REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	Febraruy 2001	Inspection

4. TITLE AND SUBTITLE
Lower Granite Dam Radial Gate Inspection and Testing

5. FUNDING NUMBERS

6. AUTHOR(S)
HDR Engineering Inc.
Wayne Edwards P.E.
Sam Planck P.E.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
HDR Engineering Inc.
505 14rh Street, Suite 940
Oakland, CA 94612

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
Northwestern Division, Walla Walla District
201 North 3rd Ave.
Walla Walla, WA 99362-1876

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
None

12a. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unliminted

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
This report is an evaluation of the overall condition of the spillway tainter gates at Lower Granite Lock and Dam, Snake River Washington.

14. SUBJECT TERMS
Spillway tainter gates inspection testing

15. NUMBER OF PAGES
250

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

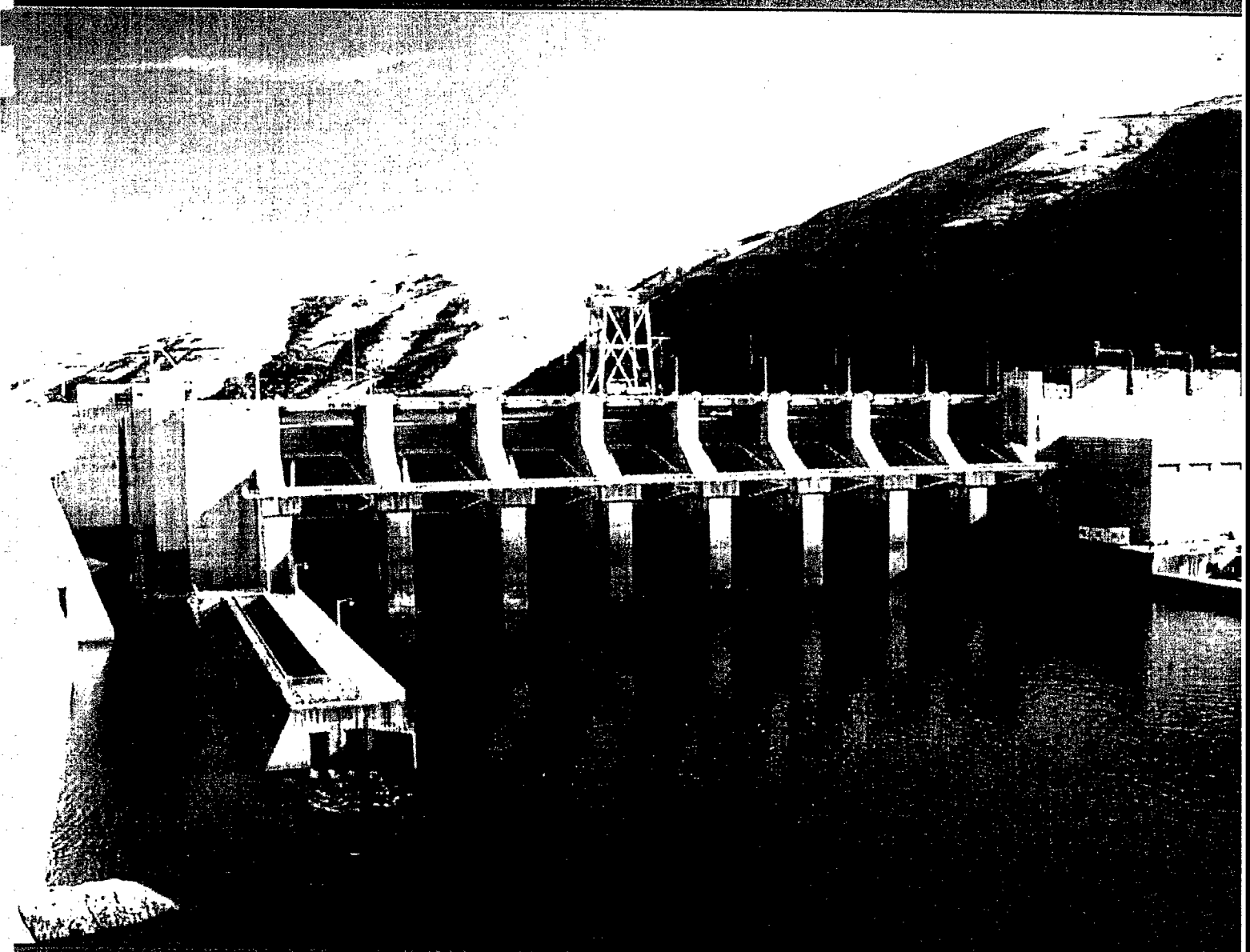
Standard Form 298 (Rev. 2-89) (EG)
Prescribed by ANSI Std. 239.18
Designed using Perform Pro, WHS/DIOR, Oct 94

AQM03-05-1167

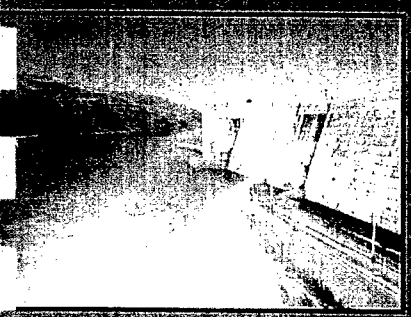
February 2001

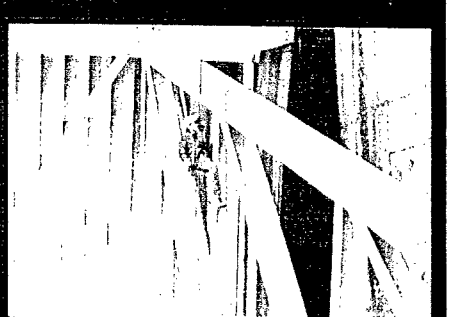
Lower Granite Dam

Radial Gate Inspection and Testing



US Army Corps of Engineers, Walla Walla District





Contents

LOWER GRANITE DAM RADIAL GATE INSPECTION AND TESTING 1

INTRODUCTION 1
Purpose 1
Scope of Investigation 1
Limitations 1

PROJECT BACKGROUND 2
Project Description 2
Gate Design and Construction 2
Gate Operation 3
Gate Maintenance 3

INSPECTION 5
General 5
Procedures 5
Member Designations 8
General Inspection Observations 8
Radial Gate – Operation, Testing and Measurements 19
Individual Gate Inspection Observations 22
Ultrasonic Testing Results 29
Hoists – Operation, Testing and Measurements 31

RECOMMENDATIONS 34

REFERENCES 35

APPENDICES
A - Gate Inspection Sheets
B - Hoist Inspection Sheets
C - Ultrasonic Testing Inspection Sheets
D - Inspection Photographs
E - As-built Drawings

LOWER GRANITE DAM RADIAL GATE INSPECTION AND TESTING

INTRODUCTION

Purpose

The Corps of Engineers, Walla Walla District, requires a comprehensive evaluation of the radial gates at Lower Granite Dam. The District retained HDR Engineering, Inc. to perform inspection and testing of the radial gates through Task Order No. 5 under Contract DACW68-00-D-0001. The task order scope of work includes review of project information, an initial meeting and inspection, comprehensive field inspection of the radial gates, testing of gate hoist machinery, recording trunnion movement, nondestructive testing of field welds, and preparation of a report.

Scope of Investigation

The scope of this investigation includes:

- Review of design, construction, maintenance and operations information provided by the District.
- Hands-on visual inspection of accessible upstream and downstream portions of eight radial gates.
- Visual inspection of the hoists and hoist equipment.
- Nondestructive testing of field splice welds.
- Testing of gates and hoists while operating.
- Recording trunnion movements while raising gates in both loaded and unloaded condition.
- A report including documentation of the design and operation of the gates and hoists, inspection and testing results, conclusions, and recommendations.

Limitations

The services under this contract include the professional opinion and judgment on the data and information reviewed. The conclusions and recommendations presented in this report are based on the information provided by the District and the inspection and testing of the radial gates and hoists. The inspection was visual only and only accessible portions of the components were inspected. Nondestructive testing was performed on field splice welds, but no laboratory testing was conducted in the course of the inspection.

PROJECT BACKGROUND

Project Description

Lower Granite Dam is located in southeastern Washington on the Snake River, 37.2 river miles upstream of Little Goose Dam, and 107.5 miles above its confluence with the Columbia River. The main project structures include a powerhouse, navigation lock, fish facilities, concrete non-overflow sections, and a rockfill embankment on the north shore. The dam is 3,200 feet long including the embankment. Construction of the project began in August 1965 and was completed in November 1975.

The spillway is 512-feet-long and is located about mid-river. The spillway consists of eight radial gate controlled bays separated by 14-feet-wide piers. The radial gates are each 50-feet wide by 60.15-feet-high. The gates are numbered 1 to 8 from left to right looking downstream. The spillway structure has a maximum height of 204.4 feet with the deck at Elev. 751.0. The spillway crest is at Elev. 681.0 and the top of gates at Elev. 740.0. The reservoir stores 483,800 acre-feet at normal full pool (Elev. 738.0).

The Spillway Design Flood (SDF) is 850,000 cfs. The spillway has a design capacity of 850,000 cfs at reservoir level Elev. 746.5. The maximum spillway capacity at normal full pool (Elev. 738.0) is 680,000 cfs. For the period from 1951 to 2000, the maximum flood of record was 332,000 cfs on June 18th, 1974. Peak flow outside the period of record was 409,000 cfs on June 5th, 1894. These values are computed from the flood marks by the U.S. Weather Bureau.

Gate Design and Construction

The Corps of Engineers designed the gates and project facilities. The gates were fabricated by Flint Steel Corporation of Tulsa, Oklahoma and Pacific Car and Foundry of Seattle, Washington. Stewart Machinery supplied the hoists.

The Walla Walla District provided copies of the engineering drawings and shop drawings for the gates. The gate and hoist specifications were also provided. The gates are very similar to the gates at Little Goose Dam. Notes in the District file indicate that the Little Goose calculations were used at Lower Granite Dam. See *Little Goose Dam Radial Gate Inspection and Testing* report for details on design. The following information was obtained from the Lower Granite Dam documents.

The 3/8-inch to 1/2-inch thick skin plate is supported by vertical ST10.5WF31 purlins. The skin plate is 3/4-inch thick on each end of the gate to act as a wear surface for the lifting cables. The purlins are connected to three horizontal plate girders. Each horizontal girder is supported by 14WF gate arms. The gate arms are braced with 14 WF members and there are ST7WF15 braces between the downstream flanges of the horizontal girders. Cable attachment brackets are mounted on the skin plate at the bottom corners. The horizontal plate girders, skin plate and cable

attachment brackets are A537 Gr. A steel (Carbon-Magnesium-Silicon, Heat Treated for Pressure Vessels). All other members are A-36 steel.

The gate end frames were fabricated in two parts connected in the field with full penetration splice welds in the middle arms. The skin plate was installed in five vertical sections and joined by full penetration welds.

Each trunnion has a 24-inch diameter forged steel pin with a cast aluminum bronze bushing. The trunnions rest on a concrete girder that is anchored to the spillway piers with two groups of 48, 1-1/4 inch diameter prestressed bars.

The gates are raised and lowered by electric hoist units mounted on the deck above the gates. Eight 1-inch diameter wire ropes on each side of the gate wind on separate drums mounted on a common shaft. The hoist operating speed is approximately 1.1 feet per minute.

The gates have rubber J-bulb side seals and rubber wedge bottom seals. The side seal plates and sill beams are heated to prevent ice formation. The heating system consists of piping embedded below the seal plates. Electrically heated oil is automatically circulated through the piping when the ambient temperature drops below 32 degrees F.

Gate Operation

The gates may be operated by manual control from stations located near each hoist, but normally the gates are remotely controlled from the powerhouse. All of the hoists can be powered from a diesel generator set.

The spillway is operated to pass the desired discharge with the best hydraulic conditions in the stilling basin. Through experience it has been shown that the most desirable stilling basin conditions are achieved with uniform discharge through all eight gates. The gates are opened in one-foot increments during the fish passage season from March 1 through December 31 according to the operating sequence in Table 1. If the desired spill exceeds the capacity of all eight gates for this spill pattern, then the gate opening sequence is repeated.

Gate Maintenance

The District performs routinely inspects, tests, and lubricates the gates and hoists. Recent significant maintenance consists of:

- In the mid 1980s the upstream face of all gates were inspected and significant corrosion and wear was noted on the cable wear plates.

- The original coating for upstream and downstream portions of the gates was a four coat vinyl system. With the exception of spot painting, there is no indication that the gates have been recoated.

LOWER GRANITE DAM

Gate Number / Gate Stops								Total	Spill
1	2	3	4	5	6	7	8	Stops	(kcfs)[1]
1	0	0	0	0	0	0	0	1	**1.75**
1	0	0	0	0	0	0	1	2	**3.50**
1	0	0	0	0	0	1	1	3	**5.25**
1	1	0	0	0	0	1	1	4	**7.00**
1	1	0	0	0	1	1	1	5	**8.75**
1	1	1	0	0	1	1	1	6	**10.50**
1	2	1	0	0	1	1	1	7	**12.37**
1	2	1	0	0	1	2	1	8	**14.25**
1	2	1	1	0	1	2	1	9	**15.99**
1	2	2	1	0	1	2	1	10	**17.86**
1	2	2	1	1	1	2	1	11	**19.61**
1	2	2	2	1	1	2	1	12	**21.48**
1	2	2	2	2	1	2	1	13	**23.35**
1	2	2	3	2	1	2	1	14	**25.27**
2	2	2	3	2	1	2	1	15	**27.14**
2	2	2	3	3	1	2	1	16	**29.06**
2	2	2	3	3	2	2	1	17	**30.93**
2	2	3	3	3	2	2	1	18	**32.85**
2	3	3	3	3	2	2	1	19	**34.77**
2	3	3	4	3	2	2	1	20	**36.67**
3	3	3	4	3	2	2	1	21	**38.61**
3	3	4	4	3	2	2	1	22	**40.53**
3	3	4	4	3	3	2	1	23	**42.45**
3	4	4	4	3	3	2	1	24	**44.37**
3	4	4	4	4	3	2	1	25	**46.29**
3	4	4	5	4	3	2	1	26	**48.21**
3	4	5	5	4	3	2	1	27	**50.13**
4	4	5	5	4	3	2	1	28	**52.05**
4	5	5	5	4	3	2	1	29	**53.97**
4	5	5	5	4	4	2	1	30	**55.89**
4	5	5	5	5	4	2	1	31	**57.81**
4	5	5	6	5	4	2	1	32	**59.73**
4	5	6	6	5	4	2	1	33	**61.65**
4	6	6	6	5	4	2	1	34	**63.57**

(1) Forebay El. 737

Table 1: Gate operating sequence

INSPECTION

General

Wayne Edwards and Mike Haynes of HDR Engineering performed an initial site visit and inspection on April 5, 2000. Based on information collected during the initial inspection, HDR prepared an inspection plan and inspection sheets that were submitted to the District for review prior to the detailed inspection.

The inspection and testing of the spillway radial gates was performed from October 2nd through 9th, by Sam Planck, P.E., Heather Yee and Tony Barela, of HDR Engineering, Inc. Steve Schmidlkofer and Jim Knowles of K&N Electric inspected the hoists, took amperage measurements, and recorded observations during testing. Destry Hall and Jim Fisher of Kleinfelder performed nondestructive testing of field splice welds. Gary Struthers Associates was responsible for operation of the gates during the loaded and unloaded testing and moved the stoplogs between gate testing. Emerald Services, Inc., as a sub-contractor to Gary Struthers, provided water blast cleaning of the skin plate during the upstream face inspection. Gus Hernandez and Frank Gates (USACE) were present during the inspections and provided on site assistance. The weather was clear with temperatures ranging from 50 to 75 degrees F. The reservoir was full during the inspection. The upstream inspection of Gate 1 was not able to be performed initially because the surface collector was in place. Sam Planck and Amy Akins of HDR Engineering returned to the site on November 20th to complete the upstream inspection of Gate 1.

Procedures

Upstream Inspection & Testing

For the upstream inspections, stoplogs were placed in front of the gates prior to the inspection. The first part of the inspection was a rope access inspection of the bottom seal, bottom of the upstream surface of the skin plate and the hoist connections. During the inspection the gates were opened approximately three feet. At certain gates, the inspection under the bottom of the gate or measurements for racking could not be made due to excessive leakage through the stoplogs and heavy flows on the spillway. Racking measurements were recorded between the bottom seal plate on the gate and the embedded spillway seal. The upstream face of the gates was inspected from the spillway deck as each gate was raised to the full open position.

The second part of the upstream inspection consisted of the transverse, operational measurements at the trunnion, amperage readings while opening and closing, and the inspection of the upstream surface of the skin plate. Measurements were made to determine transverse movement of the trunnion hub versus the trunnion yoke at the initial, full open, and final closed position. During the gate opening, visible corrosion, debris and surface inconsistencies were waterblasted from the gate face for better condition assessment, see Photo 1. Amperage readings for the hoist were recorded at initial opening, during opening and during closing.

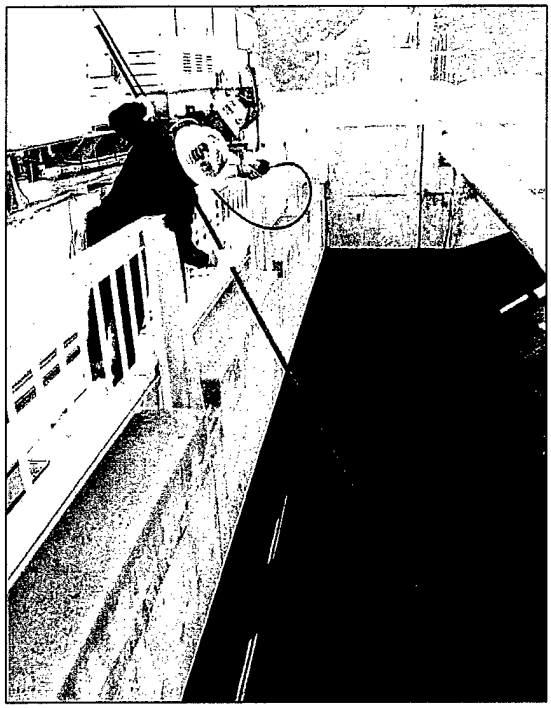


Photo. 1: Waterblasting of upstream surface of skin plate during full opening of gate.

Downstream Inspection

The downstream portions of all gates were inspected. The downstream gate members were inspected by climbing along the horizontal girders and radial struts, see Photo. 2. Inspection rigging for the downstream inspections was anchored to the gate hoist equipment and torque tubes. Visual observations were made for excessive sweep and camber of the main struts and were recorded only if an abnormal condition was observed.

Photo. 2: Rope access downstream inspection.

Operational Testing – Unloaded vs. Loaded

At the completion of the upstream inspection, with the stoplogs in place and the gate unloaded, dial gages were set at the trunnion to measure the vertical, transverse, and lateral movement of the trunnion hub versus the trunnion yoke. After initial readings were taken, the top stoplog was cracked open and the void was flooded, loading the gate. When the void between the stoplogs and the gate was completely full, final movement readings were taken. There was no gap present at the bearing between the trunnion yoke and the trunnion support beam, therefore, movement readings between the two surfaces were not made.

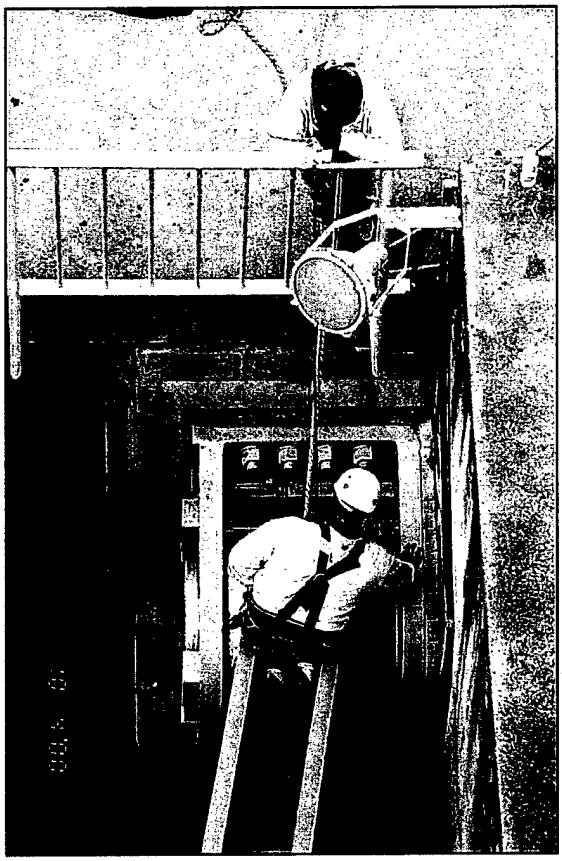


Photo. 3: Installation of dial gages at trunnion .

Operational Testing – Loaded

With the stoplogs removed and the gate fully loaded, the gates were opened to two feet. Amperage reading for the hoists were recorded at the initial opening, during the opening of the gate and during closing.

Nomenclature

The gates are identified as Gate 1 to 8, with 1 on the south end near the powerhouse looking downstream. Unless noted otherwise, all locations of observations, and notes pertaining to the radial gates are identified as right or left looking downstream.

In the inspection sheets and this report, corrosion is classified as light, moderate or heavy as follows:

- Light - Surface rust with no flaking or packing. Rust can not be scraped off by hand.
- Moderate - Some flaking, beginning to pack, but thickness of the pack is less than approximately 1/16". There is no observable loss of section.
- Heavy – Pack rust with measurable or observable section loss to the member.

Member Designations

For the radial gate inspection observations and the photographs, the member designations indicated in Figure 1 apply.

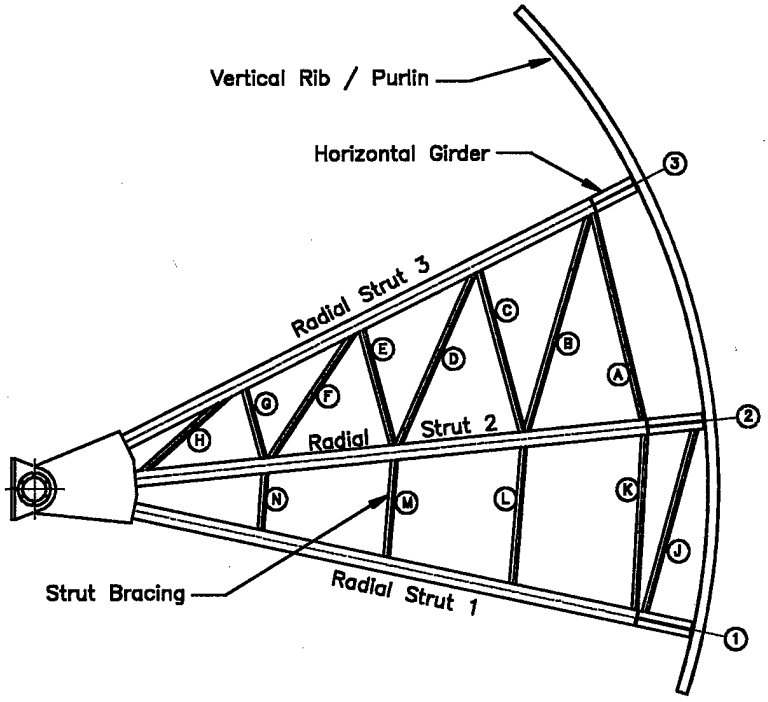


Figure 1: Radial gate member designations.

General Inspection Observations

The majority of condition observations found during the inspection are consistently found at all of the gates. The following section of the report pertains to those general observations or conditions which were found to apply to all of the gates. Specific observations or deficiencies for individual gates begin on page 22. No significant deviations from the as-built plans were observed for the radial gates. Field inspection sheets for the gates are included in Appendix A. Hoist operation and inspection sheets can be found in Appendix B.

Upstream Surface of Skin Plate

The upstream surface of the skin plate is in extremely poor condition. There is large, scattered pitting on the entire surface of every gate. On average, the pits are approximately two inches in diameter and 1/4-inch to 5/16-inch deep. Many appear to be greater than 1/4-inch deep in the 3/8-inch thick portion of the skin plate and greater the 3/8-inch deep in the 1/2-inch thick portion. See Figure 2, and photos 4 through 7 below. The 3/4-inch thick cable wear plates are in good condition with respect to cable wear, however, there is pitting present in excess of 1/2-inch deep at some locations, see Photo. 8. At many locations the pitting on both the skin plate and wear plates appears to be associated with scratches or dings in the plates original protective coating. Based on the hemispherical shape of the pitting, the corrosion appears to be microbially influenced. It is likely that increased acid levels due to microbial activity have created a concentration cell within the pits and accelerated the corrosion.

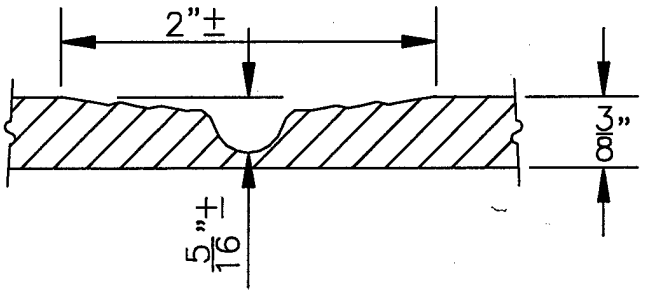


Figure 2: Typical pitting profile.

Photo. 4: Typical distribution of pitting.

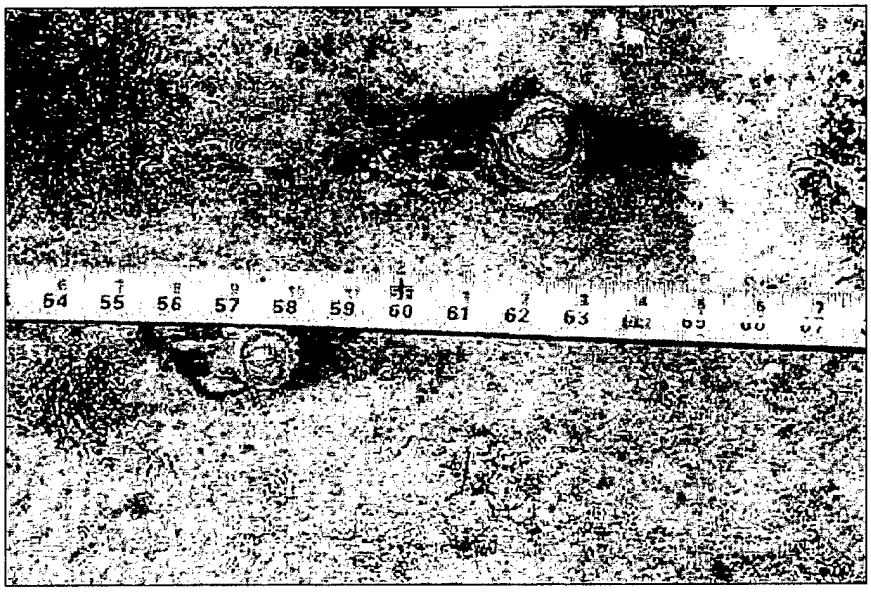


Photo. 5: Pitting, typical.

Photo. 6: Pitting, typical.

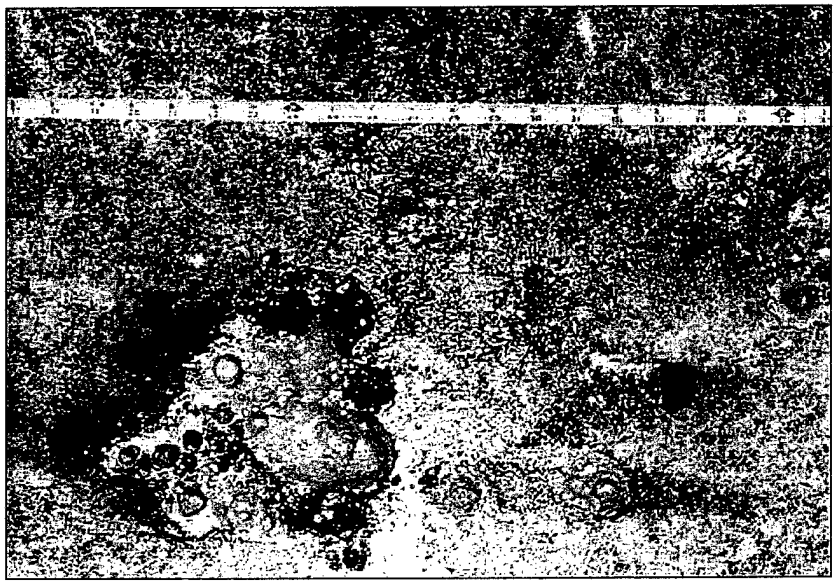


Photo. 7: Pitting, typical.

Photo. 8: Condition of cable wear plates, typical.

Hoists Connections

The hoist connections are in generally good condition with light to moderate corrosion present on the lifting lug plates. The U-bolts, socket blocks and connection pin, which appear to be stainless steel, are in very good condition, see Photo. 9 . The design or material type for the U-bolts, socket blocks and connection pin are not listed in the available plans.

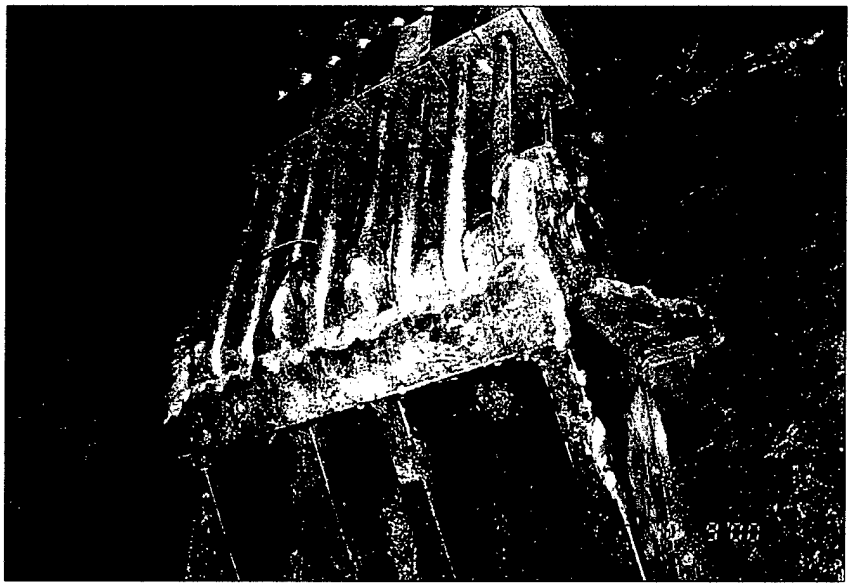


Photo. 9: Hoist connection, typical condition.

Downstream Surface of Skin Plate

The downstream surface of the skin plate is in generally good condition. Isolated spots of light surface corrosion and previous (painted over) pitting can be found at various locations.

Vertical Purlins

The vertical purlins are in generally good condition. At the bottom of the gate there is standing water between the bottom seal closure plate, the web of the purlins and the downstream side of the skin plate. Light to moderate corrosion is forming on all surfaces. There is no drainage for this space and it is consistently full of water and debris at all gates, see Figure 3 and Photo. 10.

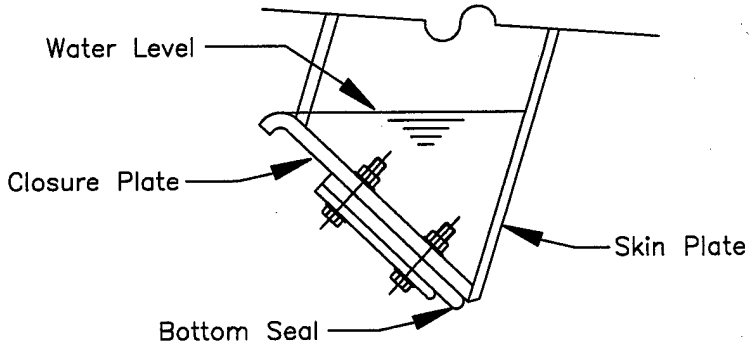


Figure 3: Standing water at bottom of gate between skin plate, purlin webs and bottom seal closure plate, typical.

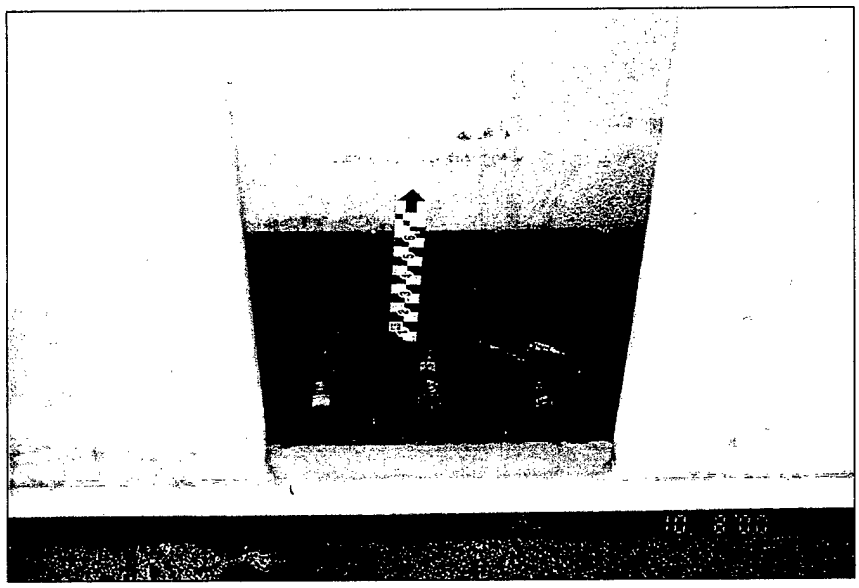


Photo. 10: Standing water at bottom of gate between skin plate, purlin webs and bottom seal closure plate, typical.

Horizontal Girders and Braces

The horizontal girders and bracing are in generally good condition. There are isolated spots of light to moderate corrosion, mostly at locations with poor drainage.

The top and middle horizontal girders are divided into twelve drainage areas due to the web stiffeners. The area at either end of the girders is free to drain off the end of the web. The remaining ten areas have only three drain holes and require water to flow horizontally through at least one notch in the stiffeners in order to reach a drain hole. There are debris lines and evidence of standing water on nearly all of the horizontal girder flanges and webs.

The worst corrosion occurs on the bottom horizontal girder, between the multiple stiffeners, at each end of the girder. There are six stiffeners in close proximity to one another with drainage only provided horizontally through a notch at the upstream (low) end of the stiffener. In order for the last space to drain, the water must travel horizontally under five stiffeners. These notches are typically clogged and the area between the stiffeners is consistently full of water and debris, see Photo. 11.

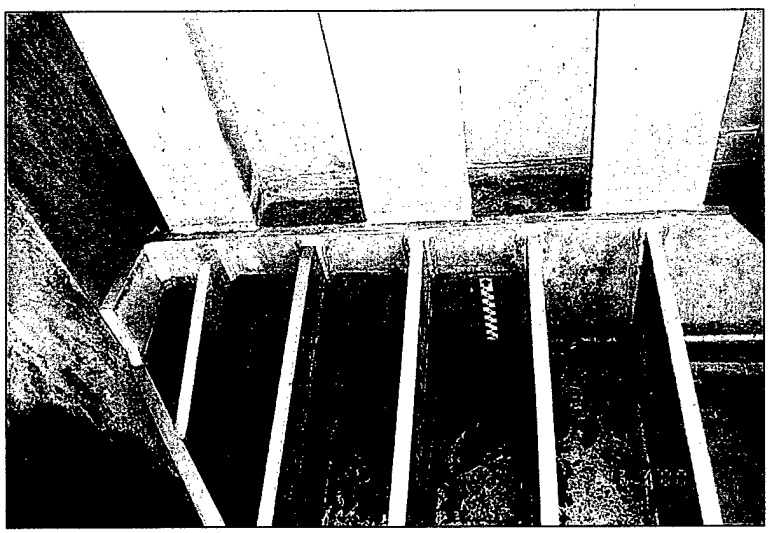


Photo. 11: Standing water between stiffeners at ends of bottom horizontal girder, typical.

Immediately upstream and slightly above the end of the bottom horizontal girders, there are stiffeners between the skin plate, purlins and upstream flange of the horizontal girders. There is no drainage from this location and the enclosed area is either full of water and/or debris on all gates. See Photo. 12.

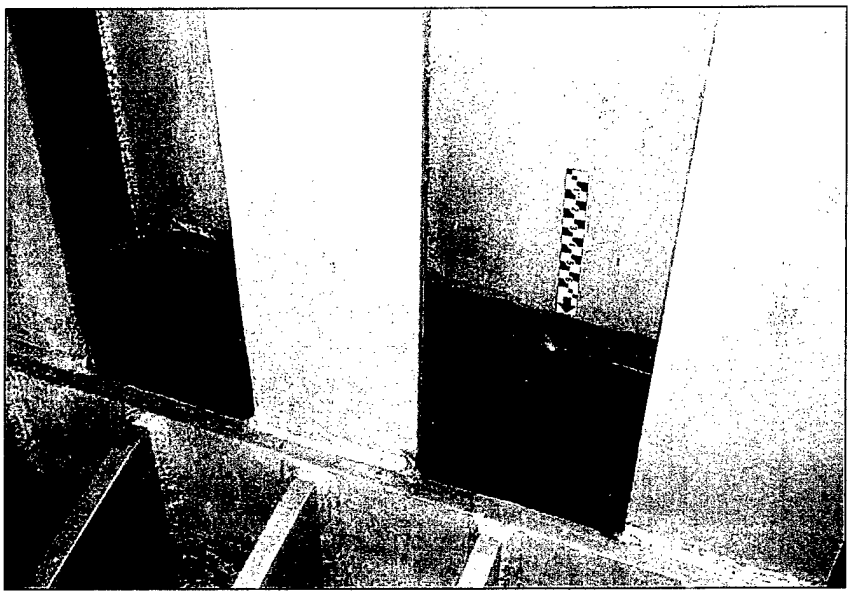


Photo. 12: Standing water and debris between purlins, skin plate and upstream horizontal girder flange, typical.

On the underside of the bottom horizontal girder, at the connection to the radial struts, there is delaminated paint and light to moderate corrosion around the drain hole in the girder web and near the adjacent stiffeners. See Photo. 13.

Photo. 13: Corrosion beneath bottom horizontal girder. Looking up at girder flange (behind hammer) and stiffener (right), typical.

Radial Struts and Braces

The radial struts are in generally good condition with only light surface corrosion at isolated locations.

There is very poor drainage from the upstream end of the bottom radial strut and ponding or debris lines (evidence of previous ponding) are found at every gate, see Photo. 14.

There is very poor drainage from the downstream end of the top radial strut at the trunnion. The three radial struts become an enclosed box section at the trunnion. Since there is no drainage vertically from between the flanges of the top strut, a small drain hole is provided horizontally through the strut flange. The drain hole is consistently clogged and standing water is present at most trunnions.

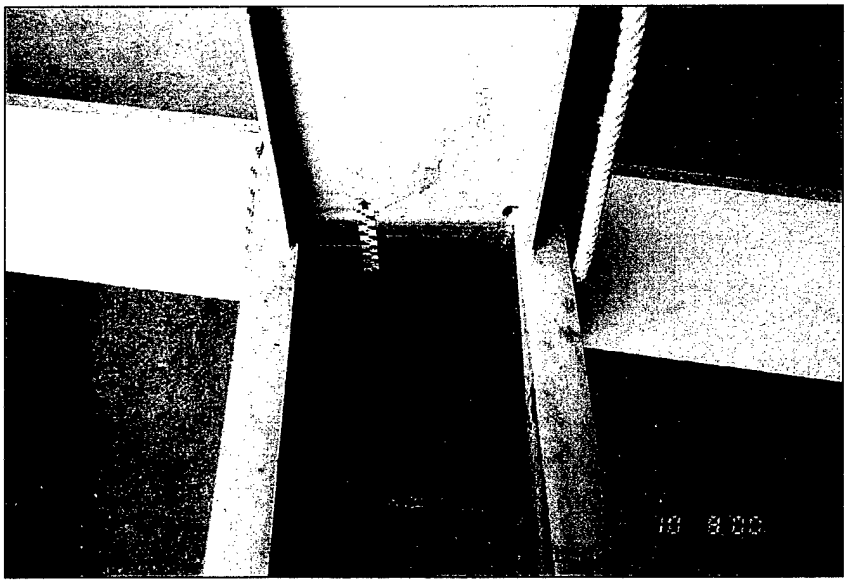


Photo. 14: Standing water at upstream end of bottom radial strut, typical.

Trunnions

The trunnion hubs, yokes and bearing material are in generally very good condition and appear well lubricated. Lubricant was observed being expelled between the yoke and hub, around the circumference of all of the trunnions.

Side and Bottom Seals

The side and bottom seals are in generally good condition. Small side and bottom seal leaks are visible on many of the gates, although no major leaks were observed. There is a leak at the bottom seal, at the spillway monolith construction joint at nearly every gate. Photo. 15. The

bottom and side seal material is in good condition with very little cracking or deterioration present.

Photo. 15: Leak at spillway monolith construction joint, typical.

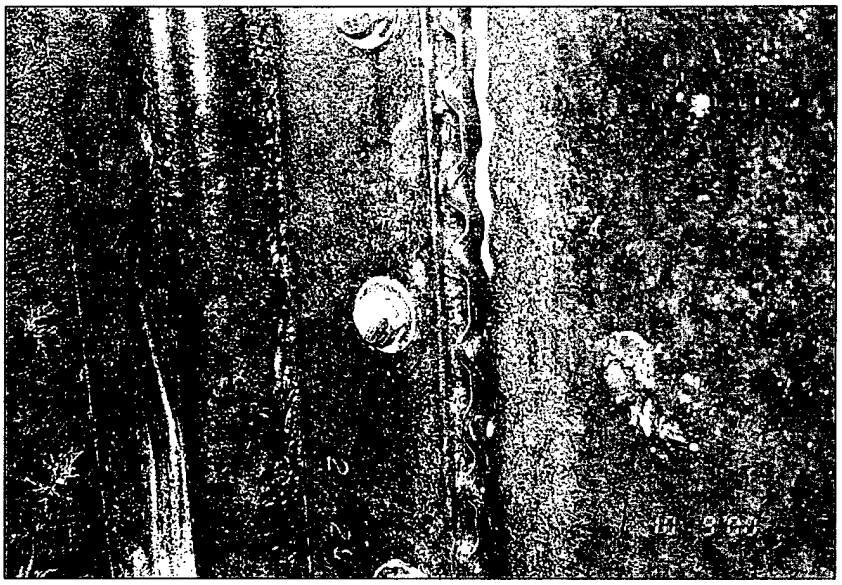


Photo. 16: Side seal from upstream side with no signs of cracking or deterioration, typical.

There is moderate corrosion on the skin plate on the upstream side of the bottom seal. The downstream side of the bottom seal is in good condition with little occurrence of corrosion. See Photo. 17 and Photo. 18.

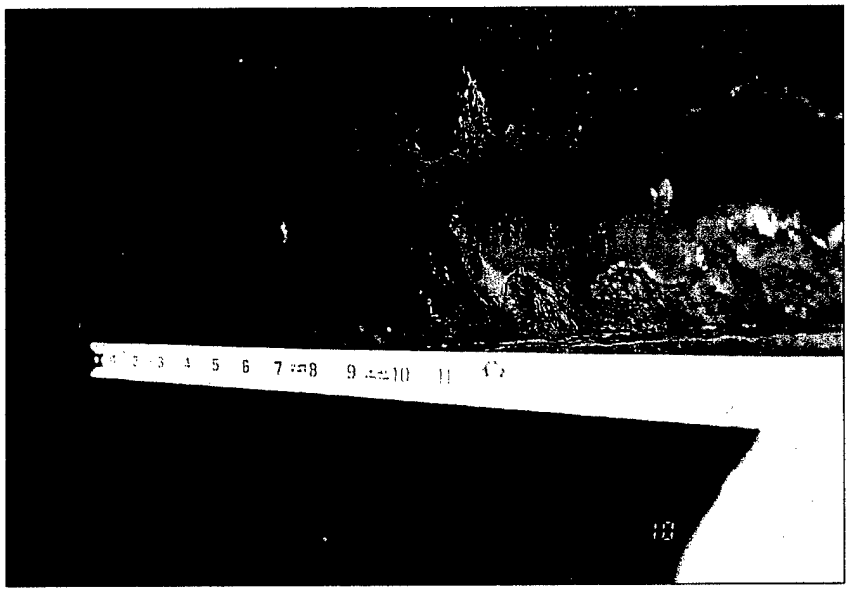


Photo. 17: Upstream side of bottom seal with light to moderate corrosion on skin plate, typical.

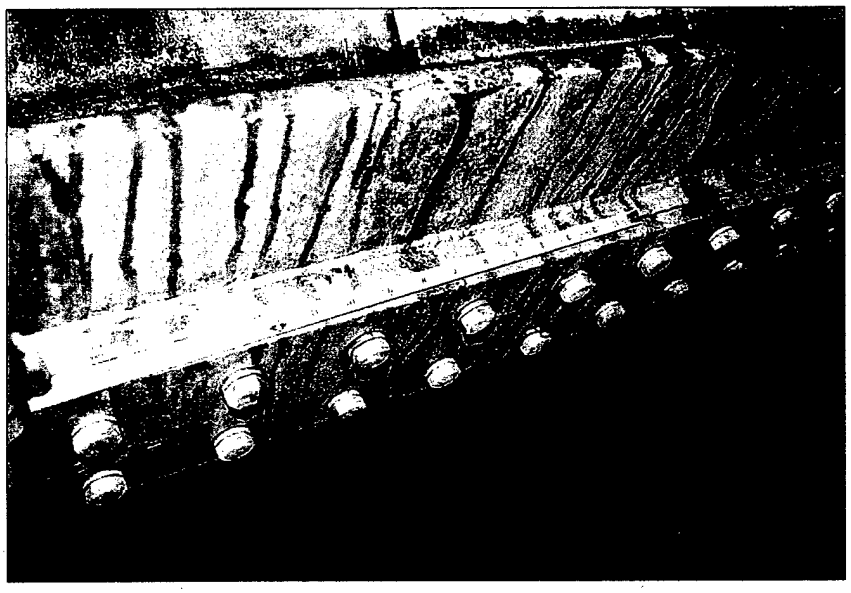


Photo. 18: Downstream side of bottom seal, typical

Radial Gate – Operation, Testing and Measurements

Member Section Dimensions

Section dimensions of main structural members were measured to verify conformance with the design drawings. These members included radial struts, radial strut bracing, horizontal girders, horizontal girder bracing and purlins. Measured dimensions were recorded on field data sheets found in Appendix A. The data sheets also contain nominal section dimensions from the American Institute of Steel Construction (AISC) *Steel Construction Manual, Seventh Edition, 1970.* Section measurements typically include the depth, d (measured at the edges of the flanges), the flange width, b_f, and the flange thickness, t_f. Web thickness, t_w, was only measured if there was an exposed portion of the web or drain holes large enough for calipers.

Differences between the design drawings and the actual field conditions of $1/16^{th}$ inch or less were deemed to be insignificant. Nearly all members in the field were found to be greater or equal in dimension than what was required in the design drawings. The larger dimensions were probably due to inaccuracies of the field measurements resulting from difficult access or with the thickness of the paint on the members. Those that were smaller were all within the fabrication tolerances. Of those measurements that were out of fabrication tolerance range, none were consistently out of range to conclude that a member other than what was specified in the design drawings was used.

Racking Measurements

Racking measurements for the gates were made at the beginning of the upstream inspection of the gates. Measurements were recorded for the distance between the bottom of the gate at the bottom corner of the bottom seal plate, and the embedded spillway plate. Measurements were made as far as possible to the left and right side of the gate depending on stoplog leakage and flow on the spillway. The gates were typically between two and three feet open when the measurements were made. The measurements for racking are as follows:

	Left (inches)	Right (inches)
Gate 1	-	-
Gate 2	35 - 3/4	36 - 1/2
Gate 3	47	47
Gate 4	14 - 1/2	14 - 3/4
Gate 5	24 - 3/4	24 - 3/4
Gate 6	30 - 1/4	30 - 1/4
Gate 7	24 - 3/4	24 - 3/4
Gate 8	26	25 - 3/8

Table 2: Gate racking measurements.

The gates were also observed at the moment of first opening to look for signs of water release beginning from one side of the gate or the other. In most cases, water release would begin at both sides of the gate simultaneously and move towards the middle of the gate at equal rates. Based on the recorded measurements and observations, there is no apparent racking of the gates.

Trunnion Hub Movement: Closed - Full Open - Closed

With the stoplogs in place, measurements were made of the transverse gap between the trunnion hub and the trunnion yoke at both trunnions. The measurements were made with the gate at the initial opening, full open, and again when closed. The maximum transverse movement recorded between any two positions is as follows:

	Left Trunnion		Right Trunnion	
	Inside (inches)	Pier Side (inches)	Inside (inches)	Pier Side (inches)
Gate 1	0	0	0	0
Gate 2	1/32	0	1/32	0
Gate 3	0	0	0	0
Gate 4	0	0	0	0
Gate 5	1/16	0	0	0
Gate 6	0	0	1/32	0
Gate 7	0	0	0	0
Gate 8	0	0	0	0

Table 3: Transverse trunnion hub movement through full opening and closing

Based on the surface irregularities of the trunnion hub and the casting tolerances, the transverse measurements between the hub and the yoke can only be considered accurate to ±1/16-inch. The recorded measurements indicate there is no appreciable lateral movement of the trunnion hubs with respect to the trunnion yoke during either opening or closing of the gate.

Trunnion Hub Movement: Unloaded vs. Loaded

Dial gages were installed at one trunnion to record the vertical, transverse and upstream / downstream movement of the trunnion hub with respect to the trunnion yoke. The initial measurement was made with the stoplogs in place and no load on the gate. The final reading was made after the top stoplog was removed and the gate was fully loaded. The maximum movements recorded at the trunnion hubs are as follows:

	Vertical (1 / 1000 inch)	Upstream / Downstream (1 / 1000 inch)	Transverse (1 / 1000 inch)
Gate 1	4	25	0
Gate 2	2	39	33
Gate 3	4	29	10
Gate 4	2	33	0
Gate 5	16	54	18
Gate 6	9	36	6
Gate 7	6	35	2
Gate 8	3	25	9

Table 4: Loaded versus unloaded trunnion movements

For the vertical movements shown in Table 4, the hub moved upward with respect to the yoke during loading. The upstream / downstream movement of the hub was in the downstream direction and the transverse movement was outward, toward the piers.

The tolerance for the 24-inch diameter trunnion pin is listed in the design plans as +0.000 inches and –0.005 inches. The tolerances for the 24-inch diameter trunnion bushing is listed as +0.012 inches and –0.000 inches. The shop plans for the pin indicate the pin should be 23.980 inches in diameter with tolerances of +0.000 inches and –0.008 inches.

Based on the tolerances listed either in the design plans or the shop plans, there is no significant displacements of the trunnion hub with respect to the trunnion yoke occurring during the loading or opening process.

Individual Gate Inspection Observations

The observations in the following section pertain only to the gates indicated and were not typically found on all of the gates.

Gate 1

- Due to the presence of the surface collector installed in the stoplog slots at Gate 1, the upstream inspection and operational tests were not performed until November 20th, see Photo. 19. The upstream surface of the skin plate was in generally the same condition as the previously inspected gates.

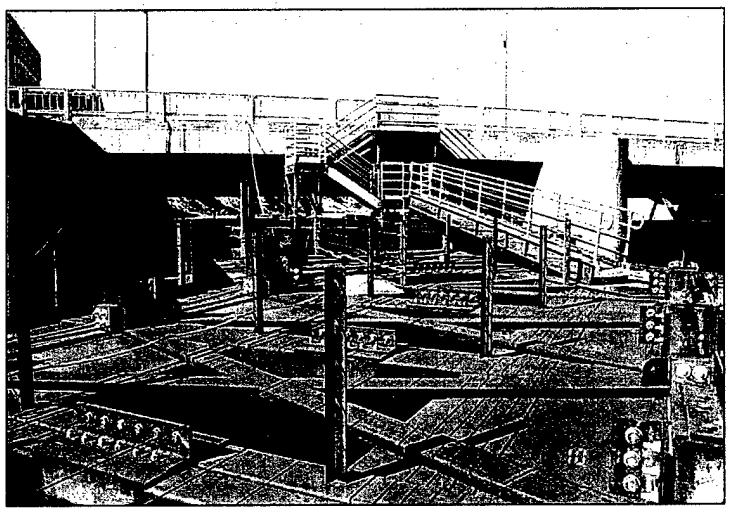


Photo. 19: Surface collector installed at Gate 1 during initial inspection.

Gate 2

- Flange and web at the top left vertical brace at connection to middle girder is deformed. The web is deformed toward the middle of the gate approximately 1 inch. See Photo. 20 and Photo. 21.

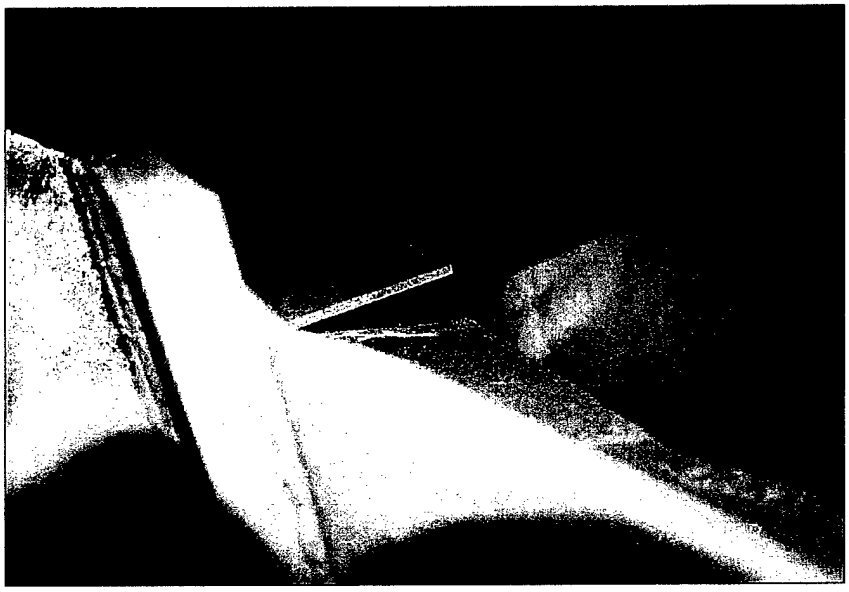


Photo. 20: 1 inch deflection in web of top left vertical brace at middle girder.

Photo. 21: ¼ inch deflection in flange of top left vertical brace middle girder.

Gate 3

- At the upstream end of the bottom right radial strut there are indentations on the outside surface of the inside (spillway side) flange. The indentations appear to be due to previous grinding which occurred prior to the most recent painting. See Photo. 22

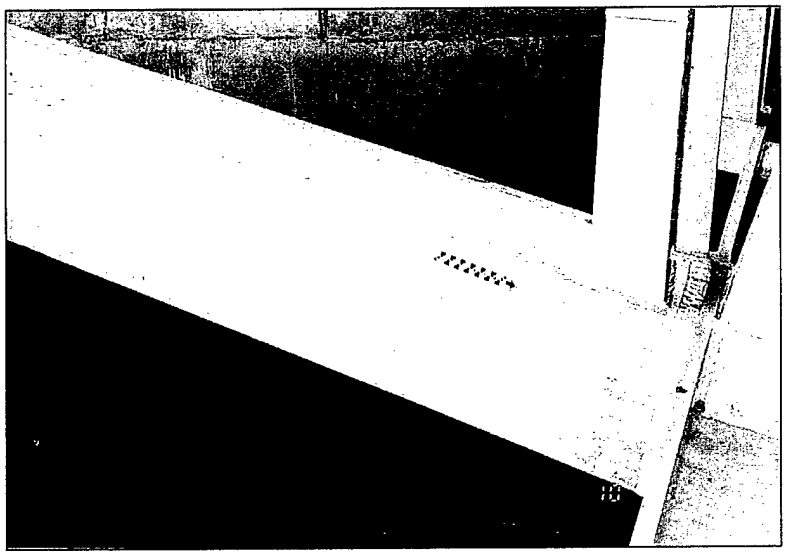


Photo. 22: Grinding marks on lower strut flange.

- There appears to be a small lubrication leak in the lubrication line to the right (looking downstream trunnion). There is a bulge of lubricant at the angle coupling between the flexible line and the trunnion hub. See Photo. 23.

Photo. 23: Lubricant bulb at connection to trunnion.

Gate 4

- Prior to the inspection of the upstream face of the gate and waterblasting, an approximately 10-inch diameter paint blister was observed on the downstream side of the skin plate. The blister was located between the middle and top horizontal girders, approximately 7-feet from the left side of the gate (looking downstream) and approximately 6-feet above the transition between the 1/2-inch and 3/8-inch skin plate. The blister did not appear to be leaking water at the time, however, rust stains were observed on and beneath the blister. After waterblasting the upstream surface of the gate, the blister developed several leaks, see Photo. 24 and Photo 25. During the downstream inspection of the gate the blistered paint was removed to expose the hole in the skin plate, see Photo 26. The actual hole through the skin plate was roughly oblong and approximately 1/4-inch wide and 1/8-inch tall.

- The leak was patched by Gus Hernandez, USACE, on October 17th using META-LOX™ Industrial-Grade Metallic Patching Compound, a 2-part epoxy and resin compound.

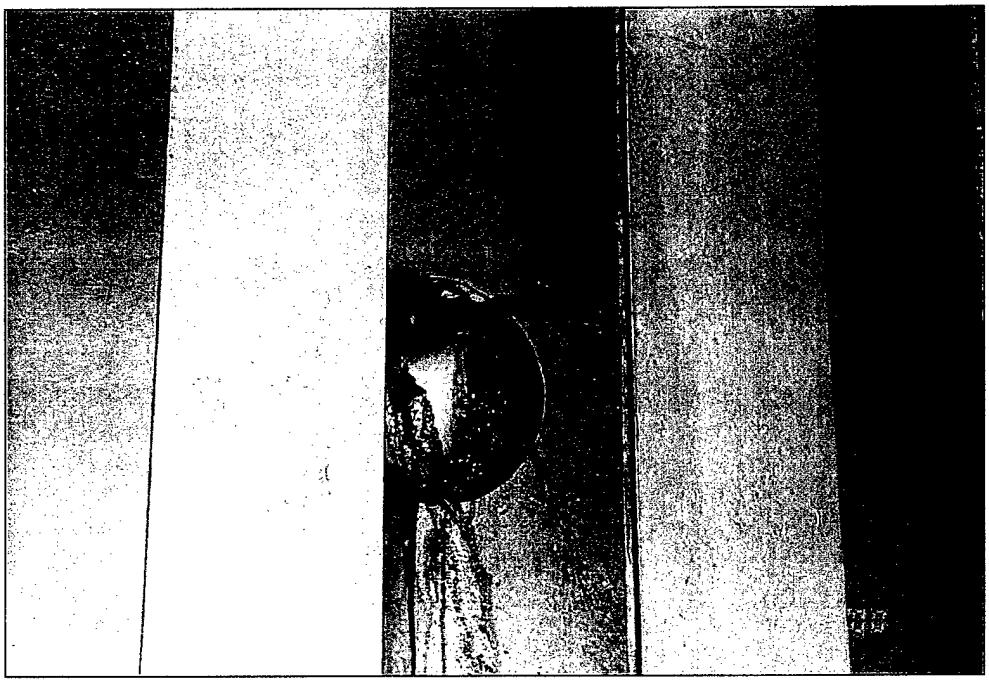


Photo. 24: Paint blister and leakage downstream side of skin plate, prior to removal of paint.

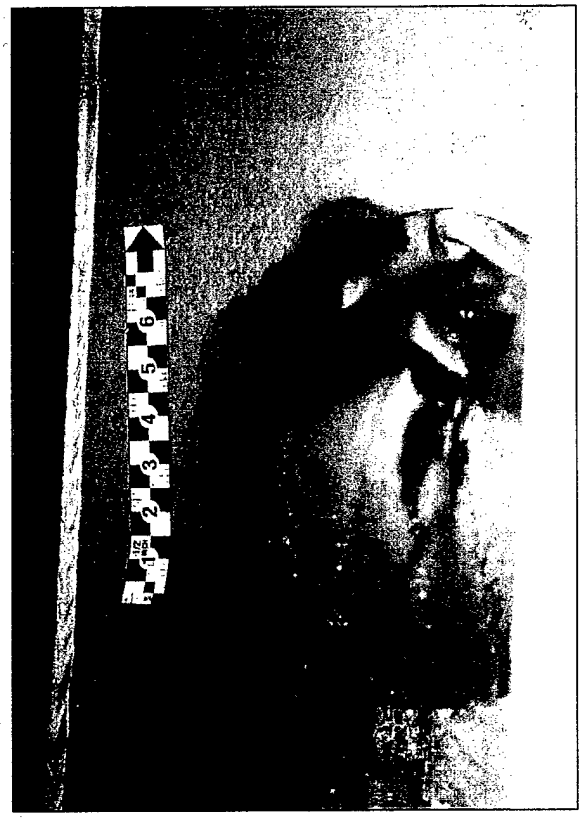


Photo. 25: Skin plate leak prior to removal of paint.

Photo. 26: Skin plate leak after removal of paint.

Gate 5

- There is a indentation in radial strut brace H on the right side frame. The indentation is approximately 2 inches long, ½ inch wide, and ¼ inch deep. The indentation appears old and probably occurred during construction. There is no sign of distress or corrosion associated with it, see Photo. 27.

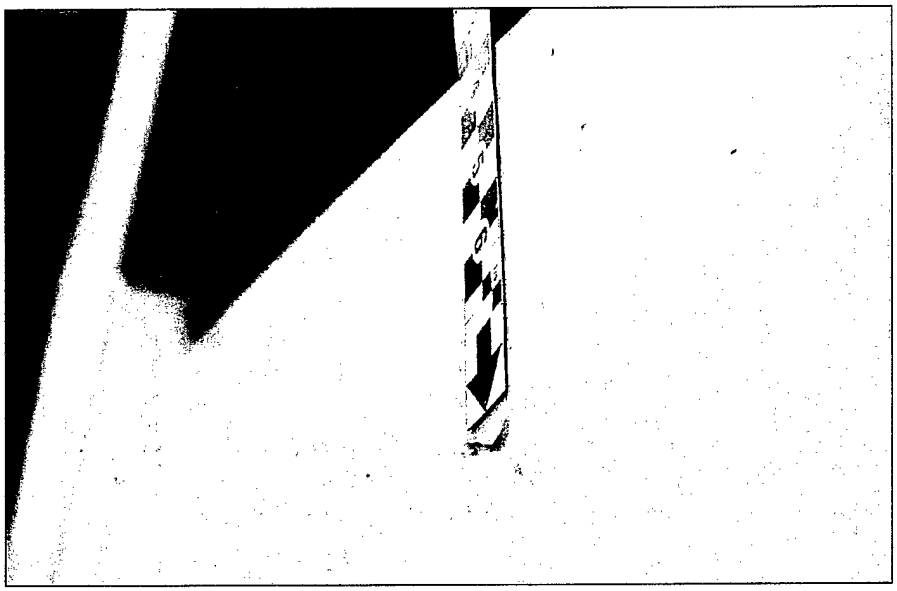


Photo. 27: Deformation in Brace H.

Gate 6

- See general condition observations.

Gate 7

- The web of the top right vertical bracing at connection to middle girder is deformed. The web is deformed towards the middle of the gate approximately 2 inches. This is similar to deformation on Gate 2. See Photo. 28.

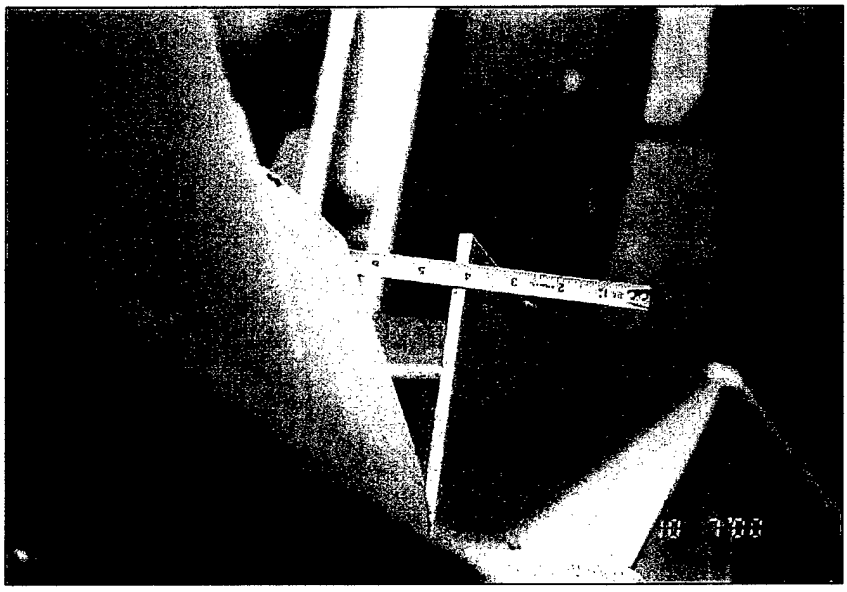


Photo. 28: 2 inch deflection in top right vertical bracing at middle girder.

Gate 8

- See general condition observations.

Ultrasonic Testing Results

Description

The field welds on the gates were tested ultrasonically to determine the amount of discontinuity present and the integrity of the welds. The location of the tested welds is shown in Figure 4.

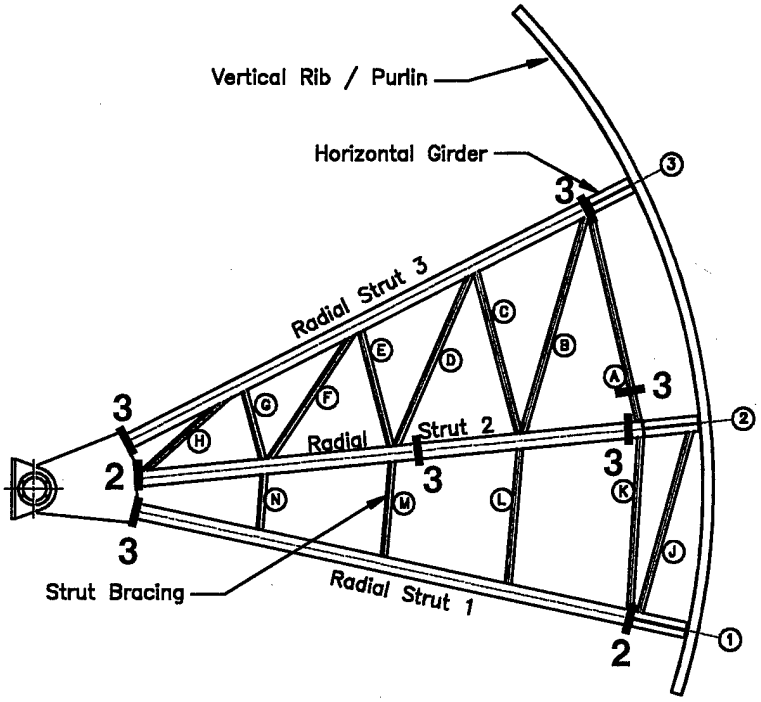


Figure 4: Ultrasonic Weld Test Locations.

A total of 352 welds were tested, of which 54 welds were rejected in accordance with the requirements of ANSI / AASHTO / AWS D1.5, 1995 Bridge Welding Code. Of the welds which failed the testing, 69% were located at the upstream end of the radial struts. Only one weld at the connection between the downstream end of the radial struts and the trunnions was found to fail the testing.

Table 5 lists the rejected welds by gate number and location on the gate. The letter 'f' indicates a flange weld, 'w' a web weld. Approximately 75% of the rejected welds were located on the flanges of the members. Figure 5 illustrates the percentage of welds which failed testing and the total number of welds which failed for each location tested.

The extent and depth of the rejected welds are marked on each of the tested welds in the field. At each rejected weld there will be a start and end mark along the weld and a number indicating the depth of the flaw. For individual gate weld test sheets, see Appendix C.

Gate	Welds Accepted	Welds Rejected	Flaw Severity Class				Locations
			A	B	C	D	
1	41	3	1	2	0	0	33w, 34f, 35f
2	42	2	2	0	0	0	58fo, 59fo
3	37	7	6	1	0	0	25f, 26f, 27f, 28f, 29f, 30f, 31w
4	27	17	12	2	0	3	36w, 37fo, 38fi, 39fi, 40fi, 42fo, 43w, 44fi, 45w, 36fo, 47fi, 48w, 49fo, 50fo,
5	41	3	3	0	0	0	78fi, 79fi, 80fi
6	41	3	2	1	0	0	60fo, 61fo, 62fi
7	29	15	15	0	0	0	63fo, 64fo, 65fi, 66w, 67fi, 68fi, 69w, 70fo, 71fi, 72fo, 73fi, 74w, 75fo, 76w,
8	40	4	4	0	0	0	54, 55w, 56fi, 57w

Table 5: Ultrasonic Testing Summary.

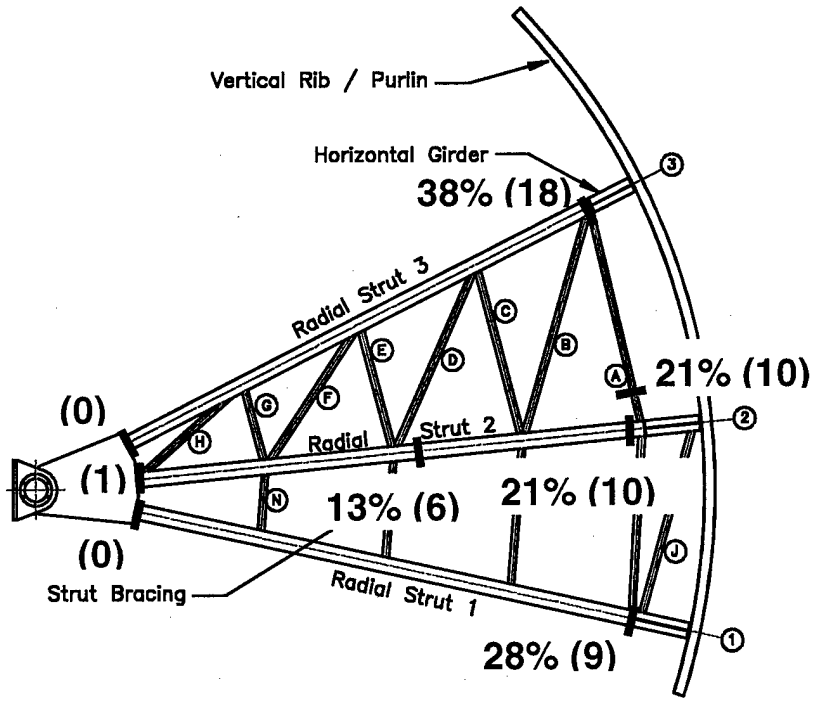


Figure 5: Ultrasonic Weld Test Locations and Percentage of Welds Failing Testing at Each Location.

Hoists – Operation, Testing and Measurements

Hoist Operation Inspection

External portions of the hoist equipment, support platforms and gate connections were visually inspected for signs of excessive corrosion, wear or damage. See Photos 29, 30 and 31 below. The hoist and hoist machinery are in generally good condition.

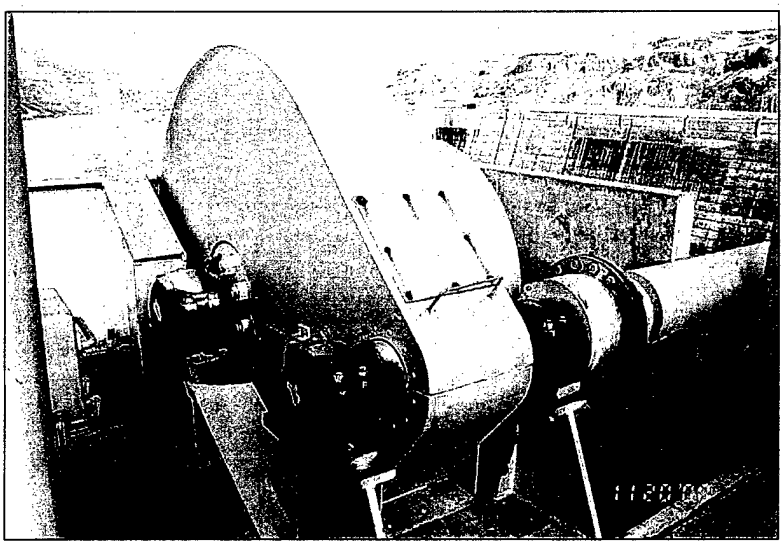


Photo. 29: Hoist, typical.

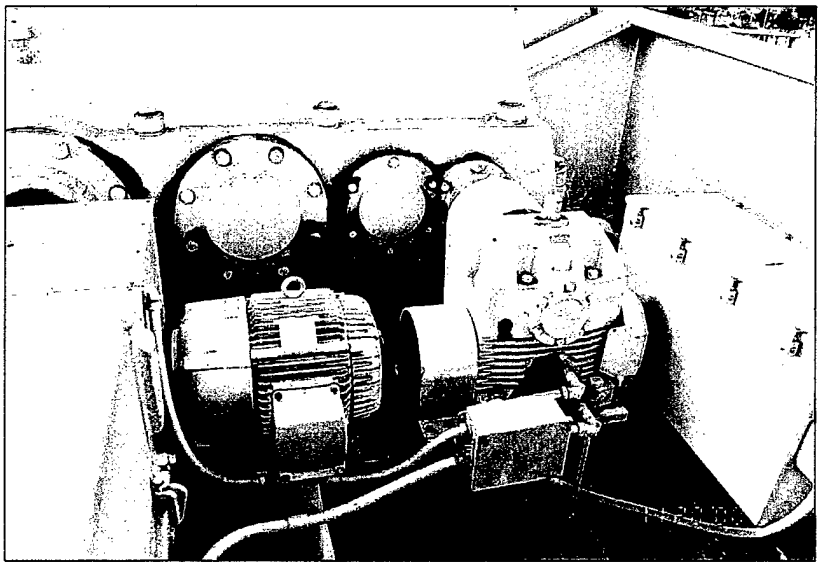


Photo. 30: Hoist motors, typical.

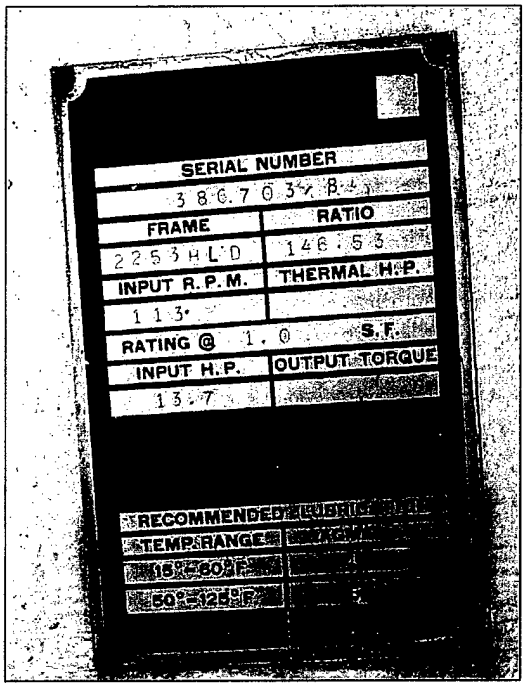


Photo 31: Hoist manufactures plate, typical.

The following observations were made at individual gate hoists:

	Hoist and Motor Observations
Gate 1	Loaded test only performed due to surface collector.
Gate 2	There is a high level of noise from the right angle gearbox. The coupling should be checked and lubricated.
Gate 3	Right angle gearbox - high level of noise –check coupling and lube. Main gearbox has severe oil leak at output shaft.
Gate 4	There is bearing noise at the motor output shaft. The main gearbox shaft seals are weeping.
Gate 5	The main gearbox output shaft seals are leaking.
Gate 6	The main gearbox seals are weeping.
Gate 7	The main gearbox seals are weeping.
Gate 8	The main gearbox seals are weeping.

Table 6: Hoist operation observations.

Hoist Amperage Measurements:

Hoist amperage readings were recorded during opening and closing of the gates in both the loaded and unloaded condition. The readings include the start up and running amperage. Running amperages were recorded for Phase A, B and C. Table 7 lists the opening and closing start up amperage and the average of the three phases for the running amperage for the gates in the unloaded condition. Table 8 lists the same information for the loaded condition.

	Start up Opening	Start up Closing	Running Opening	Running Closing
Gate 1	No unloaded test performed due to surface collector			
Gate 2	106.0	102.0	13.5	9.0
Gate 3	114.4	111.2	15.6	10.6
Gate 4	112.0	105.0	15.9	10.2
Gate 5	115.0	111.2	14.5	10.2
Gate 6	110.5	110.0	15.5	9.9
Gate 7	124.1	110.0	15.8	9.4
Gate 8	110.4	110.6	15.3	10.3

Table 7: Unloaded Gate - Hoist Amperage Readings

	Start up Opening	Start up Closing	Running Opening	Running Closing
Gate 1	112.0	110.0	16.0	9.4
Gate 2	108.0	104.5	15.3	9.9
Gate 3	117.6	114.4	16.3	10.1
Gate 4	116.2	104.8	15.7	9.6
Gate 5	108.8	112.0	15.9	10.1
Gate 6	113.6	106.4	15.7	10.2
Gate 7	116.8	110.8	15.5	9.9
Gate 8	114.0	108.0	15.7	10.0

Table 8: Loaded Gate - Hoist Amperage Readings

Based on the consistency of the readings the hoists are in generally good condition. The amperage data indicates that the tainter gate hoist motors are operating well within their design operating limits that normally allow the starting amperage to be in the range of 5 to 8 times the nameplate value. The current draw for all motors were in acceptable range and the gates appeared to be free with no apparent binding. The field inspection sheets for the hoist measurements can be found in Appendix B.

RECOMMENDATIONS

Recommended in the next year or as necessary:

- Repair pitting on skin plate and repaint (or recoat) upstream surface of gate face.
- Install sacrificial anodes on upstream side of gate. Based on the condition of the skin plate at Little Goose Dam (which has sacrificial anodes) sacrificial anodes will significantly reduce the amount and severity of pitting of the skin plate. A corrosion expert should be consulted to determine the number and location of anodes required.

  These repairs can be undertaken sequentially on all of the gates at once or the repairs could be made on an as-needed basis as the pitting penetrates the skin plate and leaks develop at individual gates.

Recommended in the next 2 years:

- Perform a structural analysis of the gates to determine capacity for trunnion friction, operating loads and the demand on the welded joints which were found to contain flaws.
- Analyze the hoist gearboxes per the manufactures recommendation and remanufacture or replace as required.
- Replace the main gearbox seals on the hoist motors.

Recommended in the next 5 years:

- Install drain hole between the multiple stiffeners at ends of the bottom horizontal girders. The recommended size for these drain holes is 1-inch in diameter.
- Install drain holes in the purlin stiffeners near the ends of the bottom horizontal girders (Plate perpendicular to skin plate, above multiple stiffeners on bottom horizontal girder). The recommended size for these drain holes is 1-inch in diameter.
- Install drain holes in the downstream portion of the bottom seal plate between every purlin. Note: the rubber bottom seal is located between the bottom seal plate and the bottom seal keeper plate. The hole should not be flame cut with the rubber bottom seal in place. The recommended size for these drain holes is 1-inch in diameter.
- Enlarge the drain holes at upstream end of lower radial struts. The recommended size for these drain holes is 1 1/2 - inch in diameter.
- For all new and inlarged drain holes, the holes should be drilled, not flame cut, to reduce jagged edges which snag debris. If drilling holes is not feasible, then the edges of the flame cut holes should be reamed smooth.

REFERENCES

1. Water Control Manual, Lower Granite Lock and Dam, U.S. Army Corps of Engineers, Walla Walla District, May 1987.

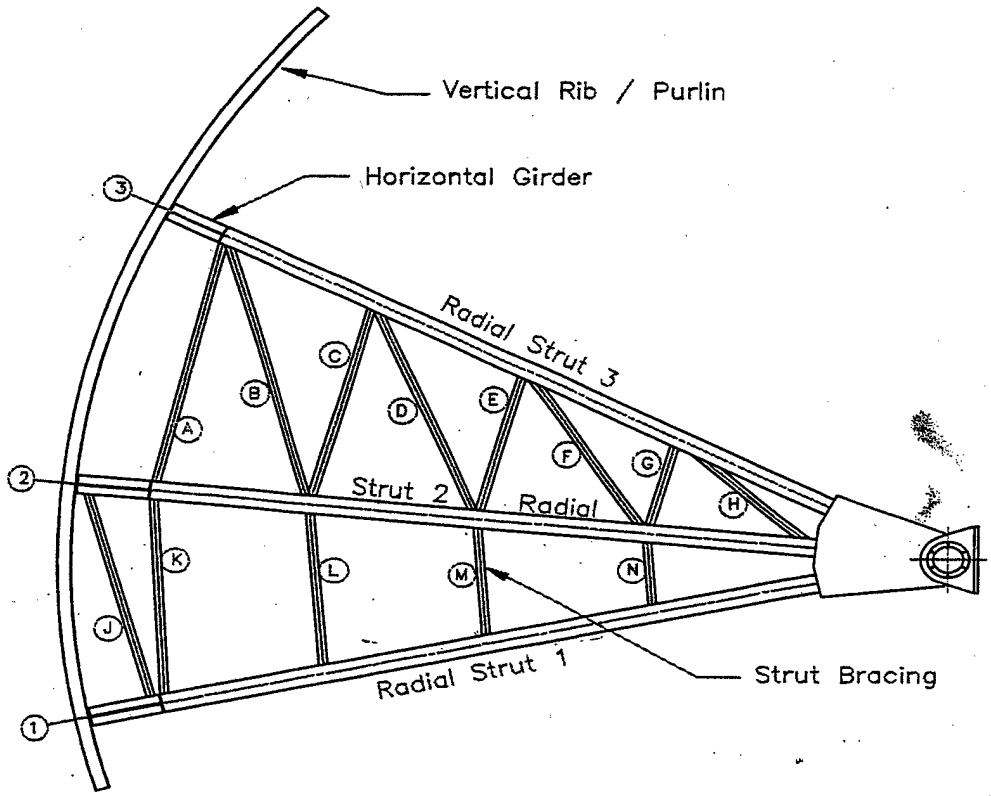
2. Lower Granite Lock and Dam, Operations Manual, SCM Consultants , Inc.

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather SUNNY 70°

Date 10/6
Sheet 1

Gate No. 1
Left Elevation B-B



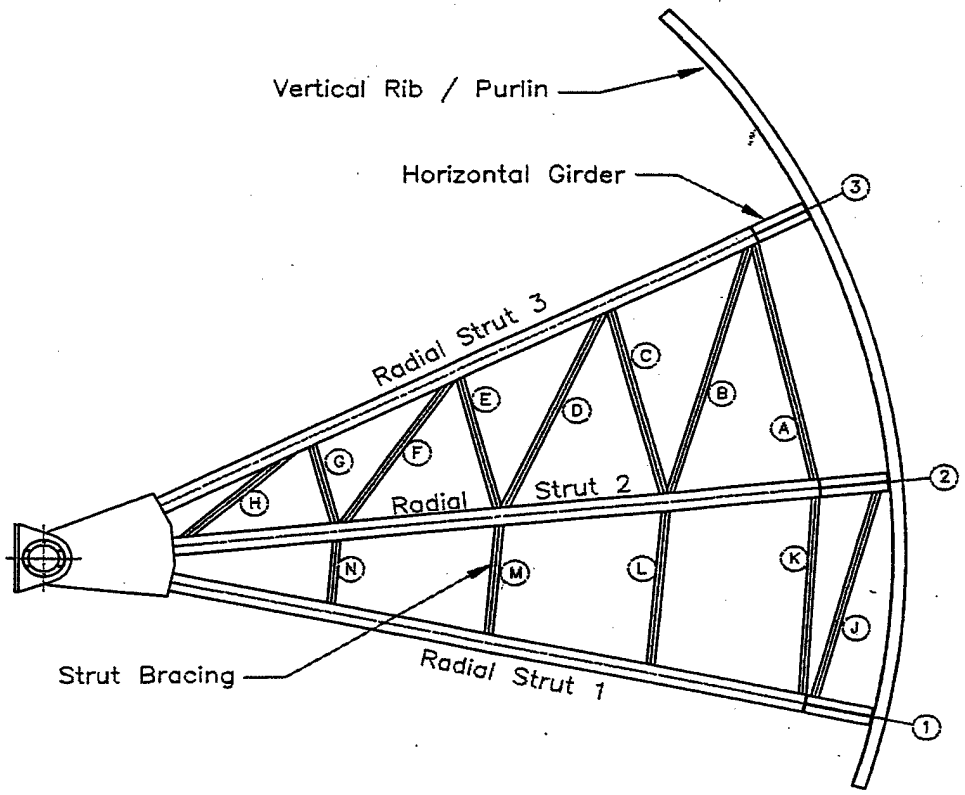
Member	Type	Depth d		Web t_w		Flange(s) b_f			t_f
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	—	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 3/4	1 9/16	—	16 3/8	✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4		1 13/16		16 5/8		2 13/16	
Brace A	14 WF 30	13 7/8	13 3/4	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	13 3/4	5/16	—	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	13 7/8	5/16	—	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14 3/16	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	13 3/4	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/6
Sheet 2

Gate No. 1
Right Elevation A-A



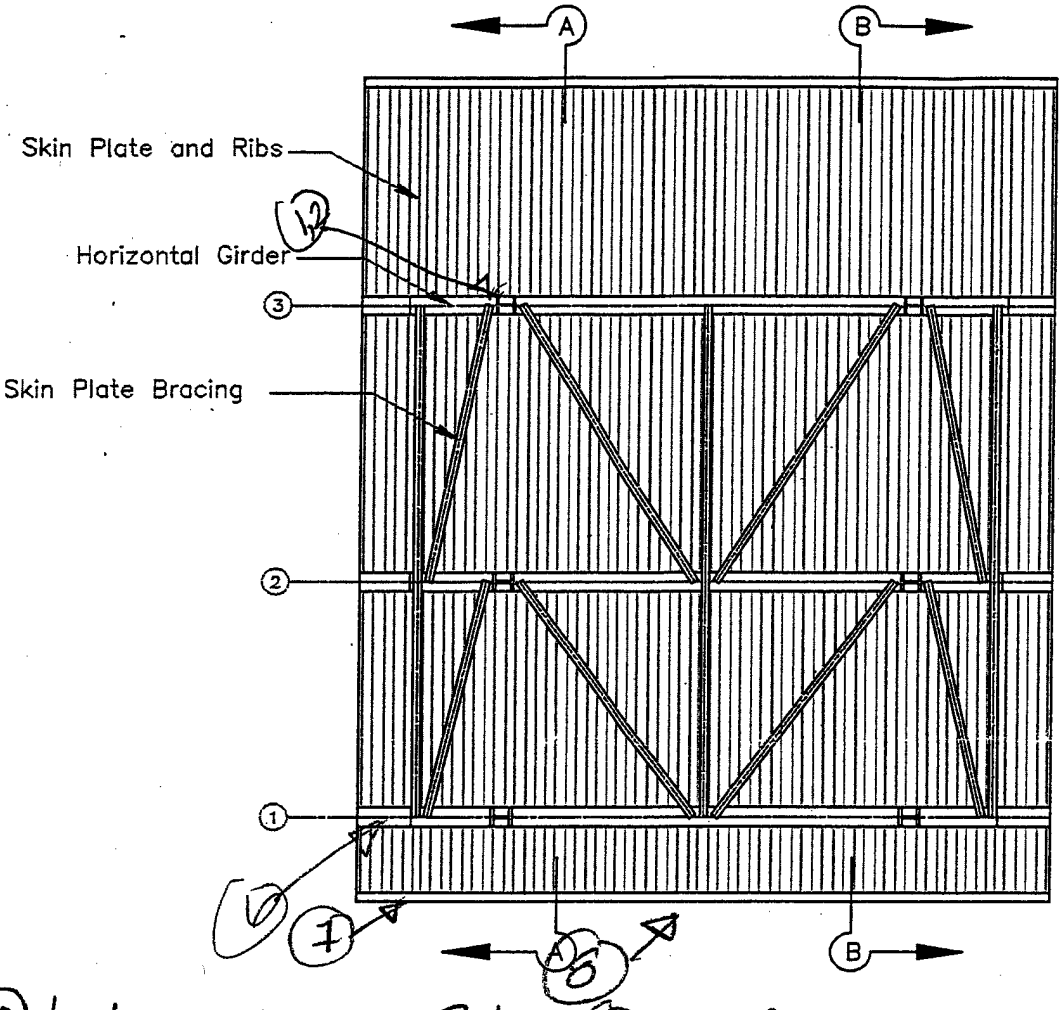
Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16	—	15 3/4	15 5/16	1 1/2	1 3/8
Strut 2	14 WF 342	17 1/2	17 1/8	1 9/16	—	16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/8	1 13/16	—	16 5/8	16 1/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	13 5/8	5/16	—	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 7/8	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB (HAY)
Weather

Date 10/6
Sheet 3

Gate No. 1 **Downstream Elevation**



(9) leaking Gate @ Bottom (9)

Member	Type	Depth d		Web t_w		Flange - End b_f		Flange - End t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	✓	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	5/8	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	—	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	—	8 1/4	✓	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	6 7/8	1/4	✓	6 3/4	✓	3/8	✓

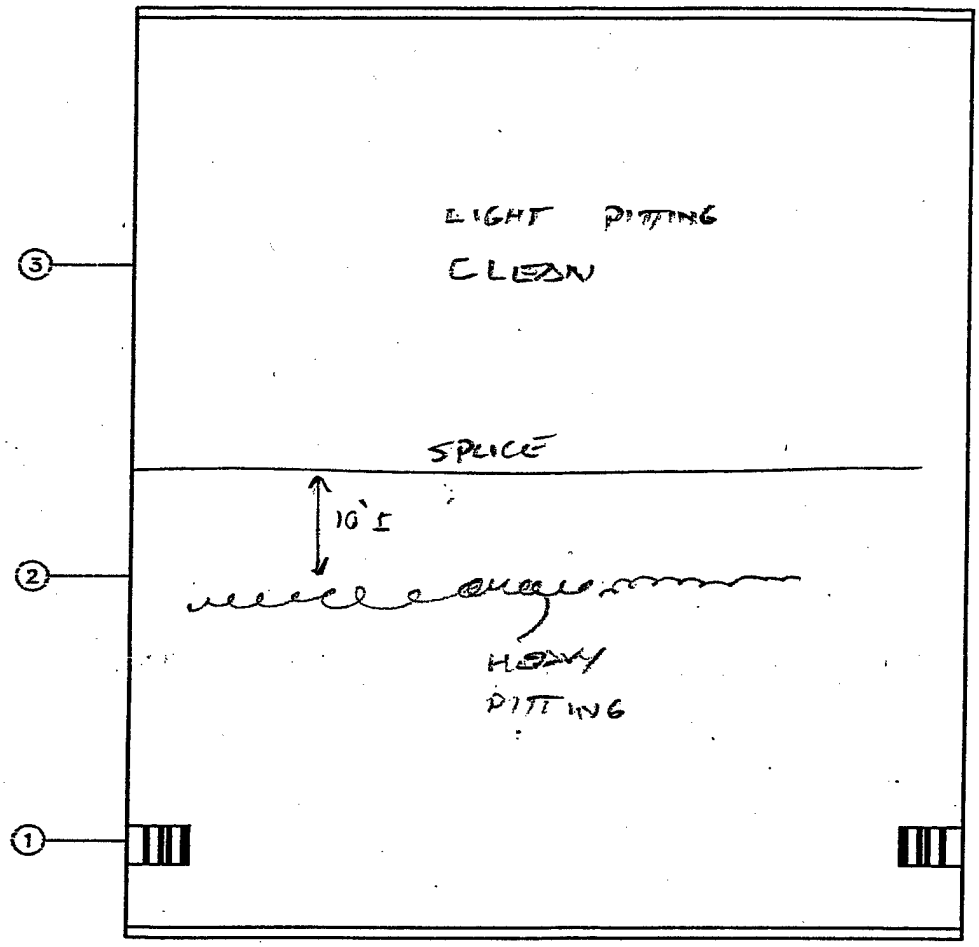
(1) Corrosion due to standing water
(2) Corrosion between splice plates due to water
(3) Leak in L side seal
(4) Corrosion on 2nd Girder
(5) Ponding water on bottom strut to bottom girder
(6) Bottom Girder, Left
(7) Standing Water @ Purlins
(8) Center @ Gate Missing concrete & Bottom Plate

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team (SMP) TDB HAY
Weather

Date 11/20
Sheet 4

Gate No. 1 **Upstream Elevation**



HEAVY PITTING @ 10' BELOW SPLICE / TYP OF OTHER GATES

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather CLDY 30°

Date 11/20
Sheet 5

Gate No. 1 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT

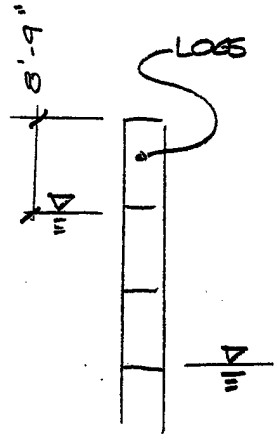
TOO MUCH LEAK AND FLOW FROM STOPLOGS TO MEASURE

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	22/32	16/32	21/32	14/32
Gate Full Open	22/32	16/32	21/32	14/32
Final Gate Closed	22/32	16/32	21/32	14/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		+0.0035		0.0000		0.0000	
US / DS	+0.0015		+0.0260		+0.0010		+0.0185	
Transverse	22/32	16/32	22/32	16/32	21/32	14/32	21/32	14/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside



GATE IS SHIFTED TO RIGHT AT FACE

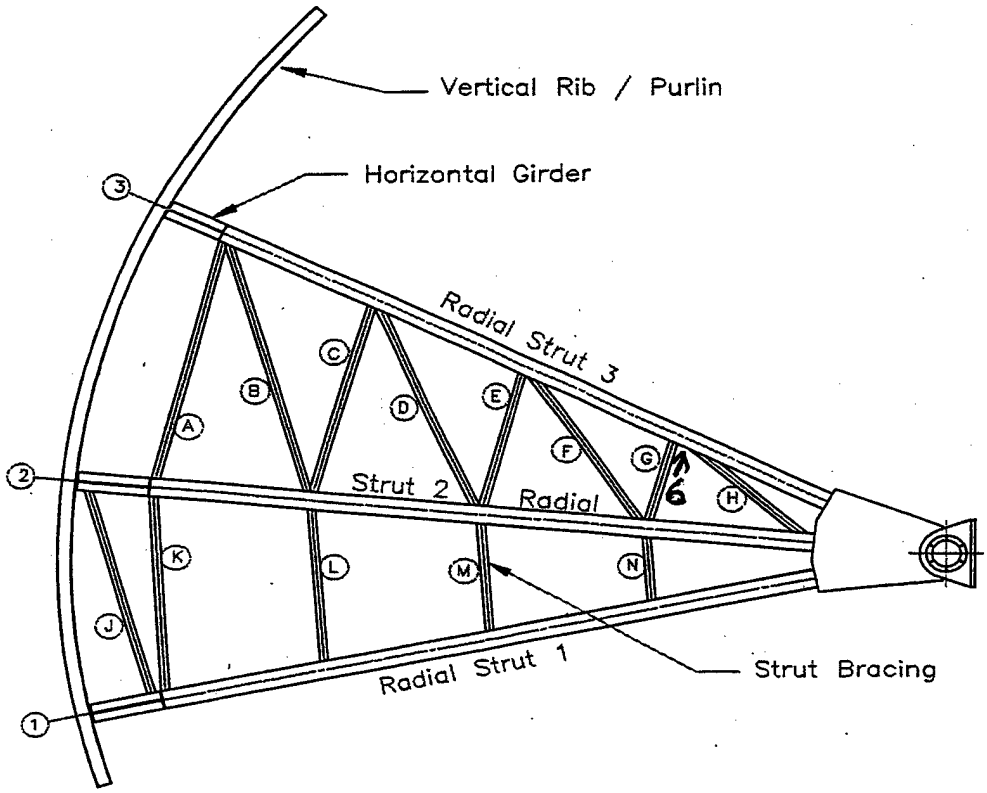
CRANE NOT AVAILABLE, VOID FILLED VIA GRAVITY, NOT FULL WHEN MEASURED ∴ 3 LOGS SHOWING

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather ~~PC~~ Sunny 75°

Date 10/5/00
Sheet 1

Gate No. 2
Left Elevation B-B



Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 5/8	1 9/16		16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 5/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	16 3/16	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace E	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16		6 3/4	↓	3/8	↓
Brace H	14 WF 30	13 7/8	14	5/16		6 3/4	↓	3/8	↓
Brace J	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace K	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 13/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8

16. Weld cut hole in top Strut.

18. RT. Trunnion

17. Overall Gate Pic.

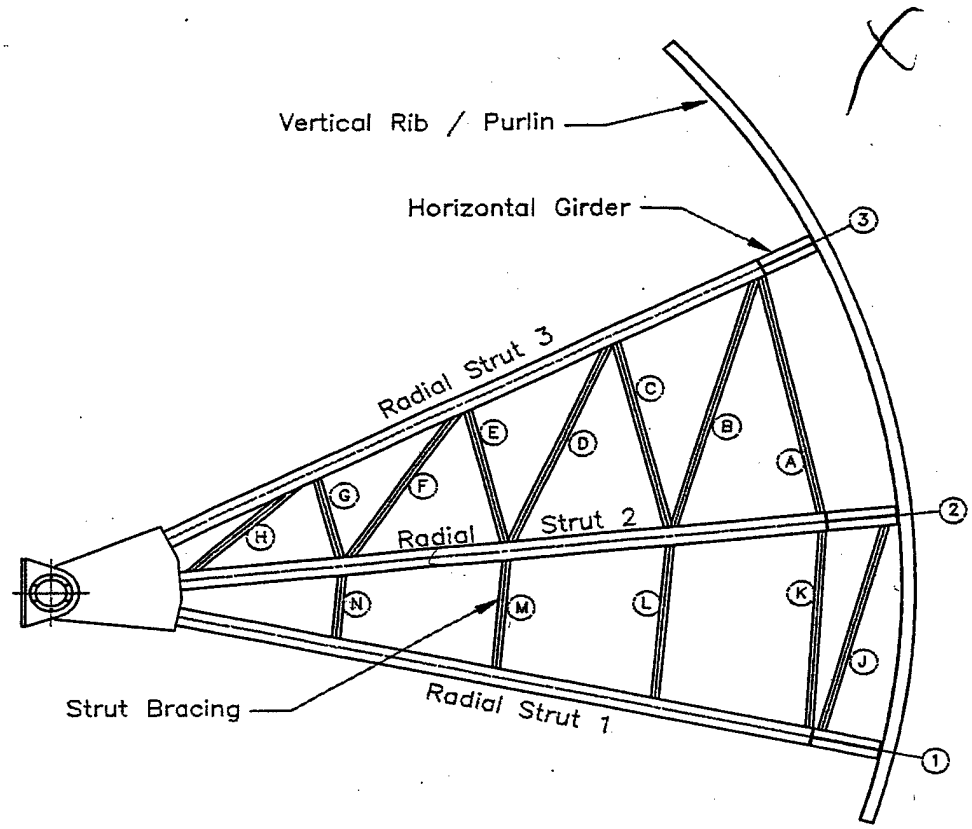
16. LFT Trunnion

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather

Date 10/5
Sheet 2

Gate No. 2
Right Elevation A-A



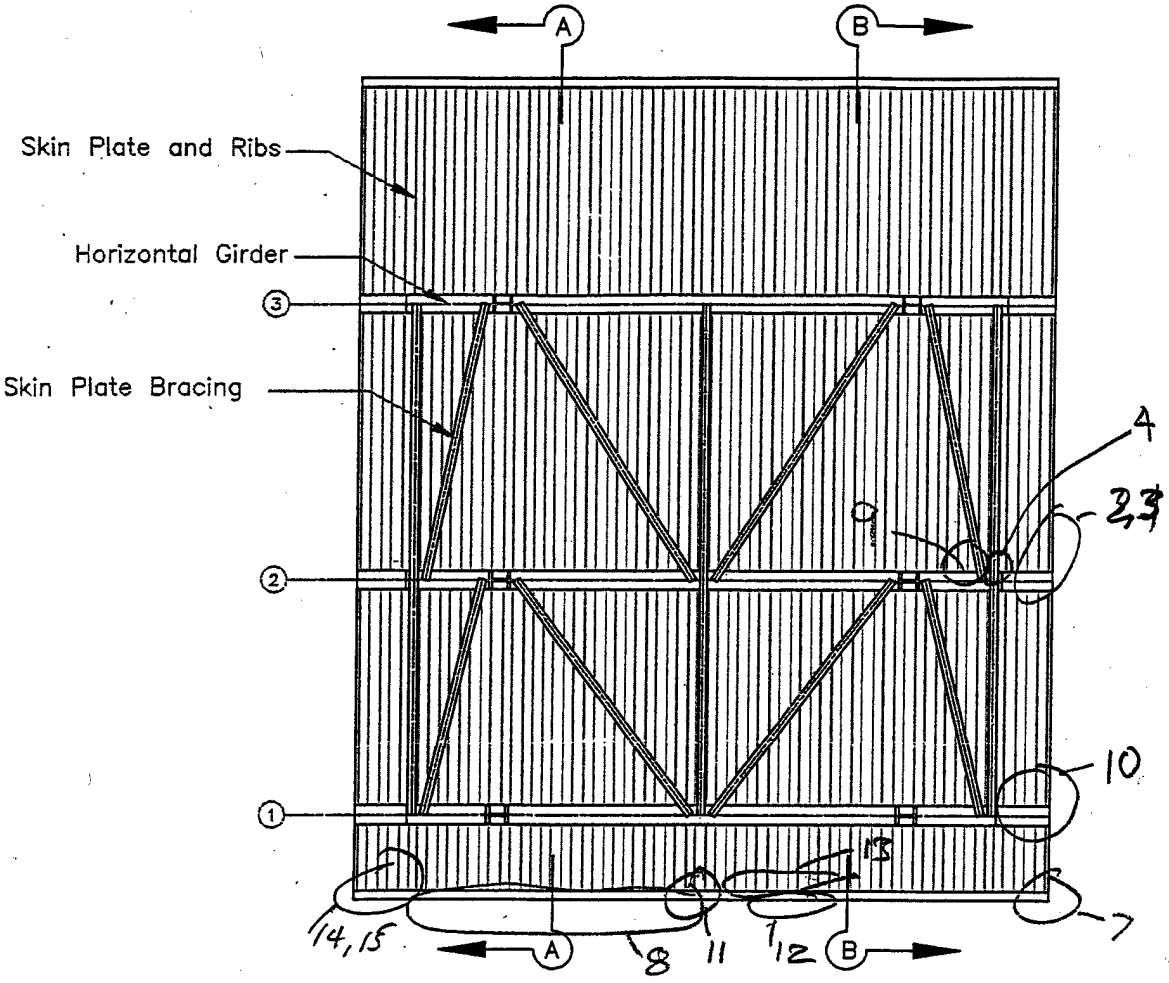
Member	Type	Depth d		Web t_w		Flange(s) b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 5/8	2 13/16	2 3/4
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	
Brace C	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	
Brace E	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	
Brace G	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	
Brace H	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace K	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace L	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 5/16	3/8	3/8
Brace N	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/5
Sheet 3

Gate No. 2 **Downstream Elevation**



14,15 Muck in Bot. Girder

Member	Type	Depth d		Web t_w		Flange - End b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	49 3/4	7/16	1/2	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 5/8	3/4		16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 9/16	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	5/16	6 3/4	6 3/4	3/8	3/8

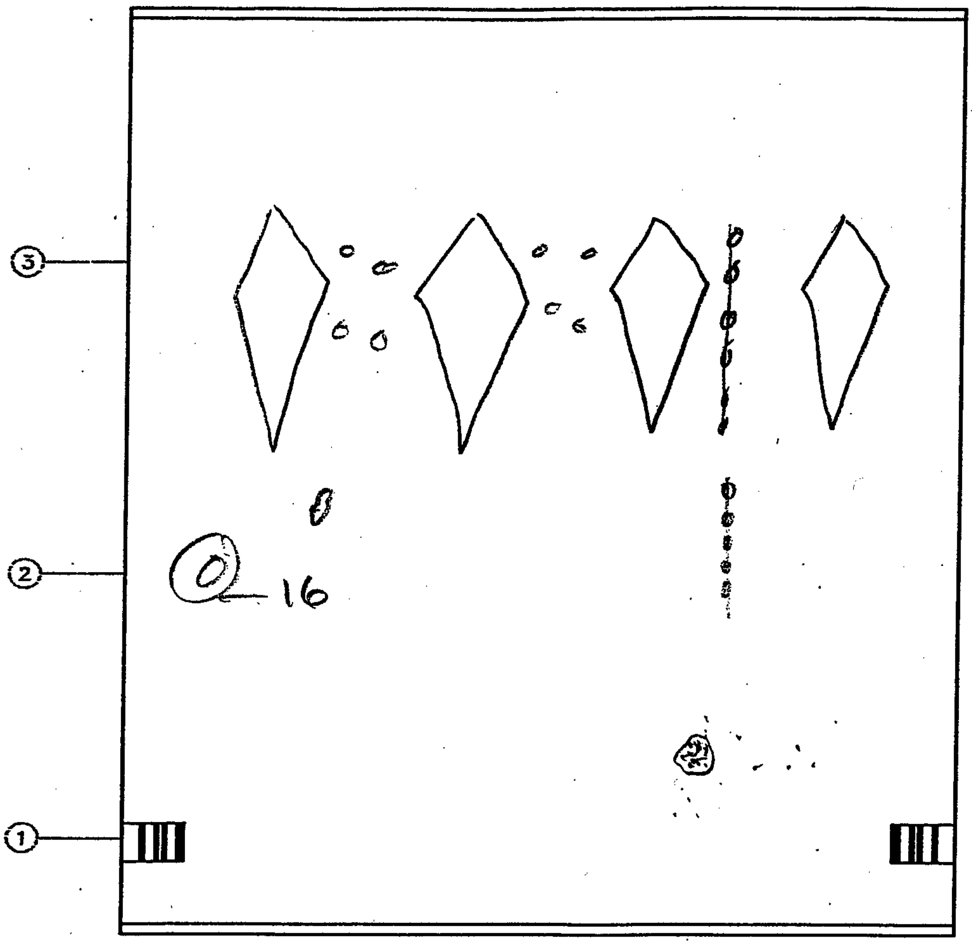
2,3 Delam. Coating (Paint?)
4. Sway in Vert bracing ≈ 1/4". the weld is Bent. @ Splice
5. Same as 4 ≈ 1"
7,8 Bottom Seal Leaks
9. Bot. Girder Moderate to Heavy Rust on Flng under ont. (Typ Picture) this is Also Seal on LRT Bot. Strut Flng
10. LFT Bot Girder Brace Pts w/ MOD and evidence of Standing H_2O
11,12 LEAKS @ Bot. Seal
13 STANDING H_2O @ Bot. Plate

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather

Date 10/5
Sheet 4

Gate No. 2 **Upstream Elevation**



- Paint Flaking off During Pressure Wash (15 14 pic)

16: Typ Pitting hole [illegible] 1/16" to 1/4" depth

17

(18)

- MORE CORR PITTING IN 1/2" PL THAN OTHER GATES (TYP)

(20) Corroded Weld on left of gate, 1/4" deep.

21, 22 →

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather WINDY 60

Date 10/9/00
Sheet 5

Gate No. 2 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
35 3/4	36 1/2

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	24/32	16/32	21/32	17/32
Gate Full Open	23/32	16/32	22/32	17/32
Final Gate Closed	24/32	16/32	21/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical					0.0000		-0.0020	
US / DS					0.0000		+0.0390	
Transverse	23/32	16/32	23/32	16/32	21/32	17/32	21/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

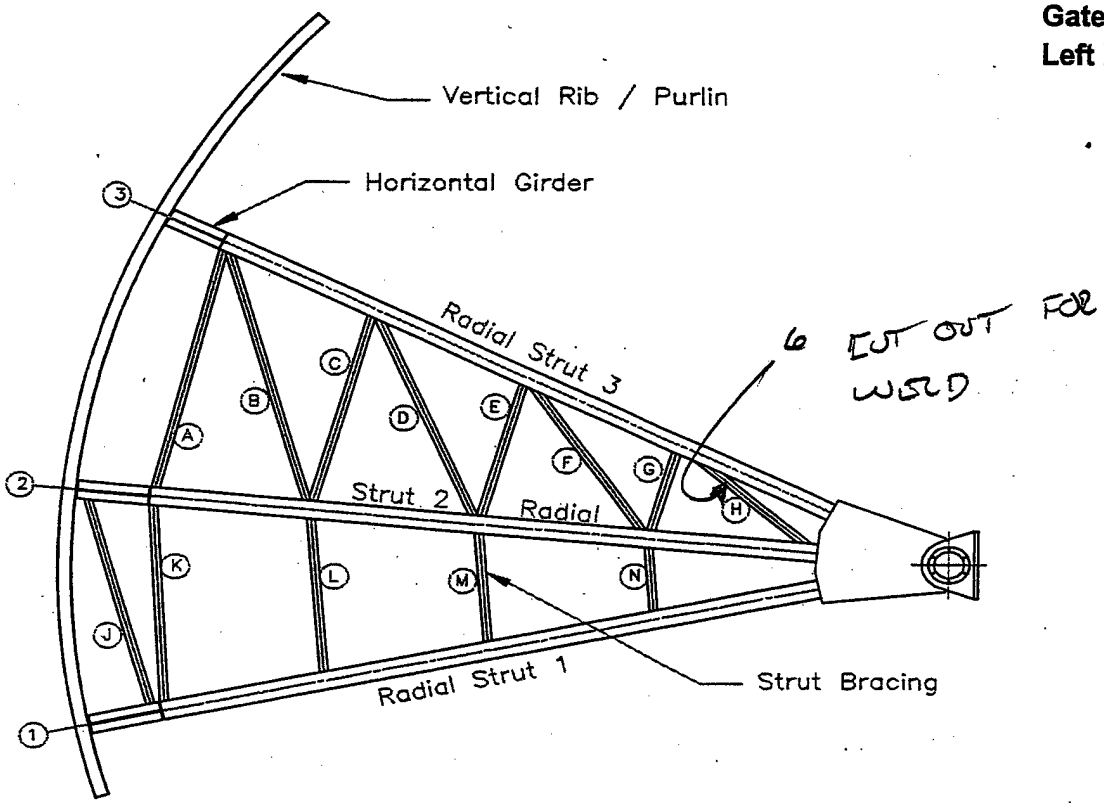
ROCK POCKET / VOID IN SPILLWAY. 10 FT FROM BT PIER

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team (SMF) TDB HAY
Weather SUNNY 65

Date 10/5
Sheet 1

Gate No. 3
Left Elevation B-B



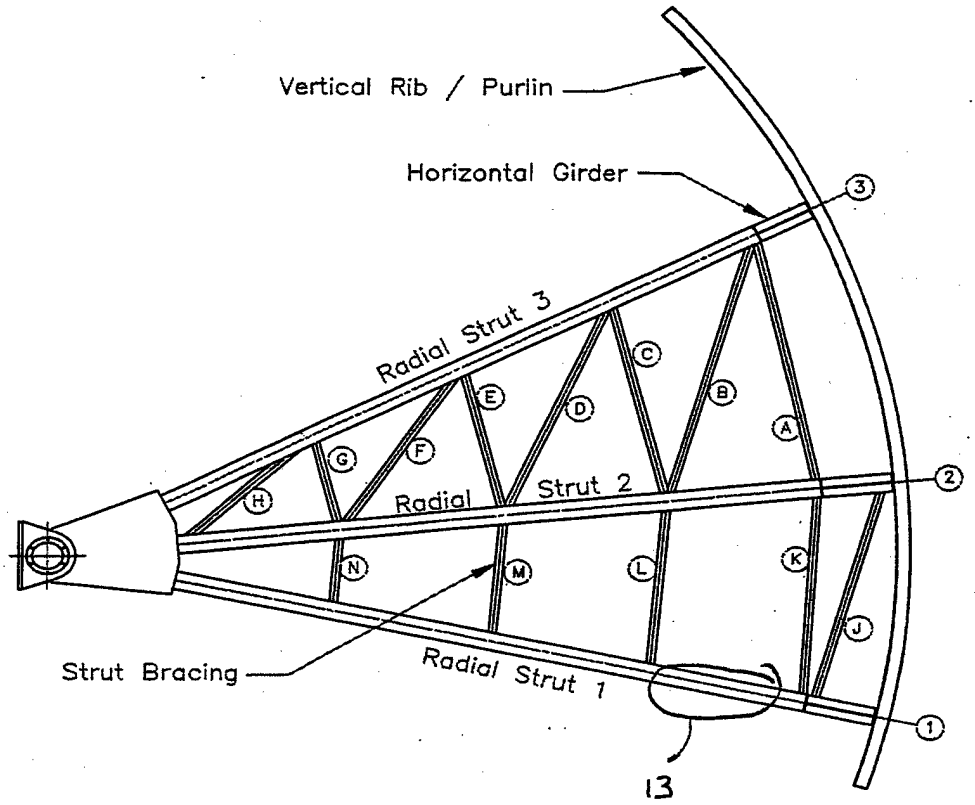
Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16	—	15 3/4	15 3/4	1 1/2	1 9/16
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 5/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 13/16	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather S 65

Date 10/5
Sheet 2

Gate No. 3
Right Elevation A-A



Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 11/16	15/16	—	15 3/4	15 3/4	1 1/2	1 9/16
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 3/8	1 13/16	—	16 5/8	16 3/8	2 13/16	2 3/16
Brace A	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8

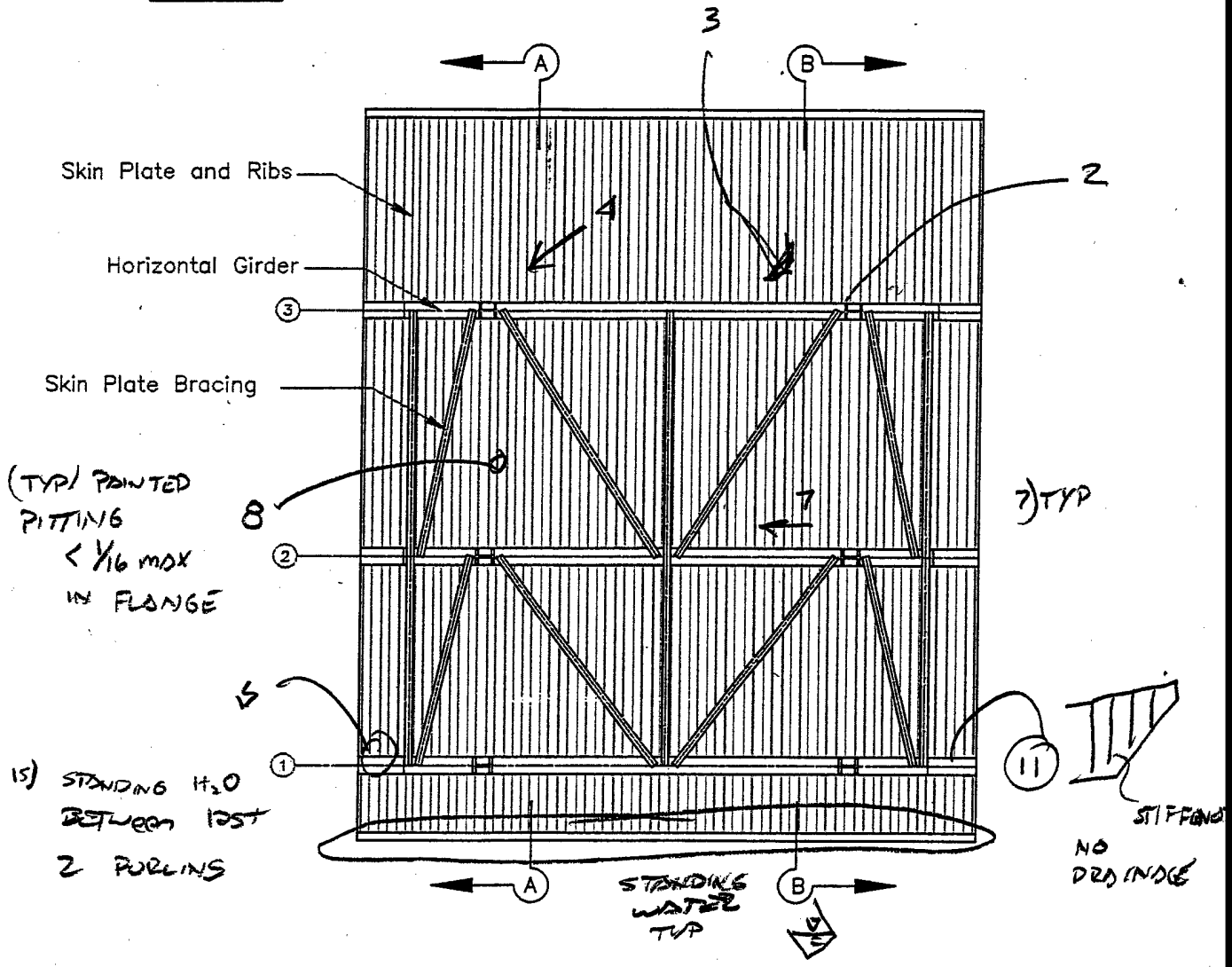
13) GRIND MARKS

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather SUNNY 65°

Date 10/5/00
Sheet 3

Gate No. 3 **Downstream Elevation**



Member	Type	Depth d		Web t_w		Flange - End b_f		Flange - End t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50	7/16	7/16	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4	3/4	16 1/2	16 1/2	1 1/4	1 5/16
Horiz. Girder 1	PL Girder	60 1/2	60 3/4	1	1	16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 1/2	13/32	—	8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 3/4	3/8	3/8

2) DELAM LIGHT COR.

