

LOWELL NATIONAL HISTORICAL PARK

**FACILITY EX CONDITION PHOTOGRAPHS:
NORTHERN CANAL GATEHOUSE (PAWTUCKET GATEHOUSE) LOCK CHAMBER GATES 2020**



PHOTO 01: EXISTING GATES



PHOTO 02: EXISTING GATES



PHOTO 03: EXISTING GATES



PHOTO 04: EXISTING GATES



PHOTO 05: EXISTING GATES



PHOTO 06: EXISTING GATES

LOWELL NATIONAL HISTORICAL PARK

FACILITY EX CONDITION PHOTOGRAPHS:
NORTHERN CANAL GATEHOUSE (PAWTUCKET GATEHOUSE) LOCK CHAMBER GATES 2020



PHOTO 07: EXISTING GATES



PHOTO 08: EXISTING GATES



PHOTO 09: EXISTING GATES



PHOTO 10: EXISTING GATES



PHOTO 11: EXISTING GATES



PHOTO 12: EXISTING GATES

LOWELL NATIONAL HISTORICAL PARK

FACILITY EX CONDITION PHOTOGRAPHS:
NORTHERN CANAL GATEHOUSE (PAWTUCKET GATEHOUSE) LOCK CHAMBER GATES 2020



PHOTO 13: NORTHERN CANAL GATEHOUSE - LOCK CHAMBER GATES



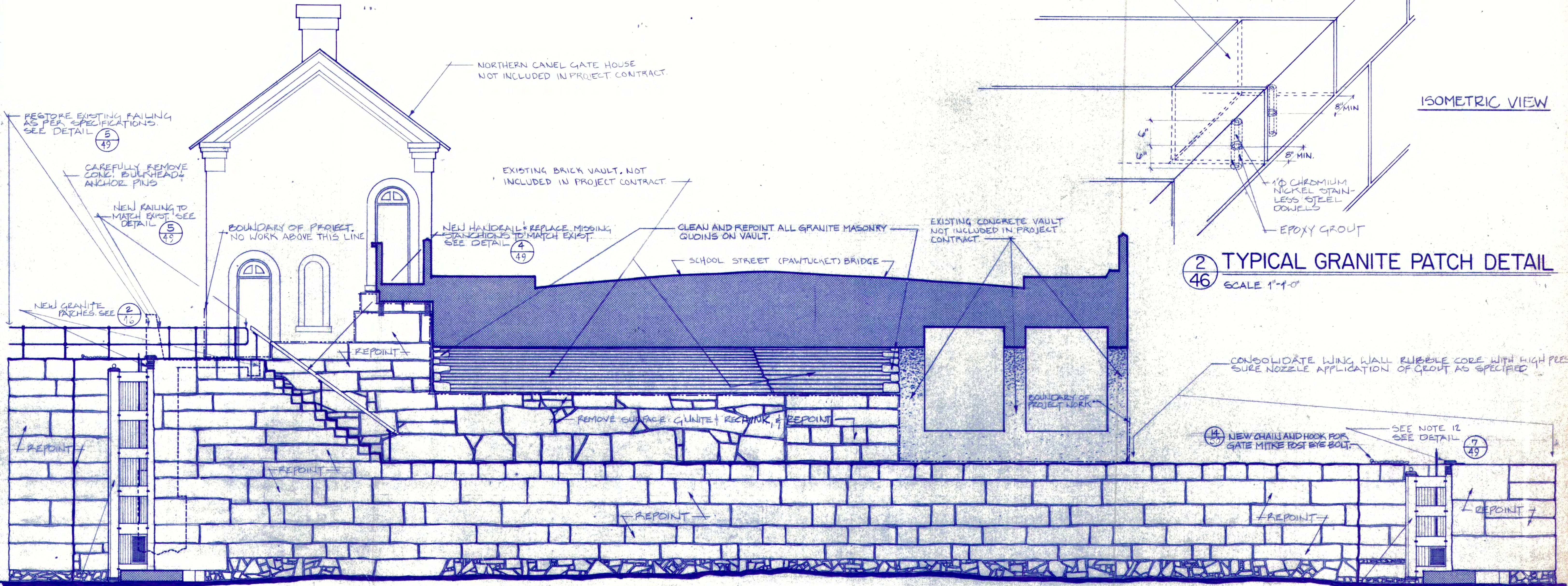
PHOTO 14: EXISTING GATES



PHOTO 15: NORTHERN CANAL GATEHOUSE - LOCK CHAMBER GATES



PHOTO 16: NORTHERN CANAL GATEHOUSE - LOCK CHAMBER GATES



1 SECTION - NORTH SIDE OF LOCK CHAMBER
 SCALE 1/4"=1'-0"
 0' 1' 2' 3' 4' 5' 10'

2 TYPICAL GRANITE PATCH DETAIL
 SCALE 1"=1'-0"

GENERAL NOTES:

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.
2. CONTRACTOR SHALL CHECK ALL WORK AND QUANTITIES SHOWN ON THE DRAWING BY AN "ON SITE" SURVEY AND REPORT HIS FINDINGS TO THE D.E.M. FIELD ENGINEER AND PROJECT ARCHITECT BEFORE RECEIVING PERMISSION TO COMMENCE WORK.
3. CONTRACTOR, FIELD ENGINEER, AND PROJECT ARCHITECT SHALL INSPECT ALL MASONRY AREAS TO BE REPOINTED AND RECHINKED IN ORDER TO DETERMINE EXISTING AREAS TO SERVE AS EXAMPLES OF QUALITY AND APPEARANCE FOR NEW WORK. THIS SHALL BE DETERMINED BEFORE COMMENCEMENT OF WORK.
4. ALL MASONRY WORK SHALL BE PERFORMED AS INDICATED WITHIN BOUNDARY LINES.
5. UNLESS DETERMINED OTHERWISE DURING FIELD INSPECTION, ALL NEW MORTAR JOINTS SHALL BE COMPACTED RAKED JOINTS AS ILLUSTRATED IN DETAIL **3/58**.
6. ALL NEW CHINKING AND RECHINKING SHALL MATCH EXISTING CHINKING ON LOCK CHAMBER WALLS IN SIZE, PATTERN, MATERIAL, AND APPEARANCE.
7. ALL RAILINGS SHALL BE RESTORED AS INDICATED ON THE DRAWING AND IN ACCORDANCE WITH DECISIONS MADE BETWEEN THE CONTRACTOR, D.E.M. FIELD ENGINEER, AND ARCHITECT FROM THE ON SITE SURVEY.
8. ALL EXISTING RAILING SHALL BE REPAINTED AND ALL NEW RAILING PRIMED AND PAINTED AS PER SPECIFICATIONS.
9. REMOVE EXISTING DAMAGED GRANITE BLOCKS AND PROVIDE AND INSTALL NEW PATCHES OF SAME DIMENSIONS AS INDICATED ON THE DRAWING, AS PER DETAIL **2/46** AND AS PER SPECIFICATIONS.
10. REBUILDING EXISTING WALLS: SEE SPECIFICATION SECTION 4 "MASONRY". RESET ALL GRANITE ASHLAR BLOCK MASONRY IN MANNER SPECIFIED AND AS PER DETAIL **2/46**. RESET ALL RUBBLE GRANITE MASONRY IN MANNER SPECIFIED AND AS PER DETAIL **4/56**.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND PRESERVATION OF ALL EXISTING HISTORIC FABRIC AND EXISTING STRUCTURES AND BUILDING FEATURES ADJACENT TO AND AFFECTED BY NEW WORK BUT NOT INCLUDED IN THE PROJECT CONTRACT.
12. REMOVE EXISTING REMAINS OF CAST IRON HARNESS HINGE. PROVIDE AND INSTALL NEW TO MATCH EXISTING ON OPPOSITE SIDE OF DOWNSTREAM GATES. SEE DETAIL **8/49**.

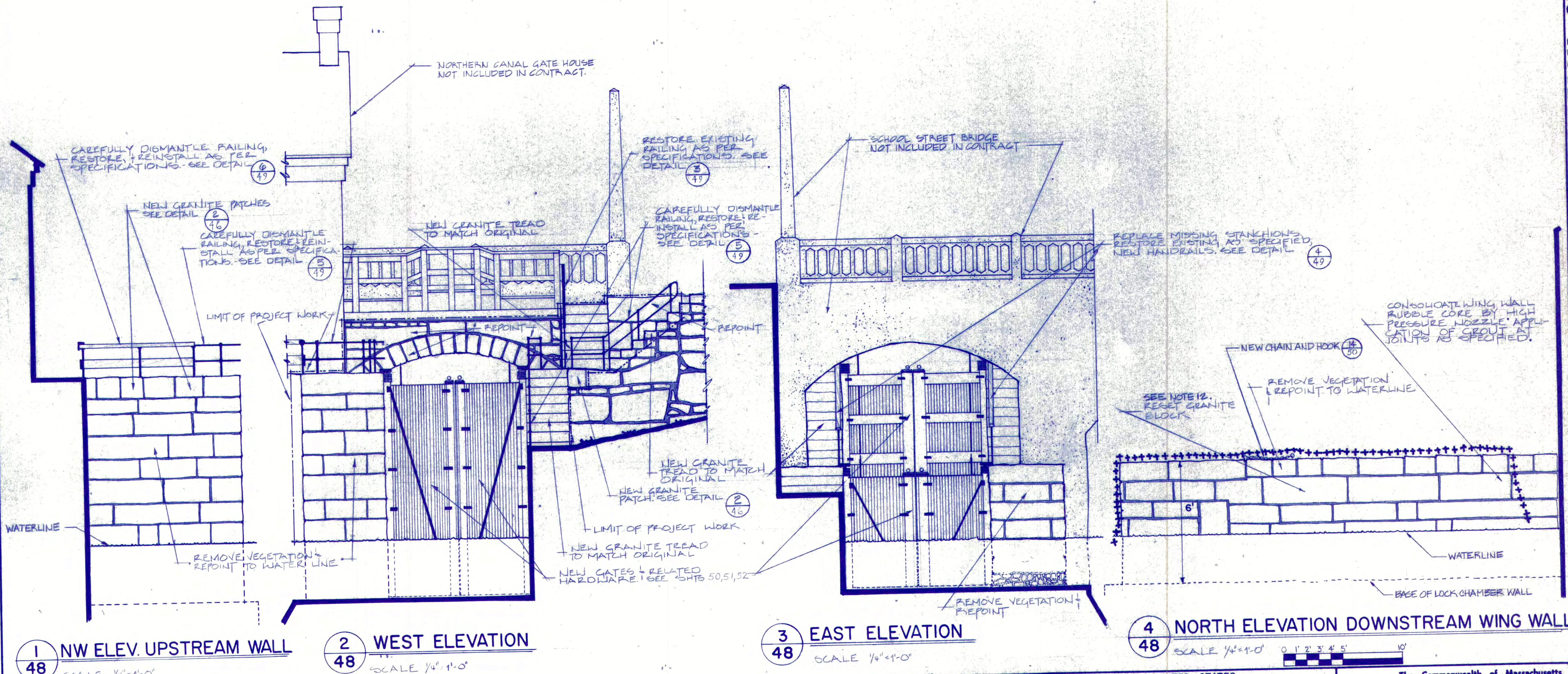
Contractor shall verify all dimensions and take own measurements at the job site before commencing work. Advise of any errors or discrepancy.

NORTHERN CANAL-RESTORATION OF MASONRY ON NORTH SIDE OF LOCK CHAMBER

 W. LEWIS BARLOW, IV NO. 4572 LOWELL, MASS. STATE OF MASSACHUSETTS PROFESSIONAL ENGINEER	PREPARED P.F. DESSAUER H.T. McGRATH DESIGNED	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK	The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks
	H.T. McGRATH DRAWN	TITLE OF DRAWING NORTHERN CANAL-RESTORATION OF MASONRY ON NORTH SIDE OF LOCK CHAMBER LOCATION WITHIN PARK PARK GENERAL NAME OF PARK LOWELL HERITAGE STATE PARK	TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS PARK: LOWELL HERITAGE STATE PARK LOCATION: PARK GENERAL Scale: AS SHOWN Project: NO. 119-83 Contract NO. 119-83
 W. L. BARLOW NO. 23616 LOWELL, MASS. STATE OF MASSACHUSETTS PROFESSIONAL ENGINEER	W.L. BARLOW CHECKED	N.A. MIDDLESEX MASS. REGION COUNTY STATE	Dwg. No. 46 Date: AUGUST 1984 Sheet 46 of 68

GENERAL NOTES:

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.
2. CONTRACTOR SHALL CHECK ALL WORK AND QUANTITIES SHOWN ON THE DRAWING BY AN "ON SITE" SURVEY AND REPORT HIS FINDINGS TO THE D.E.M. FIELD ENGINEER AND PROJECT ARCHITECT BEFORE RECEIVING PERMISSION TO COMMENCE WORK.
3. CONTRACTOR, FIELD ENGINEER, AND PROJECT ARCHITECT SHALL INSPECT ALL MASONRY AREAS TO BE REPOINTED AND RECHINKED IN ORDER TO DETERMINE EXISTING AREAS TO SERVE AS EXAMPLES OF QUALITY AND APPEARANCE FOR NEW WORK. THIS SHALL BE DETERMINED BEFORE COMMENCEMENT OF WORK.
4. ALL MASONRY WORK SHALL BE PERFORMED AS INDICATED WITHIN BOUNDARY LINES.
5. UNLESS DETERMINED OTHERWISE DURING FIELD INSPECTION, ALL NEW MORTAR JOINTS SHALL BE COMPACTED RAKED JOINTS AS ILLUSTRATED IN DETAIL (3) (58).
6. ALL NEW CHINKING AND RECHINKING SHALL MATCH EXISTING CHINKING ON LOCK CHAMBER WALLS IN SIZE, PATTERN, MATERIAL, AND APPEARANCE.
7. ALL RAILINGS SHALL BE RESTORED AS INDICATED ON THE DRAWING AND IN ACCORDANCE WITH DECISIONS MADE BETWEEN THE CONTRACTOR, D.E.M. FIELD ENGINEER, AND ARCHITECT FROM THE ON SITE SURVEY.
8. ALL EXISTING RAILING SHALL BE REPAINTED AND ALL NEW RAILING PRIMED AND PAINTED AS PER SPECIFICATIONS.
9. REMOVE EXISTING DAMAGED GRANITE BLOCKS AND PROVIDE AND INSTALL NEW PATCHES OF SAME DIMENSIONS AS INDICATED ON THE DRAWING, AS PER DETAIL (2) (46) AND AS PER SPECIFICATIONS.
10. REBUILDING EXISTING WALLS: SEE SPECIFICATION SECTION 4 "MASONRY". RESET ALL GRANITE ASHLAR BLOCK MASONRY IN MANNER SPECIFIED AND AS PER DETAIL (2) (46). RESET ALL RUBBLE GRANITE MASONRY IN MANNER SPECIFIED AND AS PER DETAIL (4) (56).
11. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND PRESERVATION OF ALL EXISTING HISTORIC FABRIC AND EXISTING STRUCTURES AND BUILDING FEATURES ADJACENT TO AND AFFECTED BY NEW WORK BUT NOT INCLUDED IN THE PROJECT CONTRACT.
12. RESET GRANITE BLOCK: CAREFULLY REMOVE AND SALVAGE TOP BLOCKS. CLEAN OUT ALL OLD MORTAR, LOOSE PARTICLES, AND DIRT. RESET STONE IN FRESH BED OF MORTAR SO THAT ALL EXPOSED SURFACES ARE FLUSH. FILL ALL INTERIOR GRANITE WALL VOIDS REVEALED BY REMOVAL WITH CONCRETE AND GROUT. REINSTALL TOP BLOCKS IN BEDS OF FRESH MORTAR IN SAME MASONRY PATTERN AS ORIGINAL. POINT AND CLEAN ALL EXPOSED JOINTS AS SPECIFIED. SEE (2) (46).



1 NW ELEV. UPSTREAM WALL
48 SCALE 1/4"=1'-0"

2 WEST ELEVATION
48 SCALE 1/4"=1'-0"

3 EAST ELEVATION
48 SCALE 1/4"=1'-0"

4 NORTH ELEVATION DOWNSTREAM WING WALL
48 SCALE 1/4"=1'-0"

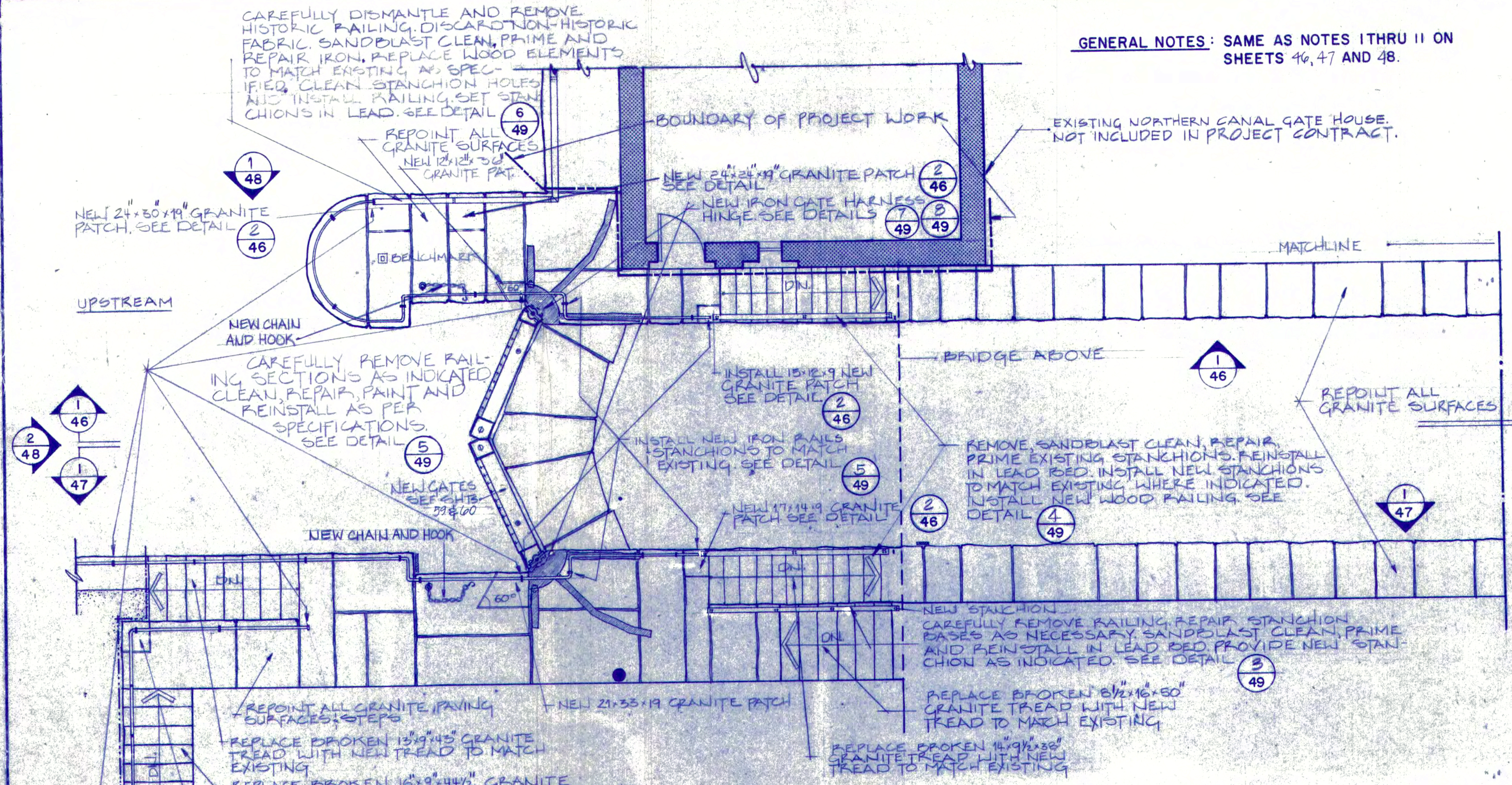
NORTHERN CANAL - RESTORATION OF MASONRY ON EAST & WEST SIDES

Contractor shall verify all dimensions and take own measurements at the job site before commencing work. Advise of any error or discrepancy.

