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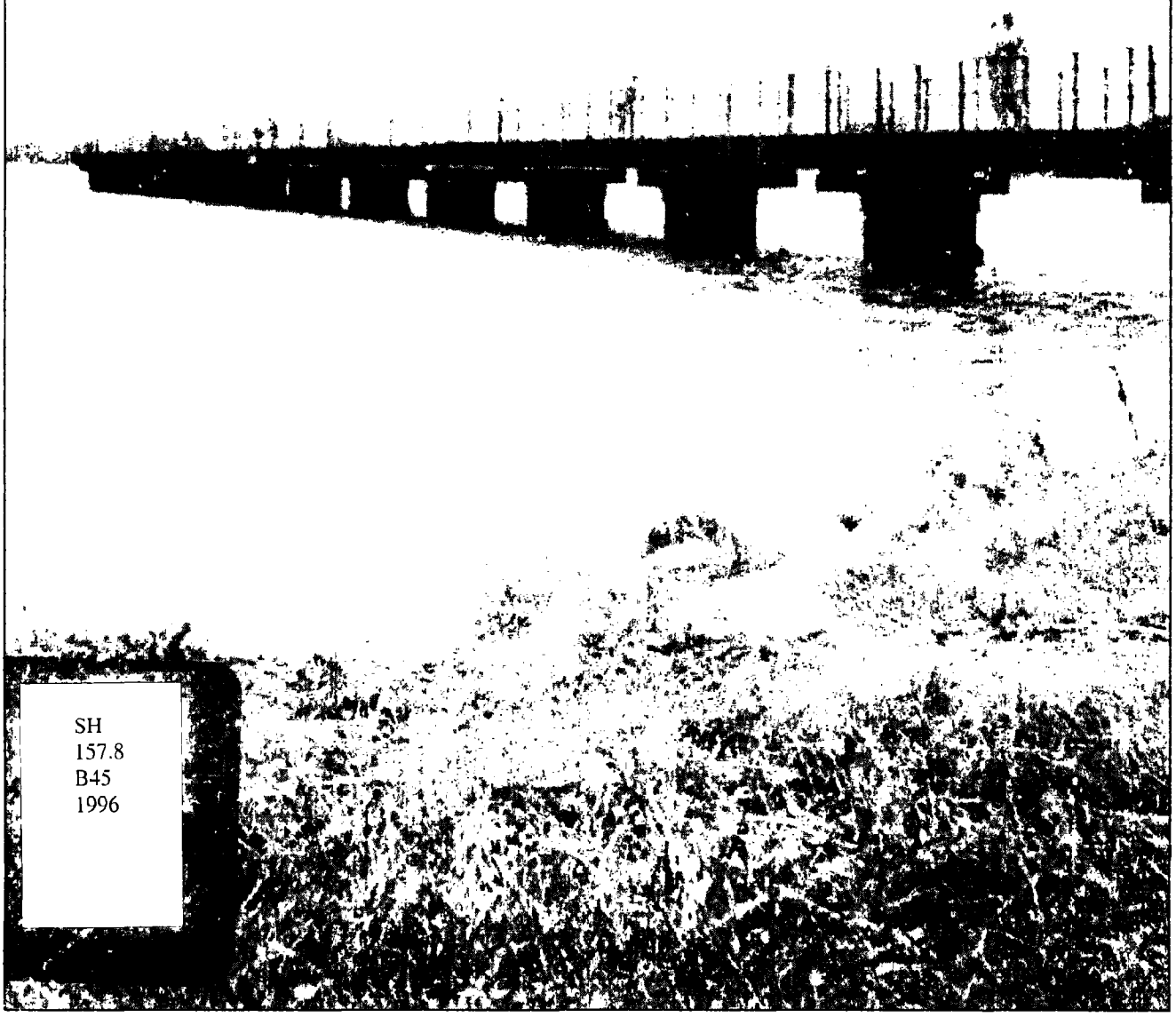
City of Detroit

Belle Isle Piers
Fishery Habitat Enhancement

Prepared by Johnson Johnson & Roy/inc

September 1996



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JJR/

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Ann Arbor, Michigan 48104-1399
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Planning
Landscape Architecture
Urban Design
Civil Engineering
Environmental Services

Johnson Johnson & Roy/inc

28 October 1996

Mr. Richard Hautau
Chief Landscape Architect
Landscape Design Unit
Recreation Department
City of Detroit
65 Cadillac Square, Suite 4000
Detroit, Michigan 48226

Re: MDNR Coastal Management Grant
Belle Isle Piers Fishery Habitat Enhancement
JJR No. 17878.00

Dear Mr. Hautau:

The enclosed deliverables fulfill the requirements of the Coastal Zone Management Grant from the Michigan Department of Natural Resources for the Belle Isle Piers Fishery Habitat Enhancement Project. Please find enclosed six copies each of the following: a report summarizing the conceptual and preferred design alternatives; preliminary plans and technical specifications; an estimate of probable construction costs; and, three copies of the completed ACOE/MDEQ permit application to dredge or fill in the waters of the United States. As described below, there still remains some unresolved issues regarding agency partners and final deposition of dredge materials that could not be resolved prior to the submittal deadline.

The enclosed documents of the Fishery Habitat Enhancement Project were developed in cooperation with the City of Detroit Recreation Department and the Michigan Department of Natural Resources (MDNR) Fisheries Division. The preferred alternatives have been reviewed by or discussed with the MDNR, Michigan Department of Environmental Quality, (MDEQ) and the U.S. Army Corps of Engineers (ACOE) Planning Branch, Regulatory Functions Branch and Project Operations Branch. The purpose of the agency coordination was to seek consensus for the design and encourage partnering for project implementation. There was general consensus for the design of the deep water habitat and its importance to the public benefit. However, final deposition of dredge materials is still being resolved.

In addition, the ACOE has expressed interest in participating as a partner in the project. It has suggested that a formal letter requesting ACOE participation be submitted identifying two separate authorities. The most viable option for ACOE participation is under Section 206 of the Water Resources Development Act (October 1996). This is a new program called the Aquatic Ecosystem Restoration which may provide funding to improve the quality of the aquatic

environment if the project is in the public interest. This project is strictly an aquatic ecosystem enhancement designed entirely for the benefit of the public trust. Participation by the ACOE would impact the project's estimate of probable construction costs.

Analysis of the physical and chemical properties is critical in determining the final deposition of the dredge materials. Physical and chemical analysis of sediments within the project area is scheduled to occur after a permit pre-application meeting with the ACOE. The meeting will be held with the U. S. Army Corp. of Engineers Regulatory Functions Branch and Environmental Division to approve the proposed sampling frequency and methodology for the sediment analysis.

Due to the above factors the final deposition of dredging materials has yet to determined. Agency coordination concerning this issue continues with Michigan Department of Natural Resources (MDNR), Michigan Department of Environmental Quality (MDEQ), and the U. S. Army Corps of Engineers (ACOE).

The enclosed construction documents, technical specifications, estimate of probable costs and the draft permit application were prepared identifying that a portion of the dredge material would be placed adjacent to the deep water habitat for the creation of fish spawning and nursery habitat. During the review of the construction documents by the MDNR and the MDEQ, it was presented that the placement of dredge material onto the Detroit River bottom would not be acceptable by the State regardless of the sediment quality. The ACOE does not necessarily agree with this position. Resolution of this issue directly impacts the estimate of probable construction costs.

Johnson Johnson & Roy/inc is committed to continue with the agency coordination to resolve the outstanding issues and to assist the City of Detroit Recreation Department with the successful completion of this project. Please do not hesitate to call me with any questions regarding this matter.

Sincerely,

JOHNSON JOHNSON & ROY/inc

Douglas L. Denison
Principal

rlg/belle-2

Enclosures

CITY OF DETROIT RECREATION DEPARTMENT
BELLE ISLE PIERS FISHERY HABITAT ENHANCEMENT
DETROIT, MICHIGAN

Prepared by
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September 1996

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SECTION I INTRODUCTION

Belle Isle, a 982 acre island park located in the Detroit River, is the most heavily used park in the City of Detroit (Figures 1 and 2). For many of its eight million annual visitors, Belle Isle is the only opportunity to experience the natural environment of which they are a part. Recognizing the value of this unique resource, the City of Detroit is committed to maintaining and improving this island park as well as restoring basic recreational activities which have historically been part of the Belle Isle experience. This commitment to maintain, improve and restore Belle Isle has been exemplified in the completion of the Belle Isle Lakes and Canal Rehabilitation Project. This project involved the development and implementation of a comprehensive, long-term management strategy to improve water quality, restore recreational activities (fishing and canoeing) and aesthetic character of the island's inland aquatic resource. The determination to improve Belle Isle's unique recreational resources has been extended to areas along the island's shoreline, notably the areas contiguous with the two fishing piers situated on the north and south shoreline. The proposed enhancement of fishery habitat adjacent to the fishing piers serves a dual purpose, creating important feeding, refuge and spawning areas for fish and providing anglers increased opportunities for successful fishing experiences.

The Fishery

Belle Isle has the potential to provide an urban population unique access to an excellent fishery. Belle Isle is located near Lake St. Clair, widely recognized as one of the premier freshwater recreational fisheries in the continental United States. The Detroit River recreational fishery consists of more than 20 species of gamefish of warm, cool and cold water varieties including smallmouth bass, muskellunge, northern pike, walleye, channel catfish, white bass and yellow perch. Several fish species including rainbow trout, lake trout, sturgeon and whitefish inhabit the Great Lakes and use the Detroit River as a migratory, spawning, forage and nursery habitat.

The Problem

Intensive commercial and industrial development along the Detroit River has rendered much of its fishery inaccessible to shore anglers. During the 1970's, two fishing piers were constructed on Belle Isle to provide urban anglers (primarily those who fish from the shore) public access to some of the finest fishing waters in the Midwest. The piers were to serve as readily accessible locations where anglers could partake in a fishing experience and enjoy the diverse recreational fishery offered by the Detroit River. Unfortunately, fishing success from the piers was poor. Consequently, anglers sought out more successful fishing opportunities at other locations along the shoreline with erratic and limited success. Strong currents existing at some of these locations cause anglers to use thicker fishing poles and larger weights. These are cumbersome for young anglers and reduce angler success when attempting to capture light-biting species such as walleye and yellow perch. Often anglers find fishing in such a large expanse of water without defined areas of structure intimidating and find it difficult to locate fish or "feel" fish habitat.

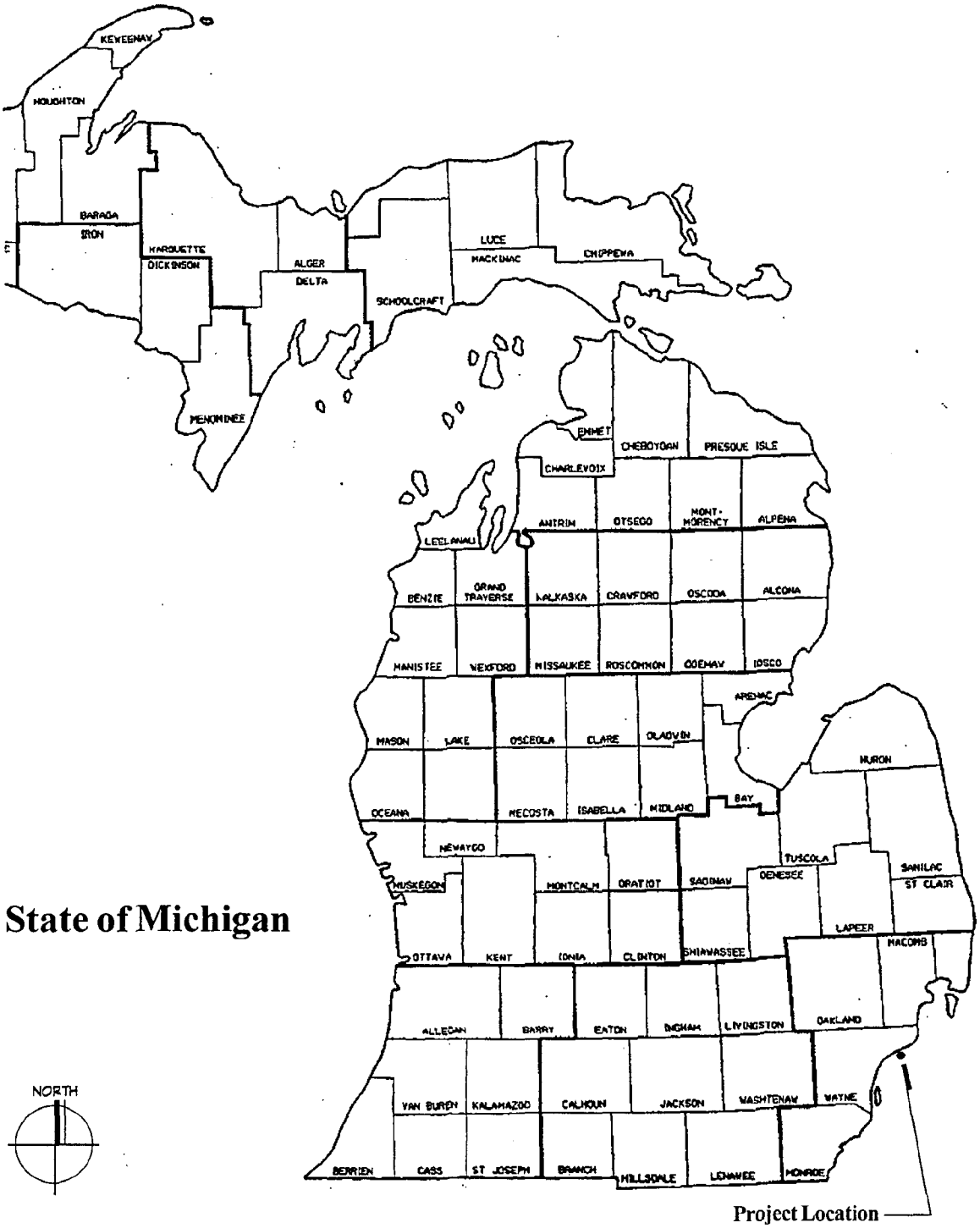
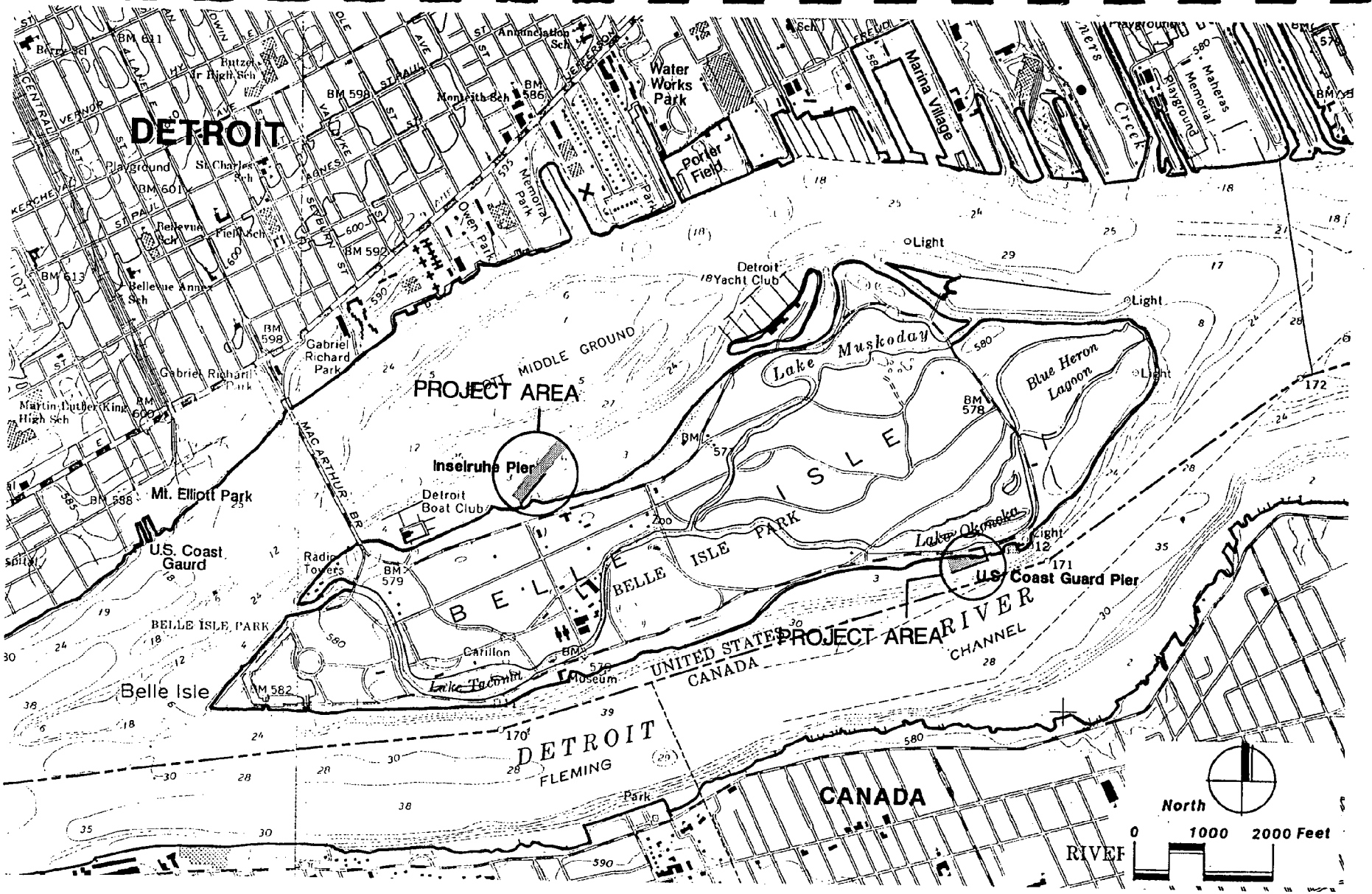


Figure 1

Location Map

Prepared by Johnson Johnson & Roy/inc, September 1996

Belle Isle Piers Fishery Habitat Enhancement



Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 2
Vicinity Map

Belle Isle Piers Fishery Habitat Enhancement

In seeking to provide anglers improved fishing success from the piers, the City of Detroit Recreation Department consulted with MDNR Fisheries Division personnel (Appendix D). As a result of these meetings, the City of Detroit Recreation Department concluded that to provide angler successful fishing experiences, fishery habitat around the piers must be improved.

The Solution

The decision to enhance fish habitat around the piers was the most prudent solution to improve the fishery and increase pier utilization. Upon review of existing information regarding habitat surrounding the piers, it became evident that the piers were constructed in two locations along the Belle Isle shoreline recognized as areas containing significant sediment deposition (Appendix A). These areas are quite shallow and exhibit little variation in river bottom elevation (Appendix A). In a freshwater riverine ecosystem, depositional areas are often deficient in habitat required to attract sufficient numbers of gamefish necessary for a successful recreational fishery. Lack of habitat such as deep water areas, submerged structures, and spawning and nursery habitat which typically constitute the foundation for a diverse recreational fishery resulted in poor gamefish populations near the piers. Construction of deep water areas and structure will attract larger numbers and sizes of gamefish. Furthermore, the structure would serve as a base for the development of a large community of macroinvertebrates and forage fish upon which gamefish prey, and result in increased gamefish populations near the piers. The created habitat will be designed to be within reach of the average angler's cast (about 50 feet). This would allow anglers to locate fish holding habitat and increase their chances of catching fish.

Enhancement of fishery habitat adjacent to the piers will produce recreational and environmental benefits. Recreational benefits include the following:

- concentrated fishing opportunities and associated pedestrian traffic in two locations;
- allows anglers to experience a Great Lakes fishery without the use of a boat or cumbersome, expensive equipment (i.e., "big water fishing with an inland water feel");
- allows shore anglers increased success in locating and catching fish;
- increases public use of the fishery and the pier structures; and,
- establishes Belle Isle Piers as one of the elite public access locations of the Great Lakes similar to Grindstone City Pier, Frankfort Pier and Grand Haven Harbor Pier.

Environmental benefits include the following:

- increased edge habitat for forage;
- increased area of refuge from current;

- increased winter refuge area;
- increase areas of spawning and nursery habitat; and,
- increased production and concentration of forage fish and macroinvertebrates.

This is the only project of its kind to be proposed in United States waters of the Detroit River. The project addresses the need for improvement of aquatic habitats for fish populations within the Detroit River which have undergone degradation since the 1800's. It will also serve to improve the quality of recreational experience associated with this natural resource resulting in greater appreciation for the resource. Greater appreciation for natural resources leads to changes in attitudes regarding environmental issues that affect the river. Decisions to protect, preserve and enhance natural resources often originate with positive experiences in the use of the resource. Therefore, enhancement of the fishery habitat will lead to other projects to improve aquatic ecosystems within the river which, in turn, result in overall improvement to the Detroit River. The City of Detroit Recreation Department believes that improvement of this natural resource will result in considerable economic, educational and environmental benefits to the City of Detroit and communities along the Detroit River.

SECTION II PROJECT DESCRIPTION

The City of Detroit Recreation Department is proposing to enhance fishery habitat adjacent to the fishing piers (Inselruhe North Wharf and U.S. Coast Guard Fishing Pier) on Belle Isle. Belle Isle is a 982 acre island city park with seven miles of shoreline. During the 1970's the piers were constructed to provide readily accessible locations whereby urban anglers and their families could partake in a fishing experience more commonly found in inland lakes and streams, while enjoying the diverse recreational fishery offered by the Detroit River. Unfortunately, the fishing piers were constructed in areas deficient in the habitat (deep water areas, spawning/nursery habitat, and submerged, structural habitat) necessary to attract sufficient numbers of gamefish needed to sustain a successful recreational fishery. Lack of deep water areas and submerged structures which typically support a diverse recreational fishery resulted in poor gamefish populations near the piers. A Fishery Habitat Enhancement Design has been developed to be implemented in a one year period and includes the following actions:

1) dredge deep water areas;
2) create structural habitat and stabilize slopes of deep water areas with riprap and bedding stone;
3) create spawning/nursery habitat; and,
4) construct a riprap sediment deflector to preserve enhanced habitat.

Agency Coordination

The design concepts of the Fishery Habitat Enhancement Project were developed in cooperation with the City of Detroit Recreation Department and the Michigan Department of Natural Resources Fisheries Division (MDNR). The preferred alternatives were reviewed by the MDNR, Michigan Department of Environmental Quality Land and Water Management Division (MDEQ).

A visit was made to the Corps of Engineers, Detroit District on October 23, 1996. Two separate discussions took place; one with the Chief of Operations Technical Support and another with two members of the District's Planning Branch, including the Branch Chief, Mr. Dale Monteith. A brief description of the alternatives was presented to the Planning Branch meeting participants and an interest in participating in the project was expressed. A number of Corps of Engineers authorities were discussed which relate to environmental restoration that could allow for partnering in developing the Fishery Habitat Enhancement Project. A formal request to the Corps of Engineers for consideration and potential participation under either Section 206 of the Water Development Act (WRDA) of 1996, and/or Section 401 of the WRDA 1990, would be the means to initiate Corps participation and determine the ability to secure Federal funds for technical assistance and/or implementation.

The most viable option for Corps participation is under Section 206 of the Water Resources Development Act (October 1996). This is a new program called the Aquatic Ecosystem Restoration. It may provide funding to improve the quality of the environment if the project is in the public interest. Funding can be made available for feasibility study, design and construction with a 35 percent local match. This project is strictly an aquatic ecosystem enhancement entirely designed for the benefit of the public trust. The second authority is the Section 401 of the Water Resources Development Act of 1990 which may provide technical, planning and engineering assistance in the development and implementation of Remedial Action Plans for the Great Lakes Areas of concern. Participation by the ACOE would impact the project's estimate of probable construction costs.

SECTION III DESCRIPTION OF PREFERRED ALTERNATIVES FOR FISHERY HABITAT ENHANCEMENT

U.S. Coast Guard Fishing Pier

The Preferred Alternative for the U.S. Coast Guard Fishing Pier Fishery Habitat Enhancement contains three important elements. Deep water areas and areas of submerged structural habitat are two elements needed for attracting and concentrating gamefish near the piers. A sediment deflector is needed for the preservation of deep water areas and structural habitat from excessive sedimentation.

