



**U.S. Army Corps  
of Engineers**

Rock Island District

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**OPERATIONS AND MAINTENANCE MANUAL  
ANDALUSIA REFUGE  
REHABILITATION AND ENHANCEMENT**

**UPPER MISSISSIPPI RIVER  
ENVIRONMENTAL MANAGEMENT PROGRAM**

**POOL 16**

**RIVER MILE 462-463**

**ROCK ISLAND COUNTY, ILLINOIS**

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**DECEMBER 1995**

OPERATION AND MAINTENANCE MANUAL  
UPPER MISSISSIPPI RIVER SYSTEM  
ENVIRONMENTAL MANAGEMENT PROGRAM

ANDALUSIA REFUGE  
REHABILITATION AND ENHANCEMENT  
POOL 16, MISSISSIPPI RIVER MILES 462 THROUGH 463  
ROCK ISLAND COUNTY, ILLINOIS

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1. INTRODUCTION.

a. Purpose and Scope.

(1) This manual will serve as a guide for the operation and maintenance of Andalusia Refuge Rehabilitation and Enhancement project. These instructions are consistent with the general procedures presented in the approved Definite Project Report. This manual has been written for project and management personnel familiar with the project and does not contain detailed information which is common to site personnel or which is presented in other existing manuals or regulations.

(2) The intent of the operating instructions is to provide information which allows orderly and efficient use of the constructed features to meet project goals and objectives. The intent of the maintenance instructions is to present preventative maintenance information consisting of systematic inspections and subsequent corrective actions which should ensure long-term utilization of equipment and features. A timely preventative maintenance program reduces and virtually eliminates breakdown of essential equipment and prevents major damage to constructed features by early corrective action.

(3) This manual provides the general standards of maintenance and establishes an initial frequency of maintenance inspections which should ensure satisfactory project performance.

b. Use of Manual.

(1) This manual is divided into the following sections: Section 1: Introduction; Section 2: Historical Summary; Section 3: Description of Project Features; Section 4: Inspections; Section 5: Operation and Maintenance of Project Features; and Section 6: Performance Monitoring and Assessment. Sections 2 and 3 present historical summaries and descriptions of actual features constructed for this project. Section 4 presents project inspection procedures and Section 5 presents operation and maintenance instructions for each project feature.

(2) Section 6 provides a summary of monitoring activities conducted through construction and provides an overview of continued monitoring actions. Performance monitoring is considered necessary to properly evaluate effects of the constructed project features.

(3) The attached as-built drawings provide general project plans and typical sections.

## 2. HISTORICAL SUMMARY.

### a. Authorization and Location.

(1) The U.S. Army Corps of Engineers, Rock Island District, in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the State of Illinois, Department of Conservation constructed and financed this project with authority granted in the 1985 Supplemental Appropriations Act (Public Law 99-88) and Section 1103 of the Water Resource Development Act of 1986, Public Law 99-662.

(2) Andalusia Refuge is a backwater complex approximately 12 miles west of Rock Island, Illinois, on the Illinois side of the Upper Mississippi River and is located in pool 16. The project area is approximately at Upper Mississippi River mile 462.5 in Rock Island County, Illinois.

### b. Planning and Construction Activities.

(1) Table 2.1 provides a summary of planning and construction activities.

TABLE 2.1

SUMMARY OF PLANNING AND CONSTRUCTION ACTIVITIES

Project Phase	Purpose	Responsible Agency	Significant Events		Remarks
			Item	Date	
Pre-project	Identify and define problems and establish need of project.	USFWS	Fact Sheet Submitted to Corps Approved by Corps	4/87 6/87	
Design	Quantify project objectives, perform preliminary design, satisfy NEPA and permit requirements, develop performance evaluation plan, obtain project approval for construction.	CORPS	<u>Definite Project Report</u> Draft Final Approved  <u>NEPA Compliance</u> SHPO Concurrence Public Review FONSI for EA  <u>Permits</u> Section 401 Section 404	8/88 2/89 6/89  9/07/88 12/23/88 2/13/89  1/17/89 2/13/89	

**TABLE 2.1 (CONTINUED)**

**SUMMARY OF PLANNING AND CONSTRUCTION ACTIVITIES**

Project Phase	Purpose	Responsible Agency	Significant Events		Remarks
			Item	Date	
Construction	Finalize plans and specifications, obtain operation and maintenance agreement, advertise and award construction contract, construct project	CORPS	Plans and Specifications approval O&M Agreement <u>Main Contract</u> Advertised Awarded Completed	5/30/89 7/12/89 7/24/89 8/24/89 9/8/94	See Appendix A
Post-Construction	Operate and maintain project.	USFWS			Reference Sections 4 and 5
	Perform evaluation monitoring	CORPS	Perform evaluation report draft final supplements	JUL 96 OCT 96 annually	Reference Section 6

(2) Goals and objectives were formulated during the design phase. Table 2.2 provides a summary of project objectives.

TABLE 2.2

Project Goals and Objectives

Goals	Objective	Unit of Measure	Enhancement Potential	
			Existing	Target
Enhance Migratory Waterfowl Habitat	Increase reliable food production area (moist soil species)	Acres	0	130
	Increase reliable resting and feeding water area.	Acres	0	200
Enhance Aquatic Habitat	Restore deep (6 ft) aquatic habitat	Acre-Feet	0	40
	Restore lentic-lotic habitat access cross-sectional area	Square Feet	0	180 (minimum)
	Improve dissolved oxygen concentration during critical seasonal stress periods.	mg/l	<4.0 mg/l	>4.0 mg/l
Reduce Sedimentation in Refuge	Decrease adjacent tributary sediment volume	Acre-Feet/Year	11	4.2

(3) The Rock Island District, Corps of Engineers designed the project in cooperation with the USFWS and the Illinois DOC. Refer to the Definite Project Report for design considerations and investigations. The Corps of Engineers, Rock Island District administered and supervised the construction contract.

(4) Construction Problems:

Excavation in Dead Slough from approximately Station 20+00 to Station 36+00 was difficult due to high water content of the excavated material. The contractor's use of drag lines contributed to the problem by not being able to maintain the in situ strength and water content of the excavated material.

Inflow to the pump station was interrupted during the fall season when floating vegetation was abundant in the back waters. The river side trash rack plugged up with vegetation, primarily duckweed, not allowing sufficient water to feed the pump. To solve the problem 2 additional screens were added to filter the vegetation. A chain link fence screen was installed near the pump station and a fence screen with wider openings was installed approximately 140 ft from the pump station.

The Flood of 1993 caused minor erosion along the access road and silted in the ditches from Sta 12+00 to 16+00. The road and ditches were restored by contract modification. The river access channel into Dead Slough experienced greater than expected siltation rates. The access channel was excavated to a bottom elevation of 538.0

c. Actual Project Costs. The actual project costs are presented in Table 2.3.

TABLE 2.3

Actual Project Costs

Feature

0.6 FISH AND WILDLIFE FACILITIES.

ITEM	DESCRIPTION	QTY	U/M	U/P	AMOUNT
0001	Clearing and Grubbing	1	LS	\$60,000.00	\$60,000.00
0002	Settlement Drawings	2	EA	900.00	1,800.00
0003A	Excavation, River Access Channel	20,021	CY	6.25	125,131.25

ITEM	DESCRIPTION	QTY	U/M	U/P	AMOUNT
0003B	Excavation, Access Road	3,046	CY	4.50	13,707.00
0003C	Excavation, Excess Embankment Between 24+17CE and 30+17CE	2,776.8	CY	4.50	12,495.60
0003D	Excavation, Refuge Islands/Drainage	63,344.1	CY	3.50	221,704.35
0004A	Embankment, Levee	88,833	CY	3.65	324,240.45
0004B	Embankment, Access Rd	6,714	CY	4.50	30,213.00
0005A	Stone Protection, Filter Fabric	4,645	SY	5.00	23,225.00
0005B	Stone Protection, Bedding	1,585.8	TN	13.00	20,615.40
0005C1	Stone Protection Riprap Type A,	5,175.2	TN	23.50	121,617.20
0005C2	Stone Protection Riprap Type B,	2,153.9	TN	23.50	50,616.65
0006	Overflow Cutoff Wall	1	LS	25,000.00	25,000.00
0007	Pump Station	1	LS	630,000.00	630,000.00
0008	Water Control Structure	1	LS	70,600.00	70,600.00
0009	Culvert	32	LF	26.00	832.00

ITEM	DESCRIPTION	QTY	U/M	U/P	AMOUNT
0010	Granular Surfacing/ Choke Stone	1,425.5	TN	13.75	19,600.63
0011	Seeding	31	AC	1,650.00	51,150.00
0012	Vehicular Barrier Gates	3	EA	1,850.00	5,550.00
0013	Field Office	23	MO	725.00	16,675.00
0014	24" CMP Culvert w/Flared End Sections	1	JB	SUM	1,357.93
0015	Water Deflection Drawing	1	JB	SUM	479.59
0016	Barricade Posts & Diversion Ditch	1	JB	LS	6,533.89
0017	Pump Station Remedial Electrical & Mechanical Work	1	JB	LS	6,804.80
0018	Silt Cleanup	1	JB	LS	2,101.21
0019	Revised Lightning Protection	1	LS	--	3,800.39
0020	(2) Staff Gages	1	JB	SUM	2,167.77
0021	Phase Converter/Electrical	1	JOB	SUM	19,086.04
0022	Flood Repair	1	JOB	SUM	16,900.79
0023	Additional Pump Run Time	1	JOB	SUM	402.98

ITEM	DESCRIPTION	QTY	U/M	U/P	AMOUNT
0024	Additional Electrical Charges	1	JOB	SUM	1,648.46
Corps Labor	Entrance Slough Excavation	1	JOB	SUM	27,000.00
DACW25-95-Q-0005	Pump Station Fence Screen	1	JOB	SUM	7,200.00

0.6	TOTAL, FISH, AND WILDLIFE FACILITIES	TOTAL	\$1,920,000.00
30.	PLANNING, ENGINEERING, AND DESIGN		390,000.00
31.	CONSTRUCTION MANAGEMENT		<u>200,000.00</u>
	<b>TOTAL PROJECT COSTS</b>		<b>\$2,510,000.00</b>

d. Project References. Table 2.4 provides a summary of related project references.

Table 2.4

PROJECT REFERENCES

Title	Date	Purpose
Definite Project Report, Andalusia Refuge Rehabilitation and Enhancement With Environmental Assessment, U.S. Army Corps of Engineers, Rock Island District	Feb 89	Provided planning, engineering, and sufficient construction details of the selected plan for project approval purposes.
Construction As-builts	Aug 95	Provides as-built construction drawings
Manufacturers' Data (Shop Drawings)	Jul 95	Provides detailed operation and maintenance instructions for specific pieces of equipment as recommended by the manufacturer.

3. DESCRIPTION OF PROJECT FEATURES.

a. Project Data. Table 3.1 presents a summary of project data.

Table 3.1

PROJECT DATA SUMMARY

Item	Quantity/Measurement	Remarks
<u>Perimeter Levee</u>		
Embankment Fill	92,000 Cubic yards	
Length	8,600 Feet	
Crown elevation	552.8	Station 12+21C to Station 11+00
	552.8 to 551.8	Varies from Station 11+00 to Station 24+17CE
Side Slopes	550.8	From Station 25+17CE to Station 29+17CE
	551.8	From Station 30+17CE to Station 34+50CE
	4:1	Horizontal to vertical from Station 12+21C to 8+00CE. Slopes flattened for over flow and soft material placement purposes
Side Slopes	4:1	From Station 9+00CE to Station 34+50CE
<u>Armored overflow levee section</u>		
Length	600 Feet	
Overflow elevation	550.8 MSL	

Item	Quantity/Measurement	Remarks
Riprap	5,200 Tons	
<u>Diversion Drainage Ditch</u>		
Approximate length	2 Feet	
Average depth	3 Feet	
Bottom slope	.0025 Foot per foot	
Watershed area	1.152 Acres	
Capacity of channel	340 CFS	(2-year precipitation event)
<u>Dead Slough Channel Excavation</u>		
Adjacent to Levee		
Approximate length	4,500 Feet	
Width at bottom	60 Feet	
Bottom elevation	36.0 MSL	
Volume of excavation	87,000 CY	
River Access Excavation		
Approximate length	1,100 Feet	
Width at bottom	30 Feet	
Bottom elevation	538 to 541 MSL	

Item	Quantity/Measurement	Remarks
Volume of excavation	23,000 CY	
<u>Refuge Drainage/Island Construction</u>		
<u>Interior drainage with islands</u>		
Length	8,600 Feet	
Width	40 Feet	
Bottom Elevation	542.0± MSL	
No. of islands	27 Each	
Area of an island above elevation 545.0	9.0 Acres	
<u>Interior drainage for adjacent levee borrow</u>		
Length	2,300 Feet	
Width at bottom	20 Feet	
Bottom elevation	536.0 MSL	
<u>Pump Station</u>		
<u>Submersible pumps</u>		
Emptying pump	1 Each	6,775 gpm at 8.5 TDH rated
Filling pump	1 Each	6,775 gpm at 8.5 TDH rated

Item	Quantity/Measurement	Remarks
Sluice gate	1 Each	3 feet x 3 feet
<u>Operating elevations</u>		
Refuge max. elevation	550.8 MSL	(overflow elevation)
Refuge min. elevation	542.0 MSL	
Sump floor elevation	539.5 MSL	
Equipment floor elevation	560.0 MSL	(100-year Mississippi River event)
<u>Electric power source</u>		
Primary supply	7,620.0 Volts	1 phase Secondary station supply
	480/277 Volts	1 phase
Transformer size	37.5 KVA	1 phase
Power converter	37.5 KVA	3 phase
<u>Trash racks</u>		
River and pond sides	2 Each	
Fence screen river side	1 Each	
<u>Water Control Structure</u>		
Sluice gate	1 Each	3 feet x 3 feet
Invert	542.0 MSL	

Item	Quantity/Measurement	Remarks
<u>Access Road</u>  Approximate length  Width	3,600 Feet  12 Feet	crushed stone surface

b. General Description.

The proposed project consists primarily of the construction of a 2-year event levee (elevation 550.8 MSL), pump station, and a water control structure. The levee is 8,600 feet long with a minimum top width of 12 feet. The levee system allows water level control on 130 acres of Refuge land. The pump station is capable of pumping 5,900 gallons per minute into or out of the Refuge. A General Plan View is shown on Drawing C-1. Fill material for the levee was excavated from Dead Slough, the Refuge, and from the diversion drainage ditch.

c. Perimeter Levee. The 2-year flood elevation for the project site is elevation 550.8 feet MSL, which represents the elevation of the overflow reach of the levee as shown on drawing C-9 from station 24+17CE to station 30+17CE (600 feet). From station 24+17CE to station 9+40 (see profile on drawing C-12), the profile of the levee is approximately five times steeper than the natural flood profiles of the Mississippi River. A detailed description of the operational features of the levee system is presented in Section 5.