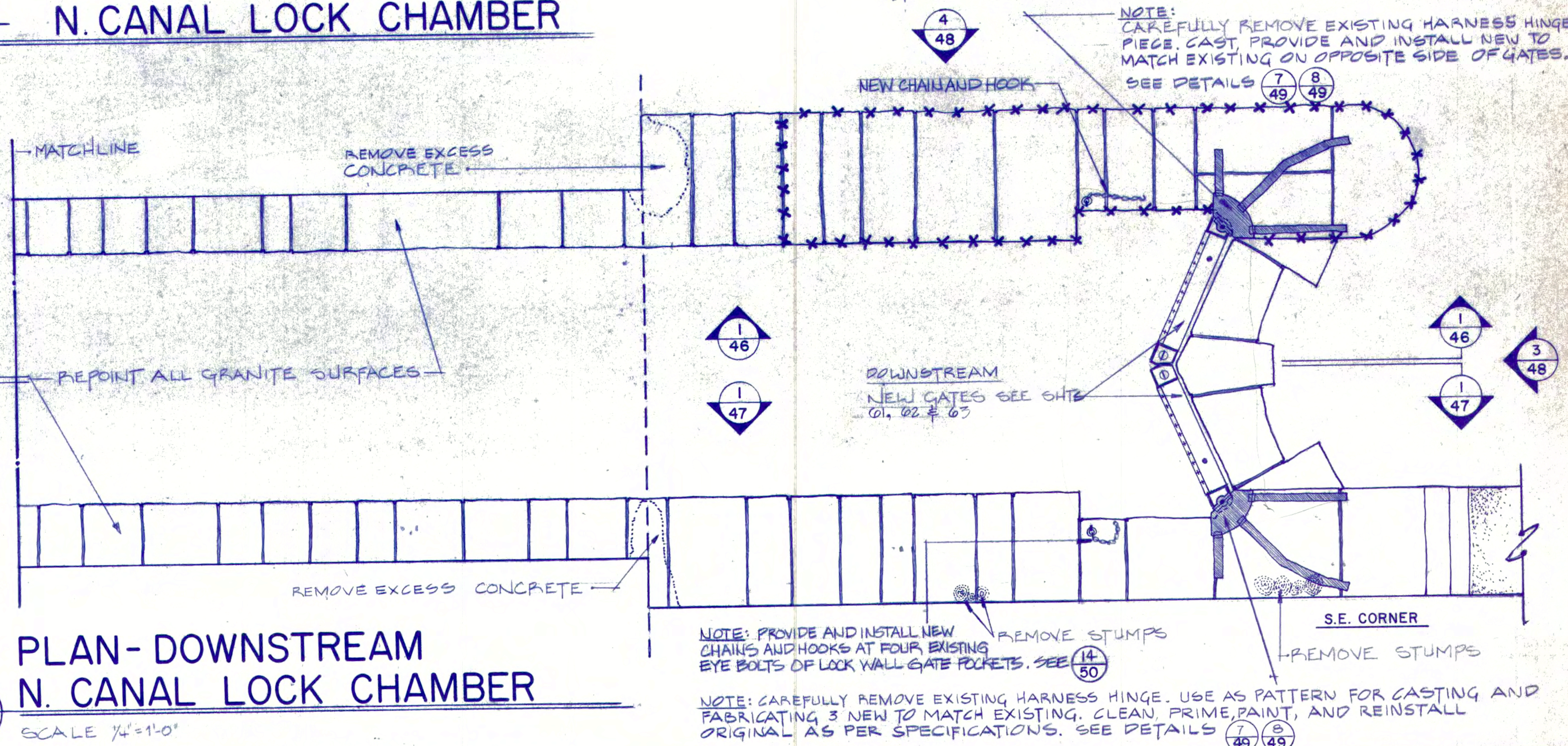
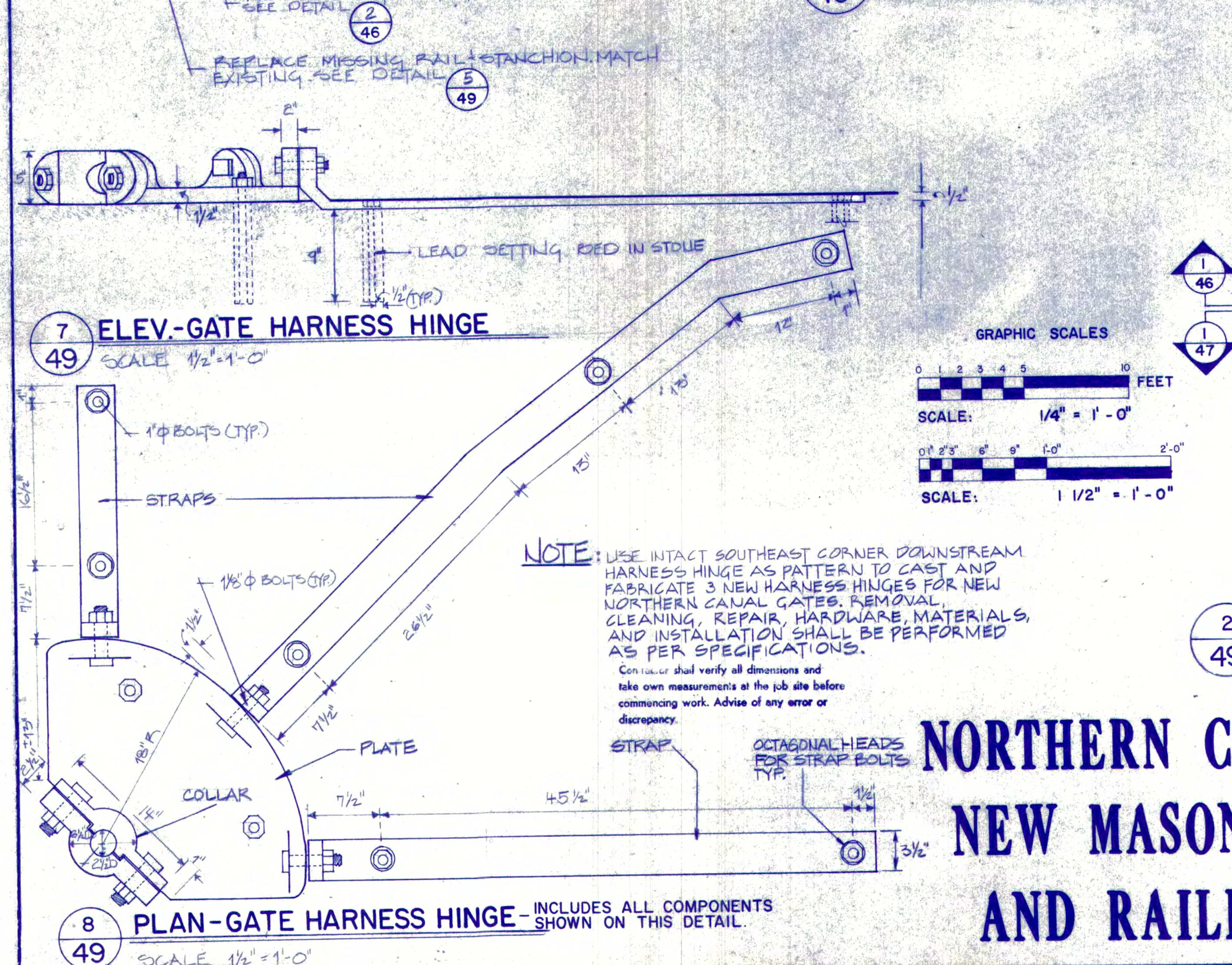
	PREPARED P.F. DESSAUER H.T. McGRATH DESIGNED	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK	The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks
	H.T. McGRATH DRAWN W.L. BARLOW CHECKED AUG. 1984 DATE	TITLE OF DRAWING NORTHERN CANAL - RESTORATION OF MASONRY WEST AND EAST SIDES LOCATION WITHIN PARK PARK GENERAL NAME OF PARK LOWELL HERITAGE STATE PARK N.A. REGION MIDDLESEX COUNTY MASS. STATE	TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS PARK: LOWELL HERITAGE STATE PARK LOCATION: PARK GENERAL Scale: AS SHOWN Dwg. Project: NO. 119-83 Contract NO. 119-83 Date: AUGUST 1984 Sheet 48 of 68

NORTHERN CANAL - RESTORATION OF MASONRY ON EAST & WEST SIDES

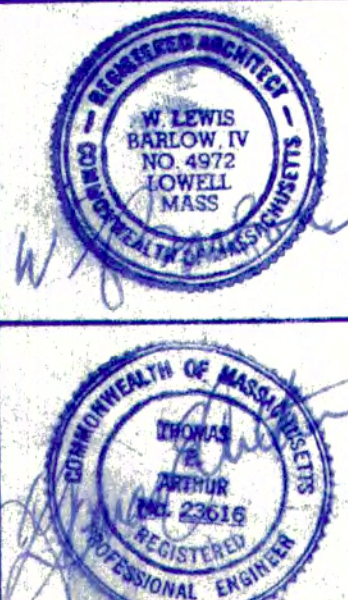
GENERAL NOTES: SAME AS NOTES I THRU II ON SHEETS 46, 47 AND 48.



1 PLAN-UPSTREAM - N. CANAL LOCK CHAMBER
49 SCALE 1/4" = 1'-0"



NORTHERN CANAL PLAN- NEW MASONRY, IRON, AND RAILING WORK



PREPARED
J. ASKINS
P.F. DESSAUER
H.T. MCGRATH
DESIGNED

H.T. MCGRATH
DRAWN

W.L. BARLOW
CHECKED

AUG. 1984
DATE

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
LOWELL NATIONAL HISTORICAL PARK

TITLE OF DRAWING
NORTHERN CANAL PLAN-NEW MASONRY,
IRON, AND RAILING WORK

LOCATION WITHIN PARK
PARK GENERAL

NAME OF PARK
LOWELL HERITAGE STATE PARK

N.A. MIDDLESEX MASS.
REGION COUNTY STATE

The Commonwealth of Massachusetts
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
Division of Forests and Parks

TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS

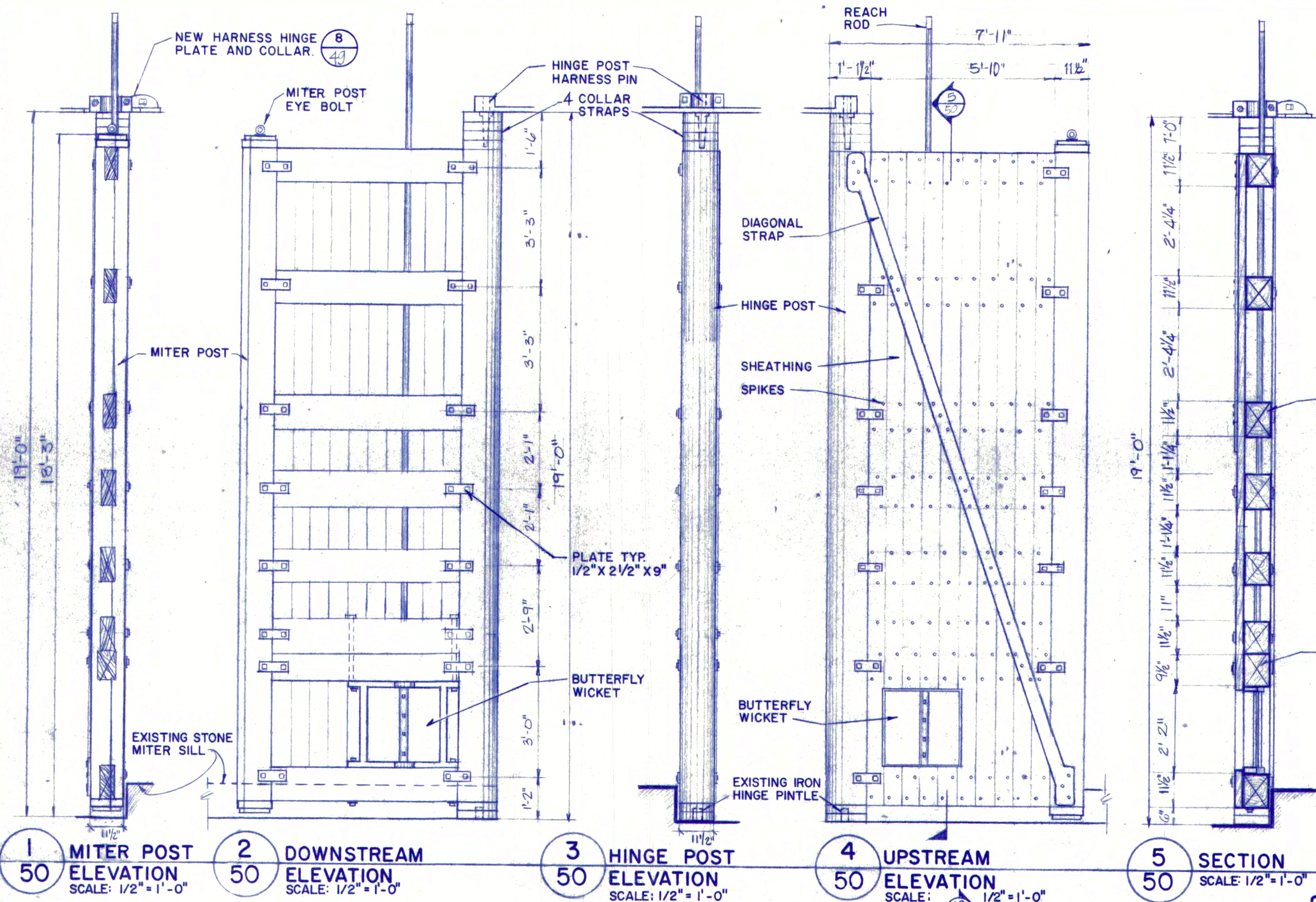
PARK: LOWELL HERITAGE STATE PARK

LOCATION: PARK GENERAL

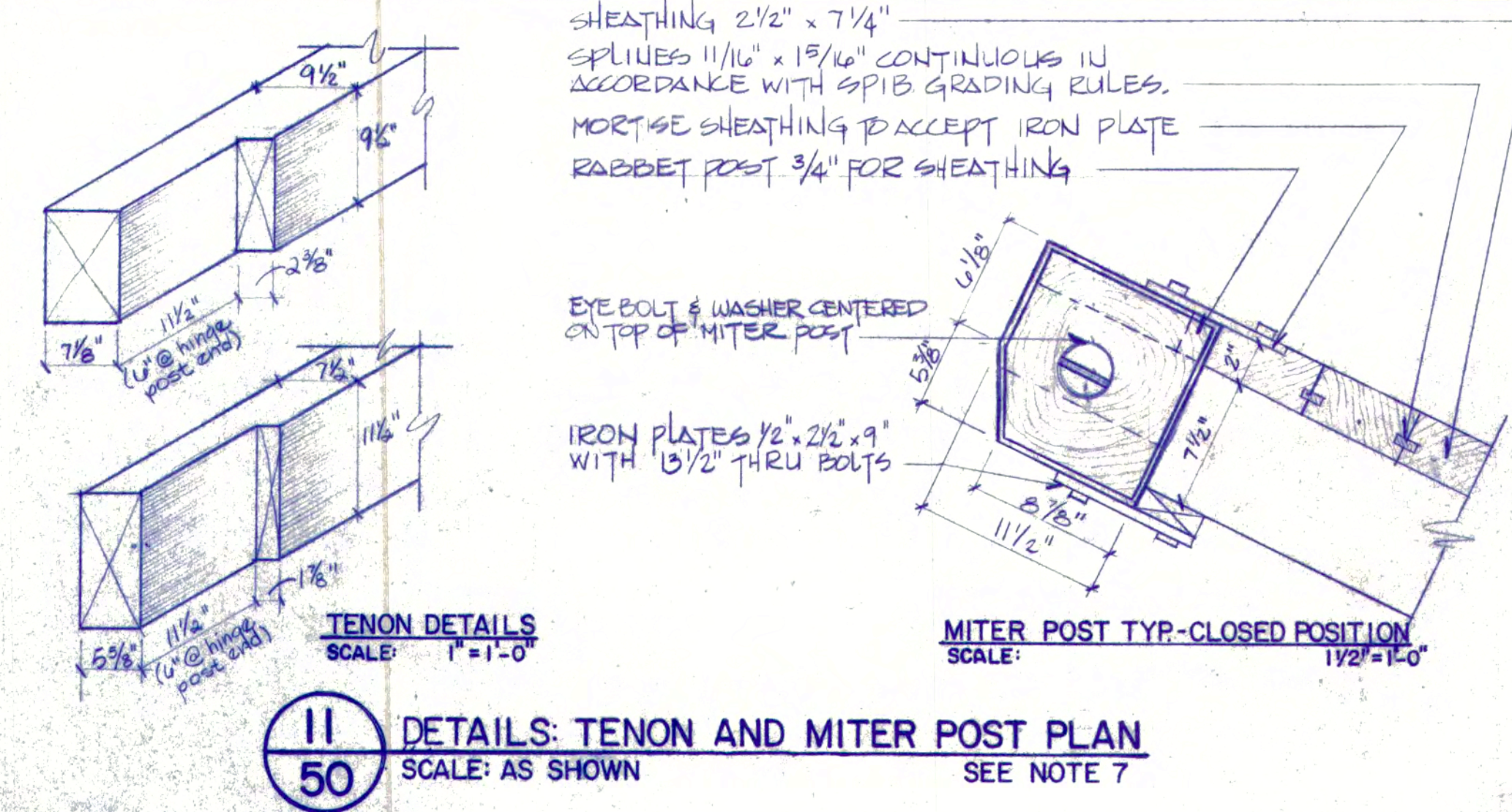
Scale: AS SHOWN Dwg.

Project: NO. 119-83 Contract NO. 119-83 Date: AUGUST 1984

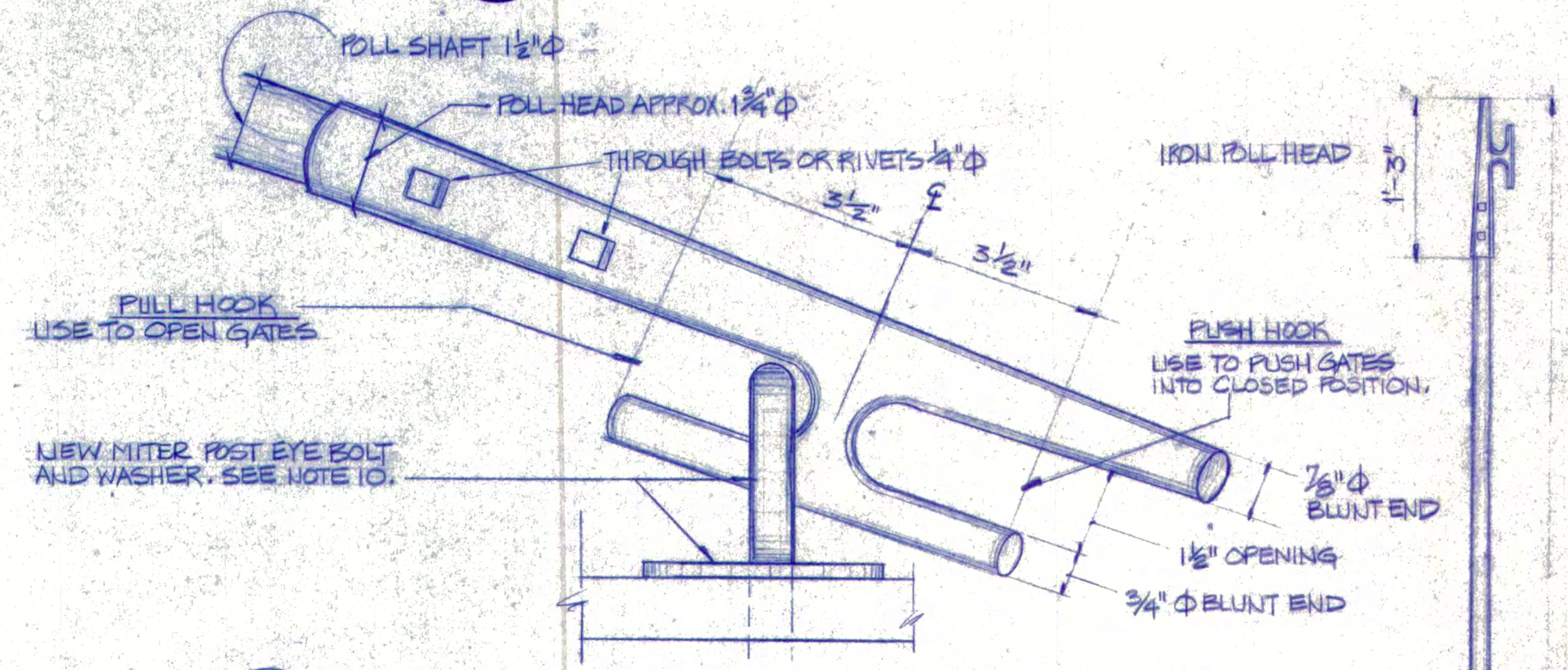
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2 NEW UPSTREAM (WEST) GATES
NORTH GATE TYPICAL
SCALE: 1/2" = 1'-0"

