. Mr. Hahn replied that the normal impoundment level would be about four feet lower from the dam upstream to location AA on the twelfth slide in Exhibit A.

Ms. Kletti noted that Map V-C was incorrectly labeled as Map IV-C. Mr. Magruder asked that a column be added to Table V-C indicating whether dam safety criteria are met.

[Secretary's Note: Map V-C was revised as requested and is attached as Exhibit B.]

Mr. Marek asked if seeding of selected exposed areas in the former impoundment was included in the operation and maintenance costs for the dam alternatives. Ms. Kletti said such costs were included in the capital costs, but not the operation and maintenance costs. Mr. Marek replied that ongoing management of the seeded areas might cost $2,000 to $3,000 per acre in the first five years after the initial seeding.

[Secretary's Note: Tables V-D and V-E were revised to include $1,500 per year for maintenance seeding in the first five years after initial seeding under each of the alternatives. Those tables are attached as included in Exhibit C.]

Mr. Hahn called the Advisory Group's attention to the first paragraph on page 10 of the Horlick dam insert to Chapter V. He noted that, in general, the costs of dam removal or modification can be highly variable, and while the costs developed under this study were developed in a consistent manner and are considered to be useful for comparison of systems-level alternatives, WDNR has indicated that, even after the final design stage, the average dam reconstruction change order amount is 40 percent of the initial capital cost estimate. Ms. Greenfield said that a footnote should be added to the cost table to state that "qualifier."

[Secretary's Note: Table V-D was revised to include qualifying language regarding possible capital cost increases (see Exhibit C).]

Ms. Kletti then moved on to review of conceptual Alternative 2, which is the same as Alternative 1 except for inclusion of a fishway.

Ms. Greenfield asked why removal of sediment accumulated in the impoundment upstream of the dam might be necessary. Ms. Kletti replied that removal would be needed if contaminated sediment were found. Mr. Marek mentioned that the Thiensville dam fishway project on the Milwaukee River would be a useful example for determining the specifics of a fishway configuration.

Ms. Kletti then reviewed conceptual Alternative 3, which calls for even more significant lowering of the spillway crest, including a notch down to the streambed.

Ms. Greenfield inquired what feature would be protected by leaving the right (looking downstream) portion of the spillway crest in place under this alternative. Ms. Kletti said that was intended to protect the integrity of the streambank adjacent to the hotel.

Mr. Martinka said that the extent of the impoundment under this condition would not look as shown on Figure V-D. Ms. Kletti responded that it was unclear what the extent of the impoundment immediately upstream of the dam would be because of the effect of the "ledge" in the streambed upstream of the dam.

> [Secretary's Note: Both Figures V-D and V-E (for Alternatives 3 and 4, respectively) indicate narrowing of the impoundment upstream of the dam site relative to Alternatives 1 and 2, and Figure V-E appropriately shows further narrowing relative to Figure V-D. Because of uncertainty regarding the degree of narrowing immediately upstream of the dam under the alternatives, no attempt will be made to revise conceptual Figures V-D and V-E.]

Mr. Marek asked if habitat improvement measures within the impoundment area were included in the costs. Ms. Kletti replied that they were not included, and the need for such measures might not be known until conditions are established following modification or removal of the dam.

During discussion of conceptual Alternative 4, which calls for removal of the dam, Ms. Greenfield asked if the river level upstream of the dam site would drop from four to six feet. Mr. Hahn replied that, under normal flow conditions, the level would drop a maximum of 10 feet, tapering to essentially no drop at STH 31.

Mr. Magruder mentioned that if the dam were removed, the County would no longer need insurance on the structure; however, Ms. Kletti replied that the County has a blanket hazard insurance policy that would include coverage for the dam, but does not specifically include a cost component for insuring the dam.

Ms. Greenfield asked if water levels would be higher downstream from the current dam site if the dam were removed. Ms. Kletti replied that they would not.

> [Secretary's Note: The floodwater storage volume above the current impoundment level upstream of the dam is relatively small compared to the runoff volume generated from the approximately 198-square-mile watershed. Thus, the dam and impoundment do not currently function to significantly reduce flood peaks and removal of the dam would not be expected to increase downstream flows.]

Mr. Martinka said that sediment that is currently deposited in the impoundment would ultimately be transported downstream, which would have a cost associated with it, given current downstream dredging needs in the harbor. Mr. Magruder mentioned that a staged drawdown, as proposed, would affect project capital costs. Mr. Marek noted that more erosion of sediment from the impoundment would be expected under the full dam removal

conceptual alternative. Ms. Kletti responded that some bank stabilization might be necessary within the impoundment.

[Secretary's Note: As noted previously, the cost estimate for each alternative includes costs for seeding the shallowest exposed sediment areas in the impoundment (see Exhibit B). Such seeding, along with consolidation of sediment during a staged drawdown, would help to stabilize those areas. If additional bank stabilization were needed within the impoundment, it could be more extensive under Alternatives 3 and 4, than under Alternatives 1 and 2, but the relative cost differences would likely be small, and would not affect the comparison of conceptual alternative costs.]

Mr. Osterman mentioned that the estimated extent of the River under conceptual Alternative 4 as shown on Figure V-D is considerably different than under the other alternatives. Ms. Kletti replied that the extent under alternatives 3 and 4 would be similar, but it is substantially less than under the other alternatives.

[Secretary's Note: Based on Mr. Osterman's comments and the discussion during an August 14, 2013, meeting with the Racine County Executive, which was attended by County staff, Ms. Greenfield, WDNR staff, and SEWRPC staff, Map V-D was revised to include two potential impoundment extents—one under Alternatives 1 and 3 and one under alternatives 3 and 4. The revised Map V-D is attached as Exhibit D. That version of the map was shown at the August 28 public meeting at River Bend Nature Center, during which Horlick dam issues were presented and discussed.]

Following the discussion of each alternative for Horlick dam, there was a general discussion of issues related to the dam.

Ms. Greenfield asked for verification that SEWRPC would not make a recommendation to Racine County regarding actions to take relative to the dam. Mr. Hahn replied that SEWRPC would not make recommendations to the County, noting that 1) the County owned the dam, 2) SEWRPC's role is to provide conceptual, systems-level alternatives for the dam to assist the County in making a decision, and 3) additional work would need to be done as the County moves through the decision process.

Mr. Yencha asked if any thought had been given to modeling the fate of sediment eroded from the impoundment and transported downstream. Mr. Hahn responded that, while the fate of eroded sediment is an important issue that needs to be considered, such a quantitative analysis is beyond the scope of the watershed restoration plan. Mr. Yencha said the fate of the sediment could become an issue.

Mr. Osterman said that, at some point, it will be necessary to involve the Racine Harbor Commission. Ms. Greenfield noted that the Harbor Commission has been invited to the stakeholder meetings. Mr. Osterman also said that he would check to see if the consultant to the County is performing any structural analyses of the dam.

Mr. Magruder suggested that a column be added to Table V-E indicating what new opportunities each alternative might present. He cited new recreational opportunities as an example.

[Secretary's Note: Table V-E was revised to include a "New Opportunities" column (see Exhibit C).]

Mr. Marek said that there was not a large difference in costs between alternatives, which he indicated was unusual for a set of alternatives that include dam removal. He asked if the contingency factor applied to the alternatives could be customized for each to reflect the relative degree of certainty for the cost estimates.

[Secretary's Note: In general, the cost of dam removal is often less than the cost of modifications to upgrade a dam to meet standards. In this case, because of the nature of the dam as a simple overflow spillway structure and the straightforward characteristics of the

conceptual alternatives, each of which essentially involves removing portions of the dam, the costs of alternatives would be expected to be close. A standard 35 percent factor was applied to the base cost of each alternative to account for engineering, administration, and contingencies. Because of the similar nature of the work to be done under each alternative, the SEWRPC staff does not think that customized contingency factors would be applicable in this case. As noted previously, a qualifier was included with the cost estimates, indicating the possibility of change orders of up to 40 percent of the estimated project cost following final design of a dam reconstruction project.]

Mr. Friedel asked for more information on the need for action relative to Horlick dam, and he noted that taxpayers would ask about that need. Mr. Luba replied that the reason alterations to the dam will be necessary is because the hydraulic capacity of the spillway is inadequate and WDNR will be issuing an order to modify the spillway capacity of the dam to pass the required flood flow. Mr. Friedel said that it is important that the need for modifications to the dam be clearly communicated.

[Secretary's Note: On page 7 of the Chapter V insert regarding Horlick dam alternatives, it is clearly stated that "a 'no action' alternative is not a viable option for the Horlick dam," and the reasons why are described. The first paragraph of the "Horlick Dam Alternatives" section on page 1 describes why action is needed, but does not specifically state that doing nothing is not an option. Thus, the paragraph was revised as follows (Text in bold is included here to indicate language changed or added to the text. Text will not be bold in the report.):

"Introduction
In Chapter IV an inventory of information on the Horlick dam was compiled. As was noted in Chapter IV, the Horlick dam spillway does not meet the requirements for a Significant Hazard dam.[1] **Due to the inadequate spillway capacity, structural modifications to the dam would be necessary if the dam is to be maintained. Thus, a "no action" alternative is not a viable option for the Horlick dam.** Therefore, in this chapter alternatives were developed to meet the regulatory requirements associated with the dam hazard rating and the effects of implementation of those alternatives on the Root River corridor in the vicinity of the dam were addressed. First, issues of concern for evaluating the current conditions and dam alternatives are summarized, next the baseline Horlick dam condition is described, and finally three potential categories of dam alternatives are detailed.

