COMMONLY USED DRAWINGS FOR OPEN IRRIGATION SYSTEMS

REPORT NO. CB-5

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

OFFICE OF CHIEF ENGINEER
CANALS BRANCH

DENVER, COLORADO

MARCH 1968
REVISED AUGUST 1970

REPORT NO. CB-5

COMMONLY USED DRAWINGS FOR OPEN IRRIGATION SYSTEMS

Canals Branch
Division of Design
Office of Chief Engineer

United States Department of the Interior

Bureau of Reclamation

Denver, Colorado

March 1968
REVISED AUGUST 1970

PREFACE

Report No. CB-5 is a selection of reusable base drawings and standard drawings commonly used by the Canals Branch, Division of Design, Office of Chief Engineer, Denver, Colorado. These drawings incorporate current design practices as used in the Canals Branch and as outlined in the Reclamation Manual, Volume X, Design Standards No. 3, CANALS AND RELATED STRUCTURES. Basically, it is intended that these drawings be used for open waterways or structures with a capacity of 100 second-feet or less, although in some cases a larger capacity is indicated.

Reusable base drawings included under Part I of this report are intended to be used in planning and to produce specifications or construction drawings for open waterways and related structures. These drawings will be updated from time to time to reflect technical advances and current practices. A finished drawing suitable for specifications use may be obtained by completing the title and, in most cases, recording tabular values for variable factors on a reproducible print. The originals of these reusable base drawings are maintained by the Canals Branch.

Also included in this report under Part II are some of the more commonly used USBR Standard Drawings. The originals of these drawings are maintained by Drawing and Data Files of the Office of Chief Engineer, Denver, Colorado.

The design engineer who uses these drawings must realize that sound engineering principles must be exercised in the selection and utilization of these drawings and that structural limitations not necessarily shown on the drawings may apply. BEFORE THESE DRAWINGS ARE USED ON A PROJECT THEY SHOULD BE REVIEWED TO DETERMINE WHETHER THEY ARE APPLICABLE. IF NOT APPLICABLE, NEW DRAWINGS SHOULD BE DEVELOPED. The use of drawings in this report in no way relieves the design engineer of his responsibility to prepare functional, economical designs.

The August 1970 revision consists of the addition of a few drawings and minor changes and updating for many of the reusable base drawings. This revision reflects the changes that have been made on the drawings since the March 1968 printing.

PART I
REUSABLE BASE DRAWINGS

PART I - Continued
REUSABLE BASE DRAWINGS

PART I - Continued
REUSABLE BASE DRAWINGS

PART I - Continued
REUSABLE BASE DRAWINGS

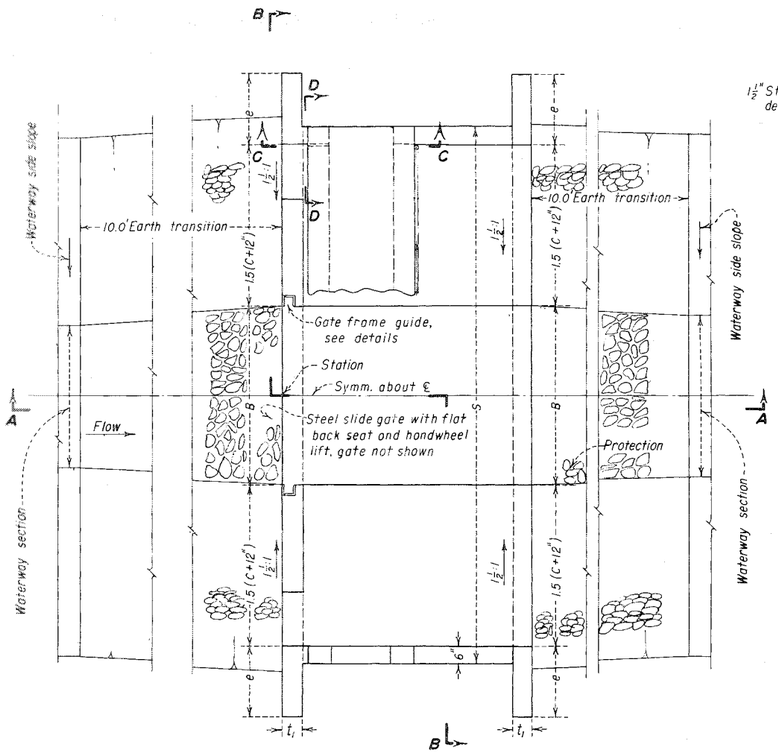
PART I - Continued
REUSABLE BASE DRAWINGS

PART I - Continued
REUSABLE BASE DRAWINGS

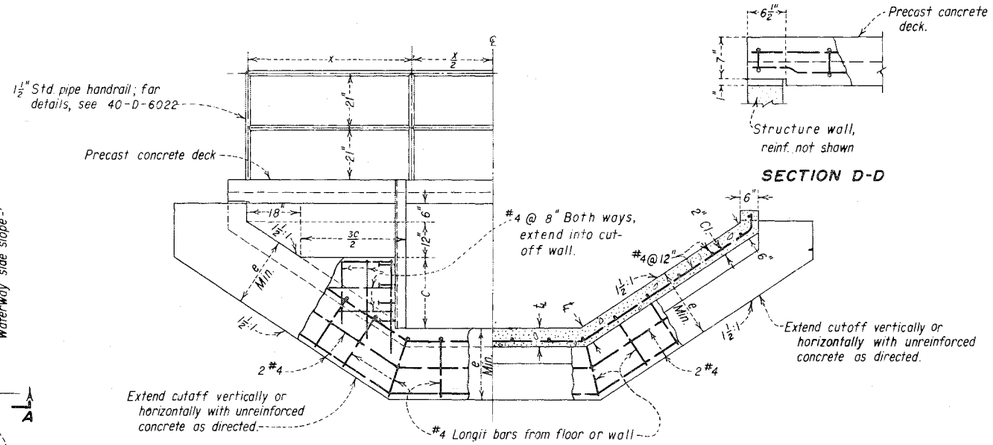
PART II
STANDARD DRAWINGS

PART II - Continued
STANDARD DRAWINGS

PART II - Continued
STANDARD DRAWINGS

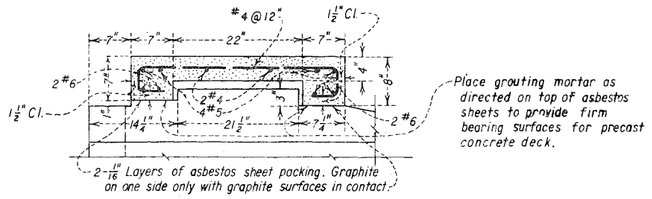


PLAN



SECTION B-B

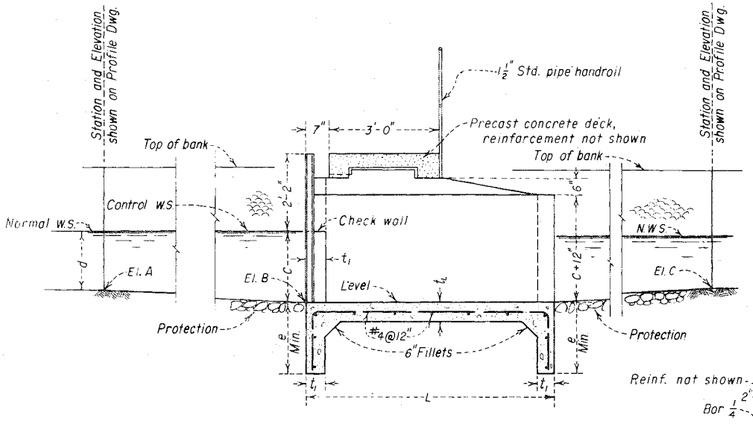
SECTION D-D



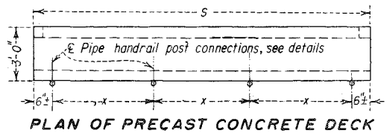
SECTION C-C

TABLE OF LOCATIONS AND ELEVATIONS

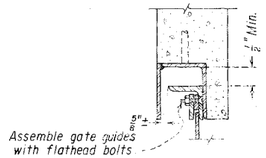
WATERWAY	STATION	STR. NO.	Q	ELEVATIONS A	ELEVATIONS B	ELEVATIONS C	REMARKS



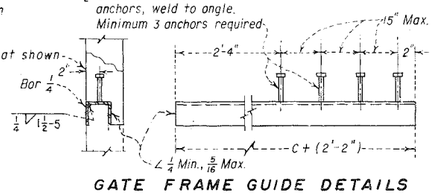
SECTION A-A



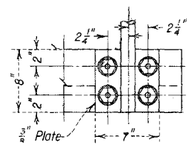
PLAN OF PRECAST CONCRETE DECK

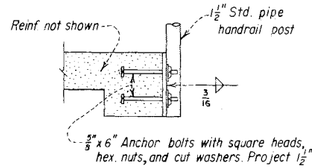


TYPICAL SLIDE GATE ASSEMBLY



GATE FRAME GUIDE DETAILS
(2 REQUIRED)





PIPE HANDRAIL POST CONNECTION DETAILS
(HANDRAIL REQUIRED WHEN C IS GREATER THAN 16")

STR. No.	MAX Q	SLIDE GATE (WIDTH x HEIGHT)*	SLIDE GATE FRM. HT.	STANDARD DIMENSIONS B	C	L	S	X	θ	t_c	t_1	ESTIMATED QUANTITIES CONC. CU. YDS	RE. STEEL LBS.	MISC. METAL LBS.	REMARKS
1	10	36"x12"	5'	3'-0"	14"	4'-6"	10'-6"	—	24°	6"	6"	2.8	330	65	
2	15	36"x18"	5'	3'-0"	20"	4'-6"	12'-0"	5'-6"	24°	6"	6"	3.2	370	195	
3	21	36"x24"	6'	3'-0"	2'-2"	5'-0"	13'-6"	6'-3"	24°	6"	6"	3.8	430	215	
4	26	36"x30"	6'	3'-0"	2'-8"	6'-0"	15'-0"	7'-0"	24°	6"	8"	5.9	540	235	
5	21	48"x18"	5'	4'-0"	21"	4'-6"	13'-3"	6'-2"	24°	6"	6"	3.5	410	210	
6	28	48"x24"	6'	4'-0"	2'-3"	5'-0"	14'-9"	6'-11"	24°	6"	6"	4.1	470	230	
7	35	48"x30"	6'	4'-0"	2'-9"	6'-0"	16'-3"	7'-8"	24°	6"	8"	6.2	580	245	
8	42	48"x36"	6'	4'-0"	3'-3"	7'-0"	17'-9"	5'-7"	24°	7"	8"	7.4	670	285	
9	35	60"x24"	6'	5'-0"	2'-3"	5'-0"	15'-9"	7'-5"	24°	6"	6"	4.3	490	275	
10	43	60"x30"	6'	5'-0"	2'-9"	6'-0"	17'-3"	5'-5"	24°	6"	8"	6.5	610	315	
11	52	60"x36"	6'	5'-0"	3'-3"	7'-0"	18'-9"	5'-11"	24°	7"	8"	7.7	700	340	
12	61	60"x42"	6'	5'-0"	3'-9"	7'-6"	20'-3"	6'-5"	24°	7"	8"	8.6	770	365	
13	42	72"x24"	6'	6'-0"	2'-3"	5'-0"	16'-9"	7'-11"	24°	6"	6"	4.5	520	280	
14	53	72"x30"	6'	6'-0"	2'-9"	6'-0"	18'-3"	5'-9"	24°	6"	8"	6.8	640	320	
15	63	72"x36"	6'	6'-0"	3'-3"	7'-0"	19'-9"	6'-3"	24°	7"	8"	8.0	730	345	

* When a gate of specified height is not available a gate with next greater available height shall be used with appropriate frame height.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Thickness of concrete to vary uniformly between dimensions shown.
Transverse bars to be continuous in walls and floor.
Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast deck.
Set Elevation B so that top of check wall is at Control Water Surface Elevation.
Handrail required when C ≧ 16".
Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWINGS

TYPICAL PROTECTION ----------

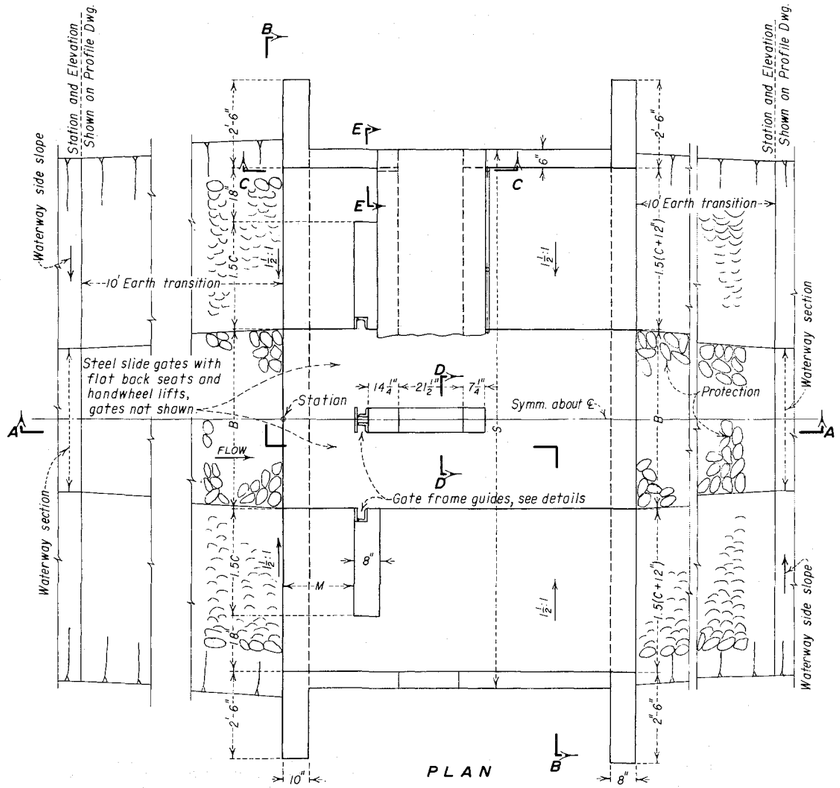
ALWAYS THINK SAFETY

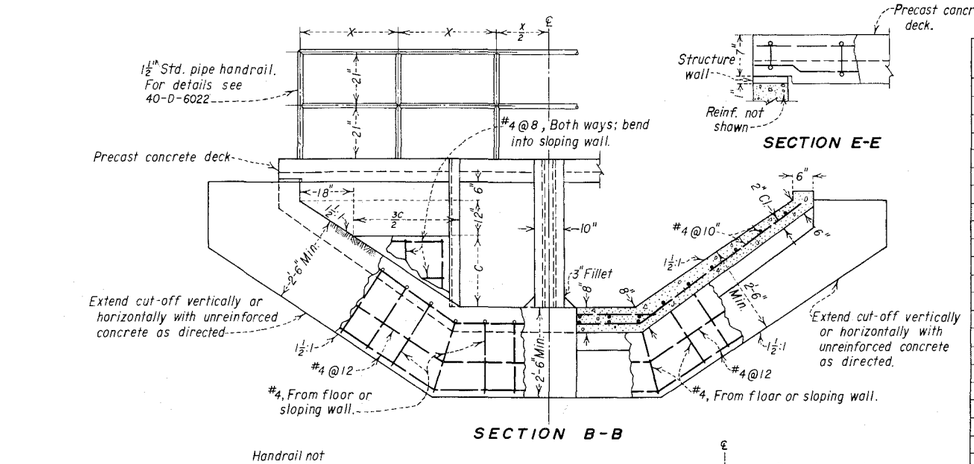
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

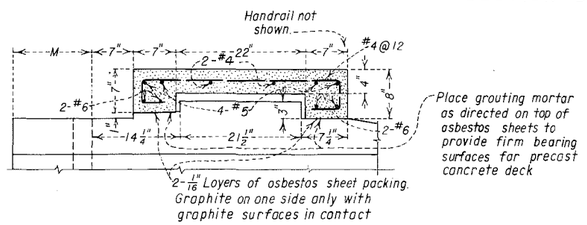
CONCRETE CHECKS - TYPE 10

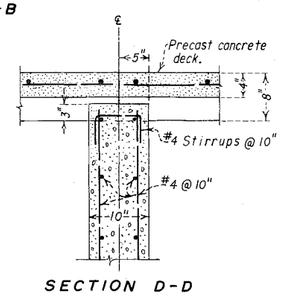
DRAWN W.A.K. SUBMITTED
TRACED D.J.P. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

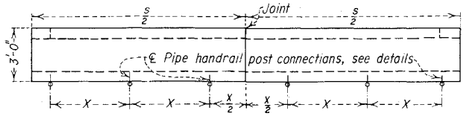
C-100-10

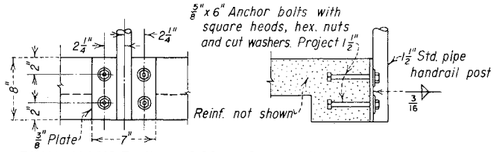


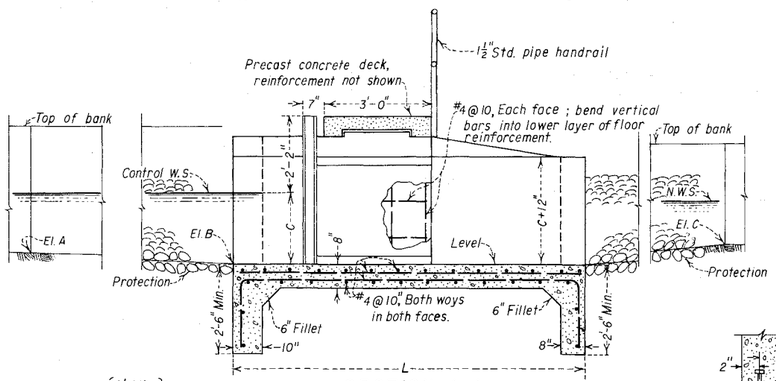


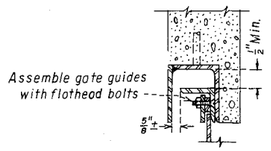


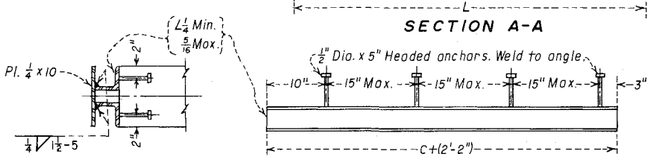












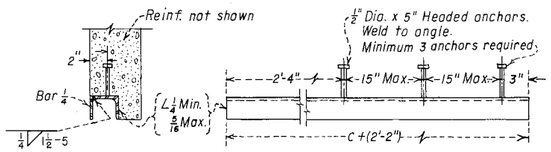


TABLE OF LOCATIONS AND ELEVATIONS

WATERWAY	STATION	STR. NO.	Q	ELEVATIONS A	ELEVATIONS B	ELEVATIONS C	REMARKS

STR. NO.	MAX. Q	** SLIDE GATES * WIDTH X HEIGHT	SLIDE GATES FRM. HT.	STANDARD DIMENSIONS B	C	L	M	S	X	ESTIMATED QUANTITIES CONC. CU. YDS.	RE. STEEL LBS.	MISC. METAL LBS.	REMARKS
1	74	42" x 36"	7'	7'-10"	3'-2"	7'-0"		21'-4"	6'-9"	9.1	930	410	
2	86	42" x 42"	7'	7'-10"	3'-8"	7'-6"		22'-10"	7'-3"	10.1	1030	440	
3	98	42" x 48"	7'	7'-10"	4'-3"	8'-0"		24'-7"	7'-10"	11.3	1140	480	
4	110	42" x 54"	8'	7'-10"	4'-9"	8'-6"		26'-1"	5'-0"	12.4	1250	550	
5	84	48" x 36"	7'	8'-10"	3'-3"	7'-0"		22'-7"	7'-2"	9.5	980	430	
6	98	48" x 42"	7'	8'-10"	3'-9"	7'-6"		24'-1"	7'-8"	10.6	1080	460	
7	112	48" x 48"	7'	8'-10"	4'-3"	8'-0"		25'-7"	4'-11"	11.7	1190	530	
8	126	48" x 54"	8'	8'-10"	4'-9"	8'-6"		27'-1"	5'-3"	12.8	1290	560	
9	140	48" x 60"	9'	8'-10"	5'-3"	10'-6"	18"	28'-7"	5'-6"	15.1	1510	710	
10	105	60" x 36"	7'	10'-10"	3'-3"	7'-6"		24'-7"	7'-10"	10.5	1090	530	
11	123	60" x 42"	7'	10'-10"	3'-9"	8'-0"		26'-1"	5'-0"	11.6	1200	610	
12	140	60" x 48"	7'	10'-10"	4'-3"	8'-6"		27'-7"	5'-4"	12.7	1310	650	
13	158	60" x 54"	8'	10'-10"	4'-9"	10'-6"	18"	29'-1"	5'-8"	15.0	1530	680	
14	175	60" x 60"	9'	10'-10"	5'-3"	14'-0"	3'-0"	30'-7"	5'-11"	18.6	1880	720	
15	147	72" x 42"	7'	12'-10"	3'-9"	9'-6"		28'-1"	5'-5"	13.3	1400	620	
16	168	72" x 48"	7'	12'-10"	4'-3"	10'-0"	18"	29'-7"	5'-9"	14.6	1510	660	
17	178	72" x 51"	8'	12'-10"	4'-6"	13'-0"	3'-0"	30'-4"	5'-10"	17.3	1790	670	

* When a gate of specific height is not available, a gate with next greater available height shall be used with appropriate frame height.

** Two gates required for each check.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Outer face tansverse bars to be continuous in walls and floor.

Thickness of concrete to vary uniformly between dimensions shown.

Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast deck.

Set Elevation B so that top of check wall is of Control Water Surface Elevation.

Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWINGS

TYPICAL PROTECTION

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE CHECKS - TYPE II

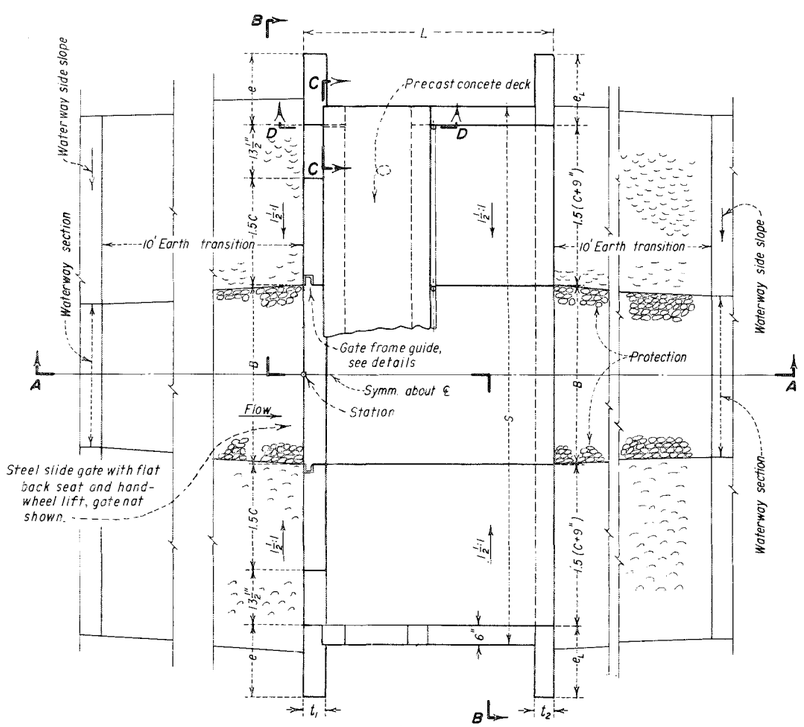
C 100.20

DRAWN W.A.K. SUBMITTED

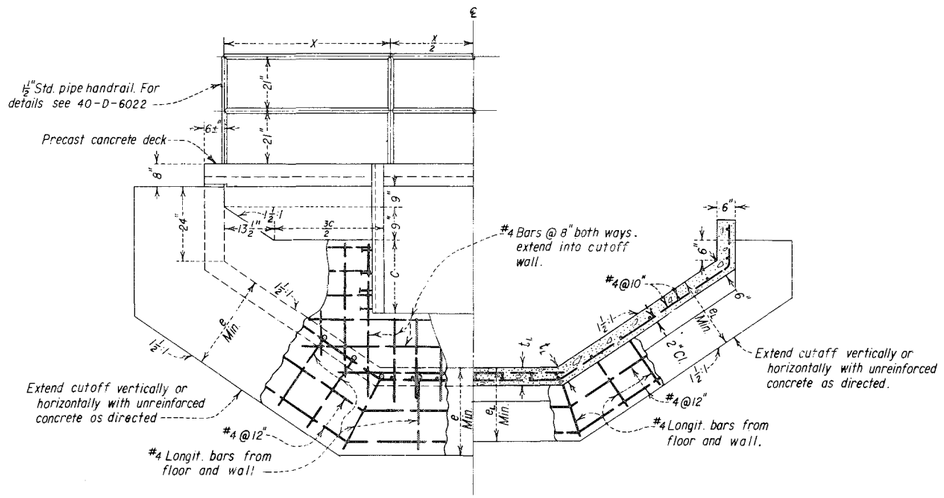
TRACED R.D.T. RECOMMENDED

CHECKED APPROVED
CHIEF, CANALS BRANCH

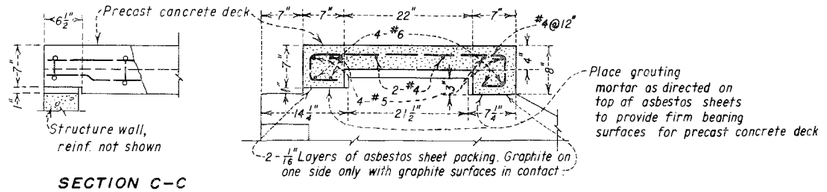
DENVER, COLORADO,



PLAN



SECTION B-B

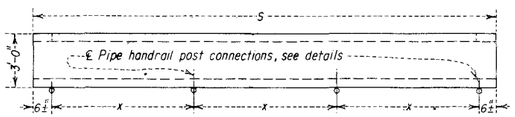


SECTION C-C

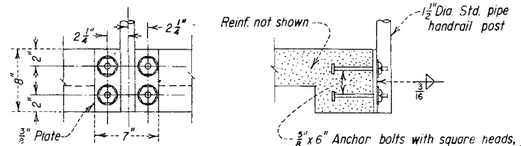
SECTION D-D

TABLE OF LOCATIONS AND ELEVATIONS

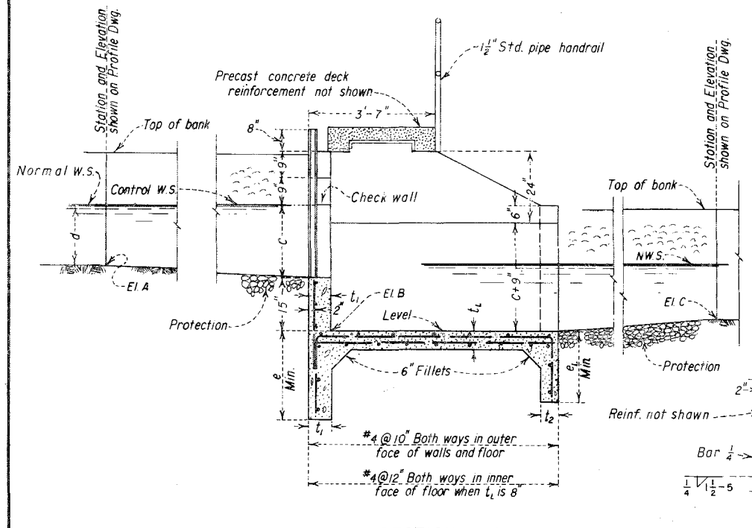
WATERWAY	STATION	STR. NO.	Q	ELEVATIONS A	ELEVATIONS B	ELEVATIONS C	REMARKS



PLAN OF PRECAST CONCRETE DECK

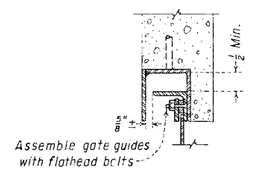


PIPE HANDRAIL POST CONNECTION DETAILS



SECTION A-A

GATE FRAME GUIDE DETAILS



TYPICAL SLIDE GATE ASSEMBLY

STR. No.	MAX. Q.	SLIDE GATE (WIDTH X HEIGHT*)	SLIDE GATE FRM HT.	STANDARD DIMENSIONS B	C	L	S	X	e	t_1	t_2	e_L	t_L	ESTIMATED QUANTITIES CONC. CU. YDS.	RE. STEEL LBS.	MISC. METAL LBS.	REMARKS
1	10	36"x12"	5'	3'-0"	14"	6'-6"	10'-6"	4'-9"	24"	8"	6"	24"	6"	3.7	440	180	
2	15	36"x18"	5'	3'-0"	20"	6'-6"	12'-0"	5'-6"	24"	8"	6"	24"	6"	4.2	500	200	
3	21	36"x24"	6'	3'-0"	2'-2"	7'-0"	13'-6"	6'-3"	24"	8"	6"	24"	7"	5.1	570	215	
4	26	36"x30"	6'	3'-0"	2'-8"	7'-6"	15'-0"	7'-0"	2'-6"	8"	8"	24"	7"	6.6	670	235	
5	21	48"x18"	5'	4'-0"	21"	7'-0"	13'-3"	6'-2"	24"	8"	6"	24"	6"	4.8	555	210	
6	28	48"x24"	6'	4'-0"	2'-3"	7'-6"	14'-9"	6'-11"	24"	8"	6"	24"	7"	5.7	630	230	
7	35	48"x30"	6'	4'-0"	2'-9"	8'-0"	16'-3"	7'-8"	2'-6"	8"	8"	24"	7"	7.2	735	245	
8	42	48"x36"	6'	4'-0"	3'-3"	8'-6"	17'-9"	5'-7"	2'-6"	9"	8"	2'-6"	8"	9.2	895	285	
9	35	60"x24"	6'	5'-0"	2'-3"	7'-6"	15'-9"	7'-5"	24"	8"	6"	24"	7"	6.0	665	275	
10	43	60"x30"	6'	5'-0"	2'-9"	8'-0"	17'-3"	5'-5"	2'-6"	8"	8"	24"	7"	7.6	770	315	
11	52	60"x36"	6'	5'-0"	3'-3"	8'-6"	18'-9"	5'-11"	2'-6"	9"	8"	2'-6"	8"	9.6	940	335	
12	42	72"x24"	6'	6'-0"	2'-3"	7'-6"	16'-9"	7'-11"	24"	8"	6"	24"	7"	6.3	700	280	
13	53	72"x30"	6'	6'-0"	2'-9"	8'-0"	18'-3"	5'-9"	2'-6"	9"	8"	24"	7"	8.2	800	320	
14	63	72"x36"	6'	6'-0"	3'-3"	8'-6"	19'-9"	6'-3"	2'-6"	9"	8"	2'-6"	8"	10.0	990	345	

* When a gate of specific height is not available, a gate with next greater available height shall be used with appropriate frame height.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Outer face transverse bars, to be continuous in walls and floors.
Thickness of concrete to vary uniformly between dimensions shown.
Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast deck.
Set Elevation B so that top of check wall is at Control Water Surface Elevation.
Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWINGS

TYPICAL PROTECTION ----------

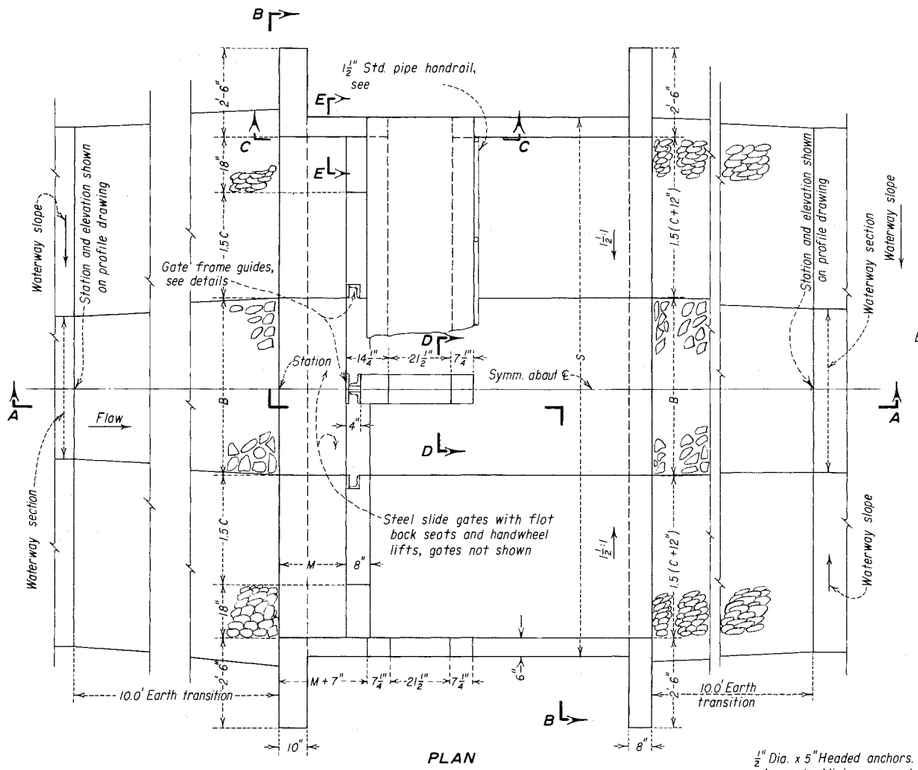
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

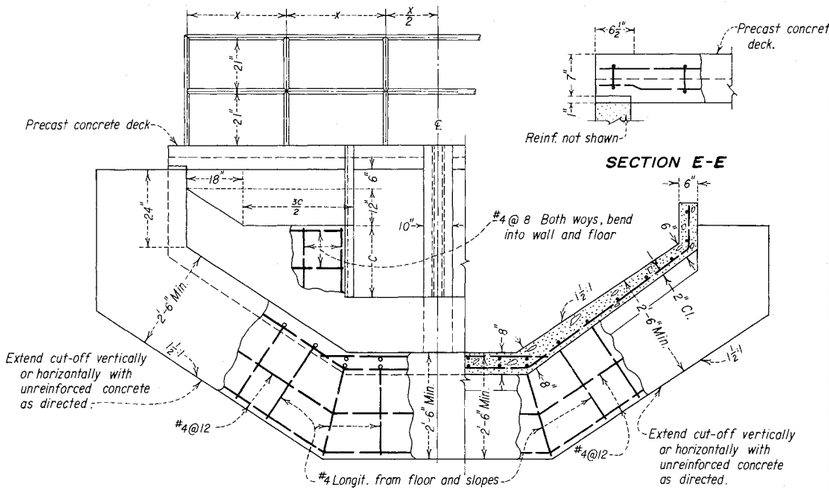
CONCRETE CHECKS WITH 1.5' DROP TYPE 13

C-100-30

DRAWN O.E.C. SUBMITTED
TRACED D.V.P. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO



PLAN

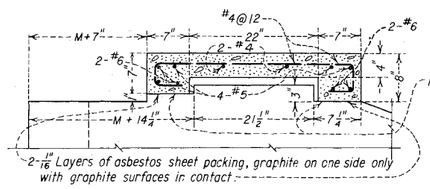


SECTION B-B

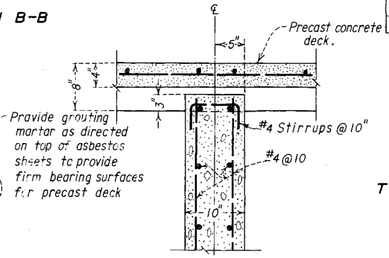
SECTION E-E

TABLE OF LOCATIONS AND ELEVATIONS

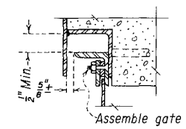
WATERWAY	STATION	STR. NO.	Q	ELEVATIONS A	ELEVATIONS B	ELEVATIONS C	REMARKS



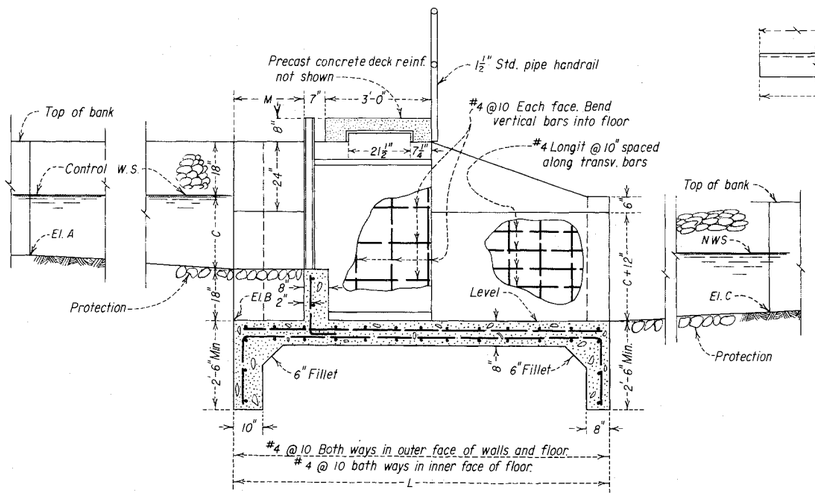
SECTION C-C



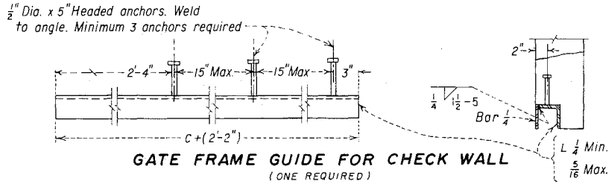
SECTION D-D



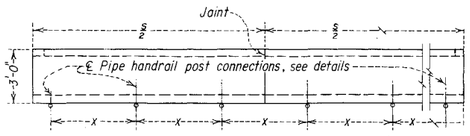
TYPICAL SLIDE GATE ASSEMBLY



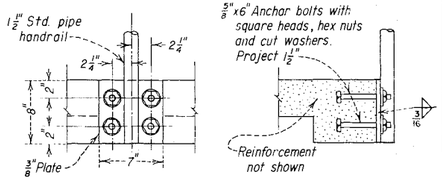
SECTION A-A



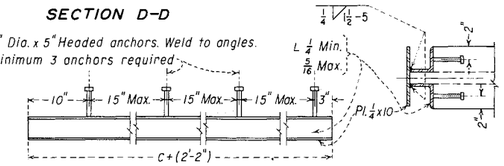
GATE FRAME GUIDE FOR CHECK WALL
(ONE REQUIRED)



PLAN OF PRECAST CONCRETE DECK



PIPE HANDRAIL POST CONNECTION DETAILS



GATE FRAME GUIDE FOR PIER WALL
(ONE REQUIRED)

STR. NO.	MAX. Q	** SLIDE GATES * WIDTH & HEIGHT	FRM. HT.	STANDARD DIMENSIONS B	C	L	M	S	X	EST. QUANTITIES CONC. CU. YDS.	REINF. STEEL LBS.	MISC. METAL LBS.
1	61	42"x 30"	6'	7'-10"	2'-8"	8'-0"	0	19'-10"	6'-3"	10.0	960	380
2	74	42"x 36"	7'	7'-10"	3'-2"	8'-6"	0	21'-4"	6'-9"	11.0	1060	410
3	86	42"x 42"	7'	7'-10"	3'-8"	10'-6"	18"	22'-10"	7'-3"	13.1	1260	440
4	98	42"x 48"	7'	7'-10"	4'-3"	13'-0"	3'-0"	24'-7"	7'-10"	15.9	1520	485
5	110	42"x 54"	8'	7'-10"	4'-9"	13'-6"	3'-0"	26'-1"	5'-0"	17.3	1650	555
6	70	48"x 30"	6'	8'-10"	2'-9"	8'-0"	0	21'-1"	6'-8"	11.5	1020	400
7	84	48"x 36"	7'	8'-10"	3'-3"	8'-6"	0	22'-7"	7'-2"	11.6	1130	430
8	98	48"x 42"	7'	8'-10"	3'-9"	10'-6"	18"	24'-1"	7'-8"	13.8	1330	460
9	112	48"x 48"	7'	8'-10"	4'-3"	13'-0"	3'-0"	25'-7"	4'-11"	16.4	1590	530
10	126	48"x 54"	8'	8'-10"	4'-9"	13'-6"	3'-0"	27'-1"	5'-3"	17.8	1710	675
11	105	60"x 36"	7'	10'-10"	3'-3"	10'-0"	18"	24'-7"	7'-10"	13.4	1330	530
12	123	60"x 42"	7'	10'-10"	3'-9"	13'-0"	3'-0"	26'-1"	5'-0"	16.4	1620	610
13	140	60"x 48"	7'	10'-10"	4'-3"	15'-0"	3'-0"	27'-7"	5'-4"	18.9	1850	650

* When a gate of specified height is not available, a gate with next greater available height shall be used with apprcpriate frame height.
** Two gates required each check.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Outer face transverse bars to be continuous in walls and floor
Thickness of concrete to vary uniformly between dimensions shown.
Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast deck.
Set El. B so that top of check wall is at control water surface elevation.
Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWING

TYPICAL PROTECTION

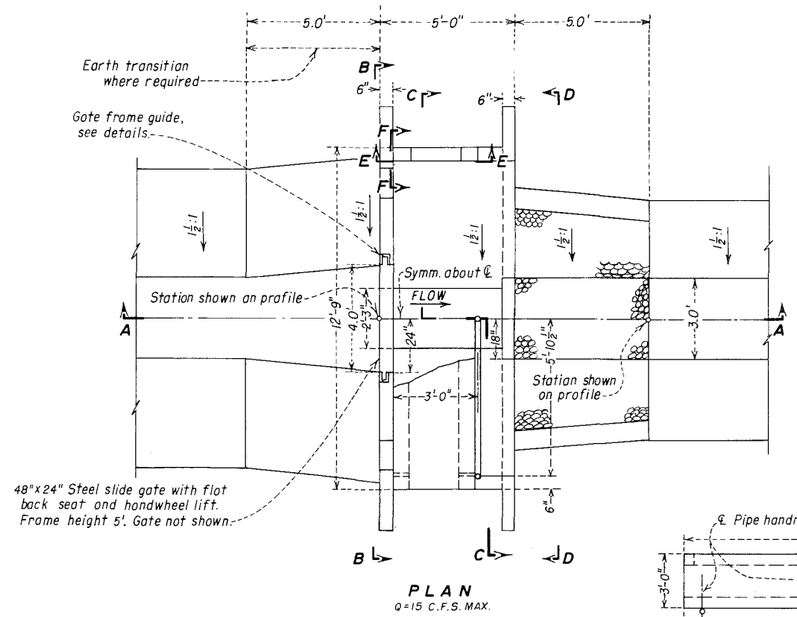
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

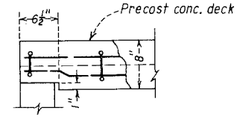
CONCRETE CHECKS WITH 1.5' DROP TYPE 14

C-100-40

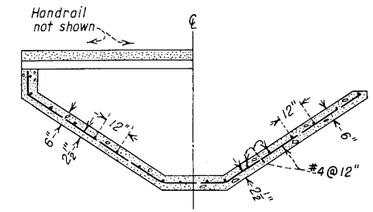
DRAWN W.A.K. SUBMITTED
TRACED D.J.P. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO



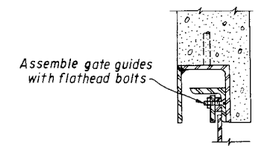
PLAN
Q=15 C.F.S. MAX.



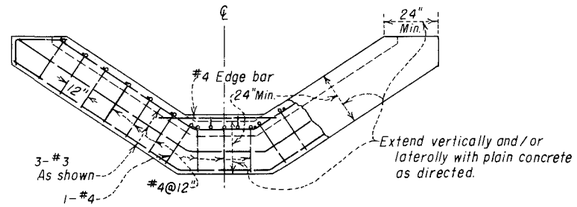
SECTION F-F



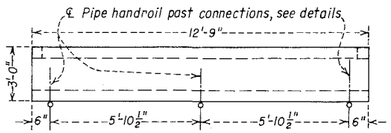
SECTION C-C



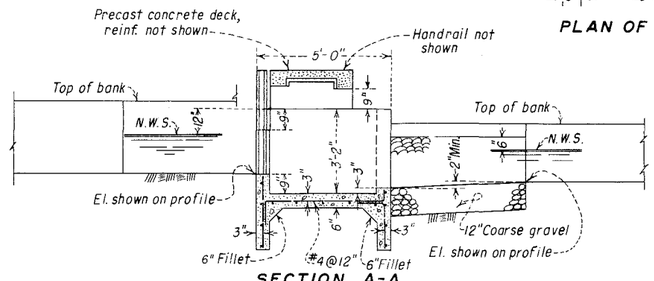
TYPICAL SLIDE GATE ASSEMBLY



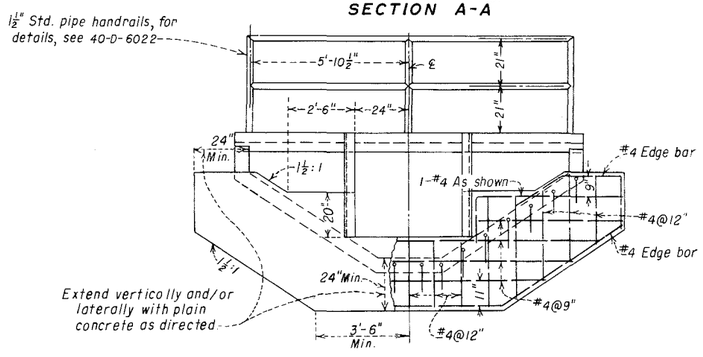
ELEVATION D-D



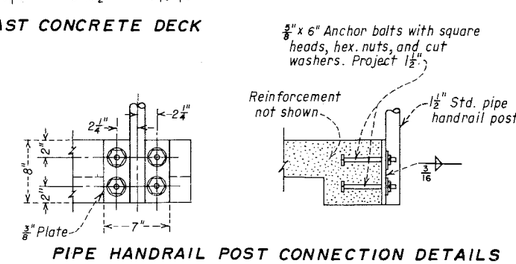
PLAN OF PRECAST CONCRETE DECK



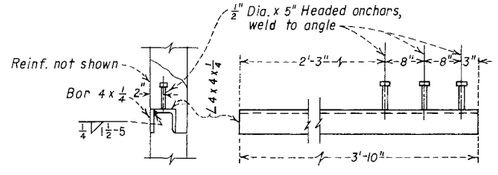
SECTION A-A



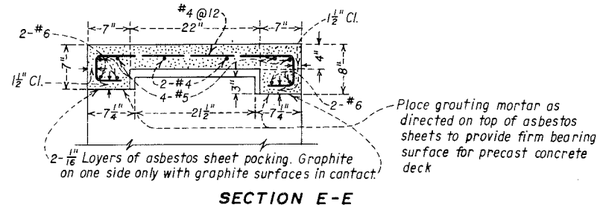
ELEVATION B-B



PIPE HANDRAIL POST CONNECTION DETAILS



GATE FRAME GUIDE DETAILS
(2 REQUIRED)



SECTION E-E

1 0 5 10
SCALE OF FEET

ESTIMATED QUANTITIES

Concrete in structure	3.5 Cu. Yds.
Reinforcement steel	370 Lbs.
Miscellaneous metal	210 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured from ℄ of gate opening.

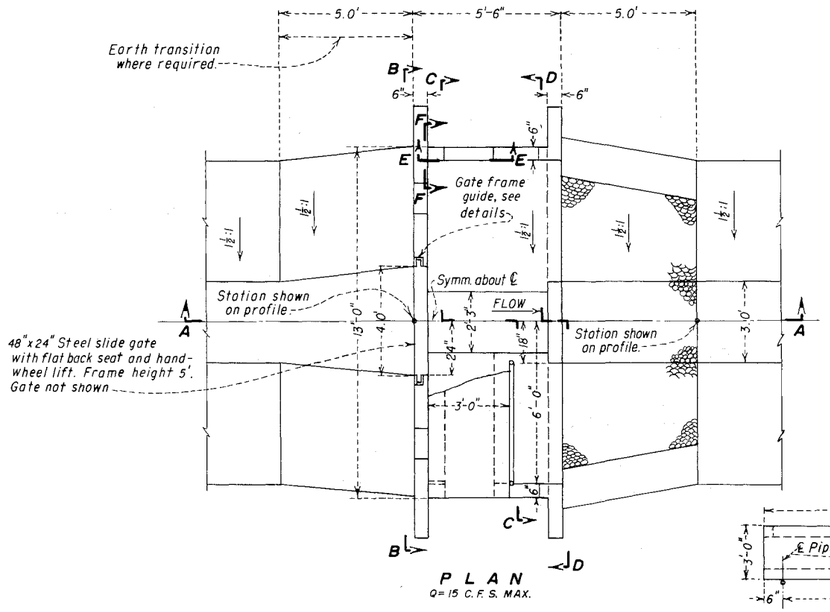
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

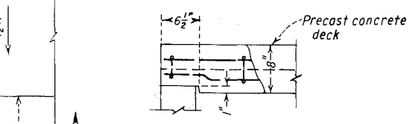
CHECK DROP TYPE I

DRAWN W.G.M. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

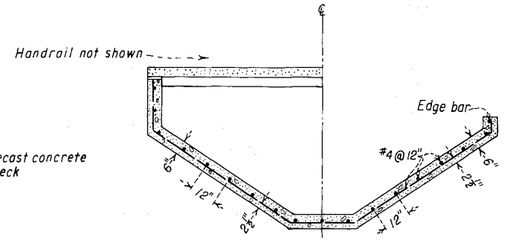
C 110.01



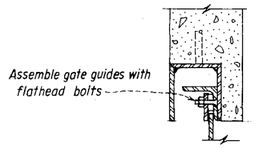
PLAN
Q=15 C.F.S. MAX.



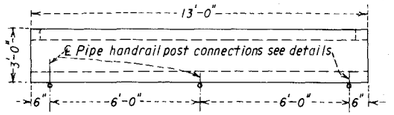
SECTION F-F



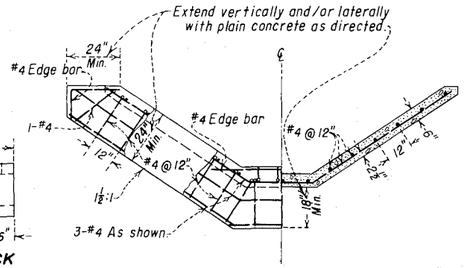
SECTION C-C



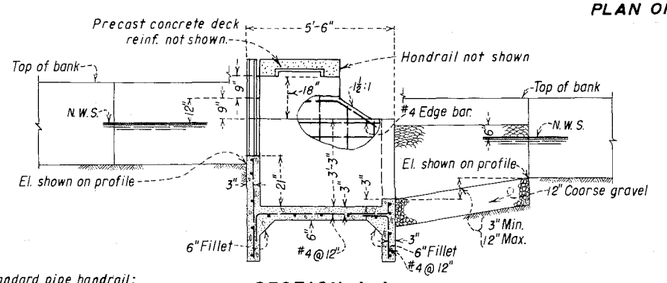
TYPICAL SLIDE GATE ASSEMBLY



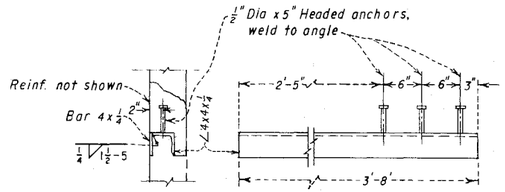
PLAN OF PRECAST CONCRETE DECK



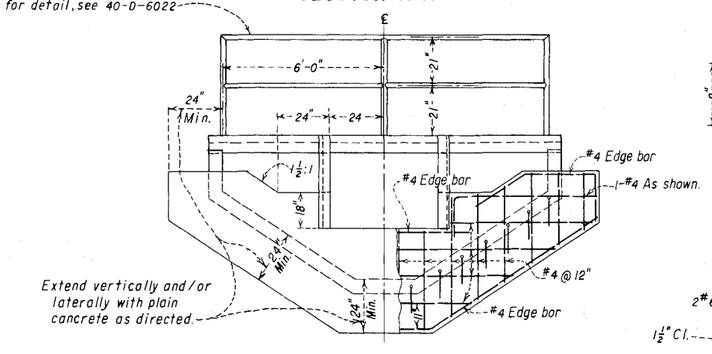
SECTION D-D



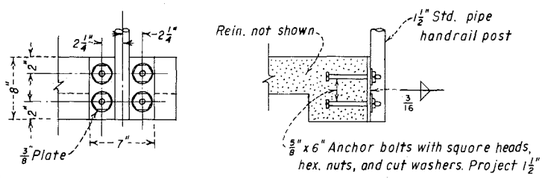
SECTION A-A



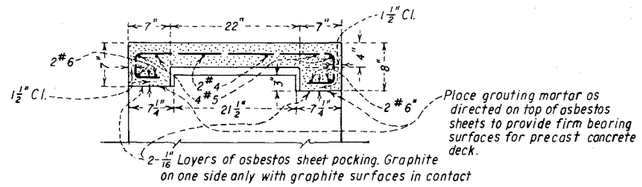
GATE FRAME GUIDE DETAILS
(2 REQUIRED)



ELEVATION B-B



PIPE HANDRAIL POST CONNECTION DETAILS



SECTION E-E

0 5 10
SCALE OF FEET

ESTIMATED QUANTITIES

Concrete in structure	3.7 Cu.Yds.
Reinforcement steel	400 Lbs.
Miscellaneous metal	200 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured from ℄ of gate opening.

ALWAYS THINK SAFETY

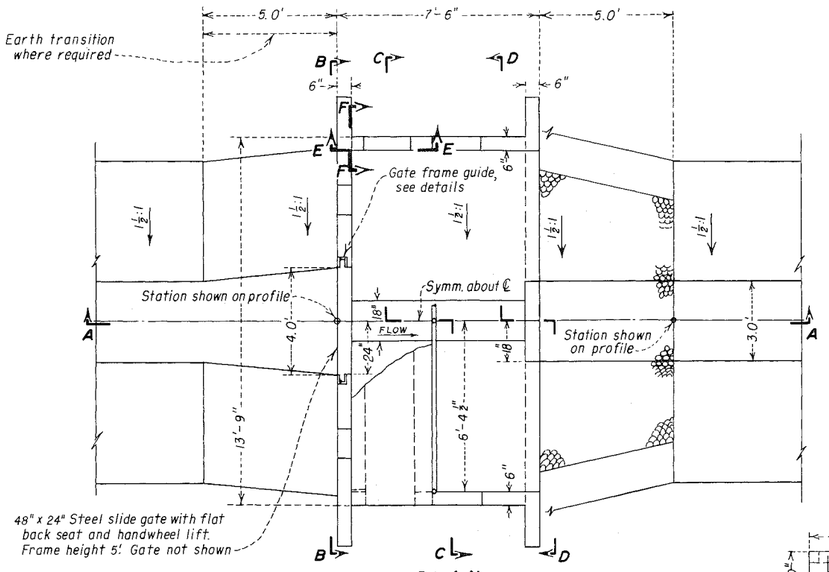
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CHECK DROP TYPE 2

C-110.02

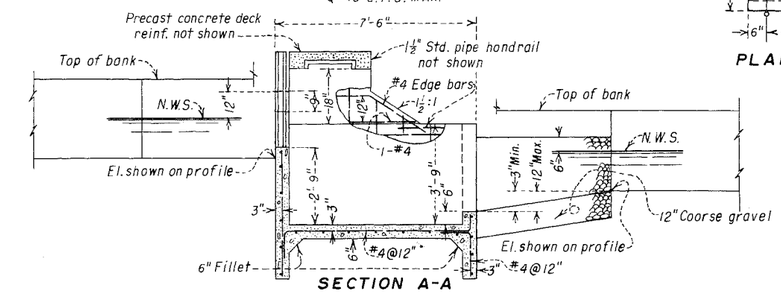
DRAWN	R.S.D.	SUBMITTED	
TRACED	G.D.B.	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH

DENVER, COLORADO

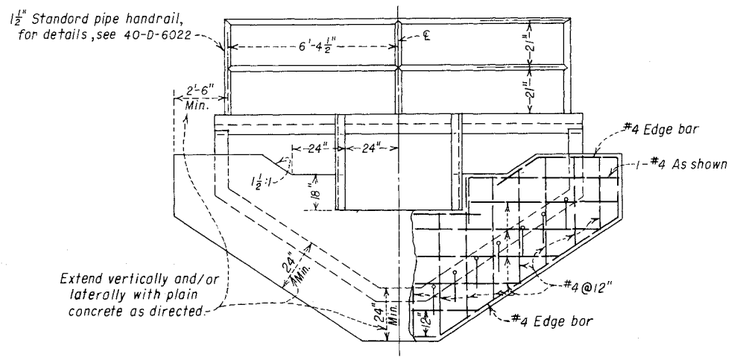


PLAN

Q = 15 C.F.S. MAX.



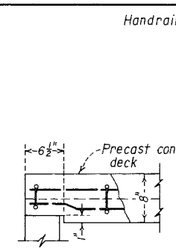
SECTION A-A



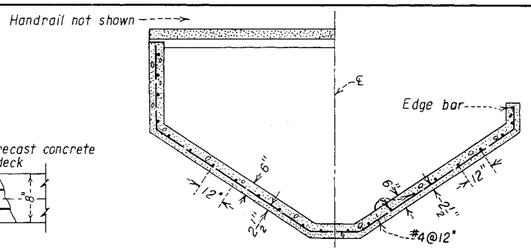
ELEVATION B-B

SCALE OF FEET

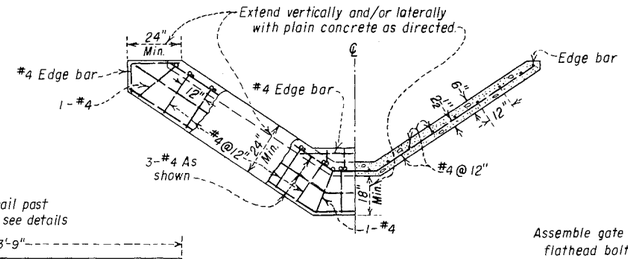
1 0 5 10



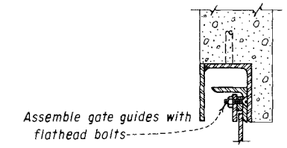
SECTION F-F



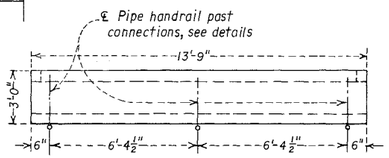
SECTION C-C



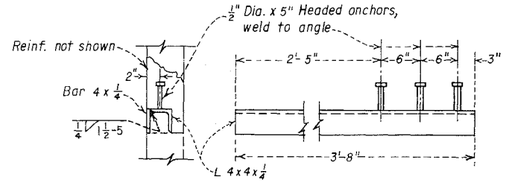
SECTION D-D



TYPICAL SLIDE GATE ASSEMBLY

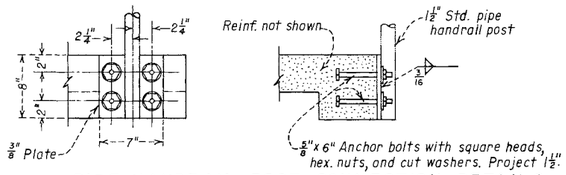


PLAN OF PRECAST CONCRETE PIPE

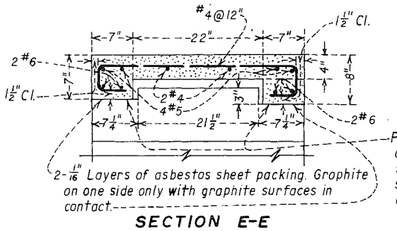


GATE FRAME GUIDE DETAILS

(2 REQUIRED)



PIPE HANDRAIL POST CONNECTION DETAILS



SECTION E-E

ESTIMATED QUANTITIES

Concrete in structure	4.6 Cu. Yds.
Reinforcement steel	480 Lbs.
Miscellaneous metal	210 Lbs.

NOTES

Chamfer all exposed corners ¾" unless otherwise shown.

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Gate frame height measured from ℄ of gate opening.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CHECK DROP TYPE 3

C 110.03

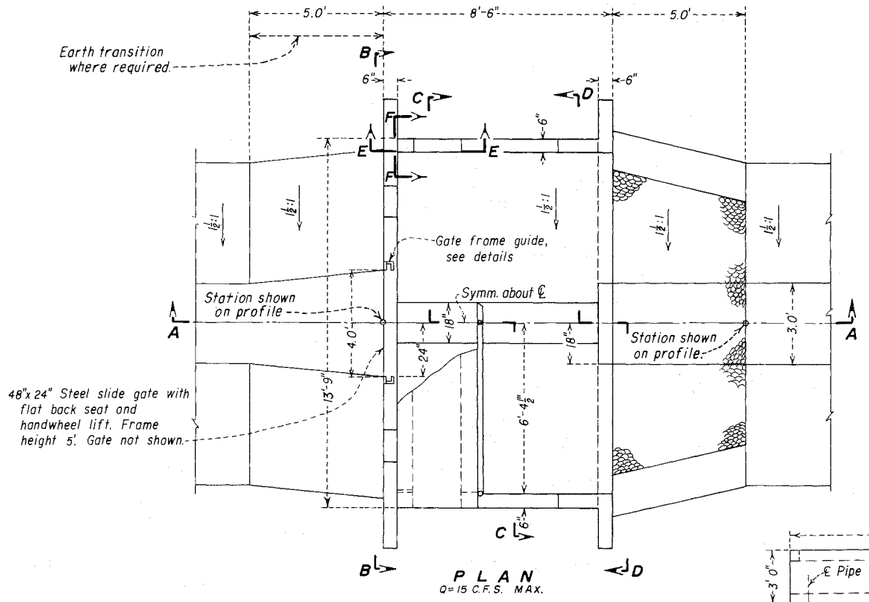
DRAWN E.V.G. SUBMITTED

TRACED H.M.G. RECOMMENDED

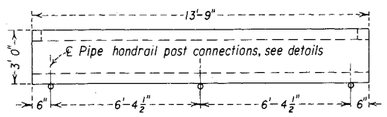
CHECKED APPROVED

CHIEF, CANALS BRANCH

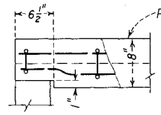
DENVER, COLORADO



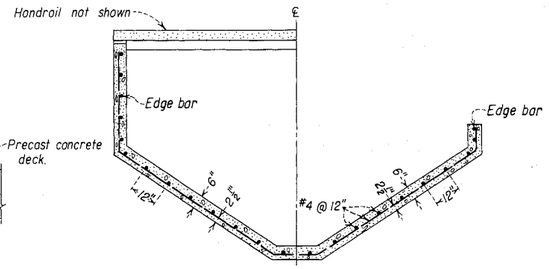
P L A N
Q = 15 C.F.S. MAX.



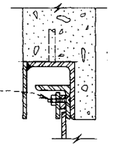
PLAN OF PRECAST CONCRETE DECK



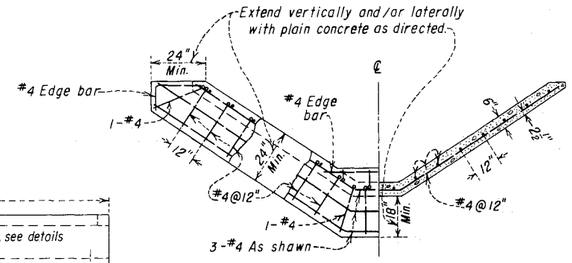
SECTION F-F



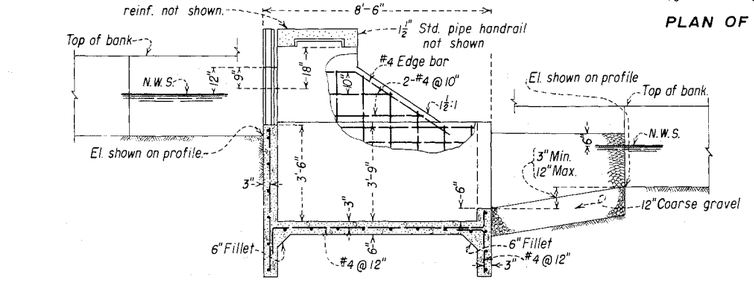
SECTION C-C



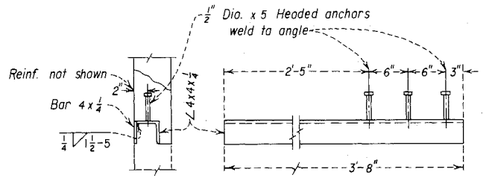
TYPICAL SLIDE GATE ASSEMBLY



SECTION D-D



SECTION A-A



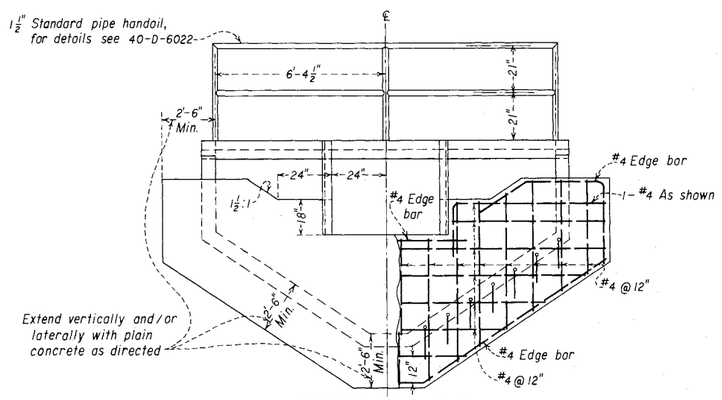
GATE FRAME GUIDE DETAILS
(2 REQUIRED)

ESTIMATED QUANTITIES

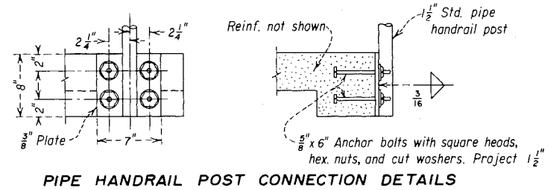
Concrete in structure	5.3 Cu. Yds.
Reinforcement steel	540 Lbs.
Miscellaneous metal	210 Lbs.

NOTES

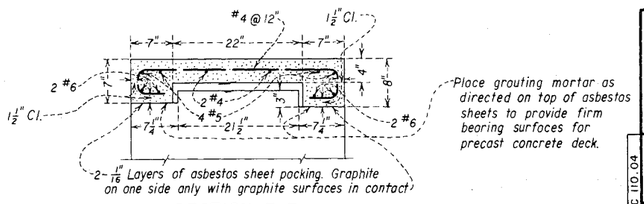
Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirments for detailing reinforcement, see 40-D-6123.
Gate frame height measured from ℄ of gate opening.



ELEVATION B-B



PIPE HANDRAIL POST CONNECTION DETAILS



SECTION E-E

Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast concrete deck.

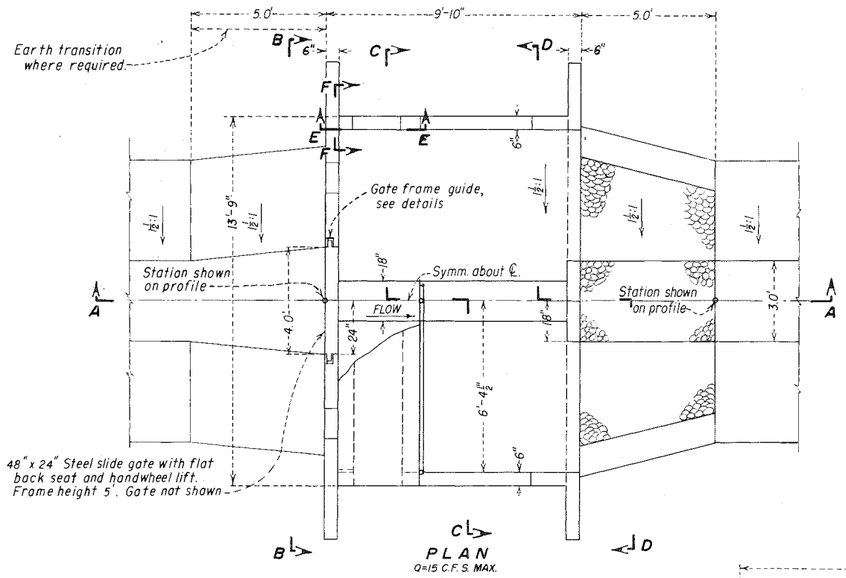
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

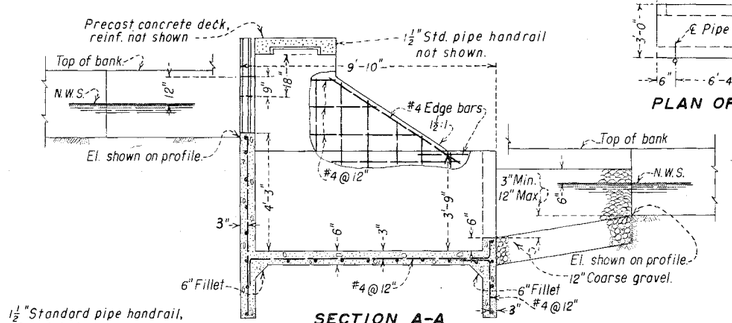
CHECK DROP TYPE 4

C 110-04

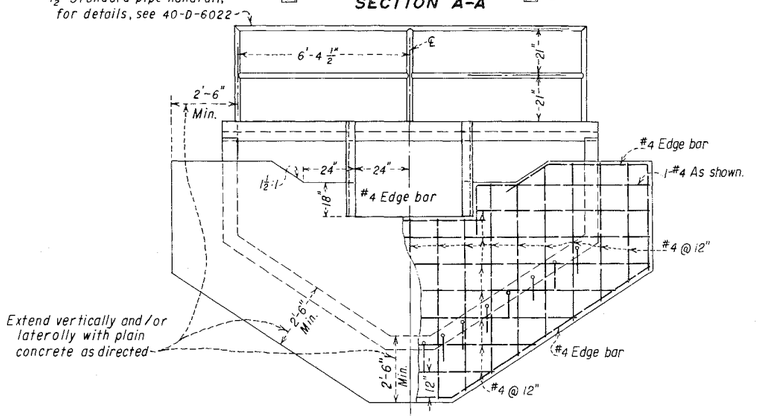
DRAWN R.S.D. SUBMITTED
TRACED C.D.B. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO.



PLAN
Q=15 C.F.S. MAX.

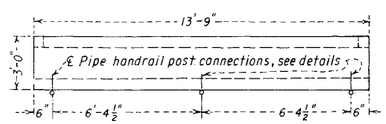


SECTION A-A

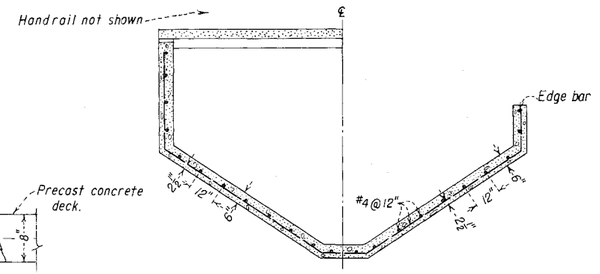


ELEVATION B-B

SCALE OF FEET

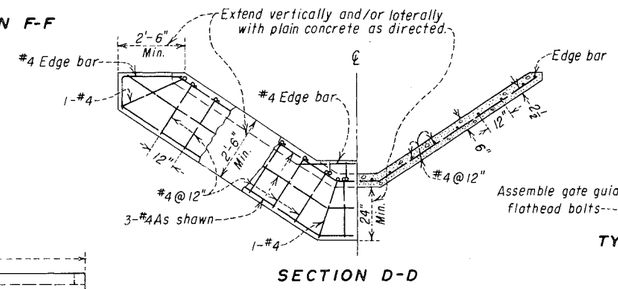


PLAN OF PRECAST CONCRETE DECK

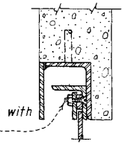


SECTION C-C

SECTION F-F



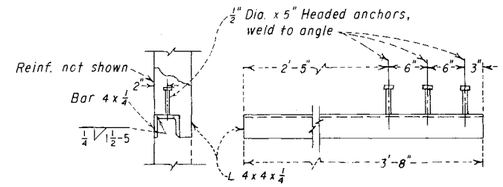
SECTION D-D



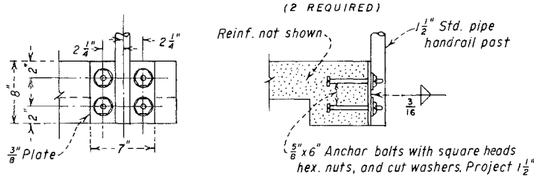
TYPICAL SLIDE GATE ASSEMBLY

ESTIMATED QUANTITIES

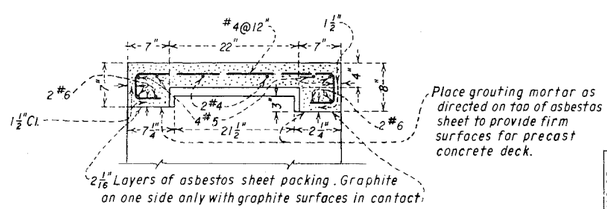
Concrete in structure	5.7 Cu. Yds.
Reinforcement steel	580 Lbs.
Miscellaneous metal	210 Lbs.



GATE FRAME GUIDE DETAILS
(2 REQUIRED)



PIPE HANDRAIL POST CONNECTION DETAILS



SECTION E-E

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirments for detailing reinforcement, see 40-D-6123.
Gate frame height measured from ℄ of gate opening

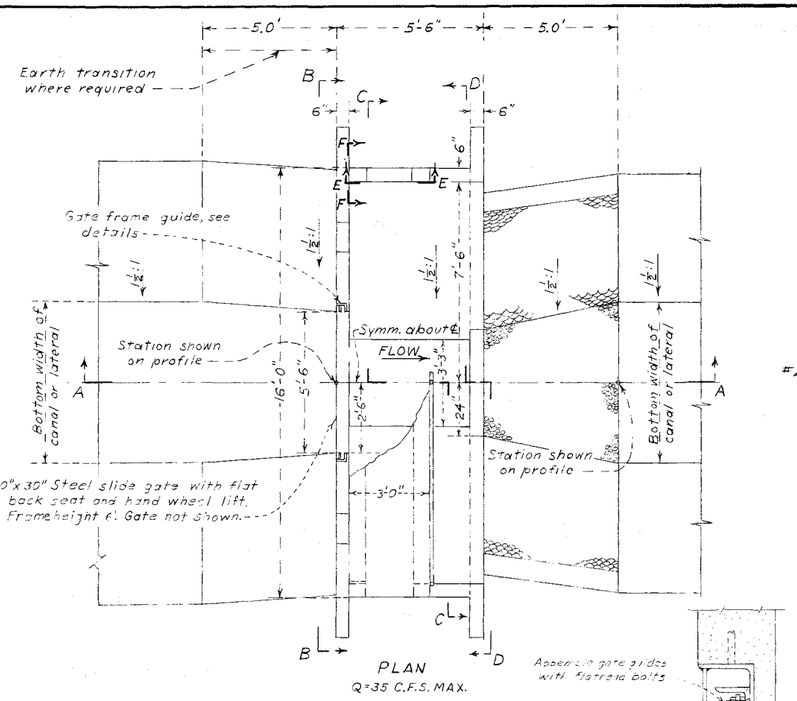
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

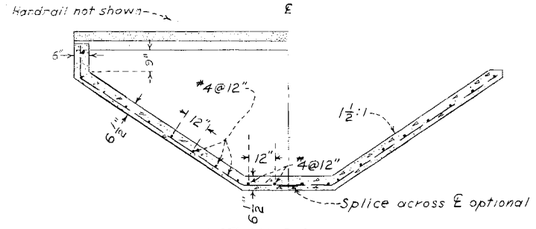
CHECK DROP TYPE 5

DRAWN	E.V.G.	SUBMITTED	
TRACED	C.D.B.	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH
DENVER, COLORADO,			

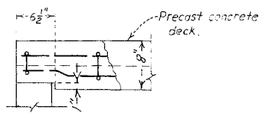
C 110.05



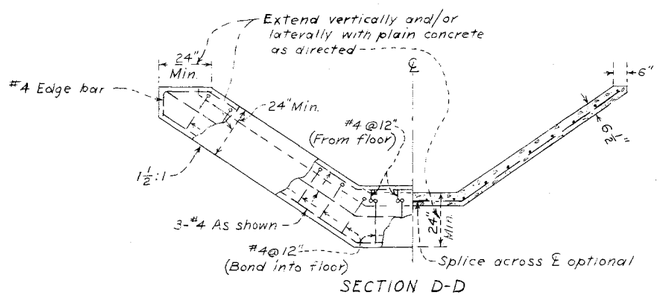
TYPICAL SLIDE GATE ASSEMBLY



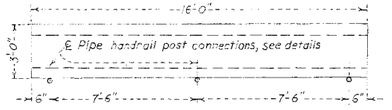
SECTION C-C



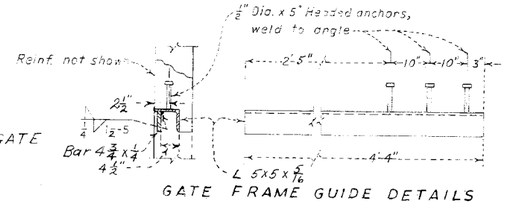
SECTION F-F



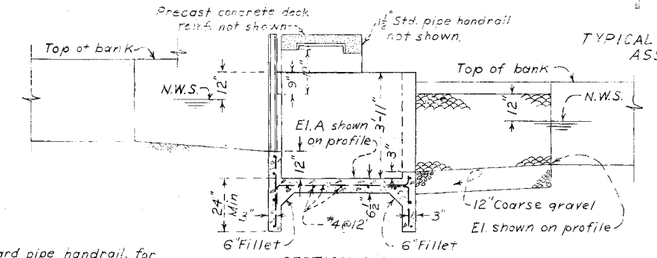
SECTION D-D



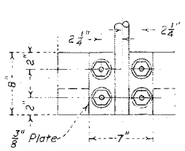
PLAN OF PRECAST CONCRETE DECK

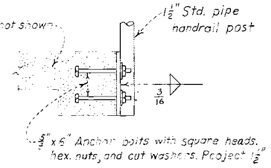


GATE FRAME GUIDE DETAILS
(2 REQUIRED)

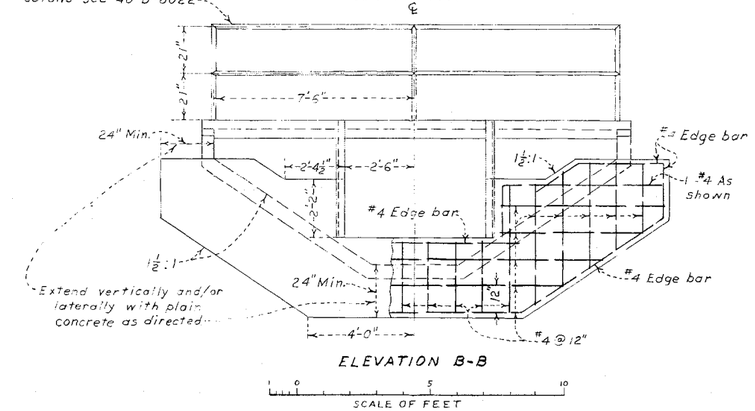


SECTION A-A



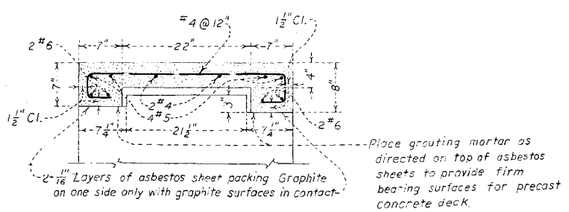


PIPE HANDRAIL POST CONNECTION DETAILS



ELEVATION B-B

SCALE OF FEET
0 5 10



SECTION E-E

ESTIMATED QUANTITIES

Concrete	4.8 Cu. Yds.
Reinforcement steel	470 Lbs.
Miscellaneous metal	330 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements, for detailing reinforcement, see 40-D-6123.
Gate frame height to be measured from ℄ of gate opening.

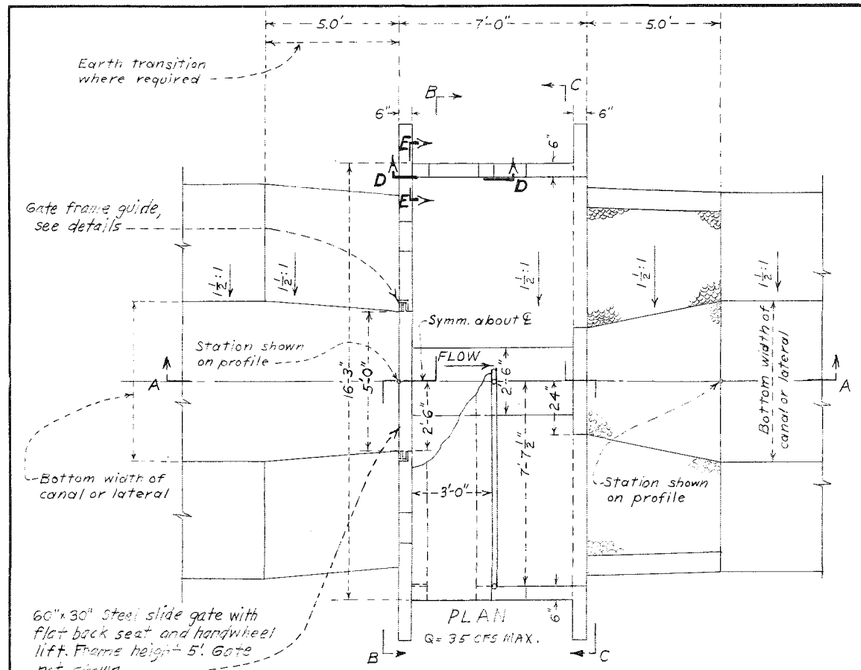
ALWAYS THINK SAFETY

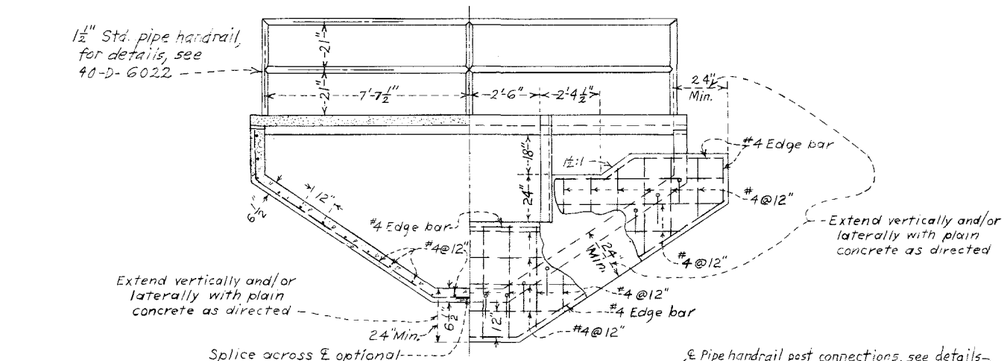
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

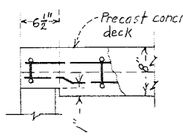
CHECK DROP TYPE 6

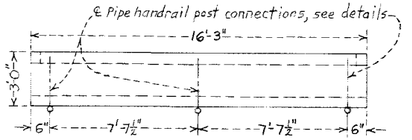
C 110.06

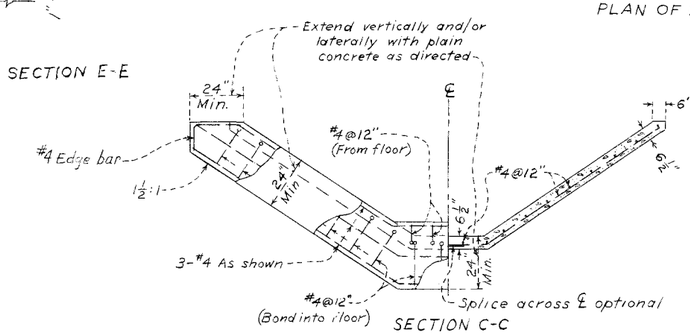
DRAWN L.F.W.-W.D.F. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO

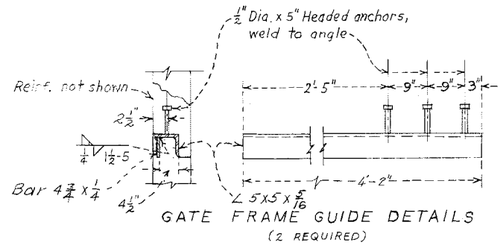


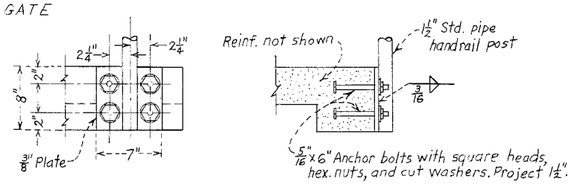












ESTIMATED QUANTITIES

Concrete	5.4 Cu. Yds.
Reinforcement steel	530 Lbs.
Miscellaneous metal	230 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height to be measured from ℄ of gate opening

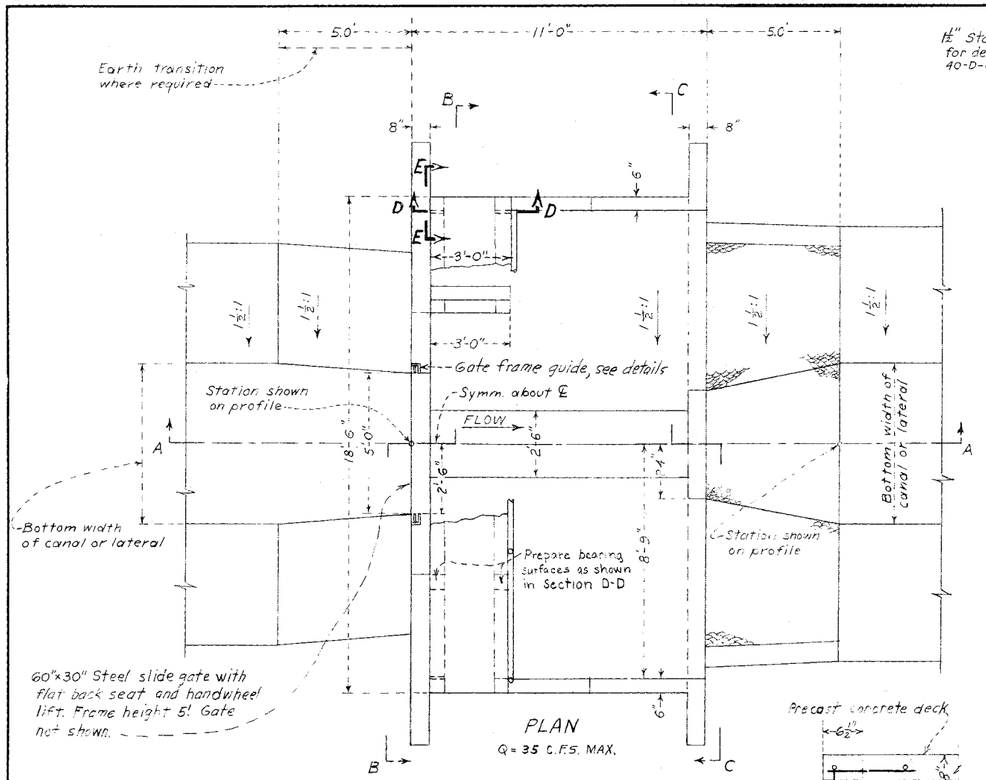
ALWAYS THINK SAFETY

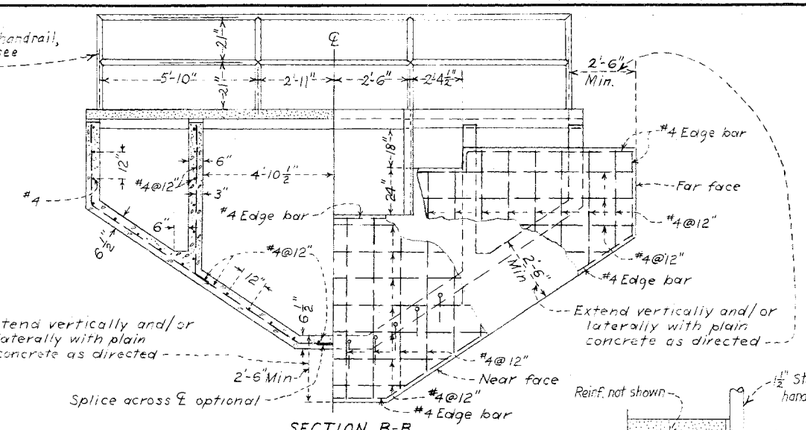
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CHECK DROP TYPE 7

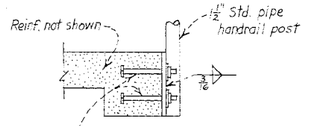
C 110.07

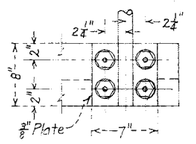
DRAWN L.F.W.-W.D.F. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO



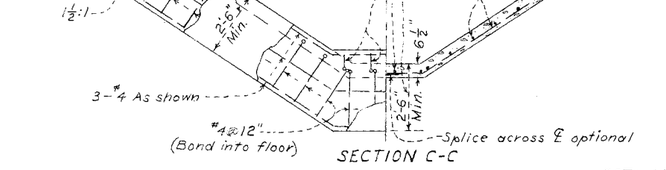


SECTION B-B

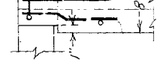




PIPE HANDRAIL POST CONNECTION DETAILS



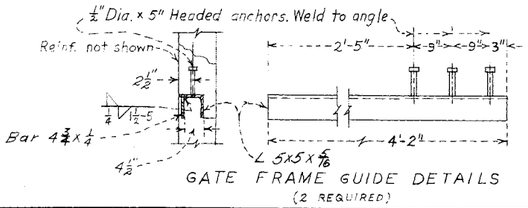
SECTION C-C



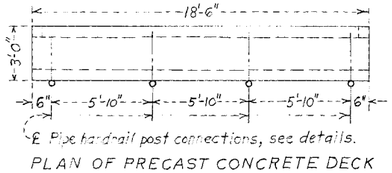
SECTION E-E

TYPICAL SLIDE GATE ASSEMBLY

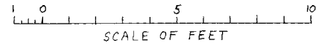
SECTION A-A

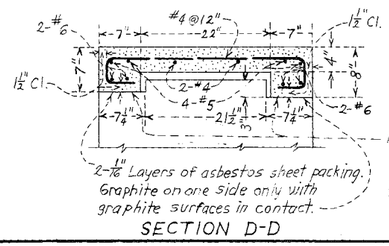


GATE FRAME GUIDE DETAILS
(2 REQUIRED)



PLAN OF PRECAST CONCRETE DECK





SECTION D-D

ESTIMATED QUANTITIES

Concrete	11.1 Cu. Yds.
Reinforcement steel	1100 Lbs.
Miscellaneous metal	260 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height to be measured from ℄ of gate opening.

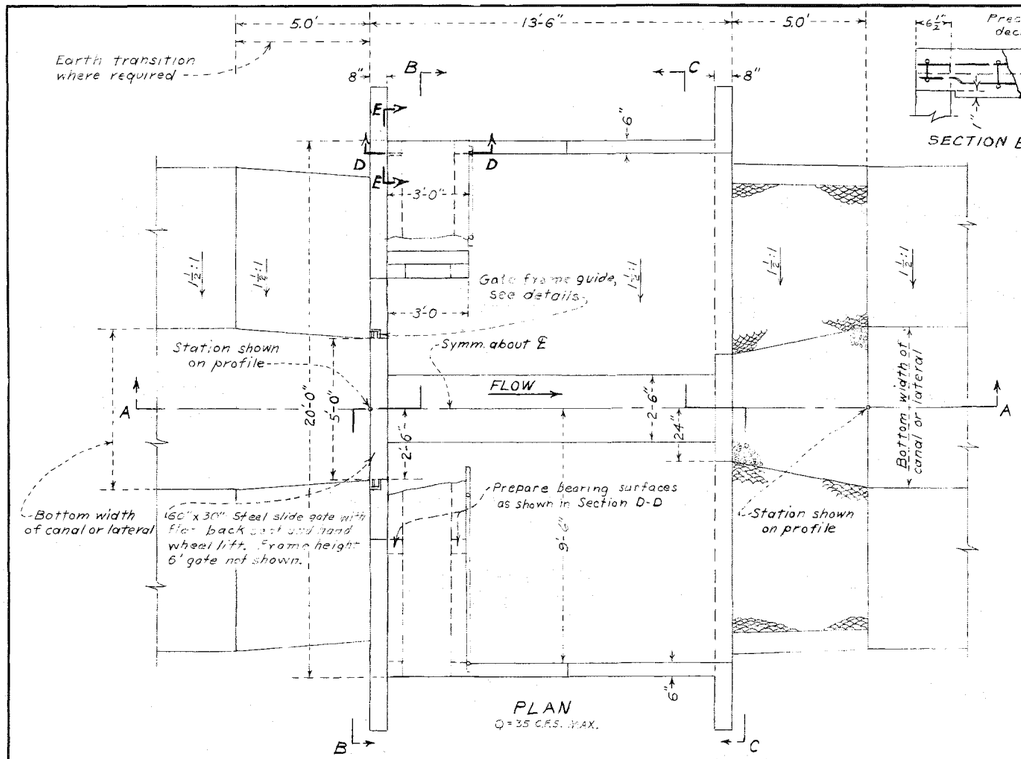
ALWAYS THINK **SAFETY**

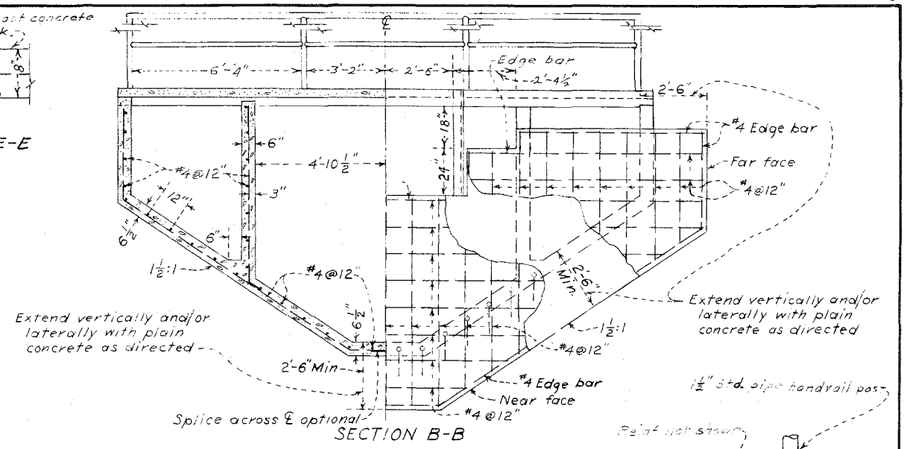
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

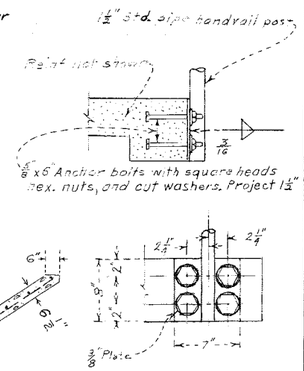
CHECK DROP TYPE 9

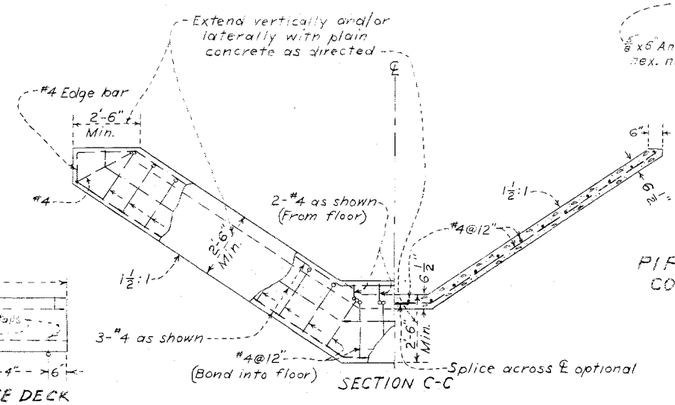
C 110.09

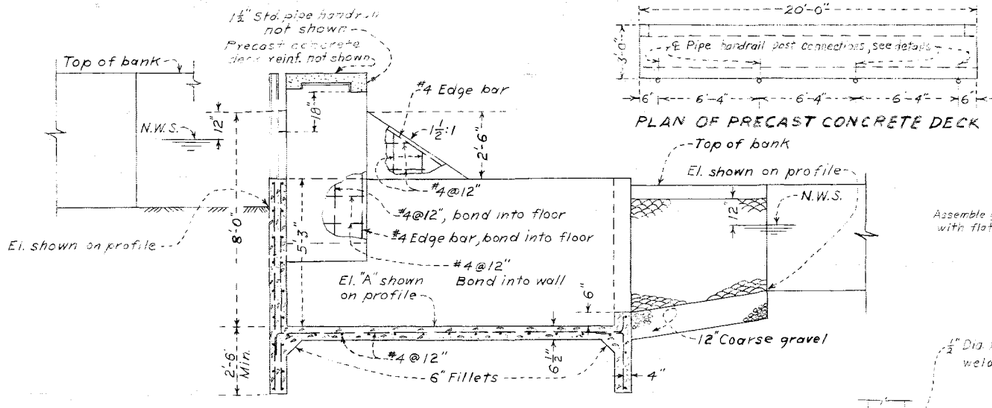
DRAWN L.E.W.-W.D.F. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO

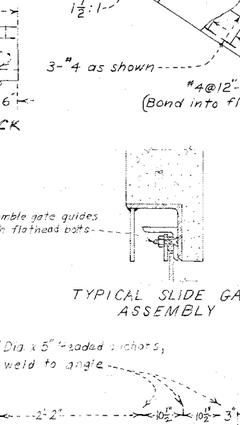


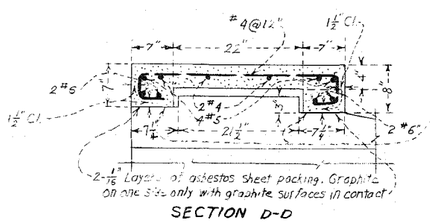




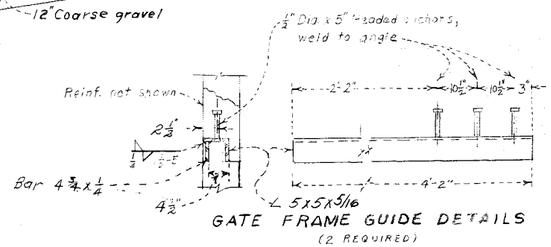








Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast concrete deck.



SCALE OF FEET
1 0 5 10

ESTIMATED QUANTITIES

Concrete	13.4 Cu. Yds.
Reinforcement steel	1310 Lbs.
Miscellaneous metal	260 Lbs.

NOTES

Chamfer all exposed corners ¾" unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-8123.
Gate frame height to be measured from ℄ of gate opening.

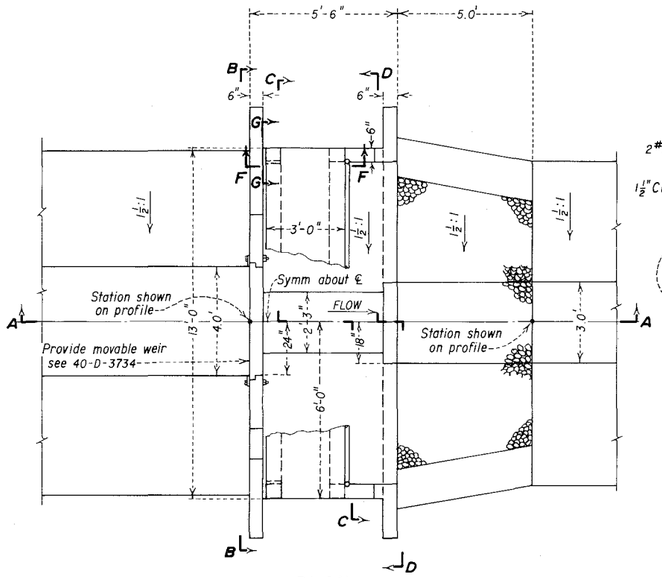
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MISSOURI RIVER BASIN PROJECT

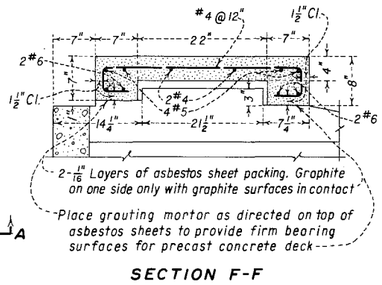
CHECK DROP TYPE 10

C 110.10

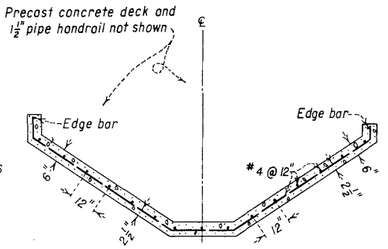
DRAWN L.E.W.-W.O.F. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO



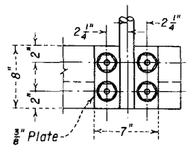
PLAN
Q= 6 C.F.S. MAX.

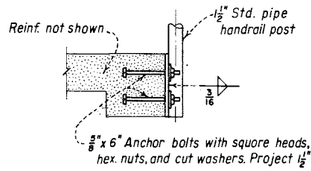


SECTION F-F

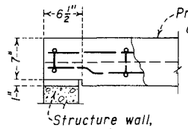


SECTION C-C

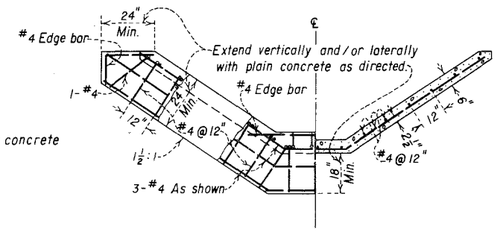




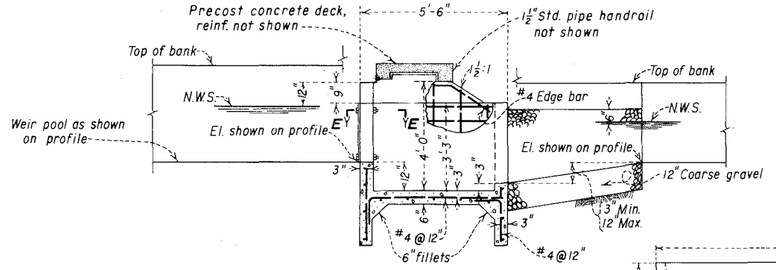
PIPE HANDRAIL POST CONNECTION DETAILS



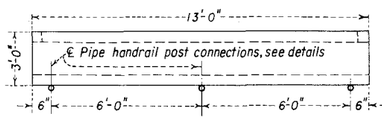
SECTION G-G



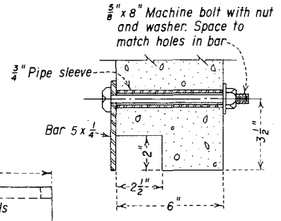
SECTION D-D



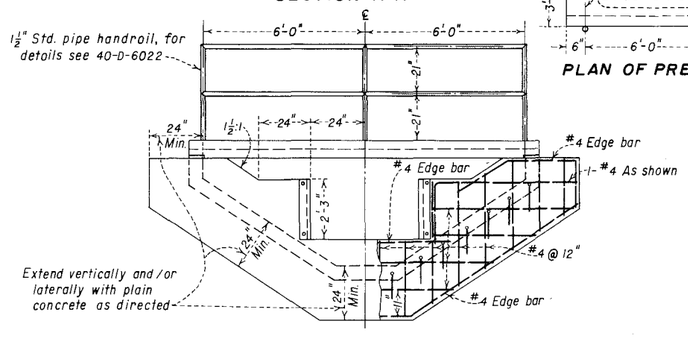
SECTION A-A



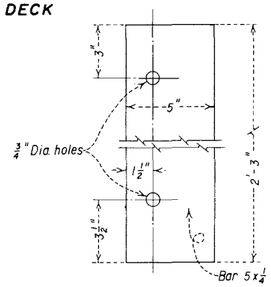
PLAN OF PRECAST CONCRETE DECK



SECTION E-E



ELEVATION B-B



DETAIL OF BAR

SCALE OF FEET
1 0 5 10

ESTIMATED QUANTITIES

Concrete in structure	3.7 Cu. Yds.
Reinforcement steel	390 Lbs.
Miscellaneous metal	140 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

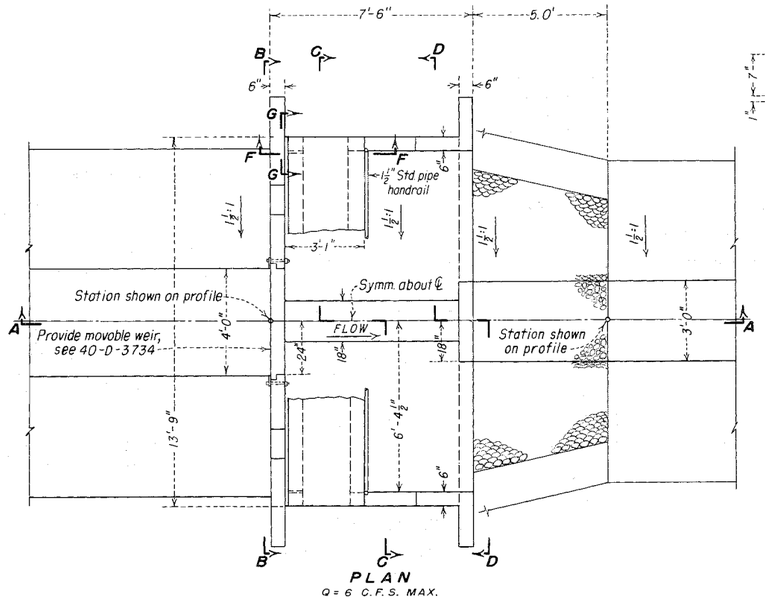
ALWAYS THINK SAFETY

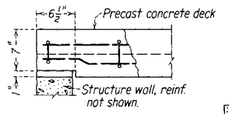
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CHECK DROP TYPE 2 WITH MOVABLE WEIR

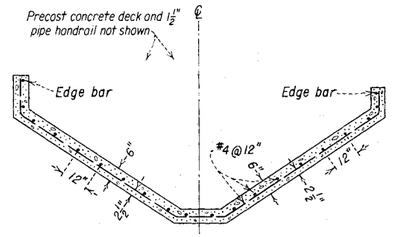
C 111-02

DRAWN R.S.D. SUBMITTED
TRACED A.W.G. RECOMMENDED
CHECKED APPROVED
CHIEF CANALS BRANCH
DENVER, COLORADO

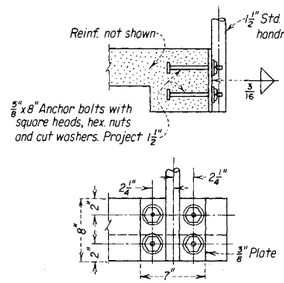




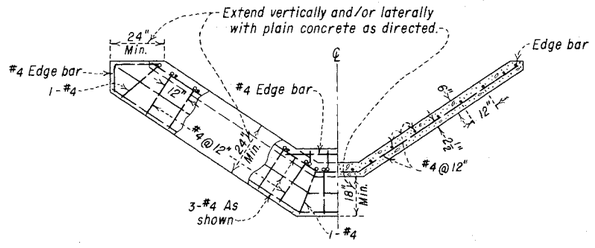
SECTION G-G



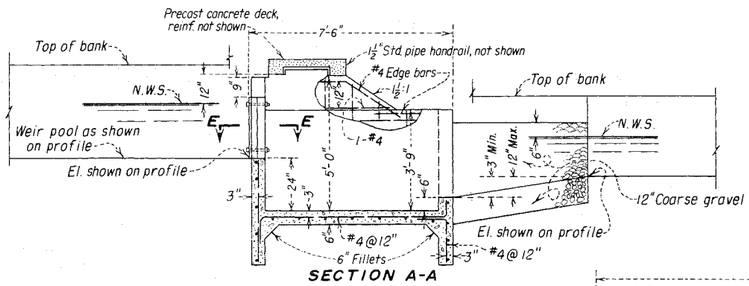
SECTION C-G



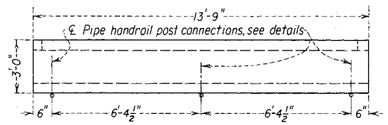
PIPE HANDRAIL POST CONNECTION DETAILS



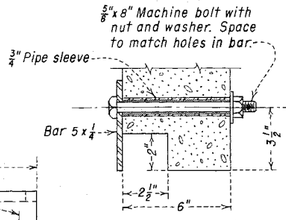
SECTION D-D



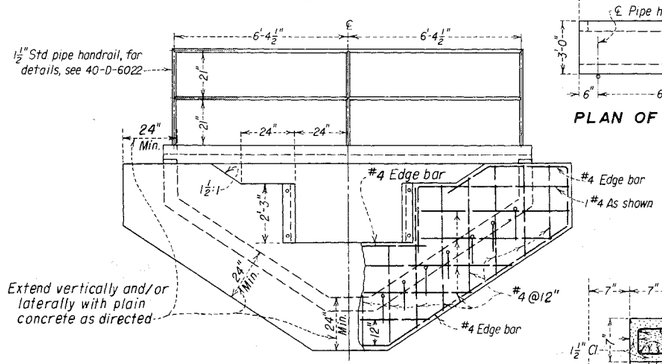
SECTION A-A



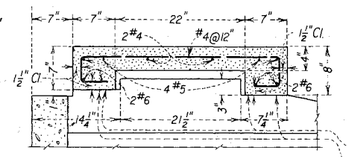
PLAN OF PRECAST CONCRETE DECK



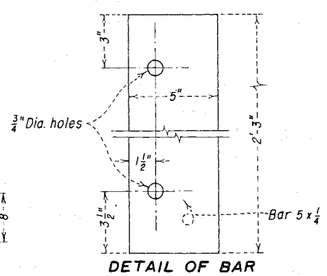
SECTION E-E



ELEVATION B-B



SECTION F-F



DETAIL OF BAR

Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast concrete deck.

2-1/16" Layers of asbestos sheet packing. Graphite on one side only with graphite surfaces in contact.

0 5 10
SCALE OF FEET

ESTIMATED QUANTITIES

Concrete in structure	4.5	Cu. Yds.
Reinforcement steel	470	Lbs.
Miscellaneous metal	160	Lbs.

NOTES

Chamfer all exposed corners ¾" unless otherwise shown
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

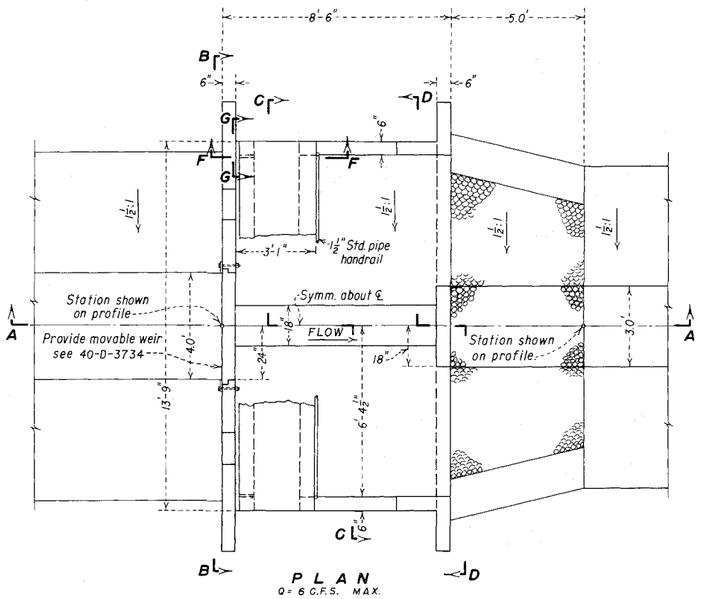
ALWAYS THINK SAFETY

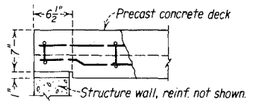
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CHECK DROP TYPE 3 WITH MOVABLE WEIR

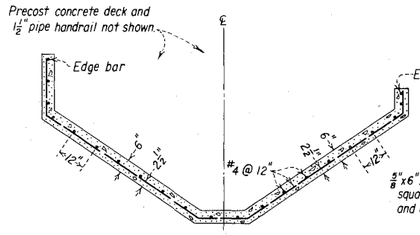
C-111-03

DRAWN E.V.G. SUBMITTED
TRACED H.M.G. - H.S.R. RECOMMENDED
CHECKED APPROVED
DENVER, COLORADO CHIEF, CANALS BRANCH

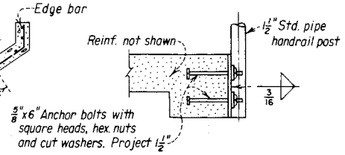


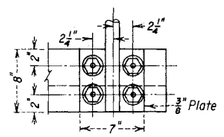


SECTION G-G

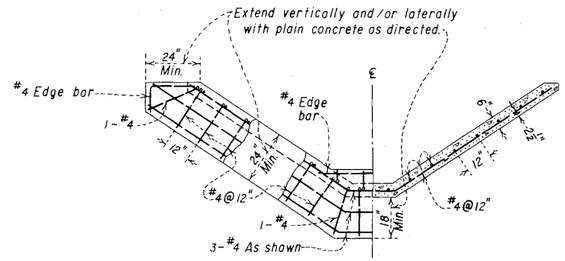


SECTION C-C





PIPE HANDRAIL POST CONNECTION DETAILS



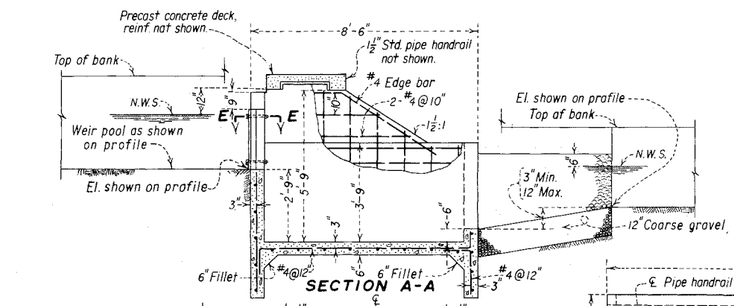
SECTION D-D

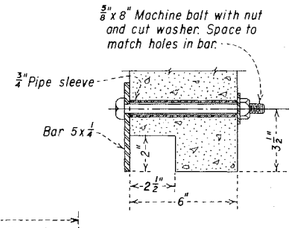
ESTIMATED QUANTITIES

Concrete in structure	5.2 Cu. Yds.
Reinforcement steel	530 Lbs.
Miscellaneous metal	160 Lbs.

