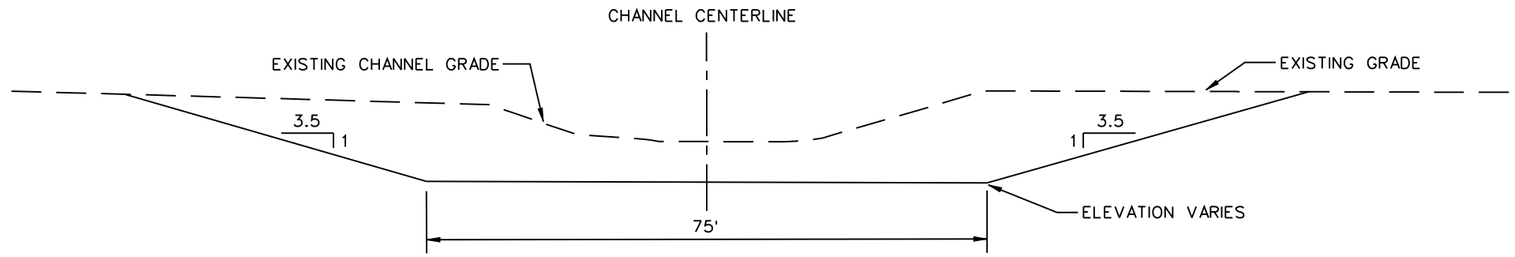
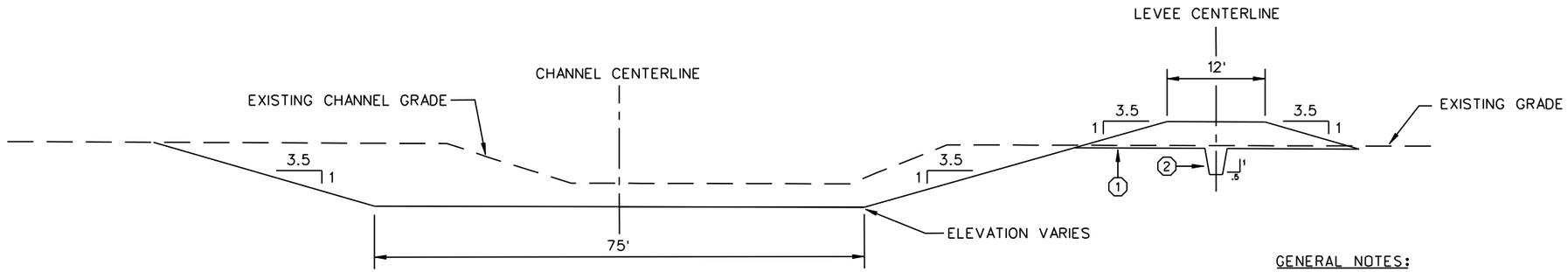


TYPICAL SECTION
IMPROVED CHANNEL - BOUGHMAN SLOUGH

KEYED NOTES:

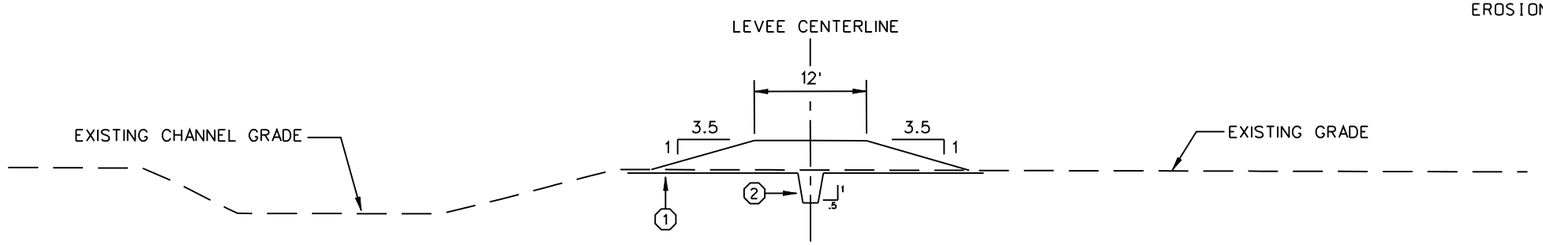
1. 6" Stripping
2. Inspection Trench(4' Max Depth; 2' Maximum Bottom Width)
3. Inspection Trench(6' Max Depth; 8' Max Bottom Width)



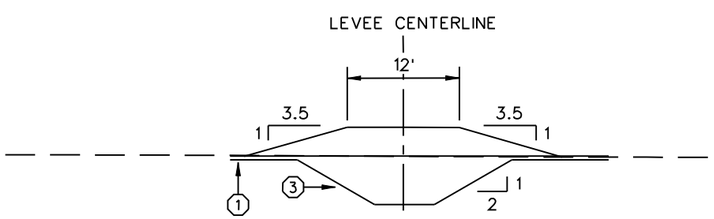
TYPICAL SECTION
IMPROVED CHANNEL AND PROPOSED LEVEE - BOUGHMAN SLOUGH

GENERAL NOTES:

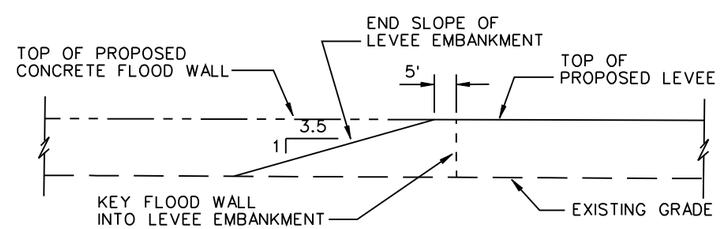
1. STRIPPING EXCAVATION SHOULD BE DONE TO A MINIMUM OF 6" BELOW THE LIMITS OF PROPOSED LEVEE.
2. THE PROPOSED SLOPES OF THE IMPROVED CHANNEL AND PROPOSED LEVEES SHALL BE TURFED WITH EROSION CONTROL GRASSES.



TYPICAL SECTION
PROPOSED LEVEE - BOUGHMAN SLOUGH



TYPICAL SECTION
PROPOSED LEVEE - COLORADO RIVER



TYPICAL SECTION
PROPOSED LEVEE-FLOOD WALL CONNECTION

50 0 50 100
SCALE IN FEET

US Army Corps of Engineers
Fort Worth District

Symbol	Description	F.O.R. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No.
Contr No.
Rev.
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

LEVEE AND CHANNEL SECTIONS

PRELIMINARY

Sheet reference number:
C001

DESIGN FILE: WHARTON_COULOCH

Contr No.

$$date$$ $$time$$
$$mes$$
$$cadd file name$$

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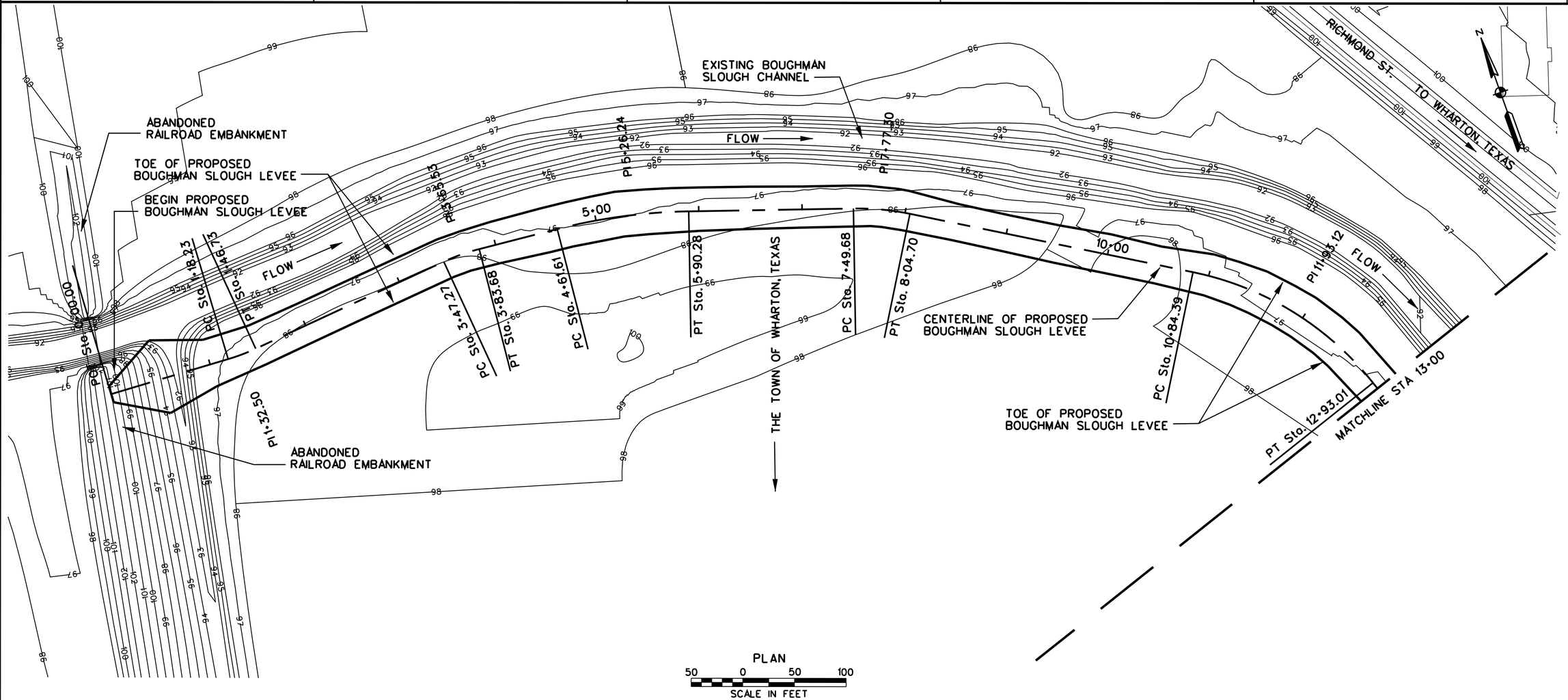
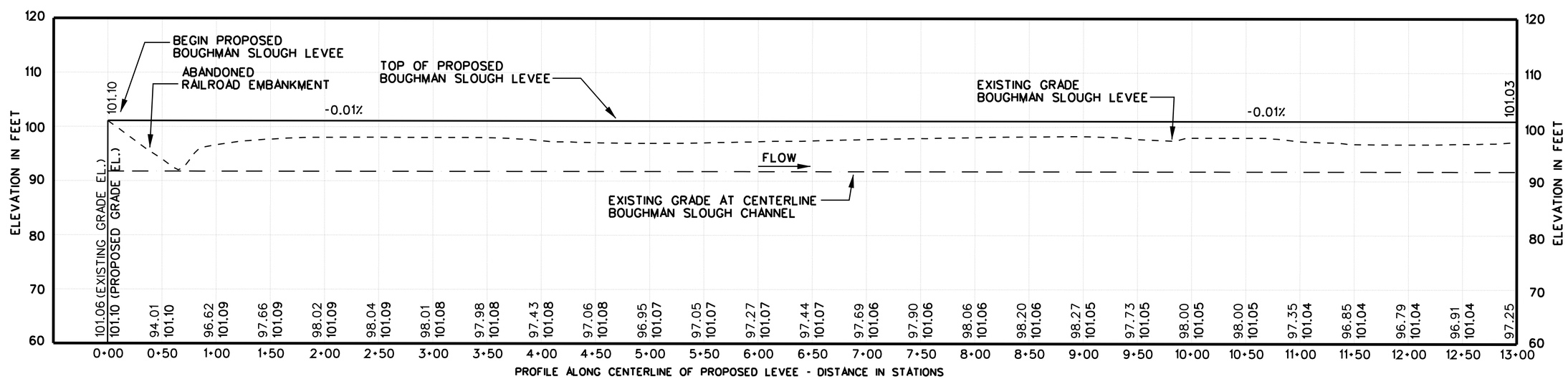


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Date: -- -- --
Rev. --
Dwn by: R. REED
Sol No.
Reviewed by: S. ARMSTRONG
Contr No.
Submitted by: MARK L. BLACK P.E. CHIEF, CIVIL SECTION
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

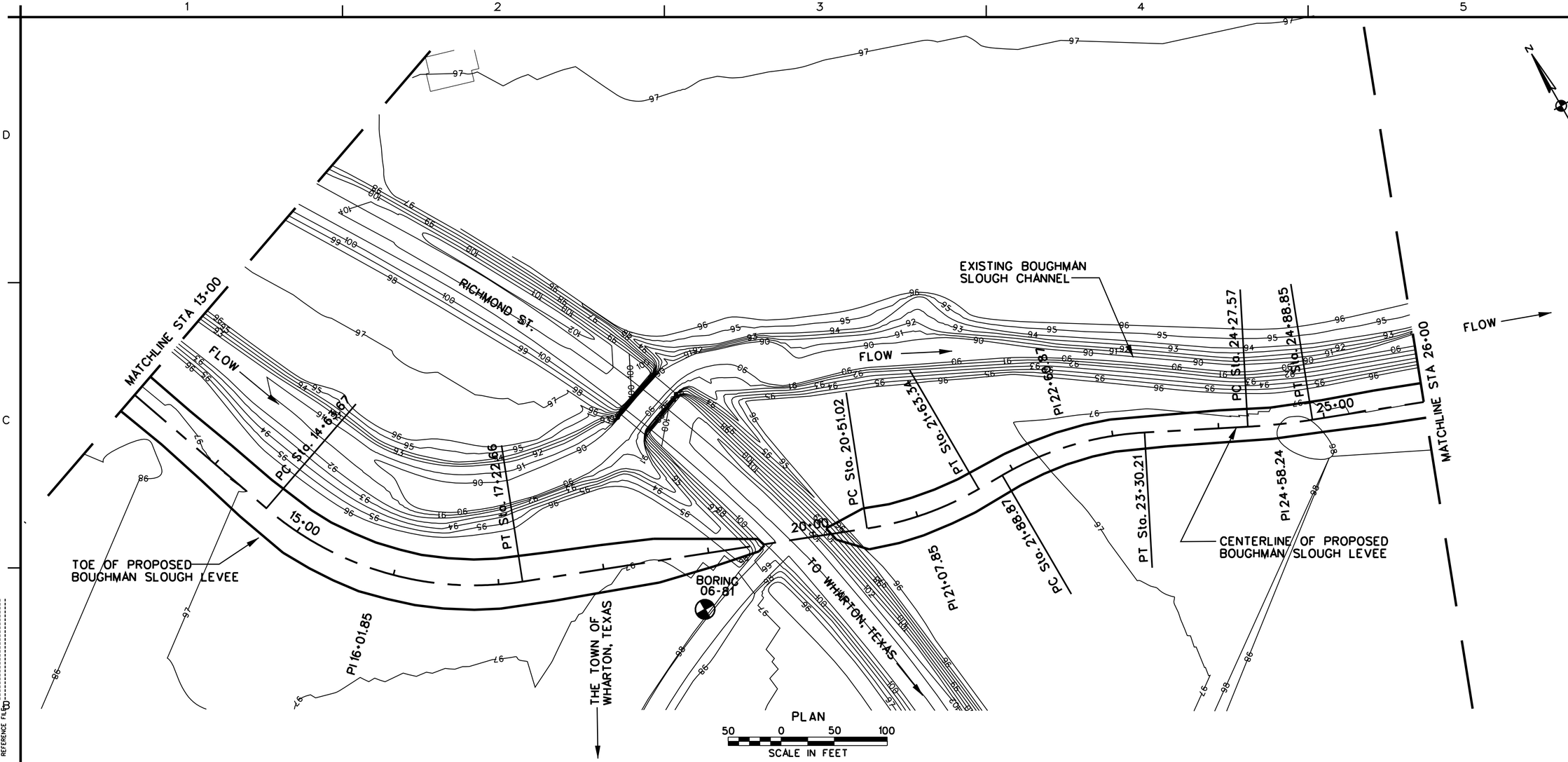
PLAN AND PROFILE
BOUGHMAN SLOUGH LEVEE AND CHANNEL NO. 1
LEVEE STA 0+00 - 13+00

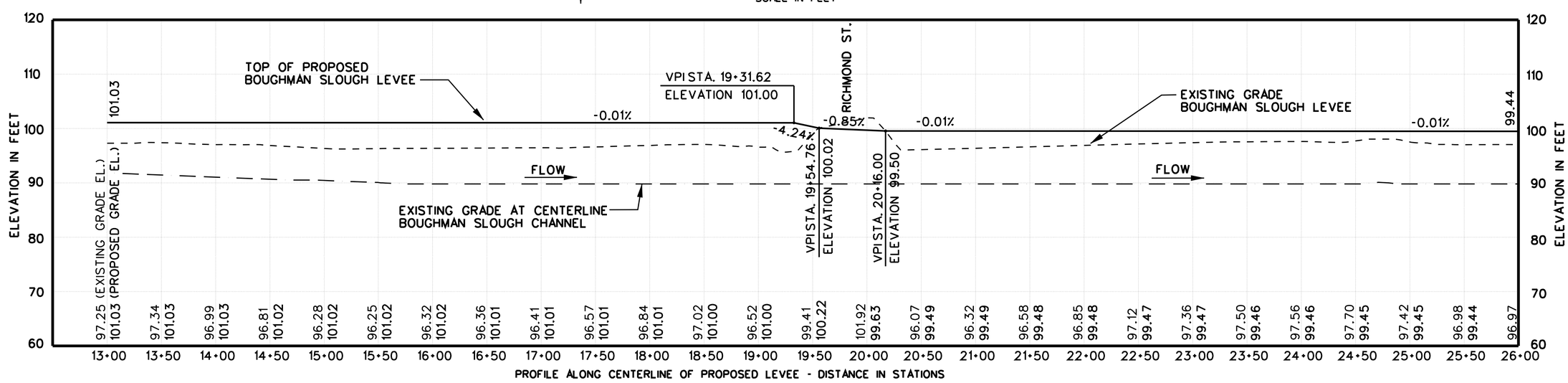
PRELIMINARY

Sheet reference number: C101

DESIGN FILE: WHARTON_C101.DGN

$$cadd file name$$ $$date$$ $$time$$





US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No.
Contr No.
Rev.
Pol date:
Pol scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN AND PROFILE
BOUGHMAN SLOUGH LEVEE AND CHANNEL NO. 1
LEVEE STA 13+00 - 26+00

PRELIMINARY

Sheet reference number: C102

DESIGN FILE: WHARTON_C01102.DGN

Contr No.

$$date$$ $$time$$
$$me$$
$$cadd file name$$

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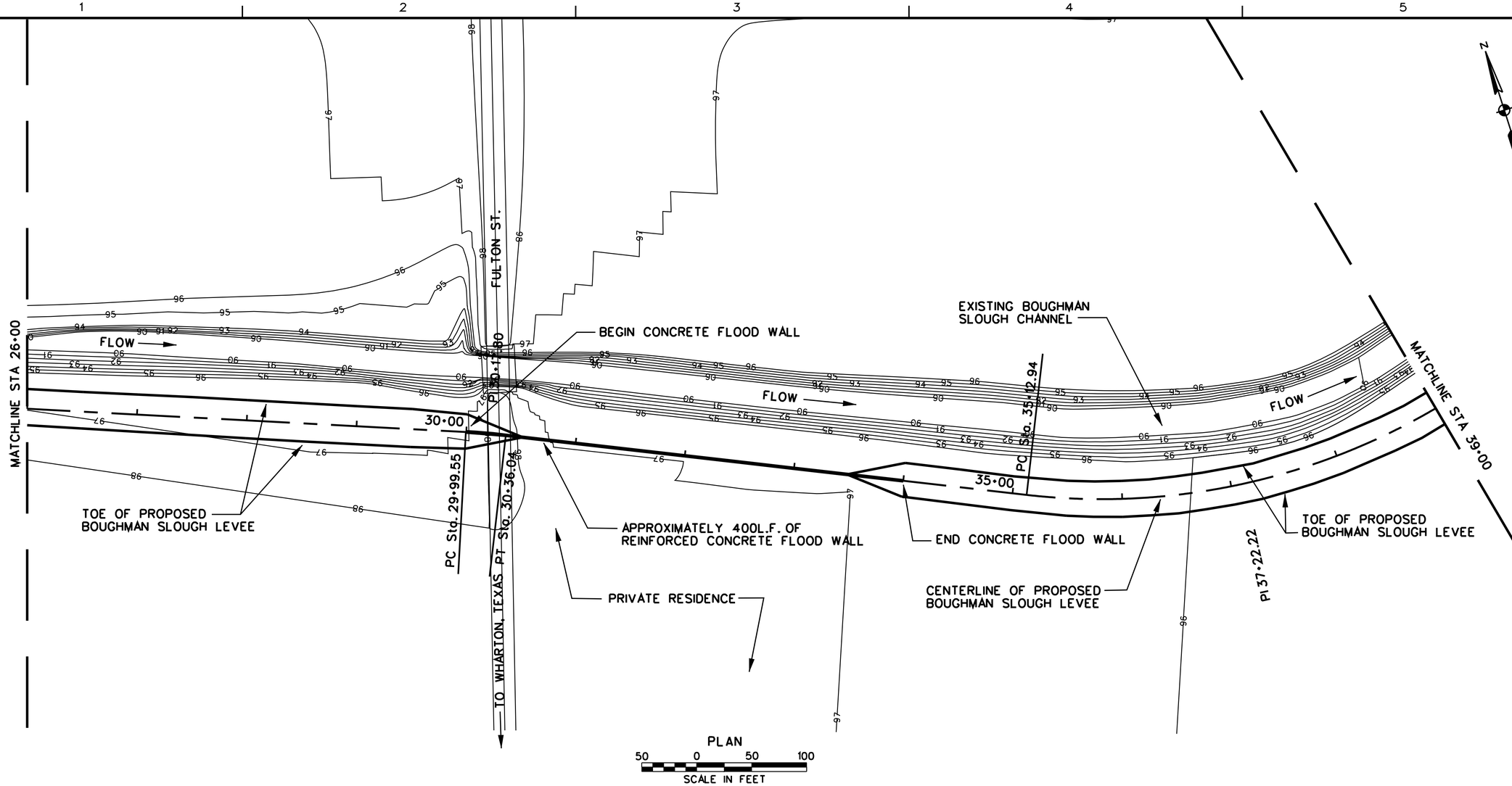

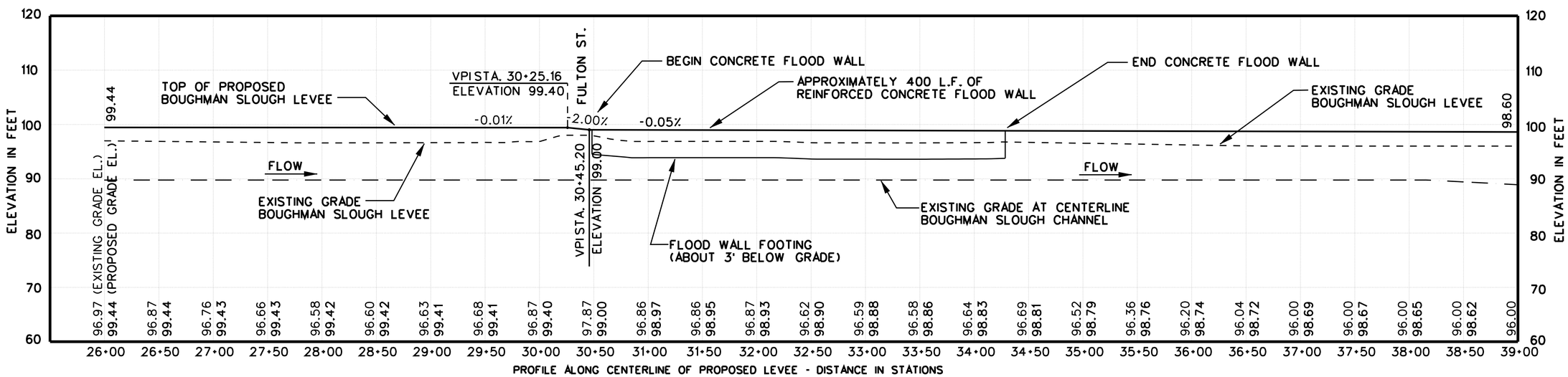

US Army Corps of Engineers
Fort Worth District

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN AND PROFILE
BOUGHMAN SLOUGH LEVEE AND CHANNEL NO. 1
LEVEE STA 26+00 - 39+00

PRELIMINARY

Sheet reference number: C103

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION

Date: -- -- --
Sol No.
Contr No.
File name:
Plot date:
Plot scale:

Rev. --

Symbol	Description	D.O. NO.	Action	Date

DESIGN FILE: WHARTON_C103.DGN

$$time$$
$$date$$
$$me$$
$$cadd file name$$

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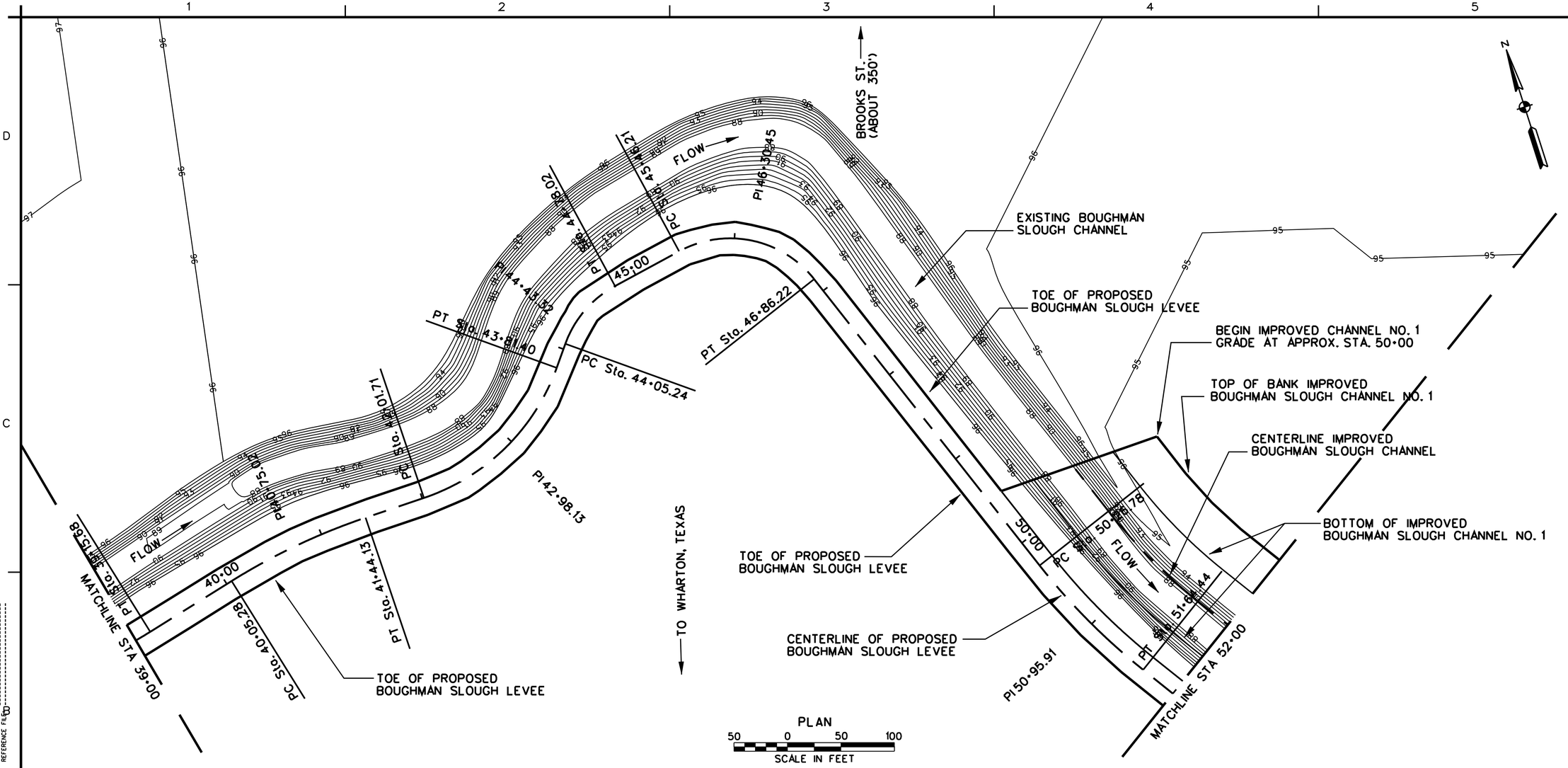

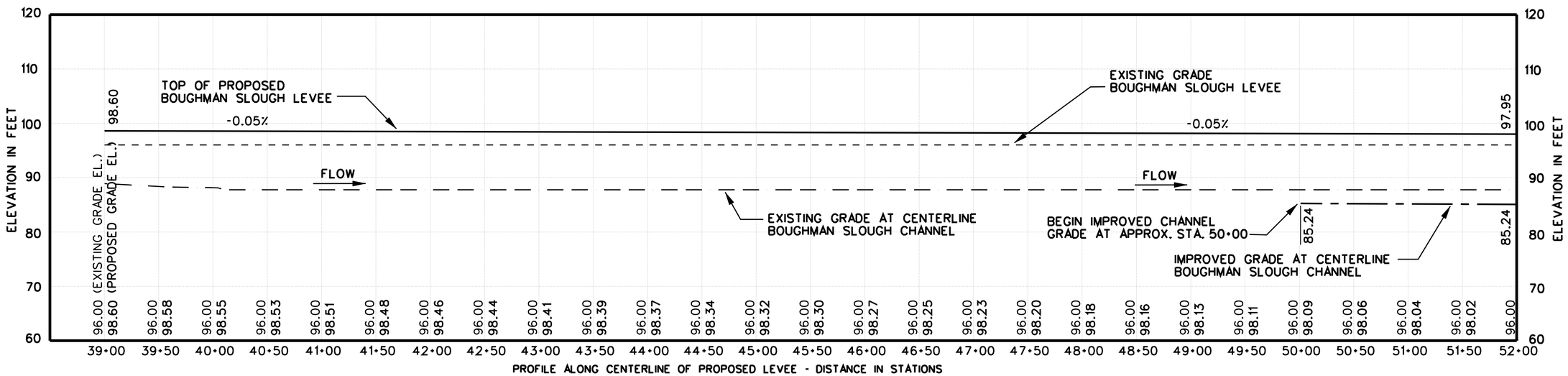

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No.
Contr No.
Rev.
Pre-const Poll date
Post scale

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN AND PROFILE
BOUGHMAN SLOUGH LEVEE AND CHANNEL NO. 1
LEVEE STA 39+00 - 52+00

PRELIMINARY

Sheet reference number: C104

DESIGN FILE: WHARTON_C104.DGN

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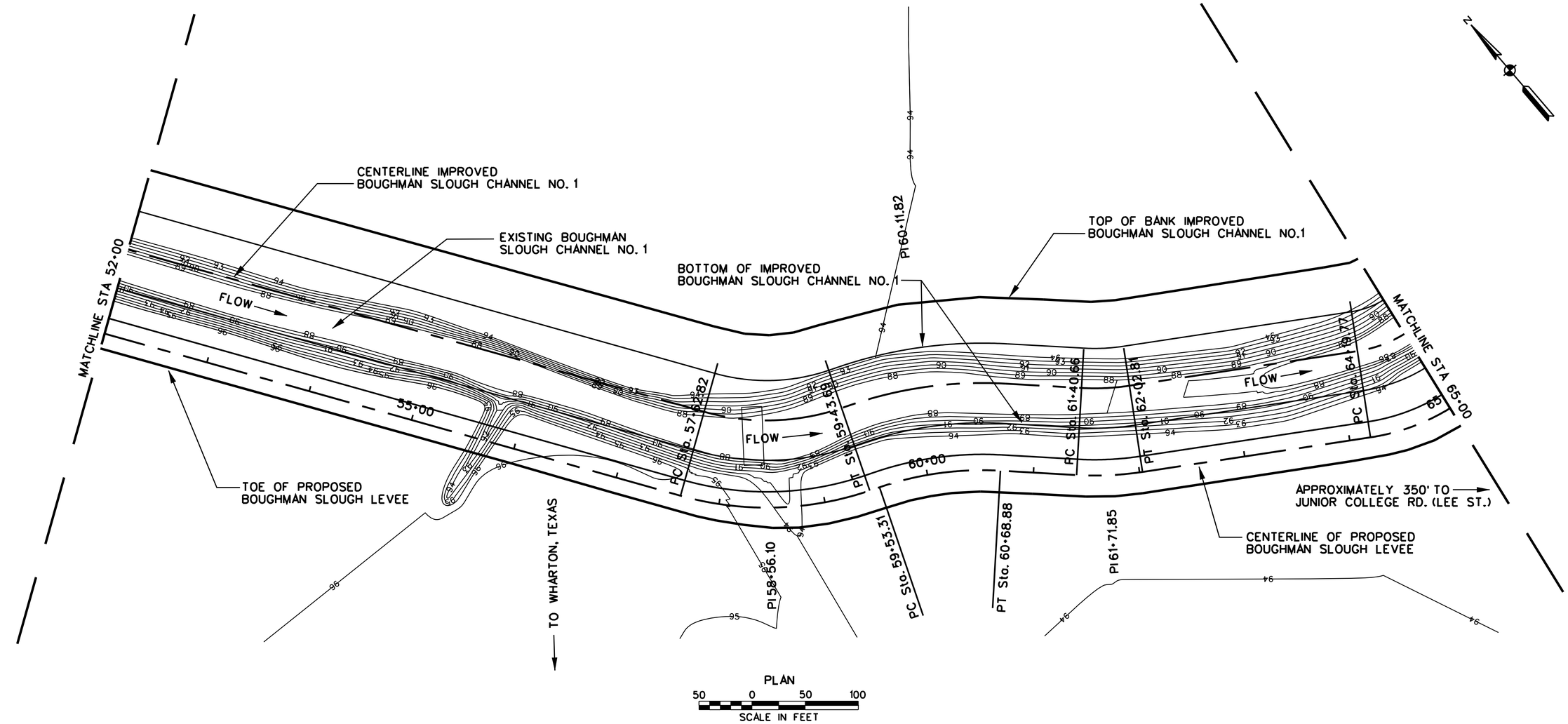

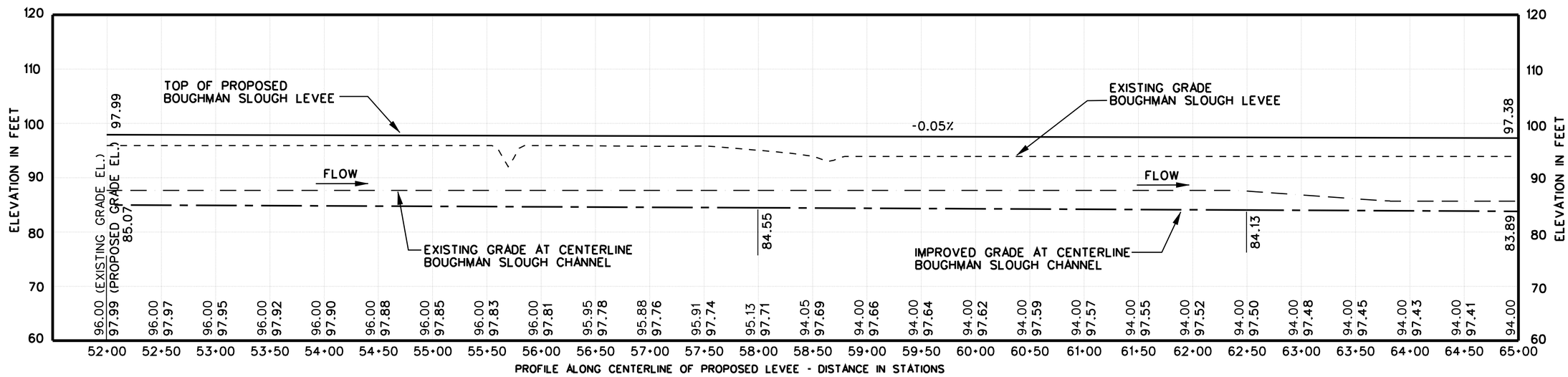

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK J. BARON, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. -- -- --
Sol No. ----
Contr No. ----
File name:
Plot date: ----
Plot scale: ----