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[1]*An engineering consultant for Racine County has prepared a dam failure analysis and the consultant and WDNR are currently coordinating the WDNR review of that analysis. The final dam hazard rating will not be known until the analysis is accepted by WDNR, but preliminary indications are that a Significant Hazard Rating is appropriate."*

In addition, it was made very clear by the SEWRPC staff during the August 28, 2013, public meeting that doing nothing relative to the dam was not an option.]

DATE AND TIME OF NEXT MEETING

Ms. Greenfield thanked everyone in attendance for their participation and noted that the public meeting on the Horlick dam will be held on August 28, 2013, at River Bend Nature Center in the Village of Caledonia.

ADJOURNMENT

There being no further business, the meeting was adjourned by unanimous consent at 12:18 p.m.

FOLLOW-UP FROM AUGUST 28, 2013, PUBLIC MEETING TO REVIEW HORLICK DAM ALTERNATIVES

The possibility of maintaining the Horlick dam spillway crest at its current elevation and raising the dam structures on either side of the spillway was raised during the August 28, 2013 public meeting to review alternatives relative to the dam. In a September 3, 2013, electronic mail message to Ms. Kletti and Mr. Hahn, Julie Anderson, Racine County Public Works and Development Services Director, asked on behalf of County Executive James Ladwig that such an additional alternative be considered. The SEWRPC staff developed that alternative, which is attached as Exhibit E.

ROOT RIVER WRP SUMMARY NOTES 08/07/2013 MEETING (00213636).DOC
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MGH/LLK/JEB/pk
09/23/13

Exhibit A

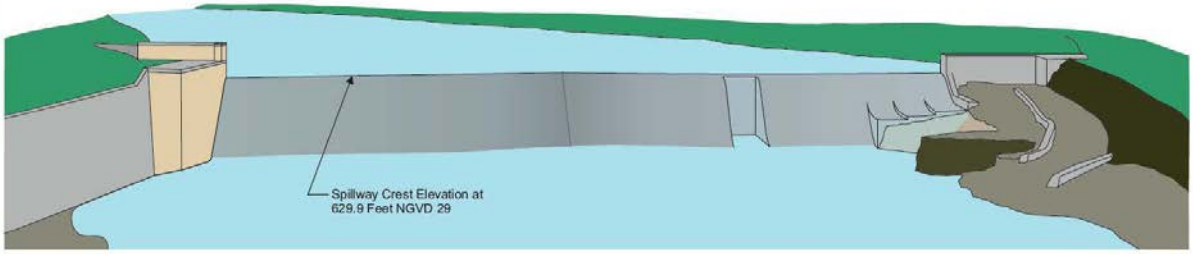
Horlick Dam Alternatives

- Issues of Concern
  - Water Quantity
  - Water Quality
  - Natural Resources
  - Social
  - Costs
- Baseline Condition
- Conceptual Alternatives

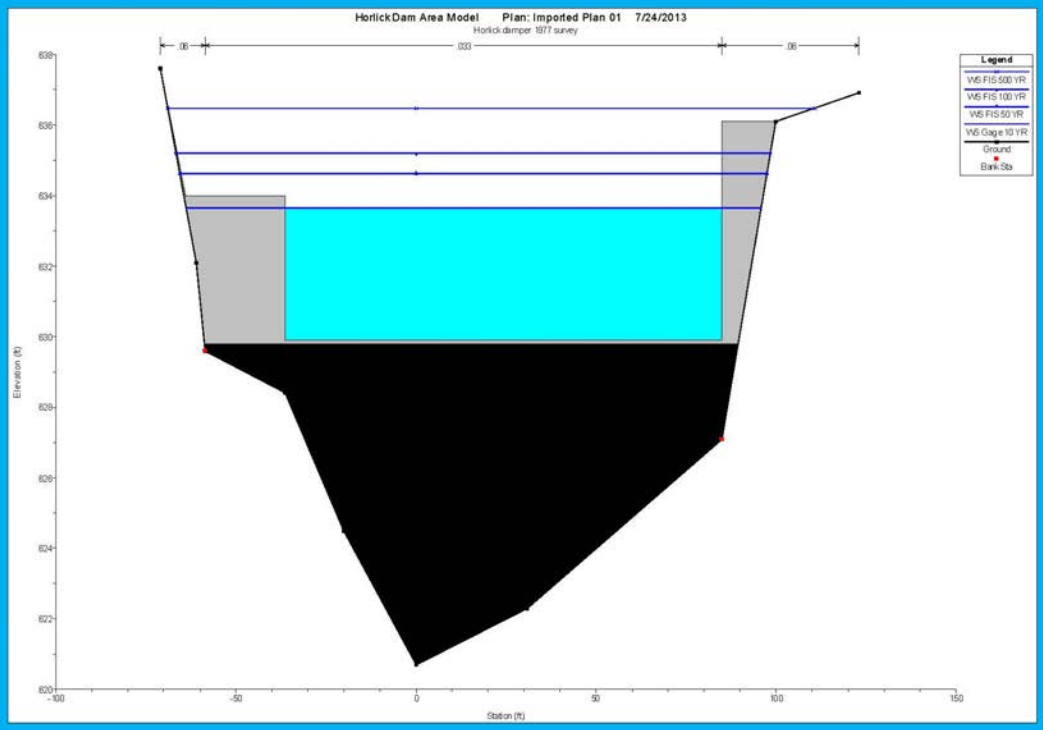
Baseline Conditions

Figure V-A

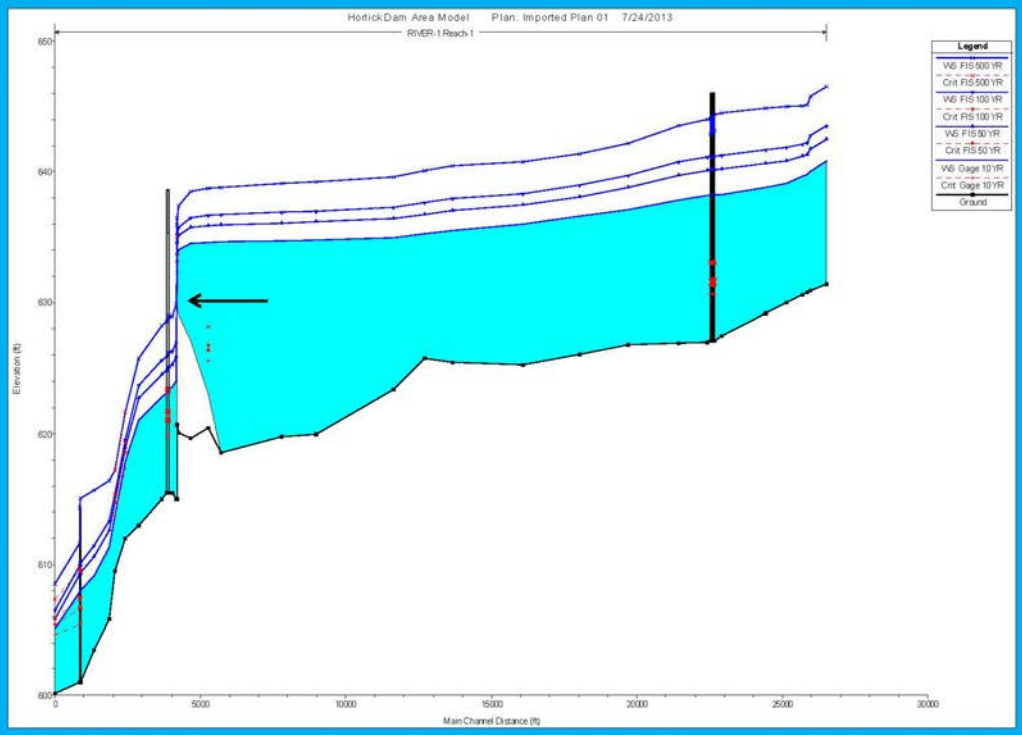
EXISTING CONDITIONS OF HORLICK DAM - LOOKING NORTH (UPSTREAM)



Baseline Conditions



Baseline Conditions



Map V-A
PRIVATE WELLS NEAR THE HORLICK
DAM IMPOUNDMENT CONSTRUCTED 1940-2010

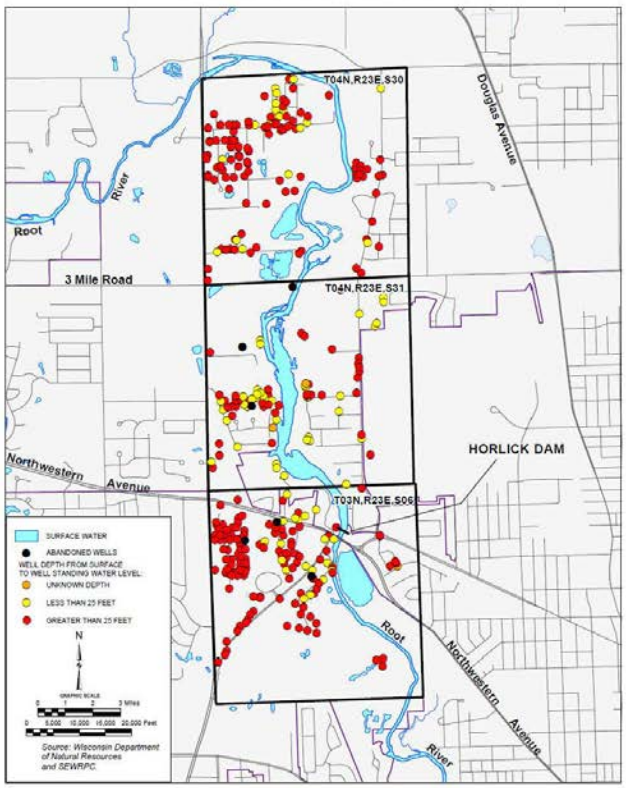


Table V-C
Fish and Invasive Summary

Alternative	Spillway Crest Elevation (feet above NGVD 29)	Tailwater Elevation Event at Crest (recurrence interval)	Chinook Passage Event (recurrence interval)	Invasive Species Passage Event (recurrence interval)	Barrier to Invasive Species
Baseline Condition	629.9	500-year	50-year	500-year	Yes
Alternative 1–500-Year Capacity	626.0	50-year	2-year	50-year	No
Alternative 1a–100-Year Capacity	627.9	Between 100 and 500-year	50-year	100-year	No
Alternative 2–Alt 1 with Fishway	626.0	50-year	2-year	50-year	No
Alternative 3–Full Notch of Dam	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No
Alternative 4–Dam Removal	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No