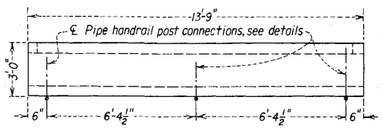
NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

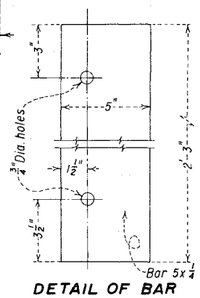




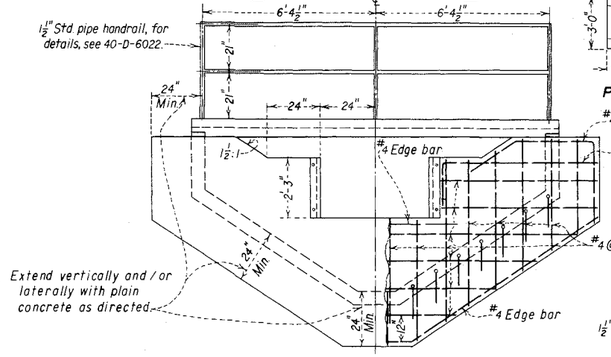
SECTION E-E

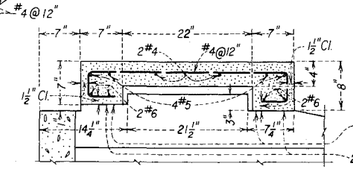


PLAN OF PRECAST CONCRETE DECK



DETAIL OF BAR





SECTION F-F

Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast concrete deck.
2-1/16" Layers of asbestos sheet packing. Graphite on one side only with graphite surfaces in contact.

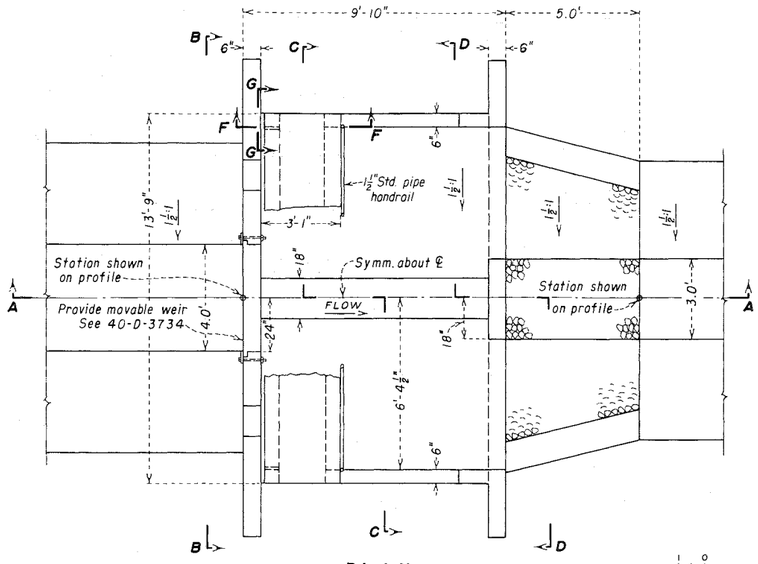
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

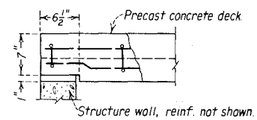
CHECK DROP TYPE 4 WITH MOVABLE WEIR

C 111.04

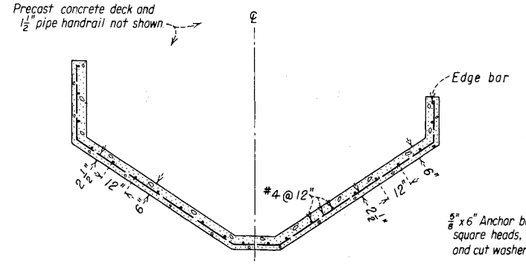
DRAWN R.S.D. SUBMITTED
TRACED D.L.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.



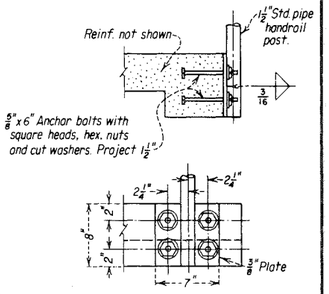
PLAN
Q = 6 C.F.S. MAX.



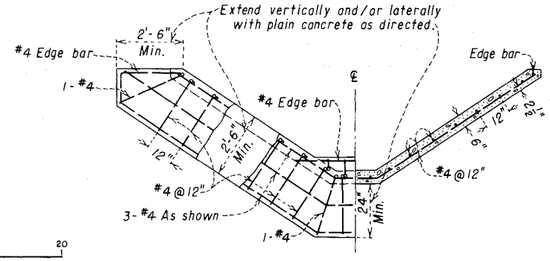
SECTION G-G



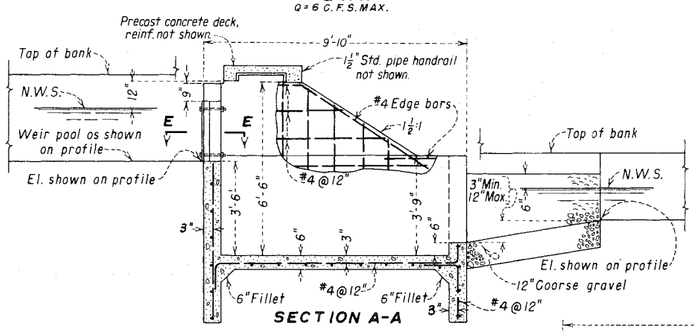
SECTION C-C



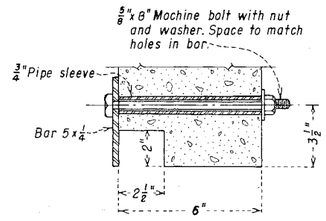
PIPE HANDRAIL POST CONNECTION DETAILS



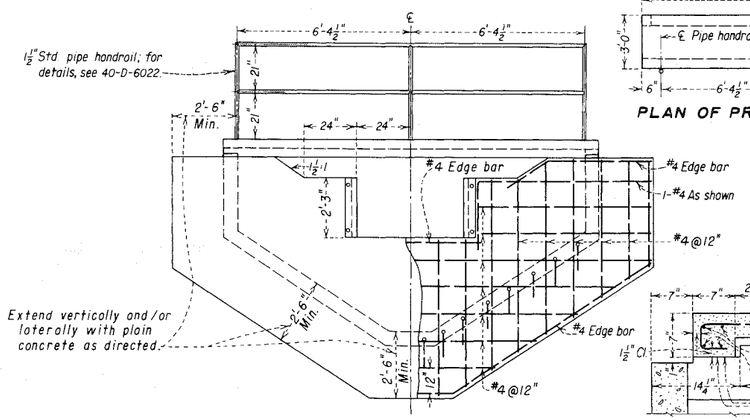
SECTION D-D



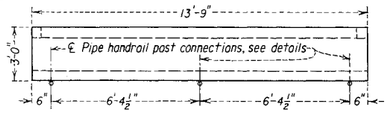
SECTION A-A



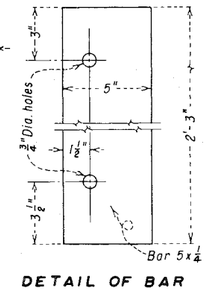
SECTION E-E



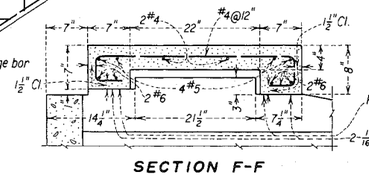
ELEVATION B-B



PLAN OF PRECAST CONCRETE DECK



DETAIL OF BAR



SECTION F-F

Place grouting mortar as directed on top of asbestos sheets to provide firm bearing surfaces for precast concrete deck.

SCALE OF FEET
1 0 5 10 15 20

ESTIMATED QUANTITIES

Concrete in structure	5.6 Cu. Yds.
Reinforcement steel	570 Lbs.
Miscellaneous metal	160 Lbs.

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

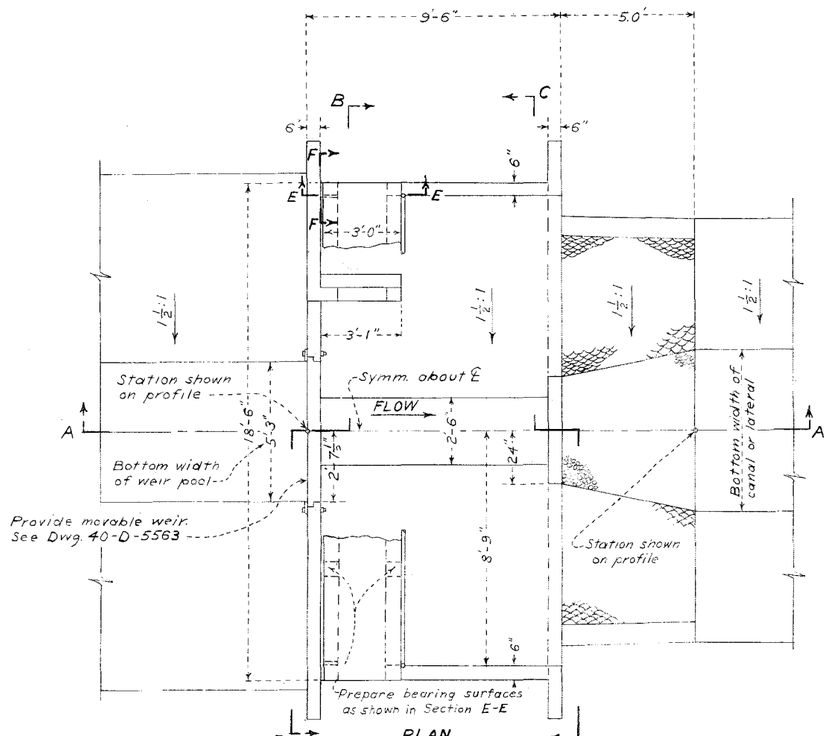
ALWAYS THINK SAFETY

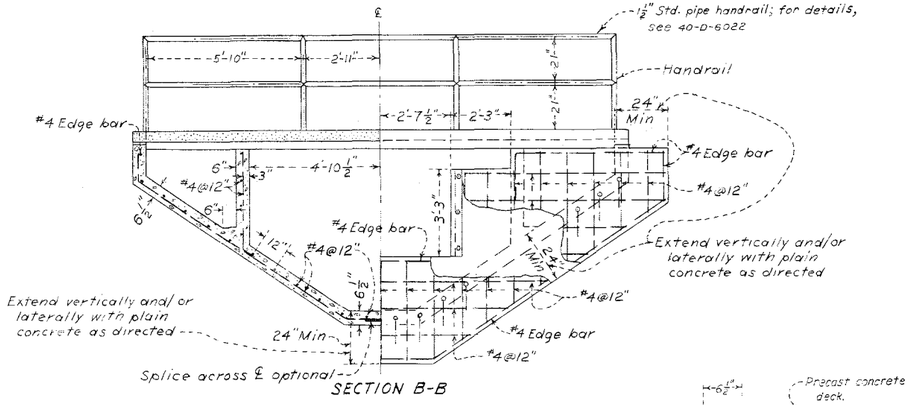
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

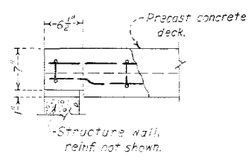
CHECK DROP TYPE 5 WITH MOVABLE WEIR

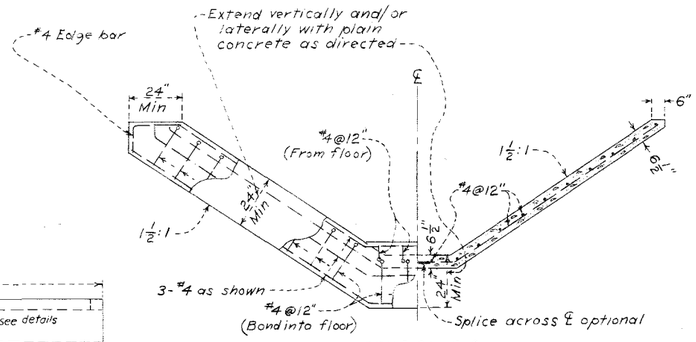
C III 05

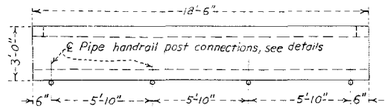
DRAWN E.V.S. SUBMITTED
TRACED E.V.C. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,

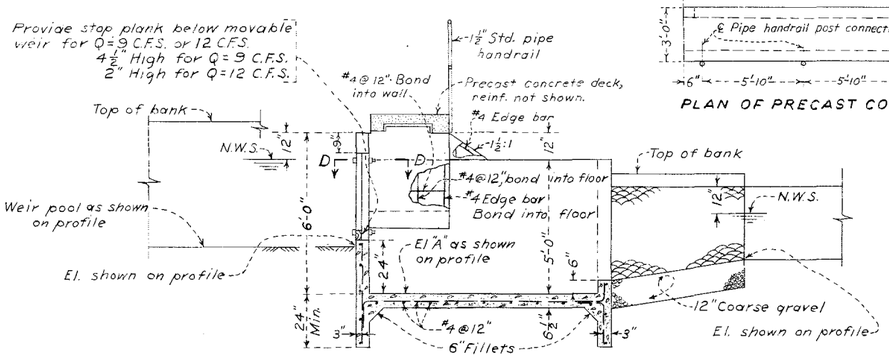


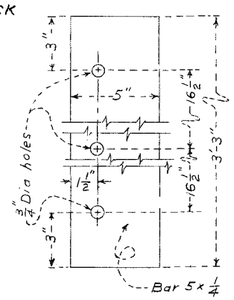












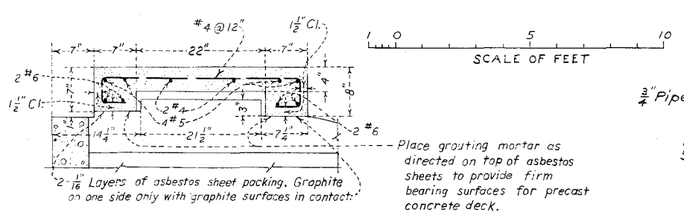
DETAIL OF BAR

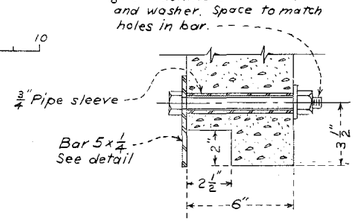
ESTIMATED QUANTITIES

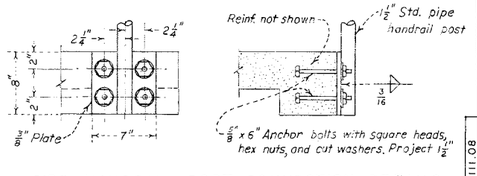
Concrete	7.9 Cu. Yds.
Reinforcement steel	730 Lbs.
Miscellaneous metal	190 Lbs.
Movable weir Q=15 C.F.S.	1 Ea.

NOTES

Chamfer all exposed corners ¾" unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.







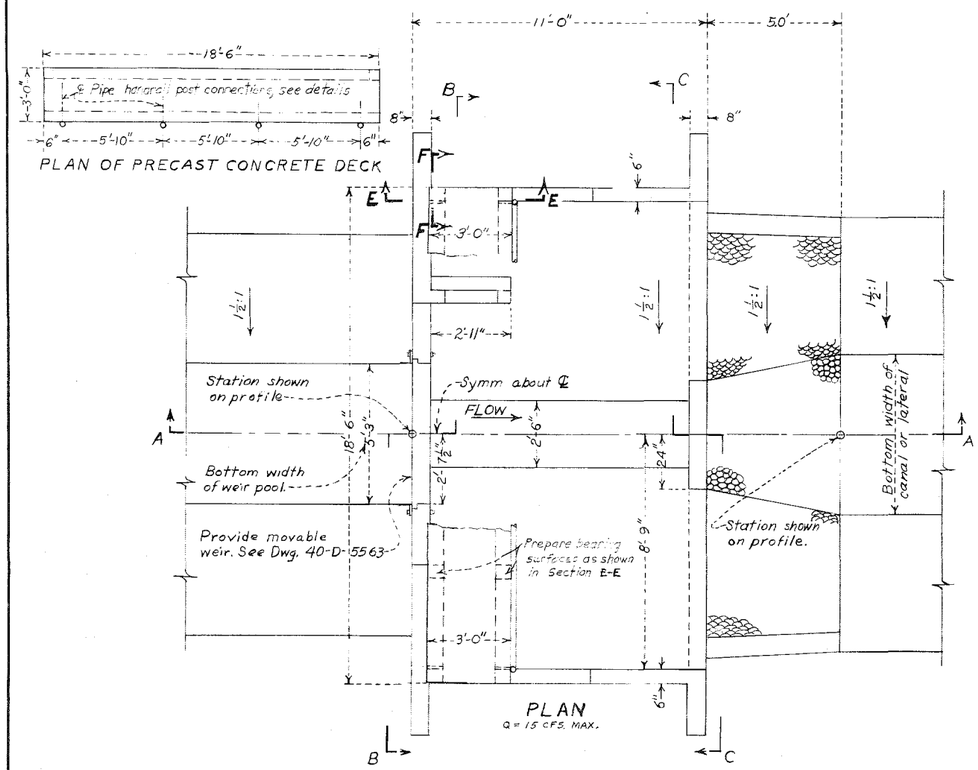
RUNWAYS THINK SAFETY

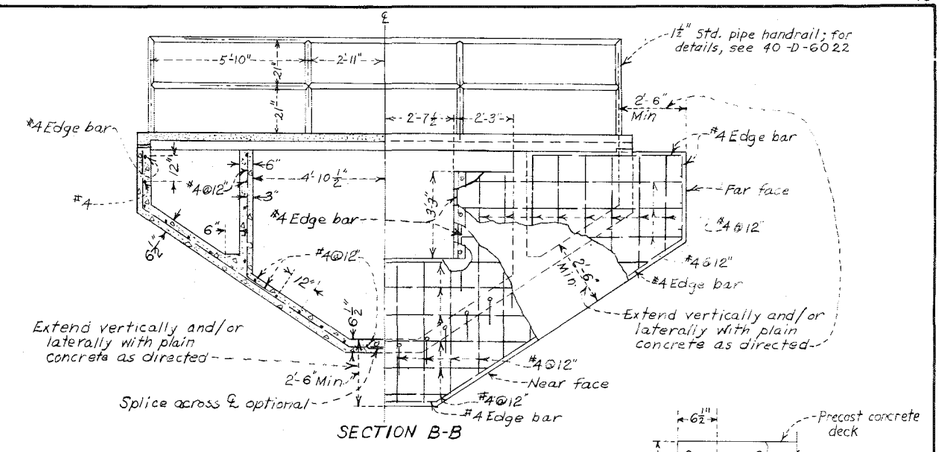
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

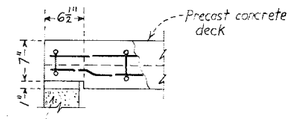
CHECK DROP TYPE 8 WITH MOVABLE WEIR

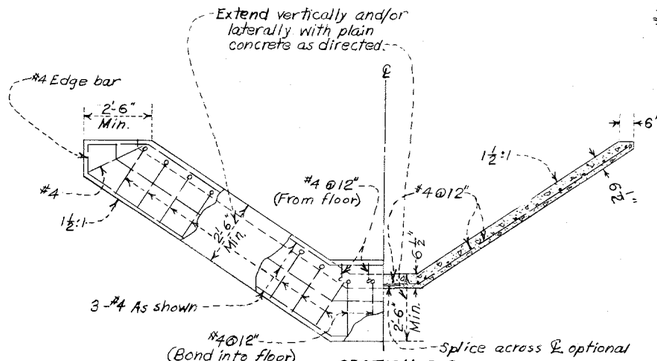
DRAWN L.F.W.-W.D.F. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO

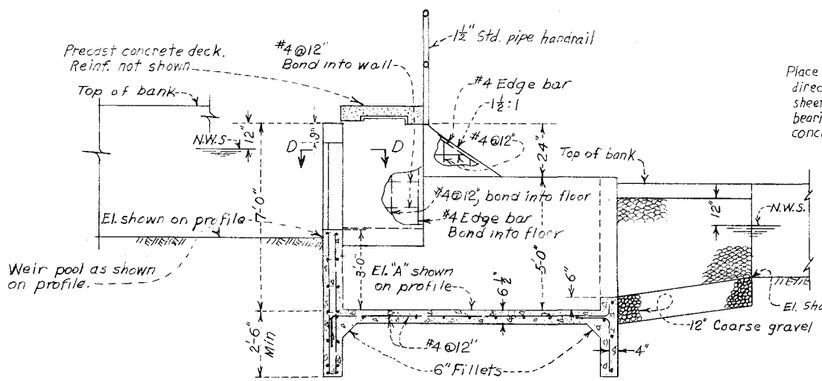
G-111.08

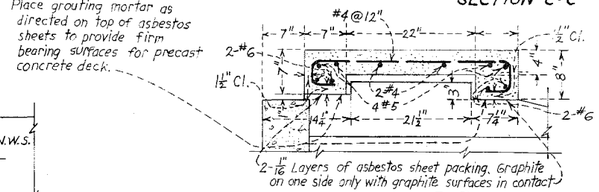










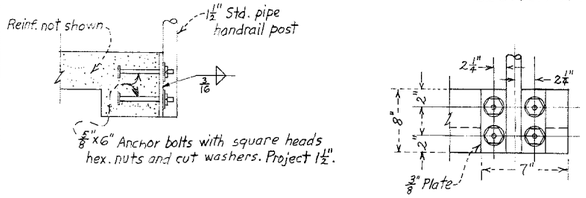


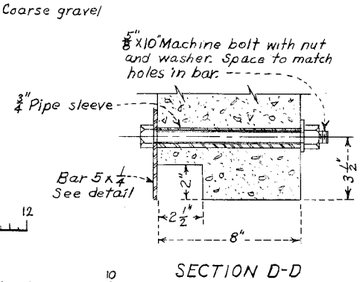
ESTIMATED QUANTITIES

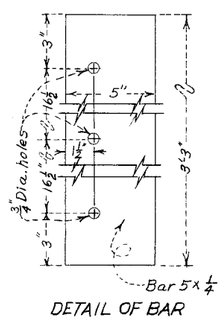
Concrete	11.0 Cu. Yds.
Reinforcement steel	1080 Lbs.
Miscellaneous metal	190 Lbs.
Movable weir - Q=15 cfs.	1 Ea.

NOTES

Chamfer all exposed edges ¾" unless otherwise shown. For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.







ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CHECK DROP TYPE 9 WITH MOVABLE WEIR

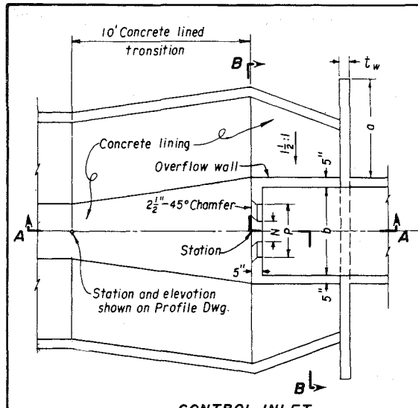
DRAWN L.F.W. W.L.P. SUBMITTED

TRACED RECOMMENDED

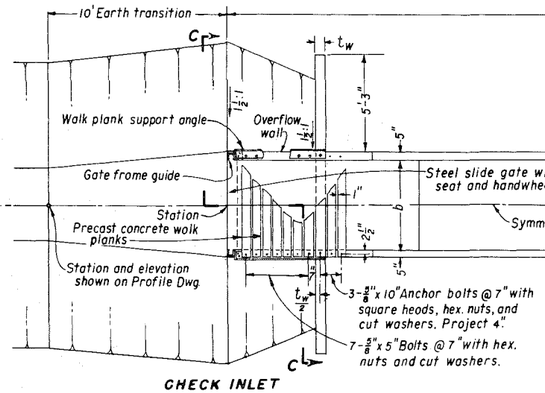
CHECKED APPROVED
CHIEF, CANALS BRANCH

DENVER, COLORADO

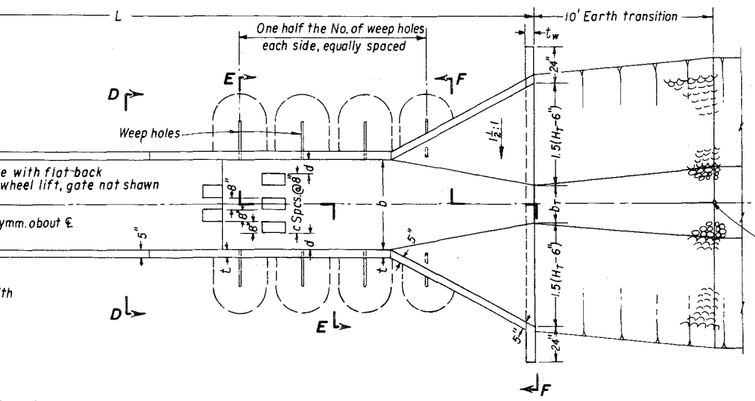
C III 09



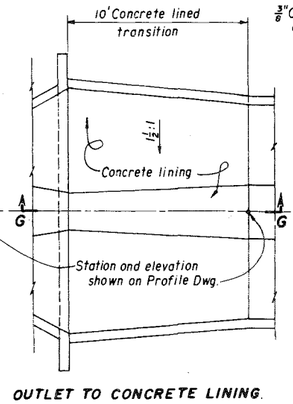
CONTROL INLET



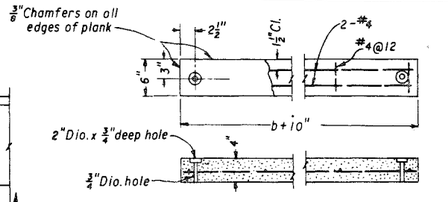
CHECK INLET



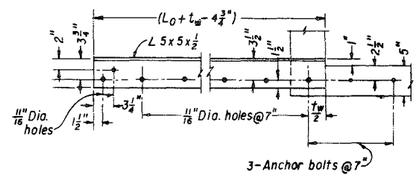
PLAN



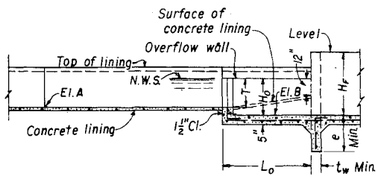
OUTLET TO CONCRETE LINING



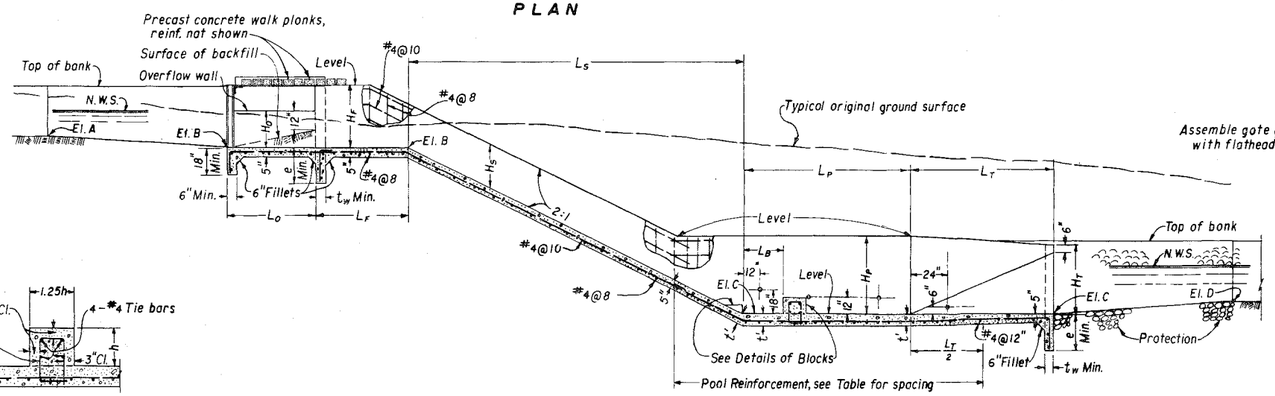
PRECAST CONCRETE WALK PLANK



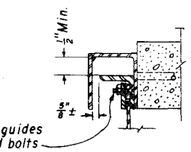
WALK PLANK SUPPORT ANGLE
(2 REQUIRED)



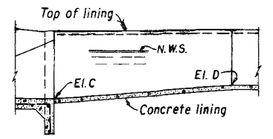
SECTION A-A



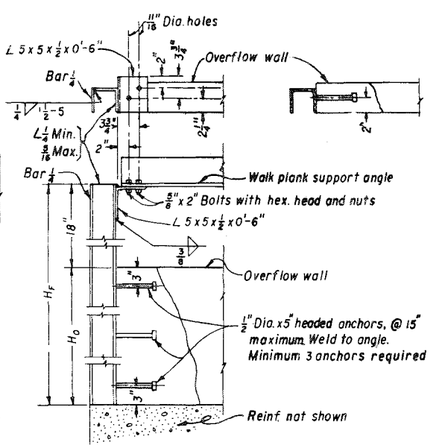
LONGITUDINAL SECTION



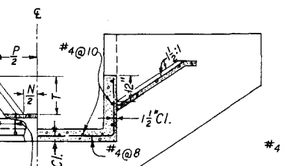
TYPICAL SLIDE GATE ASSEMBLY



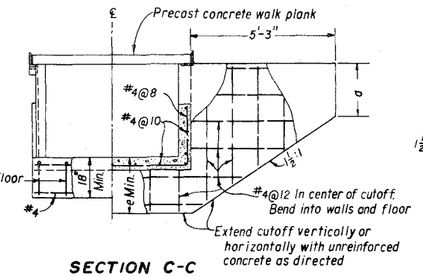
SECTION G-G



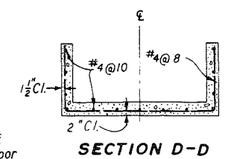
GATE FRAME GUIDE
(2 REQUIRED)



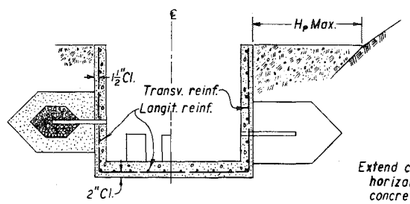
SECTION B-B



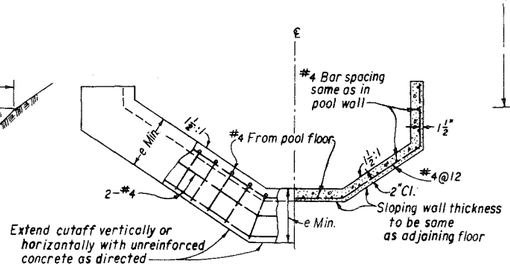
SECTION C-C



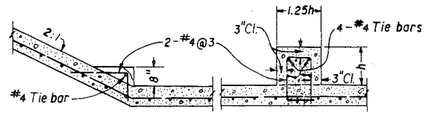
SECTION D-D



SECTION E-E



SECTION F-F



DETAILS OF BLOCKS

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWINGS

WEEP HOLES _____
TYPICAL PROTECTION _____

STRUCT. No.	WATER-WAY	STATION	Q	INLET	ELEVATIONS A	B	C	D	DIMENSIONS L	a	b	L_B	L_O	L_F	L_S	L_P	L_T	H_O	H_F	H_S	H_P	H_T	h	e	b_T	t_w	t	t'	c	d	CONTROL INLET N	P	T	CHECK INLET SLIDE GATE (WIDTH x HEIGHT)*	FRM. HT.	NO. OF WALK PLANKS	POOL REINFORCEMENT TRANSV. REINF.	LONGIT. REINF. FLOOR	LONGIT. REINF. WALLS	QUANTITIES CONC. (CU. YD.)	REINF. STEEL (LBS.)	MISC. METAL (LBS.)	NO. OF WEEP HOLES	REMARKS

*When a gate with a specified height is not available, a gate with next greater availabe height shall be used with appropriate frame height

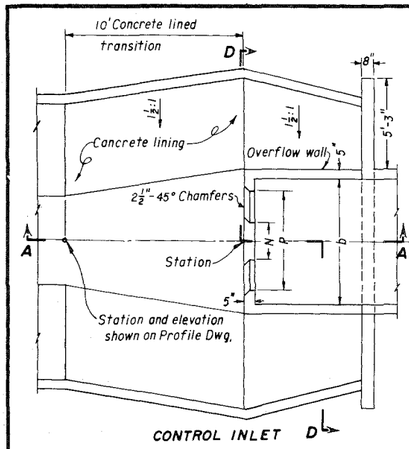
ACCIDENTS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

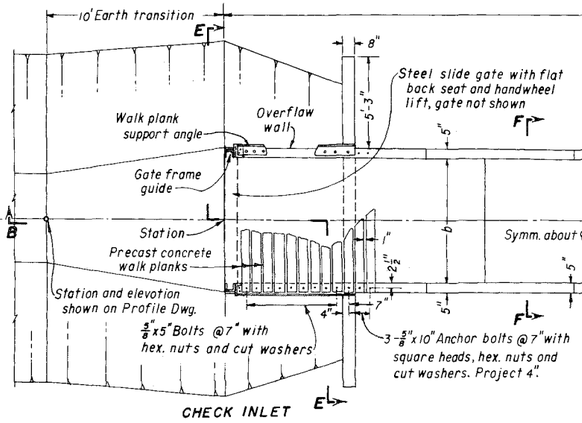
RECTANGULAR INCLINED DROPS - TYPE I

C 120.10

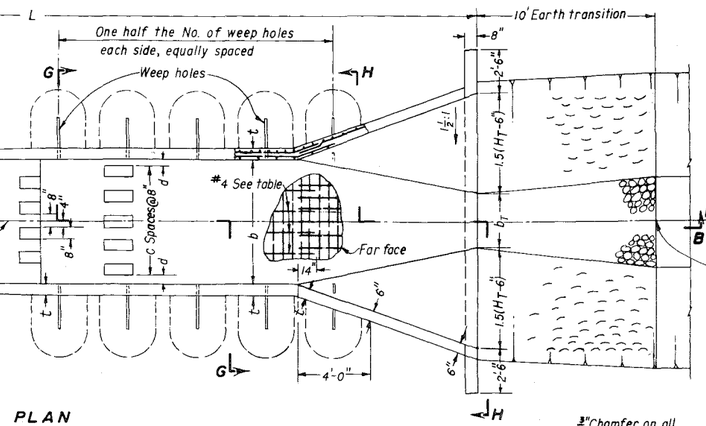
DRAWN I. K. SUBMITTED _____
TRACED H.M.G. RECOMMENDED _____
CHECKED _____ APPROVED _____ CHIEF, CANALS BRANCH
DENVER, COLORADO



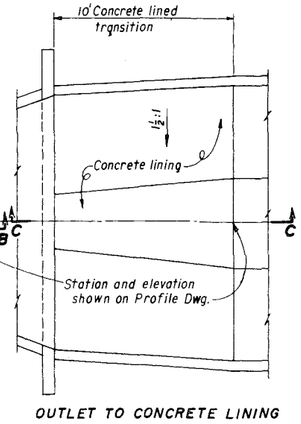
CONTROL INLET



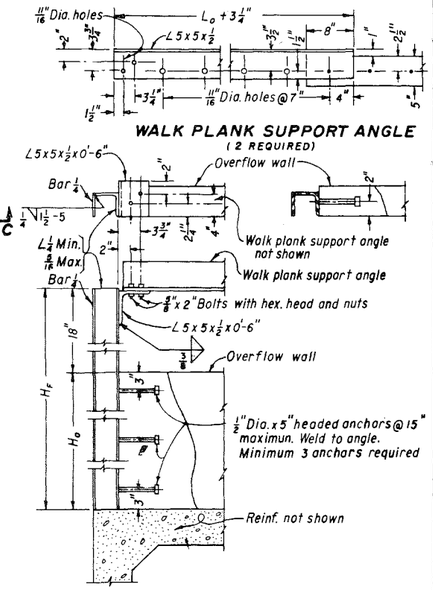
CHECK INLET

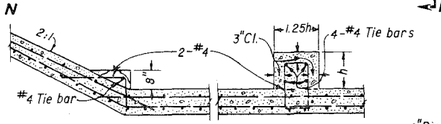


PLAN

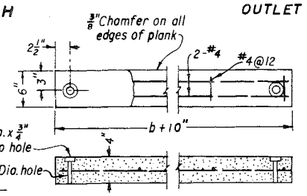


OUTLET TO CONCRETE LINING

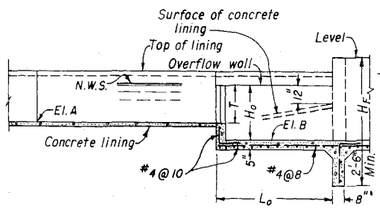




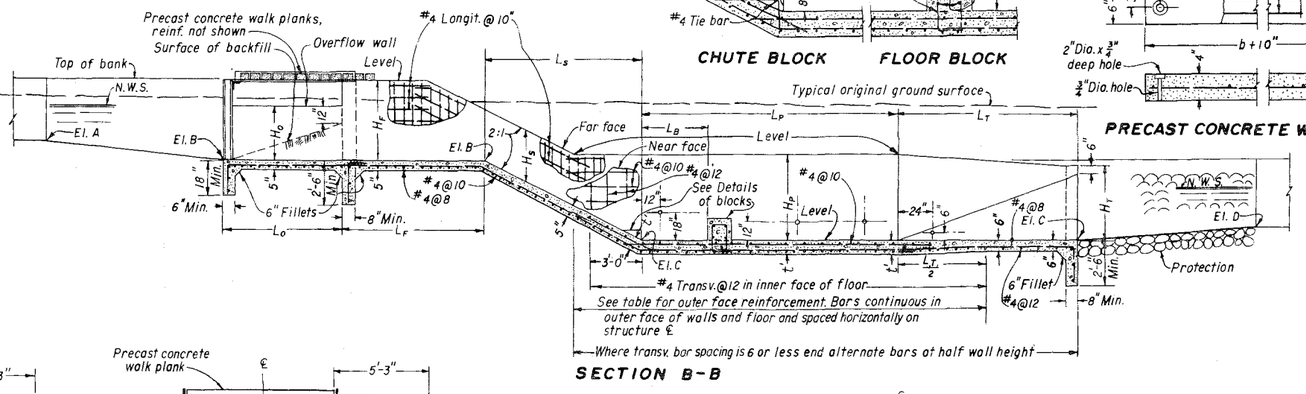
CHUTE BLOCK FLOOR BLOCK



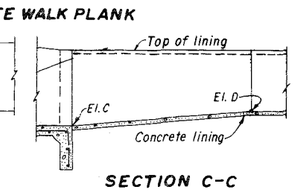
PRECAST CONCRETE WALK PLANK



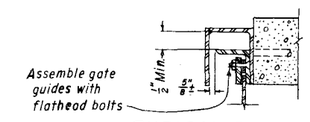
SECTION A-A



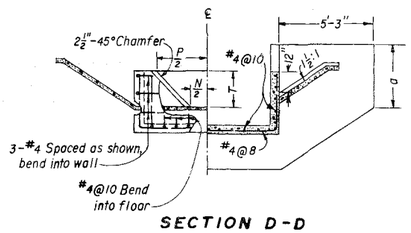
SECTION B-B



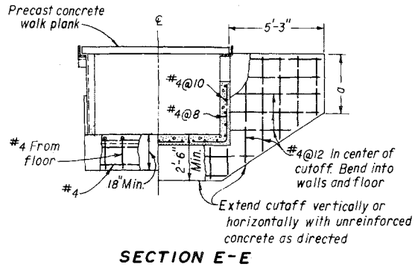
SECTION C-C



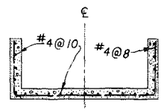
TYPICAL SLIDE GATE ASSEMBLY



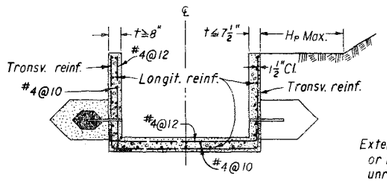
SECTION D-D



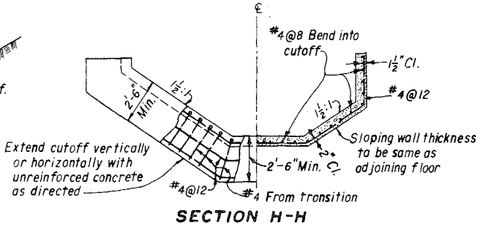
SECTION E-E



SECTION F-F



SECTION G-G



SECTION H-H

NOTE

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWINGS

WEEP HOLES _____
TYPICAL PROTECTION _____

STRUCT. No.	WATER-WAY	STATION	Q	INLET	ELEVATIONS A	B	C	D	DIMENSIONS L	a	b	L_B	L_o	L_F	L_s	L_P	L_T	H_o	H_F	H_s	H_P	H_T	b_T	t	t'	h	c	d	CONTROL INLET N	P	T	CHECK INLET SLIDE GATES (WIDTH x* HEIGHT)	FRM. HT.	NO. OF WALK PLANKS	NO. OF WEEP HOLES	POOL REINFORCEMENT (OUTER FACE) TRANSV. REINF.	LONGIT. REINF. FLOOR	LONGIT. REINF. WALLS	QUANTITIES CONC. (CU. YDS.)	REINF. STEEL (LBS.)	MISC. METAL (LBS.)

*When a gate with a specified height is not available, a gate with next greater available height shall be used with appropriate frame height

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

RECTANGULAR INCLINED DROPS-TYPE 2

DRAWN F.L.R. SUBMITTED
TRACED Y.M.Q. RECOMMENDED
CHECKED APPROVED
DENVER, COLORADO CHIEF ENGR.& BRANCH

C 120.20

TYPE 1
SINGLE LAYER REINFORCEMENT IN POOL FLOOR

STRUCT. NO.	F MAX.	Q MAX.	L_F	L_B	L_P	H_P	H_T	$d_2 + hv_2$	h	t	t'	NO. OF WEEP HOLES	POOL REINF. TRANSV. BARS IN WALLS & FLOORS	POOL REINF. LONGIT. REINF. FLOORS	POOL REINF. LONGIT. REINF. WALLS	QUANTITIES CONC. (CU.YDS.)	QUANTITIES REINF. STEEL (LBS.)	QUANTITIES MISC. METAL (LBS.)
5-3	3.0	5	3'-8"	12"	5'-0"	2'-7"	2'-7"	1.28'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	4.7	470	165
5-5	5.0	5	3'-8"	14"	6'-0"	2'-9"	2'-9"	1.42'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	5.5	560	165
5-7	7.0	5	3'-8"	15"	6'-0"	2'-11"	2'-11"	1.54'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	6.1	630	165
5-9	9.0	5	4'-0"	16"	6'-6"	3'-0"	3'-0"	1.63'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	6.8	710	165
5-11	11.0	5	4'-4"	17"	7'-0"	3'-1"	3'-1"	1.71'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	7.5	790	165
5-13	13.0	5	4'-8"	17"	7'-0"	3'-2"	3'-2"	1.77'	8	5"	6½"	4	#4@12"	#4@7½"	#4@10"	8.1	860	165
5-15	15.0	5	5'-0"	18"	7'-6"	3'-3"	3'-3"	1.84'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	8.8	940	165
10-3	3.0	10	3'-8"	16"	7'-0"	2'-10"	2'-10"	1.70'	8"	5"	6½"	4	#4@12"	#4@7½"	#4@10"	5.9	600	205
10-5	5.0	10	3'-10"	18"	7'-6"	3'-1"	3'-1"	1.89'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	6.9	700	205
10-7	7.0	10	4'-3"	20"	8'-0"	3'-3"	3'-3"	2.03'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	7.8	800	205
10-9	9.0	10	4'-8"	21"	8'-6"	3'-4"	3'-4"	2.15'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	8.6	900	205
10-11	11.0	10	5'-0"	22"	9'-0"	3'-5"	3'-5"	2.25'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	9.4	990	205
10-13	13.0	10	5'-5"	23"	9'-6"	3'-6"	3'-6"	2.33'	8"	5"	7"	6	#4@12"	#4@7"	#4@10"	10.3	1090	205
10-15	15.0	10	5'-10"	24"	10'-0"	3'-7"	3'-7"	2.42'	8"	5"	7"	6	#4@12"	#4@7"	#4@10"	11.1	1190	205
15-3	3.0	15	4'-0"	19"	8'-0"	3'-4"	3'-0"	1.96'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	7.1	710	210
15-5	5.0	15	4'-5"	21"	8'-6"	3'-7"	3'-3"	2.18'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	8.1	830	210
15-7	7.0	15	4'-10"	23"	9'-6"	3'-10"	3'-6"	2.34'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	9.3	960	210
15-9	9.0	15	5'-4"	24"	10'-0"	4'-0"	3'-8"	2.48'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	10.4	1080	210
15-11	11.0	15	5'-9"	2'-1"	10'-6"	4'-2"	3'-10"	2.58'	8"	5"	7"	6	#4@11"	#4@7"	#4@10"	11.5	1220	210
15-13	13.0	15	6'-2"	2'-2"	11'-0"	4'-3"	3'-11"	2.69'	8"	5"	7"	6	#4@11"	#4@7"	#4@10"	12.4	1330	210
15-15	15.0	15	6'-8"	2'-3"	11'-0"	4'-4"	4'-0"	2.77'	9"	5"	7"	6	#4@10"	#4@7"	#4@10"	13.2	1440	210
20-3	3.0	20	5'-0"	20"	8'-6"	3'-6"	3'-1"	2.15'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	8.3	830	250
20-5	5.0	20	5'-0"	23"	9'-6"	3'-10"	3'-5"	2.39'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	9.5	980	250
20-7	7.0	20	5'-6"	24"	10'-0"	4'-1"	3'-8"	2.56'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	10.7	1110	250
20-9	9.0	20	6'-0"	2'-2"	11'-0"	4'-4"	3'-11"	2.70'	8"	5"	7"	6	#4@10"	#4@7"	#4@10"	12.2	1300	250
20-11	11.0	20	6'-6"	2'-3"	11'-6"	4'-6"	4'-1"	2.83'	9"	5"	7"	6	#4@9"	#4@7"	#4@10"	13.3	1470	250
20-13	13.0	20	7'-0"	2'-4"	12'-0"	4'-8"	4'-3"	2.94'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	14.4	1630	250
20-15	15.0	20	7'-6"	2'-5"	12'-0"	4'-9"	4'-5"	3.03'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	15.4	1740	250
25-3	3.0	25	5'-2"	22"	9'-0"	3'-10"	3'-6"	2.29'	8"	5"	6½"	6	#4@12"	#4@7½"	#4@10"	9.2	920	255
25-5	5.0	25	5'-6"	24"	10'-0"	4'-2"	3'-10"	2.53'	8"	5"	6½"	6	#4@11"	#4@7½"	#4@10"	10.6	1100	255
25-7	7.0	25	6'-0"	2'-2"	11'-0"	4'-6"	4'-1"	2.72'	8"	5"	6½"	6	#4@9"	#4@7½"	#4@10"	12.1	1310	255
25-9	9.0	25	6'-7"	2'-4"	11'-6"	4'-8"	4'-3"	2.87'	9"	5"	7"	8	#4@8"	#4@7"	#4@10"	13.4	1500	255
25-11	11.0	25	7'-2"	2'-5"	12'-0"	4'-10"	4'-4"	3.00'	9"	5"	7"	8	#4@8"	#4@7"	#4@10"	14.6	1640	255
25-13	13.0	25	7'-8"	2'-6"	12'-6"	5'-0"	4'-6"	3.11'	10"	6"	7"	8	#4@10"	#4@7"	#4@8"	16.3	1780	255
25-15	15.0	25	8'-2"	2'-7"	13'-0"	5'-2"	4'-8"	3.22'	10"	6"	7½"	8	#4@9"	#4@6½"	#4@8"	17.8	1980	255
30-3	3.0	30	5'-6"	23"	9'-6"	4'-0"	3'-8"	2.41'	8"	5"	6½"	8	#4@12"	#4@7½"	#4@10"	10.2	1030	260
30-5	5.0	30	5'-10"	2'-1"	10'-6"	4'-4"	3'-11"	2.66'	8"	5"	6½"	8	#4@10"	#4@7½"	#4@10"	11.7	1230	260
30-7	7.0	30	6'-5"	2'-3"	11'-0"	4'-7"	4'-2"	2.85'	9"	5"	7"	6	#4@9"	#4@7"	#4@10"	13.2	1430	260
30-9	9.0	30	7'-0"	2'-5"	12'-0"	4'-10"	4'-4"	3.00'	9"	5"	7"	8	#4@8"	#4@7"	#4@10"	14.7	1640	260
30-11	11.0	30	7'-7"	2'-6"	12'-6"	5'-0"	4'-6"	3.14'	10"	6"	7"	8	#4@10"	#4@7"	#4@8"	16.5	1800	260
30-13	13.0	30	8'-2"	2'-7"	13'-0"	5'-2"	4'-8"	3.26'	10"	6"	7"	8	#4@9"	#4@7"	#4@8"	17.8	1990	260
30-15	15.0	30	8'-9"	2'-8"	13'-6"	5'-4"	4'-9"	3.36'	10"	6"	7½"	8	#4@8"	#4@6½"	#4@8"	19.4	2200	260
40-3	3.0	40	5'-9"	2'-1"	10'-6"	4'-4"	3'-11"	2.67'	8"	5"	6½"	8	#4@10"	#4@7½"	#4@10"	12.4	1230	295
40-5	5.0	40	6'-5"	2'-4"	11'-6"	4'-9"	4'-3"	2.95'	9"	5"	6½"	8	#4@8"	#4@7½"	#4@10"	14.3	1500	295
40-7	7.0	40	7'-1"	2'-6"	12'-6"	5'-0"	4'-6"	3.16'	10"	6"	7"	8	#4@10"	#4@7"	#4@8"	16.7	1710	295
40-9	9.0	40	7'-8"	2'-8"	13'-0"	5'-3"	4'-8"	3.34'	10"	6"	7"	8	#4@8"	#4@7"	#4@8"	18.2	1970	295
40-11	11.0	40	8'-4"	2'-9"	13'-6"	5'-5"	4'-10"	3.49'	11"	6"	7"	8	#4@8"	#4@7"	#4@8"	19.7	2150	295
40-13	13.0	40	9'-0"	2'-11"	14'-6"	5'-7"	5'-0"	3.62'	11"	6"	7½"	8	#4@7½"	#4@6½"	#4@8"	21.6	2400	295
40-15	15.0	40	9'-7"	3'-0"	15'-0"	5'-9"	5'-2"	3.73'	11"	6"	7½"	8	#4@7"	#4@6½"	#4@8"	23.0	2600	295
50-3	3.0	50	6'-3"	2'-3"	11'-0"	4'-7"	4'-2"	2.89'	9"	5"	6½"	8	#4@9"	#4@7½"	#4@10"	13.9	1410	310
50-5	5.0	50	7'-0"	2'-6"	12'-6"	5'-0"	4'-5"	3.19'	10"	6"	7"	8	#4@10"	#4@7"	#4@8"	16.7	1700	310
50-7	7.0	50	7'-8"	2'-8"	13'-6"	5'-4"	4'-8"	3.41'	10"	6"	7"	8	#4@8"	#4@7"	#4@8"	18.6	2010	310
50-9	9.0	50	8'-4"	2'-9"	14'-0"	5'-7"	4'-11"	3.59'	11"	6"	7"	8	#4@7½"	#4@7"	#4@8"	20.3	2240	310
50-11	11.0	50	9'-0"	3'-0"	15'-0"	5'-10"	5'-2"	3.76'	12"	6"	7½"	8	#4@7"	#4@6½"	#4@8"	22.5	2530	310
50-13	13.0	50	9'-8"	3'-1"	15'-6"	6'-0"	5'-4"	3.89'	12"	6"	7½"	10	#4@6½"	#4@6½"	#4@8"	24.1	2770	310
60-3	3.0	60	6'-6"	2'-5"	12'-0"	4'-10"	4'-4"	3.07'	9"	5"	6½"	8	#4@8"	#4@7½"	#4@10"	15.4	1610	345
60-5	5.0	60	7'-3"	2'-8"	13'-0"	5'-3"	4'-8"	3.38'	10"	6"	7"	8	#4@8"	#4@7"	#4@8"	18.2	1950	345
60-7	7.0	60	8'-0"	2'-9"	14'-0"	5'-7"	4'-11"	3.61'	11"	6"	7"	8	#4@7½"	#4@7"	#4@8"	20.3	2230	345
60-9	9.0	60	8'-8"	3'-0"	15'-0"	5'-10"	5'-2"	3.81'	12"	6"	7"	8	#4@7"	#4@7"	#4@8"	22.3	2510	345
60-11	11.0	60	9'-5"	3'-2"	16'-0"	6'-1"	5'-4"	3.97'	12"	6"	7½"	10	#4@6"	#4@6½"	#4@8"	24.6	2880	345
70-3	3.0	70	6'-9"	2'-6"	12'-6"	5'-0"	4'-5"	3.21'	10"	6"	6½"	8	#4@10"	#4@7½"	#4@8"	17.2	1740	350
70-5	5.0	70	7'-6"	2'-9"	14'-0"	5'-5"	4'-10"	3.54'	11"	6"	7"	8	#4@8"	#4@7"	#4@8"	20.0	2150	350

TYPE 1
SINGLE LAYER REINFORCEMENT IN POOL FLOOR

STRUCT. NO.	F MAX.	Q MAX.	L_F	L_B	L_P	H_P	H_T	$d_2 + hv_2$	h	t	t'	NO. OF WEEP HOLES	POOL REINF. TRANSV. BARS IN WALLS & FLOORS	POOL REINF. LONGIT. REINF. FLOORS	POOL REINF. LONGIT. REINF. WALLS	QUANTITIES CONC. (CU.YDS)	QUANTITIES REINF. STEEL (LBS.)	QUANTITIES MISC. METAL (LBS.)
70-7	7.0	70	8'-3"	3'-0"	15'-0"	5'-10"	5'-2"	3.78'	11"	6"	7"	8	#4@7"	#4@7"	#4@8"	22.4	2500	350
70-9	9.0	70	9'-0"	3'-2"	16'-0"	6'-1"	5'-5"	3.99'	12"	6"	7½"	10	#4@6"	#4@6½"	#4@8"	24.9	2900	350
70-11	11.0	70	9'-9"	3'-4"	16'-6"	6'-4"	5'-7"	4.15'	13"	7"	7½"	10	#4@7½"	#4@6½"	#4@7"	27.5	3060	350
80-3	3.0	80	7'-0"	2'-8"	13'-6"	5'-4"	4'-8"	3.46'	10"	6"	6½"	10	#4@8"	#4@7½"	#4@8"	18.1	1930	355
80-5	5.0	80	7'-9"	3'-0"	15'-0"	5'-9"	5'-1"	3.80'	12"	6"	7"	10	#4@7"	#4@7"	#4@8"	21.1	2350	355
80-7	7.0	80	8'-6"	3'-3"	16'-0"	6'-1"	5'-5"	4.06'	12"	6"	7"	10	#4@6"	#4@7"	#4@8"	23.4	2730	355
80-9	9.0	80	9'-4"	3'-5"	17'-0"	6'-5"	5'-8"	4.27'	13"	7"	7½"	10	#4@7"	#4@6½"	#4@7"	26.9	3020	355
90-3	3.0	90	7'-3"	2'-9"	13'-6"	5'-4"	4'-9"	3.56'	11"	6"	6½"	10	#4@8"	#4@7½"	#4@8"	19.6	2100	395
90-5	5.0	90	8'-0"	3'-1"	15'-0"	5'-10"	5'-2"	3.91'	12"	6"	7"	10	#4@7"	#4@7"	#4@8"	22.7	2530	395
90-7	7.0	90	8'-10"	3'-4"	16'-6"	6'-3"	5'-6"	4.18'	13"	7"	7"	10	#4@6½"	#4@7"	#4@7"	26.3	3010	395
90-9	9.0	90	9'-8"	3'-6"	17'-6"	6'-8"	5'-10"	4.40'	13"	7"	7½"	10	#4@6½"	#4@6½"	#4@7"	29.3	3360	395
100-3	3.0	100	7'-10"	2'-11"	14'-6"	5'-8"	5'-0"	3.78'	11"	6"	6½"	10	#4@7½"	#4@7½"	#4@8"	20.8	2270	400
100-5	5.0	100	8'-8"	3'-3"	16'-0"	6'-2"	5'-4"	4.14'	12"	6"	7"	10	#4@6"	#4@7"	#4@8	24.0	2800	400
100-7	7.0	100	9'-6"	3'-6"	17'-6"	6'-7"	5'-8"	4.42'	13"	7"	7"	10	#4@5½"	#4@7"	#4@7"	27.7	3330	400
100-9	9.0	100	10'-5"	3'-8"	18'-6"	6'-11"	6'-0"	4.65'	14"	7"	7½"	10	#4@5½"	#4@6½"	#4@7"	30.8	3710	400

TYPE 2
DOUBLE LAYER REINFORCEMENT IN POOL FLOOR

STRUCT. NO.	F MAX.	Q MAX.	L_F	L_B	L_P	H_P	H_T	$d_2 + hv_2$	h	t	t'	NO. OF WEEP HOLES	POOL REINF. OUTER LAYER TRANSV. REINF.	POOL REINF. OUTER LAYER LONGIT. REINF. FLOORS	POOL REINF. OUTER LAYER LONGIT. REINF. WALLS	QUANTITIES CONC. (CU.YDS)	QUANTITIES REINF. STEEL (LBS.)	QUANTITIES MISC. METAL (LBS.)
50-15	15.0	50	10'-5"	3'-3"	16'-0"	6'-2"	5'-5"	4.02'	12"	6"	8"	10	#4@6"	#4@16"	#4@8"	25.9	3160	310
60-13	13.0	60	10'-1"	3'-4"	16'-6"	6'-3"	5'-6"	4.12'	13"	7"	8"	10	#4@7½"	#4@16"	#4@7"	27.4	3150	345
60-15	15.0	60	10'-10"	3'-5"	17'-0"	6'-5"	5'-8"	4.26'	13"	7"	8"	10	#4@7"	#4@16"	#4@7"	29.1	3410	345
70-13	13.0	70	10'-6"	3'-5"	17'-0"	6'-6"	5'-9"	4.31'	13"	7"	8"	10	#4@6½"	#4@16"	#4@7"	29.7	3530	350
70-15	15.0	70	11'-3"	3'-7"	17'-6"	6'-8"	5'-10"	4.44'	14"	7"	8"	10	#4@6½"	#4@16"	#4@7"	31.5	3760	350
80-11	11.0	80	10'-1"	3'-7"	17'-6"	6'-8"	5'-10"	4.46'	14"	7"	8"	10	#4@6½"	#4@16"	#4@7"	29.2	3480	355
80-13	13.0	80	10'-10"	3'-8"	18'-6"	6'-10"	6'-0"	4.63'	14"	7"	8"	10	#4@6"	#4@16"	#4@7"	31.3	3810	355
80-15	15.0	80	11'-8"	3'-10"	19'-0"	7'-0"	6'-2"	4.77'	15"	7"	8½"	10	#4@5½"	#4@15"	#4@7"	33.6	4160	355
90-11	11.0	90	10'-6"	3'-8"	18'-0"	7'-0"	6'-0"	4.59'	14"	7"	8"	10	#4@5½"	#4@16"	#4@7"	31.9	3980	395
90-13	13.0	90	11'-4"	3'-10"	19'-0"	7'-2"	6'-2"	4.75'	14"	7"	8"	10	#4@5"	#4@16"	#4@7"	34.2	4390	395
90-15	15.0	90	12'-1"	3'-11"	19'-6"	7'-4"	6'-4"	4.90'	15"	8"	8½"	10	#4@6"	#4@15"	#4@16"	37.8	4880	395
100-11	11.0	100	11'-3"	3'-10"	19'-0"	7'-2"	6'-3"	4.85'	15"	7"	8"	10	#4@5"	#4@16"	#4@7"	33.4	4290	400
100-13	13.0	100	12'-1"	4'-0"	20'-0"	7'-4"	6'-5"	5.02'	15"	8"	8½"	10	#4@6"	#4@15"	#4@16"	37.4	4830	400
100-15	15.0	100	13'-0"	4'-2"	20'-6"	7'-6"	6'-7"	5.17'	16"	8"	8½"	10	#4@5½"	#4@15"	#4@16"	39.6	5220	400

DIMENSIONS

STRUCT. NO.	DIMENSIONS b_T	a	b	L_O	H_F	H_O	H_S	c	d	L_T	CHECK INLET GATE SIZE	CHECK INLET FRAME HT.	NO. OF WALK PLANKS	TYPE 1 ONLY e	TYPE 1 ONLY t_w
5	24"	21"	3'-0"	2'-7"	2'-6"	12"	20"	3	6"	5'-0"	36"x12"	5'-0"	7	24"	6"
10	24"	2'-1"	3'-6"	3'-7"	2'-10"	16"	24"	3	9"	6'-0"	42"x16"	5'-6"	8	24"	6"
15	24"	2'-5"	4'-0"	3'-7"	3'-2"	20"	2'-2"	5	4"	7'-0"	48"x20"	5'-6"	8	24"	6"
20	24"	2'-7"	4'-6"	4'-7"	3'-4"	22"	2'-4"	5	7"	8'-0"	54"x22"	5'-6"	10	24"	6"
25	24"	2'-9"	5'-0"	4'-7"	3'-6"	24"	2'-5"	5	10"	8'-0"	60"x24"	5'-5"	10	24"	6"
30	24"	3'-0"	5'-6"	4'-7"	3'-9"	2'-3"	2'-6"	7	5"	9'-0"	66"x27"	6'-0"	10	24"	6"
40	24"	3'-6"	6'-0"	5'-7"	4'-0"	2'-6"	2'-8"	7	8"	9'-0"	72"x30"	6'-0"	11	2'-6"	8"
50	2'-6"	4'-0"	6'-6"	5'-7"	4'-3"	2'-9"	2'-9"	7	11"	10'-0"	78"x33"	6'-0"	11	2'-6"	8"
60	2'-6"	4'-3"	7'-0"	6'-7"	4'-6"	3'-0"	2'-10"	9	6"	10'-0"	84"x36"	6'-0"	13	2'-6"	8"
70	3'-0"	4'-6"	7'-6"	6'-7"	4'-9"	3'-3"	2'-11"	9	9"	11'-0"	90"x39"	6'-6"	13	2'-6"	8"
80	3'-0"	4'-6"	7'-6"	6'-7"	5'-0"	3'-6"	3'-0"	9	9"	11'-0"	90"x42"	6'-6"	13	2'-6"	8"
90	3'-6"	5'-0"	8'-0"	7'-7"	5'-3"	3'-9"	3'-1"	11	4"	12'-0"	96"x45"	6'-6"	15	2' 6"	8"
100	3'-6"	5'-3"	8'-0"	7'-7"	5'-6"	4'-0"	3'-3"	11	4"	12'-0"	96"x45"	6'-6"	15	2'-6"	8"

DESIGN CRITERIA

Structure No. 5-3 indicates Q=5 c.f.s., F=3ft.
Structure No. 60-13 indicates Q=60 c.f.s., F=13ft.
The dimensions of the control notch at the inlet of the structure should be calculated for maximum Q and 20% of maximum Q.
Where steel slide gates are used at the inlet of the structure, the minimum width should be equal to the base width of the structure.
The base width of the structure is determined from the formula $b=\frac{360\sqrt{Q}}{v+350}$.
The minimum downstream energy gradient for full design capacity is determined by reducing the assumed "n" value for the channel by 20% and computing the depth.
"F" is the vertical foll from the normal upstream energy gradient to the minimum downstream energy gradient.
"d_2" is the height of the downstream end of the hydraulic jump and may be determined from the formula $d_2=\frac{-d_1}{2}+\sqrt{\frac{2v_1^2 d_1}{g}+\frac{d_1^2}{4}}$ or from 103-D-289.
The values of V_1 and d_1 are obtained by neglecting losses in the drop.
The bottom grade of the stilling pool is found by subtracting d_2+hv_2 from the downstream energy gradient.
The minimum stilling pool length is $4d_2$.
The minimum freeboard for the stilling pool is obtained by using 103-D-642 as a guide.
The minimum length between chute blocks and floor blocks is $.8d_2$.
Reinforcement steel design is based on working stresses of 24,000 psi.
Monolithic concrete design based on a compressive strength of 3,750 psi of 28 days.
The minimum floor thickness of the stilling pool and chute may be obtained from 40-CRB-36.
Type 3 loading is used for stilling pool walls and Type 2 loading for chute and other walls, see 40-CT-4.
Special consideration should be given to the selection of slide gates at check inlets where automotion is planned because the slide gates indicated may not operate satisfactorily with power liffts.

STANDARD DESIGNS FOR:

R.I. Drops - Type 1 ..... C 120.10
R.I. Drops - Type 2 ..... C 120.20

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS
WATERWAY STRUCTURES

RECTANGULAR INCLINED DROPS
CANALS AND LATERALS

DRAWN E.L.W. SUBMITTED
TRACED A.P.R. RECOMMENDED
CHECKED APPROVED
DENVER, COLORADO

C 220.10

TYPE 1
SINGLE LAYER REINFORCEMENT IN POOL FLOOR

STRUCT. NO.	F MAX.	Q MAX.	L_F	L_B	L_P	H_P	H_T	$d_2 + hv_2$	h	t	t'	NO. OF WEEP HOLES	POOL REINF.			QUANTITIES		
													TRANSV. BARS IN WALLS & FLOORS	LONGIT. BARS IN FLOOR	LONGIT. BARS IN WALLS	CONC. (CU.YDS.)	REINF. STEEL (LBS.)	MISC. METAL (LBS.)
5-3	3.0	5	3'-8"	12"	4'-0"	2'-7"	2'-7"	1.28'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	4.6	460	165
5-5	5.0	5	3'-8"	14"	4'-6"	2'-9"	2'-9"	1.42'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	5.3	540	165
5-7	7.0	5	3'-8"	15"	5'-0"	2'-11"	2'-11"	1.54'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	6.0	620	165
5-9	9.0	5	4'-0"	16"	5'-0"	3'-0"	3'-0"	1.63'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	6.7	700	165
5-11	11.0	5	4'-4"	17"	5'-6"	3'-1"	3'-1"	1.71'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	7.3	780	165
5-13	13.0	5	4'-8"	17"	5'-6"	3'-2"	3'-2"	1.77'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	8.0	860	165
5-15	15.0	5	5'-0"	18"	5'-6"	3'-3"	3'-3"	1.84'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	8.6	930	165
10-3	3.0	10	3'-8"	16"	5'-0"	2'-10"	2'-10"	1.70'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	5.8	580	205
10-5	5.0	10	3'-10"	18"	5'-6"	3'-1"	3'-1"	1.89'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	6.7	680	205
10-7	7.0	10	4'-3"	20"	6'-0"	3'-3"	3'-3"	2.03'	8"	5"	$6\frac{1}{2}$"	4	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	7.6	780	205
10-9	9.0	10	4'-8"	21"	6'-6"	3'-4"	3'-4"	2.15'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	8.4	880	205
10-11	11.0	10	5'-0"	22"	7'-0"	3'-5"	3'-5"	2.25'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	9.2	970	205
10-13	13.0	10	5'-5"	23"	7'-0"	3'-6"	3'-6"	2.33'	8"	5"	7"	6	#4@12"	#4@7"	#4@10"	10.1	1070	205
10-15	15.0	10	5'-10"	24"	7'-6"	3'-7"	3'-7"	2.42'	8"	5"	7"	6	#4@12"	#4@7"	#4@10"	10.8	1160	205
15-3	3.0	15	4'-0"	19"	6'-0"	3'-4"	3'-0	1.96'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	6.9	690	210
15-5	5.0	15	4'-5"	21"	6'-6"	3'-7"	3'-3"	2.18'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	7.9	810	210
15-7	7.0	15	4'-10"	23"	7'-0"	3'-10"	3'-6"	2.34'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	9.1	940	210
15-9	9.0	15	5'-4"	24"	7'-6"	4'-0"	3'-8"	2.48'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	10.0	1050	210
15-11	11.0	15	5'-9"	2'-1"	8'-0"	4'-2"	3'-10"	2.58'	8"	5"	7"	6	#4@11"	#4@7"	#4@10"	11.1	1180	210
15-13	13.0	15	6'-2"	2'-2"	8'-0"	4'-3"	3'-11"	2.69'	8"	5"	7"	6	#4@11"	#4@7"	#4@10"	12.0	1290	210
15-15	15.0	15	6'-8"	2'-3"	8'-6"	4'-4"	4'-0"	2.77'	9"	5"	7"	6	#4@10"	#4@7"	#4@10"	13.0	1420	210
20-3	3.0	20	5'-0"	20"	6'-6"	3'-6"	3'-1"	2.15'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	8.0	810	250
20-5	5.0	20	5'-0"	23"	7'-0"	3'-10"	3'-5"	2.39'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	9.3	950	250
20-7	7.0	20	5'-6"	24"	8'-0"	4'-1"	3'-8"	2.56'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	10.5	1090	250
20-9	9.0	20	6'-0"	2'-2"	8'-0"	4'-4"	3'-11"	2.70'	8"	5"	7"	6	#4@10"	#4@7"	#4@10"	11.8	1260	250
20-11	11.0	20	6'-6"	2'-3"	8'-6"	4'-6"	4'-1"	2.83'	9"	5"	7"	6	#4@9"	#4@7"	#4@10"	12.9	1420	250
20-13	13.0	20	7'-0"	2'-4"	9'-0"	4'-8"	4'-3"	2.94'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	14.1	1580	250
20-15	15.0	20	7'-6"	2'-5"	9'-0"	4'-9"	4'-5"	3.03'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	15.0	1700	250
25-3	3.0	25	5'-2"	22"	7'-0"	3'-10"	3'-6"	2.29'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	8.9	900	255
25-5	5.0	25	5'-6"	24"	7'-6"	4'-2"	3'-10"	2.53'	8"	5"	$6\frac{1}{2}$"	6	#4@11"	#4@$7\frac{1}{2}$"	#4@10"	10.4	1070	255
25-7	7.0	25	6'-0"	2'-2"	8'-0"	4'-6"	4'-1"	2.72'	8"	5"	$6\frac{1}{2}$"	6	#4@10"	#4@$7\frac{1}{2}$"	#4@10"	11.7	1270	255
25-9	9.0	25	6'-7"	2'-4"	8'-6"	4'-8"	4'-3"	2.87'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	13.0	1460	255
25-11	11.0	25	7'-2"	2'-5"	9'-0"	4'-10"	4'-4"	3.00'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	14.2	1590	255
25-13	13.0	25	7'-8"	2'-6"	9'-6"	5'-0"	4'-6"	3.11'	10"	6"	7"	6	#4@10"	#4@7"	#4@8"	15.8	1740	255
25-15	15.0	25	8'-2"	2'-7"	10'-0"	5'-2"	4'-8"	3.22'	10"	6"	$7\frac{1}{2}$"	8	#4@9"	#4@$6\frac{1}{2}$"	#4@8"	17.3	1930	255
30-3	3.0	30	5'-6"	23"	7'-0"	4'-0"	3'-8"	2.41'	8"	5"	$6\frac{1}{2}$"	6	#4@12"	#4@$7\frac{1}{2}$"	#4@10"	9.9	1000	260
30-5	5.0	30	5'-10"	2'-1"	8'-0"	4'-4"	3'-11"	2.66'	8"	5"	$6\frac{1}{2}$"	6	#4@10"	#4@$7\frac{1}{2}$"	#4@10"	11.4	1200	260
30-7	7.0	30	6'-5"	2'-3"	8'-6"	4'-7"	4'-2"	2.85'	9"	5"	7"	6	#4@9"	#4@7"	#4@10"	12.9	1400	260
30-9	9.0	30	7'-0"	2'-5"	9'-0"	4'-10"	4'-4"	3.00'	9"	5"	7"	6	#4@8"	#4@7"	#4@10"	14.3	1600	260
30-11	11.0	30	7'-7"	2'-6"	9'-6"	5'-0"	4'-6"	3.14'	10"	6"	7"	6	#4@10"	#4@7"	#4@8"	16.0	1750	260
30-13	13.0	30	8'-2"	2'-7"	10'-0"	5'-2"	4'-8"	3.26'	10"	6"	7"	8	#4@9"	#4@7"	#4@8"	17.3	1940	260
30-15	15.0	30	8'-9"	2'-8"	10'-0"	5'-4"	4'-9"	3.36'	10"	6"	$7\frac{1}{2}$"	8	#4@8"	#4@$6\frac{1}{2}$"	#4@8"	18.8	2150	260
40-3	3.0	40	5'-9"	2'-1"	8'-0"	4'-4"	3'-11"	2.67'	8"	5"	$6\frac{1}{2}$"	6	#4@10"	#4@$7\frac{1}{2}$"	#4@10"	12.0	1180	295
40-5	5.0	40	6'-5"	2'-4"	9'-0"	4'-9"	4'-3"	2.95'	9"	5"	$6\frac{1}{2}$"	6	#4@8"	#4@$7\frac{1}{2}$"	#4@10"	13.9	1450	295
40-7	7.0	40	7'-1"	2'-6"	9'-6"	5'-0"	4'-6"	3.16'	10"	6"	7"	6	#4@10"	#4@7"	#4@8"	16.1	1660	295
40-9	9.0	40	7'-8"	2'-8"	10'-0"	5'-3"	4'-8"	3.34'	10"	6"	7"	8	#4@8"	#4@7"	#4@8"	17.7	1910	295
40-11	11.0	40	8'-4"	2'-9"	10'-6"	5'-5"	4'-10"	3.49'	11"	6"	7"	8	#4@8"	#4@7"	#4@8"	19.1	2090	295
40-13	13.0	40	9'-0"	2'-11"	11'-0"	5'-7"	5'-0"	3.62'	11"	6"	$7\frac{1}{2}$"	8	#4@$7\frac{1}{2}$"	#4@$6\frac{1}{2}$"	#4@8"	20.8	2310	295
40-15	15.0	40	9'-7"	3'-0"	11'-6"	5'-9"	5'-2"	3.73'	11"	6"	$7\frac{1}{2}$"	8	#4@7"	#4@$6\frac{1}{2}$"	#4@8"	22.3	2520	295
50-3	3.0	50	6'-3"	2'-3"	8'-6"	4'-7"	4'-2"	2.89'	9"	5"	$6\frac{1}{2}$"	6	#4@9"	#4@$7\frac{1}{2}$"	#4@10"	13.6	1380	310
50-5	5.0	50	7'-0"	2'-6"	9'-6"	5'-0"	4'-5"	3.19'	10"	6"	7"	6	#4@10"	#4@7"	#4@8"	16.2	1650	310
50-7	7.0	50	7'-8"	2'-8"	10'-0"	5'-4"	4'-8"	3.41'	10"	6"	7"	8	#4@8"	#4@7"	#4@8"	18.1	1950	310
50-9	9.0	50	8'-4"	2'-10"	11'-0"	5'-7"	4'-11"	3.59'	11"	6"	7"	8	#4@$7\frac{1}{2}$"	#4@7"	#4@8"	19.8	2180	310
50-11	11.0	50	9'-0"	3'-0"	11'-6"	5'-10"	5'-2"	3.76'	12"	6"	$7\frac{1}{2}$"	8	#4@7"	#4@$6\frac{1}{2}$"	#4@8"	21.7	2440	310
50-13	13.0	50	9'-8"	3'-1"	11'-6"	6'-0"	5'-4"	3.89'	12"	6"	$7\frac{1}{2}$"	8	#4@$6\frac{1}{2}$"	#4@$6\frac{1}{2}$"	#4@8"	23.3	2680	310
60-3	3.0	60	6'-6"	2'-5"	9'-0"	4'-10"	4'-4"	3.07'	9"	5"	$6\frac{1}{2}$"	6	#4@8"	#4@$7\frac{1}{2}$"	#4@10"	14.9	1550	345
60-5	5.0	60	7'-3"	2'-8"	10'-0"	5'-3"	4'-8"	3.38'	10"	6"	7"	8	#4@8"	#4@7"	#4@8"	17.7	1890	345
60-7	7.0	60	8'-0"	2'-10"	11'-0"	5'-7"	4'-11"	3.61'	11"	6"	7"	8	#4@$7\frac{1}{2}$"	#4@7"	#4@8"	19.7	2170	345
60-9	9.0	60	8'-8"	3'-0"	11'-6"	5'-10"	5'-2"	3.81'	12"	6"	7"	8	#4@7"	#4@7"	#4@8"	21.7	2440	345
60-11	11.0	60	9'-5"	3'-2"	12'-0"	6'-1"	5'-4"	3.97'	12"	6"	$7\frac{1}{2}$"	8	#4@6"	#4@$6\frac{1}{2}$"	#4@8"	23.8	2780	345
70-3	3.0	70	6'-9"	2'-6"	9'-6"	5'-0"	4'-5"	3.21'	10"	6"	$6\frac{1}{2}$"	8	#4@10"	#4@$7\frac{1}{2}$"	#4@8"	16.6	1680	350
70-5	5.0	70	7'-6"	2'-9"	10'-6"	5'-5"	4'-10"	3.54'	11"	6"	7"	8	#4@8"	#4@7"	#4@8"	19.2	2060	350

TYPE 1
SINGLE LAYER REINFORCEMENT IN POOL FLOOR

STRUCT. NO.	F MAX.	Q MAX.	L_F	L_B	L_P	H_P	H_T	$d_2 + hv_2$	h	t	t'	NO. OF WEEP HOLES	POOL REINF.			QUANTITIES		
													TRANSV. BARS IN WALLS & FLOORS	LONGIT. BARS IN FLOOR	LONGIT. BARS IN WALLS	CONC. (CU.YDS.)	REINF. STEEL (LBS.)	MISC. METAL (LBS.)
70-7	7.0	70	8'-3"	3'-0"	11'-6"	5'-10"	5'-2"	3.78'	11"	6"	7"	8	#4@7"	#4@7"	#4@8"	21.5	2400	350
70-9	9.0	70	9'-0"	3'-2"	12'-0"	6'-1"	5'-5"	3.99'	12"	6"	$7\frac{1}{2}$"	8	#4@6"	#4@$6\frac{1}{2}$"	#4@8"	23.9	2790	350
70-11	11.0	70	9'-9"	3'-3"	12'-6"	6'-4"	5'-7"	4.15'	13"	7"	$7\frac{1}{2}$"	8	#4@$7\frac{1}{2}$"	#4@$6\frac{1}{2}$"	#4@7"	26.5	2950	350
80-3	3.0	80	7'-0"	2'-8"	10'-0"	5'-4"	4'-8"	3.46'	10"	6"	$6\frac{1}{2}$"	8	#4@8"	#4@$7\frac{1}{2}$"	#4@8"	17.6	1870	355
80-5	5.0	80	7'-9"	3'-0"	11'-0"	5'-9"	5'-1"	3.80'	12"	6"	7"	8	#4@7"	#4@7"	#4@8"	20.3	2250	355
80-7	7.0	80	8'-6"	3'-2"	12'-0"	6'-1"	5'-5"	4.06'	12"	6"	7"	8	#4@6"	#4@7"	#4@8"	22.5	2630	355
80-9	9.0	80	9'-4"	3'-4"	12'-6"	6'-5"	5'-8"	4.27'	13"	7"	$7\frac{1}{2}$"	8	#4@7"	#4@$6\frac{1}{2}$"	#4@7"	25.9	2910	355
90-3	3.0	90	7'-3"	2'-9"	10'-6"	5'-4"	4'-9"	3.56'	11"	6"	$6\frac{1}{2}$"	8	#4@8"	#4@$7\frac{1}{2}$"	#4@8"	19.0	2030	395
90-5	5.0	90	8'-0"	3'-1"	11' 6"	5'-10"	5'-2"	3.91'	12"	6"	7"	8	#4@7"	#4@7"	#4@8"	22.1	2460	395
90-7	7.0	90	8'-10"	3'-3"	12'-6"	6'-3"	5'-6"	4.18'	13"	7"	7"	8	#4@$6\frac{1}{2}$"	#4@7"	#4@7"	25.3	2900	395
90-9	9.0	90	9'-8"	3'-6"	13'-0"	6'-8"	5'-10"	4.40'	13"	7"	$7\frac{1}{2}$"	10	#4@$6\frac{1}{2}$"	#4@$6\frac{1}{2}$"	#4@7"	28.3	3250	395
100-3	3.0	100	7'-10"	2'-11"	11'-0"	5'-8"	5'-0"	3.78'	11"	6"	$6\frac{1}{2}$"	8	#4@$7\frac{1}{2}$"	#4@$7\frac{1}{2}$"	#4@8"	20.2	2200	400
100-5	5.0	100	8'-8"	3'-3"	12'-0"	6'-2"	5'-4"	4.14'	12"	6"	7"	8	#4@6"	#4@7"	#4@8"	23.2	2690	400
100-7	7.0	100	9'-6"	3'-6"	13'-0"	6'-7"	5'-8"	4.42'	13"	7"	7"	8	#4@$5\frac{1}{2}$"	#4@7"	#4@7"	26.5	3180	400
100-9	9.0	100	10'-5"	3'-8"	14'-0"	6'-11"	6'-0"	4.65'	14"	7"	$7\frac{1}{2}$"	10	#4@$5\frac{1}{2}$"	#4@$6\frac{1}{2}$"	#4@7"	29.6	3550	400

TYPE 2
DOUBLE LAYER REINFORCEMENT IN POOL FLOOR

STRUCT. NO.	F MAX.	Q MAX.	L_F	L_B	L_P	H_P	H_T	$d_2 + hv_2$	h	t	t'	NO. OF WEEP HOLES	POOL REINF. OUTER LAYER			QUANTITIES		
													TRANSV. REINF.	LONGIT. REINF. FLOOR	LONGIT. REINF. WALLS	CONC. (CU YDS)	REINF STEEL (LBS.)	MISC. METAL (LBS)
50-15	15.0	50	10'-5"	3'-2"	12'-0"	6'-2"	5'-5"	4.02'	12"	6"	8"	8	#4@6"	#4@16"	#4@8"	25.1	3050	310
60-13	13.0	60	10'-1"	3'-3"	12'-6"	6'-3"	5'-6"	4.12'	13"	7"	8"	8	#4@$7\frac{1}{2}$"	#4@16"	#4@7"	26.4	3040	345
60-15	15.0	60	10'-10"	3'-5"	13'-0"	6'-5"	5'-8"	4.26'	13"	7"	8"	8	#4@7"	#4@16"	#4@7"	28.2	3290	345
70-13	13.0	70	10'-6"	3'-5"	13'-0"	6'-6"	5'-9"	4.31'	13"	7"	8"	8	#4@$6\frac{1}{2}$"	#4@16"	#4@7"	28.6	3400	350
70-15	15.0	70	11'-3"	3'-6"	13'-6"	6'-8"	5'-10"	4.44'	14"	7"	8"	10	#4@$6\frac{1}{2}$"	#4@16"	#4@7"	30.4	3620	350
80-11	11.0	80	10'-1"	3'-6"	13'-6"	6'-8"	5'-10"	4.46'	14"	7"	8"	10	#4@$6\frac{1}{2}$"	#4@16"	#4@7"	28.2	3360	355
80-13	13.0	80	10'-10"	3'-8"	14'-0"	6'-10"	6'-0"	4.63'	14"	7"	8"	10	#4@6"	#4@16"	#4@7"	30.1	3650	355
80-15	15.0	80	11'-8"	3'-9"	14'-6"	7'-0"	6'-2"	4.77'	15"	7"	$8\frac{1}{2}$"	10	#4@$5\frac{1}{2}$"	#4@15"	#4@7"	32.3	3990	355
90-11	11.0	90	10'-6"	3'-7"	13'-6"	7'-0"	6'-0"	4.59'	14"	7"	8"	10	#4@$5\frac{1}{2}$"	#4@16"	#4@7"	30.9	3840	395
90-13	13.0	90	11'-4"	3'-19"	14'-0"	7'-2"	6'-2"	4.75'	14"	7"	8"	10	#4@5"	#4@16"	#4@7"	32.8	4200	395
90-15	15.0	90	12'-1"	3'-11"	14'-6"	7'-4"	6'-4"	4.90'	15"	8"	$8\frac{1}{2}$"	10	#4@6"	#4@15"	#4@16"	36.3	4670	395
100-11	11.0	100	11'-3"	3'-10"	14'-6"	7'-2"	6'-3"	4.85'	15"	7"	8"	10	#4@5"	#4@16"	#4@7"	32.4	4140	400
100-13	13.0	100	12'-1"	4'-0"	15'-0"	7'-4"	6'-5"	5.02'	15"	8"	$8\frac{1}{2}$"	10	#4@6"	#4@15"	#4@16"	35.9	4620	400
100-15	15.0	100	13'-0"	4'-1"	15'-6"	7'-6"	6'-7"	5.17'	16"	8"	$8\frac{1}{2}$"	10	#4@$5\frac{1}{2}$"	#4@15"	#4@16"	38.0	5000	400

DIMENSIONS

STRUCT. NO.	DIMENSIONS										CHECK INLET		NO. OF WALK PLANKS	TYPE I ONLY	
	b_T	a	b	L_O	H_F	H_O	H_S	c	d	L_T	GATE SIZE	FRAME HT.		e	t_w
5	24"	21"	3'-0"	2'-7"	2'-6"	12"	20"	3	6"	5'-0"	36"x12"	5'-0"	7	24"	6"
10	24"	2'-1"	3'-6"	3'-7"	2'-10"	16"	24"	3	9"	6'-0"	42"x16"	5'-6"	8	24"	6"
15	24"	2'-5"	4'-0"	3'-7"	3'-2"	20"	2'-2"	5	4"	7'-0"	48"x20"	5'-6"	8	24"	6"
20	24"	2'-7"	4'-6"	4'-7"	3'-4"	22"	2'-4"	5	7"	8'-0"	54"x22"	5'-6"	10	24"	6"
25	24"	2'-9"	5'-0"	4'-7"	3'-6"	24"	2'-5"	5	10"	8'-0"	60"x24"	5'-6"	10	24"	6"
30	24"	3'-0"	5'-6"	4'-7"	3'-9"	2'-3"	2'-6"	7	5"	9'-0"	66"x27"	6'-0"	10	24"	6"
40	24"	3'-6"	6'-0"	5'-7"	4'-0"	2'-6"	2'-8"	7	8"	9'-0"	72"x30"	6'-0"	11	2'-6"	8"
50	2'-6"	4'-0"	6'-6"	5'-7"	4'-3"	2'-9"	2'-9"	7	11"	10'-0"	78"x33"	6'-0"	11	2'-6"	8"
60	2'-6"	4'-3"	7'-0"	6'-7"	4'-6"	3'-0"	2'-10"	9	6"	10'-0"	84"x36"	6'-0"	13	2'-6"	8"
70	3'-0"	4'-6"	7'-6"	6'-7"	4'-9"	3'-3"	2'-11"	9	9"	11'-0"	90"x39"	6'-6"	13	2'-6"	8"
80	3'-0"	4'-6"	7'-6"	6'-7"	5'-0"	3'-6"	3'-0"	9	9"	11'-0"	90"x42"	6'-6"	13	2'-6"	8"
90	3'-6"	5'-0"	8'-0"	7'-7"	5'-3"	3'-9"	3'-1"	11	4"	12'-0"	96"x45"	6'-6"	15	2'-6"	8"
100	3'-6"	5'-3"	8'-0"	7'-7"	5'-6"	4'-0"	4'-3"	11	4"	12'-0"	96"x45"	6'-6"	15	2'-6"	8"

DESIGN CRITERIA

Structure No. 5-3 indicates Q=5 c.f.s., F=3ft.
Structure No. 60-13 indicates Q=60 c.f.s., F=13ft.
The dimensions of the control notch at the inlet of the structure should be calculated for maximum Q and 20% of maximum Q.
Where steel slide gates are used at the inlet of the structure, the minimum width should be equal to the base width of the structure.
The base width of the structure is determined from the formula $b = \frac{360\sqrt{Q}}{d^{1.360}}$.
The minimum downstream energy gradient for full design capacity is determined by reducing the assumed "n" value for the channel by 20% and computing the depth.
"F" is the vertical fall from the normal upstream energy gradient to the minimum downstream energy gradient.
"d_2" is the height of the downstream end of the hydraulic jump and may be determined from the formula, $d_2 = \frac{-d_1}{2} + \sqrt{\frac{2v_1^2 d_1}{g} + \frac{d_1^2}{4}}$ ar from 103-D-289.
The values of V_1 and d_1 are obtained by neglecting losses in the drop.
The bottom grade of the stilling pool is found by subtracting $d_2 + hv_2$ from the downstream energy gradient.
The minimum stilling pool length is $3d_2$.
The minimum freeboard for the stilling pool is obtained by using 103-D-642 as a guide.
The minimum length between chute blocks and floor blocks is $.8d_2$.
Reinforcement steel design is based on working stresses of 24,000 psi.
Monolithic concrete design based on a compressive strength of 3,750 psi at 28 days.
The minimum floor thickness of the stilling pool and chute may be obtained from 40-CRB-36.
Type 3 loading is used for stilling pool walls and Type 2 loading for chute and other walls, see 40-CT-4.
Special consideration should be given to the selection of slide gates at check inlets where automation is planned because the slide gates indicated may not operate satisfactorily with power lifts.

STANDARD DESIGNS FOR:

R.I. Drops - Type 1 ..... C 120.10
R.I. Drops - Type 2 ..... C 120.20

ALWAYS THINK **SAFETY**

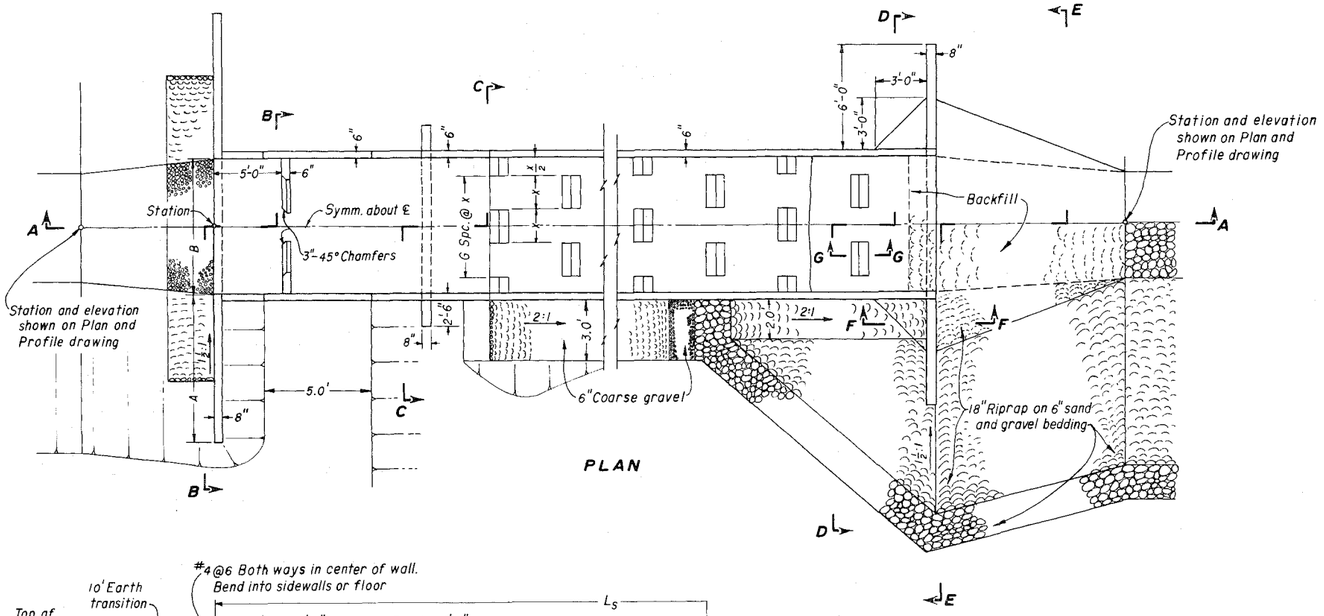
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

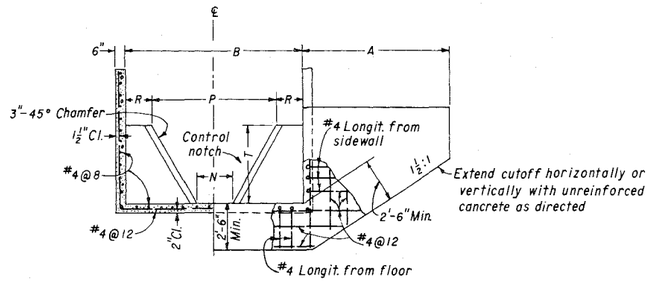
STANDARD DESIGNS
WATERWAY STRUCTURES

RECTANGULAR INCLINED DROPS
WASTEWAYS AND DRAINS

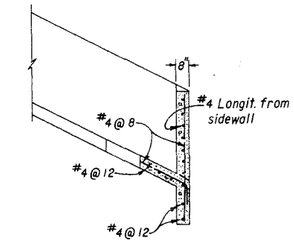
DRAWN C.K.B. SUBMITTED
TRACED A.P.A. RECOMMENDED
CHECKED APPROVED
DENVER, COLORADO

C 220.20

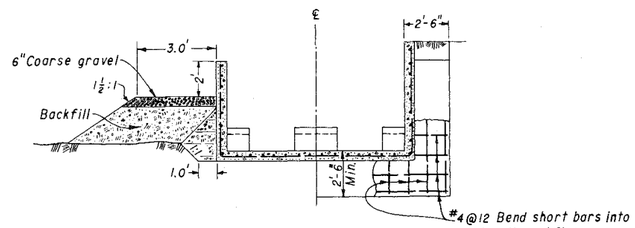




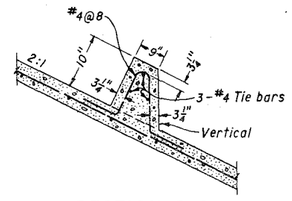
SECTION B-B



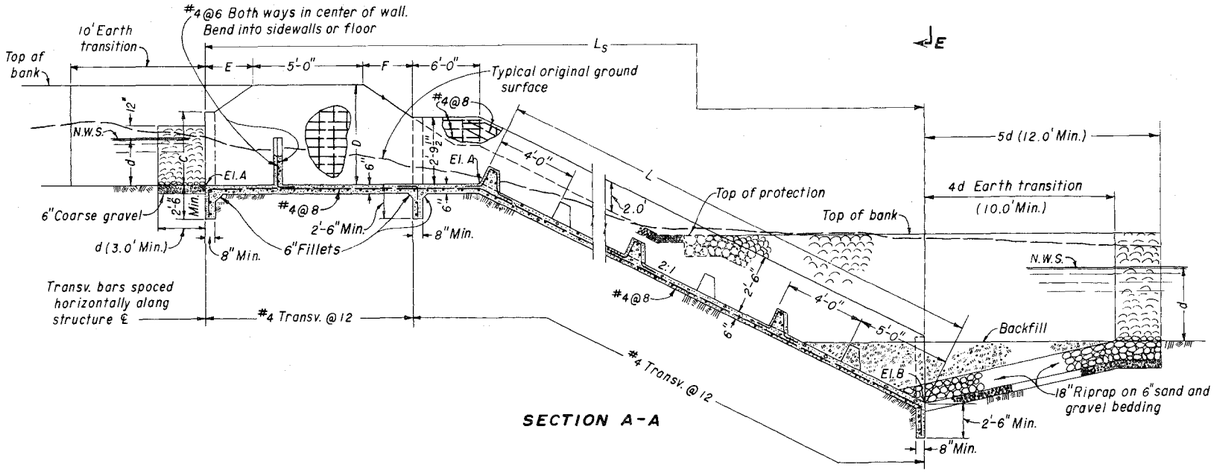
SECTION F-F



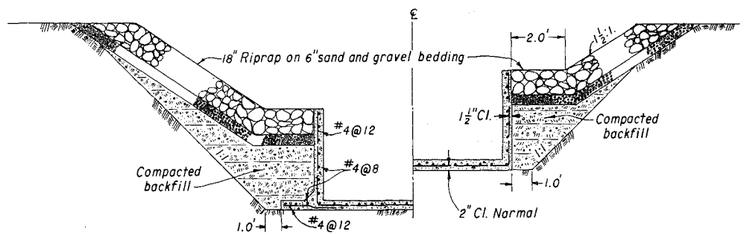
SECTION C-C



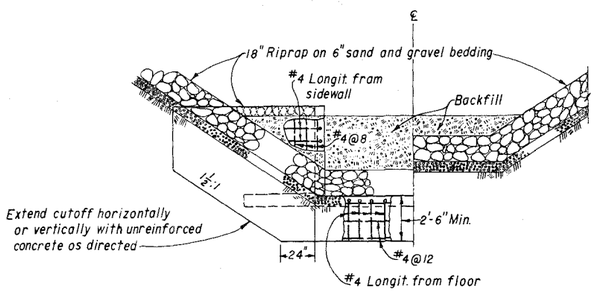
SECTION G-G



SECTION A-A



SECTION D-D



SECTION E-E

BAFFLED APRON DROP DATA

STATION	ELEVATIONS		DIMENSIONS											CONTROL NOTCH				EST. QUANTITIES	
	A	B	A	B	C	D	E	F	G	X	L	L_S		T	P	N	R	CONCRETE CU. YDS.	REINF. STEEL LBS.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Place entire structure on a foundation of undisturbed earth or thoroughly compacted fill.

ALWAYS THINK SAFETY

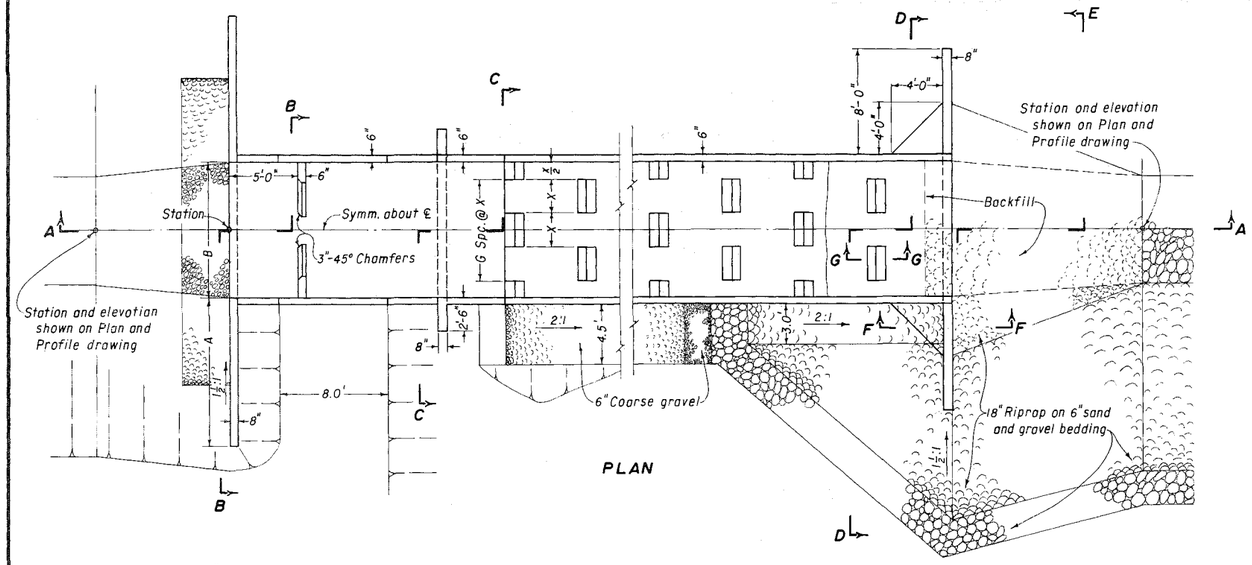
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

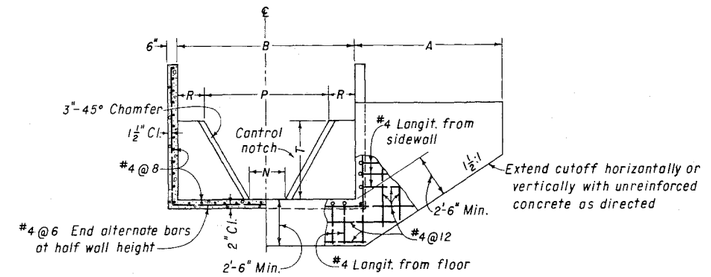
BAFFLED APRON DROPS--q=5 C.F.S.

DRAWN	A.S.C.	SUBMITTED	
TRACED	H.M.S.	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH

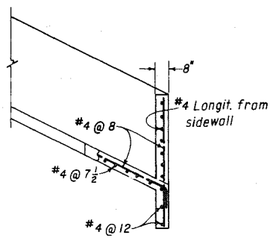
DENVER, COLORADO

C-122.05

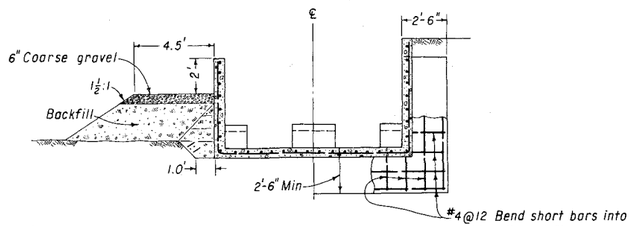




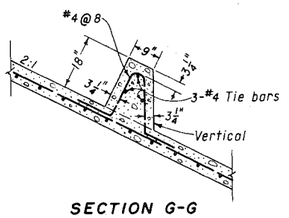
SECTION B-B



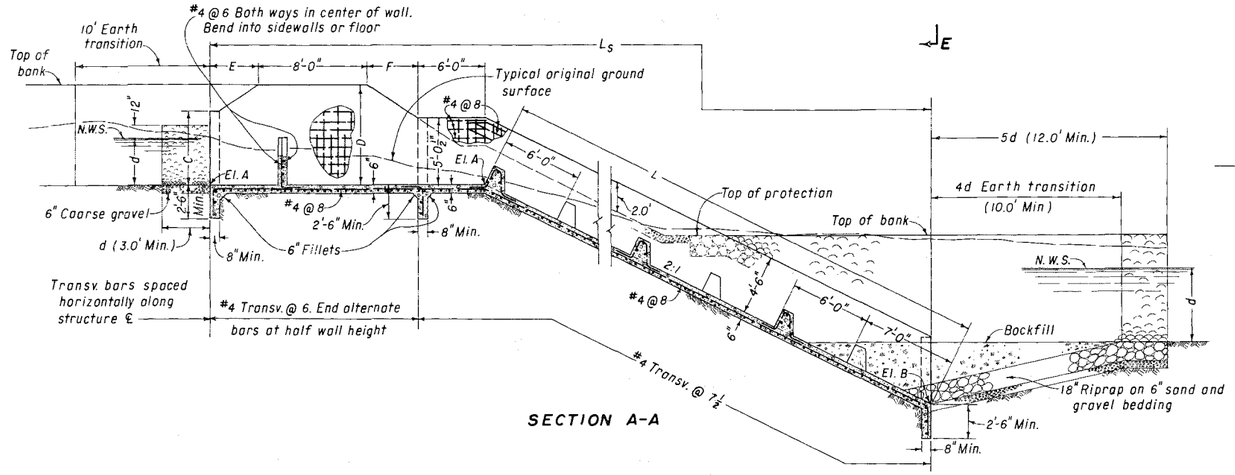
SECTION F-F



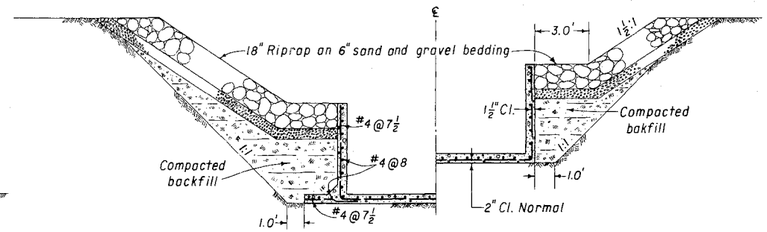
SECTION C-C



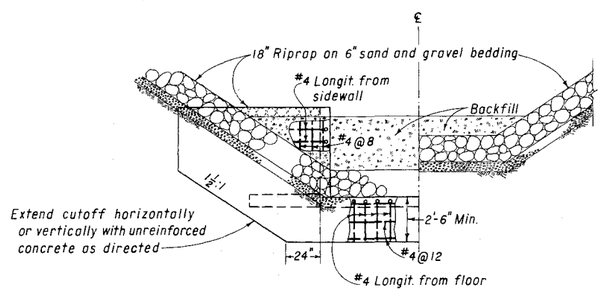
SECTION G-G



SECTION A-A



SECTION D-D



SECTION E-E

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Place entire structure on a foundation of undisturbed earth or thoroughly compacted fill.

BAFFLED APRON DROP DATA

STATION	ELEVATIONS		DIMENSIONS											CONTROL NOTCH				EST. QUANTITIES	
	A	B	A	B	C	D	E	F	G	X	L	L_S		T	P	N	R	CONCRETE CU. YDS.	REINF. STEEL LBS.

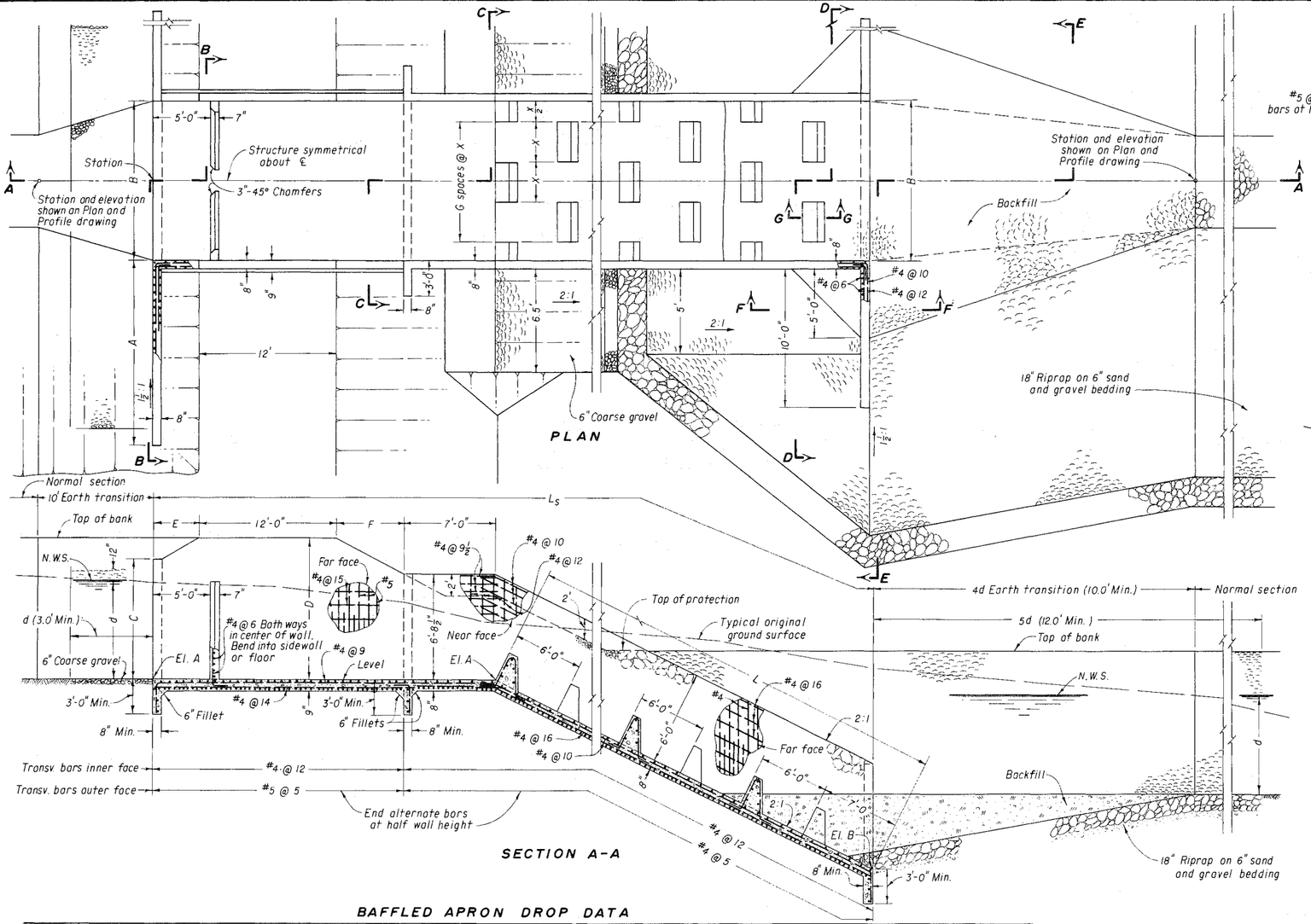
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

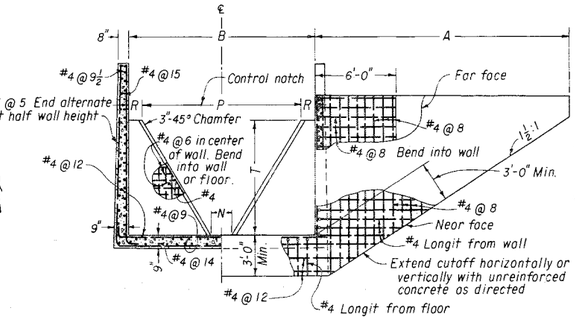
BAFFLED APRON DROPS--q=12 C.F.S.

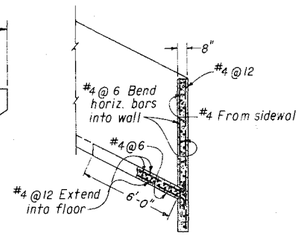
DRAWN	R.E.C.	SUBMITTED	
TRACED	W.A.W	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH

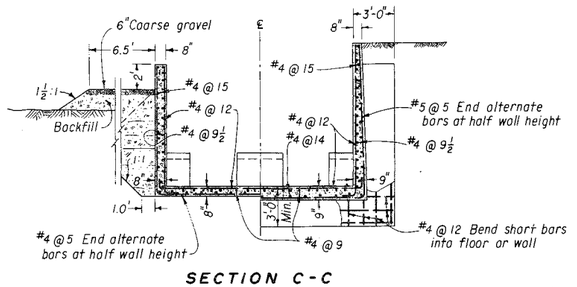
C122.12

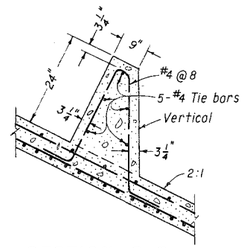
DENVER, COLORADO.

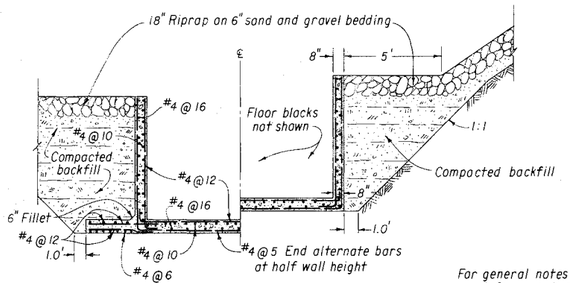










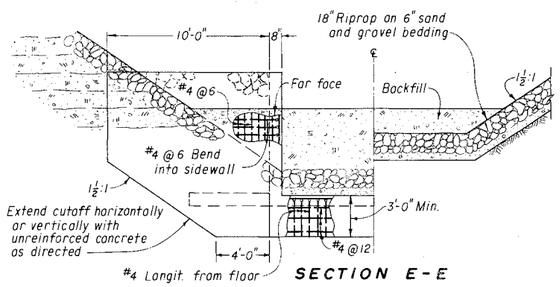


NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-0-6123
Vary thickness of concrete uniformly between dimensions shown
Place entire structure on a foundation of undisturbed earth or thoroughly compacted fill

BAFFLED APRON DROP DATA

STATION	ELEVATIONS		DIMENSIONS											CONTROL NOTCH				EST. QUANTITIES	
	A	B	A	B	C	D	E	F	G	X	L	L_S		T	P	N	R	CONCRETE CU. YDS.	REINF. STEEL LBS.



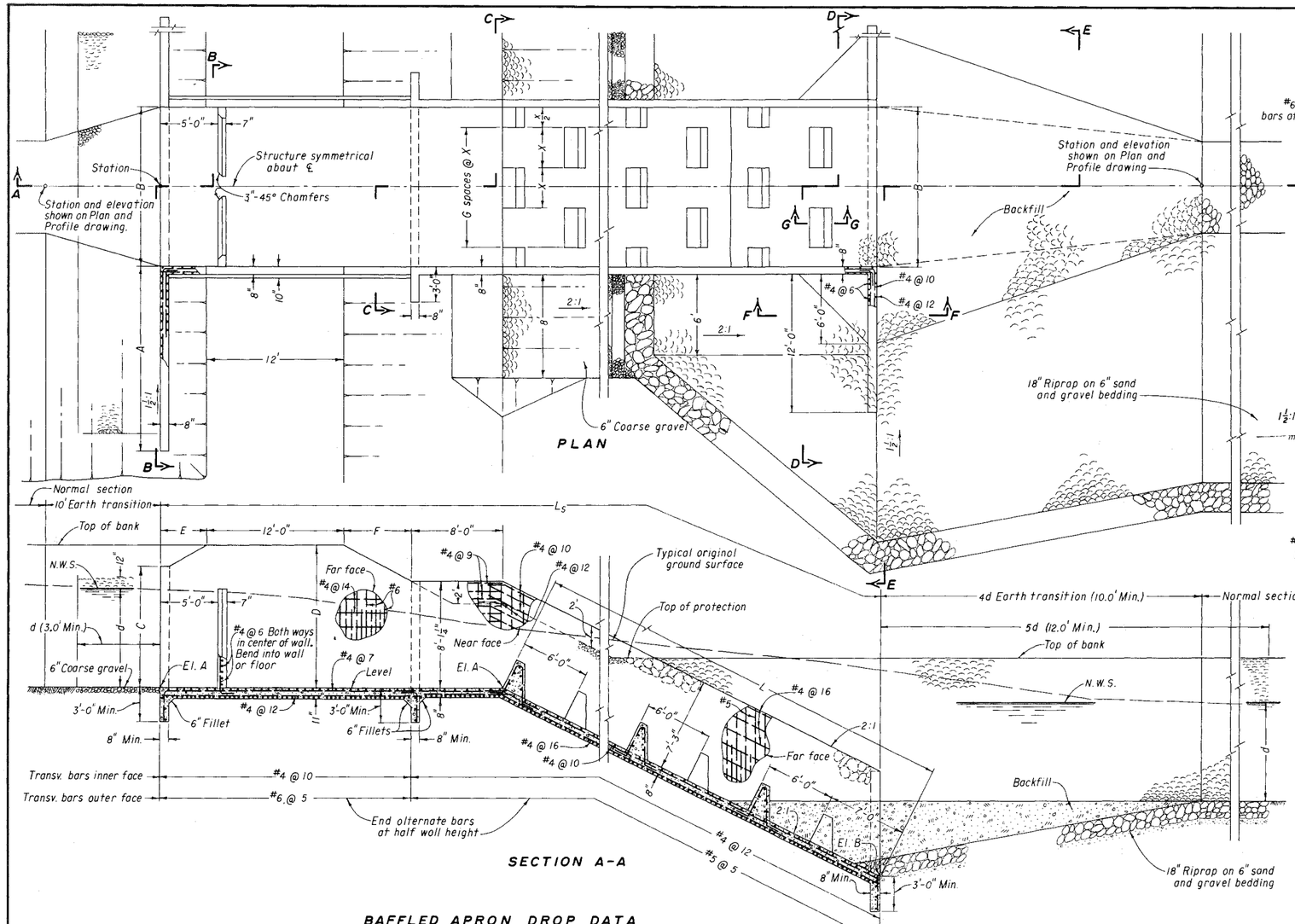
ALWAYS THINK SAFETY

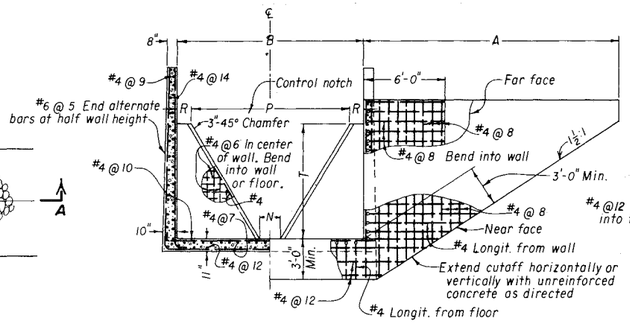
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BAFFLED APRON DROPS -- q=20 C.F.S.

