



**US Army Corps  
Of Engineers  
St. Paul District**

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# **UPPER MISSISSIPPI RIVER SYSTEM**

## **ENVIRONMENTAL MANAGEMENT PROGRAM**

### **OPERATION AND MAINTENANCE MANUAL**

# **POOL 8 ISLANDS PHASE II HABITAT REHABILITATION AND ENHANCEMENT PROJECT**

**Pool 8  
Upper Mississippi River  
Vernon County, Wisconsin**

**September 2000**

## PREFACE

The Pool 8 Islands Phase II Habitat Rehabilitation and Enhancement Project, constructed by the Corps of Engineers, was completed in June 2000. In accordance with Section 906(e) of the Water Resources Development Act of 1986, and policies set forth in the Fourth and Fifth Annual Addenda, the U.S. Fish and Wildlife Service has responsibility for the operation and maintenance of project features located on the Upper Mississippi River National Wildlife and Fish Refuge. The Corps of Engineers has prepared this manual to assist the U.S. Fish and Wildlife Service in fulfilling this responsibility.

The manual and appendices contain the latest information pertinent to operation and maintenance of this project. The project as designed and constructed will improve the quality of habitat for a variety of fish and wildlife species in the Stoddard Bay area of pool 8. The planning, design, and construction of the project were the result of a cooperative effort on the part of the involved Federal and State agencies and the public. The continuation of this cooperation and coordination as part of the operation and maintenance of the project will be important to the success of the project and is strongly recommended.

DEPARTMENT OF THE ARMY  
St. Paul District, Corps of Engineers  
Army Corps of Engineers Centre, 190 Fifth Street East  
St. Paul, Minnesota 55101-1638

UPPER MISSISSIPPI RIVER SYSTEM  
ENVIRONMENTAL MANAGEMENT PROGRAM

POOL 8 ISLANDS PHASE II, POOL 8, UPPER MISSISSIPPI RIVER  
VERNON COUNTY, WISCONSIN

OPERATION AND MAINTENANCE MANUAL

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## INTRODUCTION

This manual has been prepared to serve as a guide for the operation and maintenance of the Pool 8 Islands Phase II Habitat Rehabilitation and Enhancement Project in Vernon County, Wisconsin. Operation and maintenance instructions presented are consistent with the general procedures found in the Pool 8 Islands Phase II Definite Project Report dated May 1996. This manual has been written for project and management personnel familiar with the project. It does not contain detailed information which is common knowledge to personnel or which is presented in other existing manuals or regulations.

For ease in use, this manual is divided into two sections.

Part I. This section describes the project features and provides historical information on the project.

Part II. This section gives details on the operation and maintenance of the project.

## PART I - PROJECT FEATURES AND CONSTRUCTION HISTORY

### AUTHORIZATION AND LOCATION

The Pool 8 Islands Phase II project was authorized under the provisions of the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The project is located in the lower portion of pool 8 at Stoddard, Wisconsin. The project lies within the Upper Mississippi River National Wildlife Refuge (Refuge). Project drawings (appendix A) show the location of the project.

The Pool 8 Islands Phase II project is located on Federal lands managed as a National Wildlife Refuge. As such, operation and maintenance of those features are to be carried out in compliance with Section 906(e) of the 1986 Water Resources Development Act and policies set forth in the Fourth and Fifth Annual Addenda.

### DESCRIPTION OF THE PROJECT

#### General/Background

The Pool 8 Islands Phase II Habitat Rehabilitation and Enhancement Project is the second phase of a multi-phase effort to restore islands in lower pool 8. Since 1939, over 80 percent of the island acreage in lower pool 8 had been lost to erosion, while the loss in the Stoddard Bay area was nearly 100 percent. Accompanying the island loss was a shift to more riverine conditions in Stoddard Bay and a decline in habitat quality for the backwater fish community,

migratory waterfowl, and a wide variety of other wildlife that use islands and shallow protected aquatic habitats.

The primary feature of the project was restoration of about 10,500 linear feet of islands covering about 26 acres. Two rock sills help enclose Stoddard Bay and reduce flows to create the more quiet water conditions conducive to a healthy backwater fish community. In an area below Stoddard Bay, six innovative structures called "seed islands" were placed in an area of high sediment transport to stimulate the creation of new islands using natural river forces.

The Definite Project Report/Environmental Assessment (SP-20), Pool 8 Islands Phase II Habitat Rehabilitation and Enhancement Project, May 1996, provides additional details on the project.

### **Design Considerations**

Islands - The islands were designed to serve a number of functions. The most important of these are to (1) restore habitat diversity to Stoddard Bay; (2) reduce flows and current velocities in Stoddard Bay, especially during the winter; and (3) reduce the effects of wind and wave action in Stoddard Bay. All of the islands contribute to improving habitat diversity. Islands A, B, and C, in conjunction with the rock sills, were designed to reduce flows entering Stoddard Bay. They also serve to protect the bay from north, northwesterly, and west winds. The interior islands (D1, D2, E1, and E2) primarily serve the function of protecting the bay from southerly winds, which can be the dominant winds during the summer growing season. The interior islands were located in a manner to channel flows within Stoddard Bay to maintain the deeper areas that exist within the bay. Maintaining a diversity of water depths within the bay is desirable from a fish habitat perspective.

A number of considerations went into the basic island cross section. Island width is necessary to provide the mass to withstand river forces and insure the islands do not breach or erode away during the 50-year project life. However, excessive width was undesirable from the perspective of cost control. Total island width ranges from 31 to 43 meters, depending upon island location and height. These were considered to be the minimum widths necessary to insure stable islands.

One of the habitat objectives of the project was to maximize the amount of dredging for borrow from within Stoddard Bay for fish habitat enhancement purposes. Borings had shown that the vast majority of the accessible borrow material within Stoddard Bay was fine materials. Therefore, the island cross sections were designed to maximize the use of fine materials. From a stability and constructibility perspective it is not desirable to place fine materials in the water. Therefore, the bases of the islands (to about 0.2 meters above the normal summer water surface elevation) were constructed of granular fill (sand) with the requirement that not more than 5 percent of the material would pass a 0.075 mm sieve.

The bulk of the material (fine fill) placed above the sand had no special requirement other than it had to be borrowed from within Stoddard Bay. The top 0.3 meters of the fine fill had the

requirement that no less than 40 percent of the material had to pass a 0.075 mm sieve. The purpose of this requirement was to insure sufficient fine material content for good vegetation growth.

Island heights varied for two reasons. First, on the exterior islands (A, B, & C) it is desirable to have the islands decrease slightly in elevation from the upstream to the downstream to insure they overtop at about the same time. This prevents concentration of overtopping flows that could lead to erosion problems. Secondly, varying heights were desired to create different habitat conditions for vegetation. For example, Island A is 0.6 meters higher than the lower portion of Island C. Different vegetation communities should develop on the islands because of these elevation differences.

The interior and exterior edges of the islands consist of sand berms 6 to 10 meters wide and constructed to 0.6 meters above normal summer water elevation. These sand berms are designed to be sacrificial in the sense that some erosion is expected, as wave action will erode this material and create a stable beach zone. Erosion of the islands is controlled by rock groins. The end result should be a relatively stable scalloped shoreline.

Rock bank protection was used to protect the ends of the islands. For those island ends more exposed to erosive forces and for the connections with the rock sills, a round end design was used. On Islands E1 and E2 and on the East end of Island D2, a flat end design was used. The flat end design is more economical, the trade-off being that it is not as effective as the round end design in preventing erosion on the back side where the rock protection ends. The trade-off was considered acceptable in these locations because they are well protected sites.

Three "humps" or high spots were placed in Island A and one each in Islands D1 and D2. The primary purpose was to provide some localized topographic variety to promote visual and vegetative diversity.

One end of Islands D1, D2, E1, and E2 contain short sections that are all granular fill material. The purpose was to provide sand substrate for turtle nesting.

Rock Sills – The two rock sills were designed to complement the islands in reducing flow into Stoddard Bay. Since the entire complex will be overtopped at certain times by high water, the rock sills were designed with a lower top elevation than the islands to serve as a hard point for initial overtopping. This should minimize erosion potential on the islands from overtopping flows.

The rock sills were designed with top elevations about 0.5 meters above normal summer pool elevation. They were designed to be overtopped by the 50-percent chance (2-yr) event. The purpose is to allow high water events to flow through Stoddard Bay and promote the scouring of fine sediments from the bay.

A notch was placed in Rock Sill A to allow a flow of 50 cubic feet per second into the bay for water quality purposes. Seepage through the rock sills would allow too much flow into

Stoddard Bay, at least initially, and it was not known when or if this seepage would end. During the winter this could create unsuitable overwintering conditions for fish, negating one of the primary habitat objectives of the project. Therefore, a geotextile seepage barrier was placed within each rock sill, using the finest mesh geotextile available. It is believed that over time, this seepage barrier will be enhanced by natural deposition of sediment and other debris between the rocks.

Seed Islands – It has been observed in locations where there is relatively high bed load sand sediment movement that obstructions to flow such as existing islands, snags, etc., will cause accretion of sediment on the downstream side of the obstruction. Along the right descending side of the main channel between river miles 683 and 685 is an area of high bed load movement in relatively shallow water. This area provided the right conditions to test the ability to have natural river processes create islands in an area where islands would improve habitat diversity and quality. Therefore, six “seed islands” were constructed in this area, supplementing two similar structures constructed for the U.S. Fish and Wildlife Service and Wisconsin Department of Natural Resources in 1995.

The seed islands were sited using the following consideration:

- a. They were located in shallow water to minimize rock requirements.
- b. They were located with large shallow areas on their downstream side to promote island formation as rapidly as possible.
- c. They were located where they could maintain or stimulate the growth of channels through this area to improve bathymetric diversity.
- d. They were located with one end adjacent to deeper water to facilitate construction access with little or no dredging.

A variety of designs were used as a test to determine if there is a particular design that is more effective in promoting sediment accretion and to determine if seed island design has any effect upon sediment accretion or island formation patterns.



## CONSTRUCTION HISTORY

The contract for the Pool 8 Islands Phase II project was awarded in September 1997 to L.W. Matteson, Inc., #1 South Point, P.O. Box 667, Burlington, Iowa 52601-0667. The entire project was subcontracted to J.F. Brennan Co., Inc., P.O. Box 2557, 820 Bainbridge St., La Crosse, Wisconsin 54602-2557.

Construction began in October 1997 and was substantially completed in September 1999. Some supplemental tree plantings on Island A and additional willow and beachgrass plantings on several islands was accomplished in the spring of 2000. In addition, final project clean-up was completed at that time. The following summarizes the dates for accomplishing the various seeding and plantings for the project.

| ISLAND | SEEDED  | WILLOWS    | BEACHGRASS   | SHRUBS     | TREES      |
|--------|---------|------------|--------------|------------|------------|
| A      | 30 June | 13-15 July | N/A          | 13-15 July | 13-15 July |
| B      | 4 May   | 5 May      | N/A          | 18 May     | N/A        |
| C      | 18 June | 22 June    | N/A          | N/A        | N/A        |
| D1     | 4 May   | 6 May      | 6 and 18 May | N/A        | 18 May     |
| D2     | 29 June | 13-15 July | 13-15 July   | N/A        | N/A        |
| E1     | 19 May  | 23 June    | 23 June      | N/A        | N/A        |
| E2     | 29 June | 13-15 July | 13-15 July   | N/A        | N/A        |

\* The year for all plantings is 1999.

The construction cost of the project was \$2,646,000. Approximate material quantities were as follows:

|                                     |                        |
|-------------------------------------|------------------------|
| Island sand fill                    | 158,000 m <sup>3</sup> |
| Island fine fill                    | 51,000 m <sup>3</sup>  |
| Island groins/slope protection rock | 16,000 metric tons     |
| Rock sills                          | 22,000 metric tons     |
| Geotextile                          | 8,000 m <sup>2</sup>   |
| Seed islands (rock)                 | 6,000 metric tons      |

## **PART II - OPERATION AND MAINTENANCE**

### **GENERAL RESPONSIBILITIES AND PROCEDURES**

#### **Approved Responsibilities**

Operation and maintenance responsibilities for the Pool 8 Islands Phase II project were originally outlined in the Definite Project Report for the project. The acceptance of these responsibilities was formally recognized by an agreement signed by the U.S. Fish and Wildlife Service (USFWS) and the St. Paul District, Corps of Engineers. This agreement, dated January 3, 1997, is contained in appendix B. The capability of the USFWS to carry out the responsibilities described below will be contingent upon the passage of sufficient appropriations by Congress.

#### **District Manager**

Typically, the USFWS operation and maintenance responsibility for habitat projects located within the Refuge is given to the District Manager in charge of the Refuge District where the project is located. For the Pool 8 Islands Phase II project, the current address for the District Manager is 555 Lester Avenue, Onalaska, Wisconsin 54650. Hereafter, for the purposes of this manual, when describing responsibilities, etc., the term "District Manager" will be used.

#### **Inspections**

The District Engineer or his representative will be kept informed on operation and maintenance activities for the Pool 8 Islands Phase II project through periodic inspection of the project by the Corps and through review of an annual report submitted by the USFWS. A representative of the Corps will coordinate the periodic inspection in advance with the USFWS. The first inspection will occur within 5 years after project completion. Subsequent inspections will occur at 5-year intervals. After the first 10 years of project operation, the Corps and the USFWS will jointly review the inspection plans and make any appropriate revisions.

The findings of the periodic inspections will be transmitted to the USFWS and could include recommendations for any remedial work considered necessary to maintain the habitat project in a satisfactory condition. Any agreed upon remedial work should be completed as soon as possible by the USFWS as provided in the Memorandum of Agreement between the USFWS and the Corps.

An inspection of the project should be made by the District Manager (or a designated representative) once a year as a minimum. The frequency for inspection will be subject to review by the USFWS and Corps and could change upon mutual agreement of both parties. The timing of the inspection can be made at the discretion of the District Manager. No special inspections are required after high water events as they occur on an almost annual basis. The annual inspections should be sufficient to reveal any problems or damage caused by high water events.

## **Annual Report**

An annual report covering inspection of the habitat project shall be submitted to the St. Paul District, attn: Construction-Operations Division, at the end of the calendar year. The report should briefly summarize the condition of the project and any maintenance or repairs required during the reporting period.

## **OPERATION**

There are no operational requirements associated with the Pool 8 Islands Phase II project.

## **MAINTENANCE**

The U.S. Fish and Wildlife Service will maintain the project necessary for the project to function properly and provide the benefits for which it was designed. Because of the relatively straightforward nature of the project, only a few maintenance instructions are considered necessary.

a. The rock along the Wisconsin shoreline used for bank stabilization should be kept clear of large woody vegetation. Allowing large woody vegetation growth can lead to rock displacement if the vegetation is uprooted.

b. The notch in rock sill A is designed to pass a design flow of 50 cubic feet per second. Significant debris obstructions that would reduce this flow should not be allowed to persist.

Pertinent sections of the construction specification are contained in appendix C to be used as applicable in procuring replacement rock or other materials.

## **INSPECTIONS, TESTS, AND OPERATIONS FOLLOWING MAJOR STORMS OR FLOODS**

As stated in the Memorandum of Agreement between the USFWS and the Corps, the Corps will be responsible for any mutually agreed upon repair and rehabilitation of the Pool 8 Islands Phase II project that may be needed as a result of a specific storm or flood.

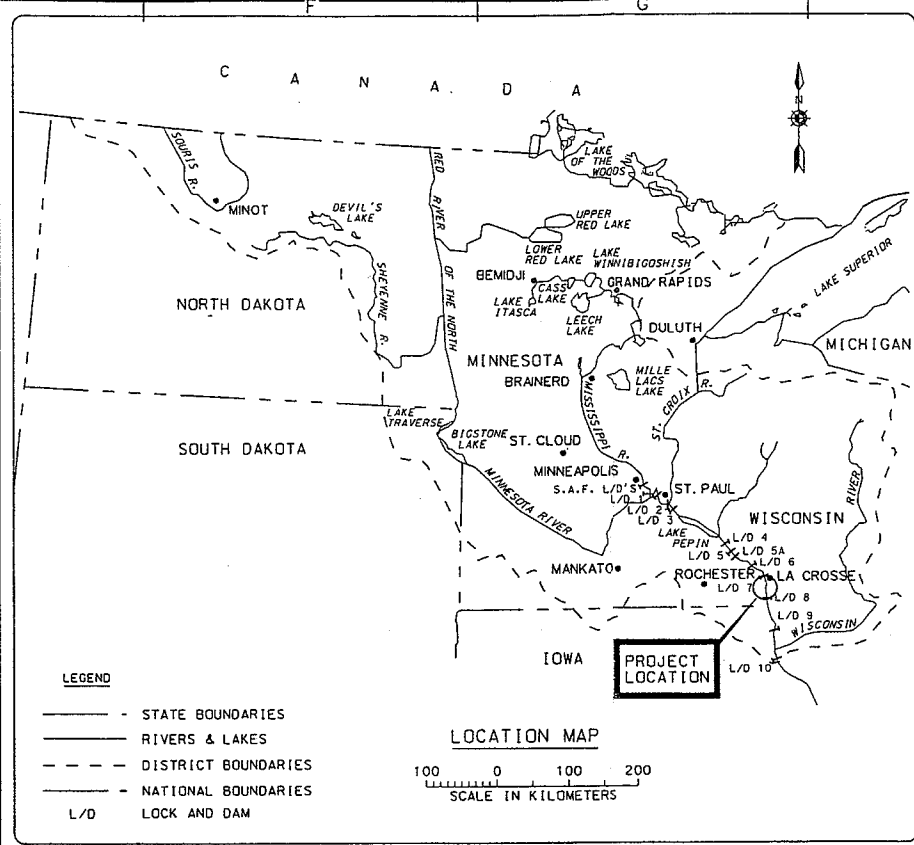
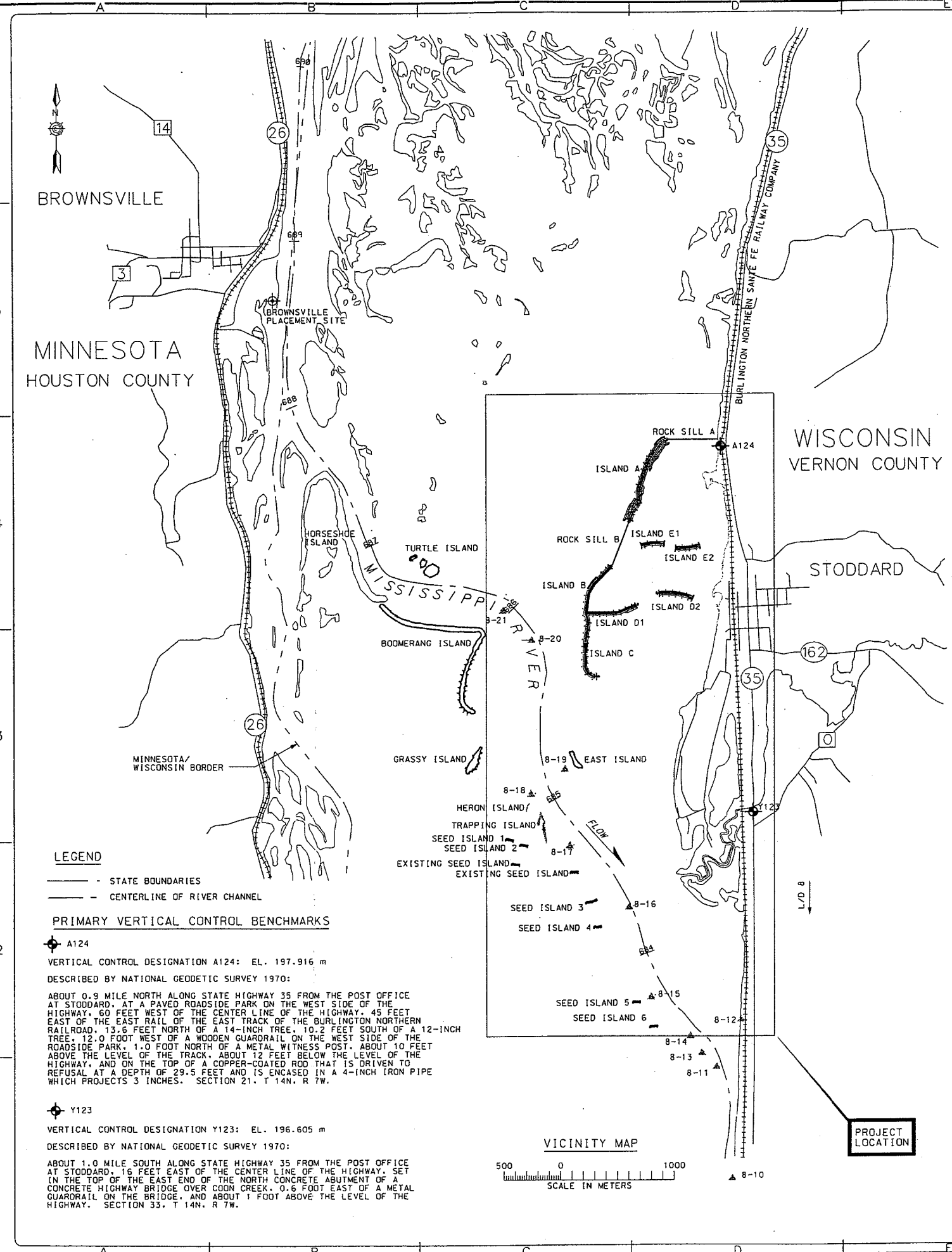
Should inspection of the project area following a major flood or natural disaster disclose substantial damage to the project, the Corps and USFWS will meet and discuss the appropriate course of action in light of original project design. The options of rehabilitation or abandonment of the project may be considered at this time. Any decision would be carried forth only upon written mutual agreement of the USFWS and the Corps. Included within such agreement would be a description of the agreed upon course of action and funding responsibilities, if any.

## **PROJECT MONITORING AND EVALUATION**

Performance monitoring of the Pool 8 Islands Phase II project will be conducted by the Corps of Engineers to help determine the extent to which the design meets the habitat improvement objectives. Information from this monitoring will also be used, if required, when ascertaining whether rehabilitation or abandonment of portions of this project would be the wisest choice.

**APPENDIX A**

**PROJECT DRAWINGS**



- NOTES:**
- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
  - ELEVATIONS REFER TO MEAN SEA LEVEL (N.G.V.D. 1912 ADJ.)
  - CONTOURS ARE BASED ON BATHYMETRIC SURVEYS TAKEN BY EMTIC IN 1989 AND BY ST. PAUL DISTRICT COE IN APRIL 1996.
  - AVERAGE WATER SURFACE ELEVATION = EL. 192.2 m.
  - GEODETIC DATUM: NORTH AMERICAN 1983 (NAD83).
  - COORDINATE SYSTEM: STATE PLANE MINNESOTA SOUTH.