3) TYP NOTE: NO WELDS U.S. STIFF

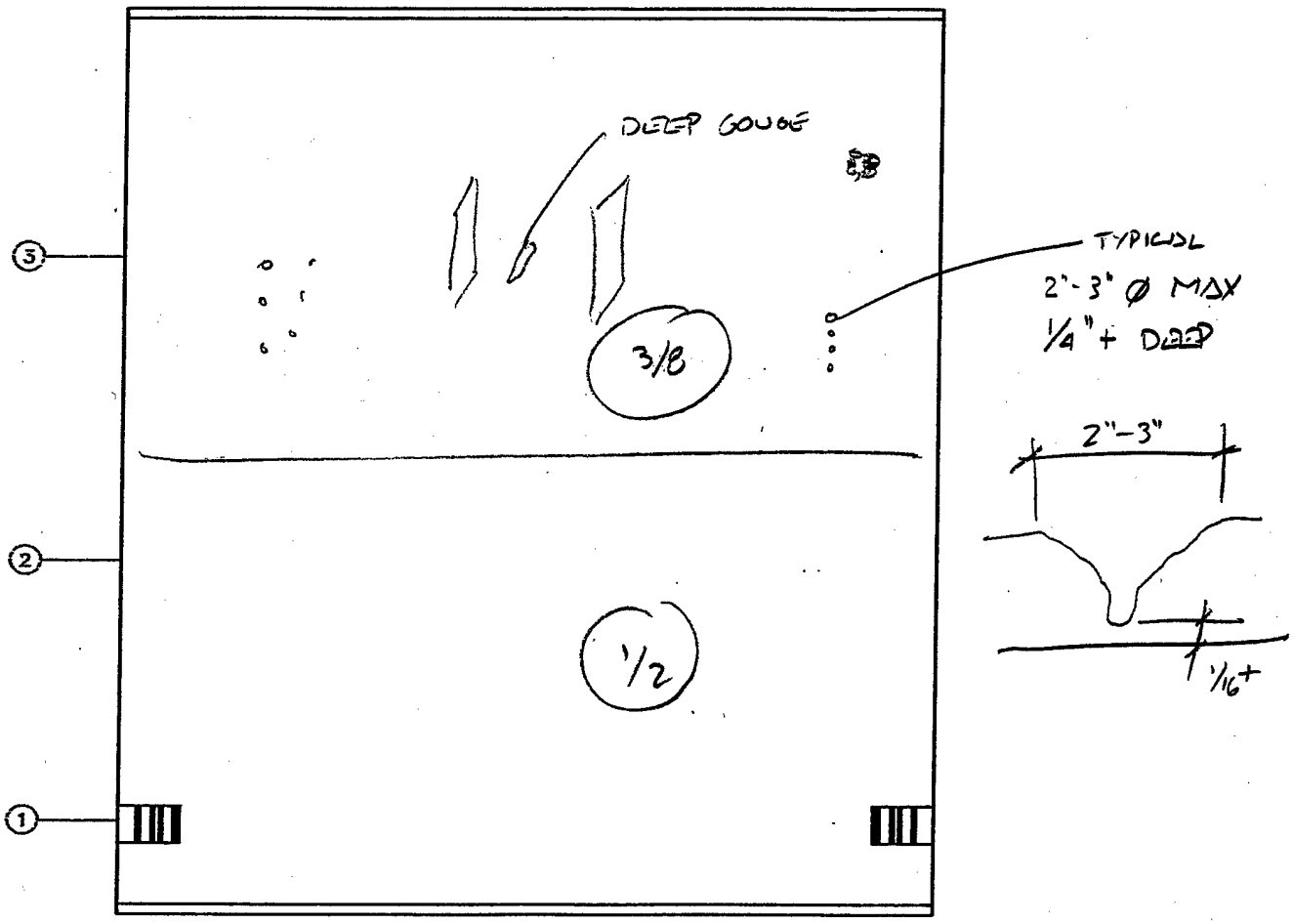
4) NO DIRECT DRAINAGE

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/8
Sheet 4

Gate No. 3 **Upstream Elevation**



- HEAVY PITTING
- APPROX 4' GRID AVERAGED
- AVG 2"-3" Ø 1/4" + IN 3/8 R, 3/8" DEEP IN 1/2" R

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather

Date 10/4/00
Sheet 5

Gate No. 3 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
47	47

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	24/32	14/32	24/32	17/32
Gate Full Open	24/32	14/32	24/32	17/32
Final Gate Closed	24/32	14/32	24/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

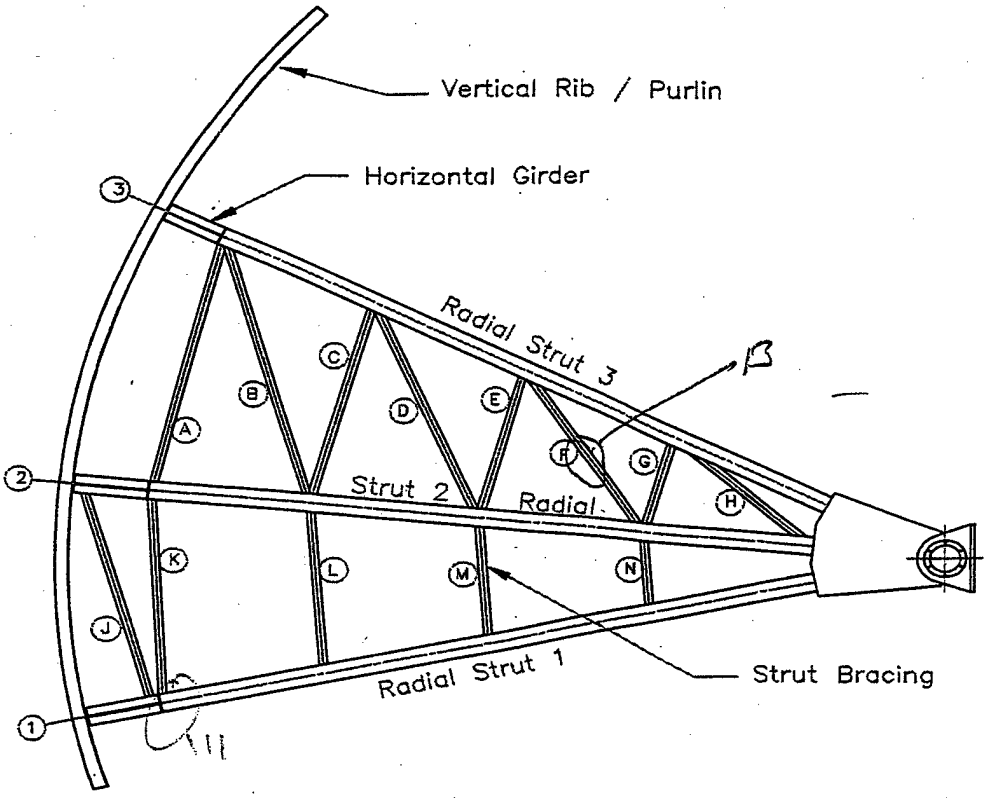
	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		-0.0040					
US / DS	0.0000		+0.0285					
Transverse	24/32	14/32	24/32	14/32	24/32	17/32	24/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMR TDB HAY
Weather SUNNY 60

Date 10/8/00
Sheet 1

Gate No. 4
~~Left~~ Elevation B-B
Right



Member	Type	Depth d		Web t_w		Flange(s) b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/8	1 13/16		16 5/8	16 3/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14 11/16	5/16		6 3/4	6 15/16	3/8	3/8
Brace B	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 15/16	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace H	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16		6 3/4	6 9/16	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8

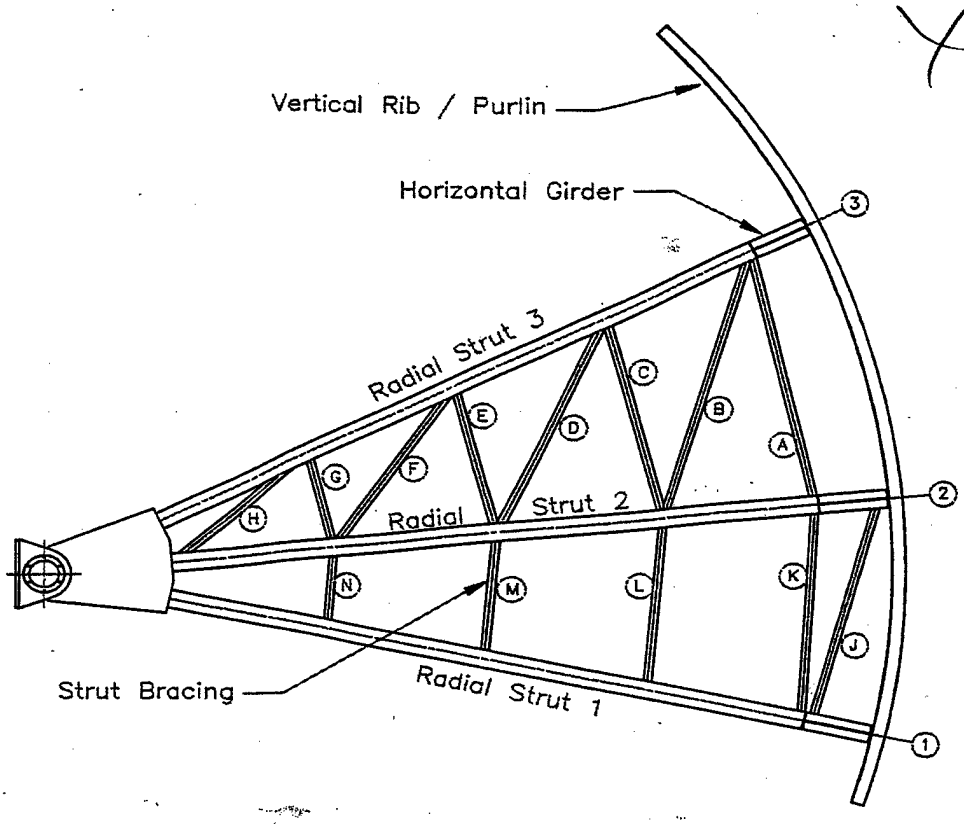
11. Clogged Drain Hole w/ Moss Growth (STANDING WATER ABOVE)
13. Small Deflection in Flange Against Pier ≈ 1/16" - 1/8"

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/8
Sheet 2

Gate No. 4
~~**Right**~~ **Elevation A-A**
LEFT



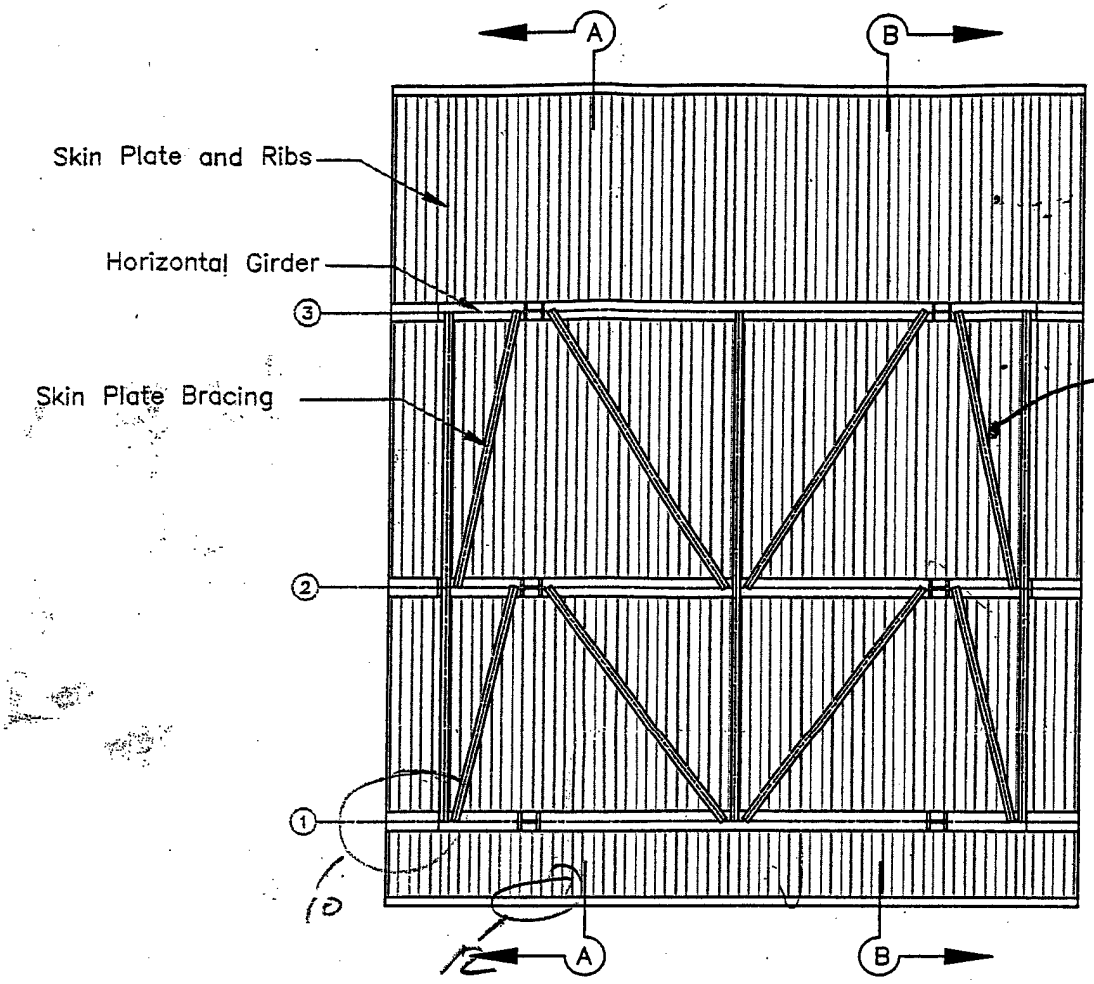
Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 3/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 5/16	1 13/16		16 5/8	16 5/16	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/16	3/8	3/8
Brace B	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 3/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 15/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14 1/8	5/16		6 3/4	6 7/8	3/8	3/8
Brace J	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	
Brace L	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 15/16	3/8	
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 15/16	3/8	
Brace N	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	

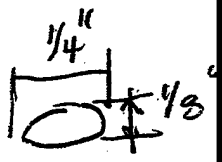
HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/8
Sheet 3

Gate No. 4 **Downstream Elevation**





Hole in Gate Face

Member	Type	Depth d		Web t_w		Flange - End b_f		Flange - End t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	49 15/16	7/16	1/2	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4		16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 3/16	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 3/8	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	5/16	6 3/4	6 15/16	3/8	3/8

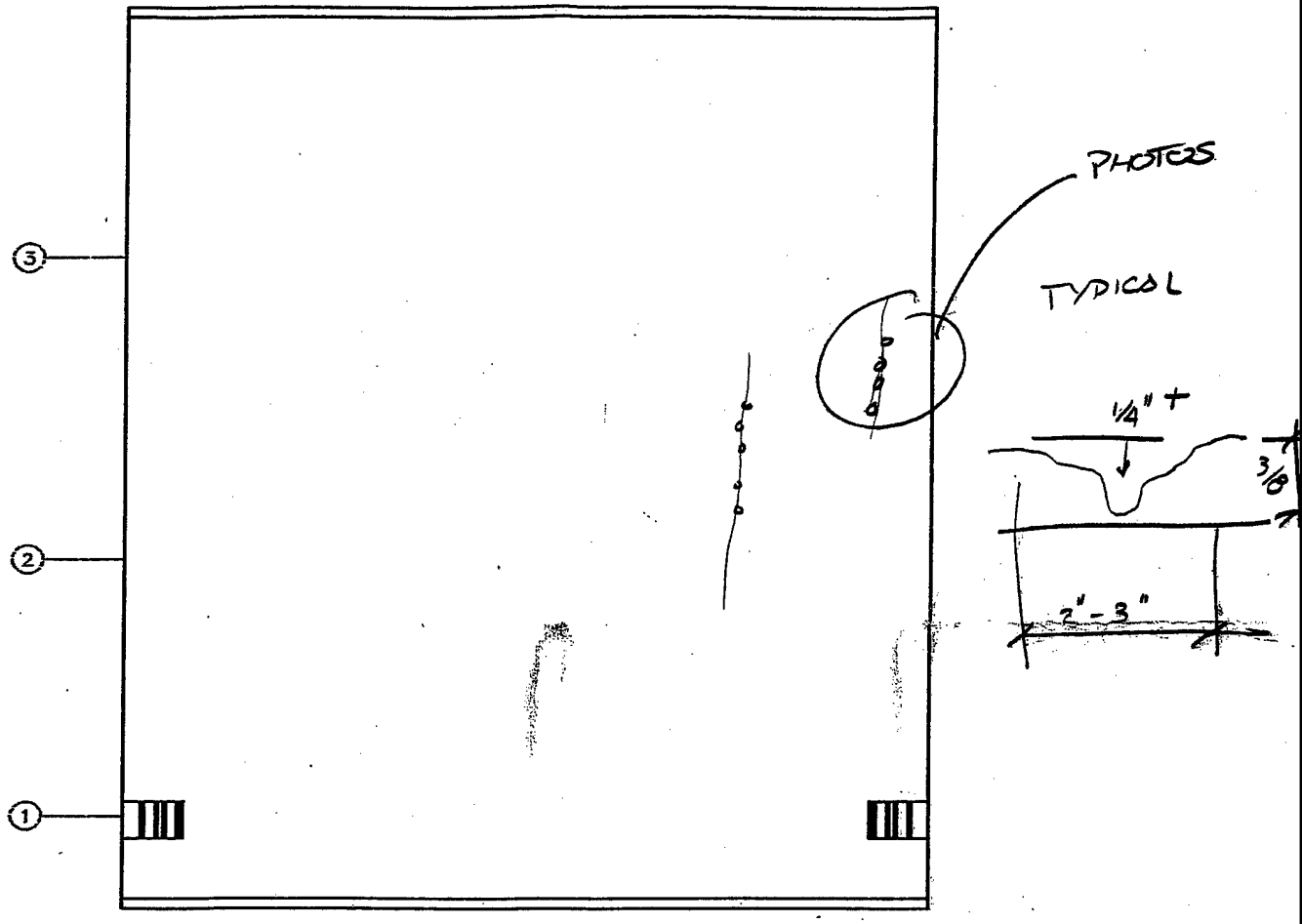
2-9 Holes in Gate Face. ± 1/4" x 1/8"
10. Muck and evidence of standing Wtr
12. Muck @ Bot. Seal Pt. NO Drain Holes

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather

Date 10/8
Sheet 4

Gate No. 4 **Upstream Elevation**



- HEAVY PITTING > 1/4" IN 3/8 PL ISOLATED SPOTS
- APPEARS TO FOLLOW SCRATCHES IN PL
- TYP 2-3" Ø
- AVG. PITT ON 4'-5' GRID

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather

Date 10/4/00
Sheet 5

Gate No. 4 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
14 1/2	14 3/4

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	21/32	16/32	22/32	18/32
Gate Full Open	21/32	16/32	22/32	18/32
Final Gate Closed	21/32	16/32	22/32	18/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		-0.0020					
US / DS	-0.0020		+0.0305					
Transverse	21/32	16/32	21/32	16/32	22/32	18/32	22/32	18/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

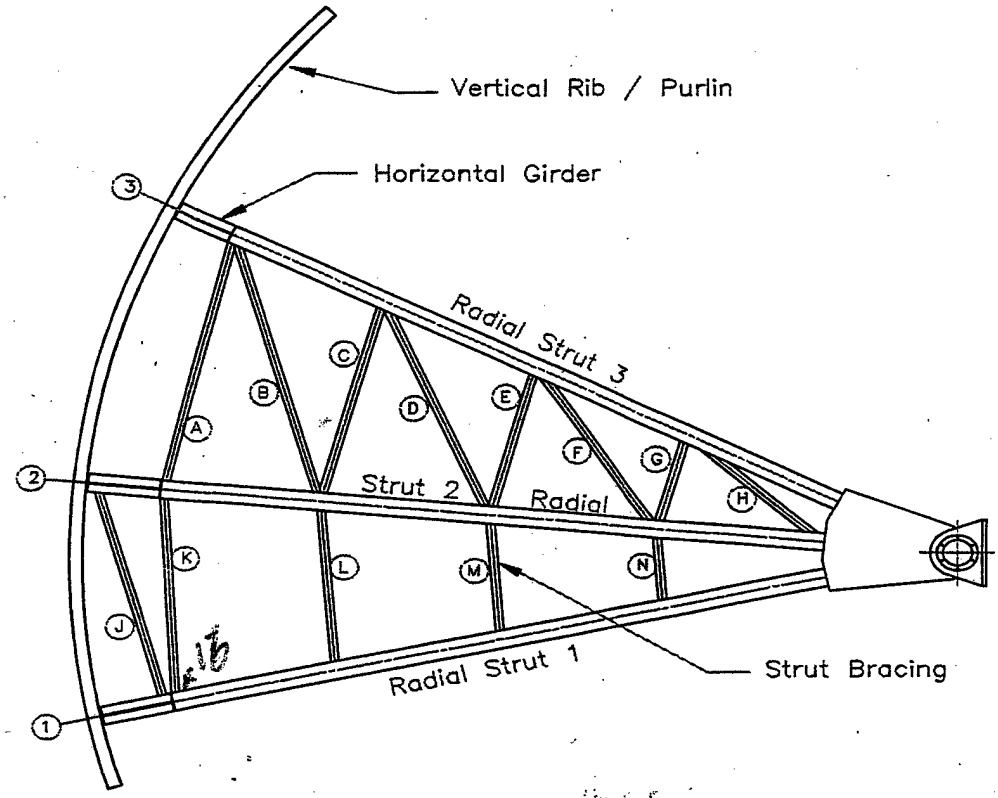
SUNDAY

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP, TDB, HAY
Weather wx

Date 10/8/2000
Sheet 1

Gate No. 5
Left Elevation B-B



Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	—	15 3/4	15 5/8	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8 ✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4	18 3/16	1 13/16	—	16 5/8	16 1/4	2 13/16	✓
Brace A	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace C	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace F	14 WF 30	13 7/8	✓	5/16	—	6 3/4	6 7/8	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace K	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓

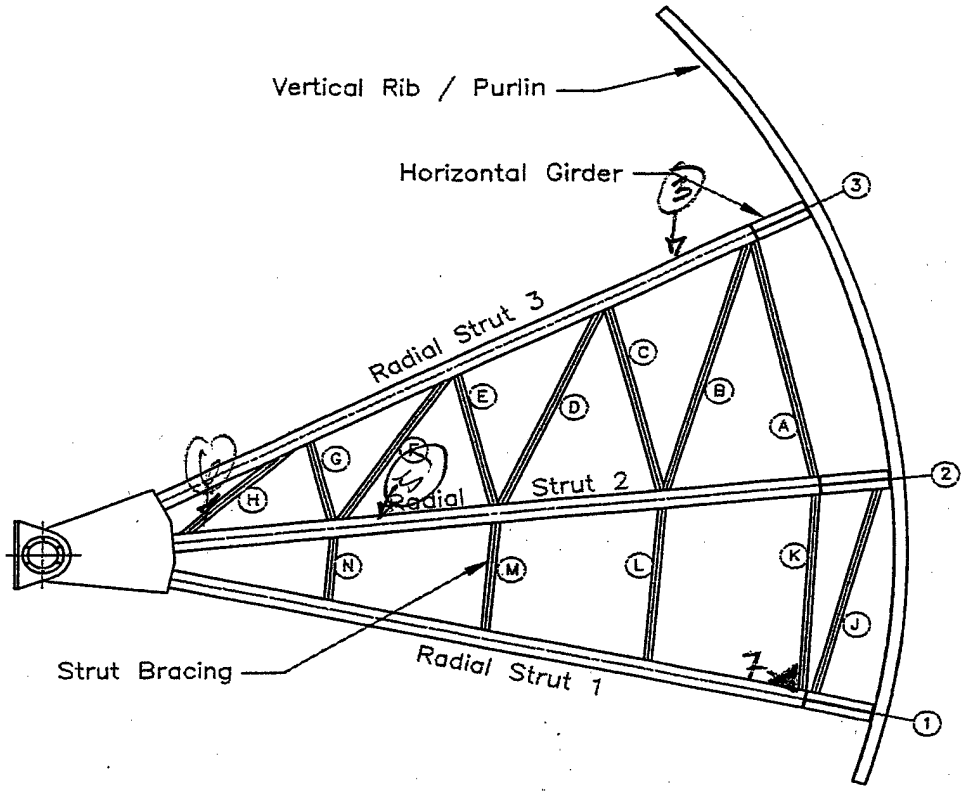
(15) Left, bottom girder @ cables.
(16) Rollers @ bottom strut

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB (HAY)
Weather

Date 10/8
Sheet 2

Gate No. 5
Right Elevation A-A



Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	—	15 3/4	15 5/16	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 7/16	1 9/16	—	16 3/8	16 1/8	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	—	16 5/8	16 7/8	2 13/16	2 5/8
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/16	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 1/8	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 1/8	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 1/8	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 1/8	3/8	✓
Brace K	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 1/8	3/8	✓
Brace L	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 1/8	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓

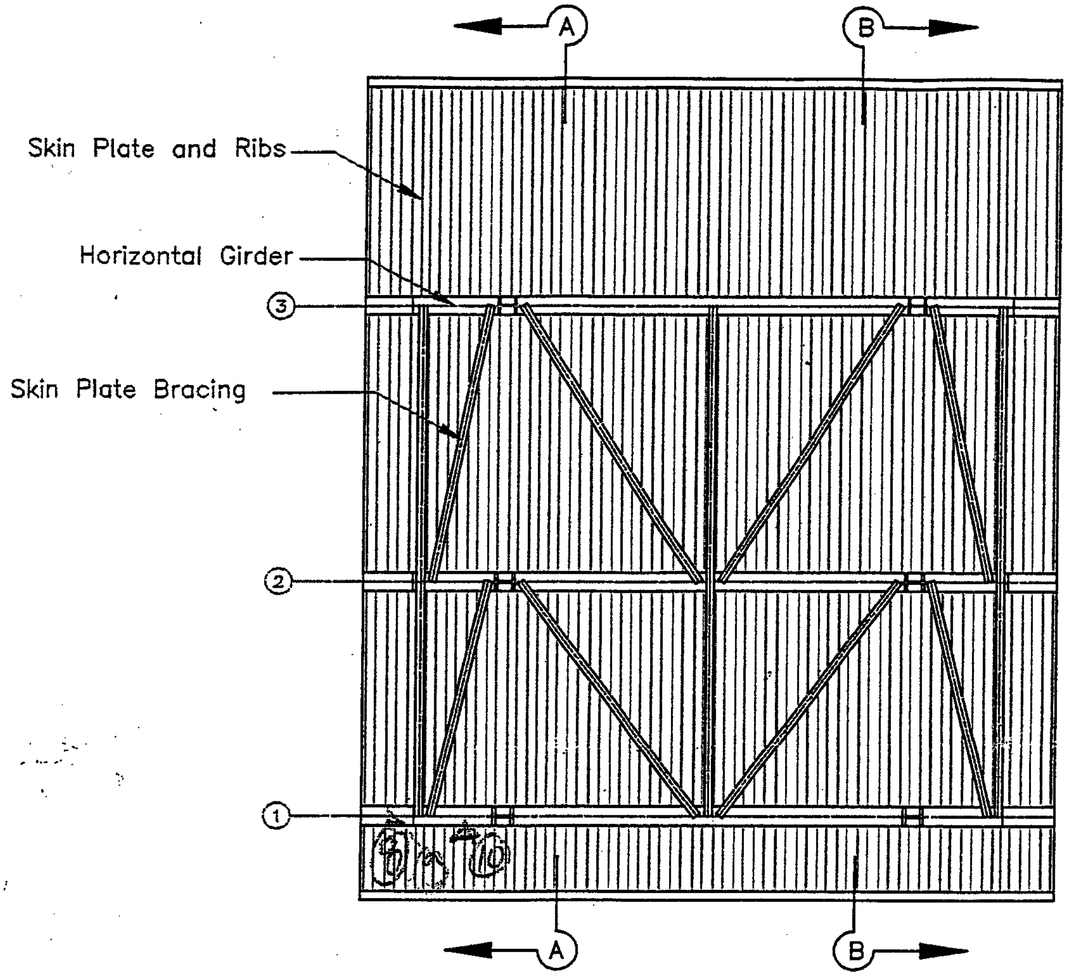
(3) Corrosion on top strut
(4) Ponding water on 2nd girder
(5) Nick in strut
(10) Nick in Diagonal member
(14) Ponding water @ bottom strt

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB (HAY)
Weather

Date 10/8
Sheet 3

Gate No. 5 **Downstream Elevation**



Member	Type	Depth d		Web t_w		Flange - End			
						b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	✓	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓ 60 1/4	1	—	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	—	8 1/4	✓	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	7 3/4	1/4	✓	6 3/4	✓	3/8	✓

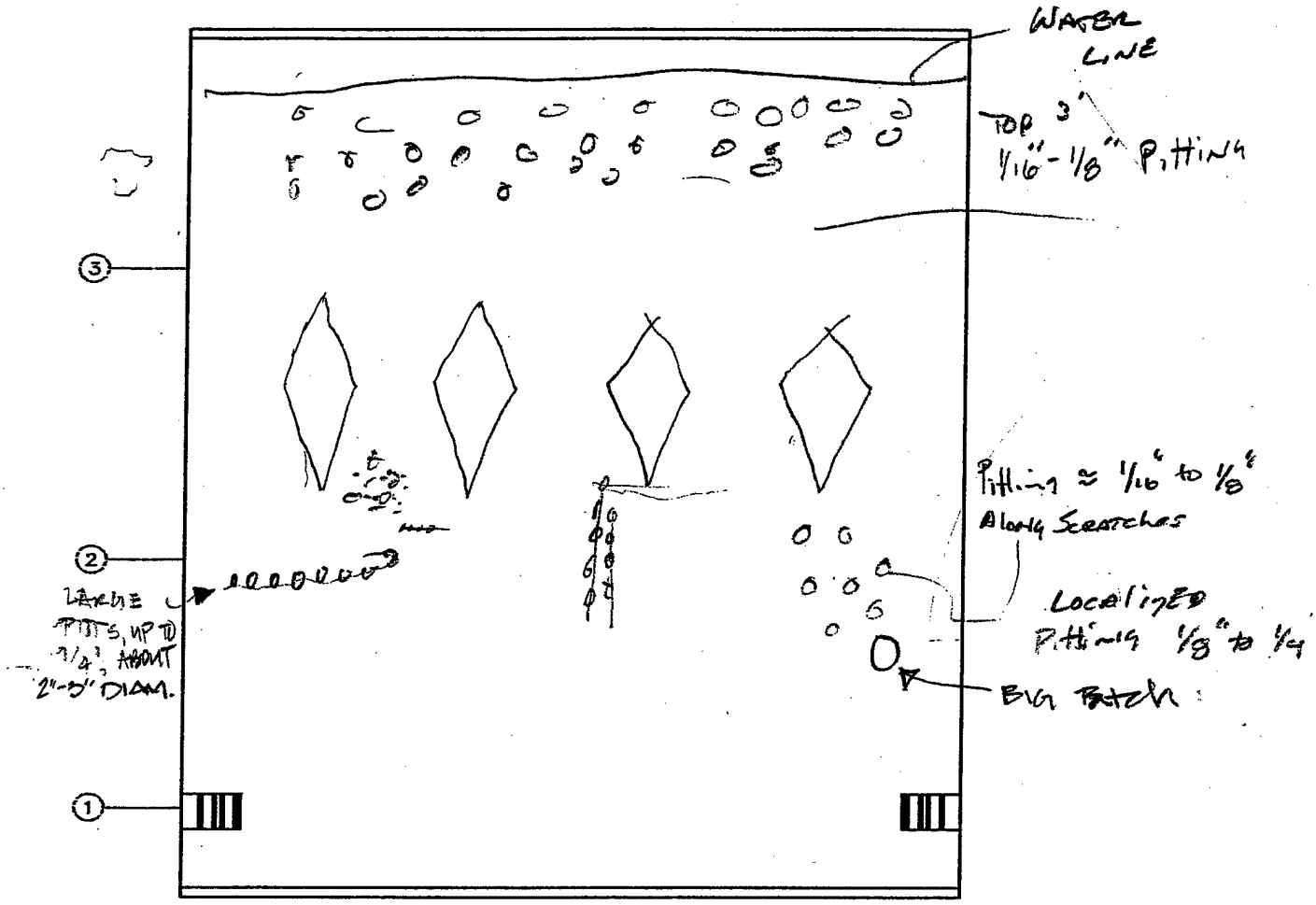
(7) leak in side seal, bm top girder
(8) ponding water @ cables
(9) ponding water overall
(10) ponding water in bottom girder
(11) side seal, right
(12) bottom seal from L → R
(13),(14) ponding in purlins & bottom gate

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/8
Sheet 4

Gate No. 5 **Upstream Elevation**



HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather

Date 10/3/00
Sheet 5

Gate No. 5 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
24 3/4	24 3/4

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	22/32	16/32	24/32	16/32
Gate Full Open	20/32	16/32	24/32	16/32
Final Gate Closed	22/32	16/32	24/32	16/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

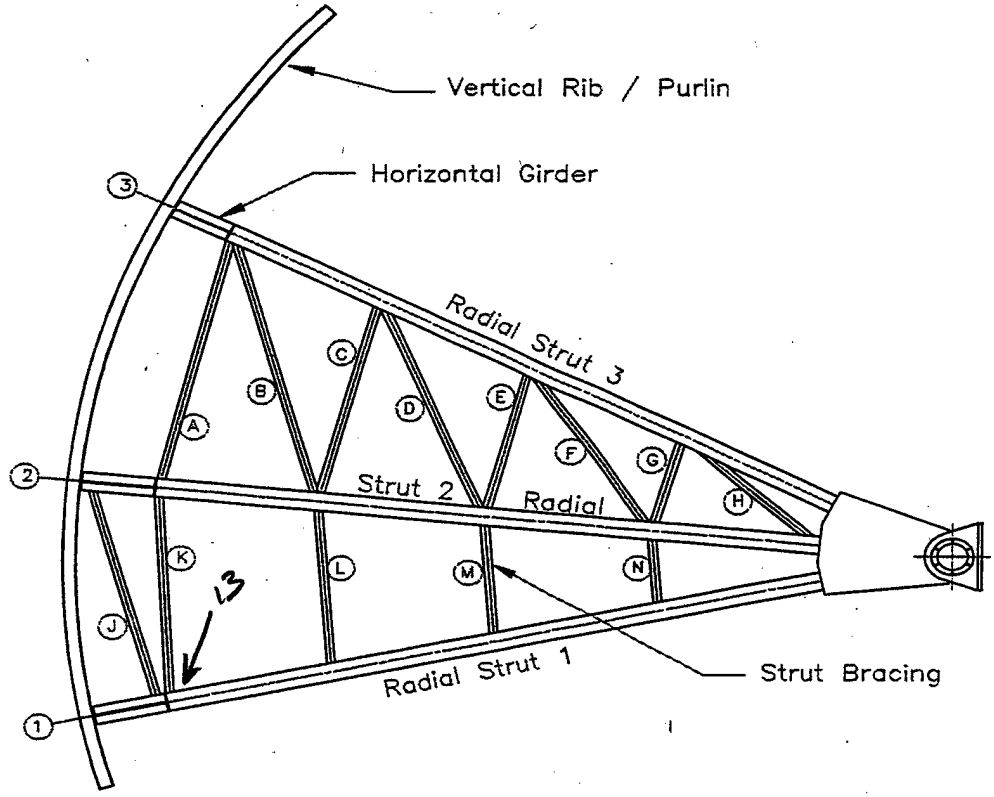
	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		+0.0150					
US / DS	-0.0030		+0.0510					
Transverse	22/32	16/32	22/32	16/32	24/32	16/32	24/32	16/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team (SMP) TDB HAY
Weather SUNNY 65°

Date 10/7
Sheet 1

Gate No. 6
Left Elevation B-B



Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 5/8	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 5/16	1 13/16	—	16 5/8	16 3/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8

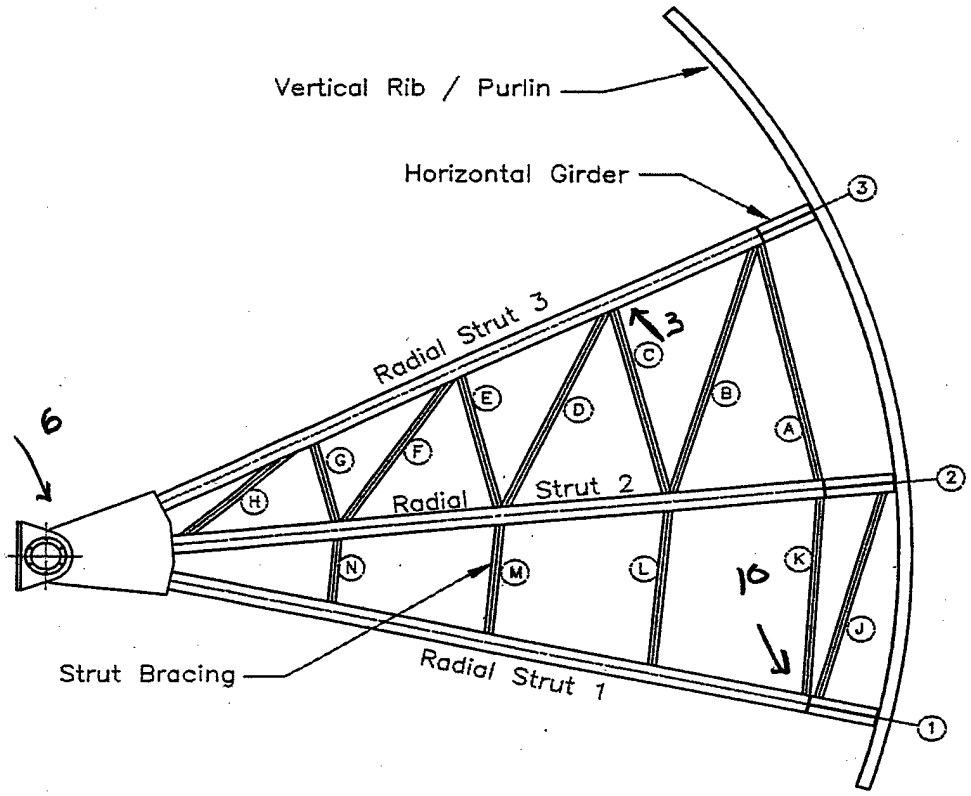
13/ LIGHT COR, PAST STANDING WATER

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/7
Sheet 2

Gate No. 6
Right Elevation A-A



Member	Type	Depth d		Web t_w		Flange(s) b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	←	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 3/8	1 9/16	←	16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	←	16 5/8	16 3/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14 1/16	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16	5/16	6 3/4	7	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 15/16	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	7	3/8	3/8
Brace E	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	7	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	7	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace K	14 WF 30	13 7/8	13 5/16	5/16	5/16	6 3/4	7	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace M	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 15/16	3/8	3/8
Brace N	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	7	3/8	3/8

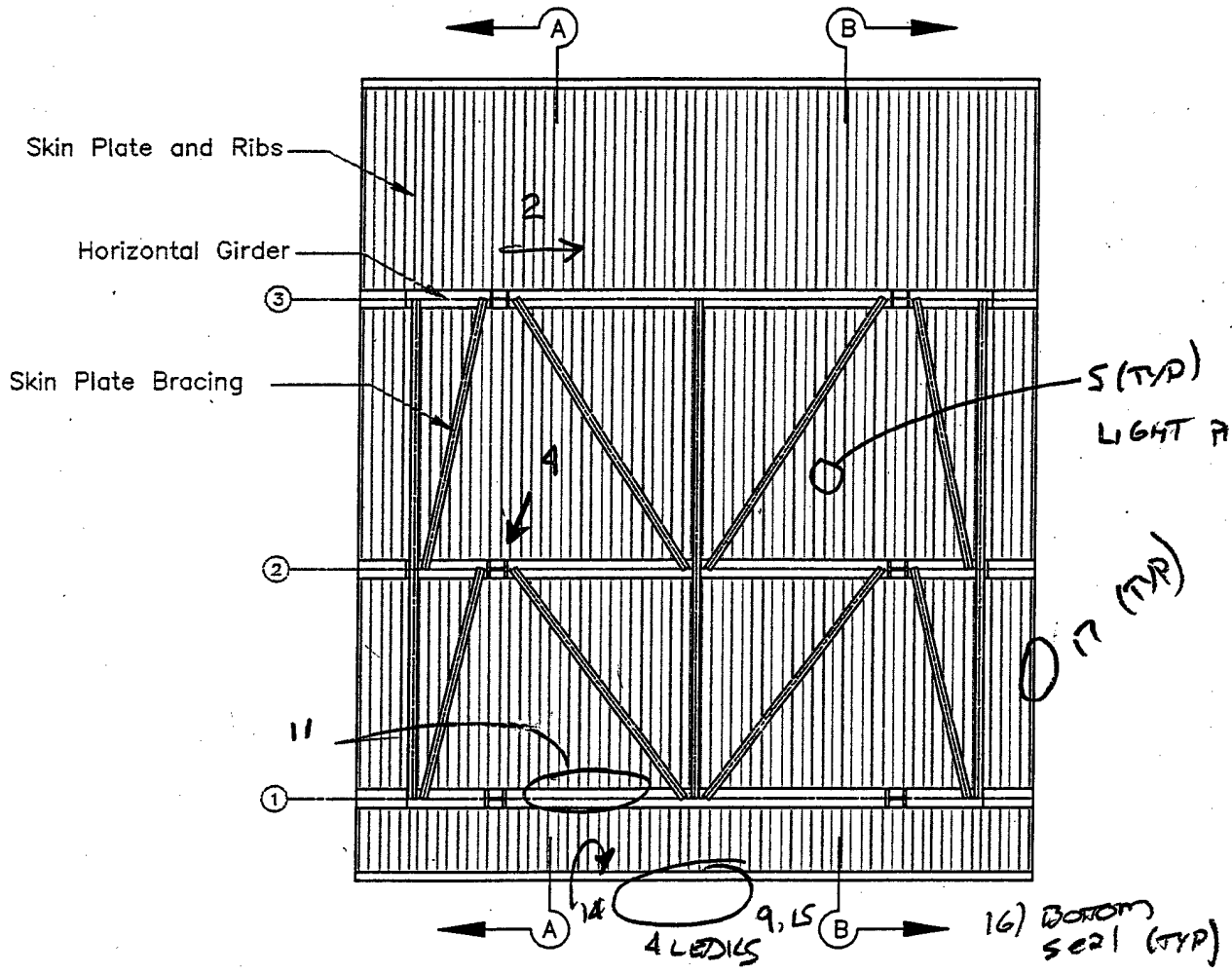
10) STANDING WATER, CLOGGED DRAIN

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team (SMP) TDB HAY
Weather

Date 10/7
Sheet 3

Gate No. 6 **Downstream Elevation**



Member	Type	Depth d		Web t_w		Flange - End b_f		Flange - End t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50 1/16	7/16	15/32	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 9/16	3/4	3/4	16 1/2	16 1/2	1 1/4	1 5/16
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1	1	16 1/2	16 1/2	1 1/4	1 5/16
Purlins	ST 10 WF 31	10 1/2	10 7/16	13/32	"	8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 7/8	3/8	3/8

2) TOP HORIZ (TYP) EVID. POST STANDING WATER

4) DS FLANGE, LIGHT COR, EVID STANDING WATER

11) EVIDENCE CLOGGED DRAIN / STANDING WATER

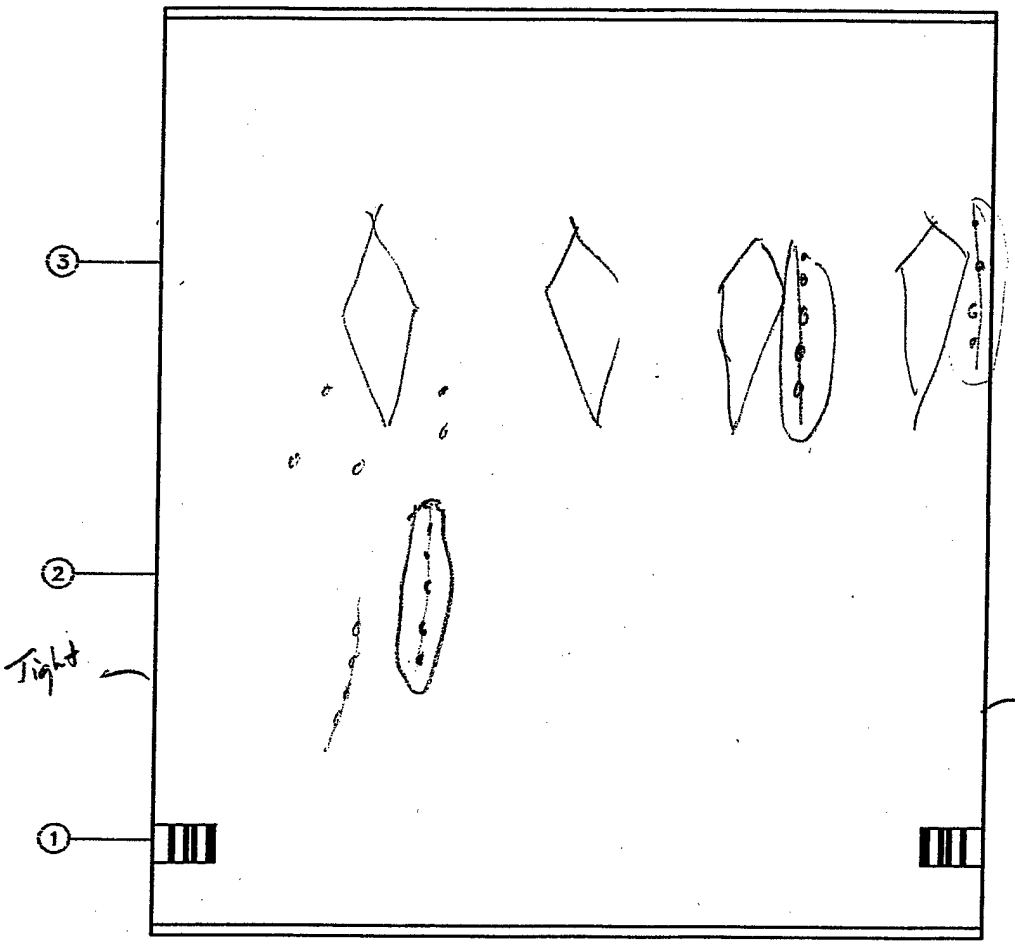
10) STANDING WATER (TYP)

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team (SMP) TDB HAY
Weather

Date 10/7
Sheet 4

Gate No. 6 **Upstream Elevation**



NOTE: THERE Appears to be Scratches along Corrosion lines.

CORR. Varies from 1/8" to 1/4"

(1) Gate ID.
(2) Pooling @ Bottom of gate
(3) Bottom Seal
(4) Bottom Seal (Gate) L → R
(5) Close up of pooling.

- the gate is tight on LEFT SIDE no/a gap on Right SIDE.

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather

Date 10/3
Sheet 5

Gate No. 6 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
30 1/4	30 1/4

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	30/32	16/32	21/32	23/32
Gate Full Open	30/32	16/32	20/32	23/32
Final Gate Closed	30/32	16/32	21/32	23/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

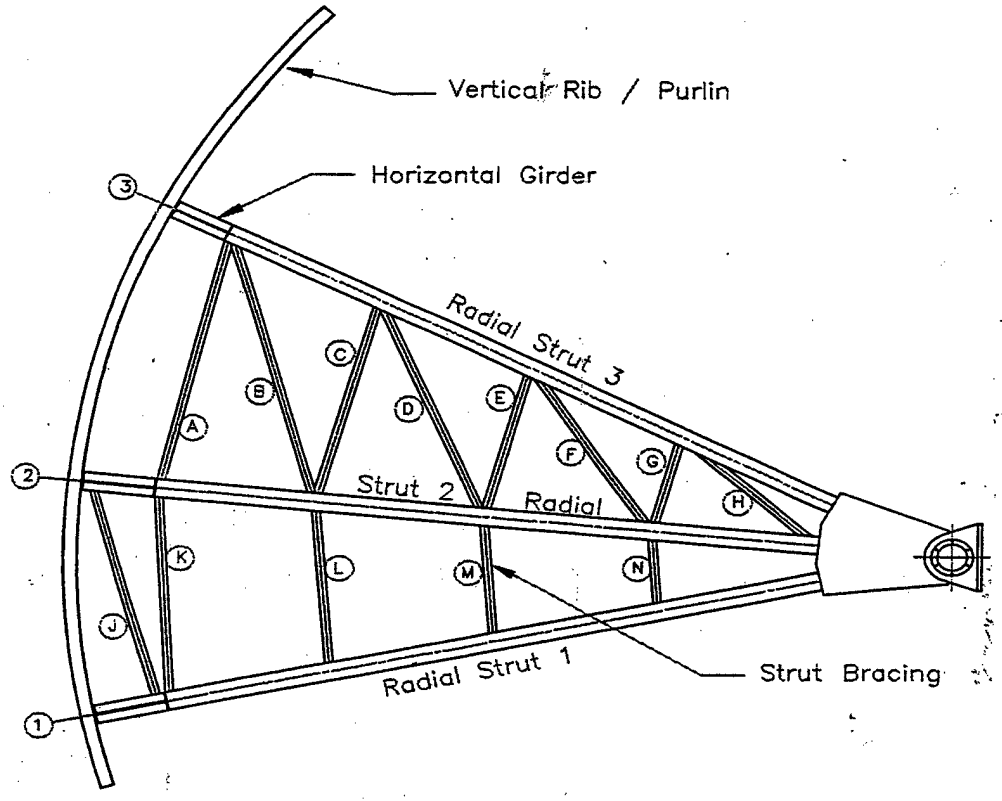
	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		-0.0095					
US / DS	-0.0005		+0.0350					
Transverse	30/32	16/32	30/32	16/32	21/32	23/32	21/32	23/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather Sunny 60

Date 10/7
Sheet 1

Gate No. 7
Left Elevation B-B



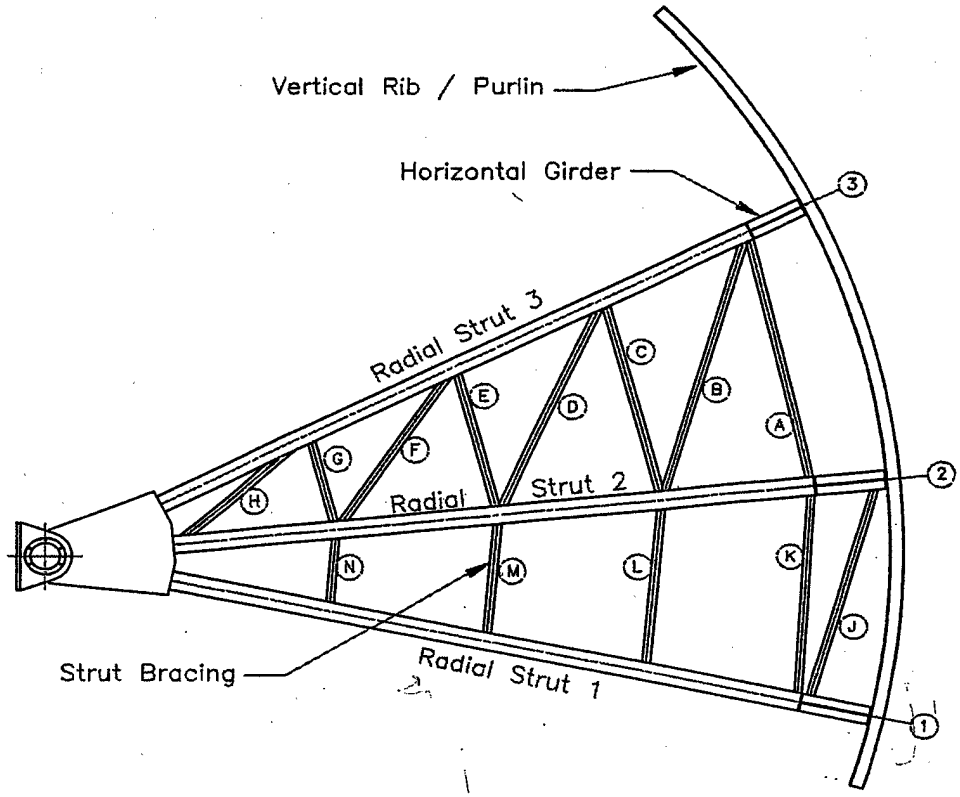
Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 5/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 9/16	1 9/16		16 3/8	16 3/16	2 7/16	2 7/16
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/16	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace E	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace K	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather

Date 10/7
Sheet 2

Gate No. 7
Right Elevation A-A



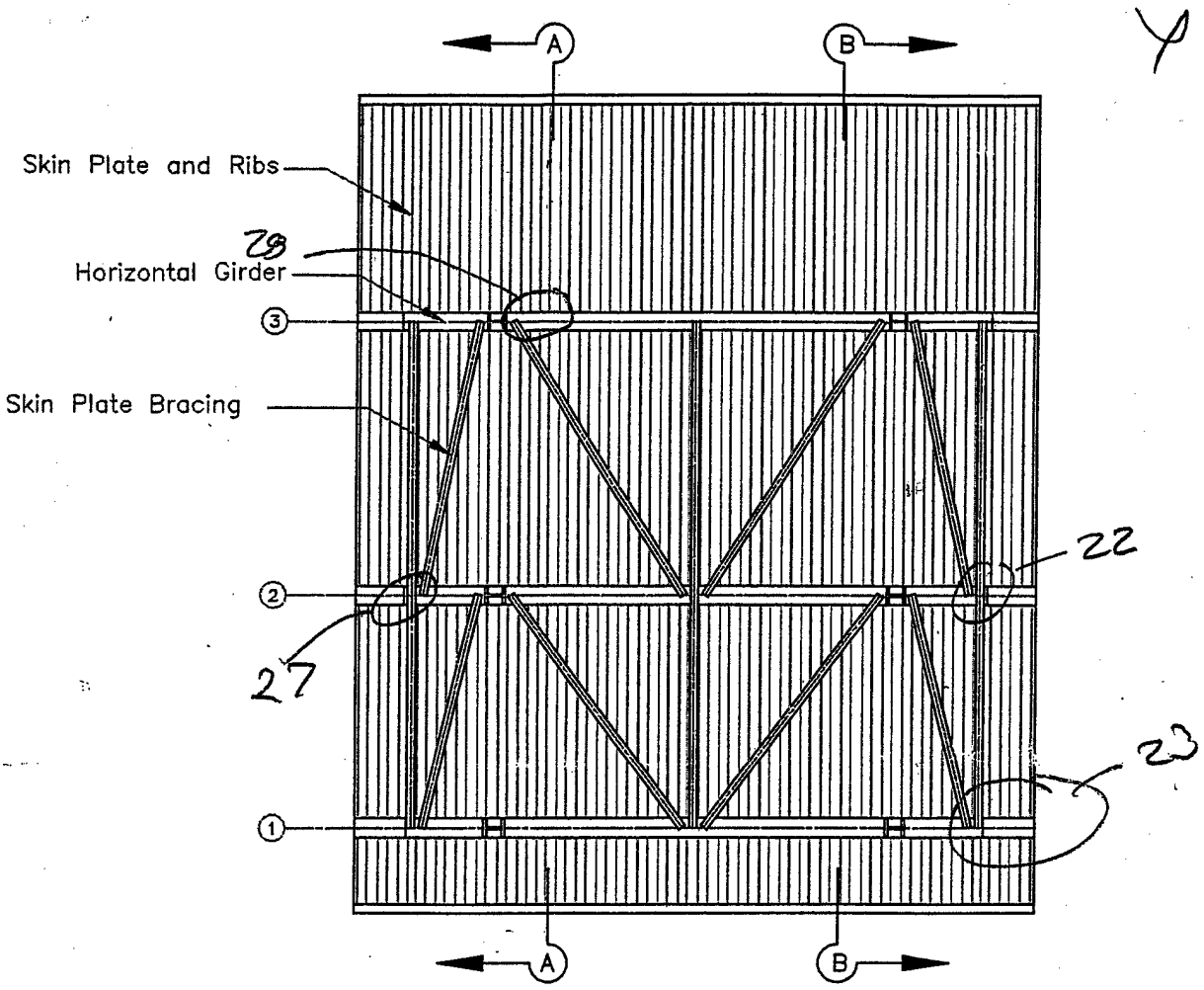
Member	Type	Depth d		Web t_w		Flange(s)			
						b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 1/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/8	1 9/16		16 3/8	16 1/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/16	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace J	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP (TDB) HAY
Weather

Date 10/7
Sheet 3

Gate No. 7 **Downstream Elevation**



Member	Type	Depth d		Web t_w		Flange - End b_f		Flange - End t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	49 13/16	7/16	7/16	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4	3/4	16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 1/2	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 3/4	3/8	3/8

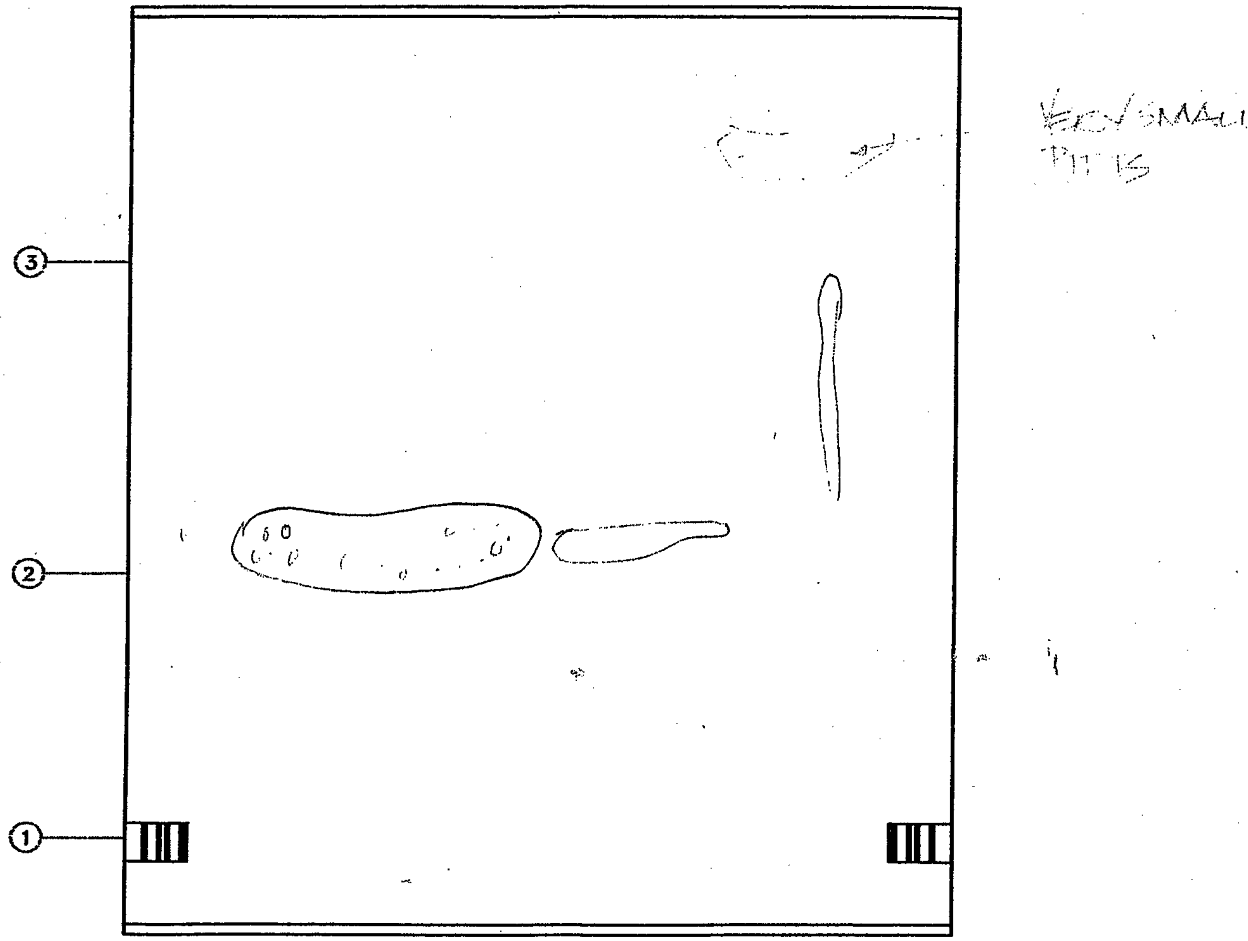
22. Brace plates @ 2nd Strut to Girder. NOT WELDED @ back of GIRDER (Typ.)
23. EVIDENCE OF STANDING H2O W/ Debris
24 STANDING H2O AND Muck in Bot. SEAL Plt.
25. LEAKS ALONG Bot. SEAL
26. Bot. LFT STRUT @ Bot GIRDER Light Rust
27. BENT WEB of T" Beam
28. Light Rust & Delam PNT.

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP/ TDB /HAY
Weather ______

Date 10/7
Sheet 4

Gate No. 7 **Upstream Elevation**



- CORROSION PITS ARE IN GROUPS 1/32 - 1/4" DEEP
- Cables on LEFT SIDE : High Vibrations
- BOTTOM 3RD Pitts ARE EVERY 1½ - 2' ON AVE.

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather

Date 10/4
Sheet 5

Gate No. 7 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
24 3/4	24 3/4

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	28/32	20/32	22/32	17/32
Gate Full Open	28/32	20/32	22/32	17/32
Final Gate Closed	28/32	20/32	22/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	+0.0023		+0.0075					
US / DS	-0.0005		+0.0340					
Transverse	28/32	20/32	28/32	20/32	22/32	17/32	22/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

HEAVY VIBRATION & HAMMER @ 18'-19' OPEN

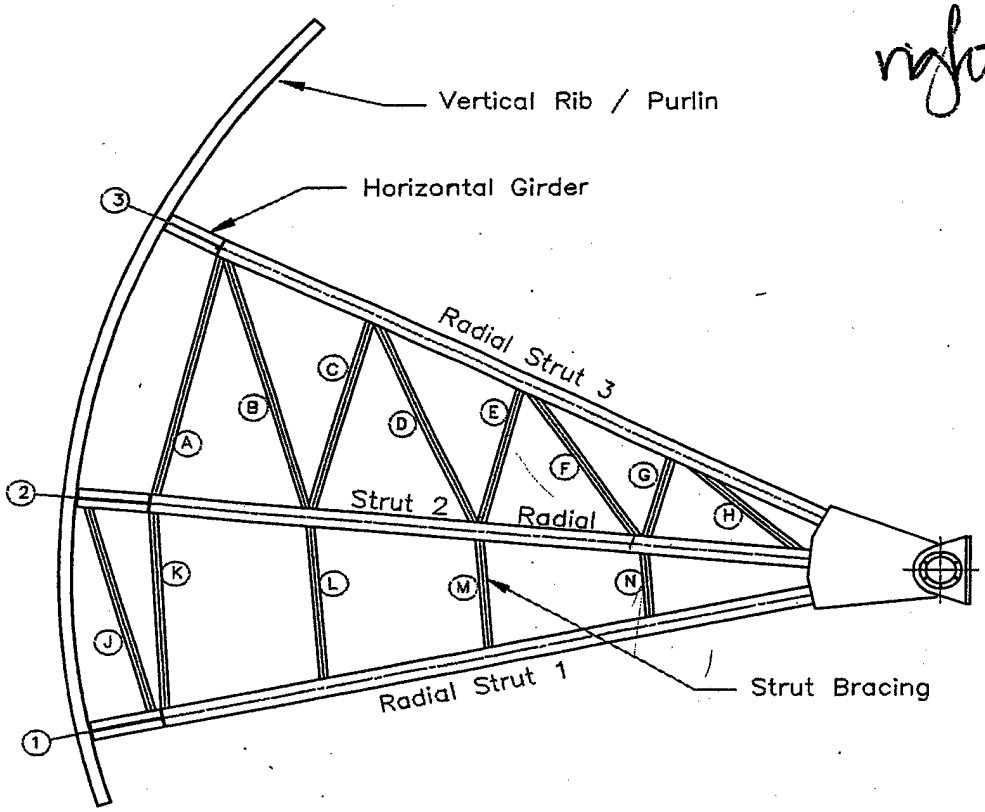
BOTTOM GIRDER, RIGHT SIDE APPEARS TO BE DRAGGING ON PIER

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather SUNNY 60

Date 10/17/00
Sheet 1

Gate No. 8
right. ~~Left~~ Elevation ~~B-B~~ A-A.



Member	Type	Depth d		Web t_w		Flange(s) b_f		Flange(s) t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	—	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 3/8	1 9/16	—	16 3/8	16	2 7/16	✓
Strut 1	14 WF 398	18 1/4	18 3/8	1 13/16	—	16 5/8	16 3/8	2 13/16	✓
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 1/8	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 5/8	3/8	✓
Brace K	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	✓	5/16	—	6 3/4	6 1/8	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓

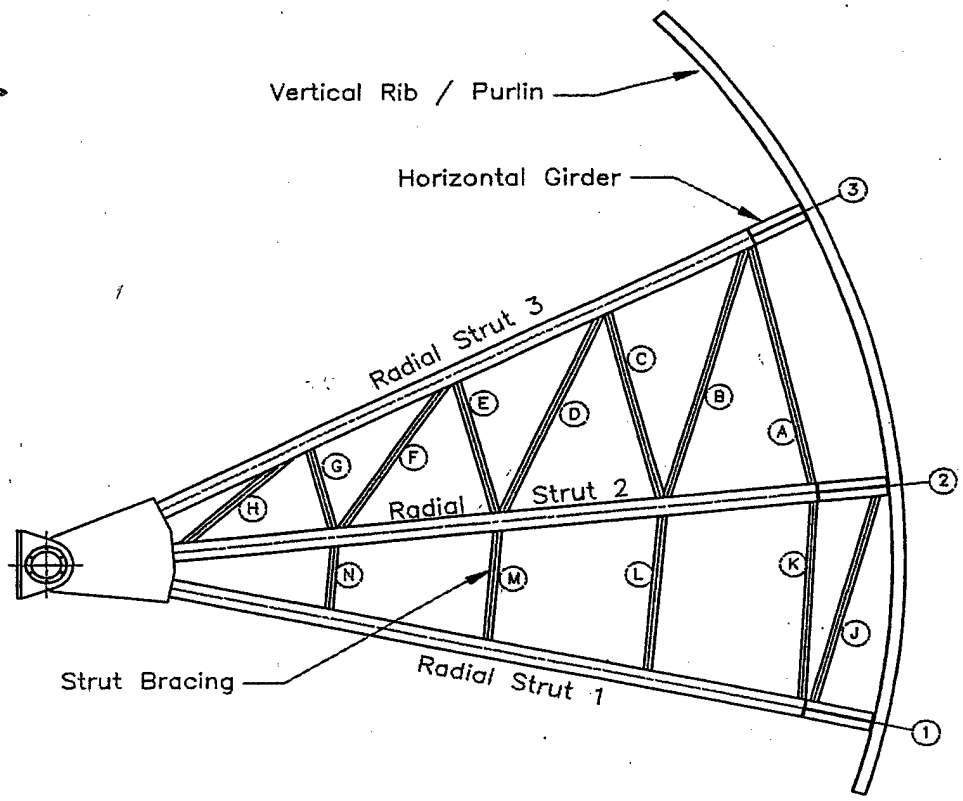
(H) cable slots, left, dry

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather Sunny, BRISK

Date 10/7
Sheet 2

Gate No. 8
~~**Right Elevation** A-A~~ B-B
Uft.



Member	Type	Depth d		Web t_w		Flange(s) b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	—	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	✓	1 9/16	—	16 3/8	16 11/16	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	—	16 5/8	16 5/8	2 13/16	✓
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16	—	6 3/4	6 7/8	3/8	✓
Brace C	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 13/16	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace G	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 13/16	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	13 15/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace M	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 7/8	3/8	✓
Brace N	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 13/16	3/8	✓

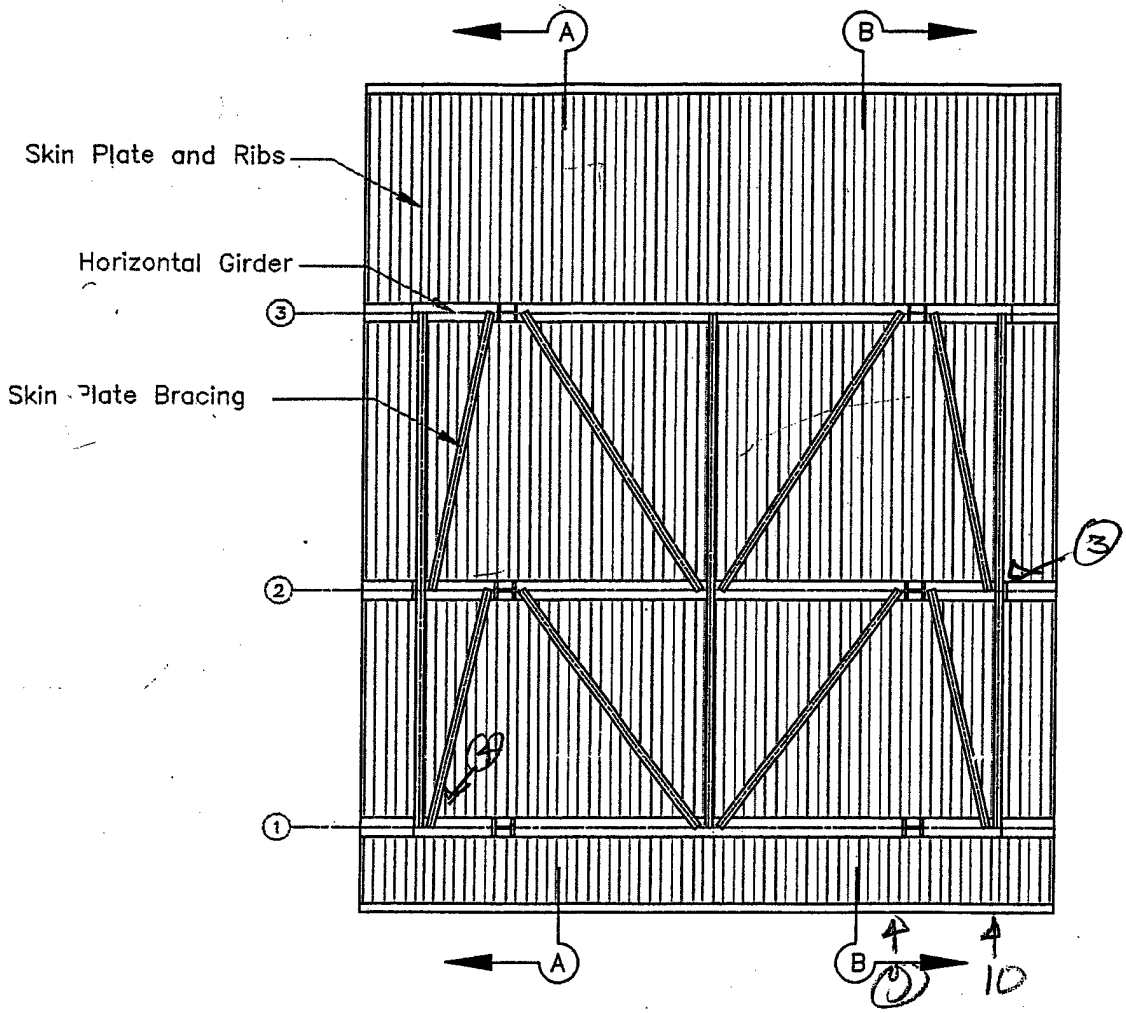
(15) Left side seal, ponding water, leak, bottom
(16) Purlin on second girder, pitting, typ
(17) Gatface in second girder, pitting, typ
(18) left trunnion, top strut, corrosion, before
(19) after, light corrosion (20) overall gate face

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather

Date 10/7
Sheet 3

Gate No. 3 **Downstream Elevation**



Member	Type	Depth d		Web t_w		Flange - End b_f		t_f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	✓	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	✓	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	—	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	—	8 1/4	8 3/8	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	✓	1/4	5/16	6 3/4	6 13/16	3/8	✓

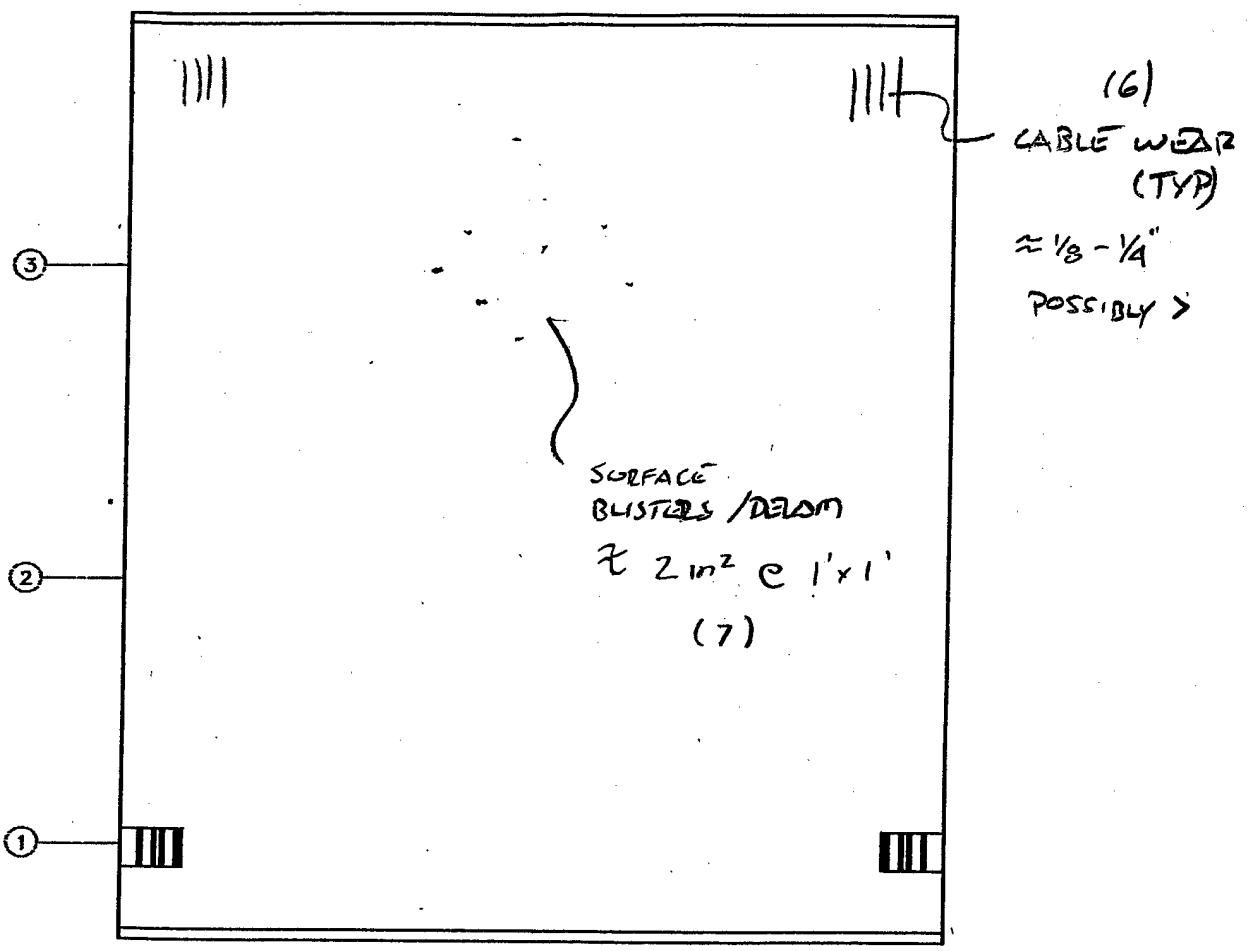
(3) Ponding in second girder, no corrosion
(4) Leak on left.
(5) Side seals, right. Look good.
(6) Leaking bottom seal, left, right
(7) Ponding water in bottom girder
(8) Ponding water, right, bottom girder, cable slots
(9) Leak in bottom seal.
(10) Leak in bottom seal, by pier
(11) middle leak.
(12) leak in bottom seal, — left.

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY
Weather SUNNY 65

Date 10/3
Sheet 4

Gate No. 8 **Upstream Elevation**



DEEP PITTING UP TO 1/4" AT TOP

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team SMP TDB HAY AMA
Weather SUNNY 60

Date 10/3
Sheet 5

Gate No. 8 **Operation and Trunnion Measurements**

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
26	25 3/8

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	14/32	30/32	17/32	26/32
Gate Full Open	14/32	30/32	17/32	26/32
Final Gate Closed	14/32	30/32	17/32	26/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		-0.0030					
US / DS	+0.0010		+0.0240					
Transverse	14/32	30/32	14/32	30/32	17/32	26/32	17/32	26/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/04/00
Sheet 1 OF 1

Gate No. 1 **Hoist Amperage Readings**

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		112.0	110.0		
Running	Phase A	16.1	9.6		
	Phase B	16.0	9.6		
	Phase C	15.8	8.9		

UNABLE TO DO UNLOADED DUE TO FISH MITAGATION

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/04/00
Sheet 1 OF 1

Gate No. 2 **Hoist Amperage Readings**

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
	Starting	108.0	104.5	106.0	102.0
Running	Phase A	15.2	9.9	13.5	9.0
	Phase B	15.7	10.6	14.6	9.2
	Phase C	14.9	9.7	14.1	10

RIGHT ANGLE GEAR BOX NOISY

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/04/00
Sheet 1 OF 1

Gate No. 3

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		**Loaded**		**Unloaded**	
		Opening	**Closing**	**Opening**	**Closing**
	Starting	117.6	114.4	114.4	111.2
Running	**Phase A**	16.1	10.1	15.5	10.6
	Phase B	16.3	11.2	15.5	10.5
	Phase C	16.6	10.4	15.8	10.6

PRIMARY WORMGEAR REDUCER NOISY (SOUNDS DRY)
MAIN REDUCER HAS SEVERE LEAK (@ OUTPUT SHAFT ODE)

ODE (OPPOSITE DRIVE END)

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/08/00
Sheet 1 OF 1

Gate No. 4

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		**Loaded**		**Unloaded**	
		Opening	**Closing**	**Opening**	**Closing**
	Starting	116.2	104.8	112.0	105.0
Running	**Phase A**	15.5	9.6	16.2	10.2
	Phase B	16.1	9.7	15.3	10.0
	Phase C	15.6	9.4	16.3	10.5

SIMILAR LEAKS TO UNITS 3
BEARING NOISE MOTOR SHAFT SIDE

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date **10/06/00**
Sheet 1 OF 1

Gate No. 5

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		**Loaded**		**Unloaded**	
		Opening	**Closing**	**Opening**	**Closing**
	Starting	108.8	112.0	115.0	111.2
Running	**Phase A**	15.0	9.6	14.1	10.1
	Phase B	15.9	10.5	14.7	10.1
	Phase C	16.9	10.2	14.7	10.4

SAME LUBE LEAKS & SEEPAGE AS OTHER UNITS
OUTPUT SHAFT SEAL LEAKING DRIVE SHAFT SIDE

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/03/00
Sheet 1 OF 1

Gate No. 6 **Hoist Amperage Readings**

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
	Starting	113.6	106.4	110.5	110.0
Running	Phase A	15.3	10.2	15.2	10.6
	Phase B	15.9	10.2	15.1	9.3
	Phase C	15.8	10.1	16.3	9.8

TYPICAL LUBRICANT SEEPAGE TO OTHER UNITS

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/04/00
Sheet 1 OF 1

Gate No. 7 **Hoist Amperage Readings**

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
	Starting	116.8	110.8	124.1	110.0
Running	Phase A	15.6	10.1	15.1	9.4
	Phase B	15.3	10.0	16.2	9.9
	Phase C	15.7	9.6	16.0	8.9

NORMAL LUBE LEAKAGE

FULL UP	35'	45'
A	14.1	12.3
B	13.1	11.9
C	13.5	12.5

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date **10/04/00**
Sheet 1 OF 1

Gate No. 8 **Hoist Amperage Readings**

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
	Starting	114.0	108.0	110.4	110.6
Running	Phase A	15.3	10.4	16.3	10.9
	Phase B	16.0	9.8	14.8	10.1
	Phase C	15.7	9.8	14.8	10.

LUBE SEEPAGE @ MOST BEARING, COUPLING LOCATIONS
LARGE LEAK @ REDUCER OUTPUT SHAFT ODE W/BUILDUP ON DECK

KLEINFELDER
An employee owned company

Ultrasonic Testing Technique Report
Steel Group

UT Report No.: 1

Client Name: HDR Engineering
Date: October 2, 2000
Project Name: Walla Walla, Lower Granite Dam
KA Project No.: 21-6149-01-001
Contractor: HDR Engineering
Client Contact: Wayne Edwards
Technique Performed By : Destry K. Hall
Level : 2

Type of Inspection (check one): Straight Beam ☐ Angle Beam ☑ Other ☑
If other please specify : Evaluation of moment resisting frames.

Drawings Referenced: Walla Walla District Corps of Engineers, Draft Scope Outline, Radial Gate Inspection, Analysis and Testing, Lower Granite Dam.

Equipment: Krautkramer Branson USN 52L s/n: 00D94J ; **Date of Calibration:** 4/26/00

Transducer: SWS, Gamma, 2.25 X .75 X .625, BNC s/n : 00CM4P ; Wedge, SF-AWS, 70 DEG. , s/n: 00D0JB

Test Block: IIW, Type 1, Steel : s/n: 7856 / DSC, Steel ; s/n: 98-6331

Method Used: Procedure # 1, Top quarter 70°, Middle half 70°, Bottom quarter 70°; Face A and Face B when possible

Scanning Method: Pattern E w/ A, B and C movement **Scanning Level:** 20 dB above Zero Reference.

Material Type: ASTM A36 / ASTM A572

Temp. of Material: Ambient **Sensitivity Level:** 80% FSH **Surface Condition:** Tight adhering paint

Examination Standard: ASTM E 164-94 **Acceptance Standard:** AWS D1.5-95 **NDT Procedure No.:** KA-NDETP-UT-001

Quality requirements - section no. : AWS D1.5-98 Section # 9.21.3 and Table 9.1; and Section 9 Part C

Weld joint AWS: TC-U5-GF, TC-U4b-GF, B-U4b-GF, B-U5-GF **Welding process :** GMAW / FCAW / SMAW

Material Thickness : 3/4 through 1-5/8

Weld identification: Each weld was identified on drawings by HDR Representative Sam Planck; All testing was performed for information only.

CERTIFICATION PAPERS ARE AVAILABLE UPON REQUEST.

We, the undersigned, certify that the statements in this record are correct and that the welds were prepared and tested in accordance with the requirements of ANSI/AASHTO/AWS D1.5 (1995) Bridge Welding Code.
year

Kleinfelder, Inc.

Inspector Signature: Level II UT/PT/MT
Inspector Name: Destry K. Hall

KLEINFELDER **5880 District Boulevard; Suite 24, Bakersfield, CA 93313** **(661) 831-2155** **(661) 831-1937 fax**

KLEINFELDER
An employee owned company

ULTRASONIC TEST REPORT

CLIENT NAME	HDR Engineering	DATE:	10-2/10-13/00
PROJECT NAME	Walla Walla; Lower Granite Dam	PROJECT NO.:	21-6149-01
CONTRACTOR	C.O.E	UT REPORT NO.:	001
GATE NO.:	1 through 8	PAGE	2 OF 10

REPORT OF ULTRASONIC TESTING OF MATERIALS

COUPLANT	Ultragel II	INSTRUMENT SN#:	00D94J	JOINT DESCRIPTION:	
CAL BLOCK SN#	IIW (7856)	REFERENCE LEVEL:	48 Db	BUTT JOINT:	B-U4b-GF / B-U5-GF
TRANSDUCER SN#	00CM4P	SCANNING LEVEL:	+20 Db	CORNER JOINT:	TC-U5-GF
ANGLE/MODE:	70 & 60 deg.	SURFACE CONDITION:	Painted	T-JOINT:	TC-U4b-GF
ACCEPT CRITERIA AWS TBL:	9.1	MATERIAL THICKNESS:	3/4" / 1-5/8"	COMMENTS: Welding process used: SMAW/GMAW/FCAW. Tested through painted surface. Information only.	
EXAMINATION FROM FACE:	A & B	VOLUMETRIC EXAM IN LEG:			
ZERO DEGREE TRANSDUCER:		DIAMETER: 1"	FREQUENCY: 2.25 Mhz		

ITEMS EXAMINED / TESTED: 3-strut arm splices and center strut mid-span splice

ITEM DESIGNATION: Gate 1, Gate 2, Gate 3, Gate 4, Gate 5, Gate 6, Gate 7 and Gate 8

Strut 1(a), Strut 2 (a), Strut 3 (a), Trunnion (a), Strut 1(b), Strut 2 (b), Strut 3 (b) and Trunnion (b),

WELD IDENTIFICATION	ACCEPTED	REJECTED	REMARKS
1. Gate 1	41	3	
2. Gate 2	42	2	
3. Gate 3	37	7	
4. Gate 4	27	17	
5. Gate 5	41	3	
6. Gate 6	41	3	
7. Gate 7	29	15	
8. Gate 8	40	4	
9.			
10.			

TOTAL WELDS TESTED: 352

TOTAL WELDS ACCEPTED: 298

TOTAL WELDS REJECTED: 54

15%

COMMENTS and/or SKETCH:

KLEINFELDER

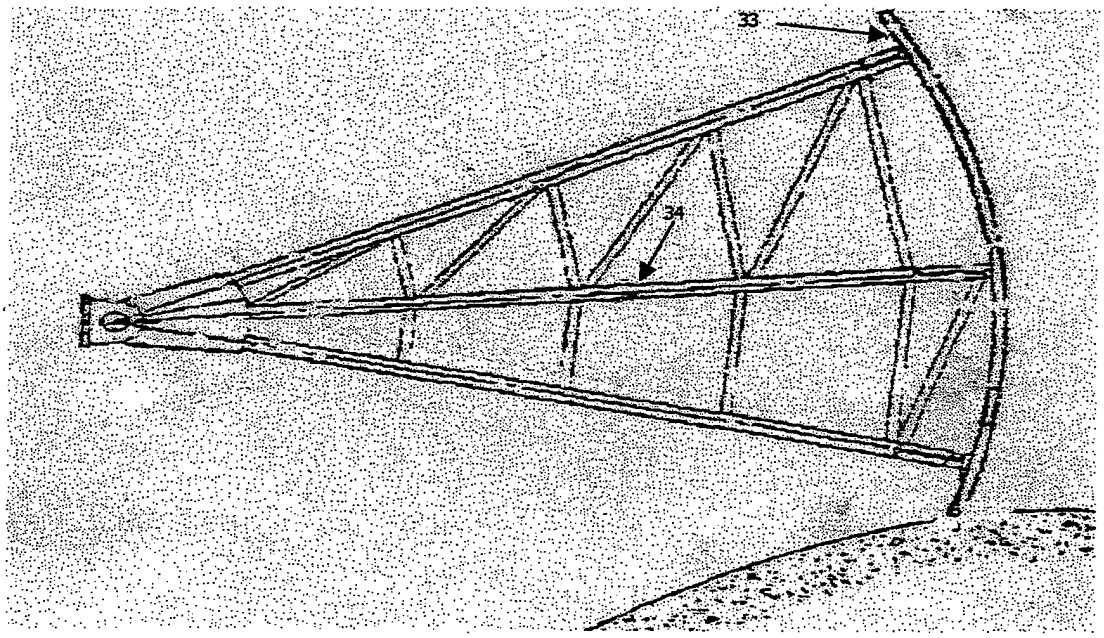
An employee owned company

ULTRASONIC TEST REPORT
GATE 1

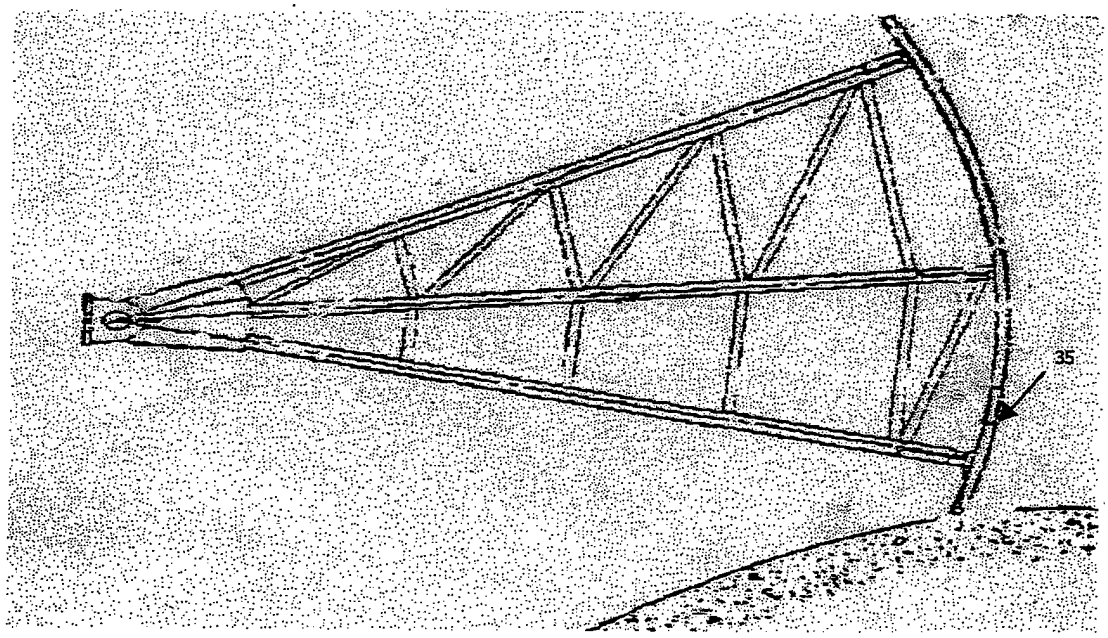
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 3 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
					a	b	c	d				From X	From Y		
1	33w	70	A	1 & 2	52dB	48 Db	.562	3.438	1.25	1.281	.832			B	
2	34f	70	A	1 & 2	54dB	48 Db	2.794	3.206	2.625	2.397	1.296			B	
3	35f	70	A	1 & 2	49dB	48 Db	1.594	-.594		1.797	1.034			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 1 (Outer Left)



GATE 1 (Inner Right)

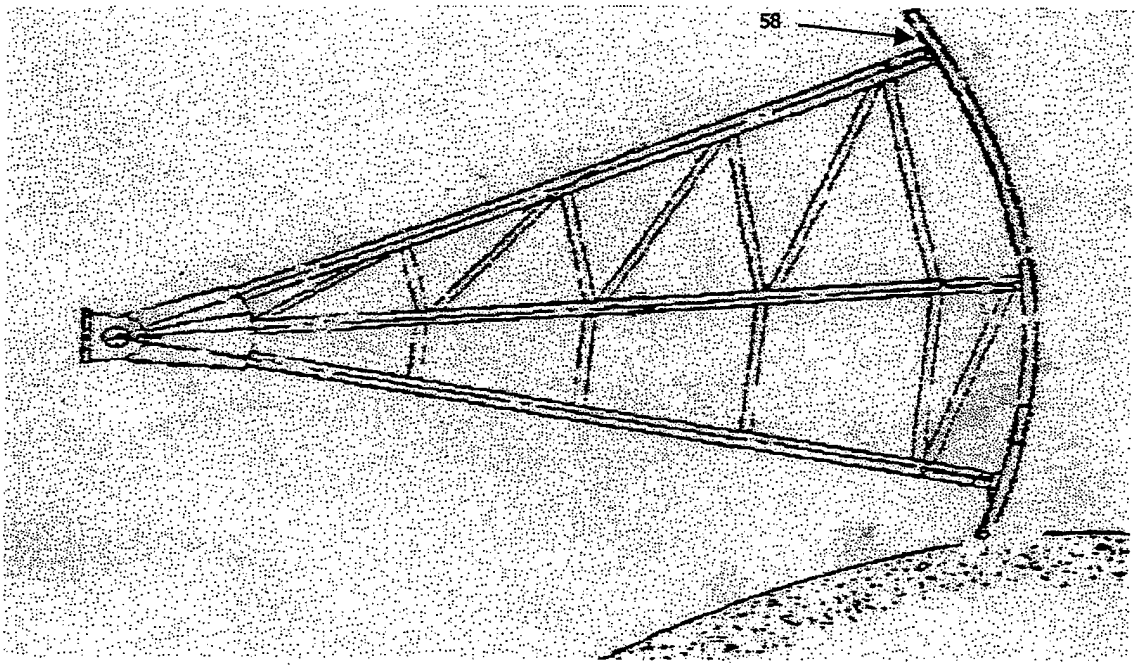
KLEINFELDER
An employee owned company

ULTRASONIC TEST REPORT
GATE 2

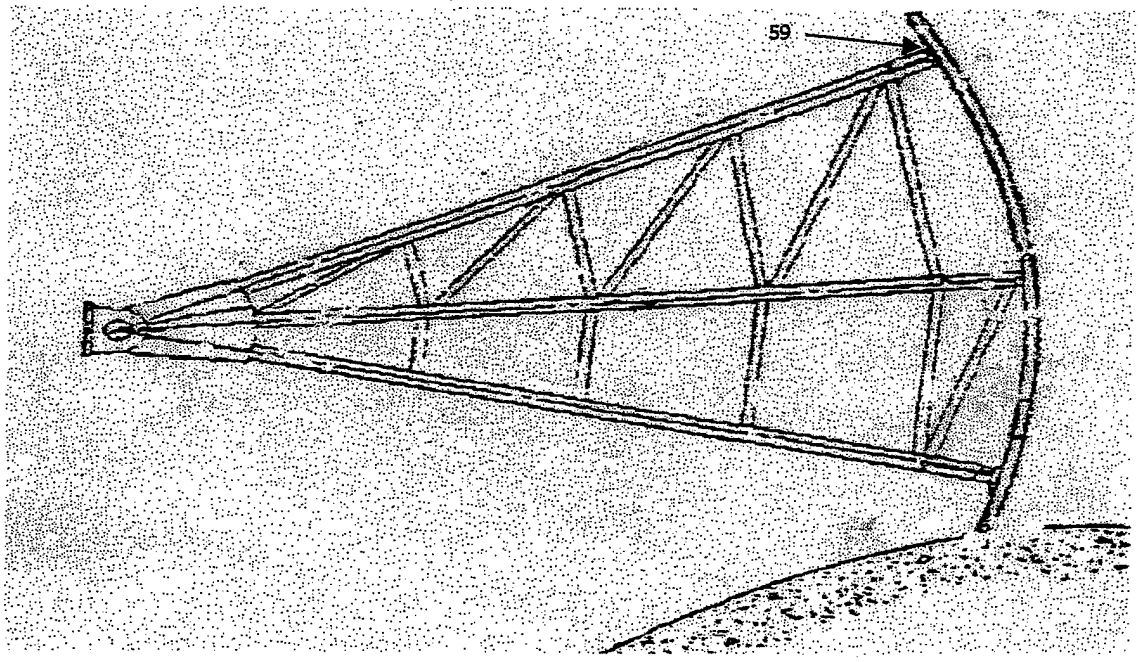
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 4 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level a	Reference Level b	Attenuation Factor c	Indication Rating d	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE From X	DISTANCE From Y		
1	58fo	70	A	1 + 2	48db	48db	5.016	-5.016		3.508	1.200			A	
2	59fo	70	A	1 + 2	52dB	48db	4.886	-.886		3.443	1.178			A	
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 2 (Outer Left)



GATE 2 (Inner Right)

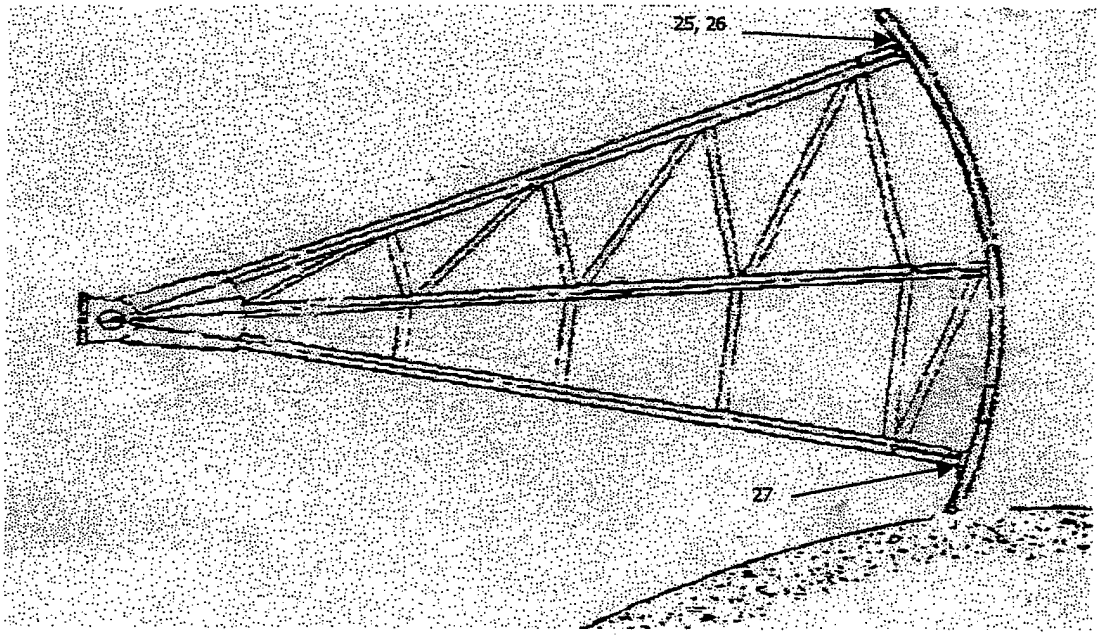
KLEINFELDER
An employee owned company

ULTRASONIC TEST REPORT
GATE 3

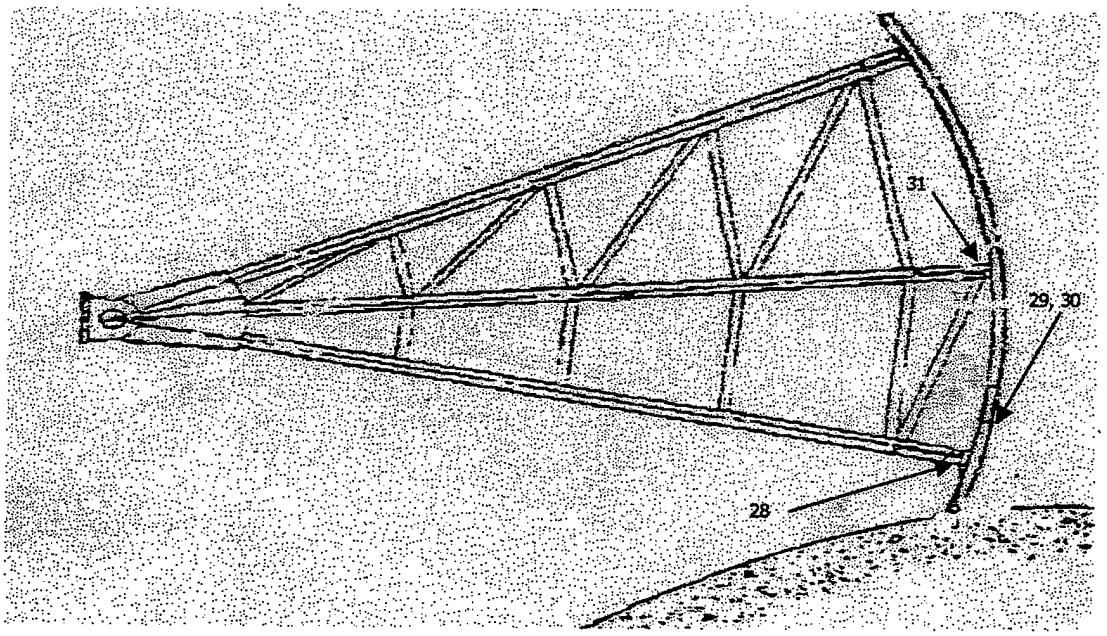
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 5 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level a	Reference Level b	Attenuation Factor c	Indication Rating d	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE From X	DISTANCE From Y		
1	25 f	70	A	1 & 2	50.2B	48 Db	1.014	.986		1.507	.758			A	
2	26 w	70	A	1 & 2	54dB	48 Db	4.35	1.65		3.175	1.034			A	
3	27 f	70	A	1 & 2	52dB	48 Db	4.048	-.048		3.024	1.234			A	
4	28 f	70	A	1 & 2	48dB	48 Db	1.268	-1.268		1.634	.978			A	
5	29 f	70	A	1 & 2	50dB	48 Db	1.718	.282		1.859	.937			A	
6	30 f	70	A	1 & 2	54dB	48 Db	3,014	2.98	1.125	2.507	.878			B	
7	31 w	70	A	1 & 2	54dB	48 Db	[illegible]	[illegible]	.875	2.853	1.178			A	
8							3.906	2.094							
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 3 (Outer Left)



GATE 3 (Inner Right)

KLEINFELDER

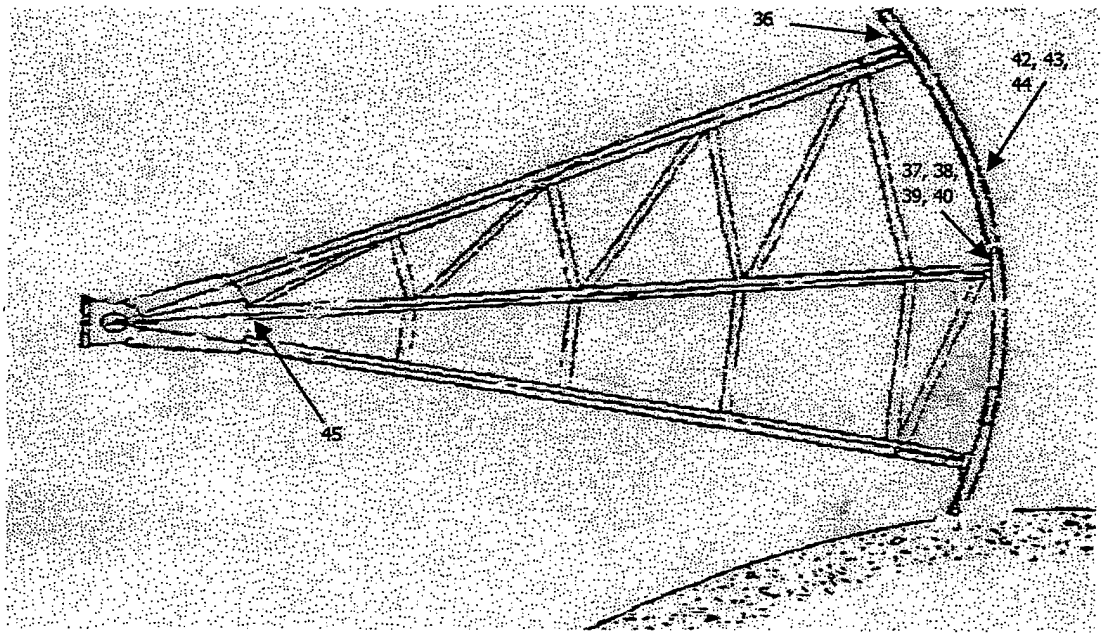
An employee owned company

ULTRASONIC TEST REPORT
GATE 4

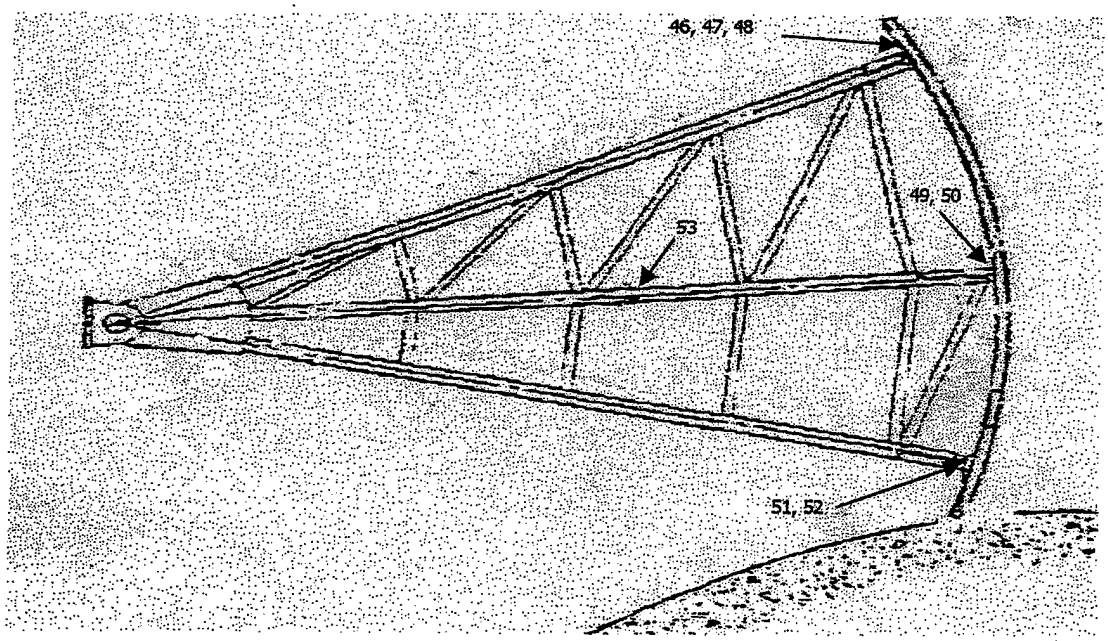
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 6 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level a	Reference Level b	Attenuation Factor c	Indication Rating d	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE From X	DISTANCE From Y		
1	36w	70	A	1 + 2	54dB	48dB	3.906	2.094		2.953	1.010			A	
2	37fo	70	A	1 + 2	54dB	48dB	.802	6.802	1.5	.599	.205			D	Acceptable
3	38fi	70	A	1 + 2	54dB	48dB	5.01	.99		3.505	1.198			A	
4	39fi	70	A	1 + 2	54dB	48dB	4.35	1.65		3.175	1.086			A	
5	40fi	70	A	1 + 2	54dB	48dB	4.542	1.458		3.271	1.119			A	
6	42fo	70	A	1 + 2	54dB	48dB	-.404	6.404	3.5"	.798	.272			D	Acceptable
7	43w	70	A	1 + 2	54dB	48dB	.562	5.438	2.5"	1.281	.438			D	Acceptable
8	44fi	70	A	1 + 2	50dB	48dB	-.294	2.294	.375"	.853	.285			A	
9	45w	70	A	1 + 2	54dB	48dB	2.542	3.458	.375"	2.271	.777			B	Acceptable by length
10	46fo	70	A	1 + 2	48dB	48dB	5.582	-5.582		3.791	1.296			A	
11	47fi	70	A	1 + 2	54dB	48dB	2.794	3.206	.875"	2.397	.820			B	
12	48w	70	A	1 + 2	50dB	48dB	3.014	-1.014		2.507	.857			A	
13	49fo	70	A	1 + 2	49dB	48dB	-.406	1.406		.797	.272			A	HAZ
14	50fo	70	A	1 + 2	48dB	48dB	.026	-.026		1.013	.346			A	HAZ
15	51fo	70	A	1 + 2	48dB	48dB	1.706	.294		1.353	.375			A	ind. out of gate, 60%fsh
16	52fi	70	A	1 + 2	49dB	48dB	5.788	-4.788		3.894	1.331			A	
17	53fo	70	A	1 + 2	48dB	48dB	4.158	-4.158		3.079	1.053			A	
18															
19															
20															



GATE 4 (Outer Left)



GATE 4 (Inner Right)

KLEINFELDER

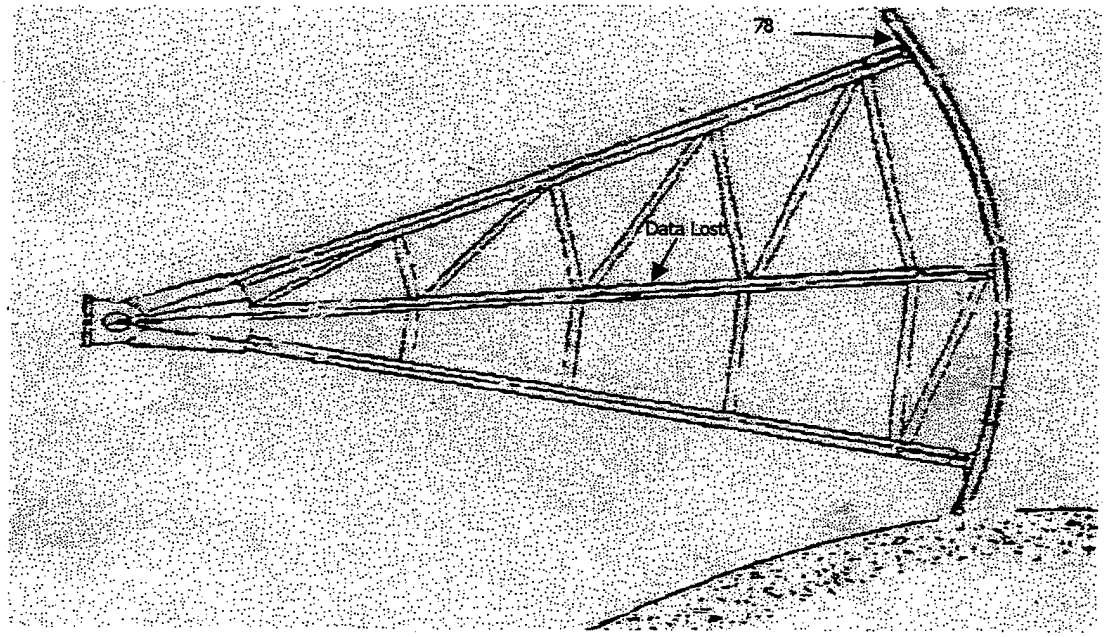
An employee owned company

ULTRASONIC TEST REPORT
GATE 5

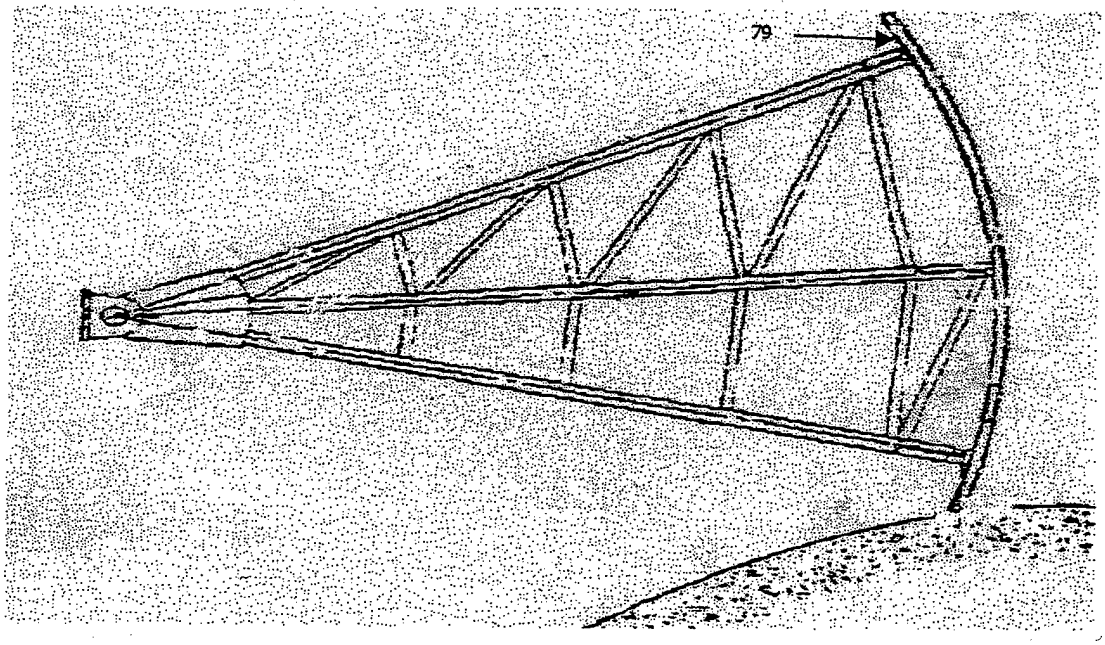
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 7 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
					a	b	c	d				From X	From Y		
1	78fi	70	A	1 + 2	50dB	48dB	3.118	-1.118	3.5"	2.559	.857			A	
2	79fi	70	A	1 + 2	52dB	48dB	2.652	1.348	.950	2.326	.855			A	no data loged
3	80fi	70	A	1 + 2	52dB	48dB	4.084	-.084		3.024	1.034			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 5 (Outer Left)



GATE 5 (Inner Right)

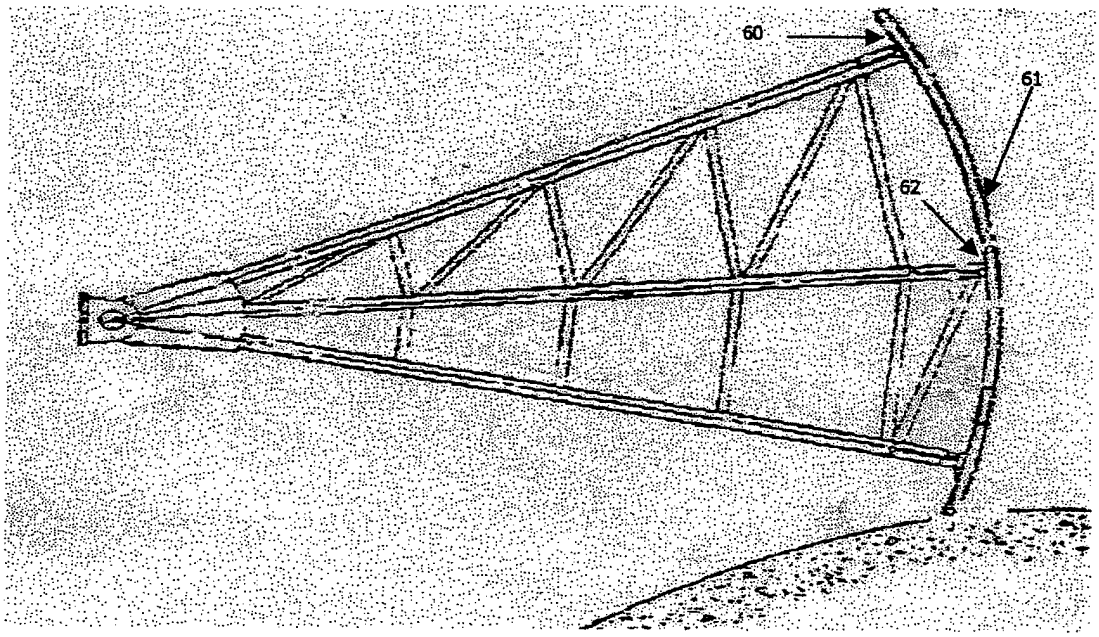
KLEINFELDER
An employee owned company

ULTRASONIC TEST REPORT
GATE 6

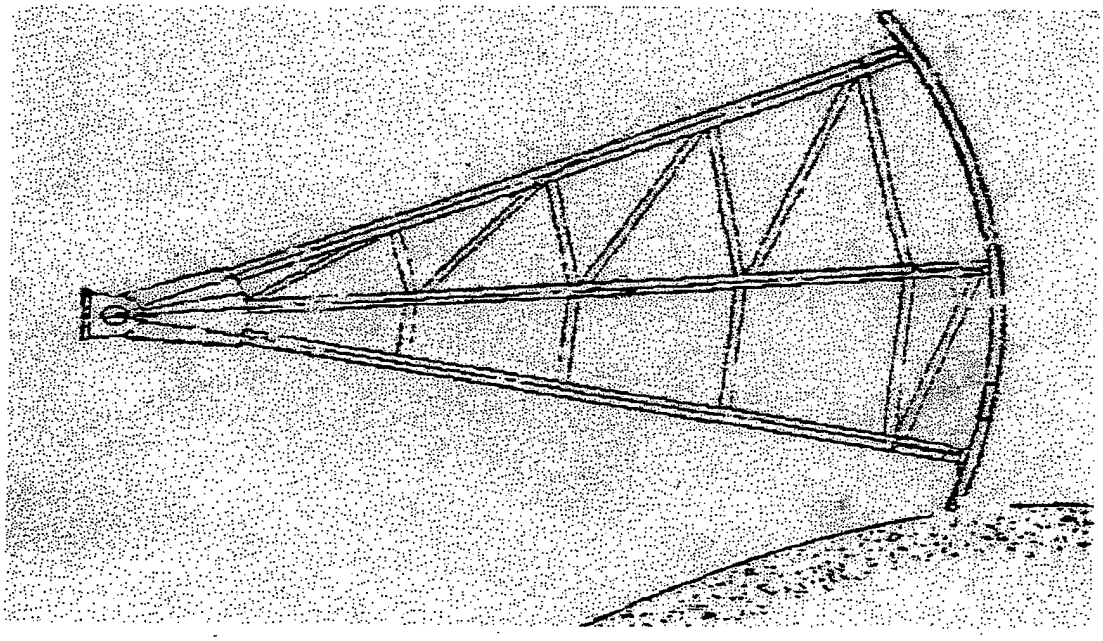
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 8 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
					a	b	c	d				From X	From Y		
1	60fo	70	A	1 + 2	48dB	48dB	1.67	-1.67	2.75"	1.835	.887			A	no data loged
2	61fo	70	A	1 + 2	50dB	48dB	-.272	2.272	full	.864	.295			B	
3	62fi	70	A	1 + 2	50dB	48dB	4.67	-2.67	3.5"	3.335	1.141			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 6 (Inner Right)



GATE 6 (Outer Left)

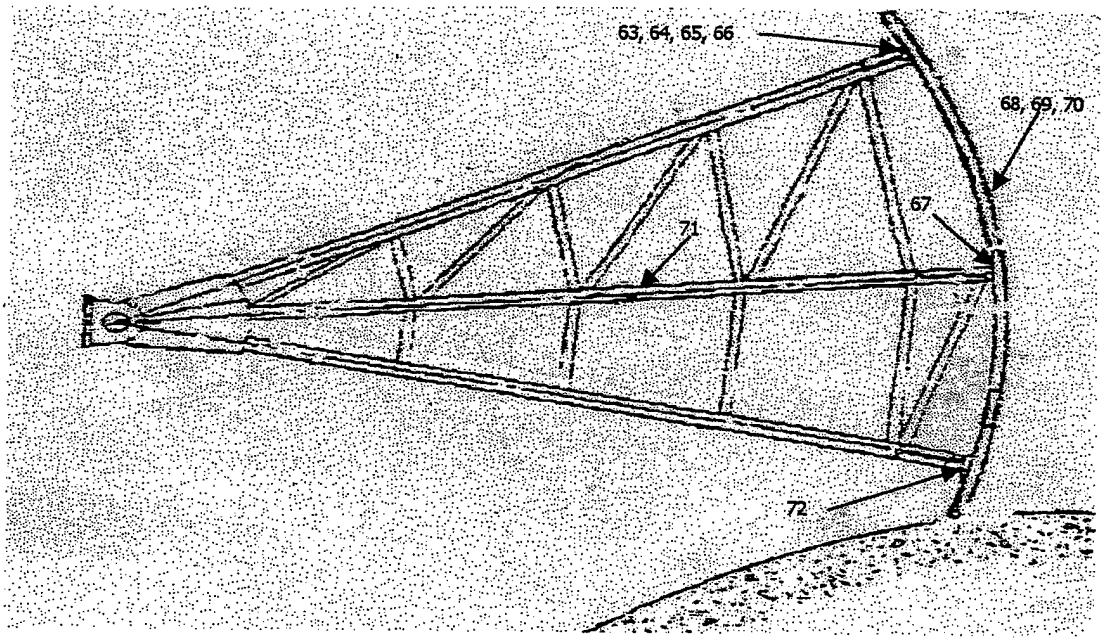
KLEINFELDER
An employee owned company

ULTRASONIC TEST REPORT
GATE 7

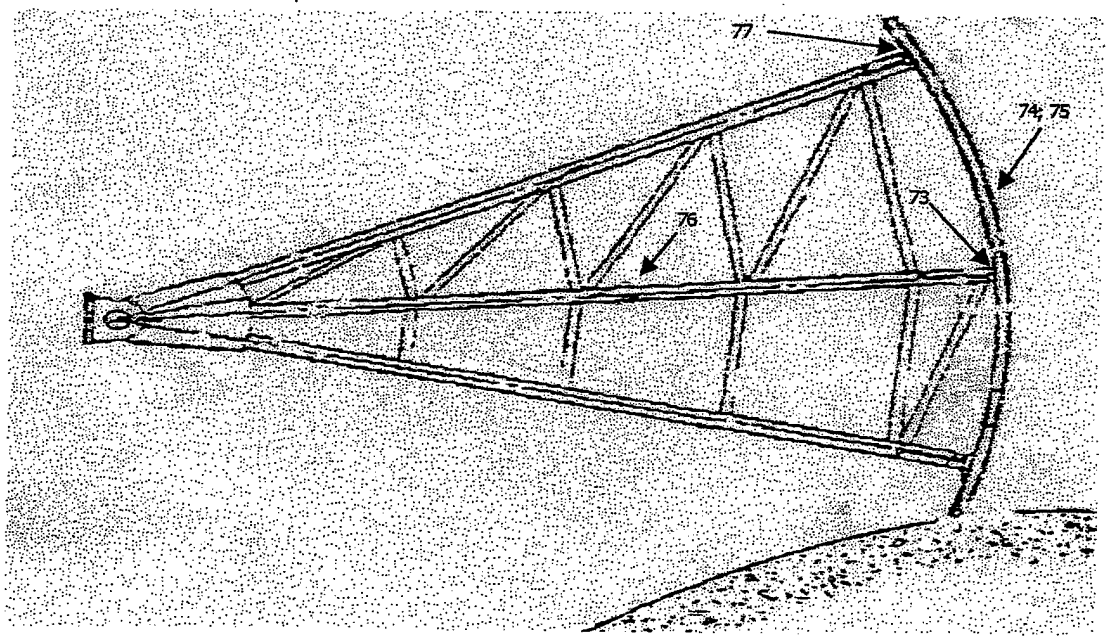
PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01
DATE: 10-2/10-13/00
PAGE: 9 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY					Discontinuity Evaluation	Remarks
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
					a	b	c	d				From X	From Y		
1	63fo	70	A	1 + 2	48dB	48dB	5.664	-5.664		3.832	1.310			A	
2	64fo	70	A	1 + 2		48dB									no data loged
3	65fi	70	A	1 + 2	48dB	48dB	5.944	-5.944		3.972	1.343			A	
4	66w	70	A	1 + 2	48dB	48dB	4.694	-4.694		3.347	1.144			A	
5	67fi	70	A	1 + 2	48dB	48dB	4.416	1.584		3.308	1.131			A	
6	68fi	70	A	1 + 2	48dB	48dB	-.118	.118		.941	.322			A	
7	69w	70	A	1 + 2	44dB	48dB	-.608	-3.392		.696	.238			A	
8	70fo	70	A	1 + 2	49dB	48dB	-.312	1.312		.844	.298			A	
9	71fi	70	A	1 + 2		48dB									no data loged
10	72fo	70	A	1 + 2	48dB	48dB	1.298	-1.298		1.649	.564			A	
11	73fi	70	A	1 + 2		48dB									no data loged
12	74w	70	A	1 + 2	48dB	48dB	-.704	.704		.648	.222			A	
13	75fo	70	A	1 + 2	48dB	48dB	-.256	.256		.872	.298			A	
14	76w	70	A	1 + 2	48dB	48dB	.734	-.734		1.367	.467			A	
15	77fo	70	A	1 + 2	50dB	48dB	3.002	-1.002		2.501	.855			A	
16															
17															
18															
19															
20															



GATE 7 (Outer Left)



GATE 7 (Inner Right)

KLEINFELDER

An employee owned company

ULTRASONIC TEST REPORT
GATE 8

PROJECT NAME: Walla Walla; Lower Granite Dam DATE: 10-2/10-13/00

PROJECT NO.: 21-6149-01 PAGE: 10 of 10

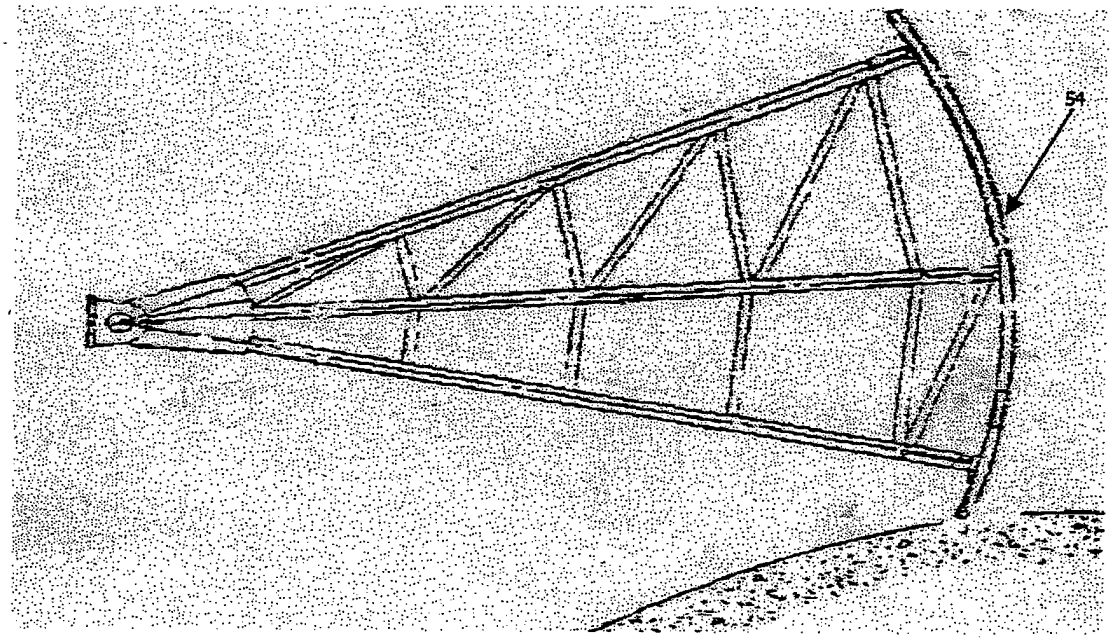
INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS Indication Level a	Reference Level b	Attenuation Factor c	Indication Rating d	DISCONTINUITY Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE From X	From Y	Discontinuity Evaluation	Remarks
1	54	70	A	1 + 2	48dB	48dB	.016	-.016	2"	.922	.315			A	
2	55w	70	A	1 + 2	50dB	48dB	1.9	.1	1.125"	1.950	.667			A	
3	56fl	70	A	1 + 2	48dB	48dB	-.246	.246		.877	.300			A	
4	57w	70	A	1 + 2	48dB	48dB	3.196	-3.196	2.75"	2.598	.888			A	
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

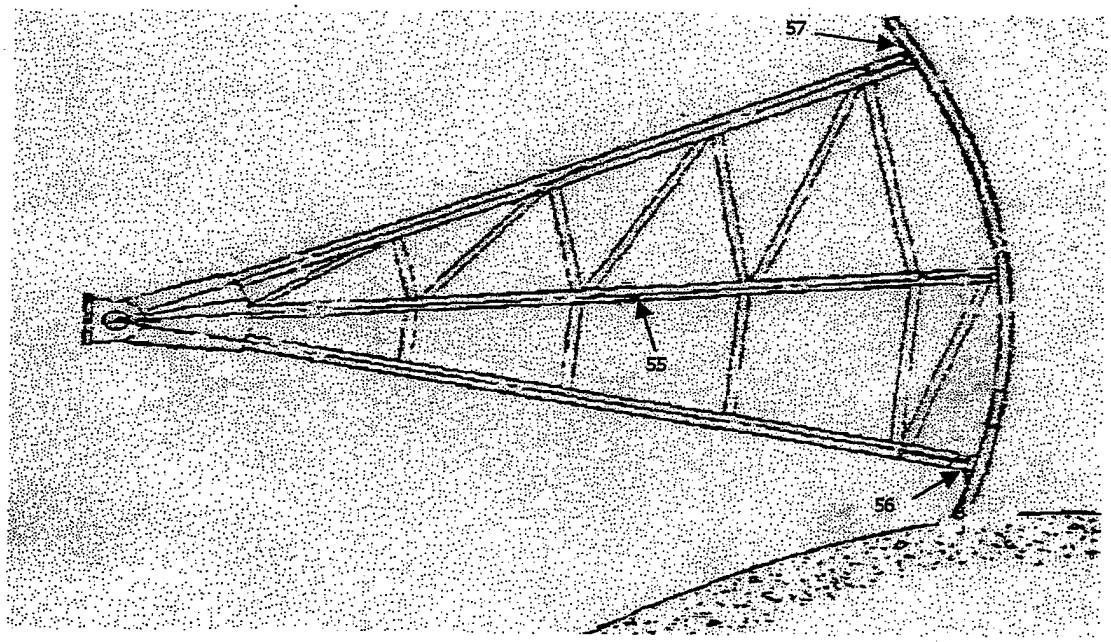
We the undersigned, certify the statements in this record are correct and the welds were prepared and tested in accordance with the requirements of ANSI/AASHTO/AWS D1.5 (1995) Bridge Welding Code.
year

INSPECTED BY: Destry K. Hall / Jim Fisher ASNT LEVEL: 2 / 2

SIGNATURE: [signature] Level II TEST DATE: 10-2/10-13/00



GATE 8 (Inner Right)

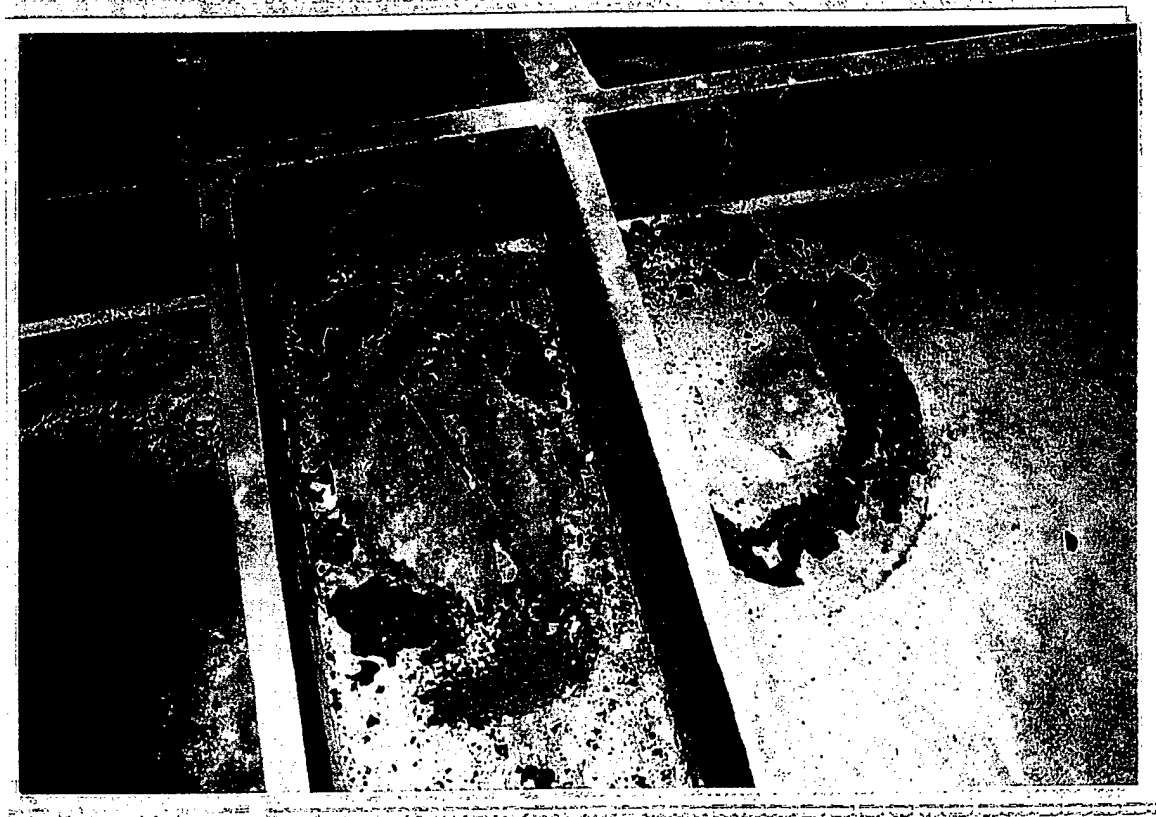


GATE 8 (Outer Left)

Lower Granite Dam 10/06/00 1-1	**Gate 1** Top horizontal girder, right side, between stiffeners at radial strut connection. Delaminated paint and light corrosion due to poor drainage.

Lower Granite Dam 10/06/00 1-2	**Gate 1** Top horizontal girder, right side, between stiffeners at radial strut connection. Delaminated paint and light corrosion due to poor drainage.

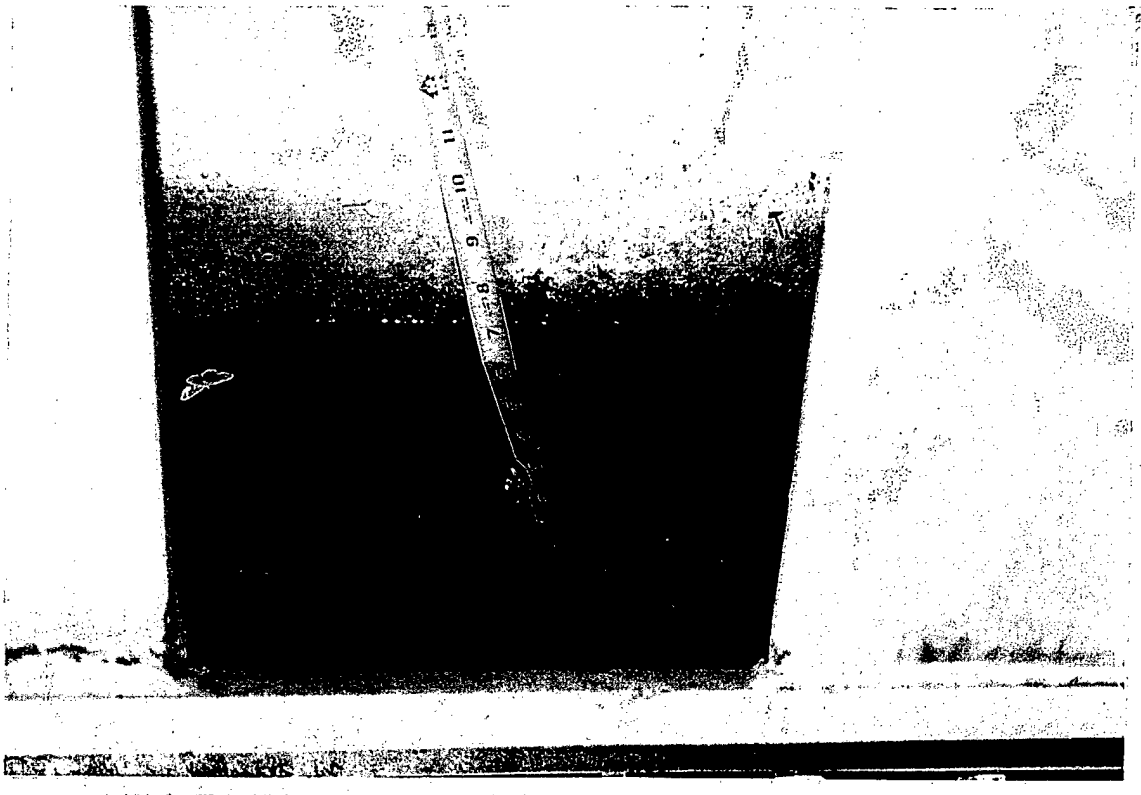
Lower Granite Dam 10/06/00 1-3	**Gate 1** Side seal leak, left side.



