Environmental Assessment for Fish Passage in
the Milwaukee River Watershed Project

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January 2010
# TABLE OF CONTENTS

**EXECUTIVE SUMMARY.................................................................................................................................**

**INTRODUCTION.........................................................................................................................................................**

1.1 **BACKGROUND.........................................................................................................................................................** 2

1.2 **NATIONAL ENVIRONMENTAL POLICY ACT........................................................................................................** 2

1.3 **PROPOSED ACTION......................................................................................................................................................** 4

1.4 **PURPOSE AND NEED FOR PROPOSED ACTION ......................................................................................................** 5

1.5 **APPLICABLE REGULATORY REQUIREMENTS AND COORDINATION...............................................................** 7

**IF THERE WERE POTENTIAL FOR SIGNIFICANT IMPACTS, THEN AN EIS WILL NEED TO BE PREPARED. IF THE IMPACTS OF AN ACTION WERE NOT EXPECTED TO BE SIGNIFICANT, A FONSI WILL BE PREPARED. A FONSI MUST BE SUPPORTED BY THE EA, AND MUST INCLUDE, SUMMARIZE, ATTACH, OR INCORPORATE BY REFERENCE THE EA (40 CFR 1508.13).**

1.5.1 **Permitting..................................................................................................................................................................** 7

1.6 **DOCUMENT ORGANIZATION......................................................................................................................................** 8

**2.0 DESCRIPTION OF PROPOSED ACTION AND NO ACTION ALTERNATIVE.................................................................................................................................** 1

2.1 **PROPOSED ACTION ALTERNATIVE..........................................................................................................................** 1

2.2 **NO ACTION ALTERNATIVE........................................................................................................................................** 8

**3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES.................................................................................................................................** 9

3.1 **MEQUON-THIENSVILLE DAM FISHWAY CONSTRUCTION...............................................................................................** 9

3.1.1 **Geology and Soils.......................................................................................................................................................**

3.1.1.1 **Affected Environment...............................................................................................................................** 9

3.1.1.2 **Environmental Consequences.....................................................................................................................** 12

3.1.1.2.1 **Proposed Action Alternative..................................................................................................................** 12

3.1.1.2.2 **No Action Alternative...........................................................................................................................** 12

3.1.2 **Land Use and Recreation........................................................................................................................................** 12

3.1.2.1 **Affected Environment....................................................................................................................................** 12

3.1.2.2 **Environmental Consequences.....................................................................................................................** 13

3.1.2.2.1 **Proposed Action Alternative..................................................................................................................** 13

3.1.2.2.2 **No Action Alternative...........................................................................................................................** 14

3.1.3 **Water Quality and Resources...............................................................................................................................** 15

3.1.3.1 **Affected Environment....................................................................................................................................** 15

3.1.3.2 **Environmental Consequences.....................................................................................................................** 17

3.1.3.2.1 **Proposed Action Alternative..................................................................................................................** 17

3.1.3.2.2 **No Action Alternative...........................................................................................................................** 21

3.1.4 **Wetlands and Floodplains........................................................................................................................................** 21

3.1.4.1 **Affected Environment....................................................................................................................................** 21

3.1.4.2 **Environmental Consequences.....................................................................................................................** 22

3.1.4.2.1 **Proposed Action Alternative..................................................................................................................** 22

3.1.4.2.2 **No Action Alternative...........................................................................................................................** 24

3.1.5 **Aquatic Biology.......................................................................................................................................................** 24

3.1.5.1 **Affected Environment....................................................................................................................................** 24

3.1.5.1.1 **Habitat...........................................................................................................................................................** 24

3.1.5.1.2 **Macroinvertebrates....................................................................................................................................** 25

3.1.5.1.3 **Aquatic Vegetation....................................................................................................................................** 27
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.5.1.4</td>
<td>Fisheries</td>
<td>28</td>
</tr>
<tr>
<td>3.1.5.1.5</td>
<td>Threatened and Endangered Species</td>
<td>29</td>
</tr>
<tr>
<td>3.1.5.2</td>
<td>Environmental Consequences</td>
<td>32</td>
</tr>
<tr>
<td>3.1.5.2.1</td>
<td>Proposed Action Alternative</td>
<td>32</td>
</tr>
<tr>
<td>3.1.5.2.2</td>
<td>No Action Alternative</td>
<td>34</td>
</tr>
<tr>
<td>3.1.6 Terrestrial Wildlife</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>3.1.6.1</td>
<td>Affected Environment</td>
<td>35</td>
</tr>
<tr>
<td>3.1.6.1.1</td>
<td>Wildlife Habitat</td>
<td>35</td>
</tr>
<tr>
<td>3.1.6.2</td>
<td>Environmental Consequences</td>
<td>35</td>
</tr>
<tr>
<td>3.1.6.2.1</td>
<td>Proposed Action Alternative</td>
<td>35</td>
</tr>
<tr>
<td>3.1.6.2.2</td>
<td>No Action Alternative</td>
<td>36</td>
</tr>
<tr>
<td>3.1.7 Vegetation</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>3.1.7.1</td>
<td>Affected Environment</td>
<td>36</td>
</tr>
<tr>
<td>3.1.7.2</td>
<td>Environmental Consequences</td>
<td>36</td>
</tr>
<tr>
<td>3.1.7.2.1</td>
<td>Proposed Action Alternative</td>
<td>36</td>
</tr>
<tr>
<td>3.1.7.2.2</td>
<td>No Action Alternative</td>
<td>37</td>
</tr>
<tr>
<td>3.1.8 Cultural and Historic Resources</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>3.1.8.1</td>
<td>Affected Environment</td>
<td>37</td>
</tr>
<tr>
<td>3.1.8.1.1</td>
<td>Archaeological and Historic Resources</td>
<td>37</td>
</tr>
<tr>
<td>3.1.8.2</td>
<td>Environmental Consequences</td>
<td>38</td>
</tr>
<tr>
<td>3.1.8.2.1</td>
<td>Proposed Action Alternative</td>
<td>38</td>
</tr>
<tr>
<td>3.1.8.2.2</td>
<td>No Action Alternative</td>
<td>39</td>
</tr>
<tr>
<td>3.1.9 Visual Quality and Aesthetics</td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>3.1.9.1</td>
<td>Affected Environment</td>
<td>39</td>
</tr>
<tr>
<td>3.1.9.2</td>
<td>Environmental Consequences</td>
<td>40</td>
</tr>
<tr>
<td>3.1.9.2.1</td>
<td>Proposed Action Alternative</td>
<td>40</td>
</tr>
<tr>
<td>3.1.9.2.2</td>
<td>No Action Alternative</td>
<td>40</td>
</tr>
<tr>
<td>3.1.10 Transportation</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>3.1.10.1</td>
<td>Affected Environment</td>
<td>40</td>
</tr>
<tr>
<td>3.1.10.1.1</td>
<td>Transportation Network</td>
<td>40</td>
</tr>
<tr>
<td>3.1.10.1.2</td>
<td>Transportation of Materials</td>
<td>42</td>
</tr>
<tr>
<td>3.1.10.2</td>
<td>Environmental Consequences</td>
<td>42</td>
</tr>
<tr>
<td>3.1.10.2.1</td>
<td>Proposed Action Alternative</td>
<td>42</td>
</tr>
<tr>
<td>3.1.10.2.2</td>
<td>No Action Alternative</td>
<td>43</td>
</tr>
<tr>
<td>3.1.11 Air Quality</td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>3.1.11.1</td>
<td>Affected Environment</td>
<td>43</td>
</tr>
<tr>
<td>3.1.11.2</td>
<td>Environmental Consequences</td>
<td>43</td>
</tr>
<tr>
<td>3.1.11.2.1</td>
<td>Proposed Action Alternative</td>
<td>43</td>
</tr>
<tr>
<td>3.1.11.2.2</td>
<td>No Action Alternative</td>
<td>44</td>
</tr>
<tr>
<td>3.1.12 Noise</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>3.1.12.1</td>
<td>Affected Environment</td>
<td>44</td>
</tr>
<tr>
<td>3.1.12.2</td>
<td>Environmental Consequences</td>
<td>45</td>
</tr>
<tr>
<td>3.1.12.2.1</td>
<td>Proposed Action Alternative</td>
<td>45</td>
</tr>
<tr>
<td>3.1.12.2.2</td>
<td>No Action Alternative</td>
<td>46</td>
</tr>
<tr>
<td>3.1.13 Human Health and Safety</td>
<td></td>
<td>46</td>
</tr>
<tr>
<td>3.1.13.1</td>
<td>Affected Environment</td>
<td>46</td>
</tr>
<tr>
<td>3.1.13.2</td>
<td>Environmental Consequences</td>
<td>46</td>
</tr>
<tr>
<td>3.1.13.2.1</td>
<td>Proposed Action Alternative</td>
<td>46</td>
</tr>
<tr>
<td>3.1.13.2.2</td>
<td>No Action Alternative</td>
<td>47</td>
</tr>
<tr>
<td>3.1.14 Socioeconomic and Environmental Justice</td>
<td></td>
<td>47</td>
</tr>
<tr>
<td>3.1.14.1</td>
<td>Affected Environment</td>
<td>47</td>
</tr>
<tr>
<td>3.1.14.2</td>
<td>Environmental Consequences</td>
<td>47</td>
</tr>
<tr>
<td>3.1.14.2.1</td>
<td>Proposed Action Alternative</td>
<td>47</td>
</tr>
<tr>
<td>3.1.14.2.2</td>
<td>No Action Alternative</td>
<td>48</td>
</tr>
<tr>
<td>3.1.15 Cumulative Impacts</td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>3.1.15.1</td>
<td>Proposed Action Alternative</td>
<td>49</td>
</tr>
<tr>
<td>3.1.15.2</td>
<td>No Action Alternative</td>
<td>49</td>
</tr>
</tbody>
</table>
3.3.1 Geology And Soils .......................................................................................................................... 95
  3.3.1.1 Affected Environment .................................................................................................................. 95
  3.3.1.2 Environmental Consequences ..................................................................................................... 96
  3.3.1.2.1 Proposed Action Alternative .................................................................................................... 96
  3.3.1.2.2 No Action Alternative ............................................................................................................... 97

3.3.2 Land Use and Recreation ............................................................................................................... 99
  3.3.2.1 Affected Environment .................................................................................................................. 99
  3.3.2.2 Environmental Consequences ..................................................................................................... 100
  3.3.2.2.1 Proposed Action Alternative .................................................................................................... 100
  3.3.2.2.2 No Action Alternative ............................................................................................................... 101

3.3.3 Water Quality and Resources ...................................................................................................... 102
  3.3.3.1 Affected Environment .................................................................................................................. 102
  3.3.3.2 Environmental Consequences ..................................................................................................... 102
  3.3.3.2.1 Proposed Action Alternative .................................................................................................... 102
  3.3.3.2.2 No Action Alternative ............................................................................................................... 103

3.3.4 Wetlands and Floodplains ............................................................................................................. 103
  3.3.4.1 Affected Environment .................................................................................................................. 103
  3.3.4.2 Environmental Consequences ..................................................................................................... 104
  3.3.4.2.1 Proposed Action Alternative .................................................................................................... 104
  3.3.4.2.2 No Action Alternative ............................................................................................................... 105

3.3.5 Aquatic Biology ............................................................................................................................. 105
  3.3.5.1 Affected Environment .................................................................................................................. 105
    3.3.5.1.1 Habitat .................................................................................................................................. 105
    3.3.5.1.2 Macroinvertebrates ................................................................................................................. 106
    3.3.5.1.3 Aquatic Vegetation .................................................................................................................. 107
    3.3.5.1.4 Fisheries ................................................................................................................................. 107
    3.3.5.1.5 Threatened and Endangered Species ......................................................................................... 109
  3.3.5.2 Environmental Consequences ..................................................................................................... 113
  3.3.5.2.1 Proposed Action Alternative .................................................................................................... 113

3.2.10 Transportation of Materials ........................................................................................................ 86
  3.2.10.1 Affected Environment .................................................................................................................. 86
  3.2.10.2 Environmental Consequences ..................................................................................................... 86
  3.2.10.2.1 Proposed Action Alternative .................................................................................................... 86
  3.2.10.2.2 No Action Alternative ............................................................................................................... 87

3.2.11 Air Quality ...................................................................................................................................... 87
  3.2.11.1 Affected Environment .................................................................................................................. 87
  3.2.11.2 Environmental Consequences ..................................................................................................... 87
  3.2.11.2.1 Proposed Action Alternative .................................................................................................... 87
  3.2.11.2.2 No Action Alternative ............................................................................................................... 88

3.2.12 Noise ............................................................................................................................................. 88
  3.2.12.1 Affected Environment .................................................................................................................. 88
  3.2.12.2 Environmental Consequences ..................................................................................................... 89
  3.2.12.2.1 Proposed Action Alternative .................................................................................................... 89
  3.2.12.2.2 No Action Alternative ............................................................................................................... 90

3.2.13 Social and Economic Justice ........................................................................................................ 90
  3.2.13.1 Affected Environment .................................................................................................................. 90
  3.2.13.2 Environmental Consequences ..................................................................................................... 90
  3.2.13.2.1 Proposed Action Alternative .................................................................................................... 90
  3.2.13.2.2 No Action Alternative ............................................................................................................... 91

3.2.14 Socioeconomic and Environmental Justice .................................................................................. 91
  3.2.14.1 Affected Environment .................................................................................................................. 91
  3.2.14.2 Environmental Consequences ..................................................................................................... 92
  3.2.14.2.1 Proposed Action Alternative .................................................................................................... 92
  3.2.14.2.2 No Action Alternative ............................................................................................................... 92

3.2.15 Cumulative Impacts ....................................................................................................................... 93
  3.2.15.1 Proposed Action Alternative ........................................................................................................ 93
  3.2.15.2 No Action Alternative .................................................................................................................. 93

3.3 BRIDGE STREET DAM FISHWAY CONSTRUCTION-ALTERNATIVE A .............................................. 95
3.3.5.2.2 No Action Alternative ................................................................. 114
3.3.6 Terrestrial Wildlife ....................................................................... 114
3.3.6.1 Affected Environment ................................................................. 114
3.3.6.1.1 Wildlife Habitat ...................................................................... 114
3.3.6.2 Environmental Consequences .................................................. 115
3.3.6.2.1 Proposed Action Alternative .................................................. 115
3.3.6.2.2 No Action Alternative .......................................................... 116
3.3.7 Vegetation ..................................................................................... 116
3.3.7.1 Affected Environment ................................................................. 116
3.3.7.2 Environmental Consequences .................................................. 116
3.3.7.2.1 Proposed Action Alternative .................................................. 116
3.3.7.2.2 No Action Alternative .......................................................... 116
3.3.8 Cultural and Historic Resources .................................................. 116
3.3.8.1 Affected Environment ................................................................. 116
3.3.8.1.1 Archaeological and Historic Resources ................................. 117
3.3.8.2 Environmental Consequences .................................................. 118
3.3.8.2.1 Proposed Action Alternative .................................................. 118
3.3.8.2.2 No Action Alternative .......................................................... 118
3.3.9 Visual Quality and Aesthetics ....................................................... 118
3.3.9.1 Affected Environment ................................................................. 118
3.3.9.2.1 Proposed Action Alternative .................................................. 119
3.3.9.2.2 No Action Alternative .......................................................... 120
3.3.10 Transportation ........................................................................ 120
3.3.10.1 Affected Environment ................................................................. 120
3.3.10.1.1 Transportation Network ....................................................... 120
3.3.10.1.2 Transportation of Materials ................................................. 121
3.3.10.2 Environmental Consequences ................................................ 121
3.3.10.2.1 Proposed Action Alternative ................................................ 121
3.3.10.2.2 No Action Alternative ........................................................ 122
3.3.11 Air Quality .............................................................................. 122
3.3.11.1 Affected Environment ................................................................. 122
3.3.11.2 Environmental Consequences ................................................ 123
3.3.11.2.1 Proposed Action Alternative ................................................ 123
3.3.11.2.2 No Action Alternative ........................................................ 123
3.3.12 Noise ...................................................................................... 123
3.3.12.1 Affected Environment ................................................................. 123
3.3.12.2 Environmental Consequences ................................................ 124
3.3.12.2.1 Proposed Action Alternative ................................................ 124
3.3.12.2.2 No Action Alternative ........................................................ 125
3.3.13 Human Health and Safety ...................................................... 125
3.3.13.1 Affected Environment ................................................................. 125
3.3.13.2 Environmental Consequences ................................................ 125
3.3.13.2.1 Proposed Action Alternative ................................................ 125
3.3.13.2.2 No Action Alternative ........................................................ 126
3.3.14 Socioeconomic and Environmental Justice ............................. 126
3.3.14.1 Affected Environment ................................................................. 126
3.3.14.2 Environmental Consequences ................................................ 127
3.3.14.2.1 Proposed Action Alternative ................................................ 127
3.3.14.2.2 No Action Alternative ........................................................ 127
3.3.15 Cumulative Impacts ............................................................... 127
3.3.15.1 Proposed Action Alternative .................................................. 127
3.3.15.2 No Action Alternative .......................................................... 128
3.4 BRIDGE STREET DAM RESTORE NATURAL CHANNEL/REMOVE DAM-ALTERNATIVE B .............. 129
3.4.1 Geology And Soils ...................................................................... 129
3.4.1.1 Affected Environment ................................................................. 129
3.4.11 Air Quality................................................................. 160
  3.4.11.1 Affected Environment............................................. 160
  3.4.11.2 Environmental Consequences................................. 161
  3.4.11.2.1 Proposed Action Alternative................................. 161
  3.4.11.2.2 No Action Alternative........................................... 161

3.4.12 Noise...................................................................... 161
  3.4.12.1 Affected Environment............................................. 161
  3.4.12.2 Environmental Consequences................................. 162
  3.4.12.2.1 Proposed Action Alternative................................. 162
  3.4.12.2.2 No Action Alternative........................................... 163

3.4.13 Human Health and Safety........................................ 163
  3.4.13.1 Affected Environment............................................. 163
  3.4.13.2 Environmental Consequences................................. 163
  3.4.13.2.1 Proposed Action Alternative................................. 163
  3.4.13.2.2 No Action Alternative........................................... 164

3.4.14 Socioeconomic and Environmental Justice.................. 164
  3.4.14.1 Affected Environment............................................. 164
  3.4.14.2 Environmental Consequences................................. 165
  3.4.14.2.1 Proposed Action Alternative................................. 165
  3.4.14.2.2 No Action Alternative........................................... 166

3.4.15 Cumulative Impacts.................................................. 166
  3.4.15.1 Proposed Action Alternative................................. 166
  3.4.15.2 No Action Alternative........................................... 167

3.5 OTHER BARRIERS - REMOVAL OR MODIFICATION............. 169

3.5.1 Geology and Soils...................................................... 171
  3.5.1.1 Affected Environment............................................. 171
  3.5.1.2 Environmental Consequences................................. 172
  3.5.1.2.1 Proposed Action Alternative................................. 172
  3.5.1.2.2 No Action Alternative........................................... 173

3.5.2 Land Use and Recreation............................................ 174
  3.5.2.1 Environmental Consequences................................. 174
  3.5.2.1.1 Proposed Action Alternative................................. 174
  3.5.2.1.2 No Action Alternative........................................... 175

3.5.3 Water Quality and Resources....................................... 175
  3.5.3.1 Affected Environment............................................. 175
  3.5.3.2 Environmental Consequences................................. 176
  3.5.3.2.1 Proposed Action Alternative................................. 176
  3.5.3.2.2 No Action Alternative........................................... 177

3.5.4 Wetlands and Floodplains............................................ 177
  3.5.4.1 Affected Environment............................................. 177
  3.5.4.2 Environmental Consequences................................. 182
  3.5.4.2.1 Proposed Action Alternative................................. 182
  3.5.4.2.2 No Action Alternative........................................... 184

3.5.5 Aquatic Biology........................................................ 184
  3.5.5.1 Affected Environment............................................. 184
  3.5.5.1.1 Habitat............................................................... 184
  3.5.5.1.3 Aquatic Vegetation................................................. 186
  3.5.5.1.4 Fisheries............................................................. 186
  3.5.5.1.5 Threatened and Endangered Species......................... 188

3.5.6 Terrestrial Wildlife..................................................... 194
  3.5.6.1 Affected Environment............................................. 194
  3.5.6.1.1 Wildlife Habitat..................................................... 194
Table E-1 Alternatives Analysis Summary

3.5.12 Socioeconomic and Environmental Justice
3.5.12.1 Affected Environment
3.5.12.2 Environmental Consequences
3.5.12.1.1 Proposed Action Alternative
3.5.12.1.2 No Action Alternative
3.5.12.2.1 Proposed Action Alternative
3.5.12.2.2 No Action Alternative

3.5.13 Human Health and Safety
3.5.13.1 Affected Environment
3.5.13.2 Environmental Consequences
3.5.13.1.1 Proposed Action Alternative
3.5.13.1.2 No Action Alternative
3.5.13.2.1 Proposed Action Alternative
3.5.13.2.2 No Action Alternative

3.5.14 Socioeconomic and Environmental Justice
3.5.14.1 Affected Environment
3.5.14.2 Environmental Consequences
3.5.14.1.1 Proposed Action Alternative
3.5.14.1.2 No Action Alternative
3.5.14.2.1 Proposed Action Alternative
3.5.14.2.2 No Action Alternative

3.5.15 Cumulative Impacts
3.5.15.1 Proposed Action Alternative
3.5.15.2 No Action Alternative

4.0 LIST OF PREPARERS AND AGENCIES CONSULTED
5.0 ABBREVIATIONS AND ACRONYMS
6.0 SCIENTIFIC NAMES
7.0 REFERENCES
Table 1.5-1 Total Permit Matrix
Table 1.5-2 Permit Consultations for the Project
Table 3.1-1 Typical Noise from Construction Equipment (dBA)
Table 3.2-1 Sediment Quality Characteristics for the LK Dam Impoundment, Milwaukee River.

LIST OF IN-TEXT FIGURES
Figure 1 – NEPA Compliance Process
Figure 2 – Contour map showing MT Dam Fishway sediment depth
Figure 3 – Number of Native Fish Species Collected from Milwaukee River at Grafton Free-Flowing versus Impounded River Reaches
Figure 4 – Fish Community Relative Abundance for Native and Exotic Species for the Milwaukee River in Grafton – Free Flowing versus Impounded River Reaches
Figure 5 – Fish Community Structure for the Milwaukee River at Grafton Free-Flowing versus Impounded River Reaches

LIST OF APPENDICES
APPENDIX A: TABLES
Table 1 – Culvert Sites EA Spreadsheet
Table 2 – Conservation Corps Sites EA Spreadsheet
Table 3 – Stream Impediment: Wetland and Flood Plain Classifications
Table 4 – WDNR Sampling in the Milwaukee River Basin

APPENDIX B: FIGURES
Figure 1 – Mequon-Thiensville Dam Wetlands and Floodplains Exhibit
Figure 2 – Lime Kiln Dam Wetlands and Floodplains Exhibit
Figure 3 – Bridge Street Dam Wetlands and Floodplains Exhibit
Figure 4 – Fredonia Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 5 – Hawthorne Drive Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 6 – Lac du Cours Outlet Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 7 – Mole Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 8 – River Edge Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 9 – Trinity Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 10 – Ulao Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 11 – Riverside Drive Creek Wetlands, Floodplains and Fish Barriers Exhibit
Figure 12 – Pigeon Creek Wetlands, Floodplains and Fish Barriers Exhibit

APPENDIX C: OTHER SUPPORTING DOCUMENTS
Document 1 – Aquatic Invasive Species Explanation Document
Document 2 – Summary of the Village of Grafton’s Reconsideration of Bridge Street Dam Fish Passage Alternatives
Document 3 – Bridge Street Dam Removal Alternative Public Concerns
Document 4 – WDNR Natural Heritage Inventory List Review for Ozaukee County’s NOAA Fish Passage Project
Document 5 – GLARC Report
EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA) Fisheries Community Restoration Program (CRP) proposes to release funding to Ozaukee County, Wisconsin under the American Recovery and Reinvestment Act of 2009 (ARRA) to conduct construction, restoration and enhancement activities intended to provide fish passage between the Milwaukee River and its tributaries and the Milwaukee Estuary - Area of Concern (AOC), Lake Michigan. The project has commonly been referred to as the Milwaukee River Fish Passage Restoration Project.

The project addresses restoration targets for several beneficial use impairments (BUIs) associated with the Milwaukee Estuary and Lake Michigan, including degraded fish and wildlife populations, degradation of aesthetics, degradation of benthos, and loss of fish and wildlife habitat. The primary goal of this project is to remove barriers to weak-swimming, native, potamodromous fish passage, thereby reconnecting fragmented aquatic habitat. This, in turn, helps assure that life-cycle-critical habitat is available to these fish, helping to restore and enhance sustainability of native fish and aquatic organisms in the AOC, portions of the river upstream of the AOC, and near-shore waters of Lake Michigan.

In addition to improving existing ecological resources, the project will enhance social and economic benefits for Ozaukee County communities. Specifically, the project is intended to support or create a significant number of American jobs during its design and construction phase, provide meaningful employment and training to disadvantaged urban youth, improve public access to prized game species and water-based recreational opportunities; create and retain jobs by promoting tourism and recreation; increase property values; and achieve long-term socioeconomic benefits.

The project consists of four main focus areas, which result in five different Proposed Actions (because there are two different Proposed Action alternatives for Bridge Street Dam). These focus areas include the following:

a. Mequon-Thiensville Dam (MT Dam)/Mequon-Thiensville Dam Fishway (MT FW): Proposed Action is to make modifications to the dam and fishway for aquatic invasive species (AIS) control, aesthetics and to improve site access for viewing the MT FW.

   The project will provide fish passage through inlet/outlet grading, AIS controls for the fishway and dam, a pedestrian bridge and fencing between public and private property.

b. Lime Kiln Dam (LK Dam): Proposed Action is to remove the LK Dam on the Milwaukee River in the Village of Grafton

c. Bridge Street Dam (BS Dam): Proposed Actions are to either construct a fishway (BS FW) at the BS Dam on the Milwaukee River in the Village of
Grafton or to remove the dam and restore the natural river channel at this location (BS R)

d. Other Barriers: Proposed Action is to remove or modify approximately 100 Other Barriers at stream crossings in tributaries to the Milwaukee River in Ozaukee County. This Proposed Action includes a Public Works component for the removal or modification of hydraulic structures (OB PW). A second component includes removal of Other Barriers to fish passage by Conservation Corps (OB CC) personnel. The Conservation Corps projects will include removal of barriers to fish passage with hand labor and small equipment (railroad ballast in the stream bed, fallen logs, etc.)

The project directly contributes to the stated long-term goals of Ozaukee County and its communities – specifically, to restore viability to the natural fishery of the Milwaukee River and its tributaries.

The alternative to the Proposed Actions is no action. Under the No Action Alternative, the project will not remove barriers to fish passage, and high-quality habitat will remain isolated and unable to reach its full ecological potential. As a result, aquatic habitat will remain fragmented, decreasing the health and abundance of a host of desirable fish species, including several that are specifically targeting for protection or restoration (e.g., lake sturgeon, striped shiner, the threatened greater redhorse and long ear sunfish). Of the two alternatives analyzed, the Proposed Action best meets the purpose and need for action.

As part of this analysis, the environmental impacts of each alternative were addressed. The following table provides a summary of these impacts for both alternatives:
Conclusions

The significance of the Proposed Action is analyzed based on the NAO 216-6 criteria and Council on Environmental Quality’s (CEQ’s) context and intensity criteria. The Proposed Action is not reasonably expected to cause significant adverse impact to the Milwaukee River and its tributaries in Ozaukee County, WI, the Milwaukee Estuary and Lake Michigan aquatic habitat with regard to the various resource areas evaluated as part of this assessment.

The Proposed Action is expected to contribute to the delisting of BUIs associated with the Milwaukee Estuary AOC and contributes to the protection and restoration of several threatened and endangered species, and species of special concern. The primary goal of the project is to allow the full ecological potential of existing natural habitat to be realized, thereby helping restore and to protect fisheries and wildlife habitat over 158 stream miles and 119,000 acres of watershed in southeastern Wisconsin.

As shown by the information and analysis presented in the Environmental Assessment, the project will further the goals of the local community, the Lake Michigan Lakewide Management Plan (LaMP), and others. The ecological and societal benefits of the project far outweigh the negative facets. All known beneficial and adverse impacts of the Proposed Action have been addressed to reach the conclusion of no significant impacts. Therefore, an environmental impact statement (EIS) for this action does not need to be prepared.
FINDING OF NO SIGNIFICANT IMPACT FOR THE FISH PASSAGE FOR THE MILWAUKEE RIVER WATERSHED PROJECT

In compliance with the National Environmental Policy Act (NEPA), a Finding of No Significant Impact (FONSI) has been prepared for the Fish Passage for the Milwaukee River Watershed Project (project). The NOAA’s Proposed Action is funding of the Project (NOAA Award # NOAA-NMFS-HCPO-2009-2001709) in the amount of $4,710,500.

The project consists of four main focus areas, which result in five different Proposed Actions (because there are two different Proposed Action alternatives for Bridge Street Dam). These focus areas include the following:

a) Mequon-Thiensville Dam (MT Dam)/Mequon-Thiensville Dam Fishway (MT FW): Proposed Action is to make modifications to the dam and fishway for aquatic invasive species (AIS) control, aesthetics and to improve site access for viewing the MT FW.

b) The project will contribute to the fish passage through inlet/outlet grading, AIS controls for the fishway and dam, a pedestrian bridge and fencing between public and private property.

c) Lime Kiln Dam (LK Dam): Proposed Action is to remove the LK Dam on the Milwaukee River in the Village of Grafton.

d) Bridge Street Dam (BS Dam): Proposed Actions are to either construct a fishway (BS FW) at the BS Dam on the Milwaukee River in the Village of Grafton or to remove the dam and restore the natural river channel at this location (BS R).

e) Other Barriers: Proposed Action is to remove or modify approximately 100 Other Barriers at stream crossings in tributaries to the Milwaukee River in Ozaukee County. This Proposed Action includes a Public Works component for the removal or modification of hydraulic structures (OB PW). A second component includes removal of Other Barriers to fish passage by Conservation Corps (OB CC) personnel. The Conservation Corps projects will include removal of barriers to fish passage with hand labor and small equipment (railroad ballast in the stream bed, fallen logs, etc.).

The project responds specifically to long term goals of Ozaukee County and its communities to restore viability of the natural fishery of the Milwaukee River and its tributaries.

1) Can the Proposed Action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?

The Proposed Action is not reasonably expected to cause substantial damage to Milwaukee River Estuary or Lake Michigan habitat or coastal habitat in the area. There is no essential fish habitat present within the project area, as defined under the Magnuson-Stevens Act. The Proposed Action reconnects biologically isolated wetland and aquatic habitats to the Milwaukee Estuary AOC, nearshore waters of Lake Michigan, and the individually isolated stretches of the Milwaukee River watershed upstream of the AOC. These actions improve and support the
health, diversity, and numbers of a large number of desirable aquatic species, including endangered and threatened species and species of special concern. As part of the Project, the habitat will be returned to a more natural state through removal of fish passage barriers.

2) Can the Proposed Action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

The Proposed Action benefits biodiversity and ecosystem function in an 119,000-acre area and in 158 stream miles. The project will restore two overlooked functions of river systems – movement of aquatic organisms and sediment. Fish passage barrier removal and site restoration activities, such as bioengineering, placing clean topsoil, removing invasive plants, and seeding with native plant mixes, will restore wetland quantity and quality, improve wetland and riverine functions, and restore channel natural morphology/sediment transport dynamics. The 1999 Milwaukee River Estuary AOC Remedial Action Plan listed 11 Beneficial Use Indicators (BUI’s) as impaired. The Proposed Action will move 4 BUI’s (Loss of Fish and Wildlife Habitat, Loss of Fish and Wildlife Populations, Degradation of Benthos and Degradation of Aesthetics) toward delisting goals. Functional improvements will include reconnection of currently fragmented natural aquatic habitat, thereby improving fish and wildlife habitat. Restored habitat will promote native plant growth and support greater diversity and abundance of plants, while the abundance of invasive plants will be reduced. Improvements to floral communities will bolster local aesthetics and could provide project examples/case studies for project to address the AOC’s degraded aesthetics BUI. The more favorable habitat is expected to support greater diversity of fish, waterfowl, migrant birds, and small mammals. Improvements to the degraded fish and wildlife populations of the AOC are also anticipated, as they will have greater access to quality habitat in the watershed. This will contribute to other efforts to delist this BUI.

Native fish species present in program streams, the Milwaukee River and the AOC will benefit from improved access to and abundance of life-cycle-dependent habitat (e.g., spawning, development, refuge and feeding). Reconnecting formerly isolated areas will also increase the genetic diversity of aquatic species already found in project streams. Increased survival of young of the year and larval fish and greater abundance of year classes could be observed for all native fish species, resulting in more even fish community population dynamics. In addition, beneficial effects on benthic species are expected. The potential exists for some negative fishery-related effects as well. Improvements for fish passage also enhance movement opportunities for AIS (e.g. sea lamprey). However, this must be tempered by the fact that no sea lamprey have been found in the Milwaukee River during the 50-year monitoring period. This includes 20 years after removal of the North Avenue Dam in Milwaukee, during which two streams that may provide suitable sea lamprey habitat have been accessible to Lake Michigan. Additionally, mitigation measures are directly incorporated into the plan to minimize the potential for AIS to spread.

3) Can the Proposed Action reasonably be expected to have a substantial adverse impact on public health or safety?

The Proposed Action will have no significant adverse effect on public health or safety. Public health and safety benefits are expected with the anticipated improvements in the quality and viability of the natural fishery and removal of safety-navigation concerns related to Milwaukee
River dams in the Village of Grafton. Redesigning and replacing deficient stream crossings will decrease the incidence of flooding of these structures. Removing dams will eliminate the potential for these structures to fail exacerbating downstream flooding.

The Proposed Action will have no significant adverse effect on air quality. During restoration activities, the Proposed Action will generate vehicle air emissions, fugitive dust, and possibly other air pollutants. However, air impacts will be minor, relatively localized, and temporary in nature. Implementing the Proposed Action will include measures to control potential human health hazards that could result from direct contact with theoretically contaminated material, inhalation of impacted particulates/dust, and spreading of contaminated material during construction. Personal protective equipment for construction and project labor is required.

4) Can the Proposed Action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?

The Proposed Action will benefit aquatic and terrestrial wildlife and vegetation. There are no federally listed species in the project area, but there are several that are state listed. Specifically, the project would benefit lake sturgeon (a species of special concern), the endangered ellipse mussel and striped shiner, and the threatened greater redhorse and long ear sunfish. Habitat improvements will likely benefit any species present in the Milwaukee River watershed, from the program area downstream to the AOC, and can encourage habitat use. Removal of fish passage barriers will provide improved access to wildlife habitat and will create corridors that allow for greater movement of native terrestrial and aquatic species present between formerly fragmented habitat thus benefiting the species. Local fish species will benefit from improved access to spawning and feeding habitats, resulting in increased survivorship and greater abundance and better population dynamics.

Short-term adverse effects of the project on aquatic habitat can occur as a result of localized disturbance during barrier removal. Restoration activities will disturb the existing sediments and aquatic plants and may negatively affect water quality through increased turbidity and re-suspension of potentially contaminated sediments. However, these impacts will be minor and temporary in nature, and phased construction, turbidity curtains and other construction site best management practices will be used at the Sites to contain disturbed sediments to the immediate project areas. Temporary disturbances to wildlife will occur from the construction activities, including increased noise levels and increased human presence in the project area. However, affected wildlife and organisms will likely habituate to the temporary conditions or will limit their use of the habitat while restoration activities are ongoing, utilizing other available habitats in the area. Restoration activities will cause temporary negative effects to the local vegetation. Limiting the extent, promptly seeding, and storing equipment and materials on previously disturbed areas after soil disturbing activities are completed will minimize the effects.

For more information on AIS as it relates to this project, see Document 1 in Appendix C.

5) Are significant social or economic impacts interrelated with natural or physical environmental effects?
The Proposed Action will benefit the socioeconomics of the communities in the project area. Specifically, the project is intended to support or create a significant number of American jobs during its design and construction phase, provide meaningful employment and training to disadvantaged urban youth, improve public access to prized game species and water-based recreational opportunities; create and retain jobs by promoting tourism and recreation; increase property values; and achieve long-term socioeconomic benefits. Improvements in the natural conditions and fishery of the Milwaukee River, the Milwaukee Estuary AOC and Lake Michigan will promote local tourism, providing for enhanced recreational, business and employment opportunities. Increase in recreational users will benefit local businesses and will have a positive effect in indirect job creation and new business opportunities. In addition, restoration activities will create a more desirable, natural shoreline that will add direct value to the local shoreline properties. The project will have no disproportionate adverse environmental or human health effects on the different socioeconomic classes residing in the Ozaukee and Milwaukee County region; in fact, the project is intended to benefit various socioeconomic classes through job creation and training opportunities ranging from professional services and project design work to manual labor. The project is likely to benefit subsistence fishing.

6) Are the effects on the quality of the human environment likely to be highly controversial?

The effects on the quality of the human environment are not highly controversial despite some controversy surrounding the ultimate means to remove the barrier to fish passage at the Bridge Street Dam (BS Dam) in the Village of Grafton, Wisconsin. The project proposes to construct a fishway at the BS Dam. There is no controversy to the fishway alternative. However, the Village of Grafton recently initiated consideration for action to restore the natural river channel at this location and remove the BS Dam. Channel restoration and dam removal meet the goals of the overall project and the goals for re-establishing fish passage at the BS Dam location. The viability of this alternative will likely be determined from the results of a pending referendum process, thereby settling the controversy. For more information, see the Summary of the Village of Grafton’s Reconsideration of Bridge Street Dam Fish Passage Alternatives (Document 2 in Appendix C) and the Bridge Street Dam Removal Alternative Public Concerns (Document 3 in Appendix C).

Controversy also exists on the AIS control function of the BS Dam. Various public officials have widely varying opinions regarding the utility of the BS Dam for blocking upstream migration of sea lamprey. Controversy also exists regarding if sea lamprey will actually use the Milwaukee River should large amounts of habitat become accessible. In any case, monitoring and control actions are proposed at the downstream MT Dam. Moreover, activities are currently being explored to create a purpose-built barrier that will provide a reliable year over year impediment to sea lamprey migration.

Restoration activities will affect the human environment through temporarily increased noise levels and visual impacts from the presence and movement of construction personnel and construction equipment, and from stockpiling of excavated materials. These impacts will last only for the duration of project construction activities. The elevated noise levels would be from earth-moving machinery such as excavators and haul trucks. Typical noise from construction equipment will range from 70 to 95 decibels (dBA). No significant controversy over noise generation is expected.
Removal of fish passage barriers on tributaries to the Milwaukee River will include some work on private property. Controversy over access to these sites will be reduced through ongoing communications and agreements between Ozaukee County and the private land owners.

7) Can the Proposed Action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, essential fish habitat, or ecologically critical areas?

The Proposed Action will have no significant adverse effect to unique areas, historic or cultural resources. Access to portions of park lands at the MT Dam and LK Dam sites will temporarily be interrupted during construction and site restoration. Safety improvements (dam removal) and embankment removal at the LK Dam site will improve aesthetics and access to the Milwaukee River at this location.

The Proposed Action will have no significant adverse effect on geology in the project area. The sediment transport function of the rivers and creeks of the project area will be restored, eliminating undesirable accretions of excessive volumes of fine sediments in slack water areas, and fine particle starvation and associated scouring of downstream areas. Unique and picturesque bedrock channel and bank features that are now buried and/or inundated will be re-exposed. Care will need to be taken to avoid soil compaction and erosion as part of construction work associated with this project.

Essentially no impact to prime farmlands or wild and scenic rivers is expected.

Natural groundwater flow and surface water/groundwater interactions have been disrupted by the creation of reservoirs above dam sites. Removing these reservoirs will restore natural hydrology to areas near the dam or perched culvert sites.

There is no designated essential fish habitat within the project’s area of affect.

As part of the permitting process, Construction Site Erosion Control Plans will be implemented to prevent off-site soil erosion and sedimentation of surface water. Project plans include protective measures such as sediment curtains, erosion control blankets, wattles, turf reinforcement and erosion mat, and vegetative seeding and plantings. Permits acquired from the United States Army Corps of Engineers (USACE) and Wisconsin Department of Natural Resources (WDNR) will also contain protective conditions.

8) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

The Proposed Action does not include highly uncertain risks or effects on the human environment or unique or unknown risks. Restoration activities will be performed using conventional, proven methods and techniques and be implemented through established federal and state standards, laws and administrative rules. The project is expected to result only in temporary, minor, and predictable impacts such as increased traffic, increased noise levels, dust generation, and alterations in visual landscape.
Exposure or release of sediment has not been identified as an area of concern. Sediment quality in the LK and BS Dam reservoirs is not expected to pose unique, uncertain or unknown risks to human health or the environment. Sediment management practices will be employed in project designs to limit incidental release.

9) Is the Proposed Action related to other actions with individually insignificant, but cumulatively significant impacts?

The Proposed Action is related to the overall effort to restore and remove barriers to fish passage that will reconnect fragmented natural aquatic habitat. As such, there is a cumulative benefit to the natural viability of fish and other aquatic organisms including potamodromous fish that seek to move to and from Lake Michigan, the Milwaukee Estuary, the Milwaukee River and its tributaries.

Due to the project’s potential to increase movement of AIS, that may also take advantage of the proposed reconnection of aquatic habitat (e.g. sea lamprey), mitigation measures are employed in project designs to provide control mechanisms aimed at preventing exploitation by such species.

The Proposed Action contributes positively to the delisting of Beneficial Use Impairments in Milwaukee Estuary AOC. It contributes to the cumulative effects of:

2. Combined Sewer Outlet Overflow Abatement in the Lower Milwaukee River and Estuary, Milwaukee Metropolitan Sewerage District, Approximately $2.5 Billion
4. Lincoln Creek Flood Abatement Project (Elements included storage, concrete channel removal and stream naturalization, wetland creation, removal of 3 fish barriers) Approximately $100 Million
5. Pigeon Creek Seminary Dam Removal, 2008 ($80,000) One of Twelve Dams Removed From The Milwaukee River Basin Since 1987 total estimated cost $600,000
6. Trinity Creek Wetland Habitat, 2002. (Elements included 4 ac of northern pike spawning habitat, 10 ac of wetland creation, 25 ac upland wetland restoration, 27 ac of wetland preservation/enhancement, 30 ac/ft of storage, prairie restoration and recreation amenities including trails. The Ozaukee Co/NOAA fish passage project includes replacement of the culvert fish passage barrier on Trinity Cr. located between Milwaukee and facility described previously.
7. Milwaukee River Watershed and Lake Michigan Lake Sturgeon Restoration, 2003 to present, Riveredge Nature Center and WDNR
9. Thiensville Dam Fishway Phase I, 2009, City of Mequon, Village of Thiensville, WDNR, WI Coastal Management, Directly Related To the Proposed Action
10. Menomonee River Flood Control Projects, MMSD Ongoing, Approximately $100 Million
11. Ozaukee County Buffer Initiative, Non-Point Pollution Control
12. Cedar Creek Superfund Site, PCBs, Mercury Marine and US EPA
13. Ulao Creek Partnership, 2008, Ulao Creek Log Jam Removal Project
14. Mole Creek Coldwater Restoration, Ongoing, Monitoring and Restoration Easement Garnering
15. Ozaukee County Non-Point Pollution Controls
   a. Conservation Reserve Program
   b. Conservation Reserve Enhancement Program
   c. Wetland Reserve Program
16. Menomonee Valley Brownfields Project, Menomonee Valley Partners, WNDR Remediation and Redevelopment Program
17. Kinnickinnic River Sediment Remediation, $20 Million

The above summary of cumulative projects affecting the Milwaukee Estuary Area of Concern was provided by the WDNR and the City of Mequon.

The Proposed Action is not related to other actions that would result in cumulatively significant adverse impacts.

10) Is the Proposed Action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

The Proposed Action is not likely to have adverse effects on districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places nor is it expected to cause loss or destruction of significant scientific, cultural, or historical resources. More information on this issue is available in the Great Lakes Archaeological Research Center’s (GLARC’s) report entitled Archaeological Investigations for the Milwaukee River Watershed Fish Passage Project, Ozaukee County, Wisconsin. See the GLARC report, Document 5 in Appendix C, for more information.

The project will require ground disturbing activities that will have minor temporary impacts to the local transportation system during construction and may potentially impact cultural resources that have not yet been identified. There is potential to locate new archaeological or historic resources as a result. In the event that any archaeological sites, human remains, funerary items, or associated artifacts are discovered during restoration and removal of fill, activities will cease immediately and the State Historic Preservation Office will be contacted. If necessary, interested federally recognized Tribes will be notified. Additional measures may be needed if unanticipated archeological resources are located within the other project sites.

11) Can the Proposed Action reasonably be expected to result in the introduction or spread of a non-indigenous species?

The Proposed Action is not expected to result in introduction or spread of non-native species. However, AIS such as sea lamprey may take advantage of the aquatic habitat reconnection, but measures to prevent invasive species from exploiting this new habitat are included in the project designs.
Barrier removal and fish passage restoration activities at some of the sites are directly targeted at removal of non-native species and re-vegetation with native plants. Adverse effects will be minimized through limiting the extent of disturbed areas, including prompt seeding and storing of equipment and materials on disturbed areas, as practicable, to further prevent spread of non-native plants.

12) Is the Proposed Action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

The Proposed Action is not expected to establish a precedent for future actions or represent a decision in principle about a future consideration. Fish passage barrier removal and site restoration activities performed as part of this Proposed Action follow well established guidelines and draw from past removals and restoration activities.

The Proposed Action will have significant beneficial effects on land use in the project area. The project will not interfere with any proposed development in the county, as future land use categorization will not be affected. On the contrary, the Proposed Action will assist in federal, state and local goals for habitat and fishery restoration and is consistent with current plans for improvements in the Milwaukee River watershed.

13) Can the Proposed Action reasonably be expected to threaten a violation of federal, state, or local law or requirements imposed for the protection of the environment?

The Proposed Action is not expected to threaten a violation of federal, state, or local laws or requirements imposed for the protection of the environment. Compliance with permit requirements (e.g., Clean Water Act Section 404) is underway and described in Section 1 of this EA. The Proposed Action will result in improved environmental protection of the Milwaukee River, its tributaries, the Milwaukee Estuary and Lake Michigan.

14) Can the Proposed Action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

The Proposed Action is not expected to result in cumulative adverse effects on the species found within the project area. It is expected that cumulative effects from the restoration activities will be beneficial. These benefits will occur within the program area as well as more distant areas, such as the Milwaukee Estuary AOC. Cumulative benefits from this project will likely help the delisting of all four BUIs. Due to the project’s potential to increase movement of AIS, that may also take advantage of the proposed reconnection of aquatic habitat (e.g. sea lamprey), mitigation measures are employed in project designs to provide control mechanisms aimed at preventing exploitation by such species.
INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) proposes to release funding to Ozaukee County, Wisconsin under the American Recovery and Reinvestment Act of 2009 (ARRA) to conduct construction, restoration and enhancement activities intended to provide fish passage between the Milwaukee River and its tributaries and the Milwaukee Estuary - Area of Concern (AOC), and Lake Michigan. The project has commonly been referred to as the Milwaukee River Fish Passage Restoration Project.

The project addresses restoration targets for several beneficial use impairments (BUIs) associated with the Milwaukee Estuary and Lake Michigan, including degraded fish and wildlife populations, degradation of aesthetics, degradation of benthos, and loss of fish and wildlife habitat. The primary goal of this project is to remove barriers to fish passage, restore and protect fisheries and wildlife habitat through the re-connection of fragmented aquatic habitat.

In addition to improving existing ecological resources, the proposed project will enhance social and economic benefits for Ozaukee County communities. As part of its overall goals, the project is intended to help improve public access; create and retain jobs through promoting tourism and recreation; increase property values; and achieve long-term socioeconomic benefits related to improved habitat for fish and wildlife populations in the Milwaukee River, its tributaries, the Milwaukee Estuary, and Lake Michigan.

The project consists of four main focus areas, which result in five different Proposed Actions (because there are two different Proposed Action alternatives for Bridge Street Dam). These focus areas include the following:

a. Mequon-Thiensville Dam (MT Dam)/Mequon-Thiensville Dam Fishway (MT FW): Proposed Action is to make modifications to the dam and fishway for aquatic invasive species (AIS) control, aesthetics and to improve site access for viewing the MT FW

The project will contribute to the fish passage through inlet/outlet grading, AIS controls for the fishway and dam, a pedestrian bridge and fencing between public and private property.

b. Lime Kiln Dam (LK Dam): Proposed Action is to remove the LK Dam on the Milwaukee River in the Village of Grafton

c. Bridge Street Dam (BS Dam): Proposed Actions are to either construct a fishway (BS FW) at the BS Dam on the Milwaukee River in the Village of Grafton or to remove the dam and restore the natural river channel at this location (BS R)

d. Other Barriers: Proposed Action is to remove or modify approximately 100 Other Barriers at stream crossings in tributaries to the Milwaukee
River in Ozaukee County. This Proposed Action includes a Public Works component for the removal or modification of hydraulic structures (OB PW). A second component includes removal of Other Barriers to fish passage by Conservation Corps (OB CC) personnel. The Conservation Corps projects will include removal of barriers to fish passage with hand labor and small equipment (railroad ballast in the stream bed, fallen logs, etc.).

The project responds specifically to long term goals of Ozaukee County and its communities to restore viability of the natural fishery of the Milwaukee River and its tributaries.

1.1 BACKGROUND

Over a century of urban development in the Milwaukee River watershed has left natural aquatic habitat isolated and fragmented. The impacts of dams and other manmade barriers on the Milwaukee River and its tributaries result in the isolation of potamodromous, adfluvial, and fluvial fish stocks from natural and historical spawning and rearing habitats resulting in decreased fish productivity and genetic diversity. Within the Lake Michigan Basin, the Milwaukee River Estuary and Milwaukee River, the needs and benefits afforded by removing or modifying these and similar barriers to fish passage are consistent with a wide range of federal, state and Great Lakes basin-wide fish and other water-based resource management objectives and strategies.

This project addresses Wisconsin Great Lakes Strategy priorities of habitat and species, and area of concern. It also meets the habitat and wildlife protection and restoration and accountability, monitoring, evaluation, communication, and partnerships focus areas of the GLRI Action Plan. The project also relates to current planning efforts of Southeastern Wisconsin Watersheds Trust watershed restoration plans for the Kinnickinnic and Menomonee Rivers, detailing specific action steps to implement the Southeastern Wisconsin Regional Planning Commission’s Regional Quality Management Plan Update. The project closely aligns with recommendations and action steps in the Milwaukee River Revitalization Council’s Riverway Plan and meets the “diverse, balanced, healthy ecosystem” goal and numerous objectives in the Lake Michigan Integrated Fisheries Management Plan. It also aligns with the Wisconsin Department of Natural Resources’ (WDNR’s) localized Lake Sturgeon Management Plan and Restoration Project and the Walleye Restoration Plan. Removal of the Milwaukee River North Avenue Dam in 1997, located at the upstream limits of the Milwaukee River Estuary and just three river miles (RM 3) upstream of the river’s confluence with Lake Michigan, enabled fish passage for the first time since construction of the dam over 150 years ago (Hirethota, et al., 2005).

1.2 NATIONAL ENVIRONMENTAL POLICY ACT
Major actions that have the potential to affect the human environment and that involve federal funding, require a permit, or other authorization from a federal agency, are subject to the requirements of the National Environmental Policy Act of 1969 (NEPA; 42 USC § 4321 et seq.). The proposed project is subject to the requirements of NEPA since NOAA is funding the project under a cooperative agreement and the project requires federal permits pursuant to Section 404 of the Federal Clean Water Act and Wisconsin State Statutes.

While each NEPA project is unique, there are three primary paths for NEPA compliance depending on the degree of the project’s environmental impact, as depicted in the figure below.

*Figure 1. NEPA Compliance Process*

Each federal agency has its own implementing regulations for NEPA. NOAA Administrative Order (NAO) 216-6 Environmental Review Procedures for Implementing the National Environmental Policy Act describes NOAA’s policies, requirements, and procedures for complying with NEPA, including the determination of significance which defines the requirements for NEPA compliance (i.e., when categorical exclusions, environmental assessments (EA), and environmental impact statements (EIS) are appropriate, as depicted in the above figure). Based on the significance of potential impacts of the proposed project, an EA is required to evaluate these potential impacts and fulfill NEPA requirements.
This EA has been prepared in accordance with the Council on Environmental Quality regulations (40 CFR Parts 1500-1508) and NAO 216-6, which describes NOAA policies, requirements, and procedures for implementing NEPA.

1.3 PROPOSED ACTION

The NOAA Fisheries Community-based Restoration Program (CRP) proposes to release funding to Ozaukee County, Wisconsin under the ARRA to conduct construction, restoration and enhancement activities intended to provide fish passage between the Milwaukee River and its tributaries and the Milwaukee Estuary - AOC and Lake Michigan.

A comprehensive suite of projects would reconnect 158 miles of biologically isolated segments of significant streams within the Milwaukee River Watershed, ensuring target species ingress and egress during critical periods.

Planning and implementation of barrier removal has long been a priority for Ozaukee County and its cities, towns, villages, residents and visitors. The Proposed Action represents a coordinated and expedited approach to improve all aspects of the fishery on affected waterways.

The state public engagement process related to the project has been ongoing and used to assess potential project controversy. The following is a list of meetings and state public engagements that County and/or state agency representatives attended:

- 1/15/09, 3/16/09, 6/15/09, 7/20/09, 8/11/09, 8/21/09, 9/21/09
- 10/19/09, 11/9/09 & 12/7/09 – Mequon-Thiensville Dam Fishway, Village of Thiensville Board Meeting and Public Informational Meetings
- 9/2/2009 – Mequon-Thiensville Dam WEPA, Public Comment Solicited Via WDNR News Release
- 9/29/2009 – Mequon-Thiensville Dam Fishway, City of Mequon Committee on Public Works Recommended Approval of Contract
- 12/14/2009 – Lime Kiln Dam Abandonment, Public Information Meeting
- 1/12/2010 – Lime Kiln Dam Abandonment, Public Comment Meeting

Bridge Street Dam Public Comment/Concerns are thoroughly documented in Appendix C.

Ongoing implementation efforts by Ozaukee County and its partners in this project have resulted in a planned incremental approach to barrier removal in the study area. Realization of the comprehensive project approach, presented herein, has been limited only by a lack of resources to accomplish a comprehensive, coordinated and expedited approach to fish passage barrier removal.

The target species to pass migration impediments is northern pike. Project barrier inventory and designs identify structures problematic to northern pike ingress/egress. Basically, if northern pike can pass, all other target
species should be able to pass. By using northern pike as a surrogate for other
target species, all impediments necessitating leaping behavior would be
removed. Water velocities during high-water spring runoff conditions should
be two feet per second or less for structures exceeding 20 feet in length. Water
velocities in shorter structures must not exceed four feet per second for a full
array of expected flow events. In general, structures would be installed well
below bed grade, backfilled with coarse substrate, and have a slope of less
than 1%. Preference would be given to arched, bottomless culverts or clear
span bridges. Deposits of natural or manmade debris would be removed and
actions taken to help assure that debris does not accumulate in a short period
of time.

Specific project elements include:

a. Remove or Modify Remaining Dams (Milwaukee River)
   a. Construct fish passage improvements at MT Dam (Village of
      Thiensville)
   b. Remove LK Dam (Village of Grafton)
   c. Construct fish passage at BS Dam (Village of Grafton); or,
   d. Remove the dam and restore the natural river channel at the BS
      Dam location

b. Remove or Modify Approximately 100 Fish Migration Barriers on
   Biologically Significant Tributaries
   a. Remove or modify other barriers at stream crossings in
      tributaries to the Milwaukee River in Ozaukee County. This
      Public Works component (OB PW) includes construction-
      intensive work on hydraulic structures.
   b. Remove smaller identified fish migration impediments using
      Conservation Corps (OB CC) personnel. The Conservation
      Corps projects will include removal of barriers to fish passage
      with hand labor and small equipment (railroad ballast in the
      stream bed, fallen logs, etc.)

1.4 PURPOSE AND NEED FOR PROPOSED ACTION

The purpose of the project is far-reaching. NOAA has identified the project as
a significant and desirable undertaking because the project:

- Materially contributes to delisting targets for four of the eleven
  Milwaukee Estuary area of concern (AOC) beneficial use impairments
  (BUIs)
- Provides substantial numbers of construction industry jobs, a sector
  particularly hard-hit in the current economic situation
• Has region-wide significance and benefit from both biological and socioeconomic standpoints
• Has local support
• Offers great potential for publicity and public awareness of American Recovery and Reinvestment Act (ARRA) funding
• Adds tangible value to the millions of dollars and thousands of volunteer hours already devoted to reaching the project goals
• When fully implemented, the project will serve as both a regional and national model on how to address stream fragmentation, and will establish a model and criteria for restoration of beneficial use impairments (BUIs) in coordination with the WDNR
• Is efficient and productive when contrasted to the accrued benefits, and can be implemented quickly
• Adds to genetic diversity and self-sustaining populations of important fish and mussel species, including several Wisconsin-listed threatened, special concern, and endangered species and an extensive list of popular game fish by enabling effective fish passage to historical fish spawning and rearing habitats
• Increases the probability of restoring sustainable populations of lake sturgeon and walleye to the Milwaukee River, its Estuary and Lake Michigan currently managed through artificial rearing and stocking programs
• Eliminates fish larvae mortality associated with the air-entrained boil below the spillways of the removed dams
• Increase recreational fishing opportunities for the state’s most populated and demographically diverse watersheds
• Conforms to local, state and federal water resource-based management plans, rules and regulations, and is consistent with long-standing state, county and community plans and active projects that are only partially complete because of funding challenges

A primary goal of the project is to restore and to protect fisheries and wildlife habitat. This will be accomplished by removing barriers that fragment natural aquatic habitat. Indirect benefits associated with the Milwaukee River, its tributaries, the Milwaukee Estuary and Lake Michigan, such as public access, recreation and visual aesthetics will be enhanced. In addition to improving existing ecological resources, the project will enhance social and economic benefits for the local and surrounding communities. As part of its overall goals, the project is intended to help improve public access; create and retain jobs, enhance tourism and recreation; and achieve long-term socioeconomic benefits related to improved habitat for fish and wildlife populations in the Milwaukee River, its tributaries, the Milwaukee Estuary and Lake Michigan.
1.5 APPLICABLE REGULATORY REQUIREMENTS AND COORDINATION

The Environmental Assessment is used to analyze the environmental impacts of a proposed federal action, as well as to provide sufficient evidence to determine the level of significance of the impacts. An EA will result in one of the following two determinations:

a. An EIS is required; or

b. A Finding of No Significant Impact (FONSI) (40 CFR 1508.9)

*IF THERE WERE POTENTIAL FOR SIGNIFICANT IMPACTS, THEN AN EIS WILL NEED TO BE PREPARED. IF THE IMPACTS OF AN ACTION WERE NOT EXPECTED TO BE SIGNIFICANT, A FONSI WILL BE PREPARED. A FONSI MUST BE SUPPORTED BY THE EA, AND MUST INCLUDE, SUMMARIZE, ATTACH, OR INCORPORATE BY REFERENCE THE EA (40 CFR 1508.13).*

Clearance from the NOAA NEPA Coordinator in Program Planning and Integration (PPI) is required for all EAs, as well as concurrence on the FONSI, prior to implementing the action (NAO 216-6, 1999).

1.5.1 Permits

Ozaukee County, on behalf of the project municipal governments and landowners will prepare applications for wetland, waterway, hydraulic structure and dam removal or modification. Preparation of supporting documentation for permitting and permit determination is underway. The permit application process has been initiated with the WDNR, Wisconsin Department of Transportation (WisDOT) and United States Army Corps of Engineers (USACE) for several of the project sites.

Project permitting has been facilitated and is being expedited by the appropriate federal and state agencies. Thus far, two state agencies and two federal agencies are involved in project permitting and authorization – see Table 1.5-1:

**Table 1.5-1 Total Permit Matrix**

<table>
<thead>
<tr>
<th>Agency</th>
<th>MT FW</th>
<th>LK</th>
<th>BS FW</th>
<th>OB PW</th>
<th>OB CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDNR</td>
<td>CWA Section 401/404 review and concurrence</td>
<td>CWA Section 401/404 review and concurrence</td>
<td>CWA Section 401/404 review and concurrence</td>
<td>WI-Statute Ch. 30 Dam Alteration</td>
<td>WI-Statute Ch. 30 Dam Alteration</td>
</tr>
<tr>
<td></td>
<td>WI-Statute Ch. 31 Dam Alteration</td>
<td>WI-Statute Ch. 31 Dam Removal</td>
<td>WI-Statute Ch. 31 Dam Alteration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WisDOT</td>
<td></td>
<td>WI-Admin. Rule TRANS 207 – Highway</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In addition, the permit process includes coordination with a number of other federal, state, and local regulatory agencies, if required. Table 1.5-2 provides a listing of permits, consultations or coordination required for various project elements. The WDNR/USACE permit and other environmental permits will include a number of requirements to ensure environmental protection during construction in accordance with project designs. Among other conditions, these permit requirements will include the use of erosion control best management practices such as stabilization matting, silt fencing, vegetative seeding and planting, and sediment sampling for disposal. All permits will be obtained as required prior to the commencement of construction and restoration activities.