Map V-B
LAND OWNERSHIP IN THE VICINITY OF HORLICK DAM IMPOUNDMENT

Map V-B (Cont.)
LAND OWNERSHIP IN THE VICINITY OF HORLICK DAM IMPOUNDMENT

Alternatives

Conceptual Alternatives

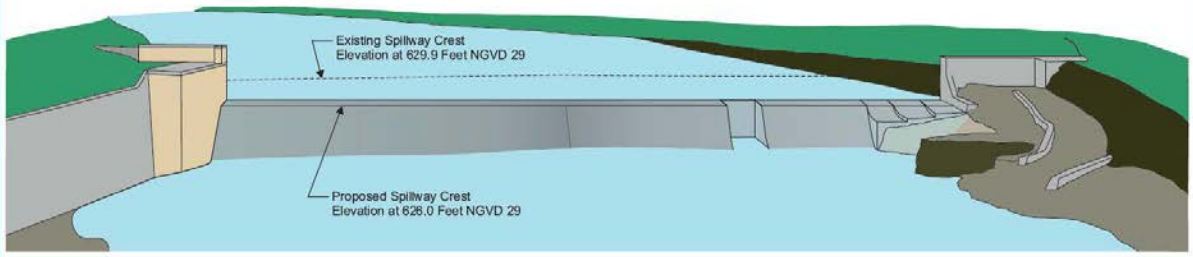
- Modify Dam to Enhance Spillway Capacity
- Modify Dam to Enhance Spillway Capacity & Fish Passage Under Low and High Flow Conditions
- Remove Dam
  - Partial Removal
  - Full Removal

Alternative 1

- Enhance Spillway Capacity

Figure V-B

CONCEPTUAL ALTERNATIVE 1:
ENHANCE SPILLWAY CAPACITY OF HORLICK DAM - LOOKING NORTH (UPSTREAM)



Alternative 1 – Side View

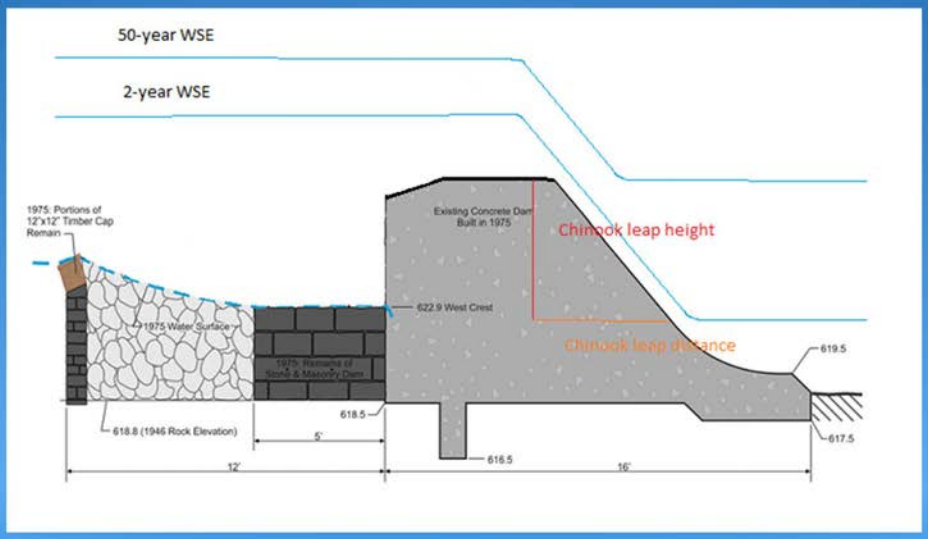


Table V-C
Fish and Invasive Summary

Alternative	Spillway Crest Elevation (feet above NGVD 29)	Tailwater Elevation Event at Crest (recurrence interval)	Chinook Passage Event (recurrence interval)	Invasive Species Passage Event (recurrence interval)	Barrier to Invasive Species
Baseline Condition	629.9	500-year	50-year	500-year	Yes
Alternative 1–500-Year Capacity	626.0	50-year	2-year	50-year	No
Alternative 1a–100-Year Capacity	627.9	Between 100 and 500-year	50-year	100-year	No
Alternative 2–Alt 1 with Fishway	626.0	50-year	2-year	50-year	No
Alternative 3–Full Notch of Dam	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No
Alternative 4–Dam Removal	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No

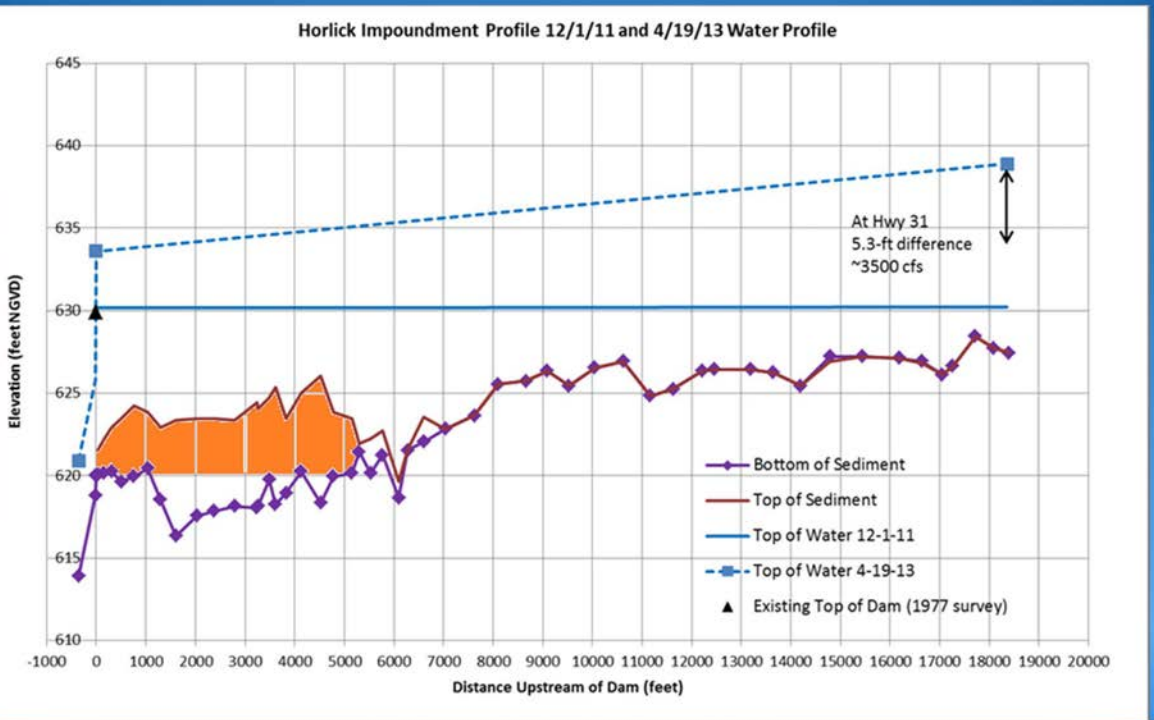
Map IV-C

SEEDING AREAS FOR PRELIMINARY COST ESTIMATES

Table V-D
Costs

Alternative	Capital Cost (dollars)	Annual Operation and Maintenance (dollars)	Total Present Worth Cost (dollars)
Alternative 1–500-Year Capacity	$370,000	$4,100	$435,000
Alternative 2–Alt 1 with Fishway	$460,000	$4,400	$529,000
Alternative 3–Full Notch of Dam	$420,000	$1,700	$447,000
Alternative 4–Dam Removal	$520,000	$ 400	$526,000

Dredging Volume

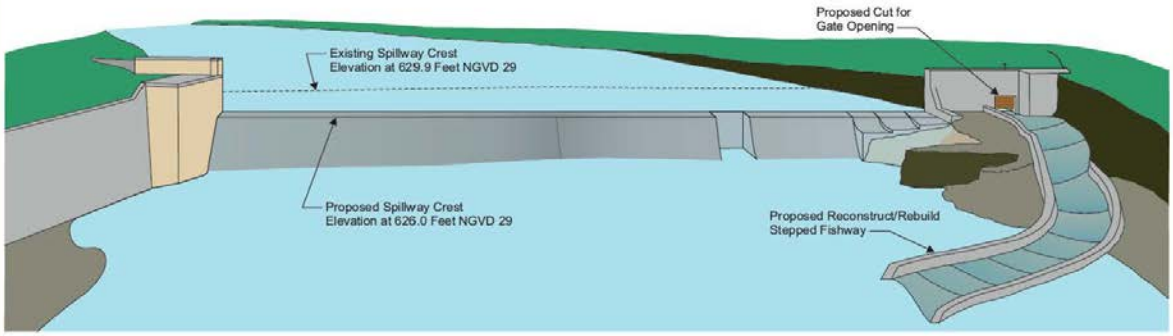


Alternative 2

- Enhance Spillway Capacity and Fish Passage

Figure V-C

CONCEPTUAL ALTERNATIVE 2:
ENHANCE SPILLWAY CAPACITY AND MODIFY FISHWAY OF HORLICK DAM - LOOKING NORTH (UPSTREAM)



