RECONNAISSANCE REPORT

September 2003

ROUGE RIVER WATERSHED, MICHIGAN

FLOOD HAZARD REDUCTION, RIVERINE ECOSYSTEM RESTORATION, AND RECREATIONAL DEVELOPMENT

US Army Corps
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Detroit District

Report Documentation Page

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Rouge River
Watershed, Michigan

Reconnaissance Study
Section 905(b) (WRDA 86) Analysis

Flood Hazard Reduction, Riverine Ecosystem Restoration, and Recreational Development

12 September 2003

US Army Corps
of Engineers®
Detroit District

EXECUTIVE SUMMARY

The Rouge River is located in southeast Michigan, primarily within the metropolitan Detroit area. Its watershed encompasses 48 communities and portions of 3 counties: Oakland, Washtenaw, and Wayne. The river extends 127 miles and drains approximately 467 square miles of the most densely populated urbanized land in the State of Michigan.

Congress (Energy and Water Development Appropriations Bill, 2002) has directed that a basin wide watershed management study be undertaken to address flood hazard reduction, riverine ecosystem, and recreation needs.

Local, county and state agencies have made significant accomplishments in restoration of the watershed. The watershed has been divided into seven (7) subwatersheds. The communities within each subwatershed formed an advisory group, which completed subwatershed management plans in 2001. The plans identified current river conditions, proposed goals, developed management actions, and identified ways to measure progress to protect and restore the beneficial uses of the river.

The purpose of this study is to evaluate the existing watershed conditions, identify problems and opportunities, formulate restoration alternatives, and determine if there is a Federal interest to participate in a cost shared project. This study will also identify any willing and able local sponsors to share in feasibility, design and construction costs for any project determined to have a Federal interest.

This study has concluded that there are projects within an area of the Rouge River Watershed known as the Gateway Area, which have Federal interest. The Gateway Area has been determined to have unique problems separate from the rest of the watershed, which are related to a Corps of Engineers flood control project completed during the mid-1970's. This report recommends more detailed evaluation in a feasibility phase for six (6) projects in the Gateway Area.

For the remainder of the watershed, outside the Gateway Area, funds have been provided by Congress to develop a Supplemental Watershed Management Plan. The Supplemental Watershed Management Plan will focus on flow management, watershed dams, and the only remaining cold water fishery within the watershed. The Supplemental Watershed Management Plan is ongoing and it is recommended that work on the plan continue until all appropriated funds have been expended. It is anticipated that as work on the Supplemental Watershed Management Plan progresses, potential projects with Federal interest may be identified. A modification to this reconnaissance report, or a new reconnaissance report will be prepared at that time to identify Federal interest.

Reconnaissance Report
Rouge River Watershed, Michigan

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Reconnaissance Study
Section 905(b) (WRDA 86) Analysis
Rouge River Watershed, Michigan
Flood Hazard Reduction, Riverine Ecosystem Restoration and Recreational Development

1. STUDY AUTHORITY

1 (a). This Section 905(b) (WRDA 1986) Analysis was prepared as a response to Section 102 of the River and Harbor Act of 1966, which reads as follows:

"The Secretary of the Army is hereby authorized and directed to cause surveys to be made at the following named localities and subject to all applicable provisions of Section 110 of the River and Harbor Act of 1950: Mexico Beach, Florida. Great Lakes, particularly Lake Ontario and Lake Erie, in connection with water supply, pollution abatement, navigation, flood control, hydroelectric power, and related water resources development and control."

1 (b). Funds in the amount of $ 200,000 were included in the Energy and Water Development Appropriations Bill, 2002, with the following language:

"Rouge River Watershed, Michigan. – The Committee has provided $ 200,000 for a basin wide watershed management study to address flood hazard reduction, riverine ecosystem restoration, and recreation needs in the Rouge River Watershed."

2. STUDY PURPOSE

The purpose of this study is to evaluate the existing watershed conditions, identify problems and opportunities, formulate restoration alternatives, and determine if there is a Federal interest to participate in a cost shared project. This study will also identify any willing and able local sponsors to share in feasibility, design, and construction costs for any project determined to have a Federal interest.

3. LOCATION OF STUDY, NON-FEDERAL SPONSOR AND CONGRESSIONAL DISTRICT

3 (a). The Rouge River is located in southeast Michigan and empties into the Detroit River, about midway between Lake St. Clair and Lake Erie. This study will focus primarily on the Gateway Area, which is the most downstream 8 miles of the river to its confluence with the Detroit River. A Location/Vicinity Map and a Rouge River Watershed Metropolitan Detroit Area Map are provided as Figures 1 and 2, respectively.

The watershed's 467 square miles lie within the most densely populated urbanized land areas of the state. The watershed encompasses 48 communities and portions of three counties: Wayne, Oakland, and Washtenaw. The main stem and three branches (the Upper, Middle, and Lower Rouge Rivers) extend 127 miles in length. More than 50 miles of the river flow through public parkland, making it one of the most publicly accessible rivers in the State.

3 (b). Wayne County, Michigan has been identified as an interested local sponsor and has actively participated in site visits, public meetings, coordination efforts, and has provided assistance identifying local stakeholders. Since 1991, Wayne County has been the lead agency in the development of the Rouge River National Wet Weather Demonstration Project. In 2001, Wayne County prepared a report, entitled: *Rouge River Gateway Master Plan*, which identified 36 projects and/or destinations of interest.

3 (c). The study area lies within the Congressional Districts of Joseph K. Knollenberg (9th District), Thaddeus G. McCotter (11th District), John Conyers, Jr. (14th District), and John D. Dingell (15th District). The United States Senators are Carl Levin and Debbie Stabenow.

4. PRIOR REPORTS AND EXISTING PROJECTS

4 (a). The following reports were reviewed as part of this study:

1) Each of the 7 subwatershed management plans were reviewed. The subwatershed management plans provide a framework for the preparation of pollution prevention initiatives to meet state and federal water quality regulations. The plans identify current river conditions and proposed goals, actions, and progress measures to protect and restore the beneficial uses of the river for the residents of each subwatershed. The purpose of these plans was to mitigate the adverse effects of pollution caused by wet weather discharges (e.g., combined sewer overflows (CSO), sanitary sewer overflows (SSO), and storm water) as well as effects associated with dry weather conditions, (e.g. illicit discharges to separate storm sewers). The plans outline the steps needed to control and reduce the adverse affects of excessive river flows that impair fish and wildlife values and injure riparian property.

The following seven (7) Subwatershed Management Plans were prepared by each of the seven Subwatershed Advisory Groups with technical assistance from the Wayne County Rouge Program Office:

- *Upper Rouge River Subwatershed Management Plan, November 2001, prepared by the Upper Rouge River Subwatershed Advisory Group;*
- *Main 1-2 Rouge River Subwatershed Management Plan, May 2001, prepared by the Main 1-2 Subwatershed Advisory Group;*
- *Lower 2 Rouge River Subwatershed Management Plan, May 2001, prepared by the Lower 2 Subwatershed Advisory Group;*
- *Middle One Rouge River Subwatershed Management Plan, April 2001, prepared by the Middle One Subwatershed Advisory Group;*
- *Main 3-4 Rouge River Subwatershed Management Group, May 2001, prepared by the Main 3-4 Rouge River Subwatershed Management Group;*
- *Lower One Rouge River Subwatershed Management Plan, April 2001, prepared by the Lower One Subwatershed Advisory Group;*
- *Middle 3 Subwatershed Management Plan, October 2001, prepared by the Middle 3 Subwatershed Advisory Group.*

2) *Rouge River Assessment, by Jennifer D. Beam and Jeffrey J. Braunscheidel, Michigan Department of Natural Resources, Fisheries Special Report No. 22, 1998.* This report described the hydrologic characteristics and biological communities of the Rouge River and its watershed in southeast Michigan.

3) *Oxbow Restoration Feasibility Study, prepared by Environmental Consulting & Technology, May 2000.* This report described the existing conditions in the Corps of Engineers flood control project area of the Rouge River and described the phased restoration plans being undertaken by the Henry Ford Museum & Greenfield Village, Wayne County, and the State of Michigan.

4) *Rouge River Gateway Master Plan, prepared by Wayne County, Michigan, April 2001.* The purpose of the master plan was to advance, extend, and coordinate current planning and redevelopment projects to achieve the goals identified for the Gateway Area, which include ecosystem restoration, heritage preservation, increased recreation and economic development along the Rouge River. The Gateway Area consists of an eight-mile stretch of the Rouge River extending from its confluence of tributaries, near Ford Road in Dearborn, to its mouth at the Detroit River. The Master Plan identified 36 projects or destinations of interest within the Gateway Area

5) *Draft Reconnaissance Level Study, Main Rouge River, Dearborn, Michigan, Gateway Master Plan Evaluation, prepared for the U.S. Army Corps of Engineers, Detroit District by the Joint Venture firm of Wade-Trim / NTH, March 2003.* The U.S. Department of Commerce, National Oceanic and Atmosphere Administration, the Office of Response and Restoration received funds from Congress (PL 106-553), December 21, 2000, with the instructions to be used for "lower Rouge River restoration". NOAA transferred those funds to the U.S. Army Corps of Engineers, Detroit District, on August 6, 2001 through a Support for Others Agreement to initiate a Preliminary Watershed Analysis Study. The Detroit District evaluated (to determine Federal interest) thirty-six (36) projects and destinations identified in the Rouge River Gateway Master Plan. An initial review of the 36 sites/destinations was made and 6 were evaluated in greater detail in the report. The remaining sites were determined to be destinations with educational, commercial, or historic significance; landmark buildings, parks, museums; or recreational developments being pursued by others.

6) *Rouge River ChannelRestoration (Upper and Lower) Section 1135 Preliminary Restoration Plan, November 2001.* The Detroit District, Corps of Engineers, is currently in the feasibility phase for two (2) Section 1135 projects. These studies are evaluating the feasibility of removing 2.3 miles of concrete lined channel from Michigan Avenue to I-94, which is within the Gateway Area and represents approximately one-half of the Corps flood control project completed in the mid-1970's. The flood control project reduced the channel length from 5.8 miles to 4.2 miles by straightening and realigning the river channel. **Thru Congressional direction** this area has been divided into 2 separate projects. The first project extends from Michigan Avenue to Rotunda Drive (1.4 miles) and is identified as the Upper Rouge River Restoration Project. The second project extends from Rotunda Drive to I-94 (0.9 miles) and is identified as the Lower Rouge River Restoration Project.

7) The Henry Ford Museum and Greenfield Village Oxbow Restoration Section 1135 Preliminary Restoration Plan was approved in July 2003.

4 (b). This reconnaissance study is investigating potential modifications to the following project:

1) A flood control project was authorized by the Flood Control Act of 1962 to prevent flooding of the Dearborn/Melvindale areas of the Rouge River. This project was completed during the mid-1970's by the U.S. Army Corps of Engineers. The Rouge River channel was realigned and lined with concrete to reduce flow resistance. The channel realignment and straightening reduced the meandering channel from 5.8 miles to 4.2 miles. The straightening decimated the aquatic and riparian habitats of the stream and left a number of cut off meanders (oxbows) without connection to the new river channel. The flood control project lies within an area now known as the "Gateway Area".

5. PLAN FORMULATION

5 (a). National Objectives.

1) The national or Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

2) The Corps also has a second national objective for Ecosystem Restoration. This objective is to contribute to the nation's ecosystems through restoring significant ecosystem function, structure, and dynamic value with contributions measured by changes in the amounts and values of habitat.

5 (b). Public Concerns.

The public concerns that are related to the establishment of planning objectives and planning constraints are identified below. These concerns represent a summarization of those expressed by stakeholders during coordination meetings in preparation of this report and are described within the seven subwatershed management plans (reference paragraph 4(a)(1)).

(1) The Rouge River is very unstable, with annual flow peaks of 20-90 times base flows, summer base flows below 10 cubic feet per second, and daily fluctuations of over 500 cubic feet per second after rain events. These fluctuations destabilize banks, create abnormally large moving sediment bedloads, dislodge and destroy habitat, strand and kill organisms, and interfere with recreational uses of the river.

(2) The river system is highly fragmented by dams. There are 62 to date; 26 are on the main stem and its headwater, 12 in the Upper Branch, 18 in the Middle Branch, and 6 in the Lower Branch. The majority of the dams are on the steeper gradient headwater tributaries, usually in areas of most desirable water quality and habitat. Headwater streams are the source of nutrients and aquatic invertebrates, which tend to migrate downstream. Two dams are especially devastating, isolating the watershed from the Detroit River (and Lake Erie ecosystem); at Wayne Road in Wayne, Michigan on the Lower Rouge River and at the Henry Ford Estate in Dearborn, Michigan on the main stem.

(3) Increasing urbanization within the watershed has had an impact on aquatic environment through degraded water quality, increased erosion, drainage of wetlands, channelization of streams, destabilization of water flow, and increases in impervious land area that increases surface runoff, decreases ground water, and increases water temperature.

(4) The flood control project within the Gateway Area has reduced flooding damage to the local communities, however, the channelization of the Rouge River in the 1970's effectively eliminated nearly all the valuable large-river habitat below the confluence of the major branches. Natural river features such as meanders, pools, riffles, and flood plain wetlands have been replaced by a wide, shallow, smooth, homogeneous concrete trough. The channel acts as a high-velocity barrier to fish populations migrating upriver from the Great Lakes to spawn.

5 (c). Problems and Opportunities.

Problems:

Urbanization has created unstable flow conditions throughout the Rouge River watershed. The subwatershed management plans prepared in 2001 indicate that the primary source of flow in the Rouge River is now surface water runoff. Highly fluctuating flows are common, and in general their frequency and magnitude have increased with increased urbanization and the associated impermeability of the watershed.

The volume of polluted water that runs off urban pavements creates numerous problems such as streambank erosion, streambed scouring, flooding, and property damage. Polluted storm water runoff contains bacteria, heavy metals, nutrients, oil and grease, pesticides, and soil particles that negatively impact the river's health.

Elevated phosphorus concentrations, low dissolved oxygen concentrations in the warmer months, sedimentation that smothers habitat, and excessive turbidity during rainstorms all cause problems for the Rouge. Removal of streamside vegetation has created increases in summer stream temperatures, which amplify the dissolved oxygen problems.

The concrete channelization of the Rouge River in the Gateway area has effectively eliminated nearly all large-river habitat below the confluence of the major branches. Historical species missing are generally the large, more desirable gamefish species such as walleye and smallmouth bass, and water quality sensitive species such as certain minnow, darters, and sculpins. The channel acts as a deterrent to fish migrations upriver from the Great Lakes in several ways. High-velocity flows in the Spring act as potential barriers to fish species that would normally be migrating upstream for spawning. The channelized section of the river can also present a high temperature and low oxygen barrier to other Great Lakes species that would normally use the downstream portions of a river this size. Historically, there were five primary vegetation covers within the project area, including: Mixed Oak-Savanna, Oak-Hickory Forest, Beech-Sugar Maple Forest, Mixed Hardwood Swamp, and Shrub Swamp/Emergent Marsh.

The watershed is negatively impacted by dams and other obstructions which act like dams. Some of the dams are not currently functioning as intended and are not maintained as necessary. In a similar way as the flood control project, dams obstruct the normal movement of fish up and down stream, thereby reducing diversity and impacting the health of the fishery.

Water quality is highly variable within the Rouge Watershed. In the areas that experience them, Combined Sewer Overflows (CSO's) have significantly degraded water quality. In general, the measured water quality parameters (i.e., dissolved oxygen, metals, bacteria, nutrients, and suspended solids) indicate much poorer water quality downstream of the CSO discharges. Approximately 38 of the 127 miles (30%) of the larger streams and tributaries of the Rouge are currently impacted by CSO's. However, significant water quality improvements have been achieved through the control of 40% of the original CSO areas. While water quality improves in areas not impacted by CSO's, bacteria and dissolved oxygen levels still do not meet Michigan water quality standards in many areas. Illicit connections (i.e. illegal or unintentional connection of waste drains into separate storm water systems), possible separate sanitary sewers overflows (SSO's), and failing septic systems are sources of pollution upstream of CSO's.

Habitat quality and fish sampling in the Rouge River watershed indicate that highly variable flows and poor water quality have caused adverse impacts for aquatic species in most areas. A 1995 Michigan Department of Natural Resources (MDNR) Fisheries Division survey indicated that pollution intolerant fish species were found in less than 50% of sites monitored in each subwatershed.

The threats (see Table 1 below) that have been identified as detrimental to the designated and desired uses of the river include: flow variability, excessive sediment and nutrient loading, bacteria, toxics and heavy metals, increase in temperature, and loss of natural features.

Table 1 - Sources of Pollutants in the Rouge River as identified in the Rouge River Subwatershed Management Plans prepared in 2001.

Threats to River Quality	Sources Identified within the Watershed
Flow Variability	• Urban storm water • Groundwater
Sediment	• Construction Sites • Roads/streets/highways • Eroding stream banks / bed scour • Agricultural land • Livestock in streams • Urban storm water
Nutrients	• Residential lawns • Failing septic systems • Illegal discharge to the storm sewer • Golf courses • Streets • Agricultural fertilizer / livestock • Combined Sewer Overflows • Sanitary Sewer Overflows
Bacteria	• Failing Septic Systems • Illegal Discharge to the Storm Sewer • Combined Sewer Overflows • Pet, waterfowl and livestock wastes
Toxics/Heavy Metals	• Atmospheric Deposition • Construction Materials • Street/roads/highway runoff • Household Hazardous Waste • Combined Sewer Overflows • Deicing of roads • Landfill leachate • Runoff from polluted areas • Illegal Discharge to Storm Sewer
Temperature increase	• Impervious surfaces • Lack of riparian vegetation
Loss of natural features	• New development • Older, urban development

Opportunities:

There are opportunities within the Rouge River Watershed to restore aquatic and wildlife habitat, control and reduce sedimentation and erosion, improve water quality, and increase recreational opportunities. Management actions, monitoring, and local ordinances would also provide positive opportunities to protect and restore threatened and endangered species and cultural and historic resources.

There are opportunities to improve habitat for migratory birds. The project area is located in the general area of the cross-section of two major North American Migration Flyways: the Atlantic Flyway and the Mississippi Flyway. Of the 233 species of breeding birds in Michigan, 120 are regular breeders in Wayne County.
U-M, Dearborn, is also home to the Rouge River Bird Observatory. The observatory's primary focus is to better understand the importance of migratory stopover sites. Many bird populations, particularly those of birds that migrate to the tropics, have been declining at an alarming pace. U-M, Dearborn, is a very important area for migratory birds.

There is an opportunity to continue the restoration efforts undertaken by many public and private organizations over that past 15 years. The following agencies are actively involved in restoration efforts on the Rouge River: Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Wayne County's Rouge River National Wet Weather Demonstration Project, U.S. Environmental Protection Agency, Rouge River Remedial Action Plan, Great Lakes Commission, Automobile National Heritage Area (ANHA), and Southeast Michigan Greenways Initiative. These agencies participated in public coordination meetings held during preparation of this reconnaissance report.

5 (d). Planning Objectives.

The restoration of the Rouge River Watershed must be a collaborative effort of a variety of local, state, and federal stakeholders.

The water and related land resource problems and opportunities identified in this study are stated as planning objectives to provide focus for the formulation of alternatives. The identified planning objectives reflect problems and opportunities and represent desired positive changes (in the without project condition) for each project site. The planning objectives are specified as follows:

- Restore movement of fish and other aquatic organisms.
- Restore aquatic habitat, wetlands, and riparian buffers.
- Reduce and/or control river flow fluctuations.
- Restore and reconnect oxbows isolated by the flood control project.
- Improve water quality.
- Stabilize eroding shoreline.
- Increase open space and recreational opportunities.
- Utilize best management practices for water quality improvement.
- Treat storm water prior to its flowing into the river.
- Evaluate watershed dams for modification, removal, proper maintenance, or alternative uses.
- Identify water retention/detention/diversion for habitat and water quality improvement.
- Increase educational experiences.
- Clear channels and channel constraints.

5 (e). Planning Constraints.

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that make achieving the planning objectives more difficult. Constraints limit the extent of the planning process. The planning constraints identified in this study are as follows:

- Some of the riparian corridor property is privately owned.
- The watershed lies within the political boundaries of 48 communities and 3 Counties.
- Public may not understand the benefits of habitat and wildlife restoration.
- Land may be expensive in this urban area.
- Channel conveyance and capacity needs to be maintained.
- Flood damages cannot be increased.
- Historical locations and structures are within the study area.

5 (f). Management Measures to Address Identified Planning Objectives.

A management measure is a feature or activity at a site, which address one or more of the planning objectives. A variety of measures were considered, some of which were found to be infeasible due to technical, economic, or environmental constraints. Each measure was assessed and a determination made regarding whether it should be retained in the formulation of alternative plans. The descriptions and results of the evaluations of the measures considered in this study are presented below.

In order to address the identified problems appropriately it was felt that the "Gateway Area" should be evaluated separately from the rest of the watershed because it is specifically impacted by the Corps of Engineers flood control project, has identifiable projects, and a local sponsor has been identified.

Identified Projects within the Rouge River Gateway Area:

- Henry Ford Estate Dam Modification for Fish Passage.
- Kingfisher Bluff Streambank Stabilization, Erosion Control, Habitat Restoration.
- Michigan Avenue /Evergreen Road storm water treatment and water quality improvement.
- Tournament Players Golf Course storm water treatment and wetland restoration.
- Oakwood Common Oxbow Restoration.
- Fordson Island Habitat Restoration.

Rouge River Watershed Outside of Gateway Area:

No projects are recommended at this time for the remainder of the watershed. The problem of highly fluctuating flows and the resulting impact on the watershed has to be resolved. This will require establishing targets for flows and habitat restoration as well as additional hydraulic modeling to evaluate the impacts of future urbanization in the watershed. Hydraulic models will have to be updated to run targeted flow conditions and to evaluate the impact of future detention/retention plans on the flow. The Detroit District is preparing a supplement to the subwatershed management plans completed in 2001 by each of the subwatershed advisory groups. During preparation of this supplemental plan there may be projects identified that appear to have Federal interest. Any projects identified in the future will be evaluated in a new reconnaissance study or by amending this reconnaissance study. The Supplemental Watershed Management Plan will focus on the following: (1) Flow Management, (2) Watershed Wide Dam Study, and (3) Johnson Creek Cold Water Fishery.