**SECONDARY HORIZONTAL CONTROL POINTS**

| HUB  | SOUTH AZIMUTH | DISTANCE | COORDINATES |               |
|------|---------------|----------|-------------|---------------|
|      |               |          | NORTH       | EAST          |
| 8-10 |               |          | 172 526.952 | 1 024 127.036 |
| 8-11 | 172°06'45"    | 998.354  | 173 515.861 | 1 023 990.033 |
| 8-12 | 207°06'46"    | 469.019  | 173 933.340 | 1 024 203.785 |
| 8-13 | 49°19'36"     | 453.172  | 173 637.987 | 1 023 860.082 |
| 8-14 | 146°07'50"    | 181.543  | 173 788.724 | 1 023 758.908 |
| 8-15 | 134°53'38"    | 488.495  | 174 133.501 | 1 023 412.850 |
| 8-16 | 166°12'13"    | 816.690  | 174 926.629 | 1 023 218.094 |
| 8-17 | 136°13'15"    | 754.047  | 175 471.060 | 1 022 696.384 |
| 8-18 | 143°05'36"    | 573.835  | 175 929.907 | 1 022 351.789 |
| 8-19 | 233°52'19"    | 374.121  | 176 150.486 | 1 022 653.967 |
| 8-20 | 165°35'18"    | 1191.664 | 177 304.652 | 1 022 357.380 |
| 8-21 | 136°21'18"    | 362.565  | 177 567.015 | 1 022 107.142 |

**METRIC**

**US Army Corps of Engineers**  
 St. Paul District

**CONTRACT DRAWINGS**  
**ENVIRONMENTAL**  
**MANAGEMENT PROGRAM**  
**MISSISSIPPI RIVER**  
**POOL 8 ISLAND PHASE II**  
**VERNON COUNTY, WISCONSIN**

**REHABILITATION AND ENHANCEMENT PROJECT**  
 UPPER MISSISSIPPI RIVER

**LOCATION AND VICINITY MAPS**

**DRAWING NUMBER:**  
 M-P8-00 /001

**APPROVAL RECOMMENDED BY:**

CHIEF MECH/ELEC/ARCH SECTION  
 CHIEF GEOTECHNICAL & GEOLOGY SECTION  
 CHIEF HYDRAULICS SECTION  
 CHIEF HYDROLOGY SECTION

**TECHNICAL MANAGER**

CHIEF COST ENGRG & SPECS SECTION  
 CHIEF GENERAL ENGINEERING SECTION  
 CHIEF STRUCTURAL ENGINEERING SECTION

**APPROVED BY:**

DISTRICT COMMANDER  
 DEPARTMENT OF THE ARMY  
 ST. PAUL DISTRICT  
 CORPS OF ENGINEERS  
 ST. PAUL, MINNESOTA

DESIGNED BY: PK. NIELSEN  
 CHECKED BY: JC. JOHNSON  
 DRAWN BY: J. BURK  
 SCALE: AS SHOWN  
 DATE: AUGUST 1997  
 CADD FILE NAME: MPODAD01.DGN  
 SOIL NO: DACW37-97-8-0009  
 AE APPROVING OFFICIAL: JCU

**STANLEY CONSULTANTS**  
 STANLEY CONSULTANTS IN ENGINEERING, ARCHITECTURE, PLANNING AND ENVIRONMENTAL SCIENCE

**SYMBOL**  
 AS - BUILT AS OF NOVEMBER 1999.  
 Description

| DRAWING INDEX |      |  | CAD FILE     |  |  |
|---------------|------|--|--------------|--|--|
| DRAWING NO.   | SHT. | DESCRIPTION                                  |              |  |  |
| M-P8-00/001   | 01   | LOCATION AND VICINITY MAPS                   | M800A001.DGN |  |  |
| M-P8-00/002   | 02   | DRAWING INDEX AND LEGEND                     | M800A002.DGN |  |  |
| M-P8-61/034   | 03   | STODDARD BAY SITE PLAN                       | M800A003.DGN |  |  |
| M-P8-61/035   | 04   | SEED ISLANDS SITE PLAN                       | M800A004.DGN |  |  |
| M-P8-61/036   | 05   | DREDGING PLAN                                | M800A005.DGN |  |  |
| M-P8-61/037   | 06   | ISLAND A. E1. AND E2: ROCK SILL A AND B PLAN | M800A006.DGN |  |  |
| M-P8-61/038   | 07   | ISLAND B. C. D1 AND D2 PLAN                  | M800A007.DGN |  |  |
| M-P8-61/039   | 08   | ISLAND SECTIONS                              | M800A008.DGN |  |  |
| M-P8-61/040   | 09   | ISLAND DETAILS                               | M800A009.DGN |  |  |
| M-P8-61/041   | 10   | ISLAND SECTIONS AND DETAILS                  | M800A010.DGN |  |  |
| M-P8-61/042   | 11   | GROIN AND ROCK SILL SECTIONS AND DETAILS     | M800A011.DGN |  |  |
| M-P8-61/043   | 12   | ISLAND A / REMNANT ISLAND INTERFACE          | M800A012.DGN |  |  |
| M-P8-61/044   | 13   | SEED ISLANDS SECTIONS AND DETAILS            | M800A013.DGN |  |  |
| M-P8-61/045   | 14   | SECTIONS AND DETAILS, MISCELLANEOUS METALS   | SPA61045.DGN |  |  |

| REFERENCE DRAWING INDEX |                      |  | CAD FILE       |  |  |
|-------------------------|----------------------|--|----------------|--|--|
| DRAWING NO.             | DESCRIPTION          |  |                |  |  |
| M-P8-10/020             | BORING LOGS          |  | P8TB000M.DGN   |  |  |
| M-P8-10/021             | BORING LOGS          |  | P8TB001M.DGN   |  |  |
| M-P8-10/022             | BORING LOGS          |  | P8TB002M.DGN   |  |  |
| M-P8-10/023             | BORING LOGS          |  | P8TR003M.DGN   |  |  |
| M-P8-10/024             | BORING LOGS          |  | P8TR004M.DGN   |  |  |
| M-P8-14/017             | FLOW DURATION CURVES |  | pool8dc_d1.DGN |  |  |
| M-P8-14/018             | FLOW DURATION CURVES |  | pool8dc_d2.DGN |  |  |
| M-P8-14/019             | HYDROGRAPHS          |  | pool8hy_h1.DGN |  |  |
| M-P8-14/020             | HYDROGRAPHS          |  | pool8hy_h2.DGN |  |  |

**GENERAL CROSS-REFERENCING SYMBOLS**

SECTION/DETAIL SUPPLEMENTAL INFORMATION SCALE: **A** SECTION/DETAIL TITLE ON SAME SHEET (CENTERED UNDER SECTION/DETAIL)

SECTION/DETAIL SUPPLEMENTAL INFORMATION SCALE: **2** SECTION/DETAIL TITLE ON ANOTHER SHEET (CENTERED UNDER SECTION/DETAIL)

**A** SECTION CUT WITH VIEW SHOWN ON SAME SHEET

**2** SECTION CUT WITH VIEW SHOWN ON ANOTHER SHEET

**A** DESCRIPTION OF DETAIL

**2** DESCRIPTION OF DETAIL

**A** DETAIL SYMBOL WITH VIEW SHOWN ON SAME SHEET

**2** DETAIL SYMBOL WITH VIEW SHOWN ON ANOTHER SHEET

**ABBREVIATIONS**

|           |                    |        |                        |
|-----------|--------------------|--------|------------------------|
| ALUM.     | ALUMINUM           | F.F.   | FAR FACE               |
| ALT. W/   | ALTERNATE WITH     | I.F.   | INSIDE FACE            |
| BOT.      | BOTTOM             | LG     | LONG                   |
| CL.       | CLEAR COVER        | MAX.   | MAXIMUM                |
| C.J.      | CONSTRUCTION JOINT | MIN.   | MINIMUM                |
| CONC.     | CONCRETE           | N.F.   | NEAR FACE              |
| CONT. JT. | CONTRACTION JOINT  | O.C.   | ON CENTER              |
| DIA.      | DIAMETER           | O.F.   | OUTSIDE FACE           |
| E.F.      | EACH FACE          | S.S.   | STAINLESS STEEL        |
| E.J.      | EXPANSION JOINT    | T & B  | TOP AND BOTTOM         |
| EL.       | ELEVATION          | TYP.   | TYPICAL                |
| E.W.      | EACH WAY           | U.N.O. | UNLESS NOTED OTHERWISE |

**GENERAL LEGEND**

|  |                           |  |      |
|--|---------------------------|--|------|
|  | BORING                    |  | FILL |
|  | HORIZONTAL CONTROL POINTS |  | CUT  |
|  | BENCH MARK                |  |      |
|  | P.I. POINTS               |  |      |
|  | WATER SURFACE             |  |      |

**MECHANICAL LEGEND**

**ELECTRICAL LEGEND**

**METRIC**

**US Army Corps of Engineers**  
St. Paul District

DATE: 11/19/99

AS - BUILT AS OF NOVEMBER 1999.

Symbol: [ ] Description: [ ]

DESIGNED BY: PK NIELSEN  
CHECKED BY: JC JOHNSON  
DATE: 11/19/99  
SCALE: AS SHOWN  
CADD FILE NAME: M800A002.DGN  
SOL. NO: DACW37-97-B-0009  
DATE: 11/19/99  
APPROVING OFFICIAL: JCJ

DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
CORPS OF ENGINEERS  
ST. PAUL, MINNESOTA

STANLEY CONSULTANTS  
INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE, PLANNING AND MANAGEMENT

POOL B ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER  
DRAWING INDEX  
AND LEGEND

DRAWING NUMBER:  
M-C8-00  
/002

SHT 2 OF 14

AS-R1111 T

**NOTES:**  
 1. UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.  
 2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL RIGHTS-OF-WAY OR GROUNDS DESIRED AT ITS OWN EXPENSE. THE CONTRACTOR'S CONSTRUCTION OPERATIONS SHALL NOT INTERFERE WITH BARGE TRAFFIC.

**REFERENCES:**  
 1. BORING LOGS.....M-P8-10/020  
 2. BORING LOGS.....M-P8-10/021  
 3. BORING LOGS.....M-P8-10/022  
 4. BORING LOGS.....M-P8-10/023  
 5. BORING LOGS.....M-P8-10/024  
 6. SEED ISLANDS SITE PLAN.....M-P8-61/035  
 7. DREDGING PLAN.....M-P8-61/036  
 8. ISLAND A, E1, AND E2; ROCK SILL A AND B PLAN.....M-P8-61/037  
 9. ISLAND B, C, D1, AND D2 PLAN.....M-P8-61/038

|        |                                |
|--------|--------------------------------|
| Symbol | AS - BUILT AS OF NOVEMBER 1999 |
|        | DESCR I.P.I.C.N.               |

|             |              |                       |                  |
|-------------|--------------|-----------------------|------------------|
| DESIGNED BY | PK. NIELSEN  | DATE                  | AUGUST 1997      |
| CHECKED BY  | DEBRA WILSON | SCALE                 | AS SHOWN         |
| DRAWN BY    | KM BURK      | CADD FILE NAME        | M800A003.DGN     |
|             |              | SOL. NO.              | DACW37-97-B-0009 |
|             |              | AE APPROVING OFFICIAL | JCJ              |

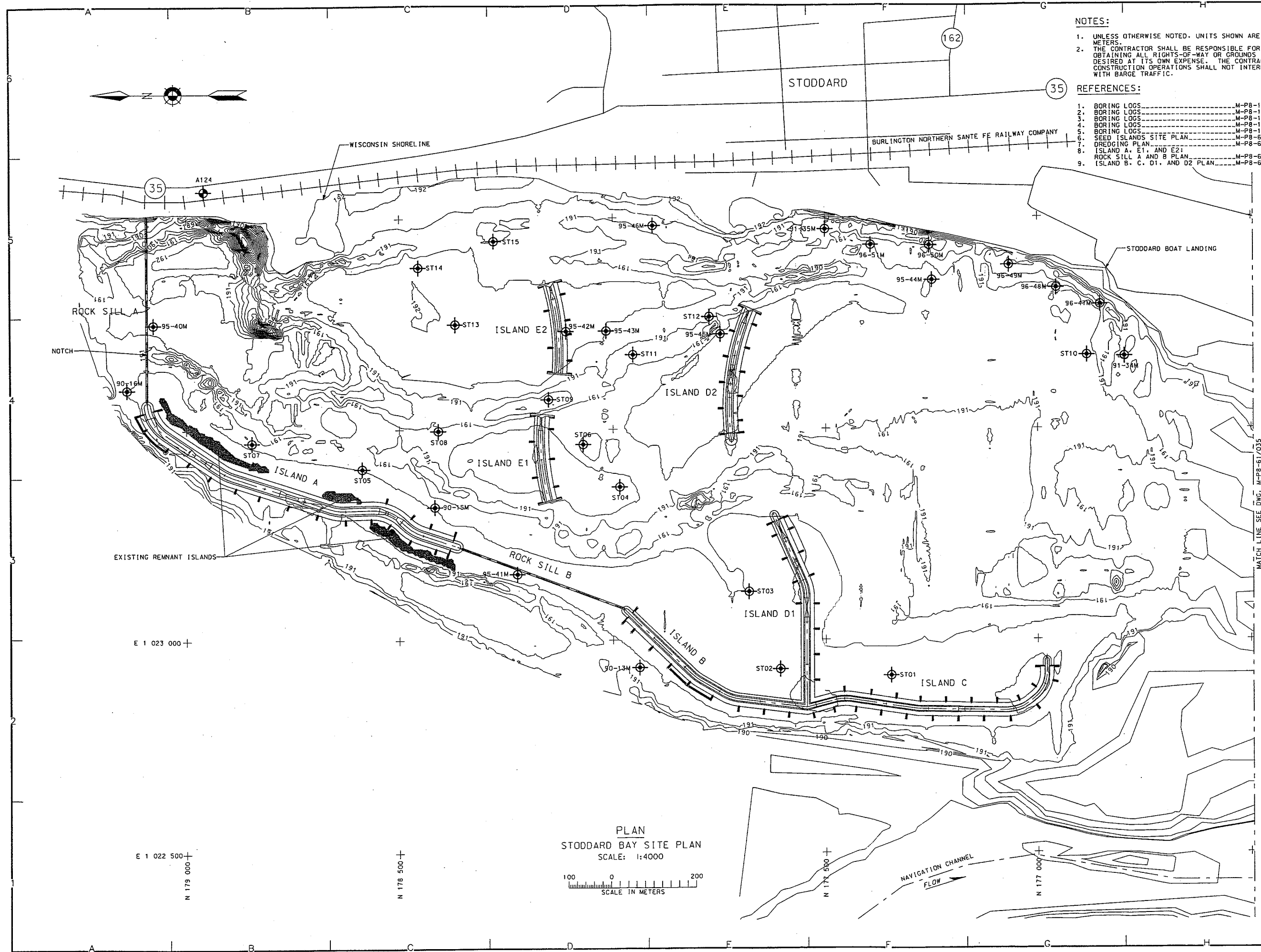
DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
CORPS OF ENGINEERS  
ST. PAUL, MINNESOTA

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PLANNING AND CONSULTING

POOL B ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER

**STODDARD BAY SITE PLAN**

DRAWING NUMBER:  
M-P8-61/034  
SHT 3 OF 14



**PLAN**  
STODDARD BAY SITE PLAN  
SCALE: 1:4000

100 0 200  
SCALE IN METERS

MATCH LINE SEE DWG. M-P8-61/035



**NOTES:**  
 1. UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.  
 2. CONTOURS AND POSITION OF EXISTING FEATURES (E.G., ISLANDS, SHORELINE, ETC.) ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY LOCATIONS OF CONTOURS AND FEATURES APPLICABLE TO WORK.

**REFERENCES:**  
 1. LOCATION AND VICINITY MAPS ..... M-P8-00/001  
 2. STODDARD BAY SITE PLAN ..... M-P8-61/034  
 3. SEED ISLAND SECTIONS AND DETAILS ..... M-P8-61/044

|        |                                |
|--------|--------------------------------|
| Symbol | AS - BUILT AS OF NOVEMBER 1999 |
| UCIG   | UCIG 1 ADP                     |

|             |                  |                       |                 |
|-------------|------------------|-----------------------|-----------------|
| DESIGNED BY | PK. NIELSEN      | DATE                  | AUGUST 1997     |
| CHECKED BY  | DAVID J. JOHNSON | SCALE                 | AS SHOWN        |
| DRAWN BY    | DAVID J. JOHNSON | CADD FILE NAME        | M800A004.DGN    |
| DATE        | 8/15/97          | SOL. NO.              | DAW37-97-B-0009 |
| BY          | MM BURK          | AE APPROVING OFFICIAL | JCJ             |

DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
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ST. PAUL, MINNESOTA

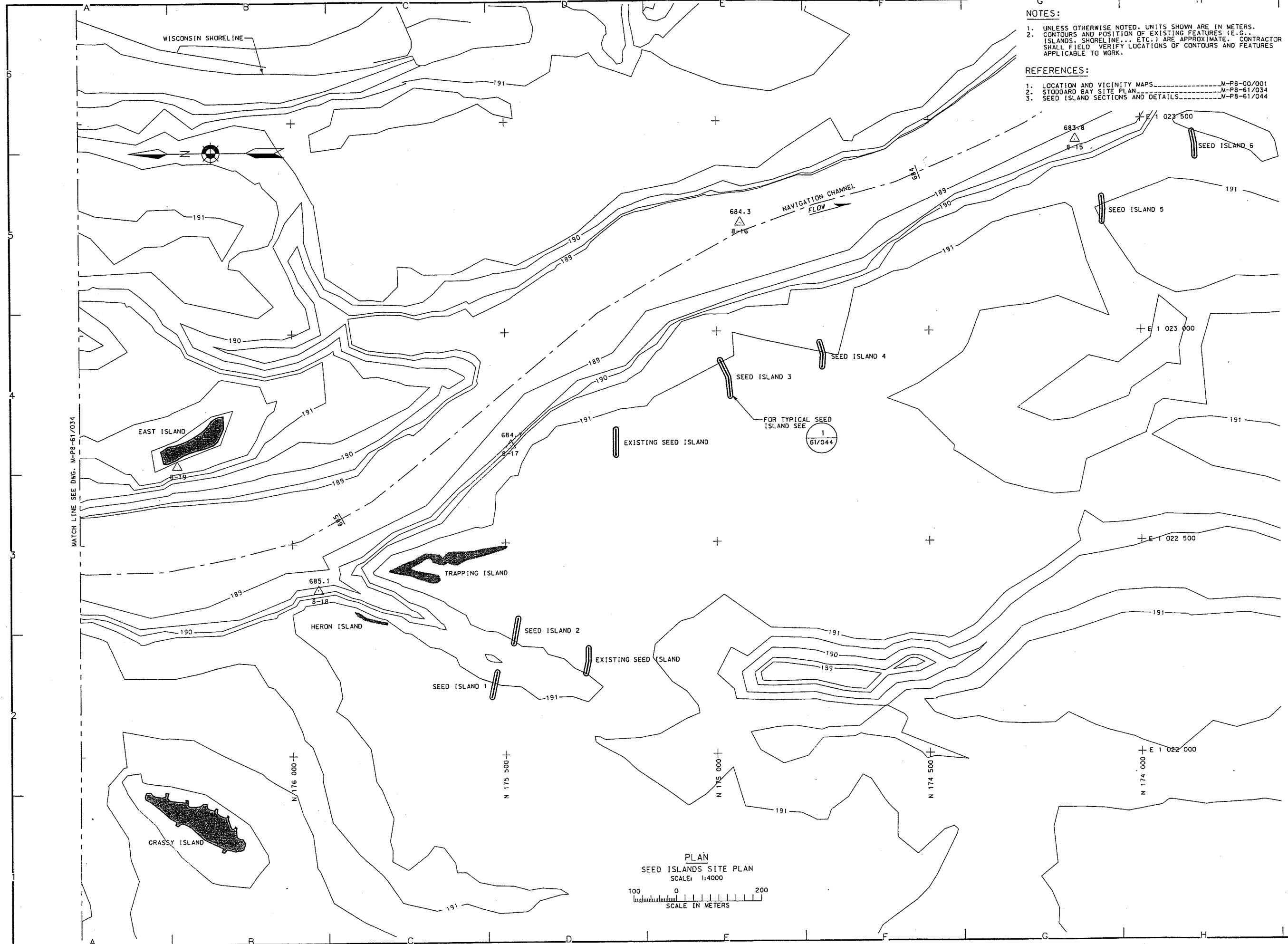
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INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE,  
PLANNING, AND CONSTRUCTION

POOL 8 ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER

**SEED ISLANDS SITE PLAN**

DRAWING NUMBER:  
M-P8-61  
/035

SHT 4 OF 14



- NOTES:**
- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
  - WITH THE EXCEPTION OF THE ACCESS POINTS (CHANNELS) SHOWN, THE CONTRACTOR SHALL NOT DREDGE WITHIN 50 METERS OF THE FOLLOWING: THE WISCONSIN SHORELINE; EACH EXISTING ISLAND; AND THE SITES FOR EACH REQUIRED NEW ISLAND TO BE CONSTRUCTED UNDER THIS CONTRACT.
  - SOIL BORINGS SHOWN ON THE DRAWINGS INDICATE THE LOCATIONS OF GRANULAR FILL MATERIAL DEPOSITS WITHIN STODDARD BAY. SEE DWG. M-P8-61/034 FOR SOIL BORING LOCATIONS.
  - FOR PURPOSES OF THIS CONTRACT, STODDARD BAY IS DEFINED AS THE GENERAL AREA ENCLOSED BY THE PROPOSED ROCK SILLS AND ISLANDS LYING NORTH OF A LINE DEFINED BY THE NORTHING COORDINATE N 176 500.

- REFERENCES:**
- BORING LOGS ..... M-P8-10/020
  - BORING LOGS ..... M-P8-10/021
  - BORING LOGS ..... M-P8-10/022
  - BORING LOGS ..... M-P8-10/023
  - BORING LOGS ..... M-P8-10/024
  - STODDARD BAY SITE PLAN ..... M-P8-61/034

| Date:                  | August 1997     |
|------------------------|-----------------|
| Scale:                 | AS SHOWN        |
| Designed by:           | J.C. JOHNSON    |
| Checked by:            | J.C. JOHNSON    |
| Drawn by:              | R.M. BURK       |
| SOL. NO.:              | DAEW7-97-B-0009 |
| AE APPROVING OFFICIAL: | J.C.J.          |

DEPARTMENT OF THE ARMY  
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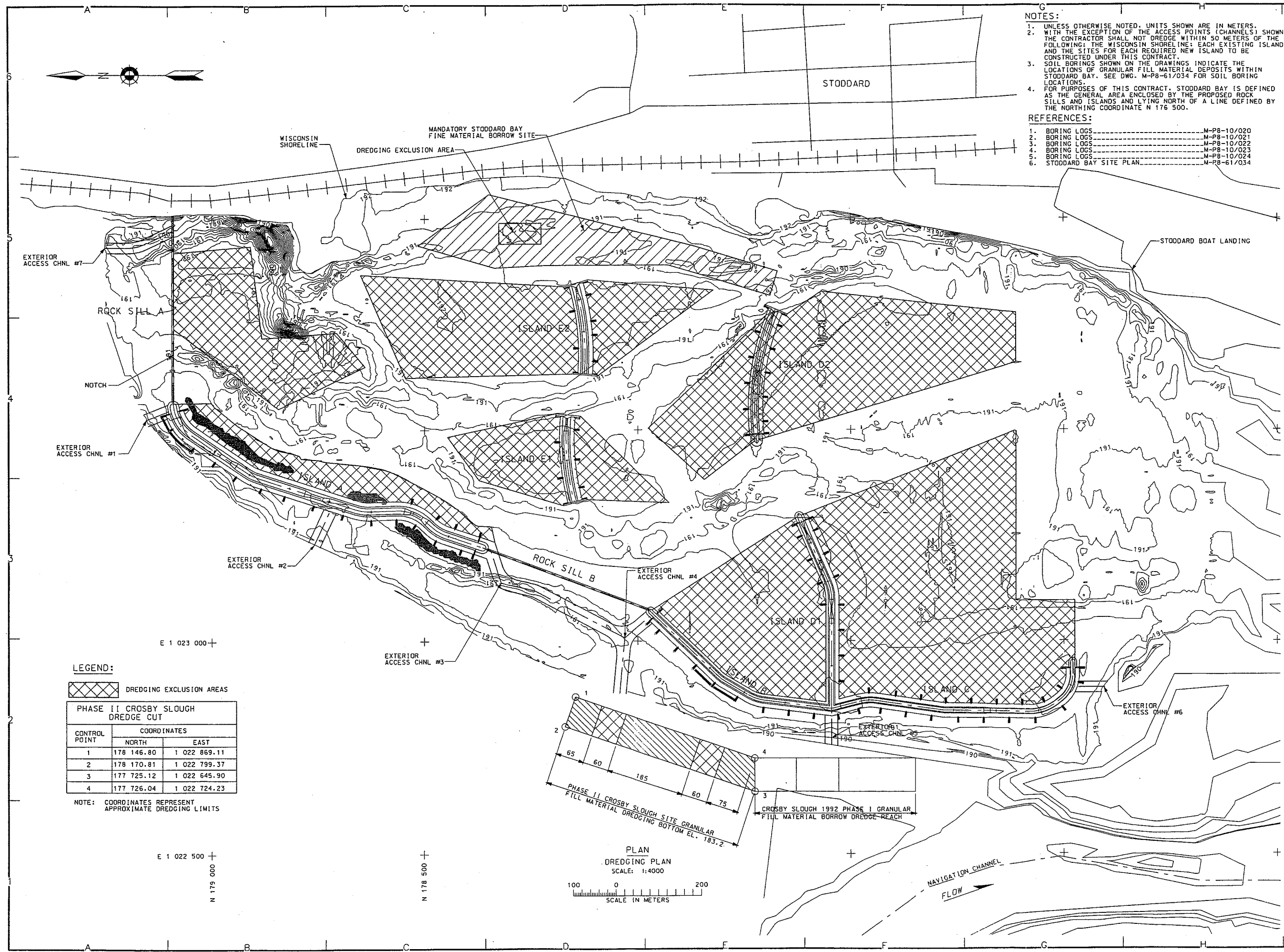
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PLANNING AND ENVIRONMENTAL ENGINEERING

POOL & ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER

DREDGING PLAN

DRAWING NUMBER:  
M-P8-61  
/036

SHT 5 OF 14



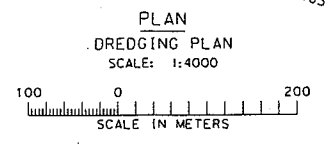
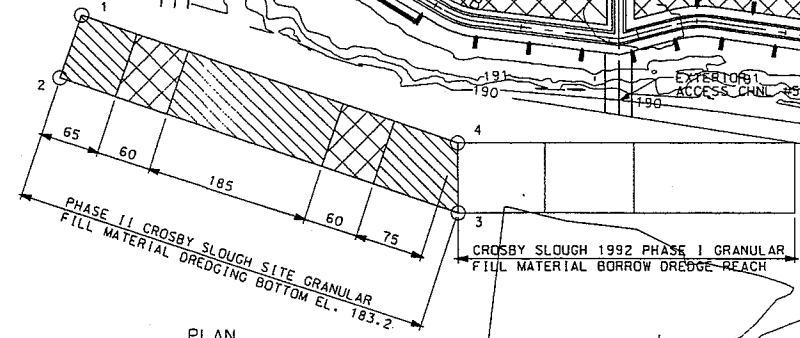
**LEGEND:**

DREDGING EXCLUSION AREAS

**PHASE II CROSBY SLOUGH DREDGE CUT**

| CONTROL POINT | COORDINATES |              |
|---------------|-------------|--------------|
|               | NORTH       | EAST         |
| 1             | 178 146.80  | 1 022 869.11 |
| 2             | 178 170.81  | 1 022 799.37 |
| 3             | 177 725.12  | 1 022 645.90 |
| 4             | 177 726.04  | 1 022 724.23 |

NOTE: COORDINATES REPRESENT APPROXIMATE DREDGING LIMITS



**NOTES:**

- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
- REMNANT ISLANDS ARE SHOWN AS FOUND ON BATHYMETRIC SURVEY BY EMTG IN 1989.