Table 1.5-2 Potential Permits and Consultations for the Project

<table>
<thead>
<tr>
<th>Agency</th>
<th>Permit/Consultation Potentially Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Department of Interior – Fish and Wildlife Service (USFWS)</td>
<td>Endangered Species Act; Section 7 Consultation. AIS concerns.</td>
</tr>
<tr>
<td>U.S. Environmental Protection Agency (USEPA)</td>
<td>Spill Prevention, Control, and Countermeasure (SPCC) Plan</td>
</tr>
<tr>
<td>Wisconsin Department of Natural Resources (WDNR) – Natural Heritage Inventory</td>
<td>Threatened and Endangered Species Consultation</td>
</tr>
<tr>
<td>Wisconsin Department of Natural Resources (WDNR), Waterway and Wetlands and the US Army Corps of Engineers (USACE)</td>
<td>Joint permit for work in wetlands and waterways or grading on the banks; Section 401 Water Quality Certification; Approval and authorization of dam removal and dam modification permits; permits for channel modification and restoration; Culvert permits; Storm Water Discharges from Small/Large Construction Activity, National Pollutant Discharge Elimination System (NPDES) Notice of Intent. Pit/Trench Dewatering.</td>
</tr>
<tr>
<td>Wisconsin Department of Transportation (WisDOT)</td>
<td>Permit for hydraulic structures (bridges and culverts)</td>
</tr>
</tbody>
</table>

1 Additional agency permits or approvals may be required beyond those identified here.

1.6 DOCUMENT ORGANIZATION
This EA has been prepared in compliance with NEPA and other relevant federal and state laws and regulations. It provides a discussion of the direct, indirect, and cumulative environmental impacts that will result from the Proposed Action.

The document is organized into the following ten parts:

- **Executive Summary**
- **FONSI**: This section presents the overall findings of the EA – the reasons why it can be concluded the proposed action will not have a significant impact on the quality of the human environment, and therefore, will not require preparation of an environmental impact statement (EIS).
- **Introduction**: This section includes information on the background of the project proposal, the regulatory requirements of NEPA, the purpose of and need for the project, the Proposed Action Alternative for achieving that purpose and need, and the applicable regulatory requirements and coordination efforts.
- **Description of the Proposed Action Alternative and No Action Alternative.**
- **Affected Environment and Environmental Consequences**: This section describes the environmental effects of implementing each Proposed Action. Under each Proposed Action, the affected environment is described first, followed by the effects of the Proposed Action Alternative, which is compared to the No Action Alternative.
- **List of Preparers and Agency Consultations**: This section provides a list of preparers and agencies consulted during the development of the Environmental Assessment.
- **Abbreviations and Acronyms**: This section provides a listing of abbreviations and acronyms used within this Environmental Assessment.
- **Scientific Names**: This section provides a listing of plant and animal species referenced within the document and includes both their common and scientific names.
- **References**: This section provides a listing of the literature cited within this Environmental Assessment.
- **Appendices**
2.0 DESCRIPTION OF PROPOSED ACTION AND NO ACTION ALTERNATIVE

2.1 PROPOSED ACTION ALTERNATIVE

The project work would occur in Ozaukee County, Wisconsin within the 584-square-mile Milwaukee River Basin. The project benefits would extend to neighboring portions of Milwaukee, Washington, and Sheboygan Counties. The Milwaukee River Basin is home to more than one million residents and includes the most densely populated and demographically diverse area of Wisconsin. The active project work sites include dams located in the City of Mequon and Villages of Grafton and Thiensville; and Milwaukee River tributaries in the City of Mequon; the Towns of Cedarburg, Fredonia, Grafton, and Saukville; and the Villages of Fredonia, Grafton, Saukville, and Thiensville.

A comprehensive suite of projects would reconnect 158 miles of biologically isolated segments of significant streams within the Milwaukee River Watershed, ensuring target species ingress and egress during critical lifecycle periods. Project elements are listed below and are followed by detailed descriptions:

1. Remove and Modify Remaining Dams (Milwaukee River)

   a. Modify MT Dam and MT FW for aquatic invasive species (AIS) control, aesthetics and to improve site access for viewing the MT FW.

      Note: The MT FW is largely constructed as part of an initial first phase. Construction under Phase 1 was funded by local, Great Lakes Protection Fund, Wisconsin Coastal Management sources and consisted of the fishway only. Phase 1 includes the following activities: dewatering millrace, placing and compacting fill and regrading the millrace, and constructing the nature-like fish passage. The Phase 1 project activities are not part of the NOAA project under evaluation herein, but a separate undertaking by the Village of Thiensville and City of Mequon with the WDNR drafting a Wisconsin Environmental Policy Act (WEPA) Environmental Assessment. They are presented here to differentiate activities and effects related to the overall project.

      Phase 2 of the project will modify the existing fishway and MT Dam to provide additional AIS control enhancements (trap and sort, inlet/outlet grading and gate), a steel lip on the dam spillway and elimination of slack flow at the left abutment, etc. In addition Phase 2 will also provide a pedestrian bridge for access and for viewing the MT FW and fencing for aesthetics. Phase 2 work will be funded under the proposed NEPA action.
A detailed evaluation of permitting requirements was completed by the WDNR as part of Phase I project permit submittals. All property required for construction of the MT FW is already owned by the Village of Thiensville. Construction of the Phase I MT Fishway improvements is scheduled for substantial completion in December 2009. Final construction activities which would include restoration of the stream banks, seeding, and landscaping, would be completed during May through June 2010.

Natural Resources Conservation Service (NRCS) Practice Standard Number 396 “Fish Passage” would be followed. The MT FW design is modeled after successful examples elsewhere, including a “rock ramp” coupled with modifications to the existing mill race to form a “bypass channel fishway” such as the one in Fuisdorf, Germany. Nature-like fishways such as the proposed MT FW would modify the riverbed grade to pass fish within the stream banks.

Project design is a site-specific modification of the existing dam and mill race and mitigation efforts described below. The proposed fish passage alternative will be constructed within the upper 2 acres of the existing 2.6-acre millrace, and will be 1,180 feet long, with a slightly meandering alignment that approximates the aesthetics of a meandering stream. The fishway will flow west for a length of 600 feet at which point it will enter a 180-degree bend and flow east toward the spillway.

Loss of flows and aesthetic values associated with the existing mill race have been identified as issues requiring mitigation by the downstream riparian land owners. Mitigation efforts would include directing the supply of water from the MT FW to the former mill race channel. Municipal storm sewer(s) would be directed into the mill race to supply flow from storm water runoff. A French drain would be installed parallel to the mill race shoreline to intercept groundwater for flow augmentation in the mill race channel.

Concerns regarding the impact of storm water on the mill race, aquatic organisms (e.g., fish, benthos, etc.) and aesthetics have been considered in the project design. Storm water would be isolated from the MT FW and used to augment flow to the former mill race. Water from the municipal storm water system, groundwater and auxiliary water supply from the upstream reservoir would be provided to augment flows to the former mill race for the benefit of downstream riparian landowners. Water supply for the MT FW would be supplied from the upstream reservoir through the auxiliary dam gate that formerly supplied water to the mill race.
Section 2.0 Description of Proposed Action and No Action Alternative

AIS control would require operation of the MT Dam auxiliary gate that supplies water to the proposed MT FW. The gate would be closed during periods of known movement of sea lamprey. Additional AIS control measures are to be considered in MT Dam Part 2 final design. Please refer to Document 1 in Appendix C for more details on AIS control for this project.

b. Remove the Lime Kiln Dam (LK Dam) on the Milwaukee River in the Village of Grafton;

The Village of Grafton recently removed a large dam formerly located between the Lime Kiln and Bridge Street Dams (known locally as the “Chair Factory Dam”). Grafton has actively publicized its intent to remove the LK Dam. The reservoir does not contain significant soft sediment volumes, so sediment control after removal is not an issue. Site access is easy.

The existing dam would be removed and submerged fish passage barriers associated with the channel bottom beneath the dam would be modified to provide the desired fish passage improvement at this site. Stream bank restoration near the dam abutments and former mill race would be restored to achieve a suitable re-establishment of the pre-dam river channel characteristics.

Soft sediment release during dam drawdown is expected. It is anticipated that this sediment volume is not significant due to the geographical setting of this site. Sediment released during removal of the dam is expected to settle out in the next downstream reservoir (the MT Dam reservoir).

No significant effect to movement of aquatic invasive species (AIS) is expected as a result of removal of the LK Dam. Priority AIS of concern include sea lamprey and the VHS virus; however, the LK Dam is known to be intermittently submerged during high flow events. As a result, these priority AIS are expected to be able to breach the LK Dam. For more discussion on AIS related to the project, see Document 1 in Appendix C.

c. Construct a nature-like fishway (BS FW) at the BS Dam on the Milwaukee River

The BS Dam was most recently re-constructed in 1918 and is nearing the end of its design life. It was originally constructed to provide power to specific industrial uses. The intended use of the dam terminated in 1961 when the mill race was filled in with concrete, rock and soil. Also in 1961, the Village of Grafton accepted ownership of the dam as a result of the conclusion of the
Section 2.0 Description of Proposed Action and No Action Alternative

industrial use and the need to continue operation and maintenance of this structure since it presents a significant hazard by its nature and location.

An alternative to provide fish passage is to construct a fishway at this dam. The BS FW follows the same design principles as the MT FW. More specifically, a nature-like fishway would be constructed approximately six feet wide and five feet tall with its fishway entrance penetrating the west abutment of the BS Dam, then bending 90 degrees north and extending approximately 400 feet north, parallel to the west bank of the upstream reservoir. The observation platform located directly above the west dam abutment would be modified to allow the BS FW to pass partially underneath. The observation platform would be restored above or adjacent to the BS FW.

The popular “riverwalk” path upstream of the BS Dam floods during high-flow periods due to the dam’s insufficient spillway capacity. The BS FW design would not cause additional flooding.

BS FW construction provides a physical control mechanism to enhance fish passage over the BS Dam. Consistent with WDNR procedures for AIS control, a control gate and trap and sort facility would be provided on the upstream end of the fish passage to be used as necessary to prevent fish and aquatic invasive movement into the upstream waterway.

d. Dam Removal and Restoration of the Natural River Channel at the BS Dam

The BS Dam structure would be removed and the bed of the river restored to provide enhanced fish passage. River bank restoration would be required in the area of the BS Dam and several thousand feet upstream. Soft sediment release would occur. These sediments would likely travel downstream to the MT Dam reservoir. Upstream water levels are expected to decrease from zero feet in the vicinity of Meadow Brook Park to eight feet at the BS Dam. The restored river channel would look more like the river channel that occurs below the dam.

Some inconvenience and noise related with dam removal and interruption of pedestrian traffic on the river walk and vehicular traffic on the Bridge Street bridge are expected during construction. Temporary aesthetic affects would become apparent once the drawdown of the upstream reservoir commences, exposing sediment that has accumulated outside of the natural river channel. These effects would continue until vegetation is established on the newly exposed floodplain.
Fish passage improvement is expected as a result of the removal of the BS Dam. Dam removal would affect regional floodplain profiles immediately above the BS Dam. Floodplain profile above the dam would decrease as a result of dam removal. No impact on floodplain elevation below the BS Dam would occur as a result of dam removal. There would be no change to regulatory floodplain profiles above the BS Dam (where a lowering of that flood profile would occur). The Village of Grafton may choose to seek a change to the regulatory floodplain in the reach above the BS Dam after removal if so desired.

Floodplain elevation reduction would occur within the current reservoir (impoundment sediment volume measurements would be made in order to estimate the displacement and disposition of this material during and after dam removal). Sediment chemical composition would also be verified. BS Dam removal would occur in phases to allow incremental drawdown of the upstream reservoir. This method of dewatering sediments would be augmented with planting and erosion control measures required to stabilize the newly exposed channel bank during drawdown.

Hydraulic and hydrological river modeling would be performed in order to ascertain the magnitude of the anticipated change in the area floodplain resulting from dam removal. Channel restoration would be guided by best management practices to reduce potential bank and riverbed/reservoir sediment erosion.

Amenities of the existing upstream reservoir would be restored after dam removal. A fishing pond that can also be used for ice skating in the winter would be created in the newly exposed floodplain at Veterans Park. A river walk and bicycle trail would also be provided for public use.

A river flow diversion structure constructed of strategically placed rock may be placed on the upstream end of a small river channel (located roughly parallel to the main river channel from Nancy Lynn Drive to Holly Lane) to provide a water source for maintenance of flow in both the main river channel and the small side channel area only.

2. Remove or modify Other Barriers stream crossings in tributaries to the Milwaukee River in Ozaukee County. See Section 3.5 for a description of each tributary where barrier removal work is proposed.

   e. Public Works component for the removal or modification of hydraulic structures (OB PW).
Improperly placed culverts would be modified or replaced. Site disturbance would be limited to the immediate location of each barrier. Upstream and downstream bed controls may be placed to improve fish movement into and/or out of the culvert. Where necessary, bed controls would consist of placement of wood, concrete or rock “steps” into the stream bed to adjust stream water level at the ends of the culvert.

Fish passage improvement is expected as a result of the removal of barriers on tributaries. Some modest flow improvements are also anticipated as culverts would generally be replaced with larger conduits to enhance fish movement. Upstream flooding at culvert sites is expected to be partially alleviated as a result.

In addition to the standard traffic and hydraulic related criteria requisite to culvert selection and installation, the Ozaukee County Highway Department would consult with the USACE, WDNR, U.S. Fish and Wildlife Service, and other guidance manuals describing “fish-friendly” stream crossings. In general, the following additional fish passage criteria based on the abilities of northern pike would be used in the design:

Artificially maintained stream channel slopes immediately upstream and downstream of the stream crossings will be identified and regraded. Examples include old crossing component debris and bedding material. All impediments necessitating leaping behavior would be removed. No cascading water conditions of any kind may exist. Water velocities must remain below two feet per second for structures exceeding 20 feet in length using flow rates typical of spring runoff.

No structures should attain water velocities greater than four feet per second for any length and for a full array of expected flow events. In general, structures would either be installed well below bed grade, backfilled with coarse substrate, and have a slope of less than 1%. Preference would be given to arched, bottomless culverts or clear span bridges. Deposits of natural or man-made debris would be removed and actions taken to help assure that debris does not accumulate in a short period of time.

Care would be taken to assure adequate depth of flow during typical flow conditions. These actions include shaping and sizing structures adequately and assuring that water does not infiltrate bedding material thereby bypassing the water-filled portion of the structure.

A table that outlines and describes the Public Works barriers and the respective preliminary improvements is attached (See...
Appendix A, Table 1 – Culverts EA Spreadsheet). The table is broken down by tributary and by barrier. Each has been assigned a unique identifier (designated by Ozaukee County GIS department) and a barrier reference number. The table includes a general description of the type of culvert, existing conditions, size and shape of the existing structure/barrier as well as a brief location description. Additional information further describes if the structure is located within an Area of Special Natural Resource Interest (ASNRI), a Public Rights Feature (PRF), a Trout Tributary, or has been permitted in the past. Lastly, an estimated cost to address the barrier based on preliminary concept plans is provided.

f. Conservation Corps component for the removal or modification of hydraulic structures (OB CC).

The Conservation Corps projects will include removal of barriers to fish passage with hand labor and small equipment (railroad ballast in the stream bed, fallen logs, etc.). These projects would generally not be subject to detailed design work, and instead would be remedied by field expedient methods developed by a trained crew leader. Best management practices for erosion control, vegetation and debris removal, safety, and other factors would mimic those used for other County-run public park and highway projects.

Debris, rock and vegetation would be removed from the tributaries. Small equipment (skid steer loader/backhoe and mule type ATV) would be utilized to deliver equipment to barrier sites and provide capability to remove obstructing materials from the waterways. Site access would be identified to aid in delivery of labor and equipment to the scattered barrier sites. It is anticipated that such access to scattered sites may involve minor brush cutting. Debris would be removed from the waterway as necessary to prevent remobilization of the debris during storm events. Erosion control and site restoration best management practices would be employed as necessary to stabilize any disturbed areas within or adjacent to the barrier sites. All disturbed access routes will be restored.

Fish passage improvements throughout the implicated waterways are expected. It is expected that removal of these barriers would reduce backwater effects from the barriers.

The project grant application included barrier removal at 58 OB CC sites that were identified and documented during the 2006-2007 field inventory. During 2009, select project stream reaches were revisited to clarify, verify, and/or refine barrier descriptions...
Section 2.0 Description of Proposed Action and No Action Alternative

for site-documentation purposes (i.e., assigning Unique Identification numbers and garnering latitude/longitude coordinates). This endeavor achieved its goal. It also located additional OB CC and other barriers, raising the total number of OB CC sites to 84. For more information, see Appendix A, Table 2 – Conservation Corps EA Spreadsheet.

The additional OB CC sites result from a refinement/update of data originally collected during winter 2007, under non-optimal field conditions and when barrier site locations were not being formally documented. The additional OB CC sites are all of similar composition (e.g., log and woody debris jams, stone deposits, and/or overgrown invasive vegetation) and within the same spatial extent as those included in the grant application. Including them in the project was deemed acceptable because of these similarities. All 84 sites were also included in the Corps’ proposal scope and sufficient funding for their removal under the current grant is anticipated. If any additional barriers are discovered during the course of the project (e.g., any that have developed since the 2006/2007 inventory), they will be documented and/or removed as time and funding allows.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the project will not be constructed, and removal or modification of barriers to fish passage or reconnection of aquatic habitat will not occur. The fragmentation of aquatic habitat and continued diminishment of fishery resources within the project area will continue. No direct, indirect, or cumulative benefits to the Milwaukee Estuary AOC would be achieved. The ecological, environmental, social, and economic benefits associated with the project will not be realized. Minor impacts associated with construction projects will not occur.

Additional description regarding the effects of the No Action Alternatives related to each main project element is provided in Section 3.
3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 MEQUON-THIENSVILLE DAM FISHWAY CONTRUCTION

3.1.1 Geology and Soils

3.1.1.1 Affected Environment

**Geology and Groundwater Hydrology**

Up to 2000 feet of Paleozoic-age sedimentary rock overlies Precambrian-age crystalline rocks in Ozaukee County. The material properties of these rocks are used to differentiate the various strata and assign formation names. These formations are grouped into two major hydrostratigraphic units: the deep Sandstone Aquifer and the shallow Niagara/Unconsolidated Sediment Aquifer. Since the study area is located in an area where a thick shale aquitard separates the two aquifers, only the shallow aquifer is of significance to the study.

Silurian-age dolomite underlies Thiensville and Mequon in the study area. Bedrock outcrops occur less than 2 miles northwest of the MT Dam, however, bedrock is anticipated to be buried by approximately 20 feet of nonconsolidated sediment at and near the MT dam and reservoir. The bedrock outcroppings occur on the bed and banks of a relic channel of the Milwaukee River.

Southeastern Wisconsin was repeatedly glaciated, with the most recent ice sheets retreating less than 13,000 years ago. These glaciations deposited a sequence of diamicton and water-laid deposits. Named glacially-deposited formations underlying Ozaukee County include the Kewaunee Formation, the Oak Creek Formation, and the Holy Hill Formation. In the Thiensville area, the Milwaukee River was an ice-margin stream during deposition of the Kewaunee Formation sediments. As such, the prototypic red clays of the Kewaunee Formation are found adjacent to or a short distance to the east of the river, while the brownish/grayish and oftentimes somewhat coarser grained sediment of the Oak Creek Formation are found both under the Kewaunee Formation and are most prevalently exposed at the surface west of the river. At the MT Dam site, alluvial sediments form both banks, with sediments of the Kewaunee formation found a short distant beyond.

Three important aquifers are present in Ozaukee County and include (in increasing depth below the land surface) the Sand-and-Gravel Aquifer formed in Pleistocene- and Holocene-age glacial deposits, the Niagara aquifer that occurs within Silurian-age dolomite, and the Sandstone Aquifer, which is chiefly comprised of Ordovician- and Cambrian-age dolomite and sandstone. The Sand-and-Gravel Aquifer often lies directly upon the Niagara Aquifer. In these situations, the two aquifers are hydraulically connected and commonly behave as one aquifer. The Sand-and-Gravel Aquifer commonly reaches
the ground surface, and therefore interacts with surface water bodies. This aquifer has great influence on local surfacewater features.

In most situations, groundwater elevation is a subdued expression of local topography. Upland areas are usually recharge areas, while lowland areas are discharge areas. Lowlands are commonly occupied by wetlands, lakes, springs, and streams. Consequently, near-surface ground water often flows perpendicular to topographic contour lines. Water in the Sand-and-Gravel Aquifer and much of the Niagara Aquifer follows this general rule. Water in deeper portions of the Niagara Aquifer and the Sandstone Aquifer follows more regional flowpaths. Under natural conditions, regional flow is east toward Lake Michigan.

Springs were reportedly formerly present near the MT Dam, lending evidence that the river in the study area was a significant groundwater discharge area. Springs persist in northwestern Thiensville, demonstrating that the area is likely a significant groundwater discharge. The MT Dam artificially raises the river elevation in relationship to groundwater, and will cause groundwater elevations to rise. Artificially high groundwater elevations disrupt natural groundwater/surface water interactions, in turn modifying the hydrology of local water bodies and wetlands. Portions of the river near the MT Dam will likely lose water to the groundwater flow system, which re-emerges at and near the dam site. These conditions increase groundwater flux and velocity near the dam.

**Soils**

The soils on the banks and terrace formed by the Milwaukee River commonly belong to the Casco-Fabius association. Casco-Fabius soils are commonly coarse grained sands and gravels near the surface underlain by clayey soils. These coarser-grained facies were deposited by flowing water, either by the river or by glacial meltwater. Soils north, south, and east of the dam, but more distant from the river are composed of clayey sediment of the Kewaunee-Manawa Association. West of the MT Dam and river, most soils are loamier clay soils of the Ozaukee-Mequon Association.

**Quantity and Quality of Impoundment Sediment**

The Milwaukee River downstream of the MT Dam averages about 225 feet in width. Water depths along the deepest part of the river’s cross-section (also known as the Thalweg) range from 1.5 feet in runs to 6 feet in the scour hole located below the dam. The shoreline is generally non-eroding with cobble, gravel and coarse sand armoring the lower bank. Bank vegetation includes grasses, lawn, trees and woody shrubs. Sediment in the Milwaukee River immediately downstream of the MT Dam in areas potentially affected by the fish passage project is dominated by gravel, cobble and boulder sized material, and lesser amounts of medium to coarse sand. Silt and clay sized
material is generally absent as a result of scouring flows. Pollutants of concern are absorbed by silt and clay sized material and organic matter. The lack of these types of material would infer that the potentially affected river bed material would not include pollutants of concern. Based on conservative estimates, the MT impoundment has accumulated between 500,000 cubic yards and 1 million cubic yards of sediment. The quantity and quality of accumulated sediments can have adverse impacts should those sediments be released as a result of a dam failure, drawdown or improperly managed dam removal.

According to work completed by Ozaukee County staff and reports from contractors, up to eight feet of soft sediment is found in the MT Dam millrace, with an average thickness of six feet (see Figure 2 below). The greater-than-anticipated soft sediment depth complicates construction. Therefore, soft sediment in the filled portion of the millrace were removed, hauled offsite, and replaced with compacted clay fill. A composite sediment/soil core sample was collected and analyzed for a variety of physical and chemical constituents. The results of this physical and chemical analysis indicates that the concentration of two common organic chemical compounds known as polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) were observed at relatively low concentrations or less than the analytical limits required for reporting or action. The sediment analysis also included tests for the presence of seven heavy metals. The results indicated that the quality of sediments will not require any special environmental management practices. Once the sediments are sufficiently dried and vegetated, there would be no special restrictions on access or use of the area.

*Figure 2 – Contour map showing MT Dam Fishway sediment depth*
3.1.1.2 **Environmental Consequences**

3.1.1.2.1 Proposed Action Alternative

Constructing the MT FW in the former millrace provides fish passage without necessitating dam removal but does require that the millrace be filled. Construction needs of the grade-critical MT FW require that excessive thicknesses of soft sediment in the millrace be removed and replaced with appropriate fill. Approximately 6,700 cubic yards of sediment removal, and import of 6,700 cubic yards of structural fill were required to construct the fishway during MT FW Part 1. These actions replaced the artificially trapped and accumulated sediments in the millrace with man-placed clean native soil fill.

MT FW construction eliminates the quiescent waters of the former millrace that trapped silty suspended sediment. The small proportion of the total suspended sediment load that passed through the millrace will be directed downstream under higher gradient conditions, rectifying a small portion of the unnatural sediment transport interruption created by the MT Dam.

MT FW construction will partially restore natural groundwater/surface-water interaction relationships immediately downstream of the dam. The millrace and dam artificially raise surface water in relationship to groundwater elevations, and therefore contribute to localized disruption of groundwater recharge/discharge relationships and groundwater elevations. It is likely that groundwater elevations along modest areas of the north river shoreline downstream of the dam will decrease to a more natural elevation.

3.1.1.2.2 No Action Alternative

If the MT FW is not constructed, natural river sediment transport processes will remain disrupted. Fine grained sediment will continue to accumulate upstream within the millrace.

Natural groundwater flow paths will remain disrupted, with areas near the millrace intercepting groundwater. The artificially high hydraulic head imposed by the millrace increases groundwater flux and flow.

3.1.2 **Land Use and Recreation**

3.1.2.1 Affected Environment

The environment directly affected by the MT FW in terms of land use and recreation consists of the current millrace water surface, which is approximately 800 feet long, 150 feet wide, and 2.6 acres in area. The north
side of the millrace includes six single residential homes and one commercial building located at the outlet of the millrace. The embankment which separates the millrace from the Milwaukee River will also be directly affected. The Village of Thiensville owns the millrace, its earthen embankment and the bed extending from the millrace earthen embankment south to the centerline of the Milwaukee River. The millrace earthen embankment is managed as a riverwalk and is an extension of the Thiensville Village Park to the east. At least one private property owner has expressed interest in the millrace water supply.

The Thiensville Village Park, located along the Milwaukee River, features baseball diamonds, tennis courts, a playground and picnic areas, and a public boat launch. Nearby, the Rotary Riverwalk is being developed along the Milwaukee River in the Town Center by the local Rotary clubs. Eventually, this walkway will extend along the banks of the Milwaukee River from Thiensville Park south to Mequon Road in Mequon.

3.1.2.2 Environmental Consequences

3.1.2.2.1 Proposed Action Alternative

Land Use

Land use in the immediate area of the millrace will remain in public ownership but will change in that a portion of the existing millrace will be converted from an ephemeral pool to a facility intended to pass fish and designed to mimic the form and function of a free-flowing stream. As a result, private interest in the millrace water supply described in riparian real estate documents will be maintained.

The MT FW will be constructed within the upper two acres of the existing 2.6-acre millrace, and will be 1,180 feet long, with a slightly meandering alignment that approximates the aesthetics of a meandering stream. The initial 600-ft length of fishway will flow west to a point where after it will bend 180-degrees and flow east toward the spillway.

Public millrace lands modified with earthen fill and adjacent to the fish passage facility will be seeded with native wetland species and managed for passive recreational uses. The MT FW facility will include display boards documenting the history of the site and current fish passage facility. Signage will include the public and private groups that contributed resources for the project. Public use and visits to the property and fishway facility will increase, especially during major fish passing periods, such as the spring and fall. The existing public river walk trail will be graded 6-inches lower than existing, but will be restored to its previous condition. The aesthetics may change as some trees are removed for purposes of stabilizing the remaining millrace earthen embankment.
Restoration work on the south dam abutment is intended to mitigate the potential for AIS uncontrolled movement past the dam at high flows (flows greater than those generated by a 5-year (20%) recurrence interval 24-hour runoff event (Q5)).

Recreation

Construction of the MT FW will result in significant enhancements to several recreational activities. It will provide enhanced opportunities for fishing and viewing at the dam site. The aesthetics of the millrace area and the riverwalk are likely to be viewed by a majority of residents as a significant improvement to the stagnant pool and minimally maintained riverwalk that existed prior to the start of construction of the MT FW. The MT FW will serve as a point of interest in the community that will broaden use of existing public park land.

Construction of the MT FW will help to greatly expand recreational fishing along the river and tributaries upstream of the MT Dam by allowing Lake Michigan sport fish consistent upstream access.

The proposed MT FW will increase the abundance and genetic diversity of fish stocks. Access to the historical habitats of native fish species would be enhanced along the Milwaukee River, its Estuary and near-shore waters of Lake Michigan. Enabling fish passage will increase the probability of developing sustainable populations of lake sturgeon and walleye along the Milwaukee River, its Estuary and near shore areas of Lake Michigan.

Construction of the MT FW would not impact boating safety issues. The area within 200 feet of the MT Dam is off-limits for boating (American Whitewater, 2009). However, the corrective measures related to the dam abutment problem and scour holes will be addressed as part of the MT FW project, and will reduce the risk of significant injuries or fatalities by reducing undertow effect.

3.1.2.2 No Action Alternative

Opportunities for expanded recreational fishing opportunities would not occur upstream of the MT Dam. In the absence of enhanced fish passage, the frequency and probability of AIS and pathogens passing beyond the MT Dam would be unchanged.

Land Use

The No Action Alternative would have no impact on land use, although safety concerns associated with the millrace would remain and would eventually require actions that could impact land uses as the No Action Alternative would not be an acceptable long term option.

Recreation
The No Action Alternative would result in: (a) the MT Dam continuing to function as a significant barrier to fish passage, (b) maintenance of the existing fragmented condition of the natural aquatic habitat, (c) continued diminishment of the viability of the Milwaukee River as a natural fishery, and (d) preclusion of the establishment of a lake-run seasonal sport fishery in upstream areas. Long-term, the existing recreational fishing resource in its current state could be further diminished by the No Action Alternative through possible future continued uncontrolled AIS movement during high flow conditions.

Boating safety would remain unchanged via the No Action Alternative. In addition, the hazards associated with the left abutment and scour hole problems would remain, as these conditions would not be corrected.

3.1.3 Water Quality and Resources

3.1.3.1 Affected Environment

The Milwaukee River watershed is located in the north central portion of the Southeastern Wisconsin Region and covers an area of approximately 700 square miles. The main stem of the Milwaukee River originates in southeastern Fond du Lac County and flows approximately 101 miles in a southerly and easterly direction to its confluence with Lake Michigan in the City of Milwaukee in Milwaukee County. Tributaries of the Milwaukee River extend into Dodge, Fond du Lac, Milwaukee, Ozaukee, Sheboygan, and Washington Counties. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. Approximately 62 percent, or 434 square miles, of the watershed is located within the Southeastern Wisconsin Region. The remaining 38 percent, or 266 square miles, is located in Dodge, Fond du Lac, and Sheboygan Counties. The Milwaukee River watershed contains 20 lakes with a surface area of 50 acres or more, along with numerous smaller named lakes and ponds (SEWRPC, 2007).

The Milwaukee River watershed is comprised of the following subwatersheds: Milwaukee River North, Milwaukee River East-West, Milwaukee River South, Cedar Creek, Menomonee River, and the Kinnickinnic River. The fish passage project is located entirely within Ozaukee County on the main stem of the Milwaukee River along with the following tributaries: Lac du Cours and Trinity Creeks (City of Mequon), Ulao Creek (City of Mequon, Town/Village of Grafton), Mole Creek (Town/Village of Grafton, Town of Saukville), Riverside Drive Creek (Towns of Saukville and Port Washington), Hawthorne Drive and Riveredge Creeks (Town of Saukville), and Fredonia Creek (Town/Village of Fredonia).

The Milwaukee River Basin contains about 600 miles of perennial streams and 450 miles of intermittent streams draining nearly 900 square miles of land. Most of the stream miles in the basin are considered full fish and
aquatic life streams, meaning they are capable of meeting water quality standards and have the ability to support a full range of fish and aquatic life as habitat and water quality allow. Fifty eight percent of basin stream miles are capable of supporting warm water sport fish communities, 12 percent support warm water forage fish communities, and 12 percent are capable of supporting cold water communities. The Milwaukee River North Branch watershed contains most of the cold water streams in the basin (47 miles). Streams that do not meet water quality standards on a consistent basis make up about 12 percent of the total stream miles in the basin. With the exception of one stream in the North Branch Watershed, the lower-quality stream miles are located in the most densely populated areas the basin. Many of these streams were modified by straightening, enclosure or concrete lining to move water off the land and more quickly downstream. In response to a U.S. Environmental Protection Agency (USEPA) requirement, the State of Wisconsin maintains a list of impaired waters, also known as the 303(d) list. About 61 miles of streams (10% of the total basin stream miles) are included on this list (WDNR, 2001).

The Milwaukee River terminates at the Milwaukee Estuary AOC in Lake Michigan. Improvements to waterways, habitats, and biological communities upstream of the AOC (i.e., in the project area) benefit the AOC and will contribute to the delisting of some BUIs.

Providing fish passage at the MT Dam will open up 10 additional river miles of historical river habitat, over 10 miles of historical tributary habitat, and 1,800 acres of additional riparian wetland before the next upstream obstruction, the LK Dam. It will extend the unique and popular seasonal trout and salmon recreational fishery that exists along the lower reaches of the Milwaukee River downstream of the MT Dam.

The Milwaukee River is classified as a Warm Water Sportfish Community. Physical and chemical water quality habitat supports a diverse fish and aquatic life community. River features downstream of the MT Dam are dominated by riffle and deep run. Substrate is dominated by large gravel, cobble and lesser amounts of boulder, small gravel and coarse sand. Dominant cover includes large woody debris and boulder. Macrophytes are present but not at nuisance levels.

The MT Dam millrace environment has limited biological functions and values and the water supply is ephemeral as a result of the normally closed millrace gate. The millrace, by statute, is part of the dam system and not waters of the state. However, at least one downstream riparian has recorded rights to millrace supply water use.

The original millrace was most likely constructed by excavating soil within the millrace footprint as the excavated spoils were likely used to construct the earthen embankment between the millrace and river. The current millrace has an ephemeral existence and is dependent on an artificial water
budget supplied by a leaking millrace gate, intermittent discharge from a storm sewer, local surface drainage and groundwater. When completely flooded by water exiting the millrace gate, water depths in the millrace range from a few inches to 4 feet, and averages 1 foot or less. A Village of Thiensville 38-inch by 24-inch storm sewer also contributes intermittent discharges of surface water runoff from a medium density residential/institutional area on Elm Street.

When flowing, surface water elevations in the millrace are higher than water elevations in the adjacent Milwaukee River. Storm sewer runoff from the Village of Thiensville Village Park parking lot drains to the impoundment by sheet flow. The millrace is located in the floodway of the Milwaukee River and is submerged with the same frequency as the MT Dam spillway. Sediment/soil depth in the millrace ranges from one foot to eight feet. A composite sediment/soil core sample was collected and analyzed for a variety of physical and chemical constituents. The results indicate that the quality of sediments will not require any special disposal requirements and may be retained or incorporated into the millrace as common fill.

The Milwaukee River downstream of the MT Dam averages about 225 feet in width. Water depths along the deepest part of the river cross-section (also known as the Thalweg) range from 1.5 feet in runs to 6 feet in the scour hole located below the dam. The shoreline is generally non-eroding with cobble, gravel and coarse sand armoring the lower bank. Bank vegetation includes grasses, lawn, trees and woody shrubs.

Sediment in the Milwaukee River in areas potentially affected by the placement of coarse fill for the construction of various fishway alternatives is dominated by gravel, cobble and boulder sized material, and lesser amounts of medium to coarse sand. Silt and clay sized material is generally absent as a result of scouring flows. Pollutants of concern adsorb to silt and clay sized particles and organic matter. The lack of these types of material would infer that the potentially affected river bed material would not include pollutants of concern. According to the Wisconsin Environmental Policy Act (WEPA) Environmental Assessment completed by the WDNR for the MT FW, laboratory testing of the sediment in the area of the proposed MT FW “indicated that inorganic and organic pollutants of concern were not present at levels requiring any special handling on or off site” (Wawrzyn et al., 2009, p. 19).

3.1.3.2 Environmental Consequences

3.1.3.2.1 Proposed Action Alternative

**Phase 1 – Millrace Conversion**

The MT FW has two phases that will have a net positive effect on the environment. Phase 1 includes the following activities:
1. Dewatering millrace

2. Placing and compacting fill and regrading the millrace

3. Constructing the nature-like fish passage. This work includes excavating the channel, creating pool and riffle sections, installing sheet piling in critical areas, and erosion control.

4. Restoration to include native seeding and rootstock to restore wetland areas, sedge meadow areas, and mesic and upland prairie areas.

The Phase 1 project activities are not part of the NOAA project under evaluation herein, but a separate undertaking by the Village of Thiensville and City of Mequon with the WDNR drafting a WEPA Environmental Assessment. They are presented here to differentiate activities and effects related to the overall project.

The physical and chemical water quality and physical habitat features of the Milwaukee River will not be significantly impacted by construction or operation of the proposed MT FW. Approximately 2.0 acres of the 2.6-acre millrace will be converted from an ephemeral pool habitat to habitat mimicking an engineered flowing stream. The remaining 0.6 acres of the fishway facility will be planted with native grasses and forbs and managed as a lowland and upland mesic prairie. Water quality in the remaining millrace will improve as the storm sewer discharge will receive some level of treatment by the addition of two basins at the storm sewer outfall. Habitat in the remaining portion of millrace will have a more perennially wet environment as water is diverted from the MT FW at a rate of 1 cubic feet per second (CFS).

The proposed MT FW will increase the abundance and genetic diversity of fish stocks. Access to their historical habitats would be enhanced along the Milwaukee River, its Estuary and near-shore waters of Lake Michigan. Enabling fish passage will increase the probability of developing sustainable populations of lake sturgeon and walleye within the Milwaukee River, its Estuary and near shore areas of Lake Michigan. Recreational fishing opportunities would be greatly expanded along the river and tributaries upstream of the MT Dam.

Modifications to the millrace will not negatively impact the fishery resources of the Milwaukee River. This proposed fish passage alternative provides a simple and cost effective means for temporarily or permanently closing the MT FW should AIS, viral hemorrhagic septicemia (VHS) or other fish pathogens be identified as a threat to upstream fishery resources. Flow to operate the MT FW and allow fish to pass through the millrace gate could be closed by physically gating the millrace opening. While a temporary or
permanent closure of the MT FW may be expected to decrease the frequency of AIS or pathogen passage, it may not decrease the probability of AIS or pathogen passage over the dam under moderate to high discharge conditions, or by other as yet unknown vectors.

The current millrace gate will be repaired or replaced to allow the gate to be easily and quickly closed for servicing the MT FW or halting the passage of fish in the event that AIS or fish pathogens are identified as a threat to upstream reaches of the watershed until other management options are available to halt or manage their spread. Closing the millrace gate would not prevent the spread of AIS or fish pathogens from upstream sources of infection.

The construction of the proposed MT FW will impact the aquatic plants in or along the Milwaukee River. Filling and construction of the MT FW in the millrace will eliminate the submerged and emergent aquatic plants within the millrace. The terrestrial portion of the constructed MT FW will be planted and managed with native grass and forbs. Great care should be taken to ensure that no new invasive species seeds or plant parts are brought in by equipment or fill during construction, especially common reed.

Phase II - Dam, Slide and South Abutment Conversion with AIS Controls

The MT FW - Phase II project activities are related to modifications to the proposed fishway for AIS control. These project elements are part of the NOAA project being reviewed in this document.

Spillway elevation changes are intended to equalize flow across the spillway and provide a flow to attract fish toward the fishway entrance. Rip rap will be added to the spillway’s scour hole to eliminate the boil and resulting mortality to fish larvae. The rip rap will provide secondary benefits for stabilizing the dam and abating the boil hazard for recreational boaters.

Specific Phase II project activities include:

1. Prepare plans and specifications to install new gate at the exit of the fishway to prevent all migration of fish through the fishway.

2. Plans and specifications to install the infrastructure for a trap and transfer facility at the exit of the fishway to allow transfer of desirable fish in the future.

3. Plans and specifications to install an 18 – 24 inch metal lip on the crest of the dam to decrease the probability of sea lamprey migration occurring during high water events.

4. The spillway elevation at the existing “fish ramp” and left dam abutment will be increased to be equal to the remainder of the spillway.
5. Eliminate slack flow areas that exist around abutments during high water events to decrease potential for uncontrolled AIS fish passage in those areas.

6. Plans and specifications to repair/reset existing upstream gate on existing box culvert (fishway water supply / fishway exit).

7. Plans and specifications to perform grading modifications for fishway inlet/exit.

8. Plans and specifications for split rail fence along path on top of the berm that isolates the private from public property.

9. Construction of Phase II fishway improvements and AIS controls at the MT FW.

10. Site restoration.

Activities related to MT FW Phase II include improvements to the fishway and east dam abutment to provide AIS control. These proposed improvements would enhance the existing fishway and MT Dam by establishing physical controls to trap and sort desirable and undesirable species. Gates will be installed or modified to provide flow control and a barrier to AIS. The fishway exit (water supply) would be modified or replaced to provide more effective flow control and barrier to AIS. A weir and gate would be added to the MT FW to provide an internal fishway control to accommodate a separate trap and sort basin. The trap and sort basin would also be constructed along the west leg of the fishway.

Other Phase II improvements would provide aquatic invasive control by modifying the dam spillway to abandon a portion of that spillway that was historically intended to provide for fish passage (AKA fish slide). This portion of the spillway will be raised approximately 6 inches to equal the elevation of the main weir. A scour hole that has developed below the fish slide at the downstream toe of the dam would be filled with large rock to reduce mortality of fish at this location. A stainless steel lip would be attached to the dam spillway to aid in the prevention of sea lamprey movement over the dam.

Finally, at high flows (>Q5, greater than a 5-year (20%) recurrence interval 24 hour runoff event), the south dam abutment can experience bypass flow outside of the abutment. The south abutment and adjacent embankment would be modified to aid in prevention of flow (and AIS movement) outside of the dam structure.

No significant impact to water quality is expected as a result of the construction of the MT FW and AIS improvements to the MT Dam. A natural biological function of the river will be restored by allowing fish and
other aquatic life to pass the MT Dam. The existing millrace waterway would be dredged and re-filled with suitable soil to accomplish the construction of the fishway. The MT FW could increase the potential for AIS movement into the upstream waterway. Mitigation measures would be incorporated in project design and construction to minimize these effects. See Appendix C for more discussion regarding the AIS issue.

3.1.3.2.2 No Action Alternative

The No Action Alternative would not change the existing MT Dam. The existing and relatively infrequent opportunities for fish passage under moderate to high river flow events would be unchanged. While rip rap may be added to the base of the spillway to stabilize it, the added cost and extent of placing rip rap to protect fish larvae passage would not be included. Similarly, other work identified in existing and future dam engineering and safety inspections would be completed solely for protection of the dam’s structural integrity, human health and property, and not to address fish passage.

This alternative is not consistent with the various individual and joint states, federal, and international water resource and fish management plans established for Lake Michigan and the Great Lakes for enhancing fish stocks and their habitat, most notably for lake sturgeon and walleye. The abundance and genetic diversity of fish stocks and access to their historical habitats would remain limited in the lower Milwaukee River, the Estuary and near-shore waters of Lake Michigan. There would be no new opportunities for restoring sustainable populations of lake sturgeon and walleye to the Milwaukee River, its Estuary and near shore areas of Lake Michigan currently managed through artificial rearing and stocking programs. Fish larvae mortality would continue unabated as a result of the boil created below the MT Dam spillway.

Opportunities for expanded recreational fishing opportunities would not occur upstream of the MT Dam. In the absence of enhanced fish passage, the frequency and probability of AIS and pathogens passing beyond the MT Dam would be unchanged.

Water quality in the existing millrace would persist in poor condition. The MT Dam would remain an AIS barrier to Q5, but the improvement to reduce migration at higher flows would be foregone. The existing barrier to fish passage presented by the MT Dam would persist and severely limit access to life-cycle critical habitat above the dam. The scour hole at the toe of the dam would remain. That hole would likely grow over time and continue to create intensified greater hazard to fish survival in this area of the river.

3.1.4 Wetlands and Floodplains

3.1.4.1 Affected Environment
The Milwaukee River Watershed at the MT Dam encompasses approximately 650 square miles of drainage and has a mean annual discharge of 453 CFS. The estimated 7Q2 (Minimum 7-Day, 2-Year Discharge) and 7Q10 (Minimum 7-Day, 10-Year Discharge) upstream at the Village of Grafton (476 square miles) is 52 CFS and 24 CFS, respectively. The estimated 1% (100-year) recurring flood interval discharge is estimated at 14,210 CFS at the MT Dam. The Milwaukee River flows approximately 102 miles from its origin in the Town of Eden, in southern Fond du Lac County to its confluence with Lake Michigan in east central Milwaukee County. While the Milwaukee River Basin is dominated by agricultural and open space land uses (75%), it is the most urbanized river (25%) basin in Wisconsin. The Milwaukee River Basin is the most demographically diverse and populated river basin in Wisconsin with approximately 1.5 million residents, or 1 of every 6 state residents.

The MT Dam millrace environment has limited biological functions and values and the water supply is ephemeral as a result of a leaking millrace gate and the near surface water table associated with the river. Overdue and required maintenance of the gate and attendant seals would greatly reduce the millrace water budget. The millrace, by statute, is a part of the dam and not waters of the state.

The wetlands associated with the MT Dam are mapped by the WDNR and classified as open water palustrine wetlands with standing water that have been excavated (wetland map symbol WoHx). Adjacent wetlands mapped along the Milwaukee River in the immediate area are forested broad leaved deciduous palustrine wetlands on wet soils (wetland map symbol T3K). Most common plant species associated with these wetland types along the Milwaukee River are second growth wet to wet-mesic lowland hardwoods such as Black Willow, Green Ash, Box Elder, Silver Maple, Cottonwood and American Elm.

See Figure 1 in Appendix B for more information on wetlands and floodplains in the MT Dam area.

3.1.4.2 Environmental Consequences

3.1.4.2.1 Proposed Action Alternative

The proposed fish passage facility will not negatively impact water levels in the Milwaukee River, downstream of the MT Dam or upstream of the dam in the impoundment, during construction or when the fishway is operating. The construction of the fishway will be performed after the area is dewatered. Accumulations of groundwater or runoff to the millrace will be pumped to silt bags and a straw bale enclosure before being discharged to the river, per WDNR dewatering permit requirements.
Currently, storm water from the Village of Thiensville 38-inch by 24-inch storm-sewer discharges to the millrace and eventually the Milwaukee River. Under the proposed fishway alternative, storm water will be treated by a bio-filtration BMP below the existing storm-sewer outfall. The outlet will include peat filter media. Water quality in the remaining millrace ephemeral pool and ultimately the Milwaukee River will benefit by the storm-water treatment.

A portion of the features and aesthetics associated with the mill pond will be lost and replaced with an engineered stream and fishway. Exposed areas will be seeded with native upland and wetland grasses and wildflowers. A portion of the mill pond will remain as a water feature (approximately 30%).

The top of the millrace earthen embankment will be modified to remove a net 6 inches of material to ensure no changes to local flood elevations. The millrace embankment surface consists of crushed gravel and is managed as a riverwalk trail. That use will be restored following construction of the MT FW. The millrace inlet and outlets are greatly undersized such that the impoundment cannot be drained through the millrace. As a result, modification of the millrace gate for purposes of providing fish passage would not impact water elevation management in the upstream impoundment.

Additional lands expected to be temporarily used or disturbed by constructing the MT FW include the Village of Thiensville’s Village Park bituminous paved public parking lot and gravel covered landing that adjoins the spillway abutment. Under the proposed fish passage alternative, there would be no increase in the existing and locally adopted 1% (100-yr) recurring flood interval.

No buildings, roads or treatment units will be built or destroyed as part of this project. The proposed fishway alternative design, plan and funding includes the construction of 450 linear feet of pedestrian friendly split-rail fencing along the outer perimeter of the fishway. The sediment in the millrace is dominated by clay and silt sized particles. Laboratory testing of the sediment indicated that inorganic and organic pollutants of concern were not present at levels requiring any special handling on or off site. The proposed placement of fill in the millrace is not expected to affect flood elevations, human health, nor the environment. The construction of the MT FW will be completed in dry conditions preventing the release of material to the Milwaukee River.

No sediment or other disturbances to the bed and bank of the Milwaukee River will occur under the proposed fishway alternative.

The open water wetlands associated with the mill pond will be temporarily impacted through draining, filling, compaction and siltation by the project plan. The net effect to wetlands will be positive, as vegetation will be improved with the addition of native plant species and hydrology will be
restored as described below. The restoration plan for the MT FW includes with a more diverse native plant community than what currently exists. A portion of the excavated wetlands will be backfilled with soils that will support wetland plants. The restored stream for fish passage will restore the hydrology of the wetland to that of a riparian wetland rather than the hydrology of the existing excavated open water wetland mill pond.

3.1.4.2.2 No Action Alternative

Issues related to the artificially high water levels and biologic isolation created by the mill pond will not be addressed with the No Action Alternative. These issues include retaining higher water temperatures and lower dissolved oxygen in the mill pond, modified surface water/groundwater interactions, inability of wetlands and floodplains to reach their full biological potential due to habitat fragmentation, and modified hydrology of riparian wetlands.

The No Action Alternative would have no beneficial impacts on the wetlands. The existing excavated wetlands and the associated water quality and habitat would remain in its degraded condition.

3.1.5 Aquatic Biology

3.1.5.1 Affected Environment

3.1.5.1.1 Habitat

The Milwaukee River is classified as a Warm Water Sportfish Community. This community includes many potamodromous and adfluvial species dependent on movement and migration within the watershed to fulfill life-cycle requirements. River features downstream of the MT Dam are dominated by riffles and deep runs. Substrate is dominated by large gravel, cobble and lesser amounts of boulder, small gravel and coarse sand. Dominant cover includes large woody debris and boulders. Macrophytes are present but not at nuisance levels.

The MT Dam millrace environment has limited biological functions and values and the water supply is ephemeral as a result of a leaking millrace gate. The millrace, by statute, is part of the dam system and not waters of the state. Water depths in the millrace range from a few inches to 4 feet, and averages 1 foot or less. A Village of Thiensville 38-inch by 24-inch storm sewer also contributes intermittent discharges of surface water runoff from a medium density residential/institutional area on Elm Street.

When flowing, surface water elevations in the millrace are higher than water elevations in the adjacent Milwaukee River. Storm sewer runoff from the Village of Thiensville Village Park parking lot drains to the impoundment by sheet flow. The millrace is located in the floodway of the Milwaukee River and is submerged with the same frequency as the MT Dam spillway.
Sediment/soil depth to refusal (depth below which a pile cannot be driven due to a restrictive layer such as bedrock or clay) in the millrace ranges from 1 foot to 8 feet. A composite sediment/soil core sample was collected and analyzed for a variety of physical and chemical constituents. The results indicate that the quality of sediments will not require any special management practices and may be retained in the millrace as common fill.

The Milwaukee River downstream of the MT Dam averages about 225 feet in width. Water depths within the deepest part of the river’s cross-section (Thalweg) range from 1.5 feet in runs to 6 feet in the scour hole located below the dam. The shoreline is generally non-eroding with cobble, gravel and coarse sand armoring the lower bank. Bank vegetation includes grasses, lawn, trees and woody shrubs.

Sediment in the Milwaukee River in areas potentially affected by the placement of coarse fill for the construction of various fishway alternatives is dominated by gravel, cobble and boulder sized material, and lesser amounts of medium to coarse sand. Silt and clay sized material is generally absent as a result of scouring flows. Pollutants of concern are adsorbed by silt and clay sized material and organic matter. The lack of these types of material would infer that the potentially affected river bed material would not include pollutants of concern. According to the WEPA EA completed by the WDNR for the MT FW, laboratory testing of the sediment in the area of the proposed MT FW “indicated that inorganic and organic pollutants of concern were not present at levels requiring any special handling on or off site” (Wawrzyn et al., 2009, p. 19).

3.1.5.1.2 Macroinvertebrates

No site specific sampling of macroinvertebrates was performed for the MT FW project site. Historic work in the vicinity indicates that macroinvertebrates are more abundant below the dam in that flowing reach of the river. Higher photosynthetic and respiration rates by the abundant macrophytes in the Bridge Street impoundment are likely responsible for wider diurnal dissolved oxygen fluctuations within that impoundment. These fluctuations are less prevalent in Lime Kiln impoundment due to the general absence of macrophytes at that location and short water retention times.

Work performed by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) determined that riffle habitats contain the highest quality macroinvertebrate communities compared to pool, run, snag, or lake habitats in the Milwaukee River watershed. Habitat types such as lakes, pools, riffles, and runs generally contain very different compositions of substrates, water depths, and flows, which affects the abundance and diversity of the associated macroinvertebrate community.
The Milwaukee River Watershed’s macroinvertebrate community quality has generally remained in the good-to-very good Hilsenhoff Biotic Index (HBI) rating from 1975 to the present within most of the subwatersheds. However, eight, or nearly 40 percent, of the subwatersheds contained sites that ranked in the fair HBI classification, which indicates some level of potential impairment to the macroinvertebrate abundance and diversity. Except for the Lincoln Creek subwatershed, most of the subwatersheds throughout the Milwaukee River watershed continue to sustain a fair to good-very good macroinvertebrate community. The macroinvertebrate community is also generally trophically balanced and not dominated by tolerant taxa.

There are five main groups of macroinvertebrates in the trophic structure. They are: shredders, collectors, filterers, scrapers and predators. Basically, the relative abundance of the various groups is directly dependent upon the abundance of the available food and habitat. In small headwater or 1st and 2nd order streams, shredder organisms should be more common and abundant than scraper organisms. Filter-feeders should be most abundant in mid-sized rivers, from 3rd to 5th order streams. However, the ratio of predators to other organisms is much more stable, when comparing small streams to large streams. Macroinvertebrate sampling protocol works from the suggestion that these groups of insects may be used as indicators of certain kinds of stream disturbance or pollution.

Further analysis of the East Branch of the Milwaukee River and Lower Milwaukee River subwatersheds indicates that the proportions of collectors have not changed significantly from 1979 to 2004. The proportion of collectors in the East Branch of the Milwaukee River subwatershed is significantly less than the Lower Milwaukee River subwatershed. This difference in the trophic structure between these subwatersheds implies that streams in the East Branch of the Milwaukee River subwatershed are potentially less disturbed or have better water quality than streams in the Lower Milwaukee River subwatershed. Similarly, the high proportion of scrapers in the East Branch of the Milwaukee River subwatershed and the loss of scrapers in the Lower Milwaukee River subwatershed from 1979 to the present also indicates that the former subwatershed contains a higher quality macroinvertebrate community trophic structure. Each of these patterns is consistent with improvement in water quality in the East Branch of the Milwaukee River subwatershed and a decline in water quality in the Lower Milwaukee River subwatershed. Water quality improvement may be related to a decrease in organic or inorganic pollution, decrease in nutrients, improvements in dissolved oxygen concentrations, decreases in heavy metals or other toxic contaminants. The East Branch of the Milwaukee River benefits from large blocks of land in passive-use public ownership, including such areas as the Kettle Moraine State Forest. The continued reforestation...
and general habitat improvement in the East Branch watershed likely contributes to improved water quality during the subject period.

The Lower Milwaukee River watershed has been undergoing intensive development during the past 30 years, with Ozaukee County’s population growing 30%, and agricultural and open space areas declining proportionally. Increasing the population of a watershed occupied by impervious surfaces is generally correlated with degrading habitat.

The Lower Milwaukee River watershed has had a much higher proportion of impervious surface when compared to the East Branch Milwaukee River watershed. Moreover, the Lower Milwaukee River has been rapidly converting to a more urbanized area while the East Branch contains large parcels of protected forest and open-space land.

Wisconsin researchers have generally found that as the amount of human land disturbance increases, such as in the Milwaukee River watershed, the subsequent macroinvertebrate community diversity and abundance decreases, which is generally supported by the data for this watershed. In addition, this fairly high quality of macroinvertebrates found throughout most of the Milwaukee River watershed may also be a function of the integrity and continuity of riparian buffers greater than 75 feet adjacent to the streams and lake systems (see the “Habitat and Riparian Corridor Conditions” section below). Effective buffers help reduce pollutant loadings and other human disturbances.

The fish community contains an abundance of both warmwater and coldwater species of fish and seems trophically balanced in the highest quality areas. These areas contain a good percentage of top carnivores (except for those species stocked), and are not dominated by tolerant fishes.

In differing degrees throughout the watershed, water, sediment, and habitat quality are important factors limiting both the fishery and macroinvertebrate community. There are several other factors that are likely to be limiting the aquatic community, including, but not limited to, 1) periodic stormwater loads and sediment toxicity; 2) decreased base flows; 3) continued fragmentation due to dams, drop structures, culverts, concrete lined channels, and enclosed conduits; 4) past channelization; 5) cropland erosion, and/or 5) increased water temperatures due to urbanization (SEWRPC, 2007).

Degraded benthos and aesthetics are two BUIs for the Milwaukee Estuary AOC. Steps to improve these attributes in the project area will likely contribute to cumulative benefits to the AOC.

3.1.5.1.3 Aquatic Vegetation

Submerged aquatic vegetation is not common along the Milwaukee River in the project vicinity. Where vegetation does occur the most commonly
observed plants include coontail, common waterweed, sago pondweed and long-leafed pondweed. When submerged during warm growing periods, the millrace is capable of producing nuisance amounts of non-native Eurasian water milfoil and curly-leaf pondweed. These plants are not normally found to be abundant in free-flowing riverine environments. The likely source for these later species is the Thiensville Impoundment which contains large and dense beds of these plants in shallow backwaters and bays. Emergent plants in the millrace include broad-leaf cattail and softstem bulrush. Purple loosestrife is also present along the shoreline. Duck weed and blue-green filamentous algae have been observed covering large portions of the millrace water surface.

3.1.5.1.4 Fisheries

Fish Community

The Milwaukee River contains a diverse cool to warm water fish community, including sport and forage fish species. Gamefish and panfish known to be present or suspected to be present within a five mile range, upstream and downstream, of the LK Dam include smallmouth and largemouth bass, walleye, northern pike, bluegill, green sunfish, pumpkinseed, rock bass, black crappie, channel catfish, flathead catfish, yellow and black bullhead, and lake sturgeon. Similarly, an abbreviated list of common forage or non-game species in the Milwaukee River within five miles of the LK Dam may include longear sunfish, logperch, johnny darter, blackside darter, fantail darter, least darter, Iowa darter, fathead minnow, spotfin shiner, golden shiner, blunt nose minnow, common carp, central and largescale stoneroller’s, sand shiner, common shiner, horneyhead chub, white sucker, striped shiner, creek chub, rosyface shiner, redfin shiner, brook stickleback, mimic shiner, central mudminnow, banded killifish, stonecat, tadpole madtom, and four species of redhorse including the greater, shorthead, golden and silver redhorse. Fall populations of coho and chinook salmon, and an occasional brown trout and fall and spring rainbow trout may be present below the LK Dam when river discharge and water depths allow a limited number of these migrants from Lake Michigan to pass over the MT Dam. The Milwaukee River is classified as a Warm Water Sportfish Community per NR 102 and NR 104. Improvements to habitat access for adfluvial/potamodromous species will likely benefit the AOC and contribute to BUI delistings (Wawrzyn et al., 2009).

Invasive species

Although the dam does obstruct fish movement during low to moderate flows and water levels, the MT Dam is not considered a complete barrier to AIS/VHS. During large flood events, the MT Dam could allow “jumping” VHS infected fish to move upstream. In addition, the proximity of the
tailwater elevation to the crest of the dam during higher flows could allow adult sea lampreys to climb the dam and move upstream.

3.1.5.1.5 Threatened and Endangered Species

**Endangered, Threatened and Special Concern Species**

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked. A survey of the Natural Heritage Inventory (NHI) for this project (see Appendix C, Document 4) includes six fish species documented as being present or potentially present in the LK Dam project area. This area is located within 2 miles upstream of the MT FW site. While some of these listed fish species are still encountered during routine field assessments, the lack of recent occurrences cannot discount their continued presence since their habitat remains intact. For the purposes of this Environmental Assessment and the MT FW project, their presence will be assumed. There are no federally listed fish species in the Milwaukee River Basin or more specifically, in the MT FW project area.

**Endangered**

The striped shiner is the only state listed endangered fish species that potentially exist or are known to exist in the project area.

**Striped Shiner**

The striped shiner is ranked with a global element of G5 and a state element rank of S1. These rankings indicate that while the striped shiner is demonstrably secure globally it is critically imperiled in Wisconsin. The S1 or critically imperiled ranking is due to extreme rarity defined as five or fewer occurrences per acre, very few remaining individuals, or because some factors make it especially vulnerable to extirpation from the State. Its numbers have declined so much in recent years that it is nearly extirpated from the state. During the mid-1990’s, WDNR crews sampled multiple reaches at various times along the Milwaukee River and identified a single specimen from the river in Ozaukee County.

The striped shiner prefers clear to only slightly turbid waters of runs and shallow pools, with dense aquatic vegetation over substrates of cobble, boulders, silt, sand, mud or bedrock. Spawning occurs from late May through June (Becker, 1983). They are likely to frequent water depths ranging from 0.1 - 1.5 m (Pfleiger, 1975). A study of striped shiners from the Milwaukee River in Ozaukee County revealed that the fish consume hymenoptera, coleoptera, other aquatic insects, filamentous algae, and
vegetative material (Trautman, 1957). During drawdown and construction, turbidity levels may increase but will be of short duration.