Along the U.S. Coast Guard Fishing Pier, mean water depth averages 6 feet. Deep water habitat is proposed 20 feet off of the shore-side face of the pier. The deep water area adjacent to the U.S. Coast Guard Fishing Pier will consist of two oval shaped basins located between the Belle Isle shoreline and the section of the pier which parallels the shoreline (Figure 3). The combined areas will require approximately 7,400 cubic yards of dredging over a 0.8 acre area.

Basin 1 will require approximately 2,800 cubic yards of dredging to create a 0.3 acre area approximately 180 feet long , 92 feet wide and 15 feet deep. Side slopes are 4:1 on the shortest axis (Figure 4). Basin 2 will require approximately 4,600 cubic yards of dredging to create a 0.5 acre area approximately 180 feet long, 130 feet wide and 15 feet deep. Side slopes will be a minimum 4:1 on the shortest axis and 8:1 on the longest axis.

Creation of structural habitat and stabilization of slopes of deep water areas will be conducted within the areas adjacent to the U.S. Coast Guard Pier (Figures 3 and 4). A total of 350 tons of bedding stone and 400 tons of will be placed along the slope of Basin 1. A total of 600 tons of bedding stone and 650 tons of riprap will be placed along the slope of Basin 2. In both basins, the toe of the stone will begin at the 84 foot river bottom elevation.

A sediment deflector to protect deep water areas and submerged structural habitat from sediment deposition will be constructed within the areas adjacent to the U.S. Coast Guard Pier. The deflector will be constructed upstream and parallel to the section of the pier that extends perpendicular to the shoreline (Figure 4). The toe of the sediment deflector will be adjacent to the pier supports. A total of 350 tons of bedding stone and 1,500 tons of riprap will be used to create a sediment deflector approximately 130 feet long by 40 feet wide at the base. Side slopes will be 2:1. A crest approximately 5 feet wide and 95 feet long will extend 2 feet above the surface of the water at elevation 96.0.

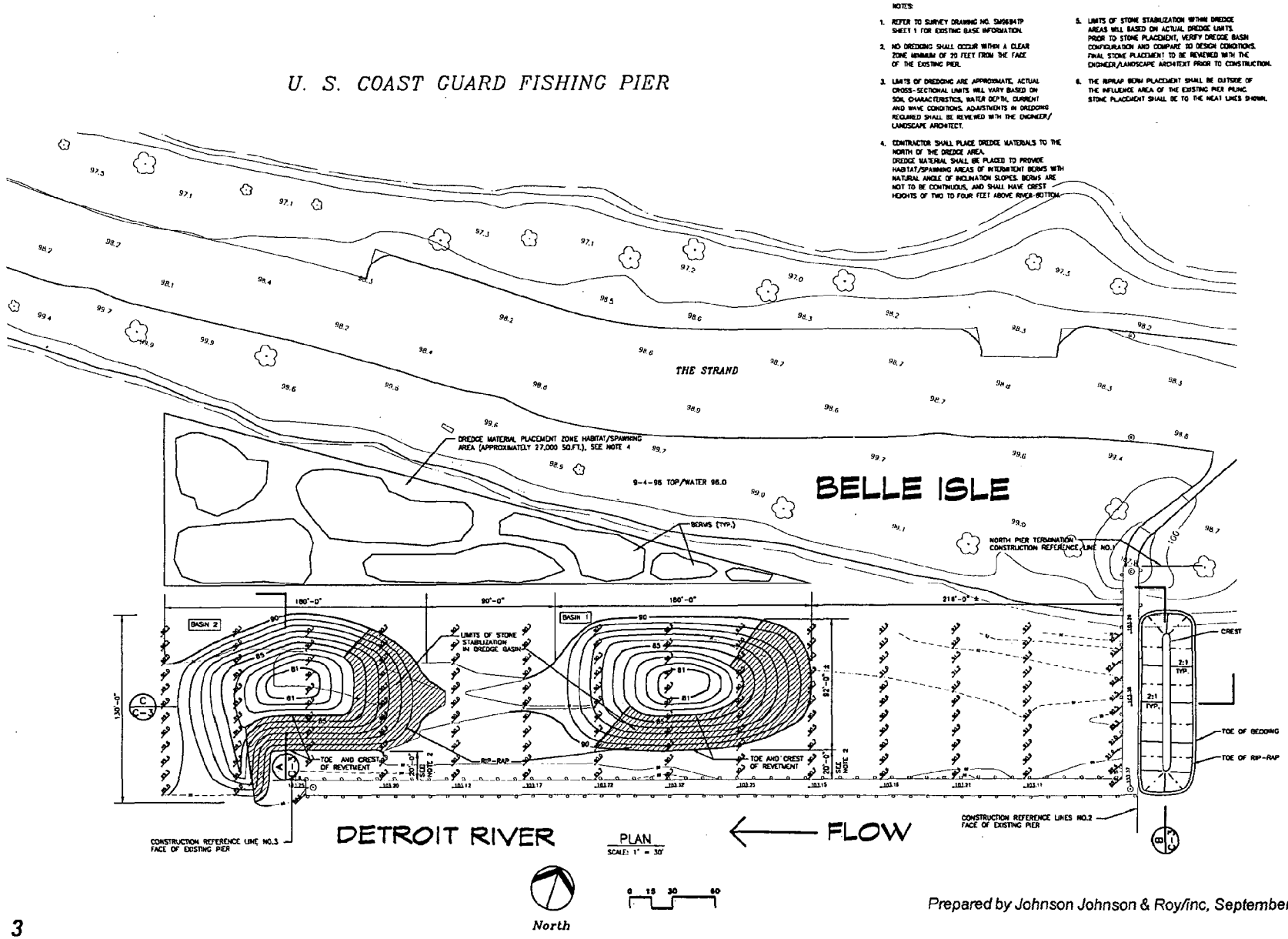
Inselruhe North Wharf

The Preferred Alternative for the Inselruhe North Wharf Fishery Habitat Enhancement was designed to encourage movement of gamefish from deep water areas, approximately 1,000 feet offshore, to areas near the pier. The design consists of a simple channel extending the length of the pier and proceeding out to a depth of about 15 feet. Spawning and nursery habitat consists of a series of mounds immediately downstream of the channel.

In the areas adjacent to the Inselruhe North Wharf, mean water depth averages 6 feet. Deep water habitat is proposed 20 feet off of the downstream face of the pier (Figure 5). The proposed deep water habitat will require approximately 12,400 cubic yards of dredging to create a channel approximately 15 feet in depth, 960 feet long, 68 feet wide at the top and approximately 4 feet at the base. Side slopes will be a minimum of 4:1 (Figure 5). The channel will be aligned parallel to the pier until termination at the 81 foot river bottom elevation.

Physical and Chemical Analysis of Sediments

Physical and chemical analysis of sediments within the project area is scheduled to be completed prior to the Fishery Habitat Enhancement project. A pre-application meeting will be held with the U. S. Army Corps of Engineers Regulatory Functions Branch and Environmental Division to approve the proposed sampling frequency and methodology for the sediment analysis. Analysis of the physical and chemical properties is critical in determining the final deposition of dredge materials. Several alternatives are currently being evaluated.



Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 3
Preferred Alternative
Final Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Plan View

Belle Isle Piers Fishery Habitat Enhancement

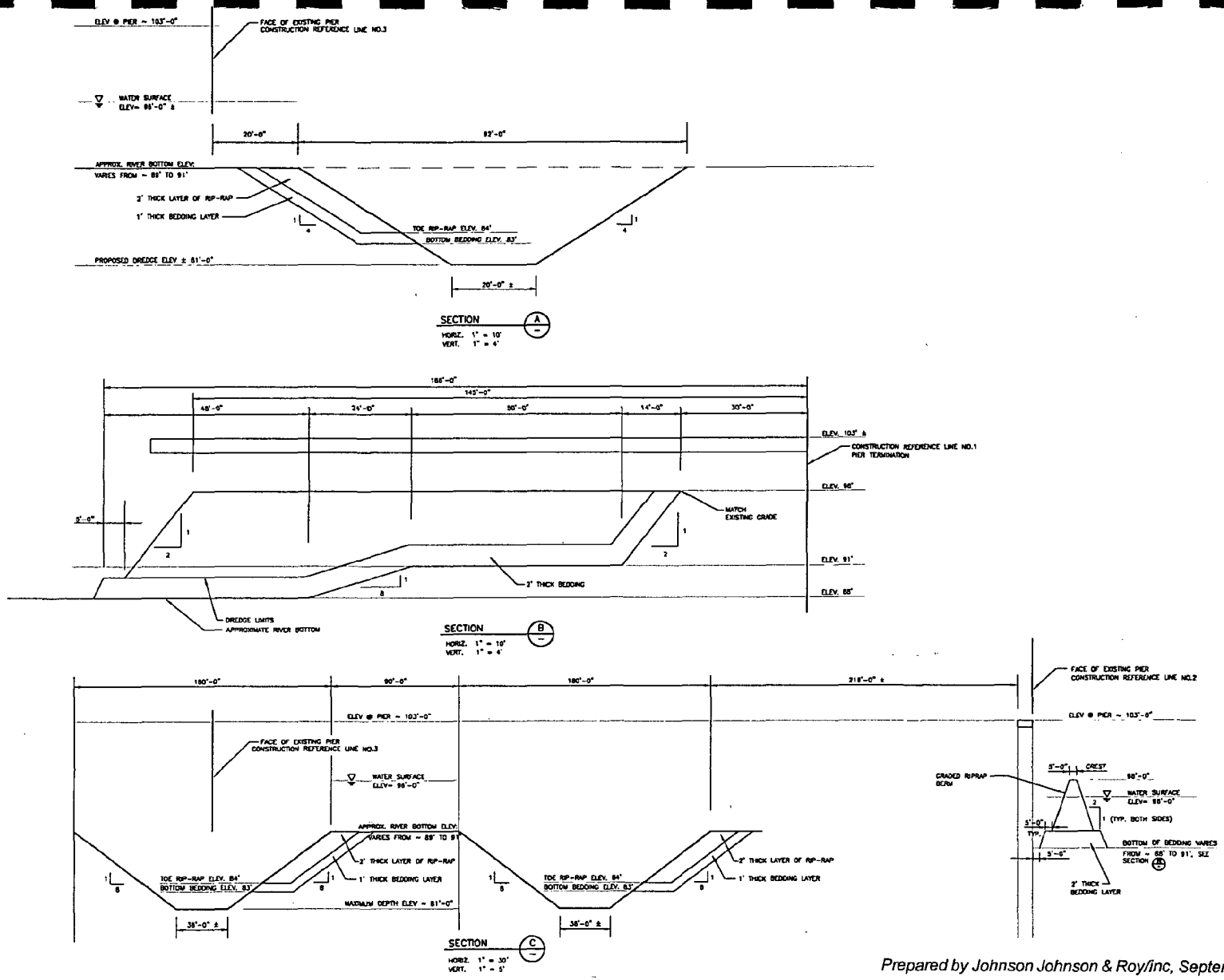


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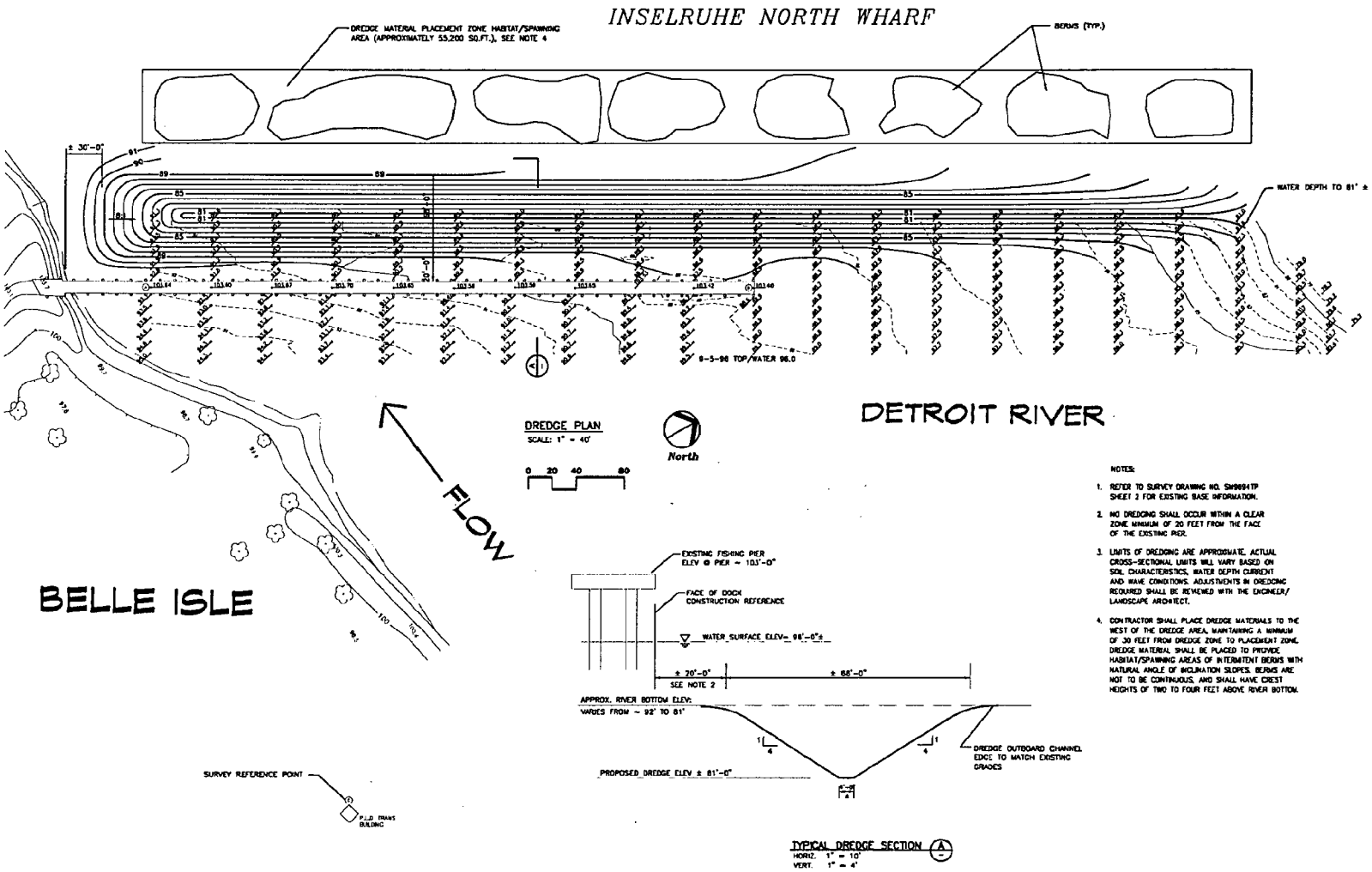
Figure 4

Preferred Alternative

Final Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Cross Section and Longitudinal View

Belle Isle Piers Fishery Habitat Enhancement



Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 5
Preferred Alternative
Final Design for Proposed Fishery Habitat along Inselruhe North Wharf - Plan View

Belle Isle Piers Fishery Habitat Enhancement

Deposition of Dredging Materials

Final deposition of dredging materials has yet to determined. Agency coordination concerning this issue continues with Michigan Department of Natural Resources (MDNR), Michigan Department of Environmental Quality (MDEQ), and the U. S. Army Corps of Engineers (ACOE).

The construction documents, technical specifications and estimate of probable construction costs were prepared identifying that a portion of the dredge material would be placed adjacent to the deep water habitat for the creation of fish spawning and nursery habitat. During the review of the construction documents by the MDNR and the MDEQ, it was presented that the placement of dredge material onto the Detroit River bottom would not be acceptable by the State regardless of the sediment quality. The ACOE does not necessarily agree with this position. Resolution of this issue directly impacts the estimate of probable construction costs. In addition, the ACOE has expressed an interest in participating as a partner in the project (See Agency Coordination). The most viable option for ACOE participation is under Section 206 of the Water Resources Development Act (October 1996). This is a new program called the Aquatic Ecosystem Restoration which may provide funding to improve the quality of the environment of this project. This too may impact final deposition of the dredge materials and probable costs.

Specific locations are being explored for dredge disposal depending on sediment quality and resolution of regulatory issues. Shoreline areas along Belle Isle have been identified as seriously eroding. If physical properties are appropriate, a portion of the material will be used to stabilize severely eroding areas along the Belle Isle shoreline. Three picnic areas on Belle Isle have flooding problems where fill would be suitable. If ACOE partners on the project, other opportunities may be presented. Suitability of the material is contingent upon results of chemical and physical analysis of sediments to be performed prior to the construction of the Fishery Habitat Enhancement Project. The final disposition of the dredge materials will be determined during the permitting process.

Summary of Proposed Actions

As part of the enhancement of fishery habitat adjacent to the existing fishing piers on Belle Isle, the City of Detroit Recreation Program is proposing to dredge deep water areas along the Inselruhe North Wharf and the U.S. Coast Guard Fishing Pier, stabilize slopes along the deep water areas adjacent to the U.S. Coast Guard Fishing Piers, allow slope stabilization material to serve as areas of submerged refuge for fish and macroinvertebrates, and construct a riprap sediment deflector to preserve enhanced fishery habitat.

Location	Action Proposed	Total Amount Dredge/Fill
Inselruhe North Wharf	Dredging	12,400 cubic yards
Inselruhe North Wharf	Physical and Chemical Analysis of Sediment	
U.S. Coast Guard Fishing Pier	Dredging	7,400 cubic yards
U.S. Coast Guard Fishing Pier	Fill/Bedding Stone	1,300 tons
U.S. Coast Guard Fishing Pier	Fill/Riprap	2,550 tons
U.S. Coast Guard Fishing Pier	Physical and Chemical Analysis of Sediment	

The cost of construction of Fishery Habitat Enhancements has been estimated at $345,998 (Appendix B).

SECTION IV DESCRIPTION OF CONCEPTUAL ALTERNATIVES FOR FISHERY HABITAT ENHANCEMENT

Conceptual alternatives for the the U.S. Coast Guard Fishing Pier and Inselruhe North Wharf Fishery Habitat Enhancements are presented in Figures 7, 8 and 10, respectively. The alternatives are modifications of the original conceptual designs submitted by MDNR Fisheries Division personnel (Figures 6 and 9).

U.S. Coast Guard Fishing Pier Fishery Habitat Enhancement Conceptual Alternatives

Alternative A

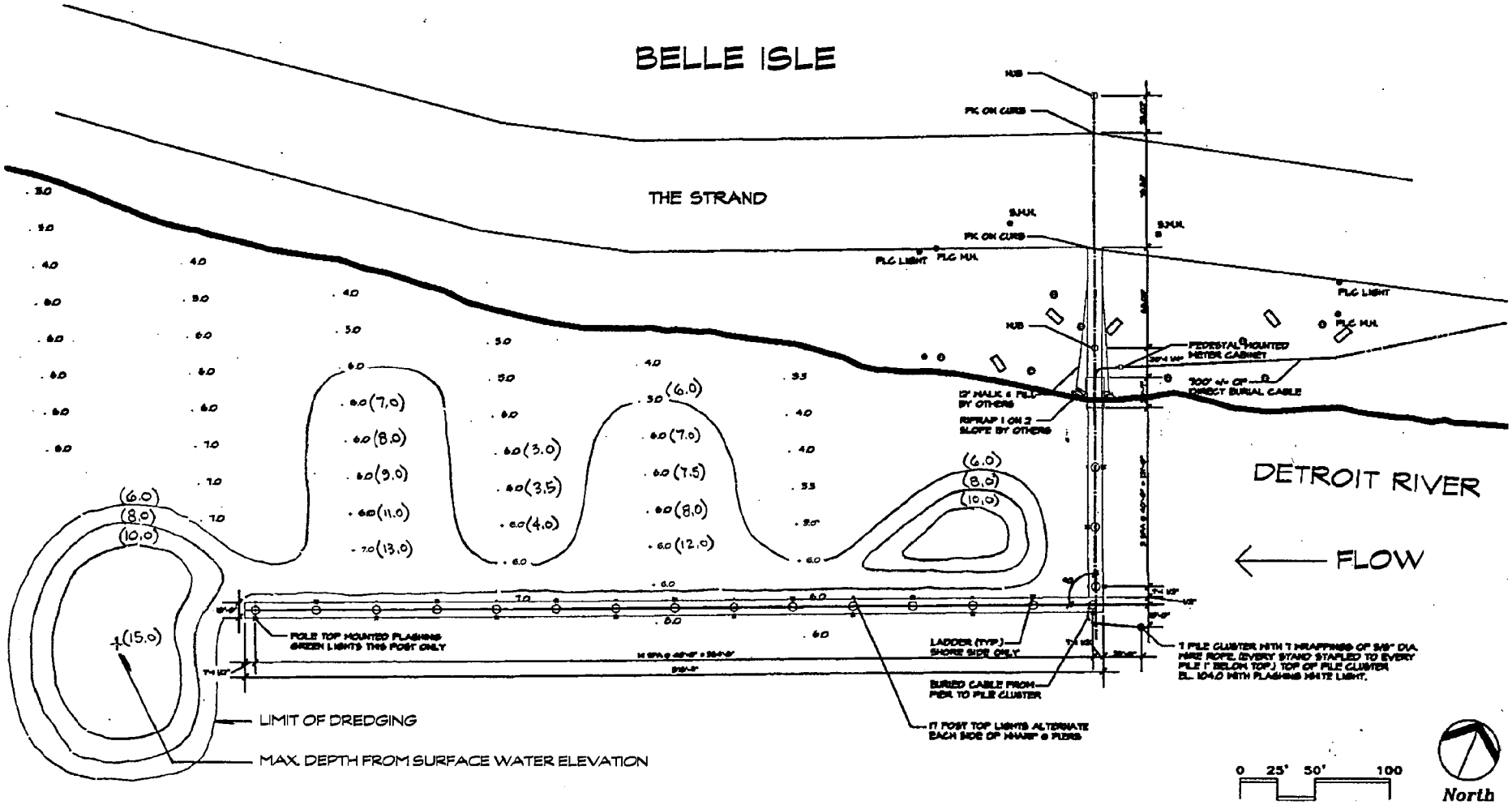
This alternative is the original conceptual design developed by MDNR Fisheries Division personnel (Figure 6). The design consists of dredging a continuous area of undulating deep water habitat. The majority of the deep water area is confined to the area between the shoreline and the arm of the pier that parallels the shoreline. A portion of deep water area extends the length of the arm and approximately 75 feet outside of the pier into the Detroit River. Alternative A was modified for the following reasons:

- successful fishery enhancement could be achieved with a reduced deep water area.
- dredging to depths ranging from 12 to 13 feet abutting the base of the pier supports may impair the structural integrity of the pier.
- design constraints posed by the bottom substrate composition prevent construction of the proposed steep side slopes. A minimum 4:1 slope is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

Alternative B

This alternative consists of a continuous channel with moderate expansion of deep water areas situated at 50 foot intervals along its course (Figure 7). The fishery enhancement extends the length of the arm of the pier that parallels the shoreline and is located 20 feet away from the pier supports. The deep water areas are approximately 75 feet long and 30 feet wide to a maximum depth of 15 feet. The channel is 10 feet wide and 15 feet deep. Alternating areas of riprap serve to stabilize the channel and function as fishery, refuge and spawning habitat. Dredge spoil is to be placed in mounds along channel for increased habitat diversity. The majority of the enhancement is confined to the area between the shoreline and the arm of the pier that parallels the shoreline. A portion of deep water area extends the length of the arm and approximately 25 feet outside of the pier into the Detroit River. Alternative B was modified for the following reasons:

- Design constraints posed by the bottom substrate composition prevent construction of the proposed (nearly vertical within the channel) side slopes. A minimum 4:1 slope is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