**REFERENCES:**

- STODDARD BAY SITE PLAN.....M-PB-61/034
- ISLAND B, C, D1, AND D2 PLAN.....M-PB-61/038
- ISLAND SECTIONS.....M-PB-61/039
- ISLAND DETAILS.....M-PB-61/040
- ISLAND SECTIONS AND DETAILS.....M-PB-61/041
- GROIN ROCK SILL SECTIONS AND DETAILS.....M-PB-61/042
- ISLAND A / REMNANT ISLAND INTERFACE.....M-PB-61/043

|                              |             |
|------------------------------|-------------|
| AS-BUILT AS OF NOVEMBER 1999 | Date        |
| Symbol                       | Description |

|                            |                                  |
|----------------------------|----------------------------------|
| DESIGNED BY:<br>K. NIELSEN | DATE:<br>AUGUST 1997             |
| CHECKED BY:<br>J. COLEMAN  | SCALE:<br>AS SHOWN               |
| DRAWN BY:<br>K.M. BLUK     | CADD FILE NAME:<br>MBO0A006.DGN  |
| DATE:<br>AUGUST 1997       | AE APPROVING OFFICIAL:<br>J.C.J. |

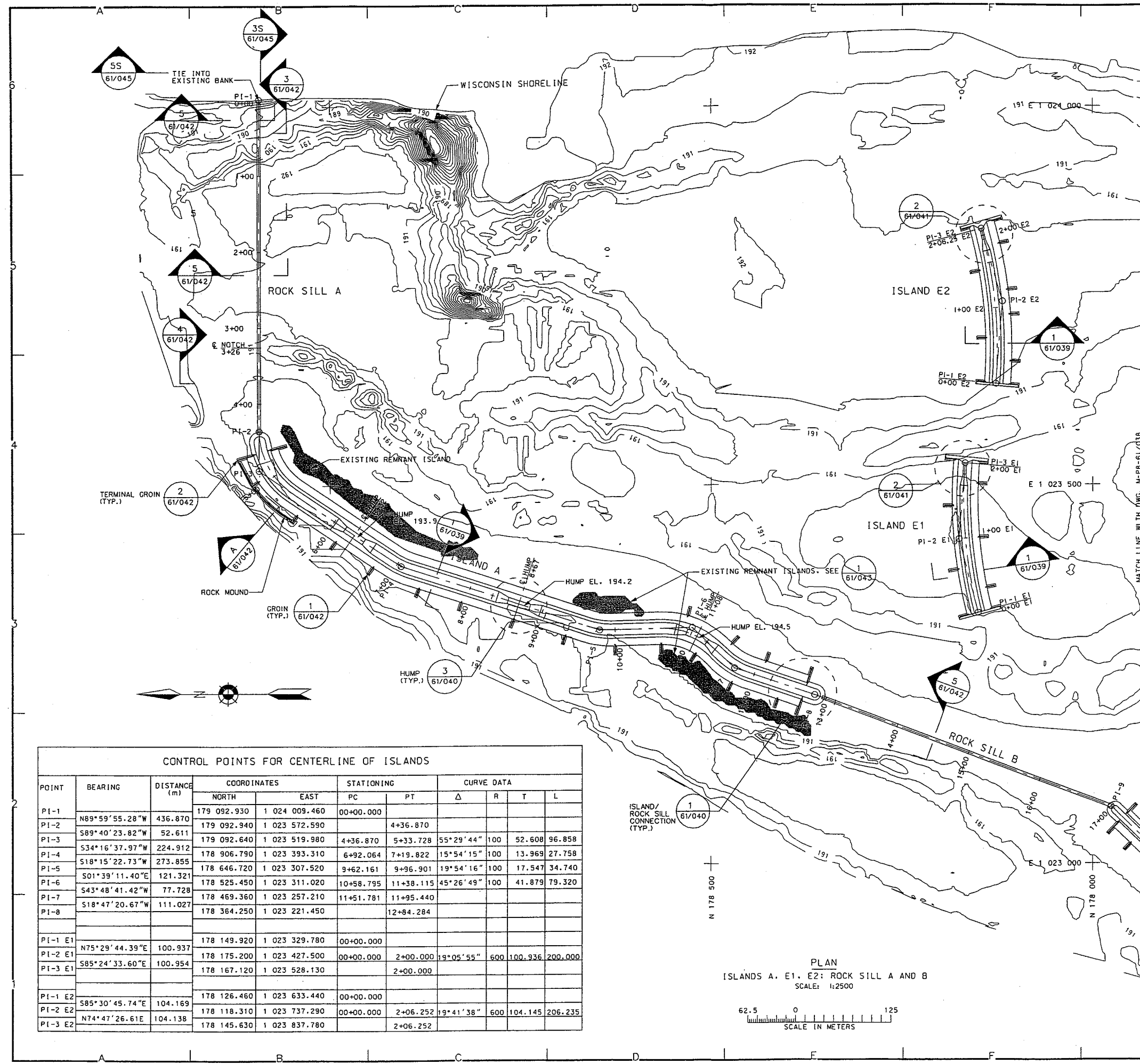
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POOL 8 ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER

ISLAND A, E1, AND E2;  
ROCK SILL A AND B PLAN

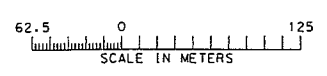
DRAWING NUMBER:  
M-C8-61/  
037



**CONTROL POINTS FOR CENTERLINE OF ISLANDS**

| POINT   | BEARING        | DISTANCE (m) | COORDINATES |               | STATIONING |           | CURVE DATA |     |         |         |
|---------|----------------|--------------|-------------|---------------|------------|-----------|------------|-----|---------|---------|
|         |                |              | NORTH       | EAST          | PC         | PT        | Δ          | R   | T       | L       |
| PI-1    |                |              | 179 092.930 | 1 024 009.460 | 00+00.000  |           |            |     |         |         |
| PI-2    | N89°59'55.28"W | 436.870      | 179 092.940 | 1 023 572.590 | 4+36.870   |           |            |     |         |         |
| PI-3    | S89°40'23.82"W | 52.611       | 179 092.640 | 1 023 519.980 | 4+36.870   | 5+33.728  | 55°29'44"  | 100 | 52.608  | 96.858  |
| PI-4    | S34°16'37.97"W | 224.912      | 178 906.790 | 1 023 393.310 | 6+92.064   | 7+19.822  | 15°54'15"  | 100 | 13.969  | 27.758  |
| PI-5    | S18°15'22.73"W | 273.855      | 178 646.720 | 1 023 307.520 | 9+62.161   | 9+96.901  | 19°54'16"  | 100 | 17.547  | 34.740  |
| PI-6    | S01°39'11.40"E | 121.321      | 178 525.450 | 1 023 311.020 | 10+58.795  | 11+38.115 | 45°26'49"  | 100 | 41.879  | 79.320  |
| PI-7    | S43°48'41.42"W | 77.728       | 178 469.360 | 1 023 257.210 | 11+51.781  | 11+95.440 |            |     |         |         |
| PI-8    | S18°47'20.67"W | 111.027      | 178 364.250 | 1 023 221.450 |            | 12+84.284 |            |     |         |         |
| PI-1 E1 |                |              | 178 149.920 | 1 023 329.780 | 00+00.000  |           |            |     |         |         |
| PI-2 E1 | N75°29'44.39"E | 100.937      | 178 175.200 | 1 023 427.500 | 00+00.000  | 2+00.000  | 19°05'55"  | 600 | 100.936 | 200.000 |
| PI-3 E1 | S85°24'33.60"E | 100.954      | 178 167.120 | 1 023 528.130 |            | 2+00.000  |            |     |         |         |
| PI-1 E2 |                |              | 178 126.460 | 1 023 633.440 | 00+00.000  |           |            |     |         |         |
| PI-2 E2 | S85°30'45.74"E | 104.169      | 178 118.310 | 1 023 737.290 | 00+00.000  | 2+06.252  | 19°41'38"  | 600 | 104.145 | 206.235 |
| PI-3 E2 | N74°47'26.61E  | 104.138      | 178 145.630 | 1 023 837.780 |            | 2+06.252  |            |     |         |         |

**PLAN**  
ISLANDS A, E1, E2; ROCK SILL A AND B  
SCALE: 1:2500



- NOTES:**
- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
  - TEMPORARY IN-WATER STOCKPILING OF FILL MATERIAL SHALL BE CONFINED TO THE LIMITS OF THE OPTIONAL MUDFLAT. THE CONTRACTOR MAY ADJUST CONFIGURATION OF OPTIONAL 2.5 ha (MAX.) MUDFLAT.
- REFERENCES:**
- STODDARD BAY SITE PLAN M-P8-61/034
  - ISLAND A, E1, AND E2: ROCK SILL A AND B PLAN M-P8-61/037
  - ISLAND SECTIONS M-P8-61/038
  - ISLAND DETAILS M-P8-61/040
  - ISLAND SECTIONS AND DETAILS M-P8-61/041
  - GROIN ROCK SILL SECTIONS AND DETAILS M-P8-61/042

|                                |             |
|--------------------------------|-------------|
| AS - BUILT AS OF NOVEMBER 1999 | DESCRIPTION |
| SYMBOL                         | DESCRIPTION |
| AS - BUILT AS OF NOVEMBER 1999 | DESCRIPTION |
| SYMBOL                         | DESCRIPTION |

|                                  |                              |
|----------------------------------|------------------------------|
| DESIGNED BY: STANLEY CONSULTANTS | DATE: AUGUST 1997            |
| CHECKED BY: AS SHOWN             | SCALE: AS SHOWN              |
| DRAWN BY: JC JOHNSON             | CADD FILE NAME: M800A007.DGN |
| DATE: AUGUST 1997                | SOL. NO: DACW57-97-B-0009    |
| REVISIONS:                       | RE APPROVING OFFICIAL: JCJ   |

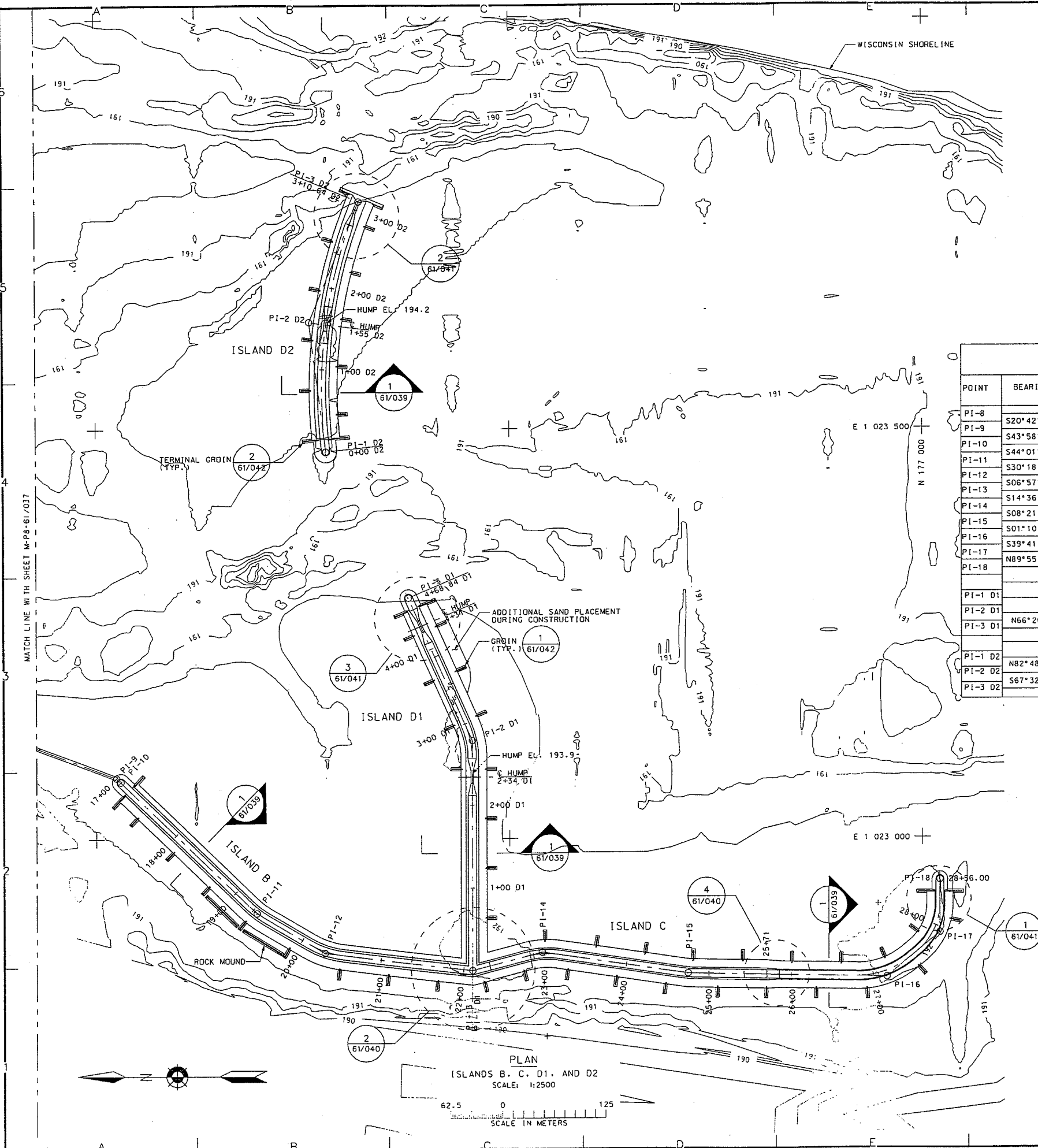
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POOL B ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER

ISLAND B, C, D1, AND  
D2 PLAN

DRAWING NUMBER:  
M-P8-61  
/038  
7 14



| POINT   | BEARING        | DISTANCE (m) | COORDINATES |               | STATIONING |           | CURVE DATA |     |         |         |
|---------|----------------|--------------|-------------|---------------|------------|-----------|------------|-----|---------|---------|
|         |                |              | NORTH       | EAST          | PC         | PT        | Δ          | R   | T       | L       |
| PI-8    | S20°42'36.05"W | 415.509      | 178 364.250 | 1 023 221.450 |            | 12+84.284 |            |     |         |         |
| PI-9    | S43°58'15.04"W | 7.086        | 177 975.590 | 1 023 074.510 |            | 16+99.793 |            |     |         |         |
| PI-10   | S44°01'08.46"W | 228.811      | 177 970.490 | 1 023 069.590 |            | 17+06.879 |            |     |         |         |
| PI-11   | S30°18'38.65"W | 95.702       | 177 805.950 | 1 022 910.590 | 19+23.676  | 19+47.590 | 13°42'06"  | 100 | 12.014  | 23.914  |
| PI-12   | S06°57'02.31"W | 179.731      | 177 723.330 | 1 022 862.290 | 20+10.613  | 20+51.369 | 23°21'05"  | 100 | 20.665  | 40.756  |
| PI-13   | S14°36'34.15"E | 86.786       | 177 544.920 | 1 022 840.540 |            | 22+10.435 |            |     |         |         |
| PI-14   | S08°21'19.50"W | 178.373      | 177 460.940 | 1 022 862.430 | 22+76.922  | 23+16.976 | 22°56'58"  | 100 | 20.299  | 40.054  |
| PI-15   | S01°10'09.95"W | 241.560      | 177 284.460 | 1 022 836.510 | 24+68.770  | 24+81.313 | 7°11'12"   | 100 | 6.280   | 12.543  |
| PI-16   | S39°41'40.86"E | 83.357       | 177 042.950 | 1 022 831.580 | 26+79.351  | 27+50.654 | 40°51'11"  | 100 | 37.242  | 71.302  |
| PI-17   | N89°55'41.44"E | 63.820       | 176 978.810 | 1 022 884.820 | 27+61.531  | 28+27.414 | 50°19'52"  | 75  | 35.237  | 65.883  |
| PI-18   |                |              | 176 978.890 | 1 022 948.640 |            | 28+55.997 |            |     |         |         |
| PI-1 D1 |                |              | 177 544.920 | 1 022 840.540 | 0+00.000   |           |            |     |         |         |
| PI-2 D1 |                | 278.570      | 177 544.920 | 1 023 119.110 | 2+57.725   | 2+98.826  | 23°32'56"  | 100 | 20.845  | 41.101  |
| PI-3 D1 | N66°26'32.29E  | 190.856      | 177 621.200 | 1 023 294.060 |            | 4+68.838  |            |     |         |         |
| PI-1 D2 |                |              | 177 721.030 | 1 023 473.060 | 0+00.000   |           |            |     |         |         |
| PI-2 D2 | N82°48'04.25E  | 158.882      | 177 740.940 | 1 023 630.690 | 0+00.000   | 3+10.640  | 29°39'44"  | 600 | 158.875 | 310.622 |
| PI-3 D2 | S67°32'10.70E  | 158.886      | 177 680.230 | 1 023 777.520 |            | 3+10.640  |            |     |         |         |

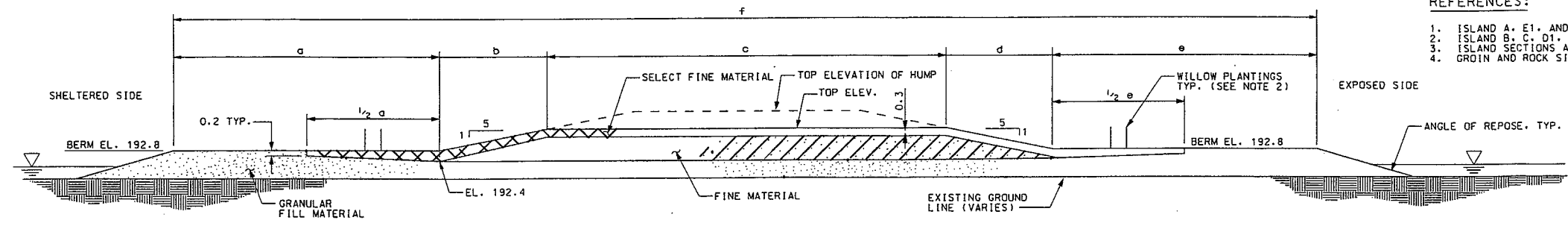
MATCH LINE WITH SHEET M-P8-61/037

**NOTES:**

- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
- FOR TYPICAL GROIN AND TERMINAL GROIN DETAIL, SEE 1/61/042 AND 2/61/042

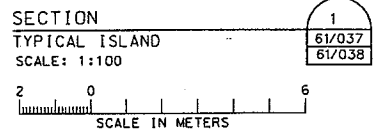
**REFERENCES:**

- ISLAND A, E1, AND E2; ROCK SILL A AND B PLAN.....M-P8-61/037
- ISLAND B, C, D1, AND D2 PLAN.....M-P8-61/038
- ISLAND SECTIONS AND DETAILS.....M-P8-61/041
- GROIN AND ROCK SILL SECTIONS AND DETAILS.....M-P8-61/042

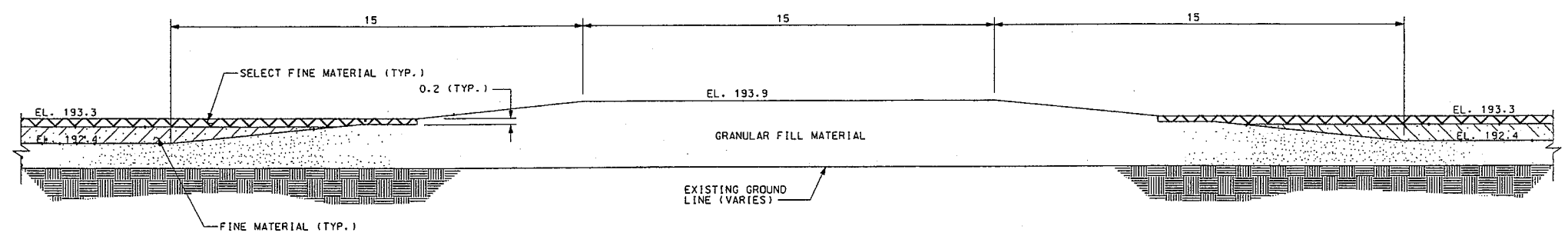
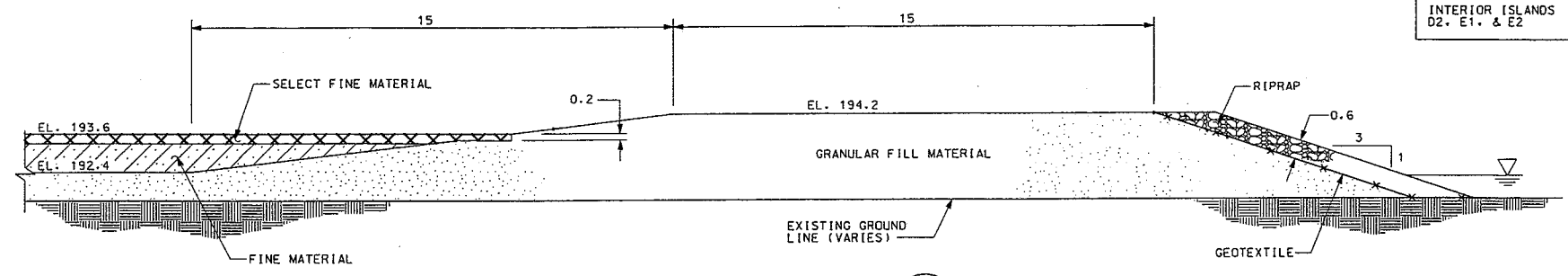


**NOTE:**

- GROINS NOT SHOWN FOR CLARITY.
- TWO ROWS OF WILLOW CUTTINGS SHALL BE PLANTED ALONG THE SHORELINES OF ALL ISLANDS WITH A 0.6m SPACING BETWEEN STAGGERED ROWS AND WILLOWS. AT ISLANDS D1, D2, E1, AND E2 NO WILLOWS SHALL BE PLANTED ALONG THE SHORELINE IN FRONT OF THE HUMPS.
- FOR HUMP LOCATIONS AND ELEVATIONS, SEE DWG. M-P8-61/037 AND 61/038.



| ISLAND DIMENSIONS                 |        |        |        |        |        |              |        |
|-----------------------------------|--------|--------|--------|--------|--------|--------------|--------|
| ISLAND NAMES                      | a<br>m | b<br>m | c<br>m | d<br>m | e<br>m | TOP<br>ELEV. | f<br>m |
| ISLAND A                          | 10     | 4      | 15     | 4      | 10     | 193.6        | 43     |
| ISLAND B                          | 6      | 2.5    | 10     | 2.5    | 10     | 193.3        | 31     |
| ISLAND C UPSTREAM OF STA. 25+71   | 10     | 2      | 10     | 2      | 10     | 193.2        | 34     |
| ISLAND C DOWNSTREAM OF STA. 25+86 | 10     | 1      | 10     | 1      | 10     | 193.0        | 32     |
| INTERIOR ISLAND D1                | 6      | 2.5    | 10     | 2.5    | 10     | 193.3        | 31     |
| INTERIOR ISLANDS D2, E1, & E2     | 6      | 4      | 10     | 4      | 10     | 193.6        | 34     |



**NOTE:**

- HUMP AT ISLAND D1 SHOWN. INTERIOR HUMP AT ISLAND D2 SIMILAR.

| Date                           | Symbol | Description |
|--------------------------------|--------|-------------|
| AS - BUILT AS OF NOVEMBER 1999 |        |             |

DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
CORPS OF ENGINEERS  
ST. PAUL, MINNESOTA

STANLEY CONSULTANTS  
ST. PAUL, MINNESOTA

DESIGNED BY: J.C. JOHNSON  
CHECKED BY: J.C. JOHNSON  
DRAWN BY: K.M. BURK

SCALE: AS SHOWN  
CADD FILE NAME: M800A08.DGN  
SOL. NO.: D:\C\37-97-B-0009  
DATE: AUGUST 1997

AE APPROVING OFFICIAL: J.C.J.