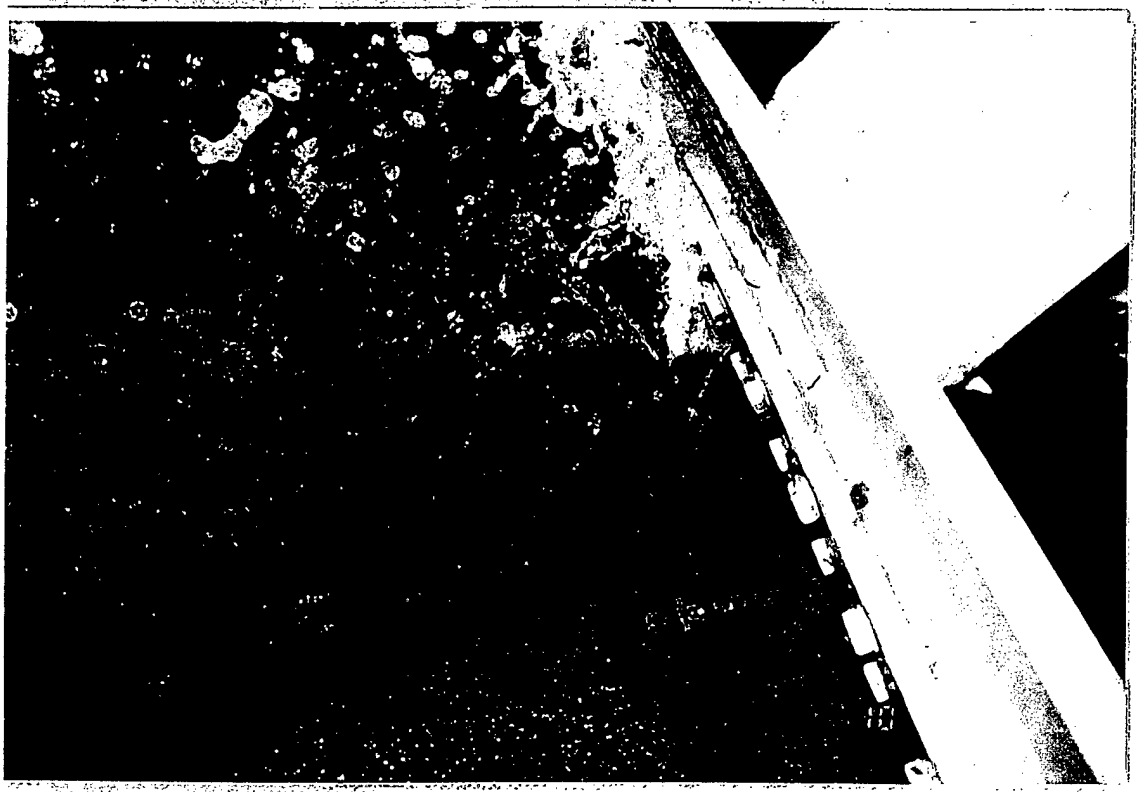
Lower Granite Dam 10/06/00 1-4	**Gate 1** Middle horizontal girder, right side, between stiffeners at radial strut connection. Delaminated paint and light corrosion due to poor drainage.

Lower Granite Dam 10/06/00 1-5	**Gate 1** Upstream end, bottom radial strut. Ponding water between strut flanges and horizontal girder flange due to poor drainage.

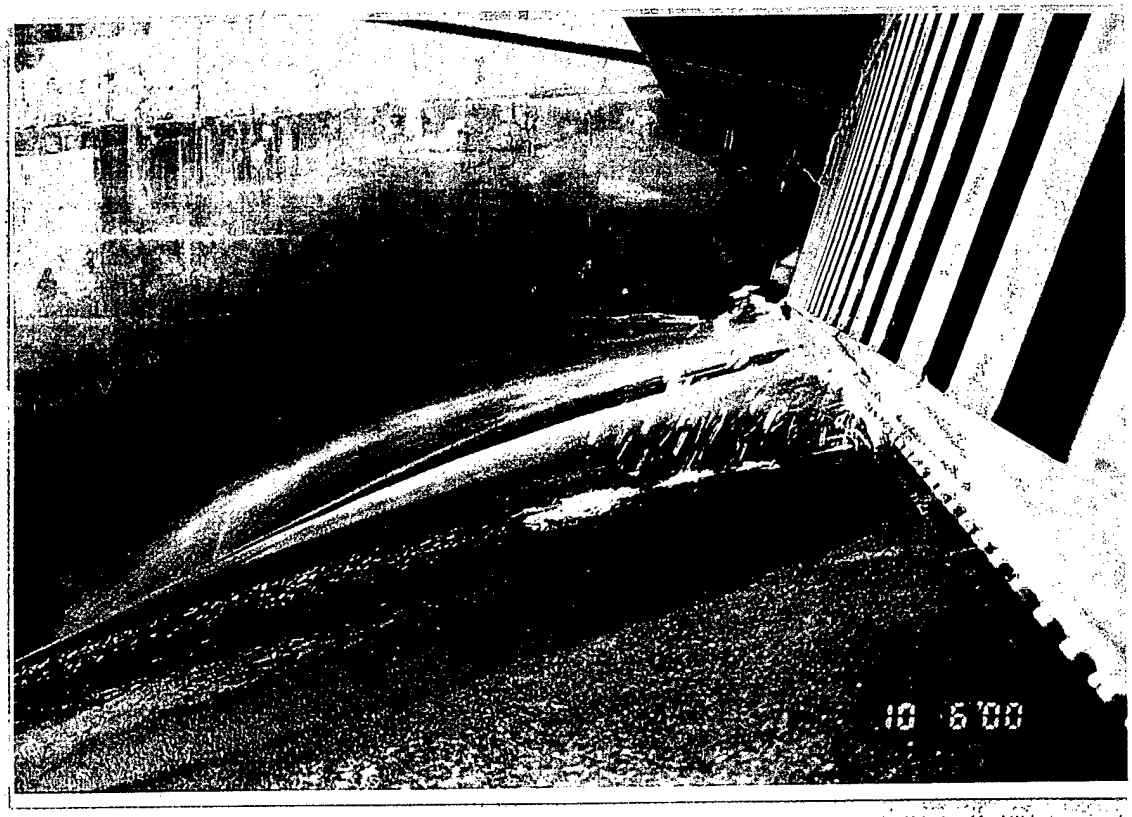
Lower Granite Dam 10/06/00 1-6	**Gate 1** Left end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage



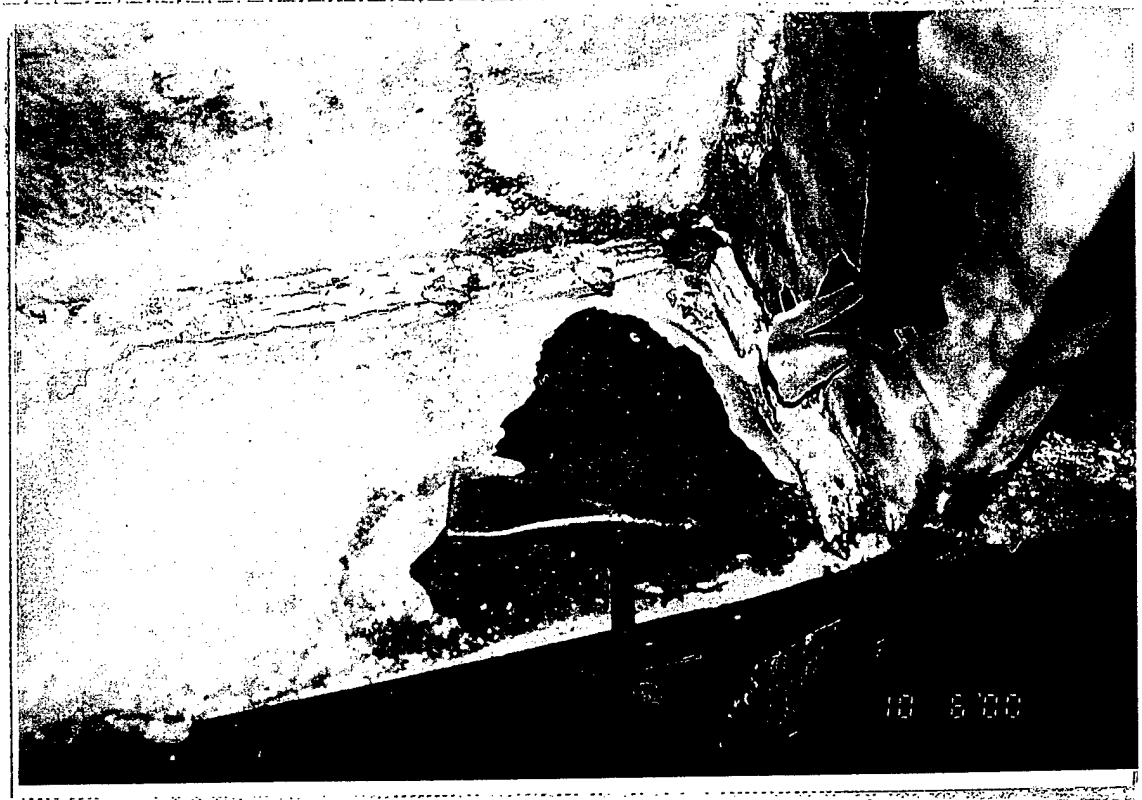
Lower Granite Dam 10/06/00 1-7	**Gate 1** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



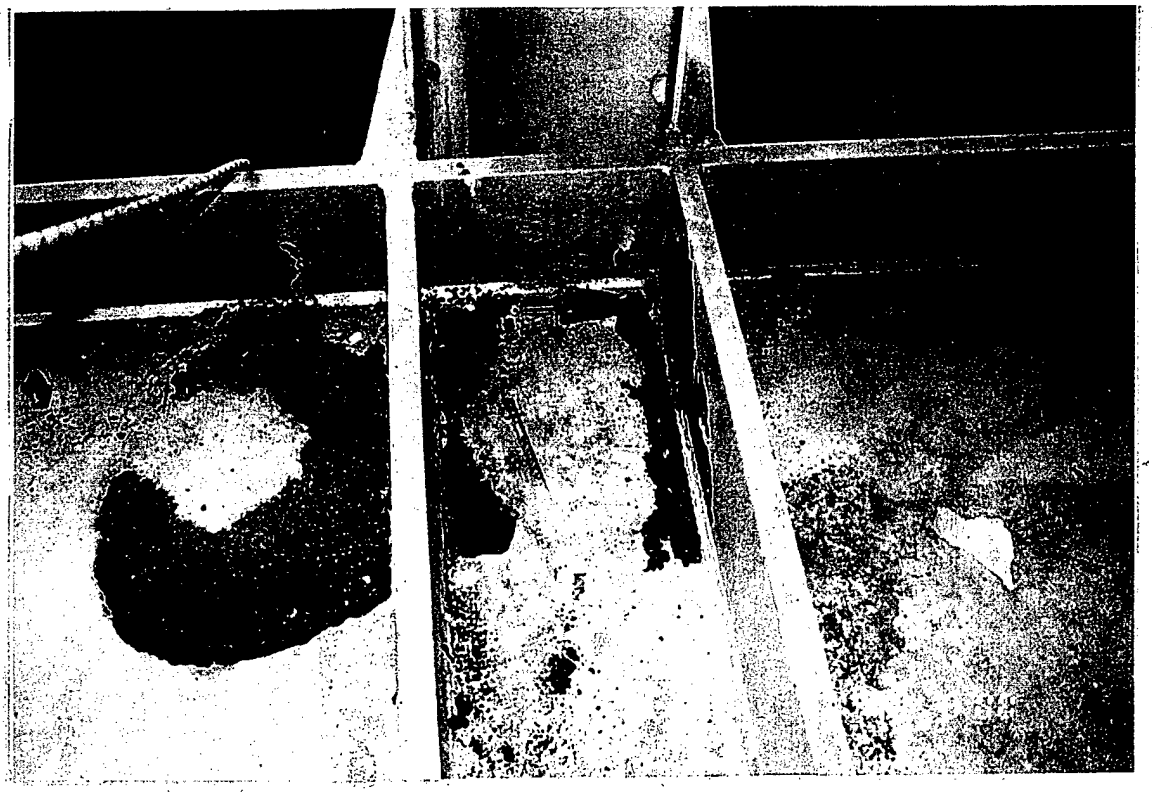
Lower Granite Dam 10/06/00 1-8	**Gate 1** Leak at center construction joint in spillway monolith.



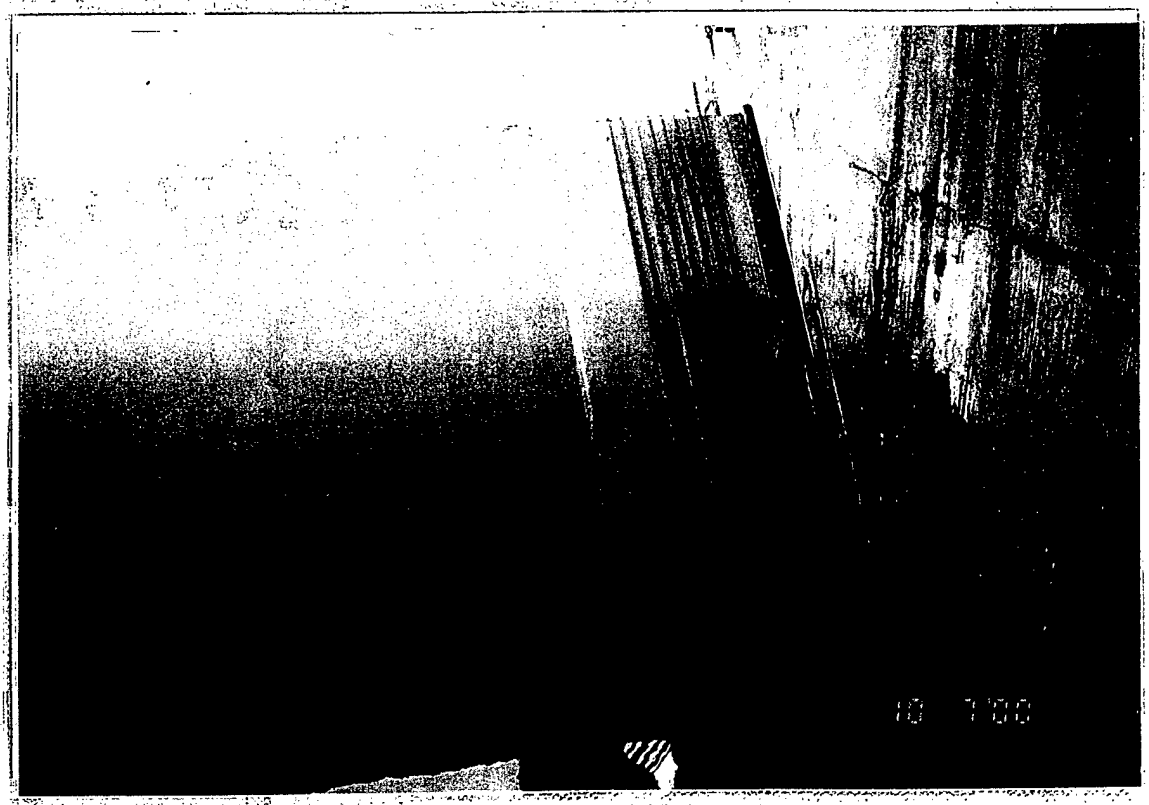
Lower Granite Dam 10/06/00 1-9	**Gate 1** Leak at center construction joint in spillway monolith.



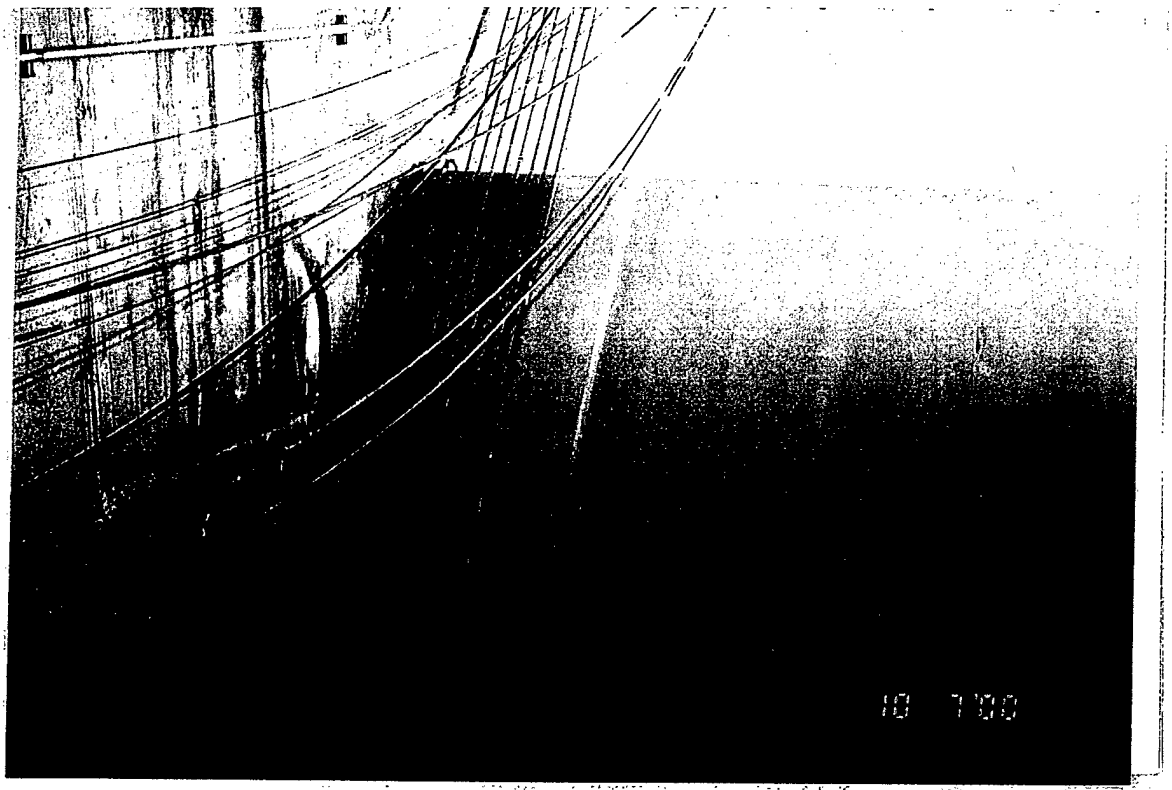
Lower Granite Dam 10/06/00 1-10	**Gate 1** Bottom of bottom horizontal girder at radial strut stiffeners. Delaminated paint, light corrosion on girder flange and stiffener plates. Typical.



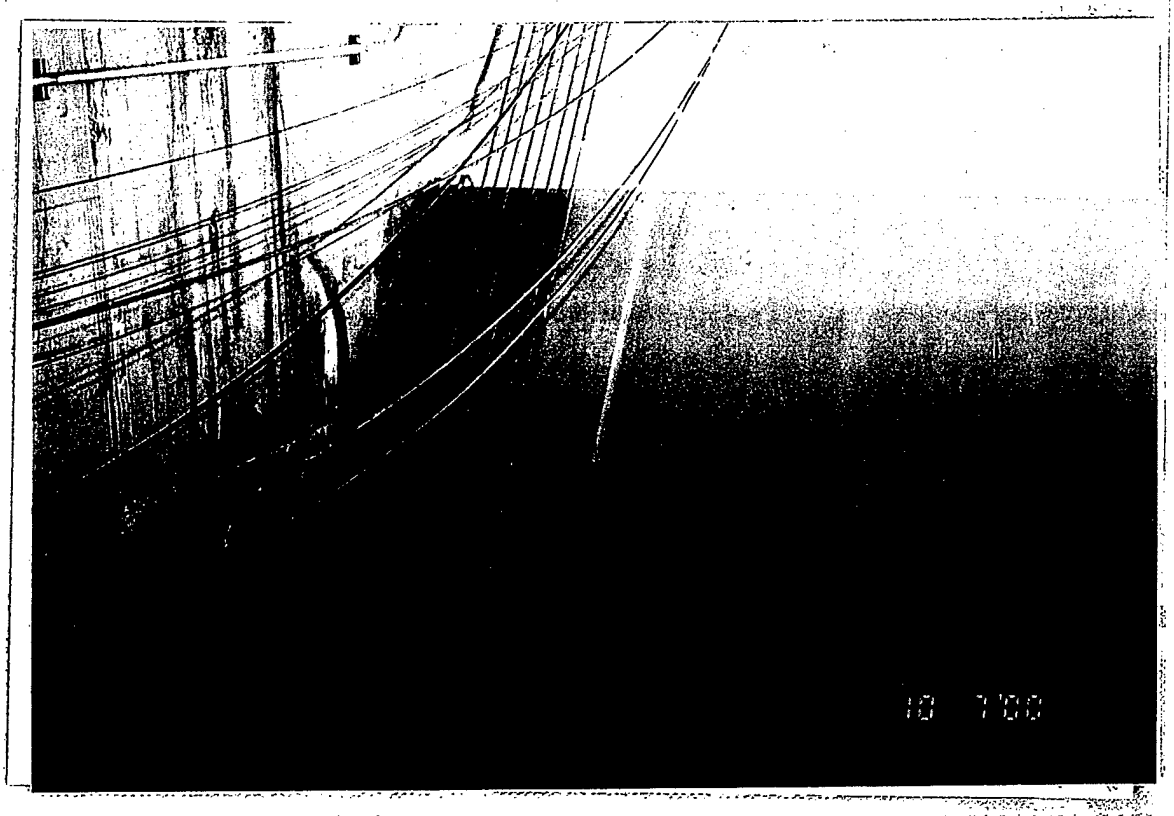
Lower Granite Dam 10/06/00 1-11	**Gate 1** Top horizontal girder, right side, between stiffeners at radial strut connection. Delaminated paint and light corrosion due to poor drainage.



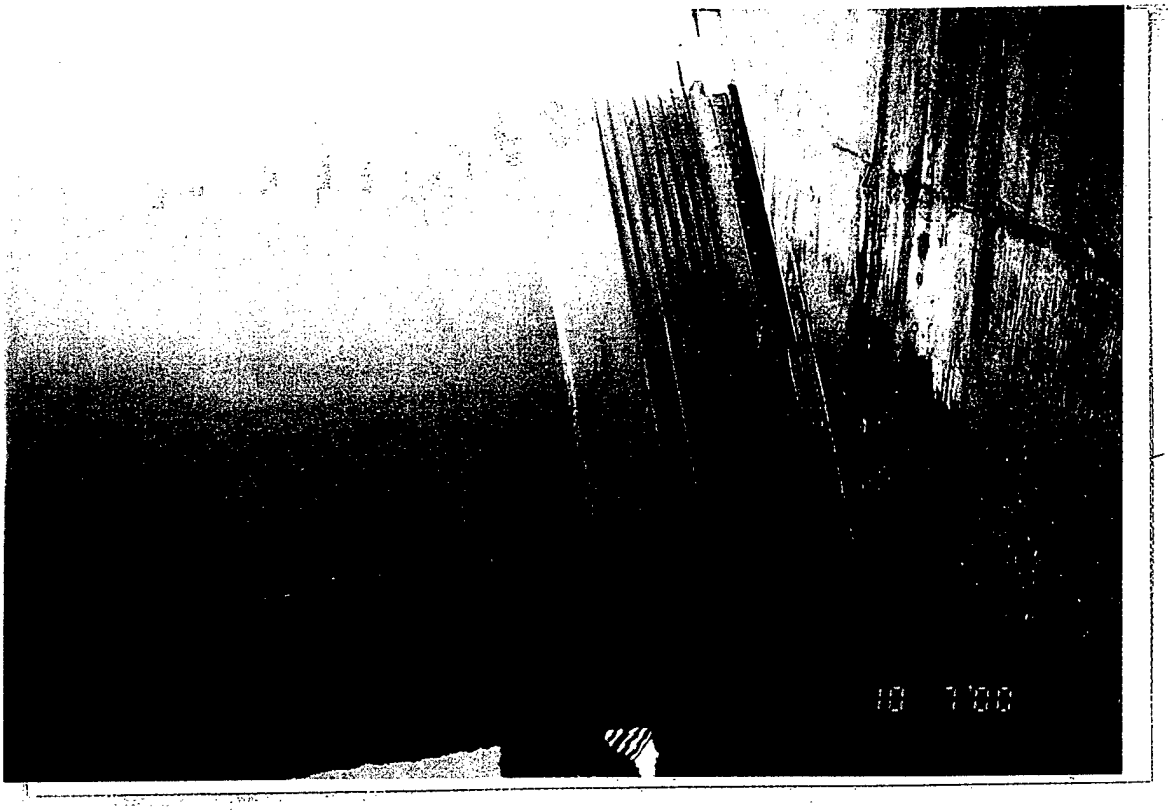
Lower Granite Dam 10/07/00 1-12	**Gate 1** Exposed portion of upstream gate face. Note: Surface collector installed at this time.



Lower Granite Dam 10/07/00 1-13	**Gate 1** Exposed portion of upstream gate face. Note: Surface collector installed at this time.

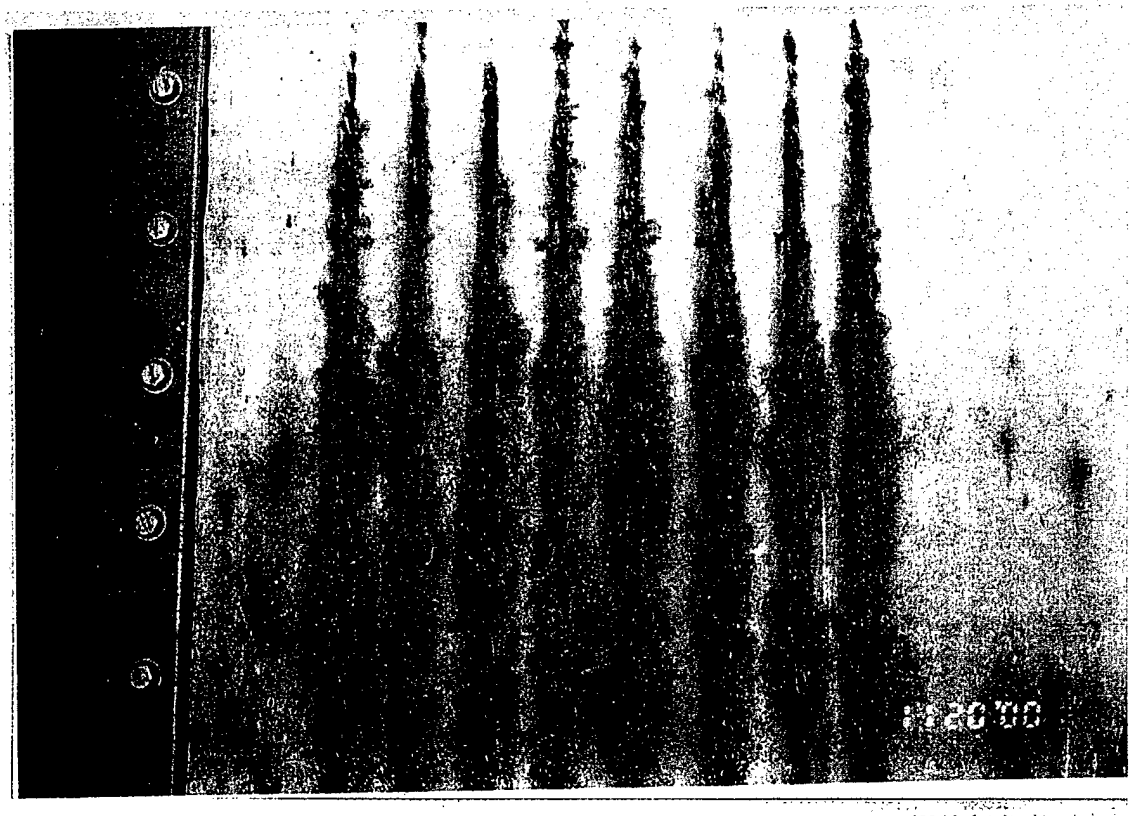


Lower Granite Dam 10/07/00 1-14	**Gate 1** Exposed portion of upstream gate face. Note: Surface collector installed at this time.

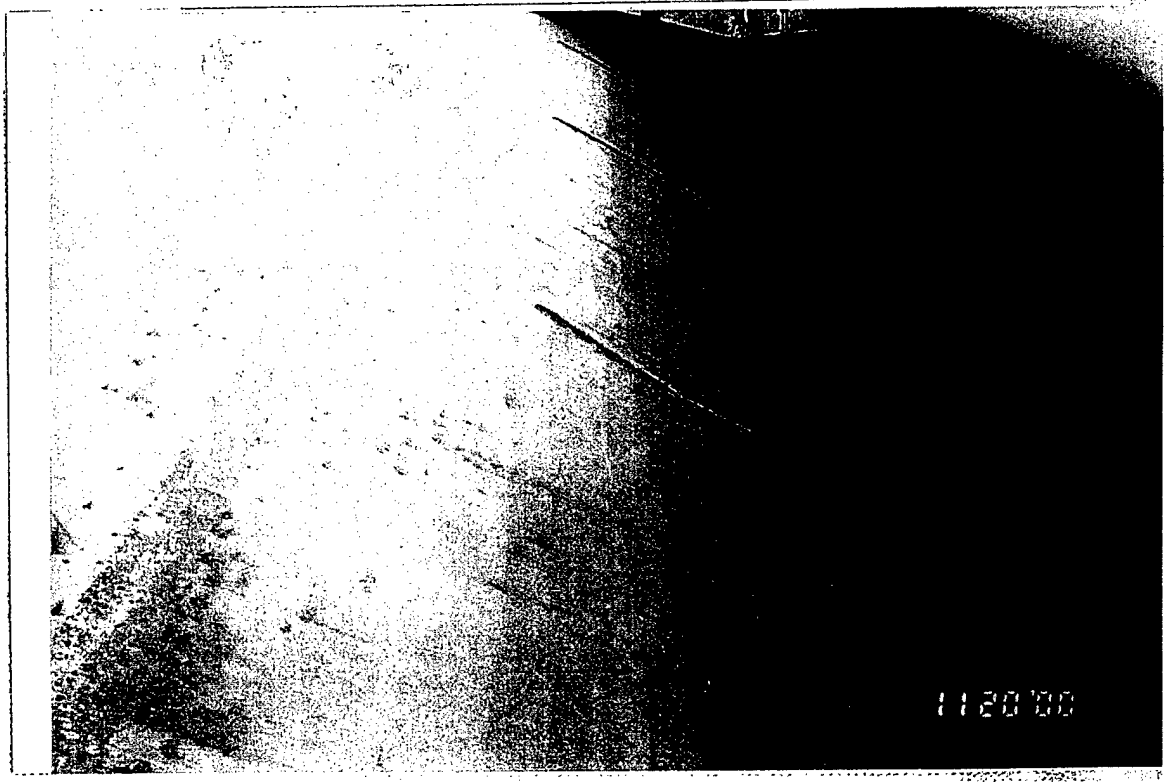


Lower Granite Dam 10/07/00 1-15	**Gate 1** Exposed portion of upstream gate face. Note: Surface collector installed at this time.

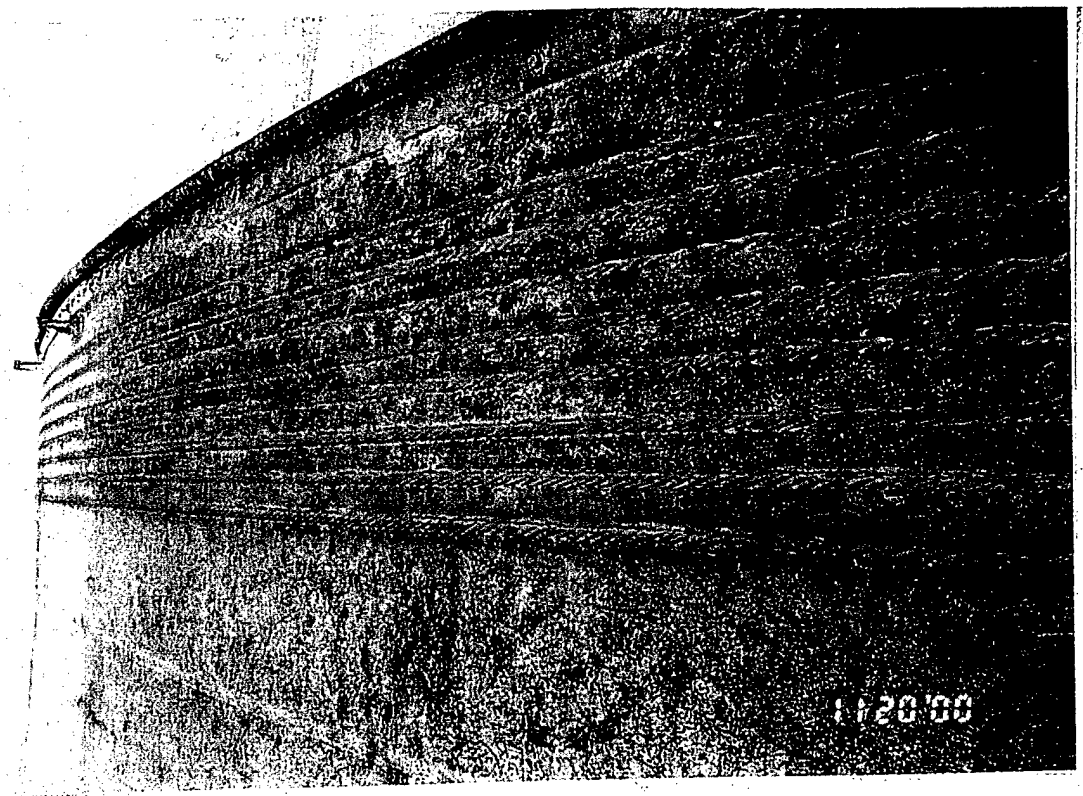
Lower Granite Dam 11/20/00 1-16	**Gate 1** Typical skin plate condition. Light pitting near normal water surface. Note: Surface collector removed.



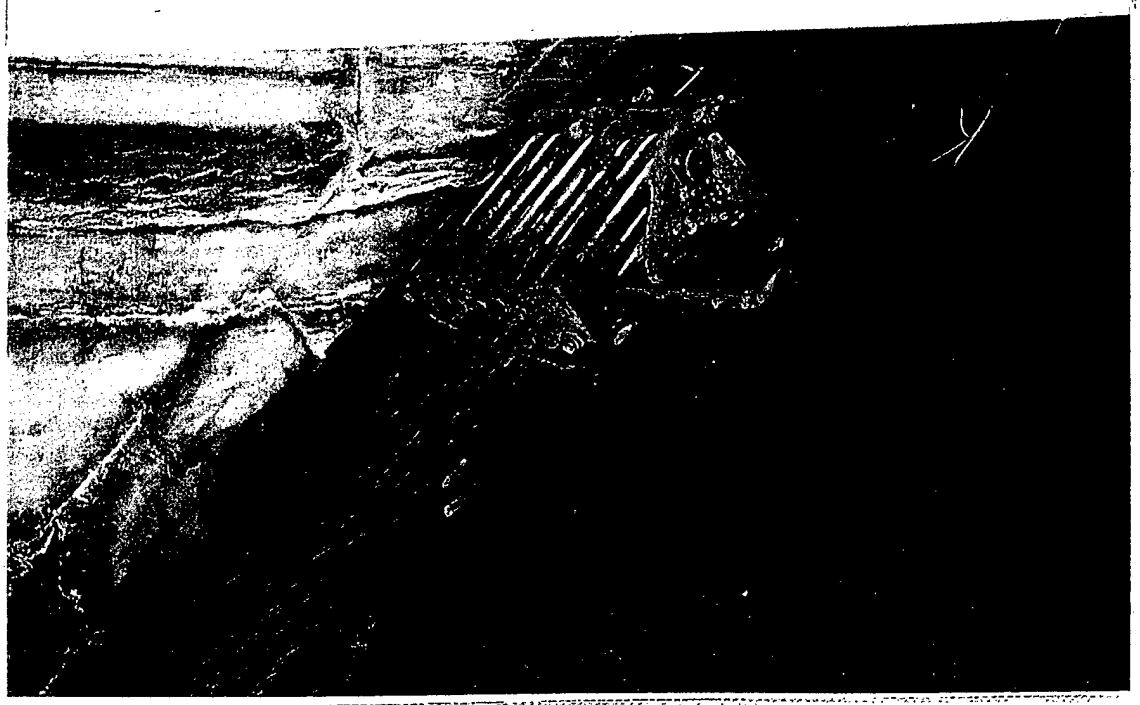
Lower Granite Dam 11/20/00 1-17	**Gate 1** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



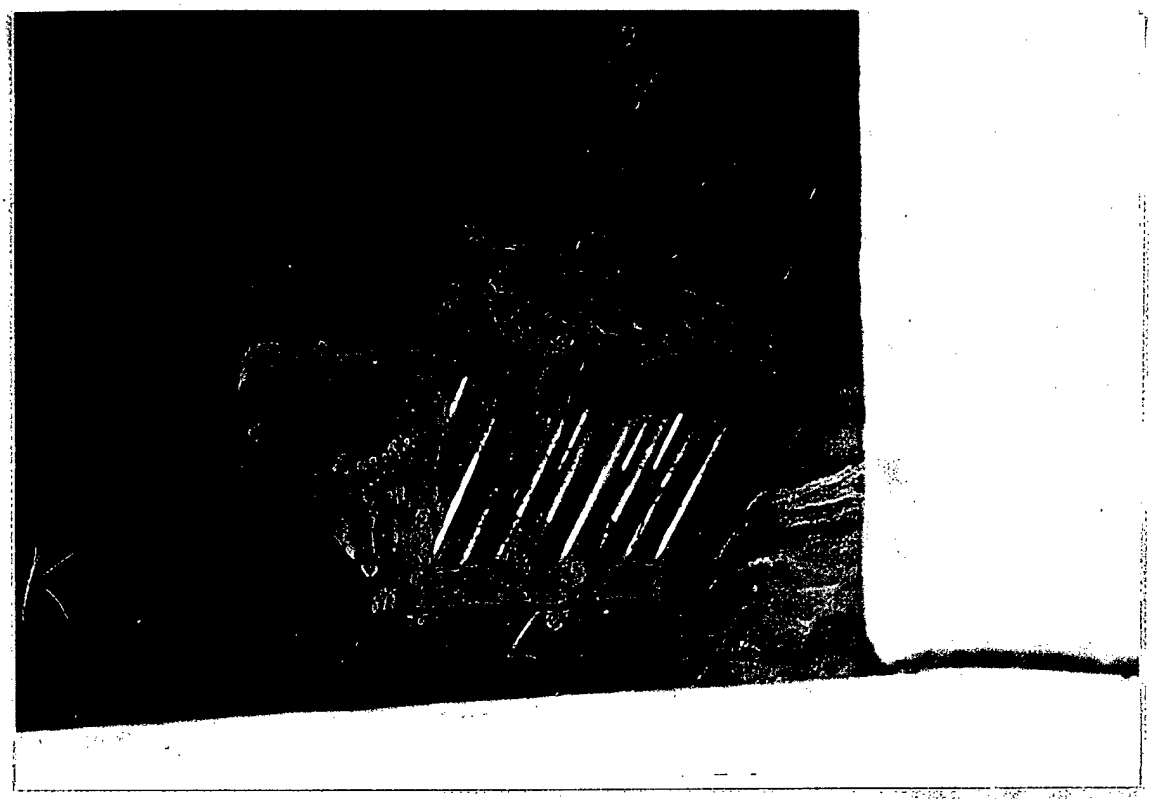
Lower Granite Dam 11/20/00	**Gate 1** Typical skin plate condition. Light pitting near normal water surface. Note: Surface collector removed.



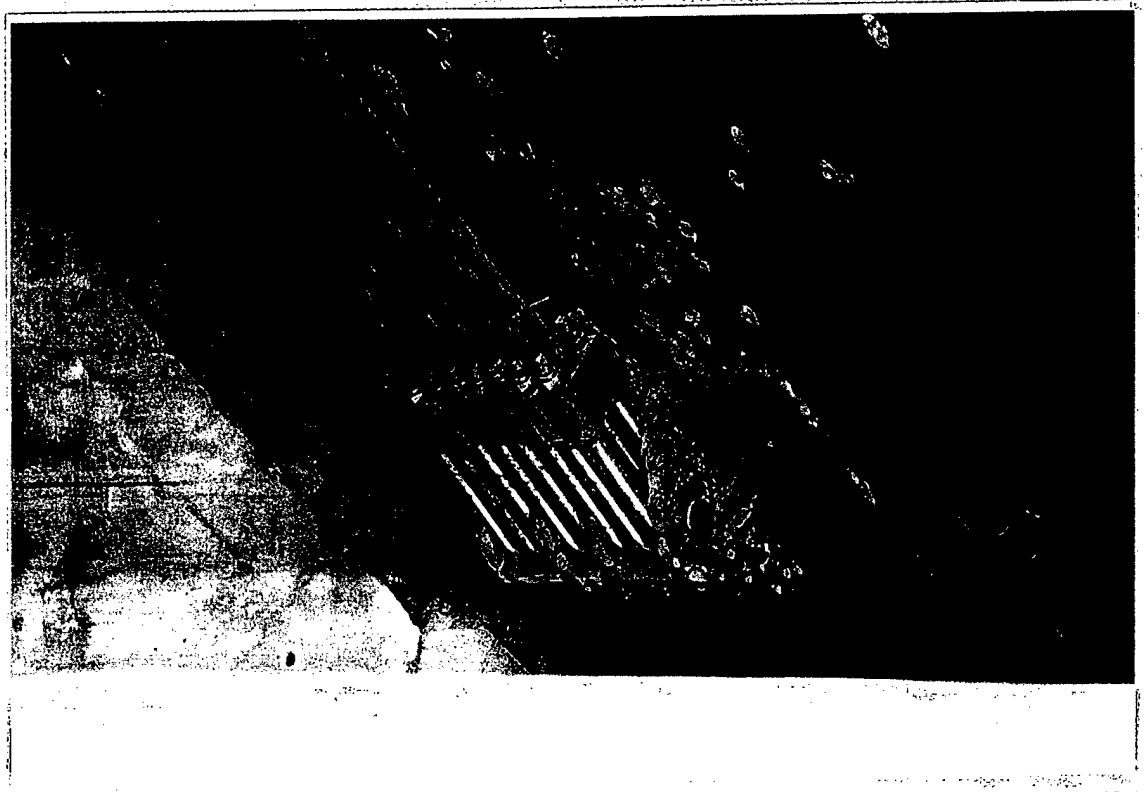
Lower Granite Dam 11/20/00 1-19	**Gate 1** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



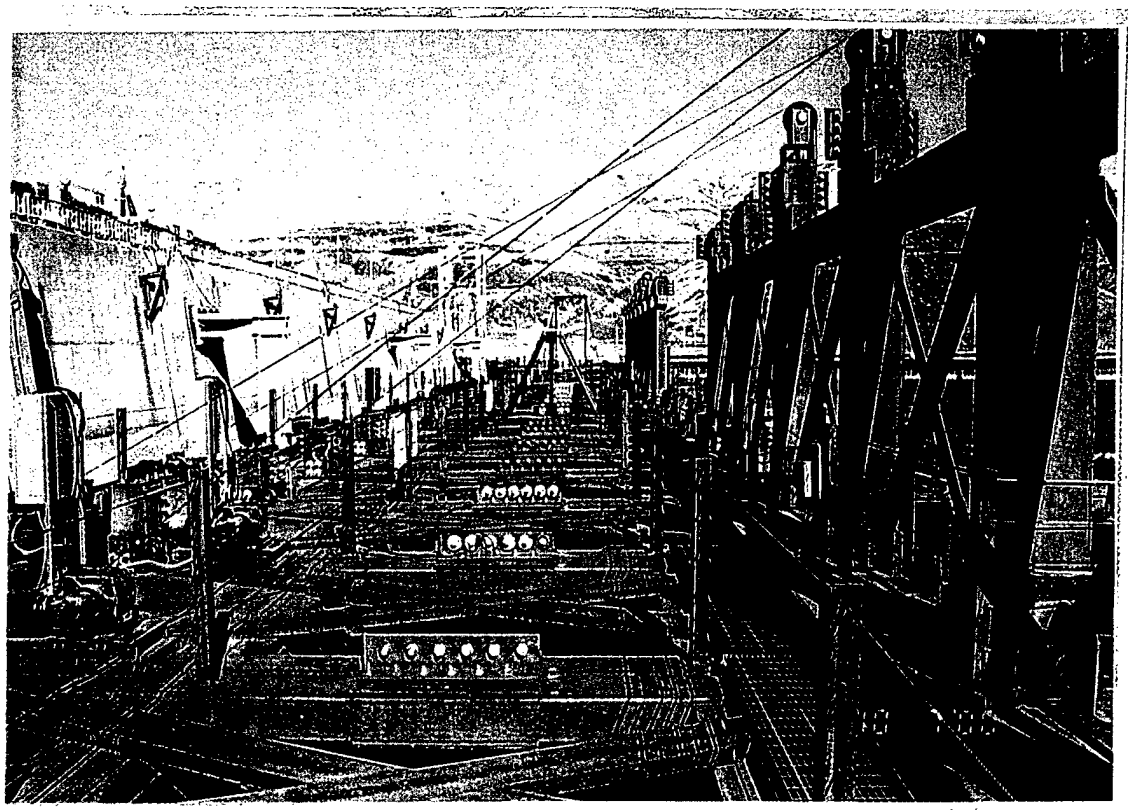
Lower Granite Dam 11/20/00 1-20	**Gate 1** Right side hoist connection. Light corrosion on lifting lugs and plates.



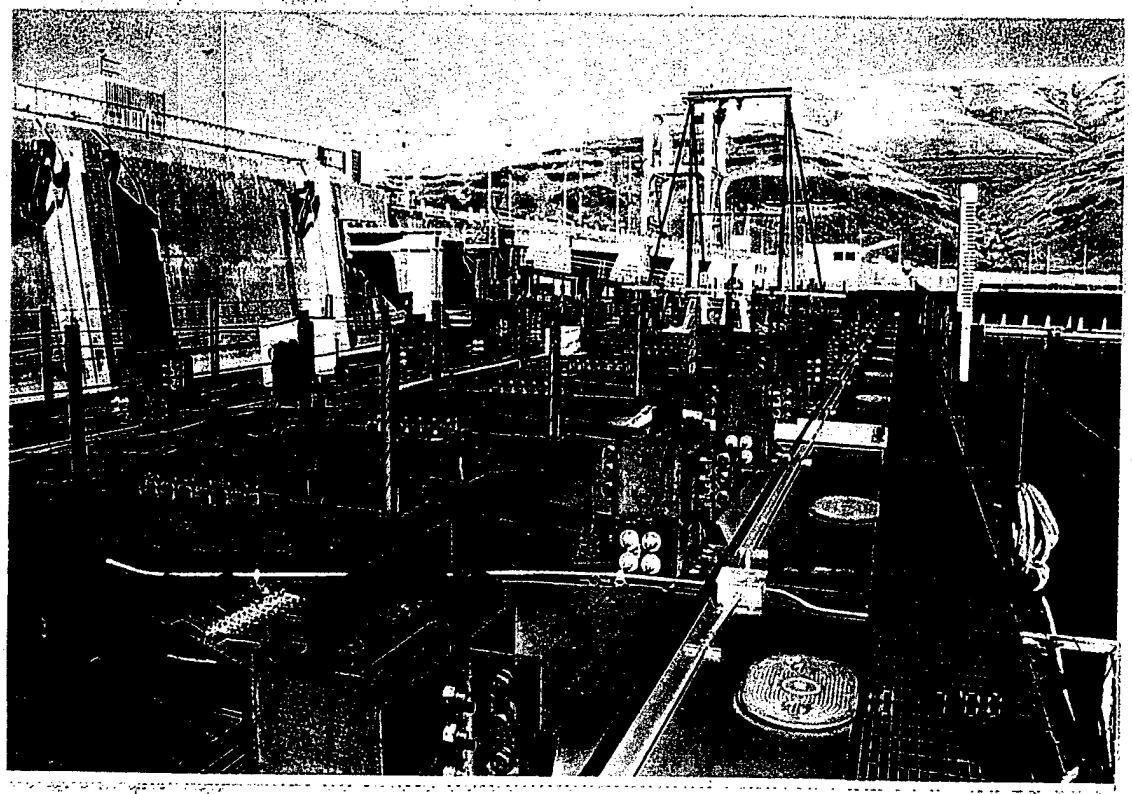
Lower Granite Dam 11/20/00 1-21	**Gate 1** Right side hoist connection. Light corrosion on lifting lugs and plates. Note: excellent condition of stainless steel U-bolts.



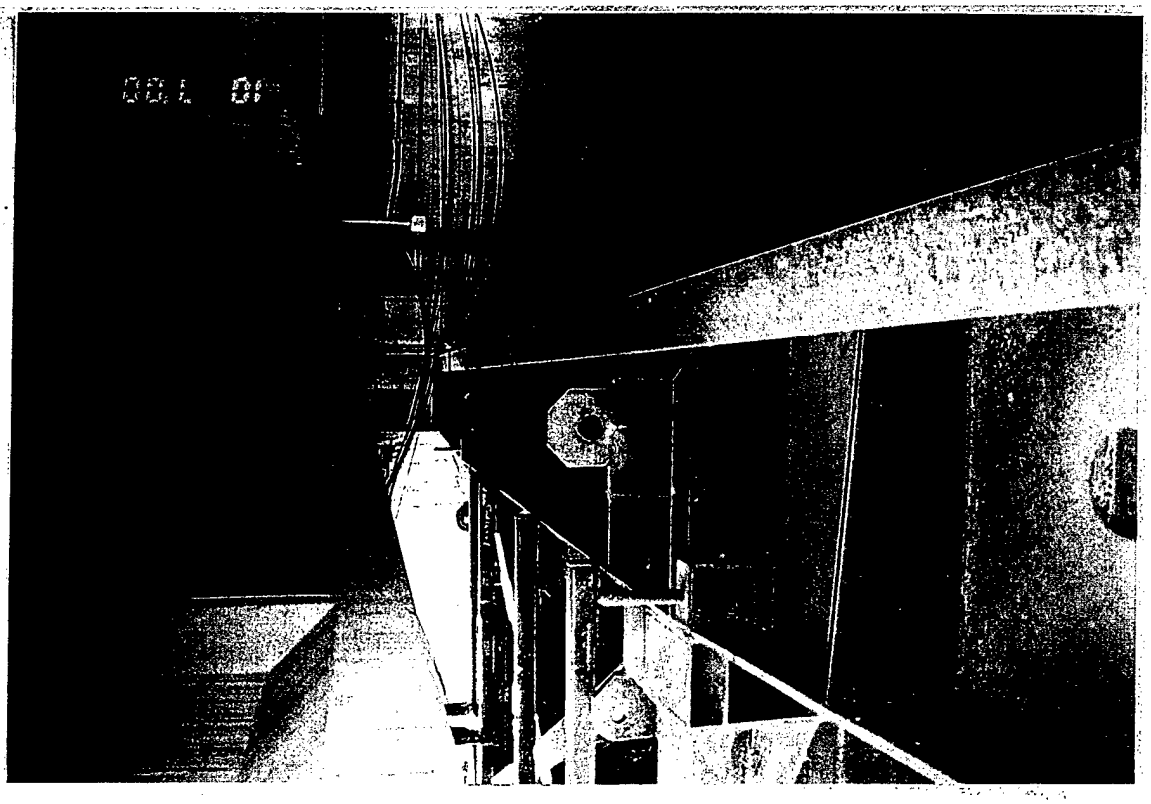
Lower Granite Dam 11/20/00 1-22	**Gate 1** Left side hoist connection. Light corrosion on lifting lugs and plates. Note: excellent condition of stainless steel U-bolts.



Lower Granite Dam 10/07/00 1-23	**Gate 1** Surface collector installed at Gate 1.



Lower Granite Dam 10/07/00 1-24	**Gate 1** Surface collector installed at Gate 1.

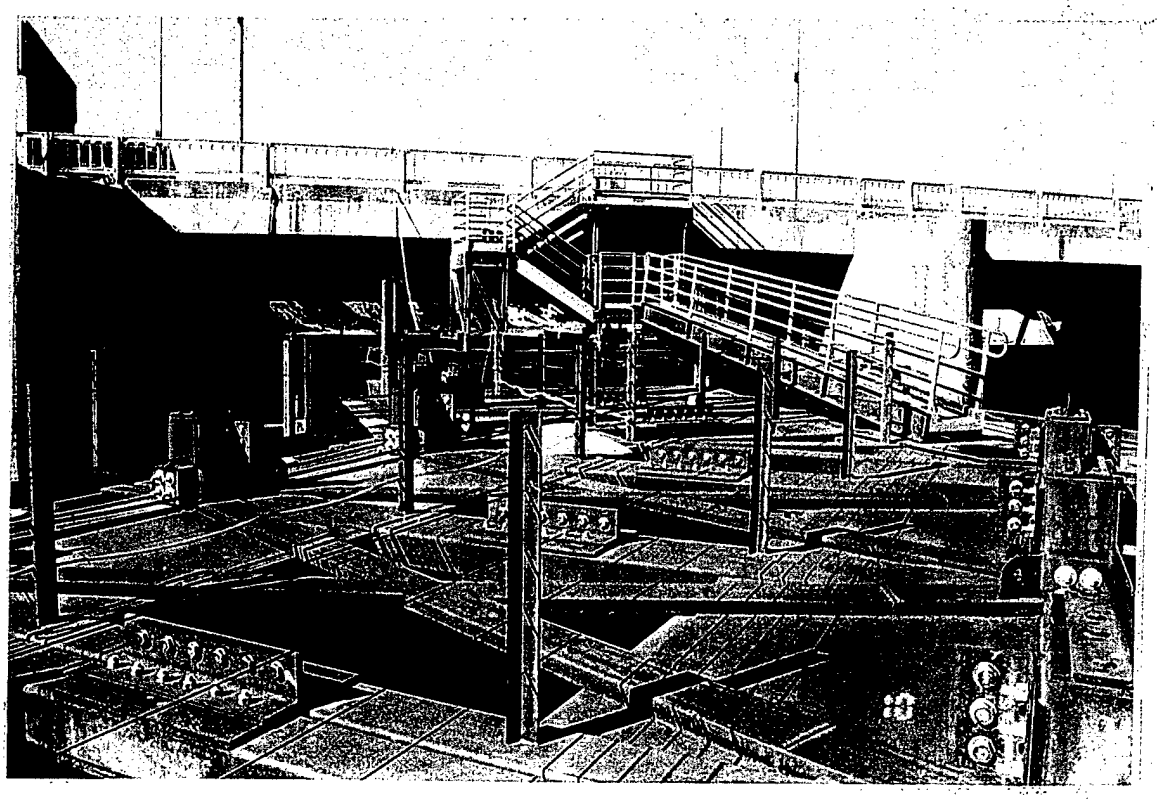


Lower Granite Dam

10/07/00

1-25

Gate 1
Gate 1 top stop log with surface collector attached to upstream side.



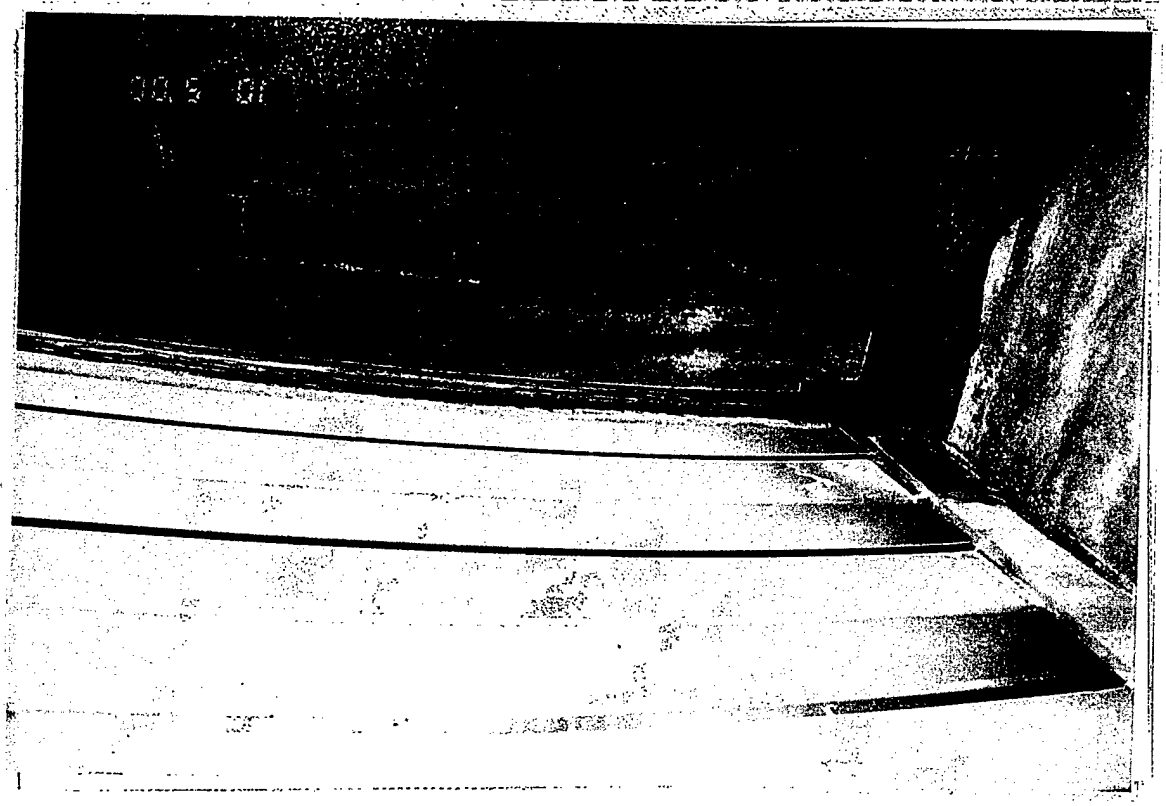
Lower Granite Dam

10/07/00

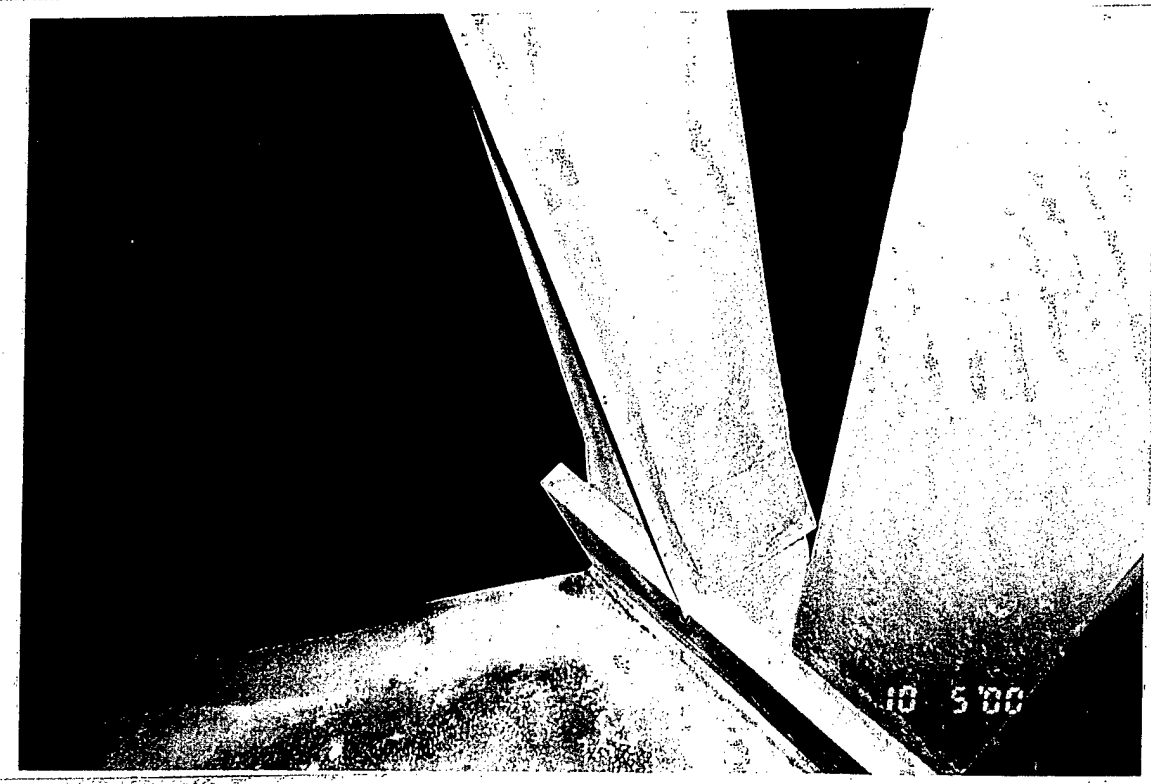
1-26

Gate 1
Surface collector installed at Gate 1.

Lower Granite Dam 10/05/00 2-1	**Gate 2** Left end, middle horizontal girder. Peeling paint on purlins, light corrosion.

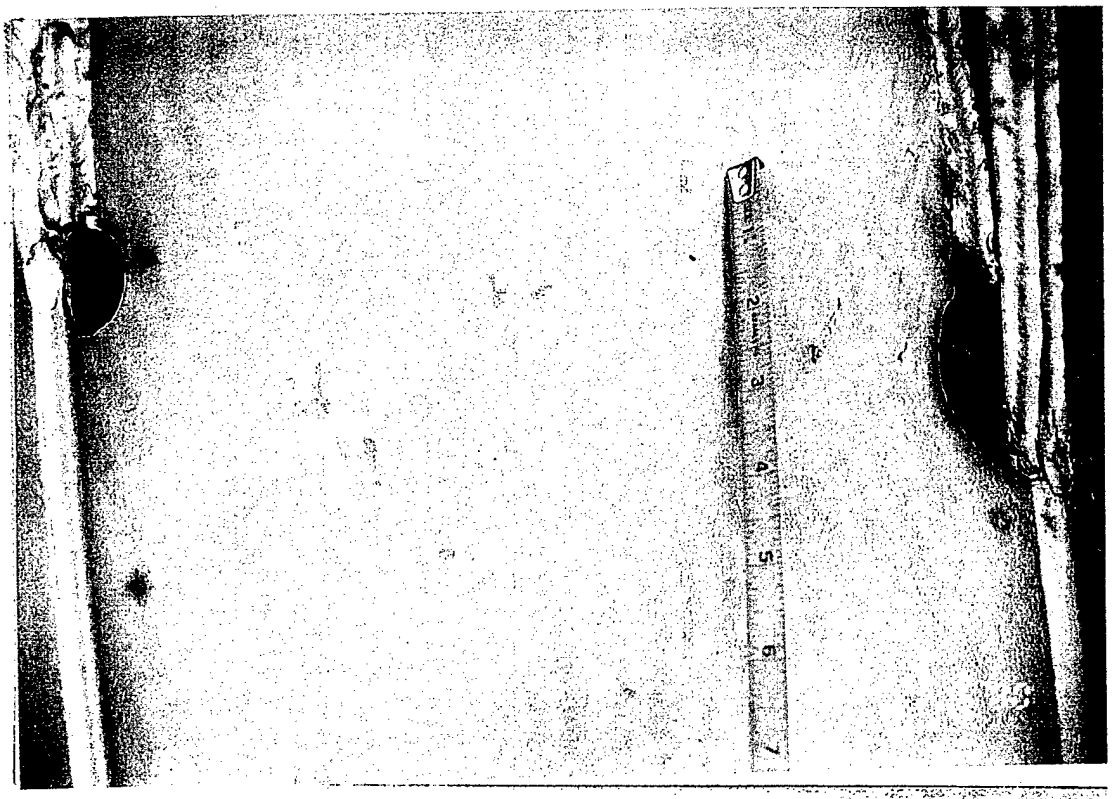


Lower Granite Dam 10/05/00 2-2	**Gate 2** Left end, middle horizontal girder. Peeling paint on purlins, light corrosion.

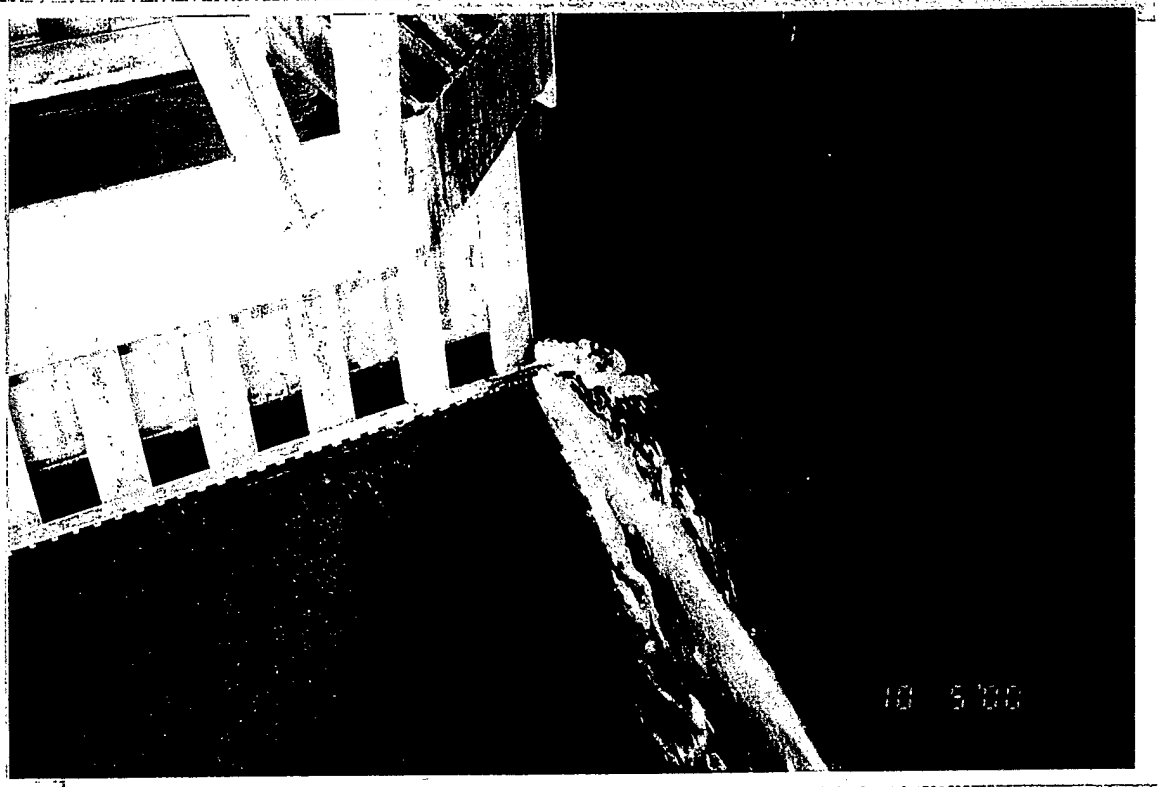


Lower Granite Dam 10/05/00 2-3	**Gate 2** Left frame, vertical Brace A at middle horizontal girder. Approx. 3/4" deformation in ST

Lower Granite Dam 10/05/00 2-4	**Gate 2** Left frame, vertical Brace A and K at middle horizontal girder. Misalignment in vertical braces due to 1" deformation in Brace A.



Lower Granite Dam 10/05/00 2-5	**Gate 2** Left frame, Brace H. Coping in brace at weld to top radial strut. Light corrosion at isolated spots.



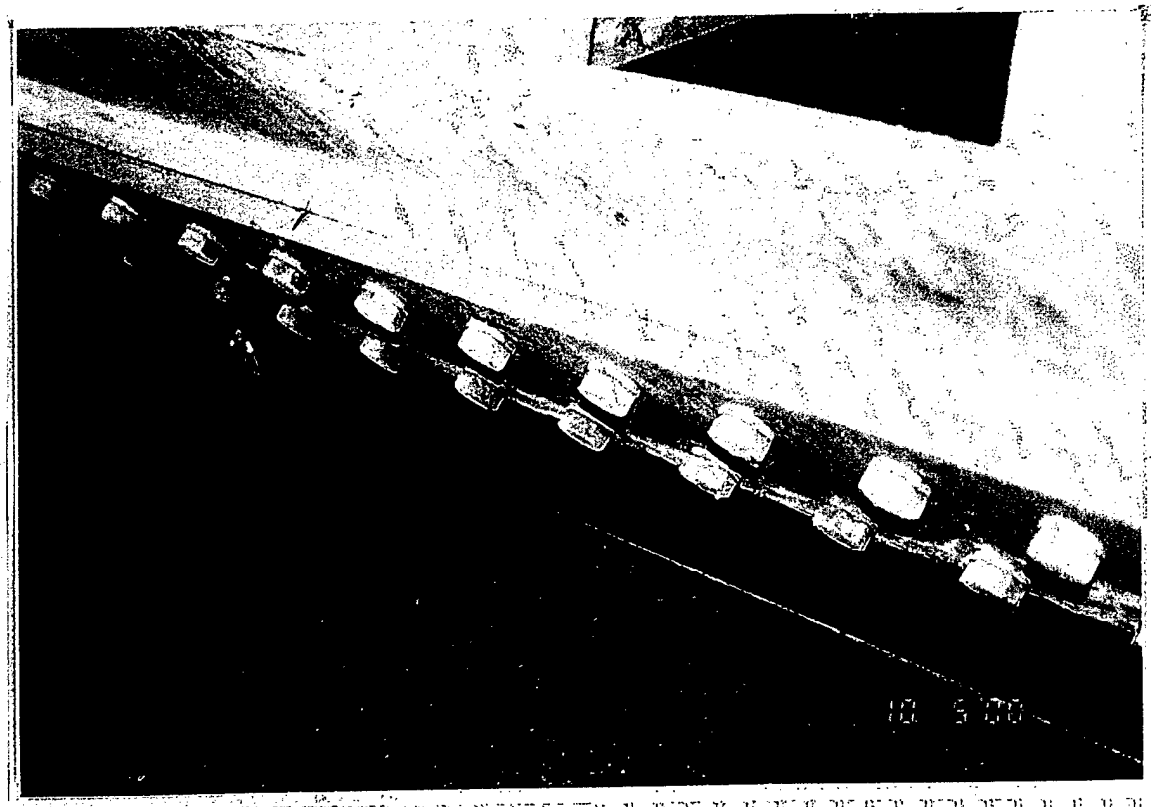
Lower Granite Dam 10/05/00 2-6	**Gate 2** Bottom / side seal leak at bottom left corner of gate.

Lower Granite Dam 10/05/00 2-7	**Gate 2** Leak at center construction joint in spillway monolith.

Lower Granite Dam 10/05/00 2-8	**Gate 2** Left end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners.

Lower Granite Dam 10/05/00 2-9	**Gate 2** Left end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage

Lower Granite Dam 10/05/00 2-10	**Gate 2** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical. Leak at center const. joint in spillway monolith.

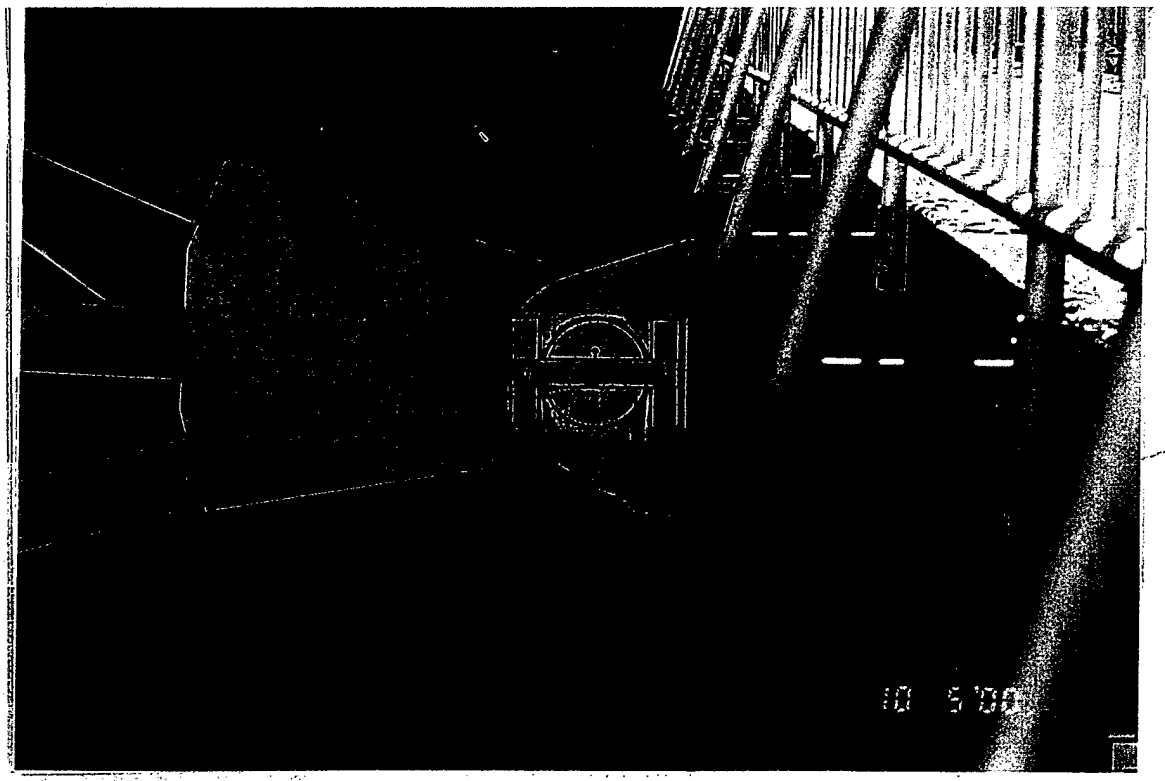


Lower Granite Dam 10/05/00 2-11	**Gate 2** Bottom seal keeper bar and closure plate, typical.

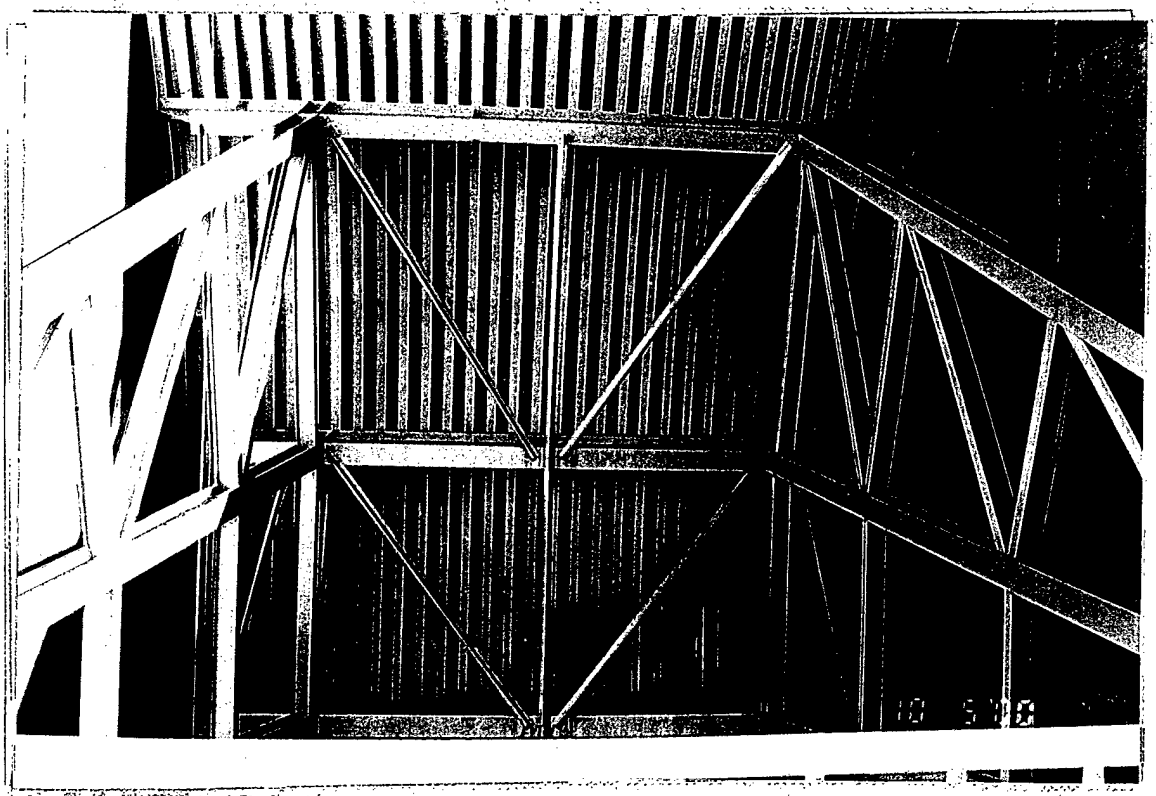
Lower Granite Dam 10/05/00 2-12	**Gate 2** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

Lower Granite Dam 10/05/00 2-13	**Gate 2** Close-up, right end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners.

Lower Granite Dam 10/05/00 2-14	**Gate 2** Right end of bottom horiz. girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage

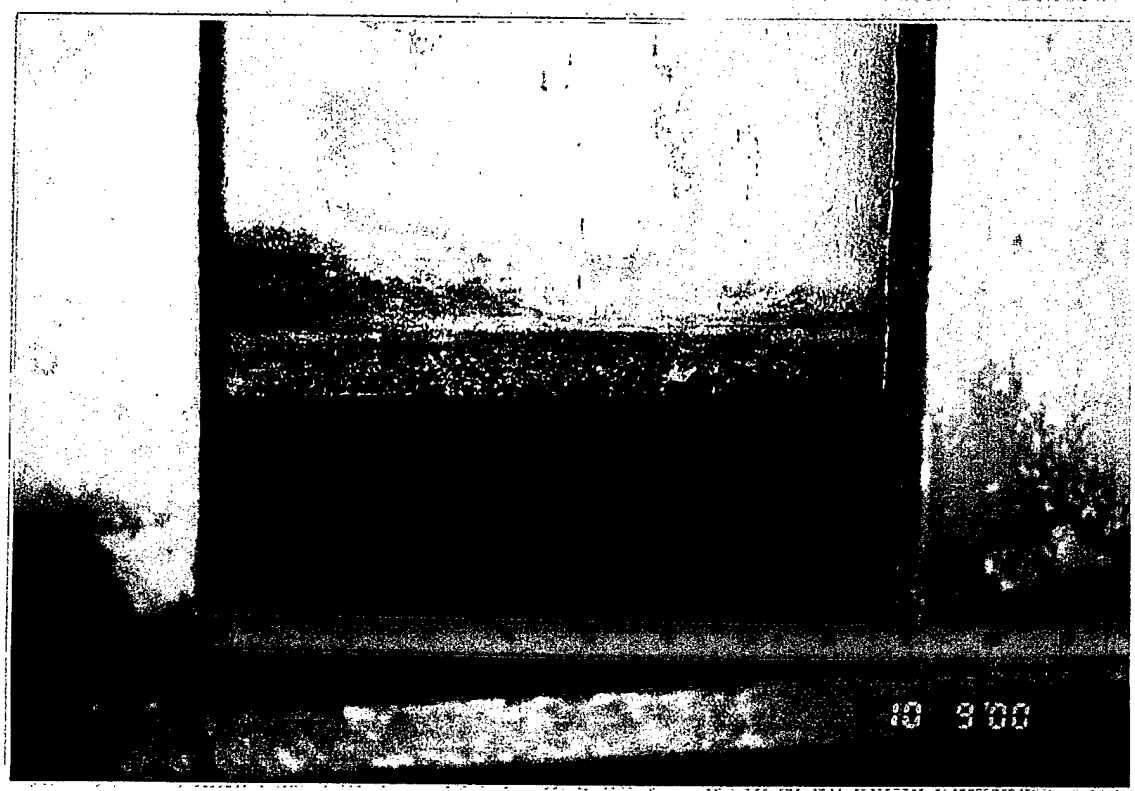


Lower Granite Dam 10/05/00 2-15	**Gate 2** Left trunnion, typical.



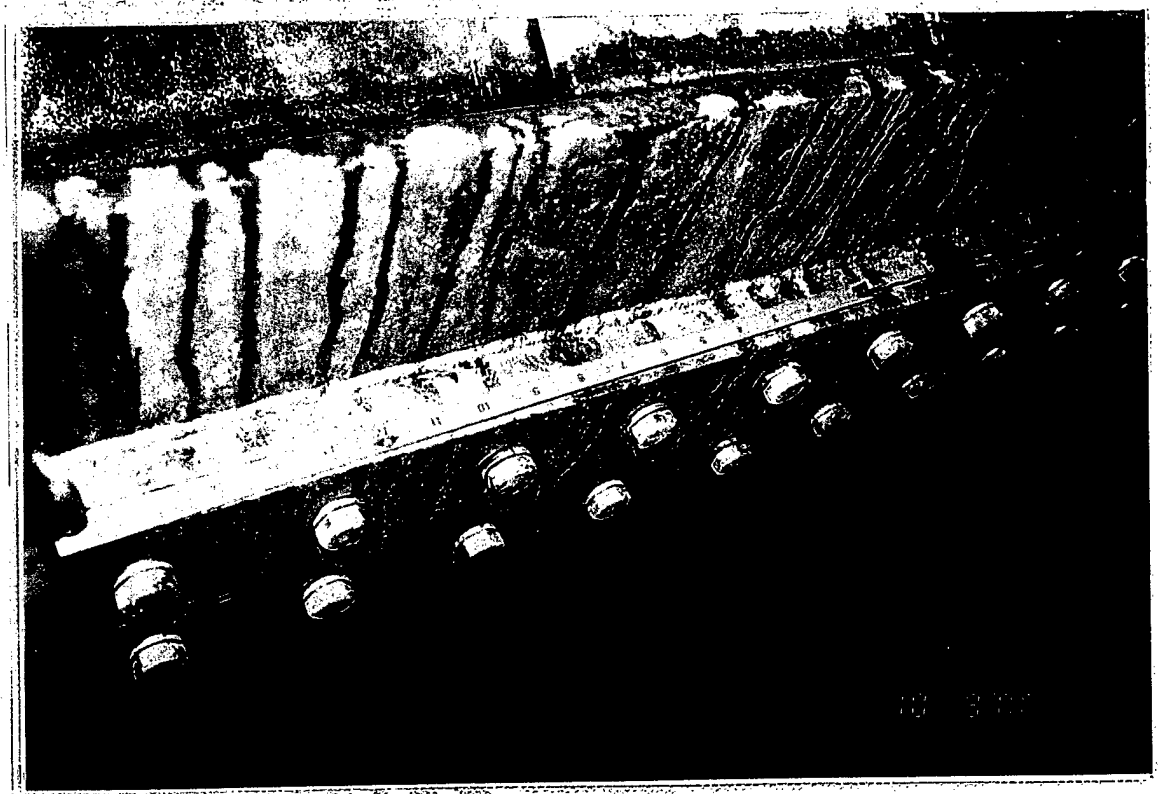
Lower Granite Dam 10/05/00 2-16	**Gate 2** Gate face and side frames, typical

Lower Granite Dam 10/05/00 2-17	**Gate 2** Top of right trunnion, typical.

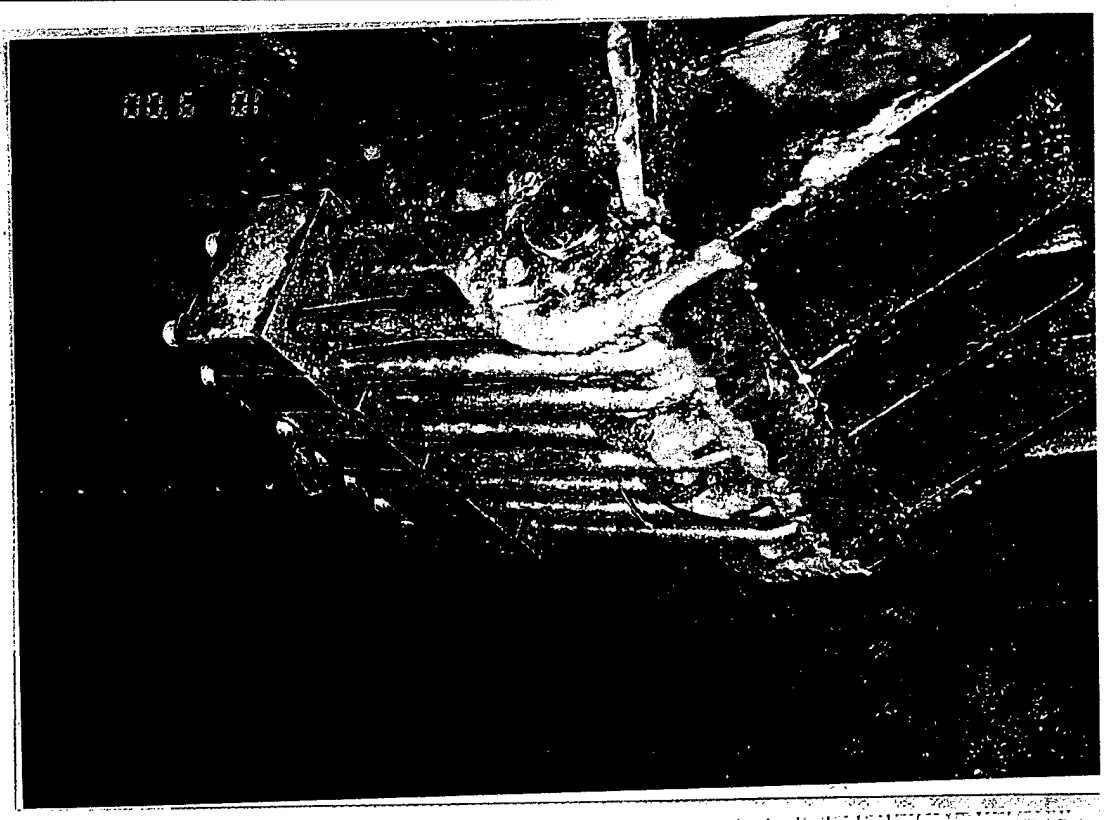


Lower Granite Dam 10/09/00 2-18	**Gate 2** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

Lower Granite Dam 10/09/00 2-19	**Gate 2** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

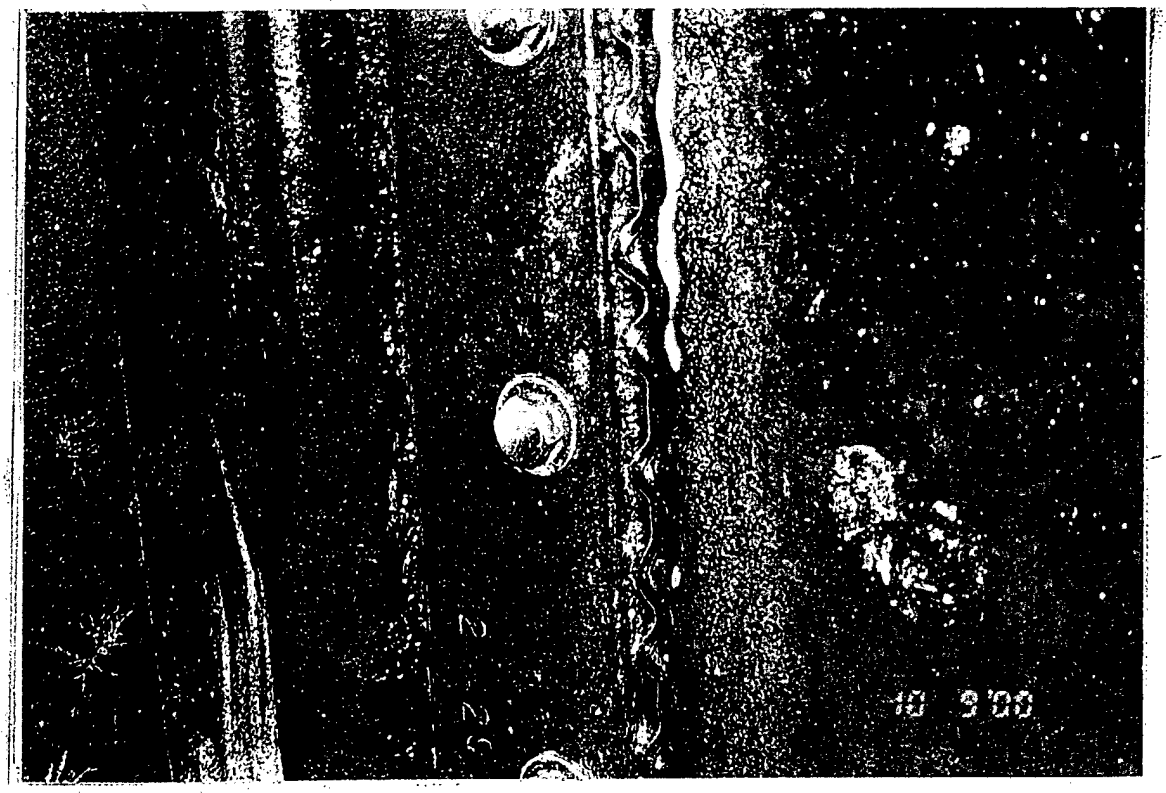


Lower Granite Dam 10/09/00	**Gate 2** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

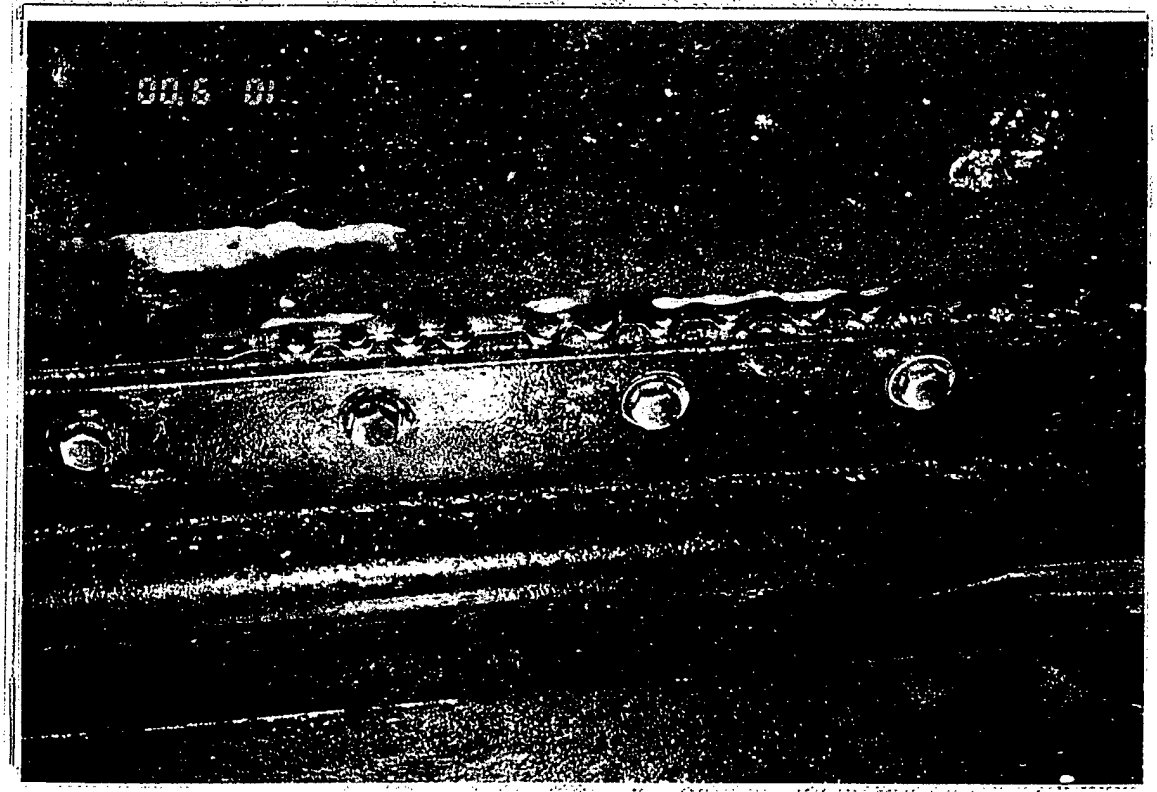


Lower Granite Dam 10/09/00 2-21	**Gate 2** Left side hoist connection. Light corrosion on lifting lugs and plates. Note: Excellent condition of stainless steel U-bolts.

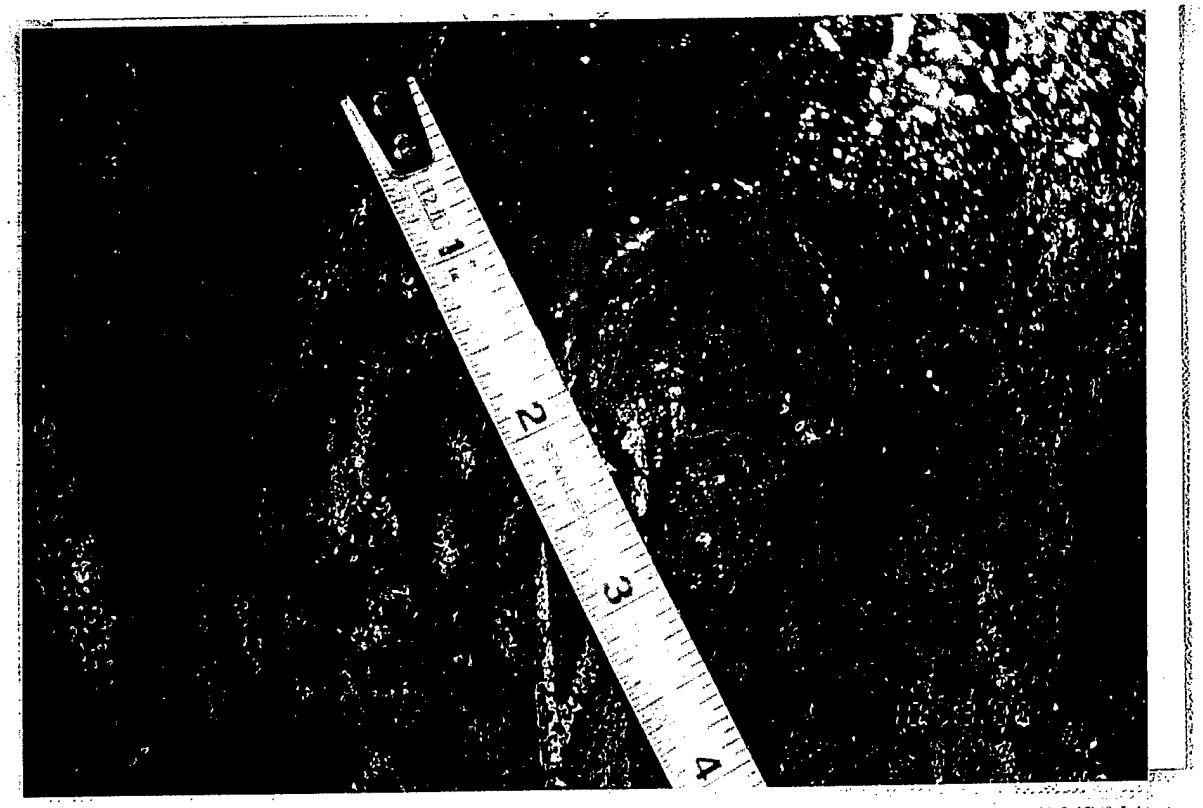
Lower Granite Dam 10/09/00 2-22	**Gate 2** Left side hoist connection. Light corrosion on lifting lugs and plates. Note: Excellent condition of stainless steel U-bolts.



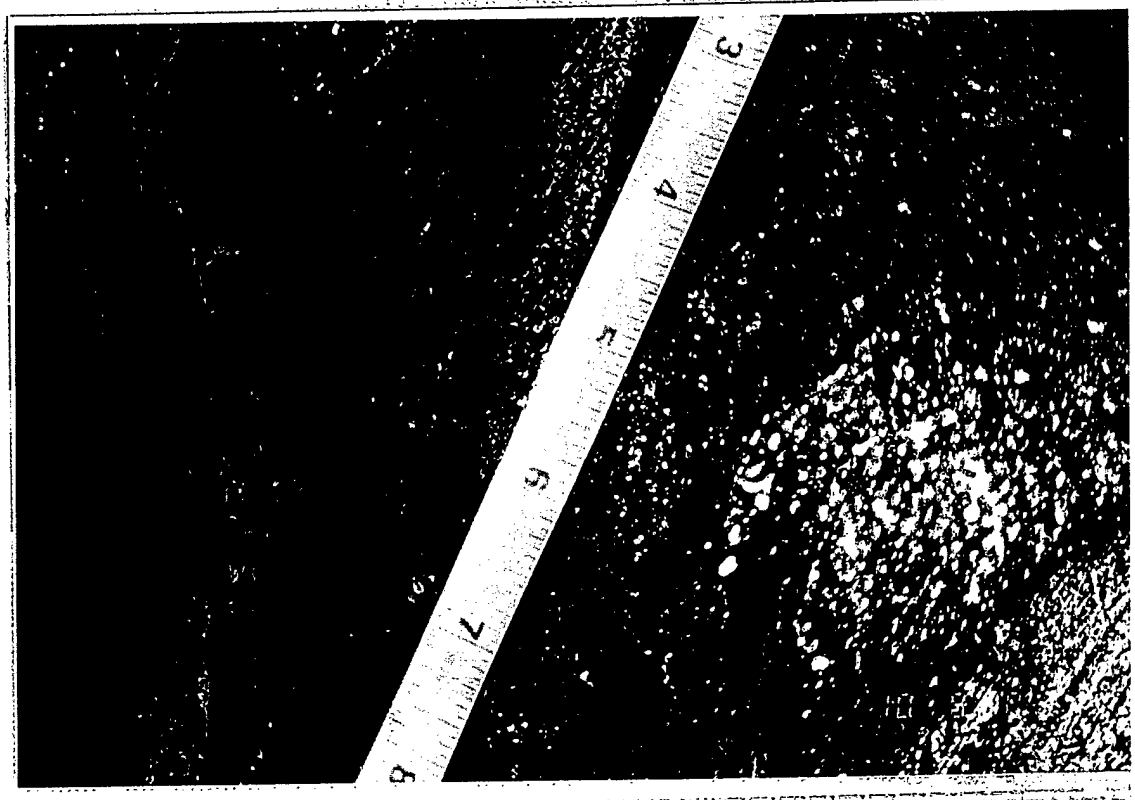
Lower Granite Dam 10/09/00 2-23	**Gate 2** Upstream side of left side seal. Light corrosion and pitting on skin plate.



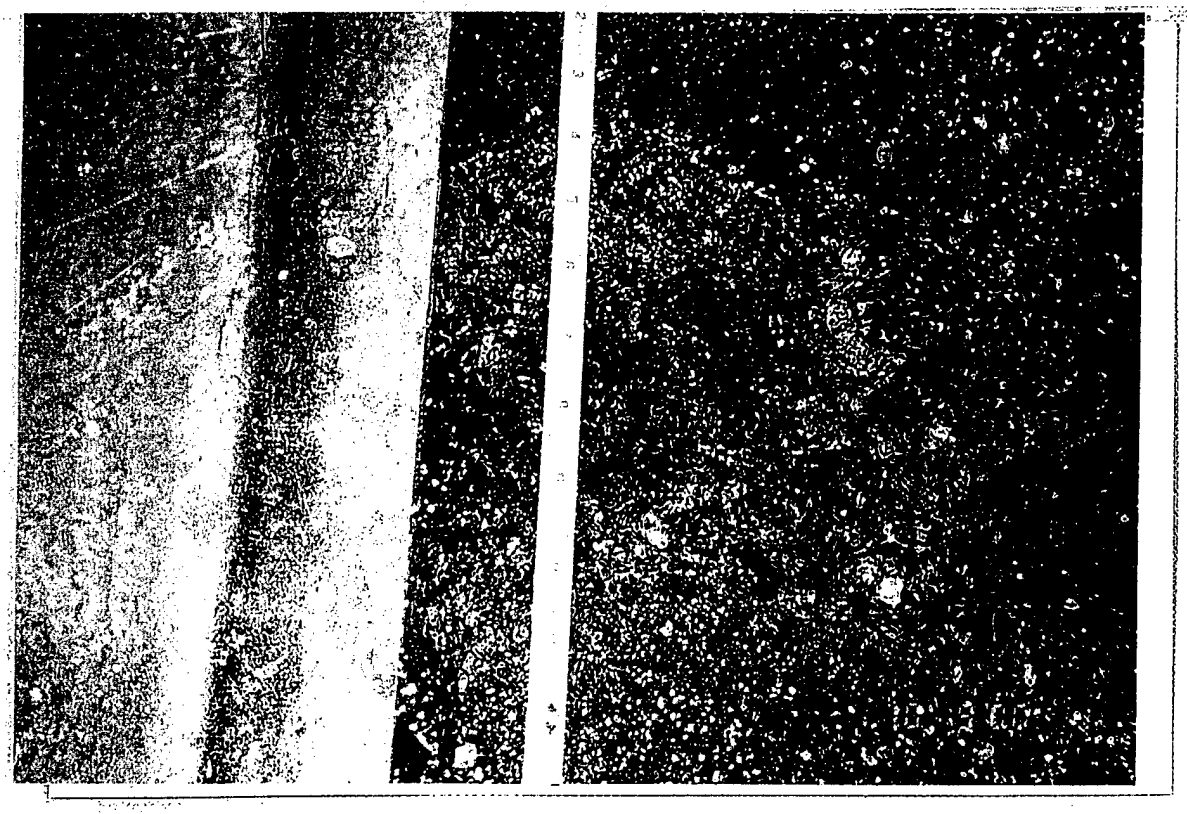
Lower Granite Dam 10/05/00 2-24	**Gate 2** Upstream side of left side seal. Light corrosion and pitting on skin plate.



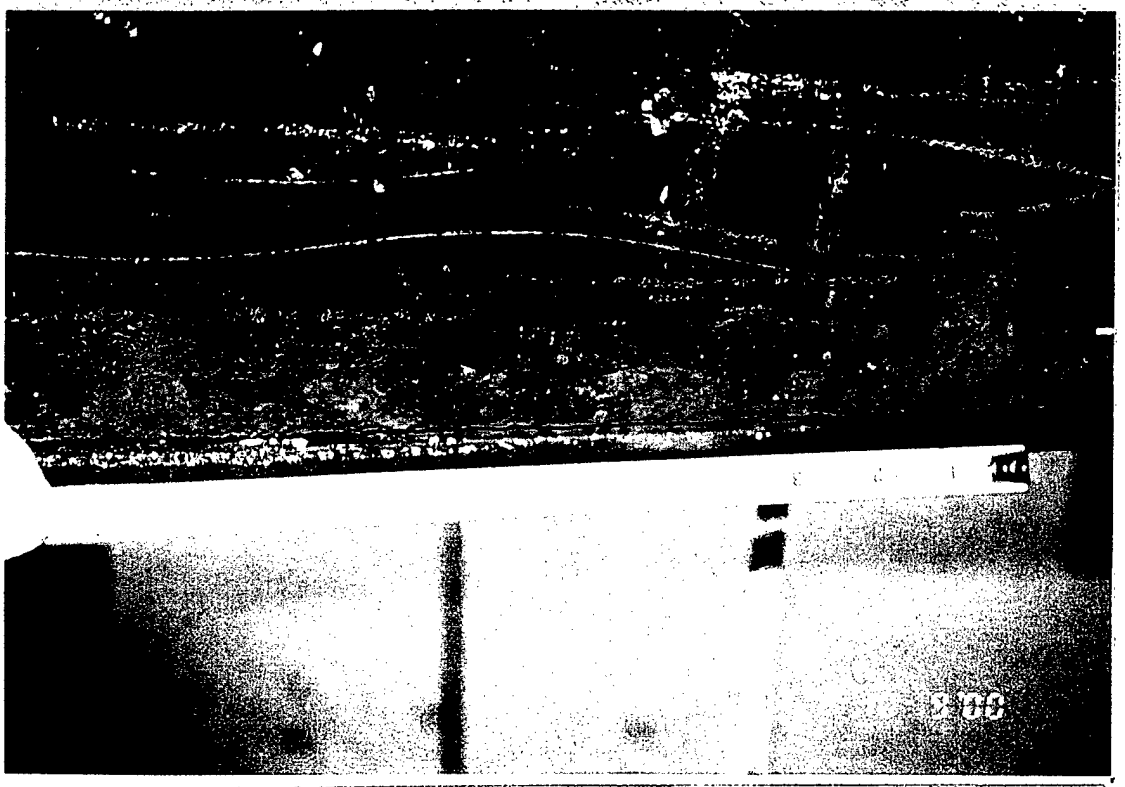
Lower Granite Dam 10/05/00 2-25	**Gate 2** Close-up, skin plate, typical.



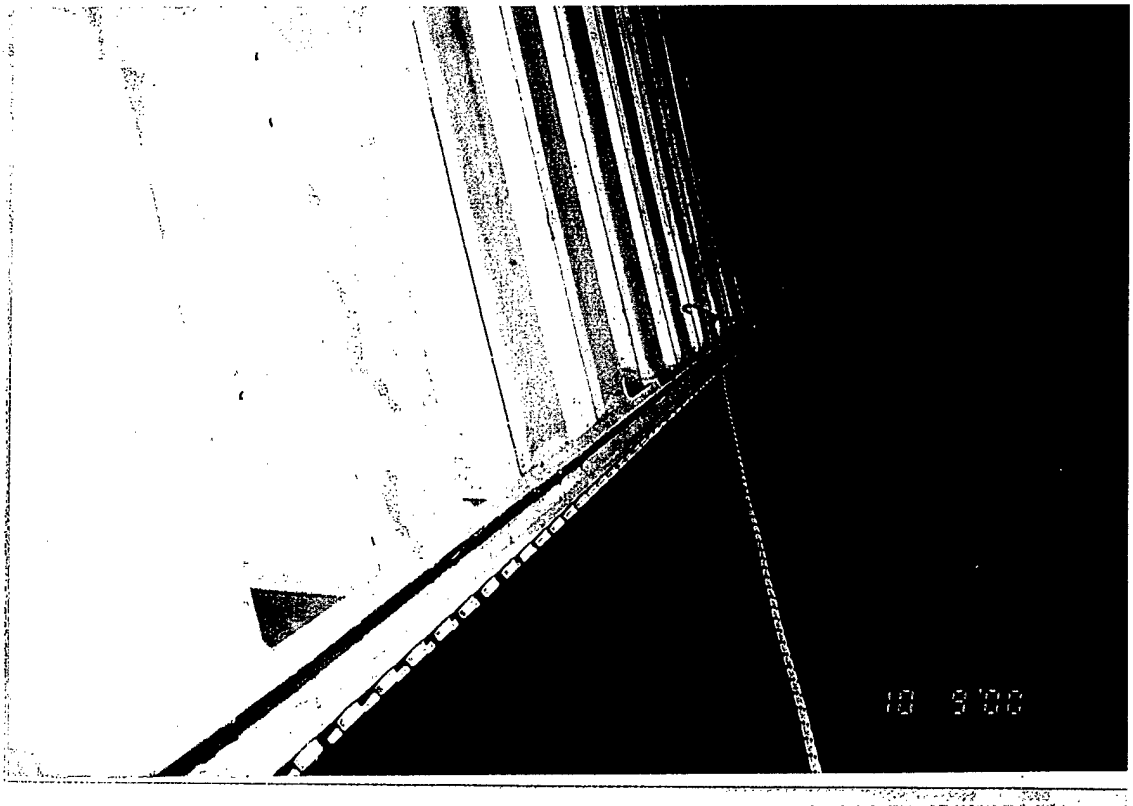
Lower Granite Dam 10/09/00 2-26	**Gate 2** Close-up skin plate, typical.



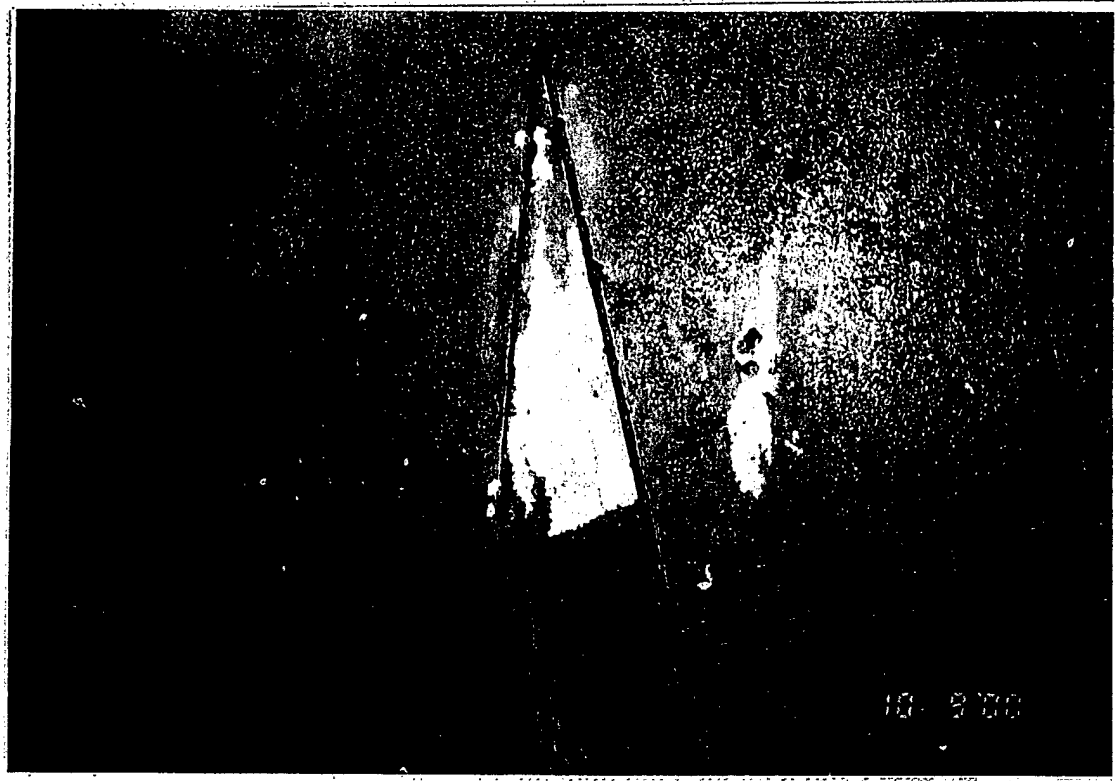
Lower Granite Dam 10/09/00 2-27	**Gate 2** Embedded bottom seal plate, looking down at spillway, typical.



Lower Granite Dam 10/09/00 2-28	**Gate 2** Upstream side of bottom seal and bottom of skin plate. Light to moderate corrosion on skin plate.

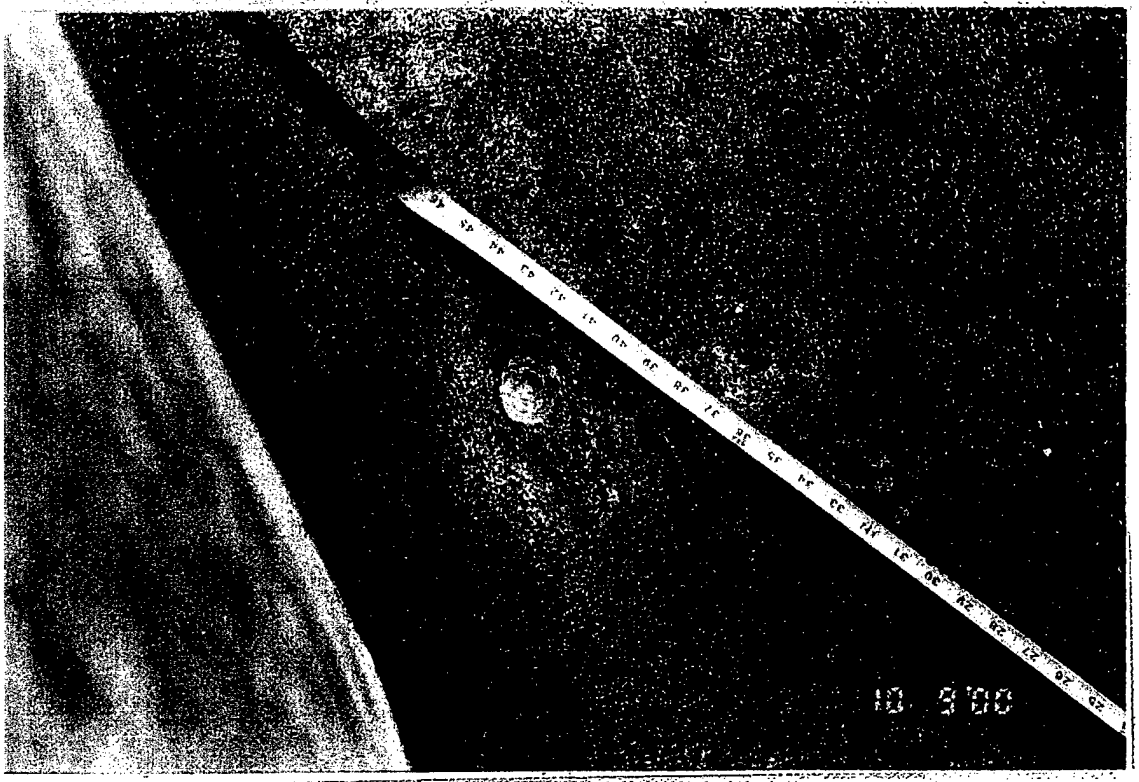


Lower Granite Dam 10/09/00 2-29	**Gate 2** Downstream side of bottom seal, typical.

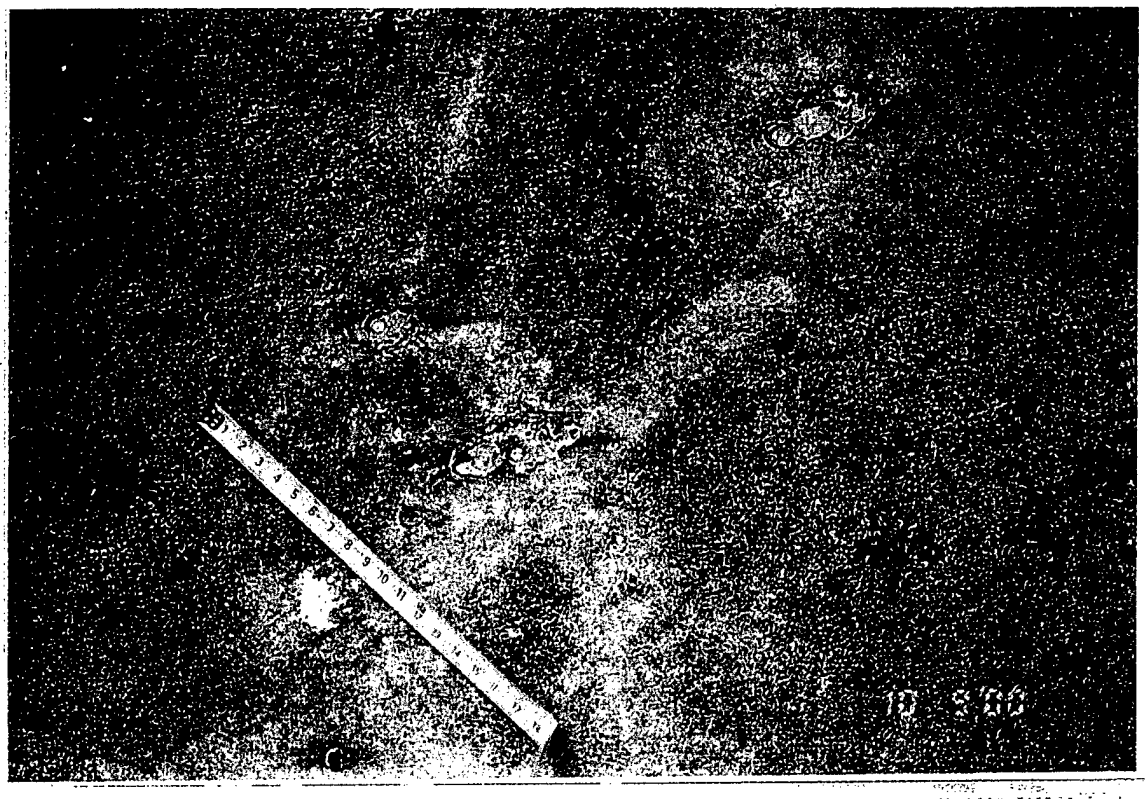


Lower Granite Dam 10/09/00 2-30	**Gate 2** Skin plate pitting, typical.

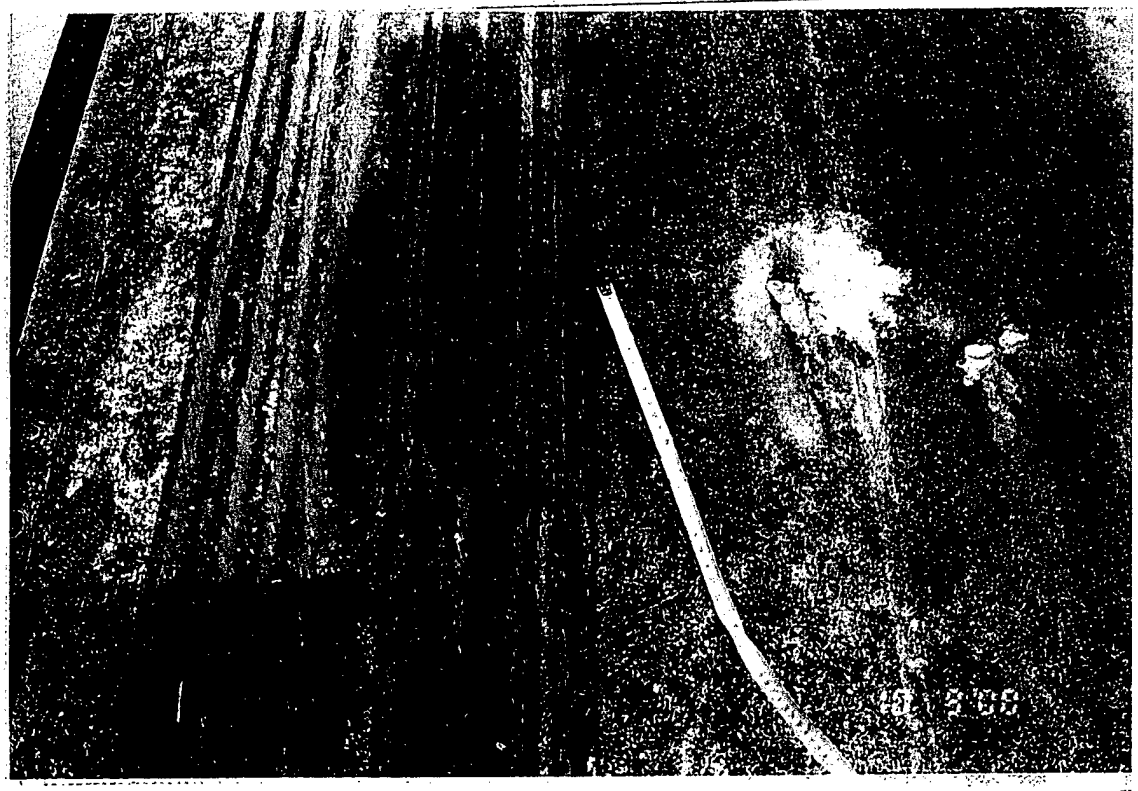
Lower Granite Dam 10/09/00 2-31	**Gate 2** Waterblasting of skin plate pitting, typical.



Lower Granite Dam 10/09/00 2-32	**Gate 2** Typical pitting.



Lower Granite Dam 10/09/00 2-33	**Gate 2** Typical pitting.

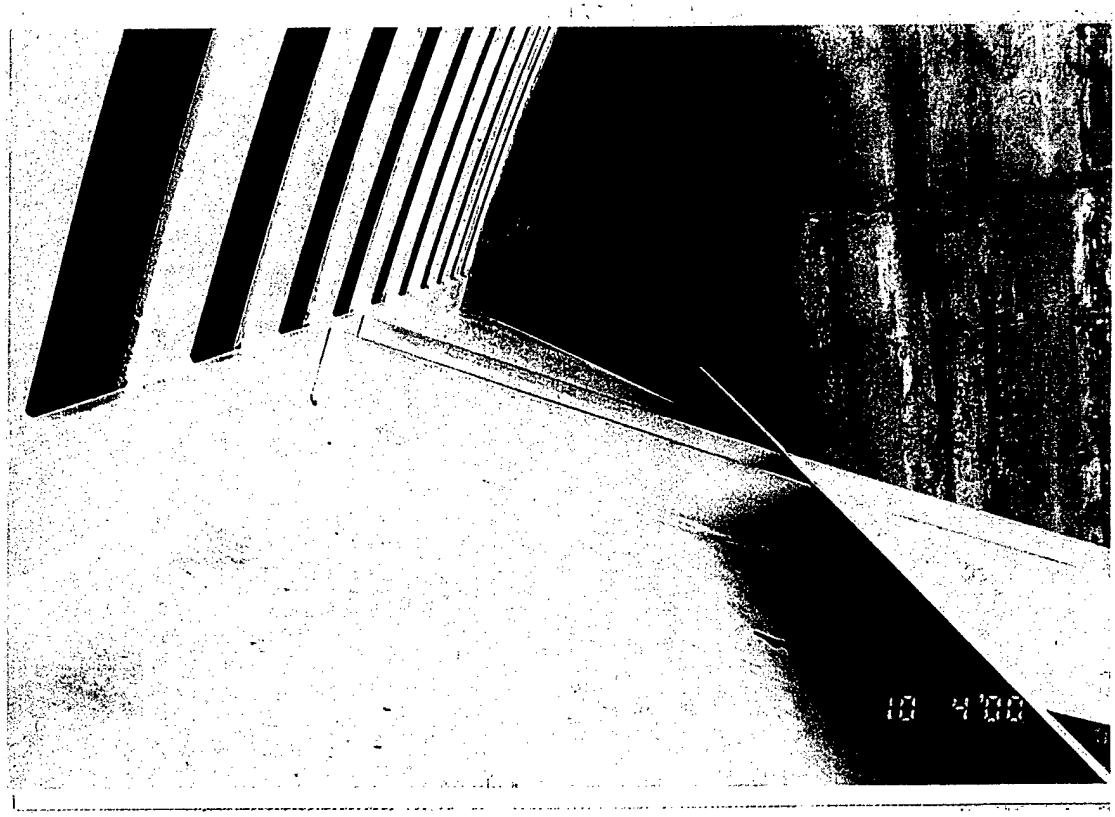


Lower Granite Dam 10/09/00 2-34	**Gate 2** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

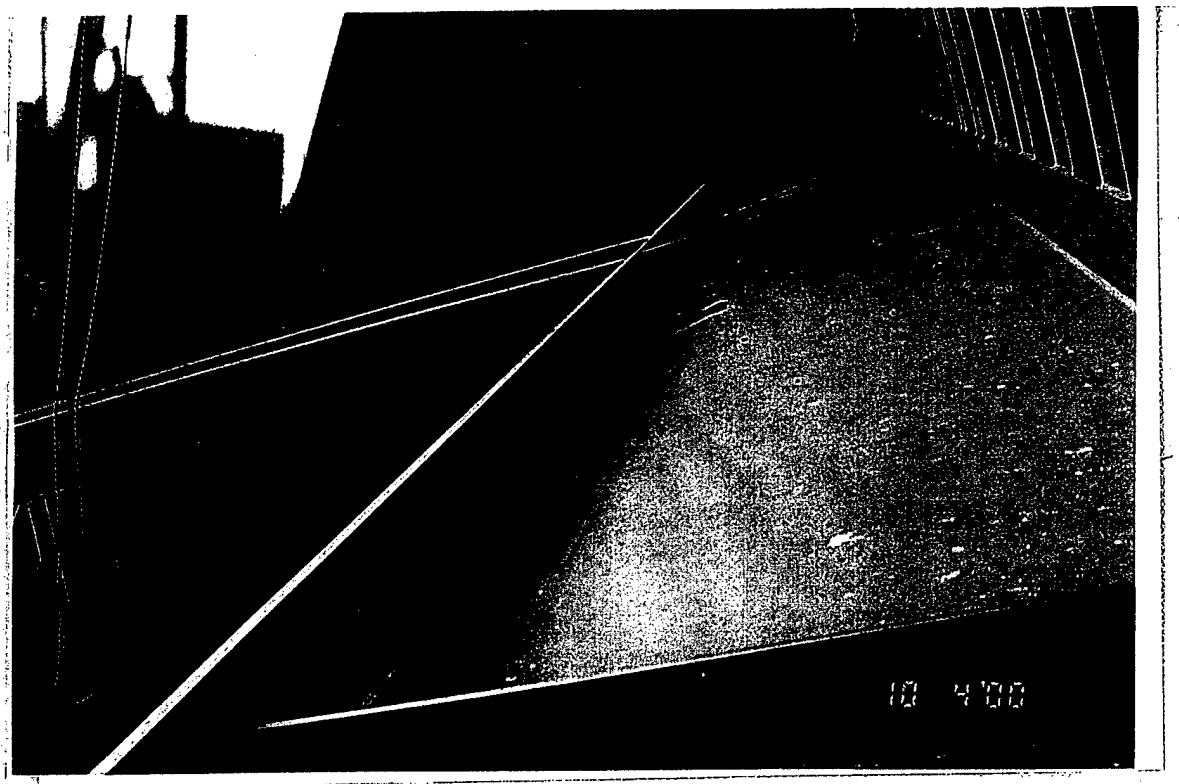
Lower Granite Dam 10/09/00 2-35	**Gate 2** Skin plate pitting and corrosion along construction joint weld at left side of gate.