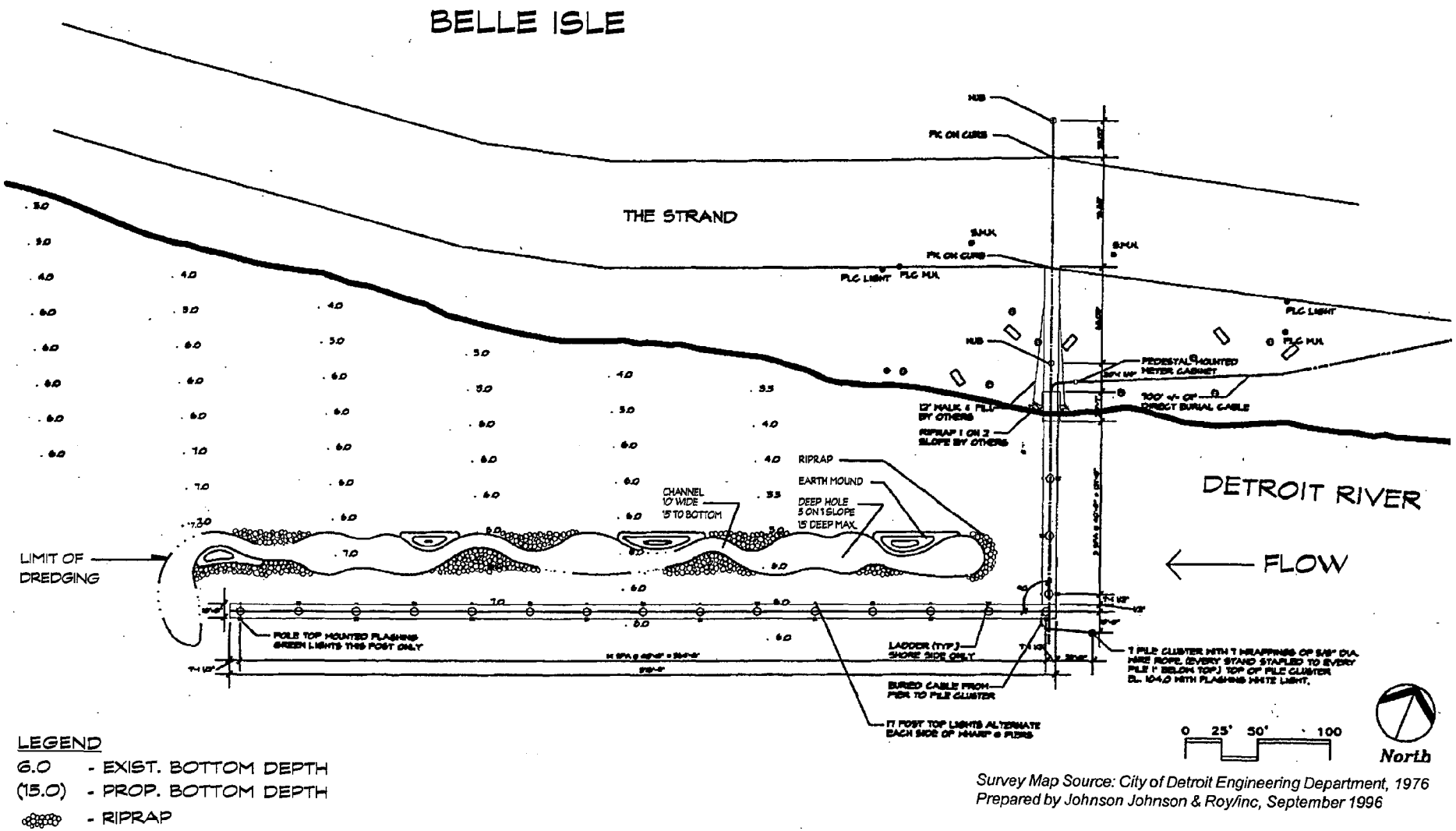


LEGEND
6.0 - EXIST. BOTTOM DEPTH
(15.0) - PROP. BOTTOM DEPTH

Survey Map Source: City of Detroit Engineering Department, 1975
Conceptual Design Submitted by MDNR Fishery Division, 1996
Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 6
Alternative A
Conceptual Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Dredging

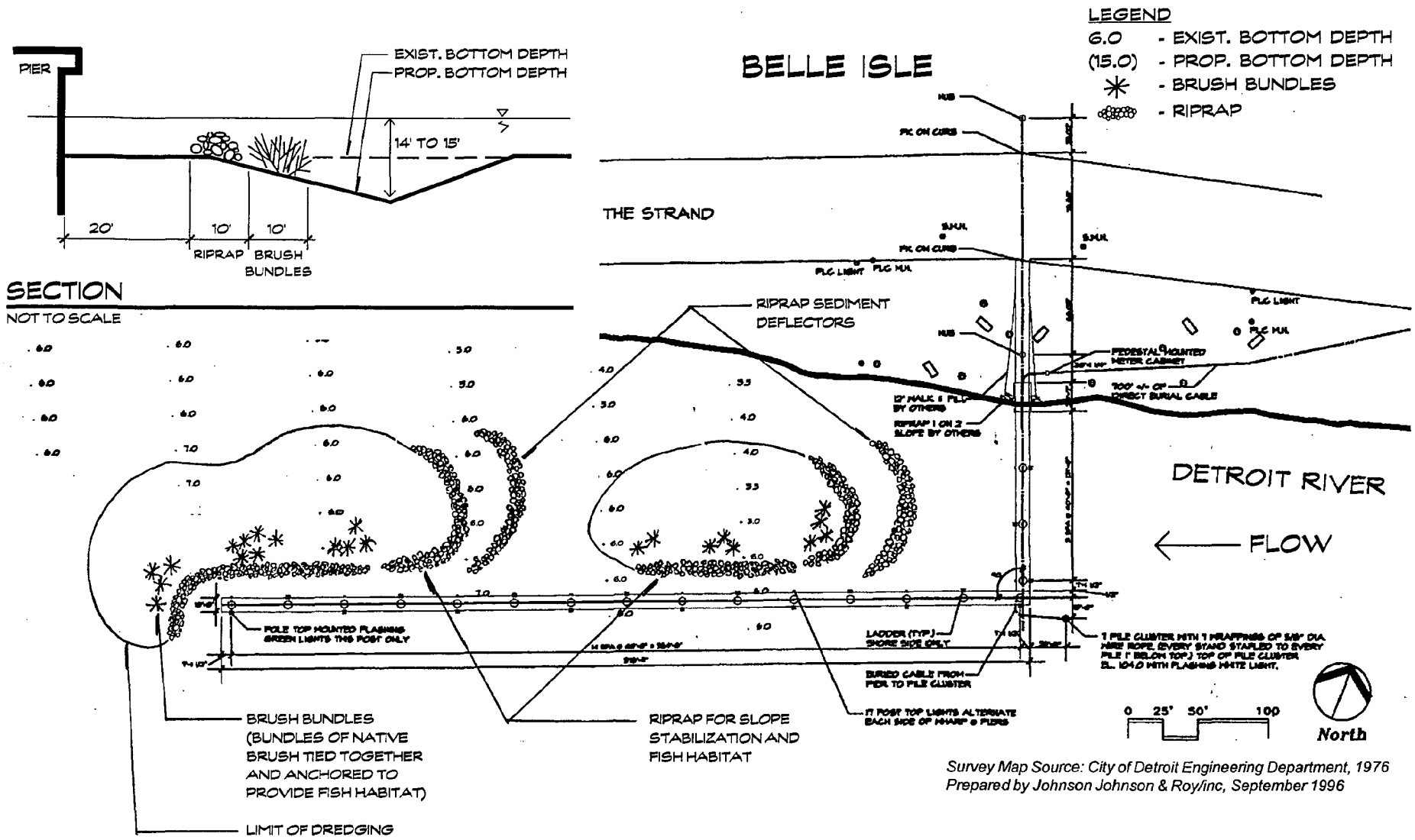
Belle Isle Piers Fishery Habitat Enhancement



Survey Map Source: City of Detroit Engineering Department, 1976
Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 7
Alternative B
Conceptual Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Structural Habitat

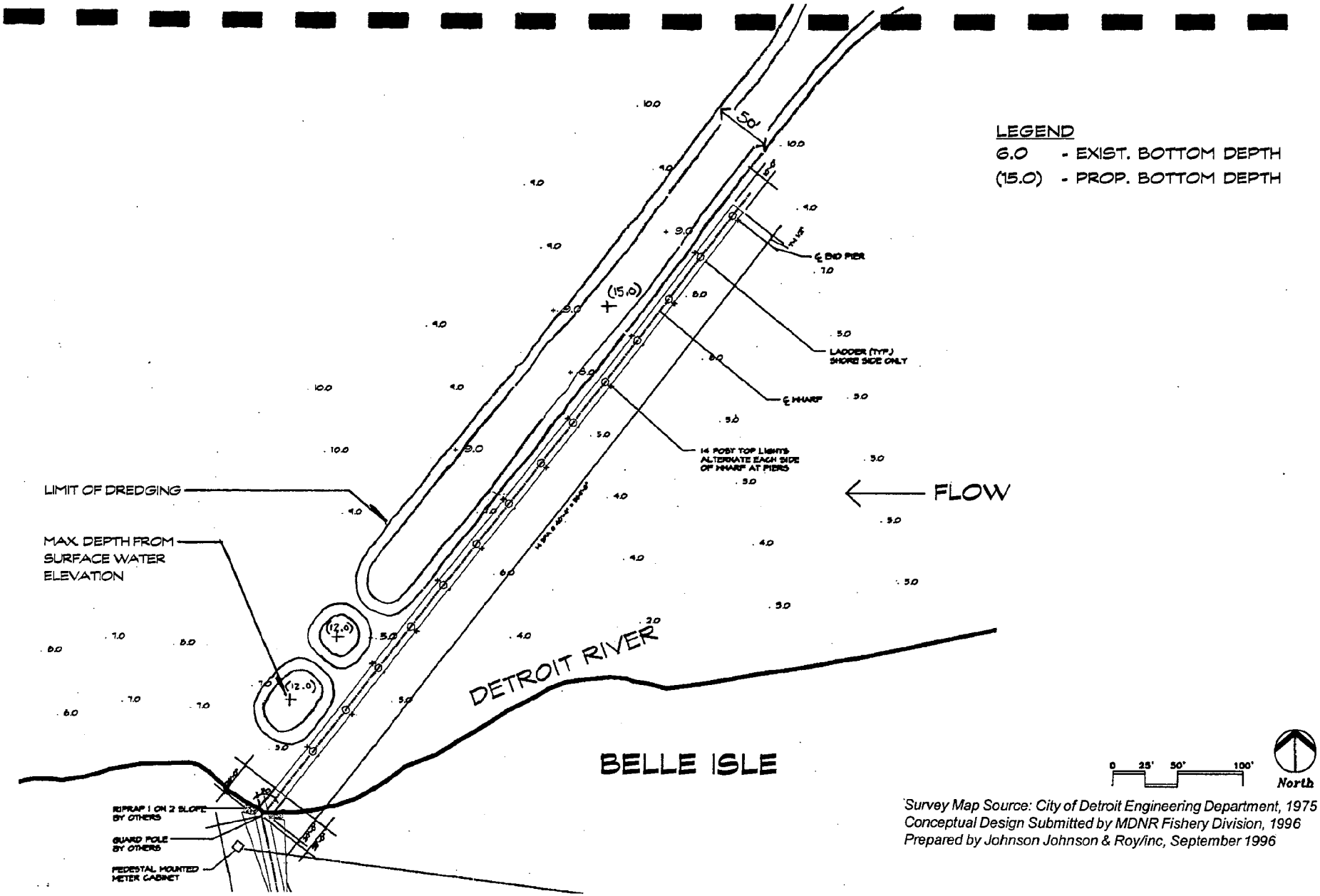
Belle Isle Piers Fishery Habitat Enhancement



Survey Map Source: City of Detroit Engineering Department, 1976
Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 8
Alternative C
Conceptual Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Structural Habitat

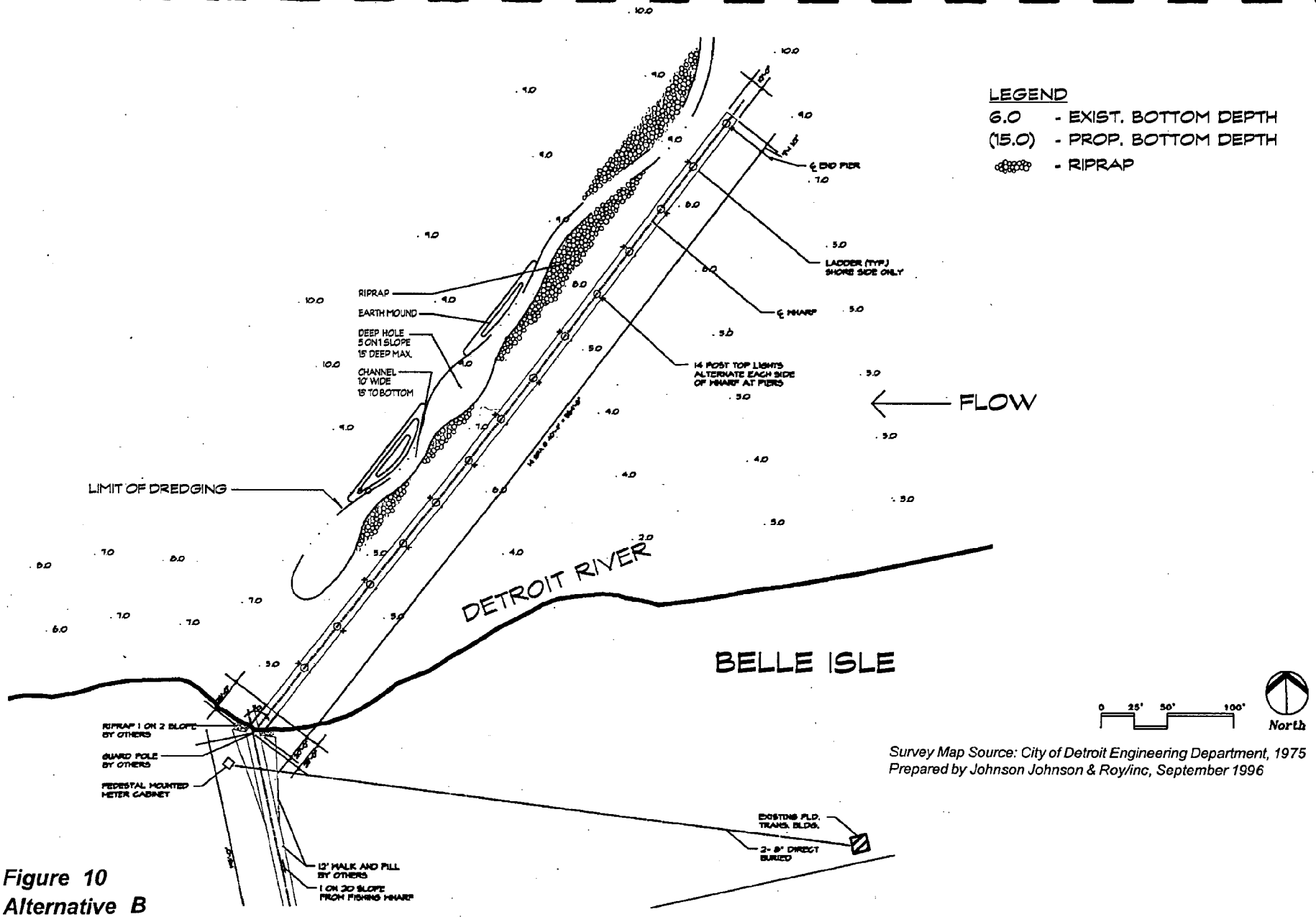
Belle Isle Piers Fishery Habitat Enhancement



Survey Map Source: City of Detroit Engineering Department, 1975
Conceptual Design Submitted by MDNR Fishery Division, 1996
Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 9
Alternative A
Conceptual Design for Proposed Fishery Habitat along Inselruhe North Wharf - Dredging

Belle Isle Piers Fishery Habitat Enhancement



Survey Map Source: City of Detroit Engineering Department, 1975
Prepared by Johnson Johnson & Roy/inc, September 1996

Figure 10
Alternative B
Conceptual Design for Proposed Fishery Habitat along Inselruhe North Wharf - Structural Habitat

Belle Isle Piers Fishery Habitat Enhancement

- The design does not include a structure to prevent sediment from upstream sources being deposited into dredged areas.

Alternative C

This alternative consists of two roughly oval shaped basins (Figure 8). The basins are approximately 180 feet long and 100 feet wide to a maximum depth of 15 feet. Riprap is placed within the basin on upstream slopes and slopes near the pier. A semi-circular sediment deflector is placed 25 feet upstream of each basin to protect the basin from sedimentation. Brush bundles (bundles of native brush bound together and anchored to the bottom) serve as refuge and forage areas for gamefish. The bundles are placed on the basin slopes facing the pier within reach of the average angler's cast (50 feet). A portion of one basin extends approximately 30 feet outside of the pier into the Detroit River. Alternative C was modified for the following reasons:

- Brush bundles are designed for lemnetic systems and will not remain stationary in areas with velocities evident in this section of the river.

- Sediment deposition protection can be achieved with less stone placed in a location better suited for sediment deflection.

Inselruhe North Wharf Fishery Habitat Enhancement Conceptual Alternatives

Alternative A

This alternative is the original conceptual design developed by a MDNR Fisheries Division personnel (Figure 9). The design consists of a two basins and a channel located 15 feet downstream of the wharf. The basin nearest to the shoreline is oval shaped, 50 wide, 75 feet long and 12 feet deep. The other basin is circular and is about 40 feet by 40 feet and 12 feet deep. The channel is 50 feet wide and approximately 1,000 feet long to a maximum depth of 15 feet. The channel is aligned parallel to the wharf and is designed to intersect with the 15 foot depth contour within the Detroit River channel. The channel will serve to attract larger fish inhabiting deep water in the river to areas near the wharf. Alternative A was modified for the following reasons:

- Enhancements to the fishery by the addition of isolated basins and channel would be negligible compared to the design of a single channel.

- A 20 foot buffer should be maintained between the dredging and pier supports.

- Design constraints posed by the bottom substrate composition prevent construction of the proposed (nearly vertical) side slopes. A minimum 4:1 slope is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

Alternative B

This alternative consists of a mildly undulating channel with moderate expansion of two deep water areas (Figure 10). The channel is located 20 feet downstream of the wharf and is 10 feet wide and approximately 1,000 feet long, to a maximum depth of 15 feet. The channel is

aligned parallel to the wharf and is designed to intersect with the 15 foot depth contour within the Detroit River channel. The deep water areas are 30 feet wide, 80 feet long and 15 feet deep. Alternating areas of riprap serve to stabilize the channel and function as refuge and spawning habitat. Dredge spoil is to be placed in mounds along the channel for increased habitat diversity. Alternative B was modified for the following reason:

- Design constraints posed by the bottom substrate composition prevent construction of the proposed side slopes (nearly vertical within the channel). A minimum 4:1 slope is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

SECTION V DISCUSSION OF PIER ENHANCEMENTS

The City of Detroit Recreation Department has taken a major step towards accomplishing its goal of providing citizens of Detroit increased opportunity for successful fishing experiences on Belle Isle. Once the implementation of the Fishery Habitat Enhancement project is complete, The City of Detroit Recreation Department will address the need to attract gamefish to the areas near the piers. Structural enhancements to the piers are the next step towards accomplishment of the aforementioned goal.

Seeking to provide anglers improved fishing success from the piers, the City of Detroit Recreation Department conducted field observations, angler interviews (Appendix C), and consulted with MDNR Fisheries Division personnel (Appendix D). As a result of these efforts, the City of Detroit Recreation Department concluded that to provide anglers successful fishing experiences, structural enhancements to the piers must be performed. The enhancements would address the following shortcomings at the U.S. Coast Guard Fishing Pier and Inselruhe North Wharf:

- No shade
- No benches
- Piers dead end, no outlet
- Existing railings are unsafe for small children
- Anglers are very high up off of the water, making landing of fish difficult

Suggested enhancements include:

- 20 feet of shade every 100 feet along the arm of the pier that parallels the shore

- Installing several wooden benches on the U.S. Coast Guard Fishing Pier

- Connecting the U.S. Coast Guard Fishing Pier to Belle Isle by a second pier adjoining the existing pier in a perpendicular fashion. This would serve as a solution to the existing "dead end" design.

  Adding wire mesh or screening to the lower sections of the railing to prevent children from falling through open spaces between the railing guards.

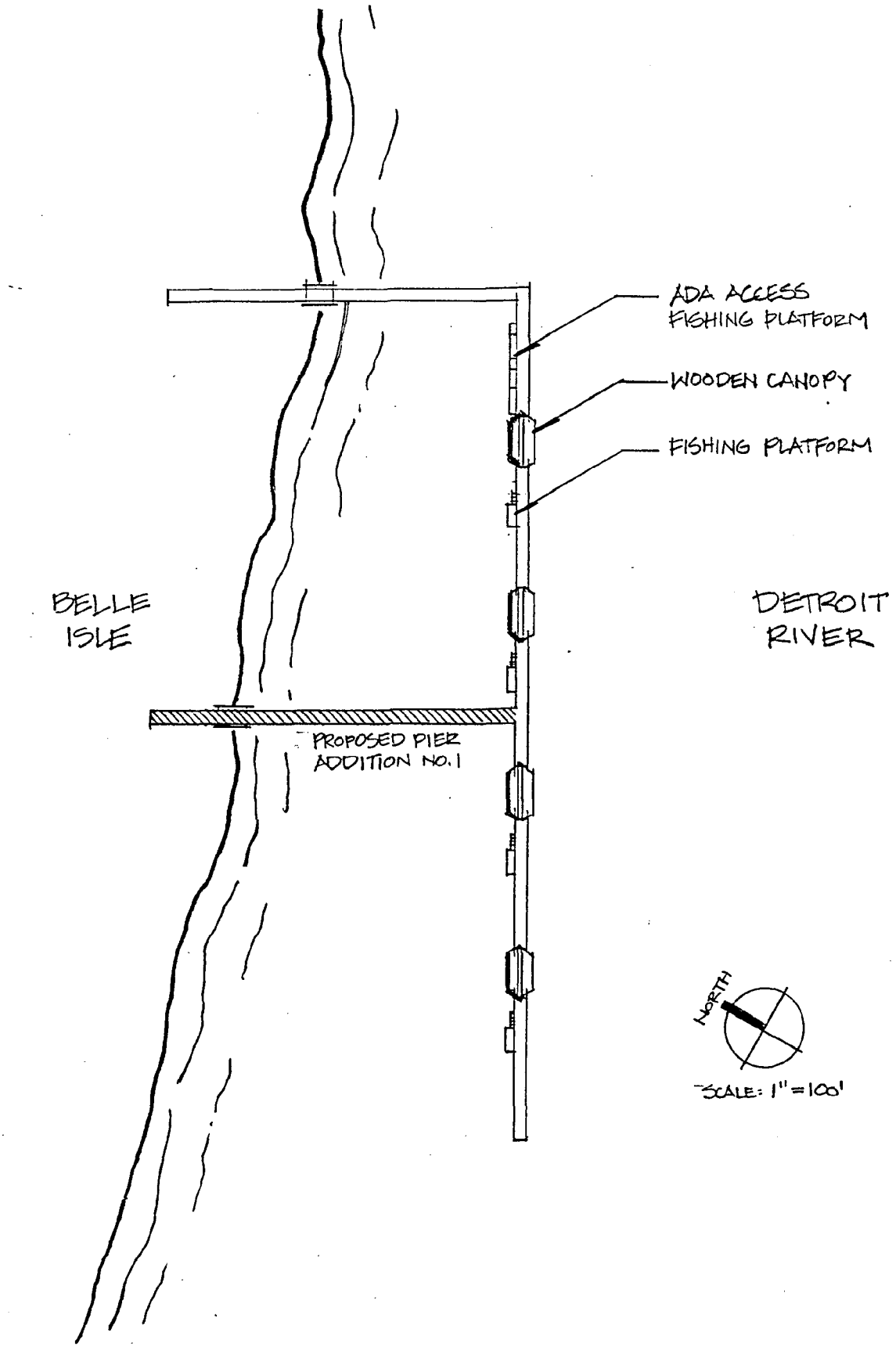


Figure 11

Conceptual Structural Improvements for the U.S. Coast Guard Fishing Pier with Pier Addition Configuration No. 1