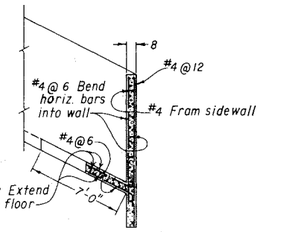
DRAWN	I.K.	SUBMITTED	
TRACED	A.P.R.	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH

C 122.20

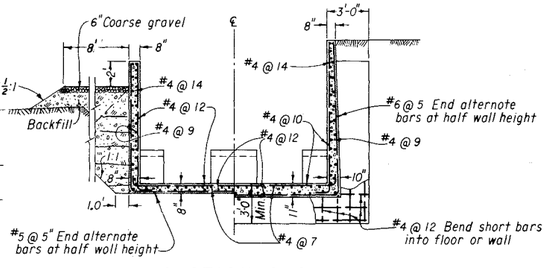




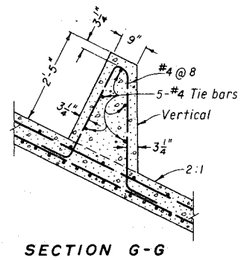
SECTION B-B



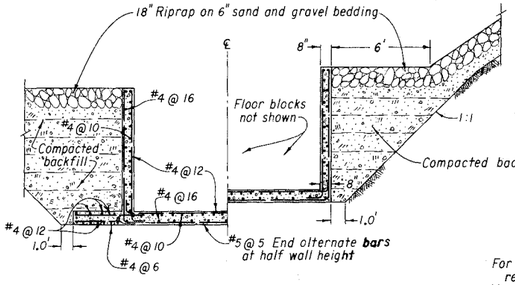
SECTION F-F



SECTION C-C



SECTION G-G



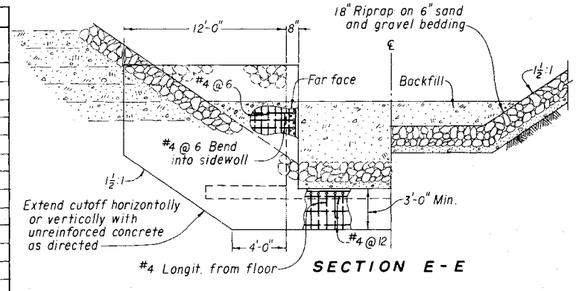
SECTION D-D

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Vary thickness of concrete uniformly between dimensions shown.
Place entire structure on a foundation of undisturbed earth or thoroughly compacted fill.

BAFFLED APRON DROP DATA

STATION	ELEVATIONS		DIMENSIONS											CONTROL NOTCH				EST. QUANTITIES	
	A	B	A	B	C	D	E	F	G	X	L	L_S		T	P	N	R	CONCRETE CU. YDS.	REINF. STEEL LBS.



SECTION E-E

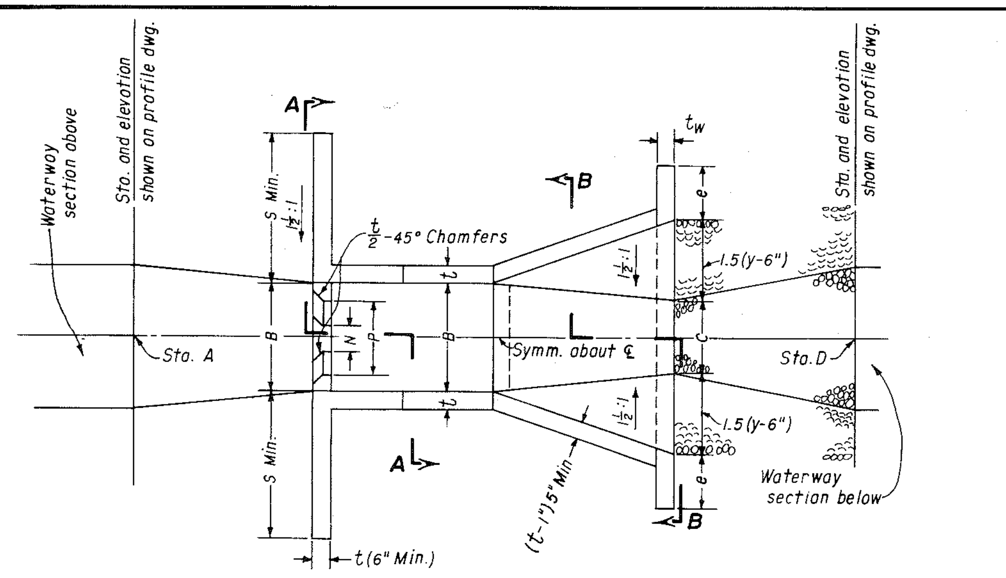
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

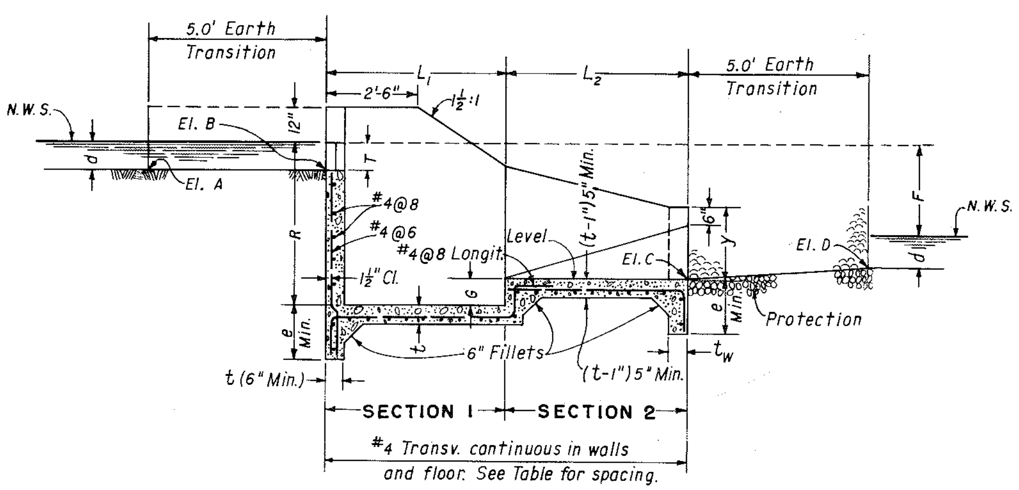
BAFFLED APRON DROPS--q=30 C.F.S.

C-122-30

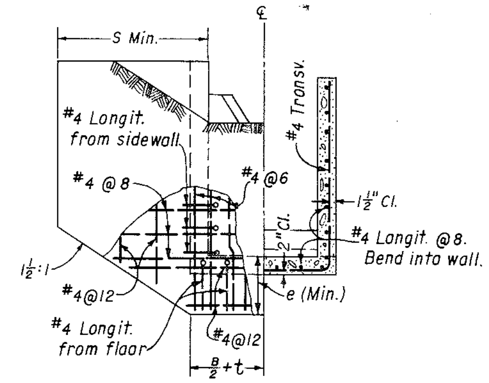
DRAWN J.K. SUBMITTED
TRACED G.L.S. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH



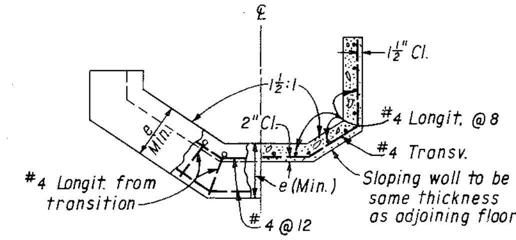
PLAN
(CONTROL INLET)



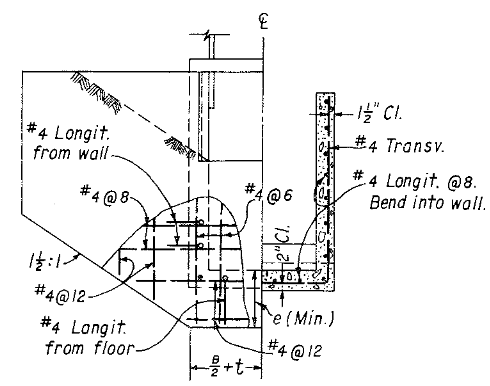
LONGITUDINAL SECTION



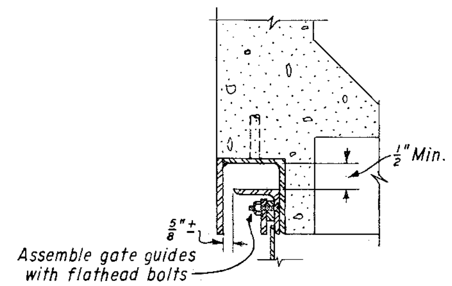
SECTION A-A



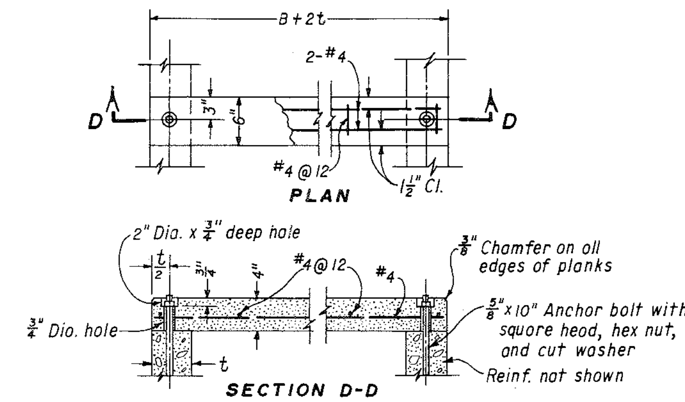
SECTION B-B



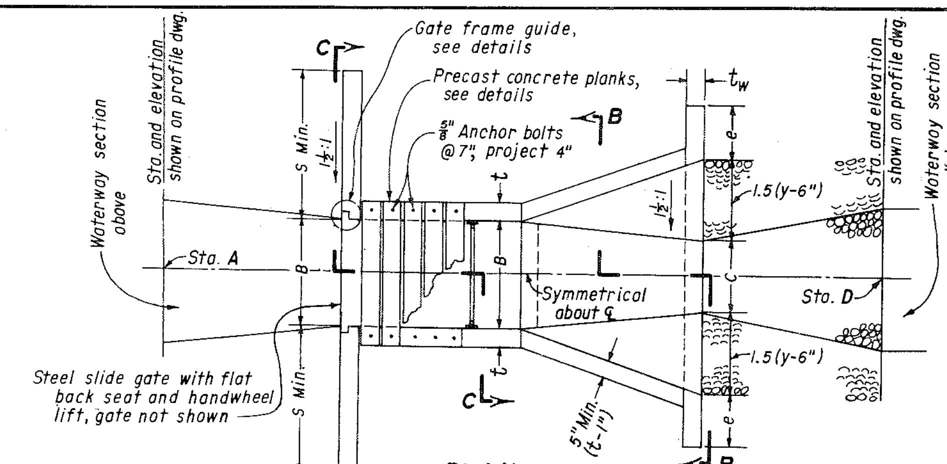
SECTION C-C



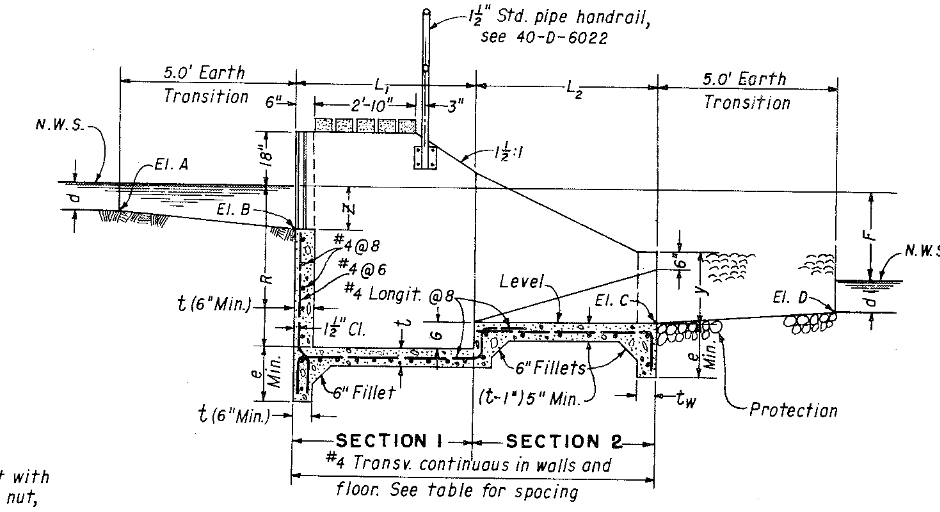
TYPICAL SLIDE GATE ASSEMBLY



DETAILS OF PRECAST CONCRETE PLANK



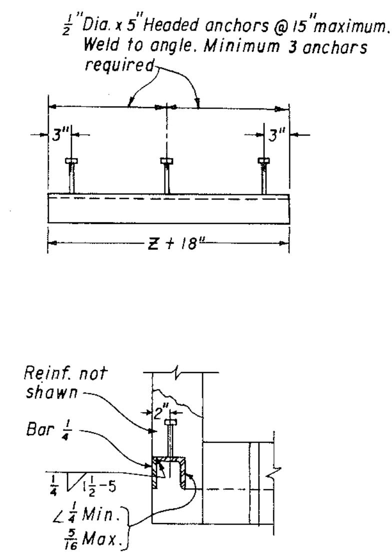
PLAN
(CHECK INLET)



LONGITUDINAL SECTION

WATERWAY	STA. A	TYPE INLET	Q	F	STA. D	R	G	y	S	Z	L_1	L_2	e	t	t_w	C	B	El. A	El. B	El. C	El. D	CONTROL N	CONTROL P	CONTROL T	#4 TRANSV. @ SEC. 1	#4 TRANSV. @ SEC. 2	EST. QUANT. CONC.	EST. QUANT. REINF.	SLIDE GATE (WIDTH x HEIGHT)*	SLIDE GATE FRAME HEIGHT

* When a gate of specified height is not available a gate with next greater availabe height shall be used with appropriate frame height



GATE FRAME GUIDE DETAILS
(2 REQUIRED)

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Elevation C to be equal to or less than elevation D.
Gate frame height measured from ℄ of gate opening.

REFERENCE DRAWINGS

TYPICAL PROTECTION

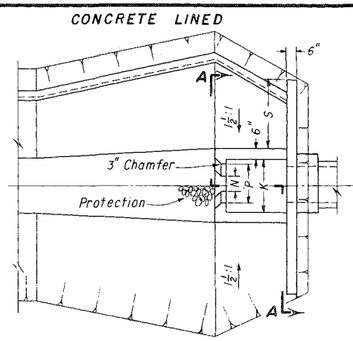
ALWAYS THINK SAFETY

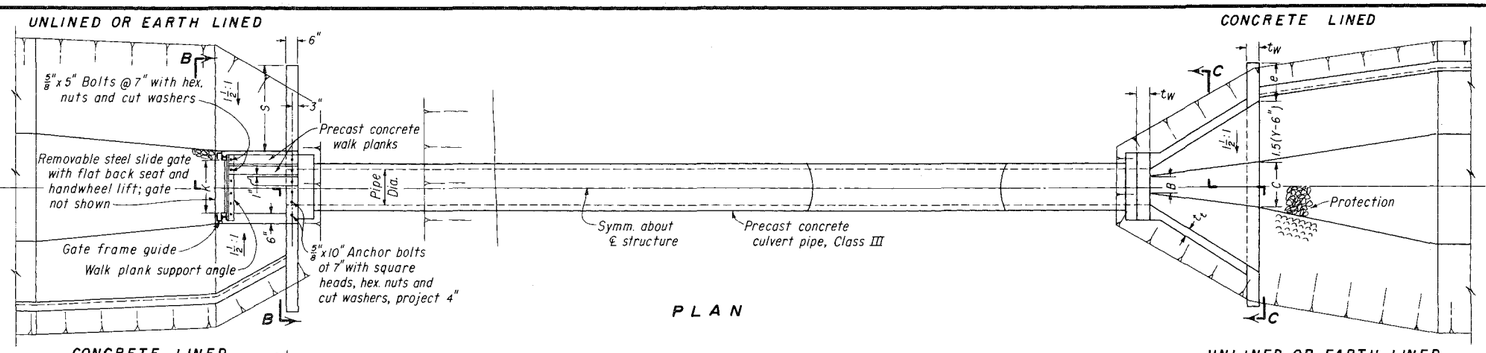
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE VERTICAL DROPS

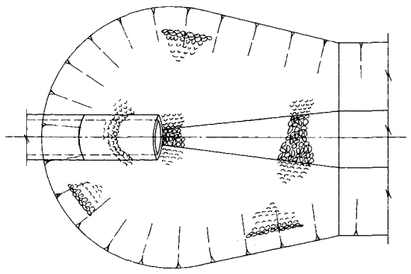
DRAWN R.E.C. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO

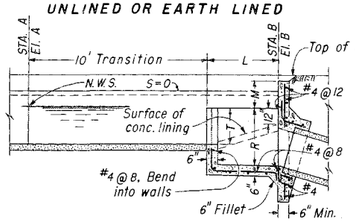
C 124.00



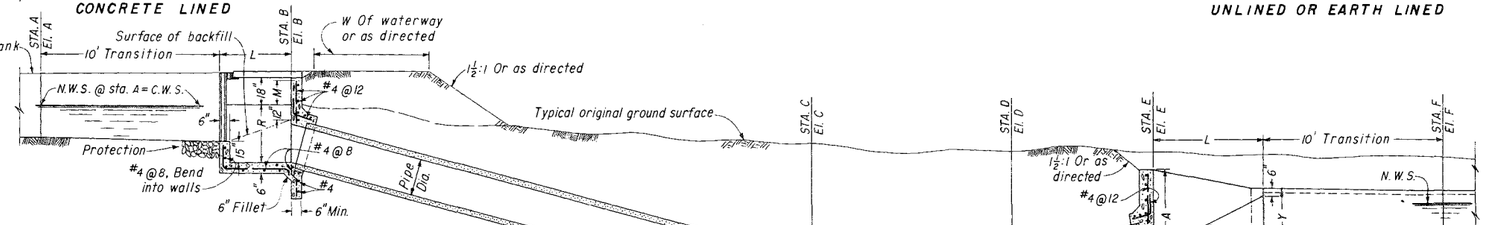


PLAN





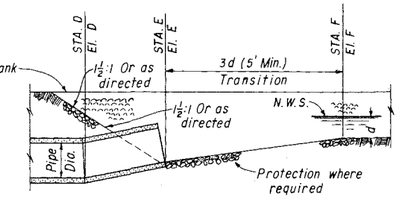
CONTROL INLET



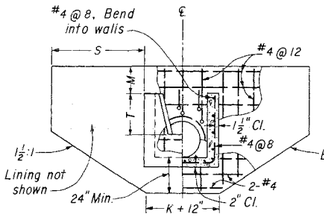
CHECK INLET

LONGITUDINAL SECTION

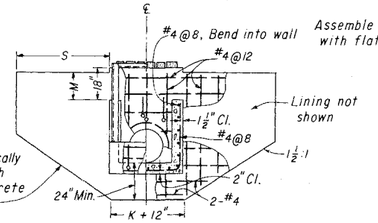
TRANSITION OUTLET



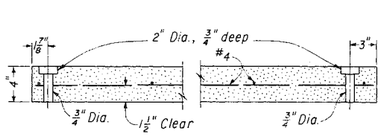
EARTH OUTLET



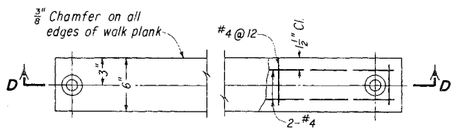
SECTION A-A



SECTION B-B

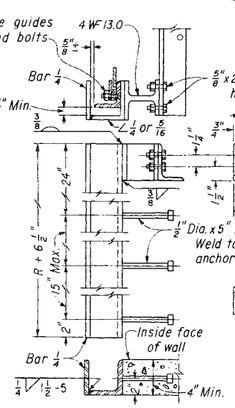


SECTION D-D

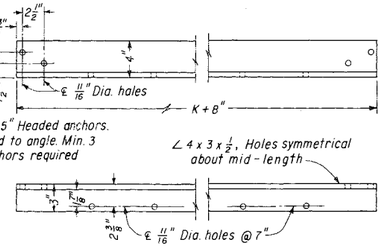


PLAN

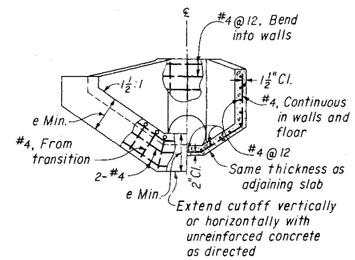
PRECAST CONCRETE WALK PLANK



GATE FRAME GUIDE



WALK PLANK SUPPORT ANGLE



SECTION C-C

REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT
BENDS FOR PRECAST CONCRETE CULVERT PIPE

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Locations of vertical P.I.'s at C and D are to be considered approximate only and may be adjusted according to actual laying length of pipe.
Pipe drop shall have earth outlet unless otherwise specified.
Lining similar to the lining in the adjoining waterway shall be placed at the inlet or outlet of the pipe drop, as shown.
Stations and elevations refer to invert unless otherwise shown.
For details of joint between concrete lining and concrete structure, see

WATERWAY	Q	PIPE DIA. In.	STATIONS AND ELEVATIONS												CHECK INLET							CONTROL INLET								TRANSITION OUTLET										EST. QUANTITIES				REMARKS
			STA. A	El. A	STA. B	El. B	STA. C	El. C	STA. D	El. D	STA. E	El. E	STA. F	El. F	R	M	S	K	L	No. WK. PLK	GATE * Width x Ht.	Fr.	R	M	S	K	L	T	P	N	A	B	C	e	L	P	Y	t_t In.	t_w In.	PIPE FT.	CONC. CU. YDS	REINF. LBS.	MISC. MTL. LBS.	

* When a gate with specified height is not available, a gate with next greater available height shall be used.

REMARKS

(1)

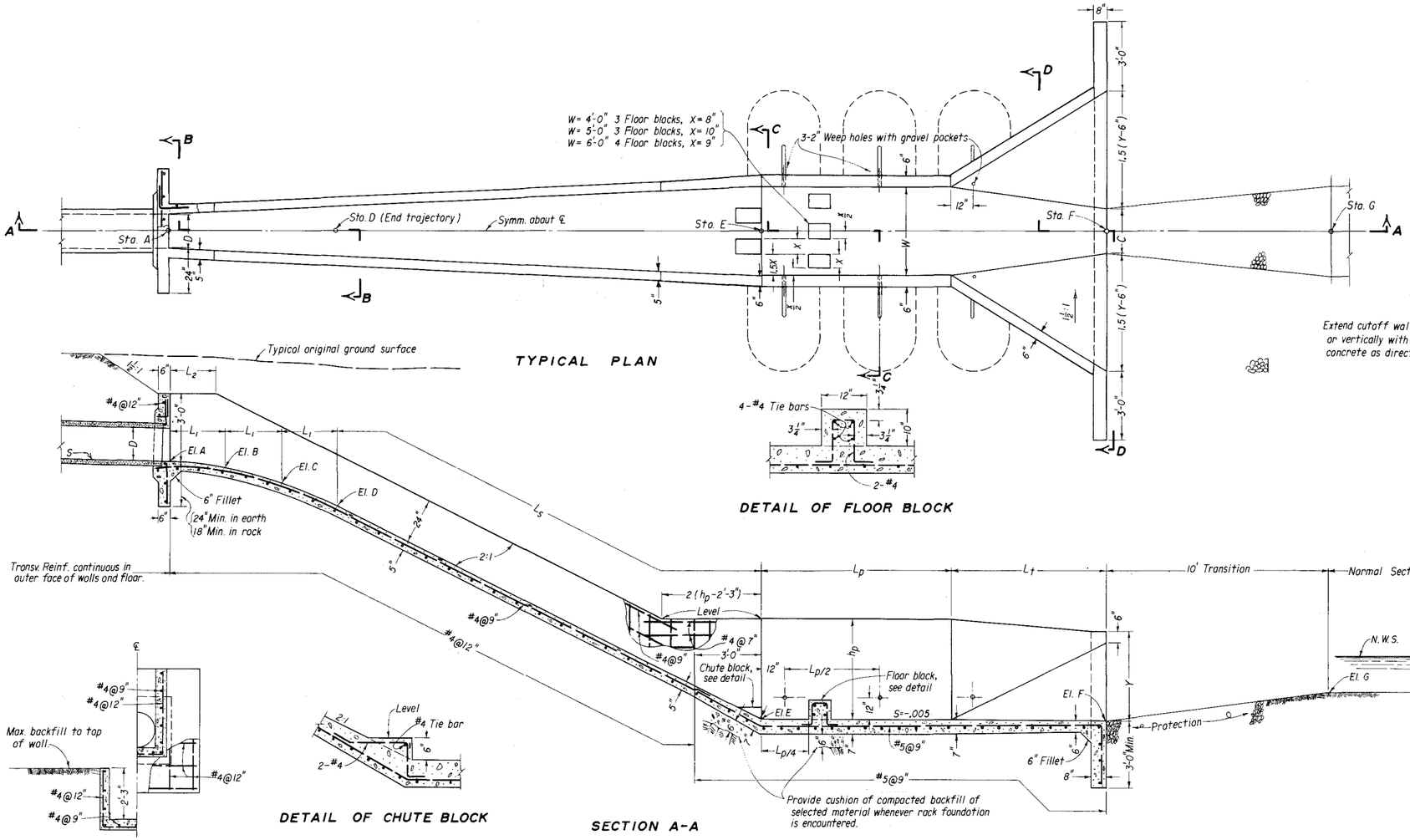
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DROP

DRAWN D.M.M. SUBMITTED
TRACED L.L.M. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO.

C 125.00



WATERWAY	Q	D	S	STATIONS A	D	E	F	G	ELEVATIONS A	B	C	D	E	F	G	DIMENSIONS L_1	L_2	L_3	L_p	L_t	h_p	W	C	Y	CONC. CU. YDS.	REMARKS

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
For Hydraulic Properties below stilling pools see Plan and Profile drawings.

REFERENCE DRAWINGS

WEEP HOLE
TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT

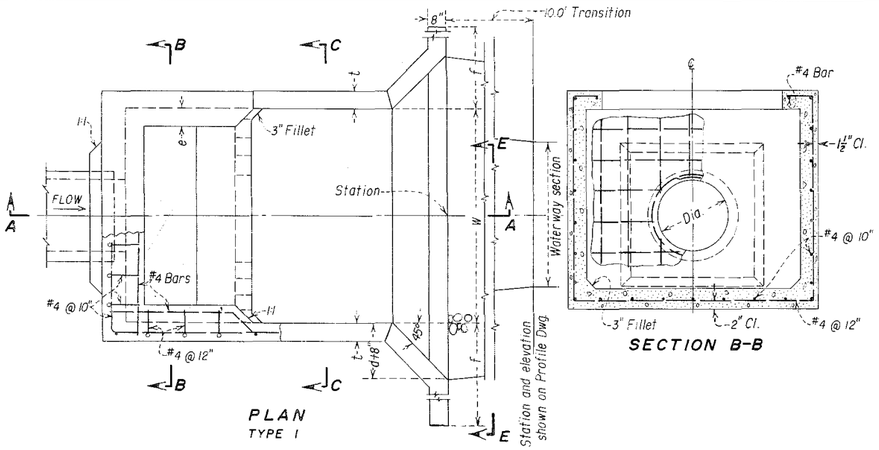
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STILLING POOLS

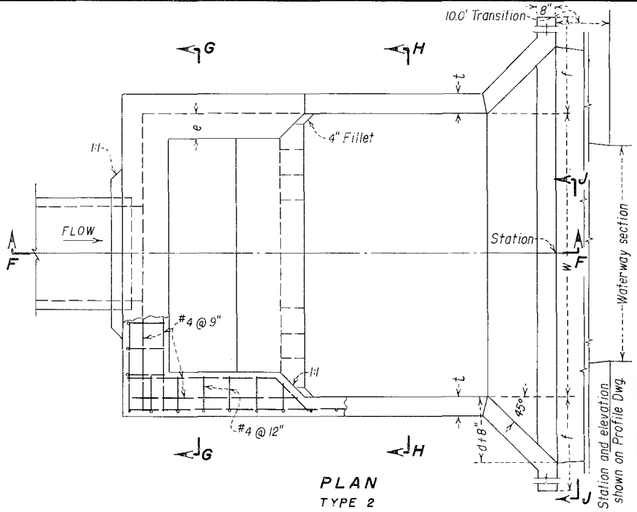
DRAWN A.W.B. SUBMITTED
TRACED W.D.A. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C 130.00

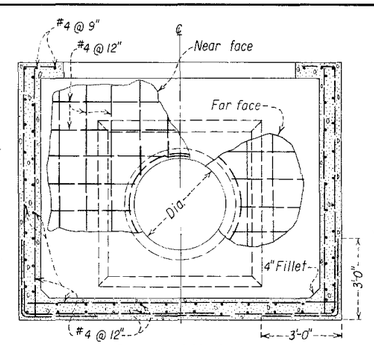


PLAN
TYPE 1

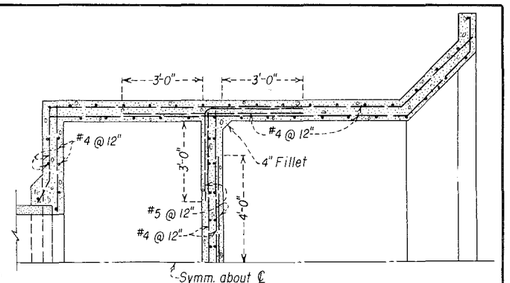
SECTION B-B



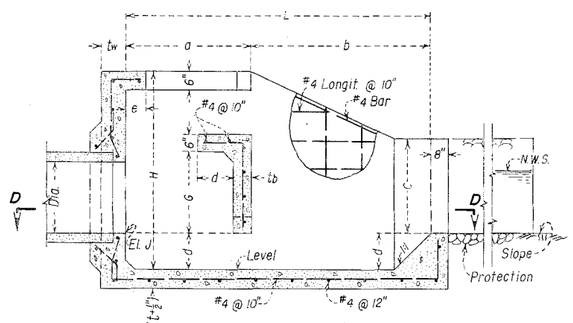
PLAN
TYPE 2



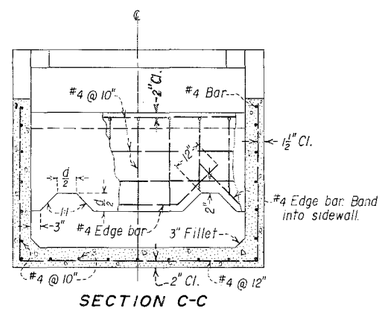
SECTION G-G



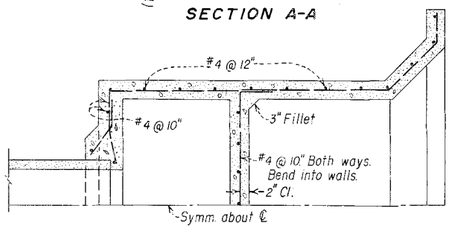
SECTION K-K



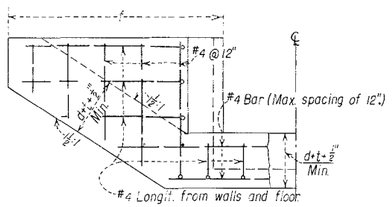
SECTION A-A



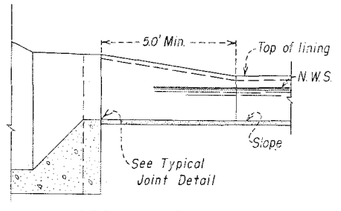
SECTION C-C



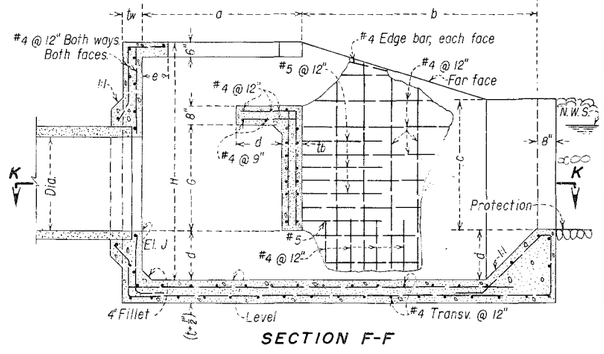
SECTION D-D



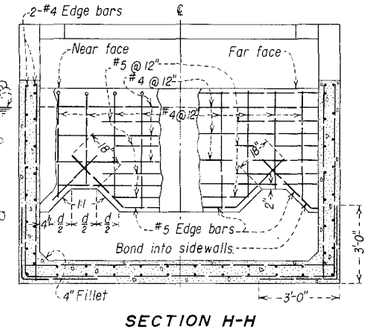
ELEVATION E-E



DETAIL OF CONNECTION TO CONCRETE LINING



SECTION F-F



SECTION H-H

TABLE OF DIMENSIONS

STRUCTURE No.	TYPE	Q	H	W	a	b	c	d	e	f	G	L		t	t_b	t_w	CONCRETE CU. YDS.	REINF. STEEL LBS.
1	1	6	4'-3"	3'-6"	3'-3"	5'-0"	2'-0"	11"	6"	6'-1"	2'-1"	8'-3"		6"	6"	6"	3.2	240
2	1	12	4'-3"	4'-6"	3'-3"	5'-0"	2'-4"	11"	6"	6'-5"	2'-1"	8'-3"		6"	6"	6"	3.6	270
3	1	21	4'-3"	5'-6"	3'-3"	5'-0"	2'-8"	11"	6"	6'-9"	2'-1"	8'-3"		6"	6"	6"	4.3	320
4	1	29	4'-9"	6'-2"	3'-7"	5'-8"	3'-0"	12"	6"	7'-2"	2'-4"	9'-3"		6"	6"	6"	5.4	400
5	1	38	5'-3"	6'-9"	3'-11"	6'-3"	3'-4"	14"	6"	7'-10"	2'-6"	10'-2"		6"	6"	6"	6.5	470
6	1	48	5'-9"	7'-5"	4'-3"	6'-10"	3'-8"	15"	7"	8'-5"	3'-0"	11'-1"		6"	7"	6"	7.8	600
7	1	59	6'-3"	8'-0"	4'-7"	7'-5"	4'-0"	16"	8"	9'-0"	3'-0"	12'-0"		6"	7"	6"	8.4	650
8	1	71	6'-9"	8'-8"	4'-11"	8'-1"	4'-4"	18"	8"	9'-8"	3'-6"	13'-0"		7"	7"	7"	11	800
9	1	85	7'-3"	9'-3"	5'-3"	8'-8"	4'-8"	19"	8"	10'-3"	3'-6"	13'-11"		7"	8"	7"	13	950
10 *	2	99	7'-8"	9'-11"	5'-8"	9'-3"	5'-0"	20"	9"	10'-10"	3'-9"	14'-11"		8"	8"	8"	17	2400
11 *	2	115	8'-0"	10'-6"	6'-0"	9'-9"	5'-4"	21"	10"	11'-5"	3'-11"	15'-9"		8"	9"	8"	20	2800

*-use #5 steel in place of #4 steel as shown on the drawing.

STRUCTURE No.	WATERWAY	STATION	DIA.	Q	EL. J

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

REFERENCE DRAWING

TYPICAL PROTECTION_____
PRECAST PIPE EMBEDMENT_____

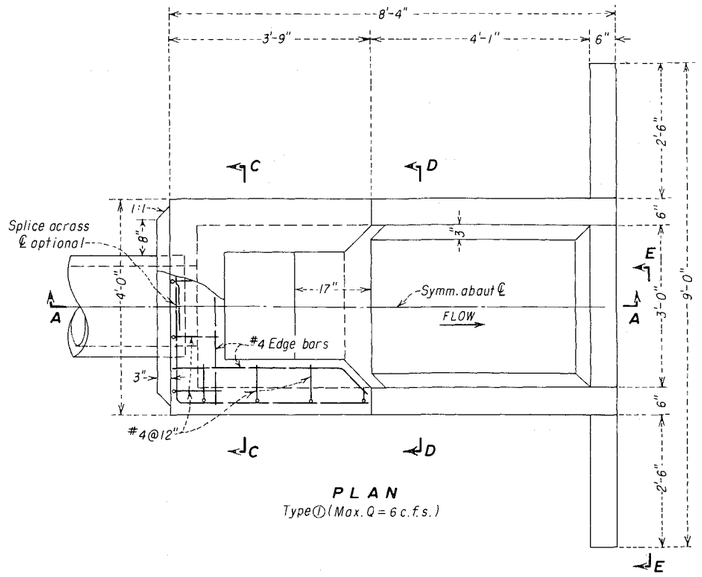
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

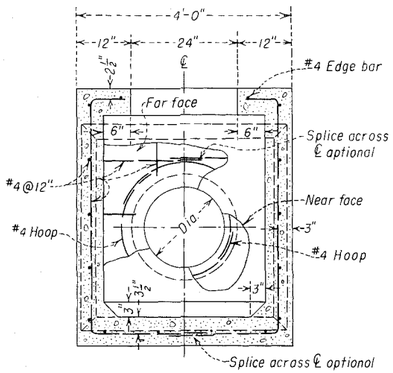
BAFFLED PIPE OUTLET

C 131.00

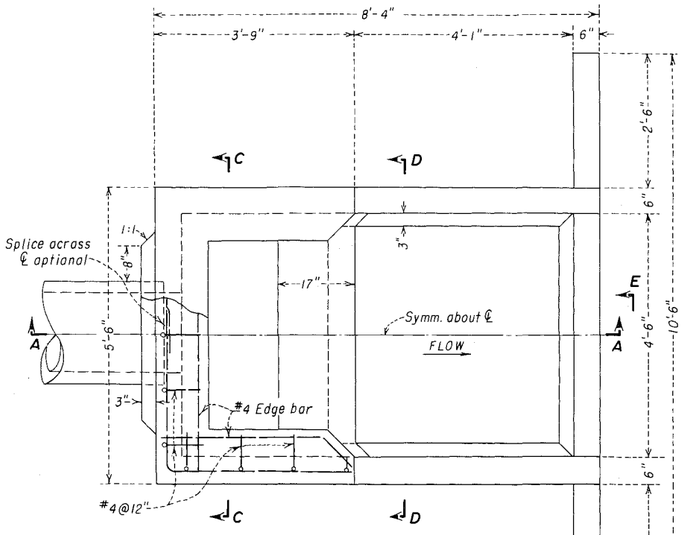
DRAWN W.A.K. SUBMITTED
TRACED S.D.B. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.



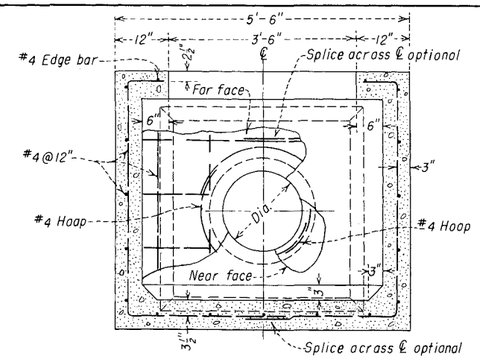
PLAN
Type① (Max. Q = 6 c.f.s.)



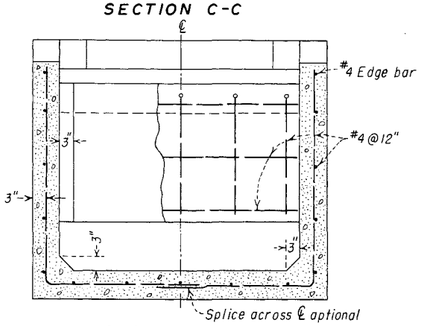
SECTION C-C



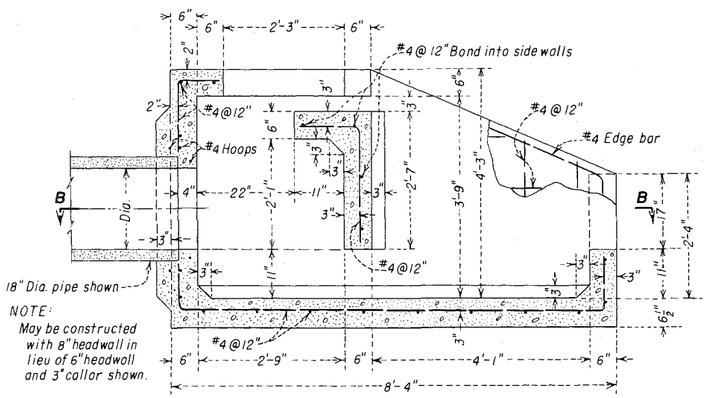
PLAN
Type② (Max. Q = 12 c.f.s.)



SECTION C-C

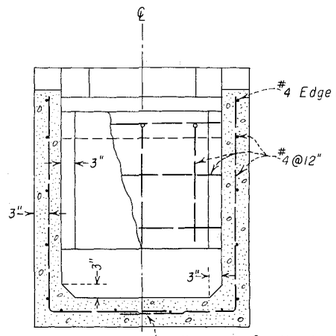


SECTION D-D

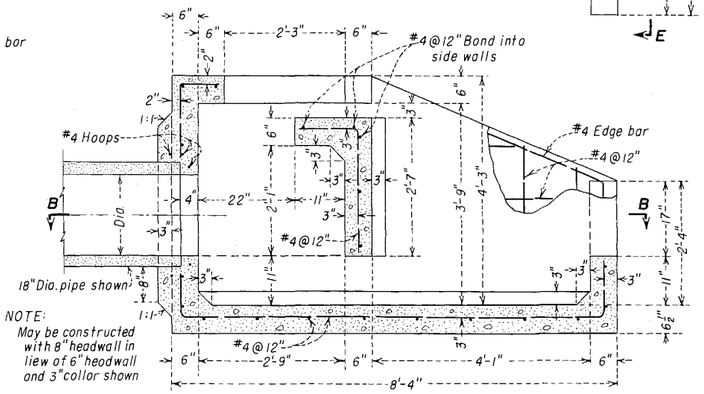


NOTE:
May be constructed with 8" headwall in lieu of 6" headwall and 3" collar shown.

SECTION A-A



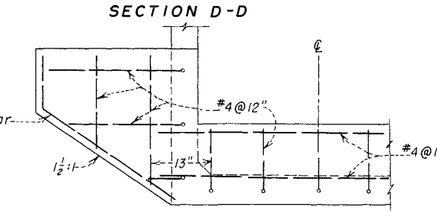
SECTION D-D



NOTE:
May be constructed with 8" headwall in liew of 6" headwall and 3" collor shown

SECTION A-A

SECTION C-C

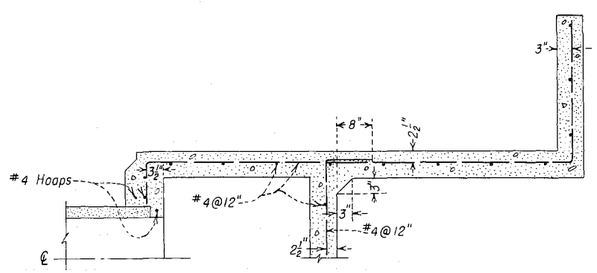


SECTION D-D

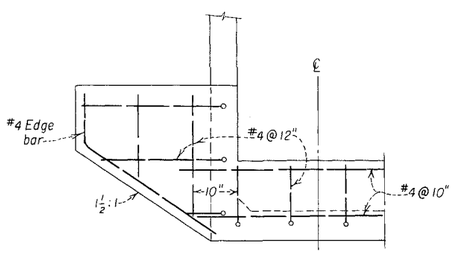
ELEVATION E-E

NOTES

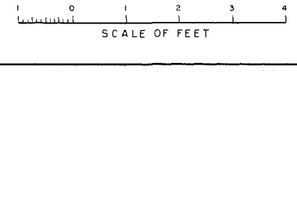
Chamfer all exposed corners ¾" unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.



SECTION B-B

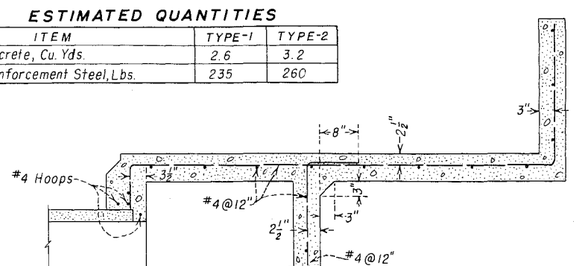


ELEVATION E-E



ESTIMATED QUANTITIES

ITEM	TYPE-1	TYPE-2
Concrete, Cu. Yds.	2.6	3.2
Reinforcement Steel, Lbs.	235	260



SECTION B-B

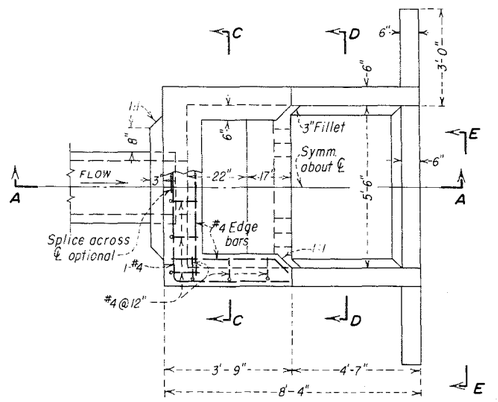
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

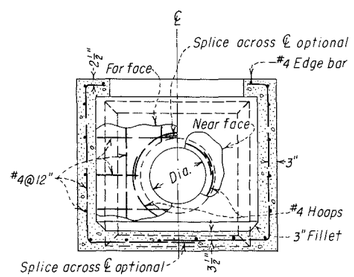
BAFFLED OUTLET TYPES 1 AND 2

DRAWN	M.J.R.	SUBMITTED	
TRACED	H.M.G.	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH
DENVER, COLORADO			

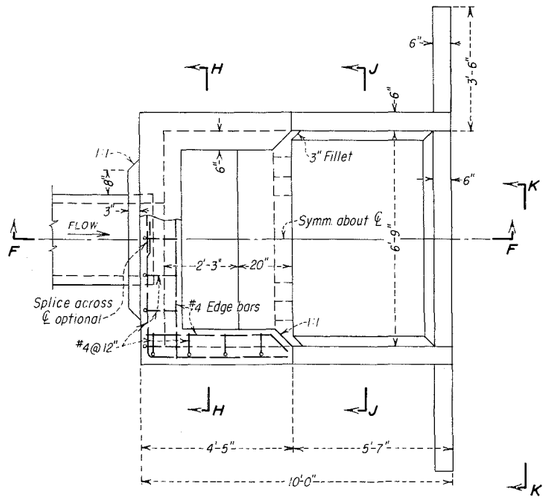
C 132.10



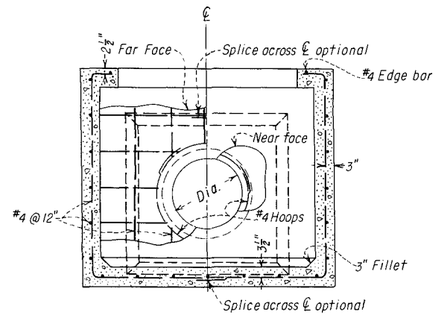
PLAN
TYPE (3) (Max. Q = 21 cfs)



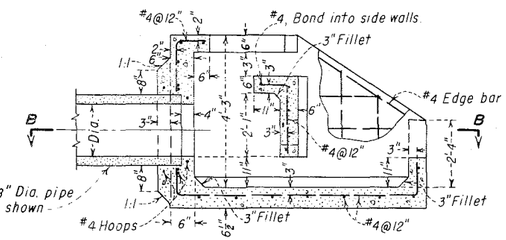
SECTION C-C



PLAN
TYPE (4) (Max. Q = 38 cfs)

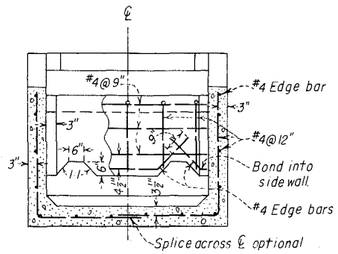


SECTION H-H

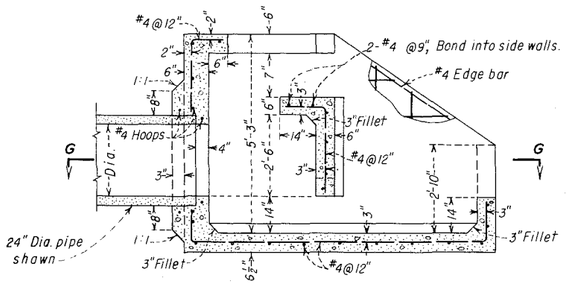


NOTE:
May be constructed with 8" headwall in lieu of 6" headwall and 3" collar shown

SECTION A-A

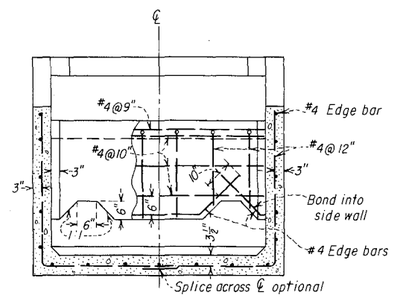


SECTION D-D



NOTE:
May be constructed with 8" headwall in lieu of 6" headwall and 3" collar shown

SECTION F-F



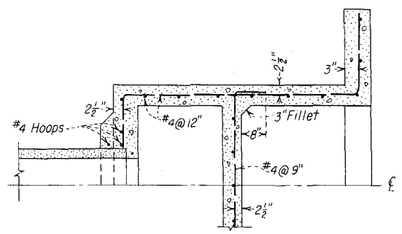
SECTION J-J

ESTIMATED QUANTITIES

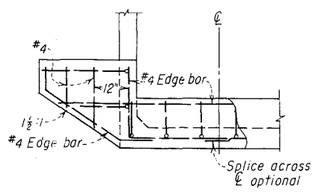
ITEM	TYPE-3	TYPE-4
Concrete, Cu.Yds.	3.5	5.3
Reinforcement Steel, lbs.	270	425

NOTES

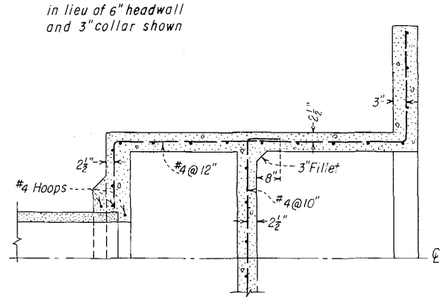
Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.



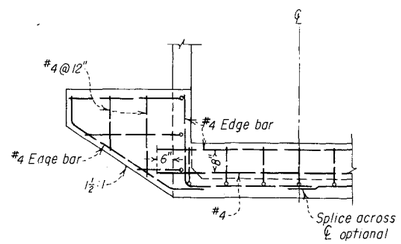
SECTION B-B



ELEVATION E-E



SECTION G-G



ELEVATION K-K

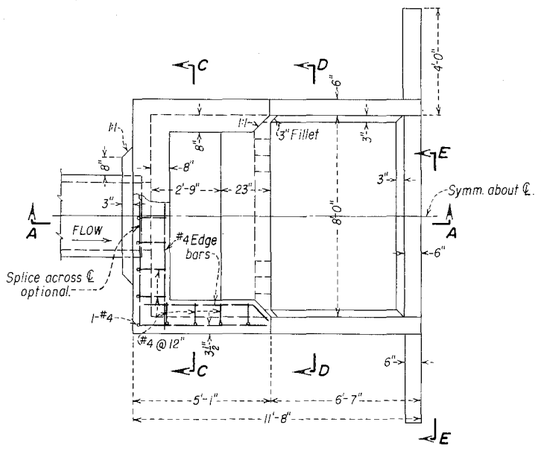
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BAFFLED OUTLET TYPES 3 AND 4

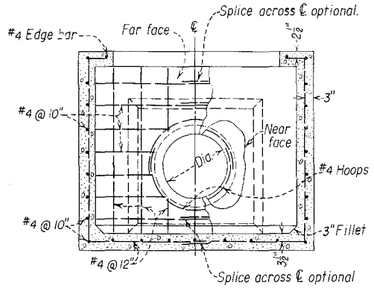
DRAWN L.P.B. - E.W.M. SUBMITTED
TRACED W.C.W. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C 132.20

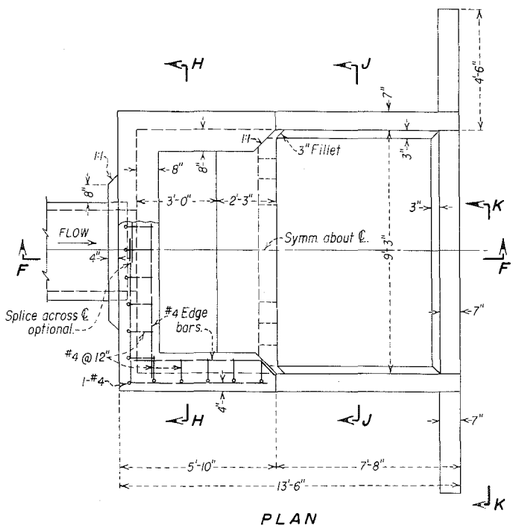


PLAN

TYPE ⑤ (MAX. Q = 59 c.f.s.)

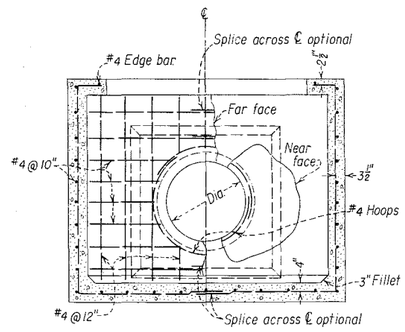


SECTION C-C



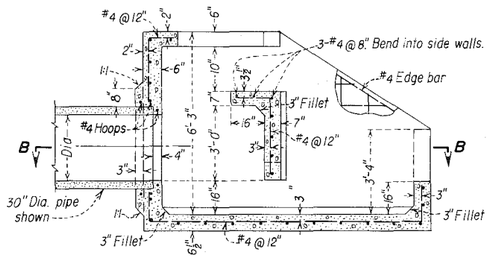
PLAN

TYPE ⑥ (MAX. Q = 85 c.f.s.)

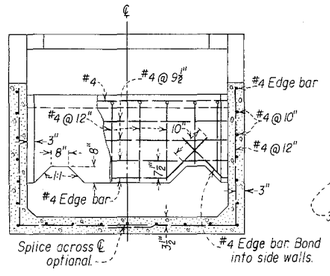


SECTION H-H

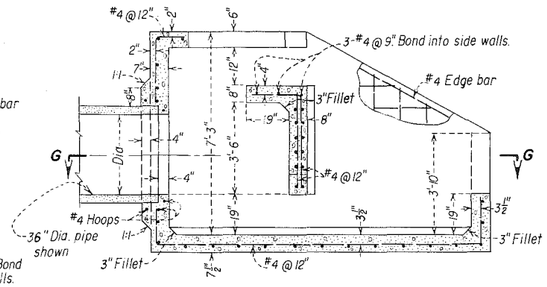
SCALE OF FEET



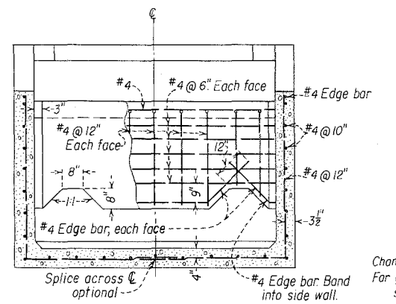
SECTION A-A



SECTION D-D



SECTION F-F



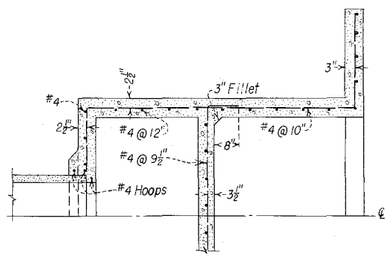
SECTION J-J

ESTIMATED QUANTITIES

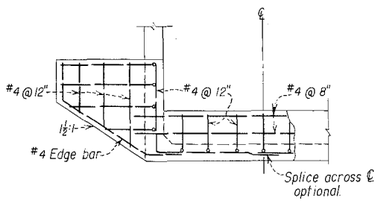
ITEM	TYPE-5	TYPE-6
Concrete, Cu. Yds.	7.3	10.9
Reinforcement Steel, Lbs.	565	830

NOTES

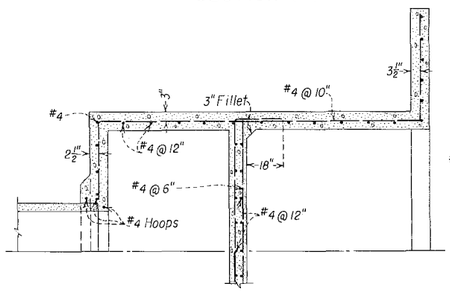
Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.



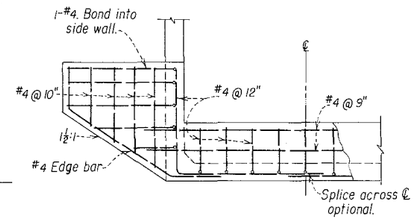
SECTION B-B



ELEVATION E-E



SECTION G-G



ELEVATION K-K

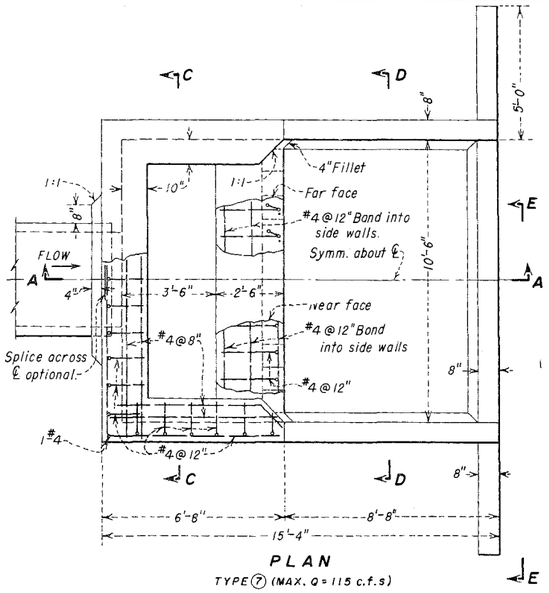
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF REALAMATION

BAFFLED OUTLET TYPES 5 AND 6

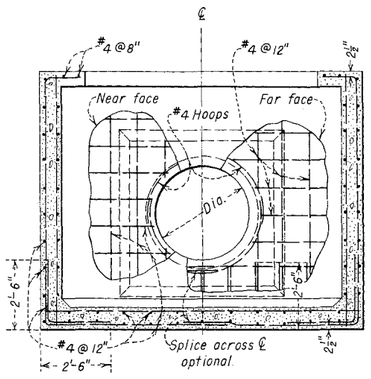
C 132.30

DRAWN E.S.H-E.W.M. SUBMITTED
TRACED G.D.B. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.



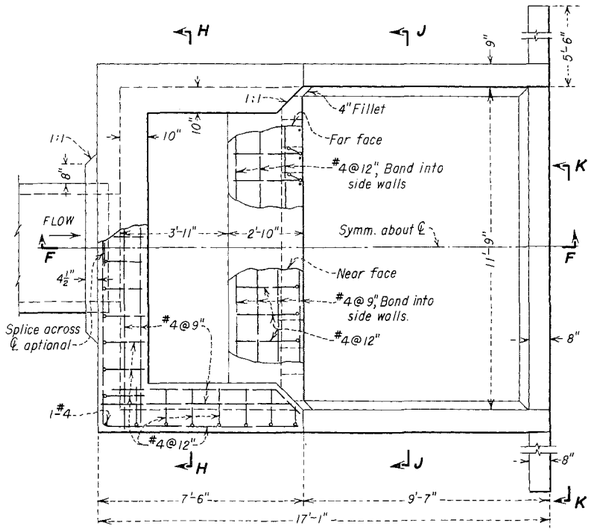
PLAN

TYPE (7) (MAX. Q = 115 c.f.s)



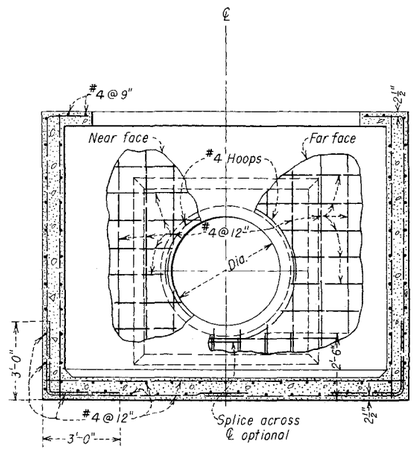
SECTION C-C

SCALE OF FEET

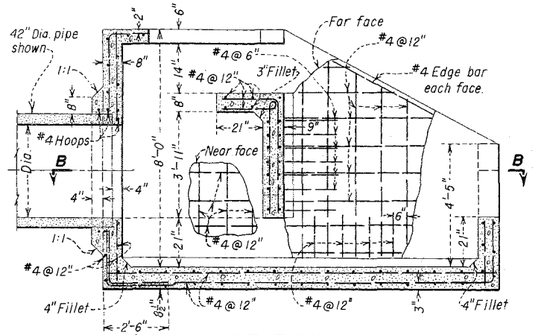


PLAN

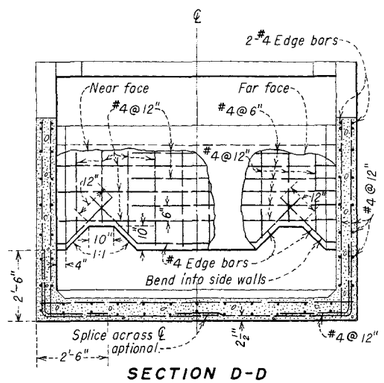
TYPE (8) (MAX. Q = 151 c.f.s.)



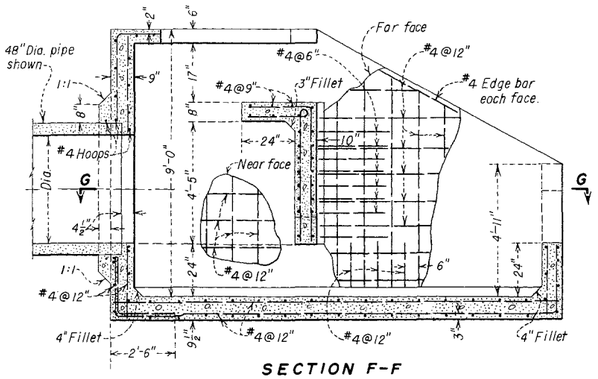
SECTION H-H



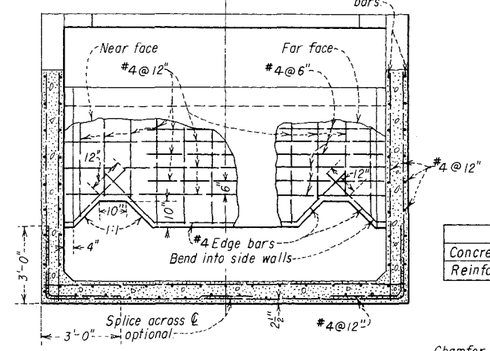
SECTION A-A



SECTION D-D



SECTION F-F



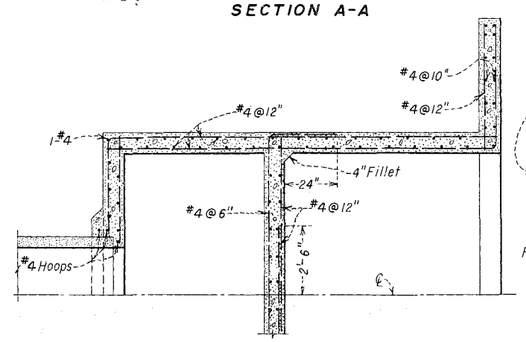
SECTION J-J

ESTIMATED QUANTITIES

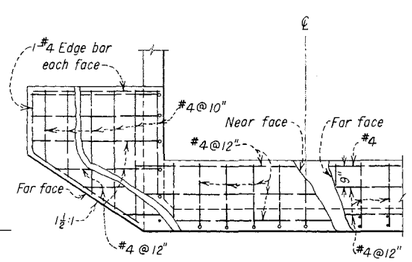
ITEM	TYPE-7	TYPE-8
Concrete, Cu. Yds.	16.1	20.8
Reinforcement Steel, Lbs.	1670	2280

NOTES

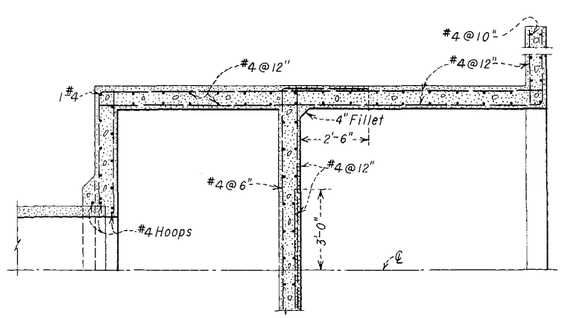
Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.



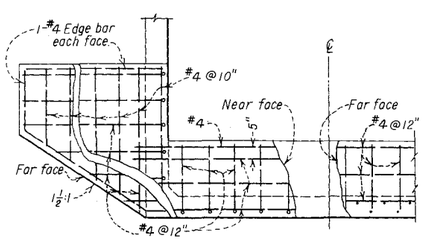
SECTION B-B



ELEVATION E-E



SECTION G-G



ELEVATION K-K

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BAFFLED OUTLET TYPES 7 AND 8

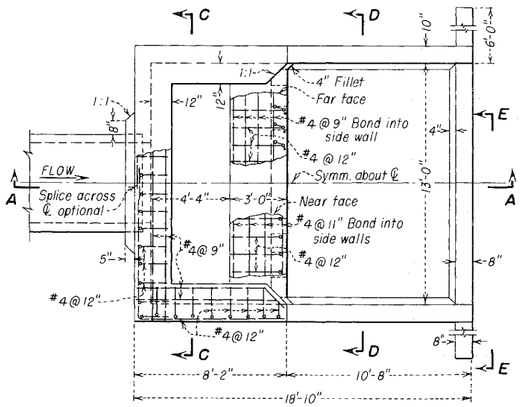
DRAWN E.S. - E.W.M. SUBMITTED

TRACED H.M.G. RECOMMENDED

CHECKED APPROVED

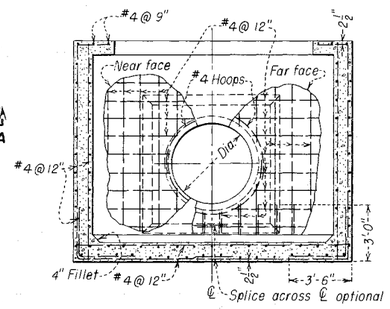
DENVER, COLORADO, CHIEF, CANALS BRANCH

C 132.40

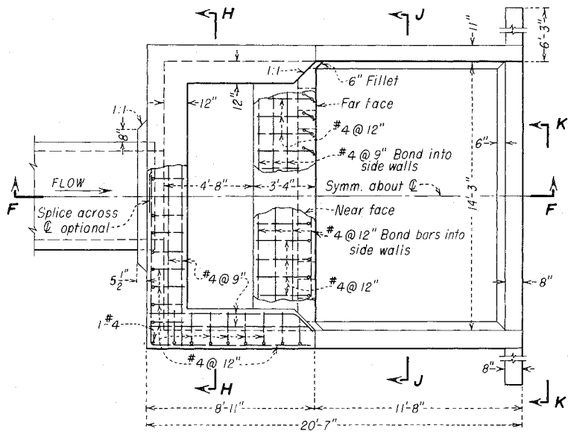


PLAN

TYPE (9) (MAX. Q = 191 c.f.s.)

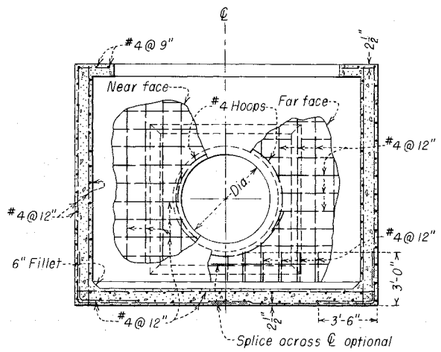


SECTION C-C

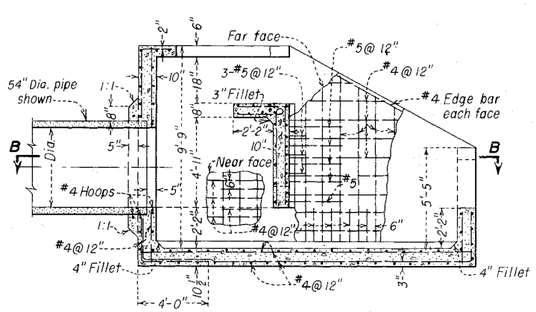


PLAN

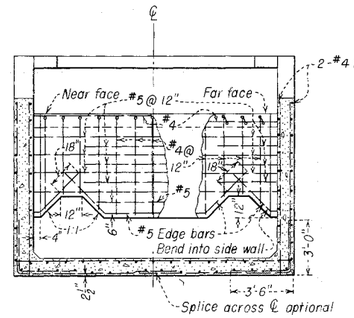
TYPE (10) (MAX. Q = 236 c.f.s.)



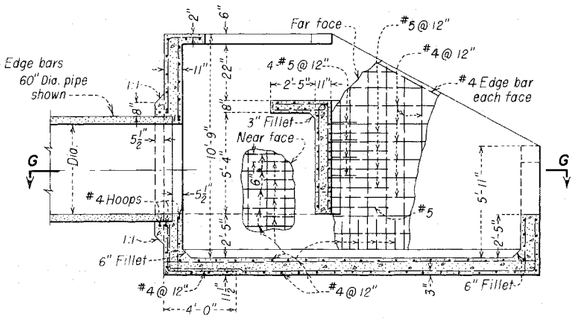
SECTION H-H



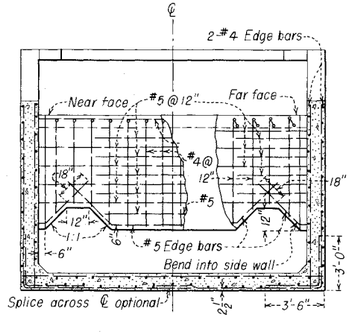
SECTION A-A



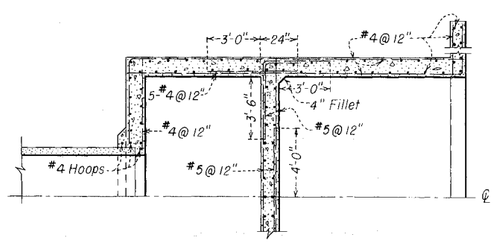
SECTION D-D



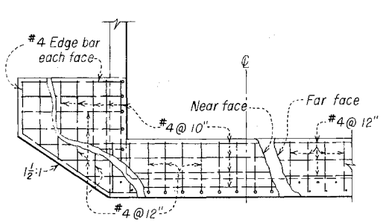
SECTION F-F



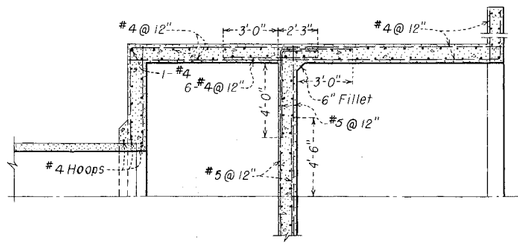
SECTION J-J



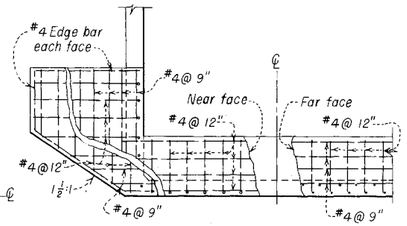
SECTION B-B



ELEVATION E-E



SECTION G-G



ELEVATION K-K

0 5 10 15
SCALE OF FEET

ESTIMATED QUANTITIES

ITEM	TYPE-9	TYPE-10
Concrete, Cu. Yds.	28	37
Reinforcement Steel, lbs.	2640	3310

NOTES

Chamfer all exposed corners ¾", unless otherwise shown.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BAFFLED OUTLET TYPES 9 AND 10

DRAWN E.S.-E.W.M. SUBMITTED
TRACED H.R.E. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER COLORADO

C 132.50

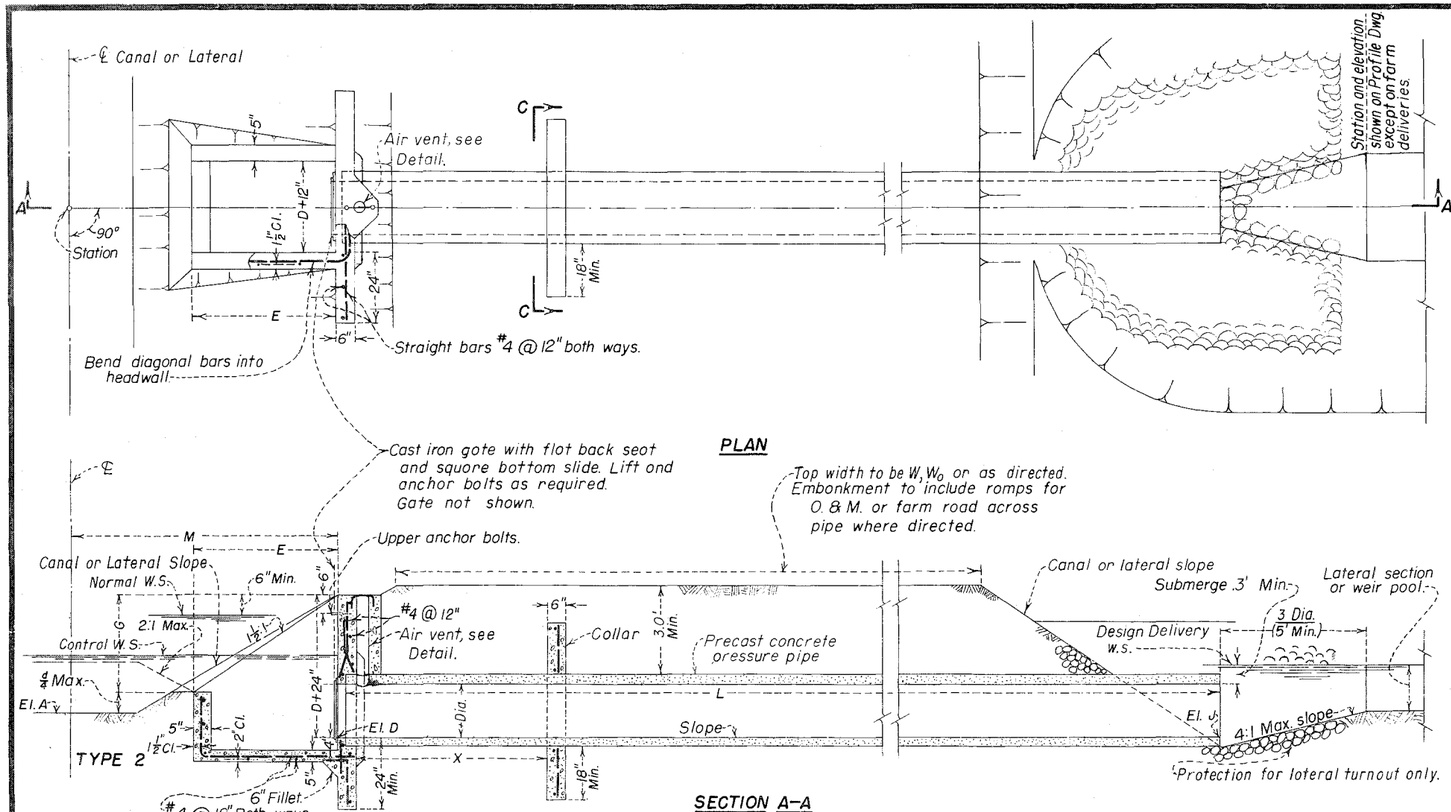
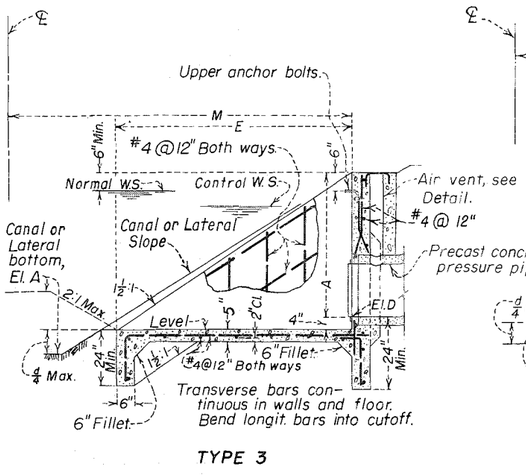
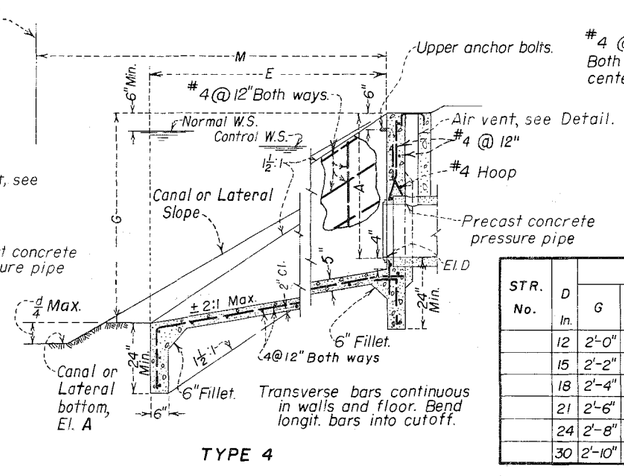
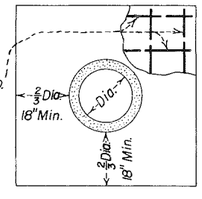


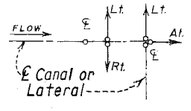
TABLE OF LOCATIONS, TYPES, DIMENSIONS & ELEVATIONS																		
CANAL OR LATERAL	STATION	T.O. to Lateral or Farm unit	Str. No.	DIR.	M	ELEVATIONS					PIPE			Collar Dist. X	Max. Q	DESIGN DEL. W.S. EL.	REMARKS
						Normal W.S.	Control W.S.	A	D	J	Dia.	L	Slope				

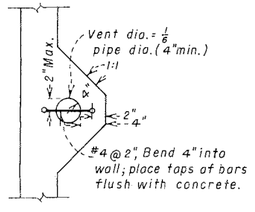
(1) Connect to road crossing at distance L and Elevation J.
(2) Connect to pipe line.
(3) Connect to pipe drop.
(4) Connect to Weir Box.
(5, Connect to pipe Div. Box











STR. No.	D In.	TYPE 2 G	E	Conc. Cu. Yds.	Reinf. Steel Lbs.	GATE Frame Ht.	TYPE 3 A	E	Conc. Cu. Yds.	Reinf. Steel Lbs.	GATE Frame Ht.	TYPE 4 A	G	E	Conc. Cu. Yds.	Reinf. Steel Lbs.	GATE Frame Ht.
	12	2'-0"	3'-0"	1.0	65	5'-0"	3'-0"	5'-0"	1.1	92	5'-0"						
	15	2'-2"	3'-3"	1.1	72	5'-0"	3'-3"	5'-4½"	1.3	105	5'-0"						
	18	2'-4"	3'-6"	1.2	78	5'-0"	3'-9"	6'-1½"	1.5	124	5'-0"						
	21	2'-6"	3'-9"	1.3	86	5'-0"	4'-3"	6'-10½"	1.8	147	6'-0"						
	24	2'-8"	4'-0"	1.4	91	5'-0"	5'-0"	8'-0"	2.2	182	6'-0"						
	30	2'-10"	4'-3"	1.7	111	6'-0"	5'-6"	8'-9"	2.6	215	7'-0"						

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
C.I. Turnout gate shall be same diameter as pipe; except, where pipe diameter is not a standard gate diameter, the next larger standard diameter gate shall be used.
Gate frame height measured above ℄ of gate opening.
Extend headwall cutoff vertically or horizontally with unreinforced concrete as directed.

REFERENCE DRAWINGS

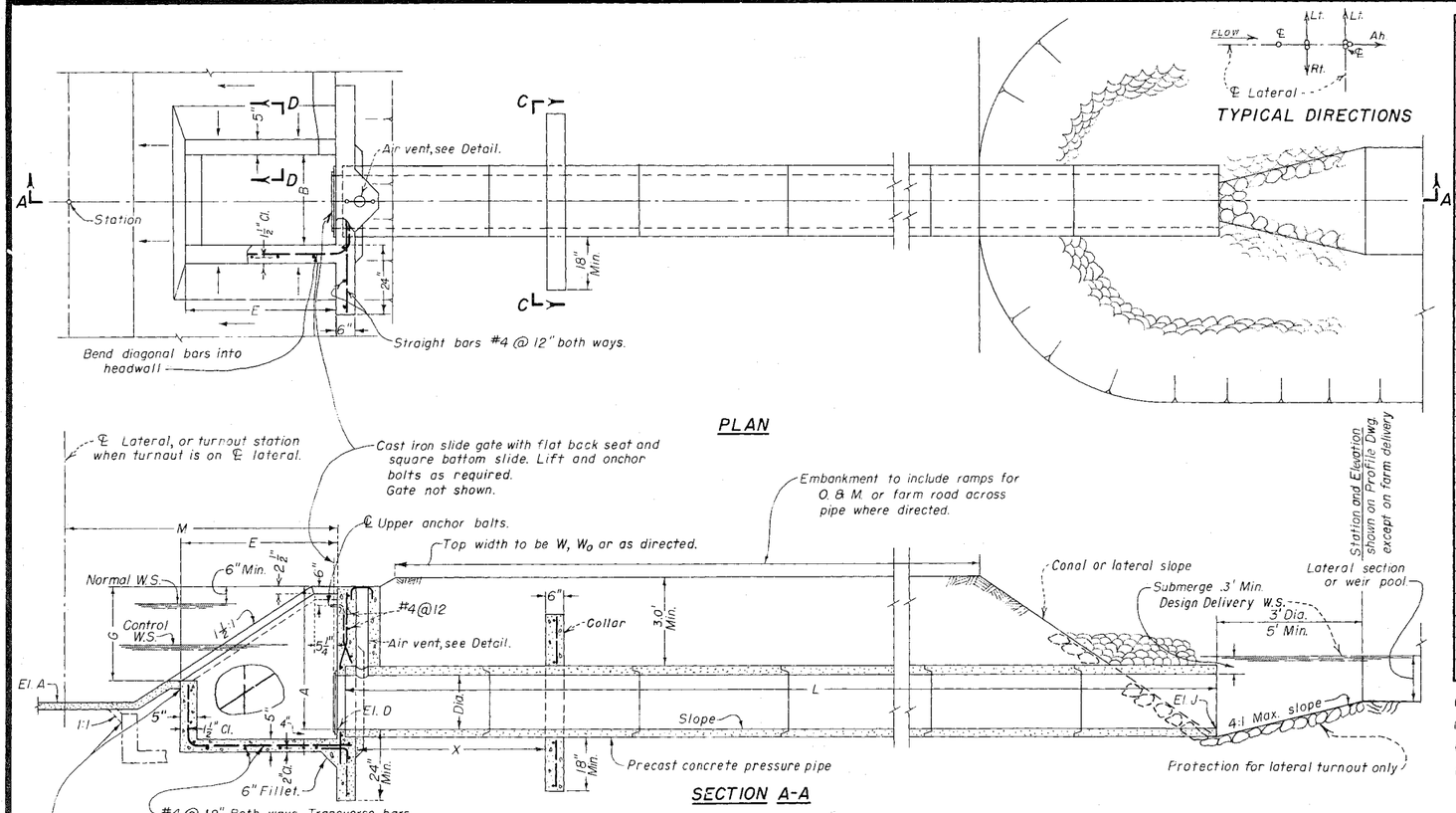
TYPICAL PROTECTION_____
PRECAST PIPE EMBEDMENT_____

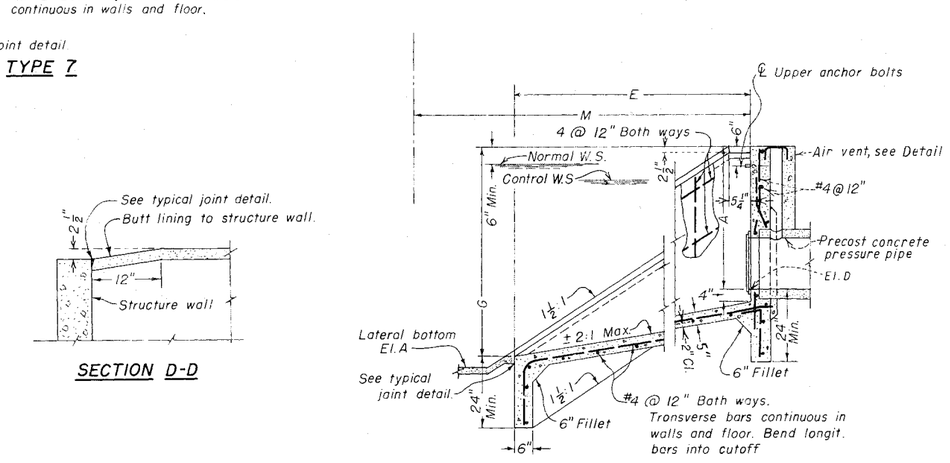
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

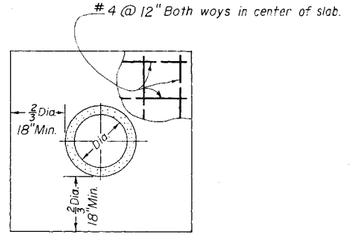
PIPE TURNOUTS-TYPES 2, 3, AND 4

DRAWN W.A.K. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO

C 140.10







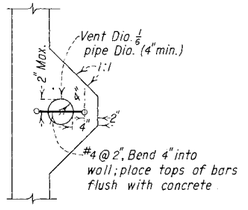


TABLE OF LOCATIONS, TYPES, DIMENSIONS & ELEVATIONS

LATERAL	STATION	T.O. to Lateral	Str. No.	DIR.	M	ELEVATIONS					PIPE			Collar Dist. X	Max. Q	DESIGN DEL. W.S. El.	REMARKS
						Normal W.S.	Control W.S.	A	D	J	Dia.	L	Slope				

(1) Connect to road crossing at distance L and Elevation J.
(2) Connect to pipe line.
(3) Connect to weir box.
(4) Connect to pipe drop.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
C.I. Turnout gate shall be same diameter as pipe; except, where pipe diameter is not a standard gate diameter, the next larger standard diameter gate shall be used.
Gate frame height measured above ℄ of gate opening.
Extend headwall cutoff vertically or horizontally with unreinforced concrete as directed.

REFERENCE DRAWINGS

PRECAST PIPE EMBEDMENT

STR. No.	DIA. In.	B	TYPE 7							TYPE 8						
			A	G	E	Conc. Cu. Yds.	Reinf. Steel Lbs.	GATE Frame Ht.		A	G	E	Conc. Cu. Yds.	Reinf. Steel Lbs.	GATE Frame Ht.	

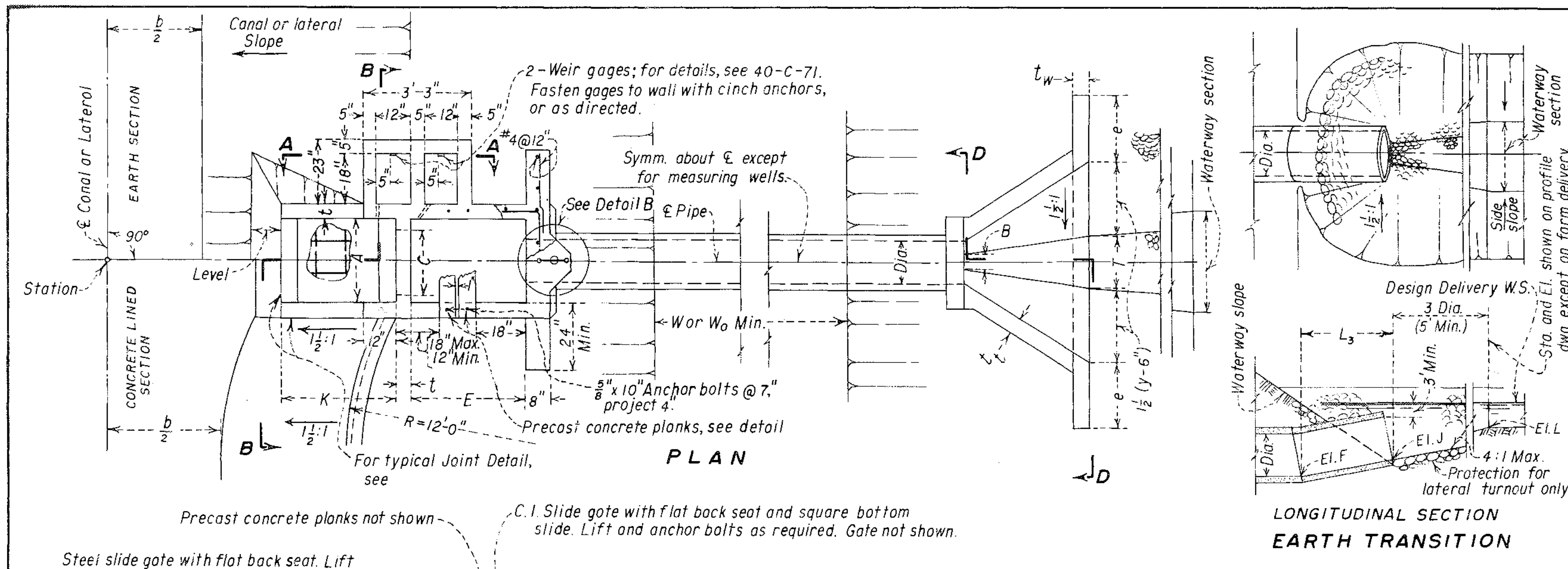
ALWAYS THINK SAFETY

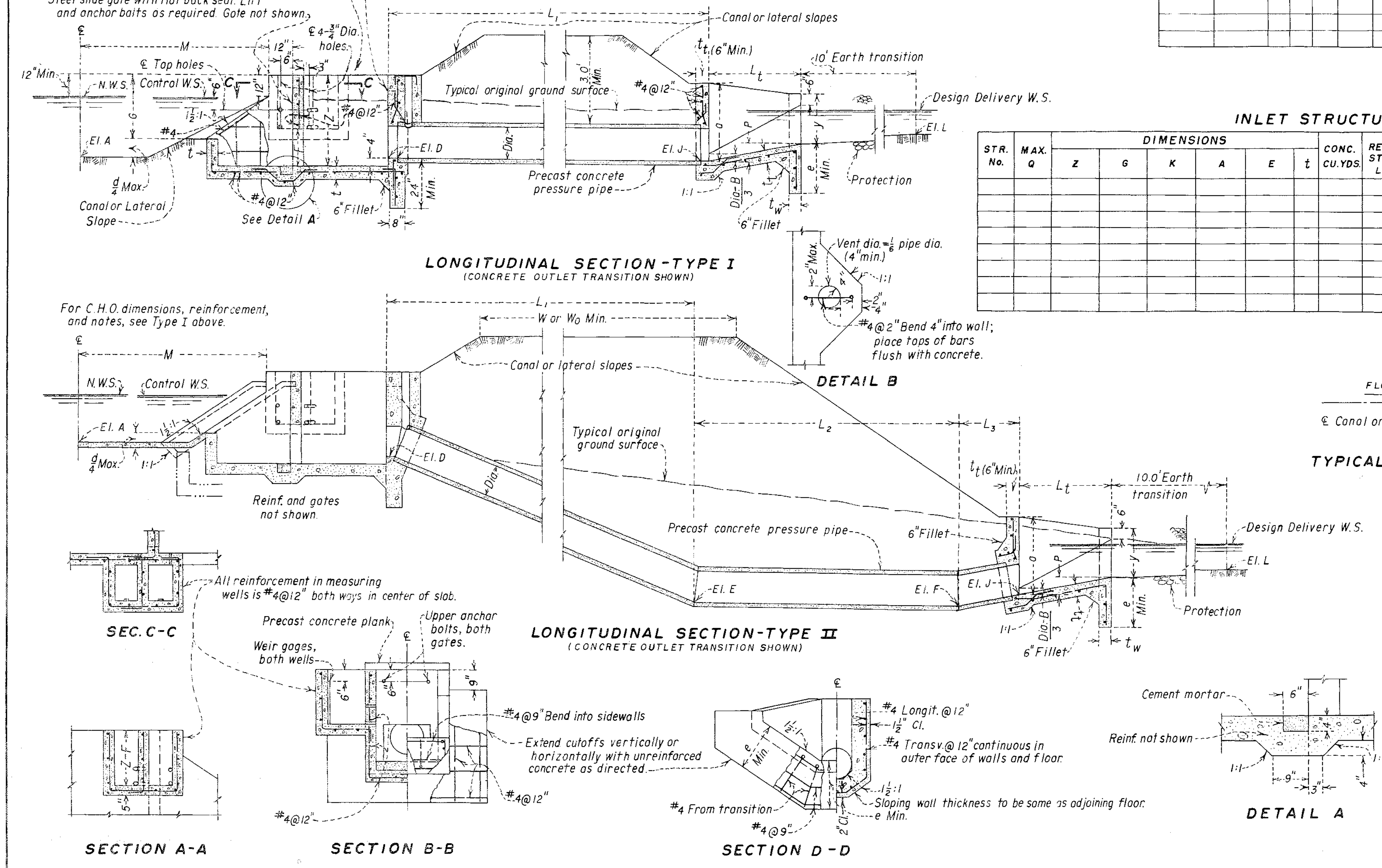
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

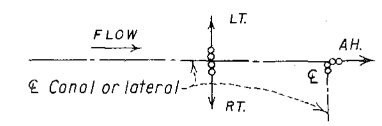
PIPE TURNOUTS TYPES 7 AND 8

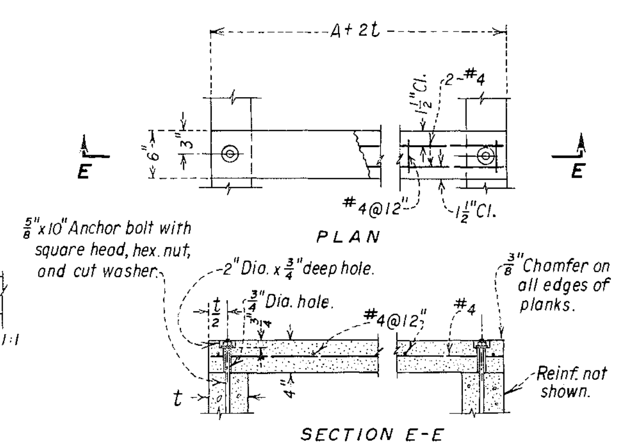
C 140-30

DRAWN W.A.K. SUBMITTED
TRACED RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO









DETAIL OF PRECAST CONCRETE PLANK

TABLE OF LOCATIONS AND ELEVATIONS

CANAL OR LATERAL	STATION	TYPE	DIR.	NOR Q.	INLET					PIPE									OUTLET				REMARKS
					STR NO.	M	NORMAL W.S. ELEV.	CONTROL W.S. ELEV.	ELEV. A	ELEVATIONS D	E	F	J	LIN FT.	DIA. (IN)	L_1	L_2	L_3	El. L.	CONC. STR. NO.	EARTH TRANSITION	DESIGN DEL. W.S. El.	

INLET STRUCTURE

STR. No.	MAX. Q	DIMENSIONS						CONC. CU.YDS.	REINF. STEEL LBS.	ORIFICE GATE			TURNOUT GATE		WEIR GAGE LENGTH
		Z	G	K	A	E	t			SIZE C	SIZE F	FRAME HT.	DIA.	FRAME HT.	

OUTLET TRANSITION

STR. No.	PIPE DIA.	DIMENSIONS										CONC. CU. YDS.	REINF. STEEL LBS.
		B	L_t	a	y	T	P	e	t_t	t_w			

NOTES

For general notes and minimum requirements for detailing reinforcement, 40-D-6123.
Gate frame height measured above Ⅽ of opening.
Discharges assumed to be as indicated in Table 31, U.S.B.R. Water Measurement Manual. Discharges should be verified by rating.
For dimensions W or W_0, see Plan and Profile drawings.
Locations of vertical P.I.'s at E and F are to be considered approximate only and may be adjusted according to actual laying length of pipe.

REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT
BENDS FOR PRECAST CONCRETE PRESSURE PIPE

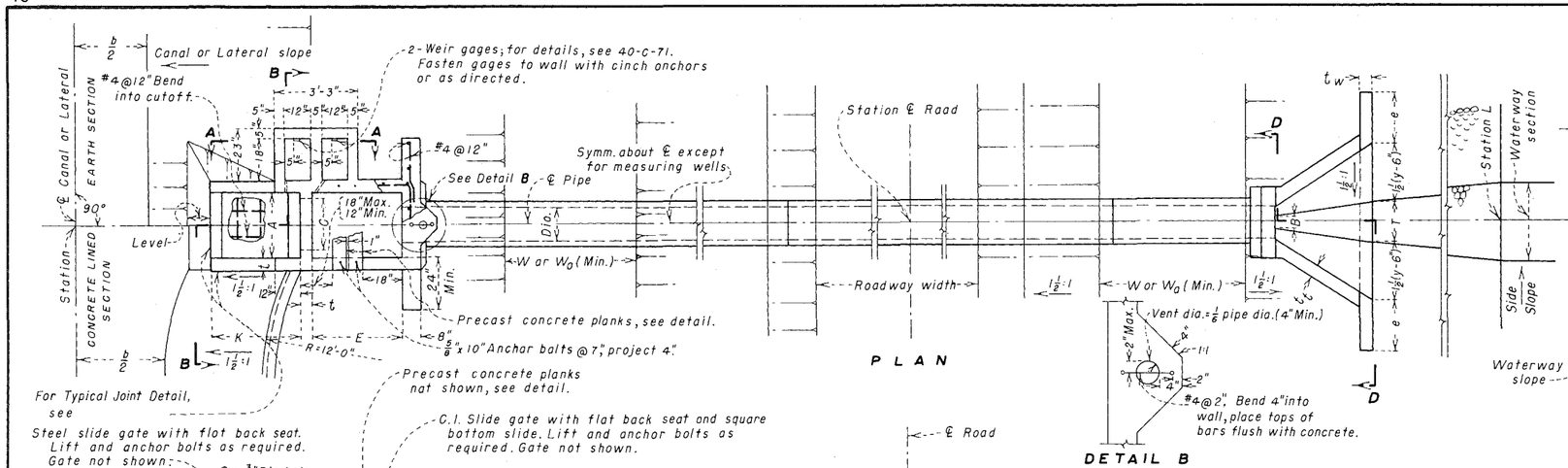
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

C.H.O. - TYPE 2

DRAWN F.L.R. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C 142.20



PLAN

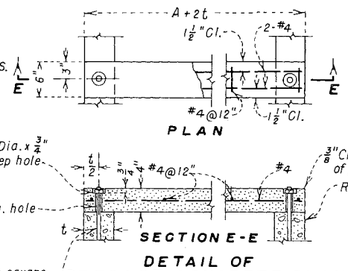
DETAIL B

LONGITUDINAL SECTION
EARTH OUTLET TRANSITION

SECTION A-A

SECTION B-B

SECTION D-D

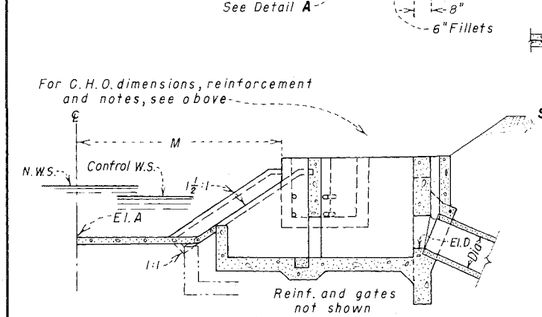


PLAN

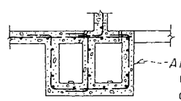
SECTION E-E

DETAIL OF PRECAST CONCRETE PLANK

5/8" x 10" Anchor bolts with square head, hex. nut, and cut washer.



LONGITUDINAL SECTION



SECTION C-C

INLET STRUCTURE

STR. No.	MAX. Q	DIMENSIONS Z	G	K	A	E	t	ORIFICE GATE SIZE C	SIZE F	FRAME HT.	TURNOUT GATE DIA.	FRAME HT.	CONC. CU.YDS.	REINF. STEEL LBS.	WEIR GAGE LENGTH

OUTLET TRANSITION

STR. No.	PIPE DIA.	DIMENSIONS B	L_t	a	y	T	P	e	t_t	t_w	CONC. CU.YDS.	REINF. STEEL LBS.

NOTES

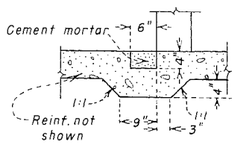
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured above ℄ of gate opening.
Locations of vertical P.I.'s at E and F are to be considered approximate only and may be adjusted according to actual laying length of pipe.
Discharges assumed to be as indicated in Table 31, U.S.B.R. Water Measurement Manual. Discharges should be verified by roting.
For dimensions W or W_0, see Plan and Profile drawings.

REFERENCE DRAWINGS

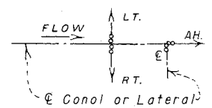
TYPICAL PROTECTION _____
PRECAST PIPE EMBEDMENT _____
BENDS FOR PRECAST CONCRETE PRESSURE PIPE ___

TABLE OF LOCATIONS AND ELEVATIONS

CANAL OR LATERAL	STATION		DIRECTION	NOR. Q	INLET STR. No.	M	NORMAL W.S. ELEVATION	CONTROL W.S. ELEVATION	ELEV. A	PIPE ELEVATIONS D	E	F	J	L_1	L_2	L_3	LIN. FEET	DIA. (IN.)	OUTLET CONC. STR. NO.	EARTH TRANSITION	ELEV. L	DESIGN DELIVERY W.S. ELEV.	STA. L	STA. ℄ ROAD	ELEV. R	REMARKS



DETAIL A



TYPICAL DIRECTIONS

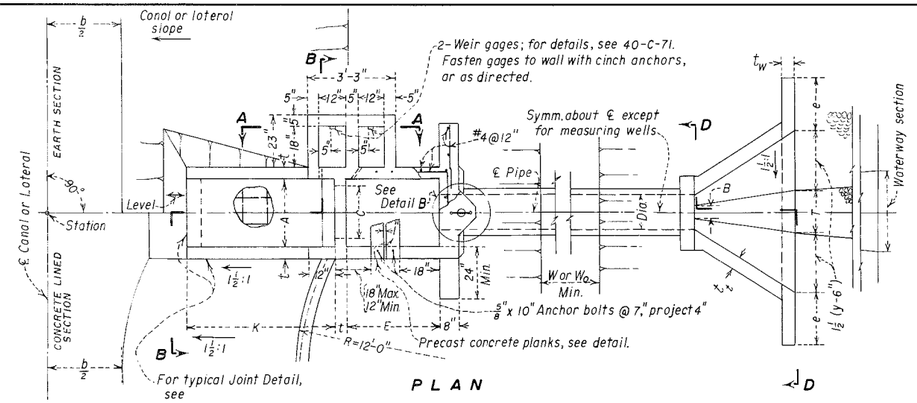
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

C.H.O. TYPE 2 WITH ROAD CROSSING

C-142.21

DRAWN F.L.R. SUBMITTED _____
TRACED E.V.C. RECOMMENDED _____
CHECKED _____ APPROVED _____ CHIEF, CANALS BRANCH
DENVER, COLORADO,



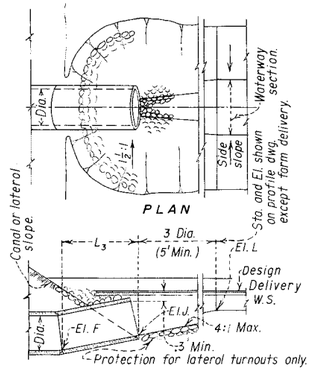


TABLE OF LOCATIONS AND ELEVATIONS

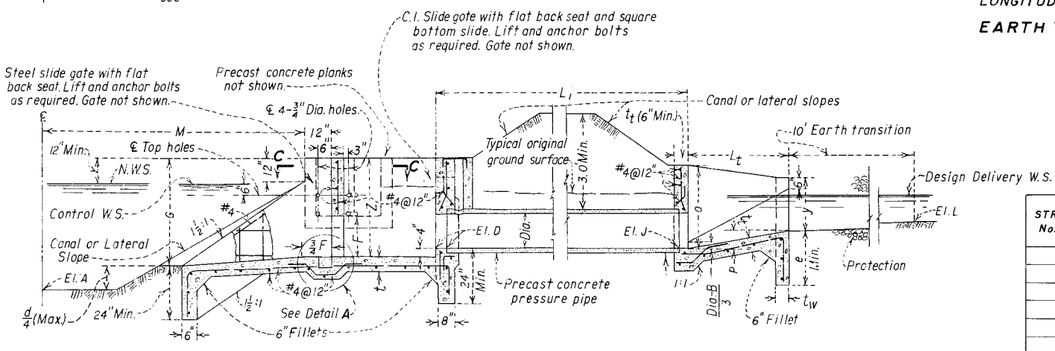
CANAL OR LATERAL	STATION	TYPE	DIR.	NOR. Q	INLET					PIPE									OUTLET				REMARKS
					STR. NO.	M	NORMAL W.S. ELEV.	CONTROL W.S. ELEV.	ELEV. A	ELEVATIONS D	E	F	J	LIN. FT.	DIA. (IN.)	L_1	L_2	L_3	ELEV. L	CONC. STR. NO.	EARTH TRANSITION	DESIGN DEL. W.S. ELEV.	

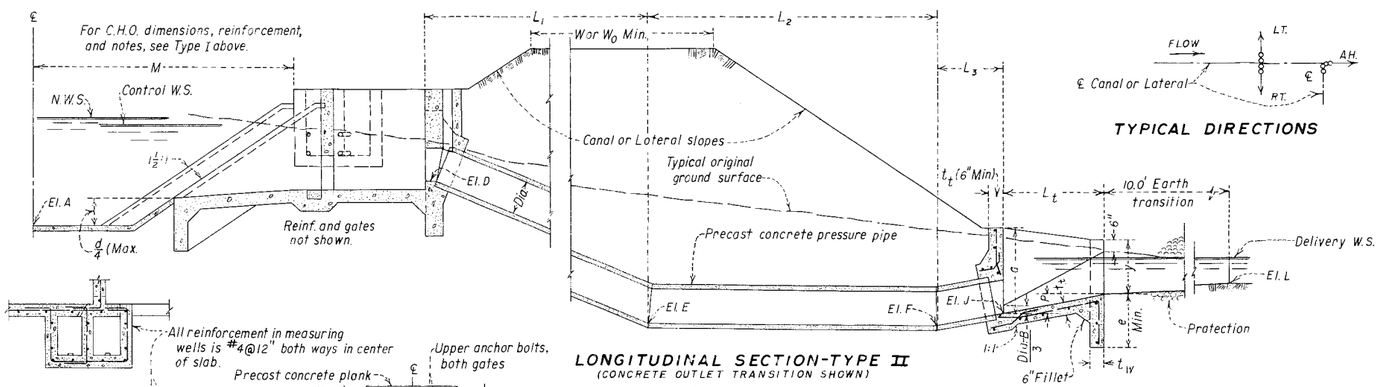
INLET STRUCTURE

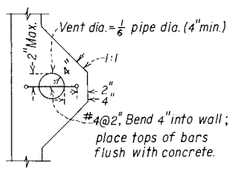
STR. No.	MAX. Q	DIMENSIONS Z	G	K	A	E	t	CONC. CU. YDS.	REINF. STEEL LBS.	ORIFICE GATE SIZE C	F	FRAME HT.	TURNOUT GATE DIA.	FRAME HT.	WEIR GAGE LENGTH

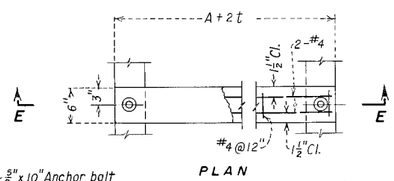
OUTLET TRANSITION

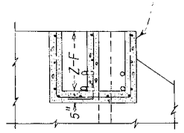
STR. No.	PIPE DIA.	DIMENSIONS B	L_t	a	y	T	P	e	t_t	t_w	CONC. CU. YDS.	REINF. STEEL

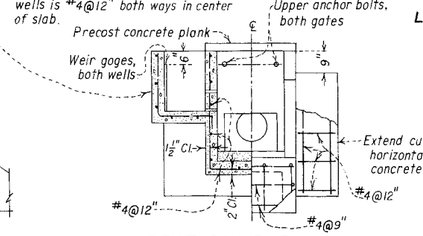


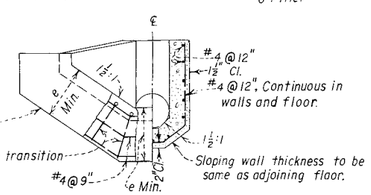


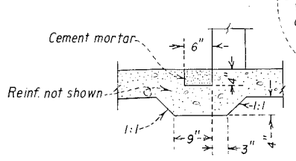


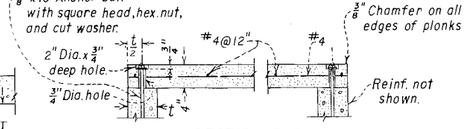












DETAIL OF PRECAST CONCRETE PLANK

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured above ℄ of gate opening.
Discharges assumed to be as indicated in Table 31, U.S.B.R. Water Measurement Manual. Discharges should be verified by rating.
For dimensions W or W_0, see Plan and Profile drawings.
Locations of vertical P.I's at E and F are to be considered approximate only and may be adjusted according to actual laying length of pipe.

REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT
BENDS FOR PRECAST CONCRETE PRESSURE PIPE

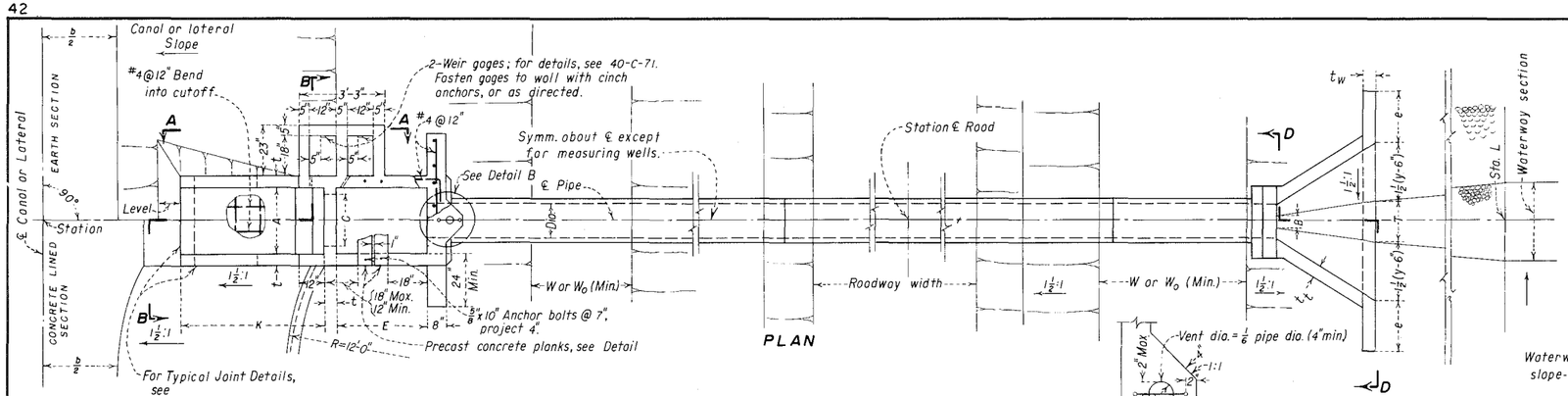
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

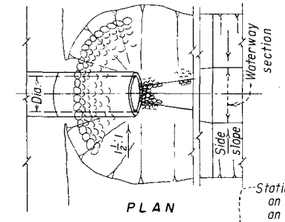
C.H.O.-TYPE 4

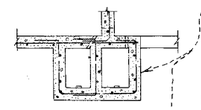
C 142.40

DRAWN A.W.B. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,



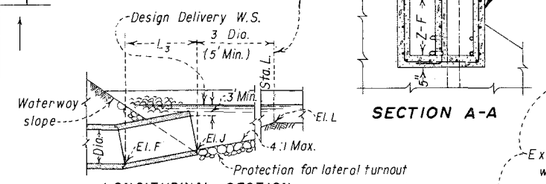
DETAIL B





SECTION C-C

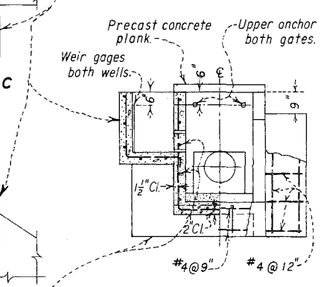
Station and elevation shown on profile Dwg. except on farm delivery.



EARTH TRANSITION

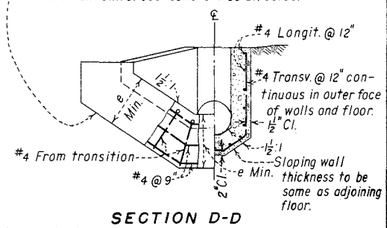
SECTION A-A

All reinforcement in measuring wells is #4@12" both ways in center of slab.