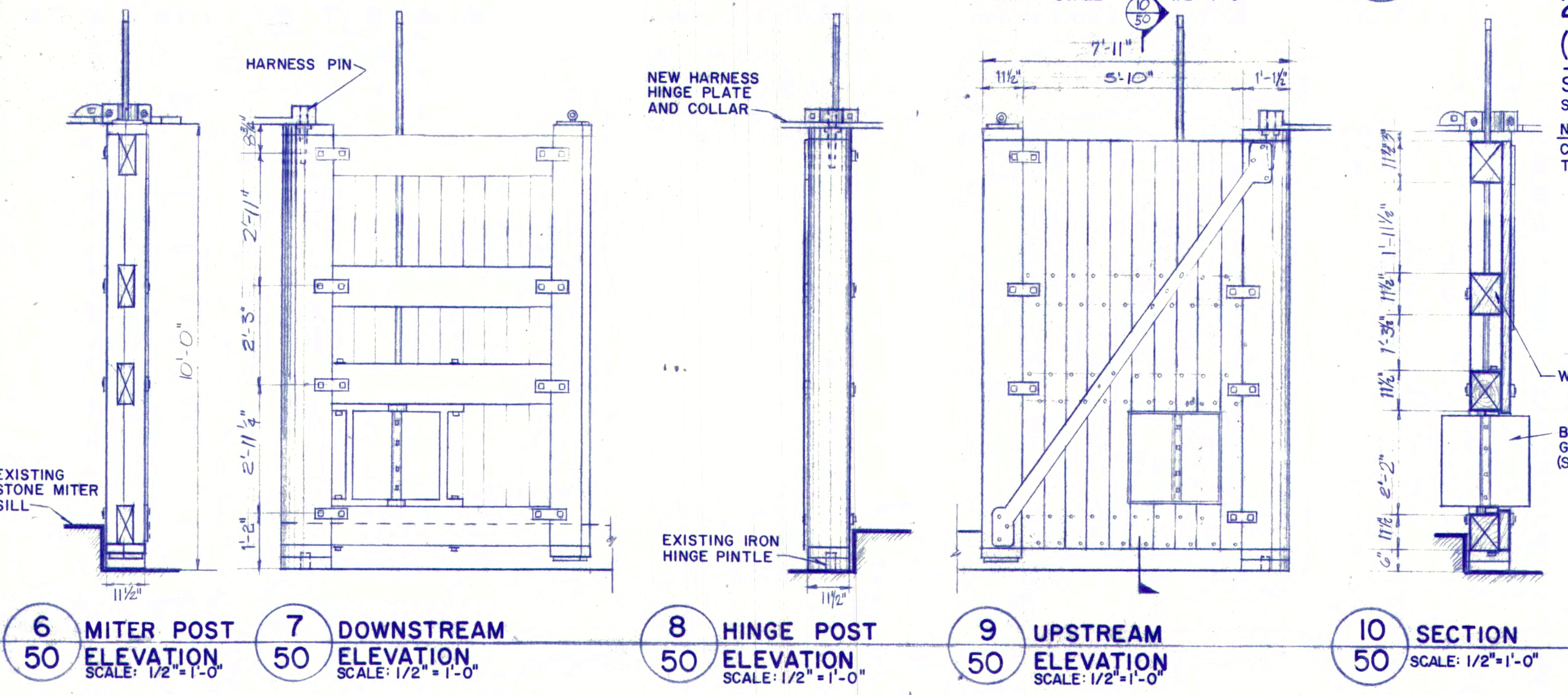


11 DETAILS: TENON AND MITER POST PLAN
SCALE: AS SHOWN
SEE NOTE 7



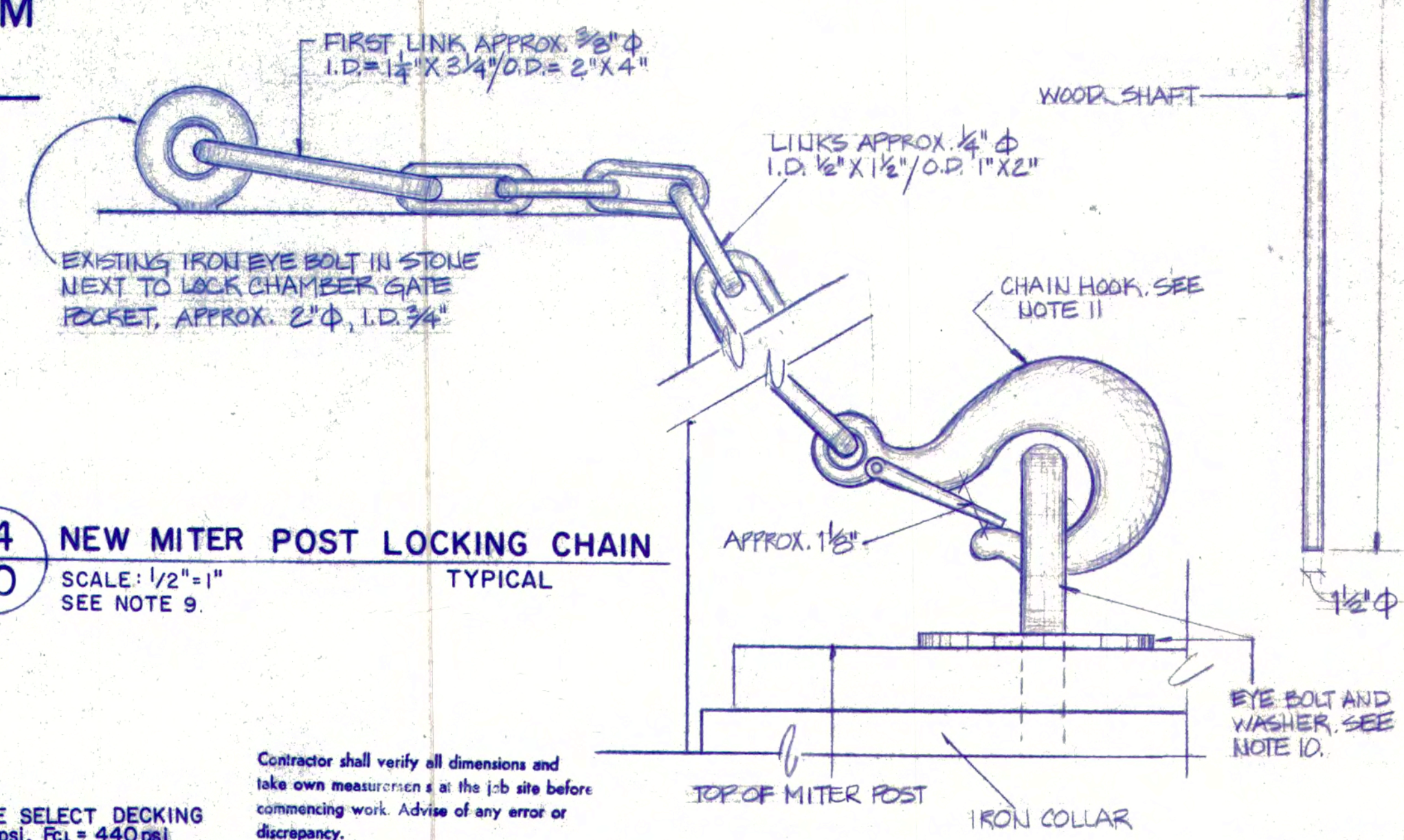
12 DETAIL: POLL HEAD TYP.
SCALE: APPROXIMATELY 1/2" = 1'-0"

13 NEW OPERATING POLL
SCALE: 1" = 1'-0" TYPICAL
SEE NOTE 8.



2 NEW DOWNSTREAM (EAST) GATES
SOUTH GATE TYPICAL
SCALE: 1/2" = 1'-0"

NOTE: CONSTRUCTION, DETAILS, AND COMPONENT TERMINOLOGY SIMILAR TO UPSTREAM (WEST) GATES.



14 NEW MITER POST LOCKING CHAIN
SCALE: 1/2" = 1'-0" TYPICAL
SEE NOTE 9.

13. ALL SHEATHING SHALL BE DENSE SELECT DECKING SOUTHERN YELLOW PINE; Fb=1350psi, Fc=440psi

GENERAL NOTES FOR NORTHERN CANAL LOCK GATES:

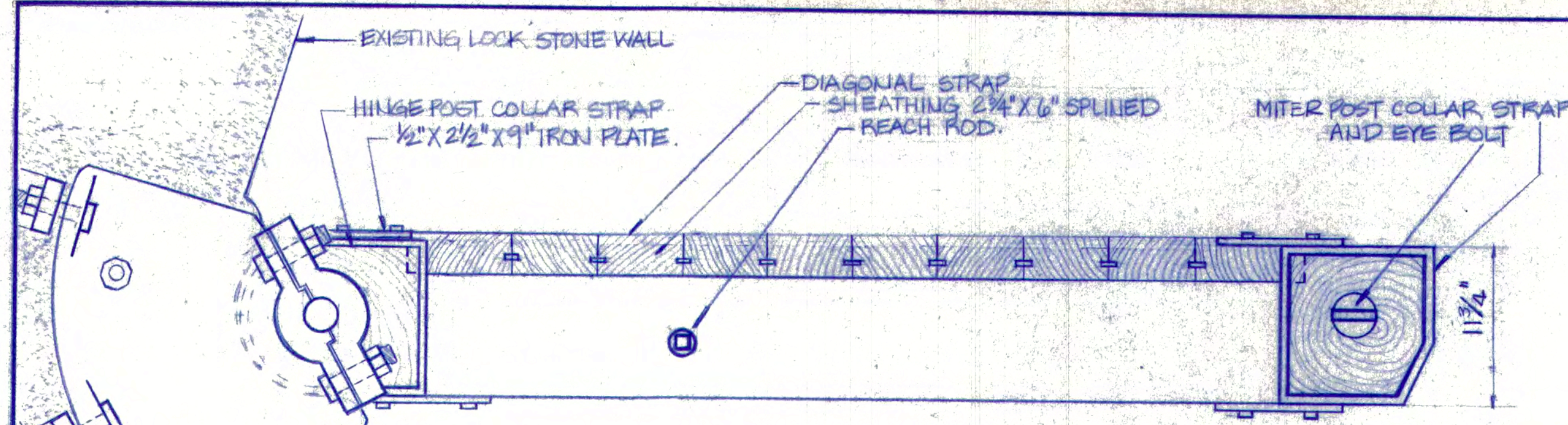
- CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.
- CONSTRUCT, PROVIDE, AND INSTALL 2 PAIRS OF NEW GATES FOR THE NORTHERN CANAL LOCK.
- ALL GATE TIMBERS AND LUMBER SHALL BE SOUTHERN YELLOW PINE AND CREOSOTE PRESERVATIVE TREATED. SEE SPECIFICATION SECTION 6.
- DIAGONAL IRON REINFORCING STRAPS, IRON PLATES, THROUGH BOLTS, IRON COLLAR STRAPS, LAG BOLTS, SPIKES, TIMBER MORTISE AND TENON CONNECTIONS, AND SPLINES ON SHEATHING SHALL BE SIMILAR TO EXISTING ON THE GUARD LOCKS GATES. SEE SHEETS NO.5, 59, 61, AND 63.

- SEE SHEET NO.49 FOR DETAIL OF NEW HARNESS HINGE PLATES.
- ALL GATE HARDWARE SHALL BE PAINTED. SEE SPECIFICATION SECTIONS 5 AND 9.
- NEW GATES SHALL OPERATE TO CLOSE FLUSH AND TIGHT.
- FABRICATE AND PROVIDE FOR THE NEW GATES 3 NEW OPERATING POLLS FROM ASH OR OAK WOOD. POLLS MUST PASS A DEMONSTRATION TEST IN THE FIELD BEFORE ACCEPTANCE IS GRANTED BY THE D. E. M. RESIDENT ENGINEER.
- PROVIDE AND INSTALL 4 NEW CHAINS AT EXISTING EYE BOLTS OF LOCK CHAMBER GATE POCKETS. CHAIN LINKS SHALL MATCH

EXISTING CHAIN REMAINS AT N.E. GATE POCKET. SEE SHEET NO.49 FOR PLAN OF LOCK.

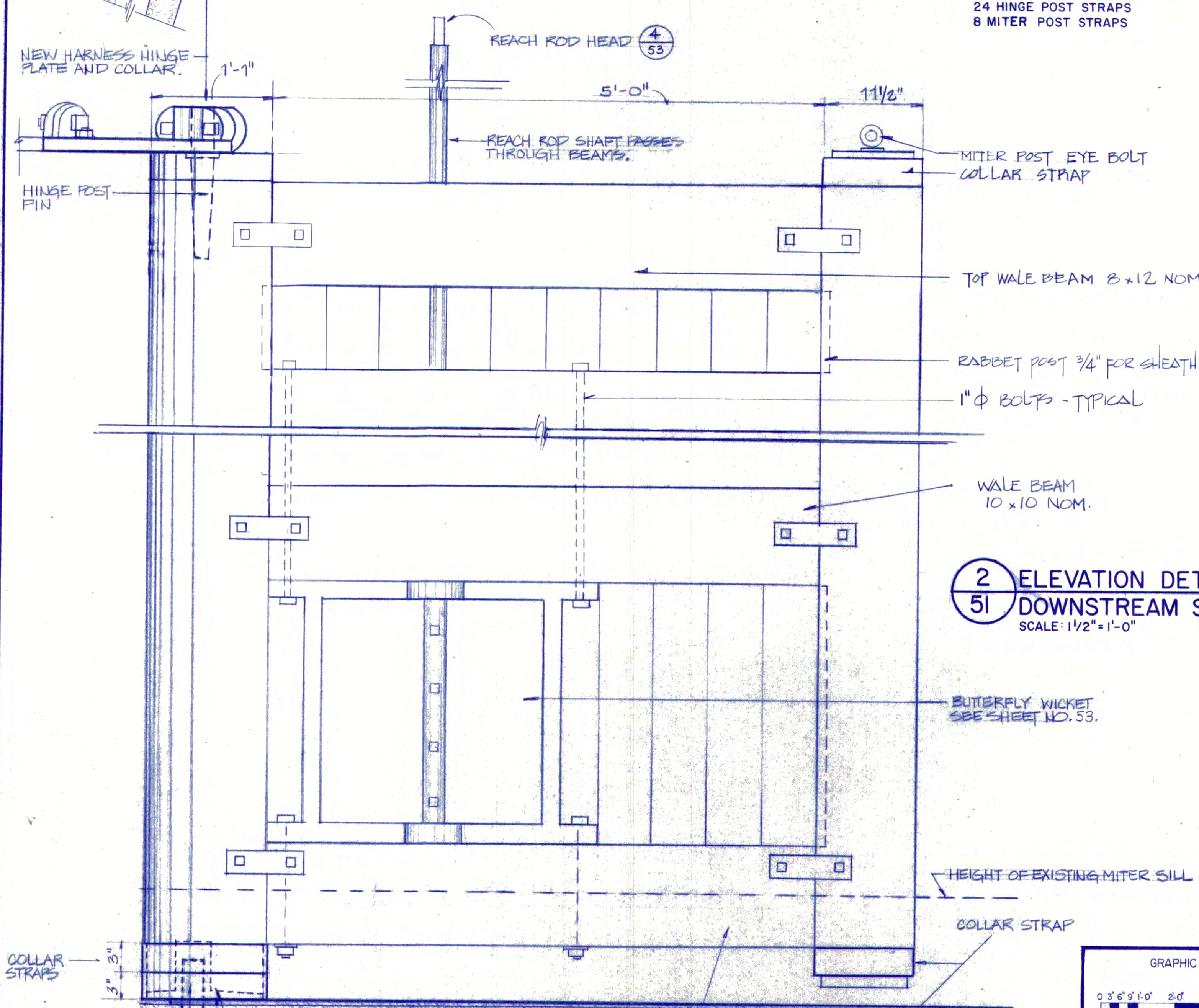
- NEW MITER POST "EYE" LAG BOLTS SHALL BE 3/4" DIA, I.D. 1 1/2", O.D. 3", AND SHANK MINIMUM 4 1/2" LONG. WASHER SHALL HAVE 3" DIAMETER.
- ANCHORS AT END OF NEW CHAINS SHALL BE IRON WITH LATCH, EITHER SPRING LOAD OR WIRE SNAP, AND A WORKING CAPACITY OF 4100 LBS.
- ALL STRUCTURAL WOOD MEMBERS SHALL BE NO.1 DENSE SR SOUTHERN YELLOW PINE; Fb=1550 psi, Fv=110psi, Fc=440psi, Fc=325psi, E=1,600,000

<p>GRAPHIC SCALES</p>		<p>UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK</p>		<p>The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks</p>	
<p>PREPARED J. ASKINS W.L. BARLOW H.T. MCGRATH P.F. DESSAUER T. WONG</p> <p>DESIGNED</p>		<p>TITLE OF DRAWING NORTHERN CANAL: NEW LOCK GATES; ELEVATIONS, SECTIONS, AND OPERATING DETAILS. LOCATION WITHIN PARK PARK GENERAL NAME OF PARK LOWELL HERITAGE STATE PARK</p>		<p>TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS PARK: LOWELL HERITAGE STATE PARK LOCATION: PARK GENERAL Scale: AS SHOWN Project: 119-83 Contract 119-83 Date: AUGUST 1984</p>	
<p>P.F. DESSAUER DRAWN</p> <p>W.L. BARLOW CHECKED</p> <p>AUG. 1984 DATE</p>		<p>N.A. MIDDLESEX MASS. REGION COUNTY STATE</p>		<p>Dwg. No. _____ Date: AUGUST 1984 Sheet 50 of 50</p>	

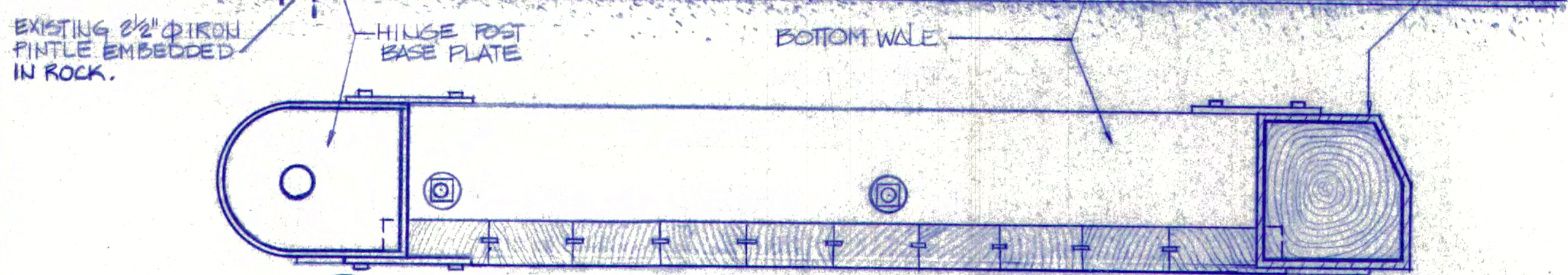


1 PLAN TYP.: TOP OF GATE
51 SCALE: 1 1/2" = 1'-0"

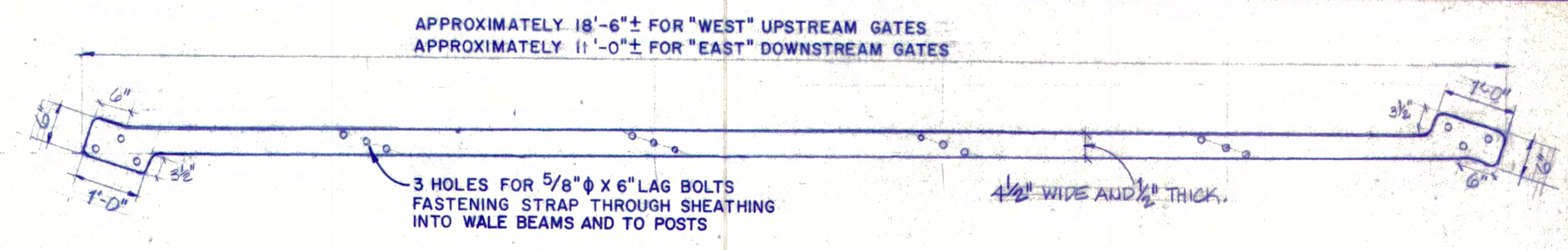
- GENERAL NOTES:**
- CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD, INCLUDING RADIUS OF EXISTING STONE HINGE POST POCKET.
 - CAST IRON: CAST 4 BASE PLATES AND 4 PINS FOR NEW GATE HINGE POSTS. PROVIDE AND INSTALL.
 - FABRICATE, PROVIDE, AND INSTALL:
4 DIAGONAL STRAPS
24 HINGE POST STRAPS
8 MITER POST STRAPS



