Final Operation, Maintenance, Repair, Replace, and Rehabilitate Manual

Howard Hanson Dam 1135 Fish & Wildlife Restoration Project
Howard Hanson Dam, Washington

TACOMA WATER
TACOMA PUBLIC UTILITIES

US Army Corps of Engineers®

1. INTRODUCTION

This document outlines the responsibilities of the City of Tacoma and the U.S. Army Corps of Engineers (Corps) for the Howard Hanson Dam 1135 Fish and Wildlife Restoration Project (HHD 1135). The City of Tacoma, as project owner, is responsible for all aspects of normal operation and maintenance (O&M) of actions based on the physical condition that those actions were transferred.

It is anticipated that beginning in 2006, the Howard Hanson Dam (HHD) reservoir will be raised an additional 20 feet under the Corps/City of Tacoma's Additional Water Storage Project (AWSP). This action will effectively negate or significantly alter all of the efforts undertaken for the HHD 1135. Because of this change in operation, the City of Tacoma will only be responsible for the O&M of the HHD 1135 project until the AWSP becomes fully operational. At that time, all O&M requirements for the HHD 1135 will either be nullified or included into the AWSP's Restoration O&M plan based on negotiations between the Corps and the City of Tacoma at that time. If the AWSP does not become fully operational, then the City of Tacoma will be responsible for continuing O&M as specified in this document.

1.1 Project Purpose.

The purpose and objective of this project is to improve fish and wildlife habitat within the Howard Hanson Dam reservoir, and to help restore downstream natural river functions to improve habitat for resident and anadromous fish.

1.2 Authorization.

Section 1135, 1986 Water Resources Development Act as amended: Environmental Protection and Restoration.

1.3 Location.

The Howard Hanson Dam (HHD) project is located on the Green River in King County, Washington, approximately 64.5 miles upstream from the mouth of the Green-Duwamish River System. The dam is approximately 35 miles southeast of Seattle and 25 miles east of Tacoma. The project lies entirely within the City of Tacoma's municipal watershed.

The project area includes the reservoir zone affected by the additional pool raise and the 64.5-mile stretch of the Green River below HHD that would be affected by the modification of the flow regime.

1.4 Site Description.

The dam is an earth-filled structure composed of rolled rock fill, a sand and gravel core, and rock shell protection. The dam is 235 feet high, has a total length of 675 feet, and is 960 feet thick at its base and 23 feet thick at the crest. The reservoir is approximately four miles long at its full conservation pool of 25,400 acre-feet, corresponding to a water surface elevation of 1,141 feet MSL.

The Green-Duwamish system varies considerably over the 64.5-mile stretch downstream from HHD. The lower part of this system is characterized by low gradient channel, constricted by levees, and with slightly higher gradient, a bottom substrate of gravels and cobbles, and a more natural and vegetated channel

bank. Significant salmonid spawning and rearing occurs in this reach. Between the Green River Gorge and HHD, the Green River is constricted by natural landforms, the gradient is moderate, and the substrate consists primarily of bedrock, boulders and large cobbles. This reach offers good rearing habitat, and a lesser amount of spawning habitat.

A detailed description of habitat/cover types found within the Green-Duwamish watershed is presented in the Section 1135 Environmental Assessment and the Feasibility Report completed in 1996.

1.5 Project Lands.

The project lies entirely within the City of Tacoma's municipal watershed.

1.6 Project Description.

This project consisted of several components including adding an additional 5,000 acre/feet of water behind the dam, the establishment of water tolerant plants within the inundation zone, expanding wildlife forage opportunities, creating a subimpoundment for wetland development, establish floating islands, and placing large woody debris (LWD) and rock clusters in reservoir tributaries. Approximately 2,500 plants of Columbia sedge (*Carex aperta*), 500 willow staves and 50 Oregon ash trees were planted to provide varying vegetation along areas of the HHD reservoir that will provide forage and cover to fish and wildlife species, reduce bank erosion and sediment transport, and improve water quality.

1.7 Monitoring Programs.

Monitoring programs for Howard Hanson Dam section 1135 fish and wildlife restoration project includes several environmental actions. These actions include; monitoring the LWD, fish & wildlife islands, willow and Oregon ash plantings, sedge plantings, the sub impoundment, and fertilization and mowing of elk pastures. Monitoring recommendations are included in Section 2.1, General Rules and Procedures.

1.8 Construction History.

- *5,000 Additional Acre-feet:* Authorization to begin holding 5,000 acre-feet of additional water was signed in 1996. Changes were made in dam's operation to allow for an increased volume of water and to hold for longer durations that when released, would help augment the downstream flows critical for fish migration during the mid-summer months. Within the reservoir, the longer period of inundation has the potential to reduce the density and change the composition of the plant community occurring below elevation 1,147 MSL. About 70 acres of non-aquatic habitats, including deciduous forest (23 acres), young coniferous forest (5.0 acres), mixed forest (4.6 acres), forested wetland (1.6 acres), scrub-shrub wetland (3.9 acres), emergent wetland/upland grassland (19.0 acres), mudflat (11.0 acres), and talus (1.0 acres), occur within the new portion of the proposed conservation pool, i.e., between elevations 1,141 feet MSL and 1,147 feet MSL.

- *Sub-impoundment:* Construction of the sub-impoundment was completed in the fall of 2001. An estimated 3,700 yards of material was used from the existing railroad grade and the "12-mile" borrow pit to bring the sub-impoundment up to an elevation of 1148 msl. At a narrow constriction point between the railroad grade and the adjacent hillside, material was used to fill in the gap to keep water from escaping on the inside of the railroad grade. A pre-existing culvert was modified to allow for a flapgate on the inside of the sub-impoundment and a fish screen on the reservoir side. The intent of this culvert is to allow water into the sub-impoundment, but not out. Willow staves and Oregon ash trees were planted throughout the sub-impoundment area.