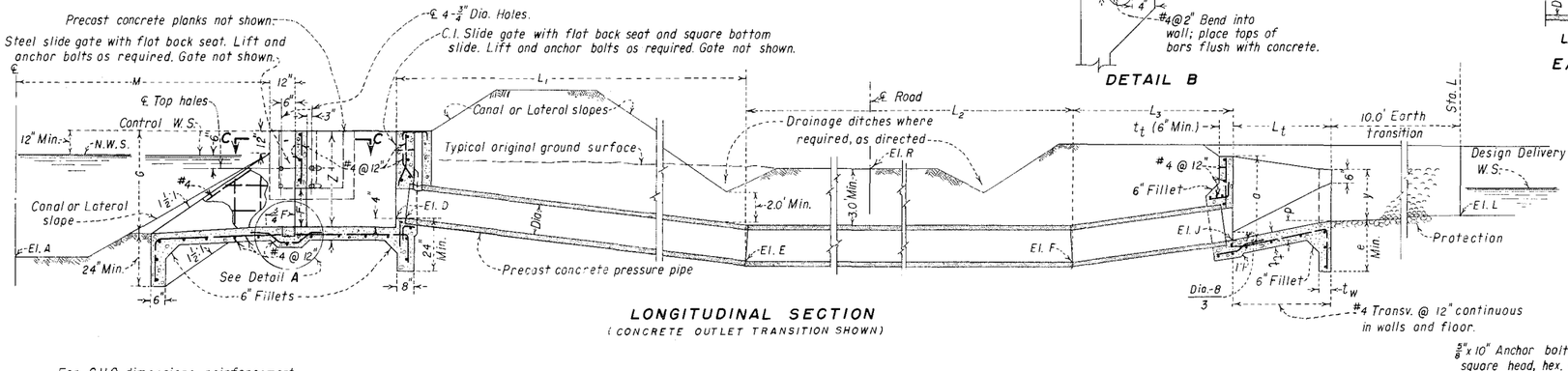


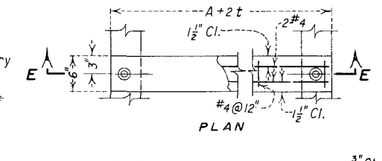
SECTION B-B

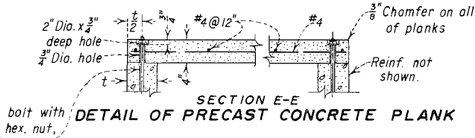
Extend cutoff vertically or horizontally with unreinforced concrete as directed.



SECTION D-D

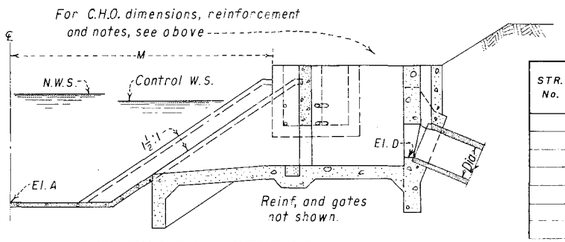






DETAIL OF PRECAST CONCRETE PLANK

5/8" x 10" Anchor bolt with square head, hex. nut, and cut washer.



LONGITUDINAL SECTION

INLET STRUCTURE

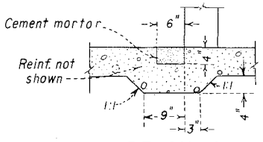
STR. No.	MAX. Q	DIMENSIONS Z	G	K	A	E	t	CONC. CU. YDS.	REINF. STEEL LBS.	ORIFICE GATE SIZE C	SIZE F	FRAME HT.	TURNOUT GATE DIA. IN.	FRAME HT.	WEIR GAGE LENGTH

OUTLET TRANSITION

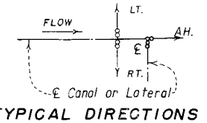
STR. No.	PIPE DIA. (IN.)	DIMENSIONS B	L_t	a	y	T	P	θ	t_t	t_w	CONC. CU. YDS.	REINF. STEEL

TABLE OF LOCATIONS AND ELEVATIONS

CANAL OR LATERAL	STATION		DIRECTION	NOR. Q	INLET STR. No.	M	NORMAL W.S. ELEVATION	CONTROL W.S. ELEVATION	ELEV. A	PIPE ELEVATIONS D	E	F	J	L_1	L_2	L_3	LIN. FEET	DIA. (IN.)	OUTLET CONC. STR. No.	EARTH TRANSITION	ELEV. L	DESIGN DELIVERY W.S. ELEV.	STA. L	STA. ℄ ROAD	ELEV. R	REMARKS



DETAIL A



TYPICAL DIRECTIONS

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height measured above ℄ of gate opening.
Locations of vertical P.I.'s at E and F are to be considered approximate only and may be adjusted according to actual laying length of pipe.
Discharges assumed to be as indicated in Table 31, U.S.B.R. Water Measurement Manual. Discharge should be verified by rating.
For dimensions W or W_0, see Plan and Profile drawings.

REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT
BENDS FOR PRECAST CONCRETE PRESSURE PIPE

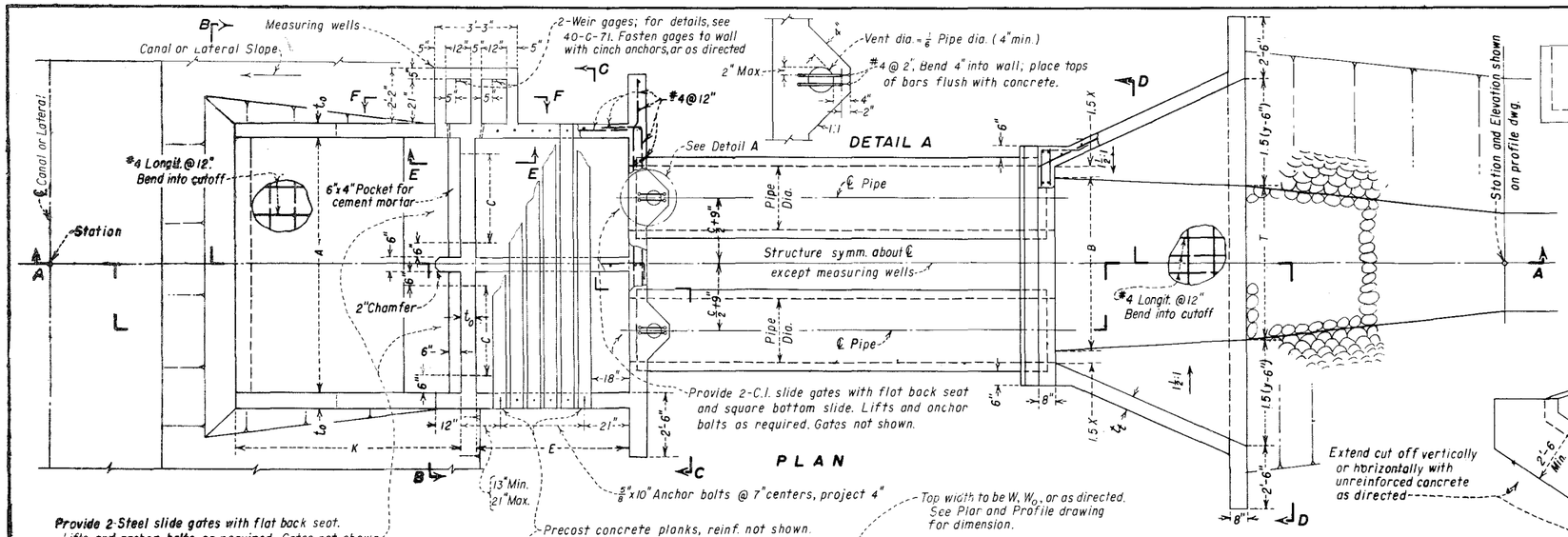
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

C.H.O. TYPE 4 WITH ROAD CROSSING

C142.41

DRAWN W.A.K. SUBMITTED
TRACED W.A.W. RECOMMENDED
CHECKED APPROVED
DENVER, COLORADO, CHIEF, CANALS BRANCH



ORIFICE TURNOUT DIMENSIONS AND QUANTITIES

STR. No.	MAX. Q	DIMENSIONS z *	K	A	E	t_o	G	WEIR GAGE LENGTH	ORIFICE GATE SIZE C	ORIFICE GATE SIZE F	ORIFICE GATE FRAME HT.	TURNOUT GATE DIA.	TURNOUT GATE FRAME HEIGHT	ESTIMATED QUANTITIES CONCRETE (CU. YDS.)	ESTIMATED QUANTITIES REINF. STEEL (LBS.)
1	35	5'-6"		8'-6"	5'-6"	6"		2'-6"	36"	30"	6'-0"		6'-0"	8.8	1000
2	43	5'-6"		9'-6"	5'-6"	6"		2'-6"	42"	30"	6'-0"		6'-0"	9.5	1070
3	51	6'-3"		9'-6"	7'-0"	6"		2'-9"	42"	36"	6'-0"		6'-0"	10.8	1210
4	59	6'-3"		10'-6"	7'-0"	6"		2'-9"	48"	36"	6'-0"		6'-0"	11.5	1300
5	68	7'-0"		10'-6"	8'-0"	7"		3'-0"	48"	42"	7'-0"		7'-0"	14.7	1660
6	86	7'-0"		12'-6"	8'-0"	7"		3'-0"	60"	42"	7'-0"		7'-0"	15.2	1820

*Based on a difference between N.W.S. and C.W.S. of approx. .5 ft.

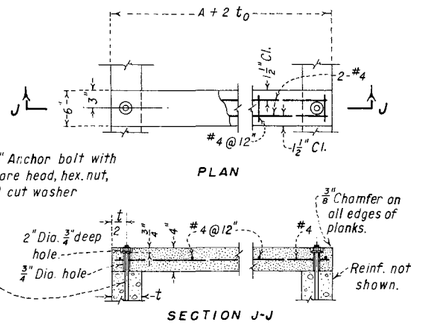
DIMENSIONS AND ESTIMATED QUANTITIES FOR OUTLET TRANSITION

STR. No.	DIMENSIONS B	L_t	a	y	T	p	x	t_t	EST. QUANTITIES CONCRETE (CU. YDS.)	EST. QUANTITIES REINF. STEEL (LBS.)

TABLE OF LOCATIONS AND ELEVATIONS

LATERAL	STATION	T.O. To LATERAL	DIR.	ORIFICE TURNOUT STR. No.	M	ELEVATIONS NORMAL W.S.	CONTROL W.S.	A	D	PIPE DIA.	L_p	OUTLET TRANSITION STR. No.	ELEV. E	DESIGN DEL. W.S. ELEV.	MAX. Q	L	REMARKS

TYPICAL DIRECTIONS



DETAIL OF PRECAST CONCRETE PLANK

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Base of structure to be placed on undisturbed earth.

C.I. Turnout gate shall be same diameter as pipe, except, where pipe diameter is not a standard gate diameter, the next larger standard diameter gate shall be used.

Discharges assumed to be as indicated in Table 31, U.S.B.R. Water Measurement Manual. Discharges should be verified by rating.

Gate frame height measured above ℄ of gate opening.

REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT

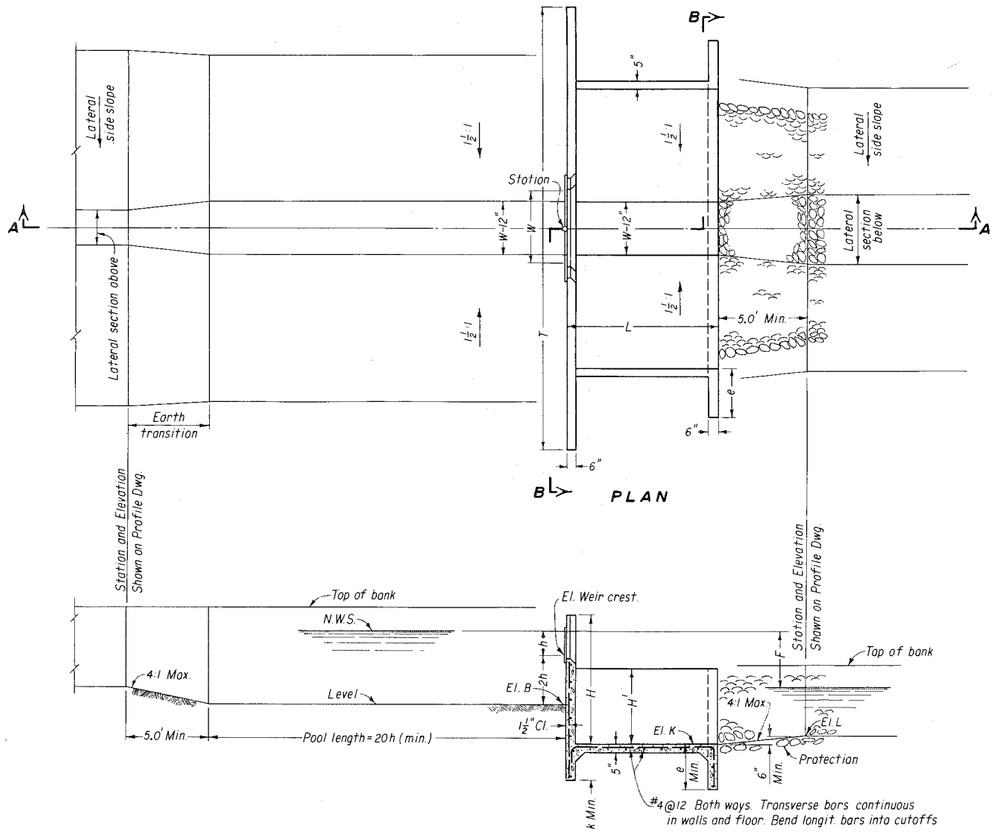
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TURNOUT C.H.O. - TYPE 14

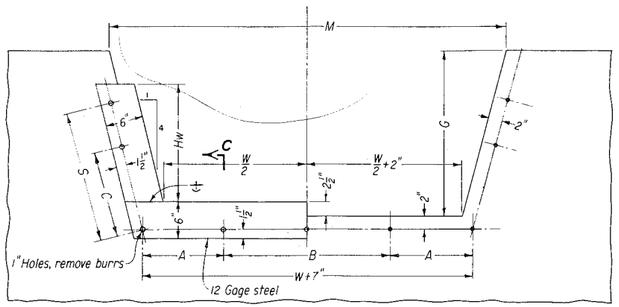
C 142.50

DRAWN W.A.K. SUBMITTED
TRACED H.M.C. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

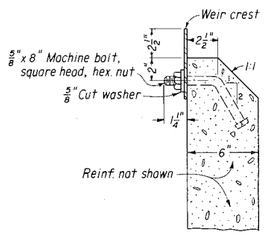


SECTION A-A

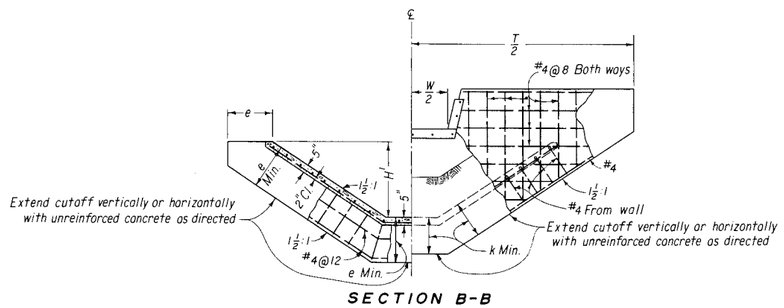
STR. No.	STANDARD DIMENSIONS								ESTIMATED QUANTITIES		
	W	MAX. Q	L	H	H'	T	k	e	CONCRETE CUBIC YARDS	REINF. STEEL POUNDS	MISC. METAL POUNDS
1	24"	4	4'-0"	3'-3"	2'-3"	13'-4"	18"	20"	1.6	160	18
2	24"	4	5'-0"	4'-0"	2'-3"	13'-4"	18"	20"	2.0	200	18
3	24"	4	6'-0"	4'-6"	2'-3"	14'-6"	18"	24"	2.2	220	18
4	24"	4	7'-0"	5'-0"	2'-3"	16'-0"	18"	24"	2.6	260	18
5	24"	4	8'-0"	5'-6"	2'-3"	17'-6"	18"	24"	3.0	300	18
6	3'-0"	10	5'-0"	4'-0"	2'-9"	17'-0"	18"	24"	2.2	220	25
7	3'-0"	10	7'-0"	5'-0"	2'-9"	17'-0"	18"	24"	2.8	280	25
8	3'-0"	10	8'-0"	5'-6"	2'-9"	18'-6"	18"	24"	3.3	330	25
9	3'-0"	10	9'-0"	6'-0"	2'-9"	20'-0"	18"	24"	3.7	370	25
10	4'-0"	20	8'-0"	5'-0"	3'-3"	21'-0"	24"	24"	3.6	360	30
11	4'-0"	20	9'-0"	6'-0"	3'-3"	21'-0"	24"	24"	4.4	440	30
12	4'-0"	20	10'-0"	6'-6"	3'-3"	22'-6"	24"	24"	4.8	480	30



WEIR DETAILS



SECTION C-C



SECTION B-B

ANCHOR BOLT AND WEIR BLADE DATA

W	H_W	G	M	A	B	S	C
24"	12"	22⅝"	3'-3¼"	15⅝"		14 7/16"	
3'-0"	16"	2'-2 1/16"	4'-5⅛"	14⅛"	1@14"	18 3/16"	10¼"
4'-0"	20"	2'-6 1/16"	5'-7¼"	13⅛"	2@14"	22 11/16"	10¼"

TABLE OF LOCATIONS AND ELEVATIONS

STR. No.	LATERAL	STATION	Q	h	F	ELEVATIONS				
						N.W.S.	B	WEIR CREST	K	L

NOTES

Weir may be placed to provide a maximum drop in water surface of 3 feet, or so that surface of water below weir will not be higher than the weir crest.
"h" is head on weir.
For general notes and minimum requirements for detailing reinf., see 40-D-6123.
Weir blade to be galvanized by the hot dip process after fabrication.

REFERENCE DRAWINGS

TYPICAL PROTECTION.

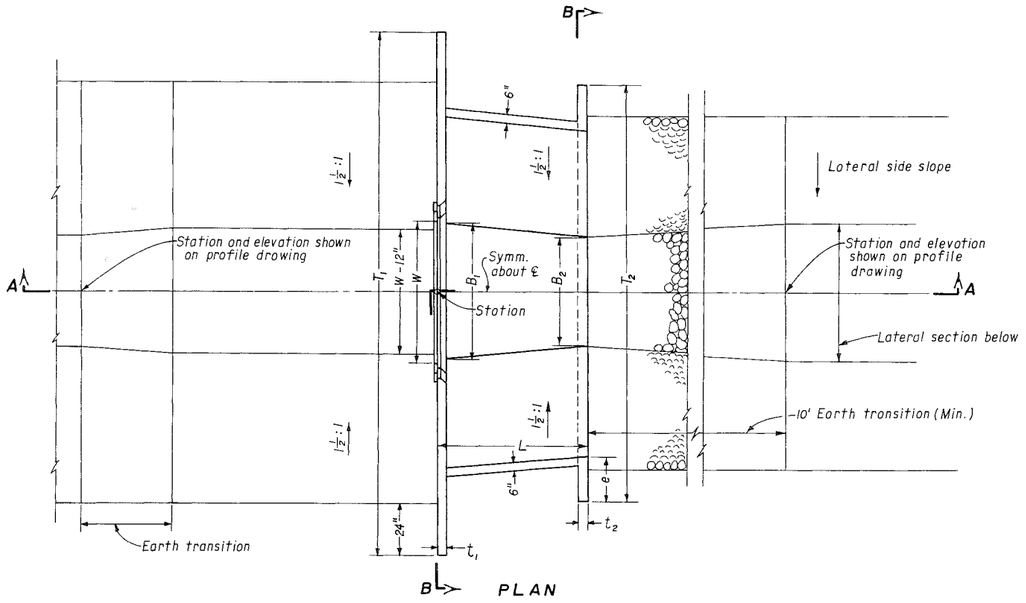
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

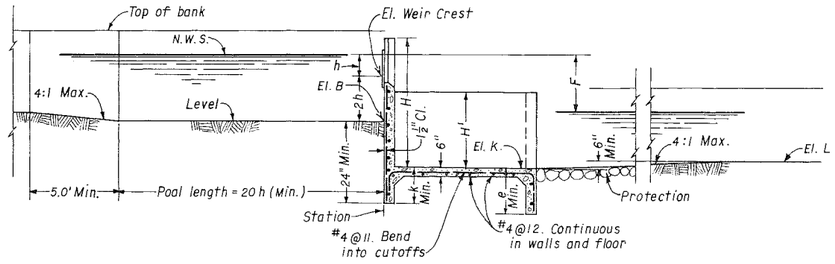
CONCRETE WEIRS
CAPACITY 3 TO 20 SECOND FEET

DRAWN A.E.C. SUBMITTED
TRACED W.D.A. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

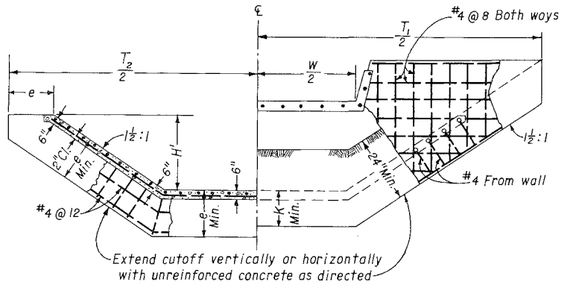
C 144.10



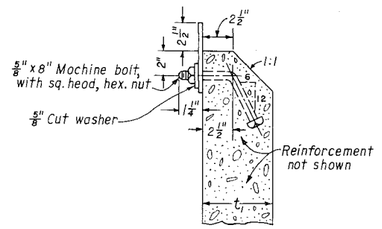
PLAN



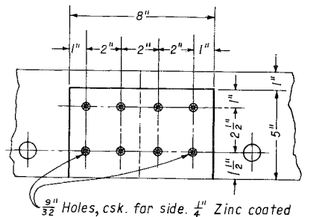
SECTION A-A



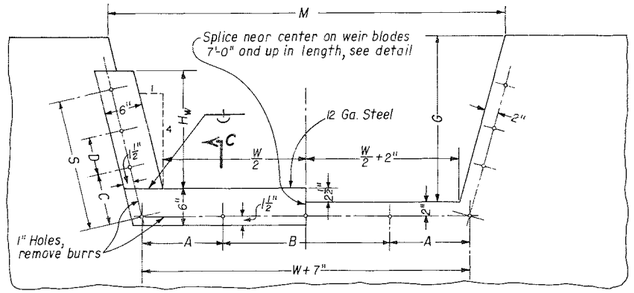
SECTION B-B



SECTION C-C



SPLICE DETAIL



WEIR DETAILS

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Weir may be placed so as to provide a maximum drop in water surface of 3 feet, or so that surface of water below weir will not be higher than the weir crest.

"h" is head on weir.

Weir blade to be galvanized by the hot dip process after fabrication.

TABLE OF LOCATIONS, ELEVATIONS AND DIMENSIONS

LATERAL	STATION	Q	h	F	W	L	H	H'	T_1	T_2	B_1	B_2	k	e	t_1	t_2	ELEVATIONS B	ELEVATIONS K	ELEVATIONS L	ELEVATIONS N.W.S. ABOVE	ELEVATIONS WEIR CREST	ESTIMATED QUANTITIES CONC. CU. YDS.	ESTIMATED QUANTITIES REINF. STEEL LBS.	ESTIMATED QUANTITIES MISC. METAL LBS.

ANCHOR BOLT AND WEIR BLADE DATA

W	H_W	G	M	A	B	S	C	D

REFERENCE DRAWING

TYPICAL PROTECTION _____

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE WEIRS
CAPACITY 21 TO 100 SECOND FEET

C-144-20

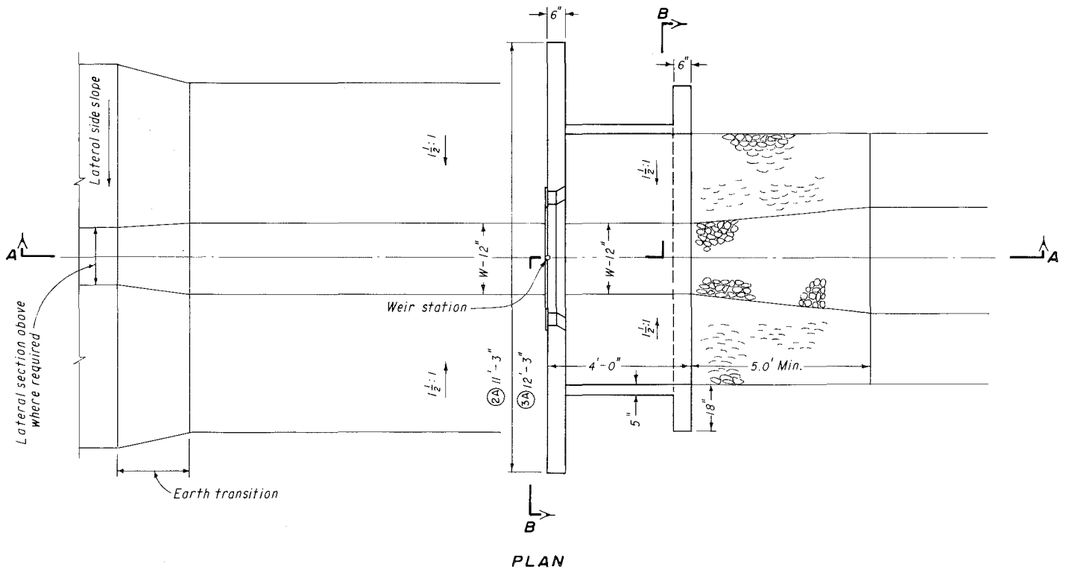
DRAWN R.E.C. SUBMITTED

TRACED J.S.M. JR. RECOMMENDED

CHECKED APPROVED

CHIEF, CANALS BRANCH

DENVER, COLORADO

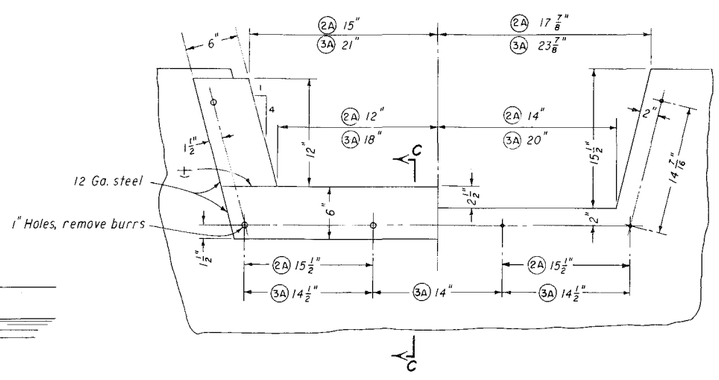


PLAN

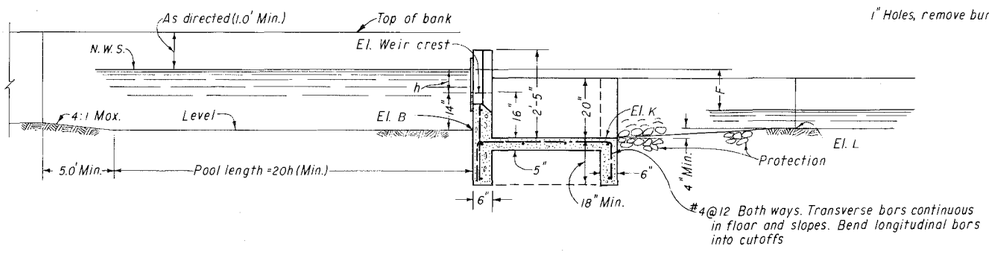
STR. NO.	W	MAX. Q	ESTIMATED QUANTITIES		
			CONC. CU. YDS.	REINF. STEEL LBS.	MISC. METAL LBS.
2A	24"	4	1.1	110	18
3A	3'-0"	6	1.2	120	18

TABLE OF LOCATIONS AND ELEVATIONS

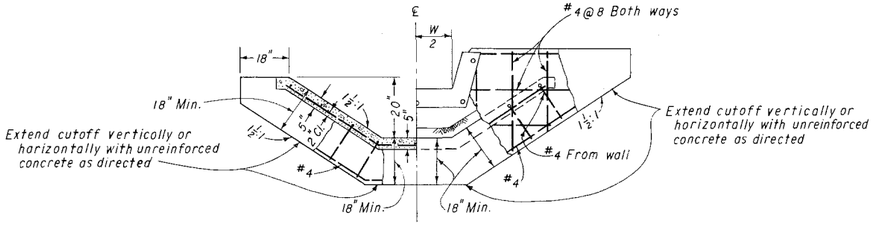
STR. NO.	LATERAL	TURNOUT OR WEIR STATION	Q	h	F	ELEVATIONS				
						N.W.S.	B	WEIR CREST	El. K	El. L



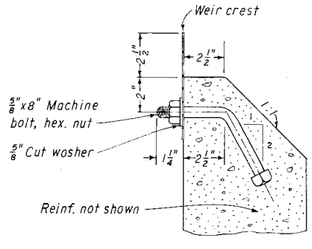
WEIR DETAILS



SECTION A-A



SECTION B-B



SECTION C-C

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Weir may be placed to provide a maximum drop in water surface of 12", or so that surface of water below weir will not be higher that the weir crest.
"h" is head on weir.
Weir blade to be galvanized by the hot dip process after fabrication.

REFERENCE DRAWINGS

TYPICAL PROTECTION _____

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE FARM WEIRS

DRAWN R.E.C. SUBMITTED
TRACED D.W.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

C-144.30

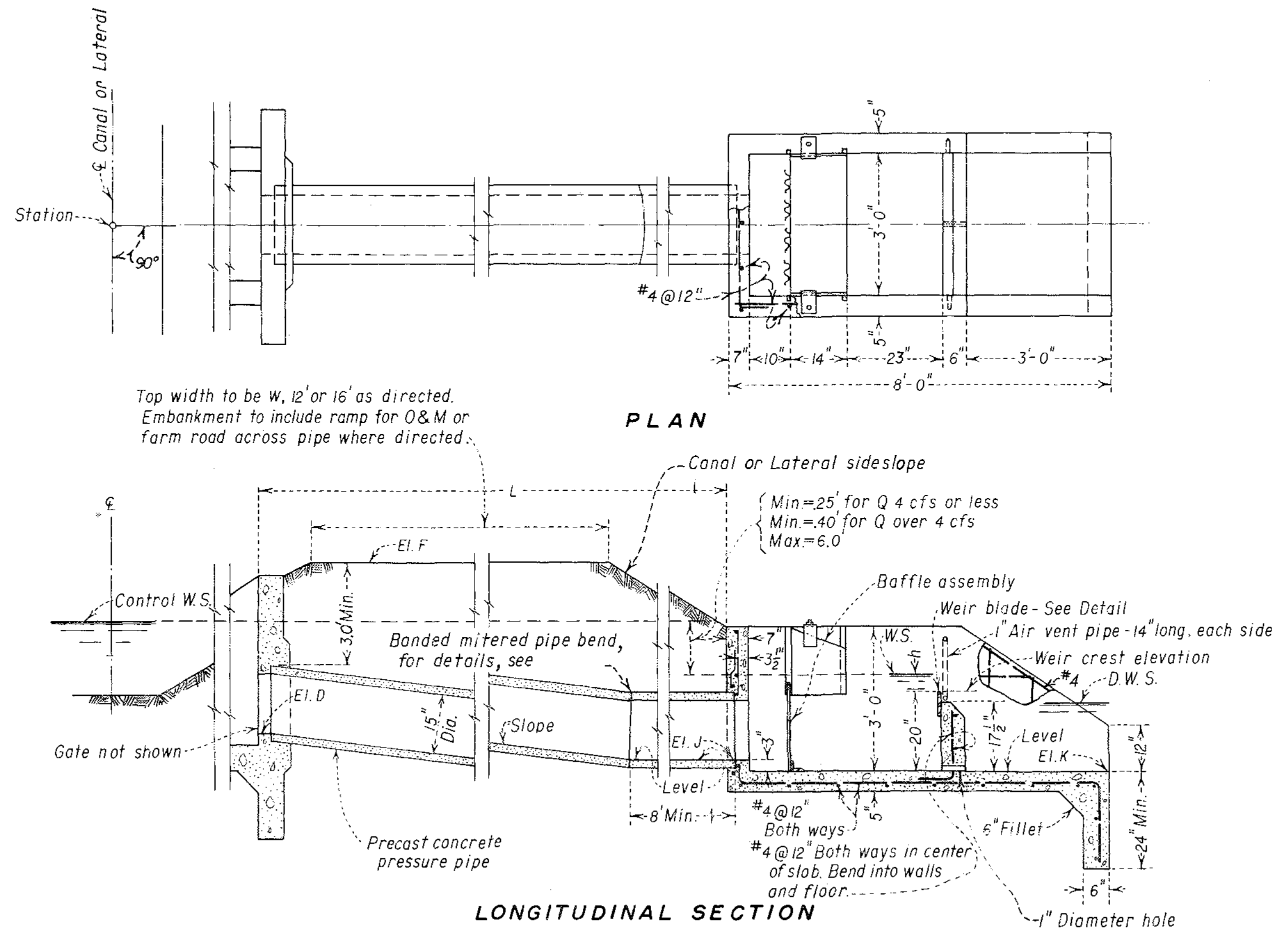
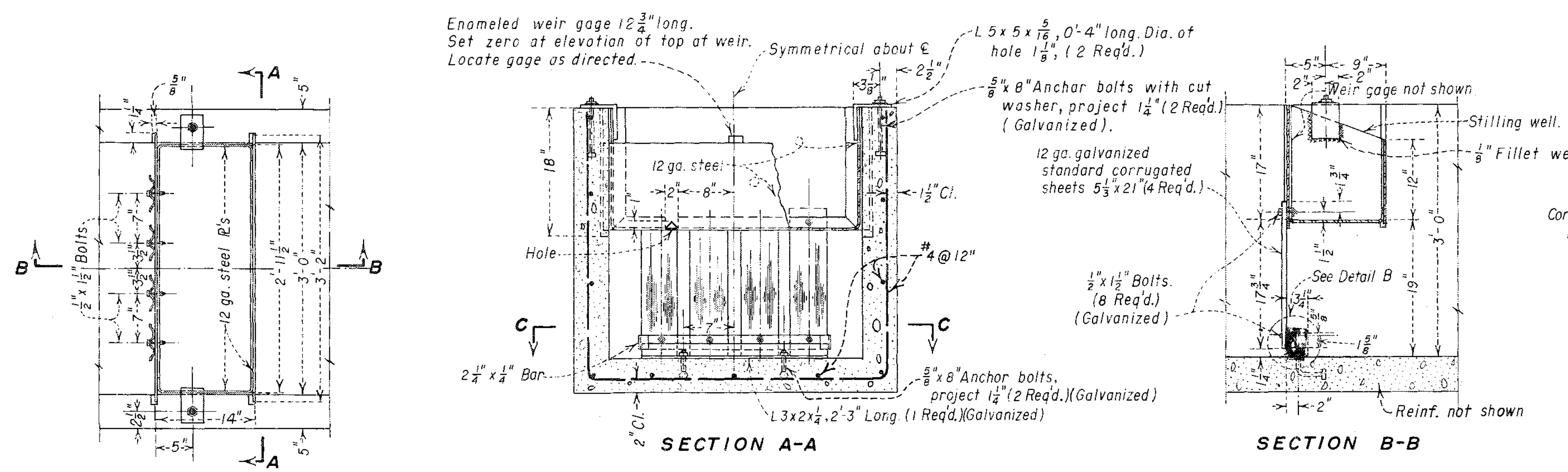


TABLE OF DISCHARGE

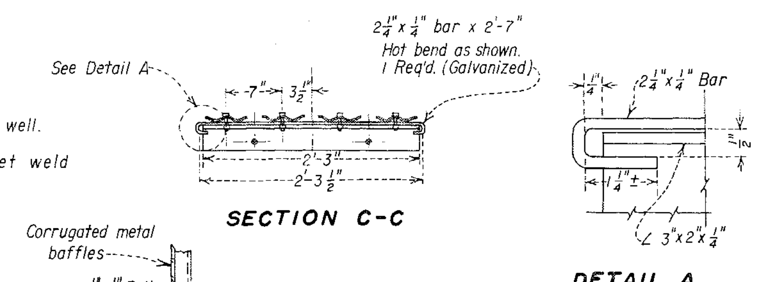
HEAD h (FEET)	Q (c.f.s.)
.10	.39
.12	.48
.14	.58
.16	.68
.18	.78
.20	.90
.22	1.05
.24	1.20
.26	1.37
.28	1.55
.30	1.73
.32	1.91
.34	2.09
.36	2.27
.38	2.45
.40	2.64
.42	2.83
.44	3.02
.46	3.22
.48	3.43
.50	3.65
.52	3.87
.54	4.10
.56	4.34
.58	4.58
.60	4.83
.62	5.00

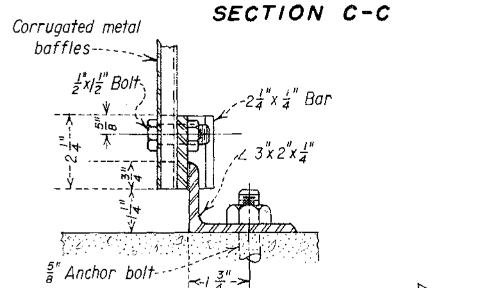
TABLE OF LOCATIONS, ELEVATIONS AND DIMENSIONS

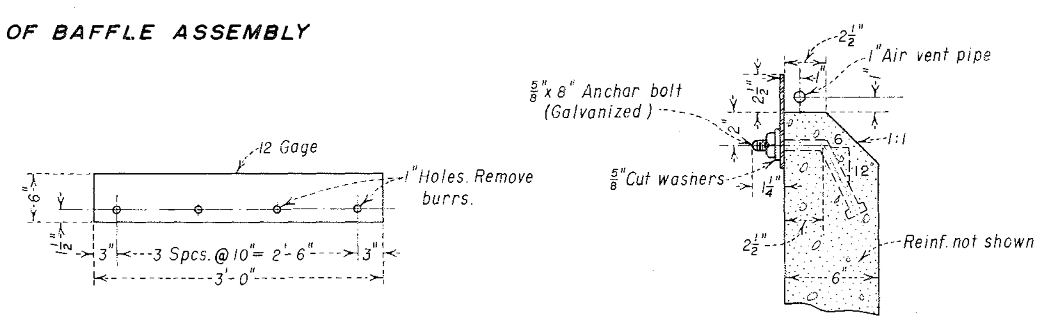
CANAL OR LATERAL	STATION	RT. OR LT.	T.O. TO LATERAL	TURNOUT STR. No.	SLOPE	DIMEN.		ELEVATIONS						Q		ESTIMATED QUANTITIES PIPE LIN.FT.	
						h	L	D	F	J	WEIR CREST	K	DESIGN DEL.W.S.				



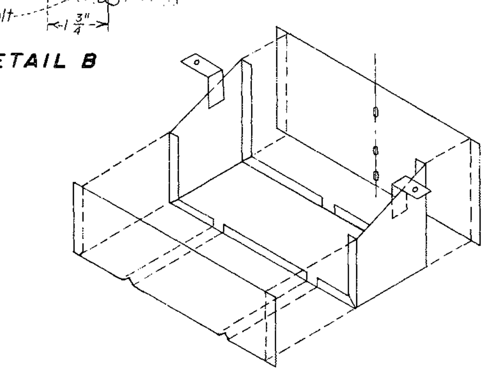
DETAIL OF BAFFLE ASSEMBLY







WEIR BLADE DETAILS



EXPLODED VIEW OF STILLING WELL

ESTIMATED QUANTITIES

Concrete .... 1.5 Cu. Yds.
Reinforcement steel .... 150 Lbs.
Miscellaneous metalwork .... 18 Lbs.
Baffle assembly .... 1 Each

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Anchor bolts to have square heads and hex nuts.
For details of weir gage, see 40-C-71.
"h" is head on weir, for Q shown in table.
Weir blade and stilling well shall be galvanized by the hot dip process after fabrication.

Baffle assembly includes all materials required for installation.
Bolted or welded fabrication of the stilling well may be used; if bolted use ¼" x ½" bolts @ 6" ±; if welded use continuous ⅛" fillet welds.

REFERENCE DRAWING

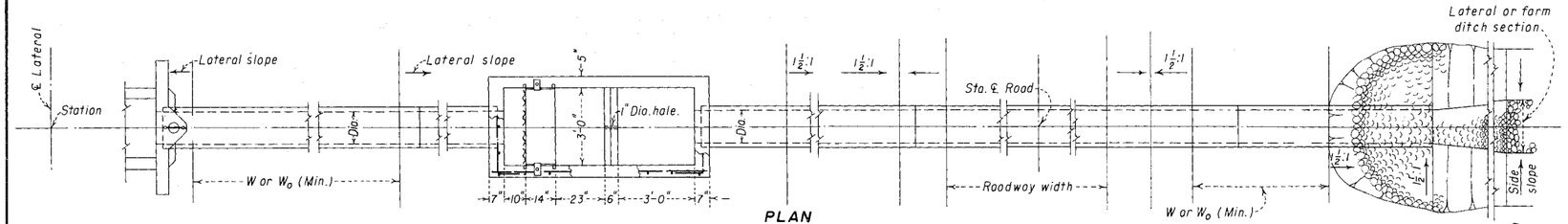
PRECAST PIPE EMBEDMENT ....
BENDS FOR PRECAST CONCRETE PRESSURE PIPE ....

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

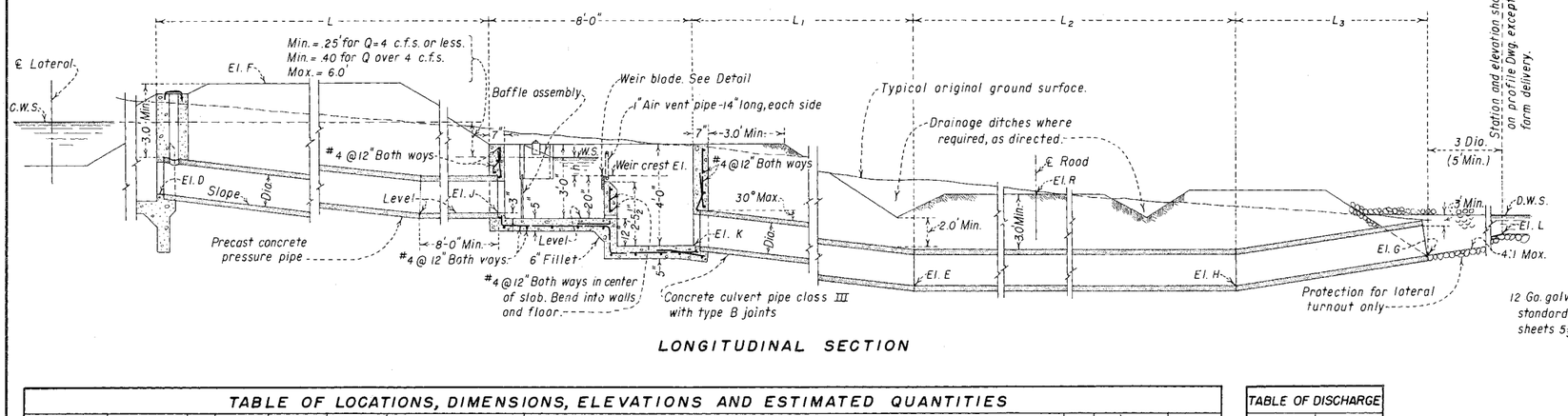
3' WEIR BOX

DRAWN R.E.C. .... SUBMITTED ....
TRACED D.D.C. .... RECOMMENDED ....
CHECKED .... APPROVED .... CHIEF, CANALS BRANCH

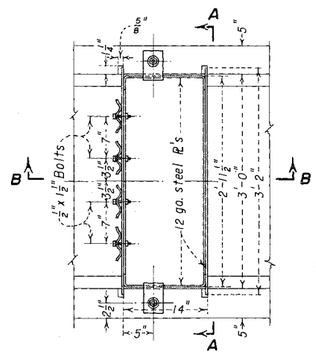
C 144.40



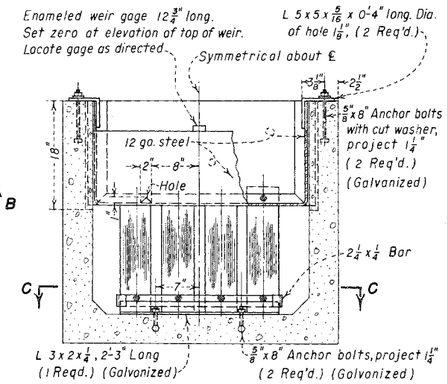
PLAN



LONGITUDINAL SECTION

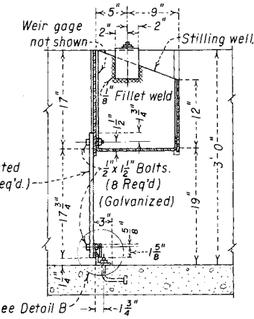


PLAN

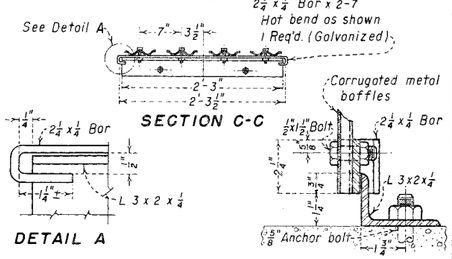


SECTION A-A

DETAIL OF BAFFLE ASSEMBLY



SECTION B-B



SECTION C-C

DETAIL A

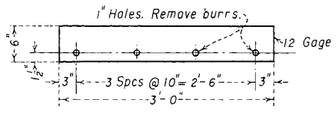
DETAIL B

TABLE OF LOCATIONS, DIMENSIONS, ELEVATIONS AND ESTIMATED QUANTITIES

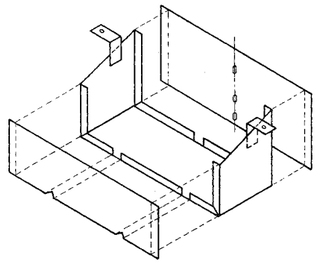
LATERAL	STATION	RT. OR LT.	T.O. TO LATERAL	TURNOUT STR. NO.	SLOPE	DIMENSIONS				ELEVATIONS										Q	PIPE DIA.	LENGTH OF PIPE LIN. FT.	STATION ℄ ROAD
						L	L₁	L₂	L₃	F	D	J	K	E	H	G	L	R	WEIR CREST	D.W.S.				

TABLE OF DISCHARGE

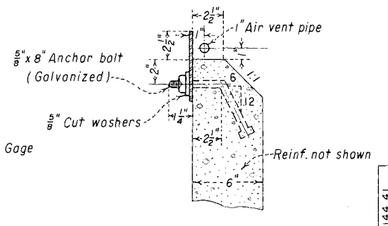
HEAD h (FEET)	Q (c.f.s.)
.10	.39
.12	.48
.14	.58
.16	.68
.18	.78
.20	.90
.22	1.05
.24	1.20
.26	1.37
.28	1.55
.30	1.73
.32	1.91
.34	2.09
.36	2.27
.38	2.45
.40	2.64
.42	2.83
.44	3.02
.46	3.22
.48	3.43
.50	3.65
.52	3.87
.54	4.10
.56	4.34
.58	4.58
.60	4.83
.62	5.00



WEIR BLADE DETAILS



EXPLODED VIEW OF STILLING WELL



ESTIMATED QUANTITIES

Concrete	2.0 Cu. Yds.
Reinforcement steel	200 Lbs.
Miscellaneous metalwork	18 Lbs.
Baffle assembly	1 Each

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Anchor bolts to have square heads and hex nuts.
For details of weir gage, see 40-C-71.
"h" is head on weir, for Q shown in table.
Weir blade and stilling well shall be galvanized by the hot dip process after fabrication.

Baffle assembly includes all materials required for installation.
Bolted or welded fabrication of the stilling well may be used; if bolted use ¼" x ½" bolts @ 6" ±; if welded use continuous ⅛" fillet welds.

REFERENCE DRAWINGS

PRECAST PIPE EMBEDMENT
TYPICAL PROTECTION
BENDS FOR PRECAST CONCRETE CULVERT PIPE

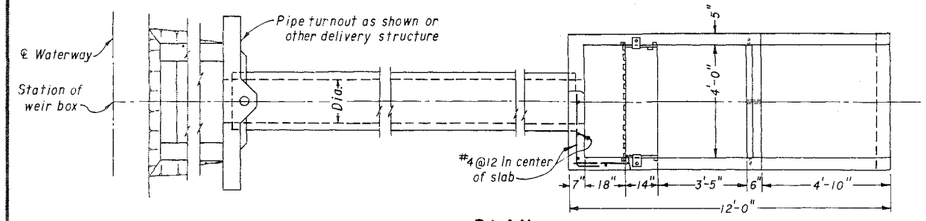
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

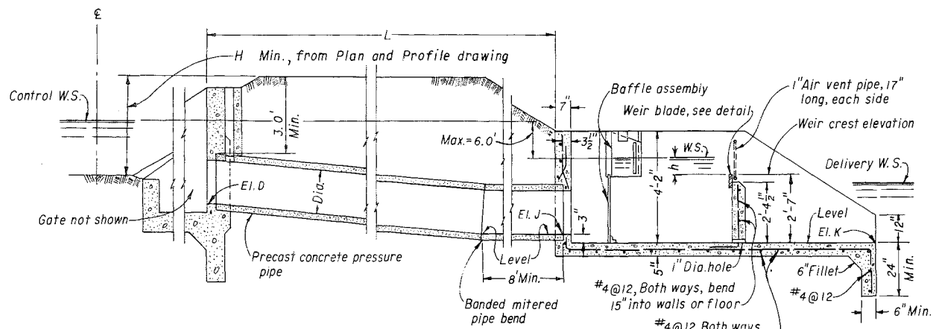
3' WEIR BOX WITH ROAD CROSSING

C 144-41

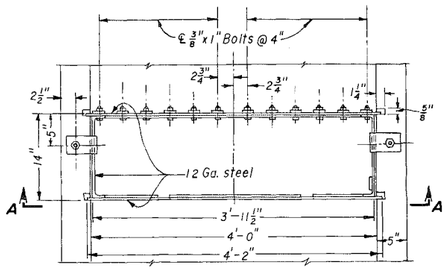
DRAWN E.L.R. SUBMITTED
TRACED W.A.W. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH



PLAN



LONGITUDINAL SECTION



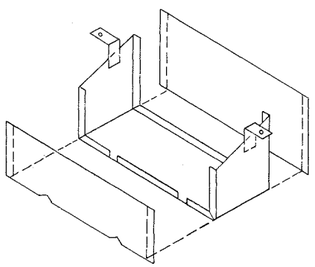
PLAN OF BAFFLE ASSEMBLY

INSTALLATION DATA

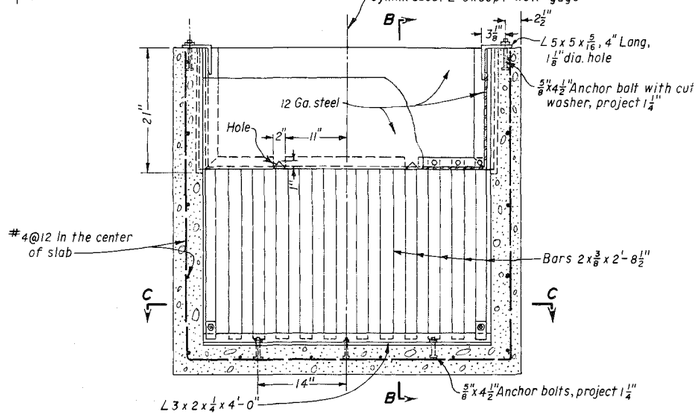
WATERWAY	STATION	RT., LT.	DELIVERY TO	Q	PIPE DIA.	L	El. D	El. J	El. K	WEIR CREST El.	DELIVERY W.S. El.	REMARKS

DISCHARGE TABLE

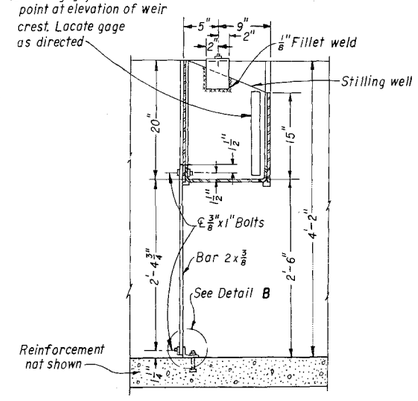
h (FT.)	Q (C.F.S.)	h (FT.)	Q (C.F.S.)
.10	.4	.50	4.9
.12	.6	.52	5.2
.14	.7	.54	5.5
.16	.8	.56	5.8
.18	1.0	.58	6.1
.20	1.2	.60	6.4
.22	1.4	.62	6.8
.24	1.6	.64	7.1
.26	1.8	.66	7.5
.28	2.0	.68	7.9
.30	2.2	.70	8.3
.32	2.5	.72	8.7
.34	2.7	.74	9.1
.36	2.9	.76	9.5
.38	3.2	.78	9.9
.40	3.5	.80	10.4
.42	3.7	.82	10.9
.44	4.0	.84	11.4
.46	4.3	.86	11.9
.48	4.6	.88	12.4



EXPLODED VIEW OF STILLING WELL



SECTION A-A



SECTION B-B

ESTIMATED QUANTITIES

(Weir box)

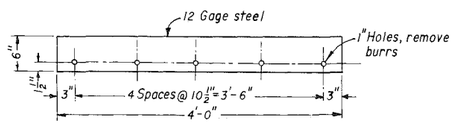
Concrete	2.8 Cu. Yds.
Reinforcement steel	280 Lbs.
Miscellaneous metalwork	18 Lbs.
Baffle assembly	1 Each

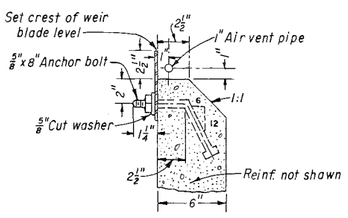
NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Anchor bolts to have square heads and hex. nuts.
"h" Is head on weir, for Q shown in table.
Baffle assembly and all miscellaneous metalwork shall be galvonized by the hot dip process after fabrication.
Baffle assembly includes all materials required for installation.
Bolted or welded fabrication of the stilling well may be used; if bolted, use ¼" x ½" bolts @ 6" ±; if welded, use continuous ⅛" fillet welds.

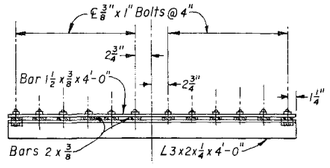
REFERENCE DRAWINGS

PRECAST PIPE EMBEDMENT	
WEIR GAGE	40-C-71
BENDS FOR PRECAST CONCRETE PRESSURE PIPE	

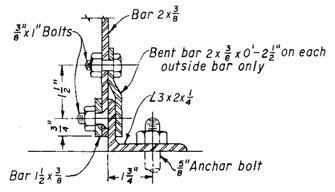




WEIR BLADE DETAILS



SECTION C-C



DETAIL B

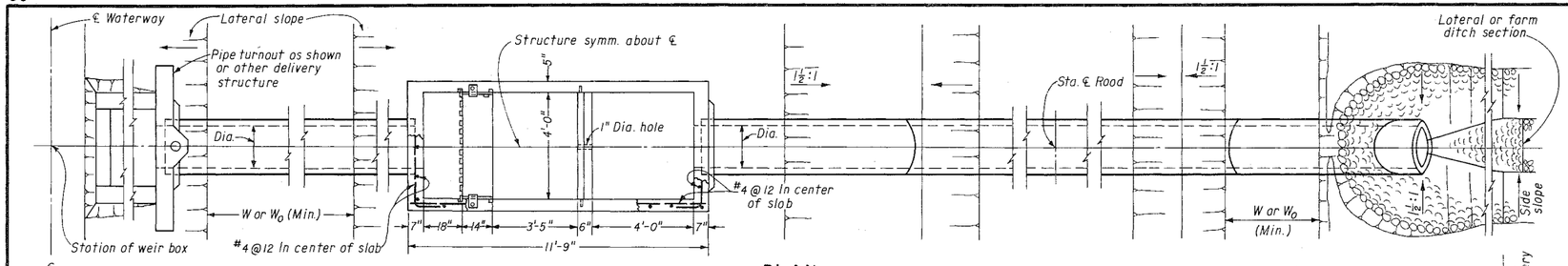
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

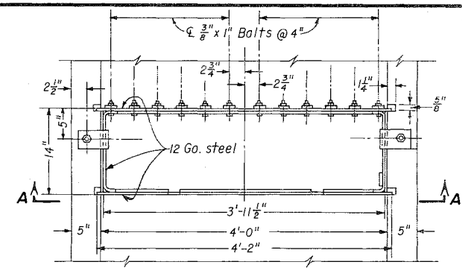
4' WEIR BOX

DRAWN D.M.M. SUBMITTED
TRACED H.M.Q. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

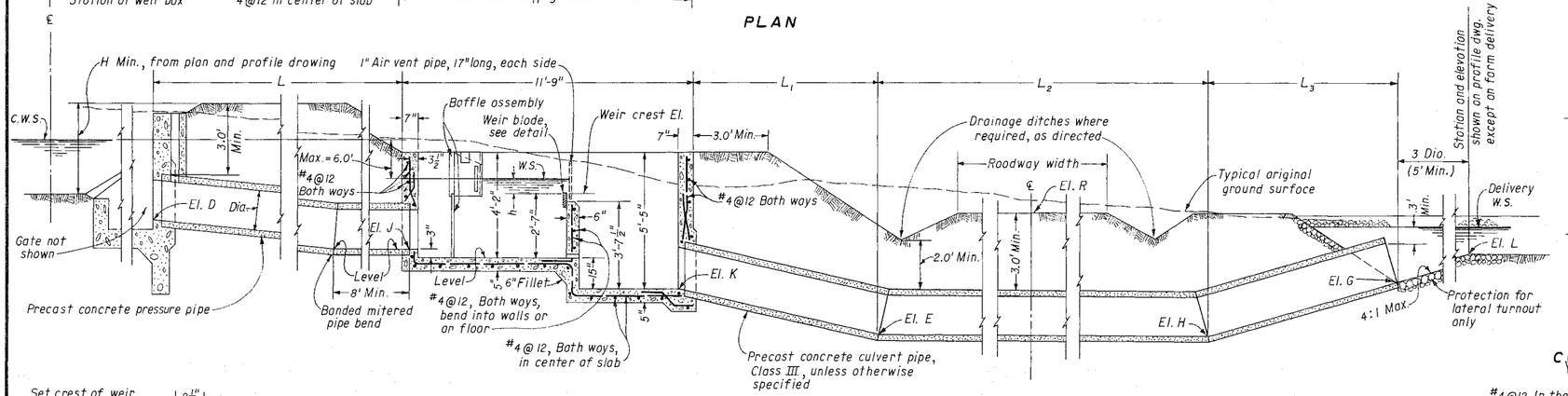
C 144.50



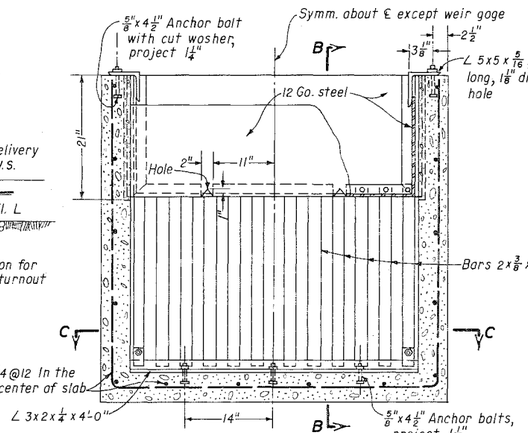
PLAN



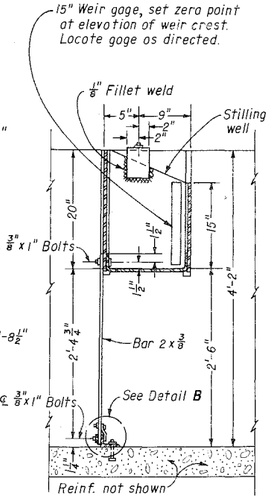
PLAN OF BAFFLE ASSEMBLY



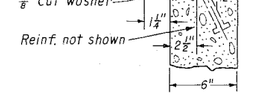
LONGITUDINAL SECTION

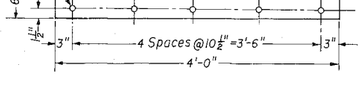


SECTION A-A

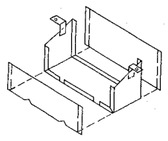


SECTION B-B

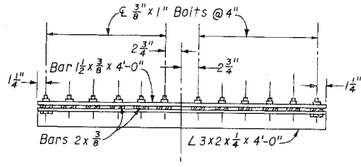




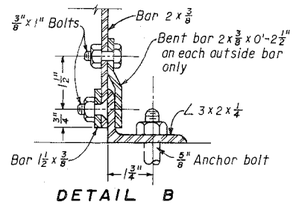
WEIR BLADE DETAILS



EXPLODED VIEW OF STILLING WELL



SECTION C-C



DETAIL B

INSTALLATION DATA

WATERWAY	STATION	RT. OR LT.	DELIVERY TO	Q	PIPE DIA.	LENGTH OF PIPE LIN. FT.	DIMENSIONS L	L_1	L_2	L_3	ELEVATIONS D	J	K	E	H	G	L	WEIR CREST	DELIVERY W.S.	R	STATION ℄ ROAD	REMARKS

DISCHARGE TABLE

h (FT.)	Q (C.F.S.)	h (FT.)	Q (C.F.S.)
.10	.4	.50	4.9
.12	.6	.52	5.2
.14	.7	.54	5.5
.16	.8	.56	5.8
.18	1.0	.58	6.1
.20	1.2	.60	6.4
.22	1.4	.62	6.8
.24	1.6	.64	7.1
.26	1.8	.66	7.5
.28	2.0	.68	7.9
.30	2.2	.70	8.3
.32	2.5	.72	8.7
.34	2.7	.74	9.1
.36	2.9	.76	9.5
.38	3.2	.78	9.9
.40	3.5	.80	10.4
.42	3.7	.82	10.9
.44	4.0	.84	11.4
.46	4.3	.86	11.9
.48	4.6	.88	12.4

ESTIMATED QUANTITIES

(Weir box)

Concrete	3.5	Cu. Yds.
Reinforcement steel	350	Lbs.
Miscellaneous metalwork	18	Lbs.
Baffle assembly	1	Each

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Anchor bolts to have square heads and hex. nuts.
"h" is head on weir, for Q shown in table.
Baffle assembly and all miscellaneous metalwork shall be galvonized by the hot dip process after fabrication.
Baffle assembly includes all materials required for installation.
Bolted or welded fabrication of the stilling well may be used: if bolted, use ¼"x½" bolts @6"±; if welded, use continuous ⅛" fillet welds.

REFERENCE DRAWINGS

PRECAST PIPE EMBEDMENT	
TYPICAL PROTECTION	
BENDS FOR PRECAST CONCRETE CULVERT PIPE	
WEIR GAGE	40-C-71

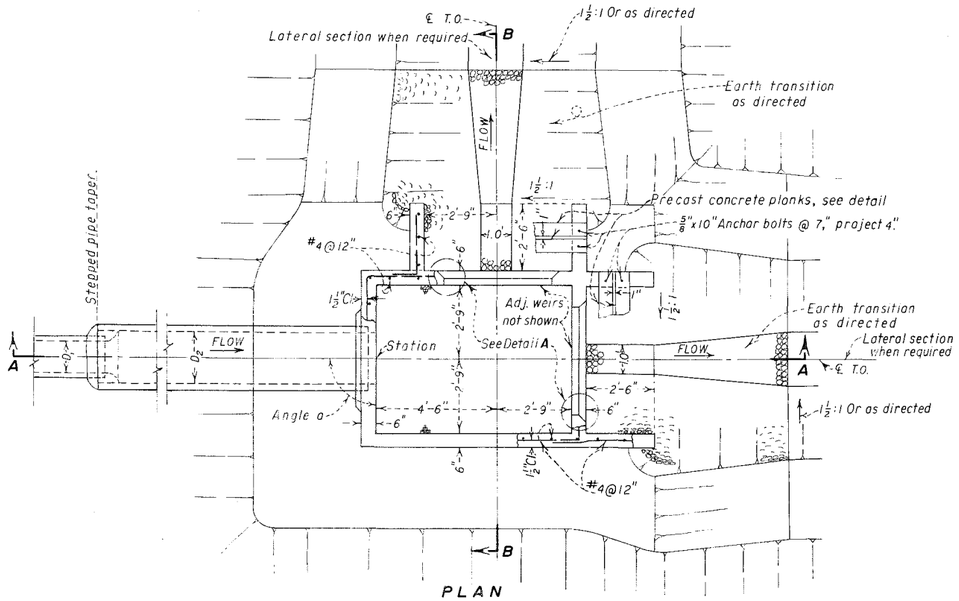
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

4' WEIR BOX WITH ROAD CROSSING

C-144.51

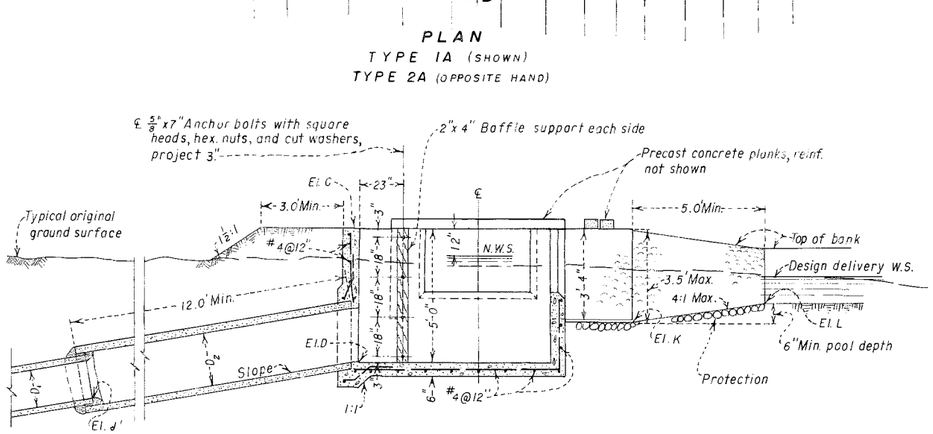
DRAWN E.L.W. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO



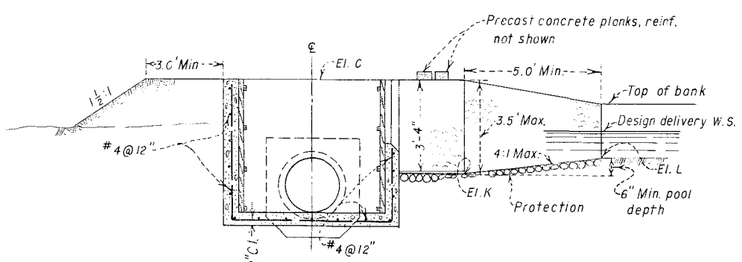
PLAN

TYPE 1A (SHOWN)

TYPE 2A (OPPOSITE HAND)



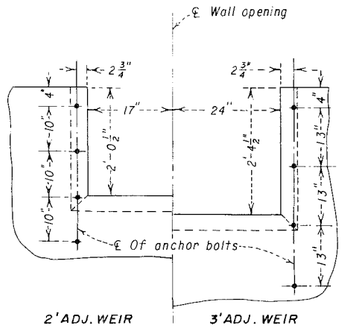
SECTION A-A



SECTION B-B

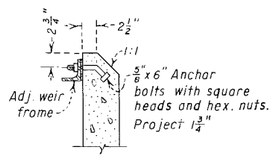
TABLE OF LOCATIONS AND ELEVATIONS

TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	INLET PIPE				ELEVATIONS							ADJ. WEIR (W)	REMARKS
						D_1	D_2	SLOPE	ANGLE α	J'	C	NORMAL W.S.	D	K	L	DESIGN DEL. W.S.		



2' ADJ. WEIR 3' ADJ. WEIR

DETAILS OF OPENING FOR ADJUSTABLE WEIR



DETAIL A

ESTIMATED QUANTITIES

Concrete ..... 4.4 Cu. Yds.

Reinforcement steel ..... 360 Lbs.

NOTES

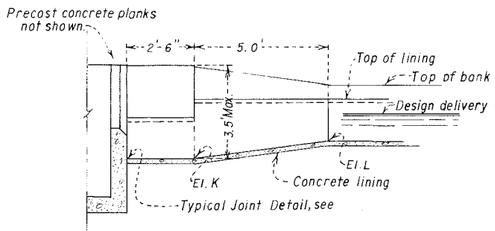
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.

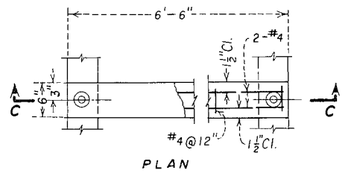
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.

Max. Q for 2' adjustable weir is 4 sec. ft.

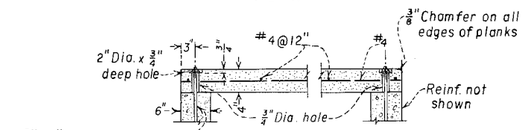
Max. Q for 3' adjustable weir is 6 sec. ft.



DETAIL OF CONNECTION TO CONCRETE LINING

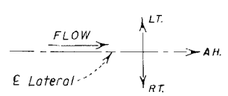


PLAN



SECTION C-C

DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

REFERENCE DRAWINGS

PRECAST PIPE EMBEDMENT .....

ADJUSTABLE WEIR W=2'-0" AND 3'-0" .....

TYPICAL PROTECTION .....

STEPPED PIPE TAPERS .....

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DIVISION BOX-TYPES 1 AND 2

C 146.10

DRAWN W.A.K. SUBMITTED .....

TRACED D.W.G. RECOMMENDED .....

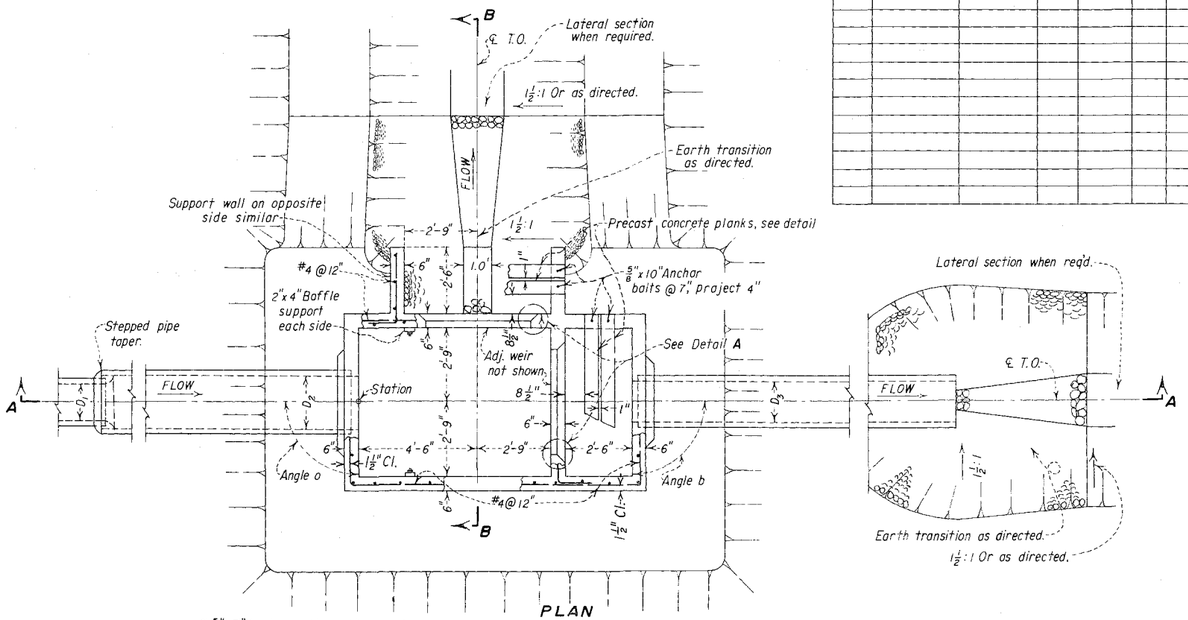
CHECKED ..... APPROVED ..... CHIEF, CANALS BRANCH

DENVER, COLORADO

TABLE OF LOCATIONS AND ELEVATIONS

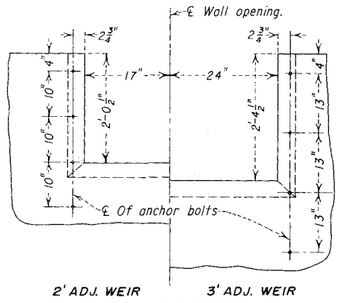
TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	INLET PIPE				ELEVATIONS								OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						D_1	D_2	SLOPE	ANGLE a.	J'	C	NORMAL W.S.	D	K	J	L	DESIGN DEL. W.S.	D_3	Lp	SLOPE	ANGLE b.		

(1) Connect to road crossing.
(2) Connect to pipe line.
(3) Connect to pipe drop.



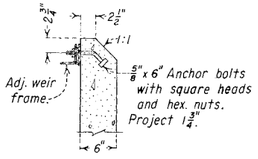
PLAN

TYPE 3 (SHOWN)
TYPE 4 (OPPOSITE HAND)



2' ADJ. WEIR 3' ADJ. WEIR

DETAILS OF OPENING FOR ADJUSTABLE WEIR



DETAIL A

ESTIMATED QUANTITIES

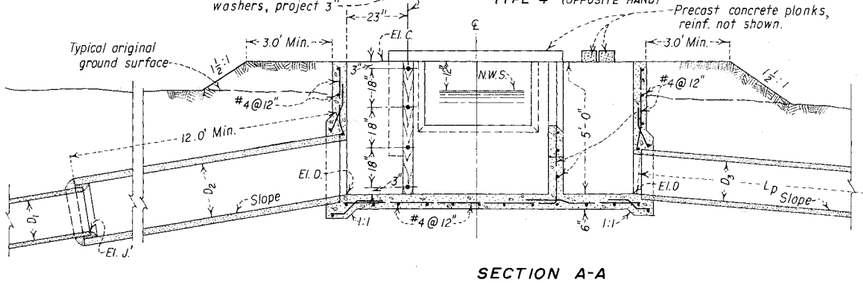
Concrete ..... 5.7 Cu. Yds.
Reinforcement steel ..... 450 Lbs.

NOTES

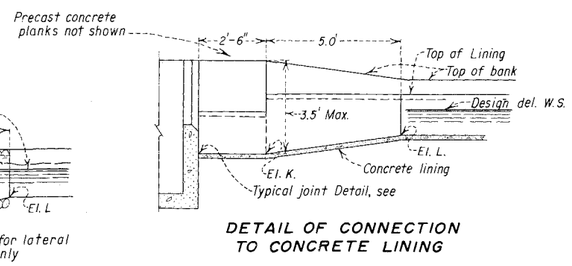
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.
Maximum Q for 2' adjustable weir is 4 sec. ft.
Maximum Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

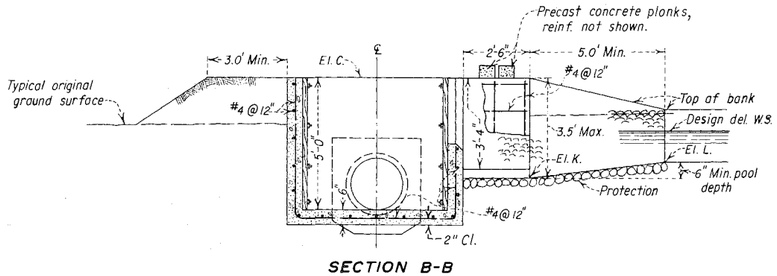
ADJUSTABLE WEIR W= 2'-0" AND 3'-0" .....
PRECAST PIPE EMBEDMENT .....
TYPICAL PROTECTION .....
STEPPED PIPE TAPERS .....



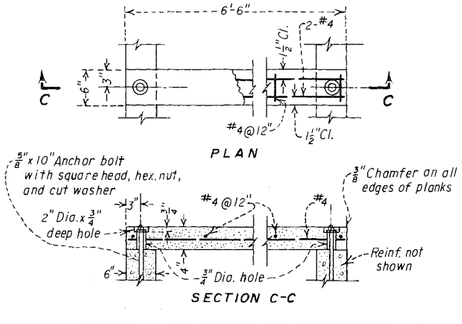
SECTION A-A



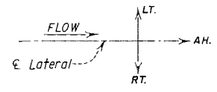
DETAIL OF CONNECTION TO CONCRETE LINING



SECTION B-B



DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

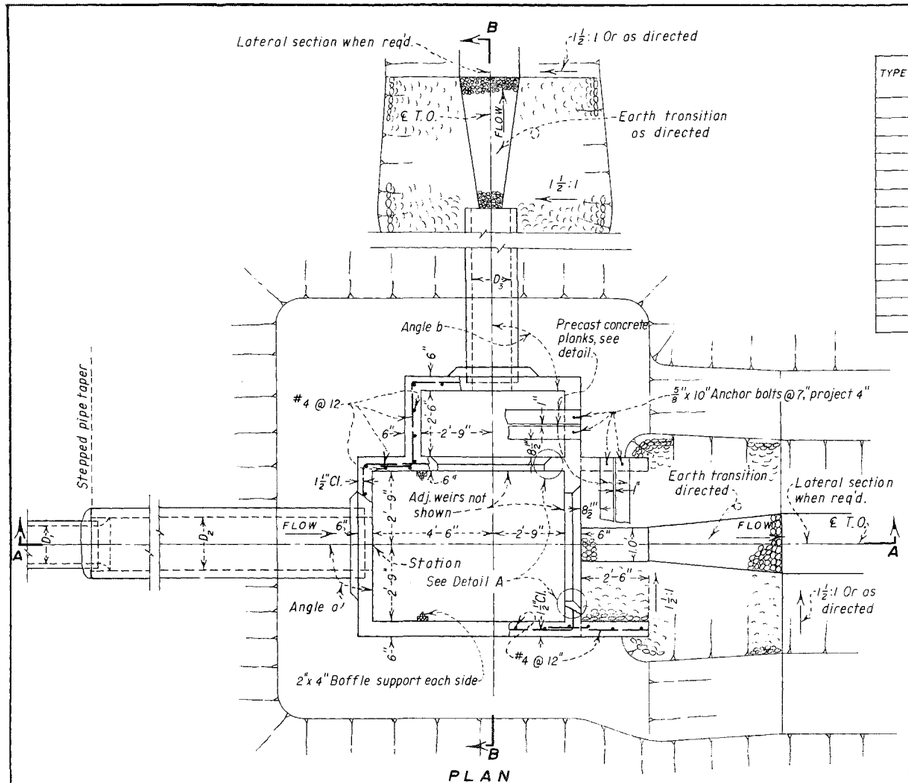
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DIVISION BOX—TYPES 3 AND 4

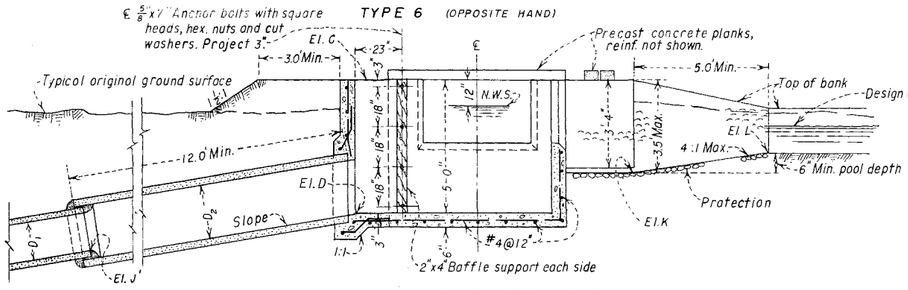
C 146-20

DRAWN W.A.K. SUBMITTED
TRACED S.W.M. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER COLORADO

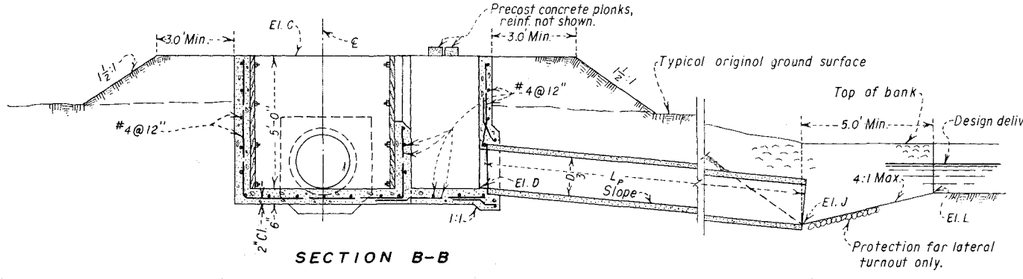


PLAN

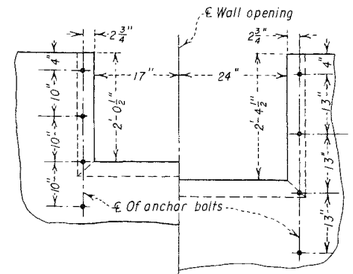
TYPE 5 (SHOWN)
TYPE 6 (OPPOSITE HAND)



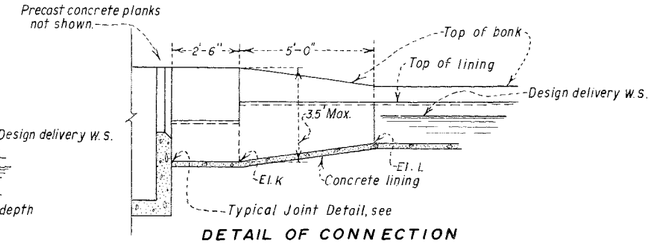
SECTION A-A



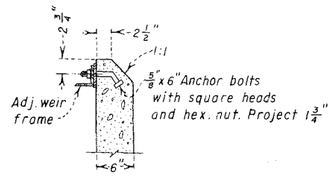
SECTION B-B



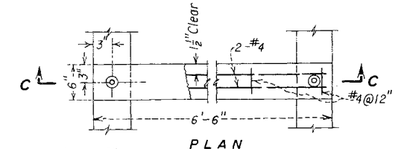
2'ADJ. WEIR 3'ADJ. WEIR
DETAILS OF OPENING FOR ADJUSTABLE WEIR



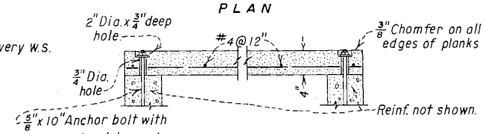
DETAIL OF CONNECTION TO CONCRETE LINING



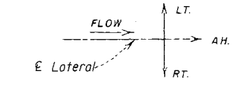
DETAIL A



PLAN



SECTION C-C
DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

TABLE OF LOCATIONS AND ELEVATIONS

TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	INLET PIPE				ELEVATIONS								OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						D_1	D_2	SLOPE	ANGLE a	J'	C	NORMAL W.S.	D	K	J	L	DESIGN DEL. W.S.	D_3	L_P	SLOPE	ANGLE b		

ESTIMATED QUANTITIES

Concrete ..... 5.4 Cu. Yds.
Reinforcement steel ..... 450 Lbs.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
Monolithic concrete design based on a compressive strength of 3,000 lbs. per square inch at 28 days.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.
Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

ADJUSTABLE WEIR W = 2'-0" AND 3'-0" .....
PRECAST PIPE EMBEDMENT .....
TYPICAL PROTECTION .....
STEPPED PIPE TAPERS .....

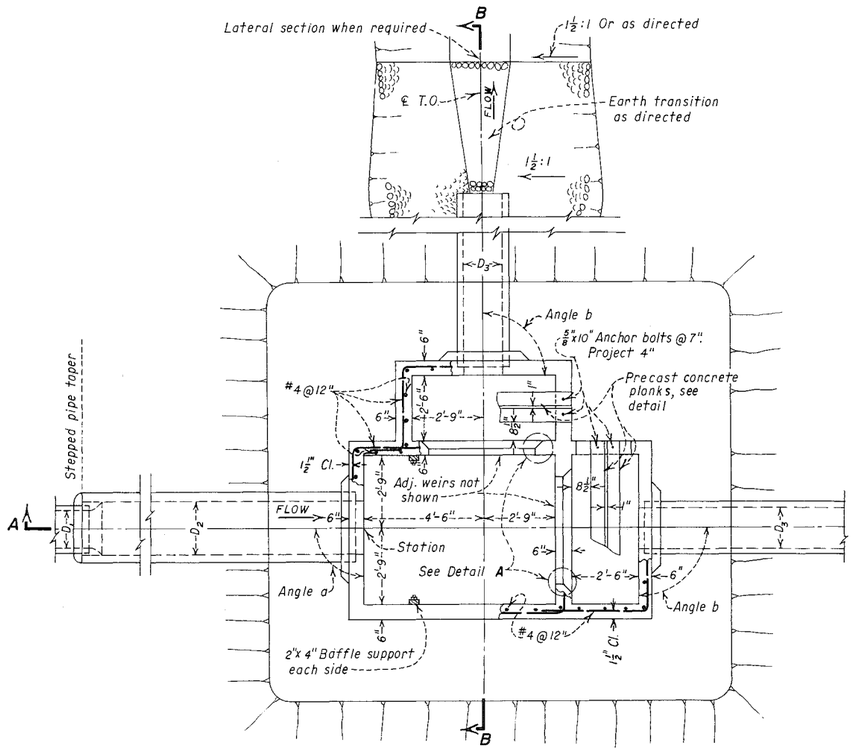
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DIVISION BOX-TYPES 5 AND 6

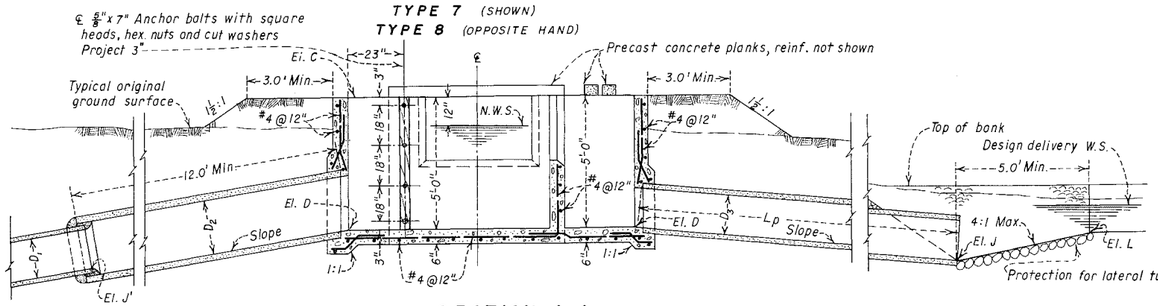
DRAWN W.A.K. SUBMITTED
TRACED D.W.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C146.30

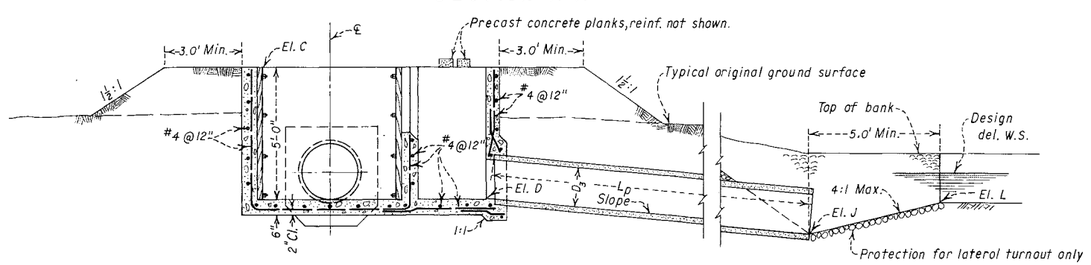


PLAN

TYPE 7 (SHOWN)
TYPE 8 (OPPOSITE HAND)



SECTION A-A



SECTION B-B

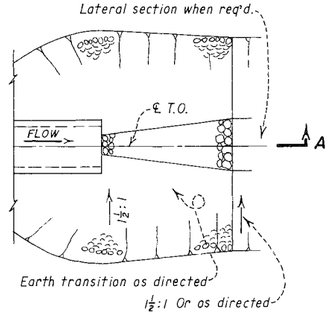
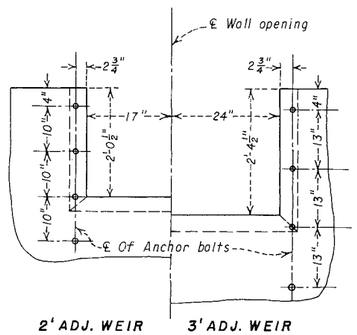


TABLE OF LOCATIONS AND ELEVATIONS

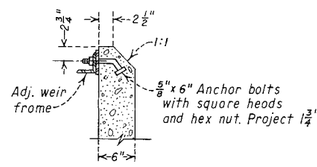
TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	INLET PIPE				ELEVATIONS							OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						D_1	D_2	SLOPE	ANGLE a	J'	C	NORMAL W.S.	D	J	L	DESIGN DEL. W.S.	D_3	L_P	SLOPE	ANGLE b		

(1) Connect to road crossing
(2) Connect to pipe line
(3) Connect to pipe drop



2' ADJ. WEIR 3' ADJ. WEIR

DETAILS OF OPENING FOR ADJUSTABLE WEIR



DETAIL A

ESTIMATED QUANTITIES

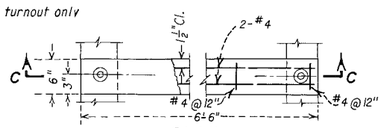
Concrete	6.5 Cu. Yds.
Reinforcement steel	540 Lbs.

NOTES

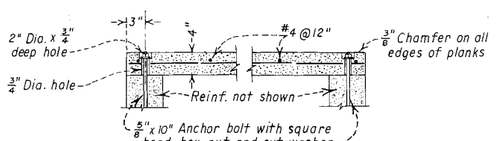
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown
Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

ADJUSTABLE WEIR W=2'0" AND 3'0"
PRECAST PIPE EMBEDMENT
TYPICAL PROTECTION
STEPPED PIPE TAPERS

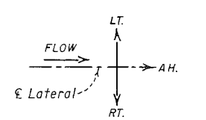


PLAN



SECTION C-C

DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DIVISION BOX-TYPES 7 AND 8

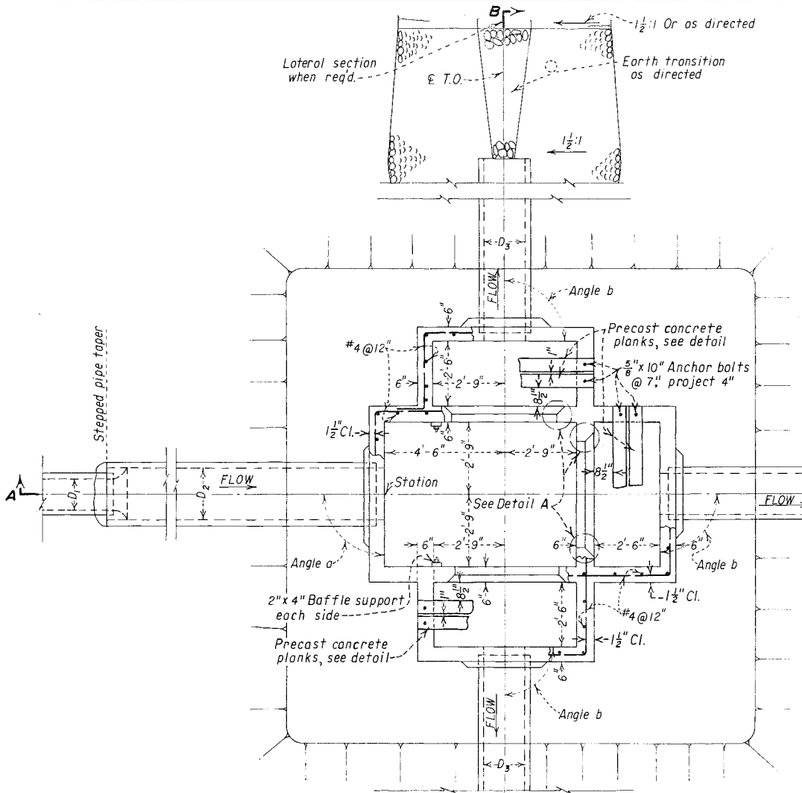
C 146.40

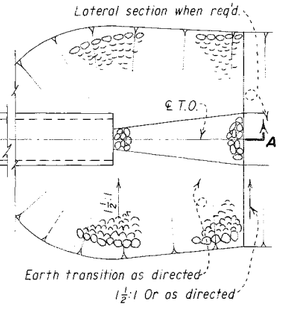
DRAWN W.A.K. SUBMITTED
TRACED J.S.M. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

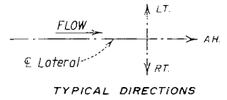
TABLE OF LOCATIONS AND ELEVATIONS

TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	INLET PIPE				ELEVATIONS							OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						D_1	D_2	SLOPE	ANGLE a.	J'	C	NORMAL W.S.	D	J	L	DESIGN DEL. W.S.	D_3	Lp	SLOPE	ANGLE b.		

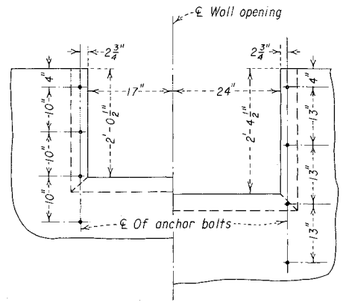
(1) Connect to road crossing
(2) Connect to pipe line
(3) Connect to pipe drop



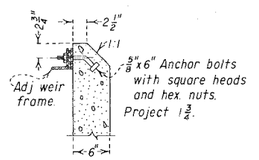




TYPICAL DIRECTIONS



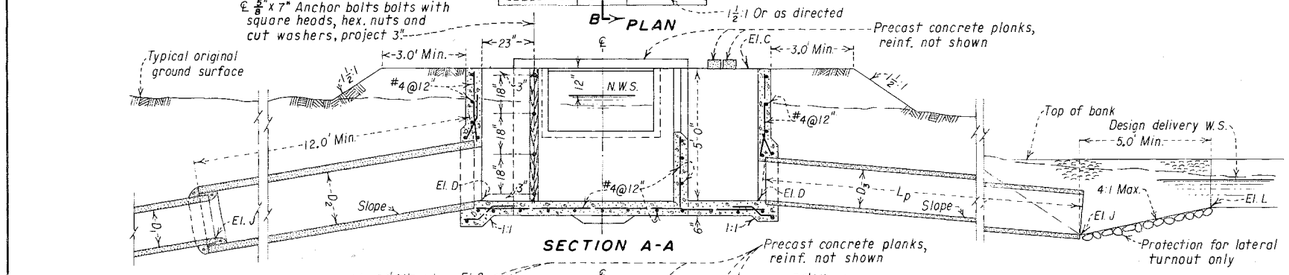
2' ADJ. WEIR 3' ADJ. WEIR
DETAILS OF OPENING FOR ADJUSTABLE WEIR

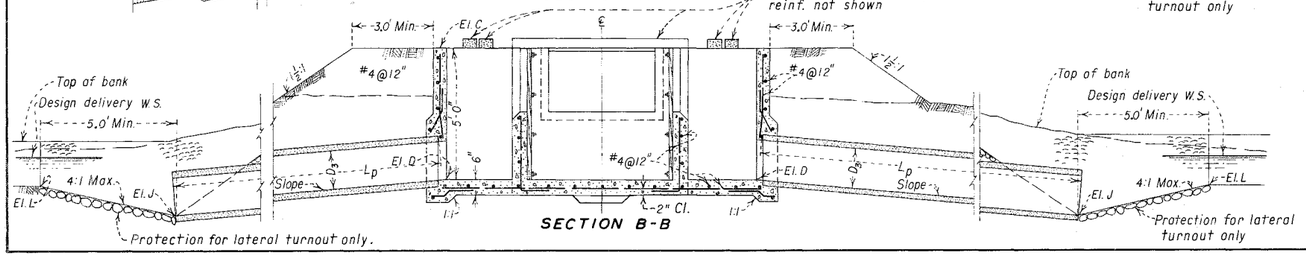


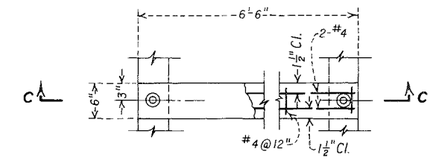
DETAIL A

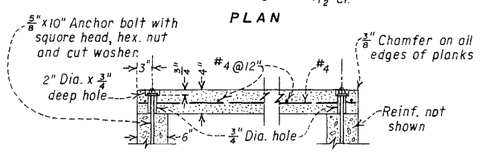
ESTIMATED QUANTITIES

Concrete ..... 8.00 Cu. yds.
Reinforcement steel ..... 670 Lbs.









DETAIL OF PRECAST CONCRETE PLANK

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.
Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

ADJUSTABLE WEIR W=2'-0" AND 3'-0"
PRECAST PIPE EMBEDMENT
STEPPED PIPE TAPERS
TYPICAL PROTECTION

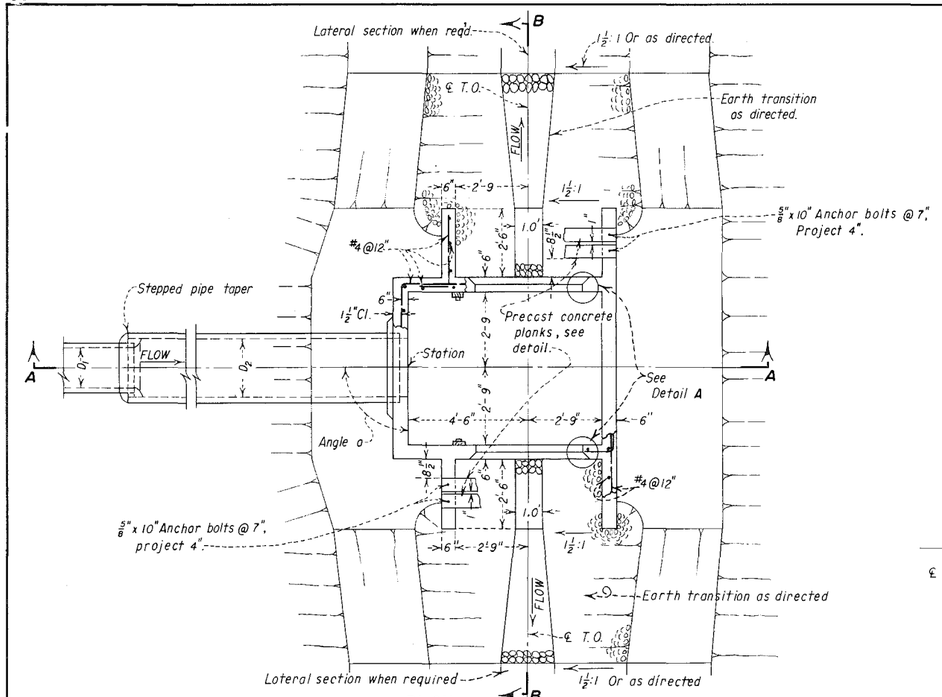
ALWAYS THINK SAFETY

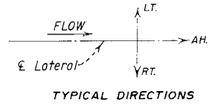
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DIVISION BOX - TYPE 9

C 146.50

DRAWN A.W.B. SUBMITTED
TRACED N.O.T. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH

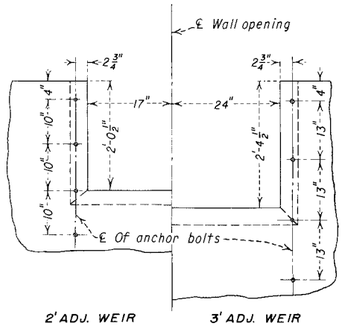




TYPICAL DIRECTIONS

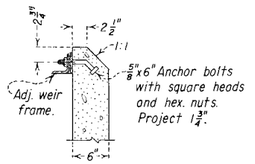
TABLE OF LOCATIONS AND ELEVATIONS

LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	INLET PIPE				ELEVATIONS							ADJ. WEIR (W)	REMARKS.
					D_1	D_2	SLOPE	ANGLE α	J'	C	N.W.S.	D	K	L	DESIGN DEL. W.S.		



2' ADJ. WEIR 3' ADJ. WEIR

DETAILS OF OPENING FOR ADJUSTABLE WEIR



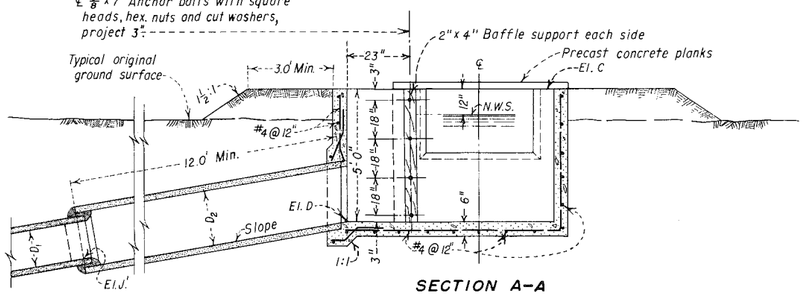
DETAIL A

ESTIMATED QUANTITIES

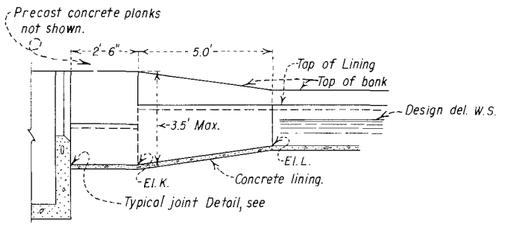
Concrete ..... 4.4 Cu.yds.
Reinforcement steel ..... 360 Lbs.

NOTES

For general notes and minmum requirement for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.
Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.



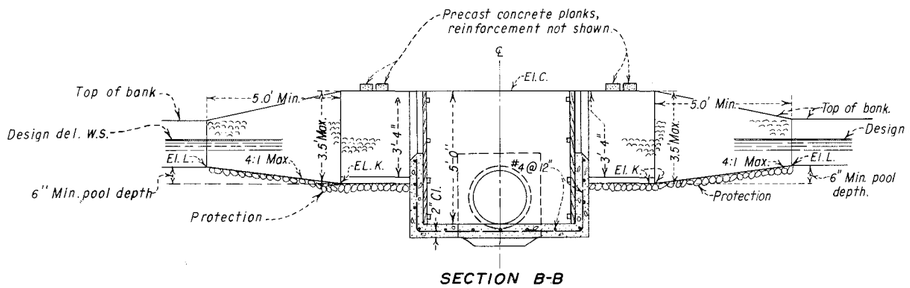
SECTION A-A



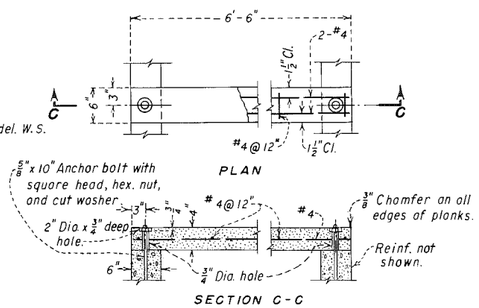
DETAIL OF CONNECTION TO CONCRETE LINING

REFERENCE DRAWINGS

ADJUSTABLE WEIR W= 2'-0" AND 3'-0"
TYPICAL PROTECTION
STEPPED PIPE TAPERS
PRECAST PIPE EMBEDMENT



SECTION B-B



DETAIL OF PRECAST CONCRETE PLANK

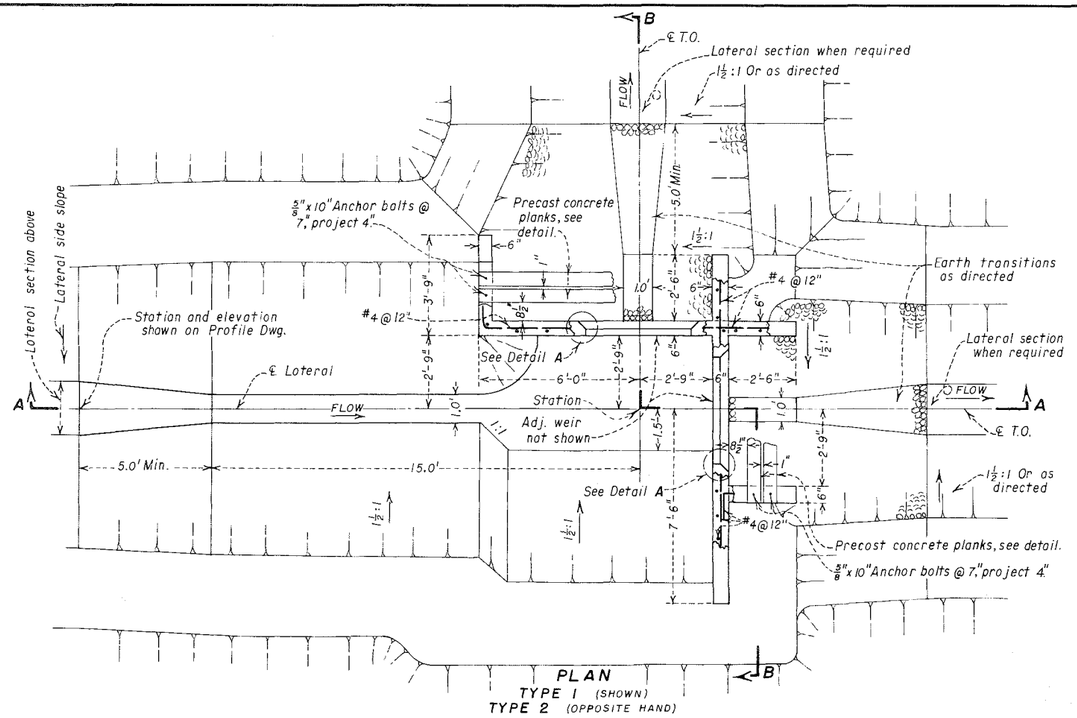
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE DIVISION BOX-TYPE 10

DRAWN W.A.K. SUBMITTED
TRACED S.W.M. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

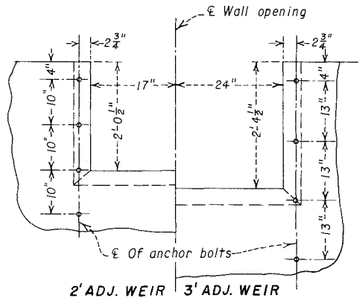
C 146.60



PLAN
TYPE 1 (SHOWN)
TYPE 2 (OPPOSITE HAND)

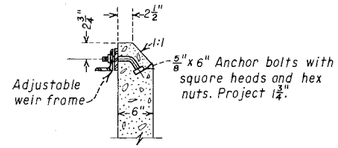
TABLE OF LOCATIONS AND ELEVATIONS

TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	ELEVATIONS					ADJ. WEIR (W)	REMARKS
						C	NORMAL W.S.	K	L	DESIGN DEL. WS.		



2' ADJ. WEIR 3' ADJ. WEIR

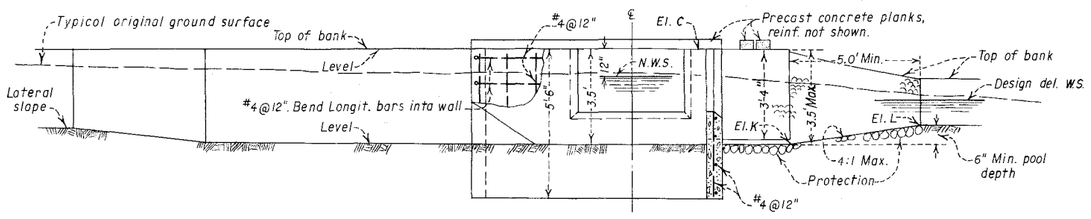
DETAILS OF OPENING FOR ADJUSTABLE WEIR



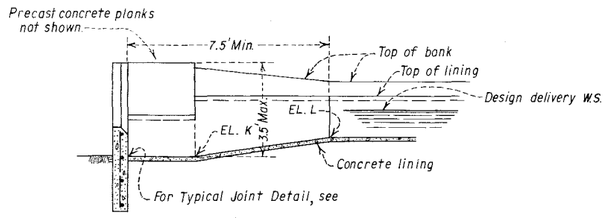
DETAIL A

ESTIMATED QUANTITIES

Concrete ..... 3.2 Cu. Yds.
Reinforcement steel ..... 280 Lbs.



SECTION A-A



DETAIL OF CONNECTION TO CONCRETE LINING

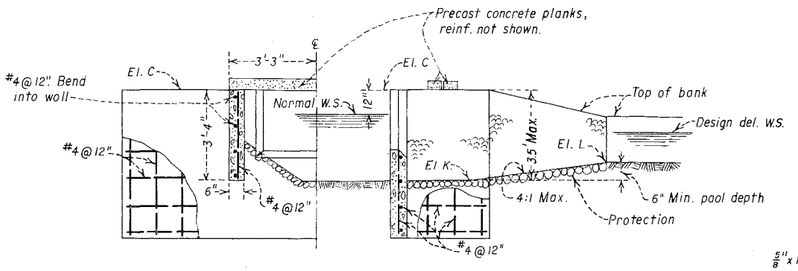
NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.

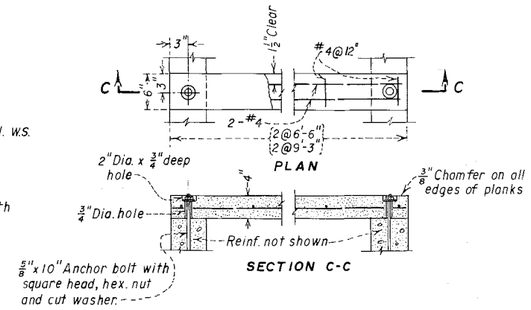
Max. Q for 2' adjustable weir is 4 sec. feet.
Max. Q for 3' adjustable weir is 6 sec. feet.

REFERENCE DRAWINGS

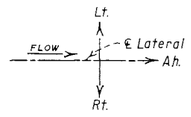
ADJUSTABLE WEIR W=2'-0" AND W=3'-0" .....
TYPICAL PROTECTION .....



SECTION B-B



DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DIVISION BOX-TYPES 1 AND 2

DRAWN W.A.K. SUBMITTED .....
TRACED J.S.M. JR. RECOMMENDED .....
CHECKED ..... APPROVED .....
CHIEF, CANALS BRANCH
DENVER, COLORADO,

C 147.10

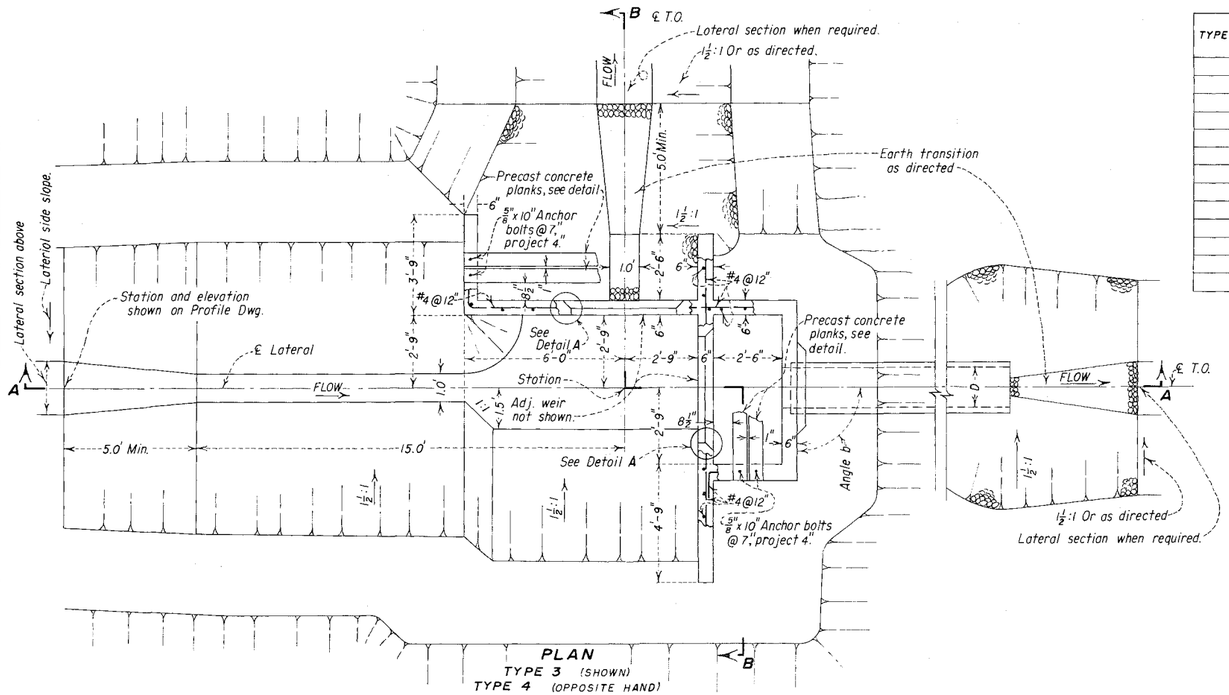
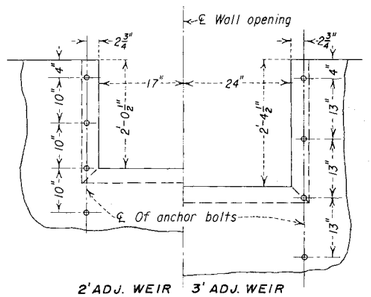


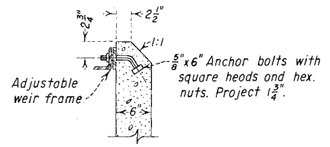
TABLE OF LOCATION AND ELEVATIONS

TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	ELEVATIONS						OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						C	NORMAL W.S.	D OR K	J	L	DESIGN DEL. W.S.	D	L_p	SLOPE	ANGLE b		

(1) Connect to road crossing.
(2) Connect to pipe line.
(3) Connect to pipe drop.