(1) Station 12+21C to Station 11+00. This reach of levee, as shown on drawing C-5, consists of a 12-foot-wide crown with an approximate height of 4 feet. Typical section is shown on drawing C-15. Borrow for this approximately 1,300 feet of levee was excavated from the nearby diversion drainage ditch and from Dead Slough excavation.

(2) Station 11+00 to Station 8+00CE. This reach of levee of about 4,100 feet consists of an approximate 60-foot-wide levee crown with 4:1 (Horizontal:Vertical) side slopes, as shown in plan on drawings C-6, C-7, and C-8 and with typical section on drawing C-15. It is located adjacent to Dead Slough such that approximately 40 feet of the levee section lies on existing ground above flat pool (elevation 545.0) with the remainder of the levee section lying within Dead Slough on land below flat pool (average elevation 544.0). This reach of the levee system has a substantially thicker section due to the placement requirement of adjacent Dead Slough excavation. The average height of this levee is 6 feet.

The overbuilt section on the slough side will require minimal maintenance. The other half of this levee section is the integral core of the levee and will require annual inspection and maintenance.

(3) Station 9+00CE to Station 24+17CE. This reach of the levee consists of approximately 1,600 lineal feet and has an average height of about 6 feet with 4:1 side slopes. This reach was constructed using adjacent borrow sources, as shown on drawings C-8 and C-9, with typical section on drawing C-15. The width of the levee crown on this reach is 12 feet.

(4) Station 24+17CE to Station 30+17CE. This reach of the levee consists of approximately 600 feet crossing the most downstream area of the MSMU. Average height of this levee is about 7 feet, with a 12-foot clay core and a 2-foot bedding and riprap blanket on the exterior for overflow and wave protection. This reach is shown on drawing C-9, with typical section on drawing C-15.

Borrow for this section of levee was obtained from adjacent in-water excavation. Typical side slopes are 4:1.

(5) Station 30+17CE to Station 34+50CE. This 433-foot reach of the levee is shown on drawing C-8 and C-9, with typical section on drawing C-16. This section of levee ties into high ground and is connected to the access road. Average height in this reach will be approximately 2 feet. Borrow was obtained from areas adjacent to the access road.

d. Diversion Drainage Ditch. The plan view of the diversion ditch is shown on drawing C-5, with section shown on drawing C-15. The bottom width of the excavated ditch is approximately 30 feet, with average depth of excavation of 3 feet. The drainage ditch was sized to pass a 2-year precipitation event within bank.

The outlet of the diversion drainage ditch was placed near flat pool in Scisco Chute which closely approximates the existing outlet and should minimize outlet area maintenance.

The entire drainage diversion ditch is located on existing Government lands; no additional easements/fee taking is required. As shown on the typical section, an additional 10-foot-wide unsurfaced maintenance access service road is available for site access. The contractor did not use this access during construction. The access is currently over-grown with vegetation. It does not require maintenance unless its use is desired.

e. Dead Slough Excavation. As shown on drawings C-6, C-7, and C-8, with typical sections on drawing C-15, the contractor excavated approximately 85,000 cubic yards for Dead Slough aquatic improvement. The average bottom width of this excavation is about 60 feet. The slough was excavated to elevation 536 MSL adjacent to the levee. The average cut for this excavation was approximately 7 feet. The excavated material was placed in the levee section adjacent to Dead Slough, as described in the above perimeter levee, from station 11+00 to station 8+00CE.

A river access channel was constructed from Scisco Chute to the Dead Slough area. The approximately 1,100 feet of excavation will consist of a 30-foot-wide cut with a depth that varies from elevation 536 to 541 MSL, with excavated material placed on adjacent land between stations 8E to 13E, as shown in section on drawing C-16. This depth will be maintained with an effort described in the Definite Project Report. Additional excavation may be required but will only be accomplished when funding is available.

f. Refuge Drainage/Islands. Interior Refuge drainage is provided by the construction of excavated channels, as shown on drawings C-6, C-7, C-8, and C-9. Two types of typical sections were constructed as shown on drawing C-16.

Type I consists of drainage channels constructed on both sides of an island. The excavated material produces an approximate 45-foot-wide island at elevation 551 feet MSL.

Type II refuge excavation consists of drainage channel constructed on one side of the excavation with excavated material producing an approximate 10-foot-wide island with an elevation of 551 feet MSL. The overall length of the refuge drainage excavation is about 8,600 feet. The profile of the refuge drainage excavation is shown on drawing C-14.

g. Pump Station. The pump station was sized to evacuate the MSMU in approximately 14 days. Actual performance exceeds design requirements and will dewater the MSMU in about 7 to 10 days. Plan views and the general layout of the pump station are shown on drawings S-3 and S-4.

The pump station has two pumps which provide the capability to dewater the MSMU during drawdown times and to pump water from the Mississippi River into the MSMU if rainfall is insufficient to maintain desired water levels. The rated capacity of these pumps is 6,775 gpm @ 8.5 ft TDH. The pump station is turned on manually and will operate automatically until turned off. An underground electrical line adjacent to the access road supplies power.

This station is being furnished with a trash rack on both the MSMU side and the river side due to flow reversals as described. The inverts of the station have been set consistent with refuge ditching and adjacent natural ground elevations. A sedimentation zone has been provided on the MSMU side with an overflow weir protecting the entrance to the station to minimize sediment entering the pump station during drawdown periods.

The station includes a 3-foot by 3-foot sluice gate to allow passage of gravity flows. An electrically driven motor operates the gate. This gate only needs to be used when gravity discharge through the gravity outlet structure alone does not have sufficient capacity to drain the refuge as quickly as required. Other times this gate may be used is when access to the gravity outlet structure is difficult due to wet conditions that would cause damage to the levee surface.

Both pumps and the gate are located within a cast-in-place concrete building structure. A vandal-resistant and durable structure was constructed.

h. Water Control Structure. The water control structure is shown in plan view on drawing S-1. The water control structure consists of a 36-inch-diameter

concrete conduit located within the levee section. The invert of the conduit is at elevation 542.0 feet MSL. A 3-foot by 3-foot sluice gate controls water flow. The gate may be operated manually or with a portable power source. The hydraulic power operator should not be run to the extreme ends of the gate operating limits to avoid damage to the gate and stem.

i. Access Road. The access road consists of the construction of approximately 3,600 lineal feet of a 12-foot-wide service road, with typical sections on drawing 19. IDOC personnel will control egress to the access road to prevent and minimize public access to the refuge area and consequent disturbance.

#### 4. INSPECTIONS.

##### a. General.

(1) An active maintenance program is based on inspections and subsequent servicing, adjustment, or repair. There are 2 main objectives of inspections: (1) to insure project serviceability by timely and thorough inspections thereby avoiding or reducing maintenance costs, and (2) to document the condition of the project as a baseline for consideration of rehabilitation for project damage resulting from a major storm or flood event.

(2) There are 2 types of inspections for the project: (1) Project Inspection by the Site Manager and (2) Joint Inspection by the Site Manager and personnel from the Corps of Engineers, Rock Island District.

##### b. Project Inspection by Site Manager.

(1) The Project Inspection should be performed by the Site Manager or appropriate representative for the purpose of noting routine deficiencies and initiating corrective actions. This inspection will be performed at periods not exceeding 12 months and will follow inspection guidance presented in subsequent sections of this manual. It is suggested that the inspection be conducted every May, which is representative of after spring flood conditions. Other Project Inspections should occur as necessary after high water events or as scheduled by the Site Manager.

(2) A Project Inspection checklist has been developed as presented in Appendix B. It is suggested that a copy of the completed checklist be furnished to the Corps of Engineers, Rock Island District, ATTN: CENCR-OD-S, P.O. Box 2004, Rock Island, Illinois, 61204-2004, immediately following each Project Inspection by the Site Manager.

##### c. Joint Inspection by Site Manager and Corps of Engineers.

(1) Routine. A Joint Inspection by the Site Manager and the Corps of Engineers will be scheduled by the Corps in accordance with ER 1130-2-339. The purpose of this inspection is to assure that adequate maintenance is being performed as presented in the DPR and this manual. The District Engineer or Authorized Representatives should have access to all portions of the constructed project upon coordination with the Site Manager for this purpose. Copies of this inspection will be furnished to the Site Manager stating project maintenance conditions. Corrective actions from these inspections should be accomplished by the Site Manager as provided by USFWS, Operation, Maintenance, and Rehabilitation Agreement, reference appendix A.

(2) Catastrophic. A Joint Inspection by the Site Manager and the Corps of Engineers should be formally requested by the Site Manager immediately following a specific storm or flood event which causes damage exceeding the annual operation and maintenance as specified in this manual and the Definite Project Report. The Project Inspections by the Site Manager and Joint Inspection results will be the basis for determining maintenance responsibility and potential rehabilitation by the Corps of Engineers.

## 5. OPERATION AND MAINTENANCE OF PROJECT FEATURES.

### a. General.

(1) This section presents operation and maintenance instructions for the major project features which were designed and constructed to minimize operation and maintenance requirements.

(2) Steps will be taken by the Site Manager to correct conditions disclosed by Project Inspections or Joint Inspections. Regular maintenance repair measures will be accomplished during the appropriate season as scheduled by the Site Manager to insure serviceability.

(3) Project features should be continuously maintained and operated to obtain maximum benefits. No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project should be permitted upon the constructed features. No improvement should be passed over, under, or through the constructed features, nor should any excavation or construction be permitted within these features without prior approval by the Corps of Engineers, Rock Island District. Such improvements or alterations which are desirable and permissible should be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice should be obtained from the District Engineer or if otherwise obtained, should be submitted for approval. Drawings or prints showing improvements or alterations as finally constructed should be furnished to the District Engineer after completion of such work.

b. Perimeter Levee.

(1) Operation.

(a) During flood periods, the levee should be inspected to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

- (i) There are no indications of slides or sloughs developing;
- (ii) Wave wash or scouring action is not occurring;
- (iii) No low reaches of levee below design grade exist which may be overtopped;
- (iv) No other conditions exist which might endanger the structure.

(b) Appropriate advance measures should be taken to insure the availability of adequate labor and materials to meet contingencies. Steps should be taken to control any condition which endangers the levee and to repair the damaged section. If additional riprap is needed to protect eroding banks, the material presented in Table 4-1, or equivalent material should be used.

Table 5-1

ANDALUSIA REFUGE RIPRAP SIZE\*

Stone Weight Pounds	Minimum Percent Larger Than
250	0
90	50
5	90

\* Iowa Class "D" riprap may be used.

(2) Maintenance.

(a) The Site Manager should provide at all times such maintenance as may be required to insure serviceability of the levee in time of flood.

Measures should be taken to promote the growth of sod and control burrowing animals. This includes routine mowing or burning (a minimum of twice per year) on the levees extending 5 feet horizontally from the toe of the levee, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces.

(b) Project inspections should be made by the Site Manager to insure that the above maintenance measures are being effectively carried out and to be certain that:

(i) no unusual settlement, sloughing, or material loss of grade or levee cross-section has taken place;

(ii) no caving has occurred on either the landside or the riverside of the levee which might affect the stability of the levee section;

(iii) no seepage, saturated areas, or sand boils are occurring;

(iv) no revetment work or riprap has been displaced, washed-out, or removed;

(v) no action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sods;

(vi) the crown of the levee is shaped to drain readily;

(vii) there is no unauthorized grazing or vehicular traffic on the levee;

(viii) encroachments are not being made on the levee which might endanger the structure or hinder its proper and efficient functioning during times of flood.

(c) Such inspections should be made prior to the beginning of the flood season, immediately following major high-water periods, and otherwise at intervals necessary to insure the best care of the levee or 1 time per year as stated in section 4b. Steps should be taken to correct conditions disclosed by such inspections. Regular maintenance repair measures should be accomplished during the appropriate season as scheduled by the Site Manager.

c. Water Control Structure.

(1) Operation.

(a) When the MSMU is in use, or water levels of the Mississippi River rise with heavy sediment loads, the gatewell structure should be closed to prevent sediment from entering upper Andalusia Refuge Lake. The gates should remain closed until:

- (i) heavy sediment flood waters recede; and/or
- (ii) low dissolved oxygen conditions exist in Andalusia Refuge Lakes;
- (iii) the MSMU is not in use;
- (iv) the river reaches elevation 550 MSL (which is 15 feet on the Fairport gage) with predicted stage to increase. Both the outlet structure gate and the pump station gate should be opened to minimize overtopping erosion.

(b) This structure was provided with a portable power source and adapter to power lift the gate. The operating stand, electric generator, and drill adapter should be stored off-site to allow ready use when needed.

(2) Maintenance.

(a) The drainage structure should be inspected during floods to determine whether seepage is taking place along the lines of its contact with the embankment. Steps should be taken to correct any adverse condition.

(b) The gate of the structure should be examined, lubricated, and trial-operated at least once a year. Follow the manufacturer's instructions for lubrication.

(c) Project inspections of the control structure should be made by the Site Manager to be certain that:

- (i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;
- (ii) Inlet and outlet channels are open;
- (iii) Care is being exercised to prevent the accumulation of trash and debris near the structures;

(iv) Erosion is not occurring adjacent to the structure which might endanger its function.

(d) Steps should be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

d. Diversion Drainage Ditch.

(1) Operation. The improved channel should be inspected immediately following major high water periods. As soon as practicable after high water events, all snags and other debris should be removed from the channel.

(2) Maintenance.

(a) Project inspections of the improved channel should be made by the Site Manager to be certain that:

(i) The channel is cleared of debris, weeds, and wild growth;

(ii) The channel is not being restricted by the depositing of waste materials, building of unauthorized structures, or other encroachments;

(iii) Banks are not being damaged by rain or wave wash and that no sloughing of banks has occurred;

(b) Steps should be taken to correct conditions disclosed by such inspections.

e. Dead Slough Excavation.

Section 5d should be followed for operation and maintenance of this feature.

f. Refuge Drainage/Islands.

(1) Operation. Specific operational requirements should be performed as determined by the Site Manager.

(2) Maintenance. Project Inspections of the dredged lake channels should be made by the Site Manager to record the presence of debris, waste materials, unauthorized structures, and sedimentation deposits. Such inspections may use visual observation and sufficient pole soundings.

g. Pump Station.

(1) Operation. The gate of the pump station should normally be closed. If its use is required as stated in paragraph 3g, or if overtopping is expected, the gate should be opened. During desired drawdown periods, the gate of the water control structure and the pump station should be closed and the pump station activated for drawdown purposes. The pump station must be manually activated but will automatically turn off at a low water level of 542.0 MSL. During drawdown periods, the pump station will automatically turn on at elevation 542.5 MSL to maintain the 542.0 drawdown elevation. The IDOC may make minor adjustments to these levels to suit refuge management purposes.