- *LWD Placement:* Construction of the LWD in the North Fork and Mainstem Green River, and Gale Creek was completed in the fall of 2001. Approximately 250 logs of varying size, species, and condition were placed along stretches of the aforementioned rivers and creek to help provide aquatic habitat, aid in channel stability, and increase fish utilization. Approximately 700 yards of rock was used to cable the LWD in place to withstand varying flows and up to 20 feet of inundation. Epoxy was used to cable the LWD to rock.

- *Willow, Oregon Ash, and Sedge Planting:* The planting of willows and Oregon ash was done in fall of 2000 and the sedge planting was done in the fall of 2001. Willows along the N.F. Green River were planted into coir fabric mats for protection against wind and wave action during high pool, and to act as sediment collectors. Several plots were cleared and some willows were planted without coir matting to test the viability in comparison to those staves planted in coir matting. Oregon ash was planted at Gale Creek, and both willow and Oregon ash was planted at the sub-impoundment. Sedge mats measuring 4'x4' were planted at elevations 1135 and 1141 below MacDonald Field.

- *Floating Fish & Wildlife Islands:* Nine floating islands were installed in the summer of 1999. Islands were constructed during low pool on bare ground using wood debris and log booms. The islands were anchored to an ecology block by chain. During the high pool the islands are floating.

Table 1. Estimated Project Costs

Engineering & Design (incl. modification to the HHD Water Control Plan) (P&S)	$100,000
LERRD	$84,480
Monitoring	$6,000
Detailed Report Cost	$61,500
Construction Cost	$310,000

2. OPERATION AND MAINTENANCE GENERAL PROCEDURES

The project will be maintained in accordance with the following Project Cooperation Agreement (PCA), Article VIII – Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R)

2.1 General Rules and Procedures.

2.1.1 Large Woody Debris

- Periodic inspections of the cables holding the LWD should be checked for fraying and destabilization. If fraying and/or destabilization does occur, the cable should be replaced and/or reattached using clamps or other means of stabilizing the log to keep it from floating away.
- Monitor the general position of the LWD jams to see if movement has occurred during the annual high pool and flood season. This task should be done annually after pool drawdown. Sketches and/or photographs recommended.

Sedge Plantings

- Survey the plantings twice a year monitoring survival success and potential spreading. Surveys should occur once before inundation, and once after inundation. Photographs would suffice in documenting survival success and spreading. Area measurements would help augment photographs for spreading success.
- Monitor sedge plants for grazing by wildlife species. If able, make a determination of either elk grazing or deer grazing given the signs around the sedges (droppings, tracks, etc.).

Tree Plantings

- Survey once a year during mid-summer checking for survival rate, browsing, etc. Representative photographs would suffice in documentation.

Fish & Wildlife Islands

- Do snorkeling surveys and creel surveys to determine if fish are utilizing structures; approximate numbers and species of fish. The HHD Corps personnel will assist in transportation only.
- Monitor the above-water portion of the island to identify wildlife use and/or the establishment of live vegetation. Document occurrences. The HHD Corps personnel will assist in transportation only.
- Visually check to see if any logs and/or debris need to be added. Add accordingly and document. The HHD Corps personnel will maintain responsibility for this portion of O&M.
- Ensure that anchoring system is functional. Do necessary maintenance to keep islands in place. The HHD Corps personnel will maintain responsibility for this portion of O&M.

Elk Pastures

- Mow grass two times a year at McDonald and Baldi field during early summer and late fall. Leave a buffer approximately 10 feet from forest edge.
- Reseed Baldi Field with a mixture of 40% blue wild rye, 40% red fescue, 20% orchard grass as needed and/or tri-annually.
- Fertilize Baldi Field every 5 years.
- Visually monitor elk usage as occasions arise. Document use and/or trends at Sponsor's discretion.

Sub Impoundment

- Visually inspect integrity of sub impoundment looking for cracks, slumps, seepage, and sloughing. Document with photographs.
- Annually inspect and clean the fish-barrier screen of debris.
- Annually inspect the flap gate for proper opening and closing. Provide periodic maintenance to ensure proper function.
- Monitor sub impoundment area during reservoir drawdown for leakage. Identify areas of leakage and document with photographs. Develop a timetable documenting the amount of time it takes the sub impoundment to fully drain over the course of a lowering pool.
- Do qualitative vegetation surveys on wetland species proliferation. Document information.
- Do qualitative wildlife surveys on wetland usage. Document information.

3. PROJECT COOPERATION REQUIRMENTS

The Corps and the City of Tacoma have entered into a PCA for this project on April 21, 2000, as required by Public Law (99-662). A copy of the duly executed PCA is included as Appendix A of the Manual.

3.1 Responsibility of Local Interests

The feasibility study lists the following responsibilities:

- For so long as the Project Modification remains authorized and viable, the Sponsor shall operate, maintain, repair, and rehabilitate the entire Project Modification as stated in Article XIII paragraph A and documented here in.
- Gives the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Sponsor owns or controls for access to the Project Modification for the purpose of inspection and if necessary, for the purpose of completing, operation, maintaining, repairing, replacing, or rehabilitating the Project Modification as stated in Article XIII paragraph B.
- Hold and save the Government free from all damages arising from the implementation, operation, maintenance, repair, replacement and rehabilitation of the Project Modification as stated in Article IX.