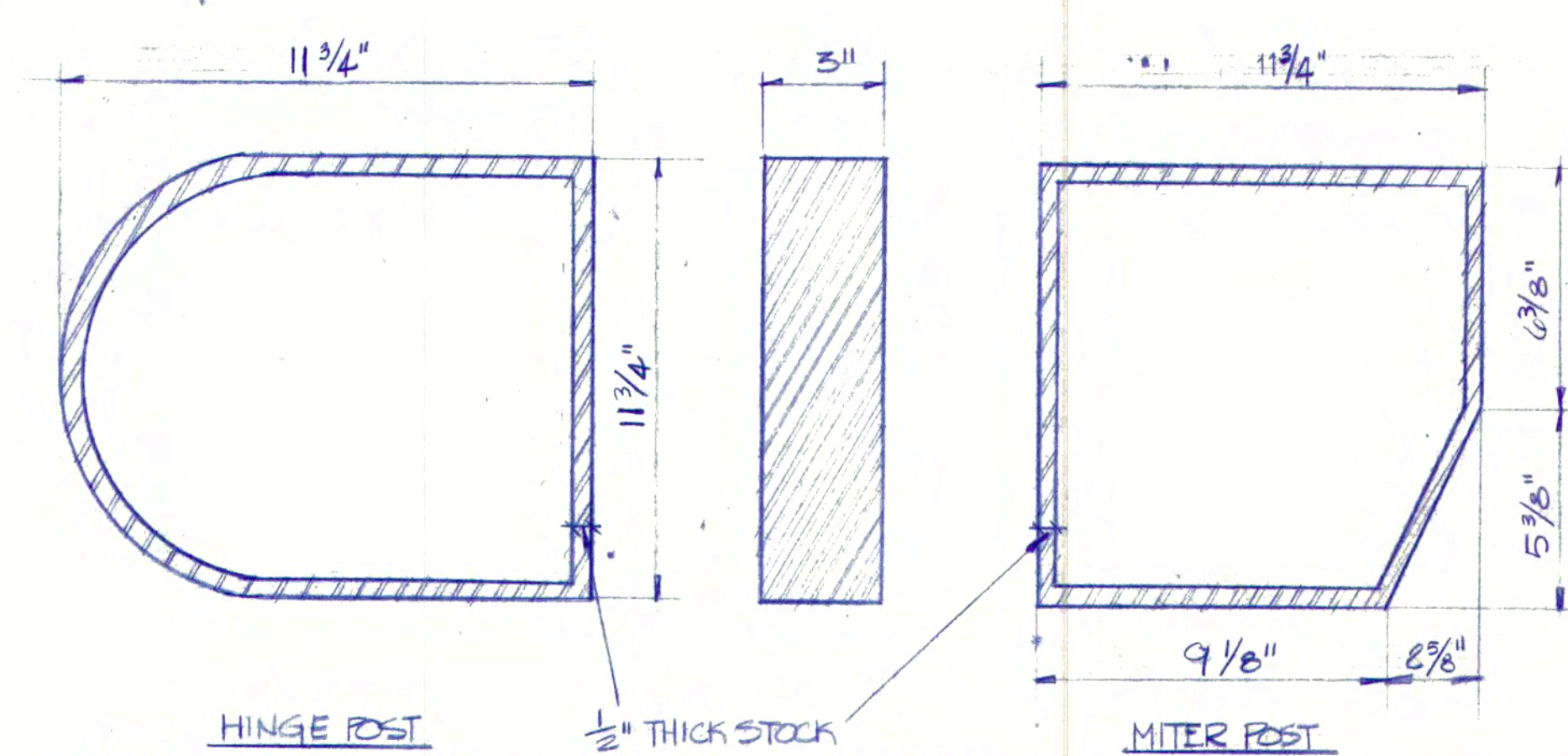
2 ELEVATION DETAILS, TYP.;
51 DOWNSTREAM SIDE OF GATE
SCALE: 1 1/2" = 1'-0"



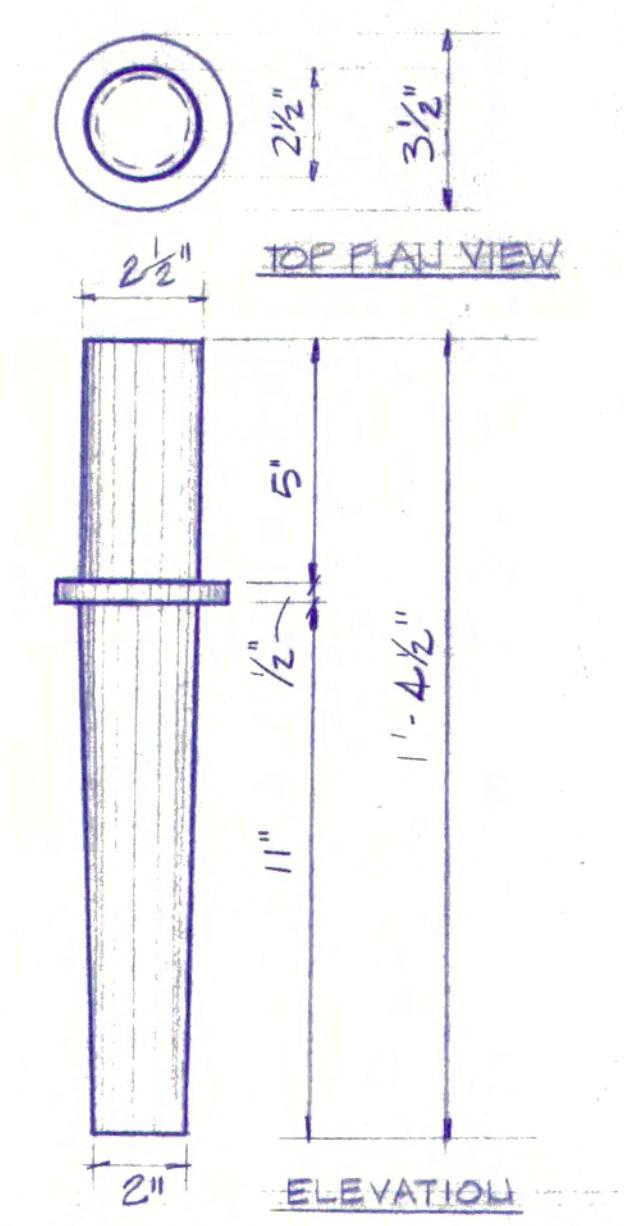
2 REFLECTIVE PLAN TYP.: BOTTOM OF GATE
51 SCALE: 1 1/2" = 1'-0"



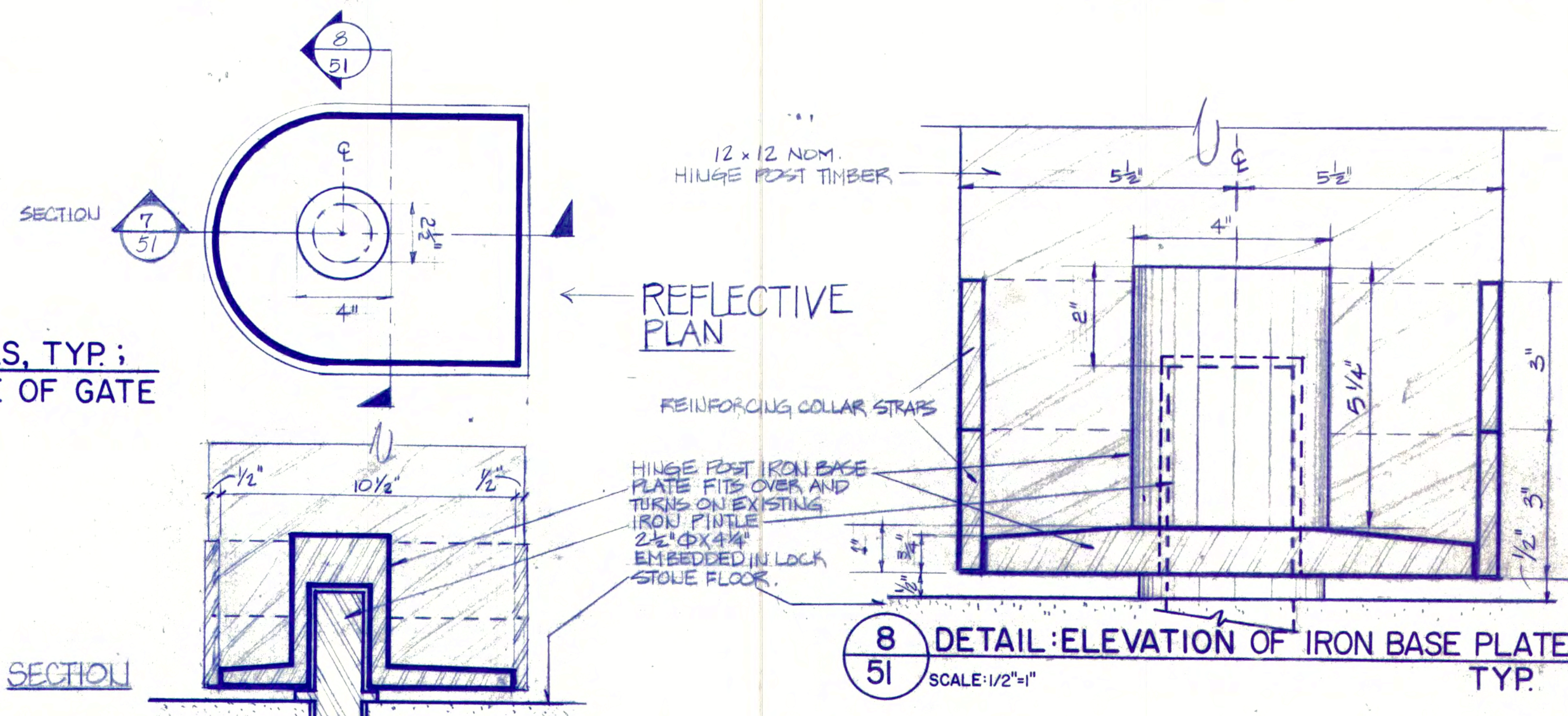
4 DETAIL: DIAGONAL IRON REINFORCING STRAP TYP.
51 SCALE: 3/4" = 1'-0"



5 DETAIL: REINFORCING IRON COLLAR STRAPS TYP.
51 SCALE: 3" = 1'-0"



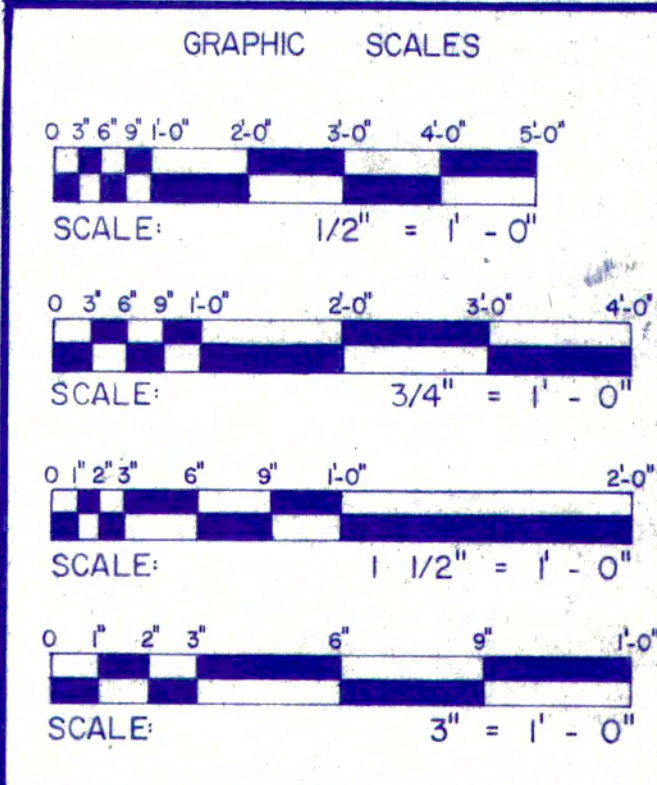
6 DETAIL: HINGE POST PIN TYP.
51 SCALE: 3" = 1'-0"



7 DETAIL: PLAN AND SECTION OF HINGE POST IRON BASE PLATE. TYP.
51 SCALE: 3" = 1'-0"

8 DETAIL: ELEVATION OF IRON BASE PLATE TYP.
51 SCALE: 1/2" = 1'-0"

Contractor shall verify all dimensions and take own measurements at the job site before commencing work. Advise of any error or discrepancy.



NEW LOCK GATES: PLANS, ELEVATION DETAILS AND HARDWARE

 PREPARED P.F. DESSAUER DESIGNED P.F. DESSAUER DRAWN W.L. BARLOW CHECKED AUG. 1984 DATE	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK TITLE OF DRAWING NORTHERN CANAL: NEW LOCK GATES, PLANS, ELEVATION DETAILS, IRON STRAPS, HINGE POST PIN, AND BASE PLATE. LOCATION WITHIN PARK PARK GENERAL NAME OF PARK LOWELL HERITAGE STATE PARK N.A. REGION MIDDLESEX COUNTY MASS. STATE	The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS PARK: LOWELL HERITAGE STATE PARK LOCATION: PARK GENERAL Scale: AS SHOWN Dwg. Project: NO. 119 - 83 Contract No. 119 - 83 Date: AUGUST 1984 Sheet 51 of 68
	CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND TAKE OWN MEASUREMENTS AT THE JOB SITE BEFORE COMMENCING WORK. ADVISE OF ANY ERROR OR DISCREPANCY.	

NORTHERN CANAL - NEW LOCK GATES: PLANS, ELEVATION DETAILS, AND HARDWARE

SURVEY MAP OF NORTHERN CANAL LOCK SITE

- LOW-4 BRASS DISK SET IN GRANITE RETENTION WALL.
N600,700.9429
E645,478.3609
BM ELEV.=92.76
- LOW-5 BRASS DISK SET IN CONC. SIDEWALK
N600,948.284
E645,633.4675
BM ELEV.=108.36
- PK-5 PK NAIL SET IN PAV.
N600,904.4840
E645,681.9092
- PK-6 PK NAIL SET IN PAV.
N600,798.9828
E645,767.8594
- PK-7 PK NAIL SET IN PAV.
N600,648.0040
E645,877.7298
- PK-8 PK NAIL SET IN PAV.
N600,565.1968
E645,750.9882
- PK-9 PK NAIL SET IN PAV.
N600,463.6669
E645,556.3484
- IP-1 IRON PIPE FOUND 4" DOWN IN PAV.
N600,647.0407
E645,874.0023
- SB-6 DRILL HOLE FOUND IN STONE BOUND.
N600,731.5817
E645,810.7903
- SB-7 CENTER BACK OF STONE BOUND FOUND.
N600,606.2179
E645,808.6322
- SB-8 CROSS CUT FOUND IN 4" HIGH GRANITE STONE BOUND.
N600,617.0447
E645,485.5178
- DH-1 DRILL HOLE SET IN SIDEWALK.
N601,032.2589
E645,621.9820
- LOW-6 BRASS DISK SET IN CONC. SIDEWALK
N601,164.0454
E645,466.6384
BM ELEV. 113.79

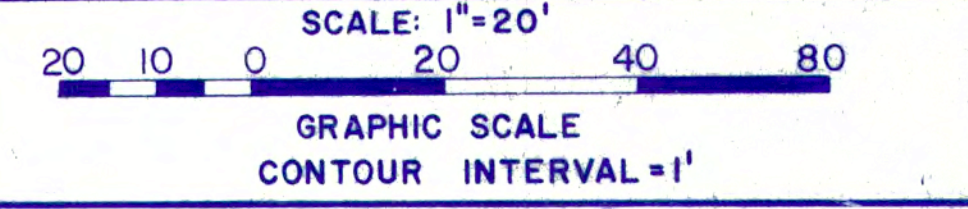
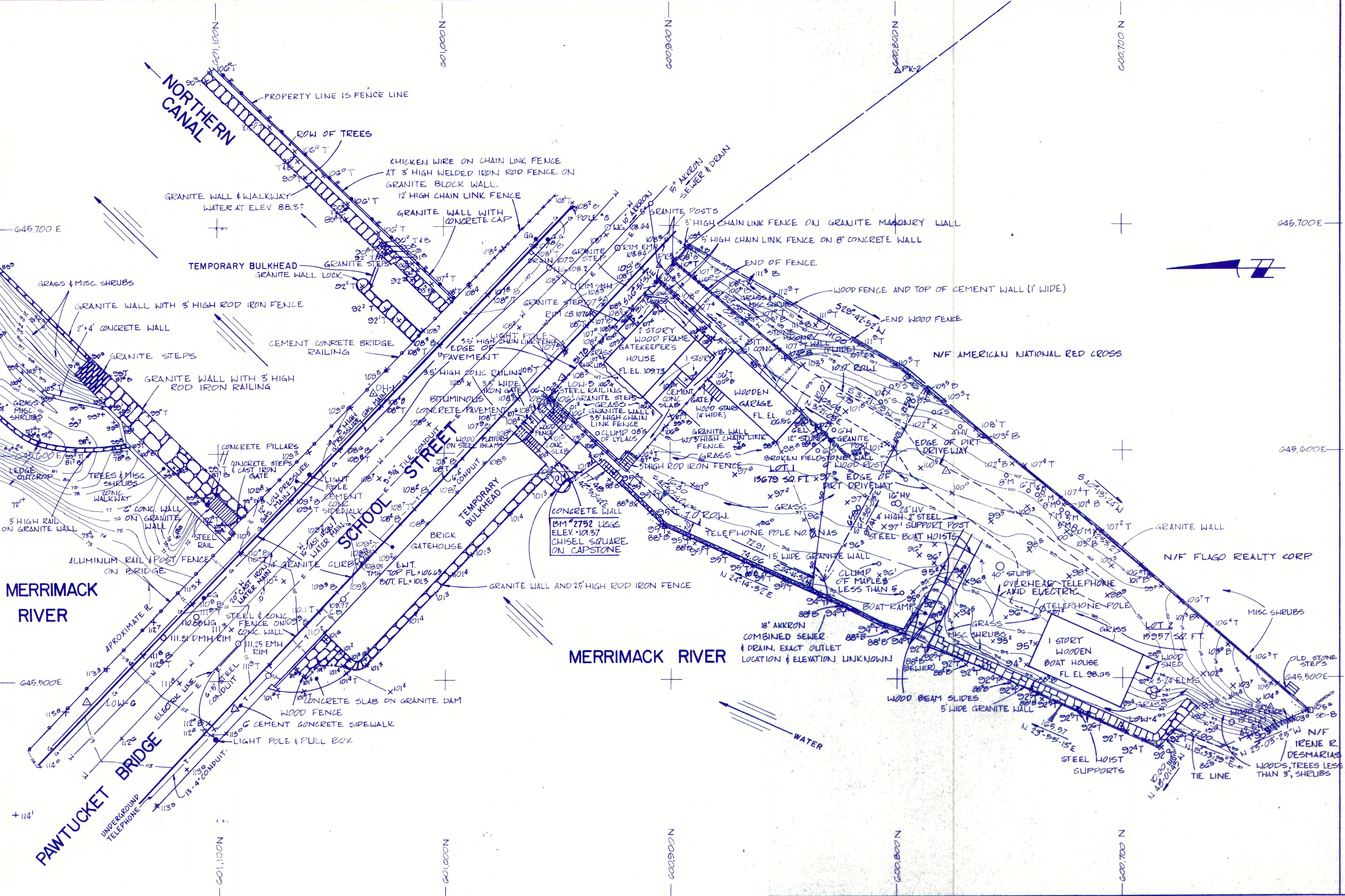
- LEGEND**
- HV TREE OF HEAVEN
 - BH BEECH
 - EL ELM
 - HW HAWTHORNE
 - SC SYCAMORE
 - AP APPLE
 - HC HICORY
 - CB CATCHBASIN
 - TMH TELEPHONE MANHOLE
 - WG WATER GATE
 - GG GAS GATE
 - T TOP
 - B BOTTOM
 - BIT BITUMINOUS
 - H HEMLOCK TREE
 - M MAPLE
 - O OAK
 - S SUMAC
 - B BIRCH
 - P PINE
 - A ASH
 - MB MULBURY

PREPARED BY:
MERRIMACK ENGINEERING SERVICES
66 MAIN STREET SUITE 13
ANDOVER, MASSACHUSETTS 01810

FLD. WK.	DRAWN	TRACED	CHECKED	BY	DATE
ROSE	HACKNEY	ALVES	S.E.S.		6/23/80

NOTES:

- SURVEY DRAWINGS COMPLETED AUGUST, 1980.
- TEMPORARY TIMBER BULKHEADS INSTALLED AUGUST, 1980. LOCK DRAINED, DESILTED, AND CLEANED AUGUST, 1980.
- SURVEY DRAWING ILLUSTRATES IMPORTANT EXISTING CONDITIONS ON SITE PRIOR TO PROJECT WORK.
- PROJECT WORK SHALL INCLUDE ANY NECESSARY REINFORCEMENTS AND POSSIBLE ADJUSTMENTS TO THE EXISTING BULKHEADS IN ORDER TO ACCOMPLISH GATE INSTALLATION, TO ACCOMPLISH ALL PROJECT WORK, PLUS COMPLETE WITHDRAWAL OF THE EXISTING TEMPORARY TIMBER BULKHEADS AT THE END OF THE PROJECT.