ROUGE RIVER GATEWAY AREA PROJECTS:

Six (6) projects have been evaluated within the Gateway Area for Federal interest with respect to aquatic habitat restoration, streambank stabilization and erosion protection, oxbow restoration, dam modification, and storm water treatment for water quality improvement. The Gateway Area is the location of the Corps of Engineers Flood Control Project completed during the mid-1970's. See Figure 3 for a plan of the six project sites within the Gateway Area.

Project Site # 1) Henry Ford Estate Dam Modification for Fish Passage

The dam at the Henry Ford Estate (known as the Fairlane Mansion) was originally constructed in 1830 and redesigned by noted landscape architect Jens Jensen in 1909. The estate and dam are designated as National Historic Landmarks. The dam is a concrete structure approximately 200 feet long with a 12-foot head. Jensen faced the dam with stepped limestone. A large limestone flowerpot that has been destroyed by past flood events was constructed in the middle of the dam. Flag stone steps were placed along the crest of the dam to provide foot access to the land west of the river during normal water levels. Both downstream banks of the dam have limestone faced concrete wing walls that extend several hundred feet along the banks. The wing walls have generally controlled erosion and contouring of the channel and riverbanks. The impoundment behind the dam remains within the channel and immediate banks of the Rouge River. Hydroelectric generators on the estate use the water to produce power for the mansion.

The dam is the first upstream dam from the mouth of the Rouge River, about 8 miles upstream of the Rouge River's confluence with the Detroit River. A Site Location Map of this area is provided as Figure 4. The next upstream dams along the Middle and Upper Branches of the Rouge are 18 and 36 miles, respectively. Restoring fish passage at the Henry Ford Estate would open these stretches of river for fish migration. A dam at Wayne Road on the Lower Branch is about 8 miles upstream of the Henry Ford Estate Dam, however, the Lower Branch of the Rouge River enters the Main Branch just downstream of the Henry Ford Estate Dam.

A fish passageway at the Henry Ford Estate would increase the aquatic biodiversity throughout the upper and lower portions of the main branch not only for fish species, but also for macro-invertebrates, mussels, and other aquatic life forms. Fish species that have been identified at the dam by the Michigan Department of Natural Resources (Fisheries Division) include small mouth bass, white suckers, walleye, redhorse suckers, northern pike, and steelhead.

The concept of a fish passageway was previously developed as a component of the University of Michigan's Heritage & Wildlife Education and Recreation Plan completed in May 2000.

Alternatives evaluated included a Denil fish passage that consists of a sloping flume with baffles that provide a backwater condition for fish to rest during transit. The typical Denil Fish Passage allows a relatively small footprint. The flume is commonly constructed of concrete and appears as a U-shaped channel with water flowing through baffles that create resting areas for fish within the structure. A Denil fish passage at this site would need to accommodate a 12-foot drop and likely include as least 2 switchbacks. The typical Denil fish passage will not pass many of the small fish species and some slower warm-water fish.

Also evaluated were three (3) variations of a fish passageway. The fish passageway alternatives are similar with the major difference being the placement of the passageway's downstream discharge point (toe of dam, 100-feet downstream of the dam, and about 500-feet downstream of the dam). The passageway could be connected to the river on the downstream end beyond the wing-wall or by bisecting the wing-wall. Typically, a fish passageway design incorporates a naturalized open channel with rock baffles at grade changes to slow water for ease of fish movement. The channel design would provide a rather low gradient condition with a number of small resting pools to accommodate fish down to 4-inch minnows. Conceptual target flows with the passageway are estimated to be 1 cubic foot per second with an overall gradient of 1:15.

Given the constraint (Henry Ford Mansion) to the east of the dam, a fish passageway would be constructed in the undeveloped parkland west of the dam. Ample flow must be discharged as close to the "splash pool" of the existing dam as possible for the passageway to provide a suitable attractant current for fish moving upriver. The typical passageway channel design allows for normal high flows within the passageway to flush debris through the structure, promoting low maintenance operation.

Upstream and downstream structures for the fish passageway would need to be substantial concrete structures to protect the stream banks and the wing-wall, direct water, and control water elevations in the fish passageway. The upstream structure should be placed far enough away to not be readily visible from vantage points on the Henry Ford Estate. The upstream structure should also be designed to deflect debris in the river from entering the passageway. A weir should be incorporated in the structure design to keep high river flows directed into the main river channel. The fish passageway could be damaged by floodwater if unrestricted flows were allowed to enter. Controlling the flow at the upstream structure would reduce costs associated with designing the passageway to accommodate flood flows. Upstream and downstream structures should be faced with limestone in a similar fashion as the dam to maintain the character of the adjacent cultural resource.

The downstream structure should direct flow into the river at an angle to provide the maximum attraction current for fish and should be designed to protect the toe of the dam, the wing-wall, and the river channel from scouring. One method of bisecting the wing-wall by the downstream structure is to offset and extend the wall upstream into the passageway. A second method is constructing a culvert to discharge the passageway under the wall. This option was discussed during coordination meetings and eliminated as providing a maintenance problem with debris potentially clogging the culvert. The culvert option was also deemed a potential safety issue should anyone fall into the water near the structure, consequently the option of discharging the passageway under the wing-wall was not considered a viable alternative for evaluation.

The alternative felt to be the most effective was a fish passageway with its downstream end at the toe of the dam. This alternative would be most effective in attracting fish into the passageway and around the dam. In addition, this alternative would also be effective in allowing passage of small fish species as well as warm and coldwater fish species. However, continued coordination with the Michigan Historical Preservation Office will be required due to the historic nature of the site. This project would alter the west wing wall, however it is believed that a project that included a feature to stabilize the deteriorating west wing wall would be acceptable to the Michigan Historical Preservation Office.

Construction Cost Summary:
Project Site # 1) Henry Ford Estate Dam Modification for Fish Passage

Alternative	Construction Cost
No Action	$ 0
Denil Fish Passage	600,000
Fish Passageway at dam face	800,000
Fish Passageway 100' downstream	750,000
Fish Passageway 500' downstream	700,000

Project Site # 2) Kingfisher Bluff Streambank Stabilization, Erosion Control, Habitat Restoration.

One of the identified threats to River quality (Table 1, Page 12) is increased sedimentation from eroding streambanks.

A bend in the river known as Kingfisher Bluff is experiencing significant erosion that is causing the loss of a band of floodplain forest and threatening adjacent parking facilities at Henry Ford Community College. The eroded area is approximately 40 feet high and 550 feet wide. A rough estimate indicates that 4 feet of bluff is lost each year. The project area is located at a relatively undisturbed portion of the Rouge River, south of Ford Road. This location provides opportunities for passive recreation as a result of the scenic vista associated with the bluff. A plan view and cross-section of this restoration alternative are provided as Figures 5 and 6, respectively.

Specific project features include:

- Creation of a terraced retaining wall system that is designed to complement and create progressive stages of floodplain each vegetated with appropriate shrub and herbaceous species for terrace elevations;
- Creation of a channel by-pass (approximately 250 lf) that diverts a portion of downstream flow during high flow flood stage events;
- Restoration of fish habitat through the inclusion of features such as submerged rock outcrops, willow overhangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) at select riparian shelf locations;
- Restoration of existing floodplain forest structure and species diversity through the planting of shrub and small tree species;
- Construction of an observation deck to take advantage of the outstanding vistas of the river and floodplain forest provided by the bluff;
- Integration of a planting program for floodplain forest enhancement and floodplain terrace creation with an experiential education program at the Community College.

Construction Cost Summary:
Project Site # 2 - Kingfisher Bluff Streambank Stabilization, Erosion Control, Habitat Restoration

Alternative	Construction Cost
No Action	$ 0
Streambank Stabilization, Erosion Control, and Habitat Restoreation	$ 1,239,700

Project Site # 3) Michigan Avenue and Evergreen Road Storm Water Treatment and Water Quality Improvement

Habitat and aquatic species in most areas of the Rouge River watershed have been impacted by highly variable flows and poor water quality. A 1995 survey report, prepared by the Michigan Department of Natural Resources, indicates that pollution intolerant fish species were found in less that 50% of the sites monitored in each subwatershed.

The referenced subwatershed management plans, prepared by each of the 7 Subwatershed Advisory Groups in 2001, identify urban storm water as a source of flow variability and sediment pollution of the river.

Currently, storm water runoff from Michigan Avenue and Evergreen Road, as well as from significant development to the north, is discharged directly into the Rouge River causing general water quality concerns from oils, greases, silts, etc., as well as erosion on the south side of the river, west of Michigan Avenue. Provided at Figure 7 is a plan view of the site. Also, provided as Figures 8 and 9, respectively are plan views of the proposed Alternatives 1 and 2 for this project site.

Specific project features include:

- Construction of detention basins (wetlands) to intercept and effectively treat storm water runoff (i.e., removal of grease, oil and suspended solids);
- Restoration of habitat functions provided by scrub/shrub, low and high marsh, floodplain forest and upland forest through a planting and seeding program;
- Enhancement of shoreline and submerged habitat through the removal of hardened (concrete riprap) shoreline and the inclusion of habitat features such as submerged rock outcrops, willow over hangs, and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian shelf locations.

Another project (Rouge River Channel Restoration, Upper and Lower Sections - Section 1135) is currently in the feasibility phase. See paragraph 10(a)(1). This study is evaluating the restoration of riparian shoreline and submerged habitat through the removal of hardened shoreline and the inclusion of habitat features such as submerged rock over hangs, willow over hangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian littoral shelf locations. This project combined with the storm water treatment wetlands would provide significant benefits to the Rouge River and adjacent riparian habitat.

Two alternatives were evaluated:

Alternative 1	Habitat Restoration (See Figure 8)
Alternative 2	Storm Water Treatment and Habitat Restoration (See Figure 9)

Project Site # 3) Alternative 1 - Michigan Avenue and Evergreen Road Habitat Restoration

This alternative proposes improved riparian habitat for numerous fish and wildlife species through the restoration of the floodplain forest and shoreline habitat that historically was present within the study area. The planting of impacted floodplain forest restoration areas is proposed. Specific base-flow and floodplain zones (i.e., 1-year and 100-year floodplain elevations) resulting from the excavation and grading of these upstream and downstream restoration areas will dictate the composition of tree, shrub, and herbaceous species planted.

On the south side of the river, roadway storm water runoff from Michigan and Evergreen would be routed to create marsh areas to supply the requisite hydro-period to the created wetland zones. However, minimal storm water treatment would be achieved by implementing this alternative due to the lack of control devices, which permit resident time of the storm water. Some of the key features for habitat restoration include:

- Plant floodplain and uplands forest where gaps exist;
- Restore habitat functions provided by high marsh, low and deep marsh, floodplain scrub/shrub and upland forest by planting a buffer area;
- Management of exotic and/or nuisance plant (NUS) species throughout the project area. Implement a habitat management and maintenance program;
- Maximize storm water treatment of roadway runoff;

Construction Cost Summary:
Project Site # 3) Alternative 1 - Michigan Avenue and Evergreen Road Habitat Restoration

Alternative	Construction Cost
No Action	$ 0
Restoration Alternative 1 – Habitat Enhancement	$ 334,200

Project Site # 3) Alternative 2 - Michigan Avenue and Evergreen Road Storm Water Treatment and Habitat Restoration

This alternative incorporates substantial improvements to fish and wildlife resources with substantial opportunity for water quality improvements on a larger scale than Alternative 1. It proposes construction of a series of filtration marshes that collect water from Michigan Avenue, Evergreen Road, and adjacent property runoff that is fully integrated with the successful creation of freshwater marsh and wet prairie and the restoration of floodplain forest and shoreline habitat. This alternative proposes the development of two constructed wetlands on the north and south sides of the Rouge River. Storm runoff collected by an existing storm water collection system would be diverted through the constructed wetlands for preliminary treatment of sediment, oil, and grease prior to discharging into the Rouge River. While mitigating storm water quality and quantity impacts, this alternative would also offer enhanced wetland habitat for wildlife and plant species. In addition, floodplain forest and forested upland along Michigan Avenue will be restored.

Inlet and outlet control structures will be constructed to manage the volume of storm water routed through the constructed wetlands. A sediment forebay area will be incorporated with an inlet control structure to trap coarse sediment before entering the wetland. Each constructed wetland will be designed using a two-tiered, meandering flow path to provide a diversity of depth zones to promote the growth of divergent wetland plants and wildlife and extend the retention time for treatment of pollutants. A micropool area will be incorporated at the outlet control structures to provide a low and deep marsh habitat and ensure the Rouge River receives the cooler temperature water.

Rip-Rap will be used around the inlet and outlet control structures and micropool entrance to protect from erosion. Geo-textile fabric will be used throughout the wetland area to aid in plant material establishment and protect the integrity of the storm water treatment structures and wetland slopes. Due to space constraints at the site and the volume of storm water, it is anticipated that this alternative can be designed to retain and filter the 2-year storm event. The system will be designed to capture the "first flush" or the initial volume of runoff from a storm event that is considered to carry the bulk of pollutants deposited since the last significant event.

Construction Cost Summary:
Project Site # 3) Alternative 2 - Michigan Avenue and Evergreen Road Storm Water Treatment and Habitat Enhancements

Alternative	Construction Cost
No Action	$ 0
Restoration Alternative 2 – Stormwater Treatment and Habitat Enhancement	$ 1,745,000

Project Site # 4) Tournament Players Golf Course Storm Water Treatment and Wetland Restoration

A significant wetland area is located adjacent to the Detroit Water and Sewer Department's Hubbell-Southfield underground storm water basin and the Tournament Players Club (TPC) Golf Course Development. This site is located south of Michigan Avenue, east of Evergreen Road and adjacent to the Rouge River Flood Control Project. The wetland is in a deteriorating condition due to high normal pool elevations and lack of fluctuations in the hydro-period. The objectives of a proposed storm water treatment and habitat restoration project at this site include the successful creation and restoration of upland/wetland herbaceous and forested habitat. In addition, this alternative includes the restoration of fishery habitat that is fully integrated with storm water treatment functions and passive recreation opportunities. Plan views of the project area and restoration are provided at Figures 10 and 11, respectively. Specific project features include:

- The interception and effective pretreatment of storm water runoff (i.e., removal of herbicides and fertilizers from the golf course and surrounding development) through a system of spreader swales combined with wet meadow overland flow prior to the discharge to a series of freshwater emergent marsh retention systems;
- Creation of a series of interconnected emergent marsh systems that retain storm water for an appropriate duration to provide for substantial removal of nutrients and dissolved solids contained within storm water runoff from the golf course and surrounding residential development;
- The creation and restoration of floodplain forest, emergent marsh and wet meadow through a systematic planting and seeding program and hydro-period modification;
- The management of exotic and/or nuisance vegetation and animal species.

Another project (Rouge River Channel Restoration, Upper and Lower Sections - Section 1135) is currently in the feasibility phase. See paragraph 10(a)(1). This study is evaluating the restoration of riparian shoreline and submerged habitat through the removal of hardened shoreline and the inclusion of habitat features such as submerged rock outcrops, willow over hangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian littoral shelf locations. This project combined with the storm water treatment wetlands would provide significant benefits to the Rouge River and adjacent riparian habitat.

Construction Cost Summary: Project Site # 4) Tournament Players Golf Course Storm Water Treatment and Wetland Restoration

Alternative	Construction Cost
No Action	$ 0
Restoration Alternative – Strom Water Treatment and Wetland Restoration	$ 4,350,000

Project Site # 5) Oakwood Common Oxbow Restoration

In the area of the proposed restoration project, the Flood Control Project straightened the natural river alignment and effectively created an oxbow wetland behind the Oakwood Common senior residence development community and adjacent to the TPC Golf Course. This wetland is isolated from the normal hydrologic processes of the river and has partially filled with sediment (particularly the area adjacent to the TPC Golf Course).

A plan view of the project site is provided as Figure 12. Plan views of the proposed project alternatives 1, 2 and 3 are provided as Figures, 13, 14, and 15, respectively.

Three potential alternatives have been formulated:

Alternative 1	Habitat Enhancement (Figure 13)
Alternative 2	Habitat Enhancement and Storm Water Treatment (Figure 14)
Alternative 3	Complete Reconnection of Oxbow to Rouge River Channel Figure 15)

Currently, the two segments remaining from the original river alignment receive significant storm water discharge from direct runoff as well as via multiple storm water outfalls. Storm water from the TPC Golf Course empties into the wetland area to the north of Rotunda Drive. Storm water discharges directly into the oxbow wetland south of Rotunda Drive from the Oakwood Common development and from the residential development to the northeast. With no natural connections to the Rouge Channel and little shoreline vegetation, water is stagnant with a high level of turbidity. Open water areas and associated shoreline that are present in the project area (i.e., Oakwood Common) are nearly devoid of emergent vegetation and display poor water quality conditions (i.e. highly turbid).

The existing forested portions of the project area are dominated by vegetation reminiscent of southeast Michigan floodplain forest. Common overstory and subcanopy species include Boxelder (*Acer negundo*), Eastern cottonwood (*Populus deltoids*), and American elm (*Ulmus Americana*). These isolated pockets of forested wetlands occur north of the oxbow between Oakwood Common and St. Joseph's Catholic Church and to the west of Rotunda Drive and the Congregational Church. Upland areas that were altered due to past land management practices (i.e., land clearing, urban development) vary with respect to the type of vegetative cover and degree of disturbance. These areas currently provide suitable habitat for a variety of songbirds and modest habitat suitability for waterfowl such as the wood duck. This existing area provides some habitat for amphibians, reptiles, waterfowl, wading birds and a limited number of fish species.

The existing project area is located in the general area of the cross-section of two major North American Migration Flyways: the Atlantic Flyway and the Mississippi Flyway. Of the 233 species of breeding birds in Michigan, 120 are regular breeders in Wayne County. U-M, Dearborn, is also home to the Rouge River Bird Observatory. The observatory's primary focus is to better understand the importance of migratory stopover sites. Many bird populations, particularly those of birds that migrate to the tropics, have been declining at an alarming pace. U-M, Dearborn, is a very important area for migratory birds. U-M's banding recapture data indicates that in the Spring, the average stay for 27 select species that stopped over is 3 days. These birds gained an average of 0.7% of their original body weight. In fall, the stay is 5.7 days for 28 select species, with a gain of 3.4% of original body weight.

The objectives of this project include the successful restoration and enhancement of an isolated segment of the Rouge River that will potentially provide substantial aquatic and wetland habitat improvement, water quality treatment, and passive recreation opportunities. Currently, these isolated segments of the Rouge River display poor water quality and provide only a fraction of the habitat quality and function that was eminent prior to its alteration via the channelization of the Rouge River.

The proposed alternatives emphasize a number of apparent and inherent principles that, in combination, optimize the effective implementation and long-term benefits to fish and wildlife habitat within the Rouge River Watershed including:

- Promotion of plant and animal species productivity and diversity within and between restored ecological community types;
- Restoration of connectivity between adjacent ecological community types (i.e., wet meadows>high marsh>low marsh>deepwater habitat);
- Maximization of retention time and treatment volumes of watershed storm water, while maintaining the viability and effectiveness of restored fish and wildlife habitat types;
- Promotion of plant and animal species productivity and diversity within and between restored and enhanced ecological community types;

Project Site # 5) Alternative 1 - Oakwood Common Oxbow Restoration, Habitat Restoration

Currently, storm water runoff is routed into the existing isolated oxbow area located to the south of Rotunda Drive alongside the Oakwood Common Retirement Community which receives approximately 10 acres of runoff from residential developments and undeveloped land via seven (7) outfall locations. The collected storm water is routed through the former oxbow area and discharged to the Rouge River via a single 60-inch diameter outlet pipe. The north oxbow area (between TPC Golf Course and the Congregational Church) currently receives storm water runoff from a section of the Tournament Players Golf Course and nearby residential development via four (4) storm water outfalls that service approximately 6 acres of the adjacent developments. A Restoration Site Plan for this Alternative is provided as Figure 13.

The polluted water that runs off of urban pavements creates numerous problems such as streambank erosion, streambed scouring, flooding, and property damage. Polluted storm water runoff contains bacteria, heavy metals, nutrients, oil and grease, pesticides, and soil particles that negatively impact the river's health.

This alternative proposes restoration of the existing storm water pond area and remnant river channel north and south of Rotunda. This restoration would include planting of emergent aquatics, shoreline grasses, and small low-rise plants to enhance water quality of the ponded areas, increase habitat for fish and wildlife, and improve potential shoreline stabilization of the area.

The habitat types to be created in the restoration project include deepwater marsh, low marsh, and willow-covered shoreline. This project would provide improved habitat for numerous fish and wildlife species. Major benefits of this alternative include:

- Improved water quality. Excavation of sediment sumps and emergent vegetation plantings would remove sediment as storm water is routed thru the pond and oxbow remnant;
- Improved shoreline stabilization and improved habitat compared to the existing turf and exposed soil condition of the existing storm water pond;
- The restoration of emergent herbaceous wetlands along the shoreline and within the remnant oxbow to maximize habitat for waterfowl and wading bird species. In addition, several species of migrant songbirds, small mammals and butterfly species would be benefited.

Project Site # 5) Oakwood Common Oxbow Restoration Habitat Restoration

Features Common to Alternatives 2 and 3

Alternatives 2 and 3 include the construction of a mosaic of habitat types including deepwater, high and low marshes, and wet meadow along manmade terraces that collect, retain, and treat storm water from segments of this watershed dominated by residential land uses. While Alternative 2 and 3 have similar habitat enhancement features, Alternative 2 has much more measurable storm water quality benefits. The major habitat restoration and enhancement elements common to these alternatives include:

- Creation of a series of interconnected, upper tiered, emergent herbaceous wetland systems that retain storm water for an appropriate duration to provide for substantial removal of nutrients and dissolved solids contained within storm water runoff from offsite land uses;
- Interception and effective pretreatment of storm water runoff (i.e., removal of grease, oil and suspended solids) through tiered storm water treatment wetlands prior to discharge to the Rouge River;
- Creation of emergent herbaceous wetlands located within the storm water treatment tiers to maximize habitat for waterfowl and wading bird species;
- Creation of emergent herbaceous wetlands located on the lower tiers of this wetland system, that is directly connected to the hydrologic and biological processes of the Rouge River, to maximize reproduction and cover and foraging habitat for fish and wildlife species;
- The restoration and enhancement of riparian shoreline and submerged habitat through the rehabilitation of eroded and sparsely vegetated shoreline conditions and the inclusion of habitat features such as submerged rock outcrops, willow over hangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian shelf locations;
- Management of exotic and/or nuisance vegetation and animal species throughout the project area.