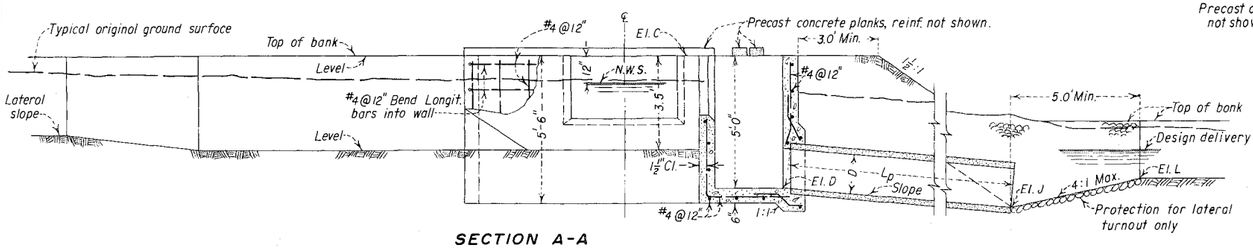
DETAILS OF OPENING FOR ADJUSTABLE WEIR



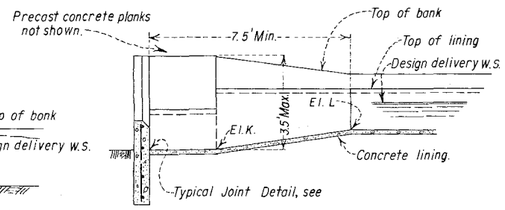
DETAIL A

ESTIMATED QUANTITIES

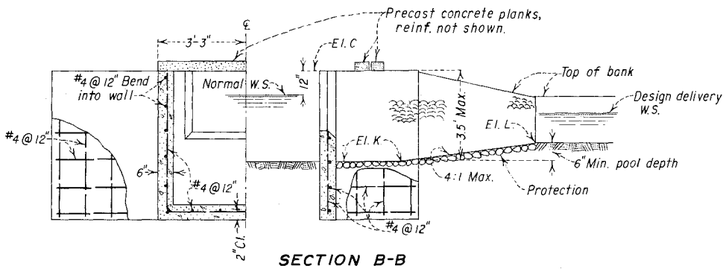
Concrete ..... 4.3 Cu. Yds.
Reinforcement steel ..... 370 Lbs.



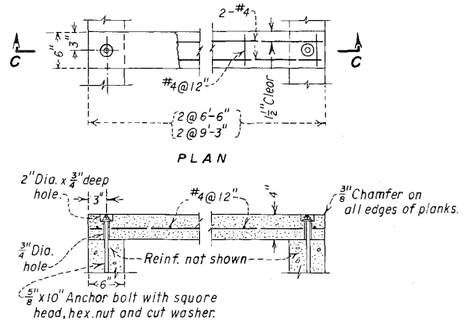
SECTION A-A



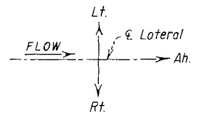
DETAIL OF CONNECTION TO CONCRETE LINING



SECTION B-B



DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.
Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

ADJUSTABLE WEIR W=2'-0" AND W=3'-0"
TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DIVISION BOX-TYPES 3 AND 4

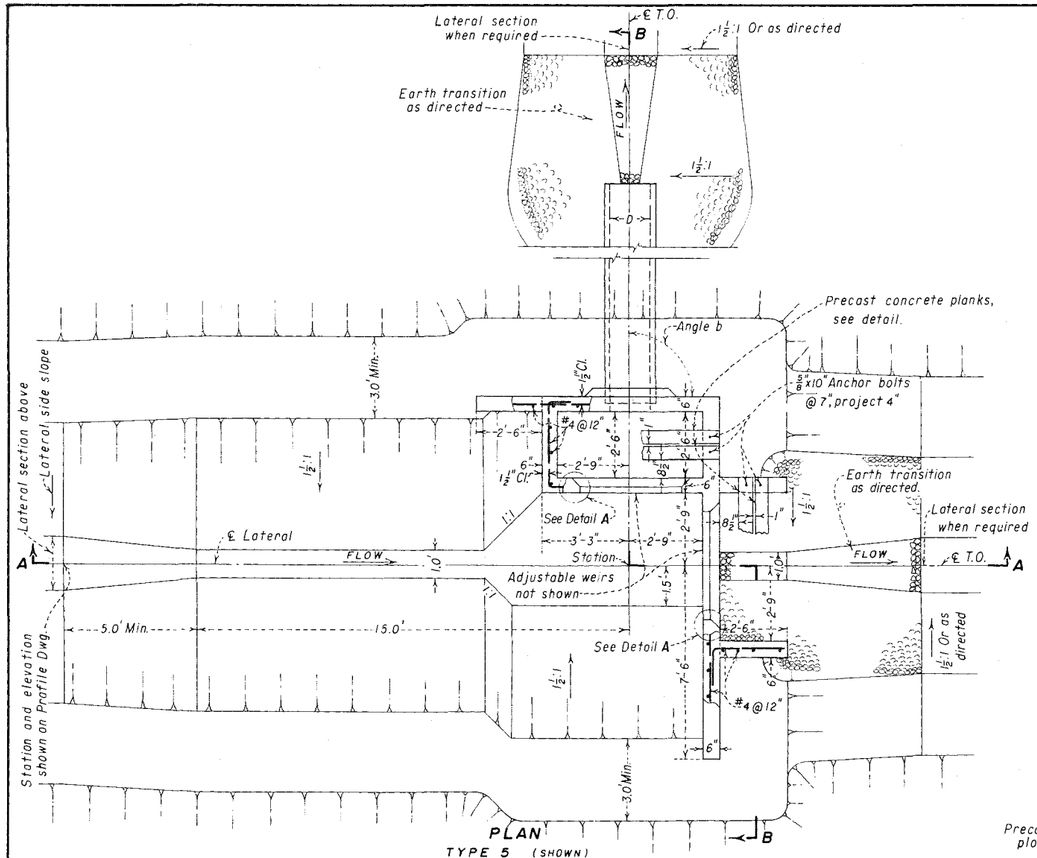
C 147.20

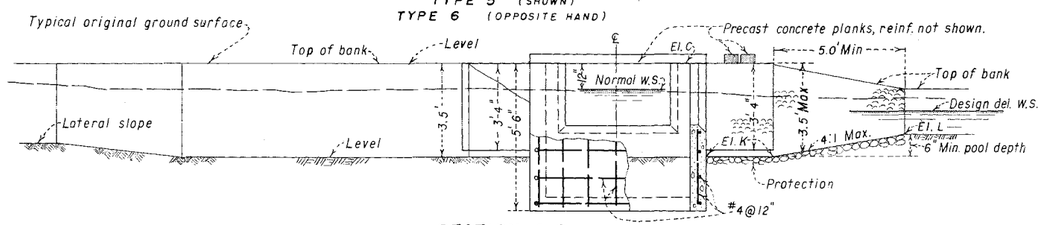
DRAWN W.A.K. SUBMITTED
TRACED S.W.M. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

TABLE OF LOCATIONS AND ELEVATIONS

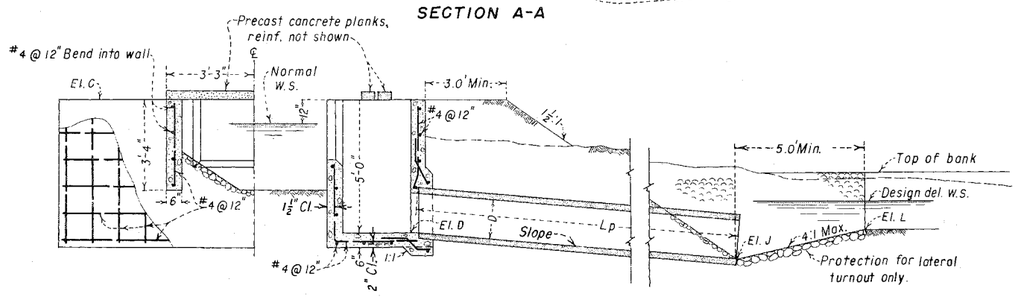
TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	ELEVATIONS						OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						C	NORMAL W.S.	D OR K	J	L	DESIGN DEL. W.S.	D	Lp	SLOPE	ANGLE b		

(1) Connect to road crossing
(2) Connect to pipe line
(3) Connect to pipe drop

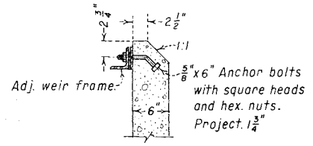




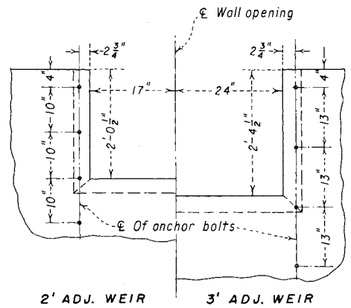
SECTION A-A



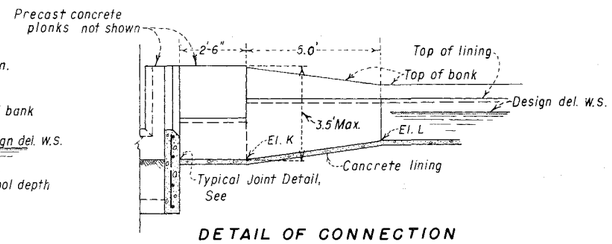
SECTION B-B



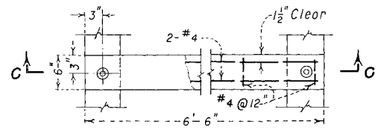
DETAIL A



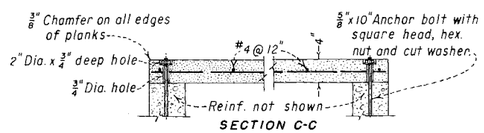
DETAILS OF OPENING FOR ADJUSTABLE WEIR



DETAIL OF CONNECTION TO CONCRETE LINING

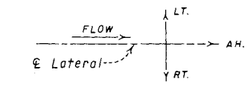


PLAN



SECTION C-C

DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

ESTIMATED QUANTITIES

Concrete ..... 4.2 Cu. Yds.
Reinforcement steel ..... 360 Lbs.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.

Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

ADJUSTABLE WEIR W= 2'-0" AND W= 3'-0" .....
TYPICAL PROTECTION .....
PRECAST PIPE EMBEDMENT .....

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DIVISION BOX-TYPES 5 AND 6

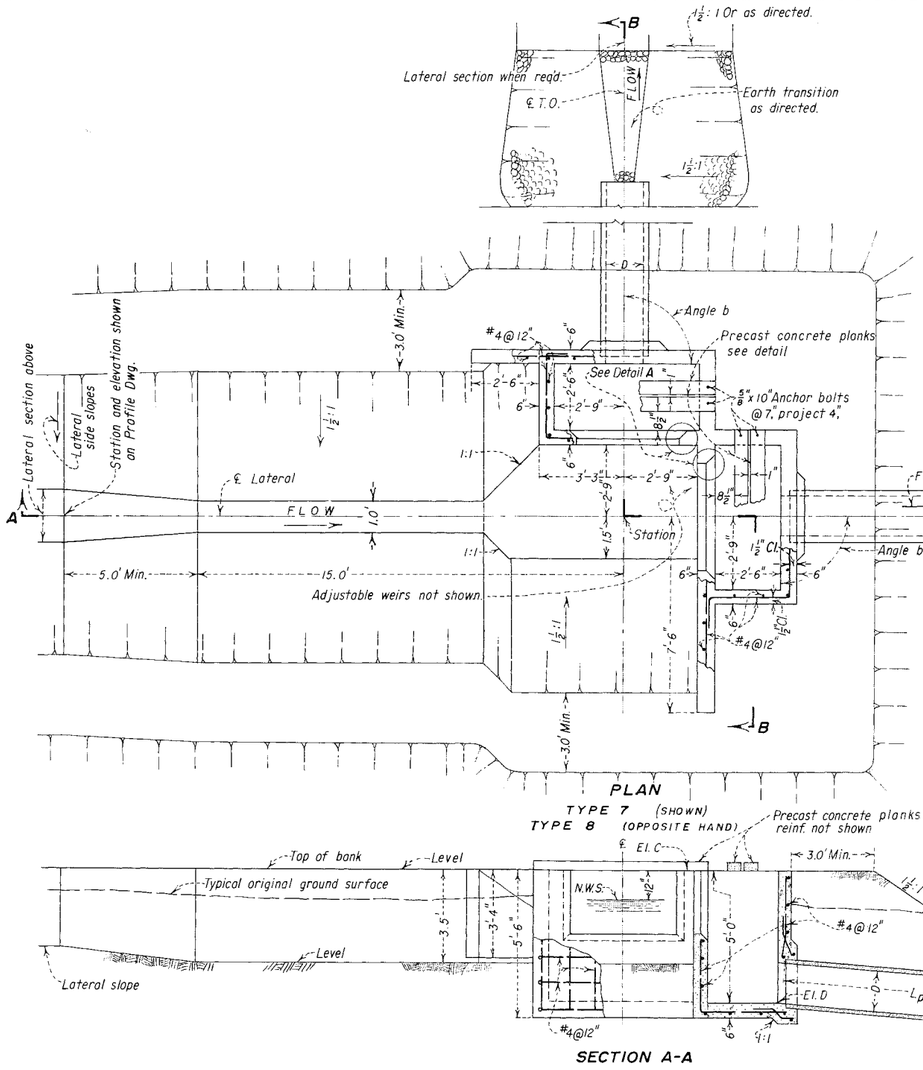
C 147.30

DRAWN W.A.K. SUBMITTED .....
TRACED W.A.W. RECOMMENDED .....
CHECKED ..... APPROVED .....
CHIEF, CANALS BRANCH
DENVER, COLORADO.

TABLE OF LOCATIONS AND ELEVATIONS

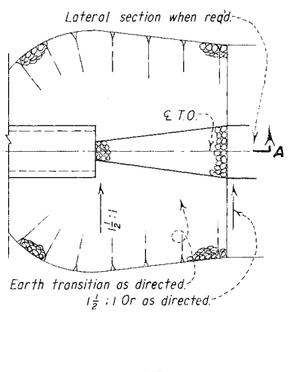
TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	ELEVATIONS						OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						C	NORMAL W.S.	D	J	L	DESIGN DEL. W.S.	D	L_P	SLOPE	ANGLE b		

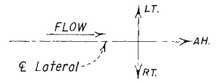
(1) Connect to road crossing.
(2) Connect to pipe line.
(3) Connect to pipe drop.



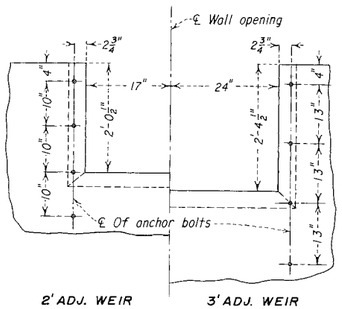
PLAN

TYPE 7 (SHOWN)
TYPE 8 (OPPOSITE HAND)





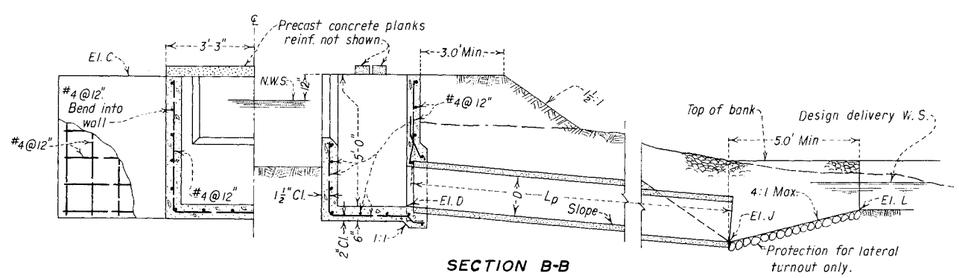
TYPICAL DIRECTIONS



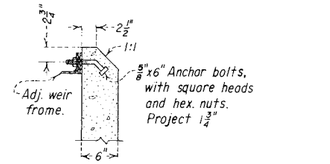
2' ADJ. WEIR 3' ADJ. WEIR

DETAILS OF OPENING FOR ADJUSTABLE WEIR

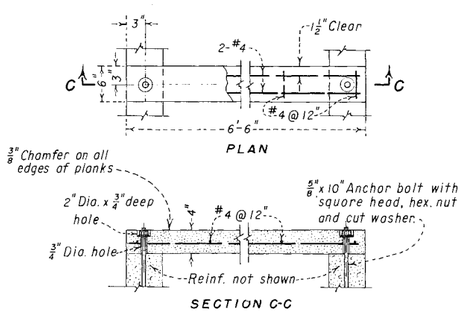
SECTION A-A



SECTION B-B



DETAIL A



DETAIL OF PRECAST CONCRETE PLANK

ESTIMATED QUANTITIES

Concrete ..... 5.3 Cu. yds.
Reinforcement steel ..... 450 Lbs.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.
All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.
Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec ft.

RRFERENCE DRAWINGS

ADJUSTABLE WEIR W=2'-0" AND 3'-0" .....
PRECAST PIPE EMBEDMENT .....
TYPICAL PROTECTION .....

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DIVISION BOX-TYPES 7 AND 8

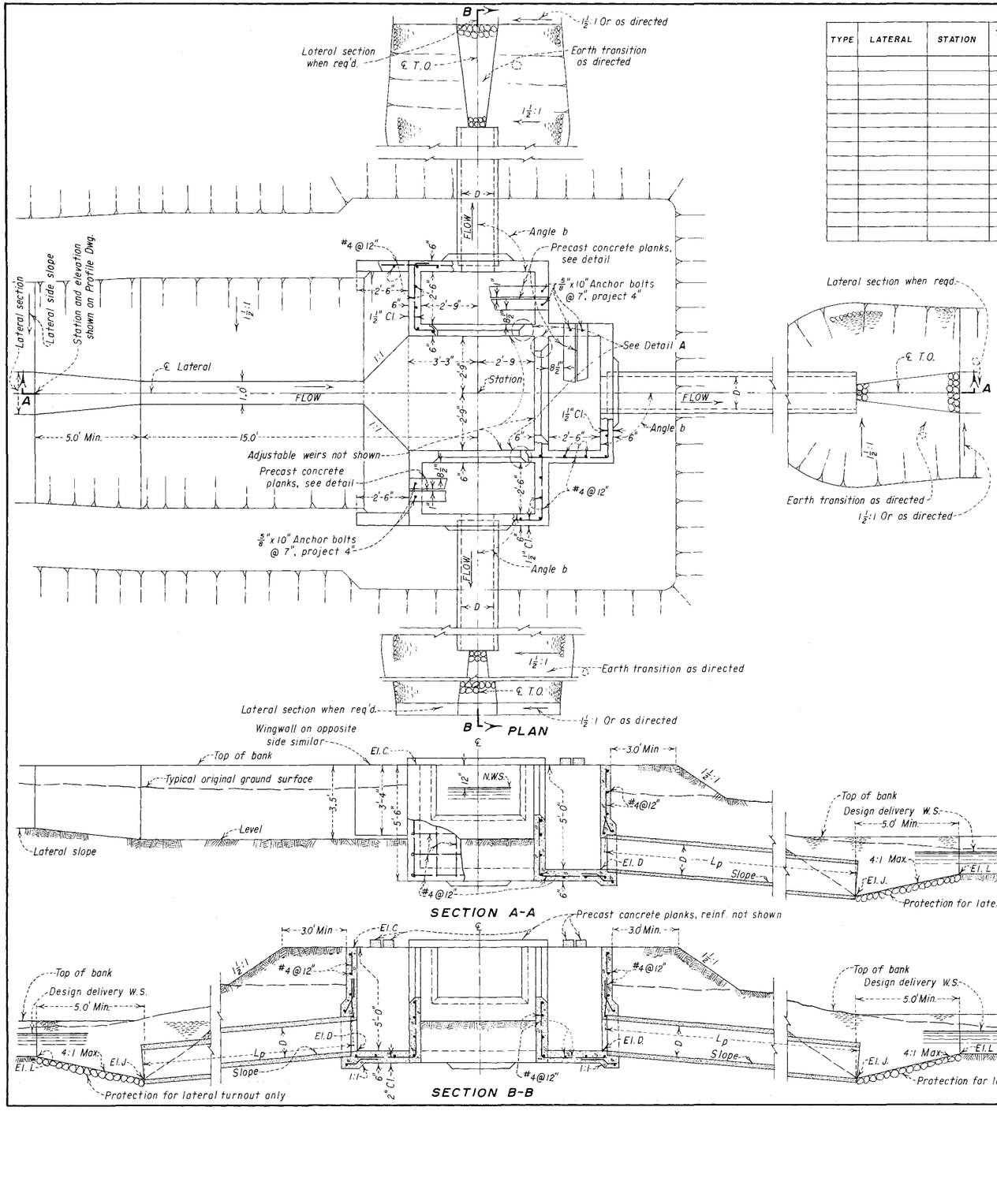
C-147-40

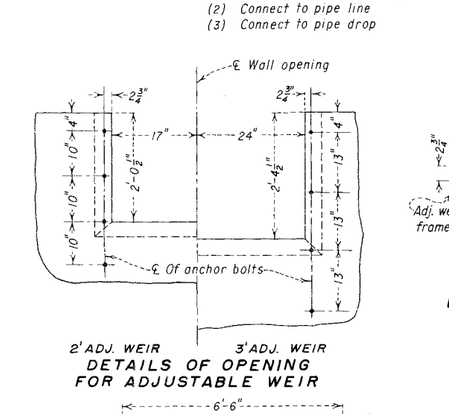
DRAWN W.A.K. SUBMITTED .....
TRACED J.W.M. RECOMMENDED .....
CHECKED ..... APPROVED .....
CHIEF, CANALS BRANCH
DENVER, COLORADO

TABLE OF LOCATIONS AND ELEVATIONS

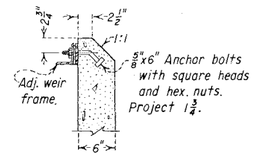
TYPE	LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OF F.U.	Q	ELEVATIONS						OUTLET PIPE				ADJ. WEIR (W)	REMARKS
						C	NORMAL W.S.	D	J	L	DESIGN DEL. W.S.	D	Lp	SLOPE	ANGLE b		

(1) Connect to road crossing
(2) Connect to pipe line
(3) Connect to pipe drop

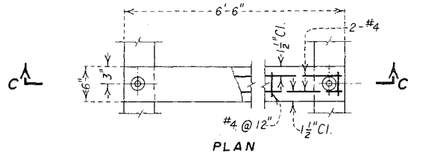




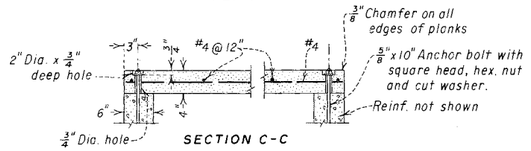
DETAILS OF OPENING FOR ADJUSTABLE WEIR



DETAIL A



PLAN



SECTION C-C

DETAIL OF PRECAST CONCRETE PLANK

ESTIMATED QUANTITIES

Concrete ..... 7.2 Cu yds.
Reinforcement steel ..... 600 Lbs.

NOTES

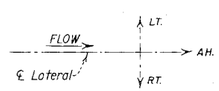
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.

All pipe is precast concrete culvert pipe, Class III with Type B joints, unless otherwise shown.

Max. Q for 2' adjustable weir is 4 sec. ft.
Max. Q for 3' adjustable weir is 6 sec. ft.

REFERENCE DRAWINGS

ADJUSTABLE WEIR W=2'-0" AND 3'-0" .....
PRECAST PIPE EMBEDMENT .....
TYPICAL PROTECTION .....



TYPICAL DIRECTIONS

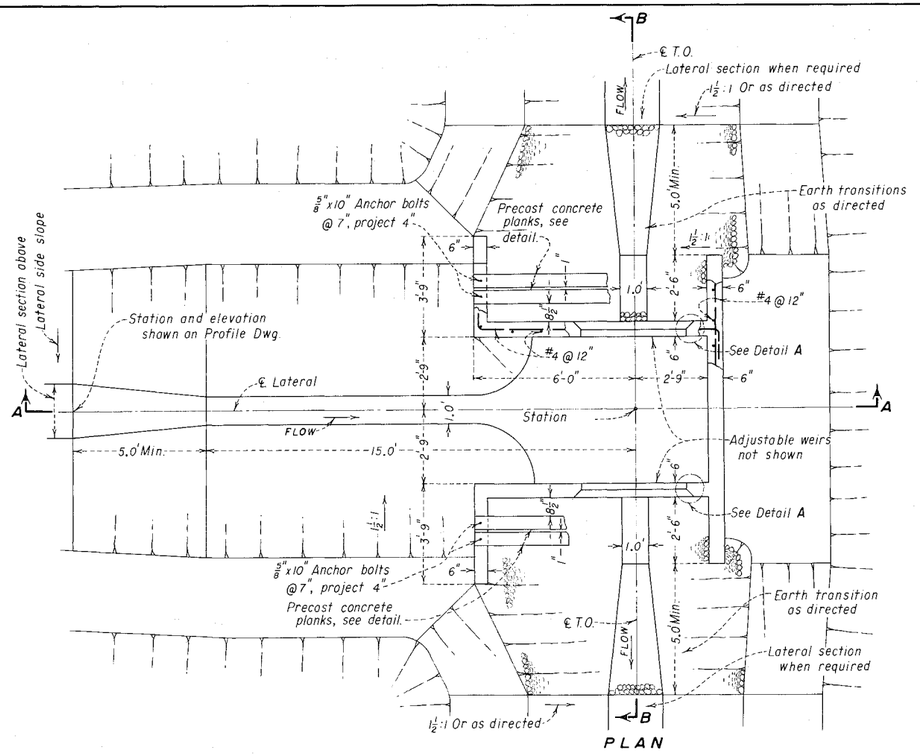
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DIVISION BOX-TYPE 9

C-147-50

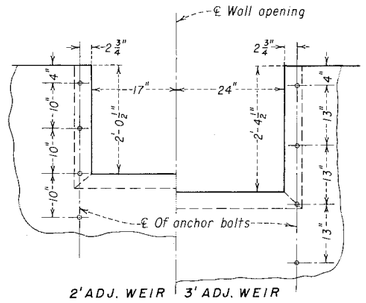
DRAWN W.A.K. SUBMITTED
TRACED S.W.M. RECOMMENDED
CHECKED APPROVED CHIEF, CANAL BRANCH
DENVER COLORADO



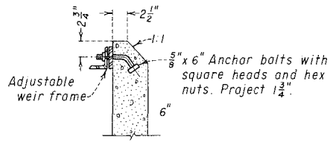
PLAN

TABLE OF LOCATIONS AND ELEVATIONS

LATERAL	STATION	T.O. DIR.	T.O. TO LAT. OR F.U.	Q	ELEVATIONS C	ELEVATIONS NORMAL W.S.	ELEVATIONS K	ELEVATIONS L	ELEVATIONS DESIGN DEL. W.S.	ADJ. WEIR (W)	REMARKS



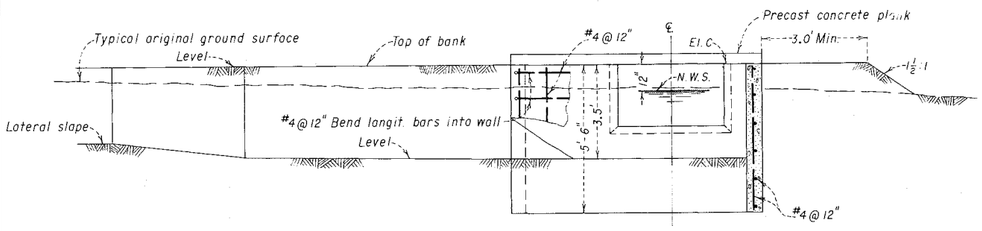
DETAILS OF OPENING FOR ADJUSTABLE WEIR



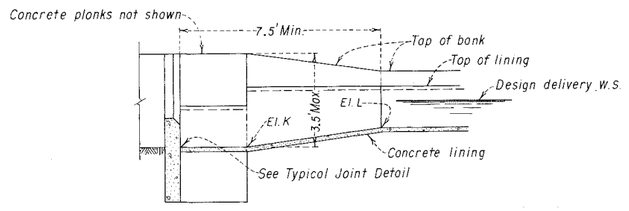
DETAIL A

ESTIMATED QUANTITIES

Concrete ..... 4.1 Cu. Yds.
Reinforcement steel ..... 340 Lbs.



SECTION A-A



DETAIL OF CONNECTION TO CONCRETE LINING

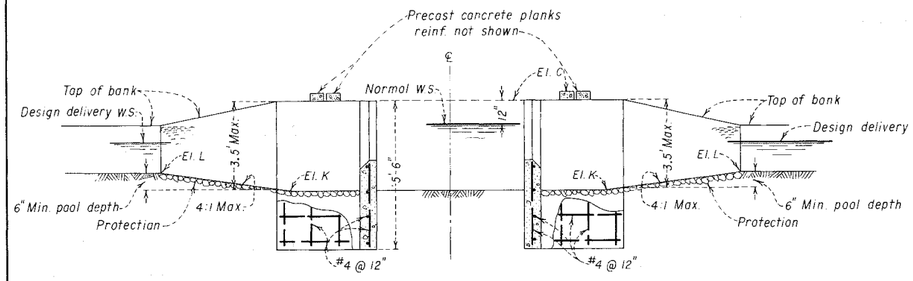
NOTES

For generol notes and minimun requirements for detailing reinforcement, see 40-D-6123.
Extend cutoff and wingwalls vertically and horizontally with unreinforced concrete as directed.

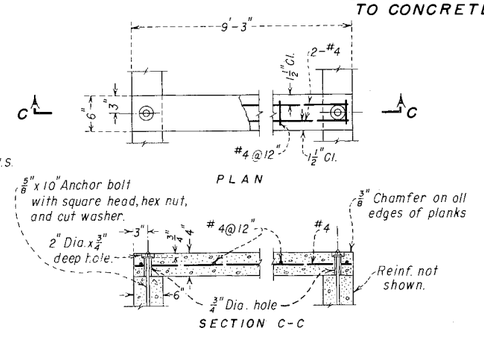
Max. Q for 2' adjustable weir is 4 sec. feet.
Max. Q for 3' adjustable weir is 6 sec. feet.

REFERENCE DRAWINGS

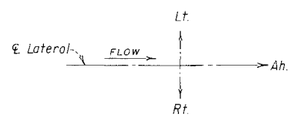
ADJUSTABLE WEIR W = 2'-0" AND W = 3'-0" .....
TYPICAL PROTECTION .....



SECTION B-B



DETAIL OF PRECAST CONCRETE PLANK



TYPICAL DIRECTIONS

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

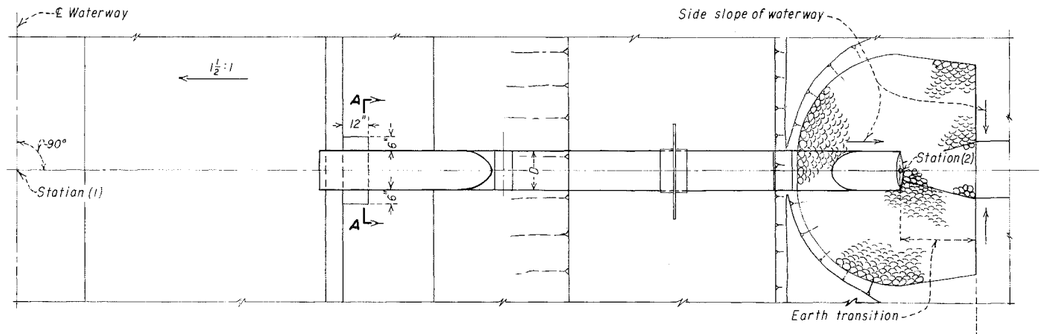
DIVISION BOX TYPE 10

C 147.60

DRAWN W.A.K. SUBMITTED
TRACED O.L.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

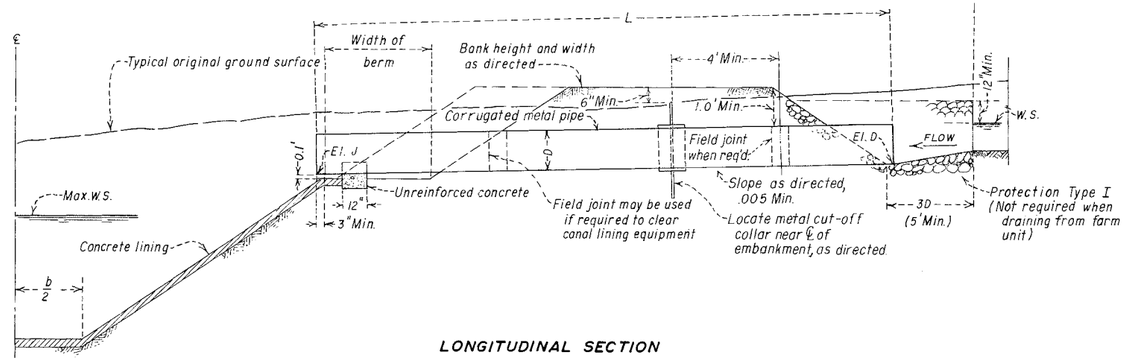
TABLE OF LOCATIONS AND ELEVATIONS

WATERWAY	STATION	RT.-LT. OF ℄	D	GAGE	L	b	ELEVATIONS			WIDTH OF BERM	REMARKS
							D	J	MAX. W.S.		

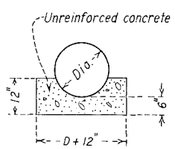


PLAN

Station and elevation shown on Profile Dwg. when structure is on ℄



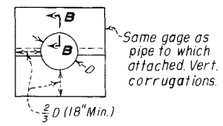
LONGITUDINAL SECTION



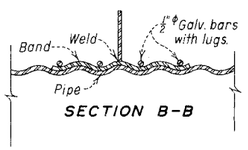
SECTION A-A

D	GAGE*
12"	16
15"	16
18"	16
21"	16
24"	14
30"	14
36"	12

*Max. fill 25'



COLLAR DETAIL



SECTION B-B

NOTES

Stations of drainage inlets and estimated pipe lengths are approximate only and may be adjusted as directed.
Joints in corrugated metal pipe shall be standard watertight joints made with bands not less than 12" wide.
(1) Station if inlet enters from side.
(2) Station of inlet on ℄.

REFERENCE DRAWING

TYPICAL PROTECTION _____

ALWAYS THINK SAFETY

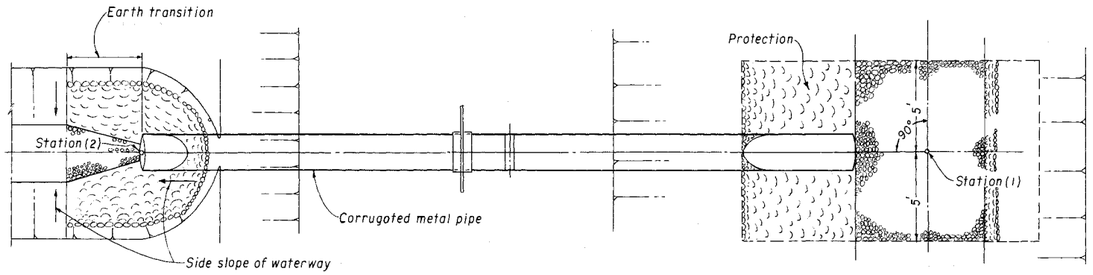
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DRAINAGE INLETS C.M.P. ON CONCRETE LINING

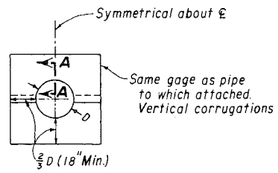
C-150-10

DRAWN R.E.C. SUBMITTED
TRACED L.D.S. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH

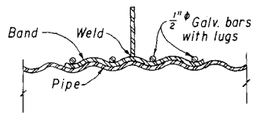
DENVER, COLORADO



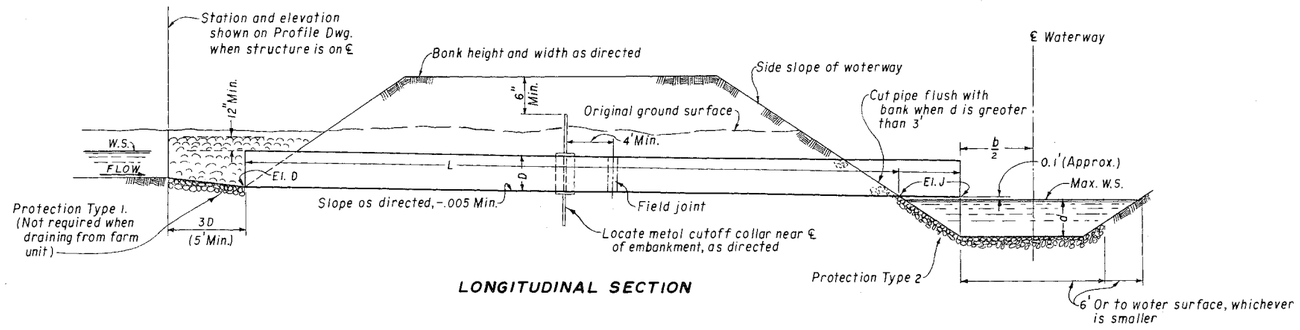
PLAN



COLLAR DETAIL



SECTION A-A



LONGITUDINAL SECTION

REMARKS

(1) Station if inlet enters from side.
(2) Station of inlet on ℄.
(3) Omit collar.

REFERENCE DRAWING

TYPICAL PROTECTION _____

TABLE OF LOCATIONS AND ELEVATIONS

WATERWAY	STATION	RT-LT of ℄	D	GAGE	L	b	ELEVATIONS D	ELEVATIONS J	ELEVATIONS MAX. W.S.	REMARKS

D	GAGE*
12"	16
15"	16
18"	16
21"	16
24"	14
30"	14
36"	12

* Max. fill 25'

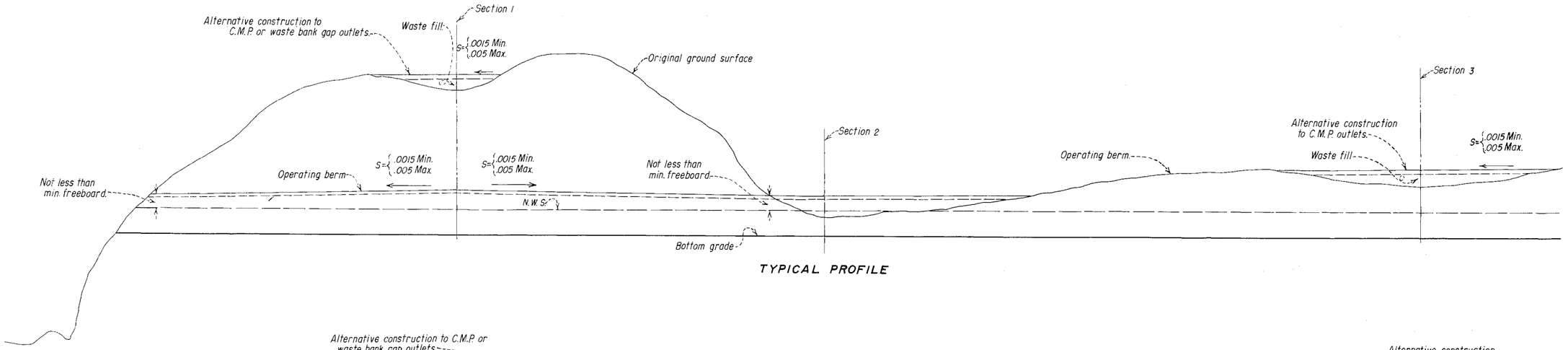
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

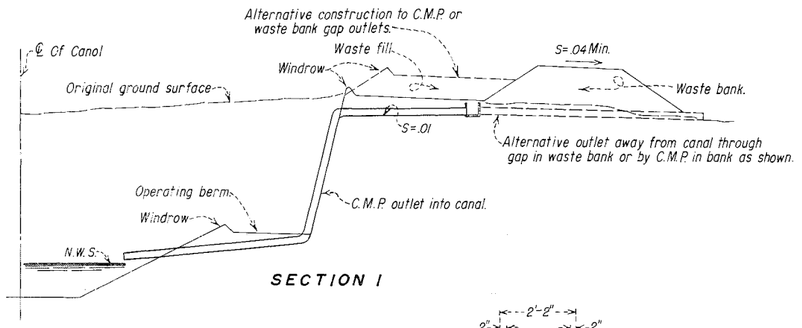
DRAINAGE INLETS
CORRUGATED METAL PIPE

C-150-20

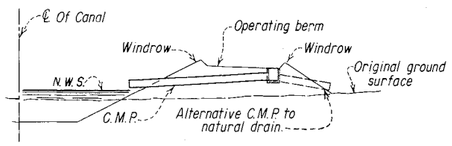
DRAWN _____ SUBMITTED _____
TRACED N.M.G. RECOMMENDED _____
CHECKED _____ APPROVED _____
DENVER, COLORADO. CHIEF, CANALS BRANCH



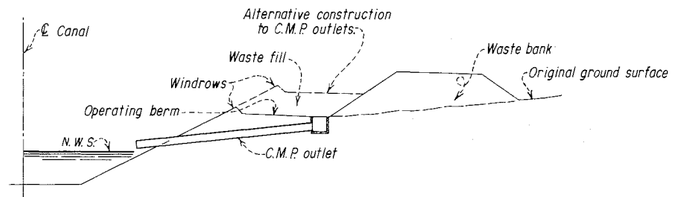
TYPICAL PROFILE



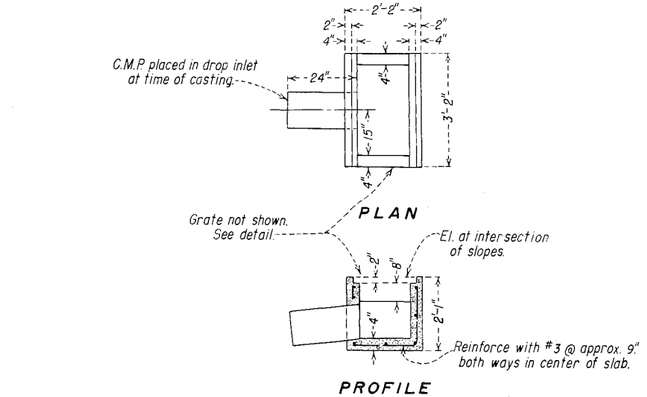
SECTION 1



SECTION 2



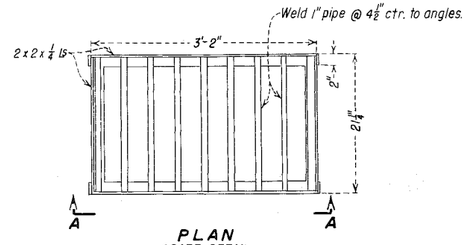
SECTION 3



PROFILE

CONCRETE DROP TYPE DRAIN INLET

ELEVATION A-A



PLAN

GRATE DETAIL

SCALE OF FEET

SCALE OF FEET

SCALE OF FEET

NOTE

For typical canal sections see

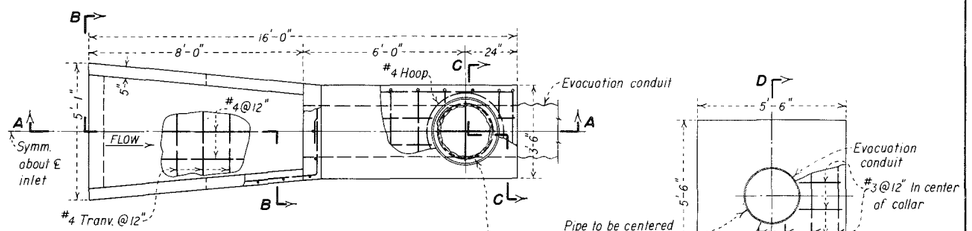
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BERM DRAINAGE WITH C.M.P. OUTLETS

DRAWN	E.H.B.-J.A.M.	SUBMITTED	
TRACED	G.D.B.	RECOMMENDED	
CHECKED		APPROVED	
DENVER, COLORADO,		CHIEF, CANALS BRANCH	

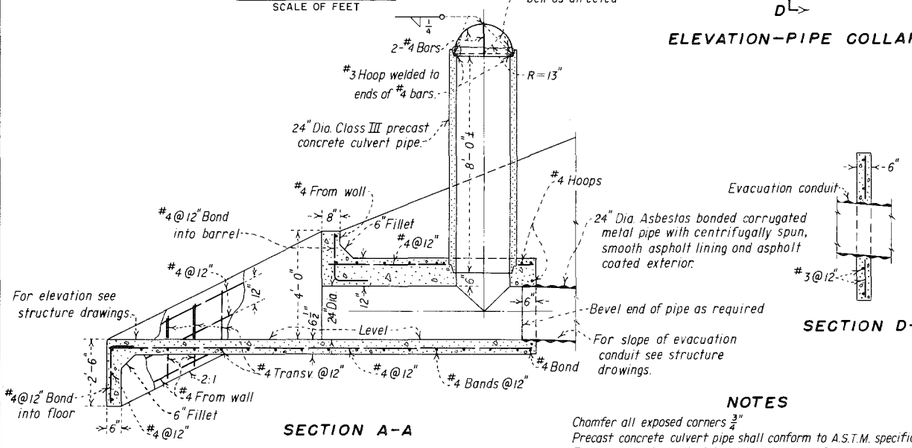
C 150.30



PLAN- INLET

SCALE OF FEET 0 1 2 3 4 5

ELEVATION—PIPE COLLAR

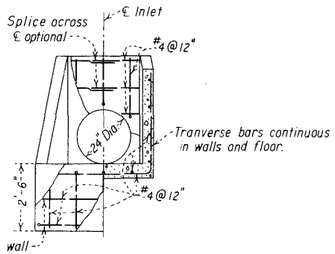


SECTION A-A

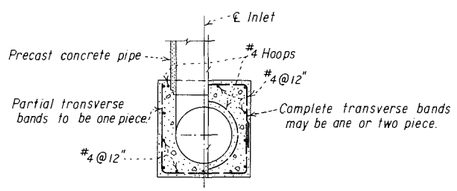
SECTION D-D

NOTES

Chamfer all exposed corners $\frac{3}{4}$"
Precast concrete culvert pipe shall conform to A.S.T.M. specification C76.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.



SECTION B-B



SECTION C-C

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

24" DIA. EVACUATION CONDUIT INLET AND PIPE COLLAR

C 151.00

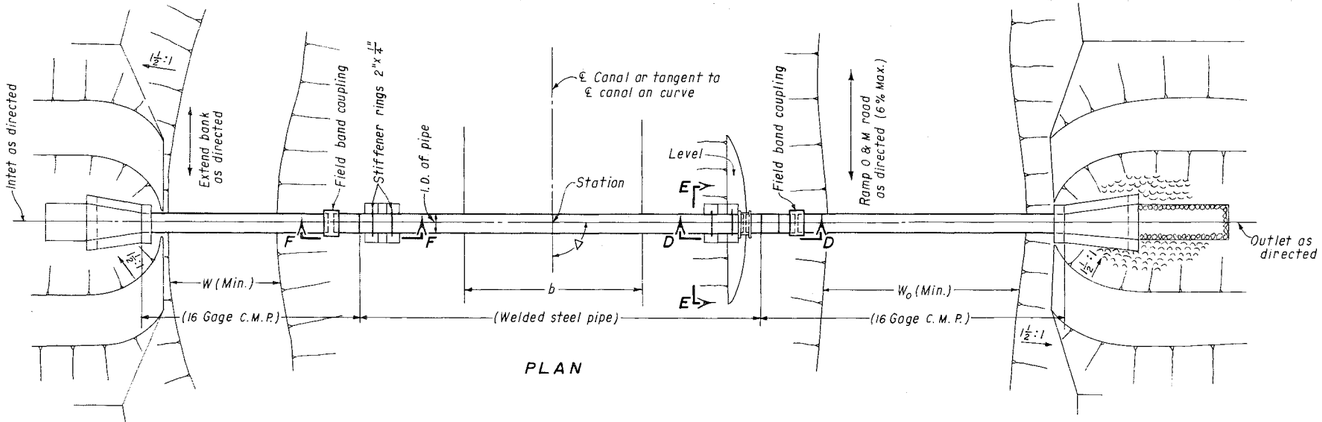
DRAWN L.F.W. SUBMITTED

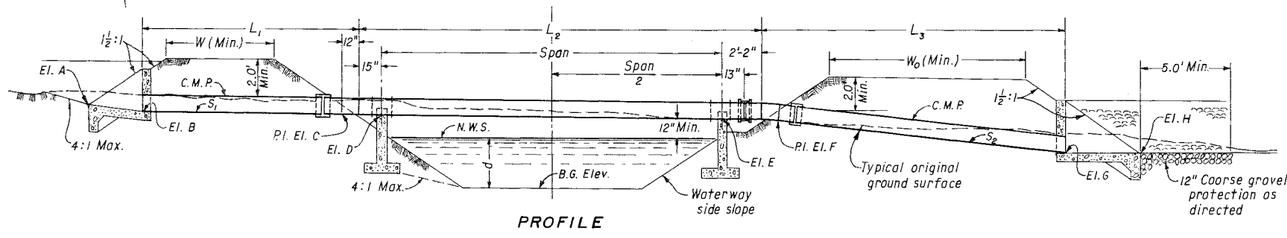
TRACED D.L.G. RECOMMENDED

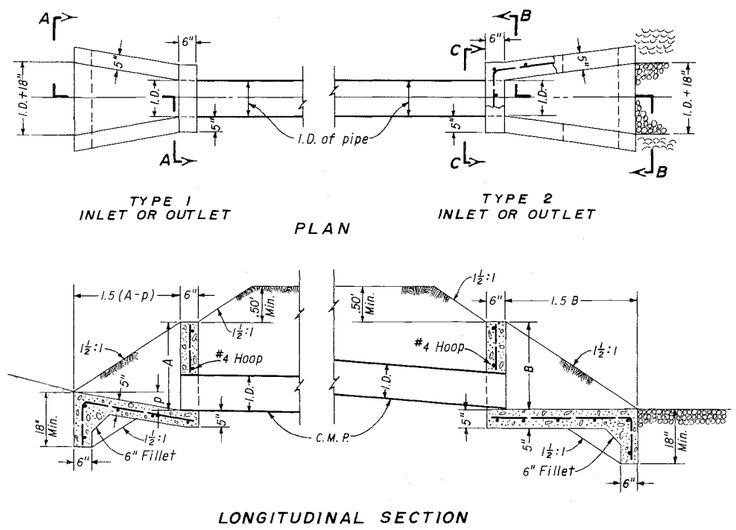
CHECKED APPROVED

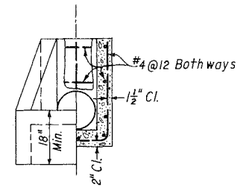
CHIEF, CANALS BRANCH

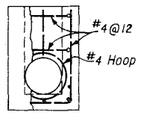
DENVER, COLORADO,

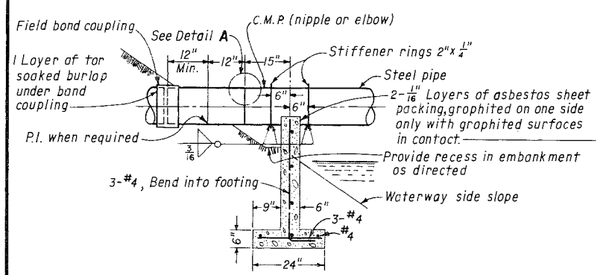


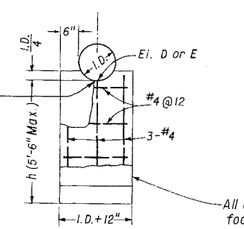


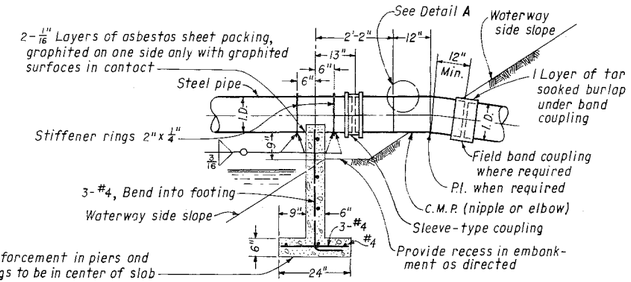


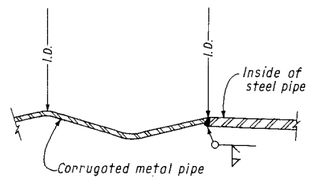












NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Backfill above top of pipe as directed, 2.0' Min.
I.D. Indicates inside diameter of W.S.P. (welded steel pipe) and C.M.P. (corrugated metal pipe)
For dimensions b, d, W_1 and W_0, see Plan and Profile drawings.

STA.	Q	ELEVATIONS									SLOPES		LENGTHS					h	Δ	TRANSITIONS		TRANSITION DIMENSIONS			ESTIMATED QUANTITIES						
		B.G.	A	B	C	D	E	F	G	H	S_1	S_2	SPAN	L_1	L_2	L_3				INLET TYPE	OUTLET TYPE	TYPE 1 A*	TYPE 1 p	TYPE 2 B*	CONC.	REINF. STEEL	16 GAGE C.M.P. 8"	16 GAGE C.M.P. 12"	16 GAGE C.M.P. 18"	WELDED STEEL PIPE 12 GAGE 8" I.D.	WELDED STEEL PIPE 10 GAGE 15" I.D.	WELDED STEEL PIPE 10 GAGE 18" I.D.

(* I.D. + 18" Min.)

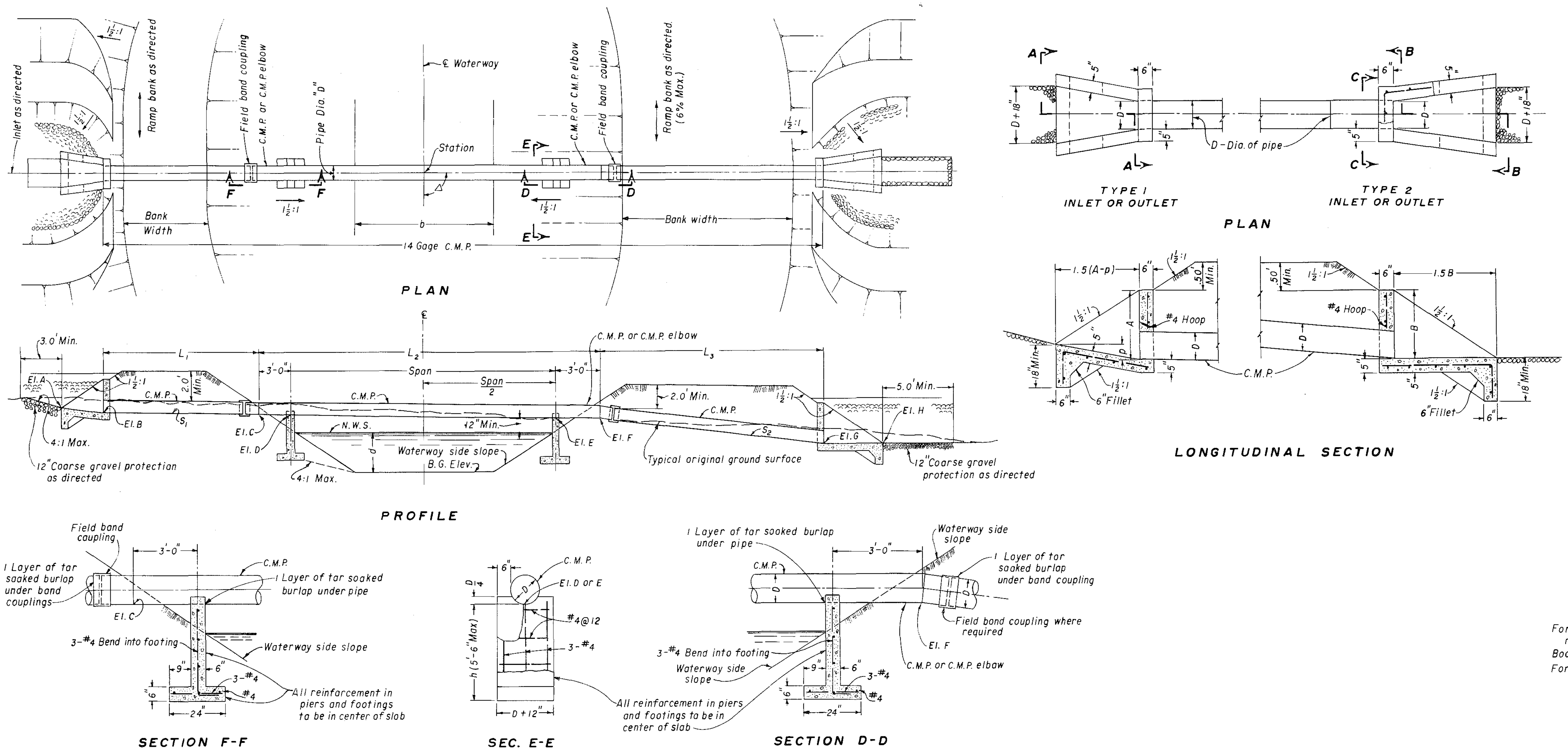
ALWAYS THINK SAFETY

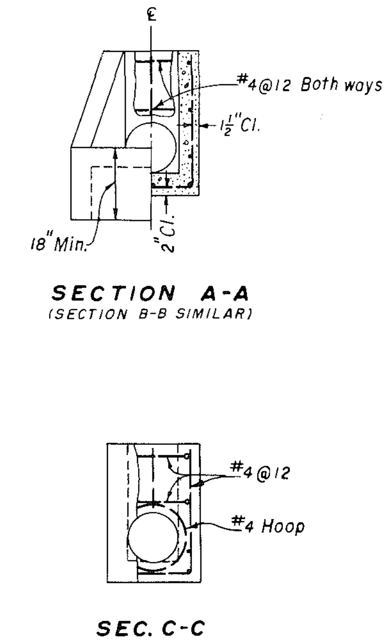
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE FLUME CROSSINGS

C 152.10

DRAWN F.L.R. SUBMITTED
TRACED J.S.M.JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,





STA.	Q	ELEVATIONS									SLOPES		LENGTHS						Δ	TRANSITIONS		TRANSITION DIMENSIONS			ESTIMATED QUANTITIES							
		B.G.	A	B	C	D	E	F	G	H	S_1	S_2	SPAN	L_1	L_2	L_3		h		INLET TYPE	OUTLET TYPE	TYPE 1		TYPE 2	CONC.	REINF. STEEL	14 GAGE C.M.P.					
																						A*	p	B*			8"D	12"D	18"D			

* D + 18" Min.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

Backfill above top of pipe as directed 2.0' Min.

For dimensions b, and d, see Plan and Profile drawings.

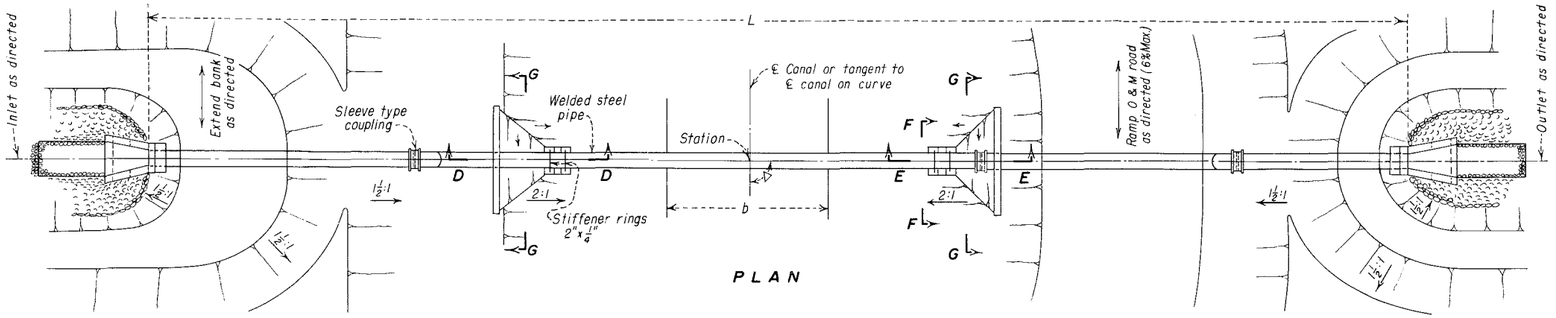
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

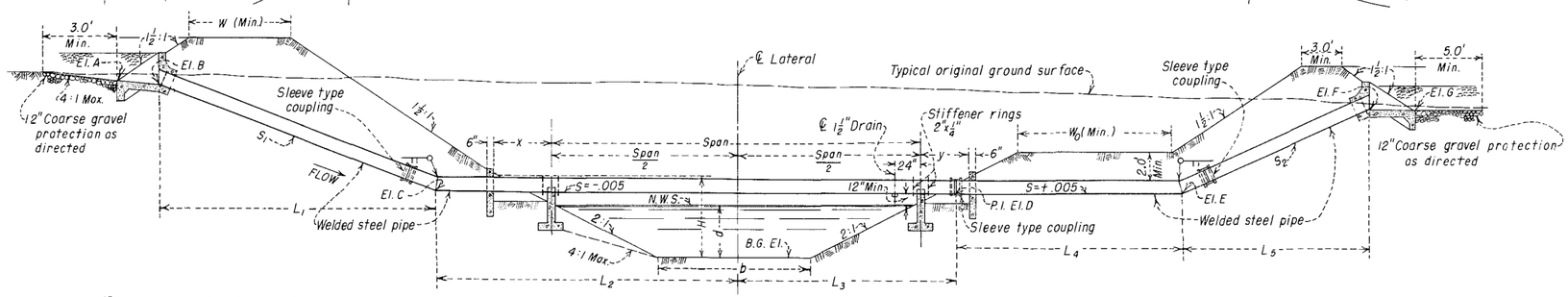
IRRIGATION CROSSINGS

DRAWN F.L.R. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

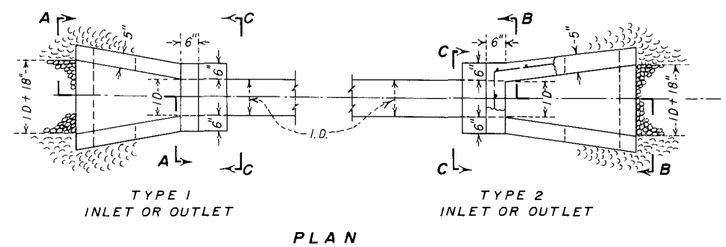
C 152.20



PLAN



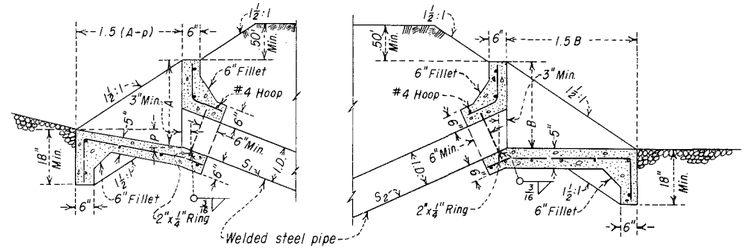
PROFILE



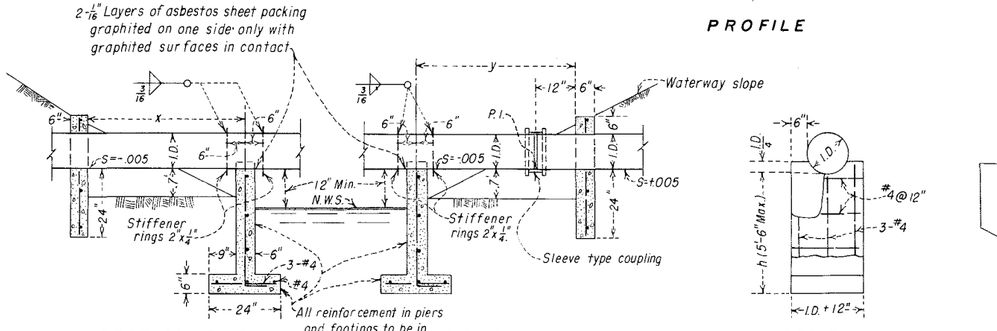
TYPE 1 INLET OR OUTLET

TYPE 2 INLET OR OUTLET

PLAN



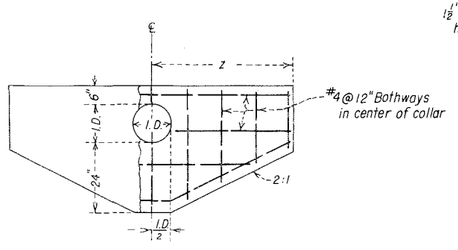
LONGITUDINAL SECTION



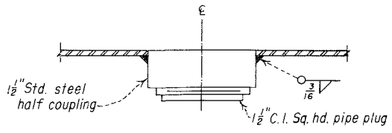
SECTION D-D

SECTION E-E

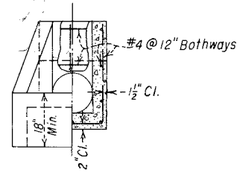
SEC. F-F



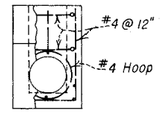
SECTION G-G



1½" DRAIN DETAIL



SECTION A-A
SECTION B-B SIMILAR



SEC. C-C

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Backfill above top of pipe as directed 2.0' Min.
For dimensions b, d, H, W, and W_o, see Plan and Profile drawings.
I.D. = Inside pipe diameter

STA.	Q	Δ	ELEVATIONS								PIPE DIA. "I.D."	SLOPES		LENGTHS											TRANSITIONS					ESTIMATED QUANTITIES				
			B.G.	A	B	C	D	E	F	G		S_1	S_2	SPAN	L	L_1	L_2	L_3	L_4	L_5	h	x	y	z	INLET TYPE	OUTLET TYPE	TYPE 1 A※	TYPE 1 P	TYPE 2 B※	CONCRETE CU. YDS.	REINF. STEEL LBS.	WELDED STEEL PIPE 12 GAGE 8" I.D.	WELDED STEEL PIPE 10 GAGE 12" I.D.	WELDED STEEL PIPE 10 GAGE 18" I.D.

※I.D.+18" Min.

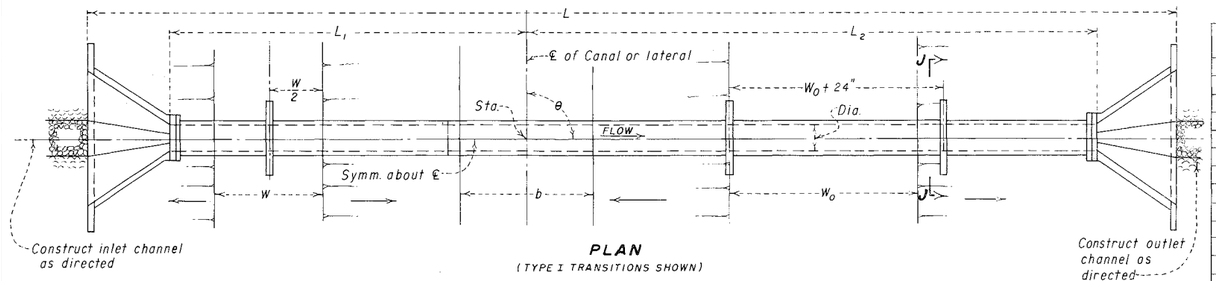
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STEEL PIPE IRRIGATION CROSSINGS

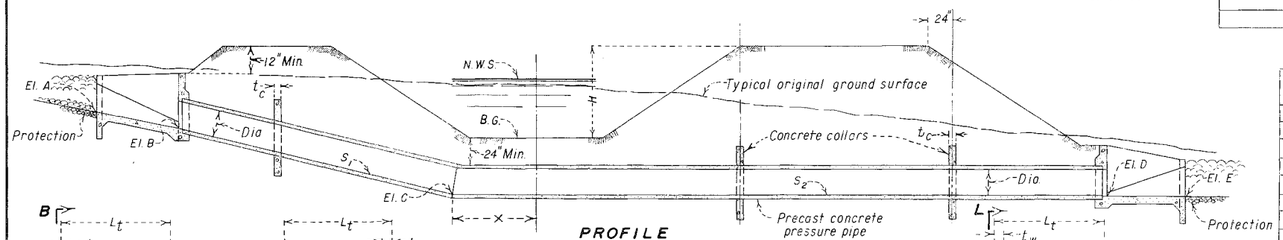
DRAWN F.L.R. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C 152.30



PLAN
(TYPE I TRANSITIONS SHOWN)

CANAL OR LATERAL	STATION	DIA.	θ	b	H	W	W_0	TYPE OF TRANSITIONS INLET	TYPE OF TRANSITIONS OUTLET	ELEVATIONS B.G.	A	B	C	D	E	S_1	S_2	X	L_1	L_2	L	PIPE SYMBOL	PIPE LIN. FT.	REMARKS



PROFILE

TABLE OF DIMENSIONS AND EST. QUANTITIES-TYPE I

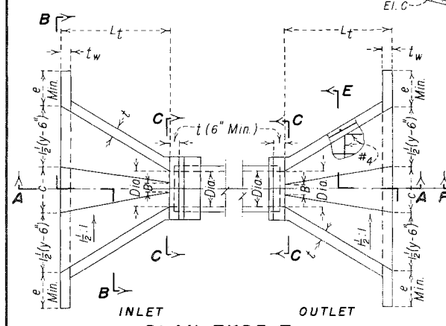
STR. No.	DIA.	a	y	e	L_t	B	c	p	t	t_w	CONC. (CU. YDS.)	REINF. (LBS.)

TABLE OF DIMENSIONS AND EST. QUANTITIES-TYPE II

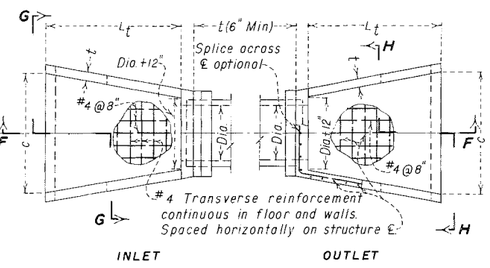
STR. No.	DIA.	a	e	L_t	c	p	t	t_w	CONC. (CU. YDS.)	REINF. (LBS.)
24-II-A	24"	5'-0"	24"	6'-0"	6'-0"	12"	5"	6"	1.7	190
24-II-B	24"	4'-0"	24"	6'-0"	6'-0"	0	5"	6"	1.5	170
30-II-A	30"	5'-11"	2'-6"	7'-0"	7'-6"	15"	6"	8"	2.6	240
30-II-B	30"	4'-9"	2'-6"	7'-0"	7'-6"	0	5"	8"	2.2	230
36-II-A	36"	6'-10"	2'-6"	8'-0"	9'-0"	18"	7"	8"	3.9	350
36-II-B	36"	5'-4"	2'-6"	8'-0"	9'-0"	0	5"	8"	2.9	300
42-II-A	42"	7'-6"	2'-6"	9'-0"	10'-6"	18"	7"	8"	4.8	460
42-II-B	42"	6'-0"	2'-6"	9'-0"	10'-6"	0	6"	8"	4.1	400

TABLE OF DIMENSIONS AND EST. QUANTITIES TYPE III

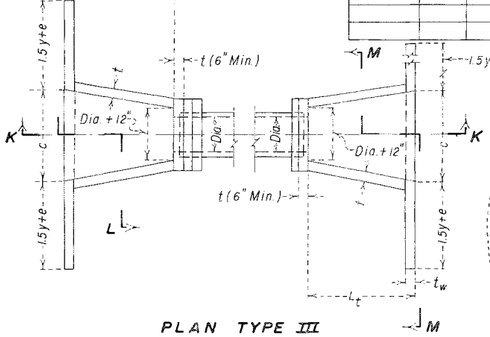
STR. No.	DIA.	a	y	e	L_t	c	p	t	t_w	CONC. (CU. YDS.)	REINF (LBS.)
24-III-A	24"	5'-0"	2'-6"	24"	6'-0"	6'-0"	12"	5"	6"	2.5	250
24-III-B	24"	4'-0"	2'-6"	24"	6'-0"	6'-0"	0	5"	6"	2.4	240
30-III-A	30"	5'-11"	3'-0"	2'-6"	7'-6"	7'-6"	15"	6"	8"	3.8	360
30-III-B	30"	4'-8"	3'-0"	2'-6"	7'-6"	7'-6"	0	5"	8"	3.5	320
36-III-A	36"	6'-10"	3'-6"	2'-6"	9'-0"	9'-0"	18"	7"	8"	6.1	580
36-III-B	36"	5'-4"	3'-6"	2'-6"	9'-0"	9'-0"	0	5"	8"	4.5	450
42-III-A	42"	7'-6"	4'-0"	2'-6"	10'-6"	10'-6"	18"	7"	8"	7.5	680
42-III-B	42"	6'-0"	4'-0"	2'-6"	10'-6"	10'-6"	0	6"	8"	6.3	600



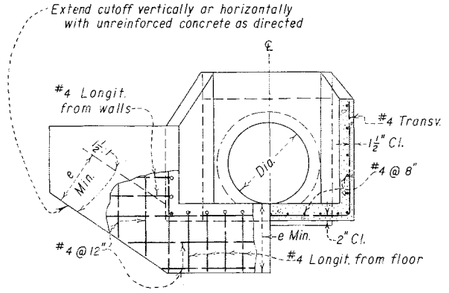
PLAN-TYPE I



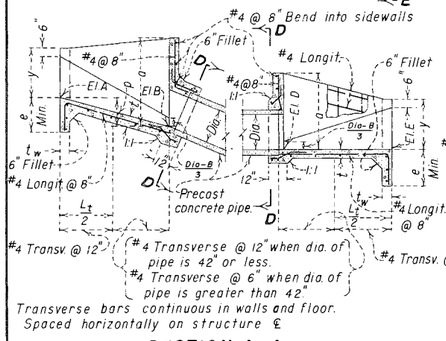
PLAN-TYPE II



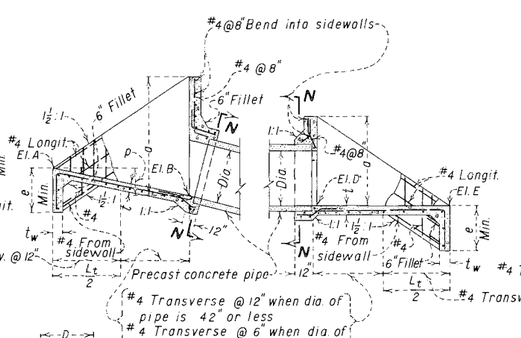
PLAN TYPE III



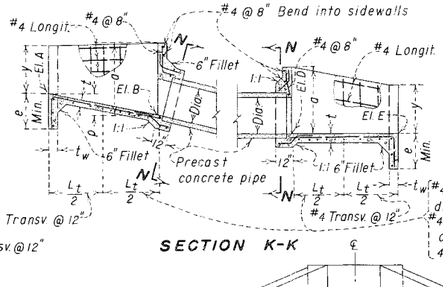
SECTION M-M
(SECTION L-L SIMILAR)



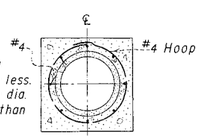
SECTION A-A



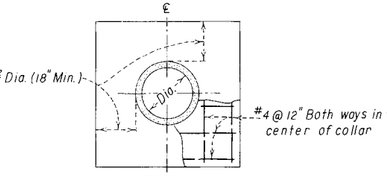
SECTION F-F



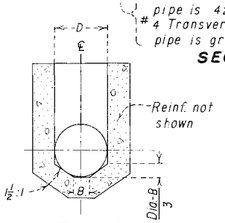
SECTION K-K



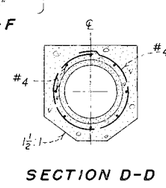
SECTION N-N



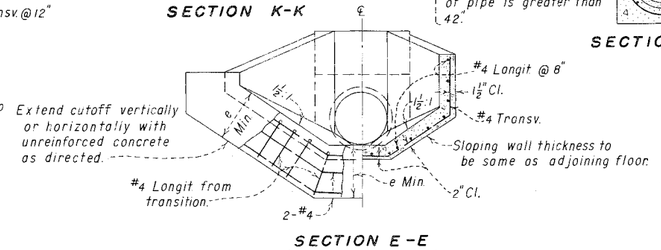
SECTION J-J



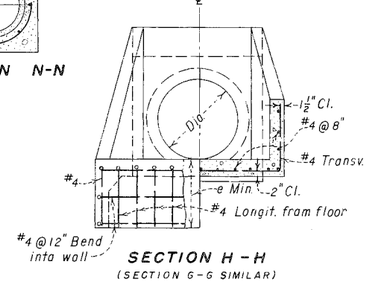
SECTION C-C



SECTION D-D



SECTION E-E
(SECTION B-B SIMILAR)



SECTION H-H
(SECTION G-G SIMILAR)

REFERENCE DRAWINGS

PRECAST PIPE EMBEDMENT_____
BENDS FOR PRECAST CONCRETE PRESSURE PIPE ___
TYPICAL PROTECTION_____

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Collar thickness t_c, 6" when Dia. ≤ 39", 8" when Dia. > 39".
For dimensions b, H, W, and W_0, see Plan and Profile drawings.

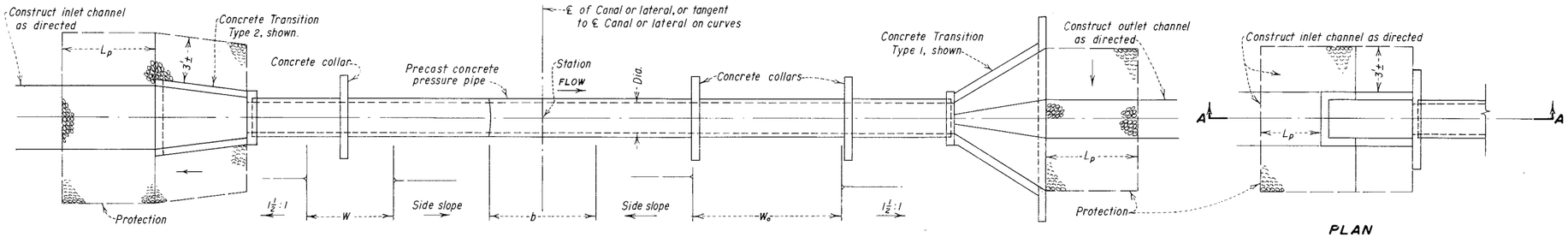
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE PIPE CULVERTS

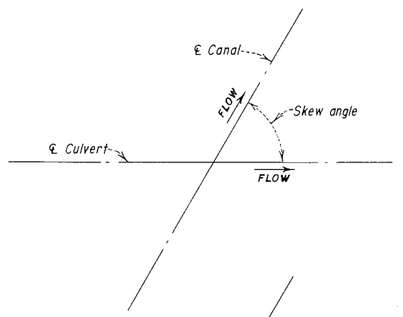
DRAWN R.E.S. SUBMITTED
TRACED L.A.C. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

C-154-10

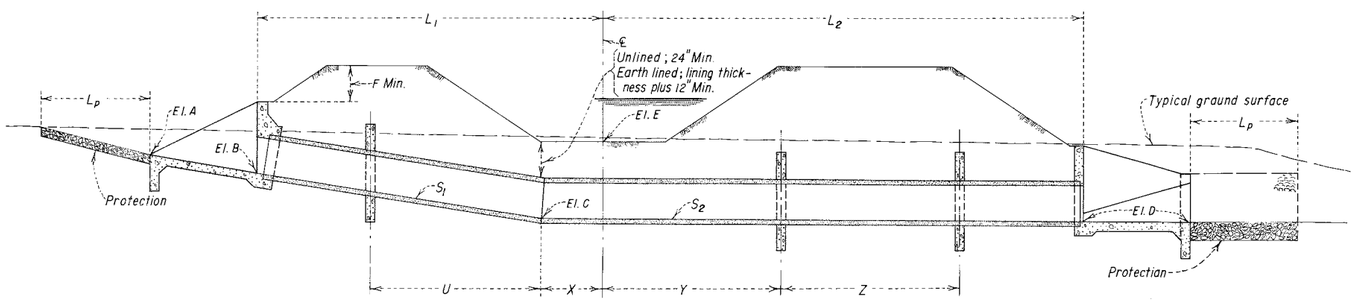


TYPICAL PLAN

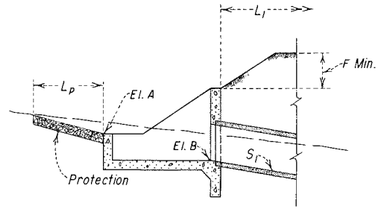
PLAN
Showing Concrete Transition Type 3 (Inlet only)



SKEW ANGLE DEFINITION



PROFILE



SECTION A-A

CANAL OR LATERAL	STATION	Q	DIA.	SKEW ANGLE	L_1	L_2	F	U	X	Y	Z	S_1	S_2	CONCRETE TRANSITION INLET TYPE	CONCRETE TRANSITION INLET EL. A	CONCRETE TRANSITION INLET EL. B	ELEVATIONS C	ELEVATIONS E	CONCRETE TRANSITION OUTLET TYPE	CONCRETE TRANSITION OUTLET EL. D	PROTECTION INLET TYPE	PROTECTION INLET L_p	PROTECTION OUTLET TYPE	PROTECTION OUTLET L_p	ESTIMATED QUANTITIES CONCRETE (Cu. Yds.)	ESTIMATED QUANTITIES REINF. STEEL (Lbs.)	ESTIMATED QUANTITIES PIPE SYMBOL	ESTIMATED QUANTITIES PIPE LIN. FT.	REMARKS

NOTES

For details of canal sections see Plan and Profile drawings. Place entire structure on a foundation of undisturbed earth or thoroughly compacted fill.

REFERENCE DRAWINGS

CONCRETE TRANSITIONS-TYPE 1_____
CONCRETE TRANSITIONS-TYPE 2_____
CONCRETE TRANSITIONS-TYPE 3_____
CONCRETE TRANSITIONS-TYPE 2L_____
PIPE COLLAR DETAILS_____
BENDS FOR PRECAST CONCRETE PRESSURE PIPE_____
TYPICAL PROTECTION_____

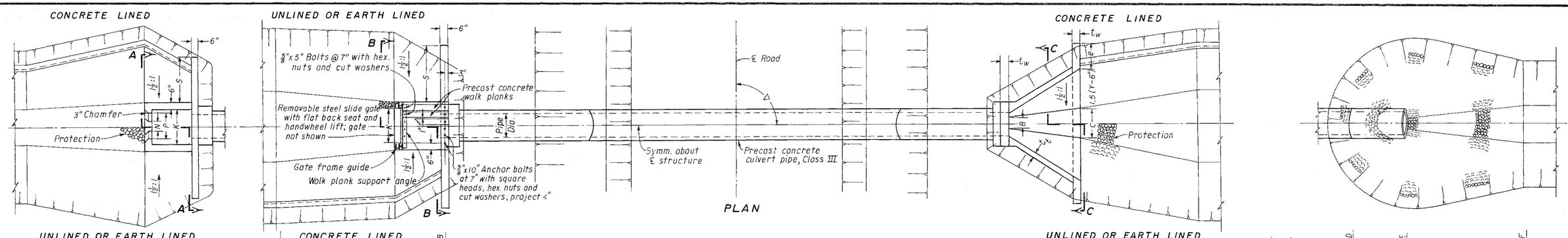
ALWAYS THINK SAFETY

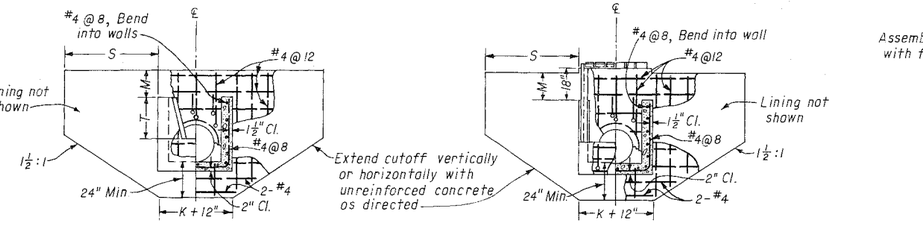
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

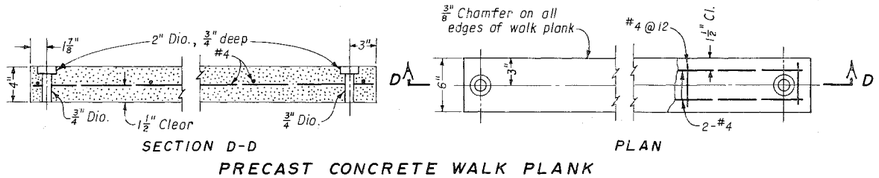
CULVERTS

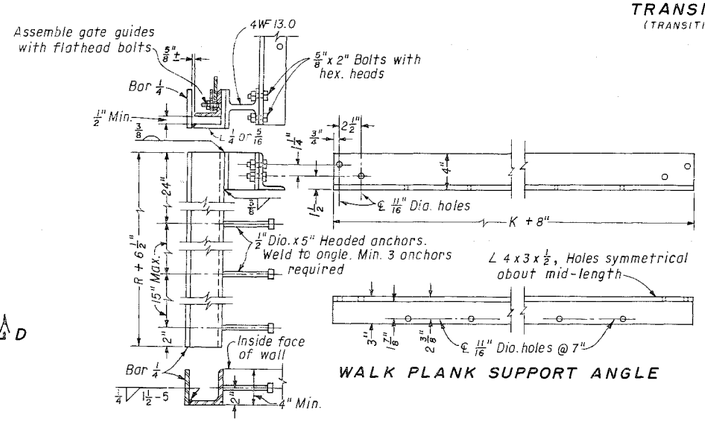
C-154-20

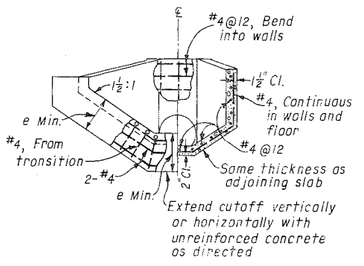
DRAWN_____ SUBMITTED_____
TRACED R.D.T. RECOMMENDED_____
CHECKED_____ APPROVED_____ CHIEF, CANALS BRANCH











REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT
BENDS FOR PRECAST CONCRETE CULVERT PIPE

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Locations of vertical P.I.'s at C and D are to be considered approximate only and may be adjusted according to actual laying length of pipe.
Road crossing shall have earth outlet unless otherwise specified.
Lining similar to the lining in the adjoining waterway shall be placed at the inlet or outlet of the road crossing, as shown.
Stations and elevations refer to invert unless otherwise shown.
For details of joint between concrete lining and concrete structure, see

WATERWAY	℄ ROAD STA.	Δ	Q	PIPE DIA. In.	STATIONS AND ELEVATIONS												TRANSITION INLET								CHECK INLET								CONTROL INLET								TRANSITION OUTLET								EST. QUANTITIES				REMARKS
					STA. A	El. A	STA. B	El. B	STA. C	El. C	STA. D	El. D	STA. E	El. E	STA. F	El. F	A	B	C	e	L	P	Y	t_f In.	t_w In.	R	M	S	K	L	NO. WK. PLK	GATE * Width x Ht.	Fn	R	M	S	K	L	T	P	N	A	B	C	e	L	P	Y	t_f In.	t_w In.	PIPE FT.	CONC. CU. YDS	REINF. LBS.	MISC. MTL. LBS.	

REMARKS: (1)

* When a gate with specified height is not available, a gate with next greater available height shall be used.

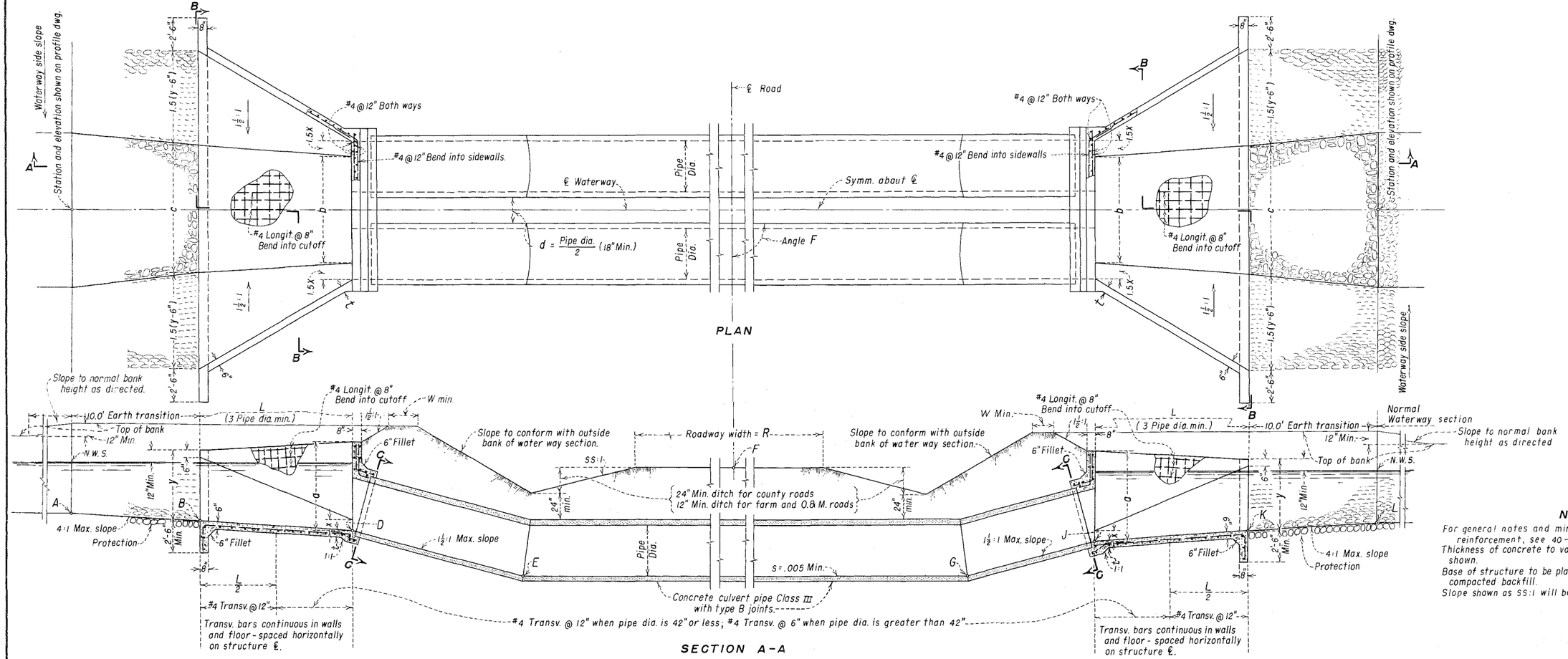
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

ROAD CROSSING

DRAWN D.M.M. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,

C-156.10



NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Thickness of concrete to vary uniformly between dimensions shown.
Base of structure to be placed on undisturbed earth or compacted backfill.
Slope shown as SS:1 will be 1½:1 for farm road crossings.

REFERENCE DRAWING

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT
BENDS FOR PRECAST CONCRETE CULVERT PIPE

TABLE OF LOCATIONS, DIMENSIONS AND ESTIMATED QUANTITIES

WATERWAY	NOR. Q	MAX. Q	PIPE DIA.	A STATION	A ELEVATION	B STATION	B ELEVATION	D ELEVATION	E STATION	E ELEVATION	F (℄ ROAD) STATION	F (℄ ROAD) ELEVATION	ANGLE F	G STATION	G ELEVATION	J ELEVATION	K STATION	K ELEVATION	L STATION	L ELEVATION	DIMENSIONS a	b	c	d	L	R	t	x	y	ESTIMATED QUANTITIES CONCRETE CU. YD.	REINF. STEEL LBS.	CONC. CUL. PIPE CLASS III LIN. FT.

SECTION C-C

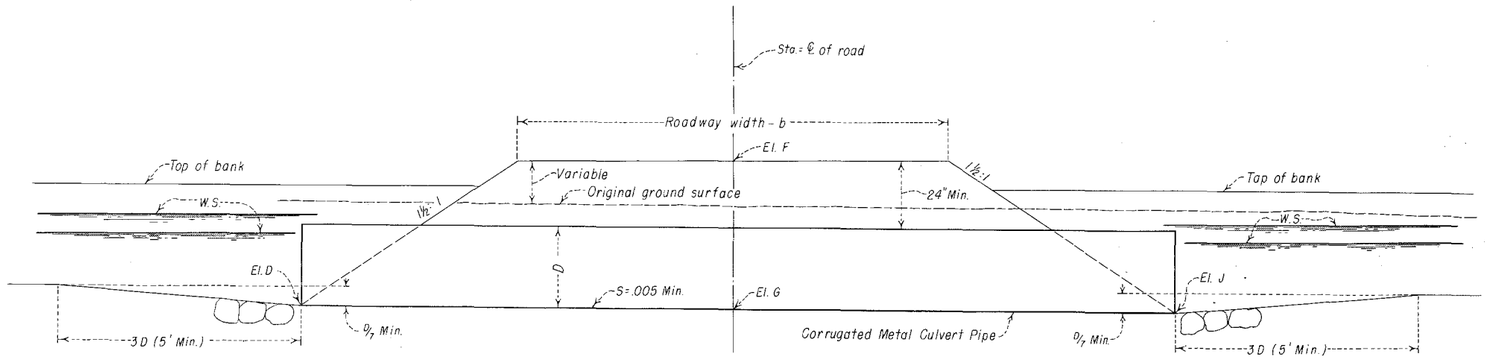
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DOUBLE BARREL ROAD CROSSINGS 30" TO 60" DIA. CONCRETE CULVERT PIPE

DRAWN W. A. K. SUBMITTED
TRACED H. S. P. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

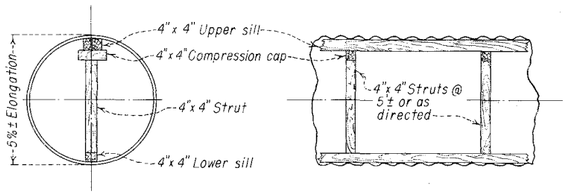
C 156.20



LONGITUDINAL SECTION

TABLE OF LOCATIONS AND ELEVATIONS												ESTIMATED QUANTITIES	
WASTEWAY	STATION AT ℄ ROAD	INLET		ELEVATION F	ELEVATION G	DIA.	Q	ROAD WIDTH -b	OUTLET		PIPE LIN. FT.*	GAGE
		STR. DWG. NO.	ELEVATION D						ELEVATION J	STR. DWG. NO.		

*Furnish necessary connecting bands to make lengths as shown.



METHOD OF STRUTTING CORRUGATED METAL PIPE

No strutting required for pipes less than 54-inches in diameter. Pipe strutting to be installed before backfill is placed, and to remain in place until embankment is completed.

NOTES

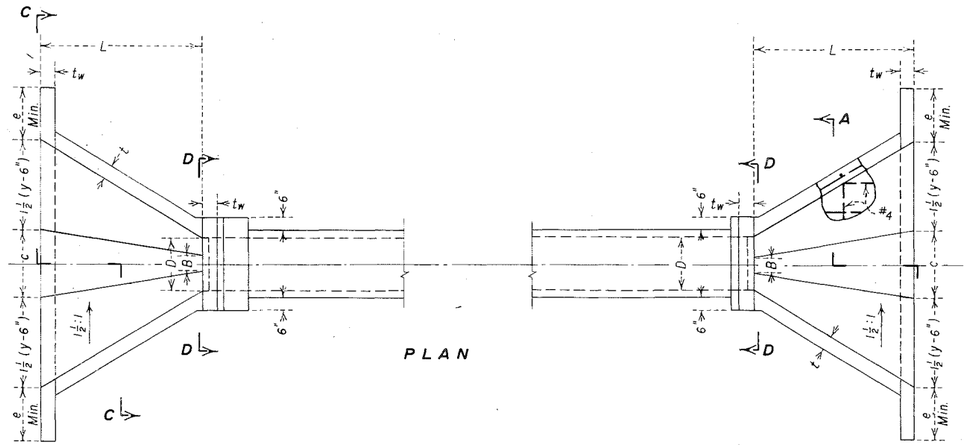
Pipe may terminate in concrete structure or transition at either end as directed.
Elevation F is approximate elevation of finished grade of road.
Elevation G is elevation of invert of pipe at ℄ of road.

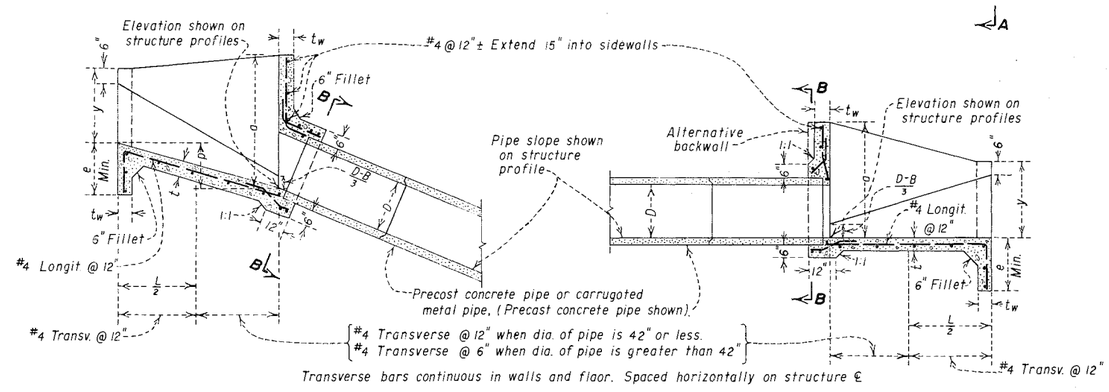
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CORRUGATED METAL PIPE ROAD CROSSINGS

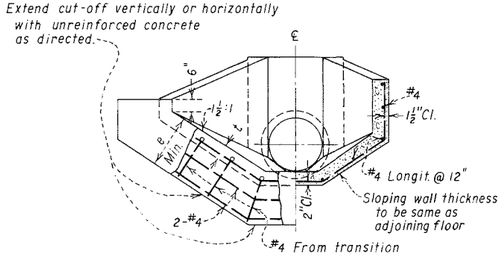
C 156.30

DRAWN W.A.K. SUBMITTED
TRACED J.L.V. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO,

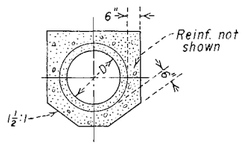




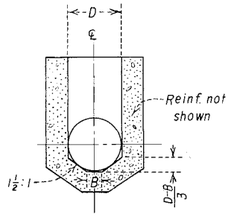
LONGITUDINAL SECTION



SECTION A-A
(SECTION C-C SIMILAR)



SECTION B-B



SECTION D-D

STR. No.	STANDARD DIMENSIONS									EST. QUANTITIES	
	B	L	a	y	c	p	t	e	t_w	Conc. Cu. Yds.	Reinf. Steel Lbs.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Outlet transition shown with p=0. Structure to have sloping floor if "p" dimension is given in standard dimensions.
First two digits of structure number indicates pipe diameter "D" in inches; for example, structure No. 21-3 shows pipe diameter "D"=21".
For details of embedment of precast pipe in monolithic concrete, see

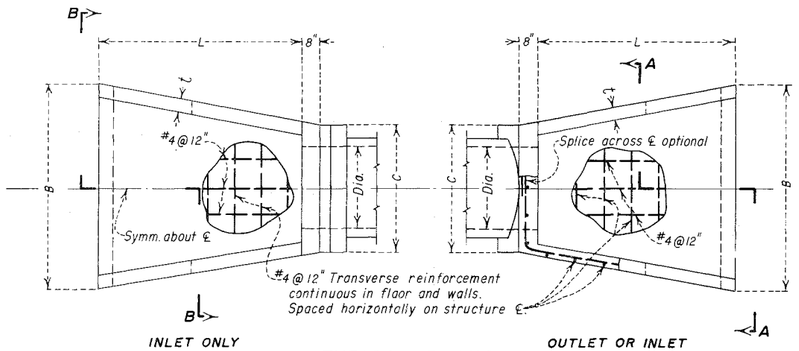
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

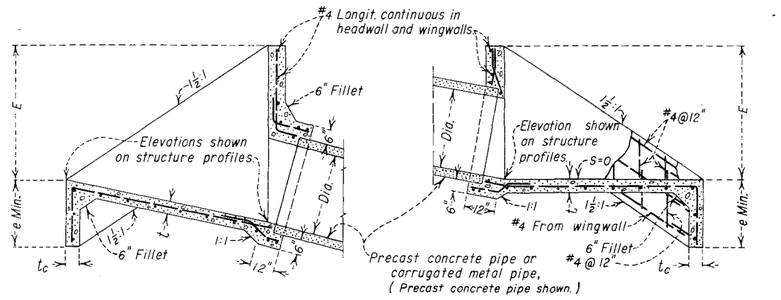
CONCRETE TRANSITIONS - TYPE I

C-160.10

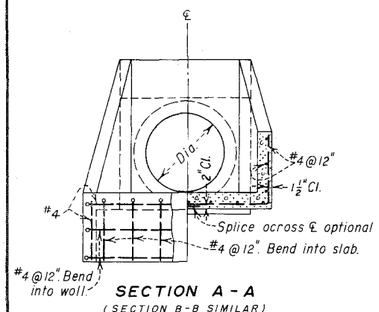
DRAWN R.E.C. SUBMITTED
TRACED G.K.W. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,



TYPICAL PLANS



LONGITUDINAL SECTIONS



SECTION A - A
(SECTION B-B SIMILAR)

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
For details of embedment of precast pipe in monolithic concrete, see

TABLE OF DIMENSIONS AND EST. QUANTITIES

DIA.	E	B	L	B	C	t	t_c	CONC. (CU.YDS.)	REINF. (LBS.)
15"	3'-0"	24"	4'-6"	4'-3"	2'-9"	5"	6"	0.9	70
18"	3'-6"	24"	5'-3"	4'-8"	3'-0"	5"	6"	1.4	110
24"	4'-0"	24"	6'-0"	5'-1"	3'-6"	5"	6"	1.7	140
27"	4'-6"	24"	6'-9"	5'-6"	3'-9"	5"	6"	2.0	160
30"	4'-6"	24"	6'-9"	6'-4"	4'-2"	5"	6"	2.2	180
36"	5'-0"	2'-6"	7'-6"	7'-7"	4'-8"	5"	8"	2.7	220
42"	5'-6"	2'-6"	8'-3"	9'-0"	5'-3"	6"	8"	3.6	290
48"	6'-0"	2'-6"	9'-0"	10'-8"	6'-0"	7"	8"	4.8	380

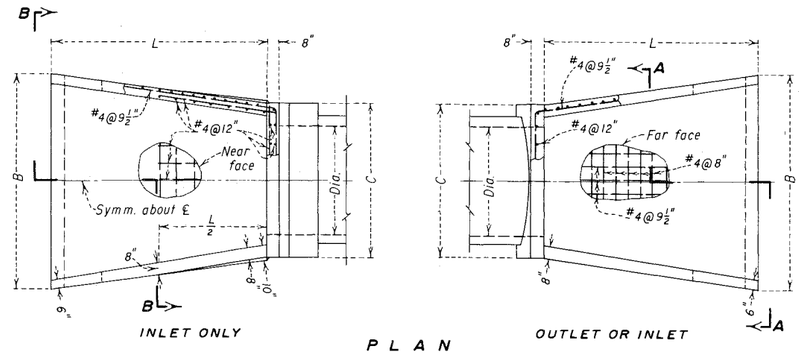
ALWAYS THINK **SAFETY**

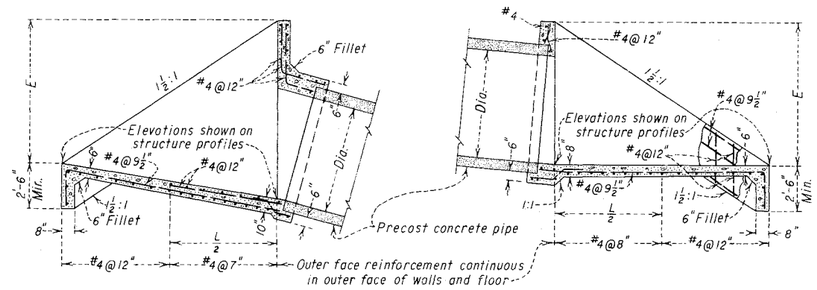
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE TRANSITIONS-TYPE 2

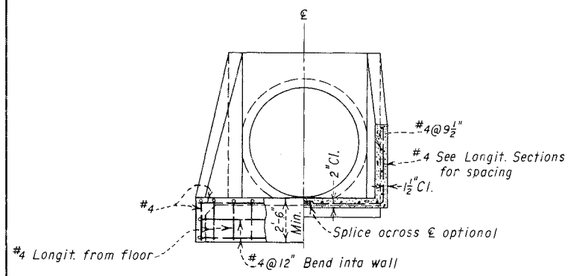
C-160-20

DRAWN R.E.C. SUBMITTED
TRACED R.B. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,





LONGITUDINAL SECTIONS



SECTION A-A
(SECTION B-B SIMILAR)

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
For details of embedment of precast pipe in monolithic concrete, see

TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES

DIA.	E	L	B	C	INLET		OUTLET	
					CONC. (Cu. Yds.)	REINF (Lbs.)	CONC. (Cu. Yds.)	REINF (Lbs.)
54"	6'-6"	9'-9"	11'-6"	6'-6"	6.9	760	5.1	460
60"	7'-0"	10'-6"	12'-2"	7'-0"	7.8	860	6.0	540
66"	7'-6"	11'-3"	13'-6"	7'-8"	8.8	970	7.0	630
72"	8'-0"	12'-0"	14'-4"	8'-2"	9.9	1090	7.8	700

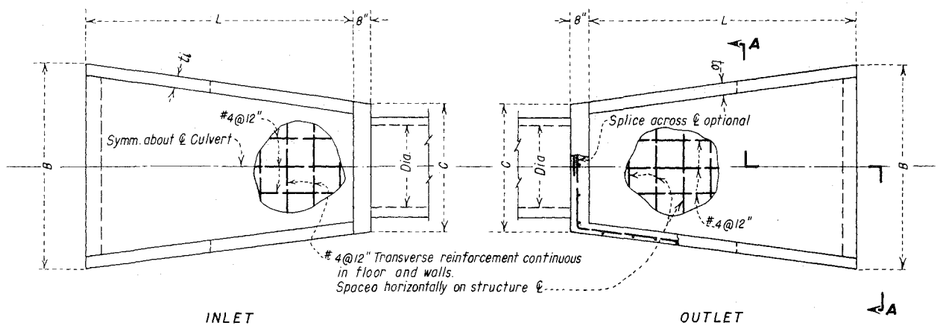
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

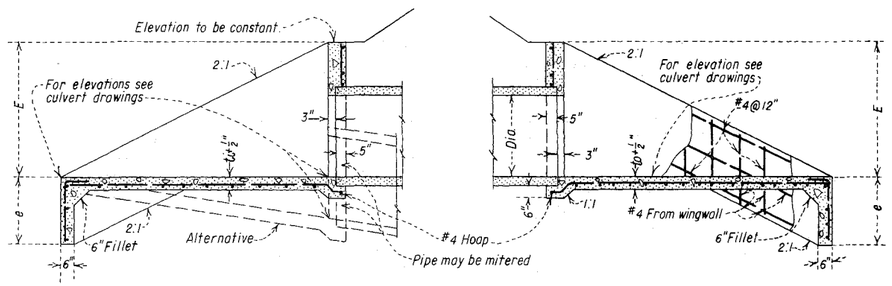
CONCRETE TRANSITIONS-TYPE 2L

DRAWN A.W.B. SUBMITTED
TRACED D.W.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

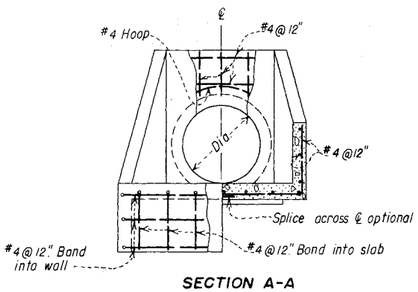
C-160.21



PLAN



LONGITUDINAL SECTION



SECTION A-A
(INLET SIMILAR)

NOTES

Chamfer all exposed corners $\frac{3}{4}$"
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

TABLE OF DIMENSIONS & QUANTITIES

DIA.	E	e	L	B	C	ti	to	CONC. (CU. YDS.)	REINF. (LBS.)
24"	4'-0"	2'-6"	8'-0"	5'-1"	3'-6"	5"	5"	1.7	120
30"	4'-6"	2'-6"	9'-0"	6'-4"	4'-1"	5"	5"	2.2	150
36"	5'-0"	2'-6"	10'-0"	7'-7"	4'-8"	5"	5"	2.7	190
42"	5'-6"	3'-0"	11'-0"	9'-0"	5'-3"	6"	6"	4.0	280
48"	6'-0"	3'-0"	12'-0"	10'-8"	6'-0"	7"	6"	4.8	340
54"	6'-6"	3'-0"	13'-0"	12'-2"	6'-7"	7"	6"	5.6	390
60"	7'-0"	3'-0"	14'-0"	13'-8"	7'-2"	7"	6"	6.5	460

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PRECAST CONCRETE PIPE CULVERT TRANSITIONS - TYPE 2

C 160.22

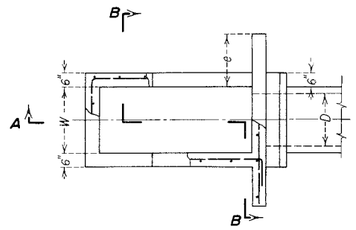
DRAWN E.W.M. SUBMITTED

TRACED J.A.H. RECOMMENDED

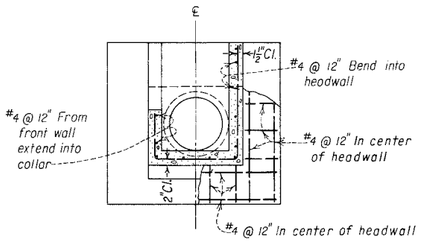
CHECKED APPROVED

CHIEF, CANALS BRANCH

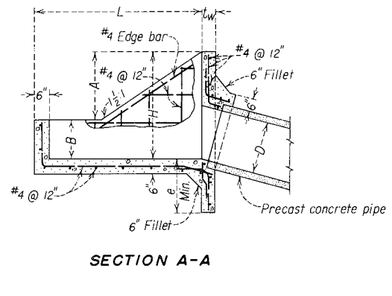
DENVER, COLORADO



PLAN



SECTION B-B



SECTION A-A

STR. No.	MAX. Q	DIMENSIONS								EST. QUANTITIES	
		D	L	W	H	A	B	t_w	e	CONCRETE CUBIC YDS.	REINF. STEEL LBS.
24-1	16	24"	6'-0"	2'-6"	4'-0"	2'-6"	18"	6"	24"	1.8	140
24-2	21	24"	6'-0"	2'-6"	4'-6"	2'-6"	24"	6"	24	2.0	160
24-3	26	24"	6'-0"	2'-6"	5'-0"	2'-6"	2'-6"	6"	24"	2.2	180
24-4	31	24"	6'-0"	2'-6"	5'-8"	2'-6"	3'-2"	6"	24"	2.4	200
27-1	35	27"	6'-9"	2'-9"	5'-6"	2'-6"	3'-0"	6"	24"	2.6	210
27-2	40	27"	6'-9"	2'-9"	6'-0"	2'-6"	3'-6"	6"	24"	2.8	220
30-1	45	30"	7'-6"	3'-2"	6'-0"	3'-0"	3'-0"	6"	24"	3.0	240
30-2	50	30"	7'-6"	3'-2"	6'-6"	3'-0"	3'-6"	6"	24"	3.2	260
36-1	55	36"	9'-0"	3'-8"	6'-0"	3'-0"	3'-0"	8"	2'-6"	4.3	290
36-2	63	36"	9'-0"	3'-8"	6'-6"	3'-0"	3'-6"	8"	2'-6"	4.6	320
36-3	71	36"	9'-0"	3'-8"	7'-0"	3'-0"	4'-0"	8"	2'-6"	5.0	340

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
For details of embedment of precast pipe in manolithic concrete, see

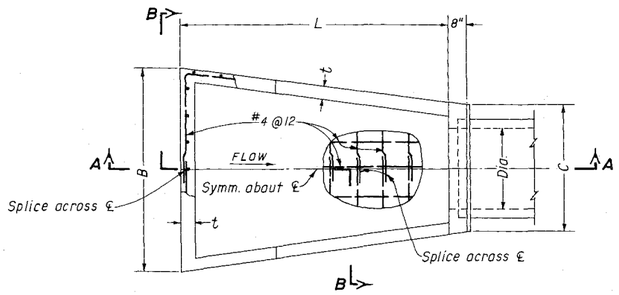
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

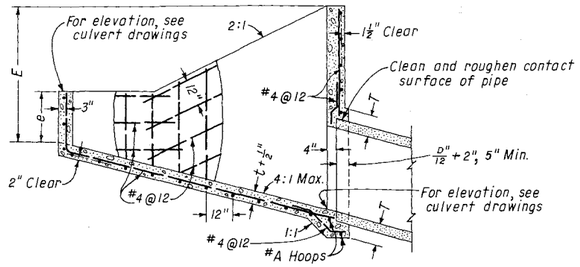
CONCRETE TRANSITIONS-TYPE 3

C-160-30

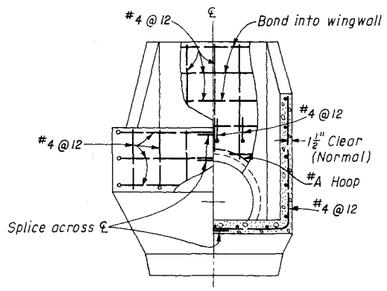
DRAWN R.E.C. SUBMITTED
TRACED T.R.H. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO



PLAN



SECTION A-A



SECTION B-B

NOTES

Chamfer all exposed corners ¾".
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

TABLE OF DIMENSIONS AND QUANTITIES

DIA.	#A	E	e	L	B	C	t	T	CONC. (CU YDS.)	REINF. (LBS.)
24"	4	4'-0"	24"	8'-0"	5'-1"	3'-6"	5"	9"	1.7	120
30"	4	4'-6"	24"	9'-0"	6'-4"	4'-1"	5"	10"	2.2	150
36"	5	5'-0"	24"	10'-0"	7'-7"	4'-8"	5"	10"	2.7	190
42"	5	5'-6"	2'-6"	11'-0"	9'-0"	5'-3"	6"	11"	4.0	280
48"	5	6'-0"	2'-6"	12'-0"	10'-8"	6'-0"	7"	11"	4.8	340
54"	5	6'-6"	2'-6"	13'-0"	12'-2"	6'-7"	7"	12"	5.6	390
60"	6	7'-0"	2'-6"	14'-0"	13'-8"	7'-2"	7"	12"	6.5	460

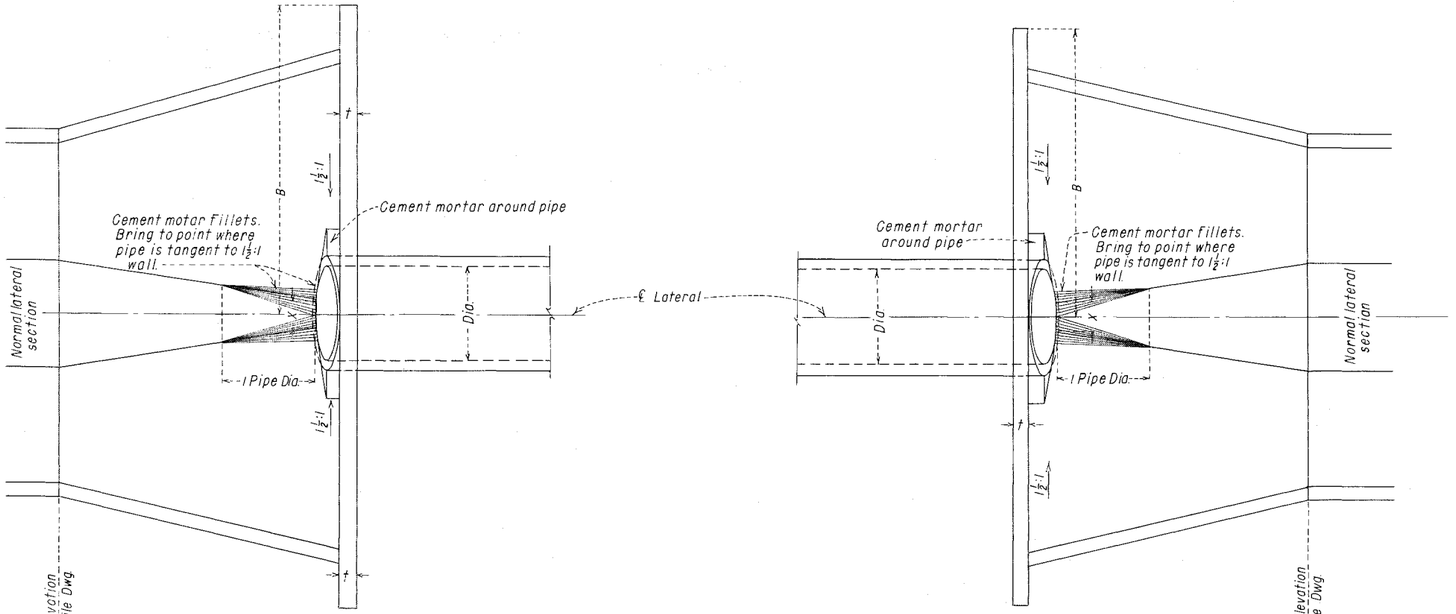
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PRECAST CONCRETE PIPE CULVERT TRANSITIONS - DROP INLET

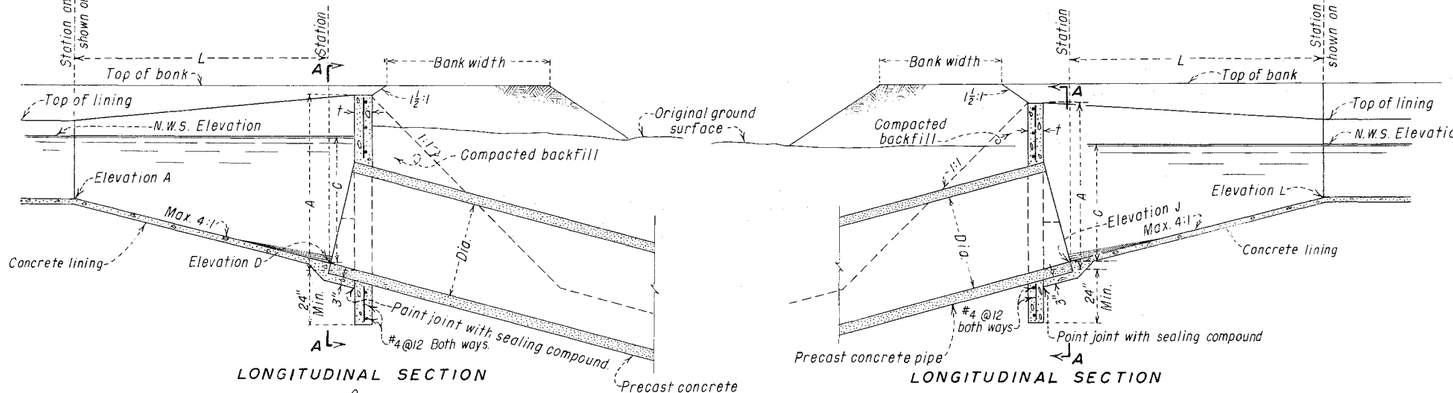
C 160.32

DRAWN L.P.B. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO



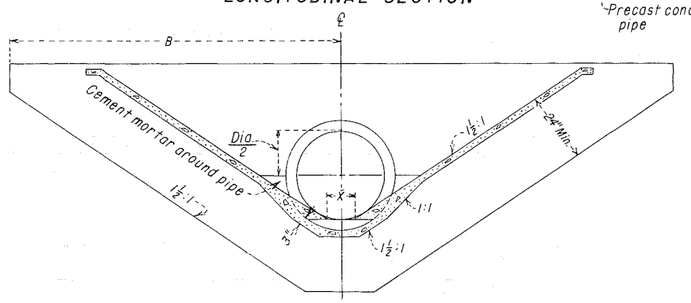
PLAN OF INLET

PLAN OF OUTLET



LONGITUDINAL SECTION

LONGITUDINAL SECTION



SECTION A-A

TABLE OF LOCATIONS AND ELEVATIONS

LATERAL	STATION	N.W.S. El.	INLET OR OUTLET	Q	DIA. (IN.)		El. D OR J	El. A OR L

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
All reinforcement in headwall is to be placed in center of slab.