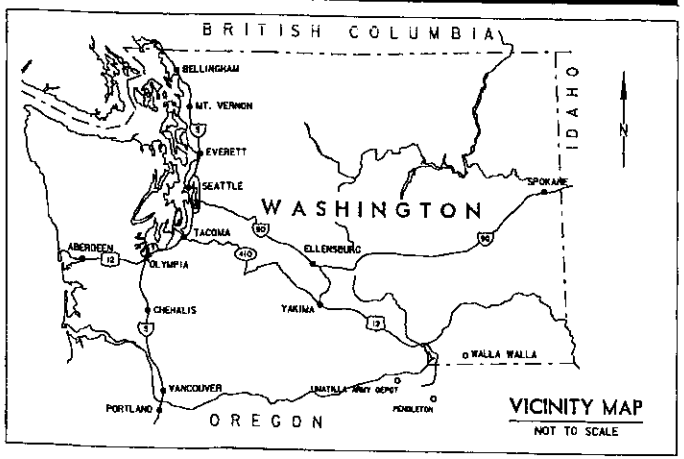
US Army Corps
of Engineers
Seattle District

REVISIONS				
SYMBOL	ZONE	DESCRIPTION	DATE	BY

HOWARD HANSON DAM 1135 PROJECT

HOWARD HANSON DAM
WASHINGTON

DRAWING INDEX			
FILE NO.	SHEET NO.	PLATE NO.	TITLE
	1	G-1	TITLE, DRAWING INDEX, AND VICINITY MAP
	2	G-2	GENERAL SITE MAP
	3	C-1	NORTH FORK GREEN RIVER
	4	C-2	CEDAR SWAMP (NOT USED)
	5	C-3	MACDONALD FIELD
	6	C-4	MACDONALD AND GALE CREEKS
	7	C-5	UPPER RESERVOIR SUBIMPOUNDMENT
	8	C-6	UPPER RESERVOIR DEBRIS AREA (NOT USED)
	9	C-7	DETAILS I
	10	C-8	DETAILS II
	11	C-9	DETAILS III (NOT USED)



VICINITY MAP
NOT TO SCALE

AS BUILT

SAFETY PAYS

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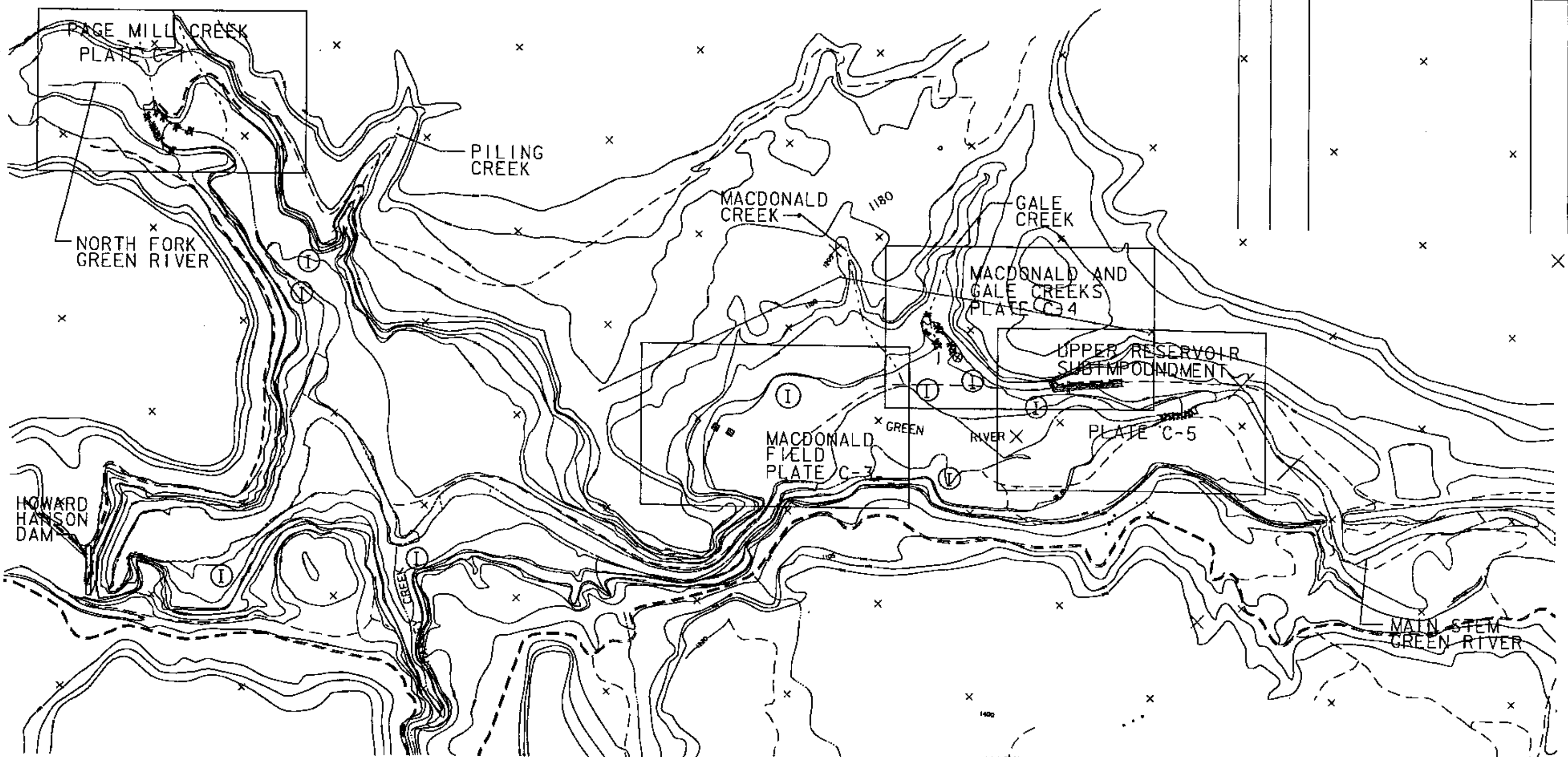
RESIZE*******