Following grading activities in specified areas, wetland planting and ground strata seeding will be implemented within the select alternative(s). These plantings are integrated into the site layout in conjunction with habitat and water quality treatment functions as well as passive recreation features and aesthetic considerations. Specifically, these restoration areas include the creation and enhancement of herbaceous wetlands and deep-water habitat within the terraced storm water treatment systems proposed for Alternatives 2 and 3.

The freshwater marsh, (i.e. high and low marsh) and its associated transition areas (i.e. wet meadow) within and adjacent to the storm water treatment system, will be planted with shrub, emergent, and transitional wetland species as specified on the plan views for Alternatives 2 and 3. Included with the planting of these areas and the enhancement of adjacent deepwater habitat will be the inclusion of structural habitat components (i.e. basking, logs, willow overhangs, submerged logs and boulders, etc.) that provide life requisites and a desirable microhabitat for fish and wetland dependent wildlife and plant species. In those areas where exotic and/or nuisance species are prevalent, NUS species management and detritus removal will be conducted.

Prior to planting, the transitional zones (wet meadow) adjacent to marsh restoration areas will be seeded to enhance the establishment of a mosaic of microhabitats dominated by native grasses that are interspersed with perennial wildflowers. All seeding will be accomplished (i.e., drilled and/or broadcast) with commercially available native seed from regional sources.

Project Site # 5) Alternative 2 - Oakwood Common Oxbow Restoration, Habitat Restoration and Storm Water Treatment

This alternative includes the construction of a tiered wetland system. This includes upper tiered marshes that collect, retain, and treat storm water. A lower tiered marsh system would be constructed that is hydraulically connected to the Rouge River. A restoration site plan of this alternative is provided as Figure 14.

Alternative 2 will benefit fish resources within this segment of the Rouge River by providing life requisites (i.e., food and cover habitat) derived from the creation of deep marsh and emergent shoreline habitat. Some fish species associated with the Rouge River that could benefit from this alternative include largemouth bass and a number of sunfish species.

In addition, the combined effect of the Alternative 2 elements (i.e., lower tier marsh and shoreline restoration) will provide habitat benefits to wading birds, waterfowl, minnow species, several butterfly species, migrant songbirds, and a number of small mammals. These benefits will be derived from the creation of deep and low marsh, and wet meadows, and the life requisites that they provide.

The upper tiers of this wetland system are comprised of deepwater habitat, deep and low marshes, and wet meadows. They would be designed to collect and treat storm water runoff. This series of wetlands will provide enhanced habitat for numerous wildlife species including wading birds, waterfowl, minnow species, songbirds with a habitat preference for freshwater marshes, and a number of small mammal species. Due to the hydraulic connection to the Rouge River between the higher and lower tiered marshes, direct benefits (i.e., small minnow and macro-invertebrate foraging opportunities) to fish and wildlife species that currently utilize this segment of the river will occur during variable storm events.

Appropriate structural improvements will be used (i.e., rip-rap and geo-textile fabric) throughout the constructed wetlands and oxbow areas to prevent flood and erosion damage. The upper tier will be constructed at elevations to maintain water depth consistent with low marsh habitat (6” – 18”). Elevations for the lower tier will be set to allow adequate flushing during smaller, more frequent storm events. Directly adjacent to the connection to the concrete channel will be areas of low and deep marsh habitat.

This alternative includes provisions for vehicular access such as a small bridge of stabilized berm to the Detroit Water and Sewer Department Hubbell-Southfield Facility and Tournament Players Club Golf Course maintenance building. This alternative will also hydraulically connect the two oxbow areas by installing a small diameter pipe, using jack and bore construction methods, under Rotunda Drive. The minor hydraulic connection would be installed between the two oxbow areas to provide additional storm water treatment capacity and varying levels of water in high and low marsh habitat north of Rotunda.

Project Site # 5) Alternative 3 - Oakwood Common Oxbow Restoration Complete Reconnection of Oxbow to Rouge River Channel

During stakeholder meetings, participants indicated the desire to evaluate the possibility of completely reconnecting and restoring the historic river alignment in the area north and south of Rotunda Drive. A Restoration Site Plan for this alternative is provided as Figure 15. Review of existing topographic data and as-built drawings of the River Rouge Flood Control Project in the vicinity of Oakwood Common indicates that the difference in elevation between the invert of the former river alignment, north of the concrete channel, and the invert of the concrete channel is approximately 12-15 feet. To provide hydraulic reconnection of this area with the channelized Rouge River, approximately 8-12 feet of the oxbow bottom would require dredging to provide adequate flow-through characteristic.

Following grading activities in specified areas, native upland and wetland planting and ground strata seeding will be implemented along the existing shoreline and the reconnected oxbow. These plantings will be integrated into the site layout to enhance recreation, erosion control, storm water treatment efficiency as well as the ecological function of on-site habitats.

The benefit of this project will be the restoration of existing habitat (i.e., shallow reservoir) to herbaceous and shrubby riparian habitat. This transformation will be accomplished by re-grading the entire oxbow length. Based upon the design hydrologic gradients developed by this alternative, a substantial area of deep and low marsh and deep-water habitat will be restored. Numerous fish will benefit from the hydrologic reconnection, including: largemouth bass, bowfin, and numerous sunfishes. This will be accomplished by providing many of the life requisites required by these species as well as refuge from the poor habitat conditions that occur within this segment of the Rouge River. The successful restoration of this oxbow section will also benefit numerous other species such as benthic macro-invertebrates, amphibian, reptiles, waterfowl, wading and shoreline birds, migratory songbirds, and small mammals.

Construction Cost Summary:
Project Site # 5) Alternatives 1, 2, and 3 - Oakwood Common Oxbow Restoration

Alternative	Construction Cost
No Action	0
Alternative 1 – Habitat Restoration	$ 1,303,700
Alternative 2– Habitat Restoration and Stormwater Treatment	$ 5,126,634
Alternative 3 – Complete Reconnection of Oxbow to Main River Channel	$ 18,010,000

Project Site # 6) Fordson Island Habitat Restoration

Fordson Island is located in the City of Dearborn, just downstream of the Turning Basin on the Southwest side of the river. The island was created in 1922 by the dredging and channeling of the Rouge River to the Ford Plant. The dredging provided a deeper channel allowing the Ford Motor Company to transport submarine chasers (Eagle Boats) out of the Rouge River and into the deeper water of the Detroit River. Ongoing negotiations between the property owner and Wayne County have created an opportunity for possible riparian and upland habitat creation/restoration, public recreation and access to the Rouge River.

Provided as Figure 16 and 17, respectively, are a plan view of the project site and a plan view of the proposed project restoration.

The objectives of the Fordson Island project include the successful restoration of the onshore and offshore habitat of a small island in the Rouge River while providing improved public access and passive recreation opportunities for the local community. Preliminary evaluations of the island have been completed by Marathon Ashland and Wayne County to identify potential hazardous material contamination. The shoreline is littered with abandoned boats and the island has been used for illicit solid waste disposal for a number of years. Surrounding land use includes concentrations of manufacturing and industrial facilities and high-density residential dwellings.

The U.S. Department of Justice / EPA have a consent decree with Marathon Ashland Oil. The consent decree involves a supplemental environmental project on Fordson Island estimated to cost $ 3.5 million. The anticipated work involves restoration, removing equipment, and environmental assessments.

- Fordson Island Site: Marathon Ashland Petroleum currently owns a majority of this island. They are in the process of transferring this land to Wayne County and are under a consent decree with the U.S. EPA for accomplishing the following activities:

  (1) Flush, cap, and abandon the existing hydrocarbon dock line to the island and reroute them to an alternative location.
  (2) Remove existing industrial equipment on the island.
  (3) Perform an environmental evaluation of Marathon Ashland Petroleum's portion of the island to applicable standards for use of the property as a public park and undertake clean up and remediation activities.

  Marathon Ashland completed a Phase 1 Environmental Site Assessment (ESA) in July 2001. Marathon Ashland completed a Phase 2 ESA and a report was submitted to Wayne County in June 2003.

The Consent Decree requires the following:

(1) Complete the Phase 2 ESA and provide a report to Wayne County. Wayne County is currently reviewing the environmental evaluation report.
(2) Continue discussions with Wayne County regarding transfer of ownership**. (Ongoing)**
(3) Develop a plan to empty and clean the pipelines from the Detroit Refinery to Fordson Island and remove buildings, electrical equipment, pipelines and loading equipment from the island**. (Complete)**

If contamination is determined to be present at the site above regulatory limits, then the local sponsor would be required to remove the contamination prior to Federal participation. Specific project features important to the success of this project include:

- The removal of solid waste, construction materials and abandoned boats along the shoreline of the island;
- Shoreline restoration with a herbaceous, emergent riparian shelf that is interspersed with pockets of willow overhangs. This would benefit the adjacent fishery and existing wading bird roost site;
- The creation of upland and wet meadows that are dominated by native grass and shrub species. Also, maximize passive recreation interaction with pollinator (e.g., bees, butterflies, etc.) and avian species;
- The restoration of, and enhancement of, forested and scrubby wetland that currently occurs on the island and provides habitat to wading birds species;
- The creation of reef habitat in deep water on the Rouge River side of the island to improve fishery opportunities in the immediate project area;
- Development of an interpretive trail to describe the importance of urban habitat restoration to fish and wildlife species;
- The management of exotic and/or nuisance vegetation and animal species throughout the project area.

Further investigations to determine Federal interest (substantial benefits to recreation or commercial navigation) for this project would look at the deepening of the channel west of Fordson Island (which is not Federally maintained channel along the Rouge River) to determine whether commercial or recreational vessels will use and benefit from the deepening. An evaluation of "incremental depths" to dredge the channel would be needed to determine the greatest achievable benefits versus costs to be derived. The channel around Fordson Island would most likely be dredged for use by recreational boaters and could be relatively shallow. Evaluation of various dredging depths incrementally is also necessary to determine locations for the greatest habitat benefits.

Construction Cost Summary:
Project Site # 5) Fordson Island Habitat Restoration

Alternative	Construction Cost
No Action	$ 0
Restoration Alternative 1 – Habitat Restoration	$ 427,800

6. STANDARDIZED OUTPUT UNITS FOR HABITAT ANALYSIS

Project Site #1) Henry Ford Estate Dam Modification for Fish Passage

Future Without Project Conditions:

Without a project, the Henry Ford Estate Dam (National Historic Landmark), which is located approximately 8 miles upstream of the Detroit River, will continue to serve as the first point in the watershed that blocks fish movement of Great Lakes Fish from the Detroit River upstream into potential spawning and foraging habitat in the Rouge as well as vice versa from the surrounding watershed into the lower reaches of the Rouge. No action would continue to limit fish migration upstream and downstream of the dam thus limiting species diversity in the Rouge River. A secondary benefit of being able to stabilize the deteriorating west wing wall of the dam structure would not occur without a project.

Future With Project Conditions:

The Rouge River National Wet Weather Demonstration Project has identified the critical importance of the dam to fishery restoration goals in the watershed. Providing a fish passage around the dam is a first step in reconnecting major segments of the Rouge for the benefit of fish and other aquatic life. Restoring fish passage at the Henry Ford Estate would open approximately 18-36 miles of river for fish migration on the upper, middle, and main branches of the Rouge River. The following site specific design objectives have been determined to be critical to the selection of the fish passage alternative:

- Provide habitat continuity for the river's fishery;
- Provide habitat continuity for aquatic invertebrates and mussels
- Low maintenance costs;
- Target flow regimes will need to be developed that consider shared flow with the Ford Estate hydroelectric turbines, the dam, and the fish passage. The average river flow is 200 cubic feet per second (cfs), with peak flows five times a year being greater than 1000 cfs;
- Minimize safety concerns;
- Aesthetic treatment should blend with the existing dam;
- Minimize impacts to existing Wayne County Park property;
- Increase public education opportunities;
- Increase recreation opportunities;
- Reduce scouring adjacent to dam;
- Limit physical change to Jens Jensen designed dam.

Standardized Output Units for Henry Ford Estate Dam Modification for Fish Passage.

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Retained Stream (Rouge River)	43.5	2	2	174
Free Stream	22	4	3	264
Upland & High Floodplains	13.13	4	3	157.56
Total	78.63	X	X	595.56
With Project				
Free Stream (Rouge River)	65.5	7	3	1375.5
Upland & High Floodplains	13.13	4	3	157.56
Total	78.63	X	X	1533.06
Net Benefit	X	X	X	937.5

NOTE: Refer to Environmental Standard Output Area of Benefit Map 1.

Project Site # 2) Kingfisher Bluff Streambank Stabilization, Erosion Control, Habitat Restoration

Future Without Project Conditions:

If no project is undertaken at the Kingfisher Bluff, there will continue to be severe erosion to the bluff due to the velocity and volume of water and the degree of deflection at this section of the river. The consequence of this would be the continued loss of uplands, high floodplains, and riparian zones. The erosion will continue to threaten adjacent parking facilities at Henry Ford Community College. The continued erosion will also contribute to the sediment loads and turbidity in the river system, which is one of the threats to river quality identified in Table 1, Paragraph 5(c).

Future With Project Conditions:

With the project, the bluff will be stabilized and the threat of erosion significantly reduced. In addition, the project will enhance the adjacent ecological communities, as well as provide passive recreation and education opportunities related to the greenway trail planned by Wayne County and University of Michigan – Dearborn. Major features of this project include:

- Creation of a terraced retaining wall system that is designed to complement and create progressive stages of floodplain, each vegetated with appropriate shrub and herbaceous species for terrace elevations;
- Creation of a channel by-pass (Approximately 250-linear feet) that diverts a portion of downstream flow during design flood stage events;
- Restoration of fish habitat through the inclusion of features such as submerged rock overhangs, willow overhangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) at select riparian shelf locations;
- Restoration of existing floodplain forest structure and species diversity through the planting of shrub and small tree species;
- Construction of an observation deck to take advantage of the outstanding vistas of the river and floodplain forest provided by the bluff;
- Integration of a planting program for floodplain forest enhancement and floodplain terrace creation with an education program at the Community College.

Standardized Output Units for Kingfisher Bluff Streambank Stabilization, Erosion Control, and Habitat Restoration

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Free Stream (Rouge River)	2.9	4	3	34.8
Riparian Zones	6.41	3	3	57.69
Upland & High Floodplains	16.01	4	3	192.12
Total	25.32	X	X	284.61
With Project				
Free Stream	2.9	6	3	52.2
Riparian Zones	6.41	7	3	134.61
Upland & High Floodplains	16.01	7	3	336.21
Total	25.32	X	X	523.02
Net Benefit	X	X	X	238.41

NOTE: Refer to Environmental Standard Output Area of Benefit Map 2.

Project Site # 3) Michigan Avenue and Evergreen Road Stormwater Treatment and Water Quality Improvement

Future Without Project Conditions:

Habitat and aquatic species in most areas of the Rouge River watershed have been impacted by highly variable flows and poor water quality. A 1995 survey report, prepared by the Michigan Department of Natural Resources, indicates that pollution intolerant fish species were found in less that 50% of the sites monitored in each subwatershed.

The referenced subwatershed management plans, prepared by each of the 7 Subwatershed Advisory Groups in 2001, identify urban stormwater as a source of flow variability and sediment pollution of the river.

With no project, storm water runoff from Michigan Avenue, Evergreen Road, and from the development to the north will continue to discharge significant volumes of runoff directly into the Rouge River. This will continue causing water quality concerns from oils, greases, silts, etc., as well as erosion on the south side of the river, west of Michigan Avenue.

Future With Project Conditions:

The overall planning objectives of the proposed improvements are guided by the following principles for ecosystem restoration projects:

- Construction of detention basins (wetlands) to intercept and effectively treat storm water runoff (i.e., removal of grease, oil, and suspended solids).
- Restoration of habitat functions provided by scrub/shrub, low and high marsh, floodplain forest, and upland forest through a planting and seeding program.

Another project (Rouge River Channel Restoration, Upper and Lower Sections - Section 1135) is currently in the feasibility phase. See paragraph 10(a)(1). This study is evaluating the restoration of riparian shoreline and submerged habitat through the removal of hardened shoreline and the inclusion of habitat features such as submerged rock over hangs, willow over hangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian littoral shelf locations. This project combined with the storm water treatment wetlands would provide significant benefits to the Rouge River and adjacent riparian habitat.

Project Site # 3) Alternative 1 - Michigan Avenue and Evergreen Road Habitat Restoration

The combined effect of this alternative is to provide improved riparian habitat for numerous fish and wildlife species through the restoration and enhancement of the floodplain forest and shoreline habitat that historically was present within the project area. Specific base flow and floodplain zones (i.e., 1-year to the 100-year floodplain elevations) resulting from the excavation and grading of these upstream and downstream restoration areas will dictate the composition of tree, shrub, and herbaceous species composition planted.

On the south side of the Rouge, roadway storm water runoff from Michigan and Evergreen is routed to created marsh areas to supply the requisite hydro-period to the created wetland zones. However, minimal storm water treatment is achieved due to the lack of control devices, which permit resident time of the storm water.

The key components of this project alternative include:

- Planting of floodplain and upland forest gaps;
- Restoration of habitat provided by high marsh, low and deep marsh, floodplain scrub/shrub, and upland forest through planting of buffer area;
- Management of invasive and/or nuisance plant species throughout the project area. Implementation of a habitat management and maintenance program;
- Maximize storm water treatment of roadway runoff.

Standardized Output Units for Alternative 1 – Michigan Avenue and Evergreen Road Habitat Restoration

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Free Stream	4.99	4	3	59.88
Retained Stream	0.84	2	2	3.36
Upland & High Floodplains	34.43	4	3	413.16
Total	40.26	X	X	476.4
With Project				
Free Stream	4.99	6	3	89.82
Retained Stream	0.84	3	2	5.04
Upland & High Floodplains	29.34	7	3	616.14
Riparian Zones	4.14	7	3	86.94
Wetlands	0.95	8	4	30.4
Total	40.26	X	X	828.34
Net Benefit	X	X	X	351.94

NOTE: Refer to Environmental Standard Output Area of Benefit Map 3.

Project Site # 3) Alternative 2 - Michigan Avenue and Evergreen Road Storm Water Treatment and Habitat Restoration

This alternative incorporates substantial improvements to fish and wildlife resources with substantial opportunity for water quality improvements on a larger scale than Alternative 1. It includes the construction of a series of marshes that collect and filter sediments and nutrients from Michigan Avenue, Evergreen Road, and adjacent property runoff. These marshes will be fully integrated with the successful creation of freshwater marsh and wet prairie and the restoration and enhancement of floodplain forest and shoreline habitat. This alternative proposes the development of two constructed wetlands on the north and south sides of the Rouge River. Storm water runoff collected by an existing collection system would be diverted through the constructed wetlands for preliminary treatment of sediment, oil, and grease prior to discharging into the Rouge River. While mitigating storm water quality and quantity impacts, this alternative would also offer an enhanced wetland habitat for wildlife and plant species. In addition, floodplain and upland forest along Michigan Avenue will be enhanced and/or restored.

Inlet and outlet control structures will be constructed to manage the volume of storm water routed through the constructed wetlands. A sediment forebay area will be incorporated with an inlet control structure to trap coarse sediment before entering the wetland. Each constructed wetland will be designed using a two-tiered, meandering flow path to provide a diversity of depth zones to promote the growth of diverse wetland plants and extend the retention time to facilitate the treatment of pollutants. A micropool area will be incorporated at the outlet control structures to provide a low and deep marsh habitat and ensure the Rouge River receives the cooler temperature water.

Riprap will be used around the inlet and outlet control structures and micropool entrance to protect from erosion. Geo-textile fabric will be used throughout the wetland area to aid in plant material establishment and protect the integrity of the storm water treatment structures and wetland slopes. Due to space constraints at the site and the volume of storm water, it is anticipated that this alternative can be designed to retain and filter the 2-year frequency storm event. The system will be designed to capture the “first flush” or the initial volume of runoff from a storm event that is considered to carry the bulk of pollutants deposited since the last significant event.

This alternative emphasizes a number of the overall planning objectives discussed previously by optimizing their effective implementation and long-term benefits to water quality and fish and wildlife habitat. These objectives include:

- The interception and effective pretreatment of storm water runoff (i.e., removal of grease, oil and suspended solids) through a system of spreader swales. Treatment would be combined with wet meadow overland flow to a series of freshwater emergent marsh retention systems.
- Creation of a series of interconnected low marsh systems, that retain storm water for an appropriate duration, to provide substantial removal of nutrients and dissolved solids contained within storm water runoff from offsite urban land uses.
- Habitat restoration functions will increase floodplain scrub/shrub, low and deep marsh areas, and upland forest through a planting and seeding program.

The key components of improvements of this project alternative include:

- Excavation of the project area to facilitate the construction of a storm water treatment system. The excavation will be conducted to elevations that maximize storm water treatment efficiency and provide for the creation of associated submerged and emergent herbaceous and/or shrubby wetlands.
- Planting of existing and historic floodplain and uplands forests
- Control of nuisance species within the project area
- Design and use of a long-term habitat management and maintenance program
- Education/demonstration of storm water treatment alternatives within Rouge Basin

Standardized Output Units for Alternative # 2 – Michigan Avenue and Evergreen Road Storm Water Treatment and Habitat Restoration

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Free Stream	4.99	4	3	59.88
Retained Stream	0.84	2	2	3.36
Upland & High Floodplains	34.43	4	3	413.16
Total	40.26	X	X	476.4
With Project				
Free Stream	4.99	7	3	104.79
Retained Stream	0.84	3	2	5.04
Upland & High Floodplains	25.58	7	3	537.18
Riparian Zones	3.42	7	3	71.82
Wetlands	5.43	8	4	173.76
Total	40.26	X	X	892.59
Net Benefit	X	X	X	416.19

NOTE: Refer to Environmental Standard Output Area of Benefit Map 4.