PREPARED MERRIMACK ENG. SERVICES DESIGNED MERRIMACK ENG. SERVICES DRAWN D.S.C. BRANCH OF SURVEYS CHECKED AUG. 1984 DATE	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK	The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks
	TITLE OF DRAWING SURVEY MAP OF NORTHERN CANAL LOCK SITE LOCATION WITHIN PARK PARK GENERAL NAME OF PARK LOWELL HERITAGE STATE PARK	TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS PARK: LOWELL HERITAGE STATE PARK LOCATION: PARK GENERAL Scale: AS SHOWN Project: NO. 119-83 Contract NO. 119-83

LOW-4 BRASS DISK SET IN GRANITE RETENTION WALL
 N600,700.9429
 E645,478.3609
 BM ELEV.=92.76

LOW-5 BRASS DISK SET IN CONC. SIDEWALK
 N600,948.2284
 E645,633.4675
 BM ELEV.=108.36

LOW-6 BRASS DISK SET IN CONC. SIDEWALK
 N601,64.0454
 E645,466.6384
 BM ELEV.=113.79

PK-5 PK NAIL SET IN PAV.
 N600,904.4840
 E645,681.9092

PK-6 PK NAIL SET IN PAV.
 N600,798.9828
 E645,767.8594

PK-7 PK NAIL SET IN PAV.
 N600,648.0040
 E645,877.7298

PK-8 PK NAIL SET IN PAV.
 N600,565.1968
 E645,750.9882

PK-9 PK NAIL SET IN PAV.
 N600,463.6669
 E645,556.3484

IP-1 IRON PIPE FOUND 4" DOWN IN PAV.
 N600,647.0407
 E645,874.0023

SB-6 DRILL HOLE FOUND IN STONE BOUND
 N600,731.5817
 E645,810.7903

SB-7 CENTER BACK OF STONE BOUND FOUND
 N600,606.2179
 E645,808.6322

SB-8 CROSS CUT FOUND IN 4' HIGH GRANITE STONE BOUND
 N600,617.0447
 E645,485.5178

DH-1 DRILL HOLE SET IN SIDEWALK
 N601,032.2589
 E645,621.9820

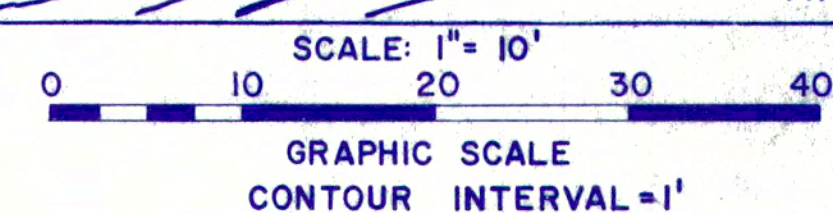
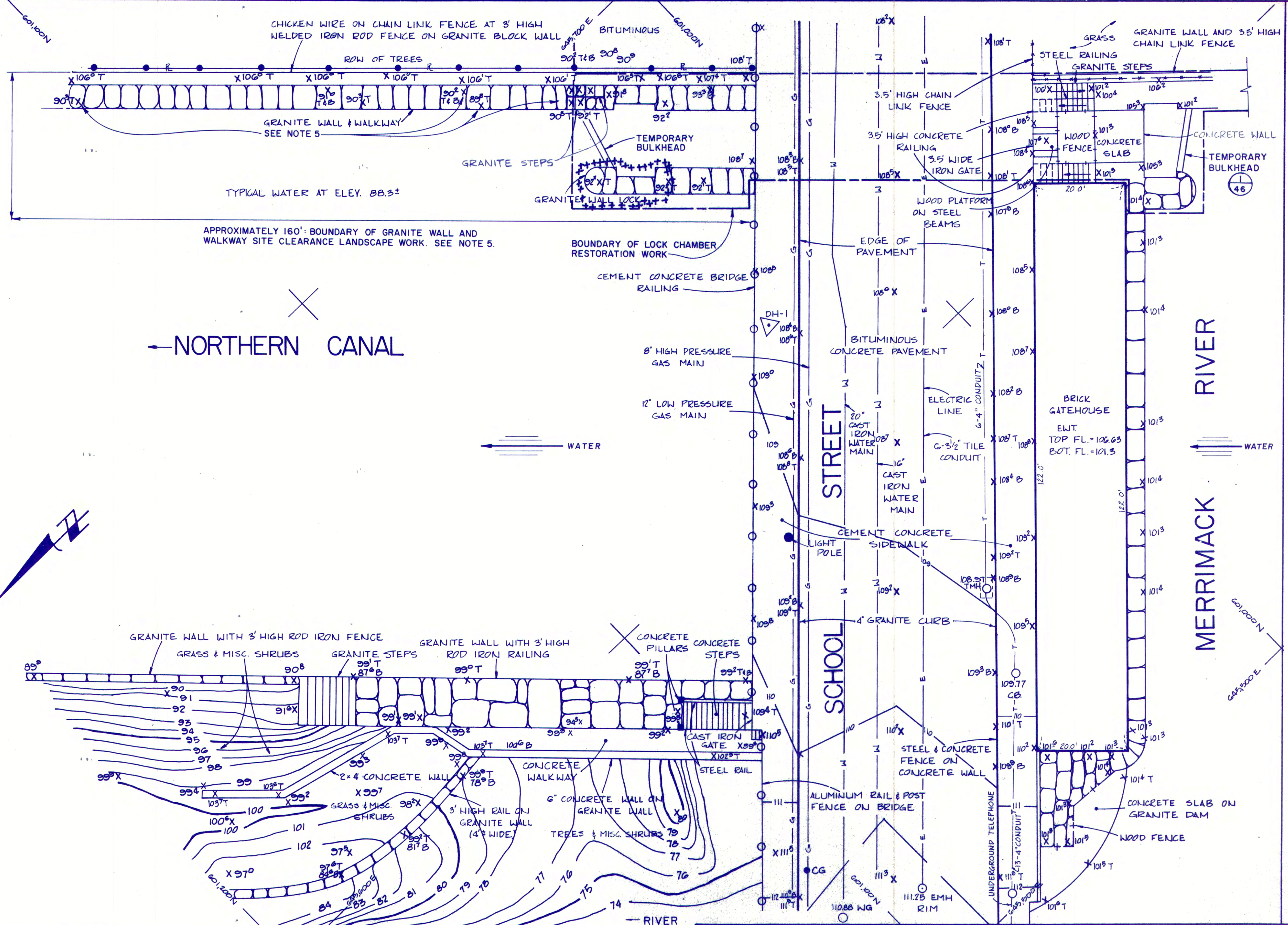
HV TREE OF HEAVEN
 BH BEECH
 EL ELM
 HW HAWTHORNE
 SC SYCAMORE
 AP APPLE
 HC HICKORY
 CB CATCH BASIN
 TMH TELEPHONE MANHOLE
 WG WATER GATE
 GG GAS GATE
 T TOP
 B BOTTOM
 BIT BITUMINOUS
 H HEMLOCK TREE
 M MAPLE
 O OAK
 S SUMAC
 B BIRCH
 P PINE
 A ASH
 MB MULBURY

PREPARED BY:
 MERRIMACK ENGINEERING SERVICES
 66 MAIN STREET SUITE 13
 ANDOVER, MASSACHUSETTS 01810

FLD. WK.	DRAWN	TRACED	CHECKED	BY	DATE	HORIZONTAL DATUM: NORTH AMERICAN 1927, MASS. COORD. SYSTEM
ROSE HACKNEY ALVES	LORRAIN		SE.S.		6/23/80	VERTICAL DATUM: SEA LEVEL DATUM OF 1929

NOTES:

- SURVEY DRAWINGS COMPLETED AUGUST, 1980.
- TEMPORARY TIMBER BULKHEADS INSTALLED AUGUST, 1980. LOCK DRAINED, DESILTED, AND CLEANED AUGUST, 1980.
- SURVEY DRAWING ILLUSTRATES IMPORTANT EXISTING CONDITIONS ON SITE PRIOR TO PROJECT WORK.
- PROJECT WORK SHALL INCLUDE ANY NECESSARY REINFORCEMENTS AND POSSIBLE ADJUSTMENTS TO THE EXISTING BULKHEADS IN ORDER TO ACCOMPLISH GATE INSTALLATION, TO ACCOMPLISH ALL PROJECT WORK, PLUS COMPLETE WITHDRAWAL OF THE EXISTING TEMPORARY TIMBER BULKHEADS AT THE END OF THE PROJECT.
- PROJECT LANDSCAPE WORK SHALL INCLUDE THE REMOVAL OF ALL STUMPS AND TREES ALONG GRANITE WALKWAY AND AT THE BASE OF THE GRANITE WALL. SEED AND MULCH FOR NEW GRASS COVER.
- CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.



PREPARED BY:
 MERRIMACK ENGINEERING SERVICES
 DESIGNED

MERRIMACK ENGINEERING SERVICES
 DRAWN

D.S.C. BRANCH OF SURVEYS
 CHECKED

AUG. 1984
 DATE

UNITED STATES DEPARTMENT OF THE INTERIOR
 NATIONAL PARK SERVICE
 LOWELL NATIONAL HISTORICAL PARK

TITLE OF DRAWING
 SURVEY MAP OF NORTHERN CANAL LOCKS: SCALE 1:10
 LOCATION WITHIN PARK
 PARK GENERAL
 NAME OF PARK
 LOWELL HERITAGE STATE PARK

N. A. MIDDLESEX MASS.
 REGION COUNTY STATE

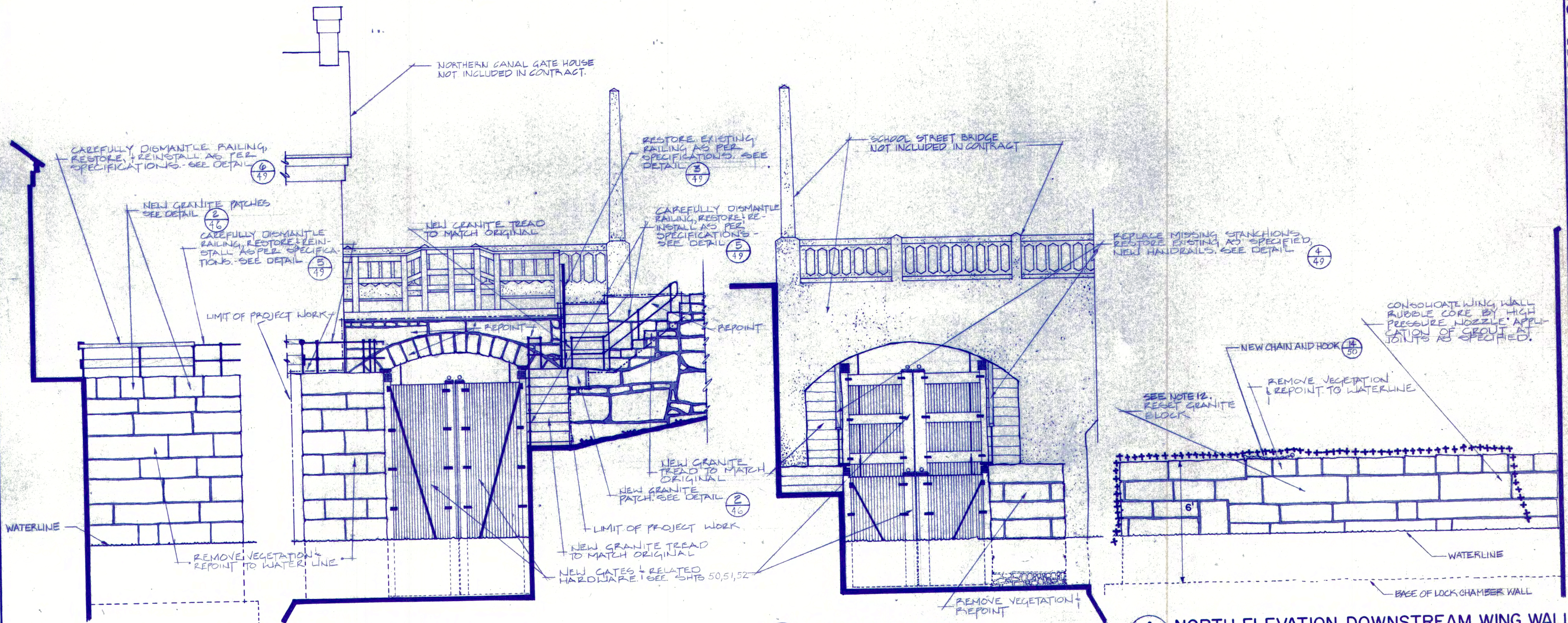
The Commonwealth of Massachusetts
 DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
 Division of Forests and Parks

TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS
 PARK: LOWELL HERITAGE STATE PARK
 LOCATION: PARK GENERAL
 Scale: AS SHOWN Dwg.
 Project NO. 119-83 Contract NO. 119-83 Date: AUGUST 1984
 Sheet 45 of 68

SURVEY MAP OF NORTHERN CANAL LOCKS

GENERAL NOTES:

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.
2. CONTRACTOR SHALL CHECK ALL WORK AND QUANTITIES SHOWN ON THE DRAWING BY AN "ON SITE" SURVEY AND REPORT HIS FINDINGS TO THE D.E.M. FIELD ENGINEER AND PROJECT ARCHITECT BEFORE RECEIVING PERMISSION TO COMMENCE WORK.
3. CONTRACTOR, FIELD ENGINEER, AND PROJECT ARCHITECT SHALL INSPECT ALL MASONRY AREAS TO BE REPOINTED AND RECHINKED IN ORDER TO DETERMINE EXISTING AREAS TO SERVE AS EXAMPLES OF QUALITY AND APPEARANCE FOR NEW WORK. THIS SHALL BE DETERMINED BEFORE COMMENCEMENT OF WORK.
4. ALL MASONRY WORK SHALL BE PERFORMED AS INDICATED WITHIN BOUNDARY LINES.
5. UNLESS DETERMINED OTHERWISE DURING FIELD INSPECTION, ALL NEW MORTAR JOINTS SHALL BE COMPACTED RAKED JOINTS AS ILLUSTRATED IN DETAIL **(3)** **(58)**.
6. ALL NEW CHINKING AND RECHINKING SHALL MATCH EXISTING CHINKING ON LOCK CHAMBER WALLS IN SIZE, PATTERN, MATERIAL, AND APPEARANCE.
7. ALL RAILINGS SHALL BE RESTORED AS INDICATED ON THE DRAWING AND IN ACCORDANCE WITH DECISIONS MADE BETWEEN THE CONTRACTOR, D.E.M. FIELD ENGINEER, AND ARCHITECT FROM THE ON SITE SURVEY.
8. ALL EXISTING RAILING SHALL BE REPAINTED AND ALL NEW RAILING PRIMED AND PAINTED AS PER SPECIFICATIONS.
9. REMOVE EXISTING DAMAGED GRANITE BLOCKS AND PROVIDE AND INSTALL NEW PATCHES OF SAME DIMENSIONS AS INDICATED ON THE DRAWING, AS PER DETAIL **(2)** **(46)** AND AS PER SPECIFICATIONS.
10. REBUILDING EXISTING WALLS: SEE SPECIFICATION SECTION 4 "MASONRY". RESET ALL GRANITE ASHLAR BLOCK MASONRY IN MANNER SPECIFIED AND AS PER DETAIL **(2)** **(46)**. RESET ALL RUBBLE GRANITE MASONRY IN MANNER SPECIFIED AND AS PER DETAIL **(4)** **(56)**.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION AND PRESERVATION OF ALL EXISTING HISTORIC FABRIC AND EXISTING STRUCTURES AND BUILDING FEATURES ADJACENT TO AND AFFECTED BY NEW WORK BUT NOT INCLUDED IN THE PROJECT CONTRACT.
12. RESET GRANITE BLOCK: CAREFULLY REMOVE AND SALVAGE TOP BLOCKS. CLEAN OUT ALL OLD MORTAR, LOOSE PARTICLES, AND DIRT. RESET STONE IN FRESH BED OF MORTAR SO THAT ALL EXPOSED SURFACES ARE FLUSH. FILL ALL INTERIOR GRANITE WALL VOIDS REVEALED BY REMOVAL WITH CONCRETE AND GROUT. REINSTALL TOP BLOCKS IN BEDS OF FRESH MORTAR IN SAME MASONRY PATTERN AS ORIGINAL. POINT AND CLEAN ALL EXPOSED JOINTS AS SPECIFIED. SEE **(2)** **(46)**.