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY
PLAN AND PROFILE
BOUGHMAN SLOUGH LEVEE
AND CHANNEL NO. 1
LEVEE STA 52+00 - 65+00

PRELIMINARY

Sheet reference number: C105

DESIGN FILE: WHARTON_C105.DGN

Contr No. ----

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$$me$$
$$cadd file name$$
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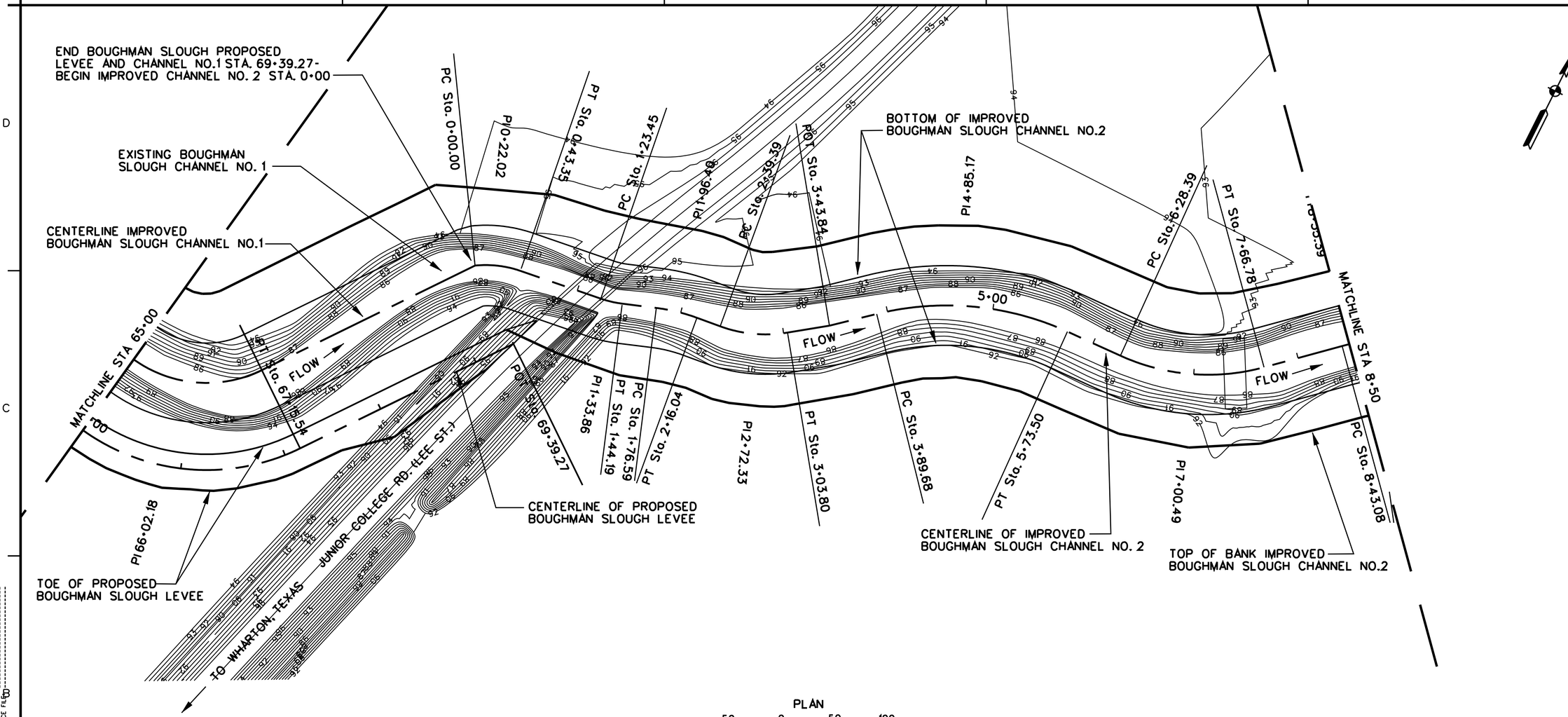
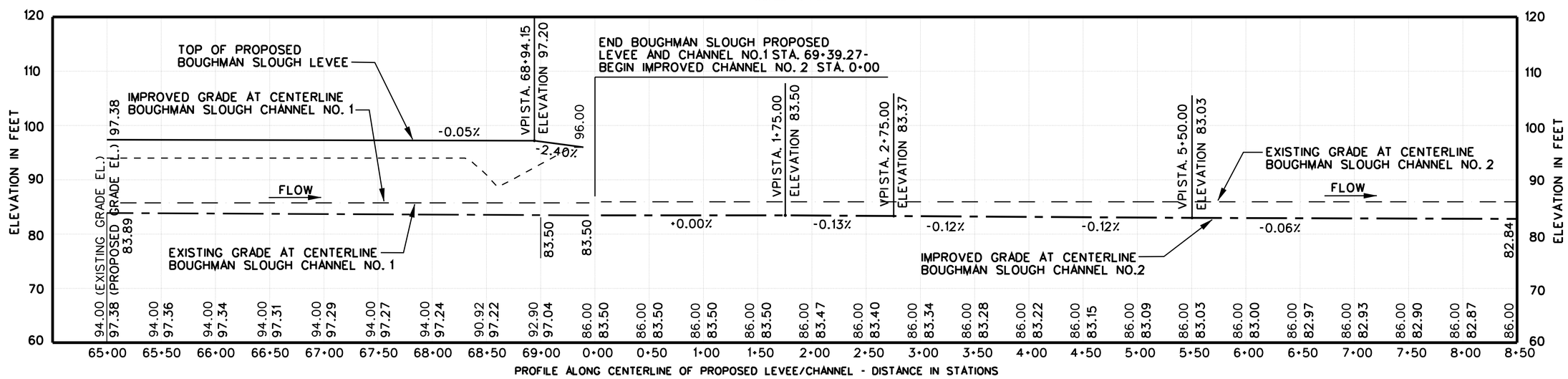


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers Fort Worth District

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION

Date: -- -- --
Sol No.
Contr No.
Rev.

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN AND PROFILE BOUGHMAN SLOUGH LEVEE AND CHANNEL NO.1 AND NO.2
LEVEE STA 65+00 - 69+39.27(END) AND CHANNEL NO.2 STA. 0+00 - 8+50

PRELIMINARY

Sheet reference number: C106

DESIGN FILE: WHARTON_C06.DGN

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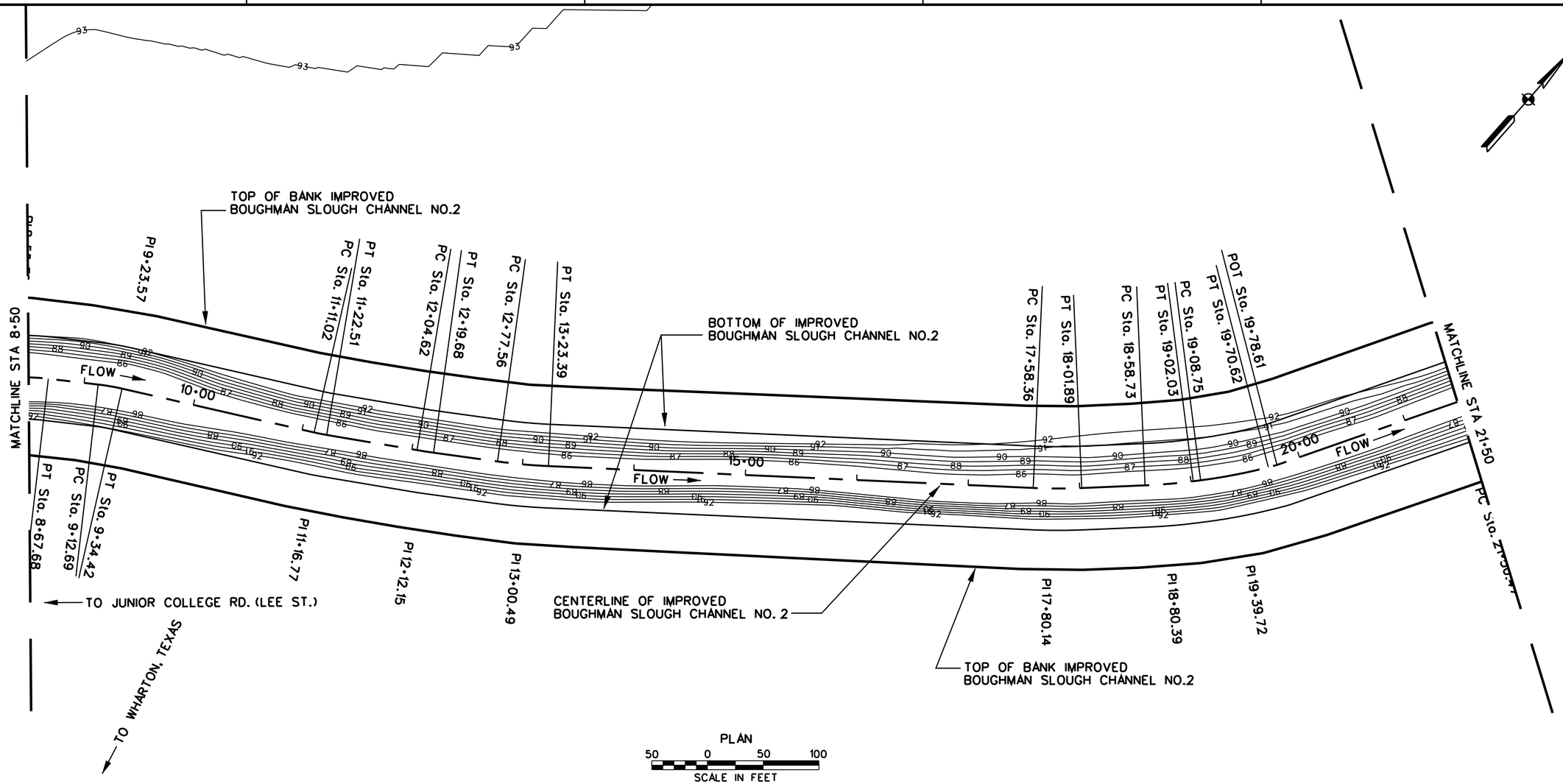

PLAN

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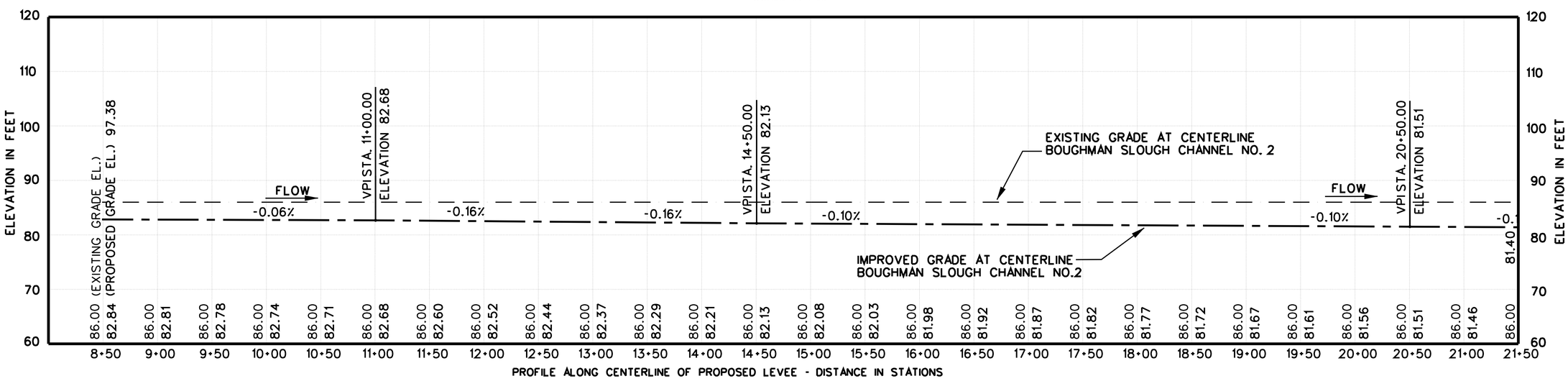
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date	Action

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION

Date: -- -- --
Sol No.
Contr No.
Rev.
Re-meas.
Post date:
Post scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
BOUGHMAN SLOUGH LEVEE
AND CHANNEL NO. 2
CHANNEL NO. 2 STA. 8+50 - 21+50

PRELIMINARY

Sheet reference number: C107

DESIGN FILE: WHARTON_C07.DGN

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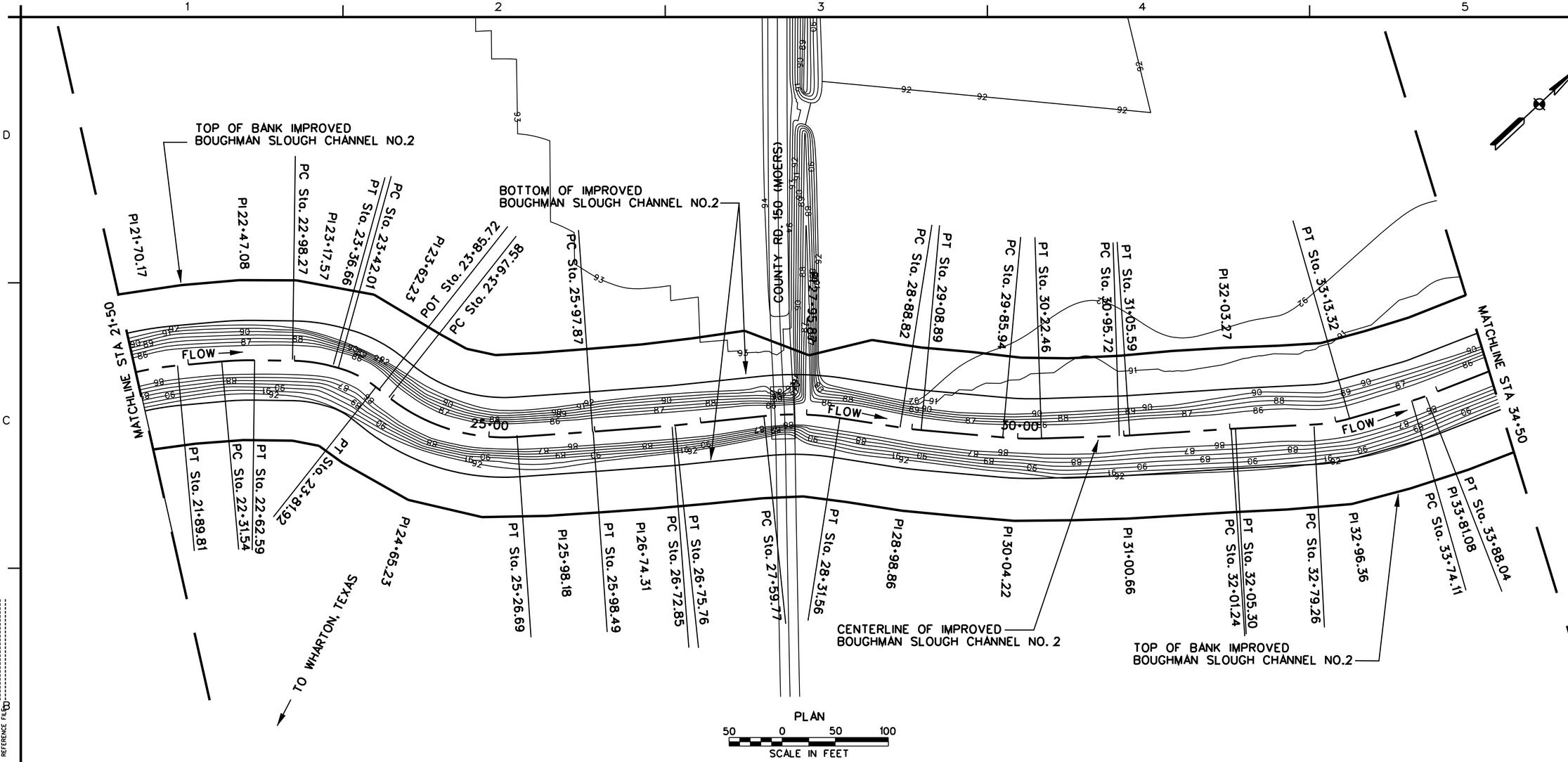

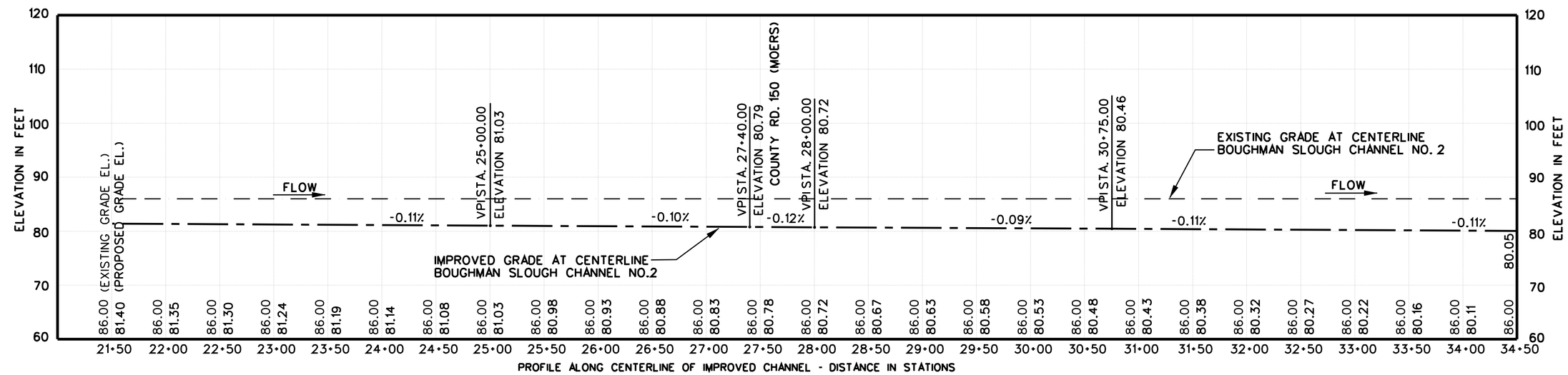

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No. --
Contr No. --
Rev. --
File name
Plot date
Plot scale

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN-AND-PROFILE
BOUGHMAN SLOUGH LEVEE
AND CHANNEL NO. 2
CHANNEL NO. 2 STA. 21+50 - 34+50

PRELIMINARY

Sheet reference number:
C108

DESIGN FILE: WHARTON_C108.DGN

Contr No.

$$date$$ $$time$$
$$me$$
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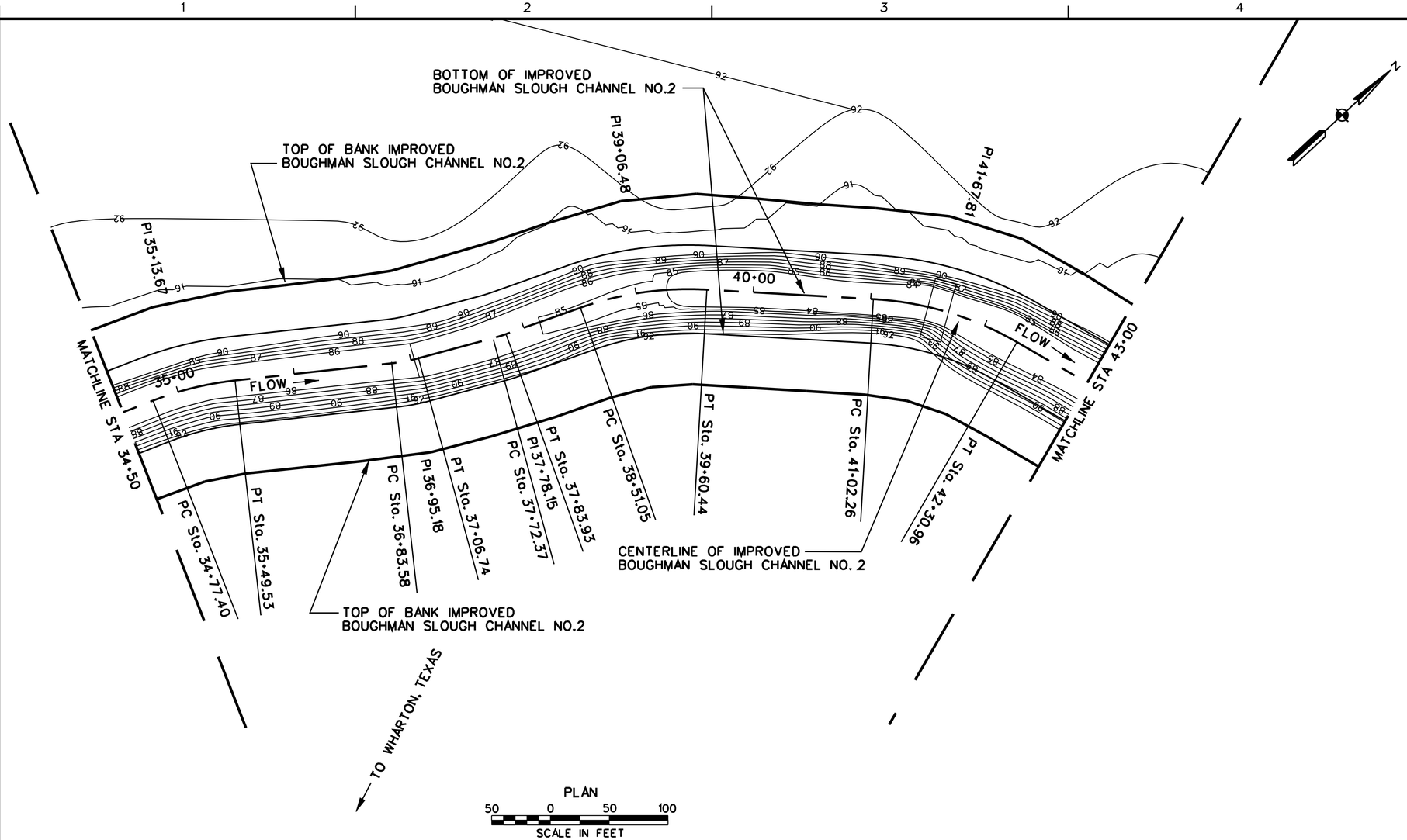

PLAN

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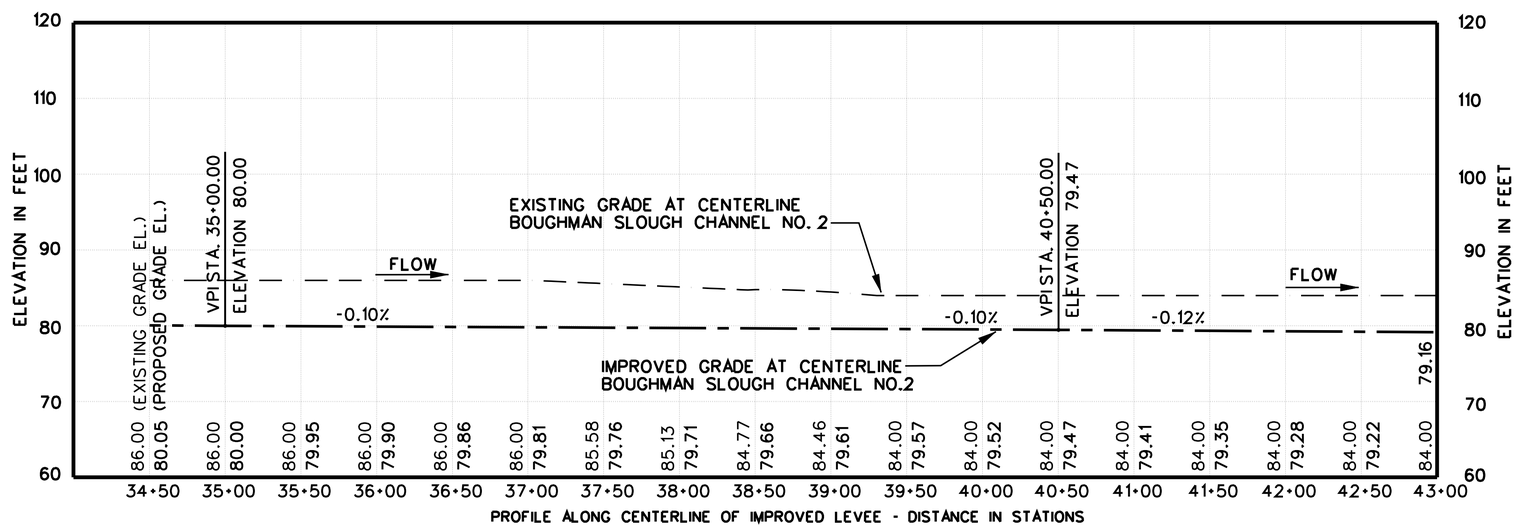
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. --
Sol No.
Contr No.
Re-seed
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN-AND-PROFILE
BOUGHMAN SLOUGH LEVEE
AND CHANNEL NO. 2

CHANNEL NO. 2 STA. 34+50 - 43+00

PRELIMINARY

Sheet reference number:
C109

DESIGN FILE: WHARTON_C109.DGN

Contr No.

$$date$$ $$time$$
$$me$$
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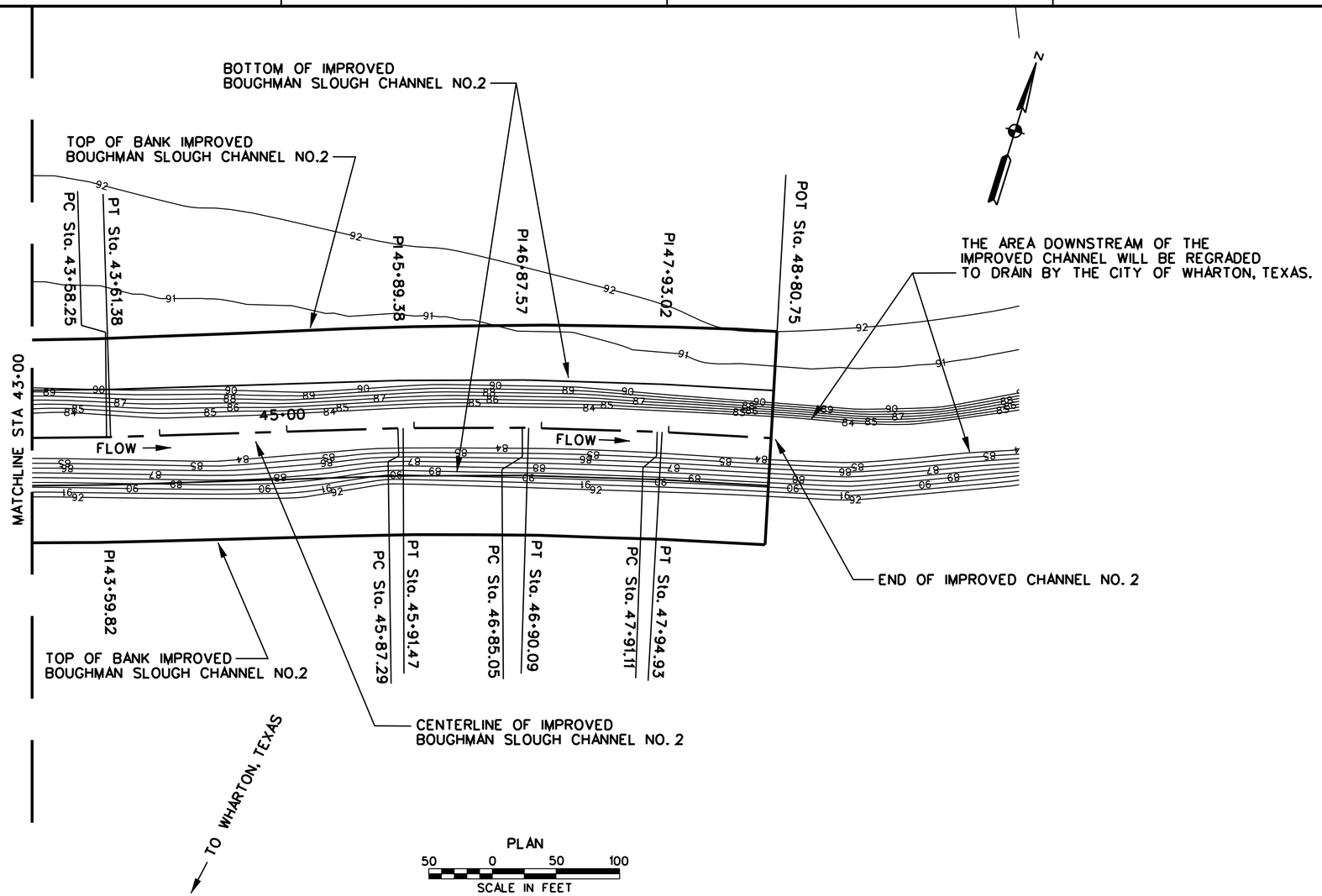

PLAN

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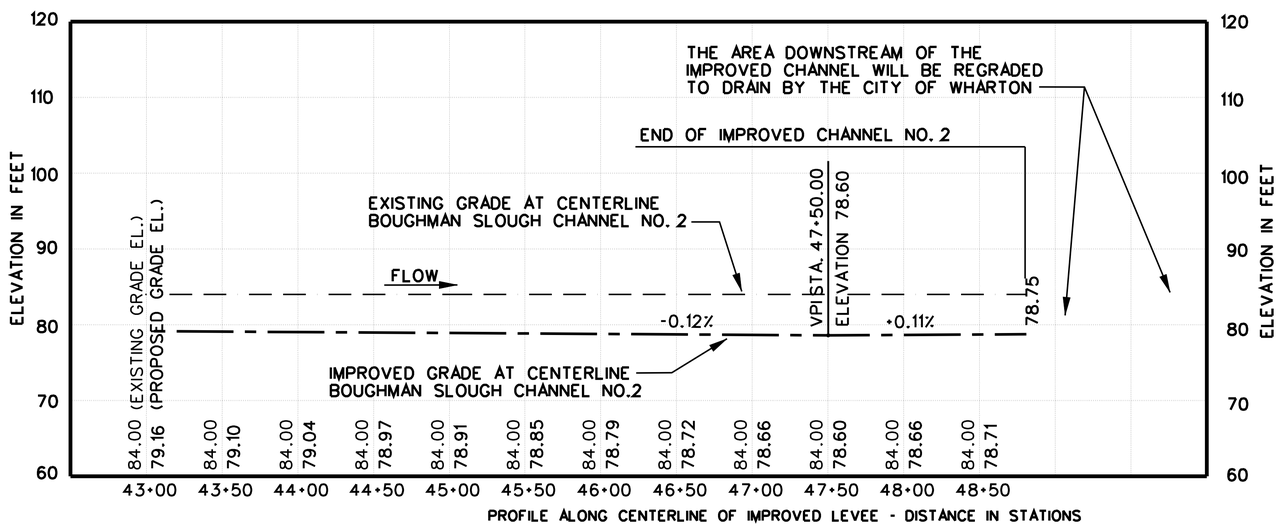
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BRADLEY, P.E. CHIEF, CIVIL SECTION

Date: -- -- --
Sol No.
Contr No.
Rev.
Re-seed:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN-AND-PROFILE
BOUGHMAN SLOUGH LEVEE
AND CHANNEL NO. 2
CHANNEL NO. 2 STA. 43+00 - 48+80.75

PRELIMINARY

Sheet reference number: C110

DESIGN FILE: WHARTON_C110.DGN

Contr No.

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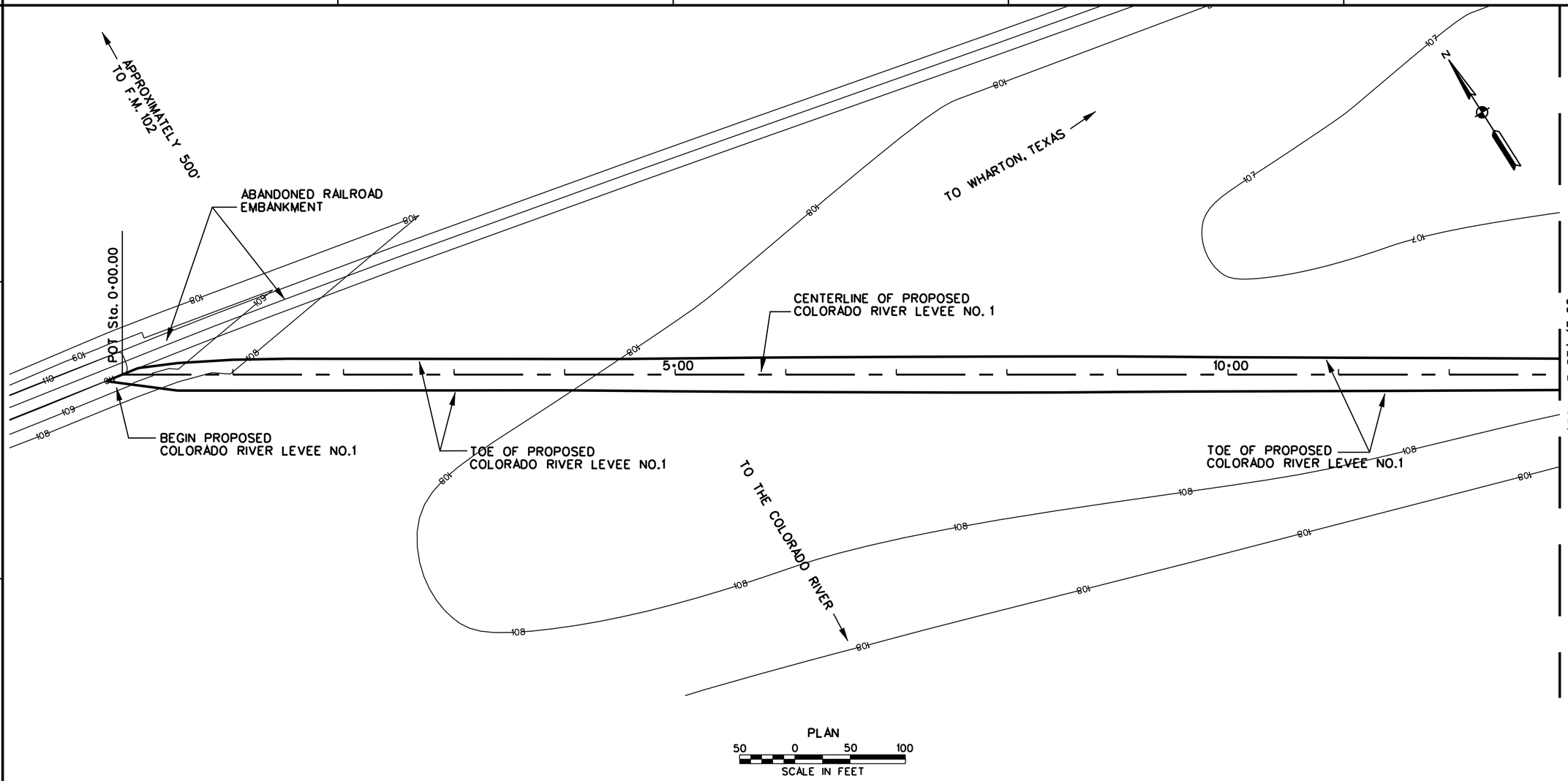

PLAN

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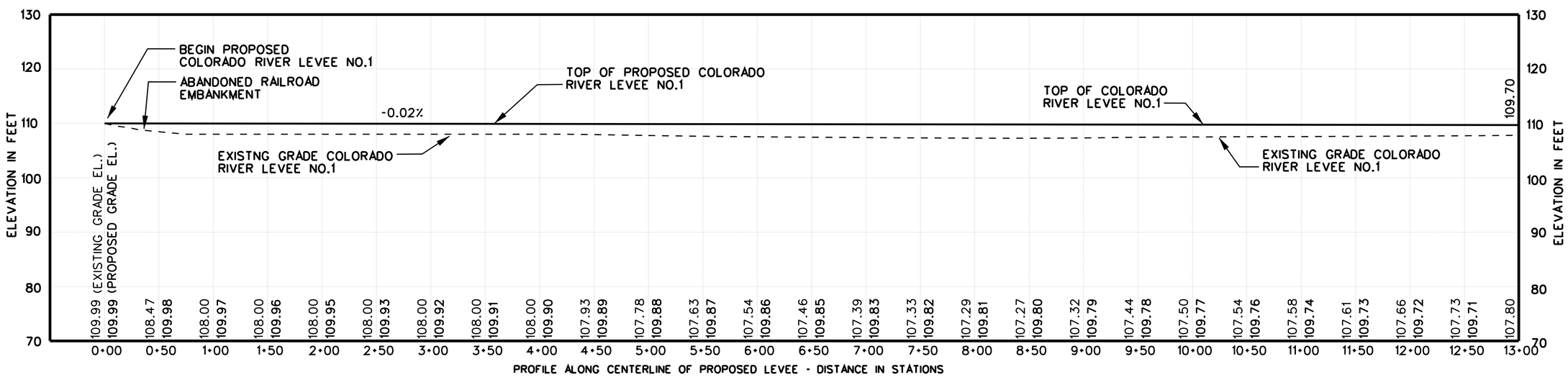
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Date: -- -- --
Rev. --
Dwn by: R. REED
Sol No. --
Contr No. --
Reviewed by: S. ARMSTRONG
Re-name
Post date -- -- --
Post scale --
Submitted by: MARK J. BLACK, P.E. CHIEF, CIVIL SECTION

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN-AND-PROFILE
COUCHMAN SLOUGH LEVEE
AND CHANNEL NO. 2
CHANNEL NO. 2 STA. 21+50 - 34+50

PRELIMINARY

Sheet reference number:
C111

DESIGN FILE: WHARTON_CIVLDGN

Contr No.