Lower Granite Dam 10/09/00 2-36	**Gate 2** Close-up, skin plate pitting and corrosion along construction joint weld at left side of gate

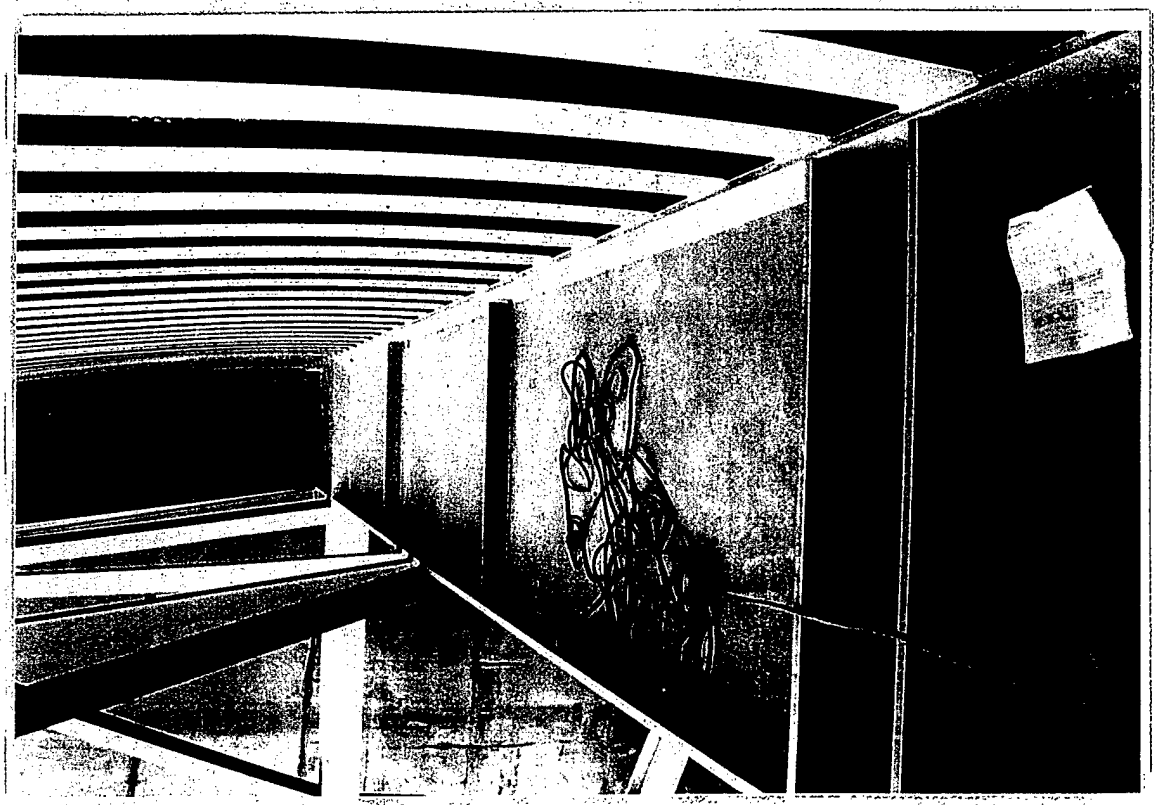
Lower Granite Dam 10/04/00 3-1	**Gate 3** Left end of top horizontal girder. Chipped paint and light surface corrosion.



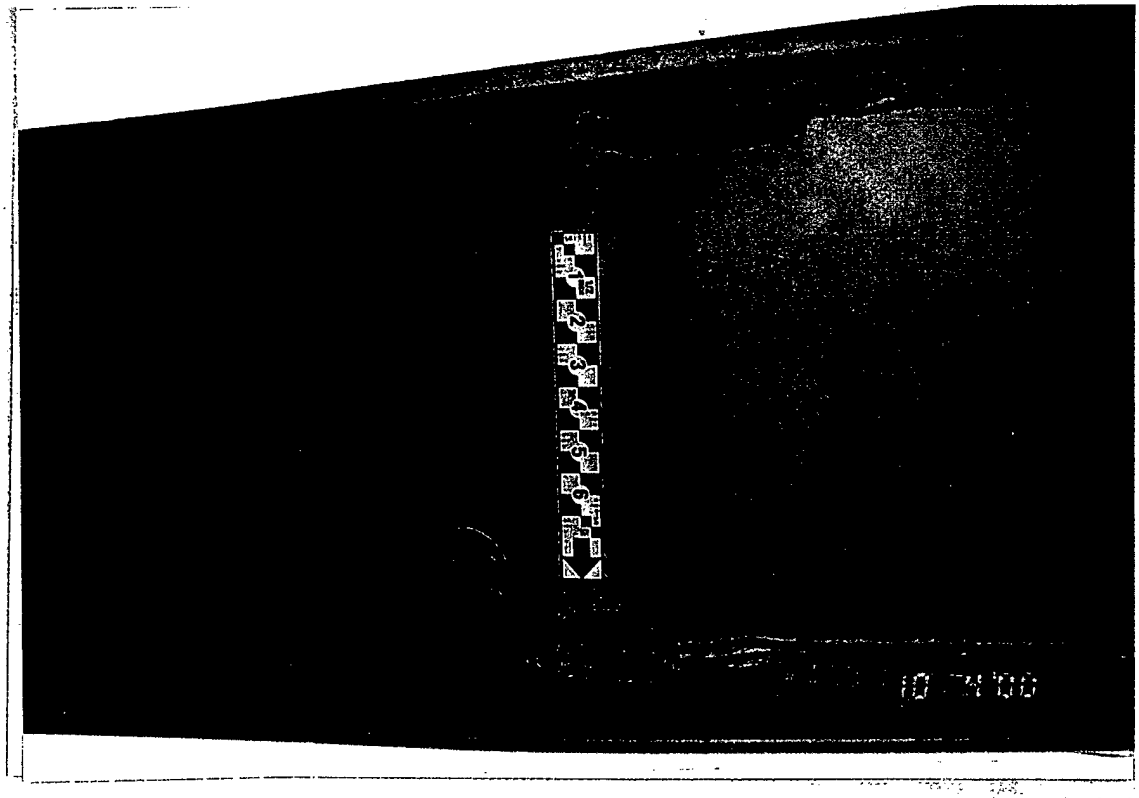
Lower Granite Dam 10/04/00 3-2	**Gate 3** Left end of top horizontal girder. Chipped paint and light surface corrosion. Note: Debris line on downstream flange of girder indicating inadequate drainage.



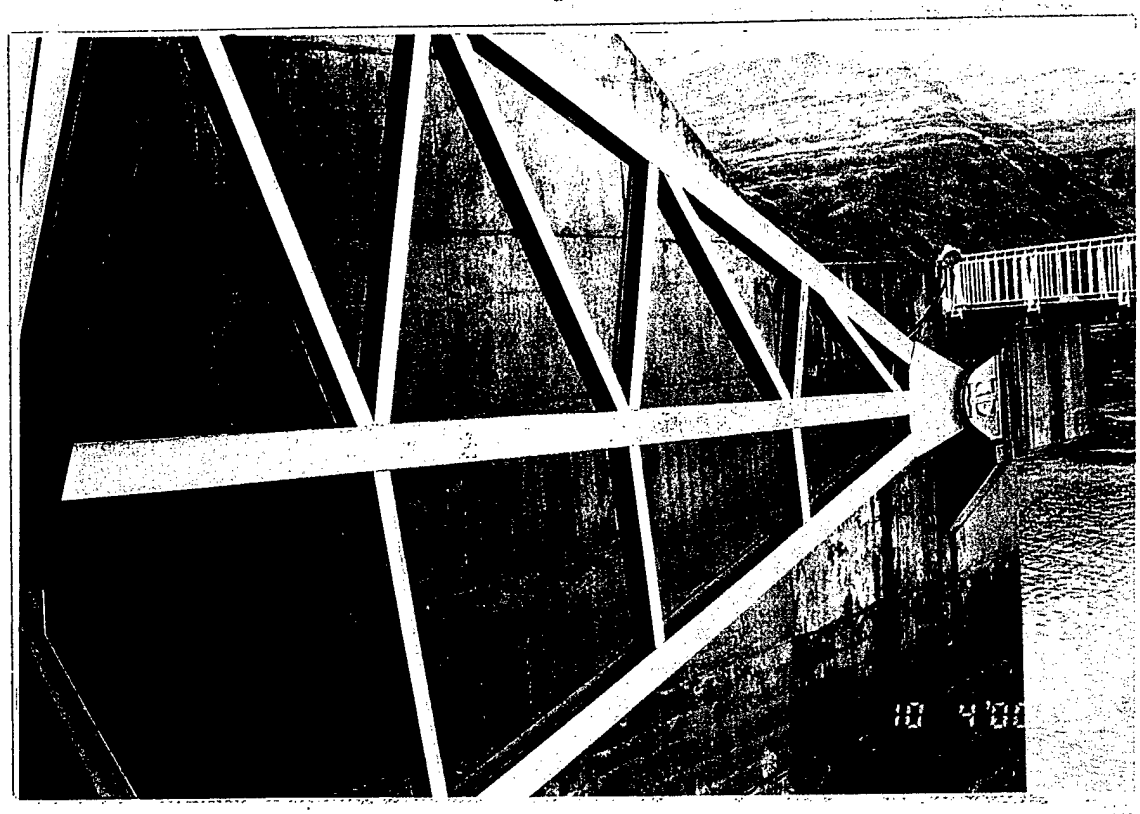
Lower Granite Dam 10/04/00 3-3	**Gate 3** Right end of top horizontal girder, typical.



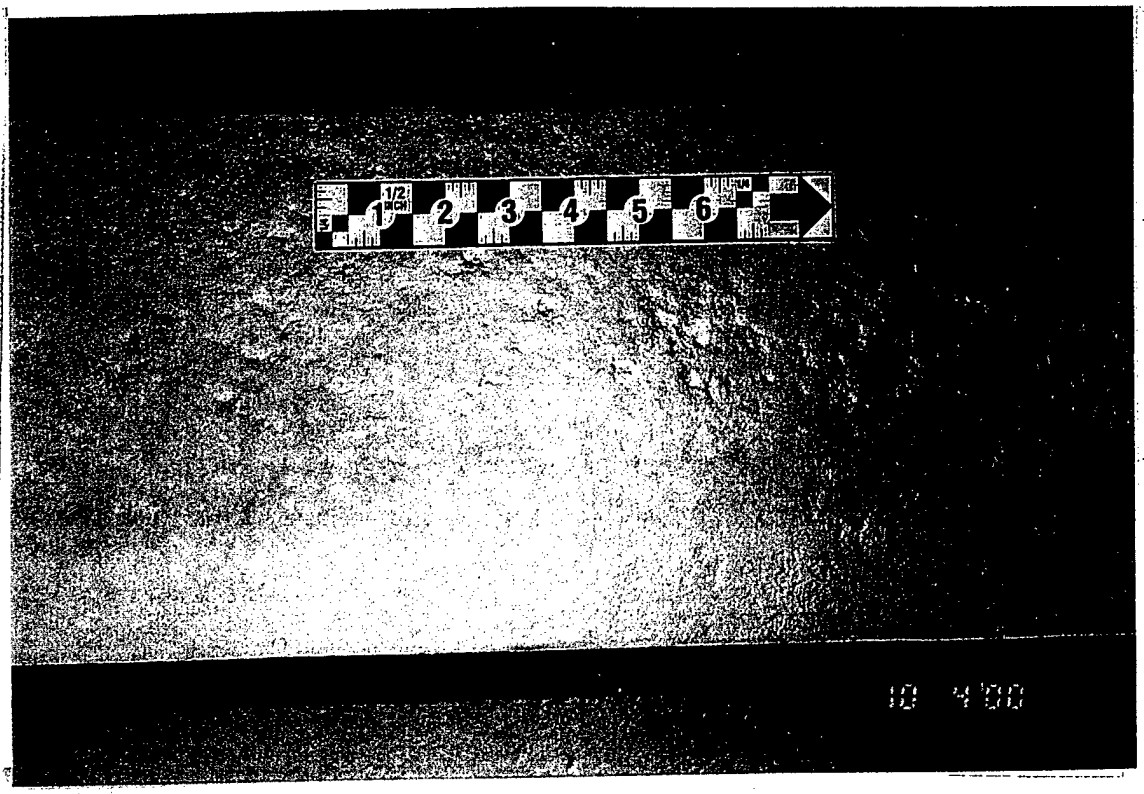
Lower Granite Dam 10/04/00 3-4	**Gate 3** Middle horizontal girder, typical.



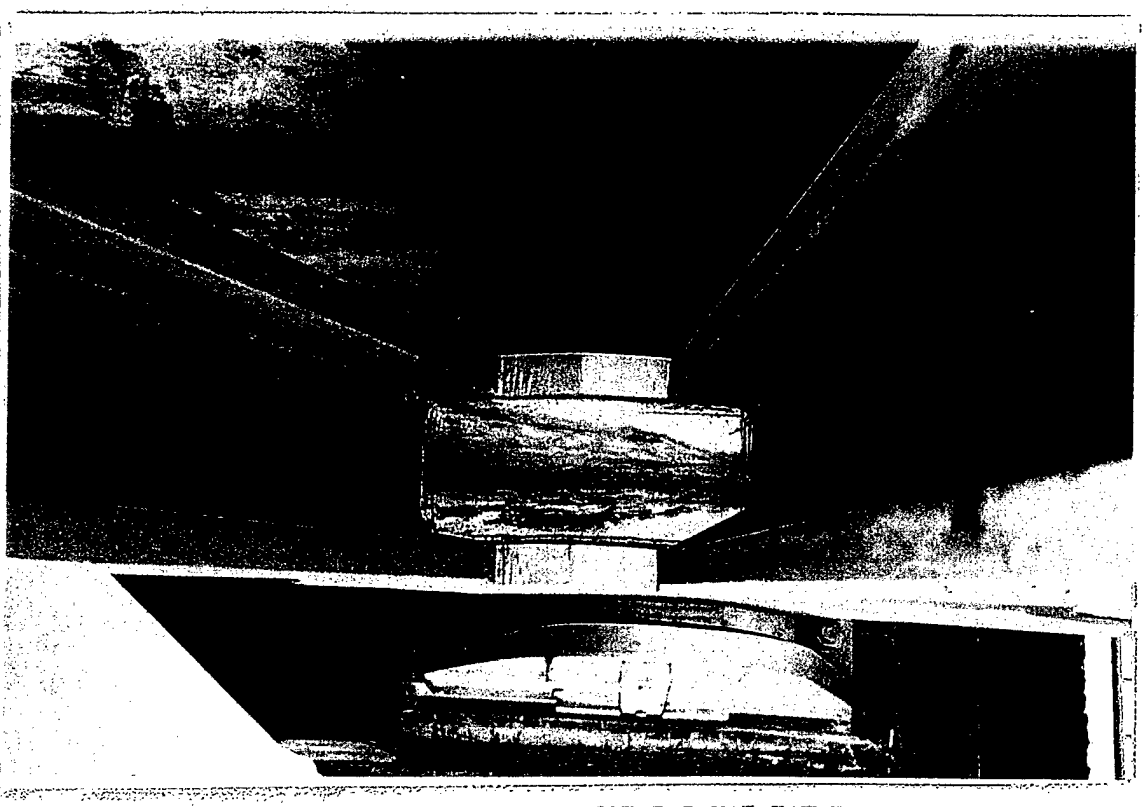
Lower Granite Dam 10/04/00 3-5	**Gate 3** Left frame, top end of Brace H. Coping in brace at weld to top radial strut, typical.



Lower Granite Dam 10/04/00 3-6	**Gate 3** Left frame, typical.

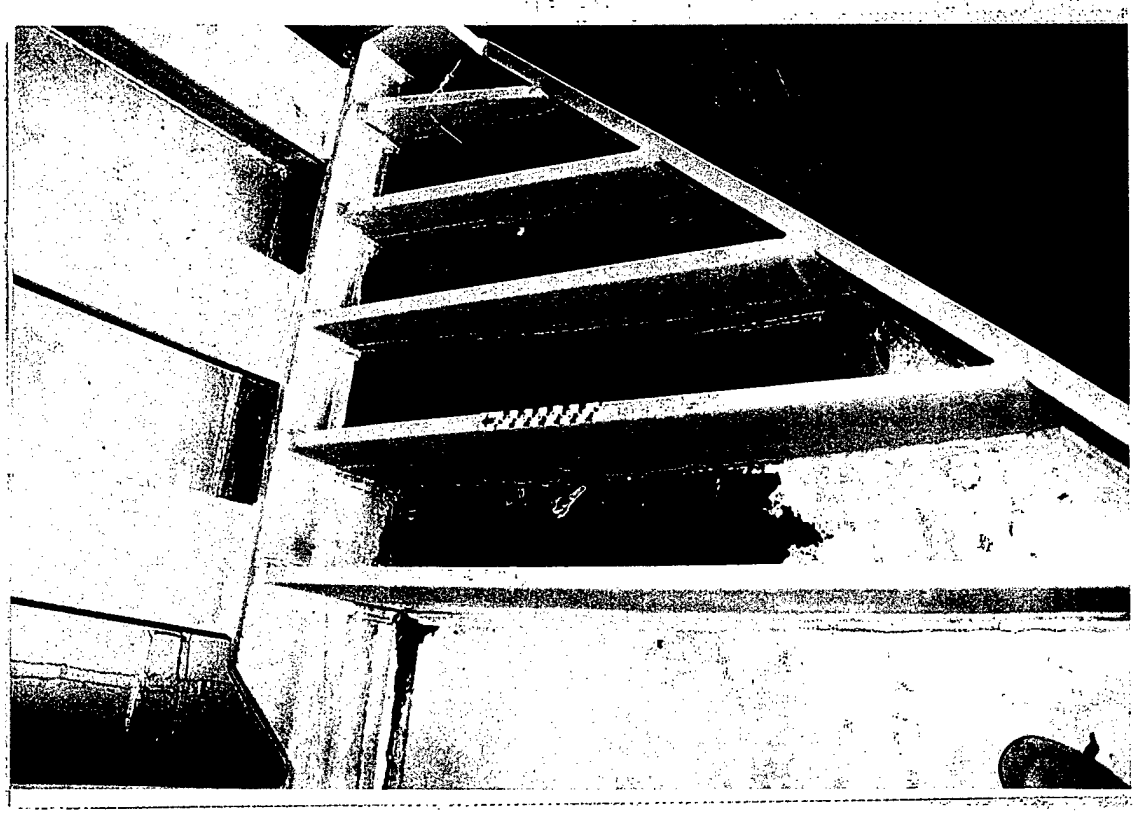


Lower Granite Dam 10/04/00 3-7	**Gate 3** Skin plate approx. 5' above middle horiz. girder, near left frame. Small pitting in skin plate, < 1/6" deep.

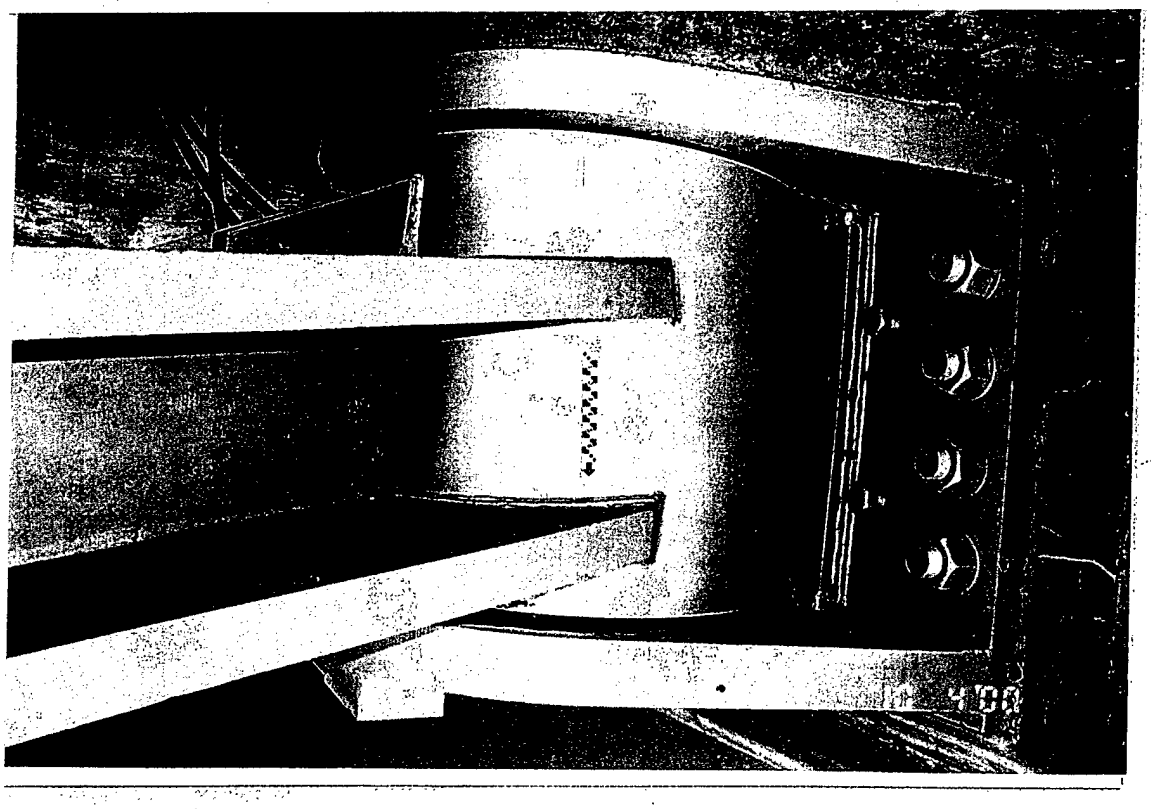


Lower Granite Dam 10/04/00 3-8	**Gate 3** Inside closure plate at right trunnion, looking downstream. Staining and light corrosion due to drain above.

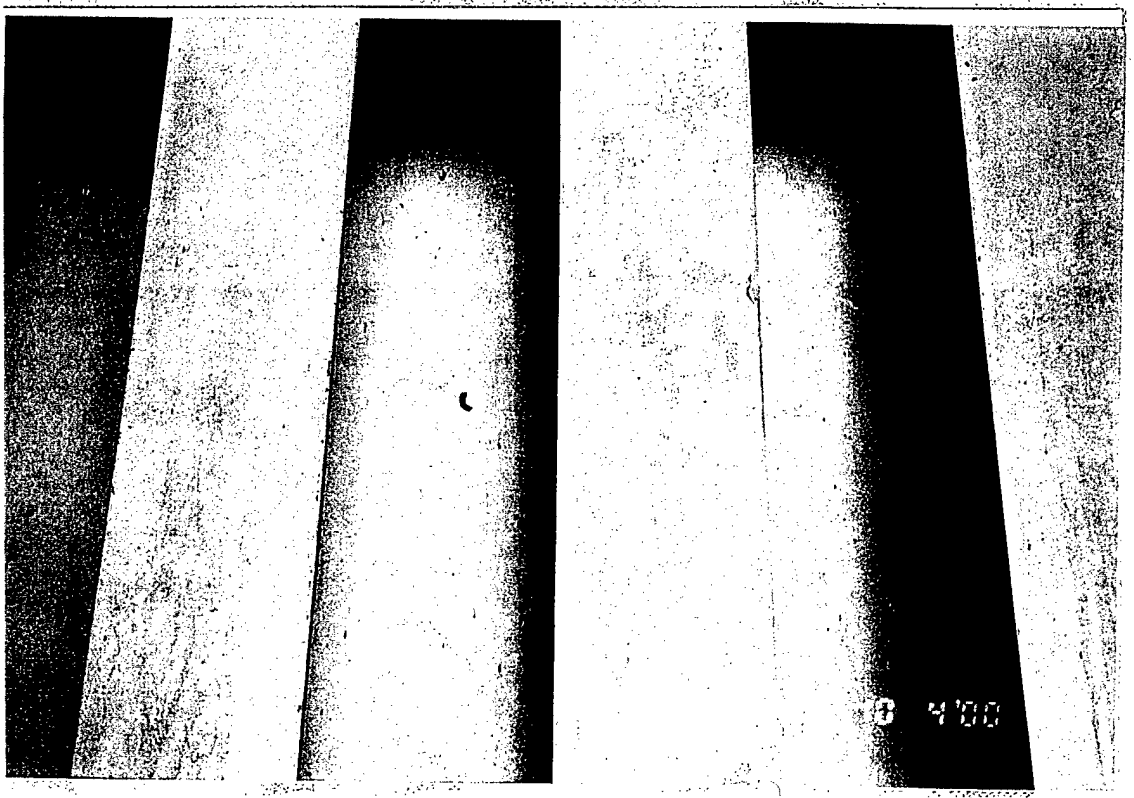
Lower Granite Dam 10/04/00 3-9	**Gate 3** Outside of left trunnion and yoke, looking downstream. Note: lubrication lines and expelled lubrication beneath trunnion.



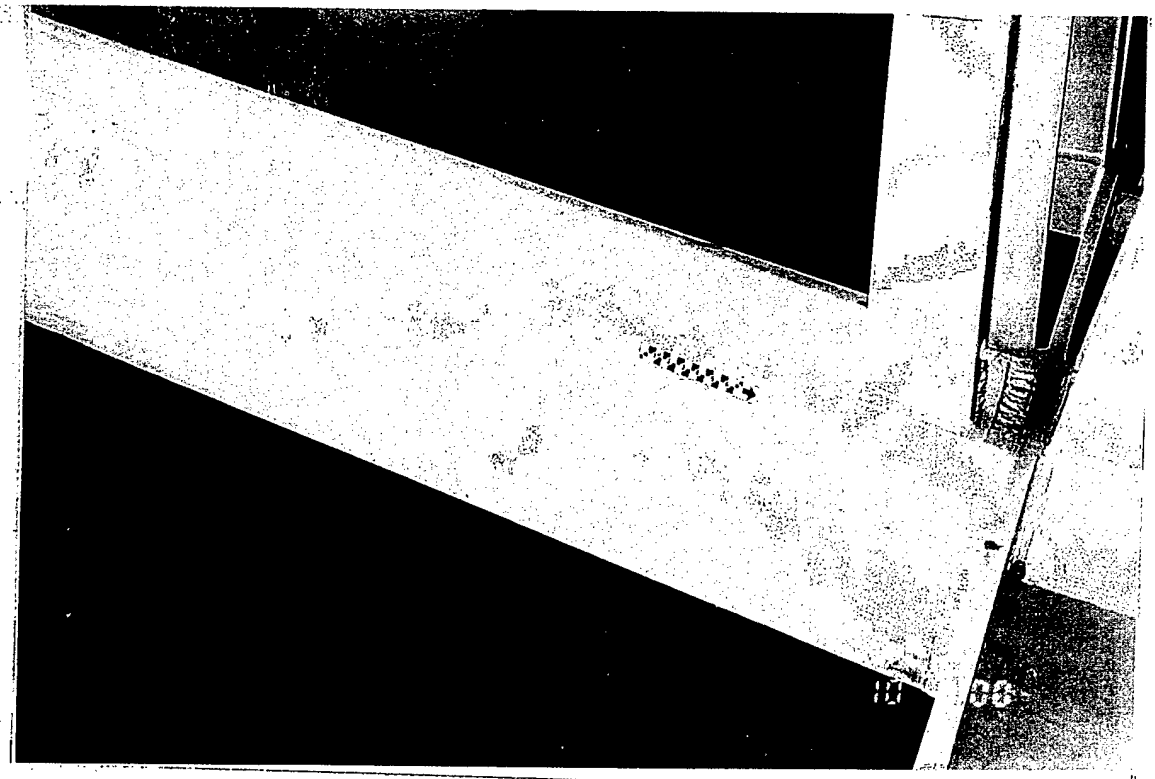
Lower Granite Dam 10/04/00 3-10	**Gate 3** Left end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, debris and no drainage



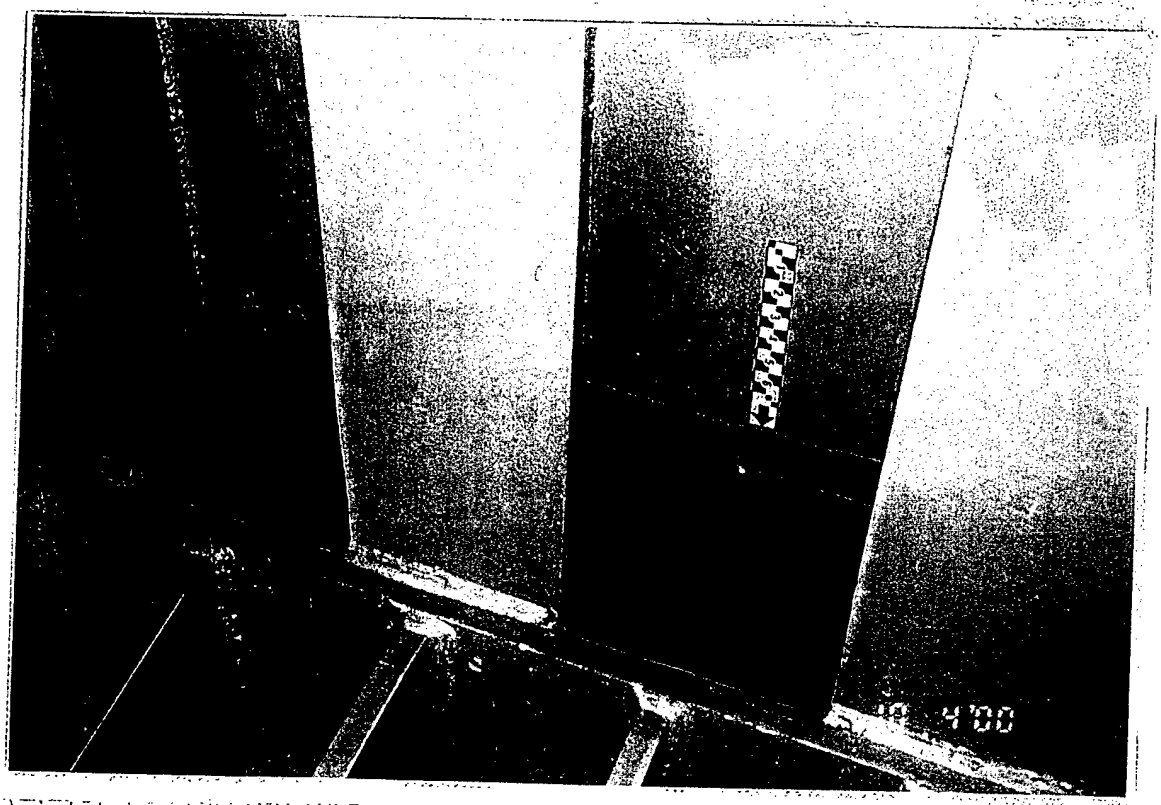
Lower Granite Dam 10/04/00 3-11	**Gate 3** Top of left trunnion, typical.



Lower Granite Dam 10/04/00 3-12	**Gate 3** Purlins and skin plate, typical.

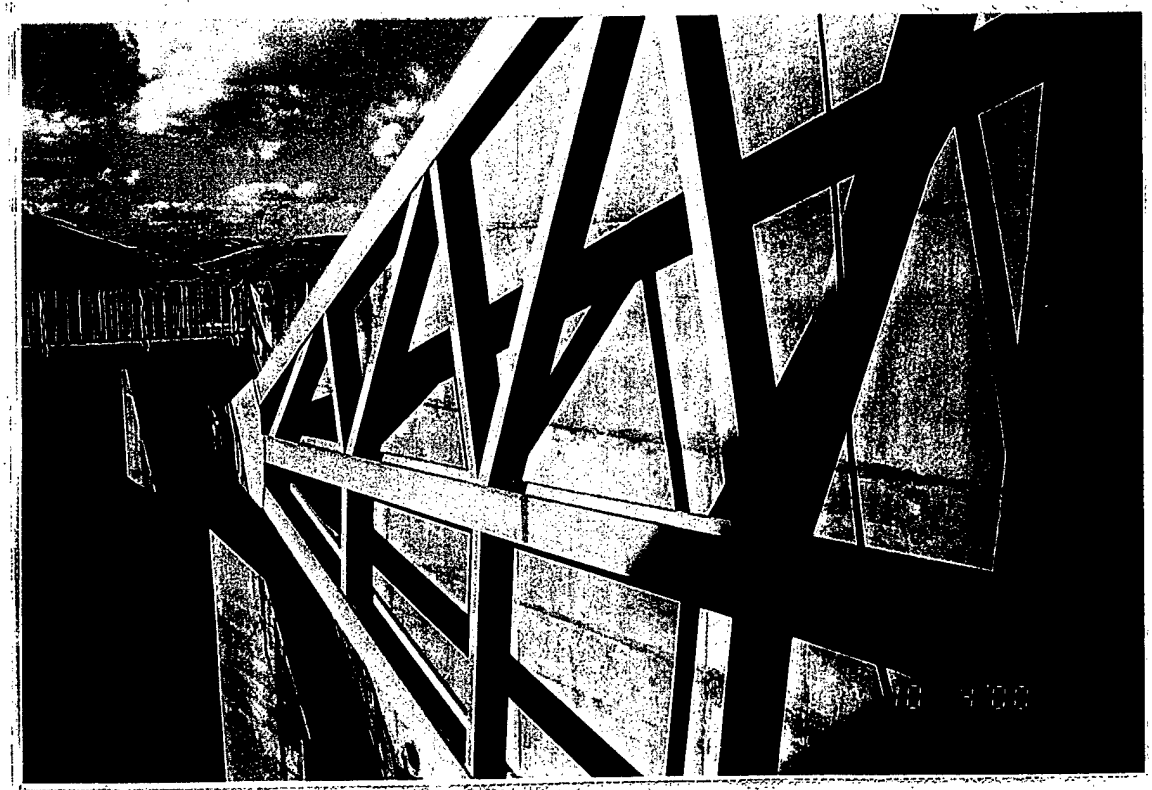


Lower Granite Dam 10/04/00 3-13	**Gate 3** Upstream end of right frame, bottom radial strut. Grind marks in flange. Note: Discoloration at welded joint to girder due to ultrasonic weld test gel.

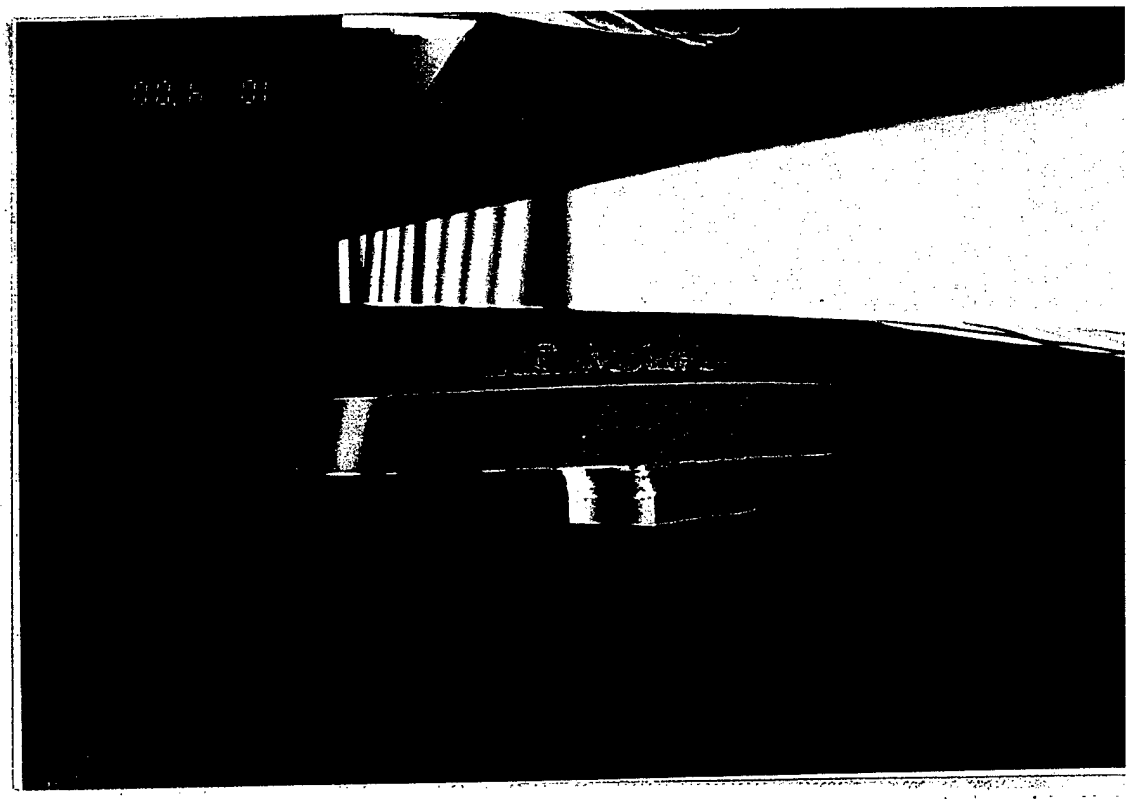


Lower Granite Dam 10/04/00 3-14	**Gate 3** Right end of bottom horizontal girder. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage

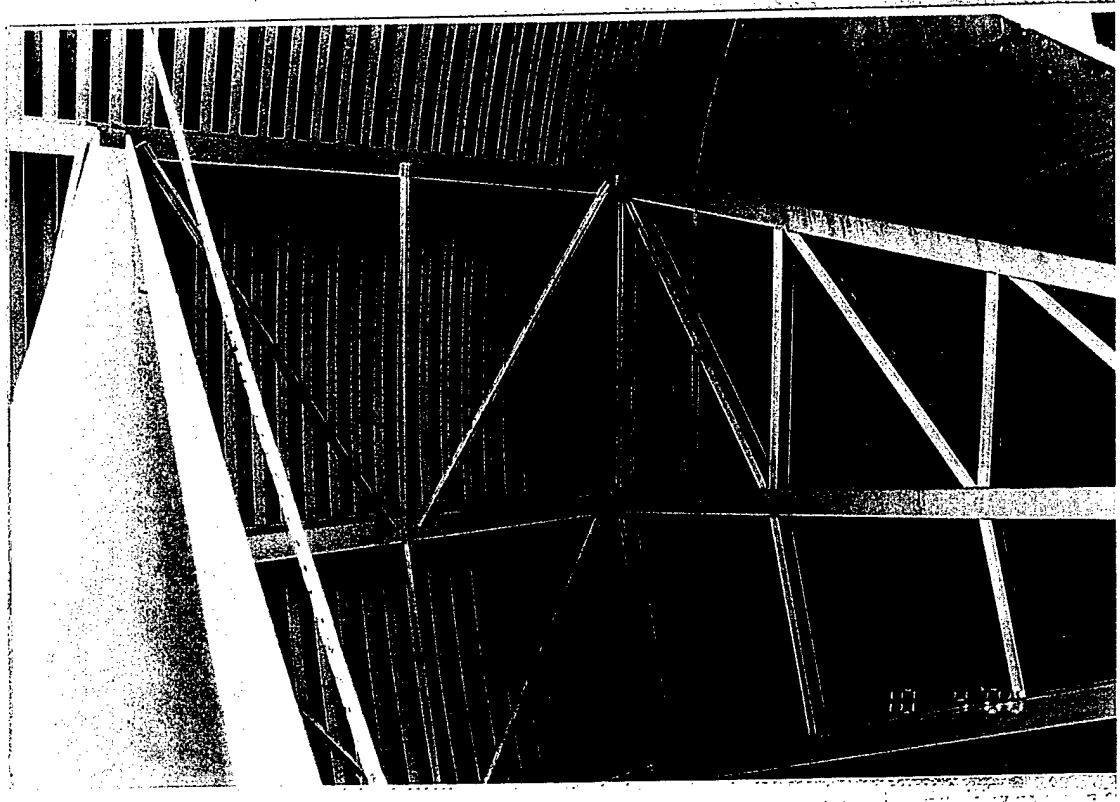
Lower Granite Dam 10/04/00 3-15	**Gate 3** Outside of right trunnion and yoke looking downstream, typical.



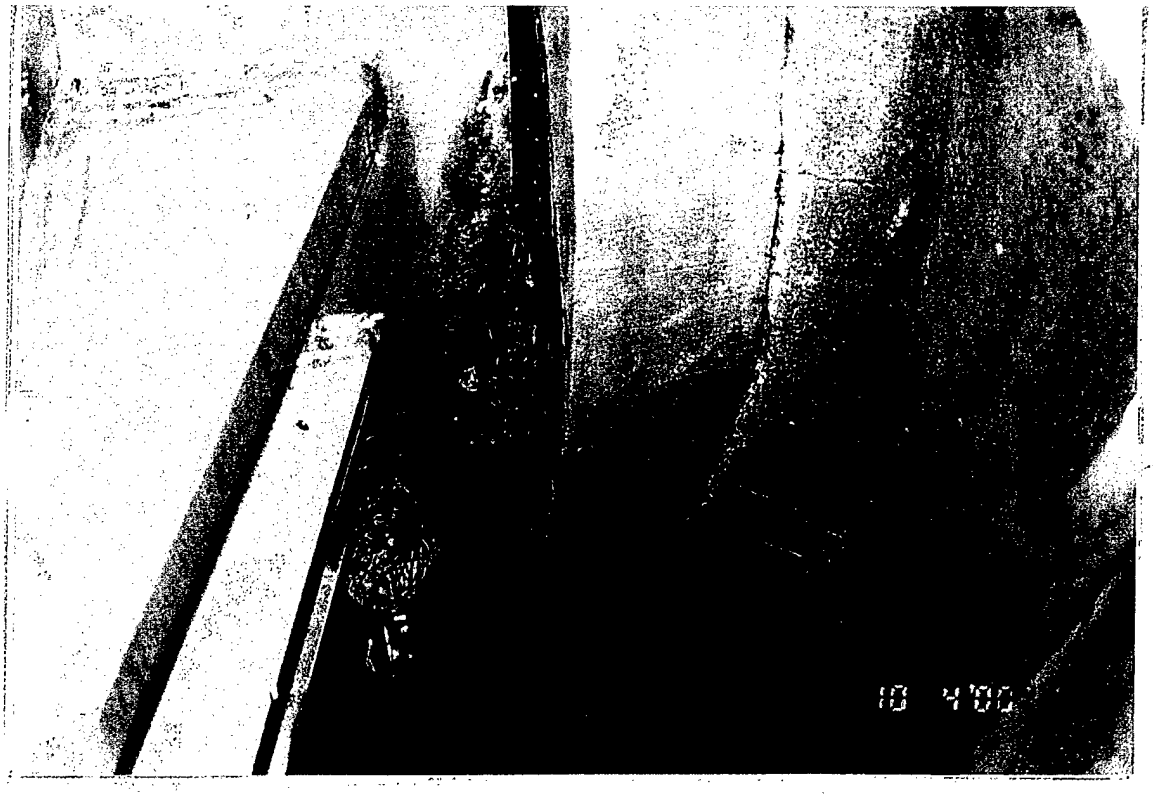
Lower Granite Dam 10/04/00 3-16	**Gate 3** Right frame, typical.



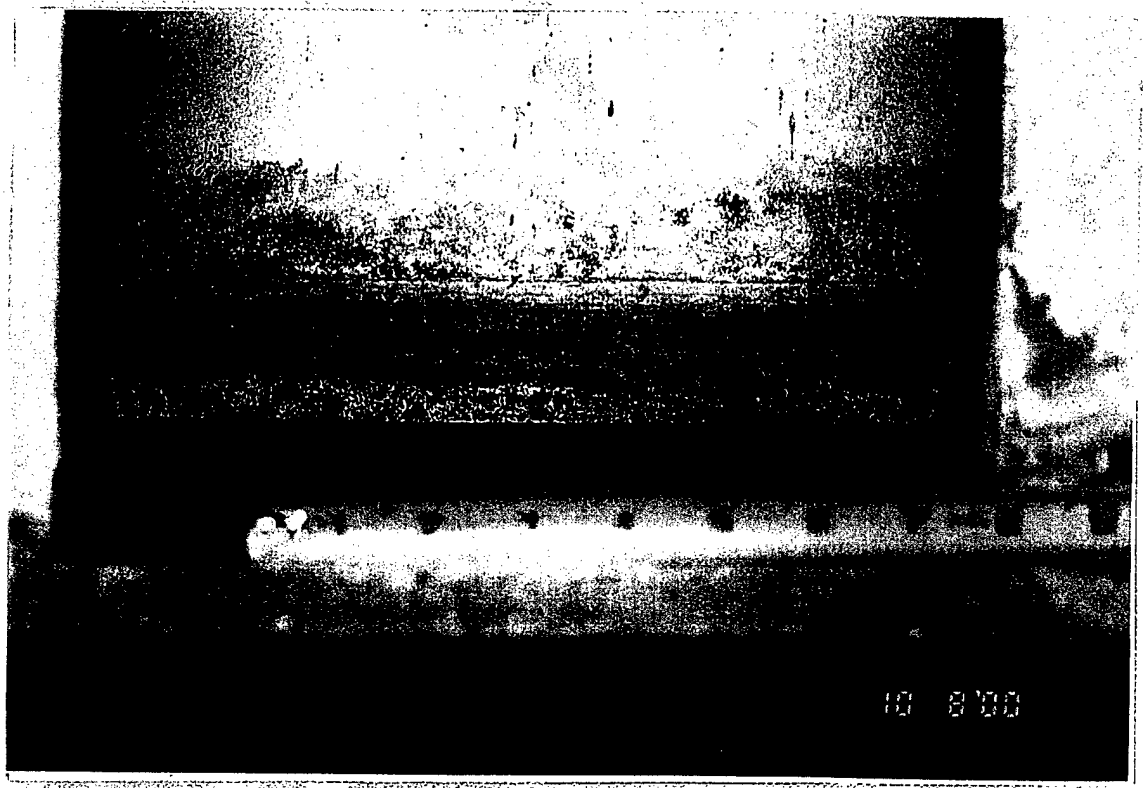
Lower Granite Dam 10/04/00 3-17	**Gate 3** Right trunnion and yoke looking downstream. Light corrosion on trunnion.



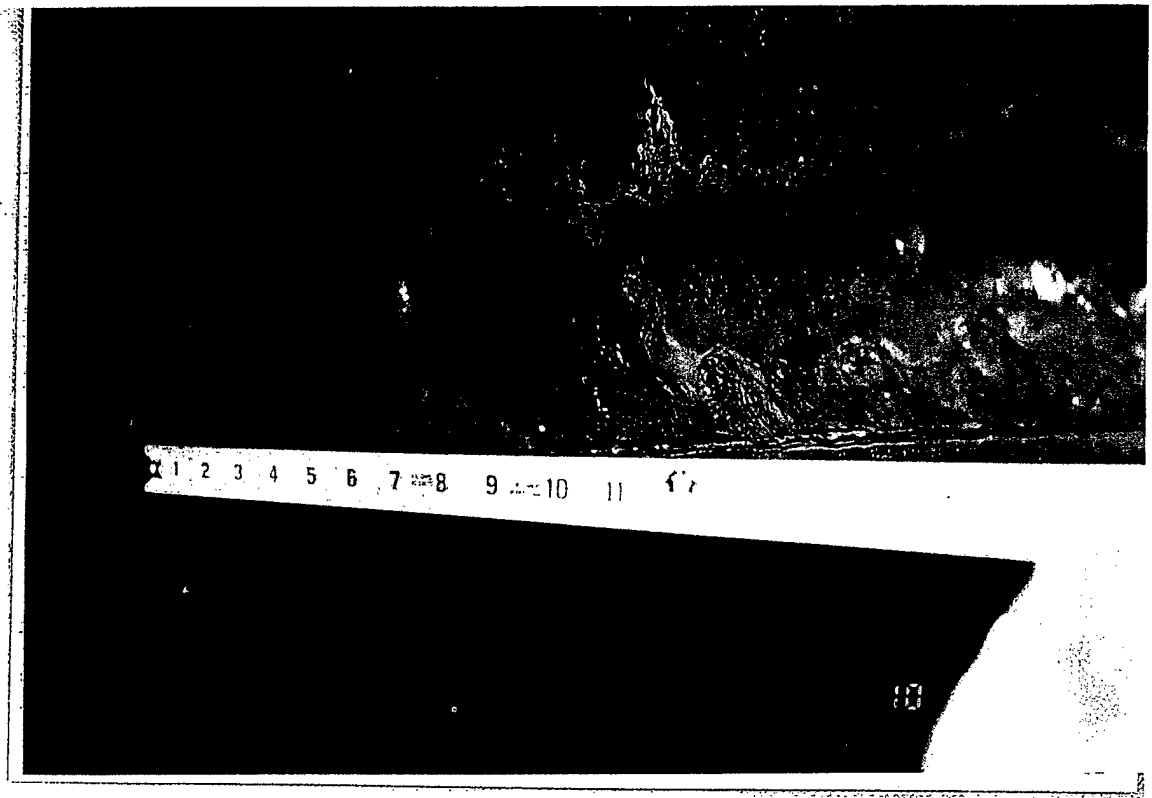
Lower Granite Dam 10/04/00 3-18	**Gate 3** Gate face and left frame, typical.



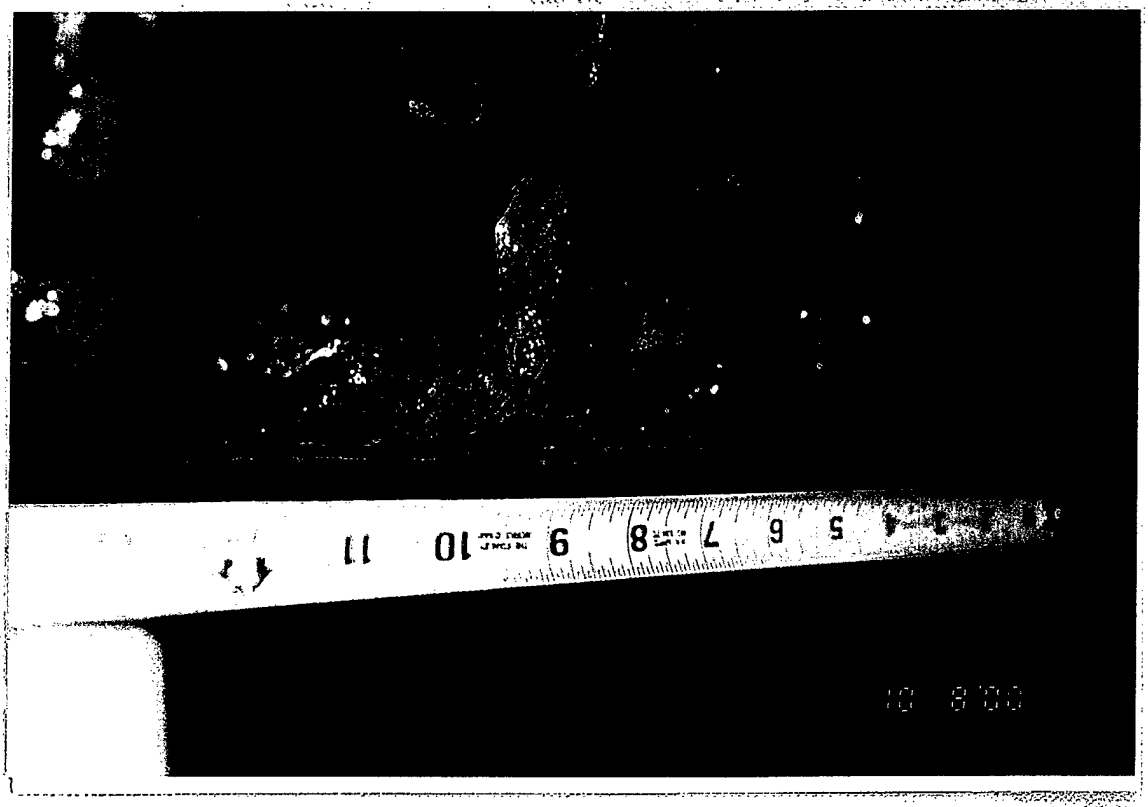
Lower Granite Dam 10/04/00 3-19	**Gate 3** Close-up of upstream side of right trunnion and yoke. Note: Small lubrication leak at connection to trunnion.



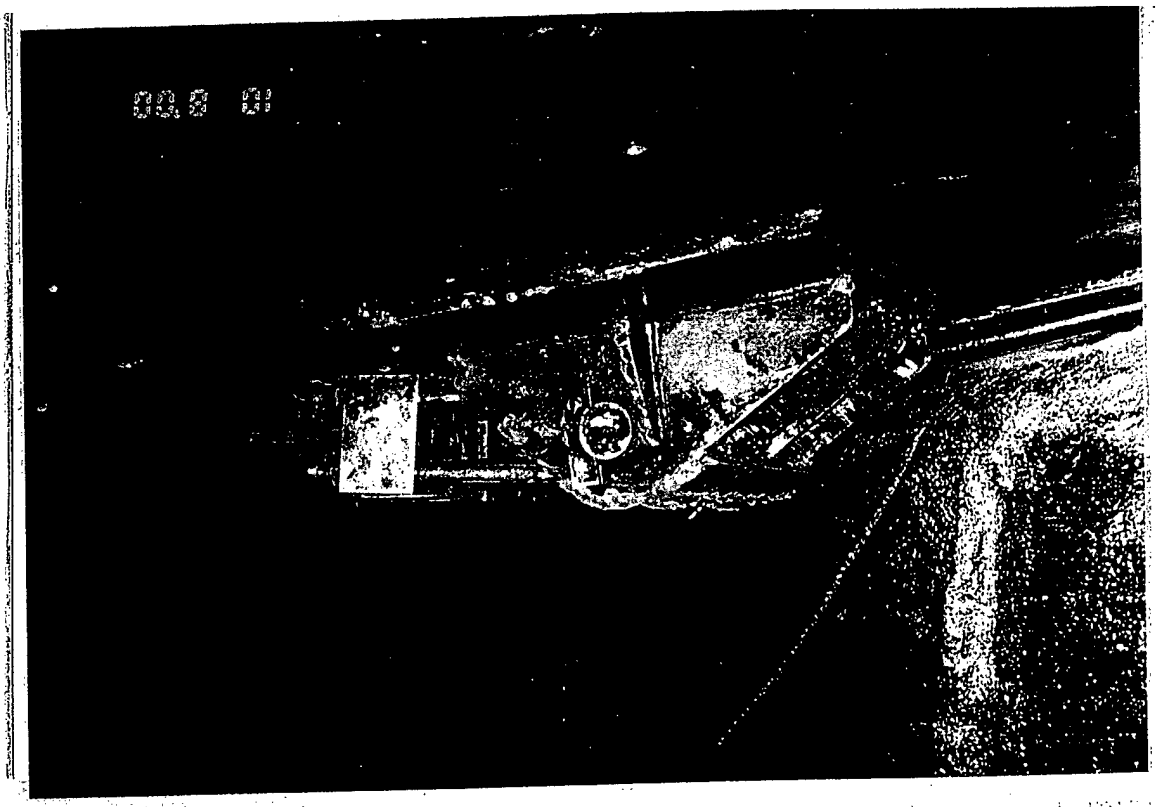
Lower Granite Dam 10/08/00 3-20	**Gate 3** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



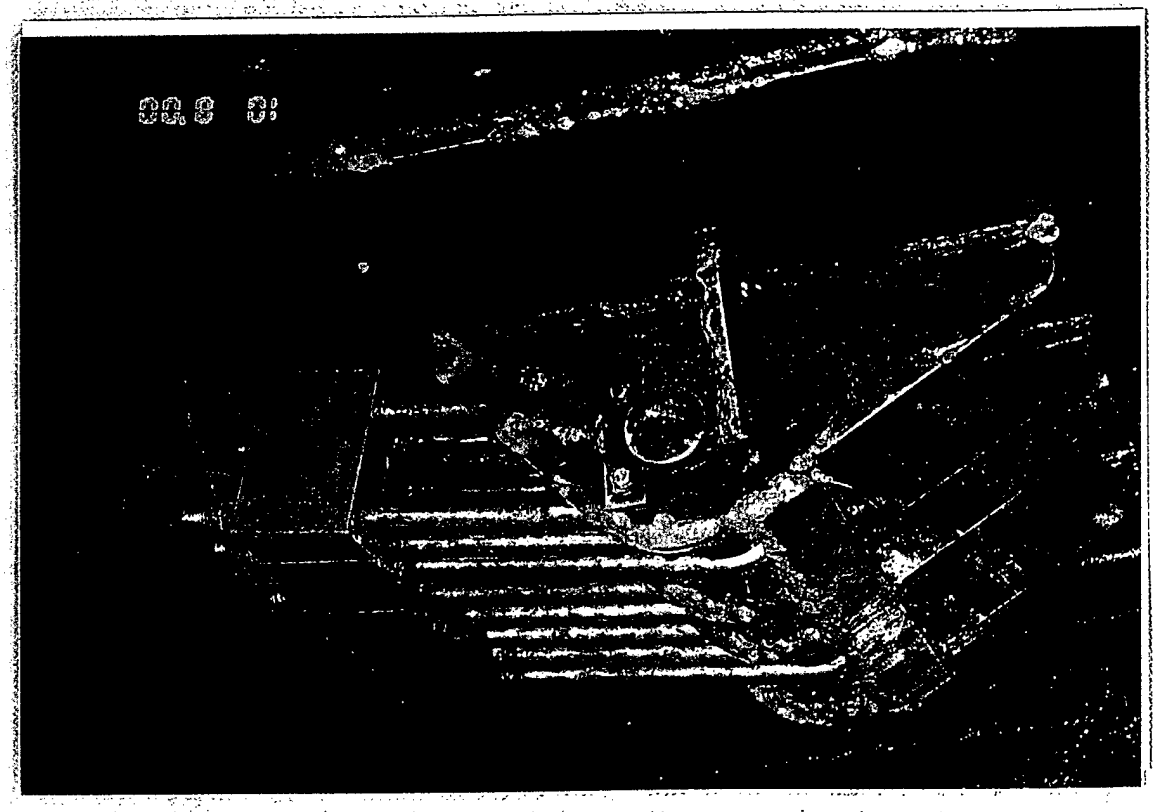
Lower Granite Dam 10/08/00 3-21	**Gate 3** Upstream side of skin plate at bottom seal. Light to moderate corrosion of skin plate, typical.



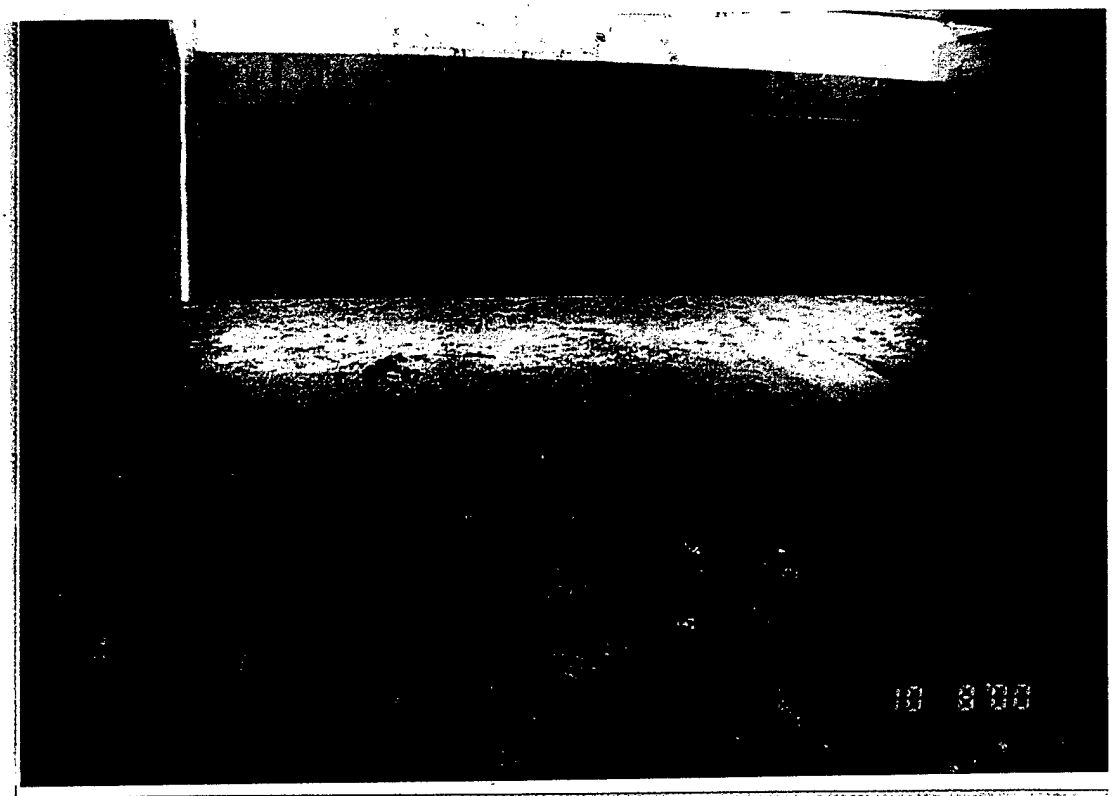
Lower Granite Dam 10/08/00 3-22	**Gate 3** Upstream side of skin plate at bottom seal. Light to moderate corrosion of skin plate, typical.



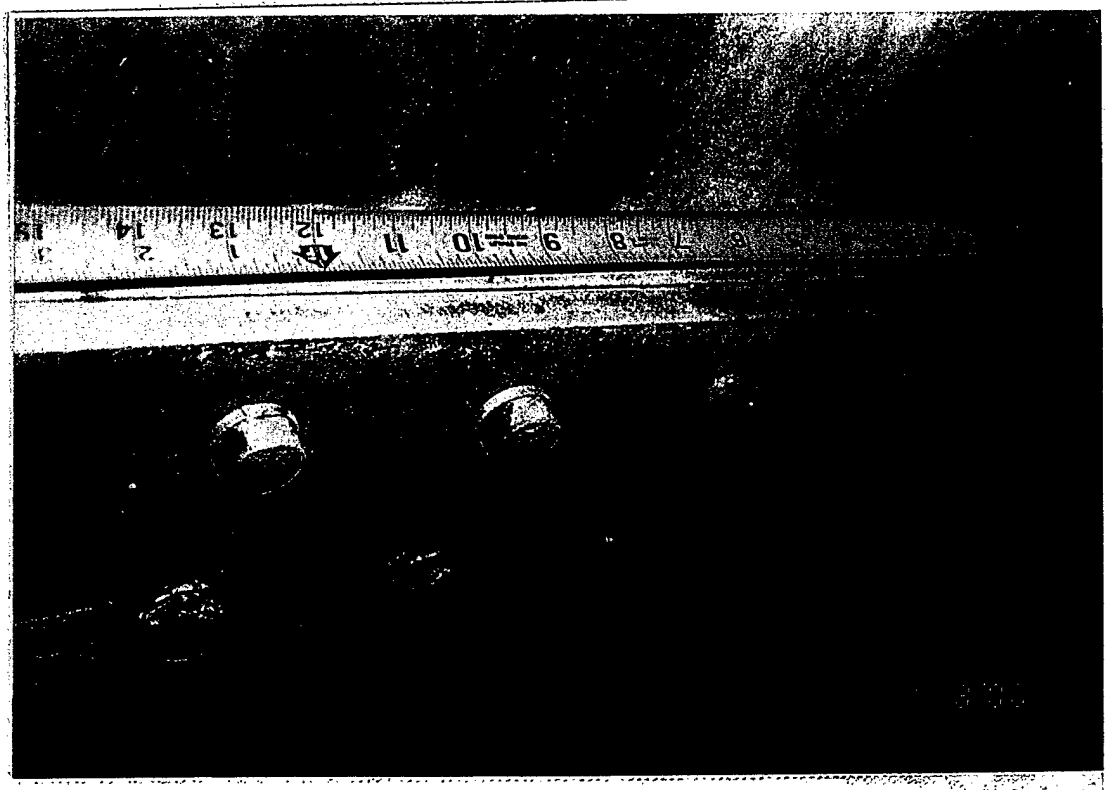
Lower Granite Dam 10/08/00 3-23	**Gate 3** Left side hoist connection. Light corrosion on lifting lugs and plates. Note: excellent condition of stainless steel U-bolts.



Lower Granite Dam 10/08/00 3-24	**Gate 3** Left side hoist connection. Light corrosion on lifting lugs and plates. Note: excellent condition of stainless steel U-bolts.



Lower Granite Dam 10/08/00 3-25	**Gate 3** Skin plate pitting, looking up, typical.



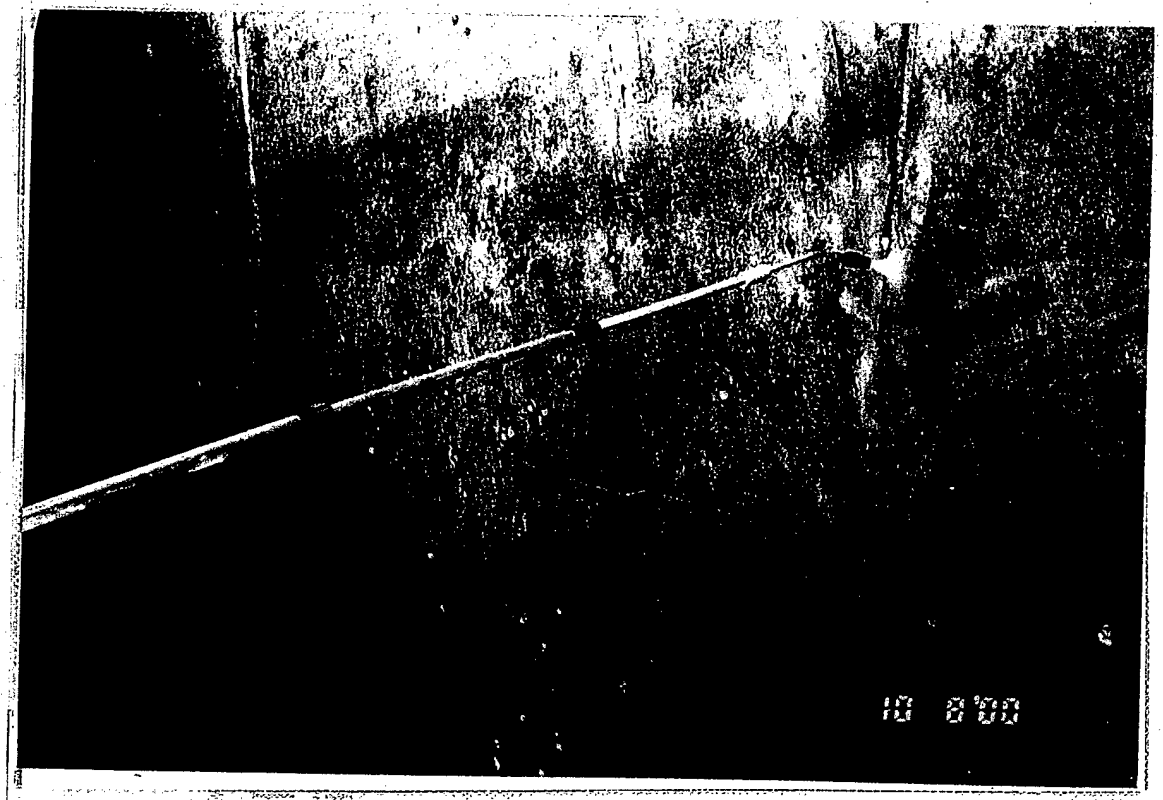
Lower Granite Dam 10/08/00 3-26	**Gate 3** Downstream side of bottom seal and keeper plate looking upstream.

Lower Granite Dam

10/08/00

Gate 3
Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

3-27

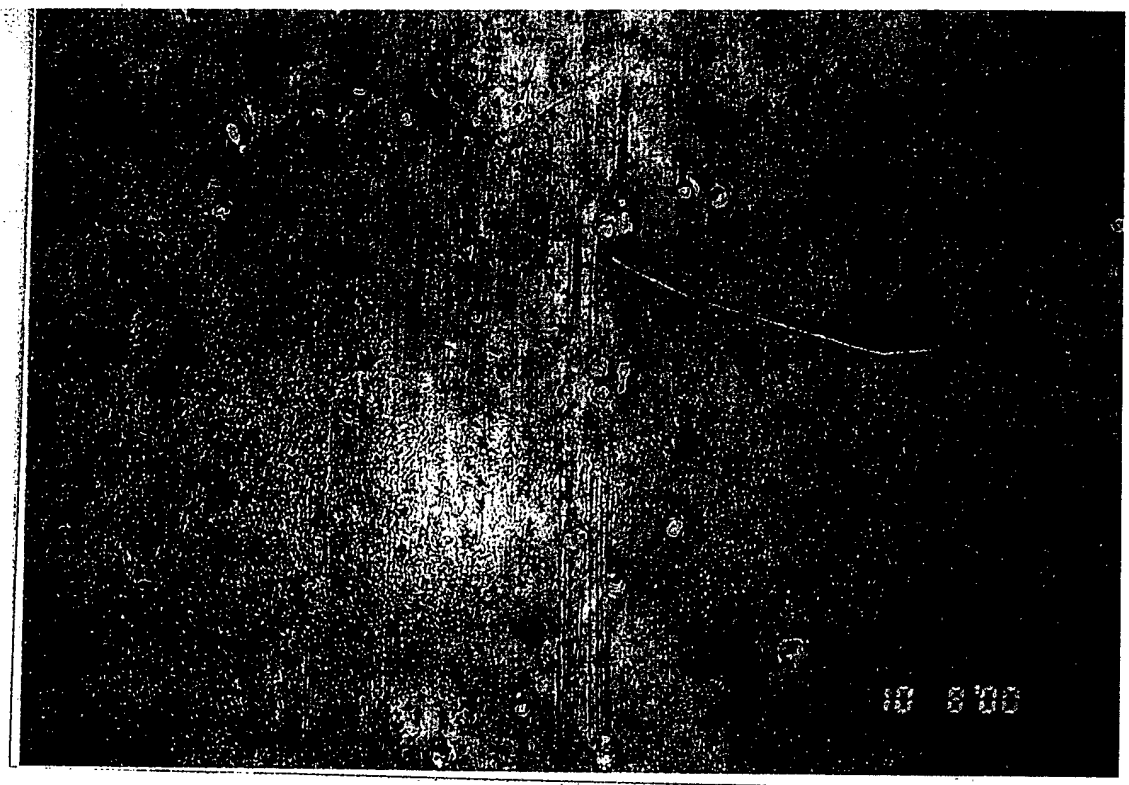


Lower Granite Dam

10/08/00

Gate 3
Waterblasting and typical skin plate condition.

3-28

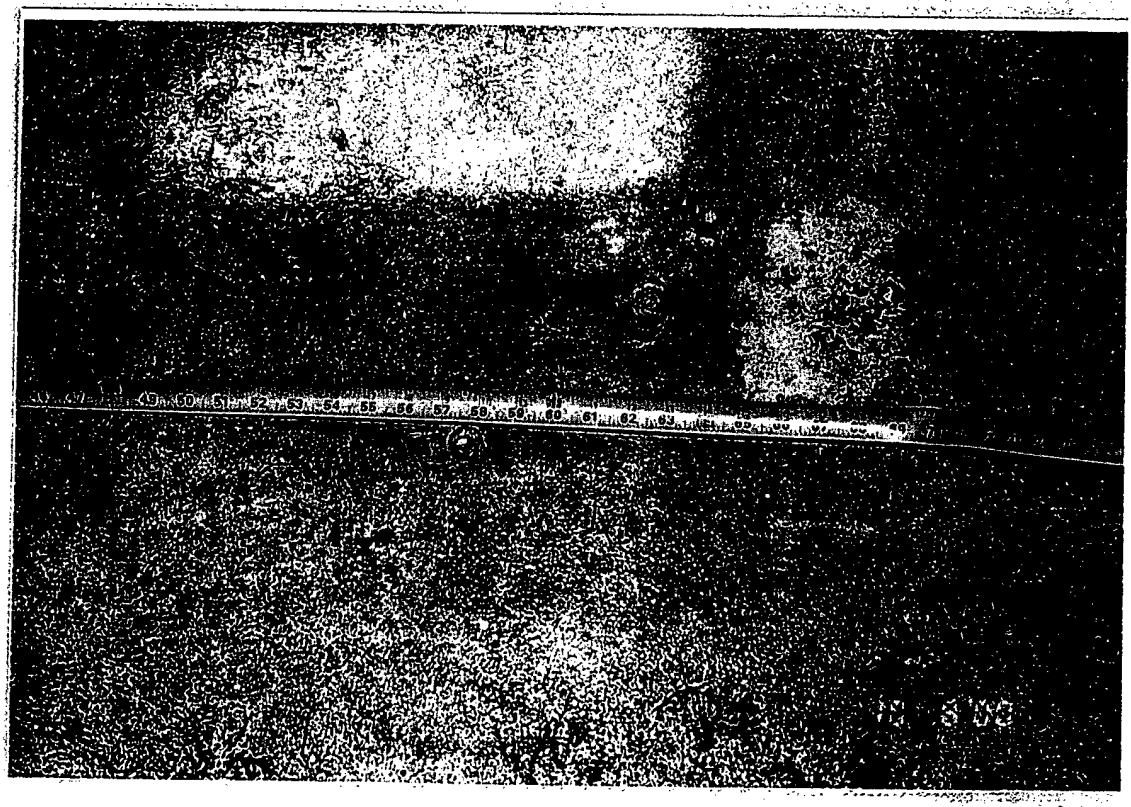


Lower Granite Dam

Gate 3
Skin plate pitting, typical.

10/08/00

3-29

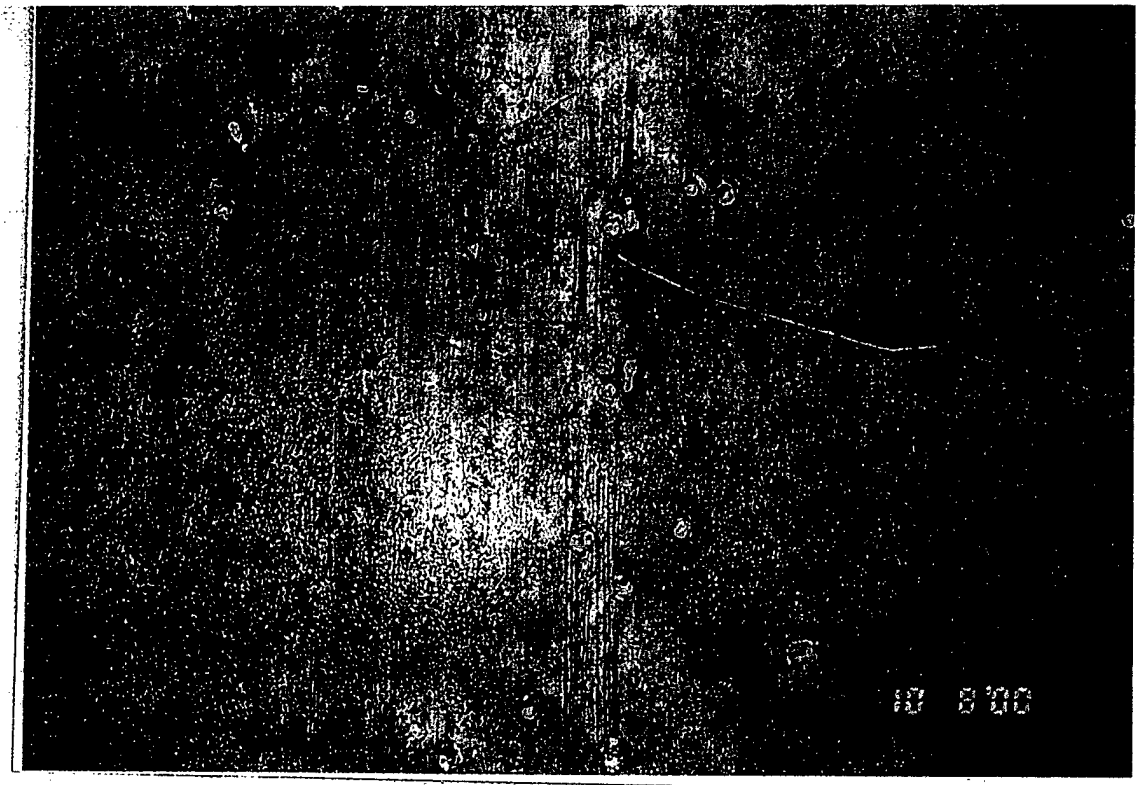


Lower Granite Dam

Gate 3
Skin plate pitting, typical.

10/08/00

3-30



Lower Granite Dam

Gate 3
Skin plate pitting, typical.

10/08/00

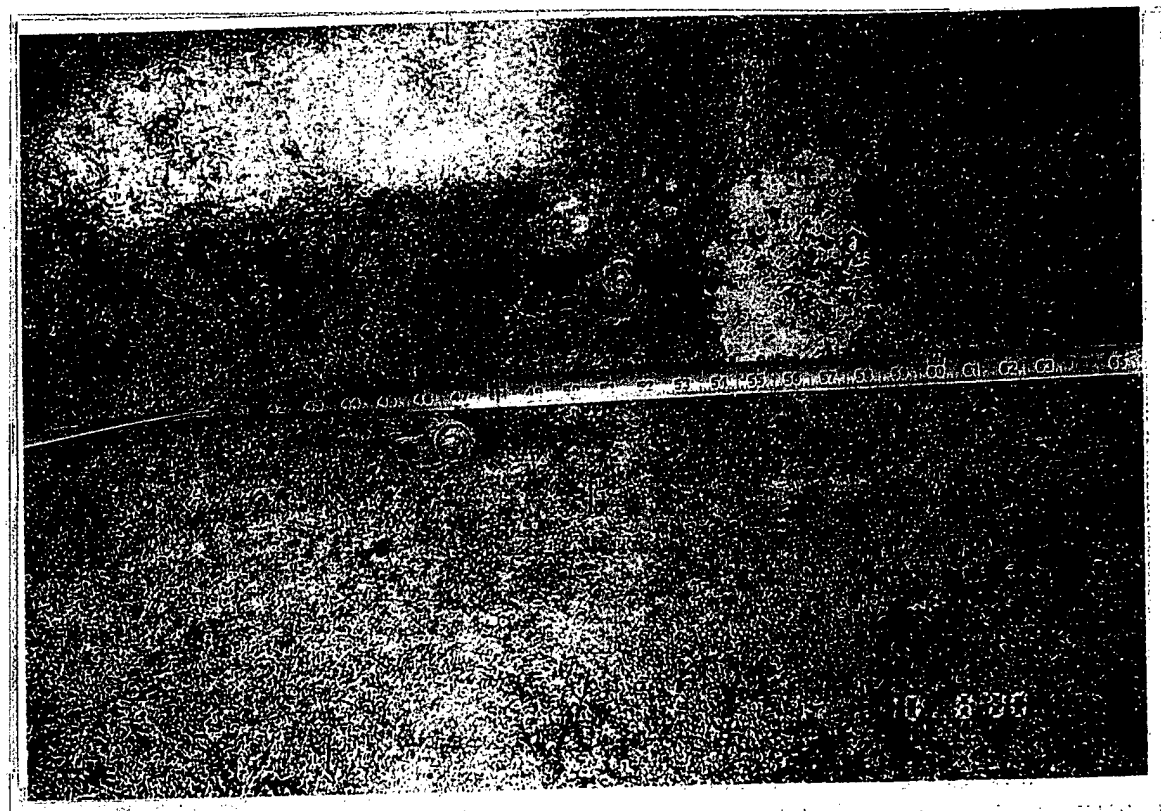
3-29

Lower Granite Dam

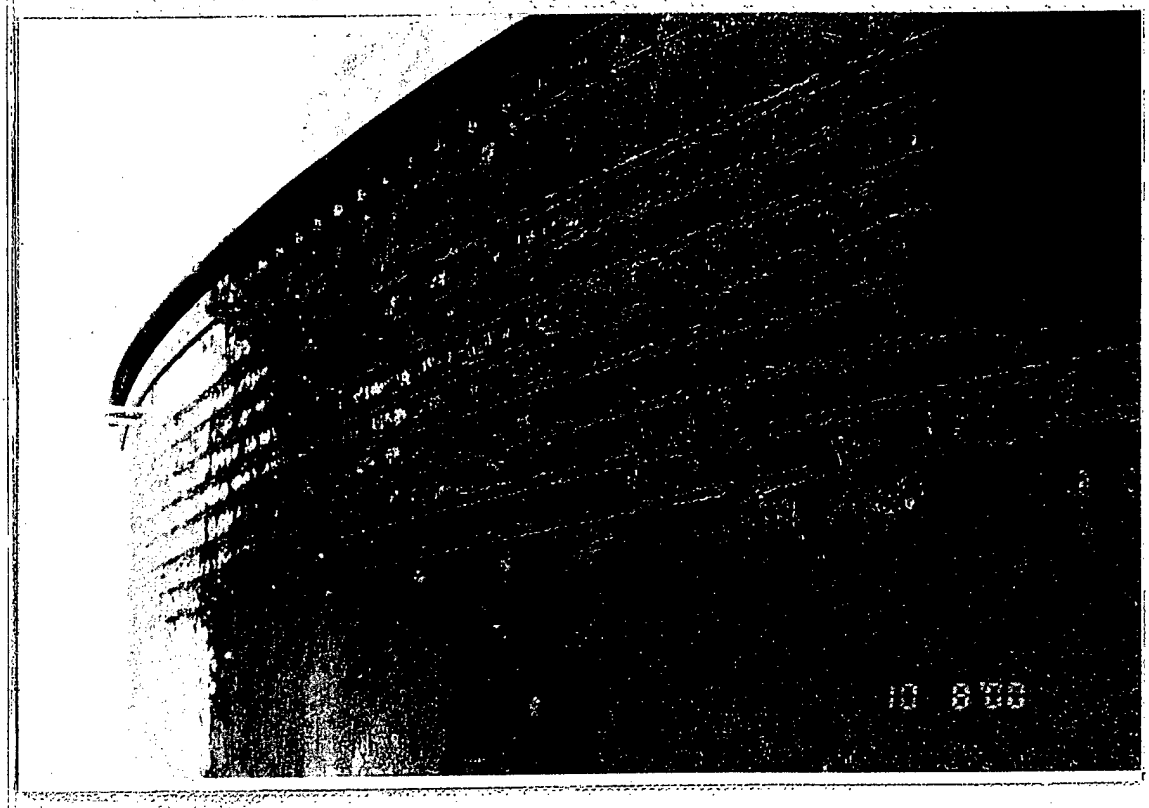
Gate 3
Skin plate pitting, typical.

10/08/00

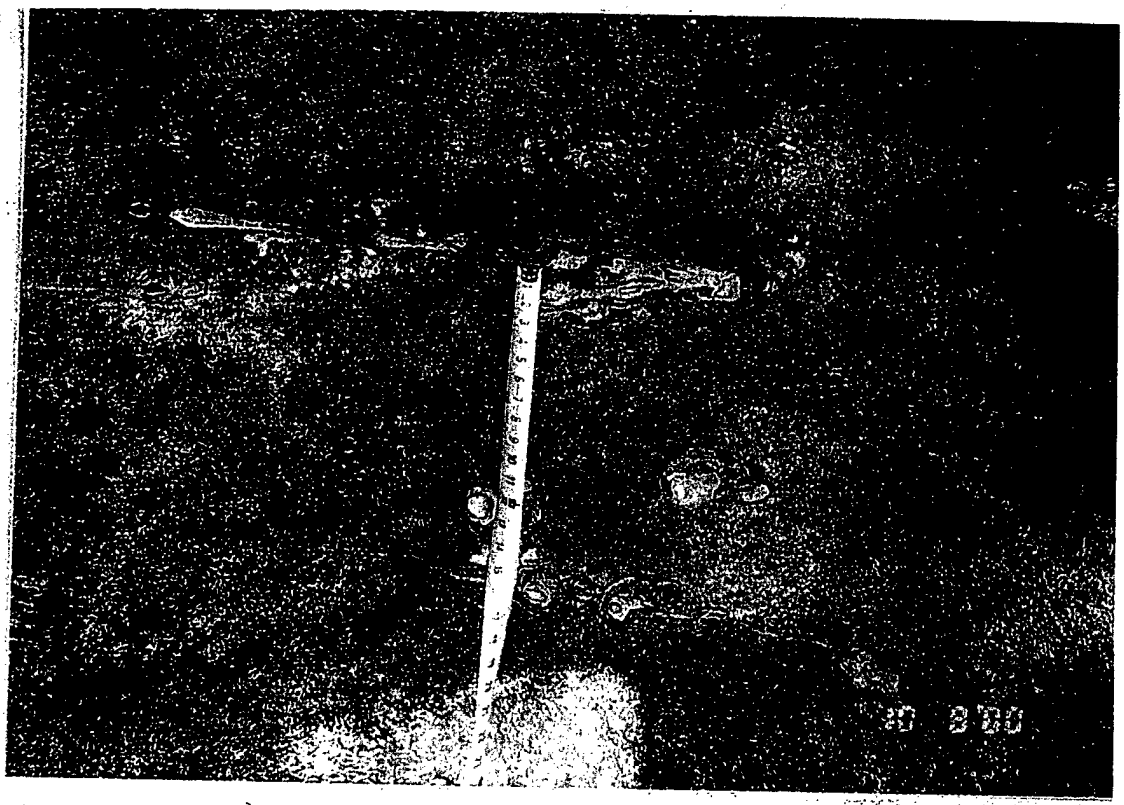
3-30



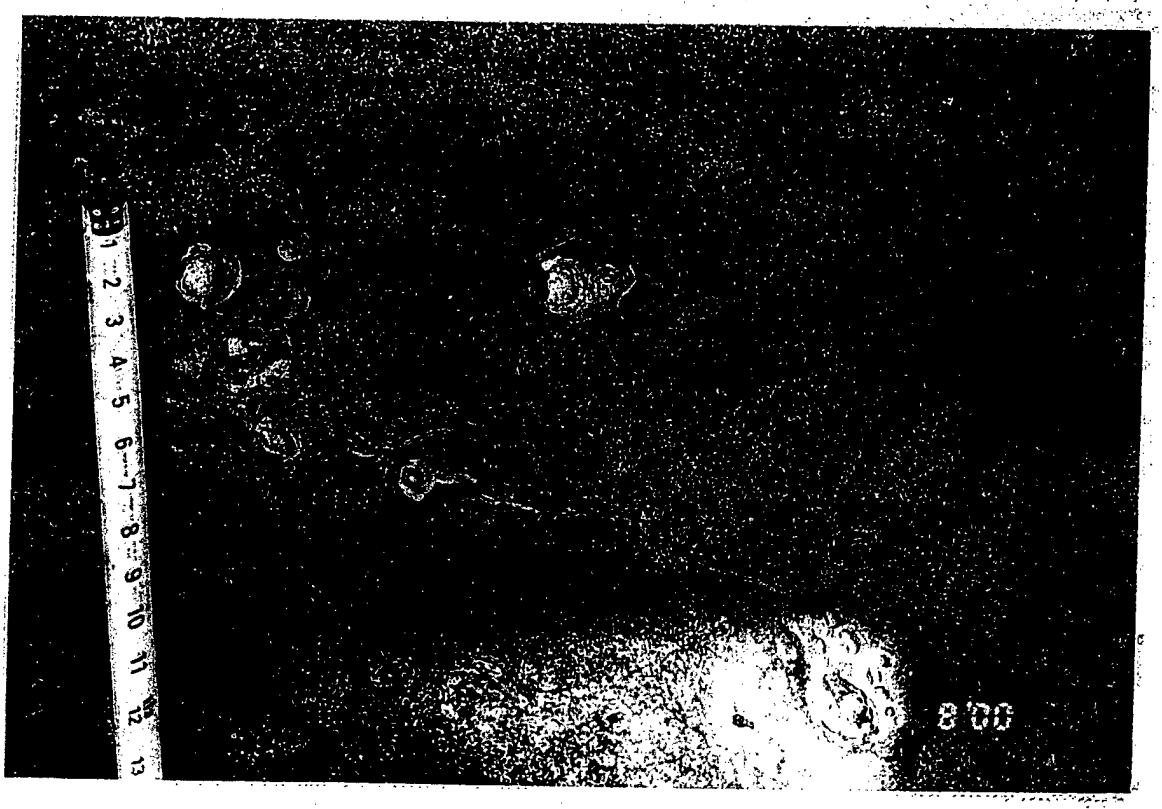
Lower Granite Dam 10/08/00 3-31	**Gate 3** Skin plate pitting, typical.



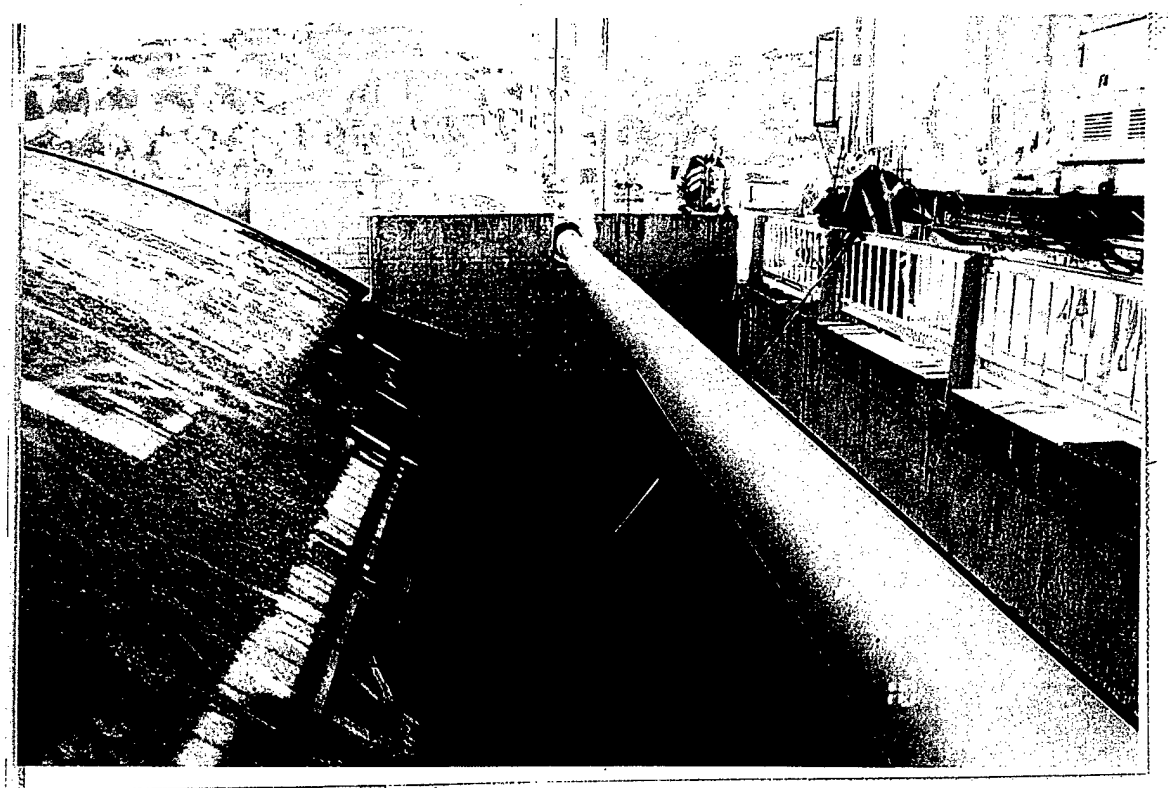
Lower Granite Dam 10/08/00 3-32	**Gate 3** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



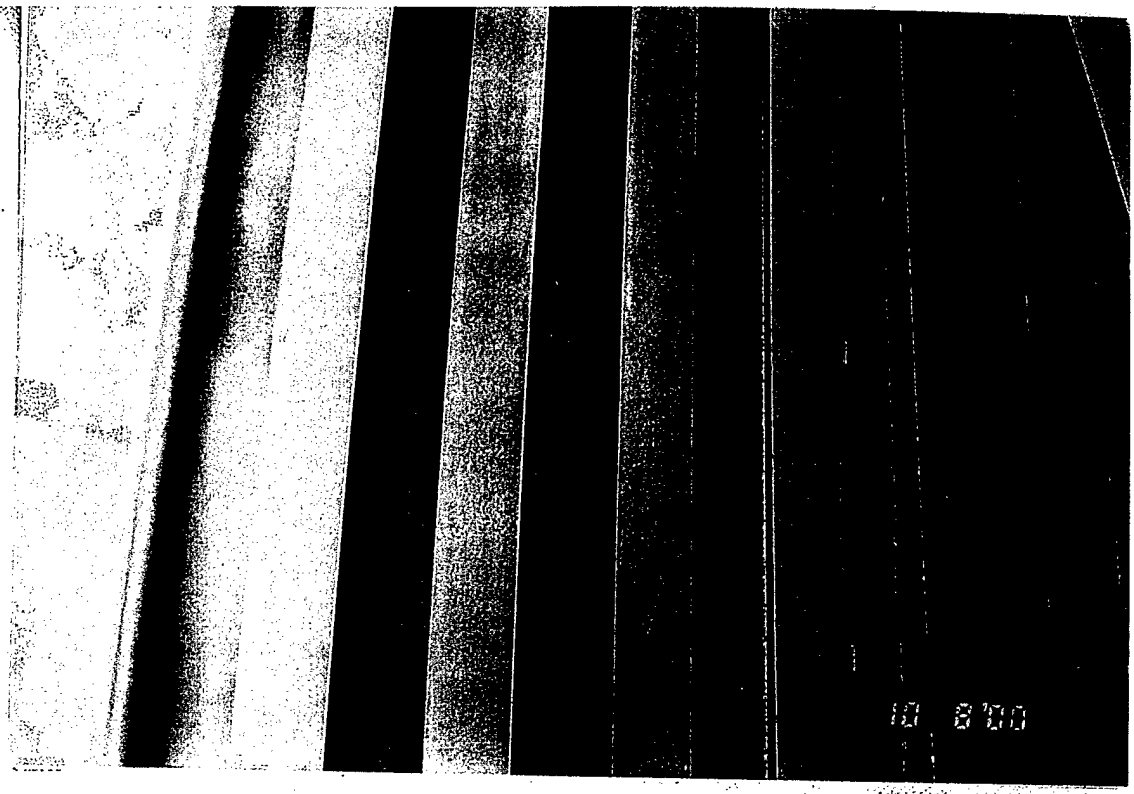
Lower Granite Dam 10/08/00 3-33	**Gate 3** Skin plate pitting apparently associated with scratches.



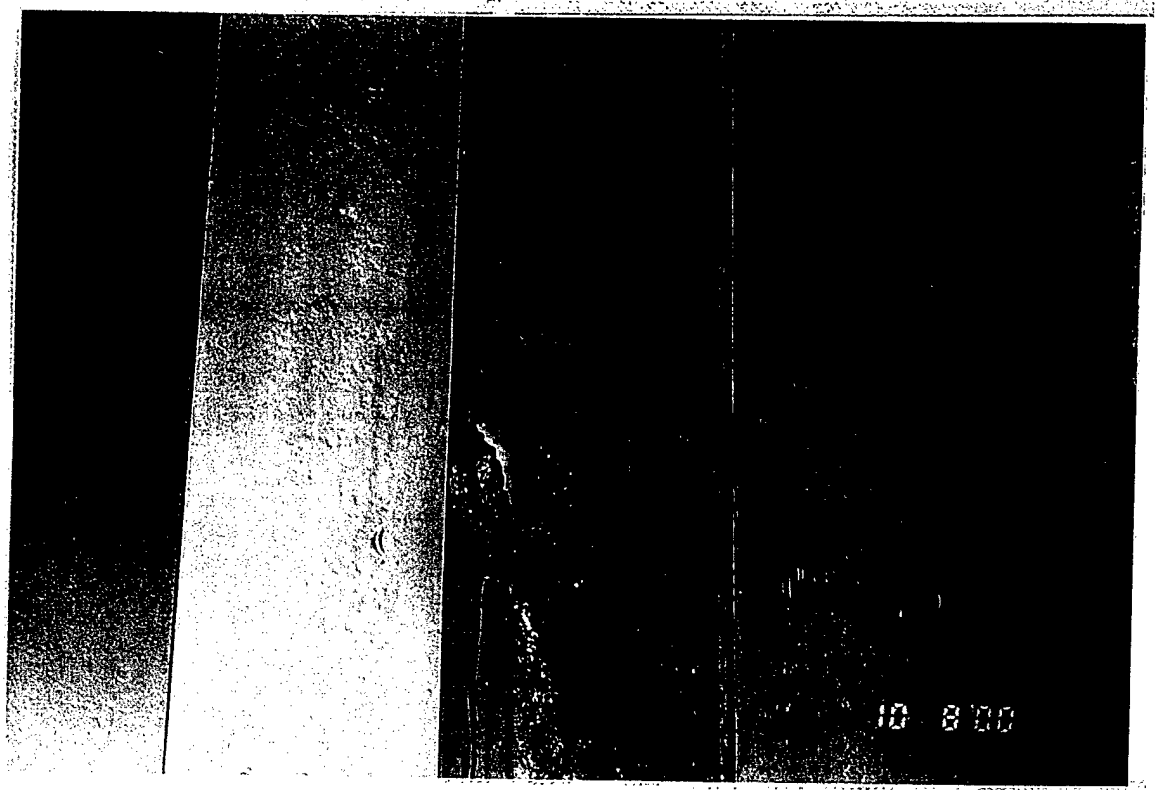
Lower Granite Dam 10/08/00 3-34	**Gate 3** Skin plate pitting apparently associated with scratches.



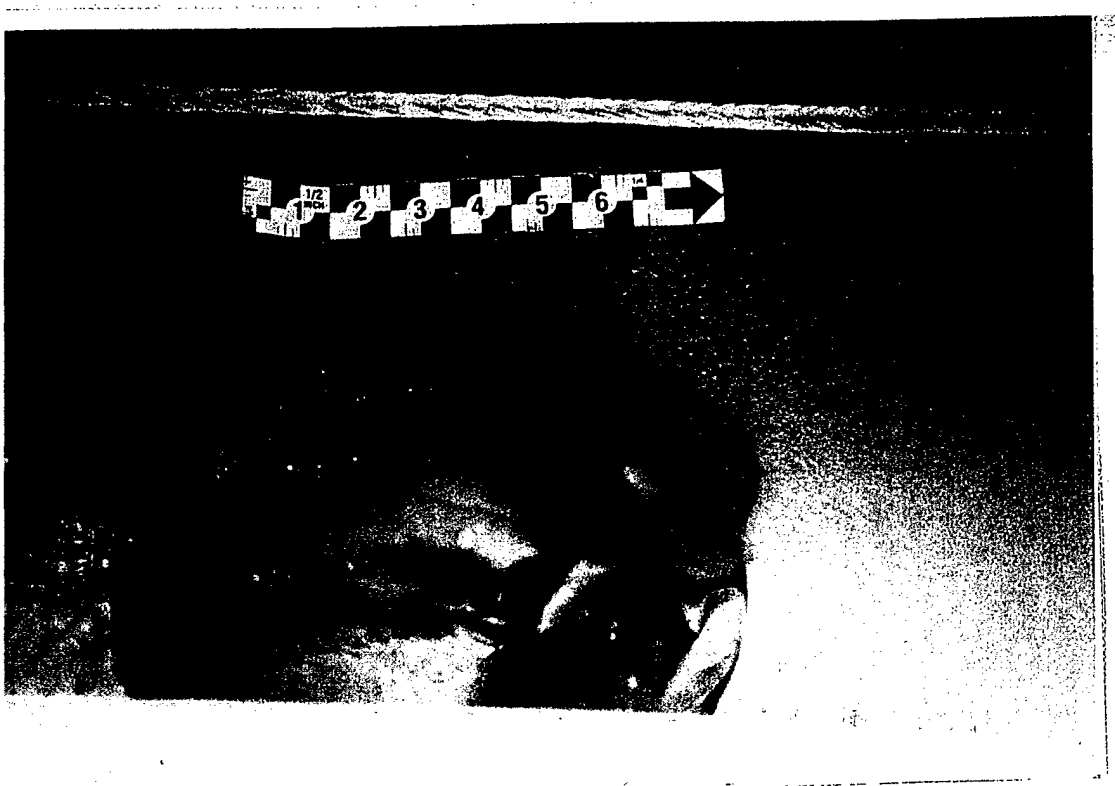
Lower Granite Dam 10/08/00 3-35	**Gate 3** Waterblasting upstream surface of skin plate.



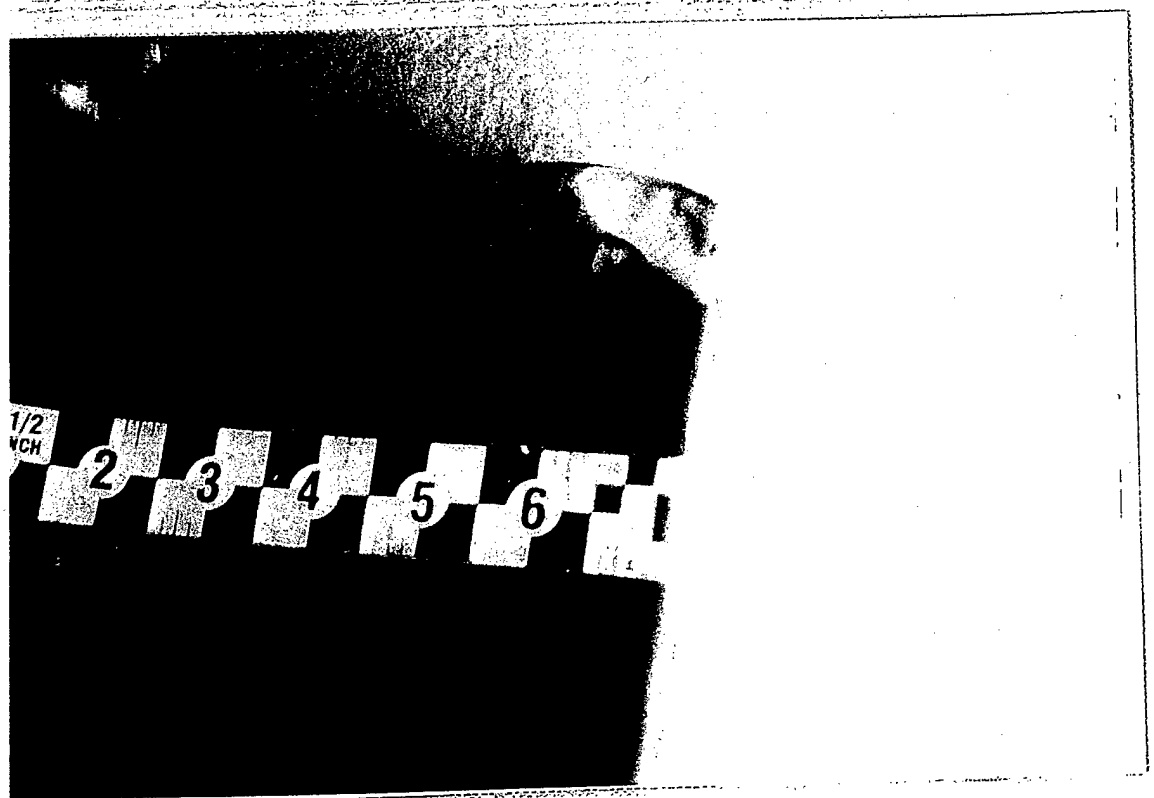
Lower Granite Dam 10/08/00 4-1	**Gate 4** Paint blister and apparent skin plate leak approximately 7' from left side of gate and 6' above 1/2" to 3/8" skin plate transition. Photo taken after waterblasting of upstream side.



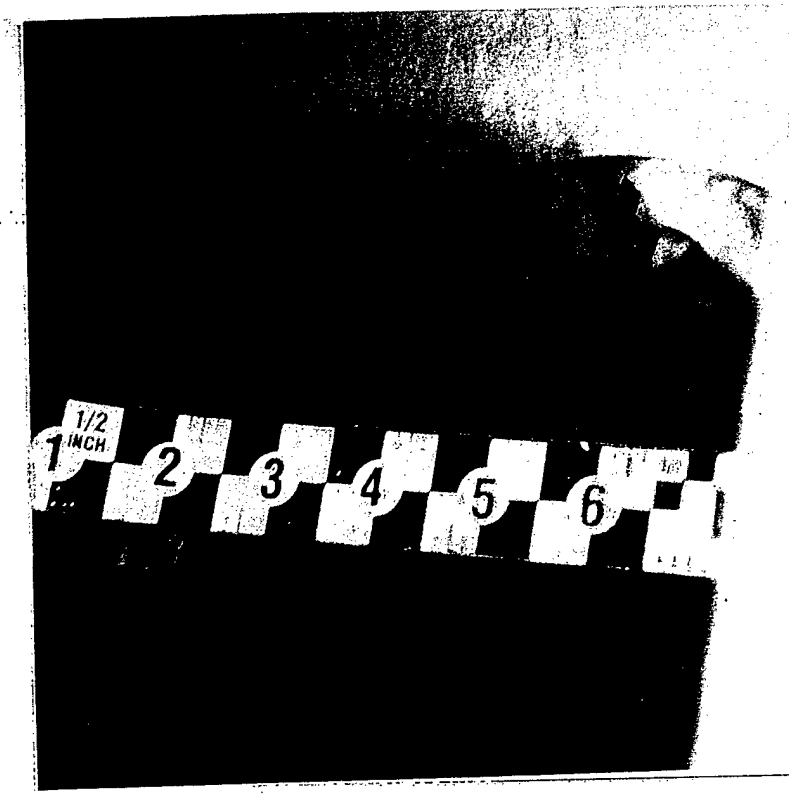
Lower Granite Dam 10/08/00 4-2	**Gate 4** Paint blister and apparent skin plate leak approximately 7' from left side of gate and 6' above 1/2" to 3/8" skin plate transition. Photo taken after waterblasting of upstream side.



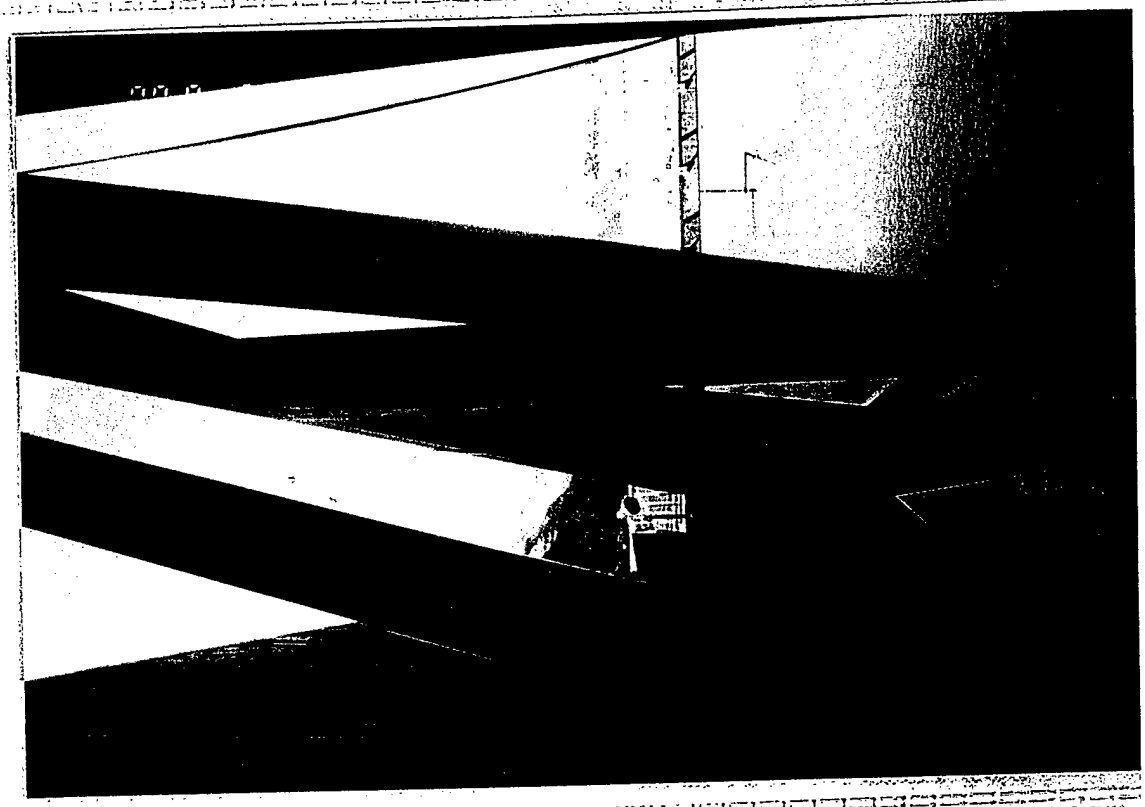
Lower Granite Dam 10/08/00 4-3	**Gate 4** Close-up of paint blister / skin plate leak.



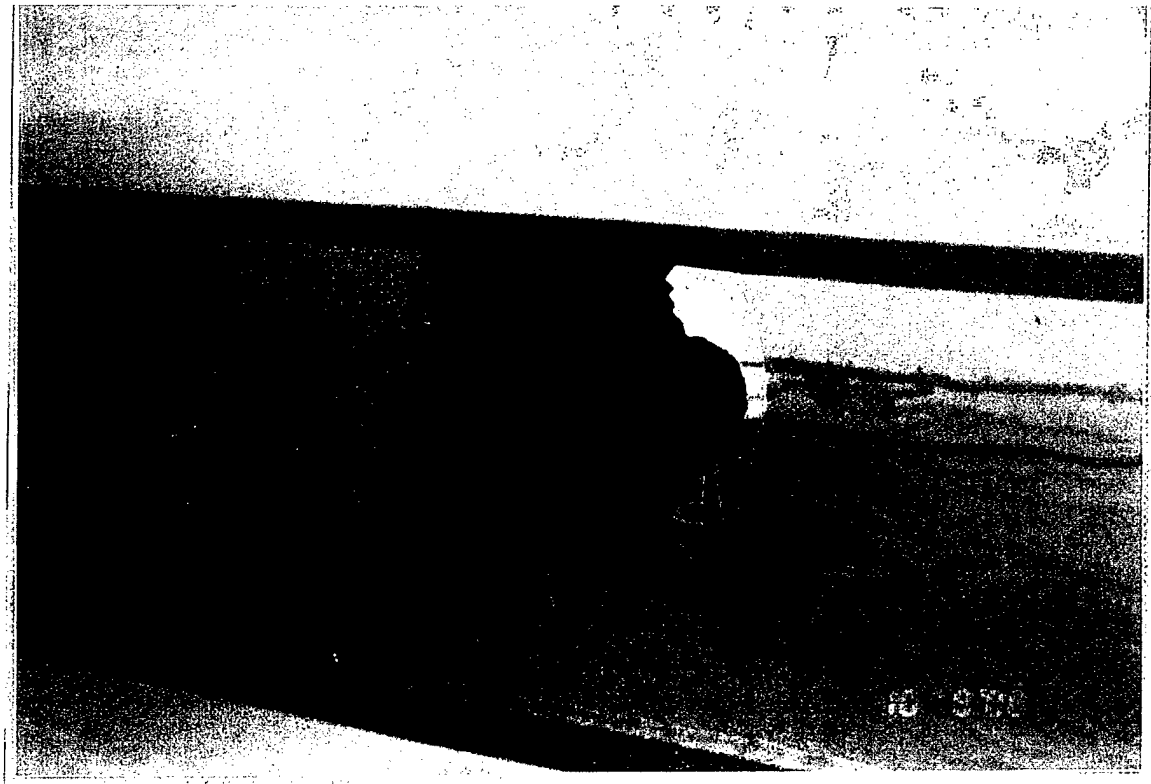
Lower Granite Dam 10/08/00	**Gate 4** Skin plate leak after removal of paint blister.



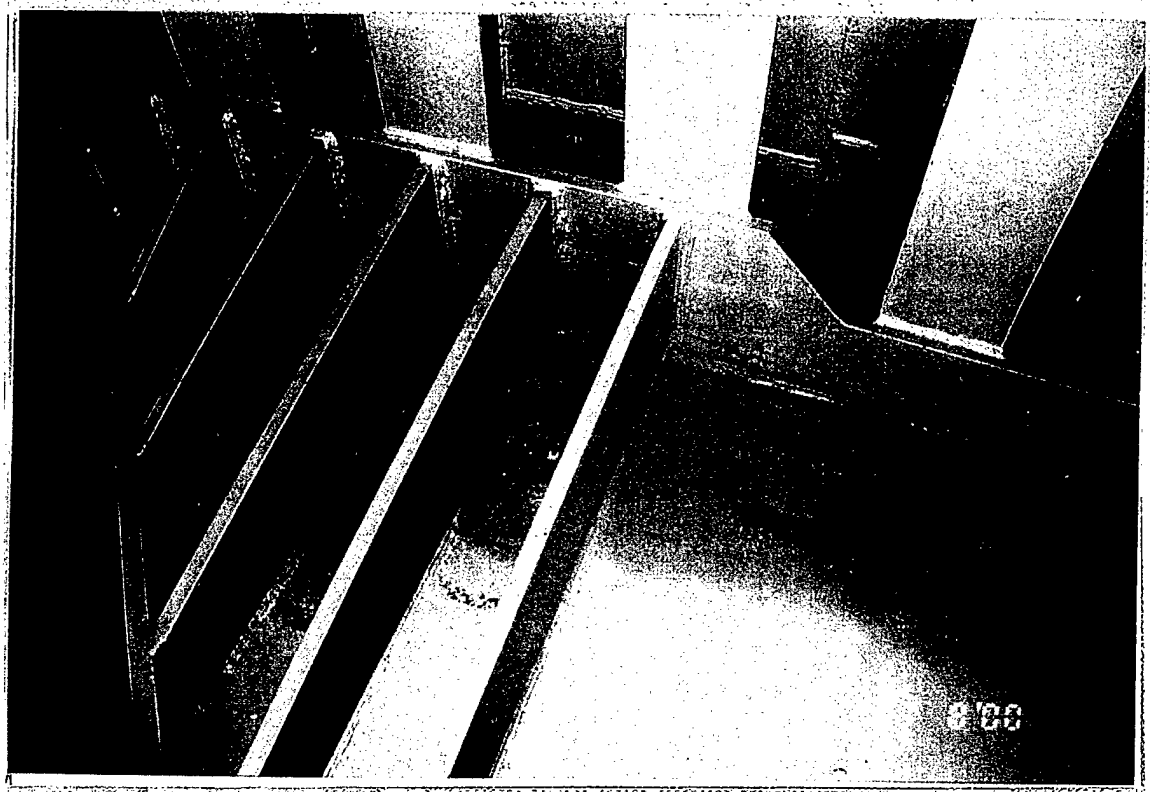
Lower Granite Dam 10/08/00 4-5	Gate 4 Skin plate leak after removal of paint blister.



Lower Granite Dam 10/08/00 4-6	Gate 4 Left side frame, along outside of frame looking downstream, typical. Note: Skin plate leak landing on middle radial strut.

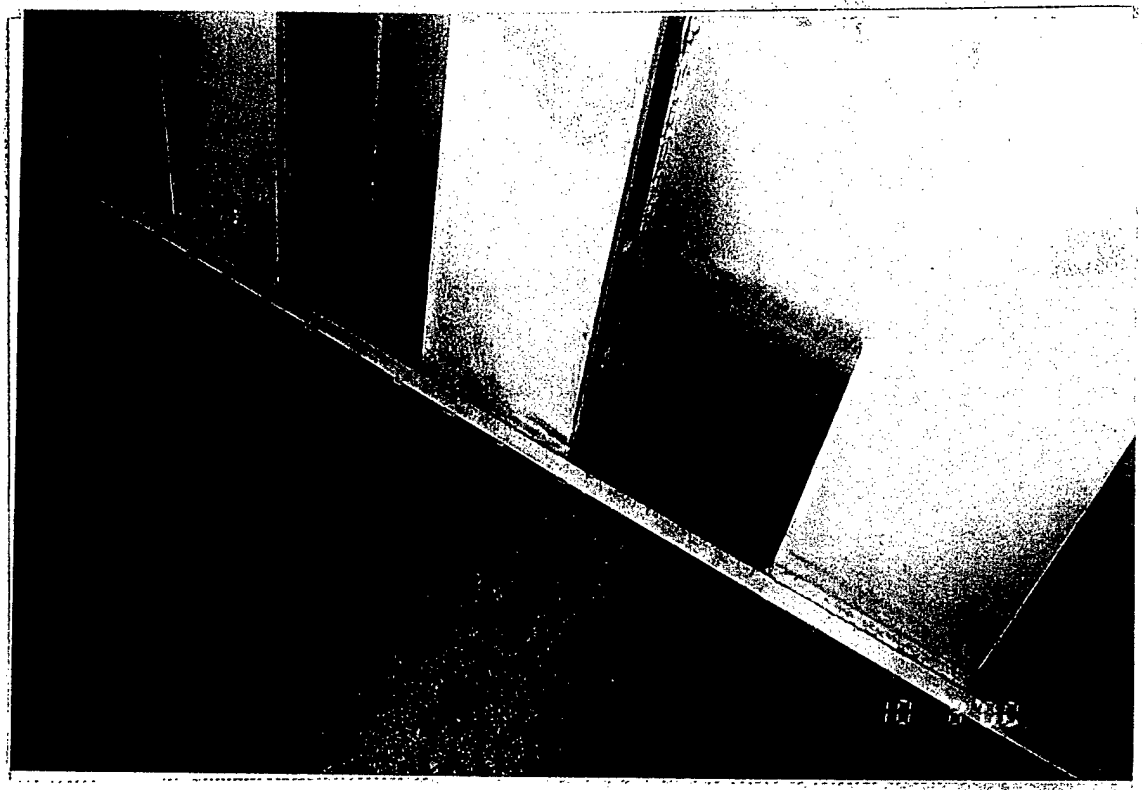


Lower Granite Dam 10/08/00 4-7	**Gate 4** Skin plate leak after removal of paint blister.

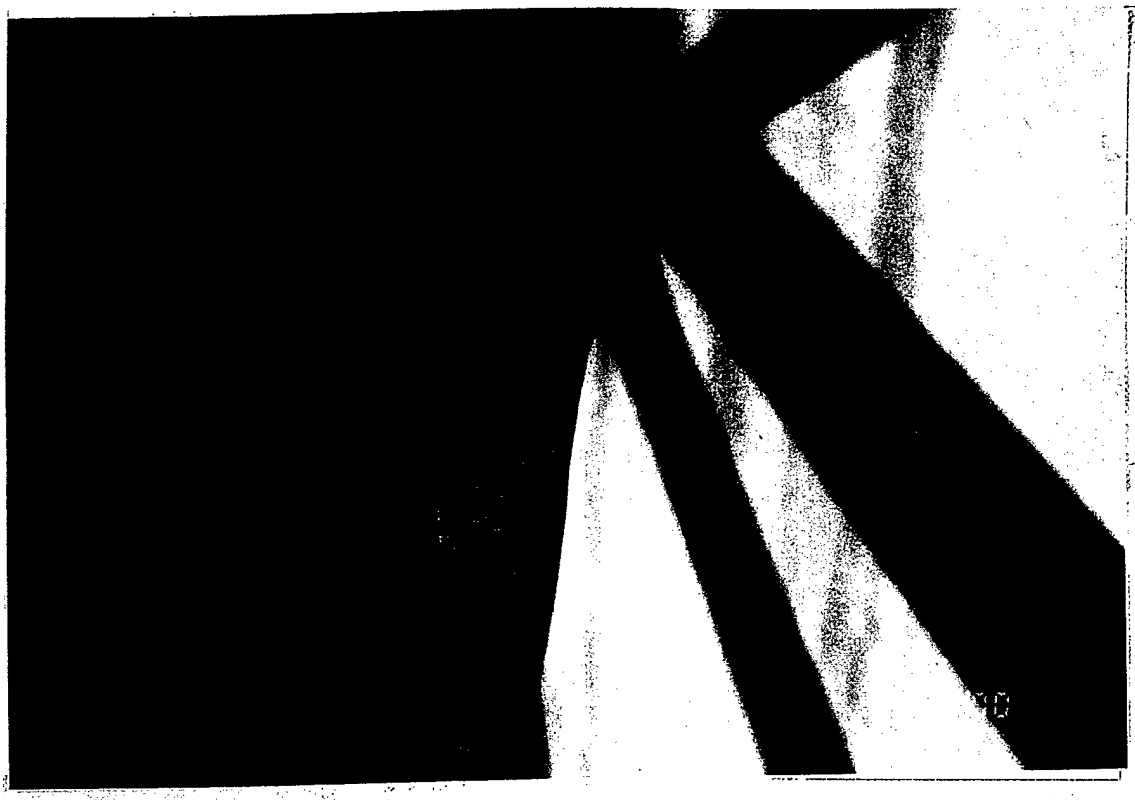


Lower Granite Dam 10/08/00 4-8	**Gate 4** Right end of bottom horiz. girder. Evidence of standing water, no drainage between multiple stiffeners. Horiz. girder to skin plate stiffeners, debris and no drainage

Lower Granite Dam 10/08/00 4-9	**Gate 4** Bottom of upstream end of bottom radial strut, drain hole, typical.

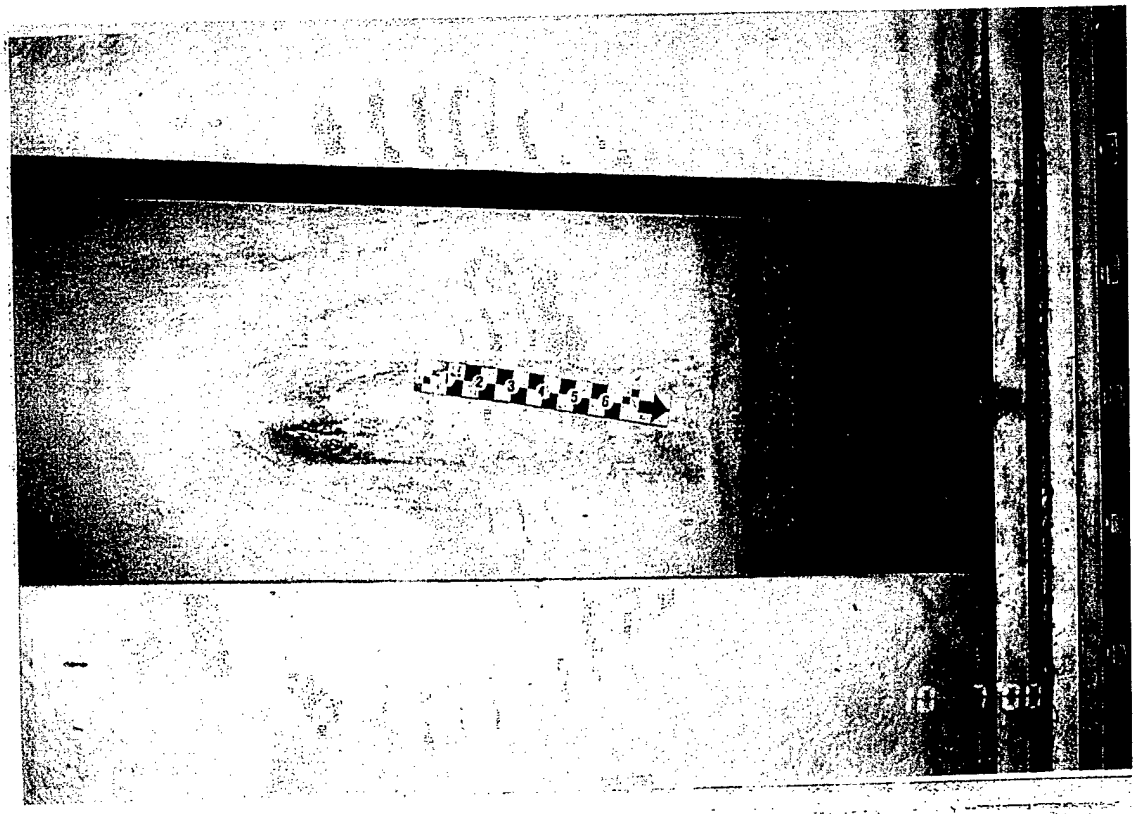


Lower Granite Dam 10/08/00 4-10	**Gate 4** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

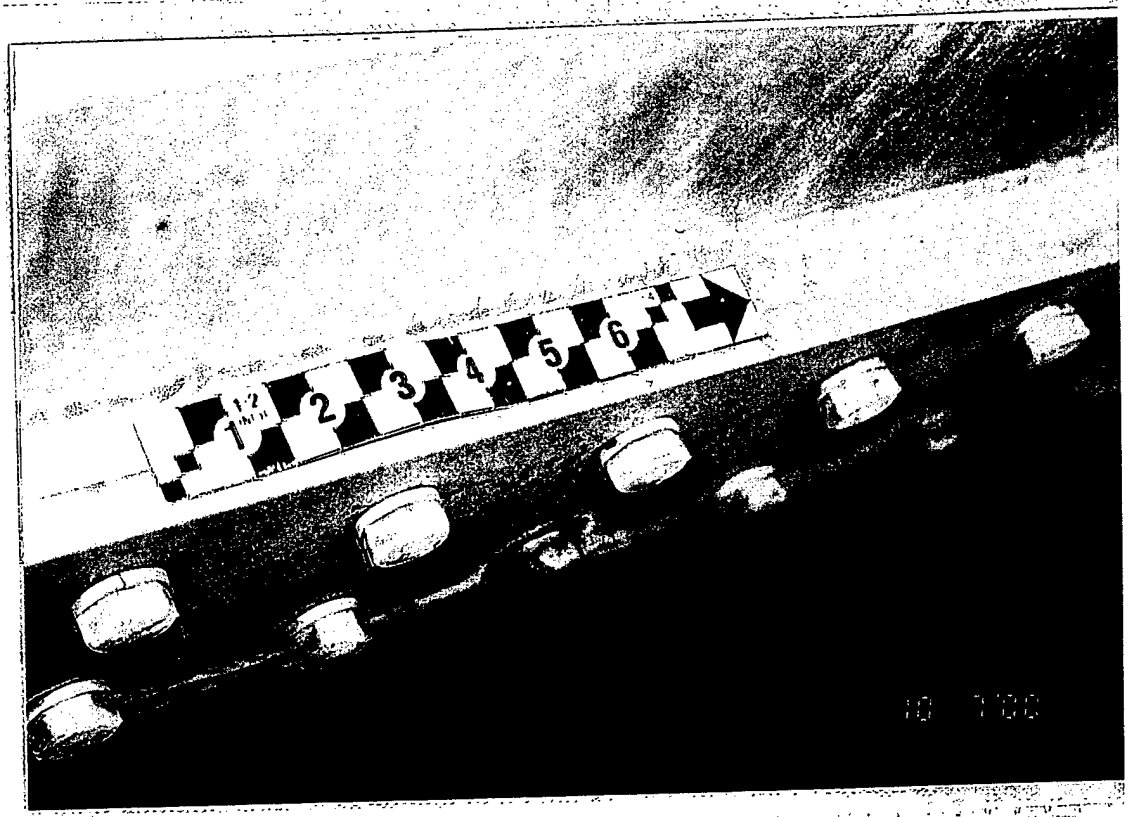


Lower Granite Dam 10/08/00 4-11	**Gate 4** Right frame, Brace F. Small deformation, approx. 1/8" on outside flange.