PREPARED DENNIS A. FISCHER, P.E.	U.S. ARMY ENGINEER DISTRICT, SEATTLE CORPS OF ENGINEERS SEATTLE, WASHINGTON
LESTER E. SOULE, P.E.	HOWARD HANSON DAM 1135 PROJECT
LLOYD G. DARKO, P.E.	TITLE, DRAWING INDEX, AND VICINITY MAP
RICK L. HOSHIER, P.E.	HOWARD HANSON DAM WASHINGTON
APPROVED JAMES M. KIGGEN, P.E.	SIZE D; DATE 01FEB26; PLATE G-1
	PROJ. FY; DR. MS



LEGEND

(I)	FISH FLOATING ISLAND SEE DETAIL, PLATE C-7		BERM CONSTRUCTION
— · —	NEW CREEK CHANNEL	— — —	WILLOW LIVE STAKING (SEE DETAIL, PLATE C-9)
(hatched)	SEDGE MAT PLANTING, (SEE DETAIL, PLATE C-9)		

NOTES:

1. SEE PLATES C-1 THRU C-6 FOR ENLARGED PLANS. SEE PLATE C-7 THRU C-9 FOR DETAILS.
2. SEE PLATE C-9 FOR PLANT SCHEDULE

FLOATING ISLAND MATRIX
9 TOTAL

AS BUILT

1" = 800' 800' 400' 0 800' 1600'

REVISIONS

SYMBOL	ZONE	DESCRIPTION	DATE	BY

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HOWARD HANSON DAM SECTION 1135

GENERAL SITE MAP

HOWARD HANSON DAM WASHINGTON

SIZE			DATE	PLATE
D			01FEB26	G-2
DSGN. NS/PY	CHK. DF		SHEET 2	

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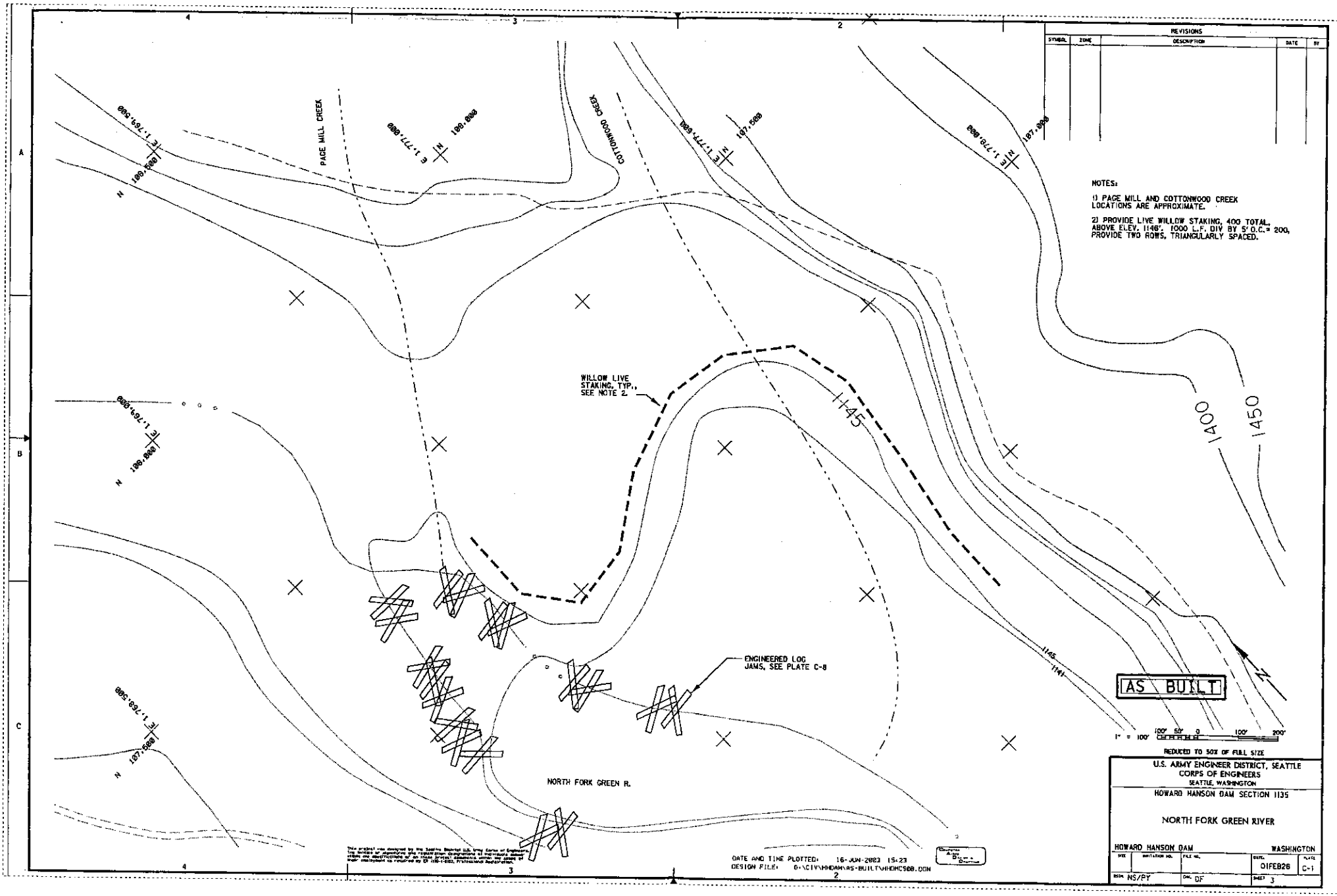

REVISIONS

SYMBOL	ZONE	DESCRIPTION	DATE	BY

NOTES:

1) PAGE MILL AND COTTONWOOD CREEK LOCATIONS ARE APPROXIMATE.