After drawdown has occurred and once vegetation has been established in the MSMU, either adjacent tributary inflow, seepage, or opening of the water control structure gate or the pump station gate will allow water into the MSMU area. Use of gates and pumps should be controlled to achieve desired water levels consistent with vegetative growth.

When it is desired to pump from the river into the MSMU, the station must be manually activated and will continue pumping automatically. The pump will automatically shut off at elevation 547.0 MSL (which can be adjusted to elevation 550.8, the elevation of the levee overflow). It is anticipated that ponding levels higher than elevation 547.0 will cause damage to adjacent agricultural fields during crop growing seasons. The IDOC must coordinate with adjacent property owners during the non-crop season prior to raising MSMU water elevations above 547.0. IDOC must determine the trade-off of operating higher than 547.0 for additional MSMU acres versus potential negative impacts and associated coordination. The highest MSMU elevation 550.8 MSL will occur when water reaches the elevation of the overflow weir.

During periods of drawdown and when river events reach elevation 550.0 MSL (which is 15 feet on the Fairport gage at river mile 462.7) with predicted stage to increase, the gates of the water control structure and the station should be opened in efforts to fill the interior of the levee without overtopping. Should the river stage exceed 550.8 MSL prior to filling using the existing water control structure and pump station conduits, the remainder of overflow will occur by means of a riprapped overflow weir station.

(2) Maintenance. Pump station inspections will be performed by the site manager. Steps should be taken to correct conditions disclosed by such inspections. The pump station inspection should include the following:

(a) Building. Visually inspect all surfaces to discover cracks, spalling of concrete, broken blocks or bricks, faulty joints, check around all opening for cracks and leaks.

(b) Gates. When operating conditions will permit, operate through a portion of their travel to determine that gates are in satisfactory condition. Examine exposed parts of gates for corrosion, cracking, deterioration of coating and other damage. Check rivets, bolts and welds. Repair when conditions will economically justify the work.

(c) Pumps.

(i) Pump should be observed for indications of improper operation or damage. Avoid operation of pump during sump cavitation or ice conditions. The pump will automatically shut down through the pump control unit located in the electrical panel on high stator winding temperature, stator casing leakage, or high bearing temperature. Test lights for these shutdown alarms should be checked before starting the respective pump. The pump station sluice gate must be fully closed to start either pump. This is due to an electrical interlock that de-energizes the pump control circuitry if the gate is not fully closed. Periodically check the sump for proper water depth, especially prior to extended operation. Mud in the sump may be a cause for cavitation during operation.

(ii) The Site Manager should have an authorized representative conduct pump inspections and maintenance and repair work in accordance with, "KSB PNT Submersible Motor-Propeller Pumps." Ancillary equipment such as cables, level sensors, starter and monitoring equipment should also be periodically inspected. Damaged components should be repaired or replaced by a qualified mechanic or electrician.

(d) Control Panel - Examine closely for over all condition. Tighten, repair, and clean as needed.

(e) Trash Racks - Check for trash accumulation at racks and remove as necessary. Should operating conditions or observations indicate trouble is developing and operating conditions will permit, inspect sufficient racks to indicate general condition. Repair as necessary to maintain a satisfactory condition. Underwater inspection of racks may be more practical than removal of racks.

h. Access Road.

The access road will require periodic maintenance to clear culverts and drainage ditches, add additional surface stone, and replenish embankment rip rap. The surface stone is Illinois DOT gradation CA 6. The rip rap size is shown in table 5-1.

## 6. PERFORMANCE MONITORING AND ASSESSMENT

a. The purpose of this section is to summarize monitoring and data collection aspects of the project. Table 6-1 presents the principal types, purposes, and responsibility of monitoring and data collection. Table 6-2 provides a summary of actual monitoring and data parameters grouped by project phase, responsible agency, and data collection intervals. Changes to the monitoring plan should be coordinated with the USFWS, IDOC, and COE.

b. Table 6-3 presents the post-construction evaluation plan. The monitoring parameters were developed to measure the effectiveness of the stated goals. The Site Manager should follow Table 6-3, as shown, to make annual field observations. The annual field observations and the quantitative monitoring parameters will form the basis of project evaluation.

TABLE 6-1

MONITORING AND PERFORMANCE EVALUATION MATRIX

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source	Implementation Instructions
Pre - Project	Sedimentation Problem Analysis	System-wide problem definition. Evaluate planning assumptions	USFWS	USFWS (EMTC)	LTRM <u>1/</u>	--
	Pre-project Monitoring	Identifies and defines problems at HREP site. Establish need of proposed project features.	USFWS	USFWS	USFWS	--
	Baseline Monitoring	Establishes baselines for performance evaluation	Corps	Corps	LTRM	See Table 6-2
Design	Data Collection for Design	Includes quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	HREP <u>2/</u>	See Table 6-2
Construction	Construction Monitoring	Assess construction impacts; assures permit conditions are met	Corps	Corps	HREP	See State Section 401 Stipulations
Post Construction	Performance Evaluation Monitoring	Determine success of project as related to objectives	Corps (quantitative) sponsor (Field Observation)	Corps USFWS	LTRM	See table 6-3
	Analysis of Biological Responses to Projects	Evaluate predictions and assumptions of habitat unit analysis. Studies beyond scope of performance evaluation, or if projects do not have desired biological results.	Corps	Corps	LTRM	--

1/ Long Term Resource Monitoring of the Environmental Management Program (P.L. 99-662)

2/ Habitat Rehabilitation and Enhancement Project of the Environmental Management Program (P.L. 99-662)

**TABLE 6-2  
RESOURCE MONITORING AND DATA COLLECTION SUMMARY 1/**

	Water Quality Data				Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre - project Phase	Design Phase	Post Const. Phase		Pre - project Phase	Design Phase	Post Const. Phase	Pre - project Phase	Design Phase	Post Const. Phase		
TYPE OF MEASUREMENT			Apr-Sep	Oct-Mar								
POINT MEASUREMENTS Water Quality Station W-M443.6G 2/											Corps	
Turbidity			2W	M								
Secchi Dish Transparency	2W		2W	M								
Suspended Solids	2W		2W	M								
Dissolved Oxygen	2W		2W	M								
Specific Conductance	2W		2W	M								
Water Temperature	2W		2W	M								
pH	2W		2W	M								
Total Alkalinity			2W	M								
Chlorophyll	2W		2W	M								
Velocity			2W	M								
Water Depth	2W		2W	M								
Water Elevation	2W		2W	M								
Percent Ice Cover				M								
Ice Depth				M								
Percent Snow Cover				M								
Snow Depth												
Wind Direction			2W	M								
Wind Velocity			2W	M								
Wave Height			2W	M								
Air Temperature			2W	M								
Percent Cloud Cover			2W	M								

**TABLE 6-2  
RESOURCE MONITORING AND DATA COLLECTION SUMMARY 1/**

	Water Quality Data			Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre - project Phase	Design Phase	Post Const. Phase	Pre - project Phase	Design Phase	Post Const. Phase	Pre - project Phase	Design Phase	Post Const. Phase		
<b>TYPE OF MEASUREMENT</b>			<b>Apr-Sep</b>	<b>Oct-Mar</b>							
<b>POINT MEASUREMENTS</b>											
Sediment Test Station <u>3/</u>										Corps	
Elutriate		1									
Bulk Sediment		1									
Column Settling Stations <u>4/</u>										Corps	
Column Settling Analysis						1					
Boring Stations <u>5/</u>										Corps	
Geotechnical Borings						1					
<b>TRANSECT MEASUREMENTS</b>											
Sedimentation Transects <u>6/</u>										Corps	
Hydrographic Soundings					1						
Sedimentation Transects <u>7/</u>										Corps	
Hydrographic Soundings							5Y				
Vegetation Transects <u>8/</u>										Corps	
Mast Tree Survey										5Y	

**TABLE 6-2**  
**RESOURCE MONITORING AND DATA COLLECTION SUMMARY 1/**

	Water Quality Data				Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre - project Phase	Design Phase	Post Const. Phase		Pre - project Phase	Design Phase	Post Const. Phase	Pre - project Phase	Design Phase	Post Const. Phase		
TYPE OF MEASUREMENT			Apr-Sep	Oct-Mar								
AREA MEASUREMENTS												
Mapping 9/ Aerial Photography								1		5Y	Corps	

LEGEND FOR TABLE 6-2

W	=	Weekly
M	=	Monthly
Y	=	Yearly
nW	=	n-Week Interval
nY	=	n-Year Interval
1,2,3,...	=	number of times data is collected within designated project phase

END NOTES FOR TABLE 6-2

1/ Post Construction monitoring sites/transects are shown on drawing MP-1. See DPR for Pre-Project and Design Phase station locations.

2/ W-M462.9T  
W-M462.6O  
W-M462.6N  
W-M462.4P

3/ Sediment Test Stations (Design Phase)

DPR-R-1  
DPR-R-2  
DPR-R-3  
DPR-L-1  
DPR-L-2  
DPR-L-3

4/ Column Settling Station (Design Phase)

(50# Settlement Analysis)  
DPR-Sample 1  
DPR-Sample 2

5/ Boring Stations (Design Phase)

DPR A-87-1 through A-87-14

6/ Sedimentation Transects (Pre-Project Phase)

DPR Tranverse with 16 cross-sections

7/ Sedimentation Transects (Post Construction Phase)

S-M462.9Q to S-M462.6X  
S-M462.8L to S-M462.5U  
S-M462.5M to S-M462.3U  
S-M462.2N to S-M462.1W  
S-M462.1N to S-M462.0Q  
S-M461.8O to S-M461.8V  
S-M461.7O to S-M461.7X  
S-M461.2S to S-M461.3Y

8/ Vegetation Transects (Post Construction Phase)

V-M462.9Q to V-M462.6X  
V-M462.8L to V-M462.5U  
V-M462.5M to V-M462.3U  
V-M462.2N to V-M462.1W

Sampling locations will be at equal 1/3 increments on each vegetative range. Excluding range end points, sampling will be every 300 feet on the upstream range and every 200 feet on the downstream range for a total of 6 points, 3 on each range.

9/ Mapping (Post Construction Phase)

Aerial survey will be performed of the project area to determine the amount of waterfowl resting and feeding water areas and to inventory potholes.

Table 6-3

## Post Construction Evaluation Plan

Goal/Objective	Enhancement Feature	Unit	Year 0 without Alternative	Year X with Alternative	Year 50 Target with Alternative	Feature Measurement Reference Table 6-2	Annual Field Observation by Site Manager
<b>Enhance Migratory Waterfowl Habitat</b>							
Increase reliable food production area (Moist soil species)	Provide water control	Acres	0	--	130	Perform Vegetation Transects <u>8/</u>	Development of Emergent Vegetation
Increase reliable resting and feeding water area	Mechanical Dredging	Acres	0	--	200	Perform hydrographic soundings of transects <u>7/</u>	Waterfowl presence or absence
<b>Enhance Aquatic Habitat</b>							
Restore deep (6 ft) aquatic habitat	Mechanical Dredging	Acre-foot	0	--	40	Perform hydrographic soundings of transects <u>7/</u>	Development of emergent vegetation within deep dredged areas
Restore Lentic-Lotic habitat access cross-sectional area	Mechanical Dredging Excavation	Sq. feet	0	--	180	Perform hydrographic soundings of transects <u>7/</u>	Development of emergent vegetation within access area
Improve dissolved oxygen concentration during critical stress periods	Mechanical Dredging and Gated Inlet Structure	Mg/l	< 4.0	--	> 4.0	Perform water quality testing at stations <u>1/</u>	Fish stress or fish kills
Reduce sedimentation in refuge	Construct Levee and divert tributary	Acre-foot / year	11	--	4.2	Perform hydrographic soundings of transects <u>7/</u>	Shoaling in shallow areas

**APPENDIX A**

**Agreement for Operation, Maintenance  
and Rehabilitation**

12 July 1989

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  
AT  
ANDALUSIA REFUGE, ILLINOIS

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 (FWS) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Andalusia Refuge, IL, 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. 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 on the Andalusia Refuge are 100% Federal, and all operation, maintenance, repair, and rehabilitation costs are to be cost shared, 75% Federal and 25% non-Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of creating a reliable food supply for migratory waterfowl, providing water level control on 130 acres of wetland, the creation of 9 acres of island habitat for the nesting of Canada geese, and the construction of deeper channels in the backwater area of Andalusia Refuge.

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. Construction: Construction of the project which consists of creating a reliable food supply for migratory waterfowl, providing water level control on 130 acres of wetland, the

creation of 9 acres of island habitat for the nesting of Canada geese, and the construction of deeper channels in the backwater area of Andalusia Refuge.

2. Major Rehabilitation: 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, DOA will construct the Andalusia Refuge Fish and Wildlife Enhancement Project as described in the Definite Project Report, "Andalusia Refuge Rehabilitation and Enhancement," dated January 1989, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The FWS 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 DOA encounters potential delays related to construction of the project, DOA will promptly notify FWS of such delays.

4. Maintenance of Records: 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. DOA shall maintain such books, records, documents, and other evidence for a minimum of three 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 FWS.

B. FWS is responsible for:

1. Operation, Maintenance, and Repair: Upon completion of construction as determined by the District Engineer, Rock Island, the FWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report entitled "Andalusia Refuge Rehabilitation and Enhancement," dated January 1989, in accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662.

2. Non-Federal Responsibilities: In accordance with Section 906(e) of the Water Resources Development Act, Public Law 99-662, the FWS shall obtain 25% of all costs associated with the operation, maintenance, and repair of the project from the Illinois Department of Conservation.

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 construction of the project.

VI. REPRESENTATIVES

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

FWS: Regional Director  
U.S. Fish and Wildlife Service  
Federal Building, Fort Snelling  
Twin Cities, Minnesota 55111

DOA: District Engineer  
U.S. Army Engineer District, Rock Island  
Clock Tower Building - P.O. Box 2004  
Rock Island, Illinois 61204-2004

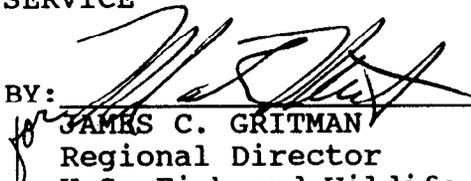
VII. EFFECTIVE DATE OF MOA

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: 

BY: 

NEIL A. SMART  
Colonel  
U.S. Army Engineer District,  
Rock Island  
Corps of Engineers

JAMES C. GRITMAN  
Regional Director  
U.S. Fish and Wildlife  
Service

DATE: 12 July 1989

DATE: July 17, 1989

**APPENDIX B**

**Site Manager's**

**Project Inspections And Monitoring Results**

ANDALUSIA REFUGE REHABILITATION AND ENHANCEMENT  
OPERATION AND MAINTENANCE MANUAL

UPPER MISSISSIPPI RIVER ENVIRONMENTAL MANAGEMENT PROGRAM  
POOL 16, RIVER MILES 462 THROUGH 463  
ROCK ISLAND, ILLINOIS

**SITE MANAGER'S PROJECT INSPECTION AND MONITORING RESULTS**

Inspected by \_\_\_\_\_ Date \_\_\_\_\_  
Type of Inspection (annual) (emergency-disaster) (other)

1. PROJECT INSPECTION.

<u>Item</u>	<u>Comment/Condition</u>
a. <u>Perimeter Levee.</u>	
( ) Settlement, sloughs, or loss of section.	_____
( ) Seepage, saturated areas, sand boils.	_____
( ) Wave-wash, scouring.	_____
( ) Overtopping erosion.	_____
( ) Vegetative cover (mowing).	_____
( ) Displaced/missing riprap.	_____
( ) Burrowing animals.	_____
( ) Unauthorized grazing or traffic.	_____
( ) Encroachments.	_____
b. <u>Water Control Structure.</u>	
( ) Pipes, gates, and operating mechanisms.	_____
( ) Concrete.	_____
( ) Displaced/missing riprap.	_____
( ) Blockage of inlet and outlet channels.	_____
( ) Erosion adjacent to structure.	_____
c. <u>Diversion Drainage Ditch.</u>	
( ) Debris.	_____
( ) Waste materials/unauthorized structures.	_____
( ) Bank Erosion.	_____

d. Dead Slough Excavation.