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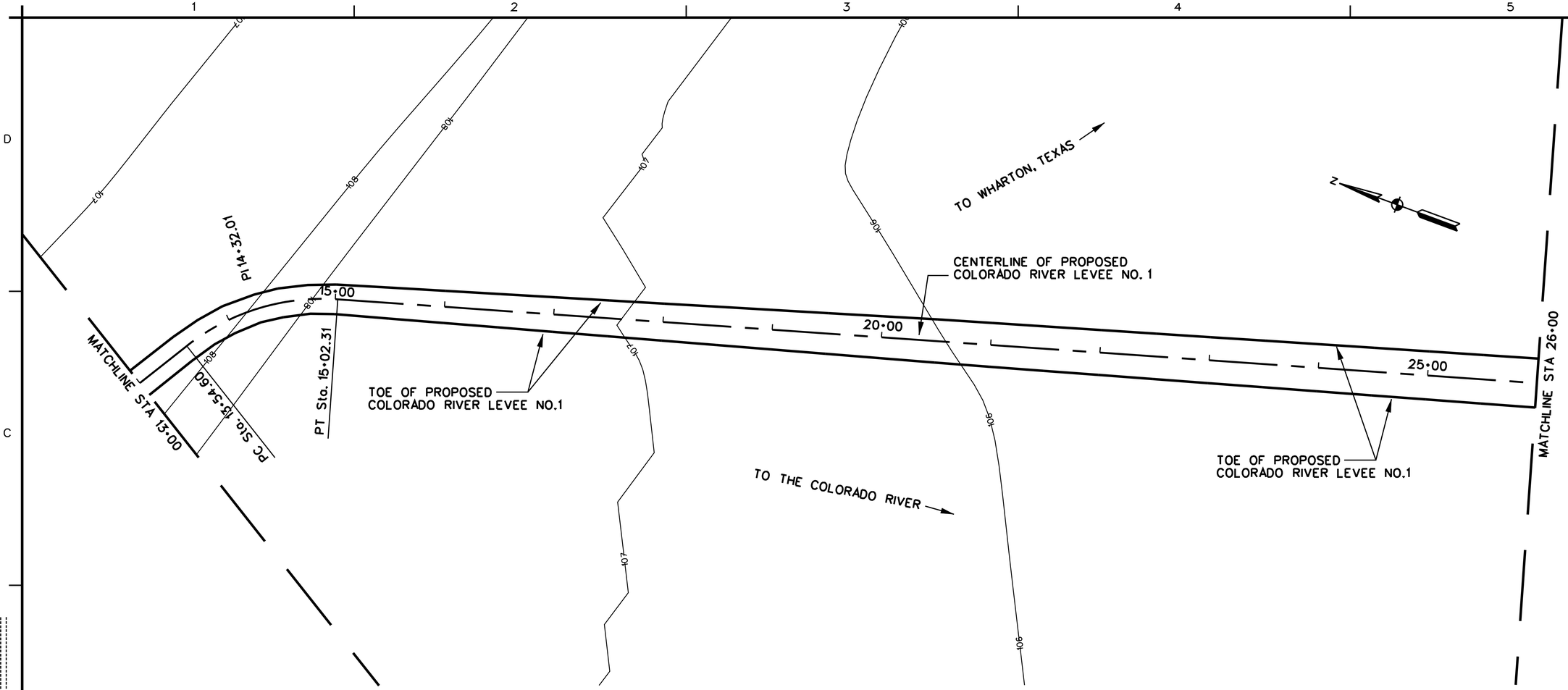
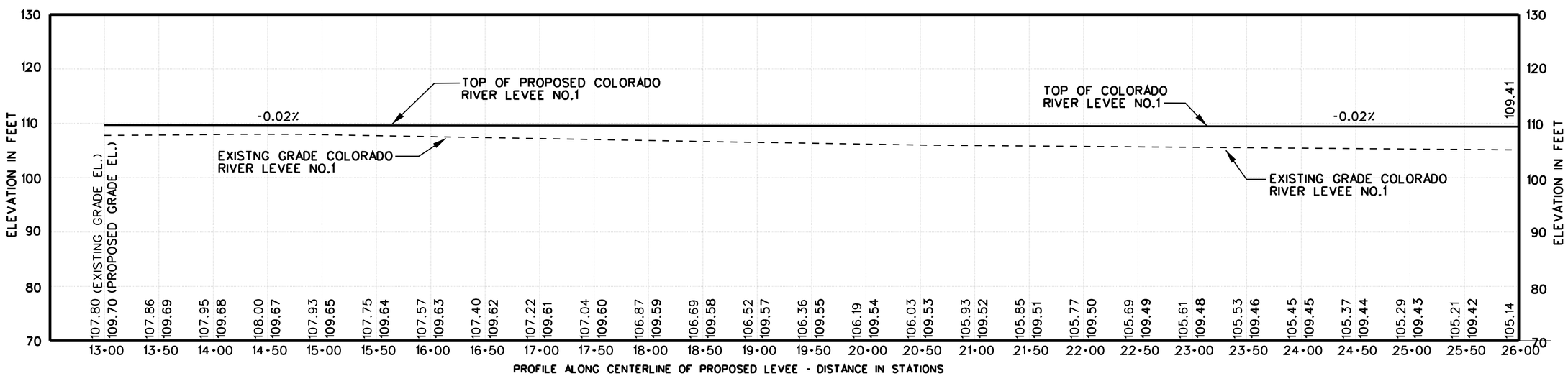


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- --- --
Rev. --
Sol No.
Contr No.
Re-name Plot date: -- --- --
Plot scale: ----

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 1
LEVEE NO. 1 STA. 13+00 - 26+00

PRELIMINARY

Sheet reference number: C112

DESIGN FILE: WHARTON_C112.DGN

Contr No.

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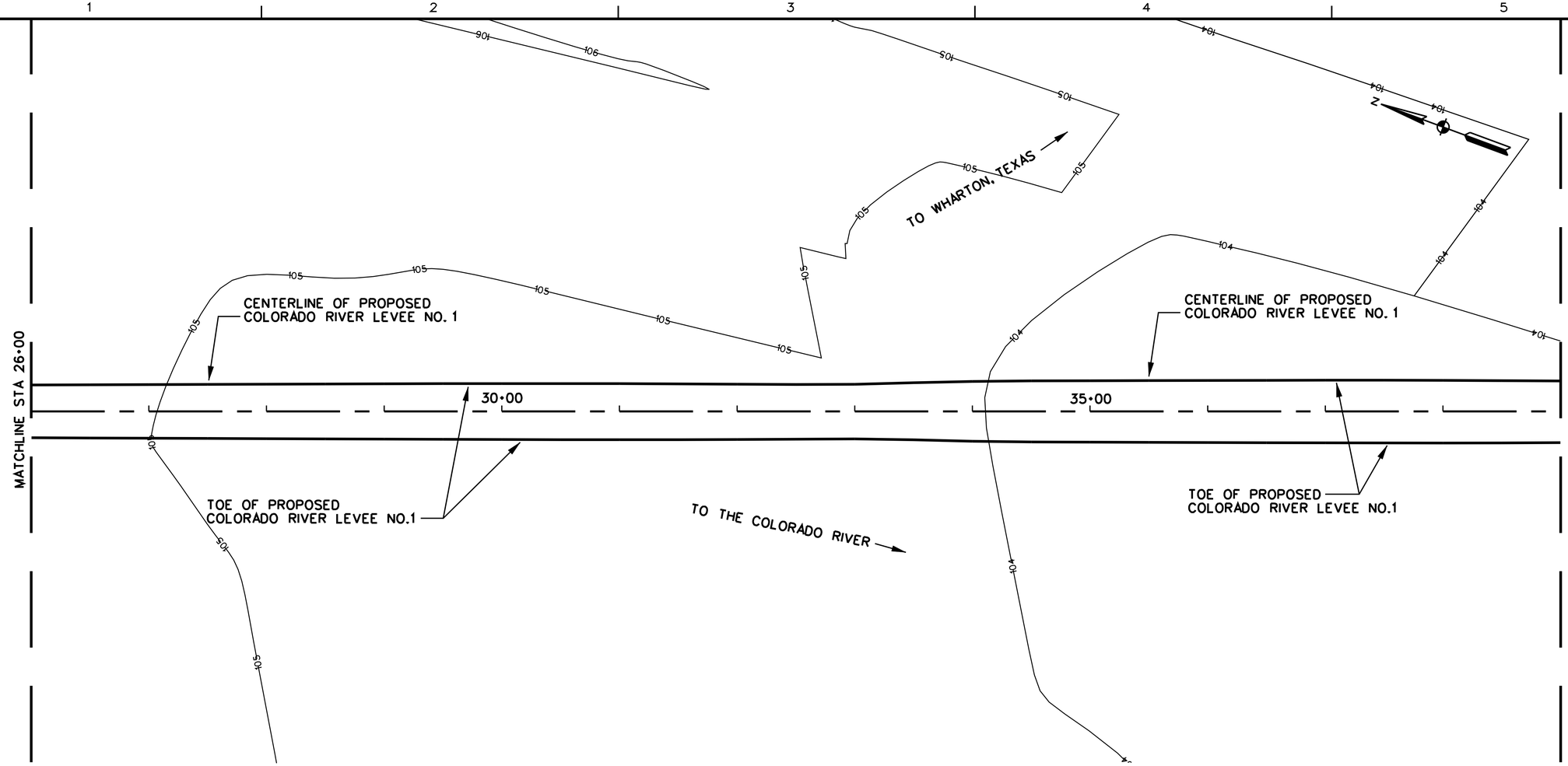
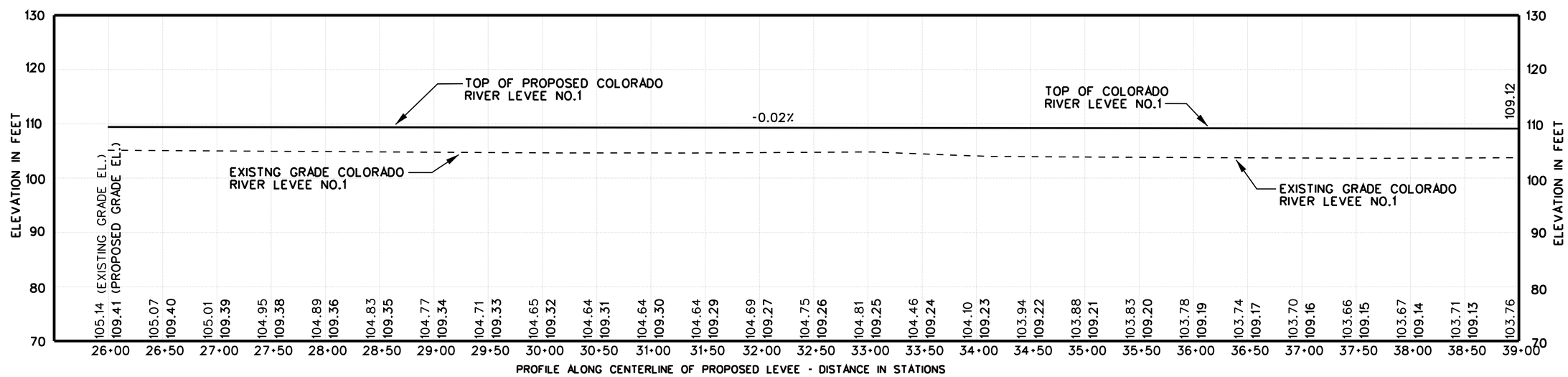


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. --
Sol No.
Contr No.
File name
Plot date -- -- --
Plot scale

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN-AND-PROFILE
COLORADO RIVER LEVEE NO. 1

LEVEE NO. 1 STA. 26+00 - 39+00

PRELIMINARY

Sheet reference number:
C113

DESIGN FILE: WHARTON_C113.DGN

Contr No.

$$date$$ $$time$$
$$me$$
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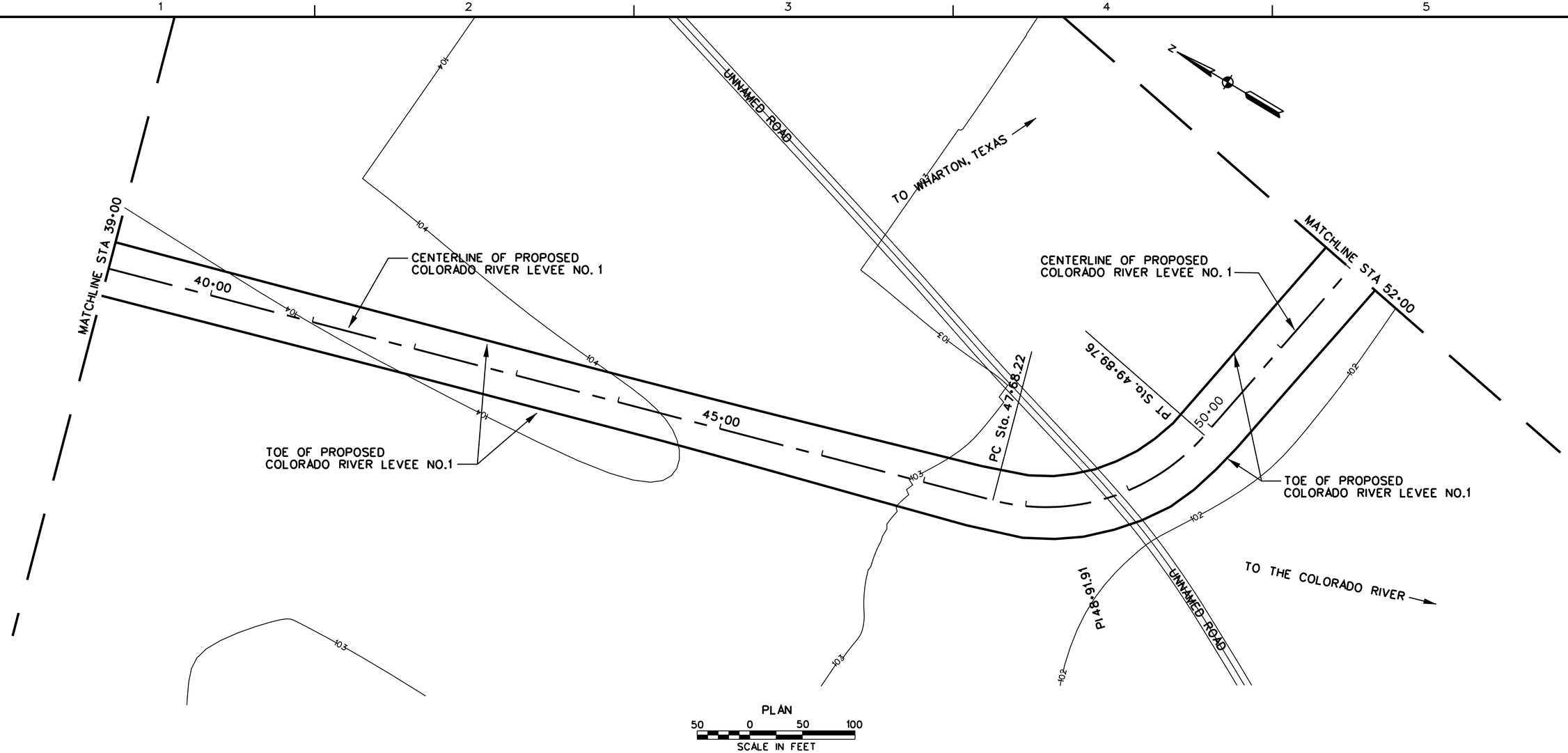

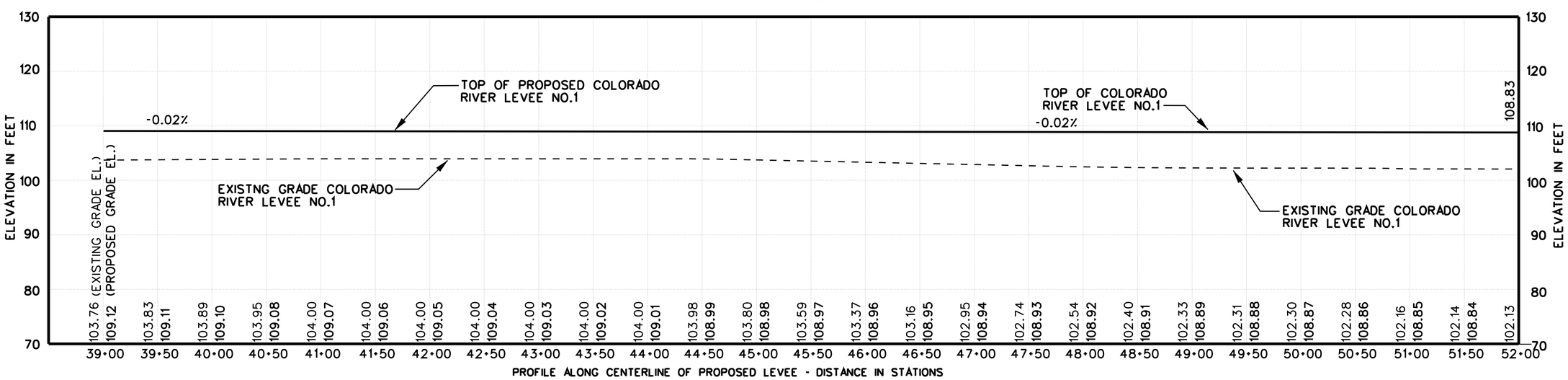

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- --- --
Sol No.
Contr No.
Rev. --
Re-name
Plot date: -- -- --
Plot scale: -----

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO.1
LEVEE NO. 1 STA. 39+00 - 52+00

PRELIMINARY

Sheet reference number: C114

DESIGN FILE: WHARTON_C114.DGN

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$$cadd file name$$

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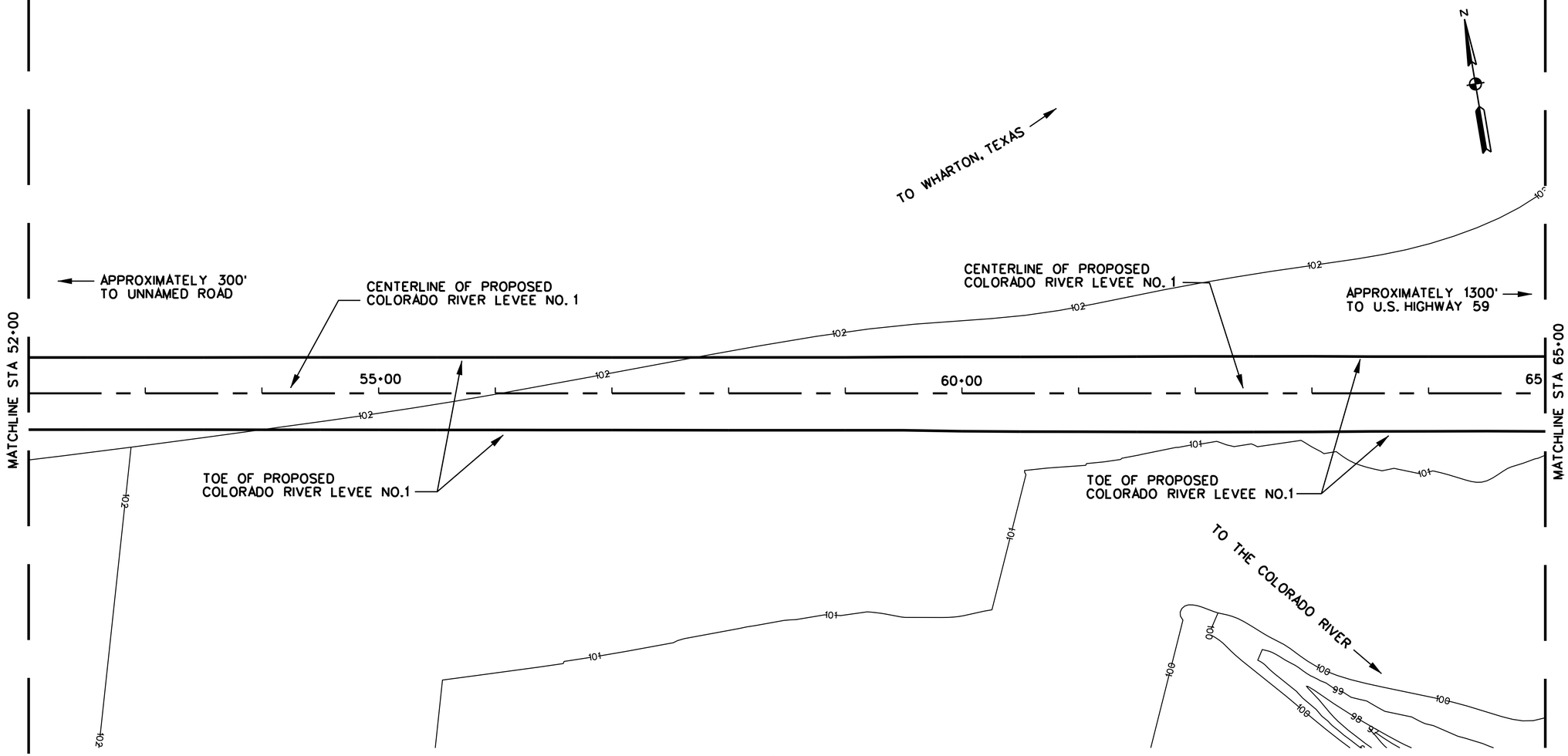
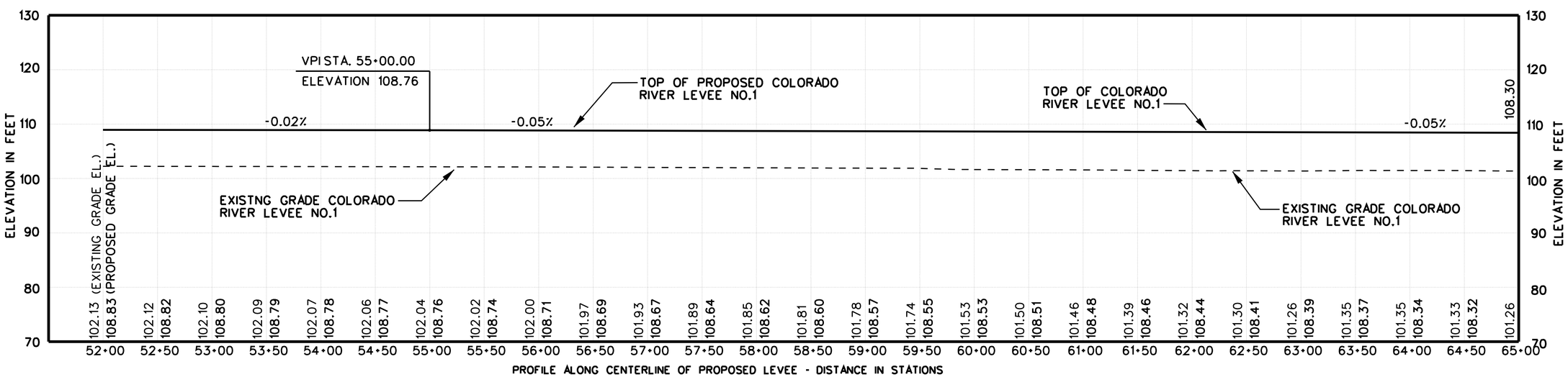


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION

Date: -- --- --
Sol No.
Contr No.
Rev. --
File name
Plot date
Plot scale

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 1
LEVEE NO. 1 STA. 52+00 - 65+00

PRELIMINARY

Sheet reference number: C115

DESIGN FILE: WHARTON_C115.DGN

Contr No.

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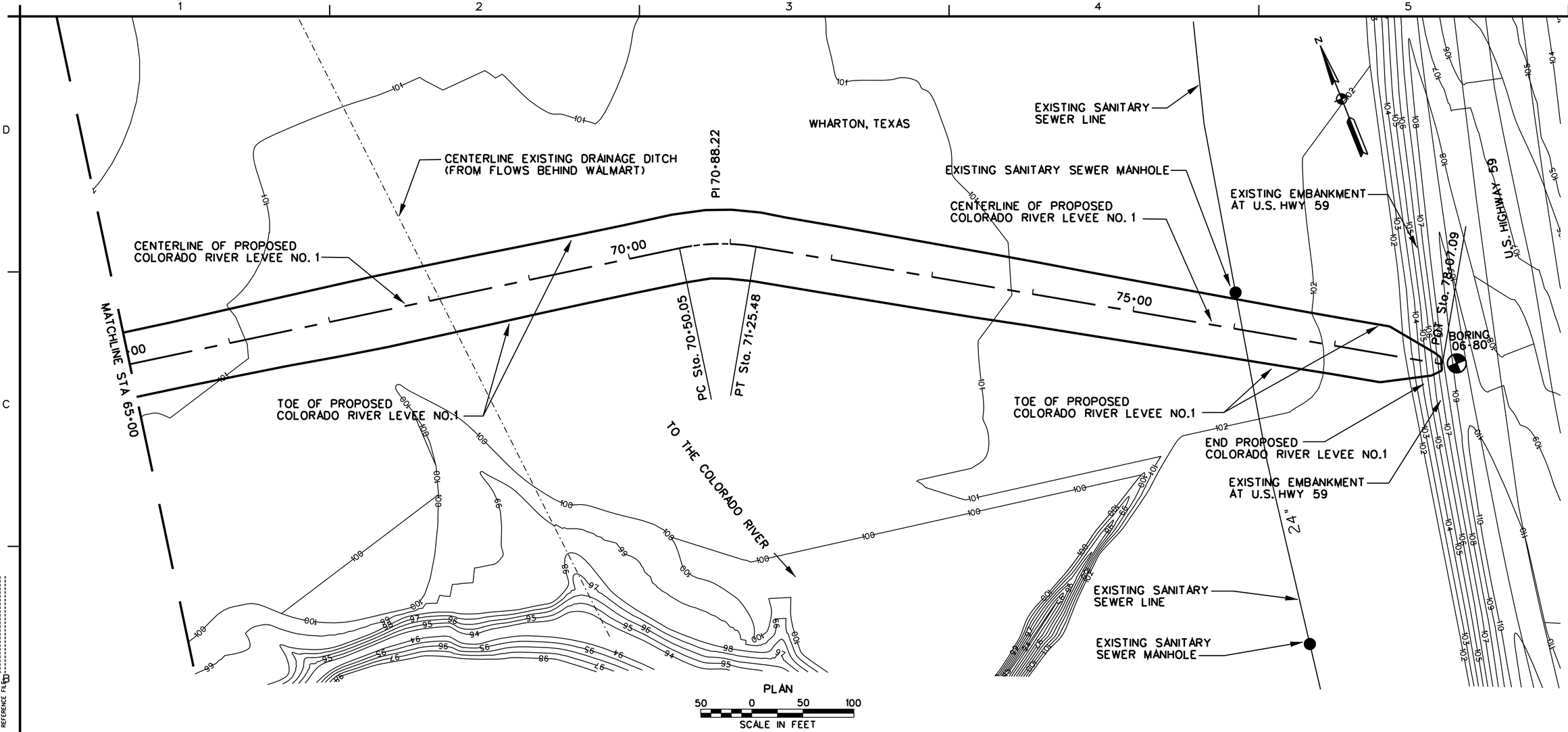

PLAN

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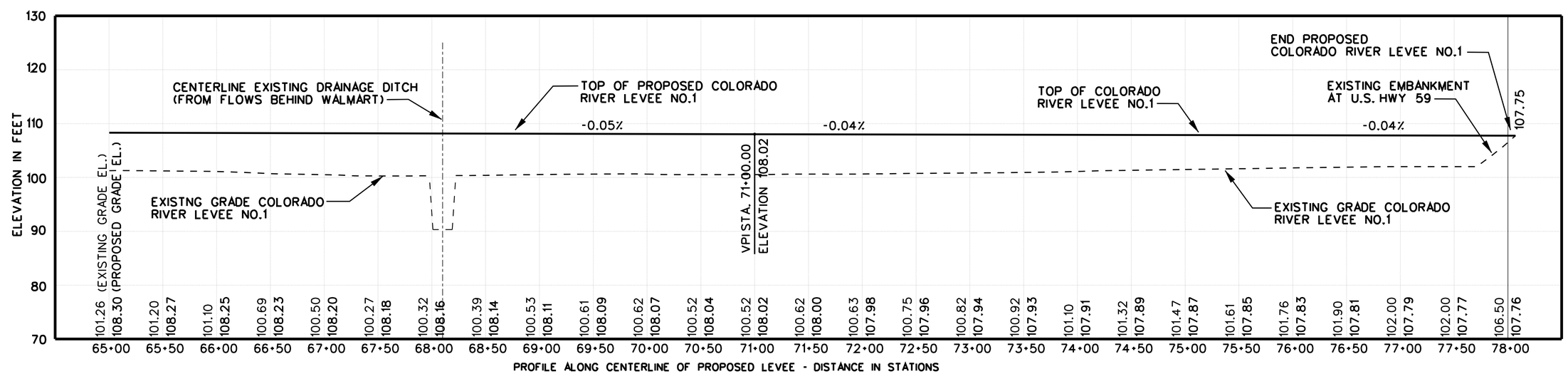
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BOSKER, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. --
Sol No. --
Contr No. --
Re-name ----------
Post date -- -- --
Post scale -- -- --

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN-AND-PROFILE COLORADO RIVER LEVEE NO.1
LEVEE NO. 1 STA. 65+00 - 78+07.09

PRELIMINARY

Sheet reference number: C116

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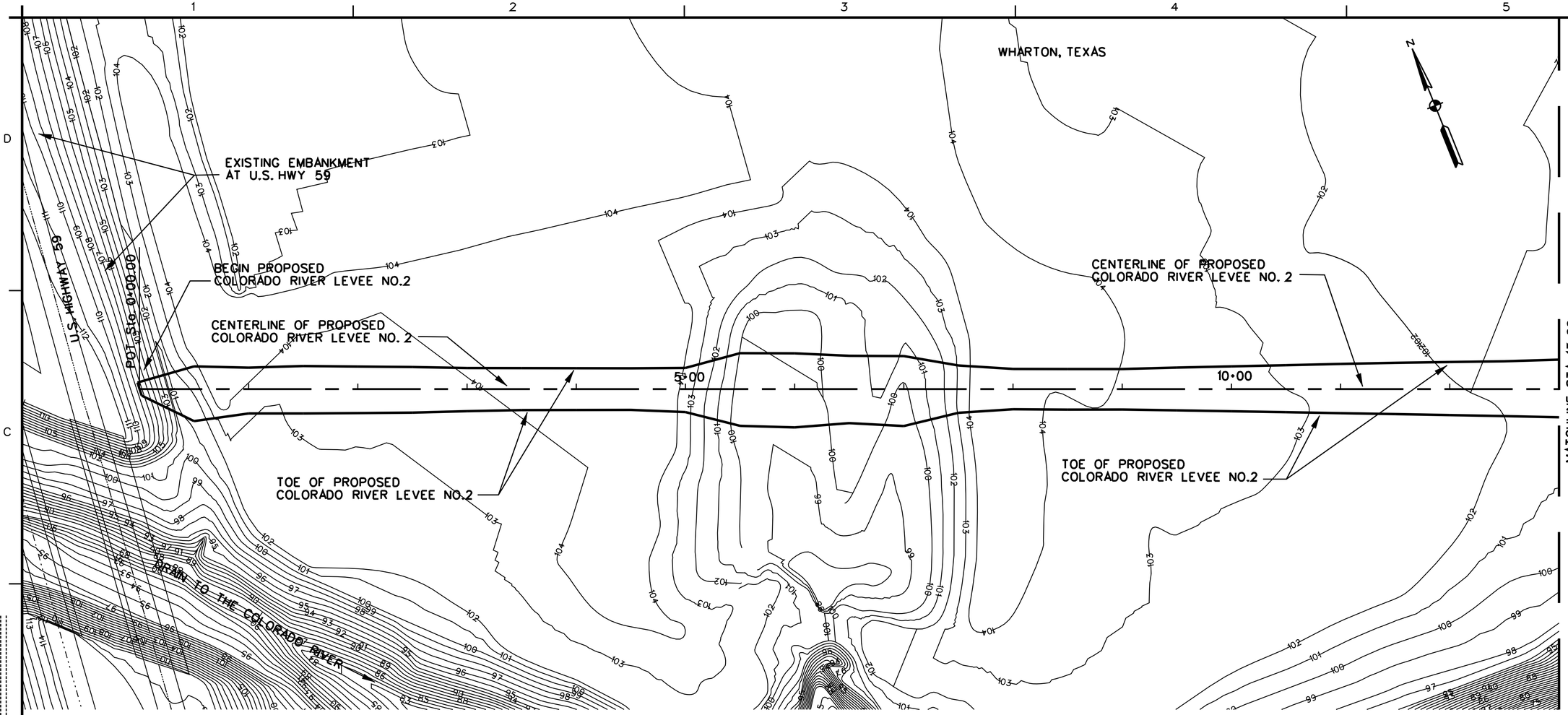