2) PROVIDE LIVE WILLOW STAKING, 400 TOTAL, ABOVE ELEV. 1148'. 1000 L.F. DIV BY 5' O.C.= 200, PROVIDE TWO ROWS, TRIANGULARLY SPACED.

REDUCED TO 50% OF FULL SIZE

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SEATTLE, WASHINGTON

HOWARD HANSON DAM SECTION 1135

NORTH FORK GREEN RIVER

HOWARD HANSON DAM WASHINGTON

SIZE	INITIATION NO.	FILE NO.	DATE	PLATE
			01FEB26	C-1

DSGN NS/PY DRN DF SHEET 3

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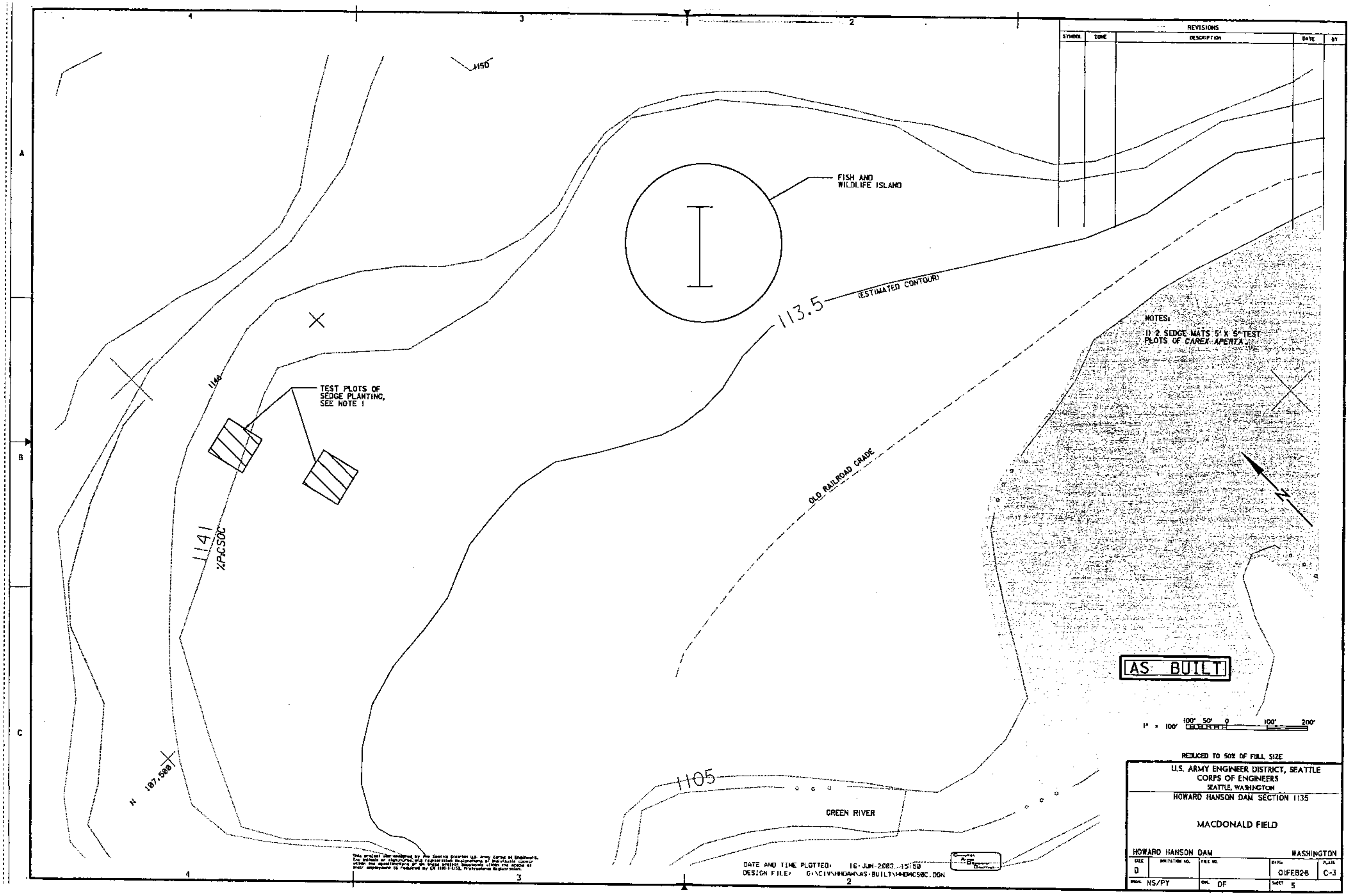