				INLET HEADWALL					OUTLET HEADWALL				
DIA.	L	t	X	C	A	B	CONCRETE (CU. YD.)	REINF STEEL (LB.)	C	A	B	CONCRETE (CU. YD.)	REINF STEEL (LB.)
12"	5'-0"	6"	4"	2.00'	3'-7"	7'-6"	1.0	70	1.30'	2'-9"	6'-4"	.7	50
15"	5'-0"	5"	5"	2.25'	3'-10"	8'-0"	1.1	75	1.60'	3'-2"	6'-11"	.9	60
18"	5'-0"	6"	6"	2.50'	4'-1"	8'-5"	1.2	85	2.00'	3'-6"	7'-6"	1.0	70
21"	5'-3"	6"	7"	2.75'	4'-4"	8'-10"	1.2	90	2.30'	3'-10"	8'-0"	1.1	80
24"	6'-0"	6"	7"	3.00'	4'-8"	9'-3"	1.3	95	2.70'	4'-3"	8'-7"	1.2	85
27"	6'-9"	7"	8"	3.25'	4'-11"	9'-9"	1.7	105	3.00'	4'-7"	9'-2"	1.5	95
30"	7'-6"	7"	9"	3.50'	5'-2"	10'-1"	1.8	110	3.30'	4'-11"	9'-9"	1.7	105
36"	9'-0"	7"	11"	4.00'	5'-8"	10'-11"	2.0	125	4.00'	5'-8"	10'-11"	2.0	125

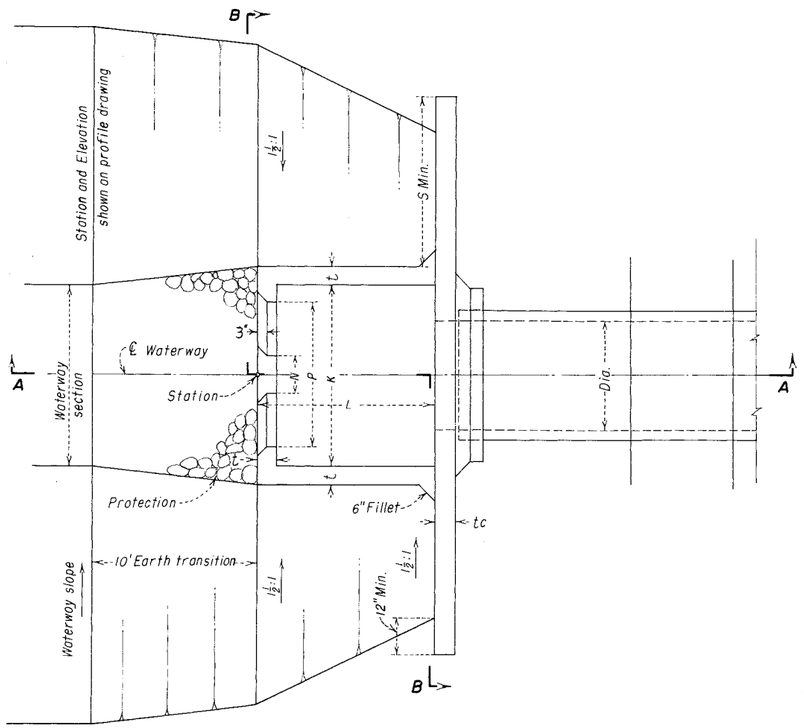
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

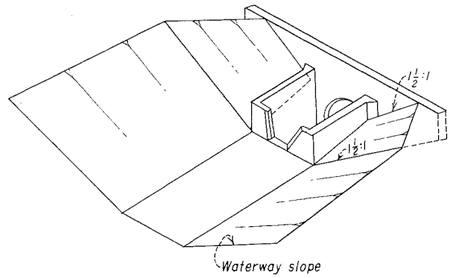
CONCRETE HEADWALLS

C 160 40

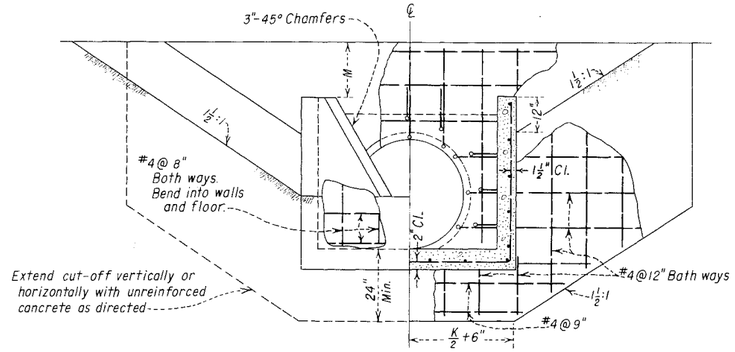
DRAWN P.A.T. SUBMITTED
TRACED M.H.J. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.



PLAN



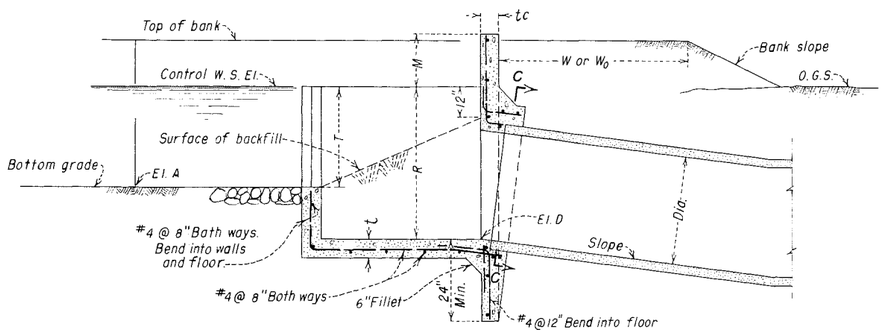
ISOMETRIC PROJECTION



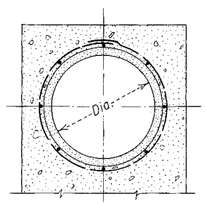
SECTION B-B

TABLE OF LOCATIONS AND ELEVATIONS

STRUCTURE No.	WATERWAY	STATION	DIA.	SLOPE		P	N	T	ELEVATIONS A	ELEVATIONS CONTROL W.S.	ELEVATIONS D	Q



SECTION A-A



SECTION C-C

STRUCTURE No.	STANDARD DIMENSIONS Q	Dia.	K	R	L	t	tc	M	S	ESTIMATED QUANTITIES CONCRETE CU. YDS.	REINF. STEEL LBS.
12-1	5	12"		2'-6"	3'-6"	6"	6"	12"	4'-0"		
15-1	7	15"	3'-0"	2'-6"	3'-6"	6"	6"	12"	4'-0"	2.0	170
18-1	10	18"	3'-6"	2'-6"	3'-6"	6"	6"	12"	4'-0"	2.1	180
18-2	15	18"	4'-6"	3'-6"	3'-6"	6"	6"	12"	4'-0"		
18-3	21	18"		5'-0"	3'-6"	6"	6"	12"	4'-0"		
21-1	13	21"	4'-0"	3'-0"	3'-6"	6"	6"	12"	4'-0"	2.3	200
21-2	28	21"		5'-3"	4'-0"	6"	6"	12"	4'-0"		
24-1	17	24"	4'-0"	3'-3"	3'-6"	6"	6"	12"	4'-0"	2.4	220
24-2	37	24"	5'-0"	5'-6"	4'-6"	6"	8"	12"	4'-0"		
27-1	21	27"	4'-6"	3'-6"	3'-6"	6"	6"	15"	4'-4"	2.8	260
27-2	47	27"	5'-6"	5'-9"	5'-0"	6"	8"	15"	4'-4"		
30-1	26	30"	4'-6"	3'-9"	3'-6"	6"	6"	15"	4'-4"	2.9	270
30-2	59	30"		6'-0"	5'-6"	6"	8"	15"	4'-4"		
33-1	31	33"		4'-0"	3'-6"	6"	6"	18"	4'-9"		
33-2	71	33"	5'-0"	6'-3"	6'-0"	6"	8"	18"	4'-9"		
36-1	36	36"	5'-0"	4'-3"	4'-0"	6"	6"	18"	4'-9"	3.5	330
36-2	84	36"		6'-6"	6'-6"	6"	8"	18"	4'-9"		
39-1	43	39"		4'-6"	4'-0"	6"	6"	18"	4'-9"		
39-2	99	39"		6'-9"	7'-0"	7"	8"	18"	4'-9"		
42-1	49	42"	5'-6"	4'-9"	4'-6"	6"	6"	18"	4'-9"	4.1	400
42-2	115	42"		7'-0"	7'-6"	7"	8"	18"	4'-9"		
48-1	64	48"	6'-0"	5'-0"	5'-0"	6"	6"	18"	4'-9"	4.6	450
48-2	151	48"		7'-6"	8'-0"	7"	8"	18"	4'-9"		
54-1	81	54"	6'-6"	5'-6"	5'-6"	6"	6"	18"	4'-9"	5.8	550
60-1	100	60"	7'-0"	6'-0"	6'-0"	6"	6"	18"	4'-9"	6.6	650

NOTE

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

REFERENCE DRAWINGS

TYPICAL PROTECTION _ _ _ _ _ _ _ _ _ _ _ _

PRECAST PIPE EMBEDMENT _ _ _ _ _ _ _ _ _ _

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONTROL AND PIPE INLET

C-161-10

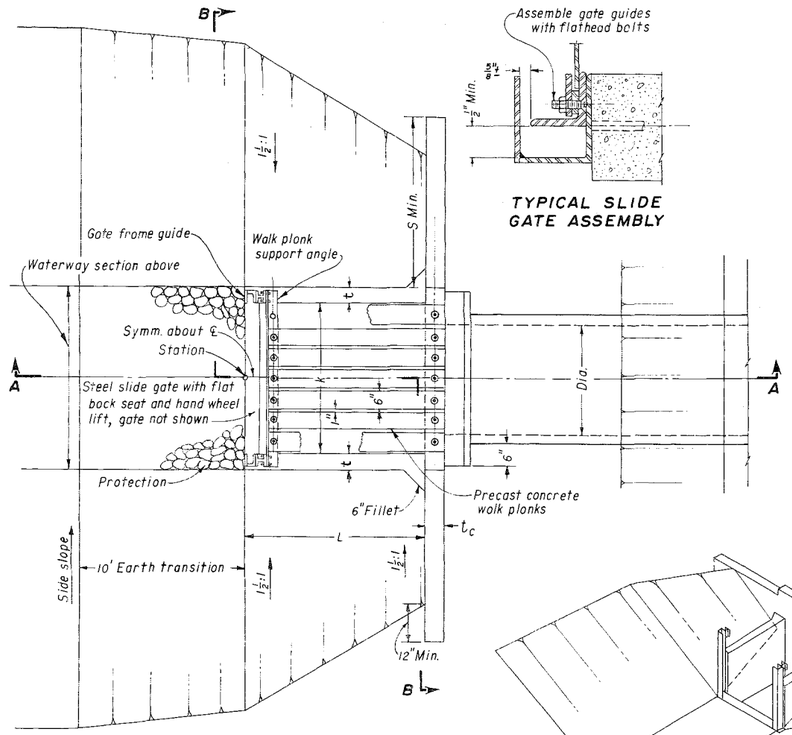
DRAWN W.A.K. SUBMITTED

TRACED H.M.G. RECOMMENDED

CHECKED APPROVED

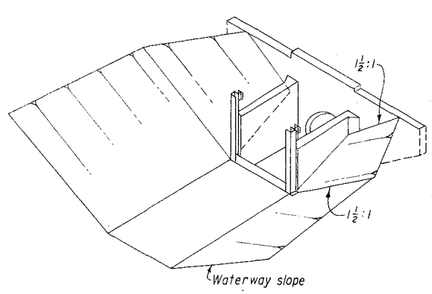
CHIEF, CANALS BRANCH

DENVER, COLORADO

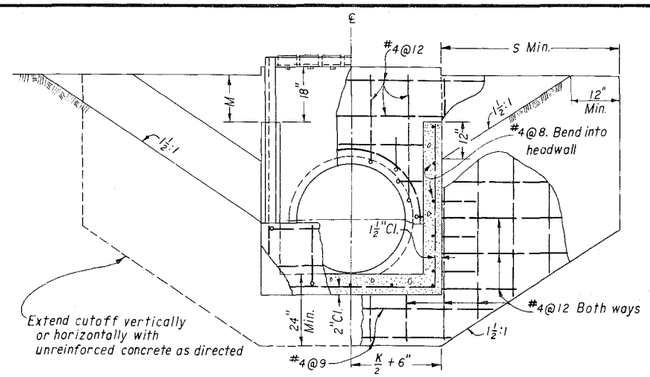


PLAN

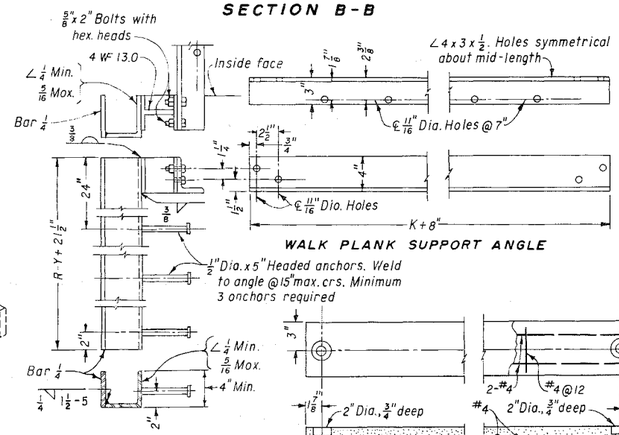
TYPICAL SLIDE GATE ASSEMBLY



ISOMETRIC PROJECTION



SECTION B-B

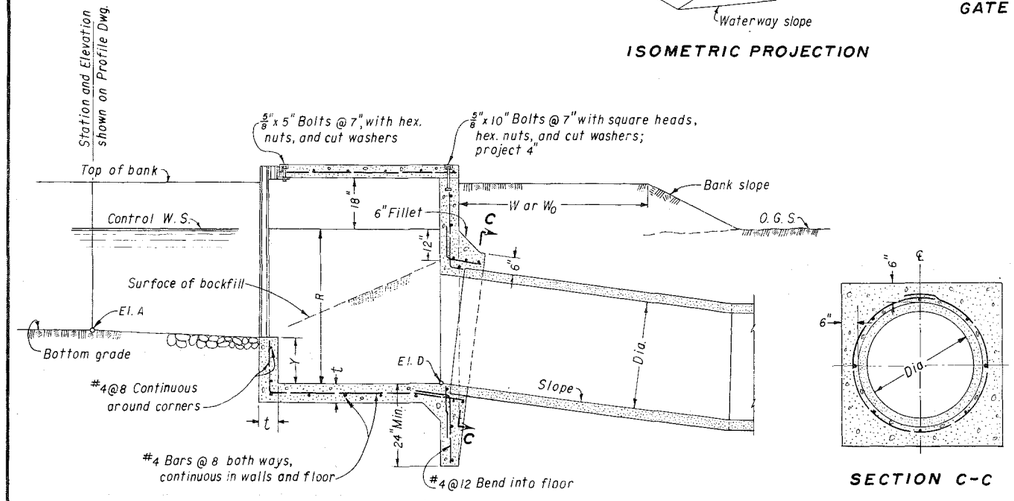


WALK PLANK SUPPORT ANGLE

GATE FRAME GUIDE

PRECAST CONCRETE WALK PLANK

STRUCTURE No.	WATERWAY	STATION	DIA.	SLOPE	ELEVATIONS A	ELEVATIONS CONT. W.S.	ELEVATIONS D	Q	REMARKS



SECTION A-A

SECTION C-C

STRUCTURE No.	STANDARD DIMENSIONS Q	DIA.	K	R	L	Y	t	t_c	M	S	No. OF WALK PLANKS	ESTIMATED QUANTITIES CONC. CU. YDS.	REINF. STEEL LBS.	MISC. METAL LBS.	SLIDE GATE WIDTH x HT.*	SLIDE GATE FRM. HT.
12-1	5	12"	24"	2'-6"	3'-6"	15"	6"	6"	12"	4'-0"	3				24"x15"	5'
15-1	7	15"	24"	2'-6"	3'-6"	15"	6"	6"	12"	4'-0"	3	1.6	160	110	24"x15"	5'
18-1	10	18"	2'-6"	2'-6"	3'-6"	15"	6"	6"	12"	4'-0"	4	1.7	170	110	30"x15"	5'
18-2	15	18"	2'-6"	3'-6"	4'-0"	21"	6"	6"	12"	4'-0"	4				30"x21"	5'
18-3	21	18"	3'-0"	5'-0"	4'-6"	3'-0"	6"	6"	12"	4'-0"	5				36"x24"	5'
21-1	13	21"	3'-0"	3'-0"	4'-0"	15"	6"	6"	12"	4'-0"	5	2.1	220	130	36"x21"	5'
21-2	28	21"	3'-6"	5'-3"	5'-0"	3'-0"	6"	6"	12"	4'-0"	6				42"x27"	5'
24-1	17	24"	3'-0"	3'-3"	4'-0"	15"	6"	6"	12"	4'-0"	5	2.2	230	140	36"x24"	5'
24-2	37	24"	4'-0"	5'-6"	5'-6"	3'-0"	6"	8"	12"	4'-0"	7				48"x30"	6'
27-1	21	27"	3'-6"	3'-6"	4'-6"	15"	6"	6"	15"	4'-4"	6	2.6	270	150	42"x27"	5'
27-2	47	27"	5'-0"	5'-9"	6'-0"	2'-10"	6"	8"	15"	4'-4"	9				60"x33"	6'
30-1	26	30"	3'-6"	3'-9"	4'-6"	15"	6"	6"	15"	4'-4"	6	2.9	300	160	42"x30"	6'
30-2	59	30"	5'-0"	6'-0"	6'-6"	2'-9"	6"	8"	15"	4'-4"	9				60"x27"	6'
33-1	31	33"	4'-0"	4'-0"	4'-6"	15"	6"	6"	18"	4'-9"	7				48"x33"	6'
33-2	71	33"	6'-0"	6'-3"	7'-0"	2'-9"	6"	8"	18"	4'-9"	10				72"x42"	6'
36-1	36	36"	4'-0"	4'-3"	5'-0"	15"	6"	6"	18"	4'-9"	7	3.4	350	180	48"x36"	6'
36-2	84	36"	6'-0"	6'-6"	7'-6"	2'-9"	6"	8"	18"	4'-9"	10				72"x45"	6'
39-1	43	39"	5'-0"	4'-6"	5'-0"	15"	6"	6"	18"	4'-9"	9				60"x39"	6'
39-2	99	39"	6'-0"	6'-9"	8'-0"	2'-4"	7"	8"	18"	4'-9"	11				72"x54"	7'
42-1	49	42"	5'-0"	4'-9"	5'-6"	15"	6"	6"	18"	4'-9"	9	4.1	420	240	60"x42"	6'
42-2	115	42"	6'-0"	7'-0"	8'-6"	24"	7"	8"	18"	4'-9"	11				72"x60"	8'
48-1	64	48"	5'-0"	5'-0"	6'-0"	15"	6"	6"	18"	4'-9"	9	4.3	450	250	60"x45"	6'
54-1	81	54"	6'-0"	5'-6"	6'-6"	15"	6"	6"	18"	4'-9"	10	5.2	550	280	72"x51"	7'
60-1	100	60"	6'-0"	6'-0"	7'-0"	15"	6"	6"	18"	4'-9"	10	5.7	600	290	72"x57"	7'

* When a gate with a specified height is not available, a gate with next greater available height shall be used with appropriate frame height

NOTE

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Gate frame height meosured from ℄ of gate opening.

REFERENCE DRAWINGS

TYPICAL PROTECTION
PRECAST PIPE EMBEDMENT

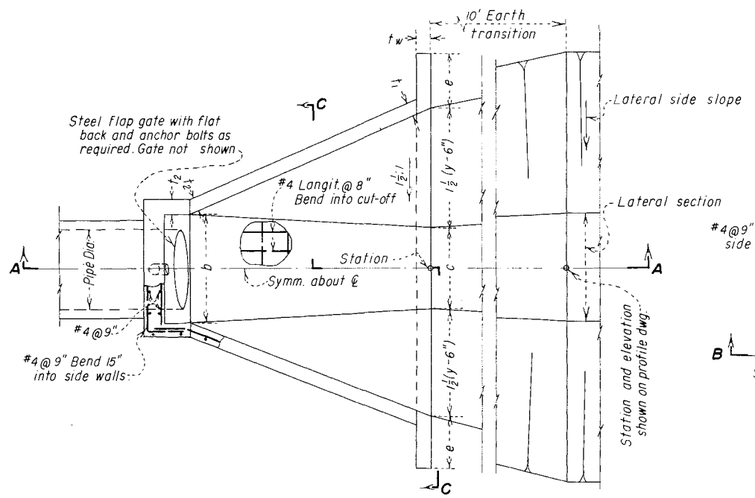
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

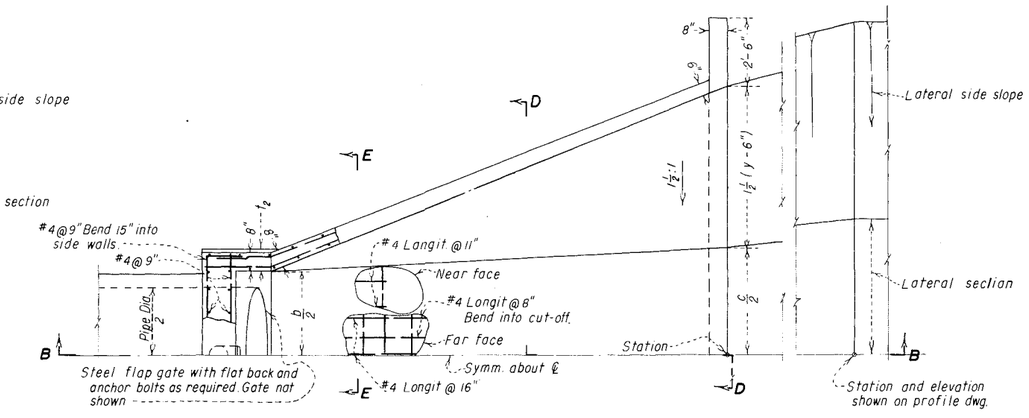
CHECK AND PIPE INLET

DRAWN R.E.C. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.

C-161.20



PLAN OF TYPICAL PUMP DISCHARGE LINE TRANSITION 15" TO 54" DIA.

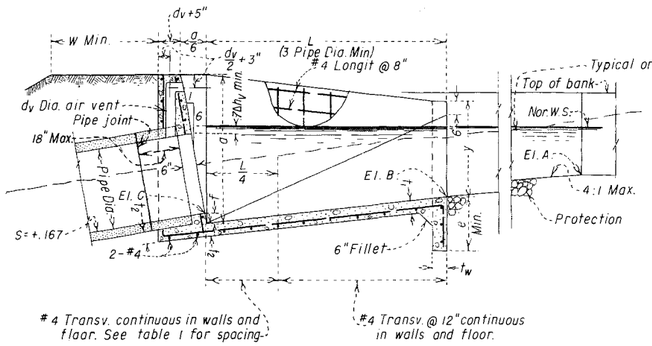


HALF PLAN OF PUMP DISCHARGE LINE TRANSITION 60" TO 78" DIA.

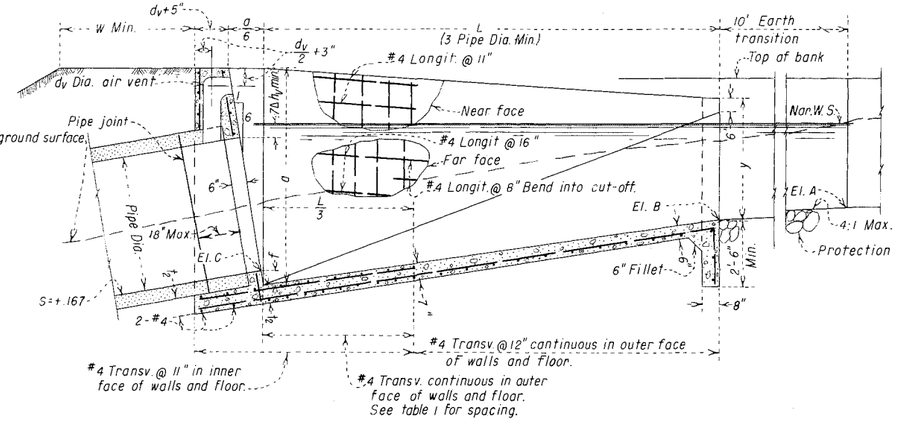
TABLE I

PIPE DIA.	a	b	t_1	t_2	e	t_w	f	d_v	TRANSV. REINF.
15"	4'-2"	2'-2"	5"	5"	24"	6"	4½"	4"	#4 @ 12"
18"	4'-5"	2'-4"	5"	5"	24"	6"	4½"	4"	#4 @ 12"
21"	4'-8"	2'-8"	5"	5"	24"	6"	5"	4"	#4 @ 12"
24"	4'-11"	2'-10"	5"	5"	24"	6"	5"	4"	#4 @ 12"
30"	5'-5"	3'-6"	5"	5"	24"	6"	5½"	5"	#4 @ 12"
36"	6'-0"	4'-0"	6"	6"	2'-6"	8"	6"	6"	#4 @ 12"
42"	6'-6"	4'-8"	6"	6"	2'-6"	8"	6½"	7"	#4 @ 12"
48"	7'-3"	5'-2"	6"	6"	2'-6"	8"	7"	8"	#4 @ 10"
54"	7'-8"	5'-8"	6"	7"	2'-6"	8"	7"	9"	#4 @ 8"
60"	9'-0"	6'-4"	6"	8"	–	–	7½"	9"	#4 @ 7½"
66"	9'-6"	6'-10"	6"	8"	–	–	8"	10"	#4 @ 6"
72"	10'-0"	7'-6"	6"	9"	–	–	8½"	11"	#4 @ 6"
78"	10'-6"	8'-0"	6"	9"	–	–	9"	12"	#4 @ 5"

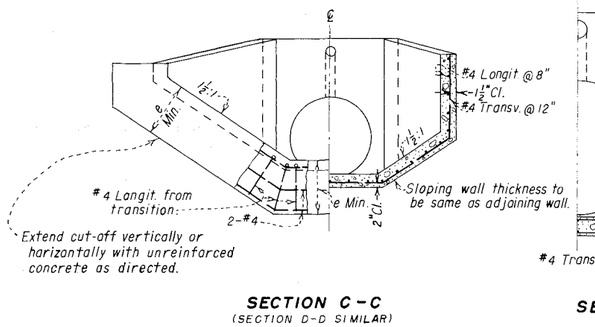
When transverse bar spacing is 6" or less, end alternate bars at half wall height.



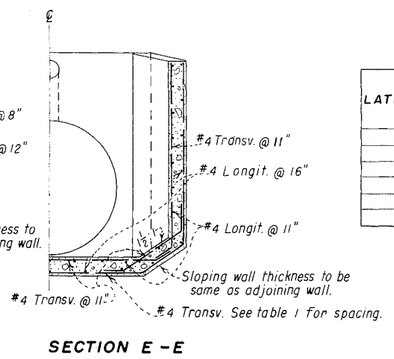
SECTION A-A



SECTION B-B



SECTION C-C
(SECTION D-D SIMILAR)



SECTION E-E

TABLE OF LOCATIONS AND ELEVATIONS

LATERAL	STATION	Q (C.F.S.)	DIMENSIONS				ELEVATIONS			EST. QUANTITIES			REMARKS
			PIPE DIA.	L	y	c	A	B	C	CONCRETE (CU. YDS.)	REINF. STEEL (LBS.)	FLAP GATE DIA.	

NOTE

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

REFERENCE DRAWING

TYPICAL PROTECTION

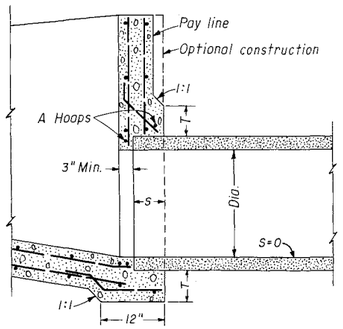
ALWAYS THINK SAFETY

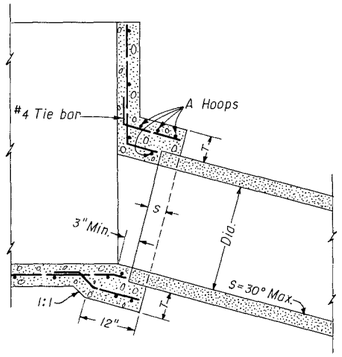
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PUMP DISCHARGE LINE TRANSITION
15" TO 78" DIA. PRECAST CONCRETE PIPE

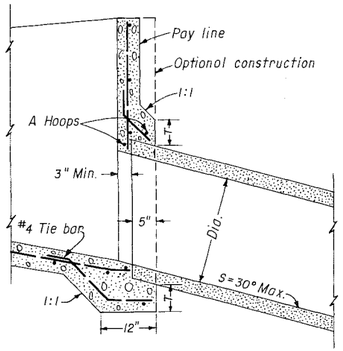
DRAWN A.W.B. SUBMITTED
TRACED J.A.H. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO.

C 161-50

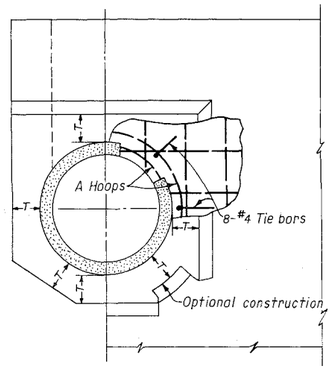




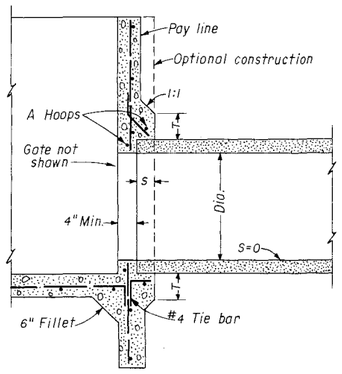
STRUCTURES WITHOUT GATE AT HEADWALL
(TYPICAL)

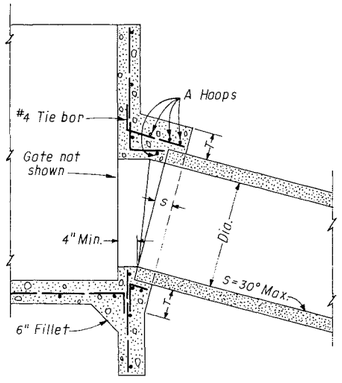


ALTERNATIVE DESIGN
FOR DIA. = 27" OR LESS

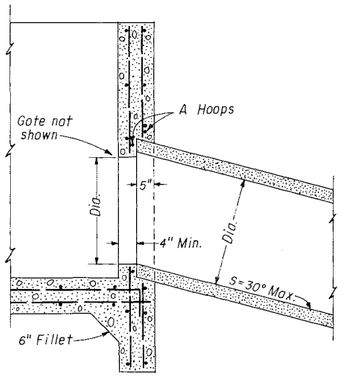


ELEVATION OF HEADWALL
SINGLE LAYER REINFORCEMENT
(TYPICAL)





STRUCTURES WITH GATE AT HEADWALL
(TYPICAL)



ALTERNATIVE DESIGN
FOR DIA. = 27" OR LESS

PIPE DIA. IN.	S IN.	T IN.	HOOPS A #
12	4	6	4
15	4	6	4
18	4	6	4
21	4	6	4
24	4	6	4
27	4	6	4
30	4	6	4
33	4	6	4
36	4	6	5
42	4½	6	5
48	5	6	5
54	5½	6	5
60	6	6	6
66	6½	7	6
72	7	7	6

NOTES

Where pressure pipe is used, a pipe joint shall be placed within 18" from outside face of structure for pipe dia. ≤ 36" and within 1" dia. for pipe dia. ≥ 36"
Cutoffs may or may not be required on structures with or without gates, see structure drawings.
For details of reinforcement in structures, see structure drawings.

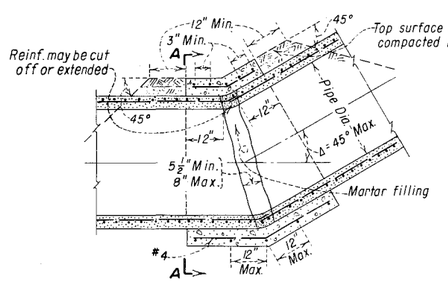
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PRECAST PIPE EMBEDMENT

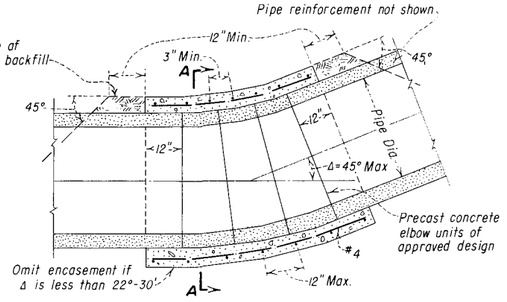
DRAWN D.M.M. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,

C 162.10

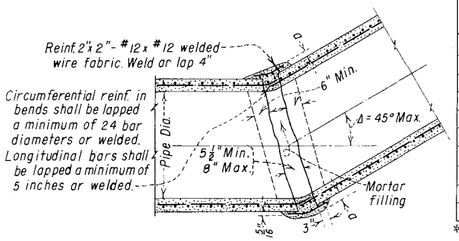


Encasement required for 42" Pipe Dia. and larger

ENCASED MITERED PIPE BEND FOR PRECAST CONCRETE CULVERT PIPE



ENCASED PRECAST ELBOW BENDS FOR PRECAST CONCRETE CULVERT PIPE

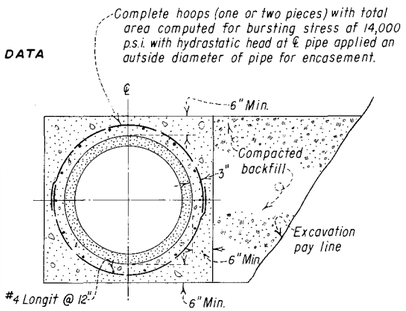


BANDED MITERED PIPE BEND FOR PRECAST CONCRETE CULVERT PIPE

BAND THICKNESS DATA

PIPE DIA (INCHES)	a*
18	1
24	1
30	1
36	1 1/8

* a = Min. band thickness in inches.



SECTION A-A

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123

Elevation of compacted backfill for unencased elbow bends and banded pipe bends shall be the same as the elevation of compacted backfill specified for the adjacent pipe.

Compact backfill to top of concrete at all encased bends.

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BENDS FOR PRECAST CONCRETE CULVERT PIPE

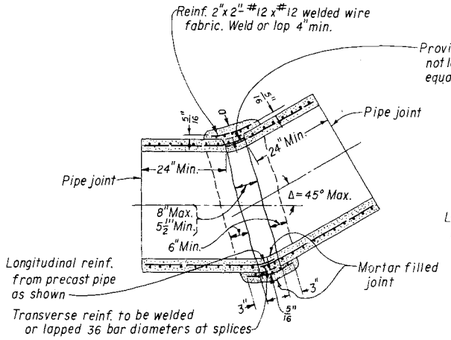
C 162.21

DRAWN W.A.K. SUBMITTED

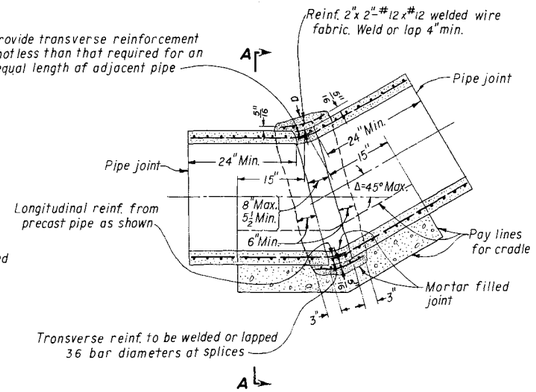
TRACED A.W.G. RECOMMENDED

CHECKED APPROVED

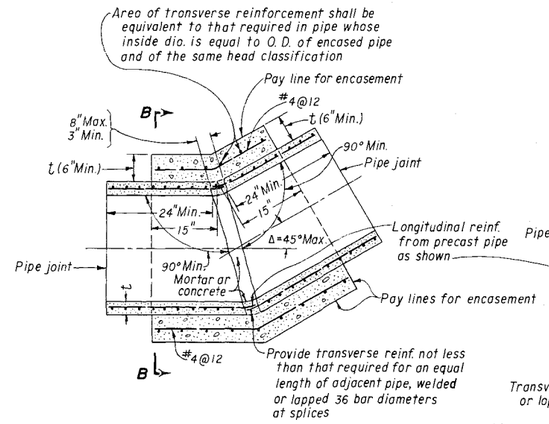
CHIEF, CANALS BRANCH



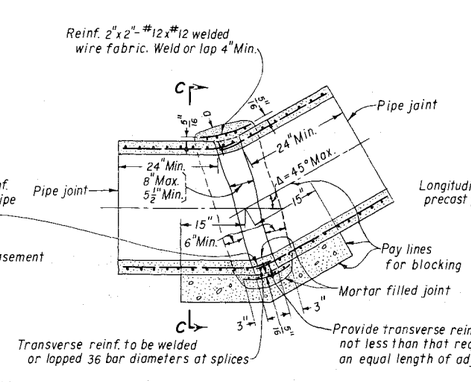
BANDED MITERED PIPE BEND
(VERTICAL OR HORIZONTAL BENDS)



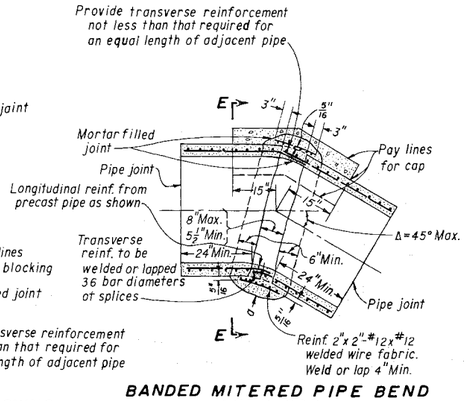
BANDED MITERED PIPE BEND WITH CRADLE
(VERTICAL BEND-UPWARD DEFLECTION)



CONCRETE ENCASED MITERED PIPE BEND
(VERTICAL OR HORIZONTAL BENDS)



BANDED MITERED PIPE BEND WITH BLOCKING
(HORIZONTAL BENDS)

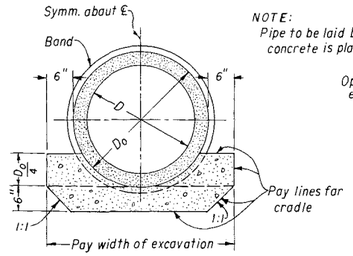


BANDED MITERED PIPE BEND WITH CAP
(VERTICAL BEND-DOWNWARD DEFLECTION)

BAND THICKNESS DATA

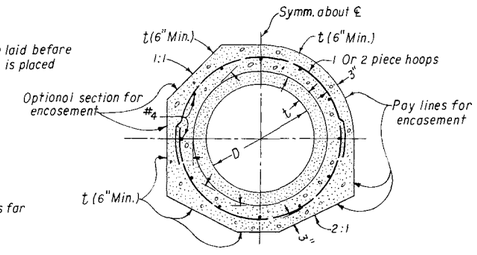
PIPE DIA. (inches)	a	PIPE DIA. (inches)	a
12",15",18"	1	54"	1¾
24"	1	60"	1¾
30"	1	66"	2
36"	1⅛	72"	2
42"	1⅜		
48"	1½		

"a"= Min. band thickness in inches

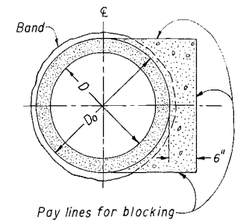


SECTION A-A
(CRADLE)

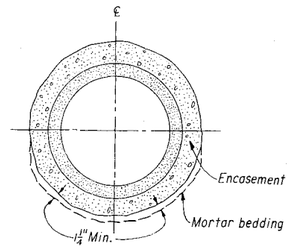
NOTE:
Pipe to be laid before concrete is placed



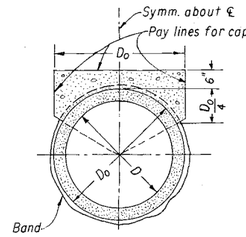
SECTION B-B
(ENCASEMENT)



SECTION C-C
(BLOCKING)



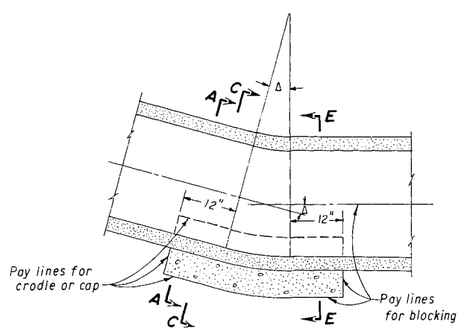
SECTION D-D
(REINF. NOT SHOWN)



SECTION E-E
(CAP)

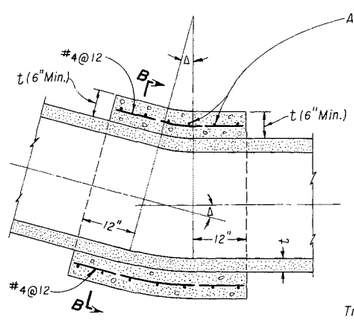
NOTES

Lap all bars 36 diameters at splices, unless otherwise shown.
A precast elbow of approved design may be substituted for any mitered bend shown on the drawings.
Bend treatment shall be provided as shown on the drawings regardless of the type of bend used.
Elevation of compacted backfill for banded vertical pipe bends shall be the same as the elevation of compacted backfill specified for the adjacent pipe.
Bonded horizontal pipe bends shall have compacted backfill to the top of the pipe or blocking.
Encased pipe bends shall have compacted backfill to the top of the encasement.
Banded vertical pipe bends with cradles shall have compacted backfill to the top of the cradle.
Compacted backfill about the pipe bends shall extend horizontally from the elevation specified above to the existing ground surface as excavated.
Where concrete or mortar encased pipe bends are not constructed in place on firm foundation, lean concrete or mortar bedding shall be provided so that the load is equally distributed over O.D. of pipe + 12".

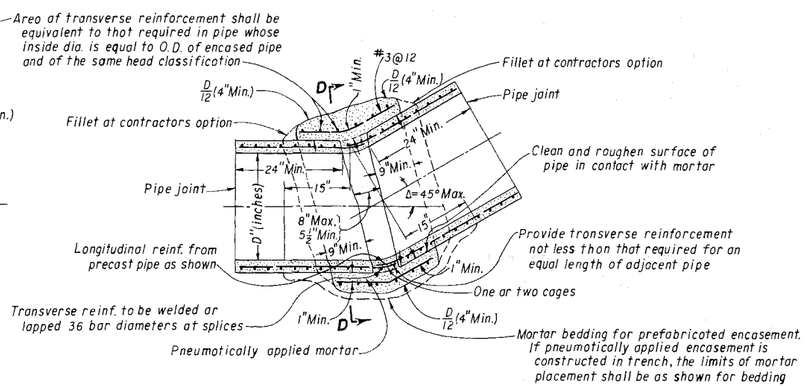


PRECAST ELBOWS WITH CRADLE, CAP OR BLOCKING
(Inverted for cap - See Section E-E)

NOTE:
Δ Angle as shown on profile



ENCASED PRECAST ELBOWS



PNEUMATICALLY APPLIED MORTAR ENCASED MITERED PIPE BEND
(ALTERNATIVE TO CONCRETE ENCASED MITERED PIPE BEND)

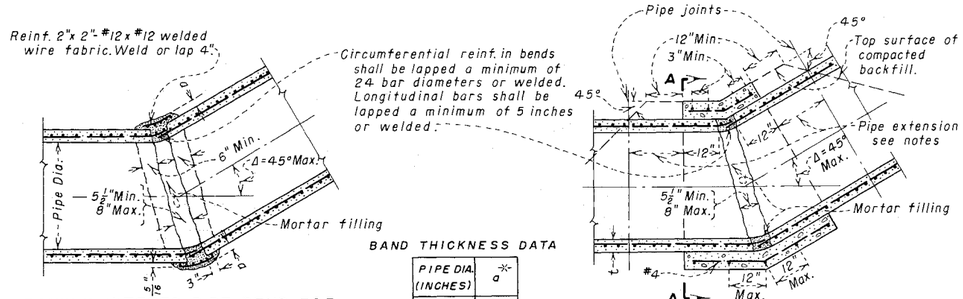
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PRECAST CONCRETE PIPE BENDS 12" TO 72" DIAMETER - HEAD = 0' TO 100'

C-162.22

DRAWN L.P.B. SUBMITTED
TRACED H.M.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO



BANDED MITERED PIPE BEND FOR REINFORCED CONCRETE PRESSURE PIPE

ENCASED MITERED PIPE BEND FOR REINFORCED CONCRETE PRESSURE PIPE

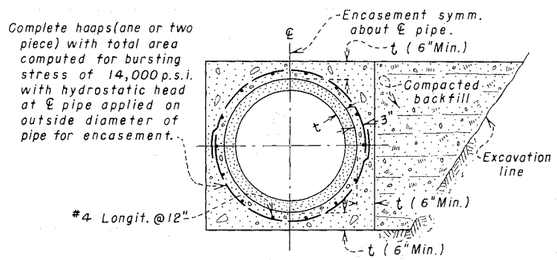
BAND THICKNESS DATA

PIPE DIA. (INCHES)	* a
15	1
18	1
24	1
27	1
30	1
36	1⅛

* a = Min. band thickness in inches.

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Compact backfill to top of encasement at all bends.
Elevation of compacted backfill for banded mitered pipe bends shall be the same as the elevation of compacted backfill specified for the adjacent pipe.
Pipe extension shall be 18" max. when D ≤ 36" and ½ D max. when D > 36".
Encase all miter bends when D ≥ 42".



SECTION A-A

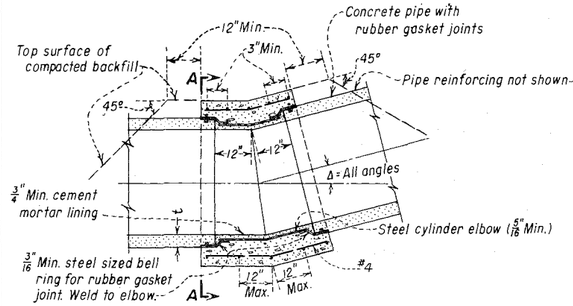
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

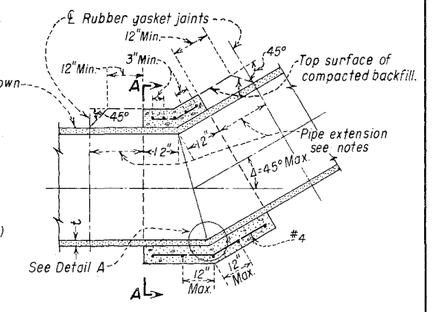
BENDS FOR PRECAST CONCRETE PRESSURE PIPE

C162.23

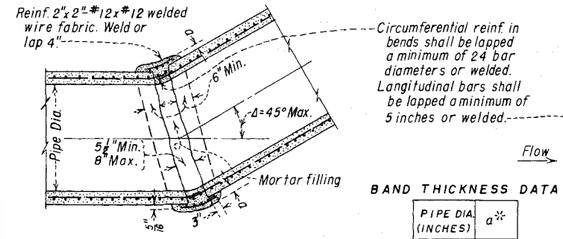
DRAWN S.E.M. SUBMITTED
TRACED E.V.C. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,



MORTAR LINED FABRICATED STEEL BEND FOR REINFORCED CONCRETE PRESSURE PIPE OR PRETENSIONED CONCRETE PIPE



ENCASED MITERED PIPE BEND FOR PRETENSIONED CONCRETE PIPE

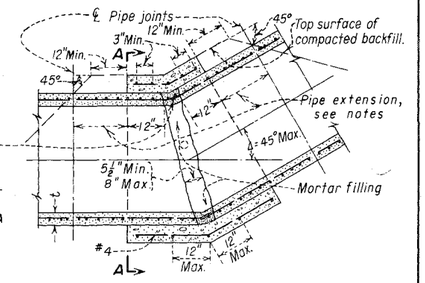


BANDED MITERED PIPE BEND FOR REINFORCED CONCRETE PRESSURE PIPE

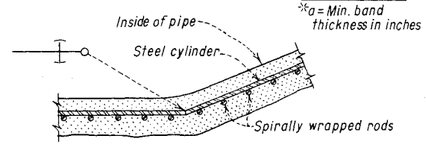
BAND THICKNESS DATA

PIPE DIA. (INCHES)	a*
15	1
18	1
24	1
27	1
30	1
36	1 1/8

*a = Min. band thickness in inches



ENCASED MITERED PIPE BEND FOR REINFORCED CONCRETE PRESSURE PIPE



DETAIL A

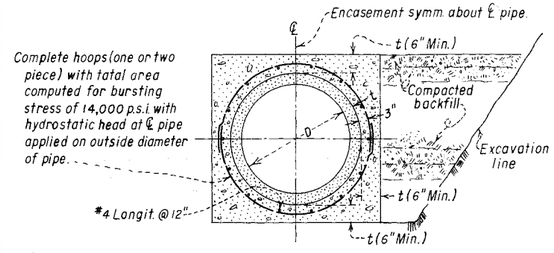
NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123

Compact backfill to top of encasement at all bends.

Elevation of compacted backfill for banded mitered pipe bends shall be the same as the elevation of compacted backfill specified for the adjacent pipe.

Pipe extension shall be 18" max. when D ≤ 36" and 1/2 D max. when D > 36"



SECTION A-A

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

BENDS FOR PRESSURE PIPE AND PRETENSIONED CONCRETE PIPE

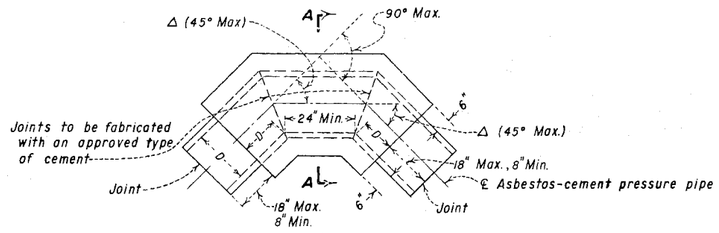
DRAWN F.L.A. SUBMITTED

TRACED S.C.S. RECOMMENDED

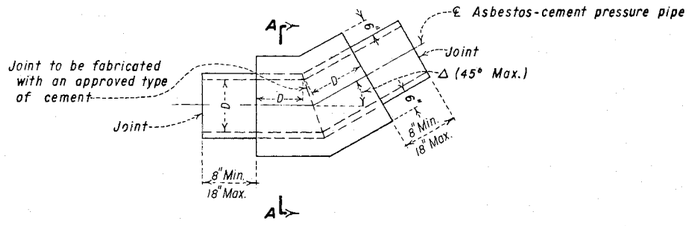
CHECKED APPROVED
CHIEF CANALS BRANCH

DENVER, COLORADO,

C 162.24



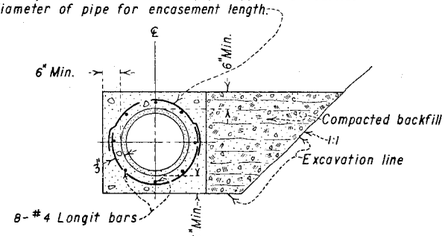
TYPICAL BEND (90° MAX.)



TYPICAL BEND (45° MAX.)

HORIZONTAL OR VERTICAL BENDS

Complete hoops (one or two pieces) with total area computed for bursting stress of 14,000 p.s.i. with hydrostatic head at ℄ pipe applied on outside diameter of pipe for encasement length.



SECTION A-A

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Compact backfill to top of encasement at all bends.

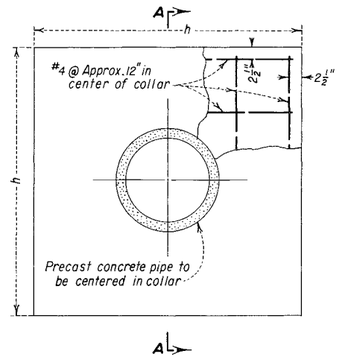
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

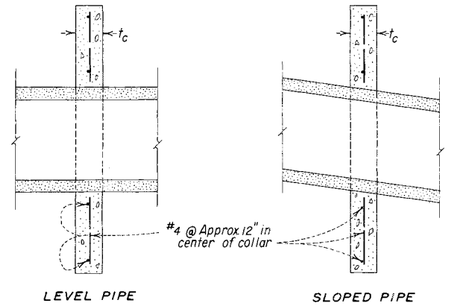
BENDS FOR ASBESTOS-CEMENT PRESSURE PIPE

C 162-25

DRAWN W.A.K. SUBMITTED
TRACED L.A.C. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,



ELEVATION



SECTION A-A

DIMENSIONS AND ESTIMATED QUANTITIES

PIPE DIA.	h	t_c	CONC. CU.YD.	REINF. LBS.
18"	5'-0"	6"	0.4	33
21"	5'-3"	6"	0.4	35
24"	5'-6"	6"	0.5	44
27"	6'-3"	6"	0.7	50
30"	7'-0"	6"	0.8	62
36"	8'-6"	6"	1.2	96
42"	9'-3"	8"	1.8	100
48"	10'-0"	8"	2.2	120
54"	11'-6"	8"	2.7	170
60"	12'-0"	8"	2.9	180

NOTE

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

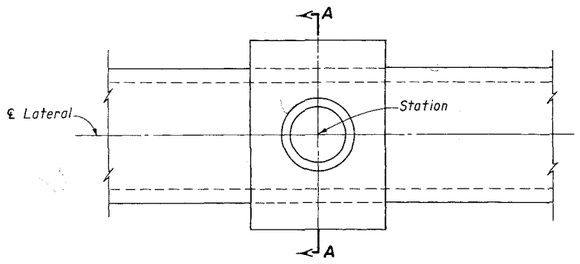
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE COLLAR DETAILS

C 162.40

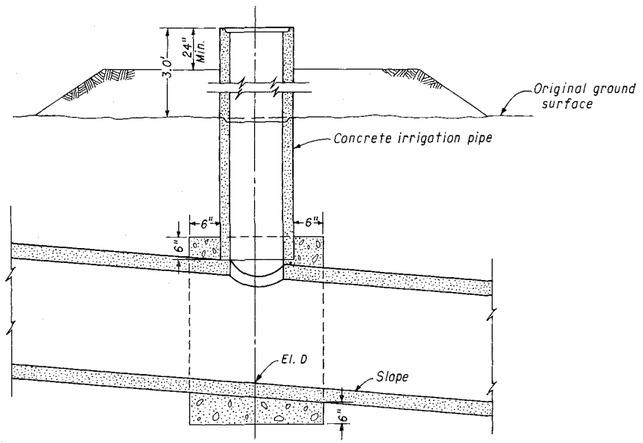
DRAWN _____ SUBMITTED _____
TRACED D.J.P. RECOMMENDED _____
CHECKED _____ APPROVED _____ CHIEF, CANALS BRANCH



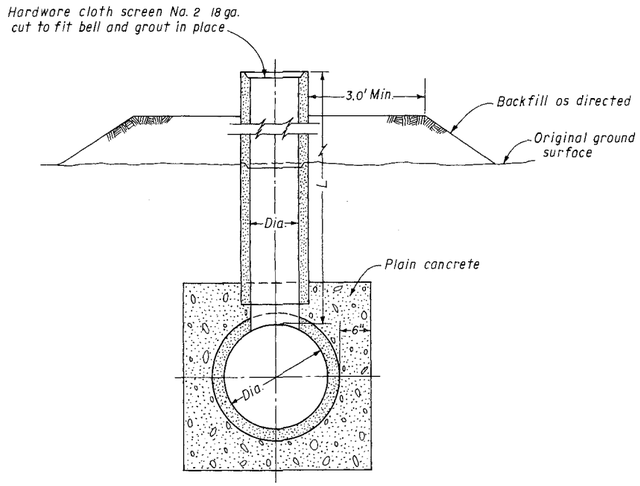
PLAN

TABLE OF LOCATIONS AND ELEVATIONS

LATERAL	STATION	ELEVATION	PIPELINE		PIPE VENT		CONC. CU. YDS.	REMARKS
		D	Dia.	Slope	Dia.	L		



LONGITUDINAL SECTION



SECTION A-A

NOTES

Clean and roughen all pipe surfaces encased in concrete.
For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.

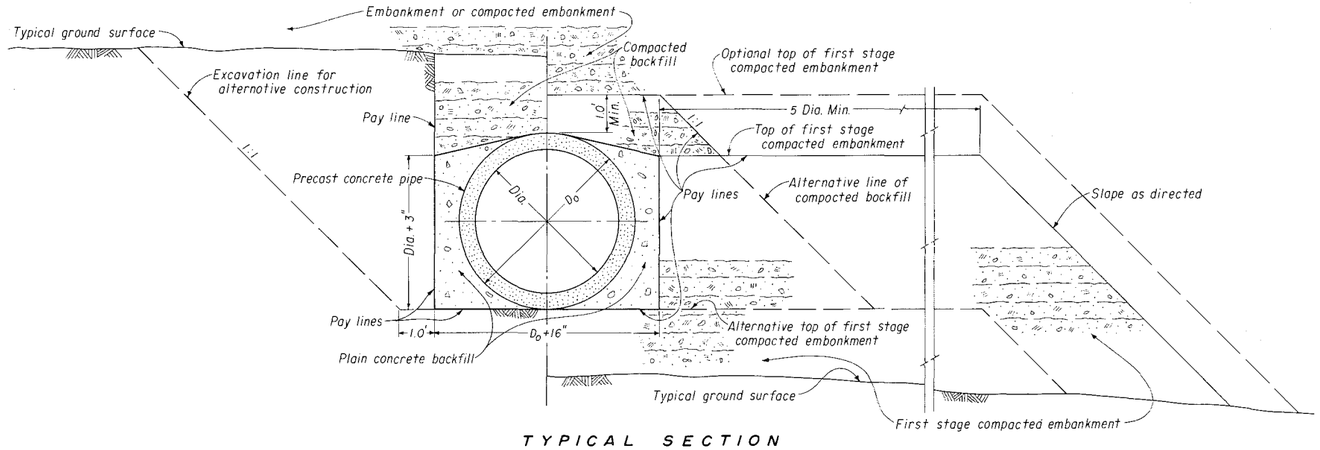
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

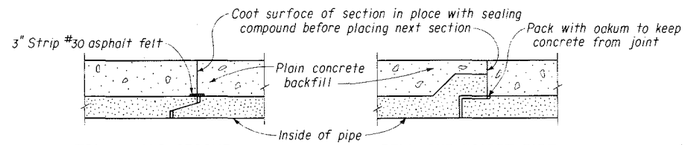
CONCRETE PIPE VENT

C-162-50

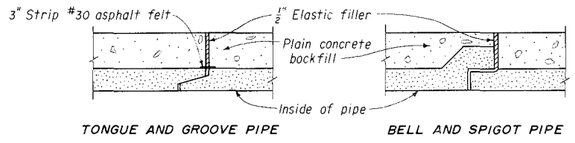
DRAWN W.A.K. SUBMITTED
TRACED J.S.N. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,



TYPICAL SECTION



CONCRETE BACKFILL JOINT
(Not to exceed 32.0' spacing)



CONCRETE BACKFILL JOINT WITH ELASTIC FILLER
(Use in lieu of concrete backfill joint where foundation changes from rock to soil and within 18' of structures)

NOTE

Pay lines apply to concrete and earthwork based on trenching method of installation. Optional or alternative construction to be paid for on the basis of pay lines shown.

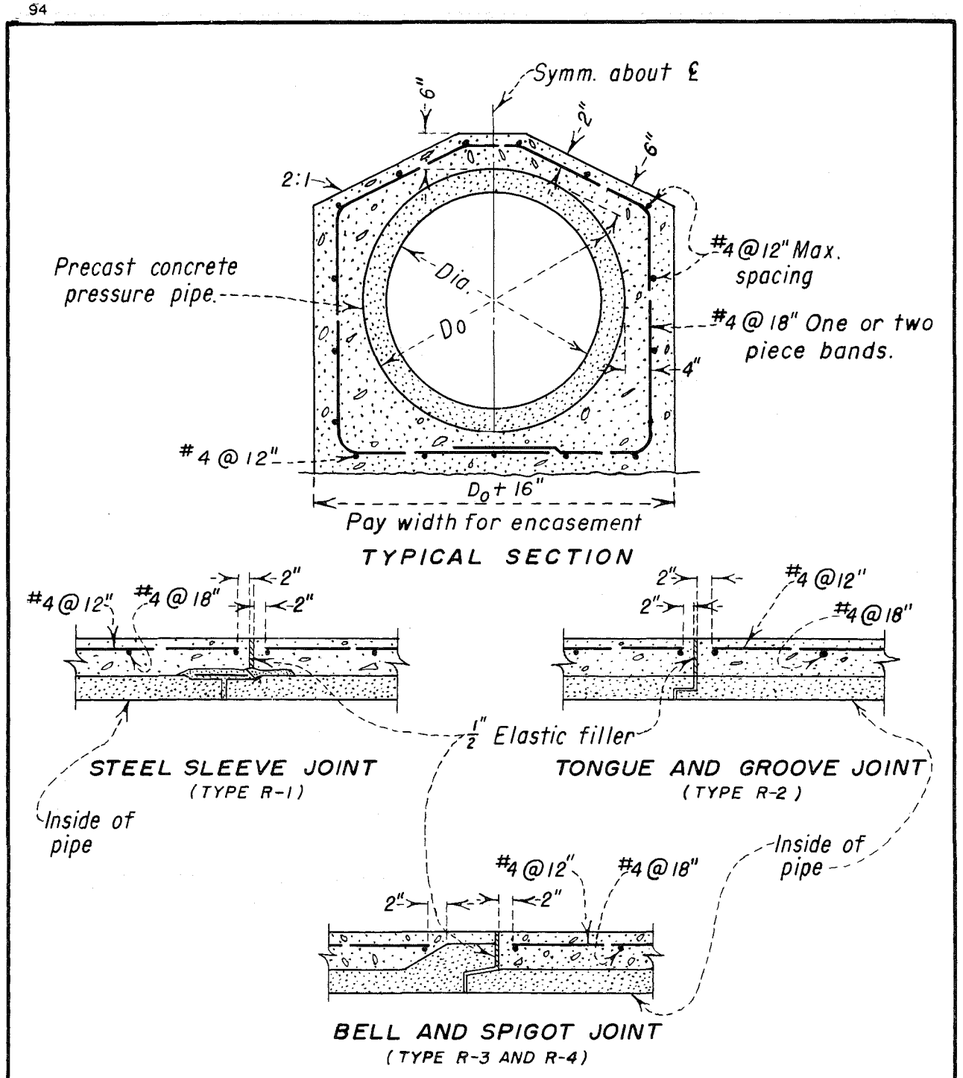
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CONCRETE BACKFILL UNDER EMBANKMENT

C 162.60

DRAWN L.F.W.-J.W.W. SUBMITTED
TRACED P.E.F. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO



TYPICAL SECTION

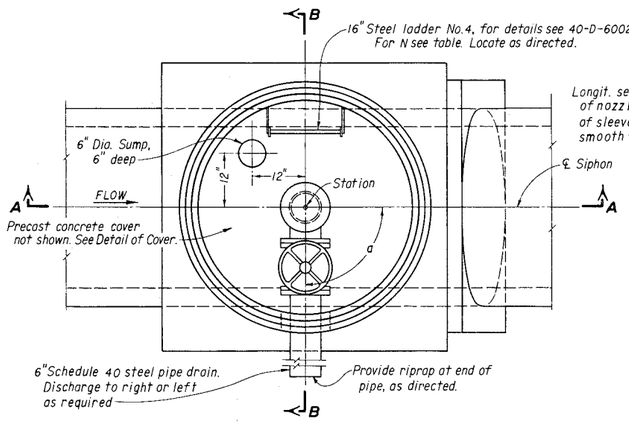
SECTIONS THROUGH TYPICAL JOINTS

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

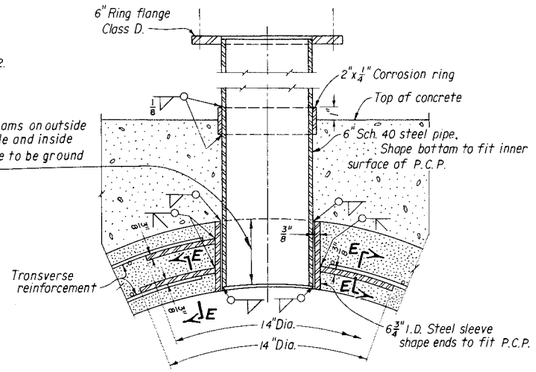
PRECAST CONCRETE PRESSURE PIPE
REINFORCED CONCRETE ENCASEMENT

C 162.70

DRAWN K.E.E. SUBMITTED
TRACED S.W.M. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER COLO.

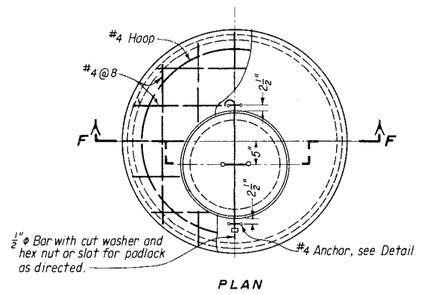


PLAN



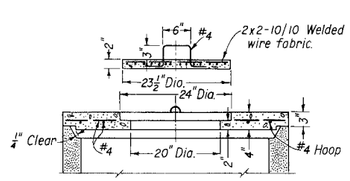
TWO LAYER REINF. STEEL ONE LAYER REINF. STEEL

SECTION C-C



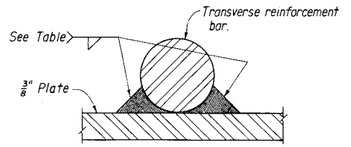
PLAN

DATA						ESTIMATED QUANTITIES			
WATERWAY	STATION	PIPE DIA.	α	RT. or LT.	L (FT.)	N	CONCRETE (CU. YDS.)	REINF. STEEL (LBS.)	48" P.C.P. (LIN. FT.)	MISC. METAL (LBS.)



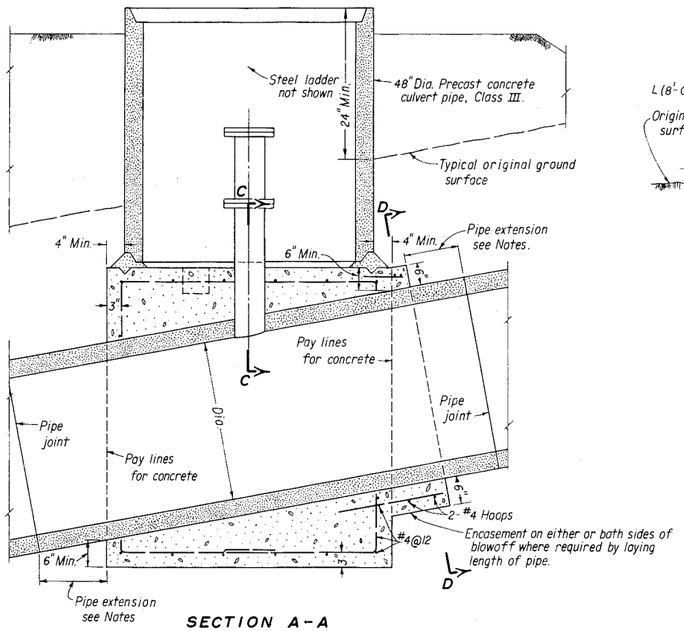
SECTION F-F

DETAIL OF COVER



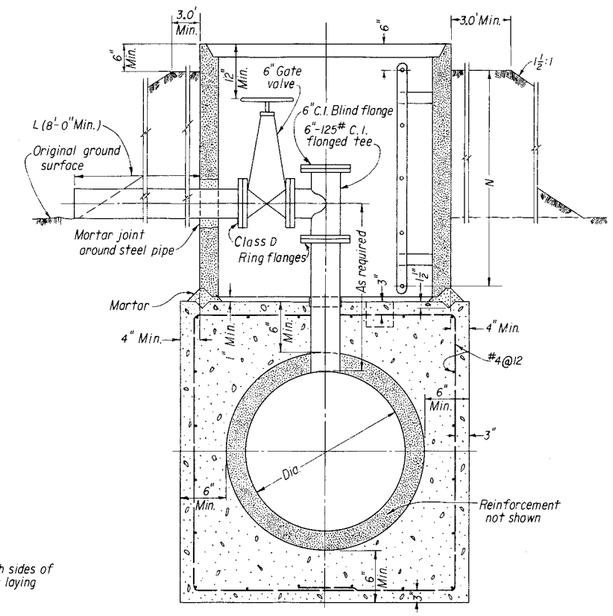
SECTION E-E

REINF. BAR	FILLET SIZE	LENGTH (IN.)
#4	1/4"	2
#5	1/4"	2
#6	1/4"	2
#7	5/16"	2
#8	5/16"	3
#9	5/16"	3 1/2
#10	3/8"	4
#11	3/8"	4 1/2

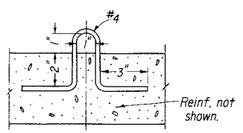


SECTION A-A

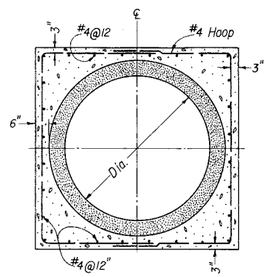
(DIA. = 24" OR LARGER)



SECTION B-B



DETAIL OF ANCHOR



SECTION D-D

NOTES

For general notes and minimum requirements for detailing Reinf., see 40-D-6123.
Pipe extension (Sec. A-A) shall be 18" Max. when Dia. ≤ 36" and 1/2 Dia. Max. when Dia. ≥ 36".
Gate valve shall be nonrising stem, double disc.
Steel pipe to be lined with either cement mortar or coal tar enamel.
Where large size transverse reinforcement bars are used, the diameter of collars at blowoff shall be increased to provide the required length of fillet weld.

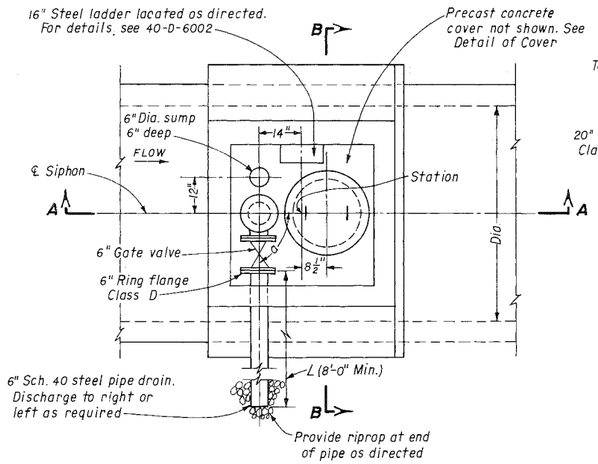
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

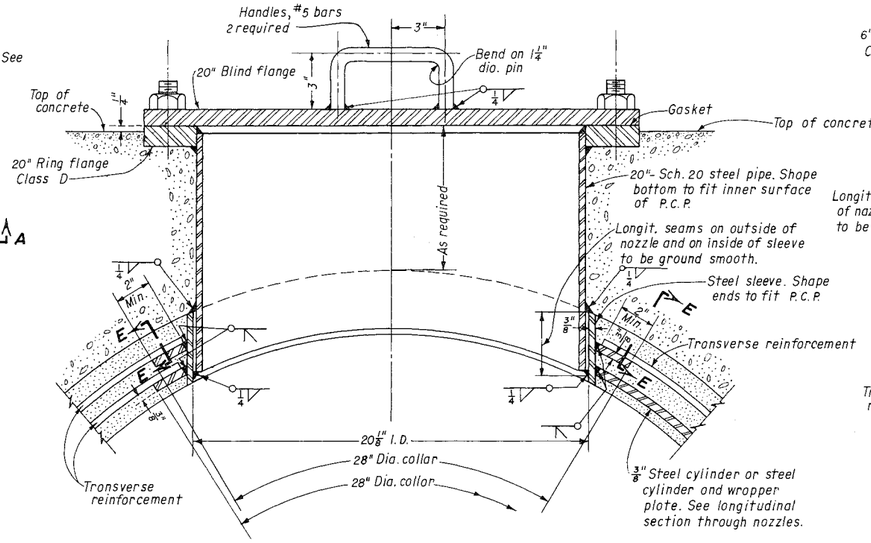
BLOWOFF
NON-CYLINDER PRECAST CONCRETE PIPE

DRAWN W.E.J. SUBMITTED
TRACED W.D.B. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

C 63.10

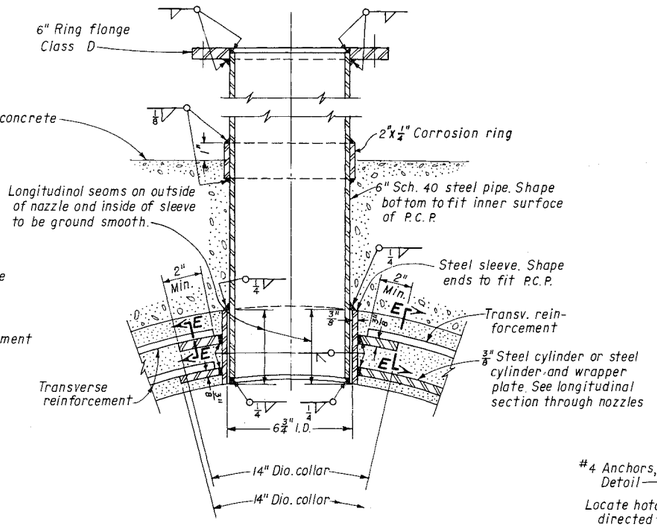


PLAN OF MANHOLE AND BLOWOFF



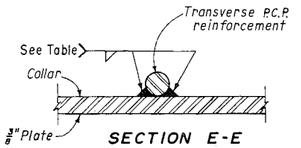
NON-CYLINDER CYLINDER

SECTION C-C



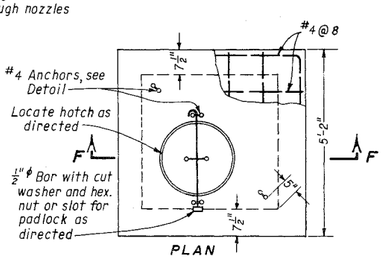
NON-CYLINDER CYLINDER

SECTION D-D

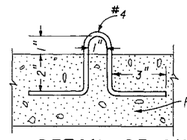


SECTION E-E

REINF. BAR	FILLET SIZE	LENGTH (IN.)
#4 or #5	¼	2
#6	¼	2
#7	5/16	2
#8	5/16	3
#9	5/16	3½
#10	⅜	4
#11	⅜	4½



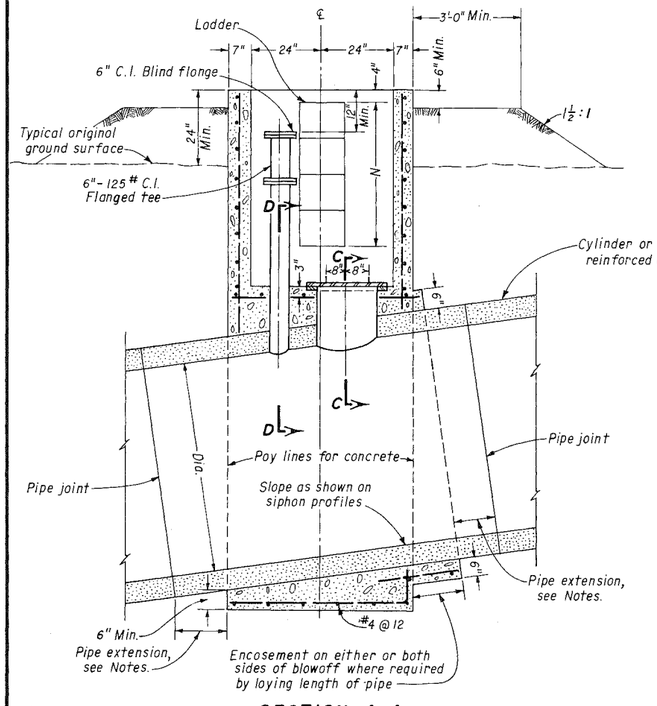
PLAN



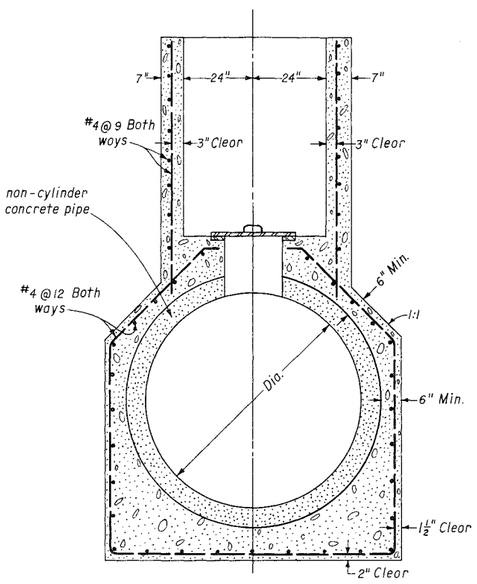
DETAIL OF ANCHOR

SECTION F-F

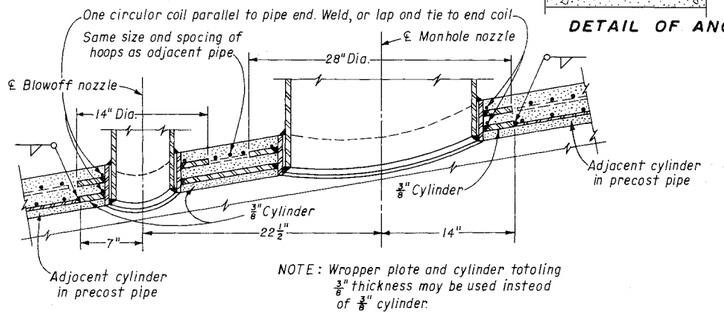
DETAIL OF COVER



SECTION A-A



SECTION B-B



NOTE: Wrapper plate and cylinder totaling ¾" thickness may be used instead of ⅜" cylinder.

LONGITUDINAL SECTION THROUGH NOZZLES

DATA						
WATERWAY	STATION	DIA. OF PIPE	α	RT. OR LT.	L	N

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Pipe extension (Sec. A-A) shall be 18" max. when dia. ≤ 36" and ½ dia. max. when dia. ≥ 36".
Steel pipe to be lined with either cement mortar or coal tar enamel.
Gate valve shall be nonrising stem, double disk.
Where large size traverse reinforcement bars are used, the diameters of collars at blowoff and manhole shall be increased to provide the required length of fillet weld.
Where "α" exceeds 90°, the locations of blowoff and manhole shall be reversed.

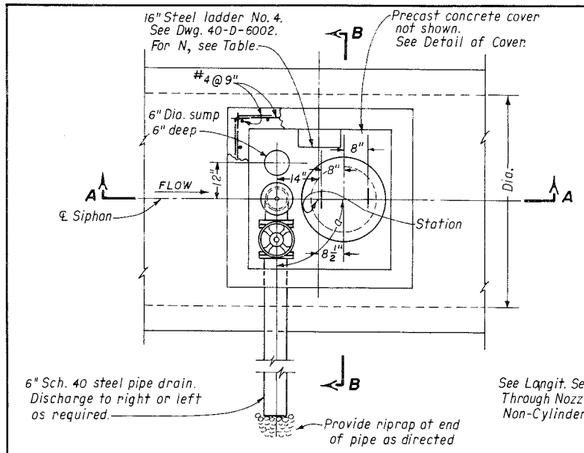
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

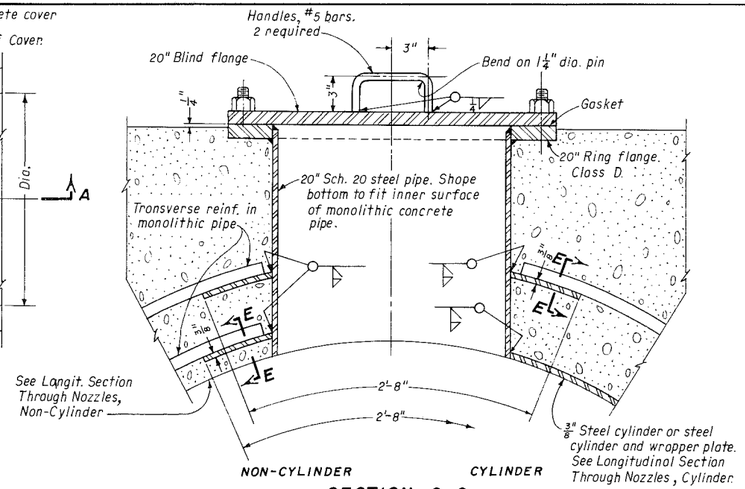
MANHOLE AND BLOWOFF CYLINDER AND NON-CYLINDER PIPE

C 163.20

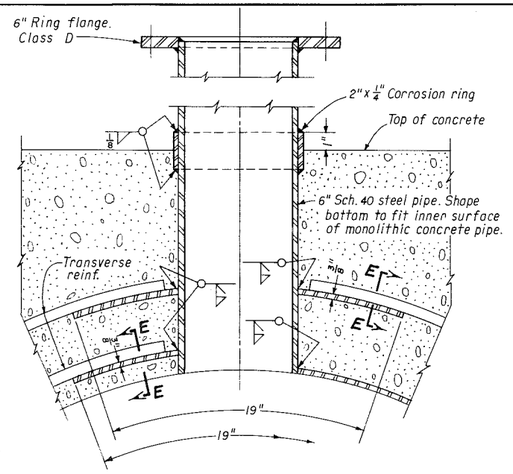
DRAWN J.O.G. SUBMITTED
TRACED J.S.M. JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.



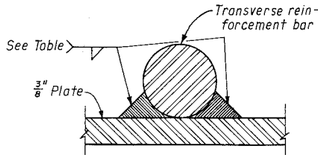
PLAN OF BLOWOFF



SECTION C-C



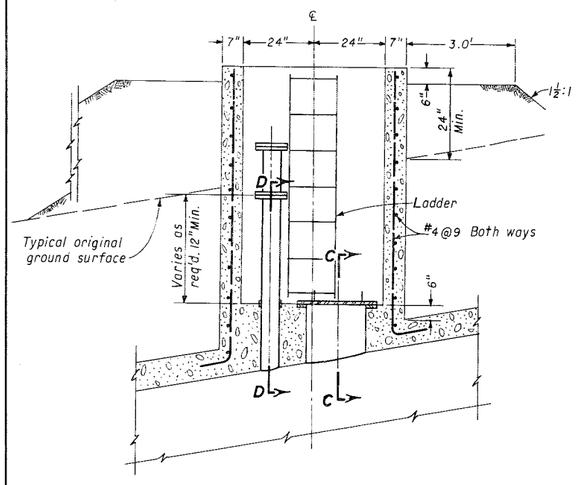
SECTION D-D



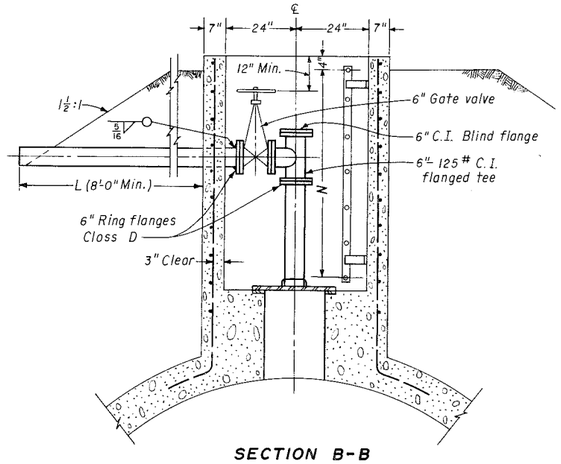
SECTION E-E

REINF. BAR	FILLET SIZE	LENGTH (IN.)
#4 or #5	¼	2
#6	¼	2
#7	5/16	2
#8	5/16	3
#9	5/16	3½
#10	⅜	4
#11	⅜	4½

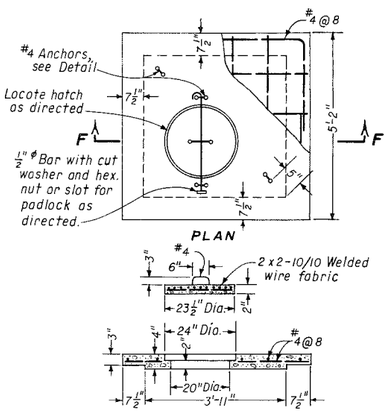
DATA							ESTIMATED QUANTITIES		
WATERWAY	STATION	PIPE DIA.	Q	RT. OR LT.	L (FT.)	N	CONC. (CU. YDS.)	REINF. STEEL (LBS.)	MISC. METAL (LBS.)



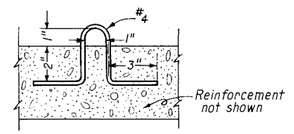
SECTION A-A



SECTION B-B



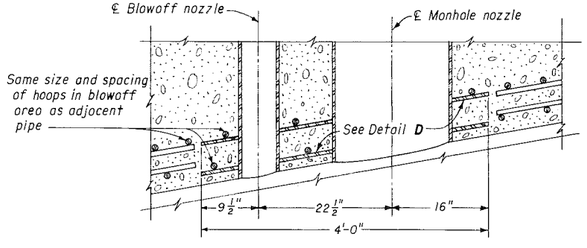
SECTION F-F
DETAIL OF COVER



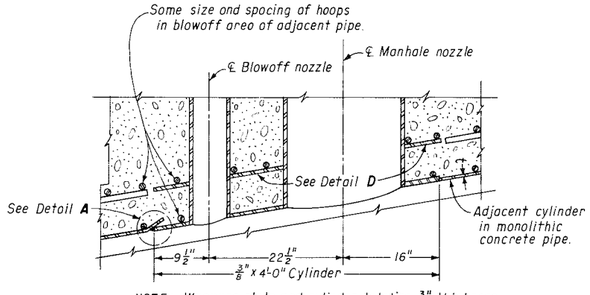
DETAIL OF ANCHOR

NOTES

For general notes and minimum requirements for detailing reinforcement, see 40-D-6123.
Steel pipe to be lined with either cement mortar or coal tar enamel.
Gate valve shall be nonrising stem, double disc.
Where "θ" exceeds 90°, the locations of blowoff and manhole shall be reversed.

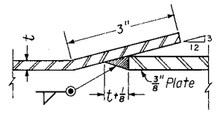


LONGITUDINAL SECTION THROUGH NOZZLES, NON-CYLINDER

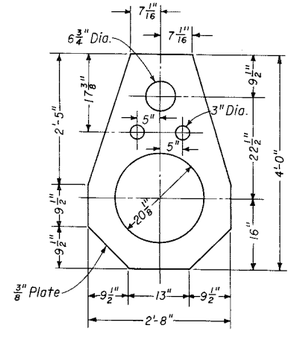


NOTE: Wrapper plate and cylinder totaling ⅜" thickness may be used instead of ¾" cylinder.

LONGITUDINAL SECTION THROUGH NOZZLES, CYLINDER



DETAIL A



Longitudinal dimensions given are for pipe with zero slope. Dimensions must be lengthened proportionally for sloping pipe.

DETAIL D

ALWAYS THINK SAFETY

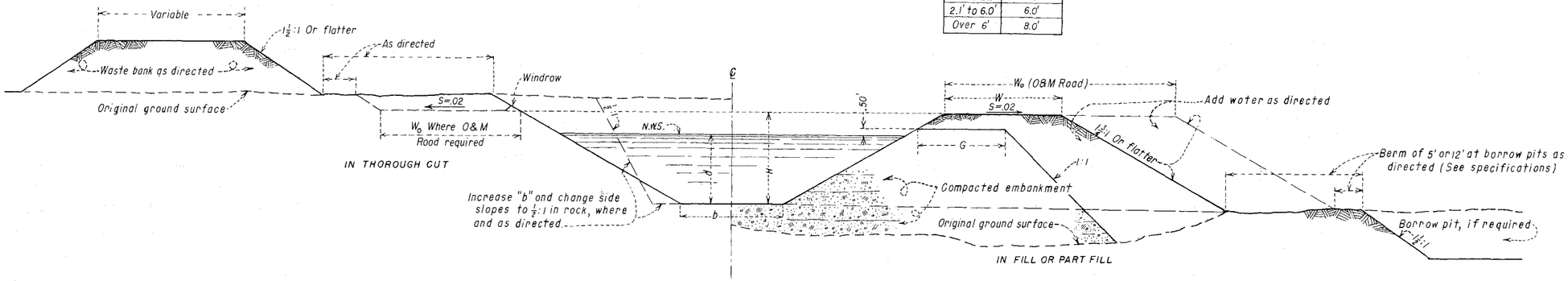
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

MANHOLE AND BLOWOFF
MONOLITHIC CONCRETE PIPE

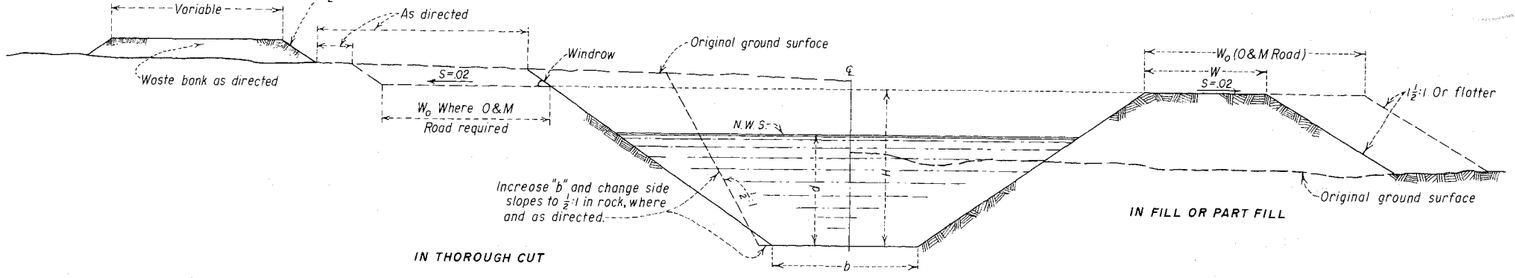
C183.30

DRAWN J.E.J. SUBMITTED
TRACED J.S.M.JR. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO

d	G
0 to 2.0'	3.0'
2.1' to 6.0'	6.0'
Over 6'	8.0'



TYPICAL UNLINED LATERAL SECTION



TYPICAL WASTEWAY AND DRAIN SECTION

NOTES

For values of b and d, minimum values of H, W, and W_o, and for location of O&M Roads, see Plans and Profiles of waterways.
Section designations, as shown on profiles; Section 224-1.2 indicates b=2', H=2.4' and d=1.2'; Section 1260-4.0 indicates b=12', H=6.0' and d=4.0'.

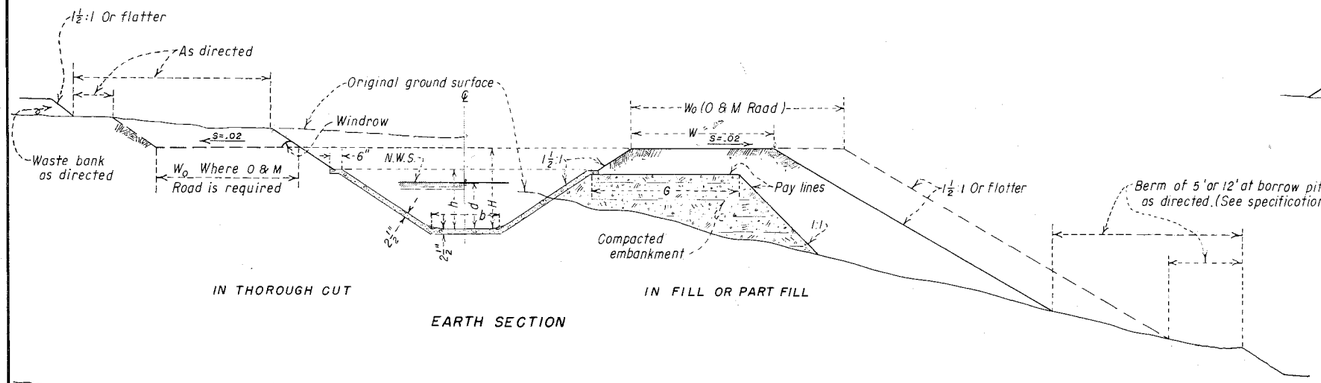
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

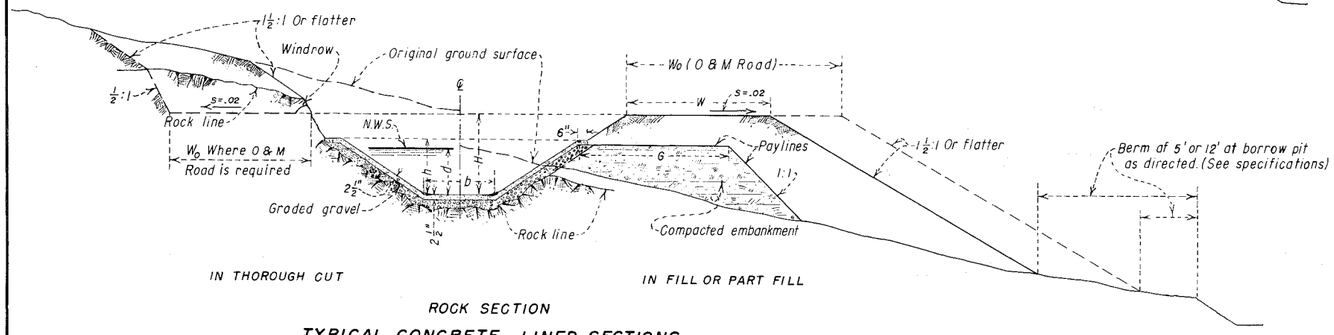
TYPICAL LATERAL, WASTEWAY, AND DRAIN SECTIONS

C 170.10

DRAWN R.E.C. SUBMITTED
TRACED C.W.G. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO



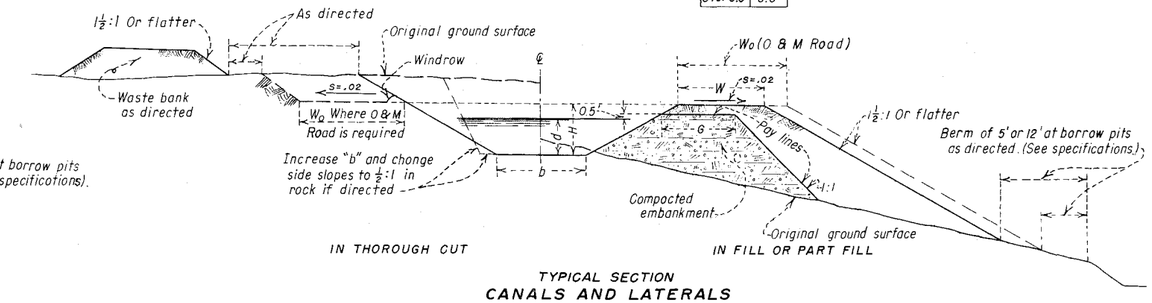
EARTH SECTION



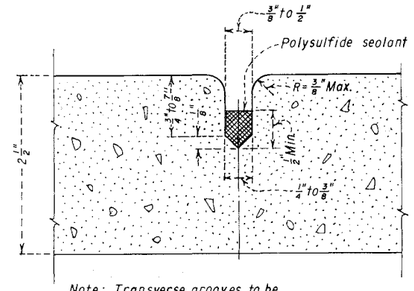
ROCK SECTION

TYPICAL CONCRETE LINED SECTIONS

d	G
0 to 2.0'	3.0'
2.1 to 6.0'	6.0'
Over 6.0'	8.0'

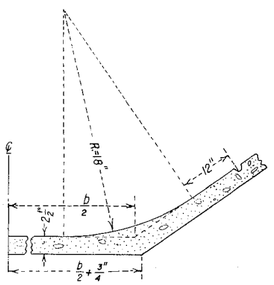


TYPICAL SECTION
CANALS AND LATERALS

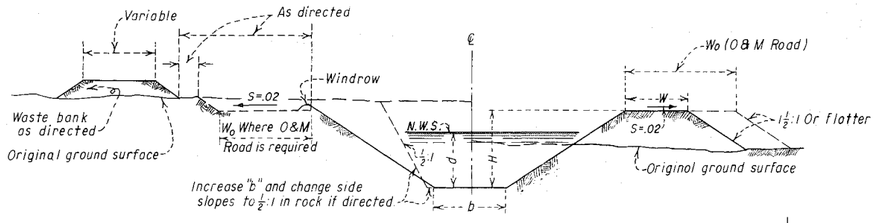


Note: Transverse grooves to be spaced at 10' maximum.

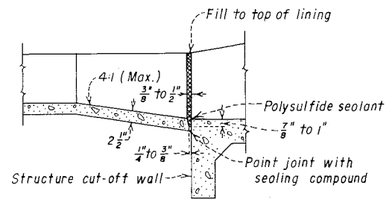
GROOVE DETAIL



LONGITUDINAL GROOVE DETAIL
(Required when d > 4.0')



TYPICAL WASTEWAY SECTION



TYPICAL JOINT DETAIL
Concrete lining to structure

NOTES

For values of b and d, minimum values of H, W and Wo and for location of O & M Roads, see plans and profiles of waterways.

Unlined Section Designations:
First figure of section designation as shown on profiles indicates finished base width, b. Second and third figures indicate finished bank height, H, in feet and tenths. Figures following section designation are, water depth: ie., Section 220-1.0 shows b of 2', H of 2.0' and water depth of 1.0'.

Lined Section Designations:
First figure of section designation as shown on profiles indicates finished base width, b. The letter indicates height of lining, h, as shown in each table of sections. Figures following section designation are water depth. Typical designation: 3f - 2.0'.

REFERENCE DRAWINGS

SAFETY LADDERS _____

ALWAYS THINK SAFETY

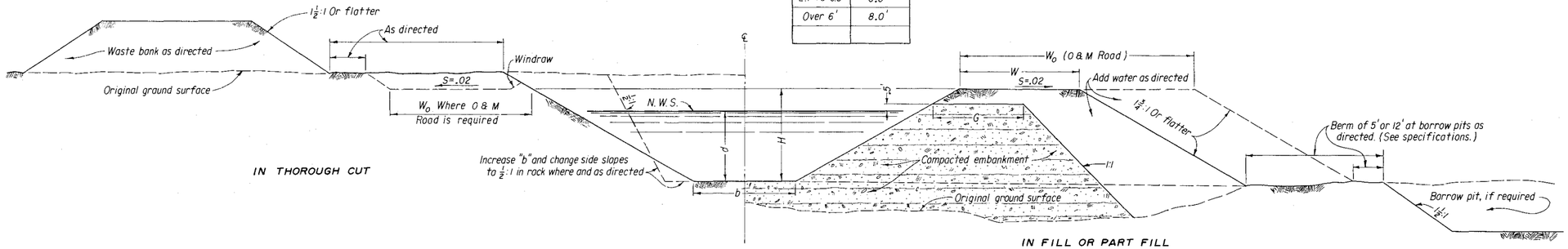
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TYPICAL SECTIONS FOR CANALS, LATERALS AND WASTEWAYS

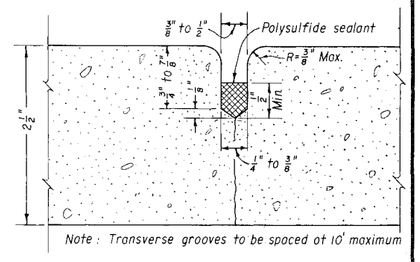
C-170.20

DRAWN W.A.K. SUBMITTED _____
TRACED J.A.H. RECOMMENDED _____
CHECKED _____ APPROVED _____
CHIEF, CANALS BRANCH
DENVER, COLORADO

d	G
0 to 2.0'	3.0'
2.1' to 6.0'	6.0'
Over 6'	8.0'

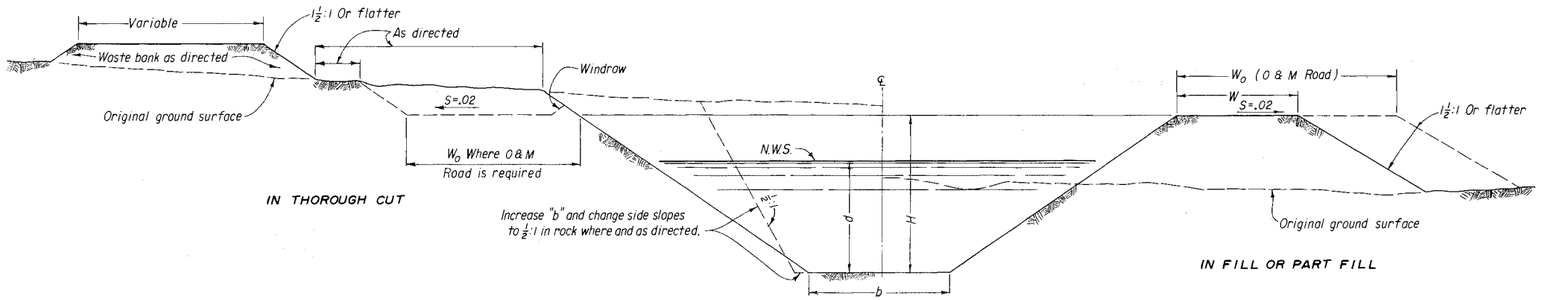


TYPICAL UNLINED LATERAL SECTION

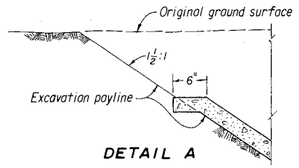


Note : Transverse grooves to be spaced at 10' maximum

GROOVE DETAIL



TYPICAL WASTEWAY AND DRAIN SECTION



DETAIL A

NOTES

For values of b and d, minimum values of H, W and W_0 and for location of O & M Roads, see Plans and Profiles of waterways.

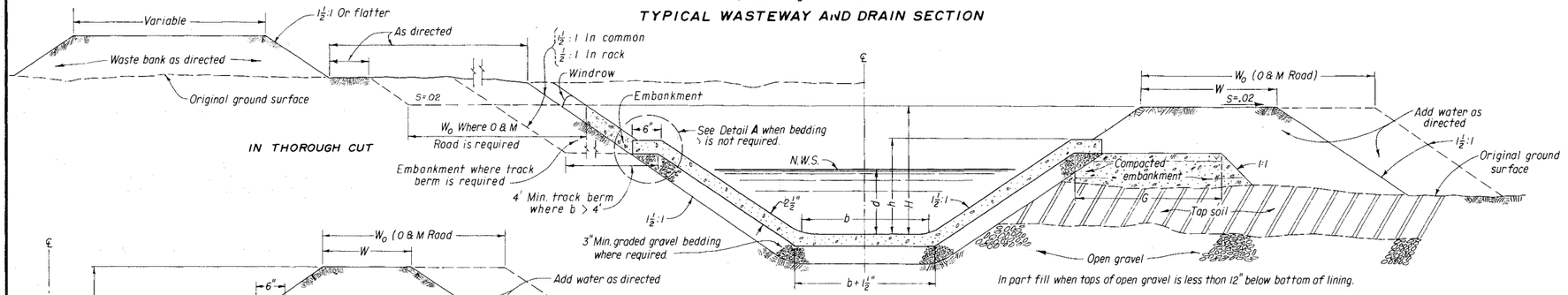
Unlined Section

Section designations, as shown on Plans and Profiles: Section 224-1.2 indicates b=2', H=2.4' and d=1.2', Section 1260-4.0 indicates b=12', H=6.0' and d=4.0'.

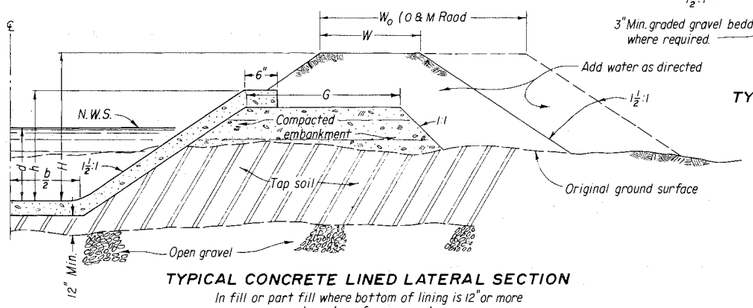
Concrete Lined Section

Section designations as shown on Plans and Profiles: Section 3f-2.0 indicates b=3', f=code for h (actual value shown in table of Hydraulic Properties).

For details of safety ladders, see 40-D-5927, or 40-D-6112.

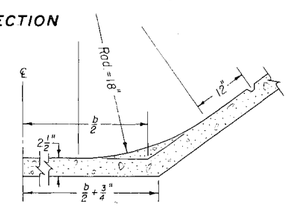


TYPICAL CONCRETE LINED LATERAL SECTION



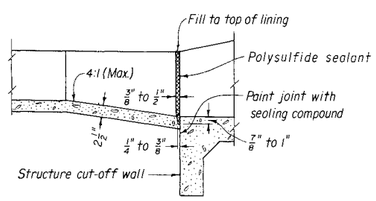
TYPICAL CONCRETE LINED LATERAL SECTION

In fill or part fill where bottom of lining is 12" or more above top of open gravel.



LONGITUDINAL GROOVE DETAIL

(Required when d > 4.0')



TYPICAL JOINT DETAIL

Concrete lining to structure

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TYPICAL LATERAL, WASTEWAY, AND DRAIN SECTIONS

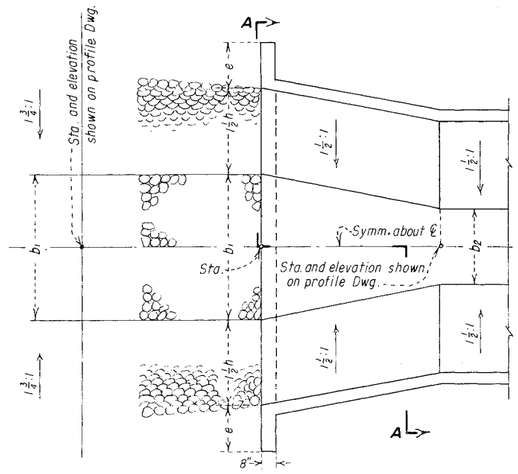
C 170.30

DRAWN R.E.C. SUBMITTED

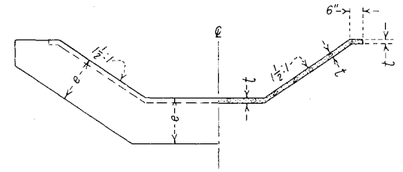
TRACED W.O.A. RECOMMENDED

CHECKED APPROVED CHIEF, CANALS BRANCH

DENVER, COLORADO



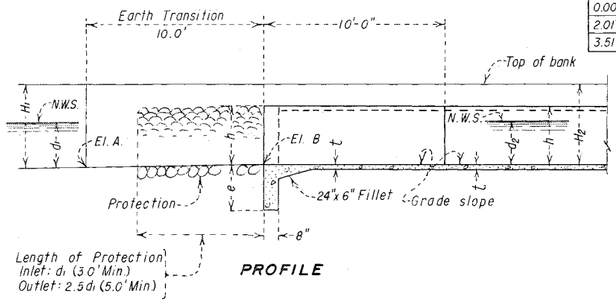
PLAN



SECTION A-A

PROTECTION

d_1	TYPE	
	INLET	OUTLET
0.00' TO 2.00'	None	None
2.01' TO 3.50'	None	6" Coarse gravel
3.51' TO 7.00'	6" Coarse gravel	12" Coarse gravel



PROFILE

LATERAL	STATION	INLET OR OUTLET	ELEVATIONS A	ELEVATIONS B	d_1	d_2	H_1	H_2	h	b_1	b_2	e	t

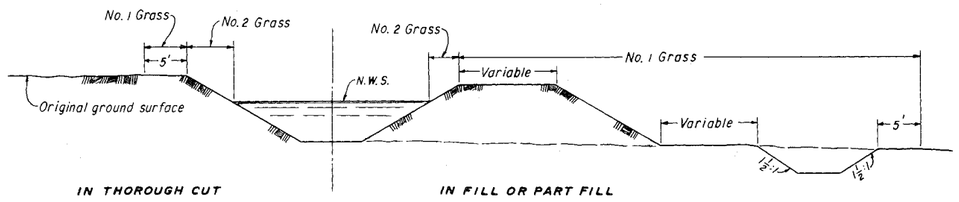
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

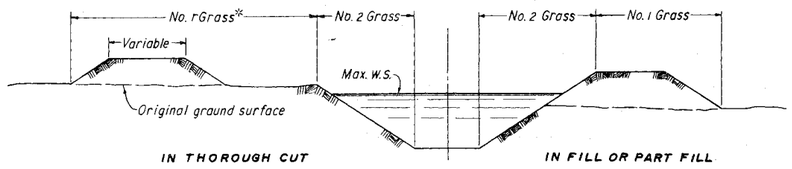
TRANSITIONS FOR CONCRETE LINING

C-170.40

DRAWN D.E.C. SUBMITTED
TRACED J.A.H. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO.



TYPICAL LATERAL SECTION



* Seed 5' Outside ditch when there is no waste bank.

TYPICAL WASTEWAY SECTION

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SEEDING
TYPICAL SECTIONS

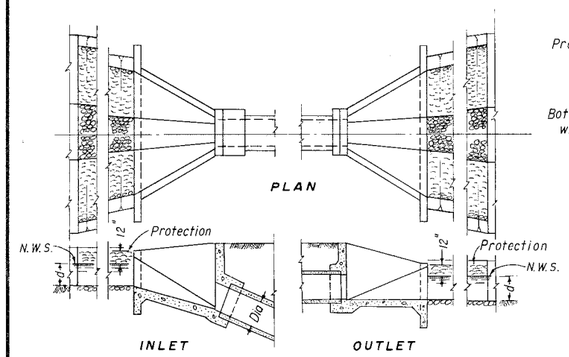
C-170.50

DRAWN W.A.K. SUBMITTED

TRACED H.M.O. RECOMMENDED

CHECKED APPROVED
CHIEF, CANALS BRANCH

DENVER, COLORADO.