PLAN

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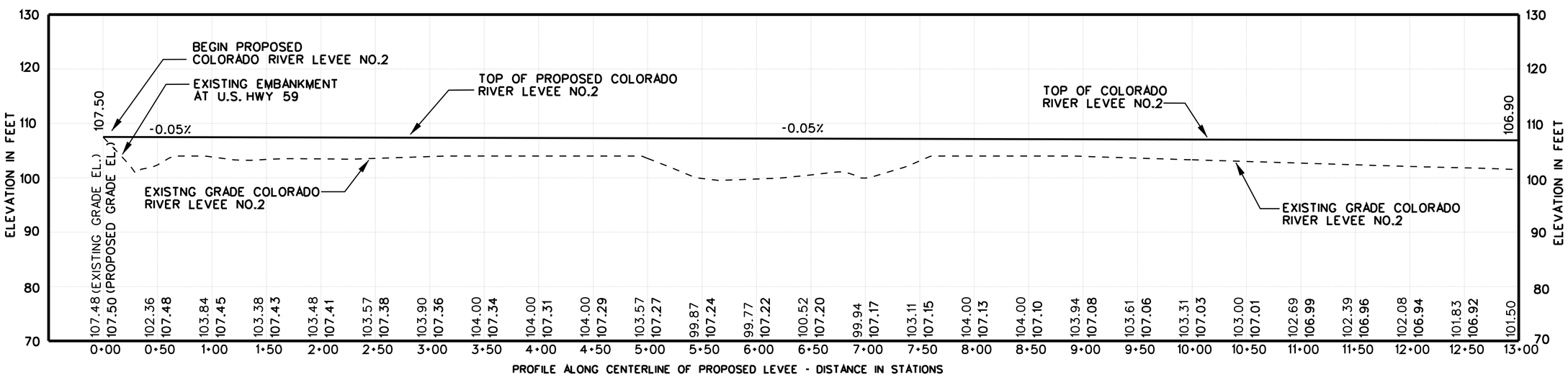
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No. ----
Contr No. ----
Rev. --
File name: ----
Plot date: ----
Plot scale: ----

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE COLORADO RIVER LEVEE NO. 2

LEVEE NO. 2 STA. 0+00 - 13+00

PRELIMINARY

Sheet reference number: C117

DESIGN FILE: WHARTON_C117.DGN

Contr No. ----

$$date$$ $$time$$
$$me$$
$$cadd file name$$

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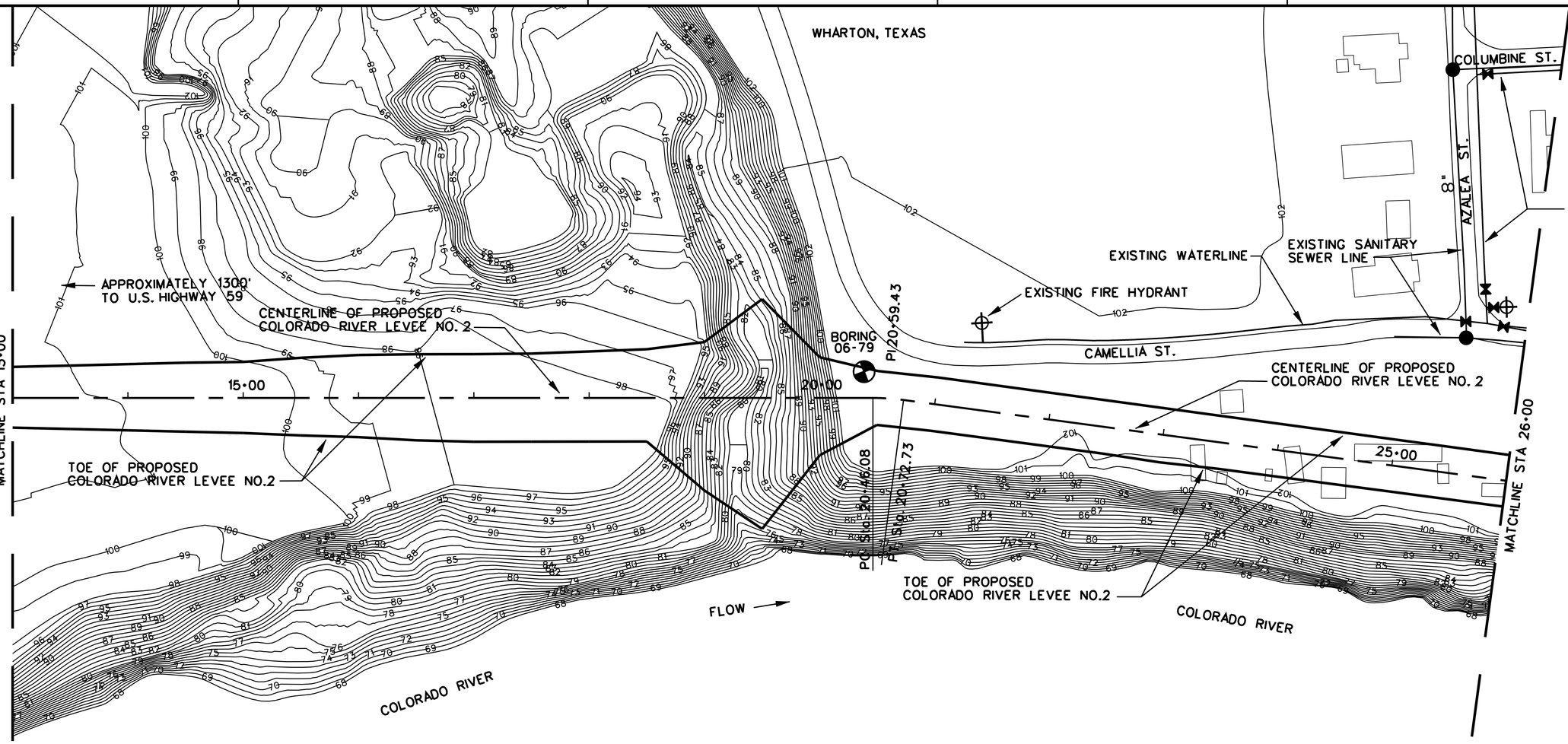
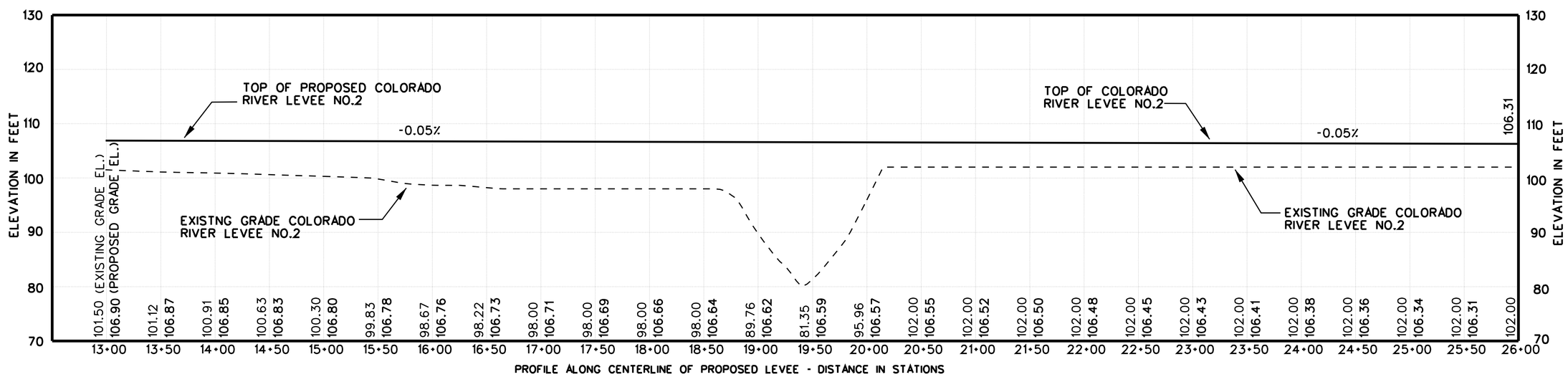


PLAN

50 0 50 100

SCALE IN FEET



No.	Description	O.D. No.	Action	Date

Symbol

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION

Date: -- -- --
Sol No. ----
Contr No. ----
Re-issue
Plot date: ----
Plot scale: ----

Rev. --

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN-AND-PROFILE COLORADO RIVER LEVEE NO.2

LEVEE NO.2 STA.13+00 - 26+00

PRELIMINARY

Sheet reference number: C118

DESIGN FILE: WHARTON_CIB.DGN

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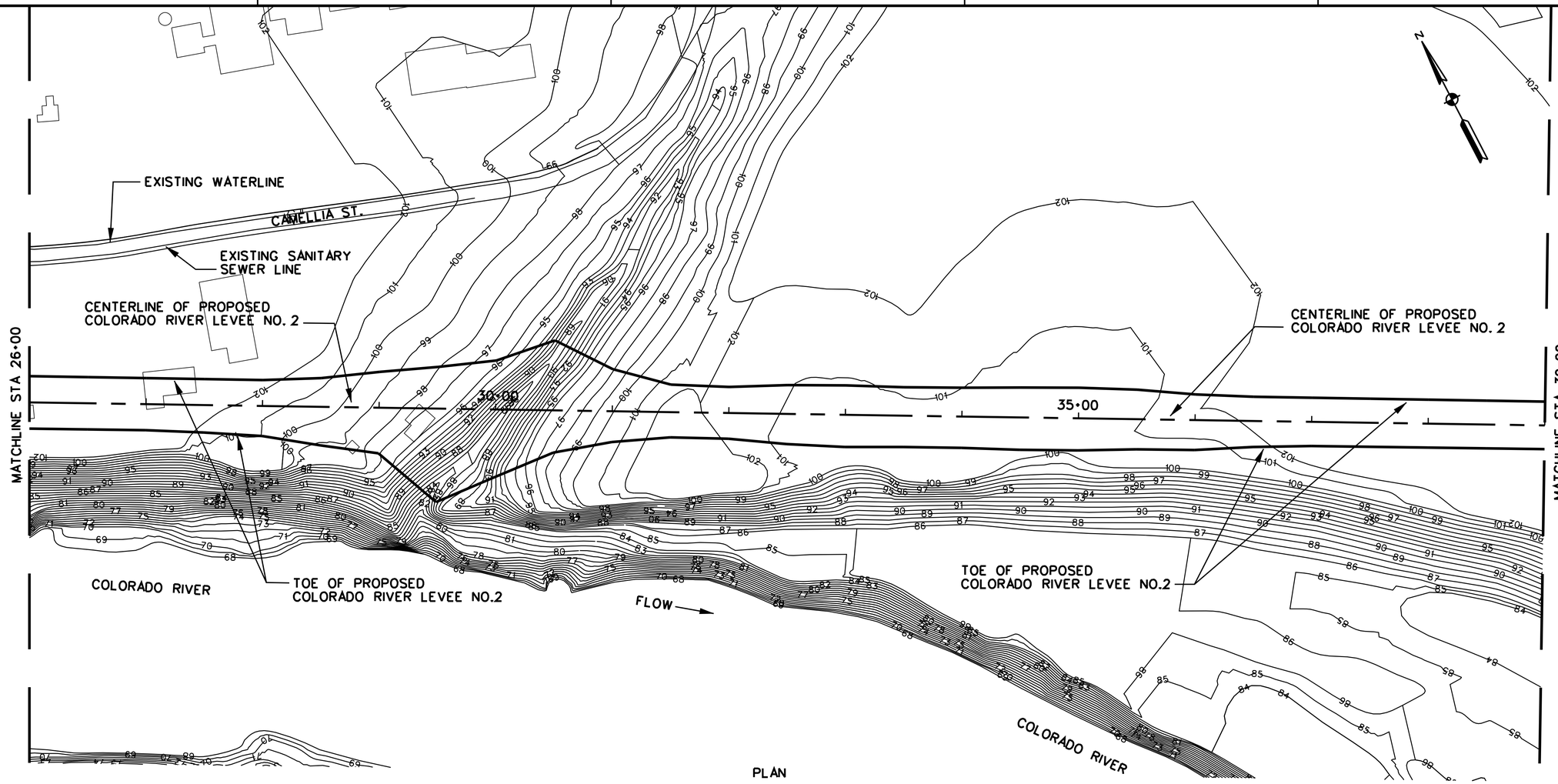
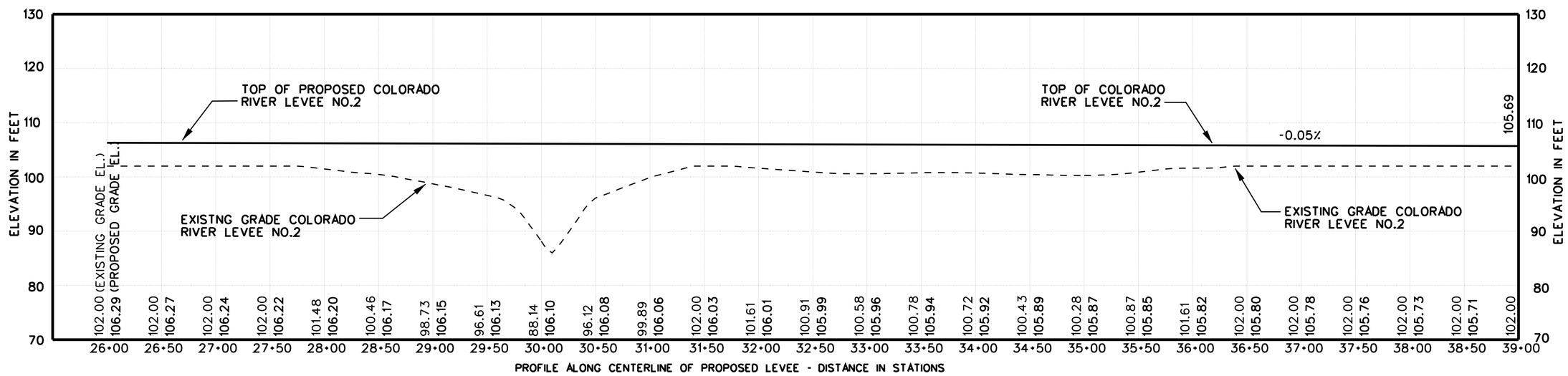


PLAN



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. -- -- --
Sol No. ----
Contr No. ----
Re-view: ----
Pol date: ----
Pol scale: ----

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN-AND-PROFILE
COLORADO RIVER LEVEE NO.2
LEVEE NO.2 STA.26+00 - 39+00

PRELIMINARY

Sheet reference number: C119

DESIGN FILE: WHARTON_C119.DGN

Contr No. ----

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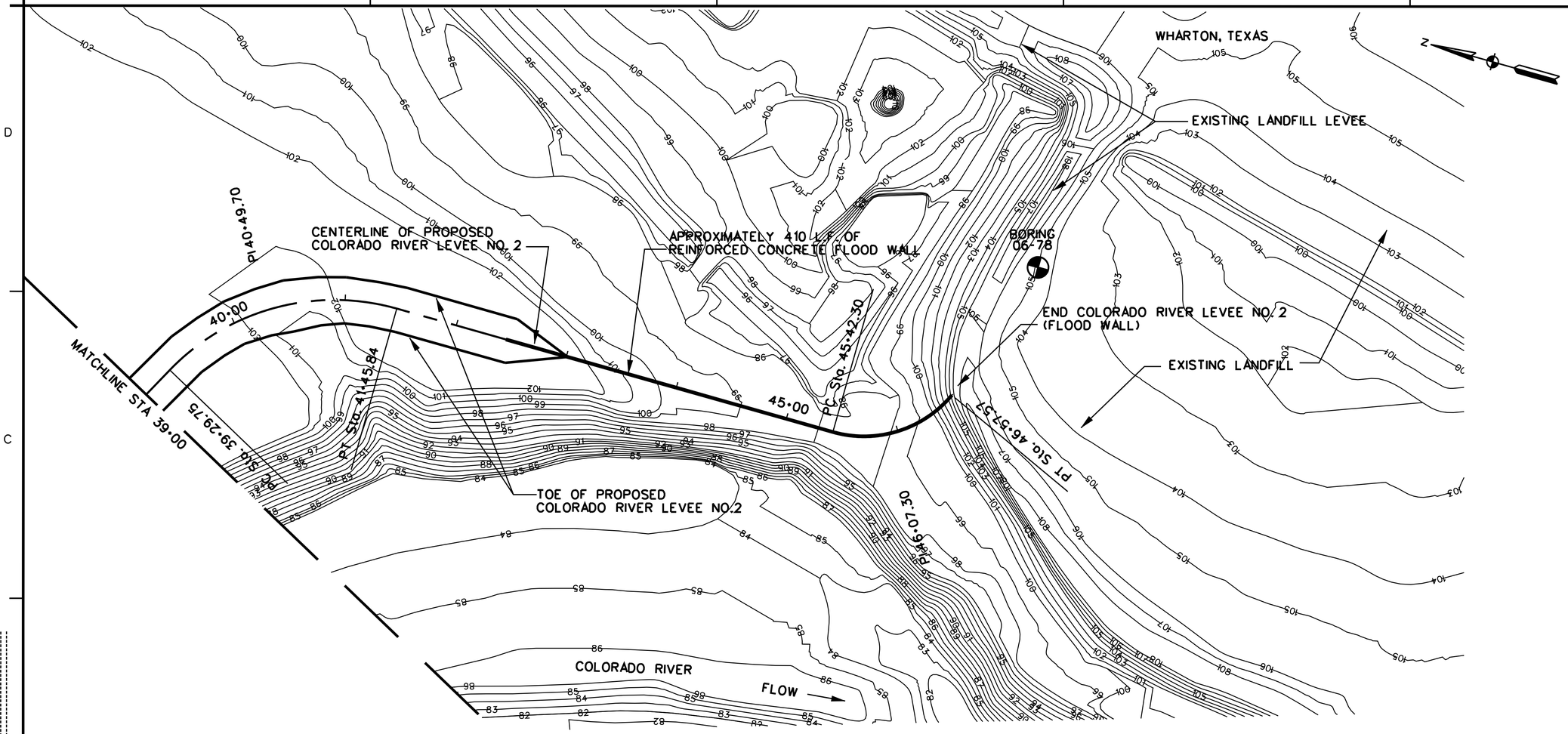

PLAN

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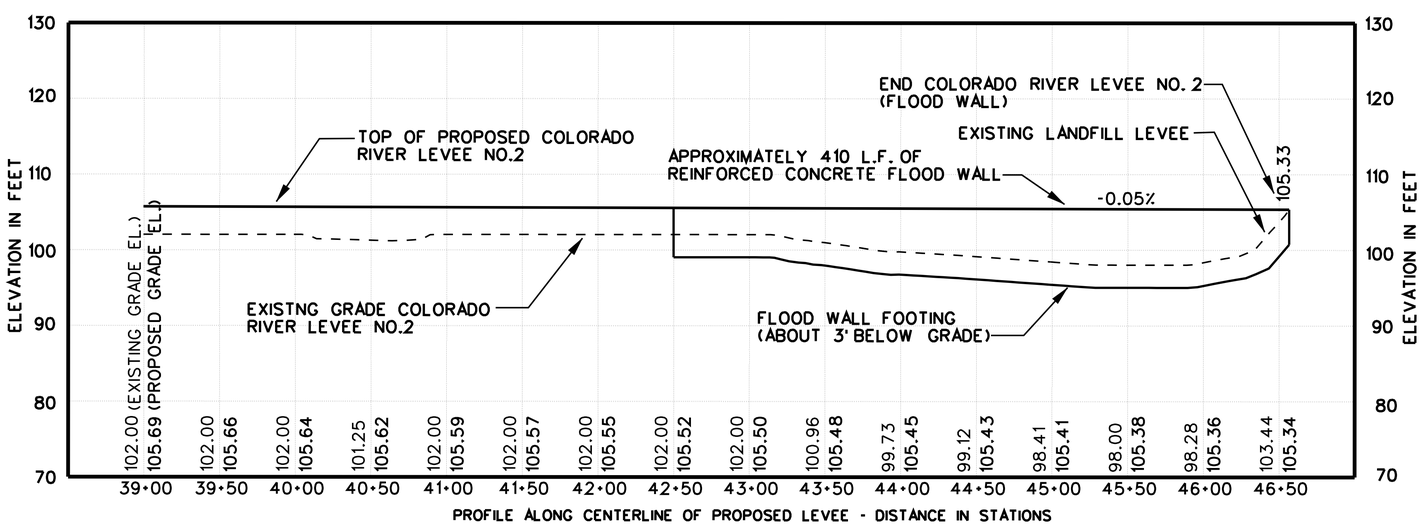
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date:
Sol No.
Contr No.
Rev.
Pl. name:
Plot date:
Plot scale:

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN-AND-PROFILE
COLORADO RIVER LEVEE NO. 2

LEVEE NO. 2 STA. 39+00 - 46+57.57

PRELIMINARY

Sheet reference number:
C120

DESIGN FILE: WHARTON_C120.DGN

$$date$$ $$time$$
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$$cadd file name$$

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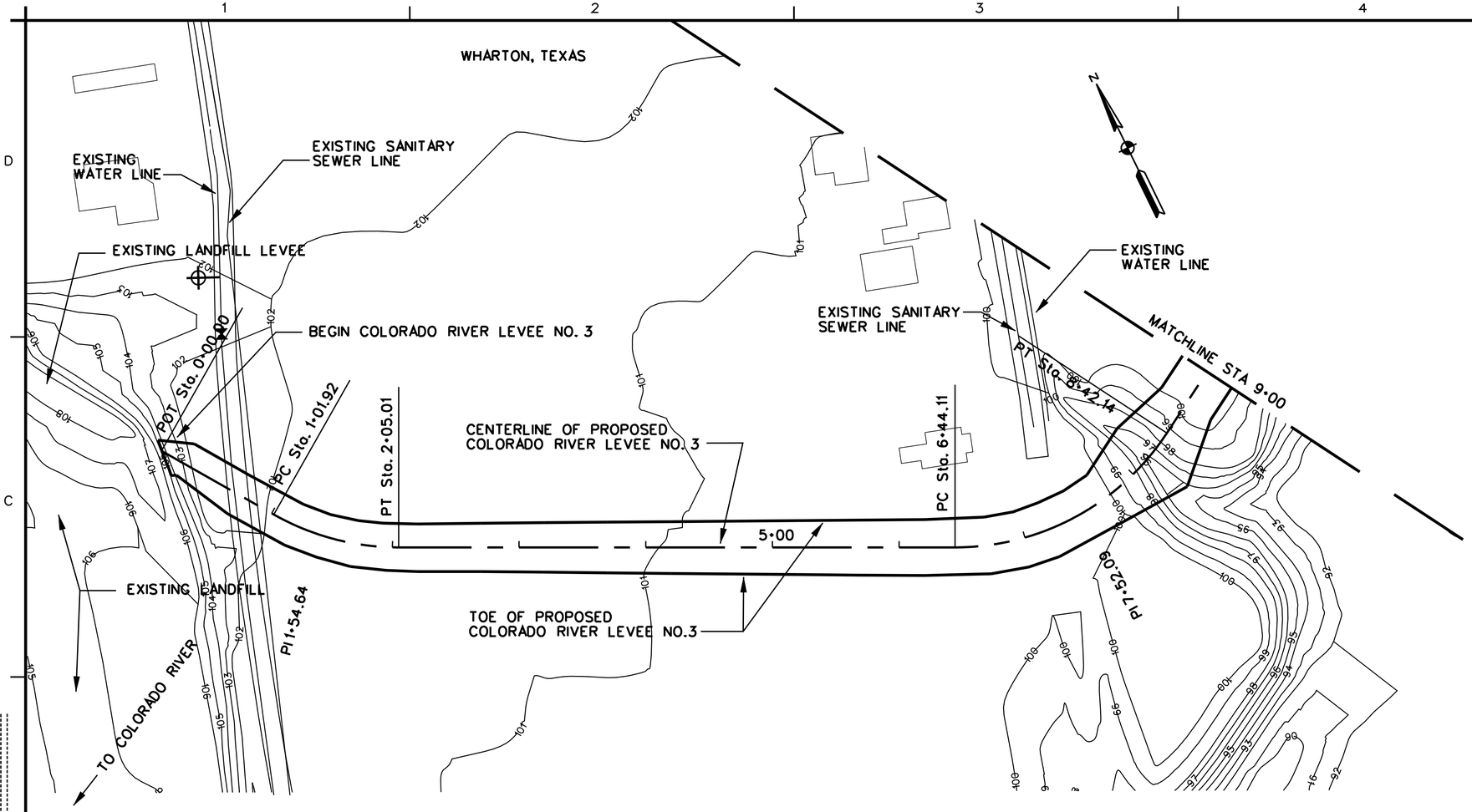
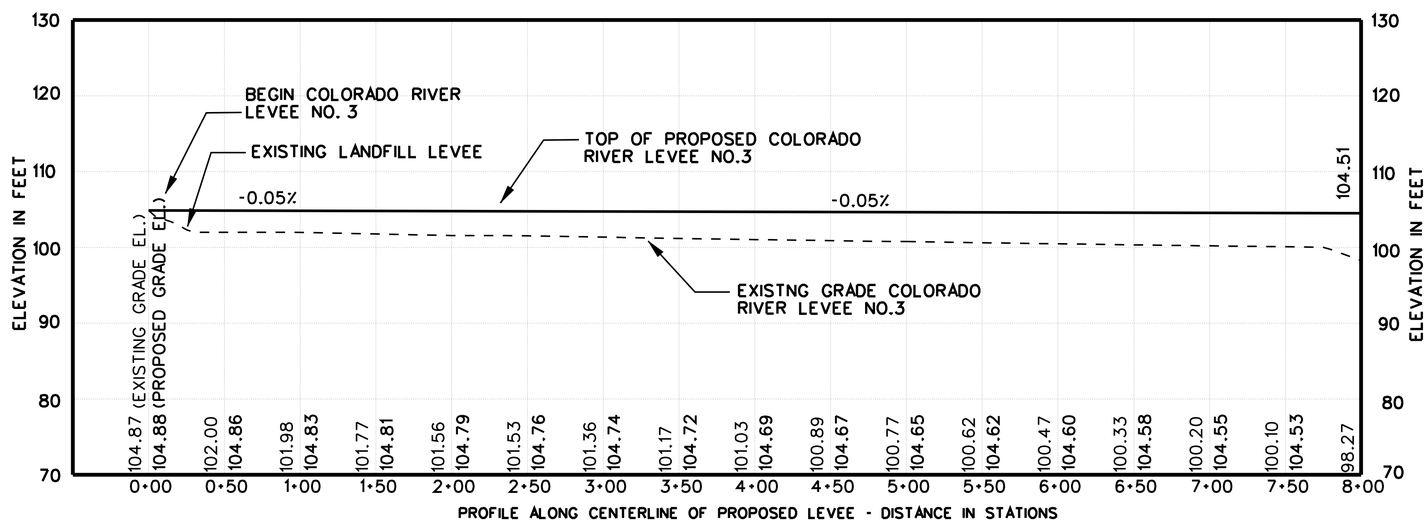


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. --
Sol No. ----
Contr No. ----
File name: ----
Plot date: ----
Plot scale: ----

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN-AND-PROFILE
COLORADO RIVER LEVEE NO. 3

LEVEE NO. 3 STA. 0+00 - 9+00

PRELIMINARY

Sheet reference number: C121

DESIGN FILE: WHARTON_CIZLOCK

$$date$$ $$time$$
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$$cadd file name$$

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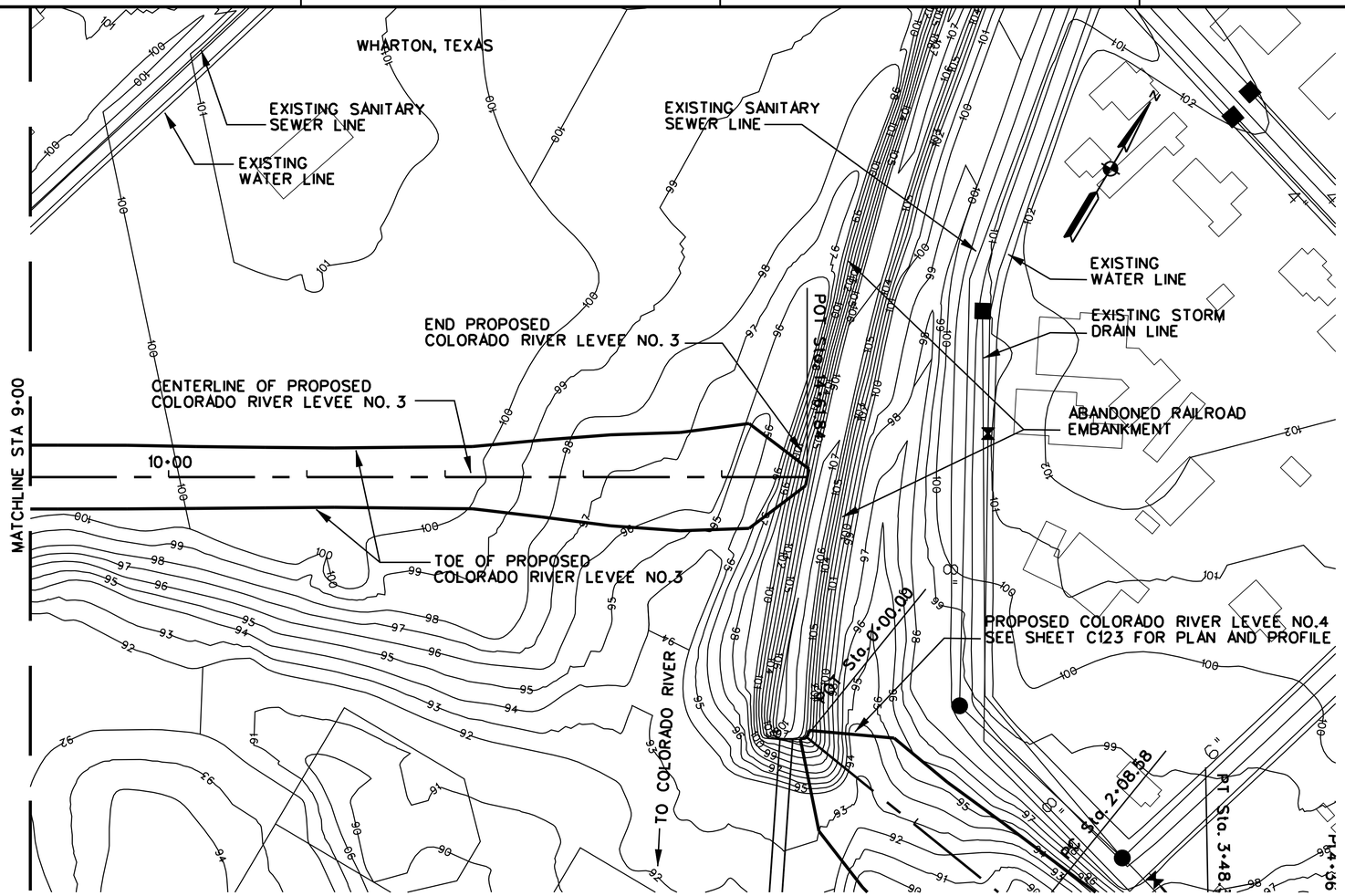
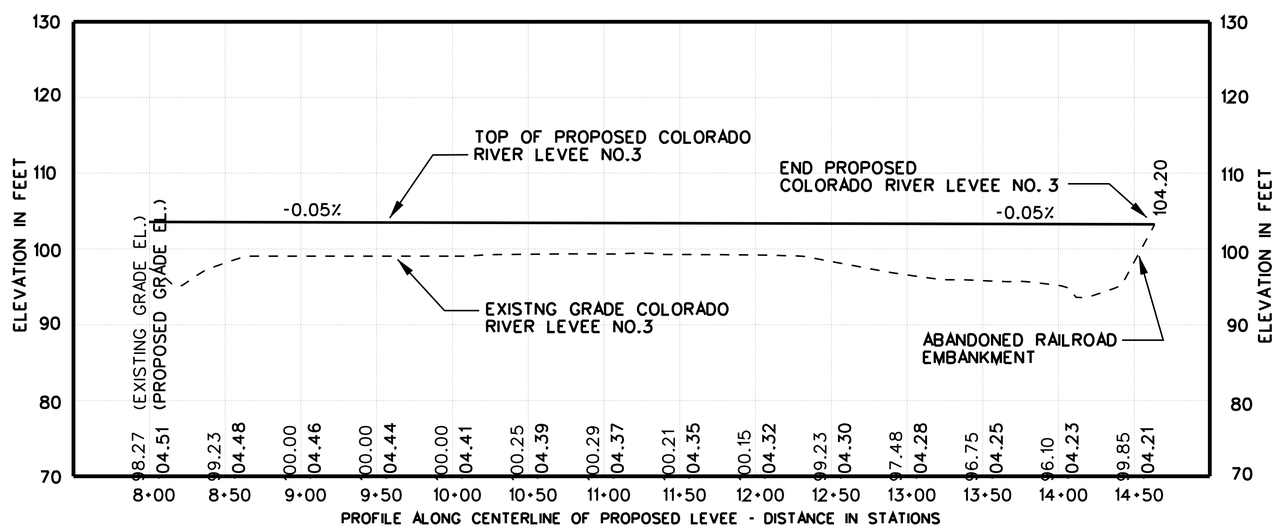


PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG	Date:	Rev.	
Dwn by: R. REED	Sol No.		
Reviewed by: S. ARMSTRONG	Contr No.		
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION	File name: Plot date: Plot scale:		

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 3

LEVEE NO. 3 STA. 9+00 - 14+61.84

PRELIMINARY

Sheet reference number: C122

DESIGN FILE: WHARTON_C02.DGN

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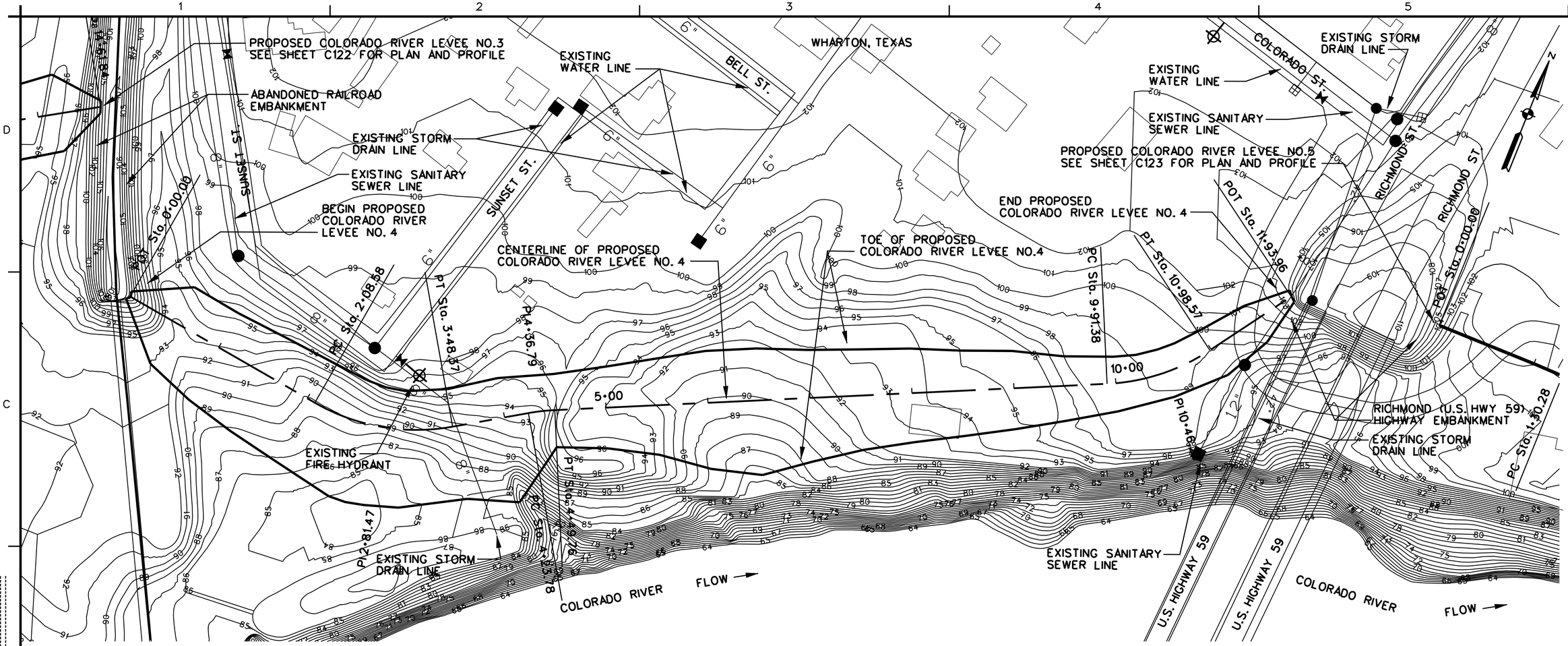

PLAN

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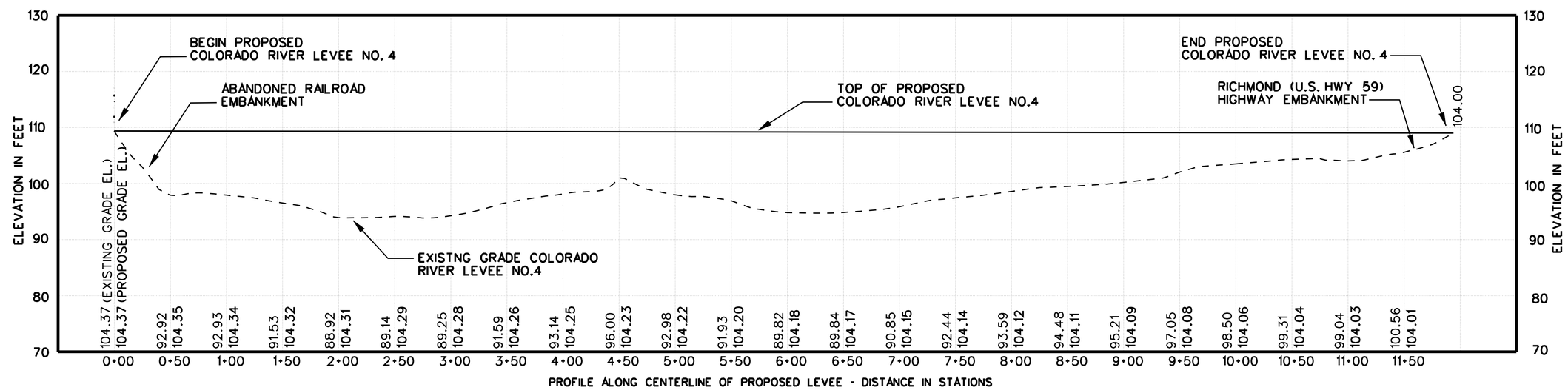
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. -- -- --
Sol No. --
Contr No. --
Re-name: Plot date: -- Plot scale: --

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 4
LEVEE NO. 4 STA. 0+00 - 11+93.96

PRELIMINARY

Sheet reference number: C123

DESIGN FILE: WHARTON_C123.DGN

Contr No.