REVISIONS
SYMBOL
ZONE
DESCRIPTION
DATE
BY
FISH AND WILDLIFE ISLAND
113.5
(ESTIMATED CONTOUR)
NOTES:
1) 2 SEDGE MATS 5' X 5' TEST PLOTS OF CAREX APERTA
1146
1150
TEST PLOTS OF SEDGE PLANTING, SEE NOTE 1
OLD RAILROAD GRADE
1141
N
N 187,500
AS BUILT
1" = 100'
100' 50' 0 100' 200'
1105
GREEN RIVER
DATE AND TIME PLOTTED: 16-JUN-2003 15:50
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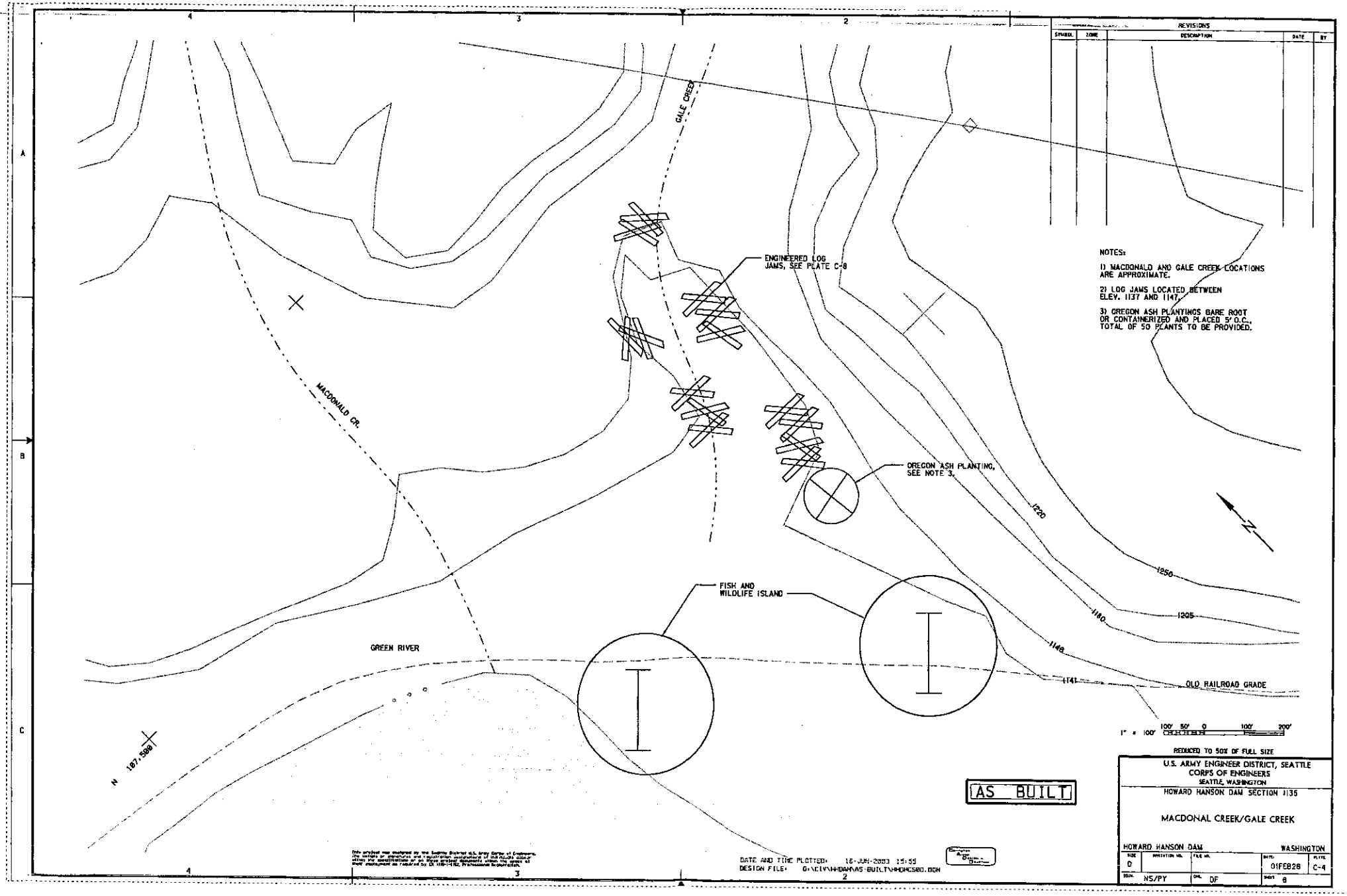
REDUCED TO 50% OF FULL SIZE
U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON
HOWARD HANSON DAM SECTION 1135
MACDONALD FIELD
HOWARD HANSON DAM
WASHINGTON
SIZE D
01FEB28
PLATE C-3
NS/PY
DF
SHEET 5



REVISIONS				
SYMBOL	ZONE	DESCRIPTION	DATE	BY

NOTES:

1) MACDONALD AND GALE CREEK LOCATIONS ARE APPROXIMATE.

2) LOG JAMS LOCATED BETWEEN ELEV. 1137 AND 1147.

3) OREGON ASH PLANTINGS BARE ROOT OR CONTAINERIZED AND PLACED 5' O.C., TOTAL OF 50 PLANTS TO BE PROVIDED.