POOL 8 ISLAND PHASE II HABITAT  
REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER

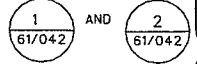
ISLAND SECTIONS

DRAWING NUMBER:  
M-P8-61/  
039

SHT 6 OF 14

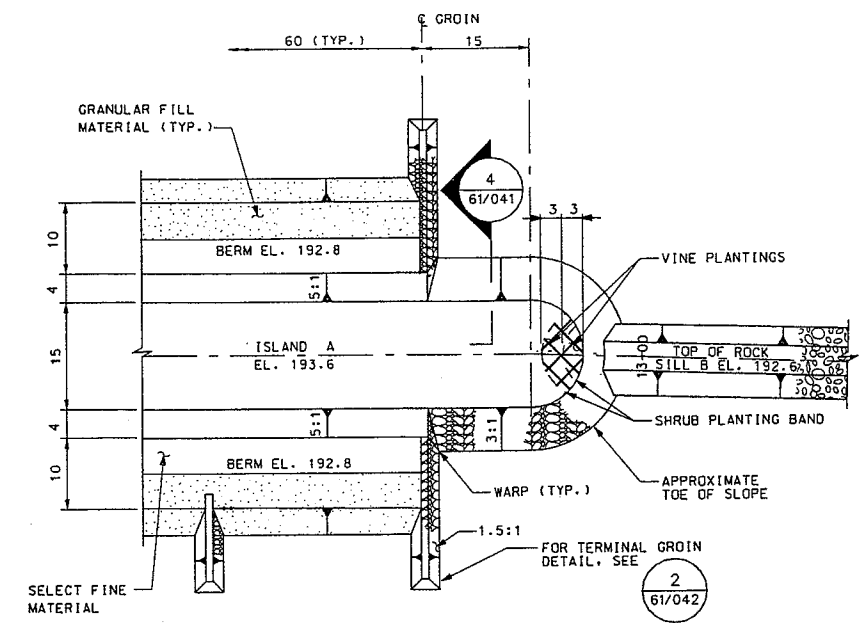
NOTES:

- UNLESS OTHERWISE NOTED, UNITS ARE IN METERS.
- FOR TYPICAL GROIN AND TERMINAL GROIN DETAIL, SEE 1 AND 2



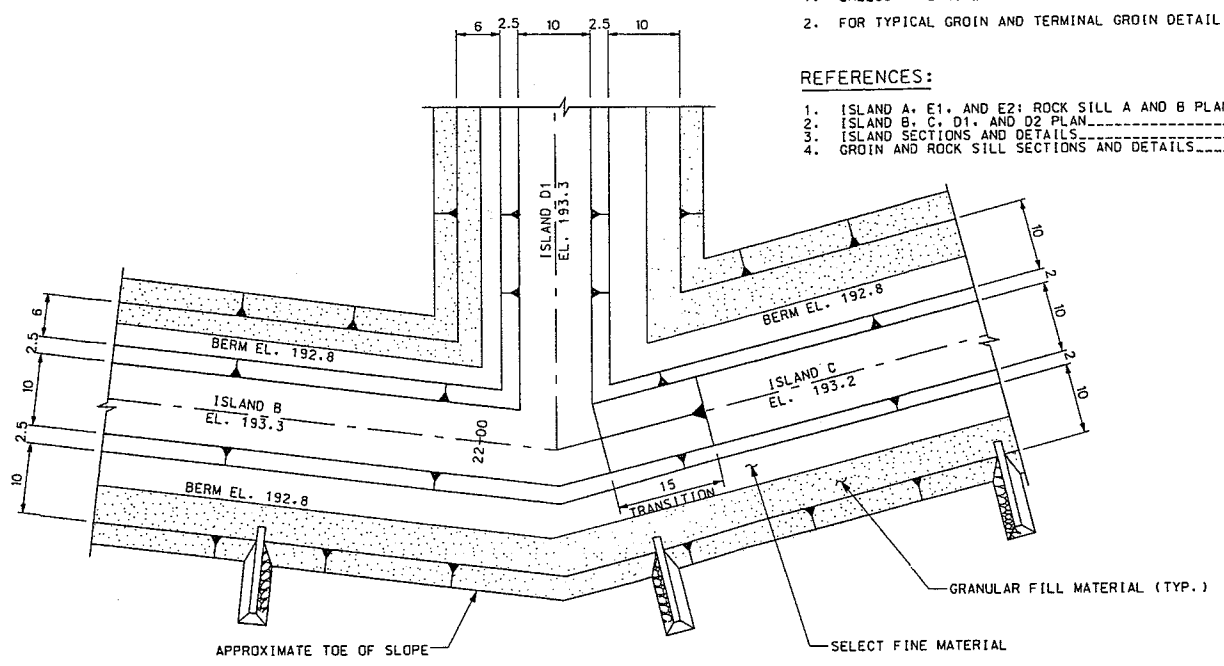
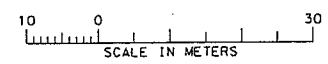
REFERENCES:

- ISLAND A, E1, AND E2; ROCK SILL A AND B PLAN.....M-P8-61/037
- ISLAND B, C, D1, AND D2 PLAN.....M-P8-61/038
- ISLAND SECTIONS AND DETAILS.....M-P8-61/041
- GROIN AND ROCK SILL SECTIONS AND DETAILS.....M-P8-61/042

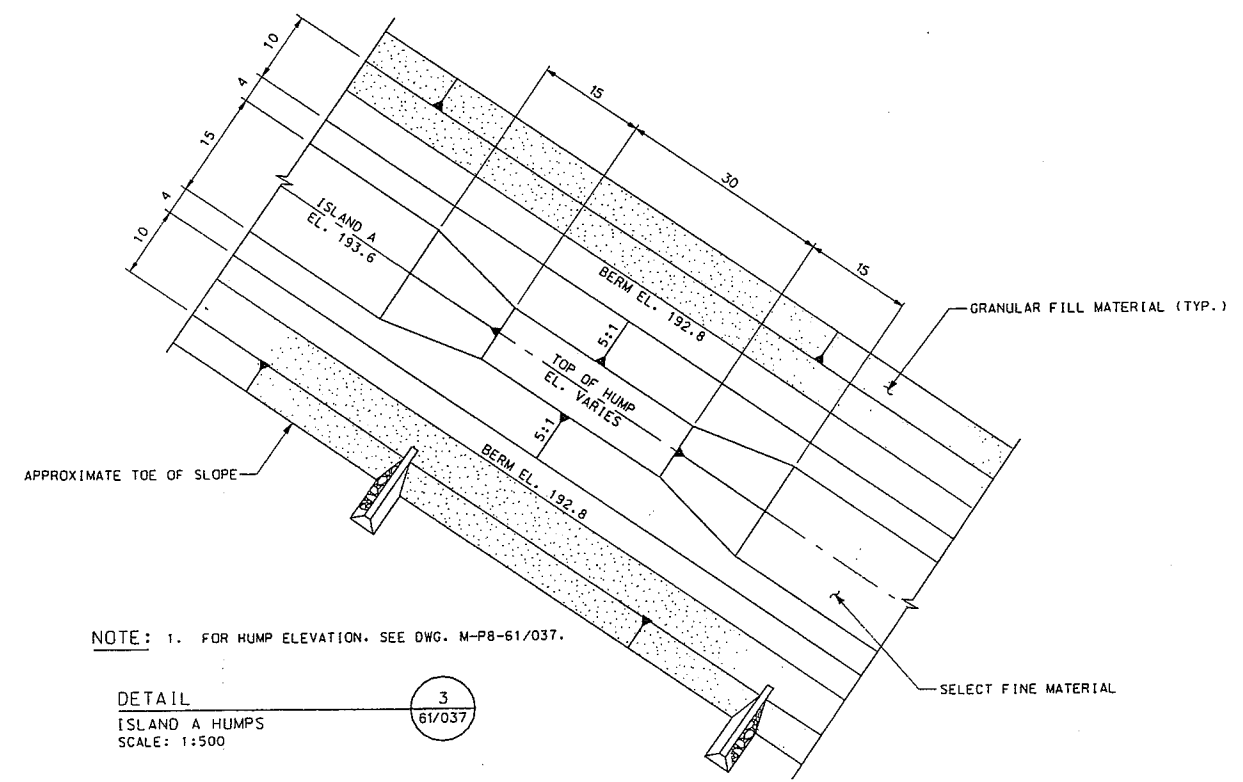
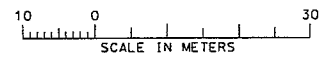


NOTE: 1. ISLAND A/ROCK SILL B CONNECTION SHOWN. OTHER ISLAND/ROCK SILL CONNECTIONS SIMILAR.

DETAIL 1  
TYPICAL ISLAND/ROCK SILL CONNECTION  
SCALE: 1:500

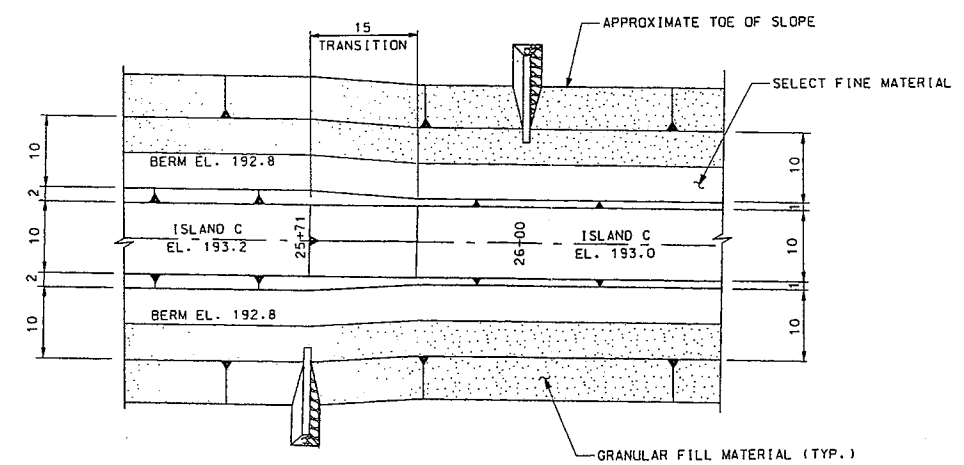
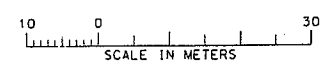


DETAIL 2  
ISLANDS B, C, & D1 TRANSITION  
SCALE: 1:500

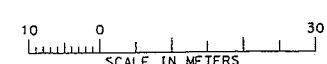


NOTE: 1. FOR HUMPS ELEVATION, SEE DWG. M-P8-61/037.

DETAIL 3  
ISLAND A HUMPS  
SCALE: 1:500



DETAIL 4  
ISLAND C TRANSITION  
SCALE: 1:500



|             |                                |                                |
|-------------|--------------------------------|--------------------------------|
| SYMBOL      | 3                              | 4                              |
| DESCRIPTION | AS - BUILT AS OF NOVEMBER 1999 | AS - BUILT AS OF NOVEMBER 1999 |
| DATE        | 3/19/97                        | 3/19/97                        |
| BY          | JK                             | JK                             |
| CHECKED     | JK                             | JK                             |
| DESIGNED    | JK                             | JK                             |

|                       |                  |
|-----------------------|------------------|
| DATE                  | AUGUST 1997      |
| SCALE                 | AS SHOWN         |
| CADD FILE NAME        | M800A009.DGN     |
| SOL. NO.              | DACW37-97-B-0009 |
| AE APPROVING OFFICIAL | JCJ              |

DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
CORPS OF ENGINEERS  
ST. PAUL, MINNESOTA

STANLEY CONSULTANTS  
INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE,  
PLANNING, AND ENVIRONMENT

DRAWING NUMBER:  
M-P8-61/  
040

|        |                                |
|--------|--------------------------------|
| Symbol | AS - BUILT AS OF NOVEMBER 1999 |
| Date   | 11/19/99                       |
| Appr.  | JCJ                            |

|           |            |                        |                 |
|-----------|------------|------------------------|-----------------|
| DESIGNER: | PK NIELSEN | DATE:                  | AUGUST 1997     |
| CHECKED:  | JC JOHNSON | SCALE:                 | AS SHOWN        |
| DRAWN:    | KM BURK    | CADD FILE NAME:        | MB00A010.DGN    |
|           |            | SOL. NO.:              | DA027-97-8-0009 |
|           |            | AE APPROVING OFFICIAL: | JCJ             |

POOL 8 ISLAND PHASE II HABITAT REHABILITATION AND ENHANCEMENT PROJECT UPPER MISSISSIPPI RIVER

ISLAND SECTIONS AND DETAILS

DRAWING NUMBER:  
M-P8-61/041

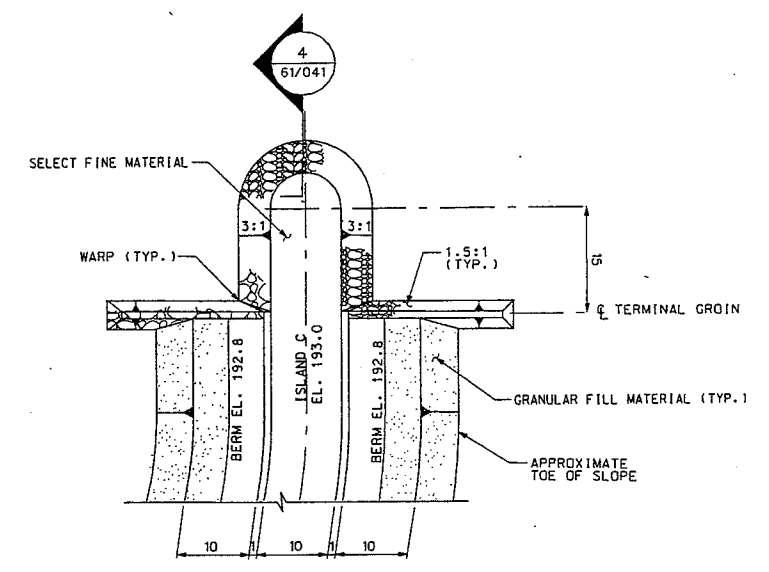
SHT 10 OF 14

NOTES:

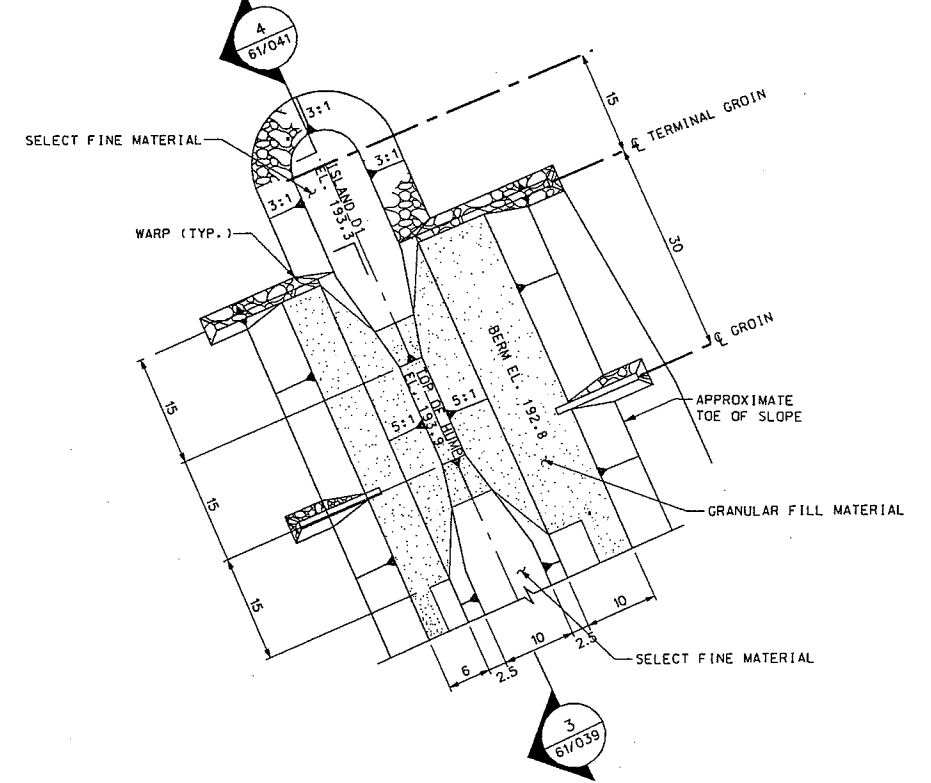
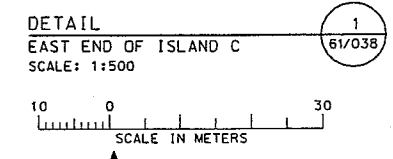
- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
- FOR TYPICAL GROIN AND TERMINAL GROIN DETAIL, SEE 1/61/042 AND 2/61/042

REFERENCES:

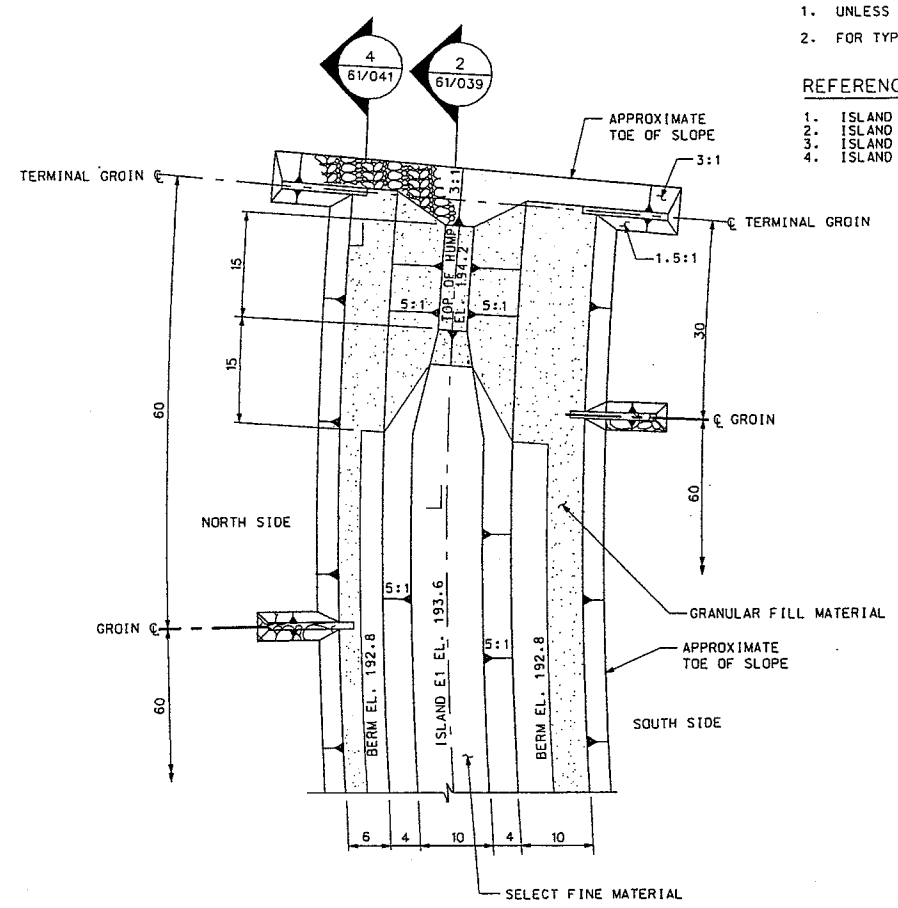
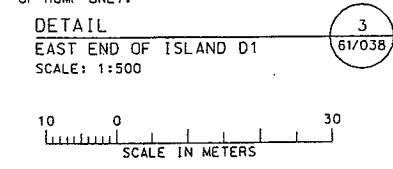
- ISLAND A, E1, AND E2; ROCK SILL A AND B PLAN.....M-P8-61/037
- ISLAND B, C, D1, AND D2 PLAN.....M-P8-61/038
- ISLAND DETAILS.....M-P8-61/040
- ISLAND SECTIONS AND DETAILS.....M-P8-61/041



NOTES: 1. WEST END OF ISLAND D2 IS SIMILAR.

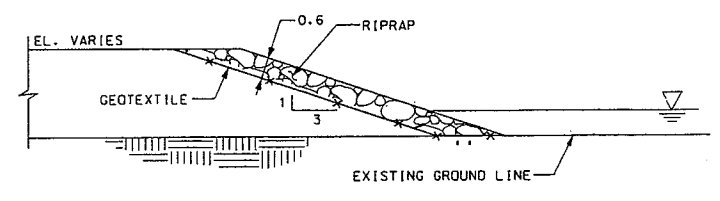
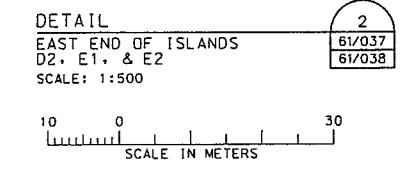


NOTES:  
1. HUMPS LOCATED AT INTERIOR OF ISLAND D1 AND D2 SIMILAR.  
2. BEACH GRASS STOLON (PLUG) SHALL BE PLANTED IN THE GRANULAR FILL MATERIAL ALONG THE 5:1 SLOPE AND TOP SIDE OF HUMP ONLY.



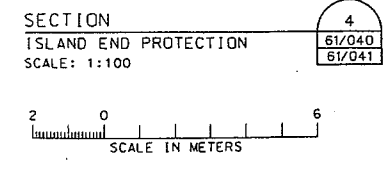
NOTES:

- ISLANDS E1 SHOWN, ISLAND D2 AND E2 SIMILAR.
- WEST END OF ISLANDS E1 & E2 ARE SIMILAR, BUT NO HUMPS REQUIRED.
- BEACH GRASS STOLON (PLUG) SHALL BE PLANTED IN THE GRANULAR FILL MATERIAL ALONG THE 5:1 SLOPE AND TOP SIDE OF HUMP ONLY.

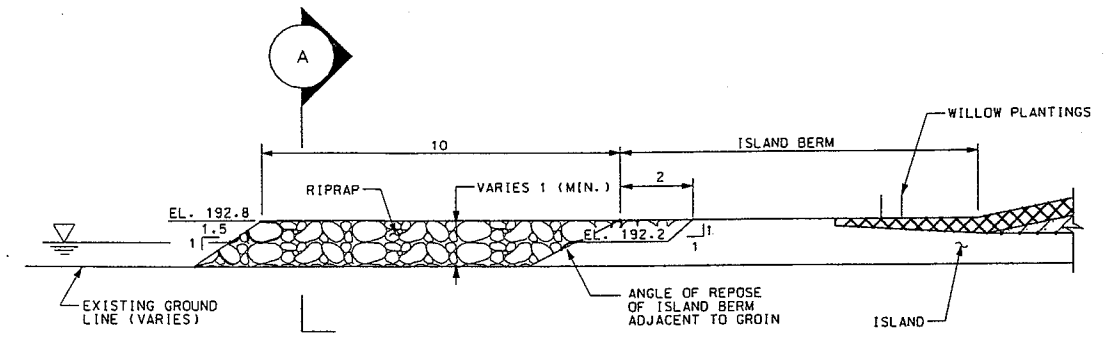


NOTES:

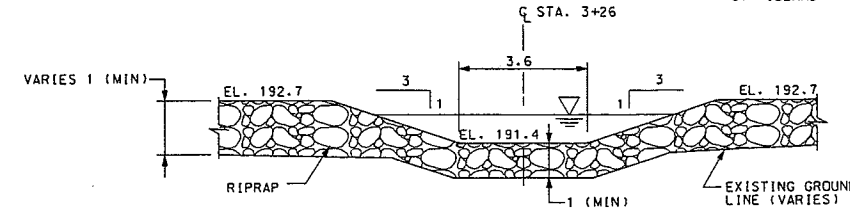
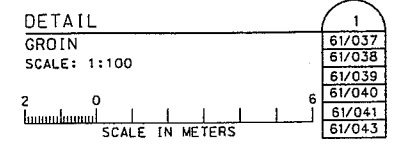
- RIPRAP REQUIRED TO TOP OF ISLAND OR HUMP AT EACH END.
- STOP GEOTEXTILE 150mm FROM TOP OF ISLAND.



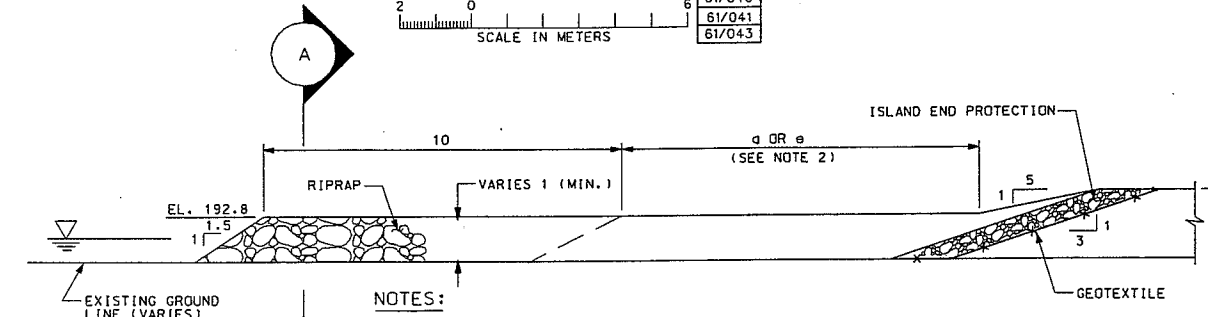
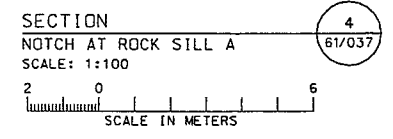
- NOTES:  
1. UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
- REFERENCES:  
1. ISLAND A, E1, AND E2; ROCK SILL A AND B PLAN M-P8-61/037  
2. ISLAND B, C, D1, AND D2 PLAN M-P8-61/038  
3. ISLAND SECTIONS M-P8-61/039  
4. ISLAND DETAILS M-P8-61/040  
5. ISLAND SECTIONS AND DETAILS M-P8-61/041  
6. ISLAND A / REMNANT ISLAND INTERFACE M-P8-61/042



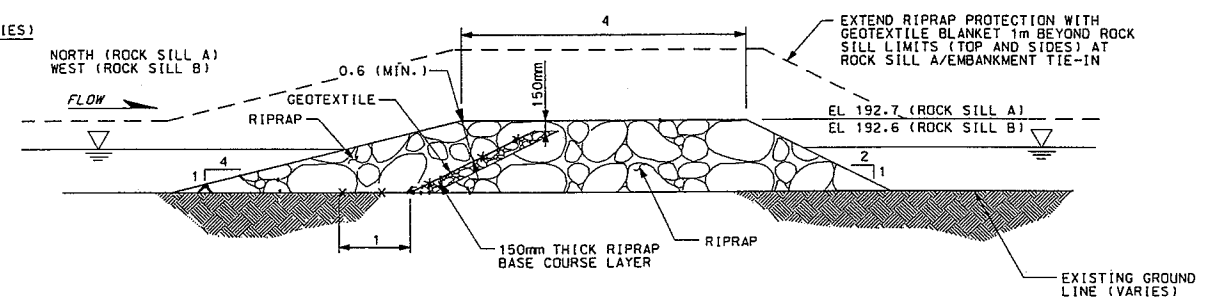
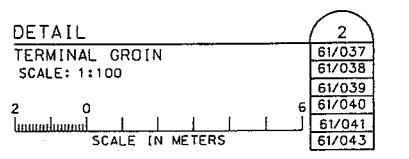
NOTE: 1. FOR GROIN LOCATIONS, SEE TABLE 1.