Project Site # 4) Tournament Players Club Golf Course Storm Water Treatment and Wetland Restoration

Future Without Project Conditions:

Habitat and aquatic species in most areas of the Rouge River watershed have been impacted by highly variable flows and poor water quality. A 1995 survey report, prepared by the Michigan Department of Natural Resources, indicates that pollution intolerant fish species were found in less that 50% of the sites monitored in each subwatershed.

The referenced subwatershed management plans, prepared by each of the 7 Subwatershed Advisory Groups in 2001, identify urban storm water as a source of flow variability and sediment pollution of the river.

The site is located adjacent to the Detroit Water and Sewer Departments Hubbell-Southfield underground storm water basin, the Tournament Players Club (TPC) Golf Course Development, and the Rouge River Flood Control Project.

Without a project, the existing wetland area will continue to deteriorate due to high normal pool elevations and lack of fluctuations in the hydroperiod. The management plans prepared in 2001 by each of the 7 subwatershed advisory groups identify golf courses as a source of nutrient pollution to the river. The pollution from fertilizers and herbicides would be expected to continue to impact the wetland.

Future With Project Conditions:

The objectives of a proposed storm water treatment and habitat restoration project at this site includes the successful creation, restoration and enhancement of upland/ wetland herbaceous and forested habitat as well as the enhancement of fishery habitat that is fully integrated with storm water treatment functions and passive recreation opportunities. The major project features include:

- The interception and effective pretreatment of storm water runoff (i.e., removal of herbicides and fertilizers from the golf course and surrounding development) through a system of spreader swales combined with wet meadow overland flow prior to the discharge to a series of freshwater emergent marsh retention systems.
- Creation of a series of interconnected emergent marsh systems that retain storm water for an appropriate duration to provide for substantial removal of nutrients and dissolved solids contained within storm water runoff from the golf course and surrounding residential development.
- The creation, restoration and enhancement of floodplain forest, emergent marsh and wet meadow through a systematic planting and seeding program and hydroperiod modification.
- The management of exotic and/or nuisance vegetation and animal species throughout the project area.

Another project (Rouge River Channel Restoration, Upper and Lower Sections - Section 1135) is currently in the feasibility phase. See paragraph 10(a)(1). This study is evaluating the restoration of riparian shoreline and submerged habitat through the removal of hardened shoreline and the inclusion of habitat features such as submerged rock outcrops, willow over hangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian littoral shelf locations. This project combined with the storm water treatment wetlands would provide significant benefits to the Rouge River and adjacent riparian habitat.

Standardized Output Units for Tournament Players Club Golf Course Storm Water Treatment and Wetland Restoration

Habitat	**Acres**	**Quality (1-10)**	**Importance (1 to 5)**	**Ecosystem Output**
Without Project				
Wetlands	15.9	3	4	190.8
Retained Stream	8.52	2	2	34.08
Total	24.42	X	X	224.88
With Project				
Wetlands	15.9	8	4	508.8
Retained Streams	8.52	3	2	51.12
Total	24.42	X	X	559.92
Net Benefit	X	X	X	335.04

NOTE: Refer to Environmental Standard Output Area of Benefit Map 5.

Project Site # 5) Oakwood Common Oxbow Restoration

Future Without Project Conditions:

The 1970's Flood Control Project straightened the natural river alignment and effectively created an oxbow wetland behind Oakwood Common and adjacent to the TPC Golf Course. Without a project, this historic river remnant will remain isolated from the normal hydrologic processes of the river. These isolated wetlands have partially filled with sediment (particularly the area adjacent to the TPC Golf Course) and would be expected to continue to fill with sediment. Currently, the two segments remaining of the original river alignment receive significant storm water discharge from direct runoff as well as via multiple storm water outfalls. Storm water from the TPC Golf Course empties into the wetland area to the north of Rotunda Drive. Storm water discharges directly into the oxbow wetland south of Rotunda from the Oakwood Common development and from the residential development to the northeast. Without this project there would continue to be no natural connection to the Rouge channel and little shoreline vegetation, therefore, water would remain stagnant with a high level of turbidity. Without this project these isolated segments of the Rouge River would continue to display poor water quality and provide only a fraction of the habitat quality and function that was historically eminent prior to its alteration due to the channelization of the Rouge River. Open water areas and associated shoreline that are present in the project area (i.e., Oakwood Common) would continue to be nearly devoid of emergent vegetation and display poor water quality conditions (i.e., highly turbid).

The existing forested portions of the project area are dominated by vegetation reminiscent of southeast Michigan floodplain forest. Common overstory and subcanopy species include Boxelder (*Acer negundo*), Eastern cottonwood (*Populus deltoids*), and American elm (*Ulmus americana*). These isolated pockets of forested wetlands occur north of the oxbow between Oakwood Common and St. Joseph's Catholic Church, and to the west of Rotunda Drive and the Congregational Church. Those areas that were altered due to past land management practices (i.e., land clearing, urban development) and vary with respect to the type of vegetative cover and degree of disturbance. These areas currently provide suitable habitat for a variety of songbirds and modest habitat suitability for waterfowl such as the wood duck. The existing area does provide habitat for amphibians, reptiles, waterfowl, wading birds and a limited number of fish species.

Future With Project Conditions:

The objectives of the proposed project include the successful restoration and enhancement of a historically isolated segment of the Rouge River that provides substantial aquatic and wetland habitat improvement, water quality treatment and passive recreation opportunities. The proposed alternatives emphasize a number of apparent and inherent principles that, in combination, optimize the effective implementation and long-term benefits to water quality and fish and wildlife habitat within the Rouge River Watershed.

Major project features include:

- Promotion of plant and animal species productivity and diversity within and between restored ecological community types;
- Enhancement of connectivity between adjacent ecological community types (i.e., wet meadow, high marsh, low marsh, open water habitat);
- Maximization of retention time and treatment volumes of storm water while maintaining the viability and effectiveness of restored fish and wildlife habitat types;
- The promotion of plant and animal species productivity and diversity within and between restored and enhanced ecological community types.

In order to accomplish these objectives, three alternative designs were considered:

Alternative 1 Habitat Restoration
Alternative 2 Habitat Restoration and Stormwater Treatment
Alternative 3 Complete Reconnection of Oxbow to Rouge River Channel

Project Site # 5) Alternative 1 - Oakwood Common Oxbow Restoration Habitat Restoration

This alternative proposes enhancement of the existing storm water pond area and remnant river channel north and south of Rotunda with emergent aquatics, shoreline grasses, and shrubs to enhance water quality of the ponded areas, increase habitat for fish and wildlife, and improve potential shoreline stabilization of the area. The habitat types to be restored include deepwater marsh, low marsh, and willow-covered shorelines. This project would provide improved habitat quantity and quality for numerous fish and wildlife species. Major benefits of this alternative include:

- Improved water quality. Excavation of sediment sumps and emergent vegetation plantings would remove sediment as storm water is routed thru the pond and oxbow remnant;
- Improved shoreline habitat and stabilization compared to the existing turf and exposed soil condition of the existing storm water pond;
- The restoration of emergent herbaceous wetland along the shoreline and within the remnant oxbow to maximize habitat value for waterfowl and wading bird species. In addition, several species of migrant songbirds, small mammals, and butterfly species would be benefited.

Standardized Output Units for Alternative #1 – Oakwood Common Oxbow Restoration, Habitat Restoration

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Wetlands	6.29	4	4	100.64
Upland & High Floodplains	27.32	2	3	163.92
Retained Streams	9.99	2	2	39.96
Total	43.6	X	X	304.52
With Project				
Wetlands	17.7	8	4	566.40
Upland & High Floodplains	15.91	2	3	95.46
Retained Streams	9.99	3	2	59.94
Total	43.6	X	X	721.8
Net Benefit	X	X	X	417.28

NOTE: Refer to Environmental Standard Output Area of Benefit Map 6.

Project Site # 5) Alternative 2 - Oakwood Common Oxbow Restoration Habitat Enhancements and Storm water Treatment

This alternative proposes the construction of a tiered wetland system that includes an upper tiered marsh that collects, retains and treats storm water from this watershed. This watershed is dominated by residential and urban land uses. A lower tiered marsh system would be constructed to hydraulically connect to the Rouge River.

The major features of this Alternative include:

- Creation of a series of interconnected, upper tiered, emergent herbaceous wetland systems that retain storm water for an appropriate duration to provide for substantial removal of nutrients and dissolved solids contained within storm water runoff from offsite land uses. The benefit is more substantial in Alternative 2;
- Interception and effective pretreatment of storm water runoff (i.e., removal of grease, oil, and suspended solids) through tiered storm water treatment wetlands prior to discharge to the Rouge River. The benefit is more substantial in Alternative 2;
- Creation of emergent herbaceous wetlands located within the storm water treatment tiers to maximize habitat for waterfowl and wading bird species;
- Creation of emergent herbaceous wetlands located on the lower tiers of this wetland system that is directly connected to the hydrologic and biological processes of the Rouge River. The benefits of this would include maximized reproduction, and cover and foraging habitat for fish and wildlife species;
- The restoration and enhancement of riparian shoreline and submerged habitat through the rehabilitation of eroded and sparsely vegetated shoreline conditions, and the inclusion of habitat features such as submerged rock outcrops, willow over-hangs and the re-creation of clusters of emergent aquatics (i.e., cover habitat) on select riparian shelf locations;
- The management of exotic and/or nuisance vegetation and animal species throughout the project area.

Alternative 2 will benefit fish resources within this segment of the Rouge River by providing life requisites (i.e., food and cover habitat) derived from the creation of deep marsh, and emergent shoreline habitat. Some fish species associated with the Rouge River that could benefit from this alternative include largemouth bass and a number of sunfish species.

In addition, the combined effect of the Alternative 2 elements (i.e., lower tier marsh and shoreline restoration) will provide habitat benefits to wading birds, waterfowl, minnow species, several butterfly species, migrant songbirds, and a number of small mammals. These benefits will be derived from the creation of deep and low marsh, and wet meadow, and the life requisites that they provide.

The upper tiers of this wetland system are comprised of deepwater habitat, deep and low marshes, and wet meadow and are designed to collect and treat storm water runoff. This series of wetlands will provide enhanced habitat for numerous wildlife species including wading birds, waterfowl, minnow species, and songbirds. During variable storm events, and due to the hydraulic connection to the Rouge River between the higher and lower tiered marshes, direct benefits (i.e., small minnow and macro- invertebrate foraging opportunities) to fish and wildlife species that currently utilize this segment of the river will occur.

Appropriate structural improvements will be used (i.e., rip-rap and geo-textile fabric) throughout the constructed wetlands and oxbow areas to prevent flood and erosion damage. The upper tier will be constructed at elevations to maintain water depth consistent with low marsh habitat (6”-18”). Elevations for the lower tier will be set to allow adequate flushing during smaller, more frequent storm events. Directly adjacent to the connection to the concrete channel will be areas of low and deep marsh habitat.

This alternative includes provisions for vehicular access such as a small bridge or stabilized berm, to the DWSD Hubbell-Southfield Facility and Tournament Players Club Golf Course maintenance building. This alternative will also hydraulically connect the two oxbow areas by installing a small diameter pipe, using jack and bore construction methods, under Rotunda Drive. The minor hydraulic connection would be installed between the two oxbow areas to provide additional storm water treatment capacity and varying levels of water in high and low marsh habitat north of Rotunda.

Standardized Output Units for Alternative 2 - Oakwood Common Oxbow Restoration Habitat Enhancements and Storm Water Treatment

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Wetlands	6.29	4	4	100.64
Upland & High Floodplains	26.48	2	3	158.88
Retained Streams	9.99	2	2	39.96
Total	42.76	X	X	299.48
With Project				
Wetlands	23.37	8	4	747.84
Upland & High Floodplains	9.4	2	3	56.4
Retained Streams	9.99	3	2	59.94
Total	42.76	X	X	864.18
Net Benefit	X	X	X	564.70

NOTE: Refer to Environmental Standard Output Area of Benefit Map 7.

Project Site # 5) Alternative 3 - Complete Reconnection of Oxbow to Rouge River Channel

During stakeholder meetings, participants indicated the desire to evaluate the possibility of completely reconnecting and restoring the historic river alignment in the area north and south of Rotunda Drive. Review of existing topographic data and as-built drawings of the River Rouge Flood Control Project in the vicinity of Oakwood Common indicates that the difference in elevation between the invert of the former river alignment, north of the concrete channel, and the invert of the concrete channel is approximately 12-15 feet. To provide hydraulic reconnection of this area with the channelized Rouge River, approximately 8-12 feet of the oxbow bottom would require dredging to provide adequate flow-through characteristics

The major features of this Alternative include:

- The excavation of the upstream and downstream portions of the oxbow to provide a complete hydrologic connection to the Rouge River. The excavation of these areas would be conducted to elevations that maximize connection to the Rouge River channel. Benefits would include restoration of submerged and emergent herbaceous and/or shrubby wetlands;
- Management of exotic and/or nuisance plant (NUS) species throughout the project area;
- The implementation of an aggressive long-term habitat management and maintenance program.

Following grading activities in specified areas; native upland, and wetland planting, and ground strata seeding will be implemented along the existing shoreline and the reconnected oxbow. These plantings will be integrated into the site layout to enhance recreational function, erosion control, storm water treatment efficiency, and the ecological function of on-site habitats.

The combined effect of this restoration project will enhance the existing habitat (i.e., shallow reservoir) to herbaceous and shrubby riparian habitat. This transformation will be accomplished by re-grading the entire oxbow length. Based upon the design hydrologic gradients developed by this alternative, a substantial area of deep and low marsh, and deep-water habitat will be restored. Numerous fish will benefit from this hydrologic reconnection and habitat enhancement including sport species like the largemouth bass, bowfin, and numerous sunfishes. This will be accomplished by providing many of the life requisites required by these species, as well as refuge from the poor habitat conditions that occur within this segment of the Rouge River. The successful restoration of this oxbow section will also benefit numerous other species such as benthic macro-invertebrates, amphibians, reptiles, waterfowl, wading and shoreline birds, migratory songbirds, and small mammals.

The main objective of this alternative would be to restore fish and wildlife habitats within the Rouge River Basin and to restore functioning riparian wetlands that were lost due to the channelization of the river. Secondary objectives include improvement of water quality, increased floodplain storage, and enhanced passive recreation opportunities.

Standardized Output Units for Alternative 3 - Complete Reconnection of Oxbow to Rouge River Channel

Habitat	Acres	Quality (1-10)	Importance (1 to 5)	Ecosystem Output
Without Project				
Wetlands	6.29	4	4	100.64
Upland & High Floodplains	24.16	2	3	144.96
Retained Stream	9.99	2	2	39.96
Total	40.44	X	X	285.56
With Project				
Wetlands	9.5	8	4	304
Upland & High Floodplains	9.4	2	3	56.4
Free Stream	11.55	7	3	242.55
Retained Stream	9.99	3	2	59.94
Total	40.44	X	X	662.89
Net Benefit	X	X	X	377.33

NOTE: Refer to Environmental Standard Output Area of Benefit Map 8.

Project Site # 6) Fordson Island Habitat Restoration

Future Without Project Conditions:

Preliminary evaluations of the island have been completed by Marathon Ashland and Wayne County to identify potential hazardous materials contamination. The shoreline is littered with abandoned boats and the island has been used for illicit solid waste disposal for a number of years. Surrounding land uses include concentrations of manufacturing and industrial facilities and high-density residential dwellings. It is likely the U.S. Department of Justice / USEPA consent decree with Marathon Ashland Oil will be implemented and include abandoning of the property, the removal of equipment, environmental assessments, and restoration.

Without this project the only work to restore the island will be that accomplished by Marathon Oil under its Consent Decree with the Department of Justice and U.S EPA. Without this project the island habitat would remain degraded of natural features due to urban development.

Future With Project Conditions:

The objectives of the Fordson Island project include the successful restoration of onshore and offshore habitat while providing improved public access and passive recreation opportunities for the local community.

The specific project features include:

- Removal of solid waste, construction materials, and abandoned boats along the shoreline of the island;
- Shoreline restoration with a herbaceous, emergent riparian shelf that is interspersed with pockets of willow overhangs. This would benefit the adjacent fishery and existing wading bird roost sites;
- Creation of upland and wet meadows, that are dominated by native grass and shrub species. Also, maximized passive recreation interaction with pollinator (e.g., bees, butterflies, etc.) and avian species;
- The restoration of, and enhancement of, forested and scrubby wetland that currently occurs on the island and provides habitat to wading bird species;
- Creation of reef habitat in deep water on the Rouge River side of the island to improve fishery opportunities in the immediate project area;
- Development of an interpretive trail to describe the importance of urban habitat restoration of fish and wildlife species;
- The management of exotic and/or nuisance vegetation and animal species throughout the project area.

Further investigations to determine Federal interest (substantial benefits to recreation or commercial navigation) in this project would look at the deepening of the channel west of Fordson Island (which is not in the Federally maintained channel along the Rouge River). A determination of whether commercial or recreational vessels will use and benefit from channel deepening should be made in the next phase, feasibility. An evaluation of "incremental depths" to dredge this channel would be needed to determine the greatest achievable benefits to be derived versus the cost. The channel around Fordson Island would most likely be dredged for use by recreational boaters and could be relatively shallow. Evaluation of various dredging depths incrementally is also necessary to determine locations for the greatest habitat benefits.

Standardized Output Units for Fordson Island Habitat Restoration

Habitat	**Acres**	**Quality (1-10)**	**Importance (1 - 5)**	**Ecosystem Output**
Without Project				
Free Stream	3.1	1	3	9.30
Retained Stream	12.46	1	2	24.92
Upland & High Floodplains	13.45	1	3	40.57
Total	29.01	X	X	74.57
With Project				
Free Stream (Oxbow Restored)	3.1	7	3	65.1
Retained Stream	12.46	3	2	74.76
Upland & High Floodplains	4.52	7	3	94.92
Wetlands	4.9	8	4	156.80
Riparian Zones	4.03	7	3	84.63
Total	29.01	X	X	476.21
Net Benefit	X	X	X	401.64

NOTE: Refer to Environmental Standard Output Area of Benefit Map 9.

6 (a). Study Methodologies

The metrics used to compare alternatives during the feasibility phase may include area of habitat, biomass of fish, species diversity, or value units. The MDNR and others have documented conditions on the Rouge River both upstream and downstream of the project areas. This data will be used to predict the changes expected to occur in the river. The metrics associated with expected benefits will be established in consultation with the MDNR and the U.S. F&WS.

Metrics used to compare alternatives during the feasibility phase should include a procedure that is:

a) Sensitivity to changes in the quality and quantity of habitat as a result of the proposed project.
b) Responsiveness to regional resource priorities.
c) Extent of public interest (i.e., economically or politically important).

A system based on Habitat Units (HU) would be a appropriate. HU incorporates both habitat quality for multiple habitat types (for both wetlands and uplands) and habitat quantity (acres). In this case, evaluation species models that depict habitat quality would be selected, as outlined above, to determine habitat quality. As part of the evaluation procedure, these habitat values would be combined with habitat quantity to yield both "without project" and "with project" comparisons. The advantage of this procedure is that it can be designed to analyze predicted changes for habitat elements that are important to species that use portions of multiple habitat types as well as those that have "within habitat " critical requirements.

6 (b). Conclusions from the Preliminary Screening.

The preliminary screening of measures indicated that at least one cost effective alternative exists for each study site to address watershed problems and opportunities. A fish passage project at the Henry Ford Estate would allow fish to migrate further up and down the river. A high flow channel and erosion protection at Kingfisher Bluff would restore habitat and protect the local community college parking lot. Oxbow restoration at Oakwood Common would open an isolated portion of the original river channel to the main river channel. Storm water treatment at the TPC Golf Course and the Michigan Avenue/Evergreen would improve the quality of water draining back into the river as well as restore habitat. The Fordson Island projects would restore the island to a more original condition and serve as an island park in a heavily urbanized area. The Gateway Area is largely impacted by the flood control project that has straightened and channelized the river.

7. REAL ESTATE

The No Federal Action Alternative does not require the non-Federal Sponsor to provide lands, easements, rights-of-way, relocations, and disposal areas.

The other alternatives and sub-alternatives require the non-Federal Sponsor to provide lands, easements, rights-of-way, relocations, and disposal areas (LERRD'S). The six areas of ecosystem restoration are the Henry Ford Estate Dam (fish ladder), Kingfisher Bluff, Michigan Avenue/Evergreen Road, Tournament Players Golf Course, Oakwood Common, and Fordson Island. Although varying somewhat in design, all areas involve restoration of aquatic or wildlife habitats.

During the Feasibility phase, the Real Estate Division will develop detailed information on the Project's real estate requirements, participate in developing Project alternatives, determine the sponsor's legal and financial capabilities, prepare a real estate cost estimate based on a gross appraisal and create a Real Estate Plan for the decision document.

The following table summarizes the reconnaissance level estimate of real estate property requirements:

Rouge River Real Estate Cost Estimate

Study Site	Permanent Features (Acres)	Access Roads (Acres)	Work & Storage Areas (Acres)
Henry Ford Estate Dam / Fish Passage	0.3	2.4	0.9
# sites/unit/discount %	2.5 x $50K x 50%	20 x $50K x 50%	7.5 x $50K x 50% x 10%
Estimated Cost	$62,500	$500,000	$18,750 Rental Per Annum
Kingfisher Bluff	2	2.4	0.9
# sites/unit/discount %	17 x $50K x 20%	20 x $50K x 50%	7.5 x $50K x 10%
Estimated Cost	$170,000	$500,000	$18,750 RPA
Mich. Ave. / Evergreen Road (Alternative 2)	34.4	0.1	0.9
# sites/unit/discount %	287 x $50K x 15%	1 x $50K x 100%	7.5 x $50K x 10%
Estimated Cost	$2,152,500	$50,000	$18,750 RPA
Tournament Players Golf Course	15.9	0.1	0.9
# sites/unit/discount %	133 x $50K x 15%	1 x $50K x 100%	7.5 x $50K x 10%
Estimated Cost	$997,500	$50,000	$18,750 RPA
Oakwood Common (Alternative 1)	17.7	0.1	0.9
# Sites/unit/discount %	148 x $50K x 15%	1 x $50K x 100%	7.5 x $50K x 10%
Estimated Cost	$1,110,000	$50,000	$18,750 RPA
Fordson Island	9	0	0.9
Acres x Unit Rate	9 x $130K		9 acres x $130K
Estimated Cost	$1,170,000		$11,700 RPA
Total Estimated Cost	**$5,662,500**	**$1,150,000**	**$105,450 Rental Per Annum**

GRAND TOTAL	**$6,812,500** **+$ 105,450** **Rental Per Annum**	
ROUNDED	**$6,800,000 +105,500**	**Rental Per Annum**

8. FEDERAL INTEREST

The authority for this study was established under Section 102 of the River and Harbor Act of 1966. There is a strong Federal interest in developing a feasibility study for ecosystem restoration, fish passage, water quality improvement, oxbow restoration, and bank stabilization of the Rouge River Gateway Area. Cost effective solutions have been identified in this reconnaissance report. The comprehensive approach to the preparation of watershed feasibility studies includes investigations related to high priority mission areas (including flood control and ecosystem restoration, recreation, recreational navigation, water quality, and shoreline protection). All have a Federal interest. The primary product of the Gateway Area Feasibility Study will be a decision document establishing, to a higher degree, the Federal interest to proceed to the final phase, which is project implementation (plans & specifications and construction). Wayne County has expressed its interest in becoming a cost sharing non-Federal sponsor of the proposed Gateway Area Feasibility Study.