Alternative 2

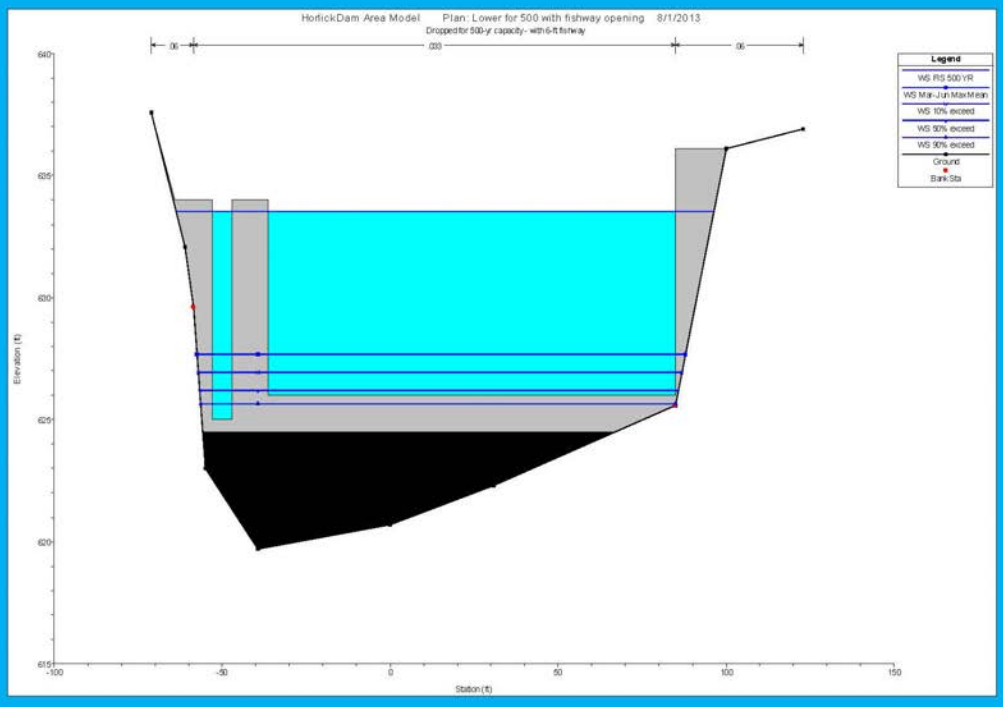


Table V-C
Fish and Invasive Summary

Alternative	Spillway Crest Elevation (feet above NGVD 29)	Tailwater Elevation Event at Crest (recurrence interval)	Chinook Passage Event (recurrence interval)	Invasive Species Passage Event (recurrence interval)	Barrier to Invasive Species
Baseline Condition	629.9	500-year	50-year	500-year	Yes
Alternative 1–500-Year Capacity	626.0	50-year	2-year	50-year	No
Alternative 1a–100-Year Capacity	627.9	Between 100 and 500-year	50-year	100-year	No
Alternative 2–Alt 1 with Fishway	626.0	50-year	2-year	50-year	No
Alternative 3–Full Notch of Dam	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No
Alternative 4–Dam Removal	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No

Table V-D
Costs

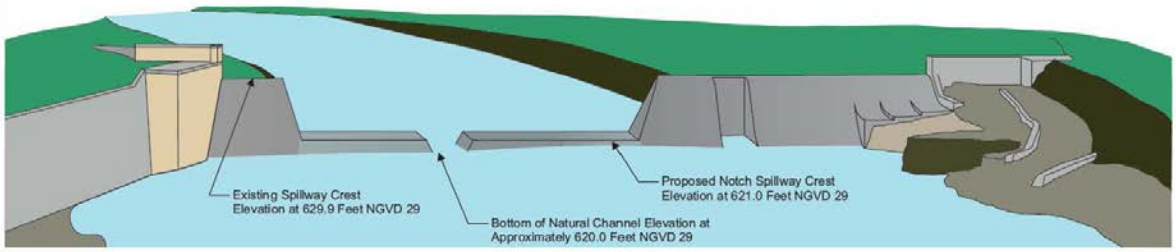
Alternative	Capital Cost (dollars)	Annual Operation and Maintenance (dollars)	Total Present Worth Cost (dollars)
Alternative 1–500-Year Capacity	$370,000	$4,100	$435,000
Alternative 2–Alt 1 with Fishway	$460,000	$4,400	$529,000
Alternative 3–Full Notch of Dam	$420,000	$1,700	$447,000
Alternative 4–Dam Removal	$520,000	$ 400	$526,000

Alternative 3

- Remove Dam as Barrier

Figure V-D

CONCEPTUAL ALTERNATIVE 3:
COMPLETELLY NOTCHED SPILLWAY OF HORLICK DAM - LOOKING NORTH (UPSTREAM)



Alternative 3

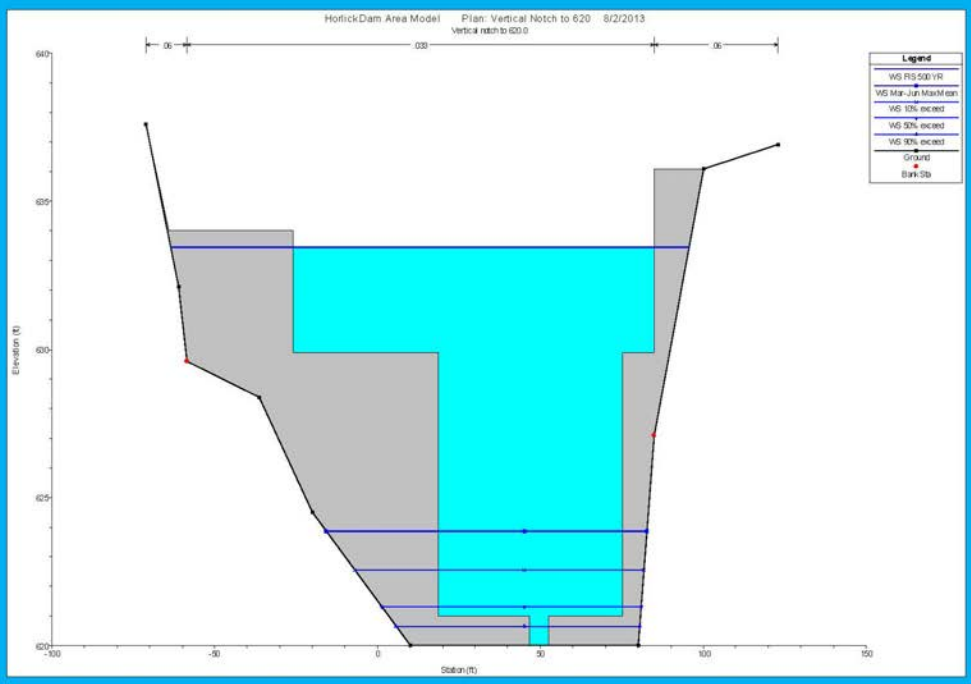


Table V-C
Fish and Invasive Summary

Alternative	Spillway Crest Elevation (feet above NGVD 29)	Tailwater Elevation Event at Crest (recurrence interval)	Chinook Passage Event (recurrence interval)	Invasive Species Passage Event (recurrence interval)	Barrier to Invasive Species
Baseline Condition	629.9	500-year	50-year	500-year	Yes
Alternative 1–500-Year Capacity	626.0	50-year	2-year	50-year	No
Alternative 1a–100-Year Capacity	627.9	Between 100 and 500-year	50-year	100-year	No
Alternative 2–Alt 1 with Fishway	626.0	50-year	2-year	50-year	No
Alternative 3–Full Notch of Dam	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No
Alternative 4–Dam Removal	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No

Table V-D
Costs

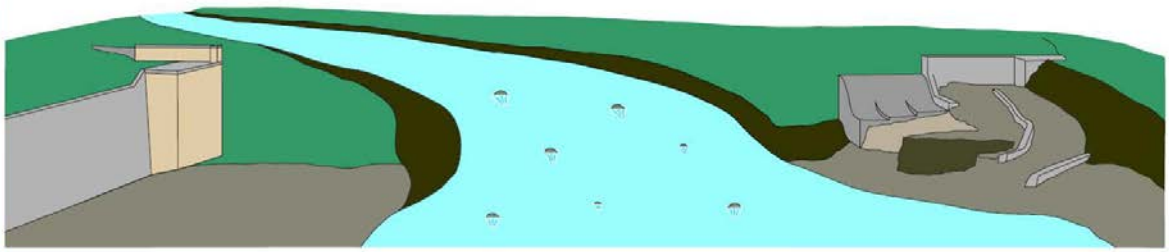
Alternative	Capital Cost (dollars)	Annual Operation and Maintenance (dollars)	Total Present Worth Cost (dollars)
Alternative 1–500-Year Capacity	$370,000	$4,100	$435,000
Alternative 2–Alt 1 with Fishway	$460,000	$4,400	$529,000
Alternative 3–Full Notch of Dam	$420,000	$1,700	$447,000
Alternative 4–Dam Removal	$520,000	$ 400	$526,000