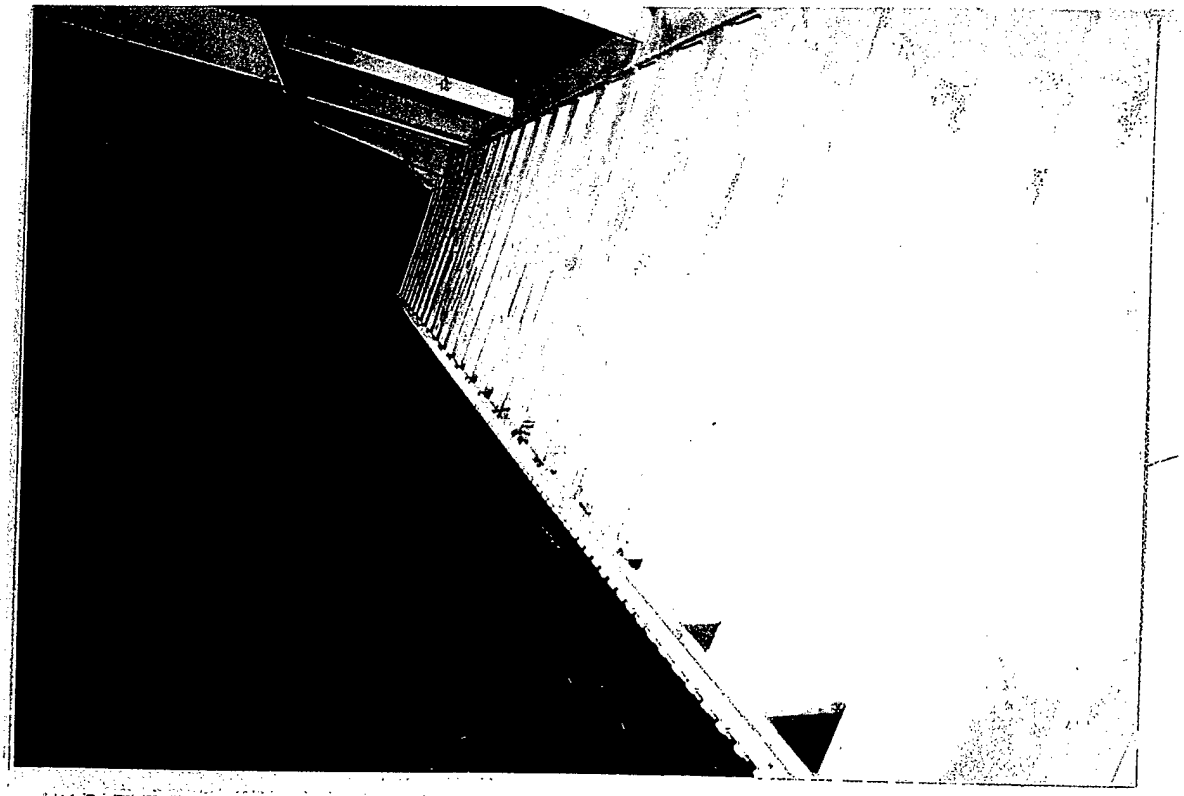
Lower Granite Dam 10/07/00 4-12	**Gate 4** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



Lower Granite Dam 10/07/00 4-13	**Gate 4** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

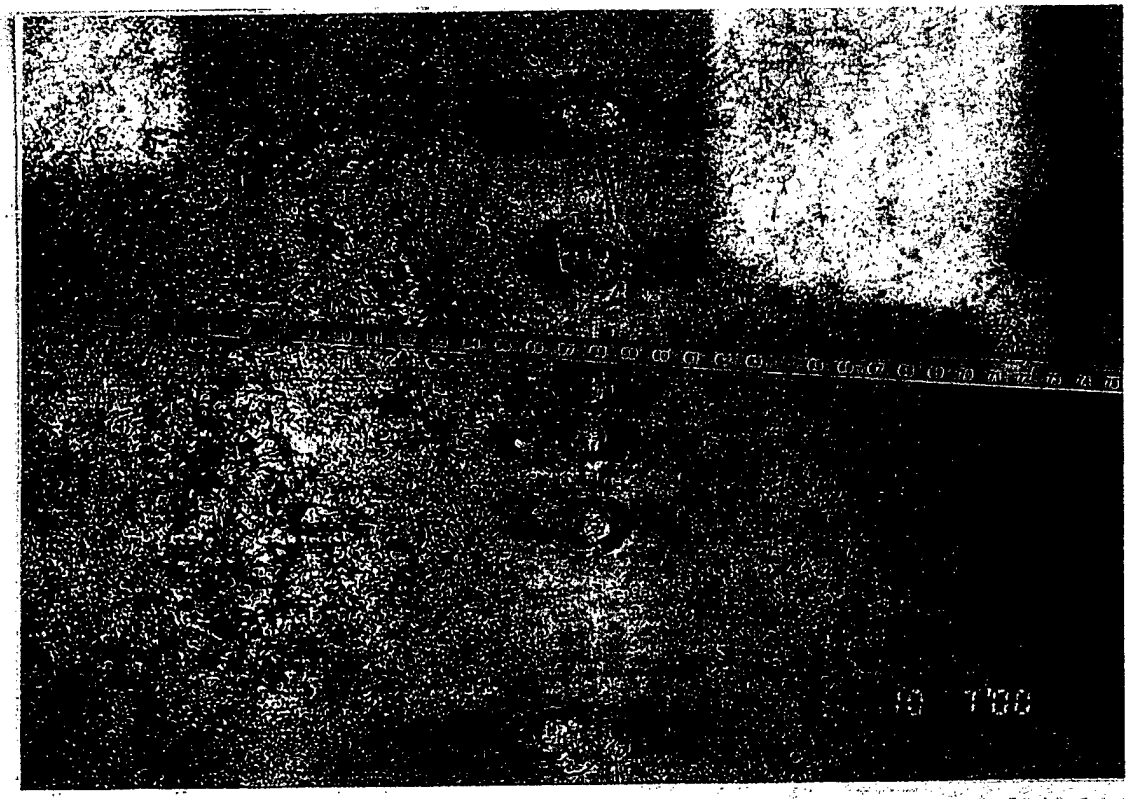


Lower Granite Dam 10/07/00 4-14	**Gate 4** Bottom seal and keeper plate, looking upstream, typical.



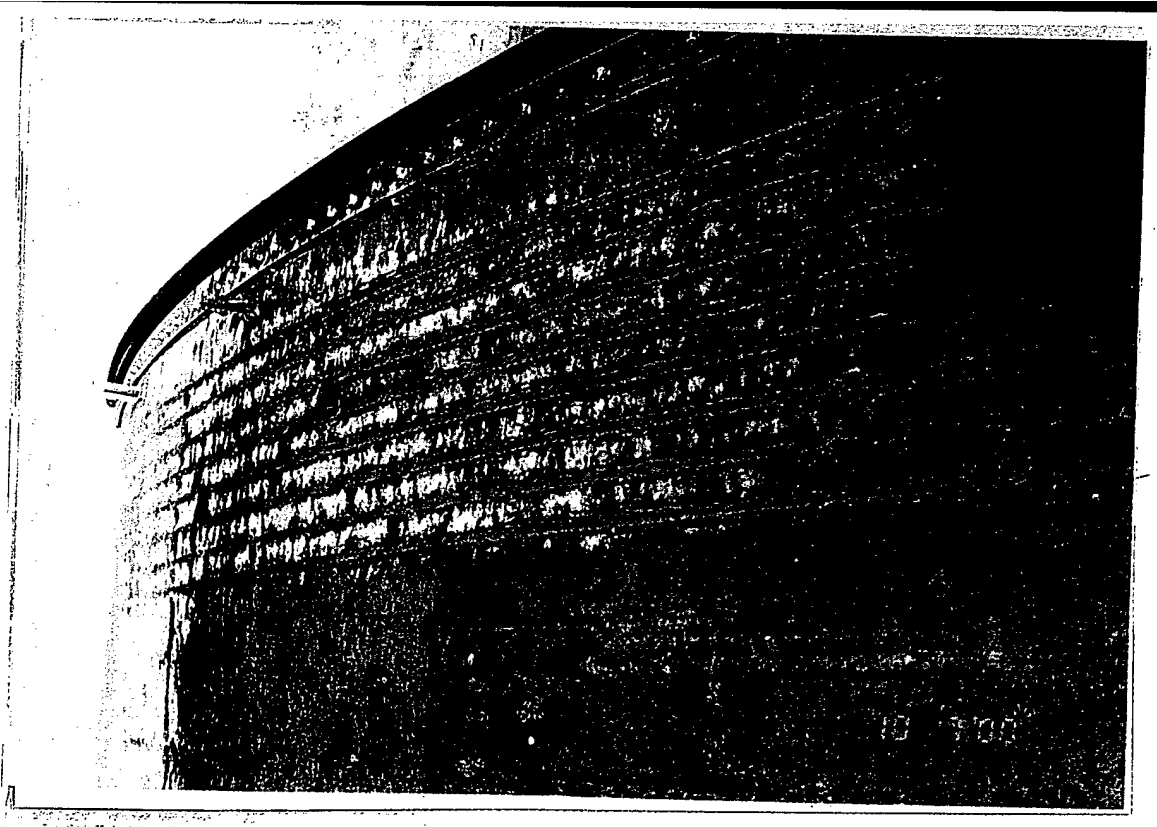
Lower Granite Dam 10/07/00 4-15	**Gate 4** Bottom of downstream side of gate, typical.

Lower Granite Dam 10/07/00 4-16	**Gate 4** Waterblasting of skinplate. Distribution of pitting, typical.



Lower Granite Dam 10/07/00 4-17	**Gate 4** Skin plate pitting, typical.

Lower Granite Dam 10/07/00 4-18	**Gate 4** Skin plate pitting, typical.

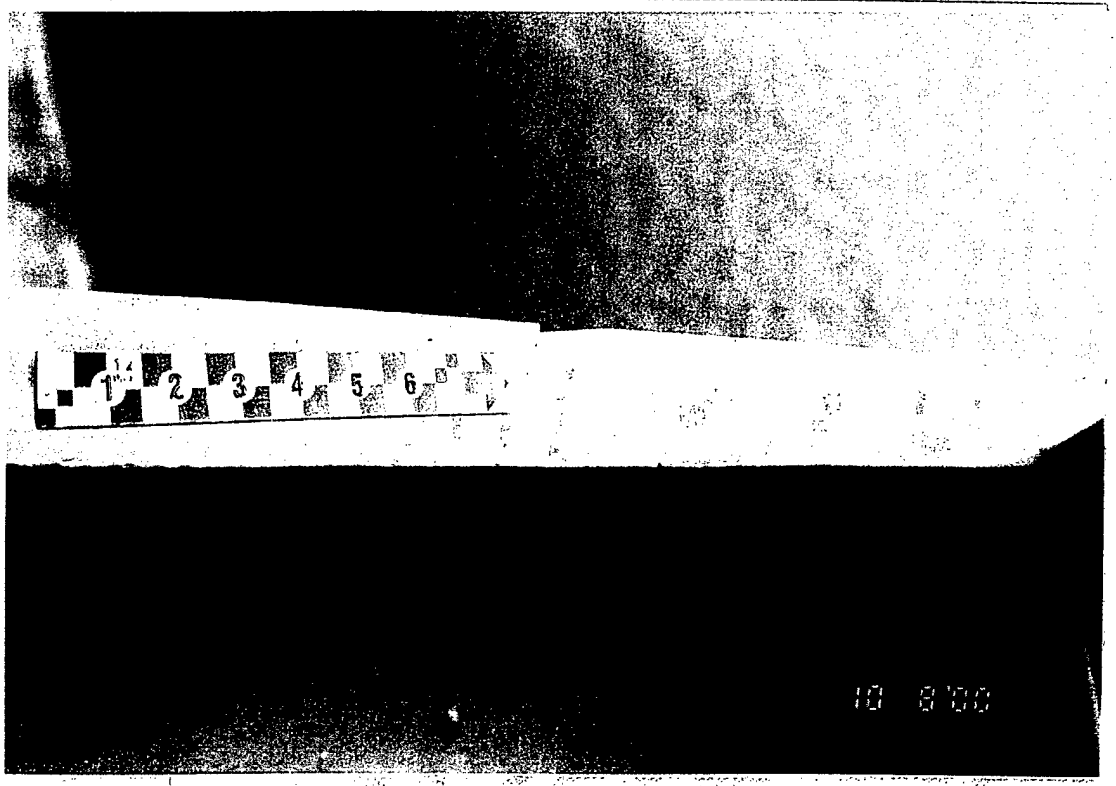


	Lower Granite Dam 10/07/00 4-19	**Gate 4** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

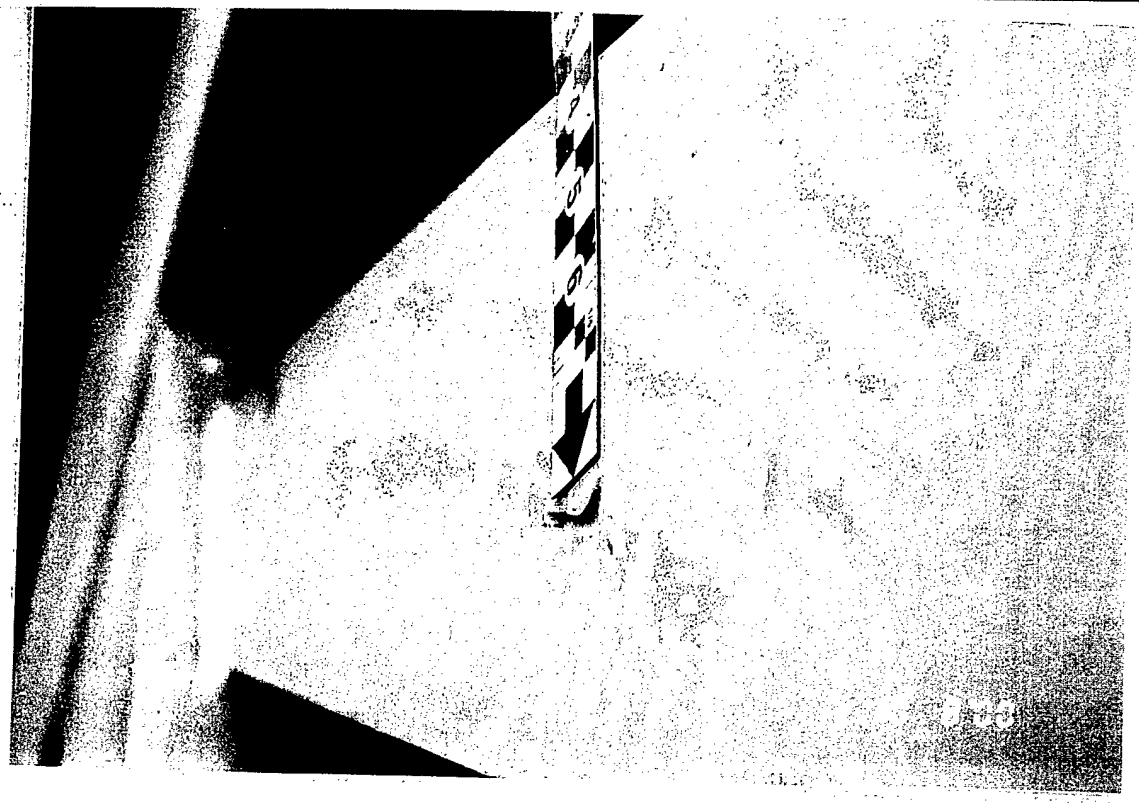
Lower Granite Dam 10/08/00 5-1	**Gate 5** Right frame, upstream end of top radial strut. Delaminated paint and light corrosion on web.

Lower Granite Dam 10/08/00 5-2	**Gate 5** Side seal leak, right side of gate.

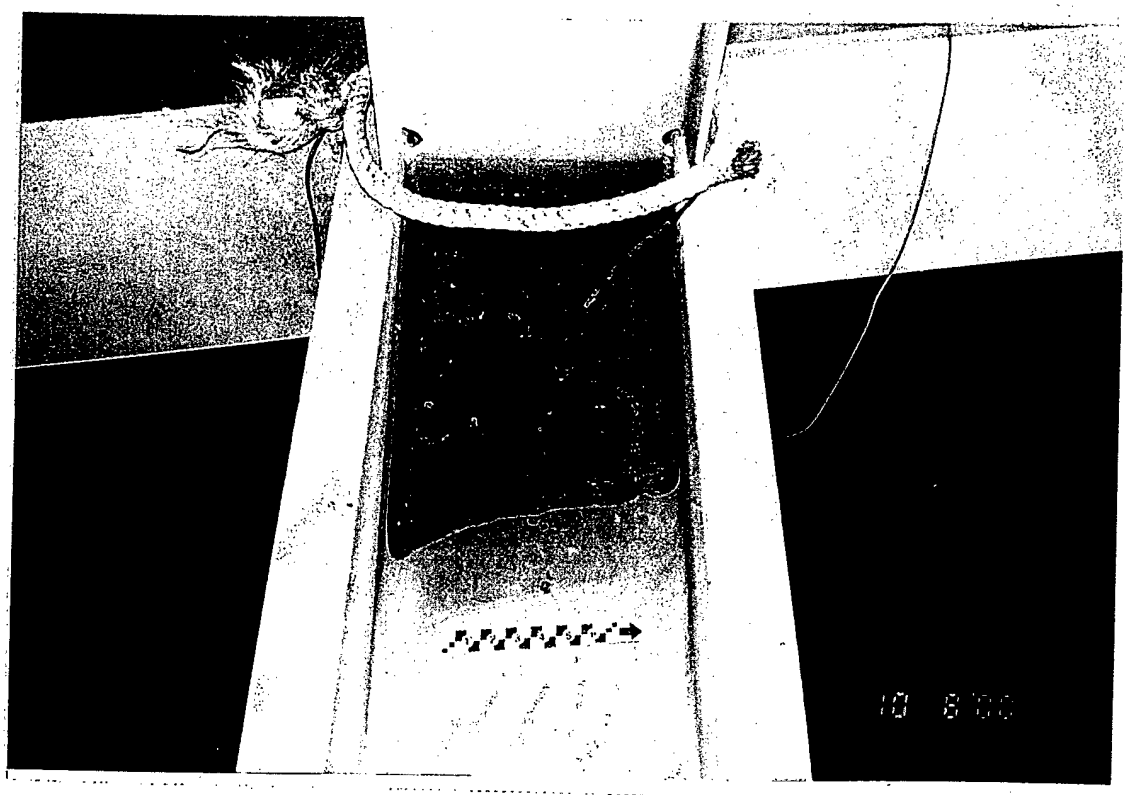
Lower Granite Dam 10/08/00 5-3	**Gate 5** Right end of middle horizontal girder. Light corrosion due to side seal leak.



Lower Granite Dam 10/08/00 5-4	**Gate 5** Right frame, middle radial strut, between braces G and E. Small deformation on top, inside flange.



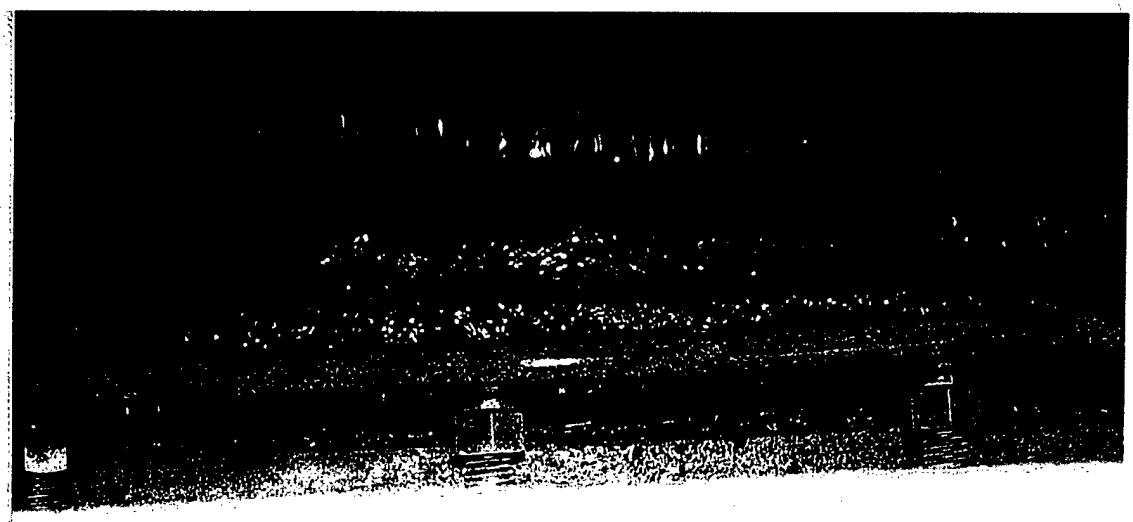
Lower Granite Dam 10/08/00 5-5	**Gate 5** Right frame, Brace H. Small deformation on inside flange.



Lower Granite Dam 10/08/00 5-6	**Gate 5** Right frame, upstream end of bottom radial strut. Ponding due to inadequate drainage.

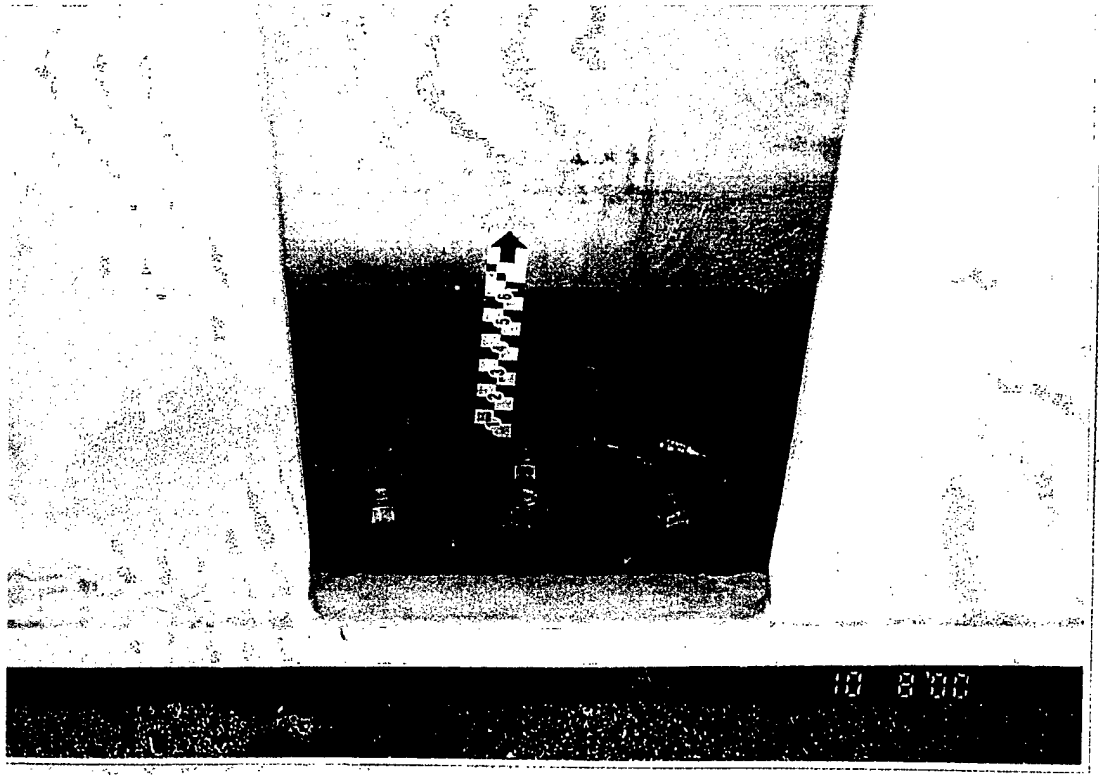
Lower Granite Dam 10/08/00 5-7	**Gate 5** Right end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage

Lower Granite Dam 10/08/00 5-8	**Gate 5** Left end of bottom horizontal girder. Standing water, inadequate drainage between stiffeners.

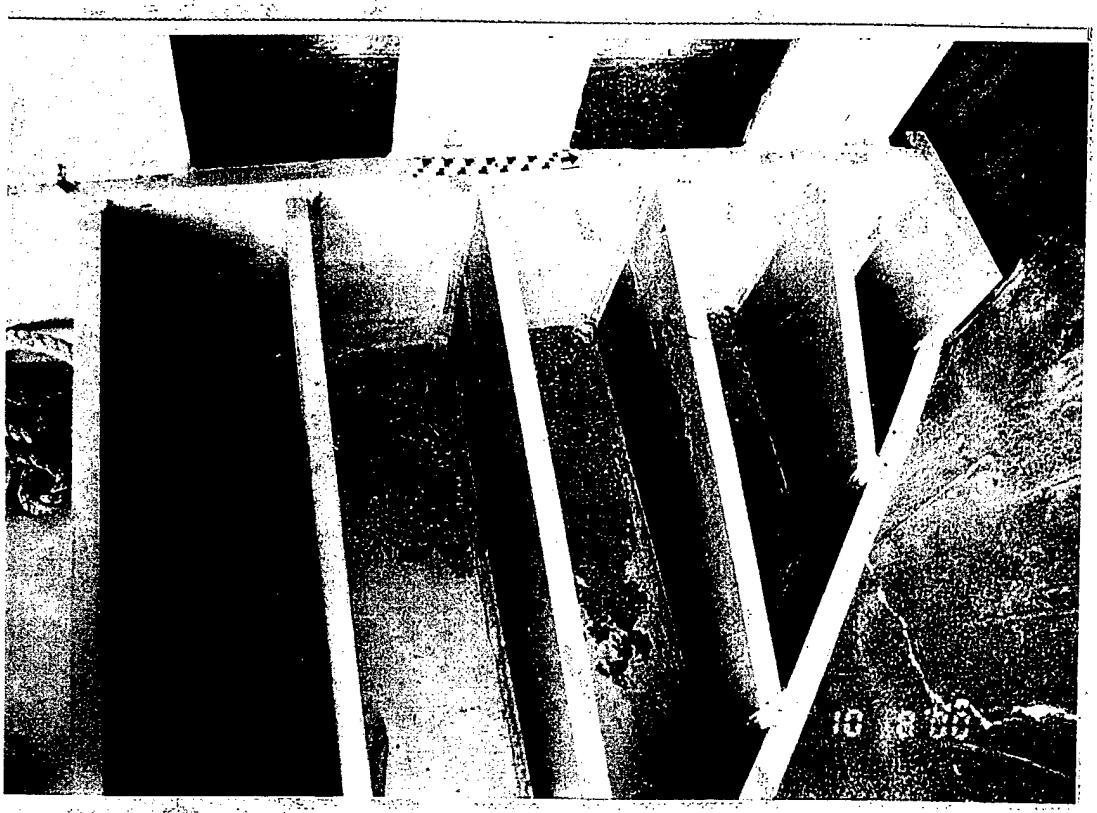


Lower Granite Dam 10/08/00 5-9	**Gate 5** Side seal, typical.

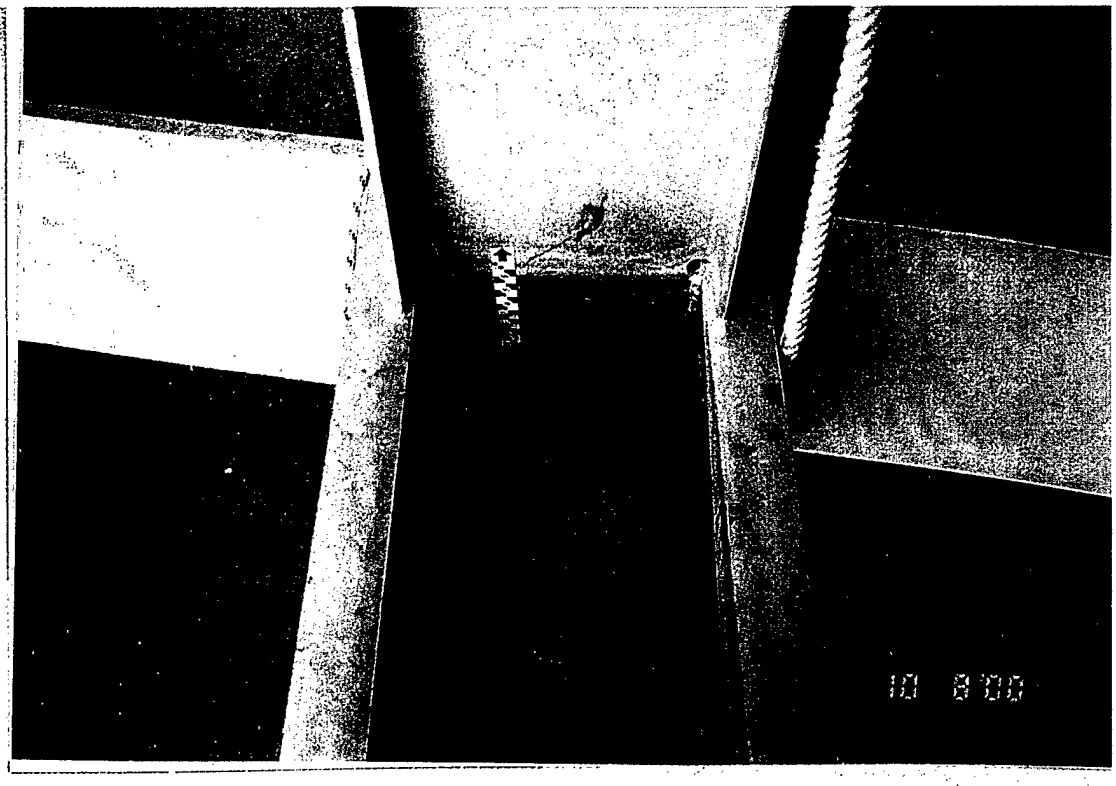
Lower Granite Dam 10/08/00 5-10	**Gate 5** Bottom of gate at spillway, typical.



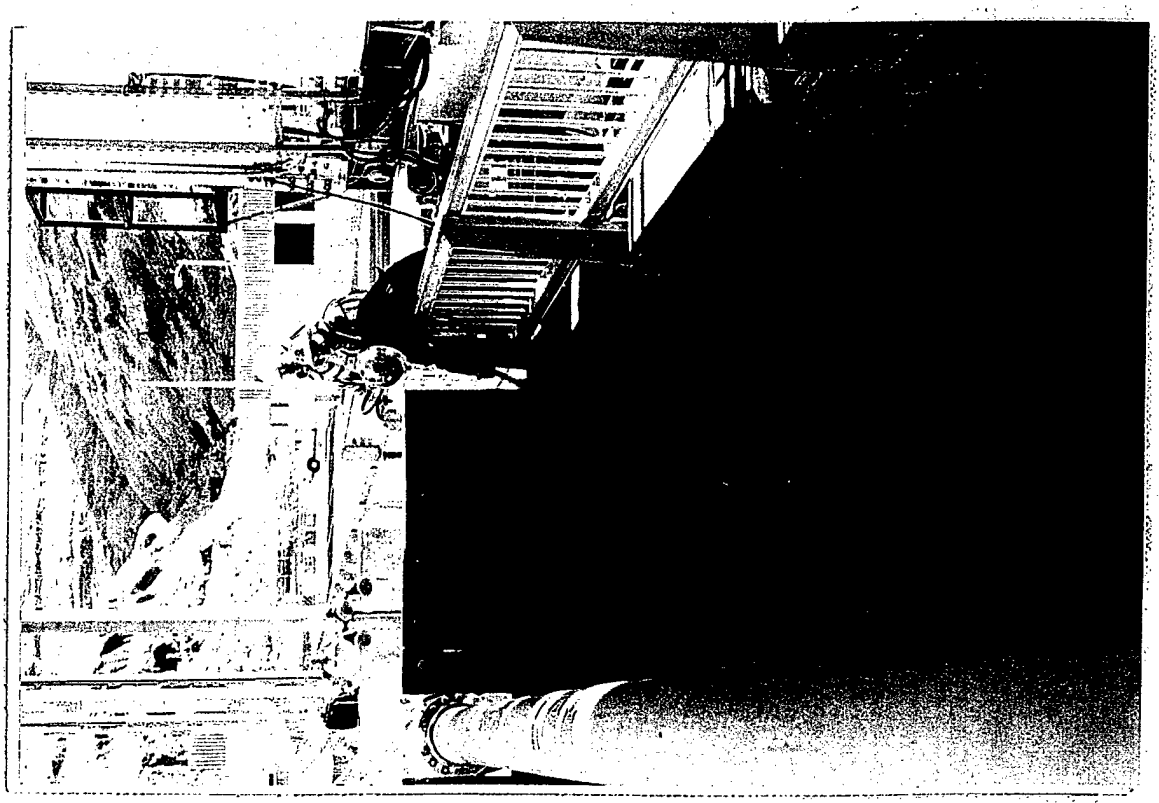
Lower Granite Dam 10/08/00 5-11	**Gate 5** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



Lower Granite Dam 10/08/00 5-12	**Gate 5** Left end of bottom horizontal girder. Evidence of standing water, no drainage between multiple stiffeners.



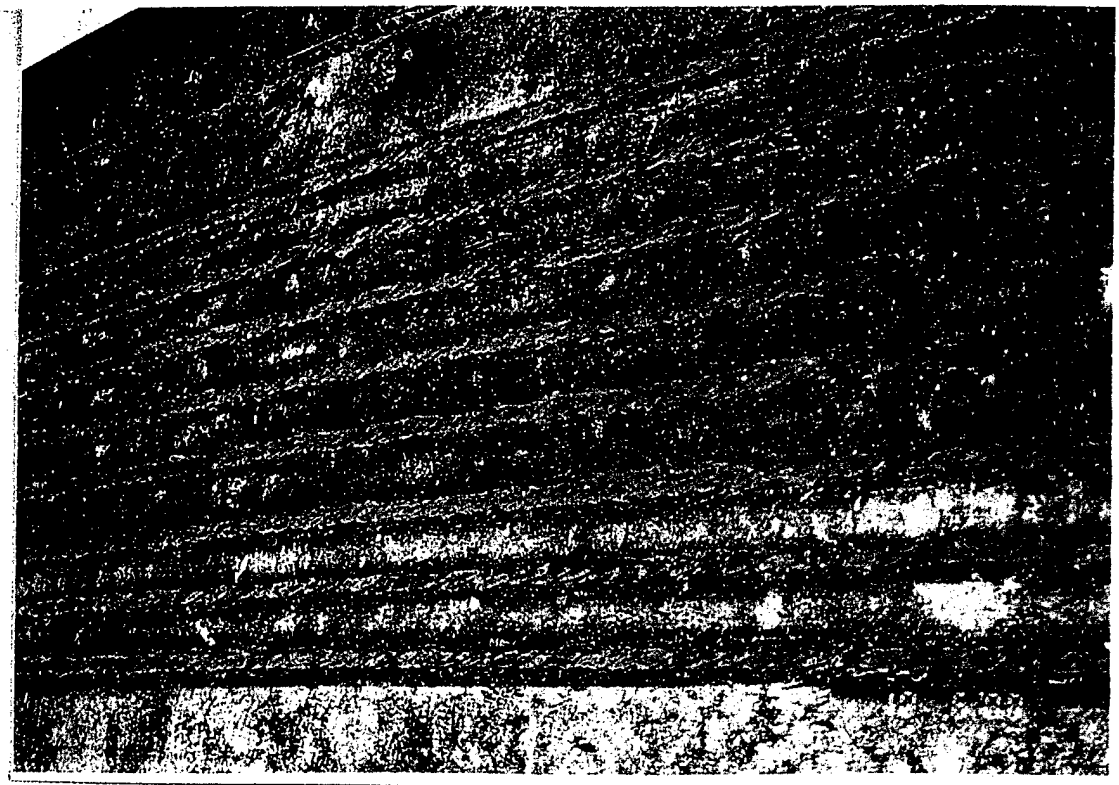
Lower Granite Dam 10/08/00 5-13	**Gate 5** Left frame, upstream end of bottom radial strut. Ponding due to inadequate drainage.



Lower Granite Dam 10/06/00 5-14	**Gate 5** Waterblasting upstream surface of skin plate.

Lower Granite Dam 10/06/00 5-15	**Gate 5** Skin plate pitting, typical.

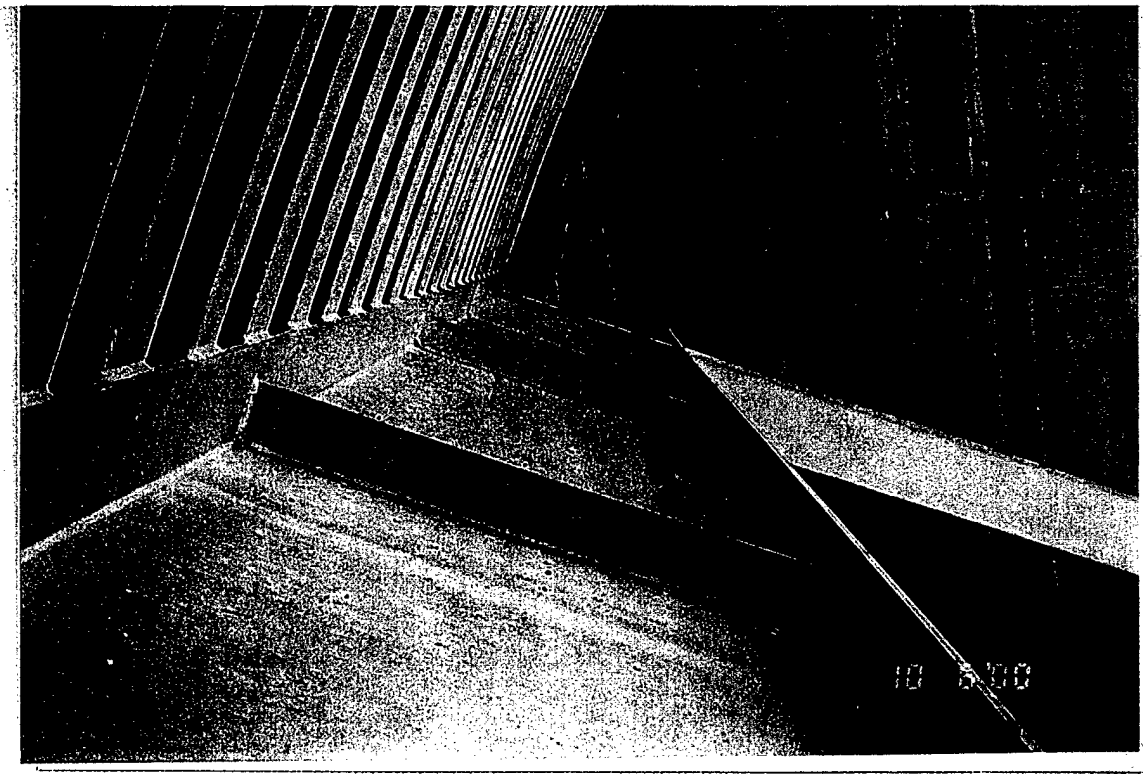
Lower Granite Dam 10/06/00 5-16	**Gate 5** Skin plate pitting, typical.



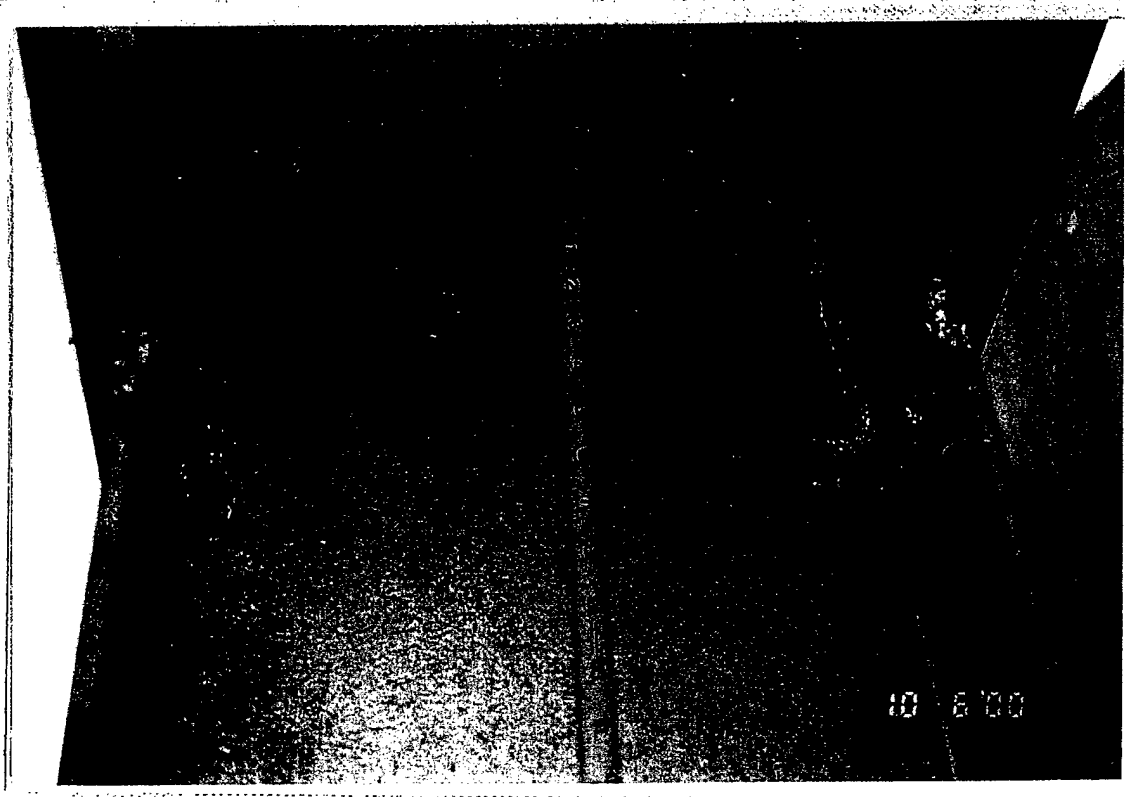
Lower Granite Dam 10/06/00 5-17	**Gate 5** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

Lower Granite Dam 10/06/00 5-18	**Gate 5** Skin plate pitting apparently associated with scratches in protective coating.

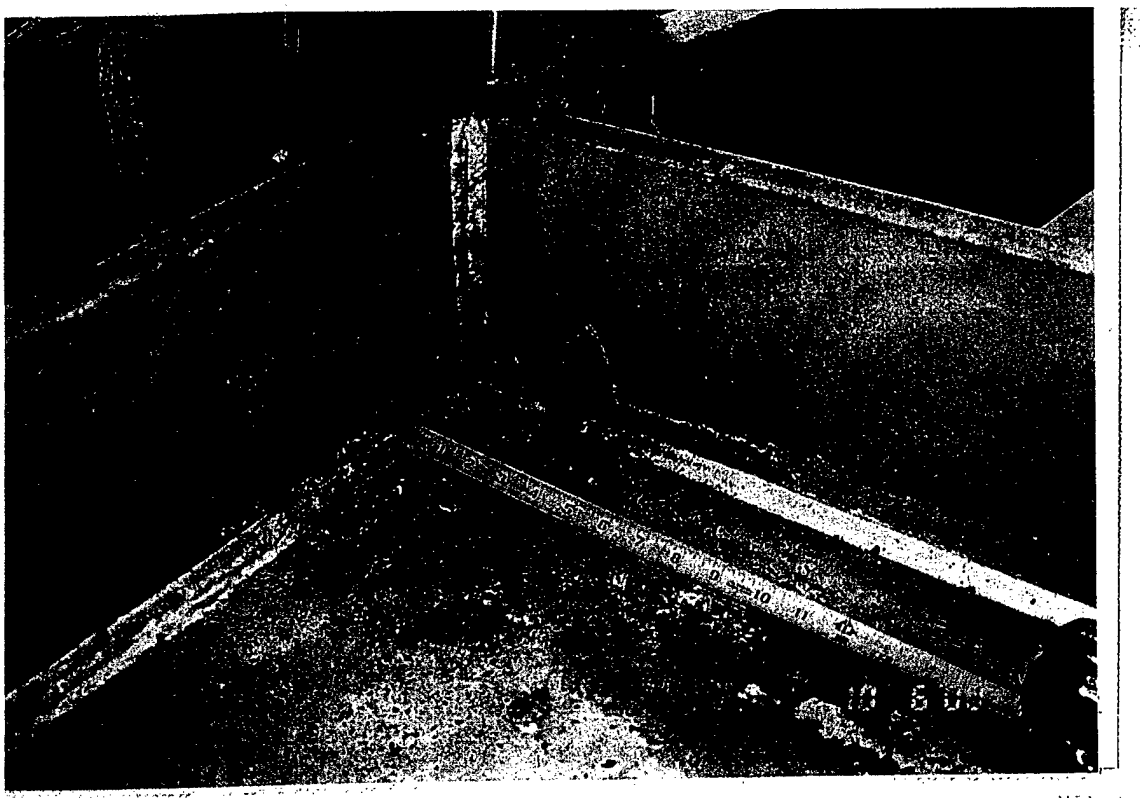
Lower Granite Dam 10/06/00 5-19	**Gate 5** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



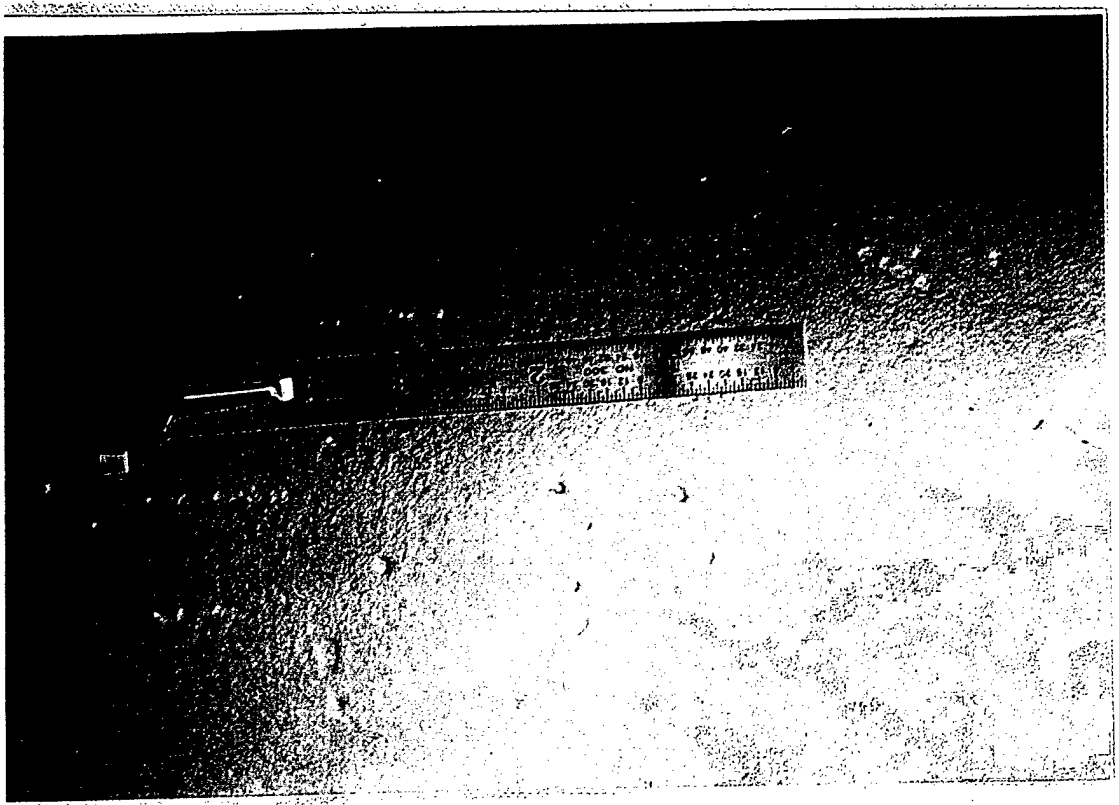
Lower Granite Dam 10/06/00 6-1	**Gate 6** Top horizontal girder looking toward left frame, typical



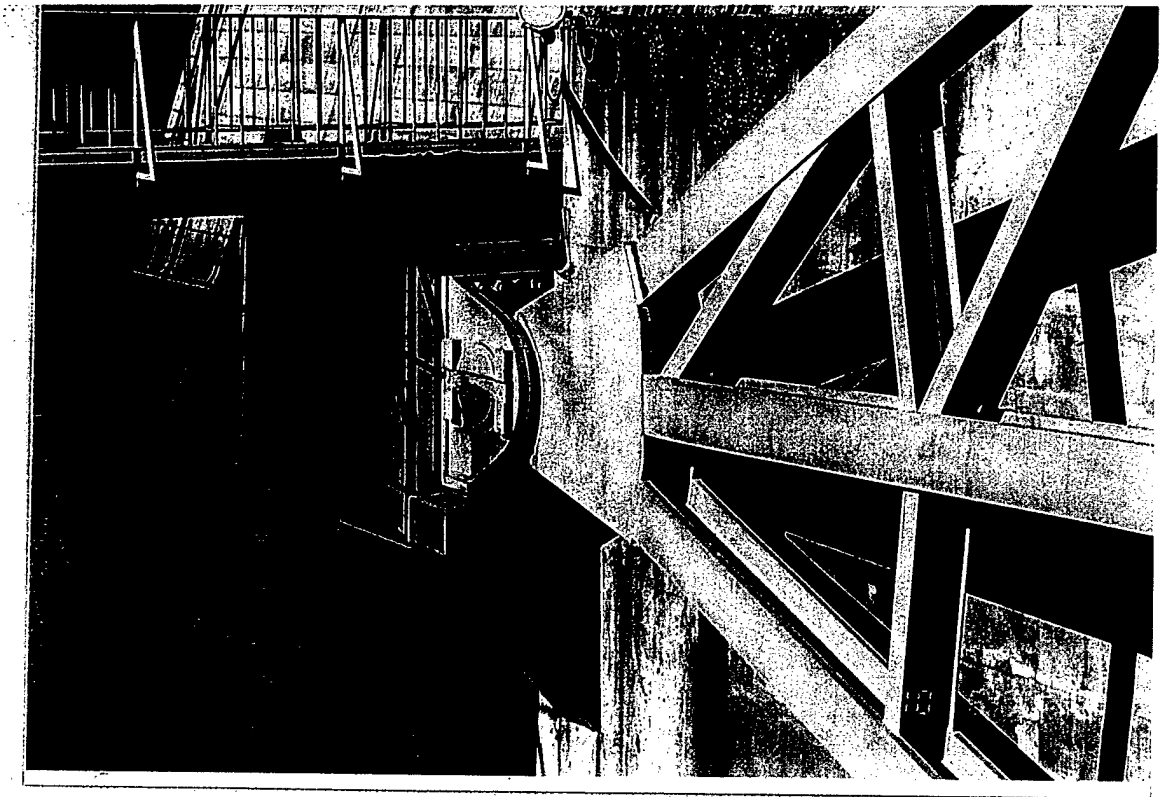
Lower Granite Dam 10/06/00 6-2	**Gate 6** Right frame, Brace C. Coping in brace at weld to top radial strut.



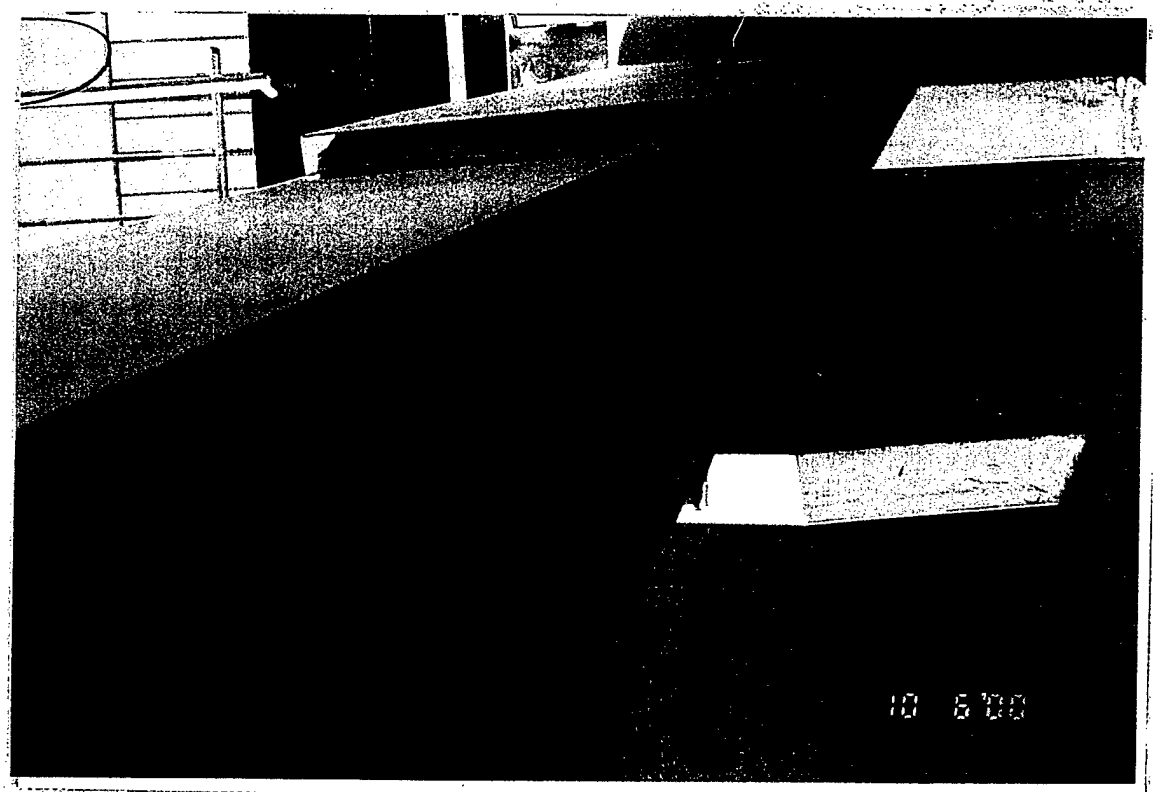
Lower Granite Dam 10/06/00 6-3	**Gate 6** Middle horizontal girder, downstream flange at connection to radial strut. Light corrosion on girder flange.



Lower Granite Dam 10/06/00 6-4	**Gate 6** Downstream surface of skin plate, approx 5' above middle horizontal girder, near left frame. Small surface pitting.

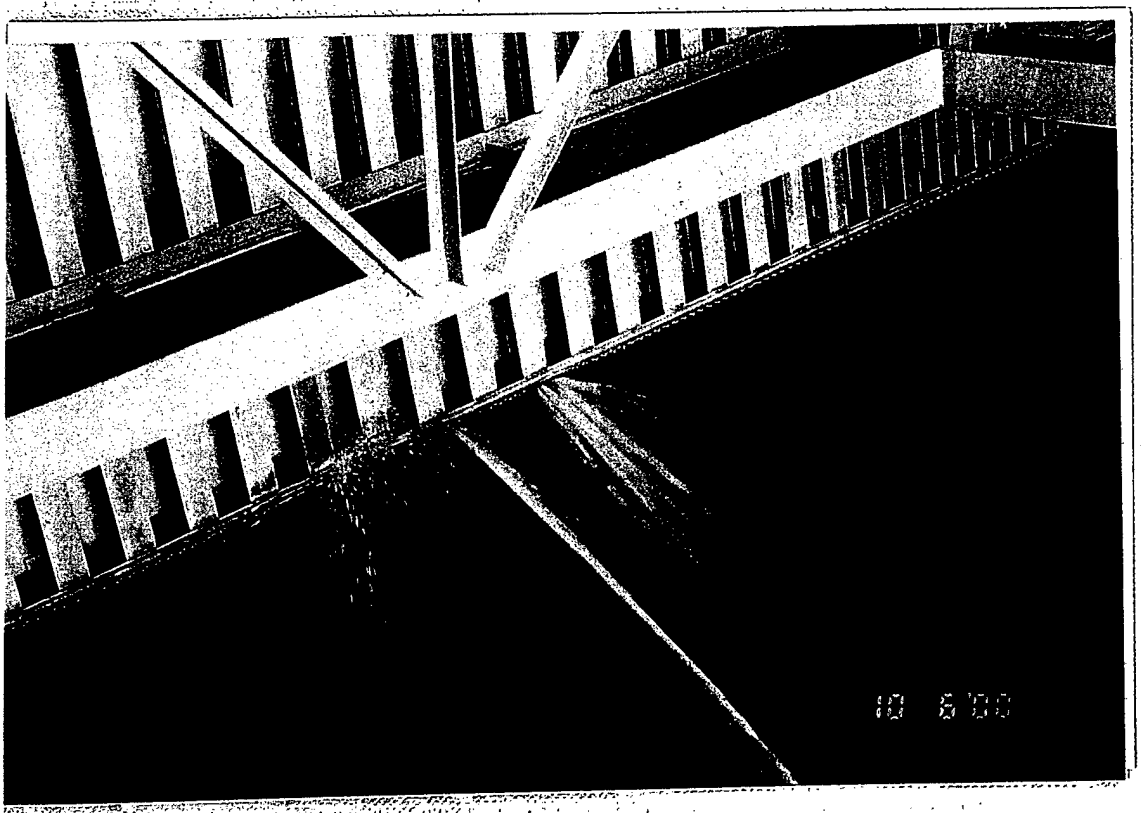


Lower Granite Dam 10/06/00 6-5	**Gate 6** Right frame and trunnion, typical.

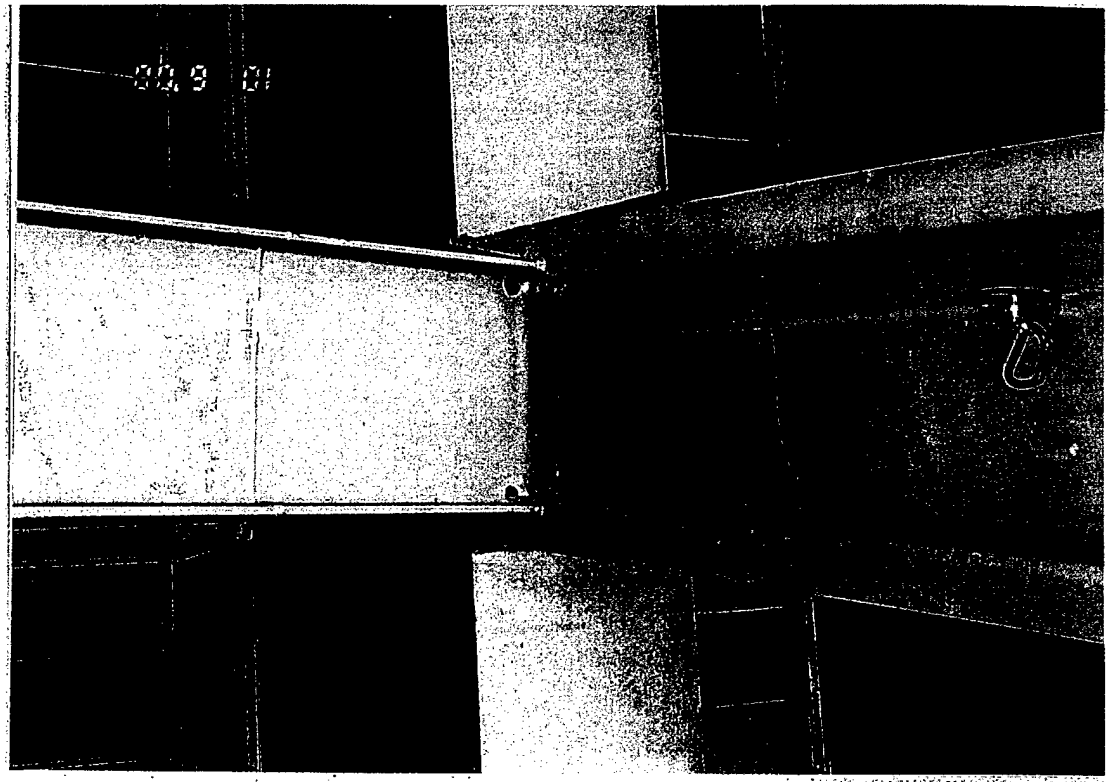


Lower Granite Dam 10/06/00 6-6	**Gate 6** Left frame, inside trunnion closure plate, typical.

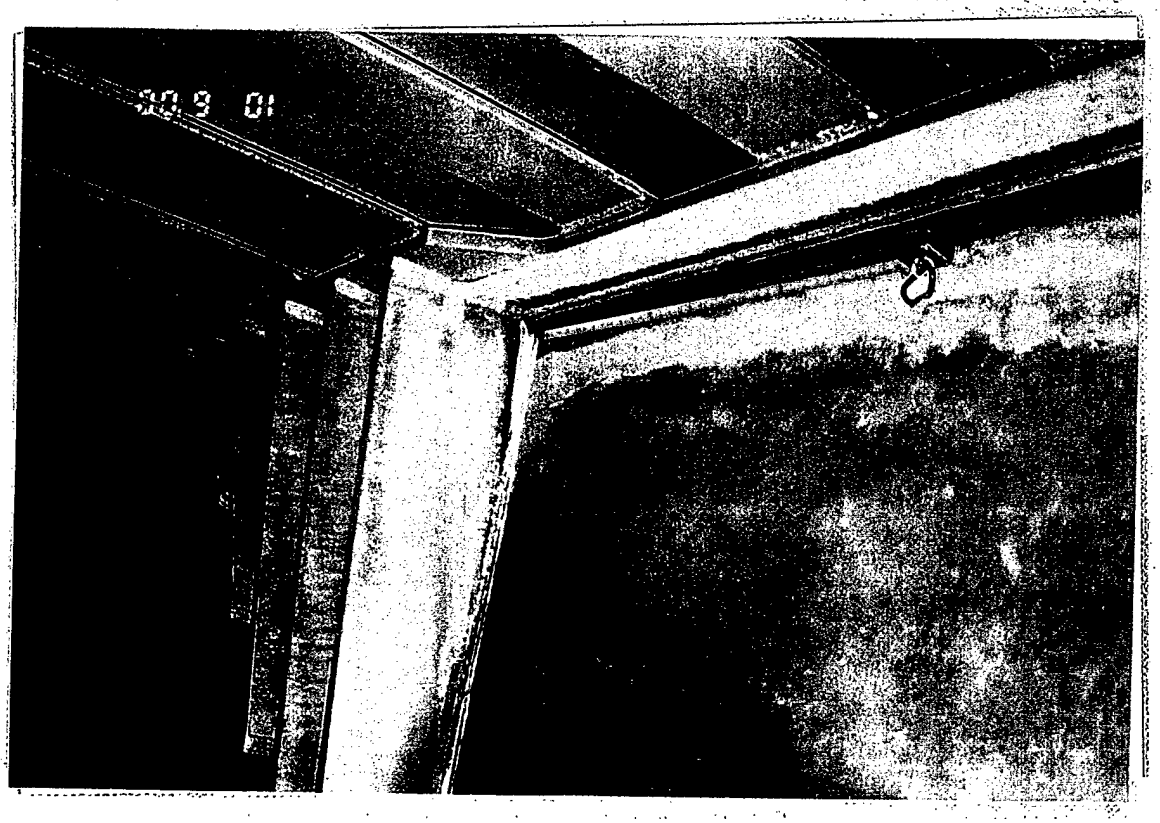
	Lower Granite Dam 10/06/00 6-7	**Gate 6** Outside of right trunnion and yoke. Note: Lubrication lines.



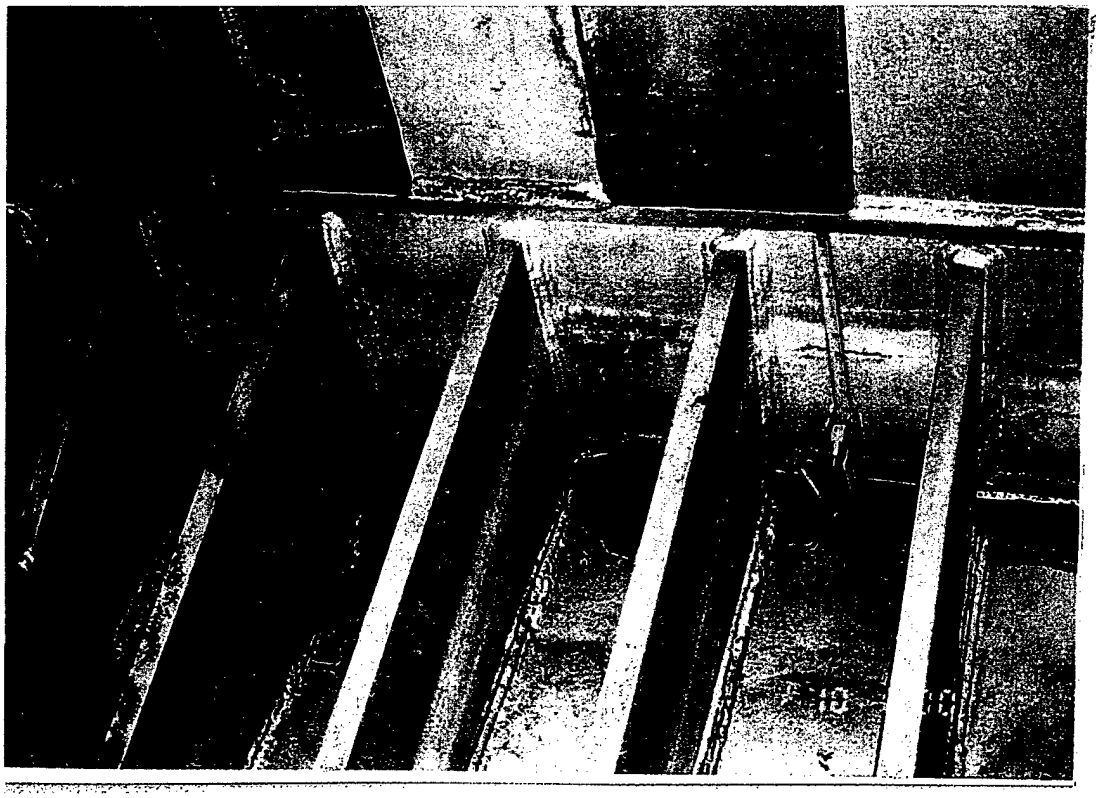
	Lower Granite Dam 10/06/00 6-8	**Gate 6** Leak at center construction joint in spillway monolith.



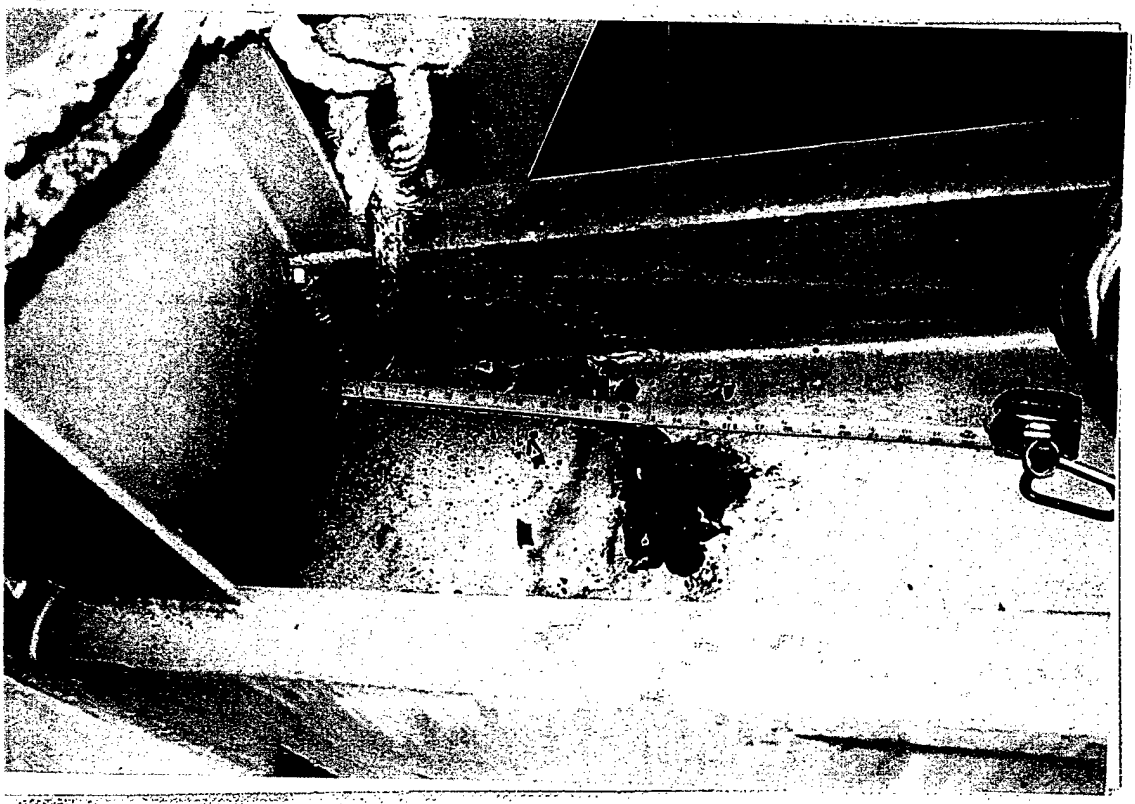
Lower Granite Dam 10/06/00 6-9	**Gate 6** Right frame, bottom radial strut. Standing water at upstream end of strut due to inadequate drainage.



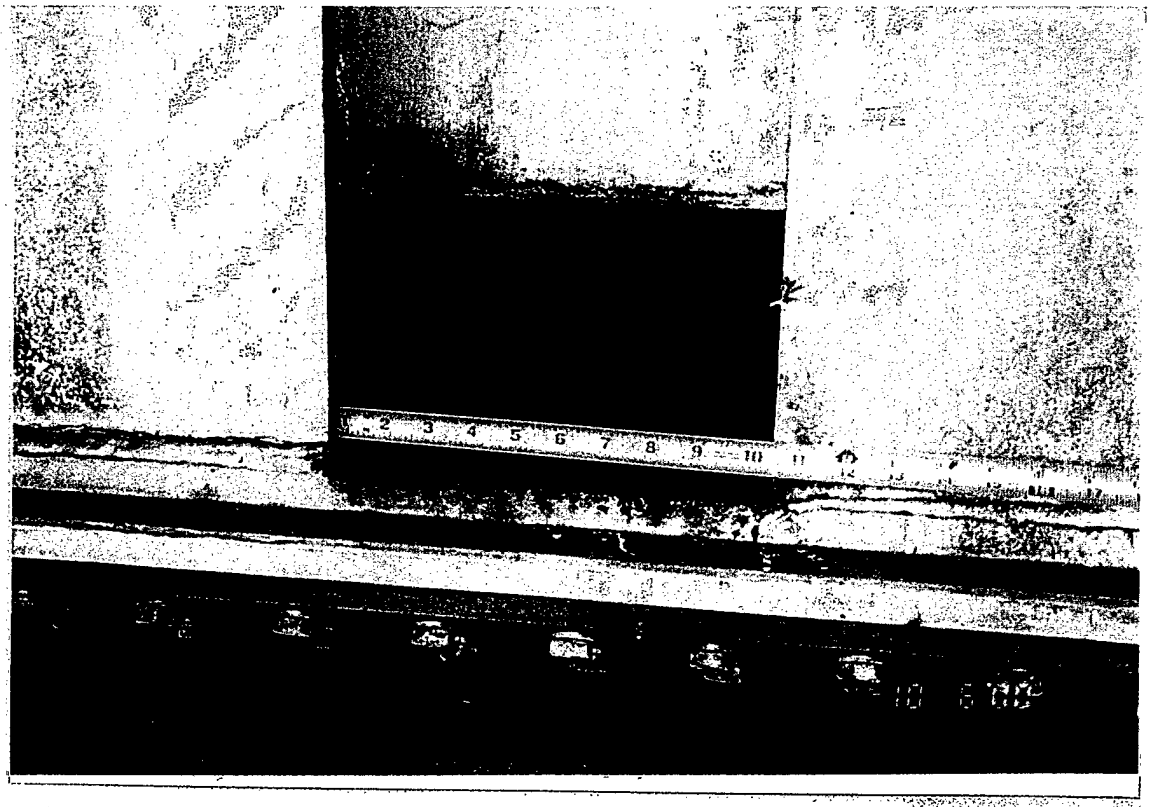
Lower Granite Dam 10/06/00 6-10	**Gate 6** Right end of bottom horizontal girder, standing water at upstream side of girder web and flange.



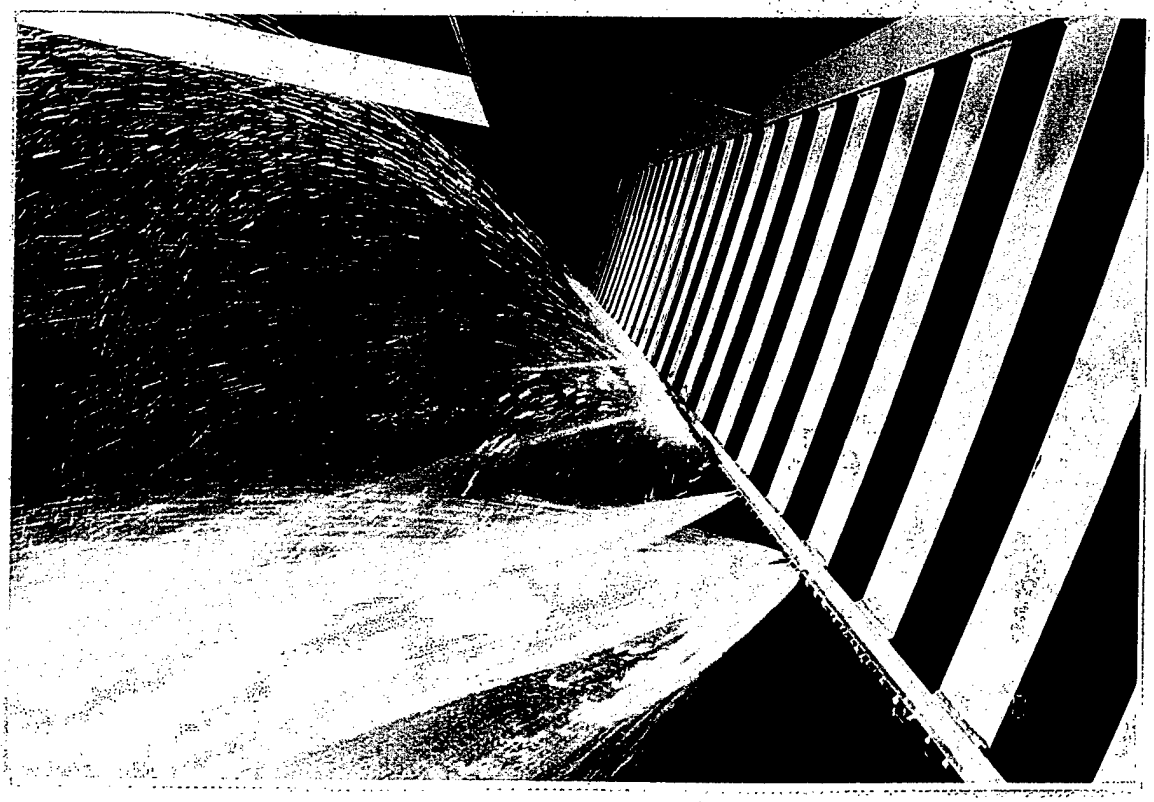
Lower Granite Dam 10/06/00 6-11	**Gate 6** Right end of bottom horiz. girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage



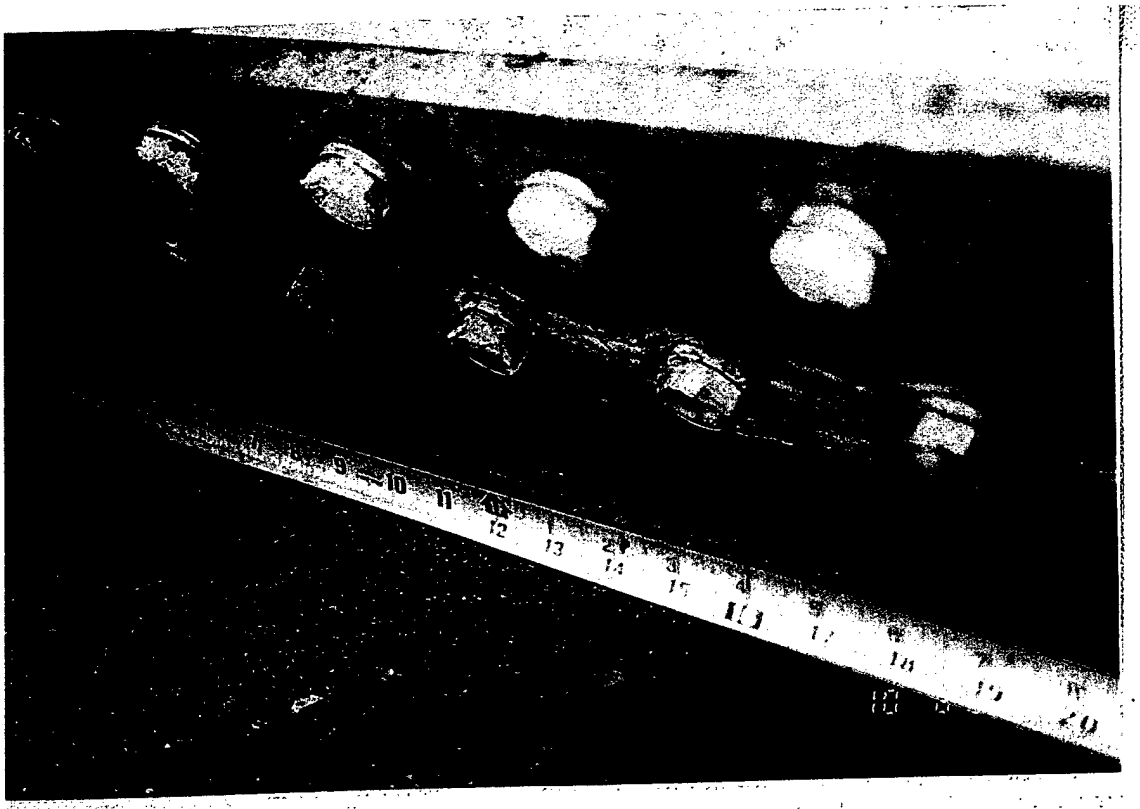
Lower Granite Dam 10/06/00 6-12	**Gate 6** Left frame, bottom radial strut. Evidence of standing water at upstream end of strut due to inadequate drainage. Light corrosion.



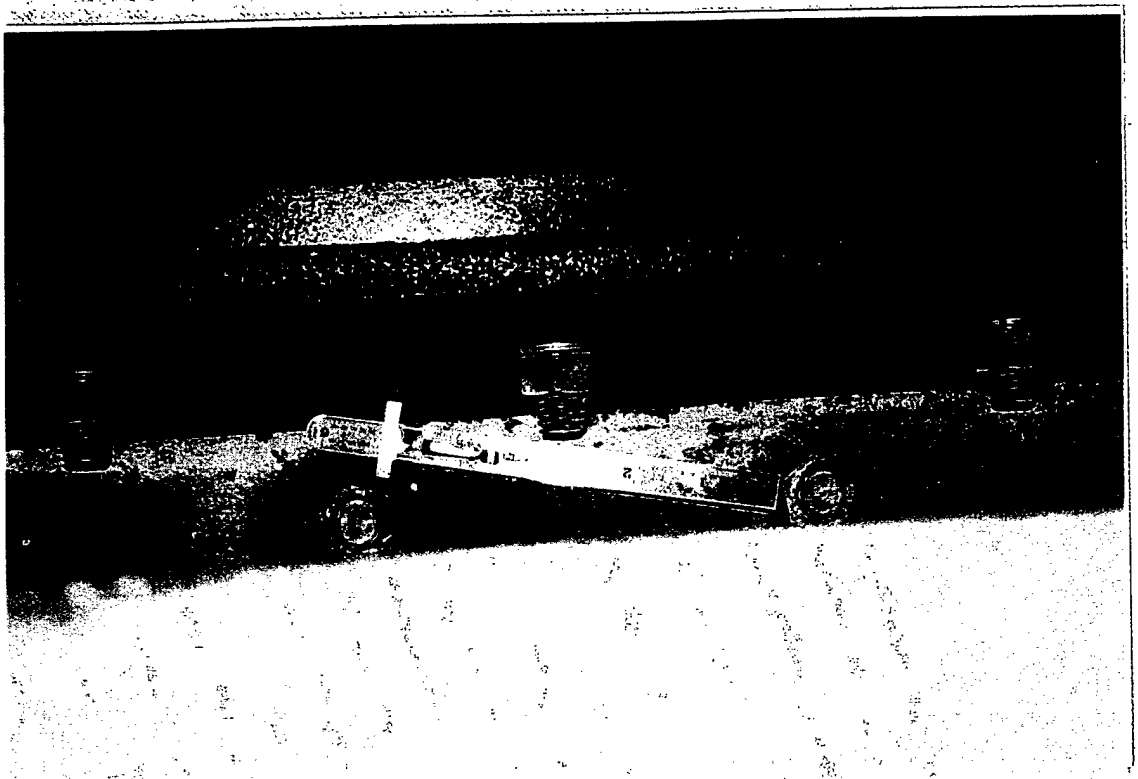
Lower Granite Dam 10/06/00 6-13	**Gate 6** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



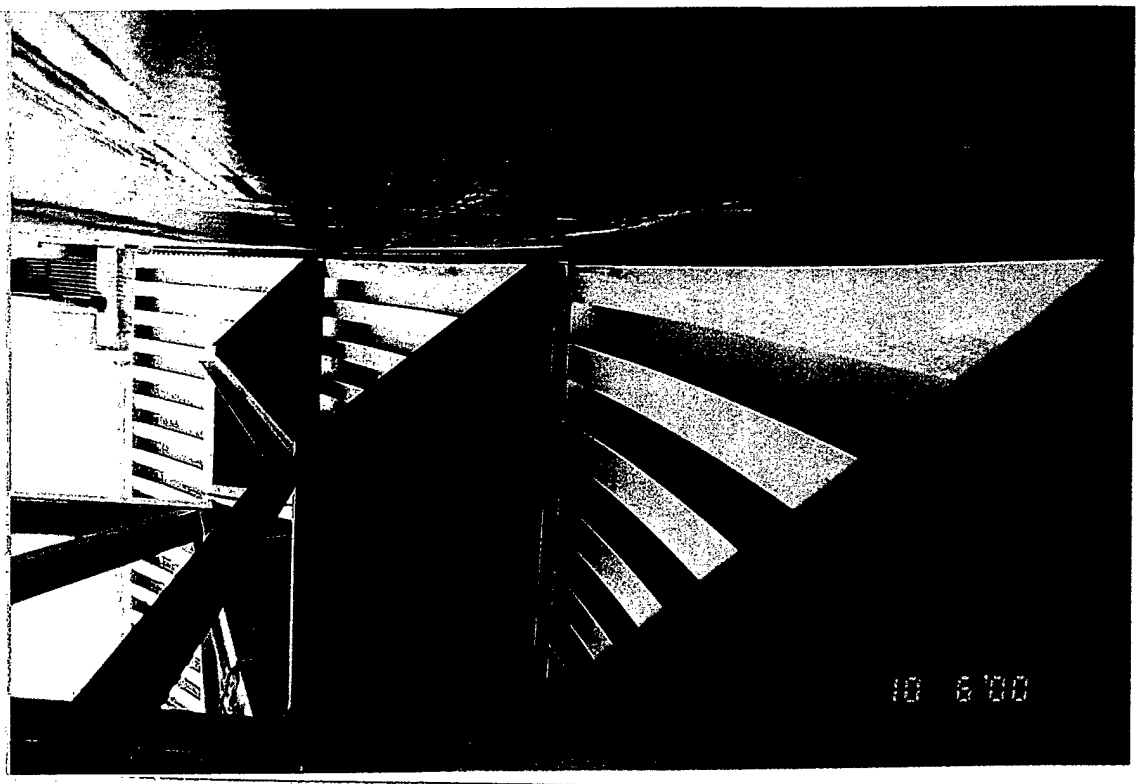
Lower Granite Dam 10/06/00 6-14	**Gate 6** Leak at center construction joint in spillway monolith, additional bottom seal leaks.



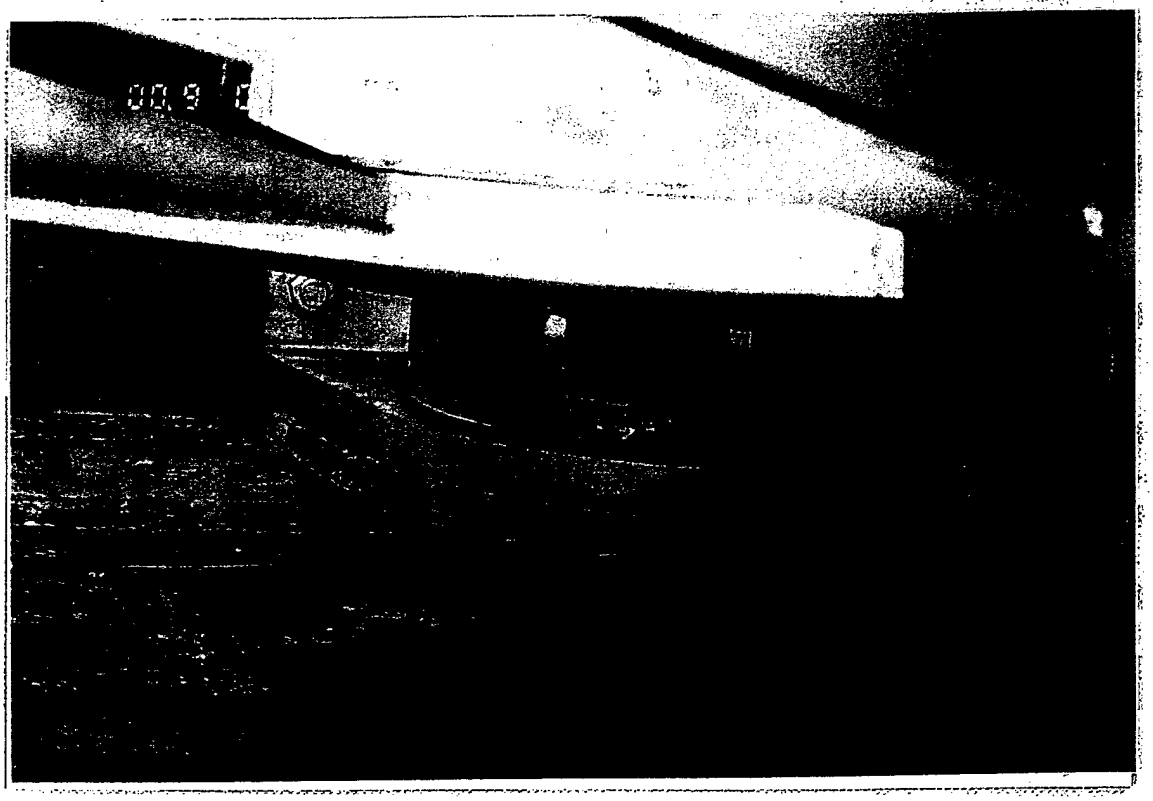
Lower Granite Dam 10/06/00 6-15	**Gate 6** Bottom seal keeper plate, looking upstream, typical.



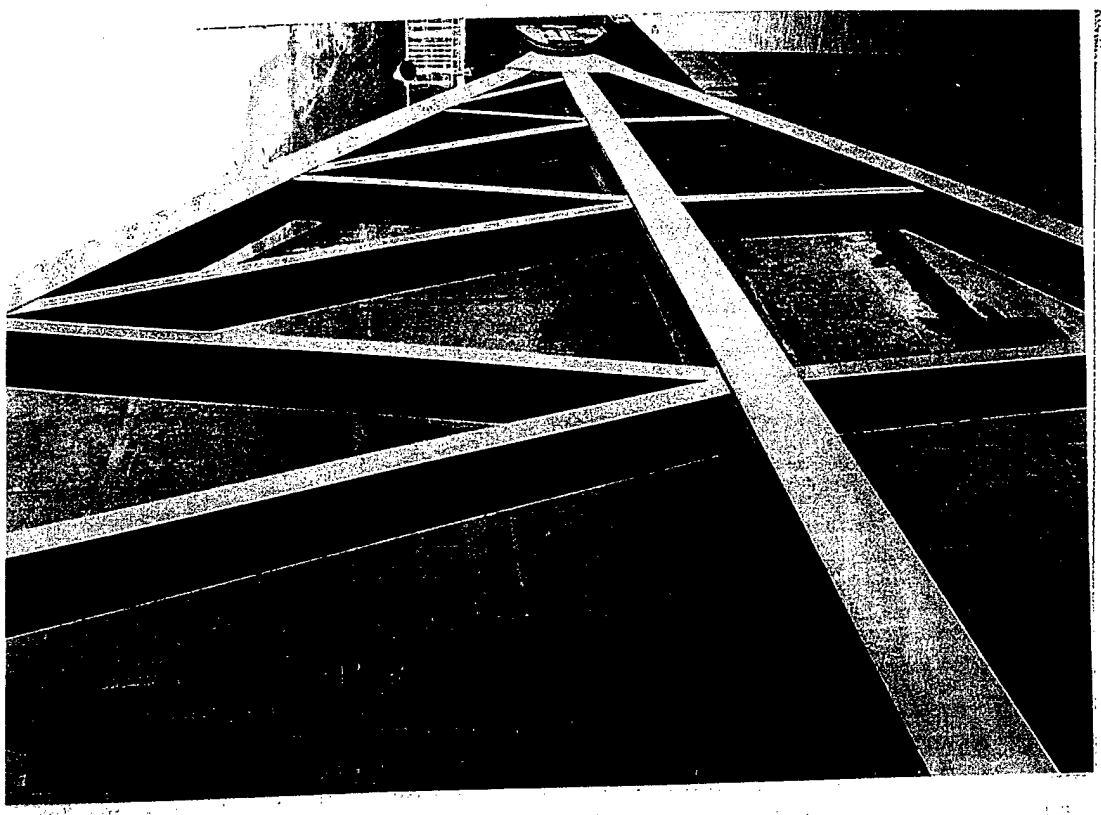
Lower Granite Dam 10/06/00 6-16	**Gate 6** Side seal, typical.



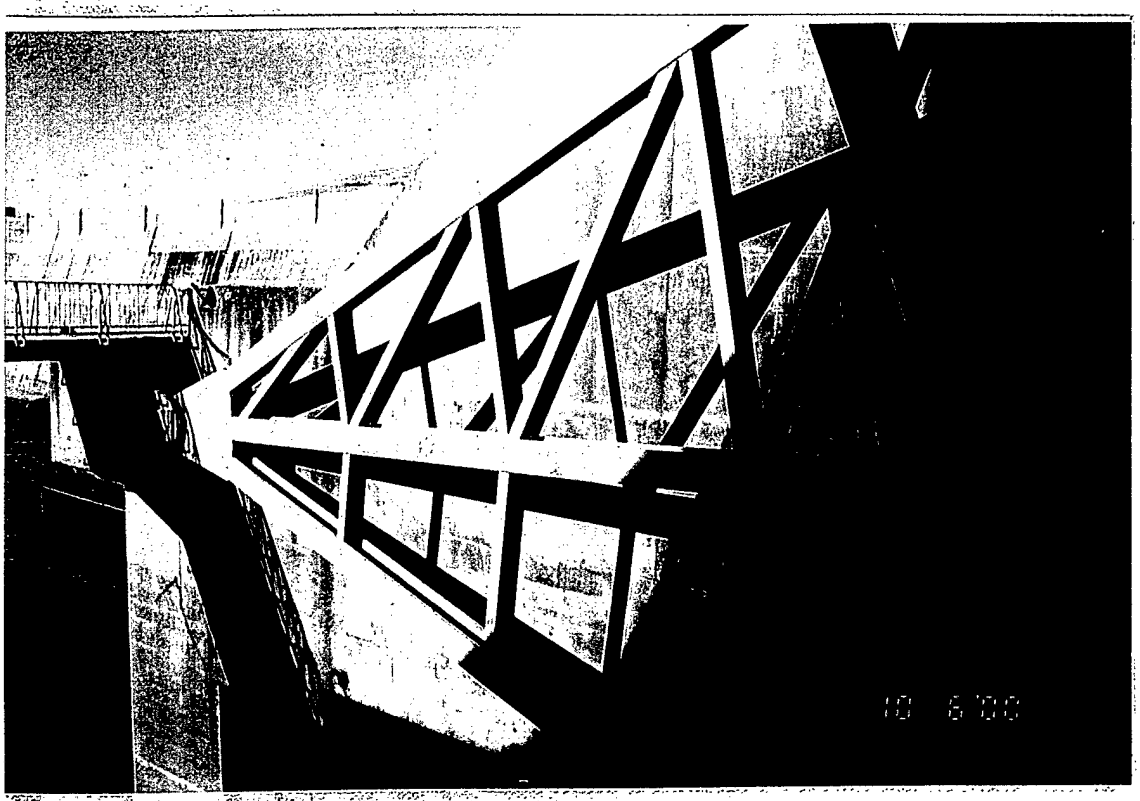
Lower Granite Dam 10/06/00 6-17	**Gate 6** Bottom of left frame horizontal girders, typical.



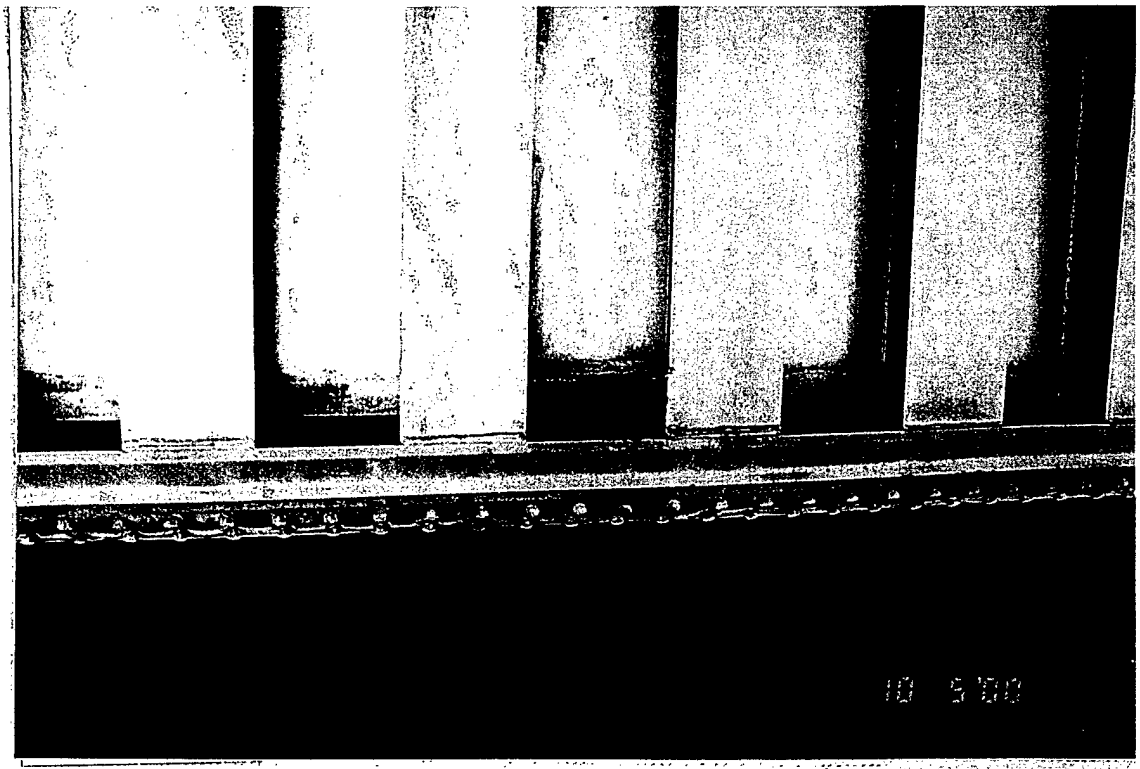
Lower Granite Dam 10/06/00 6-18	**Gate 6** Outside of left trunnion and yoke. Note: Lubrication lines and expelled lubrication between trunnion and yoke.



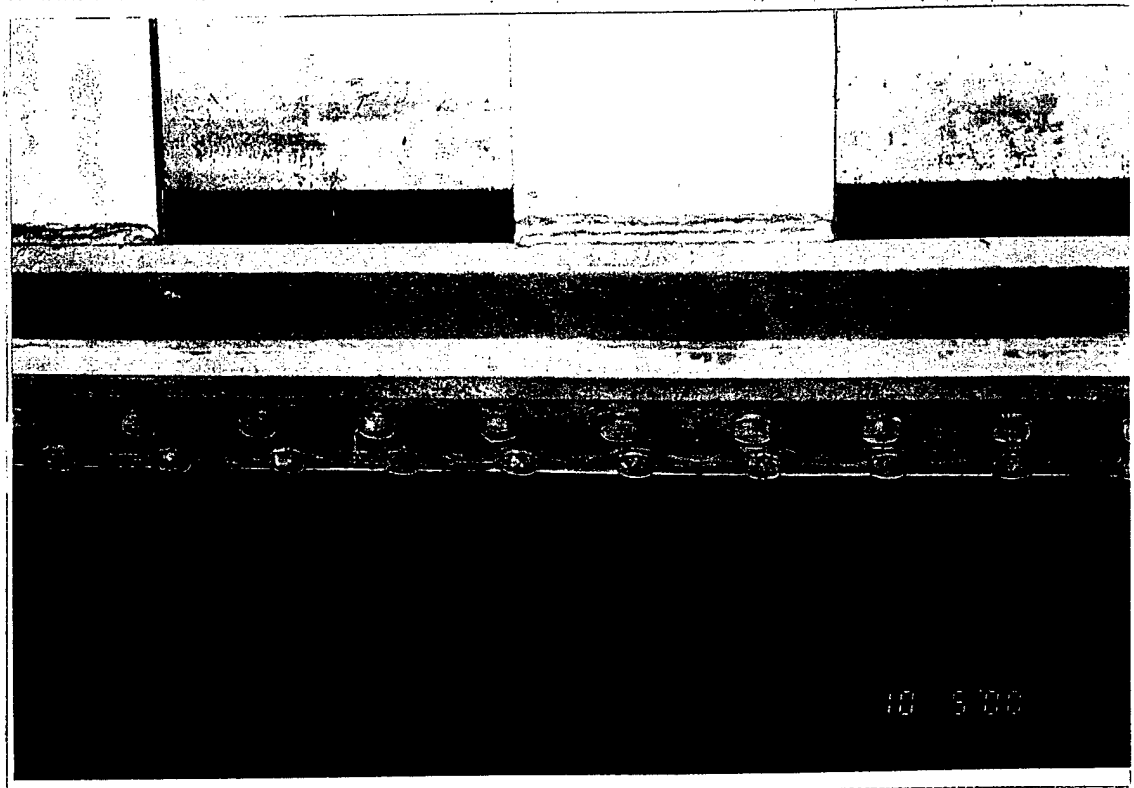
Lower Granite Dam 10/06/00 6-19	**Gate 6** Left frame, typical.



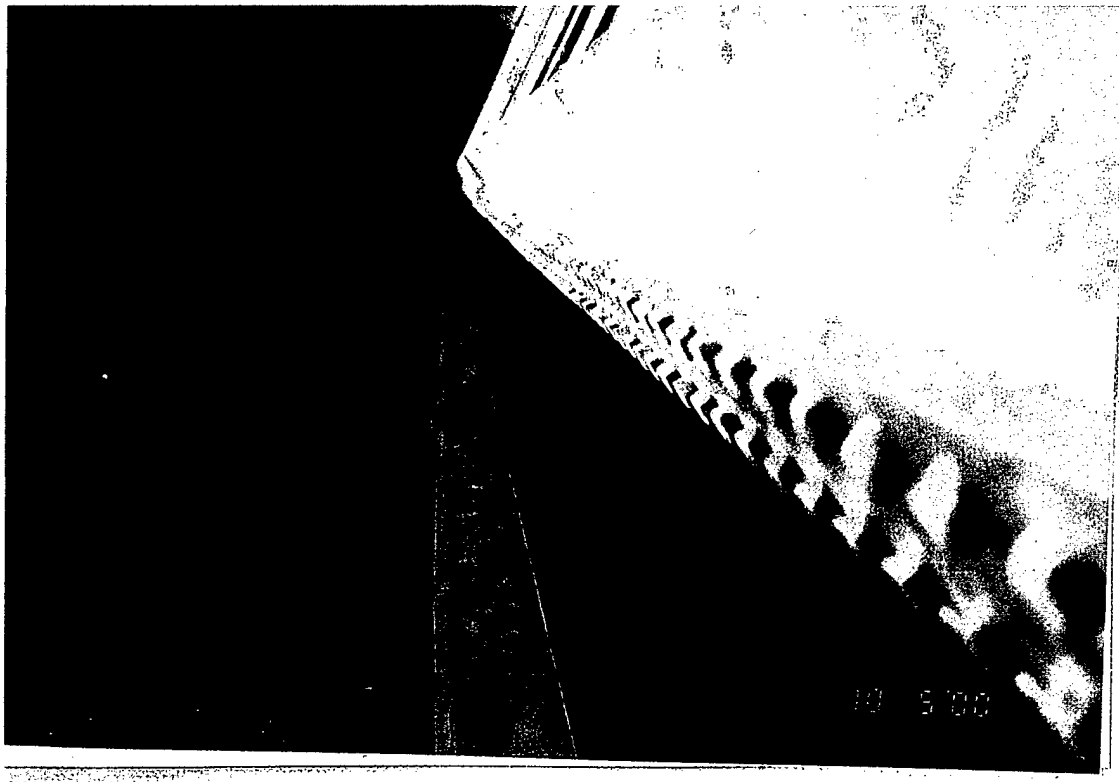
Lower Granite Dam 10/06/00 6-20	**Gate 6** Right frame, typical.



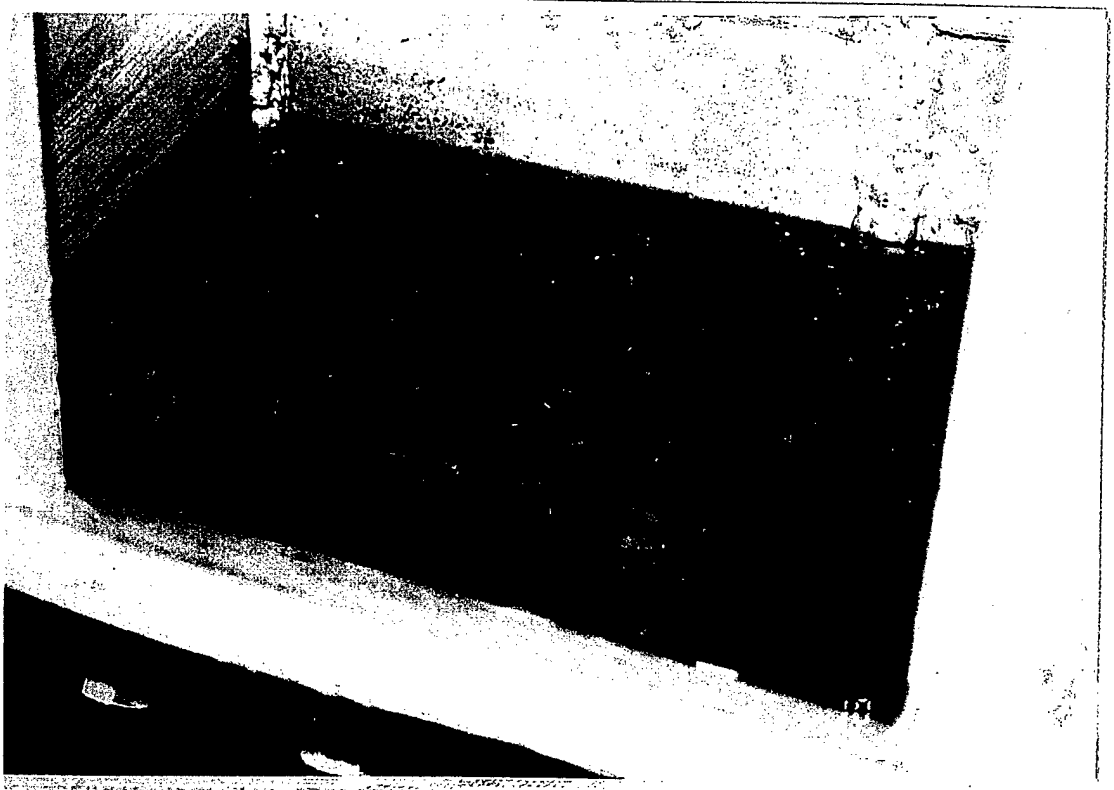
Lower Granite Dam 10/05/00 6-21	**Gate 6** Bottom seal closure plate and skin plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



Lower Granite Dam 10/05/00 6-22	**Gate 6** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.

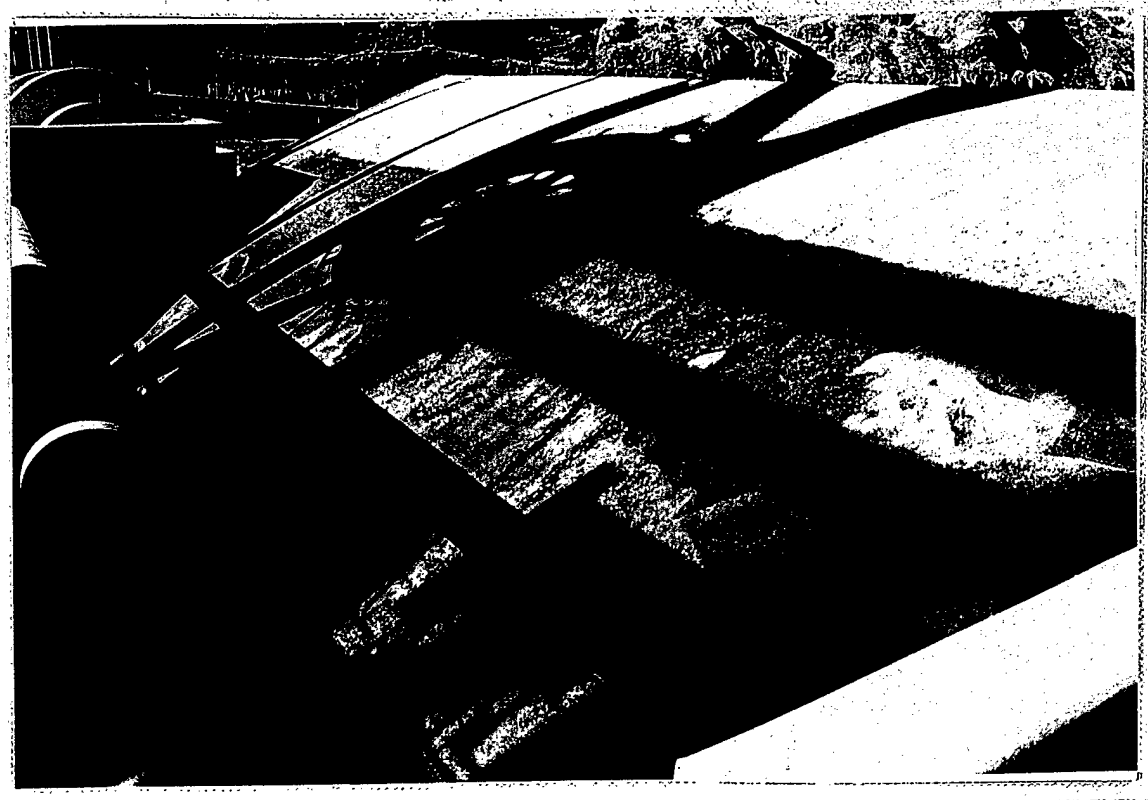


Lower Granite Dam 10/05/00 6-23	**Gate 6** Embedded bottom seal plate, typical.



Lower Granite Dam 10/05/00 6-24	**Gate 6** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, Note: good condition of stainless steel bolts and nuts.

Lower Granite Dam 10/05/00 6-25	**Gate 6** Skin plate pitting, typical.



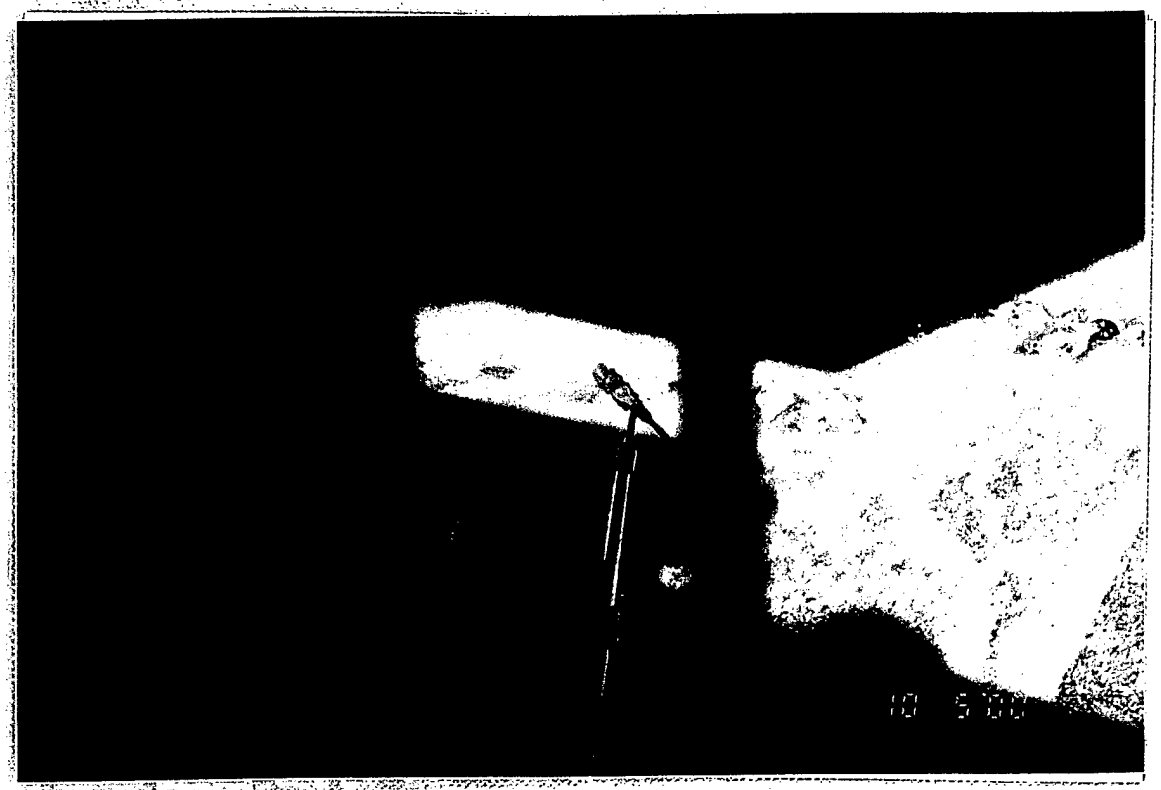
Lower Granite Dam 10/05/00	**Gate 6** Typical skin plate condition.

Lower Granite Dam

Gate 6
Waterblasting of skin plate, typical.

10/05/00

6-27



Lower Granite Dam

Gate 6
Waterblasting of skin plate, typical.

10/05/00

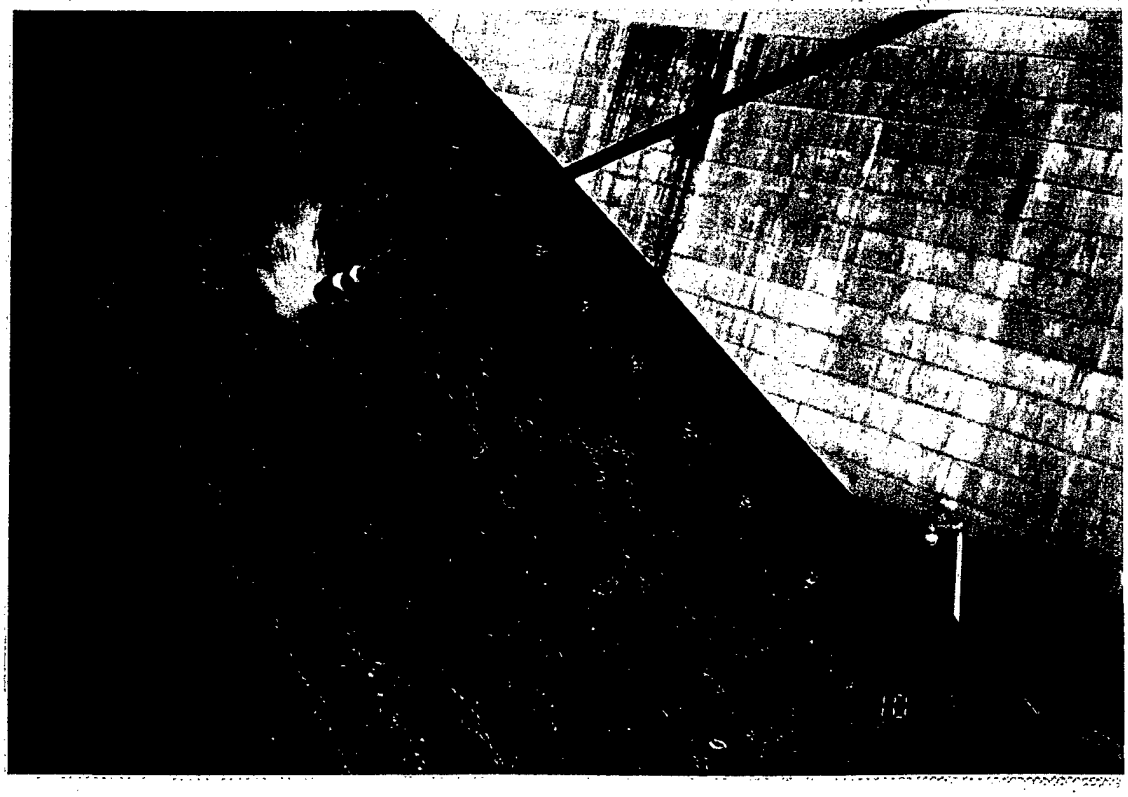
6-28

Lower Granite Dam

10/05/00

6-29

Gate 6
Skin plate pitting, typical.

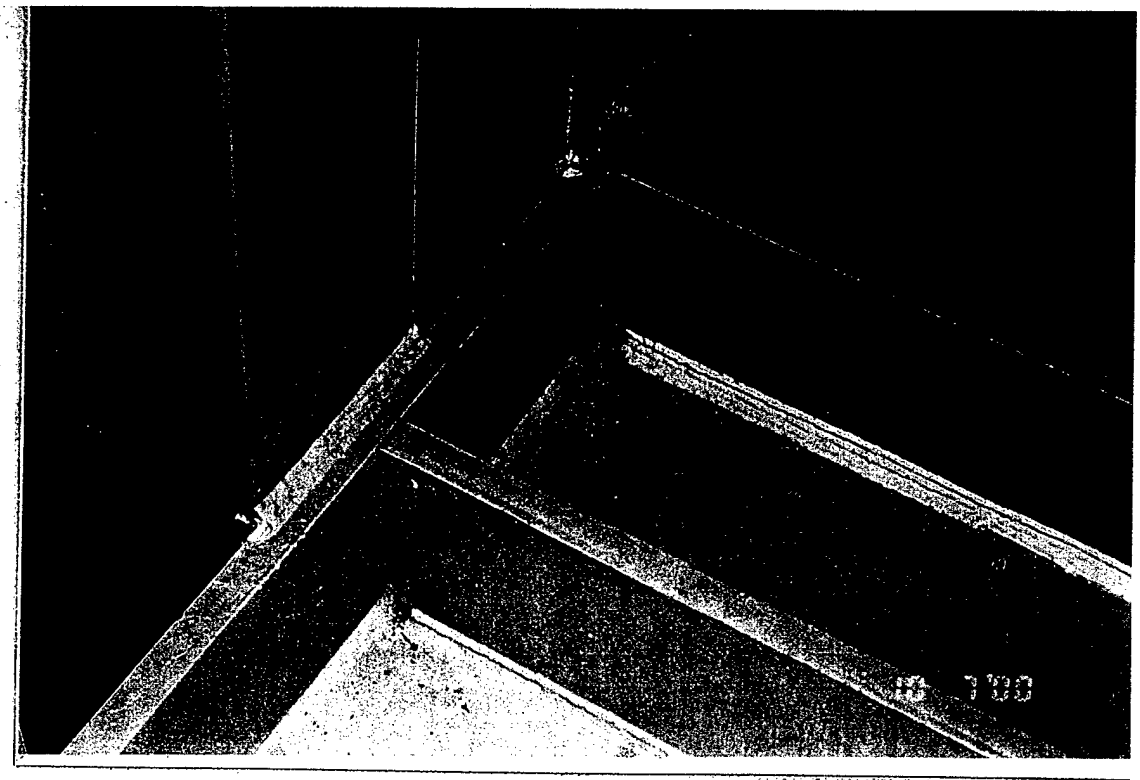


Lower Granite Dam

10/05/00

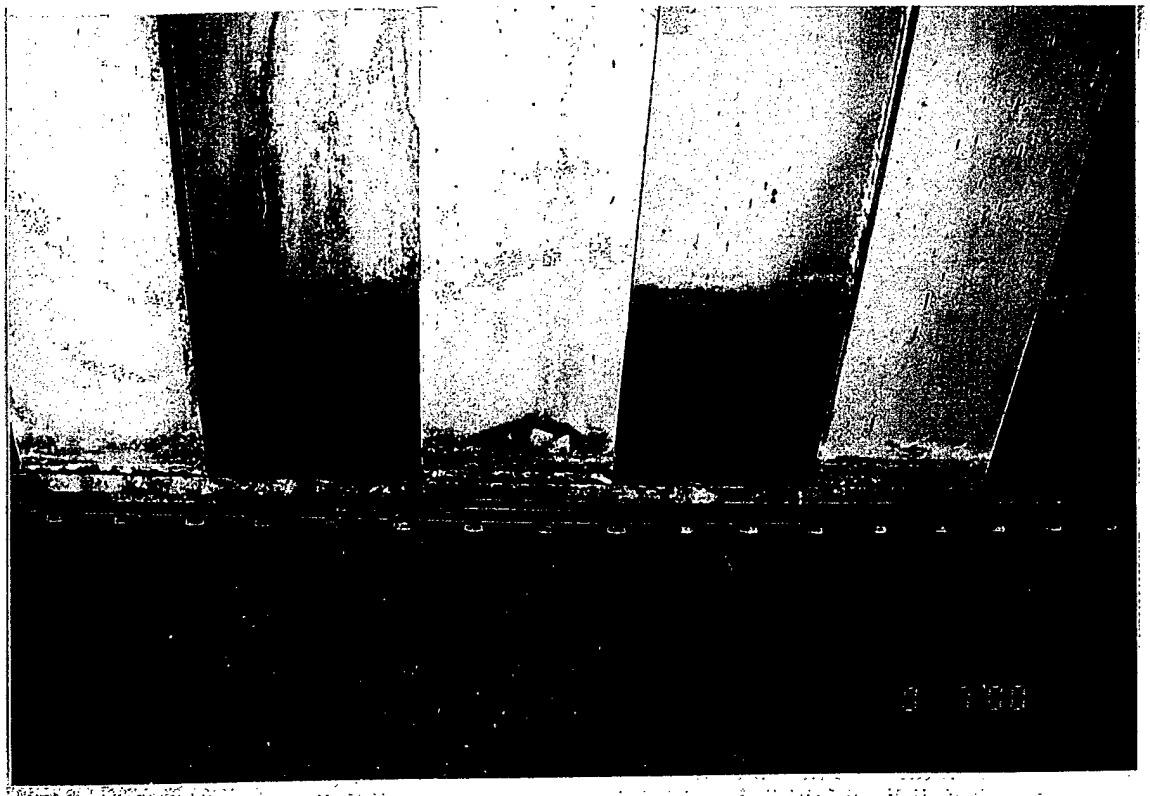
6-30

Gate 6
Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

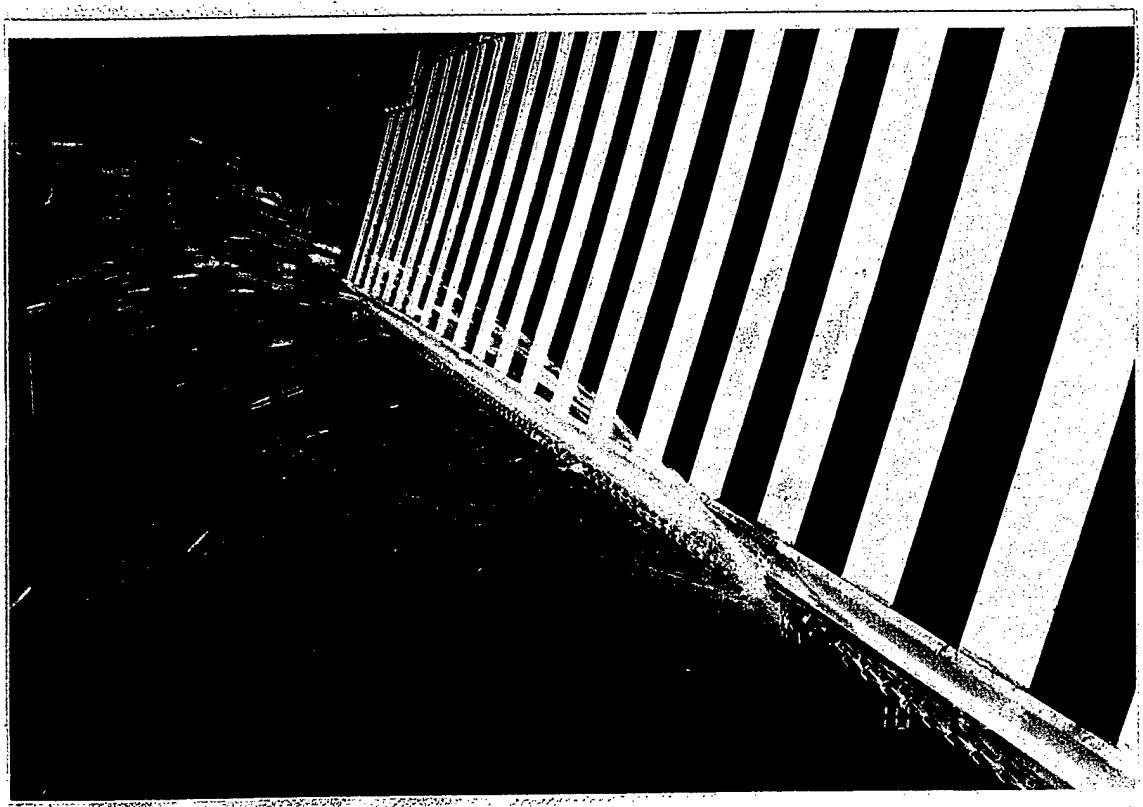


Lower Granite Dam 10/07/00 7-1	Gate 7 Horizontal girder stiffeners at left frame middle radial strut. Note: upstream end of stiffeners not welded to girder flange. Correct per plans.

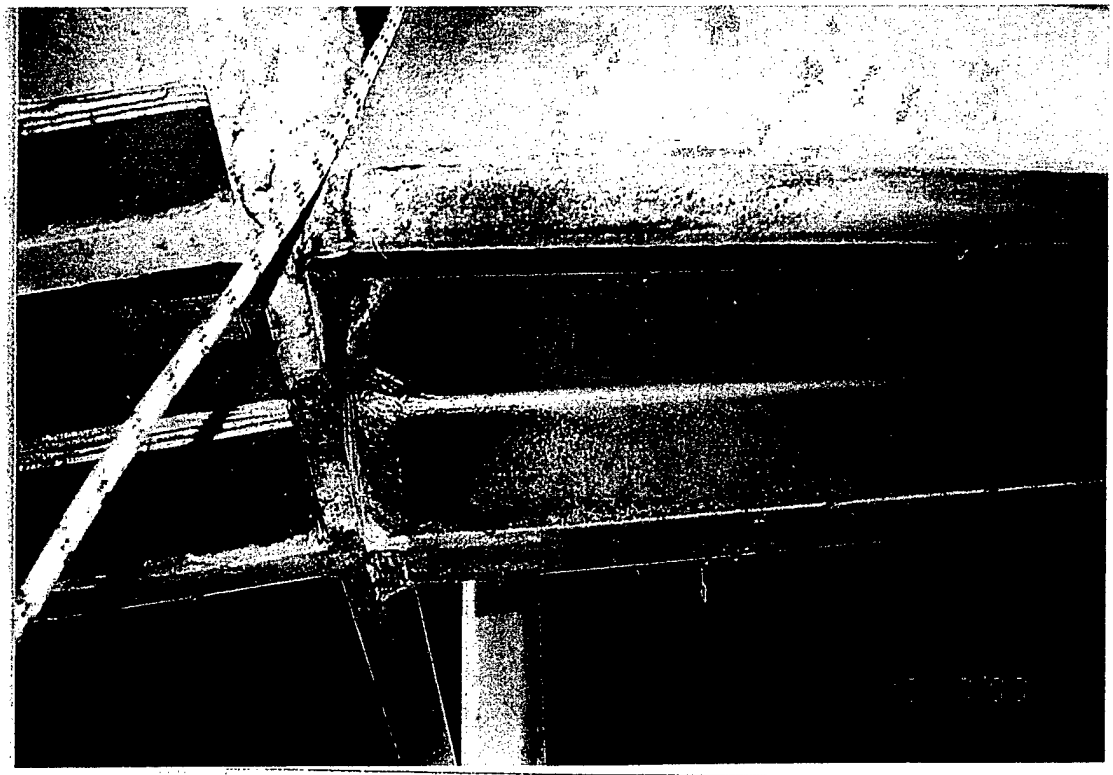
Lower Granite Dam 10/07/00 7-2	Gate 7 Left end of bottom horizontal girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage



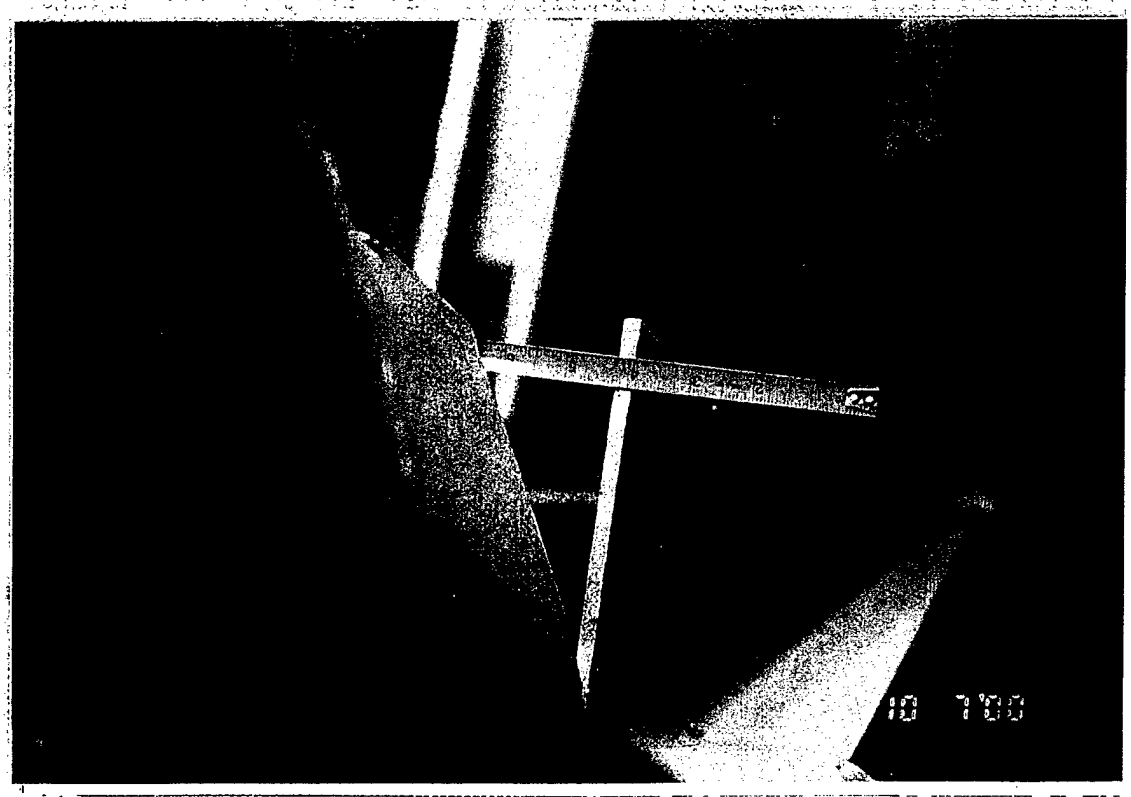
Lower Granite Dam 10/07/00 7-3	**Gate 7** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



Lower Granite Dam 10/07/00 7-4	**Gate 7** Leak at center construction joint in spillway monolith.