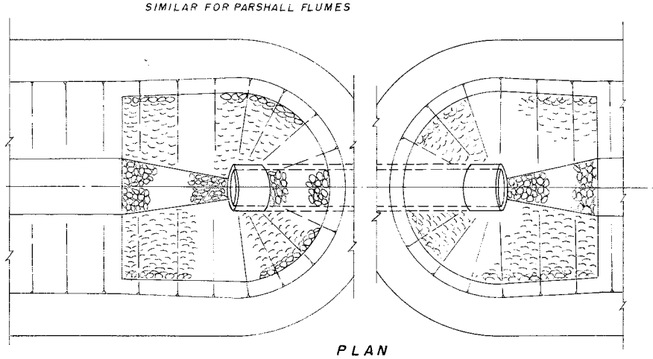


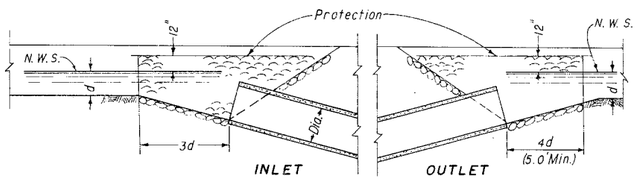
LENGTH OF PROTECTION		
STRUCTURE	INLET	OUTLET
IN-LINE	d_1(3.0' Min.)	$2.5d_1$(5.0' Min.)
DRAINAGE	$2.5d_1$(5.0' Min.)	See table

LONGITUDINAL SECTION

CONCRETE INLET OR OUTLET TRANSITIONS

SIMILAR FOR PARSHALL FLUMES

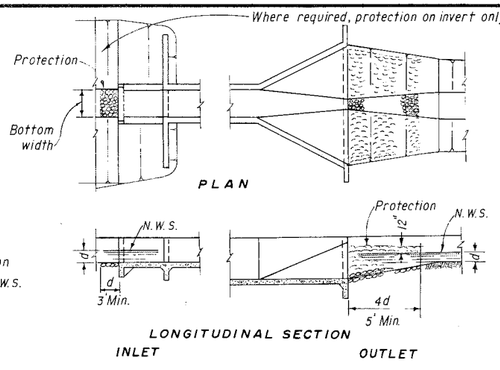




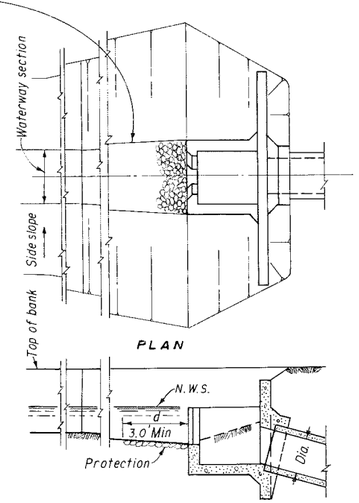
LONGITUDINAL SECTION

Use for inlet and outlet of road crossings, pipe drops, discharge pipes from constant head orifice and pipe turnouts. Not required when delivering to farm unit from any pipe or to weir pool from turnout.

PIPE INLET OR OUTLET



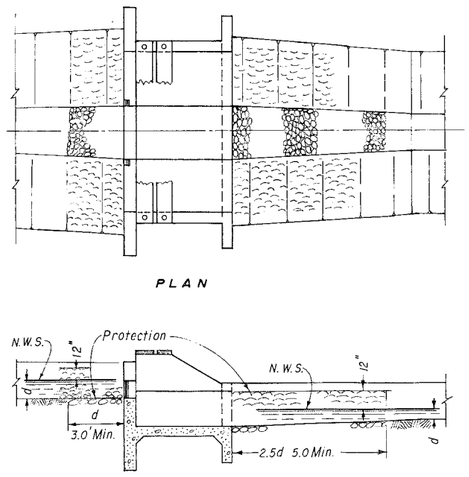
RECTANGULAR INCLINED DROP OR CHUTE



LONGITUDINAL SECTION

CONTROL AND PIPE INLET SHOWN

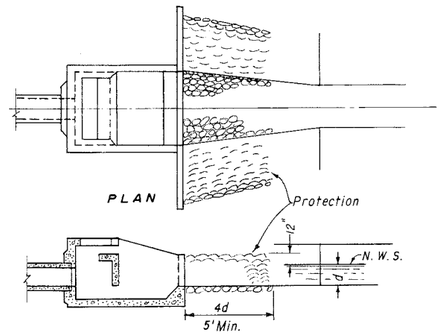
(CHECK AND PIPE INLET SIMILAR)



LONGITUDINAL SECTION

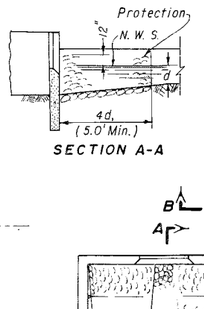
Similar for checks and concrete weirs. Not required when weir discharges on farm unit

CHECK WITH 1.5' DROP



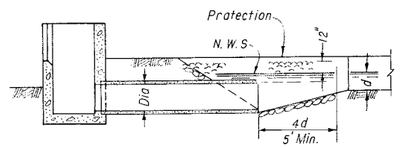
LONGITUDINAL SECTION

BAFFLED PIPE OUTLET



SECTION A-A

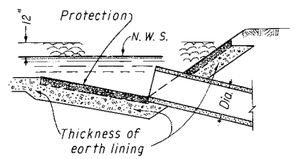
PLAN



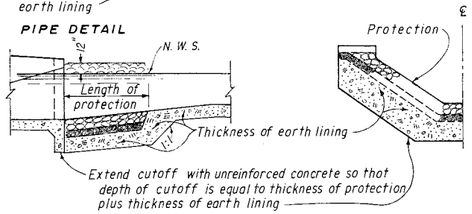
SECTION B-B

Protection not required when delivering to farm unit from pipe

DIVISION BOX WITH ADJUSTABLE WEIRS

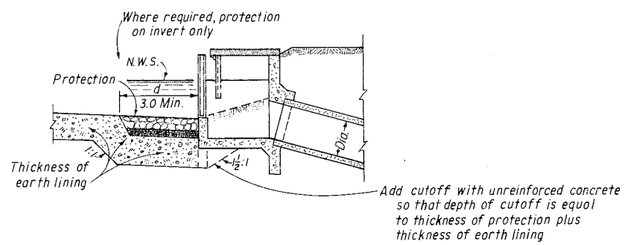


PIPE DETAIL



CUT-OFF WALL

(INLET OR OUTLET)



CHECK AND PIPE INLET SHOWN

(CONTROL AND PIPE INLET SIMILAR)

CONNECTION OF EARTH LINING WITH STRUCTURES

d	SIPHONS AND TUNNELS		CHECKS, PARSHALL FLUMES, INCLINED DROPS, CHUTES, CHECK AND PIPE INLET, CONTROL AND PIPE INLET AND CLOSED CONDUIT DROPS, ETC.		CROSS DRAINAGE (CULVERTS)				PROTECTION	
	INLET	OUTLET	INLET	OUTLET	Q (c.f.s.)	INLET	OUTLET	OUTLET LENGTH		
0' to 2.00'	NONE	NONE	NONE	TYPE 2	0 to 30	NONE	TYPE 2	8'	TYPE 1	6" Coarse gravel
2.01' to 3.50'	NONE	TYPE 1	NONE	TYPE 2	31 to 90	NONE	TYPE 2	12'	TYPE 2	12" Coarse gravel
3.51' to 7.00'	TYPE 1	TYPE 2	TYPE 1	TYPE 3	91 to 240	TYPE 1	TYPE 3	16'	TYPE 3	12" Riprap on 6" sand and gravel bedding
7.01' to 10.00'	TYPE 2	TYPE 3	TYPE 2	TYPE 4	241 to 600	TYPE 2	TYPE 4	22'	TYPE 4	18" Riprap on 6" sand and gravel bedding

NOTES

"d" Normal depth of water

Where d is not given use diameter of pipe in place of d to determine protection.

Protection to extend the length of earth transition and 12" above normal water surface for structures other than shown above.

Protection to be omitted when outlet is in material not readily erodible such as caliche or rock.

Protection voids to be filled with rock spalls or gravel.

ALWAYS THINK **SAFETY**

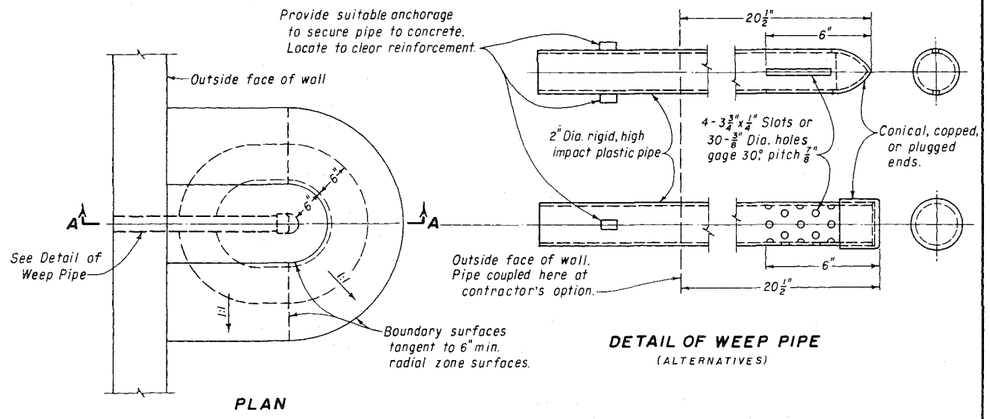
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TYPICAL PROTECTION

DRAWN	D.E.C.	SUBMITTED	
TRACED	D.W.G.	RECOMMENDED	
CHECKED		APPROVED	CHIEF, CANALS BRANCH

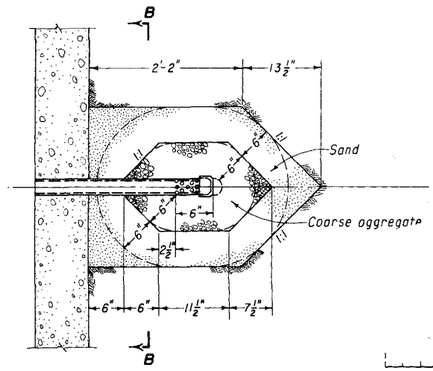
DENVER, COLORADO.

C 190.10

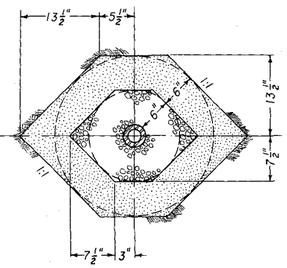


PLAN

DETAIL OF WEEP PIPE
(ALTERNATIVES)



SECTION A-A



SECTION B-B

0
SCALE OF FEET

NOTE

The configuration of the filter envelope may be changed to suit construction, provided that a minimum radial thickness of 6" is maintained for each zone.

GRADATION OF FILTER MATERIALS

FILTER MATERIAL	PERCENT (BY WEIGHT) RETAINED ON STANDARD SEIVE									
	No. 200	No. 100	No. 50	No. 30	No. 16	No. 8	No. 4	⅜"	¾"	1½"
SAND	97-100	93-97	74-85	38-70	15-45	5-25	0-5			
COARSE AGGREGATE					95-100	75-90	60-80	40-60	20-35	0

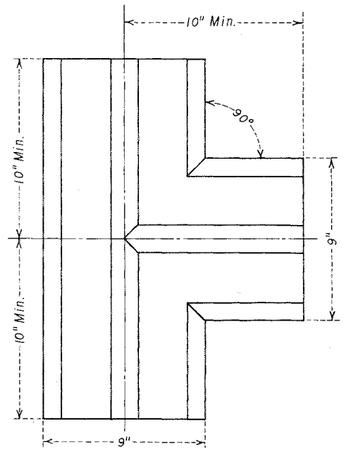
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

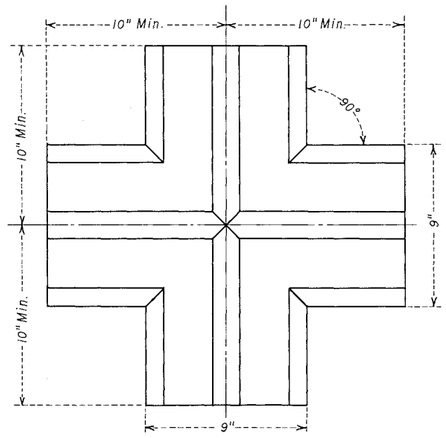
WEEP HOLE

C 190.20

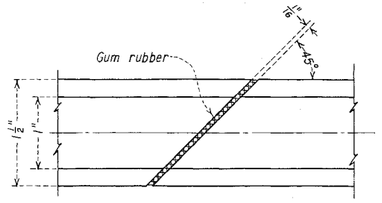
DRAWN P.C.H. SUBMITTED
TRACED W.A.W. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,



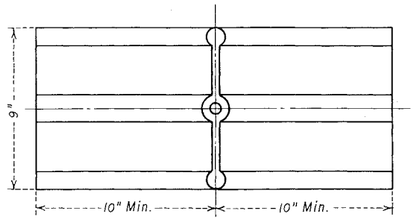
TYPE (1) INTERSECTION



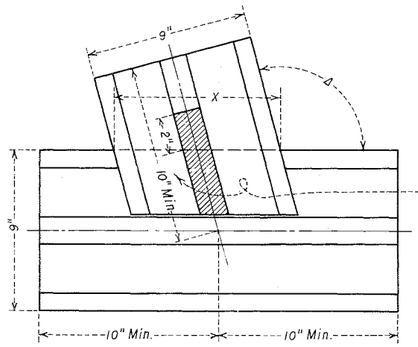
TYPE (2) INTERSECTION



TYPICAL VULCANIZED FIELD SPLICE



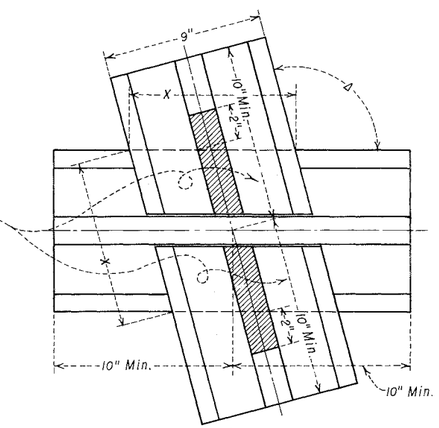
TYPE (3) INTERSECTION



TYPE ◯ THROUGH ◯ INTERSECTIONS

TYPE	Δ	X	NO. REQ'D.

Trim bulbs flush with web within intersections and vulcanize lap



TYPE ◯ THROUGH ◯ INTERSECTIONS

TYPE	Δ	X	NO. REQ'D.

NOTES

Plug hole in center bulb where center bulb is crosshatched. Government molds available for intersection types 1, 2 and 3.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

RUBBER WATERSTOP INTERSECTIONS

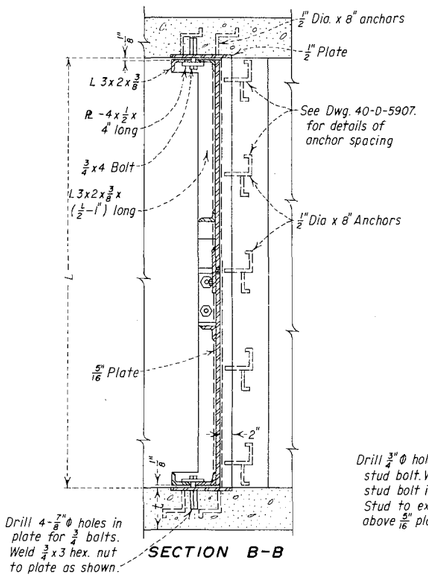
C 190.30

DRAWN T. R. H. SUBMITTED

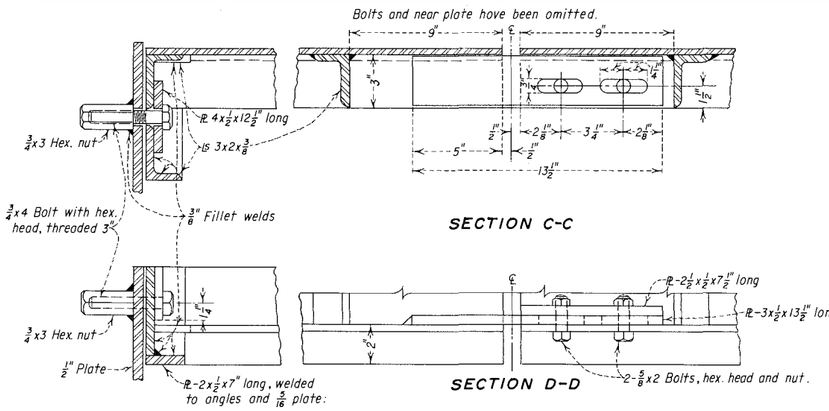
TRACED J. S. M. JR. RECOMMENDED

CHECKED APPROVED

DENVER, COLORADO.

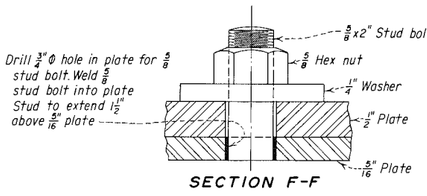


SECTION B-B

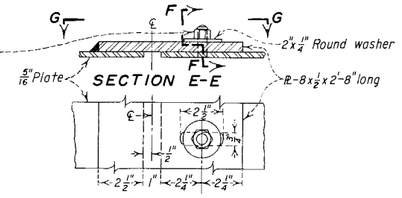


SECTION C-C

SECTION D-D

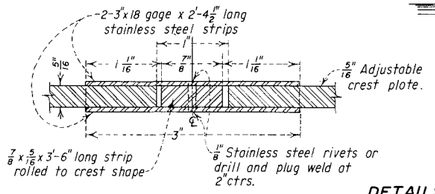


SECTION F-F

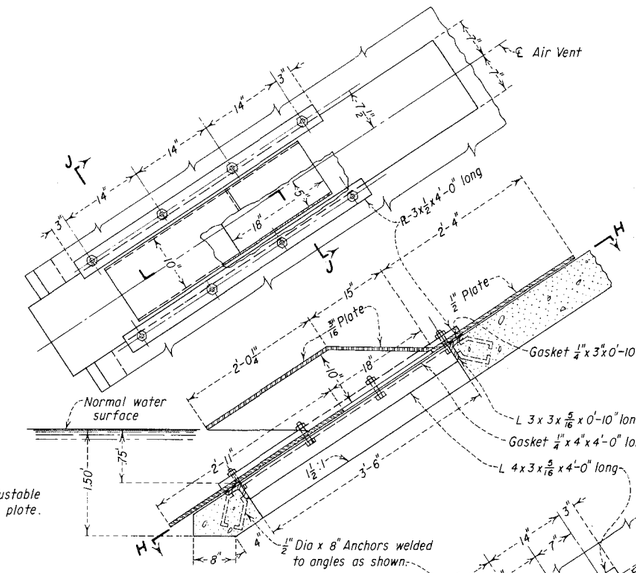


SECTION E-E

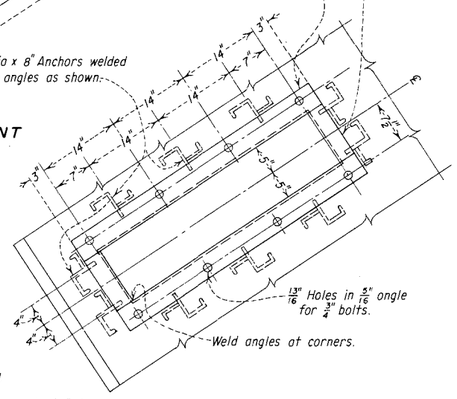
SECTION G-G



SECTION E-E,
NO SCALE

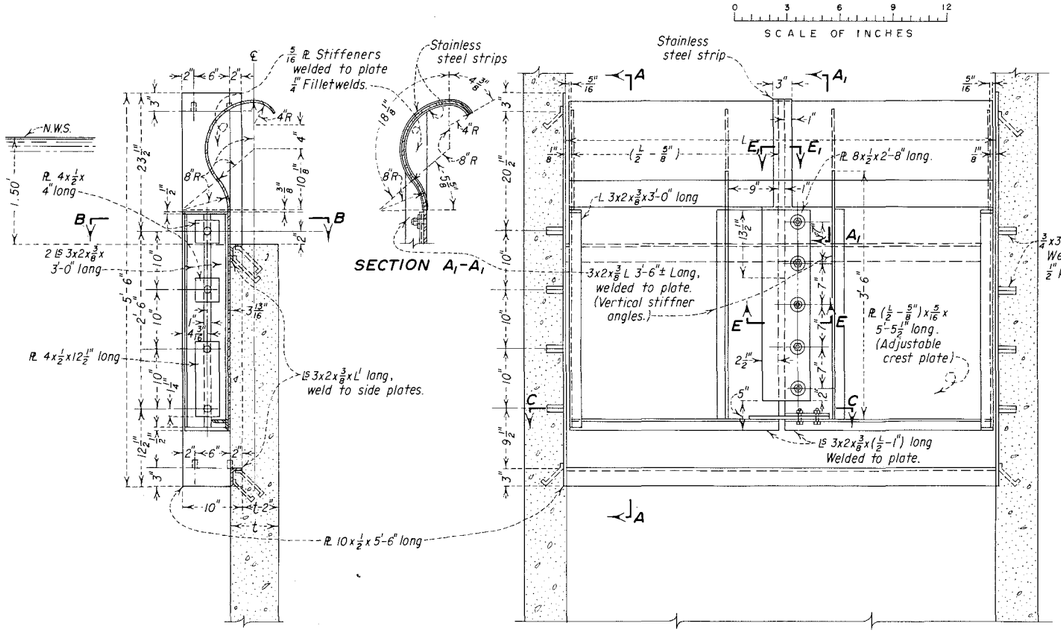


DETAILS OF ADJUSTABLE AIR VENT



SCALE OF INCHES

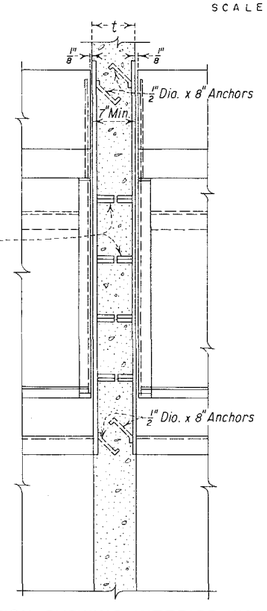
SCALE OF FEET



SECTION A-A

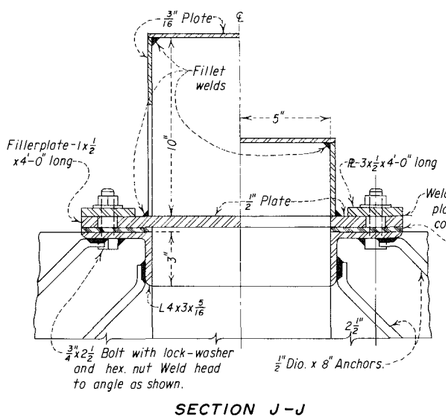
SECTION A_1-A_1

ELEVATION OF CREST

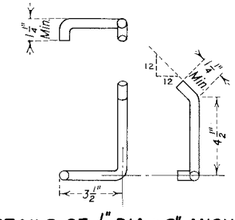


SECTION SHOWING INTERIOR WALL OF MULTIPLE BARREL SIPHON

DETAILS OF ADJUSTABLE CREST



SECTION J-J



DETAILS OF 1/2" DIA. x 8" ANCHORS

SECTION H-H

NOTES

Reinforcement not shown.
When L < 4'-0" adjustable crest plate to be one piece, omitting splice plate and vertical stiffener angles.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

ADJUSTABLE CREST AND AIR VENT FOR SIPHON SPILLWAY

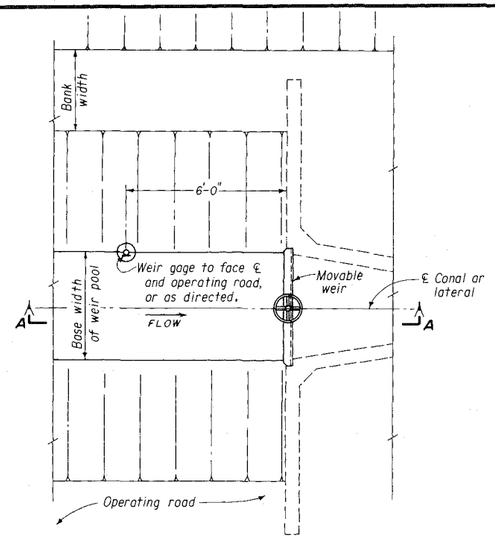
C 190.40

DRAWN W.A.K.-M.R.R. SUBMITTED

TRACED S.W.M. RECOMMENDED

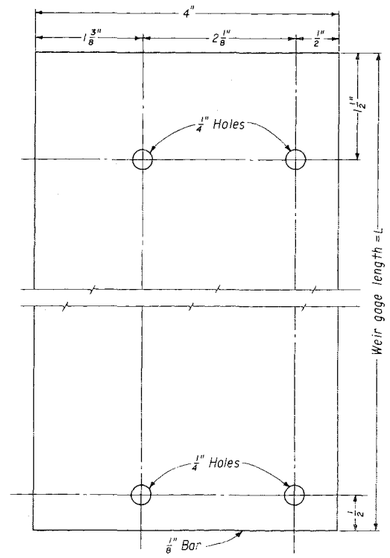
CHECKED APPROVED

CHIEF, CANALS BRANCH

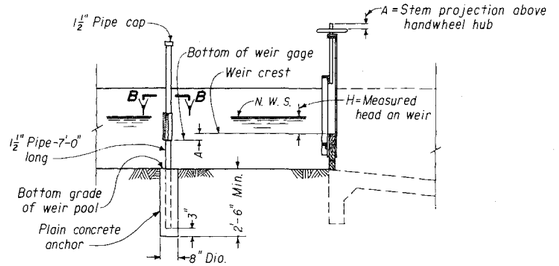


PLAN

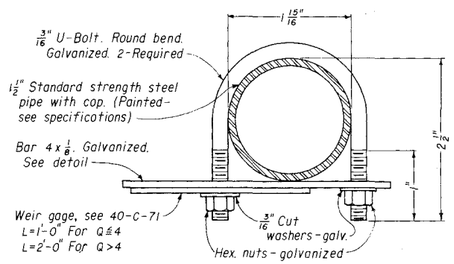
SCALE OF FEET



BAR DETAIL
Not to scale



SECTION A-A



SECTION B-B
Not to scale

NOTES

With weir in fully lowered position set zero of weir gage below crest of weir o distance equal to A.
H For any position of weir crest equals weir gage reading minus stem projection above handwheel hub.

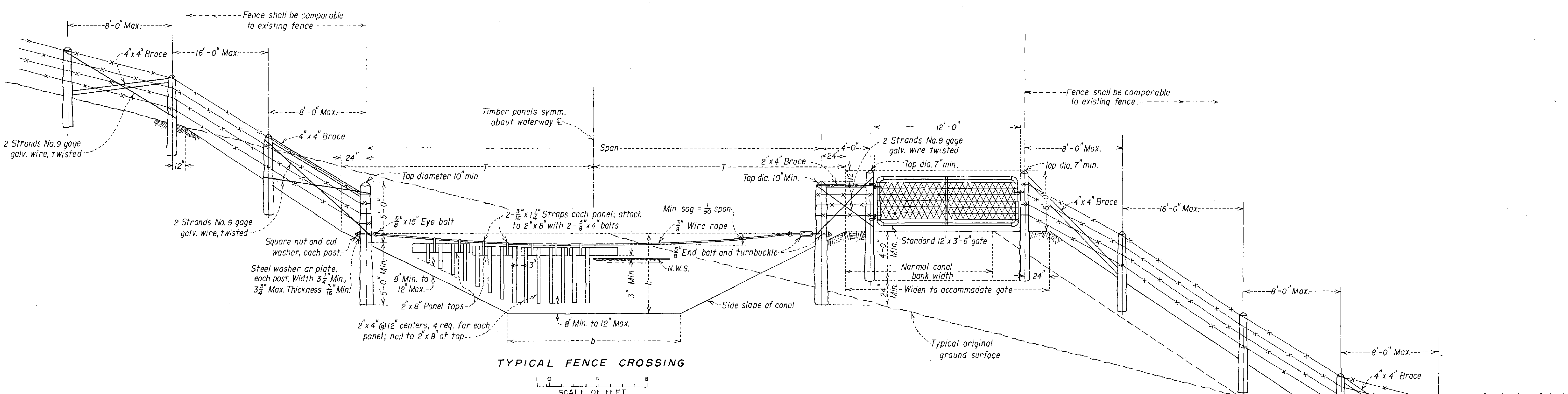
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

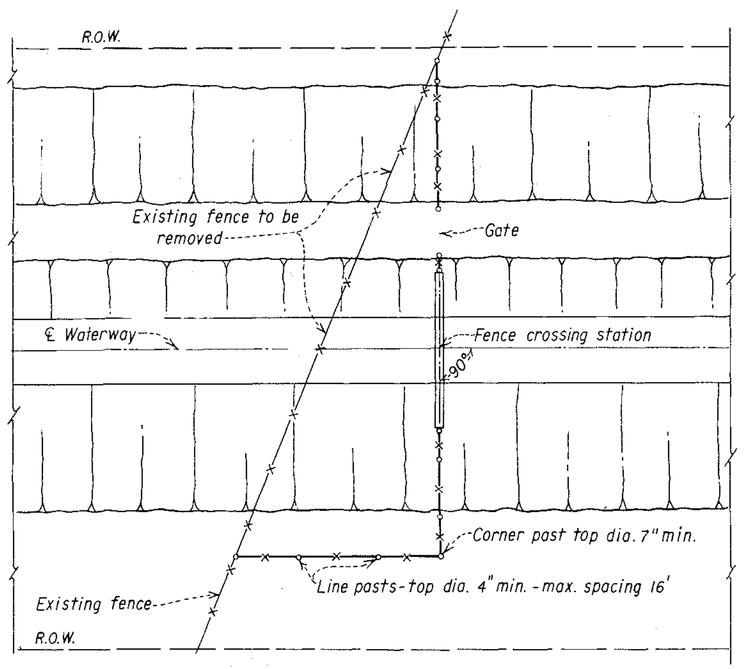
WEIR GAGE INSTALLATION Q=15 C.F.S. MAX.

DRAWN O. L. W. SUBMITTED
TRACED P. E. F. RECOMMENDED
CHECKED APPROVED CHIEF, CANALS BRANCH
DENVER, COLORADO.

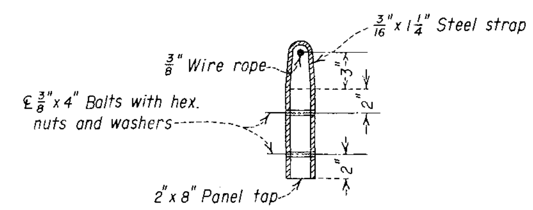
C-190-50



TYPICAL FENCE CROSSING

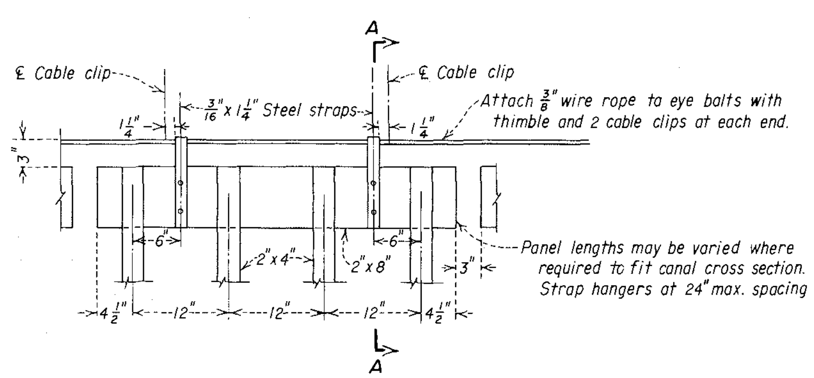


TYPICAL PLAN OF FENCE CROSSING



SECTION A-A

SCALE OF FEET



DETAIL OF FENCE CROSSING PANEL

SCALE OF FEET

FENCE CROSSINGS

STATION	b	h	T	O&M ROAD

NOTES

All posts shall be placed with butt end down.
Chamfer top of posts as directed.
Staples shall be No. 9 gage and 1½ inches long.
Mortise all braces 1" and fasten each end with 2-20 d spikes.
Ends of bracing to be creosoted or painted with white lead paint.
Posts to be placed in undisturbed earth or compacted fill.
Posts not otherwise shown will project above ground surface 4'-0", be embedded 2'-6" min., and have a top diameter of 7" minimum.
All hardware to be galvanized.

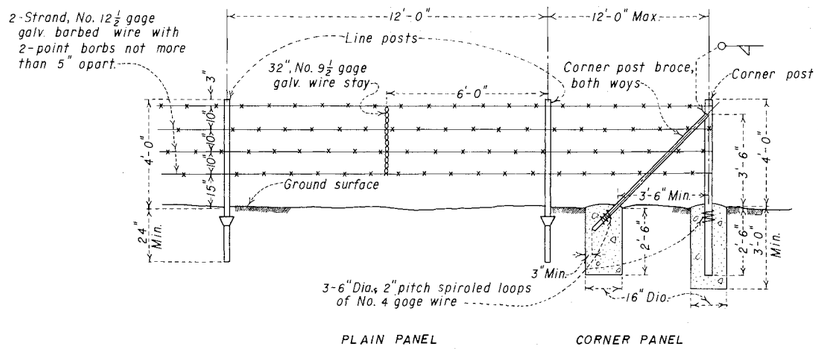
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

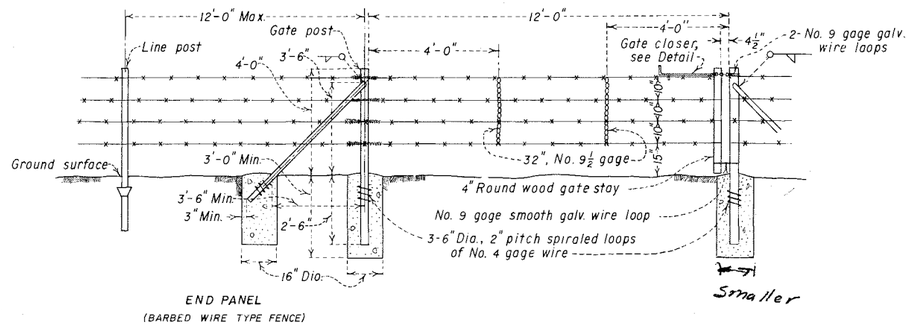
FENCE CROSSING

DRAWN R.E.C. ______ SUBMITTED ______
TRACED D.R.S. ______ RECOMMENDED ______
CHECKED ______ APPROVED ______ CHIEF, CANALS BRANCH
DENVER, COLORADO,

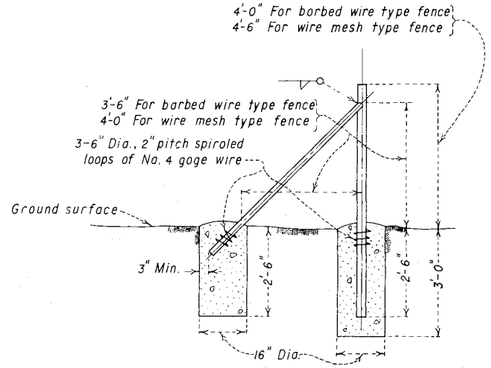
C 190.60



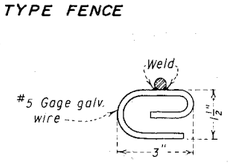
BARBED WIRE TYPE FENCE



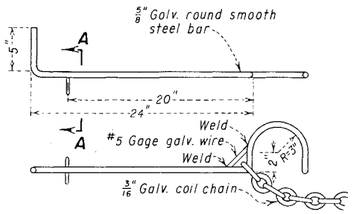
BARBED WIRE GATE AND ADJOINING PANELS



BRACE POST



SECTION A-A

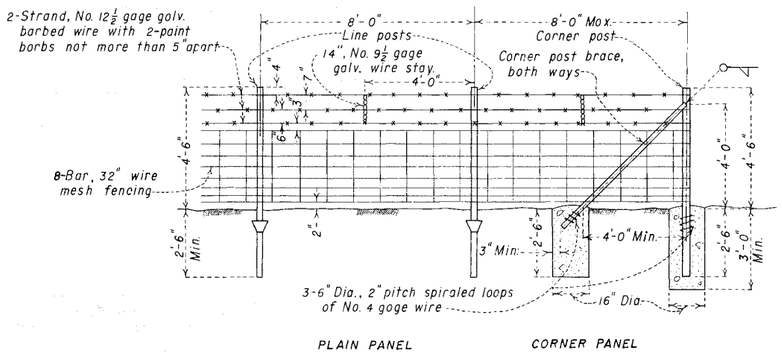


DETAIL OF GATE CLOSER

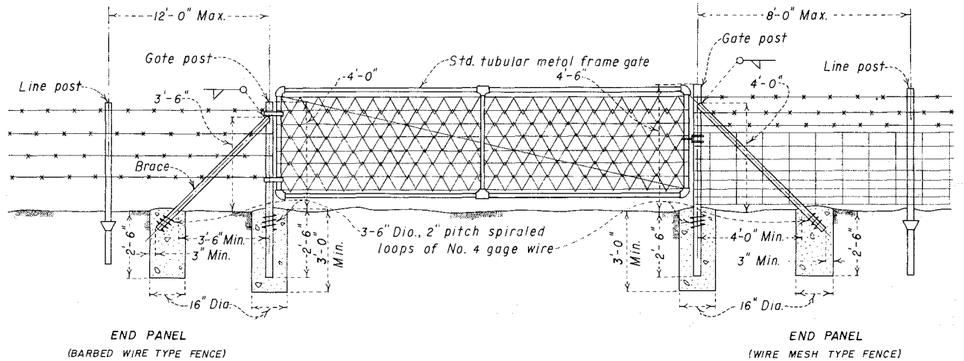
NOTES

Maximum length of fence without a corner post, end post, gate post or brace post shall be 1000 ft. Additional brace posts shall be placed where directed by the contracting officer.

Fence on curve shall have brace posts spaced as follows:
Curve radius less than 500 ft., every 2nd post.
Curve radius 500-1000 ft., every 5th post.
Curve radius over 1000 ft., every 7th post.



WIRE MESH TYPE FENCE



TUBULAR METAL FRAME GATE AND ADJOINING PANELS

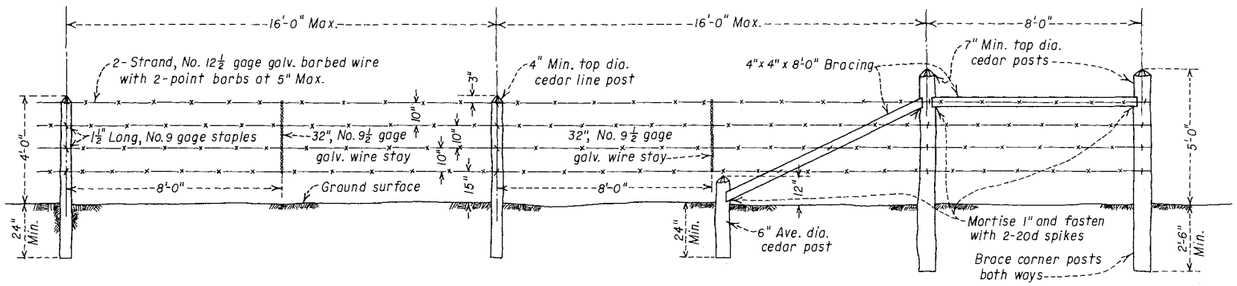
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

FENCING DETAILS
STEEL POSTS

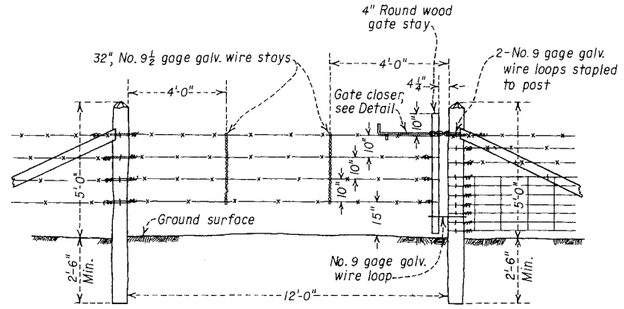
C-190.70

DRAWN D. M. M. SUBMITTED
TRACED L. A. C. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH
DENVER, COLORADO,

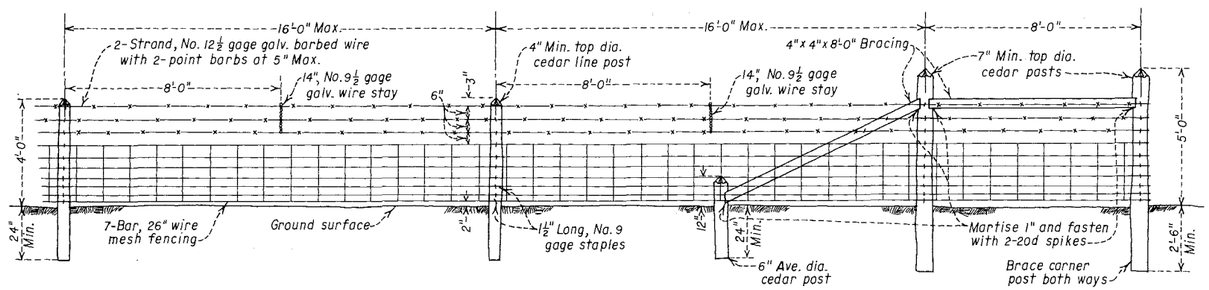


PLAIN PANEL — PANEL ADJOINING CORNER PANEL — CORNER PANEL

BARBED WIRE FENCE

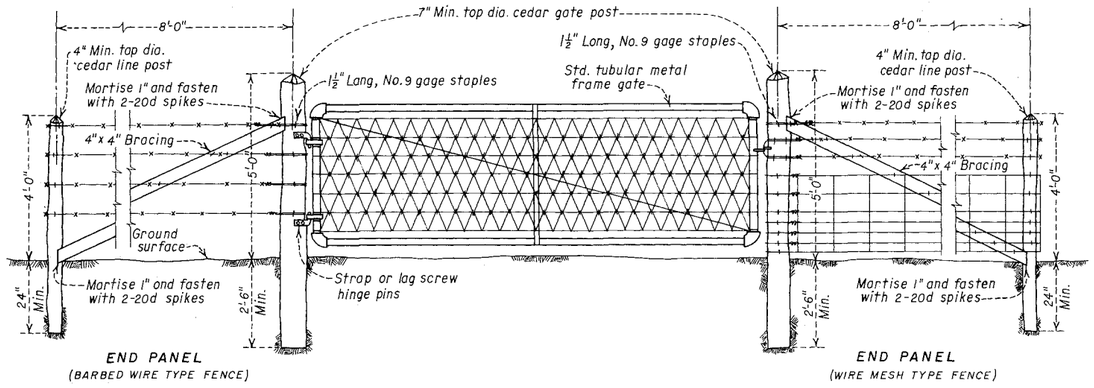


BARBED WIRE GATE



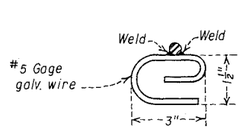
PLAIN PANEL — PANEL ADJOINING CORNER PANEL — CORNER PANEL

WIRE MESH FENCE

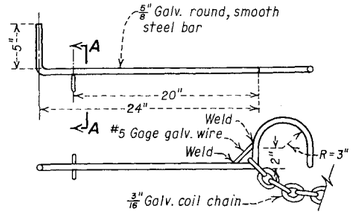


END PANEL (BARBED WIRE TYPE FENCE) — END PANEL (WIRE MESH TYPE FENCE)

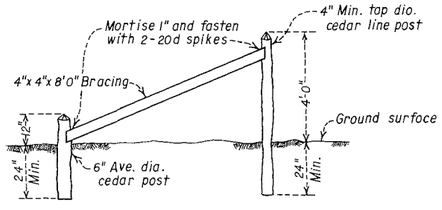
TUBULAR METAL FRAME GATE AND ADJOINING PANELS



SEC. A-A



DETAIL OF GATE CLOSER



BRACE POST ON CURVE

NOTES

Maximum length of fence without a corner, end, gate, or brace post shall be 1000 ft. Additional brace posts shall be placed where directed by the contracting officer.
Fence on curve shall have brace posts spaced as follows:
Curve radius less than 500 ft., every 2nd post.
Curve radius 500-1000 ft., every 5th post.
Curve radius over 1000 ft., every 7th post.
Ends of wood bracing to be creosoted or painted with white lead paint.
All wood posts to be placed with butt end down.
All wood posts to be placed in undisturbed natural ground or compacted fill.
For fencing and gate installation at fence crossings, see

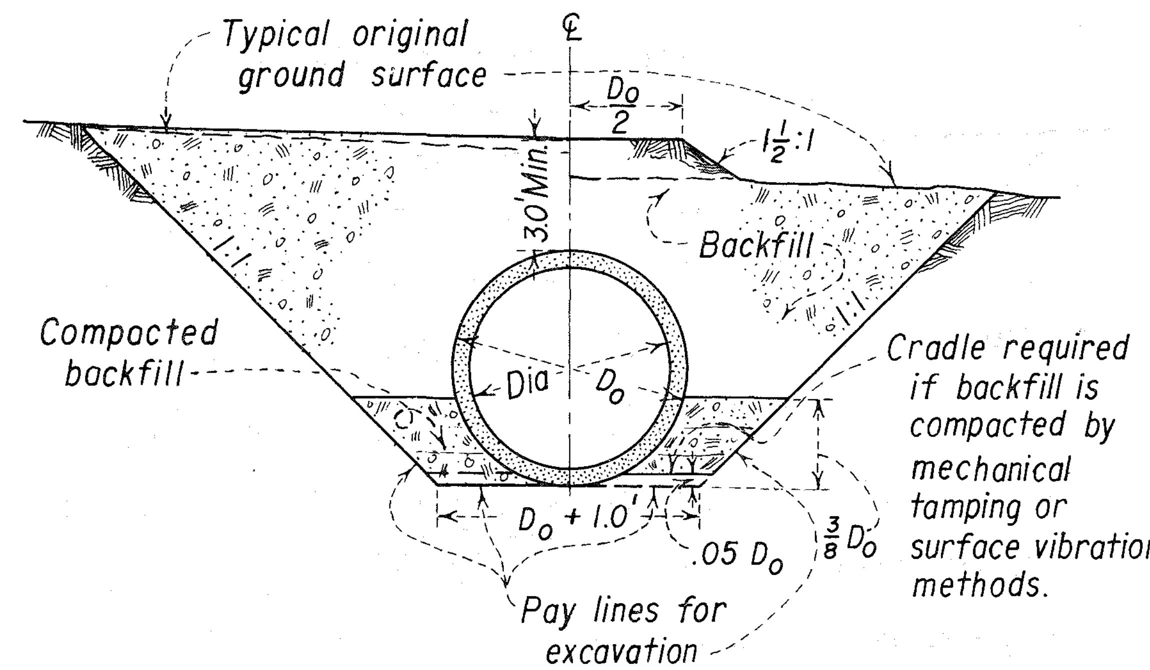
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

FENCING DETAILS WOOD POSTS

C 190.80

DRAWN R.E.C. — SUBMITTED
TRACED J.S.M. JR. — RECOMMENDED
CHECKED — APPROVED
DENVER, COLORADO, — CHIEF, CANALS BRANCH



EARTH

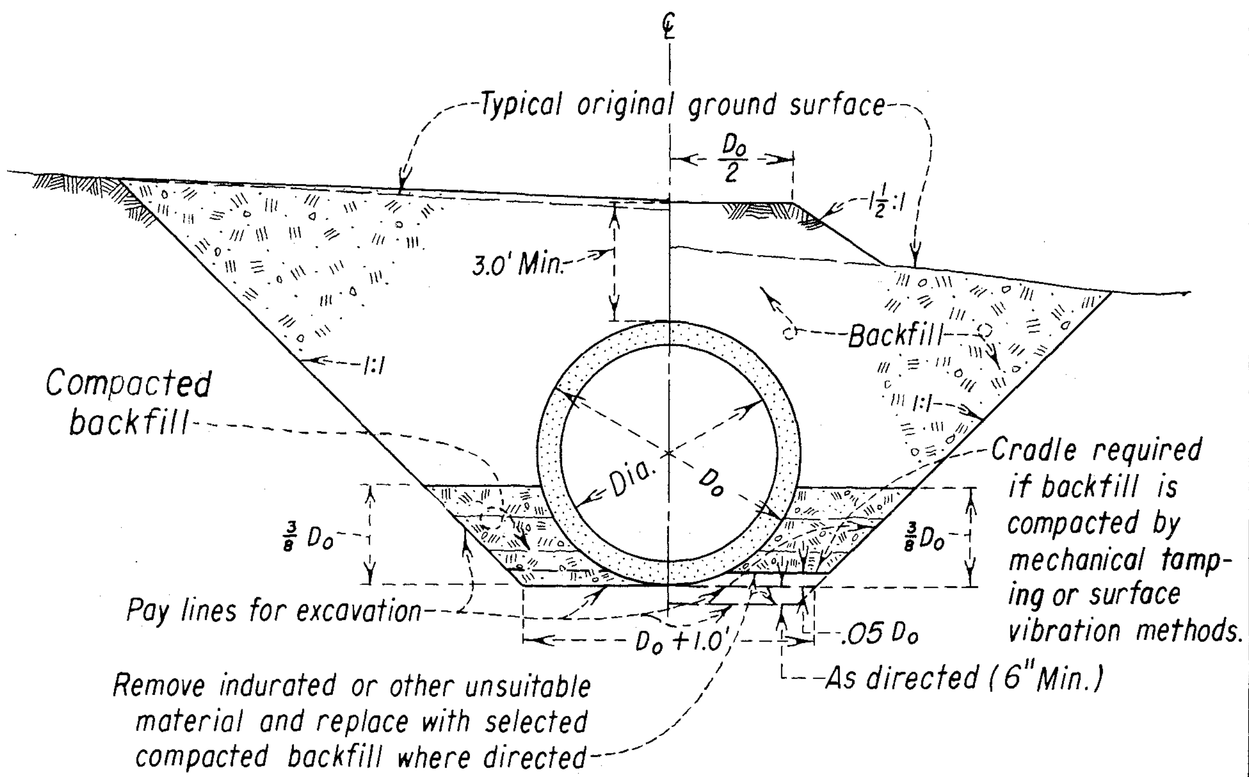
NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet and the maximum shall be 5 ft. for class A pipe, 10 ft. for Class B, 15 ft. for Class C, and 20 ft. for Class D unless otherwise indicated on the structure drawings.

Backfill shall be compacted as shown unless otherwise specified.

ALWAYS THINK SAFETY

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION
PIPE EARTHWORK DETAILS PRECAST CONCRETE OR ASBESTOS-CEMENT PIPE EARTH EXCAVATION
DRAWN A.W.B. SUBMITTED A.C. Mollin
TRACED L.F.K. RECOMMENDED J.W. Morris
CHECKED J.O.G. APPROVED [signature] CHIEF, CANALS BRANCH
DENVER, COLO AUG. 9, 1967 **103-D-1056**



NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet and the maximum shall be 5 ft. for Class A pipe, 10 ft. for Class B, 15 ft. for Class C, and 20 ft. for Class D unless otherwise indicated on the structure drawings.

Backfill shall be compacted as shown unless otherwise specified.

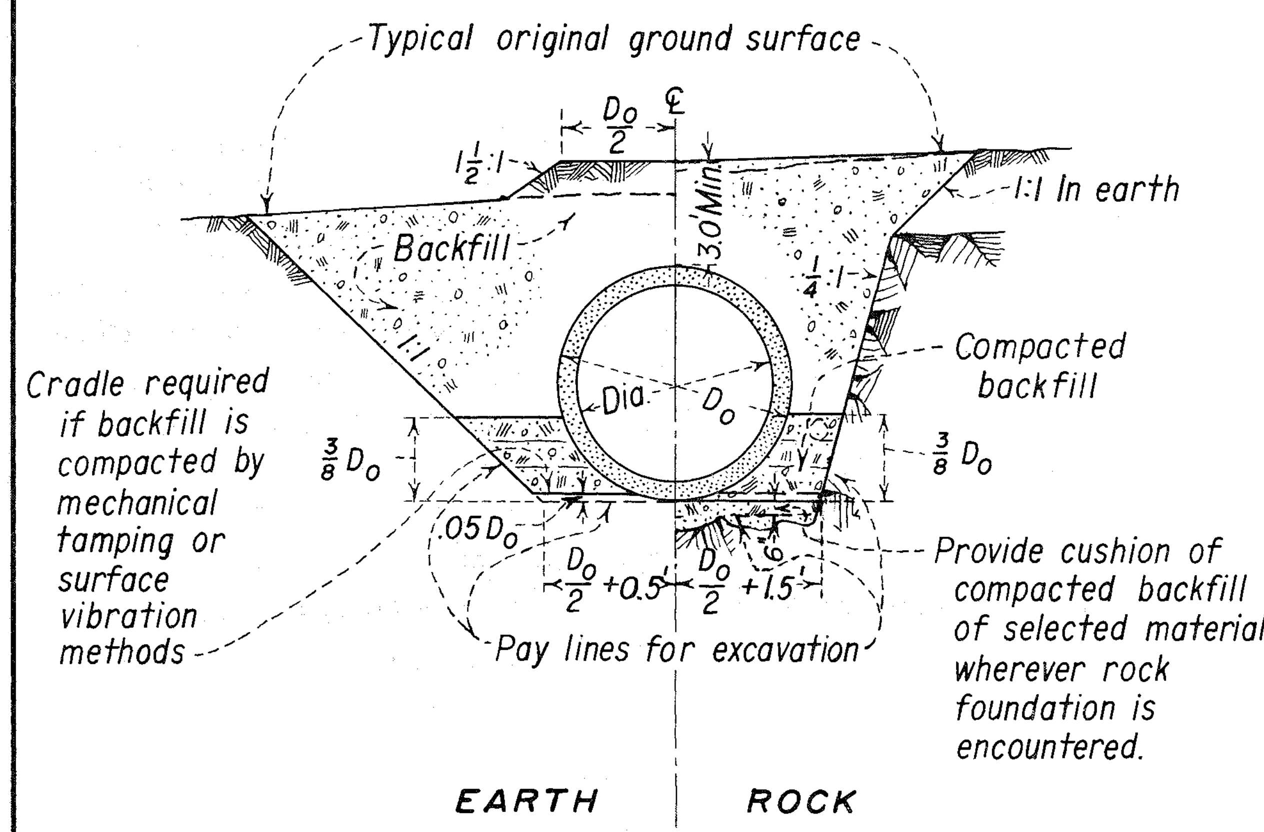
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
PRECAST CONCRETE OR ASBESTOS-CEMENT PIPE
UNCLASSIFIED EXCAVATION

DRAWN A.W.B. SUBMITTED R.E. Mellin
TRACED T.R.H. RECOMMENDED D.W. Morris
CHECKED J.O.G. APPROVED S.E. Rippon
CHIEF, CANALS BRANCH

DENVER, COLO. AUG. 9, 1967 103-D-1057



NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet and the maximum shall be 5 ft. for Class A pipe, 10 ft. for Class B, 15 ft. for Class C, and 20 ft. for Class D unless otherwise indicated on the structure drawings.

Backfill shall be compacted as shown unless otherwise specified.

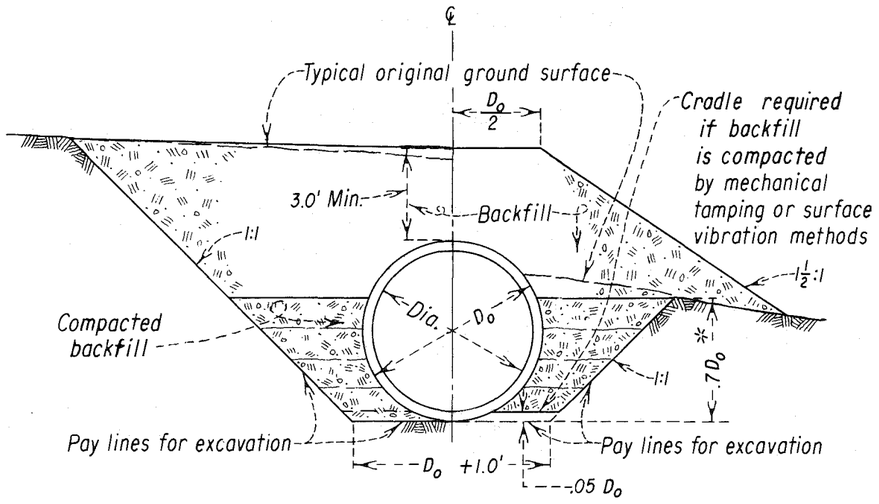
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS

PRECAST CONCRETE OR ASBESTOS-CEMENT PIPE
EARTH OR ROCK EXCAVATION

DRAWN A.W.B. SUBMITTED R. E. Mellin
TRACED L.F.K. RECOMMENDED J. W. Morris
CHECKED J.O.J. APPROVED [signature] CHIEF, CANALS BRANCH
DENVER, COLO AUG. 9, 1967 **103-D-1058**



EARTH

NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet and the maximum shall be 5 ft. for Class A pipe, 10 ft. for Class B, 15 ft. for Class C, and 20 ft. for Class D unless otherwise indicated on the structure drawings.

Backfill shall be compacted as shown unless otherwise specified.

No compaction required for 10 inch dia. pipe.

*Compact backfill to $\frac{3}{8}$ D_o for pretensioned concrete pipe with diameter of 12 inches to 18 inches.

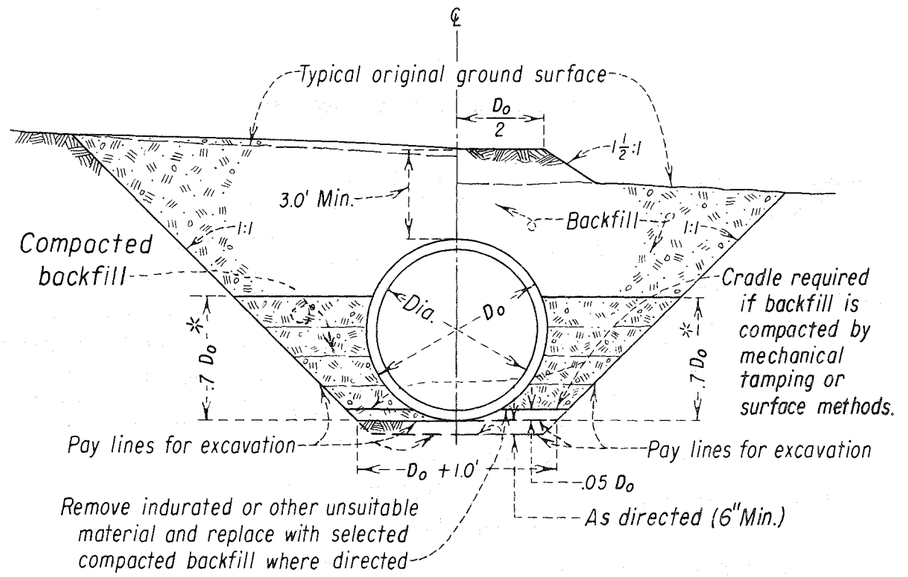
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
PRETENSIONED CONCRETE OR STEEL PIPE
EARTH EXCAVATION

DRAWN A.W.B. SUBMITTED R.E. Mollin
TRACED T.R.H. RECOMMENDED J.N. Morris
CHECKED J.O.B. APPROVED J.E. Rippon
CHIEF, CANALS BRANCH

DENVER, COLO. AUG. 9, 1967 | 103-D-1059



NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet and the maximum shall be 5 ft. for Class A pipe, 10 ft. for Class B, 15 ft. for Class C, and 20 ft. for Class D unless otherwise indicated on the structure drawings.

Backfill shall be compacted as shown unless otherwise specified.

No compaction required for 10 inch dia. pipe.

* Compact backfill to $\frac{3}{8}$ D_o for pretensioned concrete pipe with diameter of 12 inches to 18 inches.

ALWAYS THINK SAFETY

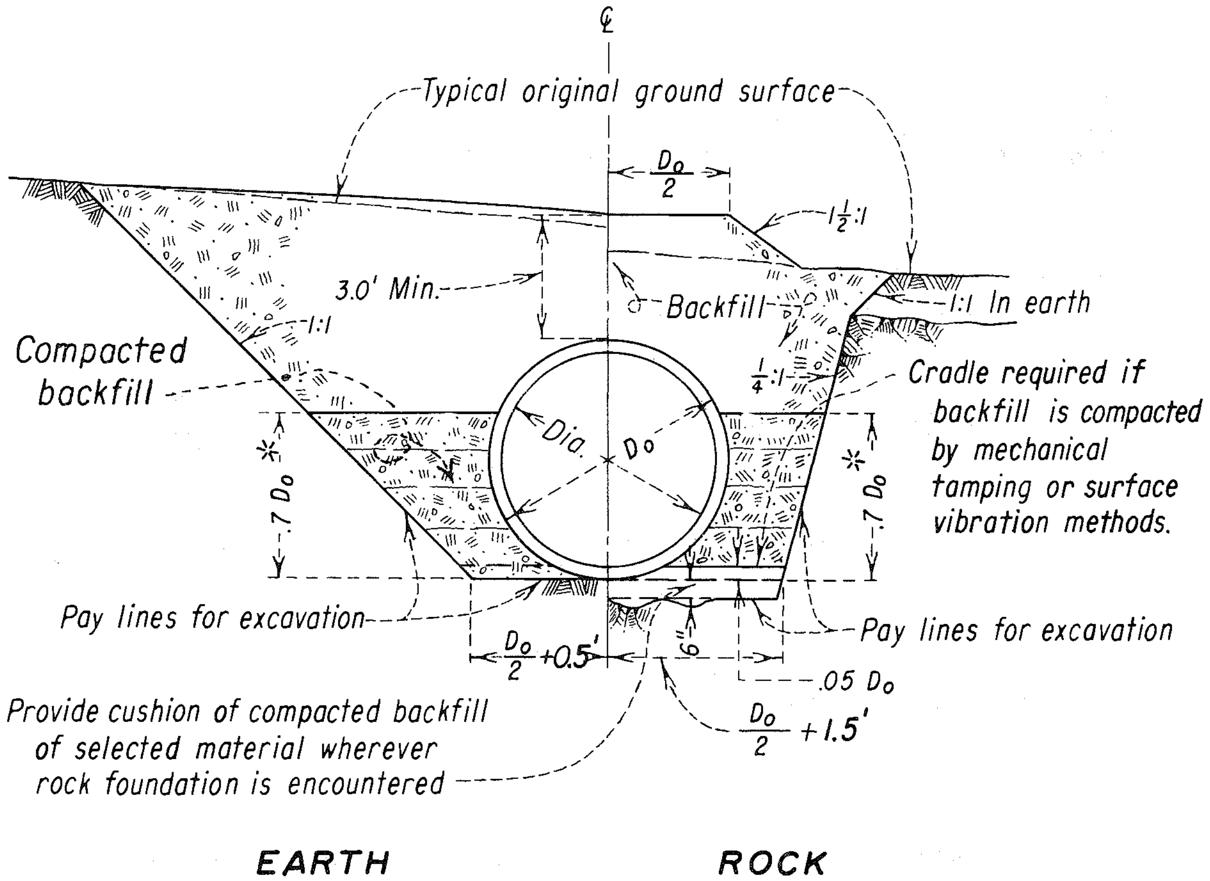
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
PRETENSIONED CONCRETE OR STEEL PIPE
UNCLASSIFIED EXCAVATION

DRAWN A.W.B. SUBMITTED E.G. Mallery
TRACED T.R.H. RECOMMENDED J.H. Morris
CHECKED J.O.D. APPROVED J.C. Rippon
CHIEF, CANALS BRANCH

DENVER, COLO. AUG. 9, 1967 | 103-D-1060

116



NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet and the maximum shall be 5 ft. for Class A pipe, 10 ft. for Class B, 15 ft. for Class C, and 20 ft. for Class D unless otherwise indicated on the structure drawings.

Backfill shall be compacted as shown unless otherwise specified.

*Compact backfill $\frac{3}{8}$ D_o for pretensioned concrete pipe with diameter of 12 inches to 18 inches.

No compaction required for 10" dia. pipe.

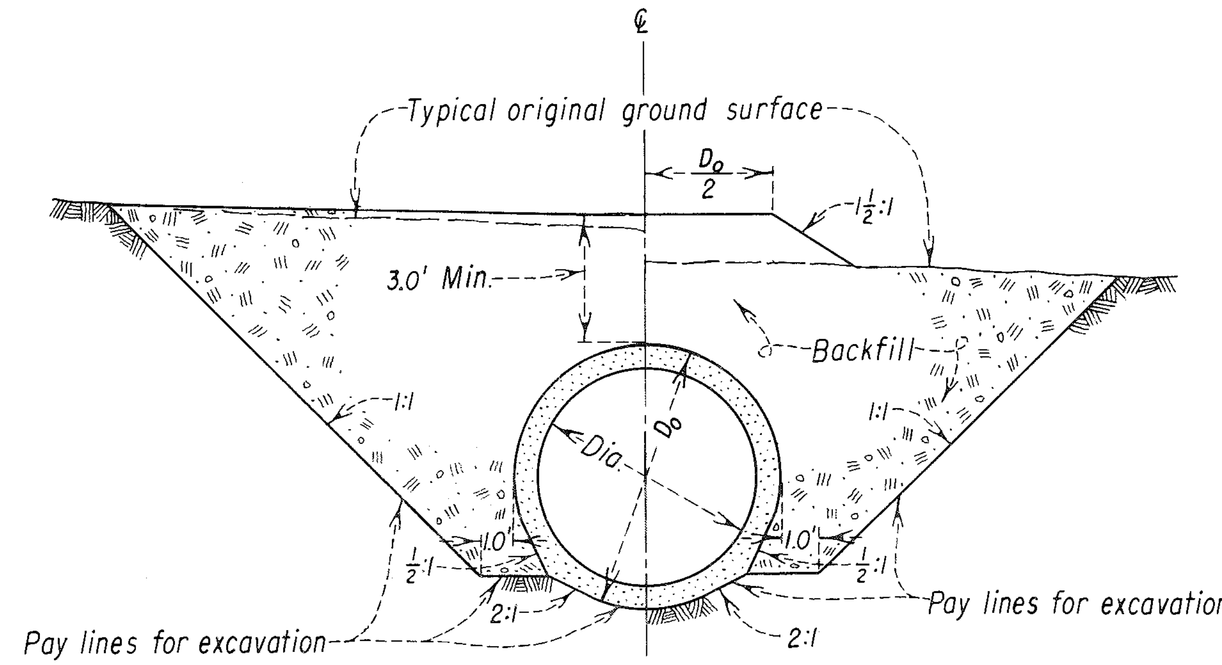
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
PRETENSIONED CONCRETE OR STEEL PIPE
EARTH OR ROCK EXCAVATION

DRAWN A.W.B. SUBMITTED
TRACED T.R.H. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH

DENVER, COLO. AUG. 9, 1967 103-D-1061



EARTH

NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet; unless otherwise indicated on the structure drawings.

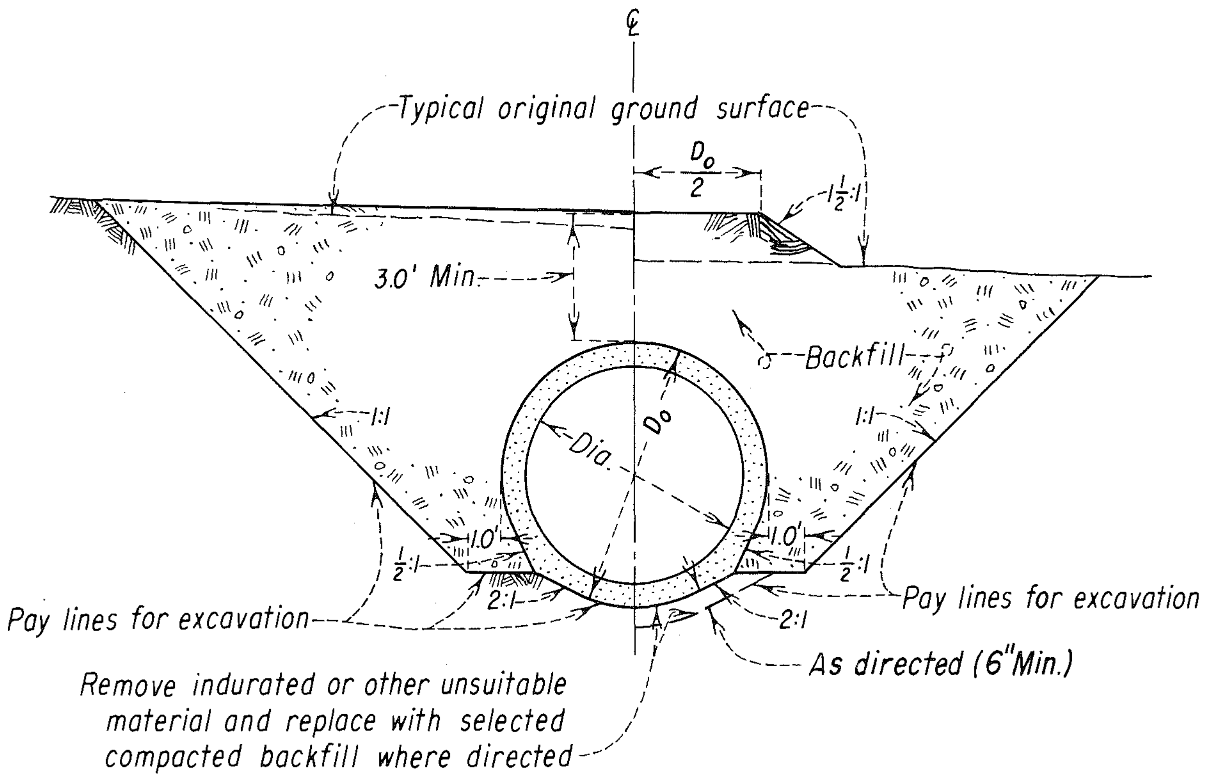
Backfill shall be compacted where required by the specifications.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
MONOLITHIC CONCRETE PIPE
EARTH EXCAVATION

DRAWN A.W.B.	SUBMITTED R. E. Mellen
TRACED T.R.H.	RECOMMENDED J. W. Morris
CHECKED J.D.G.	APPROVED W. Rippon, CHIEF, CANALS BRANCH
DENVER, COLO. AUG. 9, 1967	103-D-1062



NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet; unless otherwise indicated on the structure drawings.

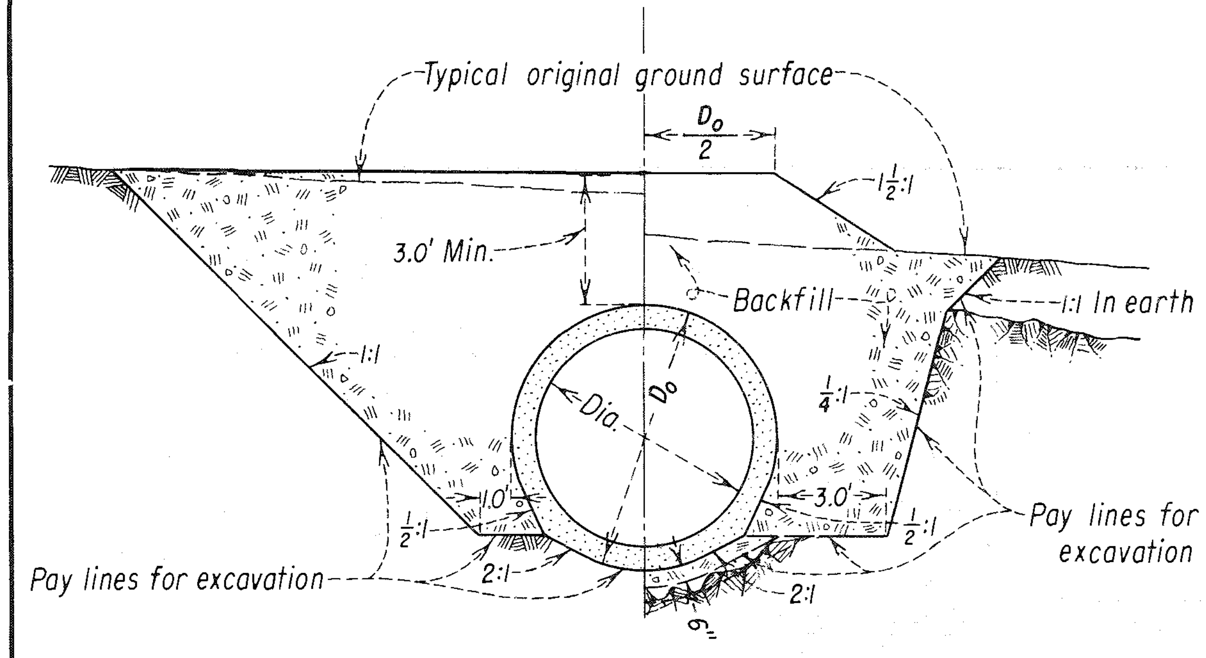
Backfill shall be compacted where required by the specifications.

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
MONOLITHIC CONCRETE PIPE
UNCLASSIFIED EXCAVATION

DRAWN A.W.B.	SUBMITTED [signature]
TRACED T.R.H.	RECOMMENDED [signature]
CHECKED [signature]	APPROVED [signature] CHIEF, CANALS BRANCH
DENVER, COLO. AUG 9, 1967	103-D-1063



EARTH ROCK

NOTES

Backfill over pipe shall be to the original ground surface except the minimum shall be 3 feet; unless otherwise indicated on the structure drawings.

Backfill shall be compacted where required by the specifications.

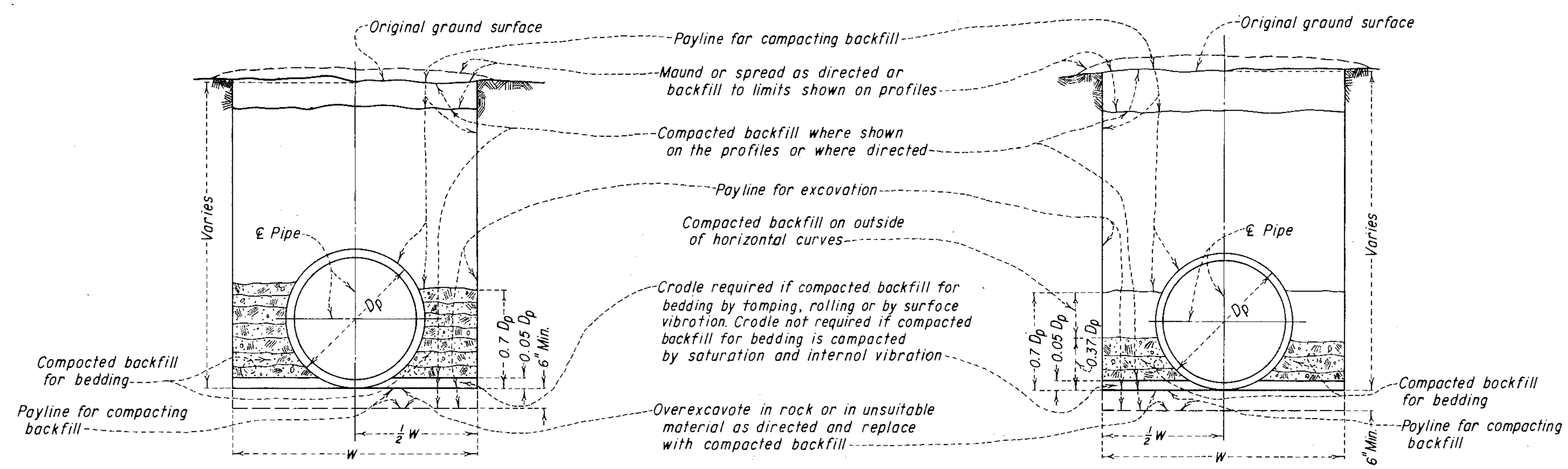
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

PIPE EARTHWORK DETAILS
MONOLITHIC CONCRETE PIPE
EARTH OR ROCK EXCAVATION

DRAWN A.W.B. SUBMITTED
TRACED T.R.H. RECOMMENDED
CHECKED APPROVED
CHIEF, CANALS BRANCH

DENVER, COLO. AUG. 9, 1967 **103-D-1064**

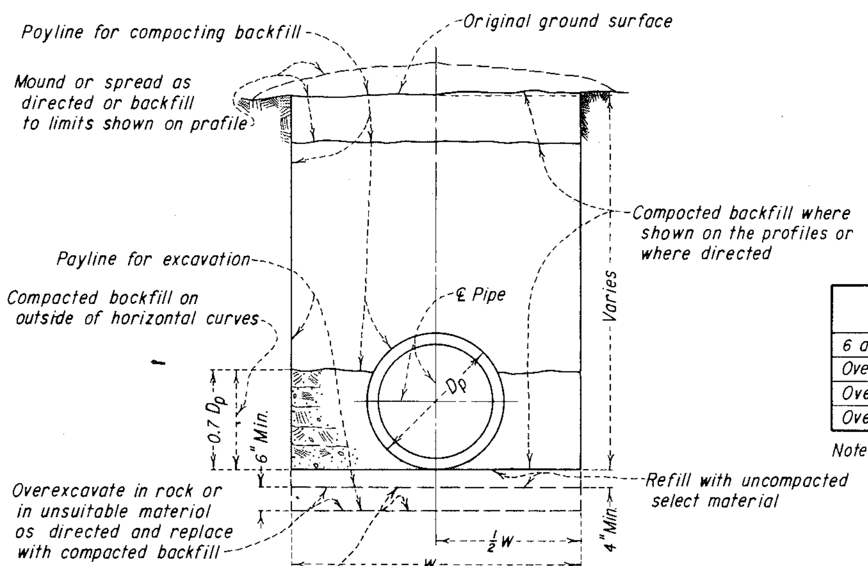


TYPICAL TRENCH

STEEL PIPE 12" AND LARGER
PRETENSIONED CONCRETE PIPE LARGER THAN 18"

TYPICAL TRENCH

ASBESTOS-CEMENT PIPE 12" AND LARGER
CONCRETE PRESSURE PIPE 12" AND LARGER
PRETENSIONED CONCRETE PIPE 12" TO 18" INCL.
NONCYLINDER PRESTRESSED CONCRETE PIPE
CYLINDER PRESTRESSED CONCRETE PIPE



TYPICAL TRENCH

ALL PIPE 10" AND SMALLER

PIPE I.D. INCHES	D_p INCHES	W FEET
6 and less	I.D.+2	2.0
Over 6 thru 18	I.D.+4	0.083 (I.D.+24)
Over 18 thru 24	I.D.+4	0.083 (I.D.+40)
Over 24	1.167 I.D.	0.083(1.167 I.D.+36)

Note: .083 = Conversion factor inches to feet.

NOTES

If compacted backfill for bedding is compacted by tamping, rolling or surface vibration, the trench width, "W," is the minimum width allowed.
If compacted backfill for bedding is compacted by saturation and internal vibration, the minimum trench width is D_p + 18".
D_p and W given in table are used for calculating pay quantities for all pipes.
I.D. is inside diameter of pipe in inches, and sizes of pipe shown refer to I.D.
Paylines for backfill will be the paylines for excavation except the volume of the pipe based on the diameter D_p will be deducted, and except where depth of backfill is limited as shown on the profiles.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

PRESSURE PIPE

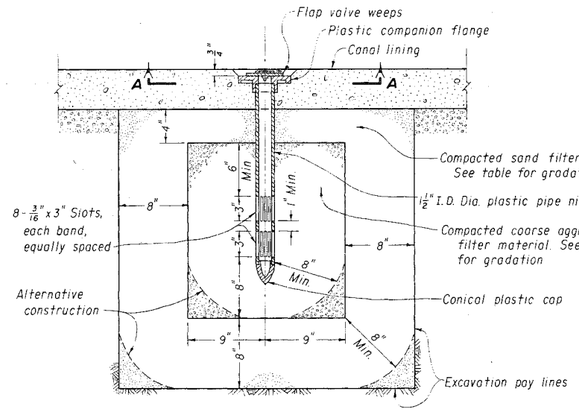
TYPICAL TRENCHES

DRAWN L.H.B. SUBMITTED [signature]
TRACED D.L.M. RECOMMENDED [signature]
CHECKED [initials] APPROVED [signature]
ACT. CHIEF ENGINEER

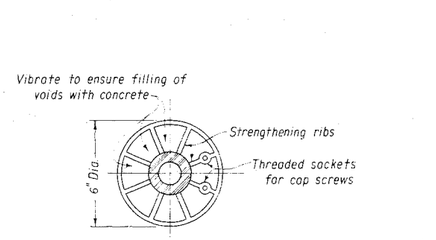
DENVER, COLORADO, MAY 7, 1965

40-D-6036

12-23-68 D. L.H.B.	D_o TO D_p AND FORMULAE FOR W.
4-20-66 D. [initials]	COMPACTED BACKFILL FOR BEDDING NOTES.

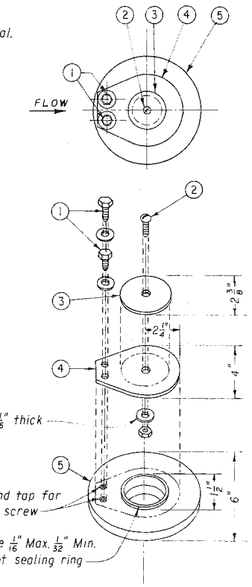


TYPICAL INSTALLATION



SECTION A-A

1. 1/4" Bronze cap screw and washer.
2. 1/4" N.C. Round Head brass machine screw, brass washer and brass nut. Tighten and stake.
3. Brass disk 1/8" minimum thickness.
4. 1/8" Thick Neoprene rubber flap with Shore "A" Durometer of 50 to 70.
5. Plastic companion flange.



FLAP VALVE
DETAIL OF PARTS

GRADATION OF FILTER MATERIALS

FILTER MATERIAL	PERCENT (BY WEIGHT) RETAINED ON STANDARD SIEVE									
	No. 200	No. 100	No. 50	No. 30	No. 16	No. 8	No. 4	3/8"	3/4	1 1/2"
Sand	97-100	93-97	74-85	38-70	15-45	5-25	0-5			
Coarse Aggregate					95-100	75-90	60-80	40-60	20-35	0

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STANDARD DESIGNS

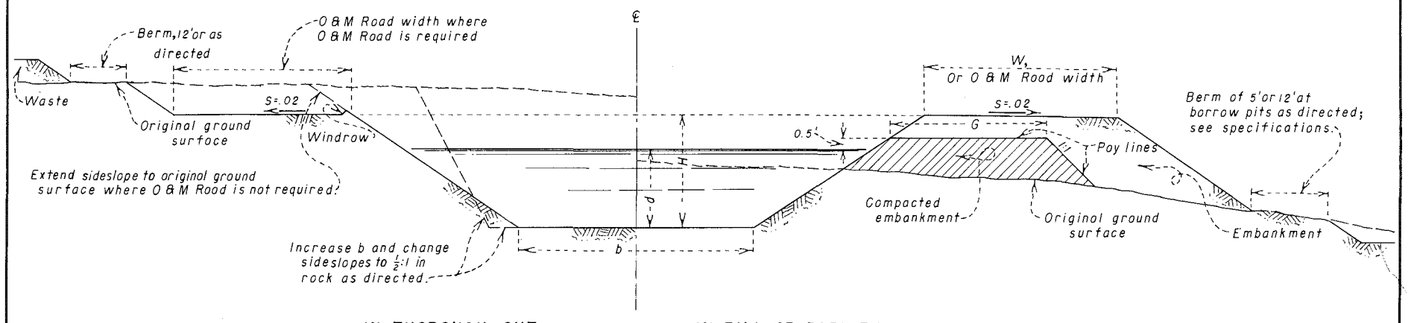
FLAP VALVE WEEPS

DRAWN J.O.C. SUBMITTED
TRACED A.B.R. RECOMMENDED
CHECKED APPROVED

DENVER, COLORADO 103-D-1044

122

d	G
0-2'	3.0'
2'-6'	6.0'
Over 6'	8.0'



IN THOROUGH CUT IN FILL OR PART FILL

TYPICAL SECTION

THIS DRAWING SUPERSEDES DRAWING NO. 103-D-705

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

TYPICAL UNLINED SECTION FOR CANALS AND LATERALS

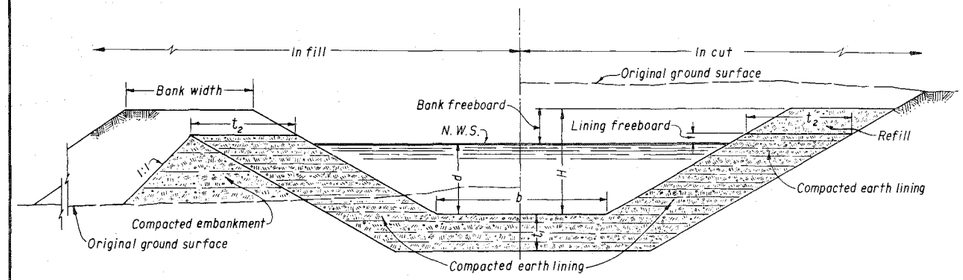
DRAWN K. G. M. SUBMITTED

TRACED E. V. C. RECOMMENDED

CHECKED APPROVED
CHIEF DESIGNING ENGINEER

DENVER, COLORADO,

103-D-828



TYPICAL EARTH LINED SECTION

TABLE FOR EARTH LINING

d	t_1	t_2
2.0' or less	1.0'	3.0'
>2.0' to 4.0'	1.5'	4.0'
>4.0' to 6.0'	2.0'	6.0'
Over 6.0'	2.0'	8.0'

NOTES

If lining material requires a protective cover of gravel or riprap to prevent scour or erosion, excavation shall be extended to provide for the designated thickness of lining plus the gravel or riprap cover.

For freeboard, see Dwg. 103-D-341 (Rev. 3-10-60)

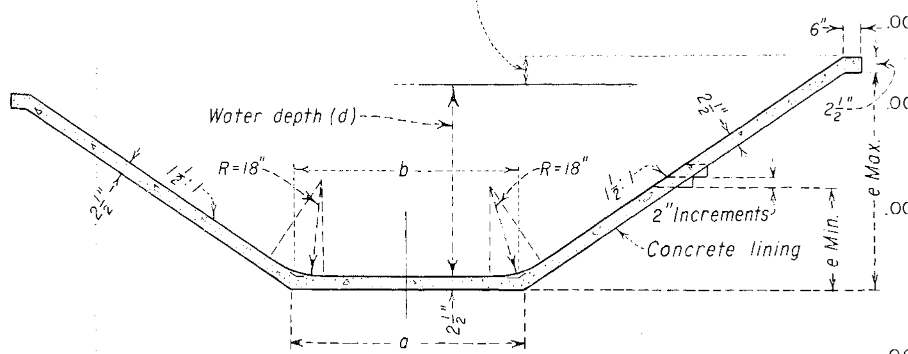
OCT. 16, 1967

103-D-1043

Freeboard, see Dwg. 103-D-341
Water depth (d)
For section A-1, b=12"
For section A-2, b=24"
4"
2½"
1:1
2½"
R=9"
b
R=9"
2" Increments
15" Min.
2'-6" Max.
Concrete lining
2½"
14 1/16" For b=12"
2'-2 1/16" For b=24"
TYPICAL SECTION
Notes: Graph based on Manning's formula, n = .014
Depths shown are water depths.
The slope of the section should not exceed recommended maximum slope to insure that critical velocities will not be reached with a grade departure of .1' and Mannings n based on .011.
SLOPE
.010
.009
.008
.007
.006
.005
.004
.003
.002
.0010
.0009
.0008
.0007
.0006
.0005
.0004
.0003
.0002
.0001
.2
.3
.4
.5
.6
.7
.8
.9
1.0
1.5
2
3
4
5
6
7
8
9
10
15
20
30
40
50
60
70
80
90
100
150
FLOW IN CUBIC FEET PER SECOND
Critical Velocity (approx.)
Recommended Maximum Slope
1' base .50' depth
1' base .75' depth
1' base 1.00' depth
2' base 1.00' depth
2' base 1.25' depth
2' base 1.50' depth
2' base 1.75' depth
2' base 2.00' depth
V=1
V=1.5
V=2
V=2.5
V=3
V=3.5
V=4
V=5
V=6
V=7
V=8
V=9
V=10
1' base width .50' to 1.00' depth
2' base width 1.00' to 2.00' depth
6-2-67 D- J.O.G.
ADDED STANDARD DIMENSIONS ON TYPICAL SECTION AND CHANGED DRAWING TITLE
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS
PROPERTIES FOR CONCRETE LINED CANALS
STANDARD SECTIONS A-1 AND A-2
DRAWN J.O.G. SUBMITTED
TRACED L.F.K. RECOMMENDED
CHECKED APPROVED
CHIEF ENGINEER
DENVER, COLORADO OCTOBER 12, 1966
103-D-1042

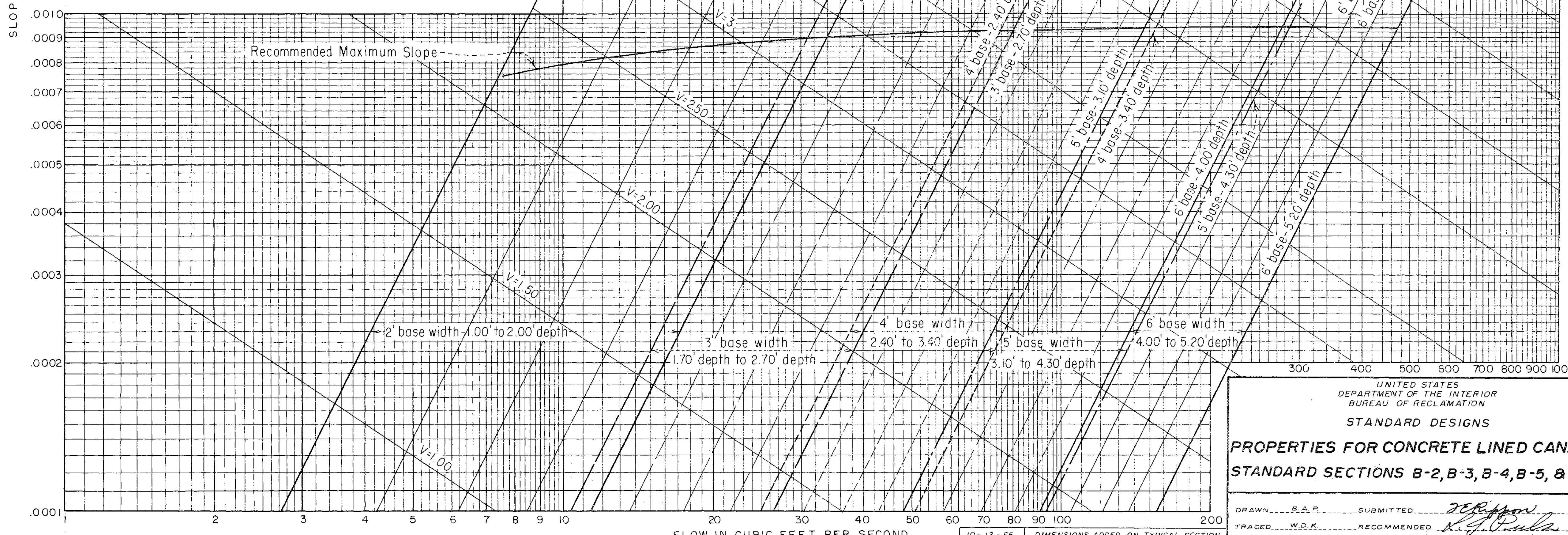
DIMENSIONS

SECTION	a	b	e Min.	e Max.
B-2	2'-1½"	24"	24"	4'-0"
B-3	3'-1½"	3'-0"	2'-3"	4'-6"
B-4	4'-1½"	4'-0"	2'-9"	5'-6"
B-5	5'-1½"	5'-0"	3'-0"	6'-0"
B-6	6'-1½"	6'-0"	3'-6"	7'-0"



TYPICAL SECTION

Notes: Graph based on Manning's formula, n = .014.
Depths shown are water depths.
The slope of the section should not exceed recommended maximum slope to insure that critical velocities will not be reached with a grade departure of .1' and Manning's n based on .011 .



6-2-67 D	ADDED STANDARD DIMENSIONS ON TYPICAL SECTION AND CHANGED DRAWING TITLE	
10-12-66 D	DIMENSIONS ADDED ON TYPICAL SECTION AND CHANGED NOTE.	
6-13-63 D	ADDED NOTE	

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

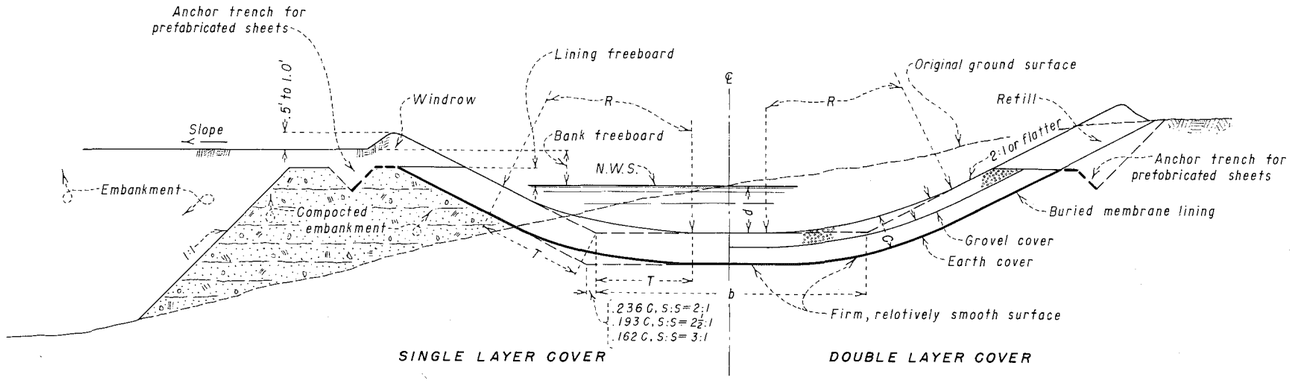
STANDARD DESIGNS

PROPERTIES FOR CONCRETE LINED CANALS

STANDARD SECTIONS B-2, B-3, B-4, B-5, & B-6

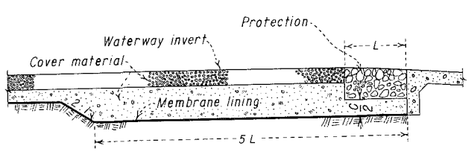
DRAWN S.A.P. SUBMITTED [signature]
TRACED W.D.K. RECOMMENDED [signature]
CHECKED G.H.K. APPROVED [signature]
ASST. COMM. AND CHIEF ENGINEER

DENVER, COLORADO MARCH 8, 1960 103-D-630

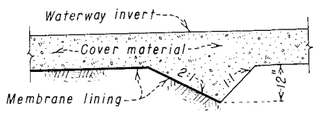


TRANSVERSE SECTION OF WATERWAY

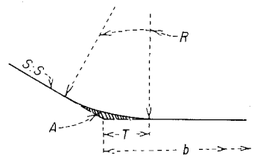
$C = 10'' + \frac{d}{12}$; Where C is in inches and d is water depth in inches. (12" Min.)



LONGITUDINAL SECTION
MEMBRANE AT STRUCTURES



LONGITUDINAL SECTION
METHOD OF ENDING MEMBRANE



b	T	S:S = 2:1, R=4.23608 T, ΔWP=.00850 R, A=.00425 R²			S:S = 2½:1, R=5.19259 T, ΔWP=.00466 R, A=.00233 R²			S:S = 3:1, R=6.16226 T, ΔWP=.00280 R, A=.00140 R²		
		R	2ΔWP	2A	R	2ΔWP	2A	R	2ΔWP	2A
2	1.0	4.24	.07	.15	5.19	.05	.13	6.16	.03	.11
3	1.0	4.24	.07	.15	5.19	.05	.13	6.16	.03	.11
4	1.0	4.24	.07	.15	5.19	.05	.13	6.16	.03	.11
5	1.5	6.35	.11	.34	7.79	.07	.28	9.24	.05	.24
6	2.0	8.47	.14	.61	10.39	.10	.50	12.32	.07	.42
8	2.8	11.86	.20	1.20	14.54	.14	.99	17.25	.10	.83
10	3.5	14.83	.25	1.87	18.17	.17	1.54	21.57	.12	1.30
12	4.3	18.22	.31	2.82	22.33	.21	2.32	26.50	.15	1.97
14	5.0	21.18	.36	3.81	25.96	.24	3.14	30.81	.17	2.66
16	5.5	23.30	.40	4.61	28.56	.27	3.80	33.89	.19	3.22
18	6.0	25.42	.43	5.49	31.16	.29	4.52	36.97	.21	3.83
20	6.5	27.53	.47	6.44	33.75	.31	5.31	40.05	.22	4.49
22	7.0	29.65	.50	7.47	36.35	.34	6.16	43.14	.24	5.21
24	7.5	31.77	.54	8.58	38.94	.36	7.07	46.22	.26	5.98
26	7.9	33.47	.57	9.52	41.02	.38	7.84	48.68	.27	6.64
28	8.3	35.16	.60	10.51	43.10	.40	8.66	51.15	.29	7.33
30	8.7	36.85	.63	11.54	45.18	.42	9.51	53.61	.30	8.05
35	9.5	40.24	.68	13.76	49.33	.46	11.34	58.54	.33	9.60
40	10.5	44.48	.76	16.82	54.52	.51	13.85	64.70	.36	11.72
45	11.2	47.44	.81	19.13	58.16	.54	15.76	69.02	.39	13.34
50	12.0	50.83	.86	21.96	62.31	.58	18.09	73.95	.41	15.31

NOTES

The gradation, type and thickness of the cover material is dependent on tractive forces and velocities in the section, and the type of material available in the area.

ΔWp is the difference between 2T and the arc length. To obtain the wetted perimeter for a section, subtract 2ΔWp from the wetted perimeter for a trapezoidal section of width b.

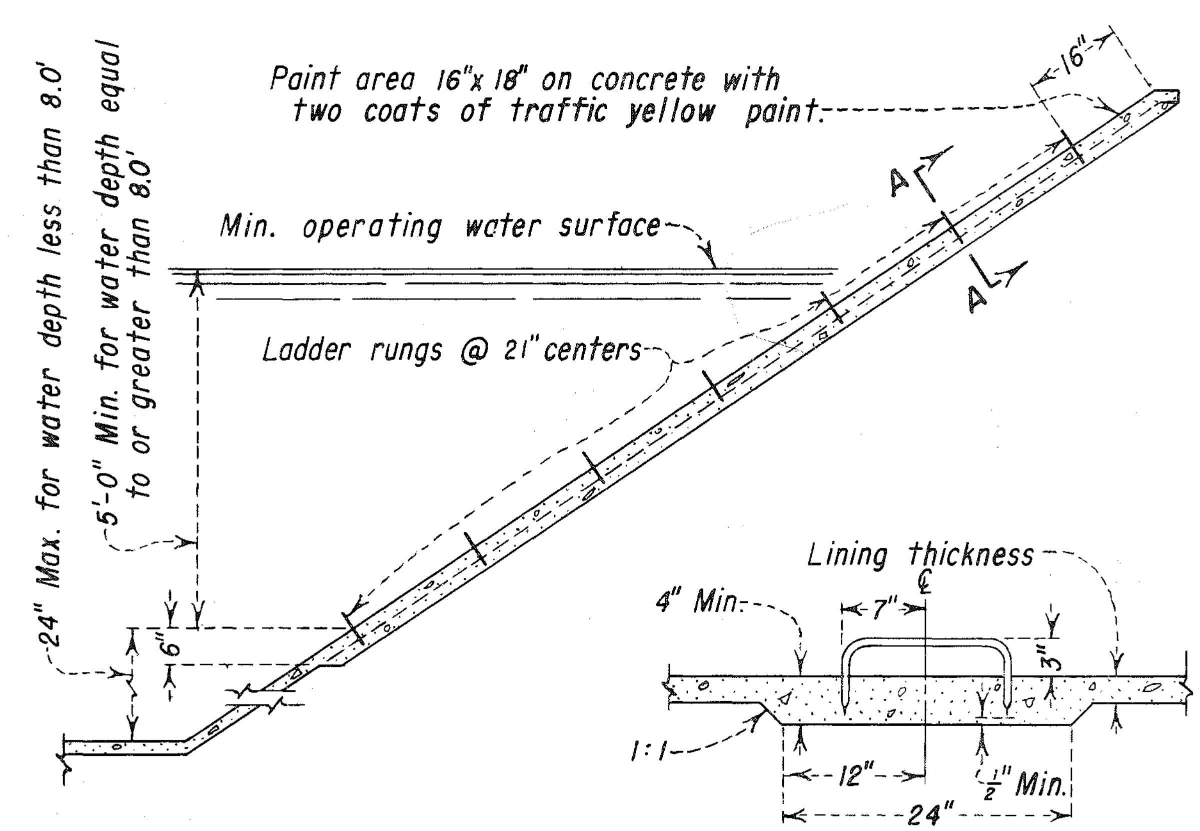
A is the area of the fillet. To obtain the area for a section, subtract 2A from the area of a trapezoidal section of width b.

For freeboard see 103-D-341.

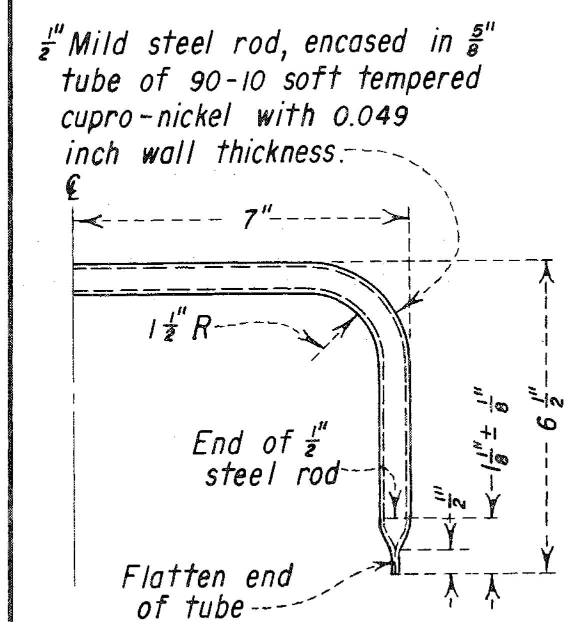
DETAILS OF BURIED MEMBRANE LININGS

MAY 26, 1960

103-D-632



SECTION A-A



LADDER RUNG

NOTES

Ladder rungs to be placed during concrete lining operations, located opposite each other at 750 ft. intervals on each side of the canal, and upstream of structures as directed.

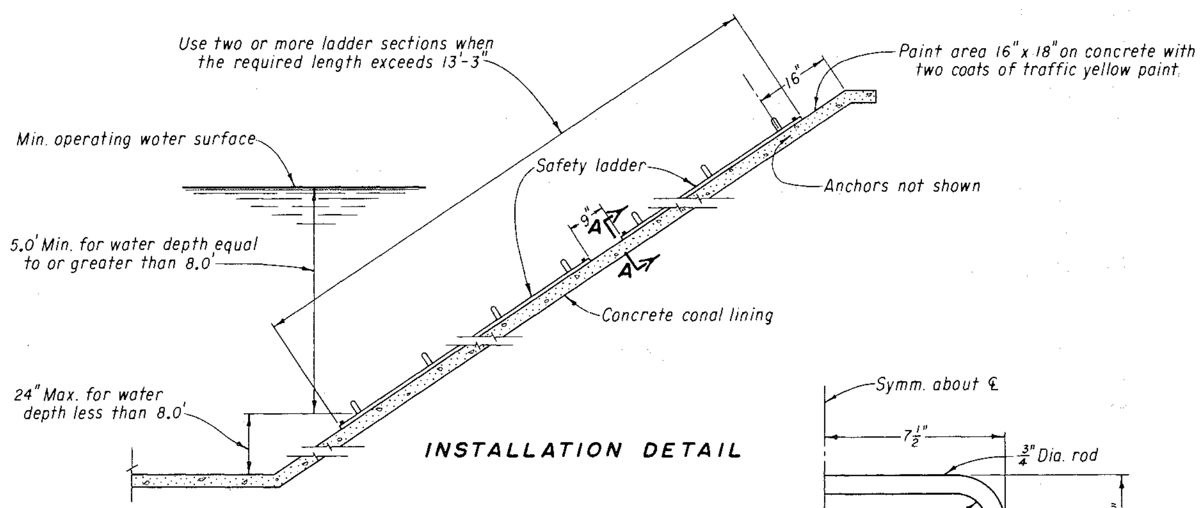
Ladder rungs are not required on sides of canals where the vertical lining height is less than 2½ feet.

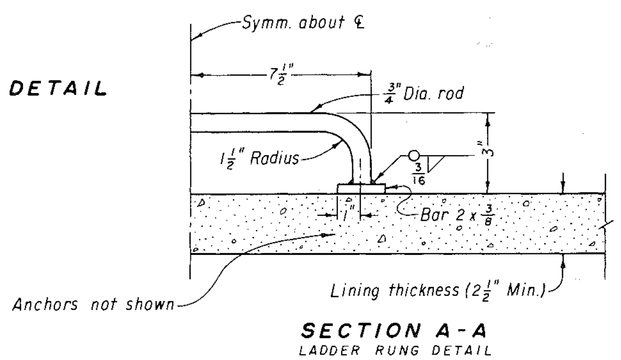
8-11-67 D-617	CHANGED NOTE CONCERNING LOCATION
	ALWAYS THINK SAFETY
2-2-67 D-4	CHANGED RUNG SPACING AND TITLE
	THIS DWG. SUPERSEDES 40-D-4848

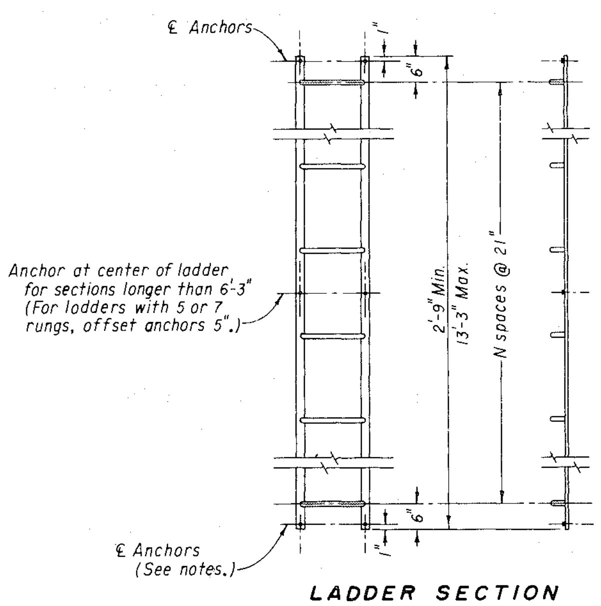
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

SAFETY LADDER RUNGS FOR CONCRETE LINED CANALS

DRAWN T.R.H. SUBMITTED P.W. Terrell
TRACED S.W.M. RECOMMENDED M. H. Light
CHECKED WB APPROVED [signature] CHIEF ENGINEER
DENVER, COLORADO NOV. 12, 1963 40-D-5927







NOTES

Ladders to be used on sides of canal where the vertical lining height is $2\frac{1}{2}$ feet or more.
Ladders to be located opposite each other at 750-foot intervals on each side of the canal, and upstream of structures as directed.
Ladders to be fabricated from steel or 6061-T6 aluminum.
Ladders shall be anchored to the canal lining with stainless steel expansion type or impact type anchors, subject to the approval of the contracting officer.
Ladders to be painted yellow after fabrication.

6-27-69 D-GJT	CHANGED PAINT NOTE.
7-21-67 D-GJT	CHANGED NOTE CONCERNING LOCATION

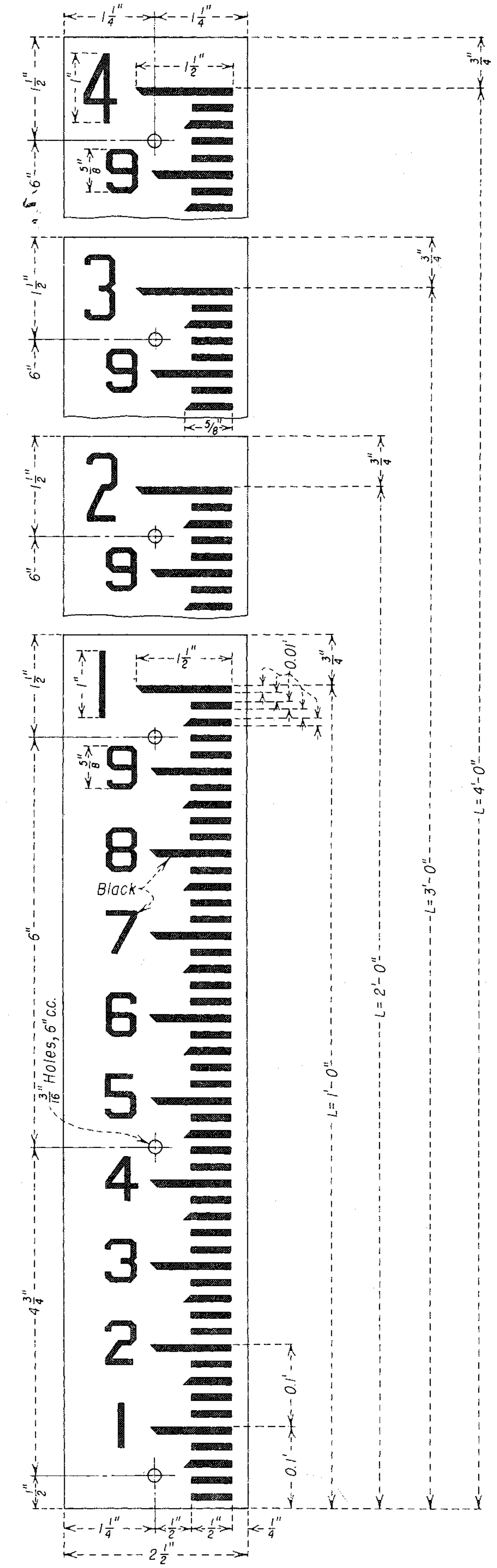
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

SAFETY LADDER FOR CONCRETE LINED CANALS

DRAWN C.E.J. SUBMITTED [signature]
TRACED G.L.S. RECOMMENDED [signature]
CHECKED [initials] APPROVED [signature]
CHIEF ENGINEER

DENVER, COLORADO, JANUARY 17, 1967 | 40-D-6112



NOTES

Gages to be made of No. 18 gage (U.S. standard) mild steel plate and to be covered with vitreous enamel with a minimum thickness of 12 mils on numeral side and 3 mils on the reverse side and on edges where plate has been cut, punched or drilled.

All cutting, drilling and punching of the plates shall be completed before the vitreous enamel is applied.

The face of the gage shall be white and all numerals and graduations shall be black.

Graduations shall be sharp and accurate to the dimensions shown.

The length "L" shall be as given in the schedule. In case a greater length than 4'-0" is required the details shall be similar to details shown for shorter lengths.

ALWAYS THINK SAFETY

1-17-58 D G.E.B.	CHANGED WORD PORCELAIN TO VITREOUS IN NOTES

RETRACED 7-25-56 M.D.B. | REV. 3-22-54 D.W. G.W.B. | RETRACED 7-19-48 L.R.G.

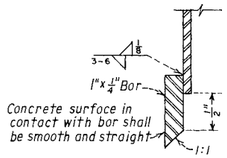
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STANDARD DESIGNS

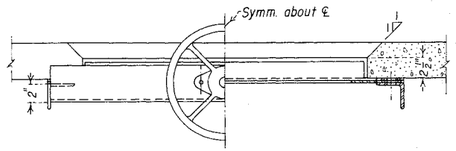
ENAMELED WEIR GAGES

DRAWN J.H. SUBMITTED
TRACED M.D.B. RECOMMENDED J. L. Savage
CHECKD J.S.L. APPROVED R. F. Walter

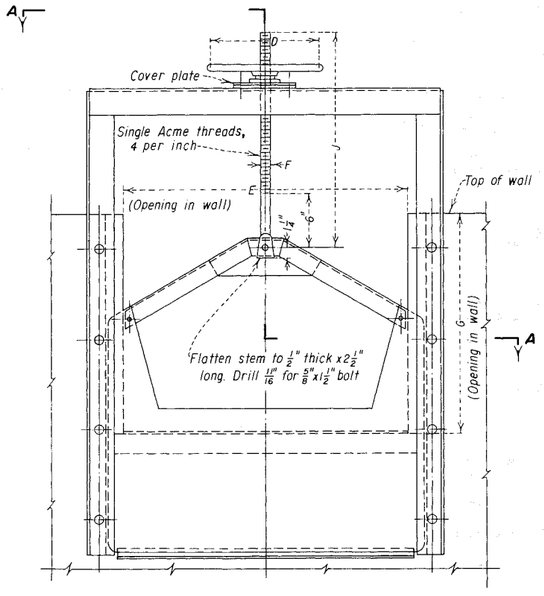
DENVER, COLORADO, APRIL 3, 1918 | 40-C-71



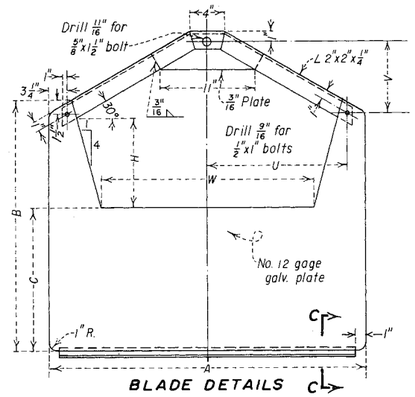
SECTION C-C

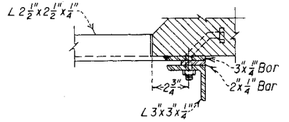


SECTION A-A

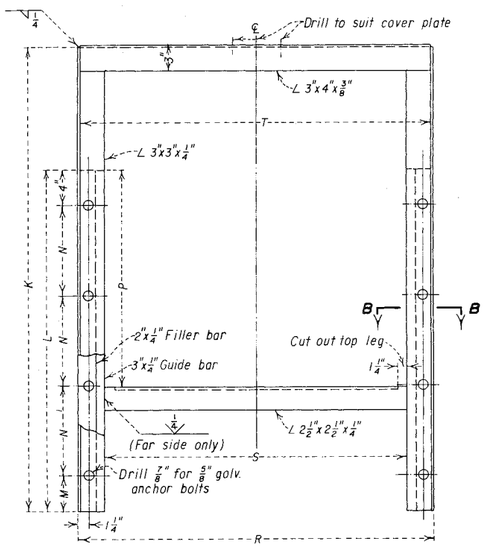


WEIR ASSEMBLY





SECTION B-B



FRAME DETAILS

Tack weld guide bars, filler bars and 3"x3"x1/4" angles together

TABLE OF DIMENSIONS

DIM.	2' WEIR	3' WEIR	
A	3'-1 1/2"	4'-3 1/2"	
B	2'-5"	3'-1"	
C	1'-5"	1'-9"	
D	1'-0"	1'-2"	
E	2'-10"	4'-0"	
F	0'-1"	0'-1 1/8"	
G	2'-0 1/2"	2-4 1/2"	
H	0'-10"	1'-2"	
J	2'-0"	2'-4"	
K	4'-4"	5'-9"	
L	3'-2"	3'-10"	
M	0'-4"	0'-3"	
N	0'-10"	1'-1"	
P	2'-0 1/4"	2'-4 1/4"	
R	3'-6"	4'-8"	
S	3'-0"	4'-2"	
T	3'-5 1/2"	4'-7 1/2"	
U	1'-3 1/2"	1'-10 1/2"	
V	0'-8"	1'-0"	
W	2'-0"	3'-0"	

NOTE

For details of handwheel, lifting nut, and cover plate; see 100-C-45.