Alternative 4

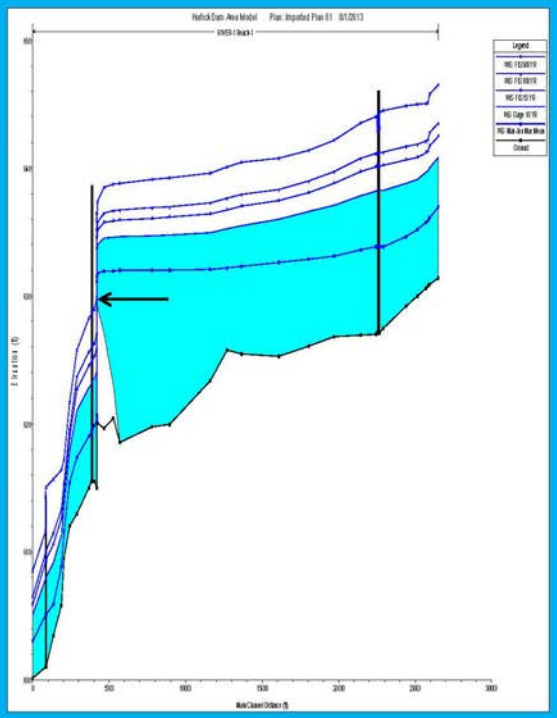
- Remove Dam

Figure V-E

CONCEPTUAL ALTERNATIVE 4:
HORLICK DAM REMOVED - LOOKING NORTH (UPSTREAM)



Baseline vs Alternative 4



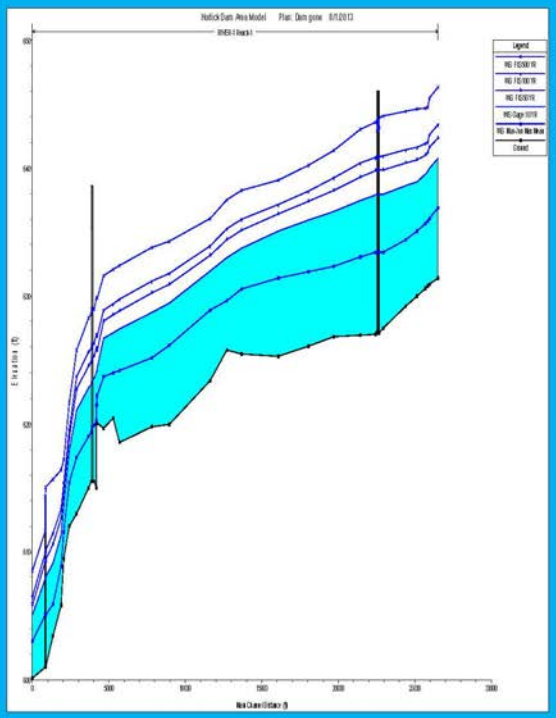


Table V-C
Fish and Invasive Summary

Alternative	Spillway Crest Elevation (feet above NGVD 29)	Tailwater Elevation Event at Crest (recurrence interval)	Chinook Passage Event (recurrence interval)	Invasive Species Passage Event (recurrence interval)	Barrier to Invasive Species
Baseline Condition	629.9	500-year	50-year	500-year	Yes
Alternative 1–500-Year Capacity	626.0	50-year	2-year	50-year	No
Alternative 1a–100-Year Capacity	627.9	Between 100 and 500-year	50-year	100-year	No
Alternative 2–Alt 1 with Fishway	626.0	50-year	2-year	50-year	No
Alternative 3–Full Notch of Dam	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No
Alternative 4–Dam Removal	620.0	Between 1 and 2-year	50 percent exceeds	10 percent exceeds	No

Map V-D

CONCEPTUAL ALTERNATIVE 4: DAM REMOVED CONDITIONS
APPROXIMATE EXTENT OF FLOODPLAIN DURING BASEFLOW (50% EXCEEDENCE)

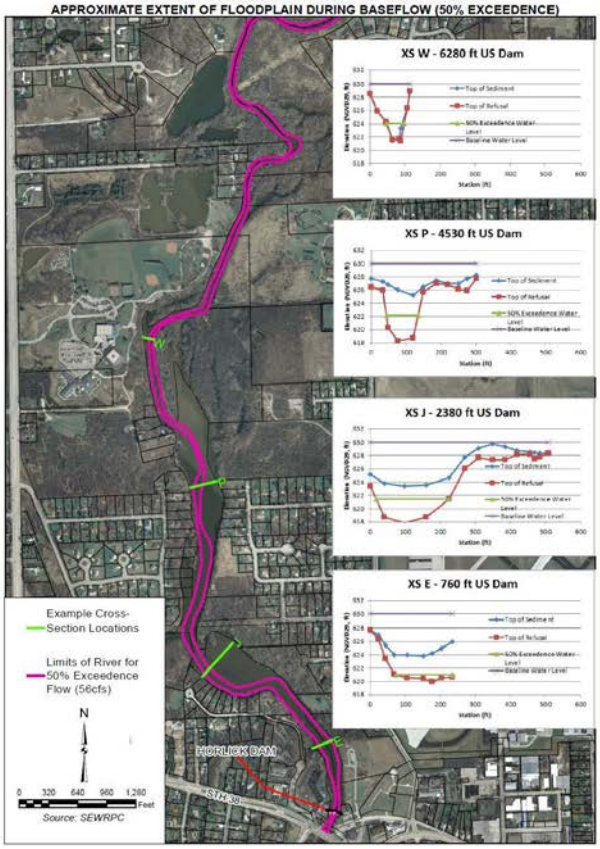


Table V-D
Costs

Alternative	Capital Cost (dollars)	Annual Operation and Maintenance (dollars)	Total Present Worth Cost (dollars)
Alternative 1–500-Year Capacity	$370,000	$4,100	$435,000
Alternative 2–Alt 1 with Fishway	$460,000	$4,400	$529,000
Alternative 3–Full Notch of Dam	$420,000	$1,700	$447,000
Alternative 4–Dam Removal	$520,000	$ 400	$526,000

Table V-E
Summary

Alternative	Flooding Upstream of Dam	Water Quality	Fish Passage and Overall Fish Community Improvement	Safety	Recreation			Access to River by Riparian Land Owners	Total Present Worth Costs (dollars)
					Paddling	Fishing Upstream of Dam	Recreational Salmon Fishing Immediately Downstream of Dam		
Baseline Condition	0	0	0	0	0	0	0	0	N/A
Alternative 1—500-Year Capacity	+	+	+	+	–	+	0	–	$435,000
Alternative 2—Alt 1 with Fishway	+	+	++	+	–	++	–	–	$529,000
Alternative 3—Full Notch of Dam	++	++	++	++	– –	+++	– –	– –	$447,000
Alternative 4—Dam Removal	++	+++	+++	+++	– –	+++	– –	– –	$526,000

Exhibit B

Map V-C

SEEDING AREAS FOR PRELIMINARY COST ESTIMATES

Exhibit C

Table V-D

HORLICK DAM ALTERNATIVE SUMMARY—COSTS

Alternative	Capital Cost[a,b] (dollars)	Annual Operation and Maintenance (dollars)[c]	Total Present Worth Cost (dollars)
Alternative 1–500-Year Capacity	$390,000	$4,500	$461,000
Alternative 2–Alt 1 with Fishway	$480,000	$4,700	$555,000
Alternative 3–Full Notch of Dam	$440,000	$2,100	$473,000
Alternative 4–Dam Removal	$540,000	$ 700	$551,000

NOTE: Additions are highlighted.

[a]*Capital costs based upon year 2013 conditions. Engineering News-Record Construction Cost Index: 12,208.*

[b]*These are systems-level planning costs and the WDNR has indicated that even after the final design stage, the average dam reconstruction change order amount is 40 percent of the initial capital cost estimate, mainly due to unforeseen site conditions once construction begins.*

[c]*Based on an interest rate of 6 percent and a project life of 50 years.*

Source: SEWRPC.

Table V-E

HORLICK DAM ALTERNATIVE SUMMARY—MAJOR ISSUES OF CONCERN

Alternative	Flooding Upstream of Dam	Water Quality	Fish Passage and Overall Fish Community Improvement	Safety	Recreation				Access to River by Riparian Land Owners[b]	Total Present Worth Costs (dollars)[c]
					Paddling	New Riparian Recreational Opportunities[a]	Fishing Upstream of Dam	Recreational Salmon Fishing Immediately Downstream of Dam		
Baseline Condition[d]	0	0	0	0	0	0	0	0	0	N/A[e]
Alternative 1— 500-Year Capacity.....	+	+	+	+	–	+	+	0	–	$461,000
Alternative 2— Alt 1 with Fishway.....	+	+	++	+	–	+	++	–	–	$555,000
Alternative 3— Full Notch of Dam.....	++	++	++	++	– –	++	+++	– –	– –	$473,000
Alternative 4— Dam Removal.....	++	+++	+++	+++	– –	++	+++	– –	– –	$551,000
Basis for Evaluation.....	Reduction/ removal of structure will lower upstream flood elevations	Reduction in impounded water should improve water quality	Elimination of structure in River or addition of fishway improves passage	Reduction/ elimination of structure in River improves public safety	Loss of impoundment area reduces consistent paddling water levels	New options within dewatered impoundment area for trails and passive recreation	Improved fish passage will improve fishing upstream	With addition of fishway or removal of dam, fish would no longer congregate on downstream side of dam	Reduction in water level removes direct access to River	N/A

NOTE: Additions are highlighted.