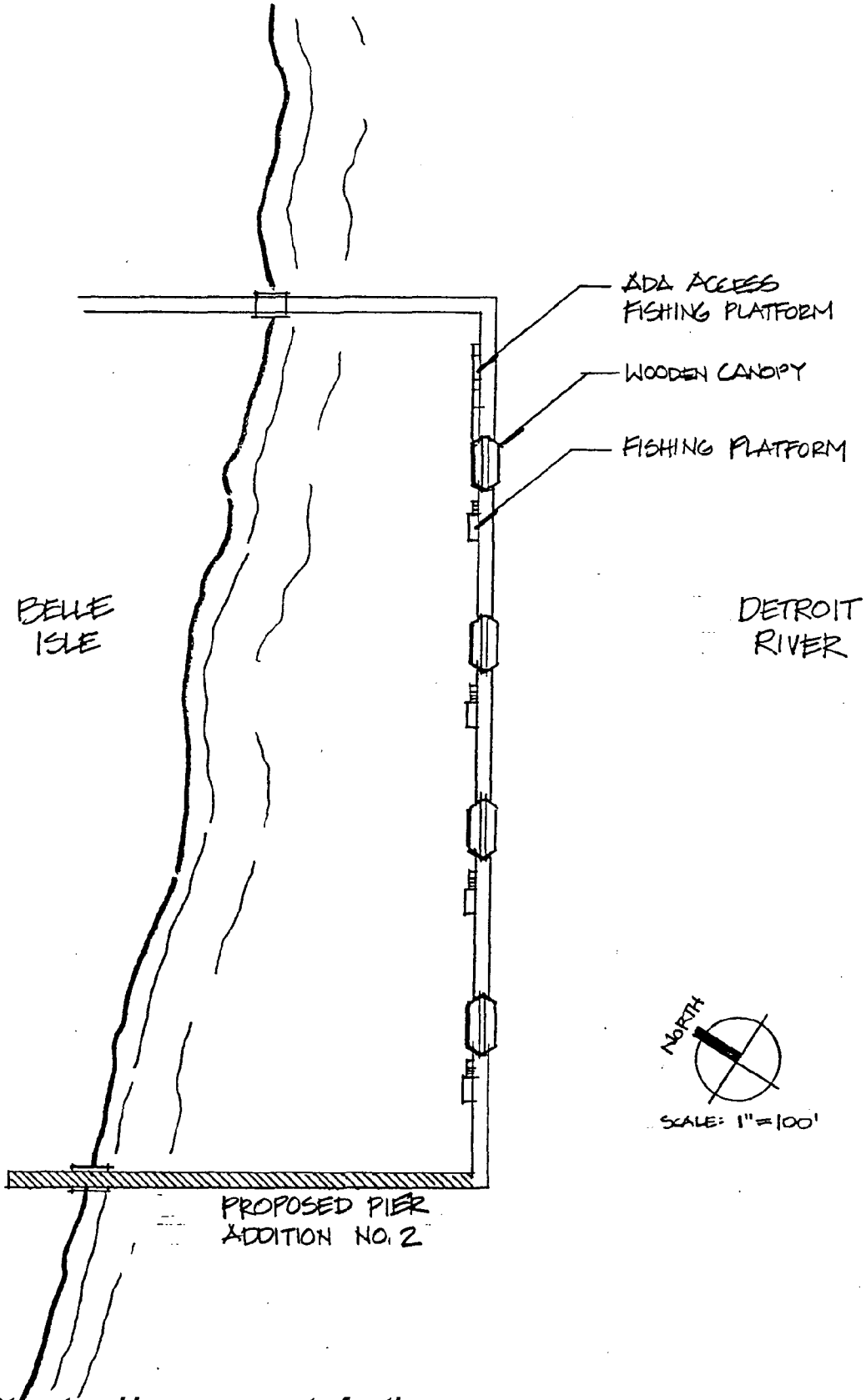


Figure 12
Conceptual Structural Improvements for the U.S. Coast Guard Fishing Pier with Pier Addition Configuration No. 2

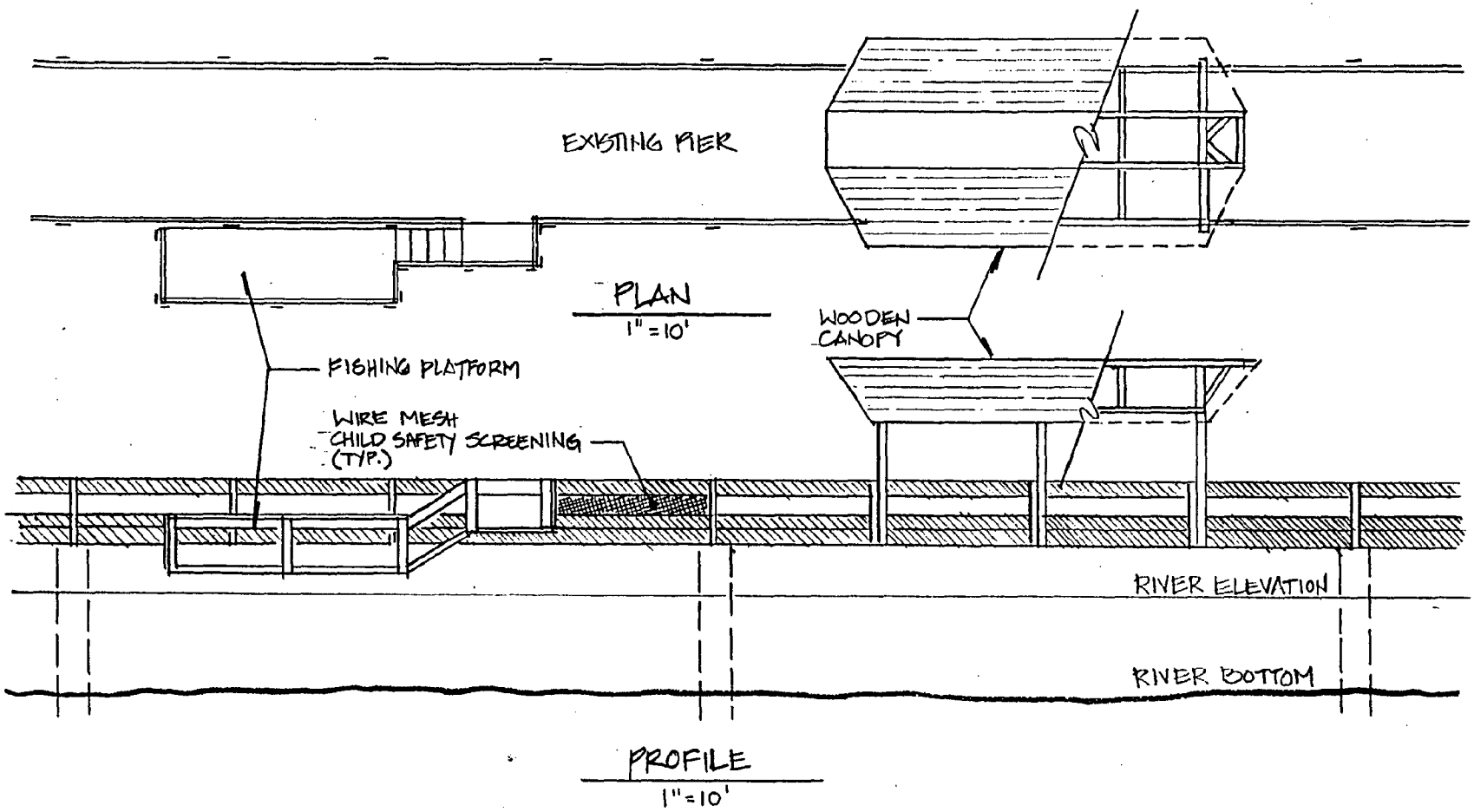


Figure 13
Conceptual Structural Improvements for the U.S. Coast Guard Fishing Pier

Belle Isle Piers Enhancement

Prepared by Johnson Johnson & Roy/inc, September 1996

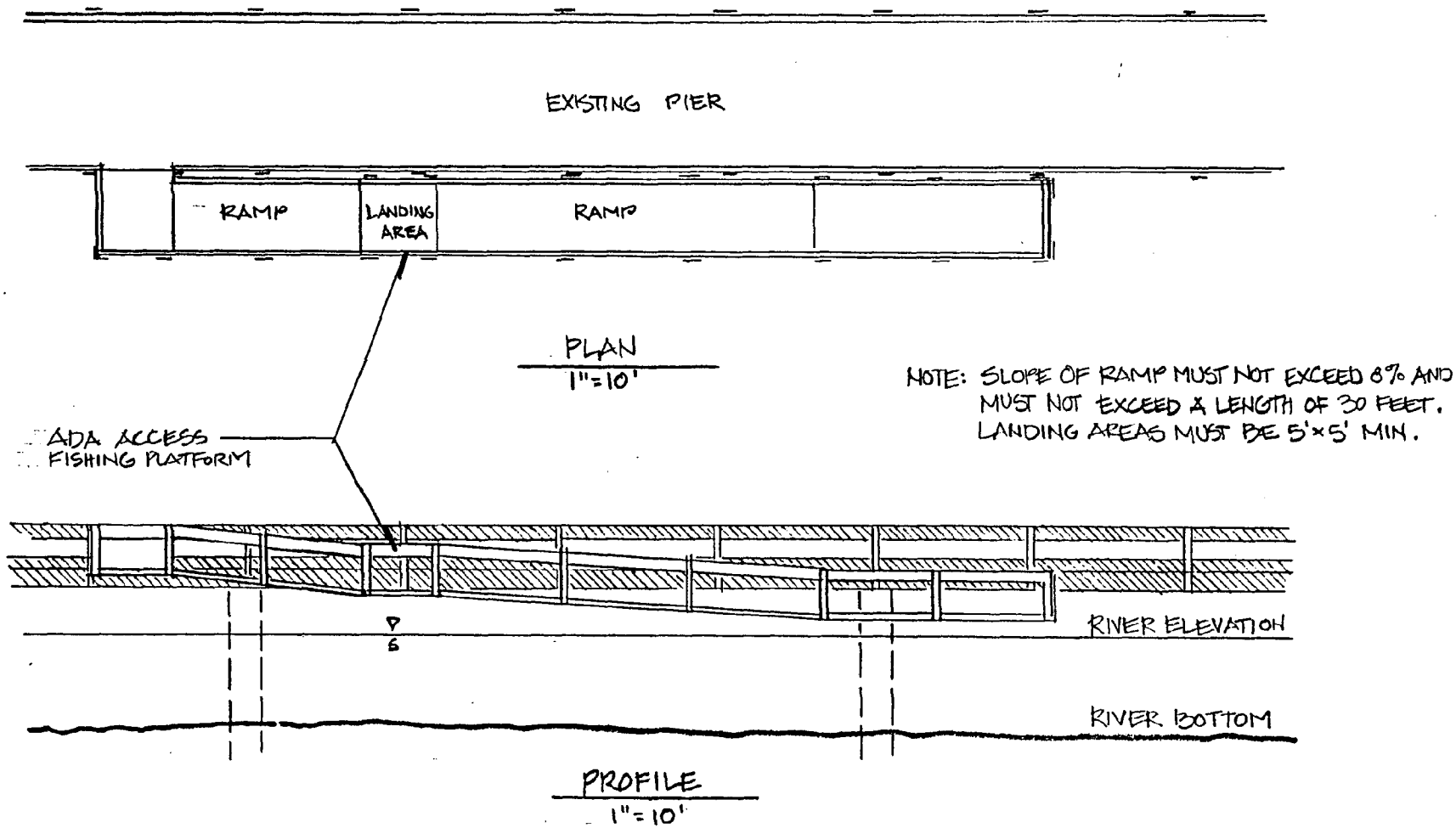
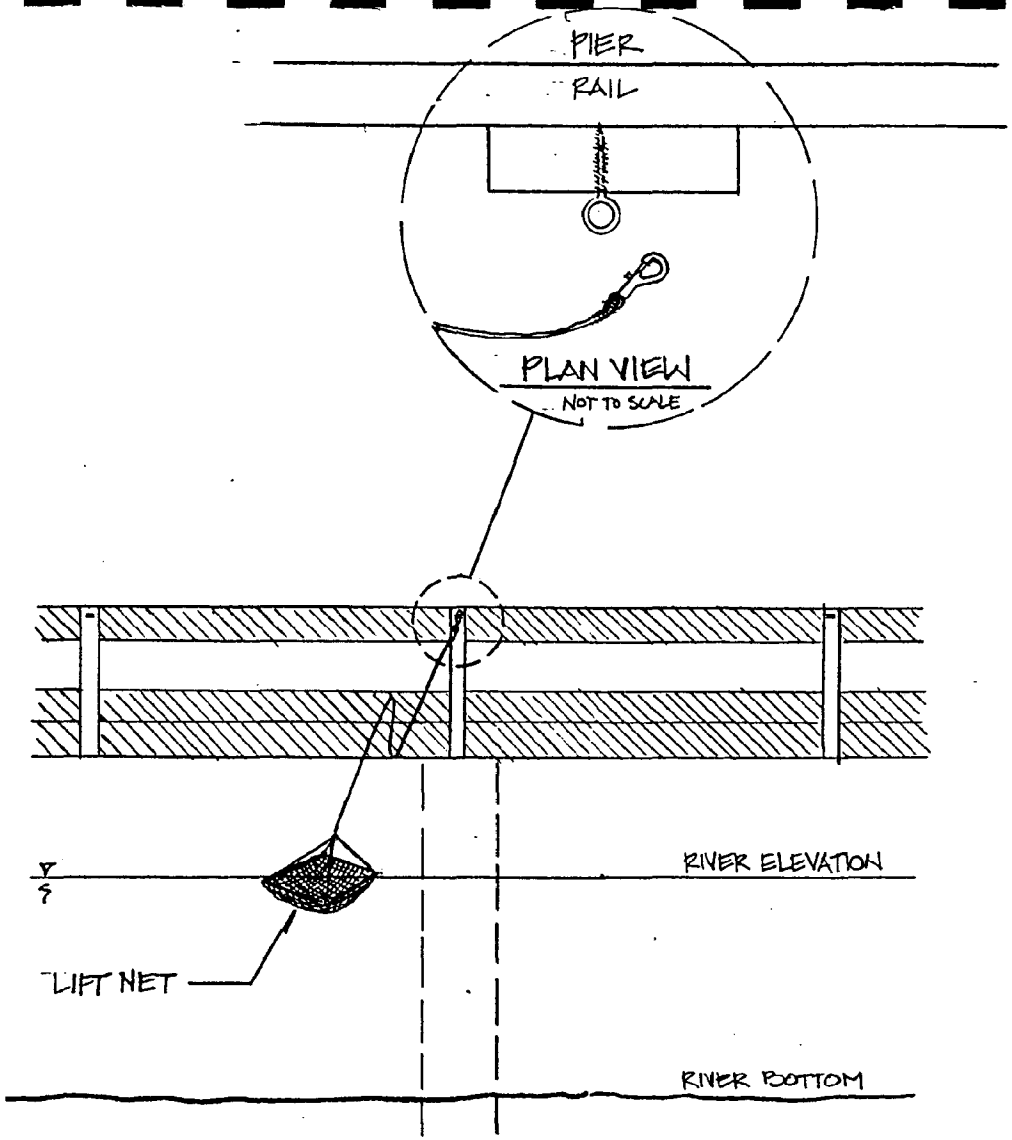


Figure 14
Conceptual ADA Access Fishing Platform for the U.S. Coast Guard Fishing Pier

Belle Isle Piers Enhancement

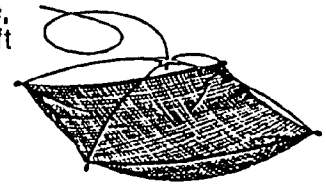
Prepared by Johnson Johnson & Roy/inc, September 1996



U.S. COAST GUARD PIER CONNECTION
NOT TO SCALE

Heavy-Duty Nylon Lift Nets

These nets are complete with 1/4-inch diameter spring-steel galvanized frame, and 1/4-inch diameter braided nylon lift ropes (1400 lb. test)

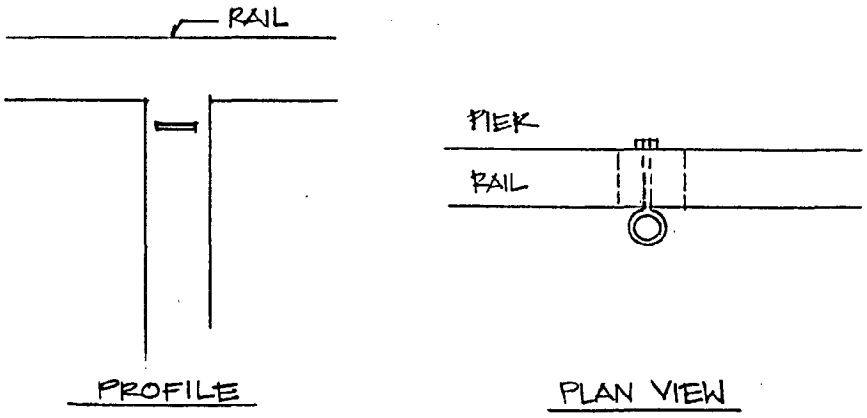


Special Options:

Netcoat — For ultraviolet protection. Black. Add $9.00 per net.

Plasti-Net — Dipped in non-tacky coating for ultraviolet and abrasion resistance. Green or Black. Add $10.00 per net.

SQUARE MESH	TWINE SIZE	FRAME 4' x 4'	SIZE (FEET) 6' x 6'	8' x 8'	10' x 10'
1"	#9	$19.95	$40.95	$51.45	$61.95
1-1/2"	#15	18.90	39.90	49.35	59.85
2"	#15	17.85	37.80	48.30	57.75
2-1/2"	#15	16.80	35.70	46.20	52.50
3"	#15	15.75	34.65	44.10	50.40