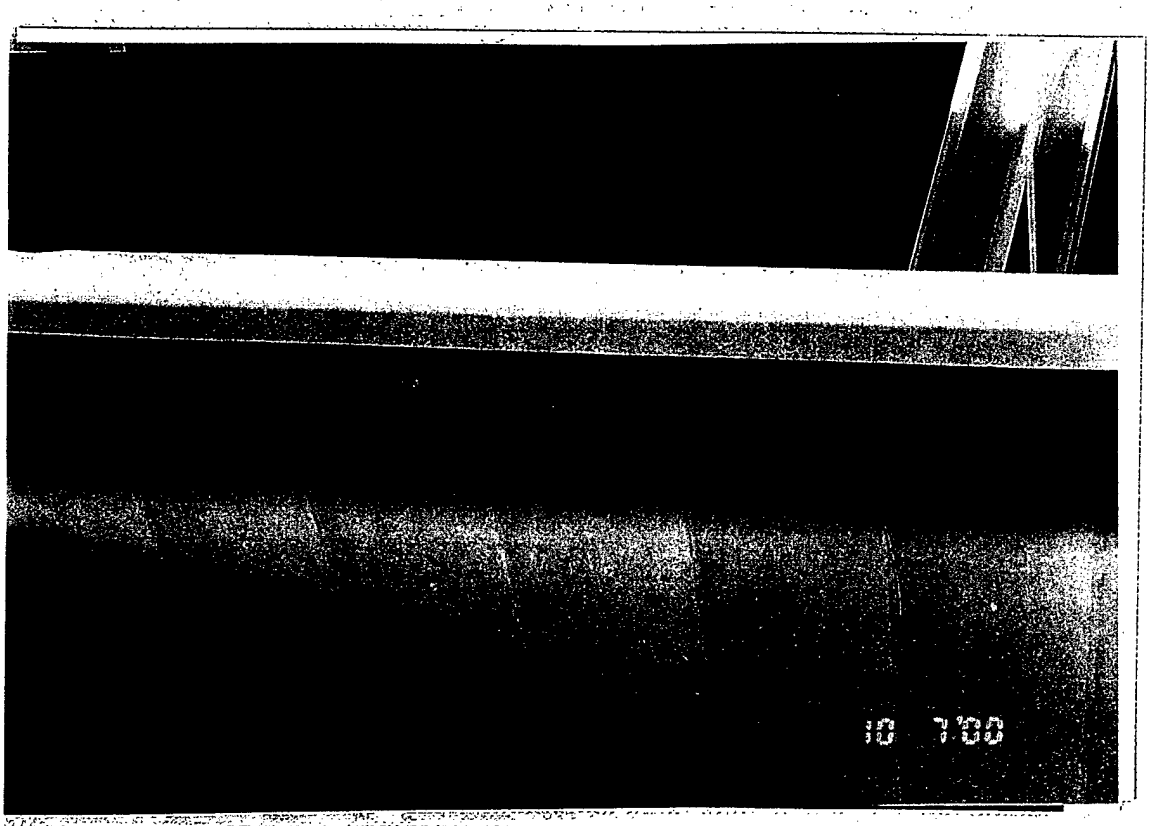


Lower Granite Dam 10/07/00 7-5	**Gate 7** Bottom of bottom left radial strut. Light corrosion at connection to bottom girder. Note: Discolorization on strut flange due to ultrasonic testing gel.



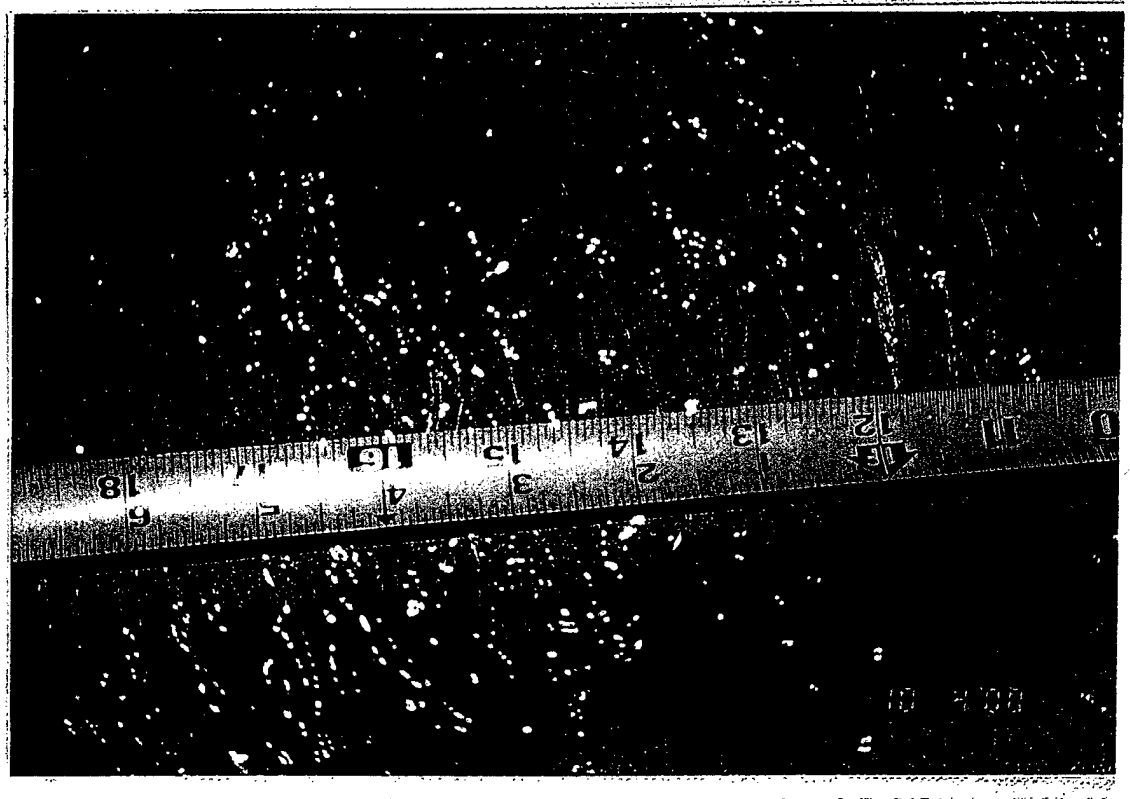
Lower Granite Dam 10/07/00 7-6	**Gate 7** Right horizontal girder bracing A to K. Deformed web in brace K.

Lower Granite Dam 10/07/00 7-7	**Gate 7** Top horizontal girder near right radial strut connection. Light corrosion

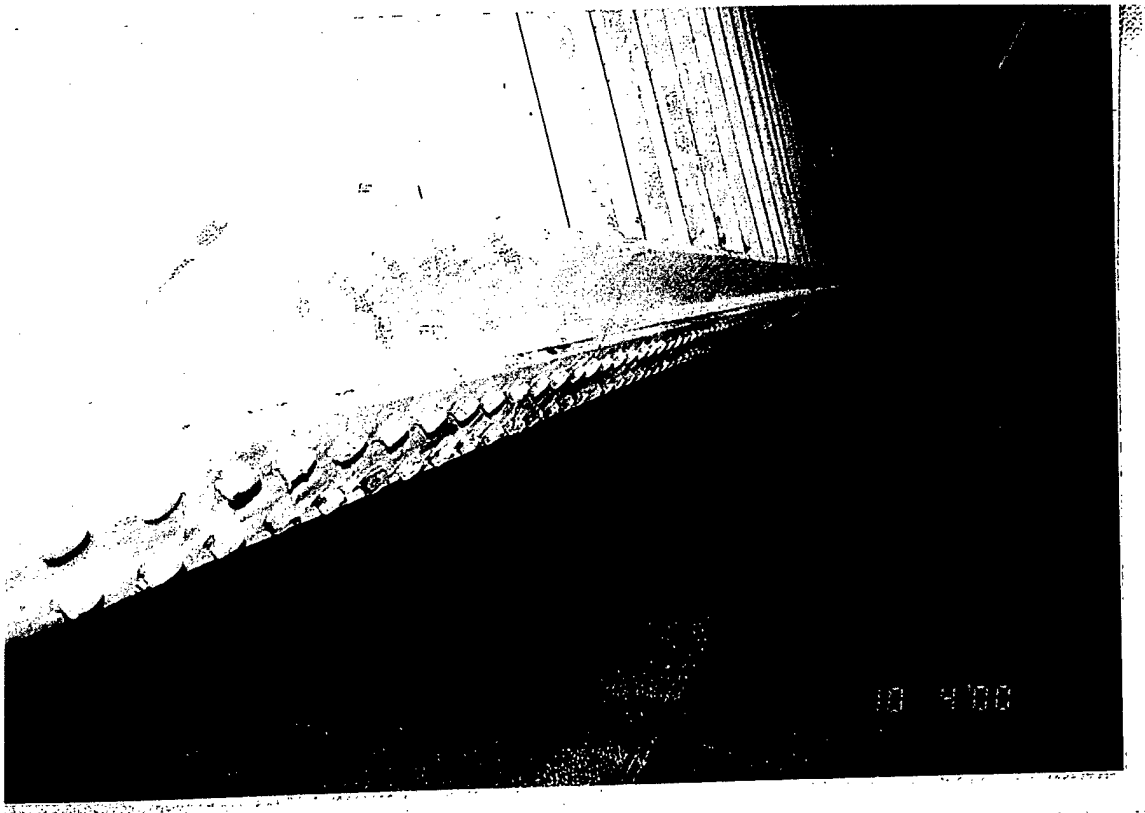


Lower Granite Dam 10/07/00 7-8	**Gate 7** Upstream surface of skin plate, typical. Note: Weld lines for purlins visible through 3/8" skin plate.

Lower Granite Dam 10/04/00 7-9	**Gate 7** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



Lower Granite Dam 10/04/00 7-10	**Gate 7** Close up embedded bottom seal plate, typical.

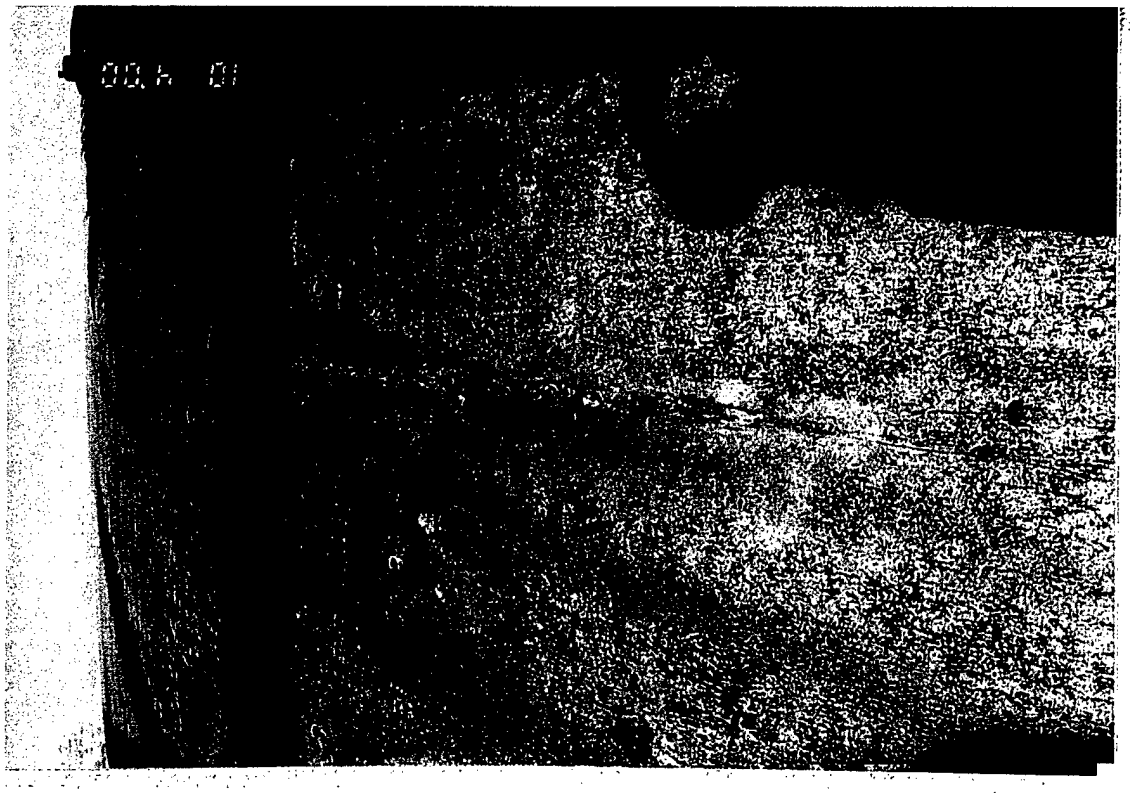


Lower Granite Dam 10/04/00 7-11	**Gate 7** Bottom seal keeper plate and embedded bottom seal plate, typical.

Lower Granite Dam 10/04/00 7-12	**Gate 7** Skin plate pitting, typical.

Lower Granite Dam 10/04/00 7-13	**Gate 7** Skin plate pitting, typical.

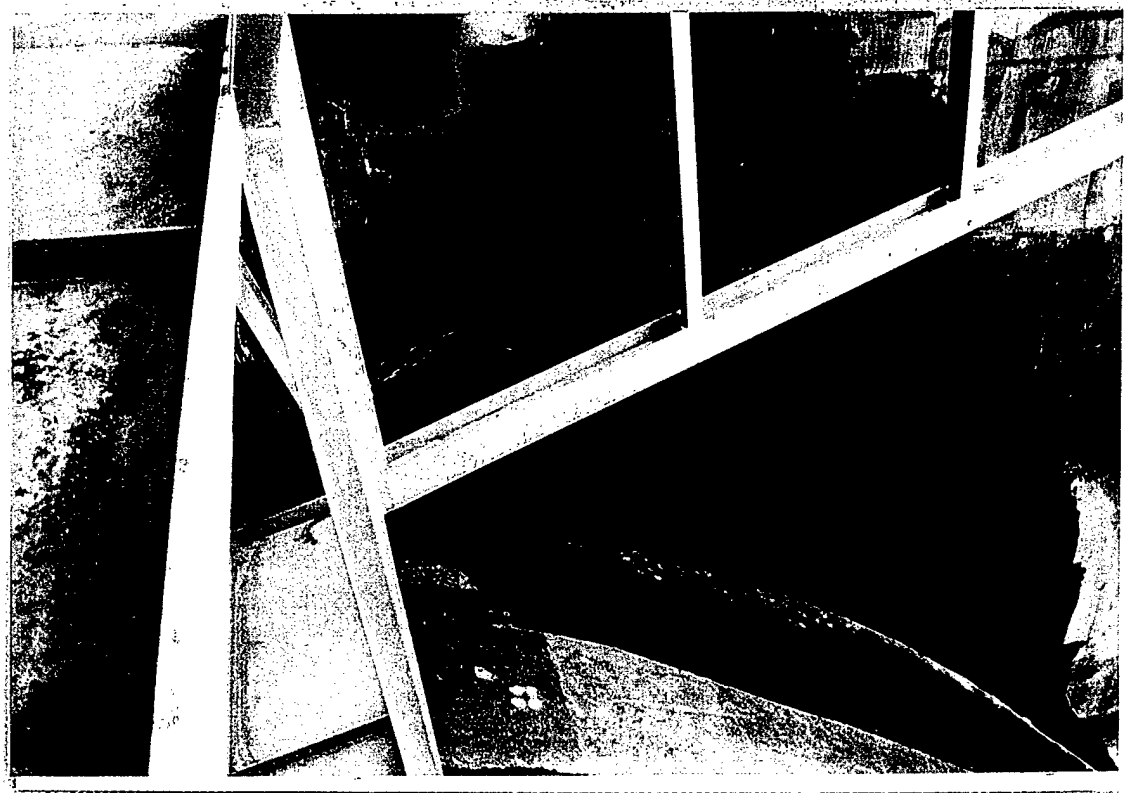
Lower Granite Dam 10/04/00 7-14	**Gate 7** Typical skin plate condition. Heavy pitting. Note: Pitting often appears to be oriented in lines associated with scratches.



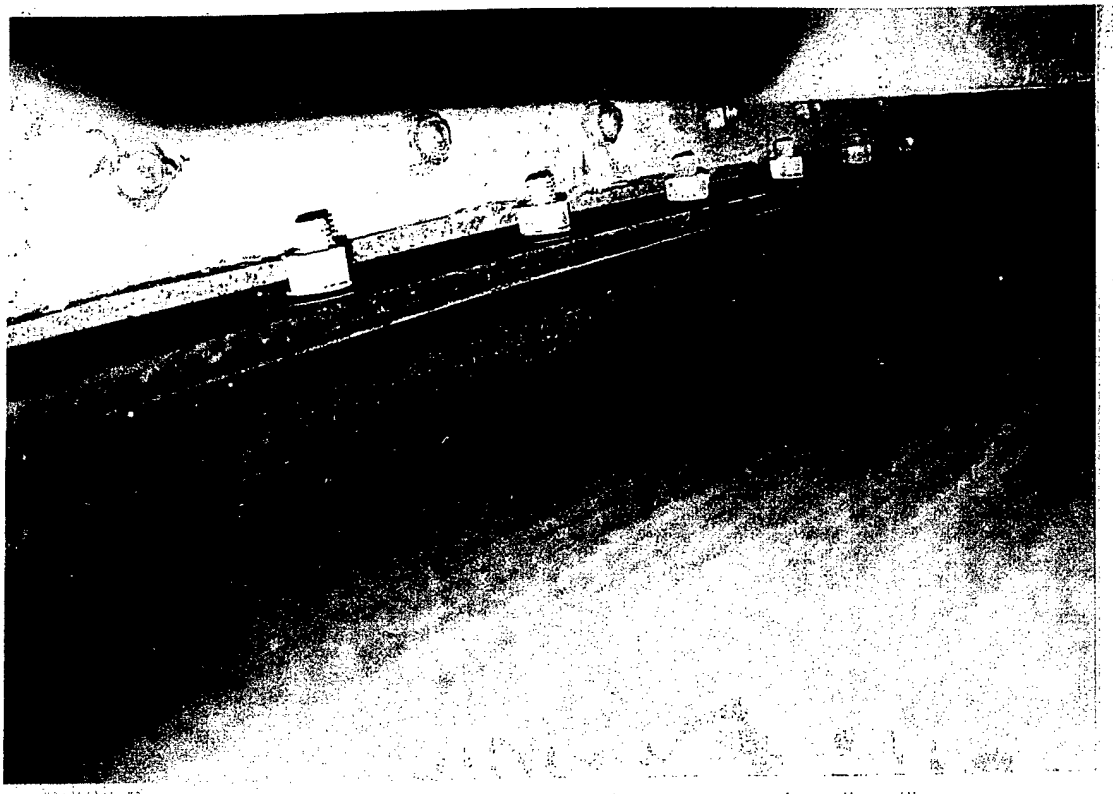
Lower Granite Dam 10/04/00 7-15	**Gate 7** Skin plate pitting, typical. Note: Pitting appears to be oriented in line associated with scratch.

Lower Granite Dam 10/04/00 7-16	**Gate 7** Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

Lower Granite Dam 10/07/00 8-1	**Gate 8** Middle horizontal girder at connection to middle right strut. Debris and evidence of standing water, light corrosion.

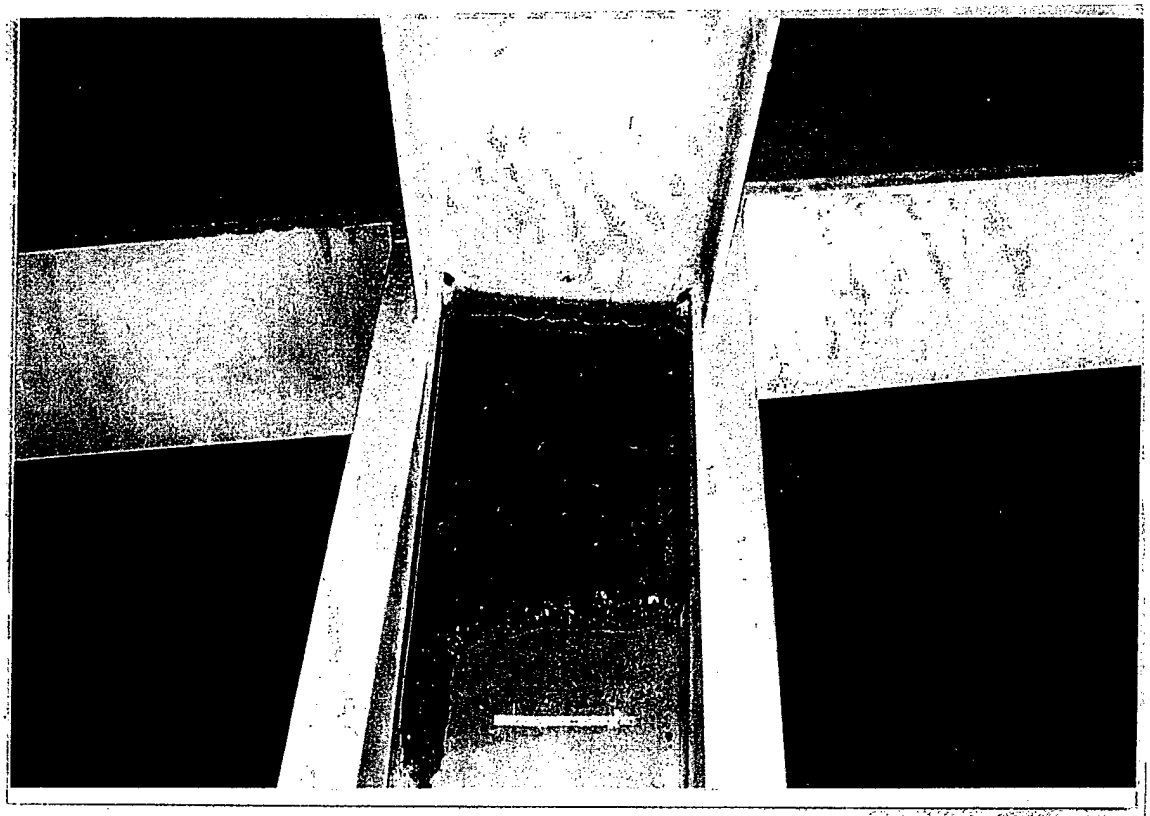


Lower Granite Dam 10/07/00 8-2	**Gate 8** Bottom corner leak at left frame.

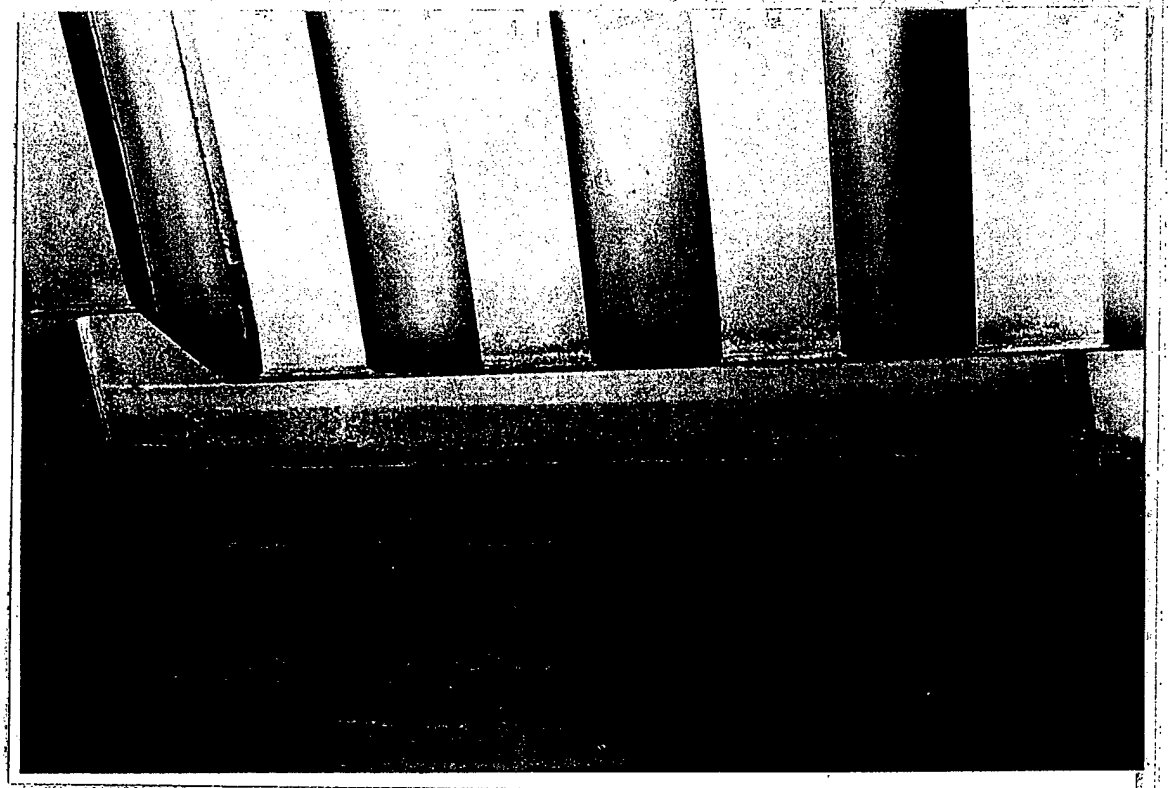


Lower Granite Dam 10/07/00 8-3	**Gate 8** Side seal, typical.

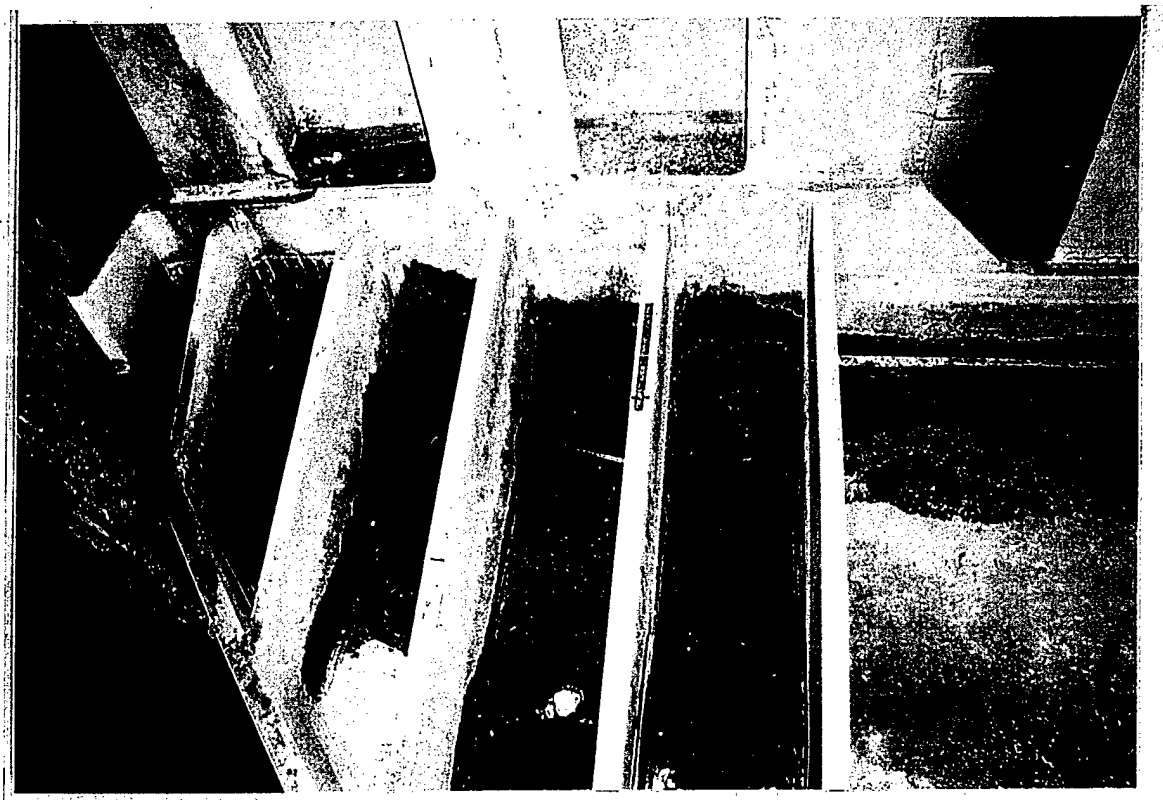
Lower Granite Dam 10/07/00 8-4	**Gate 8** .Bottom right corner seal leak.



Lower Granite Dam 10/07/00 8-5	**Gate 8** Upstream end of bottom right strut. Standing water due to inadequate drainage.

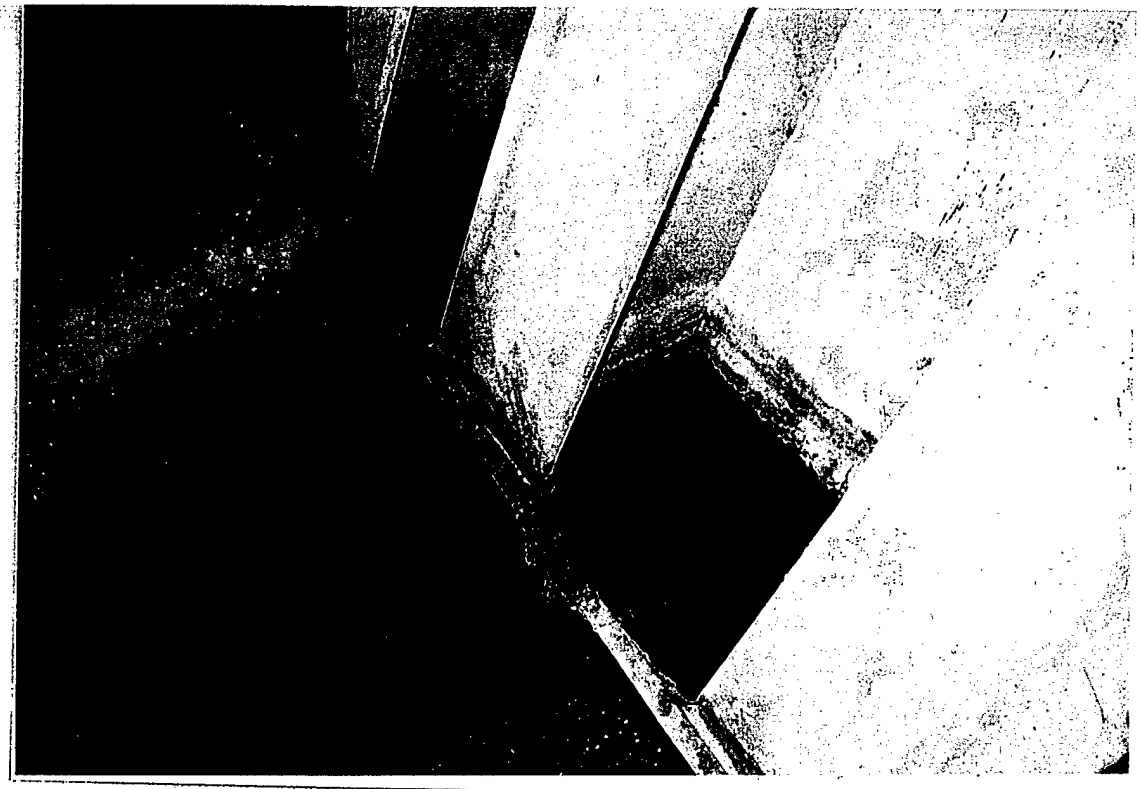


Lower Granite Dam 10/07/00 8-6	**Gate 8** Right upstream end of bottom horizontal girder. Standing water at upstream flange and web.

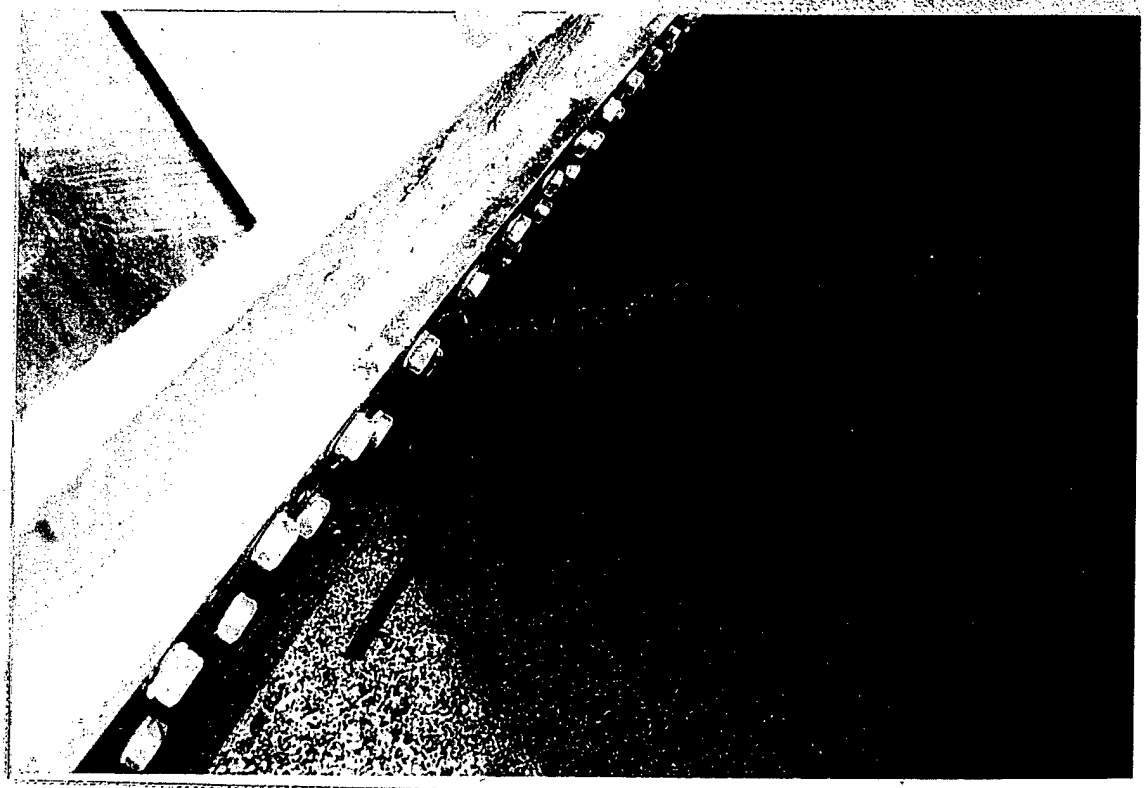


Lower Granite Dam 10/07/00 8-7	**Gate 8** Right end of bottom horiz. girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, standing water, debris and no drainage

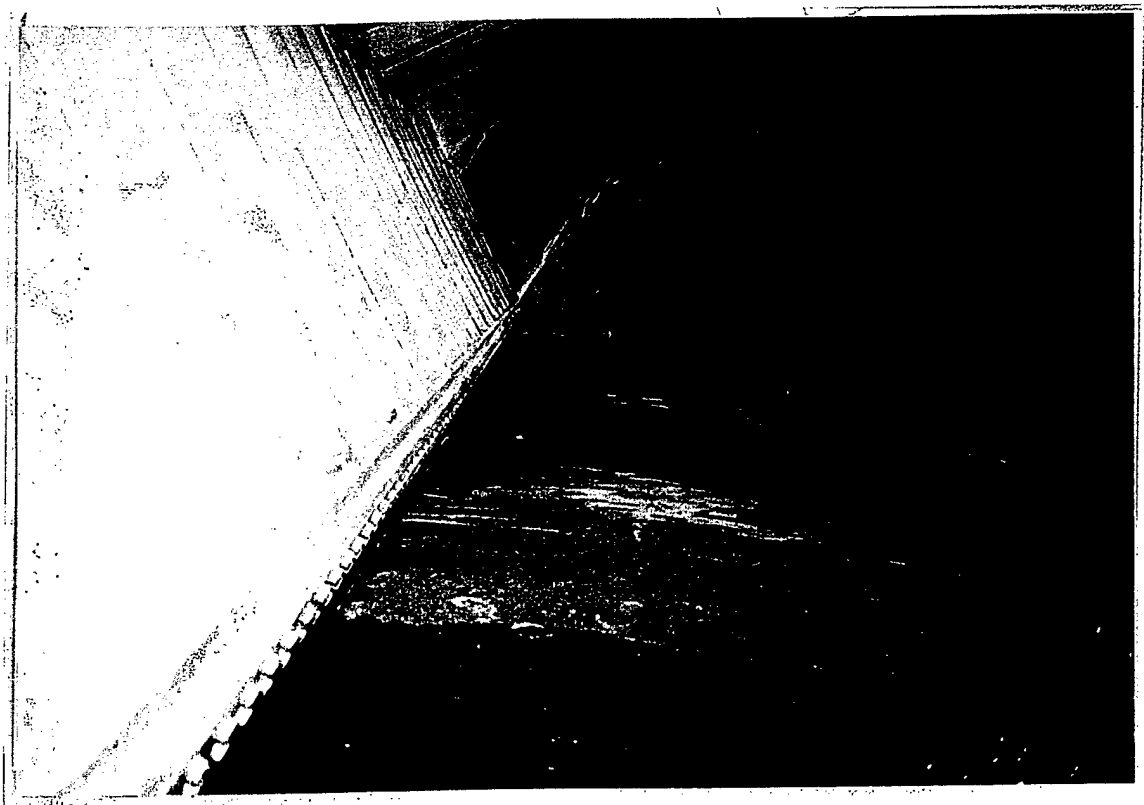
Lower Granite Dam 10/07/00 8-8	**Gate 8** Bottom seal keeper plate and leak at center construction joint in spillway monolith.



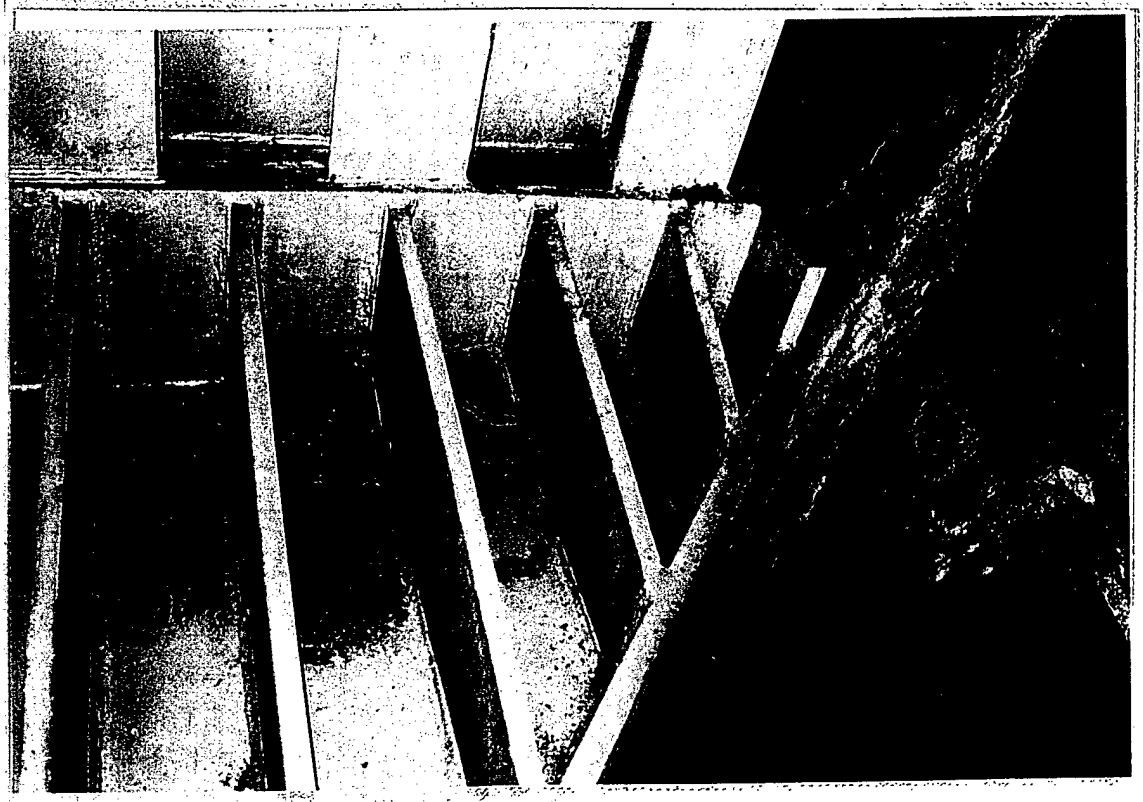
Lower Granite Dam 10/07/00 8-9	**Gate 8** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



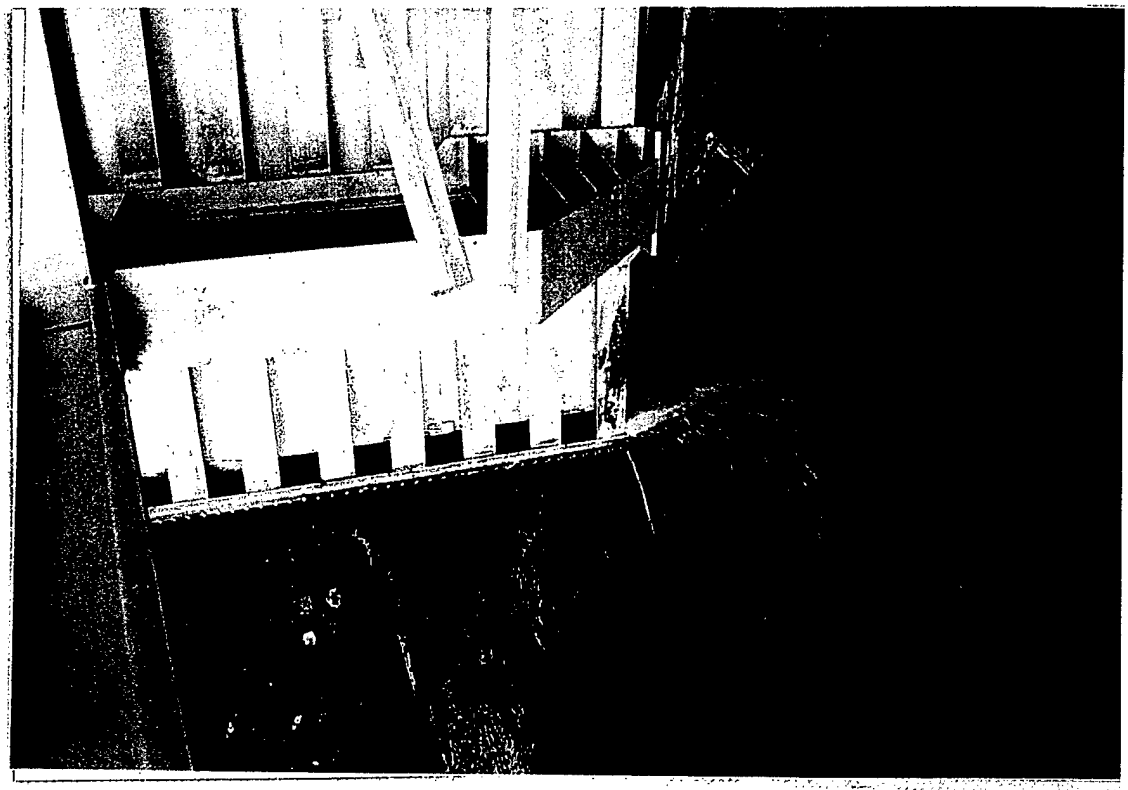
Lower Granite Dam 10/07/00 8-10	**Gate 8** Downstream side of embedded bottom seal plate and small bottom left corner leak.



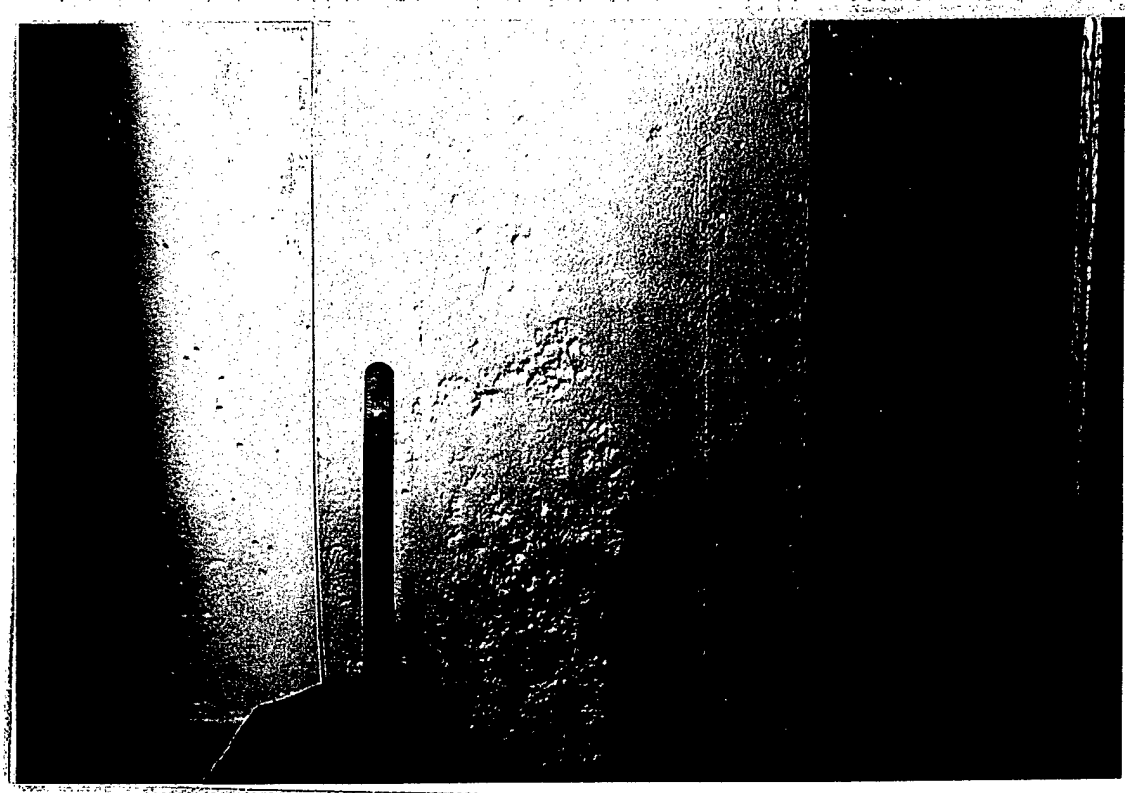
Lower Granite Dam 10/07/00 8-11	**Gate 8** Spillway looking toward left side of gate. Bottom corner leak.



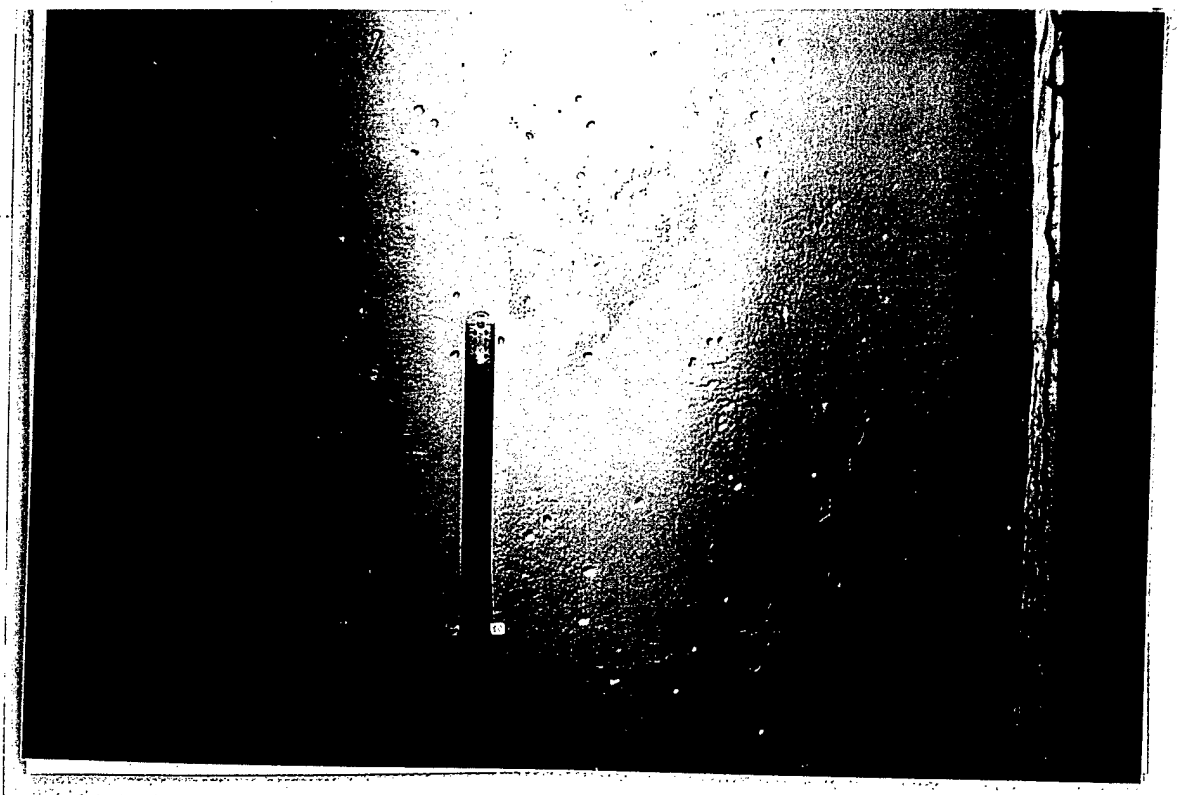
Lower Granite Dam 10/07/00 8-12	**Gate 8** Left end of bottom horiz. girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, debris and no drainage.



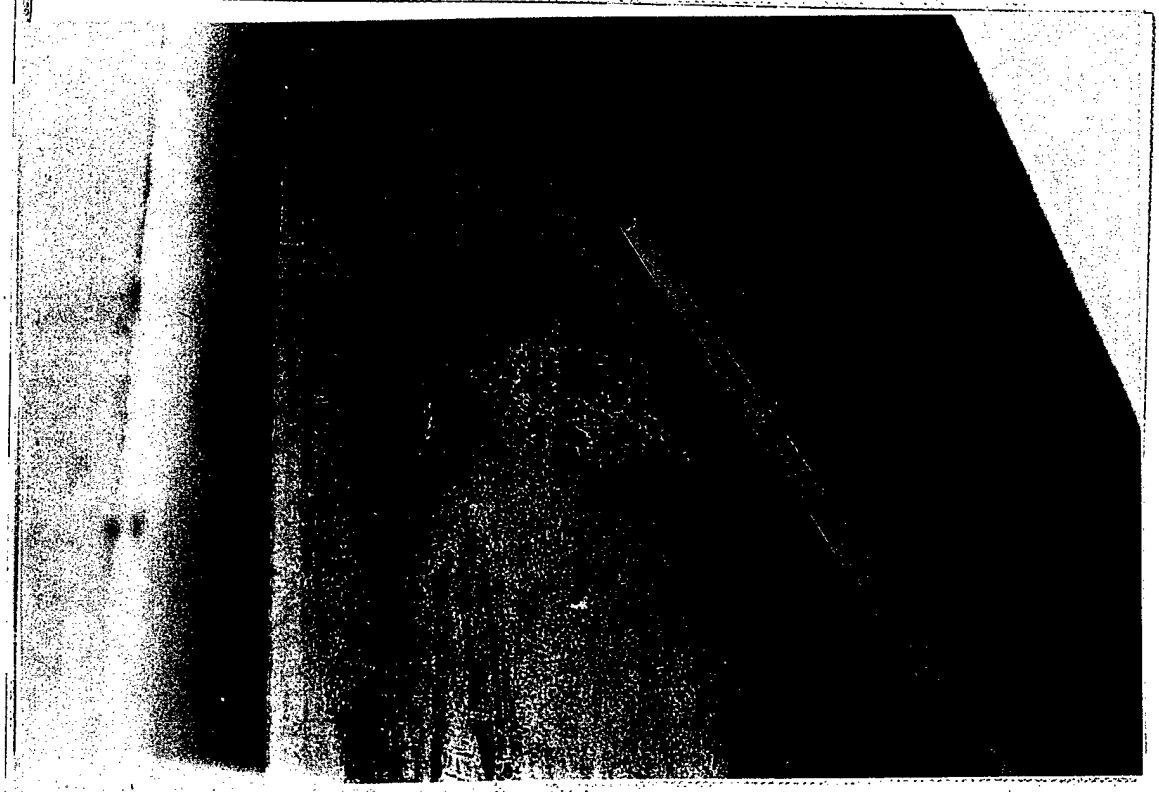
Lower Granite Dam 10/07/00 8-13	**Gate 8** Bottom left corner leak.



Lower Granite Dam 10/07/00 8-14	**Gate 8** Purlin flange small pitting, typical.

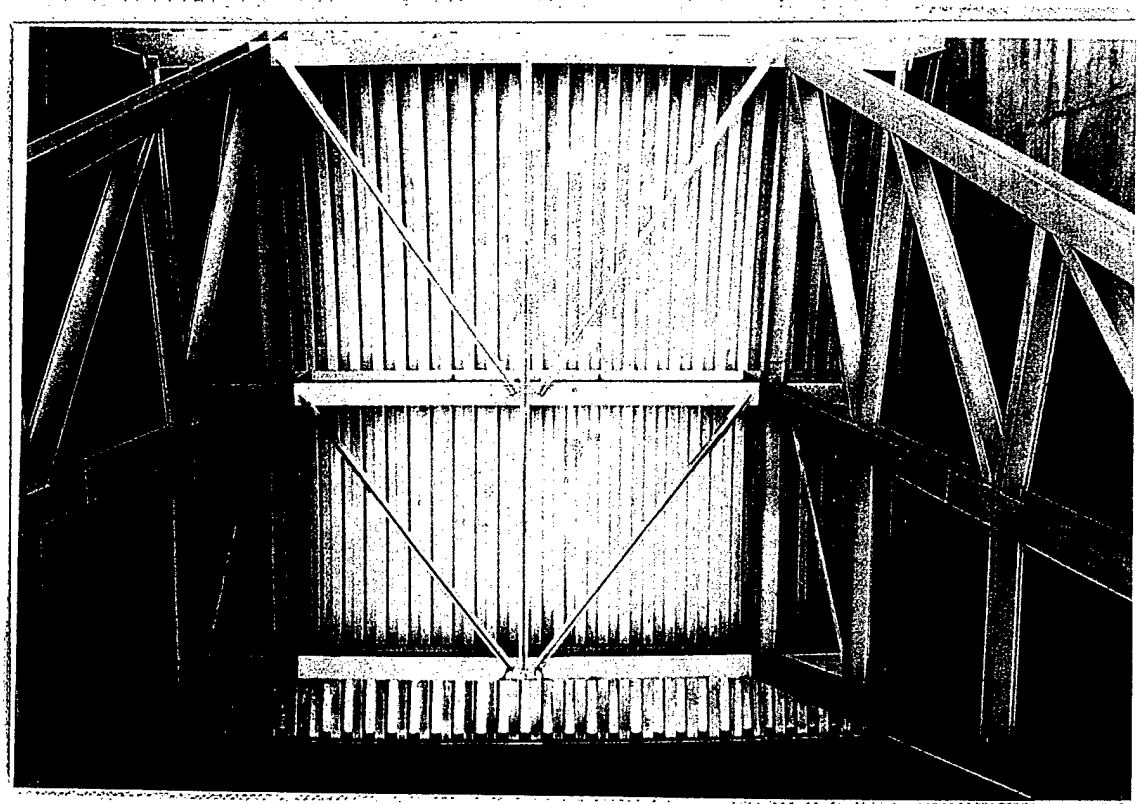


Lower Granite Dam 10/07/00 8-15	**Gate 8** Downstream surface of skin plate pitting, typical.

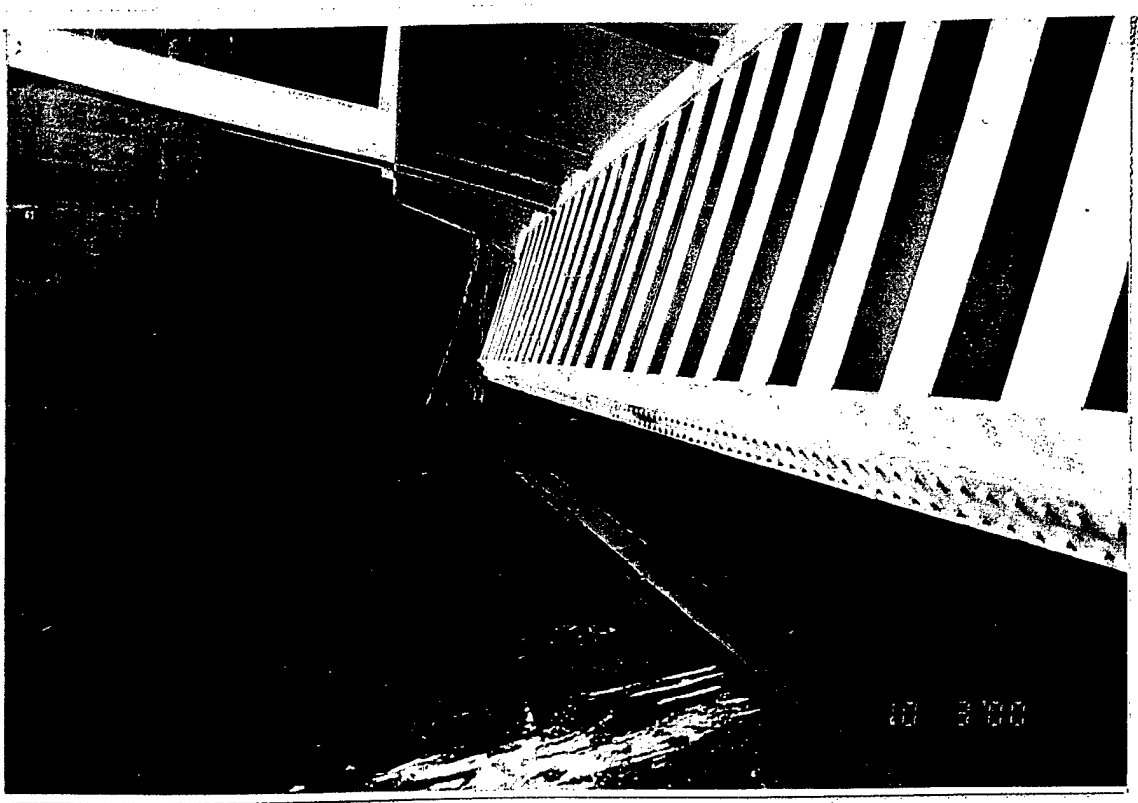


Lower Granite Dam 10/07/00 8-16	**Gate 8** Top left radial strut near trunnion. Light corrosion on top of web (before scraping).

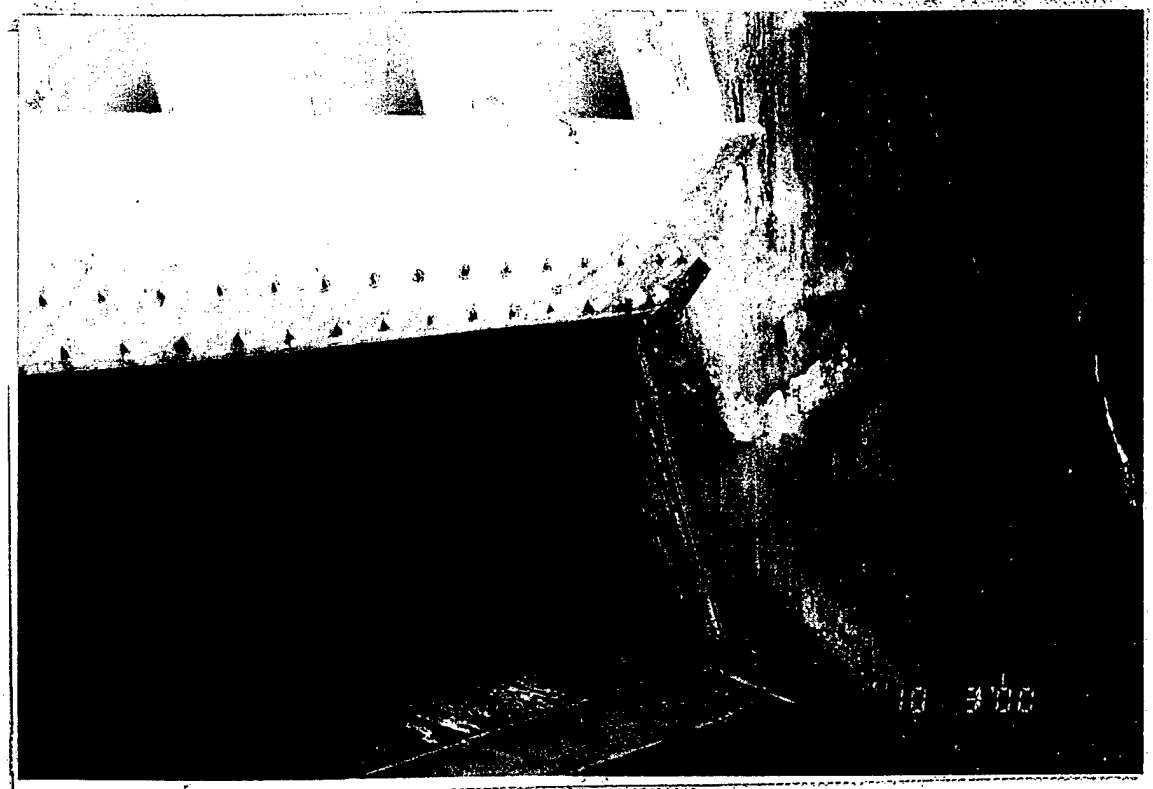
Lower Granite Dam 10/07/00 8-17	**Gate 8** Top left radial strut near trunnion. Light corrosion on top of web (after scraping).



Lower Granite Dam 10/07/00 8-18	**Gate 8** Gate looking upstream, typical.

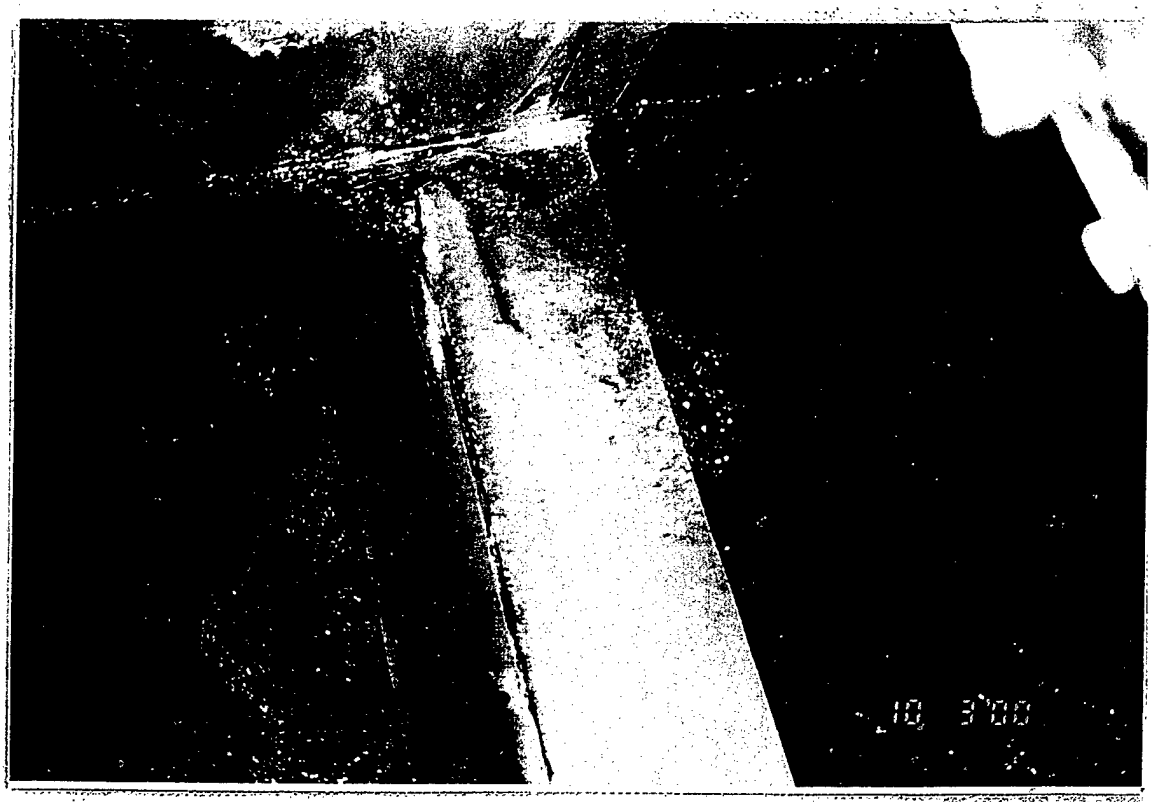


Lower Granite Dam 10/03/00 8-19	**Gate 8** Embedded bottom seal plate, typical.

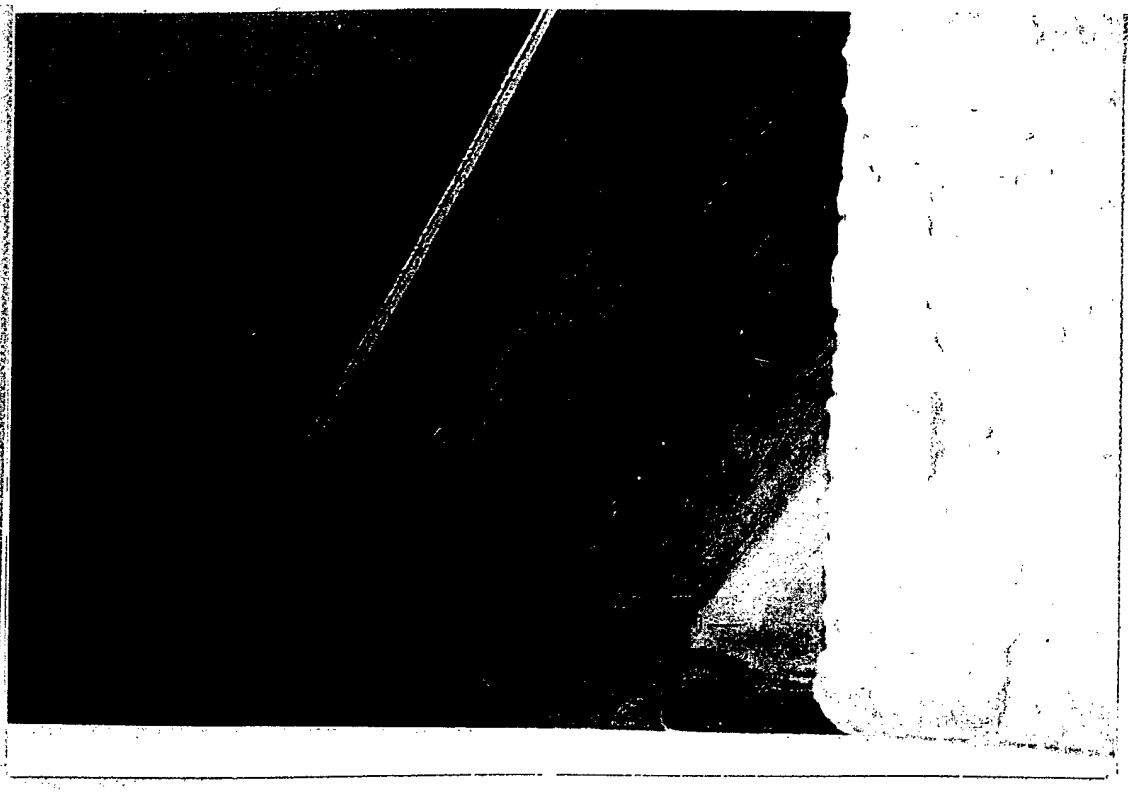


Lower Granite Dam 10/03/00 8-20	**Gate 8** Bottom left corner of gate.

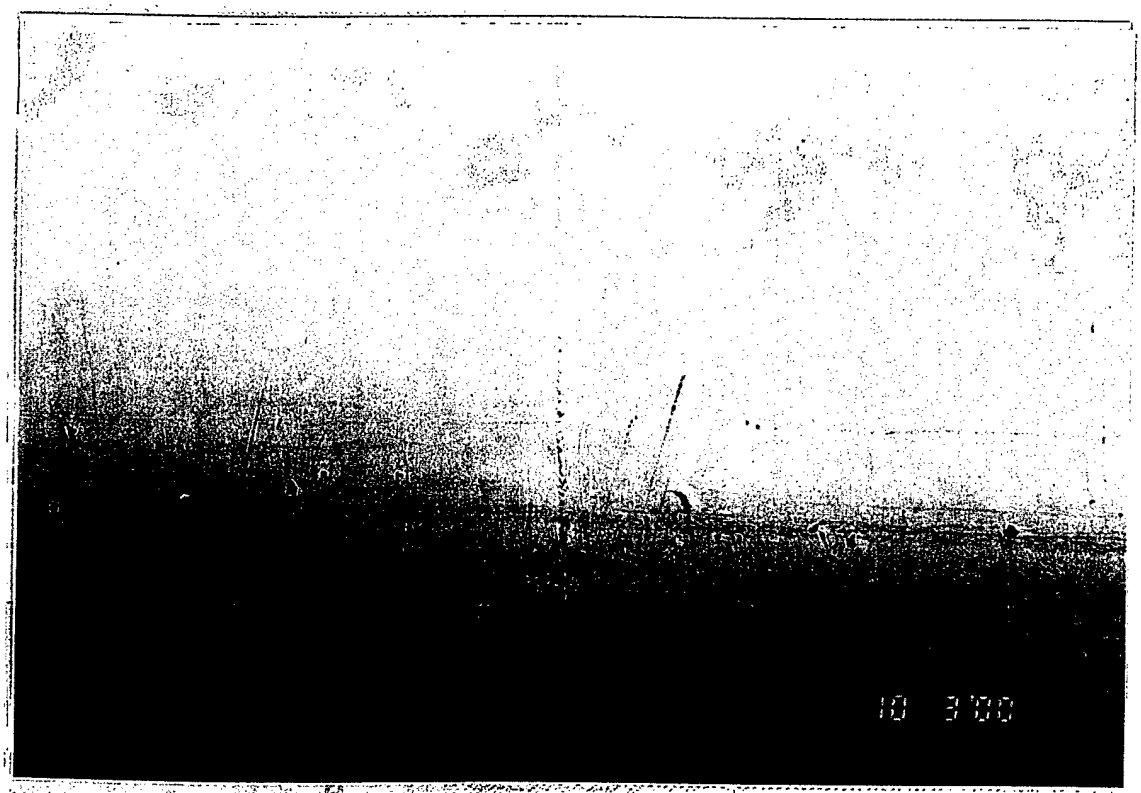
Lower Granite Dam 10/03/00 8-21	**Gate 8** Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



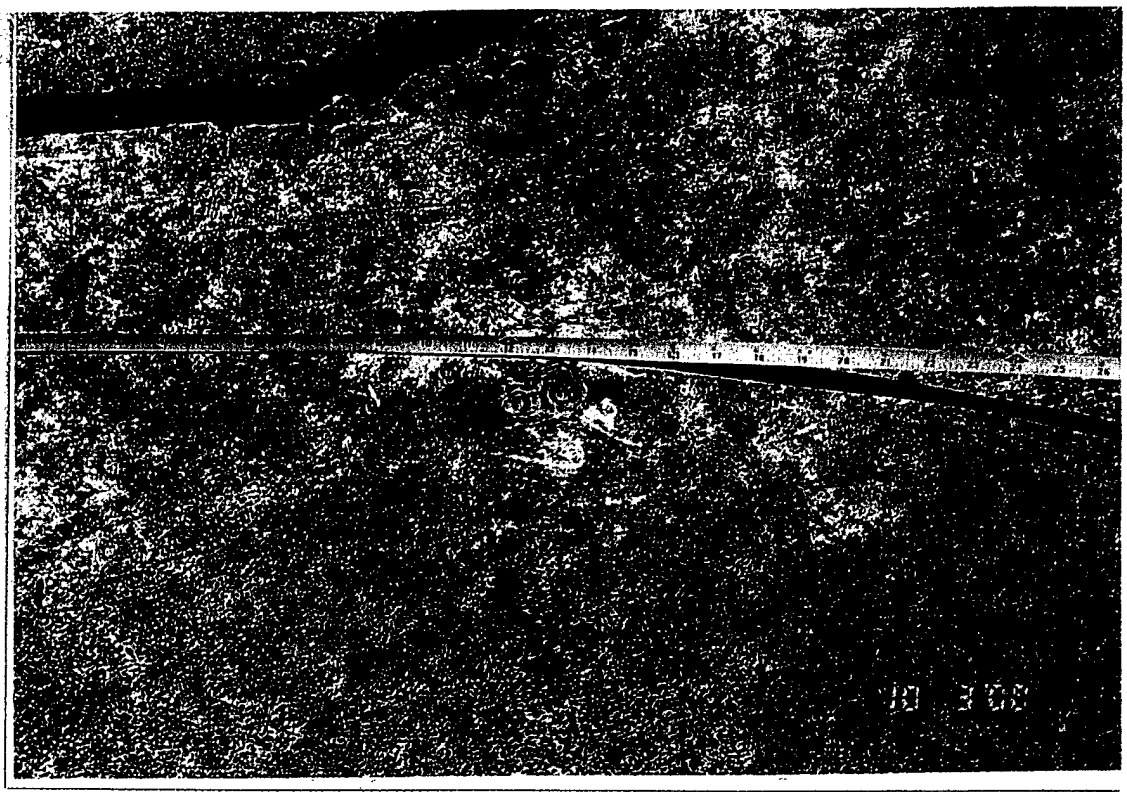
Lower Granite Dam 10/03/00 8-22	**Gate 8** Embedded bottom seal plate, typical.



Lower Granite Dam 10/03/00 8-23	**Gate 8** Upstream surface of skin plate and wear plate at normal water surface line.



Lower Granite Dam 10/03/00 8-24	**Gate 8** Close-up upstream surface of skin plate and wear plate at normal water surface line. Light pitting, scratches and scrapes above and below water surface line.



Lower Granite Dam 10/03/00 8-25	**Gate 8** Skin plate pitting, typical.

Lower Granite Dam 10/03/00 8-26	**Gate 8** Skin plate pitting near wear plate, typical.

Lower Granite Dam

Gate 8
Skin plate pitting, typical.

10/03/00

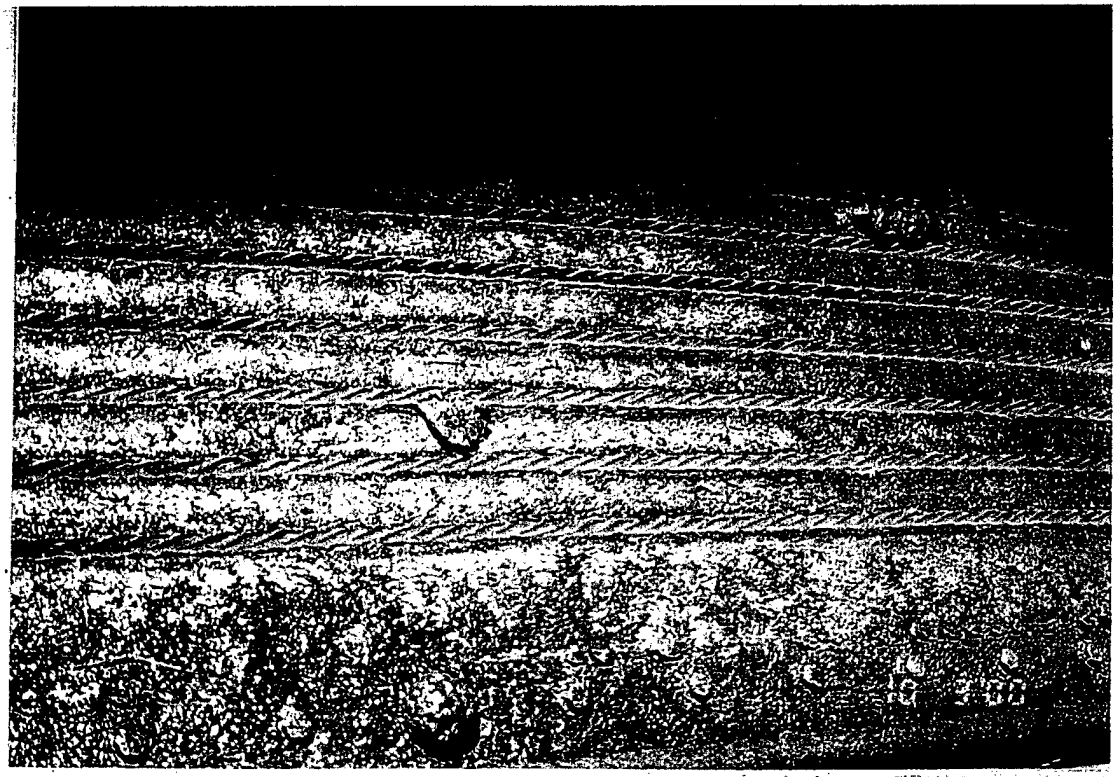
8-27

Lower Granite Dam

Gate 8
Skin plate pitting along weld line.

10/03/00

8-28



Lower Granite Dam

10/03/00

Gate 8
Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

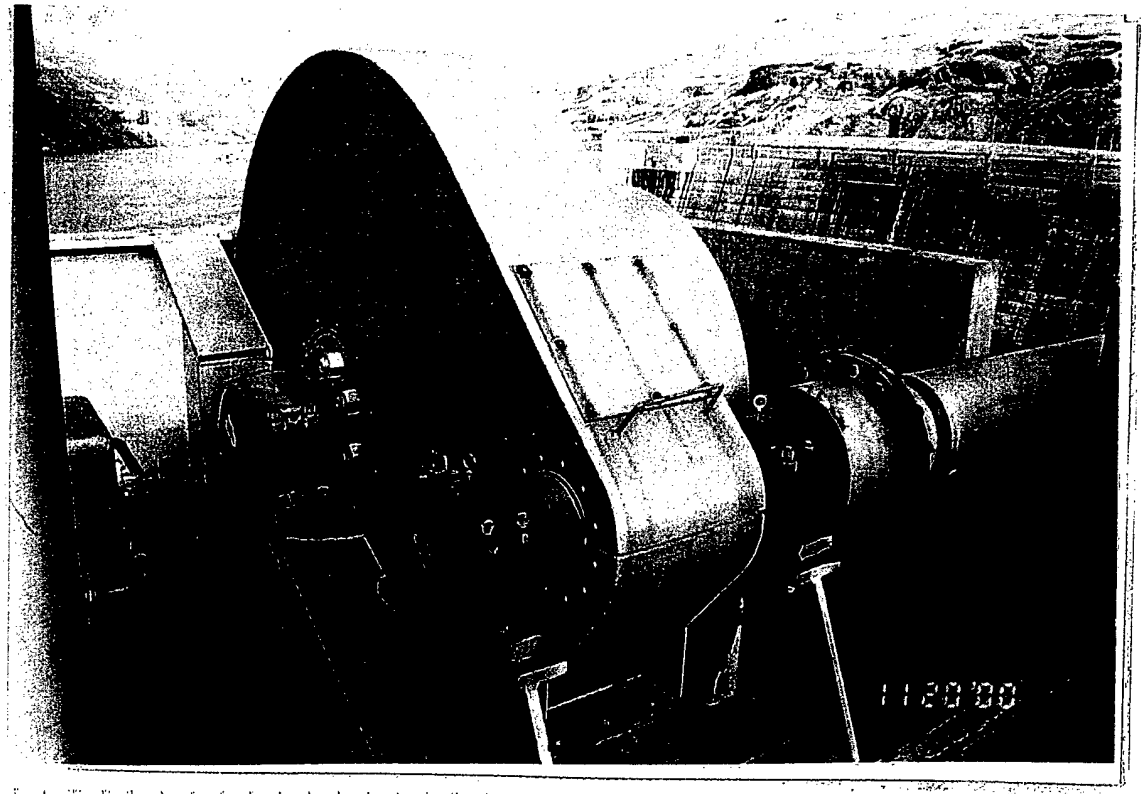
8-29

Lower Granite Dam

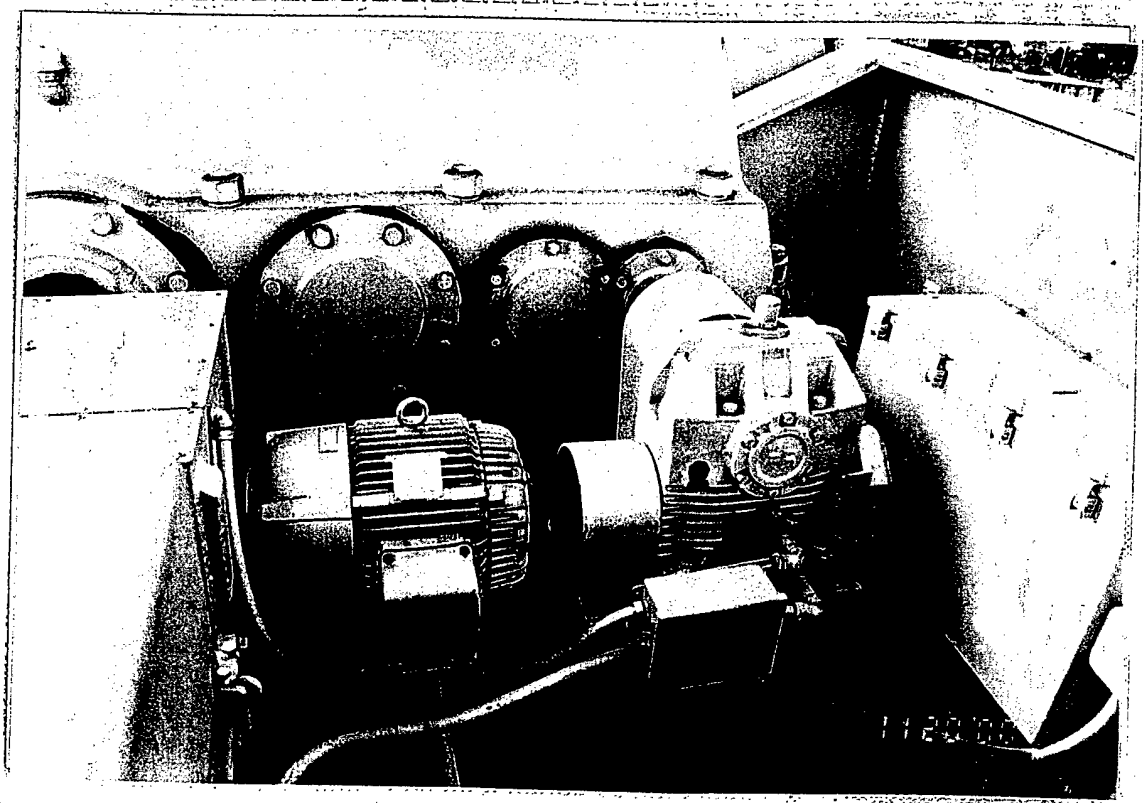
10/03/00

Gate 8
Right hoist connection. Moderate pitting on lifting lugs and plates. Stainless steel U-bolts in good condition.

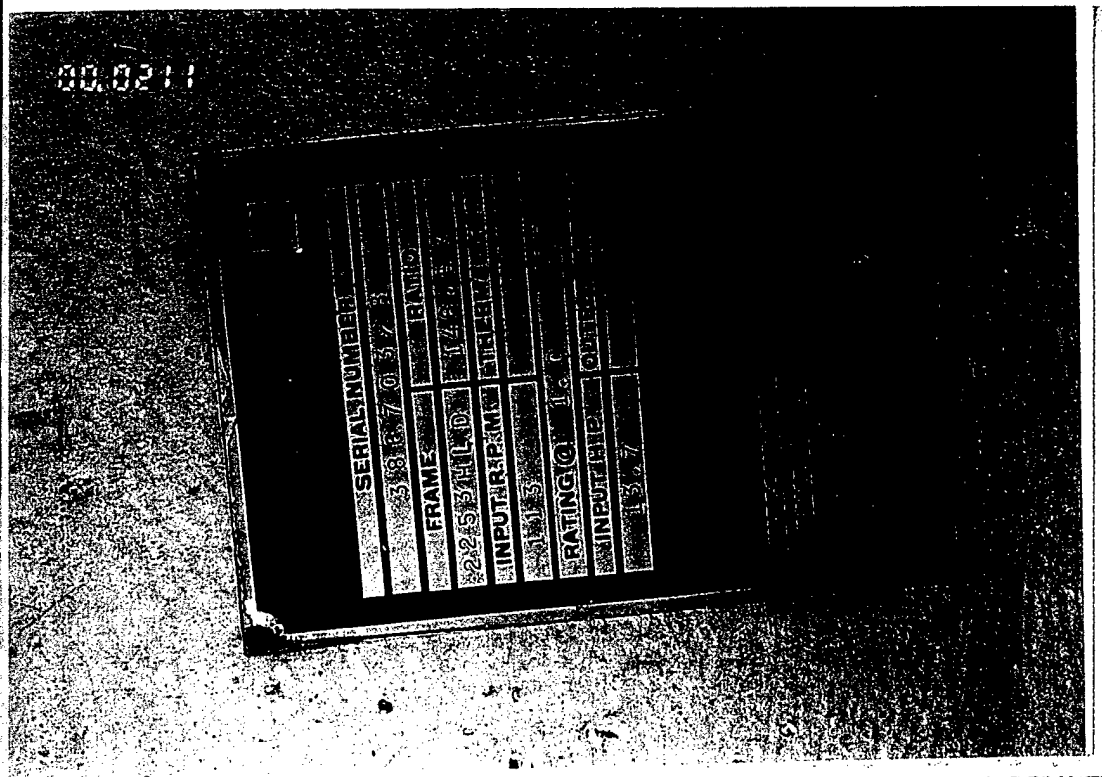
8-30



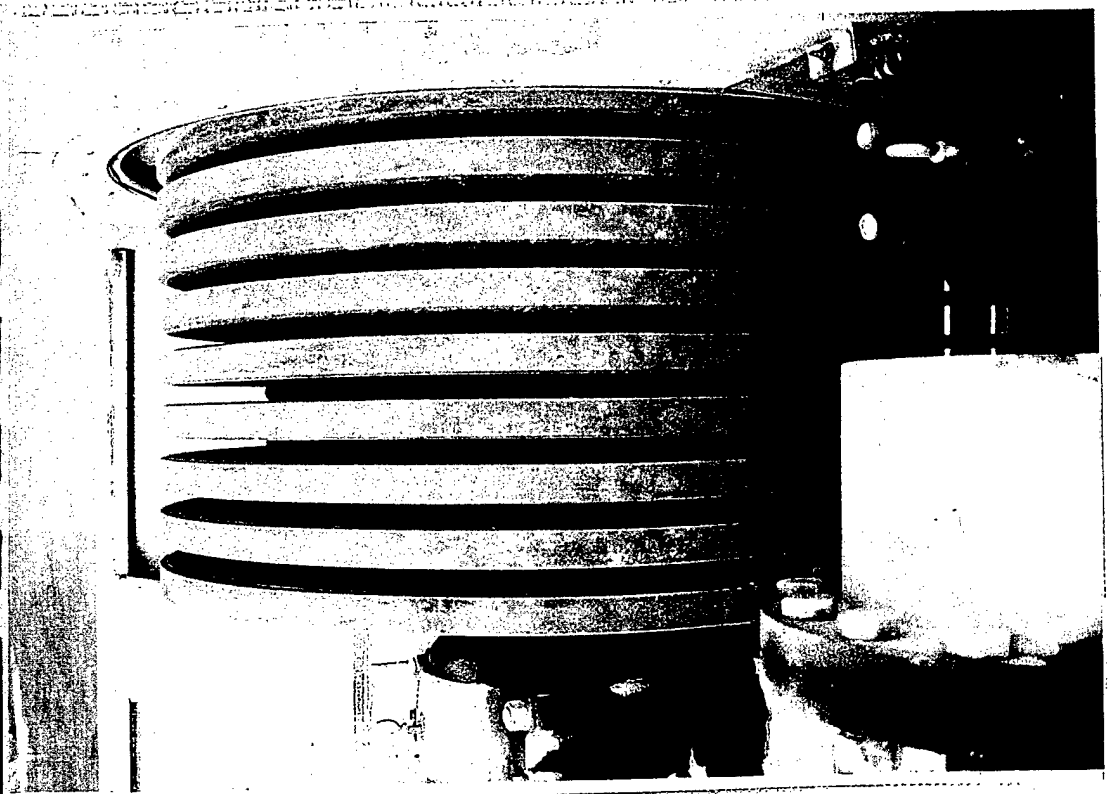
Lower Granite Dam	**Hoist & Mechanical**
	Hoist, typical
M-1	



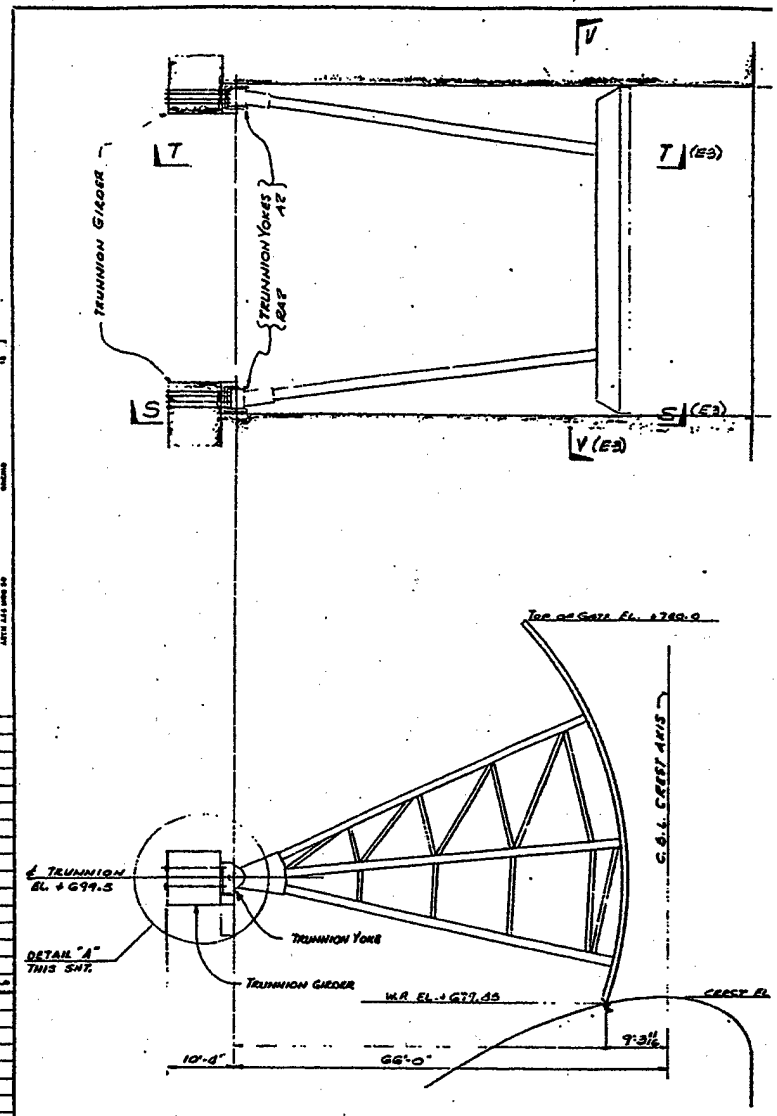
Lower Granite Dam	**Hoist & Mechanical**
	Hoist motor, typical.
M-2	



Lower Granite Dam	**Hoist & Mechanical**
	Hoist motor name plate, typical.
M-3	



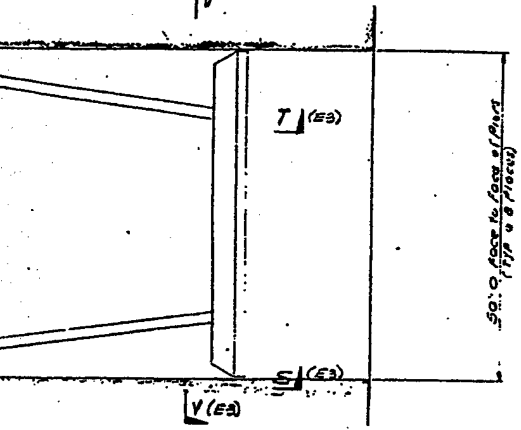
Lower Granite Dam	**Hoist & Mechanical**
	Hoist drum, typical.
M-4	

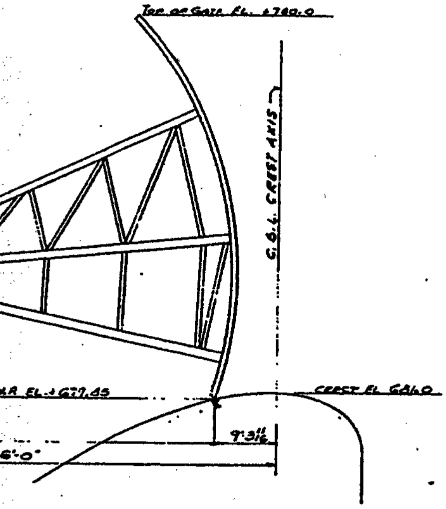


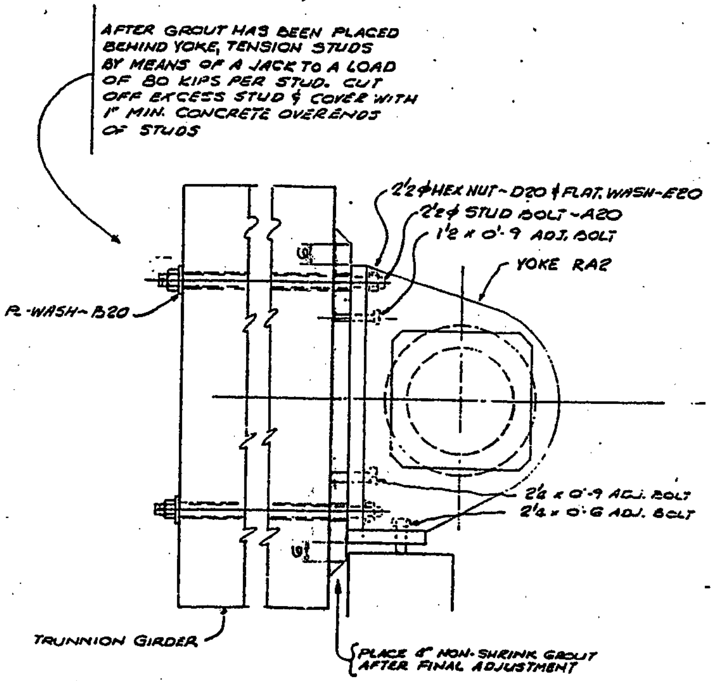
GENERAL ARRANGEMENT

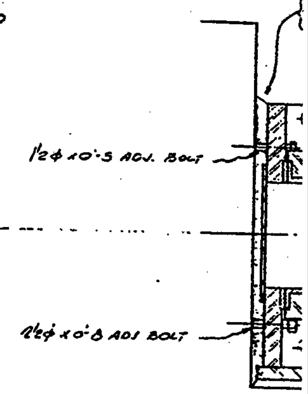
FOR ELEVATIONS & DETAILS SEE DWG'S E3 & E4

(1)









L ARRANGEMENT.

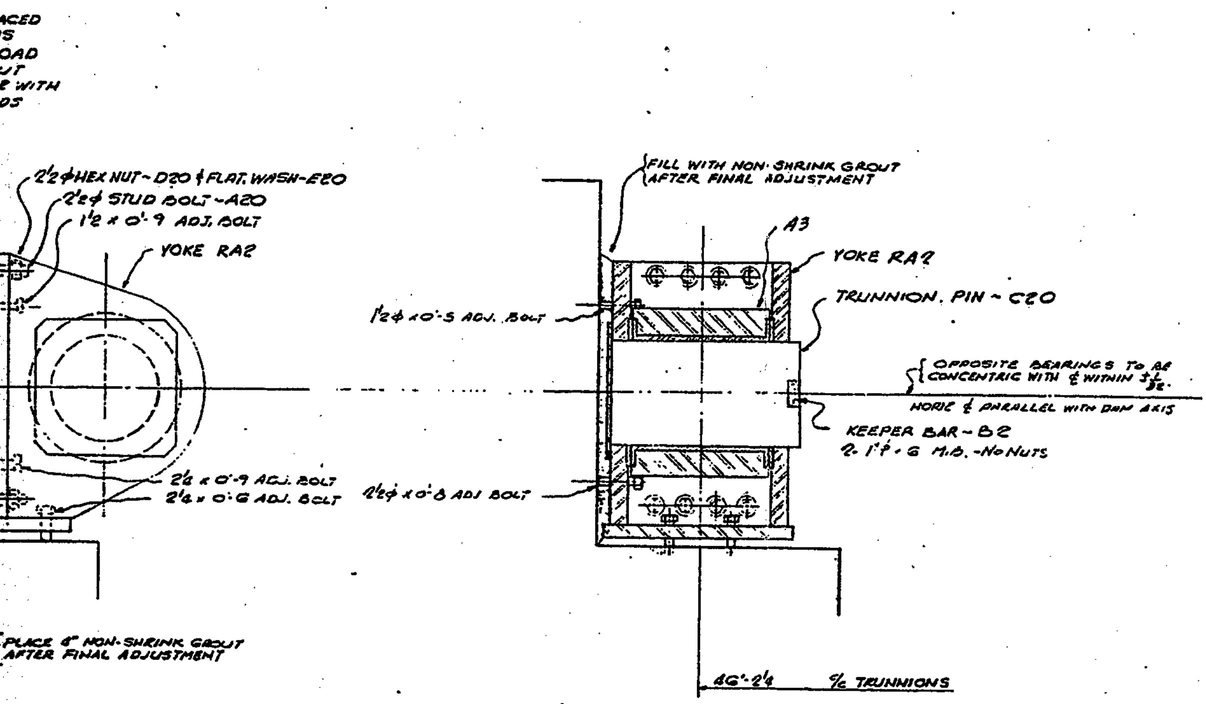
NS & DETAILS SEE DWG'S E3&E4

ERECTION NOTE -
STRUTS, GIRDERS
MUST BE ADEQUATELY
PIN-UP CLIPS ARE TO HO
TOGETHER DURING WELD
CARRY THE WEIGHT OF

(2)

HOLES ____ UNLESS NOTED	NOTES
FASTENERS ____ UNLESS NOTED	
FINISH ____	

DRAWN BY PC DATE 12-18-70
TRACED BY ____ DATE ____
CHECKED BY CM DATE 12-22-70
APPROVED BY ____ DATE ____



ERECTION NOTE ~
STRUTS, GIRDERS AND SKIN PLATE SECTIONS MUST BE ADEQUATELY SUPPORTED DURING ERECTION. PIN-UP CLIPS ARE TO HOLD THE VARIOUS SECTIONS TOGETHER DURING WELDING AND ARE NOT DESIGNED TO CARRY THE WEIGHT OF THE MEMBERS.

BID ITEM NUMBER 182
CONTRACT NUMBER DACW-68-70-C-0088

APPROVAL STAMPS

APPROVED
Subject to conformity with plans and specifications, correction of errors or omissions, and to fulfillment of any required tests. Approval does not cover detail dimensions, or assembility for assembling and fastening.
LOWER SNAKE RIVER
RESIDENT OFFICE
By [signature]
Date 25 SEP 1973

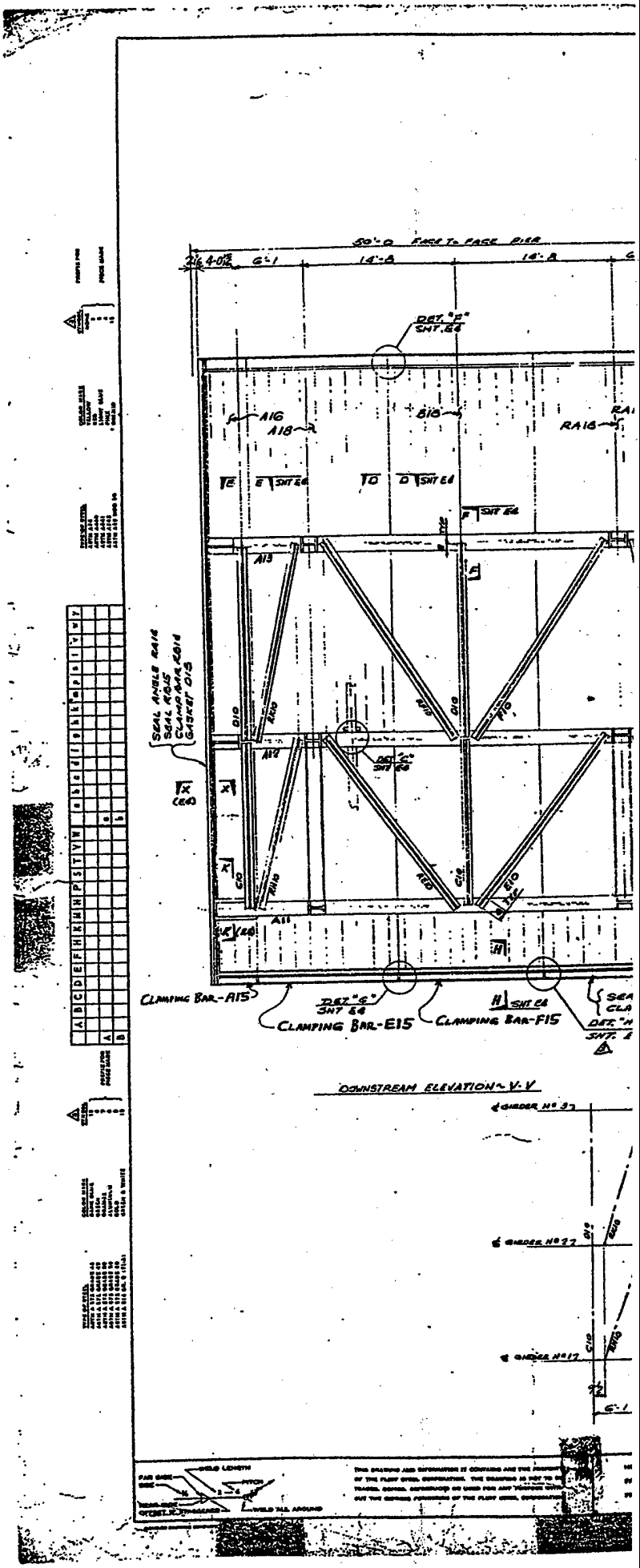
(3)

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

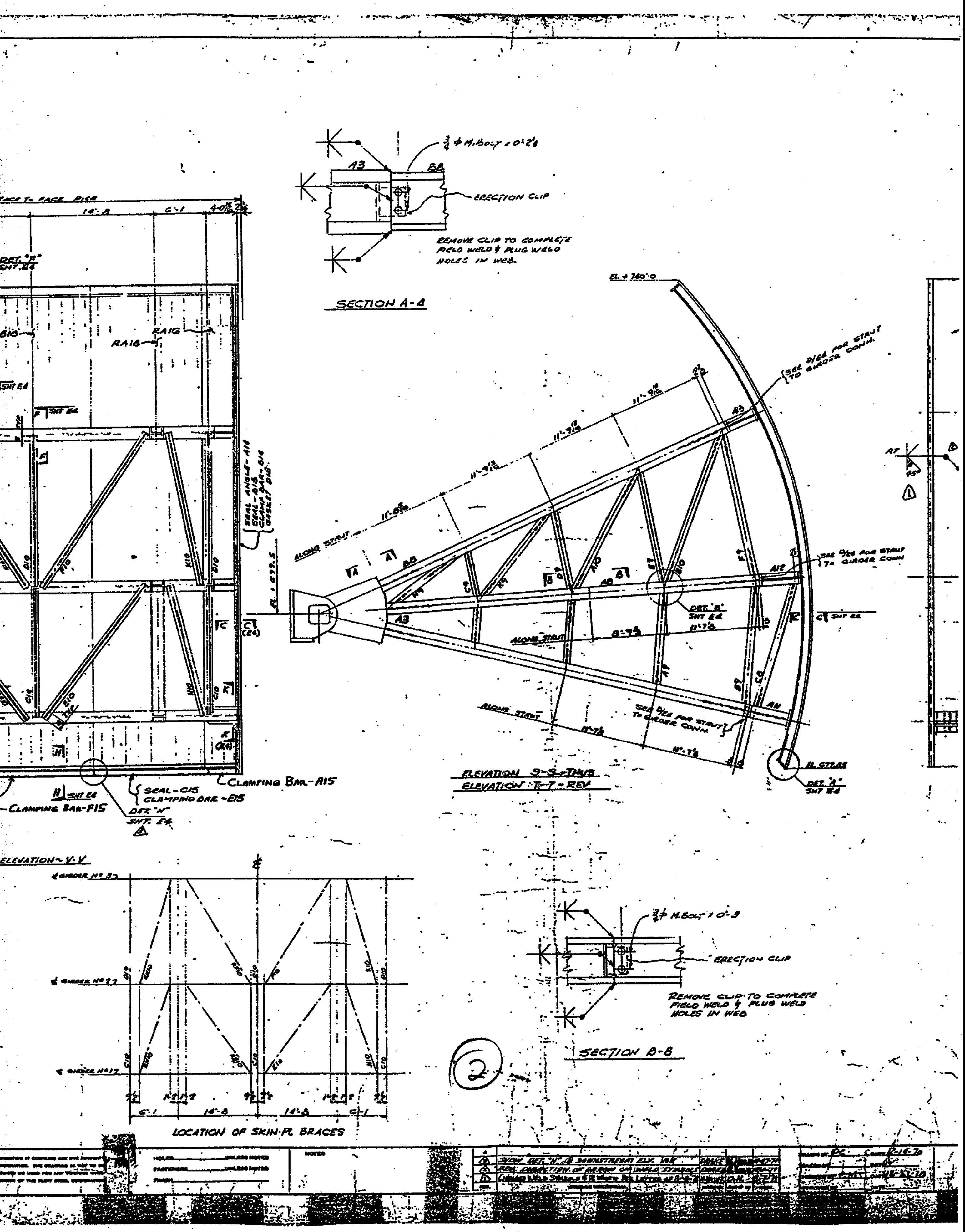
LSR 70-0088-132-004

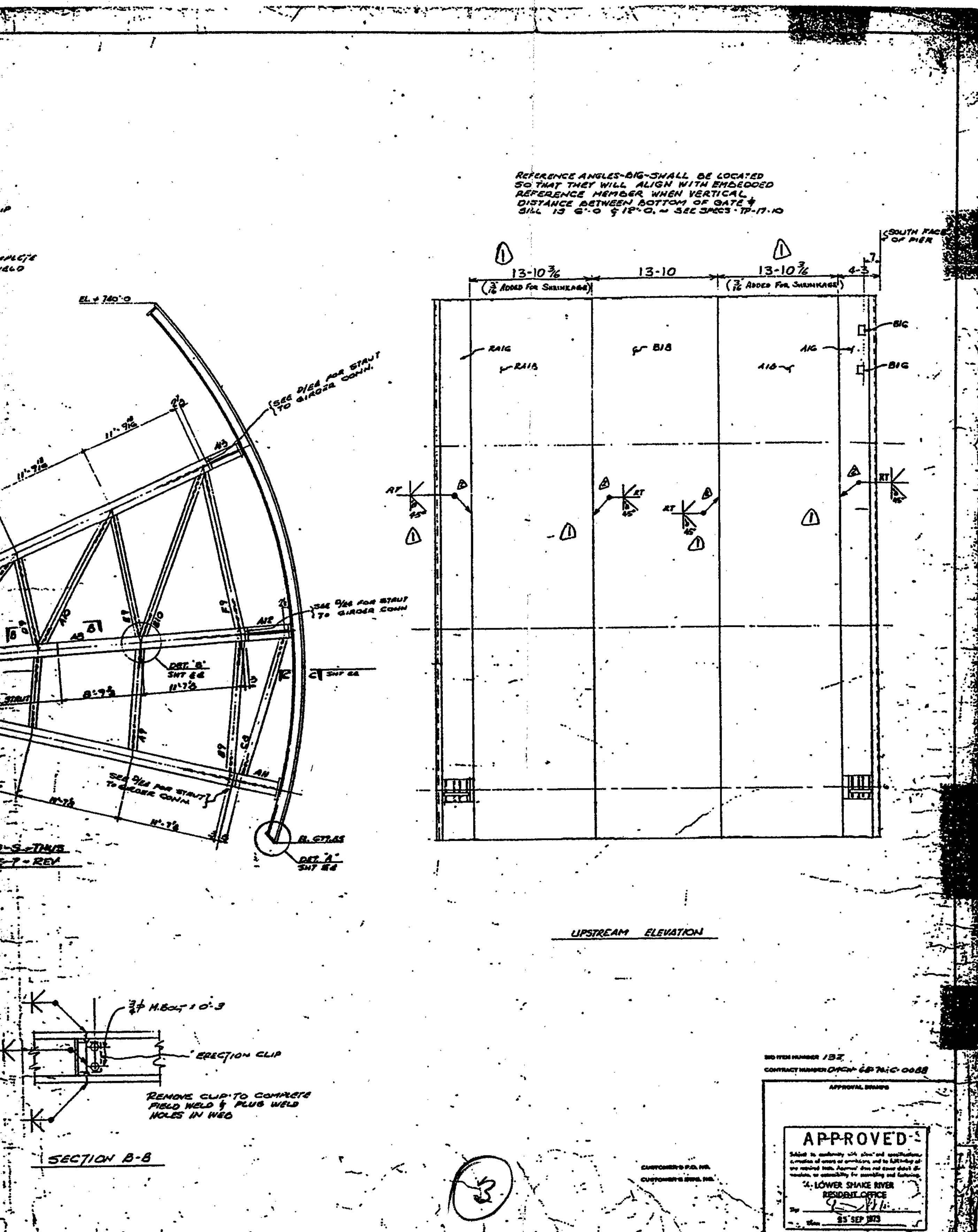
DRAWN BY PC DATE 12-14-70 TRACED BY ___ DATE ___ CHECKED BY CM DATE 12-22-70 APPROVED BY ___ DATE ___	[illegible]NT STEEL CORPORATION [illegible] 1250, TULSA, OKLAHOMA 74101 ENGINEERING DEPARTMENT	SPILLWAY GATES - GEN. ARRANGEMENT LOWER GRANITE LOCK & DAM LOWER GRANITE CONTR PULLMAN, WASH
		JOB NO. 70-0588 E2

70-C-88-351.


50'-0 FACE TO FACE PIER
14'-8
14'-8
DET "B" SHT E4
DET "C" SHT E4
DET "G" SHT E4
SEAL ANGLE R416
SEAL ANGLE
CLAMP BAR A614
GASKET 0.15
CLAMPING BAR-A15
CLAMPING BAR-E15
CLAMPING BAR-F15
DOWNSTREAM ELEVATION - V-V
GIRDER No 37
GIRDER No 27
GIRDER No 17

(1)


SECTION A-A
ERECTION CLIP
REMOVE CLIP TO COMPLETE FIELD WELD & PLUG WELD HOLES IN WEB.
ELEVATION 9-9-THIS
ELEVATION 7-7-REV
CLAMPING BAR-A15
SEAL-C15
CLAMPING BAR-E15
CLAMPING BAR-F15
ELEVATION-V-V
LOCATION OF SKIN-PL BRACES
SECTION B-B
REMOVE CLIP TO COMPLETE FIELD WELD & PLUG WELD HOLES IN WEB
ALONG STRUT
SEE D/E4 FOR STRUT TO GIRDER CONN.
2



APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
25 SEP 1970

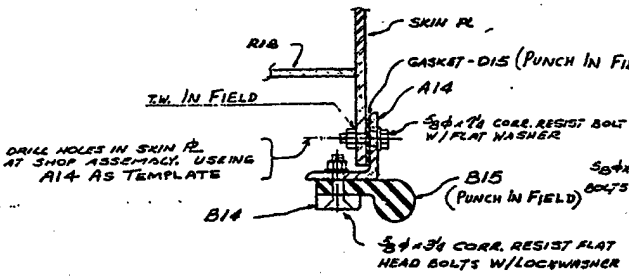
BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

FLINT STEEL CORPORATION
ENGINEERING DEPARTMENT

LSR70-0088-132-005

70-C-88-352

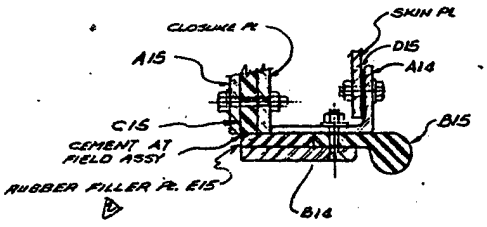
DRILL HOLES IN
AT SH
USE A15 FOR TEM



SECTION C-C - THUS
SECTION X-X - REV.

14W

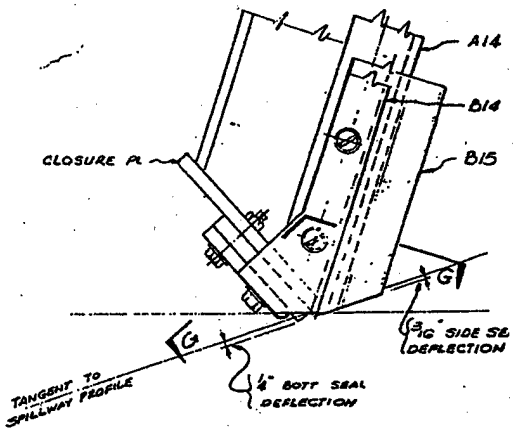
14WF5.7



WP1-2
WELD CLOSURE SEAM @ SHOP ASSEMBLY
TYPICAL

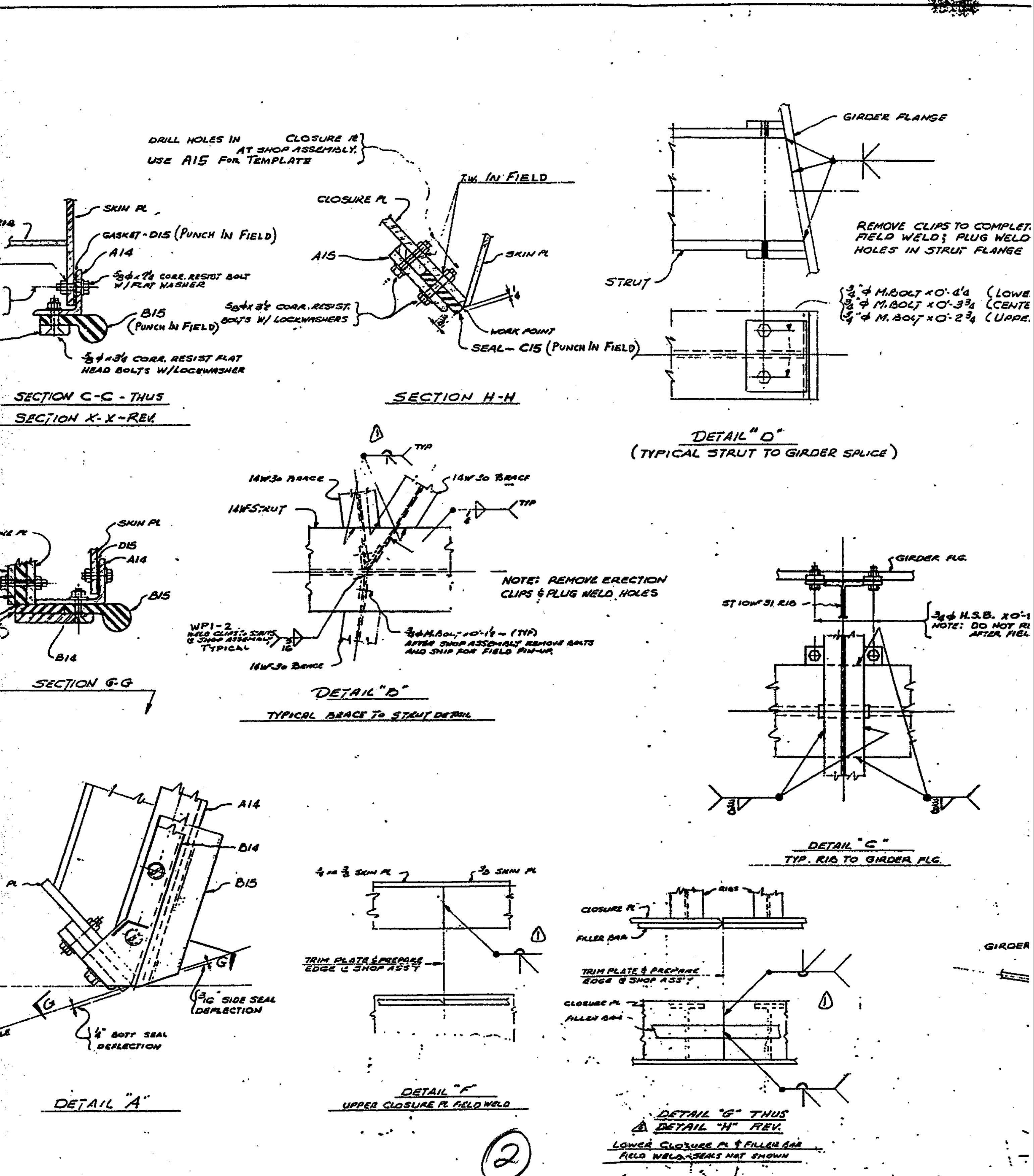
14W

SECTION G-G

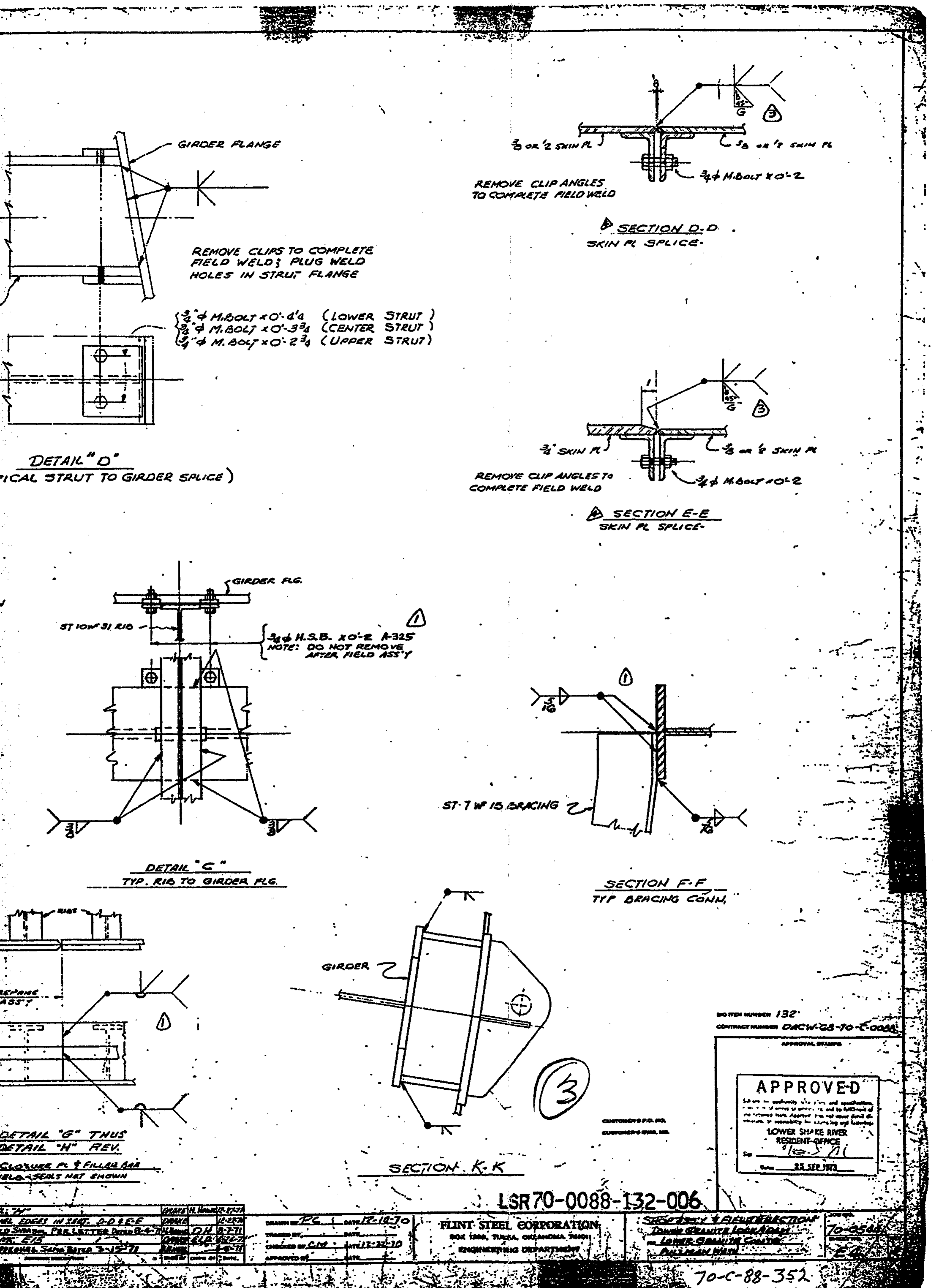


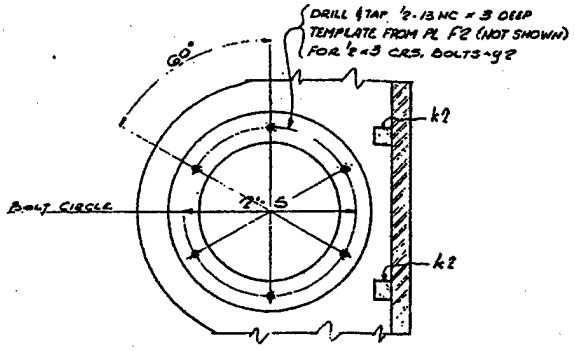
DETAIL "A"

(1)


DRILL HOLES IN CLOSURE PL AT SHOP ASSEMBLY. USE A15 FOR TEMPLATE
SKIN PL
GASKET-D15 (PUNCH IN FIELD)
A14
5/8φ CORR. RESIST BOLT W/FLAT WASHER
B15 (PUNCH IN FIELD)
CORR. RESIST FLAT HEAD BOLTS W/LOCKWASHER
SECTION C-C - THUS
SECTION X-X - REV.
CLOSURE PL
T.W. IN FIELD
A15
SKIN PL
5/8φ x 3 1/2 CORR. RESIST. BOLTS W/ LOCKWASHERS
WORK POINT
SEAL - C15 (PUNCH IN FIELD)
SECTION H-H
GIRDER FLANGE
REMOVE CLIPS TO COMPLET. FIELD WELD; PLUG WELD HOLES IN STRUT FLANGE
STRUT
DETAIL "D"
(TYPICAL STRUT TO GIRDER SPLICE)
14W30 BRACE
14WF STRUT
NOTE: REMOVE ERECTION CLIPS & PLUG WELD HOLES
WP1-2
AFTER SHOP ASSEMBLY REMOVE BOLTS AND SHIP FOR FIELD FIT-UP
DETAIL "B"
TYPICAL BRACE TO STRUT DETAIL
SKIN PL
D15
A14
B15
B14
SECTION G-G
GIRDER FLG.
ST 10WF 31 RIB
DETAIL "C"
TYP. RIB TO GIRDER FLG.
A14
B14
B15
3/16" SIDE SEAL DEFLECTION
1/4" BOTT SEAL DEFLECTION
DETAIL "A"
TRIM PLATE & PREPARE EDGE @ SHOP ASSY
DETAIL "F"
UPPER CLOSURE PL FIELD WELD
CLOSURE PL
FILLER BAR
RIBS
TRIM PLATE & PREPARE EDGE @ SHOP ASS'Y
DETAIL "G" THUS
DETAIL "H" REV.
LOWER CLOSURE PL & FILLER BAR FIELD WELD - SEALS NOT SHOWN
GIRDER

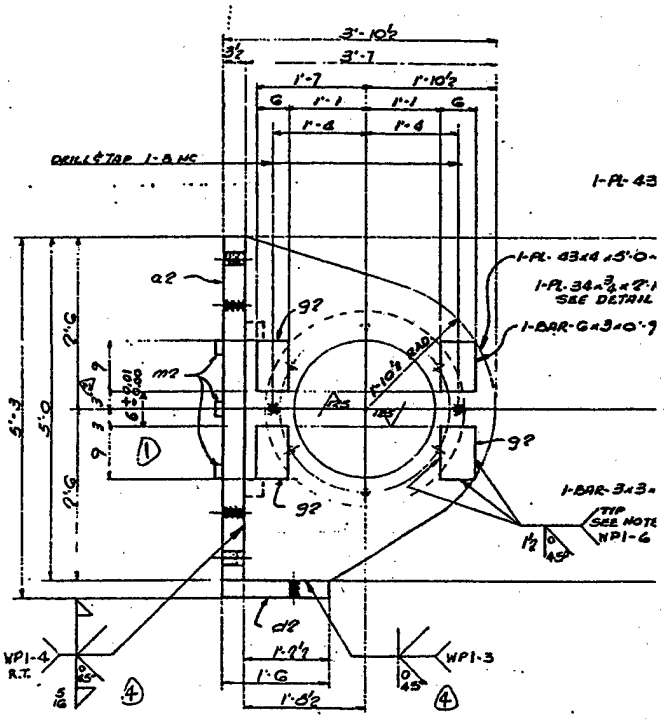
(2)

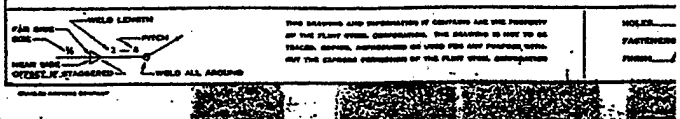

GIRDER FLANGE
REMOVE CLIPS TO COMPLETE FIELD WELD; PLUG WELD HOLES IN STRUT FLANGE
3/4"φ M.BOLT x 0'-4 1/4 (LOWER STRUT)
3/4"φ M.BOLT x 0'-3 3/4 (CENTER STRUT)
3/4"φ M.BOLT x 0'-2 3/4 (UPPER STRUT)
DETAIL "D"
(TYPICAL STRUT TO GIRDER SPLICE)
3/8 OR 1/2 SKIN PL
5/8 OR 1/2 SKIN PL
3/4φ M.BOLT x 0'-2
REMOVE CLIP ANGLES TO COMPLETE FIELD WELD
SECTION D-D
SKIN PL SPLICE
3/4" SKIN PL
5/8 OR 1/2 SKIN PL
3/4φ M.BOLT x 0'-2
REMOVE CLIP ANGLES TO COMPLETE FIELD WELD
SECTION E-E
SKIN PL SPLICE
GIRDER FLG.
ST 10W 31 RIB
3/4φ H.S.B. x 0'-2 A-325
NOTE: DO NOT REMOVE AFTER FIELD ASS'Y
DETAIL "C"
TYP. RIB TO GIRDER FLG.
ST-7 W 15 BRACING
SECTION F-F
TYP BRACING CONN.
GIRDER
SECTION K-K
DETAIL "G" THUS
DETAIL "H" REV.
CLOSURE PL & FILLER BAR
SEALS NOT SHOWN
BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088
APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
25 SEP 1973
LSR70-0088-132-006
FLINT STEEL CORPORATION
BOX 1289, TULSA, OKLAHOMA
ENGINEERING DEPARTMENT
SHOP ASS'Y & FIELD ERECTION
LOWER GRANITE LOCK
70-C-88-352



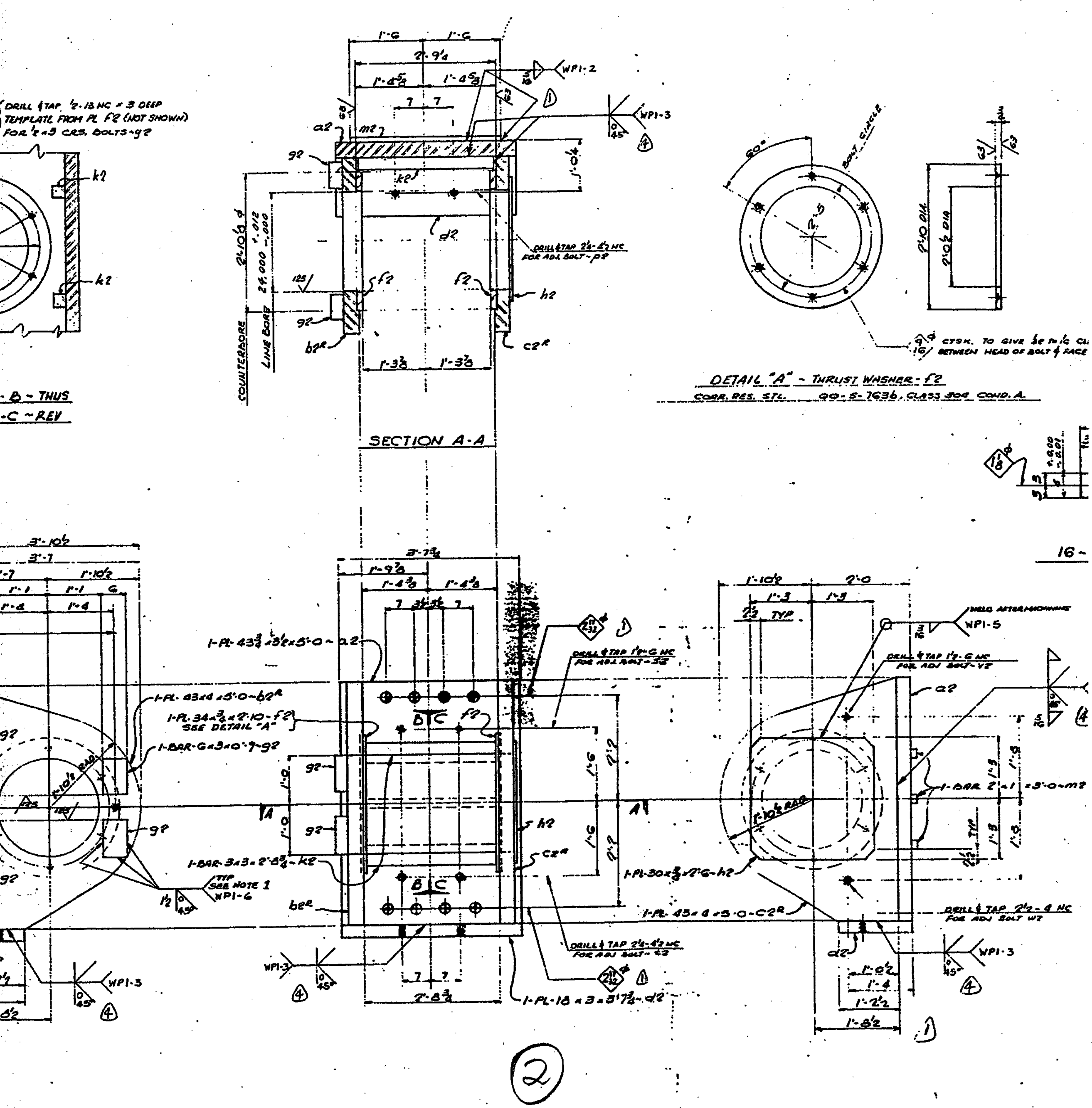
SECTION B-B - THUS
SECTION C-C - REV

COUNTERBORE 2-10½ d





(1)



8-TRUNNION YOKES - THUS - A2

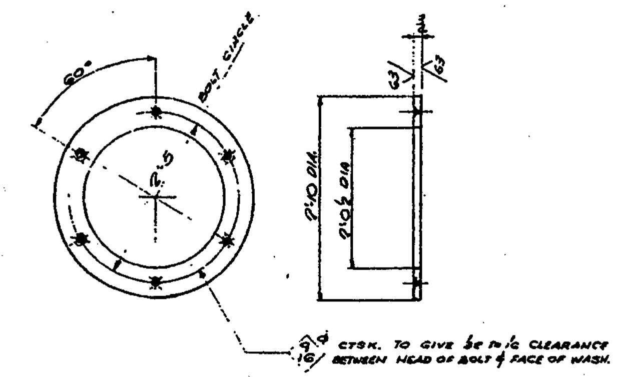
8-TRUNNION YOKES - REV - RA2

NOTE
TAG ALL MATERIAL
WITH ITEM Nº 132

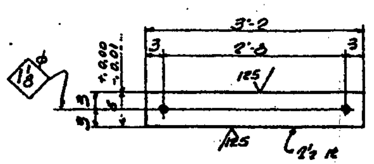
Rev	Description	Date
4	REVISED WELD SYMBOLS	10-25-71
3	CORRECTED NOTES & 1.5	3-4-71
2	CORRECTED Per: Appr. Dwg	5-20-71
1	REV. PER APPROVAL SERIES DATED 3-15-71	4-6-71

FINISH NONE

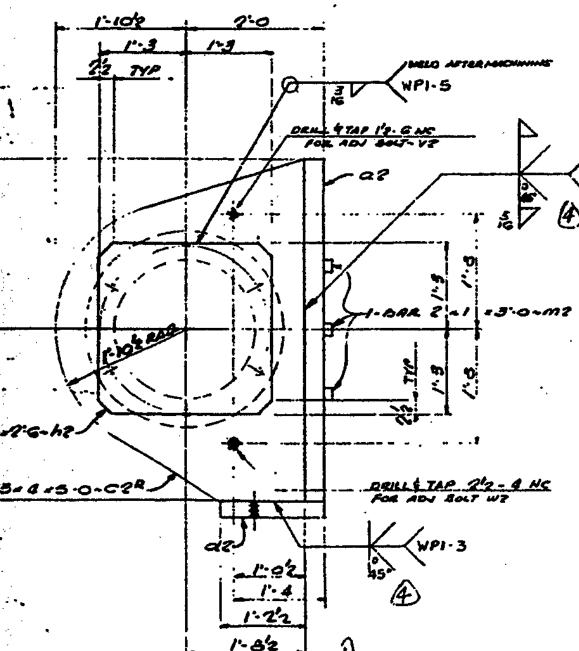
DRAWN BY PC DATE 11-17-70
CHECKED BY C.M. DATE 12-22-70



DETAIL "A" - THRUST WASHER - f2
CORR. RES. STL. QQ-S-763b, CLASS 304 COND. A.