[a] *The ability to realize enhanced recreational opportunities depends on ownership of lands exposed with a lower or eliminated impoundment.*

[b] *Based on property boundaries provided by Racine County.*

[c] *Based on an interest rate of 6 percent and a project life of 50 years.*

[d] *Alternatives are rated relative to the potential changes from the Baseline Condition which is designated neutrally as "0". Positive (+) or negative (–) signs indicate a more positive or negative effect on the issue of concern as compared to the Baseline Condition.*

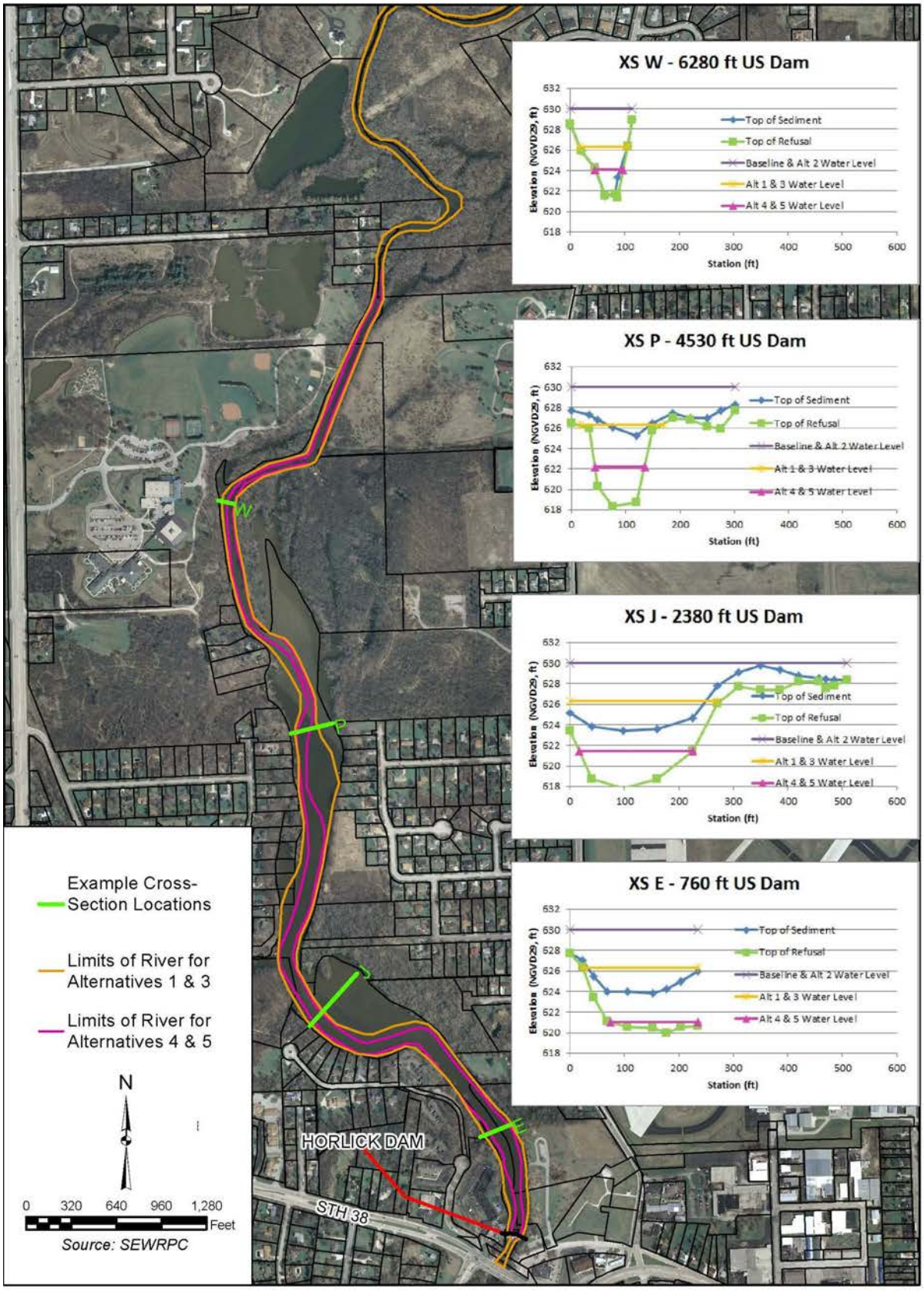
[e] *Not applicable.*

Source: SEWRPC.

Exhibit D

Map V-D

CONCEPTUAL ALTERNATIVES: APPROXIMATE EXTENT OF FLOODPLAIN DURING BASEFLOW (50% EXCEEDENCE, 56 CFS)



Alternative 2—Lengthen Current Dam Spillway and Raise Abutments for 500-Year Flood Capacity

Surface Water and Groundwater Quantity Considerations

This alternative modifies the dam to safely pass the 0.2-percent-annual-probability (500-year recurrence interval) flood by lengthening the spillway crest and raising the top of both abutments.[1] This alternative maintains the spillway crest at elevation 629.9 feet above NGVD 29 and lengthens the crest by approximately 20 feet, utilizing the old fishway area, to a total crest length of 140 feet. Both the left and right abutments would be rebuilt to a top elevation of 638.0 feet above NGVD 29. Also included in this alternative is raising Old Mill Drive to elevation 640.0 feet above NGVD 29 which is described later in this section. These changes would enable safe conveyance of the 0.2-percent-annual-probability flood within the dam spillway (Figure V-C). Modifications associated with Alternative 2 would minimally alter both the flood and normal flow profiles between the dam and STH 31 in comparison to the Baseline Condition. The 0.2- and one-percent-annual-probability (500-year and 100-year recurrence interval, respectively) flood stage elevations would be lowered approximately 0.7 foot at the dam crest relative to the corresponding flood elevations under the Baseline Condition. The one- and 0.2-percent-annual-probability flood profiles under Alternative 2 are essentially the same as under the Baseline Condition in the vicinity of STH 31. Dam tailwater elevations associated with this alternative would remain the same as under the Baseline Condition.

The hydraulic model water surface elevation just downstream of the dam is approximately at the top of the existing spillway crest (629.9 feet above NGVD 29) for the 0.2-percent-annual-probability flood. The 0.2-percent-annual-probability velocity at the dam spillway crest is approximately 12.4 feet per second (fps). The one-percent-annual-probability flood tailwater elevation is approximately three feet below the existing spillway crest, with a spillway crest velocity of approximately 9.9 fps. The two-percent-annual-probability (50-year recurrence interval) flood tailwater elevation is approximately four feet below the existing spillway crest, with a spillway crest velocity of approximately 9.3 fps.

With the same dam crest elevation as under the Baseline Condition, conditions under Alternative 2 during normal flow periods would be almost identical to those for the Baseline. The impoundment size and width would be the same, and the minimal depth over the spillway during normal flow times would still be an impediment to downstream fish passage.

With the impoundment area maintained during normal flow times, no change from the Baseline Condition would be expected for shallow groundwater levels or for the shallow wells depicted in Map V-A.

Water Quality

The modifications to the dam under Alternative 2 maintain the upstream impoundment, thus there should be no change in water quality as compared to the Baseline Condition. It is very likely that the accumulated sediment in the impoundment area would not be flushed downstream with this alternative, and that would be considered positive. The maintenance of the spillway crest at elevation 629.9 feet above NGVD 29 would still be a barrier to large woody debris passage downstream as it is under the Baseline Condition.

Natural Resources

The one-percent-annual-probability flood criterion established by the U.S. Army Corps of Engineers and adopted by WDNR for evaluating the likelihood of aquatic organism passage was discussed previously in the "Baseline Condition" subsection. The hydraulic modeling results indicate that the Alternative 2 tailwater elevation is

---

[1]*The possibility of maintaining the Horlick dam spillway crest at its current elevation and raising the dam structures on either side of the spillway was raised during the August 28, 2013, public meeting to review alternatives relative to the dam. In a September 3, 2013, electronic mail message to the SEWRPC staff, Julie Anderson, Racine County Public Works and Development Services Director, asked on behalf of County Executive James Ladwig that such an additional alternative be considered.*

approximately three feet below the spillway crest. Thus, based on the one-percent-probability flood criterion, the dam configuration under Alternative 2 represents a barrier to sea lamprey or round goby movement from downstream to upstream of the dam. The tailwater elevation is approximately at the top of the lengthened spillway crest (629.9 feet above NGVD 29) for the 0.2-percent-annual-probability flood, meaning that the dam would most likely no longer be a barrier for invasive aquatic species for this extreme flood.

Based on the fish burst speeds listed in Table V-B, northern pike and Chinook salmon could pass the lengthened Horlick dam spillway during the modeled 0.2-percent-annual-probability flood, while smallmouth bass most likely could not get past the dam spillway. Based on the leaping ability of Chinook salmon and the lengthened Horlick dam spillway configuration under Alternative 2, Chinook should also be able to jump the modified dam for the two-percent-annual-probability flood and any larger event. A summary of fish passage issues for the baseline and all alternatives is included in Table V-C.

Social

Under Alternative 2 the spillway crest would be lengthened and the crest shape would be maintained. Thus, the cascading nature of the flows is maintained as compared to the Baseline Condition, and the aesthetics are not changed appreciably at the dam. The upstream impoundment area will not change as described previously.

Boating and paddling safety issues are still a concern for this alternative as under the Baseline Condition. The original hydraulic height of the dam is maintained, so under Alternative 2 the dam would also have a hydraulic height of 12 feet, which is significant from a safety perspective.

Alternative 2 would maintain the Baseline Condition recreational opportunities at the dam and impoundment area. There would be no opportunity for new riparian trails and passive recreation as no lowering of the impoundment would occur. Under all but the most extreme floods, fish migration upstream would be continue to be stopped at the dam under the Alternative 2.

With the impoundment area maintained under Alternative 2, land ownership in this area would not be affected (Map V-B).