9. PRELIMINARY FINANCIAL ANALYSIS

As the identified local sponsor for the Rouge River Gateway Area Feasibility Study, Wayne County is also currently a partner on the Rouge River Channel Restoration (Upper and Lower) Section 1135 Feasibility Study. Wayne County has provided a letter of intent stating a willingness to pursue the Rouge River Gateway Area Feasibility Study and to share in its cost.

10. ASSUMPTIONS AND EXCEPTIONS

10 (a). Rouge River Gateway Area Feasibility Phase Assumptions:

- The Rouge River Channel Restoration (Upper and Lower) Section 1135 Project will be implemented. This is for channel restoration along 2.3 miles of flood control project in the Gateway Area of the river, from Michigan Avenue to I-94. An ongoing feasibility study is evaluating the feasibility of removing 2.3 miles of concrete lined channel from Michigan Avenue to I-94, which is within the Gateway Area and represents approximately one-half of the Corps flood control project completed in the mid-1970's. The flood control project reduced the channel length from 5.8 miles to 4.2 miles by straightening and realignment. **Thru Congressional direction** this study has been divided into 2 separate Section 1135 projects, the first section (Upper Section) is from Michigan Avenue to Rotunda Drive (1.4 miles) and the second section (Lower Section) is from Rotunda Drive to I-94 (0.9 miles).

- The Henry Ford Museum & Greenfield Village Section 1135 Oxbow Restoration/Reconnection Preliminary Restoration Plan was approved in July 2003. It is assumed this project will be implemented.

- Shoreline restoration methods and techniques developed for the Rouge River Section 1135 Channel Restoration Project will consider the proposed Gateway projects in this report and visa versa.

- An incremental analysis will be performed as part of the evaluation of ecosystem restoration alternatives.

- Appropriate historical recordation will be coordinated with the Michigan State Historical Preservation Office.

- Hydraulic modeling for all six (6) Gateway Area Project Sites will be accomplished during the next recommended phase, which is the Gateway Area Feasibility Study. Separately, the hydraulic modeling for the Rouge River Channel Restoration (Upper and Lower) Section 1135 will be accomplished in that study for removal of 2.3 miles of paved river channel.

- A detailed hydraulic evaluation will be required to confirm the flood elevation, flow split, and potential scour impacts during the Gateway Area Feasibility Study. A detailed geo-technical evaluation will be required during the Gateway Area Feasibility Study phase to determine subsurface conditions and investigate slope stability and earth retention concerns.

10 (b). Supplemental Watershed Management Plan Assumptions:

- It is assumed that funding for the continued development of a Supplemental Watershed Management Plan will be provided thru Congressional direction. This plan will focus on flow management, watershed wide dams, and the Johnson Creek Cold Water Fishery. As the Supplemental Watershed Management Plan proceeds, any identified projects, which appear to have a Federal interest, will be evaluated at that time and a new decision document prepared or a modification to this reconnaissance report will be made.

- Policy Exceptions and Streamlining Initiatives: The study will be conducted in accordance with the Principles and Guidelines and the Corps of Engineers regulations. No exceptions to established guidance have been identified at this time.

11. FEASIBILITY PHASE MILESTONES

Task Description	Duration (months)	Schedule
PMP and FCSA		
• Project Management Plan • Feasibility Cost Share Agreement	5	PMP: 1 Nov 2003 – 31 Dec 2003 FCSA: 1 Jan 2004 – 30 Mar 2004
Milestone F1 - Initiate Feasibility Study		1 Apr 2004
Milestone F2 - Public Workshop		1 Jun 2004
Milestone F3 - Feasibility Scope Meeting		15 Aug 2004
Data Collection and Field Work • Scope of Work • Topographical Survey • Geo-technical Investigations • NEPA Coordination • Sediment Sampling and Analysis • Habitat Surveys • Cultural Resource Coordination • Hydraulic Analysis	6	Start: 1 April 2004 Finish: 30 September 2004
Evaluation of Alternatives • Formulate and Evaluate	6	1 Apr 2004 – 30 Sept 2004
Preliminary Design Analysis with Construction Cost Estimates	3	1 Oct 2004 - 30 Dec 2004
Preliminary Environmental and Economic Analysis	5	1 Oct 2004 - 28 Feb 2005
Compare Alternatives	1	1 Mar 2005 – 30 Mar 2005
Select Alternative	1	1 Apr 2005 – 30 Apr 2005
Milestone F4-Alternative Review Conf		15 May 2005
Final detailed Design Analysis on Selected Alternative with Construction Cost	2	1 May 2005 – 30 June 2005
Final Economic/Environmental Analysis	1	1 Jul 2005 – 30 Jul 2005
Gross Appraisal: Lands, Easements, ROW	2	1 Jul 2005 – 30 Sep 2005
Milestone F5 - Draft Feasibility Report and NEPA document (EA or EIS)	4	1 Oct 2005 – 30 Jan 2006
Independent Technical Review	1	1 Feb 2006 – 28 Feb 2006
Incorporate ITR Comments	1	1 Mar 2006 – 30 Mar 2006
30-Day Public/Sponsor Review (Note 1)	1	1 Apr 2006 – 30 Apr 2006
Milestone F6 – Public Meeting		30 Apr 2006
Incorporate/Address Public Comments	1	1 May 2006 – 30 May 2006
Local Sponsor Letter of Intent	1	1 Jun 2006 – 30 Jun 2006
Milestone F7- Feasibility Review Conf		30 Jun 2006
NEPA Finalized/FONSI signed by District Engineer	3	1 Jul 2006 - 30 Sep 2006
Feasibility Report Finalized and Signed by District Engineer	2	1 Oct 2006 - 30 Nov 2006
Milestone F8 - Submit Feasibility Report and NEPA to HQ for Approval		1 Dec 2006
Headquarters Approval by LRD	4	1 Dec 2006 – 30 Mar 2007
Total Time Requirement	**36 months**	

Note 1: Schedule assumes an Environmental Assessment (EA) will be prepared. If an Environmental Impact Statement (EIS) is necessary, then there would be a Draft and Final Public Review Period, which would lengthen the completion schedule.

12. FEASIBILITY PHASE COST ESTIMATE - ROUGE RIVER GATEWAY AREA

WBS#	Task Description	Cost
JA000	Surveys and Mapping except Real Estate	$ 253,000
JAB00	Hydrology and Hydraulics Studies/Report	125,000
JAC00	Geo-technical Studies/Report	12,000
JAE00	Engineering and Design Analysis Report	307,000
JB000	Socioeconomic Studies	90,000
JC000	Real Estate Analysis/Report	35,000
JD000	Environmental Studies/Report (Except USF&WL)	270,000
JE000	Fish and Wildlife Coordination Act Report	50,000
JF000	HTRW Studies/Report (Soil and Sediment Testing)	120,000
JG000	Cultural Resources Studies/Report	160,000
JH000	Cost Estimates	76,000
JI000	Public Involvement Documents	20,000
JJ000	Plan Formulation and Evaluation	90,000
JK000	Draft Report Documentation	100,000
JL000	Final Report Documentation	109,000
JM000	Washington Level Approval	50,000
JN000	Technical Review Documents	90,000
JN000	Project Management and Technical Coordinator	75,000
JP000	Management Documents	25,000
	Supervision and Administration (7%)	144,000
	Contingencies (10%)	206,000
	Total	$ 2,407,000
	TOTAL FEASIBILITY STUDY COST ESTIMATE	**$ 2,400,000**

The total project costs for all phases of work (feasibility, PED, and construction are cost shared as follows:

Feasibility Phase	50% Federal	50% Non-Federal
Planning, Engineering and Design (PED) (See Note 1)	65% Federal	35% Non-Federal
Construction Phase (See Note 2)	65% Federal	35% Non-Federal

Note 1: PED phase includes preparation of Plans and Specifications. Only 25 percent of the non-Federal share of PED is collected at the start of PED. The remaining 10 percent is collected during the Construction Phase.

Note 2: Included in the Construction Phase cost is the value of lands, easements, rights-of-way, relocations, and disposal areas (LERRDS).

Total Cost for Feasibility Phase:

Feasibility Phase Cost

Phase	Total	Federal Share 50%	Non-Federal Share 50% (Note 1)
Feasibility Phase	**$ 2,400,000**	**$ 1,200,000**	**$ 1,200,000**

Note 1: Up to 100 percent of the non-Federal share of feasibility phase costs can be provided as Work-in-Kind (WIK). WIK would include the sponsor completing some of the described tasks needed to complete the feasibility study. Prior to initiation of the feasibility phase a Project Management Plan (PMP) will be prepared to identify the level of WIK proposed by the local sponsor. The PMP will identify in greater detail the described tasks and associated costs as outlined in Section 12, Feasibility Phase Cost Estimate, of this report. The PMP will be the basis for the Feasibility Study Cost Share Agreement (FCSA). The FCSA is the formal agreement between the Federal Government and the non-Federal sponsor for sharing the costs of the feasibility study.

Total Costs for PED, Construction and LERRDS for each Site

Site / Account	Total Cost (PED, Construction, and LERRDS)
Site # 1 – Henry Ford Estate Dam Modification for Fish Passage	
01 Real Estate (LERRDS)	$ 581,000
19 Buildings, Grounds & Utilities (Construction)	800,000
30 Engineering and Design	86,000
31 Construction Management	56,000
Subtotal Site # 1 - Henry Ford Estate Dam Modification for Fish Passage	$ 1,523,000
Site # 2 – Kingfisher Bluff Stabilization, Erosion Control, Habitat Restoration	
01 Real Estate (LERRDS)	$ 689,000
19 Buildings, Grounds & Utilities (Construction)	1,240,000
30 Engineering and Design	86,000
31 Construction Management	87,000
Subtotal Site # 2 - Kingfisher Bluff Stabilization, Erosion Control, Habitat Restoration	$ 2,102,000
Site # 3 – Michigan Avenue and Evergreen Road Storm Water Treatment and Water Quality Improvement (Alternative # 1 – Habitat Restoration) (See Note 1)	
01 Real Estate (LERRDS)	$ 2,221,000
19 Buildings, Grounds & Utilities (Construction)	334,000
30 Engineering and Design	87,000
31 Construction Management	23,000
Subtotal Site # 3 - Michigan Avenue and Evergreen Road Storm Water Treatment and Water Quality Improvement (Alternative # 1 – Habitat Restoration) (See Note 1)	$ 2,665,000
Site # 4 – Tournament Players Golf Course Storm Water Treatment and Wetland Restoration	
01 Real Estate (LERRDS)	$ 1,066,000
19 Buildings, Grounds & Utilities (Construction)	4,350,000
30 Engineering and Design	97,000
31 Construction Management	305,000
Subtotal # 4 - Tournament Players Golf Course Storm Water Treatment and Wetland Restoration	$ 5,818,000

Site # 5 – Oakwood Common Oxbow Restoration, Habitat Restoration (See Note 2)	
01 Real Estate (LERRDS)	$ 1,179,000
19 Buildings, Grounds & Utilities (Construction)	1,304,000
30 Engineering and Design	85,000
31 Construction Management	91,000
Subtotal # 5 - Oakwood Common Oxbow Restoration, Habitat Restoration (See Note 2)	$ 2,659,000
Site # 6 – Fordson Island Habitat Restoration	
01 Real Estate (LERRDS)	$ 1,182,000
19 Buildings, Grounds & Utilities (Construction)	428,000
30 Engineering and Design	99,000
31 Construction Management	30,000
Subtotal # 6 - Fordson Island Habitat Restoration	$ 1,739,000
Total Costs (PED, Construction, LERRDS)	**$ 16,506,000**

NOTES:

#1) Alternative 1 (Habitat Restoration) was selected for the Michigan Avenue and Evergreen Road project site because its ratio of total cost to net Standardized Output Unit benefits was the lowest.

#2) Alternative 1 (Habitat Restoration) was selected for the Oakwood Common Oxbow Restoration project site because its ratio of total cost to net Standardized Output Unit Benefits was the lowest.

Federal and Non-Federal Share of Total Project Costs for PED and Construction (including LERRD's):

Phase / Site	Total Cost	Federal Share (65%)	Non-Federal Share (35%)
PED and Construction Phase (including LERRD's)			
Site # 1 – Henry Ford Estate Dam Modification for Fish Passage	$ 1,523,000	$ 990,000	$ 533,000
Site # 2 – Kingfisher Bluff Streambank Stabilization, Erosion Control, Habitat Restoration	$ 2,102,000	$ 1,366,000	$ 736,000
Site # 3 – Michigan Avenue and Evergreen Road Storm Water Treatment and Water Quality Improvement (Alternative 1)	$ 2,665,000	$ 1,732,000	$ 933,000
Site # 4 – Tournament Players Golf Course Storm Water Treatment and Wetland Restoration	$ 5,818,000	$ 3,782,000	$ 2,036,000
Site # 5 – Oakwood Common Oxbow Restoration, Habitat Restoration (Alternative 1)	$ 2,659,000	$ 1,728,000	$ 1,123,000
Site # 6 – Fordson Island Habitat Restoration	$ 1,739,000	$ 1,130,000	$ 609,000
TOTAL PED and Construction Phase (including LERRD's)	**$ 16,506,000**	**$ 10,728,000**	**$ 5,778,000**

Operation and Maintenance (O & M) Costs:

O & M costs are 100% a non-Federal responsibility. O & M costs are not included in the 35 percent share of non-Federal total project costs. The estimate O & M costs (annual) are provided below. The O & M costs are estimated to be 1 percent of the construction cost without contingencies:

Site	O & M Cost
Site # 1 - Henry Ford Fish Passage	$ 6,700
Site # 2 - Kingfisher Bluff	$ 9,500
Site # 3 – Michigan Avenue/Evergreen Road	$ 2,800
Site # 4 – TPC Golf Course	$ 33,500
Site # 5 – Oakwood Common	$ 10.900
Site # 6 – Fordson Island	$ 3,300

13. VIEWS OF OTHER RESOURCE AGENCIES

Multiple stakeholder meetings were held in development of the reconnaissance study. Stakeholders and meeting attendees have included: Wayne County, Oakland County, Washtenaw County, Michigan Department of Natural Resources, Michigan Department of Environmental Quality, U.S. Fish and Wildlife Agency, and representatives of each of the seven (7) Subwatershed Advisory Groups (Upper Rouge, Main 1-2, Lower Rouge, Middle One, Main 3-4, Lower One, Middle 3).

All of the stakeholders and meeting attendees have actively participated in problem identification and support future restoration efforts in support of the Rouge River.

The Rouge River has had, and continues to have, the attention of a wide variety of Federal, state, and local agencies. Summaries of the views of these various agencies and/or projects are as follows:

- **Rouge River National Wet Weather Demonstration Project.** In 1991 Congressmen John Dingell introduced legislation funding for the Rouge River National Wet Weather Demonstration Project. This cooperative effort has been supported by multi-year federal grants from the USEPA. The local communities have provided additional funding. Wayne County is the lead agency in development of this project.

- **U.S. Environmental Protection Agency: Area of Concern.** USEPA has designated the Rouge River as an Area of Concern (AOC) in the Great Lakes Basin.
- **Rouge River Remedial Action Plan.** The original, nine-volume RAP is a long-term cleanup plan for the River and was completed in 1989. An update on the RAP was accomplished in 1994 and a progress report was published in 1998. This reconnaissance study fits into the objective of the Rouge River RAP. A long-term goal of the RAP is to eliminate all sources of impairments and restore the beneficial uses of the Rouge River. Included in the RAP identified use impairments are: loss of fish and wildlife habitat; minimizing the negative human effects on fish and wildlife habitat; identify and protect the remaining relatively healthy headwaters, biotic refuges, riparian areas, floodplains and smaller, intact river habitats throughout the watershed; degradation of fish populations, benthos, and wildlife populations; and restrictions on fish consumption.
- **Great Lakes Commission.** The Great Lakes Commission has issued a seven-point strategy to revitalize the Great Lakes.
- **Automobile National Heritage Area (ANHA).** The Rouge River Corridor is one of six corridors in the ANHA. It recognizes the area as thematically cohesive as it centers on the Rouge River, the Ford Family, Ford World Headquarters, Rouge Plan, Henry Ford Estate, and the Henry Ford Museum and Greenfield Village. A challenge in the area is to balance the enhancement and interpretation of rich cultural resources with the preservation of the river's valuable natural resources.
- **Southeast Michigan Greenways Initiative.** In 1998, the Rails-to-Trails Conservancy (RTC) developed a vision for Southeast Michigan Greenways. RTC's Michigan Field Office and the National Parks Service River, Trails, and Conservation Assistance Program, as well as many other local and national entities, both public and private, assisted in the development. The plan is for an interconnected greenway system for the seven counties in southeast Michigan.

14. POTENTIAL ISSUES AFFECTING INITIATION OF FEASIBILITY PHASE

Continuation of the Rouge River Watershed Reconnaissance Study (Section 905(b)) into a cost-shared feasibility phase is contingent upon an executed Feasibility Cost Share Agreement (FCSA). This is scheduled for March 2004. Since 1991, the identified local sponsor, Wayne County, Michigan has made an extensive commitment to conduct the Rouge River National Wet Weather Demonstration Project throughout the watershed. The mission of the Wet Weather Demonstration Project is to demonstrate effective solutions to water quality problems facing an urban watershed highly impacted by wet weather, and to develop potential solutions and implement projects, which will lead to the restoration of water quality in the Rouge River.

15. RECOMMENDATIONS

The Detroit District has concluded that the current ecological conditions of the Rouge River are impaired. There is a lack of native habitat in the flood control area along with a lack of plant, animal, and fishery diversity. Cost effective solutions have been identified for habitat restoration. There is a Federal interest in possible solutions and a non-Federal sponsor has been identified to share in the costs of a feasibility study.

The Institutional significance of the environmental resource is represented by the continued interest and ongoing projects undertaken by the following agencies: the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Wayne County thru the Rouge River National Wet Weather Demonstration Project, the U.S. Environmental Protection Agency, and the Great Lakes Commission. In addition, each of the seven Subwatershed Advisory Groups have expressed Public support for this study.

I recommend that the specific fish passage, habitat degradation, erosion, water quality, oxbow restoration, and bank stabilization problems and opportunities identified within the Rouge River Gateway Area be further evaluated in a feasibility study. This feasibility study should proceed as authorized under Section 102 of the River and Harbor Act of 1966.