- ( ) Debris. \_\_\_\_\_
- ( ) Waste materials/unauthorized structures. \_\_\_\_\_
- ( ) Bank Erosion. \_\_\_\_\_

e. Refuge Drainage/Islands.

- ( ) Debris. \_\_\_\_\_
- ( ) Waste materials/unauthorized structures. \_\_\_\_\_
- ( ) Bank Erosion. \_\_\_\_\_

f. Pump Station.

- ( ) Building. \_\_\_\_\_
- ( ) Gates. \_\_\_\_\_
- ( ) Pumps. \_\_\_\_\_
- ( ) Control Panel. \_\_\_\_\_
- ( ) Trash Racks. \_\_\_\_\_

g. Dredge Material Placement Site.

- ( ) Mowing/herbicide treatment. \_\_\_\_\_

h. Access Road.

- ( ) Ditches. \_\_\_\_\_
- ( ) Culverts. \_\_\_\_\_
- ( ) Stone Surface. \_\_\_\_\_
- ( ) Riprap. \_\_\_\_\_
- ( ) Entrance gate. \_\_\_\_\_

i. Additional Comments.

\_\_\_\_\_  
Site Manager

**APPENDIX C**  
**Distribution List**

APPENDIX C

DISTRIBUTION LIST

ANDALUSIA REFUGE REHABILITATION AND ENHANCEMENT  
POOL 16, MISSISSIPPI RIVER MILES 462-463  
ROCK ISLAND COUNTY, ILLINOIS 1/

Regional Director  
U.S. Fish and Wildlife Service, Region 3  
Bishop Henry Whipple Federal Building  
1 Federal Drive  
Fort Snelling, Minnesota 55111-4056

U.S. Fish and Wildlife Service  
Mr. Dick Steinbach / Mr. Ross Adams  
Mark Twain National Wildlife Refuge  
1704 North 24th Street  
Quincy, Illinois 62301

Mr. Rick Nelson  
U.S. Fish and Wildlife Service  
4469 48th Avenue Court  
Rock Island, Illinois 61201

Mr. Marvin Hubbell  
Illinois Department of Conservation  
Impact Analysis Division  
600 North Grand Avenue, West  
Suite 6  
Springfield, Illinois 62701

Mr. Steve Moser  
Hennepin Canal Visitor Center  
RR #2  
Sheffield, Illinois 61361

Mr. Steve Francisko (2)  
Black Hawk State Park  
1510 46th Avenue  
Rock Island, IL 61201

Mr. Doug Dufford  
Illinois Department of Conservation  
205 E. Seminary Street  
Mount Carroll, Illinois 61053

Illinois Department of Conservation  
2612 Locust Street  
Sterling, Illinois 61081

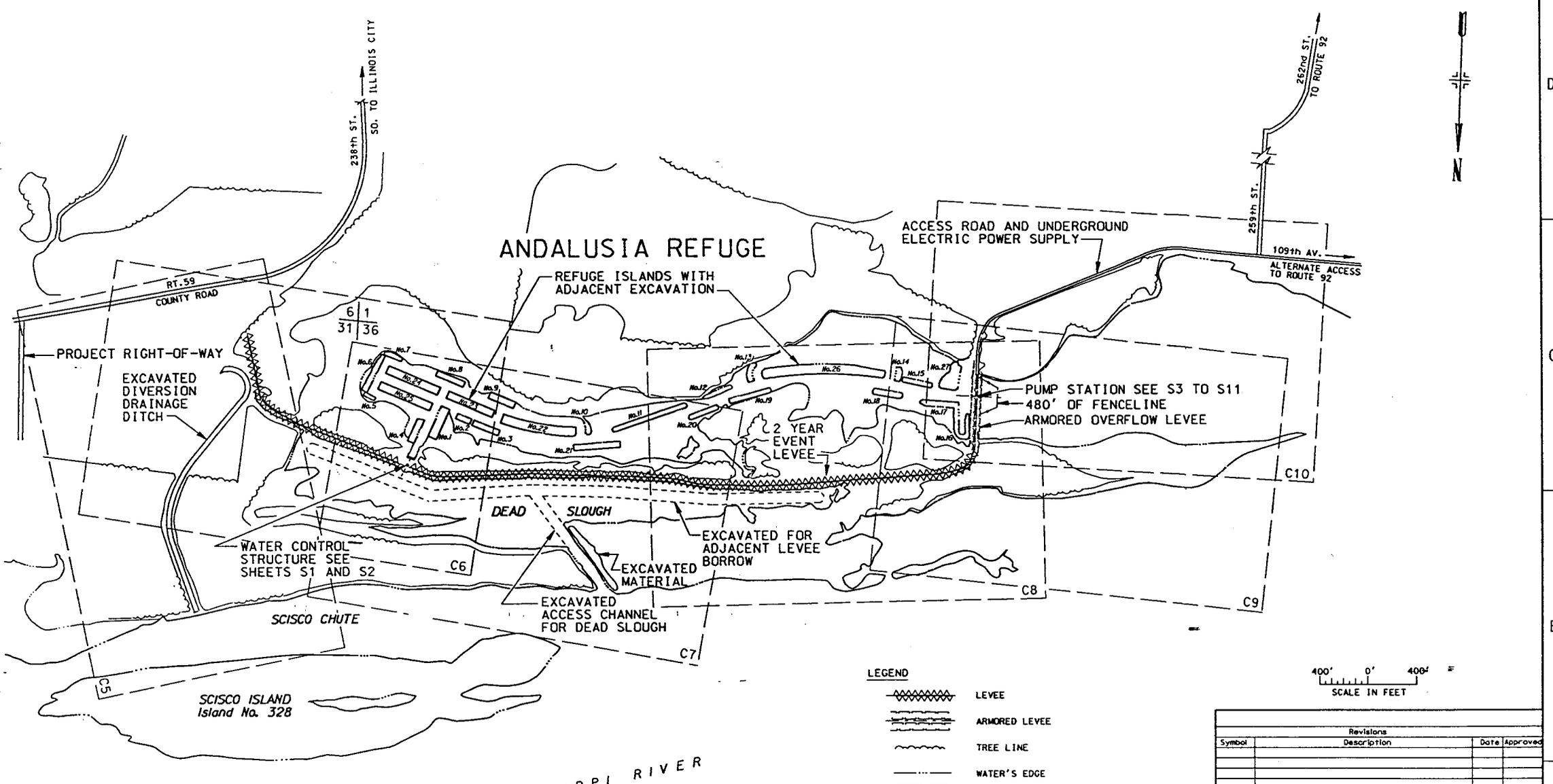
Division Engineer  
U.S. Army Engineer Division, North Central  
ATTN: CENCDD-PD-PL  
111 N. Canal Street, 12th Floor  
Chicago, Illinois 60606-7206

District Engineer  
U.S. Army Engineer District, Rock Island  
Clock Tower Building - P.O. Box 2004  
Rock Island, Illinois 61204-2004  
ATTN: CENCRED            CENCRED-HQ  
          CENCRED-D        CENCRED-PD-E  
          ✓CENCRED-DN (3) CENCRED-PD-W  
          CENCRED-DG (2) CENCRED-OD-S  
          CENCRED-G        CENCRED-OD-M  
          CENCRED-H        CENCRED-CD  
          CENCRED-IM-CL

1/ All addresses receive one copy of the document except where noted in parentheses.



# ANDALUSIA REFUGE



**LEGEND**

	LEVEE
	ARMORED LEVEE
	TREE LINE
	WATER'S EDGE
	SHEET REFERENCE

- NOTES**
- EXISTING ACCESS RIGHT-OF-WAY IS APPROXIMATELY 12' + BETWEEN EXISTING FENCES.
  - SEE DRAWING SHEETS C5 TO C11 FOR BORING LOCATIONS AND SURVEY INFORMATION.



Revisions			
Symbol	Description	Date	Approved
1	As Constructed	08-95	JJC/DRC

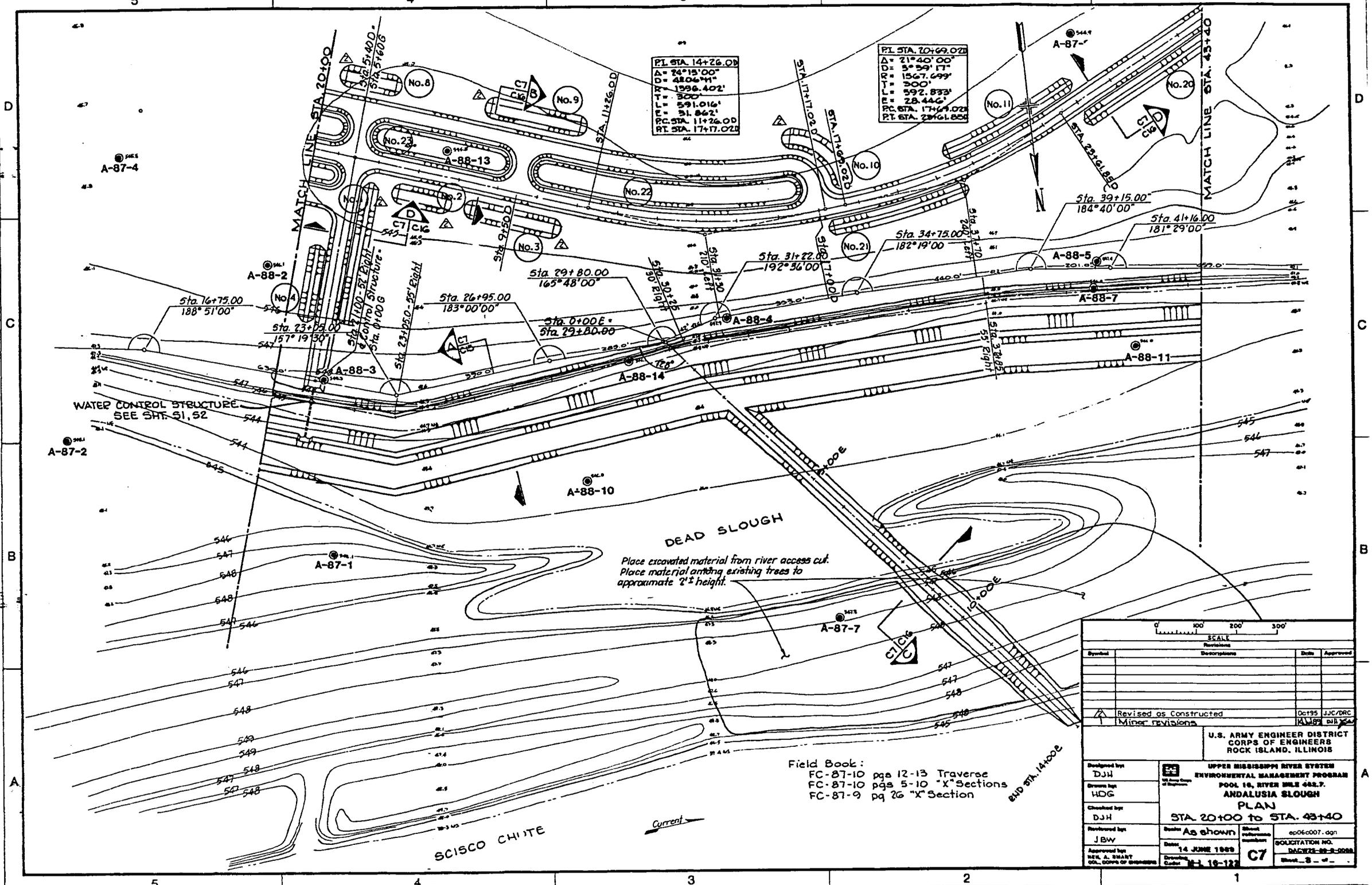
  

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS	
Designed by: DJH	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 16, RIVER MILE 462.7 ANDALUSIA SLOUGH
Drawn by: HDG BLV	<b>GENERAL PLAN</b>
Checked by: DJH	
Reviewed by: JBW	Scale: AS SHOWN Date: 14 June 1989
Approved by: REL A SHMIT COL, CORPS OF ENGINEERS	Sheet Reference Number: ep06c001.dgn Solicitation Number: DACW25-89-8-0068 Drawing Code: M-L 16-122 <b>C1</b> Sheet 2 of