Cost

A systems planning-level cost estimate for Alternative 2 was completed in 2013 dollars. Construction cost information was obtained from R.S. Means Heavy Construction Cost Data.[2] Components included in the preliminary cost estimate for Alternative 2 include abutment concrete removal, concrete construction, and road raise and reconstruction. Base costs were increased by 35-percent to account for engineering, administration, and contingencies. Based on these assumptions, the systems-level present worth cost estimate, including capital cost and operation and maintenance is $978,000. While a significant effort has been made under this system plan to collect field data and to characterize the anticipated costs associated with this alternative, at the systems-planning level there are many uncertainties in estimating costs relative to alterations of existing dams. Those uncertainties are reduced and estimated costs are refined after an alternative is selected for implementation and preliminary engineering and final design are conducted; however, it should be noted that the WDNR has indicated, that even after the final design stage, the average dam reconstruction change order amount is 40 percent of the initial capital cost estimate, mainly due to unforeseen site conditions once construction begins.

Under Alternative 2, the dam structure is retained, thus, ongoing maintenance costs would also be incurred for this conceptual alternative. Maintenance costs assumed include debris passage, inspection every four years, the development of an emergency action plan, an operation and maintenance plan, and minor corridor maintenance. A summary of all Alternative 2 costs are included in Table V-D.

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[2] *R.S. Means Company, Inc.,* RSMeans Heavy Construction Cost Data, *23rd Annual Edition, 2009.*

The only vehicular access for 15 homes and three condominium buildings located west of the impoundment is along Old Mill Drive at STH 38. Based on the current Federal Emergency Management Agency Flood Insurance Study (FIS) for Racine County, the one- and 0.2-percent-annual-probability floods would be expected to overtop the Old Mill Drive under current (Baseline) conditions. It is expected that those two floods would also overtop Old Mill Road to maximum depths of 0.4 to 2.6 feet, respectively, under Alternative 2 conditions. Under the other conceptual alternatives evaluated for the Horlick dam under this plan, the one- and 0.2-percent-annual-probability floods profiles would be reduced sufficiently to avoid overtopping of Old Mill Drive. Thus, an ancillary benefit of implementing any of those alternatives would be improvement of access to the buildings along Old Mill Drive during large floods. To provide emergency service access to Old Mill Drive during large floods under either current conditions, or Alternative 2 conditions, consideration should be given to raising the grade of the Drive. The above preliminary cost estimate includes raising Old Mill Drive to 640.0 feet above NGVD 29 to eliminate roadway overtopping during the one- and 0.2-percent-annual-probability floods. The cost estimate assumes the road would require a maximum rise of 4 feet and the total length of road raise and new roadway pavement would be approximately 800 feet. A new longer culvert would also be required in this road section to serve a small tributary area to the immediate west of the Drive.

It should also be noted that the hotel immediately west of the dam embankment is in close proximity to the right dam abutment. If the modifications included in Alternative 2 are selected for further review, the ability to raise and modify the right abutment and not adversely affect the hotel would need to be evaluated in greater detail.

Table V-B

ADULT FISH SWIMMING SPEEDS AND LEAPING DATA FOR HORLICK DAM

Fish species	Prolonged Speed (fps)	Burst Speed (fps)	Maximum Leap Height/Distance (feet)
Northern Pike	- -	5.0-13.0[a]	- -
Chinook Salmon	3.4-10.8[b]	10.8-22.4[b]	7.0/5.0[b]
Smallmouth Bass	1.8-3.9[c]	3.6-7.8[c]	- -

[a]*Luther P. Aadland,* Reconnecting Rivers: Natural Channel Design in Dam Removals and Fish Passage, Minnesota Department of Natural Resources*, January 2010 and S.J. Peake,* Swimming Performance and Behaviour of Fish Species Endemic to Newfoundland and Labrador: A Literature Review*, Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2843, 2008.*

[b]*Gregory T. Ruggerone,* Evaluation of Salmon and Steelhead Migration Through the Upper Sultan River Canyon Prior to Dam Construction*, City of Everett, July 2006.*

[c]*Stephan Peake,* An Evaluation of the Use of Critical Swimming Speed for Determination of Culvert Water Velocity Criteria for Smallmouth Bass*, Transactions of the American Fisheries Society 133: 1472-1479, 2004 and Normandeau Associates, Inc.,* Claytor Hydroelectric Project Fish Entrainment and Impingement Assessment, *Appalachian Power Company, R-20979.001, January 2009.*

Source: SEWRPC.

Table V-C

HORLICK DAM ALTERNATIVE SUMMARY—FISH PASSAGE AND INVASIVE SPECIES

Alternative	Spillway Crest Elevation (feet above NGVD 29)	Tailwater Elevation Event at Crest (recurrence interval)	Chinook Passage Event (recurrence interval)	Invasive Species Passage Event (recurrence interval)	Barrier to Invasive Species
Baseline Condition.....	629.9	500-year	50-year	500-year	Yes
Alternative 1–Lower Crest for 500-Year Capacity	626.0	50-year	2-year	50-year	No
Alternative 1A–100-Year Capacity	627.9	Between 100 and 500-year	50-year	100-year	No
Alternative 2–Lengthen Spillway for 500-Year Capacity	629.9	500-year	50-year	500-year	Yes
Alternative 3[a]–Alt 1 with Fishway.....	626.0	50-year	2-year	50-year	No
Alternative 4–Full Notch of Dam for 500-Year Capacity	620.0	Between 1 and 2-year[b]	50 percent exceeds	10 percent exceeds	No
Alternative 5–Dam Removal.....	620.0	Between 1 and 2-year[b]	50 percent exceeds	10 percent exceeds	No

NOTE: Additions are highlighted.

[a]*Assumes fishway closed for larger flood events.*

[b]*This condition represents the March through June maximum mean daily flow of 1,000 cfs.*

Source: SEWRPC.

Table V-D

HORLICK DAM ALTERNATIVE SUMMARY—COSTS

Alternative	Capital Cost[a,b] (dollars)	Annual Operation and Maintenance (dollars)[c]	Total Present Worth Cost (dollars)
Alternative 1–Lower Crest for 500-Year Capacity	$390,000	$4,500	$461,000
Alternative 2–Lengthen Spillway for 500-Year Capacity	$910,000[d]	$4,300	$978,000
Alternative 3–Alt 1 with Fishway	$480,000	$4,700	$555,000
Alternative 4–Full Notch of Dam for 500-Year Capacity	$440,000	$2,100	$473,000
Alternative 5–Dam Removal	$540,000	$ 700	$551,000

NOTE: Additions are highlighted.

[a]*Capital costs based upon year 2013 conditions. Engineering News-Record Construction Cost Index: 12,208.*

[b]*These are systems-level planning costs and the WDNR has indicated that even after the final design stage, the average dam reconstruction change order amount is 40 percent of the initial capital cost estimate, mainly due to unforeseen site conditions once construction begins.*

[c]*Based on an interest rate of 6 percent and a project life of 50 years.*

[d]*Capital cost includes raising Old Mill Drive.*

Source: SEWRPC.

Table V-E

HORLICK DAM ALTERNATIVE SUMMARY—MAJOR ISSUES OF CONCERN

Alternative	Flooding Upstream of Dam	Water Quality	Fish Passage and Overall Fish Community Improvement	Safety	Recreation				Access to River by Riparian Land Owners[b]	Total Present Worth Costs (dollars)[c]
					Paddling	New Riparian Recreational Opportunities[a]	Fishing Upstream of Dam	Recreational Salmon Fishing Immediately Downstream of Dam		
Baseline Condition[d]	0	0	0	0	0	0	0	0	0	N/A[e]
Alternative 1—Lower Crest for 500-Year Capacity.....	+	+	+	+	–	+	+	0	–	$461,000
Alternative 2—Lengthen Spillway for 500-Year Capacity	0	0	0	0	0	0	0	0	0	$978,000
Alternative 3—Alt 1 with Fishway.....	+	+	++	+	–	+	++	–	–	$555,000
Alternative 4—Full Notch of Dam for 500-Year Capacity	++	++	++	++	– –	++	+++	– –	– –	$473,000
Alternative 5—Dam Removal	++	+++	+++	+++	– –	++	+++	– –	– –	$551,000
Basis for Evaluation.....	Reduction/ removal of structure will lower upstream flood elevations	Reduction in impounded water should improve water quality	Elimination of structure in River or addition of fishway improves passage	Reduction/ elimination of structure in River improves public safety	Loss of impoundment area reduces consistent paddling water levels	New options within dewatered impoundment area for trails and passive recreation	Improved fish passage will improve fishing upstream	With addition of fishway or removal of dam, fish would no longer congregate on downstream side of dam	Reduction in water level removes direct access to River	N/A

NOTE: Additions are highlighted.