9/24/03
Date

Thomas H. Magness
Lieutenant Colonel, U.S. Army
District Engineer

FIGURES

Rouge River Watershed

FIGURE 1
ROUGE RIVER WATERSHED
LOCATION MAP

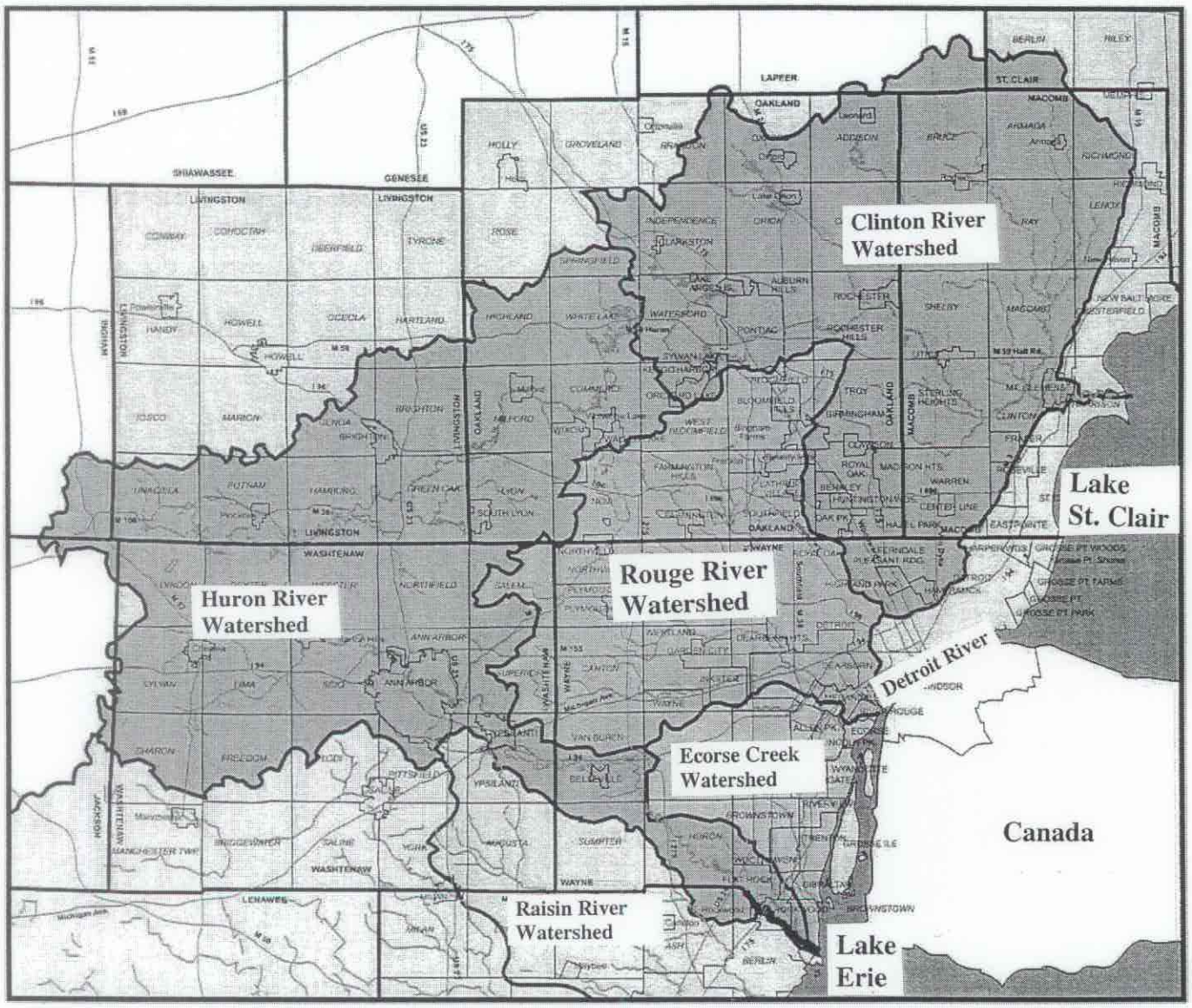


FIGURE 2
ROUGE RIVER WATERSHED
METROPOLITAN AREA

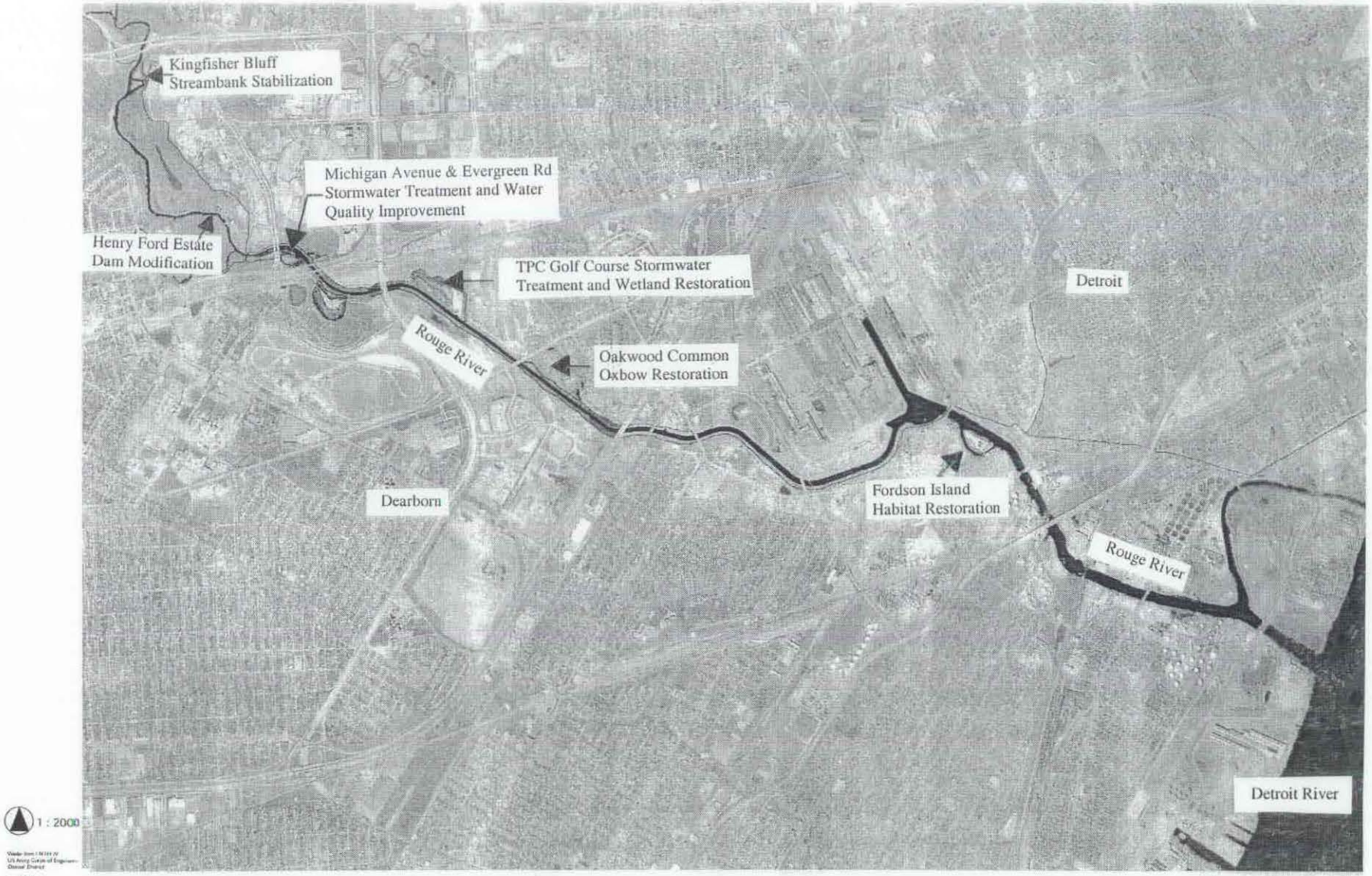


FIGURE 3
ROUGE RIVER GATEWAY AREA
6 PROJECT SITES

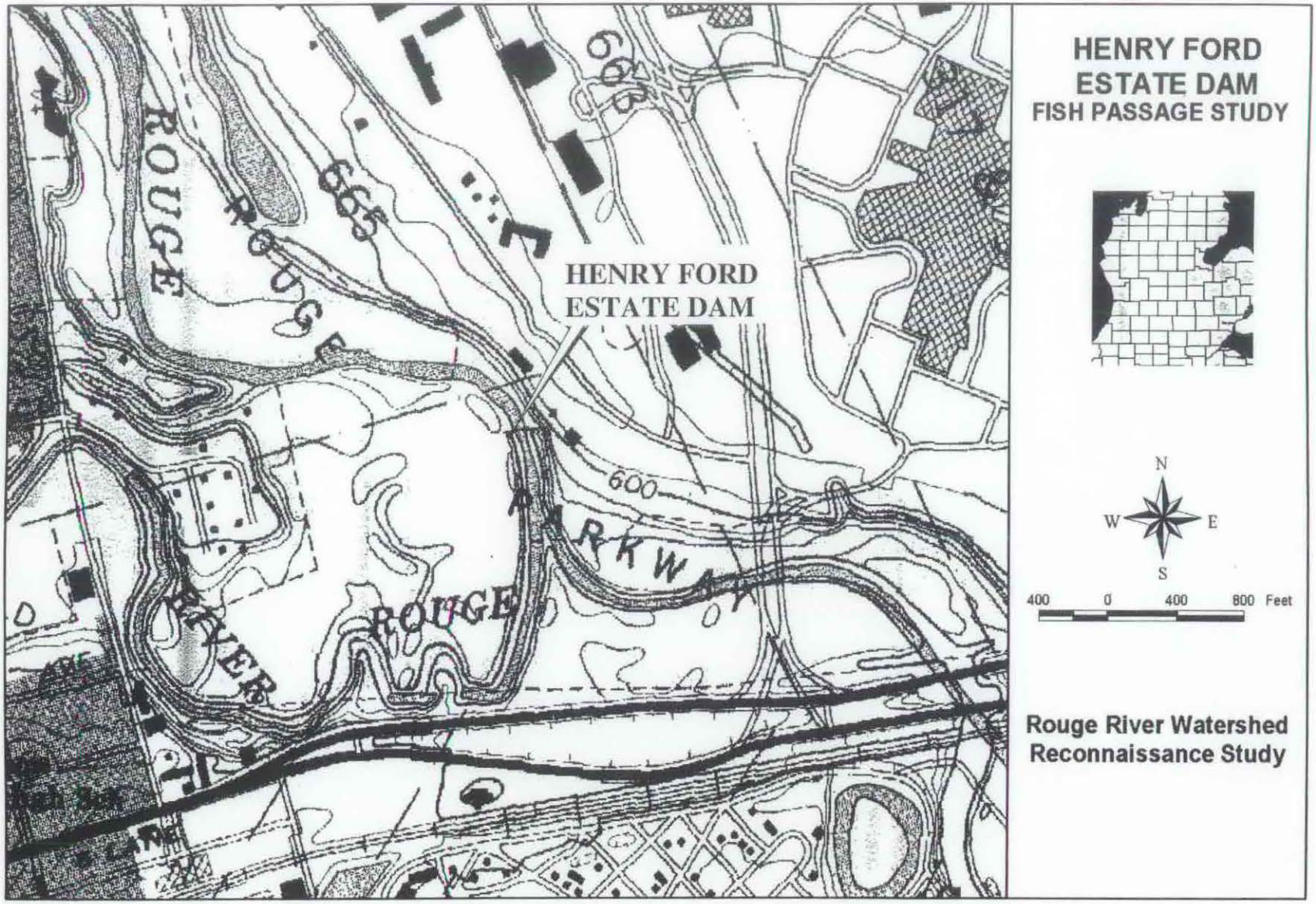


FIGURE 4
HENRY FORD ESTATE FISH PASSAGE
SITE LOCATION MAP

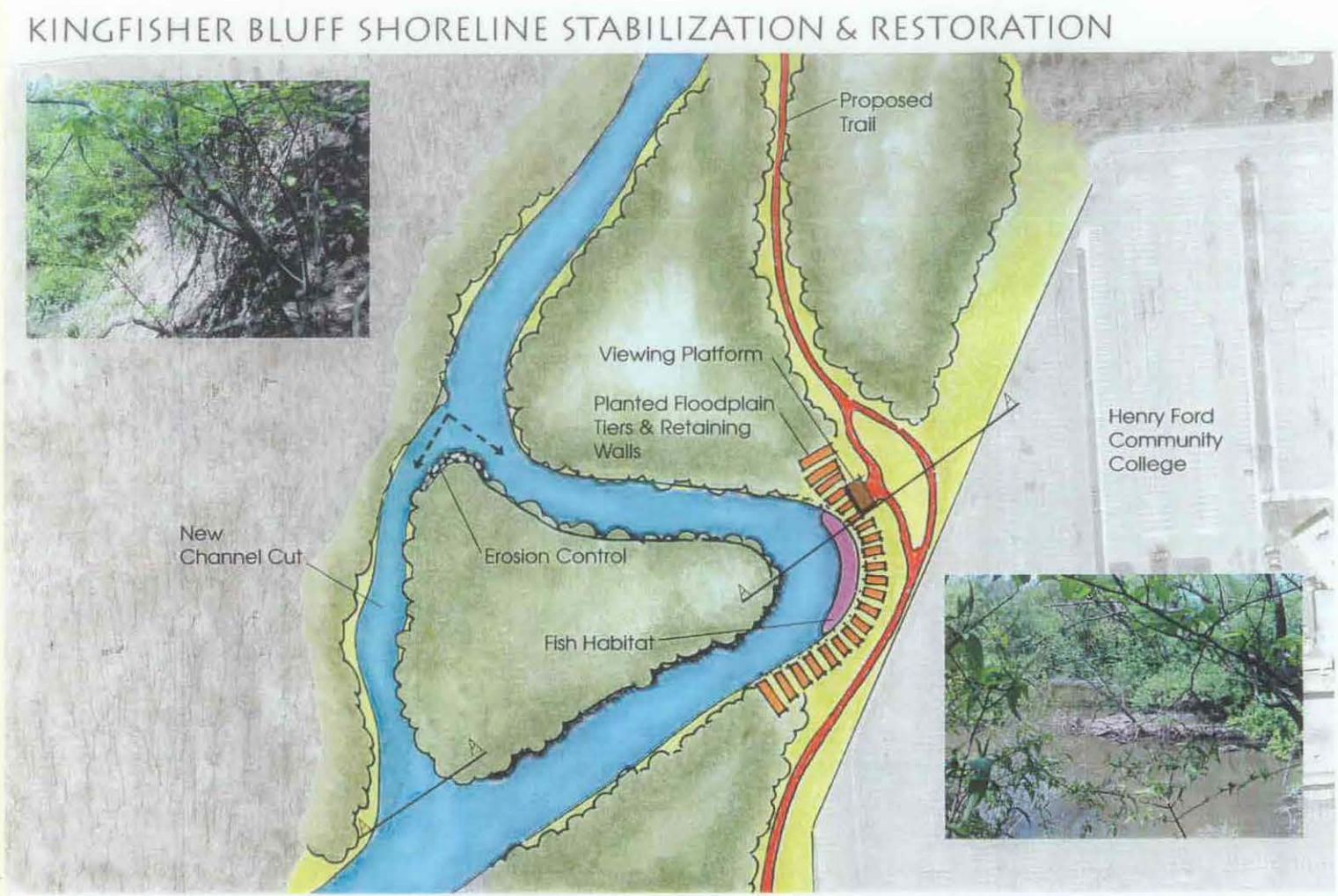
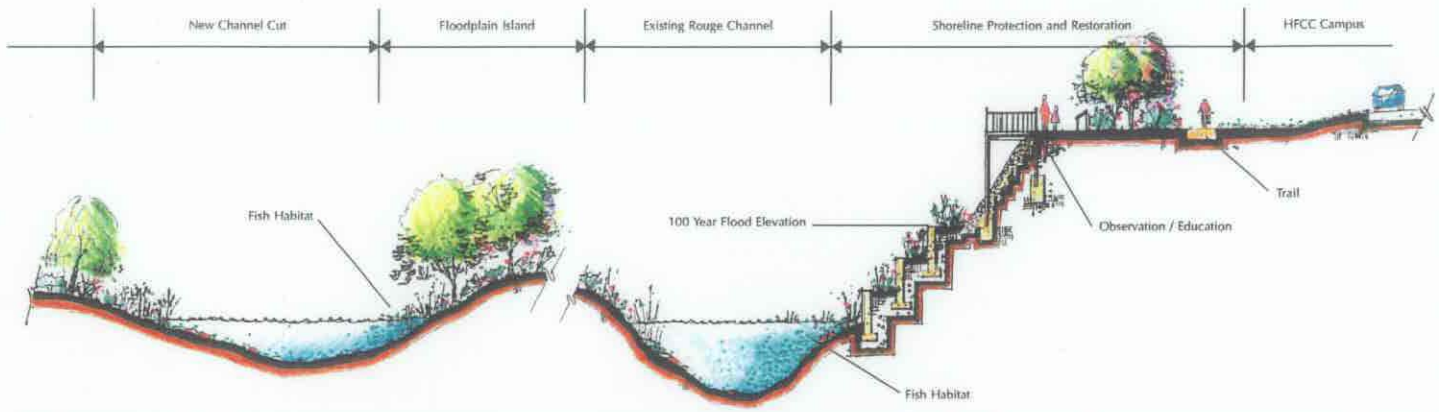