INSELRUHE NORTH WHARF CONNECTION
NOT TO SCALE

Figure 15
Lift Net and Attachment Alternative to Fishing Platforms

Belle Isle Piers Enhancement

Prepared by Johnson Johnson & Roy/inc, September 1996

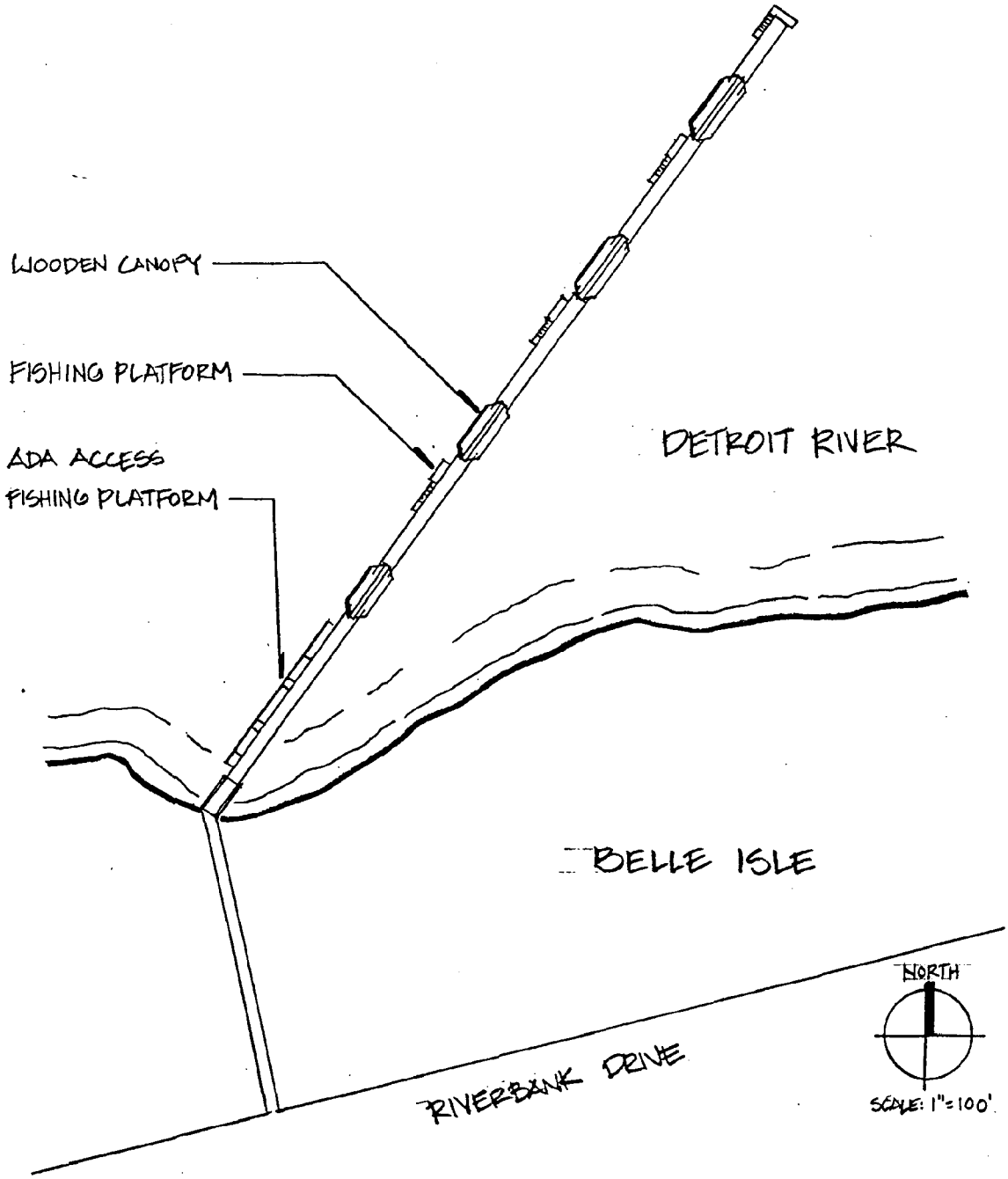


Figure 16
Conceptual Structural Improvements for the Inselruhe North Wharf

Belle Isle Piers Enhancement

Prepared by Johnson Johnson & Roy/inc
September 1996

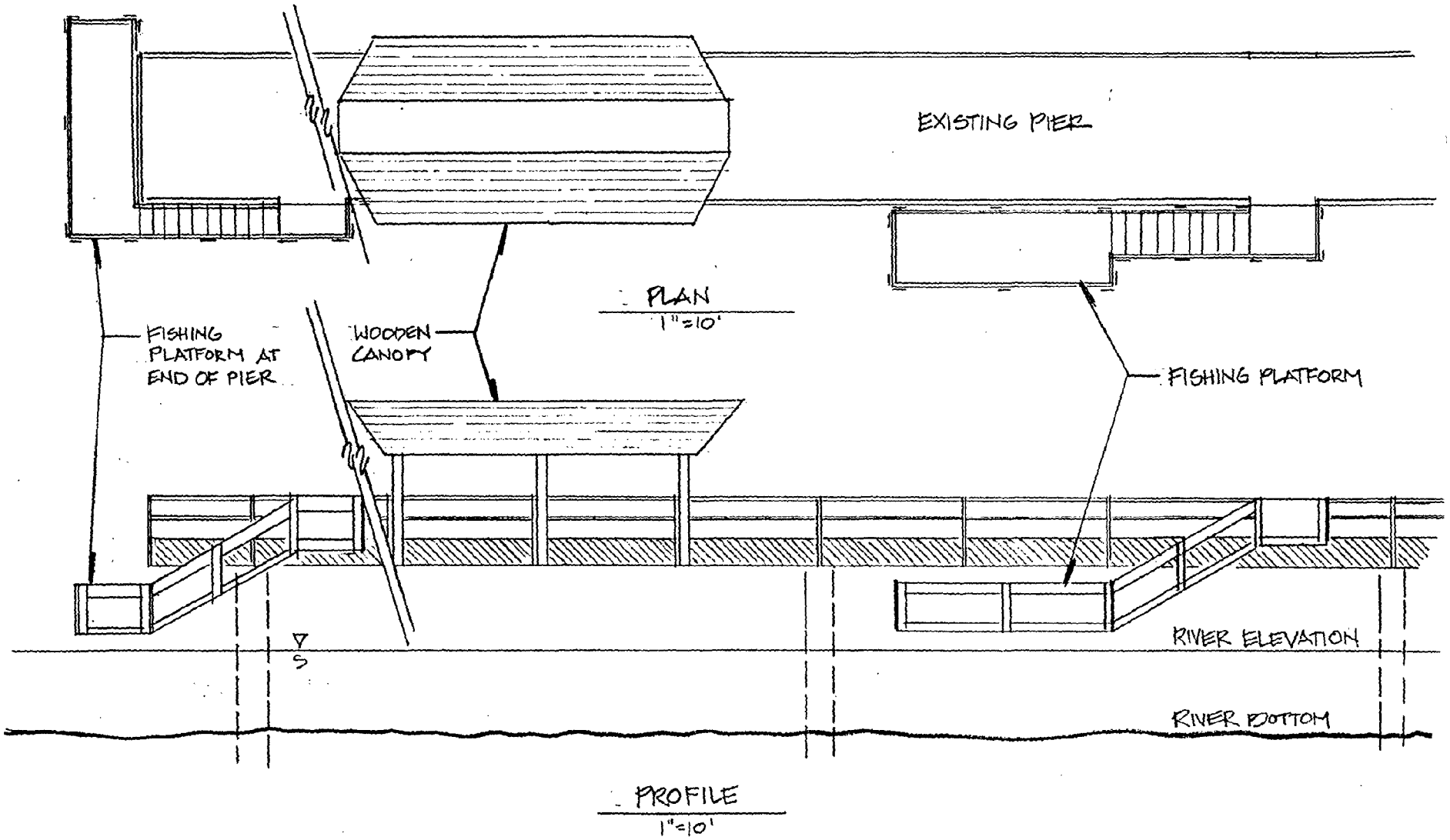


Figure 17
Conceptual Structural Improvements for the Inselruhe North Wharf

Belle Isle Piers Enhancement

Prepared by Johnson Johnson & Roy/inc, September 1996

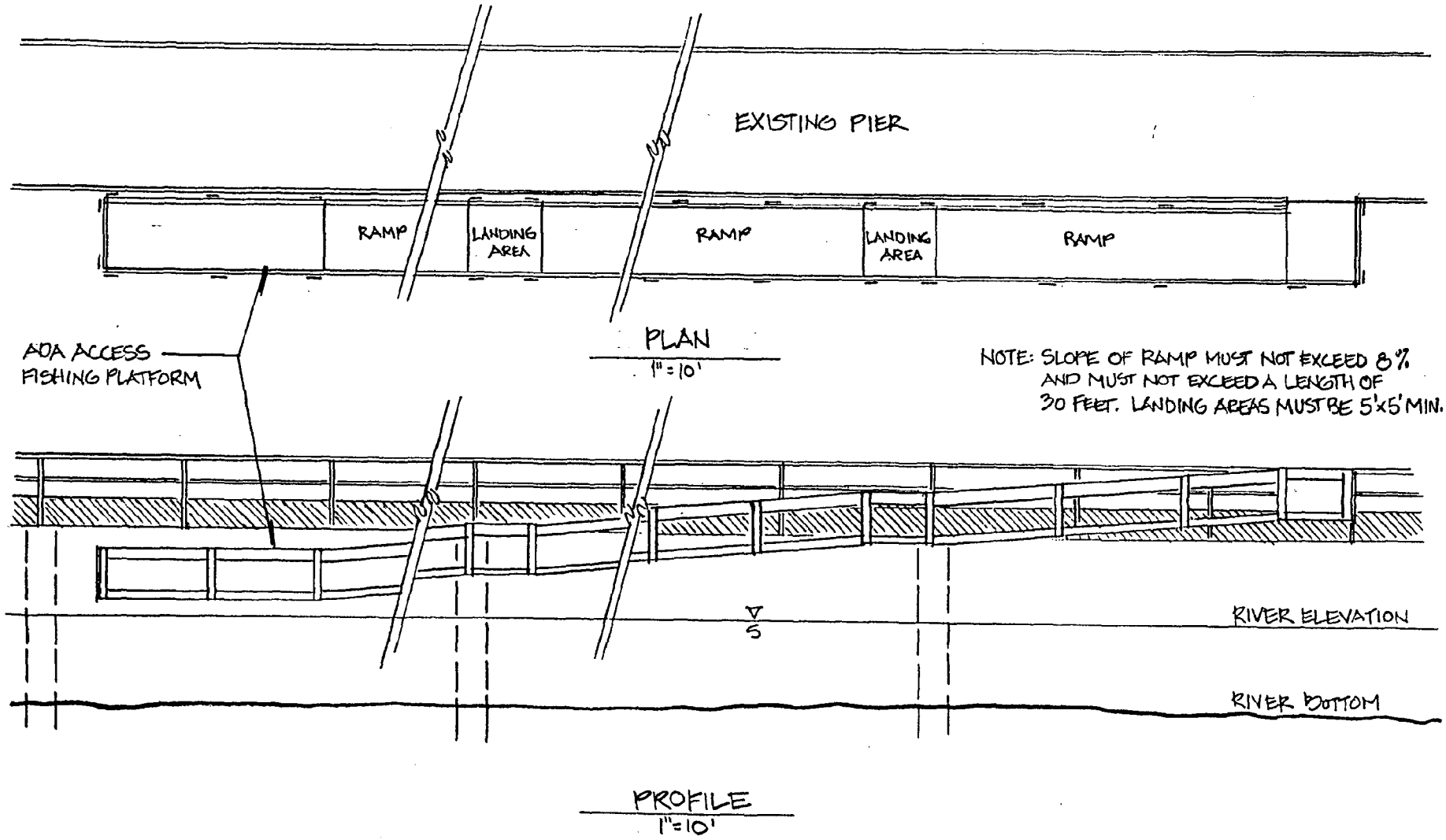


Figure 18
Conceptual ADA Access Fishing Platform for the Inselruhe North Wharf

Belle Isle Piers Enhancement

Prepared by Johnson Johnson & Roy/inc, September 1996

- Adding fishing platforms off of the side of the piers at certain intervals . These will serve to allow anglers closer access to the water. Platforms should extend far enough away from the pier to allow anglers to cast. Also one platform should be designed to meet ADA requirements and include a hinged gate that would restrict use to disabled users.

Conceptual plans to address structural shortcomings of the piers are presented in Figures 11 - 18.

U.S. Coast Guard Fishing Pier Enhancement

Conceptual plans concerning enhancement of the U.S. Coast Guard Fishing Pier are fairly extensive and address the need for improved public access, success of fish capture, comfort and safety.

Public Access

Enhancements would include construction of a second connection between the pier and Belle Isle (Figures 11 and 12). This connection would increase access to the enhanced fishery habitat and provide anglers a second location for entry or exit. Furthermore, non-anglers are expected to use the pier to view the Detroit River and passing ships and freighters. Two configurations for the addition are presented. The pier addition that would attach to the center of the pier section oriented parallel to the Belle Isle shoreline is the preferred arrangement (Figure 11). This section allows for maximum use of the proposed fishery habitat enhancement shown in Figure 3. The alternative configuration will require a longer section to be constructed and will be the most costly option (Figure 12).

Fish Capture

The addition of fishing platforms or use of lift nets are designed to increase the chance of successfully landing fish (Figures 13 - 15). Fishing platforms are permanent structures attached to the existing pier (Figures 13 and 14). They are designed to be raised or lowered based on the Detroit River surface water elevation. Platforms are designed to accommodate two anglers and fishing gear. An ADA access platform is provided within the first 100 to 200 feet from the pier entrance (Figure 14). The City of Detroit Recreation Department has developed general guidelines for the platforms including platforms should be maintenance free and able to be raised and lowered to accommodate fluctuations in Detroit River surface water elevation. Lift nets are considered an alternative to fishing platforms (Figure 15). Lift nets are commonly used to assist anglers who utilize piers along the Atlantic Coast. Lift nets are attached to the pier and allowed to remain in the water directly below the angler while fishing. Once a fish is hooked the angler guides the fish into the net, which is then lifted up onto the pier. Nets could be provided free of charge or rented to cover the cost of replacing worn nets.

Safety

Installation of wire screening in the spaces between the lower guard rail and the floor of the pier would prevent small children from accidentally falling from the pier into the River (Figure 13). A wooden canopy would provide shade and a respite from the dangers of overexposure to the sun.

Comfort

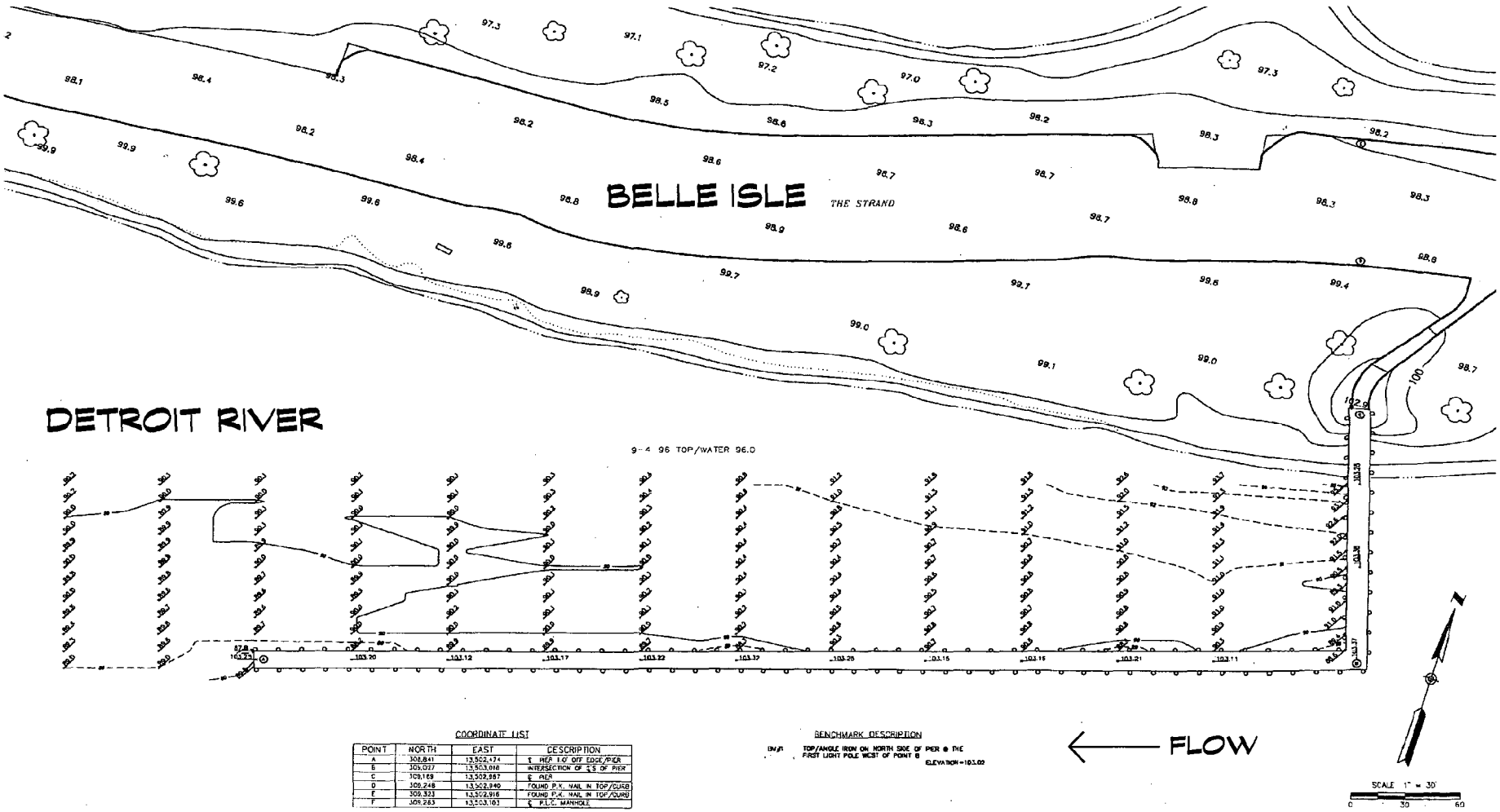
A wooden canopy would provide anglers shade (Figure 13). This addition would increase utilization of the piers by anglers and non-anglers. It is anticipated that this structure would improve the recreational experience of the piers associated with fishing and ship watching.

Inselruhe North Wharf Enhancements

Excluding reconnection of the Inselruhe North Wharf to the Island, conceptual enhancements for this pier would be identical to those proposed for the U.S. Coast Guard Fishing Pier (Figures 17 and 18).

APPENDIX A

DETROIT RIVER BOTTOM ELEVATION SURVEY



COORDINATE LIST

POINT	NORTH	EAST	DESCRIPTION
A	308,841	13,502,474	℄ PIER 1.0' OFF EDGE/PIER
B	309,037	13,503,016	INTERSECTION OF ℄'S OF PIER
C	309,169	13,502,867	℄ PIER
D	309,248	13,502,940	FOUND P.K. NAIL IN TOP/CURB
E	309,323	13,502,916	FOUND P.K. NAIL IN TOP/CURB
F	309,283	13,503,103	℄ P.L.C. MANHOLE

BENCHMARK DESCRIPTION

BM#1 TOP/ANGLE IRON ON NORTH SIDE OF PIER @ THE FIRST LIGHT POLE WEST OF POINT B

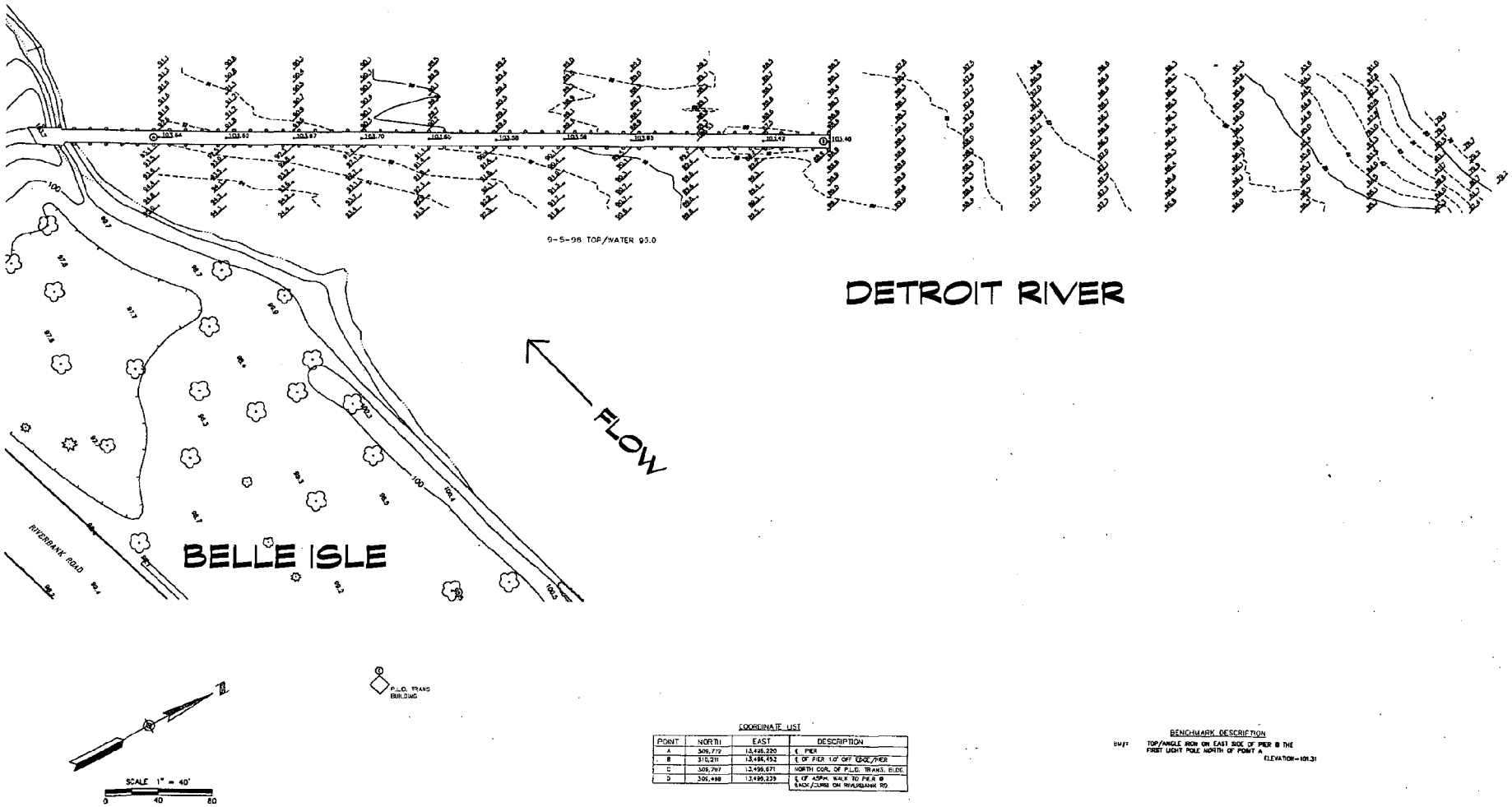
ELEVATION = 103.02

Appendix

Detroit River Bottom Elevation Survey - U.S. Coast Guard Fishing Pier

Survey by Spaulding, DeDecker & Associates
September 1996

Belle Isle Piers Fishery Habitat Enhancement



COORDINATE LIST

POINT	NORTH	EAST	DESCRIPTION
A	306,772	13,496,220	℄ PIER
B	310,211	13,496,452	℄ OF PIER 1.0' OFF EDGE/PIER
C	306,767	13,496,671	NORTH COR. OF P.L.D. TRANS. BLDG.
D	306,498	13,496,239	℄ OF ASPH. WALK TO PIER @ BACK/CURB ON RIVERBANK RD.

BENCHMARK DESCRIPTION

BM#1 TOP/ANGLE IRON ON EAST SIDE OF PIER @ THE FIRST LIGHT POLE NORTH OF POINT A
ELEVATION=101.31

Appendix

Detroit River Bottom Elevation Survey - Inselruhe North Wharf

Survey by Spaulding, DeDecker & Associates
September 1996

Belle Isle Piers Fishery Habitat Enhancement

APPENDIX B

PROJECT PRELIMINARY COST ESTIMATE

BELLE ISLE PIERS FISHERY HABITAT ENHANCEMENT
PRELIMINARY ESTIMATE OF PROBABLE CONSTRUCTION COSTS

JOHNSON JOHNSON & ROY/INC

CITY OF DETROIT RECREATION DEPARTMENT

ITEM	QUANTITY	UNIT	UNIT COST	ITEM COST
INSELRUHE NORTH WHARF HABITAT				
MOBILIZATION / DEMOBILIZATION	1	ALLOW	$7,500.00	$7,500
CONTRACTOR'S FIELD ENGINEERING	1	ALLOW	$5,000.00	$5,000
DREDGING SIDE CASTING	12400	CY	$4.50	$55,800
TEMPORARY EROSION CONTROL	1	LS	$6,250.00	$6,250
TEMPORARY NAVIGATIONAL AIDS	1	LS	$5,000.00	$5,000
SUBTOTAL INSELRUHE HABITAT AREA				$79,550
COAST GUARD FISHING PIER HABITAT				
MOBILIZATION / DEMOBILIZATION	1	ALLOW	$10,000.00	$10,000
CONTRACTOR'S FIELD ENGINEERING	1	ALLOW	$5,000.00	$5,000
DREDGING SIDE CASTING	7400	CY	$4.50	$33,300
BEDDING STONE IN PLACE	1300	TON	$35.00	$45,500
STONE RIPRAP IN PLACE	2550	TON	$35.00	$89,250
TEMPORARY EROSION CONTROL	1	LS	$7,500.00	$7,500
TEMPORARY NAVIGATIONAL AIDS	1	LS	$5,000.00	$5,000
SUBTOTAL US COAST GUARD PIER HABITAT AREA				$195,550
SUBTOTAL CONSTRUCTION				$275,100
OWNERS TESTING AGENCY				$9,000
ENGINEERING FEES				$20,633
CONTINGENCY / UNDEVELOPED DETAILS 15%				$41,265
PROJECT TOTAL COST				$345,998

NOTES TO THE STATEMENT OF PROBABLE CONSTRUCTION COSTS

1. The cost estimate is based on typical water-based construction in the Detroit area, using 1996 costs.

2. Mobilization and demobilization are based on a local contractor within the Southeastern Michigan region.

3. Contractor field engineering includes the layout, soundings and survey required for the proper implementation of the work. Also included is any quality control requirements as indicated in the technical specifications which form a part of the contract documents.

4. Dredging unit costs are based on the contractor sidecasting the material outside of the influence area of the river and current within the project area. No material removal, including loading on barges and transporting to areas for disposal outside the project area, has been included. This item will be subject to the requirements of the U.S. Army Corps. of Engineers, the Michigan Department of Environmental Quality, the U.S. Fish and Wildlife Service and the Environmental Protection Agency.

5. Temporary erosion control includes measures required to minimize the amount of suspended material transportation outside the project area.

6. Temporary navigational aids includes buoys, day lights and signs, and night time lighting and warning devices required to ensure the safety of recreational and commercial watercraft within the project area during the implementation of the work, as well as mobilization and demobilization operations.

7. Unit prices for bedding and riprap stone are based on minimum material handling and no site stockpiling of the materials. Transportation to the site by barge is assumed with lightening barges used, if required.

8. Stone placement and riprap construction is not intended to be a structural design. The placement of these materials is for the purposes of minimizing the amount of erosion and transportation of the riverbed material into the habitat areas. These riprap areas will settle and move with current, water fluctuation, ice movement and sand accumulation.

9. The owner's testing agent item includes the survey, testing and verifications required to satisfy the owner that all construction operations are being implemented within the requirements of the construction documents and permits pertaining to the work.

10. The undeveloped design details item is intended to cover unknown conditions that may arise during the construction operations. As with all water based construction, specifically with below water work, unknown conditions can arise which may result in additional costs to properly implement the work. There is no way to anticipate these conditions, and the inclusion of this line item is strongly recommended to be included in the project budgeting process.

APPENDIX C

FIELD OBSERVATION REPORT

JJR/

110 Miller
Ann Arbor, Michigan 48104-1399
313 662 4457
313 662 7520 FAX

Planning
Landscape Architecture
Urban Design
Civil Engineering
Environmental Services

Johnson Johnson & Roy/inc

FIELD OBSERVATION REPORT

project name:	Belle Isle Piers/CZM
project number:	17878.00
location:	Belle Isle, Detroit, Michigan
date:	26 April 1996
participants:	Gary Crawford - JJR

The purpose of this field visit was twofold: firstly, to identify alternatives for fishery habitat improvement, and examine the existing structure and fishery habitat surrounding the Inselruhe North Wharf and the US Coast Guard Pier; and, secondly, to support the function presented by Earth Tomorrow at the Nature Center and present alternative locations for Earth Tomorrow's wetland restoration project.

Weather

The day was windy and cool (about 45 to 50° F) with brief showers amid periods of sunshine. In the Detroit River, whitecap waves proceeded in a northeast direction. The water was fairly turbid with visibility of about 1 foot.

Inselruhe North Wharf

The existing structure is approximately 6 feet above the surface of the river and is quite sterile in appearance. It functions as an observation deck rather than a fishing wharf. Upstream of the wharf, the water is shallow, and sand and debris form a point extending approximately 20 feet from the bank. Downstream of the wharf, the water is deeper and the steep bank is armored with slabs of concrete armor stone and rebar. The wire-like rebar projecting from the armor stone bank at various intervals may be injurious to the unwary angler, and could interfere with successful landing of fish. Extending out from the downstream bank, about 100 feet from the wharf, appears to be remnants of an old boat dock consisting of approximately eight wooden pilings.