7-19-68 D DMM.	HEIGHT OF BLADE REVISED. BOTTOM SEAL ADDED TO BLADE. MINOR DETAILS.	
11-16-62 D W.A.K.	TRACED	
2-4-59 D M.L.B.	DIMENSION D CHANGED TO 1'-2" FOR 3' WEIR	

TRACED 1-16-50 EPHRATA, WASH. REV. 5-10-50 N.A.B.-W.H.G. REV. 3-5-51 A.J.D.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT-WASHINGTON

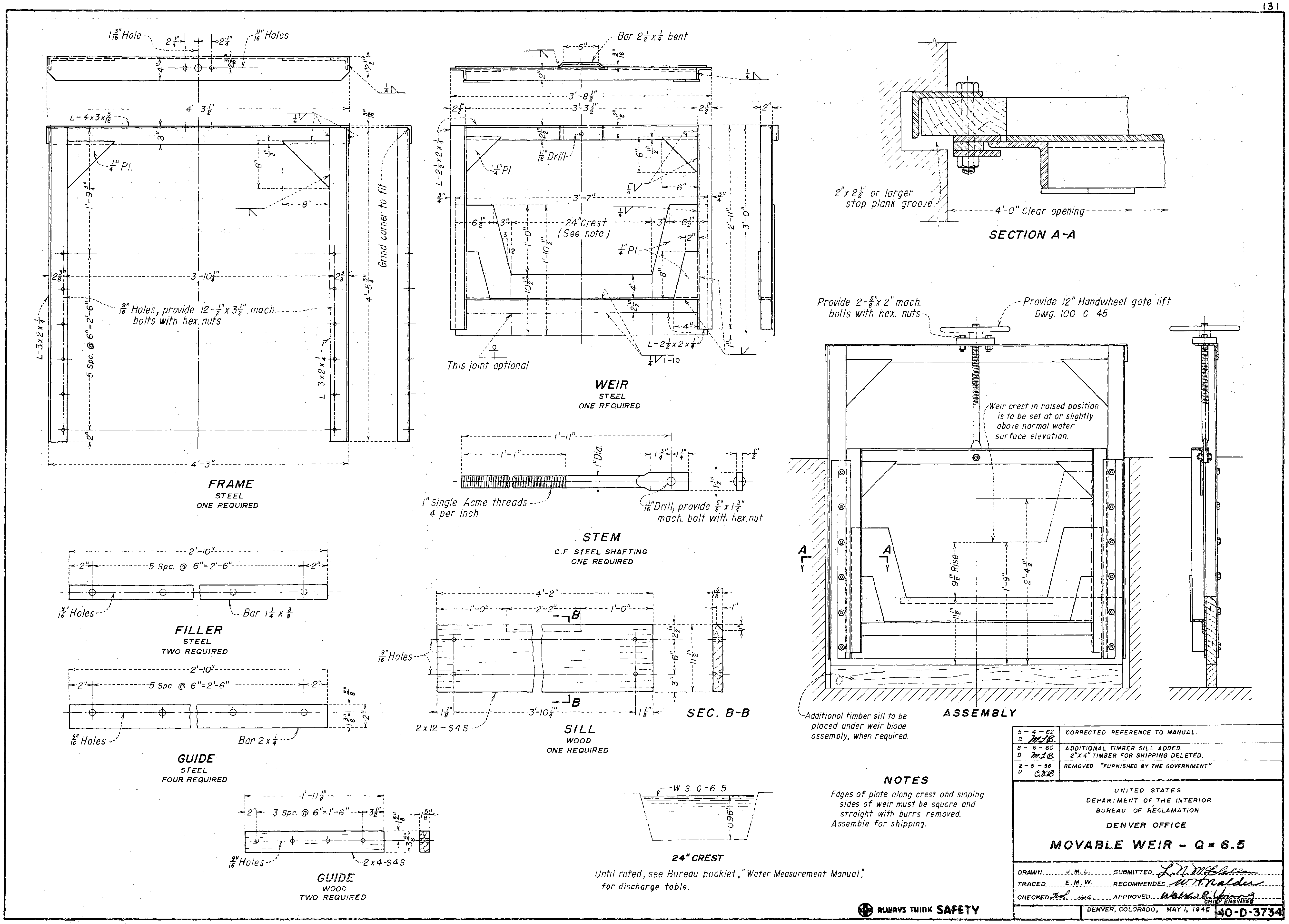
DISTRIBUTION SYSTEM

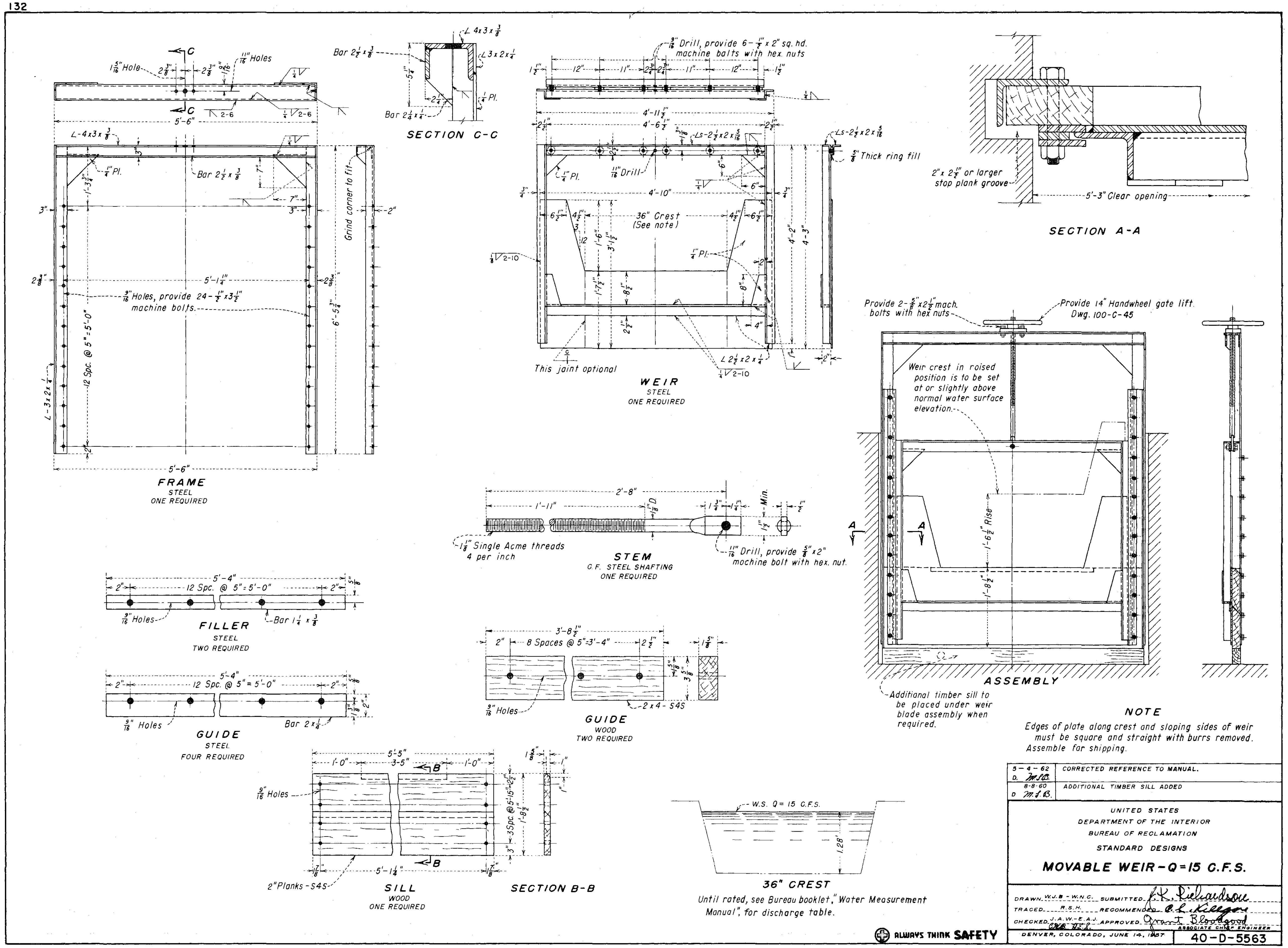
ADJUSTABLE WEIR

W=2'-0" and W=3'-0"

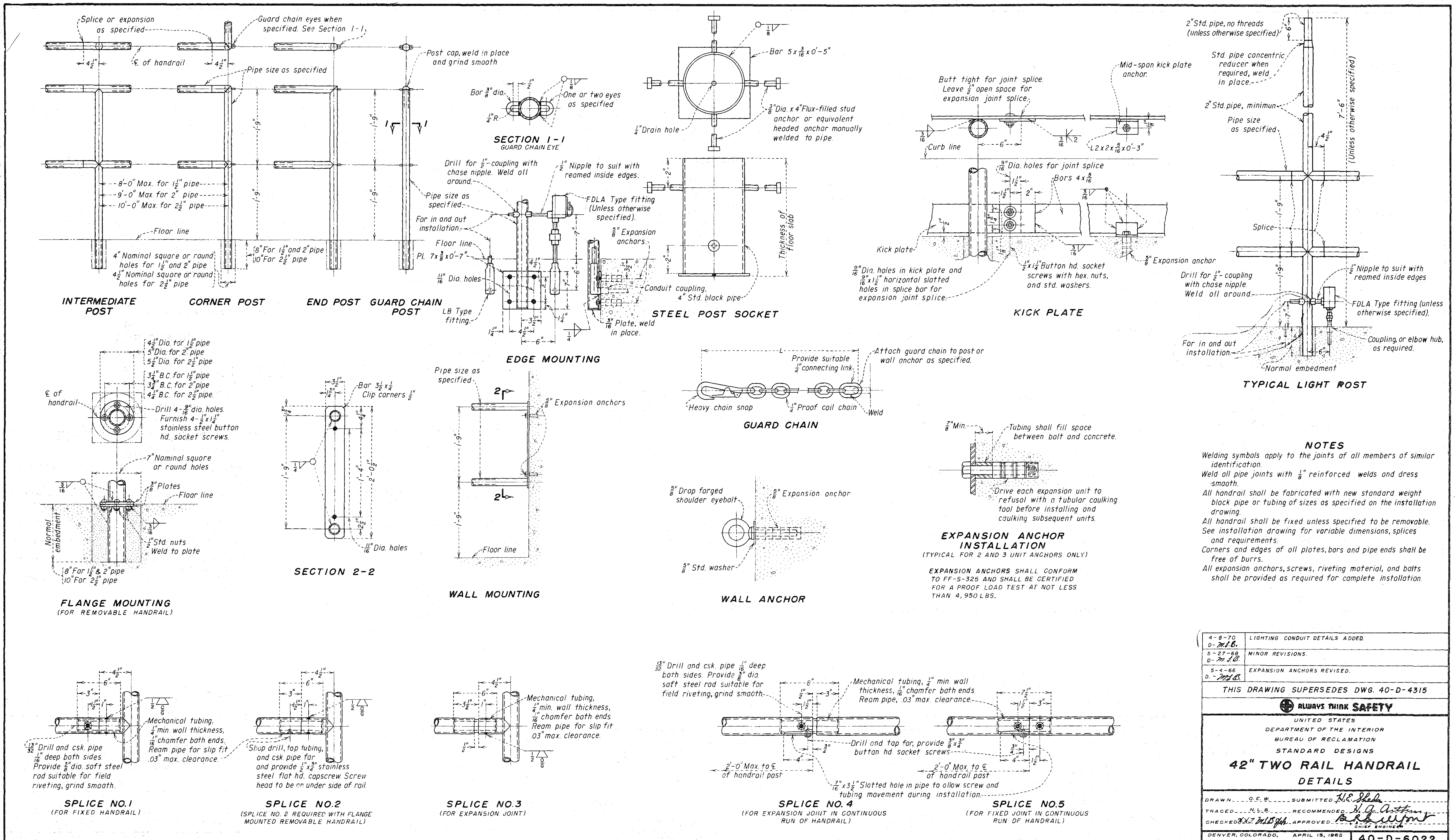
DRAWN V.D.B. SUBMITTED A.J. Davidson
TRACED W.A.D. RECOMMENDED O.L. Rice
CHECKED K.R.P.-S.W.A.-P.E.R. APPROVED L.N. McClellan, CHIEF ENGINEER

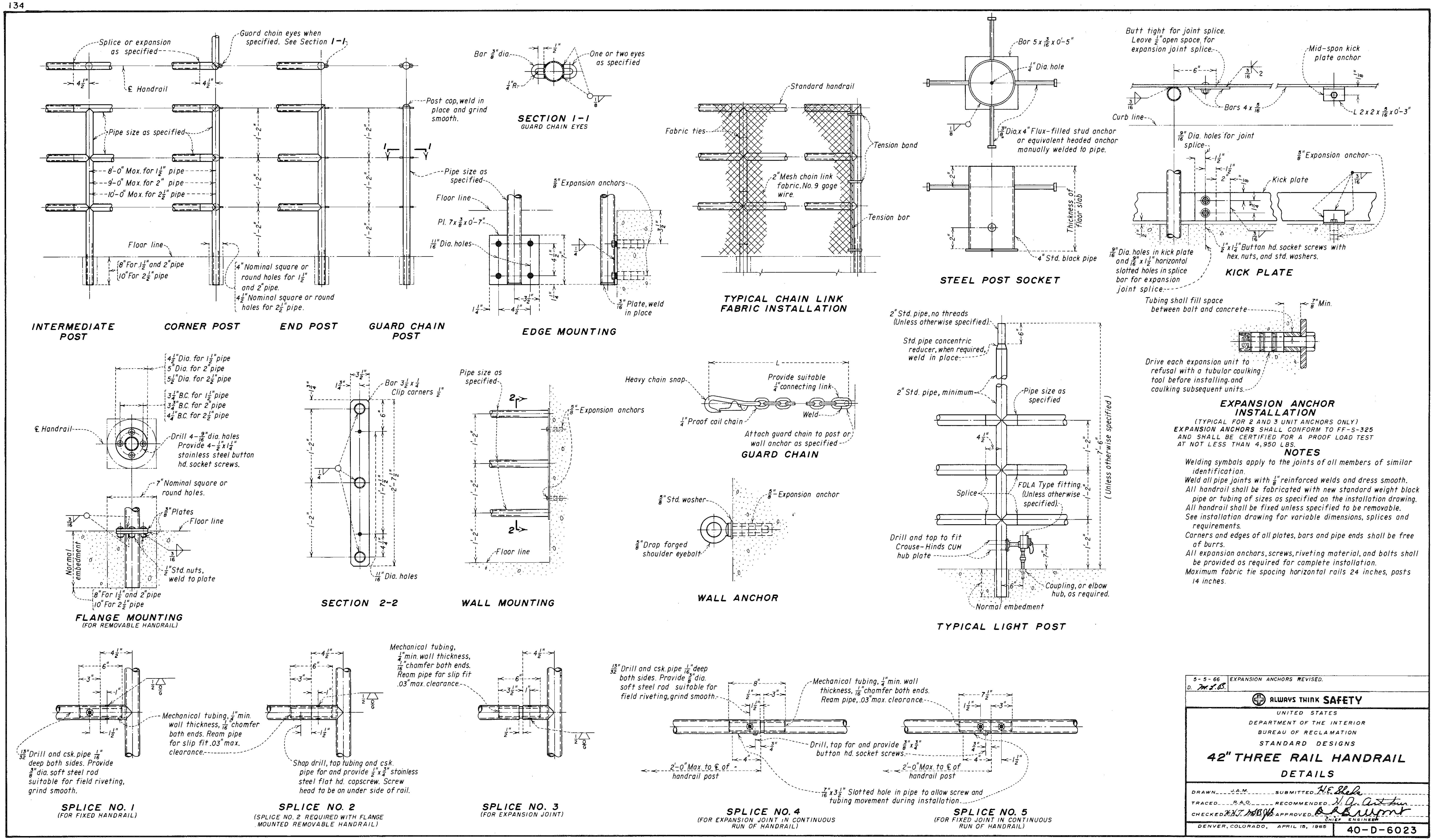
222-P-7729 | EPHRATA, WASH. AUG. 19, 1949 | 222-D-14596


FRAME
STEEL
ONE REQUIRED
L-4x3x5/16
1/4" Pl.
9/16" Holes, provide 12-1/2" x 3 1/2" mach. bolts with hex. nuts
5 Spc. @ 6"=2'-6"
L-3x2x1/4
Grind corner to fit
1 3/16" Hole
11/16" Holes
WEIR
STEEL
ONE REQUIRED
Bar 2 1/2 x 1/4 bent
11/16" Drill
24" Crest (See note)
L-2 1/2x2x1/4
This joint optional
SECTION A-A
2" x 2 1/2" or larger stop plank groove
4'-0" Clear opening
STEM
C.F. STEEL SHAFTING
ONE REQUIRED
1" Single Acme threads 4 per inch
11/16" Drill, provide 5/8" x 1 3/4" mach. bolt with hex. nut
1" Dia.
FILLER
STEEL
TWO REQUIRED
Bar 1 1/4 x 3/8
9/16" Holes
GUIDE
STEEL
FOUR REQUIRED
Bar 2 x 1/4
SILL
WOOD
ONE REQUIRED
2 x 12 - S4S
SEC. B-B
GUIDE
WOOD
TWO REQUIRED
2x4-S4S
3 Spc. @ 6"=1'-6"
Provide 2-5/8" x 2" mach. bolts with hex. nuts
Provide 12" Handwheel gate lift Dwg. 100-C-45
Weir crest in raised position is to be set at or slightly above normal water surface elevation.
9 1/2" Rise
Additional timber sill to be placed under weir blade assembly, when required.
ASSEMBLY
W.S. Q=6.5
24" CREST
Until rated, see Bureau booklet, "Water Measurement Manual," for discharge table.
NOTES
Edges of plate along crest and sloping sides of weir must be square and straight with burrs removed.
Assemble for shipping.
5-4-62 CORRECTED REFERENCE TO MANUAL.
8-8-60 ADDITIONAL TIMBER SILL ADDED. 2" x 4" TIMBER FOR SHIPPING DELETED.
2-6-56 REMOVED "FURNISHED BY THE GOVERNMENT"
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
DENVER OFFICE
MOVABLE WEIR - Q = 6.5
DRAWN J.M.L. SUBMITTED
TRACED E.M.W. RECOMMENDED
CHECKED APPROVED
CHIEF ENGINEER
DENVER, COLORADO, MAY 1, 1945
40-D-3734
ALWAYS THINK SAFETY

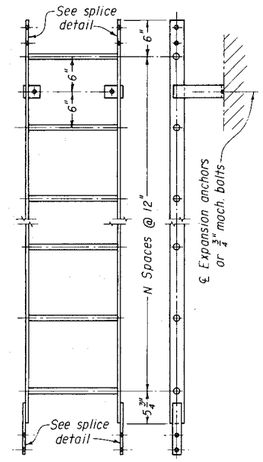


FRAME
STEEL
ONE REQUIRED
Grind corner to fit
L-4x3x 3/8
Bar 2 1/2 x 3/8
1/4" Pl.
9/16" Holes, provide 24 - 1/2" x 3 1/2" machine bolts.
12 Spc. @ 5" = 5'-0"
SECTION C-C
Bar 2 1/2 x 3/8
Bar 2 1/4 x 1/4
L 4x3x 3/8
L 3x2x 1/4
1/4" Pl.
9/16" Drill, provide 6 - 1/2" x 2" sq. hd. machine bolts with hex nuts
Ls-2 1/2 x 2 x 5/16
5/8" Thick ring fill
36" Crest (See note)
This joint optional
WEIR
STEEL
ONE REQUIRED
L 2 1/2 x 2 x 1/4
SECTION A-A
2" x 2 1/2" or larger stop plank groove
5'-3" Clear opening
Provide 2 - 5/8" x 2 1/2" mach. bolts with hex nuts
Provide 14" Handwheel gate lift. Dwg. 100-C-45
Weir crest in raised position is to be set at or slightly above normal water surface elevation.
1'-6 1/2" Rise
ASSEMBLY
Additional timber sill to be placed under weir blade assembly when required.
1 1/8" Single Acme threads 4 per inch
STEM
C.F. STEEL SHAFTING
ONE REQUIRED
11/16" Drill, provide 5/8" x 2" machine bolt with hex. nut.
FILLER
STEEL
TWO REQUIRED
Bar 1 1/4 x 3/8
GUIDE
STEEL
FOUR REQUIRED
Bar 2 x 1/4
GUIDE
WOOD
TWO REQUIRED
2 x 4 - S4S
9/16" Holes
SILL
WOOD
ONE REQUIRED
2" Planks - S4S
SECTION B-B
W.S. Q = 15 C.F.S.
36" CREST
Until rated, see Bureau booklet, "Water Measurement Manual", for discharge table.
NOTE
Edges of plate along crest and sloping sides of weir must be square and straight with burrs removed. Assemble for shipping.
5-4-62 CORRECTED REFERENCE TO MANUAL.
8-8-60 ADDITIONAL TIMBER SILL ADDED
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS
MOVABLE WEIR - Q = 15 C.F.S.
DRAWN W.J.B.-W.N.C. SUBMITTED
TRACED R.S.H. RECOMMENDED
CHECKED J.A.W.-E.A.J. APPROVED
ASSOCIATE CHIEF ENGINEER
DENVER, COLORADO, JUNE 14, 1957
40-D-5563
ALWAYS THINK SAFETY

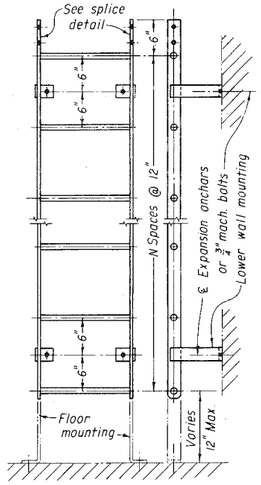

INTERMEDIATE POST
CORNER POST
END POST
GUARD CHAIN POST
Splice or expansion as specified
Guard chain eyes when specified. See Section 1-1.
℄ of handrail
Pipe size as specified
Post cap, weld in place and grind smooth
8'-0" Max. for 1½" pipe
9'-0" Max. for 2" pipe
10'-0" Max. for 2½" pipe
Floor line
4" Nominal square or round holes for 1½" and 2" pipe
4½" Nominal square or round holes for 2½" pipe
8" For 1½" and 2" pipe
10" For 2½" pipe
SECTION 1-1
GUARD CHAIN EYE
Bar ⅜" dia.
One or two eyes as specified
EDGE MOUNTING
Drill for ½"-coupling with chase nipple. Weld all around.
½" Nipple to suit with reamed inside edges.
FDLA Type fitting (Unless otherwise specified).
⅝" Expansion anchors
For in and out installation
LB Type fitting
Conduit coupling.
Plate, weld in place.
STEEL POST SOCKET
Bar 5x3/16x0'-5"
⅜" Dia. x 4" Flux-filled stud anchor or equivalent headed anchor manually welded to pipe.
¼" Drain hole
4" Std. black pipe
Thickness of floor slab
KICK PLATE
Butt tight for joint splice. Leave ½" open space for expansion joint splice.
Mid-span kick plate anchor.
Curb line
L2x2x5/16x0'-3"
9/16" Dia. holes for joint splice
Bars 4x5/16
Kick plate
9/16" Dia. holes in kick plate and 9/16"x1½" horizontal slotted holes in splice bar for expansion joint splice.
½"x1¼" Button hd. socket screws with hex. nuts, and std. washers.
⅝" Expansion anchor
TYPICAL LIGHT POST
2" Std. pipe, no threads (unless otherwise specified)
Std. pipe concentric reducer when required, weld in place.
2" Std. pipe, minimum
Pipe size as specified
7'-6" (Unless otherwise specified)
Splice
Drill for ½"-coupling with chase nipple. Weld all around.
½" Nipple to suit with reamed inside edges
FDLA Type fitting (unless otherwise specified).
For in and out installation
Coupling or elbow hub, as required.
Normal embedment
FLANGE MOUNTING
(FOR REMOVABLE HANDRAIL)
4½" Dia. for 1½" pipe
5" Dia. for 2" pipe
5½" Dia. for 2½" pipe
3¼" B.C. for 1½" pipe
3⅝" B.C. for 2" pipe
4¼" B.C. for 2½" pipe
℄ of handrail
Drill 4-9/16" dia. holes. Furnish 4-½"x1½" stainless steel button hd. socket screws.
7" Nominal square or round holes
⅜" Plates
Floor line
½" Std. nuts Weld to plate
Normal embedment
8" For 1½" & 2" pipe
10" For 2½" pipe
SECTION 2-2
Bar 3½x½ Clip corners ½"
11/16" Dia. holes
WALL MOUNTING
Pipe size as specified
⅝" Expansion anchors
Floor line
GUARD CHAIN
Provide suitable ¼" connecting link.
Attach guard chain to post or wall anchor as specified.
Heavy chain snap
¼" Proof coil chain
Weld
WALL ANCHOR
⅝" Drop forged shoulder eyebolt
⅝" Expansion anchor
⅝" Std. washer
EXPANSION ANCHOR INSTALLATION
(TYPICAL FOR 2 AND 3 UNIT ANCHORS ONLY)
Tubing shall fill space between bolt and concrete.
Drive each expansion unit to refusal with a tubular caulking tool before installing and caulking subsequent units.
EXPANSION ANCHORS SHALL CONFORM TO FF-S-325 AND SHALL BE CERTIFIED FOR A PROOF LOAD TEST AT NOT LESS THAN 4,950 LBS.
NOTES
Welding symbols apply to the joints of all members of similar identification.
Weld all pipe joints with ⅛" reinforced welds and dress smooth.
All handrail shall be fabricated with new standard weight black pipe or tubing of sizes as specified on the installation drawing.
All handrail shall be fixed unless specified to be removable.
See installation drawing for variable dimensions, splices and requirements.
Corners and edges of all plates, bars and pipe ends shall be free of burrs.
All expansion anchors, screws, riveting material, and bolts shall be provided as required for complete installation.
SPLICE NO. 1
(FOR FIXED HANDRAIL)
Drill and csk. pipe 1/16" deep both sides. Provide ⅜" dia. soft steel rod suitable for field riveting, grind smooth.
Mechanical tubing, ¼" min. wall thickness, 1/16" chamfer both ends. Ream pipe for slip fit .03" max. clearance.
SPLICE NO. 2
(SPLICE NO. 2 REQUIRED WITH FLANGE MOUNTED REMOVABLE HANDRAIL)
Shop drill, tap tubing, and csk pipe for and provide ½"x¾" stainless steel flat hd. capscrew. Screw head to be on under side of rail.
SPLICE NO. 3
(FOR EXPANSION JOINT)
Mechanical tubing, ¼" min. wall thickness, 1/16" chamfer both ends. Ream pipe for slip fit .03" max. clearance.
SPLICE NO. 4
(FOR EXPANSION JOINT IN CONTINUOUS RUN OF HANDRAIL)
Drill and csk. pipe 1/16" deep both sides. Provide ⅜" dia. soft steel rod suitable for field riveting, grind smooth.
Mechanical tubing, ¼" min. wall thickness, 1/16" chamfer both ends. Ream pipe, .03" max. clearance.
Drill and tap for, provide ⅜"x⅜" button hd socket screws
2'-0" Max. to ℄ of handrail post
7/16"x3½" Slotted hole in pipe to allow screw and tubing movement during installation.
SPLICE NO. 5
(FOR FIXED JOINT IN CONTINUOUS RUN OF HANDRAIL)
4-8-70 LIGHTING CONDUIT DETAILS ADDED.
5-27-68 MINOR REVISIONS.
5-4-66 EXPANSION ANCHORS REVISED.
THIS DRAWING SUPERSEDES DWG. 40-D-4315
ALWAYS THINK SAFETY
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS
42" TWO RAIL HANDRAIL
DETAILS
DRAWN O.E.W. SUBMITTED
TRACED N.L.B. RECOMMENDED
CHECKED APPROVED CHIEF ENGINEER
DENVER, COLORADO, APRIL 15, 1965
40-D-6022



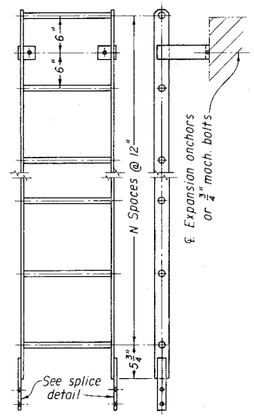
Splice or expansion as specified
Guard chain eyes when specified. See Section 1-1.
℄ Handrail
Post cap, weld in place and grind smooth.
Pipe size as specified
8'-0" Max. for 1½" pipe
9'-0" Max. for 2" pipe
10'-0" Max. for 2½" pipe
Floor line
8" For 1½" and 2" pipe
10" For 2½" pipe
4" Nominal square or round holes for 1½" and 2" pipe.
4½" Nominal square or round holes for 2½" pipe.
INTERMEDIATE POST
CORNER POST
END POST
GUARD CHAIN POST
Bar ⅜" dia.
One or two eyes as specified
SECTION 1-1
GUARD CHAIN EYES
Pipe size as specified
Floor line
Pl. 7 x ⅜ x 0'-7"
11/16" Dia. holes
⅝" Expansion anchors
3/16" Plate, weld in place
EDGE MOUNTING
Standard handrail
Fabric ties
Tension band
2" Mesh chain link fabric, No. 9 gage wire.
Tension bar
TYPICAL CHAIN LINK FABRIC INSTALLATION
Bar 5 x 3/16 x 0'-5"
¼" Dia. hole
3/8" Dia. x 4" Flux-filled stud anchor or equivalent headed anchor manually welded to pipe.
Thickness of floor slab
4" Std. black pipe
STEEL POST SOCKET
Butt tight for joint splice. Leave ½" open space for expansion joint splice.
Mid-span kick plate anchor
Bars 4 x 5/16
L 2 x 2 x 5/16 x 0'-3"
Curb line
9/16" Dia. holes for joint splice
⅝" Expansion anchor
Kick plate
9/16" Dia. holes in kick plate and 9/16" x 1½" horizontal slotted holes in splice bar for expansion joint splice
½" x 1¼" Button hd. socket screws with hex. nuts, and std. washers.
KICK PLATE
Tubing shall fill space between bolt and concrete
⅞" Min.
Drive each expansion unit to refusal with a tubular caulking tool before installing and caulking subsequent units.
EXPANSION ANCHOR INSTALLATION
(TYPICAL FOR 2 AND 3 UNIT ANCHORS ONLY)
EXPANSION ANCHORS SHALL CONFORM TO FF-S-325 AND SHALL BE CERTIFIED FOR A PROOF LOAD TEST AT NOT LESS THAN 4,950 LBS.
NOTES
Welding symbols apply to the joints of all members of similar identification.
Weld all pipe joints with ⅛" reinforced welds and dress smooth.
All handrail shall be fabricated with new standard weight black pipe or tubing of sizes as specified on the installation drawing.
All handrail shall be fixed unless specified to be removable.
See installation drawing for variable dimensions, splices and requirements.
Corners and edges of all plates, bars and pipe ends shall be free of burrs.
All expansion anchors, screws, riveting material, and bolts shall be provided as required for complete installation.
Maximum fabric tie spacing horizontal rails 24 inches, posts 14 inches.
4½" Dia. for 1½" pipe
5" Dia. for 2" pipe
5½" Dia. for 2½" pipe
3¼" B.C. for 1½" pipe
3¾" B.C. for 2" pipe
4¼" B.C. for 2½" pipe
℄ Handrail
Drill 4-9/16" dia. holes. Provide 4-½" x 1¼" stainless steel button hd. socket screws.
7" Nominal square or round holes.
⅜" Plates
Floor line
Normal embedment
½" Std. nuts, weld to plate
8" For 1½" and 2" pipe
10" For 2½" pipe
FLANGE MOUNTING
(FOR REMOVABLE HANDRAIL)
Bar 3½ x ¼
Clip corners ½"
11/16" Dia. holes
SECTION 2-2
Pipe size as specified
⅝" Expansion anchors
Floor line
WALL MOUNTING
Heavy chain snap
Provide suitable ¼" connecting link
¼" Proof coil chain
Weld
Attach guard chain to post or wall anchor as specified
GUARD CHAIN
⅝" Std. washer
⅝" Expansion anchor
⅝" Drop forged shoulder eyebolt
WALL ANCHOR
2" Std. pipe, no threads (Unless otherwise specified)
Std. pipe concentric reducer, when required, weld in place
2" Std. pipe, minimum
Pipe size as specified
Splice
FDLA Type fitting (Unless otherwise specified)
Drill and tap to fit Crouse-Hinds CUH hub plate
Coupling, or elbow hub, as required.
Normal embedment
(Unless otherwise specified)
TYPICAL LIGHT POST
Mechanical tubing, ¼" min. wall thickness, 1/16" chamfer both ends. Ream pipe for slip fit .03" max. clearance.
13/32" Drill and csk. pipe 1/16" deep both sides. Provide ⅜" dia. soft steel rod suitable for field riveting, grind smooth.
SPLICE NO. 1
(FOR FIXED HANDRAIL)
Shop drill, tap tubing and csk. pipe for and provide ½" x ¾" stainless steel flat hd. capscrew. Screw head to be on under side of rail.
SPLICE NO. 2
(SPLICE NO. 2 REQUIRED WITH FLANGE MOUNTED REMOVABLE HANDRAIL)
Mechanical tubing, ¼" min. wall thickness, 1/16" chamfer both ends. Ream pipe for slip fit .03" max. clearance.
SPLICE NO. 3
(FOR EXPANSION JOINT)
13/32" Drill and csk. pipe 1/16" deep both sides. Provide ⅜" dia. soft steel rod suitable for field riveting, grind smooth.
Mechanical tubing, ¼" min. wall thickness, 1/16" chamfer both ends. Ream pipe, .03" max. clearance.
Drill, tap for and provide ⅜" x ⅜" button hd. socket screws.
2'-0" Max. to ℄ of handrail post
7/16" x 3½" Slotted hole in pipe to allow screw and tubing movement during installation.
SPLICE NO. 4
(FOR EXPANSION JOINT IN CONTINUOUS RUN OF HANDRAIL)
SPLICE NO. 5
(FOR FIXED JOINT IN CONTINUOUS RUN OF HANDRAIL)
5-5-66 EXPANSION ANCHORS REVISED.
ALWAYS THINK SAFETY
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS
42" THREE RAIL HANDRAIL
DETAILS
DRAWN J.A.M. SUBMITTED
TRACED R.A.O. RECOMMENDED
CHECKED APPROVED CHIEF ENGINEER
DENVER, COLORADO, APRIL 15, 1965
40-D-6023



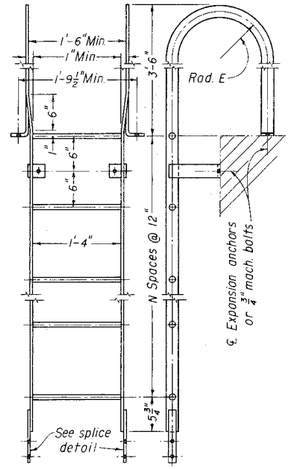
INTERMEDIATE SECTION



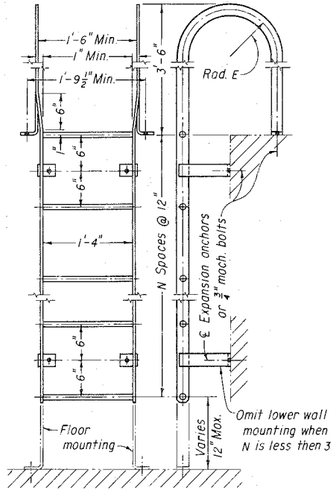
BOTTOM SECTION



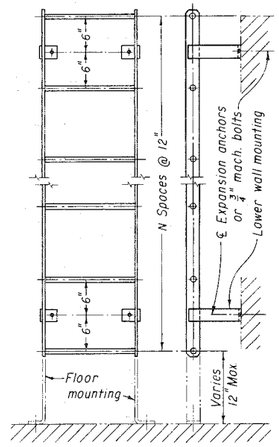
TOP SECTION No. 1



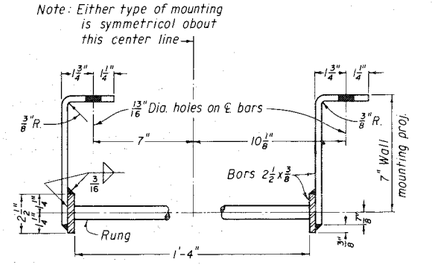
TOP SECTION No. 2



LADDER No. 3

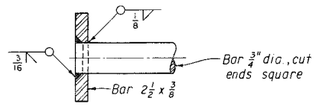


LADDER No. 4

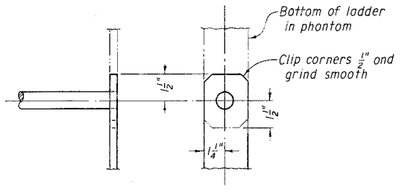


MOUNTINGS TURNED IN MOUNTINGS TURNED OUT

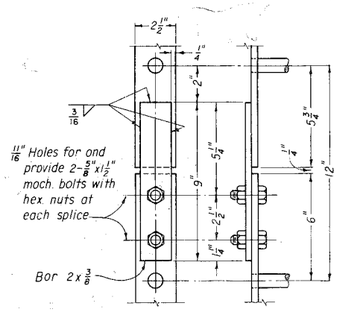
TYPICAL WALL MOUNTING DETAIL



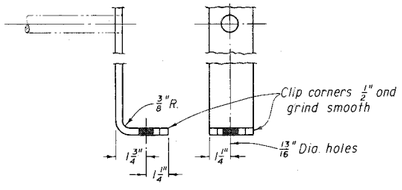
RUNG DETAIL
(TYPICAL)



SIDE BAR DETAIL
(TYPICAL TOP AND BOTTOM)



SPLICE DETAIL



FLOOR MOUNTING DETAIL
(TYPICAL TOP AND BOTTOM)

NOTES

Maximum span between mountings - 8 feet
All expansion anchors or mach. bolts shall be provided as required for complete installation.
See specifications for type of expansion anchor required.
Welding symbols apply to the joints of all members of similar identification.
When floor mounting is specified, the side bars shall continue to the floor as shown in phantom and the lower wall mounting shall be omitted.
All ladders exceeding 20 feet beteen landings shall be provided with safety coges.
All safety cages shall be in accordance with the lotest American Standards Association Sofety Code for Fixed Ladders.
Maximum distance between landings - 30 feet.
This 16" ladder has the minimum widths which will comply with all requirements of the Americon Standard Association Sofety Code for Fixed Ladders.

6-19-67 D. Prof. B.	RETRACED AND NOTES REVISED.

THIS DRAWING SUPERSEDES DWG. 40-D-5708

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

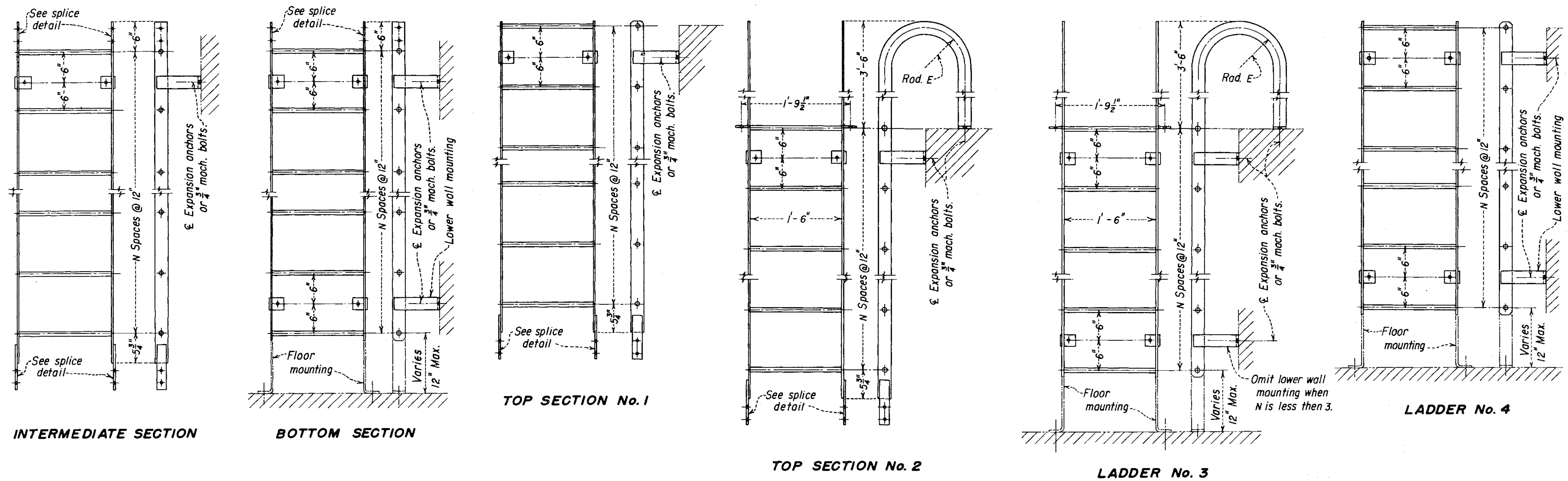
STANDARD DESIGNS

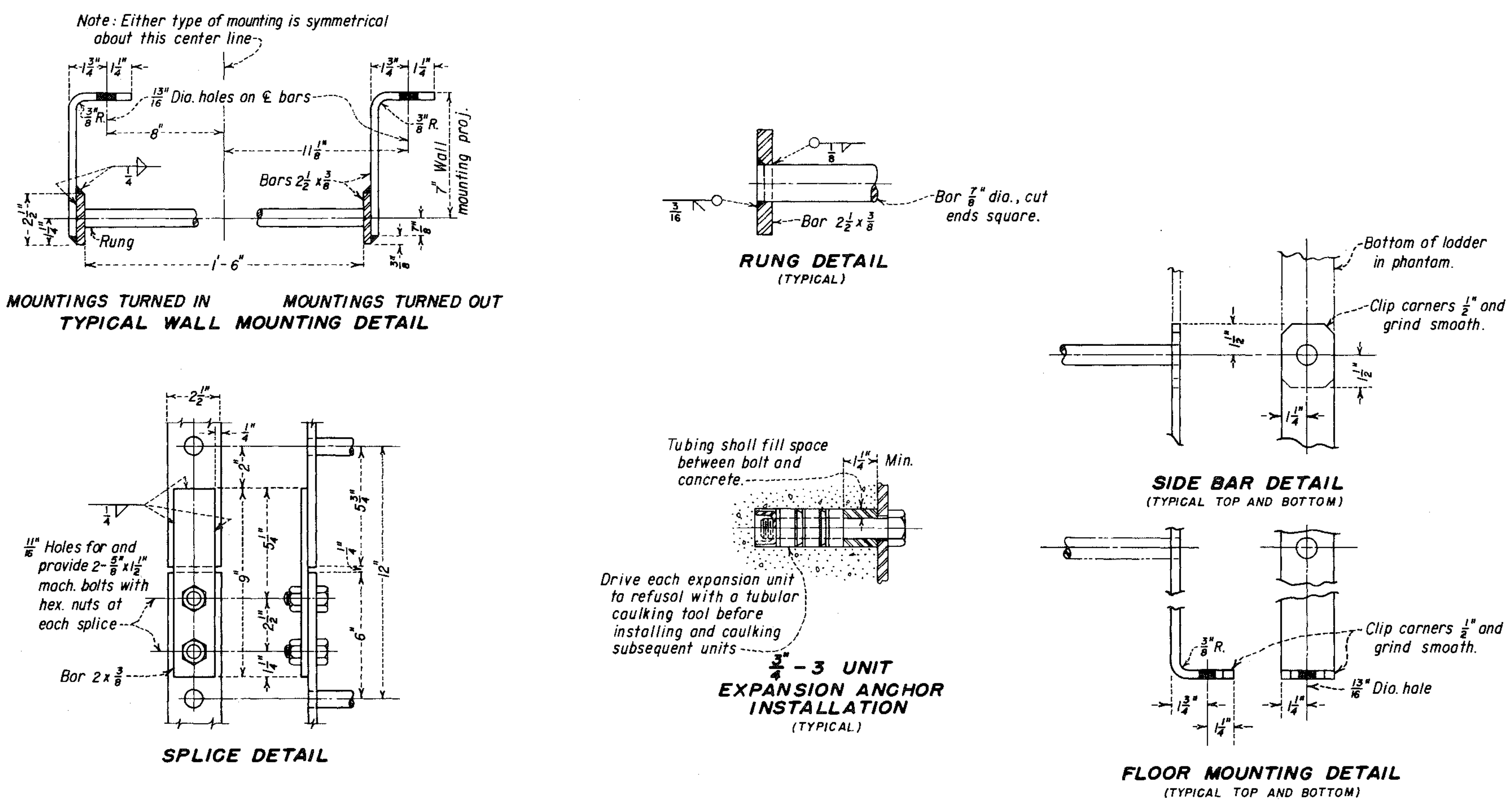
16" STEEL LADDER

DRAWN	J.M.	SUBMITTED	H.E. Sheda
TRACED	G.R.S.	RECOMMENDED	O.L. Rice
CHECKED		APPROVED	B.P. Beliport, CHIEF ENGINEER

DENVER, COLORADO, JULY 28, 1964

40-D-6002





NOTES

Maximum span between mountings - 8 feet.
All expansion anchors or mach. bolts shall be provided as required for complete installation.
Welding symbols apply to the joints of all members of similar identification.
When floor mounting is specified, the side bars shall continue to the floor as shown in phantom and the lower wall mounting shall be omitted.
All ladders exceeding 20 feet between landings shall be provided with safety cages.
All safety cages shall be in accordance with the latest American Standards Association Safety Code for Fixed Ladders.
Maximum distance between landings - 30 feet.

THIS DRAWING SUPERSEDES DRAWING 40-D-3392

ALWAYS THINK SAFETY

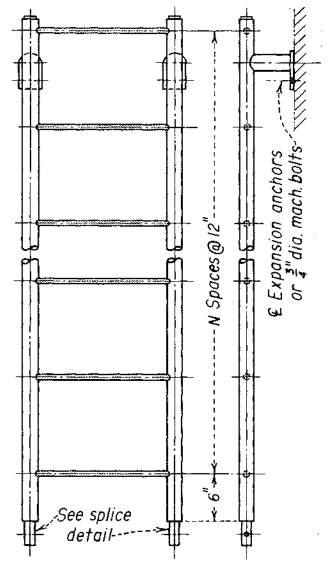
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STANDARD DESIGNS

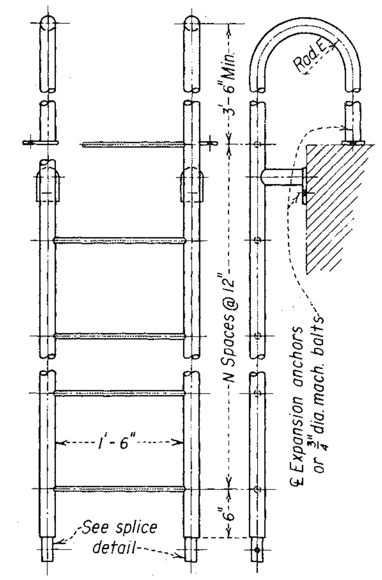
18" STEEL LADDER

DRAWN J.M. SUBMITTED H.E. Sheda
TRACED J.M. RECOMMENDED O.L. Rice
CHECKED APPROVED CHIEF ENGINEER

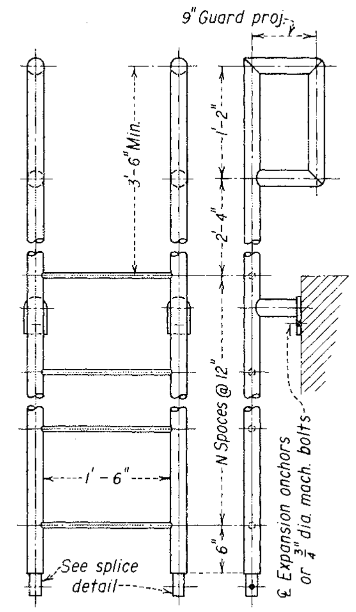
DENVER, COLORADO, JULY 28, 1964 | 40-D-6003



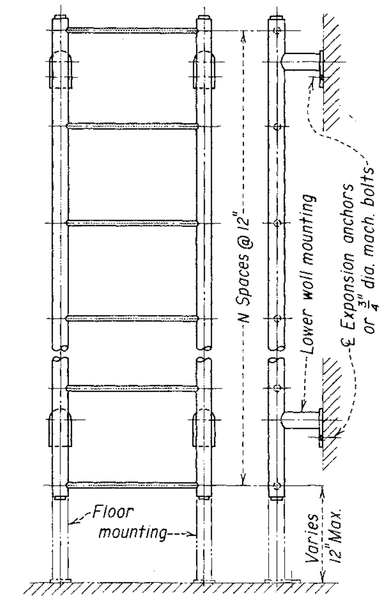
TOP SECTION No. 1



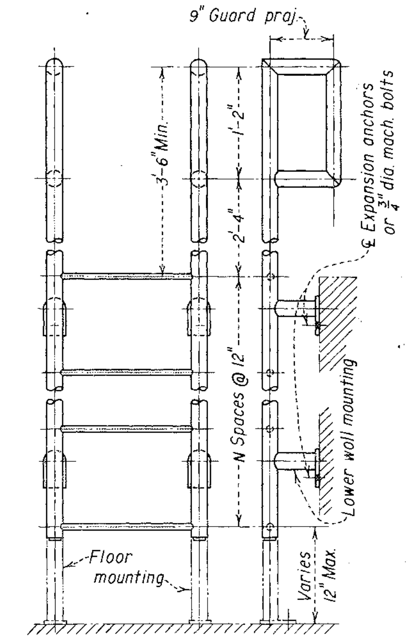
TOP SECTION No. 2



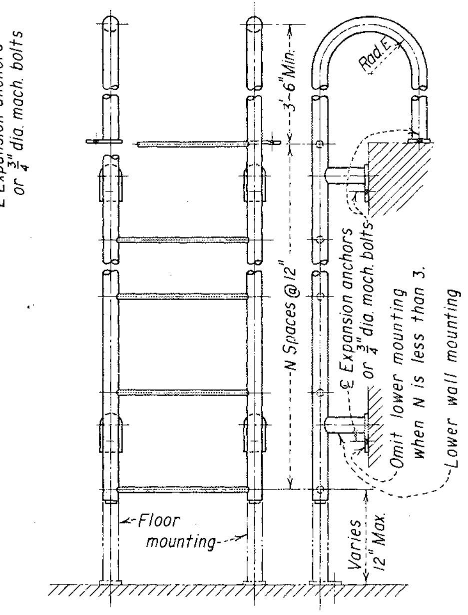
TOP SECTION No. 3



LADDER No. 4



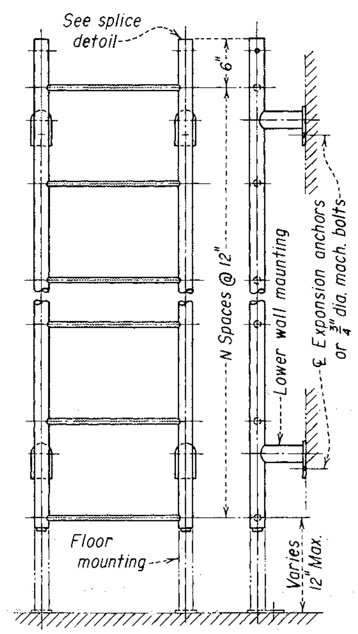
LADDER No. 5



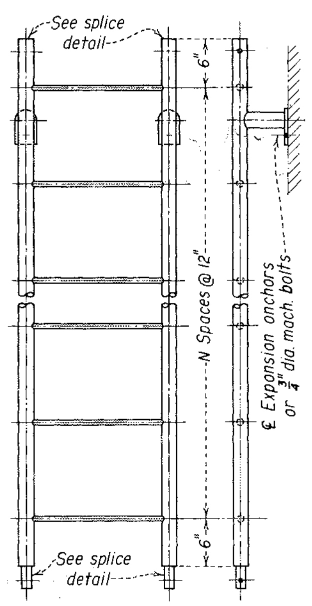
LADDER No. 6

NOTES

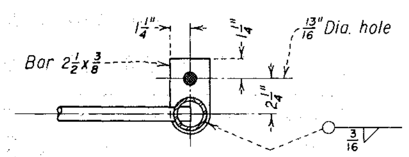
Side rails, $1\frac{1}{2}$-inch standard black pipe.
Recommended span between mountings – 8 feet.
Maximum span between mountings – 9 feet.
All expansion anchors or mach. bolts shall be provided as required for complete installation.
Welding symbols apply to the joints of all members of similar identification.
Weld all pipe joints with $\frac{1}{8}$" V reenforced welds and dress smooth.
When floor mounting is specified, the pipe side rails shall continue to the floor as shown in phantom and the lower wall mounting shall be omitted.
All ladders exceeding 20 feet between landings shall be provided with safety cages.
All safety cages shall be in accordance with the latest American Standards Association Safety Code for Fixed Ladders.
Maximum distance between landings 30 feet.



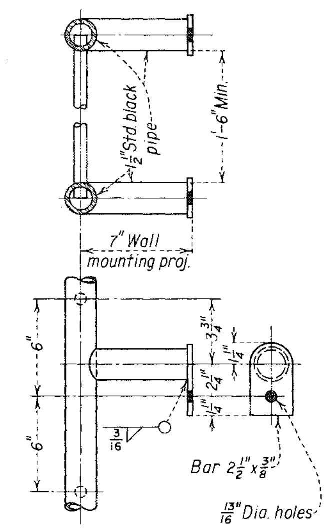
BOTTOM SECTION



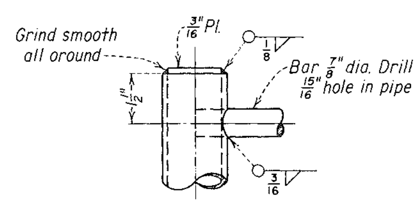
INTERMEDIATE SECTION



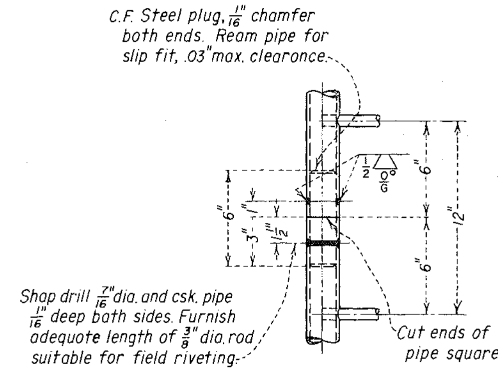
TYPICAL FLOOR MOUNTING DETAIL



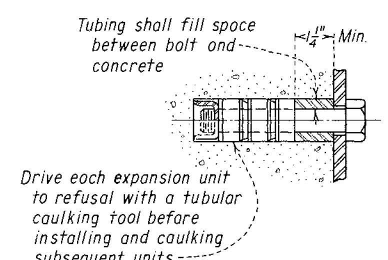
TYPICAL WALL MOUNTING DETAIL



CAP AND RUNG DETAIL
(TYPICAL)



SPLICE DETAIL



$\frac{3}{4}$"-3 UNIT EXPANSION ANCHOR INSTALLATION
(TYPICAL)

THIS DRAWING SUPERSEDES DRAWING 40-D-5199

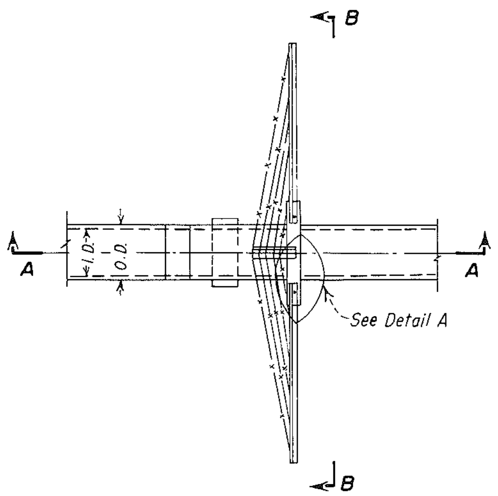
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

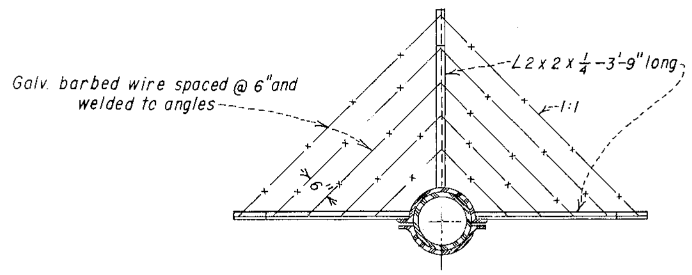
STANDARD DESIGNS

18" STEEL LADDER
PIPE SIDE RAILS

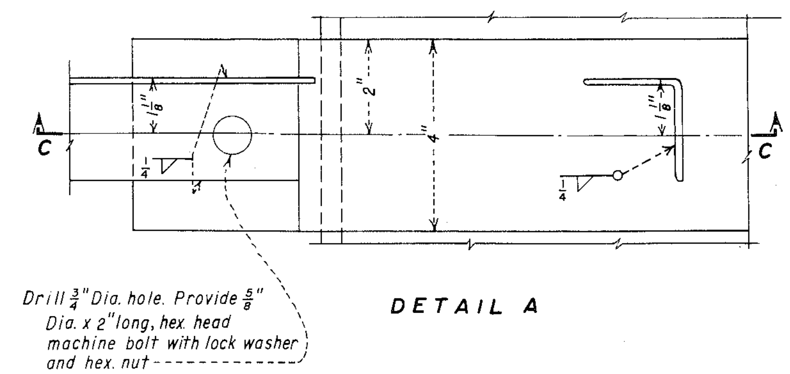
DRAWN N. L. B.	SUBMITTED H.E. Shed[illegible]
TRACED N. L. B.	RECOMMENDED O.L. Rice
CHECKED [illegible]	APPROVED [illegible] CHIEF ENGINEER
DENVER, COLORADO, JULY 13, 1964	40-D-6004



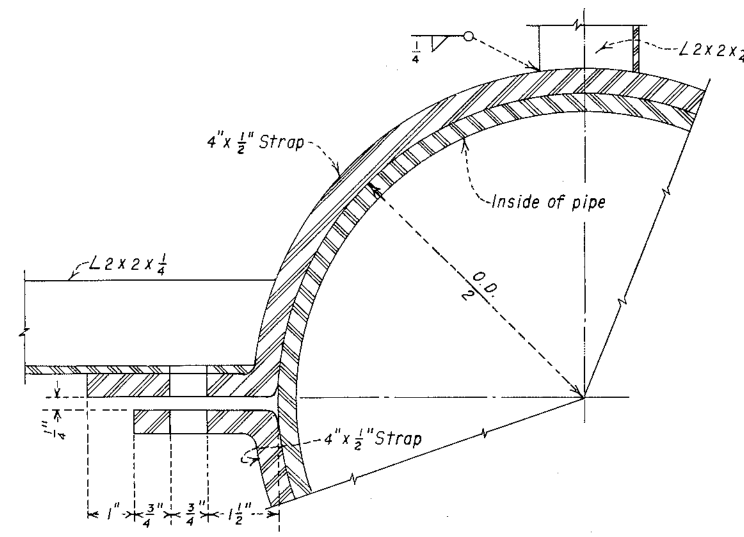
PLAN OF PIPE SAFETY BARRIER



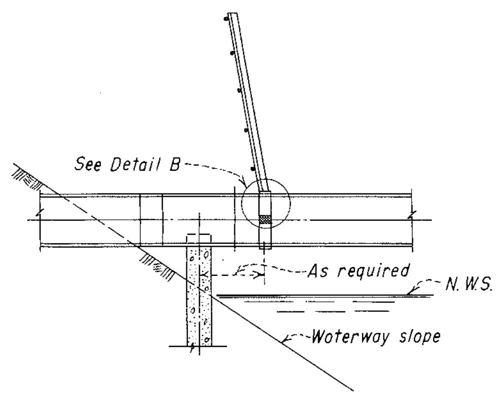
SECTION B-B



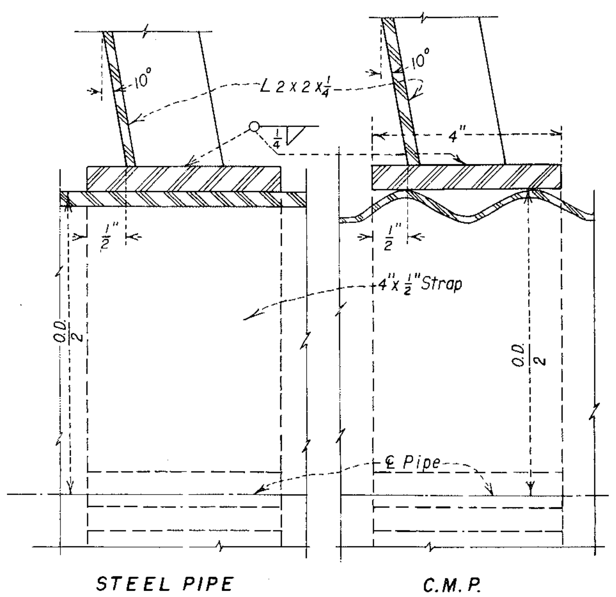
DETAIL A



SECTION C-C



SECTION A-A



DETAIL B

NOTE

Two Pipe Safety Barriers required at each pipe crossing

ALWAYS THINK SAFETY

3-13-70 D J.O.H.	CHANGE ANGLE LOCATION AND ATTACHMENT WELDS.
11-1-68 D J.O.H.	DELETED NOTE REQUIRING PARTS TO BE GALVANIZED

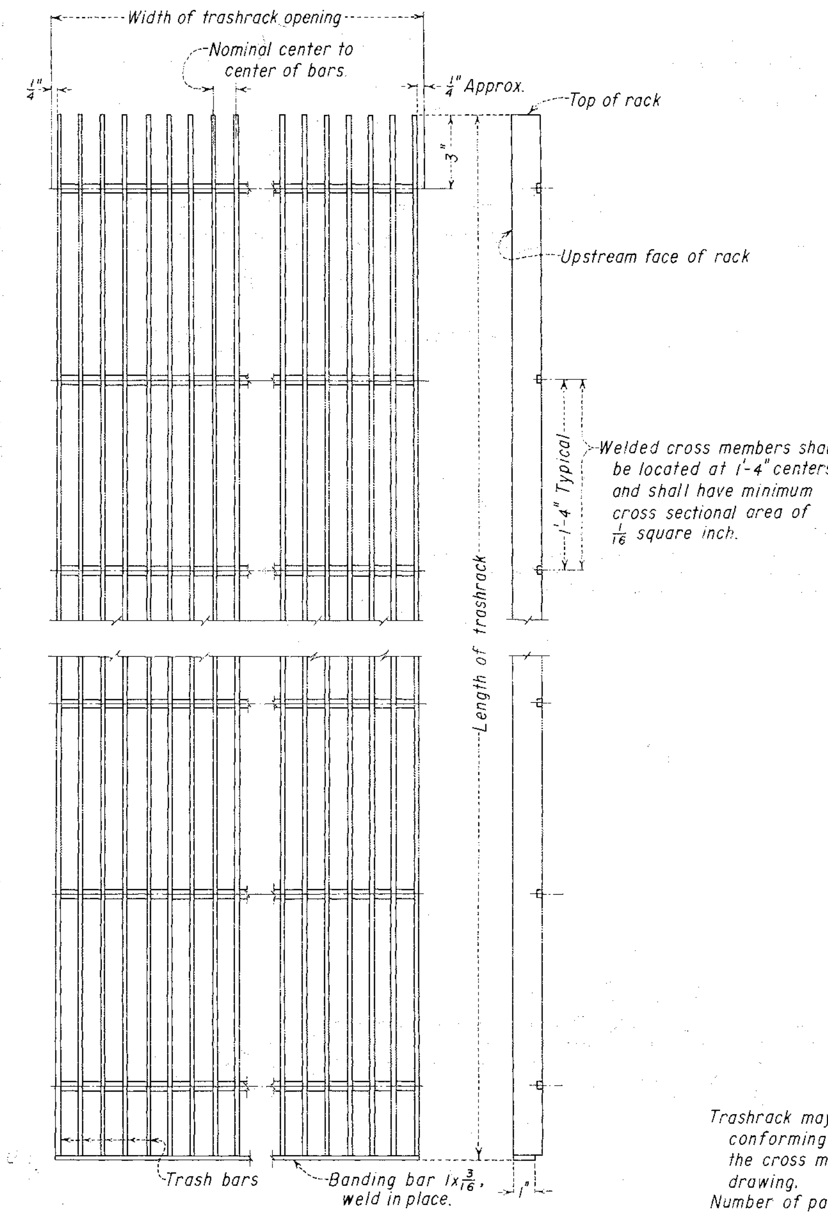
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STANDARD DESIGNS

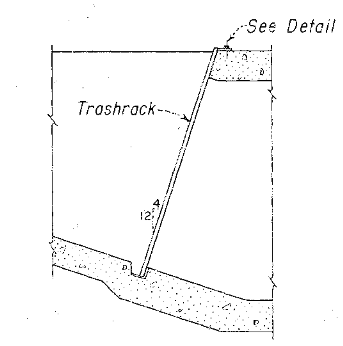
PIPE SAFETY BARRIER

DRAWN W.A.K. SUBMITTED P.N. Terrell
TRACED H.M.G. RECOMMENDED H. G. Arthur
CHECKED D.W.B. W.P. APPROVED [signature] CHIEF ENGINEER

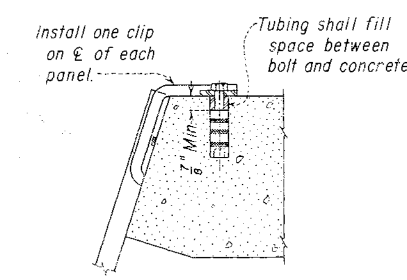
DENVER, COLORADO, DECEMBER 24, 1963 | 40-D-5931



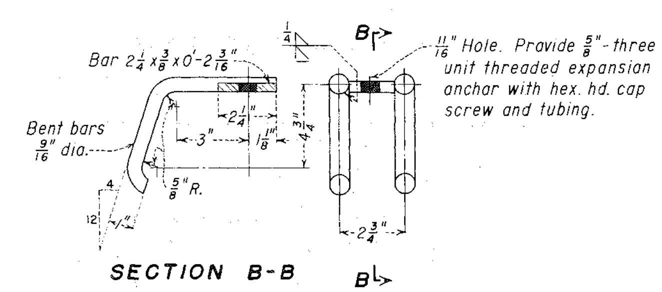
TRASHRACK
STEEL-GALVANIZED



INSTALLATION



DETAIL Z



SECTION B-B

CLIP
STEEL
ONE REQ'D. PER PANEL

NOTES

Trashrack may be Type I welded, commercial grating conforming to Federal Specification RR-G-661a, except the cross members shall be located as shown on this drawing.

Number of panels making up the overall width of trashrack is optional, but no panel shall be less than 12" wide.

The upstream face of the trashbars shall lie in a common plane within $\pm \frac{1}{4}$".

See specifications for:
- Size of trashbars.
- Width of trashrack opening.
- Length of trashrack.
- Nominal center to center of bars ($1\frac{3}{16}$" or $\frac{15}{16}$").

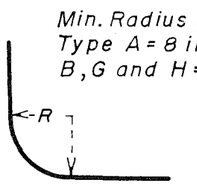
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

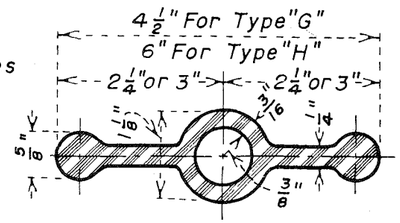
TRASHRACK
GRATING TYPE

DRAWN T.L.B. SUBMITTED H.E. Shedy
TRACED D.E.G. RECOMMENDED L. G. Puls
CHECKED H.W.T. APPROVED Grant Bloodgood, ASS'T. COMM. AND CHIEF ENGINEER

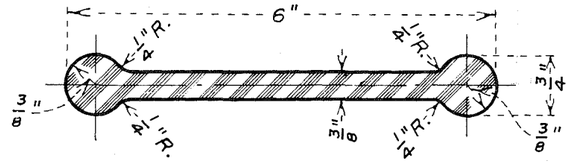
DENVER, COLORADO, DEC. 3, 1958 | 40-D-5651



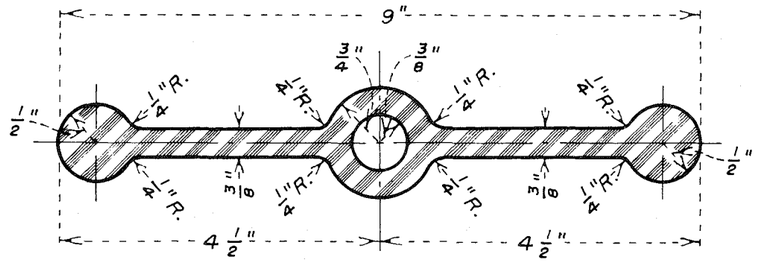
FOR FIELD INSTALLATION



TYPES "G" AND "H"



TYPE "B"



TYPE "A"

TOLERANCES

± 1/4" Width, Type A.

± 1/8" Width, Type B, G, and H.

+ 1/16" - 1/32" Web thickness, end bulb diameter, and wall thickness on center bulb, all types.

± 1/8" Diameter of center bulb, both I.D. and O.D., Types, A, G, and H.

ALWAYS THINK SAFETY

12-18-59 D	REVISED AND RETRACED.

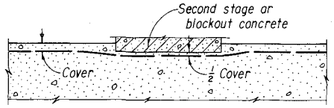
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STANDARD DESIGNS

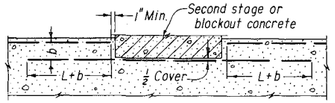
RUBBER WATERSTOPS

TYPES "A", "B", "G," AND "H"

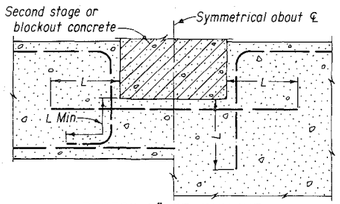
DRAWN H.C.C.	SUBMITTED H.R.McBirney
TRACED E.V.C.	RECOMMENDED K.B.Keener
CHECKED P.W.T.	APPROVED Walker R. Young
DENVER, COLO. 5-7-41	40-D-2867



RECESS LESS THAN 3" DEEP

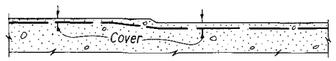


RECESS 3" TO LESS THAN 8" DEEP

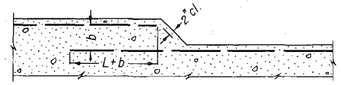


RECESS 8" OR DEEPER

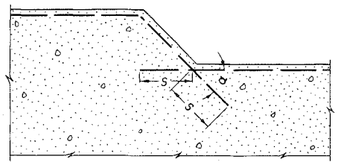
TYPICAL BLOCKOUT RECESS DETAILS
(Second stage concrete shown)



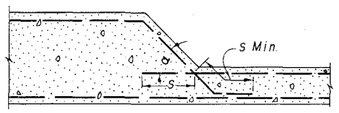
ANGLE OFFSET 2" OR LESS



ANGLE OFFSET GREATER THAN 2" TO LESS THAN 8"

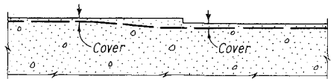


ANGLE OFFSET 8" OR MORE

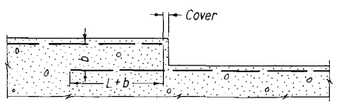


ANGLE OFFSET 8" OR MORE RESTRICTED MEMBER THICKNESS

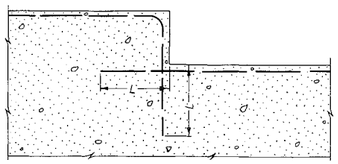
TYPICAL ANGLE OFFSET DETAILS



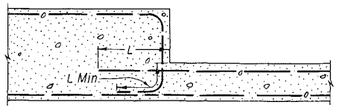
OFFSET 2" OR LESS



OFFSET GREATER THAN 2" TO LESS THAN 8"

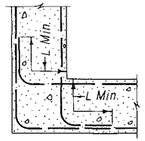


OFFSET 8" OR MORE

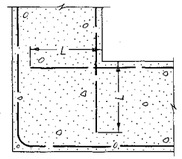


OFFSET 8" OR MORE RESTRICTED MEMBER THICKNESS

TYPICAL RIGHT ANGLE OFFSET DETAILS

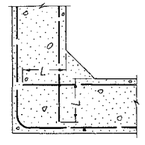


MEMBERS LESS THAN L IN THICKNESS

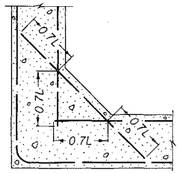


MEMBERS GREATER THAN L IN THICKNESS

TYPICAL CORNER DETAILS

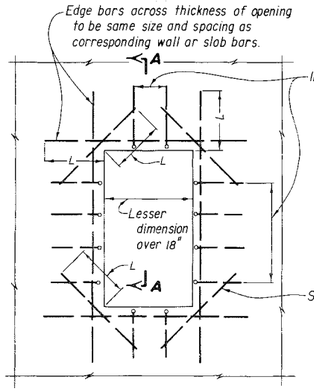


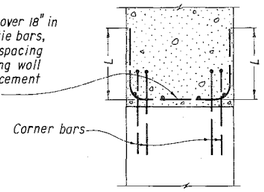
FILLET LESS THAN 12"



FILLET 12" AND GREATER

TYPICAL FILLETED CORNER DETAILS





SECTION A-A

CORNER BARS	
MEMBER THICKNESS	EACH CORNER (INCLUDES BOTH FACES)
8" or less	1-#5
9" Thru 12"	2-#6
13" Thru 18"	2-#8
19" Thru 24"	4-#8
25" Thru 36"	4-#9
37" Thru 48"	4-#10
Over 48"	4-#11

NOTES
Ties, edge, and corner bars not required for openings 18" or less. For a recess deeper than 4" but not greater than one half wall or slab thickness, use corner bars in face on recess side.

MINIMUM ADDITIONAL REINFORCEMENT AROUND OPENINGS IN WALLS AND SLABS

GENERAL NOTES

UNLESS OTHERWISE SHOWN ON THE REINFORCEMENT DESIGN DRAWINGS, THE DETAILS AND NOTES SHOWN ARE TYPICAL FOR ALL REINFORCEMENT DRAWINGS THAT REFER TO THIS DRAWING.

DESIGN:
Structural design is based on 3000 psi specified compressive concrete strength at 28 days with a working stress of 1,350 psi, and working stresses of 20,000 psi tension in reinforcement with a specified minimum yield strength of 40,000 psi.

ABBREVIATIONS:

bf = bottom face	br = bottom row	bl = bottom layer
tf = top face	tr = top row	tl = top layer
nf = near face	nr = near row	ns = near side
ff = far face	fr = far row	fs = far side
ef = each face	er = each row	es = each side
if = inside face	ir = inside row	ew = each way
of = outside face	or = outside row	ec = each corner
	mr = middle row	ml = middle layer

spc. = space or spaces
eq. spc. = equally spaced, equal spaces
D = nominal diameter of reinforcing bar
uv = uniformly varying lengths of bars between lengths shown
cl. = clear

SYMBOLS:
Bars shown thus — ⊢ #8@12 or — ⊢ #6@7½, indicate a group of identical bars equally spaced.
o— An open circle at the end of a bar indicates a bend with the bar turned away from the observer.
•— A closed circle at the end of a bar indicates a bend with the bar turned towards the observer
Splices shown thus ⌒ indicate a lapped splice, not a bend in the bar.

DIMENSIONS:
Dimensions are to the center lines of the bars unless otherwise shown. Clear cover dimensions are marked "cl."

COVER:
Place the reinforcement so that the clear distance between face of concrete and nearest reinforcement is 1½" for #5 bars and smaller and 2" for #6 bars and larger; except provide a clear distance from face of concrete placed against earth or rock of 2" where member thickness is 9" or less and 3" where member thickness is greater than 9", the clear distance being to the design dimension line.
Reinforcement paralleling construction joints shall have a minimum of 2" clear cover.

BENT BARS:
Only billet steel shall be used for bars bent to a radius of 50-bar diameters or less.
Unless larger radius bends are indicated on the design drawings, all reinforcement requiring bending shall be bent around a pin having the following diameter.

FOR CLASS B40

BAR NO.	3	4	5	6	7	8	9	10	11	14S	18S
Standard Bends Diameter of pin (in.)	1⅞	2½	3⅝	5¼	6⅝	7	9	10	11	17*	22½**
Stirrup and Tie bends Diameter of pin (in.)	1½	2	2½	4½	6⅝	7	9	10	11		

FOR CLASS B50

BAR NO.	3	4	5	6	7	8	9	10	11	14S	18S
Standard Bends Diameter of pin (in.)	2¼	3	3¾	6	7	8	10⅛	11¼	12⅜	17*	22½**
Stirrup and Tie bends Diameter of pin (in.)	1⅞	2½	3⅛	5¼	7	8	10⅛	11¼	12⅜		

*Special fabrication for bends exceeding 90° and for all grades of steel with yield point of 50,000 psi.

REINFORCEMENT DOWELS:
Dowels may be indicated on the drawing thus # 8 (d).
Dowels shall have a minimum embedment and projection equal to that required for lap splicing a bar of the same diameter.

PLAIN DOWELS:
Plain dowels across contraction joints shall be plain bars painted with one coat of red lead paint. Twist dowels to break bond before final set of first concrete placement. Immediately before the second concrete placement, the projecting half length of dowel shall be uniformly coated with a film of oil. Viscosity of the oil shall have a SAE rating of not less than 250.

STANDARD HOOKS:
Hooks shall have 180° bends and extensions of 4-bar diameters but not less than 2½" parallel to the main leg of the bar or 90° bends and extensions of at least 12-bar diameters. Hooks for stirrup and tie anchorage only shall have either a 90° or 135° bend plus an extension of at least 6-bar diameters but not less than 2½" at the free end of the bar. Radius of bend to be as specified in table for bent bars.
A bar (⌐) with a standard 180° hook on one end is referred to as an "A" bar.
A bar (⊐) with a standard 180° hook on both ends is referred to as a "B" bar.

PLACING:
Bars at small openings (max. 18") in wall and slabs may be spread apart not more than 1½ times the bar spacing.
Reinforcement may be adjusted in the field to clear waterstops, keys, form ties, anchor bars, seals, recesses, embedded metalwork, and conduits except in heavily reinforced areas. In such cases relocation of the embedded materials must be considered. In no case should bars be bent to greater than 6 to 1 slope.
Where possible, reinforcement shall be placed to maintain a clear distance of at least one inch between the reinforcement and anchor bolts, form ties, or other embedded metalwork.
Reinforcement parallel to anchor bolts or other embedded metalwork shall be placed to maintain a clear distance of at least 1½ times the maximum size aggregate.
Reinforcement not to be placed between or within 4 inches of main power leads.

SPACING:
The first and last bars in slabs and walls, stirrups in beams, and ties in columns are to start and end at a maximum of one half of the adjacent bar spacing.

SPLICES:
Unless otherwise shown the minimum length of lap for splicing parallel bars shall be as given in Table A.
When reinforcing bars of different size are to be spliced, the lap length shall be governed by the smaller diameter bar.
Splices are to be made so that the given distances to face of concrete will be maintained.
The minimum lap requirement "S" for non-parallel bars shall be as given in Table B.

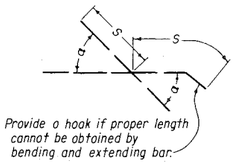
TABLE A
LENGTH OF LAPPED SPLICE "L", IN INCHES*

BAR NO.	L	BAR NO.	L
#2, #3, #4	12	#8	25
#5	15	#9	32
#6	18	#10	41
#7	21	#11	51

*Stagger splices if bars are spaced closer than a clear distance of 8-bar diameters or 8".

TABLE B
LENGTH OF SPLICE "S", FOR NON-PARALLEL BARS

ANGLE α	S
0° To 10°	0.5L
10° To 30°	0.6L
30° To 50°	0.7L
50° To 65°	0.8L
65° To 80°	0.9L
80° To 90°	1.0L



Provide a hook if proper length cannot be obtained by bending and extending bar.

ACCESSORIES:
Bar supports, spacers and other accessories are not shown on the design drawings. The recommendations of ACI 315-65 or other approved supporting systems may be used.

REFERENCES:
Numerals in parentheses ( ) following notes and section letters or numbers indicate the number of the drawing upon which the section or detail is shown; for example (524) denotes Drawing No. 557-D-524.
Unless otherwise shown follow the recommendations established by American Concrete Institutes "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315-65).

7-3-67 D-C.A.S.	RETRACED - PIN DIAMETERS REVISED
6-5-67 D-C.A.S.	MINOR CHANGES, STEEL CLASS ADDED

ALWAYS THINK SAFETY

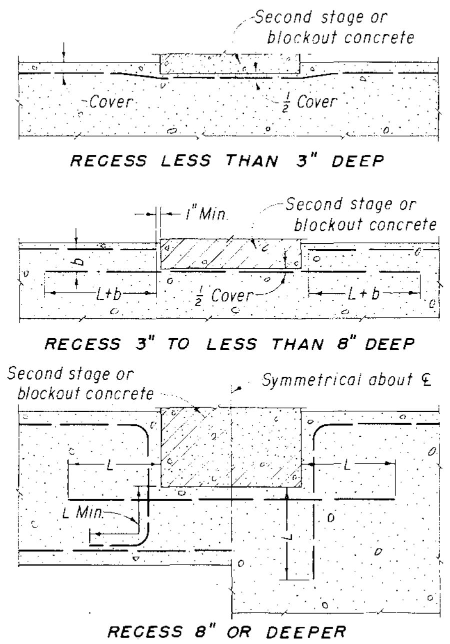
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

GENERAL NOTES AND MINIMUM REQUIREMENTS FOR DETAILING REINFORCEMENT
CLASS 40 AND CLASS 50

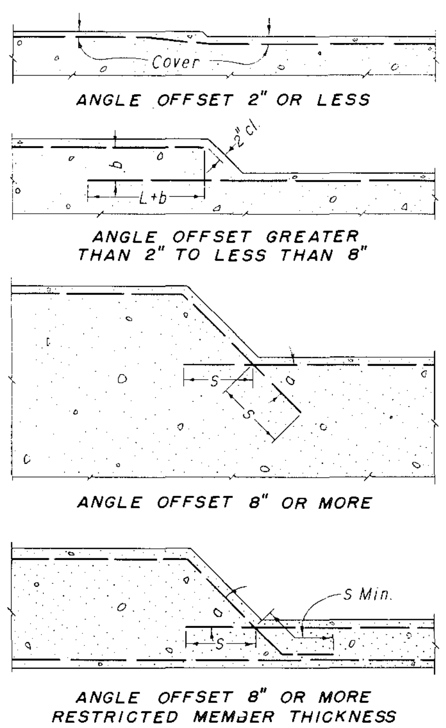
DRAWN C.P.M.-L.M.C. SUBMITTED Wm. H. Wolf
TRACED W.S. RECOMMENDED H.G. Arthur
CHECKED F.O.B.-E.P.M.-C.A.S. APPROVED B.P. Bellport CHIEF ENGINEER

DENVER, COLORADO, MARCH 26, 1966

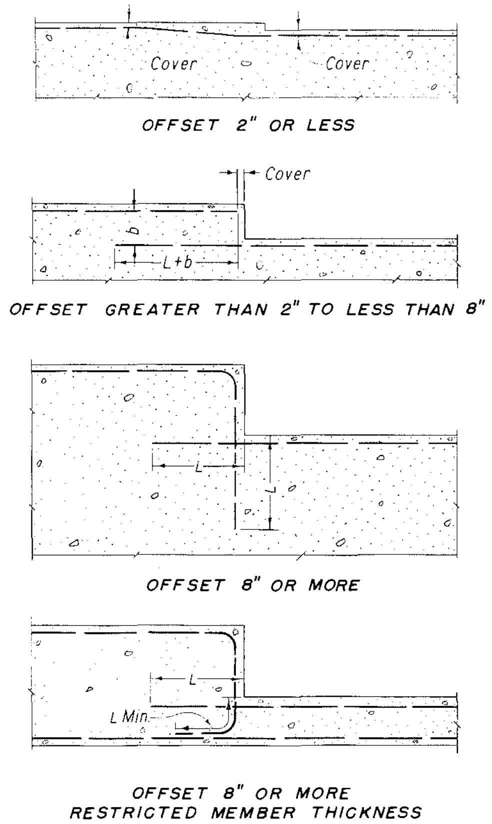
40-D-7004



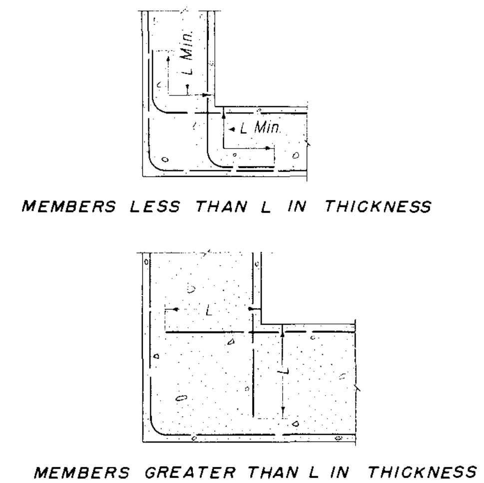
TYPICAL BLOCKOUT RECESS DETAILS
(Second stage concrete shown)



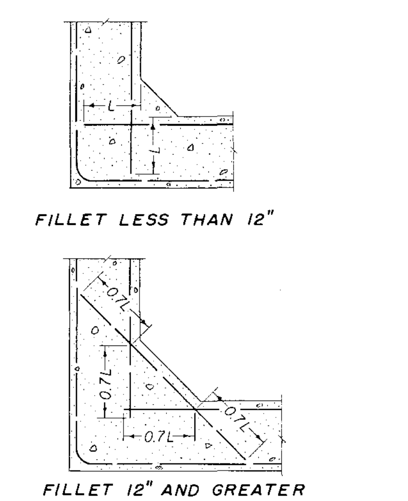
TYPICAL ANGLE OFFSET DETAILS



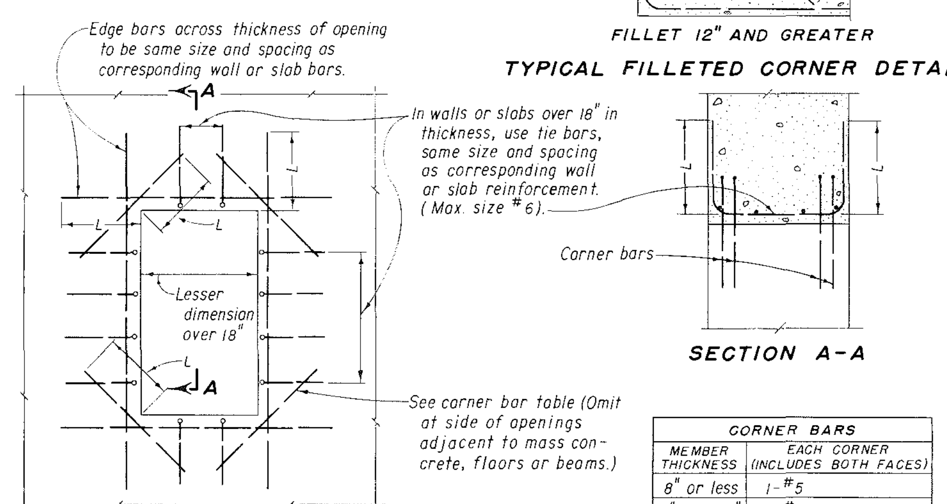
TYPICAL RIGHT ANGLE OFFSET DETAILS



TYPICAL CORNER DETAILS



TYPICAL FILLETED CORNER DETAILS



NOTES

Ties, edge, and corner bars not required for openings 18" or less.
For a recess deeper than 4" but not greater than one half wall or slab thickness, use corner bars in face on recess side.

CORNER BARS	
MEMBER THICKNESS	EACH CORNER (INCLUDES BOTH FACES)
8" or less	1-#5
9" Thru 12"	2-#6
13" Thru 18"	2-#8
19" Thru 24"	4-#8
25" Thru 36"	4-#9
37" Thru 48"	4-#10
Over 48"	4-#11

MINIMUM ADDITIONAL REINFORCEMENT AROUND OPENINGS IN WALLS AND SLABS

GENERAL NOTES

UNLESS OTHERWISE SHOWN ON THE REINFORCEMENT DESIGN DRAWINGS, THE DETAILS AND NOTES SHOWN ARE TYPICAL FOR ALL REINFORCEMENT DRAWINGS THAT REFER TO THIS DRAWING.

DESIGN:
Structural design is based on 3750 psi specified compressive concrete strength at 28 days with a working stress of 1,700 psi; and working stresses of 24,000 psi tension in reinforcement with a specified minimum yield strength of 60,000 psi.

ABBREVIATIONS:

bf = bottom face	br = bottom row	bl = bottom layer
tf = top face	tr = top row	tl = top layer
nf = near face	nr = near row	ns = near side
ff = far face	fr = far row	fs = far side
ef = each face	er = each row	es = each side
if = inside face	ir = inside row	ew = each way
of = outside face	or = outside row	ec = each corner
	mr = middle row	ml = middle layer

spc. = space or spaces
eq. spc. = equally spaced, equal spaces
D = nominal diameter of reinforcing bar
uv = uniformly varying lengths of bars between lengths shown
cl. = clear

SYMBOLS:
Bars shown thus #8@12 or #6@7½, indicate a group of identical bars equally spaced.
An open circle at the end of a bar indicates a bend with the bar turned away from the observer.
A closed circle at the end of a bar indicates a bend with the bar turned towards the observer.
Splices shown thus indicate a lapped splice, not a bend in the bar.

DIMENSIONS:
Dimensions are to the center lines of the bars unless otherwise shown. Clear cover dimensions are marked "cl."

COVER:
Place the reinforcement so that the clear distance between face of concrete and nearest reinforcement is 1½" for #5 bars and smaller and 2" for #6 bars and larger; except provide a clear distance from face of concrete placed against earth or rock of 2" where member thickness is 9" or less and 3" where member thickness is greater than 9", the clear distance being to the design dimension line.
Reinforcement paralleling construction joints shall have a minimum of 2" clear cover.

BENT BARS:
Only billet steel shall be used for bars bent to a radius of 50-bar diameters or less.
Unless larger radius bends are indicated on the design drawings, all reinforcement requiring bending shall be bent around a pin having the following diameter.

BAR NO.	3	4	5	6	7	8	9	10	11	14S	18S
Standard Bends Diameter of pin (in.)	2¼	3	3¾	6	7	8	10⅛	11¼	12⅜	17*	22½*
Stirrup and Tie bends Diameter of pin (in.)	1⅞	2½	3⅛	5¼	7	8	10⅛	11¼	12⅜		

*Special fabrication for all bends.

REINFORCEMENT DOWELS:
Dowels may be indicated on the drawing thus #8 (d).
Dowels shall have a minimum embedment and projection equal to that required for lap splicing a bar of the same diameter.

PLAIN DOWELS:
Plain dowels across contraction joints shall be plain bars painted with one coat of red lead paint. Twist dowels to break bond before final set of first concrete placement. Immediately before the second concrete placement, the projecting half length of dowel shall be uniformly coated with a film of oil. Viscosity of the oil shall have a SAE rating of not less than 250.

STANDARD HOOKS:
Hooks shall have 180° bends and extensions of 4-bar diameters but not less than 2½" parallel to the main leg of the bar or 90° bends and extensions of at least 12-bar diameters. Hooks for stirrup and tie anchorage only shall have either a 90° or 135° bend plus an extension of at least 6-bar diameters but not less than 2½" at the free end of the bar. Radius of bend to be as specified in table for bent bars.
A bar (⊐) with a standard 180° hook on one end is referred to as an "A" bar.
A bar (⊏⊐) with a standard 180° hook on both ends is referred to as a "B" bar.

PLACING:
Bars at small openings (max. 18") in wall and slabs may be spread apart not more than 1½ times the bar spacing.
Reinforcement may be adjusted in the field to clear waterstops, keys, form ties, anchor bars, seals, recesses, embedded metalwork, and conduits except in heavily reinforced areas. In such cases relocation of the embedded materials must be considered. In no case should bars be bent to greater than 6 to 1 slope.
Where possible, reinforcement shall be placed to maintain a clear distance of at least one inch between the reinforcement and anchor bolts, form ties, or other embedded metalwork.
Reinforcement parallel to anchor bolts or other embedded metalwork shall be placed to maintain a clear distance of at least 1⅓ times the maximum size aggregate.
Reinforcement not to be placed between or within 4 inches of main power leads.

SPACING:
The first and last bars in slabs and walls, stirrups in beams, and ties in columns are to start and end at a maximum of one half of the adjacent bar spacing.

SPLICES:
Unless otherwise shown the minimum length of lap for splicing parallel bars shall be as given in Table A.
When reinforcing bars of different size are to be spliced, the lap length shall be governed by the smaller diameter bar.
Splices are to be made so that the given distances to face of concrete will be maintained.
The minimum lap requirement "S" for non-parallel bars shall be as given in Table B.

TABLE A

LENGTH OF LAPPED SPLICE "L", IN INCHES*

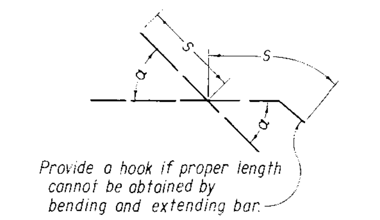
BAR NO.	L	BAR NO.	L
#3	14	#8	36
#4	18	#9	41
#5	23	#10	46
#6	27	#11	54
#7	32		

* Stagger splices if bars are spaced closer than 8 inches or 8 bar diameters, whichever is greater.

TABLE B

LENGTH OF SPLICE "S", FOR NON-PARALLEL BARS

ANGLE α	S
0° To 10°	0.5L
10° To 30°	0.6L
30° To 50°	0.7L
50° To 65°	0.8L
65° To 80°	0.9L
80° To 90°	1.0L



ACCESSORIES:
Bar supports, spacers and other accessories are not shown on the design drawings. The recommendations of ACI 315-65 or other approved supporting systems may be used.

REFERENCES:
Numerals in parentheses ( ) following notes and section letters or numbers indicate the number of the drawing upon which the section or detail is shown; for example (524) denotes Drawing No. 557-D-524.
Unless otherwise shown follow the recommendations established by American Concrete Institute's "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315-65).

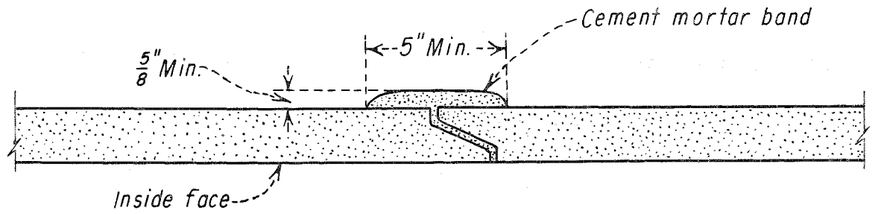
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

GENERAL NOTES AND MINIMUM REQUIREMENTS FOR DETAILING REINFORCEMENT
CLASS 60

DRAWN RLT ... SUBMITTED Jack W. Hilf
TRACED D.L.D. RECOMMENDED H. G. Arthur
CHECKED ... APPROVED ... CHIEF ENGINEER

DENVER, COLORADO, JUNE 20, 1967 | 40-D-6123



TYPE A

(For use with unreinforced irrigation pipe only)

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

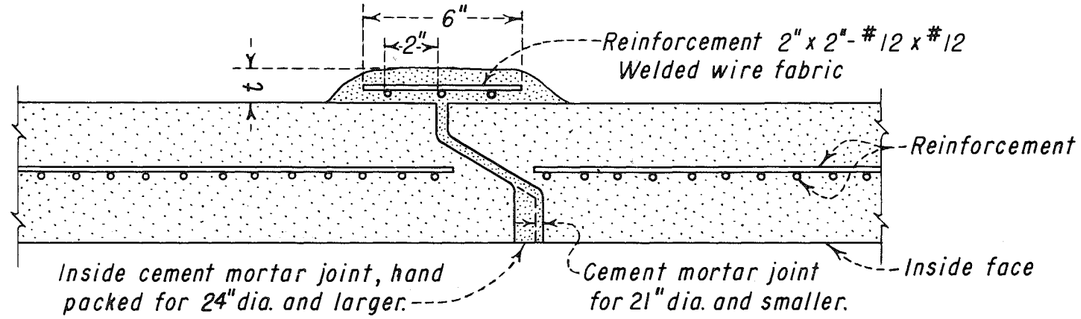
STANDARD DESIGNS

PRECAST CONCRETE PIPE JOINT

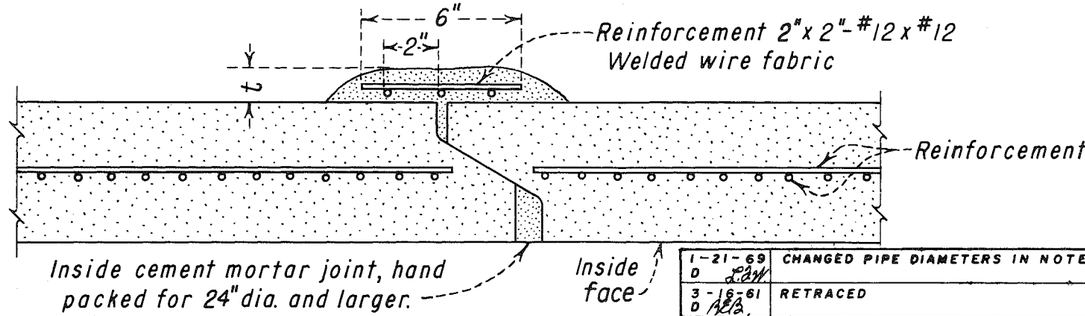
UNREINFORCED BAND TYPE A

DRAWN H.K.B. SUBMITTED F.E. Rippon
TRACED E.O.L. RECOMMENDED K.B. Keener
CHECKED P.W.T. APPROVED W.E. Blomgren
ACT. CHIEF ENGR.

DENVER, COLO., DEC. 2, 1952 | 40-D-5241



TONGUE AND GROOVE JOINT
TYPE B



SELF-CENTERING JOINT
TYPE B-1

DIA OF PIPE	12" TO 20"	21" TO 24"	27" TO 33"	36" TO 45"	48" TO 51"	54" TO 60"	63" TO 96"
MINIMUM THICKNESS (t)	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"

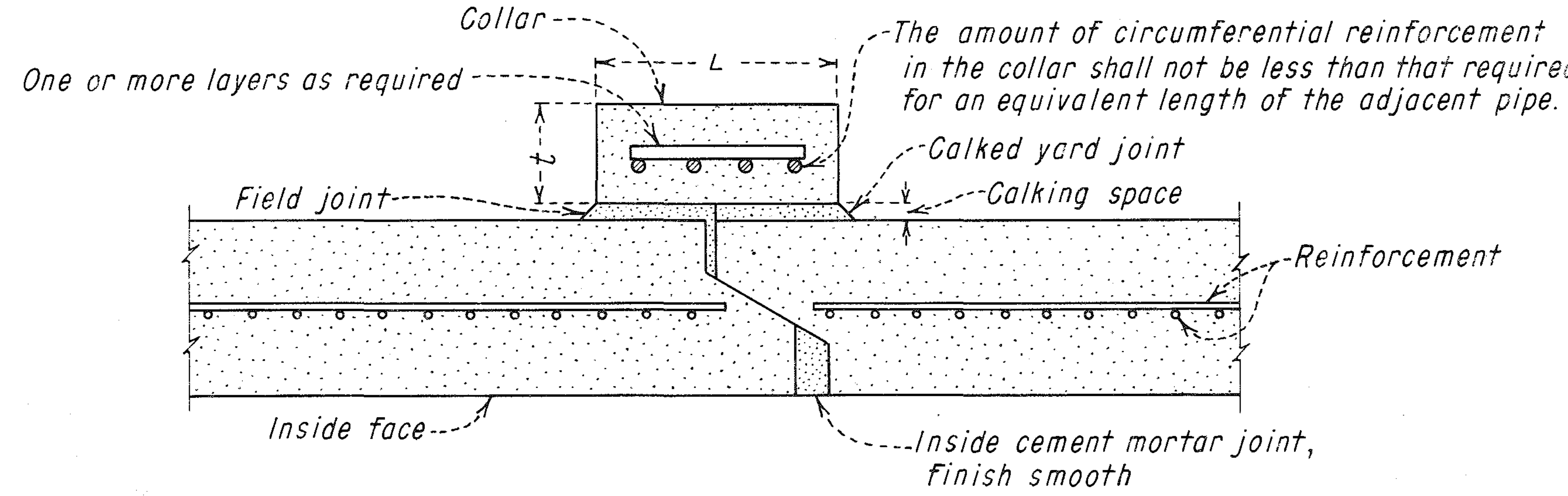
1-21-69 D CAW	CHANGED PIPE DIAMETERS IN NOTES
3-18-61 D RBZ	RETRACED

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

PRECAST CONCRETE PIPE JOINT
REINFORCED BAND
TYPE B AND TYPE B-1

DRAWN H.K.B. SUBMITTED F.E. Rippon
TRACED R.P.W. RECOMMENDED K.B. Keener
CHECKED P.W.T. APPROVED W.E. Blomgren
ACT. CHIEF ENG'R.

DENVER, COLO., DEC. 2, 1952 — 40-D-5242



TYPE C

(Collared joints for cut pipe are similar)

TABLE FOR COLLAR DIMENSIONS

DIA OF PIPE	6" TO 15"	18"	21"	24" TO 45"	48" TO 63"	66" TO 72"	78"	84"	90"	96"
MIN. THICKNESS (t)	$1\frac{1}{2}$"	$1\frac{7}{8}$"	$2\frac{1}{4}$"	$2\frac{1}{2}$"	$2\frac{3}{4}$"	4"	$5\frac{1}{2}$"	6"	$6\frac{1}{2}$"	7"
MIN. LENGTH (L)	6"		6"	$7\frac{1}{2}$"			9"			
MIN. CALKING SPACE	$\frac{5}{8}$"		$\frac{3}{4}$"							

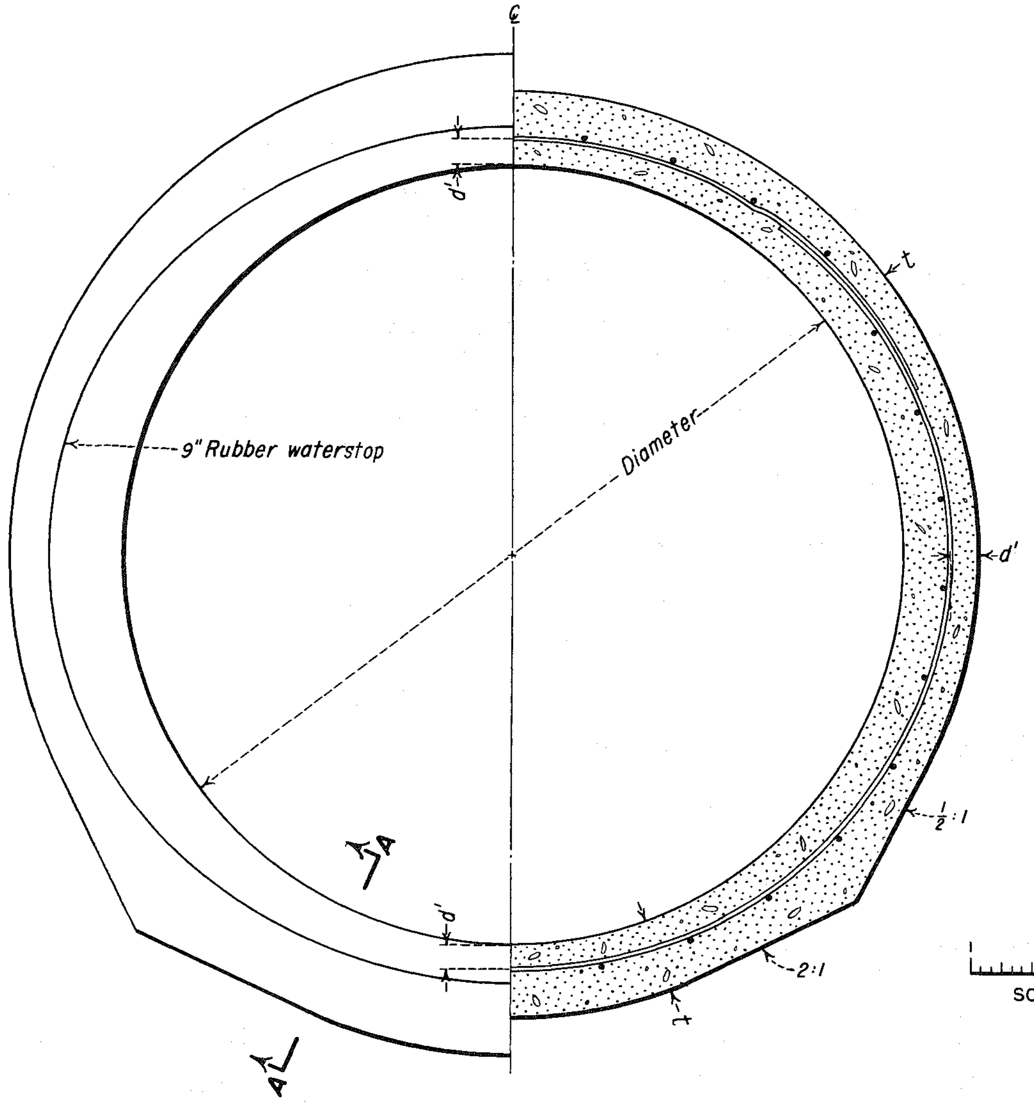
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

PRECAST CONCRETE PIPE JOINT
CALKED CONCRETE COLLAR
TYPE C

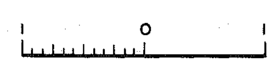
DRAWN H.K.B. SUBMITTED
TRACED E.O.L. RECOMMENDED
CHECKED O.W.T. APPROVED
ACT. CHIEF ENG'R.

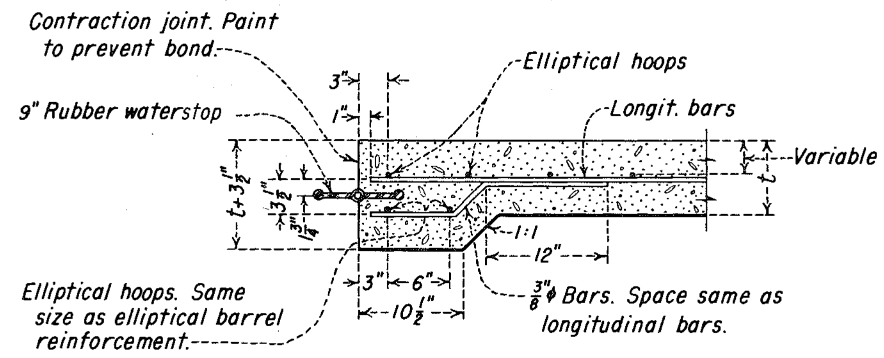
DENVER, COLO. DEC. 2, 1952 | 40-D-5243



HALF SECTION OF BARREL AT JOINT

HALF SECTION OF BARREL





SECTION A-A AT CONTRACTION JOINT

NOTES

Contraction joints at 25'± intervals, and at connections with closed transitions.
See Dwg. 40-D-2867 for details of 9" rubber waterstop.

THIS DRAWING SUPERSEDES DWG. 40-D-3344.

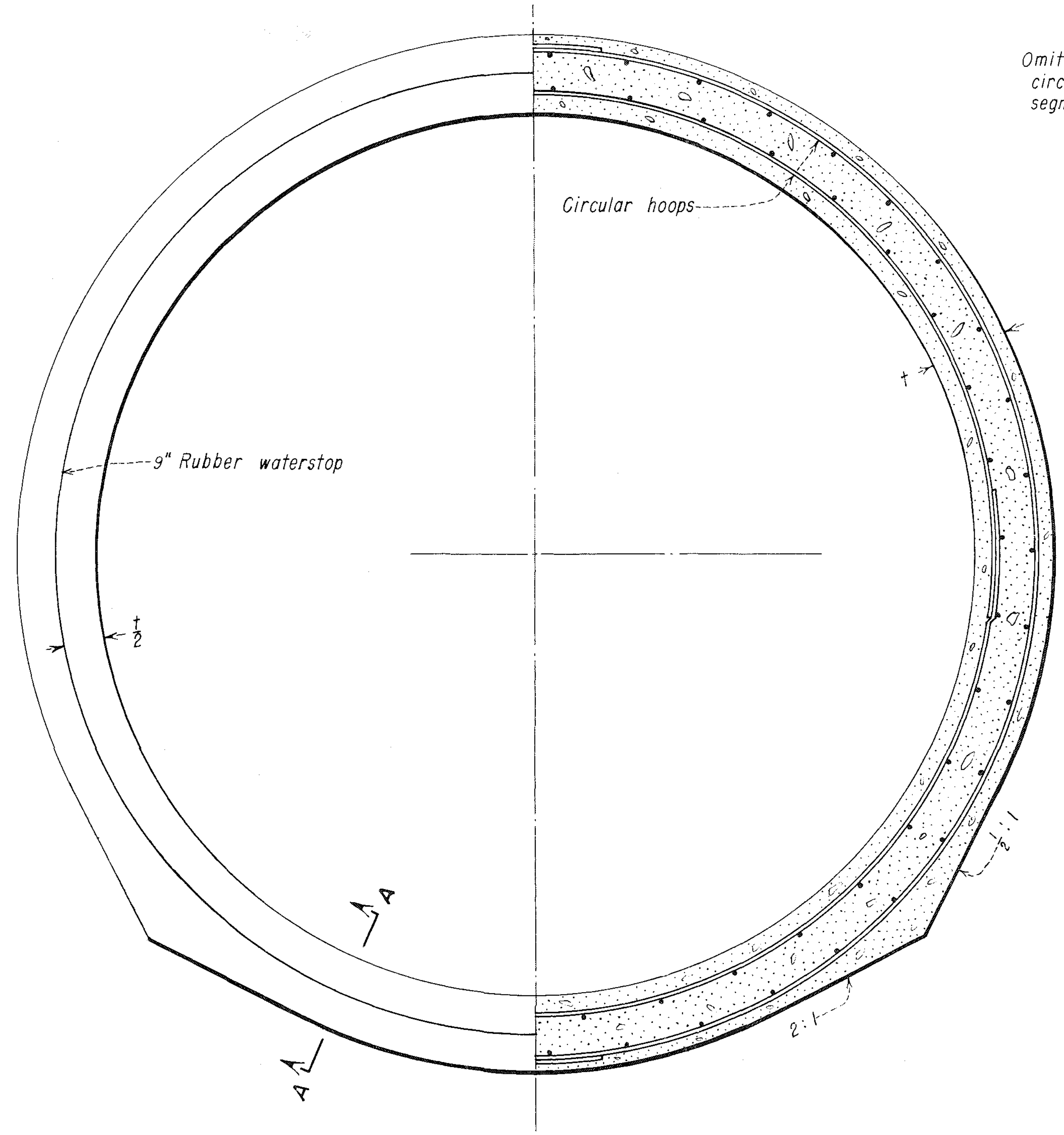
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

MONOLITHIC SIPHON BARREL
ELLIPTICAL HOOP REINFORCEMENT
CONTRACTION JOINT WITH RUBBER WATERSTOP

REV. 7-26-51 C.O.P. W.W.

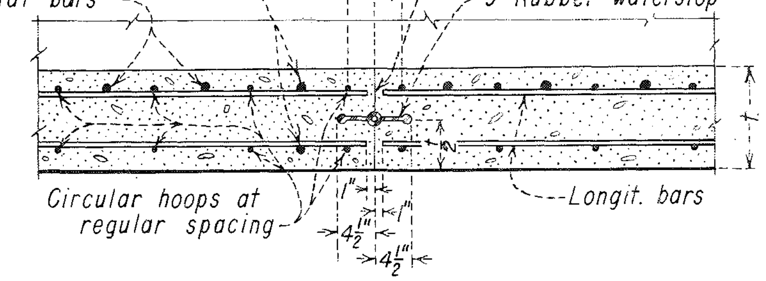
DRAWN R.P.A. SUBMITTED [signature]
TRACED H.S.P. RECOMMENDED [signature]
CHECKED [signature] APPROVED [signature] CHIEF ENGINEER

DENVER, COLORADO MARCH 16, 1951 | 40-D-5129

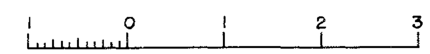


HALF SECTION OF BARREL AT JOINT

HALF SECTION OF BARREL



SECTION A-A AT CONTRACTION JOINT



NOTES

Contraction joints to be at 25'± intervals and at connections with closed transitions.
See Dwg. 40-D-2867 for details of 9" rubber waterstop.

THIS DRAWING SUPERSEDES DWG. 40-D-3164.

12-27-54 D JWB — CHANGE REINF. NOTE BY 233

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

MONOLITHIC SIPHON BARREL
TWO LAYER REINFORCEMENT
CONTRACTION JOINT WITH RUBBER WATERSTOP

REV. 7-26-51 C.O.P.W.W.

DRAWN R.P.A. SUBMITTED A.B. Reeves
TRACED R.T.S. RECOMMENDED W. H. Nalder
CHECKED J.W.J. [illegible] APPROVED L. N. McClellan, CHIEF ENGINEER

DENVER, COLORADO MARCH 16, 1951 — 40-D-5130

ALWAYS THINK SAFETY