MILE  
463







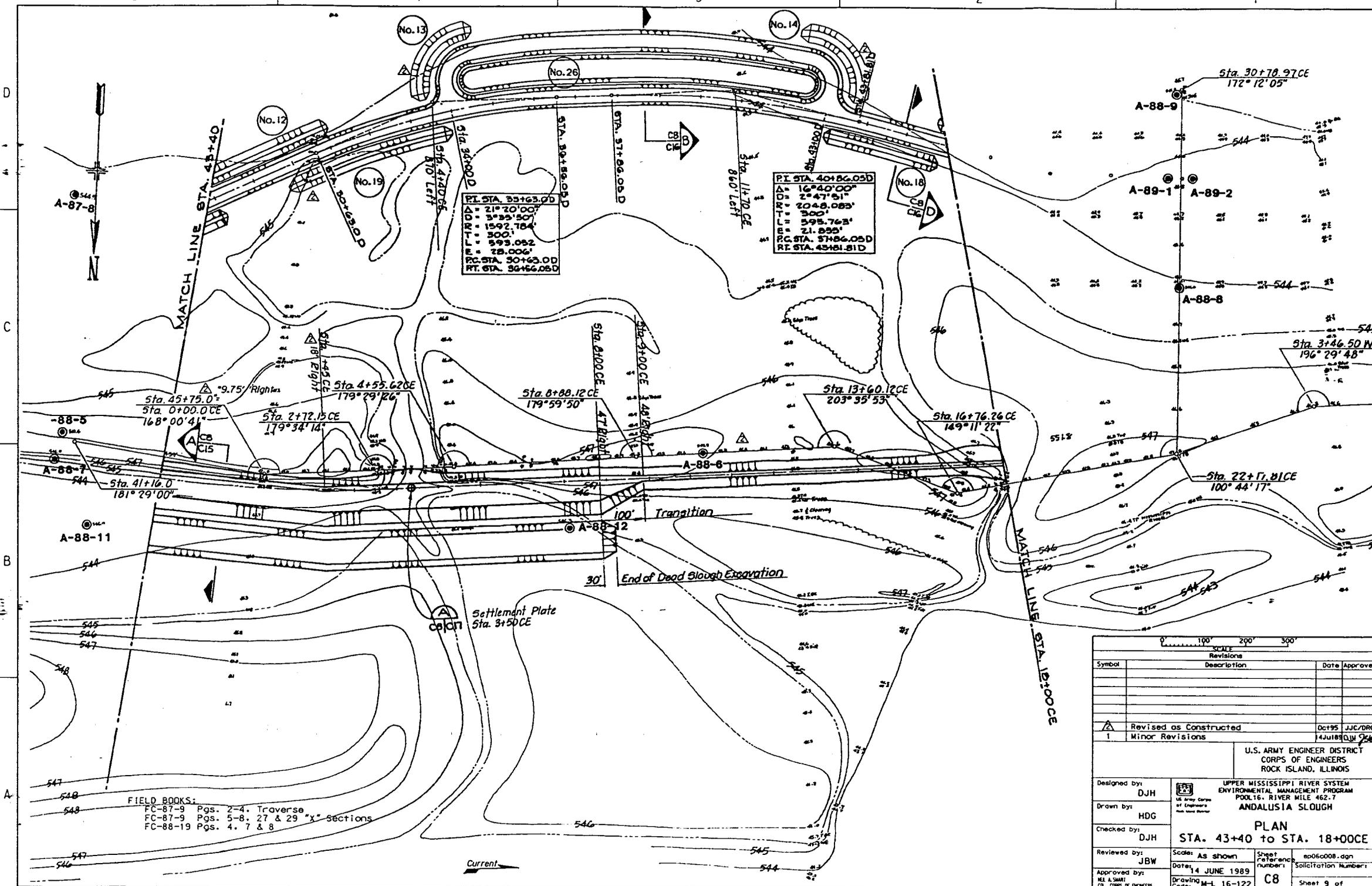
P.I. STA. 14+26.00  
 A = 24°15'00"  
 D = 4806.41'  
 L = 1996.402'  
 T = 300'  
 E = 591.016'  
 S = 51.862'  
 P.C. STA. 11+26.00  
 P.T. STA. 17+17.028

P.I. STA. 20+69.078  
 D = 21°40'00"  
 R = 1567.699'  
 L = 300'  
 E = 592.833'  
 S = 28.446'  
 P.C. STA. 17+69.078  
 P.T. STA. 23+61.055

Place excavated material from river access cut.  
 Place material around existing trees to  
 approximate 2' height.

Field Book:  
 FC-87-10 pgs 12-13 Traverse  
 FC-87-10 pgs 5-10 "X" Sections  
 FC-87-9 pg 26 "X" Section

0' 100' 200' 300' SCALE													
<table border="1"> <thead> <tr> <th>Symbol</th> <th>Description</th> <th>Date</th> <th>Approved</th> </tr> </thead> <tbody> <tr> <td>▲</td> <td>Revised as Constructed</td> <td>Oct 195</td> <td>JJC/DRC</td> </tr> <tr> <td>▲</td> <td>Minor revisions</td> <td>11/195</td> <td>WLB</td> </tr> </tbody> </table>	Symbol	Description	Date	Approved	▲	Revised as Constructed	Oct 195	JJC/DRC	▲	Minor revisions	11/195	WLB	U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS
Symbol	Description	Date	Approved										
▲	Revised as Constructed	Oct 195	JJC/DRC										
▲	Minor revisions	11/195	WLB										
Designed by DJH	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 18, RIVER MILE 482.7 ANDALUSIA SLOUGH PLAN STA. 20+00 TO STA. 43+40												
Drawn by HDG	Checked by DJH												
Reviewed by JBV	Date 14 JUNE 1959												
Approved by SEN. A. SMART COL., Corps of Engineers	Drawing C7												



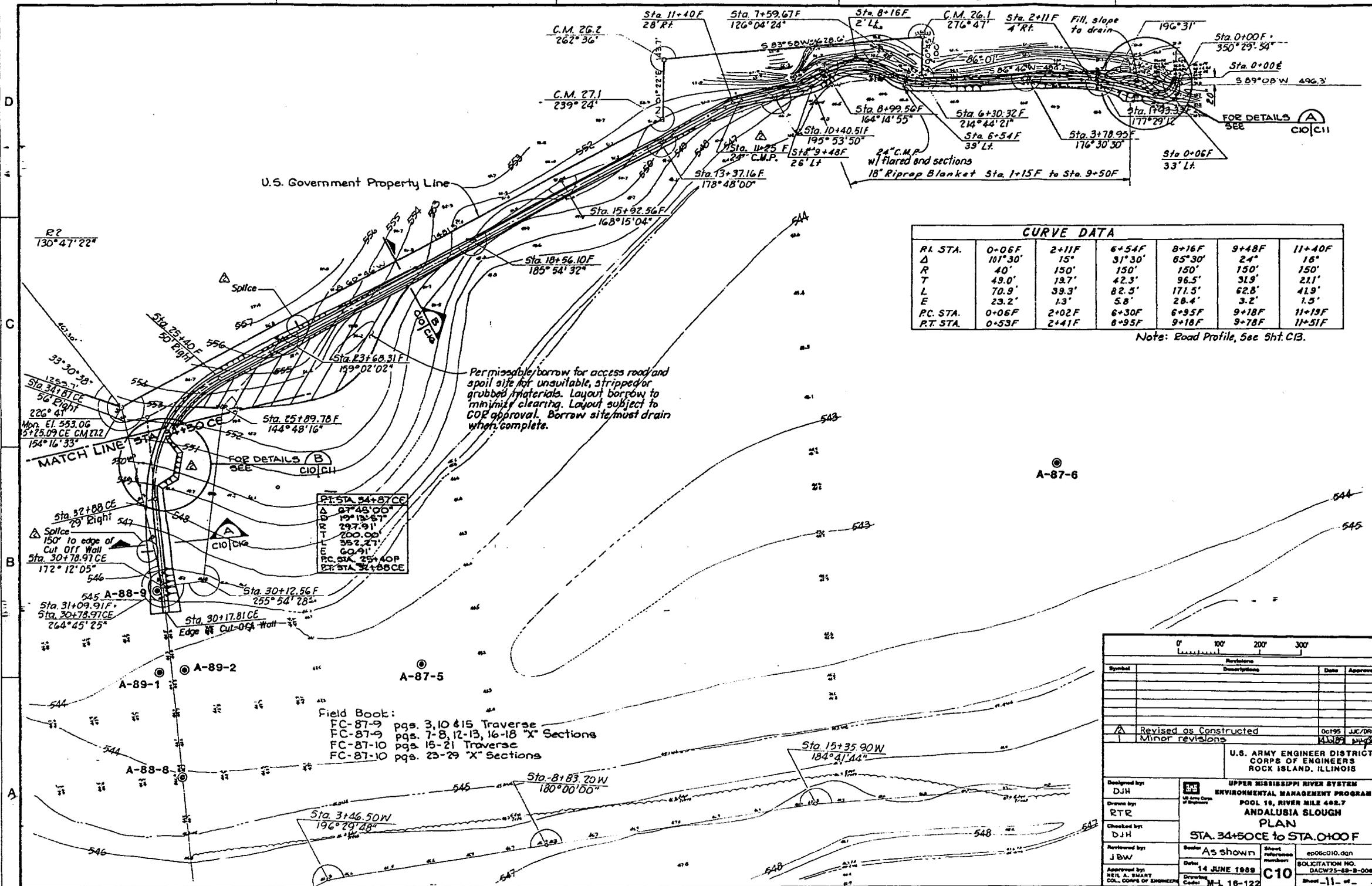
PI STA. 33+63.00  
 Δ = 21° 20' 00"  
 D = 3° 35' 50"  
 R = 2048.083'  
 T = 300'  
 L = 595.763'  
 E = 21.835'  
 PC STA. 30+63.00  
 PT STA. 36+63.00

PI STA. 40+86.05D  
 Δ = 16° 40' 00"  
 D = 2° 47' 51"  
 R = 2048.083'  
 T = 300'  
 L = 595.763'  
 E = 21.835'  
 PC STA. 37+86.05D  
 PT STA. 43+86.05D

SCALE 0 100' 200' 300'		
Revisions		
Symbol	Description	Date Approved
△	Revised as Constructed	Oct 95 JJC/DRC
1	Minor Revisions	14 Jul 89 DJW
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS		
Designed by: DJH	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 16 - RIVER MILE 462.7 ANDALUSIA SLOUGH	
Drawn by: HDG	<b>PLAN</b> <b>STA. 43+40 to STA. 18+00CE</b>	
Checked by: DJH	Scale: As shown	Sheet Reference: ep06c008.dgn
Reviewed by: JBW	Date: 14 JUNE 1989	Solicitation Number:
Approved by: MEL A. SMART CO., CORPS OF ENGINEERS	Drawing Code: M-L 16-122	Sheet 9 of

FIELD BOOKS:  
 FC-87-9 Pgs. 2-4, Traverse  
 FC-87-9 Pgs. 5-8, 27 & 29 "x" Sections  
 FC-88-19 Pgs. 4, 7 & 8





**CURVE DATA**

RI STA.	0+06F	2+11F	6+54F	8+16F	9+48F	11+40F
$\Delta$	101°30'	15°	31°30'	65°30'	24°	16°
R	40'	150'	150'	150'	150'	150'
T	49.0'	18.7'	42.3'	96.5'	31.9'	21.1'
L	70.9'	39.3'	82.5'	171.5'	62.8'	41.9'
E	23.2'	1.3'	5.8'	28.4'	3.2'	1.5'
PC STA.	0+06F	2+02F	6+30F	6+95F	9+18F	11+19F
PT STA.	0+53F	2+41F	6+95F	9+18F	9+78F	11+51F

Note: Road Profile, See Sht. C13.

**PT STA 34+87CC**

$\Delta$	97°45'00"
D	197'18.51'
R	297.91'
T	200.00'
L	352.27'
E	60.91'
PC STA.	25+40F
PT STA.	32+88CE

Field Book:  
 FC-87-9 pgs. 3, 10 & 15 Traverse  
 FC-87-9 pgs. 7-8, 12-13, 16-18 "X" Sections  
 FC-87-10 pgs. 15-21 Traverse  
 FC-87-10 pgs. 23-29 "X" Sections

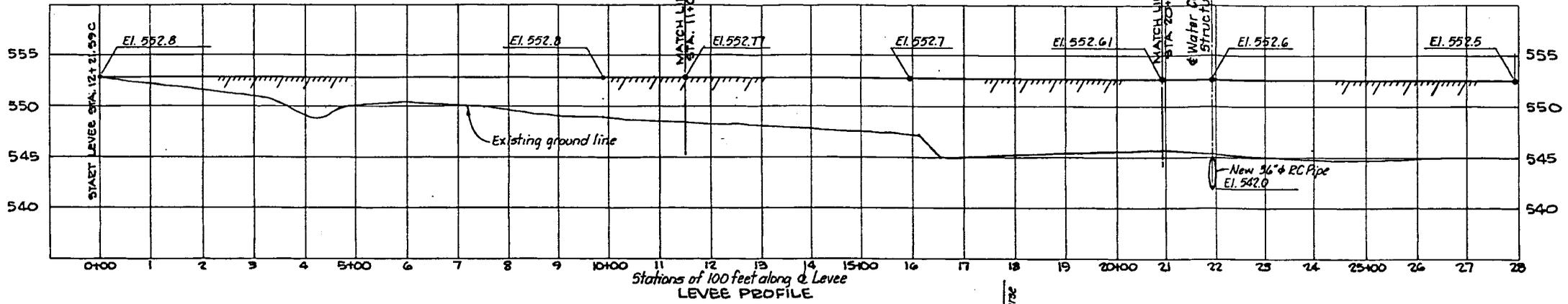
0' 100' 200' 300'

Symbol	Revisions	Date	Approved
	Revised as Constructed	Oct 95	JJC/DR
	Minor revisions	11/28/95	MJG/DR

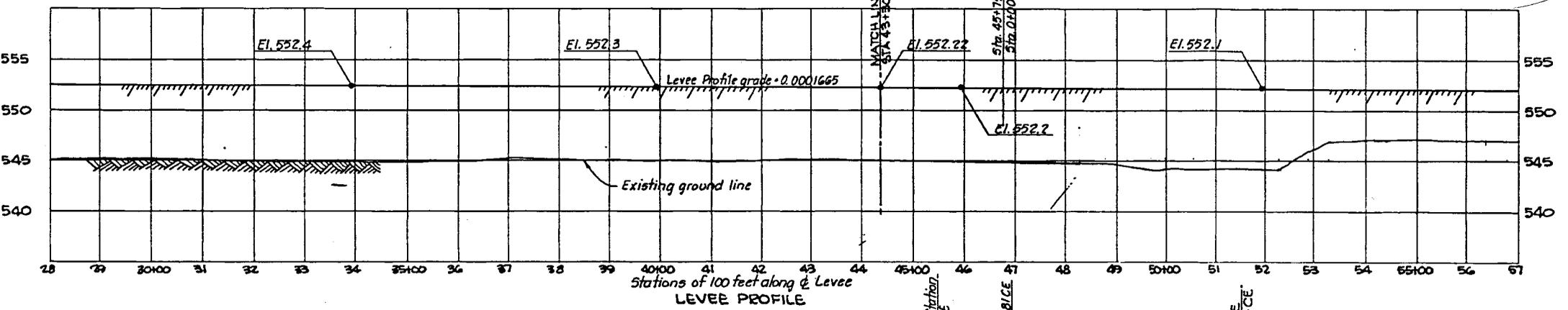
**U.S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
ROCK ISLAND, ILLINOIS**

Designed by: DJH		<b>UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM</b>	
Drawn by: RTR		POOL 16, RIVER MILE 402.7 ANDALUSIA SLOUGH	
Checked by: DJH		<b>PLAN STA. 34+50CE to STA. 0+00F</b>	
Reviewed by: JBW	Scale: As shown	Sheet reference number: ep06c010.dgn	SOLICITATION NO. DACW25-89-B-0088
Approved by: REIL A. SMARY COL., CORPS OF ENGINEERS	Date: 14 JUNE 1989	Drawing Code: M-1 16-122	Sheet -11- of -