1 NW ELEV. UPSTREAM WALL
48 SCALE 1/4"=1'-0"

2 WEST ELEVATION
48 SCALE 1/4"=1'-0"

3 EAST ELEVATION
48 SCALE 1/4"=1'-0"

4 NORTH ELEVATION DOWNSTREAM WING WALL
48 SCALE 1/4"=1'-0"

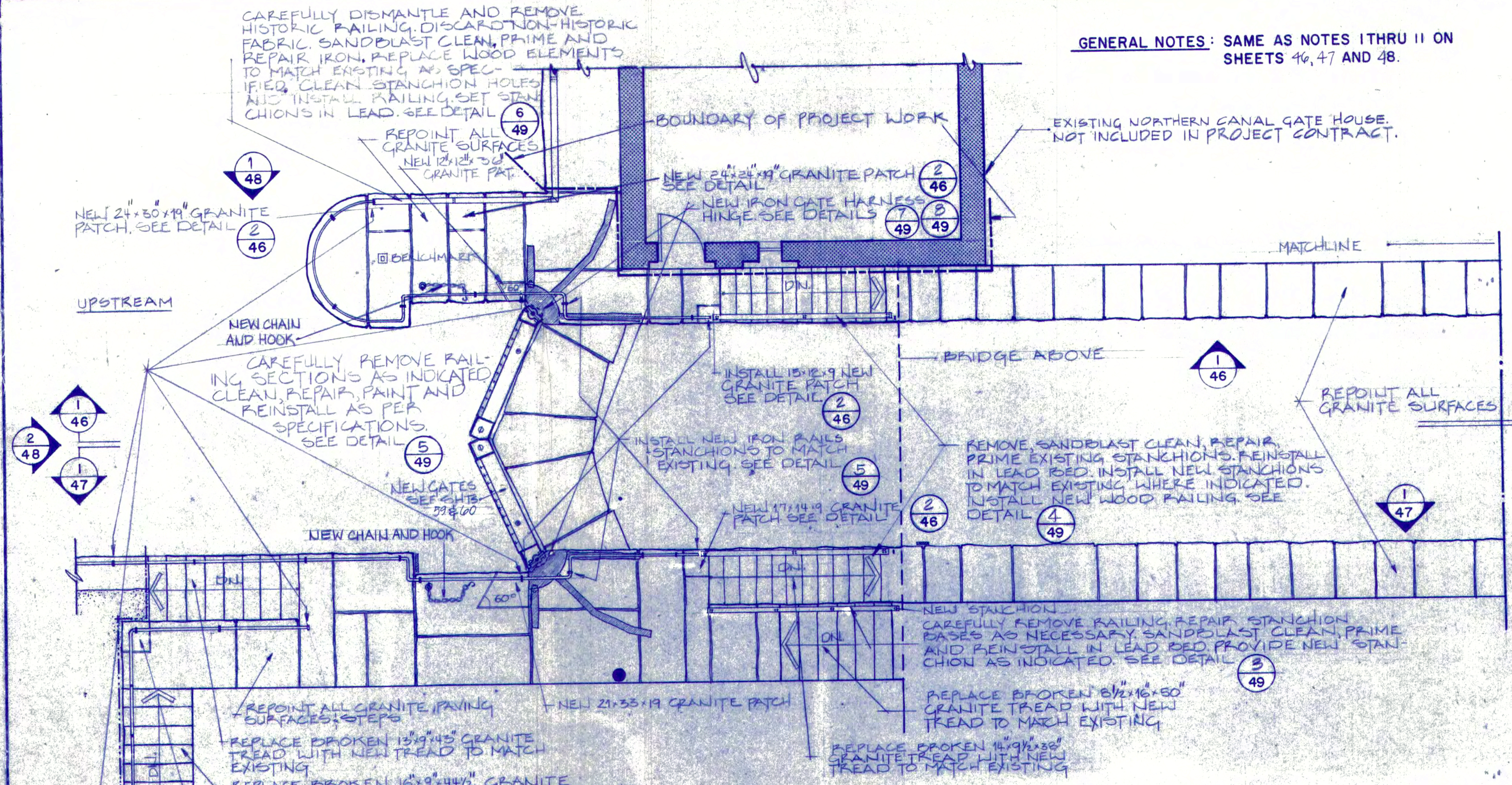
NORTHERN CANAL - RESTORATION OF MASONRY ON EAST & WEST SIDES

NORTHERN CANAL - RESTORATION OF MASONRY ON EAST & WEST SIDES

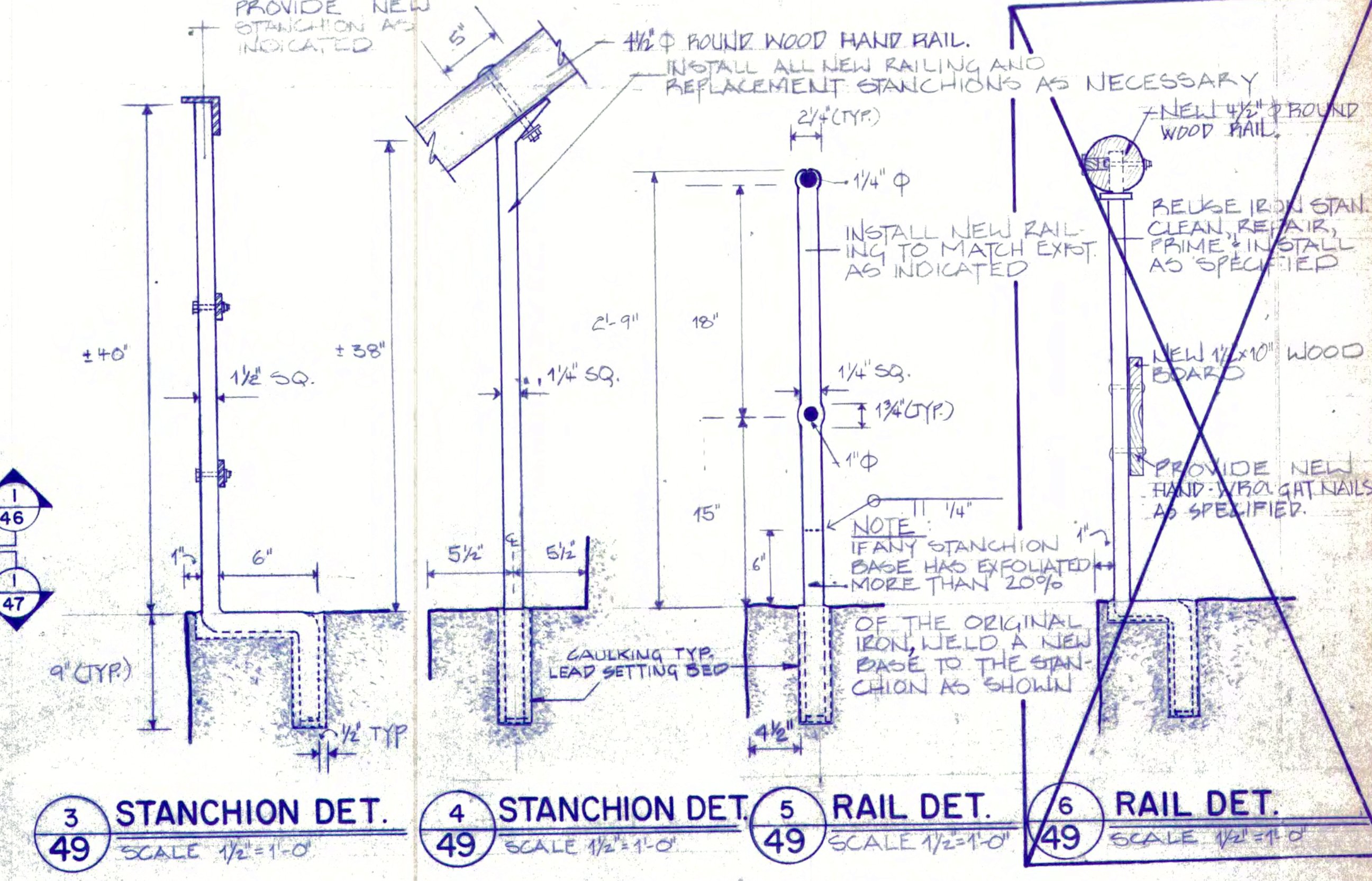
Contractor shall verify all dimensions and take own measurements at the job site before commencing work. Advise of any error or discrepancy.

	PREPARED P.F. DESSAUER H.T. McGRATH DESIGNED	UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK	The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks
	H.T. McGRATH DRAWN W.L. BARLOW CHECKED AUG. 1984 DATE	TITLE OF DRAWING NORTHERN CANAL-RESTORATION OF MASONRY WEST AND EAST SIDES LOCATION WITHIN PARK PARK GENERAL NAME OF PARK LOWELL HERITAGE STATE PARK N.A. REGION MIDDLESEX COUNTY MASS. STATE	TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS PARK: LOWELL HERITAGE STATE PARK LOCATION: PARK GENERAL Scale: AS SHOWN Dwg. Project: NO. 119-83 Contract NO. 119-83 Date: AUGUST 1984 Sheet 48 of 68

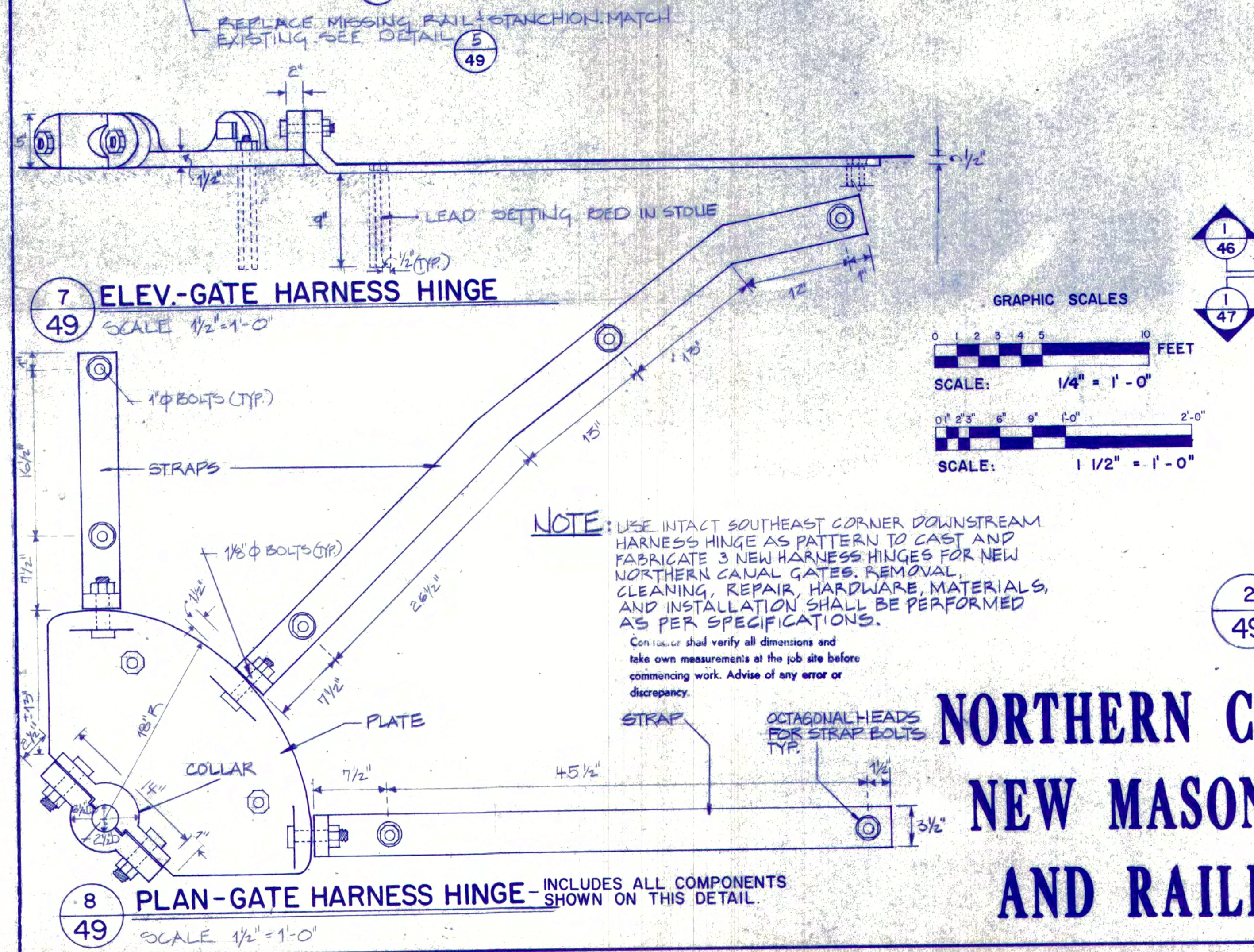
GENERAL NOTES: SAME AS NOTES I THRU II ON SHEETS 46, 47 AND 48.



1 PLAN-UPSTREAM - N. CANAL LOCK CHAMBER SCALE 1/4" = 1'-0"

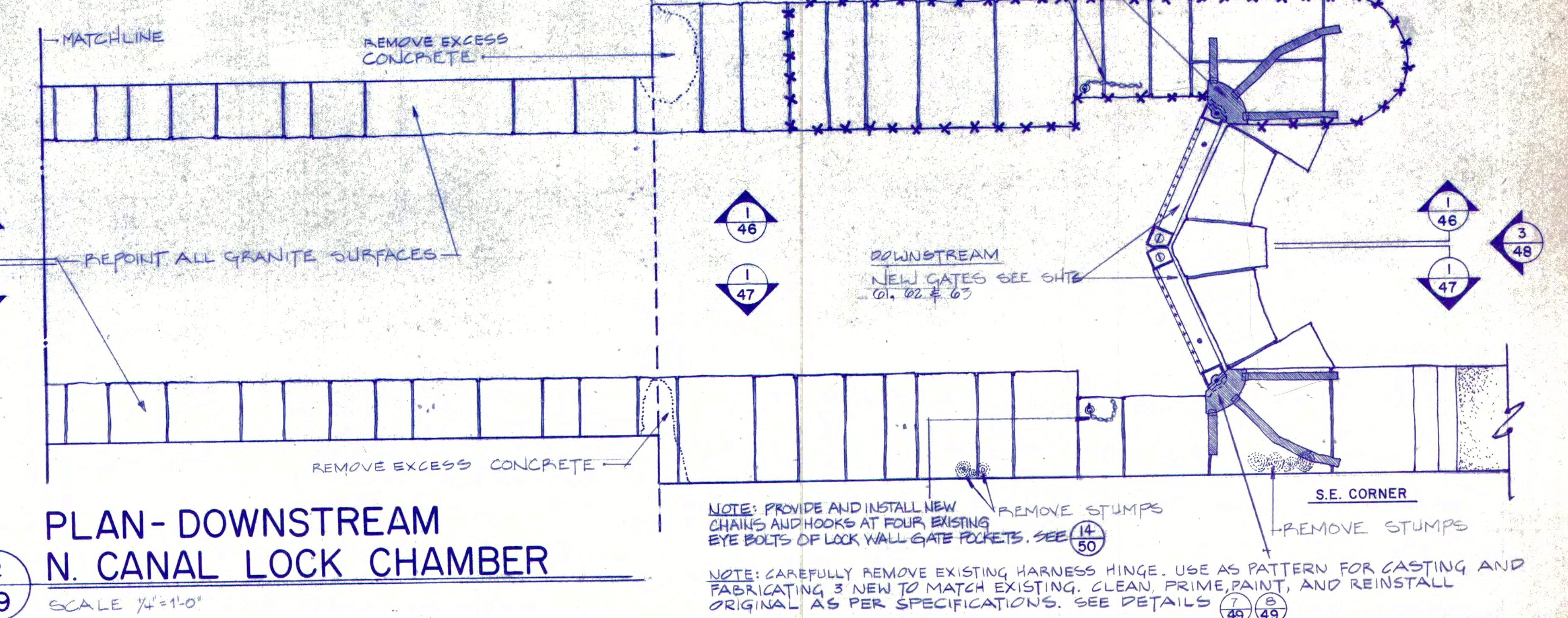


3 STANCHION DET. SCALE 1/2" = 1'-0" 4 STANCHION DET. SCALE 1/2" = 1'-0" 5 RAIL DET. SCALE 1/2" = 1'-0" 6 RAIL DET. SCALE 1/2" = 1'-0"



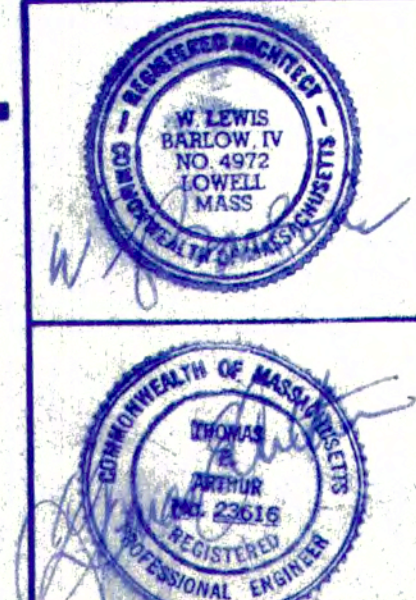
7 ELEV-GATE HARNESS HINGE SCALE 1/2" = 1'-0"

8 PLAN-GATE HARNESS HINGE - INCLUDES ALL COMPONENTS SHOWN ON THIS DETAIL. SCALE 1/2" = 1'-0"



2 PLAN-DOWNSTREAM N. CANAL LOCK CHAMBER SCALE 1/4" = 1'-0"

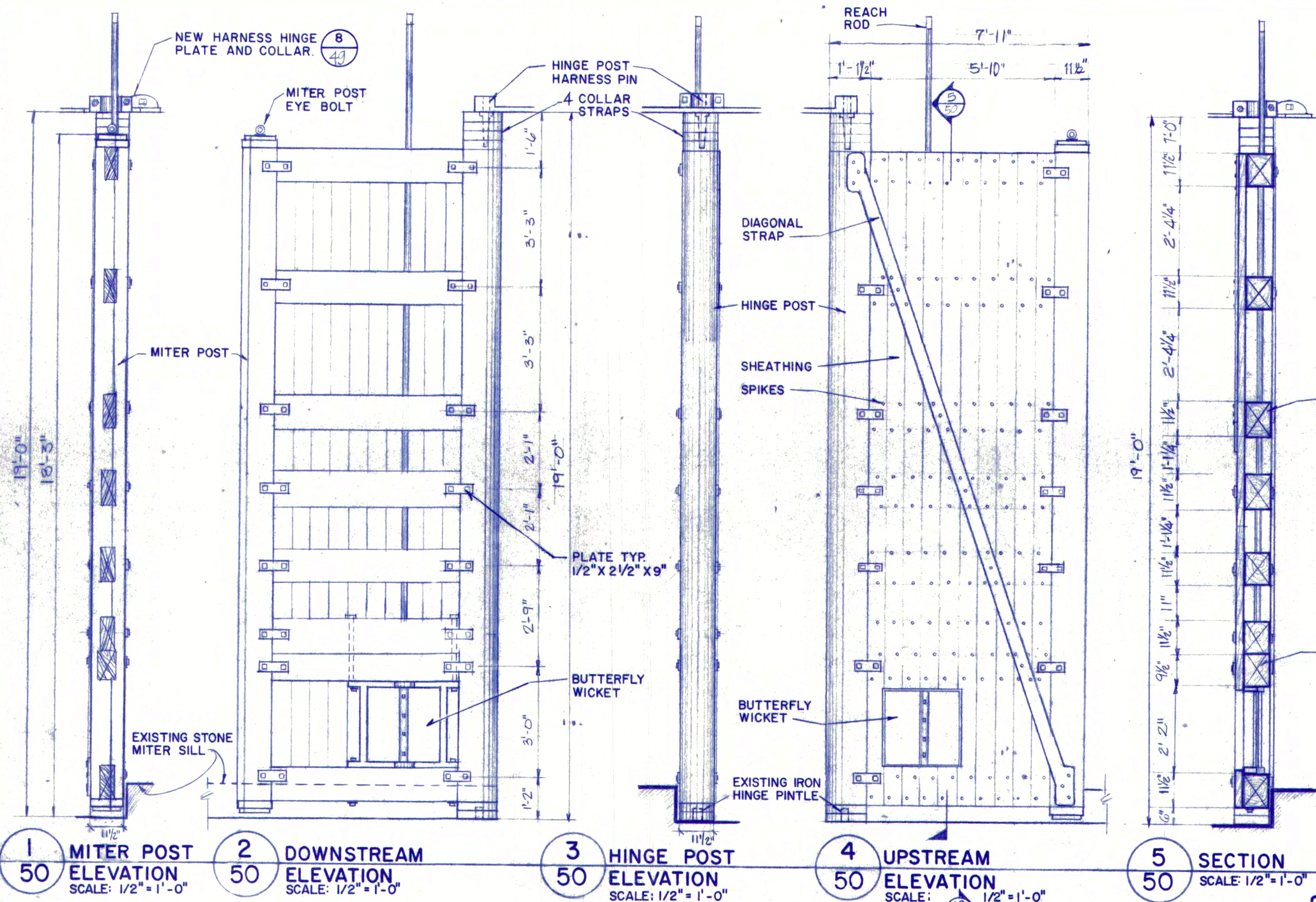
NORTHERN CANAL PLAN-NEW MASONRY, IRON, AND RAILING WORK



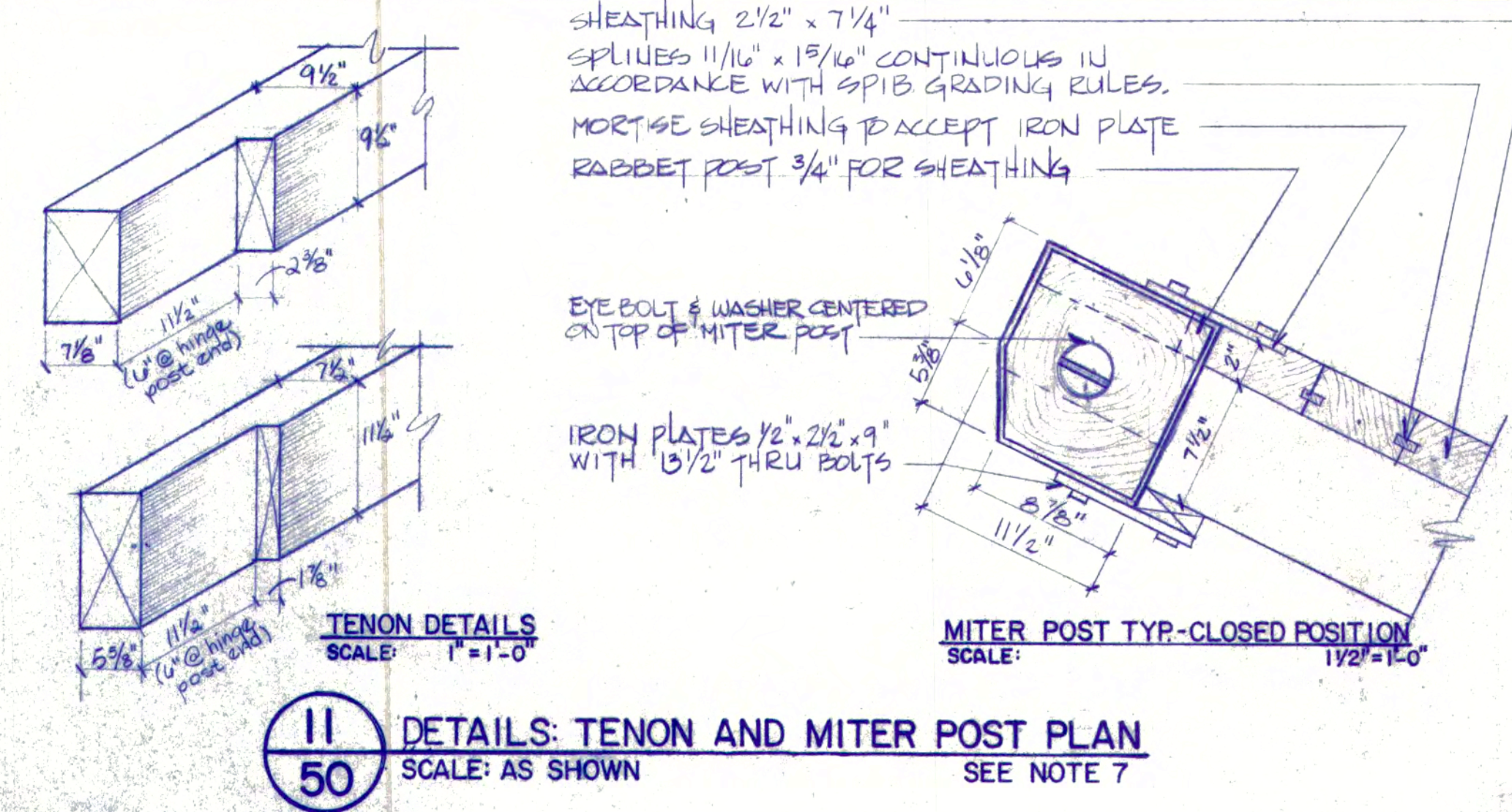
PREPARED BY J. ASKINS, P.F. DESSAUER, H.T. MCGRATH. DESIGNED BY H.T. MCGRATH. DRAWN BY W.L. BARLOW. CHECKED BY W.L. BARLOW. DATE: AUG. 1984

UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK. TITLE OF DRAWING: NORTHERN CANAL PLAN-NEW MASONRY, IRON, AND RAILING WORK. LOCATION WITHIN PARK: PARK GENERAL. NAME OF PARK: LOWELL HERITAGE STATE PARK. REGION: N.A., COUNTY: MIDDLESEX, STATE: MASS.