REDUCED TO 50% OF FULL SIZE

AS BUILT

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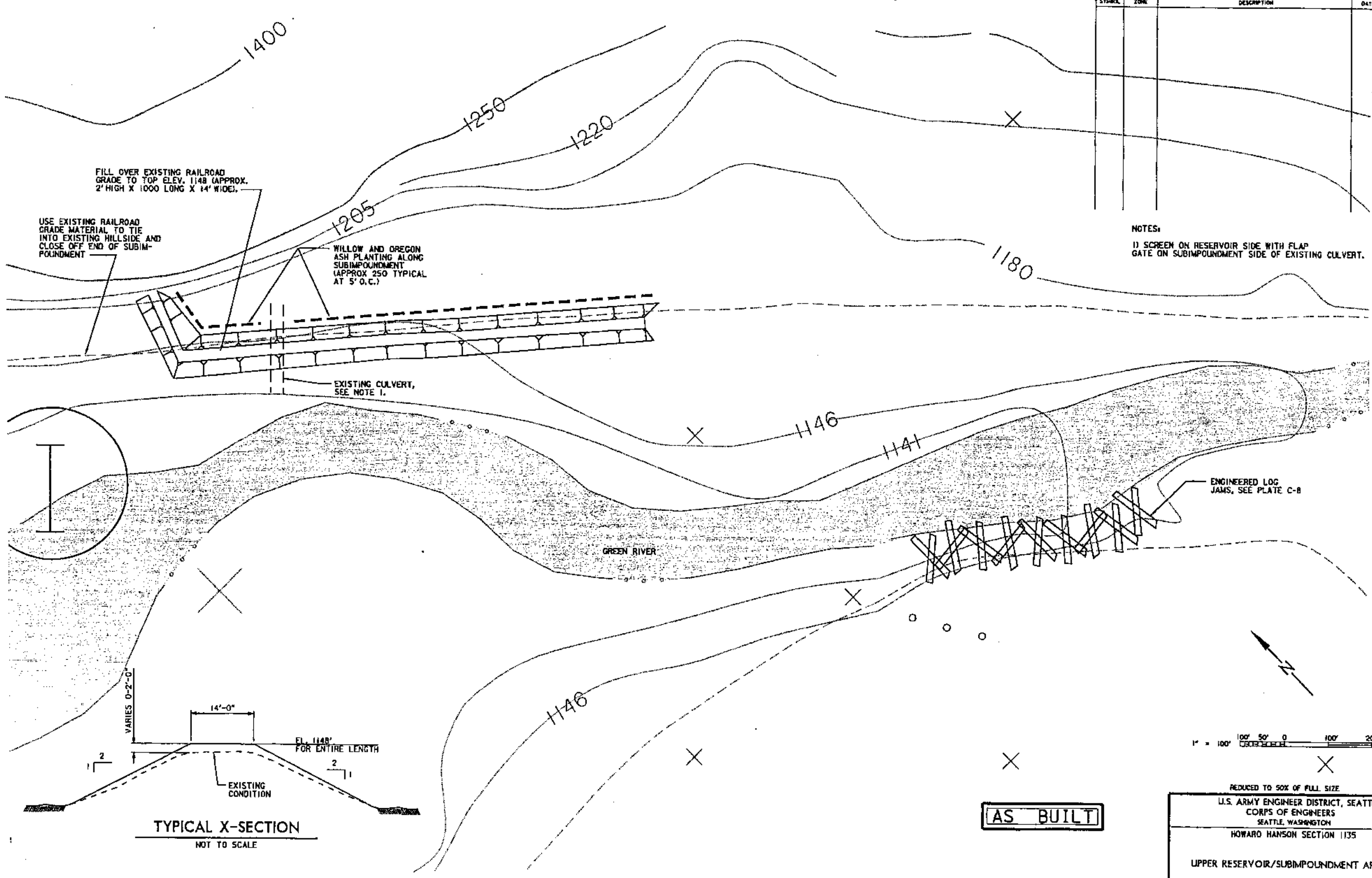
HOWARD HANSON DAM SECTION 1135

MACDONAL CREEK/GALE CREEK

HOWARD HANSON DAM			WASHINGTON
SIZE: D	DESIGNATION NO.	FILE NO.	DATE: 01FEB28
DESIGN: NS/PY	DRAWN: DF		SHEET: 8


1400
1250
1220
1205
1180
1146
1141
1146
FILL OVER EXISTING RAILROAD GRADE TO TOP ELEV. 1148 (APPROX. 2' HIGH X 1000 LONG X 14' WIDE).
USE EXISTING RAILROAD GRADE MATERIAL TO TIE INTO EXISTING HILLSIDE AND CLOSE OFF END OF SUBIMPOUNDMENT
WILLOW AND OREGON ASH PLANTING ALONG SUBIMPOUNDMENT (APPROX 250 TYPICAL AT 5' O.C.)
EXISTING CULVERT, SEE NOTE 1.
GREEN RIVER
ENGINEERED LOG JAMS, SEE PLATE C-8
I
N
VARIES 0-2'-0"
14'-0"
EL. 1148' FOR ENTIRE LENGTH
EXISTING CONDITION
2
1
TYPICAL X-SECTION
NOT TO SCALE
1" = 100'
100' 50' 0 100' 200'

SYMBOL	ZONE	REVISIONS DESCRIPTION	DATE	BY

NOTES:

1) SCREEN ON RESERVOIR SIDE WITH FLAP GATE ON SUBIMPOUNDMENT SIDE OF EXISTING CULVERT.

AS BUILT

This project was designed by the Seattle District U.S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear within the specifications or on these project documents within the scope of their employment as required by ER 1110-1-8152, Professional Registration.

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REDUCED TO 50% OF FULL SIZE

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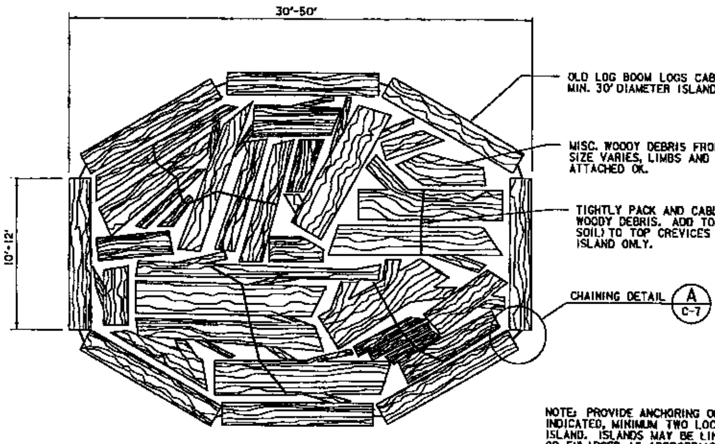
HOWARD HANSON SECTION 1135