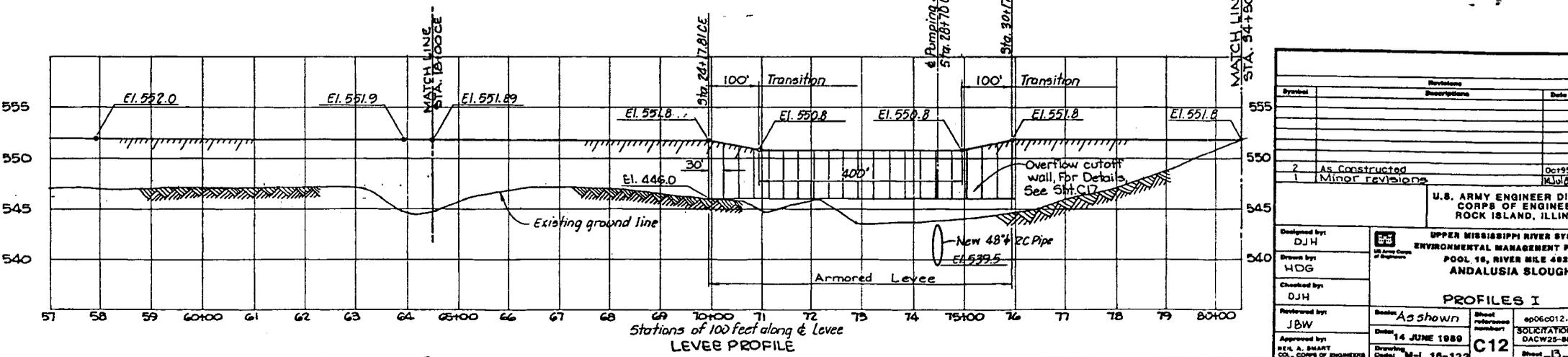
Elevations in feet (M.S.L. 1912)



Elevations in feet (M.S.L. 1912)



Elevations in feet (M.S.L. 1912)



Revisions			
Symbol	Descriptions	Date	Approved
2	As Constructed	06-95	JJC/DRC
1	Minor revisions	06-95	JJC/DRC

U.S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
ROCK ISLAND, ILLINOIS

UPPER MISSISSIPPI RIVER SYSTEM  
ENVIRONMENTAL MANAGEMENT PROGRAM  
POOL 16, RIVER MILE 482.7  
ANDALUSIA SLOUGH

PROFILES I

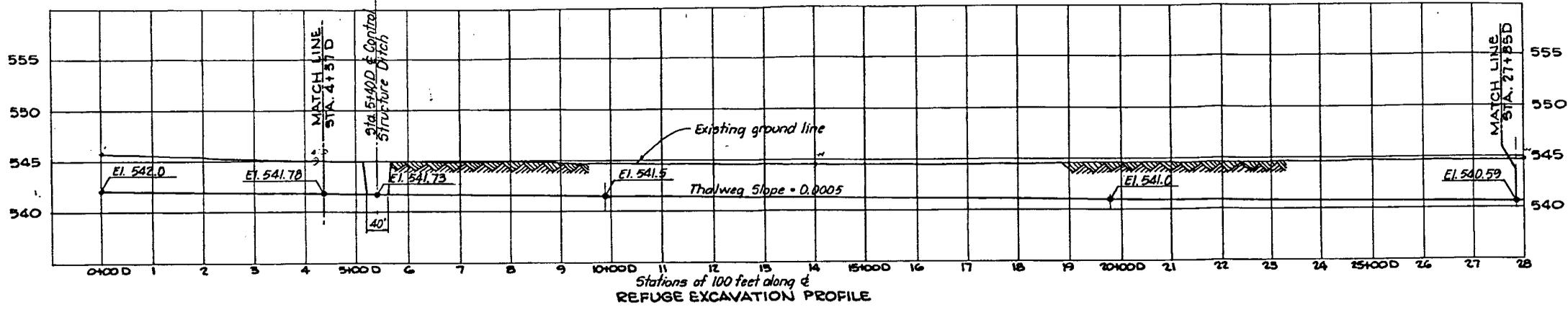
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Drawn by: HDG  
Checked by: DJH  
Reviewed by: JBW  
Approved by: REA A. SMART  
COL., CORPS OF ENGINEERS

Scale: As shown  
Date: 14 JUNE 1989  
Drawing Date: M-L 16-122

Sheet reference number: C12  
Sheet: 13 of 13

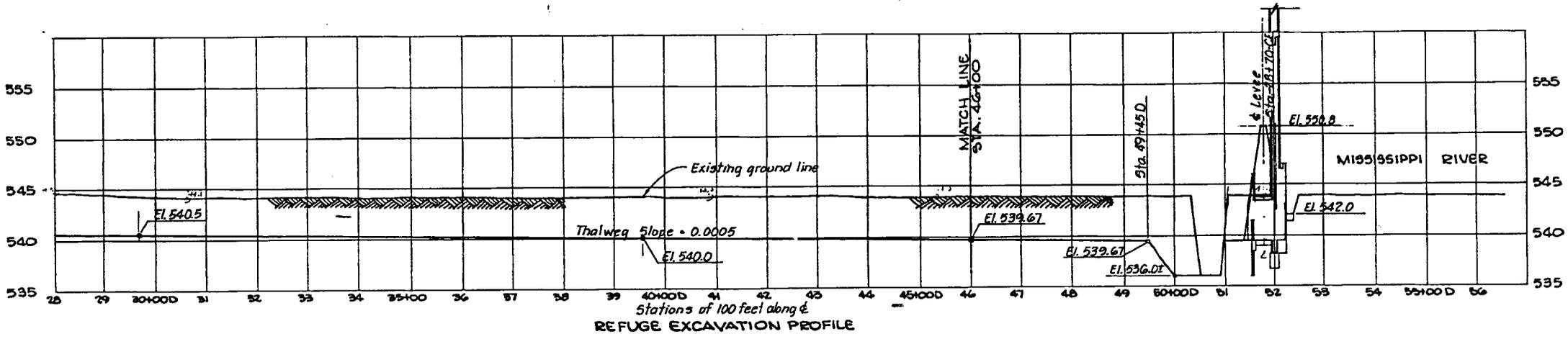


Elevations in feet (M.S.L. 1912)



Stations of 100 feet along & REFUGE EXCAVATION PROFILE

Elevations in feet (M.S.L. 1912)



Stations of 100 feet along & REFUGE EXCAVATION PROFILE

Revisions			
Symbol	Descriptions	Date	Approved
2	As Constructed	Oct 195	JJC/DR
1	Minor revisions	11/1/58	DR

U.S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
ROCK ISLAND, ILLINOIS

Designed by <b>DJH</b>		<b>UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM</b>	
Drawn by <b>HDS</b>		<b>POOL 16, RIVER MILE 462.7 ANDALUSIA SLOUGH</b>	
Checked by <b>DJH</b>		<b>PROFILES III</b>	
Reviewed by <b>JBW</b>	Scale <b>As shown</b>	Sheet reference number <b>ep06c014.dgn</b>	<b>C14</b> SOLICITATION NO. <b>DACW25-88-B-0068</b> Sheet <b>15</b> of <b>15</b>
Approved by <b>WEL A. SMART</b> COL, CORPS OF ENGINEERS	Date <b>14 JUNE 1988</b>	Directing Officer <b>M-L 16-122</b>	

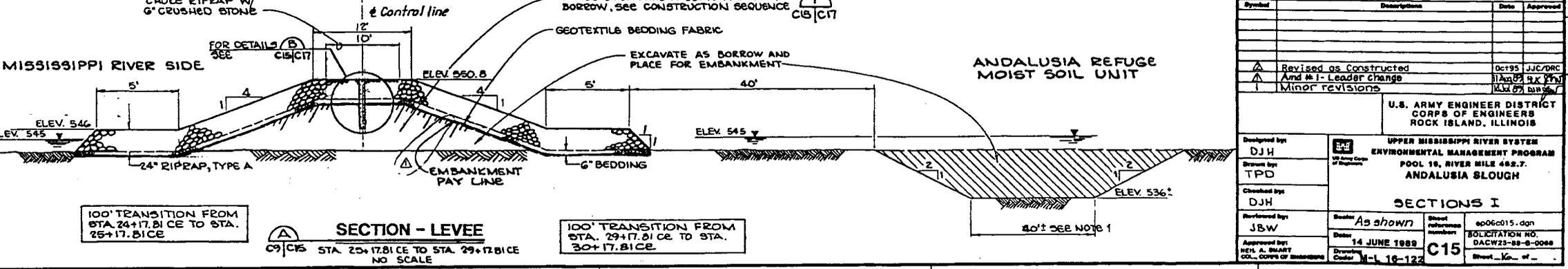
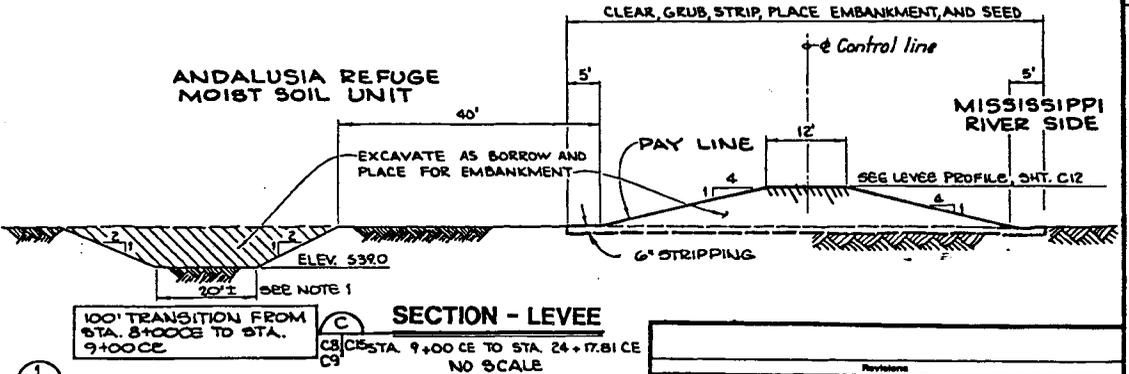
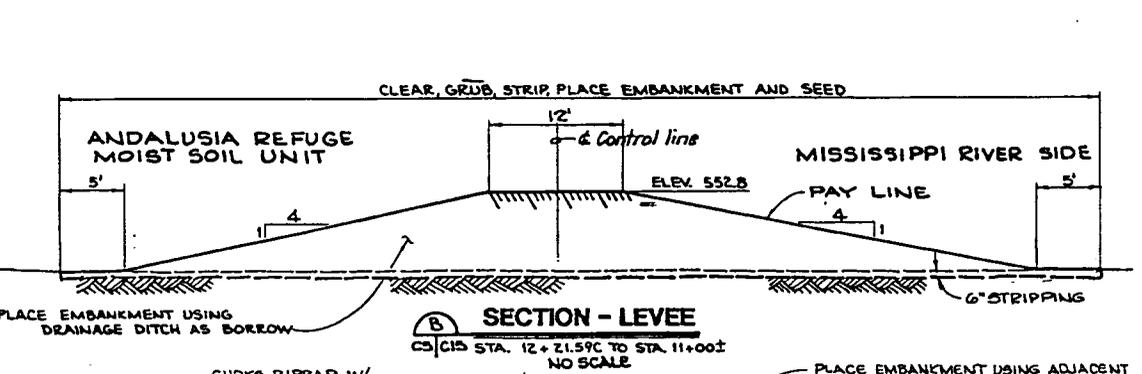
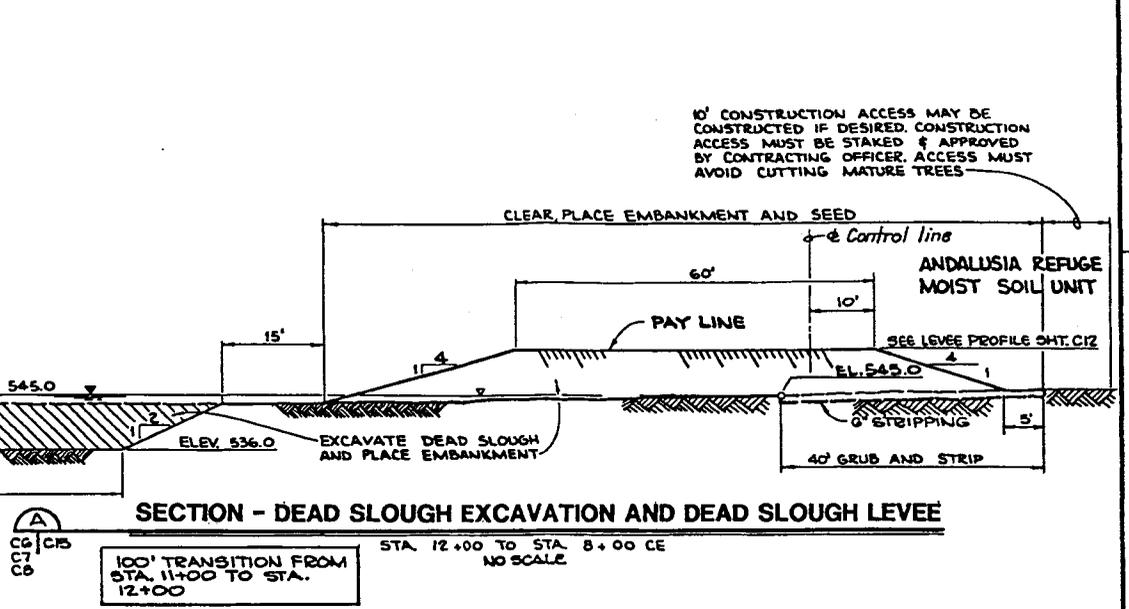
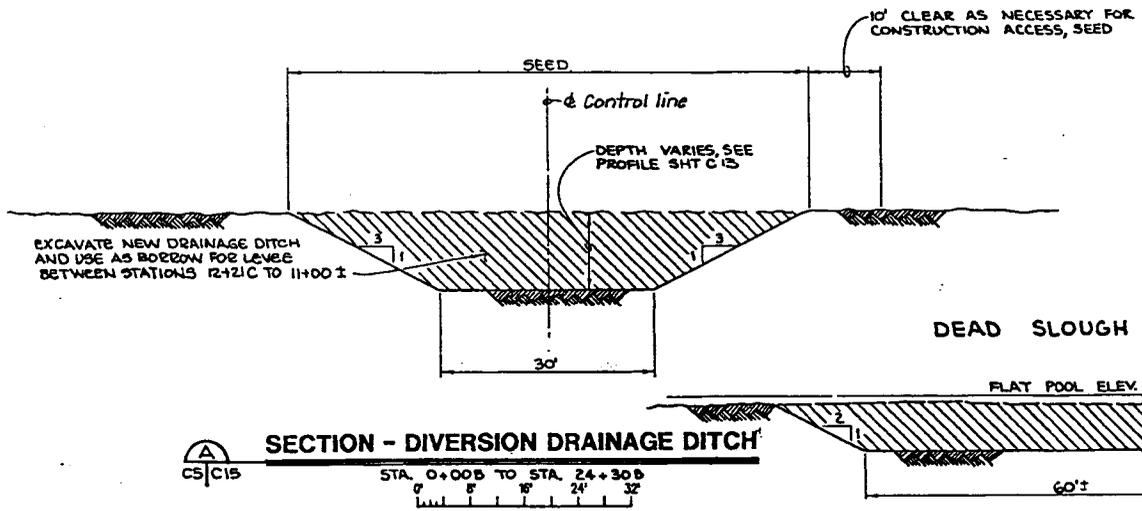
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4