**Threatened**

Three state listed threatened fish species that potentially exist or are known to exist in the project area include the greater redhorse, redfin shiner and longear sunfish.

**Greater Redhorse**

The greater redhorse is ranked globally as a G3 and has a statewide ranking of S2S3. These rankings indicate that the greater redhorse is either very rare and local throughout its range, found locally abundant in a restricted range, or that other factors may make it vulnerable to extinction throughout its range. The Milwaukee River Basin has one of the most secure populations of greater redhorse in Wisconsin.

The greater redhorse prefers clear water of medium to large rivers, over bottoms of sand, gravel, or boulders. Spawning occurs in May or June. The greater redhorse spawns over substrate consisting of gravel with mixtures of sand and small rubble in moderate to swift currents. It generally feeds on a diet of aquatic insects, mollusks, crustaceans and plant material (Becker, 1983).

**Redfin Shiner**

The redfin shiner is ranked globally as G5 and has a statewide ranking of S2. These rankings consider the Redfin shiner to be secure globally though quite rare in parts of its range. Within Wisconsin however, it is very rare and very vulnerable to extirpation. It has been collected in small numbers from the Milwaukee River and Cedar Creek in Ozaukee County, and even more infrequently from the Milwaukee River in Milwaukee County (Becker, 1983 and Lyons et al., 2000). The redfin shiner prefers more turbid waters of pools in low-gradient streams over substrates of boulders, cobble, sand, silt or detritus. Spawning occurs from early June through mid-August in sunfish nests where they coexist with sunfish in the nesting territory. Their diet is dominated by aquatic and terrestrial insects and at times, is dominated by filamentous algae (Becker, 1983).

**Longear Sunfish**

The longear sunfish is ranked globally as a G5 and has a statewide ranking of S2. These rankings consider the longear sunfish to be secure globally though it may be quite rare in parts of its range. In Wisconsin, it is very rare and very vulnerable to extirpation. The Milwaukee River Basin was once one of the states more important strongholds (Greene, 1935 and Becker, 1983). More recently, Milwaukee River Basin populations have been in steep
decline with a few remnant populations present in the Washington and Fond du Lac Counties (Lyons, et al., 2000).

The longear sunfish prefers clear, shallow, moderately warm, still waters of streams and small lakes in or near vegetation. Spawning occurs from late May through mid-July, and sporadically to August. The longear sunfish is opportunistic with a diverse diet including aquatic and terrestrial insects, fish eggs, larval fish, small crustaceans and aquatic plant material (Becker, 1983).

**Special Concern**

Three state listed fish species of special concern that potentially exist or are known to exist in the project include the banded killifish, least darter and lake sturgeon.

**Banded Killifish**

The banded killifish is ranked globally as G5 and statewide as S3. By this ranking, the banded killifish is considered to be secure globally though they may be quite rare in parts of its range. Within Wisconsin however, its ranking indicates that it is rare or uncommon and vulnerable to extirpation. Small numbers of banded killifish have been identified in the Milwaukee River and Cedar Creek watershed in Ozaukee County (Becker, 1983 and Lyons et al., 2000).

The banded killifish prefers the clear shoal waters of estuaries and lakes, backwaters and areas in streams with slower currents (Becker, 1983). Substrate preferences include a wide range of substrates including gravel, sand, silt, marl, clay, detritus or cobble generally with sparse vegetation in water depths up to 0.6 m. Spawning occurs from June through mid-August over coarse sand substrate. The diet of the banded killifish is somewhat habitat-specific and depends on the availability of food types. Generally they feed upon small crustaceans, insect larvae, plant material and algal filaments. The young have much more specific requirements and reportedly feed almost exclusively on planktonic crustacea and chironomid larvae.

**Least Darter**

The least darter is ranked globally as G3 and statewide as S3. These rankings infer that the fish is either very rare and local throughout its range or found locally in a restricted range; They are rare or uncommon in Wisconsin. Earlier records indicated the least darter to be common in southeastern Wisconsin, including the Milwaukee River Basin and in particular the Menomonee River Watershed (Greene, 1935). More recent accounts indicate that habitat changes have greatly reduced its distribution and relative abundance (Becker, 1983; Fago, 1985 and Lyons et al., 2000).
The least darter prefers clear, warm, quiet waters of overflow ponds, pools, lakes and streams over substrates of gravel, silt, sand, boulders, mud or clay with dense vegetation or filamentous algal beds, and at depths less than 1.5 m. Spawning occurs from late April into July. The diet of the least darter consists of aquatic insect larvae and nymphs, copepods and cladocerans (Becker, 1983).

Lake Sturgeon

Lake sturgeon is ranked globally as G3/G4 (vulnerable) and statewide as S3. Globally the fish is very rare and local throughout its range; or globally secure and quite rare in parts of its range. It is rare or uncommon in Wisconsin but with secure populations in the Wolf/Fox River basins. Until recently, the lake sturgeon was considered absent from the Milwaukee River basin except for a small non-reproducing remnant population in Big Cedar Lake in Washington County, a result of a non-planned stocking by the former Wisconsin Conservation Department in 1936. An occasional lake sturgeon is observed by WDNR fisheries and commercial fishers working in the Milwaukee River Estuary or near-shore waters of Lake Michigan. The WDNR and its partners have been rearing lake sturgeon at its streamside rearing facility along the Milwaukee River at Newberg in an effort to restore sustainable populations in the Milwaukee River and near-shore waters of Lake Michigan. Since 2003, approximately 64,000 larvae and 5,112 lake sturgeon fingerlings have been stocked in the Milwaukee River. Improved passage between Lake Michigan and suitable spawning/rearing habitats is essential to restoring this species, a direct biological link between the AOC, Lake Michigan, and the Milwaukee River Watershed. Its re-establishment will also help delist some AOC BUIs.

The lake sturgeon prefers large rivers and lakes. It also lives in the shoal waters of the Great Lakes. Inland it shows a preference for the deepest mid-river areas and pools. Spawning occurs from late April through early June in cold, shallow fast water over large rocky substrate. The lake sturgeon diet includes mussels, insect larvae, leeches, and snails (Becker, 1983).

3.1.5.2 Environmental Consequences

3.1.5.2.1 Proposed Action Alternative

The physical and chemical water quality and physical habitat features of the Milwaukee River will not be significantly impacted by construction or operation of the proposed fishway. Approximately 2 acres of the 2.6-acre millrace will be converted from an ephemeral pool habitat to habitat mimicking an engineered flowing stream. The remaining 0.6 acres of the fishway facility will be planted with native grasses and forbs and managed as a lowland and upland mesic prairie. Water quality in the remaining millrace will improve as the storm sewer discharge will receive some level of treatment by the addition of two basins at the storm sewer outfall. Habitat in
the remaining portion of the millrace will have a more perennially wet environment as water is diverted from the fishway at a rate of 1 CFS.

The proposed fishway will increase the abundance and genetic diversity of fish stocks. Access to their historical habitats would be enhanced along the Milwaukee River, its Estuary and near-shore waters of Lake Michigan. Enabling fish passage will increase the probability of developing sustainable populations of lake sturgeon and walleye within these waters. Recreational fishing opportunities would be greatly expanded along the river and tributaries upstream of the MT Dam.

Modifications to the millrace will not negatively impact the fishery resources of the Milwaukee River. This proposed fish passage alternative provides a simple and cost effective means for temporarily or permanently closing the fishway should the threat of AIS, VHS or other fish pathogens be identified as a threat to upstream fishery resources. While a temporary or permanent closure of the fishway may be expected to decrease the frequency of AIS or pathogen passage, it may not decrease the probability of AIS or pathogen passage over the dam under moderate to high discharge conditions, or other upstream or local vectors.

The current millrace gate will be repaired or replaced to allow the gate to be easily and quickly closed for servicing the fishway or halting the passage of fish in the event that AIS or fish pathogens are identified as a threat to upstream reaches of the watershed until such time that other management options are available to halt or otherwise manage their spread. Even if AIS and fish pathogens forced the closure of the fishway, the frequency of AIS and pathogens may be reduced but the probability would remain that AIS and pathogens would eventually pass to uninfected areas as a result of dam submergence during moderate to high flow events. Closing the millrace gate would not prevent the spread of AIS or fish pathogens from upstream sources of infection. See Document 1 in Appendix C for more discussion regarding AIS.

The construction of the proposed MT FW will not directly or indirectly impact the aquatic plants in or along the Milwaukee River. Filling and construction of the fishway in the millrace will eliminate the submerged and emergent aquatic plants. The terrestrial portion of the constructed fishway will be planted and managed with native grass and forbs. Great care should be taken to ensure that no new invasive species seeds or plant parts are brought in by equipment or fill during construction, especially common reed.

The MT FW would enhance diversity and overall integrity of the aquatic ecosystem by re-establishing natural dispersal avenues for native fauna and by restoring the biological function of previously isolated watershed areas. AIS movement could occur via the fishway. An operable gate and trap and sort facilities would be required for AIS control.
The MT FW would occupy the former millrace waterway, and left abutment improvements would occupy or disturb riparian habitat during construction. Repair of the scour hole below the existing ‘fish slide’ would reduce fish mortality. Installation of a stainless steel lip on the spillway crest and raising the spillway elevation at the location of the existing ‘fish slide’ would impede future lamprey movement at a variety of flows and enhance the effectiveness of the MT Dam as an AIS barrier.

3.1.5.2.2 No Action Alternative

The No Action Alternative would make no changes to the existing MT Dam or the fishway to protect the fishery from the potential adverse spread of aquatic invasive species. The existing and relatively infrequent opportunities for fish passage under moderate to high river flow events would be unchanged. While rip rap may be added to the base of the spillway to stabilize it, the added cost and extent of placing rip rap to protect fish larvae passage would not be included. Similarly, other work identified in existing and future dam engineering and safety inspections would be completed solely for protection of the dam’s structural integrity, human health and property, and not for fish passage.

This alternative is not consistent with the various individual and joint states, federal, and international water resource and fish management plans established for Lake Michigan and the Great Lakes for enhancing fish stocks, most notably lake sturgeon and walleye, and their habitat. The abundance and genetic diversity of fish stocks and access to their historical habitats would remain limited in the lower Milwaukee River, the Estuary and near-shore waters of Lake Michigan. There would be reduced opportunities for restoring sustainable populations of lake sturgeon and walleye to these waters currently managed through artificial rearing and stocking programs. Fish larvae mortality would continue as a result of the boil created below the MT Dam spillway. Opportunities to contribute to Milwaukee Estuary AOC BUI delistings would be unfulfilled.

Opportunities for expanded recreational fishing opportunities would not occur upstream of the MT Dam. In the absence of enhanced fish passage, the frequency and probability of AIS and pathogens passing beyond the MT Dam would be unchanged.

Failure to improve fish passage at the MT Dam location precludes establishment of consistent passage of native potamodromous fish between life-cycle critical habitat areas. The No Action Alternative would continue impediments to natural dispersal migration of fish and other native fauna. Aquatic diversity would continue to be limited. AIS movement into the river reach above the dam would be blocked to river flows equivalent to the volume associated with the 5-year, 24-hour recurrence interval storm event (Q5).
3.1.6 Terrestrial Wildlife

3.1.6.1 Affected Environment

3.1.6.1.1 Wildlife Habitat

Wildlife species observed in the vicinity of the Milwaukee River and millrace include whitetail deer, muskrat, mink, raccoon, gray squirrel, coyote and unverified reports of river otter. Bird species include robin, cardinal, warbler, cedar waxwing, chickadee, nuthatch, catbird, kingfisher, great blue heron, red-winged blackbird, Canada geese and mallard ducks. Osprey are occasionally observed fishing and flying along the Milwaukee River corridor in Ozaukee County and Milwaukee County to the south. Bald eagle nests are located approximately two miles north of the project site along a backwater of the Milwaukee River and four miles east along the Lake Michigan bluffs. The nesting pairs produce offspring and the adults have been observed flying along the Milwaukee River corridor.

No comprehensive surveys of turtles and herptiles have been completed for the Milwaukee River in the vicinity of the proposed fish passage facility or the millrace. Snapping turtle, bullfrog and green frog have been observed in the millrace especially during flowed or pooled conditions.

Based on a review of the NHI there are no federal listed threatened or endangered, proposed or candidate species located in the project area that would be affected by the proposed fish passage alternative.

3.1.6.2 Environmental Consequences

3.1.6.2.1 Proposed Action Alternative

Filling of the millrace for the proposed fishway would have the potential to temporarily or permanently displace turtles and herptiles from their current habitat. The direct impacts associated with filling the millrace can be reduced by filling during late summer or early fall prior to estivating or bromating, and by proceeding from the top of the millrace to the millrace outlet to allow herptiles to relocate to other aquatic and terrestrial sites. Ultimately, turtle and herptile numbers will decrease as the amount of ephemeral pool habitat decreases. Their numbers and diversity are not expected to change in portions of the millrace that are retained nor is their abundance and diversity subject to significant adverse impact as a result of the project.

No mammals are expected to be displaced as a result of constructing the proposed MT FW. Most of the mammals are terrestrial, therefore any addition of terrestrial habitat would improve cover for these species. The created terrestrial habitat will provide suitable feeding sites and nesting cover for beneficial snakes, such as the garter snake. Snake abundance may increase slightly as the grassland habitat matures and produces suitable prey such as small frogs, insects, mice, and snails.
Following restoration of the upland areas, suitable grass/forb or grass/shrub cover types would attract and provide feeding habitat for edge species such as house wrens, gray catbirds, and American goldfinches. These and other bird species would use the prairie cover for nesting and feeding sites. Nesting habitat and foraging perches would improve for riparian warblers. Ground nesting bird species may benefit by the addition of native grasses and forbs. Ground nesting waterfowl would also use established grassy areas as secure nest cover. The increased use by birds may also attract raptorial and mammalian predators. Many of the summer residents would consume the seeds and insects produced in the riparian vegetation.

3.1.6.2.2 No Action Alternative

There would be no impact to the wildlife in this area if no action is taken.

3.1.7 Vegetation

3.1.7.1 Affected Environment

Submerged aquatic vegetation is not common along the Milwaukee River in the project vicinity. The most commonly observed plants include coontail, common waterweed, sago pondweed and long-leaved pondweed.

When flowing during warm growing periods, the millrace is capable of producing nuisance amounts of non-native Eurasian water milfoil, and curly-leaf pondweed. These plants are not normally found to be abundant in free-flowing riverine environments. The likely source for these later species is the MT Dam impoundment which contains large and dense beds of these plants in shallow backwaters and bays. Emergent plants in the millrace include broad-leaf cattail and softstem bulrush. Purple loosestrife is also present along the shoreline. Duck weed and blue-green filamentous algae have been observed to cover large portions of the millrace water surface.

Trees located along the millrace earthen berm include willow, box elder, cottonwood and green ash.

3.1.7.2 Environmental Consequences

3.1.7.2.1 Proposed Action Alternative

The construction of the proposed MT FW will not directly or indirectly impact the aquatic or terrestrial plants in or along the Milwaukee River. Filling and construction of the MT FW in the millrace will eliminate the submerged and emergent aquatic plants. The terrestrial portion of the constructed MT FW will be planted and managed with native grass and forbs. Reasonable care should be taken to ensure that no new invasive species seeds or plant parts are brought in by equipment or fill during construction, especially common reed.

Trees and deep rooting woody shrubs will be removed from the earthen berm. The need to remove this vegetation is not a consequence of constructing the MT FW. Rather, removal is needed to maintain the
structural integrity of the millrace earthen berm and to be consistent with sound engineering practices for dam maintenance and safety. Willow, box elder, cottonwood, and green ash are the most common trees growing on the millrace embankment. Following the recommendations of dam structural engineers, removal of the wooded vegetation would eventually extend the entire length of the earthen berm, not just the section abutting the MT FW.

3.1.7.2.2 No Action Alternative

The desirable aquatic macrophytes in the millrace area struggle under poor water quality conditions. Algae and less desirable aquatic plants currently dominate and will continue to do so.

The No Action Alternative will have no impact on existing vegetation. The existing terrestrial plants are in fair to good condition. The existing barriers sustain artificial hydrology and disrupt sediment. These issues influence riparian vegetation. Vegetation removal from the millrace berm would eventually be completed in association with normal facility maintenance.

3.1.8 Cultural and Historic Resources

3.1.8.1 Affected Environment

Cultural resources within Ozaukee County, the city of Mequon and the Village of Thiensville can encompass archaeological and historic resources, including but not necessarily limited to buildings, structures, objects, districts, and sites. These resources represent a variety of periods ranging from the prehistoric to the present day.

3.1.8.1.1 Archaeological and Historic Resources

During completion of the WEPA EA for the MT FW, letters were sent to the State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Offices (THPO) of the Wyandotte Nation, Oneida Tribe of Indians of Wisconsin, the Prairie Band of Potawatomi Nation and the Winnebago Tribe of Nebraska requesting their review and comments on the project’s potential impacts to historical and cultural properties. Correspondence received from SHPO indicated there were no archaeological or architectural significant properties in the project area (Wawrzyn et al., 2009).

An archaeological investigation of the project area was completed in August 2009. As part of that study, the historical integrity of the MT Dam was also evaluated. The following paragraphs are taken or adapted from the report Archaeological Investigations for the Milwaukee River Watershed Fish Passage Project, Ozaukee County, Wisconsin (Great Lakes Archaeological Research Center (GLARC), 2009).

The Architecture History Memo included in Appendix A of the GLARC report (included as Document 5 in Appendix C of this EA) provides the following information: The MT Dam lies just west of Thiensville Village Park and is not immediately adjacent to any built resources. The original dam was
constructed in 1842 to power a flour mill nearby. The dam was rebuilt in 1886, 1913, and 1939. A series of alterations was begun in 1941 and continued until 1976 when a concrete slab was added to the spillway. Because the flour mill was demolished in 1956, no existing historic resources are currently associated with the MT Dam. Due to the large number of alterations and modifications to the dam since its last construction in 1939, it retains a low degree of historic integrity.

In August 2009, GLARC conducted Phase I archaeological investigations along seven watersheds (Fredonia Creek, Riverside Drive Creek, Trinity Creek, Lac du Cours Outlet, Ulao Creek, Riveredge Creek, and Mole Creek) and three dams (Lime Kiln, Bridge Street, and Mequon-Thiensville) within Ozaukee County. The investigations were conducted within the area of potential effect for areas of proposed impediment removal associated with the project. Archaeological investigations were conducted to partially fulfill requirements associated with the execution of Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665) as amended and 36 CFR, Part 800, which serves to implement the Act.

Investigations of the project areas were conducted in two stages. The first stage consisted of review of existing information to identify previously documented archaeological and burial sites within one mile of the project areas. The second stage consisted of archaeology survey of those portions of the project areas that would be potentially affected by ground disturbing activities. The survey included visual site inspection, surface survey, and close interval shovel testing.

During the archival and literature review, 15 archaeological and burial sites were identified within one mile of the MT Dam project area. One of the archaeological sites (47OZ0039) was identified within the immediate project area; however, no evidence of the site was found during archaeological survey of the area.

In summary, no archaeological sites, cultural materials, or historic properties that would be impacted by the project were identified as a result of archaeological survey within the project area.

3.1.8.2 Environmental Consequences

3.1.8.2.1 Proposed Action Alternative

All ground disturbing activities proposed will occur within the riverbed or immediately adjacent (within 10 feet) of the river’s edge and within the existing millpond area. These areas, including the area adjacent to the MT Dam and the area of the documented archaeological site (47OZ0039), were visually inspected during the archaeological investigation as previously discussed. The areas were found to be completely disturbed through modern land use practices. In particular, the area of the reported
archaeological site 47OZ0039 was also found to be disturbed, and is presently a landscaped park with rip rap.

The investigation found that the Proposed Action will not adversely affect the cultural resource base in the project area. However, it noted that current conventional archaeological survey techniques are inadequate to determine the presence of deeply buried archaeological or paleontological deposits. The report indicated the probability for encountering such sites is unlikely but that if any materials are encountered, construction in the area of the discovery should be halted and the State Historical Society of Wisconsin should be consulted. The same course of action would be required if human remains or other indications of a burial site are encountered.

3.1.8.2.2 No Action Alternative

The No Action Alternative will not impact existing cultural resources either directly or indirectly. This alternative will allow for existing conditions to remain as they currently are. Archaeological and historic resources will neither be preserved in another manner nor damaged under the No Action Alternative.

3.1.9 Visual Quality and Aesthetics

3.1.9.1 Affected Environment

The MT Dam has a structural height of 13 feet and forms a 700-acre and 5.5-mile-long impoundment. A 6-foot by 6-foot gated opening in the spillways north abutment discharges to the current millrace area, which is approximately 800 feet long, 150 feet wide, and 2.6 acres in area. The north side of the millrace includes six single residential homes and one commercial building located at the outlet of the millrace. The Village of Thiensville owns the millrace, its earthen embankment and the bed extending from the millrace earthen embankment south to the centerline of the Milwaukee River. The millrace earthen embankment is managed as a riverwalk and is an extension of the Thiensville Village Park.

The Thiensville Village Park, located along the Milwaukee River, features baseball diamonds, tennis courts, a playground and picnic areas, and a public boat launch. Nearby, the Rotary Riverwalk is being developed along the Milwaukee River in the Town Center by the local Rotary clubs. Eventually, this walkway will extend along the banks of the Milwaukee River from Thiensville Village Park south to Mequon Road in Mequon.

The MT FW will be constructed within the upper 2 acres of the existing 2.6-acre millrace, and will be 1,180 feet long, with a slightly meandering alignment that approximates the aesthetics of a meandering stream. The initial portion of the fishway will flow west for 600 feet where it will enter a 180-degree bend and flow east toward the spillway.
3.1.9.2 Environmental Consequences

3.1.9.2.1 Proposed Action Alternative

The construction of the MT FW is intended to mimic a natural stream to increase the aesthetic quality of the millrace area. This may also serve as a point of interest in the community that will broaden use of existing public park land. Construction of the MT FW will benefit the visual quality and aesthetics of the area by showcasing Ozaukee County’s unique combination of natural features such as land, water, vegetation, and geologic formations.

Minor visual effects would occur as the footprint of the fishway is modified to accommodate a trap and sort facility for AIS control. The steel lip proposed for the dam spillway should not be visible. Left abutment modifications would be apparent. These will be designed and constructed to complement the aesthetic design of the recently modified right dam abutment.

A pedestrian bridge will be provided for access to and viewing of the fishway. A fence will be constructed between public and private property to mitigate access and visual concerns from adjacent residents.

3.1.9.2.2 No Action Alternative

The No Action Alternative will not make any changes to the existing MT Dam and will have no impact on existing visual quality and aesthetics.

3.1.10 Transportation

3.1.10.1 Affected Environment

3.1.10.1.1 Transportation Network

State of Wisconsin

Within the State of Wisconsin, the transportation network consists of roadways, trails, rail lines, ports, and airports.

The MT Dam is located within the Milwaukee River watershed. Regional access into this area of the State is provided by state roadways under the jurisdiction of the Wisconsin Department of Transportation (WisDOT). These roadways include Interstate 43/State Trunk Highway (STH) 57/STH 32, which is the primary north-south road; STH 167, which provides east-west access though Thiensville; STH 60, which provides east-west access through Grafton; and STH 33, which provides east-west access through Port Washington and Saukville (Ozaukee County, 2009). County and local roadways then provide local access to the MT Dam.

Ozaukee County
Ozaukee County is well-served by a series of freeways, state highways, major roads, and local roads. The Ozaukee County Highway Department is responsible for maintaining a total of 448 miles of roads within the county: 27 miles of Interstate Highway, 64 miles of State Trunk Highways, 154 miles of County Trunk Highways, and 203 miles of Town Roads (Ozaukee County, 2009).

Similar to the rest of the State, within Ozaukee County, the primary means of transportation is the personal motor vehicle. Transportation within the county is guided by the official area-wide planning agency for the southeastern region of the State, SEWRPC (Ozaukee County, 2009).

Ozaukee County’s vision of the regional transportation system plan is to provide a multi-modal transportation system in order to reduce auto dependency and promote high air quality. The Ozaukee County Express Bus (Route 143) provides service to Mitchell Street, Downtown Milwaukee, Cedarburg, Fredonia, Grafton, Mequon, Port Washington and Saukville.

Transportation in Ozaukee County also includes non-motorized modes of transportation. The Ozaukee Interurban Trail abuts the project area. Although this trail does not parallel the Milwaukee River, it does connect to roadways, trail networks, and parks in the communities of Mequon, Thiensville, Port Washington, Cedarburg and Grafton.

The County also is served by one passenger and three freight railway companies (Ozaukee County, 2009). Existing railroad corridors run north-south through the project area in the communities of Mequon, Thiensville, Grafton, Cedarburg and Saukville.

The Milwaukee River does not have any commercial ports or marinas within the project limits. There is a recreational/utility boat launch near the BS Dam in Grafton, Proposed Action 3 (Ozaukee County, 2009).

Air service is available at the Milwaukee County General Mitchell International Airport, which is located in Milwaukee approximately 20 miles south of the project area. Commercial airlines provide regional services at this location. Corporate and private aircraft also utilize this airport (Ozaukee County, 2009).

City of Mequon/Thiensville

Similar to Ozaukee County, the City of Mequon/Thiensville’s roadway system consists of freeways, state highways, major roads, and local roads.

Within the City of Mequon/Thiensville, east-west traffic travels along STH 167, County Line Road, Donges Bay Road, Freistadt Road/Glen Oaks Lane, Highland Road and Bonniwell Road. North-south traffic travels along Interstate 43, County Trunk Highway (CTH) W, STH 57 and STH 181 (Ozaukee County, 2009). Average daily traffic along these roadways varies
from a low of 1,800 (on Freistadt/Glen Oaks Lane Road west of River Road) to a high of 78,900 (on Interstate 43 south of STH 100). Freistadt Road/Glen Oaks Lane will provide the primary access to the project site location once within the City of Mequon/Thiensville.

3.1.10.1.2 Transportation of Materials

State and county roadways have use restrictions placed on them by WisDOT and the Ozaukee County Highway Department for commercial motor vehicles. Restrictions are based on vehicle size, weight, and the time of year for travel (WisDOT, 2009). Temporary seasonal weight restrictions are typically placed on county roads each spring.

3.1.10.2 Environmental Consequences

3.1.10.2.1 Proposed Action Alternative

The proposed project will have no significant impact on transportation within the communities in the project area once the project is complete. Nominal increases in the use of the local and regional roads along the river may occur particularly during warmer months due to increases in tourism encouraged by the project. The reliability of the roadway network will be improved because of the improved flood performance and physical condition at the road crossings.

During construction, residents, workers, and visitors will experience both direct and indirect impacts. The potential transportation impacts associated with the project are temporary and mainly limited to the immediate surroundings of the MT Dam.

Direct impacts for transportation for Phase 2 would be associated with the temporary closure of roadways and road lanes, if required; however, as further discussed in the following paragraphs, this was not required during Phase I. Intermittently, over the duration of the project construction activities, access may be limited to specific site locations while work is being completed.

Indirect impacts will be minor in nature and consist of additional construction traffic and re-routing of traffic. Equipment used for the restoration activities and the removal of fill will need to be delivered to the project site and eventually removed. Likewise, fill and waste materials will need to be transported to and from the project site. During the construction period, additional localized traffic will result due to these activities, along with the generation of additional noise and dust from the movement of the vehicles and equipment.

The proposed project also is expected to generate or retain approximately 29 jobs. This will contribute to additional traffic on city roadways. However, the amount of additional traffic will be negligible.
While few impacts are expected, the proposed project may require the use of vehicle permits for the delivery and removal of construction materials. For any construction vehicles operating with overweight loads, proper permitting will be required. Detailed routes may be required to meet load restrictions on bridges and particular local roads, and construction scheduling may need to accommodate seasonal weight restrictions.

During construction of Phase I, there were no issues with traffic control. Construction did not require closure of any roadway.

Construction traffic was required to use local trucking routes (Green Bay Road, Friestadt Road, Cedarburg Road, and Mequon Road) rather than residential streets in the area. When traveling on Elm Street, construction vehicles like dump trucks, semi trailers, etc. were required to drive with full tags (often referred to as dolly wheels) down when fully loaded.

3.1.10.2.2 No Action Alternative

The No Action Alternative will not impact the existing transportation network or associated traffic directly or indirectly. This alternative will be compatible with transportation plans and programs, because it will allow for the existing conditions and proposed improvements to remain as they are currently.

3.1.11 Air Quality

3.1.11.1 Affected Environment

Air quality data for United States Environmental Protection Agency (USEPA) criteria pollutants measured from air monitoring sites for the state of Wisconsin are submitted to USEPA by the WDNR, and available through the USEPA’s AIRNOW Internet portal. As of December 2009, the criteria pollutants PM2.5 (fine particulate matter), CO (carbon monoxide), Pb (lead), NO2 (nitrogen dioxide), and SO2 (sulfur dioxides), continue to remain in attainment of the National Ambient Air Quality Standards (NAAQS) in Ozaukee County. On February 10, 2009, the Wisconsin Natural Resources Board re-designated Ozaukee County to “attainment” for the USEPA-revoked 1-hour ozone standard. This action was taken in compliance with the Agency’s implementation of the Clean Air Act’s “anti-backsliding” provision.

Ozaukee County remains a moderate non-attainment area with respect to the 8-hour ozone ambient air quality standard.

3.1.11.2 Environmental Consequences

3.1.11.2.1 Proposed Action Alternative

This proposed project alternative will result in direct air emissions (engine combustion products, and fugitive dust) from earth moving vehicles during construction. Gases released by newly-exposed sediments may result in odor impacts. Reductions in air quality resulting from these impacts, however, will be minor, relatively localized, and temporary in nature.
In addition, excavation and earth moving activities can cause re-entrainment of dust particulates and possibly other pollutants into the atmosphere due to removal of dirt, debris, and other materials. This effect will also be temporary and primarily local in nature, although some transport of minor amounts of airborne pollutants to downwind nearby locations within or outside the focus areas of the proposed project can occur. Airborne erosion will be minimized through erosion control best management practices and with watering trucks, as needed.

Indirect emissions from motor vehicle exhaust may occur if the enhanced, post-project river and shoreline attracts an increased number of visitors. Internal combustion engines emit carbon monoxide, nitrogen oxides, and VOCs. Nitrogen oxide and VOC emissions can contribute to ozone formation. It is not possible to predict how many additional vehicle miles traveled will result from the proposed project. Therefore, it was not possible to quantify the indirect project emissions. However, even if all the local roads were saturated with traffic, resultant nitrogen oxide and VOC emissions would not exceed the Clean Air Act Conformity de minimis levels of 100 and 50 tons per year, respectively (as specified in 40 CFR 93.153).

No significant long-term air quality related adverse impacts are expected from direct or indirect project emissions. Since it is not possible to quantify the potential indirect emissions from project-related increased vehicle traffic and, even under a worst-case scenario, they would not exceed de minimis thresholds, a Record of Non-Applicability (RONA) has not been issued.

3.1.11.2 No Action Alternative

The No Action Alternative will have no affect on existing air quality conditions. Under the No Action Alternative, mobile construction equipment use and ground disturbing impacts from restoration related activities under the proposed project will not occur. Thus, air quality impacts from material re-entrained into the ambient air and transported or deposited downwind will be avoided.

3.1.12 Noise

3.1.12.1 Affected Environment

Noise is typically defined as “unwanted sound.” It may be as mild as a general nuisance, such as a noise causing distraction or masking desired sounds, or severe enough to impede communication, affect behavior, and cause temporary or permanent hearing loss.

Noise is measured in units of decibels (dB) on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more “weight.” The A-weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5-dBA change
(either an increase or a decrease) in noise levels, however, is clearly noticeable. A 10-dBA change in noise levels is perceived as a doubling (if it is an increase in noise levels) or halving (if it is a decrease) of noise loudness.

The project area contains outdoor sound environments, ranging from well-traveled city streets to parks. Sound sources in parks typically originate from recreational activities and can result in decibel levels in the 60-70 dBA range, but can be higher depending on the activity. Noise levels from car and truck traffic on city streets within the focus areas will usually be higher, in the range of 70-90 db. For locations near the various industrial sites, sound can be in the 80-90 dBA range, but can have short duration decibel spikes above 100 dBA, depending on the type of process occurring. By way of comparison, typical indoor environments usually maintain sound levels in the 50-60 dBA range (Reagan & Grant, 1977).

Water cascading over a dam such as the MT Dam or, to a lesser extent, over a fish passage generates acoustic energy (i.e., sound). The sound energy from such sources is usually generated over a broad frequency spectrum. Whether the sound generated is perceived as objectionable and, therefore, “noise” is subjective. While such sound emissions will interfere with verbal communication to some extent, most individuals do not find such broadband, “white noise,” objectionable. In fact, it is often perceived as an amenity.

3.1.12.2 Environmental Consequences

3.1.12.2.1 Proposed Action Alternative

Noise generated by construction equipment as a result of the project activity is likely to constitute the greatest increased noise impact above existing conditions. It is anticipated that earth moving machinery such as bulldozers, backhoes, and dredges, or supporting transport equipment like heavy trucks and barges, will be utilized in the restoration activities. These sources of sound can cause temporarily elevated noise levels within and near the project area. Table 3.1-1 provides the range of noise levels experienced for typical construction equipment approximately 50 feet from the source of the noise.

<table>
<thead>
<tr>
<th>Sound Pressure Level (dBA)</th>
<th>Typical Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-80</td>
<td>Pump</td>
</tr>
<tr>
<td>75-85</td>
<td>Backhoe</td>
</tr>
<tr>
<td>80-90</td>
<td>Heavy Truck</td>
</tr>
<tr>
<td>80-85</td>
<td>Mobile Crane</td>
</tr>
<tr>
<td>80-95</td>
<td>Bulldozers</td>
</tr>
<tr>
<td>80-90</td>
<td>Graders</td>
</tr>
<tr>
<td>80-95</td>
<td>Front Loaders</td>
</tr>
</tbody>
</table>

Source: FHWA, 1977
These noise levels are comparable to the range of noise found in typical industrial and city street settings, but are higher than what is typically experienced in parks. The project site is located in a developed area with residences, a park, and city streets, not far from commercial/industrial development. To minimize the impact of temporary construction-related noise, the City of Mequon has a local noise ordinance that limits the hours for construction activities to weekdays between 7 a.m. and 9 p.m. and weekends between 9 a.m. and 5 p.m. The Village of Thiensville does not have an ordinance that deals specifically with construction-related noise.

Minor permanent noise impacts can also result from the project once restoration of the sites is complete. Noise associated with the expected growth of recreational activities such as power boating may occur. Other recreational activities that may be enhanced as a result of the project, such as fishing, sailing, kayaking, swimming, and hiking, will have no appreciable noise impact. In addition, as described in section 3.1.12.1, the slight reduction in noise level between water flowing over the fishway as opposed to the dam is expected to be unappreciable.

3.1.12.2 No Action Alternative

The No Action Alternative will not be expected to affect existing noise levels in the project area. The No Action Alternative will avoid the temporary increase in noise levels during construction and restoration due to earth removal and remediation activities under the proposed project.

3.1.13 Human Health and Safety

3.1.13.1 Affected Environment

The affected environment for human health and safety is limited to the temporary construction site at MT Dam on the Milwaukee River.

3.1.13.2 Environmental Consequences

3.1.13.2.1 Proposed Action Alternative

Potential temporary safety and health hazards related to construction of the fishway chiefly impact MT FW workers. Applicable regulations (i.e., potential hazards) include, but are not limited to, fall protection, drowning hazards, noise, confined spaces, etc. These various hazards are to be addressed through implementation of applicable OSHA and or Wisconsin Department of Commerce (WisCOMM) construction standards (29 CFR 1926), and should be outlined in site-specific safety and health plans which explain how each contractor will address compliance with these regulations for their employees. Employees working at all project sites are expected to have received training related to the potential hazards at the sites.
3.1.13.2.2 No Action Alternative

The No Action Alternative has no effect on human health and safety.

3.1.14 Socioeconomic and Environmental Justice

3.1.14.1 Affected Environment

Ozaukee County is the smallest county by land area in the state of Wisconsin, covering approximately 235 square miles. The county is located in the southeastern portion of Wisconsin on 25 linear miles of Lake Wisconsin shoreline. Current land use is variable and includes: residential, commercial, industrial, and agricultural. Unused rural/open lands, wetlands and woods are also present. The amount of land in Ozaukee County devoted to urban land use has increased by 170% since 1963. The County is home to a population of 87,000 (2009 estimate) and has the highest income per capita of any Wisconsin county. Its largest city is Mequon, with a population of 23,560.

Data for the following discussion primarily were obtained from the 2000 U.S. Decennial Census, prepared by the U.S. Census Bureau (USCB). When available, 2008 estimates are provided for Ozaukee County.

In 2008, Ozaukee County was estimated to have a population of 85,874 (USCB, 2007). The County population grew by 4.3 percent from the 2000 population of 82,317 (USCB, 2000). The County’s residents (USCB, 2008) were comprised of 96.0 percent Caucasian, 1.5 percent black or African-American, 0.3 percent Native American and Alaska Native, 1.4 percent Asian, and 2.0 percent Hispanic or Latino origin.

In 2008, Ozaukee County had 35,390 housing units; 22.9 percent of the housing units were in multi-unit structures. The homeownership rate in 2000 was 76.3 percent.

Ozaukee County had 68,847 residents who were 16 years or older in 2008 (est.), with 48,880 or 71.2 percent in the civilian labor force. In 2008, 3.6 percent of residents in the civilian labor force were unemployed. The top three employment industries in Ozaukee County were educational, health and social services (20.2 percent), manufacturing (19.8 percent), and retail trade (11.5 percent). In 2007, the median household income for Ozaukee County was $75,938 and 4.5 percent of individuals lived below poverty level. Current unemployment levels have doubled since 2008 and have been estimated at 7.3 percent as of September 2009 (USDL, 2009). For comparison, Wisconsin’s median household income was $50,567 and 10.8 percent of individuals lived below the poverty level (USCB, 2000b).

3.1.14.2 Environmental Consequences

3.1.14.2.1 Proposed Action Alternative
The Proposed Action will have positive socioeconomic effects on residents and businesses in the project area. Design and construction phases of the project will create jobs in project management, engineering design, construction trades and support positions. After construction, socioeconomic benefits will continue. The natural fishery will be enhanced, thereby benefiting sport and subsistence fishers. Businesses supporting fishers, tourists, and water-based sports will also benefit.

The proposed MT FW construction is not expected to disproportionately affect any minority population, ethnic or economically disadvantaged group. Improving and creating sustainable fish stocks within the most populated and demographically diverse river basins in the state of Wisconsin will have wide public benefit.

3.1.14.2.2 No Action Alternative

The No Action Alternative would leave conditions in the river as they are – desirable sport fish would continue to be blocked from upstream areas and there would continue to be decreased viability of stream resident populations. Recreational opportunities for local residents and visitors to the area would be reduced as would the level of recreationally-based business activity.

The No Action Alternative also results in the continued reliance on expensive and controversial hatchery and stocking programs to maintain native and sport fish populations, administered through the WDNR and funded by tax dollars.

3.1.15 Cumulative Impacts

Construction of the MT FW and AIS barrier improvements at the MT Dam would be the first in a series of fish passage improvements planned for the Milwaukee River and its tributaries in Ozaukee County. The addition of fish passage at the MT Dam site would augment past dam removals on the lower Milwaukee River, including the North Avenue Dam and, as well as current dam removal and/or alteration efforts, such as the Estabrook Dam. The MT FW would provide fish passage between the LK Dam in the Village of Grafton to the Milwaukee Estuary and Lake Michigan. Future removal of the LK Dam and provision of a fishway or dam removal at the BS Dam in Grafton, and removal of other fish passage barriers on the tributaries identified in this project would act to open 158 river miles and 119,000 acres of aquatic habitat to the regional fishery. These improvements will cumulatively benefit the Milwaukee Estuary AOC by bolstering fish populations and making fish/wildlife habitat accessible. These impacts will aid in the delisting of AOC BUIs.
Parallel to the advantage of the MT FW project to the native fishery, the MT FW would potentially open the same aquatic and wetland habitat to use by AIS.

As a resource management priority for local units of government along the Milwaukee River, other minor yet collectively significant fish passage improvements are expected in the long term.

3.1.15.1 Proposed Action Alternative

Anticipated cumulative impacts associated with the construction of the MT FW include:

- Contributes to goal of reducing Beneficial Use Impairments (BUIs) in the Milwaukee Estuary - Area of Concern (AOC).
- Enhances the biological connectivity in all areas below the LK Dam.
- Changes landscape of river area – removes former millrace and replaces with embankment and fishway.
- Contributes to reconnection (restoration) of fragmented aquatic habitat.
- Could enhance potential AIS movement. However, features are proposed to mitigate this concern.

3.1.15.2 No Action Alternative

The biological integrity of the entire watershed suffers from fragmentation. This problem continues without the provision of fish passage at the MT Dam. Naturally produced stocks of potamodromous fish in the lower Milwaukee River, its Estuary, and near shore portions of Lake Michigan are untenable. Upstream areas continue to fail to meet their full ecological value to the region.

Continuing the existence of a fish passage barrier at MT Dam would contribute to BUIs associated with the Milwaukee River Estuary.
3.2 LIME KILN DAM REMOVAL

3.2.1 Geology And Soils

3.2.1.1 Affected Environment

Geology and Groundwater Hydrology

The geology and groundwater hydrology in the vicinity of the Lime Kiln Dam area was investigated in some detail as part of a local watershed scale study (Northern Environmental, 1998). Up to 2,000 feet of Paleozoic-age sedimentary rock overlies Precambrian-age crystalline rocks in Ozaukee County. The material properties of these rocks are used to differentiate the various strata and assign formation names. These formations are grouped into two major hydrostratigraphic units: the deep Sandstone Aquifer and the shallow Niagara/Unconsolidated Sediment Aquifer. Since the study area is located in an area where a thick shale aquitard separates the two aquifers, only the shallow aquifer is of significance to the study.

Silurian-age dolomite underlies Grafton, and is exposed at the surface along the Milwaukee River. Natural cascades are present in several areas where the beds of watercourses lie directly on bedrock. A regional fault is mapped from Port Washington, and passes through Grafton, Cedarburg, Menomonee Falls, and Waukesha. This fault has been named the Waukesha Fault, and is believed to generate 30 to 100 feet of displacement in the Silurian bedrock, and is at least partially responsible for the river cascade features in these communities.

Southeastern Wisconsin was repeatedly glaciated, with the most recent ice sheets retreating less than 13,000 years before present. These glaciations deposited a sequence of diamicton and water-laid deposits. Glacially deposited formations underlying Ozaukee County include the Kewaunee Formation, the Oak Creek Formation, and the Holy Hill Formation. In the Grafton area, the Milwaukee River was an ice-margin stream during deposition of the Kewaunee Formation sediments. As such, the prototypic red clays of the Kewaunee Formation are found adjacent to or a short distance east of the river, while the brownish/grayish and somewhat coarser grained sediment of the Oak Creek Formation is found under the Kewaunee Formation which is exposed at the surface west of the river. At the LK Dam site, sediments of the Oak Creek Formation are found in both banks.

Three important aquifers are present in Ozaukee County and include (in increasing depth below the land surface) the Sand-and-Gravel Aquifer formed in Pleistocene- and Holocene-age glacial deposits, the Niagara aquifer that occurs within Silurian-age dolomite, and the Sandstone Aquifer, which is chiefly comprised of Ordovician- and Cambrian-age dolomite and sandstone. The Sand-and-Gravel Aquifer often lies directly upon the Niagara Aquifer. In these situations, the two aquifers are hydraulically connected and commonly behave as one aquifer. The Sand-and-Gravel Aquifer commonly reaches
the ground surface, and therefore interacts with surface water bodies. This aquifer has great influence on local surface water features.

In most situations, groundwater elevation is a subdued expression of local topography. Upland areas are usually recharge areas, while lowland areas are discharge areas. Lowlands are commonly occupied by wetlands, lakes, springs, and streams. Consequently, near-surface ground water often flows perpendicular to topographic contour lines. Water in the Sand-and-Gravel Aquifer and much of the Niagara Aquifer follows this general rule. Water in deeper portions of the Niagara Aquifer and the Sandstone Aquifer follows more regional flowpaths. Under natural conditions, regional flow is east toward Lake Michigan.

The Milwaukee River at the LK Dam site and much of the local area has been shown by regional studies to be an influent stream. As such, surface water enters the groundwater flow system, and moves away from the stream. Investigation of the site determined that on the west side of the river (Lime Kiln Park) the groundwater table is at essentially the same elevation as the stream bed.

An area of groundwater contaminated with volatile organic compounds (VOCs) is found several hundred feet west of the LK Dam site. The source of the VOCs is a closed municipal landfill which contaminated approximately 17 wells that supplied drinking water to homes in the Village of Grafton. The removal of the LK Dam is not expected to have interactive effects with the groundwater or the contamination source. Presently the contamination is verified only within the regional aquifer while the possibility of contamination in shallower aquifers is currently under investigation. Above the LK Dam the impoundment/river is re-charging the regional aquifer rather than groundwater seeping into the river (Kramasz, 2009). Any contaminated groundwater flowing from the Lime Kiln site into the Milwaukee River is almost certainly occurring with regional flow below the LK Dam.

Portions of the LK Dam impoundment shoreline are confined in steep vertical dolomite limestone. These steep banks restrict the channel width and the amount of land available as floodplain.

**Soils**

The soils of the terrace above the river belong to the Hocheim-Sisson-Casco association. These are well drained soils with subsoils of loam to clay-loam underlain by glacial outwash, till, or lake laid deposits. While these soils can be prone to erosion, the banks of the impoundment are armored with fractured dolomite limestone or coarse alluvial stone. Removal of the LK Dam is not expected to cause any additional erosion to the river banks.

**Quantity and Quality of Impoundment Sediment**
Ozaukee County staff completed water and sediment depth soundings during August 2009 (Dueppen, 2009). Proceeding upstream of the dam, nine transects were surveyed using a 5/8 inch diameter steel rod marked at 0.1 foot increments. Surveyed points along each transect were equally spaced. The number of measured points along a transect were dependent on the transect width. The number of points per transect ranged from 6 to 9. Measurements included water depth, depth of fine textured sediment, and depth to refusal which was assumed to be the original stream bed. Observations were also made on the estimated dominant sediment texture and refusal material (as clay-silt, sand, gravel, and cobble). All transects and sample points were geo-located in the field using GPS.

Ozaukee County and Bonestroo, Inc. staff estimated the volume of fine textured silt-clay-sand-fine gravel sediment in the LK Dam impoundment to be approximately 4000 cubic yards ranging in thickness from 0 to 4.5 feet (Dueppen, 2009 and Bonestroo, Inc., 2009). The majority of the fine textured sediment was located along a reach extending 550 feet upstream of the LK Dam and east of the existing impoundment centerline. The native substrate along the LK Dam impoundment is similar to what is known to be present along the free-flowing reaches of the Milwaukee River in Grafton, primarily coarse alluvial gravel, cobble and boulder, and fractured bedrock. Fractured bedrock can be observed along the steep confining shorelines along the LK Dam impoundment and former Chair Factory impoundment.

Typical of impoundments located in developed watersheds and as evidenced by the sediment volumes above, the LK Dam impoundment has become a depositional area for fine textured soils. While eroded uncontaminated upland soils are the primary source of these sediment deposits, these clay-silt textured sediments and organic matter have an affinity for adsorbing pollutants also discharged from point and non-point sources of pollution. The WDNR and Ozaukee County staff collected a core sample along a single transect upstream of the LK Dam and in the impoundment in August 2009. The core sample was divided into three segments based on color and texture. Each segment was analyzed for a variety of inorganic and organic chemical constituents below.

The results of this physical and chemical analysis indicate that the concentration of PAHs, PCBs and VOCs were relatively low or less than the analytical detection limits. The sediment analysis also included tests for the presence of seven heavy metals. Once the sediments are sufficiently dried and vegetated, there would be no special restrictions on access or use of the area. If sediment is removed from the former impoundment, it could be disposed of at a landfill and used as daily cover for the landfill waste.

*Table 3.2-1 Sediment Quality Characteristics for the LK Dam Impoundment, Milwaukee River.*
### Parameter and Units **

<table>
<thead>
<tr>
<th>Parameter and Units **</th>
<th>Concentration &amp; Depth of Sample (LKC 0.0-0.5)</th>
<th>Concentration &amp; Depth of Sample (LKB 0.5-1.3)</th>
<th>Concentration &amp; Depth of Sample (LKA 1.3-2.0)</th>
<th>LOD</th>
<th>LOQ</th>
<th>Report Limit</th>
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</thead>
<tbody>
<tr>
<td>Core sample segment depth (ft)</td>
<td>0.0 - 0.5</td>
<td>0.5 - 1.3</td>
<td>1.3 - 2.0</td>
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<tr>
<td>Arsenic mg/kg</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>Cadmium mg/kg</td>
<td>0.2</td>
<td>0.6</td>
<td>1.1</td>
<td>0.1</td>
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<td>Copper mg/kg</td>
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<td>Lead mg/kg</td>
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<td>24</td>
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<td>Mercury mg/kg *</td>
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<td>Nickel mg/kg</td>
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<td>Total Organic Carbon mg/kg</td>
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<td>17,100</td>
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<td>7220</td>
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<td>Total PCB mg/kg dry wt.</td>
<td>&lt; 0.024</td>
<td>0.035</td>
<td>&lt; 0.024</td>
<td>0.024</td>
<td>0.08</td>
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<tr>
<td>Acenaphthene mg/kg dry wt.</td>
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<td>0.015</td>
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</tr>
<tr>
<td>Acenaphthylene mg/kg dry wt.</td>
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<td>E</td>
<td>E</td>
<td>0</td>
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<tr>
<td>Anthracene mg/kg dry wt.</td>
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<td>0.037</td>
<td>0.022</td>
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<tr>
<td>Benzo(a)anthracene mg/kg dry wt.</td>
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<td>0.320</td>
<td>0.140</td>
<td>0</td>
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<td></td>
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<tr>
<td>Benzo(a)pyrene mg/kg dry wt.</td>
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<td>0.320</td>
<td>0.120</td>
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<tr>
<td>Benzo(e)pyrene mg/kg dry wt.</td>
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<td>Benzo(b)fluoranthene mg/kg dry wt.</td>
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<td>0.140</td>
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<td>Benzo(g,h,i)perylene mg/kg dry wt.</td>
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<td>Indeno(1,2,3-cd)pyrene</td>
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<td>1-Methylnapthalene mg/kg dry wt.</td>
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</tr>
<tr>
<td>2- Methylnapthalene mg/kg dry wt.</td>
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<tr>
<td>Perylene mg/kg dry wt.</td>
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<td>0.280</td>
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* Sample exceeds holding time
** mg/kg = ppm (parts per million)
LOD = Level of Detection
LOQ = Level of Quantification
Report Limit = It is an estimate or the lower end of the reporting range for a given test.
ND = less than Level of Detection
E = Dry weight concentration is indeterminate.

### 3.2.1.2 Environmental Consequences
3.2.1.2.1 Proposed Action Alternative

In addition to the dam, hundreds of cubic yards of artificially placed debris will be removed from the river channel. This material, consisting of boulders, concrete, timbers, reinforcing steel, and other debris will be hauled off site and used as fill or recycled. Following removal of the LK Dam, the majority of accumulated reservoir soft sediment will remain as submerged lateral and center bars, with other sediment exposed as terrestrial or future wetland soils. Sediment will be exposed above the river waterline, primarily along the east, and to a lesser extent, the west shoreline during drawdown of the reservoir and after dam removal. Other areas of sediment could also be exposed, but these deposits would be expected to be transient and more prone to scour.

Some scour and transport downstream of accumulated sediment will occur due to increased water velocity and shear stress. An estimated 500 cubic yards of the sediment may be displaced downstream of the former LK Dam due to scour. The majority of the scoured material will settle out in the floodplain or river wherever the flow rate slows enough to allow deposition to occur. Regardless of their depositional site, coarser materials will provide benefits to fish and other aquatic life. Fine clay-silt-sand sediment deposited in floodplain and exposed river sediment bars will eventually be vegetated.

The scour of anoxic sediment increases the potential for toxic un-ionized ammonia releases that could affect aquatic life in the vicinity of the dam and reservoir during drawdown. The potential for toxic effects can be minimized by completing the drawdown during the cold weather months. Cool water temperatures and lower water pH would reduce the availability of un-ionized ammonia. Higher spring flows would provide the benefit of dilution.

Removing the dam will restore riverine sediment transport processes, with finer suspended and bedload particles being continuously transported downstream. This will replenish finer grained particles in scoured areas downstream of the dam, yielding a wider variety of bottom types and sediment gradation. This will also preclude significant additional sediment accretion in the former reservoir.

Removing the LK Dam and associated impoundment will restore the historical 1,300-foot-long free-flowing reach of the Milwaukee River. Average water depths will decrease within the former boundary of the impoundment and will likely mimic water depths which currently exist along free-flowing reaches of the Milwaukee River located upstream of the Bridge Street impoundment, in the area of the restored Chair Factory Dam impoundment, and downstream of the LK Dam.

Weathered bedrock, alluvial boulder, cobble and gravel are the dominant river bed and bank material beneath the impoundment. Fractured dolomite
bedrock is also present in the area, especially along the confined upper bank. Over thousands of years, the Milwaukee River has cut its channel through the dolomite and the presence of the impoundment has done little to change the location of the river channel configuration of this bedrock. Thus the impoundment has basically occupied the original channel and had only a minimal short term effect in terms of erosion, scouring or other physical channel forming processes. Due to the presence of these confining conditions, the removal of the dam will not affect the alignment of the Milwaukee River.

Dam removal will restore natural surface-water/groundwater interactions. Areas upstream of the dam will lose less water to the groundwater system, or may return to a groundwater discharge stream reach. Local groundwater flow velocity and flux would likely decrease.

3.2.1.2.2 No Action Alternative

If the LK Dam is not removed, it will remain a fish barrier and natural river sediment transport processes will remain disrupted. Bed load and fine grained sediment will continue to deposit upstream of the LK Dam while downstream areas will be starved of fine grained materials yielding a scoured, excessively coarse grained river bottom. The uncommon bedrock escarpments and riverbed will continue to be inundated and/or obscured by accreted sediment in the reservoir area.

Natural groundwater flow paths will remain disrupted and stream reaches above the dam will remain inundated. The artificially high hydraulic head imposed by the dam increases groundwater flux and flow.

3.2.2 Land Use and Recreation

3.2.2.1 Affected Environment

In terms of land use and recreation, the areas affected by the removal of the LK Dam include the dam site, the impoundment, the former raceway, neighboring properties, and upstream and downstream areas of the watershed.

**Dam Site, Impoundment & Former Raceway**

The LK Dam is approximately 60 feet wide and 9 feet tall.

The impoundment has a surface area of approximately 4.9 acres and contains about 19.7 acre feet of water by volume. Maximum and average water depths are 9 feet and 5 feet, respectively. The impounded reach extends approximately 1,300 feet upstream of the LK Dam and has an average width of approximately 150 feet. (Dueppen, 2009).

Once the drawdown is complete and the spillway is removed, the former raceway river channel can be restored by removing earth, rock and concrete
that was used to abandon this feature. The reach of the Milwaukee River where the LK Dam was constructed historically bifurcated at the dam location as the result of a limestone outcrop (island) that occurs at the location of the dam. The river split into a larger (east) channel and a smaller (west) channel. The millrace was originally constructed in the smaller river channel and the millhouse and paddle wheel were located directly above the millrace. The millrace was completely abandoned in the early 1960’s. It was backfilled with soil, rock and concrete rubble. It is currently partially grass covered and some rubble from abandonment is exposed at the ground surface. Restoration of the millrace channel will involve removal of materials within the millrace and reestablish the original channel contour.

**Adjacent Properties**

Land use adjoining the LK Dam and the impoundment includes 9 private residential lots along the east shoreline and 3 private residential lots on the west shoreline. All of the private lots are single family residences. The Village of Grafton owns two lots totaling approximately 28 acres on the west bank of the river including the 26.8-acre Lime Kiln Park where site access is proposed (Bonestroo, Inc., 2009). Transportation access to the site is via Green Bay Road and the existing paved driveway access to the park. The area of the Lime Kiln Park immediately adjacent to the west side of the LK Dam will be used for access to remove the dam, restore disturbed areas and stage construction activities. The total disturbed area at the park is expected to be less than one acre.

**Upstream and Downstream Portions of Watershed**

The Milwaukee River Watershed at the LK Dam encompasses approximately 473 square miles of drainage and approximately 423 square miles downstream.

3.2.2.2 Environmental Consequences

3.2.2.2.1 Proposed Action Alternative

**Land Use**

Lime Kiln Park is a popular day user destination for residents of the Village. In general, land use in the vicinity of the LK Dam is expected to remain essentially unchanged, except for conversion of approximately 4.9 acres of the existing impoundment to riverine aquatic habitat, adjacent wetlands, and floodplain. The conversion of the old millrace to a restored river channel will result in a small reduction in park land area. The physical extent of the floodplain and floodway areas should be reduced to a limited degree in areas upstream of the LK Dam.

Removal of the dam and impoundment may expose sediment along some of the existing impounded shoreline. Should this occur, the exposed sediment
Section 3.2 Lime Kiln Dam (LK Dam) Removal

may create new soil deposits downstream. The ownership of these newly created lands would likely revert to the Village of Grafton according to the language in the deed and determinations by the Village attorney. These lands may or may not be located in the floodplain and could eventually revert to wetland conditions which would be zoned accordingly.

For users of the park, the project may limit access to a small portion of the park during construction. Removal of the LK Dam should not diminish use of the park in any way as the LK Dam does not add any specific cultural or recreational value to the public park that a free flowing river would also provide.

Recreation

Removal of the LK Dam will have several positive consequences for recreational uses of the dam site, the former impoundment area, and upstream and downstream portions of the Milwaukee River, as summarized below.

- **Sport Fishing** - Removal of the LK Dam will expand the recreational fishing resources in areas upstream of the dam by allowing Lake Michigan sport fish consistent upstream access. Removal of the LK Dam and restoring this reach to a free-flowing system has the potential to improve the relative abundance, diversity and habitat of native game and non-game fish species within the former impoundment while reducing the relative abundance and habitat of the undesirable species such as common carp. Similar fish community responses were observed in the native fish community and their riverine habitat along two formerly impounded reaches of the Milwaukee River at West Bend and Milwaukee (Kramasz, 2009). A walleye restoration project is currently being undertaken along the Milwaukee River and Estuary by the WDNR and Walleyes for Tomorrow. The LK Dam limits a wetland spawning strain of walleye and northern pike access to wetland spawning habitat. Its removal would ultimately benefit the Milwaukee Estuary AOC by reclaiming “lost” fish habitat and improving currently degraded fish populations, both of which are AOC BUIs.

- **Fishing Access** - Fishing is a popular activity especially below the LK Dam where public access is readily available. Populations of fish are present within the LK Dam impoundment, however public access is more difficult since a chain link fence prevents access upstream of the dam. It is anticipated that recreational fishing will be enhanced due to better access and the improved fishery when a rapidly flowing riverine environment is restored. A count of observed recreational uses along the three Village of Grafton’s impoundments (BS Dam, former Chair Factory and LK Dam impoundments) was conducted in 1987. Most recreational activity was associated with fishing, but canoeing and wading were also observed in the impoundments upstream and
downstream of the former Chair Factory Dam. The free-flowing reach what was once the Chair Factory impoundment is frequently utilized by fishers. It is anticipated that a similar dynamic will take place along the reach of the River that is part of the current impoundment for the LK Dam.

The steep and high rock terrace combined with private property limits shore access along the existing impoundment shoreline. Elimination of the impoundment should provide enhanced access to the water’s edge within portions of the impoundment that revert to ownership by the Village of Grafton.

- **Boating** - Removal of the LK Dam should enhance recreational use of the River for recreational use by canoes, kayaks, and other small watercraft. Following the permanent drawdown and removal of the dam and resulting impoundment, the former aesthetics of a wide, slow river would be lost. The historical 1300-foot long reach of the Milwaukee River will be restored resulting in a moderately fast free-flowing river dominated by riffles, deep runs and slack water areas similar to what existed under pre-development conditions and which currently exists upstream of the Grafton Millpond and downstream of the LK Dam. Average water depths will decrease within the former boundary of the impoundment and will be similar to water depths which currently exist along free-flowing reaches of the Milwaukee River located upstream of the BS Dam impoundment (Grafton Millpond), in the area of the restored Chair Factory Dam impoundment, and downstream of the LK Dam. It should be noted that the LK Dam is described on the Web site of the American Whitewater organization as having “a very wicked hydraulic and serious potential to kill” with the recommendation to “make certain to get ashore well clear of the brink of this dam” and warning that “no one should consider running this dam without fully understanding the serious risks involved, nor without safety on shore” (American Whitewater, 2009).

- **Park Recreational Use** – One of the most potentially attractive picnic areas at Lime Kiln Park is the area immediately adjacent to the LK Dam. The aesthetics of the area are significantly diminished by the presence of the unattractive chain link fence with warning signs. The fence obscures what would otherwise be one of the most attractive vistas in the Park. Removal of the dam, should reduce the hazard, and eliminate the need for the fence and warning signs, resulting in a significant improvement of the aesthetics of this area and enhancement of its use by area residents for picnicking.