UPPER RESERVOIR/SUBIMPOUNDMENT AREA

HOWARD HANSON DAM — WASHINGTON

SIZE	INVITATION NO.	FILE NO.	DATE	PLATE
D			01FEB26	C-5
DSGN. NS/PY	DWG. OF		SHEET 7	

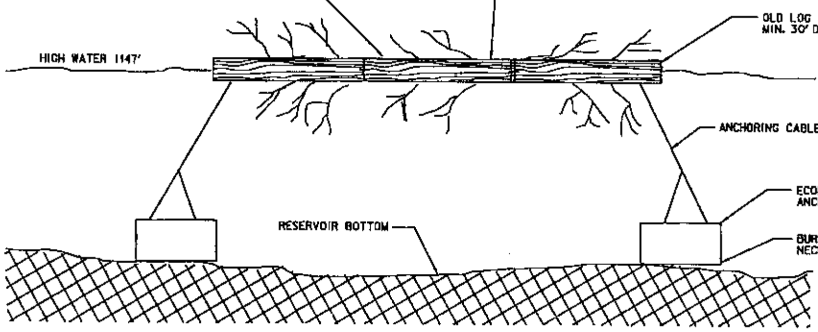
SYMBOL	ZONE	REVISIONS DESCRIPTION	DATE	BY



NOTE: PROVIDE ANCHORING OF ISLANDS AS INDICATED, MINIMUM TWO LOCATIONS EACH ISLAND. ISLANDS MAY BE LINKED TOGETHER OR ENLARGED AS APPROPRIATE.

FLOATING ISLAND – PLAN

NOT TO SCALE

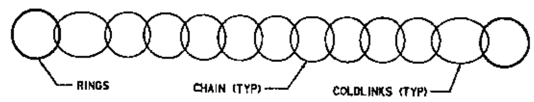


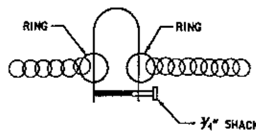
FLOATING ISLAND – SECTION

NOT TO SCALE

NOTES:

1. SET ANCHORS BELOW ELEVATION TO ASSURE FISH ISLANDS FLOAT IN OCTOBER AND MARCH, AND BIRD ISLANDS FLOAT FROM APRIL THROUGH JUNE.
2. ISLANDS WILL SIT ON RESERVOIR BOTTOM DURING LOW WATER CONDITIONS.





DETAIL (B/C-7)

NOT TO SCALE

NOTE: A DEVICE SIMILAR TO A CHOKE-CHAIN IS USED TO SECURE THE LOGS. THE CHAIN GOES THROUGH THE RING, AROUND THE END OF LOG, IT IS PULLED TIGHT AND SECURED IN PLACE WITH 6" STAPLES.

BUILDING OF BOOMLOGS FOR FISH/BIRD ISLANDS

1. USE 1/2" CHAIN WITH RINGS WELDED ON 12'-14' LENGTHS OF CHAIN.
2. ATTACH TO 30-50' BOOM LOGS CHOKING LOG AT BOTH ENDS WITH CHAIN STRAPS AND SECURING WITH 6" STAPLES.
3. ATTACH LOG ENDS WITH 3/4" SHACKLES.
4. PRICE FOR 14' CHAIN STRAP WITH RINGS ON BOTH ENDS:

A. 1/2" CHAIN 14' LONG (GSA):		$17.04
B. 2 1/2" COLD LINKS (BPA)		$ 2.86
C. 2 5/8" RINGS (BPA)		$12.34
	TOTAL	$32.24 (X12/ISLANDS)

BPA'S ARE WITH B&J INDUSTRIES
STAPLES ARE MADE BY A LOCAL VENDER IN ENUMCLAW

5. USING 6 BOOMLOGS PER ISLAND, INCLUDING THE CHAIN FOR ANCHORING, WE WILL NEED APPROX. 300' OF CHAIN, 30-5/8" WELDED RINGS, AND 30-1/2" COLD LINKS, AND ABOUT 30 STAPLES.

CHAINING DETAIL (A/C-7)

NOT TO SCALE

AS BUILT

REDUCED TO 50% OF FULL SIZE

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

HOWARD HANSON DAM SECTION 1135

DETAILS I

HOWARD HANSON DAM — WASHINGTON

SIZE	INVITATION NO.	FILE NO.	DATE	PLATE
D			01FEB26	C-7
DSGN NS/PY		CHK MJC	SHEET 9	

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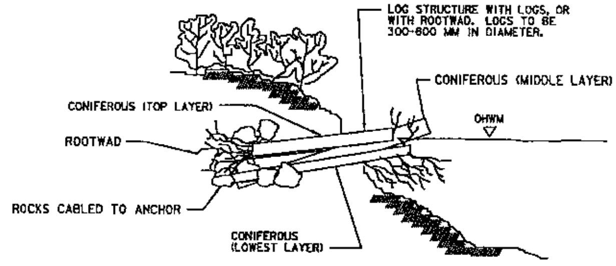
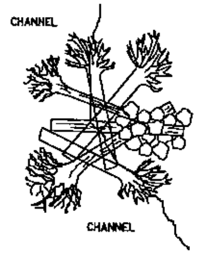


SECTION



PLAN

ENGINEERED LOG JAM

NOT TO SCALE

REVISIONS				
SYMBOL	ZONE	DESCRIPTION	DATE	BY

AS BUILT

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REDUCED TO 50% OF FULL SIZE

U.S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

HOWARD HANSON DAM SECTION 1135

DETAILS II

HOWARD HANSON DAM — WASHINGTON

SIZE	INVITATION NO.	FILE NO.	DATE	PLATE
D			01FEB26	C-8
DSGN NS/PY		CK. MJC	SHEET 10	