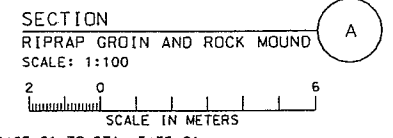
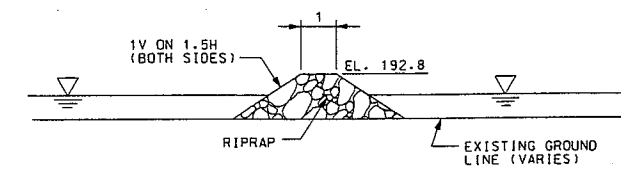
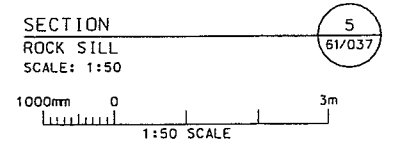
NOTE: 1. EXCAVATE AS NECESSARY TO MAINTAIN 1m (MIN) RIPRAP THICKNESS.



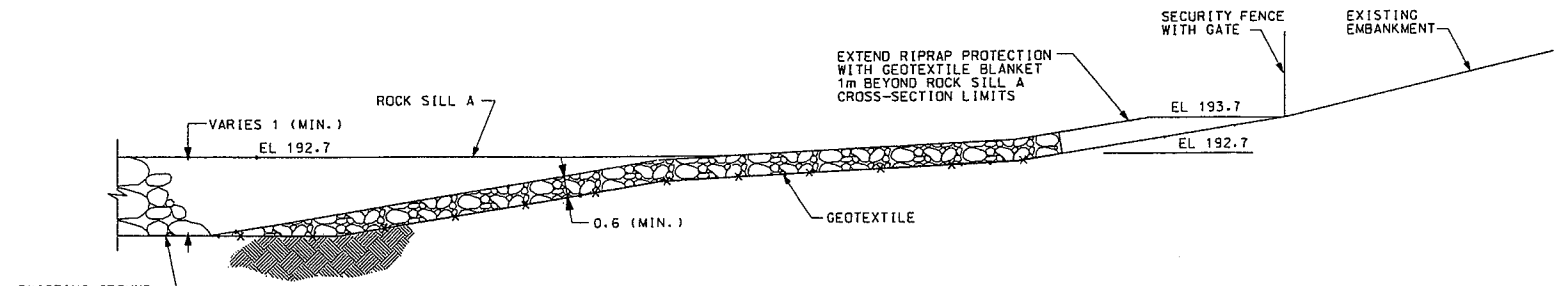
NOTES:  
1. FOR GROIN LOCATIONS, SEE TABLE 1.  
2. FOR ISLAND BERM LENGTH  $\alpha$  OR  $\theta$  SEE



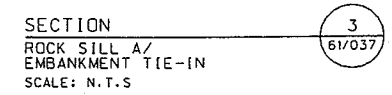
NOTE: 1. GEOTEXTILE TUBE MAY BE USED BETWEEN STATION 0+00 AND 0+86.  
2. IF GEOTEXTILE TUBE IS USED, PROVIDE 1m OVERLAP OF GEOTEXTILE WITH GEOTEXTILE TUBE.



ROCK MOUNDS  
ISLAND A STA. 4+65.01 TO STA. 5+55.01  
ISLAND B STA. 18+71.88 TO STA. 19+91.88



NOTE: 1. AT EXISTING EMBANKMENT, EXTEND 0.6 m RIPRAP PROTECTION WITH GEOTEXTILE BLANKET 40m SOUTH AND 10m NORTH OF CENTERLINE OF ROCK SILL A TO EL. 192.7.



| ISLAND   | STATION  | GROIN LOCATION | STATION  | GROIN LOCATION | ISLAND | STATION | GROIN LOCATION | STATION | GROIN LOCATION |         |    |
|----------|----------|----------------|----------|----------------|--------|---------|----------------|---------|----------------|---------|----|
| A        | 4+65.01  | W              | 4+65.01  | E              | D1     | 0+63.84 | D1             |         |                |         |    |
|          | 4+95.01  | W              |          |                |        | 1+23.84 | D1             |         |                |         |    |
|          | 5+55.01  | W              |          |                |        | 1+83.84 | D1             |         |                |         |    |
|          | 6+15.01  | W              |          |                |        | 2+43.84 | D1             |         | 2+43.84        | D1      |    |
|          | 6+75.01  | W              |          |                |        | 3+03.84 | D1             |         | 3+03.84        | D1      |    |
|          | 7+35.01  | W              |          |                |        | 3+63.84 | D1             |         | 3+63.84        | D1      |    |
|          | 7+95.01  | W              |          |                |        | 4+23.84 | D1             |         | 4+23.84        | D1      |    |
|          | 8+67.15  | W              |          |                |        | 4+83.84 | D1             |         | 4+83.84        | D1      |    |
|          | 9+39.28  | W              |          |                |        |         |                |         |                |         |    |
|          | 10+59.28 | W              |          |                |        | D2      | 0+15.00        | D2      |                | 0+15.00 | D2 |
| 11+19.28 | W        | 10+89.28       |          | 0+45.00        | D2     |         |                | 0+75.00 | D2             |         |    |
| 11+79.28 | W        |                |          | 1+05.00        | D2     |         |                | 1+35.00 | D2             |         |    |
| 12+39.28 | W        | 12+09.28       |          | 1+64.66        | D2     |         |                |         |                |         |    |
| B        | 17+21.88 | W              | 17+21.88 | E              | E1     | 0+00.00 | E1             |         | 0+00.00        | E1      |    |
|          | 17+51.88 | W              |          |                |        | 0+30.00 | E1             |         | 0+60.00        | E1      |    |
|          | 18+11.88 | W              |          |                |        | 1+00.00 | E1             |         |                |         |    |
|          | 18+71.88 | W              |          |                |        | 1+73.70 | E1             |         | 1+43.70        | E1      |    |
|          | 19+31.88 | W              |          |                |        | 2+03.70 | E1             |         | 2+03.70        | E1      |    |
|          | 19+91.88 | W              |          |                |        |         |                |         |                |         |    |
|          | 20+51.88 | W              |          |                |        | E2      | 0+00.00        | E2      |                | 0+00.00 | E2 |
|          | 21+11.88 | W              |          |                |        |         | 0+30.00        | E2      |                | 0+60.00 | E2 |
|          | 21+71.88 | W              |          |                |        |         | 0+90.00        | E2      |                |         |    |
|          | 22+31.00 | W              |          |                |        |         | 1+19.95        | E2      |                | 1+49.95 | E2 |
| C        | 22+21.44 | W              |          |                |        | 2+09.95 | E2             |         | 2+09.95        | E2      |    |
|          | 23+31.00 | W              | 23+01.00 |                |        |         |                |         |                |         |    |
|          | 23+91.00 | W              |          |                |        |         |                |         |                |         |    |
|          | 24+51.00 | W              | 24+21.00 |                |        |         |                |         |                |         |    |
|          | 25+11.00 | W              | 24+81.00 |                |        |         |                |         |                |         |    |
|          | 25+71.00 | W              | 25+41.00 |                |        |         |                |         |                |         |    |
|          | 26+31.00 | W              | 26+01.00 |                |        |         |                |         |                |         |    |
|          | 26+91.00 | W              | 26+61.00 |                |        |         |                |         |                |         |    |
|          | 27+51.00 | W              | 27+21.00 |                |        |         |                |         |                |         |    |
|          | 28+11.00 | W              | 27+81.00 |                |        |         |                |         |                |         |    |
| 28+41.00 | W        | 28+41.00       |          |                |        |         |                |         |                |         |    |

DESIGNED BY: PK-NIELSEN  
CHECKED BY: JC-JOHNSON  
DRAWN BY: KM-BURK

SCALE: AS SHOWN  
DATE: AUGUST 1997  
CADD FILE NAME: 6604011.DGN  
DATE: 08/27/97  
JOB NO: 61-039

DATE: 08/27/97  
BY: JCU  
DESCRIPTION: AS - BUILT AS OF NOVEMBER 1999

DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
CORPS OF ENGINEERS  
ST. PAUL, MINNESOTA

STANLEY CONSULTANTS  
CONSULTANTS IN CIVIL, MECHANICAL, ELECTRICAL, AND STRUCTURAL ENGINEERING

POOL & ISLAND PHASE II HABITAT REHABILITATION AND ENHANCEMENT PROJECT UPPER MISSISSIPPI RIVER

GROIN AND ROCK SILL SECTIONS AND DETAILS

DRAWING NUMBER:  
M-P8-61/042  
SHEET 11 OF 14

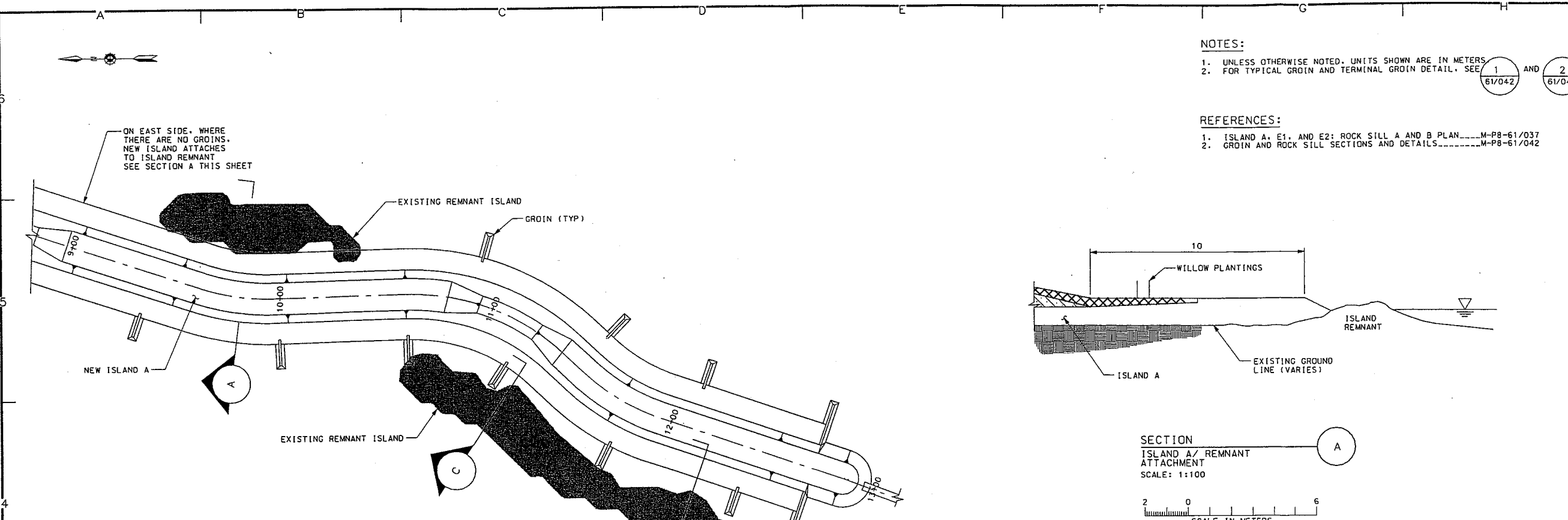


**NOTES:**

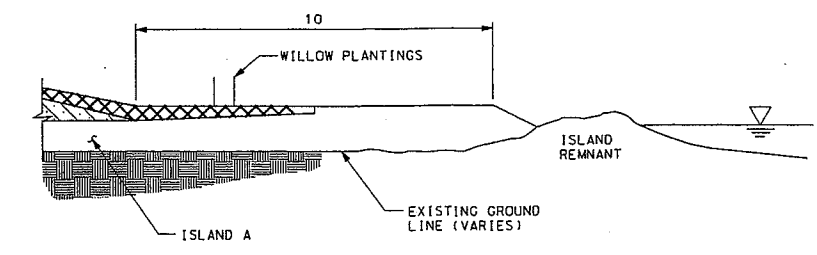
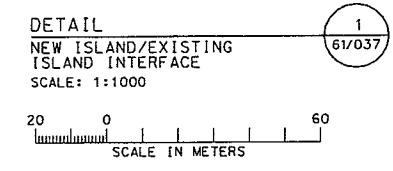
- UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.
- FOR TYPICAL GROIN AND TERMINAL GROIN DETAIL, SEE 1 AND 2 61/042 AND 61/042

**REFERENCES:**

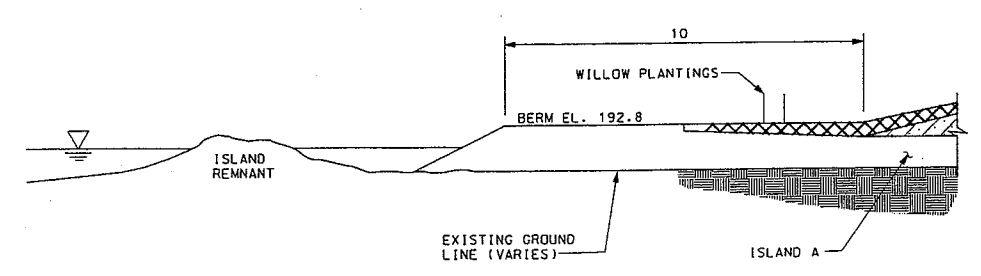
- ISLAND A, E1, AND E2: ROCK SILL A AND B PLAN.....M-P8-61/037
- GROIN AND ROCK SILL SECTIONS AND DETAILS.....M-P8-61/042



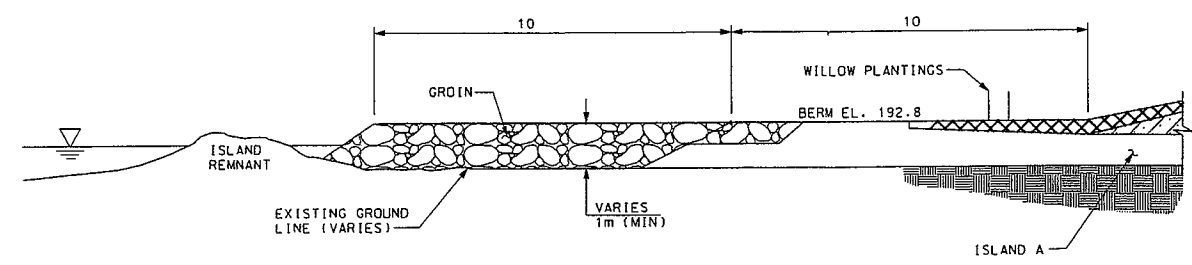
**NOTE:** 1. WHEN EXISTING REMNANT ISLAND INTERFERES WITH GROIN LAYOUT, FIELD ADJUST ALIGNMENT OF NEW ISLAND AWAY FROM EXISTING REMNANT ISLAND FAR ENOUGH SO THAT A FULL GROIN 1m (MIN.) HIGH CAN BE CONSTRUCTED IN THE WATER. SEE SECTION C.



**SECTION**  
ISLAND A/ REMNANT ATTACHMENT  
SCALE: 1:100



**SECTION**  
NEW ISLAND NEAR REMNANT ISLANDS  
SCALE: 1:100



**NOTE:** 1. ALIGN ISLAND TO CONSTRUCT FULL GROIN

**SECTION**  
GROIN AT REMNANT ISLANDS  
SCALE: 1:100

DESIGNED BY: J.C. JOHNSON  
CHECKED BY: J.C. JOHNSON  
DATE: AUGUST 1997  
SCALE: AS SHOWN  
CADD FILE NAME: M800A012.DGN  
SOL. NO: DACW37-97-B-0009  
AE APPROVING OFFICIAL: J.C.J.

DEPARTMENT OF THE ARMY  
ST. PAUL DISTRICT  
CORPS OF ENGINEERS  
ST. PAUL, MINNESOTA

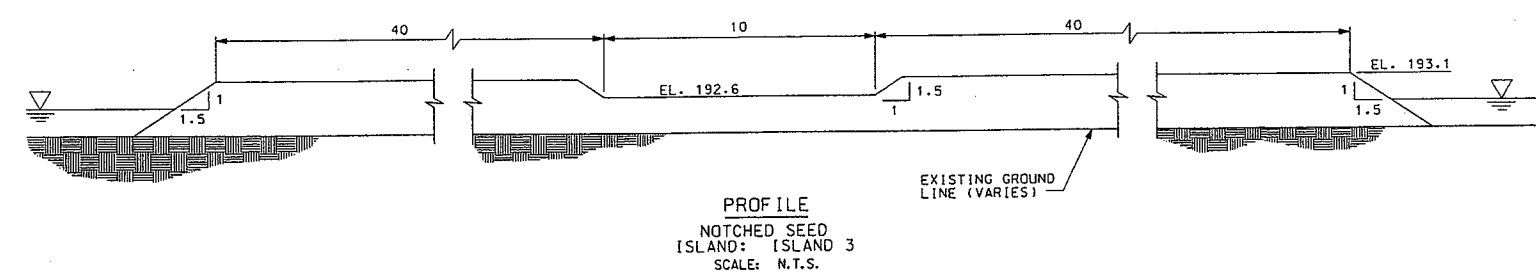
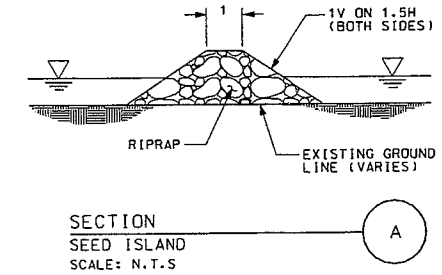
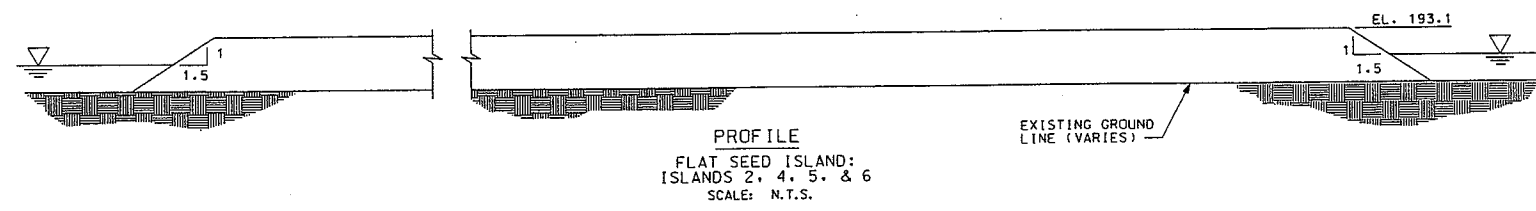
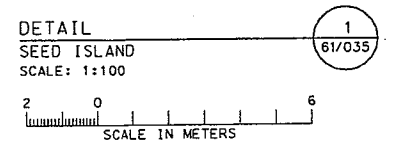
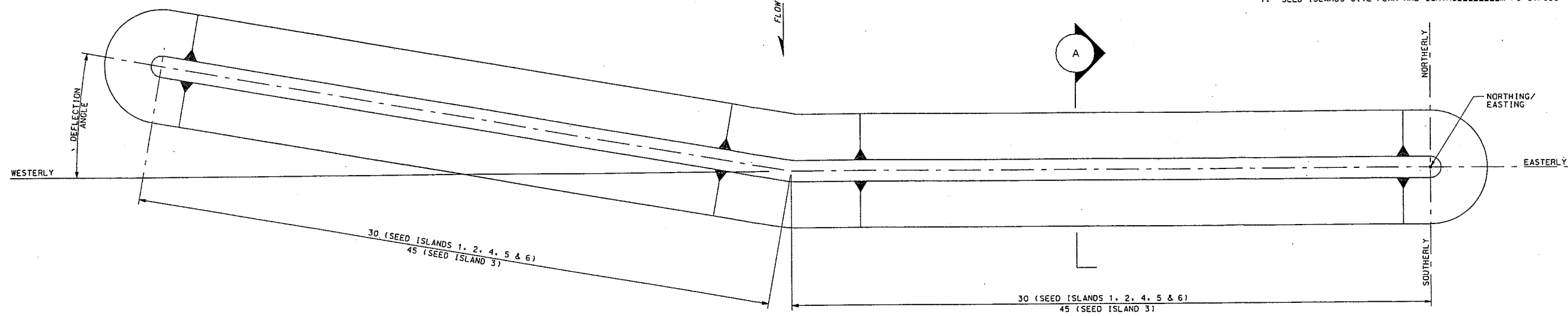
STANLEY CONSULTANTS  
INTERNATIONAL CONSULTANTS IN ENGINEERING, ARCHITECTURE, PLANNING, AND DESIGN

POOL 8 ISLAND PHASE II HABITAT REHABILITATION AND ENHANCEMENT PROJECT  
UPPER MISSISSIPPI RIVER  
ISLAND A / REMNANT ISLAND INTERFACE

DRAWING NUMBER:  
M-P8-61/043  
SHT 12 OF 14

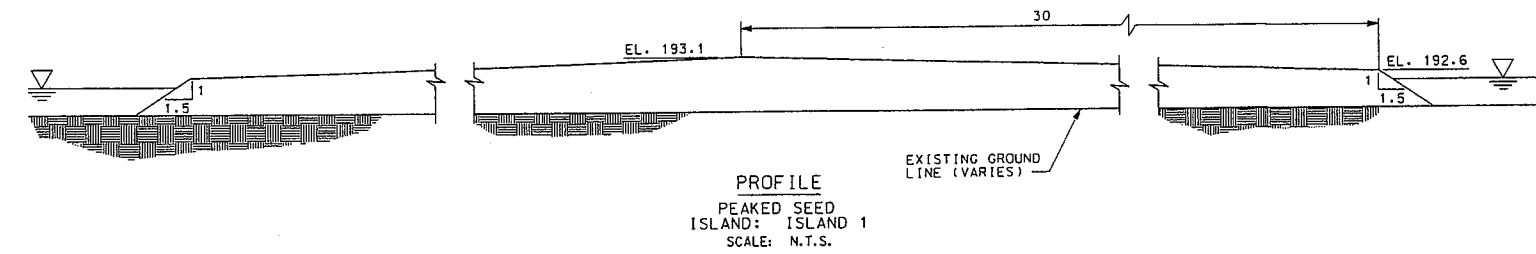
**NOTES:**  
1. UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN METERS.

**REFERENCES:**  
1. SEED ISLANDS SITE PLAN AND CONTROL M-P8-61/035



| SEED ISLAND CONTROL |            |                 |        |                          |                                      |
|---------------------|------------|-----------------|--------|--------------------------|--------------------------------------|
| SEED ISLAND         | CREST TYPE | MATERIAL        | LENGTH | NORTHING/EASTING         | AZIMUTH & DEFLECTION ANGLE (DEGREES) |
| 1                   | PEAK       | ROCK            | 60     | 175 519.9<br>1 022 195.1 | 282 (0)                              |
| 2                   | FLAT       | ROCK            | 60     | 175 470.5<br>1 022 321.3 | 280 (0)                              |
| 3                   | NOTCH      | ROCK            | 90     | 174 992.0<br>1 022 931.2 | 244 (20)                             |
| 4                   | FLAT       | ROCK OR GEOTUBE | 60     | 174 757.9<br>1 022 973.3 | 254 (20)                             |
| 5                   | FLAT       | ROCK            | 60     | 174 088.5<br>1 023 284.8 | 264 (10)                             |
| 6                   | FLAT       | ROCK            | 60     | 173 879.4<br>1 023 497.7 | 258 (10)                             |

NOTE: 1. COORDINATE SYSTEM IS STATE PLANE MINNESOTA SOUTH. THE COORDINATES REFERENCE THE EAST END ALONG THE CENTERLINE OF EACH SEED ISLAND.