[a] *The ability to realize enhanced recreational opportunities depends on ownership of lands exposed with a lower or eliminated impoundment.*

[b] *Based on property boundaries provided by Racine County.*

[c] *Based on an interest rate of 6 percent and a project life of 50 years.*

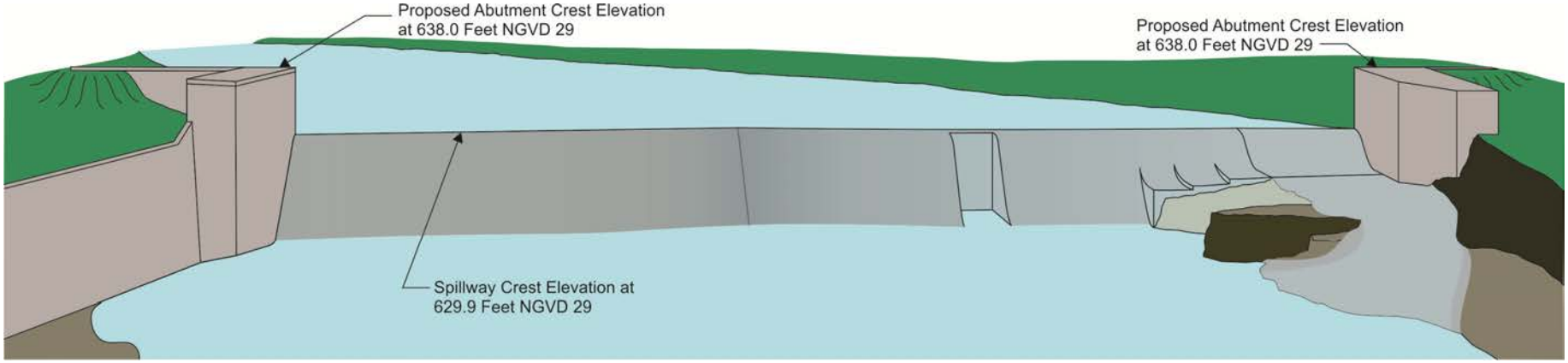
[d] *Alternatives are rated relative to the potential changes from the Baseline Condition which is designated neutrally as "0". Positive (+) or negative (–) signs indicate a more positive or negative effect on the issue of concern as compared to the Baseline Condition.*

[e] *Not applicable.*

Source: SEWRPC.

Figure V-C

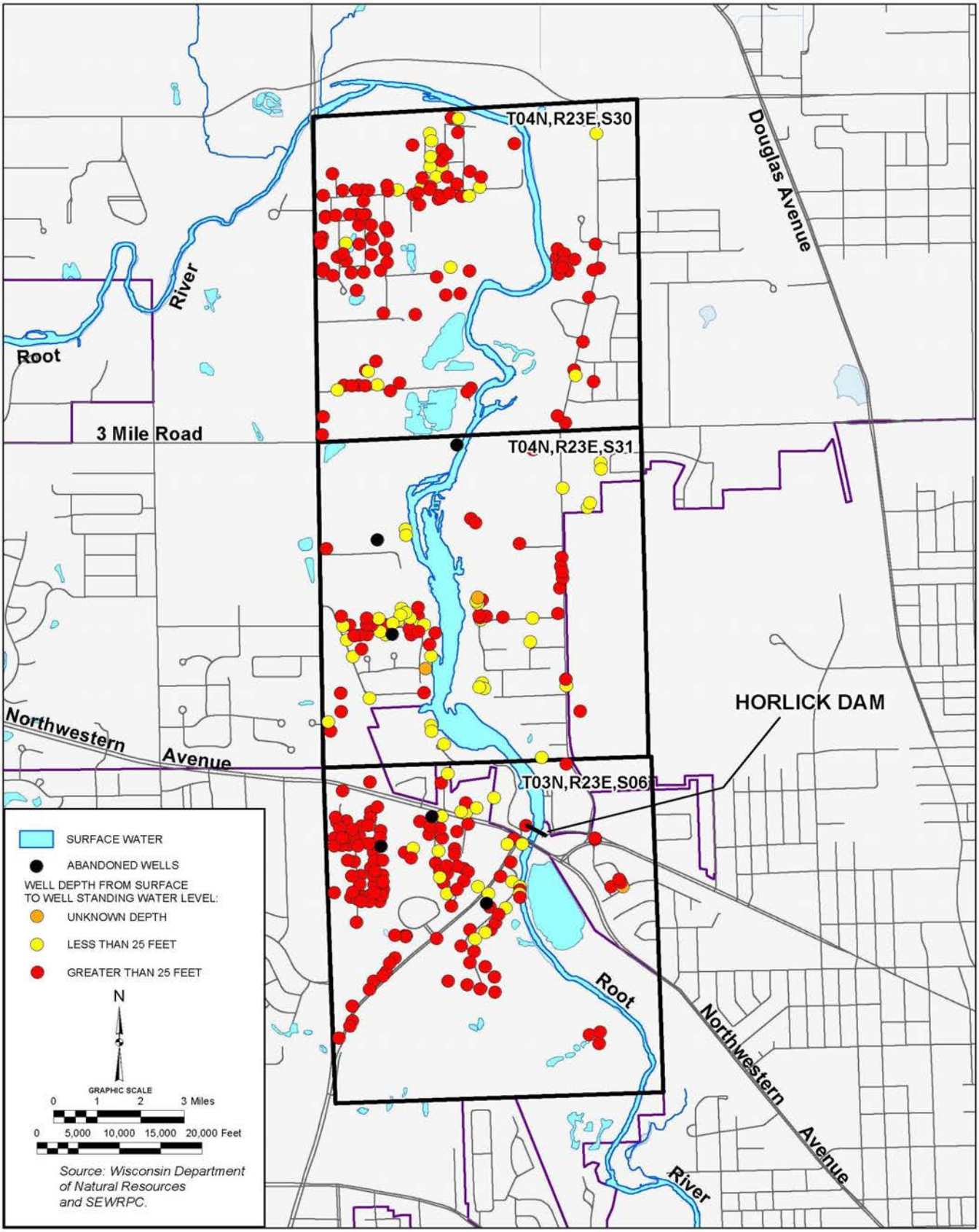
CONCEPTUAL ALTERNATIVE 2
LENGTHEN HORLICK DAM SPILLWAY AND RAISE ABUTMENTS FOR 500-YEAR FLOOD CAPACITY – LOOKING NORTH (UPSTREAM)



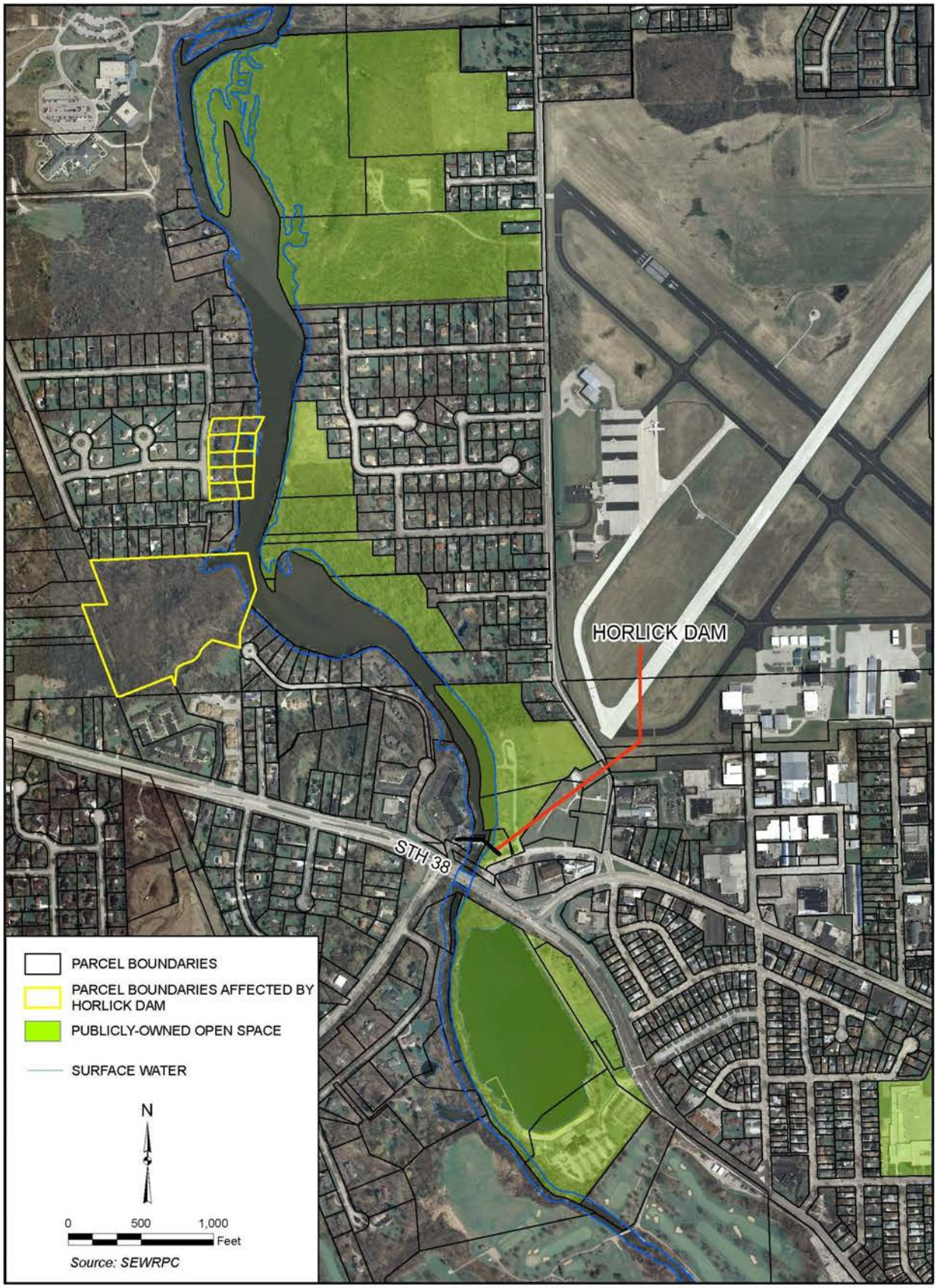
Source: SEWRPC.

Map V-A

PRIVATE WELLS NEAR THE HORLICK DAM IMPOUNDMENT CONSTRUCTED 1940-2010



Map V-B
LAND OWNERSHIP IN THE VICINITY OF
HORLICK DAM IMPOUNDMENT



Map V-B (Cont.)
LAND OWNERSHIP IN THE VICINITY OF
HORLICK DAM IMPOUNDMENT