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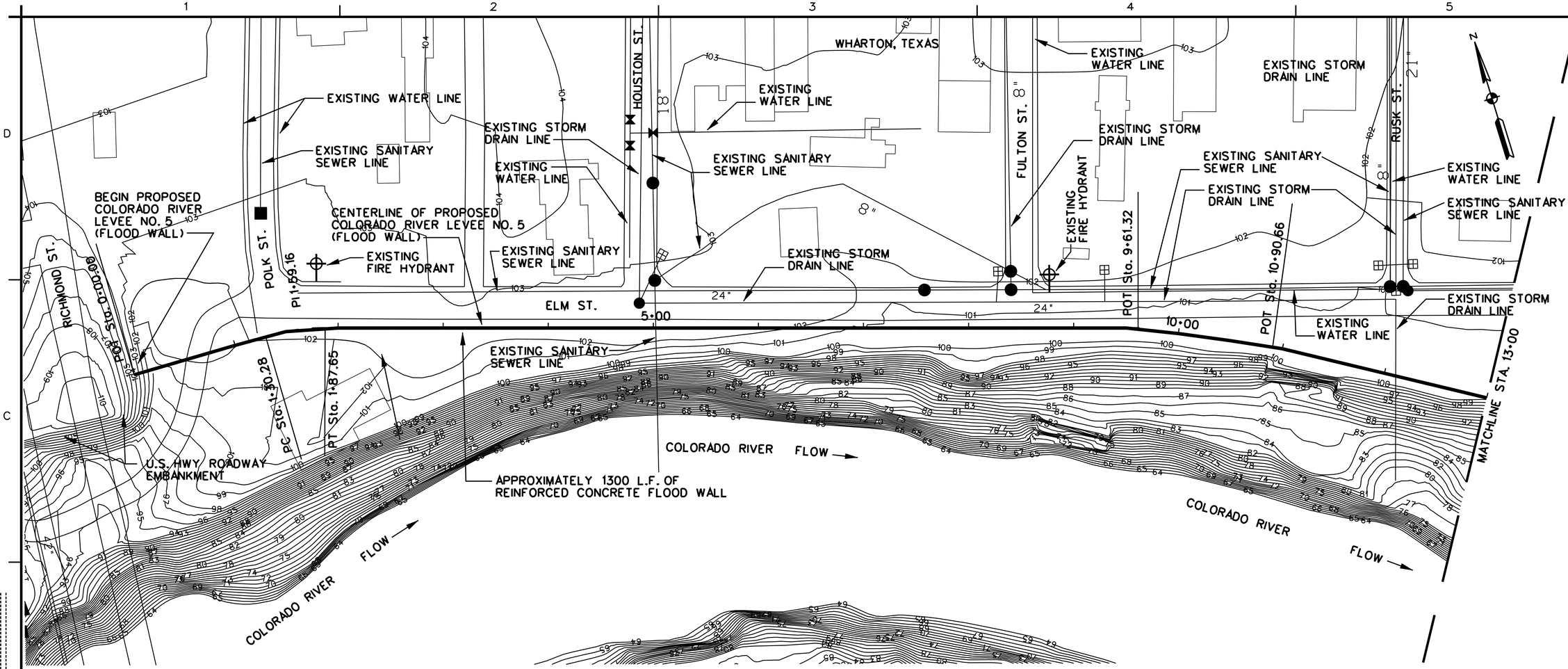

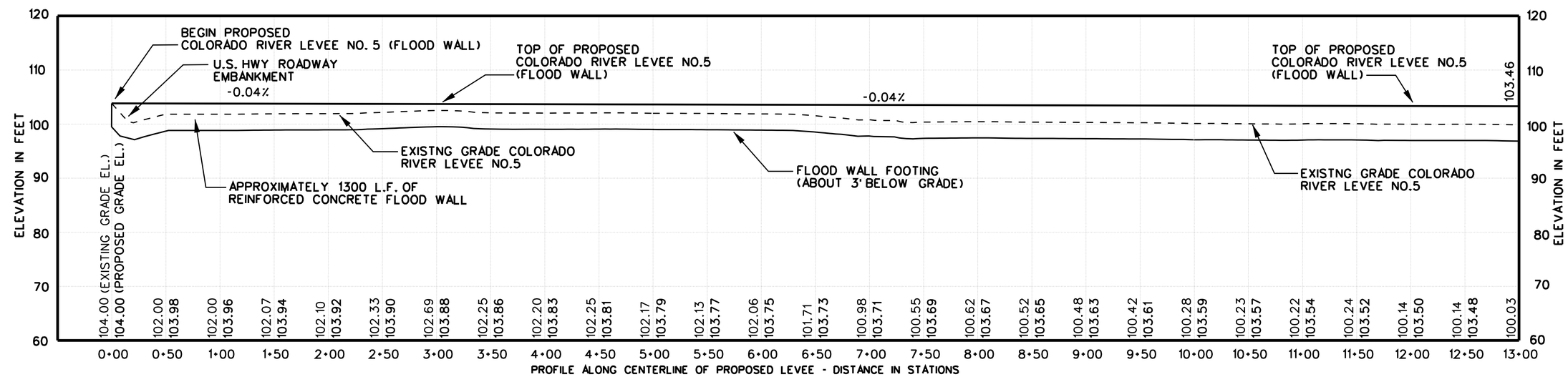

US Army Corps of Engineers
Fort Worth District

Symbol	Description	DD MM YY	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK A. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No.
Contr No.
Rev.
File name: ----
Plot date: -- -- --
Plot scale: ----

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
PLAN AND PROFILE COLORADO RIVER LEVEE NO. 5
LEVEE NO. 5 STA. 0+00 - 13+00

PRELIMINARY

Sheet reference number: C124

DESIGN FILE: WHARTON_C124.DGN

Contr No.

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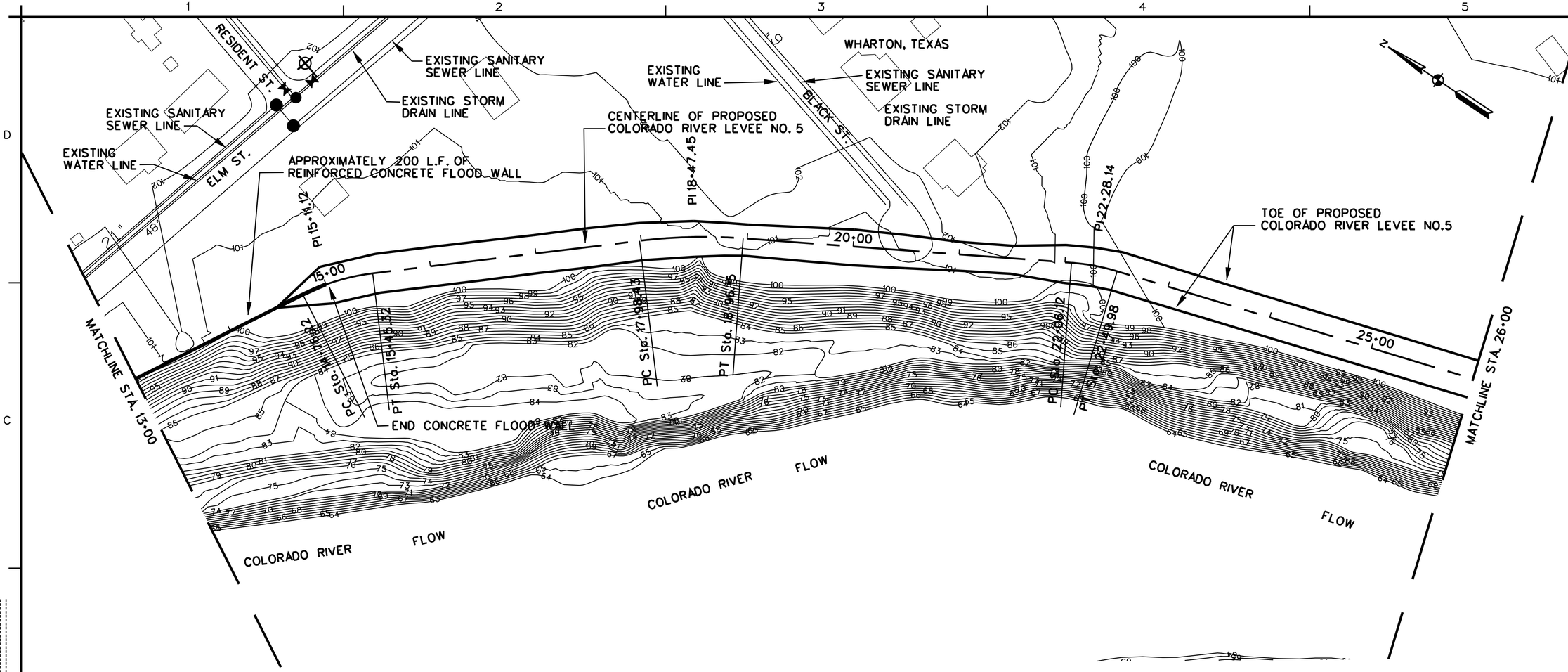

PLAN

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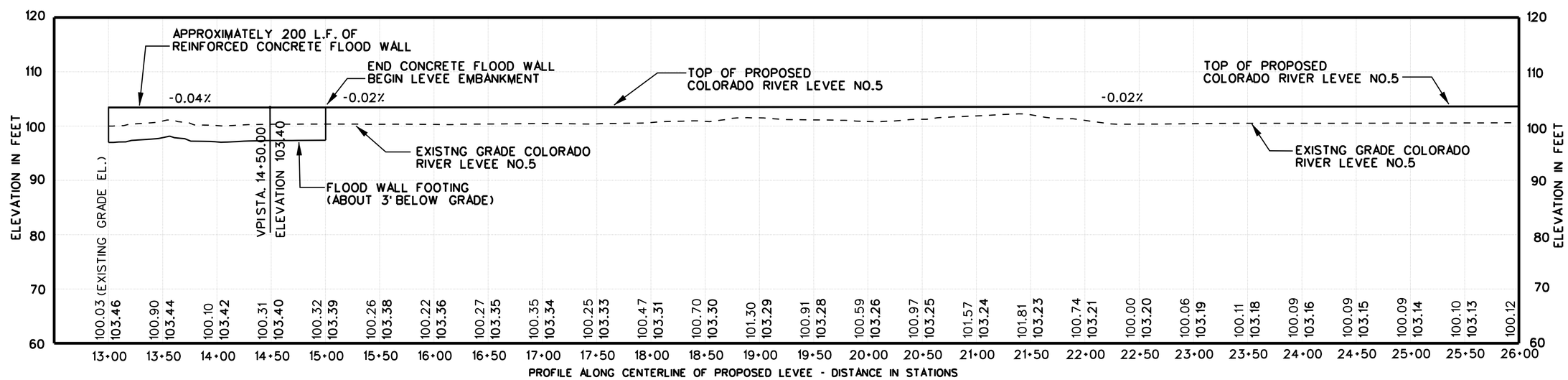
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Date: -- -- --
Rev. --
Dwn by: R. REED
Sol No.
Reviewed by: S. ARMSTRONG
Contr No.
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
File name
Plot date
Plot scale

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 5

LEVEE NO. 5 STA.13+00 - 26+00

PRELIMINARY

Sheet reference number:
C125

DESIGN FILE: WHARTON_C125.DGN

Contr No.

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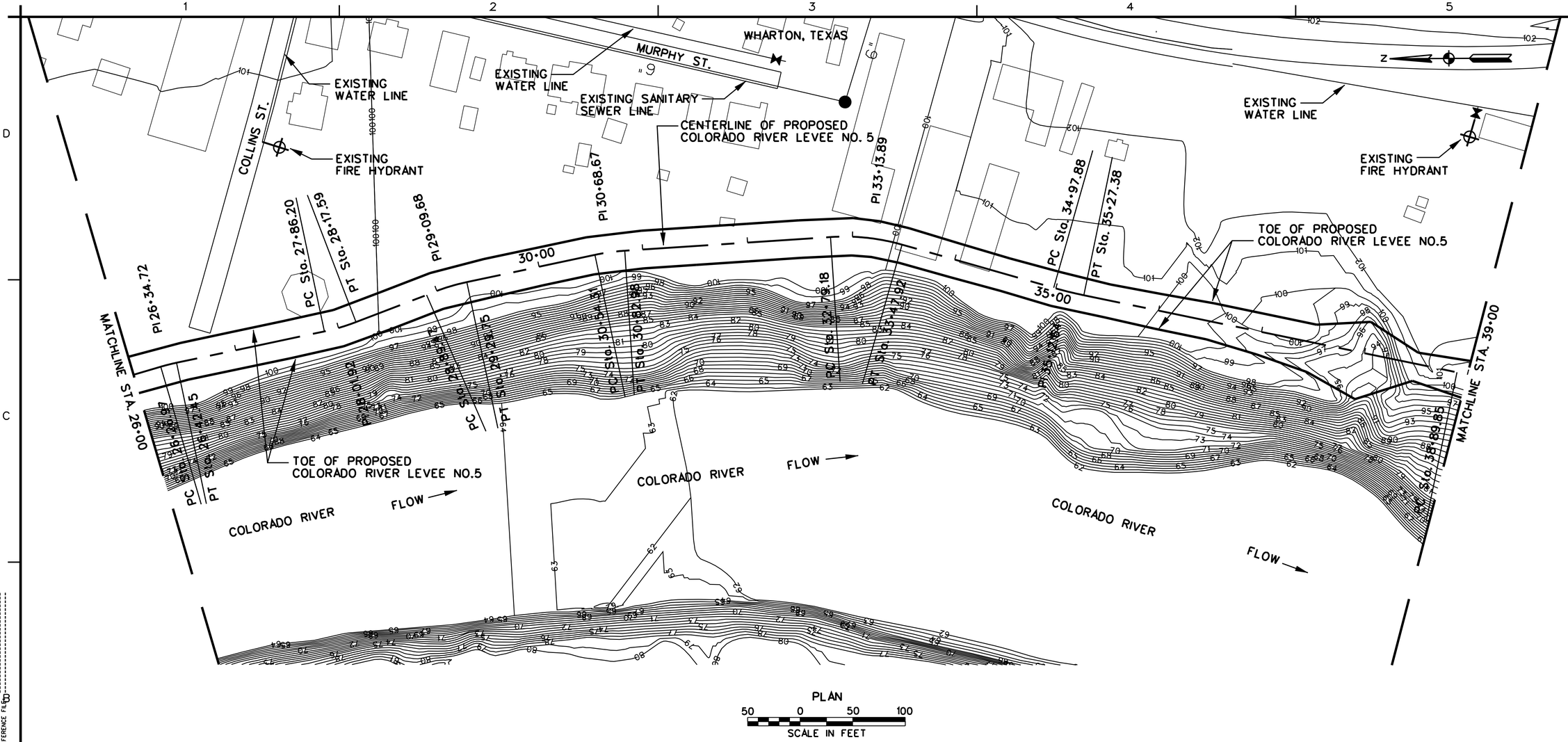

PLAN

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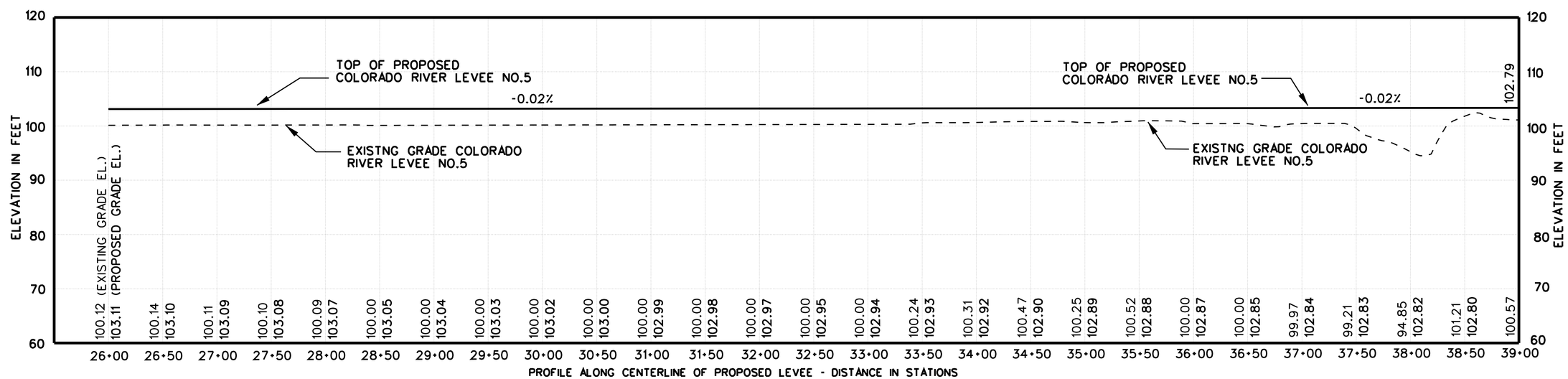
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date	Action

Designed by: S. ARMSTRONG
Date: -- -- --
Rev. --
Dwn by: R. REED
Sol No.
Contr No.
Reviewed by: S. ARMSTRONG
Submitted by: NAME: L.B. ROSS, P.E. CHIEF, CIVIL SECTION
Pw name
Plot date
Plot scale

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN-AND-PROFILE
COLORADO RIVER LEVEE NO.5

LEVEE NO. 5 STA.26+00 - 39+00

PRELIMINARY

Sheet reference number:
C126

DESIGN FILE: WHARTON_C126.DGN

Contr No.

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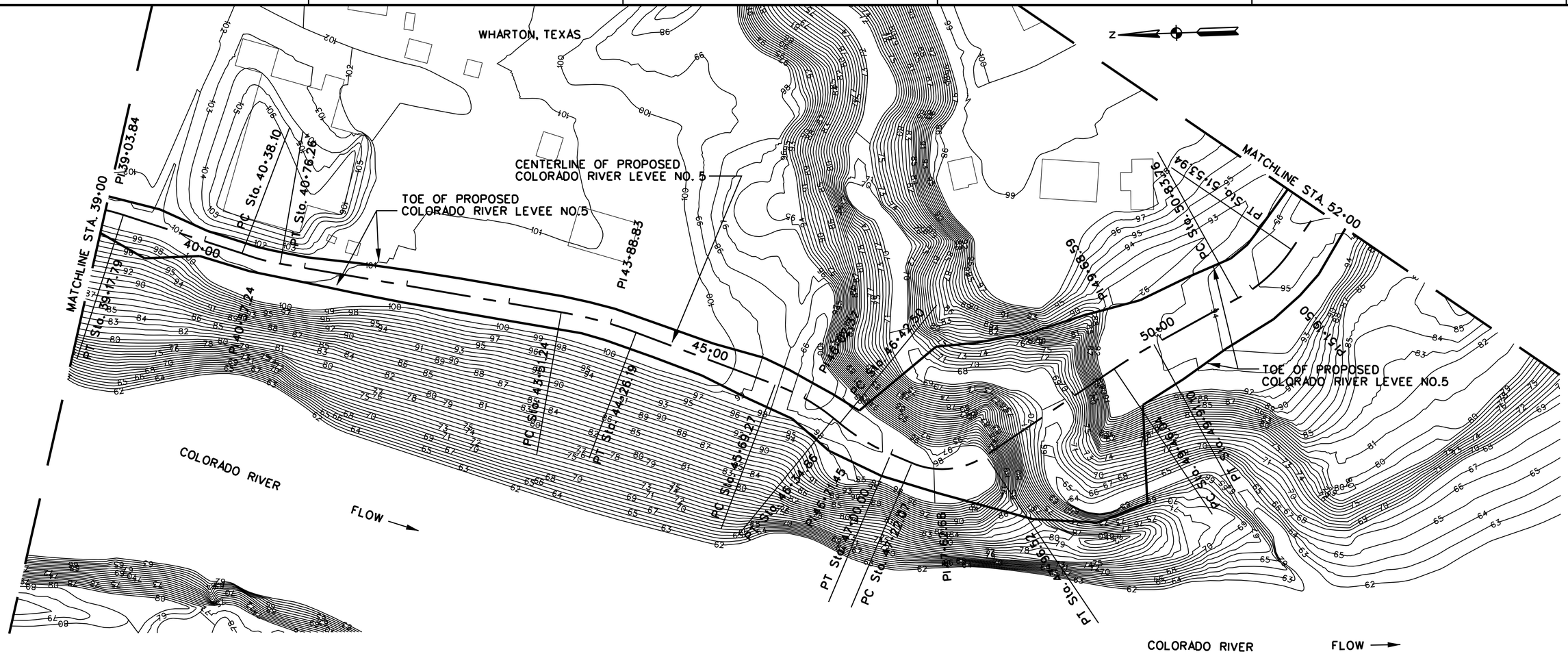
REFERENCE FILE:



PLAN

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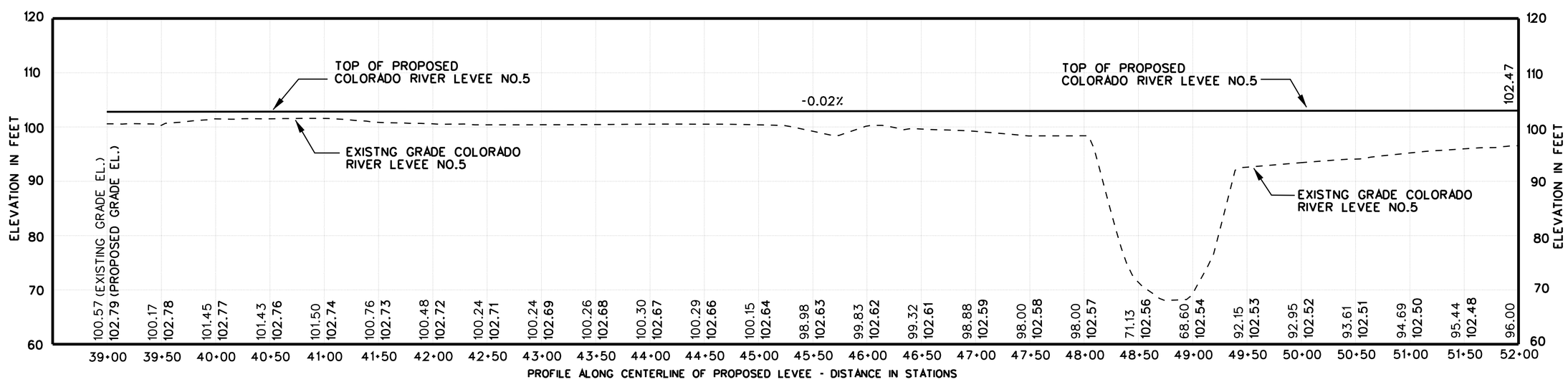
SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Date: --- --- ---
Rev. --- --- ---
Dwn by: R. REED
Sol No. ---
Reviewed by: S. ARMSTRONG
Contr No. ---
Submitted by: MARK J. BLACK, P.E. CHIEF, CIVIL SECTION
Re-view: ---
Pol date: ---
Pol scale: ---

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 5

LEVEE NO. 5 STA.39+00 - 52+00

PRELIMINARY

Sheet reference number: C127

DESIGN FILE: WHARTON_C027.DGN

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$$cadd file name$$

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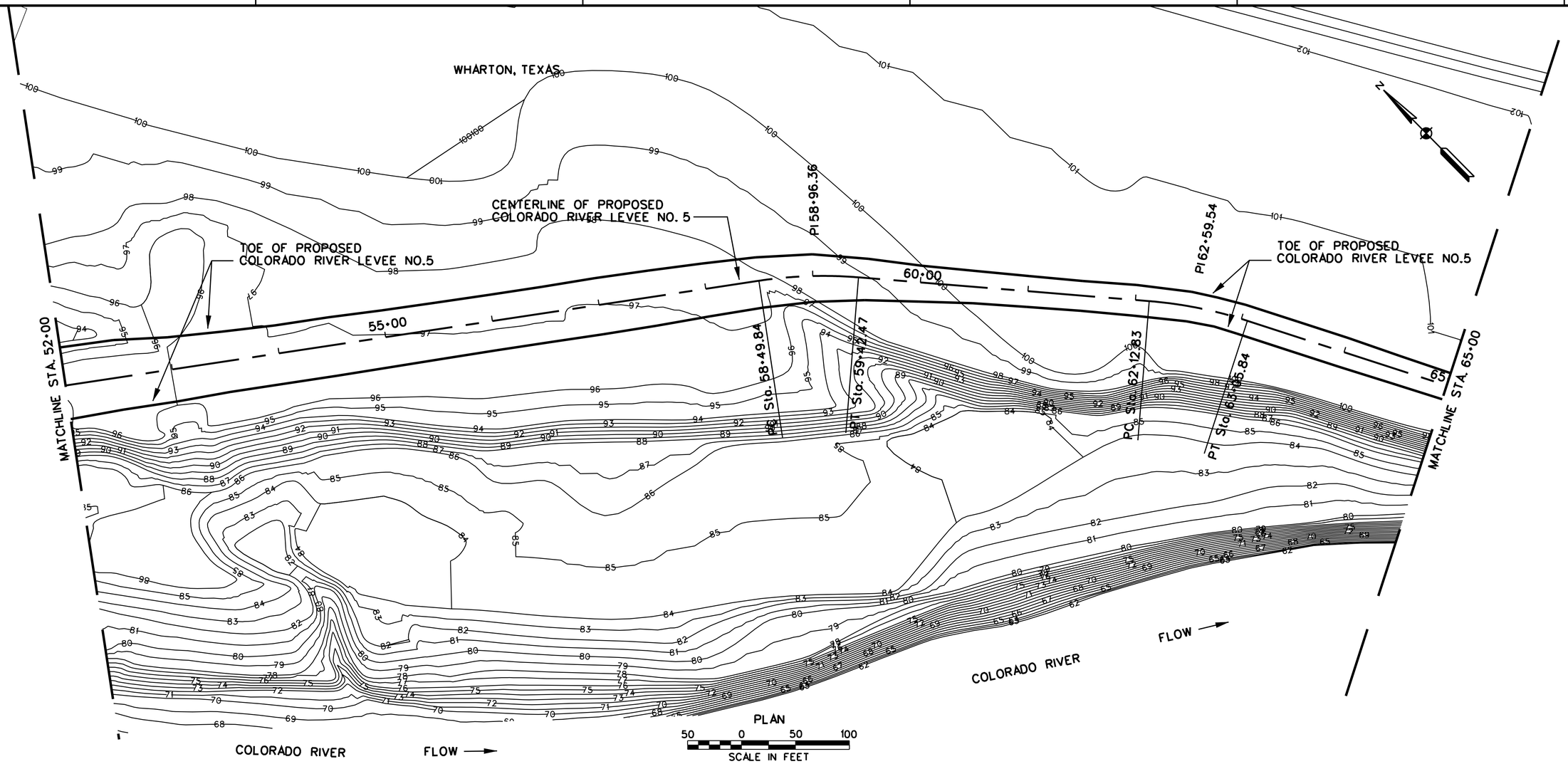
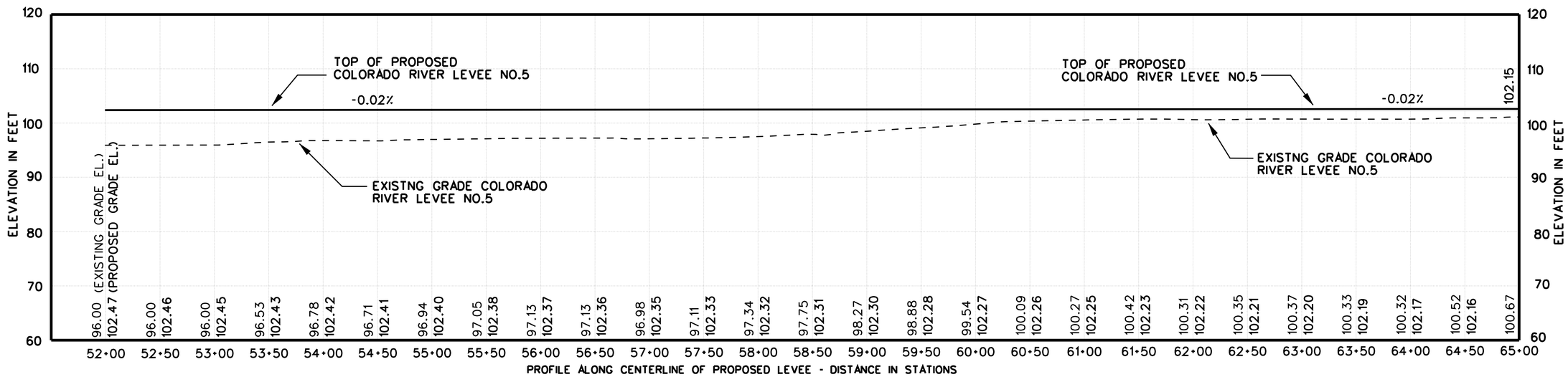




US Army Corps of Engineers
Fort Worth District

Symbol	Description	C.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Rev. -- --
Sol No.
Contr No.
File name:
Plot date: -- -- --
Plot scale:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 5

LEVEE NO. 5 STA.52+00 - 65+00

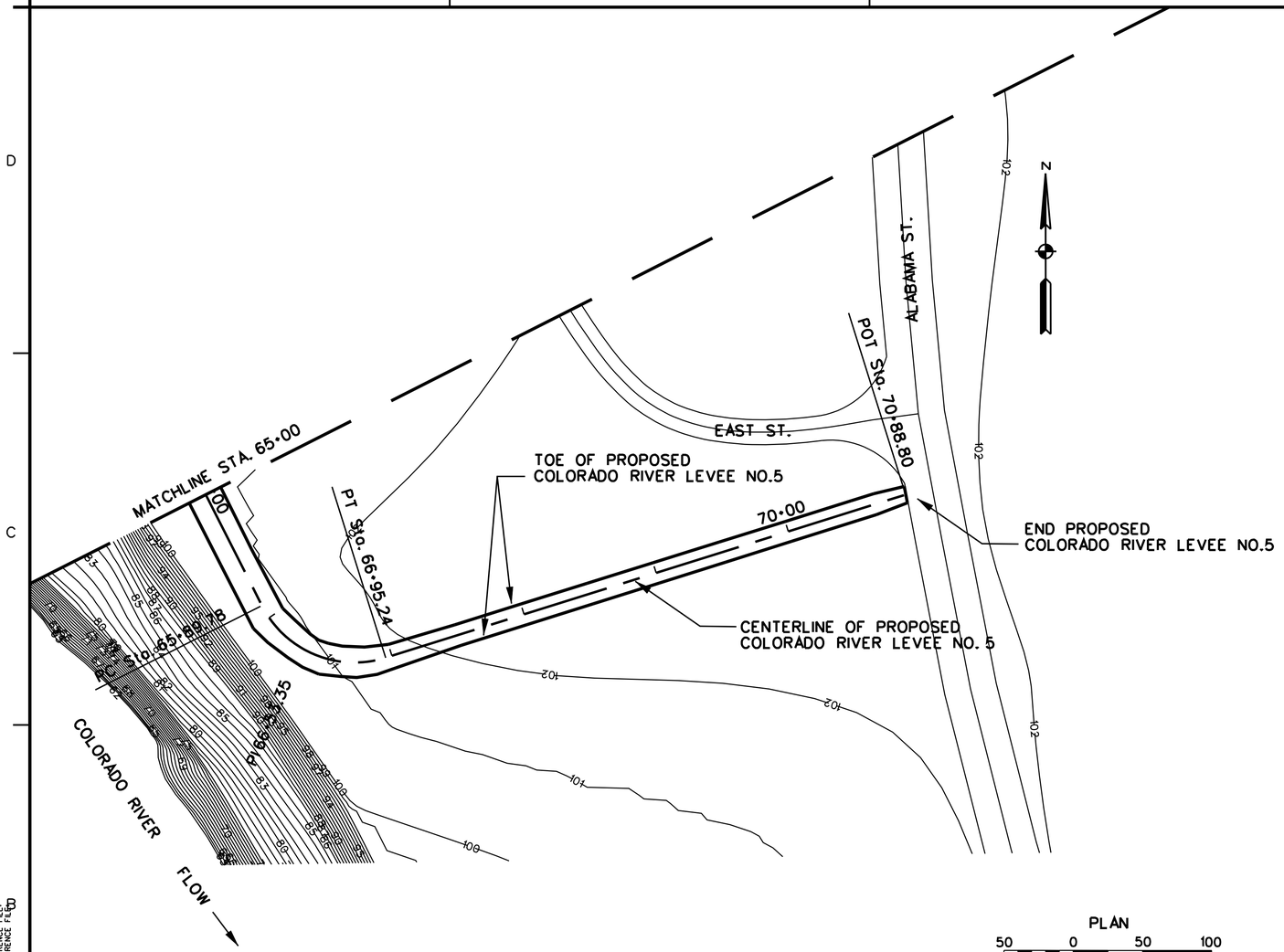
PRELIMINARY

Sheet reference number:
C128

DESIGN FILE: WHARTON_C128.DGN

Contr No.