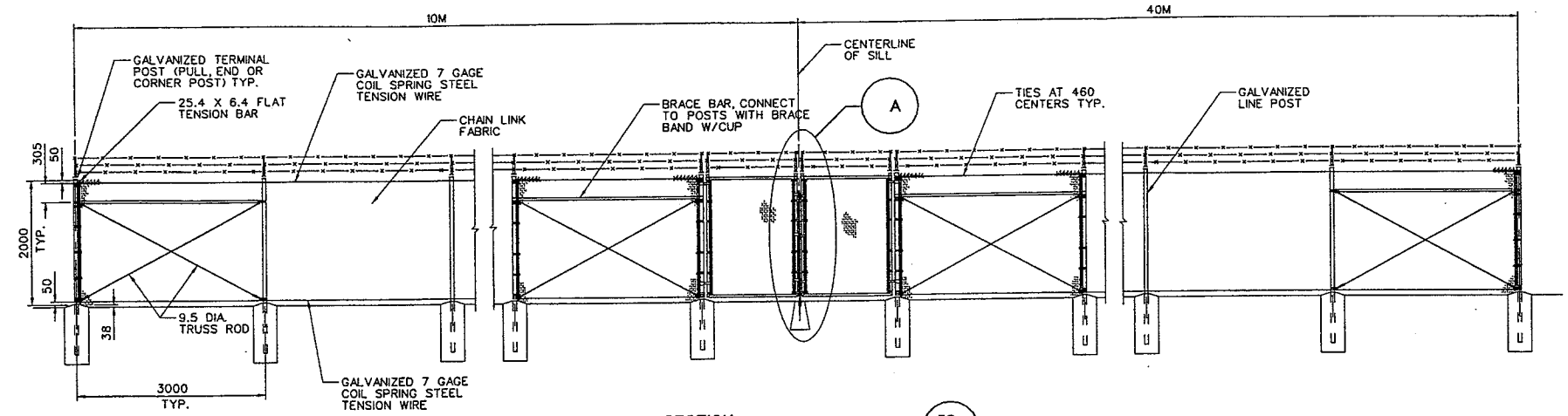
| Date     | Appr. |
|----------|-------|
| 11/19/99 | JCU   |

AS - BUILT AS OF NOVEMBER 1999  
Descr: P11011

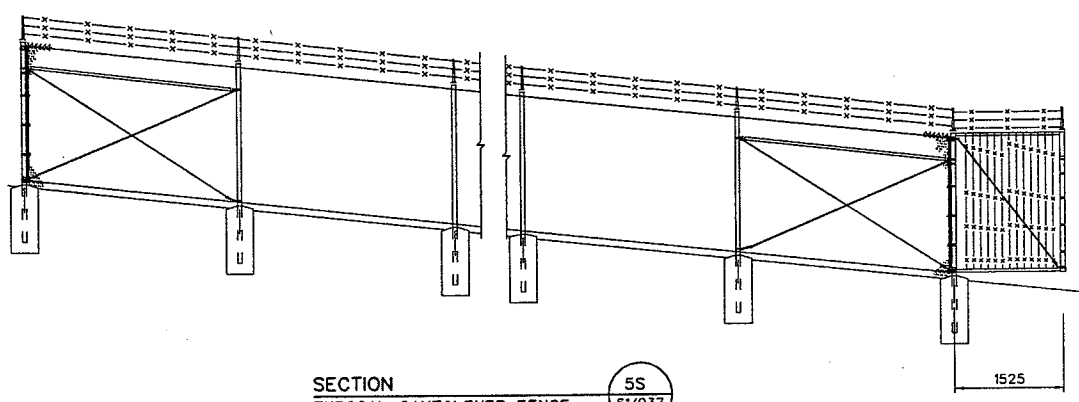
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|------------------------------|------------------------------|
| DESIGNER: PE NIELSEN         | DATE: AUGUST 1997            |
| CHECKED: JC JOHNSON          | SCALE: AS SHOWN              |
| DRAWN: KM BURK               | CAAD FILE NAME: 08060403.DGN |
| PROJECT: STANLEY CONSULTANTS | PROJECT NO: 97-8-009         |
| APPROVED: JCU                | DATE: NOVEMBER 1999          |

POOL B ISLAND PHASE II HABITAT REHABILITATION AND ENHANCEMENT PROJECT UPPER MISSISSIPPI RIVER  
SEED ISLANDS SECTIONS AND DETAILS

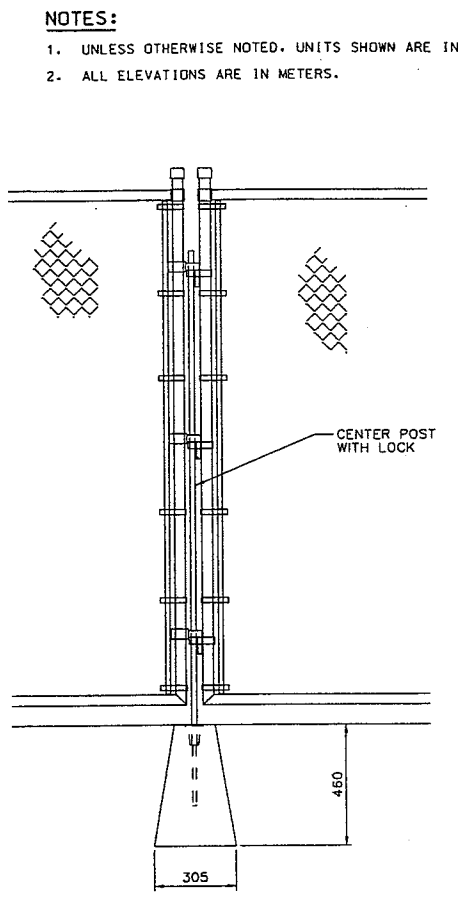
DRAWING NUMBER:  
M-P8-61/044



SECTION 3S  
TYPICAL FENCE  
SCALE: 1:50

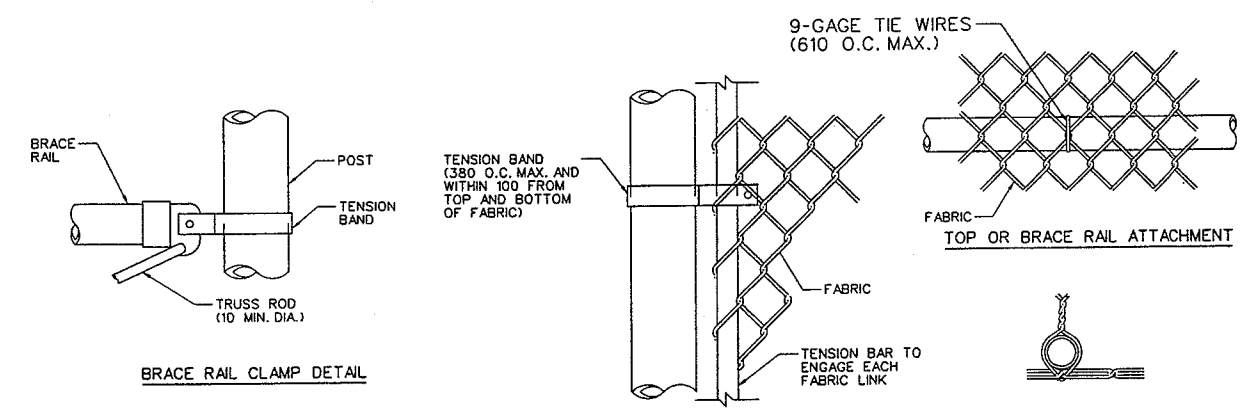


SECTION 5S  
TYPICAL CANTILEVER FENCE  
SCALE: 1:50

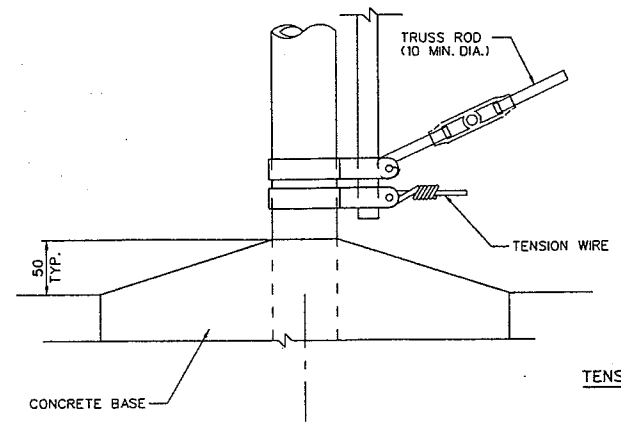


DETAIL A  
GATE CENTERPOST  
SCALE: NONE

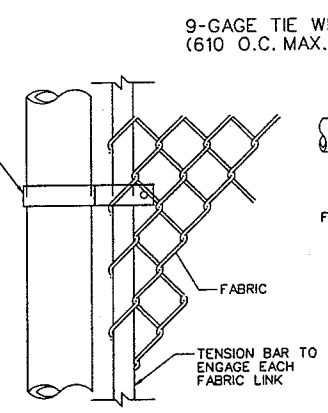
NOTES:  
1. WELD BRACE BARS TO POSTS ON CANTILEVER SECTION.



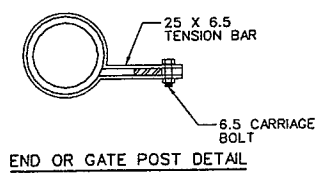
BRACE RAIL CLAMP DETAIL



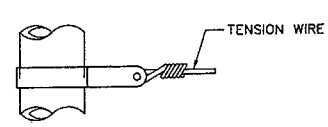
TRUSS ROD AND BAND



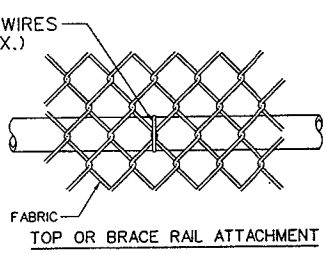
TENSION BAND DETAIL



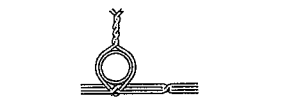
END OR GATE POST DETAIL



DETAILS  
TYPICAL FENCE FASTENING  
SCALE: NONE

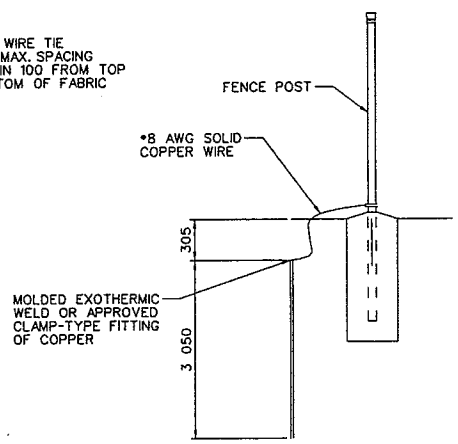


9-GAGE TIE WIRES  
(610 O.C. MAX.)  
TOP OR BRACE RAIL ATTACHMENT

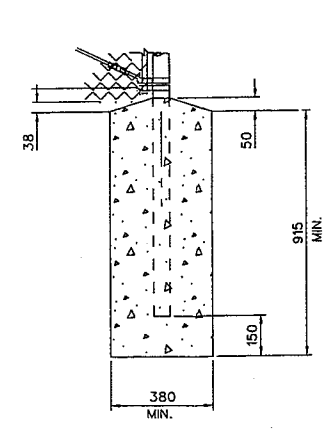


LINE POST ATTACHMENTS

| USE AND SECTION           | MINIMUM OUTSIDE DIMENSIONS (NOMINAL) |                     |                  |
|---------------------------|--------------------------------------|---------------------|------------------|
|                           | FABRIC LESS THAN 1830                | FABRIC 1830 TO 2440 | FABRIC OVER 2440 |
| CORNER, END & PULL POSTS  |                                      |                     |                  |
| TUBULAR - ROUND           | 73.0 mm O.D.                         | 86.9 mm O.D.        | 114.0 mm O.D.    |
| LINE POSTS                |                                      |                     |                  |
| TUBULAR - ROUND           | 48.3 mm O.D.                         | 73.0 mm O.D.        | 88.9 mm O.D.     |
| TOP, BOTTOM & BRACE RAILS |                                      |                     |                  |
| TUBULAR - ROUND           | 48.3 mm O.D.                         |                     |                  |



DETAIL GROUNDING  
SCALE: NONE



DETAIL TYP. POST EMBEDMENT  
SCALE: NONE

NOTES:  
1. UNLESS OTHERWISE NOTED, UNITS SHOWN ARE IN MILLIMETERS.  
2. ALL ELEVATIONS ARE IN METERS.

US Army Corps of Engineers  
St. Paul District

01-22-99

NEW DRAWING ISSUED WITH REVISION NO. R14

AS - BUILT AS OF NOVEMBER 1999.

DESIGNED: J.C.J.  
CHECKED: J.C.J.  
DATE: AUGUST 1998  
SCALE: AS SHOWN  
AS SHOWN  
CADD FILE NAME: SP461045.DGN  
DRAWN: HPA  
SOL. NO: DACW37-97-B-0009  
DESIGNED: J.C.J.  
CHECKED: J.C.J.  
OFFICIAL: J.C.J.

DEPARTMENT OF THE ARMY  
ST. PAUL, MINNESOTA  
CORPS OF ENGINEERS  
ST. PAUL DISTRICT

POOL 8 ISLAND PHASE II  
MISCELLANEOUS METALS  
SECTIONS AND DETAILS  
CHAIN LINK FENCE

DRAWING NUMBER:  
M-C8-61/  
045

SHT 14 OF 14

**APPENDIX B**

**MEMORANDUM OF AGREEMENT**

MEMORANDUM OF AGREEMENT  
BETWEEN  
THE UNITED STATES FISH AND WILDLIFE SERVICE  
AND  
THE DEPARTMENT OF THE ARMY  
FOR  
ENHANCING FISH AND WILDLIFE RESOURCES  
OF THE  
UPPER MISSISSIPPI RIVER SYSTEM  
POOL 8 ISLANDS PHASE II  
VERNON COUNTY, WISCONSIN

I. PURPOSE

The purpose of this memorandum of agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (USFWS) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Pool 8 Islands Phase II separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. The project area is managed by the USFWS and is on land managed as a national wildlife refuge. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features for the Pool 8 Islands Phase II project are 100 percent Federal, and pursuant to Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, all costs of operation and maintenance for the Pool 8 Islands Phase II project are 100 percent Federal.

### III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of rehabilitating and improving the fish and wildlife habitat in lower pool 8 of the Mississippi River. The project consists of constructing seven islands and two rock sills in the Stoddard Bay area of lower pool 8. The project area encompasses approximately 500 acres. The purpose of these structures is to improve fish and wildlife habitat by reducing flows in the area, improving conditions for growth of aquatic plants, and increasing overall habitat diversity by restoring islands lost to erosion.

In addition, six "seed islands" constructed of rock would be placed on the right descending side of the navigation channel below Heron and Trapping Islands. The purpose of the seed islands is to allow natural river processes to re-create islands in an area where there has been extensive loss of islands due to erosion.

### IV. RESPONSIBILITIES

#### A. The DOA is responsible for:

1. Construction. Construction of the project which consists of seven islands (Islands A, B, C, D1, D2, E1, and E2) and two rock sills (A and B) in the Stoddard Bay area of lower pool 8. An estimated 11,125 linear feet of islands would be constructed using sand (150,000 cubic yards (c.y.)) and fine sediments (70,000 c.y.) dredged from Crosby Slough and from within Stoddard Bay. About 5,800 c.y. of rock would be placed on the islands for stabilization. The islands would be seeded and planted with willows and trees for stabilization and habitat purposes. The two rock sills would be 1,500 and 1,300 feet in length, respectively, constructed entirely of rock (11,240 c.y. total). Six seed islands about 200 feet long would also be constructed, each requiring about 730 c.y. of rock.

2. Major Rehabilitation. The Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. Construction Management. Subject to and using funds appropriated by the Congress of the United States, and in accordance with Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, the DOA will construct the Pool 8 Islands Phase II project as described in the Definite Project Report/Environmental Assessment, Pool 8 Islands Phase II Habitat Rehabilitation and Enhancement Project, dated May 1996, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If the DOA encounters potential delays related to construction of the project, the DOA will promptly notify the USFWS of such delays.

4. Maintenance of Records. The DOA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. The DOA shall maintain such books, records, documents, and other evidence for a minimum of 3 years after completion of construction of the project and resolution of all relevant claims arising therefrom, and shall make available at its offices, at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the USFWS.

B. The USFWS is responsible for operation, maintenance, and repair: Upon completion of construction as determined by the District Engineer, St. Paul, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in

the Definite Project Report/Environmental Assessment entitled "Pool 8 Islands Phase II Habitat Rehabilitation and Enhancement Project," dated May 1996, in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580.

V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of project construction.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties.

USFWS: Regional Director  
U.S. Fish and Wildlife Service  
Bishop Henry Whipple Federal Building  
1 Federal Drive  
Fort Snelling, Minnesota 55111-4056

DOA: District Engineer  
U.S. Army Corps of Engineers, St. Paul District  
Army Corps of Engineers Centre  
190 Fifth Street East  
St. Paul, Minnesota 55101-1638

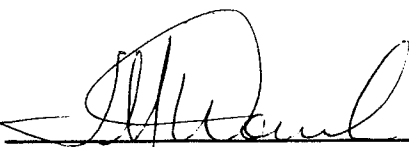


VII. EFFECTIVE DATE OF MOA

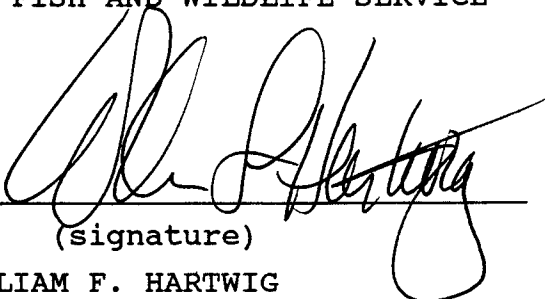
This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

THE U.S. FISH AND WILDLIFE SERVICE

BY:   
\_\_\_\_\_  
(signature)

J. M. WONSIK  
Colonel, Corps of Engineers  
St. Paul District

BY:   
\_\_\_\_\_  
(signature)

WILLIAM F. HARTWIG  
Regional Director  
U.S. Fish and Wildlife Service

DATE: 19 Dec 96

DATE: 1/3/97

**APPENDIX C**

**REPLACEMENT SPECIFICATIONS**

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| Section 02272 | Geotextile       |
| Section 02935 | Turf             |
| Section 02950 | Plantings        |

SECTION 02270  
STONE PROTECTION

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SECTION 02270  
STONE PROTECTION

PART 1 GENERAL

1.1 SCOPE

The work covered by this section includes construction of: groins, slope protection at ends of the islands, rock sills, and seed islands as indicated on the drawings; and, if determined necessary by the Contracting Officer, other locations as directed in the field by the Contracting Officer.

1.2 RELATED WORK OF OTHER SECTIONS

The following items of related work are covered under other sections:

- a. Island construction: SECTION: EMBANKMENT.
- b. Geotextile placement: SECTION: GEOTEXTILE.
- c. Geotextile tube option at Rock Sill A and Seed Island 4:  
SECTION: GEOTEXTILE TUBE.

1.3 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

STATE OF WISCONSIN DEPARTMENT OF TRANSPORTATION (WI/DOT)  
(1996) STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION

SECTION 501 Concrete Masonry

1.4 SUBMITTALS

The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES:

- a. Certified copy of test results for riprap base course as specified in PARAGRAPH: QUALITY CONTROL.
- b. Scale test reports as specified in PARAGRAPH: DELIVERY, STORAGE, AND HANDLING.
- c. On-site haul routes and site restoration plans of Brownsville site as specified in PARAGRAPH: DELIVERY, STORAGE, AND HANDLING.
- d. Material sources as specified in PARAGRAPH: SOURCES AND EVALUATION.
- e. Samples of material specified in PARAGRAPH: TESTS FOR ACCEPTABILITY.
- f. Testing procedures results as specified in PARAGRAPH: TESTS FOR GRADATION AND SHAPE.

## 1.5 MEASUREMENT AND PAYMENT

### 1.5.1 General

All riprap permitted by the Contracting Officer to remain outside of the tolerances specified will not be paid for. Volume of excess riprap will be computed using the average-end-area of excess above the tolerance line. The excess volume will be deducted from the payment quantity at a rate of 1.90 t/m<sup>3</sup>, regardless of actual weight per cubic meter.

1.5.2 Riprap used for construction of groins and slope protection at island ends shall be weighed on accurate, approved scales furnished or made available by the Contractor as specified in PARAGRAPH: DELIVERY, STORAGE, AND HANDLING. Payment shall be by the metric ton (1000 kg) of material acceptably placed within the tolerances specified, and shall constitute full compensation for all work specified in this section, including surveys, foundation preparation, riprap delivery and placement as shown and specified.

1.5.3 Riprap and riprap base course used for construction of Rock Sill A between Station 0+86 and 4+36.8 and Rock Sill B shall be weighed on accurate, approved scales furnished or made available by the Contractor as specified in PARAGRAPH: DELIVERY, STORAGE, AND HANDLING. Payment shall be by the metric ton of material acceptably placed within the tolerances specified, and shall constitute full compensation for all work specified in this section, including surveys, foundation preparation, stone delivery and placement as shown and specified.

1.5.4 Riprap used for construction of Seed Islands 1,2,3,5, and 6 shall be weighed on accurate, approved scales furnished or made available by the Contractor as specified in PARAGRAPH: DELIVERY, STORAGE, AND HANDLING. Payment shall be by the metric ton of material acceptably placed within the tolerances specified, and shall constitute full compensation for all work specified in this section, including surveys, foundation preparation, riprap delivery and placement as shown and specified.

1.5.5 The work for construction of Rock Sill A between Station 0+00 and 0+86 will not be measured for payment and shall be performed on a job basis, complete. The Contractor has the option of substituting geotextile tubes (see SECTION: GEOTEXTILE TUBE) for the rock sill (riprap, riprap base course, and geotextile) at this location. Payment will constitute full compensation for all work to complete construction of the rock sill, including surveys, foundation preparation, geotextile, riprap base course, riprap or geotextile tube delivery and placement as shown and specified.

1.5.6 The work for construction of Seed Island 4 will not be measured for payment and shall be performed on a job basis, complete. The Contractor has the option of substituting geotextile tubes (see SECTION: GEOTEXTILE TUBE) for rock fill at this location. Payment will constitute full compensation for all work to complete construction of the rock sill and seed island, including surveys, foundation preparation, geotextile, riprap or geotextile tube delivery and placement as shown and specified.

### 1.6 BIDDING SCHEDULE ITEMS

Bidding schedule items applicable to the work of this section are as follows:

| <u>Item</u>   | <u>Unit</u> |
|---|-------------|
| Groins/Slope Protection                                     | t           |
| Rock Sill A between Sta. 0+86 and 4+36.8<br>and Rock Sill B | t           |

|  |    |
|--|----|
| Seed Islands 1, 2, 3, 5, 6             | t  |
| Rock Sill A between Sta. 0+00 and 0+86 | JB |
| Seed Island 4                          | JB |

#### 1.7 QUALITY CONTROL

The Contactor shall furnish the Contracting Officer certified test results which show that the riprap base course material meets the requirements of PARAGRAPH: MATERIALS.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

1.8.1 Material provided in this section shall be weighed on accurate, approved scales furnished or made available by the Contractor. Before being approved for use, the scales shall be tested by the Department of Weights and Measures or by a reliable scale servicing company so as to operate within a degree of error not greater than one percent and be sensitive to a change in load of 1/5 of one percent, both percentages being used on the total required weight of material normally weighed as a unit on the scale. The Contractor shall submit the scale test report to the Contracting Officer. Scales shall be spot checked for accuracy and sensitivity at least once each week as the work progresses. When materials are weighed in hauling vehicles, gross weights shall be checked and the vehicle tare weight checked daily as a minimum. The Contractor shall furnish such weights, accessories, and assistance as the Contracting Officer may require for making weighing equipment tests.

1.8.2 Weighing operations shall be performed offsite, as approved, in the presence of a representative of the Contracting Officer. The Contracting Officer reserves the right to waive his/her presence during weighing operations. Each load shall be accompanied by duplicate copies of delivery tickets certified by the weighmaster. As a minimum, each ticket shall contain the following information:

- (1) Date and time.
- (2) Vehicle number.
- (3) Gross weight.
- (4) Vehicle tare weight.
- (5) Net weight.
- (6) Material weight.
- (7) Signature of weighmaster.

Delivery tickets shall be collected by the Contractor and one copy thereof furnished to the Contracting Officer at the close of each day's operation.

#### 1.8.3 Loading Sites

The Contractor may use either the existing Lock and Dam 8 loading dock and/or the existing Brownsville dredged material placement site (river mile 688.75 right bank) as rock loading sites. If the Contractor uses either site, the following conditions shall be met:

a. Use of either site shall not interfere with Corps of Engineers activities, either scheduled or unscheduled.

b. Only direct loading of barges will be permitted. No stockpiling of rock at either site will be permitted.

c. Use of the Brownsville site will require the Contractor to submit a plan of use for Contracting Officer approval showing as a minimum the on-site haul routes and site restoration plans.

d. The Brownsville site has been identified in a State of Minnesota Department of Transportation (MnDOT) project as a borrow source for fill material. The MnDOT project is scheduled to begin in 1997 and continue into 1998. The Contractor shall not interfere with any construction activities of any MnDOT contractor.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 General

Riprap shall be a durable quarried stone of suitable quality to ensure permanence in the Upper Mississippi River environment. Stone shall be free from cracks, seams and other defects that would unduly increase its deterioration from natural causes.

#### 2.1.2 Specific gravity

Stone shall have a specific gravity of not less than 2.55 and not more than 2.75.

#### 2.1.3 Shape

Neither the breadth nor thickness of any individual stone shall be less than one-third its length.

#### 2.1.4 Gradation

##### 2.1.4.1 Riprap

Riprap shall be reasonably well graded within the limits shown on the riprap gradation curve (ENG FORM 4055) located at the end of this section. The stone shall be reasonably well graded within these specified limits to permit construction of relatively dense and impervious riprap blankets. Inclusion of objectionable quantities of dirt, sand, clay, rock fines or other deleterious materials will not be allowed.

##### 2.1.4.2 Riprap Base Course

Riprap base course shall be composed of tough durable stone meeting the requirements of WI/DOT 501.3.6.4.5 for coarse aggregate, size number 2, with not more than 1 percent passing the number 10 sieve, and shall not contain any objectionable quantities of dirt, sand, or rock fines.

#### 2.1.5 Processing

Included in the Contractor's Plan of Operations submittal, as specified in SECTION: GENERAL, the Contractor shall indicate a method of processing riprap at the quarry that will preclude the inclusion of objectionable amounts of fine material or organic matter. All riprap shall be processed in accordance with the method approved.