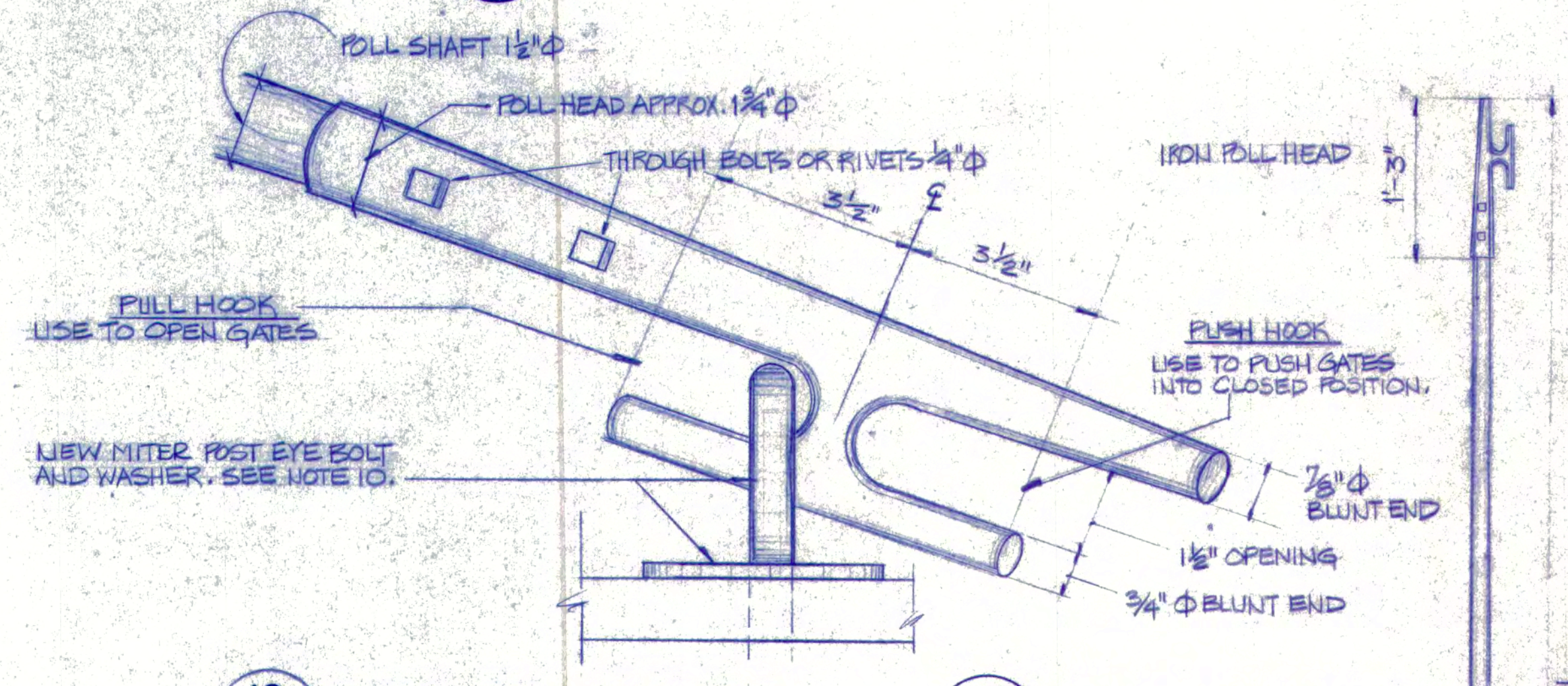
The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks. TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS. PARK: LOWELL HERITAGE STATE PARK. LOCATION: PARK GENERAL. Scale: AS SHOWN. Project: NO. 119-83 Contract NO. 119-83 Date: AUGUST 1984. Sheet 49 of 68



2 NEW UPSTREAM (WEST) GATES
NORTH GATE TYPICAL
SCALE: 1/2" = 1'-0"

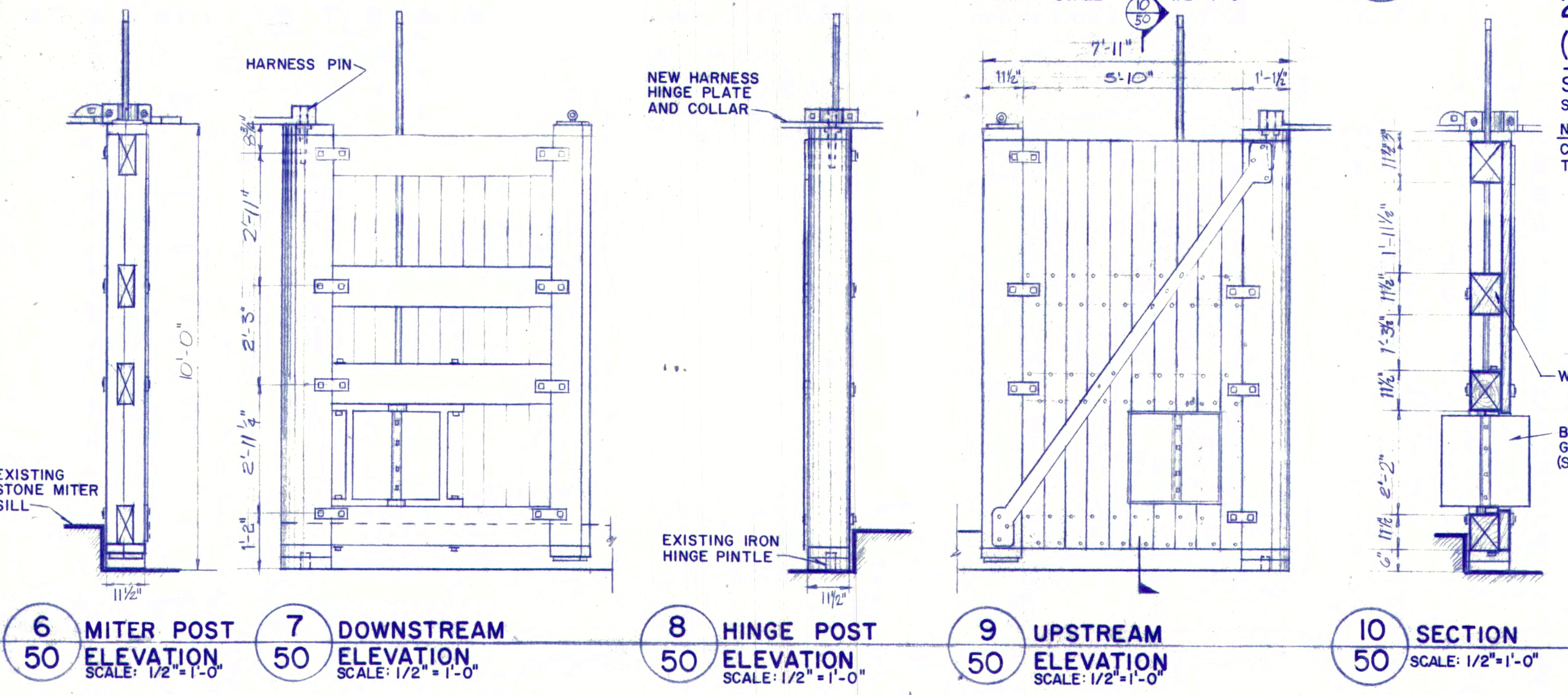


11 DETAILS: TENON AND MITER POST PLAN
SCALE: AS SHOWN
SEE NOTE 7

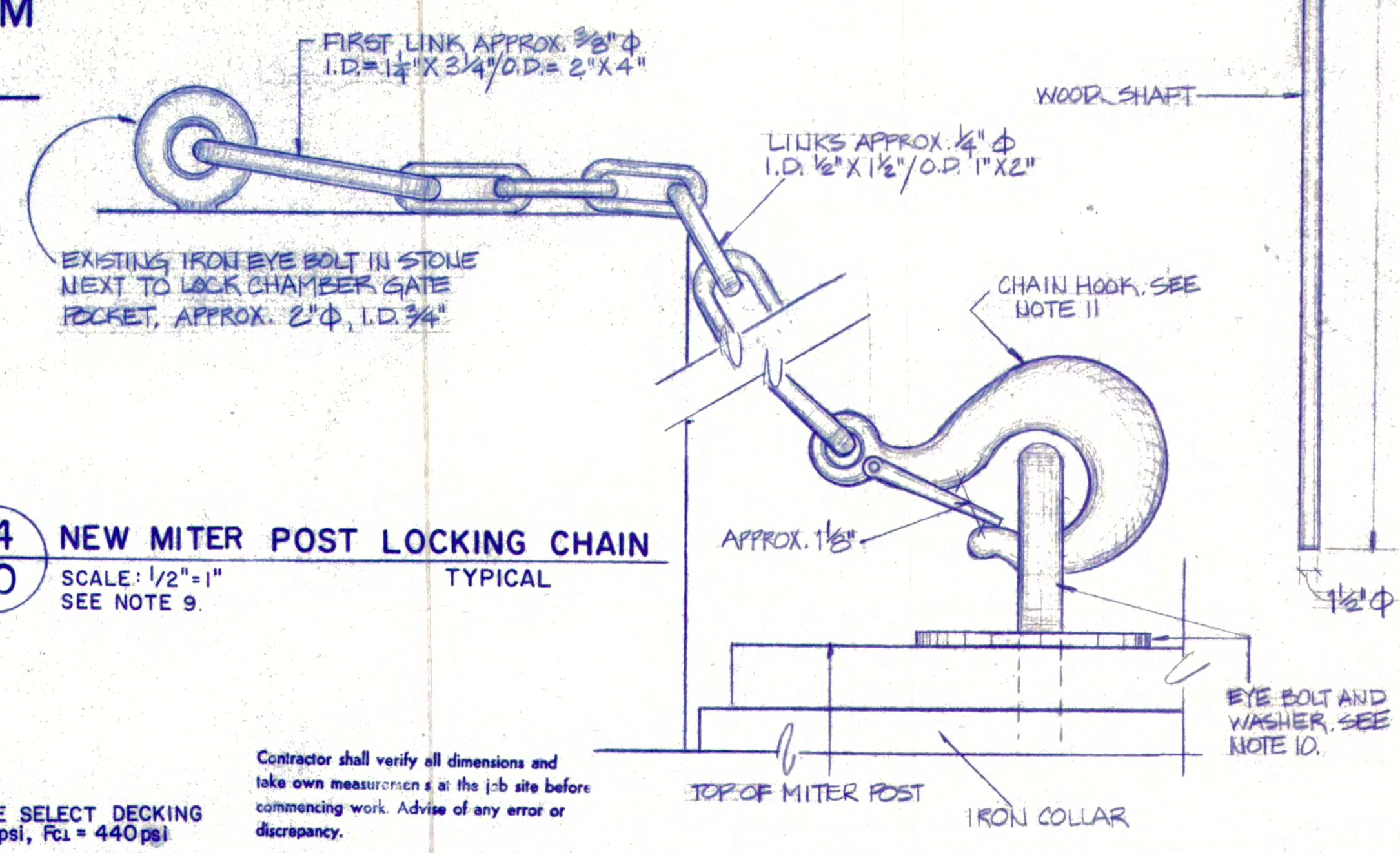


12 DETAIL: POLL HEAD TYP.
SCALE: APPROXIMATELY 1/2" = 1"

13 NEW OPERATING POLL
SCALE: 1" = 1'-0"
TYPICAL
SEE NOTE 8.



2 NEW DOWNSTREAM (EAST) GATES
SOUTH GATE TYPICAL
SCALE: 1/2" = 1'-0"
NOTE: CONSTRUCTION, DETAILS, AND COMPONENT TERMINOLOGY SIMILAR TO UPSTREAM (WEST) GATES.



14 NEW MITER POST LOCKING CHAIN
SCALE: 1/2" = 1"
SEE NOTE 9.

13. ALL SHEATHING SHALL BE DENSE SELECT DECKING SOUTHERN YELLOW PINE; Fb=1350psi, Fc=440psi

GENERAL NOTES FOR NORTHERN CANAL LOCK GATES:

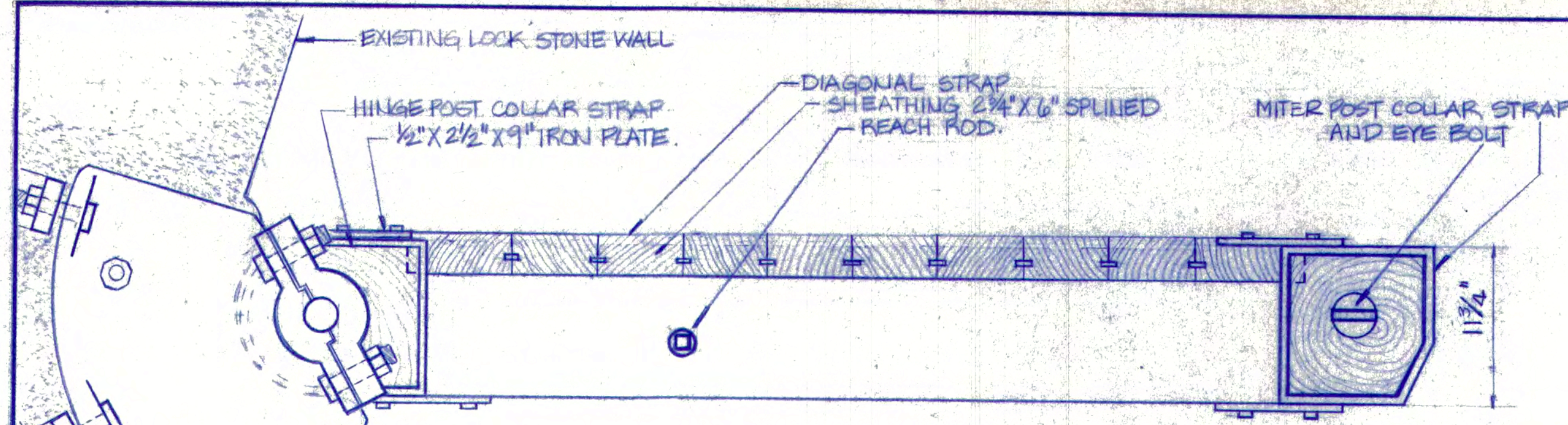
- CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.
- CONSTRUCT, PROVIDE, AND INSTALL 2 PAIRS OF NEW GATES FOR THE NORTHERN CANAL LOCK.
- ALL GATE TIMBERS AND LUMBER SHALL BE SOUTHERN YELLOW PINE AND CREOSOTE PRESSURE PRESERVATIVE TREATED. SEE SPECIFICATION SECTION 6.
- DIAGONAL IRON REINFORCING STRAPS, IRON PLATES, THROUGH BOLTS, IRON COLLAR STRAPS, LAG BOLTS, SPIKES, TIMBER MORTISE AND TENON CONNECTIONS, AND SPLINES ON SHEATHING SHALL BE SIMILAR TO EXISTING ON THE GUARD LOCKS GATES. SEE SHEETS NO.5, 59, 61, AND 63.

- SEE SHEET NO.49 FOR DETAIL OF NEW HARNESS HINGE PLATES.
- ALL GATE HARDWARE SHALL BE PAINTED. SEE SPECIFICATION SECTIONS 5 AND 9.
- NEW GATES SHALL OPERATE TO CLOSE FLUSH AND TIGHT.
- FABRICATE AND PROVIDE FOR THE NEW GATES 3 NEW OPERATING POLLS FROM ASH OR OAK WOOD. POLLS MUST PASS A DEMONSTRATION TEST IN THE FIELD BEFORE ACCEPTANCE IS GRANTED BY THE D. E. M. RESIDENT ENGINEER.
- PROVIDE AND INSTALL 4 NEW CHAINS AT EXISTING EYE BOLTS OF LOCK CHAMBER GATE POCKETS. CHAIN LINKS SHALL MATCH

EXISTING CHAIN REMAINS AT N.E. GATE POCKET. SEE SHEET NO.49 FOR PLAN OF LOCK.

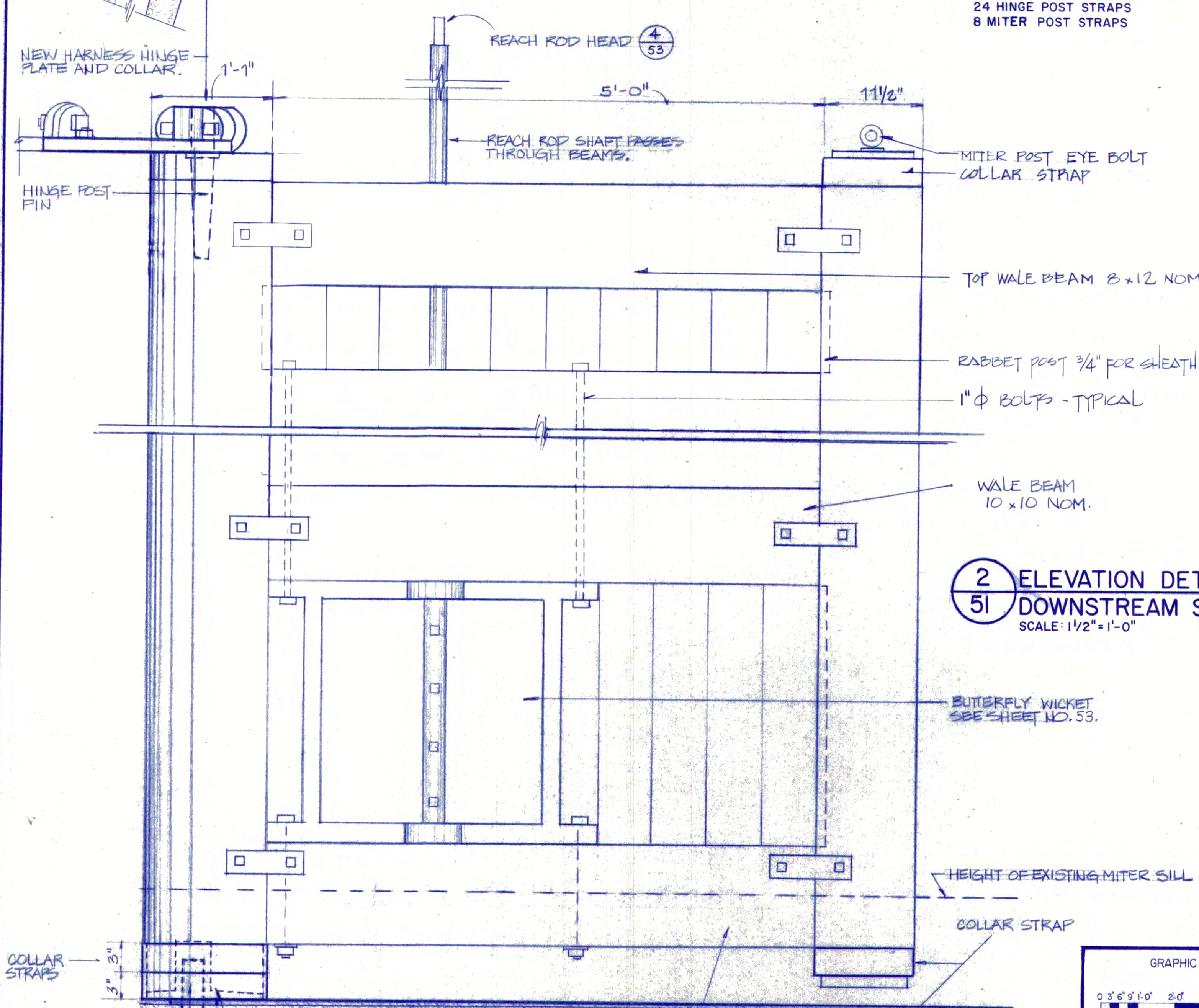
- NEW MITER POST "EYE" LAG BOLTS SHALL BE 3/4" Ø, I.D. 1 1/2", O.D. 3", AND SHANK MINIMUM 4 1/2" LONG. WASHER SHALL HAVE 3" DIAMETER.
- ANCHORS AT END OF NEW CHAINS SHALL BE IRON THROUGH LATCH, EITHER SPRING LOAD OR WIRE SNAP, AND A WORKING CAPACITY OF 4100 LBS.
- ALL STRUCTURAL WOOD MEMBERS SHALL BE NO.1 DENSE SR SOUTHERN YELLOW PINE; Fb=1550 psi, Fv=110psi, Fc=440psi, Fc=325psi, E=1,600,000