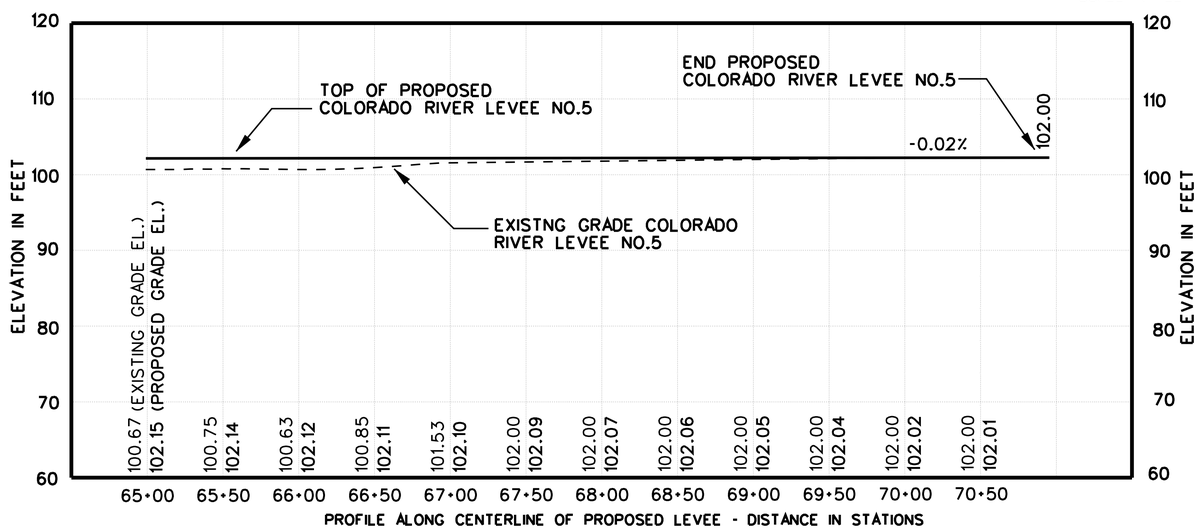
$$date$$ $$time$$
$$cadd file name$$



PLAN

50 0 50 100

SCALE IN FEET



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: --- --- ---
Rev. --
Sol No. ---
Contr No. ---
File name:
Plot date: --- --- ---
Plot scale: ---

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PLAN AND PROFILE
COLORADO RIVER LEVEE NO. 5

LEVEE NO.5 STA.65+00 - 65+88.80

PRELIMINARY

Sheet reference number:
C129

DESIGN FILE: WHARTON_C129.DGN

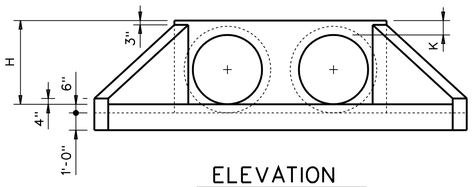
Contr No.

$$date$$ $$time$$
$$me$$
$$cadd file name$$

REFERENCE FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA OF PIPE, D	VALUES FOR ONE PIPE: W	X	Y	L	REINF (LBS)	CONC (CY) (1)	VALUES TO BE ADDED FOR EACH ADDT'L PIPE: X AND W	REINF (LBS)	CONC (CY) (1)
2:1	12"	4'- 7 1/2"	2'- 6"	2'-10"	3'- 3 1/4"	84	0.6	1'- 9"	20	0.2
	15"	5'- 5 3/4"	2'- 9 1/2"	3'- 4"	3'-10 1/4"	99	0.7	2'- 2"	24	0.3
	18"	6'- 4 1/4"	3'- 1"	3'-10"	4'- 5"	120	0.9	2'- 8"	32	0.3
	21"	7'- 2 3/4"	3'- 4 1/2"	4'- 4"	5'- 0"	137	1.1	3'- 1"	43	0.4
	24"	8'- 2 1/2"	3'- 9 1/2"	4'-10"	5'- 7"	158	1.3	3'- 7"	50	0.5
	27"	9'- 1"	4'- 1"	5'- 4"	6'- 2"	173	1.5	3'-11"	56	0.6
	30"	9'-11 1/2"	4'- 4 1/2"	5'-10"	6'- 8 3/4"	197	1.7	4'- 4"	65	0.8
	33"	10'-10"	4'- 8"	6'- 4"	7'- 3 3/4"	216	2.0	4'- 8"	71	0.9
	36"	11'- 8 1/4"	4'-11 1/2"	6'-10"	7'-10 3/4"	241	2.2	5'- 1"	81	1.0
	42"	13'- 5 1/4"	5'- 6 1/2"	7'-10"	9'- 0 1/2"	290	2.8	5'-10"	97	1.3
	48"	15'- 9"	6'- 1 1/2"	9'- 4"	10'- 9 1/4"	350	3.8	6'- 7"	117	1.7
	54"	17'- 5 3/4"	6'- 8 1/2"	10'- 4"	11'-11 1/4"	415	4.5	7'- 6"	151	2.1
	60"	19'- 2 3/4"	7'- 3 1/2"	11'- 4"	13'- 1"	469	5.3	8'- 3"	174	2.5
	66"	20'-11 1/2"	7'-10 1/2"	12'- 4"	14'- 3"	530	6.2	8'- 9"	194	2.9
	72"	22'- 8 1/2"	8'- 5 1/2"	13'- 4"	15'- 4 3/4"	587	7.1	9'- 4"	213	3.3
3:1	12"	6'- 3"	2'- 6"	4'- 3"	4'-11"	114	0.8	1'- 9"	22	0.2
	15"	7'- 5"	2'- 9 1/2"	5'- 0"	5'- 9 1/4"	133	1.1	2'- 2"	28	0.3
	18"	8'- 6 3/4"	3'- 1"	5'- 9"	6'- 7 3/4"	166	1.3	2'- 8"	37	0.5
	21"	9'- 8 3/4"	3'- 4 1/2"	6'- 6"	7'- 6"	189	1.6	3'- 1"	48	0.6
	24"	11'- 0"	3'- 9 1/2"	7'- 3"	8'- 4 1/2"	221	2.0	3'- 7"	58	0.7
	27"	12'- 2"	4'- 1"	8'- 0"	9'- 2 3/4"	245	2.3	3'-11"	67	0.8
	30"	13'- 4"	4'- 4 1/2"	8'- 9"	10'- 1 1/4"	287	2.7	4'- 4"	77	1.0
	33"	14'- 5 3/4"	4'- 8"	9'- 6"	10'-11 3/4"	310	3.1	4'- 8"	84	1.2
	36"	15'- 7 3/4"	4'-11 1/2"	10'- 3"	11'-10"	343	3.5	5'- 1"	96	1.4
	42"	17'-11 1/2"	5'- 6 1/2"	11'- 9"	13'- 6 3/4"	424	4.5	5'-10"	119	1.7
	48"	21'- 1 3/4"	6'- 1 1/2"	14'- 0"	16'- 2"	527	6.1	6'- 7"	146	2.3
	54"	23'- 5 1/2"	6'- 8 1/2"	15'- 6"	17'-10 3/4"	618	7.3	7'- 6"	186	2.9
	60"	25'- 9 1/4"	7'- 3 1/2"	17'- 0"	19'- 7 1/2"	707	8.7	8'- 3"	219	3.4
	66"	28'- 1"	7'-10 1/2"	18'- 6"	21'- 4 1/4"	797	10.1	8'- 9"	242	3.9
	72"	30'- 4 3/4"	8'- 5 1/2"	20'- 0"	23'- 1 1/4"	910	11.7	9'- 4"	272	4.4
4:1	12"	7'-10 3/4"	2'- 6"	5'- 8"	6'- 6 1/2"	144	1.1	1'- 9"	24	0.3
	15"	9'- 4"	2'- 9 1/2"	6'- 8"	7'- 8 1/2"	177	1.5	2'- 2"	32	0.4
	18"	10'- 9 1/2"	3'- 1"	7'- 8"	8'-10 1/4"	217	1.9	2'- 8"	42	0.5
	21"	12'- 2 3/4"	3'- 4 1/2"	8'- 8"	10'- 0"	254	2.3	3'- 1"	57	0.7
	24"	13'- 9 1/2"	3'- 9 1/2"	9'- 8"	11'- 2"	295	2.8	3'- 7"	67	0.9
	27"	15'- 3"	4'- 1"	10'- 8"	12'- 3 3/4"	328	3.3	3'-11"	77	1.0
	30"	16'- 8 1/4"	4'- 4 1/2"	11'- 8"	13'- 5 3/4"	379	3.8	4'- 4"	89	1.3
	33"	18'- 1 3/4"	4'- 8"	12'- 8"	14'- 7 1/2"	417	4.5	4'- 8"	101	1.4
	36"	19'- 7"	4'-11 1/2"	13'- 8"	15'- 9 1/4"	464	5.1	5'-1"	115	1.7
	42"	22'- 5 3/4"	5'- 6 1/2"	15'- 8"	18'- 1"	575	6.5	5'-10"	141	2.1
	48"	26'- 6 1/4"	6'- 1 1/2"	18'- 8"	21'- 6 3/4"	720	8.9	6'- 7"	175	2.8
	54"	29'- 5"	6'- 8 1/2"	20'- 8"	23'-10 1/4"	863	10.7	7'- 6"	226	3.6
	60"	32'- 3 3/4"	7'- 3 1/2"	22'- 8"	26'- 2"	984	12.7	8'- 3"	264	4.3
	66"	35'- 2 1/2"	7'-10 1/2"	24'- 8"	28'- 5 3/4"	1126	14.9	8'- 9"	300	4.9
	72"	38'- 1 1/4"	8'- 5 1/2"	26'- 8"	30'- 9 1/2"	1283	17.3	9'- 4"	334	5.6
6:1	12"	11'- 2"	2'- 6"	8'- 6"	9'- 9 3/4"	220	1.9	1'- 9"	28	0.4
	15"	13'- 2 1/4"	2'- 9 1/2"	10'- 0"	11'- 6 1/2"	264	2.5	2'- 2"	37	0.5
	18"	15'- 2 1/2"	3'- 1"	11'- 6"	13'- 3 1/4"	326	3.2	2'- 8"	50	0.7
	21"	17'- 2 3/4"	3'- 4 1/2"	13'- 0"	15'- 0 1/4"	381	3.9	3'- 1"	69	0.9
	24"	19'- 4 1/2"	3'- 9 1/2"	14'- 6"	16'- 9"	447	4.8	3'- 7"	80	1.2
	27"	21'- 4 3/4"	4'- 1"	16'- 0"	18'- 5 3/4"	506	5.7	3'-11"	96	1.4
	30"	23'- 5 1/4"	4'- 4 1/2"	17'- 6"	20'- 2 1/2"	587	6.7	4'- 4"	110	1.7
	33"	25'- 5 1/2"	4'- 8"	19'- 0"	21'-11 1/4"	667	7.8	4'- 8"	127	2.0
	36"	27'- 5 3/4"	4'-11 1/2"	20'- 6"	23'- 8"	727	9.0	5'- 1"	144	2.3
	42"	31'- 6 1/4"	5'- 6 1/2"	23'- 6"	27'- 1 1/2"	914	11.5	5'-10"	179	3.0
	48"	37'- 3 1/2"	6'- 1 1/2"	28'- 0"	32'- 4"	1181	15.9	6'- 7"	231	4.0
	54"	41'- 4 1/4"	6'- 8 1/2"	31'- 0"	35'- 9 1/2"	1412	19.2	7'- 6"	300	5.0
	60"	45'- 4 3/4"	7'- 3 1/2"	34'- 0"	39'- 3"	1619	22.9	8'- 3"	353	6.0



ELEVATION

Showing dimensions

1. Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.
2. For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
3. Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.
4. Quantities shown are for one structure end only (one headwall).
5. Min Length = 6" 3¥ x $\left(\frac{12 \times H - 7}{12 \times L}\right)$

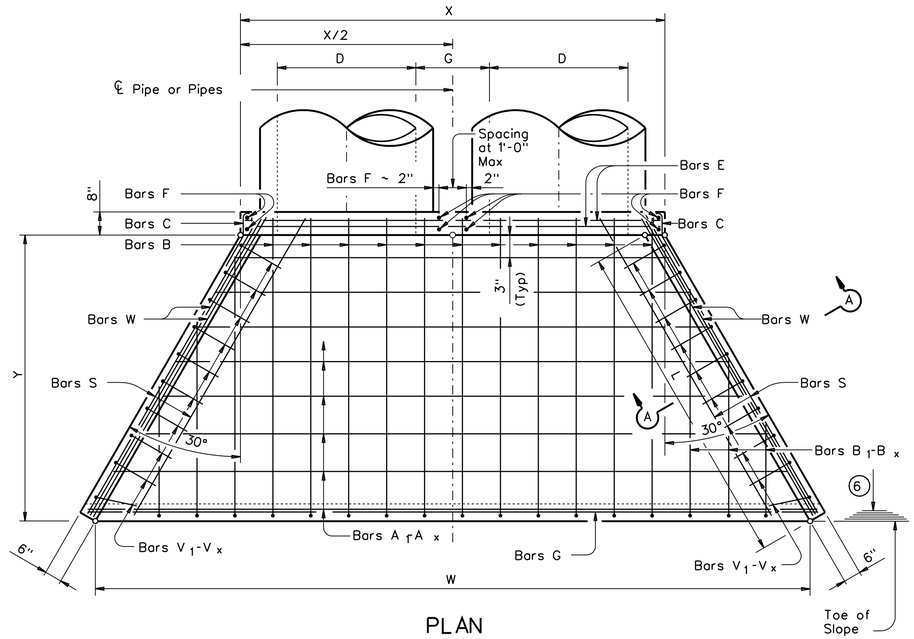
   Max Length = 12 x H 3" x $\left(\frac{12 \times H - 7}{12 \times L}\right)$ - 1"
6. Lengths of wings based on SL:1 Slope along this line.

TABLE OF REINFORCING STEEL (4)

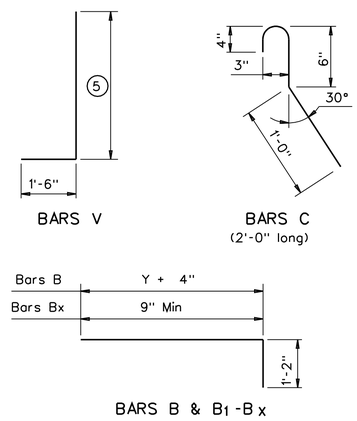
BAR	SIZE	SPA	NO.
A	• 4	1'-0"	×
B	• 3	1'-6"	×
C	• 4	1'-0"	×
D	• 3	1'-0"	×
E	• 5	×	4
F	• 5	×	×
G	• 3	×	2
S	• 4	×	6
V	• 4	1'-0"	×
W	• 5	×	4

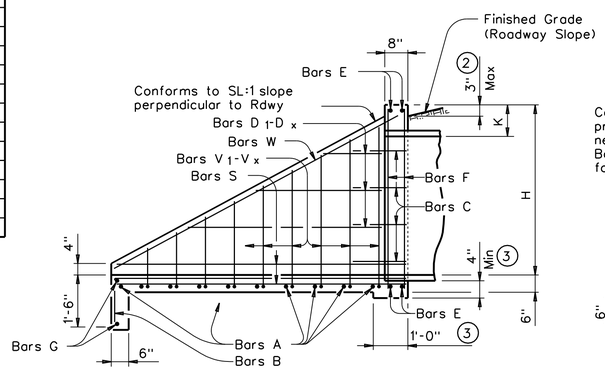
TABLE OF CONSTANT DIMENSIONS

DIA OF PIPE, D	G	K	H
12"	9"	1'- 0"	2'- 0"
15"	11"	1'- 0"	2'- 3"
18"	1'- 2"	1'- 0"	2'- 6"
21"	1'- 4"	1'- 0"	2'- 9"
24"	1'- 7"	1'- 0"	3'- 0"
27"	1'- 8"	1'- 0"	3'- 3"
30"	1'-10"	1'- 0"	3'- 6"
33"	1'-11"	1'- 0"	3'- 9"
36"	2'- 1"	1'- 0"	4'- 0"
42"	2'- 4"	1'- 0"	4'- 6"
48"	2'- 7"	1'- 3"	5'- 3"
54"	3'- 0"	1'- 3"	5'- 9"
60"	3'- 3"	1'- 3"	6'- 3"
66"	3'- 3"	1'- 3"	6'- 9"
72"	3'- 4"	1'- 3"	7'- 3"

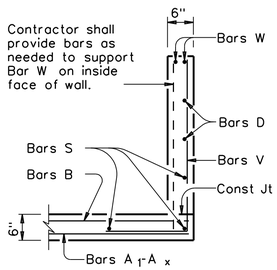


PLAN





TYPICAL WING ELEVATION



SECTION A-A

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Rev.	Date:	Designed by: R. REED	Dwn by: J. MACKEY	Reviewed by: J. McKENZIE	Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
	Sol No.	Contr No.	File name:	Plot date:	Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

STORM DRAIN DETAILS I
FLARED HEADWALL DETAILS FOR CIRCULAR PIPE

PRELIMINARY

Sheet reference number:
C901

Contr No.

DESIGN FILE: lh060234-C901.dgn

$$time$$
$$date$$
$$me$$
$$cadd file name$$

REFERENCE FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA OF PIPE,D	Values for one Pipe W	Values for one Pipe Reinf (Lbs)	Values for one Pipe Conc (CY) (1)	Values to be added for each addt'l Pipe W	Values to be added for each addt'l Pipe Reinf (Lbs)	Values to be added for each addt'l Pipe Conc (CY) (1)
2:1	12"	9'- 0"	122	1.1	1'- 9"	15	0.2
	15"	10'- 3"	136	1.3	2'- 2"	16	0.2
	18"	11'- 6"	163	1.5	2'- 8"	19	0.3
	21"	12'- 9"	200	1.8	3'- 1"	31	0.4
	24"	14'- 0"	217	2.1	3'- 7"	34	0.4
	27"	15'- 3"	254	2.4	3'-11"	37	0.5
	30"	16'- 6"	272	2.7	4'- 4"	40	0.6
	33"	17'- 9"	314	3.1	4'- 8"	43	0.6
	36"	19'- 0"	371	3.9	5'- 1"	46	0.8
	42"	21'- 6"	442	4.9	5'-10"	52	1.0
	48"	25'- 0"	569	6.4	6'- 7"	59	1.3
	54"	27'- 6"	701	7.5	7'- 6"	82	1.6
	60"	30'- 0"	794	8.8	8'- 3"	90	1.8
	66"	32'- 6"	894	10.2	8'- 9"	96	2.0
	72"	35'- 0"	1055	11.7	9'- 4"	103	2.3
3:1	12"	13'- 0"	175	1.6	1'- 9"	14	0.2
	15"	14'- 9"	193	1.9	2'- 2"	17	0.2
	18"	16'- 6"	228	2.2	2'- 8"	19	0.3
	21"	18'- 3"	299	2.6	3'- 1"	31	0.4
	24"	20'- 0"	323	3.0	3'- 7"	33	0.4
	27"	21'- 9"	371	3.5	3'-11"	37	0.5
	30"	23'- 6"	415	4.0	4'- 4"	40	0.5
	33"	25'- 3"	469	4.6	4'- 8"	43	0.6
	36"	27'- 0"	556	5.7	5'- 1"	46	0.8
	42"	30'- 6"	675	7.1	5'-10"	52	1.0
	48"	35'- 6"	837	9.2	6'- 7"	59	1.3
	54"	39'- 0"	1015	11.0	7'- 6"	84	1.6
	60"	42'- 6"	1171	12.9	8'- 3"	91	1.8
	66"	46'- 0"	1298	14.9	8'- 9"	98	2.0
	72"	49'- 6"	1561	17.1	9'- 4"	103	2.3
4:1	12"	17'- 0"	229	2.0	1'- 9"	15	0.2
	15"	19'- 3"	266	2.4	2'- 2"	17	0.2
	18"	21'- 6"	308	2.9	2'- 8"	19	0.3
	21"	23'- 9"	382	3.5	3'- 1"	31	0.3
	24"	26'- 0"	430	3.9	3'- 7"	34	0.4
	27"	28'- 3"	486	4.7	3'-11"	37	0.5
	30"	30'- 6"	539	5.2	4'- 4"	40	0.6
	33"	32'- 9"	603	6.0	4'- 8"	42	0.6
	36"	35'- 0"	738	7.5	5'- 1"	47	0.8
	42"	39'- 6"	881	9.3	5'-10"	52	1.0
	48"	46'- 0"	1102	12.1	6'- 7"	61	1.3
	54"	50'- 6"	1364	14.4	7'- 6"	84	1.6
	60"	55'- 0"	1547	16.9	8'- 3"	91	1.8
	66"	59'- 6"	1741	19.5	8'- 9"	98	2.0
	72"	64'- 0"	2069	22.4	9'- 4"	102	2.3
6:1	12"	25'- 0"	336	3.0	1'- 9"	14	0.2
	15"	28'- 3"	384	3.6	2'- 2"	17	0.2
	18"	31'- 6"	452	4.2	2'- 8"	19	0.3
	21"	34'- 9"	581	5.1	3'- 1"	31	0.4
	24"	38'- 0"	644	5.8	3'- 7"	34	0.4
	27"	41'- 3"	737	6.9	3'-11"	37	0.5
	30"	44'- 6"	807	7.7	4'- 4"	39	0.6
	33"	47'- 9"	912	8.9	4'- 8"	44	0.6
	36"	51'- 0"	1108	11.0	5'- 1"	48	0.8
	42"	57'- 6"	1318	13.7	5'-10"	54	1.0
	48"	67'- 0"	1674	17.9	6'- 7"	59	1.3
	54"	73'- 6"	2064	21.3	7'- 6"	83	1.6
	60"	80'- 0"	2343	24.9	8'- 3"	89	1.8
	66"	86'- 6"	2635	28.9	8'- 9"	96	2.0
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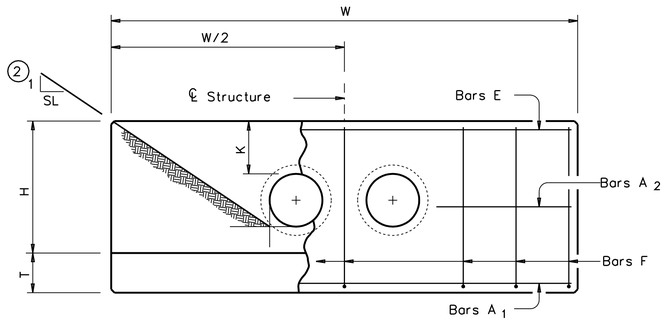
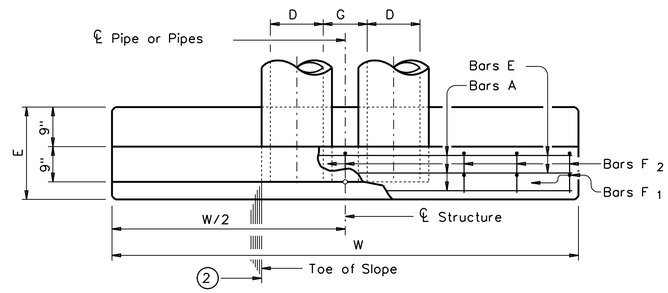
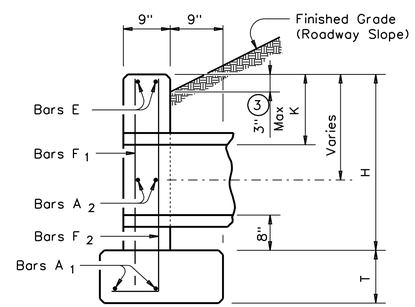


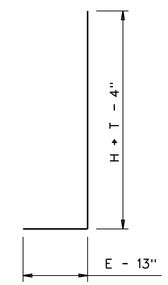
ELEVATION



PLAN OF NON-SKEWED PIPES



℄ SECTION



BARS F2

TABLE OF CONSTANT DIMENSIONS

DIA OF PIPE,D	G	K	H	T	E
12"	9"	1'- 0"	2'- 8"	9"	1'- 9"
15"	11"	1'- 0"	2'-11"	9"	1'- 9"
18"	1'- 2"	1'- 0"	3'- 2"	9"	1'- 9"
21"	1'- 4"	1'- 0"	3'- 5"	9"	2'- 0"
24"	1'- 7"	1'- 0"	3'- 8"	9"	2'- 0"
27"	1'- 8"	1'- 0"	3'-11"	9"	2'- 3"
30"	1'-10"	1'- 0"	4'- 2"	9"	2'- 3"
33"	1'-11"	1'- 0"	4'- 5"	9"	2'- 6"
36"	2'- 1"	1'- 0"	4'- 8"	1'- 0"	2'- 6"
42"	2'- 4"	1'- 0"	5'- 2"	1'- 0"	2'- 9"
48"	2'- 7"	1'- 3"	5'-11"	1'- 0"	3'- 0"
54"	3'- 0"	1'- 3"	6'- 5"	1'- 0"	3'- 3"
60"	3'- 3"	1'- 3"	6'-11"	1'- 0"	3'- 6"
66"	3'- 3"	1'- 3"	7'- 5"	1'- 0"	3'- 9"
72"	3'- 4"	1'- 3"	7'-11"	1'- 0"	4'- 0"

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A1	• 5	~	2
A2	• 5	1'-6"	~
E	• 5	~	2
F	• 5	1'-0"	~

GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(2) Indicated slope is perpendicular to centerline Pipe or Pipes.

(3) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(4) Quantities shown are for one structure end only (one headwall).

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: R. REED
Dwn by: J. MACKEY
Reviewed by: J. McKENZIE
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date:
Sol No.
Contr No.
Rev.
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PARALLEL WING WALL FOR CIRCULAR PIPE

PRELIMINARY

Sheet reference number: C902

DESIGN FILE: h060234-C902.dgn

Contr No.

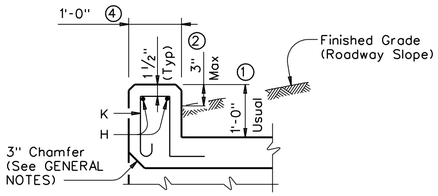
$$time$$ $$date$$ $$me$$ $$cadd file name$$

REFERENCE FILE:

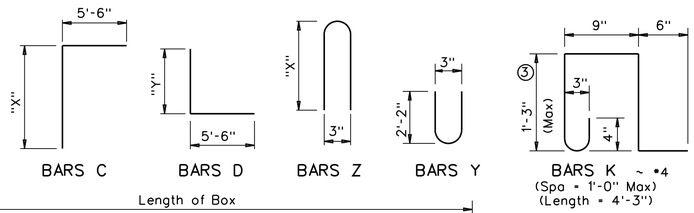
BILLS OF REINFORCING STEEL (For Box Length = 40 feet)

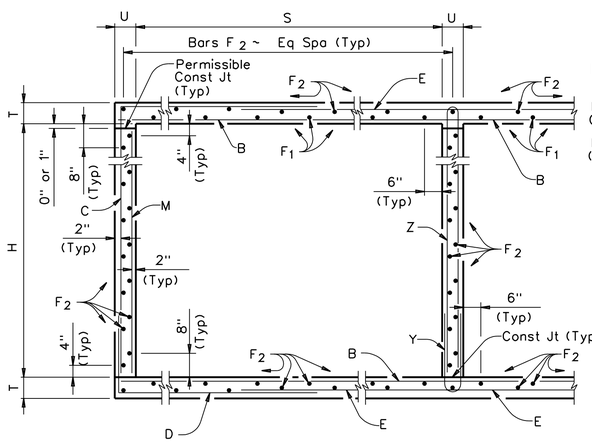
NUMBER OF SPANS	SECTION DIMENSIONS S	H	T	U	Bars B No.	Size	Spa	Length	Wt	Bars C & D No.	Size	Spa	Bar C Length	Bar C Wt	Bar D Length	Bar D Wt	Bars E No.	Size	Spa	Length	Wt	Bars F 1~#4 No.	Spa	Length	Wt	Bars F 2~#4 at 1'-6" Max No.	Length	Wt	Bars M~#4 at 1'-6" Max No.	Length	Wt	Bars Y & Z~#4 at 10" Max No.	Bar Y Length	Bar Y Wt	Bar Z Length	Bar Z Wt	Bars H 4~#4 Length	Weight	Bars K No.	Weight	QUANTITIES Per foot of Barrel Conc (CY)	Reinf (Lb)	Curb Conc (CY)	Reinf (Lb)	Total Conc (CY)	Reinf (Lb)
2	7'-0"	3'-0"	7"	7"	194	#5	5"	15'- 6"	3.136	162	#4	6"	8'-11"	965	7'- 8"	830	194	#5	5"	8'- 0"	1.619	20	8"	39'-9"	531	54	39'-9"	1.434	56	3'- 0"	112	49	4'- 6"	147	7'- 0"	229	15'- 6"	41	34	97	0.875	225.1	1.2	138	36.2	9,141
3	7'-0"	3'-0"	7"	7"	194	#5	5"	23'- 1"	4.671	162	#4	6"	8'-11"	965	7'- 8"	830	194	#5	5"	15'- 7"	3.153	30	8"	39'-9"	797	77	39'-9"	2.045	56	3'- 0"	112	98	4'- 6"	295	7'- 0"	458	23'- 1"	62	48	136	1.267	333.2	1.7	198	52.4	13,524
4	7'-0"	3'-0"	7"	7"	194	#5	5"	30'- 8"	6.205	162	#4	6"	8'-11"	965	7'- 8"	830	194	#5	5"	23'- 2"	4.688	40	8"	39'-9"	1.062	100	39'-9"	2.655	56	3'- 0"	112	147	4'- 6"	442	7'- 0"	687	30'- 8"	82	64	182	1.660	441.2	2.3	264	68.7	17,910
5	7'-0"	3'-0"	7"	7"	194	#5	5"	38'- 3"	7.740	162	#4	6"	8'-11"	965	7'- 8"	830	194	#5	5"	30'- 9"	6.222	50	8"	39'-9"	1.328	123	39'-9"	3.266	56	3'- 0"	112	196	4'- 6"	589	7'- 0"	916	38'- 3"	102	80	227	2.052	549.2	2.9	329	85.0	22,297
6	7'-0"	3'-0"	7"	7"	194	#5	5"	45'-10"	9.274	162	#4	6"	8'-11"	965	7'- 8"	830	194	#5	5"	38'- 4"	7.756	60	8"	39'-9"	1.593	146	39'-9"	3.877	56	3'- 0"	112	245	4'- 6"	736	7'- 0"	1.146	45'-10"	122	94	267	2.445	657.2	3.4	389	101.2	26,678
2	7'-0"	4'-0"	7"	7"	194	#5	5"	15'- 6"	3.136	162	#4	6"	9'-11"	1.073	7'- 8"	830	194	#5	5"	8'- 0"	1.619	20	8"	39'-9"	531	54	39'-9"	1.434	56	4'- 0"	150	49	4'- 6"	147	9'- 0"	295	15'- 6"	41	34	97	0.940	230.4	1.2	138	38.8	9,353
3	7'-0"	4'-0"	7"	7"	194	#5	5"	23'- 1"	4.671	162	#4	6"	9'-11"	1.073	7'- 8"	830	194	#5	5"	15'- 7"	3.153	30	8"	39'-9"	797	77	39'-9"	2.045	56	4'- 0"	150	98	4'- 6"	295	9'- 0"	589	23'- 1"	62	48	136	1.354	340.1	1.7	198	55.9	13,801
4	7'-0"	4'-0"	7"	7"	194	#5	5"	30'- 8"	6.205	162	#4	6"	9'-11"	1.073	7'- 8"	830	194	#5	5"	23'- 2"	4.688	40	8"	39'-9"	1.062	100	39'-9"	2.655	56	4'- 0"	150	147	4'- 6"	442	9'- 0"	884	30'- 8"	82	64	182	1.768	449.7	2.3	264	73.0	18,253
5	7'-0"	4'-0"	7"	7"	194	#5	5"	38'- 3"	7.740	162	#4	6"	9'-11"	1.073	7'- 8"	830	194	#5	5"	30'- 9"	6.222	50	8"	39'-9"	1.328	123	39'-9"	3.266	56	4'- 0"	150	196	4'- 6"	589	9'- 0"	1.178	38'- 3"	102	80	227	2.182	559.4	2.9	329	90.2	22,705
6	7'-0"	4'-0"	7"	7"	194	#5	5"	45'-10"	9.274	162	#4	6"	9'-11"	1.073	7'- 8"	830	194	#5	5"	38'- 4"	7.756	60	8"	39'-9"	1.593	146	39'-9"	3.877	56	4'- 0"	150	245	4'- 6"	736	9'- 0"	1.473	45'-10"	122	94	267	2.596	669.1	3.4	389	107.2	27,151
2	7'-0"	5'-0"	7"	7"	194	#5	5"	15'- 6"	3.136	162	#4	6"	10'-11"	1.181	7'- 8"	830	194	#5	5"	8'- 0"	1.619	20	8"	39'-9"	531	60	39'-9"	1.593	56	5'- 0"	187	49	4'- 6"	147	11'- 0"	360	15'- 6"	41	34	97	1.005	239.6	1.2	138	41.4	9,722
3	7'-0"	5'-0"	7"	7"	194	#5	5"	23'- 1"	4.671	162	#4	6"	10'-11"	1.181	7'- 8"	830	194	#5	5"	15'- 7"	3.153	30	8"	39'-9"	797	85	39'-9"	2.257	56	5'- 0"	187	98	4'- 6"	295	11'- 0"	720	23'- 1"	62	48	136	1.440	352.3	1.7	198	59.3	14,289
4	7'-0"	5'-0"	7"	7"	194	#5	5"	30'- 8"	6.205	162	#4	6"	10'-11"	1.181	7'- 8"	830	194	#5	5"	23'- 2"	4.688	40	8"	39'-9"	1.062	110	39'-9"	2.921	56	5'- 0"	187	147	4'- 6"	442	11'- 0"	1.080	30'- 8"	82	64	182	1.876	464.9	2.3	264	77.3	18,860
5	7'-0"	5'-0"	7"	7"	194	#5	5"	38'- 3"	7.740	162	#4	6"	10'-11"	1.181	7'- 8"	830	194	#5	5"	30'- 9"	6.222	50	8"	39'-9"	1.328	135	39'-9"	3.585	56	5'- 0"	187	196	4'- 6"	589	11'- 0"	1.440	38'- 3"	102	80	227	2.312	577.6	2.9	329	95.4	23,431
6	7'-0"	5'-0"	7"	7"	194	#5	5"	45'-10"	9.274	162	#4	6"	10'-11"	1.181	7'- 8"	830	194	#5	5"	38'- 4"	7.756	60	8"	39'-9"	1.593	160	39'-9"	4.248	56	5'- 0"	187	245	4'- 6"	736	11'- 0"	1.800	45'-10"	122	94	267	2.747	690.1	3.4	389	113.3	27,994
2	7'-0"	6'-0"	7"	7"	194	#5	5"	15'- 6"	3.136	162	#4	6"	11'-11"	1.290	7'- 8"	830	194	#5	5"	8'- 0"	1.619	20	8"	39'-9"	531	66	39'-9"	1.752	56	6'- 0"	224	49	4'- 6"	147	13'- 0"	426	15'- 6"	41	34	97	1.069	248.9	1.2	138	44.0	10,093
3	7'-0"	6'-0"	7"	7"	194	#5	5"	23'- 1"	4.671	162	#4	6"	11'-11"	1.290	7'- 8"	830	194	#5	5"	15'- 7"	3.153	30	8"	39'-9"	797	93	39'-9"	2.469	56	6'- 0"	224	98	4'- 6"	295	13'- 0"	851	23'- 1"	62	48	136	1.527	364.5	1.7	198	62.8	14,778
4	7'-0"	6'-0"	7"	7"	194	#5	5"	30'- 8"	6.205	162	#4	6"	11'-11"	1.290	7'- 8"	830	194	#5	5"	23'- 2"	4.688	40	8"	39'-9"	1.062	120	39'-9"	3.186	56	6'- 0"	224	147	4'- 6"	442	13'- 0"	1.277	30'- 8"	82	64	182	1.984	480.1	2.3	264	81.7	19,468
5	7'-0"	6'-0"	7"	7"	194	#5	5"	38'- 3"	7.740	162	#4	6"	11'-11"	1.290	7'- 8"	830	194	#5	5"	30'- 9"	6.222	50	8"	39'-9"	1.328	147	39'-9"	3.903	56	6'- 0"	224	196	4'- 6"	589	13'- 0"	1.702	38'- 3"	102	80	227	2.441	595.7	2.9	329	100.5	24,157
6	7'-0"	6'-0"	7"	7"	194	#5	5"	45'-10"	9.274	162	#4	6"	11'-11"	1.290	7'- 8"	830	194	#5	5"	38'- 4"	7.756	60	8"	39'-9"	1.593	174	39'-9"	4.620	56	6'- 0"	224	245	4'- 6"	736	13'- 0"	2.128	45'-10"	122	94	267	2.899	711.3	3.4	389	119.4	28,840
2	7'-0"	7'-0"	7"	7"	194	#5	5"	15'- 6"	3.136	162	#4	6"	12'-11"	1.398	7'- 8"	830	194	#5	5"	8'- 0"	1.619	20	8"	39'-9"	531	66	39'-9"	1.752	56	7'- 0"	262	49	4'- 6"	147	15'- 0"	491	15'- 6"	41	34	97	1.134	254.2	1.2	138	46.6	10,304
3	7'-0"	7'-0"	7"	7"	194	#5	5"	23'- 1"	4.671	162	#4	6"	12'-11"	1.398	7'- 8"	830	194	#5	5"	15'- 7"	3.153	30	8"	39'-9"	797	93	39'-9"	2.469	56	7'- 0"	262	98	4'- 6"	295	15'- 0"	982	23'- 1"	62	48	136	1.613	371.4	1.7	198	66.2	15,055
4	7'-0"	7'-0"	7"	7"	194	#5	5"	30'- 8"	6.205	162	#4	6"	12'-11"	1.398	7'- 8"	830	194	#5	5"	23'- 2"	4.688	40	8"	39'-9"	1.062	120	39'-9"	3.186	56	7'- 0"	262	147	4'- 6"	442	15'- 0"	1.473	30'- 8"	82	64	182	2.092	488.7	2.3	264	86.0	19,810
5	7'-0"	7'-0"	7"	7"	194	#5	5"	38'- 3"	7.740	162	#4	6"	12'-11"	1.398	7'- 8"	830	194	#5	5"	30'- 9"	6.222	50	8"	39'-9"	1.328	147	39'-9"	3.903	56	7'- 0"	262	196	4'- 6"	589	15'- 0"	1.964	38'- 3"	102	80	227	2.571	605.9	2.9	329	105.7	24,565
6	7'-0"	7'-0"	7"	7"	194	#5	5"	45'-10"	9.274	162	#4	6"	12'-11"	1.398	7'- 8"	830	194	#5	5"	38'- 4"	7.756	60	8"	39'-9"	1.593	174	39'-9"	4.620	56	7'- 0"	262	245	4'- 6"	736	15'- 0"	2.455	45'-10"	122	94	267	3.050	723.1	3.4	389	125.4	29,313