3

2

1



Revisions			
Symbol	Description	Date	Approved
△	Revised as Constructed	01/95	JJC/DRC
△	And as 1- Leader Change	11/02	RK/PW
△	Minor revisions	04/07	BR/ST

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS

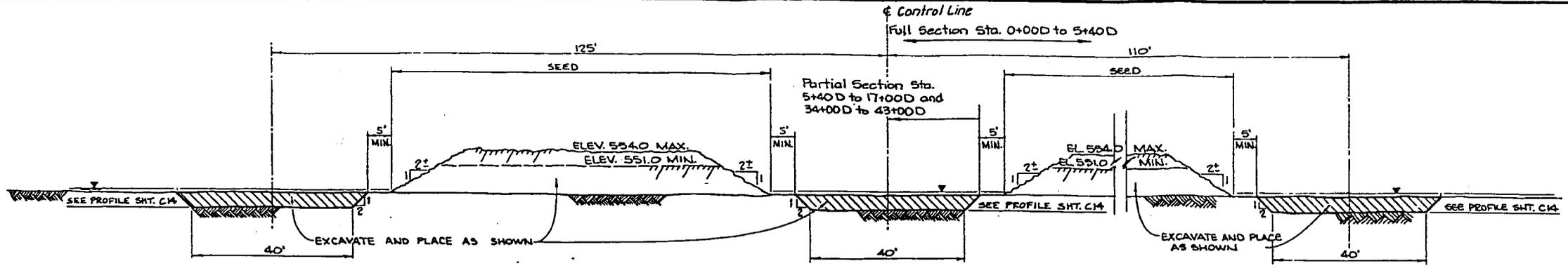
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 Drawn by: TPD  
 Checked by: DJH  
 Reviewed by: JBW  
 Approved by: NEIL A. SMART, COL., CORPS OF ENGINEERS

UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 18, RIVER MILE 482.7, ANDALUSIA SLOUGH

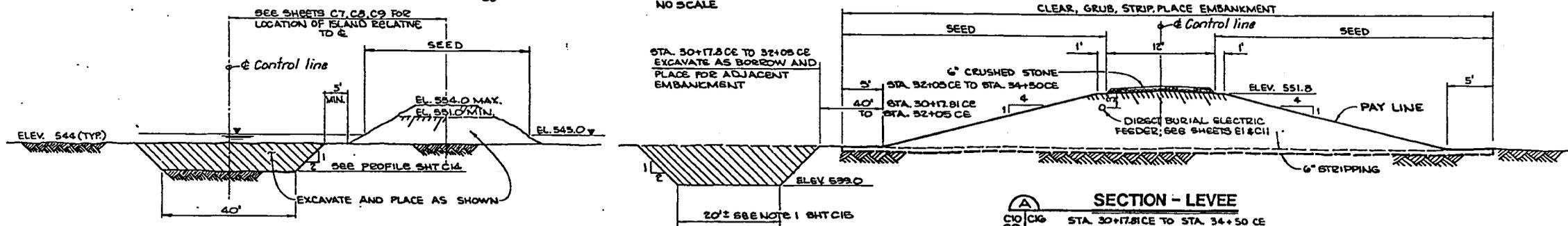
SECTIONS I

Sheet: As shown  
 Date: 14 JUNE 1989  
 Drawing Code: M-L 18-122

Sheet reference number: e006c015.dgn  
 SOLEICATION NO. DACW23-88-8-0066  
 C15

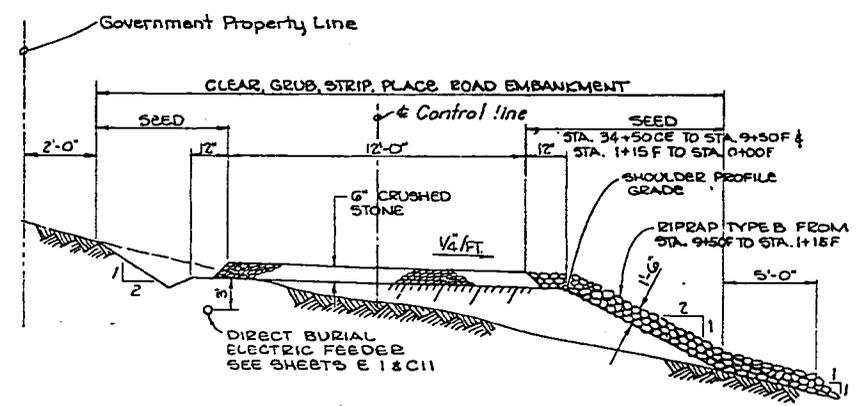


**SECTION-REFUGE ISLAND**  
 STA. 0+00D TO STA. 19+00D  
 STA. 34+00D TO STA. 43+00D  
 NO SCALE

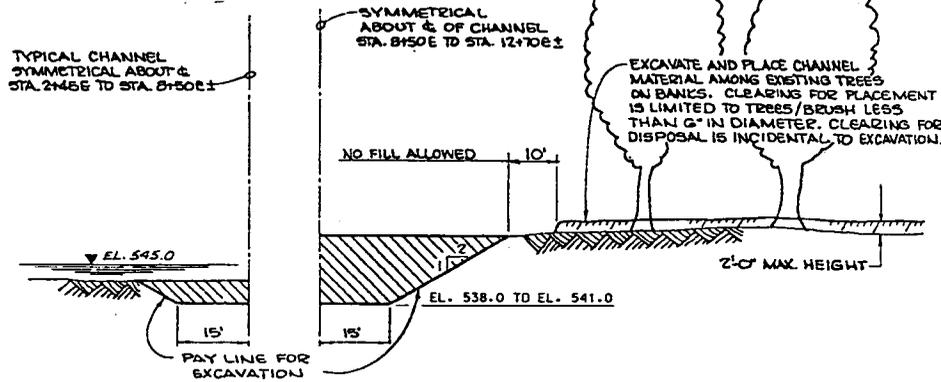


**SECTION - LEVEE**  
 STA. 30+17.81 CE TO STA. 34+50 CE

**SECTION-REFUGE ISLAND**  
 STA. 0+00G TO STA. 5+00G  
 STA. 19+00D TO STA. 34+00D  
 STA. 43+00D TO STA. 50+45D  
 NO SCALE



**SECTION - ACCESS ROAD (TYP.)**  
 STA. 34+50 CE TO STA. 0+00F  
 (NO SCALE)



**SECTION - RIVER ACCESS**  
 STA. 2+43E TO STA. 14+00E  
 (NO SCALE)

Revisions			
Symbol	Description	Date	Approved
2	As Constructed	Oct 95	JJC/DRC
1	Minor revisions	12/01/04	DJH

U.S. ARMY ENGINEER DISTRICT  
 CORPS OF ENGINEERS  
 ROCK ISLAND, ILLINOIS

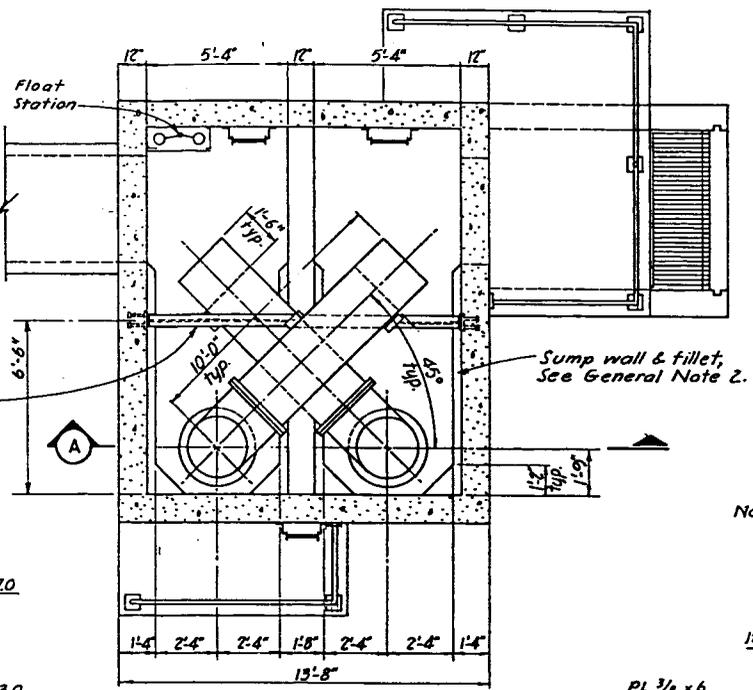
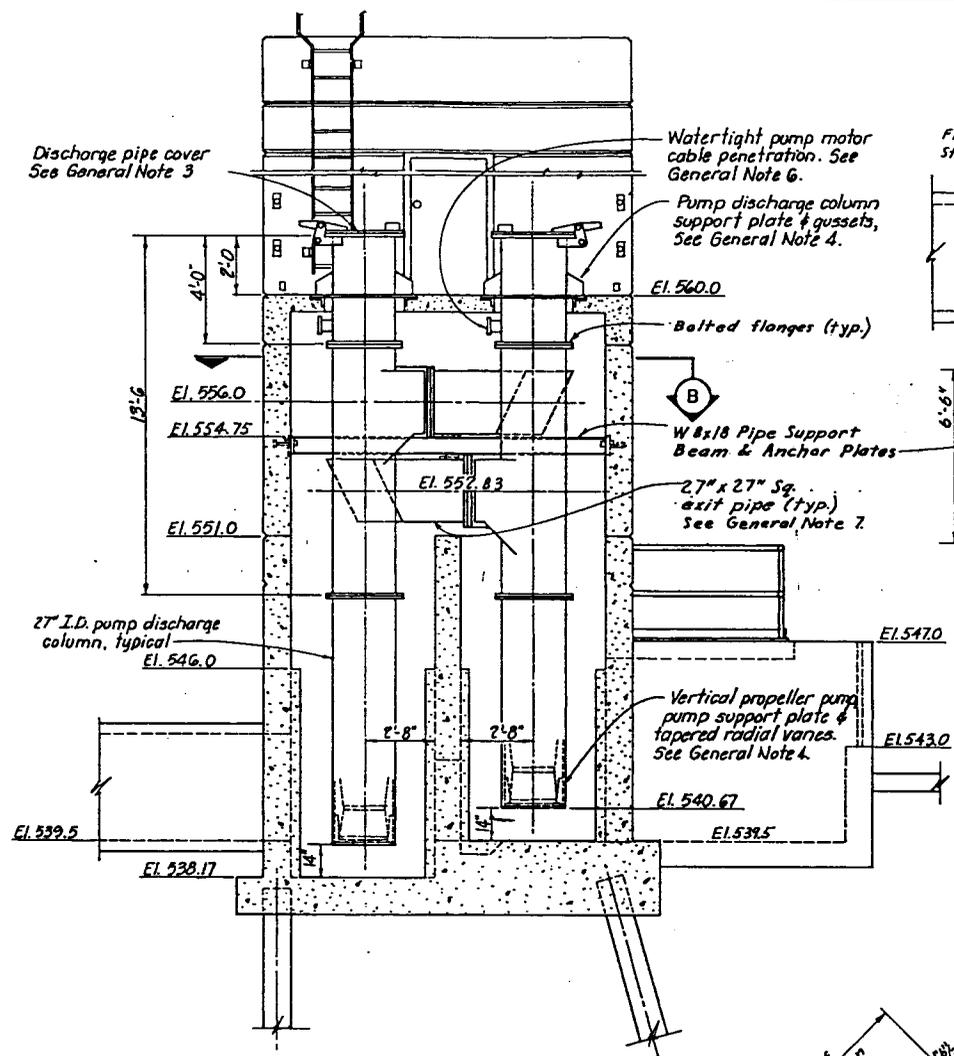
UPPER MISSISSIPPI RIVER SYSTEM  
 ENVIRONMENTAL MANAGEMENT PROGRAM  
 POOL 16, RIVER MILE 462.7  
 ANDALUSIA SLOUGH

**SECTIONS II**

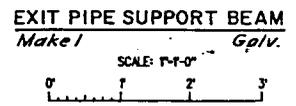
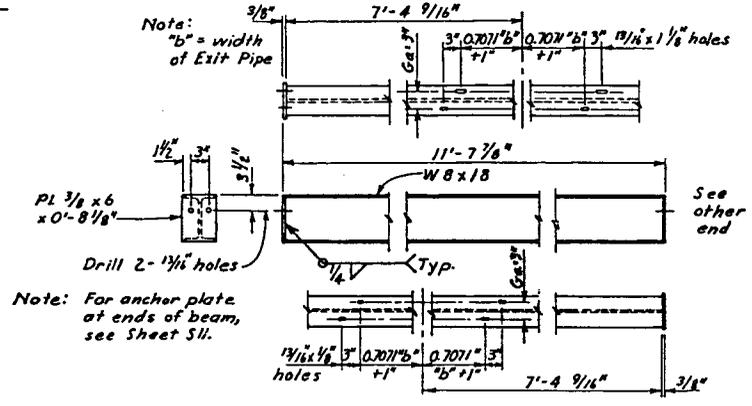
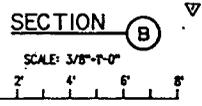
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Drawn by: TPD HDG	Date: 14 JUNE 1989	SOLICITATION NO. DACW25-89-B-0088
Checked by: DJH	Approved by: MIL. E. BERRY COL., CORPS OF ENGINEERS	Drawing Code: M-L 16-122

Sheet 17 of 17

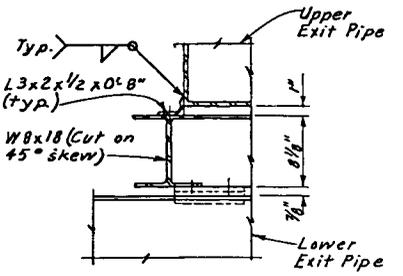
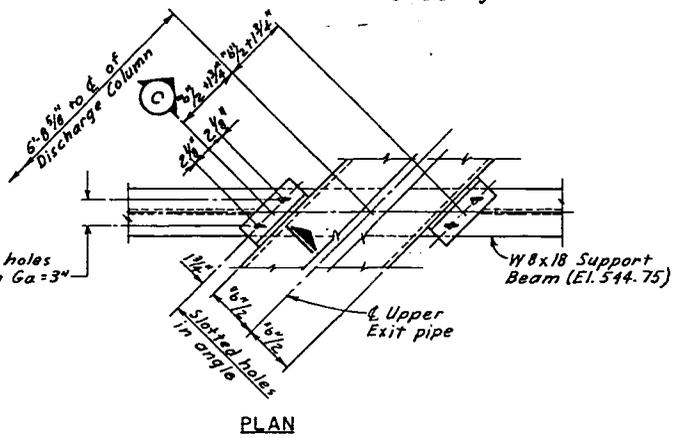




- GENERAL NOTES:**
1. THE PUMPS AND PUMP DISCHARGE COLUMNS ARE IDENTICAL EXCEPT FOR VERTICAL LOCATION OF SQUARE EXIT PIPES AND GENERAL ORIENTATION.
  2. FOR EACH SUMP THE TOP OF THE SUMP WALL AND FILLET IS AT ELEVATION 546.0.
  3. DISCHARGE COLUMNS SHALL BE FURNISHED WITH BOLTED, FLANGED, AND RINGED PIPE ACCESS COVERS WITH HANDLE, CAPABLE OF OPENING TO 115 DEGREES FROM CLOSED POSITION.
  4. DISCHARGE COLUMN, SUPPORT PLATE AND GUSSETS SHALL BE DETAILED & FABRICATED BY PUMP MANUFACTURER.
  5. INSTALL LATERAL SUPPORTS (NOT SHOWN) NEAR EACH PUMP IMPELLER AND AT OTHER LOCATIONS DEEMED NECESSARY, AS DETAILED AND FABRICATED BY PUMP MANUFACTURER. LATERAL SUPPORTS SHALL BE DETACHABLE FROM PIPING FOR EASE OF INSTALLATION.
  6. MOTOR CABLE PENETRATIONS MAY BE LOCATED AT ANY ANGLE TO FACILITATE INSTALLATION AND MAINTENANCE.
  7. VERIFY DIMENSIONS OF EXIT PIPE BEFORE FABRICATION OF SUPPORT BEAM.