<p>GRAPHIC SCALES</p>		<p>UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE LOWELL NATIONAL HISTORICAL PARK</p> <p>TITLE OF DRAWING: NORTHERN CANAL - NEW LOCK GATES; ELEVATIONS, SECTIONS, AND OPERATING DETAILS. LOCATION WITHIN PARK: PARK GENERAL. NAME OF PARK: LOWELL HERITAGE STATE PARK.</p> <p>PREPARED BY: J. ASKINS, W.L. BARLOW, H.T. MCGRATH, P.F. DESSAUER, T. WONG. DESIGNED BY: P.F. DESSAUER. DRAWN BY: W.L. BARLOW. CHECKED BY: W.L. BARLOW. DATE: AUG. 1984.</p>		<p>The Commonwealth of Massachusetts DEPARTMENT OF ENVIRONMENTAL MANAGEMENT Division of Forests and Parks</p> <p>TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS. PARK: LOWELL HERITAGE STATE PARK. LOCATION: PARK GENERAL. Scale: AS SHOWN. Project: 119-83. Contract: 119-83. Date: AUGUST 1984.</p>	
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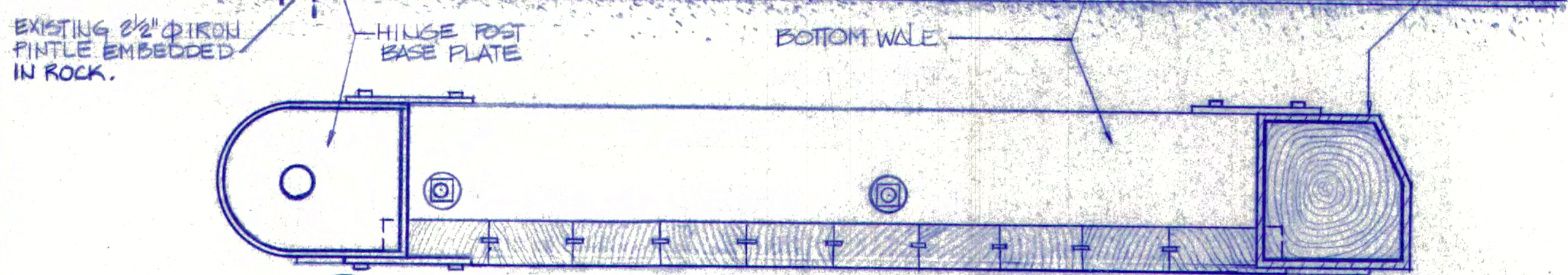


1 PLAN TYP.: TOP OF GATE
51 SCALE: 1/2" = 1'-0"

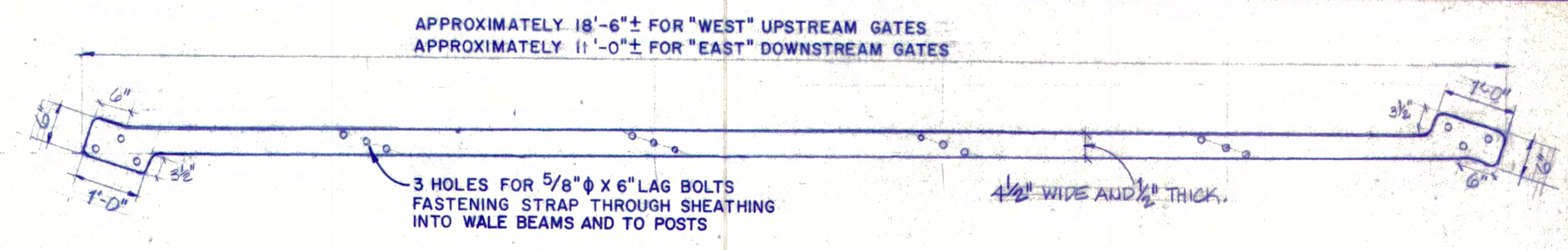
- GENERAL NOTES:**
- CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD, INCLUDING RADIUS OF EXISTING STONE HINGE POST POCKET.
 - CAST IRON: CAST 4 BASE PLATES AND 4 PINS FOR NEW GATE HINGE POSTS. PROVIDE AND INSTALL.
 - FABRICATE, PROVIDE, AND INSTALL:
4 DIAGONAL STRAPS
24 HINGE POST STRAPS
8 MITER POST STRAPS



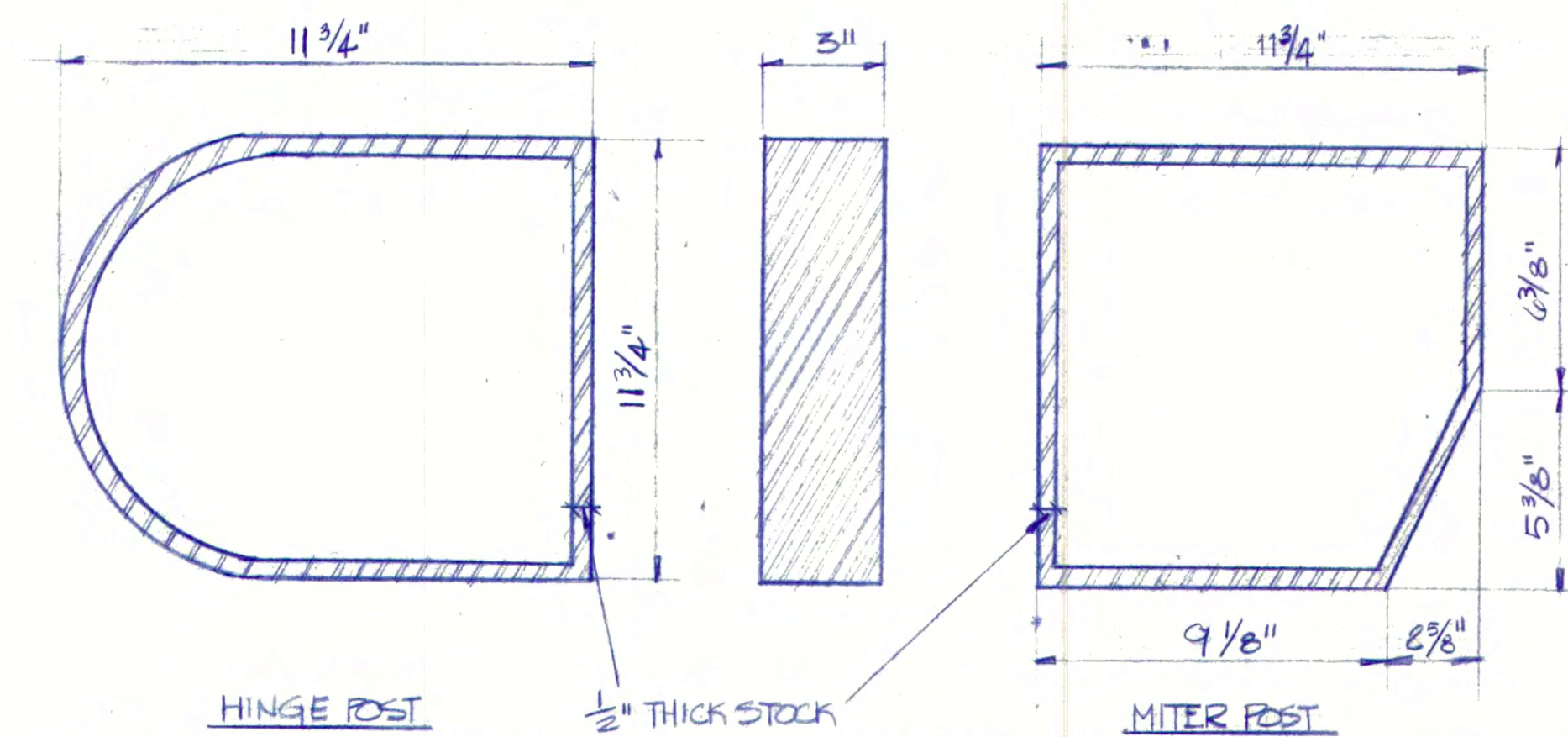
2 ELEVATION DETAILS, TYP.; DOWNSTREAM SIDE OF GATE
51 SCALE: 1/2" = 1'-0"



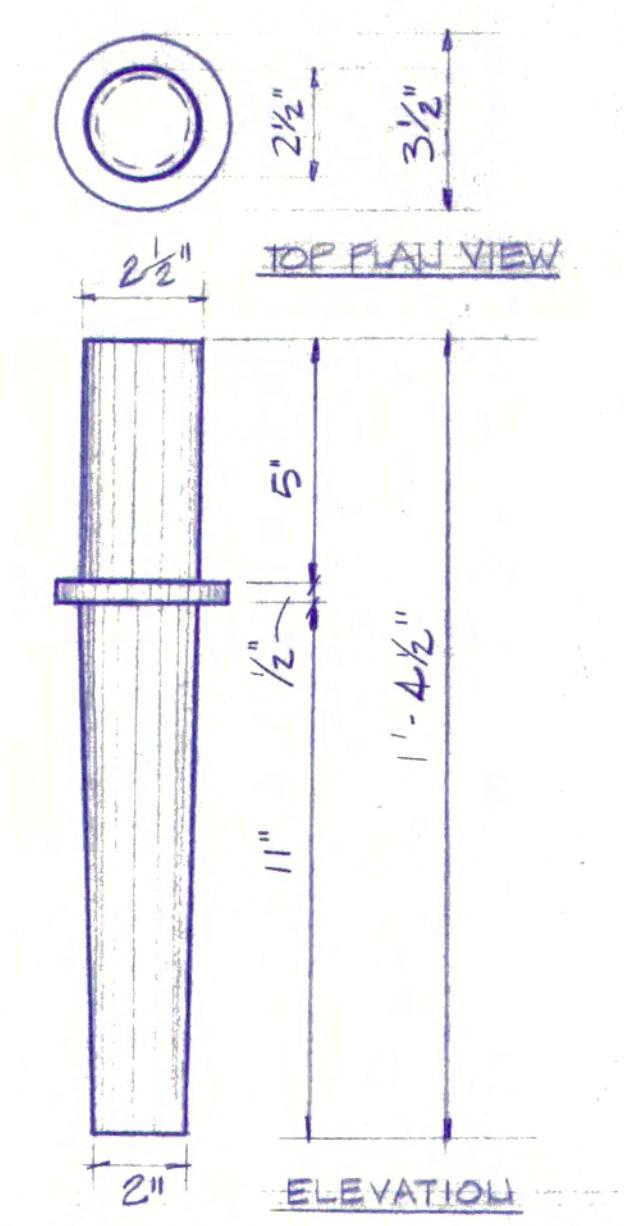
2 REFLECTIVE PLAN TYP.: BOTTOM OF GATE
51 SCALE: 1/2" = 1'-0"



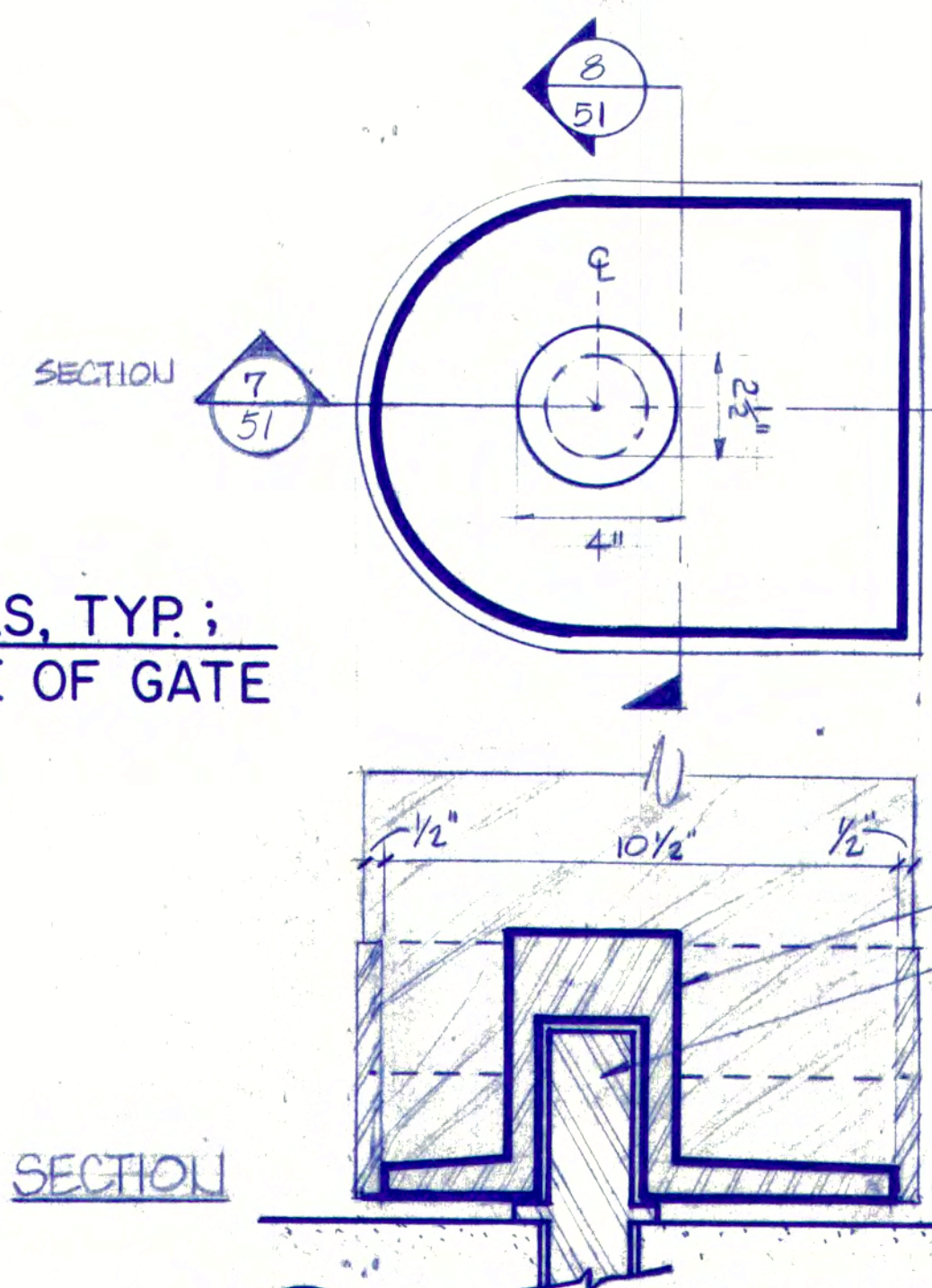
4 DETAIL: DIAGONAL IRON REINFORCING STRAP TYP.
51 SCALE: 3/4" = 1'-0"



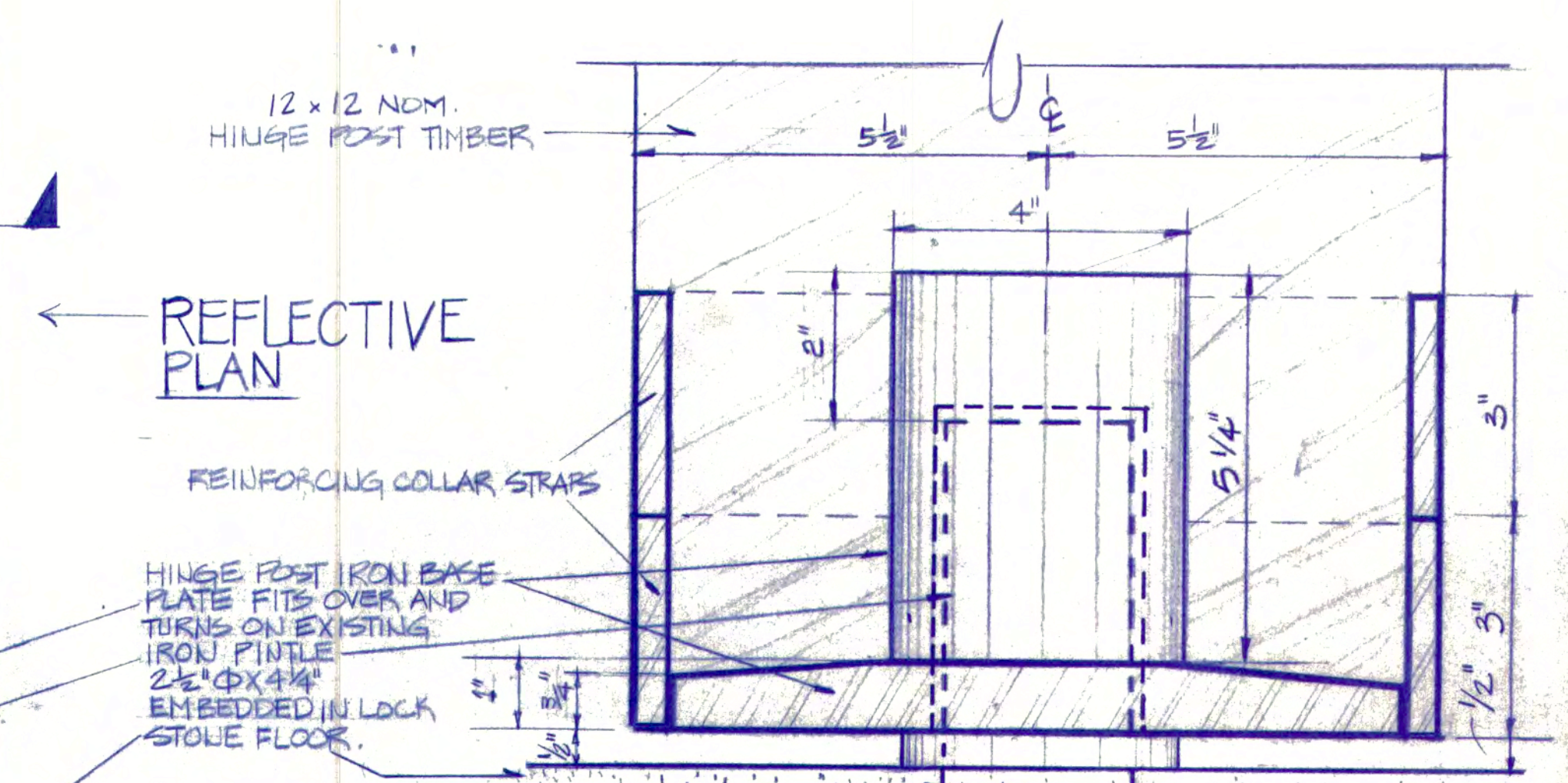
5 DETAIL: REINFORCING IRON COLLAR STRAPS TYP.
51 SCALE: 3" = 1'-0"



6 DETAIL: HINGE POST PIN TYP.
51 SCALE: 3" = 1'-0"

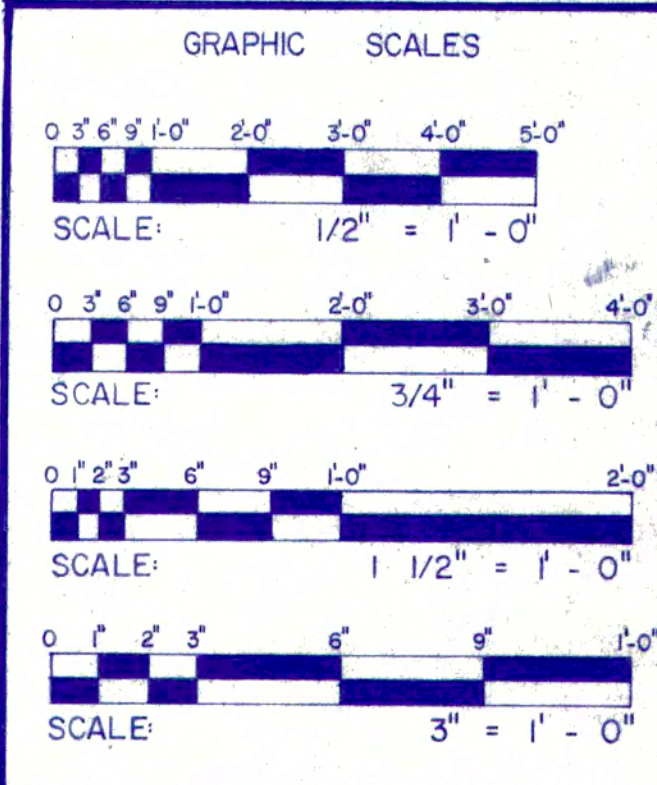


7 DETAIL: PLAN AND SECTION OF HINGE POST IRON BASE PLATE. TYP.
51 SCALE: 3" = 1'-0"



8 DETAIL: ELEVATION OF IRON BASE PLATE TYP.
51 SCALE: 1/2" = 1'-0"

Contractor shall verify all dimensions and take own measurements at the job site before commencing work. Advise of any error or discrepancy.



NEW LOCK GATES: PLANS, ELEVATION DETAILS AND HARDWARE



PREPARED
P.F. DESSAUER
DESIGNED

P.F. DESSAUER
DRAWN

W.L. BARLOW
CHECKED

AUG. 1984
DATE

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
LOWELL NATIONAL HISTORICAL PARK

TITLE OF DRAWING
NORTHERN CANAL: NEW LOCK GATES, PLANS, ELEVATION
DETAILS, IRON STRAPS, HINGE POST PIN, AND BASE PLATE.
LOCATION WITHIN PARK
PARK GENERAL
NAME OF PARK
LOWELL HERITAGE STATE PARK

N.A. MIDDLESEX MASS.
REGION COUNTY STATE

The Commonwealth of Massachusetts
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
Division of Forests and Parks

TITLE: CANAL SYSTEM RESTORATIONS AND RENOVATIONS
PARK: LOWELL HERITAGE STATE PARK
LOCATION: PARK GENERAL
Scale: AS SHOWN Dwg.

Project: NO. 119 - 83 Contract No. 119 - 83 Date: AUGUST 1984
Sheet 51 of 68

NORTHERN CANAL - NEW LOCK GATES: PLANS, ELEVATION DETAILS, AND HARDWARE