FIGURE 5
KINGFISHER BLUFF
PLAN OF RESTORATION AREA

KINGFISHER BLUFF SHORELINE EROSION AND STABILIZATION



Section A-A

FIGURE 6
KINGFISHER BLUFF
CROSS-SECTION OF RESTORATION AREA

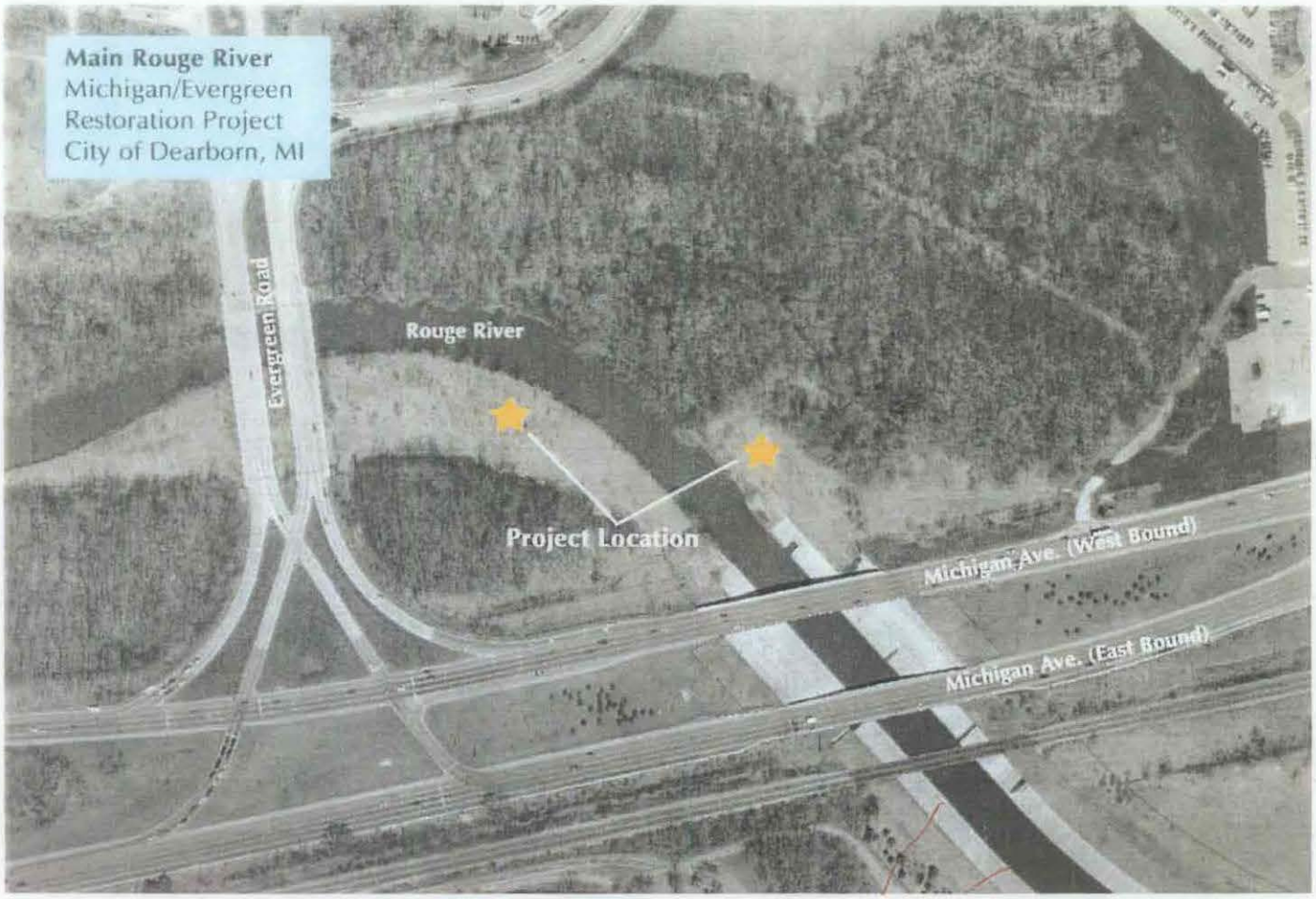


FIGURE 7
MICHIGAN AVENUE / EVERGREEN ROAD
PLAN OF RESTORATION AREA

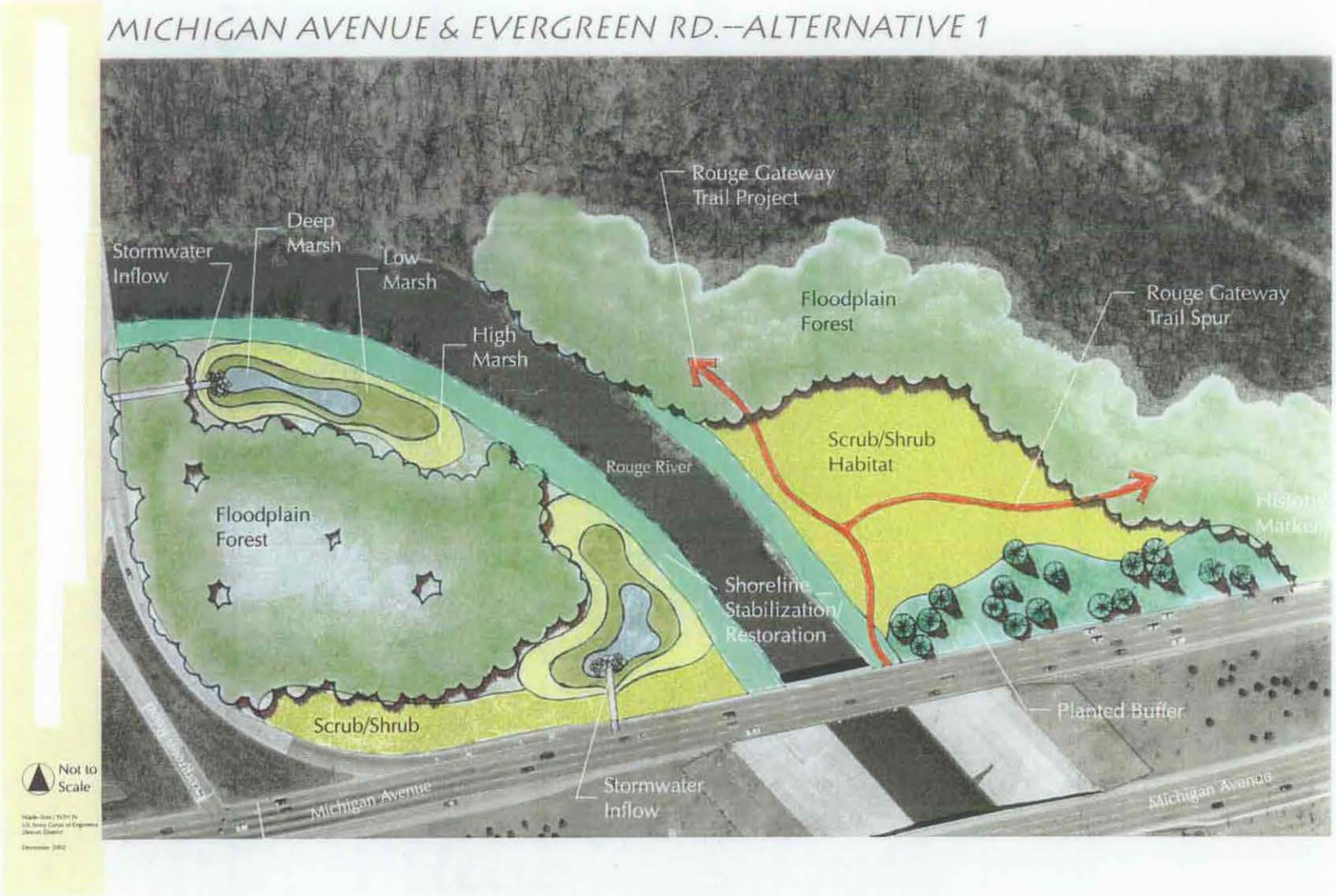


FIGURE 8
MICHIGAN AVENUE / EVERGREEN ROAD
PLAN OF ALTERNATIVE 1

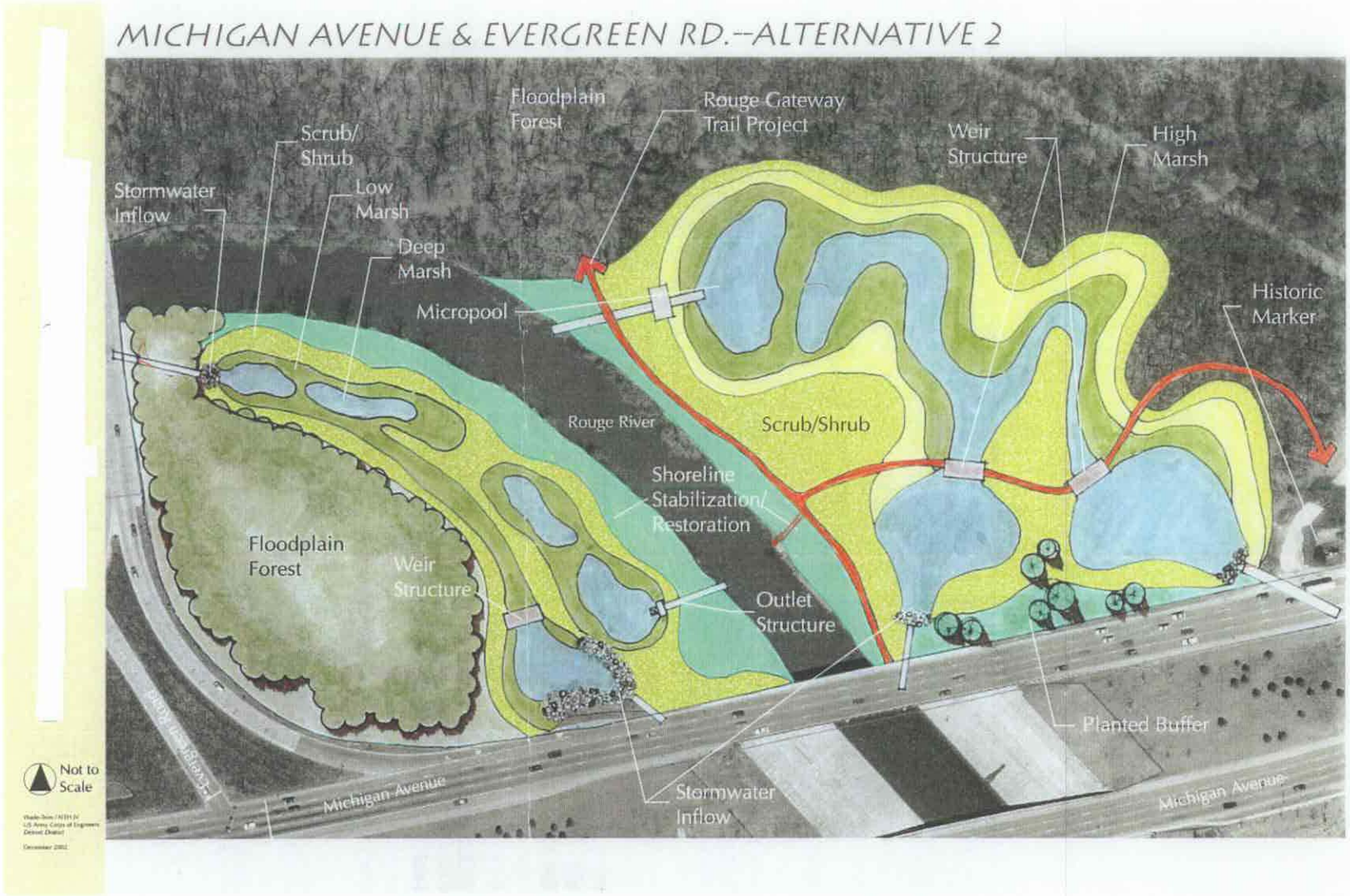


FIGURE 9
MICHIGAN AVENUE / EVERGREEN ROAD
PLAN OF ALTERNATIVE 2

FIGURE 10
TPC GOLF COURSE
SITE LOCATION PLAN

FIGURE 11
TPC GOLF COURSE
PLAN OF RESTORATION AREA

FIGURE 12
OAKWOOD COMMON
SITE LOCATION PLAN

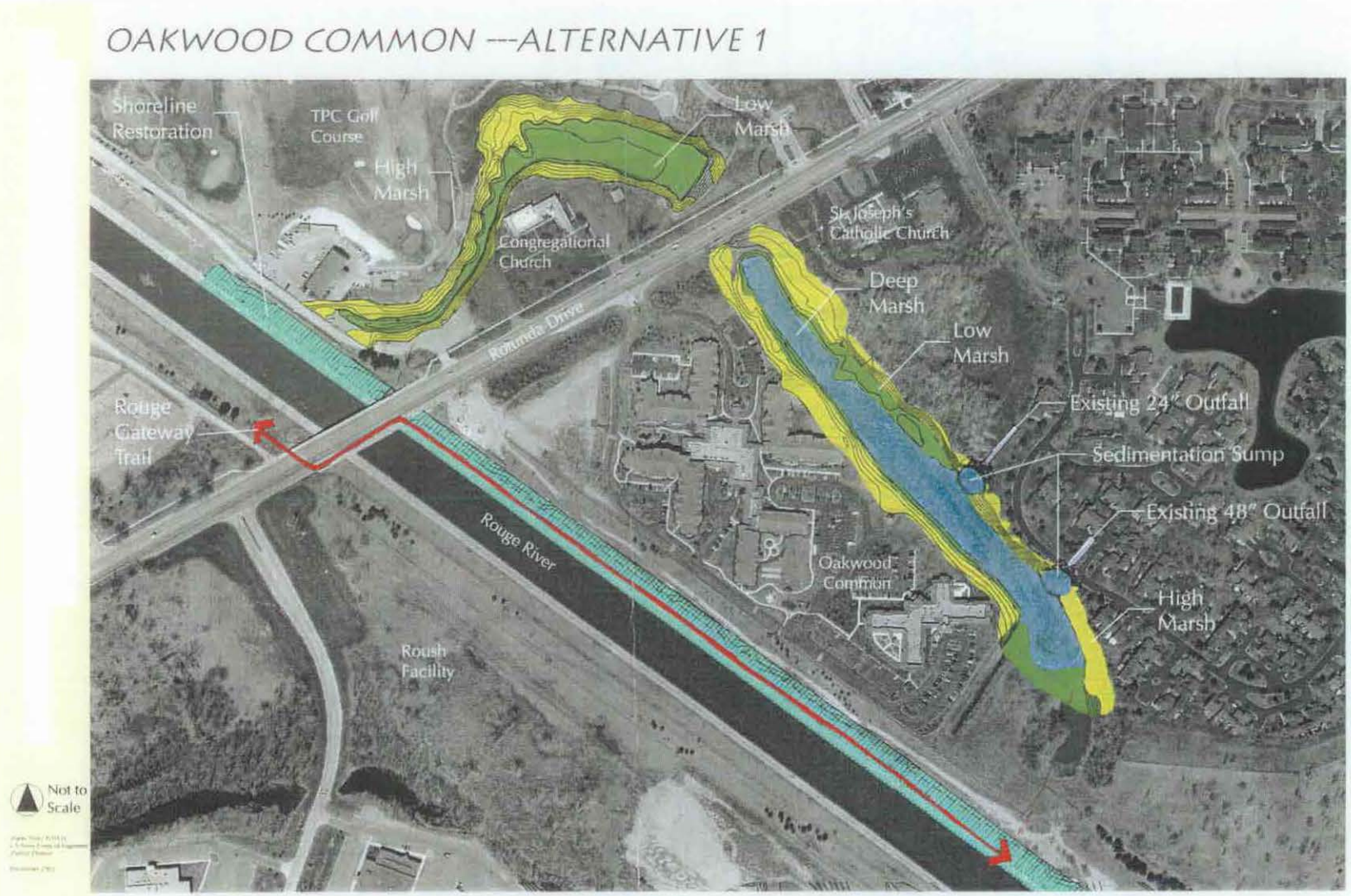


FIGURE 13
OAKWOOD COMMON
PLAN OF ALTERNATIVE 1

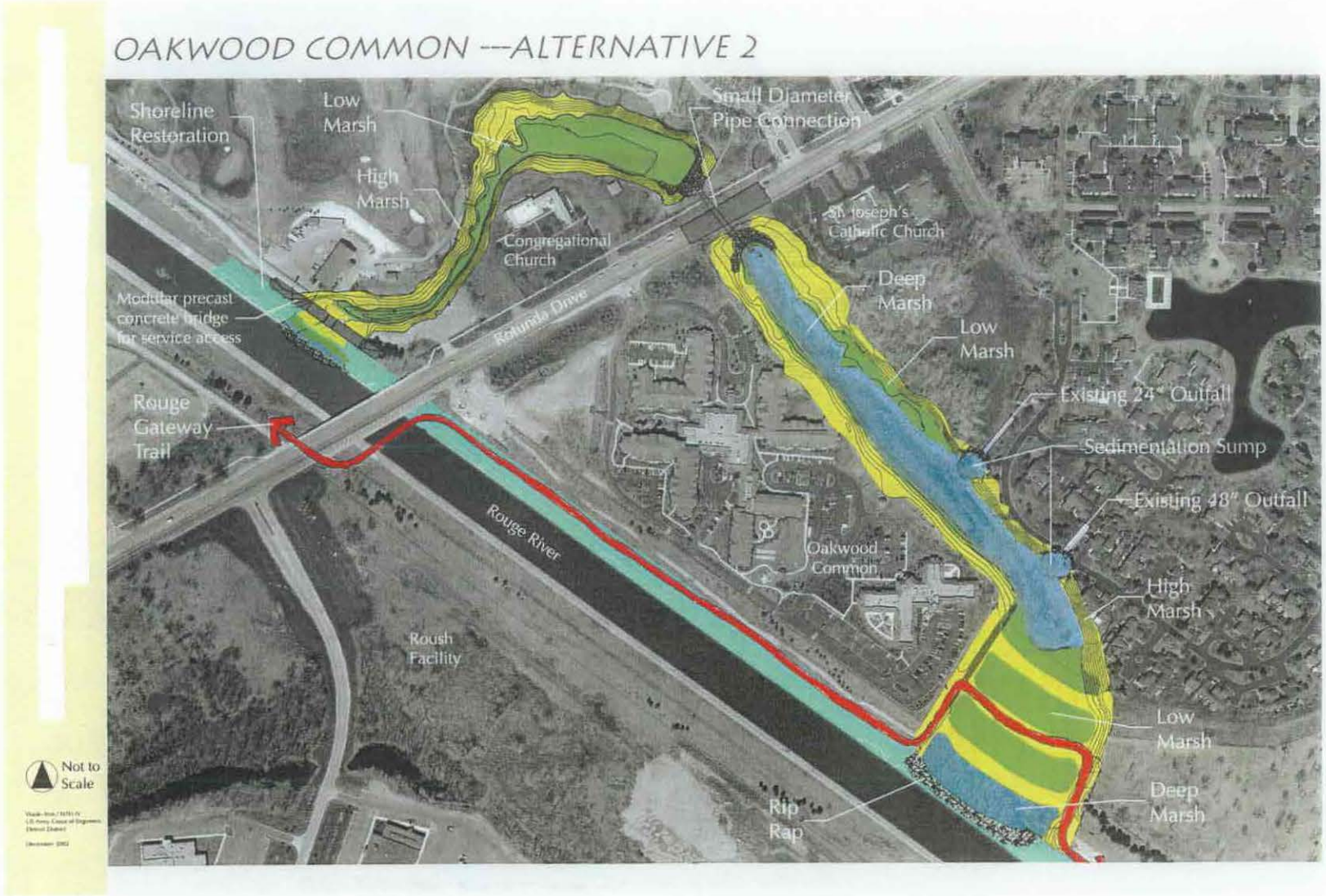


FIGURE 14
OAKWOOD COMMON
PLAN OF ALTERNATIVE 2

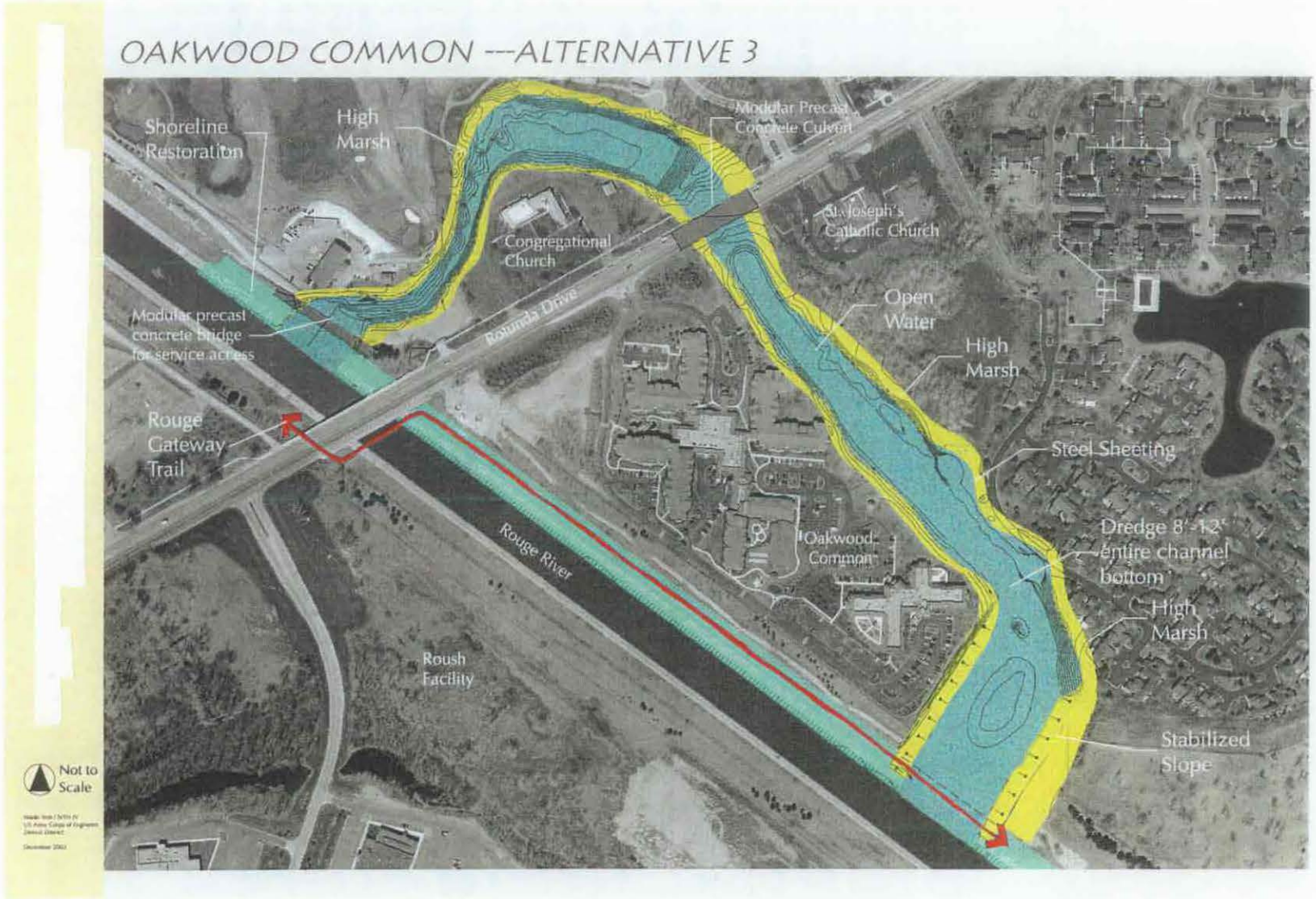


FIGURE 15
OAKWOOD COMMON
PLAN OF ALTERNATIVE 3

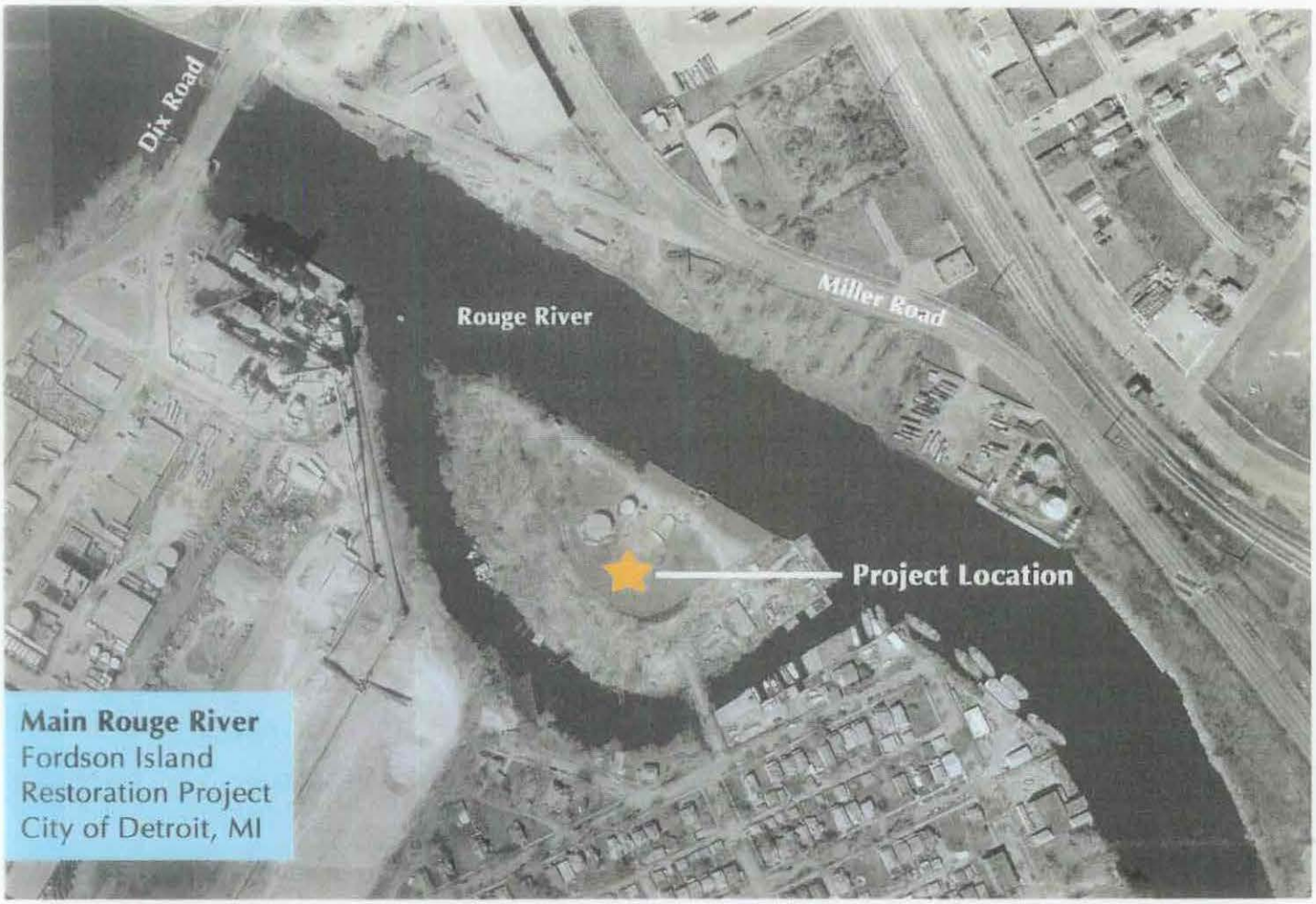


FIGURE 16
FORDSON ISLAND
SITE LOCATION PLAN

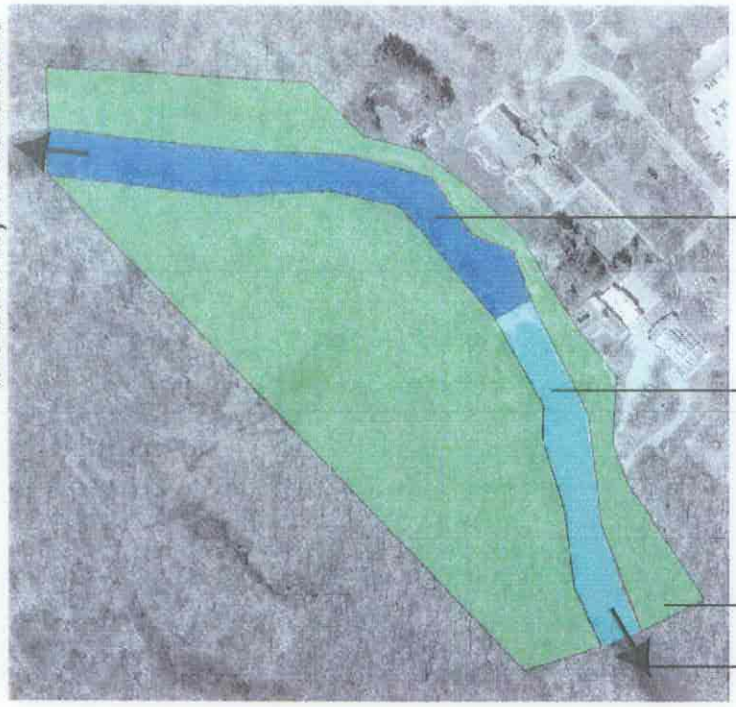
FIGURE 17
FORDSON ISLAND
PLAN OF RESTORATION AREA

ENVIRONMENTAL STANDARDIZED OUTPUT UNIT AREA MAPS

Henry Ford Estate Dam
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

It should be noted that rough estimates and acreage calculations were made based on limited knowledge of the site and existing aerial photography. Acreages were generated by drawing polygons in GIS, selecting the polygon and using the acreage calculation tool. Exact locations of habitat boundaries have not been determined at this stage of study and analysis.