### 2.2 SOURCES AND EVALUATION

Stone materials shall be produced from the sources listed in SECTION: ATTACHMENTS TO CONTRACT CLAUSES. If the Contractor proposes to furnish materials from a source not listed, the Contracting Officer will make such investigations and evaluations as necessary to determine whether or not materials meeting the requirements of this project can be produced from the proposed source. The Contractor shall be responsible for making its own investigations for sources of suitable materials and for making its own arrangements with the owners of the quarries or land for procuring the required quantities of suitable materials.



Sources from which the Contractor proposes to obtain the materials shall be selected and submitted for approval at least 60 days in advance of the time when the material will be required in the work.

### 2.3 TESTS FOR ACCEPTABILITY

2.3.1 Quality tests and service records will be used to determine the acceptability of stone materials. In the event suitable test reports and satisfactory service records are not available, as in the case of newly operated sources, the materials will be tested to determine acceptability. Tests to which the materials may be subjected include petrographic analysis, specific gravity, soundness, abrasion, absorption, freezing and thawing, and other tests considered necessary to demonstrate acceptability. Tests will be made by, or under the supervision of, the Government and at the Government's expense.

#### 2.3.2 Samples

If directed, suitable samples of materials shall be submitted for approval prior to delivery of materials to the work site. Unless otherwise directed, samples shall be obtained by the Contractor, in the presence of the Contracting Officer, and delivered at the Contractor's expense to a point designated by the Contracting Officer, at least 30 days in advance of the date that the stone protection is expected to begin. The materials must be approved by the Contracting Officer before commencing placement.

### 2.4 TESTS FOR GRADATION AND SHAPE

2.4.1 Riprap gradation tests shall be performed by and at the expense of the Contractor. Testing shall be under the direction of the Contracting Officer, unless waived. Gradation test results shall be submitted on ENG Form 4055 and on the Gradation Analysis Work sheet provided at the end of this section. One sample for each type of material shall be taken from stockpiled materials and the remaining samples shall be taken from loads prior to dumping or from in-place material, when and where directed. Prior to placing materials, the Contractor shall submit for approval proposed testing and procedures. The Contractor shall state, in writing, methods of processing and handling samples and shall notify the Contracting Officer immediately when production methods are changed. A minimum of 5 weight classes shall be used in the gradation testing. The Contractor shall select weight classes to yield approximately 75, 50 and 30 percent finer by weight gradation points. The Contractor shall weigh that portion smaller than 100 mm in each sample of riprap and indicate that weight in the total weight of the gradation test sample. Determination of the gradation of riprap material smaller than 100 mm is not required.

2.4.2 Testing results shall be submitted to the Contracting Officer immediately after testing completion. The minimum sample size for tests shall be as follows:

| <u>Material</u> | <u>Minimum Sample Size</u> |
|-----------------|----------------------------|
| Riprap          | 5.5 t                      |

#### 2.4.3 Frequency

The minimum gradation tests shall be performed as follows. The Contractor shall take as many additional tests under the Contractor's quality control program as is needed to ensure that the gradation is being met. Tests performed on materials that do not meet requirements will not be counted as part of the minimum required.

Material

Minimum Number of Tests

Riprap

1 test prior to placement, and  
1 test per 1,800 t or fraction thereof.

2.4.4 Corrective Action

If materials fail to meet gradation or shape requirements, the Contractor shall adjust his operations and verify with necessary tests that acceptable materials are being produced, or he shall propose another source and verify, with necessary tests, that acceptable material can be produced from that source. Payment will not be made for material which fails to meet requirements. Material already in place that fails to meet requirements will be removed by the Contractor at no additional cost to the Government.

PART 3 EXECUTION

3.1 FOUNDATION PREPARATION

Foundation areas shall be cleared of woody vegetation materials that could prevent proper placement of riprap. Removal of driftwood, snags, wood debris and brush within the limits of riprap protection construction shall be considered part of the riprap protection construction process and shall be disposed of in accordance with SECTION: GENERAL. Plant root systems may be left in place and intact. Plant trunks and stems that construction work can be built around and remain standing vertically through the completed groins may be left in place in order to assist in the natural revegetation of the site.

3.2 PLACEMENT

3.2.1 Riprap Base Course

Riprap base course shall be constructed at rock sills to the lines and grades shown on the drawings. Base course shall fill voids between riprap aggregates to produce a flat surface for geotextile placement.

3.2.2 Riprap shall be constructed to the lines and grades shown. All riprap shall be placed in such a manner as to produce a mass of unsegregated stone with maximum interlocking and stone to stone contact and a minimum of voids. The finished mass shall be free from pockets of small stones, clusters or larger stones and excessive voids. Placing riprap by dumping into chutes or by similar methods likely to cause segregation shall not be permitted. The Contractor shall maintain the riprap protection until accepted, and displaced material must be replaced by the Contractor at no additional cost to the Government.

3.2.3 Upon completion of placing granular material at island locations as specified in SECTION: EMBANKMENT, the Contractor shall immediately place the groin(s) for that reach of the island section and /or the stone slope protection at ends of the islands.

3.2.4 Riprap used for slope protection at each island end shall be placed to the full surface course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing riprap used for slope protection in layers shall not be permitted.

3.2.5 Riprap to be placed under water shall meet gradation requirements in the bucket or container used for placing, and be placed in a systematic manner so as to ensure a continuous uniform layer of well-graded stone of the required thickness. Stone to be placed under water shall not be cast across the surface of the water.

### 3.2.6 Placement of Riprap on Geotextile

3.2.6.1 Geotextile shall be in place prior to placement of the riprap thereon. Placement of the geotextile is specified in SECTION: GEOTEXTILE. The riprap shall be placed on the geotextile with care so as not to rupture the geotextile and shall not be dropped from a height greater than 0.3 m.

3.2.6.2 Riprap placement shall generally be initiated at the toe of the slope and progress up the slope towards the crest. The riprap shall not be allowed to roll down the geotextile. Riprap in direct contact with the geotextile shall not be pushed, or moved by mechanical equipment. Any damage to the geotextile that occurs during placement of the riprap shall be repaired, or replaced, by the Contractor at no additional cost to the Government.

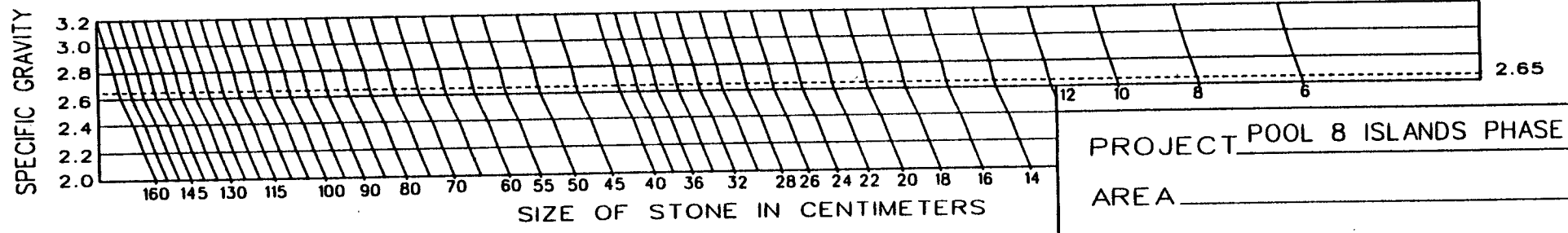
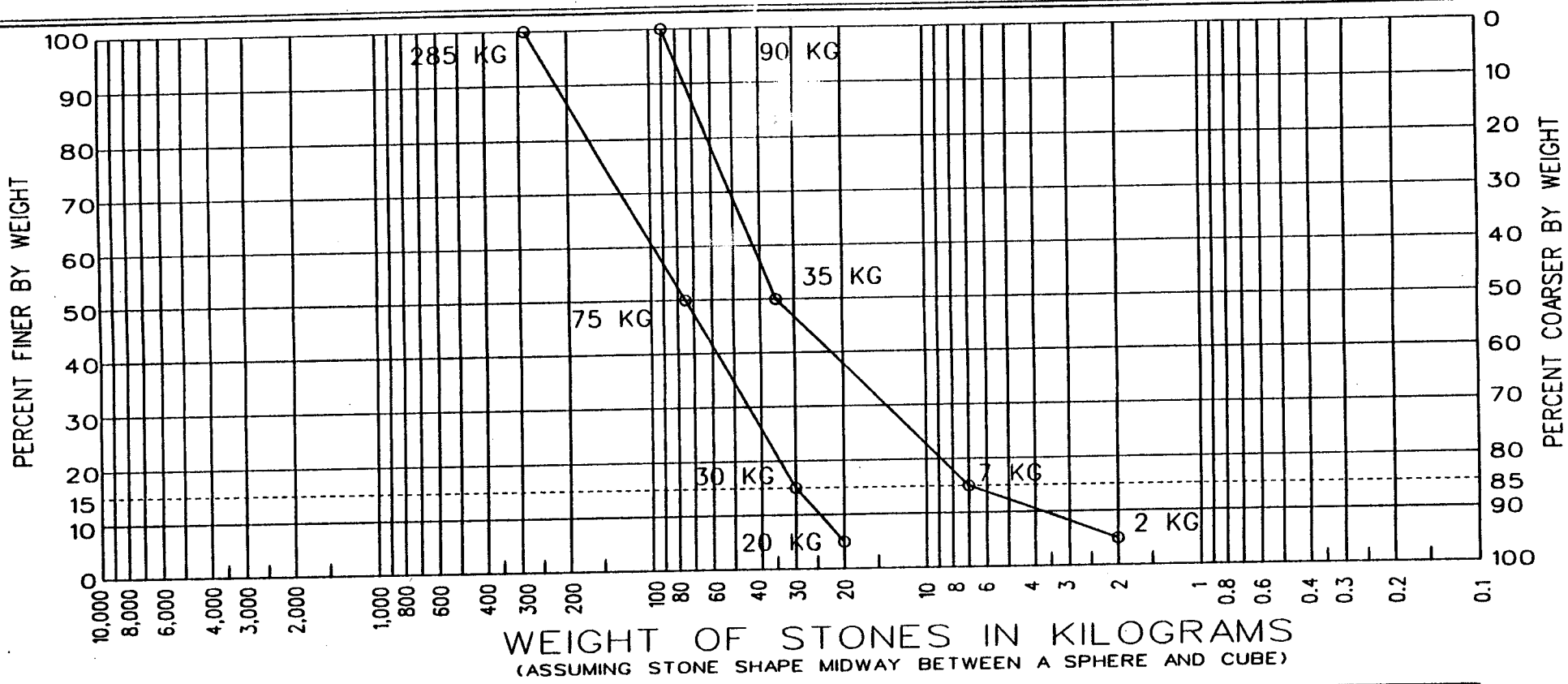
### 3.3 TOLERANCES

Unless shown or indicated otherwise rock sill and groin construction shall conform to the following tolerances:

- a. 150 mm above the prescribed grade
- b. 75 mm below the prescribed grade

Except either extreme shall not be continuous over an area greater than 18.5 m<sup>2</sup>.

--End of Section--



PROJECT POOL 8 ISLANDS PHASE II  
 AREA \_\_\_\_\_  
 DATE \_\_\_\_\_

**RIPRAP GRADATION CURVES**

SECTION 02272

GEOTEXTILE

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| 1.3              | APPLICABLE PUBLICATIONS         | 02272-1         |
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SECTION 02272

GEOTEXTILE

PART 1 GENERAL

1.1 SCOPE

This section covers geotextile fabric to be used at Rock Sills A and B to reduce seepage through the sills and as a filter material underneath the riprap slope protection at each island end.

1.2 RELATED WORK OF OTHER SECTIONS

The following items of related work are covered under other sections:

- a. Placement of Riprap on Geotextile: SECTION: STONE PROTECTION.

1.3 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM):

|             |   |
|-------------|---|
| ASTM D 123  | (1993a) Terminology Relating to Textile/Materials   |
| ASTM D 3786 | (1987) Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics -Diaphragm Bursting Strength Tester Method |
| ASTM D 4355 | (1992) Deterioration of Geotextile from Exposure to Ultraviolet light and Water (Xenon-Arc Type Apparatus)          |
| ASTM D 4491 | (1992) Water Permeability of Geotextile By Permittivity   |
| ASTM D 4533 | (1991) Trapezoid Tearing Strength of Geotextiles  |
| ASTM D 4632 | (1991) Breaking Load and Elongation of Geotextiles (Grab Method)  |
| ASTM D 4751 | (1993) Apparent Opening Size of a Geotextile  |
| ASTM D 4833 | (1988) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products                                 |
| ASTM D 4873 | (1988) Guide for Identification, Storage, and Handling of Geotextiles   |

1.4 SUBMITTALS

The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES:

- a. Certificate of compliance as specified in PARAGRAPH: QUALITY CONTROL.
- b. If requested, provide geotextile samples for testing as specified in PARAGRAPH: QUALITY CONTROL.

## 1.5 MEASUREMENT AND PAYMENT

1.5.1 Geotextile used at Rock Sill A between Station 0+86 and 4+36.8, Rock Sill B, and underneath slope protection at each island end shall be measured in place to the nearest square meter of protected area as delineated in the drawings. Payment shall be made at the contract unit price and shall constitute full compensation to the Contractor for providing all plant, labor, material, and equipment and performing all operations necessary for the complete and satisfactory installation of the geotextile. The following items are included the contract unit price for "Geotextile" and shall not be counted a second time in the process of determining the extent of geotextile placed: Material and associated equipment and operation used in laps, seams, or extra length; securing pins and associated material, equipment, and operations; and operations used to provide cushioning layer of sand or gravel or both to permit increase in allowable drop height of stone. No payment will be made for geotextiles replaced because of waste, contamination, damage, repair, or due to contractor fault or negligence.

1.5.2 Geotextile used at Rock Sill A between Station 0+00 and 0+86 will not be measured for separate payment and costs therefore shall be included in the contract items to which the work pertains.

## 1.6 BIDDING SCHEDULE ITEMS

Bidding schedule items applicable to the work of this section are as follows:

| <u>Item</u> | <u>Unit</u>    |
|-------------|----------------|
| Geotextile  | m <sup>2</sup> |

## 1.7 QUALITY CONTROL

1.7.1 The Contractor shall furnish the Contracting Officer, in duplicate, a mill certificate or affidavit signed by a legally authorized official from the manufacturer. The certificate or affidavit shall state that the geotextile shipped to the site meets the chemical requirements and exceeds the minimum average roll value listed in TABLE 1, MINIMUM PHYSICAL REQUIREMENTS FOR GEOTEXTILE. The certificate shall contain the signer's title, the name and address of the Contractor, the contract number, and the project name and location.

1.7.2 If requested by the Contracting Officer, the Contractor shall provide to the Government geotextile samples for testing to determine compliance with any or all of the requirements in this specification. When samples are to be provided, they shall be submitted a minimum of 60 days prior to the beginning of installation of the same geotextile. All samples provided shall be from the same production lot as will be supplied for the contract, and shall be the full manufactured width of the geotextile by at least 3 m long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 1.5 m. Samples submitted for testing shall be identified by manufacturers lot designation. For needle punched geotextile, the manufacturer shall certify that the geotextile has been inspected using permanent on-line metal detectors and does not contain any needles.

## 1.8 DELIVERY, STORAGE, AND HANDLING

Only approved geotextile rolls shall be delivered to the project site. All geotextile shall be labeled, shipped, stored, and handled in accordance with ASTM D 4873. No hooks, tongs, or other sharp instruments shall be used for handling geotextile.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Geotextile

The geotextile shall be a woven or a non-woven pervious sheet of plastic yarn as defined by ASTM D 123. The geotextile shall equal or exceed the minimum average roll values listed in TABLE 1, MINIMUM PHYSICAL REQUIREMENTS FOR GEOTEXTILE. Strength values indicated in the table are for the weaker principal direction.

TABLE 1  
MINIMUM PHYSICAL REQUIREMENTS FOR GEOTEXTILE

| PROPERTY                | UNITS   | MINIMUM AVERAGE VALUES                          | TEST METHOD |
|-------------------------|---------|---|-------------|
| GRAB STRENGTH           | N       | 1300  | ASTM D 4632 |
| PUNCTURE                | N       | 400   | ASTM D 4833 |
| BURST STRENGTH          | kPa     | 4000  | ASTM D 3786 |
| TRAPEZOID TEAR          | N       | 400   | ASTM D 4533 |
| APPARENT OPENING SIZE   | mm      | No finer than 0.15 mm<br>No courser than 0.6 mm | ASTM D 4751 |
| PERMITTIVITY            | 1/sec   | 0.02 (MAXIMUM)                                  | ASTM D 4491 |
| ULTRAVIOLET DEGRADATION | Percent | 50 AT 500 Hrs                                   | ASTM D 4355 |

2.1.2 Geotextile Fiber

Fibers used in the manufacturing of the geotextile shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polyamides. Stabilizers and/or inhibitors shall be added to the base polymer if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. The edges of the geotextile shall be finished to prevent the outer fiber from pulling away from the geotextile.

2.1.3 Securing Pins

The geotextile shall be secured to the embankment or foundation soil by pins to prevent movement prior to placement of revetment materials. Other appropriate means to prevent movement such as staples, sand bags, and stone could also be used. Securing pins shall be inserted through both strips of overlapped geotextile along the line passing through midpoints of the overlap. Maximum spacing between securing pins depends on the steepness of the embankment slope. The maximum pins spacing shall be equal to or less than the values listed in TABLE 2, MAXIMUM SPACING FOR SECURING PINS. When windy conditions prevail at the



construction site, the number of pins should be increased upon the demand of the Contracting Officer.

TABLE 2  
MAXIMUM SPACING FOR SECURING PINS

| EMBANKMENT            | SPACING, meter |
|-----------------------|----------------|
| STEEPER THAN 1V ON 3H | 0.6            |
| 1V ON 3H TO 1V ON 4H  | 1.0            |
| FLATTER THAN 1V ON 4H | 1.5            |

### PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

Surface on which the geotextile will be placed shall be prepared, to a relatively smooth surface condition, in accordance with the applicable portion of this specification and shall be free from obstruction, debris, depressions, erosion feature, or vegetation. Any irregularities will be removed so as to insure continuous, intimate contact of the geotextile with all the surface. Any loose material, soft or low density pockets of material, will be removed; erosion features such as rills, gullies etc. must be graded out of the surface before geotextile placement.

#### 3.2 INSTALLATION

##### 3.2.1 General

The geotextile shall be placed in the manner and at the locations shown. At the time of installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

##### 3.2.2 Placement

3.2.2.1 The geotextile shall be placed with the long dimension parallel to the centerline of the rock sill or island and laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide a minimum width of 500 mm of overlap for each joint.

3.2.2.2 Temporary pinning of the geotextile to help hold it in place until the riprap is placed shall be allowed. The temporary pins shall be removed as the riprap is placed to relieve high tensile stress which may occur during placement of material on the geotextile.

3.2.2.3 Trimming shall be performed in such a manner that the geotextile shall not be damaged in any way.

#### 3.3 PROTECTION

3.3.1 The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile.

3.3.2 Any damage to the geotextile during its installation or during placement of riprap (see SECTION: STONE PROTECTION) shall be replaced by the Contractor at no cost to the Government.

3.3.3 The work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 3 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. The geotextile shall be protected from damage prior to and during the placement of riprap or other materials. Before placement of riprap or other materials, the Contractor shall demonstrate that the placement technique will not cause damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

--End of Section--

SECTION 02935

TURF

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SECTION 02935

TURF

PART 1 GENERAL

1.1 SCOPE

This section covers site preparation, seeding, mulching, and maintenance of turf areas.

1.2 RELATED WORK OF OTHER SECTIONS

The following items of related work are covered under other sections:

- a. Select fine materials: SECTION: EMBANKMENT.

1.3 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Amended thru: Aug 1988) Federal Seed Act Regulations (Part 201-202)

1.4 SUBMITTALS

The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES.

- a. Certificates of compliance as specified in PARAGRAPH: QUALITY CONTROL
- b. A list of proposed seeding and mulching equipment to be used in performance of turfing operation, including descriptive data and calibration tests.

1.5 MEASUREMENT AND PAYMENT

Turf will be measured by the hectare (ha) seeded for each seed mix, within the indicated limits of the islands, to the nearest one-hundredth hectare. Payment will be made at the contract unit price and will include payment for fines preparation, seeding, mulching, maintenance, and work incidental to the seeding. Turf work performed for repairs to disturbed areas outside of the designated turf establishment areas on the islands will not be measured for payment.

1.6 BIDDING SCHEDULE ITEMS

Bidding schedule items applicable to the work of this section are as follows:

| <u>Item</u> | <u>Unit</u> |
|-------------|-------------|
| Turf:       |             |
| Seed Mix #1 | ha          |
| Seed Mix #2 | ha          |
| Seed Mix #3 | ha          |

## 1.7 QUALITY CONTROL

Prior to the delivery of materials, the Contractor shall submit certificates of compliance certifying that materials meet the required specifications. Certified copies of the reports for the following materials shall be included: Seed.

The report shall include: mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested and state certification.

## 1.8 DELIVERY, STORAGE, AND HANDLING

## 1.8.1 Delivery

Seed shall be inspected upon arrival at the job site by the Contracting Officer for conformity to type and quality in accordance with PARAGRAPH: PRODUCTS. Other materials shall be inspected for meeting specified requirements and unacceptable materials shall be removed from the job site.

## 1.8.2 Storage

Materials shall be stored in areas designated by the Contracting Officer. Seed shall be stored in cool, dry locations away from contaminants.

## PART 2 PRODUCTS

## 2.1 SEED

## 2.1.1 Seed Classification

Seed shall be certified to be the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

## 2.1.2 Seed Mixtures

Seed mixtures shall be proportioned by weight as follows:

## a. Seed Mix #1:

| <u>Species</u>                               | <u>(kg/ha)</u> |
|--|----------------|
| Alfalfa ( <i>Medicago sativa</i> )           | 6.72           |
| Smooth brome grass ( <i>Bromus inermis</i> ) | 6.72           |
| Timothy ( <i>Phleum pratense</i> )           | 4.48           |
| Oats ( <i>Avena sativa</i> )                 | 22             |

b. Seed Mix #2:

| <u>Grass Species</u>                          | <u>(kg/ha)</u> |
|---|----------------|
| Switchgrass (Panicum virgatum)                | 3.36           |
| Canada Wildrye (Elymus canadensis)            | 3.36           |
| Side-Oats Grama (Bouteloua curtipendula)      | 2.24           |
| Sand Bluestem (Andropogon halli)              | 1.12           |
| Sand Dropseed (Sporobolus cryptandrus)        | 1.12           |
| Oats (Avena sativa)                           | 22             |
| <u>Forb Species</u>                           | <u>(g/ha)</u>  |
| Prairie clovers (Petalostemum sp.)            | 70             |
| Partridgepea (Chamaecrista fasciculata)       | 70             |
| Maximilian Sunflower (Helianthus maximiliani) | 70             |

c. Seed Mix #3:

| <u>Grass Species</u>                           | <u>(kg/ha)</u> |
|--|----------------|
| Virginia wildrye (Elymus virginica)            | 6.72           |
| Switchgrass (Panicum virgatum)                 | 2.24           |
| Indiangrass (Sorghastrum nutans)               | 1.12           |
| Big Bluestem (Andropogon gerardi)              | 1.12           |
| Prairie Cordgrass (Spartina pectinata)         | 0.21           |
| Bluejoint Reedgrass (Calamagrostis canadensis) | 0.07           |
| Oats (Avena sativa)                            | 22             |
| <u>Forb Species</u>                            | <u>(g/ha)</u>  |
| Black-Eyed Susan (Rudbeckia hirta)             | 140            |

d. Seed Mix #4:

| <u>Grass Species</u>                     | <u>(kg/ha)</u> |
|--|----------------|
| Canada Wildrye (Elymus canadensis)       | 5.60           |
| Little Bluestem (Andropogon scoparius)   | 3.36           |
| Sand Dropseed (Sporobolus cryptandrus)   | 1.12           |
| Side-Oats Grama (Bouteloua curtipendula) | 1.12           |
| Oats (Avena sativa)                      | 22             |

| <u>Forb Species</u>                           | <u>(g/ha)</u> |
|---|---------------|
| Prairie clover (Petalostemum sp.)             | 210           |
| Partridgepea (Chamaecrista fasciculata)       | 140           |
| Maximilian Sunflower (Helianthus maximiliani) | 70            |

### 2.1.3 Quality

Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed shall be rejected. For applicable species, seed quantities shall be pure live seed.

### 2.1.4 Seed Mixing

The field mixing of seed shall be performed on site in the presence of the Contracting Officer.

## 2.2 MULCH

Mulch shall be clean straw derived from oats that is free from noxious weeds, mold, or other objectionable material. Materials that contain objectionable weed seeds or other species that might be detrimental to the planting being established or to adjacent land will not be accepted. Straw shall be in an air-dry condition and suitable for placing with blower equipment.

## 2.3 SOIL FOR REPAIRS

For fill of areas to be repaired, soil shall be of at least equal quality to that which exists in areas adjacent to the areas to be repaired. Soil shall be used that is free from roots, stones, and other materials that hinder grading, planting, maintenance operations and establishment of turf.

## PART 3 EXECUTION

### 3.1 SEEDING TIMES AND CONDITIONS

#### 3.1.1 Seeding Time

The seed mixes shall be applied during the spring, between April 20 and June 15.

#### 3.1.2 Turfing Conditions

Turf operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. Planting shall resume only when conditions are favorable or when alternate or corrective measures and procedures have been approved by the Contracting Officer. When planting operations are resumed, the Contractor shall regrade all areas to receive seed that have not been maintained to the established grades and condition as specified in PARAGRAPH: SITE PREPARATION. When special conditions warrant a variance to the turf operations, proposed times shall be submitted to and approved by the Contracting Officer.