16 - KEEPER BARS - B2



NOTE-
1- WELD g2 TO YOKE BEFORE STRESS RELEIVING
2- 24 DIA. PIN HOLES TO BE LINE BORED AFTER STRESS RELIEF.
3. ADJ. BOLTS p2 THRU w2 TO BE INSTALLED PRIOR TO SHIPPING SEE DWG E2
4. WELDMENT TO BE STRESS RELIEVED BY HEAT TREATMENT AFTER WELDING IS COMPLETED, EXCEPT FOR WELDING OF R h2.
5- ALL MACHINING TO BE DONE AFTER WELDING IS COMPLETE EXCEPT WELDING BARS h2.

	NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.		WEIGHT
	8	A2	TRUNNION YOKE				
	8	RA2	TRUNNION YOKE				
3/4	16	a2	PL 43¾ x 3½	5	0		
1/4	8/8	b2	PL 43 x 4	5	0		
2/4	8/8	c2	PL 43 x 4	5	0		
4/4	16	d2	PL 18 x 3	3	7¾		
3/11	32	f2	PL 36 x 7/8	3	0	SEE DET. A FIN 2 SIDES	
19/4	64	g2	BAR 6 x 3	0	9	FIN 1 END	
1/6	16	h2	PL 30 x 3/4	2	6		
	32	k2	BAR 3 x 3	2	8¾		
	48	m2	BAR 2 x 1	3	0		
	32	p2	2¼ø-4½NC-M.B.	0	6		
	32	s2	1½ø-6NC-M.B.	0	9	FF-B-575b	
	32	t2	2¼ø-4½NC-MB	0	9	THD FULL LEN.	
	16	v2	1½ø-6NC-MB	0	8	NO NUT	
	16	w2	2½ø-4NC-MB	0	8		
3/10	192	y2	½-13NC FH.MB	0	3	2½ THD NO NUT	
						CORR RES'T	
						(FF-B-575b COND A	
						TYPE 304)	
13/4	16	B2	PL 6 x 2½	3	2	FIN 2 EDGES	
			SHOP WELD				
			3/16 FILLET	160	0	LIN. FT.	
			5/16 FILLET	618	0		
			1½ 45° SIN. BEV.	128	0		
			3" 45° DBL BEV.	88	0		
			3½ 45° DBL BEV.	69	0		
			4" 45° DBL BEV.	104	0		
			ALL MAT'L A36	U.N.			

BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
Date 25 SEP 1973

(3)

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG NO.

NOTE
TAG ALL MATERIAL
WITH ITEM Nº 132

LSR 70-0088-132-007

SYMBOLS
... 415
... APPR. DWG
... SERIAL DATED 3-15-71

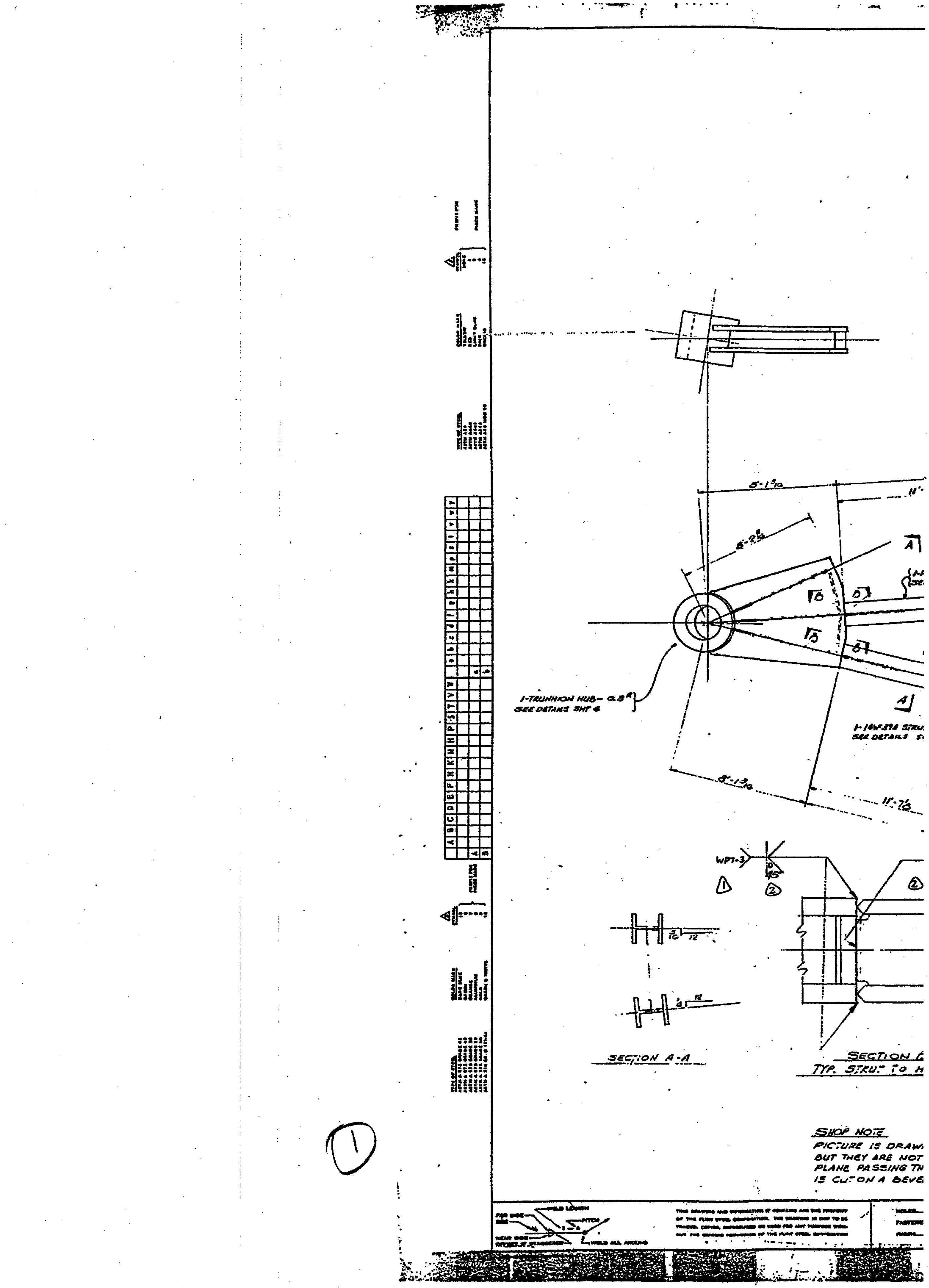
DRAWN BY PC DATE 11-17-70
TRACED BY ____ DATE ____
CHECKED BY C.M. DATE 12-22-70
APPROVED BY ____ DATE ____

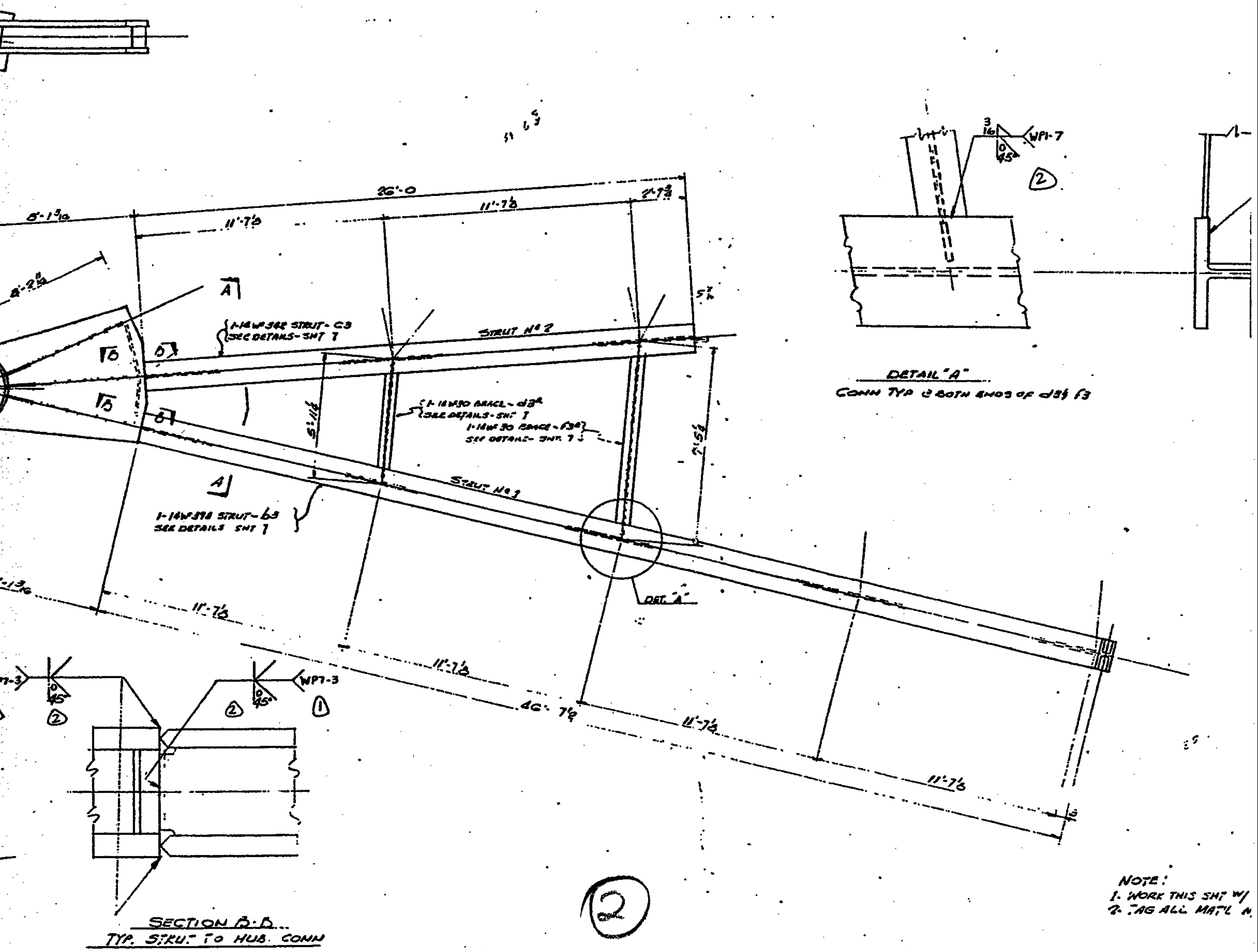
FLINT STEEL CORPORATION
BOX 1299, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

TRUNNION YOKE - SPILLWAY GATES
LOWER GRANITE LOCK & DAM
FOR LOWER GRANITE CONTR.
PULLMAN WASH.

JOB NO. 70-0544
SHEET NO. 2
REV 4

70-C-88-353


8'-1 3/16
8'-2 1/2
1-TRUNNION HUB - Q.3R
SEE DETAILS SHT 4
1-14WF398 STRU
SEE DETAILS
8'-1 3/16
11'-7 1/2
WPT-3
SECTION A-A
SECTION
TYP. STRUT TO H
SHOP NOTE
PICTURE IS DRAW
BUT THEY ARE NOT
PLANE PASSING TH
IS CUT ON A BEVE
WELD LENGTH
PITCH
WELD ALL AROUND



②

NOTE:
1. WORK THIS SHT W/
2. TAG ALL MAT'L ...

8 - TRUNNION ARM SECTIONS - THUS - A3
8 - TRUNNION ARM SECTIONS - REV - RA3

SHOP NOTE

PICTURE IS DRAWN LOOKING AT BOTH ARMS FROM A RIGHT AT THE SAME TIME. EACH ARM IS A TRUE VIEW, BUT THEY ARE NOT SHOWN IN A TRUE RELATION TO ONE ANOTHER. THE BEAMS ARE TILTED SLIGHTLY TO A PLANE PASSING THRU THEIR ℄ PER SECTION A-A. A LINE PASSING THRU THE WEB ON THE LEFT END THAT IS CUT ON A BEVEL SHOULD BE PERFECTLY HORIZONTAL. ALL DIM. MUST BE WORKED OFF ℄ OF WEB DEPTH

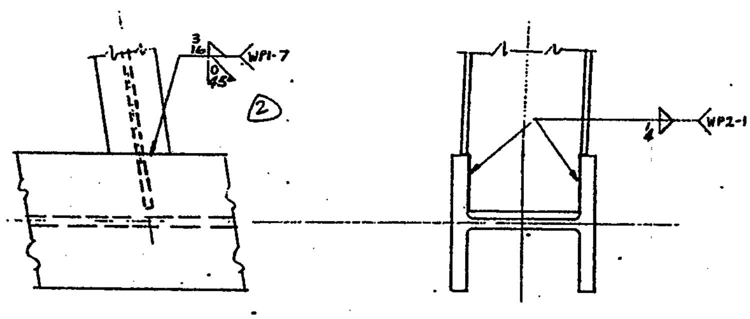
HOLES		UNLESS NOTED
FASTENERS		UNLESS NOTED
FINISH	None	

NOTES

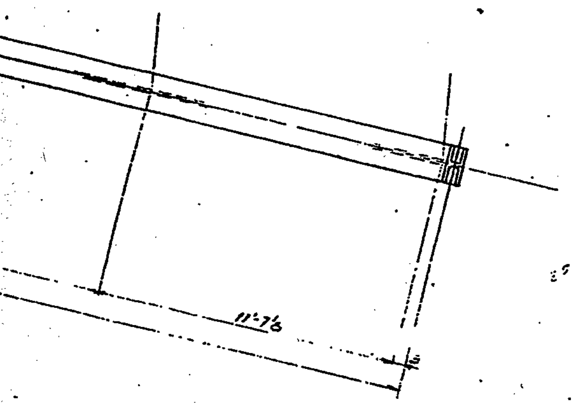
REV.	DESCRIPTION		
4			
3			
2	REVISED WELD SYMBOLS		
1	REV. PER APPVL PRINT DATED 3-18-71		4-6-71

DRAWN BY PC DATE 12-2-70
TRACED BY DATE
CHECKED BY C.M. DATE 12-22-70
APPROVED BY DATE

NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	
8	A3	TRUNNION ARM SECTIONS				
8	RA3	TRUNNION ARM SECTIONS				
8	a3ᴿ	TRUNNION HUB				
8	a3ᴸ	TRUNNION HUB				
16	b3	STRUTS (N° 2)			1/8	
16	c3	STRUTS (N° 2)			3/8	
8	d3ᴿ	BRACE			3/8	
8	d3ᴸ	BRACE				
8	f3ᴿ	BRACE			1 1/8	
8	f3ᴸ	BRACE				
64		3/4 ϕ M BOLTS	0	5	PIN-JP	
		SHOP WELD				
		3/16 FILLET	32	0	LIN. FT.	
		1/4 FILLET	150	0		
		3/8 45° SIN. BEV	67	0		
		1 1/16 45° DBL. BEV.	17	0		
		1 1/16 45° DBL. BEV.	17	0		
		1 7/16 45° DBL. BEV	44	0		
		2 1/16 45° DBL. BEV	45	0		



DETAIL "A"
CONN TYP @ BOTH ENDS OF d3 & f3



BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088

NOTE:
1. WORK THIS SHT W/ SHT 4 THRU 7
2. TAG ALL MAT'L W/ ITEM Nº 132

APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
Date 25 SEP 1973

(3)

A3
RA3

EACH ARM IS A TRUE VIEW, ARE TILTED SLIGHTLY TO A WEB ON THE LEFT END THAT WORKED OFF ℄ OF WEB DEPTH

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

LSR 70-0088-132-008

... SYMBOLS
... PAINT DATED 3-18-71

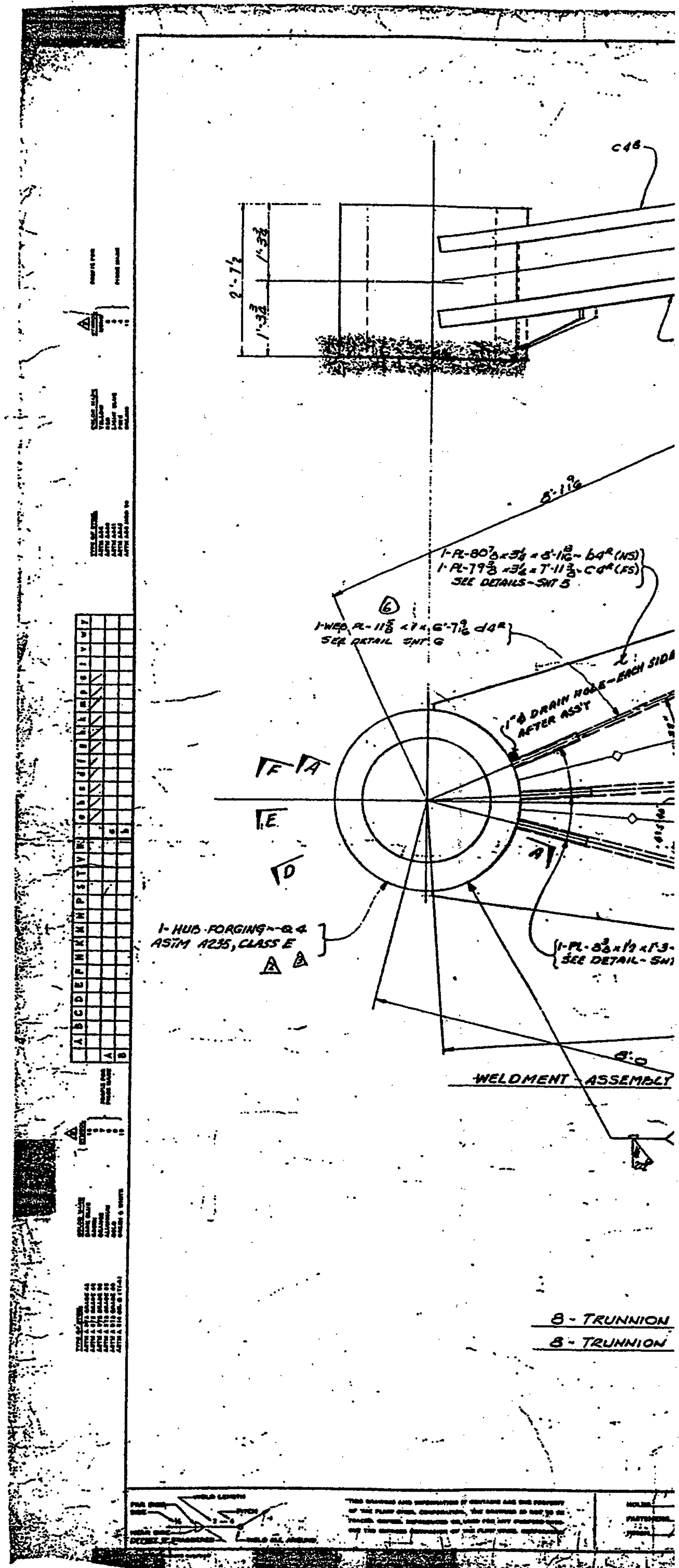
DRAWN BY PC DATE 12-2-70
TRACED BY DATE
CHECKED BY CM DATE 12-22-70
APPROVED BY DATE

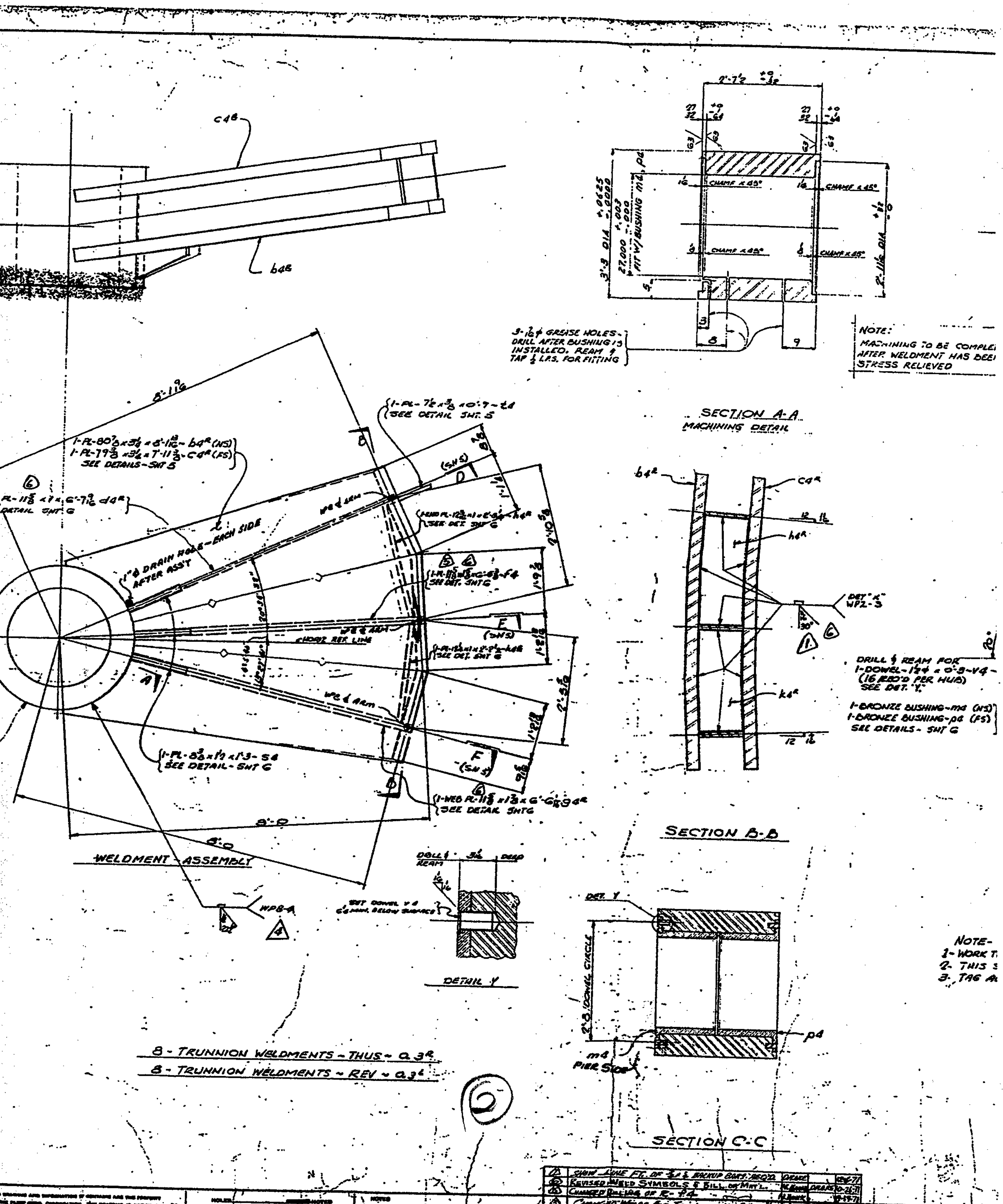
FLINT STEEL CORPORATION
BOX 1289, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

TRUNNION ARM SECTIONS
LOWER GRANITE LOCK & DAM
FOR LOWER GRANITE CONTR.
PULLMAN, WASH.

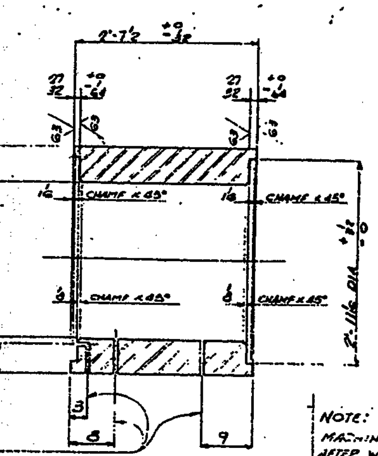
JOB NO. 70-0544
SHEET NO. 3
REV 2

70-C-88-354


C4B
2'-7 1/2
1'-3 3/4
1'-3 3/4
8'-11 9/16
1-PL-80 7/8 x 3/4 x 8'-11 13/16 - b4R (NS)
1-PL-79 3/8 x 3/4 x 7'-11 3/8 - C4R (FS)
SEE DETAILS - SHT 5
1-WEB PL-11 5/8 x 1 x 6'-7 9/16 d4R
SEE DETAIL SHT 6
1"φ DRAIN HOLE - EACH SIDE
AFTER ASS'T
F
A
E
D
A
1-HUB FORGING - a4
ASTM A235, CLASS E
1-PL-8 3/8 x 1/2 x 1'-3-
SEE DETAIL - SHT
8'-0
WELDMENT - ASSEMBLY
8 - TRUNNION
8 - TRUNNION
1

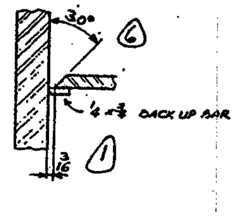


c4B
b4B
SECTION A-A
MACHINING DETAIL
3-1/2⌀ GREASE HOLES-DRILL AFTER BUSHING IS INSTALLED. REAM & TAP 1/8 I.P.S. FOR FITTING
NOTE:
MACHINING TO BE COMPLE
AFTER WELDMENT HAS BEE
STRESS RELIEVED
CHAMF x 45°
FIT W/ BUSHING m4, p4
8'-1 9/16
1-PL-7 1/2 x 3/8 x 0'-7-t4
SEE DETAIL SHT. 5
1-PL-80 7/8 x 3 1/4 x 8'-1 13/16 - b4R (NS)
1-PL-79 3/8 x 3 1/4 x 7'-11 3/8 - c4R (FS)
SEE DETAILS - SHT 5
1" ⌀ DRAIN HOLE - EACH SIDE AFTER ASS'T
WP & ARM
CHORD REF LINE
1-PL-8 3/8 x 1/2 x 1'-3 - s4
SEE DETAIL - SHT G
1-WEB PL-11 5/8 x 1 3/8 x 6'-6 5/8 g4R
SEE DETAIL SHT G
8'-0
8'-0
WELDMENT - ASSEMBLY
WP8-A
SECTION B-B
b4R
c4R
h4R
k4R
DET "X"
WPZ-3
DRILL & REAM FOR
1-DOWEL-1 1/4 x 0'-3-v4
(16 REQ'D PER HUB)
SEE DET. "Y"
1-BRONZE BUSHING-m4 (NS)
1-BRONZE BUSHING-p4 (FS)
SEE DETAILS - SHT G
DRILL & REAM 3 1/4 DEEP
SET DOWEL v4 1/16 MIN. BELOW SURFACE
DETAIL Y
DET. Y
2'-8 DOWEL CIRCLE
p4
m4
PIER SIDE
SECTION C-C
8 - TRUNNION WELDMENTS - THUS - a3R
8 - TRUNNION WELDMENTS - REV - a3L
NOTE-
1- WORK T
2- THIS
3- TAG A
REVISED WELD SYMBOLS & BILL OF MAT'L
CHANGED BILLING OF R-P4
NONE

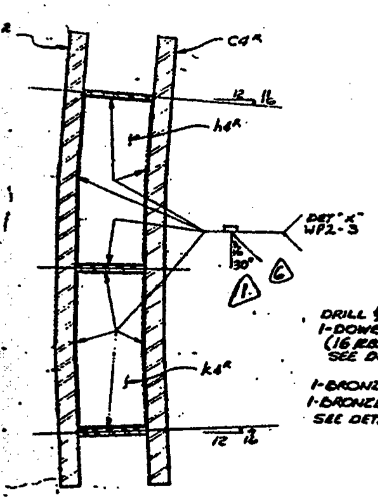


SECTION A-A
MACHINING DETAIL

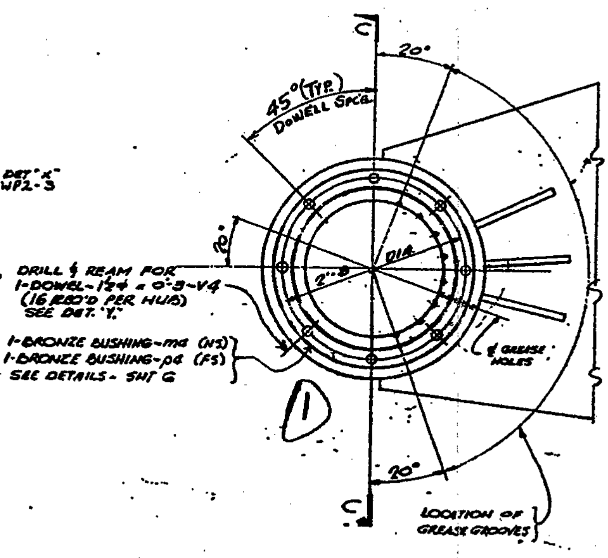
NOTE:
MACHINING TO BE COMPLETED AFTER WELDMENT HAS BEEN STRESS RELIEVED



DETAIL "X"

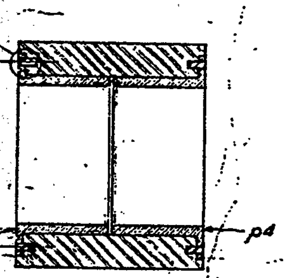


SECTION B-B



HUB ASSEMBLY

NOTE-
1- WORK THIS SHT W/SHT 3. 5&6-
2- THIS SHT DETAIL MAT'L ONLY- DO NOT SHIP-
3- TAG ALL MAT'L WITH ITEM No 132.



SECTION C-C

NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.		
8	a3	TRUNNION				
8	a3	TRUNNION				
16	a4	39 DIA	2	7½	FORGING A235	
8/8	b4	PL 80⅞ x 3¼	6	1⅝	BEND ⅞	
8/8	c4	PL 79⅜ x 3¼	7	11⅜	BEND ¾	
8/8	d4	PL 11⅞ x 1	6	7	10/5	
16	f4	PL 11⅞ x 1⅝	6	6⅜	10/4	
8/8	g4	PL 11⅞ x 1⅛	6	6	14/4	
8/8	h4	PL 12⅛ x 1	2	8¼	11/5	
8/8	k4	PL 12¼ x 1	2	2½	12/5	
16	m4	BRONZE BUSH 2-11 DIA	1	3⅝		
16	p4	BRONZE BUSH 2-11 DIA	1	3⅝		
		CAST ALUMINUM BRONZE FED SPECS QQ-A-671 B CLASS 3 H.T. OR ASTM B148 CLASS 9-C- H.T.				
48	s4	PL 8⅞ x 1½	1	3	⅕	
16	t4	PL 9 x ⅜	0	7½	⅙	
256	V4	DOWEL 1½ϕ	0	8	24/7	

SHOPWELD

¼ FILLET	30	0	LIN. FT.
1" 45° SIN. BEV	440	0	
1⅜ 45° SIN. BEV	224	0	
1½ 45° DBL BEV	84	0	
1⅝ 45° DBL BEV	776	0	
3¼ 45° DBL BEV	160	0	

975 LINE FT. OF ¼ x ¾ BACKUP BARS MAT'L ASTM A570 GRADE D TOTAL FOR 16 TRUNNIONS

MAT'L A36 U.N.

BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088
APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
Date 15 SEP 1971

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

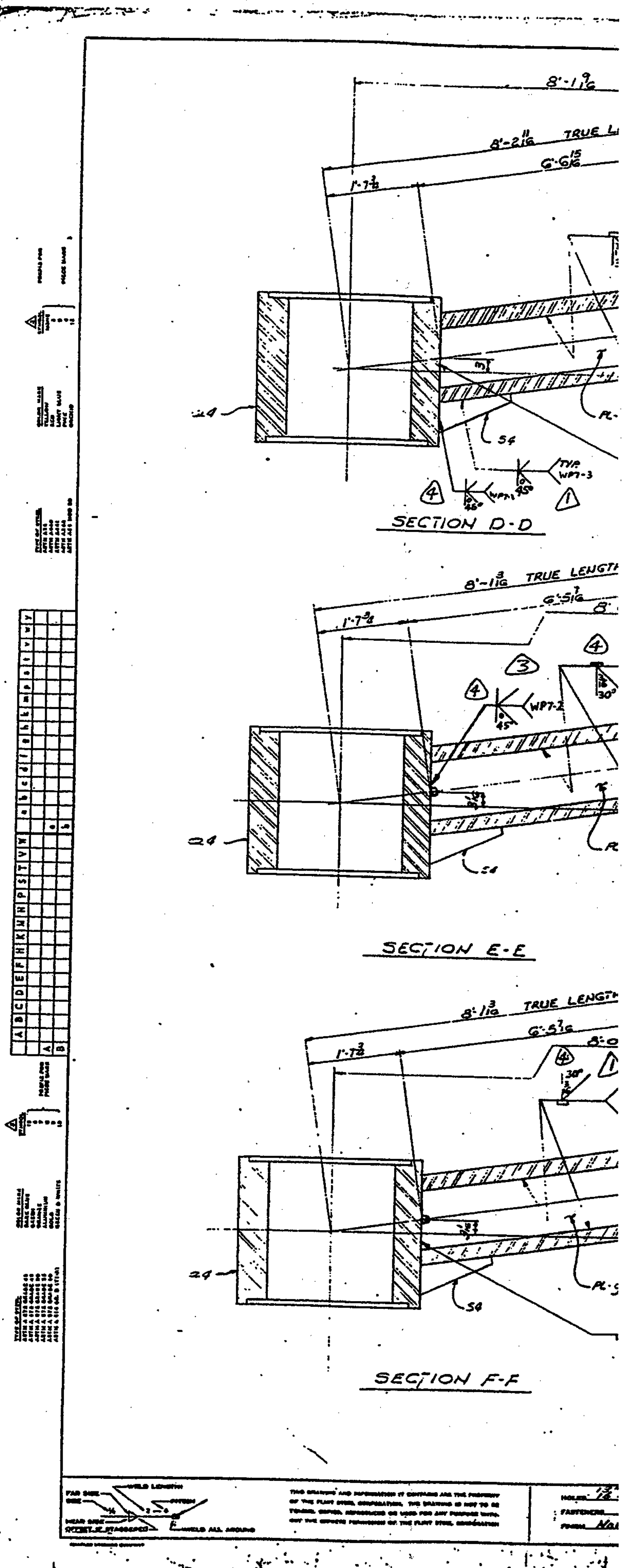
(3)

LSR 70-0088-132-009

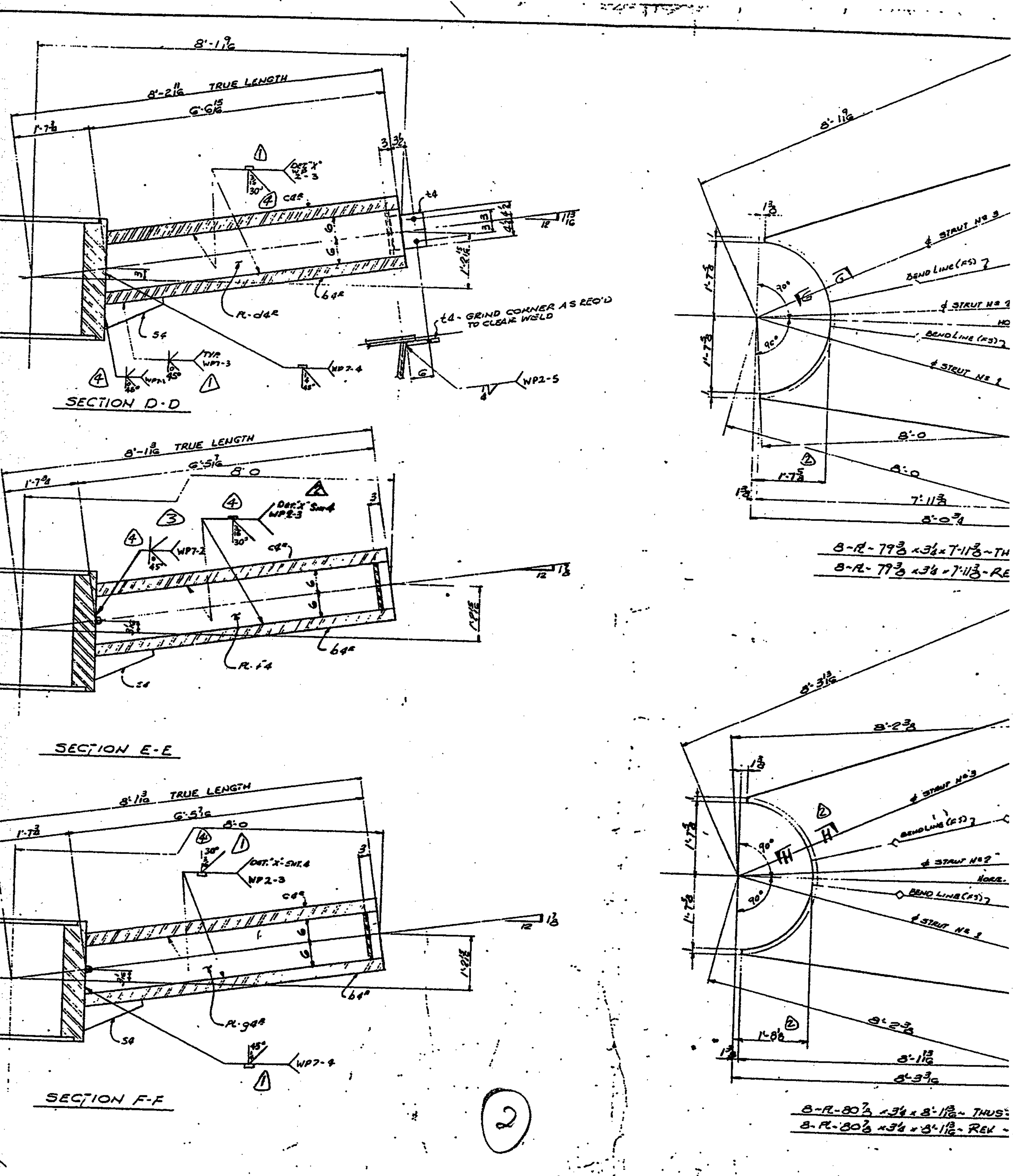
FLINT STEEL CORPORATION
BOX 1289, TULSA, OKLAHOMA
ENGINEERING DEPARTMENT

TRUNNION DETAILS - SPILLWAY GATE
LOWER GRANITE LOCK & DAM

70-C-88-355



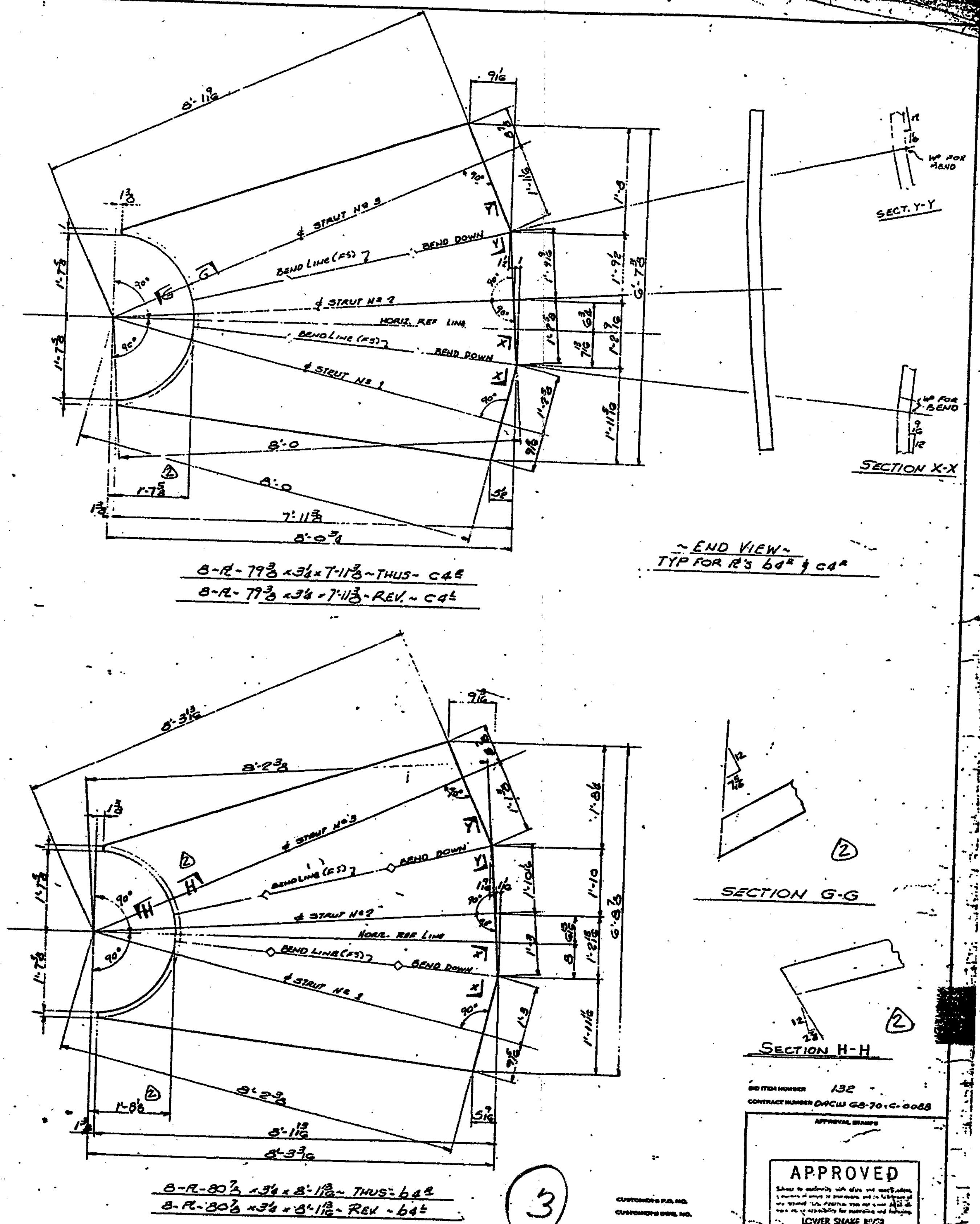
8'-1 9/16
8'-2 11/16 TRUE L
6'-6 15/16
1'-7 3/8
SECTION D-D
8'-1 3/16 TRUE LENGTH
6'-5 7/16
1'-7 3/8
WP7-2
SECTION E-E
8'-1 3/16 TRUE LENGTH
6'-5 7/16
1'-7 3/8
SECTION F-F



HOLES 13/16 ∅ UNLESS NOTED
FASTENERS UNLESS NOTED
FINISH None

REVISED WELD SYMBOLS
CHANGED WELD SYMBOLS @ SECTION E-E
REV. PER ERECTOR'S SKETCH DATED 3-15-71

DRAWN BY RC DATE 12-3-70
CHECKED BY CM DATE 12-22-70



BID ITEM NUMBER 132

CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED

LOWER SNAKE RIVER RESIDENT OFFICE

25 SEP 1973

(3)

CUSTOMER'S P.O. NO.

CUSTOMER'S DWG. NO.

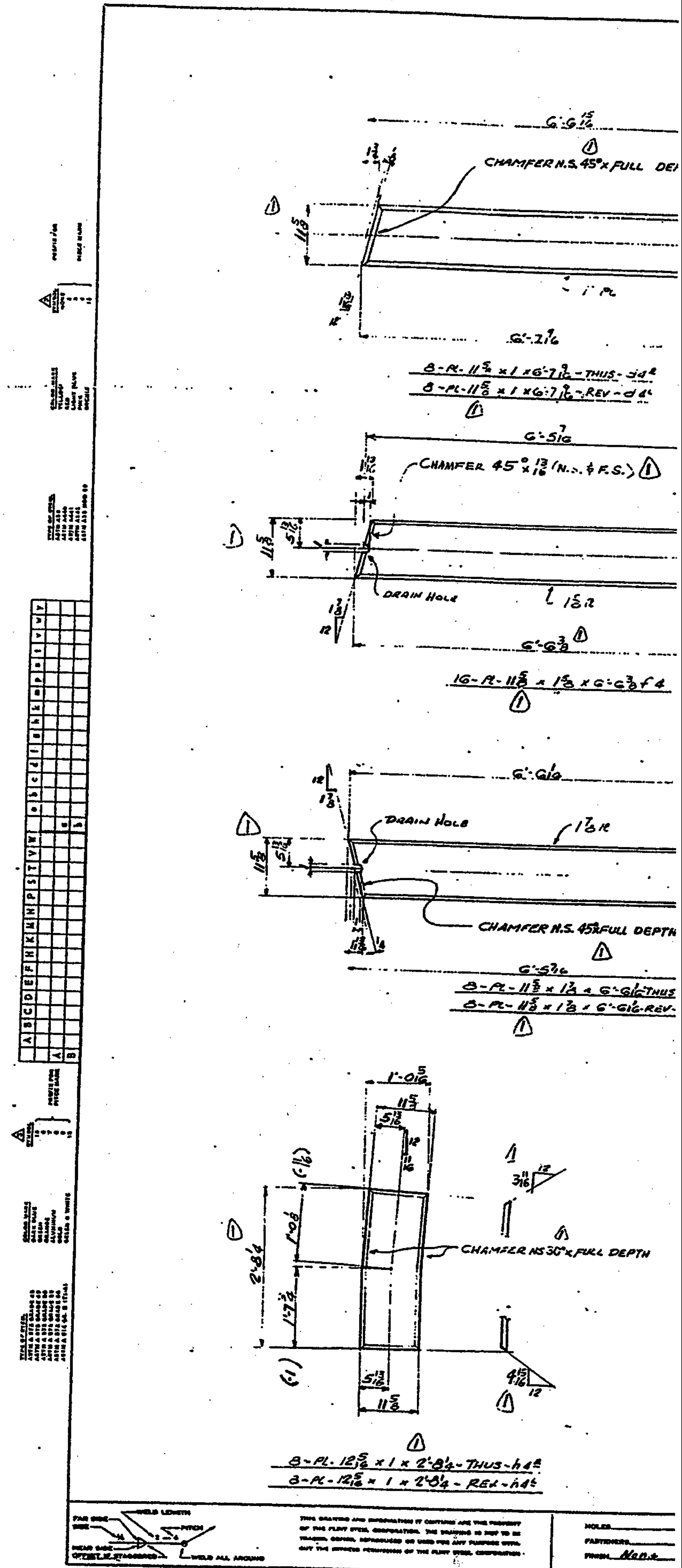
LSR70-0088-132-010

WORK THIS DWG W/ DWG No 3,446

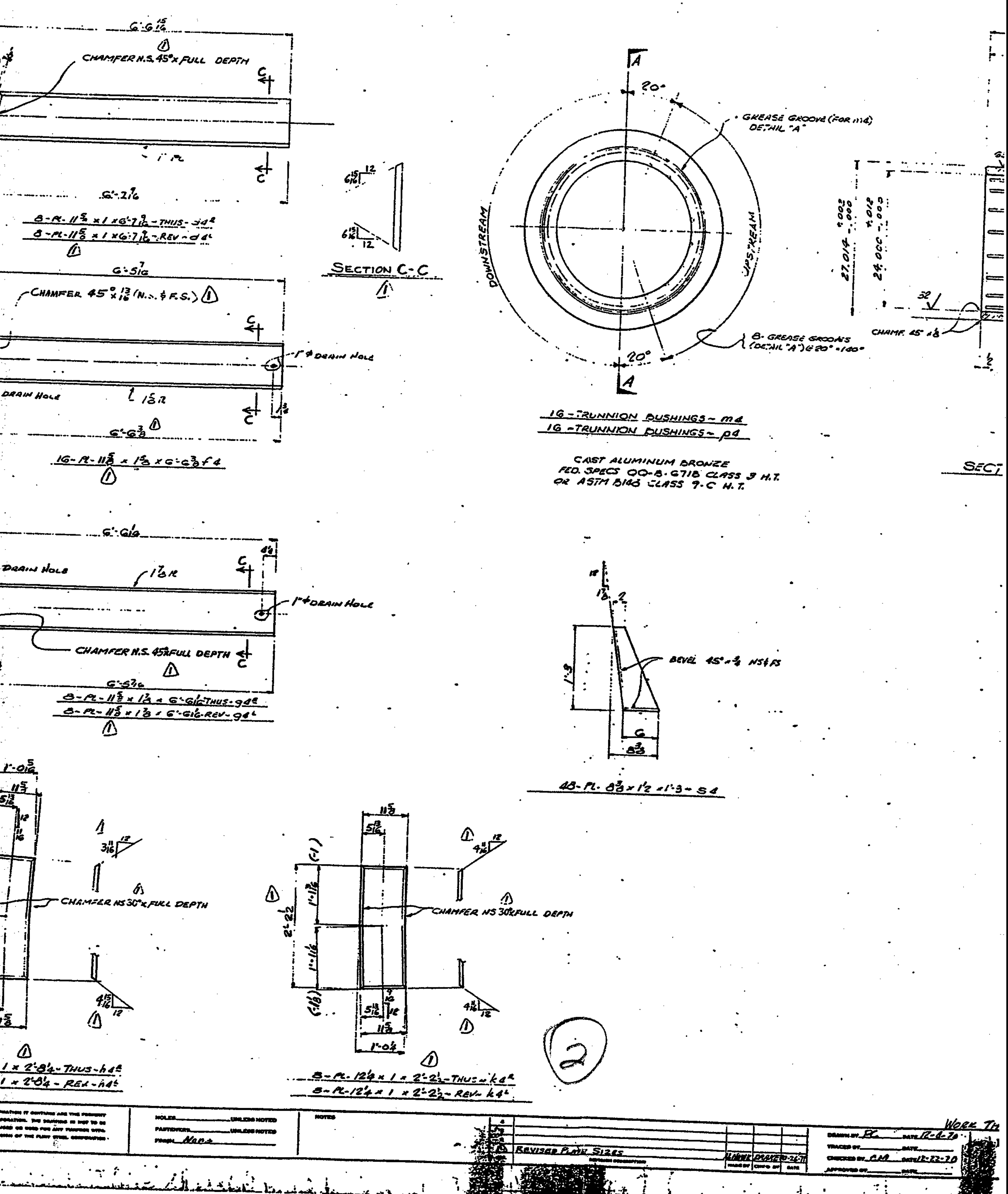
FLINT STEEL CORPORATION
BOX 1880 TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

TRUNNION DETAILS - SPILLWAY GATES

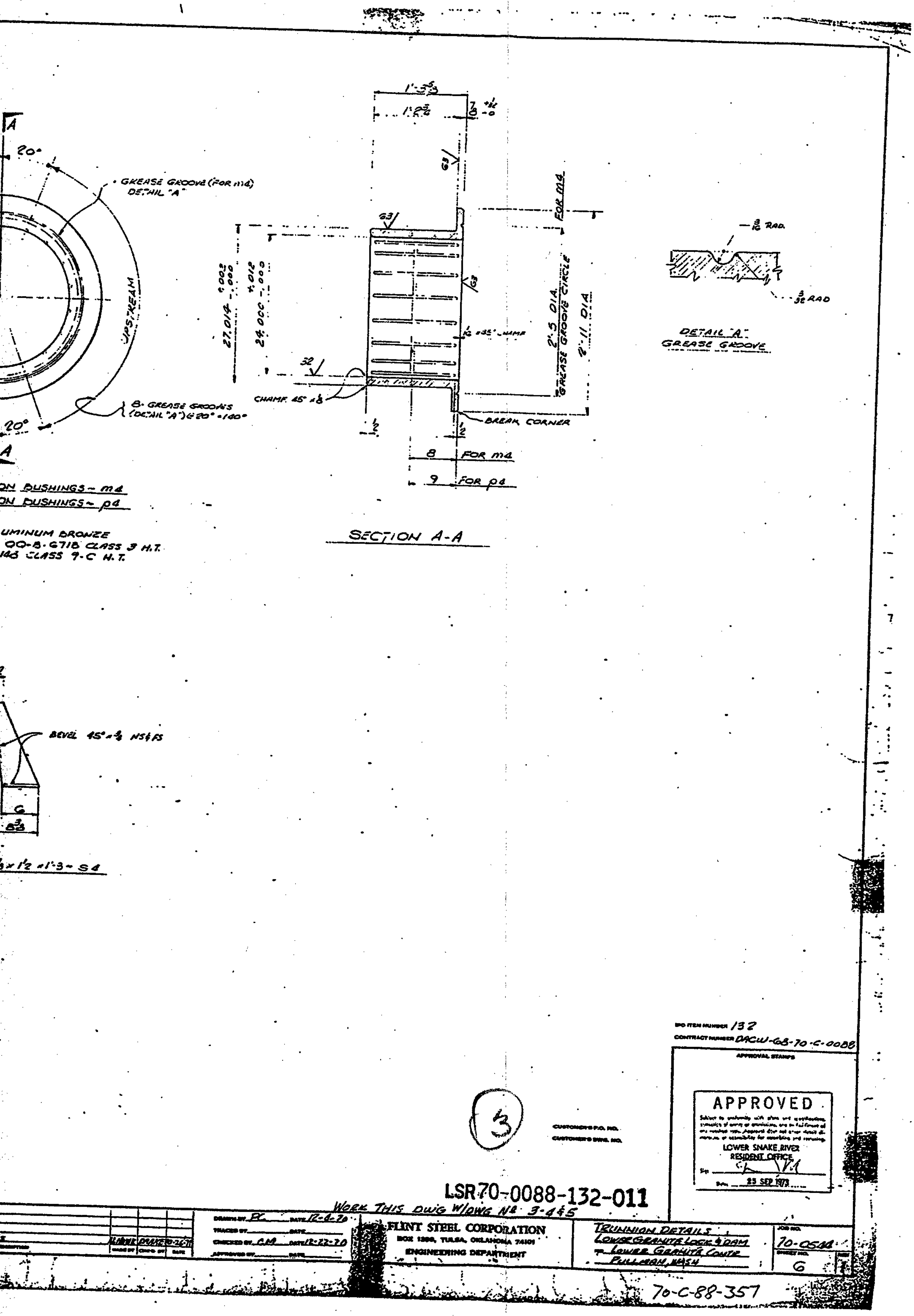
70-C-88-356



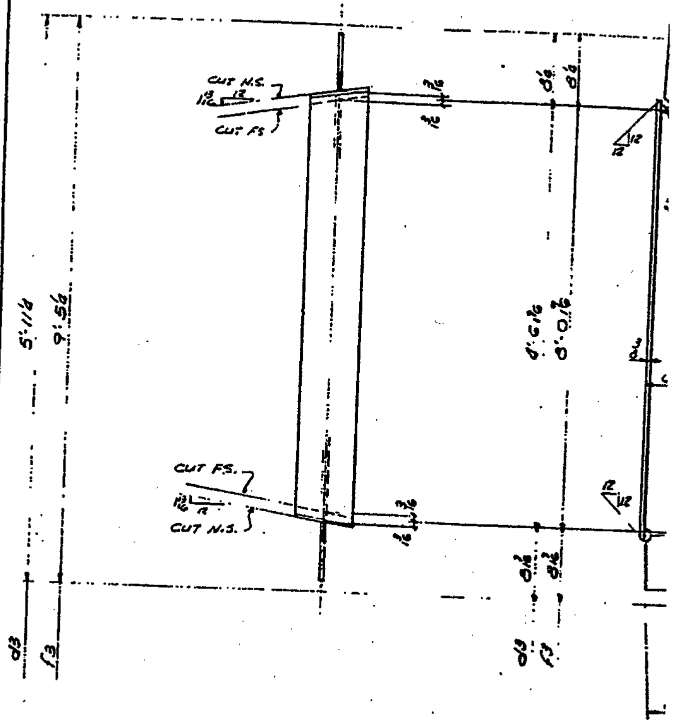
CHAMFER N.S. 45°x FULL DE
8-PL-11 5/8 x 1 x 6'-7 9/16-THUS-d4
8-PL-11 5/8 x 1 x 6'-7 9/16-REV-d4
CHAMFER 45° x 13/16 (N.S. & F.S.)
DRAIN HOLE
16-PL-11 5/8 x 1 3/8 x 6'-6 3/8 f4
DRAIN HOLE
CHAMFER N.S. 45° x FULL DEPTH
8-PL-11 5/8 x 1 3/8 x 6'-6 1/16-THUS
8-PL-11 5/8 x 1 3/8 x 6'-6 1/16-REV-
CHAMFER NS 30° x FULL DEPTH
8-PL-12 5/16 x 1 x 2'-8 1/4-THUS-h4
8-PL-12 5/16 x 1 x 2'-8 1/4-REV-h4
WELD LENGTH
PITCH
WELD ALL AROUND
FINISH None



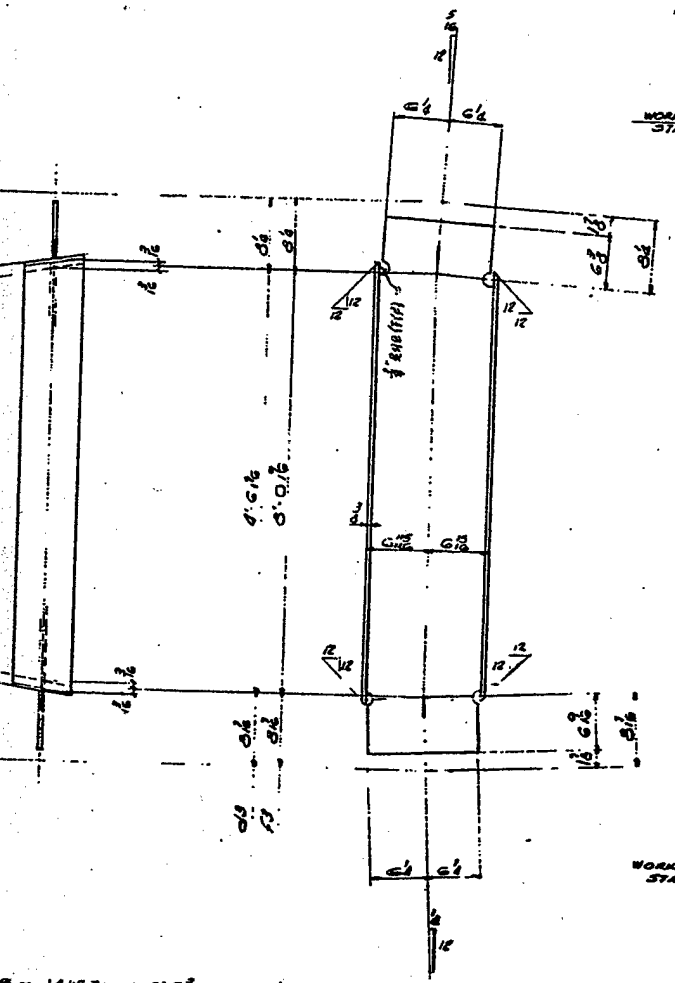
CHAMFER N.S. 45° x FULL DEPTH
SECTION C-C
CHAMFER 45° x 13/16 (N.S. & F.S.)
1" ø DRAIN HOLE
16-PL-11 5/8 x 1 5/8 x 6'-6 3/8 f4
CHAMFER N.S. 45° x FULL DEPTH
GREASE GROOVE (FOR m4) DETAIL "A"
DOWNSTREAM
UPSTREAM
8-GREASE GROOVES (DETAIL "A") @ 20° - 180°
16-TRUNNION BUSHINGS - m4
16-TRUNNION BUSHINGS - p4
CAST ALUMINUM BRONZE
FED. SPECS QQ-B-671B CLASS 3 H.T.
OR ASTM B148 CLASS 9-C H.T.
CHAMF. 45° x 1/8
BEVEL 45° x 3/4 NS & FS
48-PL. 8 3/8 x 1 1/2 x 1'-3 - S4
CHAMFER NS 30° x FULL DEPTH
8-PL-12 1/4 x 1 x 2'-2 1/2 - THUS - k4
8-PL-12 1/4 x 1 x 2'-2 1/2 - REV - k4
REVISED PLATE SIZES
WORK TH

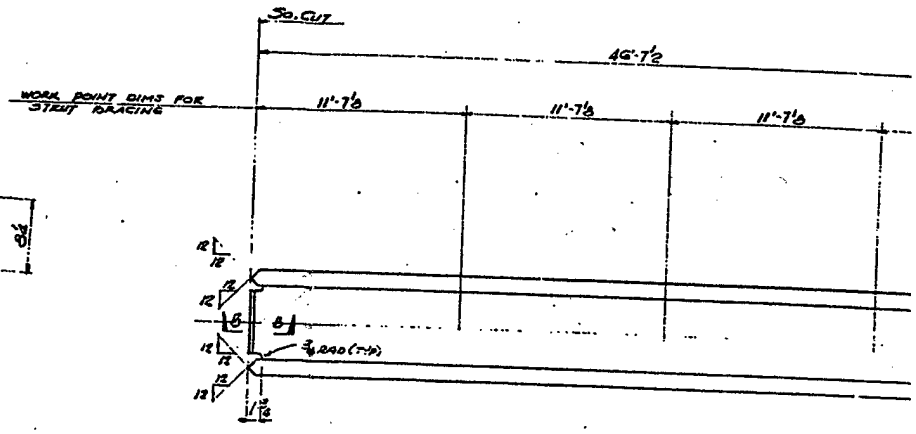


20°
GREASE GROOVE (FOR m4) DETAIL "A"
UPSTREAM
8-GREASE GROOVES (DETAIL "A") @ 20° = 140°
20°
A
ON BUSHINGS ~ m4
ON BUSHINGS ~ p4
UMINUM BRONZE
QQ-B-671B CLASS 3 H.T.
CLASS 9-C H.T.
BEVEL 45° x ⅛ NS & FS
6
8⅜
x 1½ x 1'-3 ~ S4
1'-3⅝
1'-2⅝
27.014 +.002 -.000
24.000 +.012 -.000
CHAMF. 45° x ⅛
FOR m4
2'-5 DIA. GREASE GROOVE CIRCLE
2'-11 DIA.
BREAK CORNER
8 FOR m4
9 FOR p4
SECTION A-A
DETAIL "A" GREASE GROOVE
RAD.
RAD.
BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088
APPROVAL STAMPS
APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
25 SEP 1973
CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.
3
LSR70-0088-132-011
WORK THIS DWG W/DWG Nº 3-4&5
DRAWN BY PC DATE 12-6-70
TRACED BY DATE
CHECKED BY CM DATE 12-22-70
APPROVED BY DATE
FLINT STEEL CORPORATION
BOX 1290, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT
TRUNNION DETAILS
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR
PULLMAN, WASH
JOB NO. 70-0544
SHEET NO. 6
70-C-88-357

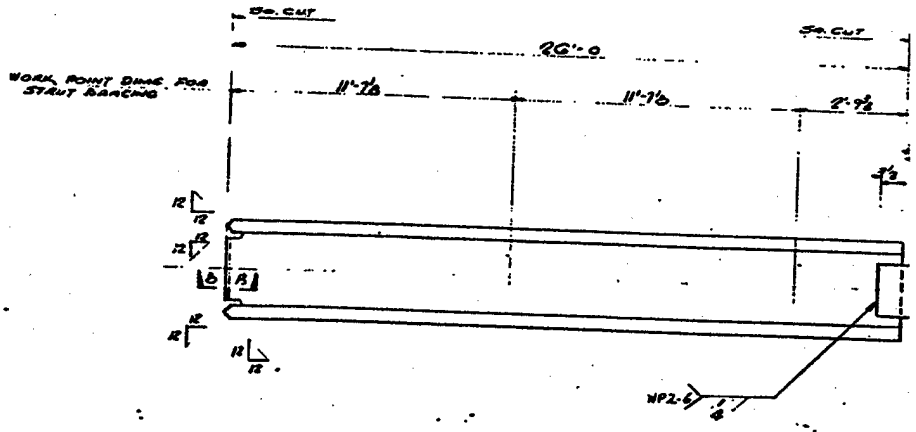


8 ~ 14 WF 30 x 5'-7 3/4 ~ THUS & NOTED ~ d3
8 ~ 14 WF 30 x 5'-7 3/4 ~ REV & NOTED ~ d3
8 ~ 14 WF 30 x 7'-1 3/4 ~ THUS & NOTED ~ F3
8 ~ 14 WF 30 x 7'-1 3/4 ~ REV. & NOTED ~ F3



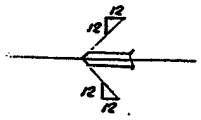


1G - STRUTS - 14 WF 398 x 46'-8¾ - G3



1G - STRUTS - 14 WF 342 x 26'-0 - G3

5 - 14 WF 30 x 5'-7¾ - THIS ½ NOTED - G4
5 - 14 WF 30 x 5'-7¾ - REV ½ NOTED - G3
3 - 14 WF 30 x 7'-1¾ - THIS ½ NOTED - F3
3 - 14 WF 30 x 7'-1¾ - REV ½ NOTED - F3

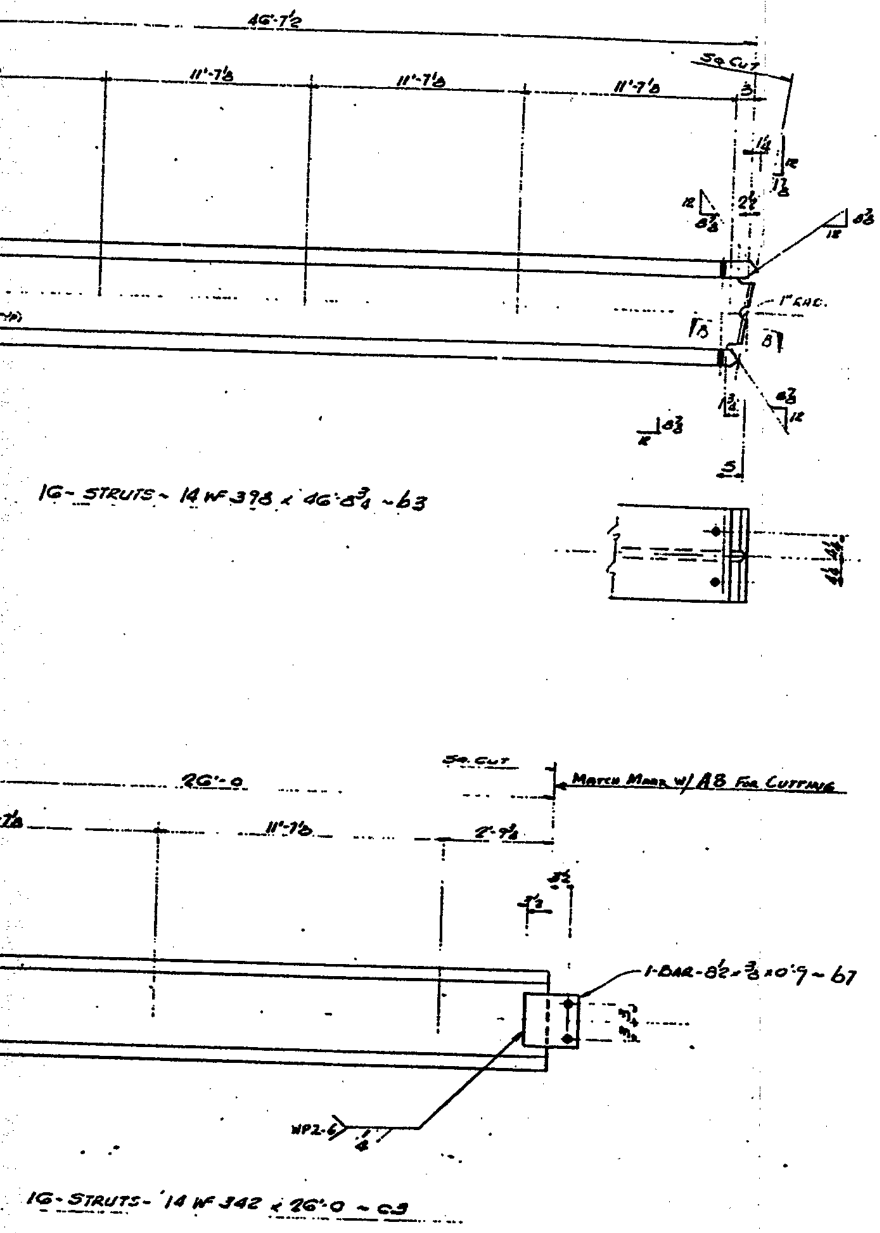


SECTION B-B

1- WOR
2- THIS
3- TAG

(2)

NOTES: 12-9 UNLESS NOTED	NOTES	DRAWN BY: PC DATE: 12.7.20
FASTENERS: UNLESS NOTED		TRACED BY: DATE:
PAINT: NONE		CHECKED BY: C.M DATE: 12-22-20
		APPROVED BY: DATE:



NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8/8	d34	14 WF 30	5	7¾	9/8	
8/8	f32	14 WF 30	9	1¾	10/8	
16	b3	14 WF 398	46	8¾	1/8	
16	c3	14 WF 342	26	0	7/8	
16	b7	BAR 8½ x ⅜	0	9		
		SHOP WELD				
		¼ FILLET	12	0	LIN. FT.	

NOTE:
1- WORK THIS SHT W/ SHT № 3
2- THIS SHT DETAIL MAT'L - DO NOT SHIP
3- TAG ALL MAT'L W/ ITEM № 132

BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088

APPROVAL STAMPS

APPROVED
Subject to conformity with plans and specifications, ... LOWER SNAKE RIVER RESIDENT OFFICE
Date 25 SEP 1973

3

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

LSR 70-0088-132-012

DRAWN BY PG DATE 12-7-70
TRACED BY ______ DATE ______
CHECKED BY C.M. DATE 12-22-70
APPROVED BY ______ DATE ______

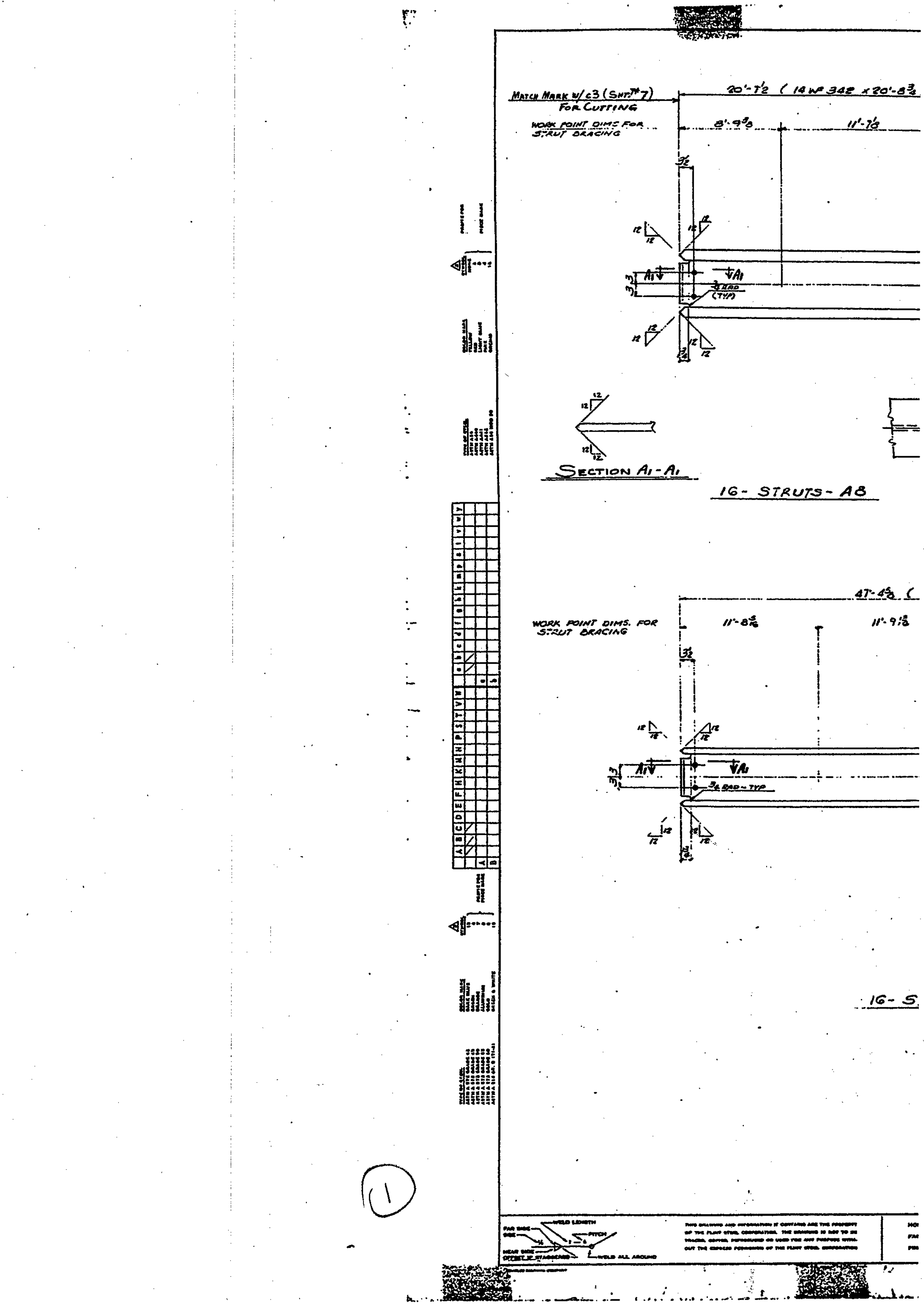
MADE BY | CHKD BY | DATE

FLINT STEEL CORPORATION
BOX 1289, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

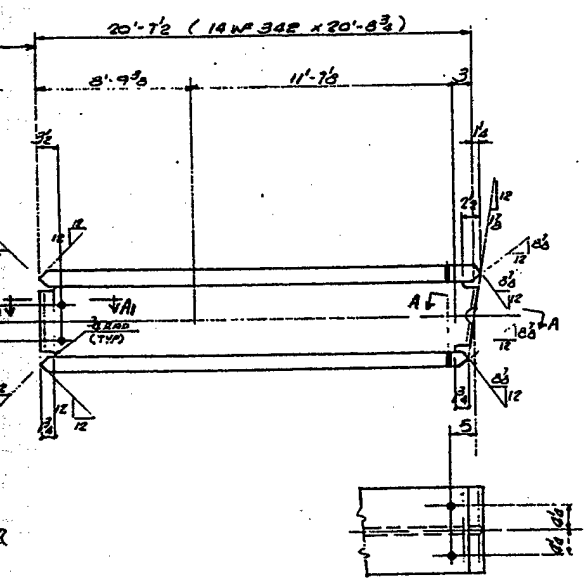
STRUT & BRACE DETAILS
LOWER GRANITE LOCK & DAM
FOR LOWER GRANITE CONTR
PULLMAN, WASH

JOB NO. 70-0544
SHEET NO 7
REV

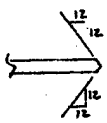
70-C88-358



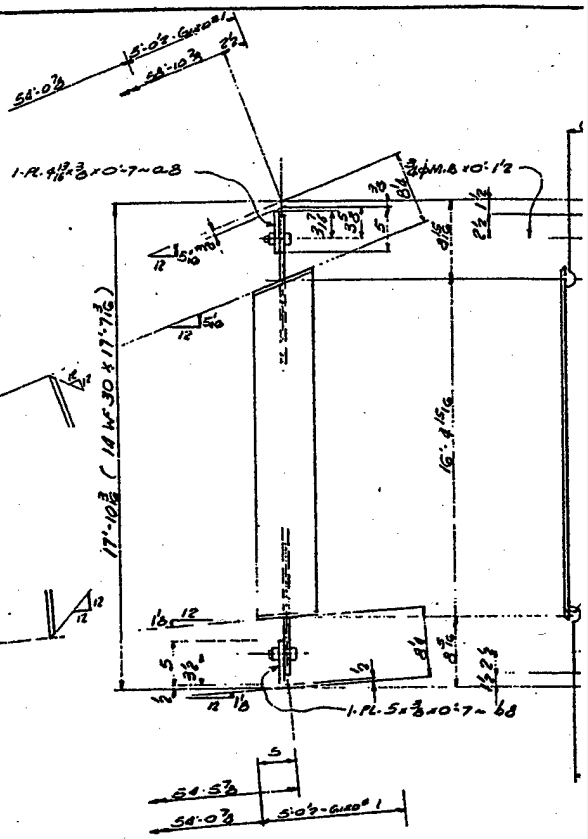
MATCH MARK w/ c3 (SHT.#7) FOR CUTTING
20'-7½ (14 WF 342 x 20'-8¾
WORK POINT DIMS FOR STRUT BRACING
8'-9⅜
11'-7⅛
SECTION A1-A1
16- STRUTS- A8
47'-4⅝ (
WORK POINT DIMS. FOR STRUT BRACING
11'-8⅝
11'-9⅛
⅜ RAD~TYP
16- S
WELD LENGTH
PITCH
WELD ALL AROUND



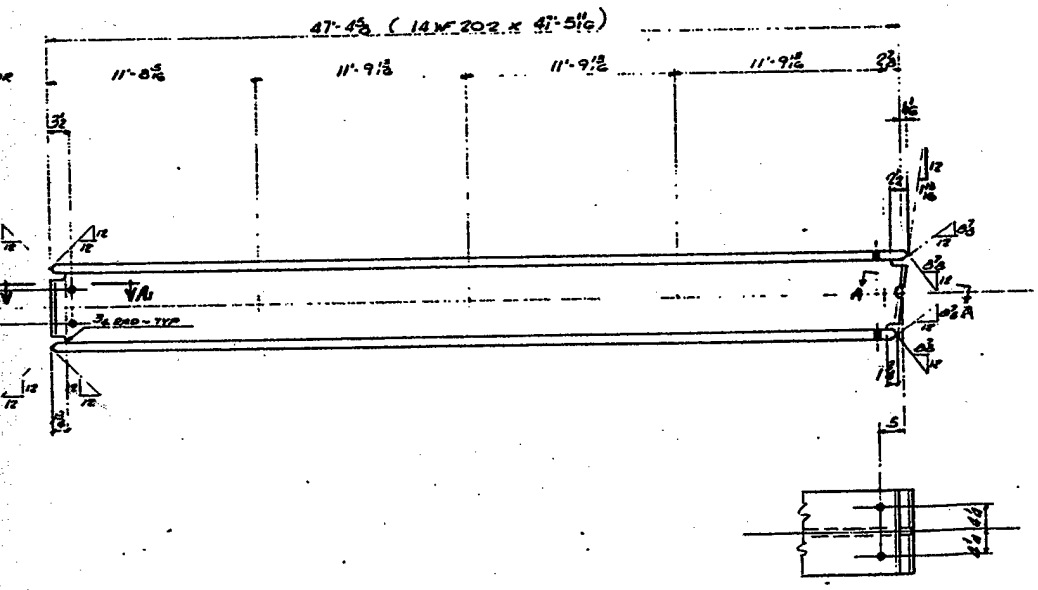
IG - STRUTS - A8



SEC. A-A



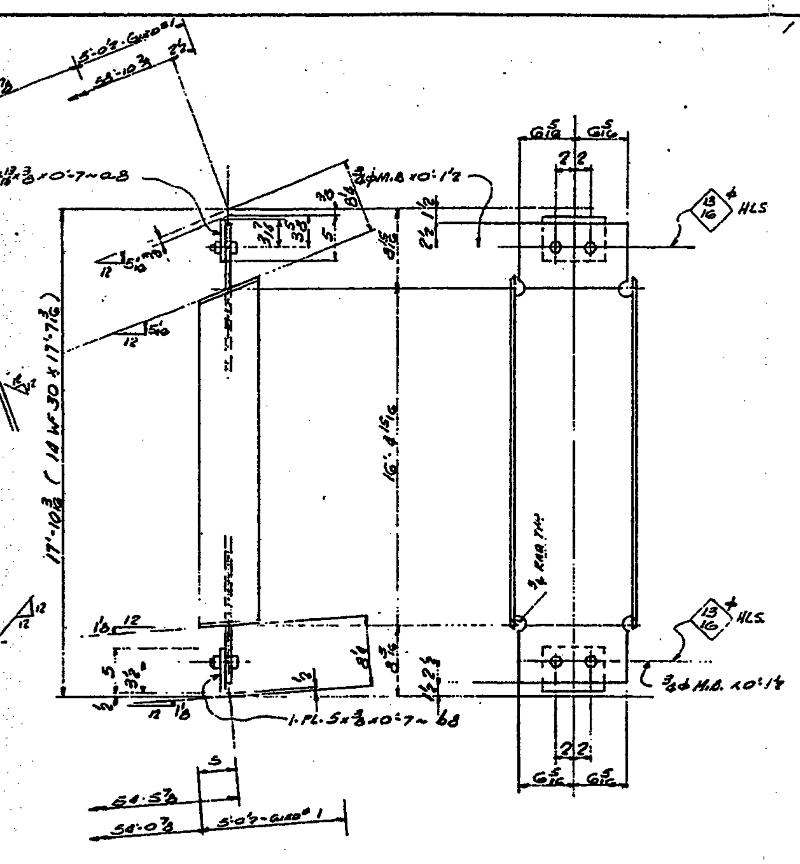
IG - BRACES - C8



IG - STRUTS - B8

(2)

HOLES 13/16 UNLESS NOTED	NOTES		DRAWN BY PC
FASTENERS UNLESS NOTED			TRACED BY
FINISH NONE			CHECKED BY C.M.
			APPROVED BY



16- BRACES~C8

NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
					4/8	
16	A8	14WF342	20	8¾		
16	B8	14WF202	47	5$^{1}/_{16}$	6/8	
16	C8	14WF30	17	7$^{3}/_{16}$		
16	a8	PL-4$^{13}/_{16}$x⅜	0	7	18/6	
16	b8	PL-5x⅜	0	7	19/6	
64		¾φ M.B.	0	1½	PIN-UP	

NOTE
TAG ALL MAT'L W/
ITEM NO 132

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
Subject to conformity with plans and specifications; correction of errors or omissions, and to full compliance with all required tests. Approval does not cover dimensions, or responsibility for assembling and fit.
LOWER SNAKE RIVER
RESIDENT OFFICE
Sig. [signature]
Date 25 SEP 1973

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

(3)

LSR 70-0088-132-013

REVISION DESCRIPTION	MADE BY	CHK'D BY	DATE

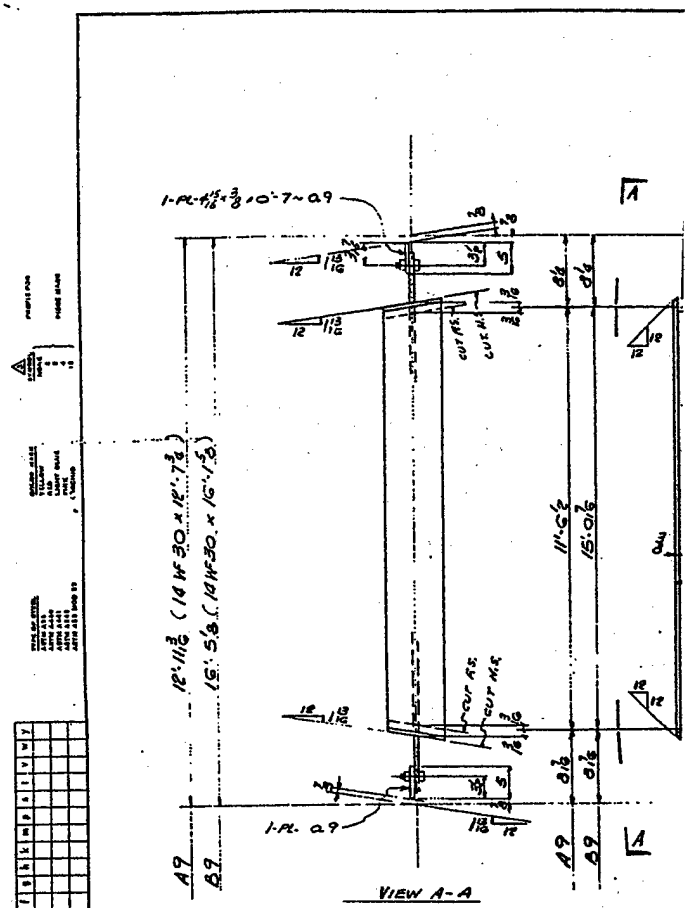
DRAWN BY PC DATE 12-7-70
TRACED BY ___ DATE ___
CHECKED BY C.M. DATE 12-22-70
APPROVED BY ___ DATE ___

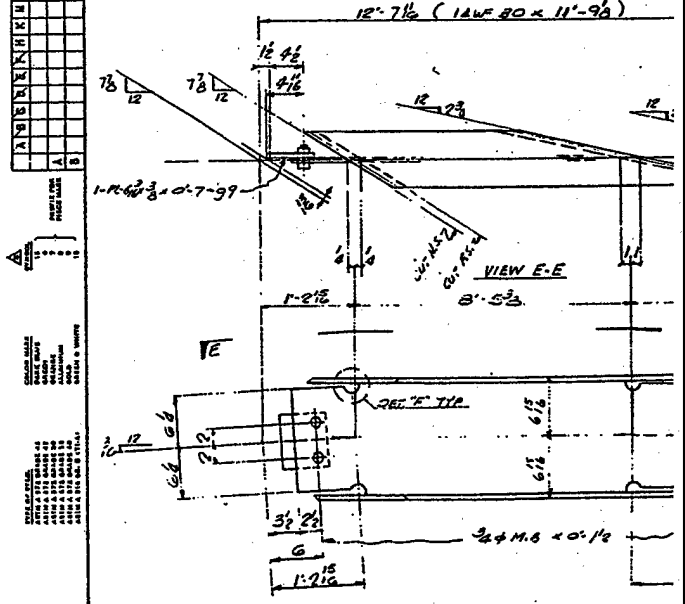
FLINT STEEL CORPORATION
BOX 1289, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

STRUTS & BRACES
LOWER GRANITE LOCK & DAM
FOR LOWER GRANITE CONTR
PULLMAN WASH.

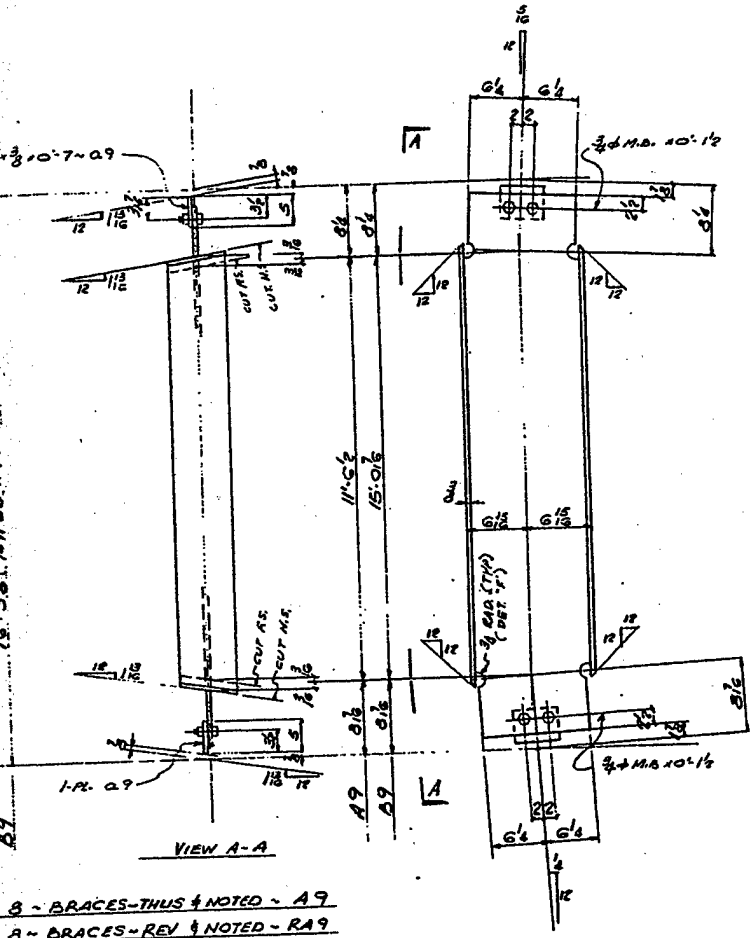
JOB NO. 70-0588
SHEET NO. 8
REV

70-C-88-359



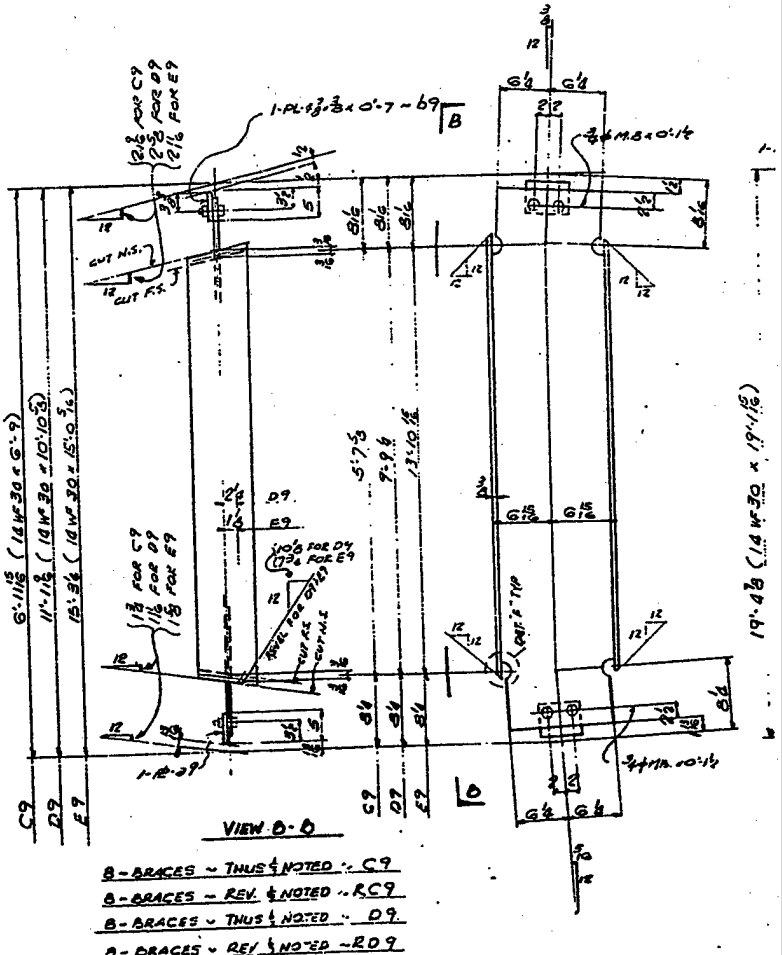


(1)



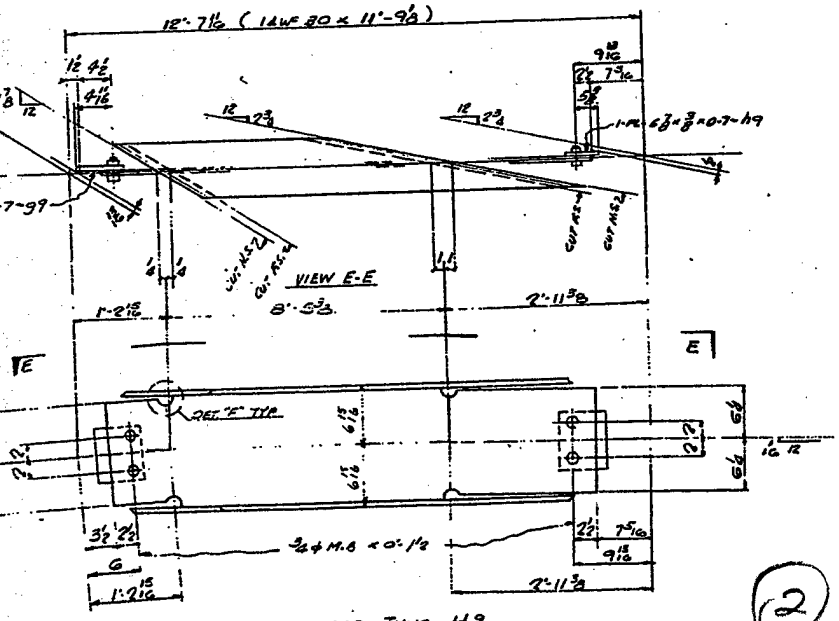
VIEW A-A

B - BRACES - THUS ϕ NOTED - A9
B - BRACES - REV ϕ NOTED - RA9
B - BRACES - THUS ϕ NOTED - B9
B - BRACES - REV ϕ NOTED - RB9



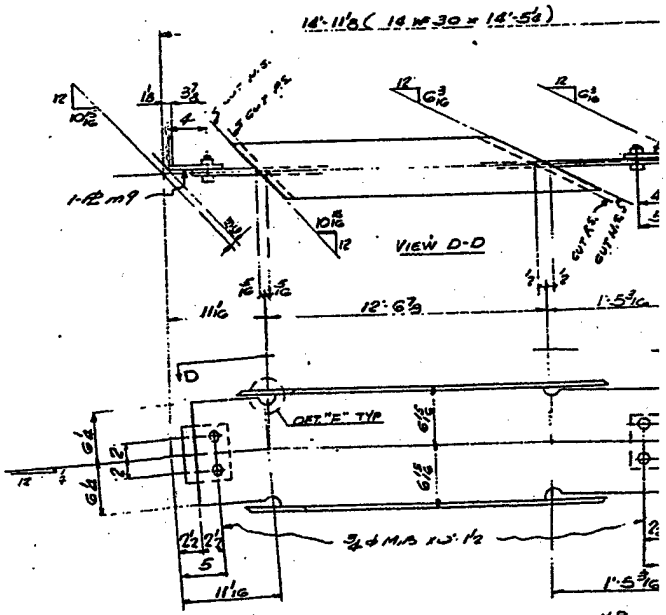
VIEW B-B

B - BRACES - THUS ϕ NOTED - C9
B - BRACES - REV ϕ NOTED - RC9
B - BRACES - THUS ϕ NOTED - D9
B - BRACES - REV ϕ NOTED - RD9
B - BRACES - THUS ϕ NOTED - E9
B - BRACES - REV ϕ NOTED - RE9



VIEW E-E

B - DIAGONAL BRACES - THUS - H9
B - DIAGONAL BRACES - REV - RH9



VIEW D-D

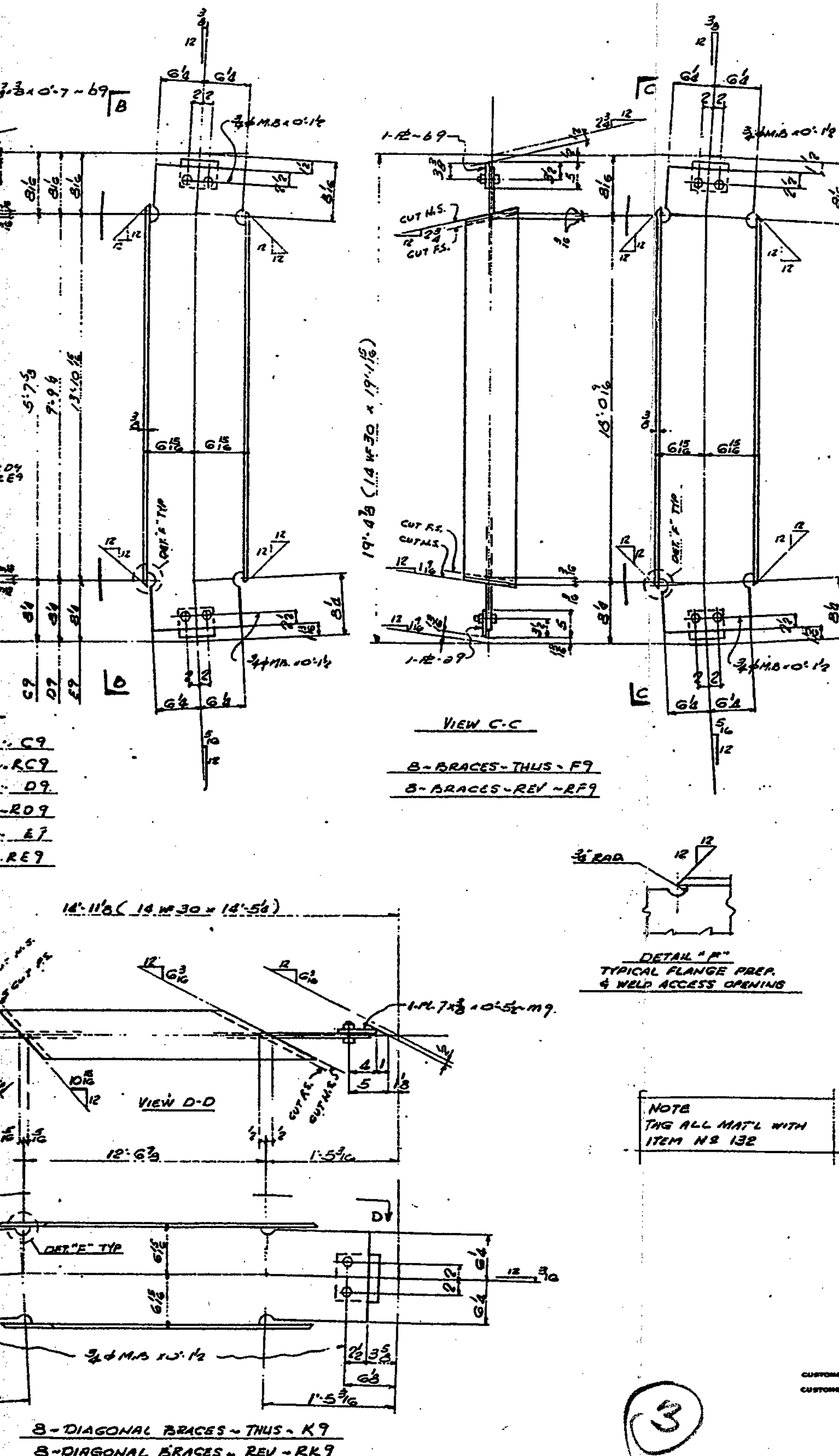
B - DIAGONAL BRACES - THUS - K9
B - DIAGONAL BRACES - REV - RK9

(2)

HOLES 13/16ϕ UNLESS NOTED
FASTENERS UNLESS NOTED
FINISH None

NOTES

THIS DRAWING AND INFORMATION IT CONTAINS ARE THE PROPERTY OF THE FLINT STEEL CORPORATION. THE DRAWING IS NOT TO BE TRACED, COPIED, REPRODUCED OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS PERMISSION OF THE FLINT STEEL CORPORATION.



NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8	A9	14 WF 30	12	7 3/4	12/78	
8	RA9	14 WF 30	12	7 3/4		
8	B9	14 WF 30	16	1 5/8	13/78	
8	RB9	14 WF 30	16	1 5/8		
64	a9	PL 4 15/16 x 3/8	0	7	29/6	
128		3/4 ϕ M.B.	0	1 1/2	PIN-UP	
8	C9	14 WF 30	6	9	14/78	
8	RC9	14 WF 30	6	9		
8	D9	14 WF 30	10	10 5/8	15/78	
8	RD9	14 WF 30	10	10 5/8		
8	E9	14 WF 30	15	0 5/16	16/78	
8	RE9	14 WF 30	15	0 5/16		
48	b9	PL 4 7/8 x 3/8	0	7	21/6	
48	a9	PL 4 15/16 x 3/8	0	7	22/6	
192		3/4 ϕ M.B.	0	1 1/2	PIN-UP	
8	F9	14 WF 30	19	1 15/16	17/78	
8	RF9	14 WF 30	19	1 15/16		
16	b9	PL 4 7/8 x 3/8	0	7	10/7	
16	a9	PL 4 15/16 x 3/8	0	7	23/6	
64		3/4 ϕ M.B.	0	1 1/2	PIN-UP	
8	H9	14 WF 30	11	9 7/8	18/78	
8	RH9	14 WF 30	11	9 7/8		
16	g9	PL 6 7/16 x 3/8	0	7	24/6	
16	h9	PL 6 3/8 x 3/8	0	7	1/7	
64		3/4 ϕ M.B.	0	1 1/2	PIN-UP	
8	K9	14 WF 30	14	5 1/4	19/78	
8	RK9	14 WF 30	14	5 1/4		
32	m9	PL 7 x 3/8	0	5 1/2	3/7	
64		3/4 ϕ M.B.	0	1 1/2	PIN-UP	
		ALL MAT'L A36				

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
Subject to conformity with plans and specifications, correction of errors or omissions, and is not a waiver of any required tests. Approval does not relieve contractor of responsibility for accuracy of dimensions or for assembling and erecting.
LOWER SNAKE RIVER
RESIDENT OFFICE
By ____
Date 25 SEP 1973

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

(3)

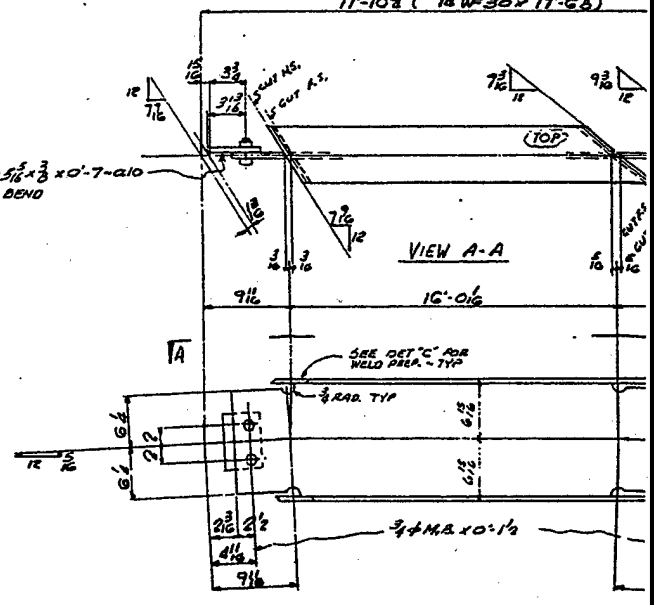
LSR 70-0088-132-014

DRAWN BY PC DATE 12-3-70	FLINT STEEL CORPORATION	TRUNNION ARM BRACING
TRACED BY ____ DATE ____	BOX 1249, TULSA, OKLAHOMA 74101	LOWER GRANITE LOCK & DAM
CHECKED BY CM DATE 12-22-70	ENGINEERING DEPARTMENT	for LOWER GRANITE CONT'R
APPROVED BY ____ DATE ____		PULLMAN, WASH

JOB NO. 70-0544
SHEET NO. 9
REV

70-C-88-360

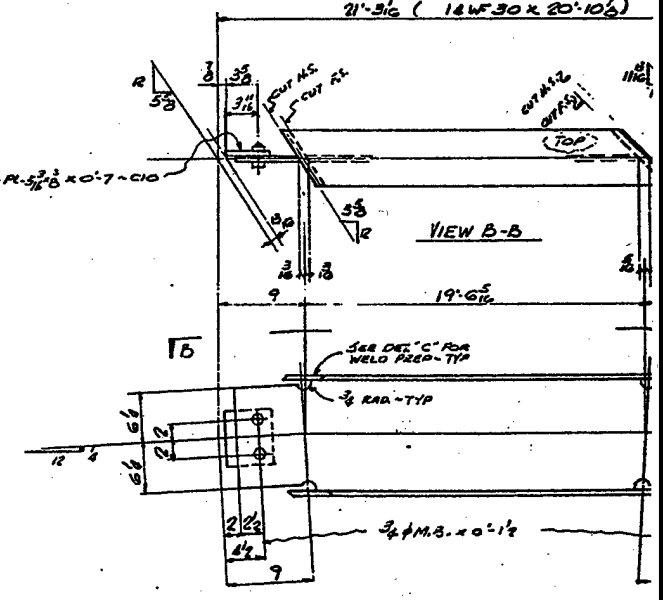
17'-10 3/8 (14 WF 30 x 17'-6 1/2)



8 - DIAGONAL BRACES - THUS - A

8 - DIAGONAL BRACES - REV - RA

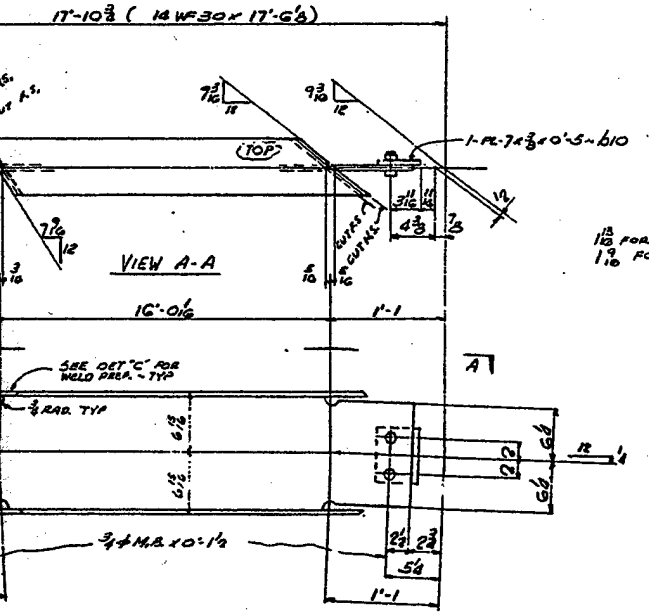
21'-9 1/16 (14 WF 30 x 20'-10 3/8)

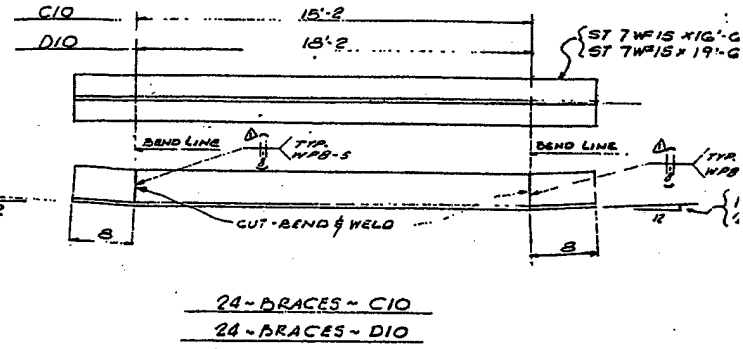


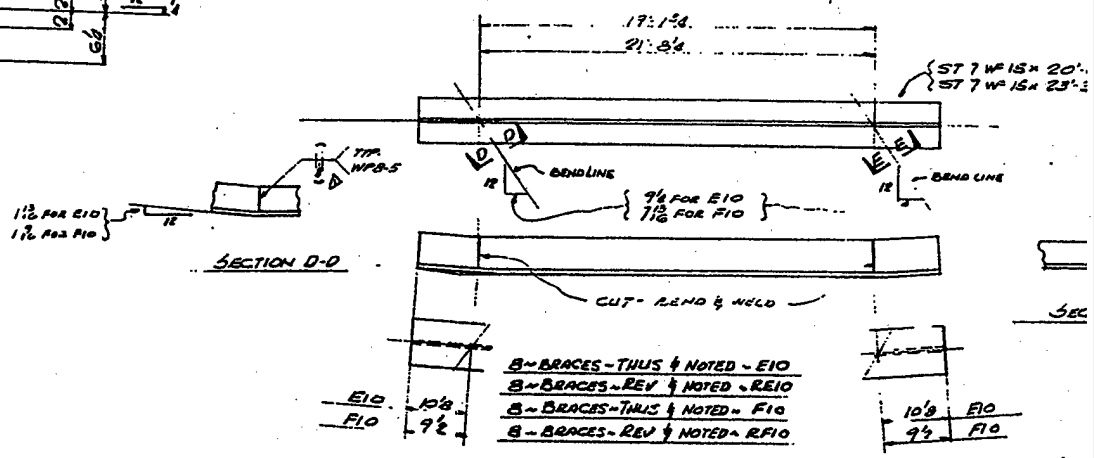
8 - DIAGONAL BRACES - THUS - B

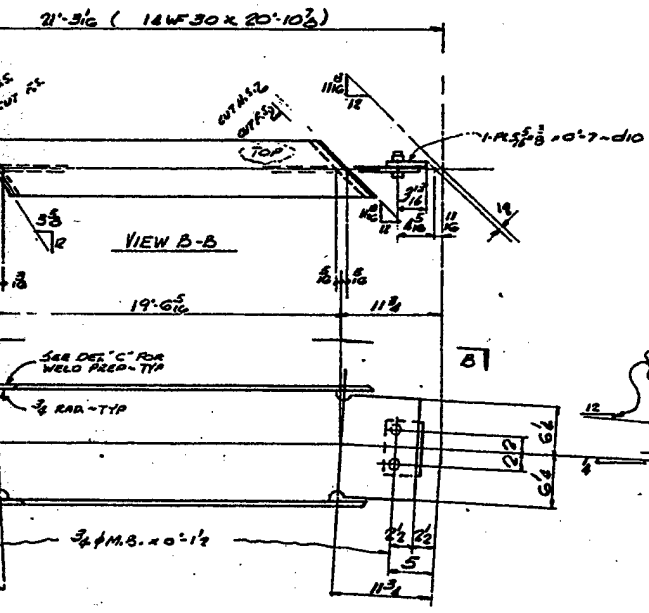
8 - DIAGONAL BRACES - REV - RB

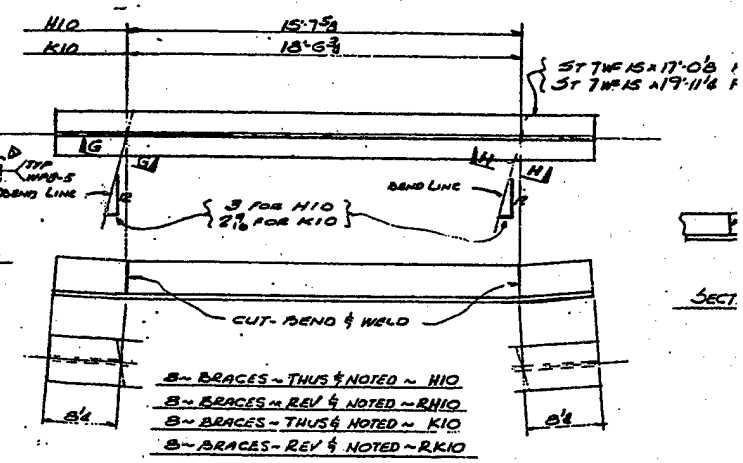
(1)

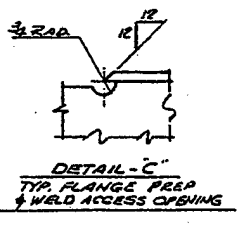






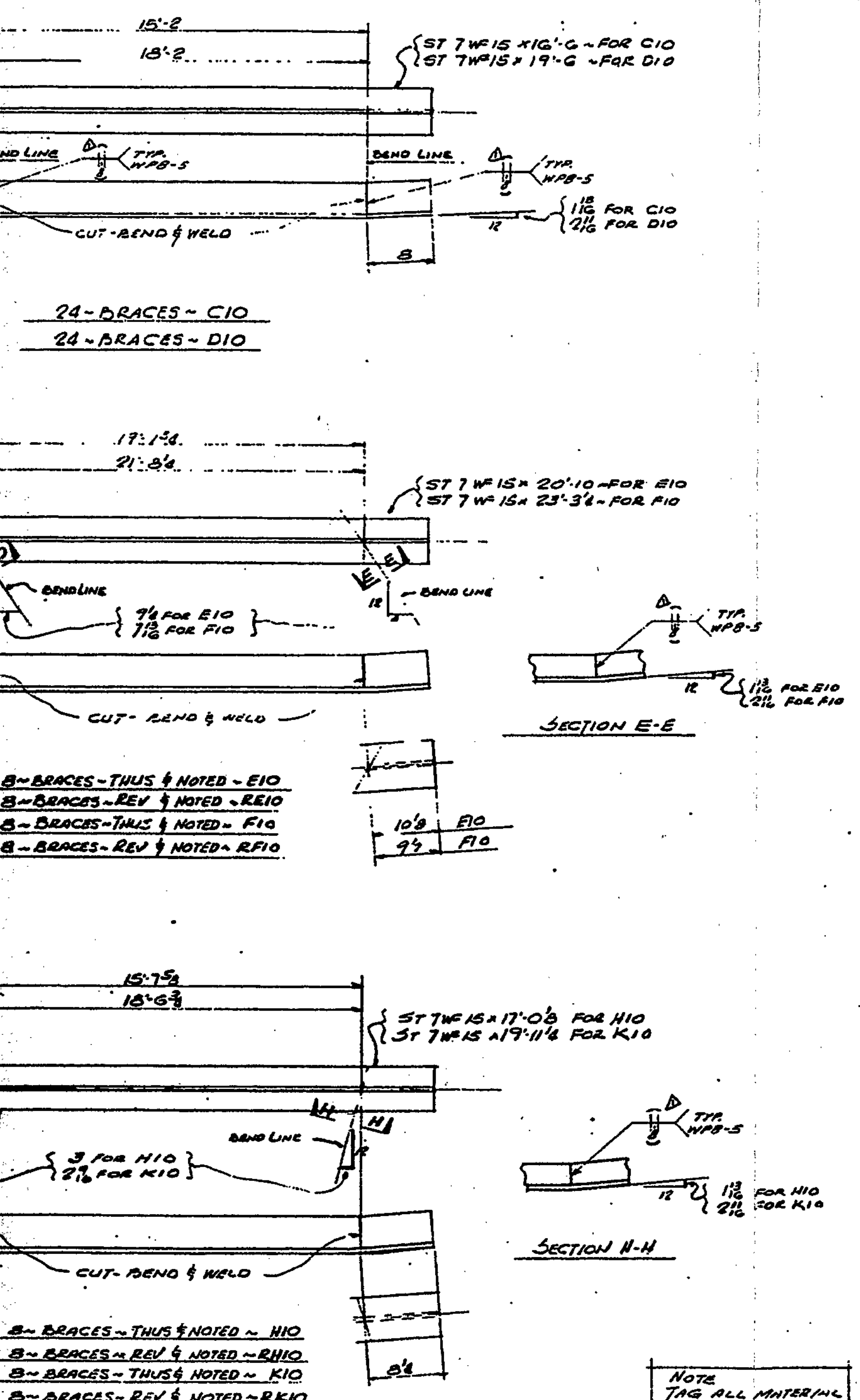






2

HOLES 13/16 ø UNLESS NOTED	NOTES		SNOW MELD SYMBOL & PROCEDURE	DRAWN BY PC	DATE 12-4-70
FASTENERS ____ UNLESS NOTED				TRACED BY ____	DATE ____
FINISH None				CHECKED BY CM	DATE 12-22-70
				APPROVED BY ____	DATE ____



NOTE
TAG ALL MATERIAL
WITH ITEM Nº 132

NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8	A10	14WF30	17	6 1/8	20/8	
8	RA10	14WF30	17	6 1/8		
16	a10	PL 5 5/16 x 3/8	0	7	5/7	
16	b10	PL 7 x 3/8	0	5	4/7	
64		3/4 ϕ MB	0	1 1/2		
8	B10	14WF30	20	10 7/8	21/8	
8	RB10	14WF30	20	10 7/8		
16	c10	PL 5 5/16 x 3/8	0	7	6/7	
16	d10	PL 5 5/16 x 3/8	0	7	7/7	
64		3/4 ϕ MB	0	1 1/2		
24	C10	ST 7 WF 15	16	6	BEND 1/9	
24	D10	ST 7 WF 15	19	6	BEND 2/9	
8	E10	ST 7 WF 15	20	10	BEND 3/9	
8	RE10	ST 7 WF 15	20	10		
8	F10	ST 7 WF 15	23	3 1/4	4/9	
8	RF10	ST 7 WF 15	23	3 1/4		
8	H10	ST 7 WF 15	17	0 5/8	BEND 5/9	
8	RH10	ST 7 WF 15	17	0 5/8		
8	K10	ST 7 WF 15	19	11 1/4	6/9	
8	RK10	ST 7 WF 15	19	11 1/4		
		1/4 BUTT WELD	66	0		

BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER
RESIDENT OFFICE
By
Date 25 SEP 1973

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

(3)

LSR 70-0088-132-015

SYMBOL & PROCEDURE	DRAKE	DOW	11-29-71
REVISION DESCRIPTION	MADE BY	CHK'D BY	DATE

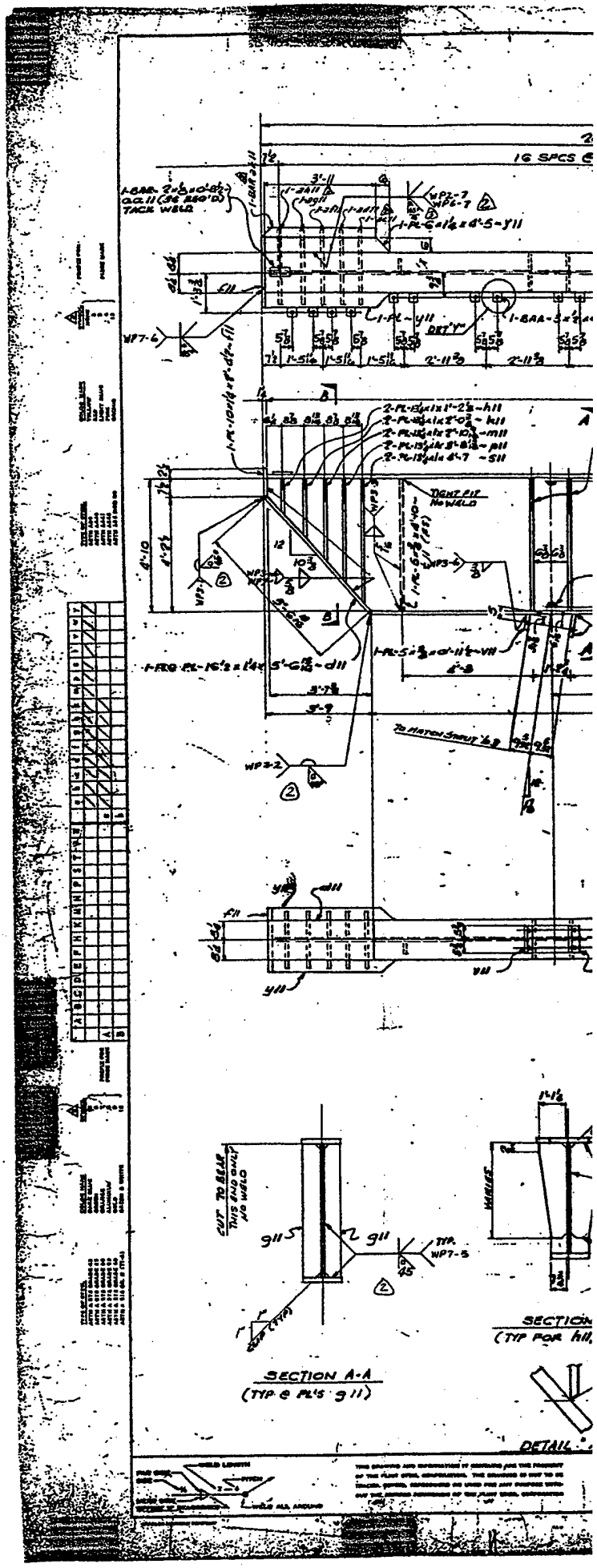
DRAWN BY PC DATE 12-4-70
TRACED BY DATE
CHECKED BY CM DATE 12-22-70
APPROVED BY DATE

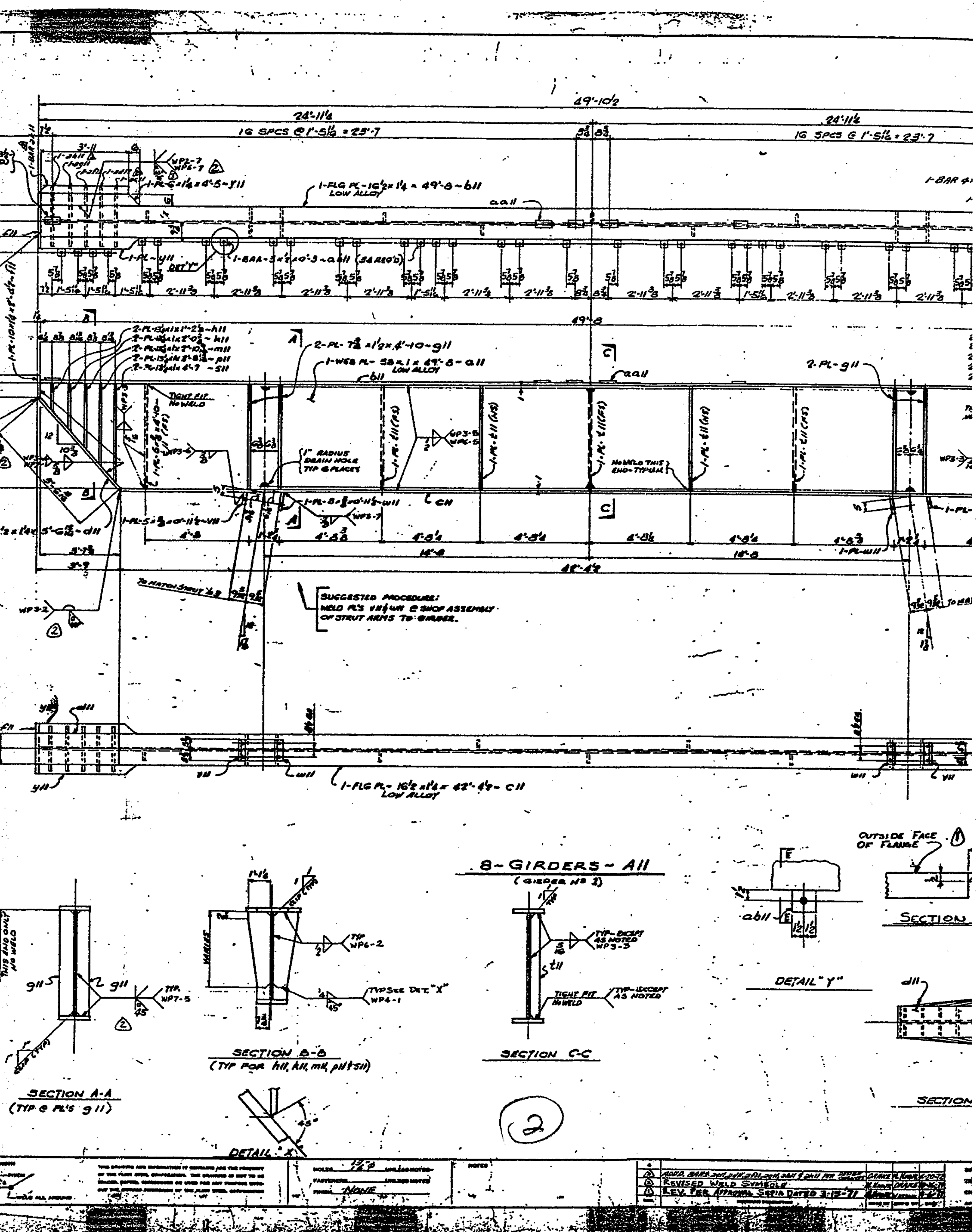
FLINT STEEL CORPORATION
BOX 1389, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

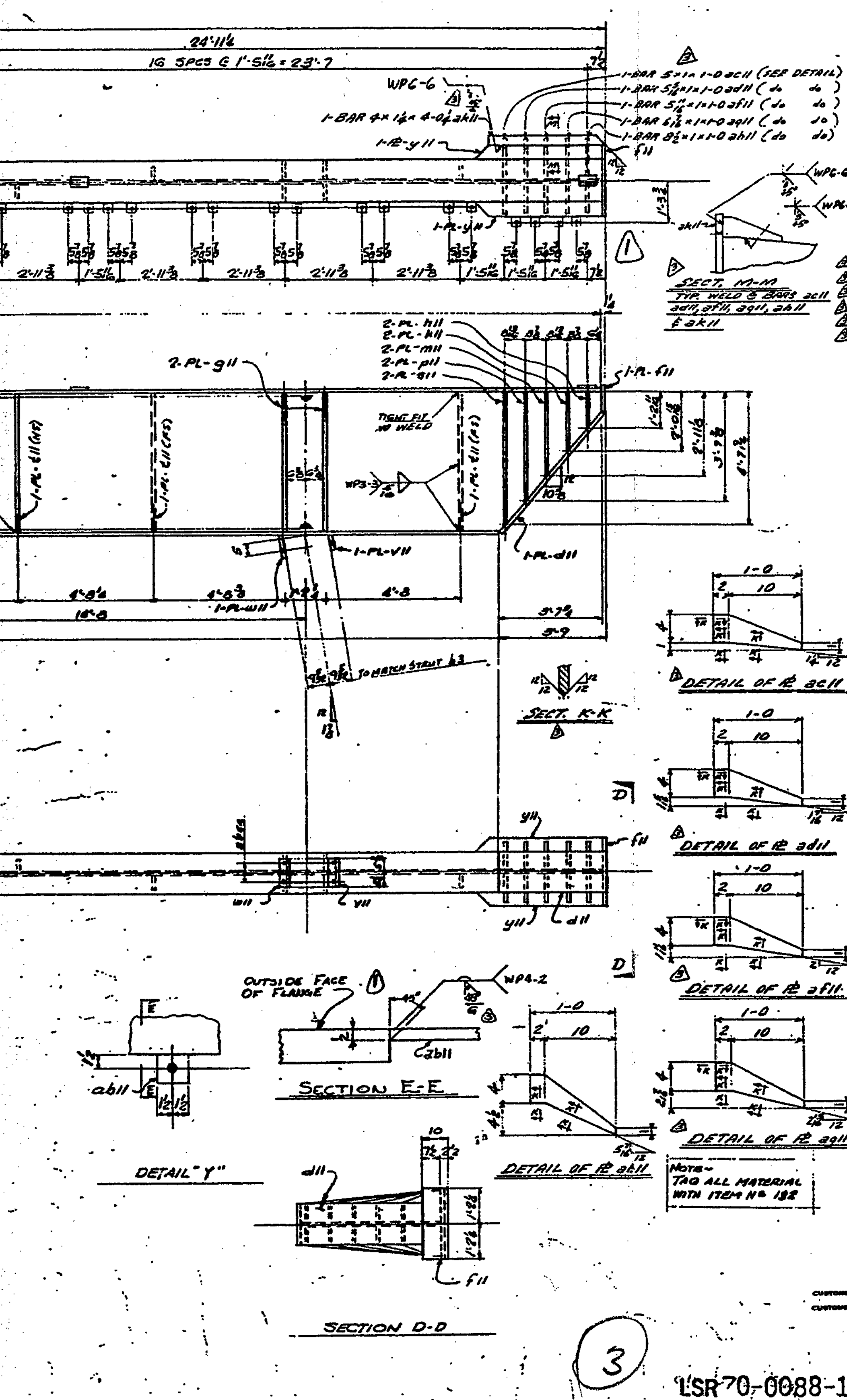
TRUNNION ARM BRACING
LOWER GRANITE LOCK & DAM
FOR LOWER GRANITE CONTR
PULLMAN, WASH

JOB NO. 70-0544
SHEET NO. 10
REV 1

70-C-88-361


SECTION A-A
(TYP @ PL'S g11)
DETAIL


49'-10½
24'-11¼
16 SPCS @ 1'-5½ = 23'-7
1-FLG PL-16½ x 1¼ x 49'-8 ~ b11
LOW ALLOY
1-BAR-3 x ¾ x 0'-3 ~ a b11 (56 REQ'D)
DET "Y"
49'-8
2-PL-7⅞ x 1½ x 4'-10 ~ g11
1-WEB PL-58 x 1 x 49'-8 ~ a11
LOW ALLOY
TIGHT FIT
NO WELD
1" RADIUS
DRAIN HOLE
TYP 6 PLACES
NO WELD THIS
END-TYPICAL
2-PL-g11
48'-4½
SUGGESTED PROCEDURE:
WELD PL'S v11 & w11 @ SHOP ASSEMBLY
OF STRUT ARMS TO GIRDER.
1-FLG PL-16½ x 1¼ x 48'-4½ ~ c11
LOW ALLOY
8 ~ GIRDERS ~ A11
(GIRDER Nº 3)
OUTSIDE FACE
OF FLANGE
SECTION A-A
(TYP @ PL'S g11)
SECTION B-B
(TYP FOR h11, k11, m11, p11 & s11)
SECTION C-C
DETAIL "X"
DETAIL "Y"
SECTION
REVISED WELD SYMBOLS
REV. PER APPROVAL SEPIA DATED 3-15-77



NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8	A11	GIRDERS				
8	a11	PL-58 x 1	49	8	LOW ALLOY A537-67a GRADE A SEE SPECS 3/1	
8	b11	PL-16½ x 1¼	49	8	4/2	
8	c11	PL-16½ x 1¼	42	4½	3/2	
16	d11	PL-16½ x 1¼	5	6¹³⁄₁₆	5/5	
16	f11	PL-10 x 1¼	2	4½	6/5	
64	g11	PL-7¾ x 1½	4	10	7/5	
32	h11	PL-13¼ x 1	1	2⅜	13/5	
32	k11	PL-13¼ x 1	2	0⅜	14/5	
32	m11	PL-13¼ x 1	2	10⁹⁄₁₆	15/5	
32	p11	PL-13¼ x 1	3	8⅛	16/5	
32	s11	PL-13¼ x 1	4	7	17/5	
56	t11	PL-5 x ⅜	4	10	11/7	
16	v11	PL-5 x ⅜	0	11½	14/7	
16	w11	PL-8 x ⅜	0	11½	15/6	
32	y11	BAR-6 x 1¼	4	5	8/5	
272	aa11	BAR-2 x ⅛	0	8½	14/9	
304	ab11	BAR-3 x ½	0	3	14/9	
16	ac11	BAR 5 x 1	1	0		
16	ad11	BAR 5⁵⁄₁₆ x 1	1	0		
16	af11	BAR 5⁹⁄₁₆ x 1	1	0		
16	ag11	BAR 6⅞ x 1	1	0		
16	ah11	BAR 8½ x 1	1	0		
16	ak11	BAR 3⅜ x 1¼	4	0¼		

SHOP WELD

¼ FILLET	75	0	LIN. FT.
⁵⁄₁₆ FILLET	560	0	
⅜ FILLET	32	0	
½ FILLET	2710	0	
⅝ FILLET	200	0	
1" BEV	95	0	
1¼ BEV	44	0	
½ DBL BEV	76	0	
1¼ DBL BEV	180	0	
1½ DBL BEV	388	0	

ALL MAT'L A36 U.N.