Criteria For Fishery habitat Improvement

The fishery would benefit from habitat improvements that accomplish several goals: 1) attract forage (i.e., minnows, crayfish and aquatic insects) for sport fish; 2) provide areas of refuge from current for large fish or migratory fish species; 3) provide areas for spawning of adult fish; and, 4) provide anglers with the opportunity for exploitation of the fishery.

Any habitat improvements must be able persist and function in conditions that occur in the Detroit River including high fluid velocities, wave action, ice scour, zebra mussel infestation and sand accretion.

Angler Interview

I spoke to one angler who was putting away his fishing tackle as I approached the wharf. He stated that he does not fish from the wharf itself, but he does fish from the bank downstream of the wharf. He stated that the majority of people fish from the shore and the catch consists of rock bass, pike (17 - 20 inches) and an occasional walleye. He said that local anglers designate the area "Pike City". He had not caught anything, but weeds, and the weeds are beginning to grow out into deeper water. He said that anglers catch small perch and pike off of the downstream face of the wharf, but must run off the wharf and land the pike from shore. I asked him what would he like to see done to improve the wharf. He said "a fresh coat of white or light blue paint, rod holders and a way to get closer to the water to make landing fish easier". He did not think benches would be needed because most people bring their own folding chairs.

Coast Guard Pier

In contrast to the Inselruhe North Wharf, the Coast Guard Pier is more inviting. This is due to increased visibility from the road resulting from the parallel orientation of the pier to the bank for the majority of its length. The womanized wood also gives it a soft, warm appearance. However, the pier is too high up and away from the water to provide successful landing of large fish with light line. The water on the inside bend of the pier is shallow and can be very weedy in the summer, but this area provides a unique opportunity to provide an improved fishery habitat structure for pier and bank anglers.

Criteria for Fishery habitat Improvement

The fishery would benefit from habitat improvements that accomplish several goals: 1) attract forage for sport fish (i.e., minnows, crayfish and aquatic insects); 2) provide areas of refuge from current for large fish or migratory fish species; 3) provide areas for spawning of adult fish; and, 4) provide anglers with the opportunity for successful capture of fish.

Any habitat improvements must be able persist and function in conditions that occur in the Detroit River including wave action, zebra mussel infestation and sand accretion. If habitat was created on the inside of the bend, smaller materials would be needed for structure, because the

pier itself serves to reduce wave action, break up current and prevent major ice scour. Also bank anglers would benefit from deep water habitat within casting distance. I believe this area may be able to sustain crappies, bluegill, largemouth bass and channel catfish if the proper structure and depth is provided. I have provided a rough illustration of one alternative.

Earth Tomorrow

I attended the Wading Into Wetlands function until lunch. I spoke to Susan Campbell, director of the Nature Center, Tim Eder and Carey Rogers about alternative locations for wetland restoration. Tim Eder and Susan Campbell were uneasy about selecting other locations until they received more information from the Department of Recreation. I believe that they favored the area behind the Nature Center. Carey was more receptive to alternative locations such as the Blue Heron Lagoon or the small wetland next to the Nature Center. Susan thought that the City had plans for the location at Blue Heron Lagoon. The overall sentiment was that they would like to restore the area behind the Nature Center if the facility and its functions are to remain intact. I encouraged them to examine and consider other locations.

Respectfully submitted,

JOHNSON JOHNSON & ROY/inc

Gary W. Crawford
Aquatic Biologist

rlg/bellepr

Attachment

APPENDIX D

AGENCY CORRESPONDENCE

JJR/

110 Miller
Ann Arbor, Michigan 48104-1399
313 662 4457
313 662 7520 FAX

Planning
Landscape Architecture
Urban Design
Civil Engineering
Environmental Services

Johnson Johnson & Roy/inc

CONFERENCE REPORT

project name: Belle Isle Piers/CZM

project number: 17878.00

location: MDNR Offices, Livonia, Michigan

date: 10 July 1996

participants: Gary Towns, Ron Spitler - MDNR
Douglas Denison, Gary Crawford - JJR

G. Crawford and D. Denison met with MDNR fishery biologists G. Towns and R. Spitler to develop a conceptual design for the improvement of fish habitat located near the Inselruhe North Wharf and U.S. Coast Guard Pier on Belle Isle, Detroit, Michigan.. Several items were discussed during the meeting including: 1) structural improvements to the piers; 2) creation and location of deep water habitat near piers; and, 3) fish stocking program for the inland waterways of Belle Isle.

Upon review of City of Detroit engineering schematics and a survey of the U.S. Coast Guard Piers, G. Towns, R. Spitler and D. Denison began to make suggestions regarding structural improvements of the pier. These improvements were directed at the structural shortcomings that prohibit angler use.

Structural Improvements

The shortcomings were identified as:

- No shade
- No benches
- Pier dead ends, no outlet
- Existing railings are unsafe for small children
- Anglers are too high up off of the water

- A survey of the depth and substrate must be provided prior to construction of deep water habitat. The survey should occur from the edge of the pier to a distance of 60 feet on both sides of the pier.

Inselruhe North Wharf

- Dredging of a 50 foot wide channel along the length of the pier. Maximum depth of the channel is 15 feet. The channel traverses parallel to the downstream side of the pier and ends in water from 15 to 20 feet deep.

- A survey of the depth and substrate must be provided prior to construction of deep water habitat. The survey should occur from the edge of the pier to a distance of 60 feet on both sides of the pier.

- Because this area has been identified by RAP as a location for conservation of wetlands within the Detroit River, there may be opposition to creation of deep water habitat within this area.

- Placement of dredge spoil and permitting through U.S. Army Corps of Engineers are challenges to the completion of the project.

Fish Stocking in Lakes and Canals

A fish stocking program for the Belle Isle inland waterway was discussed. MDNR personnel stated the following:

- Channel catfish and/or largemouth bass could be planted; however, the channel catfish fishery would have to be planted annually because the fishery would not be sustained through natural reproduction.

- Because largemouth bass are highly successful predators of juvenile channel catfish, only large channel catfish (8 to 10 inches) would be stocked in combination with largemouth bass.

- To ensure the success of the fish stocking program, planting of fish will not occur until a certain level of water quality within the canals and lakes has been reached.

Suggested improvements are:

- Twenty feet of shade every 100 feet along the arm of the pier paralleling the shoreline
- Installation of several wooden benches
- Connection of the pier to the mainland by a second pier adjoining the existing pier in a perpendicular fashion. This would serve as a solution to the existing "dead end" design.

- The addition of wire mesh or screening to the lower sections of the railing to prevent children from falling through open spaces between the railing guards.

- The addition of fishing platforms off of the side of the pier at certain intervals . These will allow anglers closer access to the water. Platforms should extend far enough away from the pier to allow anglers to cast. Also, one platform should be designed to meet ADA requirements and include a hinged gate that would restrict use to handicapped users.

Similar improvements are required for the Inselruhe North Wharf, except for reconnection to the mainland.

Conceptual Designs

Conceptual designs for the creation of deep water habitat around the piers were formulated. Design specifics for the deep water habitat are as follow:

US Coast Guard Fishing Pier

- Dredging of an undulating channel along the length of the pier. The channel traverses parallel to the inside of the pier for approximately 578 linear feet.

- The channel turns 90 degrees away from the mainland and ends perpendicular to, and past, the end of the pier.

- The channel should be within the reach of an angler's cast (no more than 50 feet from the pier). Channel depth should reach a maximum of 15 feet from surface to bottom.

- Dredge spoil can be deposited at various locations along the edge of the channel to provide a variety of relief which will attract fish and assist anglers in develop a feel for the structure.

- Rubble and cobblestone may be placed along the channel or along the mounds of dredge spoil to attract smallmouth bass and walleye and forage fish.

Our summarization of this conference is transcribed above. Please notify the writer within five (5) business days of this transcription of any disagreement as the foregoing becomes part of the project record and is the basis upon which we will proceed.

Respectfully submitted,

JOHNSON JOHNSON & ROY/inc

Gary W. Crawford
Aquatic Biologist

rlg/bellepr

cc: Participants
D. Hautau , C. Silveri, R. McGregor - Detroit Recreation Department

JJR/

110 Miller
Ann Arbor, Michigan 48104-1399
313 662 4457
313 662 7520 FAX

Planning
Landscape Architecture
Urban Design
Civil Engineering
Environmental Services

Johnson Johnson & Roy/inc

CONFERENCE REPORT

project name: Belle Isle Piers/CZM

project number: 17878.00

date: 18 October 1996

participants: Ron Spitler - MDNR
Douglas Denison, Gary Crawford - JJR

G. Crawford and D. Denison met with MDNR fishery biologist R. Spitler to review final construction designs for the enhancement of fish habitat located near the Inselruhe North Wharf and U.S. Coast Guard Pier on Belle Isle, Detroit, Michigan. The meeting was held at the office of the Michigan Department of Natural Resources and Environmental Quality, Livonia, Michigan.

R. Spitler concurred with the enhancements to fishery habitat indicated by the construction design, but suggested that we consider alternative sites for disposal of dredge material.

Our summarization of this conference is transcribed above. Please notify the writer within five (5) business days of this transcription of any disagreement as the foregoing becomes part of the project record and is the basis upon which we will proceed.

Respectfully submitted,

JOHNSON JOHNSON & ROY/inc

Gary W. Crawford
Aquatic Biologist

rlg/bellepr1

cc: Participants
D. Hautau, C. Silveri - Detroit Recreation Department
G. Towns - MDNR

APPENDIX E

U.S. ARMY CORPS OF ENGINEERS PERMIT

DRAFT

APPLICATION FOR PERMIT

DRAFT

FOR OFFICIAL USE

Corps of Engineers Department of the Army	Corps File No.	State of Michigan Department of Natural Resources Land Resource Programs	DNR File No.

PLEASE READ INSTRUCTIONS *BEFORE* FILLING OUT THIS APPLICATION — PRINT OR TYPE

1. APPLICANT (individual or corporate name)			AGENT/CONTRACTOR (firm name, if known)		
City of Detroit/Recreation Department			Johnson Johnson & Roy/inc		
ADDRESS: 65 Cadillac Square - Suite 4000			ADDRESS: 110 Miller		
CITY: Detroit	STATE: MI	ZIP: 48226	CITY: Ann Arbor	STATE: MI	ZIP: 48104
TELEPHONE (Work) (Home): (313) 224-1146	SOC. SECURITY or FED I.D. No.		TELEPHONE: (313) 662-4457		

2. If applicant is not owner of the property where the proposed activity will be conducted, provide name and address of owner and include letter of authorization from owner:

OWNER'S NAME	MAILING ADDRESS	CITY	STATE	ZIP
City of Detroit - Recreation Department				

3. PROJECT LOCATION

Street/Road	Village/City	BODY OF WATER (Lake, stream, creek, pond, or drain)
Belle Isle	Detroit	Detroit River

County	Township	Town	Range	Section(s)	Subdivision or Plat	Lot No.	Private Claim
Wayne	N/A	T2S	R12-13E	N/A			

4. PROJECT INFORMATION

(a) Describe proposed activity

Enhancement of fishery habitat in areas adjacent to the U.S.Coast Guard Fishing Pier and Inselruhe North Wharf.

(See Pages 1 - 4)

(b) Attach drawings of the proposed activity prepared in accordance with the *DRAWING REQUIREMENTS* on pages 1 & 2 of Instructions.

(c) Check appropriate Project Type (below) — **See Samples of Drawings Required**

1) [X] Dredging, Filling, Draining or Construction Work in Inland Lakes or Streams, Great Lakes Bottomlands or Wetland Areas ..... 1, 2, 3, 4, or 5
2) [ ] Work in Riverine Flood Plain ..... (See SPECIAL INSTRUCTIONS, Section 1, on back of this form) 6
3) [ ] New or Replacement Bridge or Culvert .. (See SPECIAL INSTRUCTIONS, Section 2, on back of this form) ..... 7, 8, 9 and 10
4) [ ] Dam Construction or Reconstruction ..... (See SPECIAL INSTRUCTIONS, Section 3, on back of this form) 11

NOTE: If boxes 2, 3 and/or 4, above, are checked provide appropriate additional information on the back under "SPECIAL INSTRUCTIONS"

(d) PROPOSED USE: (Check appropriate box)
1. [X] Public; [ ] Private; [ ] Commercial; [ ] Other (specify) _____
2. Will the project site be served by a new on-site Sewage Disposal System (Septic Tank) [X] No [ ] Yes

(e) Location of Source of Fill if more the 50 cubic yards are required for other than commercial source:

County	Township	Town	Range	Section	¼ Section
Commercial Sources					

Further Description (provide vicinity map of Source Site (Sample Drawing 5) if more than 50 cubic yards and source is other than commercial)

DRAFT

(f) Dredge Spoils Disposal Location Site (if required):

County	Township	Town	Range	Section	¼ Section
Dredge spoils will be placed in Detroit River adjacent to fishery habitat.					

Further Description (provide vicinity map for Disposal Site (Sample Drawing 3)

See attached (Sheets 3 - 5)

(g) Describe any project alternatives considered.

See attached (Pages 5 - 6 and Sheets 6 - 10)

If fill is required, is project water dependent? [ ] No [X] Yes

(h) Date activity will commence if permit is issued _____ ; be completed _____

(i) Is any portion of the requested project now complete? [X] No [ ] Yes. If yes, identify the completed portion on the drawings you submit and give the date activity was completed. _____

DO NOT WRITE IN THIS SPACE — FOR CASHIER USE ONLY

APPLICATION CONTINUED ON REVERSE SIDE.

REMOVE INSTRUCTIONS BEFORE MAILING

PR 2731
Rev 9/82

DO NOT REMOVE THIS STUB

APPLICATION FOR PERMIT
LAND RESOURCE PROGRAMS

(APPLICANT COMPLETE THE FOLLOWING)

NAME OF REMITTOR: City of Detroit - Recreation Department

ADDRESS: 65 Cadillac Square, Suite 4000 Detroit, MI 48226

[ ] 1972 P.A. 346 Permit Application Fee [ ] 1979 P.A. 203 Permit Application Fee

5. State why you believe the project will not cause pollution, impair or destroy the water or any natural resources:

See attached

6. List all other Federal, State or local governmental agency permits or certifications required for proposed project. Specify permit approvals or denials already received. Explain reasons for denials.

Agency	Type Approval	Identification No.	Date Applied	Date Approved/Denied

State reasons if permit denied:

7. Is there any present litigation involving the subject property? [X] No [ ] Yes If "Yes", explain:

8. Adjoining Riparian (Neighboring Waterfront Property Owner) Name and mailing address at which they may be reached.

Name of Riparian #1	Address	City	State	ZIP
N/A				
Name of Riparian #2	Address	City	State	ZIP
Name and Address of Lake Association	Address	City	State	ZIP

READ CAREFULLY BEFORE SIGNING.

9. Application is hereby made for a permit or permits to authorize the activities described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true and accurate and in compliance with the State Costal Zone Management Program. I certify that I have the authority to undertake the activities proposed in the application. By signing this application, I understand to allow representatives of the Michigan Department of Natural Resources and the U.S. Corps of Engineers to enter upon said property in order to inspect the proposed project. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirements of obtaining the permit requested hereon before commencing the project. I understand that the payment of fee does not guarantee permit.

SIGNATURE _____ DATE _____

SPECIAL INSTRUCTIONS

SECTION 1. FOR WORK IN FLOODWAY AREAS, a hydraulic engineering report prepared by a Registered Professional Engineer showing the impact of the proposal on flood stage or discharge characteristics may be needed.

SECTION 2. FOR NEW OR REPLACEMENT BRIDGES OR CULVERTS. To assist in the selection of an appropriate size structure, a design discharge may be requested from the Department of Natural Resources, Water Management Division. Requests should be accompanied by a location description giving the town, range, section, stream and road name. A location map as illustrated on page 4, Sample Drawing 11, should be included with the submission.

STRUCTURAL DATA:	**Existing**	**PROPOSED** (replacement)
Type		
Entrance Design		
Span, Rise		
Length (width)		
Waterway Area (total)		
ELEVATIONS; (Bench Mark Datum)		)
Low Steel (culvert crown)	upstr ____ dnstr ____	upstr ____ dnstr ____
Invert	upstr ____ dnstr ____	upstr ____ dnstr ____
Highwater (observed or recorded)		
ROAD GRADES	**EXISTING**	**PROPOSED**
At structure		
Low Point of Approach		

SECTION 3. DAM CONSTRUCTION OR RECONSTRUCTION, COMPLETE THE FOLLOWING:

Proposed head _____ ft. (Difference between normal pond level and stream water surface level below dam).

Proposed Impoundment size (flooded area) _____

If the proposed dam project has a head of five(5) feet or more or impounds five (5) or more surface acres, compliance with the Dam Construction Approval Act is required. Following a review of the environmental impacts of the proposed dam construction and clearance for the issuance of an Inland Lake and Streams Act Permit, you will be notified of the need to submit construction plans and specifications, prepared by a Registered Professional Engineer. Also, at that time you will be notified that an additional fee will be required in accordance with the following schedule:

Head less than five (5) feet . . . No Fee Head greater than five (5) feet but less than eight (8) feet . . . $200.00

Head greater than eight (8) feet but less than 20 feet . . . $400.00 Head greater than 20 feet . . . $600.00

4. PROJECT INFORMATION

4.(a) Description of proposed activity.

The City of Detroit Recreation Department is proposing to enhance fishery habitat adjacent to the fishing piers (Inselruhe North Wharf and US Coast Guard Fishing Pier) on Belle Isle (Sheets 1 and 2). Belle Isle is a 982 acre island city park with seven miles of shoreline. During the 1970's the piers were constructed to provide readily accessible locations whereby urban anglers could enjoy the diverse recreational fishery offered by the Detroit River. Unfortunately, the fishing piers were constructed in areas deficient in the habitat (deep water areas, spawning/nursery habitat, and submerged, structural habitat) necessary to attract sufficient numbers of gamefish needed to develop a successful recreational fishery. Lack of deep water areas and submerged structures which typically support a diverse recreational fishery, resulted in poor gamefish populations near the piers. A Fishery Habitat Enhancement Design has been developed to be implemented in a one year period which includes the following actions:

1) Dredge deep water areas;

2) Create structural habitat and stabilize slopes of deep water areas with riprap and bedding stone; and

3) Construction of a riprap sediment deflector to preserve enhanced habitat.

Agency Coordination

The design concepts of the Fishery Habitat Enhancement Project were developed in cooperation with the City of Detroit Recreation Department and the Michigan Department of Natural Resources Fisheries Division (MDNR). The preferred alternatives were reviewed by the MDNR, Michigan Department of Environmental Quality Land and Water Management Division (MDEQ).

A visit was made to the Corps of Engineers, Detroit District on October 23, 1996. Two separate discussions took place; one with the Chief of Operations Technical Support and another with two members of the District's Planning Branch, including the Branch Chief, Mr. Dale Monteith. A brief description of the alternatives was presented to the Planning Branch meeting participants and an interest in participating in the project was expressed. A number of Corps of Engineers authorities were discussed which relate to environmental restoration that could allow for partnering in developing the Fishery Habitat Enhancement Project. A formal request to the Corps of Engineers for consideration and potential participation under either Section 206 of the Water Development Act (WRDA) of 1996, and/or Section 401 of the WRDA 1990, would be the means to initiate Corps participation and determine the ability to secure Federal funds for technical assistance and/or implementation.

The most viable option for Corps participation is under Section 206 of the Water Resources Development Act (October 1996). This is a new program called the Aquatic Ecosystem Restoration. It may provide funding to improve the quality of the environment if the project is in the public interest. Funding can be made available for feasibility study, design and construction with a 35 percent local match. This project is strictly an aquatic ecosystem enhancement entirely designed for the benefit of the public trust. The second authority is the Section 401 of the Water Resources Development Act of 1990 which may provide technical, planning and engineering

assistance in the development and implementation of Remedial Action Plans for the Great Lakes Areas of concern. Participation by the ACOE would impact the project's estimate of probable construction costs.

Dredging of Deep Water Areas

Dredging of deep water areas is proposed for the areas adjacent to the US Coast Guard Fishing Pier and the Inselruhe North Wharf (See Sheets 3, 4 and 5, respectively).

Along the US Coast Guard Fishing Pier mean water depth averages 6 feet. Deep water habitat is proposed 20 feet off of the shore-side face of the pier. Deep water area adjacent to the US Coast Guard Fishing Pier will consist of two oval shaped basins located between the Belle Isle shoreline and the section of the pier which parallels the shoreline (Sheet 3). The combined areas will require approximately 7,400 cubic yards of dredging over a 0.8 acre area. Basin 1 will require approximately 2800 cubic yards of dredging to create a 0.3 acre area approximately 180 feet long , 92 feet wide, 15 feet deep. Side slopes are 4:1 on the shortest axis (Sheet 4). Basin 2 will require approximately 4600 cubic yards of dredging to create a 0.5 acre area, approximately 180 feet long , 130 feet wide, 15 feet deep. Side slopes will be a minimum 4:1 on the shortest axis and 8:1 on the longest axis (Sheet 4)..

In the areas adjacent to the Inselruhe North Wharf mean water depth averages 6 feet. Deep water habitat is proposed 20 feet off of the downstream face of the pier (Sheet 5). The proposed deep water habitat will require approximately 12,400 cubic yards of dredging to create a channel approximately 15 feet in depth, 960 feet long, 68 feet wide at the top and approximately 4 feet at the base. Side slopes will be a minimum of 4:1 (Sheet 5). The channel will be aligned parallel to the pier until termination at the 81.0 foot river bottom elevation.

Creation of Structural Habitat and Slope Stabilization

Creation of structural habitat and stabilization of slopes of deep water areas will be conducted within the areas adjacent to the US Coast Guard Pier (Sheets 3 and 4). A total of 350 tons of bedding stone and 400 tons of will be placed along the slope of Basin 1 (Sheets 3 and 4). A total of 600 tons of bedding stone and 650 tons of riprap will be placed along the slope of Basin 2 (Sheets 3 and 4). In both basins the toe of the stone will begin at the 84 foot river bottom elevation.

Sediment Deflector Construction

A sediment deflector (a graded riprap berm) to protect deep water areas and submerged structural habitat from sediment deposition, will be constructed within the areas adjacent to the US Coast Guard Pier (Sheets 3 and 4). The deflector will be constructed upstream and parallel to the section of the pier that extends perpendicular to the shoreline (Sheets 3 and 4). The toe of the sediment deflector will be adjacent to the pier supports. A total of 350 tons of bedding stone and 1500 tons of riprap will be used to create a sediment deflector approximately 130 feet long by 40 feet wide at the base (Sheets 3 and 4). Side slopes will be 2:1 (Sheet 4).. A crest approximately 5 feet wide and 95 feet long will extend 2 feet above current the surface of the water, at elevation 96.0 (Sheet 4)..

Physical and Chemical Analysis of Sediments

Physical and chemical analysis of sediments within the project area is scheduled to be completed prior to the Fishery Habitat Enhancement project. A pre-application meeting will be held with the U. S. Army Corps of Engineers Regulatory Functions Branch and Environmental Division to approve the proposed sampling frequency and methodology for the sediment analysis. Analysis of the physical and chemical properties is critical in determining the final deposition of dredge materials. Several alternatives are currently being evaluated.

Deposition of Dredging Materials

Final deposition of dredging materials has yet to determined. Agency coordination concerning this issue continues with Michigan Department of Natural Resources (MDNR), Michigan Department of Environmental Quality (MDEQ), and the U. S. Army Corps of Engineers (ACOE).

The construction documents, technical specifications and estimate of probable construction costs were prepared identifying that a portion of the dredge material would be placed adjacent to the deep water habitat for the creation of fish spawning and nursery habitat. During the review of the construction documents by the MDNR and the MDEQ, it was presented that the placement of dredge material onto the Detroit River bottom would not be acceptable by the State regardless of the sediment quality. The ACOE does not necessarily agree with this position. Resolution of this issue directly impacts the estimate of probable construction costs. In addition, the ACOE has expressed an interest in participating as a partner in the project (See Agency Coordination). The most viable option for ACOE participation is under Section 206 of the Water Resources Development Act (October 1996). This is a new program called the Aquatic Ecosystem Restoration which may provide funding to improve the quality of the environment of this project. This too may impact final deposition of the dredge materials and probable costs.