### 3.2 SITE PREPARATION

#### 3.2.1 Grading

The Contracting Officer shall verify that finished grades are as indicated on drawings, and that placing of select fine material (see SECTION: EMBANKMENT) is completed.

### 3.2.2 Finished Grading

Turf areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Turf areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of erosion or grade deficiencies shall conform to PARAGRAPH: PRODUCTS. Finished grade shall be 25 mm below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

### 3.2.3 Tillage

After the areas required to be seeded have been brought up to grade, the area(s) shall be tilled to a depth of at least 100 mm by plowing, disking, harrowing or other approved operations only during periods when, in the opinion of the Contracting Officer, beneficial results are likely to be obtained. Undulations or irregularities in the surface shall be leveled before the next specified operation. Soil compacted by construction equipment or soil on compacted cut slopes or grades shall be pulverized to a minimum depth of 100 mm by disking or tilling before applying seed.

### 3.2.4 Protection

Finished graded areas shall be protected from damage by construction traffic and erosion.

## 3.3 SEEDING

### 3.3.1 General

Prior to seeding, any previously prepared seed bed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

### 3.3.2 Equipment Calibration

The equipment to be used and the methods of turfing shall be subject to the inspection and approval of the Contracting Officer prior to commencement of turfing operations. Immediately prior to the commencement of turfing operations, the Contractor shall conduct turfing equipment calibration tests in the presence of the Contracting Officer.

### 3.3.3 Seeding Locations

#### 3.3.3.1 General

Seed shall be placed on the tops and slopes of the islands, and extend out to the edge of the select fine material limits along the berms. Granular fill material at the sand (granular fill material) humps located on Island D1, D2, E1, and E2 shall not be seeded.

#### 3.3.3.2 Islands A and D1

Seed mix 1 shall be applied to all surface areas requiring seeding.

#### 3.3.3.3 Island B

Seed mix 2 shall be applied to all surface areas requiring seeding.

#### 3.3.3.4 Island C

Seed mix 3 shall be applied to all surface areas requiring seeding.



### 3.3.3.5 Islands D2, E1, and E2

Seed mix 4 shall be applied to all surface areas requiring seeding.

### 3.3.3.6 Other Areas

Turf establishment shall be performed by the Contractor in any areas disturbed by the Contractor's operations either inside or outside the limits of work, at no additional cost to the Government. The damaged turf areas shall be re-established with seed in accordance with this section.

### 3.3.4 Applying Seed

#### 3.3.4.1 Broadcast Seeding

Broadcast seeding shall only be permitted in areas on Islands A and D1 inaccessible to drills or other equipment, and must be approved by the Contracting Officer. Seed shall be broadcast using hand spreaders or by simple hand broadcasting using seed rates approved by the Contracting Officer. Seed shall be distributed uniformly over designated areas. One half of seed shall be sown in one direction, and the remainder shall be sown at right angles to first sowing. The seed shall be covered to an average depth of 6 mm by means of spike-tooth harrow, cultipacker, or other approved device. Seed shall not be broadcast during windy weather (wind exceeding 16 km/h).

#### 3.3.4.2 Drill Seeding

a. Islands B, C, E1, E2, and D2 shall be drill seeded.

b. Drill seeding shall be accomplished using approved equipment such as cultipacker seeders and grass seed drills. The seed shall be drilled uniformly to an average depth of 13 mm. Drill seeding shall be done at right angles to surface drainage with a maximum row spacing of 200 mm. When slopes are steeper than 1 vertical on 5 horizontal, baffle plates spaced not more than 200 mm apart shall be installed in the seed box. Seed shall be drilled using equipment capable of drilling a native seed mix.

### 3.3.5 Firming Soil

Immediately after seeding operations have been completed, the surface shall be compacted by a cultipacker, roller or other approved equipment weighing 135 to 150 kg/m of roller. Under certain conditions, the Contracting Officer will direct that rolling be delayed from 15 to 30 minutes following planting to avoid balling the soil in the roller or squeezing water out of furrows. If the soil is of such type that a smooth or corrugated roller cannot be operated satisfactorily, a pneumatic-tired roller shall be used. A roller having tires of sufficient size shall be used, or sufficient passes of the roller shall be made, to cover soil surface completely.

### 3.4 MULCH

#### 3.4.1 Mulch Locations

Mulch shall be applied to all surface areas requiring seeding at Islands B, C, D2, E1, and E2. Sand (granular material) humps located on Islands D2, E1, and E2 shall not be mulched.

#### 3.4.2 Applying Mulch

Immediately after the seeding has been completed, mulch shall be spread uniformly in a continuous blanket at a rate of 3.0 t/ha. Mulch shall be spread by hand, manure spreader, modified grain combine with straw-spreader attachment or

blower-type mulch spreader. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of a steep slope, and continued uniformly until the area is covered. Mulch shall not be bunched.

### 3.4.3 Anchoring Mulch

Immediately following the spreading, the mulch shall be anchored to the soil by a V-type wheel land packer, a scalloped disk land packer designed to force mulch into the soil surface, or other suitable equipment. The number of passes needed, not to exceed three, will be determined by the Contracting Officer. All areas seeded on any given day must be mulched on that given day.

## 3.5 TURF ESTABLISHMENT PERIOD

### 3.5.1 Seeded Areas

The Contractor shall be responsible for the proper care of seeded areas during the period of establishment. The establishment period shall extend for 12 months after completion of the seeding on the entire project, unless the desired growth is established in a shorter period of time, and shortening the period of Contractor's responsibility for acceptably established areas is authorized by the Contracting Officer.

### 3.5.2 Maintenance During Establishment Period

#### 3.5.2.1 General

Maintenance of the turfed areas shall include protecting embankments from erosion, maintaining mulch, protecting turfed areas from traffic, and mowing.

#### 3.5.2.2 Mowing

Contractor shall mow the grass/forb seedings at Islands B, C, E1, E2, and D2 during the period of August 1-15 to a height ranging between 100 to 125 mm. The shrub/vine plantings at the north end of Island B shall not be mowed. Contractor shall take precautions to avoid trampling or mowing the sand humps and beachgrass plantings on Islands E1, E2, and D2.

### 3.5.3 Repair

When any portion of the turf becomes damaged, the affected portion shall be repaired to re-establish the condition and grade which existed prior to injury, as directed by the Contracting Officer. Repair work required shall be performed without additional cost to the Government.

## 3.6 FINAL ACCEPTANCE

### 3.6.1 Preliminary Inspection

Prior to the completion of the turf establishment period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The acceptability of the turf in accordance with the Turf Establishment Period shall be determined. An unacceptable stand of turf shall be repaired as soon as turfing conditions permit.

### 3.6.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing.

--End of Section--

SECTION 02950

PLANTINGS

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SECTION 02950

PLANTINGS

PART 1 GENERAL

1.1 SCOPE

This section covers providing willow cuttings, trees, shrubs, vines, and beachgrass stolons.

1.2 RELATED WORK OF OTHER SECTIONS

The following items of related work are covered under other sections:

- a. Fine Material: SECTION 02221: EMBANKMENT.

1.3 APPLICABLE PUBLICATIONS

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)

AAN-01 (1990) American Standard for Nursery Stock

1.4 SUBMITTALS

The following shall be submitted in accordance with SECTION: SUBMITTAL PROCEDURES:

- a. Certificates of compliance as specified in PARAGRAPH: QUALITY CONTROL.
- b. Maintenance Report. Written record of maintenance work performed and quantity of plant losses and replacements.
- c. Maintenance Instruction. Written instructions for year-round care.
- d. Manufacturer's Data. Manufacturer's installation and application procedures, specification data sheet or manufacturer's catalog sheets for tree shelters and tree mats.

1.5 MEASUREMENT AND PAYMENT

The work of this section will not be measured for payment and shall be performed on a job basis, complete. Payment will be made at the contract unit price and will constitute full compensation for furnishing, transportation, installation, establishment and replacement maintenance of plantings, and work incidental to the planting of Willow cuttings, trees, shrubs, beachgrass stolons and vines.

1.6 BIDDING SCHEDULE ITEMS

Bidding schedule items applicable to the work of this section are as follows:

| <u>Item</u>        | <u>Unit</u> |
|--------------------|-------------|
| Plantings:         |             |
| Beachgrass Stolons | JB          |
| Shrubs and Vines   | JB          |

|                  |    |
|------------------|----|
| Willow Plantings | JB |
| Island A Trees   | JB |
| Island D1 Trees  | JB |

1.7 QUALITY CONTROL

1.7.1 Prior to the delivery of materials, the Contractor shall submit certificates of compliance certifying that materials meet the required specifications. Certified copies of the reports for the following materials shall be included:

a. Plant Materials: For botanical and common name, size, quantity by species, grade, nursery grown.

1.7.2 Plant materials shall be subject to inspection at the growing site by the Contracting Officer.

1.7.3 Plant material shall be inspected upon arrival at the job site by the Contracting Officer for conformity to the PARAGRAPH: PLANTS and PARAGRAPH: DELIVERY, STORAGE, AND HANDLING, and any unacceptable plant material shall be removed from the job site.

1.8 DELIVERY, STORAGE, AND HANDLING

1.8.1 Delivery

1.8.1.1 Preparation

Digging and preparation for shipment shall be done in a manner that will not cause shock or damage to branches, trunk, or root systems.

a. Bare-Root Plants

Minimum root spread shall be as recommended by AAN-01. A well branched root system characteristic of the variety specified shall be provided. No roots shall be pulled from the ground. The root system shall be protected from drying out.

b. Container-Grown Plants

Container size shall be provided as recommended by AAN-01. Plants shall be grown in a container sufficiently long for new fibrous roots to have developed and for root mass to retain its shape and hold together when removed from container. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

c. Willow Cuttings

Cuttings shall be obtained prior to leaf-out. No more plant material shall be cut than that which can be planted within 48 hours after completion of cutting. Saplings shall be cut to size in a manner which does not result in frayed ends or bark. During preparation, the orientation of plant cuttings shall be maintained, i.e., cuttings shall be arranged basipetally (tops up and bases down). Additional requirements for willow cuttings include:

(a) For safety concerns, plant stock shall be cut flat (horizontal) and as close to the existing ground line as possible.

(b) The Contractor shall not make brush piles out of discarded or unsuitable plant stock material (i.e. tops and branches) but shall scatter such material uniformly over the cut area at the plant source location.

#### d. Beachgrass Stolons

Beachgrass stolons shall be handled and stored as recommended from the nursery where obtained.

##### 1.8.1.2 Antidesiccant Application

Plants shall be root dipped with an antidesiccant.

##### 1.8.1.3 Protection During Delivery

Plants shall be protected during delivery to prevent desiccation of the plant or damage to the roots or balls. Branches of plants shall be protected by tying-in the branches and covering all exposed branches.

##### 1.8.2 Storage

Plants not installed on the day of arrival at the site shall be stored and protected in areas designated by the Contracting Officer. Plants shall be maintained in moist conditions at all times; they must be stored outside, protected from the wind, and continually shaded with at least their bases submerged in water, either in natural streams or ponds or in containers. When stored in containers, the water shall be changed at least once daily. Plants may be stored, wrapped in wet burlap, under refrigeration at 32 degrees F. to 45 degrees F. During planting operations, the plants shall be kept moist until planted: this may be accomplished by carrying the plants in planting bags or buckets that are covered with moist vermiculite, sawdust, or similar material, or in water. The Contractor has the option to obtain the Willow cuttings prior to mid March and store them in a freezer with the temperature maintained between 20 degrees F. and 30 degrees F. Bare-root plants shall be heeled-in.

##### 1.8.3 Handling

Care shall be taken to avoid drying or damaging plants being moved from the source site or storage area to the planting site. Damaged plants will be rejected and shall be removed from the site. Materials shall not be dropped from vehicles. Container-grown plants shall be handled by the container. Plants shall not be handled by the trunk or stems.

## PART 2 PRODUCTS

### 2.1 PLANTS

#### 2.1.1 Varieties

Plants shall be nursery grown or plantation grown stock conforming to AAN-01 and shall be of the varieties specified in the plant list bearing botanical names listed in one or more of the publications listed under "Nomenclature" in AAN-01.

#### 2.1.2 Growing Conditions

Plants shall be grown under climatic conditions similar to those in the locality of the project.

#### 2.1.3 Quality

Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plants shall be provided that are typical of the species or variety and conforming to standards as set forth in AAN-01 and as specified herein.

#### 2.1.4 Willow Cuttings

2.1.4.1 Plant cuttings (live stakes) shall be prepared from live willow saplings (*Salix* spp.) obtained from the source site shown on the map contained in SECTION: ATTACHMENTS TO CONTRACT CLAUSES. Indigobush (*Amorpha fruticosa*) saplings will also be accepted as willow saplings. Cuttings shall be made from dormant spring stock, prior to bud burst, and free from obvious signs of canker diseases. Cuttings shall not be removed from one source site. The removal of cuttings shall be spaced as specified herein.

#### 2.1.4.2 Size

The diameter of cuttings shall not be less than 3/8 inch nor more than 1-1/4 inches. The length of cuttings shall be a minimum length of 21 inches. Each cutting shall have at least 4 buds.

#### 2.1.5 Trees

A height relationship to caliper shall be provided as recommended by AAN-01. Height of branching should bear a relationship to the size and variety of tree specified and with the crown in good balance with the trunk. All trees shall be two years old at the time of planting. Seedlings shall be well branched, fibrous root systems and be free of damage and disease. Root collars shall be at least 1/4 inch in diameter and seedlings heights shall average 12 inches or more. Seedlings shall be dormant when planted. Trees shall not be "poled" or the leader removed.

a. Single stem: Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than 150 mm from ground level.

c. Specimen: A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated. Species provided shall include the following:

#### Tree seedling Species

Bur Oak (*Quercus macrocarpa*)  
Swamp White Oak (*Quercus bicolor*)  
Black Oak (*Quercus velutina*)  
Hackberry (*Celtis occidentalis*)  
Green Ash (*Fraxinus pennsylvanica*)  
Black Walnut (*Juglans nigra*)  
Red Oak (*Quercus rubra*)  
Silver Maple (*Acer saccharinum*)  
Cottonwood (*Populus deltoides*)

#### 2.1.6 Deciduous Shrub

Plants shall be provided that have the height and number of primary stems as recommended by AAN-01. An acceptable plant shall be well shaped with sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region. Species provided shall include the following:

##### Shrub Species

Red Osier Dogwood (Cornus stolonifera)

Nannyberry (Viburnum lentago)

Winterberry (Ilex verticillata)

Indigobush (Amorpha fruitcosa)

#### 2.1.7 Vines and Stolons

Plants shall be provided with the minimum number of runners and length of runner as recommended by AAN-01. Plants shall be furnished that have heavy, well developed and balanced top with vigorous well developed root system. Species provided shall include the following:

##### Vine Species

Virginia Creeper (Parthenocissus quinquefolia)

Riverbank Grape (Vitis riparia)

##### Stolons (Plugs)

Beachgrass or Dunegrass (Ammophila brevigulata)

#### 2.2 TREE SHELTERS

2.2.1 Tree shelters shall be the standard product of a reputable manufacturer who's normal business is the production of tree shelters to be used for the purpose of protecting trees from damage due to animals, mowing, and application of herbicide, for the purpose of providing support, and for the purpose of providing improved growing conditions for seedlings through the recycling of moisture.

2.2.2 Tree shelters shall be constructed of a translucent plastic polymer that is UV stabilized for five years, seamless twin-walled around entire circumference, and have a continuous scrape free rim.

##### 2.2.3 Size

Tree shelters shall be 1200 mm long and approximately 100 mm in diameter with a minimum diameter of 90 mm.

##### 2.2.4 Stakes

Stakes for supporting tree shelters shall be solid hardwood, 25 mm square, and either pencil pointed or double-cut pointed. The length of the stake shall be as recommended by the tree shelter manufacturer.



#### 2.2.5 Ties

Tree shelter ties shall be nylon ratchet-locking ties at least 6 mm wide and as long as necessary to secure the tree and the tree shelter.

#### 2.3 TREE MATS

2.3.1 Tree mats shall be the standard product of a reputable manufacturer who's normal business is the production mats to be used for the purpose of protecting trees from the growth of adjacent weeds.

2.3.2 Tree mats shall be constructed of black polyethylene that is UV stabilized for three years and porous yet block 90 percent of the sunlight.

#### 2.3.3 Size

Tree mats shall be 1 m square and 63.5  $\mu$ m thick.

#### 2.3.4 Anchors

Tree mat anchors shall be 2.69 mm thick wire formed into staples measuring 150 mm by 25 mm by 150 mm.

#### 2.4 SOIL FOR REPAIRS

For fill and top soiling of areas to be repaired, soil shall be of at least equal quality to that which exists in areas adjacent to the areas to be repaired (see SECTION: EMBANKMENT). Soil shall be used that is free from roots, stones, and other materials that hinder grading, planting, maintenance operations and objectionable weed seed and toxic substances.

#### 2.5 ANTIDESICCANT

Antidesiccant shall be an emulsion that will provide a film over plant surfaces permeable enough to permit transpiration, and shall not damage the plant.

### PART 3 EXECUTION

#### 3.1 LAYOUT

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted by the Contracting Officer to meet field conditions.

#### 3.2 EXCAVATION

Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. Pits shall be dug with 150 mm tree augers or larger and if the sides of the pits become glazed, the glazed surface shall be scarified. The minimum allowable dimensions of plant pits shall be 150 mm deeper than the depth of ball or the depth of base roots, pit diameters shall be twice the root spread.

#### 3.3 PLANTING TIMES AND CONDITIONS

##### 3.3.1 Planting Time

- a. Install deciduous plants in Spring from April 15 to June 15.
- b. Install deciduous plants in Fall from October 15 to ground freeze.
- c. Beachgrass shall be planted by May 1.

d. Willow cuttings shall be planted by May 1 and prior to bud burst.

### 3.3.2 Planting Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to and approved by the Contracting Officer.

## 3.4 INSTALLATION

### 3.4.1 Setting Plants

Plants shall be set plumb and held in position until sufficient soil has been firmly placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth at which they were grown in the nursery, or container.

### 3.4.2 Willow Cuttings

3.4.2.1 Plant cuttings shall be planted with dibbles, star drills, steel bars, or other devices to create a starter hole and to avoid damaging the bark or buds of the cuttings. Plants shall not be driven with hammers or just pushed into the ground. The plants shall be planted after the planting bed has completely thawed and before the buds burst.

3.4.2.2 Each plant cutting shall be planted, with base down, such that about 3 inches will remain above the ground line and the planting soil tamped firmly around it in order to produce a firm hold. No air pockets or voids shall remain around the planted cuttings. Care shall be taken to ensure that the cuttings are not planted at an angle and are as plumb (vertically) as possible.

### 3.4.3 Bare-Root Plants

Bare-root plants shall be installed by arranging the roots in a natural position. Damaged roots shall be removed with a clean cut. Bare-root plants shall be backfilled with topsoil carefully worked in among the roots.

### 3.4.4 Container-Grown Plants

Non-biodegradable containers or platforms shall be removed without damage to the plant or root system. Biodegradable containers shall be split. The backfill shall be completed.

### 3.4.5 Stolons

Stolons shall be installed by arranging the roots in a natural position. Damaged roots shall be removed with a clean cut. Stolons shall be backfilled with topsoil carefully worked in among the roots.

### 3.4.6 Backfill

Topsoil shall be used as backfill in the hole and shall be blended to the surrounding grade.

3.4.7 Excess and waste material shall be removed from the work site daily. Existing planted areas that become damaged during planting operations shall be restored to their original condition, at no additional cost to the Government.

### 3.5 PLANTING DESIGN

#### 3.5.1 Willow Plantings

Two rows of willow cuttings shall be planted along the shorelines of all islands with a 0.6 m spacing between staggered rows and willows. No willows shall be planted along the shoreline in front of the humps at Islands D1, D2, E1, and E2.

#### 3.5.2 Island A

##### 3.5.2.1 Tree Seedlings

Tree seedlings shall be planted at a rate of 2,000 trees per ha, randomly mixed and spaced, over the entire top 15 m of the island, including the slopes and tops of the humps. The spacing between trees shall be between 2 m and 2.5 m. Do not plant seedlings on the island slopes or berms. An equal number (400/ha) shall be planted from the following:

Bur Oak

Swamp White Oak

Black Oak

Hackberry

Green Ash

In addition, black walnut and red oak seedlings shall be added equally to the planting mix on the humps. Except, no tree seedlings shall be planted on the 5:1 sideslopes of the humps. Thus, the planting rate per species in these areas will be approximately 285/ha.

##### 3.5.2.2 Shrubs and Vines

###### a. Shrubs

Shrubs shall be planted in the following configuration at each end of Island A where the island connects to the rock sill. Four rows of shrub seedlings spaced 600 mm with 600 mm between seedlings; stagger rows and plant a random mix of shrubs from the following:

Red Osier Dogwood

Nannyberry

Winterberry

Indigobush

###### b. Vines

Vine seedlings shall be planted at a 1 m by 1 m spacing within the areas between shrub planting bands and the rock sill as shown on the drawings. Vine species that may be used include the following:

Virginia Creeper

Riverbank Grape

### 3.5.3 Island B

#### 3.5.3.1 Tree Seedlings

No tree seedlings shall be planted on Island B.

#### 3.5.3.2 Shrubs and Vines

A shrub and vine mix as described in PARAGRAPH: ISLAND A shall be planted at the north end of Island B where the island connects to the rock sill.

### 3.5.4 Island C

#### 3.5.4.1 Tree Seedlings

No tree seedlings shall be planted on Island C.

#### 3.5.4.2 Shrubs and Vines

No shrubs or vines shall be planted on Island C.

### 3.5.5 Islands D1 and D2

#### 3.5.5.1 Tree Seedlings

Tree seedlings shall be planted at a rate of 2,000 trees per ha, randomly mixed and spaced, over the entire top 10 m of the Island D1, including those portions of the humps covered with fines. Except, no tree seedlings shall be planted on the 5:1 sideslopes of the humps. The spacing between trees being between 2 m and 2.5 m. Do not plant seedlings on the island slopes or berms. An equal number (667/ha) shall be planted from the following:

Green Ash

Silver Maple

Cottonwood

No tree seedlings shall be planted on Island D2.

#### 3.5.5.2 Shrubs and Vines

No shrubs or vines shall be planted on Island D1 and D2.

#### 3.5.5.3 Beachgrass Stolons (Plugs)

The sand (granular material) humps on each island shall be planted with stolons, or plugs, of common beachgrass or dunegrass except along slopes designated to be protected with stone. Beachgrass stolons shall be planted in staggered rows with spacing between rows and between plugs within the rows of 400 mm.

### 3.5.6 Islands E1 and E2

#### 3.5.6.1 Tree Seedlings

No tree seedlings shall be planted on Islands E1 and E2.

#### 3.5.6.2 Shrubs and Vines

No shrubs or vines shall be planted on Islands E1 and E2.

### 3.5.6.3 Beachgrass Stolons (Plugs)

The sand (granular material) hump at each island shall be planted with stolons, or plugs, of common beachgrass or dunegrass (*Ammophila brevigulata*) except along slopes designated to be protected with stone. Beachgrass stolons shall be planted in staggered rows with spacing between rows and between plugs within the rows of 400 mm.

### 3.6 TREE SHELTERS

Tree shelters shall be placed on 125 tree seedlings per ha of planted area on Islands A, and D1. Tree shelters shall be dispersed randomly across the islands, and not clumped in any one area. Tree shelters shall be placed on each species in proportion to the percentage of that species mix. Tree stakes shall be installed and tied to the tree shelters as submitted. Orient tree stakes on the upstream side of the tree shelters to maximize stability during periods of high water.

### 3.7 TREE MATS

Tree mats shall be placed on 125 tree seedlings per ha of planted area on Islands A and D1. Tree mats shall be placed on the same trees which receive tree shelters. Tree mats shall cover the ground in a radius of 450 mm around the tree and be staked with a minimum of 4 staples per mat (each corner) as submitted and approved.

### 3.8 PLANT ESTABLISHMENT PERIOD

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect until September 15 of that year (or the following year if the last planting is a fall planting). When the planting operation extends over more than one season or there is a variance to the planting times, plant establishment periods shall be established for the work completed, as directed. Written calendar time period shall be furnished to the Contracting Officer for the beginning of the plant establishment period. When there is more than one plant establishment period, describe the boundaries of the planted area covered for each period.

### 3.9 FINAL ACCEPTANCE

#### 3.9.1 Preliminary Inspection

A preliminary inspection will be held 30 calendar days from the date of the beginning of the plant establishment period to determine plant acceptability and the number, if any, of replacements. The preliminary inspection will be considered complete when the Contractor has complied with the following requirements:

- a. The maximum spacing of surviving groups of plantings shall not be more than 15 m.
- b. The survival rate for willow cuttings shall be a minimum of 60%.
- c. The survival rate for beachgrass stolons shall be a minimum of 60%.
- d. Plants shall be provided for replacement in accordance with PARAGRAPH: PLANTS. Replacement plants shall be installed in accordance with PARAGRAPH: INSTALLATION. No extended plant establishment period shall be required for replacement plants.

### 3.9.2 Final Inspection

A final inspection of all plants will be held after any replacement planting has been completed. The final inspection will be considered final acceptance provided the Contractor has complied with the following requirements:

a. Dead, missing, and defective plant materials, as determined by the Contracting Officer, shall have been replaced as directed; otherwise, final acceptance will be delayed until such replacement work has been satisfactorily accomplished.

--End of Section--