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
Date 25 SEP 1973

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

(3)

LSR 70-0088-132-016

ADD BARS ac11, ad11, af11, ag11, ah11 & ak11 PER CUSTOMER	DRAKE	R. KNAPP	6-20-73
REVISED WELD SYMBOLS			
REV. PER APPROVAL SEPIA DATED 3-15-71			

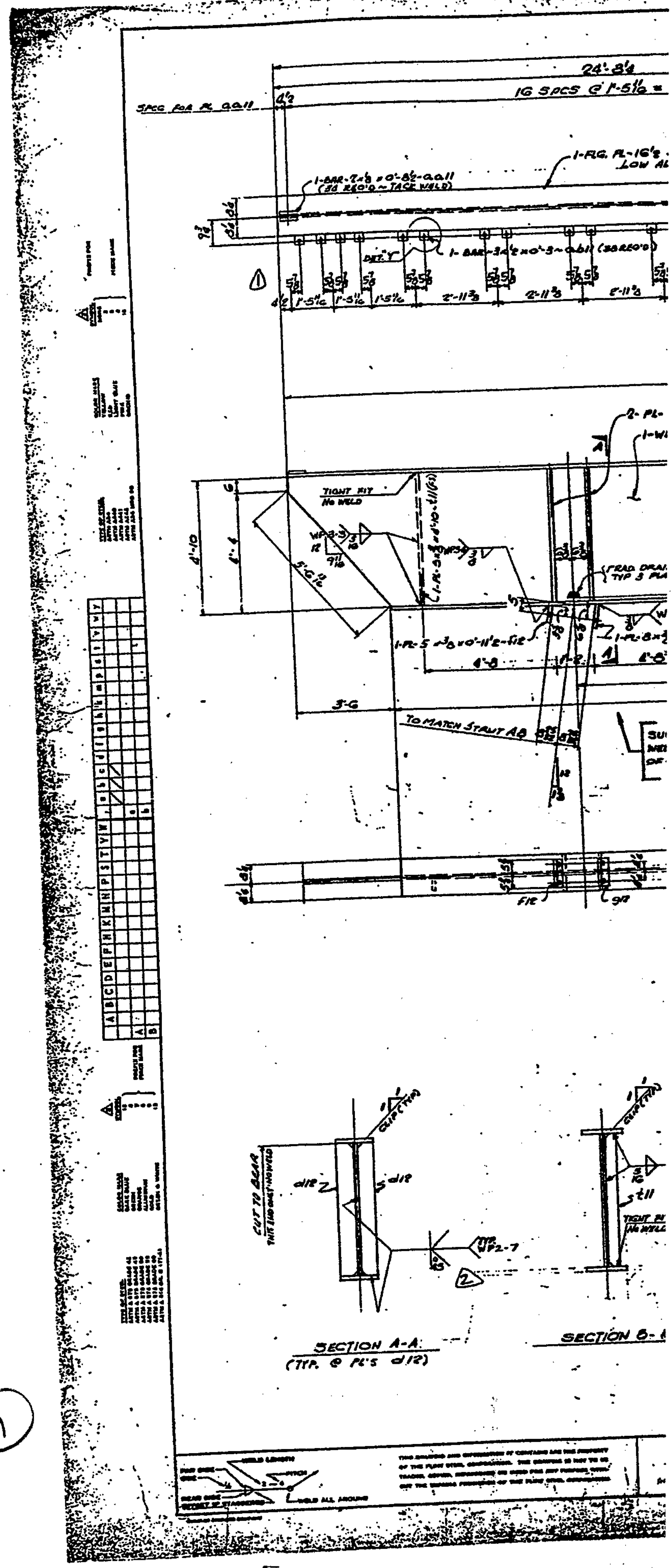
DRAWN BY PC DATE 12-10-70
TRACED BY
CHECKED BY RM DATE 12-22-70
APPROVED BY

FLINT STEEL CORPORATION
TULSA, OKLAHOMA 74100
ENGINEERING DEPARTMENT

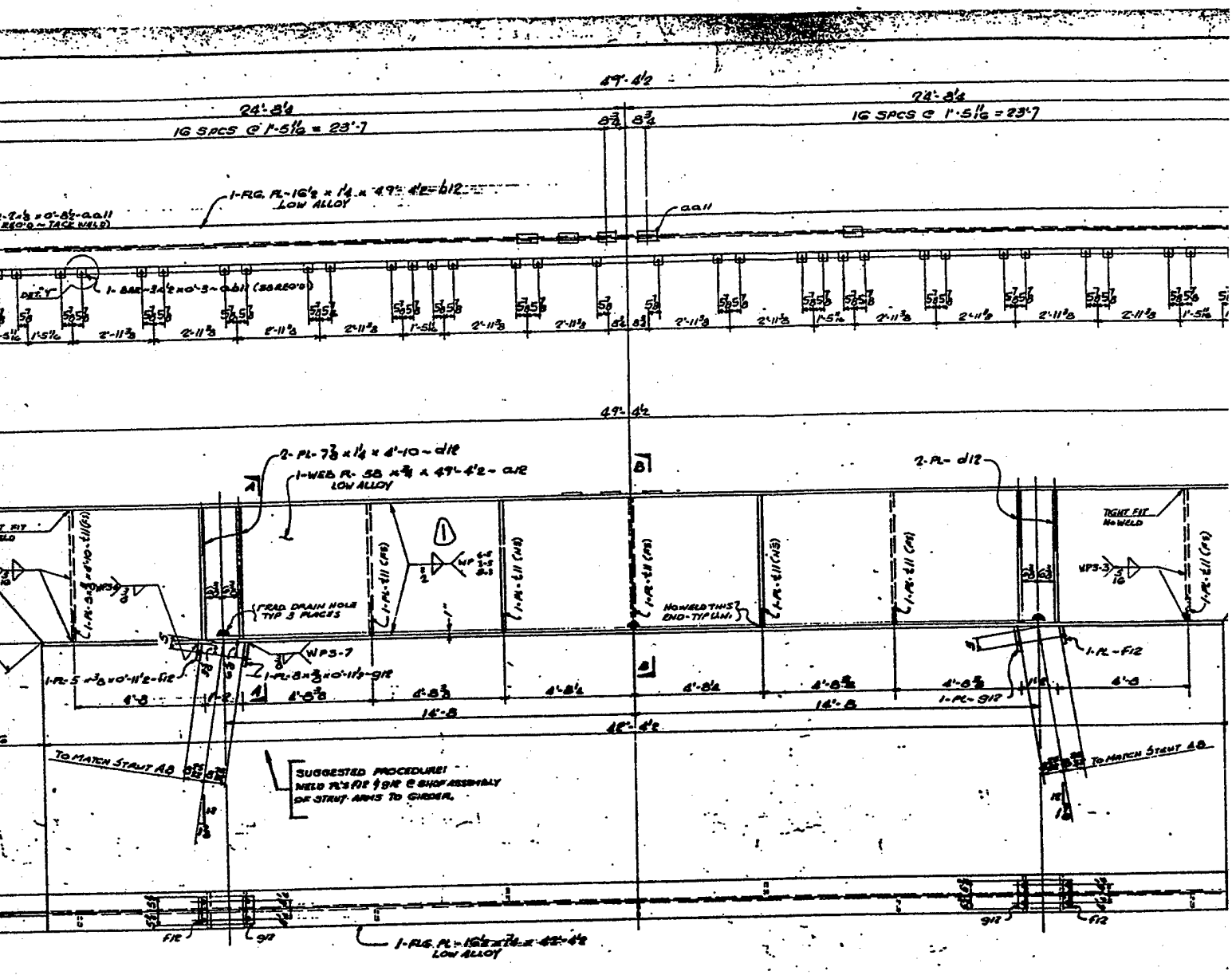
GIRDER Nº 1
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR.
PULLMAN, WASH.

JOB NO. 70-0544
SHEET NO. 11

70-C-88-362

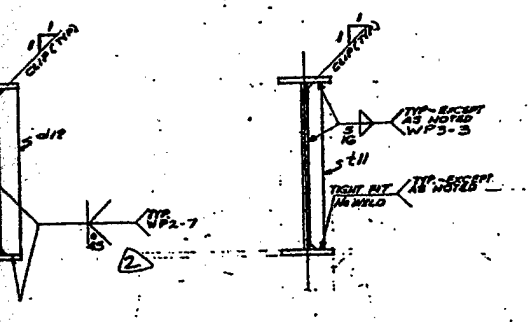

24'-8¼
16 SPCS @ 1'-5⅟₁₆ =
TIGHT FIT
No WELD
TO MATCH STRUT AB
SECTION A-A
(TYP. @ PL'S d12)
SECTION B-
CUT TO BEAR
TIGHT FIT
NO WELD
WELD ALL AROUND

(1)



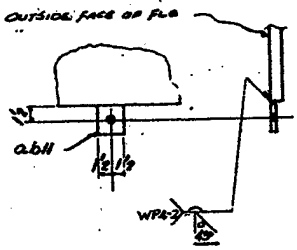
8-GIRDERS-A12

(GIRDER No 8)



ON A-A:
'S d12)

SECTION B-B

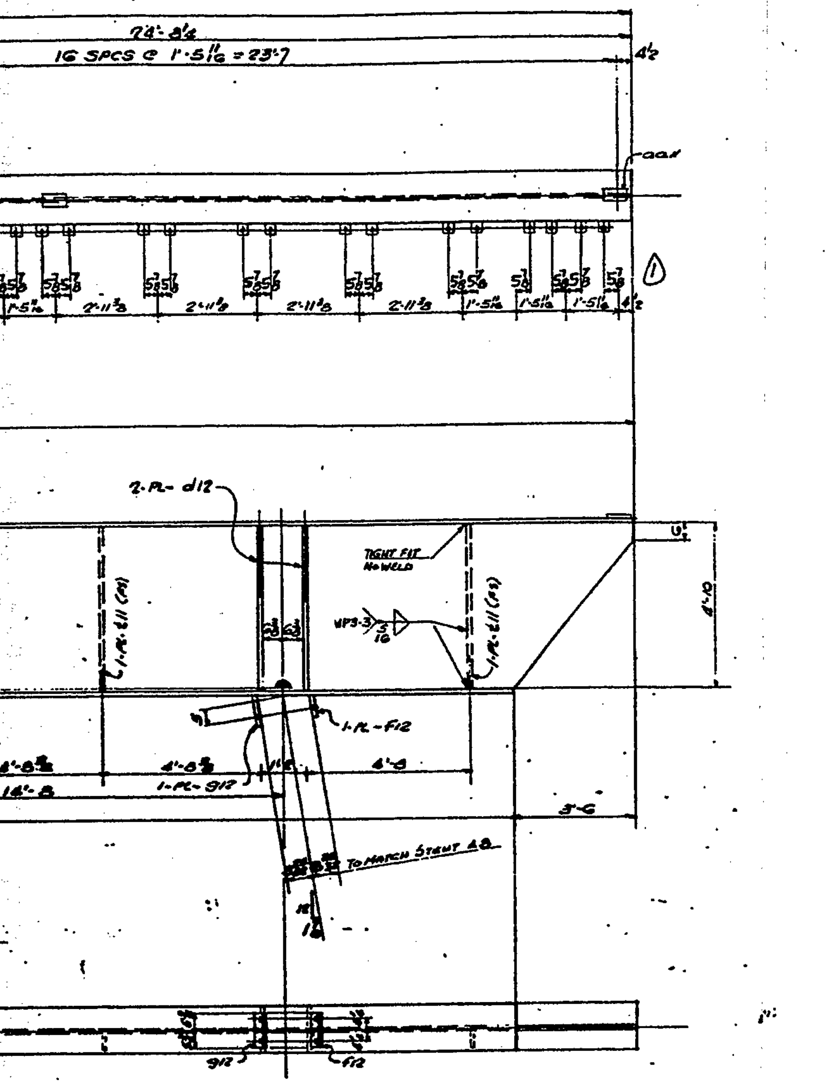


DETAIL 'Y'
(SEE SHT 11)

(2)

2	REVISED WELD SYMBOL				
1	REV. PER APPROVAL SKETCH DATED 3-15-71				
NO.					

DRAWN BY: PC
TRACED BY:
CHECKED BY: C.M
APPROVED BY:



NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8	A12	GIRDERS				
8	a12	PL-58 x ¾	49	4½	Low Alloy	4/1
8	b12	PL-16½ x 1¼	49	4½	A537-67a	4/2
8	c12	PL-16½ x 1¼	42	4½	Grade A See Specs	5/2
64	d12	PL-7⅞ x 1¼	4	10	7/5	
56	e11	PL-5 x ⅜	4	10	11/7	
16	f12	PL-5 x ⅜	0	11½	13/7	
16	g12	PL-8 x ⅜	0	11½	16/6	
272	aa11	BAR-2 x ⅛	0	8½	14/9	
304	ab11	BAR-3 x ½	0	3	16/9	
		SHOP WELD				
		5/16 FILLET	560	0	LIN. FT.	
		⅜ FILLET	32	0		
		½ FILLET	1484	0		
		½ DBL BEV.	76	0		
		1¼ DBL BEV	342	0		
		ALL MAT'L A36 U.N.				

NOTE:
TAG ALL MATERIAL WITH ITEM № 132

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
By ________
Date 25 SEP 1970

(3)

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

LSR 70-0088-132-017

D SYMBOL
... SEPIA DATED 3-15-71

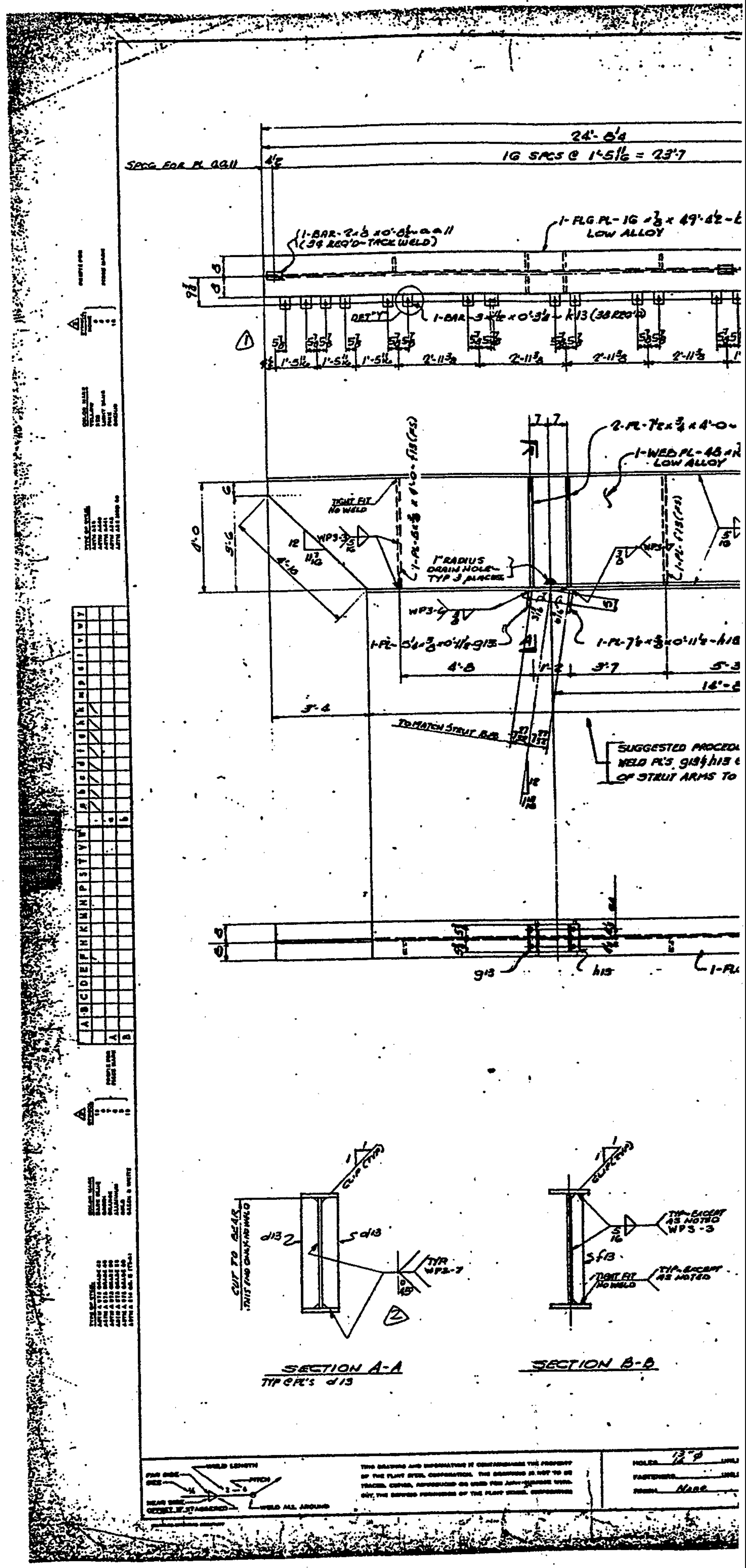
DRAWN BY PC DATE 12-10-70
TRACED BY DATE
CHECKED BY CM DATE 12-22-70
APPROVED BY DATE

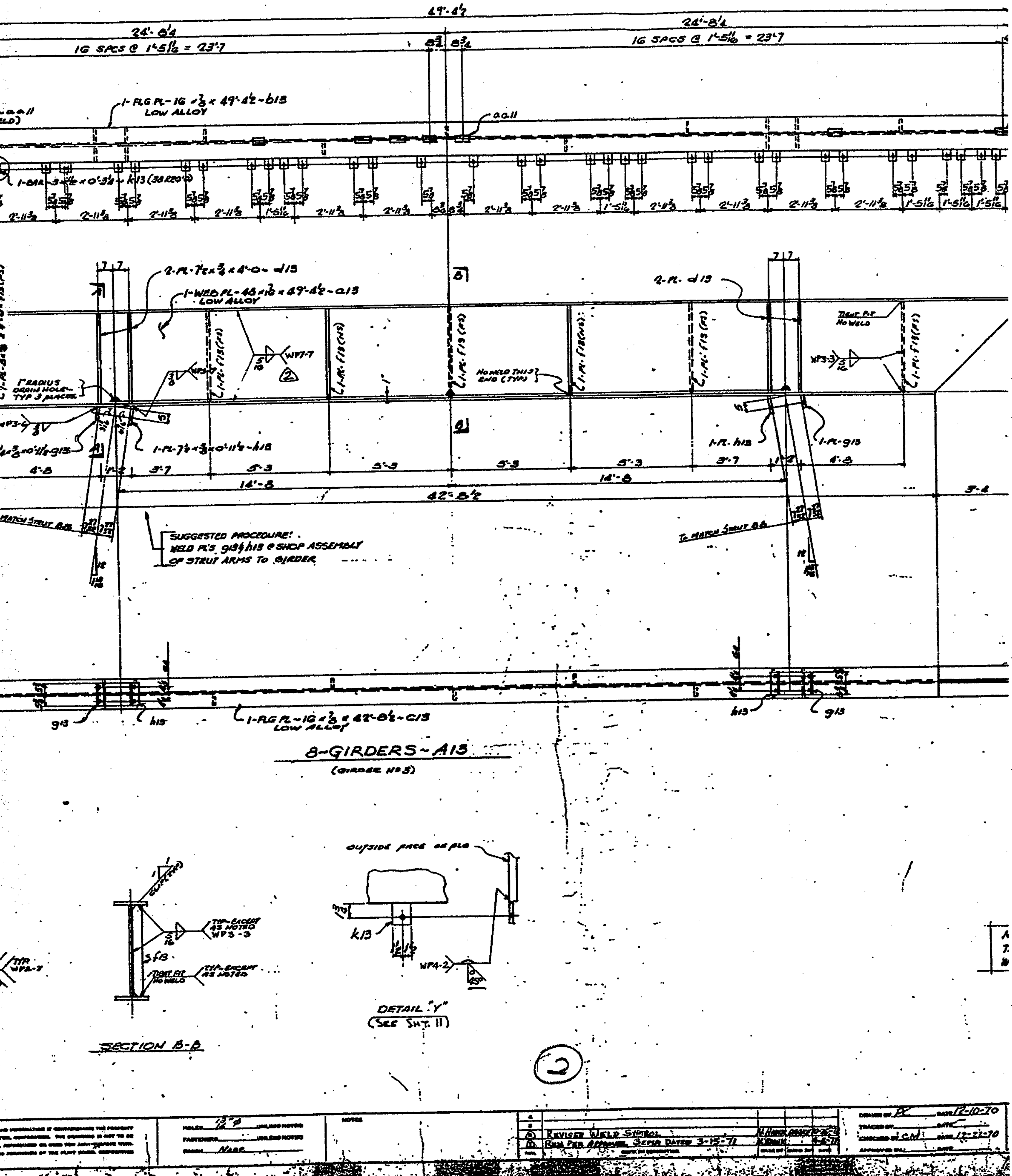
FLINT STEEL CORPORATION
BOX 1288, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

GIRDER № 2
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR.
PULLMAN WASH.

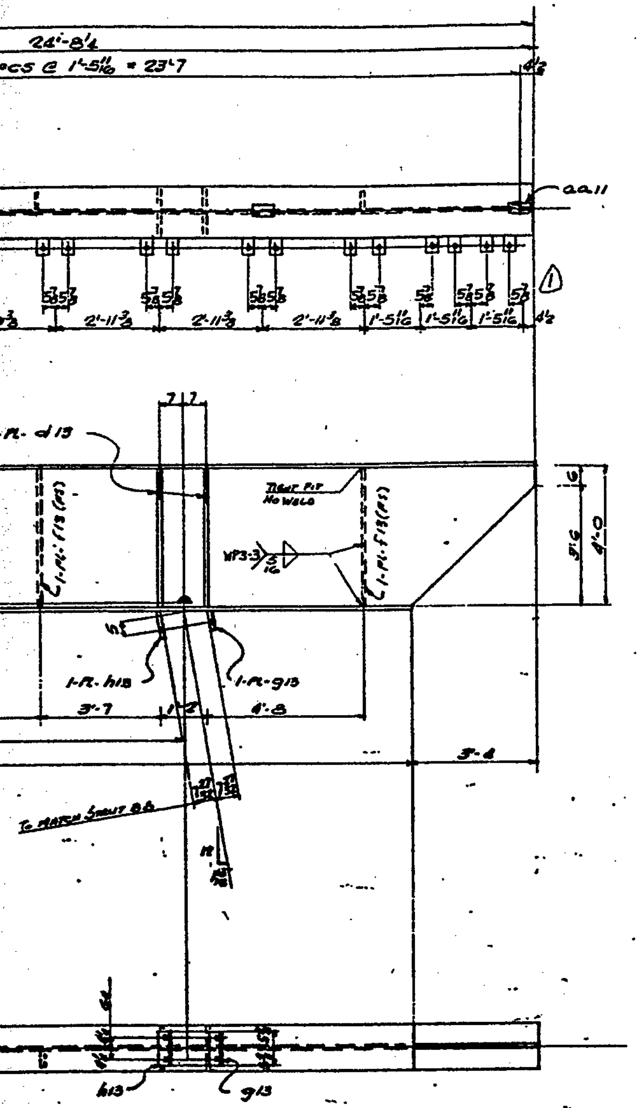
JOB NO. 70-0544
SHEET NO. 12

70-C-85-364


24'-8¼
16 SPCS @ 1'-5 1/16 = 23'-7
SPCG FOR PL aa11
LOW ALLOY
TIGHT FIT NO WELD
1" RADIUS DRAIN HOLE TYP 3 PLACES
TO MATCH STRUT B.B.
SUGGESTED PROCEDU
CUT TO BEAR
SECTION A-A
TYP @ PL'S d13
SECTION B-B
TIGHT FIT NO WELD
TYP EXCEPT AS NOTED



49'-8½
24'-8¼
16 SPCS @ 1'-5 11/16 = 23'-7
1-FLG PL-16 x 7/8 x 49'-4½-b13
LOW ALLOY
a a11
1-BAR-3 x ½ x 0'-3⅞-k13 (38 REQ'D)
2-PL-7½ x ⅜ x 4'-0-d13
1-WEB PL-48 x 7/16 x 49'-4½-a13
LOW ALLOY
2-PL-d13
TIGHT FIT
NO WELD
1" RADIUS
DRAIN HOLE
TYP 3 PLACES
NO WELD THIS END (TYP)
1-PL-7½ x ⅜ x 0'-11⅞-h13
1-PL-h13
1-PL-g13
14'-8
42'-8½
TO MATCH STRUT B-6
SUGGESTED PROCEDURE:
WELD PL'S g13 & h13 @ SHOP ASSEMBLY
OF STRUT ARMS TO GIRDER
1-FLG PL-16 x 7/8 x 42'-8½-c13
LOW ALLOY
8-GIRDERS-A13
(GIRDER NO 3)
OUTSIDE FACE OF FLG
k13
DETAIL "Y"
(SEE SHT. 11)
TYP-EXCEPT AS NOTED
WP3-3
TIGHT FIT
NO WELD
SECTION B-B
2
A REVISED WELD SYMBOL
B REV PER APPROVAL SCHED DATED 3-15-71
HOLES 13/16 Ø UNLESS NOTED
FINISH NONE
NOTES
DRAWN BY DC DATE 12-10-70
CHECKED BY CM DATE 12-22-70



NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8	A13	GIRDERS				
8	a13	PL-48 x 7/16	49	4½	LOW ALLOY	9/1
8	b13	PL. 16 x 7/8	49	4½	A-537-67A	9/2
8	c13	PL. 16 x 7/8	42	8½	GRADE A SEE SPECS	9/2
64	d13	PL. 7½ x 3/4	4	0	20/13	
56	f13	PL. 5 x 3/8	4	0	19/7	
16	g13	PL. 5¼ x 3/8	0	11½	5/6	
16	h13	PL. 7½ x 3/8	0	11½	6/6	
304	k13	BAR 3 x ½	0	3¼	13/9	
272	aa11	BAR-2 x 1/8	0	8½	16/9	
		SHOP WELD				
		5/16 FILLET	1940	0		
		3/8 FILLET	32	0		
		½ DBL BEV	76	0		
		3/4 DBL BEV	283	0		
		ALL MAT'L A36 U.N.				

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-0088

NOTE
TAG ALL MATERIAL WITH ITEM NO 132

APPROVAL STAMPS
APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
Date 25 SEP 1972

(3)

LSR 70-0088-132-018

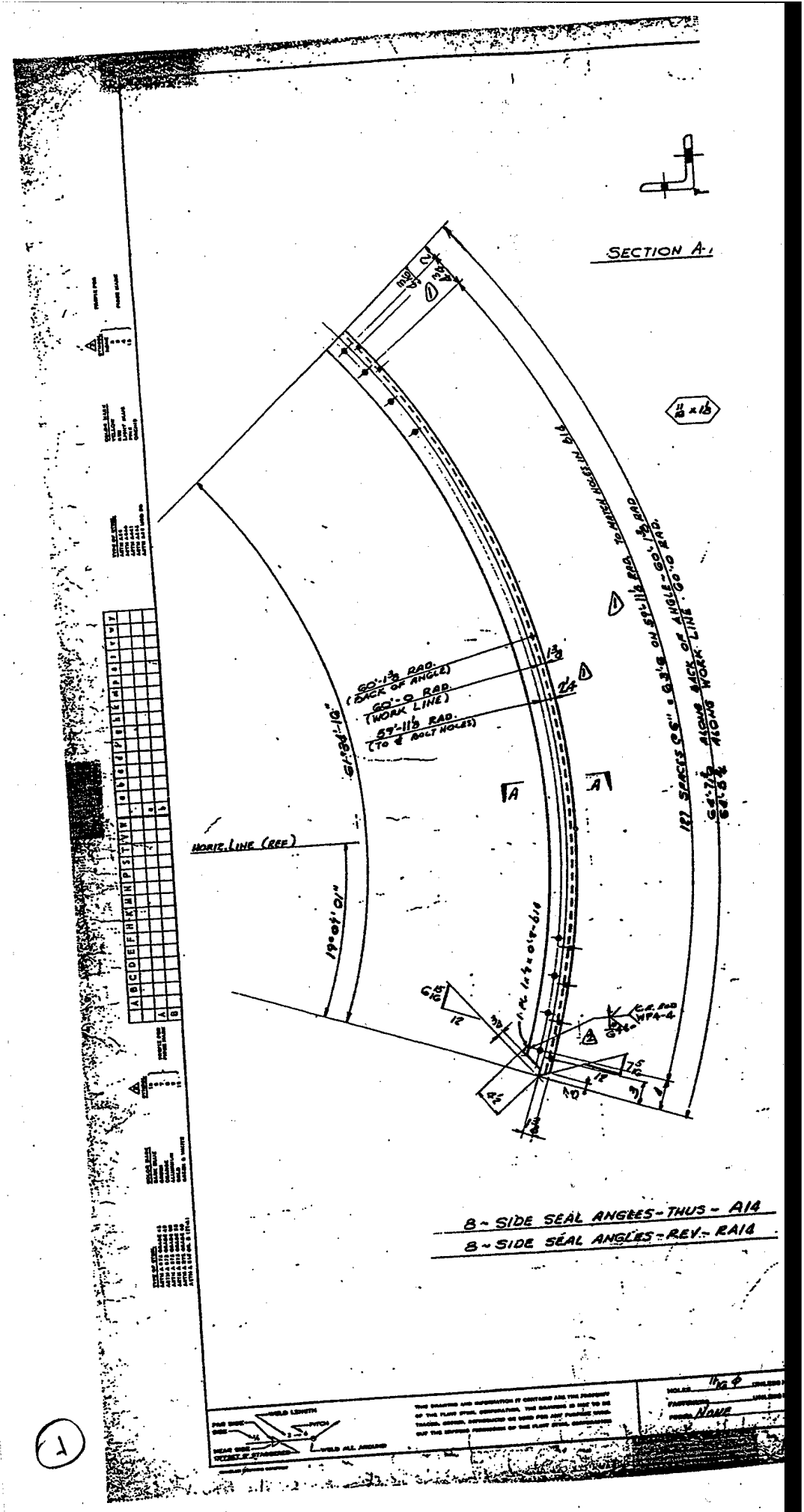
DRAWN BY PC DATE 12-10-70
CHECKED BY CM DATE 12-22-70
DATE 3-15-71

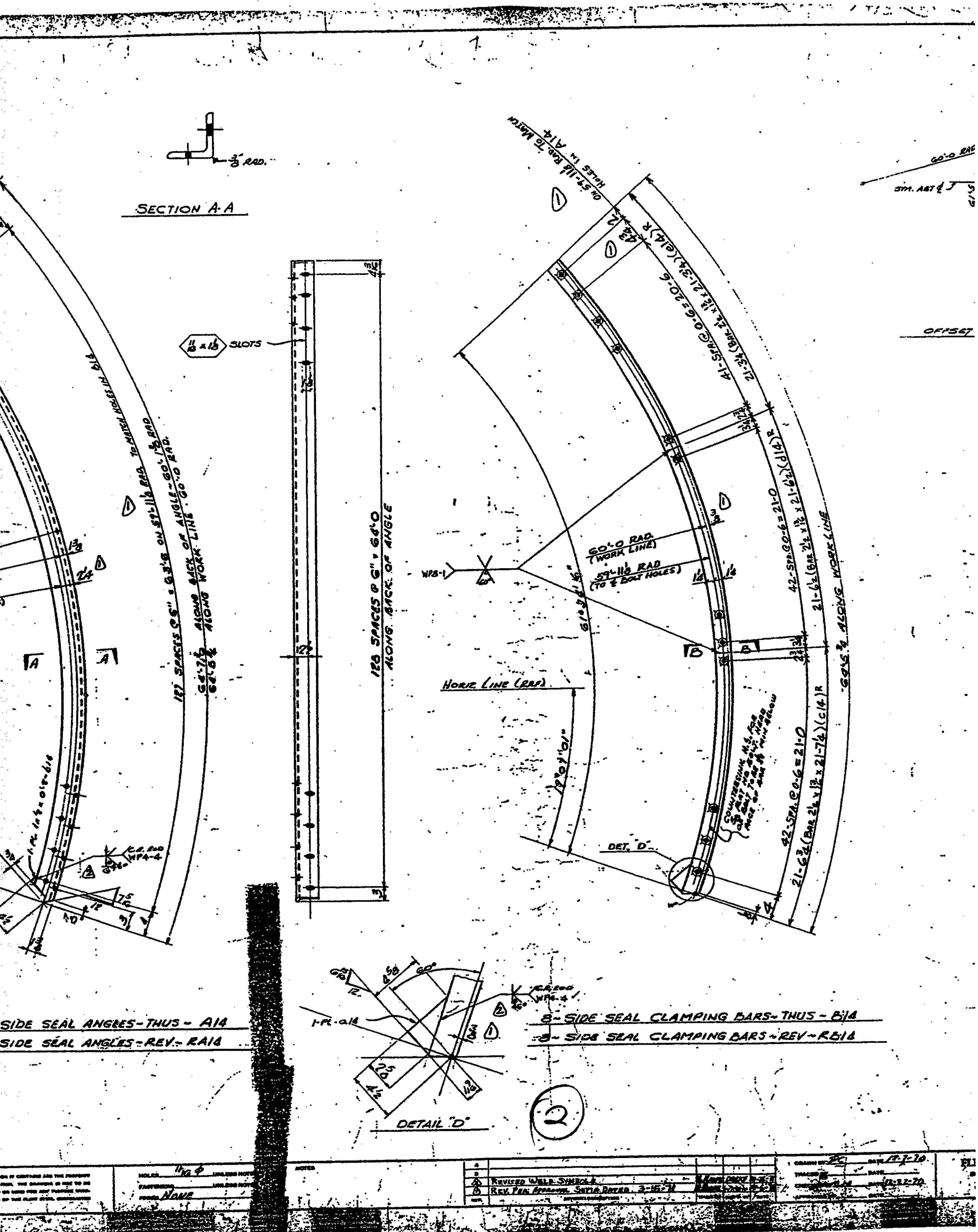
FLINT STEEL CORPORATION
BOX 1288, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

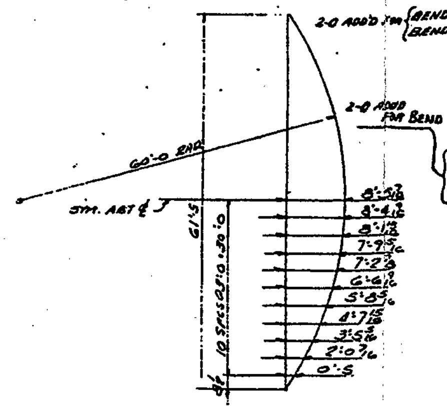
GIRDER No. 3
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR
PULLMAN, WASH.

JOB NO. 70-0544
SHEET NO. 13

70-C-89-365

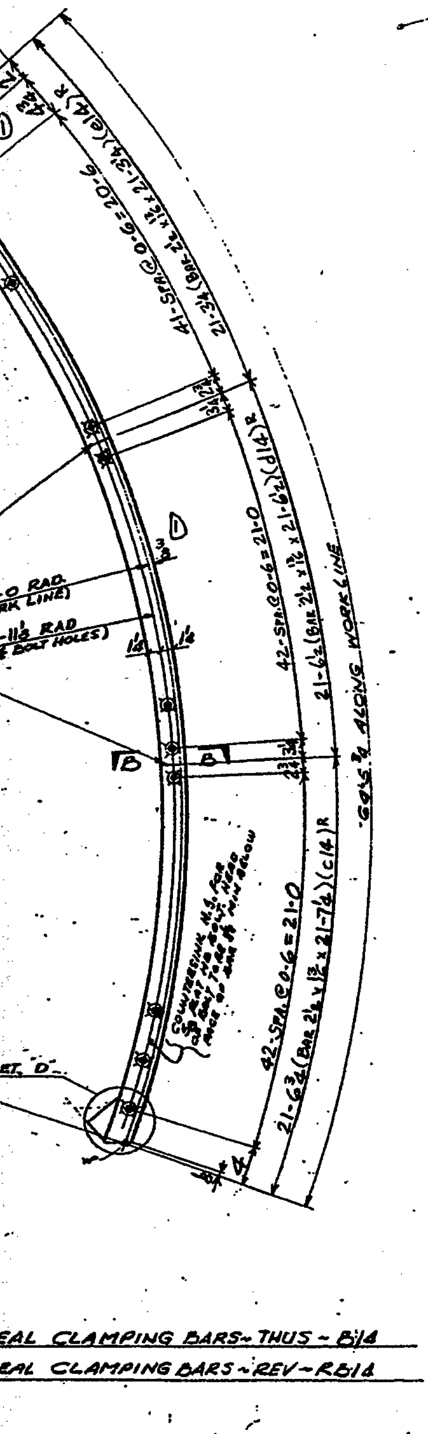

SECTION A-
11" x 17"
60'-1 3/8" RAD. (BACK OF ANGLE)
60'-0" RAD. (WORK LINE)
59'-11 1/8" RAD. (TO ℄ BOLT HOLES)
HORIZ. LINE (REF)
19°-01'-01"
121 SPACES @ 3" = 30'-3"
ALONG BACK OF ANGLE-60'-1 3/8" RAD.
ALONG WORK LINE-60'-0" RAD.
8 - SIDE SEAL ANGLES - THUS - A14
8 - SIDE SEAL ANGLES - REV. - RA14
NONE

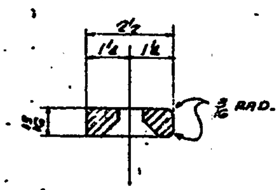

SECTION A-A
SLOTS
128 SPACES @ 6" = 64'-0
ALONG BACK OF ANGLE
127 SPACES @ 6" = 63'-6
ALONG BACK OF ANGLE
ALONG WORK LINE
60'-0 RAD.
(WORK LINE)
59'-11 1/8 RAD
(TO ℄ BOLT HOLES)
HORIZ LINE (REF)
DET. "D"
DETAIL "D"
OFFSET
ALONG WORK LINE
SIDE SEAL ANGLES - THUS - A14
SIDE SEAL ANGLES - REV. - RA14
8 - SIDE SEAL CLAMPING BARS - THUS - B14
8 - SIDE SEAL CLAMPING BARS - REV - RB14
REVISED WELD SYMBOLS
REV. PER APPROVED SEPIA DATED 3-16-71
NONE



OFFSET DIAGRAM

NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
8	A14	L4x4x½	66	7 3/16	CORR. CONFORMING TO A-176, TYP 410S	
8	RA14	L4x4x½	66	7 3/16	CORR. CONFORMING TO A-176, TYP 410S	
16	b14	PL 1x½	0	2	CORR. CONFORMING TO A-176, TYP 410S	
8	B14	BAR				
8	RB14	BAR				
16	a14	PL 2 5/8 x 13/16	0	4 5/8	CORR CONFORMING TO A-176, TYP 410S	
8/8	c14℄	BAR 2½ x 13/16	23	7¼	(A.S.T.M. A-276, TYPE 410S)	
8/8	d14℄	BAR 2½ x 13/16	23	8½	CHEMICALS TO CONFORM	
8/8	e14℄	BAR 2½ x 13/16	23	3¼	TO A-176, TYPE 410S	
		SHOP WELD				
		⅜ DBL V WELD	3	0	CORR RES	
		13/16 ↓	6	0	↓	





SECTION B-B

NOTE
TAG ALL MAT'L WITH
ITEM Nº 132

...EAL CLAMPING BARS ~ THUS ~ B14
...EAL CLAMPING BARS ~ REV ~ RB14

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER
RESIDENT OFFICE
Date 25 SEP 1973

(3)

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

LSR70-0088-132-019

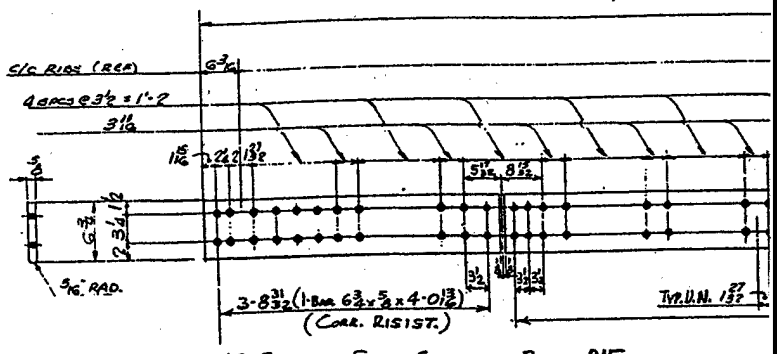
DRAWN BY PC DATE 12-7-70
TRACED BY DATE
CHECKED BY DATE 12-22-70

FLINT STEEL CORPORATION
BOX 1396, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

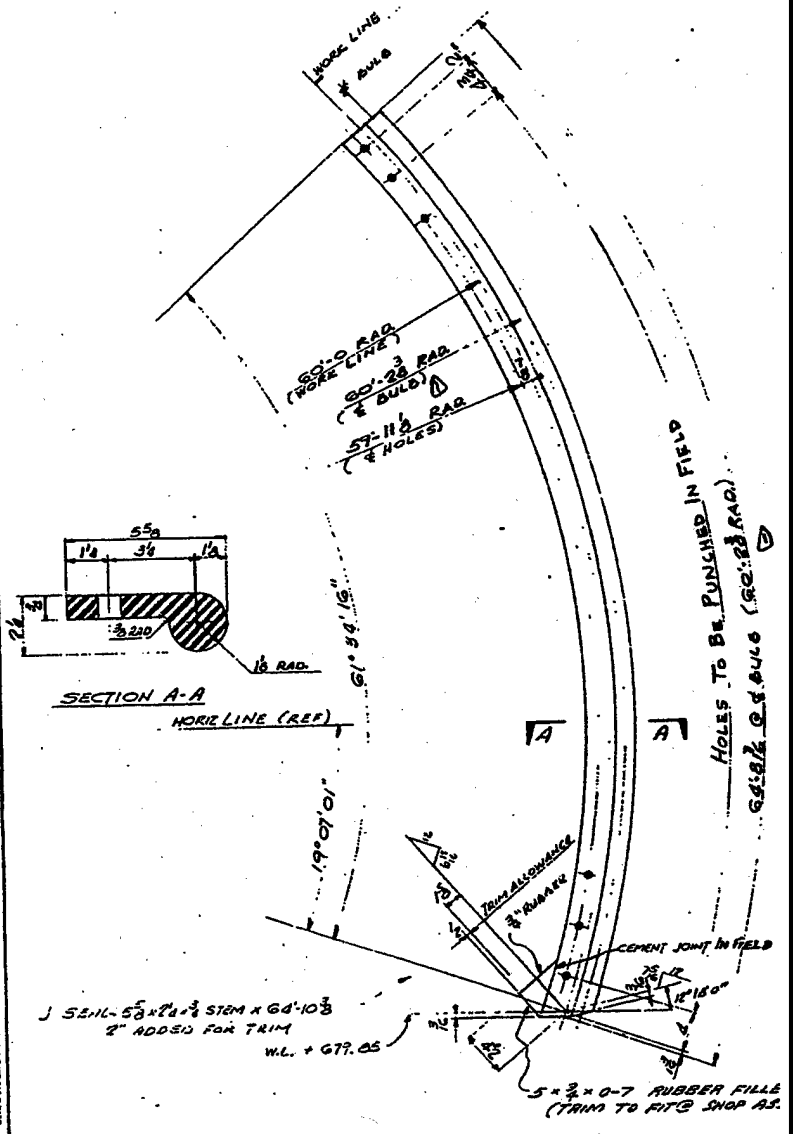
SIDE SEAL ANGLES & BARS
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR
PULLMAN WASH

JOB NO. 70-0544
SHEET NO. 14
REV 2

70-C-88-366



16-BOTTOM SEAL CLAMPING BARS - A15
(CORROSION RESISTANT STEEL)

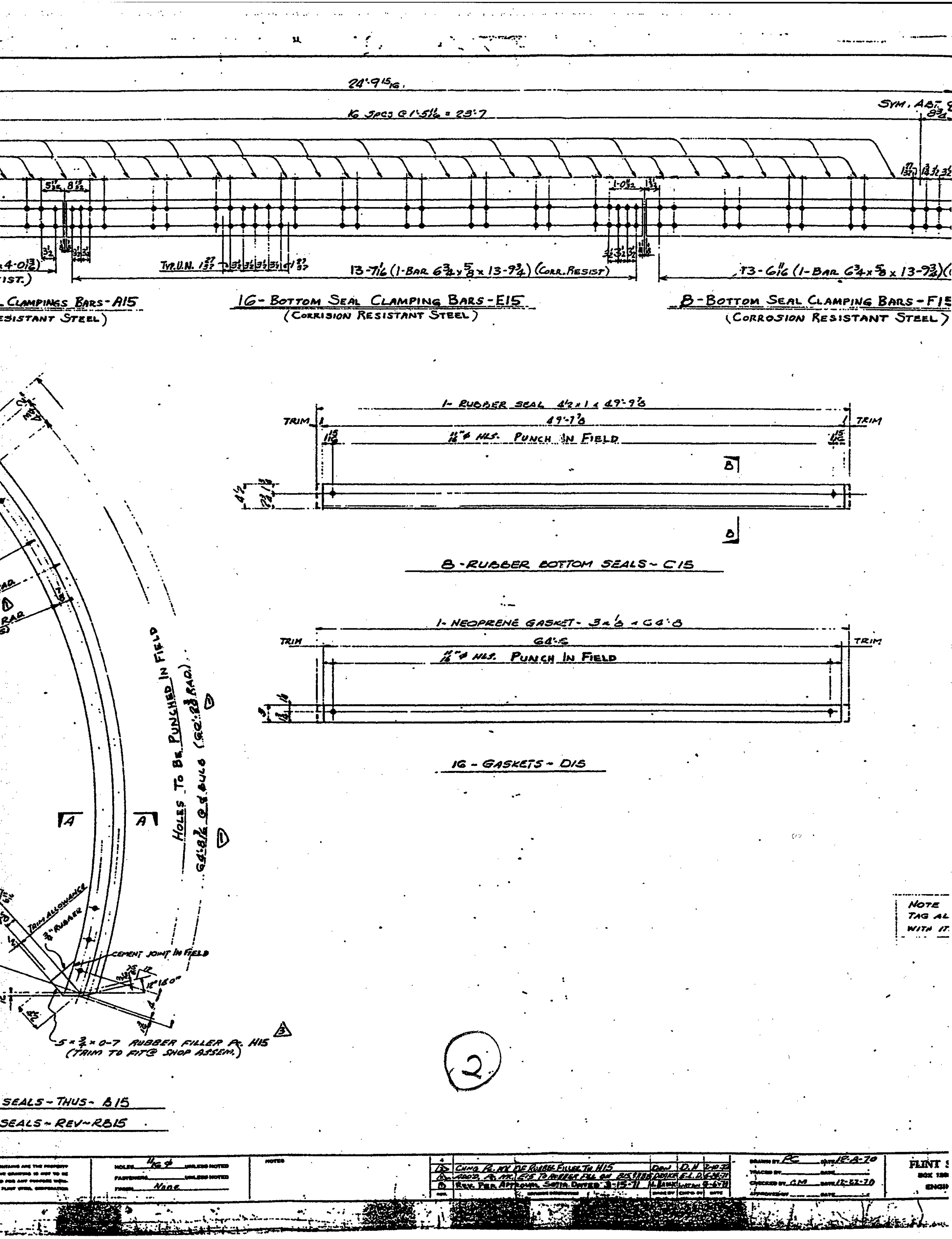


SECTION A-A
HORIZ LINE (REF)

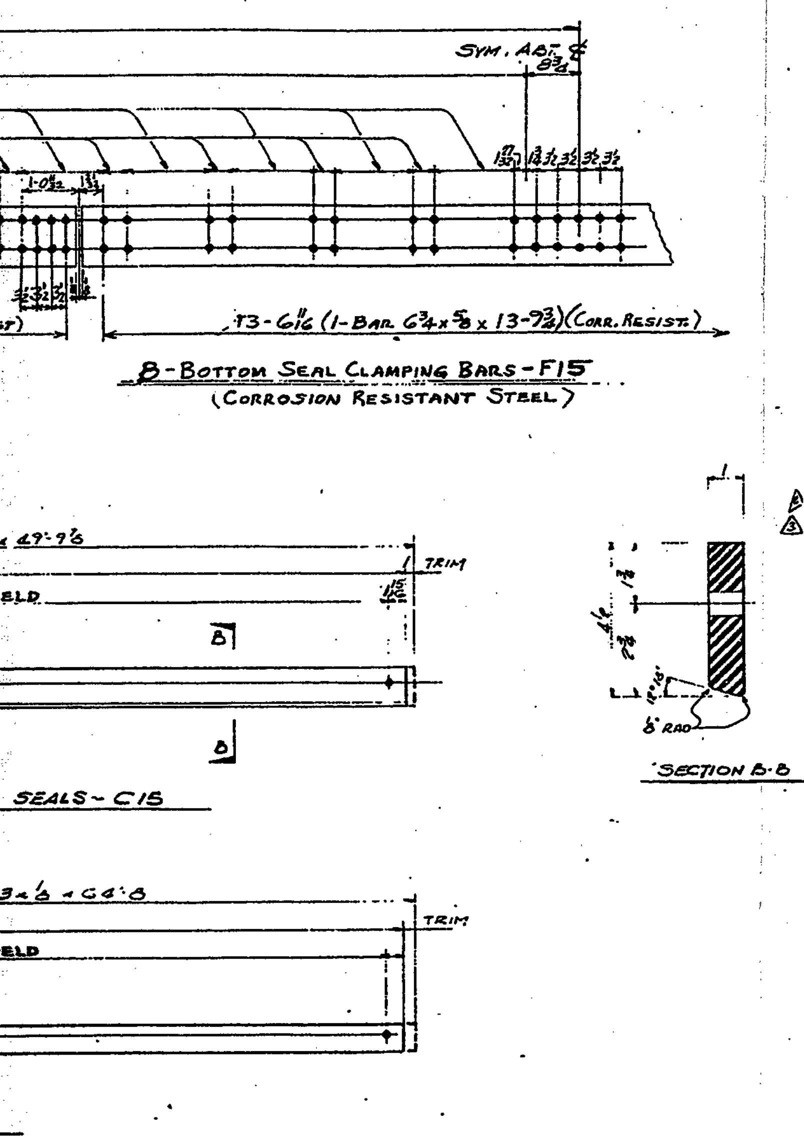
8 - RUBBER "J" SEALS - THUS - B15

8 - RUBBER "J" SEALS - REV - RB15

(1)



24'-9 15/16
16 SPCS @ 1'-5 1/16 = 23'-7
SYM. ABT. ℄
Typ. U.N. 1 27/32
13-7 1/16 (1-BAR 6 3/4 x 5/8 x 13-9 3/4) (CORR. RESIST)
13-6 1/16 (1-BAR 6 3/4 x 5/8 x 13-9 3/4)
CLAMPINGS BARS-A15
16-BOTTOM SEAL CLAMPING BARS-E15
(CORRISION RESISTANT STEEL)
8-BOTTOM SEAL CLAMPING BARS-F15
(CORROSION RESISTANT STEEL)
1-RUBBER SEAL 4 1/2 x 1 x 49'-9 7/8
TRIM
49'-7 7/8
11/16" ⌀ HLS. PUNCH IN FIELD
B
8-RUBBER BOTTOM SEALS-C15
1-NEOPRENE GASKET-3 x 1/8 x 64'-8
64'-6
11/16" ⌀ HLS. PUNCH IN FIELD
16-GASKETS-D15
HOLES TO BE PUNCHED IN FIELD
64'-8 1/16 ℄ BULB (60'-8 3/8 RAD.)
A
TRIM ALLOWANCE
3/4" RUBBER
CEMENT JOINT IN FIELD
5 x 3/4 x 0-7 RUBBER FILLER Pc. H15
(TRIM TO FIT @ SHOP ASSEM.)
SEALS-THUS-B15
SEALS-REV-RB15
NOTE
TAG AL
WITH IT
2
HOLES 11/16 ⌀
FINISH None
CHNG. Pc. MK OF RUBBER FILLER TO H15
ADD'D. Pc. MK. E15 TO RUBBER FILL ON B15
REV. PER APPROVAL SETS DATED 3-15-71
DRAWN BY PC DATE 12-8-70
CHECKED BY CM DATE 12-22-70
FLINT S



NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
16	A15	BAR 6 3/4 x 5/8	4	0 13/16	ASTM A276	3/12
16	E15	BAR 6 3/4 x 5/8	13	9 3/4	TYPE 410S	
8	F15	BAR 6 3/4 x 5/8	13	9 3/4	CHEMICALS TO CONFORM TO A176, TYPE 410S	
8	B15	RUBBER "J" SEALS 5 5/8 x 2 1/4 x 5/8 STEM	65	0		
8	RB15	RUBBER "J" SEALS 5 5/8 x 2 1/4 x 5/8 STEM	65	0		
8	C15	RUBBER SEALS 4 1/2 x 1	47	9 7/8		
16	D15	NEOPRENE GASKETS 3 x 1/8	64	8	40 DUROMETER	
16	H15	RUBBER FILLER PIECES 5 x 3/4 x 0-7				

NOTE
TAG ALL MATERIAL WITH ITEM Nº 132

ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER RESIDENT OFFICE
25 SEP 1973

(3)

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

LSR 70-0088-132-020

... H15	DON	D.H.	2-10-72
... ON B15 ...	DDK	E.L.D.	6-28-71
... 3-15-71	L. BANK	...	8-6-71
	MADE BY	CHK'D BY	DATE

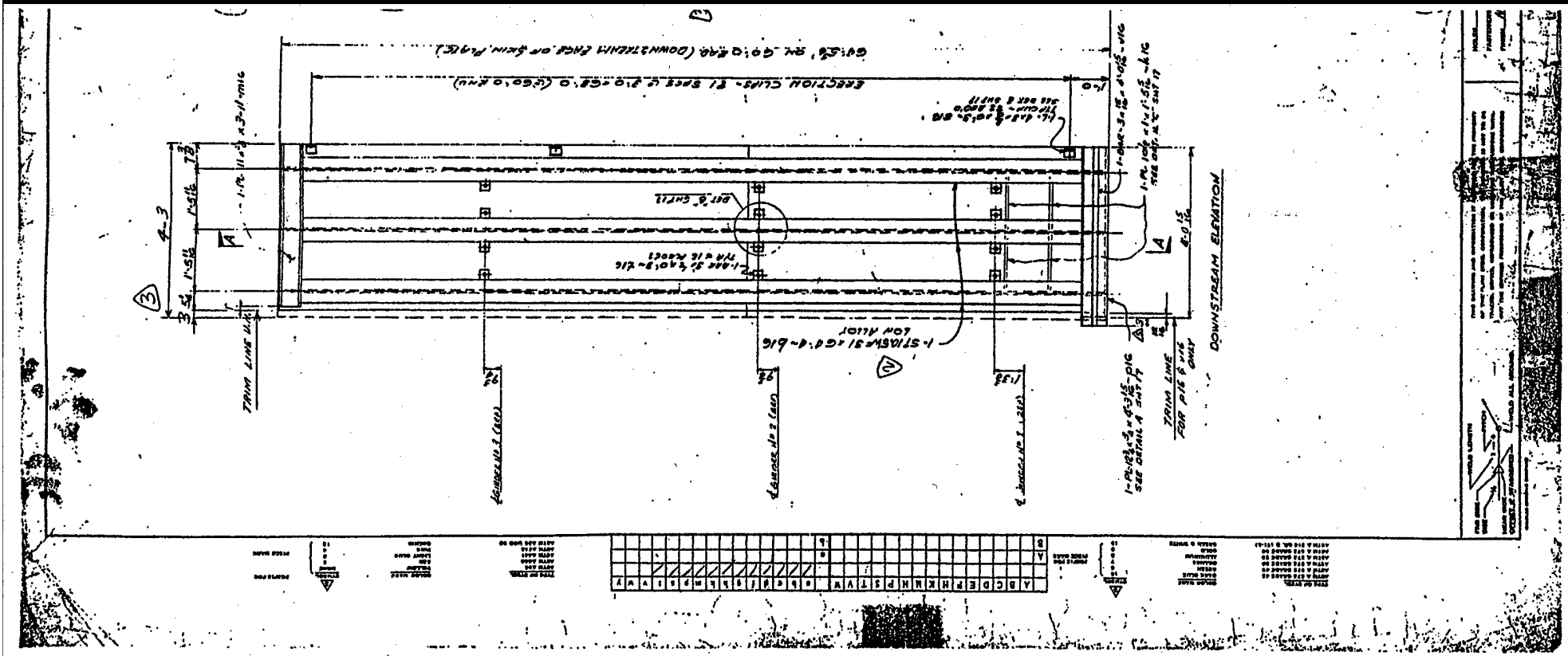
DRAWN BY PC DATE 12-8-70
TRACED BY ____ DATE ____
CHECKED BY CM DATE 12-22-70
APPROVED BY ____ DATE ____

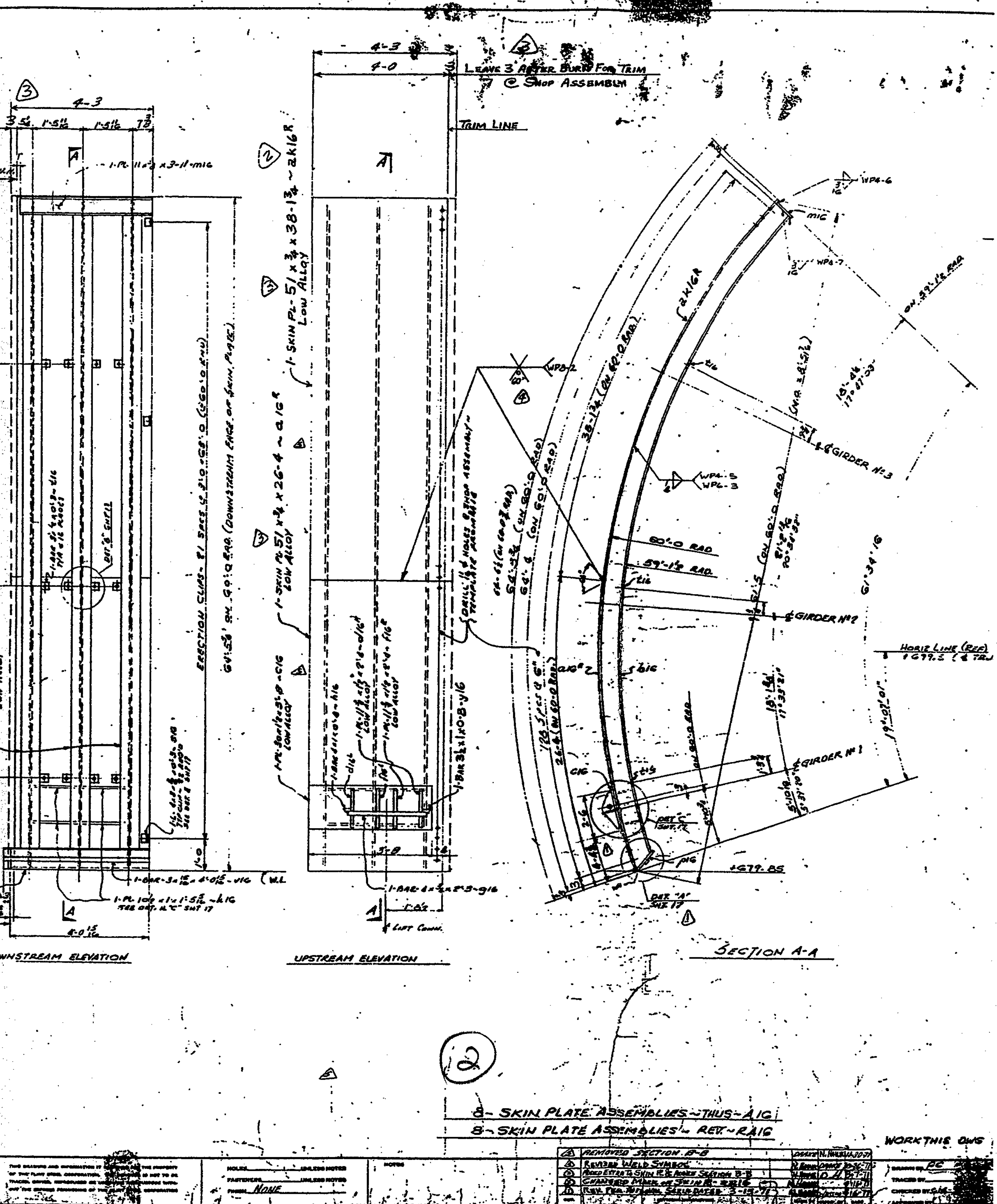
FLINT STEEL CORPORATION
BOX 1280, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

RUBBER SEALS & CLAMPING BAR
LOWER GRANITE LOCK & DAM
FOR LOWER GRANITE CONTR
PULLMAN WASH

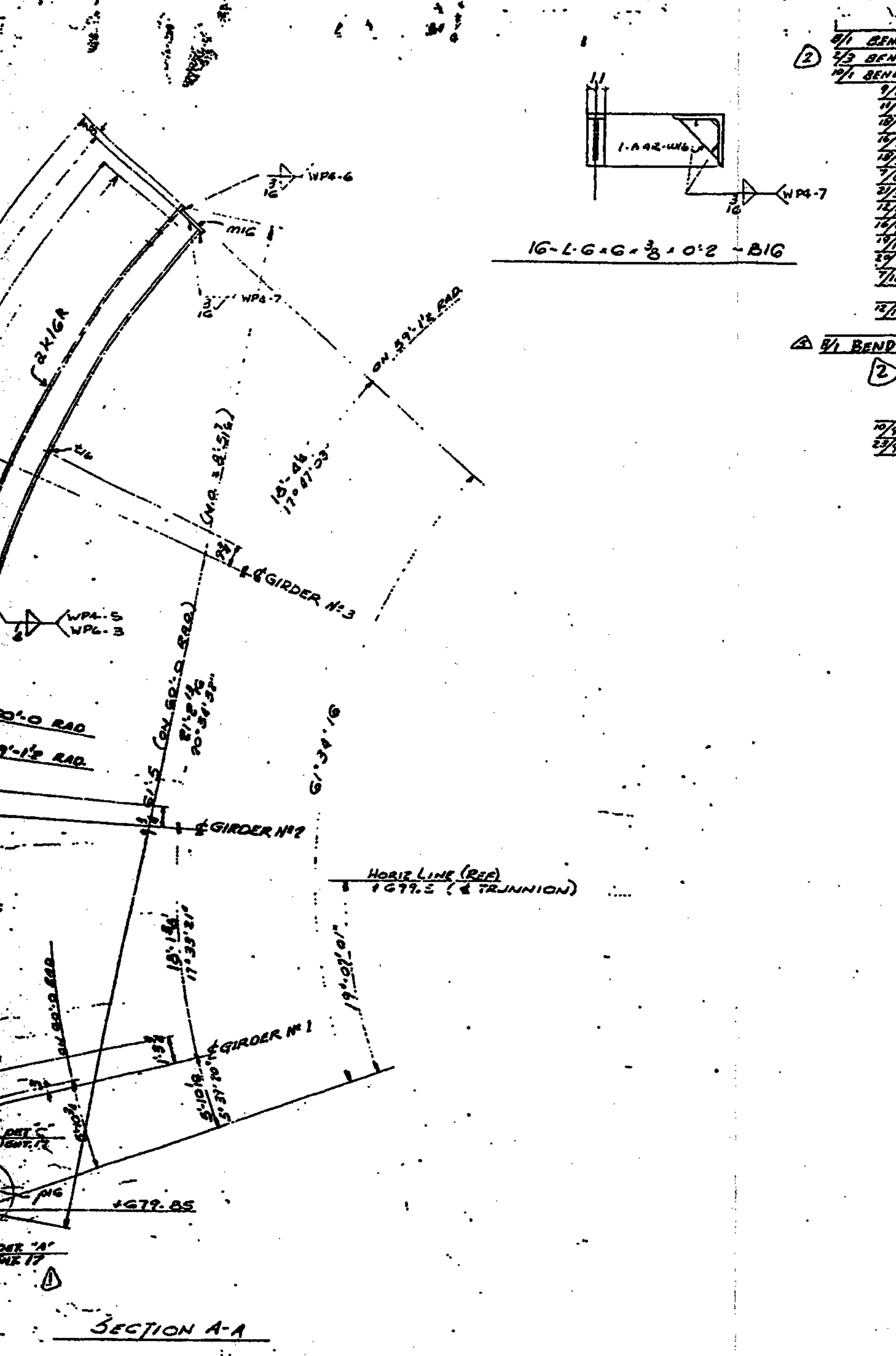
JOB NO. 70-0544
SHEET NO. 15
REV 3

70-C-88-367


DOWNSTREAM ELEVATION



LEAVE 3" AFTER BURN FOR TRIM @ SHOP ASSEMBLY
TRIM LINE
1-SKIN PL-51 x 3/4 x 38-1 3/4 ~ 2K16R LOW ALLOY
1-SKIN PL-51 x 3/4 x 26-4 ~ 2K16R LOW ALLOY
ERECTION CLIPS
GIRDER No 3
GIRDER No 2
GIRDER No 1
60'-0 RAD
59'-1 1/2 RAD
HORIZ LINE (REF)
DET "A" SHT 17
DET "C" SHT 17
DOWNSTREAM ELEVATION
UPSTREAM ELEVATION
SECTION A-A
8 - SKIN PLATE ASSEMBLIES ~ THUS ~ A16
8 - SKIN PLATE ASSEMBLIES ~ REV. ~ RA16
WORK THIS DWG
REMOVED SECTION B-B
REVISED WELD SYMBOL
CHANGED MARK ON SKIN PL
FINISH NONE



	NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	WEIGHT
	8	A16	SKIN PL ASS'YS				
	8	RA16	SKIN PL ASS'YS				
8/1 BEND	8/8	a16	PL-51 x 3/4	26	4	A537 GR.A	
(2) 2/3 BEND	48	b16	ST10.5WF31	64	10	A572 GR.50	6" ADDED FOR BENDING
10/1 BEND	16	c16	PL 30 x 1½	3	8	A537 GR.A	
9/1	16/16	d16	PL 11¾ x 1½	2	4	A537 GR.A	
11/1	16/16	f16	PL 11¾ x 1½	2	4	A537 GR.A	
18/7	16	g16	BAR 4 x ¾	2	3		
16/7	16	h16	BAR 4 x 1	0	8		
18/5	64	k16	PL 10½ x 1	1	5 5/16		
7/6	16	m16	PL 11 x 3/8	3	11		
21/5	16	p16	PL-12¾ x ¾	4	3 5/16		
12/9	352	s16	L-4 x 3 x 3/8	0	3		
16/9	192	t16	BAR 3 x ½	0	3		
19/19	16	v16	BAR 3 x 15/16	4	3 5/16		
29/7	16	y16	BAR 5½ x 1	0	8		
7/12	16	aa16	BAR 3 5/8 ⌀	2	4	QQ-S-763 TYPE 410 COND T	
12/12	32	ab16	BAR 1¾ x ½	0	6½	QQ-S-763 TYPE 203 COND A	
△ 8/1 BEND (2)	8/8	ak16	PL-51 x ¾	38	1¾	A537 GR.A	
10/9	16	B16	L6 x 6 x 3/8	0	2		
23/9	16	w16	BAR 2½ x ½	0	6¾		
	64		½ ⌀ HEX HD. CAPSCREW	0	1½	FF-S-85	STAINLESS TYPE
	64		½ LOCKWASHER			FF-W-84	
			SHOP WELD				
			3/16 FILLET	532	0	LIN. FT.	
			¼ FILLET	6370	0		
			5/16 FILLET	64	0		
			¾ FILLET	173	0		
			½ FILLET	290	0		
			¼ BEV	70	0		
			¾ BEV	279	0		
			1½ BEV	75	0		
			½ DBL BEV	48	0		
			1" DBL BEV	72	0		
			1½ DBL BEV	75	0		

ALL MAT'L A36 U.N.

NOTE-
TAG ALL MATERIAL
WITH ITEM No 132

...LIES ~ THUS ~ A16
...LIES ~ REV. ~ RA16

WORK THIS DWG W/DWG No 17

(3)

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER
RESIDENT OFFICE
Date 25 SEP 1973

LSR 70-0088-132-021

DRAWN BY PC
TRACED BY
CHECKED BY
APPROVED BY

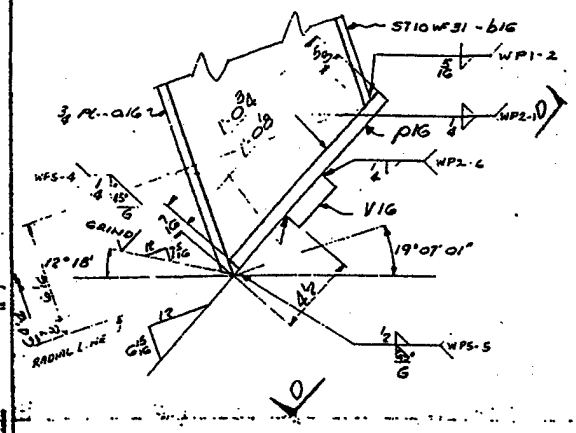
FLINT STEEL CORPORATION
BOX 1280, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

SKIN PLATE ASSEMBLIES
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR.
PULLMAN, WASH.

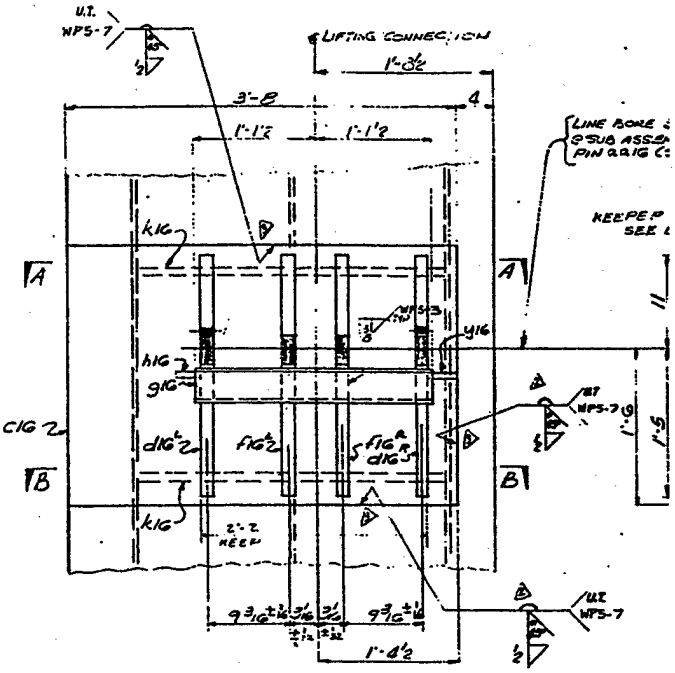
JOB NO. 70-0546
SHEET NO. 16

70-C-88-368

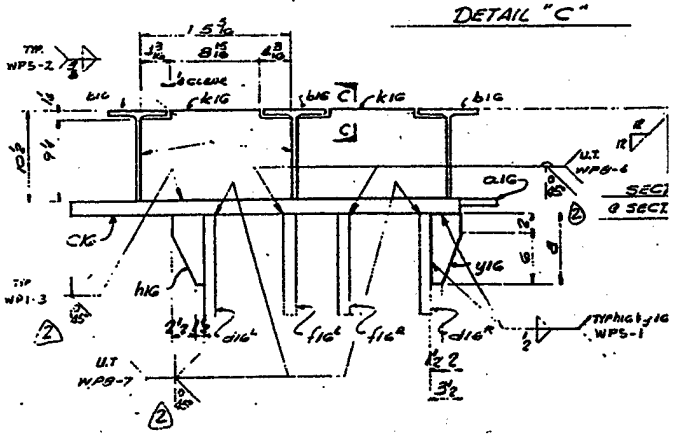
OCT 13 1981



DETAIL "A"



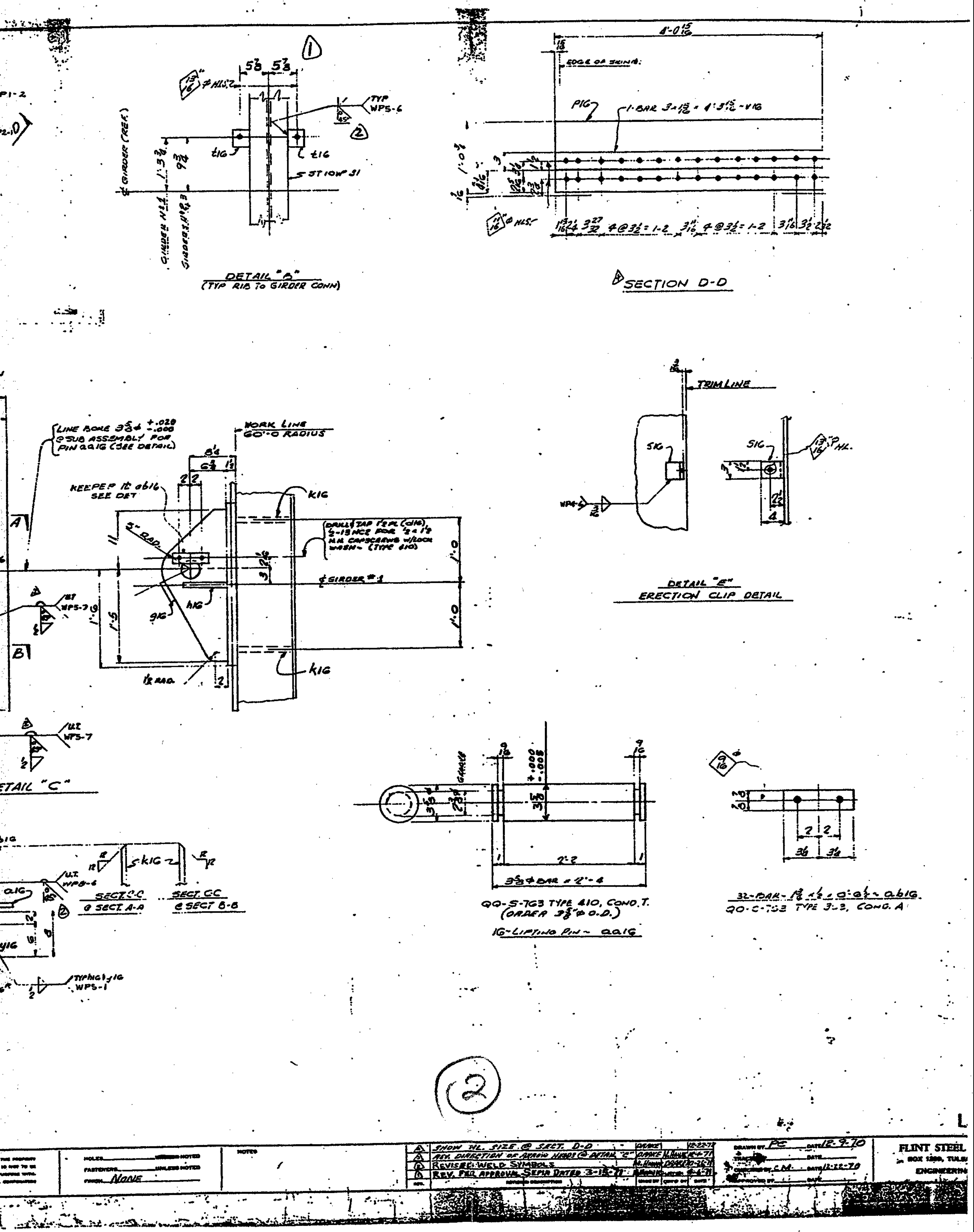
DETAIL "C"



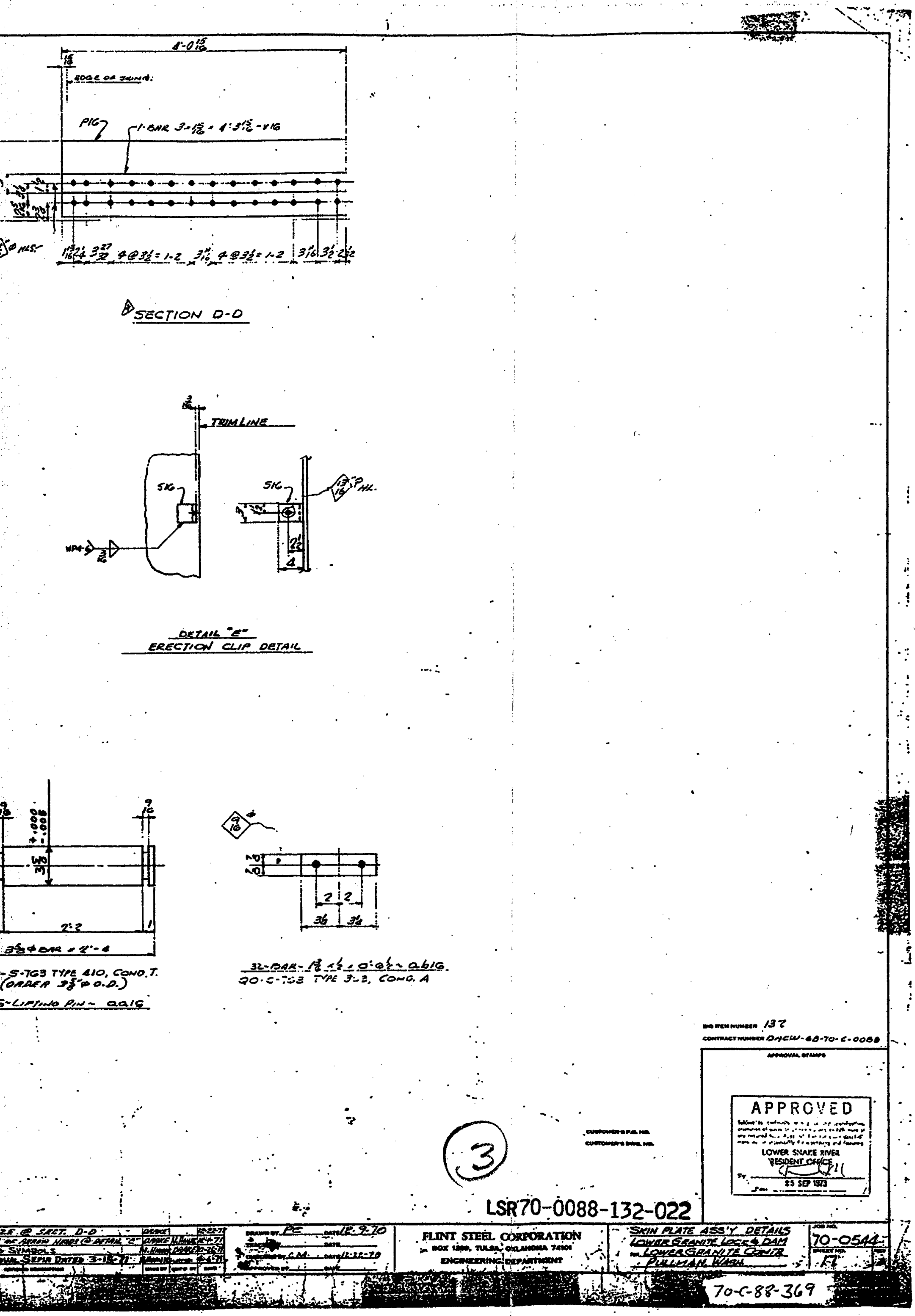
SECTION A-A

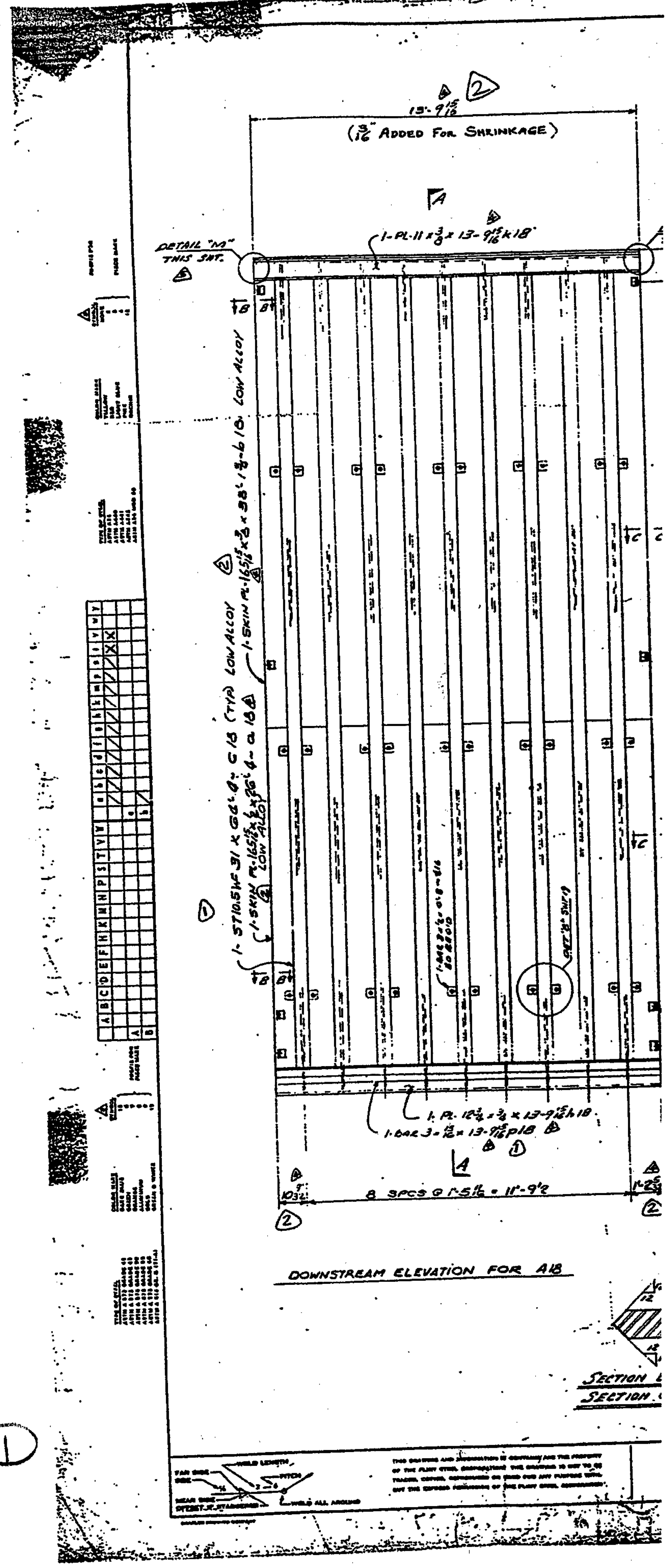
SECTION B-B

(1)

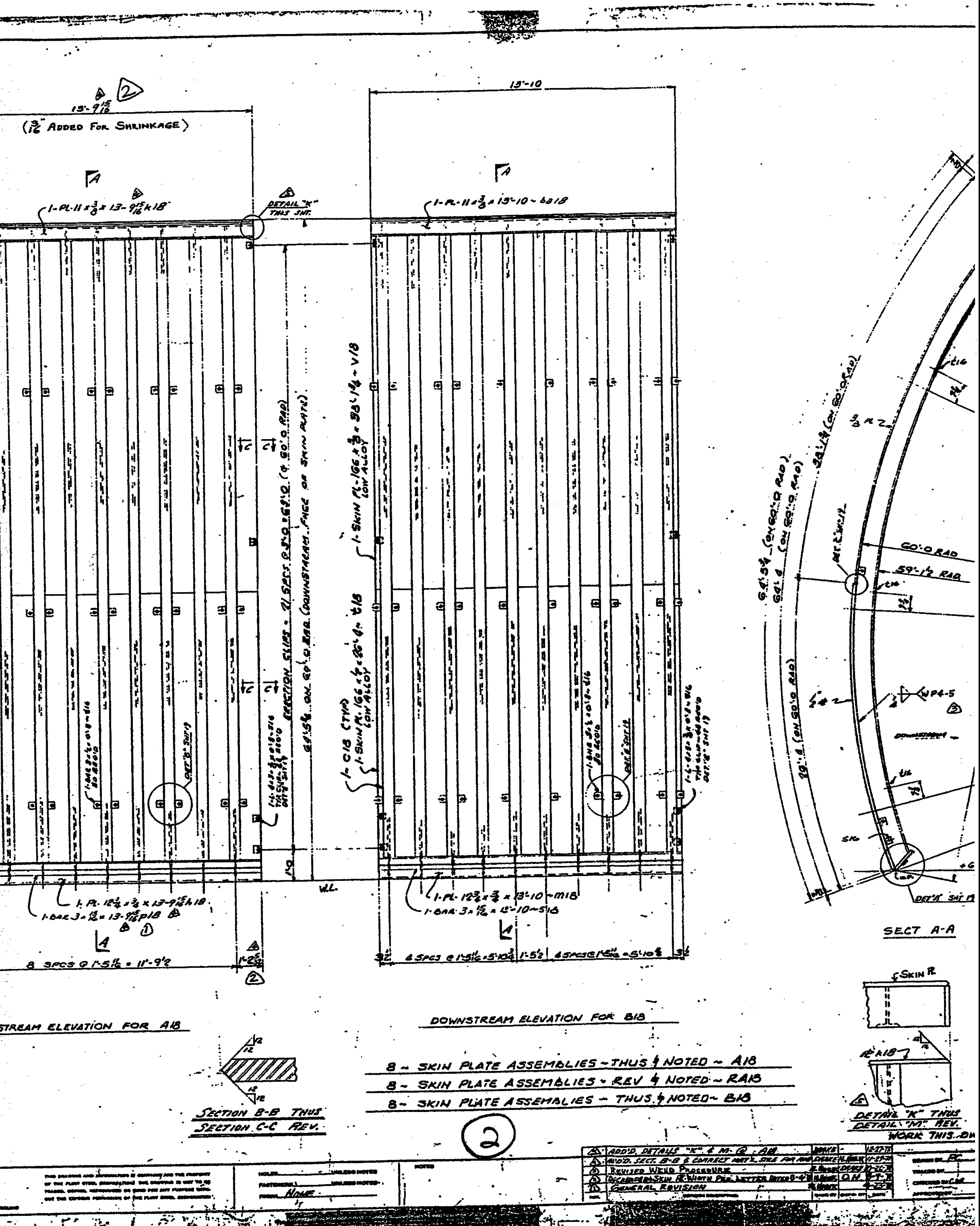


DETAIL "B"
(TYP RIB TO GIRDER CONN)
5⅜ 5⅜
13/16 ⌀ HLS.
TYP WPS-6
t16
5 ST 10 WF 31
℄ GIRDER (REF.)
GIRDER #2.1
GIRDER 3 #9.3
SECTION D-D
4'-0 15/16
EDGE OF SKIN
P16
1-BAR 3×1/2 × 4'-3 15/16 - V16
11/16 ⌀ HLS.
4@3½=1-2
4@3½=1-2
LINE BORE 3⅜⌀ +.020 -.000 @ SUB ASSEMBLY FOR PIN aa16 (SEE DETAIL)
WORK LINE 60'-0 RADIUS
KEEPER ℞ ab16 SEE DET
5" RAD.
k16
DRILL & TAP 1" ℞ (d16), 2-1/2 NC2 FOR 1/2 × 1½ H.H. CAPSCREWS W/LOCK WASH. (TYPE 410)
℄ GIRDER # 1
h16
g16
1½ RAD.
k16
U.T. WPS-7
ETAIL "C"
DETAIL "E"
ERECTION CLIP DETAIL
TRIM LINE
S16
WPS-5
13/16 ⌀ HL.
k16
U.T. WPS-6
SECT C-C @ SECT A-A
SECT. C-C @ SECT B-B
TYP. (c16 & j16) WPS-1
QQ-S-763 TYPE 410, COND. T.
(ORDER 3⅝" ⌀ O.D.)
16-LIFTING PIN ~ aa16
3⅝ ⌀ BAR × 2'-4
2-2
+.000 -.005
9/16 ⌀
32-BAR-1⅝ × ½ × 0'-6½ ~ ab16
QQ-C-763 TYPE 3-3, COND. A
(2)
HOLES ___ UNLESS NOTED
FASTENERS ___ UNLESS NOTED
FINISH NONE
NOTES
SHOW HL. SIZE @ SECT. D-D
REV. DIRECTION OF ARROW HEADS @ DETAIL "C"
REVISED WELD SYMBOLS
REV. PER APPROVAL SEPIA DATED 3-15-71
DRAWN BY PC DATE 12-9-70
CHECKED BY C.M. DATE 12-22-70
FLINT STEEL
BOX 1289, TULSA
ENGINEERING

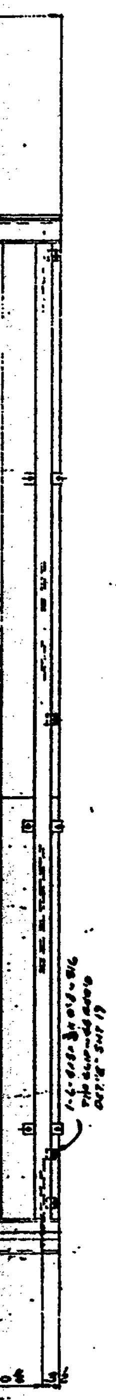

SECTION D-D
TRIM LINE
DETAIL "E"
ERECTION CLIP DETAIL
BID ITEM NUMBER 137
CONTRACT NUMBER DACW-68-70-C-0088
APPROVAL STAMPS
APPROVED
LOWER SNAKE RIVER
RESIDENT OFFICE
25 SEP 1973
LSR70-0088-132-022
FLINT STEEL CORPORATION
ENGINEERING DEPARTMENT
SKIN PLATE ASS'Y DETAILS
LOWER GRANITE LOCK & DAM
LOWER GRANITE COMTR
PULLMAN, WASH.
70-0544
70-C-88-369



13'-9 15/16"
(3/16" ADDED FOR SHRINKAGE)
1-PL-11 x 3/8 x 13-9 15/16 k18
DETAIL "M" THIS SHT.
LOW ALLOY
1-PL. 12 3/4 x 3/8 x 13-9 15/16 k18
1-BAR 3 x 15/16 x 13-9 15/16 p18
8 SPCS @ 1'-5 1/16 = 11'-9 1/2
DOWNSTREAM ELEVATION FOR A18
SECTION
SECTION



13'-9 15/16
(3/16" ADDED FOR SHRINKAGE)
13'-10
1-PL-11 x 3/8 x 13'-9 15/16 k18
1-PL-11 x 3/8 x 13'-10 ~ b318
DETAIL "K" THIS SHT.
1-SKIN PL-166 x 3/8 x 38'-1 3/4 ~ V18 LOW ALLOY
1-SKIN PL-166 x 1/2 x 26'-4 ~ t18 LOW ALLOY
1-C18 (TYP)
ERECTION CLIPS ~ 21 SPCS @ 3'-0 = 63'-0 (@ 60'-0 RAD)
63'-5 3/4 ON 60'-0 RAD. (DOWNSTREAM FACE OF SKIN PLATE)
W.L.
1-PL-12 3/4 x 3/8 x 13'-9 15/16 h18
1-BAR 3 x 15/16 x 13'-9 15/16 p18
1-PL-12 3/4 x 3/8 x 13'-10 ~ m18
1-BAR 3 x 15/16 x 13'-10 ~ s18
8 SPCS @ 1'-5 1/16 = 11'-9 1/2
4 SPCS @ 1'-5 5/16 = 5'-10 1/4
1'-5 1/2
STREAM ELEVATION FOR A18
DOWNSTREAM ELEVATION FOR B18
SECTION B-B THUS
SECTION C-C REV.
8 ~ SKIN PLATE ASSEMBLIES ~ THUS & NOTED ~ A18
8 ~ SKIN PLATE ASSEMBLIES ~ REV & NOTED ~ RA18
8 ~ SKIN PLATE ASSEMBLIES ~ THUS & NOTED ~ B18
2
60'-0 RAD
59'-1/2 RAD
64'-5 3/4 (ON 60'-0 RAD)
64'-4 (ON 60'-0 RAD)
38'-1 3/4 (ON 60'-0 RAD)
26'-4 (ON 60'-0 RAD)
SECT A-A
SKIN PL
DETAIL "K" THUS
DETAIL "M" REV.
ADD'D DETAILS "K" & M-Q-AM
ADD'D SECT. B-B & CORRECT MAT'L SIZE
REVISED WELD PROCEDURE
GENERAL REVISION



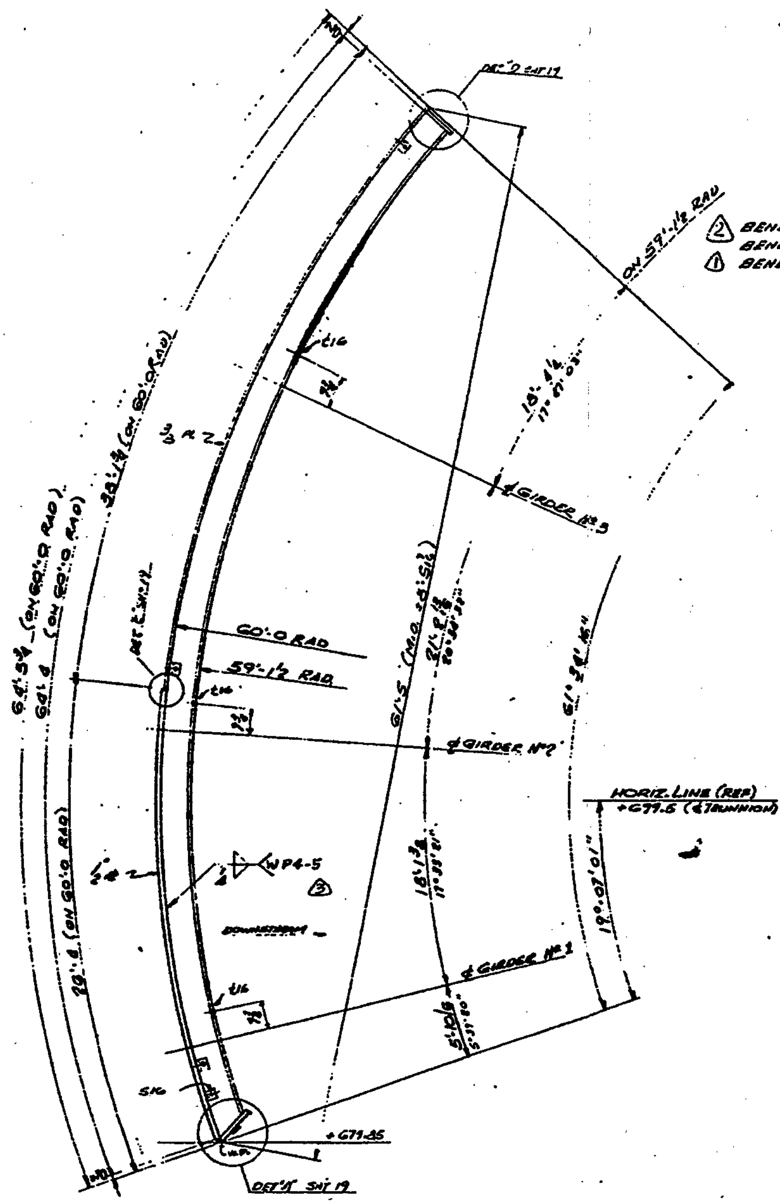
PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS
8	A18	SKIN PL ASSYS			
8	RA18	SKIN PL ASSYS			
(2) BEND 16	j18	PL 165 5/16 x 1/2	26	4	A537-GR.A 3/1
BENDS 16	b18	PL 165 5/16 x 3/8	38	1 3/4	A537-GR.A 7/1
(1) BEND 144	c18	ST15WF31	64	10	A572-GR.50
16	k19	PL-11 x 3/8	13	7 15/16	8/6
16	h18	PL-12 3/4 x 3/4	13	9 15/16	22/5
16	p18	BAR 3 x 1/16	13	9 15/16	20/9
704	SK16	L-4 x 3 x 3/8	0	3	12/9
480	t16	BAR-3 x 1/2	0	3	16/9

PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS
8	B18	SKIN PL ASSYS			
(2) BEND 8	t18	PL 166 x 1/2	26	4	A537-GR.A 3/6
BEND 8	v18	PL 166 x 3/8	38	1 3/4	A537-GR.A 7/1
(1) BEND 80	c18	ST10SWF31	64	4	A572-GR.50
8	w18	PL-11 x 3/8	13	10	8/6
8	m18	PL-12 3/4 x 3/4	13	10	22/5
8	s18	BAR-3 x 1/2	13	10	20/9
352	SK16	L-4 x 3 x 3/8	0	3	12/9
240	t16	BAR-3 x 1/2	0	3	16/9

SHOP WELD

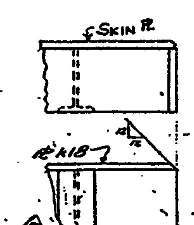
3/16 FILLET	2306	0	LIN. FT
1/4 FILLET	29,155	0	
5/16 FILLET	668	0	
1/2 FILLET	336	0	
1/4 BEV	336	0	
3/4 BEV	334	0	
3/8 DBL BEV	334	0	
1/2 DBL BEV	180	0	

ALL MAT'L A36 U.N.



SECT A-A

NOTE
TAG ALL MATERIAL WITH ITEM No 132



DETAIL "K" THUS
DETAIL "M" REV.

& NOTED ~ A18
& NOTED ~ RA18
& NOTED ~ B18

WORK THIS DWG W/ DWG No 19

BID ITEM NUMBER 132
CONTRACT NUMBER DACW 68-70-C-0088

APPROVAL STAMPS

APPROVED
LOWER SNAKE RIVER
RESIDENT OFFICE
25 SEP 1973

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

(3)

LSR70-0088-132-023

...TAILS "K" & M @ AM			12-27-71
...T. B-B & CORRECT MAT'L SIZE FOR ...	DRAWE	H.BARK	11-29-71
...WELD PROCEDURE		DRAWE	11-26-71
...SKIN PL WIDTH PER LETTER ...8-4-71		O.H	5-7-71
...REVISION			4-22-71

DRAWN BY RC DATE 12-9-70
TRACED BY ... DATE ...
CHECKED BY CM DATE 12-22-70
APPROVED BY ... DATE ...

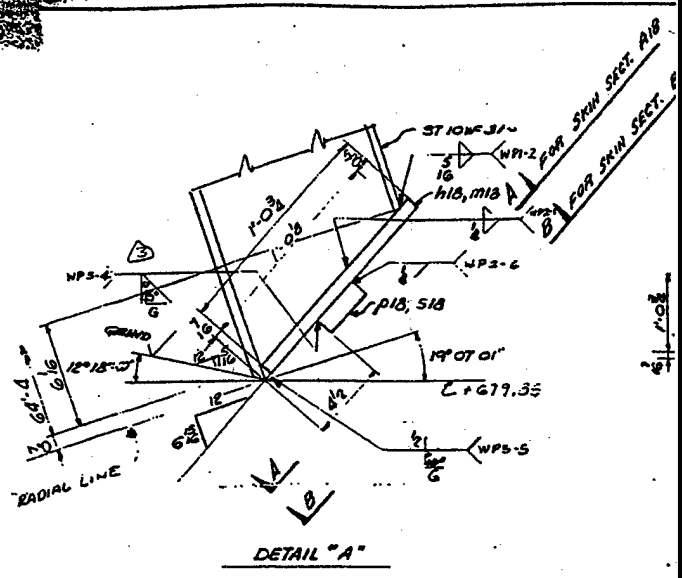
FLINT STEEL CORPORATION
BOX 1365, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

SKIN PLATE ASSEMBLIES
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONTR.
PULLMAN WASH.

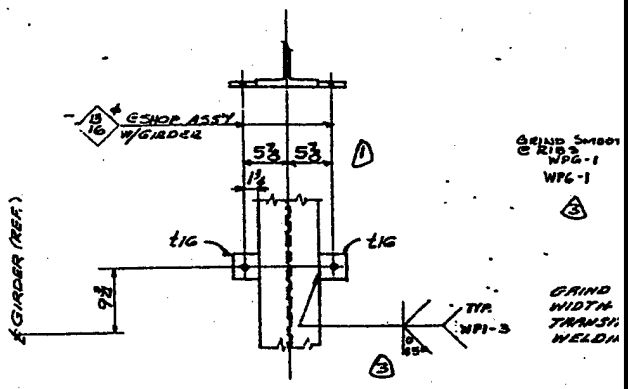
JOB NO. 70-0344
SHEET NO. 18

70-C-88-370

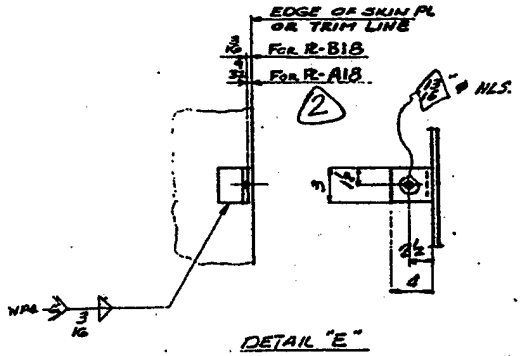
OCT 1 1981



DETAIL "A"

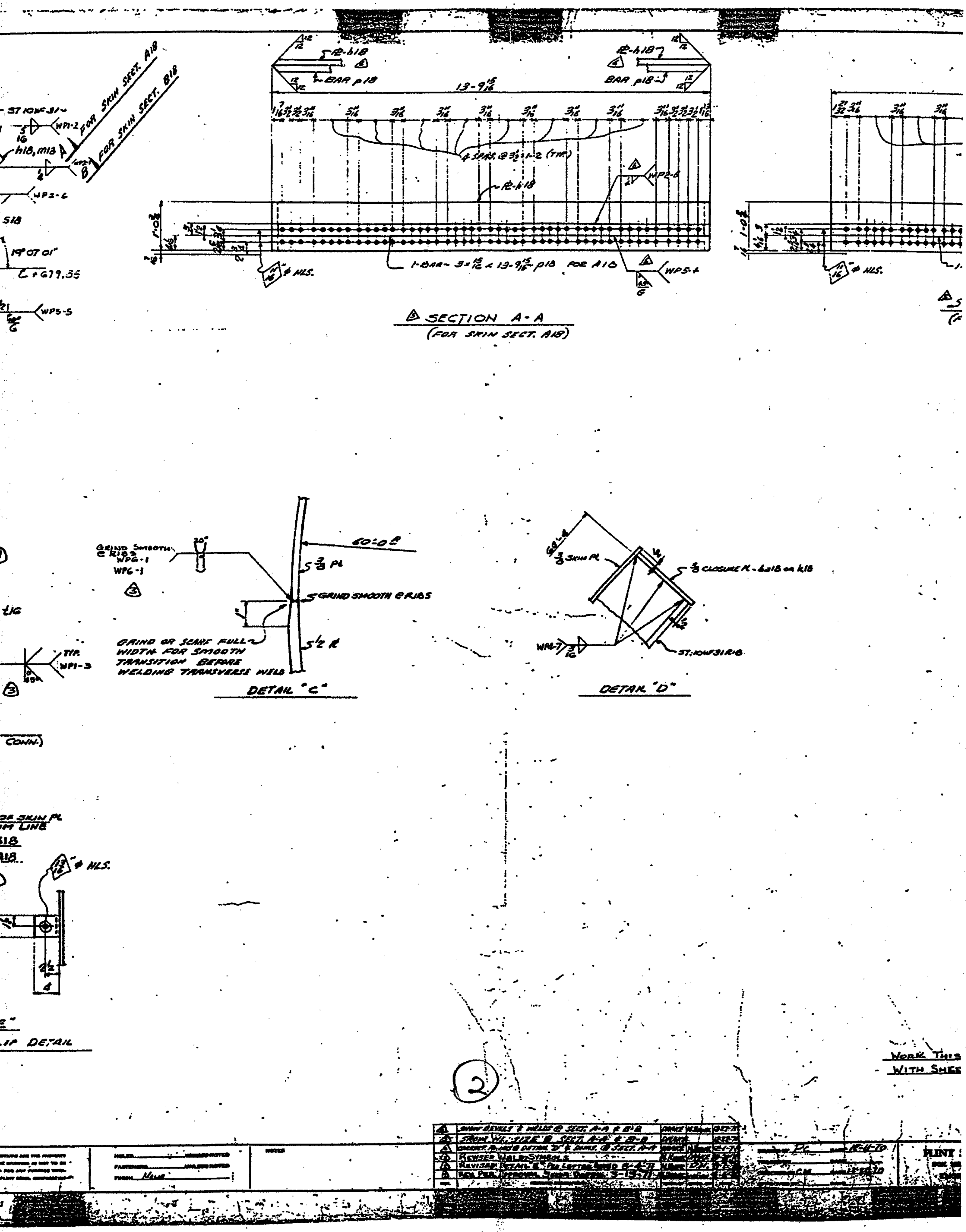


DETAIL "B"
(TYP. RIB TO GIRDER CONN.)

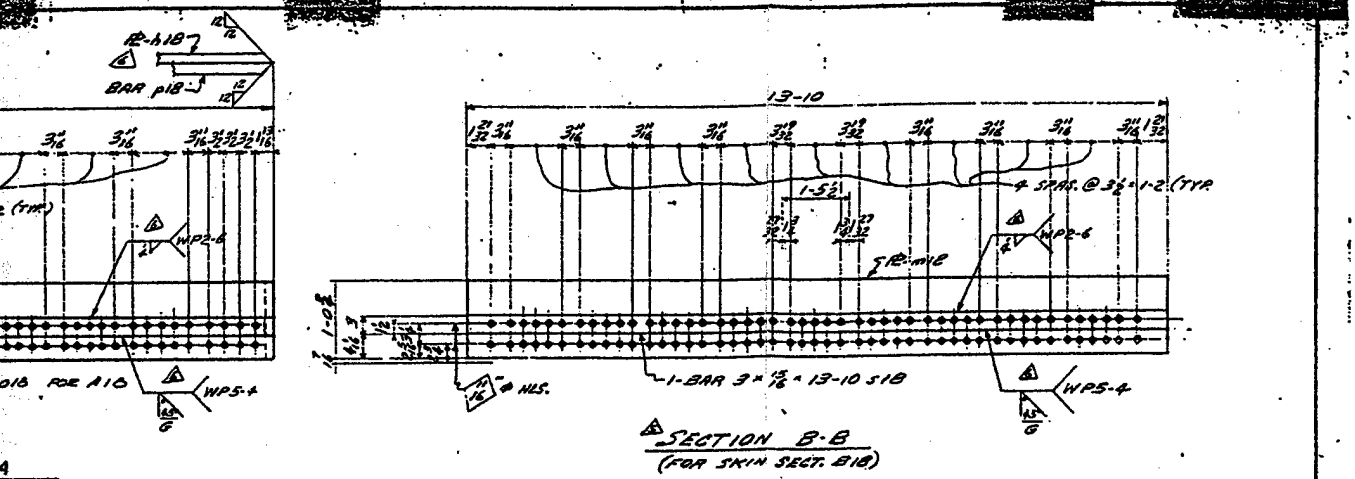


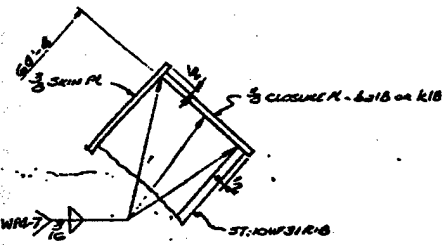
DETAIL "E"
ERECTION CLIP DETAIL

(1)



FOR SKIN SECT. A18
FOR SKIN SECT. B18
BAR p18
13-9 15/16
4 SPAS. @ 3 5/8 = 1-2 (TYP.)
1-BAR - 3 x 15/16 x 13-9 15/16 p18 FOR A18
SECTION A-A
(FOR SKIN SECT. A18)
60'-0"
5/8 PL
GRIND SMOOTH @ RIBS
1/2 PL
GRIND OR SCARF FULL WIDTH FOR SMOOTH TRANSITION BEFORE WELDING TRANSVERSE WELD
DETAIL "C"
5/8 SKIN PL
5/8 CLOSURE PL - b18 or k18
ST.10WF31R18
DETAIL "D"
WORK THIS
WITH SHEE
SHOW BEVELS & WELDS @ SECT. A-A & B-B
REVISED WELD SYMBOLS
FASTENERS
FINISH None
2





DETAIL "D"

WORK THIS SHEET WITH SHEET 18

(3)

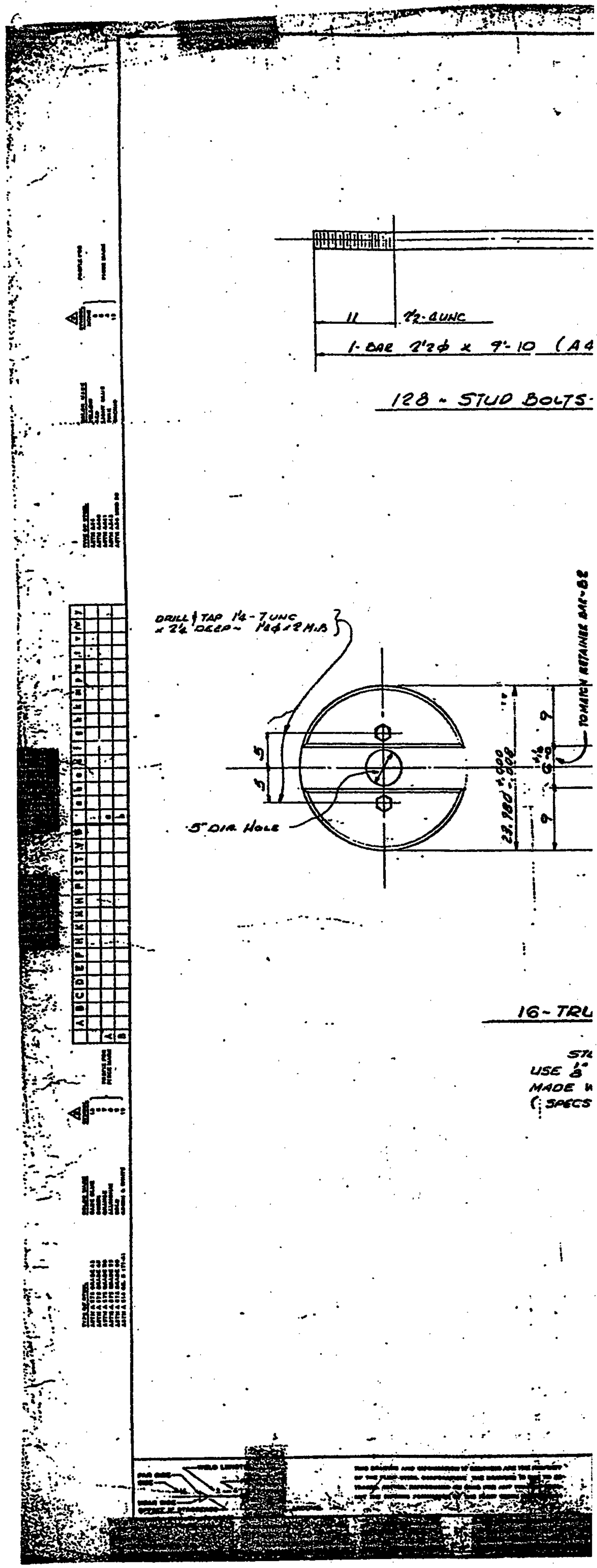
ESR70-0088-132-024

APPROVED

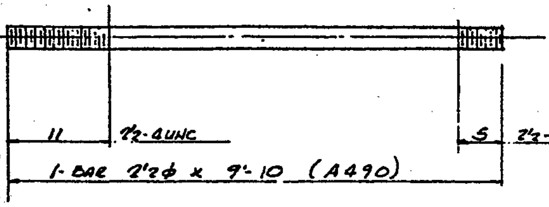
LOWER SNAKE RIVER RESIDENT OFFICE

25 SEP 1973

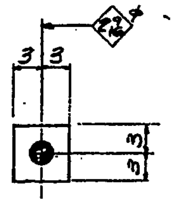
70-C-88-371


128 - STUD BOLTS-
5" DIA HOLE
23.980 +.000 -.008
TO MATCH RETAINER BAR-B2
16-TRU
USE
MADE
(SPECS

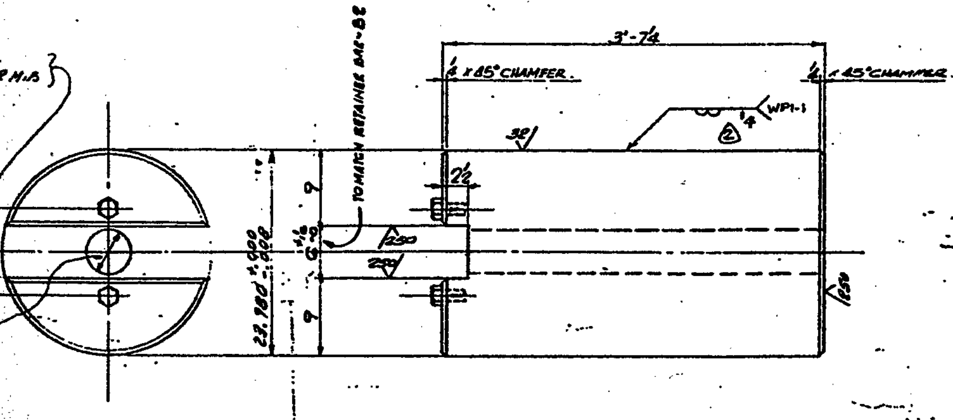
1



128 - STUD BOLTS ~ A20



128 ~ PL- 6x¾x0'-6 ~ B20 (A490)



16-TRUNNION PINS ~ C20

STEEL FORGING ASTM E85 CLASS C1.
USE ⅛" FINISHED THICKNESS WELDED OVERLAY
MADE WITH E308-15 OR 16 ELECTRODE.
(SPECS PE TP-17-7a OPTION 2)

(2)

NONE

Revise Weld Symbol

20 (A490)

NO. PCS.	MARK	MATERIAL	LENGTH FT.	LENGTH IN.	REMARKS	
128	A20	2½ φ STUD BOLT	9	10	A490	7/3
128	B20	PL 6 x ¾	0	6	A490	
16	C20	PIN 24" φ	3	7¼	SEE SKETCH	
32		1¼ φ MB	0	2	THD FULL LGTH NO NUT FF-B-575b	
	FIELD BOLTS (ACTUAL COUNT)					
32		1 φ MB	0	6	HEX HD. THD. 3½" No NUT FF-B-575b	
1064		⅝ φ MB	0	2¼	HEX HD. HEX NUT CORR. RES	
2704		⅝ φ MB	0	3½	CORR. RES	
3048		⅝ φ MB	0	3¼	HEX HD HEX NUT CORR RES	
1064		⅝ FLAT WASH			CORR. RESIST.	
4752		⅝ LOCK WASH				
256	D20	2½ φ Hx NUTS			A490	
128	E20	2½ φ FLAT WASH			A490	
	SHOP ASSEMBLY & FIELD PIN-UP BOLTS (ACTUAL COUNT)					
704		¾ φ MB	0	2		
32		¾ φ MB	0	2¼		
64		¾ φ MB	0	2¾		
32		¾ φ MB	0	3		
64		¾ φ MB	0	5¾		
64		¾ φ MB	0	4½		
704		¾ φ MB (TO BE REMOVED FROM TEMP BRACES AFTER SHOP ASS'Y)	-	-		
912		¾ φ H.S.B. A325	0	2		

(Revision mark ① beside the rows 704 ¾ φ MB 0-2 and 912 ¾ φ H.S.B. A325.)

NOTE:
TAG ALL MATERIAL
WITH ITEM Nº 132

BID ITEM NUMBER 132
CONTRACT NUMBER DACW-68-70-C-0088

APPROVAL STAMP

APPROVED
LOWER SNAKE RIVER
RESIDENT OFFICE
By: [signature]
Date: 25 SEP 1973

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

(3)

LSR70-0088-132-025

12-1-70

70-C-88-372