H	Bar Dimensions "X"	"Y"
3'-0"	3'-5"	2'-2"
4'-0"	4'-5"	2'-2"
5'-0"	5'-5"	2'-2"
6'-0"	6'-5"	2'-2"
7'-0"	7'-5"	2'-2"

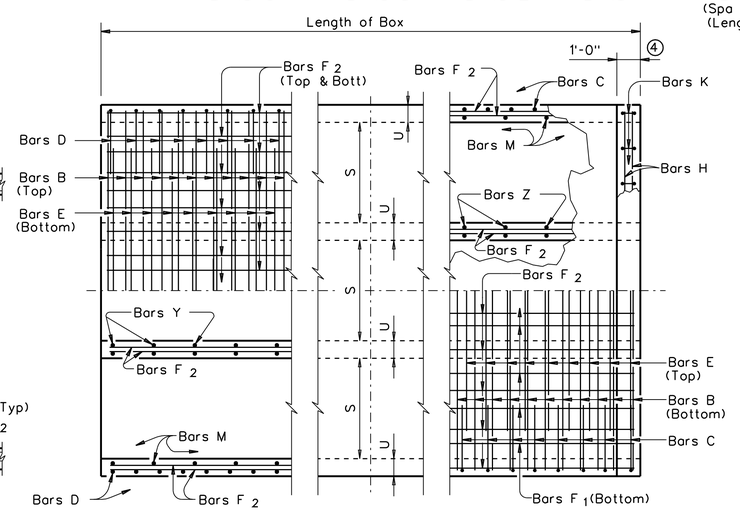


SECTION THRU CURB





TYPICAL SECTION



GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.
Designed to the maximum fill height shown.
All reinforcing steel shall be Grade 60.
All concrete shall be Class "C" with these exceptions: use Class "S" for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.
Class "C" concrete shall have a minimum compressive strength of 3,600 psi.
Class "S" concrete shall have a minimum compressive strength of 4,000 psi.
The use of permanent forms is not allowed.
The bottom edge of the top slab shall be chamfered 3" at the entrance.
Reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.
Construction joints shown at the flow line may be raised a maximum of 6" at the Contractor's option. If this option is used, Bars M may be cut off or raised, Bars C and D may be reversed, and Bars Y and Z may be reversed.
See standard MC-MD for skewed ends, angle sections and lengthening details.

① 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with bridge rail, other than T6, refer to RAC standard.

② For vehicle safety, the following requirements must be met:
- For structures without bridge rail, curbs shall project no more than 3" above finished grade.
- For structures with bridge rail, curbs shall be flush with finished grade.

Curb heights shall be reduced, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

③ For curbs less than 1'-0" high, tilt bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, bars K may be omitted.

④ 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: R. REED
Dwn by: J. MACKEY
Reviewed by: J. McKENZIE
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: Rev.
Sol No.
Contr No.
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

STORM DRAIN DETAILS III
BOX CULVERT DETAILS

PRELIMINARY

Sheet reference number: C903

DESIGN FILE: h060234-C903.dgn

$$time$$
$$date$$
$$me$$
$$cadd file name$$

REFERENCE FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (2~Wings) (3)	
Maximum Wingwall Height Hw	W	X	Y	Z	Bars J 1		Bars J 2			
					Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'- 8"	3'- 3"	2'- 9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'- 2"	3'- 6"	3'- 0"	1'- 0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'- 8"	4'- 0"	3'- 0"	1'- 1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'- 2"	4'- 6"	3'- 0"	1'- 3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

Hw = H + T + C - 0.250'

A = (Hw - 0.333') (SL)

B = (A) Tangent (30°)

Lw = (A) Cosine (30°)

For Cast-in-place culverts:

Ltw = (N) (S) (N+ 1) (U)

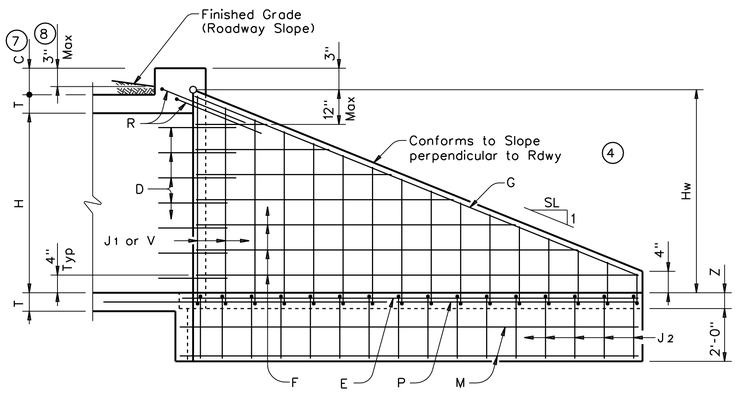
For Precast culverts:

Ltw = (N) (2U S) (N+ 1) (0.500')

Total Wingwall Area (Two Wings ~ S.F.)=(Hw 0.333')*(Lw)

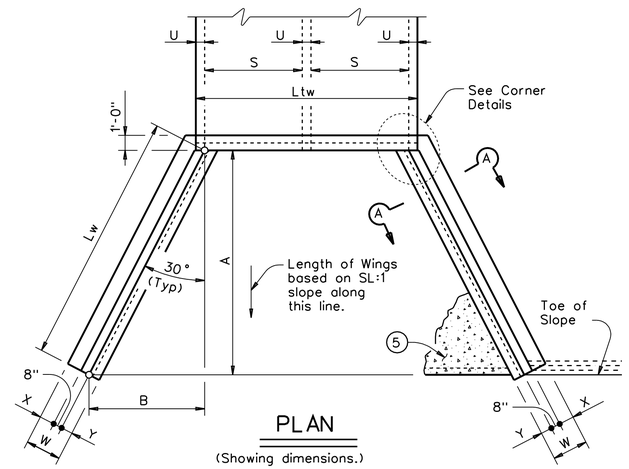
Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

See applicable box culvert standard for H, S, T, and U values.



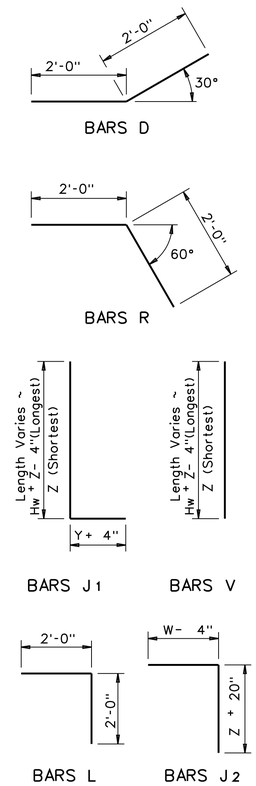
INSIDE ELEVATION

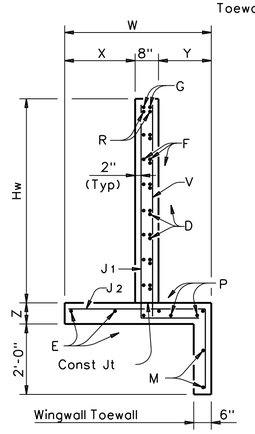
(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)



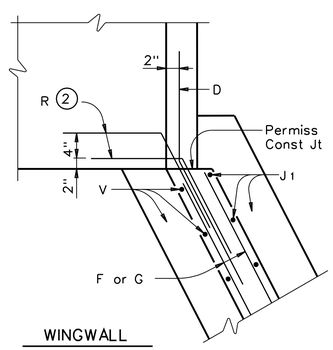
PLAN

(Showing dimensions.)

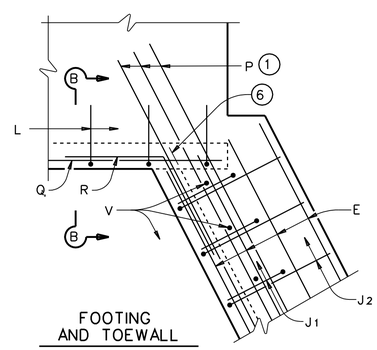




SECTION A-A



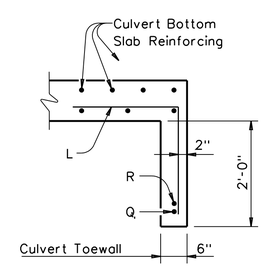
WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS

(Culvert and Culvert Toewall reinforcing not shown for clarity.)



SECTION B-B (5)

1. Extend Bars P 3'-0" minimum into bottom slab of Box Culvert.
2. Adjust to fit as necessary to maintain 1 1/4" clear cover and 4" minimum between bars.
3. Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.
4. Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1.
5. When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required. Payment for riprap shall be as required by Item 432, "Riprap".
6. At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.
7. 0" min to 5'-0" max. For T6 or C6 Rail, see T6-CM standard for additional details. For all other rail types, refer to the RAC standard. For curbs without rail and greater than 1'-0" high, see ECD standard for additional details. Estimated curb heights are shown elsewhere in the plans.
8. For vehicle safety, curb heights and wall heights shall be reduced, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.

When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

See BCS sheet for additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: R. REED
Dwn by: J. MACKEY
Reviewed by: J. McKENZIE
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date:
Sol No.
Contr No.
Rev.
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

FLARED WING HEADWALL DETAILS FOR BOX CULVERTS

PRELIMINARY

Sheet reference number: C904

DESIGN FILE: h060234-C904.dgn

$$date$$ $$time$$ $$me$$ $$cadd file name$$

REFERENCE FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

Dimensions: Maximum Wingwall Height Hw	W	X	Y	Z	Variable Reinforcing: Bars J 1 Size	Bars J 1 Spa	Bars J 2 Size	Bars J 2 Spa	Estimated Quantities per ft of wing length (2~Wings) (3): Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'- 8"	3'- 3"	2'- 9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'- 2"	3'- 6"	3'- 0"	1'- 0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'- 8"	4'- 0"	3'- 0"	1'- 1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'- 2"	4'- 6"	3'- 0"	1'- 3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

Hw = H + T + C - 0.250'

Lw = (Hw - 0.333') (SL)

For Cast-in-place culverts:

Ltw = (N) (S) (N+ 1) (+U)

For Precast culverts:

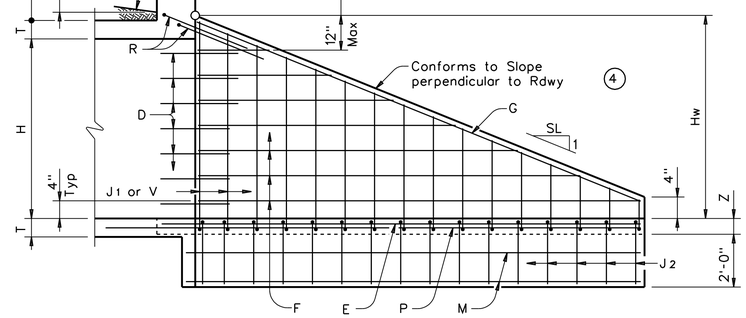
Ltw = (N) (2U S) (N+ 1) (+0.5')

Total Wingwall Area (Two Wings ~ S.F.)=(Hw 0.333')*(Lw)

Hw = Height of Wingwall
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans

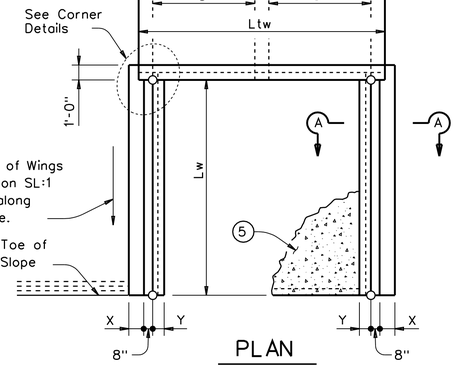
See applicable box culvert standard for H, S, T, and U values.

1. Extend Bars P 3'-0" minimum into bottom slab of Box Culvert.
2. Adjust to fit as necessary to maintain 1 1/4" clear cover and 4" minimum between bars.
3. Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.
4. Recommended values of Slope are: 2:1, 3:1, 4:1, & 6:1.
5. When shown elsewhere on the plans, a 5" deep concrete riprap shall be constructed. Unless otherwise shown on the plans or directed by the Engineer, the riprap shall have a 6" wide by 1'-6" deep reinforced concrete toewall along all edges adjacent to natural ground; the toewall shall be reinforced by extending typical riprap reinforcing into the toewall; construction joints or grooved joints, oriented in the direction of flow, shall extend across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B will not be required. Payment for riprap shall be as required by Item 432, "Riprap".
6. At Contractor's option, Culvert Toewall may be ended flush with Wingwall Toewall. Adjust reinforcing from that shown as necessary.
7. 0" min to 5'-0" max. For T6 or C6 Rail, see T6-CM standard for additional details. For all other rail types, refer to the RAC standard. For curbs without rail and greater than 1'-0" high, see ECD standard for additional details. Estimated curb heights are shown elsewhere in the plans.
8. For vehicle safety, curb heights and wall heights shall be reduced, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.



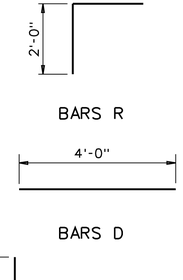
INSIDE ELEVATION

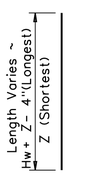
(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)



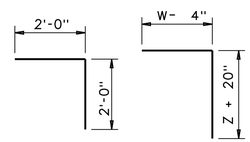
PLAN

(Showing Dimensions)

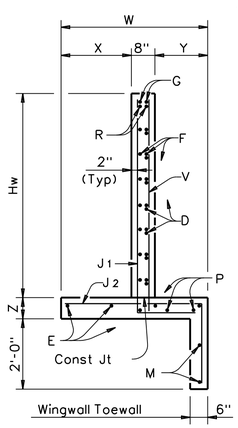




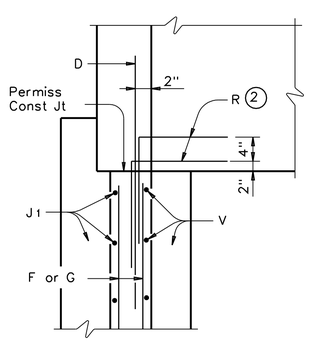
BARS J1 BARS V



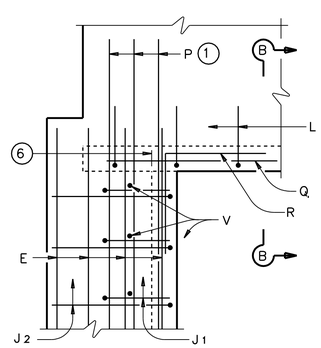
BARS L BARS J2



SECTION A-A



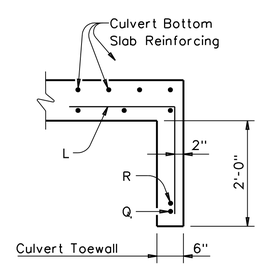
WINGWALL



FOOTING AND TOEWALL

CORNER DETAILS

(Culvert and Culvert Toewall reinforcing not shown for clarity.)



SECTION B-B

GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.

When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

See BCS sheet for additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: R. REED	Date:	Rev.	
Dwn by: J. MACKEY	Sol No.		
Reviewed by: J. McKENZIE	Contr No.		
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION	File name: Plot date: Plot scale:		

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

STORM DRAIN DETAILS V
STRAIGHT WING HEADWALL DETAILS FOR BOX CULVERTS

PRELIMINARY

Sheet reference number: C905

Contr No.

DESIGN FILE: h060234-C905.dgn

$$time$$
$$date$$ $$me$$
$$cadd file name$$

REFERENCE FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL
(Wings for One Structure End)

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~Wings) ④		Estimated Quantities per ft of Toewall (1~Toewall)	
					Bars J1		Bars J2					
Maximum Wingwall Height Hw	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	43.13	0.406	6.85	0.071
2'-9"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	43.80	0.424	6.85	0.071
3'-0"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	44.47	0.444	6.85	0.071
3'-3"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	47.81	0.462	6.85	0.071
3'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	48.48	0.480	6.85	0.071
4'-0"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	50.26	0.532	6.85	0.071
4'-6"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	54.27	0.568	6.85	0.071
5'-0"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	57.94	0.632	6.96	0.075
5'-6"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	61.95	0.668	6.96	0.075
6'-0"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	75.16	0.730	7.07	0.078
6'-6"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	79.54	0.768	7.07	0.078
7'-0"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	86.65	0.864	8.07	0.093
7'-6"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	91.03	0.902	8.07	0.093
8'-0"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	133.54	0.962	8.13	0.095
8'-6"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	138.96	1.000	8.13	0.095
9'-6"	6'-0"	2'-10"	2'-2"	9"	#5	6"	#5	6"	151.43	1.136	8.41	0.110
10'-6"	6'-5"	3'-0"	2'-5"	9"	#6	6"	#5	6"	190.76	1.234	8.57	0.117
11'-6"	7'-2"	3'-6"	2'-8"	11"	#6	6"	#6	6"	224.62	1.438	9.52	0.140
12'-6"	7'-8"	3'-9"	2'-11"	1'-0"	#7	6"	#6	6"	277.90	1.592	9.74	0.157
13'-6"	8'-2"	4'-0"	3'-2"	1'-2"	#8	6"	#6	6"	343.21	1.804	10.02	0.186
14'-6"	8'-10"	4'-5"	3'-5"	1'-4"	#9	6"	#6	6"	427.43	2.046	10.30	0.218
15'-6"	9'-6"	4'-10"	3'-8"	1'-6"	#9	6"	#7	6"	484.01	2.302	11.24	0.253
16'-0"	9'-11"	5'-0"	3'-11"	1'-7"	#9	6"	#7	6"	500.21	2.448	11.47	0.279

TABLE OF WINGWALL REINFORCING (2~Wings)

Bar	Size	No.	Spa
D1	#5	~	1'-0"
D2	#5	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#5	~	1'-0"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

Bar	Size	No	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

Hw = H + T + C

Lw = (Hw) (SL) (Cosine) ϕ

For Cast-in-place culverts:

Ltw = [(N) (S) (N+ 1) (U)] (Cosine ÷) ϕ

For Precast culverts:

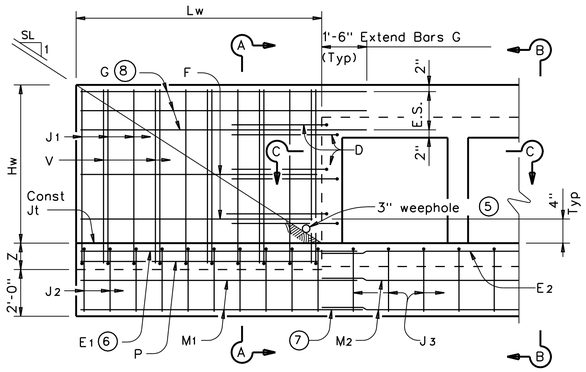
Ltw = [(N) (2 U S) + (N+ 1) (0.5')] (Cosine ÷) ϕ

Total Wingwall Area (Two Wings ~ S.F.)

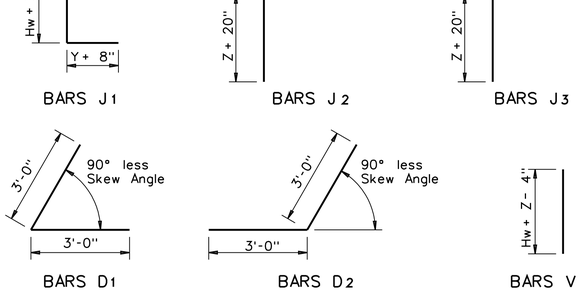
= (2) (Hw) (Lw)

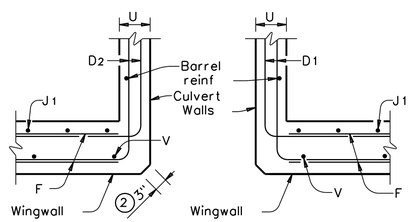
Hw = Height of Wingwall
Lw = Length of Wingwall
Ltw = Culvert Toewall Length
N = Number of Culvert Spans
SL:1 = Channel Slope ratio. (Horizontal: 1 Vertical, Usual value is 2:1)
ϕ = Culvert Skew

See applicable box culvert standard for S, H, T and U values.

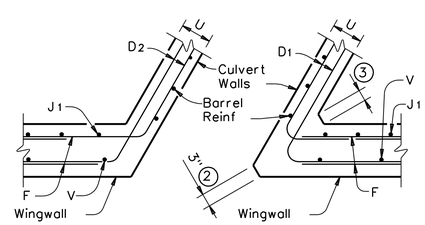


PARTIAL ELEVATION

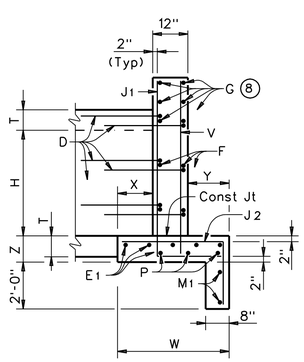




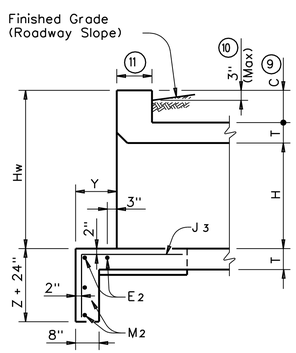
SECTION C-C



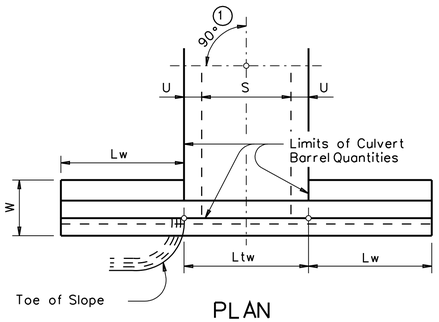
SECTION C-C



SECTION A-A
(Showing Wing Reinf)

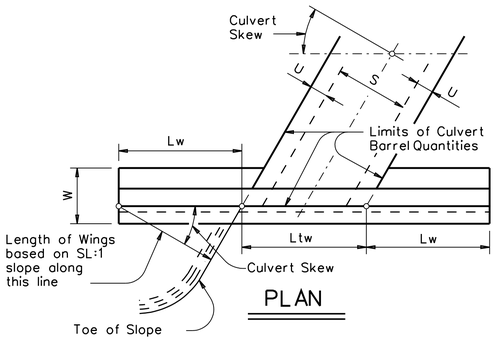


SECTION B-B
(Showing Toewall Reinf)



PLAN

DETAILS FOR NON-SKEWED BOX CULVERTS



PLAN

DETAILS FOR SKEWED BOX CULVERTS
(Showing 30° Skew)

① Skew Angle = 0°
② At discharge end, chamfer may be ¾".
③ For 15° Skew ~ 1"
For 30° Skew ~ 2"
For 45° Skew ~ 3"
④ Quantities shown are for two wings. To determine total quantities for two wings, multiply the tabulated values by Lw.
⑤ Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
⑥ Extend Bars E 1 1'-6" minimum into the bottom slab of the culvert.
⑦ Lap Bars M 1 1'-6" minimum with Bars M . 2
⑧ Bars G shall be equally spaced at 1'-0" maximum, placed as shown. There shall be at least 4 Bars G per wing.
⑨ 0" min to 5'-0" max. For T6 or C6 Rail, see T6-CM standard for additional details. For all other rail types, refer to the RAC standard. For curbs without rail and greater than 1'-0" high, see ECD standard for additional details. Estimated curb heights are shown elsewhere in the plans.
⑩ For vehicle safety, the following requirements must be met:
- For structures without bridge rail, curbs shall project no more than 3" above finished grade.
- For structures with bridge rail, curbs shall be flush with finished grade.

Curb heights shall be reduced, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
⑪ 1'-0" typical. 2'-0" typical when RAC standard is referenced elsewhere in the plans.

GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.

When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.

See BCS sheet for additional dimensions and information.

The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: R. REED	Date:	Rev.	
Dwn by: J. MACKEY	Sol No.		
Reviewed by: J. McKENZIE	Contr No.		
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION	File name: Plot date: Plot scale:		

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY
STORM DRAIN DETAILS VI
PARALLEL WING HEADWALL DETAILS BOX CULVERTS

PRELIMINARY

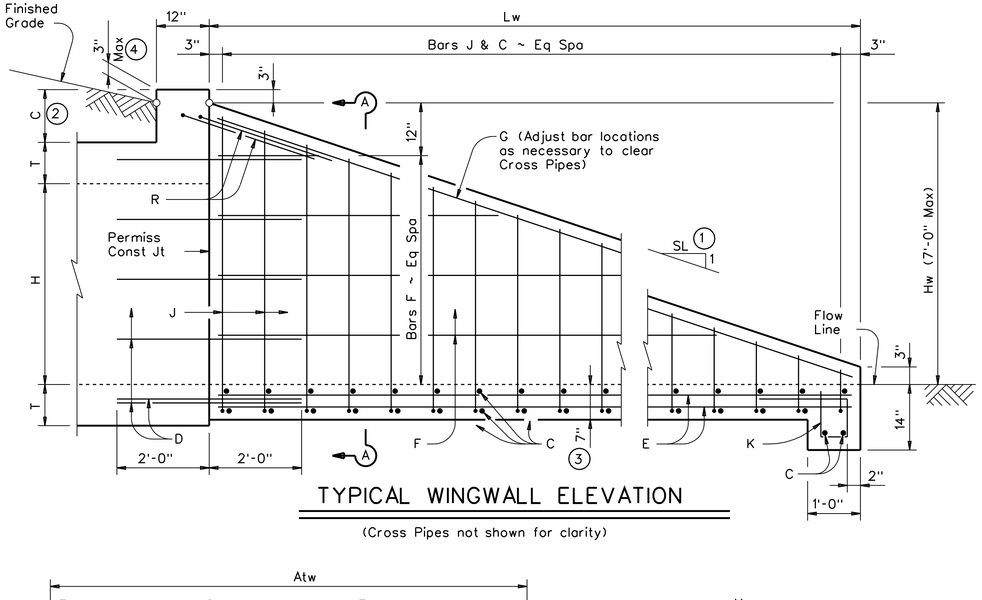
Sheet reference number:
C906

$$time$$
$$date$$
$$me$$
$$cadd file name$$

REFERENCE FILE:

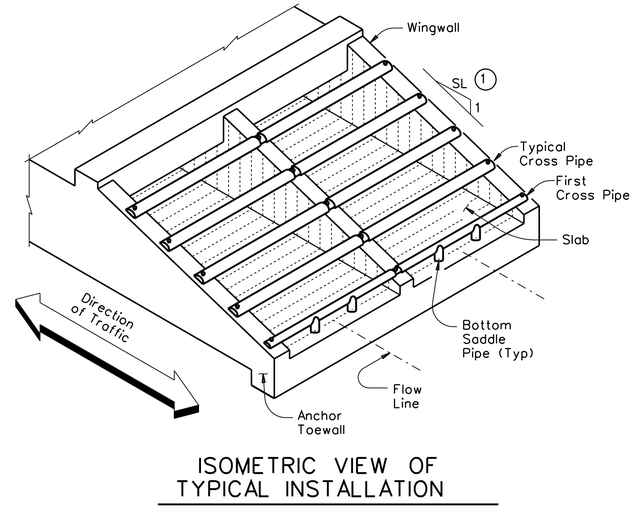
DESIGN FILE: h060234-C906.dgn

Contr No.



TYPICAL WINGWALL ELEVATION

(Cross Pipes not shown for clarity)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing Bolted Anchor Option)

Formulas: (All values are in Feet)

Hw = H + T + C − 0.250'

Lw = (Hw − 0.250') (SL)

For Cast-in-place culverts:

Atw = (N) (S) (N+ 1) (+U)

For Precast culverts:

Atw = (N) (2U S) (N+ 1) (+0.500')

Total Wingwall Area (S.F.)

= (0.5) (Hw 0.250') (Lw) (N 1) +

Total Concrete Volume (C.Y.)

= [(Wingwall Area) (0.583') +

(Lw) (Atw) (0.583') +

(Atw) (1.000') (1.167' 0.583')] (27) ÷

Total Reinforcing (Lbs)

= (1.55) (Lw) (Atw) +

(4.43) (Atw) +

(K) (Hw) (N 1)+ (Lw) √

C = Height of Curb above top of Top Slab
Hw = Height of Wingwall
K = Constant Value for use in formulas
Slope SL:1 K
6:1 ~ 10.41
Atw = Anchor Toewall Length
Lw = Length of Wingwall
N = Number of Culvert Barrels
S = Clear Span of each Barrel
SL:1 = Side Slope Ratio (Horizontal : 1 Vertical)

See applicable box culvert standard for H, S, T, and U values.

GENERAL NOTES:

Designed according to current AASHTO Standard and Interim Specifications.

The Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Cross Pipes.

Cross Pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

All reinforcing steel shall be Grade 60. All reinforcing shall be adjusted as necessary to provide a minimum clear cover of 1 1/4".

The quantities for concrete, reinforcing steel, and Cross Pipes resulting from the formulas given herein are for Contractor's information only.

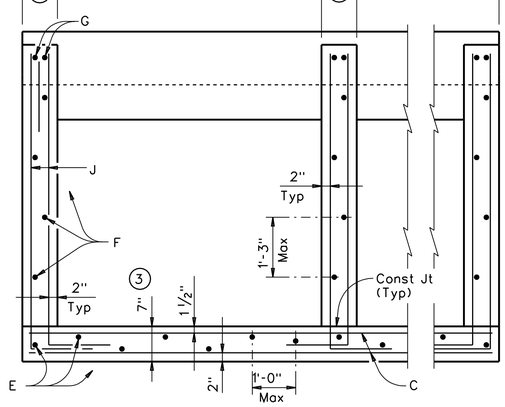
Cross Pipes, Sleeve Pipes, and Saddle Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Bolts and nuts shall conform to ASTM A307.

All steel components, except the concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

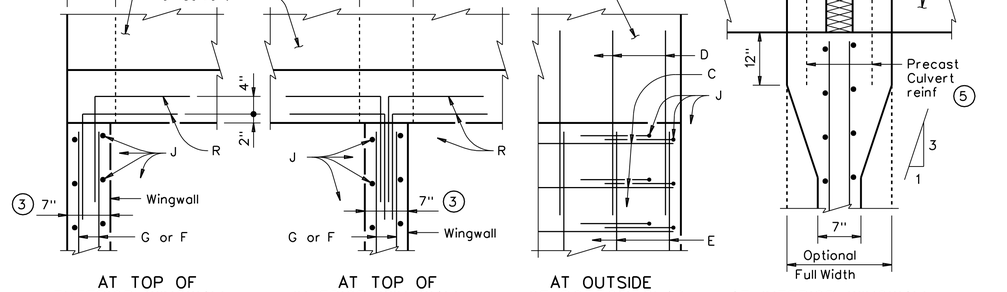
See BCS standard sheet for additional dimensions and information.

Alternate design drawings bearing the seal of a professional engineer will be acceptable for precast construction of the Safety End Treatments.