- Notes:**
1. "b" = Outside width of Exit Pipe.
  2. Lower Exit Pipe not shown for clarity.



**EXIT PIPE/SUPPORT BEAM CONNECTION DETAILS**

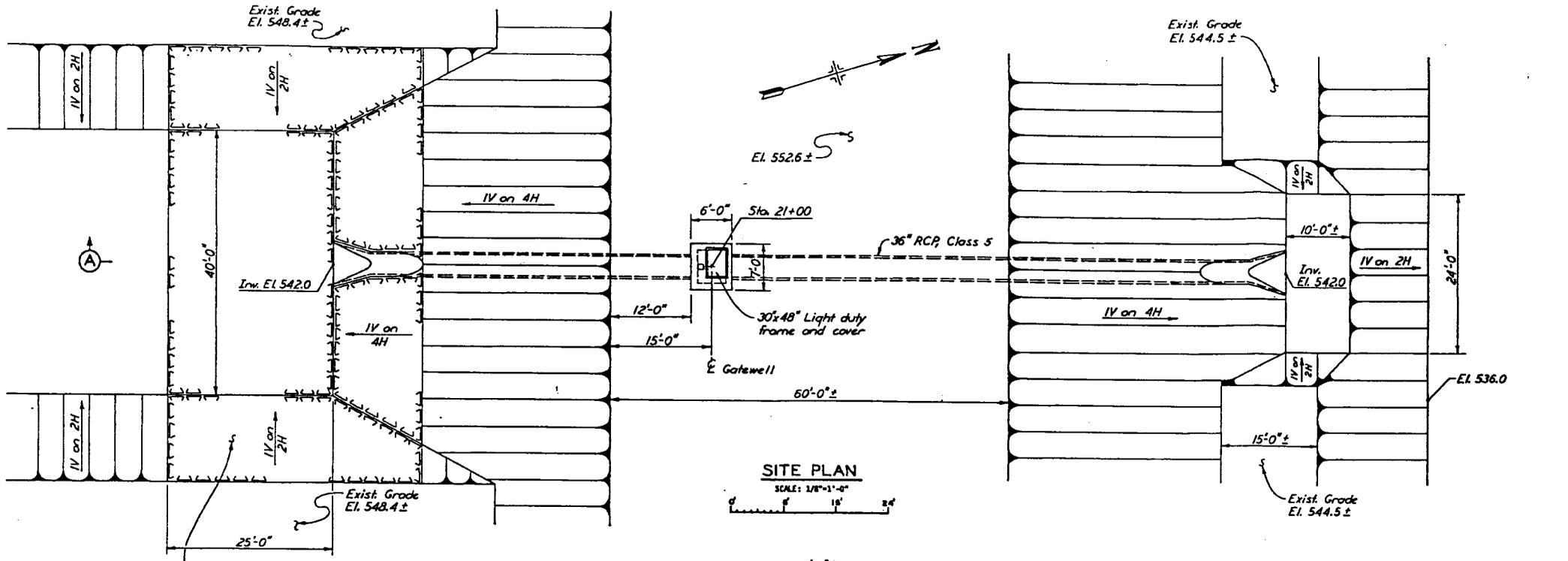
Symbol	Revisions Description	Date	Approved
2	As Constructed	06/95	JJC/DRC
✓	MINOR REVISIONS		

**U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS  
ROCK ISLAND, ILLINOIS**

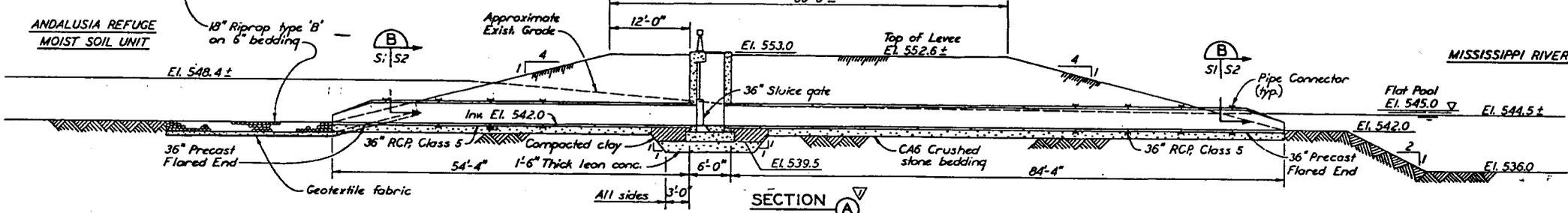
**UPPER MISSISSIPPI RIVER SYSTEM  
ENVIRONMENTAL MANAGEMENT PROGRAM  
POOL 16, RIVER MILE 462.7  
ANDALUSIA SLOUGH**

**PUMP STATION MECHANICAL**

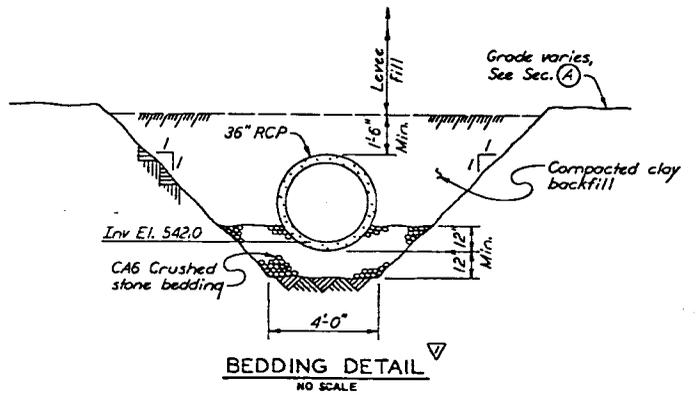
Designed by: <b>BVC KEW</b>	Scale: <b>AS SHOWN</b>	Sheet reference number: <b>ep06m016.dgn</b>
Drawn by: <b>HDG</b>	Date: <b>14 JUNE 1989</b>	SOLICITATION NO. <b>DACW25-89-8-0088</b>
Checked by: <b>DJH</b>	Drawn by: <b>M-L 16-122</b>	<b>M1</b> Sheet <b>30</b> of <b>...</b>
Reviewed by: <b>JBW</b>	Approved by: <b>W.H. A. BERRY</b> COL, CORPS OF ENGINEERS	



**SITE PLAN**  
SCALE: 1/8"=1'-0"



**SECTION A**  
SCALE: 1/8"=1'-0"



**BEDDING DETAIL**  
NO SCALE

- NOTES:**
- DESIGN CRITERIA:
    - CONCRETE: 1" (28 DAYS) = 3,800 PSI.
    - REINFORCING STEEL: ASTM A615, GRADE 60.
  - PROVIDE 3/4 INCH CHAMFER AT ALL EXPOSED EDGES.
  - PROVIDE THE FOLLOWING CONCRETE CLEAR COVER FOR REINFORCING STEEL, UNLESS OTHERWISE NOTED:
    - TOP SLAB AND SIDE WALLS: 2 INCHES.
    - TOP OF BOTTOM SLAB: 2 1/2 INCHES.
    - BOTTOM OF BOTTOM SLAB: 3 INCHES.
  - THE CONSTRUCTION SITE WILL REQUIRE DEWATERING. SEE SHEET C5 FOR TOPOGRAPHY.

- REFERENCES:**
- FOR LOCATION OF THIS WORK, SEE SHEET C1.
  - FOR BORING LOGS, SEE SHEET C4.
  - FOR HYDRAULIC DATA, SEE SHEETS C2 AND C3.
  - FOR BENCH MARK, SEE SHEET C3.

Revisions			
Symbol	Description	Date	Approved
2	AS CONSTRUCTED	OCT95	JJC/DRC
∇	MINOR REVISIONS AND GRADING CHANGES	11.AUG.95	JJC/WB

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by: <b>K.E.W.</b>	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 16, RIVER MILE 482.7, ANDALUSIA SLOUGH		
Drawn by: <b>D.G.P.</b>			
Checked by: <b>K.E.W.</b>	<b>WATER CONTROL STRUCTURE GENERAL LAYOUT</b>		
Reviewed by: <b>D.L.L.</b>	Scale: AS SHOWN	Sheet reference number: sp06s001.dgn	SOLICITATION NO. DACW25-82-S-0088 Sheet 19 of 19
Approved by: REX A. SMART COL., CORPS OF ENGINEERS	Date: 14 JUN 1989	Sheet number: <b>S1</b>	
Drawing Code: M-L 16-122			

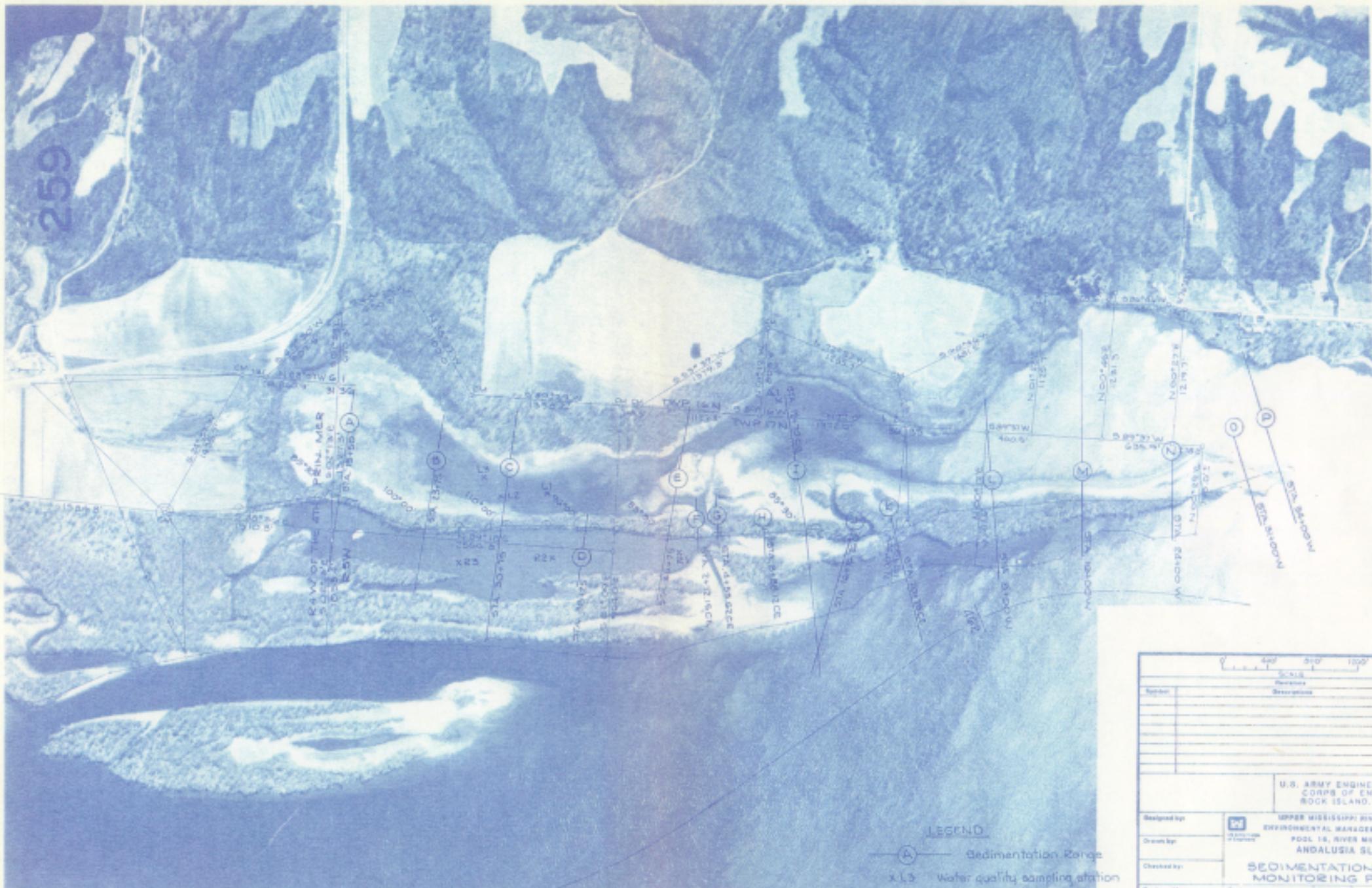












259

**LEGEND**

- (A) Sedimentation Range
- x-13 Water quality sampling station

Number	Description	Date	Approved
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS ROCK ISLAND, ILLINOIS			
Designed by:	UPPER MISSISSIPPI RIVER SYSTEM ENVIRONMENTAL MANAGEMENT PROGRAM POOL 18, RIVER MILE 482.7 ANDALUSIA SLOUGH		
Drawn by:	<b>SEDIMENTATION AND          MONITORING PLAN</b>		
Checked by:	Scale: As shown	Sheet reference number:	
Reviewed by:	Date:		
Approved by:	Drawing Code:	MPJ	Sheet - of -