### 3.2.2.2 No Action Alternative

**Land Use**
The No Action Alternative would result in no significant consequences in terms of land use, as property surrounding the LK Dam and impoundment would likely continue in the current uses as private residences and a public park (Limn Kiln Park).

Recreation

The No Action Alternative would result in several negative consequences in terms of recreational activities, as summarized below.

- **Fishery Resource** – The current diminished biological diversity and water quality in the impoundment would remain, limiting its value as a recreational fishing resource. Of greater significance, the regional efforts to establish a lake-run seasonal sport fishery in the Milwaukee River. In particular, the construction of fishways at the MT Dam and BS Dam would be significantly diminished as the LK Dam would limit the ability of fish to migrate upstream beyond the LK Dam (except in rare periods of flooding/high water) coinciding with spawning periods. No BUIs would be addressed.

- **Fishing Access** – The accessibility of the area near the LK Dam and adjacent to the impoundment for recreational fishing would remain limited.

- **Boating** – The use of this stretch of the Milwaukee River for boating would require all to portage well upstream of the dam due to the significant safety hazard.

- **Park Recreational Use** – The aesthetics of the area of the Park adjoining the dam would continue to be diminished by the continued need to maintain a fence and warning signs.

### 3.2.3 Water Quality and Resources

#### 3.2.3.1 Affected Environment

The Milwaukee River Watershed at the LK Dam encompasses approximately 473 square miles of drainage. The estimated 7Q2 (minimum 7-day 2-year flow) and 7Q10 (minimum 10-day 2-year flow) at the Village of Grafton (476 mi2) is 52 CFS and 24 CFS, respectively. The estimated 1% (100 YR) recurring flood interval discharge is estimated at 12,560 CFS.

The LK Dam impoundment has a surface area of approximately 4.9 acres and contains about 19.7 acre feet of water by volume. Maximum and average water depths are 9 feet and 5 feet, respectively. The impounded reach extends approximately 1,300 feet upstream of the dam and has an average width of approximately 150 feet (Dueppen, 2009).

Dams and impoundments can negatively impact the habitat of free-flowing river fish communities. The impacts can occur upstream and downstream of the dam and impoundment. Dams have been identified as a major cause for
the decline in fish community diversity, abundance and structure in Wisconsin. Impacts include the obstruction and timing of fish migration, fragmentation of fish habitat, and degradation of fish habitat. These impacts are the result of altered thermal regimes, increased sedimentation, degraded sediment, low water quality, and loss of stream channel stability. These cumulative impacts can directly and indirectly impact the overall viability of individual fish species, reproduction, food supply and growth, predation, resistance to disease and stress, etc. Selective dam removal has been shown to be an environmentally sound, technically feasible and cost effective means for restoring disturbed stream ecosystems in Wisconsin. Fish habitat and population degradation are two BUIs of the Milwaukee Estuary. Dam removal is likely to contribute to the delisting of BUIs.

Prior to removal of the Woolen Mills dam at West Bend in 1988, habitat quality in the Woolen Mills impoundment was rated “poor.” The impoundment was shallow and hypereutrophic with dissolved oxygen levels suppressed below the state water quality standard of 5 mg/l. This impoundment was filled in with extensive deposits of silt, cover was nearly absent and the water was turbid. Smallmouth bass populations were low and common carp were abundant. Biotic Integrity, as a measure of the entire fish assemblage, was rated “poor”. Five years after removing this dam, habitat quality improved from “good” to “excellent”; smallmouth bass abundance and biomass increased substantially, while common carp abundance and biomass declined dramatically. Biotic integrity was rated “good” as a result. Natural habitat recovery and removal of the dam as a barrier to fish movement accounted for many of the physical habitat and biological improvements (Kramasz, 2009). Following removal of the dam, dissolved oxygen levels were routinely measured above the state water quality standard of 5 mg/l.

Based on laboratory chemical analysis, LK Dam impoundment sediments are not hazardous or a threat to human health and the environment. Sediment can be managed in-place using bioengineered (e.g., vegetation), engineered (e.g., rip rap) or a combination of stabilization practices. Once sufficiently dried and vegetated, there would be no restrictions to human or wildlife access and contact. Absent the dam, these are sediments that would normally have been transported to downstream areas. Rivers naturally transport water and sediment which is necessary for maintaining channel stability and building floodplain areas, including adjacent wetlands. This process also transports food and energy for fish and other aquatic life and wildlife. As restored floodplains and wetlands, these areas will provide valuable habitat for fish, other aquatic life and wildlife as well as access while increasing aesthetic value. Both water and sediment can become a “pollutant” when the amounts become excessive resulting in degraded habitat quality.
Alluvial boulder, cobble and gravel are the dominant river bed and bank material beneath the impoundment. Fractured dolomite bedrock is also present in the area, especially along the confined upper bank.

### 3.2.3.2 Environmental Consequences

#### 3.2.3.2.1 Proposed Action Alternative

The removal of the LK Dam will eliminate the existing 4.9-acre impoundment. The current impoundment is long and narrow (1300 feet by 150 feet), so the change in visual appearance will be to a narrower, flowing river with more velocity, more meanders, and possibly more exposed boulders, pools and riffles, etc. The appearance of the river and corridor would be similar to the free-flowing reach created following removal of the former Chair Factory Dam in 2001. Average water depths will decrease within the former boundary of the impoundment and will likely be similar to the water depths which currently exist along free-flowing reaches of the Milwaukee River located upstream of the BS Dam impoundment, in the area of the former Chair Factory Dam impoundment, and downstream of the LK Dam. Removal of the dam and impoundment will not affect water depths and discharge within the Milwaukee River upstream or downstream of the former impoundment since the LK Dam was operated under “run-of-the-river” conditions.

Water velocities will increase within the restored free-flowing river reach due to the return of the historical channel grade line. Under free-flowing conditions, average stream velocities, stream width and depths will vary depending on river discharge conditions and will be similar to those which currently exist along free-flowing reaches upstream of the BS Dam impoundment and downstream of the LK Dam. During average river discharge conditions, dam removal is not expected to result in dramatic changes throughout most of the restored free-flowing river channel due to the confining effect of the steep and narrow river valley and floodplain. This reach is expected to consist of deep riffles and slack water areas. Under low river discharge conditions, the removal of the dam will result in only minor decreases in stream width and surface water area with a correspondent increase in the exposed lower bank. A decrease in surface water area is expected to occur in those areas where exposed sediment is formed, primarily along the east bank and immediately upstream of the dam. Finally, removal of the dam and attendant infrastructure will convert approximately 1.54 acres of the existing impoundment to riverine aquatic habitat, adjacent wetlands, and floodplain. The old millrace was constructed in a historical side channel and the restored river will have a split flow in this area.

Following removal of the LK Dam, an unknown amount and surface area of sediments will be exposed above the river waterline, primarily along the east, and to a lesser extent, the west shoreline. Smaller areas may also be
exposed but these deposits will be transient and more prone to scour. Volunteer plants such as smartweed are expected to colonize the mudflat areas and seeding with a cover crop of rye and oats, and eventually native grasses and forbs will also be completed. Over time, trees and shrubs will grow in this area.

Some scour and transport downstream of accumulated sediment will occur due to increased water velocity and shear stress. The majority of the scoured material will settle out in the floodplain or river wherever the flow rate slows enough to allow deposition to occur. Regardless of their depositional site, coarser materials will provide benefits to fish and other aquatic life. Fine clay-silt-sand sediment deposited in floodplain and exposed river sediment bars will eventually be vegetated.

Removal of the dam will result in the restoration of free-flowing riverine physical habitat which existed prior to construction of the dam. Over time, fine textured substrate will be scoured and replaced with coarser native gravel, cobble, and boulder sized-substrate. Thermal regimes, water depths and stream velocities will also return to pre-dam conditions. These changes in physical habitat will increase the relative abundance and diversity of macroinvertebrate populations within the former impoundment. The time needed to sufficiently scour sands and silts from the impounded reach will depend on stream discharge conditions.

Removal of the LK Dam will result in scouring and transport of some sediment stored behind the dam. The potential for some short-term adverse impacts on fish and aquatic life habitat downstream will be unavoidable. To minimize the amount and impact of scoured sediment, the drawdown is proposed to be conducted gradually to allow minimal disturbance to sediments stored outside of the future river channel alignment. This would allow newly exposed sediments to be managed in place as exposed floodplain soils or wetlands. Once the dam is removed, high recurring stream channel forming flows will redistribute the sediment to floodplain and riverine sites. Newly exposed sediments will re-vegetate naturally from local upland seed sources and seed banks contained in the former sediments. To further minimize erosion, appropriate sediment management practices would be employed, and native seed grasses and forbs applied for landscaping purposes.

If sediments are dredged from the newly flowed river channel, they can be placed on top of the exposed sediment. If sediments are removed from the former impoundment, they can be re-used at local landfill for covering daily waste material. Some transport of fine silts and sediments from the former impoundment area downstream will be unavoidable. The use of mitigation techniques will reduce but cannot completely eliminate solids transport and resulting turbidity.
The LK Dam impoundment contains an outfall structure for the Village of Grafton Wastewater Treatment Plant. The structure is located about 600-ft upstream of the LK Dam along the west bank. The drawdown and the removal of the dam will not interfere with the operation and discharge from the Village of Grafton’s Wastewater Treatment Plant or its infrastructure.

Removal of the LK Dam and impoundment may result in negative short-term water quality impacts. These impacts would be expected to be a direct result of the scouring and resuspension of previously deposited fine textured sediment. Turbidity may increase for a brief period of time. While it may not be technically feasible to prevent all sediment losses, measures will be employed to limit these releases.

Removal of the dam and impoundment is not expected to result in any long-term negative water quality impacts. In the long-term, removal of the dam will abate historical thermal impacts associated with this impoundment. Cooler water temperatures and increases in the physical re-aeration rate of the river will increase the solubility and biological availability of dissolved oxygen in the restored free-flowing river reach. Re-aeration rates increase as water velocity increases and water depth decrease.

Removal of the LK Dam and restoring this reach to a free-flowing system has the potential to improve the relative abundance, diversity and habitat of macroinvertebrates, native game and non-game fish species within the area of the abandoned impoundment while reducing the relative abundance and habitat of the undesirable species such as common carp. Similar fish community responses were observed in the native fish community and their riverine habitat along two formerly impounded reaches of the Milwaukee River at West Bend and Milwaukee (Kramasz & Wawrzyn, 2009).

The impoundment will revert back to a natural rocky-cobble substrate characteristic of the Milwaukee River. The banks and part of the impoundment will become fringe area while other portions of the river will become river bank. This conversion will have significance as the banks return to the original condition of the area preceding the construction of the dam.

Dam removal would result in restoration of the natural sediment transport function of the river and eliminate sediment accretion above the dam. The bedrock river channel would be re-exposed creating desirable spawning conditions for lake sturgeon and other high-value fish species while diminishing preferred habitat for undesirable fishes. Fish passage at the LK Dam location would be re-established although an intermittent AIS barrier would be removed.

3.2.3.2.2 No Action Alternative

Leaving the dam in place and allowing it to deteriorate due to the effects of river action, weathering, erosion, and the freeze and thaw cycle could
ultimately result in a dam failure. This could lead to an uncontrolled release of water, structural debris and sediment downstream. Ultimately, this alternative would result in the greatest negative water resource impact when compared to other alternatives. This option does not meet the purpose and need for the project. There would continue to be obstructions to fish passage at this location and, in its current condition, the LK Dam is considered an intermittent barrier to AIS or VHS. Accumulation of sediment in the reservoir above the dam and diminished water quality would persist. Reduced biological diversity would continue as a result of the barrier nature of the dam. No improvements to the Milwaukee Estuary AOC BUIs would be achieved.

3.2.4 Wetlands and Floodplains

3.2.4.1 Affected Environment

The LK Dam impoundment has a surface area of approximately 4.9 acres and contains about 19.7 acre feet of water by volume. Maximum and average water depths are 9 feet and 5 feet, respectively. The impounded reach extends approximately 1,300 feet upstream of the dam and has an average width of approximately 150 feet (Dueppen, 2009). The wetlands associated with LK Dam are along the Milwaukee River corridor. The WDNR wetland inventory maps identify these as forested broad leaved deciduous wetlands on wet soils. These wetlands are dominated by second growth wet to wet-mesic lowland hardwoods, including silver maple, black willow, green ash and box elder. Shrub species such as honeysuckle and dogwoods are also present.

Base floodplain elevations (Zone AE) exist immediately adjacent to areas upstream and downstream of LK Dam. Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depth of less than 1-foot or with drainage areas less than 1-square mile (Zone X) exist immediately adjacent to existing LK Dam impoundment. The 100-year flood elevation immediately upstream and downstream of LK Dam are 713 and 706 feet respectfully. The confined floodplain is the resulting affect of the steep and narrow river valley associated with the impoundment and downstream areas.

See Figure 2 in Appendix B for more information on wetlands and floodplains in the MT Dam area.

3.2.4.2 Environmental Consequences

3.2.4.2.1 Proposed Action Alternative

The removal of the dam and subsequent re-establishment of the river channel will alter the existing shoreline and vegetation in the impoundment area. The drawdown of the impoundment may result in emergent vegetation developing along the exposed sediment areas. The type and extent of vegetative growth will be dependent on the existence of viable dormant seed already present in the existing seed bank and what is imported from local
wetlands. Based upon existing nearshore and aquatic plants growing in the vicinity, the plants that are likely to re-establish include green and soft stem bulrush, narrow leaved cattail, reed canary grass, rush and sedge species. These are herbaceous wetland plants often described as “pioneer species” because of their tendency to quickly vegetate areas of open or disturbed soil. This herbaceous growth will probably be replaced with shrubs and eventually trees present in the adjacent forested broad leaved wetlands.

Rooted aquatic plant growth which may become re-established following drawdown of the impoundment within the new channel would likely be limited to pools and other still water areas of the new channel. These plants may include floating pondweed, common waterweed and coontail. All of these plants provide valuable habitat for fish and other provided they are not present in nuisance amounts.

The removal of the LK Dam and impoundment will result in the restoration of the historical 1,300-foot-long free-flowing reach of the Milwaukee River. Following removal of the dam, floodplain elevations along the shoreline of the former impoundment will range from just below 715 (South of Falls Road) to 706 (immediately downstream of LK Dam).

The impacts to the existing wetlands will include insignificant changes to the wetland hydrology. Considering the existing wetland hydrology has been altered by the dam construction, the impacts will be restorative in nature and will be more like a natural riparian hydrologic regime. Also, portions of the current impoundment that are not mapped as wetland will be re-exposed and will revert back to wetland increasing functional values to the channel bank and riparian corridor.

3.2.4.2.2 No Action Alternative

Leaving the dam in place will result in no changes to the existing wetland complexes and floodplain immediately upstream and downstream of LK Dam. The suite of issues related to the artificially high water levels and biologic isolation created by the existing LK Dam impoundment would not be addressed. These include retaining higher than naturally occurring water temperatures and lower dissolved oxygen than portions of the upstream area, modified surface water/ground water interactions, inability of wetlands and floodplains to reach their full biological potential due to habitat fragmentation along the riparian corridor, and modified hydrology of riparian wetlands.

3.2.5 Aquatic Biology

3.2.5.1 Affected Environment

3.2.5.1.1 Habitat

Dams and impoundments can negatively impact the habitat of free-flowing river fish communities. The impacts can occur within, upstream and
downstream of the dam and impoundment. Dams have been identified as a major cause for the decline in fish community diversity, abundance and structure in Wisconsin. Impacts include the obstruction and timing of fish migration, fragmentation of fish habitat, and degradation of fish habitat. These impacts result from altered thermal regimes, sedimentation, degraded sediment, low water quality, and impacts to stream channel structure. These cumulative impacts can directly and indirectly impact the overall viability of individual fish species, reproduction, food supply and growth, predation, resistance to disease and stress, etc. Selective dam removal has been shown to be an environmentally sound, technically feasible and cost effective means for restoring disturbed stream ecosystems in Wisconsin.

Semi-quantitative electrofishing assessments have been completed along the Milwaukee River at Grafton. The WDNR performed an assessment for the BS Dam and LK Dam impoundments, and free-flowing reaches of the Milwaukee River upstream of the BS Dam impoundment and downstream of the LK Dam and impoundment (Schmaus, 1987). The former Chair Factory impoundment could not be electrofished at that time due to inaccessibility for equipment and personnel. The former Chair Factory impoundment was electrofished in the fall of 2003, or 2.7 years following removal of the Chair Factory Dam in the fall/winter of 2000-2001.

Based on a comparison of the fish assemblages between impounded versus free-flowing river reaches, the dams and resulting impoundments are having a negative effect on the local Milwaukee River fish community structure. Twenty-one native fish species were identified along the free-flowing Milwaukee River reaches below the LK Dam and upstream of the Grafton Millpond, respectively (Figure 3). By comparison, only 6 and 8 native fish species were collected from the LK Dam and BS Dam impoundments, respectively. Collectively, the free-flowing reaches contained 25 different native fish species while eight different native fish species were collected from the two impoundments.

**Figure 3 - Number of Native Fish Species Collected from Milwaukee River at Grafton Free-Flowing versus Impounded River Reaches**

A review of other measures of fish community structure suggest that the fish communities within the impounded river reaches are degraded compared to
free-flowing river reaches located immediately downstream and upstream of the impoundments. Non-native carp comprised an average of 77% and native fish species 23% of the fish captured from the two impoundments whereas native fish species comprised an average of 83% and non-native carp 17% of the total fish captured along the free-flowing reaches (Figure 4). Carp are very tolerant of degraded habitat compared to most other native species. Relative numbers of native fish collections in free-flowing river reaches were approximately 10 times more abundant than impounded river reaches. Inversely, common carp were 16 times more abundant in the two impounded reaches than free-flowing river reaches. These differences were particularly revealing when considering that the combined sample length of the two impoundments was 9,700 feet and 2,520 feet for the free-flowing reaches. Carp catch per unit effort ranged from 3.9 to 11.6 catch per unit effort (CPUE) for the two impoundments and 0 to 1.5 CPUE for the two free-flowing reaches.

Fish species classified as being tolerant of degraded habitat comprised 77% of the individuals collected from the impoundments compared to 27% from free-flowing river reaches (Figure 5). Sedimentation within the impoundments by fine textured soils (clay-silt sized material) may be limiting macroinvertebrate food production for insectivore feeding and catostomid (sucker) species (Figure 5). The average percent of individuals as insectivores and catostomids were 15% and 8% from the impounded reaches. By comparison, the percent of individuals as insectivores and catostomids from the free-flowing river reaches were 59% and 15%. The lack of sufficient macroinvertebrate food production within the impoundments is further evidenced by the dominance of omnivore fish species. The average percent of omnivore species within the impoundment reaches was 78%, whereas 22% of the fish community was comprised of omnivores in the free-flowing river reaches.
Sedimentation within the existing impoundments can be detrimental to simple lithophillic spawning fish species which require coarse clean substrate for successful reproduction and cover for larvae and juveniles. The average percent of simple lithophillic spawners in the impounded river reaches comprised 8% of the fish community while the average percent of simple lithophillic spawners comprised 33% of the fish community within free-flowing river reaches (Figure 5).

*Figure 5 - Fish Community Structure for the Milwaukee River at Grafton Free-Flowing versus Impounded River Reaches (SOURCE: Kramasz, 2009, p. 22)*

Although the Chair Factory Dam impoundment could not be electrofished during the assessment above and prior to its removal in 2000-2001, the river in the area of the former impoundment was sampled almost three years after the dam was removed (WDNR, 2009). Post-dam removal results were similar to fish assemblages observed in other free-flowing reaches located upstream and downstream of the BS and LK Dams. Following abandonment and removal of the Chair Factory Dam, 15 native and one non-native fish (a common carp) were collected. Smallmouth bass were the most common fish species collected totaling 384 individuals. Based on age-length relationships for smallmouth bass in the Milwaukee River Basin, 60% of the 384 smallmouth bass were spawned and recruited to the river during the 2-plus years following removal of the Chair Factory Dam. This increase is likely in response to the improved spawning and rearing habitat for smallmouth bass following dam removal.

3.2.5.1.2 Macroinvertebrates

No site specific sampling of macroinvertebrates was performed for the LK Dam project site. Historic work in the vicinity leads the reviewers to understand that there is a low or depressed abundance of macroinvertebrates in the LK Dam reservoir. However, it is also understood that macroinvertebrates are more abundant below the dam in that flowing reach of the river. Higher photosynthetic and respiration rates by the
abundant macrophytes in the BS Dam impoundment (just 2 river miles upstream of the LK Dam) are likely responsible for wider diurnal dissolved oxygen fluctuations within that impoundment. These wide fluctuations are less prevalent in the LK Dam impoundment due to the general absence of macrophytes and short water retention times.

3.2.5.1.3 Aquatic Vegetation

Plants present in the existing nearshore include bulrush, cattail, reed canary grass, and fox sedge. These are wetland plants often described as “disturbance vegetation” or “pioneer species” because of their tendency to quickly vegetate areas of open or disturbed soil. This herbaceous growth will probably be replaced with shrubs and other woody species as the wetlands develop and take on characteristics associated with riparian corridor.

Floating leaved aquatic vegetation is not likely in moving water but perhaps in still water areas. Some submerged aquatic species might be found in the flowing water areas of the river, however, rooted aquatic plant growth which may become re-established following drawdown of the impoundment would likely be limited to emergent or floating vegetation with adaptations to flowing water conditions and turbidity. These plants may include floating pondweed, common waterweed, coontail and white water lily. All of these plants provide valuable fish and other aquatic life habitat provided they are not present in nuisance amounts.

3.2.5.1.4 Fisheries

**Fish Community**

The Milwaukee River contains a diverse cool to warm water fish community, including sport and forage fish species. Potamodromous and adfluvial fish species tie this community directly to other locations in the river system, including the Milwaukee Estuary AOC. Gamefish and panfish known to be present or suspected to be present within a five mile range, upstream and downstream, of the LK Dam include smallmouth and largemouth bass, walleye, northern pike, bluegill, green sunfish, pumpkinseed, rock bass, black crappie, channel catfish, flathead catfish, yellow and black bullhead, and lake sturgeon. Similarly, an abbreviated list of common forage or non-game species in the Milwaukee River within five miles of the LK Dam include longear sunfish, logperch, johnny darter, blackside darter, fantail darter, least darter, Iowa darter, fathead minnow, spotfin shiner, golden shiner, bluntnose minnow, common carp, central and largescale stonerollers, sand shiner, common shiner, horneyhead chub, white sucker, striped shiner, creek chub, rosyface shiner, redfin shiner, brook stickleback, mimic shiner, central mudminnow, banded killifish, stonecat, tadpole madtom, and four species of redhorse including the greater, shorthead, golden and silver redhorse. Fall populations of coho and chinook salmon, an occasional brown trout and fall and spring rainbow
trout may be present below the LK Dam when river discharge and water depths allow a limited number of these migrants from Lake Michigan to pass over the MT Dam. The Milwaukee River is classified as a Warm Water Sportfish Community per NR 102 and NR 104 (Kramasz, 2009).

Factors limiting fishery habitat in the study area include warm water temperatures, excessive algae growth and turbidity, low dissolved oxygen levels resulting from aquatic plant respiration and sediment oxygen demand, and extensive sedimentation by fine textured and polluted sediment (Wawrzyn et al., 1994).

**Invasive species**

Although the dam does obstruct fish movement during low to moderate flows and water levels, the LK Dam is not considered a complete barrier to AIS/VHS. During large flood events, there is only a four foot difference in water elevation immediately upstream and downstream of the dam. This difference in elevation could allow “jumping” VHS infected fish to move upstream. In addition, the proximity of the tailwater elevation to the crest of the dam during higher flows could allow adult sea lampreys to climb the dam and move upstream.

### 3.2.5.1.5 Threatened and Endangered Species

**Endangered, Threatened and Special Concern Species**

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked. A survey of the NHI for this project (see Appendix C, Document 4) includes six fish species documented as being present or potentially present in the LK Dam project area. While some of these listed fish species are still encountered during routine field assessments, the lack of recent occurrences cannot discount their continued presence since their habitat remains intact. For the purposes of this Environmental Assessment and the removal of the LK Dam their presence will be assumed. There are no federally listed fish species in the Milwaukee River Basin or more specifically, in the LK Dam removal project area.

**Endangered**

The striped shiner is the only state listed endangered fish species that potentially exist or are known to exist in the project area.

*Striped shiner*
The striped shiner is ranked with a global element of G5 and a state element rank of S1. These rankings indicate that while the striped shiner is demonstrably secure globally it is critically imperiled in Wisconsin. The S1 or critically imperiled ranking is due to extreme rarity defined as five or fewer occurrences per acre, very few remaining individuals, or because some factors make it especially vulnerable to extirpation from the State. Its numbers have declined so much in recent years that it is nearly extirpated from the state. During the mid-1990’s, WDNR crews sampled multiple reaches and times along the Milwaukee River and identified a single specimen from the river in Ozaukee County.

The striped shiner prefers clear to only slightly turbid waters of runs and shallow pools, with dense aquatic vegetation over substrates of cobble, boulders, silt, sand, mud or bedrock. Spawning occurs from late May through June (Becker, 1983). They are likely to frequent water depths ranging from 0.1 - 1.5 m (Pfleiger, 1975). A study of striped shiners from the Milwaukee River in Ozaukee County revealed that the fish had consumed hymenoptera, coleoptera, other aquatic insects, filamentous algae, and vegetative material (Trautman, 1957). During drawdown and construction, turbidity levels may increase but will be of short duration.

**Threatened**

Three state-listed threatened fish species that potentially exist or are known to exist in the project area include the greater redhorse, redfin shiner and longear sunfish.

*Greater redhorse*

The greater redhorse is ranked globally as a G3 and has a statewide ranking of S2S3. These rankings indicate that the greater redhorse is either very rare and local throughout its range, found locally abundant in a restricted range, or that other factors may make it vulnerable to extinction throughout its range. The Milwaukee River Basin has one of the most secure populations of greater redhorse in Wisconsin.

The greater redhorse prefers clear water of medium to large rivers, over bottoms of sand, gravel, or boulders. Spawning occurs in May or June. The greater redhorse spawns over substrate consisting of gravel with mixtures of sand and small rubble in moderate to swift currents. It generally feeds on a diet of aquatic insects, mollusks, crustaceans and plant material (Becker, 1983).

*Redfin shiner*

The redfin shiner is ranked globally as G5 and has a statewide ranking of S2. These rankings indicate the Redfin shiner is secure globally though quite rare in parts of its range. Within Wisconsin however, it is very rare and very vulnerable to extirpation. It has been collected in small numbers from the
Milwaukee River and Cedar Creek in Ozaukee County, and even more infrequently from the Milwaukee River in Milwaukee County (Becker, 1983 and Lyons et al., 2000). The redfin shiner prefers more turbid waters of pools in low-gradient streams over substrates of boulders, cobble, sand, silt or detritus. Spawning occurs from early June through mid-August in sunfish nests where they coexist with sunfish in the nesting territory. Their diet is dominated by aquatic and terrestrial insects and at times, is dominated by filamentous algae (Becker, 1983).

**Longear sunfish**

The longear sunfish is ranked globally as a G5 and has a statewide ranking of S2. These rankings consider the longear sunfish to be secure globally though it may be quite rare in parts of its range. In Wisconsin, it is very rare and very vulnerable to extirpation. The Milwaukee River Basin was once one of the states more important strongholds (Greene, 1935 and Becker, 1983). More recently, Milwaukee River Basin populations have been in steep decline with a few remnant populations present in the Washington and Fond du Lac Counties (Lyons, et al., 2000).

The longear sunfish prefers clear, shallow, moderately warm, still waters of streams and small lakes. Found in or near vegetation. Spawning occurs from late May through mid-July, sporadic to August. The long ear sunfish diet is opportunistic and diverse including aquatic and terrestrial insects, fish eggs, larvae fish, small crustaceans and aquatic plant material (Becker, 1983).

**Special Concern**

Three state-listed fish species of special concern that potentially exist or are known to exist in the project include the banded killifish, least darter and lake sturgeon.

**Banded killifish**

The banded killifish is ranked globally as G5 and statewide as S3. By this ranking, the banded killifish is considered to be secure globally though they may be quite rare in parts of its range. Within Wisconsin however, its ranking indicates that it is rare or uncommon and vulnerable to extirpation. Small numbers of banded killifish have been identified in the Milwaukee River and Cedar Creek watershed in Ozaukee County (Becker, 1983 and Lyons et al., 2000).

The banded killifish prefers the clear shoal waters of estuaries and lakes, backwaters and areas in streams with slower currents (Becker, 1983). Substrate preferences include a wide range of substrates including gravel, sand, silt, marl, clay, detritus or cobble generally with sparse vegetation in water depths up to 0.6 m. Spawning occurs from June through mid-August over coarse sand substrate. The diet of the banded killifish is somewhat
habitat-specific and depends on the availability of food types. Generally they feed upon small crustaceans, insect larvae, plant material and algal filaments. The young have much more specific requirements and reportedly feed almost exclusively on planktonic crustacea and chironomid larvae.

**Least darter**

The least darter is ranked globally as G3 and statewide as S3. These rankings indicate that the fish is either very rare and local through its range or found locally in a restricted range; and rare or uncommon in Wisconsin. Earlier records indicated the least darter to be common in southeastern Wisconsin, including the Milwaukee River Basin and in particular the Menomonee River Watershed (Green, 1935). More recent accounts indicate that habitat changes have greatly reduced its distribution and relative abundance (Becker, 1983; Fago, 1985 and Lyons et al., 2000).

The least darter prefers clear, warm, quiet waters of overflow ponds, pools, lakes and streams over substrates of gravel, silt, sand, boulders, mud or clay with dense vegetation or filamentous algal beds, and at depths less than 1.5 m. Spawning occurs from late April into July. The diet of the least darter consists of aquatic insect larvae and nymphs, copepods and cladocerans (Becker, 1983).

**Lake sturgeon**

Lake sturgeon is ranked globally as G3/G4 (vulnerable) and statewide as S3. Globally the fish is very rare and local throughout its range; or globally secure and quite rare in parts of its range. It is rare or uncommon in Wisconsin but with secure populations in the Wolf/Fox River basins. Until recently, the lake sturgeon was considered absent from the Milwaukee River basin except for a small non-reproducing remnant population in Big Cedar Lake in Washington County; a result of a non-planned stocking by the former Wisconsin Conservation Department in 1936. An occasional lake sturgeon is observed by WDNR fisheries and commercial fishers working in the Milwaukee River Estuary or near-shore waters of Lake Michigan. The WDNR and its partners have been rearing lake sturgeon at its streamside rearing facility along the Milwaukee River at Newberg in an effort to restore sustainable populations in the Milwaukee River and near-shore waters of Lake Michigan. Since 2003, approximately 64,000 larvae and 5,112 lake sturgeon fingerling have been stocked in the Milwaukee River (Wawrzyn Lime Kiln EA).

The lake sturgeon prefers large rivers and lakes. It also lives in the shoal waters of the Great Lakes. Inland it shows a preference for the deepest mid-river areas and pools. Spawning occurs from late April through early June in cold, shallow, fast water over large rocky substrate. The lake sturgeon diet includes mussels, insect larvae, leeches, and snails (Becker, 1983).
3.2.5.2 Environmental Consequences

3.2.5.2.1 Proposed Action Alternative

The removal of the LK Dam and impoundment will result in the elimination of a 4.9-acre impoundment. The current impoundment is long and narrow (1300’ by 150’) so the change in visual appearance will be to a narrower, flowing river with more velocity, more meanders, and possibly more exposed boulders, pools and riffles, etc. The appearance of the river and corridor would be similar to the free-flowing reach created following removal of the former Chair Factory Dam in 2001. Average water depths will decrease within the former boundary of the impoundment and will likely mimic water depths which currently exist along free-flowing reaches of the Milwaukee River located upstream of the BS Dam impoundment, in the area of the restored Chair Factory Dam impoundment, and downstream of the LK Dam. Removal of the dam and impoundment will not affect water depths and discharge within the Milwaukee River upstream or downstream of the former impoundment since the LK Dam was operated under “run-of-the-river” conditions.

Water velocities will increase within the restored free-flowing river reach due to the return of the historical channel grade line. Under free-flowing conditions, average stream velocities, stream width and depths will vary depending on river discharge conditions and will be similar to those which currently exist along free-flowing reaches upstream of the BS Dam impoundment and downstream of the LK Dam. During average river discharge conditions, dam removal is not expected to result in dramatic changes throughout most of the restored free-flowing river channel due to the confining effect of the steep and narrow river valley and floodplain. This reach is expected to consist of deep riffles and slack water areas. Under low river discharge conditions, the removal of the dam will result in only minor decreases in stream width and surface water area with a correspondent increase in the exposed lower bank. A decrease in surface water area is expected to occur in those areas where exposed sediment is formed, primarily along the east bank and immediately upstream of the dam. Finally, removal of the LK Dam and attendant infrastructure will convert approximately 4.9-acres of the existing impoundment to riverine aquatic habitat, adjacent wetlands, and floodplain. The old millrace was constructed in a historical side channel and the restored river will have a split flow in this area.

Following removal of the LK Dam, an unknown amount and surface area of sediments will be exposed above the river waterline, primarily along the east, and to a lesser extent, the west shoreline. Smaller areas may also be exposed but these deposits will be transient and more prone to scour. Based on previous dam removal projects, the exposed soils will not result in noxious odors. Volunteer plants such as smartweed are expected to colonize.
the exposed sediment areas and seeding with a cover crop of rye and oats, and eventually native grasses and forbs will also be completed. Over time, trees and shrubs will naturally colonize this area.

Some scour and transport downstream of accumulated sediment will occur due to increased water velocity and shear stress. These increases are natural conditions and vital to channel formation/maintenance. The majority of the scoured material will settle out in the floodplain or river wherever the flow rate slows enough to allow deposition to occur. Regardless of their depositional site, coarser materials will provide benefits to fish and other aquatic life. Fine clay-silt-sand sediment deposited in floodplain and exposed river sediment bars will eventually be vegetated.

The scour of anoxic sediment increases the potential for potentially toxic un-ionized ammonia releases have the potential to affect aquatic species in the vicinity of the dam during drawdown. The potential for toxic effects can be minimized by completing the drawdown during the cold weather months. Cool water temperatures and lower water pH would reduce the availability of un-ionized ammonia. Higher spring flows would provide the benefit of dilution. Sediment removal during cold winter months is preferred.

Means and methods for dam removal will be implemented to minimize sediment scour, re-suspension and transport downstream. Drawdown of the impoundment and demolition of the dam structure may result in the loss of an estimated 500 cubic yards of sediment. Excessive sediment scour, transport and deposition of sediment downstream may impact fish and other aquatic life habitat downstream of the dam site.

Removal of the LK Dam will result in the restoration of free-flowing riverine physical habitat which existed prior to construction of the dam. Over time, fine textured substrate will be scoured and replaced with coarser native gravel, cobble, and boulder sized-substrate. Thermal regimes, water depths and stream velocities will also return to pre-dam conditions. These changes in physical habitat will increase the relative abundance and diversity of macroinvertebrates populations within the former impoundment. The time needed to sufficiently scour sands and silts from the impounded reach will depend on stream discharge conditions.

Removal of the LK Dam has the potential to improve the relative abundance, diversity and habitat of macroinvertebrates, native game and non-game fish species along the abandoned impoundment while reducing the relative abundance and habitat of the undesirable species such as common carp. Similar fish community responses were observed in the native fish community and their riverine habitat along two formerly impounded reaches of the Milwaukee River at West Bend and Milwaukee (Kramasz & Wawrzyn, 2009). Improvements to adfluvial and potamodromous fish species area also likely to benefit the Milwaukee Estuary AOC by contributing to the eventual delisting of BUIs.
Impacts on Endangered, Threatened and Special Concern Species

The removal of the dam poses potential short-term negative impacts and long-term benefits for Wisconsin special status fish species present in the Milwaukee River. Short-term adverse impacts are generally related to the short-term duration of the drawdown and construction phase of the LK Dam abandonment. Specifically, there exists the potential for erosion and scour of sediment accumulated behind the dam. Excessive and/or untimely releases of these sediments could increase turbidity and siltation downstream. Construction activities related to dam demolition, equipment access in the river and construction site erosion also have the potential to directly or indirectly impact these fish species if management practices to control these losses are not followed. As discussed in previous sections, means, methods and sequencing of drawdown and construction activities are available to mitigate, but not entirely eliminate, the negative effects of this project. Mitigation techniques include the location, seasonal timing (e.g., flow and temperature) and rate of the controlled impoundment drawdown, minimizing the amount of equipment access along the stream bank and stream bed, and construction erosion control practices.

The shrinking range of these listed fish species may be due to increased turbidity, siltation, stormwater runoff, and habitat modifications including the construction of dams (WDNR, 1997). Overall, habitat for state listed fish species should improve over time. State listed species evolved in free-flowing riverine habitat. The genetic diversity and sustainability of many species (e.g., lake sturgeon) are highly dependent on the seasonal movement and interactions of adults from Lake Michigan, the Milwaukee River Estuary and river proper to access suitable habitats for spawning and eventually their uninterrupted return to these habitats. Similarly, juveniles spend various amounts of time in the river proper and its tributaries feeding, growing and seeking cover to avoid predation before migrating to their subadult and adult habitats. Following removal of the LK Dam and its impoundment, the resulting habitat will provide the various types of habitat preferred by the listed fish species present in the Milwaukee River Basin. Those habitats include free-flowing water; pool, riffle and run features; a variety of coarse substrate sizes at the expense of the monotonous clay-silts that currently dominate the impoundment; adequate water depths; and more diverse invertebrate food sources.

Spawning times for these listed fish range from early-April through mid-August. The lake sturgeon spawns in late April through mid-June. However, sexually mature spawning adults are not yet present in this reach of the Milwaukee River. The majority of the other species have overlapping spawning times from early to mid-June. The narrowest spawning time is for the longear sunfish which has a narrow spawning period between mid-July and early August. Construction activities that have a higher potential to impact these species during their peak spawning period will be avoided to
the greatest extent practicable. To minimize potential impacts, breaching and controlled drawdown of the dam could proceed during the fall and winter of 2009-2010. High spring flows and cold water temperatures (February-March) would further reduce potential impacts to fish and their habitat. Under optimum conditions, the drawdown and bulk of construction disturbances would be completed by May prior to peak spawning periods.

**Invasive species**

Once the LK Dam is removed, fish will move up and downstream at any time. This could accelerate the upstream spread of AIS that are currently blocked during normal water levels but can move during spring high water periods. The dam removal would also remove the future possibility of modifying the dam to be a more effective barrier to AIS/VHS.

For more information on this issue, see Document 1 in Appendix C.

**Aquatic Vegetation**

The removal of the LK Dam and subsequent re-establishment of the river channel may alter the existing shoreline and vegetation in the impoundment. The drawdown of the impoundment may result in emergent vegetation developing along the exposed sediment areas. The type and extent of vegetative growth will be dependent on the existence of viable dormant seed already present in the existing seed bank, imported from local upland sources or intentionally planted/seeded. Based upon existing nearshore and aquatic plants growing in the vicinity, the plants that are likely to proliferate include bulrush, cattail, reed canary grass, and sedges. This herbaceous growth will probably be replaced with shrubs and other woody species as the wetlands develop and take on characteristics associated with riparian corridor.

Floating leaved aquatic vegetation is not likely in moving water but perhaps in still water areas. Some submerged aquatic species might be found in the flowing water areas of the river, however, rooted aquatic plant growth which may become re-established following drawdown of the impoundment would likely be limited to emergent or floating vegetation with adaptations to flowing water conditions and turbidity. These plants may include floating pondweed, common waterweed, and coontail. All of these plants provide valuable fish and other aquatic life habitat provided they are not present in nuisance amounts.

Long-term effects on the riparian system and aquatic life should be beneficial. Improvements will occur in physical characteristics which will create ecological and biological benefits. The natural rocky-cobble substrate characteristic of the Milwaukee River will be restored. The banks and part of the impoundment will become fringe area other portions of the river will become river bank. This conversion will have significance as the banks
return to the original condition of the area preceding the construction of the LK Dam.

In summary, removal of the LK Dam restores a portion of the natural riverine landscape and ecosystem to its natural condition. Increased aquatic biodiversity and viability of the fishery is expected. The natural sediment transport function of the river reach would be restored. A pathway for potential AIS movement in the river reach above the dam would be provided. Fragmented aquatic habitat would be reconnected, thus benefitting the project areas as well as the watershed and the Milwaukee Estuary AOC.

3.2.5.2.2 No Action Alternative

Leaving the dam in place will result in ongoing negative impacts to aquatic biodiversity are expected. Desirable riverbed substrate for use by aquatic species remains buried by dam components and fine grained sediment. Interruption of the normal sediment transport function of the river and the continued possibility for aggregation of contaminants in sediments remains. Important aquatic habitat remains fragmented. No benefits to the Milwaukee Estuary AOC would be achieved.

3.2.6 Terrestrial Wildlife

3.2.6.1 Affected Environment

3.2.6.1.1 Wildlife Habitat

The Milwaukee River up and downstream from LK Dam provides many habitat requirements (food, cover, water, space and solitude) for a variety of birds, mammals, reptiles, amphibians and invertebrates. The river way also provides an important wildlife “corridor” of habitat linking other blocks of habitat upstream and downstream from the LK Dam, however, linkage for herptiles is diminished by the presence of the LK Dam.

Common mammals known to occur in the project area are opossum, striped skunk, raccoon, muskrat, mink, red, gray and fox squirrel, cottontail rabbit, eastern chipmunk, thirteen-lined ground squirrel, red fox, coyote, woodchuck, white-tailed deer, and various species of moles, voles, shrews, weasels, mice and bats. Incidental mammals include river otter and possibly beaver.

Birds known to occur in the area are Canada geese (both the nesting “Giant” and migratory “Interior” subspecies), puddle ducks (especially mallards, wood ducks, and blue-winged teal), grebes, coots, great blue herons, egrets, various hawk species (Cooper’s, sharp-shinned, red-tailed, American kestrel), wild turkeys, and numerous species of songbirds and other birds.

Additional species using the river seasonally during migration include many other puddle duck species (green-winged teal, American wigeon, American
Section 3.2 Lime Kiln Dam (LK Dam) Removal

black duck, etc.), diving ducks (ring-necked ducks, buffleheads, common goldeneyes, scaup, common merganser, etc.), and various species of terns, songbirds, shorebirds, rails, sandpipers, snipe, American woodcock, and gulls.

Common reptiles known to occur along the current river way are painted turtles, snapping turtles, and eastern garter snakes. Amphibians known to occur are American toads, chorus frogs, green frogs, and northern leopard frogs. Other species of frogs, turtles, snakes and salamanders and newts most likely are present.

3.2.6.2 Environmental Consequences

3.2.6.2.1 Proposed Action Alternative

A temporary disturbance of wildlife is expected during construction through the increased presence of humans and construction equipment.

Restoring the river to its original bifurcated channel would be very positive for wildlife. The middle island section would provide excellent loafing and resting habitat for turtles, mallards, snakes, etc. The spatial separation recreated between the channels would provide additional breeding habitat for mallards and other birds.

The planted and natural vegetation that would grow on the drawn down areas will provide habitat characteristics somewhat different (i.e., shrubby-grassy areas, or additional wooded areas) than what is currently found on the adjacent wooded side slopes some of which are mowed or developed.

It is unlikely any mammal species would be lost due to removal of the dam. Most mammals are terrestrial and the addition of terrestrial habitat would improve habitat conditions for those species. The continued presence of the river and wider, uninterrupted shoreline would be attractive to raccoons, mink, muskrats, and otters. Exposed sediment area stabilization and revegetation would benefit shrews, mice, voles, cottontail rabbits, red fox, coyotes, and white-tailed deer. The new habitat may increase incidents of wildlife moving into parks and residential areas. Removing the dam would slightly reduce the surface water area, reducing the amount of “loafing” habitat and open water for waterfowl such as Canada geese, mallards and diving ducks. It is unlikely any bird species would be adversely impacted if the dam is removed.

WDNR Wildlife Biologist Harvey Halverson, in an assessment of the North Avenue dam removal downstream from this project, stated that because of dam removal and mud flat stabilization, the habitat conditions would improve for 46 common bird species. Similar results can be expected for the LK Dam site. Suitable grass/forb or grass/shrub cover types would attract and provide feeding habitat for raptors. Edge species such as house wrens, gray catbirds, and American goldfinches would use the riparian cover for
nesting and feeding sites. Nesting habitat and foraging perches would improve for riparian warblers, notably the yellow warbler and the common yellow throat. Ground nesting waterfowl, such as the blue-winged teal and mallard, would also use established grassy areas as nest cover.

The increased use by birds would also attract raptorial and mammalian predators, such as the great-horned owl, American kestrel, red-tailed hawk, and red fox. Feeding habitat for birds using the adjacent wooded areas would improve. Many of the summer residents would consume the seeds and insects produced in the riparian vegetation.

Bird watching opportunities may increase with the influx of species adaptable to newly established riparian vegetation on the drawdown area. Viewing opportunities would increase as the vegetation matures and attracts migratory and summer resident birds. Local citizens who winter feed birds may note an increase in bird diversity at their feeding stations. Songbirds attracted to the corridor are usually opportunistic, seeking available food sources and alternative feeding sites during periods of harsh winter weather.

No change in species diversity and richness is expected by removing the LK Dam. The exposed and stabilized mud flats and shoreline would provide suitable feeding sites and nesting cover for beneficial snakes, such as garter snakes. Snake abundance may increase as the riparian habitat matures and produces suitable prey such as small frogs, insects, mice, and snails. Turtle numbers are not expected to noticeably change. Exposed river bottom (tree roots, gravel bedrock areas, etc.) will be used as basking sites or egg-laying habitat for snapping turtles and painted turtles.

3.2.6.2.2 No Action Alternative

The No Action Alternative will have no impact on existing wildlife habitat. Under the No Action Alternative, diminished terrestrial organism movements due to reduced riparian zone will continue to occur.

3.2.7 Vegetation

3.2.7.1 Affected Environment

Submerged aquatic vegetation is not common along the Milwaukee River in the project vicinity. The most commonly observed plants include coontail, common waterweed, sago pondweed and long-leafed pondweed.

The adjacent woody, brushy and grassy shorelines provide an important component for the corridor. Mature trees provide wildlife food and cover and screen the river channel from adjacent urban housing and infrastructure. The wooded areas provide birding opportunities and refuge areas for wildlife in populated urban setting. The area is a migration corridor and vegetation attracts neotropical woodland birds, waterfowl, raptors (including Bald eagles) and other bird species.
3.2.7.2 Environmental Consequences

3.2.7.2.1 Proposed Action Alternative

Existing park roads will be used for access to the site. No grading is needed for access and minimal vegetation removal will be required for construction.

The removal of the LK Dam and subsequent re-establishment of the river channel may alter the existing shoreline and vegetation in the impoundment. The drawdown of the impoundment may result in emergent vegetation developing along the exposed sediment areas. The type and extent of vegetative growth will be dependent on the existence of viable dormant seed already present in the existing seed bank and imported from local upland sources or intentionally planted/seeded. Based upon existing nearshore and aquatic plants growing in the vicinity, the plants that are likely to proliferate include bulrush, cattail, reed canary grass, and sedges.

Rooted aquatic plant growth which may become re-established following drawdown of the impoundment would likely be include emergent, submergent and floating vegetation with adaptations to flowing water conditions and turbidity. These plants may include floating pondweed, common waterweed, and coontail. All of these plants provide valuable fish and other aquatic life habitat provided they are not present in nuisance amounts.

3.2.7.2.2 No Action Alternative

The No Action Alternative will have no impact on existing vegetation. The existing terrestrial plants are in fair to good condition. The existing barriers sustain artificial hydrology and disrupt sediment. These issues influence riparian vegetation.

3.2.8 Cultural and Historic Resources

3.2.8.1 Affected Environment

Cultural resources within Ozaukee County and the Village of Grafton can encompass archaeological and historic resources, including but not necessarily limited to buildings, structures, objects, districts, and sites. These resources represent a variety of periods ranging from the prehistoric to the present day.

3.2.8.1.1 Archaeological and Historic Resources

The WEPA EA for the LK Dam Removal project states there is no indication of “unknown artifacts or other archaeologically significant remnants” present in the area (Kramasz, 2009, p. 26).

An archaeological investigation of the project area was completed in August 2009. The following paragraphs are taken or adapted from the report "Archaeological Investigations for the Milwaukee River Watershed Fish Passage"
Project, Ozaukee County, Wisconsin (Great Lakes Archaeological Research Center, 2009).

The Architecture History Memo included in Appendix A of the report (see Document 5 in Appendix C of this EA) provides the following information: The LK Dam lies on the eastern edge of Lime Kiln Park adjacent to open parkland (no built resources). The original dam was constructed in about 1890 to provide to the nearby Milwaukee Falls Lime Company’s quarries for the drilling of stone. The dam was rebuilt around 1920, at which time the original timber construction was replaced with concrete. Significant alterations and repairs were made in 1963 after the dam ceased to provide power to the Milwaukee Falls Lime Company. As a result of these modifications, the dam maintains a low degree of historic integrity. Three of the original five Milwaukee Falls Lime Company kilns remain in Grafton’s Lime Kiln Park and were collectively recognized as a local historic landmark in 1991.

In August 2009, Great Lakes Archaeological Research Center (GLARC) conducted Phase I archaeological investigations along seven watersheds (Fredonia Creek, Riverside Drive Creek, Trinity Creek, Lac du Cours Outlet, Ulao Creek, Riveredger Creek, and Mole Creek) and three dams (Lime Kiln, Bridge Street, and Mequon-Thiensville) within Ozaukee County. The investigations were conducted within the area of potential effect for areas of proposed impediment removal associated with the Milwaukee River Watershed Fish Passage project in Ozaukee County, Wisconsin. Archaeological investigations were conducted to partially fulfill requirements of Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665) as amended and 36 CFR, Part 800, which serves to implement the Act.

Investigations of the project areas were conducted in two stages. The first stage consisted of review of existing information to identify previously documented archaeological and burial sites within one mile of the project areas. The second stage consisted of archaeology survey of those portions of the project areas that would be potentially affected by ground disturbing activities. The survey included visual site inspection, surface survey, and close interval shovel testing.

During the archival and literature review, 32 archaeological and burial sites were identified within one mile of the LK Dam project area. No sites were identified within the immediate project area.

In summary, no archaeological sites, cultural materials, or historic properties were identified as a result of archaeological survey within the project area.

3.2.8.2 Environmental Consequences

3.2.8.2.1 Proposed Action Alternative
All ground disturbing activities proposed will occur within the channel and along the channel slopes. The area adjacent to the dam is sloped and rocky; no areas were appropriate for more intensive archaeological testing. No cultural resources were observed adjacent to the dam, based on the visual inspection.

The investigation found that the Proposed Action will not adversely affect the cultural resource base in the project area. However, it noted that current conventional archaeological survey techniques are inadequate to determine the presence of deeply buried archaeological or paleontological deposits. The report indicated the probability for encountering such sites is unlikely but that if any materials are encountered, construction in the area of the discovery should be halted and the State Historical Society of Wisconsin should be consulted. The same course of action would be required if human remains or other indications of a burial site are encountered.

3.2.8.2.2 No Action Alternative

The No Action Alternative will not impact existing cultural resources either directly or indirectly. This alternative will allow for existing conditions to remain as they currently are. Archaeological and historic resources will neither be preserved in another manner nor damaged under the No-Action Alternative.

3.2.9 Visual Quality and Aesthetics

3.2.9.1 Affected Environment

In terms of visual quality and aesthetics, the areas affected by the removal of the LK Dam include: (a) the dam site, (b) the impoundment, (c) the former raceway, (d) neighboring properties, and (e) upstream and downstream areas of the watershed.

**Dam Site:** The LK Dam is approximately 60 feet wide and 9 feet tall.

**Impoundment:** The LK Dam impoundment has a surface area of approximately 4.9 acres and contains about 19.7 acre feet of water by volume. Maximum and average water depths are 9 feet and 5 feet, respectively. The impounded reach extends approximately 1,300 feet upstream of the Dam and has an average width of approximately 150 feet. (Dueppen, 2009).

**Former Raceway:** Once the drawdown is complete and the spillway is removed, the former raceway river channel is to be restored by removing earth, rock and concrete that was used to abandon this feature. The reach of the Milwaukee River where the LK Dam was constructed historically bifurcated at the dam location as the result of a limestone outcrop (island) that occurs at the location of the dam. The river split into a larger (east) channel and a smaller (west) channel. The millrace was originally
constructed in the smaller river channel. Materials used to abandon the millrace will be removed and disposed offsite. The channel contour would be re-established.

Adjacent Properties: Land use adjoining the LK Dam and the impoundment includes 9 private residential lots along the east shoreline and 3 private residential lots on the west shoreline. All of the residential lots are single family residences. The Village of Grafton owns two lots totaling approximately 28 acres on the west bank of the river including the 26.8 acre Lime Kiln Park.

3.2.9.2 Environmental Consequences

3.2.9.2.1 Proposed Action Alternative

Removal of the LK Dam and impoundment may expose sediment along some of the existing impounded shoreline.

Removal of the LK Dam should enhance access to the river bed and the riparian areas currently adjacent to the Dam and impoundment. Due to the safety hazard associated with the dam, access to the dam is currently restricted by the presence of a chain link fence posted with a warning and no trespassing signs. The steep and high rock terrace combined with private property limits shore access along the impoundment shoreline. Elimination of the impoundment and the chain link fence should provide enhanced access to the water’s edge within portions of the impoundment that revert to ownership by the Village of Grafton.

Following the permanent drawdown of the impoundment and removal of the dam, the former aesthetics of a wide, slow river would be lost. The historical 1,300-foot-long reach of the Milwaukee River will be restored to a moderately fast free-flowing river dominated by riffles, deep runs and slack water areas which existed under pre-development conditions and which currently exists upstream of the Grafton Millpond and downstream of the LK Dam. The change from a slow, stagnant pool to a more visually diverse, dynamic and natural area increases the visual and aesthetic quality of the area.

3.2.9.2.2 No Action Alternative

The No Action Alternative would result in no significant consequences in terms of visual quality or aesthetics, as property surrounding the LK Dam and impoundment would likely to continue in the current uses as private residences and a public park.

The aesthetics of the area of the park adjoining the LK Dam would continue to be diminished by the continued need to maintain a fence and warning signs along with continued exposure of concrete, rock and soil associated with embankment fills.
3.2.10 Transportation

3.2.10.1 Affected Environment

3.2.10.1.1 Transportation Network

State of Wisconsin

Within the State of Wisconsin, the transportation network consists of roadways, trails, rail lines, ports, and airports.

The LK Dam is located within the Milwaukee River watershed. Regional access into this area of the state is provided by state roadways under the jurisdiction of the Wisconsin Department of Transportation (WisDOT). These roadways include Interstate 43/State Trunk Highway (STH) 57/STH 32, which is the primary north-south road; STH 167, which provides east-west access though Thiensville; STH 60, which provides east-west access through Grafton; and STH 33, which provides east-west access through Port Washington and Saukville (Ozaukee County, 2009). County and local roadways then provide local access to the LK Dam.

Ozaukee County

Ozaukee County is well-served by a series of freeways, state highways, major roads, and local roads. The Ozaukee County Highway Department is responsible for maintaining a total of 448 miles of roads within the county: 27 miles of Interstate Highway, 64 miles of State Trunk Highways, 154 miles of County Trunk Highways, and 203 miles of Town Roads (Ozaukee County, 2009).

Similar to the rest of the State, within Ozaukee County, the primary means of transportation is the personal motor vehicle. Transportation within the county is guided by the official areawide planning agency for the southeastern region of the State, Southeastern Wisconsin Regional Planning Commission (SEWRPC). (Ozaukee County, 2009).

Ozaukee County’s vision of the regional transportation system plan is to provide a multi-modal transportation system in order to reduce auto dependency and promote high air quality. The Ozaukee County Express Bus (Route 143) provides service to Mitchell Street, Downtown Milwaukee, Cedarburg, Fredonia, Grafton, Mequon, Port Washington and Saukville.

Transportation in Ozaukee County also includes non-motorized modes of transportation. The Ozaukee Interurban Trail abuts the project area. Although this trail does not parallel the Milwaukee River, it does connect to roadways, trail networks, and parks in the communities of Mequon, Thiensville, Port Washington, Cedarburg and Grafton.

The County also is served by the one passenger and three freight railway companies (Ozaukee County, 2009). Existing railroad corridors run north-
south through the project area in the communities of Mequon, Thiensville, Grafton, Cedarburg and Saukville.

The Milwaukee River does not have any commercial ports or marinas within the project limits. There is a recreational/utility boat launch near the BS Dam in Grafton, Proposed Action 3 (Ozaukee County, 2009).

Air service is available at the Milwaukee County General Mitchell International Airport, which is located in Milwaukee approximately 20 miles south of the project area. Commercial airlines provide regional services at this location. Corporate and private aircraft also utilize this airport (Ozaukee County, 2009).

**Village of Grafton**

Similar to Ozaukee County, the Village of Grafton’s roadway system consists of freeways, state highways, major roads, and local roads.

Within the Village of Grafton, east-west traffic travels along STH 60/Washington Street and Falls Road. North-south traffic travels along CTH O/Green Bay Road and Interstate 43 (Ozaukee County, 2009). Average daily traffic along these roadways varies from a low of 5,400 (on CTH O/Green Bay Road north of Cedar Creek Road) to a high of 52,400 (on Interstate 43 north of STH 60). STH 60/Washington Street and CTH O/Green Bay Road will provide the primary access to the LK Dam site once within the Village of Grafton.

3.2.10.1.2 Transportation of Materials

State and county roadways have use restrictions placed on them by WisDOT and the Ozaukee County Highway Department for commercial motor vehicles. Restrictions are based on vehicle size, weight, and the time of year for travel (WisDOT, 2009). Temporary seasonal weight restrictions are typically placed on county roads each spring.

3.2.10.2 Environmental Consequences

3.2.10.2.1 Proposed Action Alternative

The Proposed Action will have no significant impact on transportation within the communities in the project area once the project is complete. Nominal increases in the use of the local and regional roads along the river may occur during construction and post-construction, particularly during warmer months due to increases in tourism encouraged by the project.

During construction, residents, workers, and visitors will experience both direct and indirect impacts. The potential transportation impacts associated with the project are temporary and mainly limited to the immediate surroundings of the LK Dam location.
Indirect impacts will be minor and consist of additional construction traffic and re-routing of traffic. Equipment used for the restoration activities and the removal of fill will need to be delivered to the individual sites and eventually removed. Likewise, fill and waste materials will need to be transported to and from project sites. During the construction period, additional localized traffic will result due to these activities, along with the generation of additional noise and dust from the movement of the vehicles and equipment.

The proposed project also is expected to temporarily or permanently generate or retain approximately 29 jobs. This will contribute to additional traffic on city roadways. However, the amount of additional traffic will be negligible.

While few impacts are expected, the proposed project may require the use of vehicle permits for the delivery and removal of construction materials. For any construction vehicles operating with overweight loads, proper permitting will be required. Detailed routes may be required to meet load restrictions on bridges and particular local roads, and construction scheduling may need to accommodate seasonal weight restrictions.

3.2.10.2.2 No Action Alternative

The No Action Alternative will not impact the existing transportation network or associated traffic directly or indirectly. This alternative will be compatible with transportation plans and programs, because it will allow for the existing conditions and proposed improvements to remain as they currently are.

3.2.11 Air Quality

3.2.11.1 Affected Environment

Air quality data for USEPA criteria pollutants measured from air monitoring sites for the state of Wisconsin are submitted to USEPA by the WDNR, and available through the USEPA’s AIRNOW Internet portal. As of December 2009, the criteria pollutants PM2.5, CO, Pb, NO2, and SO2, continue to remain in attainment of the NAAQS in Ozaukee County. On February, 10, 2009, the Wisconsin Natural Resources Board redesignated Ozaukee County to “attainment” for the USEPA-revoked 1-hour ozone standard. This action was taken in compliance with the Agency’s implementation of the Clean Air Act’s “anti-backsliding” provision.

Ozaukee County remains a moderate non-attainment area with respect to the 8-hour ozone ambient air quality standard.

3.2.11.2 Environmental Consequences

3.2.11.2.1 Proposed Action Alternative
This proposed project alternative will result in direct air emissions (engine combustion products, and fugitive dust) from earth moving vehicles during construction. Gases released by newly-exposed sediments are unlikely to cause odor impacts. Reductions in air quality resulting from these impacts, however, will be minor, relatively localized, and temporary in nature.

In addition, excavation and earth moving activities can cause re-entrainment of dust particulates and possibly other pollutants into the atmosphere due to removal of dirt, debris, and other materials. This effect will also be temporary and primarily local in nature, although some transport of minor amounts of airborne pollutants to downwind nearby locations within or outside the focus areas of the proposed project can occur.