Specific locations are being explored for dredge disposal depending on sediment quality and resolution of regulatory issues. Shoreline areas along Belle Isle have been identified as seriously eroding. If physical properties are appropriate, a portion of the material will be used to stabilize severely eroding areas along the Belle Isle shoreline. Three picnic areas on Belle Isle have flooding problems where fill would be suitable. If ACOE partners on the project, other opportunities may be presented. Suitability of the material is contingent upon results of chemical and physical analysis of sediments to be performed prior to the construction of the Fishery Habitat Enhancement Project. The final disposition of the dredge materials will be determined during the permitting process.

Summary of Proposed Actions

As part of the enhancement of fishery habitat adjacent to the existing fishing piers on Belle Isle, the City of Detroit Recreation Program is proposing to dredge deep water areas along the Inselruhe North Wharf and the U.S. Coast Guard Fishing Pier, stabilize slopes along the deep water areas adjacent to the U.S. Coast Guard Fishing Piers, allow slope stabilization material to serve as areas of submerged refuge for fish and

macroinvertebrates, and construct a riprap sediment deflector to preserve enhanced fishery habitat.

Location	Action Proposed	Total Amount Dredge/Fill
Inselruhe North Wharf	Dredging	12,400 cubic yards
Inselruhe North Wharf	Physical and Chemical Analysis of Sediment	
U.S. Coast Guard Fishing Pier	Dredging	7,400 cubic yards
U.S. Coast Guard Fishing Pier	Fill/Bedding Stone	1,300 tons
U.S. Coast Guard Fishing Pier	Fill/Riprap	2,550 tons
U.S. Coast Guard Fishing Pier	Physical and Chemical Analysis of Sediment	

4.(g) Describe any project alternatives

Conceptual alternatives for the Inselruhe North Wharf and US Coast Guard Fishing Pier Fishery Habitat Enhancements are presented in Sheets 7, 8, and 10, respectively. The alternatives are modifications of original conceptual designs submitted by MDNR Fisheries Division personnel (Sheets 6 and 9). Preferred alternatives for the Inselruhe North Wharf and the US Coast Guard Fishing Pier Fishery Habitat Enhancements are presented in Sheets 6,7 and 10 respectively.

US Coast Guard Fishing Pier Fishery Habitat Enhancement Conceptual Alternatives

Alternative A
This alternative is the original conceptual design developed by a MDNR Fisheries Division personnel (See Sheet 6). The design consists of dredging a continuous area of undulating deep water habitat. The majority of the deep water area is confined to the area between the shoreline and the arm of the pier that parallels the shoreline. A portion of deep water area extends the length of the arm and approximately 75 feet outside of the pier into the Detroit River. Alternative A was modified for the following reasons:

- Successful fishery enhancement could be achieved with a reduced deep water area.
- Dredging to depths ranging from 12 to 13 feet abutting the base of the pier supports may impair structural integrity of the pier.
- Design constraints posed by the bottom substrate composition prevent construction of steep side slopes. A minimum slope of 4 to 1 is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

Alternative B
This alternative consists of a continuous channel with moderate expansion of deep water areas situated at 50 foot intervals along its course (See Sheet 7). The fishery enhancement extends the length of the arm of the pier that parallels the shoreline and is located 20 feet away from the pier supports. The deep water areas are approximately 75 feet long, 30 feet wide to a maximum depth of 15 feet deep. The channel is 10 feet wide and 15 feet deep. Alternating areas of riprap serve to stabilize the channel and function as fishery, refuge and spawning habitat. Dredge spoil is to be placed in mounds along channel for increased habitat diversity. The majority of the enhancement is confined to the area between the shoreline and the arm of the pier that parallels the shoreline. A portion of deep water area extends the length of the arm and approximately 25 feet outside of the pier into the Detroit River. Alternative B was modified for the following reasons:

- Design constraints posed by the bottom substrate composition prevent construction of the proposed (nearly vertical within the channel) side slopes. A minimum slope of 4 to 1 is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.
- The design does not include a structure to prevent sediment from upstream sources being deposited into dredged areas.

Alternative C
This alternative consists of two roughly, oval shaped basins (See Sheet 8). The basins are approximately 180 feet long, 100 feet wide to a maximum depth of 15 feet deep. Riprap is placed within the basin on upstream slopes and slopes near the pier. A semi-circular sediment deflector is placed 25 feet upstream of each basin to protect the basin from sedimentation. Brush bundles

(bundles of native brush bound together and anchored to the bottom) serve as refuge and forage areas for gamefish. The bundles are placed on the basin slopes facing the pier within reach of the average anglers cast (50 feet). A portion of one basin extends approximately 30 feet outside of the pier into the Detroit River. Alternative C was modified for the following reasons:

- Brush bundles are designed for lemnetic systems and will not persist in areas with velocities evident in this section of the river.

- Sediment deposition protection can be achieved with less stone placed in a location better suited for sediment deflection.

Preferred Alternative: See 4.(a) Description of proposed activity and Sheets 3 and 4.

Inselruhe North Wharf Fishery Habitat Enhancement Conceptual Alternatives

Alternative A
This alternative is the original conceptual design developed by a MDNR Fisheries Division personnel (See Sheet 9). The design consists of a two basins and a channel located 15 feet downstream of the wharf. The basin nearest to the shoreline is oval shaped, 50 wide, 75 feet long and 12 feet deep. The other basin is circular and is about 40 feet by 40 feet and 12 feet deep. The channel is 50 feet wide, approximately 1000 feet long to a maximum depth of 15 feet. The channel is aligned parallel to the wharf and is designed to intersect with the 15 foot depth contour within the Detroit River channel. The channel will serve to attract larger fish inhabiting deep water in the river to the areas near the wharf. Alternative A was modified for the following reasons:

- Improvements to the fishery by the addition of isolated basins and channel would be negligible compared to the design of a single channel

- A 20 foot buffer should be maintained between the dredging and pier supports

- Design constraints posed by the bottom substrate composition prevent construction of the proposed (nearly vertical) side slopes. A minimum slope of 4 to 1 is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

Alternative B
This alternative consists of a mildly, undulating channel with moderate expansion of two deep water areas (See Sheet 10). The channel is located 20 feet downstream of the wharf and is 10 feet wide, approximately 1000 feet long, to a maximum depth of 15 feet. The channel is aligned parallel to the wharf and is designed to intersect with the 15 foot depth contour within the Detroit River channel. The deep water areas are 30 feet wide and 80 feet long and 15 feet deep. Alternating areas of riprap serve to stabilize the channel and function as refuge and spawning habitat. Dredge spoil is to be placed in mounds along channel for increased habitat diversity. Alternative B was modified for the following reason:

- Design constraints posed by the bottom substrate composition prevent construction of the proposed (nearly vertical within the channel) side slopes. A minimum slope of 4 to 1 is assumed to be necessary for creation of stable side slopes within this section of the Detroit River.

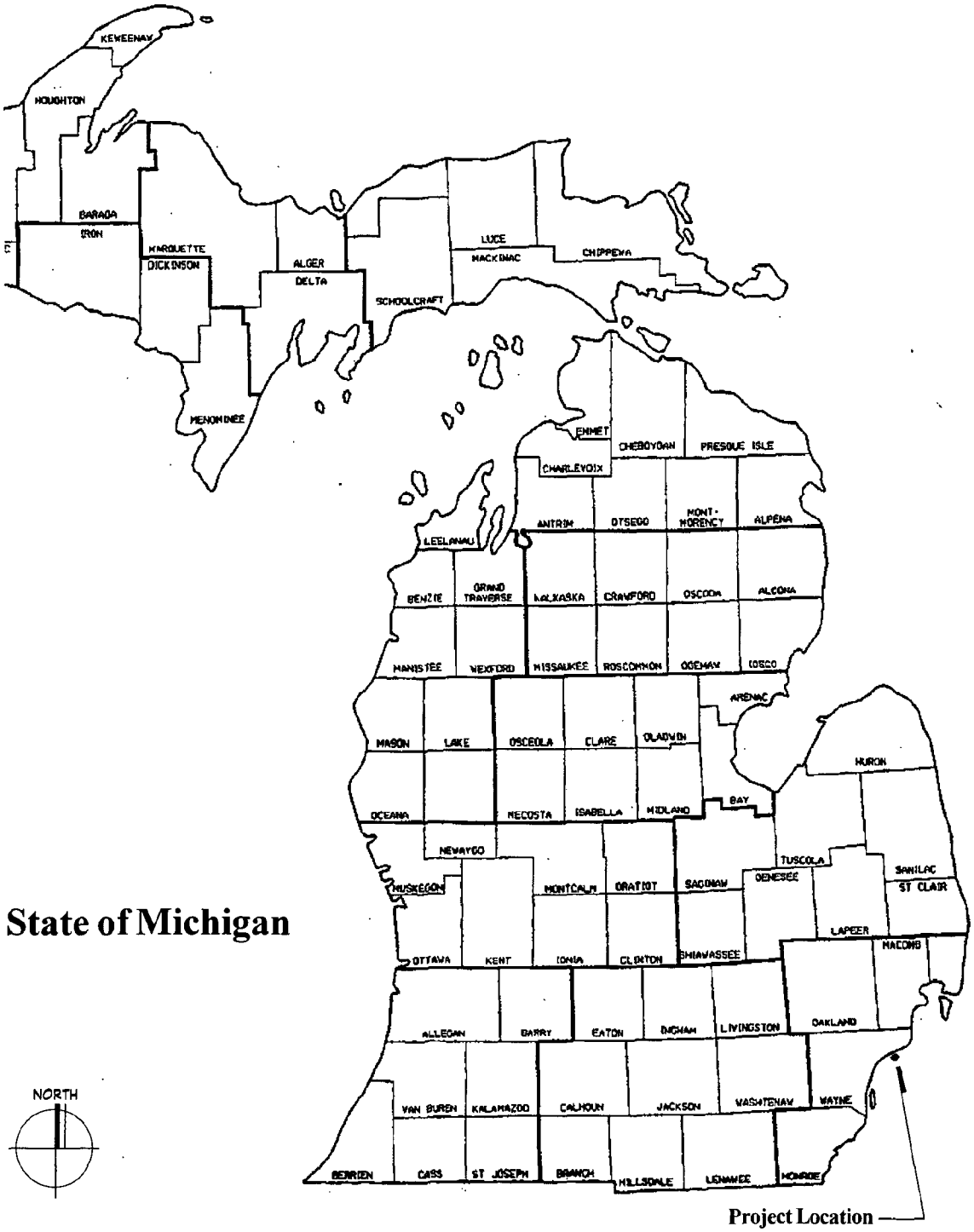
Preferred Alternative: See 4.(a) Description of proposed activity and Sheet 5.

5. State why you believe the project will not cause pollution, impair or destroy the water or any natural resources.

The proposed actions are part of an effort to enhance fishery habitat adjacent to the Belle Isle Piers. These improvements will result in an increase in the number and average size of gamefish in areas near the piers, and may serve as spawning areas for important gamefish species. Increased gamefish populations near the piers will result in greater fishing success for anglers, which will increase use and appreciation of the natural resource. Therefore, long-term recreational benefits resulting from improvement of the natural resource will exceed short-term impairment to water quality.

Construction of the Inselruhe North Wharf Fishery Habitat Enhancement will involve mechanical dredging of deep water areas. This activity will cause short-term, local increases in turbidity in areas immediately downstream of the enhanced habitat. This work is being conducted within a depositional zone and it is expected that suspended sediment will be deposited immediately downstream of the area.

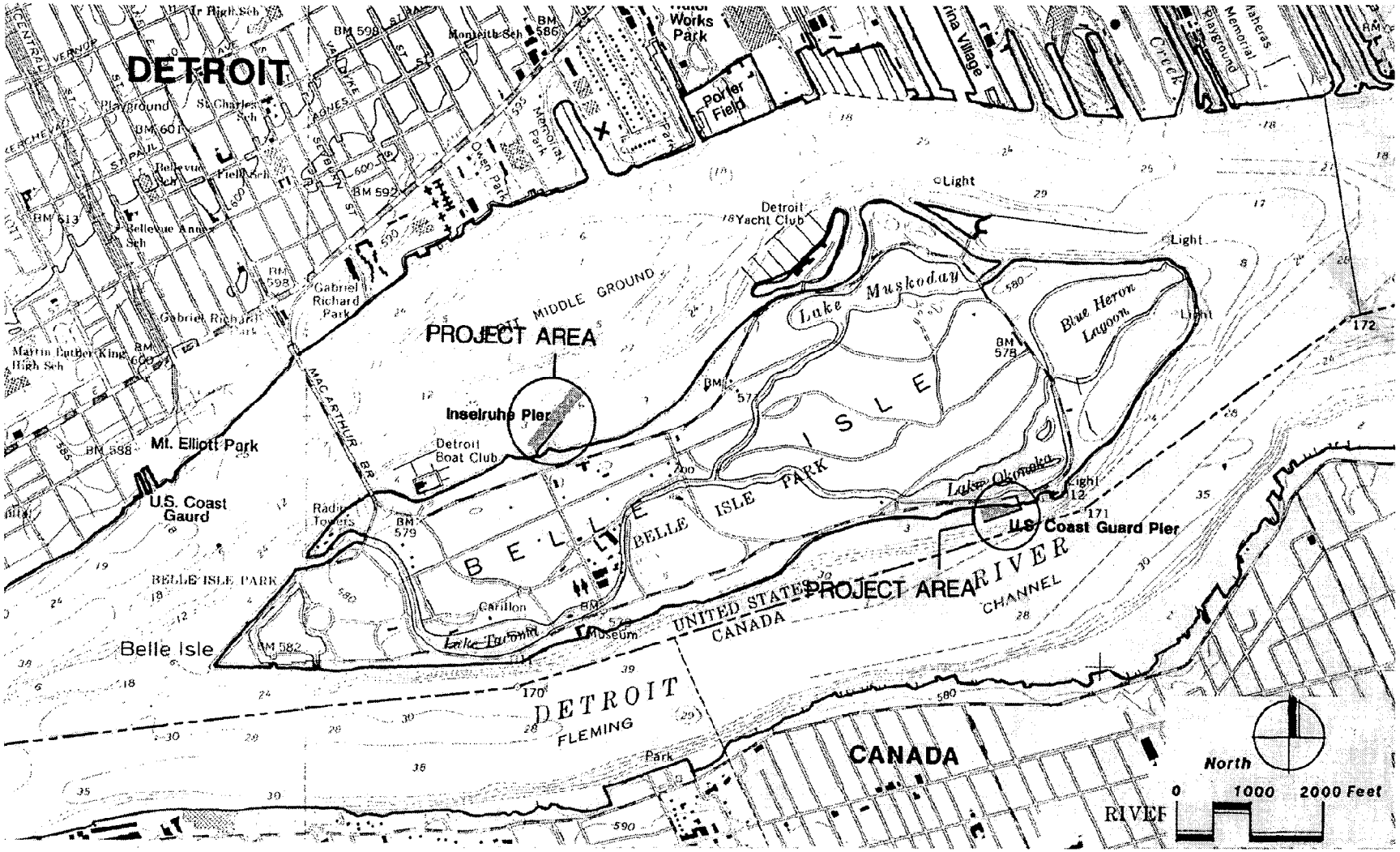
Construction of US Coast Guard Fishing Pier Fishery Habitat Enhancement will involve mechanical dredging of deep water areas, placement of riprap and bedding stone in deep water areas and the construction of a sediment deflector. Mechanical dredging of deep water areas will cause short-term, local increases in turbidity in areas immediately downstream of the enhanced habitat. This work is being conducted within a depositional zone and it is expected that sediment will be deposited in the immediate vicinity. Analysis of sediment will be conducted prior to construction (see Deposition of Dredged Material). Riprap and bedding stone will not adversely impact water quality and only commercial grade materials will be used. Construction of the sediment deflector will cause and increase in sediment accumulation upstream of the pier, however, is not expected to cause impairment of water quality.



Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	1 of 10

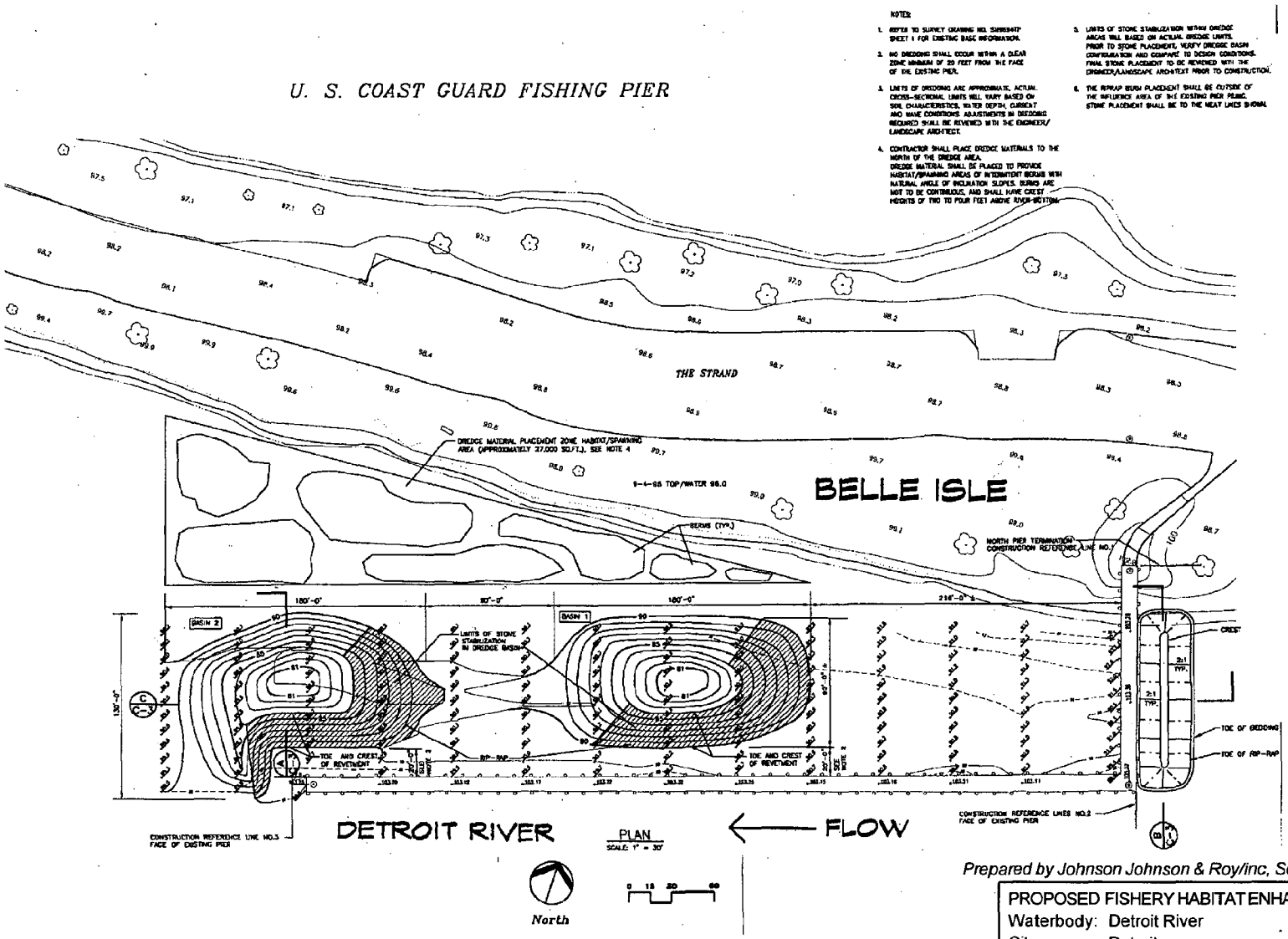
Location Map



Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	2 of 10

Vicinity Map

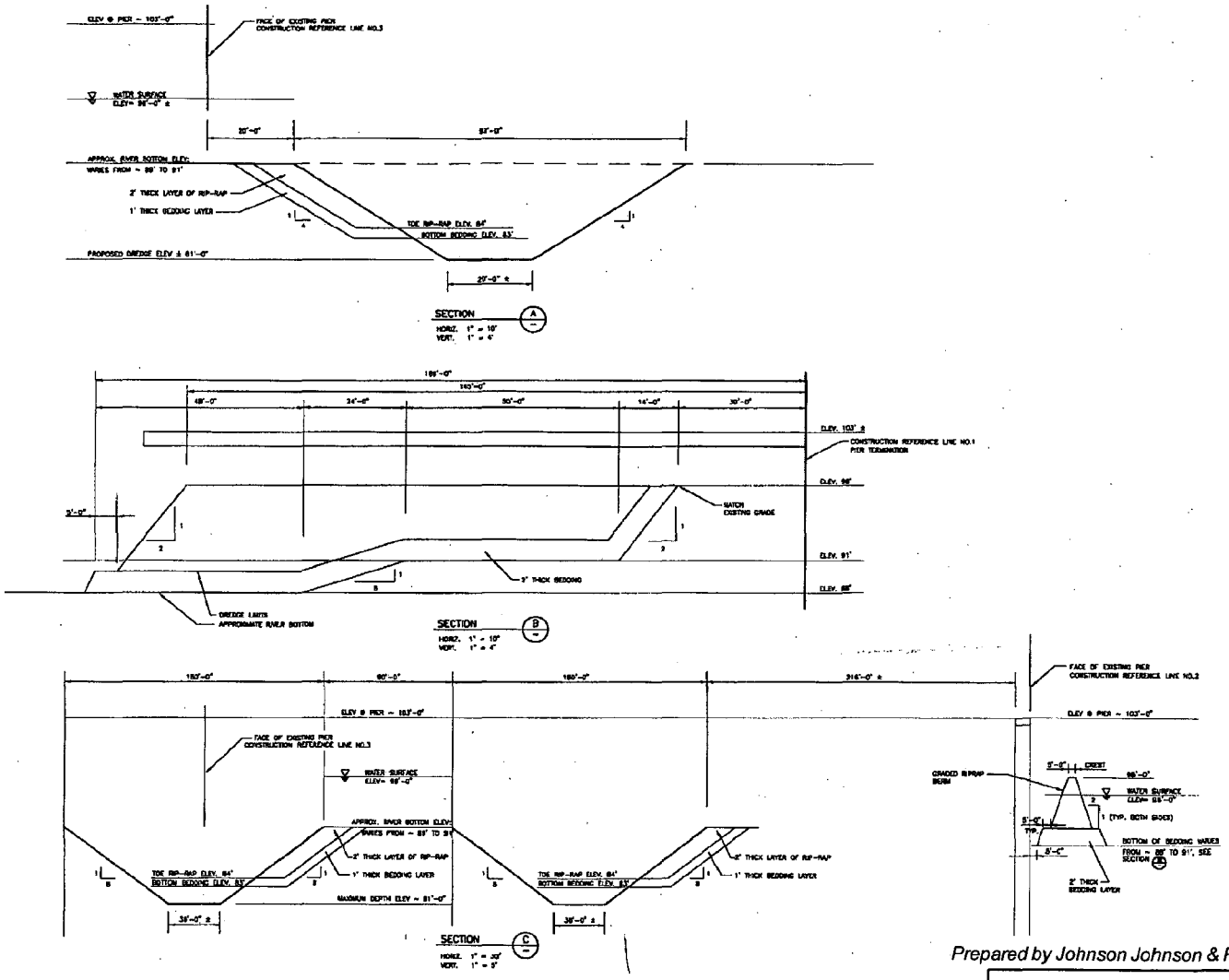


Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	3 of 10

Preferred Alternative

Final Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Plan View

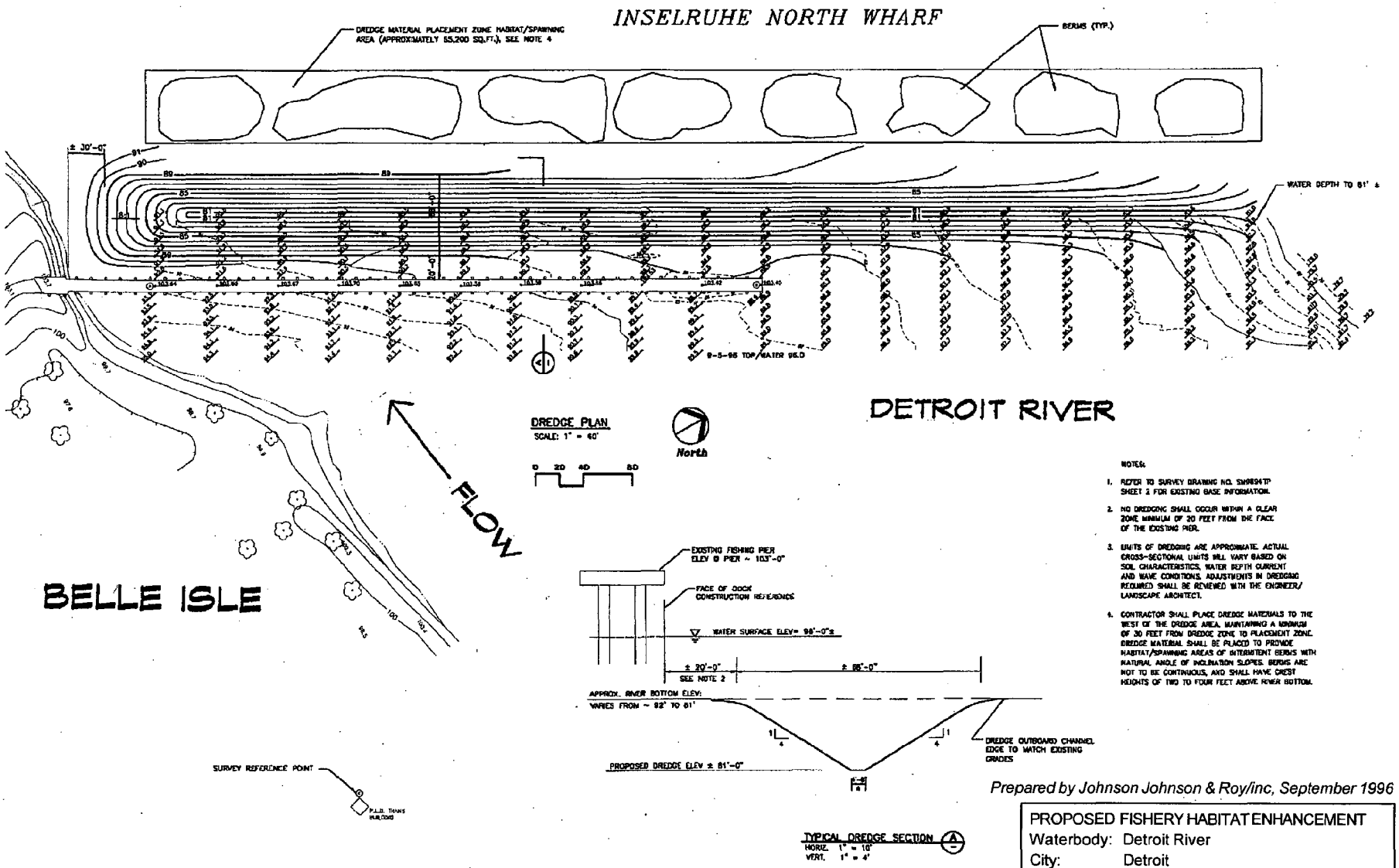


Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	4 of 10

Preferred Alternative

Final Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Cross Section and Longitudinal View