Without Project Conditions



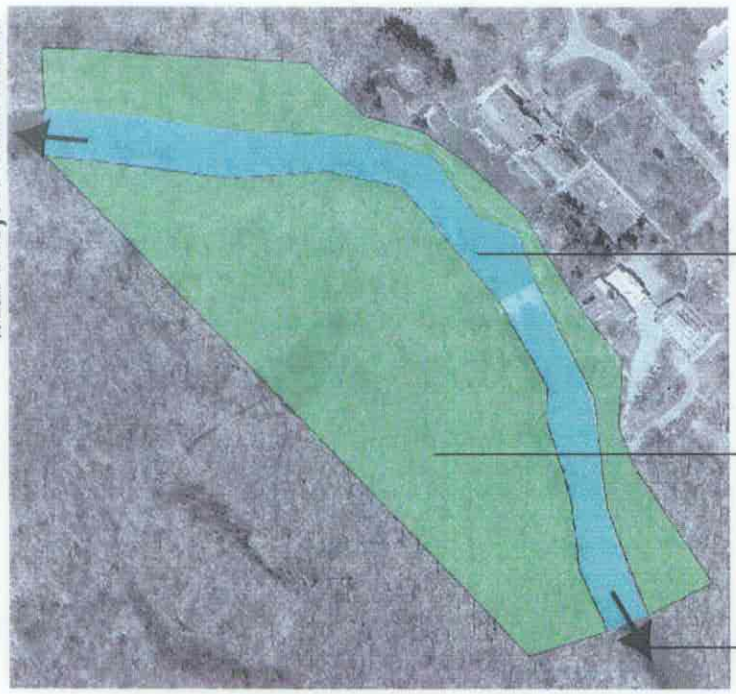
Retained Stream 43.50 ac
Approximated dam at river mile 8 and the next upstream impoundment at river mile 18. Also guesstimated river to be 35 feet wide.

Free Stream 22.00 ac
Approximated dam at river mile 8. In the 8 miles to the Detroit River, estimated approximately 4 miles of retained stream in the concrete channel. Guesstimated river to be 45 feet wide.

Upland & High Floodplain 13.13 ac

Project area extends upstream and downstream

With Project Conditions



Free Stream 65.50 ac

Upland & High Floodplain 13.13 ac

Project area extends upstream and downstream

MAP 1
STANDARDIZED OUTPUT UNITS
HENRY FORD ESTATE

US Army Corps of Engineers
Revised July 2003

Kingfisher Bluff
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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Without Project Conditions

Note: **Reference Figure 5 (Kingfisher Bluff Plan of Restoration Area) for view of the New Channel Cut.**

With Project Conditions

MAP 2
STANDARDIZED OUTPUT UNITS
KINGFISHER BLUFF

US Army Corps of Engineers
Revised July 2003

Michigan/Evergreen---Alternative One
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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Without Project Conditions

With Project Conditions

MAP 3
STANDARDIZED OUTPUT UNITS
MICHIGAN AVENUE / EVERGREEN ROAD
ALTERNATIVE 1

US Army Corps of Engineers
Revised July 2003

Michigan/Evergreen---Alternative Two
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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Without Project Conditions

With Project Conditions

MAP 4
STANDARDIZED OUTPUT UNITS
MICHIGAN AVENUE / EVERGREEN ROAD
ALTERNATIVE 2

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Tournament Players Club
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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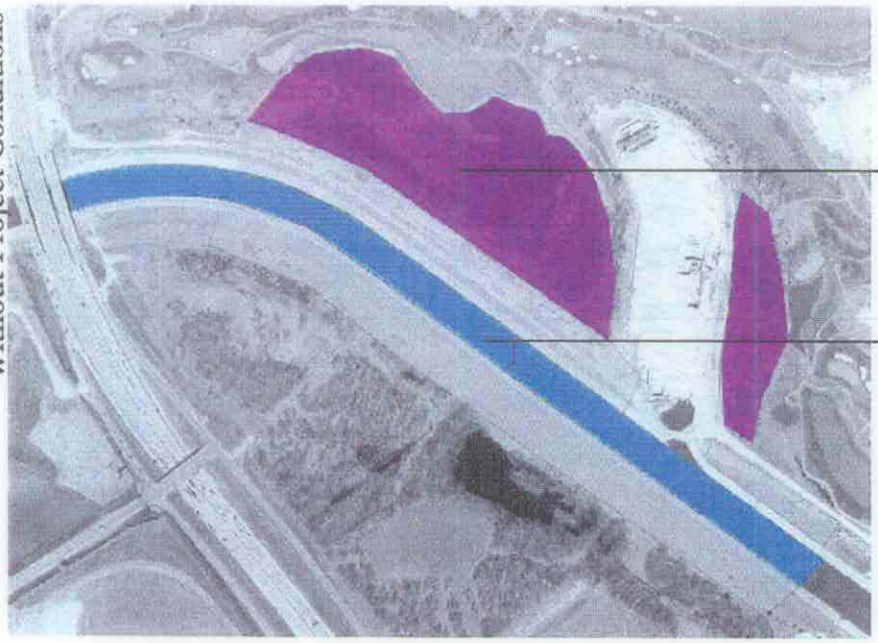
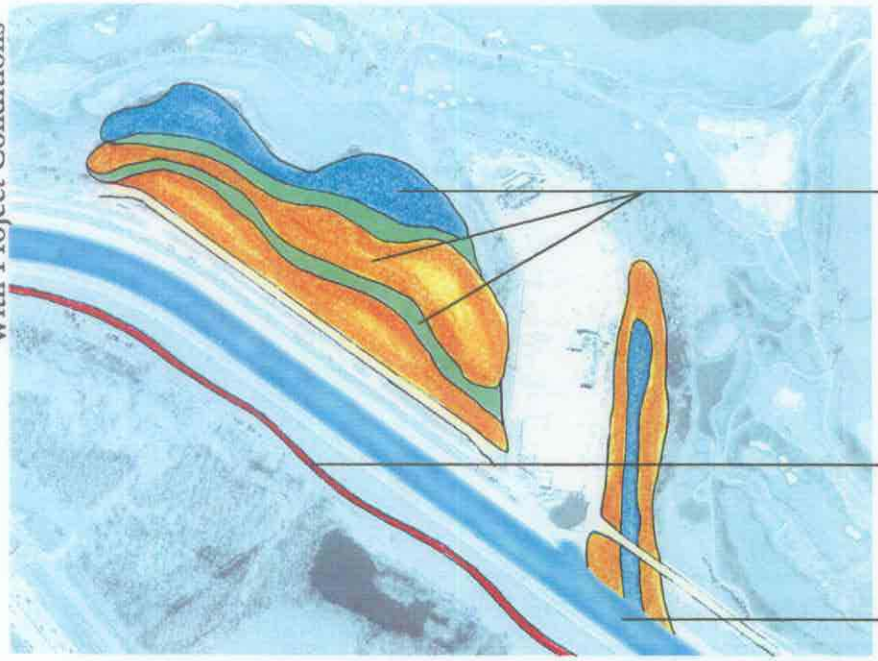
Without Project Conditions



With Project Conditions



MAP 5
STANDARDIZED OUTPUT UNITS
TOURNAMENT PLAYERS CLUB (TPC)
GOLF COURSE

US Army Corps of Engineers
Revised July 2003

Oakwood Common--Alternative One
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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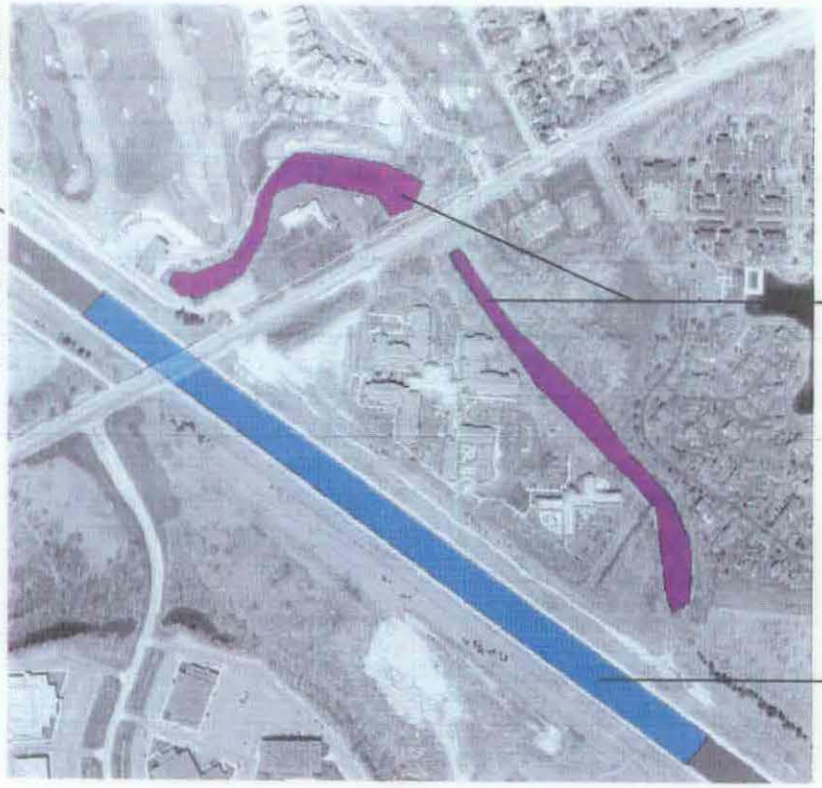
MAP 6
STANDARDIZED OUTPUT UNITS
OAKWOOD COMMON
ALTERNATIVE 1

Without Project Conditions



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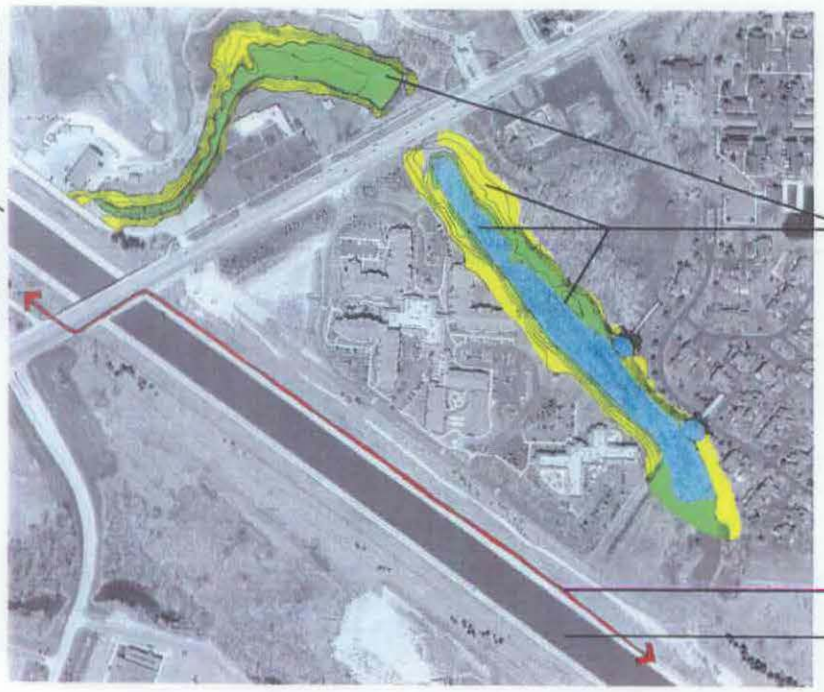

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Oakwood Common--Alternative Two
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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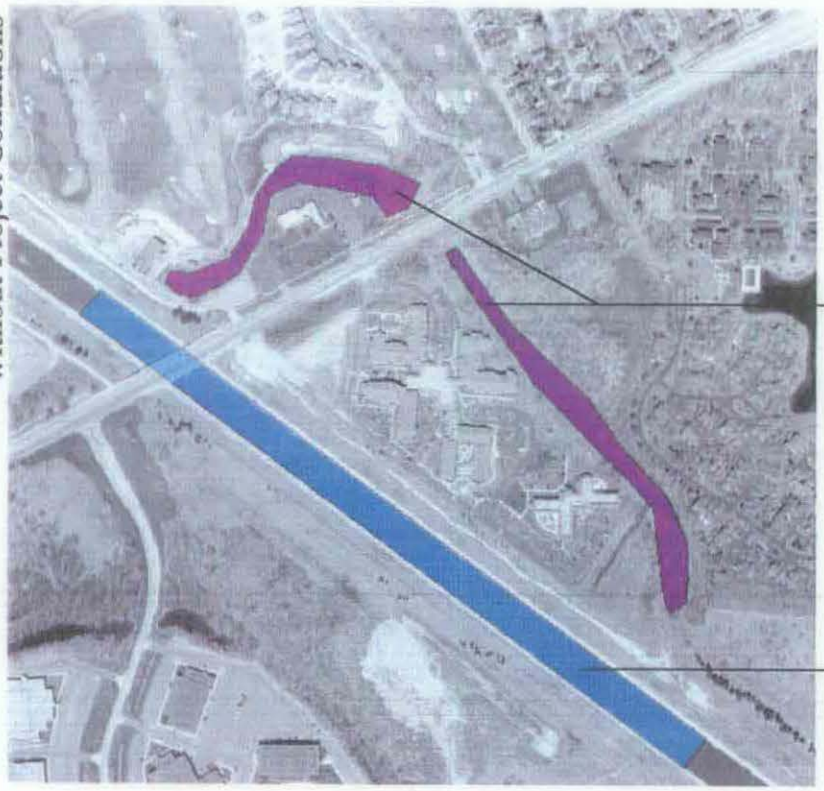
MAP 7
STANDARDIZED OUTPUT UNITS
OAKWOOD COMMON
ALTERNATIVE 2

Without Project Conditions



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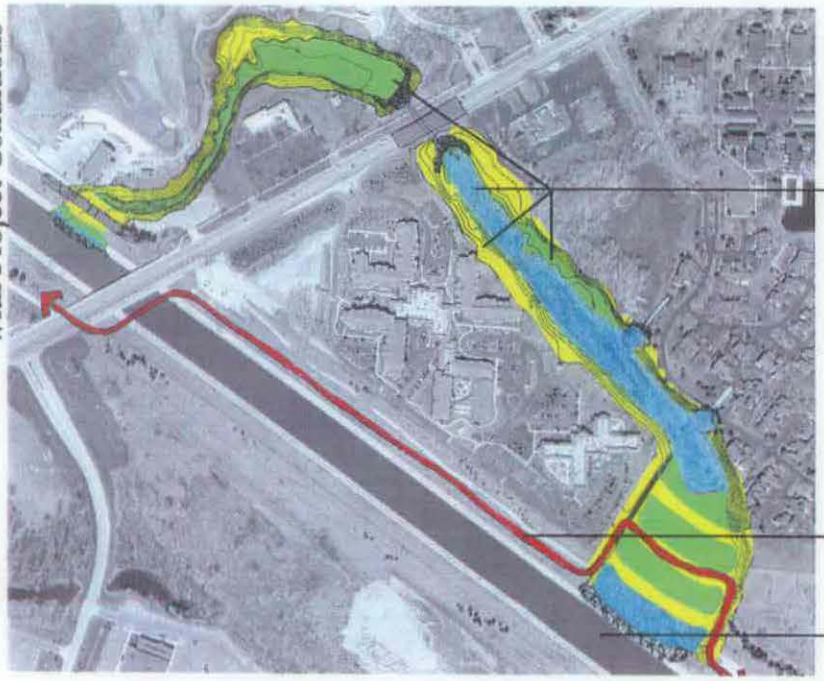

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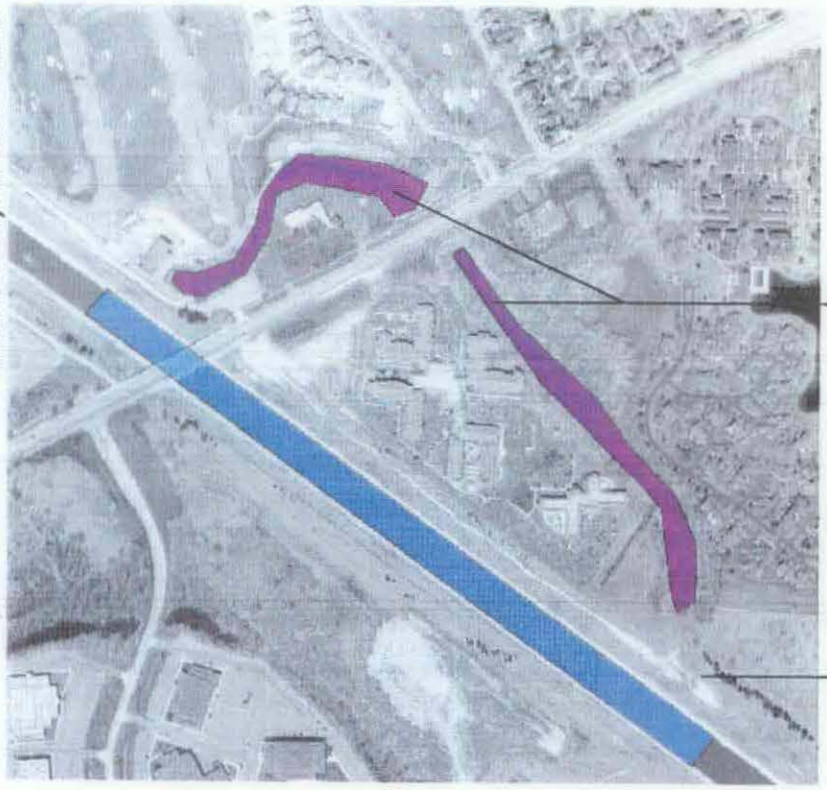
Oakwood Common--Alternative Three
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

It should be noted that rough estimates and acreage calculations were made based on limited knowledge of the site and existing aerial photography. Acreages were generated by drawing polygons in GIS, selecting the polygon and using the acreage calculation tool. Exact locations of habitat boundaries have not been determined at this stage of study and analysis.

MAP 8
STANDARDIZED OUTPUT UNITS
OAKWOOD COMMON
ALTERNATIVE 3

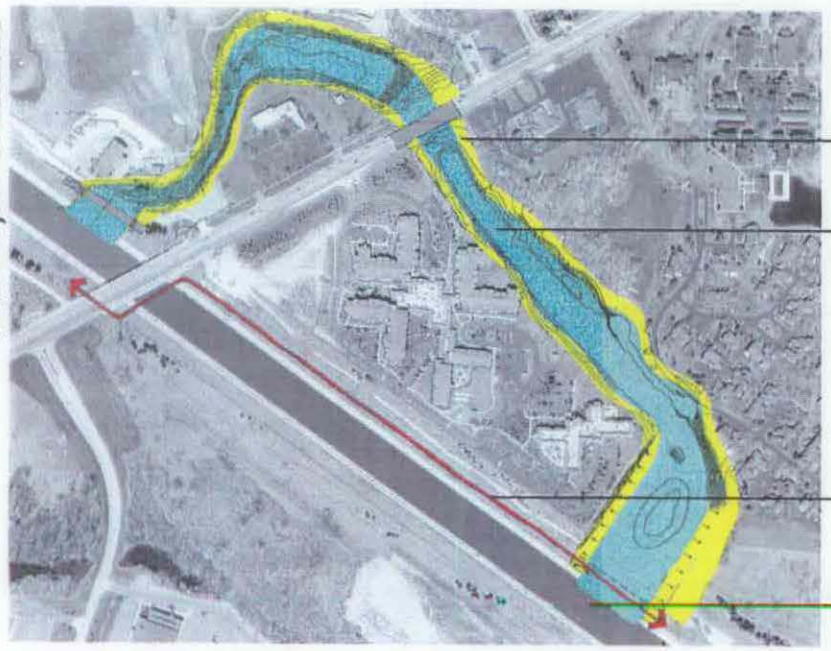
Without Project Conditions



Wetlands 6.29 ac

Retained Stream 9.99 ac

With Project Conditions



Wetlands 9.50 ac
(High & Deep Marsh)

Free Stream 11.55 ac

Proposed Path

Retained Stream 9.99 ac

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Fordson Island
Environmental Standardized Outputs Analysis
Estimated Habitat Type Areas

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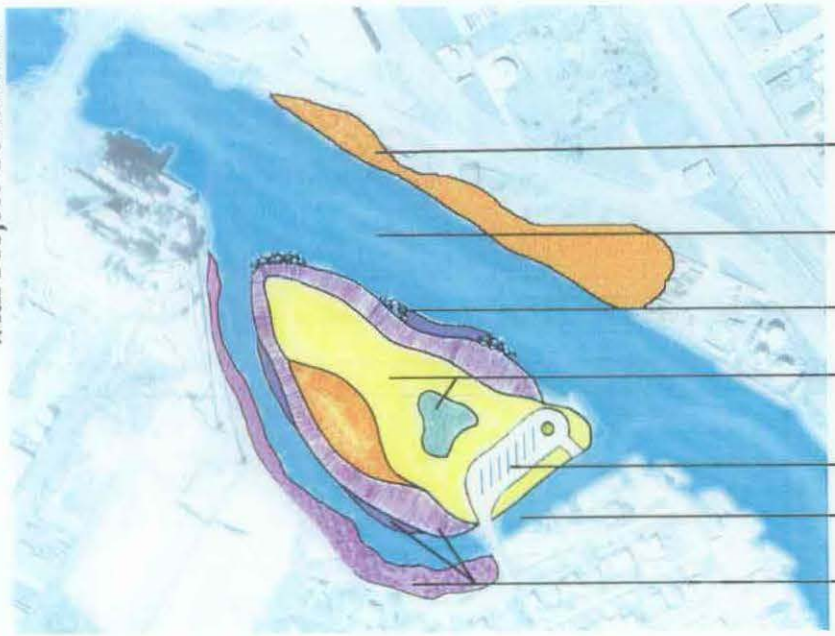
Without Project Conditions

With Project Conditions



MAP 9
STANDARDIZED OUTPUT UNITS
FORDSON ISLAND

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