Indirect emissions from motor vehicle exhaust may occur if the enhanced, post-project river and shoreline attracts an increased number of visitors. Internal combustion engines emit carbon monoxide, nitrogen oxides, and VOCs. Nitrogen oxide and VOC emissions can contribute to ozone formation. It is not possible to predict how many additional vehicle miles traveled will result from the proposed project. Therefore, it was not possible to quantify the indirect project emissions. However, even if all the local roads were saturated with traffic, resultant nitrogen oxide and VOC emissions would not exceed the Clean Air Act Conformity de minimis levels of 100 and 50 tons per year, respectively (as specified in 40 CFR 93.153).

No significant long-term air quality related adverse impacts are expected from direct or indirect project emissions. Since it is not possible to quantify the potential indirect emissions from project-related increased vehicle traffic and, even under a worst-case scenario, they would not exceed de minimis thresholds, a Record of Non-Applicability (RONA) has not been issued.

3.2.11.2 No Action Alternative

The No Action Alternative will have no affect on existing air quality conditions. Under the No Action Alternative, mobile construction equipment use and ground disturbing impacts from restoration related activities under the proposed project will not occur. Thus, air quality impacts from material re-entrained into the ambient air and transported or deposited downwind will be avoided.

3.2.12 Noise

3.2.12.1 Affected Environment

Noise is typically defined as “unwanted sound.” It may be as mild as a general nuisance, such as a noise causing distraction or masking desired sounds, or severe enough to impede communication, affect behavior, and cause temporary or permanent hearing loss.
Noise is measured in units of decibels (dB) on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more “weight.” The A-weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5-dBA change (either an increase or a decrease) in noise levels, however, is clearly noticeable. A 10-dBA change in noise levels is perceived as a doubling (if it is an increase in noise levels) or halving (if it is a decrease) of noise loudness.

The project area contains outdoor sound environments that consist primarily of streets and parks. Sound sources in parks typically originate from recreational activities and can result in decibel levels in the 60-70 dBA range, but can be higher depending on the activity. Noise levels from car and truck traffic on city streets within the focus areas will usually be higher, in the range of 70-90 db. By way of comparison, typical indoor environments usually maintain sound levels in the 50-60 dBA range (Reagan & Grant, 1977).

Water cascading over a dam such as the LK Dam generates acoustic energy (i.e., sound). The sound energy from such sources is usually generated over a broad frequency spectrum. Whether the sound generated is perceived as objectionable and, therefore, “noise” is subjective. While such sound emissions will interfere with verbal communication to some extent, most individuals do not find such broad-band, “white noise,” objectionable. In fact, it is often perceived as an amenity.

### 3.2.12.2 Environmental Consequences

#### 3.2.12.2.1 Proposed Action Alternative

Noise generated by construction equipment as a result of the project activity is likely to constitute the greatest increased noise impact above existing conditions. It is anticipated that earth moving machinery such as bulldozers, backhoes, and dredges, or supporting transport equipment like heavy trucks and barges, will be utilized in the restoration activities. These sources of sound can cause temporarily elevated noise levels within and near the project area. Table 3.12-1 provides the range of noise levels experienced for typical construction equipment approximately 50 feet from the source of the noise.

### Table 3.12-1 Typical Noise from Construction Equipment (dBA)

<table>
<thead>
<tr>
<th>Sound Pressure Level (dBA)</th>
<th>Typical Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-80</td>
<td>Pump</td>
</tr>
<tr>
<td>75-85</td>
<td>Backhoe</td>
</tr>
<tr>
<td>80-90</td>
<td>Heavy Truck</td>
</tr>
<tr>
<td>80-85</td>
<td>Mobile Crane</td>
</tr>
<tr>
<td>80-95</td>
<td>Bulldozers</td>
</tr>
<tr>
<td>80-90</td>
<td>Graders</td>
</tr>
</tbody>
</table>
These noise levels are comparable to the range of noise found in typical industrial and city street settings, but are higher than what is typically experienced in parks. The site is located adjacent to or near city streets; however, temporary increases in noise levels will be most evident to residential occupants. To minimize the impact of temporary construction-related noise, the Village of Grafton has a local noise ordinance that limits the hours for construction activities to between 7:00 a.m. and 9:30 p.m.

Minor permanent noise impacts can also result from the project once restoration of the site is complete. Growth of recreational activities may occur, such as fishing, sailing, kayaking, swimming, and hiking, but these activities will have no appreciable noise impact. As described in section 3.2.12.1, water flowing over the dam creates noise in the current environment. After the dam is removed, comparable noise will come from water rushing over rocks and moving through the area at a faster velocity; this change is expected to balance with the elimination of water cascading over the dam and, therefore, be unappreciable.

3.2.12.2 No Action Alternative

The No Action Alternative would not be expected to affect existing noise levels in the project area. The No Action Alternative would avoid the temporary increase in noise levels during restoration due to earth removal and remediation activities under the proposed project. Noise levels from water cascading over the LK Dam would remain the same.

3.2.13 Human Health and Safety

3.2.13.1 Affected Environment

The affected environment includes the dam structure, its current impoundment, and areas downstream that are within the floodplain. In addition, the affected environment under the Proposed Action Alternative would include a temporary construction site on the river during dam removal.

3.2.13.2 Environmental Consequences

3.2.13.2.1 Proposed Action Alternative

The Proposed Action Alternative poses no impact to human health for the general public. Several benefits to public safety may be realized as hazards associated with concrete, rubble and rock from the dam and exposed structure are removed from the river.

Potential temporary safety and health hazards related to dam removal chiefly impact workers at the sites. Applicable regulations (i.e. potential
hazards) include, but are not limited to fall protection, drowning hazards, noise, confined spaces, etc. These various hazards are to be addressed through implementation of applicable OSHA and/or WisCOMM construction standards (29 CFR 1926), and should be outlined in site-specific safety and health plans which explain how each contractor will address compliance with these regulations for their employees. Employees working at all project sites are expected to have training related to the potential hazards at the sites.

3.2.13.2.2 No Action Alternative

The No Action Alternative would result in leaving the LK Dam in place, posing safety hazards due to the concrete, rubble and rock that are in place. In addition, no action would allow the dam to continue deteriorating due to the effects of river action, weathering, erosion, and freeze and thaw cycle. Ultimately, dam failure would likely occur as an uncontrolled release of water, structural debris and sediment downstream.

3.2.14 Socioeconomic and Environmental Justice

3.2.14.1 Affected Environment

Ozaukee County is the smallest county by land area in the state of Wisconsin, covering approximately 235 square miles. The County is located in the southeastern portion of Wisconsin on 25 linear miles of Lake Michigan shoreline. Current land use is variable and includes: residential, commercial, industrial, and agricultural. Unused rural/open lands, wetlands and woods are also present. The amount of land in Ozaukee County devoted to urban land use has increased by 170% since 1963. The County is home to a population of 87,000 (2009 estimate) and has the highest income per capita of any Wisconsin county. Its largest city is Mequon, with a population of 23,560.

Data for the following discussion were primarily obtained from the 2000 U.S. Decennial Census, prepared by the US Census Bureau (USCB). When available, 2008 estimates are provided for Ozaukee County.

In 2008, Ozaukee County was estimated to have a population of 85,874 (USCB, 2007). The county population grew by 4.3 percent from the 2000 population of 82,317 (USCB, 2000). The county’s residents (2008) were comprised of 96.0 percent Caucasian, 1.5 percent black or African-American, 0.3 percent Native American and Alaska Native, 1.4 percent Asian, and 2.0 percent Hispanic or Latino origin.

In 2008, Ozaukee County had 35,390 housing units, with 22.9 percent of the housing units being multi-unit structures. The homeownership rate in 2000 was 76.3 percent.
Ozaukee County had 68,847 residents who were 16 years or older in 2008 (est.), with 48,880 or 71.2 percent, in the civilian labor force. In 2008, 3.6 percent of residents in the civilian labor force were unemployed. The top three employment industries in Ozaukee County were educational, health and social services (20.2 percent), manufacturing (19.8 percent), and retail trade (11.5 percent). In 2007, the median household income for Ozaukee County was $75,938 and 4.5 percent of individuals lived below poverty level. Current unemployment levels have doubled since 2008 and have been estimated at 7.3 percent as of September 2009 (USDL, 2009). For comparison, Wisconsin’s median household income was $50,567 and 10.8 percent of individuals lived below the poverty level in 2000 (USCB, 2000b).

Lime Kiln Park is a popular day user destination for residents of the Village of Grafton. Fishing is a popular activity, especially below the LK Dam where public access is readily available. Fishable populations are present within the LK Dam impoundment but public access in the immediate vicinity of LK Dam is more difficult due to a chain link fence preventing access to the Dam structure. Access to the impoundment is limited due to the steep terrain and private property ownership along the impoundment shoreline.

3.2.14.2 Environmental Consequences

3.2.14.2.1 Proposed Action Alternative

There is no particular social, ethnic, or cultural group that will receive greater benefits due to the project (Kramasz, 2009).

The Proposed Action (dam removal and restoration of the natural river channel) will have positive socioeconomic effects on residents and businesses in the project area. Design and construction phases of the project will create jobs in project management, engineering design, construction trades and support positions. After construction, socioeconomic benefits will continue. The natural fishery will be enhanced, thereby benefiting sport and subsistence fishers. In addition, businesses supporting fishers, tourists, and water-based sports will benefit.

The Proposed Action will relieve the financial burden of local funding needed to repair, maintain, or replace the LK Dam.

The Proposed Action is not expected to disproportionately affect any minority population, ethnic or economically disadvantaged group. Improving and creating sustainable fish stocks within the most populated and demographically diverse river basins in the state of Wisconsin will have wide public benefit.

3.2.14.2.2 No Action Alternative

The No Action Alternative would leave conditions in the river as they are – desirable sport fish would continue to be blocked from upstream areas and
there would continue to be decreased viability of stream resident populations. Recreational opportunities for local residents and visitors to the area would be reduced as would the level of recreationally-based business activity. There would be no benefit to the local economy as a result of the proposed work (i.e. job creation).

The No Action Alternative also results in the continued reliance on expensive and controversial hatchery and stocking programs to maintain native and sport fish populations. In addition, it requires large sums of local funding to repair or replace the LK Dam in the long run.

3.2.15 **Cumulative Impacts**

Removal of the LK Dam would be the second in a series of fish passage improvements planned for the Milwaukee River and its tributaries in Ozaukee County, WI. The addition of fish passage at the LK Dam site would augment past dam removals on the lower Milwaukee River. Removal of LK Dam would provide fish passage between the BS Dam in the Village of Grafton to the Milwaukee Estuary and Lake Michigan. Future provision of a fishway or dam removal at the BS Dam in Grafton, and removal of other fish passage barriers on the tributaries identified in this project would contribute to reconnection of 158 river miles and 119,000 acres of aquatic habitat to the regional fishery, the Milwaukee Estuary and Lake Michigan.

LK Dam removal would potentially contribute to expansion of the same aquatic and wetland habitat to use by AIS.

As a resource management priority for local units of government along the Milwaukee River, other minor yet collectively significant fish passage improvements are expected in the long term.

3.2.15.1 *Proposed Action Alternative*

Removal of the LK Dam contributes to the goal of reducing BUI’s in the Milwaukee Estuary AOC. It would contribute to enhancement of fish passage opportunity beyond the BS Dam, also in the Village of Grafton. Isolated aquatic habitat would be reconnected and biodiversity of the aquatic ecosystem would be enhanced in the long term.

Physical changes to the landscape result as the spillway and embankment fill are removed and the river channel restored to natural condition. The natural sediment transport function of the riverine environment will be restored in the vicinity of the dam.

Finally, dam removal at the Lime Kiln project site would contribute to potential AIS movement from BS Dam at river mile 32 to the Milwaukee Estuary and Lake Michigan.

3.2.15.2 *No Action Alternative*
If there is no removal of the LK Dam, fragmentation of aquatic habitat would persist and the viability and diversity of the natural fishery of the Milwaukee River would continue to be negatively impacted. There would be no contribution to the delisting of the BUI's of the Milwaukee Estuary and Lake Michigan Area of Concern. The biological and geomorphological integrity of the entire watershed would suffer from habitat fragmentation. Naturally produced stocks of potamodromous fish in the lower Milwaukee River, its Estuary and near shore portions of Lake Michigan are untenable. Upstream areas continue to fail to meet their full ecological potential to the region. River resident fauna suffer from decreased abundance, diversity and sustainability.
3.3 BRIDGE STREET DAM FISHWAY CONSTRUCTION-ALTERNATIVE A

3.3.1 Geology And Soils

3.3.1.1 Affected Environment

Geology and Groundwater Hydrology

The geology and groundwater hydrology of the local area was investigated in some detail as part of a local watershed scale study (Northern Environmental, 1998). Up to 2,000 feet of Paleozoic-age sedimentary rock overlies Precambrian-age crystalline rocks in Ozaukee County. The material properties of these rocks are used to differentiate the various strata and assign formation names. These formations are grouped into two major hydrostratigraphic units: the deep Sandstone Aquifer and the shallow Niagara/Unconsolidated Sediment Aquifer. Since the study area is located in an area where a thick shale aquitard separates the two aquifers, only the shallow aquifer is of significance to the study.

Silurian-age dolomite underlies Grafton, and is exposed at the surface along the Milwaukee River. Natural cascades are present in several areas where the beds of watercourses lie directly on bedrock. A regional fault is mapped from Port Washington, and passing through Grafton, Cedarburg, Menomonee Falls, and Waukesha. This fault has been named the “Waukesha Fault, and is believed to generate 30 to 100 feet of displacement in the Silurian bedrock, and to be at least partially responsible for the cascades in these communities.

Southeastern Wisconsin was repeatedly glaciated, with the most recent ice sheets retreating less than 13,000 years before present. These glaciations deposited a sequence of diamicton and water-laid deposits. Glacially-deposited formations underlying Ozaukee County include the Kewaunee Formation, the Oak Creek Formation, and the Holy Hill Formation. In the Grafton area, the Milwaukee River was an ice-margin stream during deposition of the Kewaunee Formation sediments. The prototypic red clays of the Kewaunee Formation are found a short distance east of the river. The brownish/grayish and somewhat coarser grained sediment of the Oak Creek Formation is found under the Kewaunee Formation and is exposed at the surface west of the river. At the dam site, sediments of the Oak Creek Formation are found in both banks.

Three important aquifers are present in Ozaukee County and include (in increasing depth below the land surface) the Sand-and-Gravel Aquifer formed in Pleistocene- and Holocene-age glacial deposits, the Niagara aquifer that occurs within Silurian-age dolomite, and the Sandstone Aquifer, which is chiefly comprised of Ordovician- and Cambrian-age dolomite and sandstone. The Sand-and-Gravel Aquifer often lies directly upon the Niagara Aquifer. In
these situations, the two aquifers are hydraulically connected and commonly behave as one aquifer. The Sand-and-Gravel Aquifer commonly reaches the ground surface, and therefore interacts with surface water bodies. This aquifer has great influence on local surfacewater features.

In most situations, groundwater elevation is a subdued expression of local topography. Upland areas are usually recharge areas, while lowland areas are discharge areas. Lowlands are commonly occupied by wetlands, lakes, springs, and streams. Consequently, near-surface ground water often flows perpendicular to topographic contour lines. Water in the Sand-and-Gravel Aquifer and much of the Niagara Aquifer follows this general rule. Water in deeper portions of the Niagara Aquifer and the Sandstone Aquifer follows more regional flowpaths. Under natural conditions, regional flow is east toward Lake Michigan.

The Milwaukee River at the dam site and much of the surrounding area has been determined in regional studies to be an influent stream. As such, surface water enters the groundwater system, and groundwater flows away from the stream.

**Soils**

The native soils on the top of the terrace formed by the river belong to the Hocheim-Sisson-Casco association. These are well drained soils with subsoils of loam to clay-loam underlain by glacial outwash, till, or lake laid deposits. While these soils can be prone to erosion, the banks of the impoundment are armored with fractured dolomite limestone or coarse alluvial stone. Considerable grading, mixing and filling of the native soils have occurred within the project area. Removal of the dam will not cause any additional erosion to the river banks.

**Quantity and Quality of Impoundment Sediment**

Ozaukee County staff completed water and sediment depth soundings during August 2009 (Dueppen, 2009). Proceeding upstream of the dam, approximately 12 transects were surveyed between the BS Dam and Highway 60 Bridge, and 30 more transects were surveyed north of the Highway 60 Bridge using a 5/8 inch diameter steel rod marked at 0.1-foot increments. Surveyed points along each transect were equally spaced. The number of measured points along a transect were dependent on the transect width. The number of points per transect ranged from 6 to 9. Measurements included water depth, depth of fine textured sediment, and depth to refusal which was assumed to be the original stream bed. Observations were also made on the estimated dominant sediment texture and refusal material (as clay-silt, sand, gravel, and cobble). All transects and sample points were geolocated in the field using GPS.
Ozaukee County and Bonestroo, Inc. staff estimated the volume of fine textured silt-clay-sand-fine gravel sediment in the BS Dam impoundment to be approximately 38,000 cubic yards ranging in thickness from 0 to 6.5 feet (Dueppen, 2009 and Bonestroo, Inc., 2009). The majority of the fine textured sediment was located along a reach extending approximately one mile upstream of the dam and east of the existing impoundment centerline. Sediment deposits generally decrease in quantity and fine texture progressing upstream of STH 60. Maximum sediment deposition generally alternates laterally and opposite the meandering thalweg. The native alluvial substrate along the BS Dam impoundment is similar to what is known to be present along the free-flowing reaches of the Milwaukee River in Grafton, primarily coarse alluvial gravel, cobble, boulder, and fractured bedrock. Fractured bedrock can be observed along the steep and narrow confining shorelines nearest the BS Dam and extending downstream along the Milwaukee River, the former Chair Factory impoundment, and Lime Kiln impoundment and dam site.

The WDNR and Ozaukee County staff collected a core sample along a single transect upstream of the BS Dam and in the impoundment in August 2009. The core sample was divided into three segments based on color and texture. Each segment was analyzed for a variety of inorganic and organic chemical constituents – see Table 3.3-1 below.

Typical of impoundments located in developed watersheds and as evidenced by the sediment volumes above, the BS Dam impoundment has become a depositional area for fine textured soils. While eroded uncontaminated upland soils are the primary source of these sediment deposits, clay-silt textured sediments and organic matter have an affinity for adsorbing pollutants also discharged from point and non-point sources.

The results of this physical and chemical analysis indicates that the concentration of two common organic chemical compounds known as polyaromatic hydrcarbons (PAHs) and polychlorinated biphenyls (PCBs) were relatively low or less than the analytical detection limits. The sediment analysis also included tests for the presence of seven heavy metals. Overall, the sediment contained in the BS Dam impoundment is not a hazard to human health and the environment. If sediment is removed from the former impoundment to construct the BS FW, it would be disposed of at a landfill and used as daily cover for the landfill waste. If disposed at a site other than an approved landfill site (e.g., park), the site would need review and approval by WDNR’s Remediation and Redevelopment staff, and covered with a 6-inch layer of “clean soil”.

97
3.3.1.2 **Environmental Consequences**

3.3.1.2.1 Proposed Action Alternative

BS FW construction will partially restore natural groundwater/surface-water interaction relationships immediately downstream of the dam. The BS Dam artificially raises surface water in relationship to groundwater elevations, and therefore contributes to localized disruption of groundwater...
recharge/discharge relationships and groundwater elevations. Local groundwater flow velocity and flux will decrease.

### 3.3.1.2.2 No Action Alternative

If the BS FW is not constructed, natural river sediment transport processes will remain completely disrupted. Fine grained sediment will continue to thicken upstream.

Natural groundwater flow paths will remain disrupted with groundwater level held artificially high and with continued disruption of recharge/discharge relationships.

### 3.3.2 Land Use and Recreation

#### 3.3.2.1 Affected Environment

Land use immediately adjacent to the Bridge Street Dam project area includes a Village owned and maintained riverwalk, a new condominium complex, older commercial buildings that front 12th street and provide limited access to the Milwaukee River shoreline and an outdoor rear seating area and balcony associated with a restaurant along 12th Street. Current recreational uses in the area include fishing, boating, ice skating, walking and jogging along the adjacent riverwalk.

In terms of land use and recreation, the areas affected by the construction and installation of the BS FW include: (a) the dam site, (b) the impoundment, (c) neighboring properties, and (d) upstream and downstream areas of the Milwaukee River and its tributaries.

**Dam Site:** The BS Dam itself will be minimally affected by the fishway as the BS Dam will remain.

**Impoundment and Adjacent Riparian Land:** The BS Dam impoundment has a surface area of approximately 33 acres. Maximum and average water depths are approximately 11 feet and 2.5 feet, respectively. The impounded reach extends approximately 1 mile upstream of the Dam. Significant short term and long term affects associated with the fishway will occur on the west shoreline of the impoundment extending from the Dam to an area just south of Highway 60.

**Adjacent Properties:** The BS FW could result in both short term and long term affects on adjacent public and private properties that border the Dam site and the impoundment. The riverine system will be impacted during construction, but will be restored to its current condition following construction.

**Upstream and Downstream Portions of Watershed:** The BS FW could have several indirect impacts on land use and recreation in upstream and downstream portions of the Milwaukee River and its tributaries.
3.3.2.2 Environmental Consequences

3.3.2.2.1 Proposed Action Alternative

**Land Use:** Construction of the BS FW will have the following consequences for land use in the affected areas.

- **Dam Site** - The dam site itself will be minimally impacted as the dam will remain.
- **Impoundment and Adjacent Riparian Land** - The primary short term and long term land use impacts will occur within the footprint of the proposed fishway which includes the west edge of the impoundment and adjoining riparian land. The construction of the fishway will have a significant short term impact on land use in the adjacent riparian land on the west edge of the impoundment and in the area between the BS Dam to just south of Highway 60, as the current public riverwalk will be closed during construction. Following construction, it is anticipated that land use in this area will be essentially the same as prior to construction, only with the fishway serving as an additional attraction and point of interest for residents and visitors using the riverwalk. Potential areas for additional storm water quality basins are not proposed under this alternative.
- **Adjacent Properties** - It is anticipated that land use on adjacent properties will remain the same following construction of the fishway.
- **Upstream and Downstream Portions of the Watershed** - It is anticipated that construction of the fishway will have minimal impact on upstream or downstream land uses other than to incrementally increase recreational uses for fishing.

**Recreation:** Construction of the BS FW will have the following consequences for recreation in the affected areas.

- **Fishing** - It is anticipated that construction of the BS FW will have a significant positive impact on recreational fishing opportunities both in the immediate vicinity of the BS Dam and in upstream and downstream areas. The BS Dam, as it currently exists, is a key barrier preventing access by fish to major areas of spawning and other habitat that is present in upstream areas. Construction of the BS FW will connect aquatic habitat up and downstream of the existing dam. Construction of the BS FW will be a key component to expand the recreational fishery in areas upstream of the BS Dam by allowing Lake Michigan sport fish consistent upstream access. This access may also aid in the eventual delisting of Milwaukee Estuary AOC BUIs related to degraded fish populations and lost fish habitat. On the negative side, the BS Dam would not function as a barrier to AIS without incorporating mitigation measures into the BS FW. See Document 1 in Appendix C for additional discussion regarding AIS.
**Boating** - The BS FW will result in no significant changes for recreational boating. Boating safety issues and inconvenience created by impassable waterfall will remain. Kayaks and canoes will not be able to use the fishway for recreational purposes.

**Ice Skating** - The BS FW will result in no impact on ice skating occurring in the upper portions of the impoundment.

**Swimming and Wading** - The BS FW will not impact swimming or wading within the River. The degraded water quality and sediment accumulation will continue to be use impairments within the BS Dam impoundment.

**Walking and Jogging** - During construction, the fishway project will reduce or eliminate access to the existing riverwalk. Following construction, it is anticipated that the existing riverwalk will be retained or reconstructed and that there will be no negative consequences on recreational walking or jogging associated with the fishway.

**Wildlife Viewing** - Construction of the fishway will result in increased opportunity for viewing fish movement and will create a point of interest in the community.

### 3.3.2.2.2 No Action Alternative

The environmental consequences of the No Action Alternative on land use and recreation are summarized below.

**Land Use:** The No Action Alternative would have no impact on land use, although safety concerns associated with the BS Dam (noncompliance with Chapter NR333, Wis. Admin. Code) would remain and would eventually require actions that may impact land uses.

**Recreation:** The No Action Alternative would result in the following consequences for recreation:

- **Fishing** - The No Action Alternative would result in the BS Dam continuing to function as a significant barrier to fish passage. The existing fragmented condition of the natural aquatic habitat would be maintained and the viability of the Milwaukee River (including the Milwaukee Estuary AOC) as a natural fishery would continue to be limited. The No Action Alternative would preclude the establishment of a lake-run seasonal sport fishery in upstream areas. On the positive side, the BS Dam would continue to function as a barrier to AIS movement.

- **Boating** - The No Action Alternative would result in no significant changes for recreational boating. Boating safety issues and inconvenience created by the impassable waterfall will remain.
• **Ice Skating** - The No Action Alternative would result in no impact on ice skating occurring in the upper portions of the impoundment.

• **Swimming and Wading** - Degraded water quality and sediment accumulation will continue to be use impairments within BS Dam impoundment.

• **Walking and Jogging** - The No Action Alternative would result in no impacts for walking and jogging and would eliminate (at least for the near term) the disruption to jogging and walking that would occur as a result of closure of the existing riverwalk during construction.

• **Wildlife Viewing** - The No Action Alternative would result in no changes for wildlife viewing, but would not result in the enhanced opportunities for wildlife viewing that would be provided by the fishway.

### 3.3.3 Water Quality and Resources

#### 3.3.3.1 Affected Environment

In sampling three impoundments including the BS Dam, LK Dam and the former Chair Factory Dam, the impoundments did appear to have an effect on dissolved oxygen levels and water temperature. Higher photosynthetic and respiration rates by the abundant macrophytes and filamentous algae in the BS Dam impoundment are likely responsible for wider diurnal dissolved oxygen fluctuations within that impoundment.

The BS Dam impoundment’s summer base-flow water temperatures are 2°C to 4.5°C warmer than temperatures measured upstream of the impoundment. This trend is consistent with other studies that reported shallow non-stratified impoundment’s increase water temperatures during summer months and decrease water temperatures during the winter months. Impoundment’s can create additional summer thermal stress to biota and may be most limiting during drought and low-flow conditions. Since water temperatures are inversely related to dissolved oxygen solubility in water, the higher water temperatures likely limit the availability of oxygen for fish and other aquatic life in this impoundment.

#### 3.3.3.2 Environmental Consequences

#### 3.3.3.2.1 Proposed Action Alternative

There are no long term impacts to water quality as a result of constructing the BS FW. Construction activities would result in negative short-term water quality impacts. These impacts would be expected to be a direct result of the scouring and resuspension of previously deposited fine textured sediment and from dust and debris released during construction. Turbidity may increase for a brief period of time. While it may not be technically feasible to
prevent all sediment losses, measures will be employed to limit these releases.

Water resource impacts are limited to the placement of the BS FW structure on or adjacent to the river bed. Fish and other aquatic life passage would be enabled and fragmented aquatic habitat would be re-connected. Enhanced biodiversity is expected in the aquatic environment by the BS FW providing continuity between reaches of the Milwaukee River. AIS control would be provided by installing an operable gate at the fishway exit to isolate those organisms from upstream movement as necessary.

3.3.3.2.2 No Action Alternative

In the No Action Alternative, no modification of the BS Dam is provided to reconnect fragmented habitat or to provide fish passage at this location. Biological diversity and abundance of fish and aquatic life occurring within the dam reservoir remain diminished relative to the free flowing reaches above and below the project site. AIS movements are impeded to flows less than that which is associated with a 100-year, 24-hour runoff event (<Q100). The current interruption to the natural river sediment transport function continues. Floodplain elevation above the dam remains altered.

3.3.4 Wetlands and Floodplains

3.3.4.1 Affected Environment

The BS Dam was most recently reconstructed in 1918 and is nearing the end of its design life. It was originally constructed to provide power to specific industrial uses. The intended use of the dam terminated in 1961 when the millrace was filled in with concrete, rock and soil. Also in 1961, the Village of Grafton accepted ownership and maintenance responsibilities of this structure when its industrial use ended.

The wetlands associated with the BS Dam are mapped by the WDNR and classified as emergent wet meadow, palustrine wetlands with standing water (E4H); non vegetated flats wetlands with flowing water on wet soils (FoR); and forested, broad leaved, deciduous, palustrine wetlands (T3k). Most common plant species associated with these wetland types along the Milwaukee River are second growth wet to wet-mesic lowland hardwoods composed of black willow, green ash, box elder, silver maple, cottonwood and American elm and emergent wet meadow with reed canary grass and cattails.

The WDNR provided the Village with a July 16, 2009, letter documenting the requirements necessary to ensure the BS Dam complies with Chapter NR333, Wis. Admin. Code. The process requires the Village to hire an engineer registered in Wisconsin to assess the dam’s spillway capacity and propose any necessary upgrades to meet established spillway standards.
The WDNR reissued a dam failure analysis for the BS Dam as part of the Ozaukee County Map Modernization Project in 2007. The resulting profile and floodway data table were adopted by the Village of Grafton on April 7, 2008. As part of the analysis, the BS Dam was assigned a hazard rating of significant. The dam is required to have a minimum total spillway capacity of the 500-year flood event (e.g., 0.2% chance of occurring or being exceeded in any given year). According to the current Flood Insurance Study, the 500-year discharge is 15,420 cubic feet per second (CFS). The Village has one year to assess the spillway capacity of the dam, and NR333 allows 10 years to construct necessary upgrades to meet the established spillway requirements.

Preliminary estimates indicate that the current structure provides approximately 4,100 CFS or less than 30% of the necessary spillway capacity. The WDNR believes a complete dam reconstruction may be needed due to limitations of the current arch spillway design. The new structure may look distinctly different from the existing structure. The WDNR would review plans and specifications to ensure the proposed design meets code requirements. A new dam with a fish passage and gates would not change the Milwaukee River flood profile during a 100-year event.

See Figure 3 in Appendix B for more information on wetlands and floodplains in the BS Dam area.

3.3.4.2 Environmental Consequences

3.3.4.2.1 Proposed Action Alternative

The modification of the BS Dam and addition of the fishway will not impact flood water surface elevations or the extent of the 1% chance flood occurrence or more frequent chance flood occurrences. The proposed project will not impact the local or regional quality or quantity of groundwater.

Construction of the BS FW will not cause any significant or permanent erosion to the river banks provided erosion control plans and practices are adhered to. The BS FW will be constructed of stable and non-eroding sheet pile and rip rap.

The proposed BS FW will not negatively impact any special resources. The BS FW is proposed to be constructed along a developed and paved portion of the Milwaukee River shoreline or previously enclosed section of the dam’s millrace. The bed of the impoundment proposed for the BS FW consists of rip rap and silt-clay deposits.

The popular riverwalk path upstream of the dam floods during high-flow periods due to the dam’s insufficient spillway capacity. The BS FW design will not cause additional flooding, but instead will reduce it. Since the BS FW penetrates the constricting dam abutment, it allows the hydraulic capacity of the weir to be sufficiently increased to avoid future flooding. The observation deck will be maintained with the BS FW passing below. A bonus
associated with this modification is creation of an excellent public viewing location for migratory fish. Additional lands expected to be temporarily used or disturbed by constructing the BS FW include the Village of Grafton paved public riverwalk, streets and observation deck that adjoin the spillway abutment. Under the proposed fish passage alternative, there would be no increase in the existing and locally adopted 1% recurring flood interval.

No buildings or roads will be built or destroyed as part of this project. Laboratory testing of the sediment indicated that inorganic and organic pollutants of concern were not present at levels requiring any special handling on or off site. The construction of the BS FW will be completed in dry conditions preventing the release of material to the Milwaukee River.

3.3.4.2.2 No Action Alternative

This alternative would involve leaving the dam in its current condition. The proposed fishway would not be constructed. No other alternative described herein that would enable fish passage would be pursued. The Village of Grafton would continue to operate and maintain the BS Dam according to state and federal dam safety standards.

This alternative does not meet the purpose of the NOAA grant and the goals of a variety of fish and other water-based management plans. As such, this alternative was eliminated from further consideration. It is not consistent with individual and joint states, federal, and international water resource and fish management plans established for Lake Michigan and the Great Lakes. The goal of these plans is for enhancing fish stocks, most notably lake sturgeon and walleye, and their habitat. The abundance and genetic diversity of fish stocks and access to their historical habitats would remain limited in the lower Milwaukee River, the Estuary and near-shore waters of Lake Michigan.

The No Action Alternative would have no beneficial impact on wetlands. Only the existing wetlands and the associated water quality and habitat would remain in its degraded condition.

3.3.5 Aquatic Biology

3.3.5.1 Affected Environment

3.3.5.1.1 Habitat

The aquatic resources affected in the project area include the free flowing section of the river below the dam (500 square feet), and the fishway proposed to be constructed on the bed of the impoundment upstream of the dam (6,000 square feet). No additional aquatic resources, including wetlands, will be disturbed as a result of this project.
Section 3.3 Bridge Street Dam (BS Dam) Fishway (BS FW) Construction (Alternative A)

Dams and other barriers to fish movement negatively impact the connectivity of fish populations to their historical range and habitat. The impacts occur upstream and downstream of the barrier. Dams and other barriers to fish movement have been identified as a major cause for the decline in fish community diversity, abundance and structure in Wisconsin. Barrier impacts include the obstruction and timing of fish migration; fragmentation of fish overwintering, feeding, spawning and rearing habitats; reduced genetic diversity and degraded fish habitat. These cumulative impacts can directly and indirectly impact the overall viability of individual fish species, reproduction, food supply, growth, predation, resistance to disease and stress, etc. Dams and other barriers to fish movement have been implicated in the decline of mussel populations. Modification or removal of these barriers has been shown to be an environmentally sound, technically feasible and cost effective means for enhancing the values and function of disturbed stream ecosystems in Wisconsin.

Construction of the BS FW will mitigate, but not necessarily eliminate, the impacts of the BS Dam on fish movement. While the effectiveness of fishways in passing fish has been demonstrated for fish species having higher assigned economic and recreational “values”, the effectiveness in passing non-consumptive or non-recreational forage species has not always been demonstrated. Only complete removal of the BS Dam can guarantee passage of all fish and other aquatic life at this location.

Construction of the BS FW may result in a small quantity of substrate removed or otherwise displaced from the bed of the BS Dam impoundment. The physical habitat associated with the fishway right-of-way is generally poor, being limited to rip rap, concrete, other debris, and silt-clay sized sediment. Construction of the BS FW will not significantly impact critical habitat for other aquatic plant and animals.

Given the limited aquatic footprint for this project, the developed nature of the upland construction site, and degraded habitat in the impoundment, it is unlikely that the project will significantly impact plants and animals or their habitat. Fish and aquatic habitat in the impoundment is degraded by extensive and deep deposits of fine-textured clay-silt substrate, nuisance amounts of non-native rooted aquatic plants and filamentous algae. Construction of the BS FW will not enhance or further degrade the limited habitat. Existing fish populations will benefit from the BS FW as they will have access to higher quality, historical spawning and rearing habitat present in the Milwaukee River upstream of the BS Dam impoundment. This will enhance genetic diversity and the relative abundance of fish species. This is also likely to benefit the Milwaukee Estuary AOC BUIs related to fish population degradation and habitat loss.

3.3.5.1.2 Macroinvertebrates
No site specific sampling of macroinvertebrates was performed for the BS FW project site. Historic work in the vicinity indicates macroinvertebrates are more abundant below the dam in that flowing reach of the river. Higher photosynthetic and respiration rates by the abundant macrophytes in the BS Dam impoundment are likely responsible for wider diurnal dissolved oxygen fluctuations within the impoundment.

See also Section 3.1.5.1.2

3.3.5.1.3 Aquatic Vegetation

Aquatic vegetation, filamentous algae and rooted macrophytes are very abundant especially in the shallow backwater. Non-native Eurasian watermilfoil and curley-leaf pondweed are abundant limiting aquatic life habitat and recreational uses. Duckweed can also form extensive mats in shallow and stagnant backwater areas of the impoundment.

The proposed BS FW is located adjacent to the Village of Grafton riverwalk. A narrow strip of landscape plantings and native plants occurs between the river walk and the proposed structure. Based upon existing nearshore and aquatic plants growing in the vicinity, the plants that are likely to proliferate include bulrush, cattail, reed canary grass, and sedges. These are herbaceous wetland plants often described as “disturbance vegetation” or “pioneer species” because of their tendency to quickly vegetate areas of open or disturbed soil.

Rooted aquatic plant growth which may become re-established following construction would likely be limited to emergent or floating vegetation with adaptations to flowing water conditions and turbidity. These plants may include floating pondweed, common waterweed, coontail and white water lily. All of these plants provide valuable fish and other aquatic life habitat provided they are not present in nuisance amounts.

3.3.5.1.4 Fisheries

**Fish Community**

An abbreviated list of common forage or non-game species in the Milwaukee River within five miles of the BS Dam includes longear sunfish, logperch, johnny darter, blackside darter, fantail darter, least darter, Iowa darter, fathead minnow, spotfin shiner, common shiner, golden shiner, bluntnose minnow, common carp, central and largescale stoneroller’s, sand shiner, horneyhead chub, white sucker, striped shiner, creek chub, rosiface shiner, redfin shiner, brook stickleback, mimic shiner, central mudminnow, banded killifish, stonecat, tadpole madtom, and four species of redhorse including the greater, shorthead, golden and silver redhorse. Fall populations of coho and chinook salmon, and an occasional brown trout and fall and spring rainbow trout may be present below the BS Dam when river discharge and water depths allow a limited number of these migrants from
Lake Michigan to pass over the MT Dam and LK Dams. The presence of these species downstream of the Bridge Street Dam will become an annual occurrence once the MT FW becomes operational and the LK Dam is removed, in 2010. These Lake Michigan potomadromous species will be provided access upstream of the BS Dam following construction and operation of the BS FW. Their migrations and subsequent proliferation will benefit the project area and other portions of the watershed, including the Milwaukee Estuary AOC by increasing fish populations and species diversity. The Milwaukee River is classified as a Warm Water Sportfish Community per NR 102 and NR 104 (Kramasz & Wawrzyn, 2009).

**Invasive species**

Several animal and plant aquatic invasive species are established in the Milwaukee River Basin. Common carp are the most widespread and abundant non-native fish species in the basin. They are especially common in the eutrophic impoundments where they can thrive in the degraded habitat. Established non-native aquatic vegetation includes Eurasian water milfoil and curley-leaf pondweed. Like the common carp, these plants are often present in nuisance amounts in the degraded eutrophic impoundments like the BS Dam impoundment. Zebra mussels are established in Lake Michigan. They are also present in the Milwaukee River Basin headwaters of Long Lake and Mauthe Lake, upstream of the proposed project area. Zebra mussels have yet to be observed in the free-flowing reaches of the Milwaukee River and its tributaries.

AIS fish species established in Lake Michigan include the parasitic sea lamprey and the round goby. Monitoring by the U.S. Fish and Wildlife Service (USFWS) since 1959 and more recently by the WDNR has not identified any adult or larvae sea lamprey in the lower Milwaukee River. WDNR sampling data from 1991 through 2009 for the Milwaukee River Basin in Washington, Milwaukee and Ozaukee Counties is included in Appendix A, Table 4. No adult or larvae sea lamprey were identified. After the North Avenue Dam was abandoned, sea lamprey would have had access the upper reaches of the Milwaukee River and the higher quality tributaries in Ozaukee County. Over the last nineteen years, the USFWS and WDNR have conducted fish community monitoring in the upper reaches and have not detected sea lamprey adults and larvae up to the Village of Grafton’s LK Dam located at RM 30.

Similarly, round goby was first observed in the Great Lakes in 1990. Since then, the round goby has infested Lake Michigan including the Milwaukee River Estuary. Monitoring by WDNR since 1999 and more recently by Kornis (2009) has not documented any round goby movement upstream of the former North Avenue Dam.
The USFWS criteria for an acceptable barrier to sea lamprey is a minimum 1.5-foot elevation difference between the spillway crest and tailwater during the 10% or less frequent annual chance flood occurrence; the absence of flooding around the dam abutments at all water levels; and the absence of spillway breaches large enough for lamprey to swim through (USFWS, 2009). In some instances, the USFWS will design sea lamprey barriers to have a minimum 1.5-foot elevation difference between the spillway crest and tailwater between the 25% and 10% annual chance flood occurrences. Based on the estimated range of annual chance flood occurrence surface water elevations derived from the Ozaukee County Flood Insurance Study (FIS), the BS Dam meets the criteria for a minimum elevation difference of 1.5-foot for the 10% and less frequent annual chance flood occurrence.

Following the recent June 2008 flood events, corresponding real-time river discharge measures, photo documentation and observations suggest that the BS Dam may not meet the USFWS criteria for an acceptable barrier to sea lamprey passage. Briefly, a more recent assessment suggests that the June 2008 flood event may have corresponded to a 20% or more frequent annual chance flood occurrence (Wawrzyn, 2009). A photograph of the BS Dam provided by a Milwaukee Journal Sentinel photographer of real-time river discharge conditions suggests that spillway crest/tailwater elevation differences may be smaller than predicted in the Ozaukee County flood insurance study. The photograph also shows significant flooding around the west or right spillway abutment. Nevertheless, the USFWS cannot revise its original conclusion that the BS Dam meets its criteria as a sea lamprey barrier without a more detailed hydrologic and hydraulic analysis beyond the Ozaukee County FIS. In a letter sent to WDNR and Village of Grafton officials, the USFWS is not opposed to a fishway at the BS Dam provided it is designed to include flash boards or similar structure to enable the fishway to be closed to fish passage if required. The USFWS and Great Lakes Fish Commission do not support removal of the BS Dam as a means of providing fish passage without some means of blocking sea lamprey in the Milwaukee River further downstream.

VHS is known to infect fish from Lake Michigan but there are no verified VHS infections of fish stocks in the lower Milwaukee River. The difference in elevation between the spillway crest and tailwater for annual chance flood occurrences > 20% may allow VHS infected fish with “jumping” and high burst speed swimming capabilities (e.g., trout and salmon) to move upstream of the BS Dam.

3.3.5.1.5 Threatened and Endangered Species

Endangered, Threatened and Special Concern Species

The Wisconsin Natural Heritage (NHI) Working List contains species known or suspected to be rare in the state and natural communities present in
Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked. A survey of the NHI for this project (see Appendix C, Document 4) includes seven fish species documented as being present or potentially present in the BS Dam project area. While most of these listed fish species are still encountered during routine field assessments, the lack of recent occurrences cannot discount their continued presence since their habitat remains intact. For the purposes of this Environmental Assessment these species will be assumed to be present. There are no federally listed fish species in the Milwaukee River Basin or more specifically, in the BS FW project area.

Listed plant species potentially present in the project area include the state Special Concern marbleseed, hooker’s orchid and waxleaf meadowrue. Listed animal species potentially present in the project area include the Endangered queensnake. Given the limited aquatic footprint for this project, and the highly disturbed and developed nature of the upland construction site, it is unlikely these plants and animals, if present, would be impacted by the project. A NHI listing of potential listed species in the project area and within 1 mile of the project area is included in Appendix C, Document 4. There are no federally listed species in the project area.

**Endangered**

The striped shiner is the only state listed endangered fish species that potentially exist or are known to exist in the project area.

*Striped shiner*

The striped shiner is ranked with a global element of G5 and a state element rank of S1. These rankings indicate that while the striped shiner is demonstrably secure globally, it is critically imperiled in Wisconsin. The S1 or critically imperiled ranking is due to extreme rarity defined as five or fewer occurrences per acre, very few remaining individuals, or because some factors make it especially vulnerable to extirpation from the State. Its numbers have declined so much in recent years that it is nearly extirpated from the state. During the mid-1990’s, WDNR crews sampled multiple reaches and times along the Milwaukee River and identified a single specimen from the river in Ozaukee County.

The striped shiner prefers clear to only slightly turbid waters of runs and shallow pools, with dense aquatic vegetation over substrates of cobble, boulders, silt, sand, mud or bedrock. Spawning occurs from late May through June (Becker, 1983). They are likely to frequent water depths ranging from 0.1 - 1.5 m (Pfleiger, 1975). A study of striped shiners from the Milwaukee River in Ozaukee County revealed that the fish had consumed hymenoptera, coleoptera, other aquatic insects, filamentous algae, and vegetative material (Trautman, 1957).
Threatened

Three state listed threatened fish species that potentially exist or are known to exist in the project area include the greater redhorse, redfin shiner and longear sunfish.

Greater redhorse

The greater redhorse is ranked globally as a G3 and has a statewide ranking of S2S3. These rankings indicate that the greater redhorse is either very rare and local throughout its range, found locally abundant in a restricted range, or that other factors may make it vulnerable to extinction throughout its range. The Milwaukee River Basin has one of the most secure populations of greater redhorse in Wisconsin.

The greater redhorse prefers clear water of medium to large rivers, over bottoms of sand, gravel, or boulders. Spawning occurs in May or June. The greater redhorse spawns over substrate consisting of gravel with mixtures of sand and small rubble in moderate to swift currents. It generally feeds on a diet of aquatic insects, mollusks, crustaceans and plant material (Becker, 1983).

Redfin shiner

The redfin shiner is ranked globally as G5 and has a statewide ranking of S2. These rankings indicate the redfin shiner is secure globally though quite rare in parts of its range. Within Wisconsin however, it is very rare and very vulnerable to extirpation. It has been collected in small numbers from the Milwaukee River and Cedar Creek in Ozaukee County, and even more infrequently from the Milwaukee River in Milwaukee County (Becker, 1983 and Lyons et al., 2000). The redfin shiner prefers more turbid waters of pools in low-gradient streams over substrates of boulders, cobble, sand, silt or detritus. Spawning occurs from early June through mid-August in sunfish nests where they coexist with sunfish in the nesting territory. Their diet is dominated by aquatic and terrestrial insects and at times, is dominated by filamentous algae (Becker, 1983).

Longear sunfish

The longear sunfish is ranked globally as a G5 and has a statewide ranking of S2. These rankings consider the longear sunfish to be secure globally though it may be quite rare in parts of its range. In Wisconsin, it is very rare and very vulnerable to extirpation. The Milwaukee River Basin was once one of the states more important strongholds (Greene, 1935 and Becker, 1983). More recently, Milwaukee River Basin populations have been in steep decline with a few remnant populations present in the Washington and Fond du Lac Counties (Lyons, et al., 2000).
The longear sunfish prefers clear, shallow, moderately warm, still waters of streams and small lakes. Found in or near vegetation. Spawning occurs from late May through mid-July, sporadic to August. The longear sunfish diet is opportunistic and diverse including aquatic and terrestrial insects, fish eggs, larvae fish, small crustaceans and aquatic plant material (Becker, 1983).

Special Concern

Three state listed fish species of special concern that potentially exist or are known to exist in the project include the banded killifish, least darter and lake sturgeon.

Banded killifish

The banded killifish is ranked globally as G5 and statewide as S3. By this ranking, the banded killifish is considered to be secure globally though they may be quite rare in parts of its range. Within Wisconsin however, its ranking indicates that it is rare or uncommon and vulnerable to extirpation. Small numbers of banded killifish have been identified in the Milwaukee River and Cedar Creek watershed in Ozaukee County (Becker, 1983 and Lyons et al., 2000).

The banded killifish prefers the clear shoal waters of estuaries and lakes, backwaters and areas in streams with slower currents (Becker, 1983). Substrate preferences include a wide range of substrates including gravel, sand, silt, marl, clay, detritus or cobble generally with sparse vegetation in water depths up to 0.6 m. Spawning occurs from June through mid-August over coarse sand substrate. The diet of the banded killifish is somewhat habitat-specific and depends on the availability of food types. Generally they feed upon small crustaceans, insect larvae, plant material and algal filaments. The young have much more specific requirements and reportedly feed almost exclusively on planktonic crustacea and chironomid larvae.

Least darter

The least darter is ranked globally as G3 and statewide as S3. The global ranking means the fish is either very rare, local through its range or found locally in a restricted range. Within Wisconsin, the species is rare or uncommon. Earlier records indicated the least darter to be common in southeastern Wisconsin, including the Milwaukee River Basin and, in particular, the Menomonee River Watershed (Green, 1935). More recent accounts indicate that habitat changes have greatly reduced its distribution and relative abundance (Becker, 1983; Fago, 1985 and Lyons et al., 2000).

The least darter prefers clear, warm, quiet waters of overflow ponds, pools, lakes and streams over substrates of gravel, silt, sand, boulders, mud or clay with dense vegetation or filamentous algal beds at depths less than 1.5 m. Spawning occurs from late April into July. The diet of the least darter
consists of aquatic insect larvae and nymphs, copepods and cladocerans (Becker, 1983).

Lake sturgeon

Lake sturgeon are ranked globally as G3G4 and statewide as S3. Globally the fish is very rare and local throughout its range or globally secure and quite rare in parts of its range. It is rare or uncommon in Wisconsin but with secure populations in the Wolf/Fox River basins. Until recently, the lake sturgeon was considered absent from the Milwaukee River basin except for a small non-reproducing remnant population in Big Cedar Lake in Washington County, a result of a non-planned stocking by the former Wisconsin Conservation Department in 1936. An occasional lake sturgeon is observed by WDNR fisheries and commercial fishers working in the Milwaukee River Estuary or near-shore waters of Lake Michigan. The WDNR and its partners have been rearing lake sturgeon at its streamside rearing facility along the Milwaukee River at Newberg in an effort to restore sustainable populations in the Milwaukee River and near-shore waters of Lake Michigan. Since 2003, approximately 64,000 larvae and 5,112 lake sturgeon fingerlings have been stocked in the Milwaukee River. Improved passage between Lake Michigan and suitable spawning/rearing habitat is essential to restoring this species, a direct biological link between the AOC, Lake Michigan, and the Milwaukee River Watershed. Its re-establishment will also help delist some AOC BUIs.

The lake sturgeon prefers large rivers and lakes. It also lives in the shoal waters of the Great Lakes. Inland it shows a preference for the deepest mid-river areas and pools. Spawning occurs from late April through early June in cold, shallow fast water over large rocky substrate. The lake sturgeon diet includes mussels, insect larvae, leeches, and snails (Becker, 1983).

3.3.5.2 Environmental Consequences

3.3.5.2.1 Proposed Action Alternative

The shrinking range of Wisconsin’s listed fish species may be due to increased turbidity, siltation, stormwater runoff, and habitat modifications including the construction of dams (WDNR, 1997). Overall, the fishway project will benefit state listed and non-listed fish species. The genetic diversity and sustainability of many species (e.g., lake sturgeon) are highly dependent on the seasonal movement and interactions of adults from Lake Michigan, the Milwaukee River Estuary and river proper to access suitable habitats for spawning and eventually their uninterrupted return to these habitats. Similarly, juveniles spend various amounts of time in the river and its tributaries feeding, growing and seeking cover to avoid predation before migrating to their sub-adult and adult habitats, including Lake Michigan, the Milwaukee Estuary AOC, and others.
Construction of the fishway poses minimal short-term or long-term negative impacts for Wisconsin special status species present in the Milwaukee River. Potential short-term adverse impacts are related to the short-term duration of construction. Specifically, there exists the potential for limited re-suspension of sediment and construction site erosion behind the dam and within the abandoned mill race. Excessive and/or untimely releases of these sediments could increase turbidity and siltation downstream. Construction methods, sequencing of construction activities, and erosion control practices are available to mitigate, but not entirely eliminate, the potential negative effects of this project. Mitigation techniques include the location and seasonal timing (e.g., flow and temperature) of work in the river, minimizing the amount of equipment access along the stream bank and stream bed, and construction erosion control practices.

Spawning times for Wisconsin listed fish range from early-April through mid-August. The lake sturgeon spawns in late April through mid-June. However, sexually mature spawning adults are not yet present in this reach of the Milwaukee River. The majority of the other species have overlapping spawning times from early to mid-June. The narrowest spawning time is for the longear sunfish which has a spawning period between mid-July and early August. Construction activities that have a higher potential to impact these species during their peak spawning period will be avoided to the greatest extent practicable.

See Section 3.1.5.2.1

3.3.5.2.2 No Action Alternative

In the No Action Alternative, no fishway passage is provided. Many species (e.g., lake sturgeon) will not have access to additional suitable habitats for spawning. Juveniles will not have access to additional tributaries for feeding and growing purposes and access to areas with additional cover to avoid predation before migrating.

3.3.6 Terrestrial Wildlife

3.3.6.1 Affected Environment

3.3.6.1.1 Wildlife Habitat

Existing public roads and right-of-ways will be used for accessing the site for construction. Most of the construction footprint is currently enclosed millrace or paved concrete riverwalk. Minimal vegetation removal will be required for construction. Disturbed areas will be restored to pre-construction conditions as riverwalk or landscape.

The Milwaukee River up and downstream from the BS Dam is an urban setting with isolated strips of wooded and grassy shoreline. The wooded and grassy areas provide habitat requirements for a variety of birds,
mammals, reptiles, amphibians and invertebrates. The river way also provides an important wildlife “corridor” of habitat linking other blocks of habitat upstream and downstream from the dam.

Common mammals known to occur in the project area are opossum, striped skunk, raccoon, muskrat, mink, red, gray and fox squirrel, cottontail rabbit, eastern chipmunk, thirteen-lined ground squirrel, red fox, coyote, woodchuck, white-tailed deer, feral cats and various species of moles, voles, shrews, weasels, mice and bats. Incidental mammals include river otter and possibly beaver.

Birds known to occur in the area are Canada geese (both the nesting “Giant” and migratory “Interior” subspecies), puddle ducks (especially mallards, wood ducks, and blue-winged teal), grebes, coots, great blue herons, egrets, various hawk species (Cooper’s, sharp-shinned, red-tailed, American kestrel), wild turkeys, and numerous species of songbirds.

Additional species using the river seasonally during migration include many other puddle duck species (green-winged teal, American wigeon, American black duck, etc.), diving ducks (ring-necked ducks, buffleheads, common goldeneyes, scaup, common merganser, etc.), and various species of terns, songbirds, shorebirds, rails, sandpipers, snipe, American woodcock, and gulls.

Common reptiles known to occur along the current river way are painted turtles, snapping turtles, and eastern garter snakes. Amphibians known to occur are American toads, chorus frogs, green frogs, and northern leopard frogs. Other species of frogs, turtles, snakes and salamanders and newts most likely are present.

3.3.6.2 Environmental Consequences

3.3.6.2.1 Proposed Action Alternative

The impacts of the proposed BS FW to wildlife or their habitat are minimal. Wildlife habitat for terrestrial or semi-aquatic wildlife species along the proposed fishway shoreline is developed and paved with concrete and a few landscape plantings. No mammal species would be lost due to constructing the fishway.

Constructing the BS FW would slightly reduce the impoundment surface water area, reducing the amount of “loafing” habitat and open water for waterfowl such as Canada geese, mallards and diving ducks. These birds would likely relocate to other nearby open water areas to loaf or roost. Similarly, construction of the BS FW and disturbance of the concrete riverwalk would not impact any bird species critical habitat, their presence/absence or relative abundance.
Given the limited construction footprint for the BS FW and the developed nature of the site, the fishway construction and operation will not significantly negatively impact wildlife populations or their habitat.

3.3.6.2.2 No Action Alternative

There is no impact to the wildlife in this area if no action is taken. Conditions will remain as they currently are.

3.3.7 Vegetation

3.3.7.1 Affected Environment

Rooted aquatic plant will be disturbed or eliminated in the fishway right-of-way. Aquatic vegetation is common to abundant in the BS Dam impoundment. Non-native Eurasian watermilfoil and curley-leaf pondweed are present at nuisance amounts in shallow and stagnant slack water areas limiting aquatic habitat and some water-based recreational and aesthetic uses. A reduction in the amount of these AIS plant species and native plant species if present would not significantly impact fish, other aquatic life or wildlife habitat.

This section of the Milwaukee River is located in an urban area. Downstream of the dam, both sides of the river are wooded with some shrubs and broadleaf plants. The upstream impoundment area is generally maintained Bluegrass sod and landscape.

3.3.7.2 Environmental Consequences

3.3.7.2.1 Proposed Action Alternative

The construction of the proposed BS FW will not directly or indirectly significantly impact the aquatic or terrestrial plants in or along the Milwaukee River. Filling and construction of the fishway along the west shoreline will eliminate the submerged and emergent aquatic plants.

3.3.7.2.2 No Action Alternative

The desirable aquatic macrophytes in the BS Dam impoundment struggle under poor water quality conditions. Algae and less desirable aquatic plants currently dominate and will continue to do so.

The No Action Alternative will have no impact on existing vegetation. The existing terrestrial plants are in fair to good condition. The existing barriers sustain artificial hydrology and disrupt sediment. These issues influence riparian vegetation.

3.3.8 Cultural and Historic Resources

3.3.8.1 Affected Environment
Cultural resources within Ozaukee County and the Village of Grafton can encompass archaeological and historic resources, including but not necessarily limited to buildings, structures, objects, districts, and sites. These resources represent a variety of periods ranging from the prehistoric to the present day.

3.3.8.1.1 Archaeological and Historic Resources

An archaeological investigation of the project area was completed in August 2009. The following paragraphs are taken or adapted from the report *Archaeological Investigations for the Milwaukee River Watershed Fish Passage Project, Ozaukee County, Wisconsin* (GLARC, December, 2009).

The Architecture History Memo included in Appendix A of the GLARC report (see Appendix C, Document 5 of this EA) provides the following information: The BS Dam is located just north of Bridge Street in the Village of Grafton. The only developed properties adjacent to the dam are a row of condominiums of recent construction and a mid twentieth century Ranch house with no particular historic or architectural significance. The original dam was constructed in the mid-nineteenth century to provide power for the nearby Grafton Flour Mill. The dam was reconstructed in 1881 and 1918. Since the dam’s last reconstruction, a variety of repairs and modifications have left little, if any, of the original timber and earthen structure remaining, and only a questionable amount of original 1918 material. As a result, the dam maintains a low degree of historic integrity. In 1983, the Grafton Flour Mill (AHI #13445) was listed in the National Register of Historic Places as part of the “Mills of Grafton Thematic Group” Multiple Property Submittal. The BS Dam is not integral to the historic significance of the Grafton Flour Mill.

In August 2009, GLARC conducted Phase I archaeological investigations along seven watersheds (Fredonia Creek, Unnamed Creek #2, Trinity Creek, Lac du Cours Outlet, Ulao Creek, Riveredge Creek, and Mole Creek) and three dams (Lime Kiln, Bridge Street, and Mequon-Thiensville) within Ozaukee County. The investigations were conducted within the area of potential effect for areas of proposed impediment removal associated with the Milwaukee River Watershed Fish Passage project in Ozaukee County, Wisconsin. Archaeological investigations were conducted to partially fulfill requirements associated with the execution of Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665) as amended and 36 CFR, Part 800, which serves to implement the Act.

Investigations of the project areas were conducted in two stages. The first stage consisted of review of existing information to identify previously documented archaeological and burial sites within one mile of the project areas. The second stage consisted of archaeology survey of those portions of the project areas that would be potentially affected by ground disturbing
activities. The survey included visual site inspection, surface survey, and close interval shovel testing.

During the archival and literature review, seven archaeological and burial sites were identified within one mile of the BS Dam project area. No sites were identified within the immediate project area.

It should be noted that although the BS Dam was found to have a low degree of historic integrity, the Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a historic feature and focal point of the community.

3.3.8.2 Environmental Consequences

3.3.8.2.1 Proposed Action Alternative

All ground disturbing activities proposed will occur along the west side of the channel and north of Bridge Street and the dam. The areas were visually inspected during the archaeological investigation as previously discussed and found to be totally disturbed through modern land use practices.

The investigation found that the Proposed Action will not adversely affect the cultural resource base in the project area. However, it noted that current conventional archaeological survey techniques are inadequate to determine the presence of deeply buried archaeological or paleontological deposits. The report indicated the probability for encountering such sites is unlikely but if any materials are encountered, construction in the area of the discovery should be halted and the State Historical Society of Wisconsin should be consulted. The same course of action would be required if human remains or other indications of a burial site are encountered.

The Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a historic feature and focal point of the community. The Proposed Action would change the historic vista with a view of a fishway.

3.3.8.2.2 No Action Alternative

The No Action Alternative will not impact existing cultural resources either directly or indirectly. This alternative will allow for existing conditions to remain as they currently are. Archaeological and historic resources will neither be preserved in another manner nor damaged under the No Action Alternative.

3.3.9 Visual Quality and Aesthetics

3.3.9.1 Affected Environment

The environment directly affected by the BS FW in terms of visual quality and aesthetics consists of the west shoreline immediately upstream of the dam, which is approximately 500 feet long 75 feet wide, and .86 acres in area.
Land use immediately adjacent to this area includes a Village owned and maintained riverwalk, a recently construction condominium complex, older commercial buildings that front 12th street and provide limited access to the Milwaukee River shoreline and an outdoor rear seating area and balcony associated with a restaurant along 12th Street.

The riverwalk and site amenities that separate the proposed BS FW from the residential and commercial structures will also be directly affected. The Village of Grafton secured the necessary easement to construct and maintain the riverwalk and observation area immediately adjacent to the river and dam. The riverwalk extends north from the dam to areas immediately south of HWY 60 (Washington Street Bridge) before turning west just beyond the outdoor seating area and extending to an existing public road sidewalk system associated with 12th street.

The Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a historic feature and focal point of the community.

3.3.9.2.1 Proposed Action Alternative

The visual quality and aesthetics in the immediate area of the BS FW will be altered by the introduction of the cast-in-place concrete with rock fill fishway. The natural shoreline will be replaced with a facility intended to pass fish. Multiple fishway vantage points will be introduced along the restored riverwalk system as part of the overall BS FW project. It is anticipated that similar plantings and riverwalk configuration will be incorporated in final restoration plan and BS FW design.

The facility will include display boards documenting the history of the site and current fish passage facility. Signage will include public and private groups that contributed resources for the project. Public use and visits to the property and BS FW facility will increase over existing conditions, especially during major fish passing periods, such as the spring and fall. The aesthetics may change as some trees are removed for purposes of accommodating the fishway and viewing platforms.

The construction of the BS FW would provide enhanced opportunities for viewing at the dam site. It would serve as a point of interest in the community that will increase use of the existing public riverwalk impoundment viewing area.

However, some residents have expressed opposition to the change. The Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a historic feature and focal point of the community. The Proposed Action would change the historic vista with a view of a fishway. The aesthetics of the BS FW and the riverwalk may be viewed by some residents as less desirable when compared to the
impoundment shoreline along the existing riverwalk. However, the enhanced viewing and educational opportunities that the BS FW will present along the public riverwalk are considered to be more beneficial to the community than merely preserving the view as it is today.

3.3.9.2.2 No Action Alternative

The No Action Alternative would result in no significant consequences in terms of visual quality or aesthetics, as property surrounding the BS Dam and impoundment would likely continue in the current uses as commercial, private residences and a public park (Veterans Park).

3.3.10 Transportation

3.3.10.1 Affected Environment

3.3.10.1.1 Transportation Network

**State of Wisconsin**

Within the State of Wisconsin, the transportation network consists of roadways, trails, rail lines, ports, and airports.

The BS Dam is located within the Milwaukee River watershed. Regional access into this area of the state is provided by state roadways under the jurisdiction of the Wisconsin Department of Transportation (WisDOT). These roadways include Interstate 43/State Trunk Highway (STH) 57/STH 32, which is the primary north-south road; STH 167, which provides east-west access through Thiensville; STH 60, which provides east-west access through Grafton; and STH 33, which provides east-west access through Port Washington and Saukville (Ozaukee County, 2009). County and local roadways then provide local access to the project location.

**Ozaukee County**

Ozaukee County is well-served by a series of freeways, state highways, major roads, and local roads. The Ozaukee County Highway Department is responsible for maintaining a total of 448 miles of roads within the county: 27 miles of Interstate Highway, 64 miles of State Trunk Highways, 154 miles of County Trunk Highways, and 203 miles of Town Roads (Ozaukee County, 2009).

Similar to the rest of the State, within Ozaukee County, the primary means of transportation is the personal motor vehicle. Transportation within the county is guided by the official area wide planning agency for the southeastern region of the State, Southeastern Wisconsin Regional Planning Commission (SEWRPC), (Ozaukee County, 2009).

Ozaukee County’s vision of the regional transportation system plan is to provide a multi-modal transportation system in order to reduce auto
dependency and promote high air quality. The Ozaukee County Express Bus (Route 143) provides service to Mitchell Street, Downtown Milwaukee, Cedarburg, Fredonia, Grafton, Mequon, Port Washington & Saukville. Transportation in Ozaukee County also includes non-motorized modes of transportation. The Ozaukee Interurban Trail abuts the project area. Although this trail does not parallel the Milwaukee River, it does connect to roadways, trail networks, and parks in the communities of Mequon, Thiensville, Port Washington, Cedarburg and Grafton. The County also is served by one passenger and three freight railway companies (Ozaukee County, 2009). Existing railroad corridors run north-south through the project area in the communities of Mequon, Thiensville, Grafton, Cedarburg and Saukville. The Milwaukee River does not have any commercial ports or marinas within the project limits. There is a recreational/utility boat launch near the BS Dam in Grafton (Ozaukee County, 2009).

Air service is available at the Milwaukee County General Mitchell International Airport, which is located in Milwaukee approximately 20 miles south of the project area. Commercial airlines provide regional services at this location. Corporate and private aircraft also utilize this airport (Ozaukee County, 2009).

**Village of Grafton**

Similar to Ozaukee County, the Village of Grafton’s roadway system consists of freeways, state highways, major roads, and local roads. Within the Village of Grafton, east-west traffic travels along STH 60/Washington Street and Falls Road. North-south traffic travels along CTH O/Green Bay Road and Interstate 43 (Ozaukee County, 2009). Average daily traffic along these roadways varies from a low of 5,400 (on CTH O/Green Bay Road north of Cedar Creek Road) to a high of 52,400 (on Interstate 43 north of STH 60). STH 60/Washington Street and CTH O/Green Bay Road will provide the primary access to the BS FW site location once within the Village of Grafton.

3.3.10.1.2 Transportation of Materials

State and county roadways have use restrictions placed on them by WisDOT and the Ozaukee County Highway Department for commercial motor vehicles. Restrictions are based on vehicle size, weight, and the time of year for travel (WisDOT, 2009). Temporary seasonal weight restrictions are typically placed on county roads each spring.

3.3.10.2 Environmental Consequences

3.3.10.2.1 Proposed Action Alternative
The proposed project will have no significant impact on transportation within the community in the project area once the project is complete. Nominal increases in the use of the local and regional roads along the river may occur particularly during warmer months due to increases in tourism encouraged by the project. The reliability of the roadway network will be improved because of the improved flood performance and physical condition at the road crossings.

During construction, residents, workers, and visitors will experience both direct and indirect impacts. The potential transportation impacts associated with the project are temporary and mainly limited to the immediate surroundings.

Direct impacts on transportation will be associated with the temporary closure of roadways and road lanes. Intermittently, over the duration of the project, construction activities and access may be limited to specific site locations while work is being completed.

Indirect impacts will be minor in nature consisting of additional construction traffic and re-routing of traffic. Equipment used for the restoration activities and the removal of fill will need to be delivered to the project site and eventually removed. Likewise, fill and waste materials will need to be transported to and from the project site. During the construction period, additional localized traffic will result due to these activities, along with the generation of additional noise and dust from the movement of the vehicles and equipment.

The proposed project also is expected to generate or retain approximately 29 jobs. This will contribute to additional traffic on city roadways. However, the amount of additional traffic will be negligible.

While few impacts are expected, the proposed project may require the use of vehicle permits for the delivery and removal of construction materials. For any construction vehicles operating with overweight loads, proper permitting will be required. Detailed routes may be required to meet load restrictions on bridges and particular local roads, and construction scheduling may need to accommodate seasonal weight restrictions.

3.3.10.2.2 No Action Alternative

The No Action Alternative will not impact the existing transportation network or associated traffic directly or indirectly. This alternative will be compatible with transportation plans and programs, because it will allow for the existing conditions and proposed improvements to remain as they currently are.

3.3.11 Air Quality

3.3.11.1 Affected Environment
Air quality data for USEPA criteria pollutants measured from air monitoring sites for the state of Wisconsin are submitted to USEPA by the WDNR, and available through the USEPA’s AIRNOW Internet portal. As of December 2009, the criteria pollutants PM2.5 (fine particulate matter), CO (carbon monoxide), Pb (lead), NO2 (nitrogen dioxide), and SO2 (sulfur dioxides), continue to remain in attainment of the National Ambient Air Quality Standards (NAAQS) in Ozaukee County. On February, 10, 2009, the Wisconsin Natural Resources Board redesignated Ozaukee County to “attainment” for the USEPA-revoked 1-hour ozone standard. This action was taken in compliance with the Agency’s implementation of the Clean Air Act’s “anti-backsliding” provision.

Ozaukee County remains a moderate non-attainment area with respect to the 8-hour ozone ambient air quality standard.

3.3.11.2 Environmental Consequences

3.3.11.2.1 Proposed Action Alternative

This proposed project alternative will result in air emissions (engine combustion products, and fugitive dust) from earth moving vehicles during construction. Gases released by newly exposed sediments are not likely to be a problem. Reductions in air quality resulting from these impacts, however, will be minor, relatively localized, and temporary in nature.

In addition, excavation and earth moving activities can cause re-entrainment of dust particulates and possibly other pollutants into the atmosphere due to removal of dirt, debris, and other materials. This effect will also be temporary and primarily local in nature, although some transport of minor amounts of airborne pollutants to downwind nearby locations within or outside the focus areas of the proposed project can occur.

No significant long-term air quality related impacts are expected under the proposed project.

3.3.11.2.2 No Action Alternative

The No Action Alternative will have no affect on existing air quality conditions. Under the No Action Alternative, mobile construction equipment use and ground disturbing impacts from restoration related activities under the proposed project will not occur. Thus, air quality impacts from material re-entrained into the ambient air and transported or deposited downwind will be avoided.

3.3.12 Noise

3.3.12.1 Affected Environment

Noise is typically defined as “unwanted sound.” It may be as mild as a general nuisance, such as a noise causing distraction or masking desired
sounds, or severe enough to impede communication, affect behavior, and cause temporary or permanent hearing loss.

Noise is measured in units of decibels (dB) on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more “weight.” The A-weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5 dBA change (either an increase or a decrease) in noise levels, however, is clearly noticeable. A 10 dBA change in noise levels is perceived as a doubling (if it is an increase in noise levels) or halving (if it is a decrease) of noise loudness.

The project area contains a wide variety of outdoor sound environments. They include commercial businesses as well as condominiums and single-family residences. The city streets and parks are well traveled. Sound sources in parks typically originate from recreational activities and can result in decibel levels in the 60-70 dBA range, but can be higher depending on the activity. Noise levels from car and truck traffic on city streets within the focus areas will usually be higher, in the range of 70-90 db.

Water cascading over a dam such as the BS Dam or, to a lesser extent, over a fish passage generates sound. The sound energy from such sources is usually generated over a broad frequency spectrum. Whether the sound generated is perceived as objectionable and, therefore, “noise” is subjective. While such sound emissions will interfere with verbal communication to some extent, most individuals do not find such broad-band, “white noise,” objectionable. In fact, it is often perceived as an amenity.

3.3.12.2 Environmental Consequences

3.3.12.2.1 Proposed Action Alternative

Noise generated by construction equipment as a result of the project activity is likely to constitute the greatest increased noise impact above existing conditions. It is anticipated that earth moving machinery such as bulldozers, backhoes, and dredges, or supporting transport equipment like heavy trucks and barges, will be utilized in the restoration activities. These sources of sound can cause temporarily elevated noise levels within and near the project area. Table 3.12-1 provides the range of noise levels experienced for typical construction equipment approximately 50 feet from the source of the noise.

Table 3.1-1 Typical Noise from Construction Equipment (dBA)

<table>
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<tr>
<th>Sound Pressure Level (dBA)</th>
<th>Typical Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-80</td>
<td>Pump</td>
</tr>
<tr>
<td>75-85</td>
<td>Backhoe</td>
</tr>
<tr>
<td>80-90</td>
<td>Heavy Truck</td>
</tr>
<tr>
<td>80-85</td>
<td>Mobile Crane</td>
</tr>
</tbody>
</table>
These noise levels are comparable to the range of noise found in typical industrial and city street settings, but are higher than what is typically experienced in parks. The project site is located near single family homes, condominiums, a restaurant, other commercial development, a park, and city streets. During construction, temporary increases in noise levels will be evident. To minimize the impact of temporary construction-related noise, the Village of Grafton has a local noise ordinance that limits the hours for construction activities to between 7:00 AM and 9:30 PM.

Minor permanent noise impacts may also result from the project once restoration of the site is complete. Noise associated with the expected growth of recreational activities such as small utility boating may occur. Other recreational activities that may be enhanced as a result of the project, such as fishing, kayaking, swimming, and hiking, will have no appreciable noise impact. In addition, as described in section 3.3.12.1, the slight reduction in noise level between water flowing over the fishway as opposed to the dam is expected to be unappreciable.

### 3.3.12.2 No Action Alternative

The No Action Alternative will not be expected to affect existing noise levels in the project area. The No Action Alternative will avoid the temporary increase in noise levels during restoration due to earth removal and remediation activities under the proposed project.

### 3.3.13 Human Health and Safety

#### 3.3.13.1 Affected Environment

The affected environment includes the dam structure and areas downstream that are within the floodplain. In addition, the affected environment under the Proposed Action Alternative would include a temporary construction site on the river during BS FW construction and restoration of the riverwalk.

As it stands today, the dam represents a safety hazard due to its noncompliance with Chapter NR333, Wis. Admin. Code. This hazard remains regardless of whether the Proposed Action Alternative or No Action Alternative is selected. The Village of Grafton reportedly plans to address these concerns within the next 10 years.

#### 3.3.13.2 Environmental Consequences

#### 3.3.13.2.1 Proposed Action Alternative
Potential temporary safety and health hazards related to fishway construction and riverwalk reconstruction chiefly impact workers at the sites. Applicable regulations (i.e. potential hazards) include, but are not limited to, fall protection, drowning hazards, noise, confined spaces, etc. These various hazards are to be addressed through implementation of applicable OSHA and or Wisconsin Department of Commerce (WisCOMM) construction standards (29 CFR 1926), and should be outlined in site-specific safety and health plans which explain how each contractor will address compliance with these regulations for their employees. Employees working at the project site are expected to have received training related to the potential hazards at the sites.

3.3.13.2.2 No Action Alternative

The No Action Alternative has no impact on current human health and safety conditions.

3.3.14 Socioeconomic and Environmental Justice

3.3.14.1 Affected Environment

Ozaukee County is the smallest county by land area in the state of Wisconsin, covering approximately 235 square miles. The county is located in the southeastern portion of Wisconsin on 25 linear miles of Lake Wisconsin shoreline. Current land use is variable and includes: residential, commercial, industrial, and agricultural. Unused rural/open lands, wetlands and woods are also present. The amount of land in Ozaukee County devoted to urban land use has increased by 170% since 1963. The county is home to a population of 87,000 (2009 estimate) and has the highest income per capita of any Wisconsin county. Its largest city is Mequon, with a population of 23,560.

Data for the following discussion primarily were obtained from the 2000 U.S. Decennial Census, prepared by the US Census Bureau (USCB). When available, 2008 estimates are provided for Ozaukee County.

In 2008, Ozaukee County was estimated to have a population of 85,874 (USCB, 2007). The county population grew by 4.3 percent from the 2000 population of 82,317 (USCB, 2000). The county’s residents (USCB, 2008) were comprised of 96.0 percent Caucasian, 1.5 percent black or African-American, 0.3 percent Native American and Alaska Native, 1.4 percent Asian, and 2.0 percent Hispanic or Latino origin.

In 2008, Ozaukee County had 35,390 housing units with 22.9 percent in multi-unit structures. The homeownership rate in 2000 was 76.3 percent.

Ozaukee County had 68,847 residents who were 16 years or older in 2008 (est.), with 48,880 or 71.2 percent in the civilian labor force. In 2008, 3.6 percent of residents in the civilian labor force were unemployed. The top
three employment industries in Ozaukee County were educational, health and social services (20.2 percent), manufacturing (19.8 percent), and retail trade (11.5 percent). In 2007, the median household income for Ozaukee County was $75,938 and 4.5 percent of individuals lived below poverty level. Current unemployment levels have doubled since 2008 and have been estimated at 7.3 percent as of September 2009 (USDL, 2009). For comparison, Wisconsin’s median household income was $50,567 and 10.8 percent of individuals lived below the poverty level (USCB, 2000b).

3.3.14.2 Environmental Consequences

3.3.14.2.1 Proposed Action Alternative

The Proposed Action (BS FW construction) will have positive socioeconomic effects on residents and businesses in the project area. Design and construction phases of the project will create jobs in project management, engineering design, construction trades and support positions. After construction, socioeconomic benefits will continue. The natural fishery will be enhanced, thereby benefiting sport and subsistence fishers. In addition, businesses supporting fishers, tourists, and water-based sports will benefit.

The Proposed Action is not expected to disproportionately affect any minority population, ethnic or economically disadvantaged group. Improving and creating sustainable fish stocks within the most populated and demographically diverse river basins in the state of Wisconsin will have wide public benefit.

3.3.14.2.2 No Action Alternative

The No Action Alternative would leave conditions in the river as they are – desirable sport fish would continue to be blocked from upstream areas and there would continue to be decreased viability of stream resident populations. Recreational opportunities for local residents and visitors to the area would be reduced as would the level of recreationally-based business activity.

The No Action Alternative also results in the continued reliance on expensive and controversial hatchery and stocking programs to maintain native and sport fish populations.

Cumulative Impacts

3.3.15.1 Proposed Action Alternative

Construction of a fishway and AIS barrier improvements at the BS Dam would be the third large project in a series of fish passage improvements planned for the Milwaukee River and its tributaries in Ozaukee County, WI. The addition of fish passage at the BS Dam site would augment past dam removals on the lower Milwaukee River. The BS FW would provide fish passage between the Newberg Dam in the Village of Newberg to the
Milwaukee Estuary and Lake Michigan. Future removal of the other fish passage barriers on tributaries to the Milwaukee River in Ozaukee County, WI identified in this project would further lead to opening 158 river miles and 119,000 acres of aquatic habitat to the regional fishery. These improvements will cumulatively benefit the Milwaukee Estuary AOC by bolstering fish populations and making fish/wildlife habitat accessible. These impacts will aid in the delisting of AOC BUIs.

In addition to the positive impacts of the BS FW project, the proposed BS FW could potentially open the same aquatic and wetland habitat to AIS, such as sea lamprey. However, proposed modifications to close the fishway when/if AIS are present in the river would mitigate this potential.

As a resource management priority for local units of government along the Milwaukee River, other minor yet collectively significant fish passage improvements are expected in the long term.

**3.3.15.2 No Action Alternative**

Anticipated cumulative impacts of the No Action Alternative (no fishway is constructed at the BS Dam) include diminished biological integrity of the entire watershed as a result of continued fragmentation of aquatic habitat. Naturally produced stocks of potamodromous fish in the lower Milwaukee River, its Estuary, and near shore portions of Lake Michigan are untenable. Upstream areas continue to fail to meet their full ecological value to the region. Fauna within the river and corridor remain low in abundance, diversity, and sustainability.
3.4 BRIDGE STREET DAM RESTORE NATURAL CHANNEL/REMOVE DAM-ALTERNATIVE B

3.4.1 Geology And Soils

3.4.1.1 Affected Environment

Geology and Groundwater Hydrology

The geology and groundwater hydrology of the local area was investigated in some detail as part of a local watershed scale study (Northern Environmental, 1998). Up to 2,000 feet of Paleozoic-age sedimentary rock overlies Precambrian-age crystalline rocks in Ozaukee County. The material properties of these rocks are used to differentiate the various strata and assign formation names. These formations are grouped into two major hydrostratigraphic units: the deep Sandstone Aquifer and the shallow Niagara/Unconsolidated Sediment Aquifer. Since the study area is located in an area where a thick shale aquitard separates the two aquifers, only the shallow aquifer is of significance to the study.

Silurian-age dolomite underlies Grafton, and is exposed at the surface along the Milwaukee River. Natural cascades are present in several areas where the beds of watercourses lie directly on bedrock. A regional fault is mapped from Port Washington, which passes through Grafton, Cedarburg, Menomonee Falls, and Waukesha. This fault has been named the “Waukesha Fault, and is believed to generate 30 to 100 feet of displacement in the Silurian bedrock, and is thought to be at least partially responsible for the cascades in these communities.

Southeastern Wisconsin was repeatedly glaciated, with the most recent ice sheets retreating less than 13,000 years before present. These glaciations deposited a sequence of diamicton and water-laid deposits. Glacially-deposited formations underlying Ozaukee County include the Kewaunee Formation, the Oak Creek Formation, and the Holy Hill Formation. In the Grafton area, the Milwaukee River was an ice-margin stream during deposition of the Kewaunee Formation sediments. As such, the prototypic red clays of the Kewaunee Formation are found adjacent to or a short distance to the east of the river. The brownish/grayish and somewhat coarser grained sediment of the Oak Creek Formation is found under the Kewaunee Formation and is exposed at the surface west of the river. At the dam site, sediments of the Oak Creek Formation are found in both banks.

Three important aquifers are present in Ozaukee County and include (in increasing depth below the land surface) the Sand-and-Gravel Aquifer formed in Pleistocene- and Holocene-age glacial deposits, the Niagara aquifer that occurs within Silurian-age dolomite, and the Sandstone Aquifer, which is chiefly comprised of Ordovician- and Cambrian-age dolomite and sandstone. The Sand-and-Gravel Aquifer often lies directly upon the Niagara Aquifer. In
these situations, the two aquifers are hydraulically connected and commonly behave as one aquifer. The Sand-and-Gravel Aquifer commonly reaches the ground surface, and therefore interacts with surface water bodies. This aquifer has great influence on local surfacewater features.

In most situations, groundwater elevation is a subdued expression of local topography. Upland areas are usually recharge areas, while lowland areas are discharge areas. Lowlands are commonly occupied by wetlands, lakes, springs, and streams. Consequently, near-surface ground water often flows perpendicular to topographic contour lines. Water in the Sand-and-Gravel Aquifer and much of the Niagara Aquifer follows this general rule. Water in deeper portions of the Niagara Aquifer and the Sandstone Aquifer follows more regional flowpaths. Under natural conditions, regional flow is east toward Lake Michigan.

The Milwaukee River at the dam site and much of the local area has been shown by regional studies to be an influent stream. As such, surface water enters the groundwater system flows away from the stream.

**Soils**

The native soils on the top of the terrace formed by the river belong to the Hocheim-Sisson-Casco association. These are well drained soils with subsoils of loam to clay-loam underlain by glacial outwash, till, or lake laid deposits. While these soils can be prone to erosion, the banks of the impoundment are armored with fractured dolomite limestone or coarse alluvial stone. Considerable grading, mixing and filling of the native soils have occurred in the project area. Removal of the dam will not cause any additional erosion to the river banks.

**Quantity and Quality of Impoundment Sediment**

Ozaukee County staff completed water and sediment depth soundings during August 2009 (Dueppen, 2009) as noted in Alternative A. See that section for a complete description.

Ozaukee County and Bonestroo, Inc. staff estimated the volume of fine textured silt-clay-sand-fine-gravel sediment in the BS Dam impoundment to be approximately 38,000 cubic yards ranging in thickness from 0 to 6.5 feet (Dueppen, 2009 and Bonestroo, Inc., 2009). The majority of the fine textured sediment was located along a reach extending approximately 2,800 ft upstream of the dam and east of the existing impoundment centerline. The native substrate along the BS Dam impoundment is similar to what is known to be present along the free-flowing reaches of the Milwaukee River in Grafton, primarily coarse alluvial gravel, cobble and boulder, and fractured bedrock. Fractured bedrock can be observed along the steep confining shorelines along the BS Dam impoundment.
The WDNR and Ozaukee County staff collected a core sample from the BS Dam impoundment in August 2009. The core sample was divided into three segments based on color and texture. Each segment was analyzed for a variety of inorganic and organic chemical constituents below.

Typical of impoundments located in developed watersheds and as evidenced by the sediment volumes above, the BS Dam impoundment has become a depositional area for fine textured soils. While eroded uncontaminated upland soils are the primary source of these sediment deposits, these clay-silt textured sediments and organic matter have an affinity for absorbing pollutants also discharged from point and non-point sources of pollution.

The results of this physical and chemical analysis indicates that the concentration of two common organic chemical compounds known as polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) were relatively low or less than the analytical detection limits. The sediment analysis also included tests for the presence of seven heavy metals. Overall, the sediment contained in the Bridge Street Dam impoundment is not a hazard to human health and the environment. If sediment is removed from the former impoundment for purposes of constructing the fishway, it would be disposed of at a landfill and used as daily cover for the landfill waste. If disposed at a site other than an approved landfill site (e.g., park), the site would need review and approval by WDNR’s Remediation and Redevelopment staff, and covered with a 6-inch layer of “clean soil”.

3.4.1.2 Environmental Consequences

3.4.1.2.1 Proposed Action Alternative

Removal of BS Dam removal will include hundreds of cubic yards of artificially placed debris from the river channel. This material, consisting of boulders, concrete, timbers, reinforcing steel, and other debris will be hauled off site and used as fill or recycled. Following removal of the dam, the majority of accumulated reservoir soft sediment will remain as submerged lateral and center bars with other exposed sediment incorporated as terrestrial or wetland soils. An unidentified amount of sediments will be exposed above the river waterline, primarily along the east, and to a lesser extent, the west shoreline. Smaller areas may also be exposed but these deposits will be transient and more prone to scour.

Some scour and transport of accumulated sediment downstream will occur due to increased water velocity and shear stress. An estimated 8,000 cubic yards of the sediment may be displaced downstream of the former dam due to scour. The majority of the scoured material will settle out in the floodplain or river wherever the flow rate slows enough to allow deposition to occur. Regardless of their depositional site, coarser materials will provide benefits
to fish and other aquatic life. Fine clay-silt-sand sediment deposited in floodplain and exposed river sediment bars will eventually be vegetated. 

The scour of anoxic sediment increases the potential for toxic un-ionized ammonia releases during drawdown. The potential for toxic effects can be minimized by completing the drawdown during the cold weather months. Cool water temperatures and lower water pH would reduce the availability of un-ionized ammonia. Higher spring flows would provide the benefit of dilution.

Removing the dam will restore riverine sediment transport processes, with finer suspended and bedload particles being continuously transported downstream. This will replenish finer grained particles in scoured areas downstream of the dam, yielding a wider variety of bottom types and sediment gradation. This will also preclude significant additional sediment accretion in the former reservoir.

Removing the dam and resulting impoundment will restore the historical, approximately one-mile-long, free-flowing reach of the Milwaukee River. Riverine conditions are expected to return within the area of the existing BS Dam impoundment similar to what currently exist along free-flowing reaches of the Milwaukee River located upstream of the impoundment, and downstream of the dam.

Weathered bedrock, alluvial boulder, cobble and gravel are the dominant river bed and bank material beneath the impoundment. Fractured dolomite bedrock is also present in the area, especially along the confined upper bank. Over thousands of years, the Milwaukee River has cut its channel through the dolomite and the presence of the impoundment has done little to change the location of the river channel configuration of this bedrock. Thus the impoundment has basically occupied the original channel and had only a minimal long term effect in terms of erosion, scouring or other physical channel forming processes. Due to the presence of these confining conditions, the removal of the dam will not affect the alignment of the Milwaukee River.

Dam removal will restore natural surface-water/groundwater interactions. Areas upstream of the dam will lose less water to the groundwater system, or may return to groundwater discharge areas. Local groundwater flow velocity and flux will decrease.

3.4.1.2.2 No Action Alternative

If the dam is not removed, natural river sediment transport processes will remain disrupted. Bedload and fine grained sediment will continue to accumulate upstream of the dam while downstream areas will be starved of fine grained materials yielding a scoured, excessively coarse grained river
bottom. The uncommon bedrock escarpments and riverbed will continue to be inundated and/or buried by accreted sediment in the reservoir area.

Natural groundwater flow paths will remain disrupted, with areas above the dam loosing stream reaches. The artificially high hydraulic head imposed by the dam increases groundwater flux and flow.

### 3.4.2 Land Use and Recreation

#### 3.4.2.1 Affected Environment

In terms of land use and recreation, the areas affected by the removal of the BS Dam will include: (a) the dam site, (b) the impoundment, (c) neighboring properties, and (d) upstream and downstream areas of the Milwaukee River and its tributaries.

- **Dam Site:** The BS Dam will be significantly affected as the dam will be removed in its entirety and replaced by a free flowing river segment.

- **Impoundment and Adjacent Riparian Land:** The BS Dam impoundment has a surface area of approximately 33 acres. Maximum and average water depths are approximately 11 feet and 2.5 feet, respectively. The impounded reach extends approximately 1 mile upstream of the BS Dam. BS Dam removal would result in significant short-term and long-term effects on land use and recreation within the impoundment area and adjacent riparian land as significant portions of the impoundment would become exposed land.

- **Adjacent Properties:** Removal of the BS Dam could result in both short term and long term affects on adjacent public and private properties that border the Dam site and the impoundment due to the creation of a significant riparian shoreline area and the elimination of the impoundment.

- **Upstream and Downstream Portions of Watershed:** Removal of the BS Dam would have several indirect impacts on land use and recreation in upstream and downstream portions of the Milwaukee River and its tributaries.

#### 3.4.2.2 Environmental Consequences

#### 3.4.2.2.1 Proposed Action Alternative

**Land Use:** Removal of the BS Dam will have the following consequences for land use in the affected areas.

- **Dam Site** – The BS Dam site itself will be significantly impacted in that the BS Dam will be removed and replaced with a free flowing river segment. The former location of the dam would become safely accessible to a variety of recreational land uses.
• **Impoundment and Adjacent Riparian Land** – Removal of the BS Dam would eliminate the impoundment, expand the riparian land area, and result in some changes to land uses within these areas (although the overall use would remain a combination of natural/environmental and public recreational uses). Following removal, an estimated 12 acres of the 33 acres of the impoundment that is now submerged would become exposed land as shown on drawings prepared by Bonestroo (2009). Some water based recreational uses would no longer take place in these areas and opportunities for new recreational and other uses would be created. Portions of newly exposed lands may be used to construct public works improvements (water quality treatment facilities/ponds), pedestrian paths, etc.

It should be noted that only minimal changes will occur in the upper portion of the impoundment. Greater changes will take place in the lower portion of the impoundment where the Milwaukee River would flow within a substantially narrower channel characterized by rapids, falls, and escarpments.

• **Adjacent Properties** – It is anticipated that removal of the BS Dam would have minimal impacts on adjacent properties which would remain in use for private residential and public recreational purposes. In the long term, creation of a riparian zone accessible to the public could have some indirect impacts on land uses on adjacent properties in terms of reduced privacy. BS Dam removal could have a positive impact on land use on certain adjacent properties by removing portions of the properties from the existing floodplain or floodway.

• **Upstream and Downstream Portions of the Watershed** – Removal of the BS Dam should have limited impact on upstream or downstream land uses other than to incrementally increase recreational uses for fishing and boating.

**Recreation:** Removal of the BS Dam will have the following consequences for recreation in the affected areas.

• **Fishing** – It is anticipated that the removal of the dam will have a significant positive impact on recreational fishing opportunities in the immediate vicinity of the BS Dam and in upstream and downstream areas, including the Milwaukee Estuary AOC. The BS Dam as it currently exists is a key barrier preventing access by fish to major areas of spawning and other habitat that is present in upstream areas. Removal of the BS Dam will increase the value of aquatic habitat up and downstream as fragmented habitat is connected after removal of the BS dam. Removal of the BS Dam and restoring this reach to a free-flowing system has the potential to improve the relative abundance, diversity and habitat of native game and non-game fish species within the former impoundment while reducing the relative abundance and habitat of the
undesirable species such as common carp. Similar fish community responses were observed in the native fish community and their riverine habitat along two formerly impounded reaches of the Milwaukee River at West Bend and Milwaukee (Kramasz, 2009). Removal of the BS Dam is a key component to greatly expand recreational fishing in areas upstream of dam by allowing Lake Michigan sport fish consistent upstream access. Wading, fishing and passive forms of boating (e.g., canoe and kayak) will likely increase if the site becomes more accessible and recreational fish populations increase. The Village has also found that recreational use of the impoundment is diminishing as it has become shallower due to sedimentation. Nuisance aquatic plant growth is an annual occurrence during the summer recreating period. Removal of the BS Dam could enhance the value and water-based uses of private and public currently submerged by the dam and its corridor.

If sea lamprey or other aquatic invasive species were to move into the waterway above the current dam, they would likely be able to exploit available spawning and rearing habitat. River substrates upstream of the BS Dam reservoir are considered prime habitat for critical lamprey and other AIS life cycle events that could result in increases in the abundance of these invasive species in the Milwaukee River system and Lake Michigan.

Removal of the BS Dam will enable the movement of fish, other aquatic life and wildlife upstream and downstream of the existing Dam. If AIS and VHS become established in the lower watershed, the absence of the dam could accelerate the upstream spread of AIS or VHS if they become established in the lower Milwaukee River watershed. The BS Dam is not a “complete” barrier to all forms of AIS or VHS under a full range of annual chance flood occurrences. It does meet the USFWS criteria as an effective barrier to sea lamprey passage. While free-swimming AIS species are currently blocked from moving upstream of the dam during more frequent flood events, they may not be completely blocked during moderate to high flow or less frequent flood events. Removing the BS Dam will increase the potential frequency for passing AIS and VHS, but not necessarily eliminate the probability for future AIS infestations. Its removal would ultimately benefit the Milwaukee Estuary AOC by reclaiming “lost” fish habitat and improving currently degraded fish populations, both of which are AOC BUIs.

- **Boating** – Removal of the BS Dam would have several significant impacts on recreational boating. The reduced water depths and surface area could diminish use of the former impoundment area by motor powered boats. The removal of the dam may enhance or diminish recreational use by canoes and other watercraft depending on the experience and skill levels of the boaters, and their preference for a slower moving or quicker more free-flowing river environment.
Regardless of skill levels, removal of the BS Dam will eliminate the significant safety hazard representing by the existing dam and the high waterfall (although a lower natural waterfall will remain that could be a challenge for certain boaters). For kayakers, removal of the BS Dam should significantly enhance the attractiveness of this section of the river for recreational use by eliminating one of the required portage points, eliminating the safety hazard, and creating a free flowing segment of River with falls and rapids that would be attractive to white water kayakers.

- **Ice Skating** – Removal of the BS Dam could reduce opportunities for ice skating within the lower portions the impoundment, in particular, the lower 1,000 feet where the River channel would be significantly reduced and the water velocity significantly increased.

- **Swimming and Wading** – Removal of the BS Dam will have no impact on swimming and wading opportunities as a consequence of reducing the impoundment. Shallow water depths presently limit swimming and wading opportunities.

- **Walking and Jogging** – Removal of the BS Dam would reduce or eliminate access to the existing riverwalk during the period of construction. Following construction, it is anticipated that an expanded riverwalk or trail would be constructed within new areas of exposed riparian land, enhancing opportunities for recreational walking or jogging.

- **Wildlife Viewing** – It is anticipated that removal of the BS Dam would enhance opportunities for wildlife viewing in the downtown area of Grafton, as the free flowing river combined with the newly exposed riparian land would provide suitable habitat for a wider range of wildlife.

### 3.4.2.2 No Action Alternative

The environmental consequences of the No Action Alternative on land use and recreation are summarized below.

**Land Use:** The No Action Alternative would have no impact on land use, although safety concerns associated with the BS Dam would remain and would eventually require structural medications or full dam replacement. At that time, the future modifications or the dam replacement would impact immediate land uses. Due to the need to address safety concerns, the “no action” alternative would not be an acceptable long term option.

**Recreation:** The No Action Alternative would result in the following consequences for recreation:

- **Fishing** – The No Action Alternative would result in the BS Dam continuing to function as a significant barrier to fish passage. The
existing fragmented condition of the natural aquatic habitat would be maintained and the viability of the Milwaukee River as a natural fishery would continue to be limited. The No Action Alternative would preclude the establishment of a lake-run seasonal sport fishery in upstream areas. No benefits to the Milwaukee Estuary AOC would be achieved. On the positive side, the BS Dam would continue to function as an effective barrier to AIS movement. In addition, fishing for species well suited for the existing impoundment would continue.

- **Boating** – The No Action Alternative should result in no significant changes for recreational boating. Boating safety issues and inconvenience created by the impassable waterfall will remain.
- **Ice Skating** – The No Action Alternative should result in no impact on ice skating occurring in the upper portions of the impoundment.
- **Swimming and Wading** – The No Action Alternative should result in no significant changes for swimming and wading.
- **Walking and Jogging** – The No Action Alternative should result in no impacts for walking and jogging. For the near term, the disruption to jogging and walking that would occur as a result of closure of the existing riverwalk during construction would be eliminated.
- **Wildlife Viewing** – The No Action Alternative should result in no changes for wildlife viewing, but would not result in the enhanced opportunities for wildlife viewing that would be provided by the fishway.

### 3.4.3 Water Quality and Resources

#### 3.4.3.1 Affected Environment

After sampling the three impoundments associated with Bridge Street Dam, Lime Kiln Dam and the former Chair Factory Dam, it appeared the impoundments had an effect on dissolved oxygen levels and water temperature. Higher photosynthetic and respiration rates by the abundant macrophytes and filamentous algae in the Bridge Street impoundment are likely responsible for wider diurnal dissolved oxygen fluctuations within that impoundment.

Water quality trends were observed to be most affected by the Village of Grafton’s wastewater discharge to the Lime Kiln impoundment. The concentrations of major cations and anions remained relatively stable throughout the complex with the exceptions of chloride (Cl-) and sodium (Na+). The concentrations of these elements rose in the area upstream of Lime Kiln and may be due to the discharge from the Grafton Wastewater Treatment Plant (WTP) and/or salt from road applications upstream and in the Village. The Grafton WTP typically produces a high quality effluent. Elevated bacteria levels in the complex (the three impoundments) correspond to precipitation and stormwater runoff events (WDNR, 1993).
The BS Dam impoundment’s summer base-flow water temperatures are 2o C to 4.5o C warmer than temperatures measured upstream of the impoundment. This trend is consistent with other studies that reported shallow non-stratified impoundment’s increase water temperatures during summer months and decrease water temperatures during the winter months. Impoundments can create additional summer thermal stress to biota and may be most limiting during drought and low-flow conditions. Since water temperatures are inversely related to dissolved oxygen solubility in water, higher water temperatures limit the availability of oxygen for fish and other aquatic life.

The BS Dam was most recently re-constructed in 1918 and is nearing the end of its design life. It was originally constructed to provide power for specific industrial uses. The intended use of the dam terminated in 1961 when the mill race was filled in with concrete, rock and soil. At this time, the Village of Grafton accepted ownership of the dam and continued operation and maintenance of this structure since it presents a significant hazard by its nature and location.

Sediment analysis previously performed by Wisconsin Department of Natural Resources in the reservoir above the BS Dam revealed levels of contaminants that do not require special handling if managed in-place. Confirmation testing has been performed to determine consequences of exposure to humans and wildlife, and for material handling prior to dam removal. Reservoir dewatering would be performed incrementally during dam removal to retain sediment in-place and to avoid transport of excessive sediment downstream.

3.4.3.2 Environmental Consequences

3.4.3.2.1 Proposed Action Alternative

Dam removal and dewatering of the dam impoundment will largely return the river to its pre-settlement orientation and appearance similar to the river upstream and downstream of the reservoir. Approximately 12 acres of land will be re-exposed, and the river will continue to inundate approximately 23 acres of the 33-acre impoundment. The exposed soft sediments will dewater and decrease in volume by approximately 25 percent. Reservoir dewatering would be performed incrementally during dam removal to retain sediment in-place and to avoid transport of excessive sediment downstream.

River channel width will not change in all areas of the impoundment, especially north of River Island Park. In this area, the river will likely downcut into sands and gravels and may become slightly narrower and more entrenched. A 4- to 5-foot natural waterfall that is now submerged in the dam reservoir will be re-exposed after dam removal.
Certain shallow backwater areas adjacent to the river will dewater and appreciably narrow the open-water surface at the southern end of River Island Park and in the embayment just north of Veterans’ Park. Substantial areas of wetlands will be created, but the areas will likely remain in the floodplain. Perhaps the most pronounced change in channel appearance will occur south of Veterans’ Park. Currently, the river is approximately 285 feet wide in this reach. During normal flow conditions, the new channel will contract to between 65 and 95 feet wide.

The regulatory floodplain will not automatically change if the dam is removed. Areas now regulated as floodplain will remain floodplain unless a new hydraulic modeling study is completed. Areas well upstream of the dam will see little influence on floodplain elevations if the dam is removed.

The potential effect on the movement of AIS is greater with dam removal since there is no longer a mechanism to prohibit their movement above or below the location of the existing dam. The next upstream barrier to AIS occurs at the Newburg Dam.

Water quality impacts include the expected improvement by lowering water temperature and turbidity, and increasing dissolved oxygen. Water resource effects include the re-establishment of the sediment transfer function of the natural river. Fragmented aquatic habitat will be re-connected. Improvements to the abundance and diversity of fish and other aquatic life are expected this barrier is removed from the river system. A barrier to AIS movement (<Q100) will also be removed from the river. Opportunities for human access to and use of the water resource are expected to be improved following the removal of the BS Dam.

3.4.3.2.2 No Action Alternative

In the No Action Alternative, no removal of the BS Dam is provided. No restoration of the natural river channel is achieved. Aquatic habitat remains fragmented and no fish passage is provided at this location. Biological diversity and abundance of fish and aquatic life occurring within the dam reservoir remain diminished relative to the free flowing reaches above and below the project site. AIS movements are impeded to <Q100. The current interruption to the natural river sediment transport function continues. Floodplain elevation above the dam remains altered. The No Action Alternative does not meet the purpose and need for the project.

3.4.4 Wetlands and Floodplains

3.4.4.1 Affected Environment

The wetlands associated with the BS Dam are mapped by the WDNR and classified as emergent, wet meadow, palustrine wetlands with standing water (E4H), unvegetated flats wetlands with flowing water on wet soils (F0R) and forested, broad leaved, deciduous, palustrine wetlands (T3K).
Most common plant species associated with these wetland types along the Milwaukee River are second growth wet to wet-mesic lowland hardwoods with black willow, green ash, box elder, silver maple, cottonwood and American elm and emergent fresh wet meadow with reed canary grass and cattails.

The WDNR provided the Village with a July 16, 2009, letter documenting the requirements necessary to ensure the BS Dam complies with Chapter NR333, Wis. Admin. Code. The process requires the Village to hire an engineer registered in Wisconsin to assess the dam’s spillway capacity and propose any necessary upgrades to meet established spillway standards.

The WDNR reissued a dam failure analysis for the BS Dam as part of the Ozaukee County Map Modernization Project in 2007. The resulting profile and floodway data table were adopted by the Village of Grafton on April 7, 2008. As part of the analysis, the BS Dam was assigned a hazard rating of significant. The dam is required to have a minimum total spillway capacity of the 500-year flood event (e.g., 0.2% chance of occurring or being exceeded in any given year). According to the current Flood Insurance Study, the 500-year discharge is 15,420 cubic feet per second (CFS). The Village has one year to assess the spillway capacity of the dam, and NR333 allows 10 years to construct necessary upgrades to meet the established spillway requirements.

See Figure 3 in Appendix B for more information on wetlands and floodplains in the BS Dam area.

3.4.2 Environmental Consequences

3.4.2.1 Proposed Action Alternative

The removal of the BS Dam and subsequent re-establishment of the river channel will alter the existing shoreline and vegetation in the impoundment area. The drawdown of the impoundment may result in emergent vegetation developing along the exposed sediment areas. The type and extent of vegetative growth will be dependent on the existence of viable dormant seed already present in the existing seed bank and imported from local wetlands. Based upon existing near shore and aquatic plants growing in the vicinity, the plants that are likely to re-establish include green and soft stem bulrush, narrow-leaved cattail, reed canary grass, rush and sedge species. These are herbaceous wetland plants often described as “pioneer species” because of their tendency to quickly vegetate areas of open or disturbed soil. This herbaceous growth will probably be replaced with shrubs and other woody species associated with the adjacent forested, broad leaved wetlands.

Rooted aquatic plant growth which may become re-established within the new channel following drawdown of the impoundment would likely be limited to emergent or floating vegetation within pools and still water areas. These plants may include cattails, water plantain, floating pondweed,
common waterweed and coontail. All of these plants provide valuable fish and other aquatic life habitat provided they are not present in nuisance amounts.

The removal of the BS Dam and impoundment will result in the restoration of an historical 6,000 ft. long free-flowing reach of the Milwaukee River. Following removal of the dam, average water depths will decrease from zero to five feet within the former boundary of the impoundment. Removal of the BS Dam and impoundment will not affect water depths and discharge within the Milwaukee River upstream or downstream of the impoundment since the dam and impoundment was operated under “run-of-the-river” conditions.

Water velocities will increase within the restored free-flowing river reach due to the return of the historical channel grade line. Under free-flowing conditions, average stream velocities, stream width and depths will vary depending on river discharge conditions and slopes, and will be similar to those which currently exist along free-flowing reaches farther upstream of the BS Dam impoundment. During average river discharge conditions, the dam removal is not expected to result in dramatic changes throughout most of the restored free-flowing river channel due to the confining effect of the steep and narrow river valley and floodplain. This reach is expected to consist of deep riffles, chutes, waterfalls, runs and pools over bedrock, with minor back water areas. Under low river discharge conditions, the removal of the dam will result in minor decreases in stream width and surface water area with a correspondent increase in the exposed lower bank. A decrease in surface water area is expected to occur in those areas where exposed sediment is formed, primarily along the banks immediately upstream of the dam. Removal of the dam infrastructure will increase riverine aquatic habitat along approximately 6,000 linear feet of shoreline.

Following removal of the BS Dam, the free-flowing riverine and riparian characteristics, and functions will be very similar to those that developed along the Milwaukee River following removal of the Village of Grafton’s Chair Factory Dam in 2000-2001. The Chair Factory Dam was located between the LK and BS Dams in Grafton (Ref- LK EA).

The impacts to the existing wetlands will include minor changes to the hydrology of existing wetlands. Considering the existing wetland hydrology has been altered by the dam construction, the impacts will be beneficial in nature by restoring the natural riparian hydrologic regime. Also, portions of the current impoundment that are not mapped as wetland will be re-exposed and will revert back to wetland increasing functional values to the channel bank and riparian corridor.

3.4.4.2.2 No Action Alternative
Section 3.4 Bridge Street Dam (BS Dam) Restore Natural Channel/Remove Dam (Alternative B)

No action would result in leaving the BS Dam in place and allowing it to deteriorate due to the effects of river action, weathering, erosion, and the freeze/thaw cycle. The Village of Grafton would continue to operate and maintain the BS Dam according to state and federal dam safety standards.

The impacts of the artificially high water levels on wetlands and floodplain created by the existing impoundment would not be addressed. These include inability of the wetlands and floodplains to reach their full biological potential due to habitat fragmentation and modification of the hydrology of riparian wetlands.

3.4.5  Aquatic Biology

3.4.5.1  Affected Environment

3.4.5.1.1  Habitat

The existing habitat at the site is relatively low-quality and typical of an impoundment, with raised water temperature and lower dissolved oxygen levels as compared to other reaches of the river. Factors limiting fishery habitat in the area include warm water temperatures, excessive algae growth, turbidity, low dissolved oxygen levels resulting from aquatic plant respiration and sediment oxygen demand, and extensive sedimentation by fine textured and polluted sediment (Wawrzyn et al., 1994).

An alternative to restore fish passage through Grafton is to return the river to its pre-settlement channel. This necessitates removal of both the original timber crib dam and the later concrete dam. These structures occupy the site of a bedrock-induced falls and rapids sections just north of Bridge Street. With the dams’ removal, the millpond will be transformed from a quiescent pool with a 12-foot vertical drop at the dam to a free-flowing river, with rapids and small waterfalls. The restored channel would be passable to target fish species and small boats such as kayaks. Additionally, the rocky bed re-exposed to swiftly flowing water is ideal spawning habitat for many target fish species. Presently, these areas are often capped with a layer of sand and silt in the impoundment.

During typical flow periods, the BS Dam forms a 33-acre impoundment stretching upstream almost 1 mile to a location approximately midway between River Island Park and the Interurban Bridge. The relatively slower-flowing water created by the reservoir likely extends to the Interurban Bridge during high flows. As would be expected, the deepest water in the impoundment is found just upstream of the dam, where small areas attain 11 feet in depth. In the upper third of the impoundment, water depths approximate those found in un-impounded reaches of the river. Overall, water depth in the current impoundment averages $2\frac{1}{2}$ feet deep.

Using data collected as part of the recent BS Dam Fish Passage Feasibility Study, approximately 38,000 cubic yards of soft sediment have accumulated...
behind in the former river channel upstream of the dam. Most of this accumulated sediment is not in the original river channel, but instead, is located in areas that will become exposed if the impoundment is dewatered. Chemical analyses have not revealed concentrations of contaminants injurious to human and/or environmental health.

Local geology strongly influences river channel characteristics. Bedrock is not buried deeply in the area and forms the bed of the original river channel south of Veterans’ Park. The bedrock creates a narrow, high-gradient channel between Highway 60 and the dam, with rock escarpments on either side of the channel nearer the dam. These escarpments may be 10 feet in height at the dam site. Additionally, a natural waterfall underlies the original timber crib dam and a “chute” is incised into the bedrock near the western side of the falls. If the dam was removed, most flow would be transmitted by the chute during low to normal conditions. Consequently, the “falls” may commonly appear to be a steeply inclined rapids similar to areas at the former Chair Factory dam site.

3.4.5.1.2 Macroinvertebrates

No site specific sampling of macroinvertebrates was performed for the BS Dam site. Historic work in the vicinity indicates that macroinvertebrates are more abundant below the dam in that flowing reach of the river. Higher photosynthetic and respiration rates by the abundant macrophytes in the BS Dam impoundment are likely responsible for wider diurnal dissolved oxygen fluctuations within that impoundment.

3.4.5.1.3 Aquatic Vegetation

Based upon existing nearshore and aquatic plants growing in the vicinity, the plants that are likely to proliferate include bulrush, cattail, reed canary grass, and smartweeds. These are wetland plants often described as “disturbance vegetation” or “pioneer species” because of their tendency to quickly vegetate areas of open or disturbed soil.

Aquatic vegetation, as filamentous algae and rooted macrophytes, are very abundant especially in the shallow backwater. Non-native Eurasian watermilfoil and curley-leaf pondweed are abundant limiting aquatic habitat and recreational uses. Duckweed can also form extensive mats in shallow and stagnant backwater areas of the impoundment.

3.4.5.1.4 Fisheries

**Fish Community**

An abbreviated list of common forage or non-game species in the Milwaukee River within five miles of the BS Dam includes longear sunfish, logperch, johnny darter, blackside darter, fantail darter, least darter, Iowa darter, fathead minnow, spotfin shiner, common shiner, golden shiner,
bluntnose minnow, common carp, central and largescale stonerollers, sand shiner, horneyhead chub, white sucker, striped shiner, creek chub, rosysface shiner, redfin shiner, brook stickleback, mimic shiner, central mudminnow, banded killifish, stonecat, tadpole madtom, and four species of redhorse including the greater, shorthead, golden and silver redhorse. Fall populations of coho and chinook salmon, an occasional brown trout and fall and spring rainbow trout may be present below the BS Dam when river discharge and water depths allow a limited number of these migrants from Lake Michigan to pass over the MT and LK Dams. The presence of these species downstream of the BS Dam will become an annual occurrence once the MT FW becomes operational and the LK Dam is removed, in 2010. These Lake Michigan potamodromous species will be observed upstream of the BS Dam following its removal. Improvements to these and other fish populations will also benefit BUIs of the Milwaukee River AOC. The Milwaukee River is classified as a Warm Water Sportfish Community per NR 102 and NR 104 (Kramasz & Wawrzyn, 2009).

Invasive species

Several animal and plant aquatic invasive species are established in the Milwaukee River Basin. Common carp are the most widespread and abundant non-native fish species in the basin. They are especially common in the eutrophic impoundments where the degraded habitat allows them to flourish. Established non-native aquatic vegetation includes Eurasian water milfoil and curley-leaf pondweed. Like the common carp, these plants are often present in nuisance amounts in the degraded eutrophic BS Dam impoundment. Zebra mussels are established in Lake Michigan. They are also present in the Milwaukee River Basin headwaters of Long Lake and Mauthe Lake, upstream of the proposed project area. Zebra mussels have yet to be observed in the free-flowing reaches of the Milwaukee River and its tributaries.

AIS fish species established in Lake Michigan include the parasitic sea lamprey and the round goby. Monitoring by the USFWS since 1959 and more recently by the WDNR has not identified any adult or larvae sea lamprey in the lower Milwaukee River. Sea lamprey would have been able access to the Milwaukee River and higher quality tributaries in Ozaukee County following abandonment of the North Avenue Dam located 3.2 river miles (RM 3.2) upstream of the River’s confluence with Lake Michigan. The North Avenue Dam gates were opened in 1990 and the dam fully abandoned in 1997. Both events would have allowed sea lamprey access to the upper reaches of the river. WDNR sampling data from 1991 through 2009 for the Milwaukee River Basin in Washington, Milwaukee and Ozaukee Counties is included in Appendix A, Table 4. No adult or larvae sea lamprey were identified. Fish community monitoring by the USFWS over this 19-year
Section 3.4 Bridge Street Dam (BS Dam) Restore Natural Channel/Remove Dam (Alternative B)

period has been negative for sea lamprey adults and larvae up to the Village of Grafton’s Lime Kiln Dam located at RM 30.

Similarly, round goby was first observed in the Great Lakes in 1990. Since then, the round goby has infested Lake Michigan including the Milwaukee River Estuary. Monitoring by WDNR since 1999 and more recently by Kornis (2009) has not documented any round goby movement upstream of the former North Avenue Dam.

The USFWS criteria for an acceptable barrier to sea lamprey is a minimum 1.5-ft elevation difference between the spillway crest and tailwater during the 10% or less frequent annual chance flood occurrence; the absence of flooding around the dam abutments at all water levels; and the absence of spillway breaches large enough for lamprey to swim through (USFWS, 2009). In some instances, the USFWS will design sea lamprey barriers to have a minimum 1.5-ft elevation difference between the spillway crest and tailwater between the 25% and 10% annual chance flood occurrences. Based on the estimated range of annual chance flood occurrence surface water elevations derived from the Ozaukee County Flood Insurance Study (FIS), the BS Dam meets the criteria for a minimum elevation difference of 1.5-ft for the 10% and less frequent annual chance flood occurrence.

Following the recent June 2008 flood events, corresponding real-time river discharge measures, photo documentation and observations suggest that the BS Dam may not meet the USFWS criteria for an acceptable barrier to sea lamprey passage, in full or in part. Briefly, a more recent assessment suggests that the June 2008 flood event may have corresponded to a 20% or more frequent annual chance flood occurrence (Wawrzyn, 2009). A photograph of the BS Dam provided by a Milwaukee Journal Sentinel photographer corresponding to real-time river discharge conditions suggests that spillway crest/tailwater elevation differences may be smaller than predicted in the Ozaukee County flood insurance study. The photograph also shows significant flooding around the west or right spillway abutment. Nevertheless, the USFWS cannot revise its original conclusion that the BS Dam meets its criteria as a sea lamprey barrier without a more detailed hydrologic and hydraulic analysis beyond which exists for the Ozaukee County FIS. In a letter sent to WDNR and Village of Grafton officials, the USFWS is not opposed to a fishway at the BS Dam provided is designed to include flash boards or similar structure to enable the fishway be closed to fish passage. The USFWS and Great Lakes Fish Commission do not support removal of the BS Dam as a means of providing fish passage.

VHS is known to infect fish from Lake Michigan but there are no verified VHS infections of fish stocks in the lower Milwaukee River. This difference in elevation between the spillway crest and tailwater for annual chance flood occurrences > 20% may allow VHS infected fish to move upstream of the BS
Section 3.4 Bridge Street Dam (BS Dam) Restore Natural Channel/Remove Dam (Alternative B)

Dam for fish having “jumping” and high burst speed swimming capabilities (e.g., trout and salmon).

Although the dam does obstruct fish movement during low to moderate flows and water levels, the BS Dam may be considered a partial barrier to AIS/VHS. A more detailed discussion on AIS as it relates to the project can be found in Document 1, Appendix C. During large flood events, there is an approximately 8-foot difference in water elevations immediately upstream and downstream of the dam. This difference in elevation could allow “jumping” VHS infected fish to move upstream. In addition, the proximity of the tailwater elevation to the crest of the dam during higher flows could allow adult sea lampreys to climb the dam and move upstream.

3.4.5.1.5 Threatened and Endangered Species

**Endangered, Threatened and Special Concern Species**

The Wisconsin Natural Heritage (NHI) Working List contains species known or suspected to be rare in the state and natural communities present in Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked. A survey of the NHI for this project (see Appendix C, Document 4) includes seven fish species documented as being present or potentially present in the Bridge Street Dam project area. While most of these listed fish species are still encountered during routine field assessments, the lack of recent occurrences cannot discount their continued presence since their habitat remains intact. For the purposes of this Environmental Assessment these species will be assumed to be present. There are no federally listed fish species in the Milwaukee River Basin or more specifically, in the Bridge Street Dam fishway project area.

Listed plant species potentially present in the project area include the state Special Concern marbleseed, hooker’s orchid and waxleaf meadowrue. Listed animal species potentially present in the project area include the Endangered queensnake. Given the limited aquatic footprint for this project, and the highly disturbed and developed nature of the upland construction site, it is unlikely these plants and animals, if present, would be impacted by the project. A NHI listing of potential listed species in the project area and within 1 mile of the project area is included as Document 4 in Appendix C. There are no federally listed species in the project area.

**Endangered**

The striped shiner is the only state listed endangered fish species that potentially exists or is known to exist in the project area.

*Striped shiner*
The striped shiner is ranked with a global element of G5 and a state element rank of S1. These rankings indicate that while the striped shiner is demonstrably secure globally it is critically imperiled in Wisconsin. The S1 or critically imperiled ranking is due to extreme rarity defined as five or fewer occurrences per acre, very few remaining individuals, or because some factors make it especially vulnerable to extirpation from the State. Its numbers have declined so much in recent years that it is nearly extirpated from the state. During the mid-1990’s, WDNR crews sampled multiple reaches and times along the Milwaukee River and identified a single specimen from the river in Ozaukee County.

The striped shiner prefers clear to only slightly turbid waters of runs and shallow pools, with dense aquatic vegetation over substrates of cobble, boulders, silt, sand, mud or bedrock. Spawning occurs from late May through June (Becker, 1983). They are likely to frequent water depths ranging from 0.1 - 1.5 m (Pfleiger, 1975). A study of striped shiners from the Milwaukee River in Ozaukee County revealed that the fish had consumed hymenoptera, coleoptera, other aquatic insects, filamentous algae, and vegetative material (Trautman, 1957).

**Threatened**

Three state listed threatened fish species that potentially exist or are known to exist in the project area include the greater redhorse, redfin shiner and longear sunfish.

*Greater redhorse*

The greater redhorse is ranked globally as a G3 and has a statewide ranking of S2S3. These rankings indicate that the greater redhorse is either very rare and local throughout its range, found locally abundant in a restricted range, or that other factors may make it vulnerable to extinction throughout its range. The Milwaukee River Basin has one of the most secure populations of greater redhorse in Wisconsin.

The greater redhorse prefers clear water of medium to large rivers, over bottoms of sand, gravel, or boulders. Spawning occurs in May or June. The greater redhorse spawns over substrate consisting of gravel with mixtures of sand and small rubble in moderate to swift currents. It generally feeds on a diet of aquatic insects, mollusks, crustaceans and plant material (Becker, 1983).

*Redfin shiner*

The redfin shiner is ranked globally as G5 and has a statewide ranking of S2. These rankings indicate the Redfin shiner is secure globally though quite rare in parts of its range. Within Wisconsin, however, it is very rare and very vulnerable to extirpation. It has been collected in small numbers from the
Milwaukee River and Cedar Creek in Ozaukee County, and even more infrequently from the Milwaukee River in Milwaukee County (Becker, 1983 and Lyons et al., 2000). The redfin shiner prefers more turbid waters of pools in low-gradient streams over substrates of boulders, cobble, sand, silt or detritus. Spawning occurs from early June through mid-August in sunfish nests who they coexist with in the nesting territory. Their diet is dominated by aquatic and terrestrial insects and, at times, is dominated by filamentous algae (Becker, 1983).

**Longear sunfish**

The longear sunfish is ranked globally as a G5 and has a statewide ranking of S2. These rankings consider the longear sunfish to be secure globally though it may be quite rare in parts of its range. In Wisconsin, it is very rare and very vulnerable to extirpation. The Milwaukee River Basin was once one of the states more important strongholds (Greene, 1935 and Becker, 1983). More recently, Milwaukee River Basin populations have been in steep decline with a few remnant populations present in the Washington and Fond du Lac Counties (Lyons, et al., 2000).

The longear sunfish prefers clear, shallow, moderately warm, still waters of streams and small lakes in or near vegetation. Spawning occurs from late May through mid-July, sporadically to August. The longear sunfish diet is opportunistic and diverse including aquatic and terrestrial insects, fish eggs, larval fish, small crustaceans and aquatic plant material (Becker, 1983).

**Special Concern**

Three state listed threatened fish species that potentially exist or are known to exist in the project include the banded killifish, least darter and lake sturgeon.

**Banded killifish**

The banded killifish is ranked globally as G5 and statewide as S3. By this ranking, the banded killifish is considered to be secure globally though they may be quite rare in parts of its range. Within Wisconsin, however, its ranking indicates that it is rare or uncommon and vulnerable to extirpation. Small numbers of banded killifish have been identified in the Milwaukee River and Cedar Creek watershed in Ozaukee County (Becker, 1983 and Lyons et al., 2000).

The banded killifish prefers the clear shoal waters of estuaries and lakes, backwaters and areas in streams with slower currents (Becker, 1983). Substrate preferences include a wide range of substrates including gravel, sand, silt, marl, clay, detritus or cobble generally with sparse vegetation in water depths up to 0.6 m. Spawning occurs from June through mid-August over coarse sand substrate. The diet of the banded killifish is somewhat
habitat-specific and depends on the availability of food types. Generally they feed upon small crustaceans, insect larvae, plant material and algal filaments. The young have much more specific requirements and reportedly feed almost exclusively on planktonic crustacea and chironomid larvae.

Least darter

The least darter is ranked globally as G3 and statewide as S3. G3 indicates that the fish is both very rare and local through its range. S3 indicates the fish is rare or uncommon in Wisconsin. Earlier records indicated the least darter to be common in southeastern Wisconsin, including the Milwaukee River Basin and, in particular, the Menomonee River watershed (Green, 1935). More recent accounts indicate that habitat changes have greatly reduced its distribution and relative abundance (Becker, 1983; Fago, 1985 and Lyons et al., 2000).

The least darter prefers clear, warm, quiet waters of overflow ponds, pools, lakes and streams over substrates of gravel, silt, sand, boulders, mud or clay. It also prefers dense vegetation or filamentous algal beds at depths less than 1.5 m. Spawning occurs from late April into July. The diet of the least darter consists of aquatic insect larvae and nymphs, copepods and cladocerans (Becker, 1983).

Lake sturgeon

Lake sturgeon are ranked globally as G3G4 and statewide as S3. Globally the fish is very rare and local throughout its range or globally secure and quite rare in parts of its range. It is rare or uncommon in Wisconsin but with secure populations in the Wolf/Fox River basins. Until recently, the lake sturgeon was considered absent from the Milwaukee River basin except for a small non-reproducing remnant population in Big Cedar Lake in Washington County due to a non-planned stocking by the former Wisconsin Conservation Department in 1936. An occasional lake sturgeon is observed by WDNR fisheries and commercial fishers working in the Milwaukee River Estuary or the near-shore waters of Lake Michigan. The WDNR and its partners have been rearing lake sturgeon at its streamside facility along the Milwaukee River at Newberg in an effort to restore sustainable populations in the Milwaukee River and near-shore waters of Lake Michigan. Since 2003, approximately 64,000 larvae and 5,112 lake sturgeon fingerlings have been stocked in the Milwaukee River.

The lake sturgeon prefers large rivers and lakes. It also lives in the shoal waters of the Great Lakes. Inland it shows a preference for the deepest mid-river areas and pools. Spawning occurs from late April through early June in cold, shallow fast water over large rocky substrate. The lake sturgeon diet includes mussels, insect larvae, leeches, and snails (Becker, 1983).

3.4.5.2 Environmental Consequences
3.4.5.2.1 Proposed Action Alternative

The removal of the dam poses potential short-term negative impacts and long-term benefits for Wisconsin special status fish species present in the Milwaukee River. Short-term adverse impacts are generally related to the short-term duration of the drawdown and construction phase of the dam abandonment. Specifically, there exists the potential for erosion and scour of sediment accumulated behind the dam. Excessive and/or untimely releases of these sediments could increase turbidity and siltation downstream. Construction activities related to dam demolition, equipment access in the river and construction site erosion also have the potential to directly or indirectly impact these fish species if management practices to control these impacts are not followed. As discussed in previous sections, methods and sequencing of drawdown and construction activities are available to mitigate, but not entirely eliminate, the negative effects of this project. Mitigation techniques include the location of primary dewatering flow, seasonal timing (with regard to flow and temperature), rate of the controlled impoundment drawdown, limiting equipment access along the stream bank and stream bed, and use of construction erosion control best management practices.

Removal of the BS Dam and restoration of the natural river channel and riparian habitat is expected to enhance and improve the abundance and biodiversity of aquatic species. Viability of the natural fishery would also be improved. The project would remove a known impediment to fish passage (to less than Q100) and reconnect fragmented aquatic habitat, benefitting the project area as well as the Milwaukee Estuary AOC and watershed. Chemical analyses have not revealed concentrations of contaminants injurious to human and/or environmental health.

It is understood that dam removal is the best alternative that would meet the purpose and need for re-establishment of fish passage since the barrier to fish movement would be completely removed. However, the potential of AIS spreading into the upstream portions of the Milwaukee River watershed is greater with dam removal since there is no longer a mechanism to prohibit their movement above or below the location of the existing dam. For more information on AIS within the project area, see Document 1 in Appendix C.

See Section 3.2.5.2.1

3.4.5.2.2 No Action Alternative

In the No Action Alternative, no removal of the BS Dam is provided. No restoration of the natural river channel is achieved. Aquatic habitat remains fragmented and no fish passage is provided at this location. No benefits to Milwaukee Estuary AOC BUIs will be achieved. Biological diversity and abundance of fish and aquatic life occurring within the dam reservoir remain diminished relative to the free flowing reaches above and below the
project site. AIS movements and barrier effectiveness up to Q100 are the basis of much discussion among agencies. The no-action alternative does not meet the purpose and need for the project.

See Section 3.2.5.2.2

3.4.6 Terrestrial Wildlife

3.4.6.1 Affected Environment

3.4.6.1.1 Wildlife Habitat

Existing public roads and right-of-ways will be used for accessing the site for construction. Most of the construction footprint will be confined to the millrace or paved concrete riverwalk. Minimal vegetation removal will be required for construction. Disturbed areas will be restored to pre-construction conditions as riverwalk or landscape.

The Milwaukee River up and downstream from the BS Dam is an urban setting with isolated strips of wooded and grassy shoreline with some residences and businesses very close to the water’s edge. The wooded and grassy areas provide habitat for a variety of birds, mammals, reptiles, amphibians and invertebrates. The river way also provides an important wildlife “corridor” linking other blocks of habitat upstream and downstream from the dam.

Common mammals known to occur in the project area are opossum, striped skunk, raccoon, muskrat, mink, red, gray and fox squirrel, cottontail rabbit, eastern chipmunk, thirteen-lined ground squirrel, red fox, coyote, woodchuck, white-tailed deer, and various species of moles, voles, shrews, weasels, mice and bats. Incidental mammals include river otter and possibly beaver.

Birds known to occur in the area are Canada geese (both the nesting “Giant” and migratory “Interior” subspecies), puddle ducks (especially mallards, wood ducks, and blue-winged teal), grebes, coots, great blue herons, egrets, various hawk species (Cooper’s, sharp-shinned, red-tailed, American kestrel), wild turkeys, and numerous species of songbirds.

Additional species using the river seasonally during migration include other puddle duck species (green-winged teal, American wigeon, American black duck, etc.), diving ducks (ring-necked ducks, buffleheads, common goldeneyes, scaup, common merganser, etc.), and various species of terns, songbirds, shorebirds, rails, sandpipers, snipe, American woodcock, and gulls.

Common reptiles known to occur along the current river way are painted turtles, snapping turtles, and eastern garter snakes. Amphibians known to occur are American toads, chorus frogs, green frogs, and northern leopard...
frogs. Other species of frogs, turtles, snakes and salamanders and newts most likely are present.

### 3.4.6.2 Environmental Consequences

#### 3.4.6.2.1 Proposed Action Alternative

The planted and/or natural vegetation that reverts on the drawn down areas will provide additional habitat (i.e., shrubby-grassy areas, or additional wooded areas) than what is currently found on the adjacent wooded and mowed side slopes. The increased width of the bank and vegetated riparian corridor will greatly enhance the fish and wildlife habitat in the project area.

It is unlikely any mammal species would be lost due to removal of the dam. Most mammals utilize terrestrial habitat and the addition of terrestrial habitat through this project will improve conditions for these species. The continued presence of the river and wider, uninterrupted shoreline would be attractive to raccoons, mink, muskrats, and otters. Mud flat stabilization and revegetation would benefit shrews, mice, voles, cottontail rabbits, red fox, coyotes, and white-tailed deer. These species would most likely expand their territories into the floodplain after the drawdown. Removing the dam would reduce the surface water area (former impoundment), which would limit “loafing” habitat and open water for waterfowl.

It is unlikely any bird species would be lost if the dam is removed.

Bird watching opportunities may increase with the influx of species adaptable to newly established riparian vegetation on the draw down area. Viewing opportunities would increase as the vegetation matures and attracts migratory and summer resident birds. Nearby residents who feed birds in the winter may note an increase in bird diversity at their feeding stations. Songbirds attracted to the corridor are usually opportunistic, seeking available food sources and alternative feeding sites during periods of harsh winter weather.

No change in species diversity is expected by removing the dam. The exposed and stabilized mud flats and shoreline would provide suitable feeding sites and nesting cover for beneficial snakes, such as garter snakes. Snake abundance may increase as the riparian habitat matures and produces suitable prey such as small frogs, insects, mice, and snails. Turtle numbers are not expected to noticeably change. Exposed river bottom (tree roots, gravel bedrock areas, etc.) will be used as basking sites or egg-laying habitat for snapping turtles and painted turtles.

Removal of the BS Dam and impoundment reduces the extent of deepwater areas impeding terrestrial organism crossing.

#### 3.4.6.2.2 No Action Alternative
The No Action Alternative will have no impact on existing wildlife habitat. Under the No Action Alternative, diminished terrestrial organism movements due to reduced riparian zone and deep water will continue to occur. The riparian zone will remain in its current urban landscape.

### 3.4.7 Vegetation

#### 3.4.7.1 Affected Environment

If present, rooted aquatic plants would be disturbed or eliminated in the fishway right-of-way. Aquatic vegetation is common to abundant in the BS Dam impoundment. Non-native Eurasian watermilfoil and curley-leaf pondweed are present at nuisance amounts in shallow and stagnant slack water areas limiting aquatic habitat and some water-based recreational and aesthetic uses. A reduction in the amount of these AIS plant species and native plant species if present would not significantly impact fish, other aquatic life or wildlife habitat.

This section of the Milwaukee River is located in an urban area. Downstream of the BS Dam, both sides of the river are wooded with some shrubs and broadleaf plants. The upstream impoundment area is generally maintained Bluegrass sod and landscape.

#### 3.4.7.2 Environmental Consequences

**3.4.7.2.1 Proposed Action Alternative**

The removal of the dam and subsequent re-establishment of the river channel may alter the existing shoreline and vegetation in the impoundment. The drawdown of the impoundment may result in emergent vegetation developing along the exposed sediment areas. The type and extent of vegetative growth will be dependent on the existence of viable dormant seed already present in the existing seed bank and imported from local upland sources. Based upon existing aquatic vegetation growing in the vicinity, the plants that are likely to proliferate include bulrush, cattail, reed canary grass, and sedges. These are herbaceous wetland plants often described as “disturbance vegetation” or “pioneer species” because of their tendency to quickly vegetate areas of open or disturbed soil. This herbaceous growth will probably be replaced with shrubs and other woody species as the sediments dry out and take on characteristics associated with upland soils.

Rooted aquatic plant growth which may become re-established following drawdown of the impoundment would likely be limited to emergent or floating vegetation in pools or other still water areas. These plants may include floating pondweed, common waterweed, coontail and white water lily. All of these plants provide valuable fish and other aquatic life habitat provided they are not present in nuisance amounts.
3.4.7.2.2 No Action Alternative

The natural function of riparian and aquatic vegetation would continue to be diminished due to inundation of the riverbed and banks beneath the BS Dam reservoir.

This alternative would leave the dam in its current condition. No other alternative described herein that would enable fish passage would be pursued. The Village of Grafton would continue to operate and maintain the BS Dam according to state and federal dam safety standards. This alternative does not meet the purpose of the NOAA grant and the goals of a variety of fish and other water-based management plans. As such, this alternative was eliminated from further consideration (Kramasz & Wawrzyn, 2009).

3.4.8 Cultural and Historic Resources

3.4.8.1 Affected Environment

Cultural resources within Ozaukee County and the Village of Grafton can encompass archaeological and historic resources, including but not necessarily limited to buildings, structures, objects, districts, and sites. These resources represent a variety of periods ranging from the prehistoric to the present day.

3.4.8.1.1 Archaeological and Historic Resources

An archaeological investigation of the project area was completed in August 2009. The following paragraphs are taken or adapted from the report Archaeological Investigations for the Milwaukee River Watershed Fish Passage Project, Ozaukee County, Wisconsin (Great Lakes Archaeological Research Center, 2009).

The Architecture History Memo included in Appendix A of the report (see Document 5 in Appendix C of this EA) provides the following information: The BS Dam is located just north of Bridge Street in the Village of Grafton. The only developed properties adjacent to the dam are a row of condominiums of recent construction and a mid twentieth century Ranch house with no particular historic or architectural significance. The original dam was constructed in the mid-nineteenth century to provide power for the nearby Grafton Flour Mill. The dam was reconstructed in 1881 and 1918. Since the dam’s last reconstruction, a variety of repairs and modifications have left little, if any, of the original timber and earthen structure remaining, and only a questionable amount of original 1918 material. As a result, the dam maintains a low degree of historic integrity. In 1983, the Grafton Flour Mill (AHI #13445) was listed in the National Register of Historic Places as part of the “Mills of Grafton Thematic Group” Multiple Property Submittal. The BS Dam is not integral to the historic significance of the Grafton Flour Mill.
In August 2009, GLARC conducted Phase I archaeological investigations along seven watersheds (Fredonia Creek, Riverside Drive Creek, Trinity Creek, Lac du Cours Outlet, Ulao Creek, Riveredge Creek, and Mole Creek) and three dams (Lime Kiln, Bridge Street, and Mequon-Thiensville) within Ozaukee County. The investigations were conducted within the area of potential effect for areas of proposed impediment removal associated with the Milwaukee River Watershed Fish Passage project in Ozaukee County, Wisconsin. Archaeological investigations were conducted to fulfill requirements contained in Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665) as amended and 36 CFR, Part 800, which serves to implement the Act.

During the archival and literature review, seven archaeological and burial sites were identified within one mile of the BS Dam project area. No sites were identified within the immediate project area.

3.4.8.2 Environmental Consequences

3.4.8.2.1 Proposed Action Alternative

All ground disturbing activities proposed will occur along the west side of the channel and north of Bridge Street and the dam. The areas were visually inspected during the archaeological investigation as previously discussed and found to be totally disturbed through modern landuse practices.

The investigation found that the Proposed Action will not adversely affect the cultural resource base in the project area. However, it noted that current conventional archaeological survey techniques are inadequate to determine the presence of deeply buried archaeological or paleontological deposits. The report indicated the probability for encountering such sites is unlikely but that if any materials are encountered, construction in the area of the discovery should be halted and the State Historical Society of Wisconsin should be consulted. The same course of action would be required if human remains or other indications of a burial site are encountered.

The Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a historic feature and focal point of the community. Removal of the dam would result in the loss of the historic vista.

3.4.8.2.2 No Action Alternative

The No Action Alternative will not impact existing cultural resources either directly or indirectly. This alternative will allow for existing conditions to remain as they currently are. Archaeological and historic resources will neither be preserved in another manner nor damaged under the No-Action Alternative.

3.4.9 Visual Quality and Aesthetics
3.4.9.1 Affected Environment

In terms of visual quality and aesthetics, the areas affected by the removal of the BS Dam include: (a) the dam site, (b) the impoundment, and (c) neighboring properties.

Dam Site: The BS Dam is approximately 120 feet wide and 12 to 14 feet tall. Remnants of a submerged historic rock crib dam exist approximately 50 north of the existing BS Dam.

Impoundment: The BS Dam forms a 33-acre impoundment stretching almost 1 mile upstream to approximately midway between River Island Park and the Interurban Bridge. The relatively slower-flowing water created by the reservoir likely extends to the Interurban Bridge during high flows. The deepest water in the impoundment is found just upstream of the dam, where small areas attain 11 feet in depth. In the upper third of the impoundment, water depths approximate those found in un-impounded reaches of the river. Overall, water depth in the current impoundment averages 2½ feet deep.

Adjacent Properties: The adjacent properties include residences, commercial businesses, recently constructed condominiums and a riverwalk. Mowed parklands are also adjacent to banks upstream of the dam.

3.4.9.2 Environmental Consequences

3.4.9.2.1 Proposed Action Alternative

Dam removal will result in the loss of a community icon (BS Dam). Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a focal point of the community. The river will largely return to its pre-settlement orientation, with appearances and configuration similar to those found upstream and downstream of the reservoir. Approximately 12 acres of land will be re-exposed and the river will continue to inundate approximately 23 acres of the 33-acre impoundment.

Removal of the BS Dam and loss of a portion of the impoundment may be perceived by some residents and visitors to the area as an adverse effect on visual quality and aesthetics. The effect would be experienced to varying degrees depending on the visual perspective of the residents and visitors to the downtown Grafton area. Mitigation for the adverse effect could include supplementing the historical record maintained by the Grafton Historical Society with photographs that document the dam, impoundment area, and other components as they exist today, and compiling additional information related to its history and importance to the community.

River channel width will not change in a uniform fashion in all areas of the former impoundment. In some areas, especially those located north of River.
Island Park, the channel width will not appreciably change. In this area, the river will likely downcut into sands and gravels and may become slightly narrower and more entrenched in some reaches.

Certain shallow backwater areas adjacent to the river will dewater and appreciably narrow the open-water surface at the southern end of River Island Park and in the embayment just north of Veterans’ Park. Substantial areas of wetlands will be created, but will likely remain in the floodplain. Perhaps the most pronounced change in channel appearance will occur south of Veterans’ Park. Currently, the river is approximately 285 feet wide in this reach. During normal flow conditions, the new channel will contract to between 65 and 95 feet wide.

Following the permanent drawdown and removal of the dam and resulting impoundment, the former aesthetics of a wide, slow river would be lost. The historical, approximately one-mile-long reach of the Milwaukee River will be restored to a moderately fast, free-flowing river dominated by riffles, deep runs and slack water areas similar to what existed under pre-development conditions and which currently exists upstream of the Grafton Millpond and downstream of the LK Dam. Average water depths will decrease within the former boundary of the impoundment and will be similar to the free-flowing reaches of the Milwaukee River located upstream of the BS Dam impoundment, in the area of the restored Chair Factory Dam impoundment, and downstream of the LK Dam. The BS Dam and former rock crib dam structures occupy the site of a bedrock-induced falls and rapids sections just north of Bridge Street. Both these features will be exposed once the impoundment is drawndown. Bedrock is not buried deeply in the area, and forms the bed of the original river channel south of Veterans’ Park. The bedrock creates a narrow, high-gradient channel between Highway 60 and the dam, with rock escarpments on either side of the channel nearer the dam. These escarpments may be 10 feet in height at the dam site. Additionally, a natural waterfall underlies the original timber crib dam. A “chute” is incised into the bedrock near the western side of the falls. If the dam was removed, most water may be transmitted by the chute during low to normal flow. Consequently, the “falls” may commonly appear to be a steeply inclined rapids similar to many areas at the former Chair Factory dam site.

Removal of the dam, former timber crib dam and impoundment will expose sediment along some of the existing impounded shoreline and may result in the suspension, transport and re-deposition of fine sediment in the former reservoir and the downstream river reach. This is a temporary effect during construction and restoration phase that will require mitigation in the form of soil stabilization, planting, seeding, monitoring and maintenance. These lands may or may not be located in the floodplain and will most likely revert to wetland.
Removal of the BS Dam and loss of the impoundment as a visual quality are likely to varying degrees depending on the visual perspective of the residents and visitors to the downtown Grafton area.

### 3.4.9.2.2 No Action Alternative

Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a focal point of the community. The No Action Alternative would result in retaining the existing visual quality and aesthetics, as property surrounding the BS Dam and impoundment would likely continue in the current uses as commercial, private residences and a public park (Veterans Park).

### 3.4.10 Transportation

#### 3.4.10.1 Affected Environment

##### 3.4.10.1.1 Transportation Network

**State of Wisconsin**

Within the State of Wisconsin, the transportation network consists of roadways, trails, rail lines, ports, and airports.

The BS Dam is located within the Milwaukee River watershed. Regional access is provided by state roadways under the jurisdiction of WisDOT. These roadways include Interstate 43/State Trunk Highway (STH) 57/STH 32, which is the primary north-south road; STH 167, which provides east-west access through Thiensville; STH 60, which provides east-west access through Grafton; and STH 33, which provides east-west access through Port Washington and Saukville (Ozaukee County, 2009). County and local roadways then provide local access to the site.

**Ozaukee County**

Ozaukee County is well-served by a series of freeways, state highways, major roads, and local roads. The Ozaukee County Highway Department is responsible for maintaining a total of 448 miles of roads within the county: 27 miles of Interstate Highway, 64 miles of State Trunk Highways, 154 miles of County Trunk Highways, and 203 miles of Town Roads (Ozaukee County, 2009).

Similar to the rest of the State, within Ozaukee County, the primary means of transportation is the personal motor vehicle. Transportation within the county is guided by the official areawide planning agency for the southeastern region of the State, Southeastern Wisconsin Regional Planning Commission (SEWRPC), (Ozaukee County, 2009).

Ozaukee County’s vision of the regional transportation system plan is to provide a multi-modal transportation system in order to reduce auto
dependency and promote high air quality. The Ozaukee County Express Bus (Route 143) provides service to Mitchell Street, Downtown Milwaukee, Cedarburg, Fredonia, Grafton, Mequon, Port Washington & Saukville.

Transportation in Ozaukee County also includes non-motorized modes of transportation. The Ozaukee Interurban Trail abuts the project area. Although this trail does not parallel the Milwaukee River, it does connect to roadways, trail networks, and parks in the communities of Mequon, Thiensville, Port Washington, Cedarburg and Grafton.

The County also is served by the one passenger and three freight railway companies (Ozaukee County, 2009). Existing railroad corridors run north-south through the project area in the communities of Mequon, Thiensville, Grafton, Cedarburg and Saukville.

The Milwaukee River does not have any commercial ports or marinas within the project limits. There is a recreational/utility boat launch near the BS Dam in Grafton (Ozaukee County, 2009).

Air service is available at the Milwaukee County General Mitchell International Airport, which is located in Milwaukee approximately 20 miles south of the project area. Commercial airlines provide regional services at this location. Corporate and private aircraft also utilize this airport (Ozaukee County, 2009).

**Village of Grafton**

Similar to Ozaukee County, the Village of Grafton’s roadway system consists of freeways, state highways, major roads, and local roads.

Within the Village of Grafton, east-west traffic travels along STH 60/Washington Street and Falls Road. North-south traffic travels along CTH O/Green Bay Road and Interstate 43 (Ozaukee County, 2009). Average daily traffic along these roadways varies from a low of 5,400 (on CTH O/Green Bay Road north of Cedar Creek Road) to a high of 52,400 (on Interstate 43 north of STH 60). STH 60/Washington Street will provide the primary access to the site location once within the Village of Grafton.

3.4.10.1.2 Transportation of Materials

State and county roadways have use restrictions placed on them by WisDOT and the Ozaukee County Highway Department for commercial motor vehicles. Restrictions are based on vehicle size, weight, and the time of year for travel (WisDOT, 2009). Temporary seasonal weight restrictions are typically placed on county roads each spring.

3.4.10.2 Environmental Consequences

3.4.10.2.1 Proposed Action Alternative
The proposed project will have no significant impact on transportation within the communities in the project area once the project was complete. Nominal increases in the use of the local and regional roads along the river may occur particularly during warmer months due to increases in tourism encouraged by the project. The reliability of the roadway network will be improved because of the improved flood performance and physical condition at the road crossings.

During construction, residents, workers, and visitors will experience both direct and indirect impacts. The potential transportation impacts associated with the project are temporary and mainly limited to the immediate surroundings of the BS Dam.

Direct impacts for transportation will be associated with the temporary closure of roadways and road lanes. Intermittently, over the duration of the project construction activities, access may be limited to specific locations while work is being completed.

Indirect impacts will be minor in nature and consist of additional construction traffic and re-routing of traffic. Equipment used for the restoration activities and the removal of fill will need to be delivered to the individual sites and eventually removed. Likewise, fill and waste materials will need to be transported to and from project sites. During the construction period, additional localized traffic will result due to these activities, along with the generation of additional noise and dust from the movement of the vehicles and equipment.

The proposed project also is expected to generate or retain approximately 29 temporary or permanent jobs. This will contribute to additional traffic on city roadways. However, the amount of additional traffic will be negligible.

While few impacts are expected, the proposed project may require the use of vehicle permits for the delivery and removal of construction materials. For any construction vehicles operating with overweight loads, proper permitting will be required. Detailed routes may be required to meet load restrictions on bridges and particular local roads, and construction scheduling may need to accommodate seasonal weight restrictions.

3.4.10.2.2 No Action Alternative

The No Action Alternative will not impact the existing transportation network or associated traffic directly or indirectly. This alternative will be compatible with transportation plans and programs, because it will allow for the existing conditions and proposed improvements to remain as they currently are.

3.4.11 Air Quality

3.4.11.1 Affected Environment
Air quality data for USEPA criteria pollutants measured from air monitoring sites for the state of Wisconsin are submitted to USEPA by the WDNR, and available through the USEPA’s AIRNOW Internet portal. As of December 2009, the criteria pollutants PM2.5 (fine particulate matter), CO (carbon monoxide), Pb (lead), NO2 (nitrogen dioxide), and SO2 (sulfur dioxides), continue to remain in attainment of the National Ambient Air Quality Standards (NAAQS) in Ozaukee County. On February, 10, 2009, the Wisconsin Natural Resources Board redesignated Ozaukee County to “attainment” for the USEPA-revoked 1-hour ozone standard. This action was taken in compliance with the Agency’s implementation of the Clean Air Act’s “anti-backsliding” provision.

Ozaukee County remains a moderate non-attainment area with respect to the 8-hour ozone ambient air quality standard.

### 3.4.11.2 Environmental Consequences

#### 3.4.11.2.1 Proposed Action Alternative

This proposed project alternative will result in air emissions (engine combustion products, and fugitive dust) from earth moving vehicles during construction. Gases released by newly-exposed sediments may result in odor impacts. Reductions in air quality resulting from these impacts, however, will be minor, relatively localized, and temporary in nature.

In addition, excavation and earth moving activities can cause re-entrainment of dust particulates and possibly other pollutants into the atmosphere due to removal of dirt, debris, and other materials. This effect will also be temporary and primarily local in nature, although some transport of minor amounts of airborne pollutants to downwind nearby locations within or outside the focus areas of the proposed project can occur.

No significant long-term air quality related impacts are expected under the proposed project.

#### 3.4.11.2.2 No Action Alternative

The No Action Alternative will have no affect on existing air quality conditions. Under the No Action Alternative, mobile construction equipment use and ground disturbing impacts from restoration related activities under the proposed project will not occur. Thus, air quality impacts from material re-entrained into the ambient air and transported or deposited downwind will be avoided.

### 3.4.12 Noise

#### 3.4.12.1 Affected Environment

Noise is typically defined as “unwanted sound.” It may be as mild as a general nuisance, such as a noise causing distraction or masking desired
sounds, or severe enough to impede communication, affect behavior, and cause temporary or permanent hearing loss.

Noise is measured in units of decibels (dB) on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more “weight.” The A-weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5 dBA change (either an increase or a decrease) in noise levels, however, is clearly noticeable. A 10 dBA change in noise levels is perceived as a doubling (if it is an increase in noise levels) or halving (if it is a decrease) of noise loudness.

The project area contains outdoor sound environments that primarily include well traveled city streets to parks. Sound sources in parks typically originate from recreational activities and can result in decibel levels in the 60-70 dBA range, but can be higher depending on the activity. Noise levels from car and truck traffic on city streets within the focus areas will usually be higher, in the range of 70-90 db. By way of comparison, typical indoor environments usually maintain sound levels in the 50-60 dBA range (Reagan & Grant, 1977).

Water cascading over a dam such as the BS Dam generates acoustic energy (i.e., sound). The sound energy from such sources is usually generated over a broad frequency spectrum. Whether the sound generated is perceived as objectionable and, therefore, “noise” is subjective. While such sound emissions will interfere with verbal communication to some extent, most individuals do not find such broad-band, “white noise,” objectionable. In fact, it is often perceived as an amenity.

3.4.12.2 Environmental Consequences

3.4.12.2.1 Proposed Action Alternative

Noise generated by construction equipment as a result of the project activity is likely to constitute the greatest increased noise impact above existing conditions. It is anticipated that earth moving machinery such as bulldozers, backhoes, and dredges, or supporting transport equipment like heavy trucks and barges, will be utilized in the restoration activities. These sources of sound can cause temporarily elevated noise levels within and near the project area. Table 3.12-1 provides the range of noise levels experienced for typical construction equipment approximately 50 feet from the source of the noise.

Table 3.12-1 Typical Noise from Construction Equipment (dBA)

<table>
<thead>
<tr>
<th>Sound Pressure Level (dBA)</th>
<th>Typical Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-80</td>
<td>Pump</td>
</tr>
<tr>
<td>75-85</td>
<td>Backhoe</td>
</tr>
<tr>
<td>80-90</td>
<td>Heavy Truck</td>
</tr>
</tbody>
</table>
Table 1

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-85 Mobile Crane</td>
<td></td>
</tr>
<tr>
<td>80-95 Bulldozers</td>
<td></td>
</tr>
<tr>
<td>80-90 Graders</td>
<td></td>
</tr>
<tr>
<td>80-95 Front Loaders</td>
<td></td>
</tr>
</tbody>
</table>

Source: FHWA, 1977

These noise levels are comparable to the range of noise found in typical industrial and city street settings, but are higher than what is typically experienced in parks. The BS Dam is located adjacent to or near city streets; however, for the areas furthest removed from developed areas, temporary increases in noise levels will be most evident. To minimize the impact of temporary construction-related noise, the Village of Grafton has a local noise ordinance that limits the hours for construction activities to between 7 a.m. and 9:30 p.m.

Minor permanent noise impacts can also result from the project once restoration of the sites is complete. Recreational activities that may be enhanced as a result of the project, such as fishing, sailing, kayaking, swimming, and hiking, will have no appreciable noise impact, although the frequency may increase. As described in section 3.4.12.1, water flowing over the dam creates noise in the current environment. After the dam is removed, comparable noise would come from water rushing over rocks and moving through the area at a faster velocity; this change is expected to balance with the elimination of water cascading over the dam and would, therefore, be unappreciable.

3.4.12.2.2 No Action Alternative

The No Action Alternative will not be expected to affect existing noise levels in the project area. The No Action Alternative will avoid the temporary increase in noise levels during restoration due to earth removal and remediation activities under the proposed project.

3.4.13 Human Health and Safety

3.4.13.1 Affected Environment

The affected environment includes the dam structure and areas downstream that are within the floodplain. In addition, the affected environment under the Proposed Action Alternative would include a temporary construction site on the river during dam removal.

3.4.13.2 Environmental Consequences

3.4.13.2.1 Proposed Action Alternative

As it stands today, the dam represents a safety hazard due to its noncompliance with Chapter NR333, Wis. Admin. Code. This hazard is effectively eliminated by the Proposed Action Alternative.
Potential temporary safety and health hazards related to dam removal chiefly impact workers at the sites. Applicable regulations (i.e. potential hazards) include, but are not limited to, fall protection, drowning hazards, noise, confined spaces, etc. These various hazards are to be addressed through implementation of applicable OSHA and or Wisconsin Department of Commerce (WisCOMM) construction standards (29 CFR 1926), and should be outlined in site-specific safety and health plans which explain how each contractor will address compliance with these regulations for their employees. Employees working at all project sites are expected to have receiving training related to the potential hazards at the sites.

The Proposed Action Alternative presents an increased winter ice safety concern resulting from the change in water velocity. This diminishes the potential to use the river for recreation which is a function of the current impoundment. Considerations for mitigating this impact include constructing a pond on newly exposed riparian lands, which could then be used for ice skating.

3.4.13.2.2 No Action Alternative

No action results in the current, non-compliant dam being left in place. This represents potential safety hazards due to the structure and associated rubble, rock and concrete that compose the dam. These safety hazards remain if no action is taken.

With the dam in place, ice conditions in the reservoir are considered safer than they would be with higher-velocity water moving underneath (as a result of dam removal and natural river restoration). The potential for recreational (e.g., ice skating) use of the impoundment is greater with the No Action Alternative. However, measures to mitigate this concern are being considered.

3.4.14 Socioeconomic and Environmental Justice

3.4.14.1 Affected Environment

Ozaukee County is the smallest county by land area in the state of Wisconsin, covering approximately 235 square miles. The county is located in the southeastern portion of Wisconsin on 25 linear miles of Lake Wisconsin shoreline. Current land use is variable and includes: residential, commercial, industrial, and agricultural. Unused rural/open lands, wetlands and woods are also present. The amount of land in Ozaukee County devoted to urban land use has increased by 170% since 1963. The county is home to a population of 87,000 (2009 estimate) and has the highest income per capita of any Wisconsin county. Its largest city is Mequon, with a population of 23,560.
Data for the following discussion primarily were obtained from the 2000 U.S. Decennial Census, prepared by the US Census Bureau (USCB). When available, 2008 estimates are provided for Ozaukee County.

In 2008, Ozaukee County was estimated to have a population of 85,874 (USCB, 2007). The county population grew by 4.3 percent from the 2000 population of 82,317 (USCB, 2000). The county’s residents (USCB, 2008) were comprised of 96.0 percent Caucasian, 1.5 percent black or African-American, 0.3 percent Native American and Alaska Native, 1.4 percent Asian, and 2.0 percent Hispanic or Latino origin.

In 2008, Ozaukee County had 35,390 housing units; 22.9 percent of the housing units were in multi-unit structures. The homeownership rate in 2000 was 76.3 percent.

Ozaukee County had 68,847 residents who were 16 years or older in 2008 (est.), with 48,880 or 71.2 percent in the civilian labor force. In 2008, 3.6 percent of residents in the civilian labor force were unemployed. The top three employment industries in Ozaukee County were educational, health and social services (20.2 percent), manufacturing (19.8 percent), and retail trade (11.5 percent). In 2007, the median household income for Ozaukee County was $75,938 and 4.5 percent of individuals lived below poverty level. Current unemployment levels have doubled since 2008 and have been estimated at 7.3 percent as of September 2009 (USDL, 2009). For comparison, Wisconsin’s median household income was $50,567 and 10.8 percent of individuals lived below the poverty level (USCB, 2000b).

3.4.14.2 Environmental Consequences

3.4.14.2.1 Proposed Action Alternative

The Proposed Action (dam removal and restoration of the natural river channel) will have positive socioeconomic effects on residents and businesses in the project area. Design and construction phases of the project will create jobs in project management, engineering design, construction trades and support positions. After construction, socioeconomic benefits will continue. The natural fishery will be enhanced, thereby benefiting sport and subsistence fishers, including those outside of the project area. In addition, businesses supporting fishers, tourists, and water-based sports will benefit.

The Proposed Action will relieve the burden of local funding needed to repair, maintain, or replace dam.

The Proposed Action is not expected to disproportionately affect any minority population, ethnic or economically disadvantaged group. Improving and creating sustainable fish stocks within the most populated and demographically diverse river basins in the state of Wisconsin will have wide public benefit.
3.4.14.2.2 No Action Alternative

The No Action Alternative would leave conditions in the river as they are – desirable sport fish would continue to be blocked from upstream areas and there would continue to be decreased viability of stream resident populations. Recreational opportunities for local residents and visitors to the area would be reduced as would the level of recreationally-based business activity.

The No Action Alternative also results in the continued reliance on expensive and controversial hatchery and stocking programs to maintain native and sport fish populations. In addition, it requires large sums of local funding to retain or replace the dam in the long run.

3.4.15 Cumulative Impacts

Removal of the BS Dam would be the third in a series of fish passage improvements under consideration for the Milwaukee River and its tributaries in Ozaukee County, WI. The addition of fish passage at the BS Dam site would augment past dam removals on the lower Milwaukee River and be additive to the impact of removal of the LK Dam and the fish passage being provided at the MT Dam. Removal of BS Dam would provide fish passage from Newberg, WI (RM 50) to the Milwaukee Estuary and Lake Michigan. Dam removal at Bridge Street in Grafton and removal of other fish passage barriers on the tributaries identified in this project would contribute to reconnection of 158 river miles and 119,000 acres of aquatic habitat to the regional fishery, the Milwaukee Estuary and Lake Michigan. These improvements will cumulatively benefit the Milwaukee Estuary AOC by bolstering fish populations and making fish/wildlife habitat accessible. These impacts will aid in the delisting of AOC BUIs.

Conversely, the BS Dam removal project would potentially open up the same aquatic and wetland habitat to use by AIS.

As a resource management priority for local units of government along the Milwaukee River, other minor yet collectively significant fish passage improvements are expected in the long term.

3.4.15.1 Proposed Action Alternative

Cumulative impacts associated with the removal of the BS Dam include:

- Contributes to goal of reducing Beneficial Use Impairments (BUIs) in the Milwaukee Estuary - Area of Concern (AOC).
- Provides fish passage beyond the BS Dam, reconnects 158 river miles and 119,000 acres of aquatic habitat.
- Restores natural sediment transport function of the river.
Removes community icon (BS Dam). Village of Grafton Historical Society, village and area residents have identified the BS Dam and reservoir as a focal point of the community.

Provides potential new vista, focal point and icon for identification of the river, water fall and cascades with the Village of Grafton.

Provides enhanced use of river, shoreline and riparian lands for fishing, kayaking, access and viewing.

Diminishes river use of some forms of canoeing, motorized boating and ice skating. Canoeing is expected to be normally achievable above the Hwy. 60 bridge in a portion of the former reservoir.

Improves water quality, terrestrial and aquatic biodiversity.

Changes landscape of river area – removes BS Dam and restores natural river bed, banks and riparian lands, and the functions of these elements within the aquatic ecosystem.

Contributes to reconnection (restoration) of fragmented aquatic habitat.

Contributes to potential AIS movement. Additional details on the AIS issues are attached to this document in Document 1 of Appendix C.

3.4.15.2 No Action Alternative

If there is no removal of the BS Dam, fragmentation of aquatic habitat would persist, the viability and diversity of the natural fishery of the Milwaukee River would remain in its impacted state, and the delisting of BUI’s within the Milwaukee Estuary and Lake Michigan AOC would not occur. The biological and geomorphological integrity of the entire watershed would suffer from habitat fragmentation. Naturally produced stocks of potamodromous fish in the lower Milwaukee River, its Estuary and near shore portions of Lake Michigan would not be possible. Upstream areas continue to fail to meet their full ecological value to the region. River resident fauna suffer from decreased abundance, diversity and sustainability.

Other cumulative impacts of the No Action Alternative include:

- Does not contribute to delisting AOC BUIs.
- Impedes fish passage and sediment transport.
- Preserves community icon (BS Dam). Village of Grafton Historical Society, village and area residents have made clear their concern that they have identified the BS Dam and reservoir as a focal point of the community and it is inextricably linked to community identity. Some express concern that dam removal diminishes uses of river for fishing, canoeing, access and viewing.
- Provides for ice skating on the river.
- Diminishes biodiversity and water quality.
Section 3.4 Bridge Street Dam (BS Dam) Restore Natural Channel/Remove Dam (Alternative B)

- Retains current landscape of the river area.
- Provides barrier to AIS movement to <Q100.
3.5 OTHER BARRIERS - REMOVAL OR MODIFICATION

A description of each stream where barriers are to be modified or removed is provided below:

Lac Du Cours Creek is in the Milwaukee River South watershed and originates from the south shore of Lac Du Cours in southern Ozaukee County and passes through a small lake formed from an old non-metallic mining site. The channel reforms on the west side of the unnamed lake and continues south to its confluence within the Milwaukee River. The stream is approximately 1.4 miles long.

Trinity Creek is in the Milwaukee River South watershed and consists of two branches that converge at the Trinity Creek wetland habitat area in Mequon to form the main branch that flows to the Milwaukee River east of North Cedarburg Road. The two branches comprise 3.1 stream miles. The WNDR 2001 State of the Milwaukee River Basin report indicates that Trinity Creek is likely to be a limited forage fishery because of low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of forage fish and aquatic life. The probable sources of pollution in Trinity Creek include: cropland erosion, urban storm water runoff, stream bank erosion, and hydrologic modifications. Impacts or effects of these sources include the degradation or loss of habitat, stream flow fluctuations caused by unnatural conditions, and bacteriological contamination.

Pigeon Creek begins west of the Village of Thiensville in the rural portions of the City of Mequon and drains to the Milwaukee River. Pigeon Creek is 6.8 miles long. Pigeon Creek has a 6,927-acre tributary watershed and a history of overflowing its banks and flooding the downtown sections of the Village of Thiensville (1973, 1986, 1993, 1996, 1997, and 2002). The Village obtained a $1.7 million FEMA grant to help fund a $2.5 million flood mitigation project along Pigeon Creek which would remove approximately 20 acres from the floodplain. The conveyance improvements include widening three reaches of the channel, reconfiguring riprap beneath the Main Street Bridge, removing existing culverts and replacing them with a 60-foot stream channel, removing and replacing two bridges, and installing a new 70-foot pedestrian/utility bridge. The FEMA project would also remove fill that has accumulated in the floodplain and would widen the channel to 60 feet thus increasing the capacity of Pigeon Creek. The increased flow would also remove some of the sediment that settles in the stream and restore a gravel base that is a better substrate for aquatic life.

Ulao Creek is in the Milwaukee River South watershed and originates in the Ulao swamp southwest of Port Washington. It flows southwest to its confluence with the Milwaukee River in Mequon. Portions of the stream have been straightened for agricultural drainage. Ulao Creek has a stream length of 8.6 miles. The WDNR 2001 State of the Milwaukee River Basin
Section 3.5 Other Barriers – Removal or Modification

Report indicates that Ulao Creek is a warm water forage fish community which includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life. Probable sources of pollution include cropland erosion, stream bank erosion, hydrologic modification, barnyard or exercise lot runoff, stream bank pasturing, and urban stormwater runoff. Impacts or effects of these sources include loss or degradation of habitat, bacteriological contamination, nutrient enrichment, stream flow fluctuations caused by unnatural conditions, and low dissolved oxygen levels.

Mole Creek is a perennial stream in the Milwaukee River South watershed. It originates from wetland springs west of Saukville and flows south to its confluence with the Milwaukee River near Grafton for a distance of 4 miles. According to the 2001 State of the Milwaukee River Basin report, Mole Creek is the only river in the Milwaukee South Watershed with the ability to sustain cool and cold water fish species. Extensive surveys on Mole Creek during the 2000 Baseline Monitoring Program found a wide variety of fish species including species such as mottled sculpin, Iowa darter and brook stickleback that rely on cool water. Probable sources of pollution include cropland erosion, hydrologic modification, landfills, stream bank erosion, barnyard or exercise lot runoff, and urban stormwater runoff. Impacts or effects of these sources include loss or degradation of habitat, bacteriological contamination, hydrologic modification, and fluctuations in temperature levels. 100 percent of dissolved oxygen, temperature, ammonia, and total phosphorous samples met water quality standards in the 2007 SEWRPC technical report.

Riverside Drive Creek is in the Milwaukee River South watershed and originates from agricultural fields northeast of the State Highway 57 and Meadow Lark Road intersection and flows south and west to its confluence with the Milwaukee River north of Saukville. The creek is approximately 3.4 miles long.

Hawthorne Drive Creek is in the Milwaukee River South watershed and originates from a large cattail marsh west of State Highway 57. It forms a low gradient channel with fine-particle bed materials that passes through two small manmade ponds, one of which was built to retain floodwater. The Main branch then flows through forested and agricultural areas before crossing Blueberry Road just north of Hawthorne Drive and travels west to its confluence with the Milwaukee River. The creek is approximately 1.7 miles long.

Riveredge Creek is in the Milwaukee River East-West watershed and originates from a small unnamed lake and disperses into a shallow flooded marsh complex before flowing through the forested riparian corridor in local agricultural land and the Riveredge Nature Preserve (Northern, 2006). Riveredge Creek outlets to the Milwaukee River north of downtown.
Newburg. The WDNR 2001 State of the Milwaukee River Basin report indicates that Riveredge Creek is a warm water forage fish community which includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life. Probable sources of pollution include stream bank erosion and the subsequent loss or degradation of habitat. 100 percent of temperature samples taken at Riveredge Creek met water quality standards and criteria in the 2007 SEWRPC Technical Report. The creek is approximately 2.2 miles long.

Fredonia Creek is in the Milwaukee River South watershed and drains from a small unnamed lake in northern Ozaukee County and flows to its confluence with the Milwaukee River at Waubedonia Park in Fredonia. Its channel remains low-gradient throughout and flows through urban areas near Fredonia and agricultural areas elsewhere. The creek has both perennial and intermittent reaches with a bed composed of predominately fine-silt and muck (Northern, 2006). The WDNR 2001 State of the Milwaukee River Basin report indicates that Fredonia Creek is a warm water forage fish community which includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life. Probable sources of pollution include heavy metal toxicity, stream bank erosion, cropland erosion, urban storm-water runoff, barnyard or exercise lot runoff, and nearby landfills. The impacts or effects of this pollution include the loss or degradation of habitat, stream flow fluctuations caused by unnatural conditions, nutrient enrichment, and bacteriological contamination. The creek is approximately 4.1 miles long.

3.5.1 Geology and Soils

3.5.1.1 Affected Environment

Geology and Groundwater Hydrology

Bedrock beneath Ozaukee County is composed of Precambrian age crystalline rock followed by up 2,000 feet of Cambrian sandstones, Ordovician sedimentary rock, Silurian dolomite, Devonian dolomite and shale. In general, these rock units slant downward from west to the east across the county with bedrock elevations typically ranging from 600 to 800 feet below ground surface (Young and Batten, 1980). The bedrock topographic surface is irregular with pre-glacial bedrock valleys present throughout eastern and southern Ozaukee County. A regional fault has been mapped from Port Washington through Grafton, Cedarburg, Menomonee Falls, to Waukesha. This fault has been named the “Waukesha Fault” and is believed to generate 30 to 100 feet of displacement in the Silurian bedrock.

Southeastern Wisconsin was repeatedly glaciated, with the most recent ice sheets retreating less than 13,000 years before present. These glaciations deposited a sequence of diamicton and water-laid deposits. Named
glacially-deposited formations underlying Ozaukee County include the Kewaunee Formation, the Oak Creek Formation, and the Holy Hill Formation. The thickness of these formations ranges from zero where bedrock is exposed in isolated areas of Grafton and Mequon, to more than 200 feet in southern portions of the County.

Three important aquifers are present in Ozaukee County and include (in increasing depth below the land surface) the Sand-and-Gravel Aquifer formed in Pleistocene- and Holocene-age glacial deposits, the Niagara aquifer that occurs within Silurian-age dolomite, and the Sandstone Aquifer, which is chiefly comprised of Ordovician- and Cambrian-age dolomite and sandstone. The Sand-and-Gravel Aquifer often lies directly upon the Niagara Aquifer. In these situations, the two aquifers are hydraulically connected and commonly behave as one aquifer. The Sand-and-Gravel Aquifer commonly reaches the ground surface, and therefore interacts with surface water bodies. This aquifer has great influence on local surfacewater features.

In most situations, groundwater elevation is a subdued expression of local topography. Upland areas are usually recharge areas, while lowland areas are discharge areas. Lowlands are commonly occupied by wetlands, lakes, springs, and streams. Consequently, near-surface ground water often flows perpendicular to topographic contour lines. Water in the Sand-and-Gravel Aquifer and much of the Niagara Aquifer follows this general rule. Water in deeper portions of the Niagara Aquifer and the Sandstone Aquifer follows more regional flowpaths. Under natural conditions, regional flow is east toward Lake Michigan.

Soils

Five soil associations are present in Ozaukee County including the Kewanee-Manawa association, Ozaukee-Mequon association, Hochheim-Sisson-Casco association, Houghton-Adrian association, and the Casco-Fabius association. Except for the Houghton-Adrian association, these associations are generally well drained to somewhat poorly drained and consist of a subsoil of loam, clay, sandy clay, silty clay loam and/or silty clay. Most soil in these associations is cultivated. The Houghton-Adrian association is characterized by very poorly drained organic soils present in basins and depressions.

3.5.2 Environmental Consequences

3.5.2.1 Proposed Action Alternative

Other barrier removals would consist of 46 OB PW projects where structures such as bridge abutments and improperly designed/installed culverts would be modified or removed. For more information on the OB PW projects, see Table 1 in Appendix A. A second component would also include 84 OB CC projects involving the removal of smaller identified fish
Section 3.5 Other Barriers – Removal or Modification

migration impediments such as log jams, construction materials, railroad ballast deposits, etc. For more information on the OB CC projects, see Table 2 in Appendix A. Obstruction removals of this scale would eliminate hundreds of cubic yards of naturally and artificially placed debris from river and stream channels. This material, consisting of boulders, concrete, timber, fill, reinforcing steel and other debris would be hauled off site and used as fill or recycled. The Conservation Corps type projects are likely to have little to no effect on native geologic features. Larger scale Public Works projects could expose or suspend accumulated soft sediment. However, it is more likely that sediment will remain submerged as lateral and center bars, and/or be exposed as terrestrial or future wetland soils.

Some very minor scour and transport downstream of accumulated sediment could occur due to increased water velocity, shear stress and construction activities. The majority of the scoured material would likely settle out in the floodplain or river wherever the flow rate slows enough to allow deposition to occur. Deposition of coarser materials would provide benefits to fish and other aquatic life. Fine clay-silt-sand sediment deposited in floodplain and exposed river sediment bars would eventually be vegetated.

The scour of anoxic sediment would increase the potential for potentially toxic un-ionized ammonia releases during drawdown and possible adverse effects to aquatic life in the vicinity of the barrier being removed. The potential for toxic effects could be minimized by completing the drawdown during the colder months. Cool water temperatures and lower water pH would reduce the availability of un-ionized ammonia. Higher spring flows would dilute this substance.

Removing impediments would restore riverine sediment transport processes with finer suspended and bedload particles being continuously transported downstream. This would replenish finer grained particles in scoured areas downstream of the barrier, yielding a wider variety of bottom types and sediment gradation. This would also eliminate additional sediment accretion originally created by the impendiment. In addition, average water depths would decrease and water depths would return to preexisting free-flowing conditions.

Obstruction removal would restore natural surface-water/groundwater interactions. Areas upstream of the impendiment would lose less water to the groundwater system, or may return to groundwater discharge areas. Local groundwater flow velocity and flux may decrease.

3.5.1.2.2 No Action Alternative

The No Action Alternative does not meet the purpose and need for the project. Barriers to fish and other aquatic life passage would remain. Habitat access for aquatic organisms is likely to be diminished as a result of the
continued habitat fragmentation. Erosion, scour, sediment aggregation due to improperly sized/placed hydraulic structures would persist.

### 3.5.2 Land Use and Recreation

With regard to land use and recreation, the areas affected by the removal of barriers to fish migration would include: (a) the areas directly associated with structures or materials forming each barrier, (b) areas in the immediate vicinity of each barrier potentially affected by proposed construction activities necessary to remove/modify the barriers, (c) adjacent properties in the vicinity of the barriers potentially affected by proposed construction activities necessary to remove/modify the barriers, and (d) upstream and downstream areas of the tributary where the barrier is to be modified or removed and (e) the Milwaukee River.

With the exception of some restored recreational fishing opportunities, there is likely to be little public recreational value associated with the immediate areas adjacent to the OB PW and OB CC projects due to small stream sizes and proximity to private property or road right-of-ways. Barriers removed from reaches bordered by private property (residential or agricultural) may also provide some recreational fishing opportunities to local landowners. Beyond limited fishing restoration, recreation is unlikely to increase significantly in these areas because they are typically in or near a waterway and/or wetland where past impacts such as installation of a culvert, road crossing, or farming have occurred.

#### 3.5.2.2 Environmental Consequences

3.5.2.2.1 Proposed Action Alternative

**Land Use:** It is anticipated that none of the proposed barrier removal activities would result in any changes to land use. Barriers that are culverts would remain culverts but will be enhanced for fish passage. Barriers formed by log jams, sediment accumulations, rock obstructions in streams would be removed with no change occurring in the associated land use. Where undersized culverts are reconstructed a minor reduction in the physical extent of the floodplain immediately upstream from the barrier could result.

**Recreation:** Impacts on recreational activities anticipated as a result of the removal of certain barriers to fish passage could enhance recreational fishing. The elimination of the barriers would enhance and help to reestablish a seasonal (and in some instances, a perennial) fishery. Removal of each barrier would cumulatively contribute to reconnecting fragmented habitat and re-establishment of fish passage throughout the Milwaukee River watershed. Direct impacts on recreational boating, swimming, wading, ice skating, walking, jogging, or wildlife viewing are not anticipated. There are no anticipated negative impacts on recreation from any of the proposed barrier elimination/ modification projects.
3.5.2.2 No Action Alternative

The environmental consequences of the No Action Alternative on land use and recreation are summarized below.

Land Use: The No Action Alternative would have no impact on land use as current land uses should continue. The No Action Alternative would result in a continuation of greater flooding in areas upstream of undersized culverts and a continuation on restrictions on land use associated with portions of these areas remaining in the floodplain.

Recreation: The No Action Alternative would have no impact on most recreational activities. The only recreational activity impacted in a significant way is recreational fishing, which is presently impacted in a negative way. Key spawning and other fish habitat adjacent to the targeted tributaries would remain inaccessible to fish that might otherwise support a recreational sport fishery.

3.5.3 Water Quality and Resources

3.5.3.1 Affected Environment

130 documented non-dam barriers exist on the following Milwaukee River tributaries: Lac du Cours, Pigeon Creek and Trinity Creeks (City of Mequon), Ulao Creek (City of Mequon, Town/Village of Grafton), Mole Creek (Town/Village of Grafton, Town of Saukville), Riverside Drive Creek (Towns of Saukville and Port Washington), Hawthorne Drive and Riveredge Creeks (Town of Saukville), and Fredonia Creek (Town/Village of Fredonia).

Many reaches of the project streams have been channelized for agricultural drainage and other uses. Channelization can produce a number of effects on the hydrology of a stream, including an increase in a stream’s gradient and accompanying increase in the water velocity. This can have major impacts on the structural stability of the channel and result in erosion, degradation of the banks and an increase in the sediment load downstream. Excessive sedimentation can cause disruption in the pool-riffle sequence, impact habitat, cause greater temperature fluctuations, and downstream flooding.

Barriers in the target tributaries are typically of two categories: human-influenced and naturally occurring. Human-influenced barriers consist of culverts under road crossings, foot bridges, railroad ballast deposits, low-flow dams, and invasive species encroachment. Naturally occurring barriers are typically debris/woody debris jams and stream channels choked by excessive vegetation or sedimentation. The presence of these barriers not only impedes fish movement, but also presents a number of other hydrological and ecological effects within a watershed. Some barriers, including areas of excessive sedimentation, perched culverts, and large debris jams can hold water upstream and cause localized flooding. Barriers
can change the pattern of sediment transport and lead to excessive deposition upstream of the barrier and less sediment transport to downstream reaches. This can ultimately lead to downstream erosion. Solar influence in these small impounded areas may lead to higher water temperatures and subsequent fluctuations in oxygen and nutrient levels.

3.5.3.2 Environmental Consequences

3.5.3.2.1 Proposed Action Alternative

Removal of the 130 barriers would result in minor long-term improvements to water quality and would cumulatively contribute to AOC BUI delisting. Arched, bottomless culverts or clear-span bridges would replace perched culverts and bridges with large, impeding abutments. Deposits of natural or manmade debris would be removed and actions taken to help assure that debris does not accumulate in a short period of time. All obstructions requiring fish to jump would be removed. No structures are to attain water velocities greater than four feet per second for any length at a full array of expected flow events (2yr-24hr, 5yr-24hr, 10yr-24hr, etc.). In general, structures would be installed well below grade, backfilled with coarse substrate, and have a slope less than 1%. Care would be taken to assure adequate depth during typical flow conditions. These actions include shaping and sizing structures adequately and assuring that water does not infiltrate bedding material and bypass the water filled portion of the structure. Invasive species would be removed and treated to ensure uninterrupted stream flow.

Barrier removal would abate thermal impacts associated with these impounded areas. Cooler water temperatures and increases in the physical aeration of the water would increase the solubility and biological availability of dissolved oxygen in the restored free-flowing stream reaches. Barrier removal may result in short-term water quality effects but these are anticipated to be of minimal impact. Sediment stored behind the barriers could be released and re-suspended as work crews and equipment move in and around the stream bed. A localized increase in turbidity levels is expected. The majority of the sediment would settle out downstream where low flow rates occur. In areas where impoundments exist (behind low-flow dams or large perched culverts) exposed, unvegetated stream banks may result in sedimentation during rain events until the banks are restored. However, best management practices per permit requirements for soil erosion would be employed to minimize these effects. Native plantings would be encouraged wherever possible to stabilize disturbed areas.

Barrier removal would restore portions of the target streams to free-flowing reaches and may increase water velocities. However, due to the low or intermittent flow of most streams, barrier removal is not expected to greatly impact the general alignment of the stream reach or result in downstream flooding. The removal of barriers in certain locations would convert several
acres of impoundment to riverine aquatic habitat, adjacent wetlands, and/or floodplain. This would reconnect fragmented aquatic habitat along the given stream.

Removal of these barriers and restoring stream reaches to historical conditions has the potential to improve the relative abundance, diversity and habitat of native game and non-game fish species along with the general aquatic ecosystem. Barrier removal would increase passage of fish and other aquatic life throughout the Milwaukee River and its tributaries. Long-term effects on the riparian system and aquatic life would be beneficial. Physical improvements would lead to ecological and biological benefits and improved water quality. It is anticipated that as the water quality and water resource is improved, local residents would take pride in their watershed and develop a greater degree of stewardship.

3.5.3.2.2 No Action Alternative

This No Action Alternative has been dismissed based on local and regional planning priorities for restoration of natural fish passage and reproduction in the Milwaukee River and its tributaries. The No Action Alternative does not support the purpose and need for the project. In the No Action Alternative, no removal of the barriers for fish passage is provided and no restorative habitat work is likely to be achieved. Aquatic habitat remains fragmented and no fish passage is likely to be provided on these streams. Biological diversity and abundance of fish and aquatic life occurring within these streams remain diminished relative to the free flowing reaches below the project sites – preserved and restored aquatic habitat in the landscape is likely to be prevented from reaching its full ecological function.

The current, minimal interruption to the natural stream sediment transport function continues, and improperly sized-structures alter river morphology by causing pooling, scour and erosion. Localized impacts to water quality remain present. The AOC delisting criteria are not addressed and goals and objectives stated in numerous resource plans are not realized. Water velocities in high-water spring runoff conditions could remain greater than two feet per second for structures exceeding 20 feet in length. This is likely to be greater than the swimming capabilities of most fish present in the Milwaukee River watershed as it pertains to this project. A need would still exist to supplant artificial stocking, habitat manipulation, and creation of artificial aquatic habitat.

Culverts and other stream crossings would need to be repaired eventually and would likely be done so by traditional methods. Water quality impacts would remain the same. Gamefish populations would likely exist, but would not be able to utilize the available natural resource to its fullest potential.

3.5.4 Wetlands and Floodplains

3.5.4.1 Affected Environment
Fredonia Creek – Barriers and Habitat

The majority of the wetlands along Fredonia Creek are T3K, S3K and E2H forested broadleaf deciduous, shrub, and narrow-leaf emergent wetland types. The creek bed is predominately fine-silt and muck, and there are both perennial and intermittent reaches. Moderately turbid flowing water was observed from Willow Valley Road downstream to the Milwaukee River confluence and from Unnamed Lake 2 downstream to Belgium Kohler Road during a September 12, 2006 field investigation. No flowing water was observed between Willow Valley and Belgium Kohler Roads during the same inspection.

See Figure 4 in Appendix B for more specific information on wetlands and mapped floodplains in the Fredonia Creek area in relation to the culverts and other barriers.

Hawthorne Drive Creek – Barriers and Habitat

The Hawthorne Drive Creek (the Creek) main branch (the Main Branch) has perennial flow, drains a large cattail marsh west of State Highway 57, and passes through two small manmade ponds, one of which was built for water quality protection. No water was observed in the cattail marsh headwaters during a September 28, 2006 field investigation. The Main Branch then passes through broadleaf deciduous forested wetlands and agricultural areas before crossing Blueberry Road just north of Hawthorne Drive. Water observed east of Blueberry Road was flowing almost indistinguishably due to dense reed canary grass in the channel during the same inspection. West of Hawthorne Drive, the Main Branch has little to no in-channel vegetation. It remains a moderate gradient until its confluence with the Milwaukee River.

The north branch of the Creek (the North Branch) is intermittent and flows from a cattail/reed canary grass wetland east of Blueberry Road that is dominated by reed canary grass, red osier dogwood, and sandbar willow. It passes south, largely through ditches along Blueberry Road, before meeting the Main Branch east of Blueberry Road. No flowing water was observed in the North Branch during the field investigation.

See Figure 5 in Appendix B for more specific information on wetlands and mapped floodplains in the Hawthorne Creek area in relation to the culverts and other barriers.

Lac du Cours Outlet Creek – Barriers and Habitat

The wetlands associated with the creek are T3K and WOHx forested and open-water wetlands. The T3K wetlands are dominated by green ash, American elm, cottonwood, and box elder. Bed materials include fine silt and muck.
See Figure 6 in Appendix B for more specific information on wetlands and mapped floodplains in the Lac du Cours Outlet Creek area in relation to the culverts and other barriers.

**Mole Creek – Barriers and Habitat**

Mole Creek (the Creek) can be generally divided into two sections. The first section extends upstream from the Milwaukee River confluence to the outlet of a natural pond located west of Shady Lane. Cobble and pebble bed materials are common throughout this section and much of the riparian zones are either dominated by common buckthorn or in power line clearings dominated mostly by reed canary grass. The second section, longer extends from the natural pond west of Shady Lane to the headwater springs west of Saukville, has a low-gradient (0.002 ft/ft overall) channel, flows predominantly through agricultural land, and has a bed dominated by silt and fine sand. Flowing water was observed in all reaches of the Creek during field inspections on September 25 and 27, 2006. This reach flows through mostly T3K/S3K broadleaf forested and shrub wetlands and some E2H cattail/reed canary grass marsh areas.

See Figure 7 in Appendix B for more specific information on wetlands and mapped floodplains in the Mole Creek area in relation to the culverts and other barriers.

**River Edge Creek – Barriers and Habitat**

River Edge Creek (the Creek) originates from a small unnamed lake (Unnamed Lake 3) and disperses into a shallow flooded marsh complex before flowing through the lowland hardwood forested wetland/riparian corridor in agricultural land and the River Edge Nature Preserve. It outlets to the Milwaukee River is just north of Newburg, Wisconsin. Considerable flow was observed on September 13, 2006 in all reaches downstream of the marsh complex suggesting a perennial regime, although the Wisconsin Conservation Department’s 1963 publication Surface Water Resources of Ozaukee County indicates the Creek historically became intermittent during drought years.

The Creek has a stable channel, clean cobble and pebble bed, and swift flow velocity even during low-flow. Lower-gradient sections had fine silt and much beds, slow-flowing water, and dense bank vegetation. The wetlands associated with the Creek are mostly T3K broadleaf deciduous wetlands dominated by ash, elm, cottonwood and willow with lesser amounts of shrub (S3K) and marsh (E2H) wetlands.

See Figure 8 in Appendix B for more specific information on wetlands and mapped floodplains in the River Edge Creek area in relation to the culverts and other barriers.
Trinity Creek – Barriers and Habitat

Trinity Creek (the Creek) has two branches that converge at the Trinity Creek wetland habitat area in Mequon, Wisconsin to form the main branch (the Main Branch) that flows to the Milwaukee River east of North Cedarburg Road (Highway 57). The south branch of Trinity Creek (the South Branch) passes through a largely agricultural (active and fallow) area, along with E3H and S3K marsh and shrub wetlands adjacent to the Creek and agricultural fields. The Creek has a bed made of silt, clay, and fine sand. Much of the north branch of Trinity Creek (the North Branch) flows through land that has been developed for residential or commercial uses with little natural wetland vegetation and little floodplain, while the south branch has a much larger floodplain complex associated with it. The North Branch channel is channelized and/or entrenched in many places and the bed is made of silt and other fine-particle materials like those of the South Branch.

Flowing water was observed in the perennial Main Branch between the Trinity Creek wetland habitat area and the Milwaukee River during field investigations of September 25 and 26, 2006. Standing water was observed in the Trinity Creek Wetland Habitat Area ponds was also observed. The North and South Branches have intermittent flow.

See Figure 9 in Appendix B for more specific information on wetlands and mapped floodplains in the Trinity Creek area in relation to the culverts and other barriers.

Ulao Creek – Barriers and Habitat

Ulao Creek (the Creek) originates in the Ulao Swamp southwest of Port Washington, Wisconsin in the Town of Grafton and flows southwest to its confluence with the Milwaukee River in Mequon, Wisconsin.

The Creek flows through a variety of riparian land-use types, including second-growth lowland and upland forests, wetlands, fallow and active agriculture, and residential. A hydrologic study of the Creek by the Ulao Creek Partnership and its partners during 1997 found that some reaches of the channel “lose” water to infiltration through fine sands in the stream bed, an interesting trait that correlates to field observations of an intermittent reach near Arrowhead Road on September 27, 2006.

The wetlands associated with the Creek are mostly T3K forested lowland hardwood wetlands dominated by green ash, elm, cottonwood, willow and box elder. Some other wetland areas include S3K wetlands dominated by willows and dogwoods, and E2H wetlands dominated mostly by reed canary grass.
See Figure 10 in Appendix B for more specific information on wetlands and mapped floodplains in the Ulao Creek area in relation to the culverts and other barriers.

**Riverside Drive Creek – Barriers and Habitat**

Riverside Drive Creek (the Creek), also referred to as “Highway W Creek,” has a bed dominated by silt and other fine-particle materials, a channel that was historically dredged in some reaches, remains almost completely sediment-filled in others. The adjacent wetlands (E2H) are mostly dominated by reed canary grass, sandbar willow, or cattails in many places. Sluggishly flowing water was observed on September 28, 2006 in reaches from the Milwaukee River confluence upstream to Hawthorne Road. The volume of flowing water diminished to only a small trickle at Hawthorne Road and reaches of channel filled with agricultural sediment had no visible flow during the field inspection. There is no mapped floodplain on the Creek, with the exception of the most downstream end that is affected by the Milwaukee River floodplain.

See Figure 11 in Appendix B for more specific information on wetlands and mapped floodplains in the Riverside Drive Creek area in relation to the culverts and other barriers.

**Pigeon Creek – Barriers and Habitat**

Pigeon Creek has a 6,927-acre tributary watershed and a history of overflowing its banks and flooding the downtown sections of the Village of Thiensville (1973, 1986, 1993, 1996, 1997, and 2002). The Village obtained a $1.7 million FEMA grant to help fund a $2.5 million flood mitigation project along Pigeon Creek which would remove approximately 20 acres from the floodplain. The conveyance improvements include widening three reaches of the channel, reconfiguring riprap beneath the Main Street Bridge, removing existing culverts and replacing them with a 60-foot stream channel, removing and replacing two bridges, and installing a new 70-foot pedestrian/utility bridge. The FEMA project would also remove fill that has accumulated in the floodplain and would widen the channel to 60 feet thus increasing the capacity of the Pigeon Creek. The increased flow would also remove some of the sediment that settles in the stream and restore a gravel base that is healthier for aquatic life.

The modifications that are proposed under this project are north of the FEMA-related work. The proposed project would beneficially impact the FEMA project.

The wetlands associated with the Creek are mostly T3K broadleaf deciduous wetlands dominated by ash, elm, willow, cottonwood and box elder. S3K,
E2H, and WOHx shrub, emergent and open-water wetlands occur to a lesser degree.

See Figure 12 in Appendix B for more specific information on wetlands and mapped floodplains in the Pigeon Creek area in relation to the culverts and other barriers.

### 3.5.4.2 Environmental Consequences

#### 3.5.4.2.1 Proposed Action Alternative

The wetlands directly adjacent to the barrier or culvert will be insignificantly, temporarily impacted during construction. Impacts may include minor grading and/or filling (culverts) and impacts to vegetation to provide access for construction. Wetlands will have a more natural hydrologic regime established after removal of barriers or culverts. Standard erosion control best management practices will be utilized on all barrier removal and culvert replacements to minimize impacts to wetlands.

**Public Works Projects (see Table 1 in Appendix A for detailed individual barrier descriptions)**

Wetland and floodplain impacts as a result of barrier removal will be insignificant. Wetland impacts may include limited clearing, grubbing, grading and filling to remove barriers and will be offset by the positive impacts to water quality and fisheries. Floodplain impacts will be less than 0.1 feet up and downstream of barriers and are regulated by the WDNR through an individual permit application for any work in floodplains.

Fish passage improvement is likely as a result of the removal of barriers on tributaries. Some modest flow improvements are also anticipated as culverts would generally be replaced with hydraulically modified conduits to enhance fish movement. Upstream flooding at culvert sites is expected to be partially alleviated as a result. These projects would address the “loss of fish and wildlife populations” BUI.

Artificially maintained stream channel slopes immediately upstream and downstream would be identified and re-graded as a part of improved stream crossing. Examples include old crossing component debris and exposed bedding material. All impediments necessitating fish leaping behavior would be removed. No cascading water conditions of any kind should exist in normal base-flow conditions.

Improperly placed culverts would be modified or replaced. Site disturbance would be limited to the immediate location of each barrier. Upstream and downstream bed controls may be placed to improve fish movement into and/or out of the culvert. Where necessary, bed controls would consist of placement of cross-vane structures or small weirs in the stream bed to adjust stream water level at the ends of the culvert.
In general, crossing structures would either be installed well below bed grade, backfilled with coarse substrate, and have a slope of less than 1%. Preference would be given to arched or bottomless box culverts or clear span bridges. Care would be taken to assure adequate depth of flow during typical flow conditions. These actions include shaping and sizing structures adequately and assuring that water does not infiltrate bedding material thereby bypassing the water-filled portion of the structure. Deposits of natural or manmade debris would be removed and actions taken to help ensure that debris does not accumulate in a short period of time. These actions include shaping and sizing structures adequately and assuring that water does not infiltrate bedding material thereby bypassing the water-filled portion of the structure.

**Conservation Corps Projects (see Table 2 in Appendix A for detailed individual descriptions)**

Wetland and floodplain impacts as a result of barrier removal will be insignificant. Wetland impacts may include limited clearing, grubbing, grading and filling to remove barriers and will be offset by the positive impacts to water quality and fisheries. Floodplain impacts will be less than 0.1 feet up and downstream of barriers and are regulated by the WDNR through an individual permit application for any work in floodplains.

These projects would generally not be subject to detailed design work, and instead would be remedied by field expedient methods developed by a trained crew leader. Best management practices for erosion control, vegetation and debris removal, safety, and other factors would mimic those used for other County-run public park and highway projects. Debris, rock and vegetation would be from the tributaries. Barriers to fish passage would be physically removed by hand labor. Small equipment (skid steer loader/backhoe and mule type ATV) would be utilized to deliver equipment to barrier sites and provide capability to remove obstructing materials from the waterways.

Site access would be identified to aid in delivery of labor and equipment to the scattered barrier sites. It is likely to be anticipated that such access to scattered sites may involve minor brush cutting. All disturbed access routes would be restored using standard erosion control best management practices. Site access would be established in coordination with Ozaukee County project management staff.

It is expected that removal of these barriers would reduce backwater effects from the barriers. Debris would be removed from the waterway as necessary to prevent remobilization of the debris during storm events. Minor silt may be released downstream during construction. Erosion control and site restoration best management practices would be employed as necessary to stabilize any disturbed areas within or adjacent to the barrier sites. WDNR
technical standards and guidance would be used for implementing construction site erosion control for these projects.

3.5.4.2.2 No Action Alternative

This alternative has been dismissed based on local and regional planning priorities for restoration of natural fish passage and reproduction in the Milwaukee River and its tributaries. Restoring fish passage on tributaries is requisite to the overall objective of the project since the tributaries provide access to natural spawning and rearing areas which are often wetlands or are directly related to wetlands. The No Action Alternative does not support the purpose and need for the project.

Wetlands in and adjacent to tributaries in the Milwaukee River watershed would not provide habitat or other biological functions due to habitat fragmentation under the No Action alternative.

3.5.5 Aquatic Biology

3.5.5.1 Affected Environment

3.5.5.1.1 Habitat

The affected environment related to the aquatic biology habitat is likely to be the micro habitat associated with each of the 105 sites. The habitat at the sites, in general, has been altered by either a crossing or blockage that results in degraded aquatic habitat. Upstream conditions have led to increased sedimentation that results in buried important substrates for aquatic organisms. Downstream of barriers, increased flows and scour due to improperly sized culverts and lower base flows from debris blockages have also altered in-stream habitat.

The fish passage barriers identified in this project correspond to those slated for public works or conservation corps (or coordinated with both) labor, equipment and materials. Public works projects involve the modification or replacement of roadway culverts or small weirs on tributary streams. Conservation corps projects largely involve removing deposits of stone, riprap, and rock ballast, log and debris jams, and overgrown invasive vegetation.

3.5.5.1.2 Macroinvertebrates

No site specific sampling of macroinvertebrates was performed for the OB PW and OB CC project sites. Historic work in the vicinity, within the Milwaukee River Watershed, indicates macroinvertebrates are more abundant in flowing reaches than in intermittent reaches.

Work performed by SEWRPC found that riffle habitats contain the highest quality macroinvertebrate communities compared to pool, run, snag, or lake habitats in the Milwaukee River watershed. Habitat types such as lakes, pools, riffles, and runs generally contain very different compositions of
substrates, water depths, and flows, which greatly affects the abundance, diversity and type of the associated macroinvertebrate community found there.

The macroinvertebrate community quality has generally remained in the good-to-very good Hilsenhoff Biotic Index (HBI) rating from 1975 to the present within most of the Milwaukee River subwatersheds. Eight, or nearly 40 percent, of the subwatersheds contained sites that ranked in the fair HBI classification, which indicates some level of potential impairment to the macroinvertebrate communities in these locations. Except for the Lincoln Creek subwatershed, most of the subwatersheds throughout the Milwaukee River watershed continue to maintain a fair to good-very good macroinvertebrate community. It should be noted that any effects on macroinvertebrates from the recently completed Milwaukee Metropolitan Sewerage District (MMSD) Lincoln Creek environmental restoration and flood control project would not be reflected in the data, which only extend through 2004.

Further analysis of the East Branch of the Milwaukee River and Lower Milwaukee River subwatersheds indicates that the proportions of collectors have not changed significantly from 1979 to 2004. The proportion of collectors in the East Branch of the Milwaukee River subwatershed is likely to be significantly less than the Lower Milwaukee River subwatershed. This difference in the trophic structure between these subwatersheds implies that streams in the East Branch of the Milwaukee River subwatershed are potentially less disturbed and have better water quality and benthic substrate characteristics than streams in the Lower Milwaukee River subwatershed. Similarly, the high proportion of scrapers in the East Branch of the Milwaukee River subwatershed and the loss of scrapers in the Lower Milwaukee River subwatershed from 1979 to the present also indicates that the former subwatershed contains a higher quality macroinvertebrate community trophic structure. Each of these patterns is likely to be consistent with improvement in water quality in the East Branch of the Milwaukee River subwatershed and a decline in water quality in the Lower Milwaukee River subwatershed. Water quality improvement may be related to a decrease in organic or inorganic pollution, decrease in nutrients, improvements in dissolved oxygen concentrations, decreases in heavy metals or other toxic contaminants.

Wisconsin researchers have generally found that as the amount of human land disturbance increases, macroinvertebrate community diversity and abundance typically decrease. Data for the Milwaukee River Watershed support this general correlation but the fairly high quality of macroinvertebrates found throughout most of the watershed also suggest that the integrity and continuity of riparian buffers extending more than 75
feet away from streams, lakes, and other waterways effectively reduces pollutant loadings and other human disturbances.

Macroinvertebrate communities are classified as fair to good-very good at present. The macroinvertebrate community is also generally trophically balanced and not dominated by tolerant taxa. Overall, the macroinvertebrate communities in the Milwaukee River watershed are of a better quality than those communities in the other watersheds in the study SEWRPC area.

The benthic macroinvertebrate habitat quality is largely limited by siltation, as well as diminished in-stream cover abundance and quality throughout the watershed. Benthic macroinvertebrate communities in watershed areas where water quality improvements have been made continue to be impaired by sediment toxicity problems in their habitats. Other factors likely limiting macroinvertebrate communities include periodic stormwater loads and sediment toxicity, decreased base flows, ongoing habitat fragmentation by dams, drop structures, culverts, concrete lined channels, and enclosed conduits, past channelization, cropland erosion, and increased water temperatures due to urbanization (SEWRPC, 2007).

3.5.5.1.3 Aquatic Vegetation

In-stream submergent and floating vegetation is likely to be mostly absent from these tributaries, however, pondweeds, coontail, watercress and duckweed are present. Table 1 and Table 2 in Appendix A describe conditions at each site in more detail and identifies whether the site is likely to be mapped as a wetland or not, giving a good indication of the type of aquatic vegetation, if present.

3.5.5.1.4 Fisheries

Except for some areas within the Upper Milwaukee River, West Branch of the Milwaukee River, East Branch of the Milwaukee River, Middle Milwaukee River, Upper Lower Milwaukee River, and Lower Milwaukee River subwatersheds that contain good and in some cases excellent fishery quality, the watershed of the Milwaukee River in general contains a poor to fair fishery. The fish community contains a high abundance of both warmwater and coldwater species of fishes, seems trophically balanced in the highest quality areas, contains a good percentage of top carnivores (except for those species stocked), and is not dominated by tolerant fishes.

Fish Community

The following Milwaukee River tributaries are connected with the Milwaukee River: Lac du Cours and Trinity Creeks (City of Mequon), Ulao Creek (City of Mequon, Town/Village of Grafton), Mole Creek (Town/Village of Grafton, Town of Saukville), Riverside Drive Creek (Towns of Saukville and Port Washington), Hawthorne Drive and Riveredge
Creeks (Town of Saukville), Fredonia Creek (Town/Village of Fredonia) and Pigeon Creek (City of Mequon).

The general riparian land uses and channelization observed during this study along Trinity Creek were also documented in the Wisconsin Conservation Department’s 1963 publication Surface Water Resources of Ozaukee County:

“…a small, slow moving drainage stream flowing eastward into the Milwaukee River. It flows through an urban area in the lower region. The stream channel is straightened and agricultural drainage is its major use. No sport fish are known to be present.”

It has a fairly low overall gradient (0.001 ft/ft overall), a bed dominated by silt and other fine particles, and an intermittent flow regime with greatly varying discharge as documented in the Wisconsin Conservation Department’s 1963 publication Surface Water Resources of Ozaukee County:

“…a small drainage stream formed by the joining of three intermittent streams at its head end. Eventually it flows into the Milwaukee River just above Pit Lake. Due to fluctuating water levels, sport fishery value is negligible. Portions of the stream have been straightened for agricultural drainage.”

The Milwaukee River contains a diverse cool to warm water fish community, including sport and forage fish species. Gamefish and panfish known to be present or suspected to be present within a five mile range, upstream and downstream, of the LK Dam include smallmouth and largemouth bass, walleye, northern pike, bluegill, green sunfish, pumpkinseed, longear sunfish, rock bass, black crappie, channel catfish, flathead catfish, yellow and black bullhead, and lake sturgeon. Similarly, an abbreviated list of common forage or non-game species in the Milwaukee River within five miles of the LK Dam include may include logperch, johnny darter, blackside darter, fantail darter, least darter, Iowa darter, fathead minnow, spotfin shiner, golden shiner, blunt nose minnow, common carp, central and largescale stonerollers, sand shiner, common shiner, horneyhead chub, white sucker, striped shiner, creek chub, rosyface shiner, redfin shiner, brook stickleback, mimic shiner, central mudminnow, banded killifish, stonecat, tadpole madtom, and four species of redhorse including the greater, shorthead, golden and silver redhorse. Fall populations of coho and chinook salmon, an occasional brown trout and fall and spring rainbow trout may be present below the BS Dam when river discharge and water depths allow a limited number of these migrants from Lake Michigan to pass over the MT and LK Dams. The Milwaukee River is classified as a Warm Water Sportfish Community per NR 102 and NR 104 (Kramasz, 2009).

Invasive species
None of the 130 other barriers are considered a barrier to AIS/VHS or other AIS, such as zebra mussel, quagga mussel, New Zealand mudsnail, or rusty crayfish. The presence of AIS at each site was neither confirmed nor denied during field visits.

3.5.1.5 Threatened and Endangered Species

**Endangered, Threatened and Special Concern Species**

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked. A survey of the NHI for this project, attached in Appendix C – Document 4, includes seven fish species, four plant species, two reptile species and freshwater mussels documented as being present or potentially present in the OB project area. While some of these listed fish species are still encountered during routine field assessments, the lack of recent occurrences cannot discount their continued presence since their habitat remains intact. For the purposes of this Environmental Assessment and the removal of the 130 other barriers, their presence is assumed. There are no federally listed fish species in the Milwaukee River Basin or more specifically, in the OB PW and OB CC project areas. More detailed descriptions of the non-fish species can be found in Document 4 of Appendix C.

**Endangered**

The striped shiner is likely to be the only state listed endangered fish species that potentially exist or is known to exist in the project area.

**Striped shiner**

The striped shiner is ranked with a global element of G5 and a state element rank of S1. These rankings indicate that while the striped shiner is demonstrably secure globally it is critically imperiled in Wisconsin. The S1 or critically imperiled ranking is due to extreme rarity defined as five or fewer occurrences per acre, very few remaining individuals, or because some factors make it especially vulnerable to extirpation from the State. Its numbers have declined so much in recent years that it is likely to be nearly extirpated from the state. During the mid-1990's, WDNR crews sampled multiple reaches and times along the Milwaukee River and identified a single specimen from the river in Ozaukee County.

The striped shiner prefers clear to only slightly turbid waters of runs and shallow pools, with dense aquatic vegetation over substrates of cobble, boulders, silt, sand, mud or bedrock. Spawning occurs from late May through June (Becker, 1983). They are likely to frequent water depths
ranging from 0.1 - 1.5 m (Pfleiger, 1975). A study of striped shiners from the Milwaukee River in Ozaukee County revealed that the fish had consumed hymenoptera, coleoptera, other aquatic insects, filamentous algae, and vegetative material (Trautman, 1957). During construction, turbidity levels may increase but would be of short duration.

**Threatened**

Three state listed threatened fish species that potentially exist or are known to exist in the project area include the greater redhorse, redfin shiner and longear sunfish. The state listed threatened Butler’s gartersnake and Blanding’s turtle is also known to exist or potentially exist in the project area. The state listed forked aster is also known to exist or potentially exist in the project area.

*Greater redhorse*

The greater redhorse is ranked globally as a G3 and has a statewide ranking of S2S3. These rankings indicate that the greater redhorse is either very rare and local throughout its range, found locally abundant in a restricted range, or that other factors may make it vulnerable to extinction throughout its range. The Milwaukee River Basin has one of the most secure populations of greater redhorse in Wisconsin.

The greater redhorse prefers clear water of medium to large rivers, over bottoms of sand, gravel, or boulders. Spawning occurs in May or June. The greater redhorse spawns over substrate consisting of gravel with mixtures of sand and small rubble in moderate to swift currents. It generally feeds on a diet of aquatic insects, mollusks, crustaceans and plant material (Becker, 1983).

*Redfin shiner*

The redfin shiner is ranked globally as G5 and has a statewide ranking of S2. These rankings consider the Redfin shiner to be secure globally though quite rare in parts of its range. Within Wisconsin however, it is likely to be very rare and very vulnerable to extirpation. It has been collected in small numbers from the Milwaukee River and Cedar Creek in Ozaukee County, and even more infrequently from the Milwaukee River in Milwaukee County (Becker, 1983 and Lyons et al., 2000). The redfin shiner prefers more turbid waters of pools in low-gradient streams over substrates of boulders, cobble, sand, silt or detritus. Spawning occurs from early June through mid-August in sunfish nests where they coexist with sunfish in the nesting territory. Their diet is dominated by aquatic and terrestrial insects and at times, is dominated by filamentous algae (Becker, 1983).

*Longear sunfish*

The longear sunfish is ranked globally as a G5 and has a statewide ranking of S2. These rankings consider the longear sunfish to be secure globally.
though it may be quite rare in parts of its range. In Wisconsin, it is likely to be very rare and very vulnerable to extirpation. The Milwaukee River Basin was once one of the states more important strongholds (Greene, 1935 and Becker, 1983). More recently, Milwaukee River Basin populations have been in steep decline with a few remnant populations present in the Washington and Fond du Lac Counties (Lyons, et al., 2000).

The longear sunfish prefers clear, shallow, moderately warm, still waters of streams and small lakes. Found in or near vegetation. Spawning occurs from late May through mid-July, sporadic to August. The longear sunfish diet is opportunistic and diverse including aquatic and terrestrial insects, fish eggs, larvae fish, small crustaceans and aquatic plant material (Becker, 1983).

**Special Concern**

Three state listed fish species of special concern that potentially exist or are known to exist in the project area include the banded killifish, least darter and lake sturgeon. Three state listed plant species of special concern – reflexed trillium, American gromwell and Northern yellow lady’s slipper, potentially exist or are known to exist in the project area. Freshwater mussels are not listed as state species of special concern by the NHI, but they may be present in the project area.

**Banded killifish**

The banded killifish is ranked globally as G5 and statewide as S3. By this ranking, the banded killifish is considered to be secure globally though they may be quite rare in parts of its range. Within Wisconsin however, its ranking indicates that it is likely to be rare or uncommon and vulnerable to extirpation. Small numbers of banded killifish have been identified in the Milwaukee River and Cedar Creek watershed in Ozaukee County (Becker, 1983 and Lyons et al., 2000).

The banded killifish prefers the clear shoal waters of estuaries and lakes, backwaters and areas in streams with slower currents (Becker, 1983). Substrate preferences include a wide range of substrates including gravel, sand, silt, marl, clay, detritus or cobble generally with sparse vegetation in water depths up to 0.6 m. Spawning occurs from June through mid-August over coarse sand substrate. The diet of the banded killifish is somewhat habitat-specific and depends on the availability of food types. Generally they feed upon small crustaceans, insect larvae, plant material and algal filaments. The young have much more specific requirements and reportedly feed almost exclusively on planktonic crustacea and chironomid larvae.

**Least darter**

The least darter is ranked globally as G3 and statewide as S3. These rankings infer that the fish is either very rare and local through its range or found locally in a restricted range; and rare or uncommon in Wisconsin. Earlier
records indicated the least darter to be common in southeastern Wisconsin, including the Milwaukee River Basin and in particular the Menomonee River Watershed (Green, 1935). More recent accounts indicate that habitat changes have greatly reduced its distribution and relative abundance (Becker, 1983; Fago, 1985 and Lyons et al., 2000).

The least darter prefers clear, warm, quiet waters of overflow ponds, pools, lakes and streams over substrates of gravel, silt, sand, boulders, mud or clay with dense vegetation or filamentous algal beds, and at depths less than 1.5 m. Spawning occurs from late April into July. The diet of the least darter consists of aquatic insect larvae and nymphs, copepods and cladocerans (Becker, 1983).

Lake sturgeon

Lake sturgeon is ranked globally as G3/G4 (vulnerable) and statewide as S3. Globally the fish is very rare and local throughout its range; or globally secure and quite rare in parts of its range. It is rare or uncommon in Wisconsin but with secure populations in the Wolf/Fox River basins. Until recently, the lake sturgeon was considered absent from the Milwaukee River basin except for a small non-reproducing remnant population in Big Cedar Lake in Washington County; a result of a non-planned stocking by the former Wisconsin Conservation Department in 1936. An occasional lake sturgeon is observed by WDNR fisheries and commercial fishers working in the Milwaukee River Estuary or near-shore waters of Lake Michigan. The WDNR and its partners have been rearing lake sturgeon at its streamside rearing facility along the Milwaukee River at Newberg in an effort to restore sustainable populations in the Milwaukee River and near-shore waters of Lake Michigan. Since 2003, approximately 64,000 larvae and 5112 lake sturgeon fingerling have been stocked in the Milwaukee River.

The lake sturgeon prefers large rivers and lakes. It also lives in the shoal waters of the Great Lakes. Inland it shows a preference for the deepest mid-river areas and pools. Spawning occurs from late April through early June in cold, shallow fast water over large rocky substrate. The lake sturgeon diet includes mussels, insect larvae, leeches, and snails (Becker, 1983).

3.5.5.2 Environmental Consequences

3.5.5.2.1 Proposed Action Alternative

Tables 1 and 2 in Appendix A indicate site-specific characteristics, the preferred alternative, possible alternatives, site access considerations, and the direct, indirect, and cumulative environmental impacts of the OB PW and OB CC projects. General environmental impact information relative to the cumulative impacts of all OB CC sites for the preferred alternative and no-action alternatives are discussed in Table 2. One or more of the various impacts listed below were chosen for each site.
Movement of AIS is expected as a result of the removal of barriers to fish movement on tributary streams. The removal and/or modification of these barriers would significantly improve fishery access to naturally occurring upstream habitat and enhance the successful natural reproduction of native fish species. Physical controls to create temporary barriers to AIS movement are not proposed on Milwaukee River tributaries. The WDNR has indicated a preference for such controls since they can be more effective when placed on the main river channel where operation and maintenance of such devices is more practical and likely more effective for all types of AIS.

AIS movement on tributaries is expected to occur with or without physical controls. Obstructions to fish passage on tributaries are recognized as temporary barriers to AIS control since these barriers are frequently inundated with storm water runoff and thereby are not recognized as complete barriers to AIS movement. Control of AIS in tributaries is likely to be not practical to achieve due to the large number of tributaries and pathways for such movement. AIS control at the MT FW would provide the most effective and practical means to manage AIS movement into the tributaries.

Fish passage improvements and auxiliary flow and habitat throughout the implicated waterways are expected.

Appendix C, Document 4 contains a table detailing the likely occurrence of threatened and endangered species in each subwatershed and how to minimize potential impacts. The net effect of the other barriers projects will be positive on the threatened and endangered species present in the project area.

In general, OB CC projects would not be subject to detailed design work and would be completed using standardized field methods under supervision from a trained crew leader. Best management practices for erosion control, vegetation and debris removal, safety, and other factors would correspond with permit requirements and those practices used for other County-run public park and highway projects. Site access would be coordinated by Ozaukee County program staff.

Removal of the other barriers would provide enhanced movement of aquatic organisms into the tributary streams and expanded access to aquatic habitat. Natural reproduction and viability of the native fishery would be improved. Fragmented aquatic habitat would be reconnected. Problems resulting from improperly designed or construction of hydraulic structures (and other impediments) would be eliminated or modified to improve movement by aquatic organisms. Short-term construction impacts to aquatic and riparian habitat are expected. Implementation of erosion control, site stabilization, monitoring, and maintenance of best management practices would be required to lessen the anticipated disturbance.
In some cases, aquatic vegetation control would be required. Plants would be removed as a physical control to re-establish the thalweg of the tributary stream. Management of plant removal may affect aquatic vegetation. Where aquatic invasive plants are encountered, work protocol requires specific handling to prevent the spread of undesirable vegetation.

Public works project effects on aquatic resources would result from the following activities:

1. Barriers to fish passage would be physically removed or modified using heavy machinery.
2. During culvert replacement, work would occur on and adjacent to riparian and aquatic habitat.
3. Fine sediment may be re-suspended and deposited downstream.
4. Barrier removal may cause minor, short-term disturbances of the immediate project area.

Mitigation would be required to minimize construction related disturbance to riparian and aquatic habitat. Such measures would include:

1. Detailed site data, construction and erosion control plans, and plan review and approval by the WDNR would be required.
2. Debris would be removed from the channel as necessary to prevent remobilization. Erosion control and site restoration best management practices would be employed as necessary and according to site stabilization plans for disturbed areas within or adjacent to the barrier sites.

Conservation Corps project effects on aquatic resources would result from the following activities:

1. Barriers to fish passage would be physically removed by hand labor.
2. Debris, rock and vegetation would be removed as needed and disposed of at an appropriate location.
3. Small equipment (skid-steer loader and mule-type ATV) would be used to transport equipment and materials to and from site as needed. Short term site disturbance to riparian and aquatic habitat is expected.
4. Fine sediment may be re-suspended and deposited downstream.
5. Barrier removal may cause minor, short-term disturbances of the immediate project area.
Mitigation would be required to minimize construction related disturbance to riparian and aquatic habitat. Such measures would include:

1. Debris would be removed from the channel as necessary to prevent remobilization.

2. Erosion control and site restoration best management practices would be employed as necessary and/or according to site stabilization plans for disturbed areas within or adjacent to the barrier sites.

3.5.5.2 No Action Alternative

The No Action Alternative does not meet the purpose and need for the project. Barriers to fish and other aquatic life passage would remain. Habitat access for aquatic organisms would remain diminished as a result of the continued habitat fragmentation. Erosion, scour, and unbalanced sediment loading due to improperly sized or placed hydraulic structures would continue. The loss of fish and wildlife habitat and degradation of fish and wildlife population BUIs would remain unaddressed. The No Action Alternative will have no impact on threatened and endangered species, although it can be said that continued degradation of habitat may negatively impact threatened and endangered species in the project area in the long-range timeline.

3.5.6 Terrestrial Wildlife

3.5.6.1 Affected Environment

3.5.6.1.1 Wildlife Habitat

Wildlife species observed in the vicinity of the Milwaukee River include whitetail deer, muskrat, mink, raccoon, gray squirrel, coyote and unverified reports of river otter. Bird species include robin, cardinal, warbler, cedar waxwing, chickadee, nuthatch, catbird, kingfisher, great blue heron, red-winged blackbird, Canada geese and mallard ducks. Osprey are occasionally observed fishing and flying along the Milwaukee River corridor in Ozaukee County and Milwaukee County to the south. A bald eagle nest is located approximately two-miles north of the project site along a backwater of the Milwaukee River and another nest site is located four miles east along the Lake Michigan bluffs. The nesting pairs produce offspring and the adults have been observed flying along the Milwaukee River corridor.

No comprehensive surveys of turtles and herptiles have been completed for the Milwaukee River in the vicinity of the barrier removal areas.

3.5.6.2 Environmental Consequences

3.5.6.2.1 Proposed Action Alternative

Removing or modifying the existing barriers would be very positive for wildlife habitat. It is unlikely any mammal species would be lost due to removal or modification of the barriers. Most mammals are terrestrial and
the removal of the barriers would increase terrestrial wildlife movements in the riparian zone. The modified areas would provide mechanisms for movement of terrestrial organisms within modified structures and would accommodate normal bed width and dry shoreline in culvert/bridge crossings. This would contribute to the delisting of the loss of fish and wildlife habitat BUI for the Milwaukee Estuary AOC.

The improved riparian cover could increase nesting and feeding sites for edge species such as house wrens, gray catbirds, and American goldfinches. Nesting habitat and foraging perches would improve for riparian warblers, notably the yellow warbler and the common yellow throat. Ground nesting waterfowl, such as the blue-winged teal and mallard, could also use established grassy areas as nest cover.

3.5.6.2.2 No Action Alternative

The No Action Alternative would have no impact on existing wildlife habitat. Under the No Action Alternative, diminished terrestrial organism movements due to reduced riparian zone in improperly sized hydraulic structures would continue to occur. The loss of fish and wildlife habitat BUI for the Milwaukee Estuary AOC would remain unaddressed.

3.5.7 Vegetation

3.5.7.1 Affected Environment

The areas of the creeks that would be disturbed by the removal or modifications of the existing barriers have vegetation consisting of forested second growth lowland hardwood swamp (e.g., American elm, green ash, and silver maple) and wet meadows (e.g., reed canary grass, willow, cattail, and red osier dogwood).

The adjacent woody, brushy and grassy shorelines provide an important component for the corridor. Mature trees provide wildlife food and cover and screen the river channel from adjacent urban housing and infrastructure. The wooded areas provide birding opportunities and refuge areas for wildlife in a heavily industrialized and populated urban setting. The corridor attracts and acts as a migration corridor for neotropical woodland birds, waterfowl, raptors (including Bald eagles) and other bird species.

3.5.7.2 Environmental Consequences

3.5.7.2.1 Proposed Action Alternative

Removal of other barriers would occur on a much smaller scale and have far less potential effect on the environment than construction of a fishway or dam removal and thus have more limited and short-term impacts to vegetation.

The OB CC projects are likely to have minimal short-term effect on native vegetation in the form of trimming, clearing and trampling of vegetation.
Larger scale OB PW projects may lead to direct mortality of plants and individual trees. Effects would be minimized by installing and maintaining erosion control practices, and seeding and planting native species. As the natural hydrology is restored, natural vegetation would re-colonize the impacted areas.

3.5.7.2.2 No Action Alternative

The No Action Alternative would have no impact on existing vegetation. The existing terrestrial plants are in fair to good condition. The existing barriers sustain artificial hydrology and disrupt sediment. These issues influence riparian vegetation.

3.5.8 Cultural and Historic Resources

3.5.8.1 Affected Environment

Cultural resources within Ozaukee County and the communities in which the Other Barriers – Removal or Modification projects are proposed can encompass archaeological and historic resources, including but not necessarily limited to buildings, structures, objects, districts, and sites. These resources represent a variety of periods ranging from the prehistoric to the present day.

3.5.8.1.1 Archaeological and Historic Resources

An archaeological investigation of the project area was completed in August 2009. The following paragraphs are taken or adapted from the report Archaeological Investigations for the Milwaukee River Watershed Fish Passage Project, Ozaukee County, Wisconsin (Great Lakes Archaeological Research Center, December, 2009), hereby incorporated.

In August 2009, GLARC conducted Phase I archaeological investigations along seven watersheds (Fredonia Creek, Riverside Drive Creek, Trinity Creek, Lac du Cours Outlet, Ulao Creek, Riveredge Creek, and Mole Creek) within Ozaukee County. The investigations were conducted within the area of potential effect for areas of proposed impediment removal associated with the Milwaukee River Watershed Fish Passage project in Ozaukee County, Wisconsin. Archaeological investigations were conducted to fulfill requirements of Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665) as amended and 36 CFR, Part 800, which serves to implement the Act.

Archaeological and historical evaluation of Pigeon Creek barriers has not been completed but will be performed prior to use of project funds on removal activities.

Investigations of the project areas were conducted in two stages. The first stage consisted of review of existing information to identify previously documented archaeological and burial sites within one mile of the project areas. The second stage consisted of archaeology survey of those portions of
the project areas that would be potentially affected by ground disturbing activities. The survey included visual site inspection, surface survey, and close interval shovel testing.

During the archival and literature review, a number of archaeological and burial sites were identified within one mile of the areas in which work is proposed. A list of the watershed areas included in the archaeological investigation and the number of sites documented is provided below.

Fredonia Creek - 32 documented archaeological and burial sites within one mile; none coincident with immediate project area.

Riverside Drive Creek - 30 documented archaeological and burial sites within one mile; one archaeological site (47OZ0062) partially coincident with immediate project area.

Trinity Creek - 35 documented archaeological and burial sites within one mile; none coincident with immediate project area.

Lac du Cours Outlet - 11 documented archaeological and burial sites within one mile; one burial site (47OZ0345 (BOZ0048)) partially coincident with immediate project area.

Ulao Creek - 20 documented archaeological and burial sites within one mile; three archaeological sites (47OZ0065, 47OZ0104, and 47OZ0110) partially coincident with immediate project area.

Riveredge Creek - 30 documented archaeological and burial sites within one mile; three archaeological and burial sites (47OZ0284, 47OZ0285, and 47OZ0288) partially coincident with immediate project area.

Mole Creek - 74 documented archaeological and burial sites within one mile; six archaeological and burial sites (47OZ0054, 47OZ0083, 47OZ0112, 47OZ0118, 47OZ0120, and 47OZ0134) partially coincident with immediate project area.

Visual inspection and shovel testing (except in rocky steeply sloped areas) was completed for the areas of potential ground disturbance. No cultural resource materials were encountered in any of the areas investigated with the exception of one area in the Fredonia Creek project area. The few pieces of historic/modern materials found in this area appeared to be isolated and not associated with any significant cultural deposit or definable archaeological site.

In summary, no significant archaeological sites, cultural materials, or historic properties were identified as a result of archaeological survey within the project area.
3.5.8.2 Environmental Consequences

3.5.8.2.1 Proposed Action Alternative

No ground disturbing activities are proposed as part of the Conservation Corps projects. For the Public Works projects, all ground disturbing activities proposed would occur within or close to the stream channels in areas previously disturbed. All areas were visibly inspected and areas where ground disturbance would occur were shovel tested. No cultural resource materials were encountered in any of the areas investigated with the exception of one area in the Fredonia Creek project area as discussed above. The few pieces of historic/modern materials found in this area appeared to be isolates and not associated with any significant cultural deposit or definable archaeological site.

The investigation found that the Proposed Action would not adversely affect the cultural resource base in the project area. However, it noted that current conventional archaeological survey techniques are inadequate to determine the presence of deeply buried archaeological or paleontological deposits. The report indicated the probability for encountering such sites is unlikely but that if any materials are encountered, construction in the area of the discovery should be halted and the State Historical Society of Wisconsin should be consulted. The same course of action would be required if human remains or other indications of a burial site are encountered.

3.5.8.2.2 No Action Alternative

The No Action Alternative would not impact existing cultural resources either directly or indirectly. This alternative would allow for existing conditions to remain as they currently are. Archaeological and historic resources would neither be preserved in another manner nor damaged under the No Action Alternative.

3.5.9 Visual Quality and Aesthetics

3.5.9.1 Affected Environment

As part of the 2006 Comprehensive Plan process, Ozaukee County and 14 cities, villages, and towns retained the University of Wisconsin – Milwaukee Center for Urban Initiatives and Research to conduct a survey on behalf of the County. Based on the surveys, the 2007 Ozaukee County Comprehensive Plan listed the following goals:

- Preserve and enhance Ozaukee County’s natural resources, including Lake Michigan, open space, and agricultural land.
- Preserve primary environmental corridors, secondary environmental corridors, and isolated natural resources areas in Ozaukee County.
- Preserve natural areas in Ozaukee County.
- Preserve critical species habitat sites and critical aquatic sites located outside of natural areas in Ozaukee County.
While most of the land that may be impacted by the fish barrier removal is not owned primarily for recreation, many owners enjoy hiking, bird watching, fishing, and other outdoor recreational activities on their land. With the exception of Mole Creek, where approximately ten barriers are located near existing homes, most barriers to be modified or removed are in or near agricultural, forested or wetland areas away from residential areas. However, many of these natural areas have some public access so that others can enjoy the bounties of nature. Improved culverts and removal of debris are expected to have a positive impact on the overall aesthetic quality of the project area.

3.5.9.2 Environmental Consequences

3.5.9.2.1 Proposed Action Alternative

Removing or modifying the existing barriers would maintain or restore terrestrial species and increase vegetative diversity. Proper burial of culverts would reduce the unsightly intrusion of culvert pipes into the natural surroundings. The changes would increase the appeal of the mostly rural project area and be beneficial to visual quality and aesthetic by enhancing the overall impression created by Ozaukee County’s unique combination of visual features such as land, water, vegetation, geologic formation, and structures.

The proposed other barrier removal component of the project would improve the views and visual character of the surrounding community. The proposed project components would blend into the current surrounding land use patterns, whether manmade or natural. The removal or modification of the other barriers would not result in the elimination or major screening of scenic views known to be important to county residents. Removing or modifying existing barriers would eliminate unsightly log/debris jams, unsightly slack water impoundments, and channel-encroaching invasive vegetation. In many locations, free flowing stream reaches would be established and negate the accumulation of flotsam and other debris that barriers collect. The proposed other barrier removal project would also address Ozaukee County’s Comprehensive Plan goals and increase the opportunity for fishing throughout the project area.

3.5.9.2.2 No Action Alternative

The No Action Alternative would have no impact on existing visual quality and aesthetics.

3.5.10 Transportation

3.5.10.1 Affected Environment

3.5.10.1.1 Transportation Network

State of Wisconsin
Within the State of Wisconsin, the transportation network consists of roadways, trails, rail lines, ports, and airports.

The Proposed Actions contained within this project are located within the Milwaukee River watershed. Regional access into this area of the state is provided by state roadways under the jurisdiction of the Wisconsin Department of Transportation (WisDOT). These roadways include Interstate 43/State Trunk Highway (STH) 57/STH 32, which is likely to be the primary north-south road; STH 167, which provides east-west access though Thiensville; STH 60, which provides east-west access through Grafton; and STH 33, which provides east-west access through Port Washington and Saukville (Ozaukee County, 2009). County and local roadways then provide local access into the Proposed Action locations.

**Ozaukee County**

Ozaukee County is well-served by a series of freeways, state highways, major roads, and local roads. The Ozaukee County Highway Department is responsible for maintaining a total of 448 miles of roads within the county: 27 miles of Interstate Highway, 64 miles of State Trunk Highways, 154 miles of County Trunk Highways, and 203 miles of Town Roads (Ozaukee County, 2009).

Similar to the rest of the State, within Ozaukee County, the primary means of transportation is likely to be the personal motor vehicle. Transportation within the county is guided by the official areawide planning agency for the southeastern region of the State, Southeastern Wisconsin Regional Planning Commission (SEWRPC), (Ozaukee County, 2009).

Ozaukee County’s vision of the regional transportation system plan is to provide a multi-modal transportation system in order to reduce auto dependency and promote high air quality. The Ozaukee County Express Bus (Route 143) provides service to Mitchell Street, Downtown Milwaukee, Cedarburg, Fredonia, Grafton, Mequon, Port Washington & Saukville.

Transportation in Ozaukee County also includes non-motorized modes of transportation. The Ozaukee Interurban Trail abuts the project area. Although this trail does not parallel the Milwaukee River, it does connect to roadways, trail networks, and parks in the communities of Mequon, Thiensville, Port Washington, Cedarburg and Grafton.

The County also is served by the one passenger and three freight railway companies (Ozaukee County, 2009). Existing railroad corridors run north-south through the project area in the communities of Mequon, Thiensville, Grafton, Cedarburg and Saukville.

The Milwaukee River does not have any commercial ports or marinas within the project limits. There is a recreational/utility boat launch near the BS Dam in Grafton, Proposed Action 3 (Ozaukee County, 2009).
Air service is available at the Milwaukee County General Mitchell International Airport, which is located in Milwaukee approximately 20 miles south of the project area. Commercial airlines provide regional services at this location. Corporate and private aircraft also utilize this airport (Ozaukee County, 2009).

3.5.10.1.2 Transportation of Materials

State and county roadways have use restrictions placed on them by WisDOT and the Ozaukee County Highway Department for commercial motor vehicles. Restrictions are based on vehicle size, weight, and the time of year for travel (WisDOT, 2009). Temporary seasonal weight restrictions are typically placed on county roads each spring.

3.5.10.2 Environmental Consequences

3.5.10.2.1 Proposed Action Alternative

The proposed project would have no significant impact on transportation within the communities in the project area once the work is complete. Nominal increases in the use of the local and regional roads along the river may occur particularly during warmer months due to increases in tourism encouraged by the project. The reliability of the roadway network would be improved because of the improved flood performance and physical condition at the road crossings.

During construction, residents, workers, and visitors would experience both direct and indirect impacts. The potential transportation impacts associated with the project are temporary and mainly limited to the immediate surroundings of the 46 OB PW locations and 84 OB CC locations.

Direct impacts to transportation would be associated with the temporary closure of roadways and road lanes. Intermittently, over the duration of the project construction activities, access may be limited to specific site locations while work is being completed.

Indirect impacts would be minor in nature and consist of additional construction traffic and re-routing of traffic. Equipment used for the restoration activities and the removal of fill would need to be delivered to the individual sites and eventually removed. Likewise, fill and waste materials would need to be transported to and from project sites. During the construction period, additional localized traffic would result due to these activities, along with the generation of additional noise and dust from the movement of the vehicles and equipment.

The proposed project also is expected to generate or retain approximately 29 temporary or permanent jobs. This would contribute to additional traffic on city roadways. However, the amount of additional traffic would be negligible.
While few impacts are expected, the proposed project may require the use of vehicle permits for the delivery and removal of construction materials. For any construction vehicles operating with overweight loads, proper permitting would be required. Detailed routes may be required to meet load restrictions on bridges and particular local roads, and construction scheduling may need to accommodate seasonal weight restrictions.

3.5.10.2.2 No Action Alternative

The No Action Alternative would not impact the existing transportation network or associated traffic directly or indirectly. This alternative would be compatible with transportation plans and programs, because it would allow for the existing conditions and proposed improvements to remain as they currently are.

3.5.11 Air Quality

3.5.11.1 Affected Environment

Air quality data for USEPA criteria pollutants measured from air monitoring sites for the state of Wisconsin are submitted to USEPA by the WDNR, and available through the USEPA’s AIRNOW Internet portal. As of December 2009, the criteria pollutants PM2.5, CO, Pb, NO2, and SO2 continue to remain in attainment of the NAAQS in Ozaukee County. On February 10, 2009, the Wisconsin Natural Resources Board redesignated Ozaukee County to “attainment” for the USEPA-revoked 1-hour ozone standard. This action was taken in compliance with the Agency’s implementation of the Clean Air Act’s “anti-backsliding” provision.

Ozaukee County remains a moderate non-attainment area with respect to the 8-hour ozone ambient air quality standard.

3.5.11.2 Environmental Consequences

3.5.11.2.1 Proposed Action Alternative

This proposed project alternative would result in air emissions (engine combustion products, and fugitive dust) from earth moving vehicles during construction. Gases released by newly-exposed sediments may result in odor impacts. Reductions in air quality resulting from these impacts, however, would be minor, relatively localized, and temporary in nature.

In addition, excavation and earth moving activities can cause re-entrainment of dust particulates and possibly other pollutants into the atmosphere due to removal of dirt, debris, and other materials. This effect would also be temporary and primarily local in nature, although some transport of minor amounts of airborne pollutants to downwind nearby locations within or outside the focus areas of the proposed project can occur.

No significant long-term air quality related impacts are expected under the proposed project.
3.5.11.2.2 No Action Alternative

The No Action Alternative would have no affect on existing air quality conditions. Under the No Action Alternative, mobile construction equipment use and ground disturbing impacts from restoration related activities under the proposed project would not occur. Thus, air quality impacts from material re-entrained into the ambient air and transported or deposited downwind would be avoided.

3.5.12 Noise

3.5.12.1 Affected Environment

Noise is typically defined as “unwanted sound.” It may be as mild as a general nuisance, such as a noise causing distraction or masking desired sounds, or severe enough to impede communication, affect behavior, and cause temporary or permanent hearing loss.

Noise is measured in units of dB on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more “weight.” The A-weighted decibel (dBA) scale corresponds to the sensitivity range for human hearing. A noise level change of 3 dBA is barely perceptible to average human hearing. A 5-dBA change (either an increase or a decrease) in noise levels, however, is clearly noticeable. A 10-dBA change in noise levels is perceived as a doubling (if it is an increase in noise levels) or halving (if it is a decrease) of noise loudness.

The project area contains a wide variety of outdoor sound environments, from industrial facilities to well traveled city streets to parks. Sound sources in parks typically originate from recreational activities and can result in decibel levels in the 60-70 dBA range, but can be higher depending on the activity. Noise levels from car and truck traffic on city streets within the focus areas would usually be higher, in the range of 70-90 db. For locations near the various industrial sites, sound can be in the 80-90 dBA range, but can have short duration decibel spikes above 100 dBA, depending on the type of process occurring. By way of comparison, typical indoor environments usually maintain sound levels in the 50-60 dBA range (Reagan & Grant, 1977).

3.5.12.2 Environmental Consequences

3.5.12.2.1 Proposed Action Alternative

Noise generated by construction equipment as a result of the project activity is likely to constitute the greatest increased noise impact above existing conditions. It is anticipated that earth moving machinery such as bulldozers, backhoes, and dredges, or supporting transport equipment like heavy trucks and barges, would be utilized in the restoration activities. These sources of sound can cause temporarily elevated noise levels within and near the project area. Table 3.12-1 provides the range of noise levels experienced for
typical construction equipment approximately 50 feet from the source of the noise.

*Table 3.1-1 Typical Noise from Construction Equipment (dBA)*

<table>
<thead>
<tr>
<th>Sound Pressure Level (dBA)</th>
<th>Typical Sources</th>
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<tbody>
<tr>
<td>70-80</td>
<td>Pump</td>
</tr>
<tr>
<td>75-85</td>
<td>Backhoe</td>
</tr>
<tr>
<td>80-90</td>
<td>Heavy Truck</td>
</tr>
<tr>
<td>80-85</td>
<td>Mobile Crane</td>
</tr>
<tr>
<td>80-95</td>
<td>Bulldozers</td>
</tr>
<tr>
<td>80-90</td>
<td>Graders</td>
</tr>
<tr>
<td>80-95</td>
<td>Front Loaders</td>
</tr>
</tbody>
</table>

Source: FHWA, 1977

These noise levels are comparable to the range of noise found in typical industrial and city street settings, but are higher than what is likely to be typically experienced in parks. All of the Sites are located adjacent to or nearby industrial areas and/or city streets; however, for those Sites furthest removed from developed areas, temporary increases in noise levels would be most evident. To minimize the impact of temporary construction-related noise, construction activities would be limited to daylight hours and/or ordinances of the community in which the work is proposed.

Minor permanent noise impacts can also result from the project once restoration of the sites is complete.

3.5.12.2.2 No Action Alternative

The No Action Alternative would not be expected to affect existing noise levels in the project area. The No Action Alternative would avoid the temporary increase in noise levels during restoration due to earth removal and remediation activities under the proposed project.

3.5.13 Human Health and Safety

3.5.13.1 Affected Environment

The affected environment includes the 130 barrier sites on tributaries of the Milwaukee River.

3.5.13.2 Environmental Consequences

3.5.13.2.1 Proposed Action Alternative

Potential temporary safety and health hazards related to barrier removal chiefly impact workers at the sites. Applicable regulations (i.e. potential hazards) include, but are not limited to, fall protection, drowning hazards, noise, confined spaces, etc. These various hazards are to be addressed through implementation of applicable OSHA and or WisCOMM construction standards (29 CFR 1926) and should be outlined in site-specific safety and health plans which explain how each contractor would address
compliance with these regulations for their employees. Employees working at all project sites are expected to receive training related to the potential hazards at the sites.

Because some of the other barriers would be removed by volunteers or paid Conservation Corps personnel, the need for safety training and supervision during construction is imperative. These project participants may not be accustomed to construction site protocol and the associated health and safety precautions, so thorough training and careful supervision must be provided.

With updated designs for stream crossings at some of the barriers, human safety may be enhanced by the new structures that are installed.

3.5.13.2.2 No Action Alternative

The No Action Alternative does not affect human health and safety.

3.5.14 Socioeconomic and Environmental Justice

3.5.14.1 Affected Environment

Ozaukee County is the smallest county by land area in the state of Wisconsin, covering approximately 235 square miles. The county is located in the southeastern portion of Wisconsin on 25 linear miles of Lake Wisconsin shoreline. Current land use is likely to be variable and includes: residential, commercial, industrial, and agricultural. Unused rural/open lands, wetlands and woods are also present. The amount of land in Ozaukee County devoted to urban land use has increased by 170% since 1963. The county is home to a population of 87,000 (2009 estimate) and has the highest income per capita of any Wisconsin county. Its largest city is Mequon, with a population of 23,560.

Data for the following discussion primarily were obtained from the 2000 U.S. Decennial Census, prepared by USCB. When available, 2008 estimates are provided for Ozaukee County.

In 2008, Ozaukee County was estimated to have a population of 85,874 (USCB, 2007). The county population grew by 4.3 percent from the 2000 population of 82,317 (USCB, 2000). The county’s residents (USCB, 2008) were comprised of 96.0 percent Caucasian, 1.5 percent black or African-American, 0.3 percent Native American and Alaska Native, 1.4 percent Asian, and 2.0 percent Hispanic or Latino origin.

In 2008, Ozaukee County had 35,390 housing units; 22.9 percent of the housing units were in multi-unit structures. The homeownership rate in 2000 was 76.3 percent.

Ozaukee County had 68,847 residents who were 16 years or older in 2008 (est.), with 48,880 or 71.2 percent in the civilian labor force. In 2008, 3.6
percent of residents in the civilian labor force were unemployed. The top three employment industries in Ozaukee County were educational, health and social services (20.2 percent), manufacturing (19.8 percent), and retail trade (11.5 percent). In 2007, the median household income for Ozaukee County was $75,938 and 4.5 percent of individuals lived below poverty level. Current unemployment levels have doubled since 2008 and have been estimated at 7.3 percent as of September 2009 (USDL, 2009). For comparison, Wisconsin’s median household income was $50,567 and 10.8 percent of individuals lived below the poverty level (USCB, 2000b).

### 3.5.14.2 Environmental Consequences

#### 3.5.14.2.1 Proposed Action Alternative

The Proposed Action would have positive socioeconomic effects on residents and businesses in the project area. Design and construction phases of the project would create jobs in project management, engineering design, construction trades and support positions. After construction, socioeconomic benefits would continue. The natural fishery would be enhanced, thereby benefiting sport and subsistence fishers. In addition, businesses supporting fishers, tourists, and water-based sports would benefit. The public works projects would concurrently replace aging infrastructure, thereby reducing local tax burden.

The Proposed Action is not expected to disproportionately affect any minority, ethnic or economically disadvantaged group. Improving and creating sustainable fish stocks within the most populated and demographically diverse river basins in the state of Wisconsin would have wide public benefit.

#### 3.5.14.2.2 No Action Alternative

The No Action Alternative would leave conditions in the river as they are – desirable sport fish would continue to be blocked from upstream areas and there would continue to be decreased viability of stream resident populations. Recreational opportunities for local residents and visitors to the area would be reduced as would the level of recreationally-based business activity. No additional job creation would be realized.

### 3.5.15 Cumulative Impacts

Removal of 130 documented non-dam barriers that exist on Milwaukee River tributaries in Ozaukee County, WI would enhance these waters and expand their capability of supporting an expanded community of fish and aquatic life. These tributary surface waters are capable of supporting an abundant diverse community of forage fish and other aquatic life. Removal of fish passage barriers in the tributaries would serve to make accessible vast areas of natural habitat for potamodromous species.
These projects (OB PW and OB CC) would be the fourth major element in a series of fish passage improvements under consideration for the Milwaukee River and its tributaries in Ozaukee County. The addition of fish passage at these individual sites would augment past dam removals on the lower Milwaukee River, the addition of a fishway or removal of the BS Dam, removal of the LK Dam and fish passage at the MT Dam. Removal of these 130 other barriers would reconnect aquatic habitat on a watershed basis. Removal fish passage barriers on the tributaries identified in this project would contribute to reconnection of 158 river miles and 119,000 acres of aquatic habitat to the regional fishery, the Milwaukee Estuary and Lake Michigan. These improvements will cumulatively benefit the Milwaukee Estuary AOC by bolstering fish populations and making fish/wildlife habitat accessible throughout the watershed. These impacts will aid in the delisting of AOC BUIs.

It is generally accepted that the removal of other barriers to fish passage in Milwaukee River tributaries would not contribute to expansion of the same aquatic and wetland habitat to use by AIS since the most effective location of AIS control barriers is likely to be on the main stem of the river.

As a resource management priority for local units of government along the Milwaukee River, other minor yet collectively significant fish passage improvements are expected in the long term.

3.5.15.1 Proposed Action Alternative

Each successive removal of a fish passage barrier on a tributary stream incrementally increases the habitat available to fish and other aquatic life. Removal of the 130 other barriers contributes to the goal of reducing BUI’s in the Milwaukee Estuary AOC. It would contribute to enhancement of fish passage opportunity from the Newberg Dam, at river mile 50, to the Milwaukee Estuary and Lake Michigan. Isolated aquatic habitat throughout the river and tributary areas would be reconnected and biodiversity of the aquatic ecosystem would be enhanced in the long term. The natural sediment transport function of the riverine tributary system would be restored by removing the identified existing barriers to fish passage.

Finally, removal of the 130 other barriers could contribute to potential AIS movement throughout aquatic habitat of the tributary streams from the Newberg Dam at river mile 50 to the Milwaukee Estuary and Lake Michigan.

A summary of the cumulative impacts of other barrier removal includes:

- Contributes to the goal of reducing BUIs in the Milwaukee River Estuary - AOC.
- Reconnects fragmented aquatic habitat.
- Restores natural sediment transport function of tributaries.
Improves water quality and aquatic biodiversity.
Provides improved use of tributaries for subsistence and sport fishing.

3.5.15.2 No Action Alternative
If there is no removal of the other barriers to fish passage fragmentation of aquatic habitat would persist with no improvement realized to the viability and diversity of the natural fishery of the Milwaukee River and its tributaries. Persistence of these fish passage barriers contributes to the BUI’s of Milwaukee Estuary and Lake Michigan AOC. The biological and geomorphological integrity of the entire watershed will continue to suffer from habitat fragmentation. Naturally produced stocks of potamodromous fish in the lower Milwaukee River, its Estuary and near shore portions of Lake Michigan will not occur. Upstream areas continue to fail to meet their full ecological value to the region. River resident fauna will continue to suffer from decreased abundance, diversity and sustainability.

A cumulative summary of the impacts of the No Action Alternative include:

- Contributes to AOC BUIs.
- Diminishes biodiversity and water quality.
- The biological and geomorphological integrity of the entire watershed suffers from fragmentation.
- Important areas continue to fail to meet their full ecological value to the region.
- River resident fauna suffer from decreased abundance, diversity, and sustainability.
- Fragments aquatic habitat.
- Interrupts natural sediment transport function of tributaries.
- Diminishes water quality and aquatic biodiversity.
- Diminishes fishery.
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Agencies Consulted

Wisconsin Department of Natural Resources
# 5.0 Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AOC</td>
<td>Area of Concern</td>
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<tr>
<td>ARRA</td>
<td>American Recovery and Reinvestment Act</td>
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<td>ASNRI</td>
<td>Area of Special Natural Resource Interest</td>
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<td>BUI</td>
<td>Beneficial Use Impairment</td>
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<td>CFS</td>
<td>Cubic Feet per Second</td>
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<td>CPUE</td>
<td>Catch per Unit Effort</td>
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<td>Community Restoration Program</td>
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<td>County Trunk Highway</td>
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<td>dB</td>
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<td>dBA</td>
<td>A-weighted decibel</td>
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<td>FONSI</td>
<td>Finding of No Significant Impact</td>
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<td>HBI</td>
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<td>NAAQS</td>
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<td>State Historic Preservation Office</td>
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<td>Spill Prevention, Control and Countermeasure</td>
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<td>Abbreviation</td>
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<tr>
<td>USFWS</td>
<td>United States Fish and Wildlife Service</td>
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<tr>
<td>VHS</td>
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### 6.0 SCIENTIFIC NAMES

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<tr>
<td>American black duck</td>
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document presented by the Village of Grafton


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