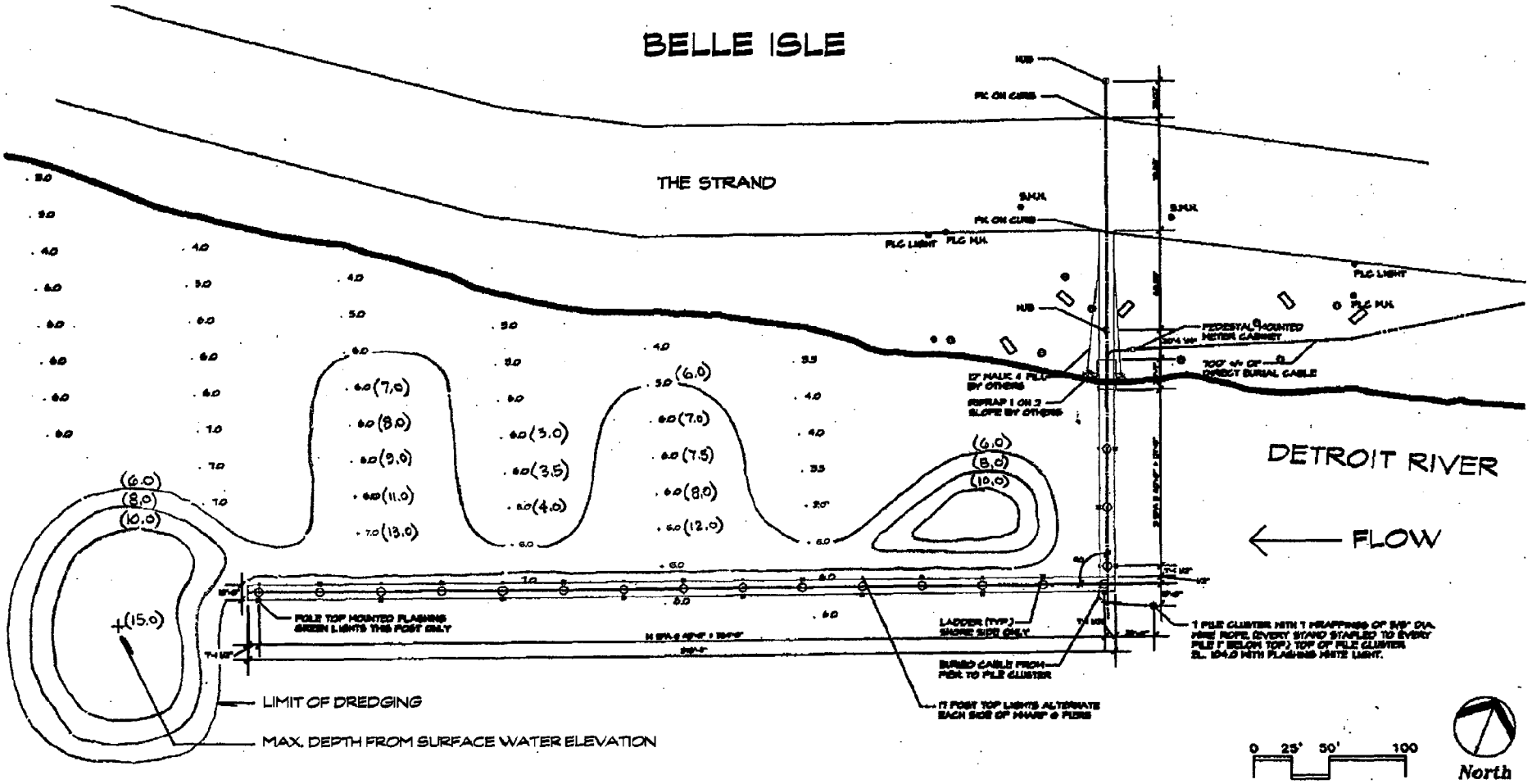


Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	5 of 10

Preferred Alternative

Final Design for Proposed Fishery Habitat along Inselruhe North Wharf - Plan View



LEGEND

6.0 - EXIST. BOTTOM DEPTH

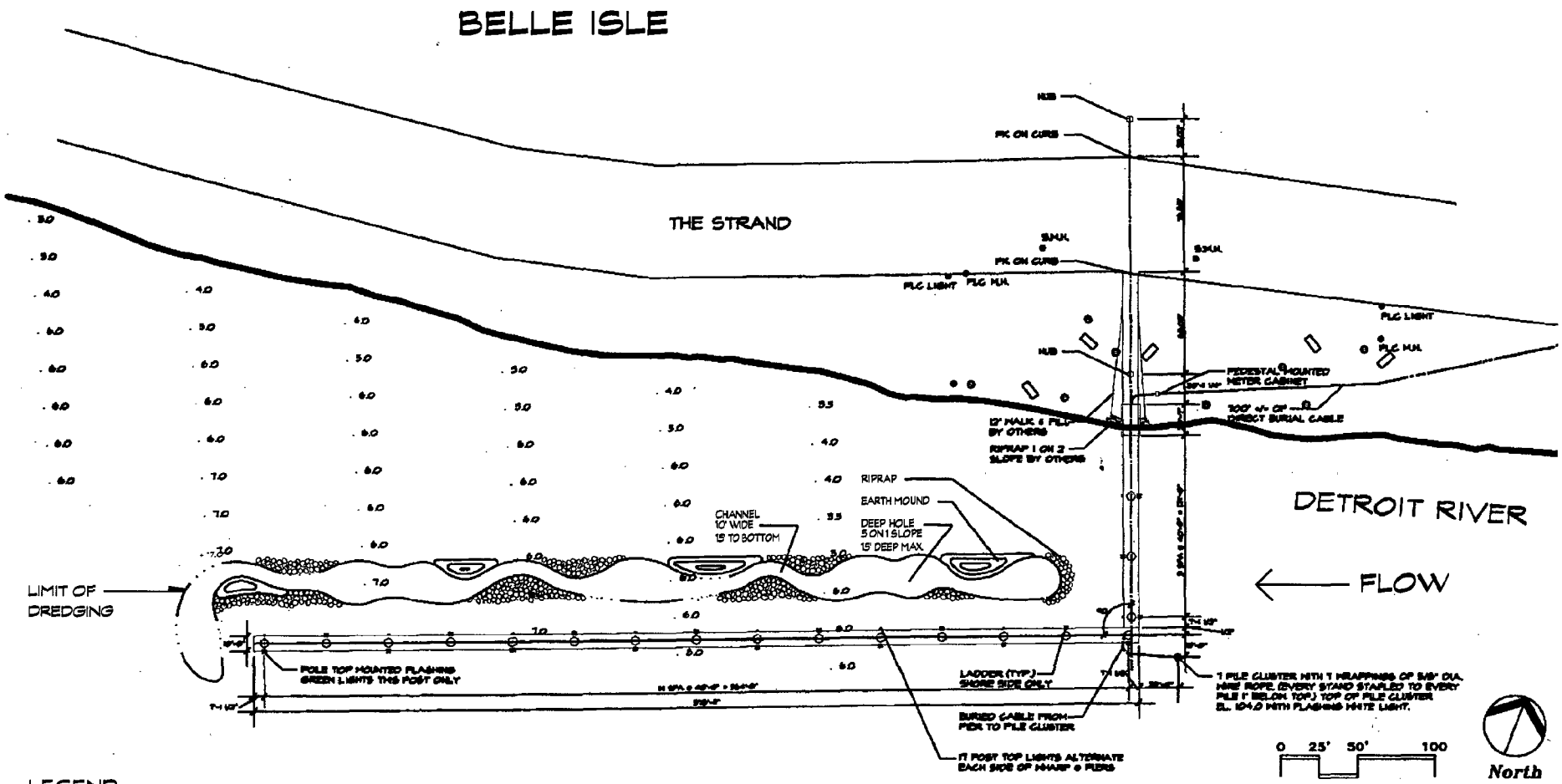
(15.0) - PROP. BOTTOM DEPTH

Survey Map Source: City of Detroit Engineering Department, 1975
Conceptual Design Submitted by MDNR Fishery Division, 1996
Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	6 of 10

Alternative A

Conceptual Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Dredging



LEGEND

6.0 - EXIST. BOTTOM DEPTH

(15.0) - PROP. BOTTOM DEPTH

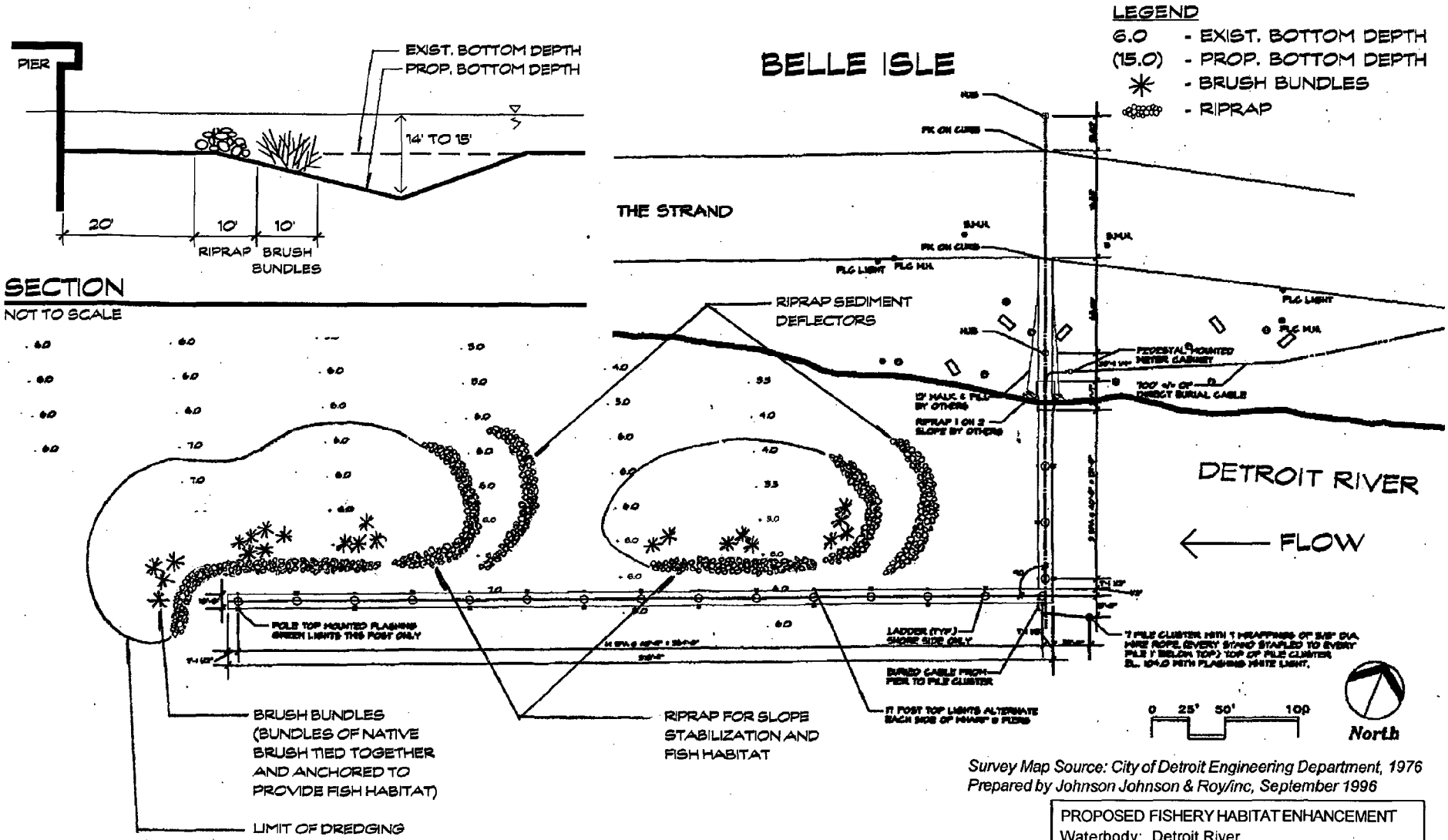
- RIPRAP

Survey Map Source: City of Detroit Engineering Department, 1976
Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	7 of 10

Alternative B

Conceptual Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Structural Habitat

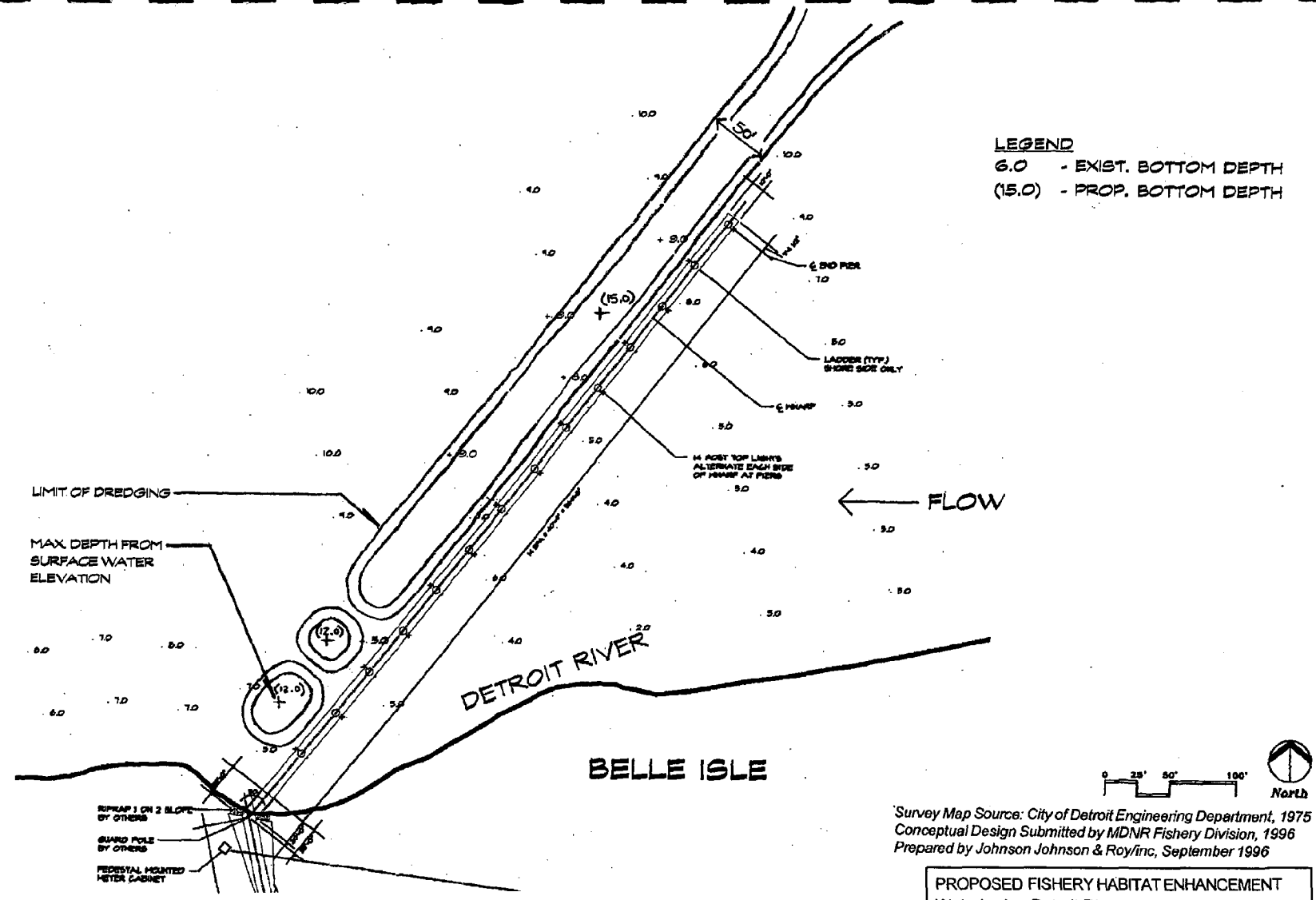


Survey Map Source: City of Detroit Engineering Department, 1976
Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	8 of 10

Alternative C

Conceptual Design for Proposed Fishery Habitat along U.S. Coast Guard Fishing Pier - Structural Habitat

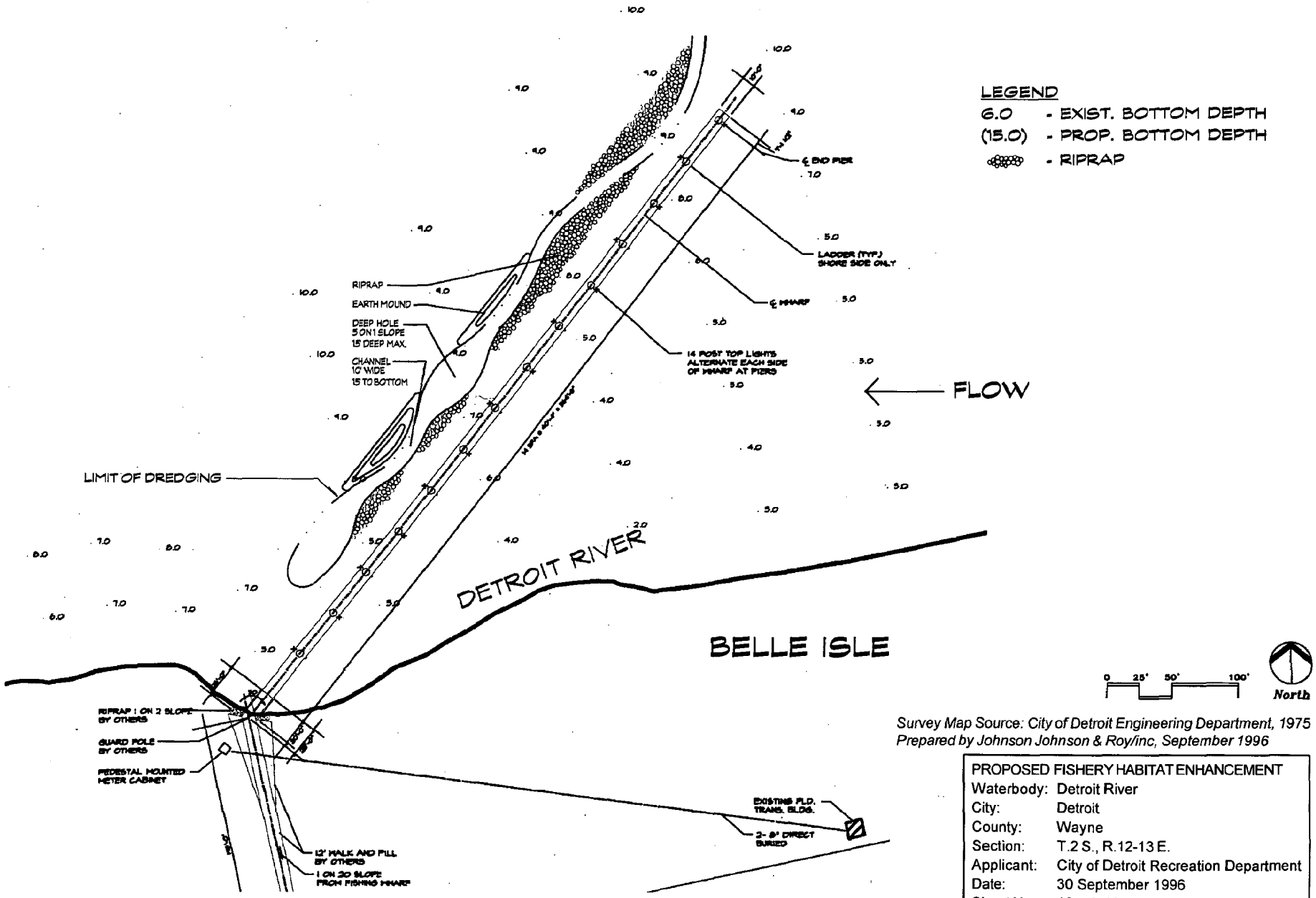


Survey Map Source: City of Detroit Engineering Department, 1975
Conceptual Design Submitted by MDNR Fishery Division, 1996
Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	9 of 10

Alternative A

Conceptual Design for Proposed Fishery Habitat along Inselruhe North Wharf - Dredging



Survey Map Source: City of Detroit Engineering Department, 1975
Prepared by Johnson Johnson & Roy/inc, September 1996

PROPOSED FISHERY HABITAT ENHANCEMENT	
Waterbody:	Detroit River
City:	Detroit
County:	Wayne
Section:	T.2 S., R.12-13 E.
Applicant:	City of Detroit Recreation Department
Date:	30 September 1996
Sheet No.	10 of 10

Alternative B

Conceptual Design for Proposed Fishery Habitat along Inselruhe North Wharf - Structural Habitat

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