SECTION A-A

(Showing typical Wingwall and Wing Slab reinforcing)
(Pipe Runners not shown for clarity)



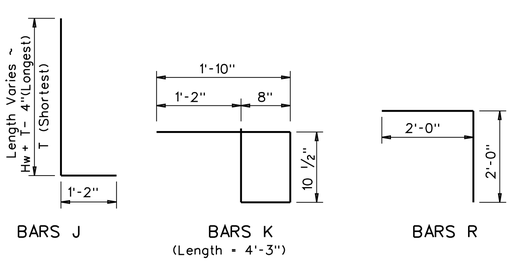
AT TOP OF EXTERIOR WINGWALL (Cast-in-Place Culvert)

AT TOP OF INTERIOR WINGWALL (Cast-in-Place Culvert)

AT OUTSIDE OF BOTTOM SLAB (Cast-in-Place Culvert)

AT INTERIOR WINGWALL (Precast Culvert)

PLAN VIEWS OF CORNER DETAILS



BARS J

BARS K (Length = 4'-3")

BARS R

TABLE OF REINFORCING BAR SIZES & SPACING		
Bar	Size	Spacing
C	#4	10" Max
D	#4	match F & E
E	#4	1'- 0" Max
F	#4	1'- 3" Max
G	#6	Shown
J	#4	10" Max
K	#4	1'- 0" Max
R	#4	Shown

1. Recommended values of slope are: 3:1, 4:1, & 6:1. Slope shall be 3:1 or flatter.
2. 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to ECD standard.
3. Wingwall and slab thicknesses may be the same as the adjacent culvert wall and slab thicknesses (7" Minimum). If thicknesses greater than the minimum (7") are used, no changes will be made in quantities and no additional compensation will be allowed.
4. For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
5. For Culverts with C = 0", the precast culvert reinforcing may extend 1'-0" minimum into Wingwall. Wingwall Bars D and R may be omitted. Otherwise, refer to the "Wingwall Connection Detail" on the SCP-MD standard.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Rev.	Date:	Sol No.	Contr No.	File name:	Plot date:	Plot scale:

Designed by: R. REED
Dwn by: J. MACKEY
Reviewed by: J. McKENZIE
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

SAFETY END TREATMENT DETAILS FOR BOX CULVERTS

PRELIMINARY

Sheet reference number: C907

DESIGN FILE: h060234-C907.dgn

Contr No.

$$time$$
$$date$$
$$me$$
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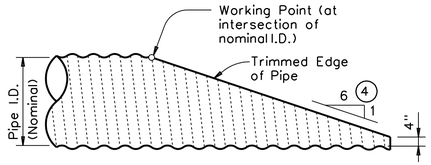
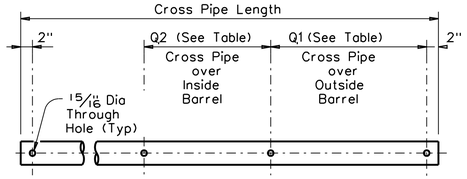
REFERENCE FILE:



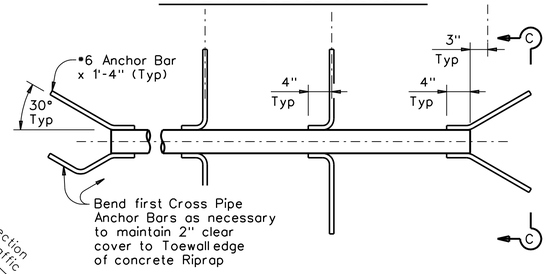
NOTE: All Cross Pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

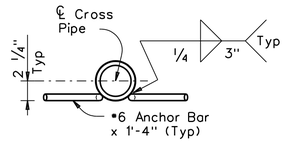
(Showing Corrugated Metal Pipe Culvert.)
(Details at Concrete Pipe Culvert are similar.)



PIPE W/ BOLTED ANCHOR

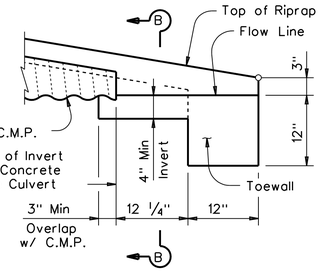


PIPE W/ ANCHOR BARS



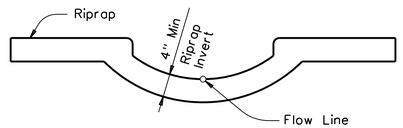
SECTION C-C

CROSS PIPE DETAILS



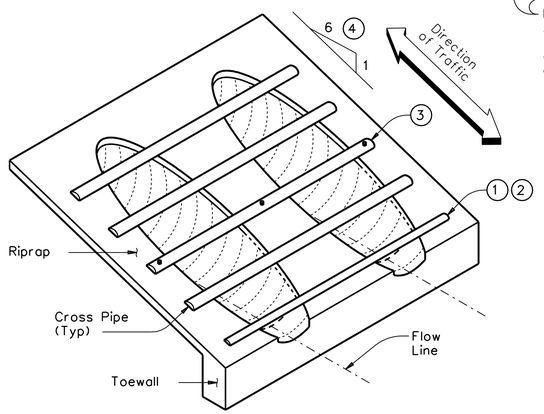
DETAIL "A"

(Showing Invert with Corrugated Metal Pipe Culvert. Concrete Pipe Culvert details are similar. Cross Pipes not shown for clarity.)

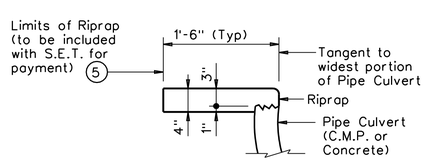


SECTION B-B

(Cross Pipes not shown for clarity.)

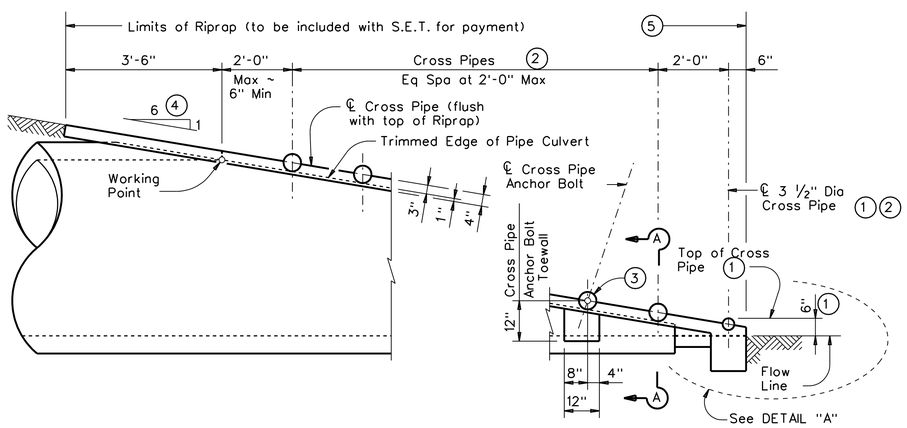


ISOMETRIC VIEW OF TYPICAL INSTALLATION



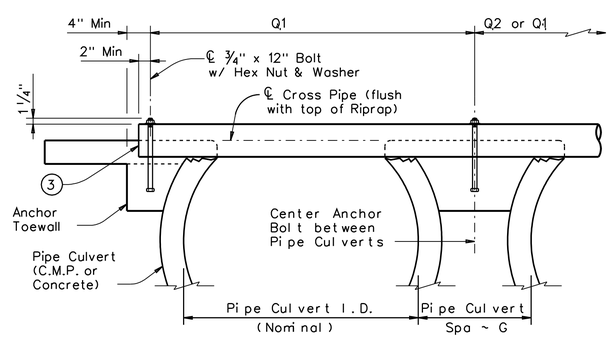
SHOWING TYPICAL PIPE CULVERT & RIPRAP

SHOWING CROSS PIPE WITH ANCHOR BAR



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing Concrete Pipe Culvert.)
(Details at Corrugated Metal Pipe Culvert are similar.)



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, & RIPRAP QUANTITIES (2)

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for use of Cross Pipes	Cross Pipe Size
12"	0.6	9"	N/A	2'- 1"	1'- 9"	3 or more Pipe Culverts	3" Std (3.500" O.D.)
15"	0.7	11"	N/A	2'- 5"	2'- 2"		
18"	0.8	1'- 2"	N/A	2'-10"	2'- 8"		
21"	0.9	1'- 4"	N/A	3'- 2"	3'- 1"		
24"	0.9	1'- 7"	N/A	3'- 6"	3'- 7"		
27"	1.0	1'- 8"	N/A	3'-10"	3'-11"	3 or more Pipe Culverts	3 1/2" Std (4.000" O.D.)
30"	1.1	1'-10"	N/A	4'- 2"	4'- 4"	2 or more Pipe Culverts	
33"	1.2	1'-11"	4'- 2"	4'- 5"	4'- 8"	All Pipe Culverts	
36"	1.3	2'- 1"	4'- 5"	4'- 9"	5'- 1"	All Pipe Culverts	4" Std (4.500" O.D.)
42"	1.5	2'- 4"	4'-11"	5'- 5"	5'-10"		
48"	1.7	2'- 7"	5'- 5"	6'- 0"	6'- 7"	All Pipe Culverts	5" Std (5.563" O.D.)
54"	2.0	3'- 0"	5'-11"	6'- 9"	7'- 6"		
60"	2.2	3'- 3"	6'- 5"	7'- 4"	8'- 3"		
66"	2.4	3'- 3"	6'-11"	7'-10"	8'- 9"		
72"	2.7	3'- 4"	7'- 5"	8'- 5"	9'- 4"		

(1) The proper installation of the first Cross Pipe is critical for vehicle safety. The top of the first Cross Pipe must be placed at no more than 6" above the flow line.

(2) Size of Cross Pipes, except the first bottom pipe, shall be as shown in the PIPE SIZE table. The first bottom pipe shall be 3 1/2" Standard Pipe (4" O.D.).

(3) The third Cross Pipe from the bottom of the Culvert shall always be installed using a bolted connection. Care shall be taken to ensure that Riprap concrete does not flow into the Cross Pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, all other Cross Pipes may also be installed using the bolted connection details.

(4) Match Cross Slope as shown elsewhere in the plans. Cross Slope of 6:1 or flatter is required for vehicle safety.

(5) Riprap placed beyond the limits shown will be paid as Concrete Riprap in accordance with Item 432, "Riprap".

(6) Quantities shown are for one end of one reinforced Concrete Pipe Culvert. For multiple pipe culverts or for Corrugated Metal Pipe Culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

GENERAL NOTES:

Cross Pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Cross Pipes.

Riprap and all necessary inverts shall be Concrete Riprap conforming to the requirements of Item 432, "Riprap".

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.

Cross Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API5LX52.

Bolts and nuts shall conform to ASTM A307.

All steel components, except concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. NO.	Action	Date

Designed by: R. REED
Dwn by: J. MACKEY
Reviewed by: J. McKENZIE
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date:
Rev.
Sol No.
Contr No.
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

PRELIMINARY

STORM DRAIN DETAILS VIII
SAFETY END TREATMENT DETAILS FOR CIRCULAR PIPES

Sheet reference number: C908

Contr No.

DESIGN FILE: h060234-C908.dgn

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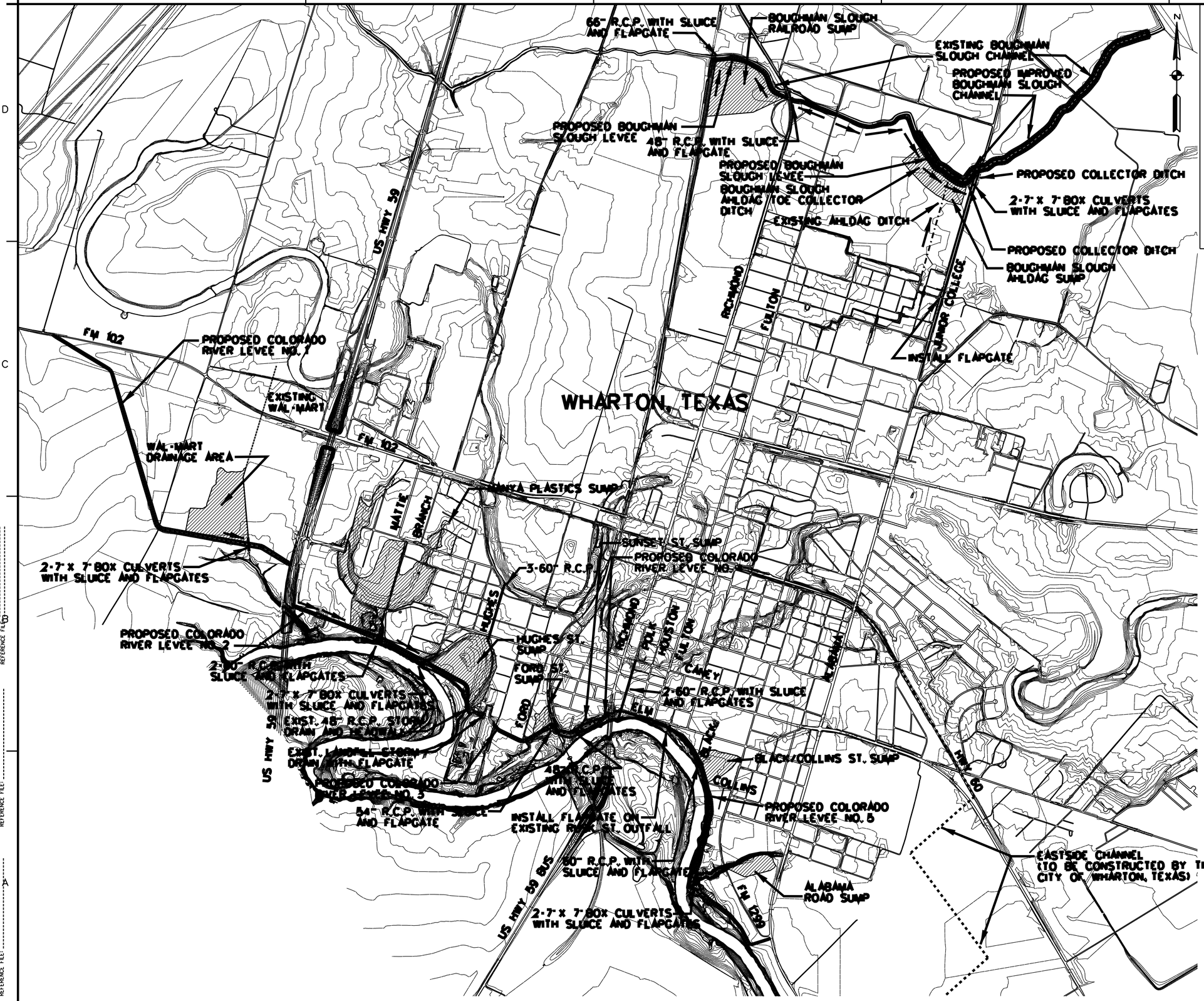

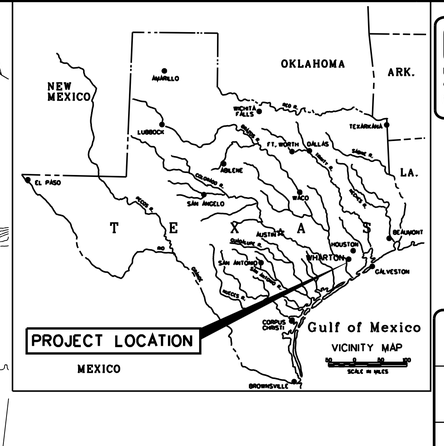

US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date	Action	Dwg. No.

Rev.	Date:	Designed by: S. ARMSTRONG	U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS	ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH
	Sol No.	Dwn by: R. REED		
	Contr No.	Reviewed by: S. ARMSTRONG		
		Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION		

Re-name:
Plot date:
Plot scale:

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PROJECT SITE MAP

PRELIMINARY

Sheet reference number: G301

Contr No.

DESIGN FILE: WHARTON_GOULDCH

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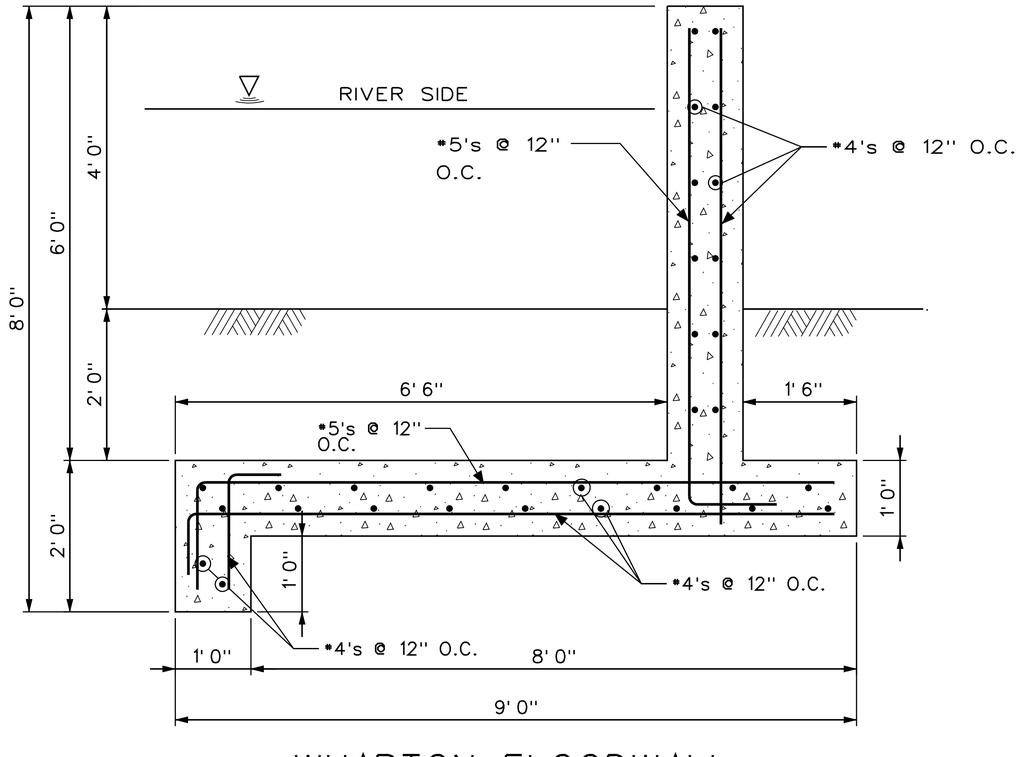
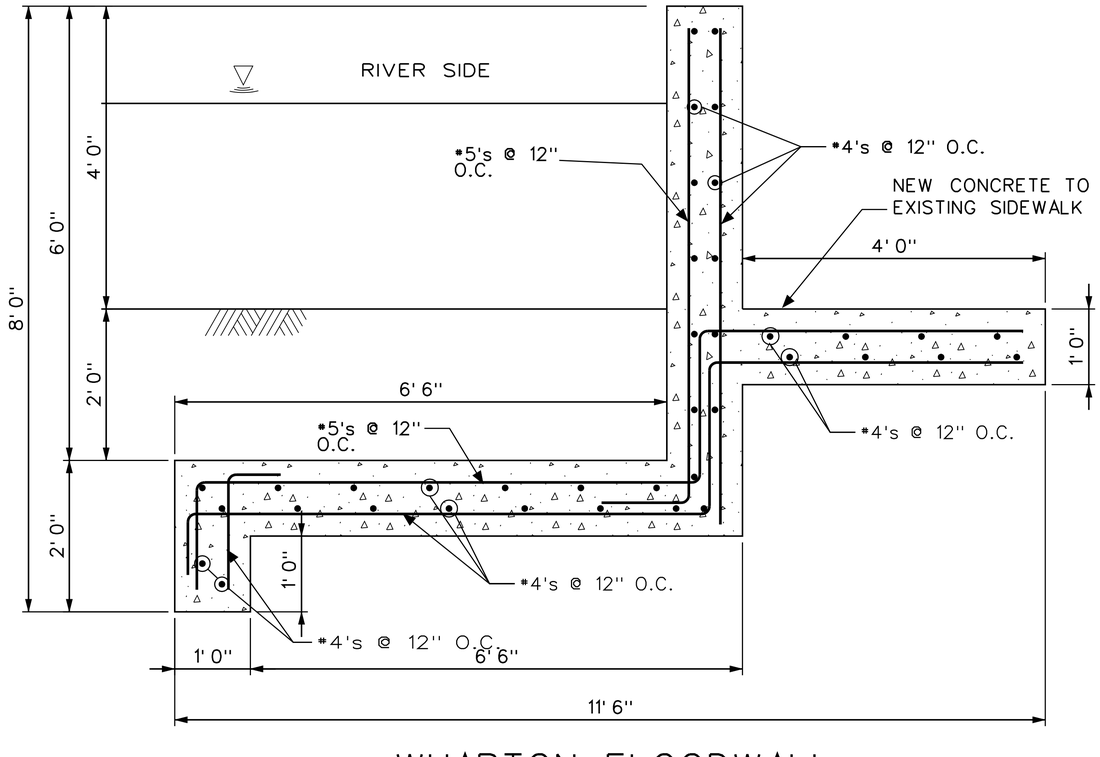


WHARTON FLOODWALL WITHOUT SIDEWALK

CONCRETE - 0.6 CU.YDS/FT
REINFORCING - 54 LBS/FT



WHARTON FLOODWALL WITH SIDEWALK

CONCRETE - 0.7 CU.YDS/FT
REINFORCING - 63 LBS/FT

NOT TO SCALE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date:
Sol No.
Contr No.
Re name
Post date:
Post scale:
Rev.

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

FLOODWALL AND FLAPGATE DETAILS

PRELIMINARY

Sheet reference number: S201

Contr No.

DESIGN FILE: WHARTON_S201.DGN

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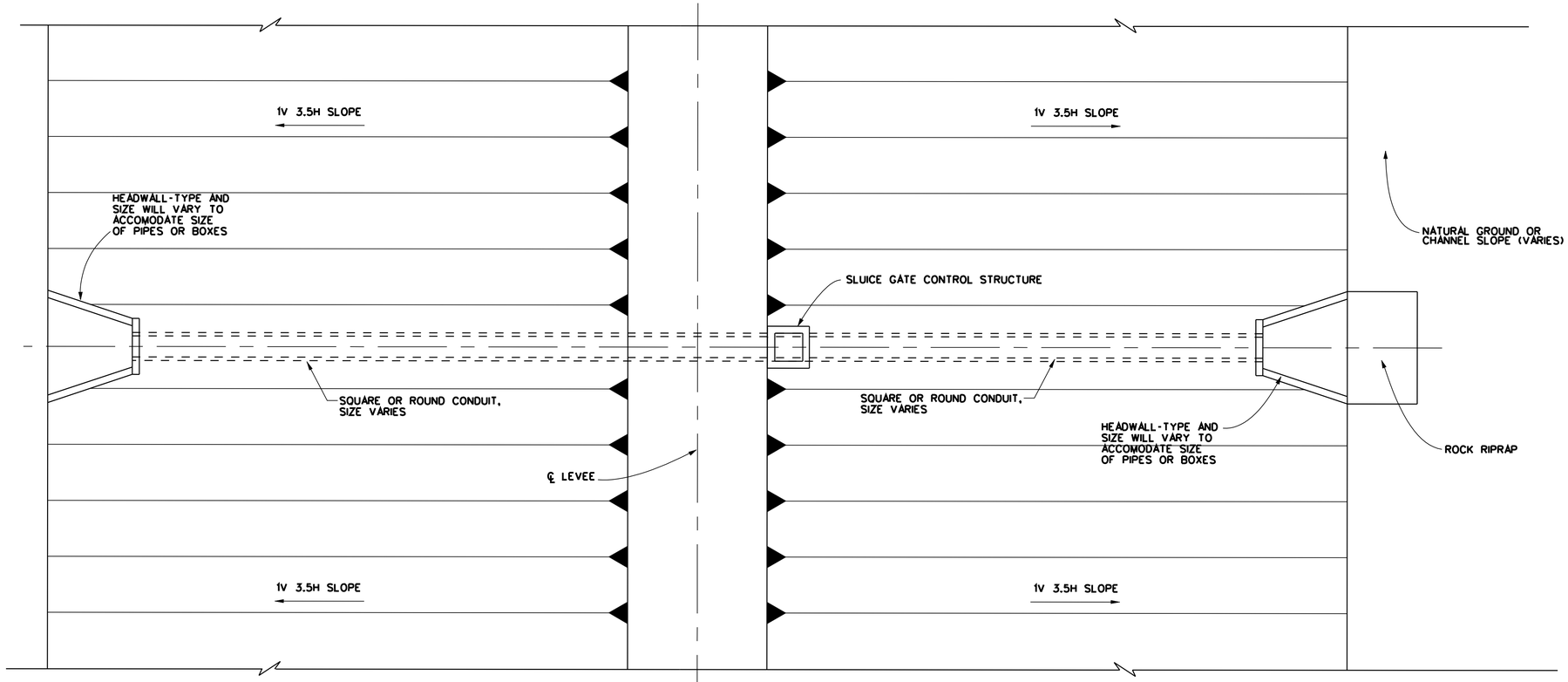
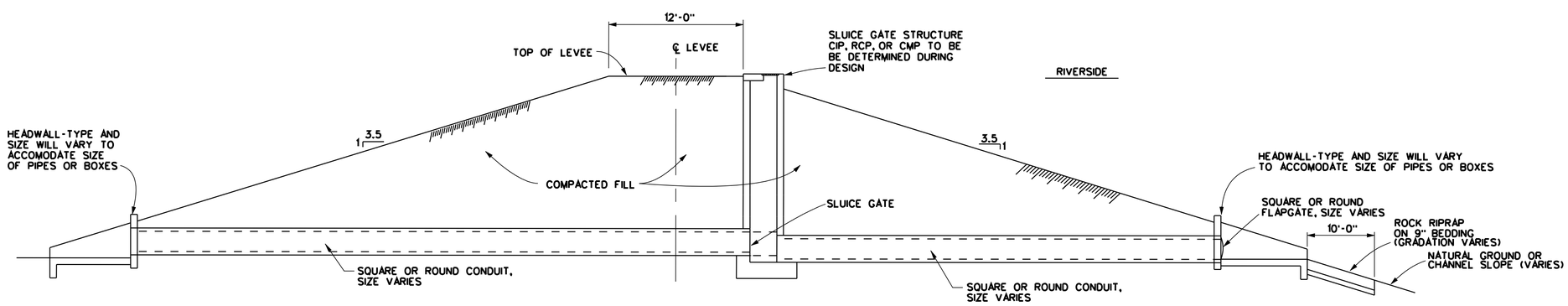


PLAN VIEW

N.T.S.



SLUICE GATE STRUCTURE ELEVATION

N.T.S.

DETAILS PROVIDED ON THESE SHEETS ARE PROPOSED FROM TXDOT STANDARDS AND MAY CHANGE DURING DESIGN PHASE

US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ABNISIGONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date: -- -- --
Sol No. --
Contr No. --
File name: ----------
Plot date: -- -- --
Plot scale: ----------

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS

ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT FEASIBILITY STUDY

SLUICE GATE STRUCTURE PLAN AND ELEVATION

PRELIMINARY

Sheet reference number: S202

DESIGN FILE: WHARTON_S202.DGN

Contr No. ----------

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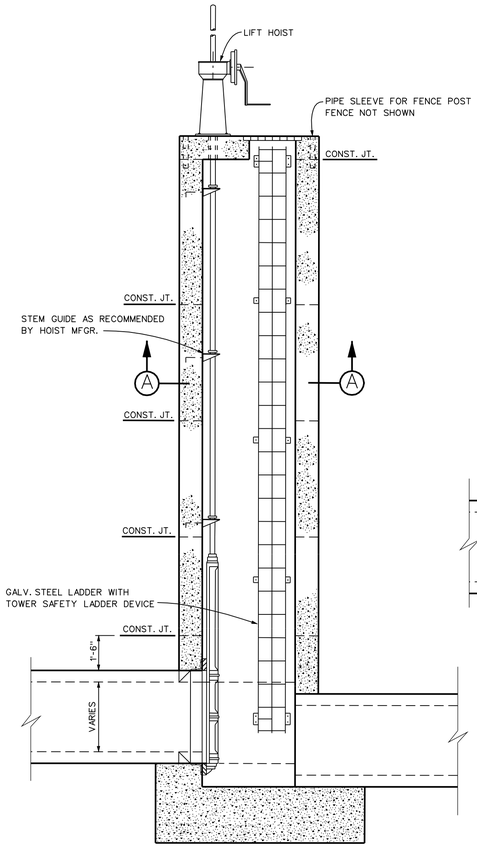
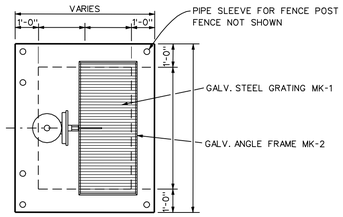
REFERENCE FILE: ----------



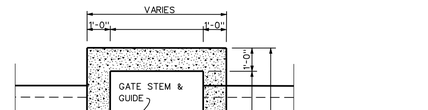
LONGITUDINAL SECTION

SCALE: 3/8" = 1'-0"



PLAN - HOIST PLATFORM

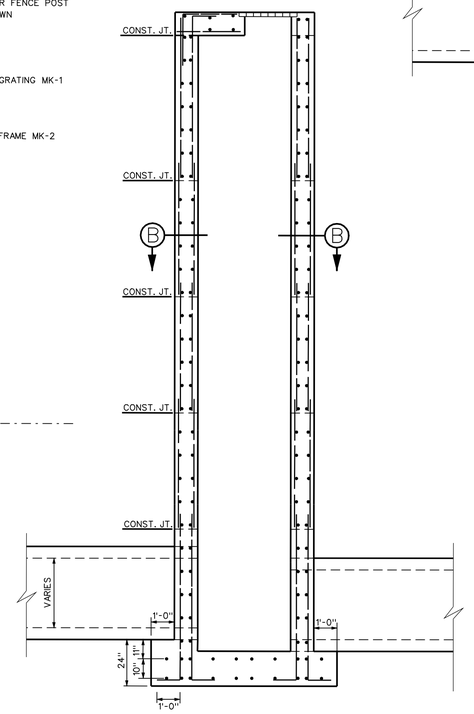
SCALE: 3/8" = 1'-0"



LONGITUDINAL SECTION

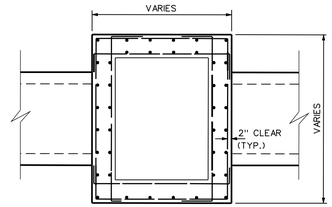
SCALE: 3/8" = 1'-0"

NOTE:
SLUCE GATE LADDER, AND
MECHANICAL ACCESSORIES NOT
SHOWN



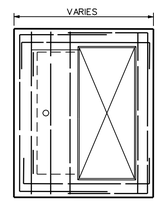
LONGITUDINAL SECTION

SCALE: 3/8" = 1'-0"



FLOOR PLAN
GATE TOWER

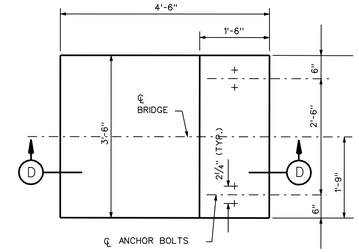
SCALE: 3/8" = 1'-0"



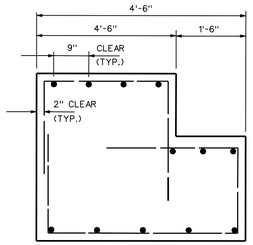
NOTE:
HOIST NOT SHOWN

SECTION B-B

SCALE: 3/8" = 1'-0"



PLAN



SECTION D-D

NOTE:
ALL REINF. #3
SPACED AS SHOWN

SERVICE BRIDGE ABUTMENT

SCALE: 3/4" = 1'

US Army Corps
of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Designed by: S. ARMSTRONG
Dwn by: R. REED
Reviewed by: S. ARMSTRONG
Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION
Date:
Sol No.
Contr No.
Rev.
File name:
Plot date:
Plot scale:

U.S. ARMY ENGINEER DISTRICT,
CORPS OF ENGINEERS
FORT WORTH, TEXAS

ENGINEERING/
CONSTRUCTION DIVISION
DESIGN BRANCH

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

SLUICE GATE STRUCTURE DETAILS

PRELIMINARY

Sheet
reference
number:
S203

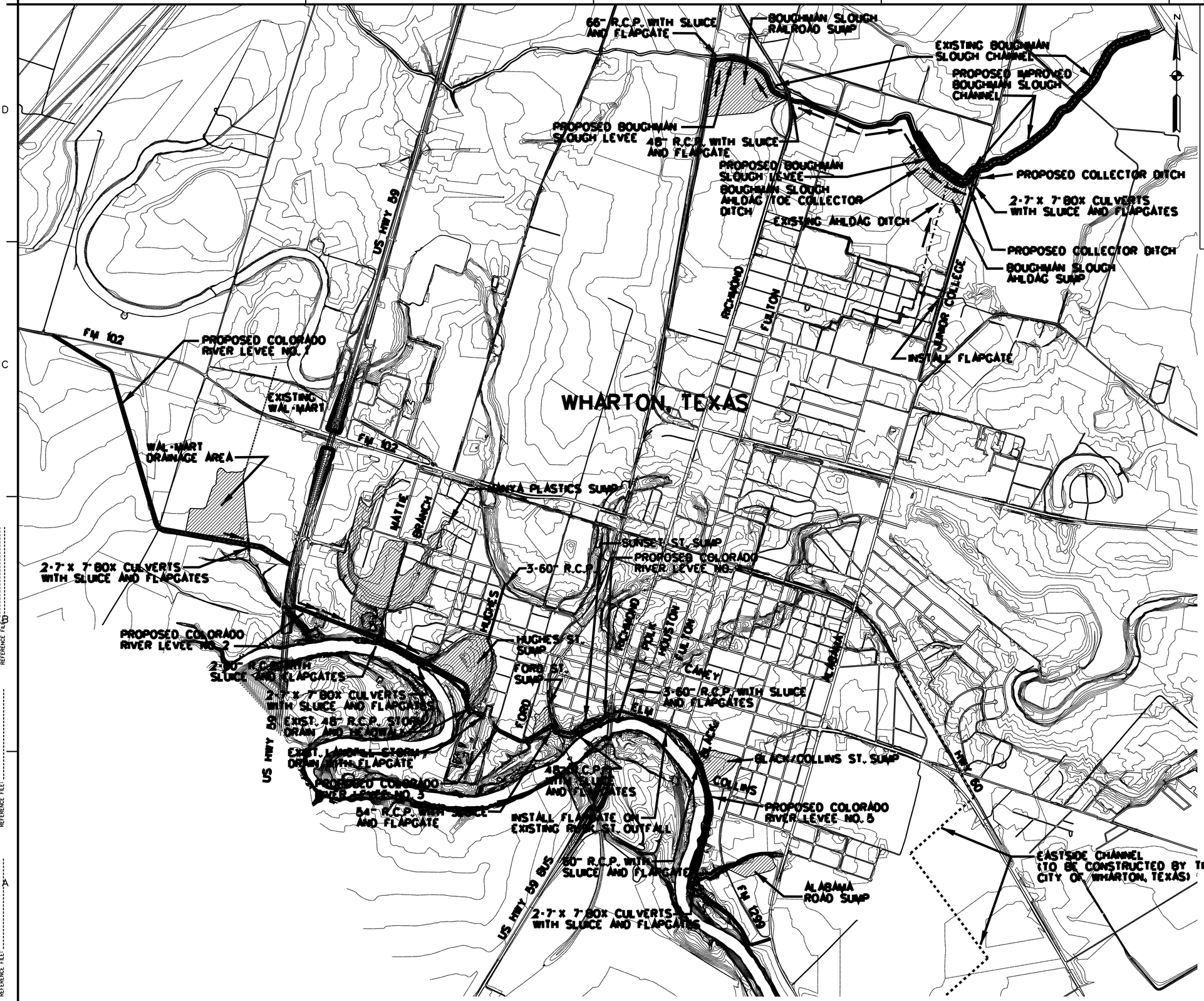
DESIGN FILE: WHARTON_S203.DGN

Contr No.

7/14/2006 3:41:29 PM

WHARTON_S203.dgn

REFERENCE FILE:



US Army Corps of Engineers
Fort Worth District

Symbol	Description	D.O. No.	Action	Date

Rev.	Date:	Designed by: S. ARMSTRONG	U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS FORT WORTH, TEXAS	ENGINEERING/ CONSTRUCTION DIVISION DESIGN BRANCH
	Sol No.	Dwn by: R. REED		
	Contr No.	Reviewed by: S. ARMSTRONG		
		Submitted by: MARK L. BLACK, P.E. CHIEF, CIVIL SECTION		

Pl name:
Pl date:
Pl scale:

WHARTON, TEXAS
LEVEE AND CHANNEL IMPROVEMENT
FEASIBILITY STUDY

PROJECT SITE MAP

PRELIMINARY

Sheet reference number: G301

Contr No.

DESIGN FILE: WHARTON_G301.DGN

$$cadd file name$$ $$date$$ $$time$$ $$me$$

REFERENCE FILE: