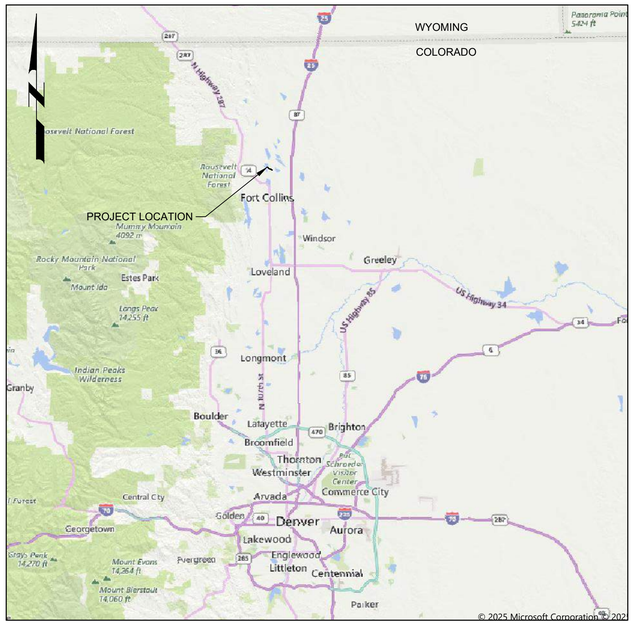
THORNTON WATER PROJECT

SOURCE WATER PUMP STATION ACCESS ROAD

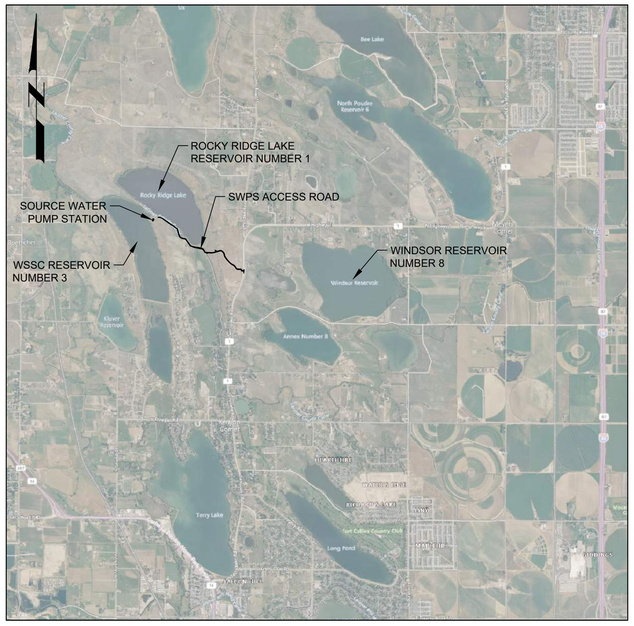
ISSUED FOR BID
SEPTEMBER 2025

PROJECT #12-777R

OVERALL COUNT	AREA NUMBER	SHEET DSGNT.	PG # HOLDER	
				GENERAL
1	10	G	01	COVER SHEET AND DRAWING INDEX
2	10	G	02	NOTES AND SYMBOLS
3	10	GC	01	CIVIL LEGEND
4	10	GC	02	CIVIL NOTES AND ABBREVIATIONS
5	10	GC	03	SURVEY CONTROL PLAN
6	10	GE	01	ELECTRICAL LEGEND
7	10	GE	02	ELECTRICAL ABBREVIATIONS
				CIVIL
8	10	C	01	ROAD KEYPLAN
9	10	C	02	ROAD PLAN AND PROFILE STA 12+40 TO 20+00
10	10	C	03	ROAD PLAN AND PROFILE STA 20+00 TO 30+00
11	10	C	04	ROAD PLAN AND PROFILE STA 30+00 TO 40+00
12	10	C	05	ROAD PLAN AND PROFILE STA 40+00 TO 50+00
13	10	C	06	ROAD PLAN AND PROFILE STA 50+00 TO 60+00
14	10	C	07	ROAD PLAN AND PROFILE STA 60+00 TO 70+00
15	10	C	08	ROAD PLAN AND PROFILE STA 70+00 TO 72+25.85
16	10	C	09	ROCKY RIDGE LAKE RESERVOIR NO. 1 ACCESS ROAD
17	10	C	10	CANAL CROSSING ENLARGED PLAN
18	10	C	11	COLORADO HIGHWAY 1 ACCESS ENLARGED PLAN
19	10	C	12	ROAD DETAILS
20	10	C	13	CULVERT GENERAL INFORMATION
21	10	C	14	CULVERT GENERAL LAYOUT & TYPICAL SECTION
22	10	C	15	CULVERT HYDRAULIC LAYOUT
23	10	C	16	CULVERT WINGWALL DETAILS
				EROSION CONTROL
24	10	EC	01	KEY MAP, LEGEND, AND LARIMER COUNTY STANDARD NOTES 1
25	10	EC	02	LARIMER COUNTY STANDARD NOTES 2
26	10	EC	03	INITIAL STA 12+40 TO 45+00
27	10	EC	04	INITIAL STA 45+00 TO 72+25.85
28	10	EC	05	FINAL STA 12+40 TO 45+00
29	10	EC	06	FINAL STA 45+00 TO 72+25.85
30	10	EC	07	DETAILS 1
31	10	EC	08	DETAILS 2
32	10	EC	09	DETAILS 3
33	10	EC	10	DETAILS 4
				ELECTRICAL
34	10	E	03	ELECTRICAL SITE PLAN
				TYPICAL DETAILS
35	10	TC	01	CIVIL DETAILS
36	10	TE	01	ELECTRICAL DETAILS
				REFERENCE DOCUMENTS
37-68				APPLICABLE CDOT STANDARD DETAILS



VICINITY MAP



LOCATION MAP

JASON PIERCE, P.E. - PROJECT DIRECTOR DATE

JOHN HIMYAK, P.E - PROJECT ENGINEER DATE

MICHAEL WELKER, P.E. - PROJECT MANAGER DATE

TONY STOUT, P.E. - OWNER'S ADVISOR DATE

COLORADO LICENSED
MARY LEE GLASS
43662
PROFESSIONAL ENGINEER

carollo®

JOB NO.	203505
DRAWING NO.	10G01
SHEET NO.	1 OF 36

LAST SAVED BY: SNeet

PROJECT NO. 11599A10 FILE NAME: 203505_AR_10G01.dwg

Plot Date: 7/9/2025 4:05:28 PM

DETAIL REFERENCES

PLAN/TITLE

VIEW
DESCRIPTION
VIEW TITLE
A PLAN
SCALE: SCALE
FILE: FILE
PLAN NOT REFERENCED

SECTION CUT

A VIEW
##X##
- = SHOWN ON SAME DRAWING
##X## = SEE INDICATED DRAWING

SECTION OR DETAIL

ALPHA = SECTION
NUMERIC = DETAIL
DESCRIPTION
VIEW TITLE
C/1 ELEVATION
##X##
SCALE: SCALE
FILE: FILE

TITLE W/ REFERENCE

DRAWING CUT ORIGINATION

DETAIL CALL-OUT
(ENLARGED)

1 VIEW
##X##
SEE INDICATED
DRAWING

DRAWING REFERENCE

AREA DESIGNATOR
(WHEN APPLICABLE)
DISCIPLINE DESIGNATOR
##X##
CONSECUTIVE
SHEET NUMBER

TYPICAL DETAIL
REFERENCE

TYPICAL DETAIL #
? TYP

EXTERIOR ELEVATION
VIEWS

A ##X##

PHOTO LOCATION

-
ARROW INDICATES
POINT OF VIEW

GRID BUBBLE

TYPICAL DETAIL #
? TYP
LINE 3
LINE 1
LINE 2
TYPICAL DETAIL TITLE
S
MODIFICATION NOTE
S = STANDARD
J = JOB SPECIFIC
R = REVISED
N = NOTE TO TYPICAL DETAIL USER
SHT X OF X
SHEETS IN
DETAIL
XX/XX/20XX
DATE CREATED
(REVISED)

GENERAL SYMBOLS

NORTH ARROW/
PLANT NORTH

30.0°
NORTH
NORTH
TRUE
PLANT

SCALE

0 10' 20' 40'
SCALE: 1" = 20'

BRACKET

BREAK LINE

PIPE BREAK
PLAN VIEW

PIPE BREAK
CROSS SECTION

PIPE CONTINUATION
(SINGLE LINE)

KEY NOTE

34

REVISION DELTA

2

EXISTING ELEVATION

EX TOW XXXX.X±

ELEVATION

TOC XXXX.XX

EQUIPMENT/DEVICE
KEY TAG

1

EQUIPMENT/DEVICE
TAG AND NUMBER

XXX-XX-XXXX
EQUIPMENT
EX-EQUIP = EXISTING EQUIPMENT
EF-EQUIP = FUTURE EQUIPMENT

PIPE TAG

PIPE SIZE
FLOW STREAM
X" XXX
SIZE FLOW STREAM
EX-SIZE FLOW STREAM = EXISTING
EF-SIZE FLOW STREAM = FUTURE

STRUCTURAL HATCH PATTERNS

ALUMINUM

BRICK OR BLOCK

BRONZE, BRASS,
OR COPPER

CAST IRON OR
FIBERGLASS

CONCRETE
(ALL CLASSES)

SPAN
GRATING

RUBBER

SAND OR GROUT

STEEL

TREAD PLATE

WOOD

GENERAL NOTES

1. FOLLOWING NOTES ARE GENERAL AND APPLY TO ALL SHEETS OF THESE CONTRACT DOCUMENTS AS IF THEY WERE WRITTEN IN THEIR ENTIRETY ON EACH SHEET.
2. CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE STARTING WORK AND SHALL IMMEDIATELY NOTIFY THE CONSTRUCTION MANAGER OF ANY DISCREPANCIES. CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS INCLUDING LOCATION AND DIMENSIONS OF ALL EXISTING CONSTRUCTION AND UTILITIES. CONTRACTOR SHALL NOTIFY CONSTRUCTION MANAGER IF THERE IS A CONFLICT BETWEEN THE CONTRACT DOCUMENTS AND EXISTING CONSTRUCTION BEFORE PROCEEDING WITH WORK.
3. UNLESS DETAILED, SPECIFIED, OR OTHERWISE INDICATED ON THE DRAWINGS, CONSTRUCTION SHALL BE AS INDICATED IN THE APPLICABLE TYPICAL DETAILS AND GENERAL NOTES. TYPICAL DETAILS SHALL APPLY EVEN THOUGH NOT REFERENCED AT SPECIFIC LOCATIONS ON DRAWINGS.
4. WHERE NO CONSTRUCTION DETAILS ARE SHOWN OR NOTED FOR ANY PART OF WORK, DETAILS SHALL BE IN THE SAME AS FOR OTHER SIMILAR WORK.
5. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT FROM DAMAGE EXISTING FACILITIES AND UTILITIES SHOWN OR NOT SHOWN THAT ARE TO REMAIN IN PLACE. ALL FACILITIES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED TO THE ORIGINAL OR BETTER CONDITION AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
6. THE CONTRACTOR IS RESPONSIBLE FOR ARRANGING ALL REQUIRED INSPECTIONS. THE PRESENCE OR ABSENCE OF THE INSPECTOR WILL NOT RELIEVE THE CONTRACTOR OF FULL RESPONSIBILITY FOR THE PROPER PERFORMANCE OF THE WORK.

811 Know what's below. Call before you dig.

Call before you Overhead

LAST SAVED BY: SNeet

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED CE
DRAWN CE
CHECKED CE
DATE SEPTEMBER 2025

COLORADO LICENSED
SMIT LEE GILES
43662
Digitally signed by Bart L. Giles
Date: 2025.09.10 15:57:47 -06'00'
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
GENERAL
NOTES AND SYMBOLS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

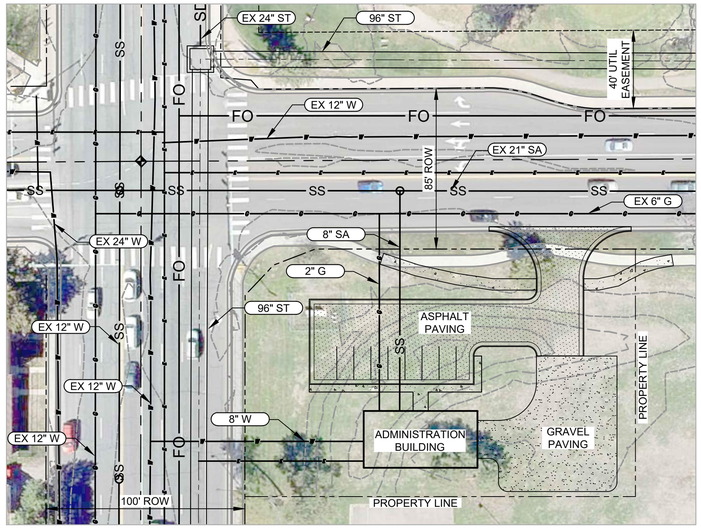
JOB NO. 203505
DRAWING NO. 10G02
SHEET NO. 2 OF 36

PROJECT NO. 203505-100000 FILE NAME: 203505_AR_10G02.dwg

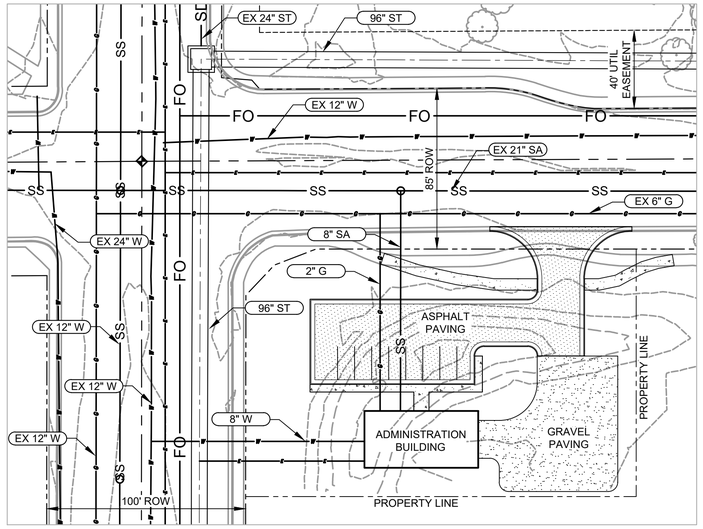
Plot Date: 9/9/2025 2:59 PM

PLAN VIEW LAYOUT EXAMPLES

WITH AERIAL BACKGROUND



WITHOUT AERIAL BACKGROUND



LINEWORK

GENERAL

- NEW CONSTRUCTION
- EXISTING FEATURES (NO AERIAL)
- EXISTING FEATURES (AERIAL)
- REMOVE OR ABANDONED
- FUTURE WORK

PROPERTY AND RIGHT-OF-WAY

- SECTION LINE
- PROPERTY LINE OR RIGHT-OF-WAY
- EASEMENT
- CITY LIMITS

PLANIMETRIC FEATURES AND TOPOGRAPHY

- EXISTING INDEX CONTOUR (5280)
- EXISTING INTERMEDIATE CONTOUR
- FINAL INDEX CONTOUR (5280)
- FINAL INTERMEDIATE CONTOUR
- EXISTING GRADE (PROFILE)
- FINAL GRADE (PROFILE)
- CUT/FILL BOUNDARY
- TOP OF SLOPE
- TOE OF SLOPE
- FENCE (X)
- FLOWLINE
- SHORING
- RAILROAD TRACKS
- SLOPE
- SWALE
- CURB & GUTTER
- CURB

CONSTRUCTION BOUNDARIES & RESTRICTIONS

- LIMITS OF CONSTRUCTION (LOC)
- SILT FENCE (SF)
- WETLAND BOUNDARY
- ORDINARY HIGH WATER MARK
- ACTIVE RAPTOR NEST BUFFER
- FLOODPLAIN/ FLOODWAY BOUNDARY

UTILITY PIPELINES

- PIPING >24-INCH DIAMETER
- PIPING <24-INCH DIAMETER
- WATER (W)
- SANITARY SEWER (SS)
- FORCEMAIN SANITARY SEWER (FM)
- STORM DRAIN (SD)
- IRRIGATION (IRR)
- NATURAL GAS (G)
- PETROLEUM GAS (F)
- OVERHEAD ELECTRIC (OHU)
- UNDERGROUND ELECTRIC (UGE)
- CABLE TV (UNDERGROUND) (CTV)
- TELEPHONE (TEL)
- FIBER OPTIC (FO)

SUBSURFACE UTILITY ENGINEERING

SUE NOTES:

THE EXISTING SURVEY BASE MAPPING INCLUDES VARYING DEGREES OF SUBSURFACE UTILITY ENGINEERING (SUE) AS DEFINED IN ASCE 38-02, STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA. THE FOUR EXISTING UTILITY DATA QUALITY LEVELS ARE DEFINED BELOW:

QUALITY LEVEL A	PRECISE HORIZONTAL AND VERTICAL LOCATIONS OBTAINED BY PHYSICALLY EXPOSING AND SURVEYING THE UTILITY.
QUALITY LEVEL B	INFORMATION OBTAINED USING SURFACE GEOPHYSICAL METHODS TO DETERMINE THE EXISTENCE AND APPROXIMATE HORIZONTAL LOCATION OF THE UTILITY.
QUALITY LEVEL C	INFORMATION OBTAINED BY SURVEYING VISIBLE ABOVE GRADE FEATURES THAT ARE INDICATIVE OF SUBSURFACE UTILITIES.
QUALITY LEVEL D	INFORMATION DERIVED FROM EXISTING RECORDS OR ORAL RECOLLECTIONS.

SUE LEGEND:

- SUE QUALITY LEVEL A (W, PH-24)
- SUE QUALITY LEVEL B (W)
- SUE QUALITY LEVEL C (W[C])
- SUE QUALITY LEVEL D (W[D])

HATCH PATTERNS

PAVEMENT

- ASPHALT PAVING
- CONCRETE PAVING
- GRAVEL SURFACE
- IMPERVIOUS PAVING

EARTH/ FILL MATERIALS

- UNDISTURBED SOIL
- STRUCTURAL FILL OR BACKFILL
- AGGREGATE BASE COURSE (ABC)
- GRAVEL OR DRAIN ROCK
- CONCRETE (ALL CLASSES)
- RIPRAP
- CLSM
- BEDROCK
- SOIL CEMENT

CONSTRUCTION

- STAGING AREA
- WETLAND
- LANDSCAPING GRASS OR SOD

SYMBOLS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CONTROL POINT		SHRUB/HEDGE
	SURVEY MONUMENT		TREE
	SECTION CORNER		SIGN POST
B-XX	SOIL BORING		LIGHT
PH-XX	POTHOLE		UTILITY POLE
	FLOW/SLOPE DIRECTION		GUY WIRE
	MANHOLE		FIRE HYDRANT
	CATCH BASIN		YARD HYDRANT
E	ELEC MANHOLE	CO	CLEANOUT
M	METER BOX		AIR RELEASE VALVE
P	PULL BOX		BLOW OFF VALVE
T	TELEPHONE PEDESTAL		SERVICE CONNECTION
CTV	CABLE TV		BALL VALVE
	ELECTRICAL TOWER		BUTTERFLY VALVE
	GATE		GATE VALVE
	HEADWALL		PLUG VALVE
	ROCK WALL		PIPE CAP
			REDUCER

COORDINATES / ELEVATION

COORDINATES: XX (N=1600000.00, E=1000000.00)

FINAL SPOT ELEVATION: FG XX.XX / TC XX.XX

EXISTING SPOT ELEVATION: X 1325.00

SLOPE CALLOUT: 2:1 | 2 / 1 | 2.0% | S=0.0020

ALIGNMENT CURVES: LENGTH, CURVE NUMBER (CXX), PC, CLOCKWISE, ANGLE, PT, RADIUS, RADIUS POINT; EDGE OF PVMT OR OUTSIDE FACE OF CURB

CUT/FILL BOUNDARY: C / F

811 Know what's below. Call before you dig.

Call before you Overhead

LAST SAVED BY: RFALK

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED — MATT LEE GILES — 43662 — Digitally signed by Matt L. Giles — Date: 2025.09.10 16:52:36 -06'00' — PROFESSIONAL ENGINEER

carollo®

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

GENERAL CIVIL

CIVIL LEGEND

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10GC01
SHEET NO. 3 OF 36

PROJECT NO. 203505 FILE NAME: 203505_10GC01.DWG

ABBREVIATIONS

	△	DELTA, DEFLECTION ANGLE, OR CENTRAL ANGLE
	#	NUMBER (REBAR Ø)
	@	AT (MEASUREMENT)
	+/-	PLUS/MINUS
A	ABC	AGGREGATE BASE COURSE
	ABND	ABANDONED
	AC	ASPHALTIC CONCRETE
	ACI	AMERICAN CONCRETE INSTITUTE
	ACP	ASBESTOS CEMENT PIPE
	ADDL	ADDITIONAL
	ADJ	ADJACENT, ADJUST(ABLE)
	AL	ALUMINUM
	APPROX	APPROXIMATE(LY)
	ARV	AIR RELEASE VALVE
	ASSY	ASSEMBLY
	ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
	AVG	AVERAGE
	AVV	AIR AND VACUUM VALVE
B	BC	BEGIN CURB
	BF	BLIND FLANGE
	BFP	BACK FLOW PREVENTER
	BFV	BUTTERFLY VALVE
	BH	BOREHOLE
	BLDG	BUILDING
	BM	BENCH MARK
	BO	BLOW OFF
	BOC	BACK OF CURB
	BOP	BOTTOM OF PIPE
	BOT	BOTTOM
	BV	BALL VALVE
	BVC	BEGINNING OF VERTICAL CURVE
	BYP	BYPASS
C	CATV	CABLE TV
	CAV	COMBINATION AIR VALVE
	CB	CATCH BASIN
	CC	CENTER OF CURVATURE, CENTER TO CENTER, CONCRETE CURB
	CDT	CONDUIT
	CF	CUBIC FEET
	CFM	CUBIC FOOT PER MINUTE
	CFS	CUBIC FEET PER SECOND
	CI	CAST IRON
	CIP	CAST IRON PIPE
	CIPP	CURED IN PLACE PIPE
	CJ	CONSTRUCTION JOINT
	CL	CENTER LINE
	CLK	CHAIN LINK
	CLR	CLEAR / CLEARANCE
	CLSM	CONTROL LOW STRENGTH MATERIAL
	CMLC	CEMENT MORTAR LINED AND COATED
	CMP	CORRUGATED METAL PIPE
	CMU	CONCRETE MASONRY UNIT
	CO	CLEANOUT
	CONC	CONCRETE
	CONN	CONNECT, CONNECTION
	CONST	CONSTRUCTION
	CONT	CONTINUOUS OR CONTINUATION OR (D)
	COORD	COORDINATE
	CP	CONTROL POINT
	CPLG	COUPLING
	CSP	CORRUGATED STEEL PIPE
	CTJ	CONTROL JOINT
	CTL	CONTROL
	CTR	CENTER, CENTERED
	CU	CUBIC
	CULV	CULVERT
	CY	CUBIC YARD
D	D	DRAIN, DEPTH
	D/W	DRIVEWAY APRON
	DEG or °	DEGREE
	DEMO	DEMOLISH, DEMOLITION
	DET	DETAIL
	DI	DROP INLET
	DIA or Ø	DIAMETER
	DIFF	DIFFERENCE
	DIM	DIMENSION
	DIP	DUCTILE IRON PIPE
	DIST	DISTANCE
	DR	DRIVE, DRAIN
	DWG(S)	DRAWING(S)
E	E	ELECTRICAL, EAST
	EA	EACH
	EC	END OF CURB
	ECC	ECCENTRIC REDUCER
	EG	EXISTING GROUND
	EL	ELEVATION
	ELL	ELBOW
	ELEC	ELECTRICAL
	EMH	ELECTRICAL MANHOLE
	EOP	END OF PIPE
	EP	EDGE OF PAVEMENT
	EQ	EQUAL
	EQUIP	EQUIPMENT
	ES	EACH SIDE
	ESMT	EASEMENT
	EVC	END OF VERTICAL CURVE
	EW	EACH WAY
	EX/EXIST	EXISTING
	EXP	EXPANSION
	EXT	EXTERIOR
F	FC	FLEXIBLE COUPLING
	FCA	FLANGE COUPLING ADAPTER
	FF	FINISHED FLOOR
	FG	FINISHED GRADE
	FH	FIRE HYDRANT
	FIN	FINISH
	FL	FLOOR, FLOW LINE
	FLEX	FLEXIBLE
	FLG	FLANGE(D)
	FM	FORCE MAIN
	FND	FOUNDATION
	FO	FIBER OPTIC
	FOB	FLAT ON BOTTOM
	FOC	FACE OF CURB
	FOT	FLAT ON TOP
	FPM	FEET PER MINUTE
	FS	FIRE SERVICES
	FSP	FABRICATED STEEL PIPE
	FT or '	FOOT, FEET
	FTG	FOOTING
G	G	GAS, GUTTER
	GA	GAUGE
	GAL	GALLONS
	GALV	GALVANIZE(D)
	GB	GRADE BREAK
	GC	GROOVED COUPLING
	GEN	GENERAL, GENERATOR
	GM	GAS METER
	GND	GROUND
	GPD	GALLONS PER DAY
	GPM	GALLONS PER MINUTE
	GR	GRADE
	GRTG	GRATING
	GSP	GALVANIZED STEEL PIPE
	GV	GATE VALVE
H	HDPE	HIGH DENSITY POLYETHYLENE
	HORIZ	HORIZONTAL
	HP	HIGH POINT
	HPGM	HIGH PRESSURE GAS MAIN
	HW	HEADWALL, HOT WATER
	HWL	HIGH WATER LEVEL
	HWY	HIGHWAY
	HYD	HYDRANT
I	ID	INSIDE DIAMETER
	IE	INVERT ELEVATION
	IN or "	INCHES
	INCL	INCLUDE, INCLUDING
	INSTR	INSTRUMENTATION
	INV	INVERT
	IP	IRON PIPE
	IRR	IRRIGATION
J	JT	JOINT
L	L	LENGTH
	LAT	LATERAL, LATITUDE
	LB(S)	POUND(S)
	LF	LINEAL FEET
	LH	LEFT HAND
	LONG	LONGITUDINAL
	LP	LOW POINT
	LT	LEFT
	LWL	LOW WATER LEVEL
M	MATL	MATERIAL
	MAX	MAXIMUM
	MECH	MECHANICAL
	MFR	MANUFACTURER
	MGD	MILLION GALLONS PER DAY
	MH	MANHOLE
	MIN	MINIMUM
	MISC	MISCELLANEOUS
	MJ	MECHANICAL JOINT
	MON	MONUMENT
N	N	NORTH, NORTHING
	NA	NOT APPLICABLE
	NE	NORTHEAST
	NG	NATURAL GAS
	NIC	NOT IN CONTRACT
	NO. or #	NUMBER
	NOM	NOMINAL
	NW	NORTHWEST
O	O.F.	OUTSIDE FACE
	OC	ON CENTER
	OD	OUTSIDE DIAMETER, OUTSIDE DIMENSION
	OHE	OVERHEAD ELECTRIC
P	PB	PULLBOX
	PC	POINT OF CURVATURE
	PCC	POINT OF COMPOUND CURVE
	PERM	PERMANENT
	PERP	PERPENDICULAR
	PH	POTHOLE
	PI	POINT OF INTERSECTION
	PL	PLATE, PROPERTY LINE
	POB	POINT OF BEGINNING
	PP	POWER POLE
	PRC	POINT OF REVERSE CURVATURE
	PROP	PROPERTY
	PL	PROPERTY LINE
	PSI	POUNDS PER SQUARE INCH
	PT	POINT, POINT OF TANGENCY
	PV	PLUG VALVE
	PVC	POINT OF VERTICAL CURVATURE
	PVC	POLYVINYL CHLORIDE
	PVI	POINT OF VERTICAL INTERSECTION
	PVMT	PAVEMENT
	PVT	POINT OF VERTICAL TANGENCY
Q	QTY	QUANTITY
R	R	RADIUS
	RAD	RADIAL
	RCB	REINFORCED CONCRETE BOX CULVERT
	RCP	REINFORCED CONCRETE PIPE
	RED	REDUCER
	REF	REFERENCE
	REINF	REINFORCE(D)(ING)(MENT)
	REQ'D	REQUIRED
	REV	REVISION
	RFCA	RESTRAINED FLEX COUPLING ADAPTER
	RH	RIGHT HAND
	R/W or ROW	RIGHT OF WAY
	RR	RAILROAD
	RT	RIGHT
S	S	SLOPE, SOUTH
	SCH	SCHEDULE
	SD	STORM DRAIN
	SDDI	STORM DRAIN DROP INLET
	SDMH	STORM DRAIN MANHOLE
	SE	SOUTHEAST
	SECT	SECTION
	SHLD	SHOULDER
	SHT	SHEET
	SIM	SIMILAR
	SL	SLOPE
	SPEC(S)	SPECIFICATION(S)
	SQ	SQUARE
	SS	SANITARY SEWER
	SSCO	SANITARY SEWER CLEANOUT
	SSMH	SANITARY SEWER MANHOLE
	SST	STAINLESS STEEL
	ST	STREET
	STA	STATION
	STD(S)	STANDARD(S)
	STL	STEEL
	STRUCT	STRUCTURAL
	SW	SOUTHWEST
	SWK	SIDEWALK
	SWPS	SOURCE WATER PUMP STATION
	SYM	SYMMETRICAL
T	TB	THRUST BLOCK
	TC	TOP OF CURB
	TEL	TELEPHONE
	TEMP	TEMPORARY
	TOG	TOP OF GRATING
	TMH	TELEPHONE MANHOLE
	TOC	TOP OF CONCRETE
	TOP	TOP OF PIPE
	T.O.W. or TW	TOP OF WALL
	TRD	TREAD
	TYP	TYPICAL
U	UC	UNDERCUT
	UG	UNDERGROUND
	UGE	UNDERGROUND ELECTRIC
	UNKN	UNKNOWN
	UNO	UNLESS NOTED OTHERWISE
	USA	UNDERGROUND SERVICE ALERT
V	V	VERTICAL, VALVE
	VAR	VARIES
	VB	VALVE BOX
	VC	VERTICAL CURVE, VICTAULIC COUPLER
	VCP	VITRIFIED CLAY PIPE
	VERT	VERTICAL
	VLT	VAULT
	VPI	VERTICAL POINT OF INTERSECTION
W	W	WATER, WIDTH OR WEST
	W/	WITH
	W/O	WITHOUT
	WL	WATER LEVEL
	WM	WATER METER
	WS	WATER SURFACE
	WSP	WELDED STEEL PIPE
	WSSC	WATER STORAGE AND SUPPLY COMPANY
	WSTP	WATERSTOP
	WV	WATER CONTROL VALVE
	WW	WASTEWATER
X	XFMR	TRANSFORMER
Y	YD	YARD

NOTES

GENERAL NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL SURVEY MONUMENTS AND CORNER MARKERS. SURVEY MONUMENTS AND PROPERTY CORNER MARKERS DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE REESTABLISHED BY A PROFESSIONAL SURVEYOR LICENSED IN THE STATE OF THE WORK.
2. DIMENSIONS TO STRUCTURES, REFERENCED PIPING, PAVING, AND OTHER IMPROVEMENTS ARE APPROXIMATE. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND CONDITIONS 14 DAYS IN ADVANCE OF CONSTRUCTION. THE CONTRACTOR SHALL REPORT ANY DISCREPANCIES TO THE CONSTRUCTION MANAGER.
3. ALL PLANIMETRIC FEATURES AND STRUCTURES SUCH AS CURBS AND GUTTERS, ACCESS DRIVES, WALKWAYS, PAVING BRICKS, FENCING, RETAINING WALLS, SIGNS, POSTS, MARKERS, MAIL BOXES, ETC. SHALL BE RESTORED TO PRECONSTRUCTION CONDITIONS.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE TO EXISTING ROADS, BUILDINGS, STRUCTURES, OR ANY OTHER FEATURE RESULTING FROM CONTRACTORS CONSTRUCTION ACTIVITIES. REPAIRS SHALL BE MADE TO THE SATISFACTION OF THE OWNER AND THE CONSTRUCTION MANAGER AT NO COST TO THE OWNER.
5. CONTRACTOR SHALL PROTECT AND MAINTAIN ALL EXISTING TREES, SHRUBS, AND PLANTS, UNLESS OTHERWISE NOTED.
6. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS PRIOR TO CONSTRUCTION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
7. IF PROVIDED BY THE OWNER, STAGING AREAS SHOWN ON THE PLANS ARE AVAILABLE FOR THE CONTRACTOR'S USE. ANY ADDITIONAL STAGING AREAS REQUIRED FOR THE WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
8. CONTRACTOR SHALL INSTALL PIPELINES, PAVING, WALKWAYS, AND CURB AND GUTTER AT UNIFORM GRADE BETWEEN ELEVATIONS DEPICTED ON THE DRAWINGS.
9. THE CONTRACTOR SHALL MAINTAIN DRIVEWAY ACCESS TO ALL ADJOINING PROPERTIES ACCESSIBLE TO THE PUBLIC AND EMERGENCY VEHICLES. DESIGNS FOR MAINTAINING ACCESS WILL BE PREPARED BY THE CONTRACTOR AND SUBMITTED TO THE CONTROLLING AGENCY FOR REVIEW AND APPROVAL.
10. CONTRACTOR SHALL COMPLY WITH TRENCH PLATE REQUIREMENTS OF THE GOVERNING JURISDICTION. IF TRENCH PLATE REQUIREMENTS ARE NOT SPECIFIED, THE CONTRACTOR SHALL APPLY SKID RESISTANT COATING ON THE TRENCH PLATES AND COLD MIX ASPHALT CONCRETE AT THE EDGES. THE TRENCH PLATES SHALL BE NOTCHED INTO THE ASPHALT CONCRETE OR TRAVELED SURFACE TO PREVENT SLIPPAGE AND ROCKING UNDER TRAFFIC.
11. THE CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE, COUNTY, AND LOCAL LAWS AND ORDINANCES RELATING TO THE SAFETY AND CHARACTER OF WORK, EQUIPMENT, AND PERSONNEL. THIS INCLUDES, BUT IS NOT LIMITED TO SHEETING, SHORING, BRACING, VENTILATION, CONFORMANCE WITH TRAFFIC CONTROL AND MAINTENANCE OF BARRICADES AND WARNING DEVICES.
12. CONTRACTOR SHALL KEEP COMPLETE AND ACCURATE RECORD DRAWINGS OF THE WORK, UTILITY POTHOLE DATA, AND EXISTING CONDITIONS THAT HAVE CHANGED OR ARE DIFFERENT THAN SHOWN ON THE PLANS.
13. FIRE LANES AND PRIVATE DRIVES USED FOR FIRE LANES SHOWN ON THESE PLANS ARE DESIGNED TO BE FLAT, HARD, ALL-WEATHER DRIVING SURFACES CAPABLE OF SUPPORTING 80,000 POUNDS TO MEET POUDRE FIRE AUTHORITY REQUIREMENTS AND INTERNATIONAL FIRE CODE (IFC) 2021 APPENDIX D102.1 AMENDMENT.

GENERAL UTILITY NOTES:

1. ALL EXISTING UTILITIES SHOWN ON THE PLANS ARE BASED ON A COMBINATION OF UTILITY MAPS, RECORD DRAWINGS, SURVEY, AND UTILITY LOCATION SERVICES AND REPRESENTS THE BEST AVAILABLE INFORMATION AT THE TIME OF DESIGN. THE CONTRACTOR SHALL VERIFY AND VALIDATE LOCATIONS AND ELEVATIONS OF UTILITIES USING THEIR OWN UTILITY LOCATE INVESTIGATIONS AND/OR SUBSURFACE UTILITY ENGINEERING (SUE). THE CONTRACTOR SHALL UPDATE AS-BUILT DRAWINGS MONTHLY WITH UPDATE UTILITY LOCATIONS AND ELEVATIONS.
2. THE CONTRACTOR SHALL CONTACT 811 AND ANY KNOWN PRIVATE UTILITIES TO IDENTIFY AND LOCATE ALL KNOWN BURIED UTILITIES. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES WITH ALL KNOWN UTILITY OWNERS TO DEFINE THE REQUIREMENTS AND METHODS TO ACCOMMODATE THE PROTECTION, TEMPORARY SUPPORT, ADJUSTMENT, OR RELOCATION OF ANY UTILITIES AFFECTED BY THE PROPOSED WORK. ADDITIONALLY, THE CONTRACTOR SHALL MAKE ARRANGEMENTS FOR UTILITY OWNER INSPECTIONS, IF REQUIRED, PRIOR TO CONSTRUCTION.
3. PRIOR TO EXCAVATION FOR NEW STRUCTURES, ELECTRICAL CONDUIT, FABRICATION OF NEW PIPING AND/OR OTHER PROPOSED UTILITIES, CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION OF ALL EXISTING PIPING AND UTILITIES IN THE CONSTRUCTION AREA. THE CONTRACTOR SHALL TEMPORARILY RELOCATE CONFLICTING EXISTING UTILITIES AT NEW TO EXISTING CONNECTIONS AND REINSTALL THEM AS REQUIRED TO ELIMINATE THE CONFLICT.
4. THE CONTRACTOR SHALL CONTACT ALL KNOWN OVERHEAD ELECTRIC UTILITY OWNERS PRIOR TO CONSTRUCTION AND MAKE ARRANGEMENTS FOR ANY SPECIAL OWNER REQUIREMENTS, ENCROACHMENT PERMITS, AND UTILITY OWNER INSPECTIONS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL ABIDE BY THE NATIONAL ELECTRIC CODE WHILE IN PROXIMITY TO OVERHEAD ELECTRIC LINES.

GENERAL EARTHWORK NOTES:

1. CLEAR THE CONSTRUCTION AREA OF NATURAL OBSTRUCTIONS EXISTING FOUNDATIONS, BUILDINGS, FENCES, LUMBER, WALLS, STUMPS, BRUSH, WEEDS, RUBBISH, TREES, BOULDERS, AND ANY OTHER ITEMS WHICH INTERFERES WITH CONSTRUCTION OPERATIONS OR ARE DESIGNATED FOR REMOVAL.
2. GRUB OUT AND DISPOSE OF TREE TRUNKS AND ROOT MATERIAL BELOW THE GROUND SURFACE REMAINING AFTER CLEARING.
3. DISPOSE OF THE UNACCEPTABLE BACKFILL MATERIAL FROM THE CLEARING AND GRUBBING OPERATIONS AT NO ADDITIONAL COST TO THE OWNER.
4. STRIP AND STOCKPILE THE TOPSOIL. THE DEPTH OF STRIPPING SHALL BE ESTIMATED TO BE 12-INCHES BUT WILL BE DETERMINED IN THE FIELD AS SOIL CONDITIONS DICTATE.
5. REPLACE STOCKPILED SOIL AND RESTORE SITE AS SPECIFIED.
6. ROCK AND AGGREGATE STORAGE AREAS SHALL BE RESTORED BY EXCAVATING ANY SOILS CONTAINING ROCK OR AGGREGATE AND BACKFILLING WITH TOPSOIL. SOIL REMOVED MAY BE USED FOR TRENCH BACKFILL ABOVE THE PIPE ZONE AND 3 FEET BELOW FINISHED GRADE.
7. CONTRACTOR SHALL COMPLY WITH LOCAL CONSTRUCTION STORM WATER DISCHARGE REGULATIONS AND REQUIREMENTS.

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GALLAS 43662 Digitally signed by Matt L. Gallas Contact Info: Carollo Engineers, Inc. Date: 2025.09.10 16:53:30 -06'00' PROFESSIONAL ENGINEER

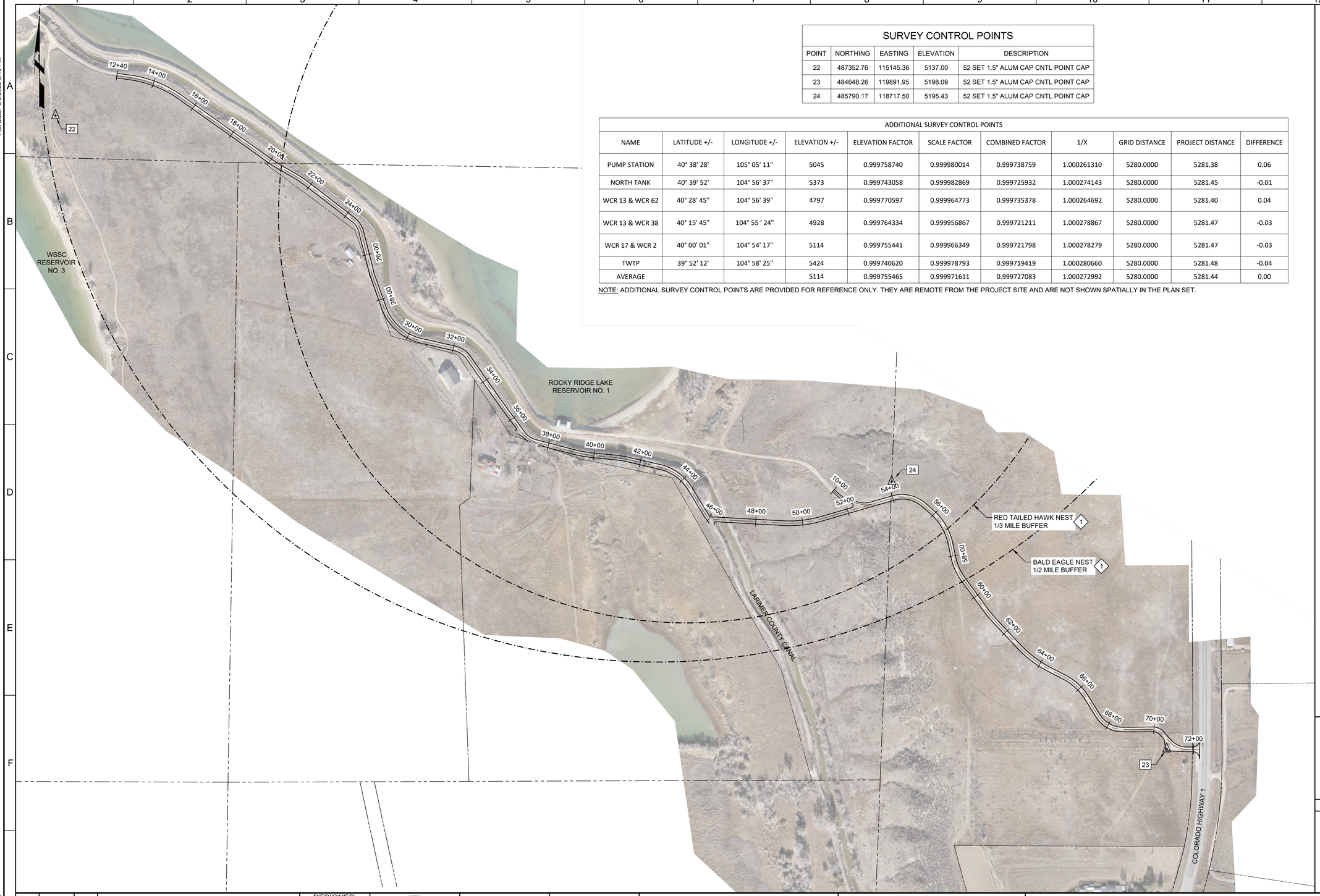
CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
GENERAL CIVIL
CIVIL NOTES AND ABBREVIATIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10GC02
SHEET NO. 4 OF 36

Plot Date: 9/9/2025 2:59 PM
LAST SAVED BY: RFALK
PROJECT NO. 203505
FILE NAME: 203505_10GC02.DWG

Plot Date: 9/9/2025 3:15 PM



SURVEY CONTROL POINTS

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
22	487352.76	115145.36	5137.00	52 SET 1.5" ALUM CAP CNTL POINT CAP
23	484648.26	119891.95	5198.09	52 SET 1.5" ALUM CAP CNTL POINT CAP
24	485790.17	118717.50	5195.43	52 SET 1.5" ALUM CAP CNTL POINT CAP

ADDITIONAL SURVEY CONTROL POINTS

NAME	LATITUDE +/-	LONGITUDE +/-	ELEVATION +/-	ELEVATION FACTOR	SCALE FACTOR	COMBINED FACTOR	1/X	GRID DISTANCE	PROJECT DISTANCE	DIFFERENCE
PUMP STATION	40° 38' 28"	105° 05' 11"	5045	0.999758740	0.999980014	0.999738759	1.000261310	5280.0000	5281.38	0.06
NORTH TANK	40° 39' 52'	104° 56' 37"	5373	0.999743058	0.999982869	0.999725932	1.000274143	5280.0000	5281.45	-0.01
WCR 13 & WCR 62	40° 28' 45"	104° 56' 39"	4797	0.999770597	0.999964773	0.999735378	1.000264692	5280.0000	5281.40	0.04
WCR 13 & WCR 38	40° 15' 45"	104° 55 ' 24"	4928	0.999764334	0.999956867	0.999721211	1.000278867	5280.0000	5281.47	-0.03
WCR 17 & WCR 2	40° 00' 01"	104° 54' 17"	5114	0.999755441	0.999966349	0.999721798	1.000278279	5280.0000	5281.47	-0.03
TWTP	39° 52' 12'	104° 58' 25"	5424	0.999740620	0.999978793	0.999719419	1.000280660	5280.0000	5281.48	-0.04
AVERAGE			5114	0.999755465	0.999971611	0.999727083	1.000272992	5280.0000	5281.44	0.00

NOTE: ADDITIONAL SURVEY CONTROL POINTS ARE PROVIDED FOR REFERENCE ONLY. THEY ARE REMOTE FROM THE PROJECT SITE AND ARE NOT SHOWN SPATIALLY IN THE PLAN SET.

GENERAL NOTES:

1. PROJECT COORDINATES ARE BASED ON USING STATE PLANE NORTH ZONE 83/2011 COORDINATES.
2. THE COMBINED SCALE FACTOR IS 1.000272992 TO BRING STATE PLANE COORDINATES TO PROJECT COORDINATES THEN THE VALUES NEED TO BE TRUNCATED.
3. PROJECT NORTHING = (STATE PLANE NORTHING * 1.000272992) - 1,000,000.
4. PROJECT EASTING = (STATE PLANE EASTING * 1.000272992) - 3,000,000.
5. ALL ELEVATIONS ARE BASED ON NAVD 88 DATUM.

KEY NOTES:

1. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

Know what's **below.** **Call** before you dig.

Call before you Overhead

SCALE

0 100' 200' 400'

SCALE: 1" = 200'

LAST SAVED BY: RFALK

REV	DATE	BY	DESCRIPTION

ISSUED FOR BID

DESIGNED	RJF
DRAWN	RJF
CHECKED	JJK
DATE	SEPTEMBER 2025

COLORADO LICENSED — GARY LEE GEER — 43662 — Digitally signed by Bart L. Gilles — PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD

GENERAL CIVIL

SURVEY CONTROL PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505

DRAWING NO. 10GC03

SHEET NO. 5 OF 36

PROJECT NO. 203505 FILE NAME: 203505_10GC03.DWG

ELECTRICAL PLAN SYMBOLS

IDENTIFICATION SYMBOLS

EQUIP # — EQUIPMENT / INSTRUMENT IDENTIFICATION

■ — EQUIPMENT / INSTRUMENT LOCATOR

b (X) a / c — LUMINAIRE IDENTIFICATION
- a = CIRCUIT DESIGNATION
- b = DEVICE SWITCH FROM
- c = MOUNTING HEIGHT FROM FINISHED FLOOR TO BOTTOM OF FIXTURE
- X = LUMINAIRE TYPE, REFER TO THE LUMINAIRE SCHEDULE

XXX — CONDUIT IDENTIFICATION
XXX = CONDUIT NUMBER
REFER TO CONDUIT SCHEDULE UNLESS OTHERWISE NOTED.
GROUPED CONDUITS ARE LABELED LEFT TO RIGHT OR TOP TO BOTTOM

(#) — INDICATES KEYNOTE #
(PERTAINS ONLY TO SHEET WHERE NOTE IS FOUND)

DISCONNECT SWITCH

CAMERA

LUMINAIRES

*SIZE OF BLOCK MAY APPEAR SMALLER OR LARGER DEPENDING ON SCALE OF DRAWINGS

LINEAR FIXTURE

2' X 2' LAY-IN TROFFER

2' X 4' LAY-IN TROFFER

LUMINAIRE POLE MOUNTED

LUMINAIRE, EMERGENCY BATTERY-POWERED

LUMINAIRE, EMERGENCY/EXIT BATTERY-POWERED

LUMINAIRE, EMERGENCY BATTERY-POWERED REMOTE

LUMINAIRE, SURFACE OR PENDANT MOUNTED

LUMINAIRE, WALL MOUNTED

LUMINAIRE, FLOOD / SPOT

LUMINAIRE, EXIT ONE OR TWO FACES AS INDICATED. ARROW POINTS IN DIRECTION OF EGRESS.

SWITCHES / RECEPTACLES

c S a b — SINGLE POLE SWITCH
- a = CIRCUIT DESIGNATION
- b = DEVICE SWITCHED DESIGNATION
- c = TYPE
  - 2 = DOUBLE POLE SWITCH
  - 3 = THREE-WAY SWITCH
  - 3P = THREE POSITION SWITCH
  - 4 = FOUR-WAY SWITCH
  - K = KEY OPERATED SWITCH
  - F = SWITCH AND FUSESTAT HOLDER
  - P = SWITCH AND PILOT LIGHT
  - T = THERMOSTAT
  - D = DIMMER SWITCH
  - L = LOW VOLTAGE LIGHT SWITCH
  - M = MANUAL MOTOR STARTER
  - N = NETWORK SINGLE OR MULTIPLE SWITCH LOCATIONS
  - WP = WEATHER PROOF

REFER TO ABBREVIATIONS LEGEND FOR ALL OTHER DESIGNATIONS

b (X) a / c — OCCUPANCY SENSOR
- a = CIRCUIT DESIGNATION
- b = DEVICE SWITCH FROM
- c = MOUNTING HEIGHT FROM FINISHED FLOOR TO BOTTOM OF FIXTURE
- X = SENSOR TYPE, REFER TO THE LUMINAIRE CONTROL COMPONENT SCHEDULE

(PE) — PHOTOCELL

a b — SWITCH AND SINGLE RECEPTACLE
- a = CIRCUIT DESIGNATION
- b = DEVICE TYPE DESIGNATION

a b — DUPLEX RECEPTACLE

a b — QUADRUPLEX RECEPTACLE

a b — IN FLOOR DUPLEX RECEPTACLE

a b — IN FLOOR QUADRUPLEX RECEPTACLE

a b — DUPLEX RECEPTACLE w/SPLIT WIRE

a b — DEDICATED RECEPTACLE

a b — SPECIAL PURPOSE RECEPTACLE

a b — WELDING RECEPTACLE
- a = CIRCUIT DESIGNATION
- b = DISCONNECT TYPE

a — TWIST LOCK RECEPTACLE
- a = AMP RATING

TELEPHONE OUTLET

a — DATA COMMUNICATIONS OUTLET
- a = NETWORK SWITCH

GROUNDING

UNDERGROUND GROUND CABLE #4/0 SDBC UNLESS OTHERWISE NOTED

GROUND ROD

GROUND ROD AND GROUND WELL

RACEWAY

EXPOSED CONDUIT

EXPOSED CONDUIT HIDDEN BEHIND WALLS, FLOORS OR OTHER STRUCTURES

CONDUIT IN DUCT BANK

DIRECT BURIED CONDUIT

CONDUIT IN SLAB

CONDUIT VERTICAL CHANGE IN DIRECTION

BREAK AND CONTINUATION IN CONDUIT RUN

CONDUIT CAP

CONDUIT SEAL

CONDUIT TEE

JUNCTION BOX

DUCT BANK
APPROXIMATE DIMENSIONS SHOWN ON DUCT BANK SECTIONS

CONDUIT SIZE AND CONDUCTORS

INDIVIDUAL CONDUCTORS

W"C-(3-X (Ø), 1-Y (N) & 1-Z (G)

W"C (WHERE INDICATED): W = CONDUIT TRADE SIZE

3-X (Ø):
- 3 = QUANTITY
- X = SIZE OF CONDUCTORS
- (Ø) = DESIGNATES PHASE CONDUCTORS

1-Y (N) (WHERE INDICATED):
- 1 = QUANTITY
- Y = SIZE OF CONDUCTORS
- (N) = DESIGNATES NEUTRAL CONDUCTOR

1-Z (G) (WHERE INDICATED):
- 1 = QUANTITY
- Z = SIZE OF CONDUCTORS
- (G) = DESIGNATES GROUND CONDUCTORS

U{3-X (Ø) & 1-X (G)}
- U = NUMBER OF PARALLEL RUNS

VFD CONDUCTORS

U{[N/C-X (Ø) & INTEGRAL (G)]:VFD}
- U = NUMBER OF PARALLEL RUNS
- N/C = NUMBER OF PHASE CONDUCTORS IN CABLE
- X = SIZE OF CONDUCTORS
- VFD = VFD CABLE

MULTI CONDUCTOR CABLES

K/2/C#16S
- K (WHERE INDICATED) = NUMBER OF PAIRS
- 2/C#16S = TWO CONDUCTOR, 16 GAUGE TWISTED SHIELDED PAIR

K/3/C#16S
- K (WHERE INDICATED) = NUMBER OF TRIPLETS
- 3/C#16S = THREE CONDUCTOR, 16 GAUGE TWISTED SHIELDED TRIPLETS

U{[N/C-X (Ø) & INTEGRAL (G)]:MC}
- U = NUMBER OF PARALLEL RUNS
- MC = MULTICONDUCTOR CABLE
- N/C = NUMBER OF PHASE CONDUCTORS IN THE CABLE
- X = SIZE OF CONDUCTORS

FIRE ALARM

FACP — FIRE ALARM CONTROL PANEL

ELECTRICAL ONE-LINE SYMBOLS

MISCELLANEOUS

HP (a) — MOTOR
- HP = HORSE POWER
- a = RPM
- FULL LOAD AMPS AS NOTED

a / b — PACKAGED EQUIPMENT
LOAD RATING AS INDICATED
- a = RATED LOAD
- b = UNIT (HP, KW, KVA) AS INDICATED

f, g / a b c d e h — TRANSFORMER
- a = DEVICE I.D.
- b = KVA RATING
- c = NUMBER OF PHASES
- d = PRIMARY VOLTAGE
- e = SECONDARY VOLTAGE
- f,g = CONNECTION TYPE SYMBOL
- h = IMPEDANCE

△ — DELTA CONNECTION

GROUND WYE CONNECTION

G ~ / a b c d e f — ENGINE-GENERATOR RATINGS AS INDICATED ON THE DRAWINGS
- a = DESIGNATION
- b = KVA/KW
- c = VOLTAGE/CONNECTION
- d = PHASE
- e = WIRE
- f = PF

a / b — CURRENT TRANSFORMER WITH SHORTING TERMINAL BLOCK
- a = QUANTITY
- b = RATIO

c, a, d / b — POTENTIAL TRANSFORMER
- a = QUANTITY
- b = RATIO
- c,d = CONNECTION SYMBOL

SSM a b — SOLID STATE MULTI-FUNCTION METER
- a = DESIGNATION
- b = NETWORK PROTOCOL

SPD a — SURGE PROTECTIVE DEVICE
- a = DESIGNATION

ATP — AMPERE TEST POINT

VTP — VOLTAGE TEST POINT

a / b — UTILITY METER
- a = DESIGNATION
- b = METER TYPE

LIGHTNING ARRESTOR

DRAWOUT CONNECTION

GROUND

CAPACITOR

BATTERY

(K) — KIRK KEY INTERLOCK

a / b / c — LOAD BANK
- a = DESIGNATION
- b = VOLTAGE
- c = WATTAGE

a / b / c — RESISTOR
- a = DESIGNATION
- b = AMPERAGE
- c = TIME(S)

LOW VOLTAGE

b, c, d / e, a, f, g — LOW VOLTAGE CIRCUIT BREAKER
- a = TYPE
  - MCP = MOTOR CIRCUIT PROTECTOR
  - TM = THERMAL MAGNETIC
  - SS = SOLID STATE
- b = FRAME SIZE (MANUFACTURER TO DETERMINE FRAME SIZE UNLESS INDICATED)
- c = NUMBER OF POLES
- d = TRIP SETTING
  - AT = AMP TRIP
  - AC = MCP CONTINUOUS RATING
- e = DESIGNATION
- f = INTERRUPTING RATING
- g = NETWORK PROTOCOL

LOW VOLTAGE CIRCUIT BREAKER AUXILIARY OPERATOR
- * = S = SHUNT TRIP
- = G = GROUND FAULT INTERRUPTER
- = V = SOLENOID KEY RELEASE

DISCONNECT SWITCH

FUSE

b / a / c — MOTOR STARTER/DRIVE
- a = STARTER TYPE
  - VFD-6 = 6-PULSE VFD
  - VFD-18 = 18-PULSE VFD
  - VFD-RH = REDUCED HARMONIC VFD (18-PULSE OR ACTIVE FRONT END AS DEFINED IN THE SPECIFICATIONS
  - RVSS = REDUCED VOLTAGE SOLID STATE STARTER
  - RVAT = REDUCED VOLTAGE AUTO TRANSFORMER
  - a/B = DEVICE WITH BYPASS STARTER REFER TO THE SPECIFICATIONS
  - FVNR = FULL VOLTAGE NON-REVERSING
  - FVR = FULL VOLTAGE REVERSING REFER TO ABBREVIATIONS LEGEND FOR ALL OTHER DESIGNATIONS
- b = VFD INPUT OPTIONS
  - LL = LINE REACTOR
  - PHF = PASSIVE HARMONIC FILTER
- c = VFD
  - LR = LOAD REACTOR
  - DV/DT = XX
  - SINEWAVE = XX
- c = FVNR
  - SIZE # = NEMA STARTER SIZE

ONE-LINE LINETYPES

ELECTRICAL ONE-LINES

ONE-LINE CONTROL CABLES

EQUIPMENT ENCLOSURE

MEDIUM VOLTAGE

a / b c d e f — AUTOMATIC TRANSFER SWITCH
- a = DESIGNATION
- b = AMP
- c = VOLT
- d = PHASE
- e = POLES
- f = KASC RATING

a / 52 / b — CIRCUIT BREAKER, MEDIUM VOLTAGE
- a = CIRCUIT BREAKER NUMBER
- b = FRAME SIZE

a / b — ANSI RELAY DEVICE
- a = ANSI DEVICE FUNCTION
- b = QUANTITY

MEDIUM VOLTAGE DISCONNECT SWITCH NON-FUSED CUT OUT

MEDIUM VOLTAGE DISCONNECTING FUSE SINGLE FUSE CUT OUT

MEDIUM VOLTAGE DISCONNECTING FUSE DOUBLE FUSE CUT OUT

MEDIUM VOLTAGE SINGLE FUSE

MEDIUM VOLTAGE DOUBLE FUSE

MEDIUM VOLTAGE LINE FRONT TERMINATOR

MEDIUM VOLTAGE ELBOW

MEDIUM VOLTAGE TEE

MOV-ELBOW ARRESTOR

MEDIUM VOLTAGE CONTACTOR

MEDIUM VOLTAGE STARTER

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED CE
DRAWN CE
CHECKED CE
DATE EPTEMBER 2025

COLORADO LICENSED — GARY LEE GILES — 43662 — digitally signed by Gary L. Giles — Contact Info: Carollo Engineers — Date: 2025.09.10 16:54:47 — PROFESSIONAL ENGINEER

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THORNTON WATER PROJECT

CITY OF THORNTON
HORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
ELECTRICAL
LEGEND

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10GE01
SHEET NO. 6 OF 36

LAST SAVED BY: CGilford

PROJECT NO. 203505-100000 FILE NAME: 203505_10GE01.dwg

ABBREVIATIONS

A	AMP
ABS	ABSOLUTE
AC	ALTERNATING CURRENT
ACK	ACKNOWLEDGE
ACTR	ACTUATOR
AF	AMP FRAME
AFC	AUTOMATIC FREQUENCY CONTROL
AIC	AMP INTERRUPTING CAPACITY
AM	AMMETER
ANN	ANNUNCIATOR
ANT	ANTENNA
APU	AUXILIARY POWER UNIT
ARM	ARMORED CABLE
AS	AMMETER SWITCH
ASYM	ASYMMETRICAL
AT	AMP TRIP
ATO	AUTOMATIC THROW OVER
ATP	AMMETER TEST POINT
ATS	AUTOMATIC TRANSFER SWITCH
AUTO XFMR	AUTOMATIC TRANSFORMER
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
B	BELL
BAT	BATTERY
BFG	BELOW FINISHED GRADE
BHP	BRAKE HORSEPOWER
BKR	BREAKER
BRF	BELOW RAISED FLOOR
C	CONDUIT / CONTINUOUS LOAD
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CCW	COUNTER CLOCKWISE
CKT	CIRCUIT
COAX	COAXIAL CABLE
COM	COMMON
COMM	COMMUNICATION
CPT	CONTROL POWER TRANSFORMER
CR	CONTROLLED RECEPTACLE
CS	CONTROL SWITCH
CT	CURRENT TRANSFORMER
CV	CONTROL VALVE
CW	CLOCKWISE / COOL WHITE
DC	DIRECT CURRENT
DCS	DISTRIBUTED CONTROL SYSTEM
DCU - X	DISTRIBUTED CONTROL UNIT NO. X
DEMO	DEMOLITION
DISC	DISCONNECT SWITCH
DM	DEMAND METER
DPDT	DOUBLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DS	DOOR SWITCH
E/G	EMERGENCY GENERATOR
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
ENCL	ENCLOSURE
ENG	ENGINE
ENT	ELECTRICAL NON-METALLIC TUBING
EP	EXPLOSION PROOF
ETM	ELAPSED TIME METER
F	SUB-FED
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FDR	FEEDER
FLA	FULL LOAD AMPS
FLX	FLEXIBLE CONDUIT
FO	FIBER OPTIC
FRC	FIBERGLASS RIGID CONDUIT
FREQ	FREQUENCY
FU	FUSE
FU SW	FUSED SWITCH
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
FWD	FORWARD
G	GROUND / EQUIPMENT GROUND / GROUND FAULT
GEN	GENERATOR
GRC	GALVANIZED STEEL RIGID CONDUIT
GFCI	GROUND FAULT CIRCUIT INTERRUPTER (RECEPTACLE)
GFI	GROUND FAULT INTERRUPTER (BREAKER)
GFR	GROUND FAULT RELAY
H	HOT-LEG
HF	HIGH FREQUENCY
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HR	HOUR
HSTAT	HUMIDISTAT
HV	HIGH VOLTAGE
HVAC	HEATING/VENTILATION/AIR CONDITIONING
HZ	HERTZ
I	INSTANTANEOUS / INTERMITTENT LOAD
IC	INTERRUPTING CAPACITY
IJB	INSTRUMENT JUNCTION BOX
IMC	INTERMEDIATE METAL CONDUIT
INST	INSTANTANEOUS
INT	INTERLOCK
INTERCOM	INTERCOMMUNICATION
J	JUNCTION BOX
K	KEY INTERLOCK
KA	KILOAMP
KV	KILOVOLT
KVA	KILOVOLT AMPERE
KVAR	KILOVAR (REACTANCE)
KW	KILOWATT
KWD	KILOWATT DEMAND
KWH	KILOWATT HOUR
L	LONG-TIME
L-B	LINE-BUS
L-G	LINE-GROUND
LA	LIGHTNING ARRESTOR
LBL	LABEL
LC	LIGHTING CONTACTOR
LCP- X	LOCAL CONTROL PANEL NO. X
LL	LEAD-LAG LOAD REACTOR
LP	LIGHT POLE
LP - X	LIGHTING PANEL NO. X
LTG	LIGHTING
LV	LOW VOLTAGE
LVL	LEVEL
M-X	MOTOR CONTROLLER NO. X
MA	MILLIAMPERE
MCA	MOTOR CIRCUIT AMPS
MCC - X	MOTOR CONTROL CENTER NO. X
MCP	MOTOR CIRCUIT PROTECTOR
MH	MANHOLE / MOUNTING HEIGHT
MLO	MAIN LUGS ONLY
MOD	MOTOR OPERATED DAMPER
MOV	METAL OXIDE VARISTOR
MPR	MOTOR PROTECTION RELAY
MS-X	MOTOR STARTER NO. X
MSP	MOTOR STARTING PANEL
MTO	MANUAL THROW OVER
MTR-X	MOTOR NO. X
MTS	MANUAL TRANSFER SWITCH
MV	MEGAVOLT
MVA	MEGAVOLT-AMPERES
MVS	MEDIUM VOLTAGE SWITCH
MW	MEGAWATT
N	NEUTRAL
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NFC	NONMETALLIC FLEXIBLE CONDUIT
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NP	NAMEPLATE
O	OPEN OR OPENED
OH	OVERHEAD
OL	OVERLOAD RELAY
P	POLE
PA	PUBLIC ADDRESS
PB	PUSHBUTTON / PULL BOX
PCS	PVC COATED GALVANIZED STEEL CONDUIT
PCM	PROCESS CONTROL MODULE
PE	PHOTOCELL
PF	POWER FACTOR
PFCC	POWER FACTOR CORRECTION CAPACITOR
PFR	PHASE FAILURE RELAY
PH	PHASE
PNL	PANEL
PPX	POWER PANEL NO. X
PRI	PRIMARY
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE RIGID PLASTIC CONDUIT
PWR	POWER
RAC	RIGID ALUMINUM CONDUIT
RECPT	RECEPTACLE
REV	REVERSE
RF	RADIO FREQUENCY
RMS	ROOT MEAN SQUARED
RVAT	REDUCED VOLTAGE AUTO TRANSFORMER
RVNR	REDUCED VOLTAGE NON-REVERSING
RVSS	REDUCED VOLTAGE SOLID STATE
S	SHIELD / SHORT-TIME
SA	SURGE ARRESTER
SC	SHORT CIRCUIT
SDBC	SOFT DRAWN BARE COPPER
SFL	SUB FEED LUGS
SLT	SEALTIGHT LIQUIDTIGHT FLEXIBLE CONDUIT
SM	SURFACE MOUNTED
SP	SINGLE POLE
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE DOUBLE THROW
SPST	SINGLE POLE SINGLE THROW
SPKR	SPEAKER
SS	SOLID STATE
STB	SHORTING TERMINAL BLOCK
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
TACH	TACHOMETER
TB - X	TERMINAL BLOCK - UNIT X
TC	THERMOCOUPLE / TIME CLOCK / TRAY CABLE
TD	TEMPERATURE DETECTOR RELAY
TE	TOTALLY ENCLOSED
TEFC	TOTALLY ENCLOSED FAN COOLED
TENV	TOTALLY ENCLOSED NON-VENTILATED
TERM	TERMINAL
TJB	TERMINAL JUNCTION BOX
TM	THERMAL MAGNETIC
TP	TWISTED PAIR
TS	TEMPERATURE SWITCH
TS1W	TWO SPEED CONSEQUENT POLE, ONE WINDING
TS2W	TWO SPEED SEPARATE WINDING
TSTAT	THERMOSTAT
UHF	ULTRA HIGH FREQUENCY
UNG	UNGROUNDED
UPS	UNINTERRUPTIBLE POWER SUPPLY
UVR	UNDER VOLTAGE RELAY
V	VOLT
VA	VOLT AMPERE
VAR	VARMETER
VCP	VENDOR CONTROL PANEL
VFD	VARIABLE FREQUENCY DRIVE
VHF	VERY HIGH FREQUENCY
VM	VOLTMETER
VP	VAPORPROOF
VR	VOLTAGE REGULATOR
VS	VOLTAGE SWITCH
VT	VOLTAGE TRANSFORMER
VTP	VOLTAGE TEST POINT
W	WATT / WEST
WT	WATER TIGHT
WP	WEATHER PROOF
XFMR	TRANSFORMER

NOTES:

1. REFER TO SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL ABBREVIATIONS.

POWER DEVICE FUNCTION NUMBERS

1	MASTER ELEMENT
2	TIME-DELAY STARTING OR CLOSING RELAY
3	CHECKING OR INTERLOCKING RELAY
4	MASTER CONTACTOR
5	STOPPING DEVICE
6	STARTING CIRCUIT BREAKER
7	ANODE CIRCUIT BREAKER
8	CONTROL POWER DISCONNECTING DEVICE
9	REVERSING DEVICE
10	UNIT SEQUENCE SWITCH
11	MULTIFUNCTION DEVICE
12	OVER-SPEED DEVICE
13	SYNCHRONOUS-SPEED DEVICE
14	UNDER-SPEED DEVICE
15	SPEED OR FREQUENCY MATCHING DEVICE
16	DATA COMMUNICATIONS DEVICE
17	SHUNTING OR DISCHARGE SWITCH
18	ACCELERATING OR DECELERATING DEVICE
19	STARTING-TO-RUNNING TRANSITION CONTACTOR
20	ELECTRICALLY OPERATED VALVE
21	DISTANCE RELAY
22	EQUALIZER CIRCUIT BREAKER
23	TEMPERATURE CONTROL DEVICE
24	VOLTS PER HERTZ RELAY
25	SYNCHRONIZING OR SYNCHRONISM-CHECK DEVICE
26	APPARATUS THERMAL DEVICE
27	UNDERVOLTAGE RELAY
27N	GROUND FAULT UNDERVOLTAGE RELAY
28	FLAME DETECTOR
29	ISOLATING CONTACTOR
30	ANNUNCIATOR RELAY
31	SEPARATE EXCITATION DEVICE
32	DIRECTIONAL POWER RELAY
33	POSITION SWITCH
34	MASTER SEQUENCE DEVICE
35	BRUSH-OPERATING OR SLIP-RING SHORT-CIRCUITING DEVICE
36	POLARITY DEVICE
37	UNDERCURRENT OR UNDERPOWER RELAY
38	BEARING PROTECTIVE DEVICE
39	MECHANICAL CONDITION MONITOR
40	FIELD RELAY
41	FIELD CIRCUIT BREAKER
42	RUNNING CIRCUIT BREAKER
43	MANUAL TRANSFER OR SELECTOR DEVICE
44	UNIT SEQUENCE STARTING RELAY
45	ABNORMAL ATMOSPHERIC CONDITION MONITOR
46	REVERSE-PHASE OR BALANCE CURRENT RELAY
47	PHASE-BALANCE OR PHASE-SEQUENCE VOLTAGE RELAY
48	INCOMPLETE SEQUENCE RELAY
49	MACHINE OR TRANSFORMER THERMAL RELAY
50	INSTANTANEOUS OVERCURRENT RELAY
51	AC TIME OVERCURRENT RELAY
52	AC CIRCUIT BREAKER
53	FIELD EXCITATION RELAY
54	TURNING GEAR ENGAGING DEVICE
55	POWER FACTOR RELAY
56	FIELD APPLICATION RELAY
57	SHORT-CIRCUITING OR GROUNDING DEVICE
58	RECTIFICATION FAILURE RELAY
59	OVERVOLTAGE RELAY
60	VOLTAGE OR CURRENT BALANCE RELAY
61	DENSITY SWITCH OR SENSOR
62	TIME-DELAY STOPPING OR OPENING RELAY
63	PRESSURE SWITCH
64	GROUND DETECTOR RELAY
65	GOVERNOR
66	NOTCHING OR JOGGING DEVICE
67	AC DIRECTIONAL OVERCURRENT RELAY
68	BLOCKING OR OUT OF STEP RELAY
69	PERMISSIVE CONTROL DEVICE
70	RHEOSTAT
71	LIQUID LEVEL SWITCH
72	DC CIRCUIT BREAKER
73	LOAD-RESISTOR CONTACTOR
74	ALARM RELAY
75	POSITION CHANGING MECHANISM
76	DC OVERCURRENT RELAY
77	TELEMETERING DEVICE
78	PHASE-ANGLE MEASURING RELAY
79	AC RECLOSING RELAY
80	FLOW SWITCH
81	FREQUENCY RELAY
82	DC LOAD MEASURING RECLOSING RELAY
83	AUTOMATIC SELECTIVE CONTROL OR TRANSFER RELAY
84	OPERATING MECHANISM
85	PILOT COMMUNICATIONS, CARRIER OR PILOT-WIRE RELAY
86	LOCKOUT RELAY
87	DIFFERENTIAL PROTECTIVE RELAY
88	AUXILIARY MOTOR OR MOTOR GENERATOR
89	LINE SWITCH
90	REGULATING DEVICE
91	VOLTAGE DIRECTIONAL RELAY
92	VOLTAGE AND POWER DIRECTIONAL RELAY
93	FIELD-CHANGING CONTACTOR
94	TRIPPING OR TRIP-FREE RELAY

COMMONLY USED SUFFIX LETTER APPLIED TO POWER DEVICE FUNCTION NUMBERS

A	ALARM ONLY
B	BUS PROTECTION
G	GROUND FAULT PROTECTION (RELAY CT IN A SYSTEM NEUTRAL CIRCUIT OR GENERATOR PROTECTION)
GS	GROUND FAULT PROTECTION (RELAY CT IN TOROIDAL OR GROUND SENSOR TYPE)
L	LINE PROTECTION
M	MOTOR PROTECTION
N	NEGATIVE SEQUENCE (RELAY COIL CONNECTED IN RESIDUAL CT CIRCUIT)
T	TRANSFORMER PROTECTION
V	VOLTAGE
P	PHASE PROTECTION

ABBREVIATIONS

AFD	ARC FLASH DETECTOR
CLK	CLOCK OR RIMING SOURCE
DDR	DYNAMIC DISTURBANCE RECORDER
DFR	DIGITAL FAULT RECORDER
ENV	ENVIRONMENTAL DATA
HIZ	HIGH IMPEDANCE FAULT DETECTOR
HMI	HUMAN MACHINE INTERFACE
HST	HISTORIAN
LGC	SCHEME LOGIC
MET	SUBSTATION METERING
PDC	PHASOR DATA CONCENTRATOR
PMU	PHASOR MEASUREMENT UNIT
PQM	POWER QUALITY MONITOR
RIO	REMOTE I/O DEVICE
RTU	REMOTE TELEMETRY UNIT/REMOTE TERMINAL UNIT
SER	SEQUENCE OF EVENTS RECORDER
TCM	TRIP CIRCUIT MONITOR

REV	DATE	BY	DESCRIPTION

ISSUED FOR BID

DESIGNED CE
DRAWN CE
CHECKED CE
DATE SEPTEMBER 2025

COLORADO LICENSED — Brett LEE GILES — 43662 — Digitally signed by Bart L. Giles — Date: 2025.09.10 16:54:48 -06'00' — PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

ELECTRICAL

ABBREVIATIONS

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505

DRAWING NO. 10GE02

SHEET NO. 7 OF 36

LAST SAVED BY: CGifford

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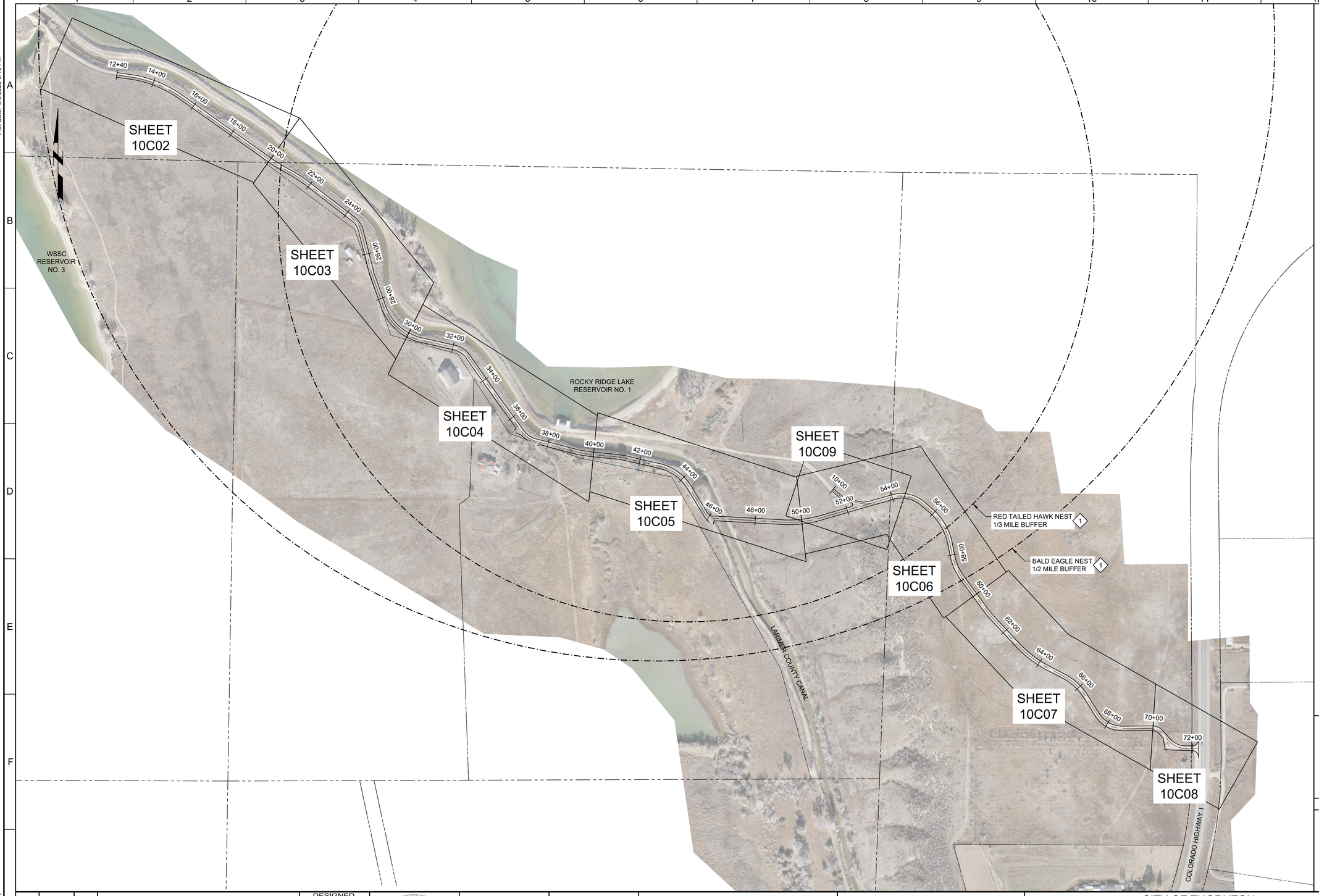

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.

KEY NOTES:

1. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

811 Know what's below. Call before you dig.

Call before you Overhead

SCALE

0 100' 200' 400'

SCALE: 1" = 200'

REV	DATE	BY	DESCRIPTION

ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED BART LEE GILES 43662 PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

CIVIL

ROAD KEYPLAN

VERIFY SCALES

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0 1"

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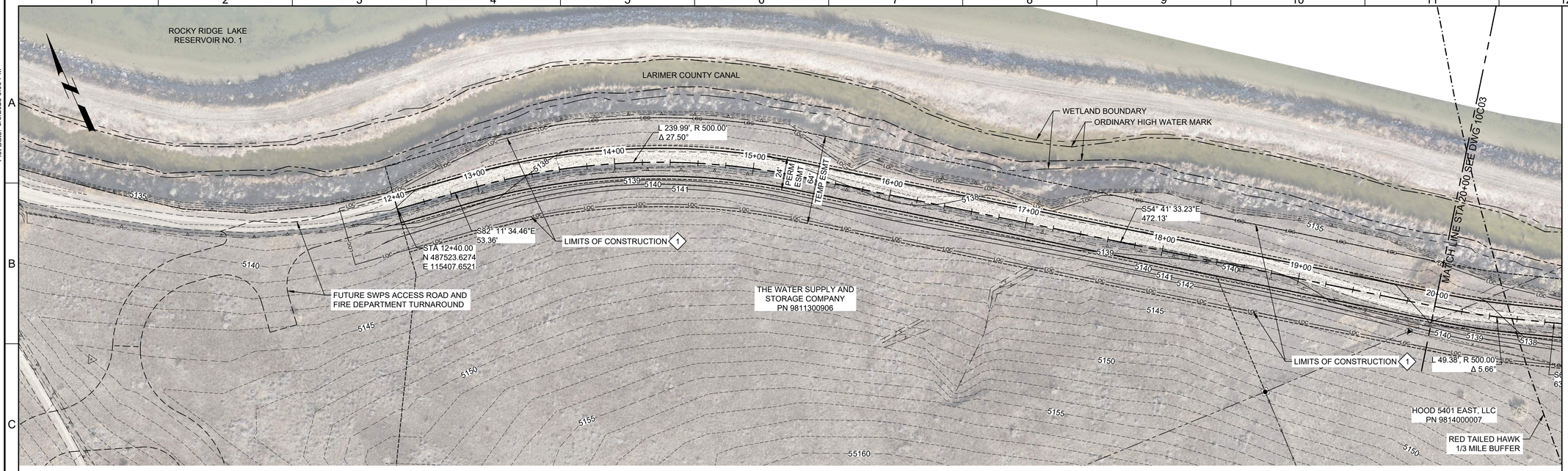
JOB NO. 203505

DRAWING NO. 10C01

SHEET NO. 8 OF 36

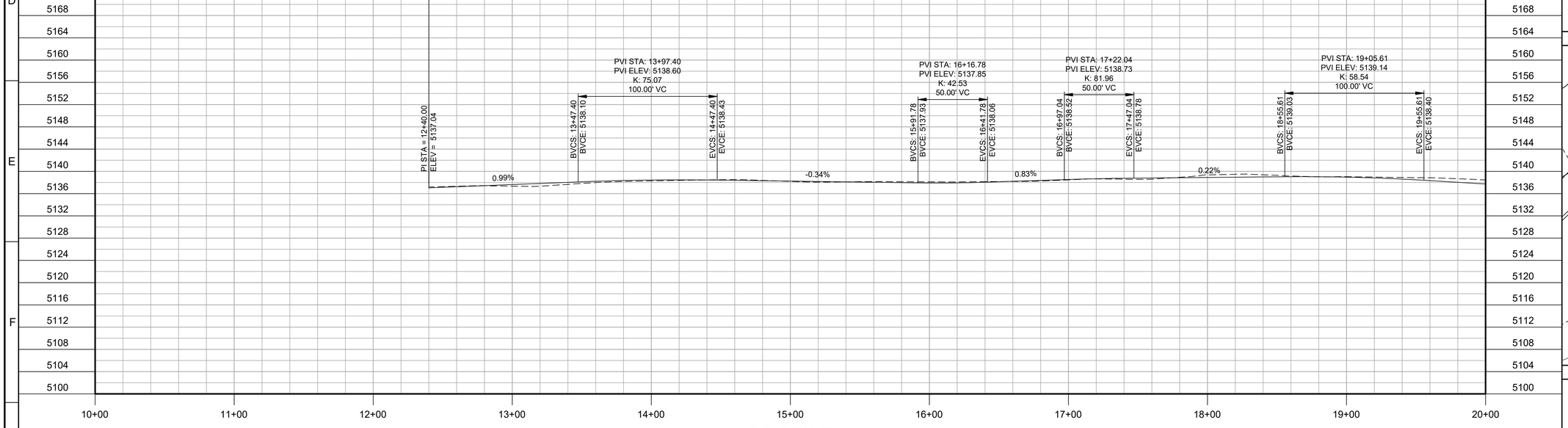
LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510C01.DWG



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. ALL WORK SHOWN ON THIS SHEET IS WITHIN THE BALD EAGLE NEST BUFFER. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

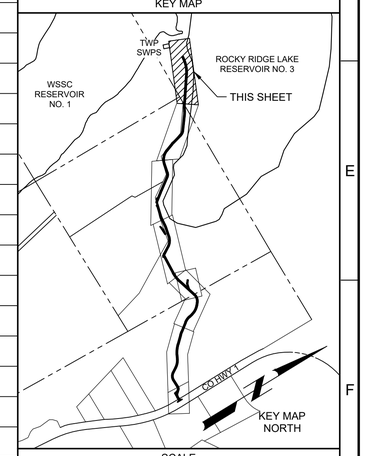
KEY NOTES:

1. CONSTRUCTION TO OCCUR WITHIN LIMITS OF CONSTRUCTION SHOWN HEREON. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK, EVEN IN AREAS WHERE THE TEMPORARY EASEMENT EXTENDS INTO THE CANAL.

Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

0 5' 10' 20'

SCALE: 1" = 10'

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GEER
43662
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD PLAN & PROFILE
STA 12+40 TO 20+00

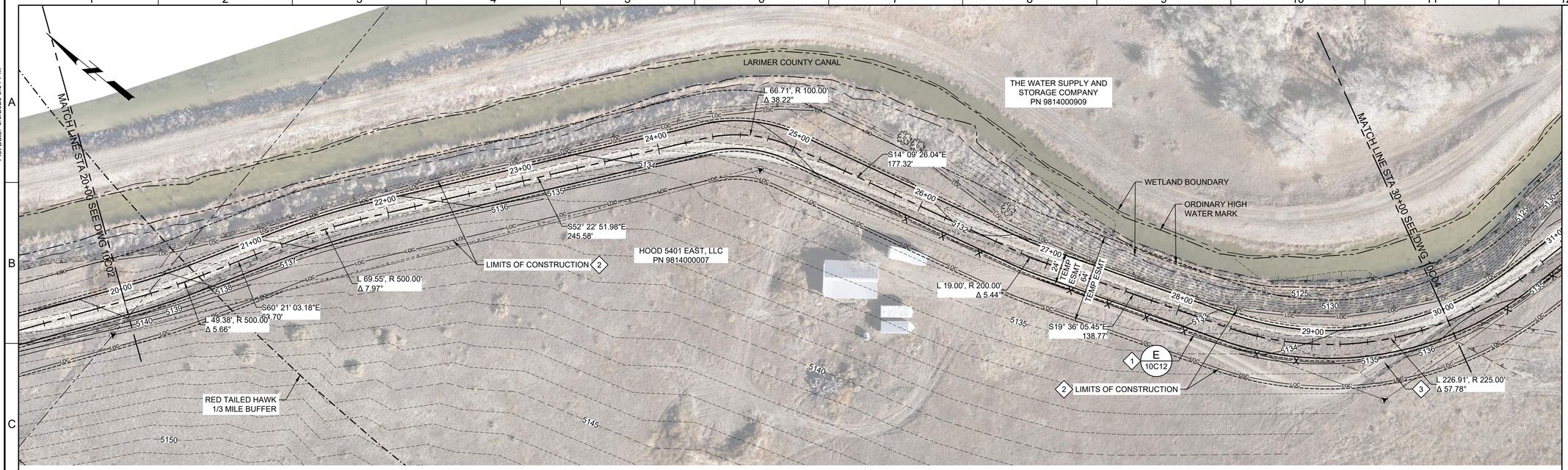
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C02
SHEET NO. 9 OF 36

LAST SAVED BY: RFALK

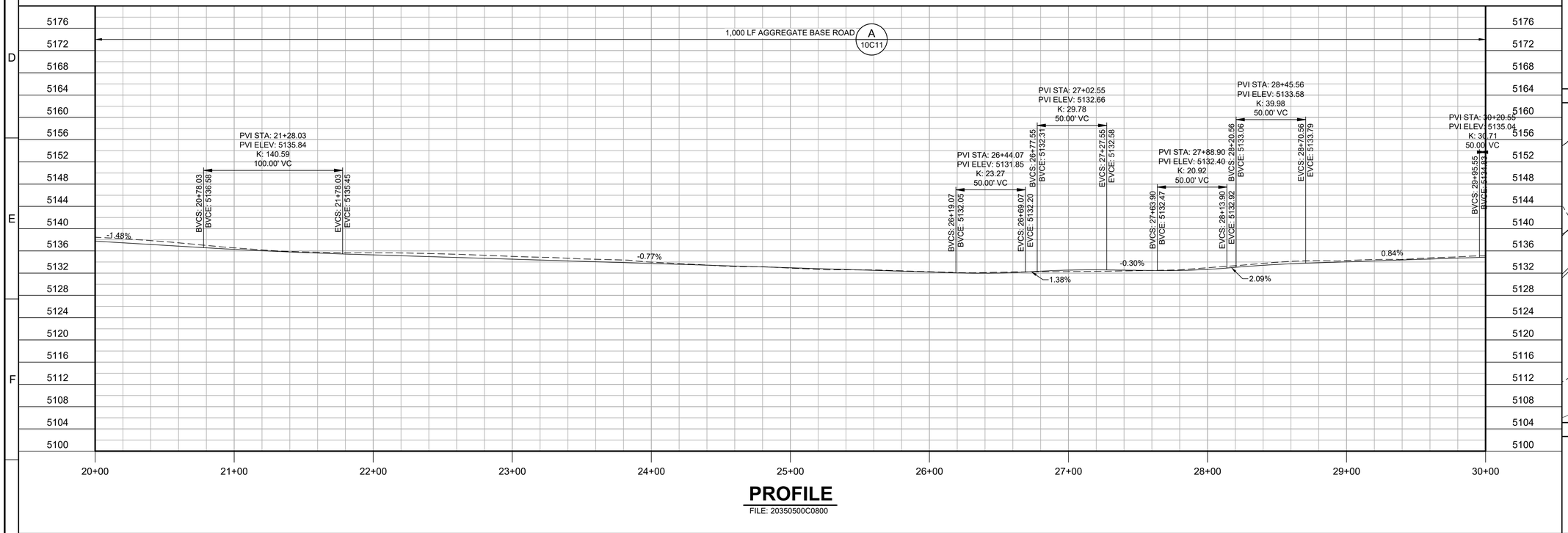
PROJECT NO. 203505 FILE NAME: 20350510C02.DWG

Plot Date: 9/9/2025 3:01 PM



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK EXCEPT AT THE CANAL CROSSING LOCATION.

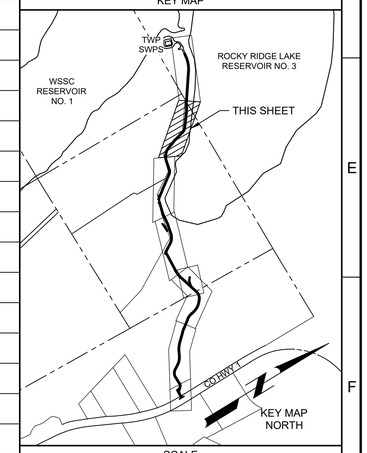
KEY NOTES:

1. RESTORE BARBED WIRE FENCE, PLACE OUTSIDE OF ROAD EXTENTS AS SHOWN.
2. CONSTRUCTION TO OCCUR WITHIN LIMITS OF CONSTRUCTION SHOWN HEREON. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK, EVEN IN AREAS WHERE THE TEMPORARY EASEMENT EXTENDS INTO THE CANAL.
3. CONTRACTOR TO PROVIDE SMOOTH TRANSITION TO EXISTING DIRT ROAD.

811 Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

0 5' 10' 20'

SCALE: 1" = 10'

LAST SAVED BY: RFALK

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GILES 43662 PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

CIVIL

ROAD PLAN & PROFILE STA 20+00 TO 30+00

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

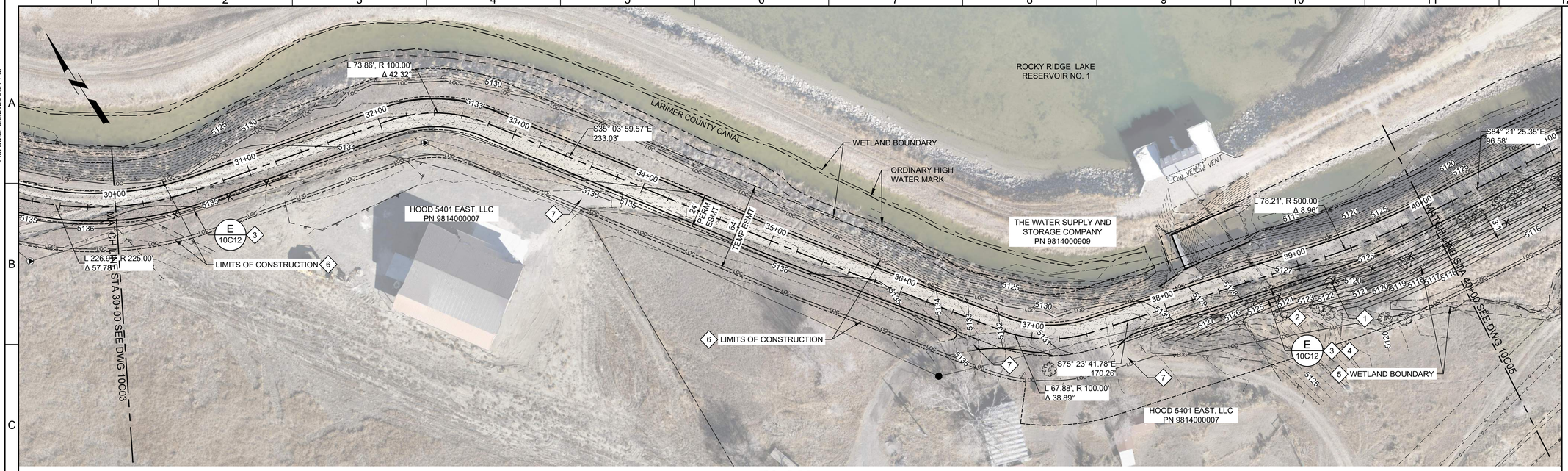
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505

DRAWING NO. 10C03

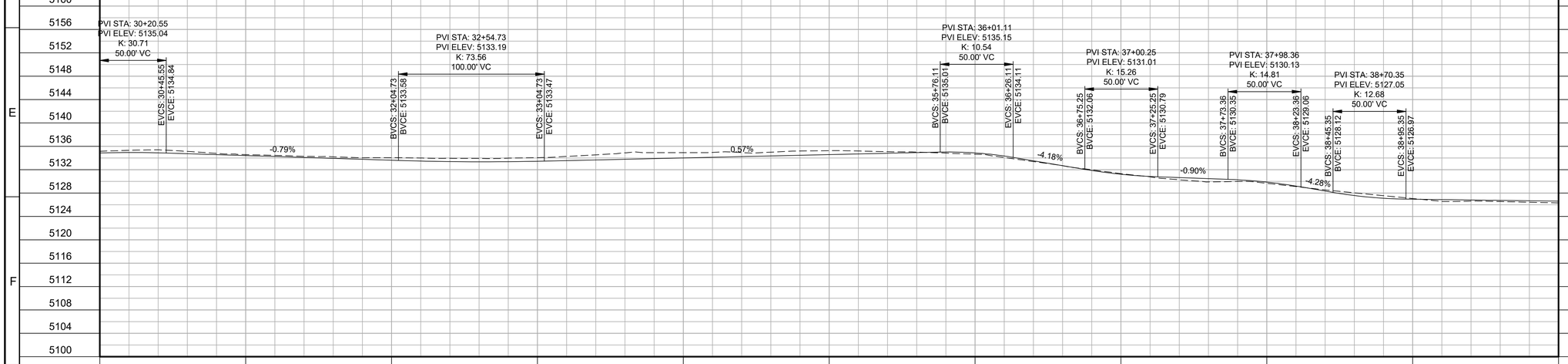
SHEET NO. 10 OF 36

PROJECT NO. 203505 FILE NAME: 20350510C02.DWG



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. CONTRACTOR TO APPLY NECESSARY SAFETY PRECAUTIONS FOR WORK UNDER OVERHEAD POWER LINE.
3. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK EXCEPT AT THE CANAL CROSSING LOCATION.
4. ALL WORK SHOWN ON THIS SHEET IS WITHIN THE BALD EAGLE NEST BUFFER. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

KEY NOTES:

1. REMOVE ALL EXISTING TREES WITHIN GRADED AREA.
2. PVREA POWER POLE TO BE RELOCATED BY PVREA DURING ROAD CONSTRUCTION. CONTRACTOR TO REMOVE TREES AND BRUSH AROUND POLE FOR RELOCATION AND COORDINATE GRADING WORK WITH PVREA.
3. RESTORE BARBED WIRE FENCE, PLACE OUTSIDE OF ROAD EXTENTS AS SHOWN.
4. CONTRACTOR RESPONSIBLE FOR PROVIDING AND MAINTAINING TEMPORARY LIVESTOCK FENCING DURING CONSTRUCTION.
5. SEE RESEEDING REQUIREMENTS SHOWN ON EROSION CONTROL PLANS, SHEET 10EC04. SEE SPECIFICATION SECTION 32_92_19 SEEDING FOR TOPSOIL PRESERVATION AND OTHER REQUIREMENTS.
6. CONSTRUCTION TO OCCUR WITHIN LIMITS OF CONSTRUCTION SHOWN HEREON. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK, EVEN IN AREAS WHERE THE TEMPORARY EASEMENT EXTENDS INTO THE CANAL.
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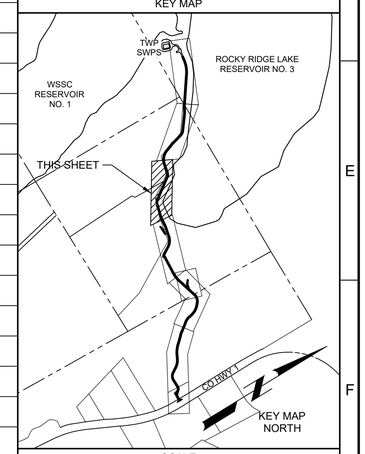

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REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED RJF
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GEER
43662
Digitally signed by Bart L. Gilles
DN: cn=Carollo Engineers, c=US
2025.09.10 15:38:47
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD PLAN & PROFILE
STA 30+00 TO 40+00

VERIFY SCALES
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0 1"
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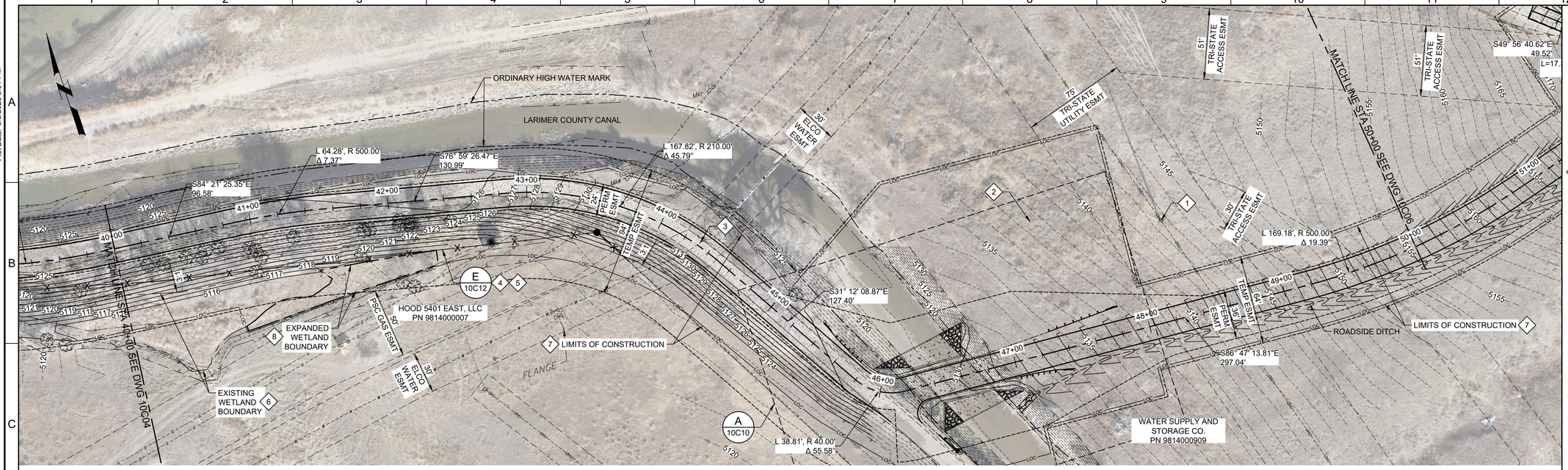
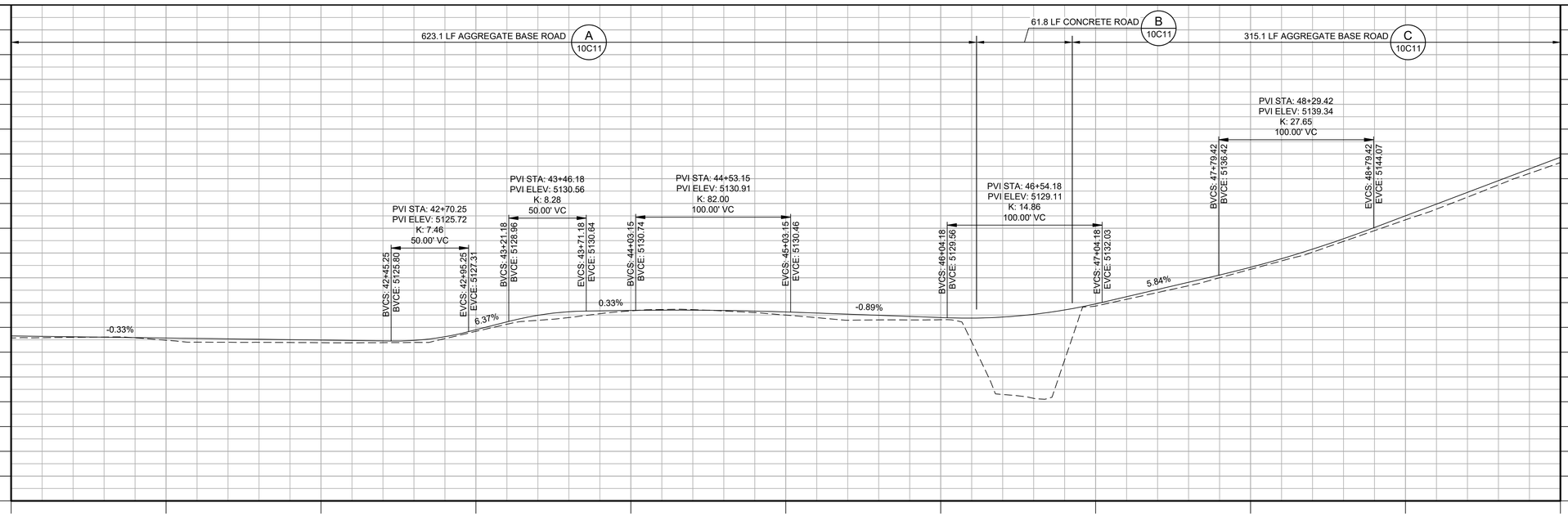
JOB NO. 203505
DRAWING NO. 10C04
SHEET NO. 11 OF 36

Plot Date: 9/9/2025 3:01 PM
LAST SAVED BY: RFALK
PROJECT NO. 203505
FILE NAME: 20350510C02.DWG



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

GENERAL NOTES:

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4. ALL WORK SHOWN ON THIS SHEET IS WITHIN THE BALD EAGLE NEST BUFFER. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

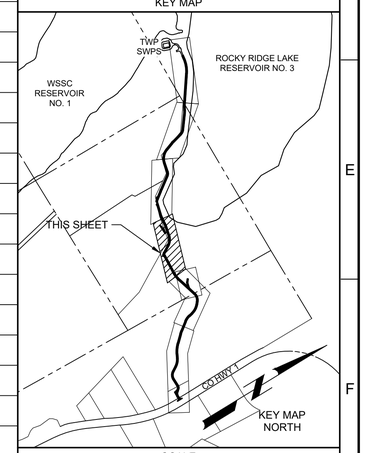
KEY NOTES:

1. PROTECT IN PLACE EXISTING POWER POLE.
2. CONSTRUCTION LAYDOWN AREA TO BE LOCATED OUTSIDE OF TRI-STATE UTILITY EASEMENT AND LCC. CONTRACTOR TO RESTORE AREA TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION.
3. PROVIDE MINIMUM 4.5' OF COVER OVER EXISTING 12" ELCO WATER LINE AND MINIMIZE ADDITIONAL COVER OVER WATER LINE. CONTRACTOR TO PROVIDE ADEQUATE PROTECTION OF EXISTING WATER LINE DURING GRADING, ROAD INSTALLATION, AND COMPACTION OPERATIONS.
4. RESTORE BARBED WIRE FENCE, PLACE OUTSIDE OF ROAD EXTENTS AS SHOWN.
5. CONTRACTOR RESPONSIBLE FOR PROVIDING AND MAINTAINING TEMPORARY LIVESTOCK FENCING DURING CONSTRUCTION.
6. SEE RESEEDING REQUIREMENTS SHOWN ON EROSION CONTROL PLANS, SHEET 10EC04. SEE SPECIFICATION SECTION 32_92_19 SEEDING FOR TOPSOIL PRESERVATION AND OTHER REQUIREMENTS.
7. CONSTRUCTION TO OCCUR WITHIN LIMITS OF CONSTRUCTION SHOWN HEREON. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK, EVEN IN AREAS WHERE THE TEMPORARY EASEMENT EXTENDS INTO THE CANAL.
8. CREATE APPROXIMATELY 1,950 SF ADDITIONAL WETLAND AREA PER SOURCE WATER PUMP STATION WETLAND MITIGATION PLAN, SEE SPECIFICATION SECTION 01_11_00.

Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



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			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GEER
43662
Digitally signed by Bart L. Gilles
PE/Inspector Info: Carollo Engineers, Inc.
2025.09.10 15:49:42 -06'00'
PROFESSIONAL ENGINEER

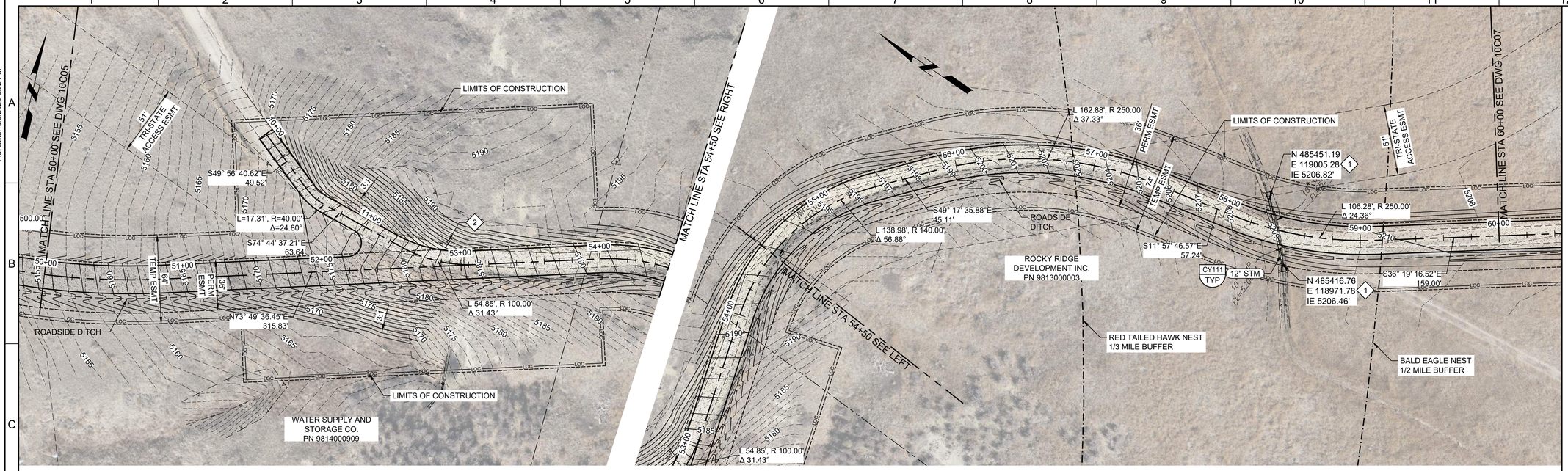
CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD PLAN & PROFILE STA 40+00 TO 50+00

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C05
SHEET NO. 12 OF 36

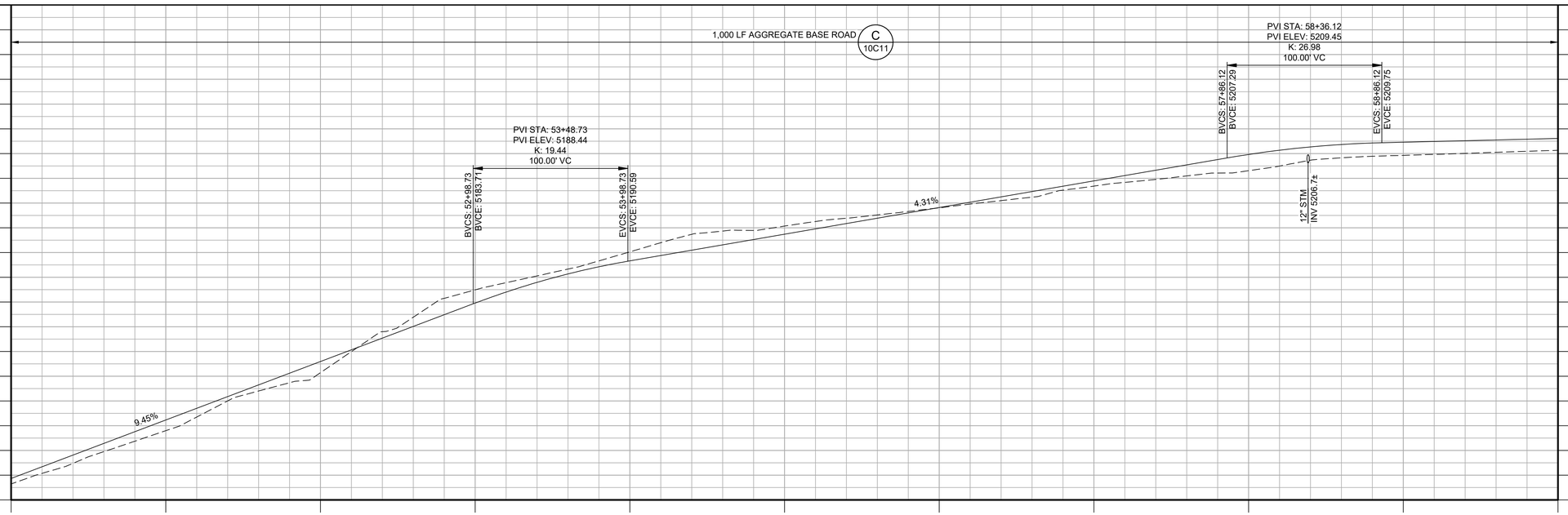
LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510C02.DWG



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. WORK RESTRICTIONS APPLY TO WORK SHOWN ON THIS SHEET WITHIN THE BALD EAGLE NEST BUFFER. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFER.

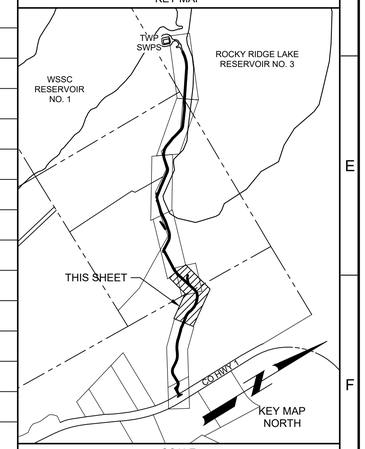
(#) KEY NOTES:

1. REMOVE 20-LF EXISTING 10" CMP AND REPLACE WITH 48-LF 12" CLASS V RCP STORM DRAIN PIPE WITH FLARED END SECTIONS. RCP INVERT ELEVATIONS ARE BASED ON SURVEY AND MAY REQUIRE FIELD ADJUSTMENT TO MATCH EXISTING CHANNEL INVERT.
2. INSTALL TUBULAR STEEL WAYFINDING "SOURCE WATER PUMP STATION" SIGN WITH ARROW POINTING WEST TOWARDS PUMP STATION SITE.

811 Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

0 5' 10' 20'

SCALE: 1" = 10'

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED GARY LEE GEES 43662 PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

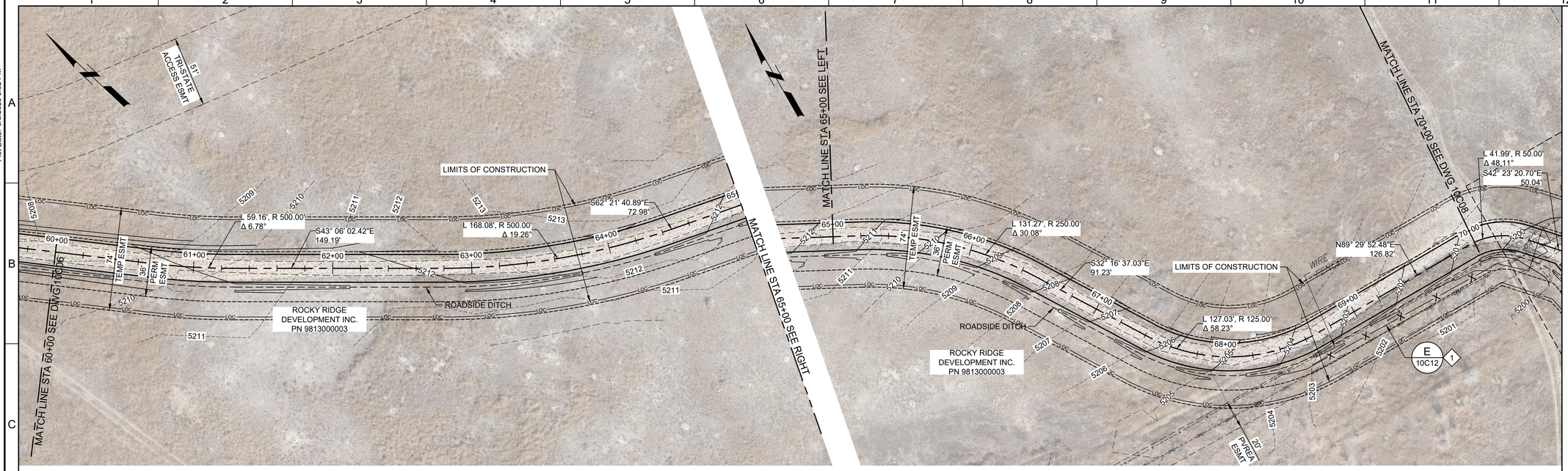
CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD PLAN & PROFILE
STA 50+00 TO 60+00

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C06
SHEET NO. 13 OF 36

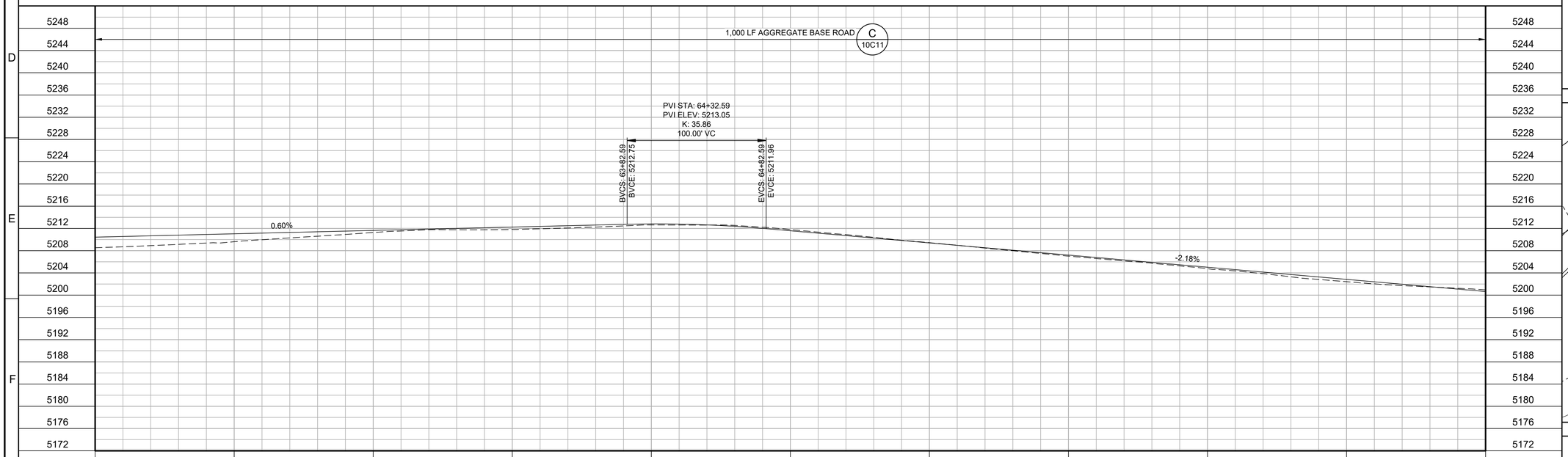
LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510C02.DWG



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.

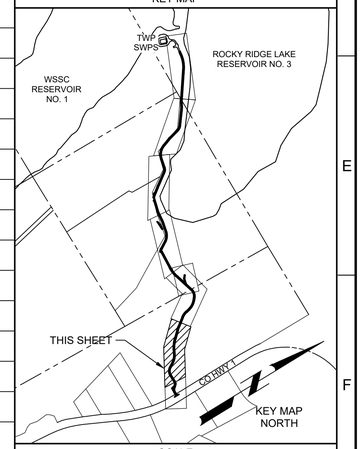
KEY NOTES:

1. RESTORE BARBED WIRE FENCE, PLACE OUTSIDE OF ROADSIDE DITCH AS SHOWN.

Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

0 5' 10' 20'

SCALE: 1" = 10'

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED — GARY LEE GEER — 43662 — Digitally signed by Bart L. Gilles — Contact Info: Carollo Engineers — 2025.09.10 15:46:47 -06:00 — PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD PLAN & PROFILE
STA 60+00 TO 70+00

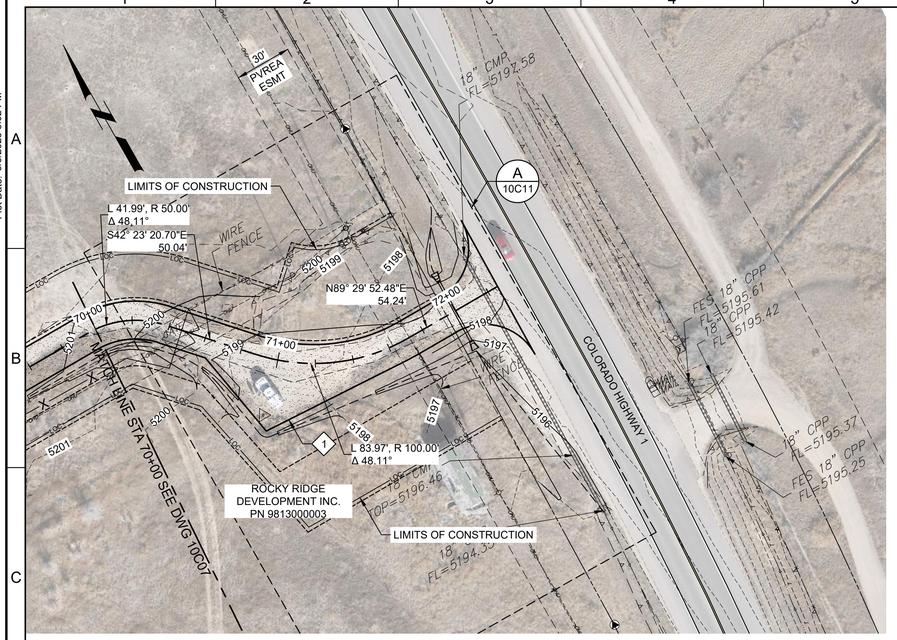
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C07
SHEET NO. 14 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510C02.DWG

Plot Date: 9/9/2025 3:02 PM



PLAN

FILE: 20350500C0800

PROFILE

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.

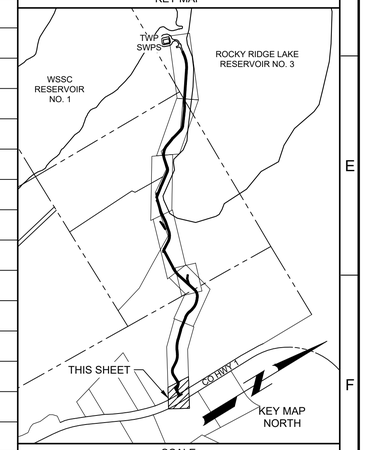
KEY NOTES:

1. ROAD TURN-OUT AREA, MATCH ROAD SECTION PER DETAIL C, SHEET 10C12.

Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

0 5' 10' 20'

SCALE: 1" = 10'

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GEER
43662
Digitally signed by Bart L. Gilles
Contact info: Carollo Engineers, Inc.
Date: 2025.09.10 16:41:49 -06'00'
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD PLAN & PROFILE
STA 70+00 TO 72+25

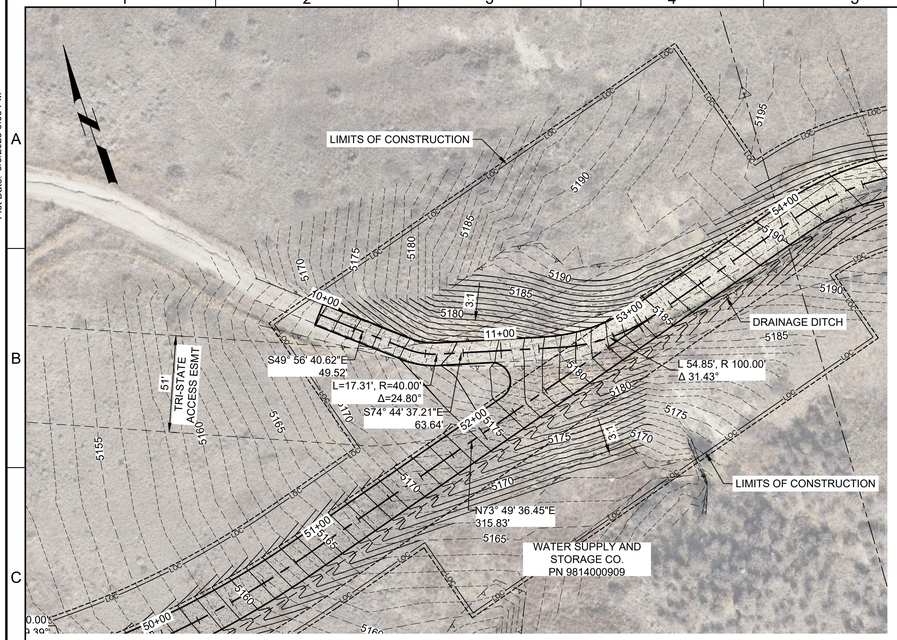
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C08
SHEET NO. 15 OF 36

LAST SAVED BY: RFALK

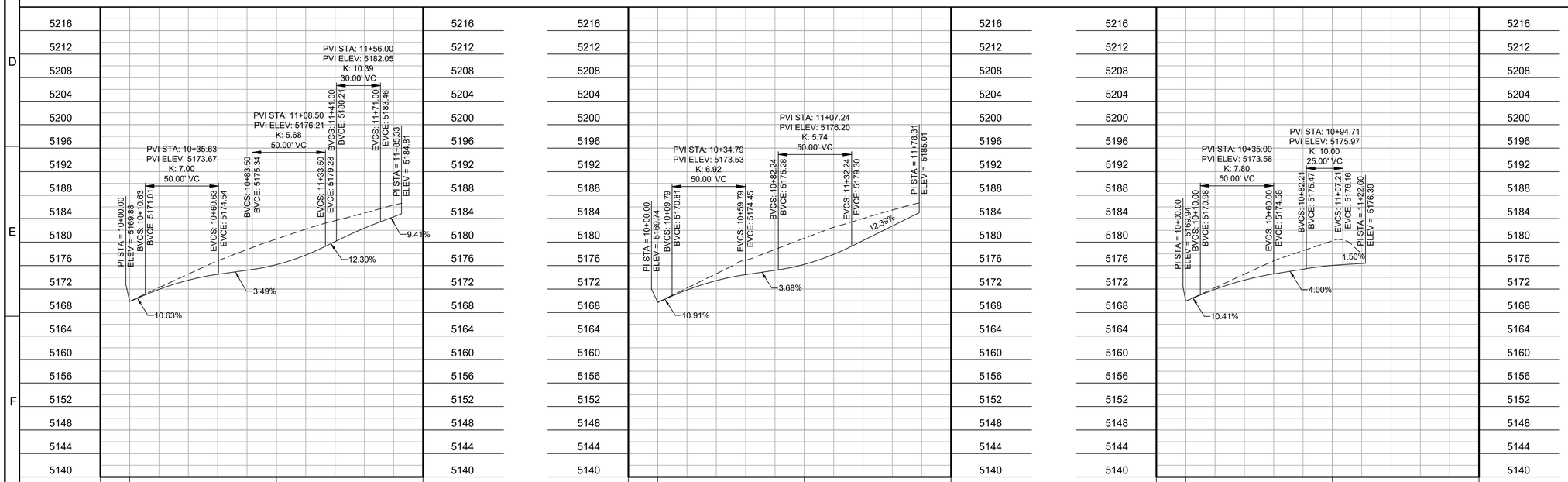
Plot Date: 9/9/2025 3:02 PM

PROJECT NO. 203505 FILE NAME: 20350510C02.DWG



PLAN

FILE: 20350500C0800



PROFILE

FILE: 20350500C0800

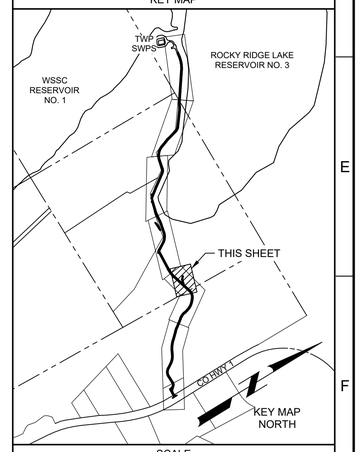
GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. ALL WORK SHOWN ON THIS SHEET IS WITHIN THE BALD EAGLE NEST BUFFER. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

811 Know what's below. Call before you dig.

Call before you Overhead

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

0 5' 10' 20'

SCALE: 1" = 10'

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED — GARY LEE GILES — 43662 — Digitally signed by Gary L. Giles — Contact Info: Carollo Engineers — Date: 2025.09.10 16:49:22 -06'00' — PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROCKY RIDGE LAKE RESERVOIR NO. 1 ACCESS ROAD

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C09
SHEET NO. 16 OF 36

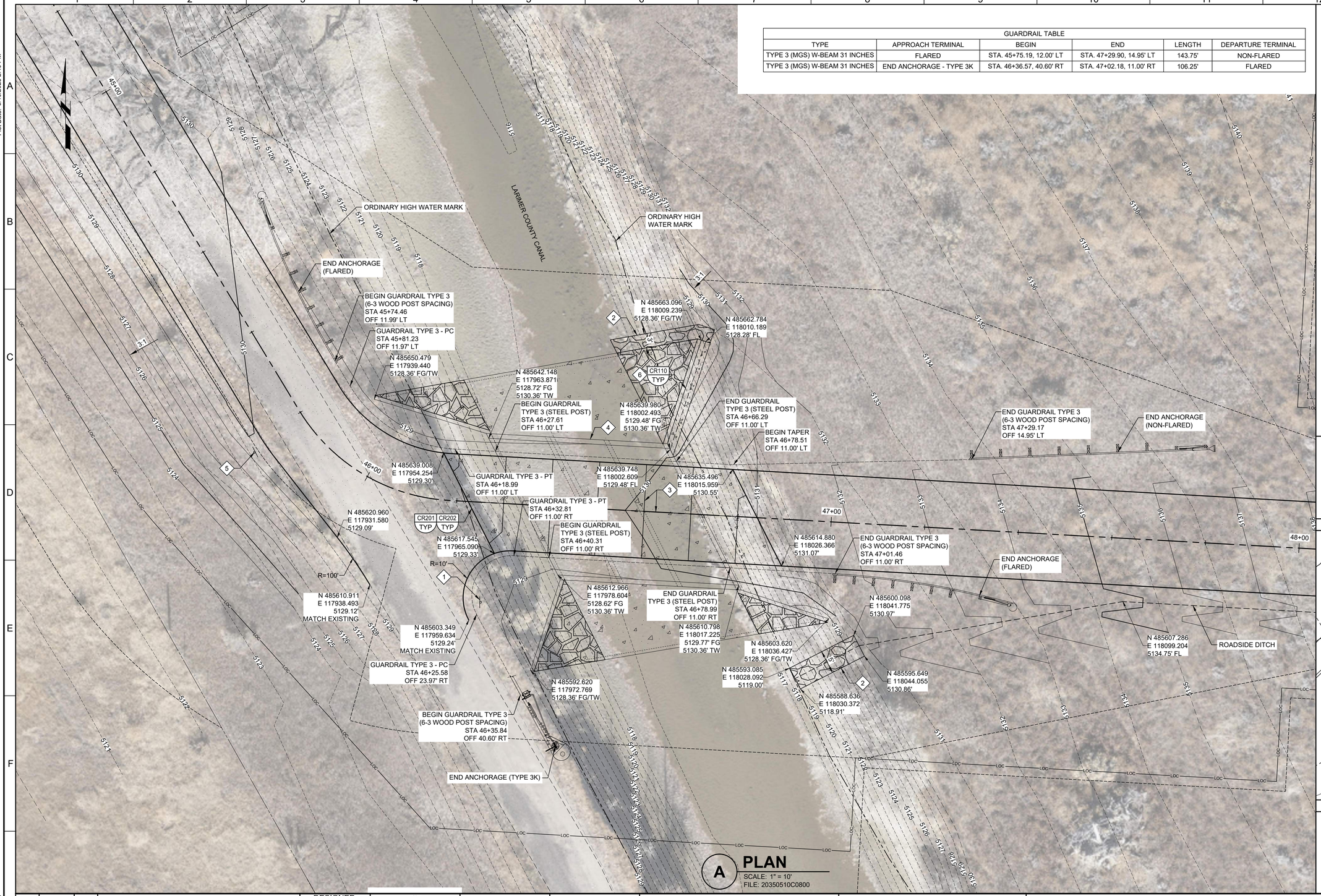
LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510C02.DWG

Plot Date: 9/9/2025 3:03 PM

Plot Date: 9/10/2025 2:40 PM

GUARDRAIL TABLE					
TYPE	APPROACH TERMINAL	BEGIN	END	LENGTH	DEPARTURE TERMINAL
TYPE 3 (MGS) W-BEAM 31 INCHES	FLARED	STA. 45+75.19, 12.00' LT	STA. 47+29.90, 14.95' LT	143.75'	NON-FLARED
TYPE 3 (MGS) W-BEAM 31 INCHES	END ANCHORAGE - TYPE 3K	STA. 46+36.57, 40.60' RT	STA. 47+02.18, 11.00' RT	106.25'	FLARED



A **PLAN**
SCALE: 1" = 10'
FILE: 20350510C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. ALL WORK SHOWN ON THIS SHEET IS WITHIN THE BALD EAGLE NEST BUFFER. SEE SPECIFICATION SECTION 01_11_00 SUMMARY OF WORK FOR WORK RESTRICTIONS RELATED TO RAPTOR NEST BUFFERS.

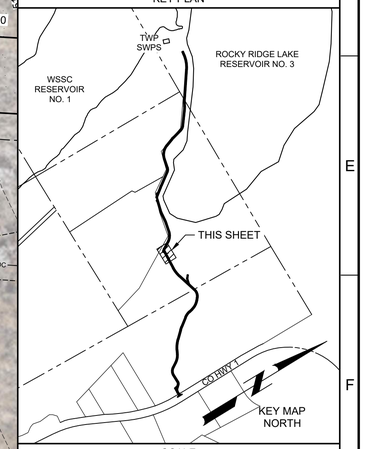
KEY NOTES:

1. INSTALL TUBULAR STEEL "PRIVATE ROAD" SIGN FACING WEST PER CDOT STANDARD PLAN NO. S-614-8.
2. GROUTED RIPRAP, 3-FT DEPTH, D50=12 INCH.
3. PROVIDE LONGITUDINAL AND TRANSVERSE CONCRETE JOINTS WITH MAXIMUM 10' SPACING WITHIN CONCRETE PAVEMENT. CONTRACTOR SHALL SUBMIT SPECIFIC JOINT LAYOUT PLAN FOR NEW CONCRETE PAVING. CONCRETE PAVING AND REBAR PER CDOT SPECIFICATION SECTIONS 601 AND 602.
4. MAXIMUM 30 CFS ALLOWABLE FLOW THROUGH CANAL TO BE ROUTED AROUND CULVERT DURING CONSTRUCTION, SEE SUMMARY OF WORK SPECIFICATION 01_11_00.
5. INSTALL TUBULAR STEEL WAYFINDING "SOURCE WATER PUMP STATION" SIGN WITH ARROW POINTING NORTH TOWARDS PUMP STATION SITE.
6. PROVIDE CONCRETE EXPANSION JOINT BETWEEN WINGWALL AND 2' VALLEY GUTTER.

Know what's below. Call before you dig.

Call before you Overhead

KEY PLAN



SCALE

0 5' 10' 20'

SCALE: 1" = 10'

LAST SAVED BY: RFALK

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED GARY LEE GILES 43662 Digitally signed by Gary L. Giles Contact Info: Carollo Engineers, Inc. Date: 2025.09.10 16:49:42 -06'00' PROFESSIONAL ENGINEER

FELSBURG HOLT & ULLEVIG

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
CIVIL
CANAL CROSSING ENLARGED PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C10
SHEET NO. 17 OF 36

PROJECT NO. 203505 FILE NAME: 20350510C10.DWG

Plot Date: 9/9/2025 3:20 PM

N 484685.839
E 120033.599
5198.57' FS
MATCH EXISTING

COLORADO HIGHWAY 1

N 484605.454
E 120032.529
5197.68' FS
MATCH EXISTING

R=30'

R=20'

N 484706.945
E 120024.410
5197.34' FL

N 484696.155
E 120021.285
5197.25' FL

-1.99%

N 484679.318
E 120010.572
5196.72' FL

2 DRAINAGE DITCH

R=20'

3 CY111 TYP 14"x23" STM

72+00

N 484622.160
E 120006.541
5196.00' INV/FL

-0.74%

1

DRAINAGE DITCH 2

N 484514.731
E 120023.045
5195.20' FL

CDOT ROW

30' PVREA ESMT

N 484668.971
E 120007.451
5196.50' INV/FL

39' PERM ESMT

124' TEMP ESMT

-1.78%

71+00

LIMITS OF CONSTRUCTION

LIMITS OF CONSTRUCTION

N 484640.123
E 119889.163
5198.60' FS

N 484636.523
E 119889.832
5198.07' FL

F
10C12

R=5'

N 484640.605
E 119885.521
5198.19' FL

ROADSIDE DRAINAGE DITCH

R=50'

N 484673.715
E 119879.598
5198.79' FL

N 484698.619
E 119867.308
5199.29' FL

A **PLAN**
SCALE: 1" = 10'
FILE: 20350510C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.

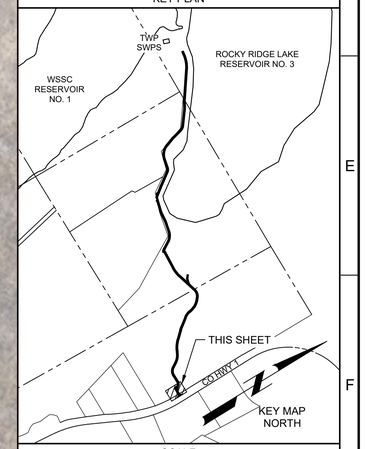
KEY NOTES:

1. REMOVE 154-LF OF EXISTING 18" CMP.
2. RELOCATE AND REGRADE EXISTING COLORADO HIGHWAY 1 DITCH AS SHOWN.
3. INSTALL 35-LF ELLIPTICAL 14"x23" RCP CLASS III PIPE WITH FLARED END SECTIONS.

Know what's below. Call before you dig.

Call before you Overhead

KEY PLAN



SCALE

0 5' 10' 20'
SCALE: 1" = 10'

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED GARY LEE GILES 43662 PROFESSIONAL ENGINEER
Digitally signed by Gary L. Giles
Contact Info: Carollo Engineers
Date: 2025.09.10 16:40:40 -06'00'

carollo

THORNTON WATER PROJECT

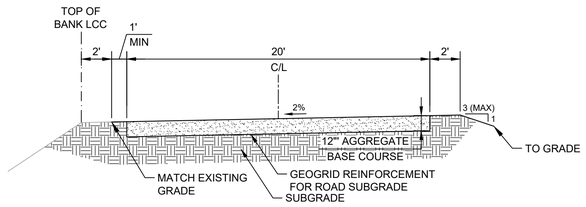
CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
CIVIL
COLORADO HIGHWAY 1 ACCESS ENLARGED PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C11
SHEET NO. 18 OF 36

LAST SAVED BY: RFALK

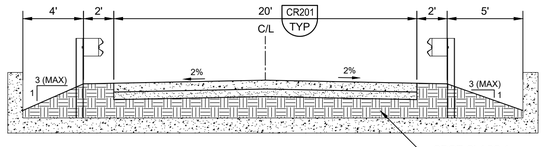
PROJECT NO. 203505 FILE NAME: 20350510C11.DWG



20' AGG BASE TYPICAL SECTION - ADJACENT TO LCC

A DETAIL

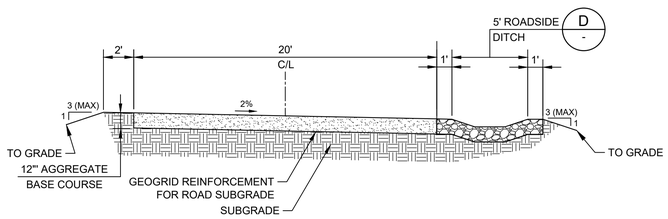
SCALE: 1" = 5'
FILE: 203505_10C10



20' CONCRETE PAVING - LCC BRIDGE

B DETAIL

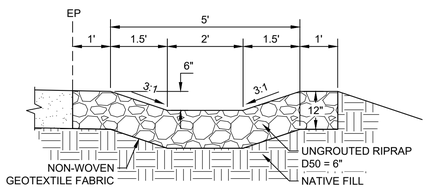
SCALE: 1" = 5'
FILE: 203505_10C10



20' AGG BASE TYPICAL SECTION - EAST OF BRIDGE

C DETAIL

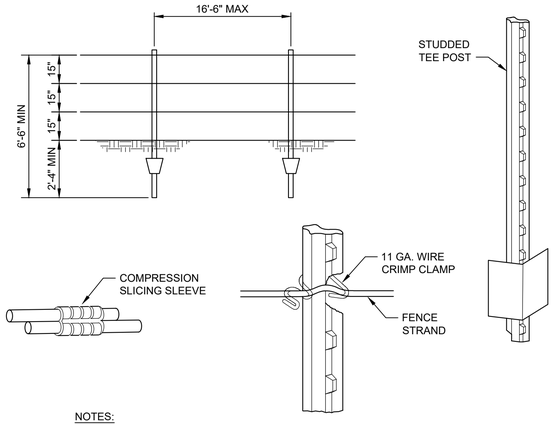
SCALE: 1" = 5'
FILE: 203505_10C10



ROADSIDE DITCH

D DETAIL

SCALE: 1" = 2'
FILE: 203505_10C10

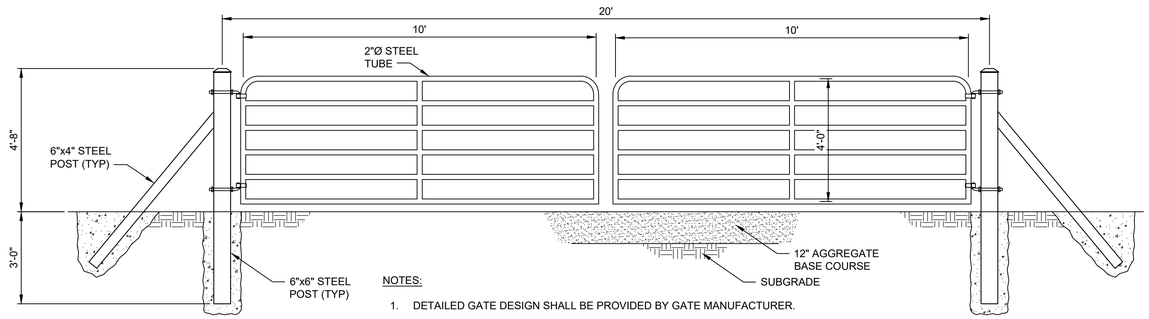


NOTES:

1. METAL POSTS AND BRACES SHALL BE IN ACCORDANCE WITH AASHTO M281.
2. FENCE WIRE, TIES, CLIPS, STAPLES, AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M232.
3. FENCE WIRE SHALL BE EITHER SMOOTH OR BARBED TO MATCH EXISTING, OR AS NOTED ON THE PLANS.
4. WIRE SPLICING SHALL BE APPROVED BY THE ENGINEER.
5. CORNER AND LINE BRACE POSTS SHALL MEET THE FOLLOWING REQUIREMENTS:
   - TYPE: 2 ½ IN. x 2 ½ IN. x ¼ IN. STRUCTURAL STEEL ANGLES
   - WEIGHT: 4.10 LB./LF.
   - LENGTH: 6'-6"
   - NUMBER OF BRACES: TWO (2)

E 3 STRAND WIRE FENCE

SCALE: NTS
FILE:



NOTES:

1. DETAILED GATE DESIGN SHALL BE PROVIDED BY GATE MANUFACTURER.
2. FURNISH GATE CHAIN FOR LOCKING GATE. OWNER TO PROVIDE PADLOCK.
3. PAINT GATE IN ACCORDANCE WITH MANUFACTURE RECOMMENDATIONS. COORDINATE WITH CONSTRUCTION MANAGER REGARDING ANY SPECIAL COLOR REQUIREMENTS FROM PROPERTY OWNER.
4. FURNISH KNOX GATE KEY SWITCH THAT FITS THE KNOX KEY SYSTEM FOR POUDRE FIRE AUTHORITY TO PROVIDE A MEANS OF OPENING THE GATE BY FIRE DEPARTMENT PERSONNEL FOR EMERGENCY ACCESS.

F DUAL SWING STEEL GATE

SCALE: NTS
FILE:

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GILES
43662
Digitally signed by Gary L. Giles
Contact Info: Carollo Engineers, Inc.
Date: 2025.09.10 16:40:42 -06'00'
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
ROAD DETAILS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C12
SHEET NO. 19 OF 36

Plot Date: 9/9/2025 3:21 PM
LAST SAVED BY: RFALK
PROJECT NO. 203505
FILE NAME: 20350510C11.DWG

GENERAL NOTES:

ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, 2025 EDITION, AS APPLICABLE TO THE PROJECT.

STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH CDOT STANDARD PLANS, M&S STANDARDS M-206-1, UNLESS OTHERWISE NOTED ON PLANS.

EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATIONS M-213.

ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).

ALL CONCRETE EXPOSED TO SOIL SHALL CONFORM TO CEMETITIOUS METERIALS REQUIREMENTS CLASS 1, CORRESPONDING TO SULFATE EXPOSURE CLASS 1.

THE FINAL FINISH FOR ALL EXPOSED CONCRETE SURFACES SHALL BE CLASS 2 TO 1'-0" BELOW FINISHED GRADE.

ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE APPROVED BY THE ENGINEER.

ALL CONSTRUCTION JOINTS SHALL BE ROUGHENED TO ¼" AMPLITUDE MINIMUM AND THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.

THE CONTRACTOR SHALL NOT BACKFILL STRUCTURES UNTIL TOP SLAB AND WALLS HAVE REACHED 80% OF DESIGN STRENGTH.

ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾", UNLESS SHOWN OR OTHERWISE NOTED.

GRADE 60 REINFORCING STEEL IS REQUIRED.

ALL REINFORCING STEEL SHALL BE BLACK (NON-EPOXY COATED) UNLESS OTHERWISE NOTED.

(E) DENOTES EPOXY COATED REINFORCING STEEL.

ALL REINFORCEMENT SHALL HAVE A CLEAR COVERAGE OF 2", EXCEPT AS SHOWN ON THE PLANS. CLEAR COVERAGE SHALL BE MEASURED FORM THE SURFACE OF THE CONCRETE TO THE OUTSIDE OF THE REINFORCEMENT.

THE STOCK LENGTH USED FOR ALL REINFORCING IS 60 FEET.

ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.

STATIONS, ELEVATIONS, AND DIMENSIONS IN THESE PLANS ARE CALCULATED FROM A RECENT FIELD SURVEY. THE CONTRACTOR SHALL VERIFY ALL DEPENDENT DIMENSIONS IN THE FIELD BEFORE ORDERING OR FABRICATING ANY MATERIAL.

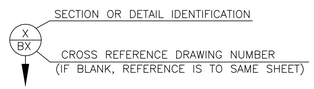
UTILITIES ARE DEPICTED ON THESE PLANS IN ACCORDANCE WITH THEIR ACHIEVED "QUALITY LEVEL" AS DEFINED IN THE AMERICAN SOCIETY OF CIVIL ENGINEER'S DOCUMENT ASCE 38, "STANDARD GUIDELINE FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA". RELIANCE UPON THESE DATA FOR RISK MANAGEMENT PURPOSES DURING BIDDING DOES NOT RELIEVE THE EXCAVATOR OR UTILITY OWNER FROM FOLLOWING ALL APPLICABLE UTILITY DAMAGE PREVENTION STATUTES, POLICIES, AND/OR PROCEDURES DURING EXCAVATION.

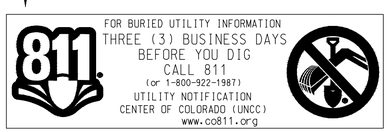
IT IS IMPORTANT THAT THE CONTRACTOR INVESTEGATES AND UNDERSTANDS THE SCOPE OF WORK BETWEEN THE PROJECT OWNER AND THEIR ENGINEER REGARDING THE SCOPE AND LIMITS OF THE UTILITY INVESTIGATIONS LEADING TO THESE UTILITY DEPICTIONS.

THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATIONS CENTER OF COLORADO AT 811 (1-800-922-1987) AT LEAST 3 DAYS (2 DAYS NOT INCLUDING THE DAY OF NOTIFICATION) PRIOR TO ANY EXCAVATION OR OTHER EARTHWORK.

ABBREVIATIONS:

E.F. = EACH FACE
F.F. = FAR FACE
N.F. = NEAR FACE
C.J. = CONSTRUCTION JOINT
E.O.P. = EDGE OF PAVEMENT
H.C.L. = HORIZONTAL CONTROL LINE
I.F. = INSIDE FACE
O.F. = OUTSIDE FACE
O.D. = OUTSIDE DIAMETER
T.O.P. = TOP OF PIPE
CONT. = CONTINUOUS





THE EXISTING FILL IS NOT SUITABLE FOR SUPPORT OF THE FOOTINGS. THESE MATERIALS SHOULD NOT BE USED FOR DIRECT SUPPORT OF FOOTINGS AND SHOULD BE OVER-EXCAVATED BY AT LEAST 1'-6" BELOW THE BEARING ELEVATION AND REPLACED WITH DESIGNATED FILL.

FOUNDATION PREPARATION SHOULD BE OBSERVED BY A QUALIFIED ENGINEER TO CONFIRM ADEQUACY OF BEARING SURFACE.

DEWATERING DURING CONSTRUCTION SHALL BE IN ACCORDANCE WITH PROJECT SPECIFICATION 31 23 19.

DESIGN DATA:

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS TENTH ED. WITH CURRENT INTERIMS

DESIGN METHOD:
LOAD AND RESISTANCE FACTOR DESIGN

DESIGN LOADING (BOX CULVERT):
AASHTO, HL-93
LIVE LOAD SURCHARGE ON EXTERIOR WALLS & WINGWALLS = 2 FT. OF EARTH

UNIT SOIL WEIGHT = 130 pcf
MAXIMUM DESIGN FILL HEIGHT = 8 FEET
ACTIVE LATERAL EARTH PRESSURE: 37 pcf

DESIGN LOADING (WINGWALLS):
NOMINAL BEARING PRESSURE = 3,000 psf
UNIT SOIL WEIGHT = 130 pcf
EQUIVALENT FLUID PRESSURE = 37 psf
NOMINAL COEFFICIENT OF SLIDING FRICTION = 0.35

REINFORCED CONCRETE:
CLASS D CONCRETE: f'c = 4,500 psi
REINFORCING STEEL: fy = 60,000 psi

INDEX OF DRAWINGS:

10C13 CULVERT GENERAL INFORMATION
10C14 CULVERT GENERAL LAYOUT & TYPICAL SECTION
10C15 CULVERT HYDRAULIC LAYOUT
10C16 CULVERT WINGWALL DETAILS

STRUCTURE DESCRIPTION:

TRIPLE CELL (10'-0"Wx10'-0"Hx35'-0" LONG)
CAST-IN-PLACE CONCRETE BOX CULVERT WITH CAST-IN-PLACE WINGWALLS

SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	CBC	TOTALS
206-00000	STRUCTURE EXCAVATION	CY	466	466
206-00050	STRUCTURE BACKFILL (SPECIAL)	CY	188	188
206-00100	STRUCTURE BACKFILL (CLASS 1)	CY	253	253
206-01781	SHORING (AREA 1)	L S	1	1
208-00521	TEMPORARY STREAM CROSSING	EACH	1	1
304-06007	AGGREGATE BASE COURSE (CLASS 6)	CY	94	94
506-00030	GROUTED RIPRAP	CY	65	65
515-00120	WATERPROOFING (MEMBRANE)	SY	134	134
601-03030	CONCRETE CLASS D (BOX CULVERT)	CY	240	240
602-00000	REINFORCING STEEL	LB	41,846	41,846
606-00302	GUARDRAIL TYPE 3 (31 INCH MIDWEST GUARDRAIL SYSTEM)	LF	250	250
606-01390	END ANCHORAGE TYPE 3K	EACH	1	1
606-02003	END ANCHORAGE (NONFLARED)	EACH	1	1
606-02005	END ANCHORAGE (FLARED)	EACH	2	2

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED BRM
DRAWN CDM
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
BRIAN R. MOORE
53500
PROFESSIONAL ENGINEER
09/10/25

FELSBURG HOLT & ULLEVIG

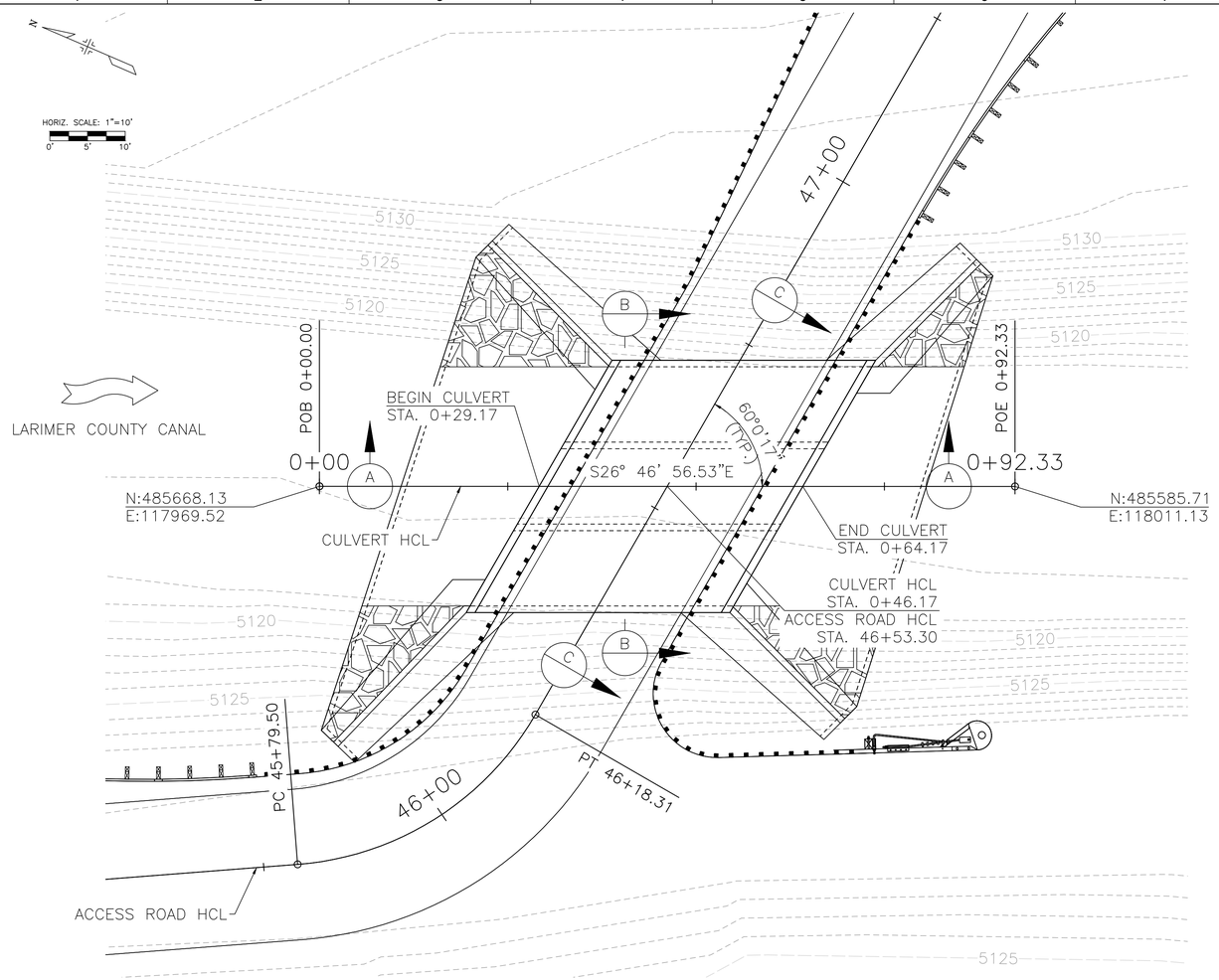
carollo

THORNTON WATER PROJECT

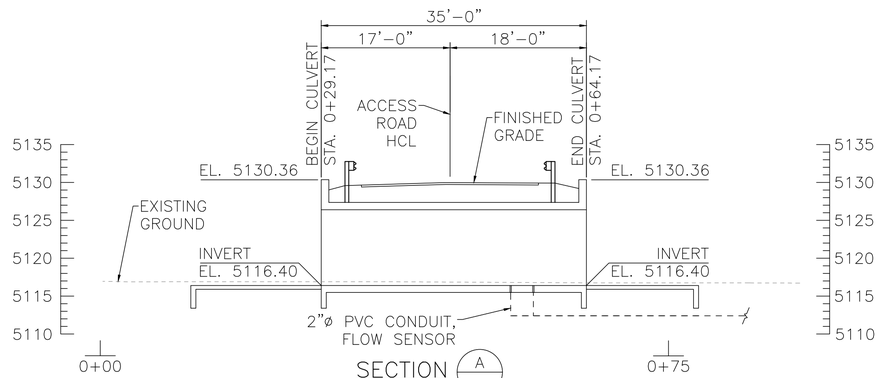
CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
CIVIL
CULVERT
GENERAL INFORMATION

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10C13
SHEET NO. 20 OF 36

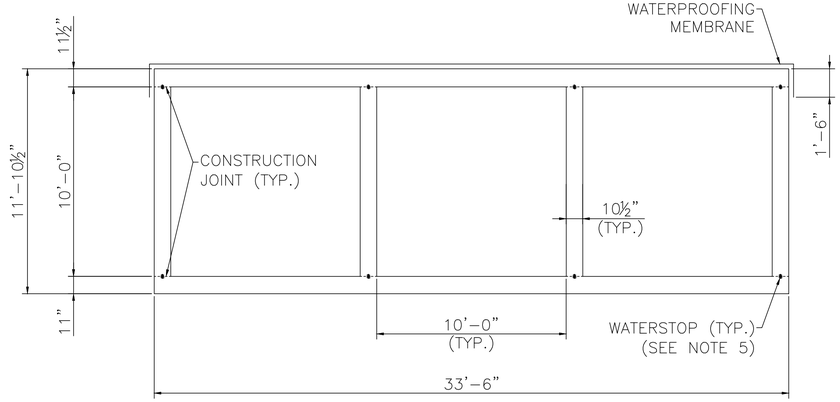


PLAN



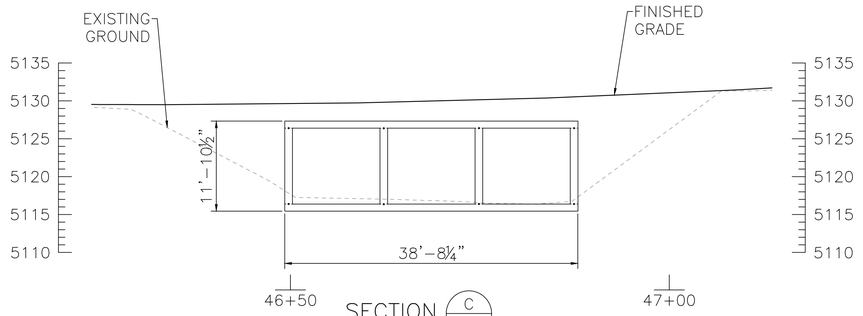
SECTION (A)

(TAKEN AT CULVERT HCL)



SECTION (B)

(SECTION NORMAL TO CULVERT HCL)



SECTION (C)

(TAKEN AT ACCESS ROAD HCL)

NOTES:

1. USE CDOT M&S STANDARD M-601-3 FOR CBC DESIGN INFORMATION (S=10', R=10', FILL HEIGHT=2' TO 8').
2. USE CDOT M&S STANDARD M-601-20 FOR WINGWALL DESIGN INFORMATION (m=14', k=9').
3. USE CDOT M&S STANDARD M-606-1 FOR CONNECTION BETWEEN GUARDRAIL TYPE 3 AND CULVERT TOP SLAB.
4. SEE GEOTECHNICAL ENGINEERING STUDY BY GEI CONSULTANTS (PROJ. NO 240846 DATE: MAY 2025) FOR SITE PREPARATION RECOMMENDATIONS.
5. PROVIDE CONTINUOUS BENTONITE/BUTYL RUBBER-BASED WATERSTOP (MIRADRI MIRASTOP OR APPROVED EQUAL) AT JOINTS AT BASE OF EACH WALL AND AT ANY CONSTRUCTION JOINT IN BARREL, SLAB, APRON, WINGWALLS, OR FOOTINGS. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. BENTONITE/BUTYL RUBBER-BASED WATERSTOP SHALL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN ITEM 601, CONCRETE CLASS D (BOX CULVERT).

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COLORADO LICENSED
BRIAN R. MOORE
53500
09/10/25
PROFESSIONAL ENGINEER

FELSBURG HOLT & ULLEVIG

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
CIVIL
CULVERT
GENERAL LAYOUT AND TYPICAL SECTION

VERIFY SCALES
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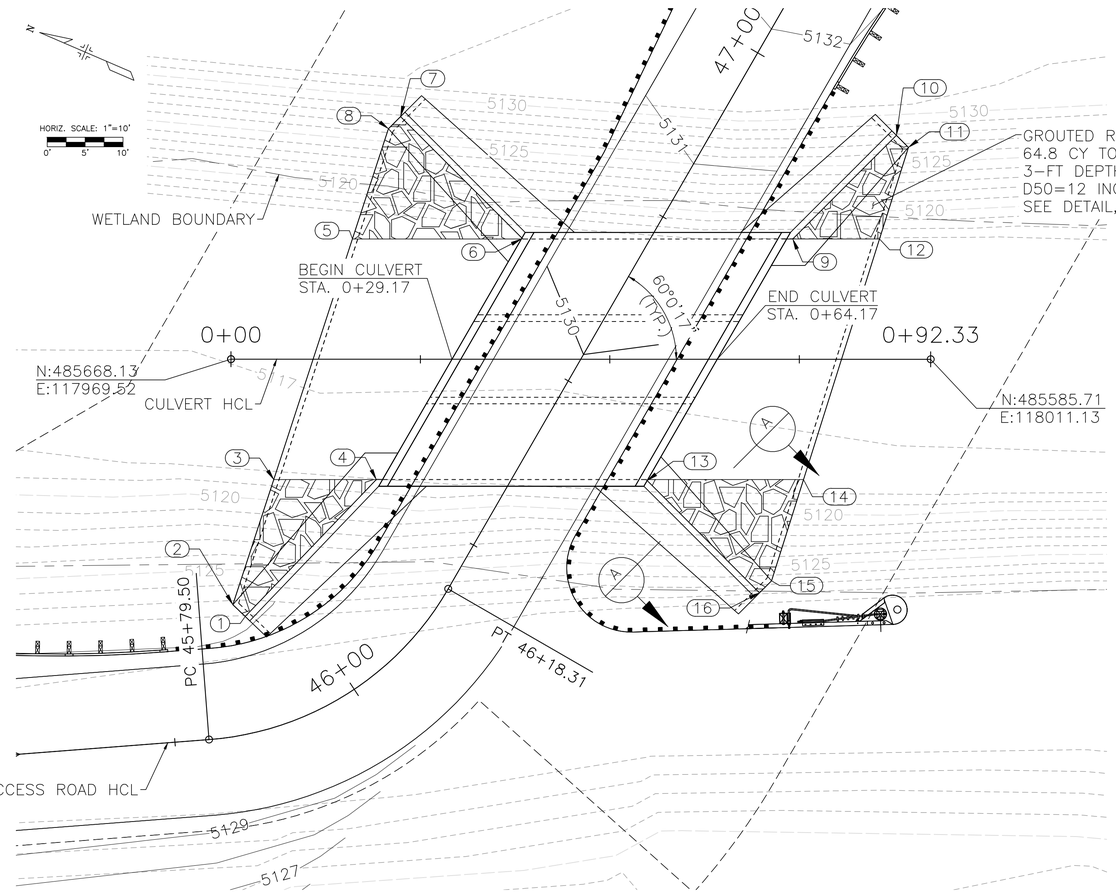
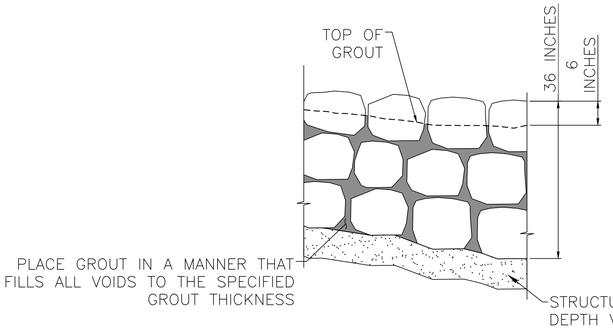
JOB NO. 203505
DRAWING NO. 10C14
SHEET NO. 21 OF 36



PLAN

POINT TABLE				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	485651.16	117940.07	5128.06	GROUTED RIPRAP
2	485653.31	117940.73	5127.27	GROUTED RIPRAP
3	485655.93	117957.89	5116.40	GROUTED RIPRAP
4	485643.86	117963.99	5116.40	GROUTED RIPRAP
5	485660.97	117990.91	5116.40	GROUTED RIPRAP
6	485641.07	118000.96	5116.40	GROUTED RIPRAP
7	485662.58	118008.19	5127.84	GROUTED RIPRAP
8	485663.29	118006.06	5126.44	GROUTED RIPRAP

POINT TABLE				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
9	485609.10	118017.10	5116.40	GROUTED RIPRAP
10	485603.06	118035.48	5127.88	GROUTED RIPRAP
11	485600.92	118034.77	5126.59	GROUTED RIPRAP
12	485598.88	118022.26	5116.40	GROUTED RIPRAP
13	485611.89	117979.99	5116.40	GROUTED RIPRAP
14	485593.53	117989.40	5116.40	GROUTED RIPRAP
15	485591.28	117975.57	5126.62	GROUTED RIPRAP
16	485591.98	117973.44	5127.89	GROUTED RIPRAP

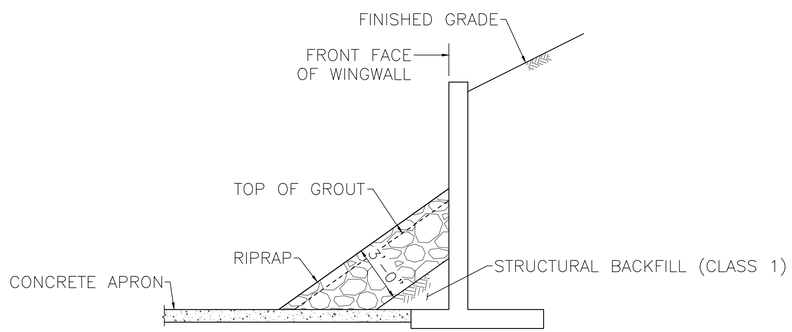


RIPRAP PLACEMENT NOTES:
1. PLACE STRUCTURAL BACKFILL CONSISTING OF WELL-GRADED GRANULAR MATERIAL OR UNIFORMLY GRADED GRANULAR MATERIAL.
2. ROCK USED SHOULD BE FREE OF FINES SO THAT PENETRATION OF GROUT MAY BE ACHIEVED.
3. PLACE 9 INCH RIPRAP TO A DEPTH OF 12 INCHES. PLACE RIPRAP AS TIGHTLY TOGETHER AS POSSIBLE WITHOUT TOUCHING WHILE PROVIDING ENOUGH ROOM BETWEEN THEM TO THOROUGHLY VIBRATE THE GROUT AND TO ENSURE NO GAPS IN THE GROUT.
4. BEFORE GROUTING, CLEAN ALL DIRT AND MATERIAL FROM ROCK THAT COULD PREVENT THE GROUT FROM BINDING TO THE ROCK. AVOID SLIDING RIPRAP AGAINST SUBGRADE TO PROPERLY POSITION.
5. PLACE 3 FEET HORIZONTAL AND 18 INCH DEEP BURIED GROUT-FREE 12 INCH RIPRAP LEVEL ON THE UPSTREAM AND DOWNSTREAM ENDS OF THE GROUTED RIPRAP.

MATERIAL SPECIFICATIONS:
1. ALL GROUT SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH EQUAL TO 3200 PSI.
2. THE AGGREGATE SHALL BE COMPRISED OF 70% NATURAL SAND (FINES) AND 30% 3/8-INCH ROCK (COARSE).
3. THE GROUT SLUMP SHALL BE BETWEEN 4-INCHES TO 6-INCHES.

GROUT PLACEMENT SPECIFICATIONS:
1. SPECIAL PROCEDURES SHALL BE REQUIRED FOR GROUT PLACEMENT WHEN THE AIR TEMPERATURES ARE LESS THAN 40°F OR GREATER THAN 90°F. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE DESIGN ENGINEER OF THE PROCEDURES TO BE USED FOR PROTECTING THE GROUT.
2. GROUT SHALL BE DELIVERED BY MEANS OF A LOW PRESSURE (LESS THAN 10 PSI) GROUT PUMP USING A 2-INCH DIAMETER (MAXIMUM) NOZZLE.
3. FULL DEPTH PENETRATION OF THE GROUT INTO THE RIPRAP VOIDS SHALL BE ACHIEVED BY INJECTING GROUT STARTING WITH THE NOZZLE NEAR THE BOTTOM AND RAISING IT AS THE GROUT FILLS, WHILE VIBRATING GROUT INTO PLACE USING A PENCIL VIBRATOR.
4. ALL GROUT BETWEEN RIPRAP SHALL BE TREATED WITH A BROOM FINISH.
5. AFTER GROUT PLACEMENT, EXPOSED RIPRAP FACES SHALL BE CLEANED AND FREE OF GROUT.
6. ALL FINISHED GROUT SURFACES SHALL BE SPRAYED WITH A CLEAR LIQUID MEMBRANE CURING COMPOUND AS SPECIFIED IN ASTM C309.

GROUTED RIPRAP PLACEMENT DETAIL
N.T.S.



SECTION A

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED BRM
DRAWN CDM
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED JOSHUA R. KUIT 43883 9/10/2025 PROFESSIONAL ENGINEER

FELSBURG HOLT & ULLEVIG

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
CIVIL
CULVERT HYDRAULIC LAYOUT

VERIFY SCALES
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0 1"
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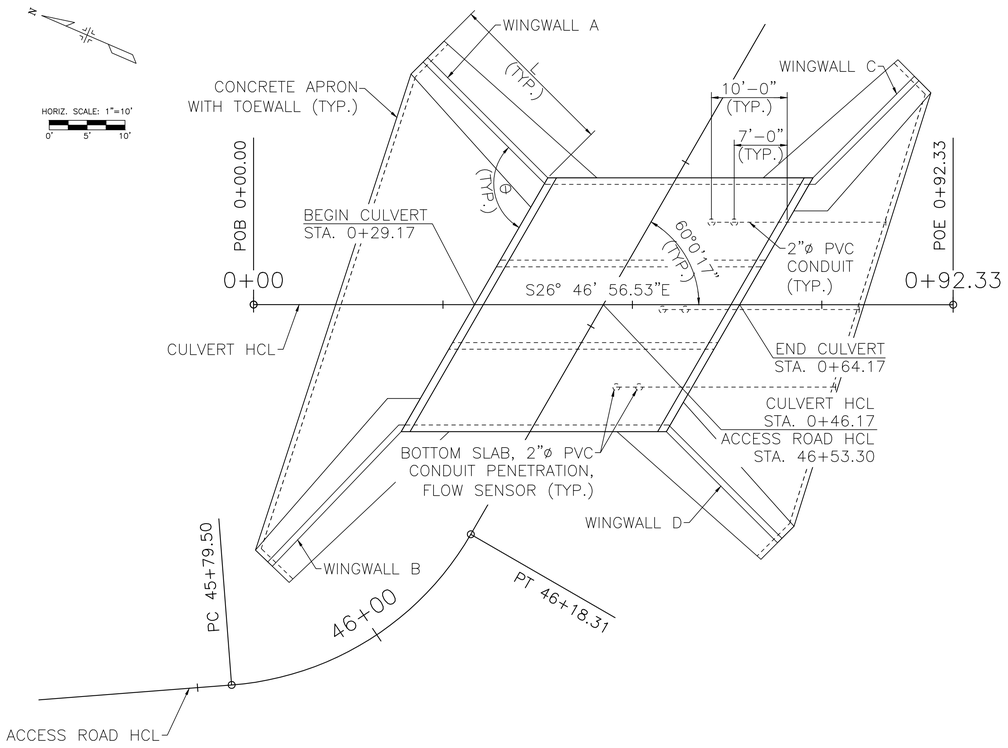
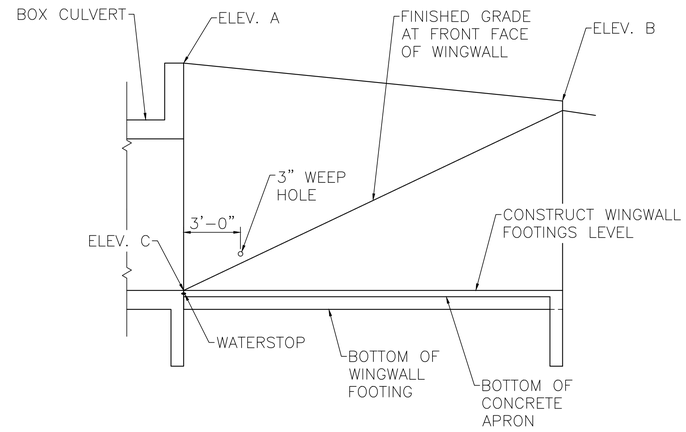
JOB NO. 203505
DRAWING NO. 10C15
SHEET NO. 22 OF 36



PLAN

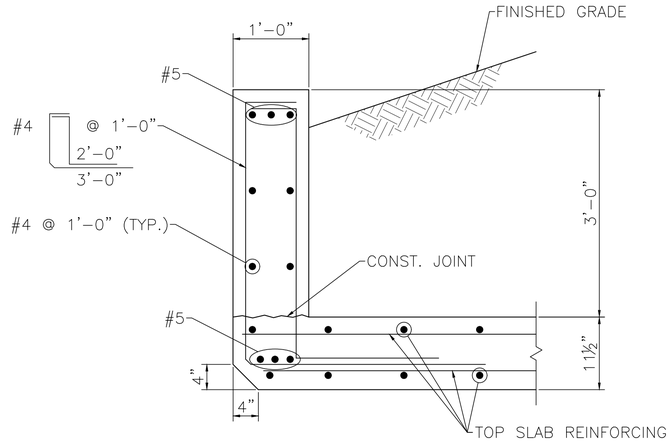


ELEVATION AT WINGWALLS

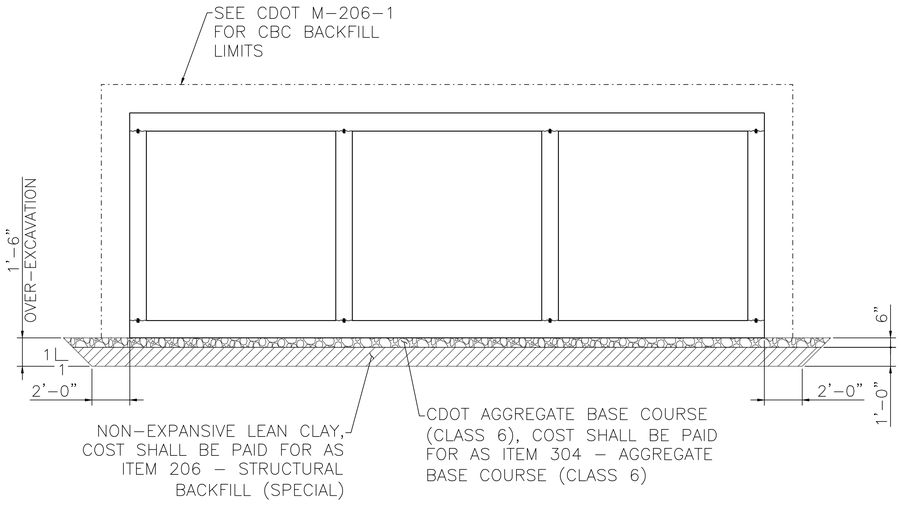
WINGWALL	θ	L	ELEV. A	ELEV. B	ELEV. C
A	105°00'00"	22'-5"	5130.36	5128.36	5116.40
B	166°14'00"	24'-7"	5130.36	5128.36	5116.40
C	165°00'00"	18'-11"	5130.36	5128.36	5116.40
D	105°00'00"	20'-9"	5130.36	5128.36	5116.40

NOTES:

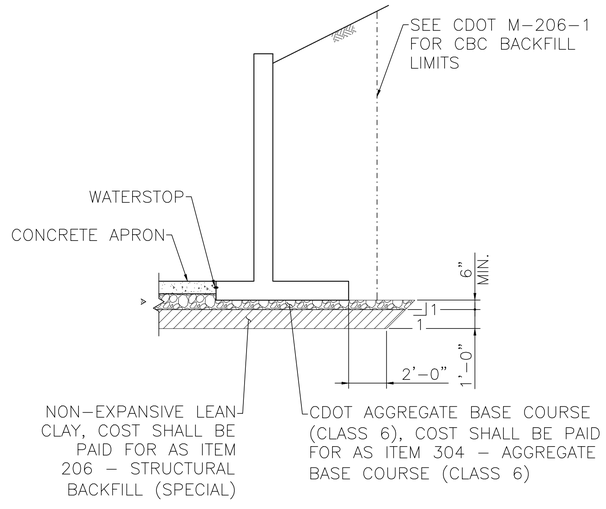
1. SEE CDOT M&S STANDARD PLAN M-601-20 FOR WINGWALL DETAILS, DIMENSIONS, AND REINFORCING (m=14', k=9').
2. ALL REINFORCING STEEL FOR WINGWALLS AND FOOTINGS SHALL BE BLACK REINFORCING BARS.
3. COARSE AGGREGATE AND NON-EXPANSIVE LEAN CLAY ARE REQUIRED BELOW APRONS.
4. SUBGRADE PREPARATION BELOW THE OVER-EXCAVATION SHALL INCLUDE A MINIMUM EXISTING SUBGRADE SCARIFICATION AND RECOMPACTION OF 8 INCHES.
5. NON-EXPANSIVE LEAN CLAY MAY BE IMPORTED OR SOURCED FROM OTHER LOCATIONS ON SITE.
6. ALL MATERIALS SHALL BE COMPACTED TO A MINIMUM 95% OF STANDARD PROCTOR COMPACTION AND WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT (ASTM D698).
7. SEE ELECTRICAL PLANS FOR 2" PVC CONDUIT INFORMATION.



HEADWALL DETAIL



CULVERT OVER-EXCAVATION LIMITS



WINGWALL OVER-EXCAVATION LIMITS

REV	DATE	BY	DESCRIPTION
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DATE SEPTEMBER 2025

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BRIAN R. MOORE
53500
PROFESSIONAL ENGINEER
09/10/25

FELSBURG HOLT & ULLEVIG

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
CIVIL
CULVERT WINGWALL DETAILS

VERIFY SCALES
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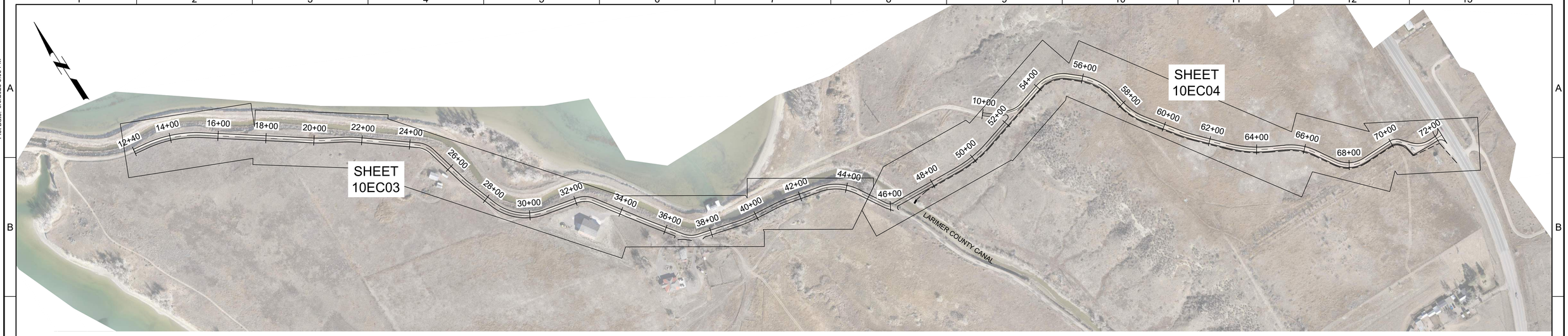
JOB NO. 203505
DRAWING NO. 10C16
SHEET NO. 23 OF 36



LARIMER COUNTY CONSTRUCTION STORMWATER CONTROL STANDARD NOTES:

GENERAL EROSION CONTROL REQUIREMENTS

1. THE PROPERTY OWNER, OWNER'S REPRESENTATIVE, DEVELOPER, DESIGN ENGINEER, GENERAL CONTRACTOR, SUB-CONTRACTORS, OR SIMILAR TITLE FOR THE DEVELOPING ENTITY (HEREAFTER REFERRED TO AS THE DEVELOPER) HAS PROVIDED THESE EROSION CONTROL MATERIALS IN ACCORDANCE WITH THE EROSION CONTROL CRITERIA SET FORTH IN THE STANDARDS AS AN ATTEMPT TO IDENTIFY EROSION, SEDIMENT, AND OTHER POTENTIAL POLLUTANT SOURCES ASSOCIATED WITH THESE CONSTRUCTION ACTIVITIES AND TO PREVENT THOSE POLLUTANTS FROM LEAVING THE PROJECT SITE AS AN ILLICIT DISCHARGE.

2. THE DEVELOPER SHALL MAKE THEMSELVES THOROUGHLY FAMILIAR WITH THE PROVISIONS AND THE CONTENT OF THE SPECIFICATIONS LAID OUT IN THE STANDARDS, THE DEVELOPMENT AGREEMENT, THE EROSION CONTROL MATERIALS COMPILED FOR THIS PROJECT, AND THE FOLLOWING NOTES AS ALL THESE MATERIALS ARE APPLICABLE TO THIS PROJECT.

3. THE DEVELOPER SHALL IMPLEMENT AND MAINTAIN CONTROL MEASURES FOR ALL POTENTIAL POLLUTANTS FROM THE START OF LAND DISTURBING ACTIVITIES UNTIL FINAL STABILIZATION OF THE CONSTRUCTION SITE.

4. THE COUNTY EROSION CONTROL INSPECTOR SHALL BE NOTIFIED AT LEAST TWENTY-FOUR (24) HOURS PRIOR TO THE DESIRED START OF ANY CONSTRUCTION ACTIVITIES ON THIS SITE TO ALLOW ADEQUATE TIME FOR ON-SITE CONFIRMATION (INITIAL INSPECTION WHICH CAN TAKE UP TO TWO BUSINESS DAYS AFTER RECEIVING THE REQUEST) THAT THE SITE IS IN FACT PROTECTED FROM SEDIMENT AND POLLUTANTS DISCHARGES OFF SITE. PLEASE CONTACT THE COUNTY EARLY TO SCHEDULE THOSE INITIAL EROSION CONTROL INSPECTIONS WELL IN ADVANCE SO THAT DEMOLITION, CLEARING, GRUBBING, TREE REMOVAL, AND SCRAPING MAY BEGIN WITHOUT DELAY. FAILURE TO RECEIVE AN ON-SITE CONFIRMATION BEFORE CONSTRUCTION ACTIVITIES COMMENCE IS AN AUTOMATIC "NOTICE OF VIOLATION" AND CAN RESULT IN FURTHER ENFORCEMENT ACTIONS.

5. THE DEVELOPER SHALL PROACTIVELY PROVIDE ALL APPROPRIATE CONTROL MEASURES TO PREVENT DAMAGE TO ADJACENT DOWNSTREAM AND LEEWARD PROPERTIES. THIS INCLUDES BUT IS NOT LIMITED TO TREES, SHRUBS, LAWNS, WALKS, PAVEMENTS, ROADWAYS, STRUCTURES, CREEKS, WETLANDS, STREAMS, RIVERS, AND UTILITIES THAT ARE NOT DESIGNED FOR REMOVAL, RELOCATION, OR REPLACEMENT IN THE COURSE OF CONSTRUCTION.

6. AT ALL TIMES THE DEVELOPER SHALL BE RESPONSIBLE TO ENSURE ADEQUATE CONTROL MEASURES ARE DESIGNED, SELECTED, INSTALLED, MAINTAINED, REPAIRED, REPLACED, AND ULTIMATELY REMOVED IN ORDER TO PREVENT AND CONTROL EROSION SUSPENSION, SEDIMENT TRANSPORTATION, AND POLLUTANT DISCHARGE AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS PROJECT.

7. ALL APPLICABLE CONTROL MEASURES BASED UPON THE SEQUENCING AND/OR PHASING OF THE PROJECT SHALL BE INSTALLED PRIOR TO THOSE CONSTRUCTION ACTIVITIES COMMENCING.

8. AS DYNAMIC CONDITIONS (DUE TO THE NATURE, TIMING, SEQUENCE, AND PHASING OF CONSTRUCTION) IN THE FIELD MAY WARRANT CONTROL MEASURES IN ADDITION TO, OR DIFFERENT FROM, WHAT IS SHOWN ON THESE PLANS, THE DEVELOPER SHALL AT ALL TIMES BE RESPONSIBLE TO IMPLEMENT THE CONTROL MEASURES THAT ARE MOST EFFECTIVE WITH THE CURRENT STATE AND PROGRESS OF CONSTRUCTION. THE DEVELOPER SHALL IMPLEMENT WHATEVER MEASURES ARE DETERMINED NECESSARY AND/OR AS DIRECTED BY THE COUNTY EROSION CONTROL INSPECTOR. THE DEVELOPER SHALL ENSURE THAT ALL EROSION AND SEDIMENT CONTROL PLANS (MAPS) OR SWMP DOCUMENTS ARE UPDATED TO REFLECT THE CURRENT SITE CONDITIONS, WITH UPDATES BEING INITIALED AND DATED. THESE SITE INSPECTIONS AND SITE CONDITION UPDATES SHALL BE MADE AVAILABLE UPON REQUEST BY THE COUNTY.

9. ALL LISTINGS, PROVISIONS, MATERIALS, PROCEDURES, ACTIVITIES, SITE WORK AND THE LIKE ARTICULATED IN THIS OR OTHER WRITTEN SITE-SPECIFIC DOCUMENTS (INCLUDING BUT NOT LIMITED TO THE EROSION CONTROL REPORTS, DEVELOPMENT AGREEMENTS, LANDSCAPE, AND DRAINAGE MATERIALS) SHALL MEET OR EXCEED THE MOST RESTRICTIVE LANGUAGE FOR CITY, COUNTY, STATE, AND FEDERAL REGULATIONS WITH REGARDS TO EROSION, SEDIMENT, POLLUTANT, AND OTHER POLLUTION SOURCE CONTROL MEASURES. THE DEVELOPER SHALL BE RESPONSIBLE TO COMPLY WITH ALL OF THESE AFOREMENTIONED LAWS AND REGULATIONS.

10. THE DEVELOPER SHALL ENSURE THAT ALL APPROPRIATE PERMITS (CDPS GENERAL PERMIT STORMWATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY, DEWATERING, CLEAN WATER ACT, ARMY CORPS OF ENGINEERS' 404 WETLANDS MITIGATION PERMIT, ETC.) HAVE BEEN ATTAINED PRIOR TO COMMENCEMENT OF THE RELEVANT ACTIVITY. THESE PERMITS OR COPIES SHALL BE MADE AVAILABLE UPON REQUEST BY THE COUNTY.

11. THE DEVELOPER SHALL FURNISH ALL CONVENIENCES AND ASSISTANCES TO AID THE EROSION CONTROL INSPECTOR'S REVIEW OF MATERIALS, WORKMANSHIP, RECORDS, AND SELF-INSPECTIONS, ETC., OF THE CONTROL MEASURES IN USE AT THE CONSTRUCTION SITE.

12. THE DEVELOPER SHALL REQUEST CLARIFICATION OF ALL APPARENT SITE CONSTRUCTION ISSUES THAT MAY ARISE DUE TO INCONSISTENCIES IN CONSTRUCTION PLANS FOR THE SITE OR SITE CONDITIONS AROUND THE SELECTED CONTROL MEASURES BY CONTACTING THE EROSION CONTROL INSPECTOR. THE EROSION CONTROL INSPECTOR WILL NOT BE RESPONSIBLE FOR ANY EXPLANATIONS, INTERPRETATIONS, OR SUPPLEMENTARY DATA PROVIDED BY OTHERS.

13. ALL CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARDS.

14. THE COUNTY RESERVES THE RIGHT TO REQUIRE ADDITIONAL CONTROL MEASURES AS SITE CONDITIONS WARRANT, TO THE EXTENT AUTHORIZED BY RELEVANT LEGAL AUTHORITY.

15. AS WITH ANY CONSTRUCTION STANDARDS, OCCASIONS MAY ARISE WHERE THE MINIMUM EROSION CONTROL STANDARDS ARE EITHER INAPPROPRIATE OR CANNOT BE JUSTIFIED. IN THESE CASES, A VARIANCE TO THESE STANDARDS MAY BE APPLIED FOR PURSUANT TO THE TERMS, CONDITIONS, AND PROCEDURES OF THE STANDARDS.

16. INSPECTION: THE DEVELOPER SHALL INSPECT SITE POLLUTANT SOURCES AND IMPLEMENT CONTROL MEASURES AT A MINIMUM OF ONCE EVERY TWO WEEKS DURING CONSTRUCTION AND WITHIN 24 HOURS FOLLOWING A PRECIPITATION EVENT. DOCUMENTATION OF EACH INSPECTION SHALL BE RECORDED AND RETAINED BY THE DEVELOPER.

17. ALL TEMPORARY CONTROL MEASURES SHALL BE CLEANED, REPAIRED, OR RECONSTRUCTED AS NECESSARY TO ASSURE CONTINUAL PERFORMANCE OF THEIR INTENDED FUNCTION. ALL RETAINED SEDIMENTS, PARTICULARLY THOSE ON PAVED ROADWAY SURFACES, SHALL BE REMOVED AND DISPOSED OF IN A MANNER AND LOCATION SO AS NOT TO CAUSE THEIR RELEASE INTO ANY DRAINAGEWAY.

18. ANY CONTROL MEASURE MAY BE SUBSTITUTED FOR ANOTHER STANDARD CONTROL MEASURE SO LONG AS THAT CONTROL MEASURE PROVIDES PROTECTION THAT IS EQUAL TO OR GREATER THAN THE ORIGINAL CONTROL MEASURE THAT WAS TO BE USED IN THAT LOCATION (E.G., SILT FENCE FOR WATTLES OR FOR COMPACT BERMS). WATTLES ALONE ON COMMERCIAL CONSTRUCTION SITES HAVE SHOWN TO BE AN INEFFECTIVE SUBSTITUTE FOR SILT FENCE OR COMPACT BERMS UNLESS ACCOMPANIED BY A CONSTRUCTION FENCE TO PREVENT VEHICLE TRAFFIC.

19. ANY IMPLEMENTATION OR REPLACEMENT OF EXISTING CONTROL MEASURES WITH A NON-STANDARD CONTROL, OR ALTERNATIVE CONTROL MEASURE, SHALL REQUIRE THE REVIEW AND ACCEPTANCE OF THE COUNTY EROSION CONTROL STAFF BEFORE THE MEASURE WILL BE ALLOWED TO BE USED ON THIS PROJECT. THE CONTROL MEASURE DETAILS SHALL BE SUBMITTED, REVIEWED, AND ACCEPTED AS IN CONFORMANCE WITH THE COUNTY'S EROSION CONTROL CRITERIA BASED UPON THE FUNCTIONALITY AND EFFECTIVENESS OF THE CONTROL MEASURE IN ACCORDANCE WITH SOUND ENGINEERING AND HYDROLOGICAL PRACTICES. LAND DISTURBANCE, STOCKPILES, AND STORAGE OF SOILS.

LAND DISTURBANCE, STOCKPILES, AND STORAGE OF SOILS

20. THERE SHALL BE NO EARTH-DISTURBING ACTIVITY OUTSIDE THE LIMITS DESIGNATED ON THE ACCEPTED PLANS. OFF-ROAD STAGING AREAS OR STOCKPILES MUST BE PREAPPROVED BY THE COUNTY. DISTURBANCES BEYOND THESE LIMITS SHALL BE RESTORED TO ORIGINAL CONDITION.

21. PRE-DISTURBANCE VEGETATION SHALL BE IDENTIFIED, PROTECTED, AND RETAINED WHEREVER POSSIBLE. REMOVAL OR DISTURBANCE OF EXISTING VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS, AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME. THIS SHOULD INCLUDE SEQUENCING AND PHASING CONSTRUCTION ACTIVITIES IN A WAY SO THAT THE SOIL IS NOT EXPOSED FOR LONG PERIODS OF TIME OR BY LIMITING GRADING TO SMALL AREAS. WHEN PRACTICAL, THIS SHOULD ALSO INCLUDE ADVANCING THE SCHEDULE ON STABILIZATION ACTIVITIES SUCH THAT LANDSCAPING TAKES PLACE SHORTLY, IF NOT IMMEDIATELY, AFTER GRADING HAS OCCURRED. VEGETATION EFFORTS SHALL START AS SOON AS POSSIBLE TO RETURN THE SITE TO A STABILIZED CONDITION. SENSITIVE AREAS SHOULD AVOID CLEARING AND GRADING ACTIVITIES AS MUCH AS POSSIBLE.

22. ALL EXPOSED SOILS OR DISTURBED AREAS ARE CONSIDERED A POTENTIAL POLLUTANT AND SHALL HAVE CONTROL MEASURES IMPLEMENTED ON THE SITE TO PREVENT MATERIALS FROM LEAVING THE SITE.

23. ALL SOILS EXPOSED DURING LAND DISTURBING ACTIVITY (STRIPPING, GRADING, UTILITY INSTALLATIONS, STOCKPILING, FILLING, ETC.) SHALL BE KEPT IN A ROUGHENED CONDITION AT ALL TIMES BY EQUIPMENT TRACKING, SCARIFYING OR DISKING THE SURFACE ON A CONTOUR WITH A 2-TO-4-INCH MINIMUM VARIATION IN SOIL SURFACE UNTIL MULCH, VEGETATION, AND/OR OTHER PERMANENT EROSION CONTROL IS INSTALLED.

24. NO SOIL STOCKPILE SHALL EXCEED TEN (10) FEET IN HEIGHT. ALL SOIL STOCKPILES SHALL BE PROTECTED FROM SEDIMENT TRANSPORT THROUGH THE USE OF SURFACE ROUGHENING, WATERING, AND DOWN GRADIENT PERIMETER CONTROLS. ALL SOIL STOCKPILES SHALL BE PROTECTED FROM SEDIMENT TRANSPORT BY WIND. ALL STOCKPILES SHALL BE FLATTENED TO MEET GRADE OR REMOVED FROM THE SITE AS SOON AS PRACTICAL AND NO LATER THAN THE COMPLETION OF CONSTRUCTION ACTIVITIES OR ABANDONMENT OF THE PROJECT. IF FREQUENT ACCESS FROM HARDSCAPE TO THE STOCKPILE IS NEEDED, A STRUCTURAL TRACKING CONTROL MEASURE SHALL BE IMPLEMENTED.

25. ALL REQUIRED CONTROL MEASURES SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITY (STOCKPILING, STRIPPING, GRADING, ETC.). ALL OF THE REQUIRED EROSION CONTROL MEASURES MUST BE INSTALLED AT THE APPROPRIATE TIME IN THE CONSTRUCTION SEQUENCE AS INDICATED IN THE APPROVED PROJECT SCHEDULE, CONSTRUCTION PLANS, AND EROSION AND SEDIMENT CONTROL PLAN.

26. ALL INLETS, CURB-CUTS, CULVERTS, AND OTHER STORM SEWER INFRASTRUCTURE WHICH COULD BE POTENTIALLY IMPACTED BY CONSTRUCTION ACTIVITIES SHALL BE PROTECTED WITH CONTROL MEASURES. MATERIAL ACCUMULATED FROM THIS CONTROL MEASURE SHALL BE PROMPTLY REMOVED AND, IN CASES WHERE THE PROTECTION HAS FAILED, THE PIPES SHALL BE THOROUGHLY CLEANED OUT.

27. ALL STREAMS, STREAM CORRIDORS, BUFFERS, WOODLANDS, WETLANDS, OR OTHER SENSITIVE AREAS SHALL BE PROTECTED FROM IMPACT BY ANY CONSTRUCTION ACTIVITY THROUGH THE USE OF CONTROL MEASURES.

28. ALL EXPOSED DIRT SHALL HAVE PERIMETER CONTROL. ANY PERIMETER CONTROLS THAT DRAIN OFF OR HAVE THE ABILITY TO BE TRACKED ONTO THE NEARBY HARDSCAPE SHALL HAVE SOME FORM OF EFFECTIVE SEDIMENT CONTROL AS, OR AS PART OF, THE PERIMETER CONTROL.

29. ALL EXPOSED SLOPES SHOULD BE PROTECTED. ALL EXPOSED STEEP SLOPES (STEEPER THAN 3H:1V) SHALL BE PROTECTED FROM EROSION AND SEDIMENT TRANSPORT THROUGH USE OF CONTROL MEASURES.

30. NO SOILS SHALL REMAIN EXPOSED BY LAND DISTURBING ACTIVITY FOR MORE THAN THIRTY (30) DAYS AFTER ACTIVITY HAS CEASED BEFORE REQUIRED TEMPORARY SEEDING OR PERMANENT EROSION CONTROL (E.G., SEED/MULCH, LANDSCAPING, ETC.) IS INSTALLED. THIS IS NOT JUST LIMITED TO PROJECTS THAT ARE ABANDONED; THIS INCLUDES ANY PROJECT THAT IS TEMPORARILY HALTED, AND NO IMMEDIATE ACTIVITY IS TO RESUME WITHIN THE NEXT THIRTY (30) DAYS, UNLESS OTHERWISE APPROVED BY THE COUNTY EROSION CONTROL INSPECTOR. DURING A SEASON WHEN SEEDING DOES NOT PRODUCE VEGETATIVE COVER, ANOTHER TEMPORARY EROSION CONTROL SHALL BE IMPLEMENTED WITH OR UNTIL TEMPORARY SEEDING OR PERMANENT EROSION CONTROL CAN BE PERFORMED.

31. ALL INDIVIDUAL LOTS SHALL HAVE EFFECTIVE SEDIMENT CONTROLS LOCATED ON THE STREET SIDE AND ANY DOWN GRADIENT SIDE. TYPICALLY, MOST LOTS DRAIN TO THE FRONT YET ON THOSE CASES WHERE HOUSES ARE ALONG A POND OR DRAINAGE SWALE HAVE THE LOT DRAIN IN A DIFFERENT DIRECTION THAN THE STREET, THOSE INDIVIDUAL LOTS WILL NEED PROTECTION ON THAT DOWN GRADIENT SIDE TO PREVENT SEDIMENT FROM LEAVING THE LOT.

VEHICLE TRACKING

32. AT ALL POINTS WHERE VEHICLES EXIT OR LEAVE THE EXPOSED DIRT AREA ON TO A HARDSCAPE OR SEMI HARDSCAPE (CONCRETE, ASPHALT, ROAD BASE, ETC.), THE DEVELOPER SHALL HAVE INSTALLED AT LEAST ONE STRUCTURAL TRACKING CONTROL MEASURE TO PREVENT VEHICLE TRACKING. ALL AREAS NOT PROTECTED BY ADEQUATE PERIMETER CONTROL SHALL BE CONSIDERED A POINT WHERE VEHICLES EXIT THE SITE. ACCESS POINTS SHOULD BE LIMITED TO AS FEW ENTRANCES AS POSSIBLE (ALL PERIMETER AREAS SHALL BE PROTECTED FROM TRACKING ACTIVITIES).

33. IN ALL AREAS WHERE THE STRUCTURAL TRACKING CONTROL MEASURES FAIL TO PREVENT VEHICLE TRACKING, COLLECTION AND PROPER DISPOSAL OF THAT MATERIAL IS REQUIRED. ALL INLETS LOCATED NEAR ACCESS POINTS AND AFFECTED BY TRACKING ACTIVITIES SHALL BE PROTECTED FROM THE INTRODUCTION OF SEDIMENT INTO THE DRAINAGE SYSTEM.

34. IF REPEATED DEPOSIT OF MATERIAL OCCURS ON A SITE, ADDITIONAL STRUCTURAL TRACKING CONTROLS MAY BE REQUIRED OF THE DEVELOPER BY THE COUNTY EROSION CONTROL INSPECTOR.

EROSION AND SEDIMENT CONTROL BMP LEGEND:

CF	CONSTRUCTION FENCE
CW	CONCRETE WASHOUT
ECB	EROSION CONTROL BLANKET
IPC	CULVERT INLET PROTECTION
SF	SILT FENCE
SM	SEEDING AND MULCHING
SSA	STABILIZED STAGING AREA
TSC	TEMPORARY STREAM CROSSING
VTC	VEHICLE TRACKING CONTROL

REVIEWED BY:

LARIMER COUNTY ENGINEERING DATE

THE LARIMER COUNTY REVIEW CONSTITUTES COMPLIANCE WITH THESE STANDARDS. REVIEW BY THE COUNTY DOES NOT CONSTITUTE APPROVAL OF THE PLAN DESIGN.

THIS REVIEW DOES NOT CONSTITUTE REVIEW/APPROVAL OF ANY PRIVATE ON-SITE IMPROVEMENTS WHICH MAY BE SHOWN. THESE PLANS ARE INTENDED TO BE FOR COUNTY REVIEW OF PUBLIC IMPROVEMENTS ADJACENT TO THE PROPERTY. CONSTRUCTION OF ON-SITE PRIVATE IMPROVEMENTS CANNOT COMMENCE UNTIL ALL REQUIRED TRAFFIC WORKSHEET OR STUDY(S), FINAL DEVELOPMENT PLAN(S), SPECIAL REVIEW(S), AND BUILDING PERMIT(S) ARE COMPLETE, APPROVED AND ON FILE WITH LARIMER COUNTY.

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GILES
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Date: 2025.09.10 16:40:27 -06'00'
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
EROSION CONTROL
KEY MAP, LEGEND, AND LARIMER COUNTY STANDARD NOTES 1

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10EC01
SHEET NO. 24 OF 36

LARIMER COUNTY CONSTRUCTION STORMWATER CONTROL STANDARD NOTES (CONT.)

LOADING AND UNLOADING OPERATIONS

35. THE DEVELOPER SHALL APPLY CONTROL MEASURES TO LIMIT TRAFFIC IMPACTS (SITE WORKER OR PUBLIC) AND PROACTIVELY LOCATE MATERIAL DELIVERED TO THE SITE IN CLOSE PROXIMITY TO THE WORK AREA OR IMMEDIATELY INCORPORATE MATERIALS INTO CONSTRUCTION TO LIMIT OPERATIONAL IMPACTS TO DISTURBED AREAS, VEHICLE TRACKING, AND SEDIMENT DEPOSITION THAT COULD IMPACT WATER QUALITY.

36. ANY MATERIALS OF A NON-POLLUTING NATURE (STEEL, ROCK, BRICK, LUMBER, ETC.) SHALL BE ROUTINELY INSPECTED FOR ANY RESIDUE COMING OFF THE MATERIAL AND WILL GENERALLY BE LOCATED AT LEAST FIFTY (50) FEET FROM ANY PERMANENT OR INTERIM DRAINAGEWAYS, WHERE PRACTICAL.

37. ANY POLLUTANT WITH POTENTIAL FOR SIGNIFICANT ENVIRONMENTAL IMPACT THAT IS HIGHLY LIKELY TO RESULT IN DISCHARGE WHEN IN CONTACT WITH STORMWATER (LUBRICANTS, FUELS, PAINTS, SOLVENTS, DETERGENTS, FERTILIZERS, CHEMICAL SPRAYS, BAGS OF CEMENT MIX, ETC.) SHOULD NOT BE KEPT ON SITE, WHERE PRACTICAL. WHEN OFF-SITE STORAGE IS NOT PRACTICAL, POLLUTANTS SHOULD BE STORED INSIDE (VEHICLE, TRAILER, CONEX, BUILDING, ETC.) AND OUT OF CONTACT WITH STORMWATER OR STORMWATER RUNOFF. WHERE INTERIOR STORAGE IS NOT AVAILABLE, POLLUTANTS SHALL BE STORED OUTSIDE IN A RAISED (HIGH SPOTS OR ON PALLETS), COVERED (PLASTIC OR TARPED), AND SEALED (LEAK PROOF) SECONDARY CONTAINMENT LOCATION. THE SECONDARY CONTAINMENT OR OTHER CONTROL MEASURE SHALL BE ADEQUATELY SIZED, LOCATED AT LEAST FIFTY (50) FEET FROM ANY PERMANENT OR INTERIM STORMWATER STRUCTURES OR DRAINAGEWAYS (WHERE PRACTICAL), AND MONITORED AS PART OF THE ROUTINE INSPECTIONS.

VEHICLE AND EQUIPMENT MAINTENANCE AND FUELING

38. PARKING, REFUELING, AND MAINTENANCE OF VEHICLES AND EQUIPMENT SHOULD BE LIMITED TO ONE AREA OF THE SITE TO MINIMIZE POSSIBLE SPILLS AND FUEL STORAGE AREAS. THIS AREA SHALL BE LOCATED, WHERE PRACTICAL, AT LEAST FIFTY (50) FEET FROM ANY PERMANENT OR INTERIM STORMWATER STRUCTURES OR DRAINAGEWAYS AND SHALL BE MONITORED AS PART OF THE ROUTINE INSPECTIONS. ALL AREAS SHALL KEEP SPILL KITS AND SUPPLIES CLOSE.

CONCRETE TRUCK/EQUIPMENT WASHING, INCLUDING THE CONCRETE TRUCK CHUTE AND ASSOCIATED FIXTURES AND EQUIPMENT

39. ALL CONCRETE AND EQUIPMENT WASHING SHALL USE STRUCTURAL CONTROL MEASURES APPROPRIATE TO THE VOLUME OF WASH AND FREQUENCY OF USE. THESE CONTROL MEASURES SHALL BE LOCATED, WHERE PRACTICAL, AT LEAST FIFTY (50) FEET FROM ANY PERMANENT OR INTERIM STORMWATER STRUCTURES OR DRAINAGEWAYS AND SHALL BE MONITORED AS PART OF THE ROUTINE INSPECTIONS. THESE AREAS SHALL BE CLEARLY IDENTIFIED, AND ANY WASH PREVENTED FROM LEAVING THE CONTROL MEASURE. IF FREQUENT ACCESS FROM HARDSCAPE TO THE CONTROL MEASURE IS TO OCCUR, A STRUCTURAL TRACKING CONTROL MEASURE SHALL BE IMPLEMENTED. THESE CONTROL MEASURES SHALL BE FREQUENTLY CLEANED OUT.

40. THE DEVELOPER IS RESPONSIBLE FOR ENSURING WASHING ACTIVITY IS TAKING PLACE AT THE APPROPRIATE CONTROL MEASURE AND SITE WORKERS ARE NOT WASHING OR DUMPING WASH WATER ONTO THE DIRT OR IN OTHER UNCONTROLLED LOCATIONS.

DEDICATED ASPHALT AND CONCRETE BATCH PLANTS

41. DEDICATED ASPHALT AND CONCRETE BATCH PLANTS ARE NOT ACCEPTABLE ON CONSTRUCTION SITES WITHIN THE COUNTY WITHOUT AN EXPRESSED WRITTEN REQUEST, PLAN TO REDUCE POLLUTANTS ASSOCIATED WITH THAT TYPE OF ACTIVITY, AND APPROVAL BY THE COUNTY'S EROSION CONTROL INSPECTOR. THE DEVELOPER SHALL INFORM THE EROSION CONTROL INSPECTION STAFF OF ANY DEDICATED ASPHALT OR CONCRETE BATCH PLANT THAT IS TO BE USED ON SITE.

WASTE MATERIALS STORAGE AND SANITARY FACILITIES

42. TRASH, DEBRIS, MATERIAL SALVAGE, AND/OR RECYCLING AREAS SHALL BE, WHERE PRACTICAL, AT LEAST FIFTY (50) FEET FROM ANY PERMANENT OR INTERIM STORMWATER STRUCTURES OR DRAINAGEWAYS AND SHALL BE MONITORED AS PART OF THE ROUTINE INSPECTIONS. THESE FACILITIES SHALL BE LOCATED OUT OF THE WIND AND COVERED AS ABLE. WHERE NOT ABLE TO COVER, LOCATE SAID AREAS ON THE SIDE OF OTHER STRUCTURES TO REDUCE EXPOSURE TO WINDS, AND FOLLOW MAXIMUM LOADING GUIDELINES AS MARKED ON THE CONTAINER. THE DEVELOPER IS REQUIRED TO PRACTICE GOOD HOUSEKEEPING TO KEEP THE CONSTRUCTION SITE FREE OF LITTER, CONSTRUCTION DEBRIS, AND LEAKING CONTAINERS.

43. SANITARY FACILITIES SHALL BE PREVENTED FROM TIPPING THROUGH THE USE OF ANCHORING TO THE GROUND OR LASHING TO A STABILIZED STRUCTURE. THESE FACILITIES SHALL ALSO BE LOCATED AS FAR AS PRACTICAL FROM AN INLET, CURB CUT, DRAINAGE SWALE, OR OTHER DRAINAGE CONVEYANCE TO PREVENT MATERIAL TRANSPORT FROM LEAVING THE LOCAL AREA. THIS CONSISTS OF THE FACILITY BEING LOCATED, WHERE PRACTICAL, AT LEAST FIFTY (50) FEET FROM ANY PERMANENT OR INTERIM DRAINAGEWAYS.

OTHER SITE OPERATIONS AND POTENTIAL SPILL AREAS

44. SPILLS: FOR THOSE SPILLS LESS THAN 5 GALLONS THAT HAVE NO POTENTIAL TO IMPACT STATE WATERS, NOTIFY THE COUNTY BY EMAIL AT ENG-STORMWATER@LARIMER.ORG. FOR SPILLS 5 GALLONS OR GREATER OR THAT HAVE THE POTENTIAL TO IMPACT STATE WATERS OR HUMAN HEALTH, CONTACT THE COUNTY HEALTH DEPARTMENT (LCDHE) THROUGH LARIMER COUNTY SHERIFF DISPATCH (970) 416- 1985. ALL SPILLS SHALL BE CLEANED UP IMMEDIATELY.

45. SELECTION OF "PLASTIC WELDED" EROSION CONTROL BLANKETS SHALL NOT BE USED IN AREAS WHERE WILDLIFE, SUCH AS SNAKES, ARE LIKELY TO BE LOCATED AS THESE HAVE PROVEN TO CAUSE ENTRAPMENT ISSUES.

FINAL STABILIZATION AND PROJECT COMPLETION

46. ANY STORMWATER FACILITIES USED AS TEMPORARY CONTROL MEASURES SHALL BE RESTORED AND STORM SEWER LINES SHALL BE CLEANED UPON COMPLETION OF THE PROJECT AND BEFORE TURNING MAINTENANCE OVER TO THE OWNER, HOMEOWNERS ASSOCIATION (HOA), OR OTHER PARTY RESPONSIBLE FOR LONG TERM MAINTENANCE OF THOSE FACILITIES.

47. ALL DISTURBED AREAS DESIGNED TO BE VEGETATED SHALL BE AMENDED, SEEDED AND MULCHED, OR LANDSCAPED AS SPECIFIED IN THE LANDSCAPE PLANS WITHIN 14 WORKING DAYS OF FINAL GRADING.

48. ALL SEEDING SHALL REFER TO LANDSCAPING PLANS FOR SPECIES MIXTURE, APPLICATION RATES, AND DEPTH REQUIREMENTS.

49. ALL SEED SHALL BE DRILLED WHERE PRACTICAL TO A DEPTH BASED UPON THE SEED TYPE. BROADCAST SEEDING SHALL BE APPLIED AT DOUBLE THE RATE AS PRESCRIBED FOR DRILL SEEDING AND SHALL BE LIGHTLY HAND RAKED AFTER APPLICATION. HYDROSEEDING MAY BE SUBSTITUTED FOR DRILL SEEDING ON SLOPES STEEPER THAN 3H:1V OR ON OTHER AREAS NOT PRACTICAL TO DRILL SEED AND CRIMP AND MULCH. ALL HYDROSEEDING MUST BE CONDUCTED AS TWO SEPARATE PROCESSES OF SEEDING AND TACKIFICATION.

50. ALL SEEDED AREAS MUST BE MULCHED WITHIN TWENTY-FOUR (24) AFTER PLANTING. ALL MULCH SHALL BE MECHANICALLY CRIMPED AND/OR HAVE AN ADEQUATELY APPLIED TACKIFIER. THE USE OF CRIMPED MULCH OR TACKIFIER MAY REQUIRE MULTIPLE RE-APPLICATIONS IF NOT PROPERLY INSTALLED OR IF WEATHERING OR DEGRADATION OCCURS BEFORE VEGETATION HAS BEEN ESTABLISHED. AREAS OF EMBANKMENTS HAVING SLOPES GREATER THAN OR EQUAL TO 3H:1V SHALL BE STABILIZED WITH AN EROSION MAT OR APPROVED EQUAL TO ENSURE SEED WILL BE ABLE TO GERMINATE ON THE STEEP SLOPES. DURING A SEASON WHEN SEEDING DOES NOT PRODUCE VEGETATIVE COVER, ANOTHER TEMPORARY EROSION CONTROL SHALL BE IMPLEMENTED ALONG WITH, OR UNTIL, TEMPORARY SEEDING OR PERMANENT EROSION CONTROL CAN BE PERFORMED.

51. THE DEVELOPER SHALL WARRANTY AND MAINTAIN ALL VEGETATIVE MEASURES FOR TWO GROWING SEASONS AFTER INSTALLATION OR UNTIL SEVENTY PERCENT (70%) VEGETATIVE COVER HAS BEEN ESTABLISHED, WHICHEVER IS LONGER.

52. THE DEVELOPER SHALL MAINTAIN, MONITOR, REPAIR, AND REPLACE ALL APPLICABLE CONTROL MEASURES UNTIL FINAL STABILIZATION HAS BEEN OBTAINED. ALL CONTROL MEASURES MUST REMAIN UNTIL SUCH TIME AS ALL UPSTREAM CONTRIBUTING POLLUTANT SOURCES HAVE BEEN VEGETATED OR REMOVED FROM THE SITE. WHEN THE SITE HAS BEEN DEEMED STABILIZED AND VERIFIED BY THE COUNTY EROSION CONTROL INSPECTOR, ALL TEMPORARY CONTROL MEASURES CAN BE FULLY REMOVED. WHEN ANY CONTROL MEASURE IS REMOVED, THE DEVELOPER SHALL BE RESPONSIBLE FOR THE CLEANUP AND REMOVAL OF ALL SEDIMENT AND DEBRIS FROM THAT CONTROL MEASURE. ALL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL STABILIZATION IS ACHIEVED.

53. THE RESPONSIBLE PARTY SHALL MAINTAIN AND KEEP CURRENT ALL PAYMENTS OR RELATED FORMS OF SECURITY FOR THE EROSION CONTROL ESCROW UNTIL 1) STABILIZATION HAS BEEN REACHED AND 2) ALL CONTROL MEASURES AND/OR BMPS HAVE SEDIMENT MATERIALS COLLECTED AND THE CONTROL MEASURES HAVE BEEN REMOVED FROM THE SITE. AT THAT TIME THE SITE WILL BE CONSIDERED COMPLETED AND ANY REMAINING EROSION CONTROL ESCROW SHALL BE RETURNED TO THE APPROPRIATE PARTIES.

OTHER STANDARD NOTES

1. ALL REFERENCES TO ANY PUBLISHED STANDARDS SHALL REFER TO THE LATEST REVISION OF SAID STANDARD, UNLESS SPECIFICALLY STATED OTHERWISE.

2. THE DEVELOPER SHALL COMPLY WITH ALL TERMS AND CONDITIONS OF THE COLORADO PERMIT FOR STORM WATER DISCHARGE (CONTACT COLORADO DEPARTMENT OF HEALTH, WATER QUALITY CONTROL DIVISION, (303) 692-3517), THE STORM WATER MANAGEMENT PLAN, AND THE EROSION AND SEDIMENT CONTROL PLAN.

3. THE LOCAL ENTITY SHALL NOT BE RESPONSIBLE FOR THE MAINTENANCE OF STORM DRAINAGE FACILITIES LOCATED ON PRIVATE PROPERTY. MAINTENANCE OF ONSITE DRAINAGE FACILITIES SHALL BE THE RESPONSIBILITY OF THE PROPERTY OWNER(S).

4. PRIOR TO FINAL INSPECTION AND ACCEPTANCE BY THE LOCAL ENTITY, CERTIFICATION OF THE DRAINAGE FACILITIES, BY A REGISTERED ENGINEER, MUST BE SUBMITTED TO AND APPROVED BY THE STORMWATER UTILITY DEPARTMENT. CERTIFICATION SHALL BE SUBMITTED TO THE STORMWATER UTILITY DEPARTMENT AT LEAST TWO WEEKS PRIOR TO THE RELEASE OF A CERTIFICATE OF OCCUPANCY FOR SINGLE FAMILY UNITS. FOR COMMERCIAL PROPERTIES, CERTIFICATION SHALL BE SUBMITTED TO THE STORMWATER UTILITY DEPARTMENT AT LEAST TWO WEEKS PRIOR TO THE RELEASE OF ANY BUILDING PERMITS IN EXCESS OF THOSE ALLOWED PRIOR TO CERTIFICATION PER THE DEVELOPMENT AGREEMENT.

5. ALL RECOMMENDATIONS OF THE FINAL DRAINAGE AND EROSION CONTROL STUDY (NAME OF THE STUDY AND DATE) BY (ENGINEERING FIRM) SHALL BE FOLLOWED AND IMPLEMENTED.

6. TEMPORARY EROSION CONTROL DURING CONSTRUCTION SHALL BE PROVIDED AS SHOWN ON THE EROSION AND SEDIMENT CONTROL PLAN. ALL EROSION CONTROL MEASURES SHALL BE MAINTAINED IN GOOD REPAIR BY THE DEVELOPER, UNTIL SUCH TIME AS THE ENTIRE DISTURBED AREA IS STABILIZED WITH HARD SURFACE OR LANDSCAPING.

7. THE DEVELOPER SHALL BE RESPONSIBLE FOR ENSURING THAT NO MUD OR DEBRIS SHALL BE TRACKED ONTO THE EXISTING PUBLIC STREET SYSTEM. MUD AND DEBRIS MUST BE REMOVED WITHIN 24 HOURS BY AN APPROPRIATE MECHANICAL METHOD (I.E., MACHINE BROOM SWEEP, LIGHT DUTY FRONT-END LOADER, ETC.) OR AS APPROVED BY THE LOCAL ENTITY'S STREET INSPECTOR.

8. AT ALL TIMES DURING CONSTRUCTION, THE DEVELOPER SHALL BE RESPONSIBLE FOR PREVENTING AND CONTROLLING ON-SITE EROSION INCLUDING KEEPING THE PROPERTY SUFFICIENTLY WATERED SO AS TO MINIMIZE WIND-BLOWN SEDIMENT. THE DEVELOPER SHALL ALSO BE RESPONSIBLE FOR INSTALLING AND MAINTAINING ALL EROSION CONTROL FACILITIES SHOWN HEREIN.

9. THE STORMWATER VOLUME CAPACITY OF DETENTION PONDS WILL BE RESTORED, AND STORM SEWER LINES WILL BE CLEANED UPON COMPLETION OF THE PROJECT AND BEFORE TURNING THE MAINTENANCE OVER TO THE OWNER OR HOMEOWNERS ASSOCIATION (HOA).

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GILES 43662 Digitally signed by Matt L. Giles Contact Info: Carollo Engineers, Inc. Date: 2025.09.10 16:42:40 -06'00' PROFESSIONAL ENGINEER

carollo®

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
EROSION CONTROL
LARIMER COUNTY STANDARD NOTES 2

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

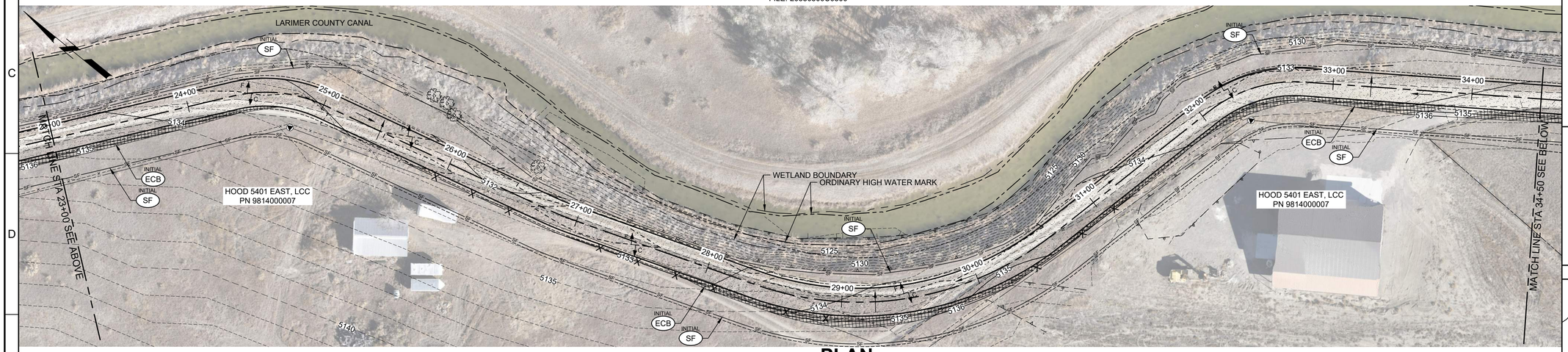
JOB NO. 203505
DRAWING NO. 10EC02
SHEET NO. 25 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510EC01.DWG

PLAN

FILE: 20350500C0800



PLAN

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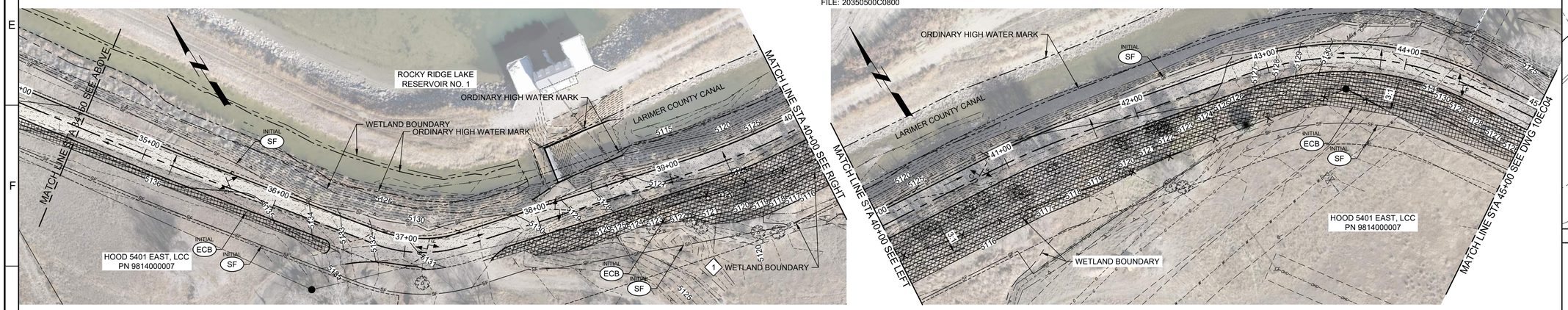


PLAN

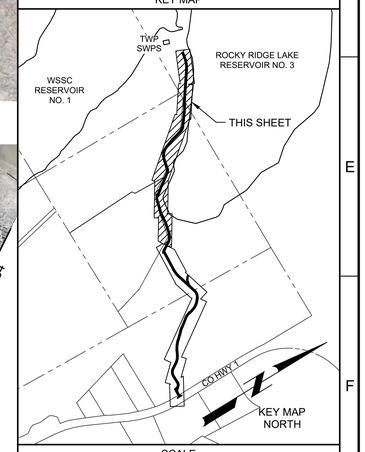
FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK EXCEPT AT THE CANAL CROSSING LOCATION.

811 Know what's below. Call before you dig. usanorth811.org

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MARY LEE SEITZ 43662 PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

EROSION CONTROL

INTIIAL PLAN STA 12+40 TO 45+00

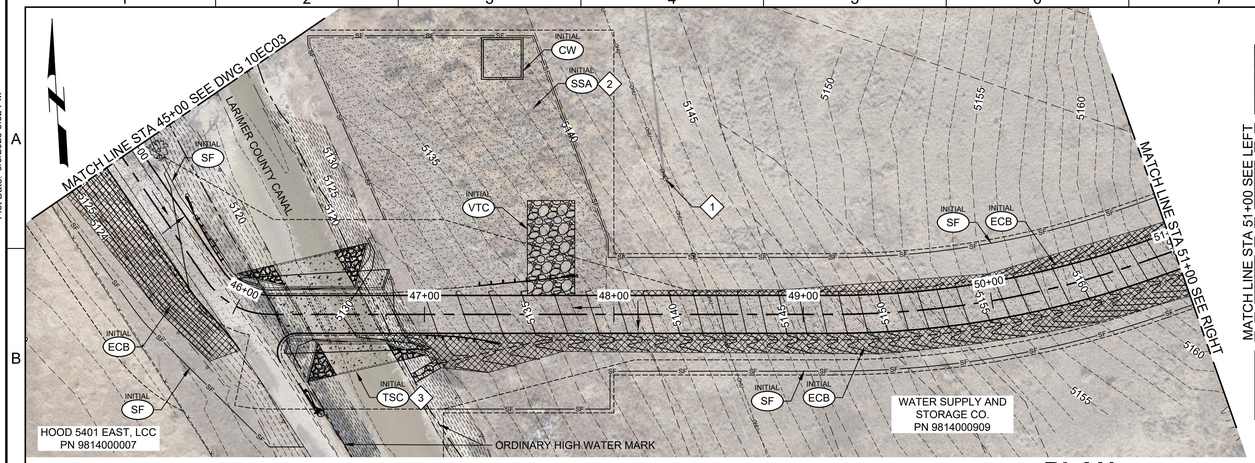
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

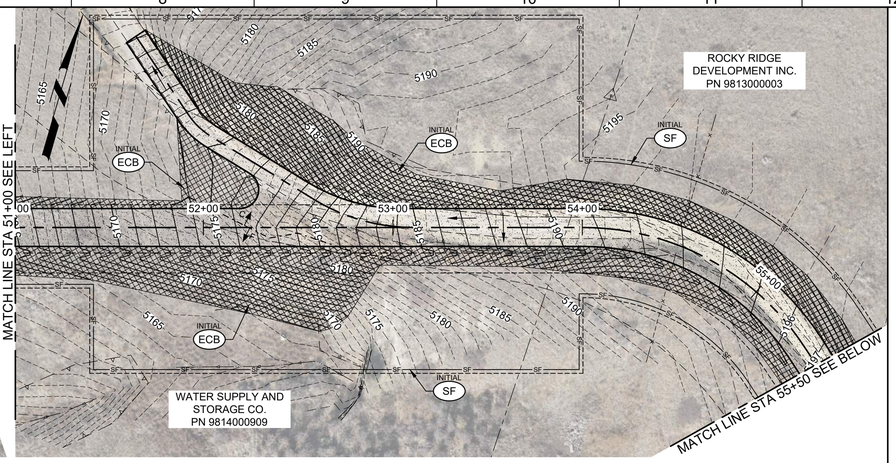
JOB NO. 203505
DRAWING NO. 10EC03
SHEET NO. 26 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510EC03.DWG

Plot Date: 9/9/2025 3:32 PM





PLAN

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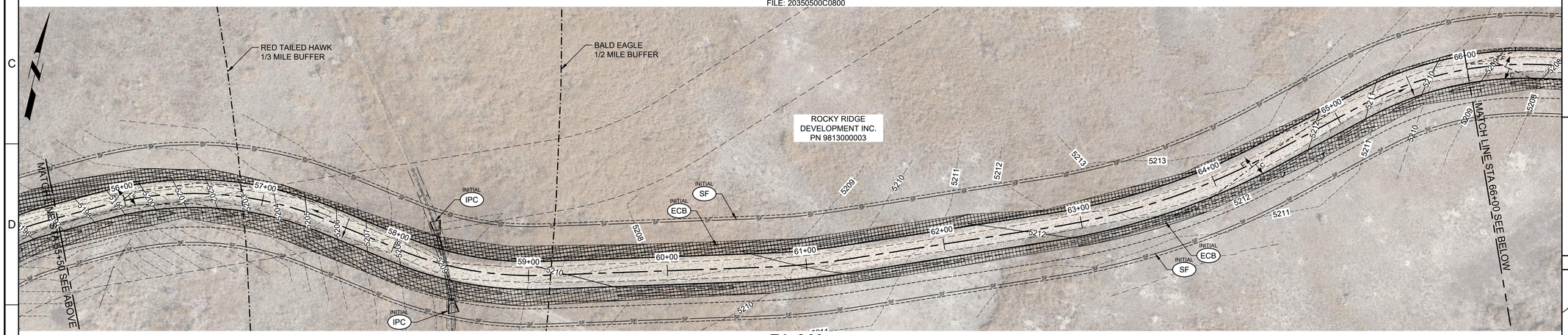

PLAN

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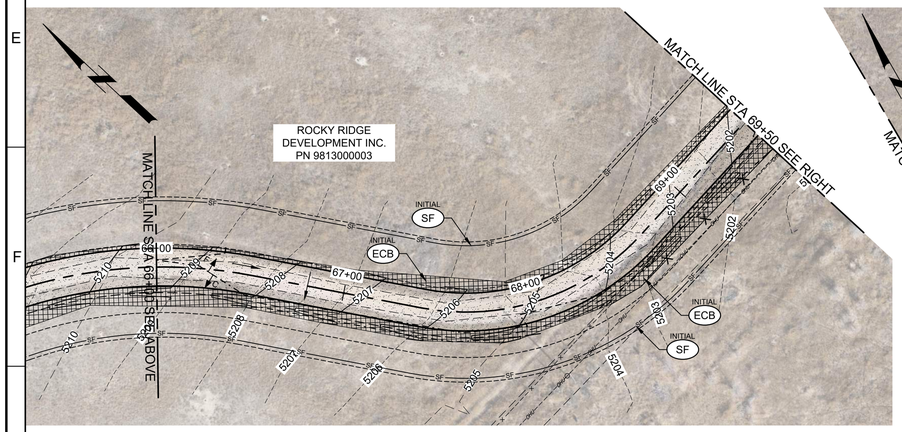
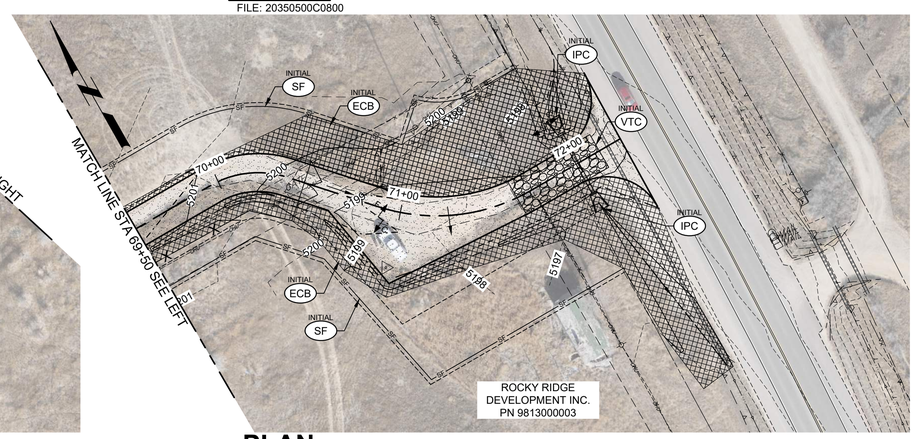




PLAN

FILE: 20350500C0800

GENERAL NOTES:

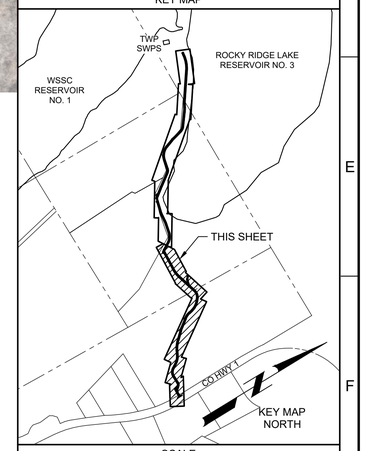
1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. CONTRACTOR TO APPLY NECESSARY SAFETY PRECAUTIONS FOR WORK UNDER OVERHEAD POWER LINE.
3. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK EXCEPT AT THE CANAL CROSSING LOCATION.

KEY NOTES:

1. PROTECT IN PLACE EXISTING POWER POLE.
2. CONSTRUCTION LAYDOWN AREA TO BE LOCATED OUTSIDE OF TRI-STATE UTILITY EASEMENT AND LCC. CONTRACTOR TO RESTORE AREA TO ORIGINAL CONDITION FOLLOWING CONSTRUCTION.
3. MAXIMUM 30 CFS ALLOWABLE FLOW THROUGH CANAL TO BE ROUTED AROUND CULVERT DURING CONSTRUCTION. SEE SUMMARY OF WORK SPECIFICATION 01_11_00.

811 Know what's below. Call before you dig. usanorth811.org

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
MATT LEE GRABB
43662
Digitally signed by Matt L. Grabb
Date: 2025.09.10 14:42:49 -06'00'
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
EROSION CONTROL
INITIAL PLAN STA 45+00 TO 72+25

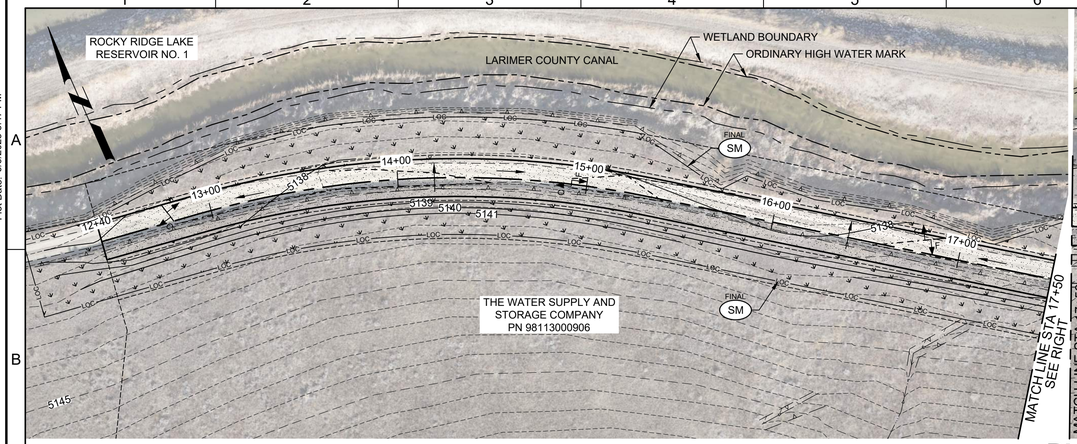
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

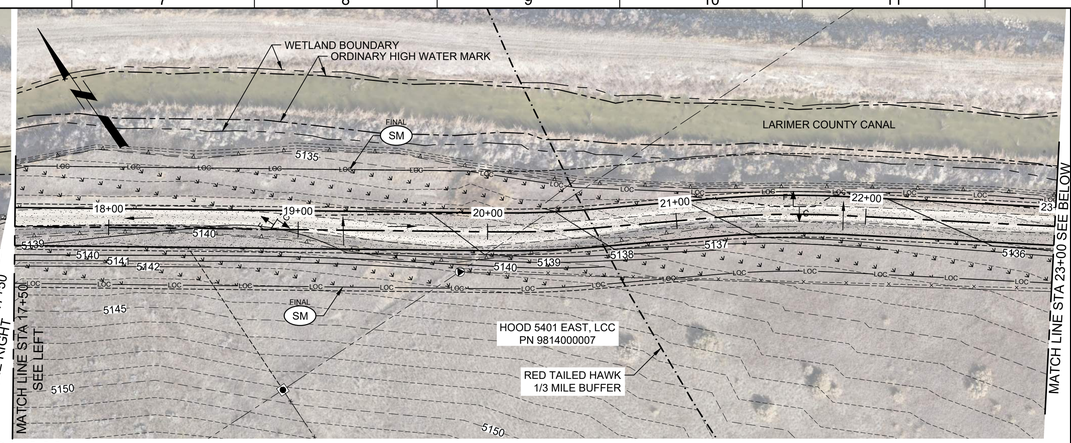
JOB NO. 203505
DRAWING NO. 10EC04
SHEET NO. 27 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510EC03.DWG

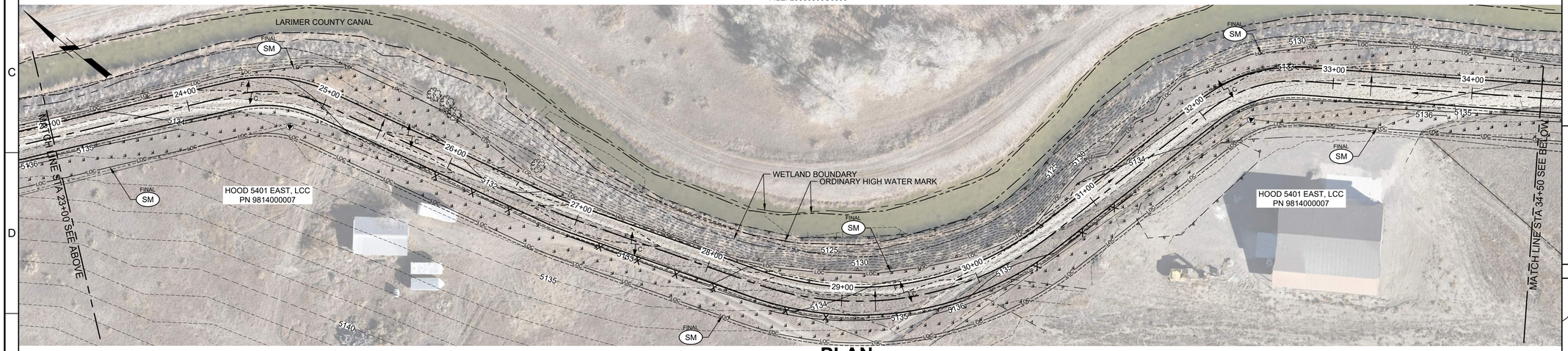
Plot Date: 9/9/2025 3:47 PM





PLAN

FILE: 20350500C0800



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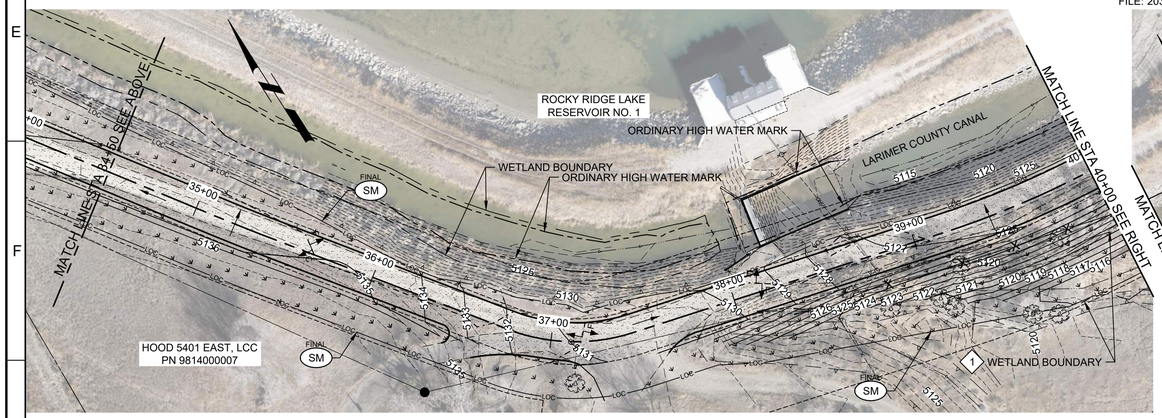
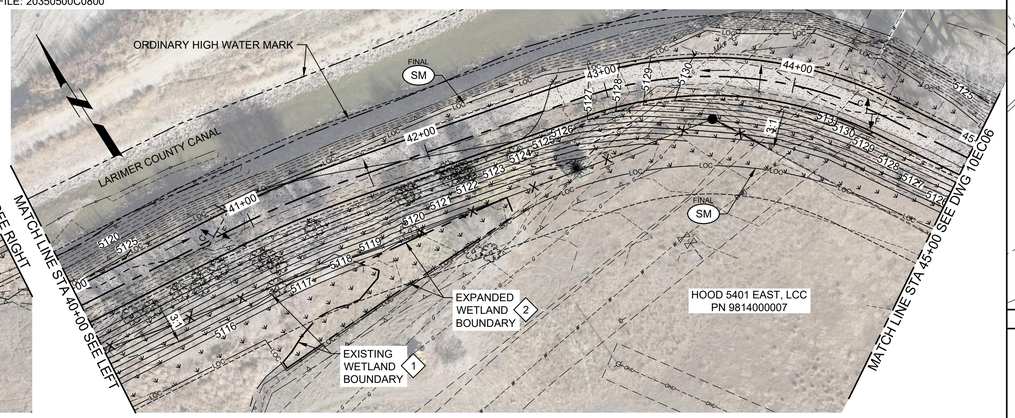




PLAN

FILE: 20350500C0800

GENERAL NOTES:

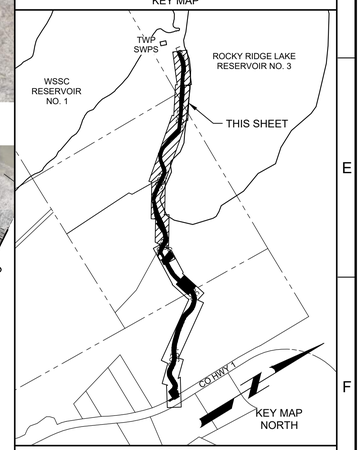
1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
2. NO CONSTRUCTION TO OCCUR WITHIN 1' OF THE LARIMER COUNTY CANAL TOP OF BANK EXCEPT AT THE CANAL CROSSING LOCATION.
3. ALL AREAS OUTSIDE OF WETLAND BOUNDARY TO BE RESEEDED WITH "UPLAND SEED MIX" PER SPECIFICATION SECTION 32_92_19.

(#) KEY NOTES:

1. RESEED WITH "WETLAND SEED MIX" PER SPECIFICATION 32_92_19 WITHIN WETLAND BOUNDARY.
2. RESEED EXPANDED WETLAND AREA PER SOURCE WATER PUMP STATION WETLAND MITIGATION PLAN, SEE SPECIFICATION SECTION 01_11_00.

Know what's below. Call before you dig.
usanorth811.org

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED	RJF
DRAWN	RJF
CHECKED	JJK
DATE	SEPTEMBER 2025

COLORADO LICENSED
AMY LEE GILES
43662
Digitally signed by Bart L. Giles
Contact Info: Carollo Engineers
Date: 2025.09.10 16:49:47 -06'00'
PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

EROSION CONTROL

FINAL PLAN STA 12+40 TO 45+00

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

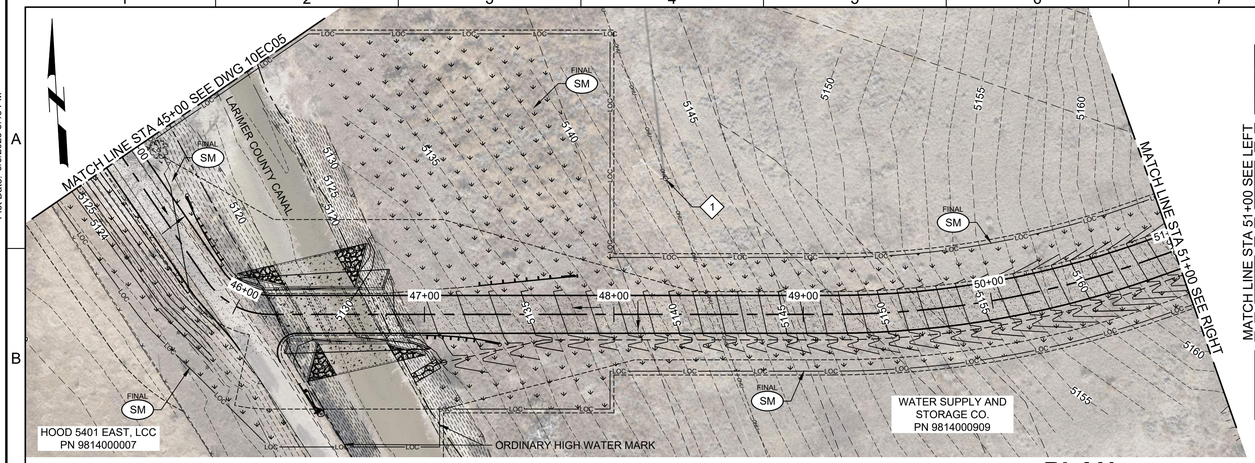
JOB NO. 203505

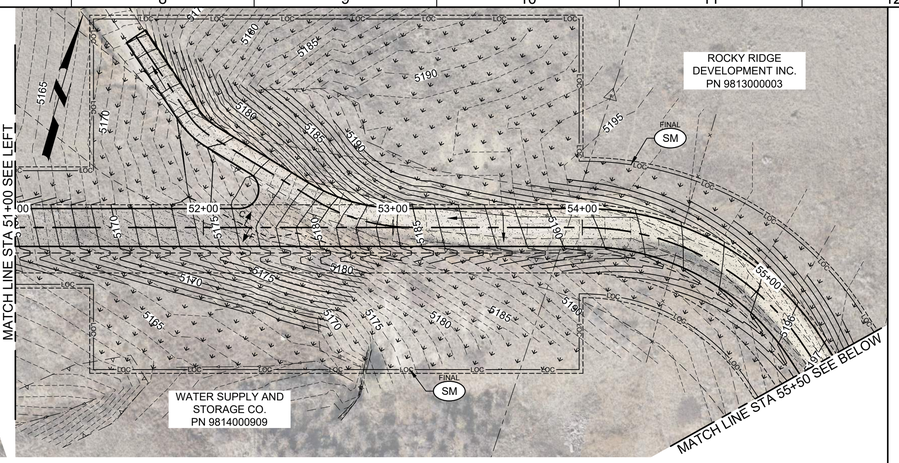
DRAWING NO. 10EC05

SHEET NO. 28 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510EC04.DWG





PLAN

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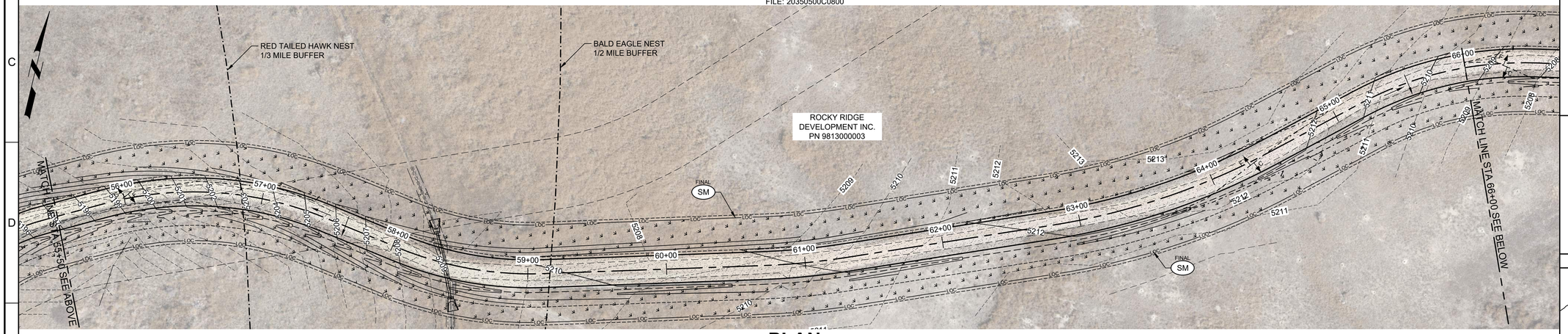

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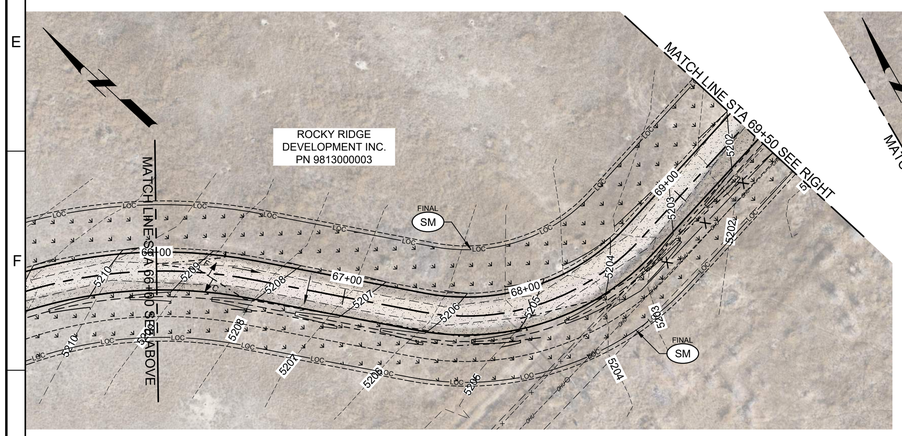

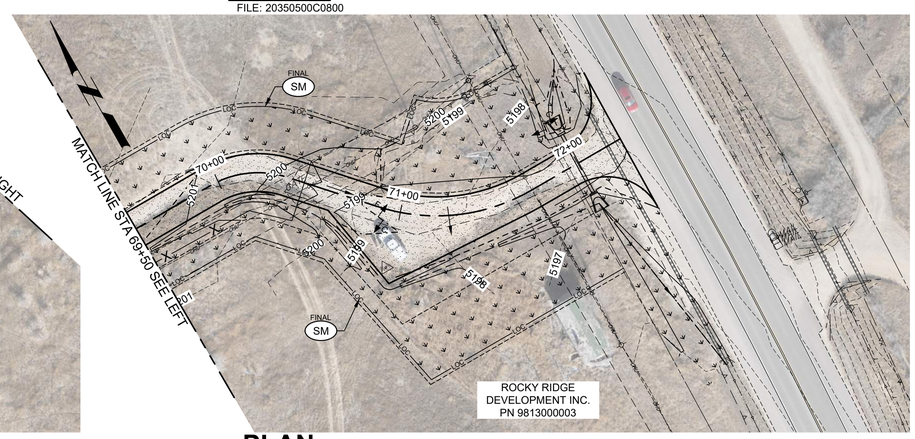

PLAN

FILE: 20350500C0800

GENERAL NOTES:

1. SURVEY DATUM IS BASED ON STATE PLANE NORTH ZONE 83/2011 AND NAVD 88.
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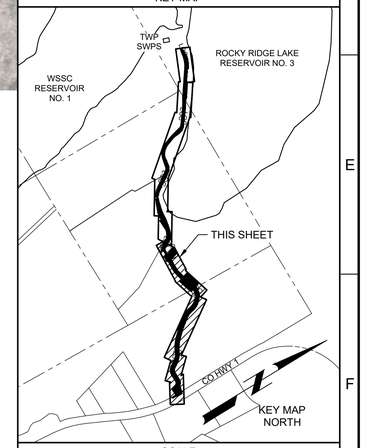
4. ALL AREAS OUTSIDE OF WETLAND BOUNDARY TO BE RESEEDED WITH "UPLAND SEE MIX" PER SPECIFICATION SECTION 32_92_19.

KEY NOTES:

1. PROTECT IN PLACE EXISTING POWER POLE.

811 Know what's below. Call before you dig. usanorth811.org

KEY MAP



SCALE

0 20' 40' 80'

SCALE: 1" = 40' (HORIZ)

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GEER
43662
PROFESSIONAL ENGINEER
Digitally signed by Bart L. Gilles
DN: cn=Bart L. Gilles, o=Carollo Engineers, ou=Water, email=bgilles@carollo.com, c=US
Date: 2025.09.10 15:48:22 -06'00'

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD

EROSION CONTROL

FINAL PLAN STA 45+00 TO 72+25

VERIFY SCALES
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0 1"
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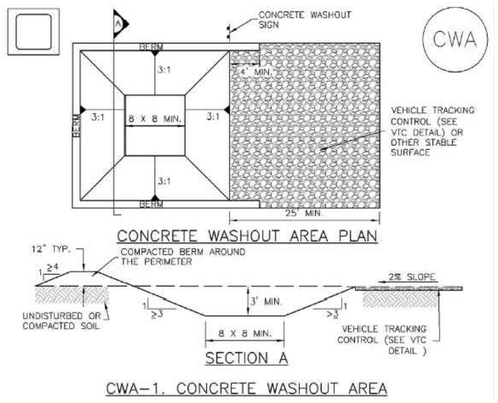
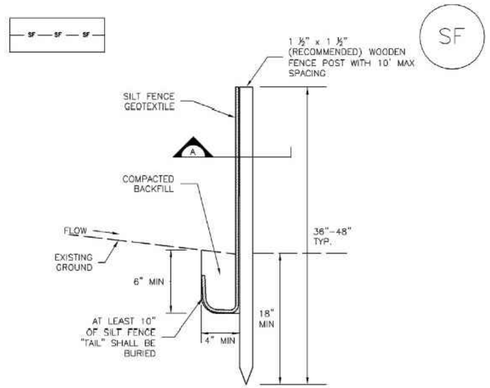
JOB NO. 203505
DRAWING NO. 10EC06
SHEET NO. 29 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510EC04.DWG



CWA–1. CONCRETE WASHOUT AREA



SF–1. SILT FENCE

CW INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -CW INSTALLATION LOCATION.
2. DO NOT LOCATE AN UNLINED CW WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CW MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE AREA SHOULD BE USED.
3. THE CW SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.
4. CW SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8'. SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.
5. BERM SURROUNDING SIDES AND BACK OF THE CW SHALL HAVE MINIMUM HEIGHT OF 1'.
6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CW.
7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CW, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CW TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

CW MAINTENANCE NOTES

1. INSPECT BMPS EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPS SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPS AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPS IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPS HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. THE CW SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE. CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.
5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER-TIGHT CONTAINER AND DISPOSED OF PROPERLY.
6. THE CW SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACE.
7. WHEN THE CW IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

SILT FENCE INSTALLATION NOTES

1. SILT FENCE MUST BE PLACED AWAY FROM THE TOE OF THE SLOPE TO ALLOW FOR WATER PONDING. SILT FENCE AT THE TOE OF A SLOPE SHOULD BE INSTALLED IN A FLAT LOCATION AT LEAST SEVERAL FEET (2-5 FT) FROM THE TOE OF THE SLOPE TO ALLOW ROOM FOR PONDING AND DEPOSITION.
2. A UNIFORM 6" X 4" ANCHOR TRENCH SHALL BE EXCAVATED USING TRENCHER OR SILT FENCE INSTALLATION DEVICE. NO ROAD GRADERS, BACKHOES, OR SIMILAR EQUIPMENT SHALL BE USED.
3. COMPACT ANCHOR TRENCH BY HAND WITH A "JUMPING JACK" OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
4. SILT FENCE SHALL BE PULLED RIGHT AS IT IS ANCHORED TO THE STAKES. THERE SHOULD BE NO NOTICEABLE SAG BETWEEN STAKES AFTER IT HAS BEEN ANCHORED TO THE STAKES.
5. SILT FENCE FABRIC SHALL BE ANCHORED TO THE STAKES USING 1" HEAVY DUTY STAPLES OR NAILS WITH 1" HEADS. STAPLES AND NAILS SHOULD BE PLACED 3" ALONG THE FABRIC DOWN THE STAKE.
6. AT THE END OF A RUN OF SILT FENCE ALONG A CONTOUR, THE SILT FENCE SHOULD BE TURNED PERPENDICULAR TO THE CONTOUR TO CREATE A "J-HOOK". THE "J-HOOK" EXTENDING PERPENDICULAR TO THE CONTOUR SHOULD BE OF SUFFICIENT LENGTH TO KEEP RUNOFF FROM FLOWING AROUND THE END OF THE SILT FENCE (TYPICALLY 10'-20').
7. SILT FENCE SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT BMPS EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPS SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPS AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPS IN EFFECTIVE OPERATING CONDITION. INSPECTION AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPS HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. SEDIMENT ACCUMULATED UPSTREAM OF THE SILT FENCE SHALL BE REMOVED AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY 6".
5. REPAIR OR REPLACE SILT FENCE WHEN THERE ARE SIGNS OF WEAR, SUCH AS SAGGING, TEARING, OR COLLAPSE.
6. SILT FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION, OR IS REPLACED BY AN EQUIVALENT PERIMETER SEDIMENT CONTROL BMP.
7. WHEN SILT FENCE IS REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

CW CONCRETE WASHOUT
SCALE: NTS

SF SILT FENCE
SCALE: NTS

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GRABER 43662 digitally signed by Matt L. Graber Date: 2025.09.10 14:47:39 -06'00' PROFESSIONAL ENGINEER

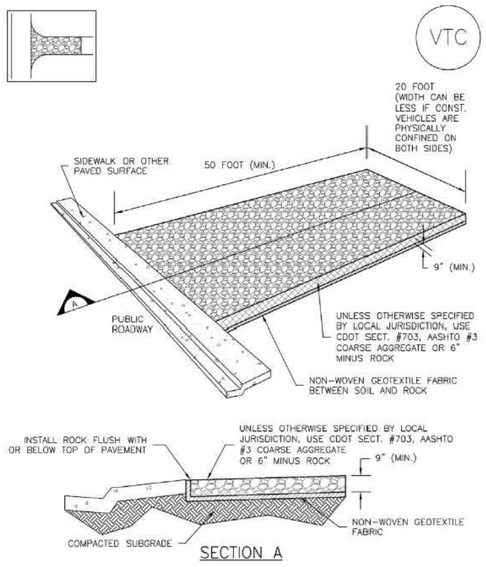
CITY OF THORNTON
THORNTON WATER PROJECT SOURCE
WATER PUMP STATION ACCESS ROAD
EROSION CONTROL
DETAILS 1

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10EC07
SHEET NO. 30 OF 36

LAST SAVED BY: RFALK

PROJECT NO. 203505 FILE NAME: 20350510EC06.DWG



VTC-1. AGGREGATE VEHICLE TRACKING CONTROL

STABILIZED CONSTRUCTION ENTRANCE/EXIT INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF CONSTRUCTION ENTRANCE(S)/EXIT(S).
   -TYPE OF CONSTRUCTION ENTRANCE(S)/EXIT(S) (WITH/WITHOUT WHEEL WASH, CONSTRUCTION MAT OR TRM).
2. CONSTRUCTION MAT OR TRM STABILIZED CONSTRUCTION ENTRANCES ARE ONLY TO BE USED ON SHORT DURATION PROJECTS (TYPICALLY RANGING FROM A WEEK TO A MONTH) WHERE THERE WILL BE LIMITED VEHICULAR ACCESS.
3. A STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE LOCATED AT ALL ACCESS POINTS WHERE VEHICLES ACCESS THE CONSTRUCTION SITE FROM PAVED RIGHT-OF-WAYS.
4. STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
5. A NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED UNDER THE STABILIZED CONSTRUCTION ENTRANCE/EXIT PRIOR TO THE PLACEMENT OF ROCK.
6. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703 AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

STABILIZED CONSTRUCTION ENTRANCE/EXIT MAINTENANCE NOTES

1. INSPECT BMPS EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPS SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPS AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPS IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPS HAVE FAILED REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY TO THE STABILIZED ENTRANCE/EXIT TO MAINTAIN A CONSISTENT DEPTH.
5. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED THROUGHOUT THE DAY AND AT THE END OF THE DAY BY SHOVELING OR SWEEPING. SEDIMENT MAY NOT BE WASHED DOWN STORM SEWER DRAINS.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

VTC VEHICLE TRACKING CONTROL

SCALE: NTS

UDFCD EC-14 - WIND EROSION/DUST CONTROL DESIGN AND INSTALLATION NOTES:

THE FOLLOWING CONSTRUCTION BMPS CAN BE USED FOR DUST CONTROL:

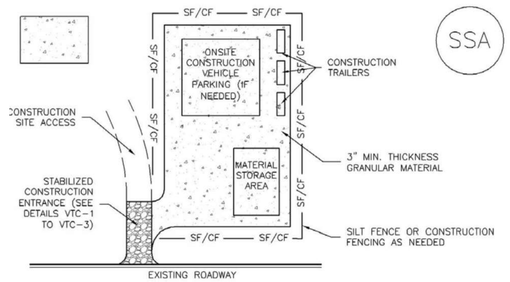
1. AN IRRIGATION/SPRINKLER SYSTEM CAN BE USED TO WET THE TOP LAYER OF DISTURBED SOIL TO HELP KEEP DRY SOIL PARTICLES FROM BECOMING AIRBORNE.
2. SEEDING AND MULCHING CAN BE USED TO STABILIZE DISTURBED SURFACES AND REDUCE DUST EMISSIONS.
3. PROTECTING EXISTING VEGETATION CAN HELP TO SLOW WIND VELOCITIES ACROSS THE GROUND SURFACE, THEREBY LIMITING THE LIKELIHOOD OF SOIL PARTICLES TO BECOME AIRBORNE.
4. SPRAY-ON BINDERS FORM A BOND BETWEEN SOIL PARTICLES KEEPING THEM GROUNDED. CHEMICAL TREATMENTS MAY REQUIRE ADDITIONAL PERMITTING REQUIREMENTS. POTENTIAL IMPACTS TO SURROUNDING WATERWAYS AND HABITAT MUST BE CONSIDERED PRIOR TO USE.
5. PLACING ROCK ON CONSTRUCTION ROADWAYS AND ENTRANCES WILL HELP KEEP DUST TO A MINIMUM ACROSS THE CONSTRUCTION SITE.
6. WIND FENCES CAN BE INSTALLED ON SITE TO REDUCE WIND SPEEDS. INSTALL FENCES PERPENDICULAR TO THE PREVAILING WIND DIRECTION FOR MAXIMUM EFFECTIVENESS.

UDFCD EC-14 - WIND EROSION/DUST CONTROL MAINTENANCE AND REMOVAL:

1. WHEN USING AN IRRIGATION/SPRINKLER CONTROL SYSTEM TO AID IN DUST CONTROL, BE CAREFUL NOT TO OVERWATER. OVERWATERING WILL CAUSE CONSTRUCTION VEHICLES TO RACK MUD OFF-SITE.

DC WIND EROSION/DUST CONTROL

SCALE: NTS



SSA-1. STABILIZED STAGING AREA

UDFCD SM-06 - STABILIZED STAGING AREA INSTALLATION NOTES:

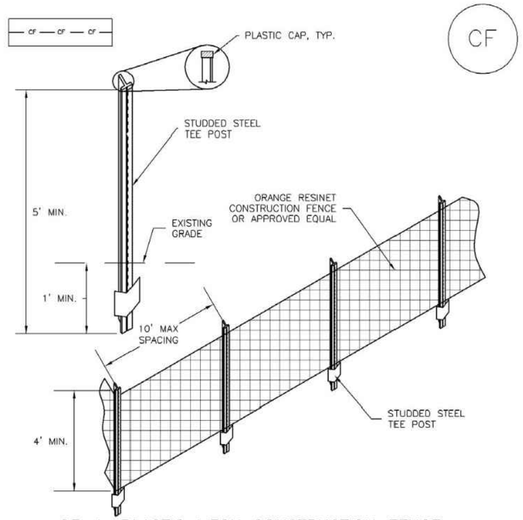
1. SEE PLANS FOR LOCATION OF STAGING AREA(S). CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.
2. STABILIZED STAGING AREA SHOULD BE APPROPRIATE FOR THE NEEDS OF THE SITE. OVERSIZING RESULTS IN A LARGER AREA TO STABILIZE FOLLOWING CONSTRUCTION.
3. STAGING AREA SHALL BE STABILIZED PRIOR TO OTHER OPERATIONS ON THE SITE.
4. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM 3" THICK GRANULAR MATERIAL.
5. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION. ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.
6. ADDITIONAL PERIMETER BMPs MAY BE REQUIRED INCLUDING BUT NOT LIMITED TO SILT FENCE AND CONSTRUCTION FENCING.

UDFCD SM-06 - STABILIZED STAGING AREA MAINTENANCE NOTES:

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY IF RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.
5. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING/LOADING OPERATIONS.
6. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE LOCAL JURISDICTION, USED ON SITE, AND THE AREA COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

SSA STABILIZED STAGING AREA

SCALE: NTS



CF-1. PLASTIC MESH CONSTRUCTION FENCE

UDFCD SM-03 - CONSTRUCTION FENCE INSTALLATION NOTES:

1. SEE PLANS FOR LOCATION OF CONSTRUCTION FENCE.
2. CONSTRUCTION FENCE SHOWN SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
3. CONSTRUCTION FENCE SHALL BE COMPOSED OF ORANGE, CONTRACTOR-GRADE MATERIAL THAT IS AT LEAST 4' HIGH. METAL POSTS SHOULD HAVE A PLASTIC CAP FOR SAFETY.
4. STUDDED STEEL TEE POSTS SHALL BE UTILIZED TO SUPPORT THE CONSTRUCTION FENCE. MAXIMUM SPACING FOR STEEL TEE POSTS SHALL BE 10'.
5. CONSTRUCTION FENCE SHALL BE SECURELY FASTENED TO THE TOP, MIDDLE, AND BOTTOM OF EACH POST.

UDFCD SM-03 - CONSTRUCTION FENCE MAINTENANCE NOTES:

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. CONSTRUCTION FENCE SHALL BE REPAIRED OR REPLACED WHEN THERE ARE SIGNS OF DAMAGE SUCH AS RIPS OR SAGS. CONSTRUCTION FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.
5. WHEN CONSTRUCTION FENCES ARE REMOVED, ALL DISTURBED AREAS ASSOCIATED WITH THE INSTALLATION, MAINTENANCE, AND/OR REMOVAL OF THE FENCE SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED. OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

CF CONSTRUCTION FENCE

SCALE: NTS

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
BART LEE GILES
43662
PROFESSIONAL ENGINEER
Digitally signed by Bart L. Giles
DN: cn=Bart Giles, o=Carollo Engineers, Inc.
Date: 2025.09.10 16:44:44 -06'00'

carollo

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

EROSION CONTROL

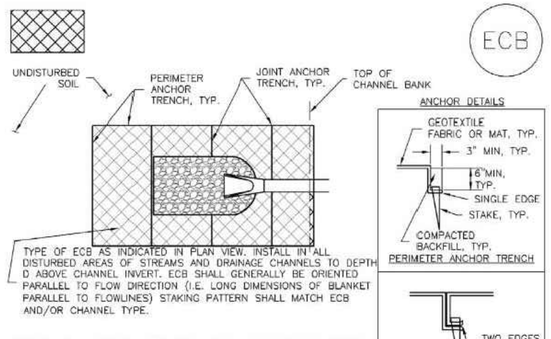
DETAILS 2

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

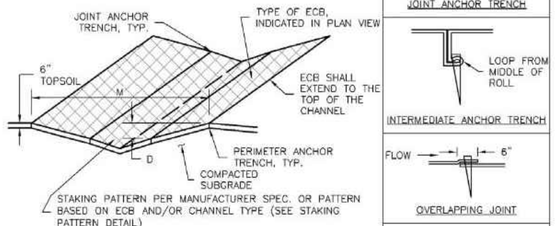
JOB NO. 203505
DRAWING NO. 10EC08
SHEET NO. 31 OF 36

LAST SAVED BY: RFALK

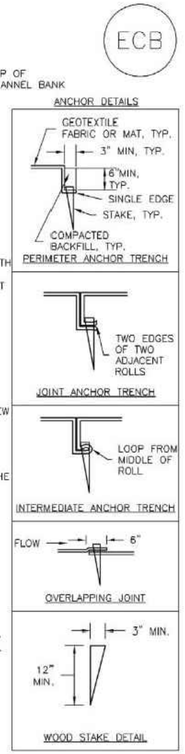
PROJECT NO. 203505 FILE NAME: 20350510EC06.DWG

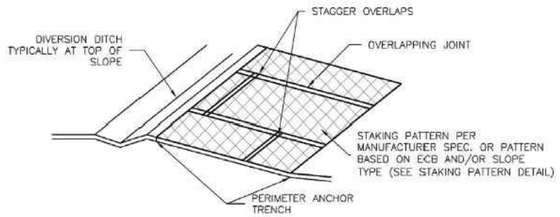


ECB–1. PIPE OUTLET TO DRAINAGEWAY

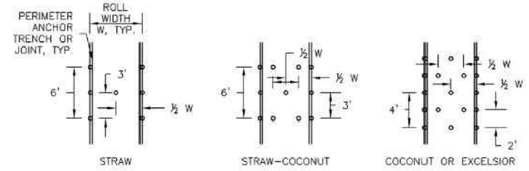


ECB–2. SMALL DITCH OR DRAINAGEWAY

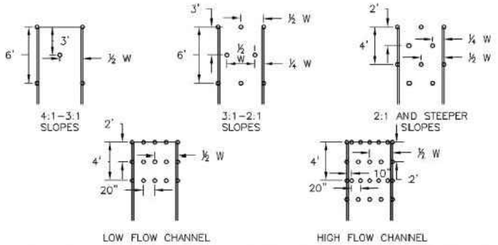




ECB–3. OUTSIDE OF DRAINAGEWAY



STAKING PATTERNS BY ECB TYPE



STAKING PATTERNS BY SLOPE OR CHANNEL TYPE

UDFCD EC-06 - EROSION CONTROL BLANKET INSTALLATION NOTES:

1. SEE PLANS FOR LOCATION OF ECB, TYPE OF ECB (STRAW, STRAW-COCONUT, COCONUT, OR EXCELSIOR), AND AREA OF ECB IN SQUARE YARDS OF EACH TYPE OF ECB.
2. FURNISH 100% NATURAL AND BIODEGRADABLE MATERIALS FOR ECPs.
3. IN AREAS WHERE ECBs ARE SHOWN ON THE PLANS, THE PERMITTEE SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO ECB INSTALLATION AND THE ECB SHALL BE IN FULL CONTACT WITH SUBGRADE. NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.
4. PERIMETER ANCHOR TRENCH SHALL BE USED ALONG THE OUTSIDE PERIMETER OF ALL BLANKET AREAS.
5. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL ECBs EXCEPT STRAW WHICH MAY USE AN OVERLAPPING JOINT.
6. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE-HALF ROLL LENGTH FOR COCONUT AND EXCELSIOR ECBs.
7. OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER FOR ECBs ON SLOPES.
8. MATERIAL SPECIFICATIONS OF ECBs SHALL CONFORM TO TABLE ECB-1.
9. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING ECBS SHALL BE RESEEDED AND MULCHED.
10. DETAILS ON DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION WILL GOVERN IF DIFFERENT FROM THOSE SHOWN HERE.

UDFCD EC-06 - EROSION CONTROL BLANKET MAINTENANCE NOTES:

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. ECBs SHALL BE LEFT IN PLACE TO EVENTUALLY BIODEGRADE, UNLESS REQUESTED TO BE REMOVED BY THE LOCAL JURISDICTION.
5. ANY ECB PULLED OUT, TORN, OR OTHERWISE DAMAGED SHALL BE REPAIRED OR REINSTALLED. ANY SUBGRADE AREAS BELOW THE GEOTEXTILE THAT HAVE ERODED TO CREATED A VOID UNDER THE BLANKET, OR THAT REMAIN DEVOID OF GRASS SHALL BE REPAIRED, RESEEDED AND MULCHED AND THE ECB REINSTALLED.

UDFCD EC-06 - MATERIAL SPECIFICATION:

Product Type	Slope Applications	Channel Applications	
	Maximum Gradient	Maximum Shear Stress[4,5]	Minimum Tensile Strength[2,3]
TRMs with a minimum thickness of 0.25 inches (6.35 mm) per ASTM D 6525 and UV stability of 80% per ASTM D 4355 (500 hours exposure).	0.5:1 (H:V)	6.0 lbs/ft^2 (288 Pa)	125 lbs/ft (1.82 kN/m)
	0.5:1 (H:V)	8.0 lbs/ft^2 (384 Pa)	150 lbs/ft (2.19 kN/m)
	0.5:1 (H:V)	10.0 lbs/ft^2 (480 Pa)	175 lbs/ft (2.55 kN/m)

ECB EROSION CONTROL BLANKET
SCALE: NTS

UDFCD SM-10 - TEMPORARY STREAM CROSSING (TSC):

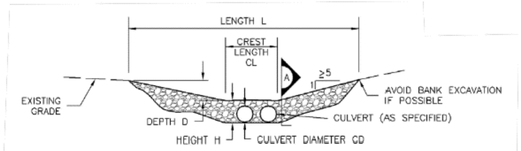
TEMPORARY STREAM CROSSING INSTALLATION NOTES:

1. CONTRACTOR TO SUBMIT STREAM CROSSING PLAN TO ENGINEER FOR REVIEW. PLAN SHALL INCLUDE:
   - LOCATIONS OF TEMPORARY STREAM CROSSINGS.
   - STREAM CROSSING TYPE (FORD, CULVERT, OR FLUME).
   - FOR FORD CROSSING: LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).
   - FOR CULVERT CROSSING: LENGTH (L), CREST LENGTH (CL), CROSSING HEIGHT (H), DEPTH (D), CULVERT DIAMETER (CD), AND NUMBER, TYPE AND CLASS OR GAUGE OF CULVERTS.
2. TEMPORARY STREAM CROSSING DIMENSIONS, D50, AND NUMBER OF CULVERTS SHALL BE CONSIDERED MINIMUM DIMENSIONS; ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASEFLOW OR FLOOD EVENTS SHALL BE PROMPTLY REPAIRED.
3. SEE MAJOR DRAINAGE CHAPTER FOR RIPRAP GRADATIONS.
4. WHERE FAILURE OF A STREAM CROSSING CAN RESULT IN SIGNIFICANT DAMAGE OR HARM IT MUST BE DESIGN BY A STRUCTURAL ENGINEER.

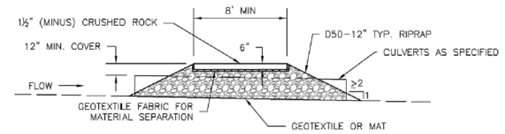
TEMPORARY STREAM CROSSING MAINTENANCE NOTES:

1. INSPECT BMPS EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPS SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPS AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPS IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPS HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. REMOVE SEDIMENT ACCUMULATED UPSTREAM OF CROSSING AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE CROSSING.
5. STREAM CROSSINGS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED AND SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.
6. WHEN STREAM CROSSINGS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED AND COVERED WITH GEOTEXTILE OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

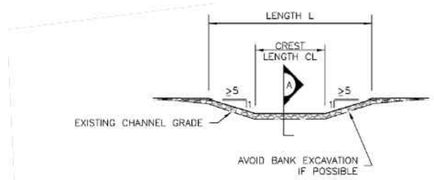


CULVERT CROSSING SECTION

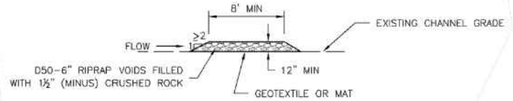


SECTION A

TSC–1. CULVERT CROSSING

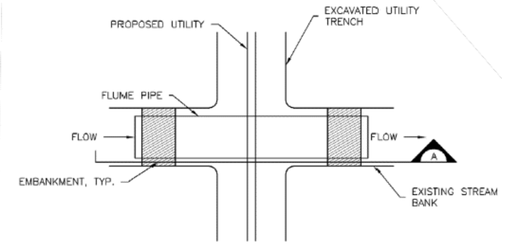


FORD CROSSING SECTION

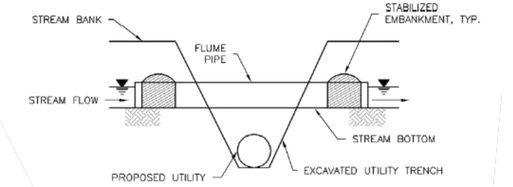


SECTION A

TSC–2. FORD CROSSING



FLUME CROSSING PLAN



SECTION A

TSC–3. FLUME CROSSING

TSC TEMPORARY STREAM CROSSING
SCALE: NTS

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GILES 43662 PROFESSIONAL ENGINEER

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
EROSION CONTROL
DETAILS 3

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10EC09
SHEET NO. 32 OF 36

Plot Date: 9/9/2025 3:05 PM
LAST SAVED BY: RFALK
PROJECT NO. 203505
FILE NAME: 20350510EC06.DWG

UDFCD EC-02 - TEMPORARY AND PERMANENT SEEDING (TS/PS):

PRIOR TO SEEDING, ENSURE THAT AREAS TO BE REVEGETATED HAVE SOIL CONDITIONS CAPABLE OF SUPPORTING VEGETATION. OVERLOT GRADING CAN RESULT IN LOSS OF TOPSOIL AND COMPACTION, RESULTING IN POOR QUALITY SUBSOILS AT THE GROUND SURFACE THAT HAVE LOW NUTRIENT VALUE, LITTLE ORGANIC MATTER CONTENT, FEW SOIL MICROORGANISMS, ROOTING RESTRICTIONS, AND CONDITIONS LESS CONDUCIVE TO INFILTRATION OF PRECIPITATION. AS A RESULT, IT IS TYPICALLY NECESSARY TO PROVIDE STOCKPILED TOPSOIL, COMPOST, OR OTHER SOIL AMENDMENTS AND ROTOTILL THEM INTO THE SOIL TO A DEPTH OF 6 INCHES OR MORE.

TOPSOIL SHOULD BE SALVAGED DURING GRADING OPERATIONS FOR USE AND SPREAD ON AREAS TO BE REVEGETATED LATER. TOPSOIL SHOULD BE VIEWED AS AN IMPORTANT RESOURCE TO BE UTILIZED FOR VEGETATION ESTABLISHMENT, DUE TO ITS WATER-HOLDING CAPACITY, STRUCTURE, TEXTURE, ORGANIC MATTER CONTENT, BIOLOGICAL ACTIVITY, AND NUTRIENT CONTENT. THE ROOTING DEPTH OF MOST NATIVE GRASSES IN THE SEMI-ARID DENVER METROPOLITAN AREA IS 6 TO 18 INCHES. IF PRESENT, AT A MINIMUM OF THE UPPER 6 INCHES OF TOPSOIL SHOULD BE STRIPPED, STOCKPILED, AND ULTIMATELY RESPREAD ACROSS AREAS THAT WILL BE REVEGETATED.

WHERE TOPSOIL IS NOT AVAILABLE, SUBSOILS SHOULD BE AMENDED TO PROVIDE AN APPROPRIATE PLANT-GROWTH MEDIUM. ORGANIC MATTER, SUCH AS WELL DIGESTED COMPOST, CAN BE ADDED TO IMPROVE SOIL CHARACTERISTICS CONDUCIVE TO PLANT GROWTH. OTHER TREATMENTS CAN BE USED TO ADJUST SOIL PH CONDITIONS WHEN NEEDED. SOIL TESTING, WHICH IS TYPICALLY INEXPENSIVE, SHOULD BE COMPLETED TO DETERMINE AND OPTIMIZE THE TYPES AND AMOUNTS OF AMENDMENTS THAT ARE REQUIRED.

IF THE DISTURBED GROUND SURFACE IS COMPACTED, RIP OR ROTOTILL THE UPPER 12 INCHES OF THE SURFACE PRIOR TO PLACING TOPSOIL. IF ADDING COMPOST TO THE EXISTING SOIL SURFACE, ROTOTILLING IS NECESSARY. SURFACE ROUGHENING WILL ASSIST IN PLACING A STABLE TOPSOIL LAYER ON STEEPER SLOPES, AND ALLOW INFILTRATION AND ROOT PENETRATION TO GREATER DEPTH. TOPSOIL SHOULD NOT BE PLACED WHEN EITHER THE SALVAGED TOPSOIL OR RECEIVING GROUND ARE FROZEN OR SNOW COVERED.

PRIOR TO SEEDING, THE SOIL SURFACE SHOULD BE ROUGH AND THE SEEDBED SHOULD BE FIRM, BUT NEITHER TOO LOOSE NOR COMPACTED. THE UPPER LAYER OF SOIL SHOULD BE IN A CONDITION SUITABLE FOR SEEDING AT THE PROPER DEPTH AND CONDUCIVE TO PLANT GROWTH. SEED-TO-SOIL CONTACT IS THE KEY TO GOOD GERMINATION. REFER TO MHFD'S TOPSOIL MANAGEMENT GUIDANCE FOR DETAILED INFORMATION ON TOPSOIL ASSESSMENT, DESIGN, AND CONSTRUCTION.

TEMPORARY VEGETATION:

TO PROVIDE TEMPORARY VEGETATIVE COVER ON DISTURBED AREAS WHICH WILL NOT BE PAVED, BUILT UPON, OR FULLY LANDSCAPED OR WORKED FOR AN EXTENDED PERIOD (TYPICALLY 30 DAYS OR MORE), PLANT AN ANNUAL GRASS APPROPRIATE FOR THE TIME OF PLANTING AND MULCH THE PLANTED AREAS. TEMPORARY GRAIN SEED MIXES SUITABLE FOR THE DENVER METROPOLITAN AREA ARE LISTED IN TABLE TS/PS-1. NATIVE TEMPORARY SEED MIXES ARE PROVIDED IN USDCM VOLUME 2, CHAPTER 13, APPENDIX A. THESE ARE TO BE CONSIDERED ONLY AS GENERAL RECOMMENDATIONS WHEN SPECIFIC DESIGN GUIDANCE FOR A PARTICULAR SITE IS NOT AVAILABLE. LOCAL GOVERNMENTS TYPICALLY SPECIFY SEED MIXES APPROPRIATE FOR THEIR JURISDICTION.

PERMANENT REVEGETATION:

TO PROVIDE VEGETATIVE COVER ON DISTURBED AREAS THAT HAVE REACHED FINAL GRADE, A PERENNIAL GRASS MIX SHOULD BE ESTABLISHED. PERMANENT SEEDING SHOULD BE PERFORMED PROMPTLY (TYPICALLY WITHIN 14 DAYS) AFTER REACHING FINAL GRADE. EACH SITE WILL HAVE DIFFERENT CHARACTERISTICS AND A LANDSCAPE PROFESSIONAL OR THE LOCAL JURISDICTION SHOULD BE CONTACTED TO DETERMINE THE MOST SUITABLE SEED MIX FOR A SPECIFIC SITE. IN LIEU OF A SPECIFIC RECOMMENDATION, ONE OF THE PERENNIAL GRASS MIXES APPROPRIATE FOR SITE CONDITIONS AND GROWTH SEASON LISTED IN SEED MIX TABLES IN THE USDCM VOLUME 2 REVEGETATION CHAPTER CAN BE USED. THE PURE LIVE SEED (PLS) RATES OF APPLICATION RECOMMENDED IN THESE TABLES ARE CONSIDERED TO BE ABSOLUTE MINIMUM RATES FOR SEED APPLIED USING PROPER DRILL-SEEDING EQUIPMENT. THESE ARE TO BE CONSIDERED ONLY AS GENERAL RECOMMENDATIONS WHEN SPECIFIC DESIGN GUIDANCE FOR A PARTICULAR SITE IS NOT AVAILABLE. LOCAL GOVERNMENTS TYPICALLY SPECIFY SEED MIXES APPROPRIATE FOR THEIR JURISDICTION.

IF DESIRED FOR WILDLIFE HABITAT OR LANDSCAPE DIVERSITY, SHRUBS SUCH AS RUBBER RABBITBRUSH (CHRYSOTHAMNUS NAUSEOSUS), FOURWING SALTBUSH (ATRIPLEX CANESCENS) AND SKUNKBRUSH SUMAC (RHUS TRILOBATA) COULD BE ADDED TO THE UPLAND SEED MIXES AT 0.25, 0.5 AND 1 POUND PLS/ACRE, RESPECTIVELY. IN RIPARIAN ZONES, PLANTING ROOT STOCK OF SUCH SPECIES AS AMERICAN PLUM (PRUNUS AMERICANA), WOODS ROSE (ROSA WOODSII), PLAINS COTTONWOOD (POPULUS SARGENTII), AND WILLOW (SALIX SPP.) MAY BE CONSIDERED. ON NON-TOPSOILED UPLAND SITES, A LEGUME SUCH AS LADAK ALFALFA AT 1 POUND PLS/ACRE CAN BE INCLUDED AS A SOURCE OF NITROGEN FOR PERENNIAL GRASSES.

TIMING OF SEEDING IS AN IMPORTANT ASPECT OF THE REVEGETATION PROCESS. FOR UPLAND AND RIPARIAN AREAS ON THE COLORADO FRONT RANGE, THE SUITABLE TIMING FOR SEEDING IS FROM OCTOBER THROUGH MAY. THE MOST FAVORABLE TIME TO PLANT NON-IRRIGATED AREAS IS DURING THE FALL, SO THAT SEED CAN TA
KE ADVANTAGE OF WINTER AND SPRING MOISTURE. SEED SHOULD NOT BE PLANTED IF THE SOIL IS FROZEN, SNOW COVERED, OR WET.
SEEDING DATES FOR THE HIGHEST SUCCESS PROBABILITY OF PERENNIAL SPECIES ALONG THE FRONT RANGE ARE GENERALLY IN THE SPRING FROM APRIL THROUGH EARLY MAY AND IN THE FALL AFTER THE FIRST OF SEPTEMBER UNTIL THE GROUND FREEZES. IF THE AREA IS IRRIGATED, SEEDING MAY OCCUR IN SUMMER MONTHS, AS WELL. SEE TABLE TS/PS-2 FOR APPROPRIATE SEEDING DATES.

MULCH:

COVER SEEDED AREAS WITH MULCH OR AN APPROPRIATE ROLLED EROSION CONTROL PRODUCT TO PROMOTE ESTABLISHMENT OF VEGETATION. ANCHOR MULCH BY CRIMPING, NETTING OR USE OF A NON-TOXIC TACKIFIER. SEE THE USDCM VOLUME 2 REVEGETATION CHAPTER AND VOLUME 3 MULCHING BMP FACT SHEET (EC-04) FOR ADDITIONAL GUIDANCE.

UDFCD EC-04 - MULCHING:

CLEAN, WEED-FREE AND SEED-FREE CEREAL GRAIN STRAW SHOULD BE APPLIED EVENLY AT A RATE OF 2 TONS PER ACRE AND MUST BE TACKED OR FASTENED BY A METHOD SUITABLE FOR THE CONDITION OF THE SITE. STRAW MULCH MUST BE ANCHORED (AND NOT MERELY PLACED) ON THE SURFACE. THIS CAN BE ACCOMPLISHED MECHANICALLY BY CRIMPING OR WITH THE AID OF TACKIFIERS OR NETS. ANCHORING WITH A CRIMPING IMPLEMENT IS PREFERRED, AND IS THE RECOMMENDED METHOD FOR AREAS FLATTER THAN 3:1. MECHANICAL CRIMPERS MUST BE CAPABLE OF TUCKING THE LONG MULCH FIBERS INTO THE SOIL TO A DEPTH OF 3 INCHES WITHOUT CUTTING THEM. AN AGRICULTURAL DISK, WHILE NOT AN IDEAL SUBSTITUTE, MAY WORK IF THE DISK BLADES ARE DULL OR BLUNTED AND SET VERTICALLY; HOWEVER, THE FRAME MAY HAVE TO BE WEIGHTED TO AFFORD PROPER SOIL PENETRATION.

GRASS HAY MAY BE USED IN PLACE OF STRAW; HOWEVER, BECAUSE HAY IS COMPRISED OF THE ENTIRE PLANT INCLUDING SEED, MULCHING WITH HAY MAY SEED THE SITE WITH NON-NATIVE GRASS SPECIES WHICH MIGHT IN TURN OUT-COMPETE THE NATIVE SEED. ALTERNATIVELY, NATIVE SPECIES OF GRASS HAY MAY BE PURCHASED, BUT CAN BE DIFFICULT TO FIND AND ARE MORE EXPENSIVE THAN STRAW. PURCHASING AND UTILIZING A CERTIFIED WEED-FREE STRAW IS AN EASIER AND LESS COSTLY MULCHING METHOD. WHEN USING GRASS HAY, FOLLOW THE SAME GUIDELINES AS FOR STRAW (PROVIDED ABOVE).

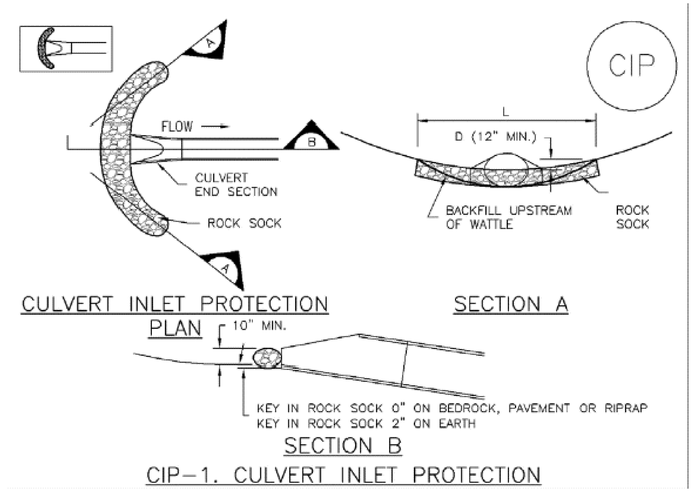
ON SMALL AREAS SHELTERED FROM THE WIND AND HEAVY RUNOFF, SPRAYING A TACKIFIER ON THE MULCH IS SATISFACTORY FOR HOLDING IT IN PLACE. FOR STEEP SLOPES AND SPECIAL SITUATIONS WHERE GREATER CONTROL IS NEEDED, EROSION CONTROL BLANKETS ANCHORED WITH STAKES SHOULD BE USED INSTEAD OF MULCH.

HYDRAULIC MULCHING CONSISTS OF WOOD CELLULOSE FIBERS MIXED WITH WATER AND A TACKIFYING AGENT AND SHOULD BE APPLIED AT A RATE OF NO LESS THAN 1,500 POUNDS PER ACRE (1,425 LBS OF FIBERS MIXED WITH AT LEAST 75 LBS OF TACKIFIER) WITH A HYDRAULIC MULCHER. FOR STEEPER SLOPES, UP TO 2000 POUNDS PER ACRE MAY BE REQUIRED FOR EFFECTIVE HYDROSEEDING. HYDROMULCH TYPICALLY REQUIRES UP TO 24 HOURS TO DRY; THEREFORE, IT SHOULD NOT BE APPLIED IMMEDIATELY PRIOR TO INCLEMENT WEATHER. APPLICATION TO ROADS, WATERWAYS AND EXISTING VEGETATION SHOULD BE AVOIDED.

EROSION CONTROL MATS, BLANKETS, OR NETS ARE RECOMMENDED TO HELP STABILIZE STEEP SLOPES (GENERALLY 3:1 AND STEEPER) AND WATERWAYS. DEPENDING ON THE PRODUCT, THESE MAY BE USED ALONE OR IN CONJUNCTION WITH GRASS OR STRAW MULCH. NORMALLY, USE OF THESE PRODUCTS WILL BE RESTRICTED TO RELATIVELY SMALL AREAS. BIODEGRADABLE MATS MADE OF STRAW AND JUTE, STRAW-COCONUT, COCONUT FIBER, OR EXCELSIOR CAN BE USED INSTEAD OF MULCH. (SEE THE ECM/TRM BMP FOR MORE INFORMATION.)

SOME TACKIFIERS OR BINDERS MAY BE USED TO ANCHOR MULCH. CHECK WITH THE LOCAL JURISDICTION FOR ALLOWED TACKIFIERS. MANUFACTURER'S RECOMMENDATIONS SHOULD BE FOLLOWED AT ALL TIMES. (SEE THE SOIL BINDER BMP FOR MORE INFORMATION ON GENERAL TYPES OF TACKIFIERS.)

SM SEEDING AND MULCHING
SCALE: NTS



CIP–1. CULVERT INLET PROTECTION

UDFCD SC-6 - INLET PROTECTION (IP):

CULVERT INLET PROTECTION INSTALLATION NOTES:

1. SEE PLAN VIEW FOR LOCATION OF CULVERT INLET PROTECTION.
1. SEE ROCK SOCK DESIGN DETAIL FOR ROCK GRADATION REQUIREMENTS AND JOINTING DETAIL.

CULVERT INLET PROTECTION MAINTENANCE NOTES:

1. INSPECT BMPS EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPS SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPS AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPS IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPS HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. SEDIMENT ACCUMULATED UPSTREAM OF THE CULVERT SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS 1/2 THE HEIGHT OF THE ROCK SOCK.
5. CULVERT INLET PROTECTION SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

GENERAL INLET PROTECTION INSTALLATION NOTES:

1. SEE PLAN VIEW FOR LOCATION OF INLET PROTECTION AND TYPE OF INLET PROTECTION.
2. INLET PROTECTION SHALL BE INSTALLED PROMPTLY AFTER INLET CONSTRUCTION OR PAVING IS COMPLETE (TYPICALLY WITHIN 48 HOURS). IF A RAINFALL/RUNOFF EVENT IS FORECAST, INSTALL INLET PROTECTION PRIOR TO ONSET OF EVENT.
3. MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

CULVERT INLET PROTECTION MAINTENANCE NOTES:

1. INSPECT BMPS EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPS SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPS AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPS IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPS HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED AS NECESSARY TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN STORAGE VOLUME REACHES 50% OF CAPACITY, A DEPTH OF 6" WHEN SILT FENCE IS USED, OR 1/2 OF THE HEIGHT FOR STRAW BALES.
5. INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED, UNLESS THE LOCAL JURISDICTION APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.
6. WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.
NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF INLET PROTECTION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY PROPRIETARY INLET PROTECTION METHODS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY INLET PROTECTION; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.
NOTE: SOME MUNICIPALITIES DISCOURAGE OR PROHIBIT THE USE OF STRAW BALES FOR INLET PROTECTION. CHECK WITH LOCAL JURISDICTION TO DETERMINE IF STRAW BALE INLET PROTECTION IS ACCEPTABLE.

IPC INLET PROTECTION - CULVERT
SCALE: NTS

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED RJF
DRAWN RJF
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED
GARY LEE GILES
43662
Digitally signed by Gary L. Giles
Date: 2025.09.10 15:46:47
PROFESSIONAL ENGINEER

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
EROSION CONTROL
DETAILS 4

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10EC10
SHEET NO. 33 OF 36

Plot Date: 5/30/2025 10:55 AM
LAST SAVED BY: KWIEDERRICH
PROJECT NO. 203505
FILE NAME: 20350510EC06.DWG

Plot Date: 9/10/2025 2:52 PM

LARIMER COUNTY CANAL

EM136 TYP

EM015 TYP (TYP)

2 - 2-INCH PCS CONDUITS (TYP)

FLOW METER AND BUBBLER CONTROL PANELS 4

PV PACKAGED SYSTEM 5

EG001 TYP

L-10-100
L-10-110
L-10-120 6

9 FT DIAMETER SWEEPS (TYP)

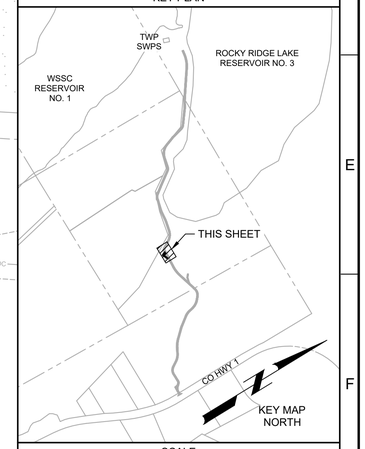
A PLAN

SCALE: 1" = 10'
FILE: 20350510C0800

KEY NOTES:

1. PROVIDE 6-INCH BY 6-INCH WOOD POST FOR MOUNTING OF CONTROL PANELS AND PHOTOVOLTAIC PACKAGED SYSTEM. PROVIDE MINIMUM POST HEIGHT OF 4 FEET ABOVE GRADE WITH 3 FEET BELOW GRADE. EMBED POST IN 18-INCH DIAMETER CONCRETE FOOTING, EXTENDED 1 FOOT BELOW BOTTOM OF POST.
2. INSTALL GREYLINE AVFM 6.1 ULTRASONIC FLOW MONITOR IN EACH OF THE CULVERTS AT 7'-0" FROM FACE OF MAIN BOX CULVERT STRUCTURE (3 TOTAL). CONDUIT SHALL HAVE A 9'-0" DIAMETER MINIMUM SWEEP UNDER THE BOX CULVERT PENETRATION.
3. INSTALL BUBBLER IN EACH OF THE CULVERTS AT 10'-0" FROM FACE OF MAIN BOX CULVERT STRUCTURE (3 TOTAL). CONDUIT SHALL HAVE A 9'-0" DIAMETER MINIMUM SWEEP UNDER THE BOX CULVERT PENETRATION.
4. PROVIDE NEMA 4X SST ENCLOSURE TO HOUSE AVFM 6.1 ULTRASONIC FLOW MONITOR AND 12V PORTABLE DIAPHRAGM COMPRESSOR.
5. PROVIDE PHOTOVOLTAIC (PV) PACKAGED SYSTEM. FOR INFORMATION AND REQUIREMENTS REFER TO SPECIFICATION SECTION 26_31_ 05 - PACKAGED PHOTOVOLTAIC SYSTEM.
6. L-10-110 1"C, 4-#12, 1-#12 (G). FLOW MONITOR POWER COMPRESSOR POWER
   L-10-120 1"C, 4-#12, 1-#12 (G). FLOW MONITOR POWER COMPRESSOR POWER
   L-10-130 1"C, 4-#12, 1-#12 (G). FLOW MONITOR POWER COMPRESSOR POWER

KEY PLAN



SCALE

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SCALE: 1" = 10'

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			ISSUED FOR BID

DESIGNED JD
DRAWN QGS
CHECKED JJK
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GILES 43662 Digitally signed by Matt L. Giles Contact Info: Carollo Engineers Date: 2025.09.10 16:55:40 -06'00' PROFESSIONAL ENGINEER

carollo

THORNTON WATER PROJECT

CITY OF THORNTON
THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD
ELECTRICAL
ELECTRICAL SITE PLAN

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO. 203505
DRAWING NO. 10E10
SHEET NO. 34 OF 36

LAST SAVED BY: FOLIVARES

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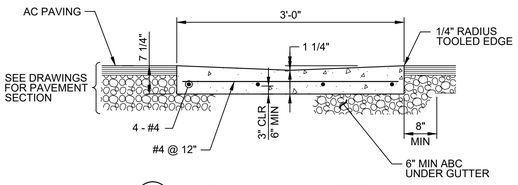
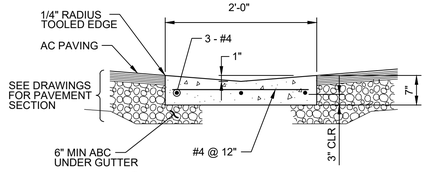


A - SECTION - CROSS GUTTER



B - SECTION - VALLEY GUTTER

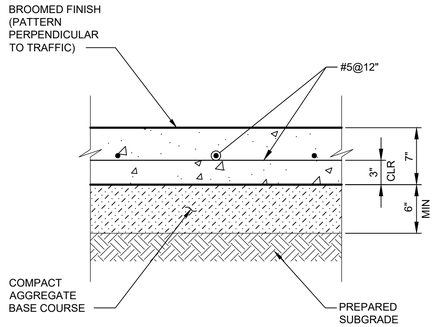
NOTES:

1. PROVIDE 3/4" EXPANSION JOINTS AT ENDS OF CONCRETE PLACEMENT, AT POINTS OF CURVATURE, AT INTERSECTIONS, AND AT MAXIMUM SPACING OF 30 FEET. EXPANSION JOINTS SHALL BE 3/4" WIDE WITH 1/4" RADIUS CONCRETE EDGES AT BOTH SIDES OF JOINT. USE BITUMINOUS FIBER EXPANSION JOINT MATERIAL.
2. DO NOT PASS REINFORCING BARS THROUGH EXPANSION JOINTS.
3. PROVIDE WEAKENED PLANE JOINTS AT 10 FEET OC MAXIMUM. AT FRONT, TOP AND BACK FACES, PROVIDE 1/2" RADIUSED EDGE EACH SIDE AT JOINTS.

CR110 GUTTER - CROSS AND VALLEY

TYP

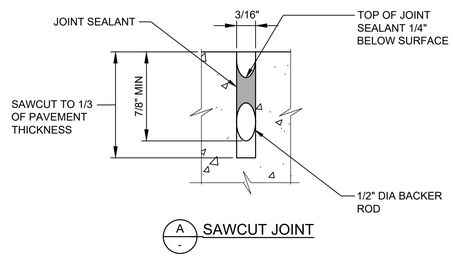
12/29/2020



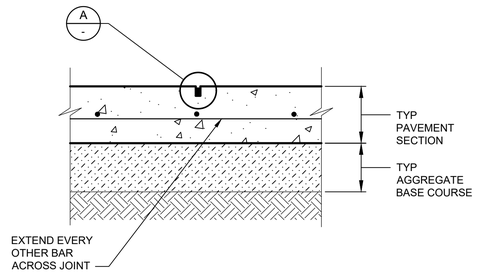
CR201 TYP PAVEMENT SECTION

TYP

10/13/20



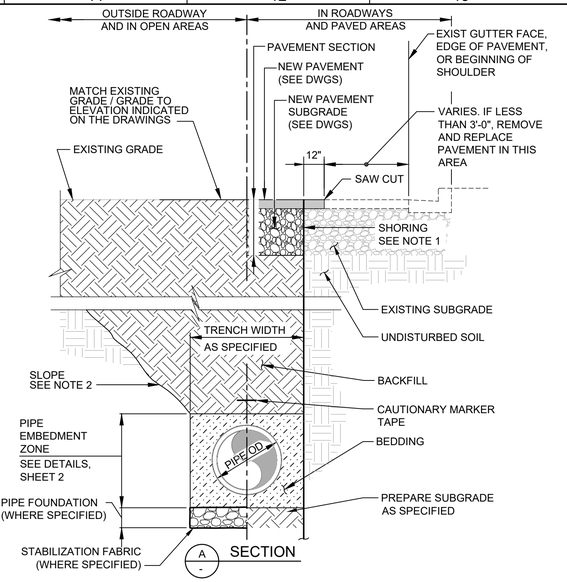
A - SAWCUT JOINT



CR202 CONCRETE PAVEMENT CONTRACTION JOINT

TYP

10/13/20



A - SECTION

NOTES:

1. SEE SPECIFICATIONS FOR SHORING REQUIREMENTS.
2. SEE SPECIFICATIONS FOR SLOPE REQUIREMENTS.
3. SEE SPECIFICATIONS FOR TRENCH DEPTH AND WIDTH REQUIREMENTS.

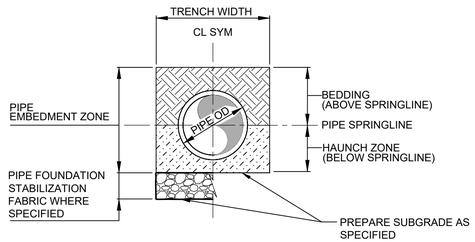
CY111 PIPE TRENCH

TYP

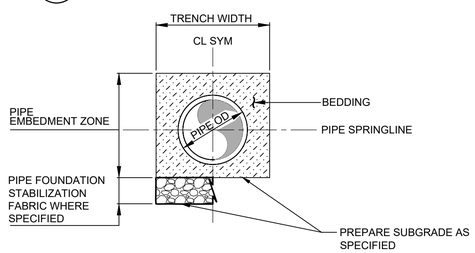
N

SHEET 1 OF 2

6/16/2025



A - PIPE EMBEDMENT ZONE - RIGID PIPE



B - PIPE EMBEDMENT ZONE - FLEXIBLE PIPE

CY111 PIPE TRENCH

TYP

N

SHEET 2 OF 2

6/16/2025

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			ISSUED FOR BID

DESIGNED CE
DRAWN CE
CHECKED
DATE SEPTEMBER 2025

COLORADO LICENSED MATT LEE GALLAS 43662 Digitally signed by Matt L. Gallas Contact Info: Carollo Engineers, P.C. Date: 2025.09.10 16:55:42 -06'00' PROFESSIONAL ENGINEER

carollo®

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

TYPICAL DETAILS

CIVIL TYPICAL DETAILS 1

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
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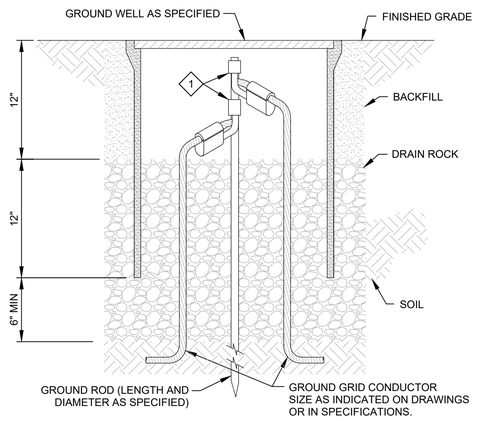
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

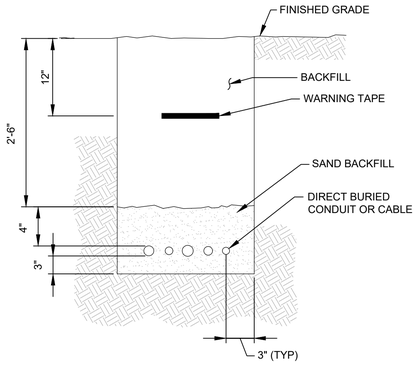
JOB NO. 203505
DRAWING NO. 10TC01
SHEET NO. 35 OF 36



KEY NOTES:

1. GROUND ROD TO GROUND GRID CROSS CONNECTOR. SIZE FOR ROD AND CABLE PER CONNECTOR MANUFACTURERS GUIDELINES.

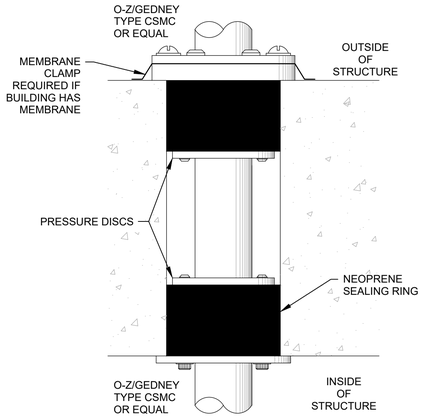
EG001 TYP — GROUND ROD AND GROUNDWELL COMPRESSION CONNECTION



GENERAL NOTES:

1. ALL DIMENSIONS ARE MINIMUM UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
2. REFER TO THE SPECIFICATIONS FOR TRENCH BACKFILL REQUIREMENTS.

EM015 TYP N — DIRECT BURIED CONDUIT OR CABLE



EM136 TYP N — CORE HOLE CONDUIT FLOOR PENETRATION

REV	DATE	BY	DESCRIPTION
			ISSUED FOR BID

DESIGNED CE
DRAWN CE
CHECKED CE
DATE SEPTEMBER 2025

COLORADO LICENSED — GARY LEE GEER — 43662 — Digitally signed by Gary L. Geer — PROFESSIONAL ENGINEER

carollo®

THORNTON WATER PROJECT

CITY OF THORNTON

THORNTON WATER PROJECT SOURCE WATER PUMP STATION ACCESS ROAD

TYPICAL DETAIL

ELECTRICAL 1

VERIFY SCALES
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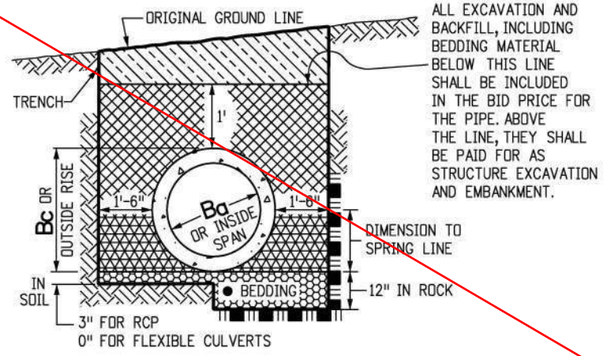
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

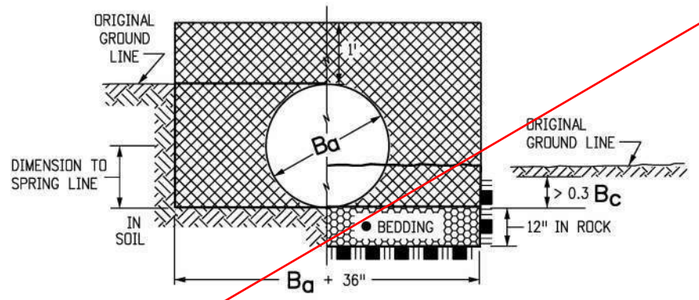
JOB NO. 203505
DRAWING NO. 10TE01
SHEET NO. 36 OF 36

LAST SAVED BY: FOlivares

PROJECT NO. 203505-100000 FILE NAME: 203505_10TE01.dwg



PIPE IN TRENCH

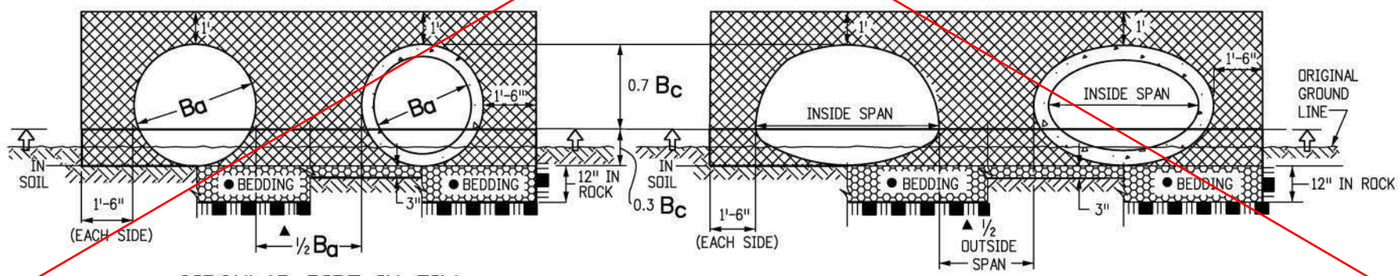


CIRCULAR PIPE

(WHERE ORIGINAL GROUND LINE IS BETWEEN 0.3 B_C AND B_C + 1 FT. ABOVE FLOWLINE)

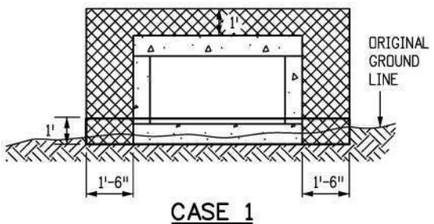
● THE BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OF LOOSE STRUCTURE BACKFILL, CLASS 1.

▲ WHEN TWO OR MORE CONDUITS ARE LAID SIDE-BY-SIDE, THEY SHALL BE PLACED SO THAT THEY ARE ½ OUTSIDE DIAMETER, OR ½ OUTSIDE SPAN, OR 3 FT. APART, WHICHEVER IS LESS. HOWEVER, IF END SECTIONS ARE USED, THE MINIMUM SPACING SHALL BE 1 FT. BETWEEN END SECTIONS.



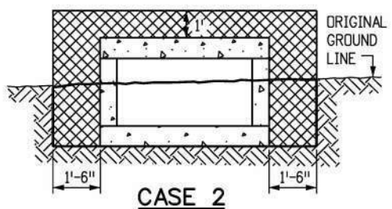
CIRCULAR PIPE IN FILL

ARCH OR ELLIPTICAL PIPE IN FILL



CASE 1

APPLIES WHEN THE ORIGINAL GROUND LINE IS LESS THEN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT. THE EMBANKMENT SHALL BE BUILT UP TO 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT AND THEN EXCAVATED TO THE BOTTOM OF THE BOX CULVERT. THIS EMBANKMENT AND EXCAVATION WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.

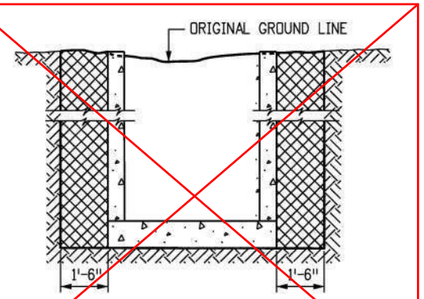


CASE 2

APPLIES WHEN THE ORIGINAL GROUND LINE IS MORE THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT.

CONCRETE BOX CULVERT

IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.



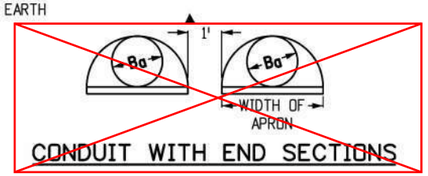
DROP INLETS AND DIVISION BOXES

GENERAL NOTES

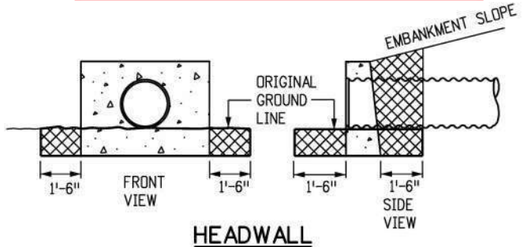
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THESE SHEETS WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. EXCAVATION FOR CHANNEL CHANGE OR CHANNEL IMPROVEMENT WILL BE EITHER UNCLASSIFIED EXCAVATION OR MUCK EXCAVATION AND WILL BE NOTED ON THE PLANS. EXCAVATION FROM THE CHANNEL FLOWLINE TO THE DEPTH REQUIRED FOR THE NEW STRUCTURE AND INCIDENTAL CHANNEL EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.
3. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09(b).
4. STRUCTURAL PLATE CULVERTS SHALL BE CONSTRUCTED AS SHOWN ON THE PLANS.
5. B_a EQUALS THE INSIDE DIAMETER OF A PIPE AND B_c EQUALS THE OUTSIDE DIAMETER OF A PIPE. FOR THIN WALLED PIPES, IT IS ASSUMED THAT $B_a = B_c$.
6. APPROXIMATE STRUCTURE EXCAVATION AND BACKFILL QUANTITIES, UP TO 1 FT. OVER THE PIPE WILL BE SHOWN ON THE PLANS, FOR INFORMATION ONLY.

LEGEND

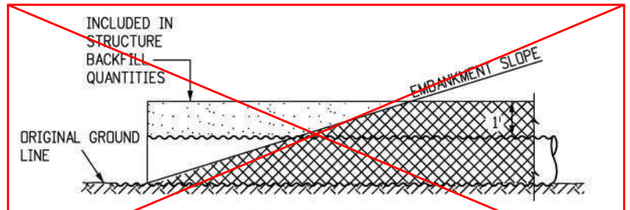
- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- STRUCTURE BACKFILL, CLASS 1
- EMBANKMENT MATERIAL
- EARTH
- ROCK
- BEDDING
- CONCRETE
- = WHEN FLOW LINE OF CULVERT IS LESS THAN 0.3 B_c BELOW THE ORIGINAL GROUND LINE, EMBANKMENT SHALL BE BUILT UP TO 0.3 B_c ABOVE THE FLOW LINE AND TRENCH EXCAVATED TO THE BOTTOM OF PIPE OR AS SHOWN.



CONDUIT WITH END SECTIONS



HEADWALL



END OF PIPE

Computer File Information		Sheet Revisions	
		Date:	Comments
Creation Date: 07/31/19			
Designer Initials: JBK	(R-X)		
Last Modification Date: 07/31/19	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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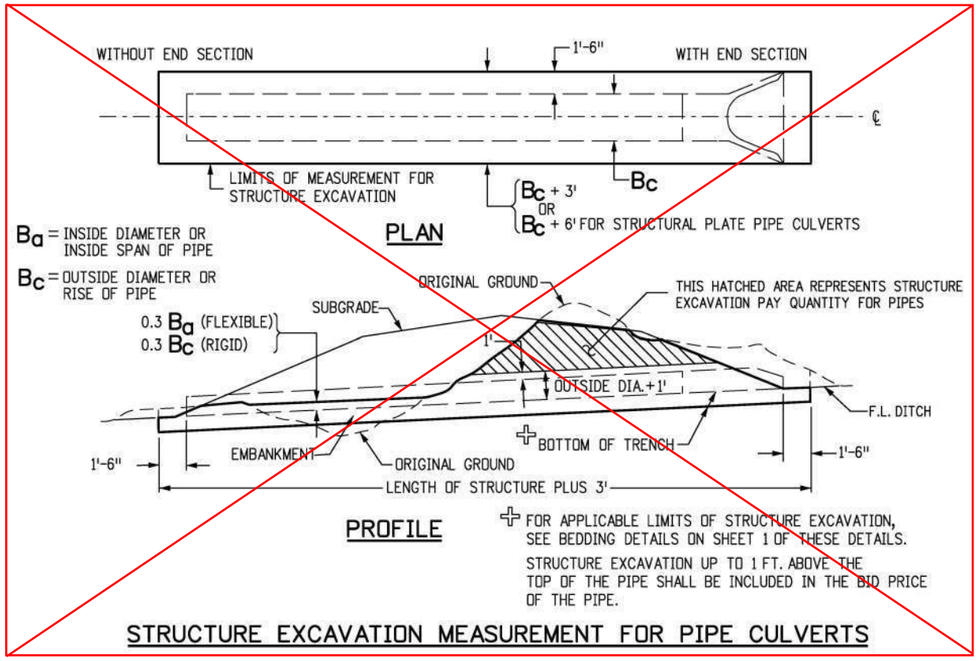
Project Development Branch JBK

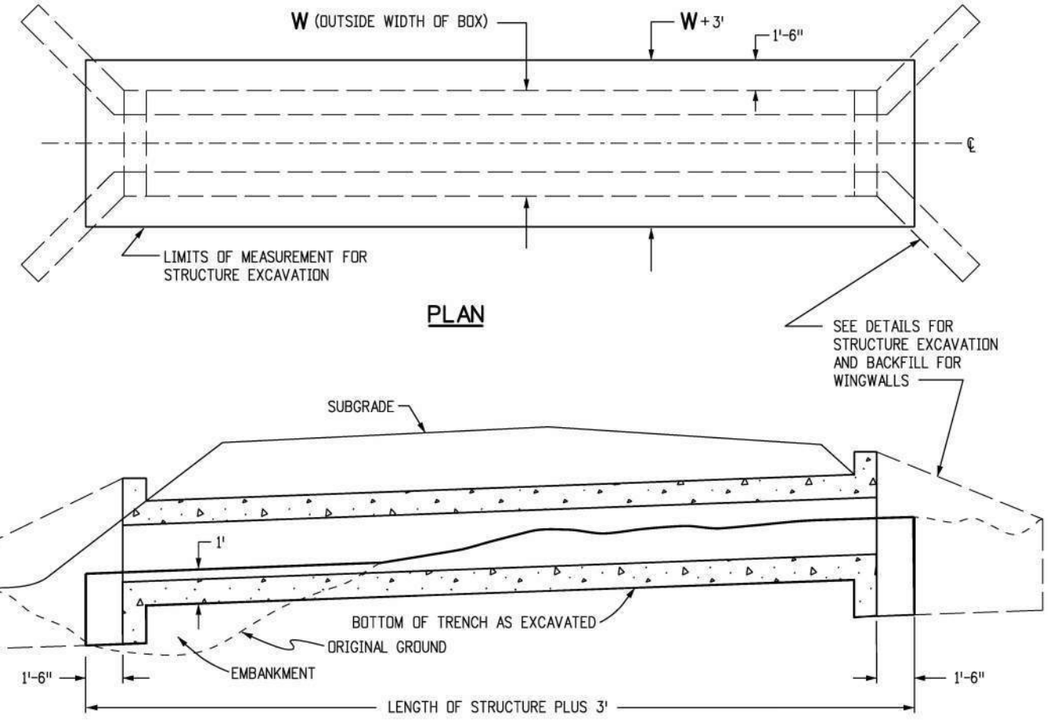
EXCAVATION AND BACKFILL FOR STRUCTURES

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-206-1
Standard Sheet No. 1 of 2
Project Sheet Number:

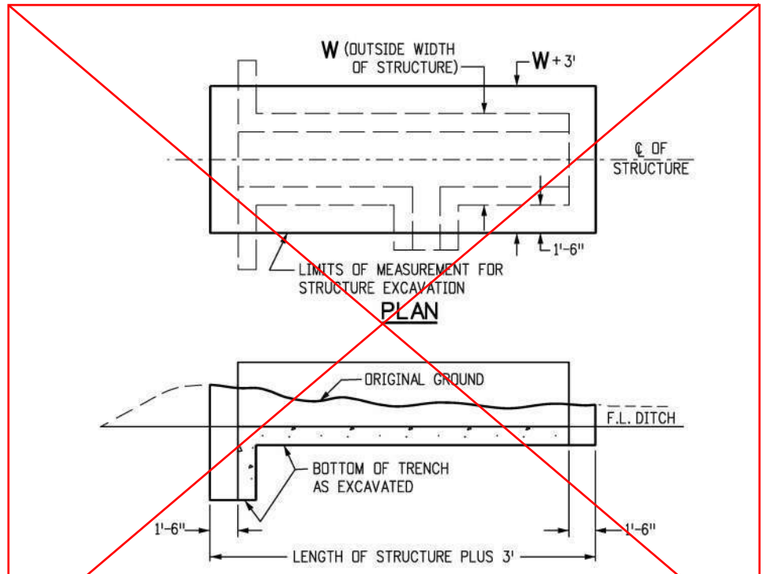


STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS

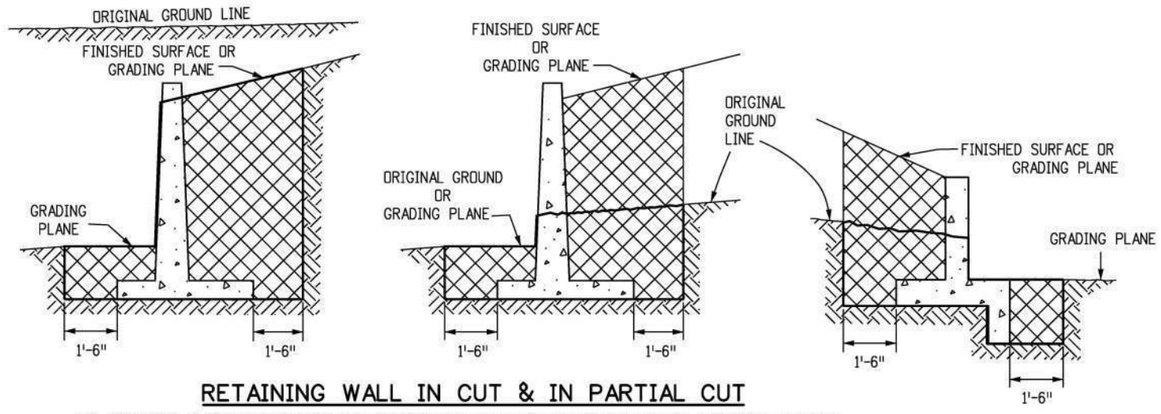


PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS



STRUCTURE EXCAVATION MEASUREMENT FOR DIVISION BOXES



RETAINING WALL IN CUT & IN PARTIAL CUT

ANY ADDITIONAL EXCAVATION BEHIND THE LIMITS SHOWN SHALL BE FILLED WITH CLASS I BACKFILL MATERIAL. THE ADDITIONAL EXCAVATION AND BACKFILL WILL NOT BE MEASURED AND PAID FOR.

WINGWALL

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 07/31/19	(R-X)		
Detailer Initials: LTA	(R-X)		
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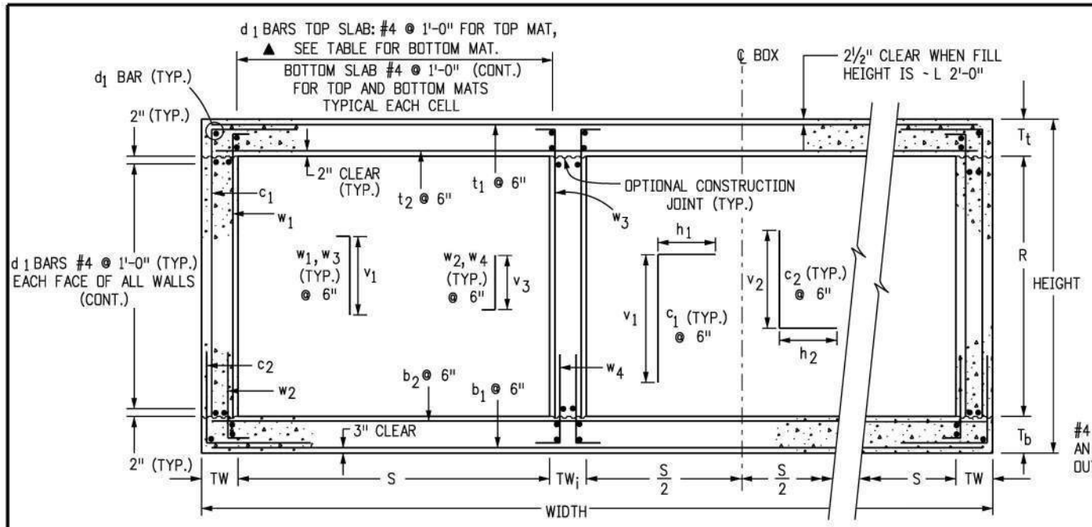
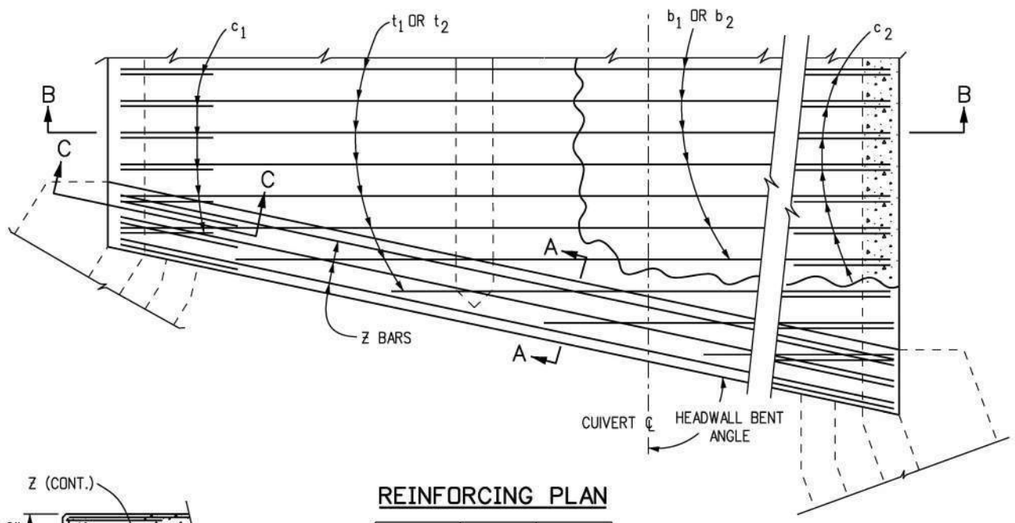
EXCAVATION AND BACKFILL FOR STRUCTURES

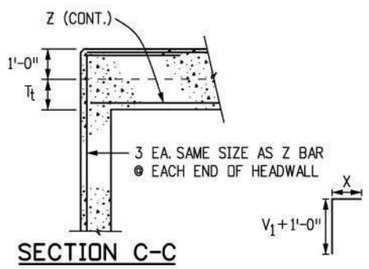
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-206-1
Standard Sheet No. 2 of 2
Project Sheet Number:



SECTION B-B



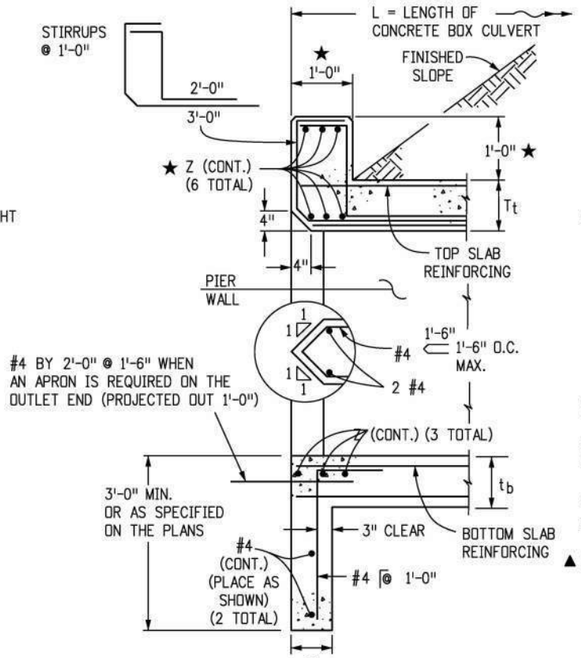


SECTION C-C

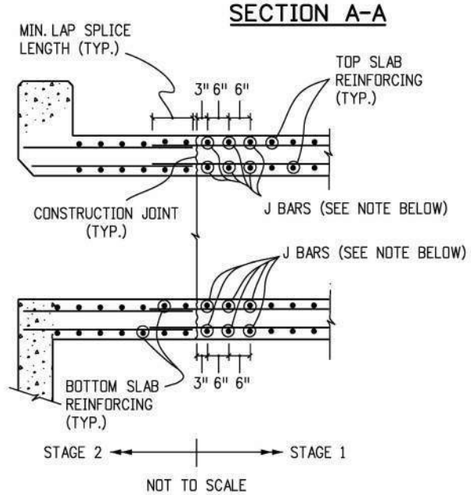
REINFORCING PLAN

BAR SIZE (#)	EPOXY X (FT.-IN.)	BLACK X (FT.-IN.)
4	2-4	1-11
5	2-10	2-4
6	3-5	2-10
7	4-1	3-3
8	5-3	4-3
9	6-8	5-5

HEADWALL CORNER REINFORCING DETAIL



SECTION A-A



CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ℄ OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'c.
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-7"	2'-5"	2'-10"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-1"	1'-4"	1'-7"	1'-11"	2'-6"	3'-1"	3'-11"	4'-10"

THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.

11. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
13. ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
14. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
16. FOR FILL HIEGHTS LESS THAN 2 FT, A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18" DOWN ALONG THE TOPS OF THE EXTERIOR WALLS.
▲ 17. FOR FILL HIEGHTS LESS THAN 2 FT. THE d_1 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	8, 9, 10	14, 16, 18	20
BAR SIZE:	#5	#6	#7
SPACING	1'-0"	1'-0"	1'-0"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
RATING DATA: 2ND EDITION, 2011, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION
LOADING DATA: f_y = 60,000 psi., f'_c = 4,500 psi.,
LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK AND NRL
DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.
DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.
WEARING SURFACE - 12 IN. THICK CONCRETE PAVEMENT.
DEAD LOAD - TYPE 7 BARRIER.
THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.
EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDOT DRAINAGE MANUAL.
EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.
LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19 AND NOTES BELOW):
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY SPECIAL DESIGN FOR STIRRUPS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT OF GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

Computer File Information		Sheet Revisions	
		Date:	Comments
Creation Date: 07/31/19			
Designer Initials: JBE	(R-X)		
Last Modification Date: 07/31/19	(R-X)		
Detailer Initials: LTA	(R-X)		
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TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-601-3
Standard Sheet No. 1 of 2
Project Sheet Number:

TRIPLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

BOX SIZE S	R	HT.	WIDTH	FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES) T_t	T_b	TW & TW_i	BAR SIZES t_1*	t_2	b_1	b_2	w_1* & w_2	w_3* & w_4	c_1*	c_2	d_1▲	DIMENSIONS h_1	h_2	v_1	v_2	v_3	QUANTITIES CONCRETE	REBAR STL	WATERPROOFING	RATING FACTORS HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE
FT	FT	FT-IN	FT-IN	FT-FT				#	#	#	#	#	#	#	#	NO.	FT-IN	FT-IN	FT-IN	FT-IN	FT-IN	CY/LF	LBS/LF	SY/LF				
8	6	7-10.5	27-4	< 2	12.5	10	10	5	6	5	6	4	4	5	5	168	3-5	2-4	6-10	2-4	1-11	2.639	531	3.370	1.21	1.57	1.82	1.69
		7-9.5	27-4	2 TO 8	10.5	11	10	4	5	4	5	4	4	5	5	168	2-6	2-4	6-8	3-2	2-0	2.555	429		1.47	1.90	2.07	1.83
		8-0	27-4	8 TO 12	11	13	10	4	5	4	5	4	4	5	5	168	2-6	2-4	6-9	3-4	2-2	2.765	432		3.38	4.39	4.80	5.22
		8-0	27-4	12 TO 16	11	13	10	5	4	4	4	5	5	5	5	168	2-6	2-4	6-9	3-4	2-2	2.765	462		6.80	8.81	9.35	8.63
		8-0	27-4	16 TO 20	11	13	10	5	4	5	4	5	5	5	5	168	2-4	2-4	6-9	3-5	2-2	2.765	482		1.69	2.19	2.20	2.27
		8-3.5	27-4	20 TO 25.9	13	14.5	10	5	5	5	5	5	5	5	5	168	2-6	2-4	6-11	2-4	2-3	3.061	523		6.80	8.82	8.50	5.95
		8-4.5	27-10	26 TO 30	13.5	15	11.5	5	6	5	6	5	5	5	5	168	3-3	2-6	6-11	3-6	2-4	3.300	587		◆	◆	◆	◆
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		9-9.5	27-4	2 TO 8	10.5	11	10	4	5	4	5	4	4	5	5	175	2-6	2-4	8-8	3-2	2-0	2.801	461		1.46	1.89	2.00	1.82
		10-0	27-4	8 TO 12	11	13	10	4	5	4	5	4	4	5	5	184	2-6	2-4	8-9	3-4	2-2	3.012	464		3.45	4.47	4.89	5.12
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		10-4	27-6	20 TO 25.9	13.5	14.5	10.5	5	6	5	5	6	6	5	5	184	3-3	2-4	8-11	3-6	2-3	3.414	675		1.78	2.32	2.23	1.56
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		8-1	33-4	8 TO 12	11.5	13.5	10	5	7	5	7	5	5	5	5	192	2-6	2-4	6-9	3-4	2-2	3.313	721		2.81	3.65	3.73	4.04
		8-2.5	33-4	12 TO 16	12	14.5	10	6	6	5	7	5	5	5	5	192	2-6	2-4	6-10	3-7	2-4	3.467	720		2.67	3.47	3.58	3.84
		8-6	33-4	16 TO 22	14	16	10	6	5	6	5	5	5	5	5	192	2-6	2-4	7-0	3-7	2-5	3.827	658		2.44	3.17	3.04	3.14
	8	10-0	33-6	< 2	14	10	10.5	6	7	6	7	5	5	5	5	208	3-5	2-4	8-11	3-1	1-11	3.519	840	4.056	1.20	1.56	1.40	1.33
		9-11.5	33-4	2 TO 6	11.5	12	10	6	7	6	7	5	5	5	5	208	2-6	2-4	8-9	2-4	2-0	3.405	817		1.65	2.14	2.44	2.39
		10-1	33-4	6 TO 8	11.5	13.5	10	5	7	5	7	5	5	5	5	208	2-6	2-4	8-9	3-3	2-0	3.560	760		3.11	4.04	3.99	4.60
		10-1	33-4	8 TO 12	11.5	13.5	10	5	7	5	7	5	5	5	5	208	2-6	2-4	8-9	3-5	2-2	3.560	763		2.85	3.69	3.76	4.07
		10-5	33-4	12 TO 16	13.5	15.5	10	5	7	5	7	5	5	5	5	208	2-6	2-4	8-11	3-7	2-4	3.971	768		3.36	4.36	4.60	4.04
		10-6	33-4	16 TO 22	14	16	10	6	7	6	7	5	5	5	5	208	2-6	2-4	9-0	3-7	2-5	4.074	831		2.37	3.08	2.93	2.10
	10	12-0	33-6	< 2	14	10	10.5	6	7	6	7	5	5	5	5	224	3-5	2-4	10-11	2-4	1-11	3.778	879	4.056	1.17	1.52	1.36	1.30
		11-10.5	33-6	2 TO 8	11.5	11	10.5	6	7	6	7	5	5	5	5	224	2-6	2-4	10-9	3-2	2-0	3.623	864		1.65	2.14	2.15	2.06
		12-0.5	33-8	8 TO 12	11.5	13	11	5	7	5	7	5	5	5	5	224	2-6	2-5	10-9	3-4	2-2	3.904	808		3.09	4.00	3.92	3.08
		12-3	33-4	12 TO 14	12.5	14.5	10	5	5	5	5	5	5	5	5	224	2-6	2-4	10-10	3-6	2-3	4.012	675		1.68	2.17	2.10	1.50
		12-5	33-6	14 TO 16	13.5	15.5	10.5	5	7	5	7	5	5	5	5	224	2-6	2-4	10-11	3-7	2-4	4.295	812		1.59	2.06	1.99	1.41
		12-6	34-0	16 TO 22	14	16	12	6	7	6	7	5	5	6	6	224	2-10	2-8	11-0	2-4	2-5	4.630	914		1.40	1.82	1.75	1.24
12	6	8-1	39-6	< 2	15	10	10.5	6	7	6	7	5	5	5	5	216	3-9	2-4	7-0	3-1	1-11	3.826	905	4.722	1.03	1.33	1.14	1.15
		7-11.5	39-4	2 TO 4	12.5	11	10	6	7	6	7	5	5	5	5	203	2-6	2-4	6-10	3-2	2-0	3.594	881		1.34	1.74	1.46	1.55
		8-2	39-4	4 TO 8	13.5	12.5	10	5	7	5	7	5	5	5	5	216	2-6	2-4	6-11	3-7	2-5	3.897	818		1.10	1.42	1.27	1.36
		8-6.5	39-4	8 TO 10	14.5	16	10	5	7	5	7	5	5	5	5	216	3-3	2-4	7-0	3-7	2-5	4.443	823		2.22	2.88	2.82	3.06
		8-8	39-6	10 TO 12	16	16	10.5	6	5	6	5	5	5	5	5	216	3-3	2-4	7-2	2-4	2-3	4.679	735		3.48	4.51	4.97	5.27
		8-8	39-8	12 TO 16	16	16	11	6	5	6	5	5	5	5	5	216	3-3	2-5	7-2	3-7	2-5	4.733	745		2.48	3.22	3.40	3.59
		8-11	39-8	16 TO 18	17	18	11	6	5	6	5	5	5	5	5	216	3-3	2-4	7-3	3-9	2-7	5.100	748		2.09	2.71	2.79	2.86
	8	10-1.5	39-6	< 2	15	10.5	10.5	6	7	6	7	5	5	6	6	232	3-9	2-8	9-0	3-5	1-11	4.146	984	4.722	1.07	1.39	1.19	1.20
		9-11.5	39-4	2 TO 4	12.5	11	10	6	7	6	7	5	5	5	5	232	2-6	2-4	8-10	3-2	2-0	3.841	923		1.31	1.70	1.44	1.52
		10-2.5	39-4	4 TO 8	13.5	13	10	5	5	5	5	5	5	5	5	232	2-6	2-4	8-11	2-4	2-2	4.205	695		1.15	1.50	1.34	1.43
		10-9.5	39-8	8 TO 12	16	17.5	11	5	5	5	5	5	5	5	5	232	3-3	2-5	9-2	3-9	2-6	5.188	716		2.51	3.26	2.93	3.11
		10-11	39-8	12 TO 18	17	18	11	6	5	6	5	5	5	5	5	232	3-3	2-5	9-3	3-9	2-7	5.371	790		1.98	2.57	2.63	2.71
	10	12-3	39-6	< 2	16	11	10.5	6	7	6	7	5	5	6	6	248	4-4	2-8	11-1	2-8	2-0	4.588	1030	4.722	1.11	1.44	1.23	1.24
		11-11.5	39-4	2 TO 4	12.5	11	10	6	7	6	7	5	5	5	5	248	2-6	2-4	10-10	3-2	2-0	4.087	964		1.30	1.69	1.43	1.50
		12-4.5	39-4	4 TO 8	13.5	15	10	5	5	5	5	5	5	5	5	248	2-6	2-4	10-11	2-4	2-4	4.694	739		1.60	2.07	2.17	2.61
		12-9.5	39-8	8 TO 12	16	17.5	11	5	5	5	5	5	5	5	5	248	3-3	2-5	11-2	3-9	2-6	5.459	757		2.57	3.34	3.00	3.06
		12-11	39-8	12 TO 18	17	18	11	6	5	6	5	5	5	5	5	248	3-3	2-5	11-3	3-9	2-7	5.643	832		1.36	1.77	1.70	1.21
14	6	8-3	45-6	< 2	16	11	10.5	7	8	7	8	5	5	5	5	240	3-9	2-4	7-1	3-2	2-0	4.569	1243	5.389	1.00	1.30	1.10	1.12
		8-1	45-4	2 TO 4	13	12	10	7	8	7	8	5	5	5	5	240	2-6	2-4	6-11	3-3	2-1	4.239	1196		1.31	1.69	1.67	1.69
		8-2	45-4	4 TO 8	13	13	10	7	8	7	8	5	5	5	5	240	2-6	2-4	6-11	2-4	2-2	4.379	1193		1.98	2.57	2.82	2.90
		8-5	45-8	8 TO 12	14	15	11	7	8	7	8	5	5	6	6	240	2-10	2-9	7-0	3-10	2-4	4.902	1242		3.51	4.54	3.93	4.17
	8	10-3.5	45-6	< 2	16	11.5	10.5	7	8	7	8	5	5	5	5	256	3-9	2-4	9-1	3-2	2-0	4.899	1284	5.389	1.04	1.35	1.14	1.16
		10-1	45-4	2 TO 4	13	12	10	7	8	7	8	5	5	5	5	256	2-6	2-4	8-11	3-3	2-1	4.486	1237		1.43	1.86	1.63	1.65
		10-2	45-4	4 TO 8	13	13	10	7	8	7	8	5	5	5	5	256	2-6	2-4	8-11	3-4	2-2	4.626	1238		2.10	2.73	2.76	2.84
		10-5	46-0	8 TO 12	14	15	12	7	8	7	8	5	5	6	6	256	2-10	2-10	9-0	2-4	2-4	5.302	1285		3.52	4.56	3.95	4.19
	10	12-4.5	45-6	< 2	16.5	12	10.5	7	8	7	8	5	5	5	5	272	3-9	2-4	11-2	3-2	2-1	5.299	1328	5.389	1.07	1.39	1.18	1.20
		12-1	45-4	2 TO 4	13	12	10	7	8	7	8	5	5	5	5	272	2-6	2-4	10-11	3-3	2-1	4.733	1278		1.41	1.83	1.61	1.62
		12-2	45-4	4 TO 8	13	13	10	7	8	7	8	5	5	5	5	272	2-6	2-4	10-11	3-4	2-2	4.872	1280		1.95	2.53	2.62	2.81
		12-5.5	46-0	8 TO 12	14	15.5	12	7	8	7	8	7	7	6	6	272	2-10	2-10	11-0	3-11	2-4	5.670	1561		3.77	4.89	4.56	3.99
16	6	8-5	51-6	< 2	16.5	12.5	10.5	7	8	7	8	5	5	6	6	264	4-4	2-8	7-2	2-4	2-1	5.387	1410	6.056	1.07	1.39	1.13	1.18
		8-1.5	51-4	2 TO 4	13	12.5	10	7	8	7	8	5	5	6	6	264	2-10	2-8	6-11	3-8	2-1	4.781	1359		1.25	1.62	1.31	1.37
		8-2	51-4	4 TO 6	13	13	10	7	8	7	8	5	5	6	6	264	2-10	2-10	6-11	3-8	2-2	4.860	1361		1.64	2.13	1.75	1.77
		8-3.5	51-4	6 TO 8	13.5	14	10	7	8	7	8	5	5	6	6	264	2-10	2-8	6-11	3-9	2-3	5.098	1361		1.75	2.27	1.87	1.92
		8-6	51-8	8 TO 10	14.5	15.5	11	7	8	7	8	5	5	6	6	264	3-8	2-9	7-0	3-11	2-4	5.599	1377		2.06	2.68	2.21	2.28
	8	10-5	51-6	< 2	16.5	12.5	10.5	7	8	7	8	5	5	6	6	280	4-4	2-8	9-2	2-4	2-1	5.647	1455	6.056	1.02	1.33	1.08	1.13
		10-3	51-4	2 TO 4	14	13	10	7	8	7	8	5	5	6	6	280	2-10	2-8	9-0	3-8	2-2	5.265	1406		1.31	1.70	1.38	1.44
		10-3	51-4	4 TO 6	14	13	10	7	8	7	8	5	5	6	6	280	2-10	2-8	9-0	3-8	2-2	5.265	1406		1.57	2.03	1.67	1.70
		10-4.5	51-4	6 TO 8	14	14.5	10	7	8	7	8	5	5	6	6	280	2-10	2-8	9-0	3-10	2-4	5.503	1410		2.01	2.61	2.15	2.21
		10-6.5	51-8	8 TO 10	15	15.5	11	7	8	7	8	6	6	6	6	280	3-8	2-9	9-1	3-11	2-4	5.950	1519		1.99	2.58	2.13	2.21
	10	12-6	51-6	< 2	17	13	10.5	7	8	7	8	5	5	6	6	296	4-4	2-8	11-2	2-4	2-1	6.065	1500	6.056	1.06	1.37	1.12	1.16
		12-3	51-4	2 TO 4	14	13	10	7	8	7	8	5	5	6	6	296	2-10	2-8	11-0	3-8	2-2	5.512	1452		1.30	1.68	1.36	1.43
		12-3	51-4	4 TO 6	14	13	10	7	8	7	8	5	5	6	6	296	2-10	2-8	11-0	3-8	2-2	5.512	1452		1.54	2.00	1.64	1.68
		12-5	51-4	6 TO 8	14	15	10	7	8	7	8	5	5	6	6	296	2-10	2-8	11-0	3-10	2-4	5.829	1455		2.24	2.91	2.50	2.57
		12-7	51-8	8 TO 10	15	16	11	7	8	7	8	5	5	6	6	296	3-8	2-9	11-1	3-11	2-5	6.301	1469		2.35	3.05	2.52	2.61
18	6	8-6.5	57-6	< 2	17	13.5	10.5	7	8	7	8	5	5	7	7	288	5-0	3-1	7-2	2-4	2-1	6.191	1589	6.722	1.07	1.39	1.09	1.16
		8-5	57-4	2 TO 4	15	14	10	7	8	7	8	5	5	6	6	288	3-8	2-8	7-1	3-9	2-3	5.872	1499		1.15	1.50	1.15	1.25
		8-6.5	57-8	4 TO 6	15.5	15	11	7	8	7	8	5	5	6	6	288	3-8	2-9	7-1	3-10	2-4	6.243	1507		1.50	1.94	1.52	1.57
		8-9	57-8	6 TO 8	16	17	11	7	8	7	8	5	5	6	6	288	3-8	2-9	7-2	4-0	2-6	6.688	1512		1.91	2.48	1.98	2.04
	8	10-6.5	57-6	< 2	17	13.5	10.5	7	8	7	8	5	5	7	7	304	5-0	3-1	9-2	4-1	2-1	6.450	1653	6.722	1.02	1.33	1.05	1.11
		10-5	57-4	2 TO 4	15	14	10	7	8	7	8	5	5	6	6	304	3-8	2-8	9-1	2-4	2-3	6.119	1535		1.13	1.46	1.13	1.22
		10-6.5	57-8	4 TO 6	15.5	15	11	7	8	7	8	5	5	6	6	304	3-8	2-9	9-1	3-10	2-4	6.515	1552		1.44	1.87	1.47	1.52
		10-9	57-8	6 TO 8	16	17	11	7	8	7	8	5	5	6	6	304	3-8	2-9	9-2	4-0	2-6	6.960	1557		1.88	2.44	1.93	1.99
	10	12-7	57-6	< 2	17	14	10.5	7	8	7	8	5	5	7	7	320	5-0	3-1	11-2	4-1	2-2	6.798	1703	6.722	1.06	1.38	1.08	1.15
		12-5	57-4	2 TO 4	15	14	10	7	8	7	8	5	5	6	6	320	3-8	2-8	11-1	3-9	2-3	6.366	1589		1.11	1.44	1.11	1.20
		12-6.5	57-8	4 TO 6	15.5	15	11	7	8	7	8	5	5	6	6	320	3-8	2-9	11-1	2-4	2-4	6.787	1588		1.41	1.83	1.43	1.49
		12-9	57-8	6 TO 8	16	17	11	7	8	7	8	5	5	6	6	320	3-8	2-9	11-2	4-0	2-6	7.231	1602		1.85	2.40	1.90	1.97
20	6	8-8	63-8	< 2	18	14	11	8	9	8	9	6	6	7	7	312	5-0	3-2	7-3	4-2	2-6	7.103	2195	7.407	1.00	1.30	1.00	1.07
		8-8	63-8	2 TO 4	16	16	11	7	8	7	8	5	5	6	6	312	3-8	2-9	7-2	3-11	2-5	7.103	1639		1.14	1.47	1.13	1.25
		8-8	63-8	4 TO 6	16	16	11	8	8	8	8	5	5	6	6	312	3-8	2-9	7-2	3-11	2-5	7.103	1798		1.61	2.09	2.00	2.27
	8	10-8.5	63-8	< 2	18	14.5	11	8	9	8	9	6	6	7	7	328	5-0	3-2	9-3	2-4	2-6	7.473	2259	7.407	1.02	1.33	1.02	1.09
		10-8	63-8	2 TO 4	16	16	11	7	8	7	8	5	5	6	6	328	3-8	2-9	9-2	3-11	2-5	7.374	1684		1.14	1.48	1.10	1.22
		10-8	63-8	4 TO 6	16	16	11	8	8	8	8	5	5	6	6	328	3-8	2-9	9-2	3-11	2-5	7.374	1843		1.83	2.38	2.08	2.21
	10	12-9	63-8	< 2	18	15	11	8	9	8	9	6	6	7	7	344	5-0	3-2	11-3	4-3	2-6	7.843	2335	7.407	1.06	1.37	1.05	1.13
		12-8	63-8	2 TO 4	16	16	11	7	8	7	8	5	5	6	6	344	3-8	2-9	11-2	3-11	2-5	7.646	1729		1.12	1.46	1.09	1.20
		12-8	63-8	4 TO 6	16	16	11	8	8	8	8	5	5	6	6	344	3-8	2-9	11-2	2-4	2-5	7.646	1878		1.87	2.43	2.05	2.18

HEADWALL AND TOEWALL QUANTITIES

HEADWALL BENT ANGLE	90° TO 75°			74° TO 60°			59° TO 45°		
CLEAR SPAN (S)	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF
8	4	4	19.2	5	4	23.5	7	4	34.4
10	5	4	23.9	6	4	28.7	9	4■	54.0
12	6	4	28.7	6	4	28.2	9	5■	59.2
14	6	4	27.9	7	4	33.5	★	★	★
16	6	4	27.5	8	5	44.1	★	★	★
18	7	4	33.0	9	5	51.8	★	★	★
20	7	4	32.8	★	★	★	★	★	★
CONCRETE QUANTITY = 0.086 CY/LF									

NOTES

■ 1. SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.

2. QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL. STEEL QUANTITIES INCLUDE ALL REINFORCING. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.

★ 3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

4. FOR HEADWALL AND TOEWALL DETAILS SEE M-601-3, SHEET 1 OF 2.

5. WHEN THE FILL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT, ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (*), AND THE d_1 BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

6. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.

7. WHEN A (RISE) R OF LESS THAN 6 FT IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT RISE (IF AVAILABLE ON THE TABLE).

▲ 8. FOR SIZE AND SPACING OF THE BOTTOM MAT BARS IN THE TOP SLAB SEE TABLE ON M-601-3, SHEET 1 OF 2. ALL OTHER d_1 BARS ARE #4's AT 1'-0" SPACING. THE NUMBER OF BARS REQUIRED IS LISTED ON THIS SHEET AND INCLUDES BOTH #4 BARS AND THOSE FROM THE TABLE.

◆ 9. LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDOT RATING MANUAL.

10. FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDOT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDOT RATING MANUAL.

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBE	(R-X)		
Last Modification Date: 07/31/19	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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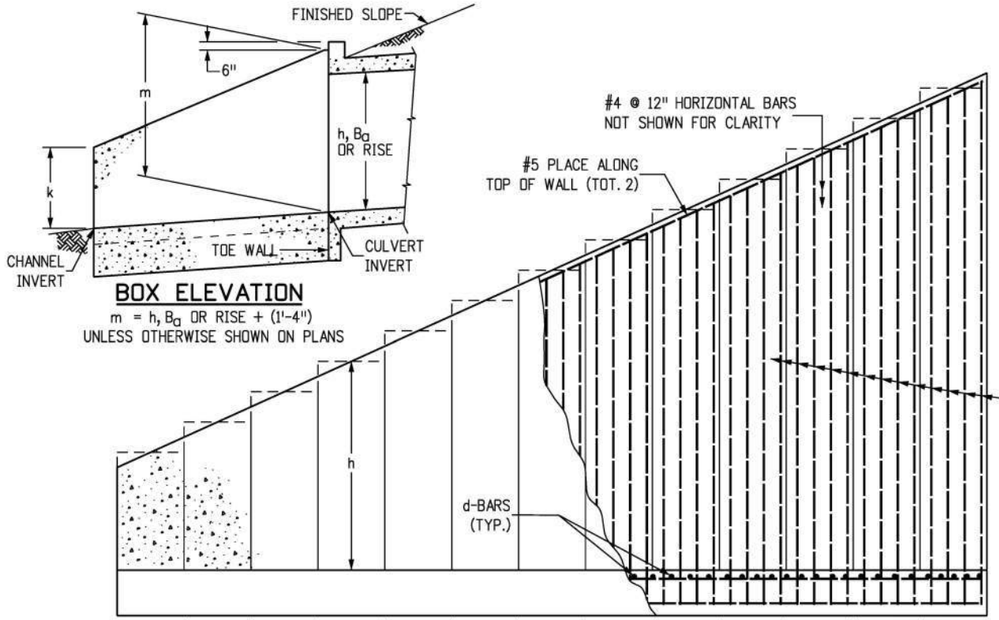
Project Development Branch JBK

TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

STANDARD PLAN NO.
M-601-3
Standard Sheet No. 2 of 2

Issued by the Project Development Branch: July 31, 2019

Project Sheet Number:



BOX ELEVATION

m = h, B_d OR RISE + (1'-4")
UNLESS OTHERWISE SHOWN ON PLANS

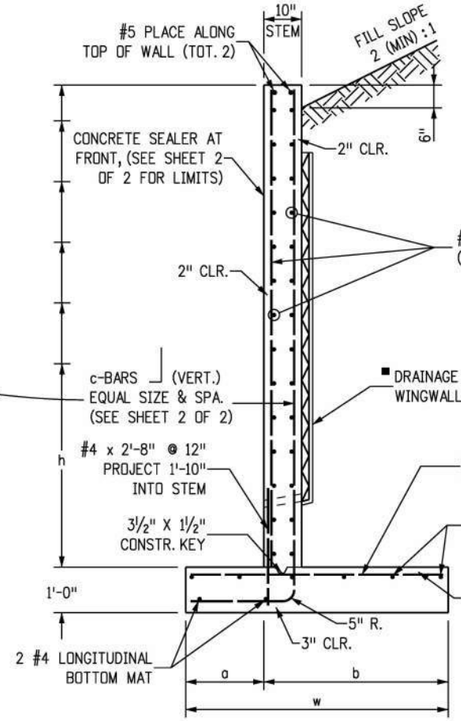
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	■ 12'	■ 13'	■ 14'
a =	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	2'-8"	2'-10"	3'-0"
b =	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	5'-0"	5'-4"	5'-8"
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	7'-8"	8'-2"	8'-8"
d-BARS	#4 @ 9"	#4 @ 9"	#4 @ 9"	#4 @ 9"	#4 @ 9"	#4 @ 9"	#5 @ 11"	#5 @ 10"	#5 @ 10"	#5 @ 8"	#6 @ 8"	#7 @ 9"	#7 @ 7"
✳ CONC. CY/LF	0.161	0.210	0.259	0.309	0.358	0.407	0.457	0.506	0.556	0.605	0.654	0.704	0.753

✳ DOES NOT INCLUDE TOE WALL QUANTITIES
SEE SHEET 2 OF 2 FOR REINFORCING STEEL QUANTITY

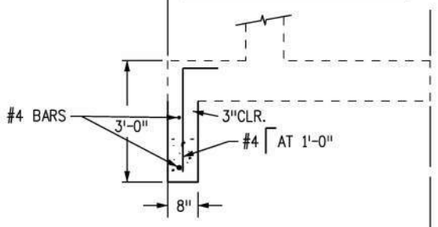
■ REQUIRED DRAINAGE BEHIND WINGWALLS
SEE NOTE 6

PLAN

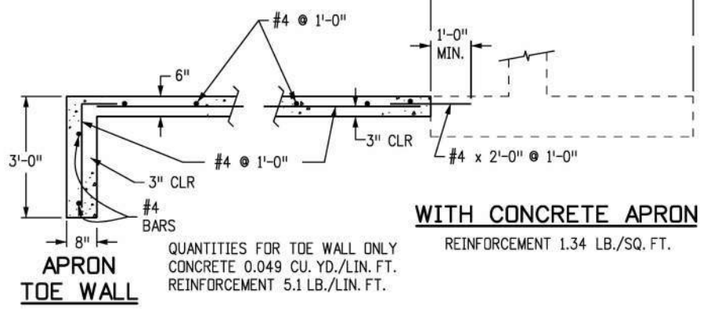
ELEVATION
DESIGN EXAMPLE



TYPICAL SECTION



WITH TOE WALL

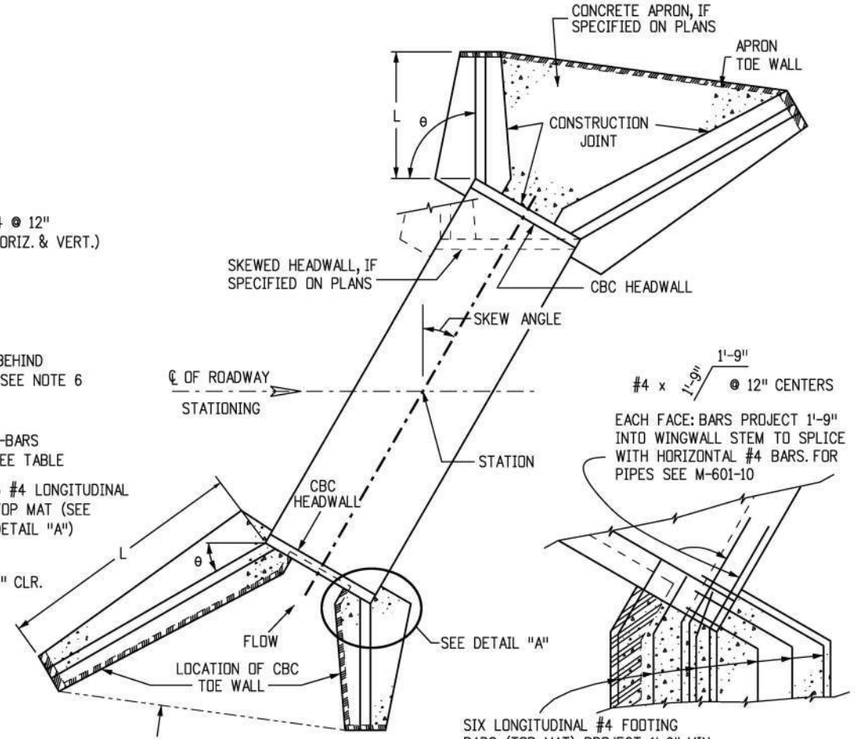


APRON TOE WALL

QUANTITIES FOR TOE WALL ONLY
CONCRETE 0.049 CU. YD./LIN. FT.
REINFORCEMENT 5.1 LB./LIN. FT.

WITH CONCRETE APRON

REINFORCEMENT 1.34 LB./SQ. FT.



TYPICAL CULVERT LAYOUT

DETAIL "A"

DESIGN DATA:

AASHTO LRFD EIGHTH EDITION, 2017
DESIGN METHOD: LOAD AND RESISTANCE FACTOR DESIGN, YIELD LINE METHOD

REINFORCED CONCRETE:
CONCRETE CLASS D (BOX CULVERT): f'_c = 4,500 PSI
REINFORCING STEEL: f_y = 60,000 PSI

LOADING:
AT-REST EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 55 PCF FOR 2 (MIN.) : 1 SLOPED BACKFILL
ACTIVE EARTH (FLUID) PRESSURE FOR CONCRETE FOOTING DESIGN = 40 PCF FOR 2 (MIN.) : 1 SLOPED BACKFILL
LIVE LOAD SURCHARGE = 2'
MINIMUM RESISTANCE FOR SOIL BEARING = 5.5 KSF
SOIL BEARING RESISTANCE FACTOR = 0.45

GENERAL NOTES:

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
2. WINGWALL FOOTING AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
3. DIMENSIONS "h", "k", "L", "m" AND ANGLE "θ" FOR WINGWALL SHALL BE AS SHOWN ON THE PLANS.
4. MINIMUM CLASS B LAP SPLICE LENGTH FOR BLACK REINFORCING BARS:

BAR SIZE:	#4	#5	#6	#7
SPLICE LENGTH:	1'- 6"	1'-11"	2'-3"	2'-7"

5. DESIGN DOES NOT CONSIDER ANY SCOUR EFFECTS.
6. WINGWALL DRAIN SHALL BE REQUIRED IF "h" ≥ 12.0 FT., SEE SHEET 2 OF 2 FOR DETAILS.

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 07/31/19	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

Colorado Department of Transportation
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Denver, CO 80204
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Project Development Branch JBK

WINGWALLS FOR PIPE OR BOX CULVERTS

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-601-20
Standard Sheet No. 1 of 2
Project Sheet Number:

c-BARS AND REINFORCING STEEL QUANTITY (EXCLUDE TOE WALL)

✳ REINFORCING STEEL QUANTITY INCLUDES STEM AND FOOTING QUANTITIES, BUT DOES NOT INCLUDE TOE WALL QUANTITIES.

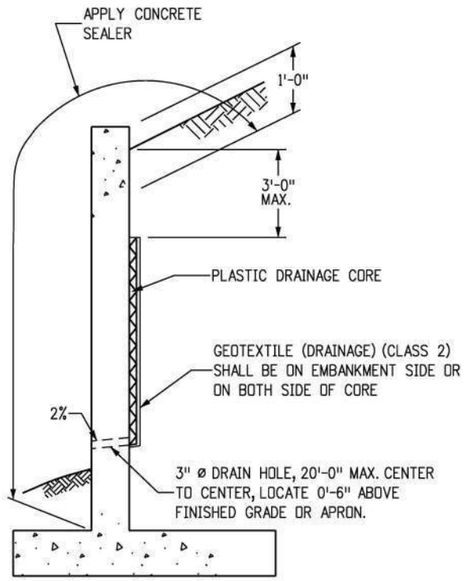
L (MULTIPLE OF m)		≤ (1.0 x m)		≤ (1.25 x m)		≤ (1.5 x m)		≤ (1.75 x m)		≤ (2.0 x m)		≤ (2.25 x m)		≤ (2.5 x m)		≤ (2.75 x m)		≤ (3.0 x m)		≤ (3.25 x m)		≤ (3.5 x m)	
m (FT)	k (FT)	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.
14	4	#4 @ 10"	53.60	#5 @ 10"	57.95	#5 @ 10"	57.10	#5 @ 8"	60.22	#5 @ 7"	62.43	#5 @ 7"	62.09	#5 @ 6"	65.38	#5 @ 6"	65.15	#6 @ 8"	67.10	#6 @ 8"	66.94	#6 @ 7"	70.66
	5	#4 @ 10"	55.86	#5 @ 10"	60.46	#5 @ 10"	59.60	#5 @ 8"	62.89	#5 @ 7"	65.23	#5 @ 7"	64.88	#5 @ 6"	68.34	#5 @ 6"	68.11	#6 @ 8"	70.17	#6 @ 8"	70.00	#6 @ 7"	73.90
	6	#5 @ 10"	64.43	#6 @ 10"	70.60	#6 @ 10"	69.69	#6 @ 8"	74.93	#6 @ 8"	74.45	#6 @ 7"	78.30	#6 @ 6"	83.64	#6 @ 6"	83.40	#6 @ 6"	83.22	#6 @ 6"	83.05	#7 @ 7"	89.64
	7	#5 @ 10"	67.29	#6 @ 10"	73.76	#6 @ 10"	72.83	#6 @ 8"	78.32	#6 @ 8"	77.84	#6 @ 7"	81.87	#6 @ 6"	87.45	#6 @ 6"	87.21	#6 @ 6"	87.02	#6 @ 6"	86.86	#7 @ 7"	93.73
	8	#5 @ 8"	74.71	#6 @ 8"	83.46	#6 @ 7"	87.09	#6 @ 6"	92.54	#7 @ 7"	99.47	#7 @ 7"	99.08	#7 @ 6"	107.11	#7 @ 6"	106.86	#7 @ 6"	106.66	#7 @ 6"	106.49	#7 @ 6"	106.35
	9	#5 @ 8"	78.10	#6 @ 8"	87.23	#6 @ 7"	91.03	#6 @ 6"	96.72	#7 @ 7"	103.93	#7 @ 7"	103.54	#7 @ 6"	111.90	#7 @ 6"	111.65	#7 @ 6"	111.45	#7 @ 6"	111.28	#7 @ 6"	111.13
13	4	#4 @ 10"	50.51	#4 @ 10"	49.25	#5 @ 10"	53.71	#5 @ 10"	53.09	#5 @ 10"	52.36	#5 @ 9"	53.85	#5 @ 8"	55.54	#5 @ 7"	57.85	#5 @ 7"	57.67	#5 @ 7"	57.51	#6 @ 9"	59.93
	5	#4 @ 10"	52.66	#4 @ 10"	51.37	#5 @ 10"	56.09	#5 @ 10"	55.46	#5 @ 10"	54.99	#5 @ 9"	56.29	#5 @ 8"	58.08	#5 @ 7"	60.51	#5 @ 7"	60.33	#5 @ 7"	60.17	#6 @ 9"	62.72
	6	#4 @ 10"	54.92	#5 @ 10"	59.48	#5 @ 9"	60.31	#6 @ 9"	67.56	#6 @ 9"	67.08	#6 @ 9"	66.70	#6 @ 8"	69.53	#6 @ 8"	69.28	#6 @ 7"	73.12	#6 @ 7"	72.95	#6 @ 7"	72.81
	7	#4 @ 10"	57.36	#5 @ 10"	62.16	#5 @ 9"	63.05	#6 @ 9"	70.66	#6 @ 9"	70.16	#6 @ 9"	69.78	#6 @ 8"	72.75	#6 @ 8"	72.50	#6 @ 7"	76.52	#6 @ 7"	76.35	#6 @ 7"	76.20
	8	#5 @ 10"	66.39	#6 @ 10"	72.82	#6 @ 8"	77.97	#6 @ 7"	81.68	#6 @ 7"	81.19	#6 @ 6"	86.67	#6 @ 6"	86.37	#7 @ 7"	93.18	#7 @ 7"	92.97	#7 @ 7"	92.80	#7 @ 7"	92.64
	9	#5 @ 10"	69.37	#6 @ 10"	76.10	#6 @ 8"	81.49	#6 @ 7"	85.37	#6 @ 7"	84.87	#6 @ 6"	90.59	#6 @ 6"	90.29	#7 @ 7"	97.39	#7 @ 7"	97.18	#7 @ 7"	97.00	#7 @ 7"	96.85
12	2	#4 @ 10"	43.91	#4 @ 10"	42.65	#4 @ 10"	41.82	#4 @ 10"	41.22	#4 @ 10"	40.78	#4 @ 9"	41.29	#5 @ 10"	44.61	#5 @ 10"	44.37	#5 @ 10"	44.18	#5 @ 10"	44.01	#5 @ 10"	43.87
	3	#4 @ 10"	45.82	#4 @ 10"	44.55	#4 @ 10"	43.71	#4 @ 10"	43.11	#4 @ 10"	42.66	#4 @ 9"	43.22	#5 @ 10"	46.75	#5 @ 10"	46.51	#5 @ 10"	46.32	#5 @ 10"	46.15	#5 @ 10"	46.01
	4	#4 @ 10"	47.80	#4 @ 10"	46.51	#4 @ 10"	45.65	#5 @ 10"	50.06	#5 @ 10"	49.59	#5 @ 10"	49.23	#5 @ 10"	48.94	#5 @ 10"	48.69	#5 @ 9"	50.00	#5 @ 8"	51.72	#5 @ 8"	51.57
	5	#4 @ 10"	49.84	#4 @ 10"	48.53	#4 @ 10"	47.66	#5 @ 10"	52.33	#5 @ 10"	51.85	#5 @ 10"	51.48	#5 @ 10"	51.19	#5 @ 10"	50.94	#5 @ 9"	52.33	#5 @ 8"	54.14	#5 @ 8"	54.00
	6	#4 @ 10"	51.99	#4 @ 10"	50.65	#5 @ 10"	55.34	#5 @ 8"	58.41	#5 @ 8"	57.93	#6 @ 10"	60.60	#6 @ 10"	60.29	#6 @ 9"	62.42	#6 @ 9"	62.22	#6 @ 9"	62.04	#6 @ 8"	64.89
	7	#4 @ 10"	54.30	#5 @ 10"	58.80	#5 @ 10"	57.87	#5 @ 8"	61.10	#5 @ 8"	60.61	#6 @ 10"	63.43	#6 @ 10"	63.11	#6 @ 9"	65.35	#6 @ 9"	65.15	#6 @ 9"	64.97	#6 @ 8"	67.96
	8	#5 @ 10"	62.91	#5 @ 10"	61.45	#5 @ 7"	67.46	#5 @ 6"	70.68	#5 @ 6"	70.20	#6 @ 7"	76.44	#6 @ 7"	76.13	#6 @ 7"	75.87	#6 @ 6"	81.30	#6 @ 6"	81.12	#6 @ 6"	80.98
	9	#5 @ 10"	65.64	#5 @ 10"	64.15	#5 @ 7"	70.44	#5 @ 6"	73.82	#5 @ 6"	73.33	#6 @ 7"	79.86	#6 @ 7"	79.54	#6 @ 7"	79.28	#6 @ 6"	84.95	#6 @ 6"	84.77	#6 @ 6"	84.62
11	2	#4 @ 10"	41.70	#4 @ 10"	40.42	#4 @ 10"	39.57	#4 @ 10"	38.96	#4 @ 10"	38.50	#4 @ 10"	38.15	#4 @ 10"	37.87	#4 @ 10"	37.63	#4 @ 9"	38.25	#5 @ 10"	41.46	#5 @ 10"	41.31
	3	#4 @ 10"	43.57	#4 @ 10"	42.27	#4 @ 10"	41.40	#4 @ 10"	40.79	#4 @ 10"	40.33	#4 @ 10"	39.97	#4 @ 10"	39.69	#4 @ 10"	39.45	#4 @ 9"	40.12	#5 @ 10"	43.54	#5 @ 10"	43.39
	4	#4 @ 10"	45.48	#4 @ 10"	44.16	#4 @ 10"	43.28	#4 @ 10"	42.66	#4 @ 9"	43.09	#5 @ 10"	46.57	#5 @ 10"	46.27	#5 @ 10"	46.02	#5 @ 10"	45.82	#5 @ 10"	45.65	#5 @ 10"	45.50
	5	#4 @ 10"	47.46	#4 @ 10"	46.10	#4 @ 10"	45.21	#4 @ 10"	44.58	#4 @ 9"	45.06	#5 @ 10"	48.74	#5 @ 10"	48.44	#5 @ 10"	48.19	#5 @ 10"	47.99	#5 @ 10"	47.81	#5 @ 10"	47.67
	6	#4 @ 10"	49.52	#4 @ 10"	48.14	#4 @ 9"	48.23	#5 @ 10"	51.88	#5 @ 10"	51.38	#5 @ 9"	52.57	#5 @ 9"	52.27	#5 @ 8"	53.99	#5 @ 8"	53.79	#5 @ 7"	56.16	#5 @ 7"	56.01
	7	#4 @ 10"	51.73	#4 @ 10"	50.31	#4 @ 9"	50.43	#5 @ 10"	54.29	#5 @ 10"	53.78	#5 @ 9"	55.04	#5 @ 9"	54.73	#5 @ 8"	56.55	#5 @ 8"	56.35	#5 @ 7"	58.84	#5 @ 7"	58.70
	8	#4 @ 10"	54.00	#5 @ 10"	58.44	#5 @ 10"	57.45	#5 @ 8"	60.64	#5 @ 7"	62.92	#5 @ 6"	66.25	#5 @ 6"	65.94	#5 @ 6"	65.69	#6 @ 8"	67.76	#6 @ 8"	67.57	#6 @ 7"	71.45
	9	#4 @ 10"	56.20	#5 @ 10"	60.87	#5 @ 10"	59.85	#5 @ 8"	63.21	#5 @ 7"	65.60	#5 @ 6"	69.09	#5 @ 6"	68.78	#5 @ 6"	68.52	#6 @ 8"	70.69	#6 @ 8"	70.51	#6 @ 7"	74.57
10	2	#4 @ 10"	39.84	#4 @ 10"	38.53	#4 @ 10"	37.65	#4 @ 10"	37.03	#4 @ 10"	36.57	#4 @ 10"	36.20	#4 @ 10"	35.91	#4 @ 10"	35.67	#4 @ 10"	35.48	#4 @ 9"	36.07	#4 @ 9"	35.93
	3	#4 @ 10"	41.68	#4 @ 10"	40.35	#4 @ 10"	39.47	#4 @ 10"	38.84	#4 @ 10"	38.36	#4 @ 10"	38.00	#4 @ 10"	37.71	#4 @ 10"	37.46	#4 @ 10"	37.27	#4 @ 9"	37.91	#4 @ 9"	37.76
	4	#4 @ 10"	43.58	#4 @ 10"	42.22	#4 @ 10"	41.31	#4 @ 10"	40.67	#4 @ 10"	40.19	#4 @ 10"	39.82	#4 @ 10"	39.53	#4 @ 10"	39.28	#4 @ 10"	39.08	#4 @ 9"	39.77	#4 @ 9"	39.63
	5	#4 @ 10"	45.53	#4 @ 10"	44.14	#4 @ 10"	43.21	#4 @ 10"	42.56	#4 @ 10"	42.07	#5 @ 10"	46.44	#5 @ 10"	46.13	#5 @ 10"	45.87	#5 @ 10"	45.67	#5 @ 10"	45.49	#5 @ 10"	45.34
	6	#4 @ 10"	47.58	#4 @ 10"	46.14	#4 @ 10"	45.20	#4 @ 10"	44.53	#4 @ 10"	44.03	#5 @ 10"	48.67	#5 @ 10"	48.35	#5 @ 10"	48.08	#5 @ 10"	47.88	#5 @ 10"	47.69	#5 @ 10"	47.54
	7	#4 @ 10"	49.79	#4 @ 10"	48.31	#4 @ 10"	47.34	#5 @ 10"	51.97	#5 @ 10"	51.45	#5 @ 10"	51.04	#5 @ 9"	52.29	#5 @ 9"	52.03	#5 @ 8"	53.79	#5 @ 8"	53.61	#5 @ 7"	56.00
	8	#4 @ 10"	52.06	#4 @ 10"	50.54	#4 @ 10"	49.54	#5 @ 10"	54.43	#5 @ 10"	53.89	#5 @ 10"	53.47	#5 @ 9"	54.80	#5 @ 9"	54.53	#5 @ 8"	56.39	#5 @ 8"	56.20	#5 @ 7"	58.72
9	2	#4 @ 10"	38.01	#4 @ 10"	36.75	#4 @ 10"	35.85	#4 @ 10"	35.21	#4 @ 10"	34.73	#4 @ 10"	34.36	#4 @ 10"	34.06	#4 @ 10"	33.81	#4 @ 10"	33.61	#4 @ 10"	33.44	#4 @ 10"	33.30
	3	#4 @ 10"	39.93	#4 @ 10"	38.56	#4 @ 10"	37.64	#4 @ 10"	36.99	#4 @ 10"	36.51	#4 @ 10"	36.13	#4 @ 10"	35.83	#4 @ 10"	35.58	#4 @ 10"	35.38	#4 @ 10"	35.21	#4 @ 10"	35.06
	4	#4 @ 10"	41.81	#4 @ 10"	40.40	#4 @ 10"	39.47	#4 @ 10"	38.81	#4 @ 10"	38.31	#4 @ 10"	37.93	#4 @ 10"	37.63	#4 @ 10"	37.37	#4 @ 10"	37.17	#4 @ 10"	36.99	#4 @ 10"	36.84
	5	#4 @ 10"	43.75	#4 @ 10"	42.30	#4 @ 10"	41.35	#4 @ 10"	40.67	#4 @ 10"	40.17	#4 @ 10"	39.78	#4 @ 10"	39.47	#4 @ 10"	39.20	#4 @ 9"	39.86	#5 @ 10"	43.28	#5 @ 10"	43.12
	6	#4 @ 10"	45.79	#4 @ 10"	44.30	#4 @ 10"	43.31	#4 @ 10"	42.62	#4 @ 10"	42.10	#4 @ 10"	41.71	#4 @ 10"	41.39	#4 @ 10"	41.12	#4 @ 9"	41.82	#5 @ 10"	45.46	#5 @ 10"	45.30
	7	#4 @ 10"	48.04	#4 @ 10"	46.50	#4 @ 10"	45.49	#4 @ 10"	44.77	#5 @ 10"	49.29	#5 @ 10"	48.86	#5 @ 10"	48.53	#5 @ 10"	48.24	#5 @ 10"	48.03	#5 @ 10"	47.84	#5 @ 10"	47.67
	8	#4 @ 10"	50.43	#4 @ 10"	48.84	#4 @ 10"	47.80	#4 @ 10"	47.06	#5 @ 10"	51.83	#5 @ 10"	51.40	#5 @ 10"	51.05	#5 @ 10"	50.77	#5 @ 10"	50.54	#5 @ 10"	50.35	#5 @ 10"	50.18
8	2	#4 @ 10"	36.41	#4 @ 10"	35.01	#4 @ 10"	34.08	#4 @ 10"	33.42	#4 @ 10"	32.92	#4 @ 10"	32.54	#4 @ 10"	32.23	#4 @ 10"	31.97	#4 @ 10"	31.77	#4 @ 10"	31.59	#4 @ 10"	31.44
	3	#4 @ 10"	38.23	#4 @ 10"	36.80	#4 @ 10"	35.85	#4 @ 10"	35.18	#4 @ 10"	34.67	#4 @ 10"	34.28	#4 @ 10"	33.97	#4 @ 10"	33.70	#4 @ 10"	33.50	#4 @ 10"	33.32	#4 @ 10"	33.17
	4	#4 @ 10"	40.09	#4 @ 10"	38.61	#4 @ 10"	37.64	#4 @ 10"	36.95	#4 @ 10"	36.44	#4 @ 10"	36.04	#4 @ 10"	35.72	#4 @ 10"	33.45	#4 @ 10"	35.25	#4 @ 10"	35.07	#4 @ 10"	34.91
	5	#4 @ 10"	41.99	#4 @ 10"	40.47	#4 @ 10"	39.47	#4 @ 10"	38.76	#4 @ 10"	38.24	#4 @ 10"	37.83	#4 @ 10"	37.50	#4 @ 10"	37.23	#4 @ 10"	37.02	#4 @ 10"	36.84	#4 @ 10"	36.68
	6	#4 @ 10"	43.97	#4 @ 10"	42.40	#4 @ 10"	41.36	#4 @ 10"	40.64	#4 @ 10"	40.10	#4 @ 10"	39.68	#4 @ 10"	39.35	#4 @ 10"	39.07	#4 @ 9"	43.33	#5 @ 10"	43.13	#5 @ 10"	42.96
	7	#4 @ 10"	46.19	#4 @ 10"	44.56	#4 @ 10"	43.49	#4 @ 10"	42.74	#4 @ 10"	42.18	#4 @ 10"	41.75	#4 @ 10"	41.41	#4 @ 10"	41.13	#4 @ 9"	45.65	#5 @ 10"	45.45	#5 @ 10"	45.28
7	2	#4 @ 10"	34.90	#4 @ 10"	33.44	#4 @ 10"	32.47	#4 @ 10"	31.78	#4 @ 10"	31.27	#4 @ 10"	30.86	#4 @ 10"	30.54	#4 @ 10"	30.27	#4 @ 10"	30.06	#4 @ 10"	29.88	#4 @ 10"	29.72
	3	#4 @ 10"	36.73	#4 @ 10"	35.23	#4 @ 10"	34.23	#4 @ 10"	33.53	#4 @ 10"	33.00	#4 @ 10"	32.59	#4 @ 10"	32.26	#4 @ 10"	31.99	#4 @ 10"	31.78	#4 @ 10"	31.59	#4 @ 10"	31.43
	4	#4 @ 10"	38.59	#4 @ 10"	37.04	#4 @ 10"	36.01	#4 @ 10"	35.29	#4 @ 10"	34.75	#4 @ 10"	34.33	#4 @ 10"	33.99	#4 @ 10"	33.71	#4 @ 10"	33.50	#4 @ 10"	33.31	#4 @ 10"	33.14
	5	#4 @ 10"	40.48	#4 @ 10"	38.86	#4 @ 10"	37.80	#4 @ 10"	37.06	#4 @ 10"	36.50	#4 @ 10"	36.07	#4 @ 10"	35.73	#4 @ 10"	35.44	#4 @ 10"	35.22	#4 @ 10"	35.03	#4 @ 10"	34.86
	6	#4 @ 10"	42.39	#4 @ 10"	40.71	#4 @ 10"	39.61	#4 @ 10"	38.84	#4 @ 10"	38.26	#4 @ 10"	37.82	#4 @ 10"	37.47	#4 @ 10"	37.17	#4 @ 10"	36.95	#4 @ 10"	36.75	#4 @ 10"	36.58

EXAMPLE:

SELECT THE c-BARS SIZE, SPACING AND STEEL QUANTITY FOR A 25.0 FEET LONG WINGWALL WITH m = 11.8 FT. AND k = 6.3 FT.

SOLUTION:

1. DETERMINE WINGWALL LENGTH IN MULTIPLE OF m:
   L / m = 25.0 / 11.8 = 2.12
   L = (2.12 x m), USE L ≤ (2.25 x m)
2. ROUND TO REAREST WHOLE NUMBER FOR m AND k:
   m = 11.8 FT., USE m = 12.0 FT.
   k = 6.3 FT., USE k = 6.0 FT.
3. DETERMINE c-BARS BY USING THE TABLE:
   L ≤ (2.25 x m)
   m = 12
   k = 6
   c-BARS: #6 @ 10"
   REINF. STEEL = 60.60 LB / LF
4. DETERMINE REINFORCING STEEL QUANTITY OF WHOLE WINGWALL:
   REINFORCING STEEL QUANTITY = 25.0 x 60.60 = 1,515 LB.



LIMITS OF CONCRETE SEALER AND WINGWALL DRAIN DETAILS

NOTES: 1. THE GEOCOMPOSITE SHALL BE SECURED TO THE WALL TO PREVENT MOVEMENT DURING BACKFILLING.

2. COST OF GEOCOMPOSITE DRAIN AND CONCRETE SEALER SHALL BE INCLUDED IN THE WORK.

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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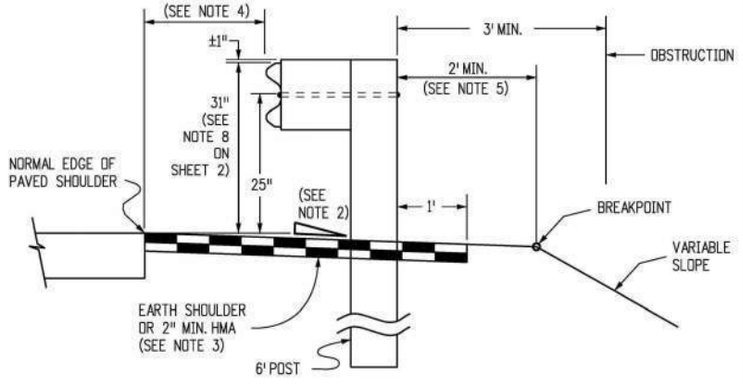
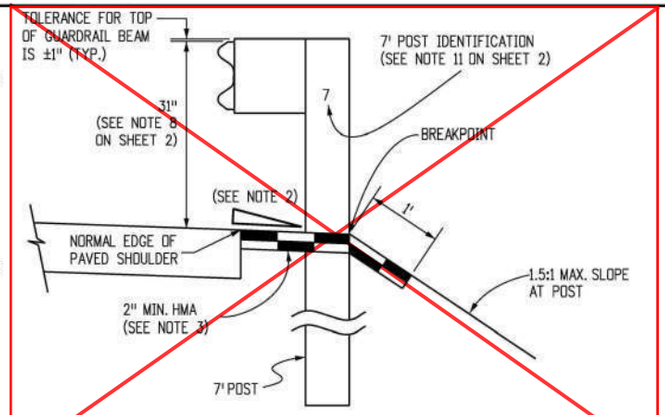
WINGWALLS FOR PIPE OR BOX CULVERTS

Issued by the Project Development Branch: July 31, 2019

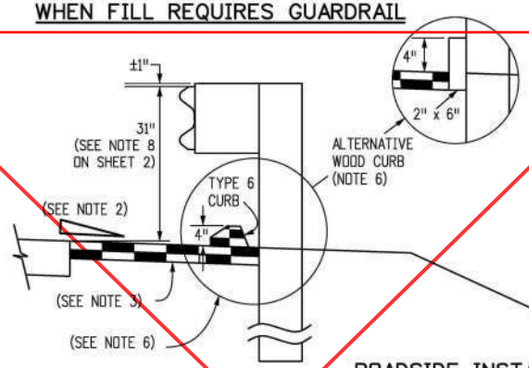
STANDARD PLAN NO.
M-601-20
Standard Sheet No. 2 of 2
Project Sheet Number:



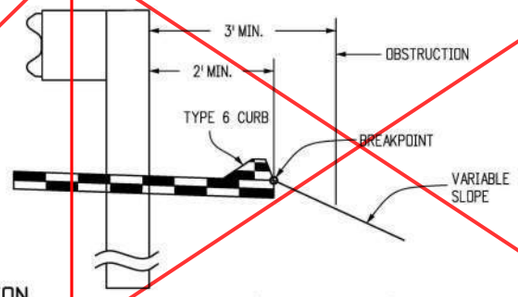
NORMAL ROADSIDE INSTALLATION
WHEN FILL REQUIRES GUARDRAIL



RESTRICTIVE ROADSIDE INSTALLATION
WITH 7 FOOT GUARDRAIL POSTS
(SEE NOTE 5)

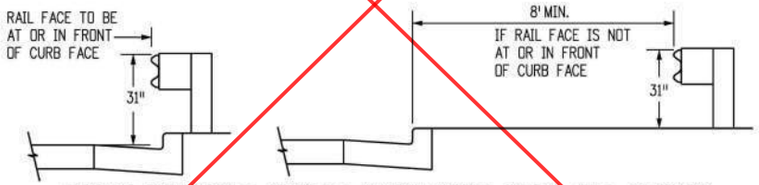


OPTION A



OPTION B (PREFERRED)

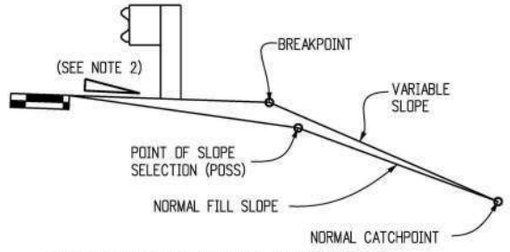
ROADSIDE INSTALLATION
WITH EROSION CONTROL CURB



URBAN ROADSIDE INSTALLATION WITH CURB AND GUTTER

LOCATION	SPACING
ALL LOCATIONS EXCEPT BRIDGE RAIL LOCATIONS	6'-3"
BRIDGE OR STRUCTURE APPROACH	SEE SHEETS 11 & 19

NORMAL CENTER-TO-CENTER POST SPACING



EMBANKMENT WITH GUARDRAIL

(NOTE: THE CATCHPOINT REMAINS THE SAME AS THAT FOR "NORMAL" FILL SLOPE. FOR THE WIDER "Z" DISTANCES, THE VARIABLE SLOPE MAY "CATCH" AT THE POSS.)

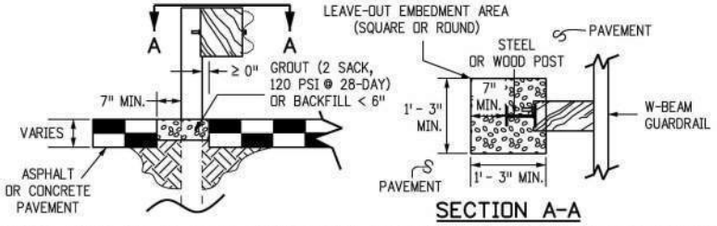
GENERAL NOTES (CONTINUE ON SHEET 2)

1. ALL GUARDRAILS SHOWN ARE MASH 2016 TL-3 COMPLIANT.
2. RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
   A. FOR GUARDRAIL FACE 2 FT. OR LESS FROM THE NORMAL EDGE OF PAVED SHOULDER, CONTINUE THE RATE OF SLOPE OF THE NORMAL PAVED SHOULDER TO THE BREAKPOINT.
   B. FOR GUARDRAIL FACE MORE THAN 2 FT. FROM THE NORMAL EDGE OF THE PAVED SHOULDER, THE SLOPE SHALL BE 10:1 OR FLATTER.
3. WHEN SPECIFIED ON THE PLANS, EXTEND A 2 IN. MINIMUM THICKNESS PAVED SURFACE TO 1 FT. BEHIND THE GUARDRAIL POSTS OR TO THE EROSION CONTROL CURB AS SHOWN ON PLANS. ASPHALT CUTTING & PATCHING OR OTHER APPROVED METHOD SHALL BE USED TO MINIMIZE DAMAGE TO ALL PAVED SURFACES UNDER GUARDRAIL INSTALLATIONS. ALL REPAIRS TO THE PAVED AREA WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. A MINIMUM 3 IN. THICK FIBER REINFORCED CONCRETE PAVEMENT MAY ALSO BE USED FOR PAVING BENEATH THE GUARDRAIL. INSTALL THE POST IN A $\frac{1}{2}$ IN. OVERSIZED FORMED HOLE FOR GUARDRAIL RUNS AND TERMINALS AS DIRECTED. PAYMENT FOR THIS PAVED SURFACE WILL BE MADE UNDER A PAVEMENT OR CONCRETE PAY ITEM WITH QUANTITIES SHOWN ON THE PLANS.
4. THE MINIMUM GUARDRAIL OFFSET FROM PAVED SHOULDER EDGE SHALL BE:
   0 FT. FOR SHOULDERS 8 FT. OR WIDER
   2 FT. FOR SHOULDERS 6 FT. OR LESS

   THE GUARDRAIL OFFSET FROM PAVED INSIDE SHOULDER EDGE OF A DIVIDED HIGHWAY SHALL BE;
   0 FT. MINIMUM FOR SHOULDERS 6 FT. OR WIDER
   2 FT. DESIRABLE FOR 4 FT. SHOULDERS

   THE ABOVE 2 FT. GUARDRAIL TO SHOULDER OFFSET IS DESIRABLE BUT NOT REQUIRED FOR:
   A. FOR AN EXISTING HIGHWAY WITH A DESIGN SPEED LESS THAN 50 MPH, THE MINIMUM OFFSET IS 4 FT. FROM THE TRAVELED WAY.
   B. FOR A ONE-WAY ONE-LANE RAMP, AND WHERE ONE OR MORE OF THE FOLLOWING ARE TRUE:
      (1) THE NON-OFFSET GUARDRAIL BEGINS AT LEAST 100 FT. BEYOND RAMP NOSE.
      (2) THE NON-OFFSET GUARDRAIL IS NOT LOCATED ON THE RAMP EXIT OR ENTRANCE CURVE CONNECTION TO THE MAJOR HIGHWAY.
      (3) THE RAMP SHOULDERS ARE 4 FT. OR WIDER.

   USE OF GREATER THAN MINIMUM OFFSET DIMENSIONS IS ENCOURAGED TO MEET THE DESIRABLE GOAL OF PLACING THE GUARDRAIL AS FAR AS POSSIBLE FROM THE TRAVEL WAY, EVEN FOR SHORT DISTANCES, WHILE PROVIDING A SMOOTH CHANGE IN GUARDRAIL ALIGNMENT.
5. IF 2 FT. CANNOT BE PROVIDED BETWEEN THE BACK OF THE GUARDRAIL POST AND THE BREAKPOINT, USE 7 FT. GUARDRAIL POSTS. REFER TO THE "RESTRICTIVE ROADSIDE INSTALLATION" DETAIL.
6. WHEN SPECIFIED ON THE PLANS, INSTALL 4 IN. HIGH TYPE 6 CURB WITH ITS FACE AT OR BEHIND THE RAIL FACE. AS AN ALTERNATIVE WHEN SPECIFIED ON THE PLANS, INSTALL A 2 IN. x 6 IN. TREATED (AASHTO M 133) WOOD CURB. FASTEN WITH A 4 IN. LAG BOLT AND WASHER AT EACH WOOD POST, OR WITH A 1#4 IN. DIA. BOLT WITH WASHER AND NUT AT EACH STEEL POST. IF THE 2 IN. x 6 IN. WOOD CURB IS SPECIFIED, IT WILL BE INCLUDED IN THE COST OF THE GUARDRAIL. IF APPROVED BY THE ENGINEER, A 2 IN. x 4 IN. TREATED WOOD CURB MAY BE SUBSTITUTED FOR THE 2 IN. x 6 IN. CURB AND SET ON TOP OF PAVEMENT SURFACE AND ATTACHED AS DESCRIBED ABOVE. NO SPLICING SHALL BE ALLOWED IN WOOD CURBS. ADJACENT BOARDS SHALL BE BUTTED TOGETHER AND BOLTED AT A POST LOCATION. JOINTS SHALL BE LOCATED AT THE POSTS.



SECTION A-A

LEAVE-OUT AREA FOR GUARDRAIL POSTS LOCATED IN PAVEMENT

NOTE: LEAVE-OUT AREAS SHALL BE PROVIDED FOR ALL GUARDRAIL POSTS LOCATED IN PAVEMENT TO ALLOW THE POSTS TO ROTATE IN THEIR EMBEDMENT SUCH THAT VEHICLE IMPACT LOADS ARE DISTRIBUTED THROUGH THE POST INTO THE EMBEDMENT MATERIAL PRIOR TO THE POSTS BREAKING PREMATURELY.

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)	03/05/20	Revised Gen. Note 1 to show MASH compliant.
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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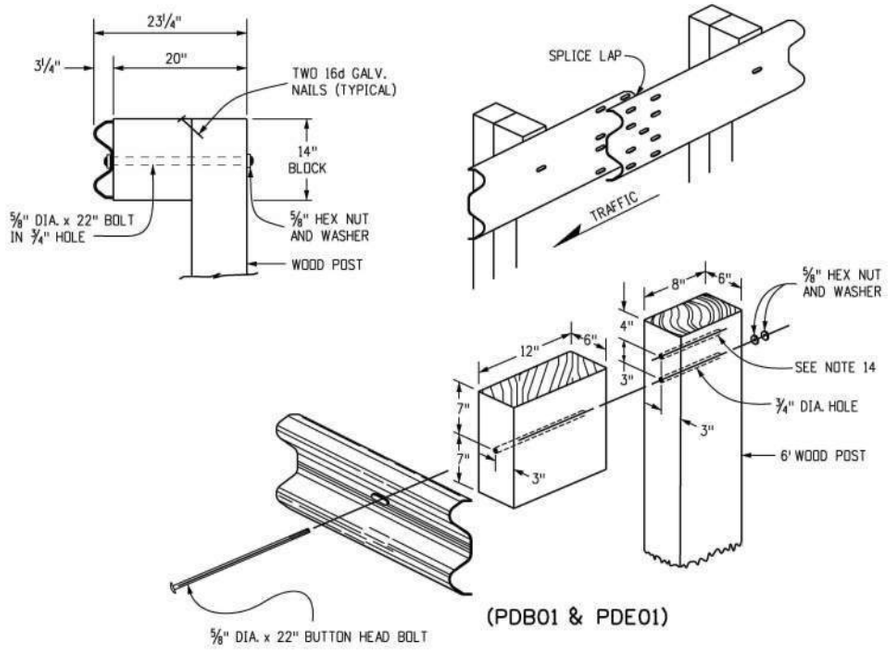
MIDWEST GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

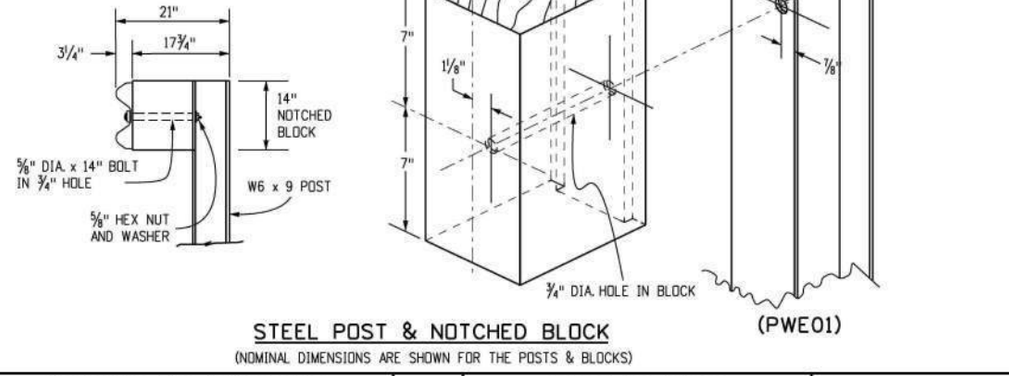
STANDARD PLAN NO.
M-606-1
Standard Sheet No. 1 of 19
Project Sheet Number:



(PDB01 & PDE01)

WOOD POST & BLOCK

(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)



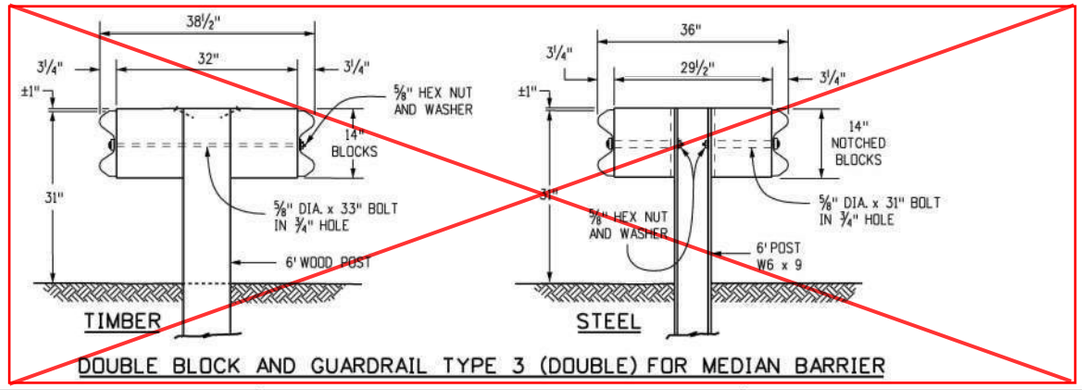
(PWE01)

STEEL POST & NOTCHED BLOCK

(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)

GENERAL NOTES (CONTINUED FROM SHEET 1)

7. SEE SHEETS 7 AND 9 FOR CURB TREATMENTS AT GUARDRAIL TERMINALS.
8. IF THIS DIMENSION WILL BE LESS THAN 28 INCHES, RESET GUARDRAIL HEIGHT TO 28 INCHES OR ABOVE.
9. ALL W-BEAM SPLICES, AND SPLICES OF TERMINAL CONNECTORS TO W-BEAM SHALL BE LAPPED IN THE DIRECTION OF TRAFFIC UNLESS OTHERWISE NOTED IN THE PLANS OR BY THE MANUFACTURER.
10. MATERIAL TYPE AND SHAPE OF POSTS AND BLOCKS SHALL BE THE SAME THROUGHOUT THE PROJECT EXCEPT WHEN SPECIFIC POSTS AND BLOCKS ARE SPECIFIED, i.e. AT END ANCHORAGES AND BOX CULVERTS.
11. WHEN SPECIFIED IN THE CONTRACT, 7 FT. POSTS SHALL BE INSTALLED INSTEAD OF THE STANDARD 6 FT. POSTS. THE 7 FT. POSTS SHALL BE MARKED WITH THE NUMBER 7 TO ENSURE PERMANENT INDENTIFICATION. STEEL POSTS SHALL BE STAMPED PRIOR TO GALVANIZING. THE NUMBER 7 SHALL BE A MINIMUM 2 IN. TALL AND LOCATED AS SHOWN ON THE ELEVATION VIEW ON SHEET 1.
12. THE STANDARD 3 IN. X 1¾ IN. X 5/16 IN. RECTANGULAR WASHER USED UNDER POST BOLT HEADS IN THE PAST MAY REMAIN IN EXISTING INSTALLATIONS BUT SHALL NOT BE USED IN NEW CONSTRUCTION, REPAIRS, OR RESETTING OF RAIL, EXCEPT WHEN SPECIFICALLY IDENTIFIED ON THE STANDARD PLAN.
13. STANDARD GALVANIZED ROUND STEEL WASHERS SHALL BE USED UNDER ALL NUTS IN CONTACT WITH WOOD POSTS.
14. AN ADDITIONAL HOLE SHALL BE PROVIDED IN THE POSTS TO FACILITATE FUTURE RAISING OF THE RAIL ELEMENTS AND BLOCKS FOR OVERLAYS. POSTS PROVIDED MAY ALSO HAVE ADDITIONAL HOLES (UP TO 4 PER FLANGE) FOR MEDIAN GUARDRAIL APPLICATION.
15. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT. INTERVALS (SEE SHEETS 6 AND 8 FOR EXCEPTIONS). RETROREFLECTOR TABS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. THE TABS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS AND SHALL BE MOUNTED SO THE BOLT SLOT FACES AWAY FROM TRAFFIC, AND THE RETROREFLECTOR SURFACE FACES THE APPROACHING TRAFFIC FOR ONE-WAY ROADS. FOR TWO-WAY ROADS, BOTH SIDES OF THE TABS SHALL BE RETROREFLECTIVE, SO THAT DELINEATION IS PROVIDED FOR BOTH DIRECTIONS OF TRAVEL. THE RETROREFLECTIVE SHEETING COLOR SHALL MATCH THE COLOR OF THE ADJACENT TRAVEL WAY EDGE LINE. SEE THE RETROREFLECTOR TAB DETAIL ON SHEET 3.
16. AT THE TIME OF INSTALLATION, WOOD POSTS OR BLOCKS WITH SEASONING CHECKS GREATER THAN ¼ IN. SHALL NOT BE USED WHEN THE CHECK EXTENDS THE FULL LENGTH OF THE PIECE.
17. WOOD BLOCKS SHALL BE CUT FROM THE SAME CROSS-SECTION, SPECIES, AND GRADE, AND SHALL RECEIVE THE SAME PRESERVATIVE TREATMENT AS THE POSTS WHEN WOOD POSTS ARE USED.
18. REFERENCES SUCH AS "PDB01", "PDE01", AND "PWE01" IN THIS STANDARD PLAN SPECIFY HARDWARE DETAILS FROM "A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" PREPARED BY THE AASHTO-AGC-ARTBA JOINT COOPERATIVE COMMITTEE.
19. RAIL BLOCKS MANUFACTURED FROM SYNTHETIC MATERIAL WILL BE ACCEPTED AS ALTERNATIVES TO WOOD BLOCKS FOR USE WITH STEEL POSTS PROVIDED THAT THE BLOCKS HAVE RECEIVED FHWA APPROVAL.
20. WOOD POSTS SHALL BE MADE OF TIMBER WITH AN EXTREME FIBER STRESS IN BENDING OF 1200 PSI STRESS GRADING AND POST DIMENSIONS SHALL CONFORM WITH THE RULES OF THE WEST COAST INSPECTION BUREAU, OR THE SOUTHERN PINE BUREAU, OR THE WESTERN WOOD PRODUCTS ASSOCIATION. TIMBER FOR POSTS SHALL BE EITHER ROUGH SAWN (UNPLANED) OR S4S (SURFACED FOUR SIDES) WITH NOMINAL DIMENSIONS INDICATED. ONLY ONE TYPE OF SURFACE FINISH SHALL BE USED FOR POSTS AND BLOCKS IN ANY ONE CONTINUOUS LENGTH OF GUARDRAIL.
21. GLULAM POSTS AND BLOCKS WILL BE ACCEPTED AS ALTERNATIVES PROVIDED THAT THE SUPPLIED MATERIALS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL.
22. PRESSURE TREATMENT OF POSTS AND BLOCKS SHALL CONFORM TO AASHTO M 133 EXCEPT THAT BLOCKS NEED NOT BE INCISED. PRESERVATION ASSAY RETENTION REPORTS SHALL BE SUBMITTED TO THE ENGINEER. THE CONTRACTOR SHALL CERTIFY THAT THE SPECIES AND GRADE MEET THE REQUIREMENTS OF THE CONTRACT.
23. W-BEAM AND THRIE-BEAM GUARDRAIL POSTS SHALL BE MANUFACTURED USING AASHTO M 270 (ASTM A 709) GRADE 36 STEEL UNLESS CORROSION RESISTANT STEEL IS REQUIRED, IN WHICH CASE THE POST SHALL BE MANUFACTURED FROM AASHTO M 270 (ASTM A 709) GRADE 50W STEEL. THE DIMENSIONS OF THE CROSS-SECTION SHALL CONFORM TO A W6 X 9 SECTION AS DEFINED IN AASHTO M 160 (ASTM A 6). W6 X 8.5 WIDE FLANGE STEEL POSTS ARE AN ACCEPTABLE ALTERNATIVE TO THE W6 X 9.
24. AFTER THE SECTION IS CUT AND ALL HOLES ARE DRILLED OR PUNCHED THE COMPONENT SHALL BE ZINC-COATED CONFORMING TO AASHTO M 111 (ASTM A 123) UNLESS CORROSION-RESISTANT STEEL IS USED. WHEN CORROSION-RESISTANT STEEL IS USED THE PORTION OF THE POST TO BE EMBEDDED IN SOIL SHALL BE ZINC-COATED CONFORMING TO AASHTO M 111 (ASTM A 123) AND THE PORTION ABOVE THE SOIL SHALL NOT BE ZINC-COATED, PAINTED OR OTHERWISE TREATED.
25. FIELD MODIFICATION TO RAIL ELEMENTS IS ALLOWED PER MANUFACTURER'S RECOMMENDATIONS, OR WITH THE APPROVAL OF THE STANDARDS AND SPECIFICATIONS UNIT. POSTS SHALL NOT BE MODIFIED. COMPONENTS ON WHICH THE SPELTER COATING HAS BEEN DAMAGED SHALL BE EITHER REGALVANIZED OR RECOATED IN CONFORMANCE WITH AASHTO M 36, OR PAINTED WITH ONE FULL BRUSH COAT OF ZINC RICH PAINT CONFORMING TO MILITARY SPECIFICATION DOD-P-21035A.



DOUBLE BLOCK AND GUARDRAIL TYPE 3 (DOUBLE) FOR MEDIAN BARRIER

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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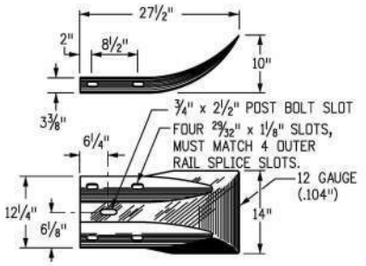
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

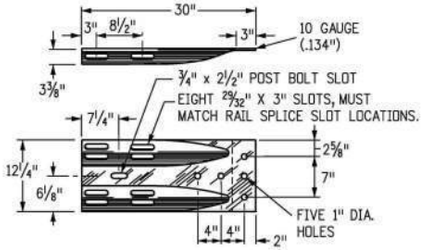
STANDARD PLAN NO. M-606-1

Standard Sheet No. 2 of 19

Project Sheet Number:



TERMINAL SECTION (FLARED)



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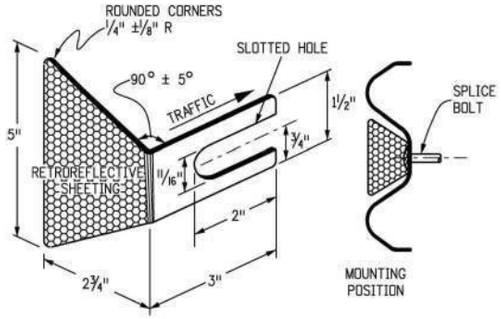
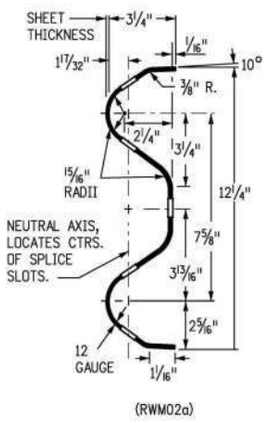
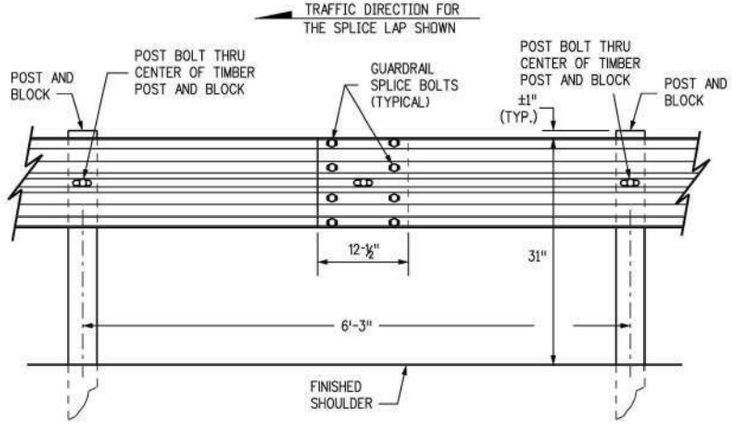


RETROREFLECTOR TAB

NOTE: RETROREFLECTOR TABS SHALL BE MANUFACTURED FROM 12 TO 14 GAUGE STEEL AND SHALL CONFORM TO THE REQUIREMENTS OF S STANDARD S-612-1.



W-BEAM RAIL SECTION

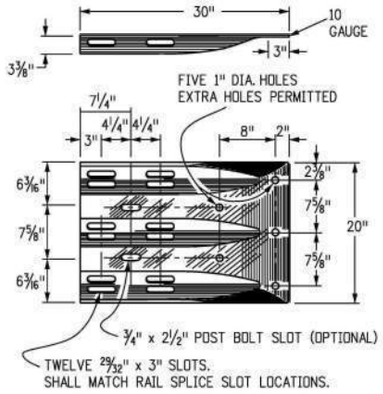


W-BEAM RAIL SPLICE

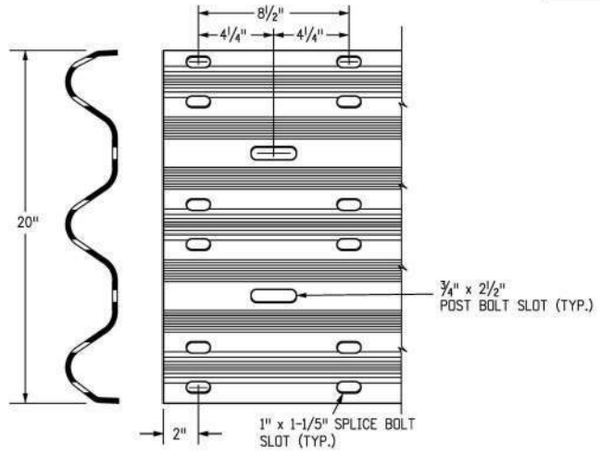
PART	MATERIAL SPEC.	GALVANIZING SPEC.	CORROSION-RESISTANT SPEC.
W-BEAM RAIL & TERMINAL SECTIONS	AASHTO M 180, CLASS A OR B	AASHTO M 180, TYPE 1 OR 2	AASHTO M 180, TYPE 4
BASE PLATE	ASTM A 36	AASHTO M 111	N.A.
NUTS, BOLTS & STUDS FOR GENERAL USE	ASTM A 307	AASHTO M 232, CLASS C OR ASTM B 695 CLASS 50 TYPE 1	
HIGH STRENGTH BOLTS & NUTS	ASTM A 325		
HIGH STRENGTH STUDS & NUTS	ASTM A 449		
ROUND STEEL WASHERS	ASTM F 436		
RECTANGULAR WASHERS	AASHTO M 180		
OTHER FITTINGS	ASTM A 36	AASHTO M 111	

THE TABULATION OF GUARDRAIL WILL SPECIFY THE TYPE OF CORROSION PROTECTION: GALVANIZED OR CORROSION - RESISTANT STEEL.

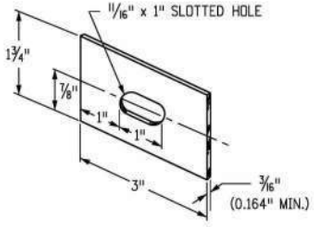
STEEL POSTS SHALL HAVE THE SAME CORROSION PROTECTION AS SPECIFIED FOR THE METAL BEAM RAIL. PUNCHING, DRILLING, CUTTING, OR WELDING OF POSTS WILL NOT BE PERMITTED AFTER GALVANIZING.



THRIE BEAM TERMINAL SECTION (CONNECTOR)

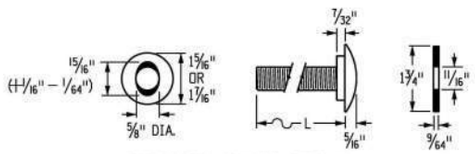


THRIE BEAM DETAIL



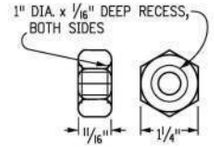
RECTANGULAR WASHER

(TO BE USED ONLY WHERE SPECIFIED.)



BUTTON HEAD BOLT WITH OVAL SHOULDER

WASHER



HEX NUT

DIAMETER & TYPE (INCHES)	12" BLOCKS L = LENGTH (INCHES)	THREAD LENGTH (INCHES)	INTENDED USE	AASHTO-AGC-ARTBA STANDARD NUMBER	NO. BOLTS, NUTS & WASHERS
⅝	1¼	FULL (1 1/32)	ALL RAIL SPLICES	FBB01	8 PER SPLICE*
BUTTONHEAD OVAL SHLDR.	22	MIN. 2½	SINGLE BLOCK & POST (TIMBER)	FBB04	1 PER POST
	33	MIN. 2	DOUBLE BLOCK & POST (TIMBER)	FBB05	1 PER POST
	14	MIN. 2	FASTEN NOTCHED BLOCK TO STEEL POST	FBB03	1 PER BLOCK
WASHERS NOT USED AT RAIL SPLICES					

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

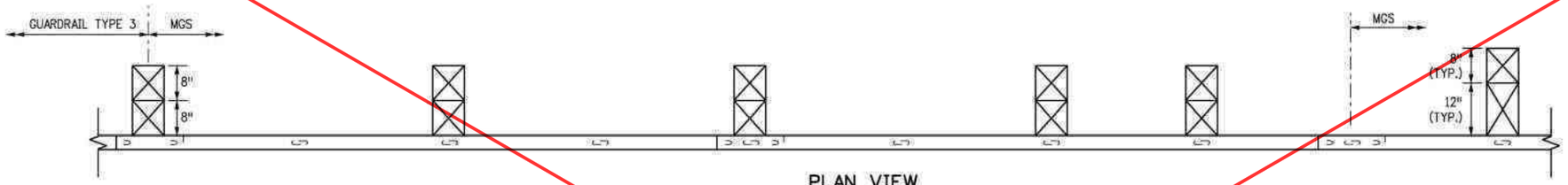
STANDARD PLAN NO. M-606-1

Standard Sheet No. 3 of 19

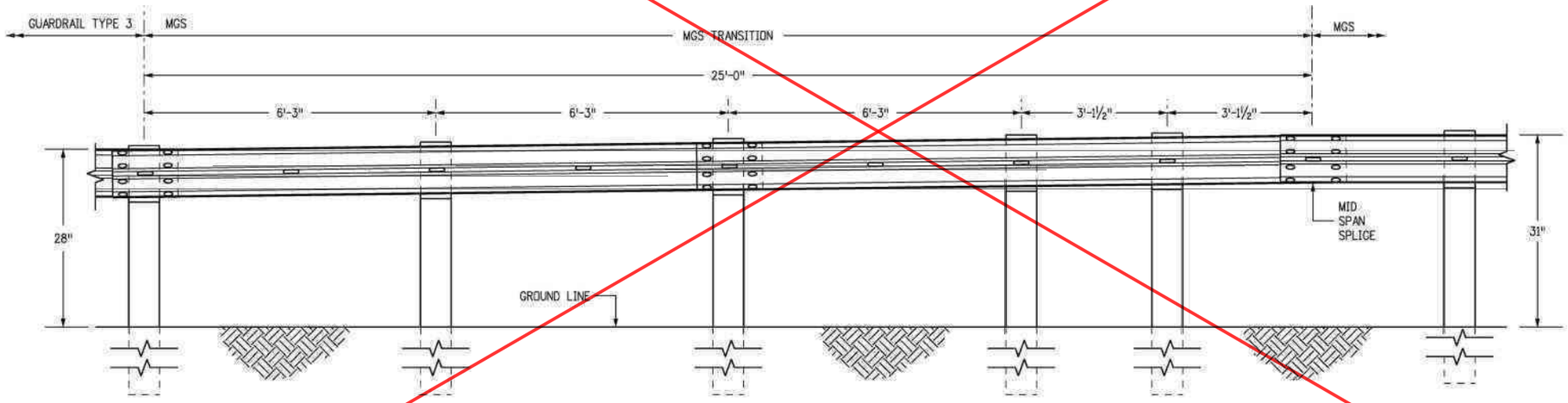
Project Sheet Number:

NOTES

1. THE MGS TRANSITION FROM A TYPE 3 GUARDRAIL SHALL BE COMPLETED OUTSIDE THE MGS END ANCHORAGE LIMITS.

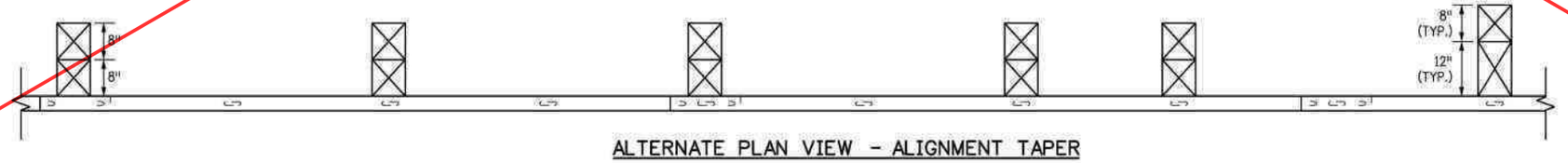


PLAN VIEW



ELEVATION VIEW

TRANSITION FROM 28 INCH GUARDRAIL TO 31 INCH MGS



ALTERNATE PLAN VIEW - ALIGNMENT TAPER

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
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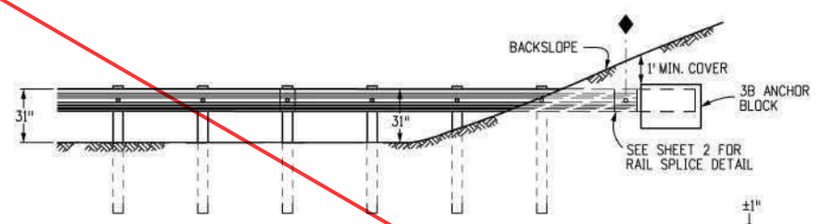
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

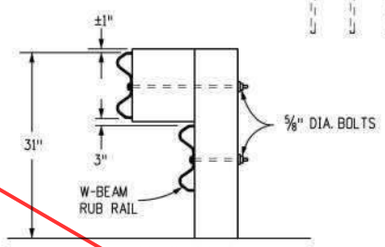
STANDARD PLAN NO.
M-606-1
Standard Sheet No. 4 of 19
Project Sheet Number:



SEE TYPE 3B (RUB RAIL) PLAN VIEW FOR ALIGNMENT. THE 100 FT. FLARE LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

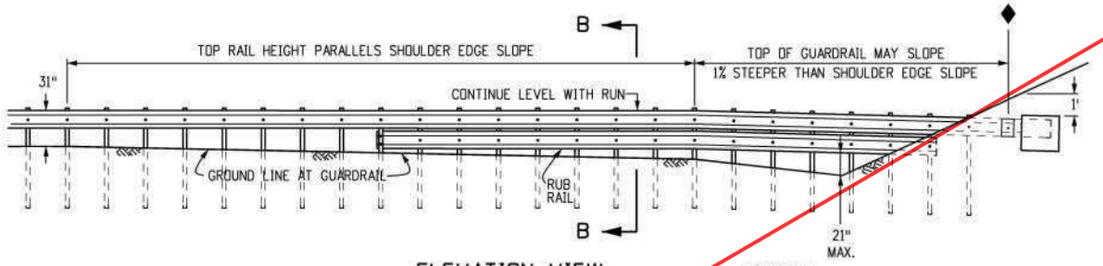
END ANCHORAGE TYPE 3B

(MAX. 10:1 AND NO ROADSIDE DITCH AT GUARDRAIL)



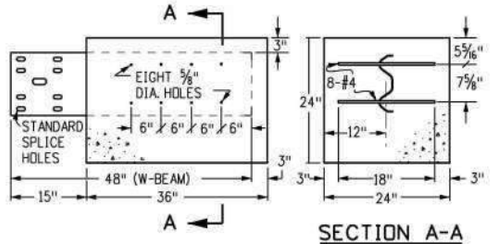
SECTION B-B

MOUNT A W-BEAM RUB RAIL 1-1/2 IN. BELOW THE TOP RAIL WHEN THE TOP RAIL HEIGHT EXCEEDS 33 IN. ABOVE THE GROUND



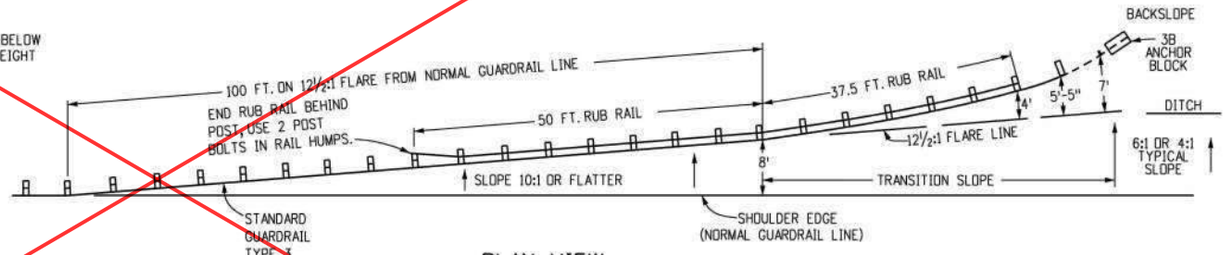
ELEVATION VIEW

(MAXIMUM 4:1 FORSLOPE)



SECTION A-A

TYPE 3B ANCHOR BLOCK DETAIL

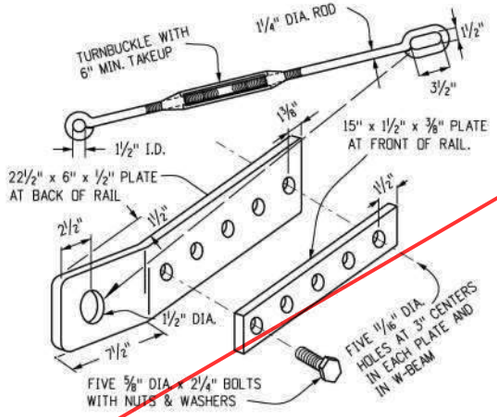


PLAN VIEW

END ANCHORAGE TYPE 3B (RUB RAIL)

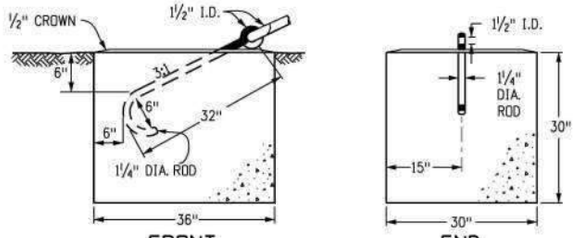
(WITH ROADSIDE DITCH AT GUARDRAIL)

END OF GUARDRAIL PAY LENGTH

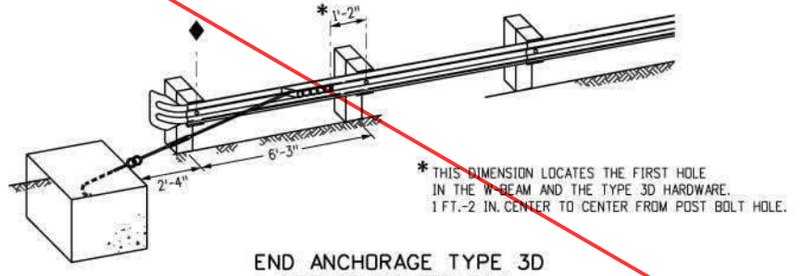


TYPE 3D HARDWARE DETAILS

NOTE: ALL PARTS SHALL BE GALVANIZED



TYPE 3D ANCHOR BLOCK DETAIL



END ANCHORAGE TYPE 3D DEPARTURE TERMINAL

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

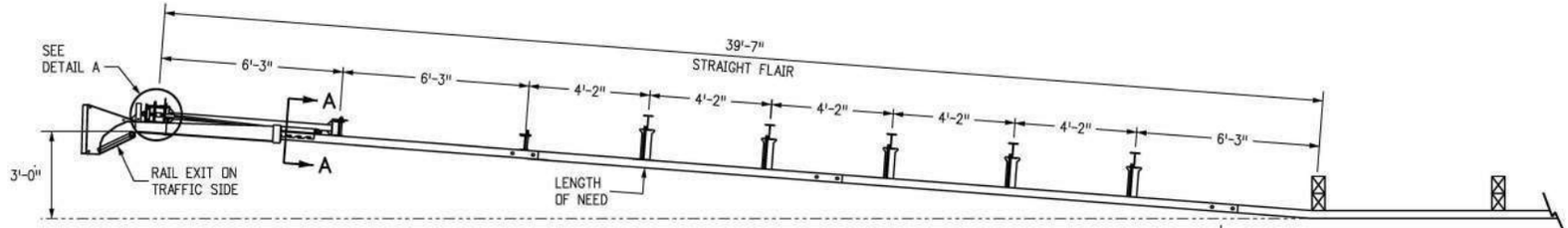
STANDARD PLAN NO. M-606-1

Standard Sheet No. 5 of 19

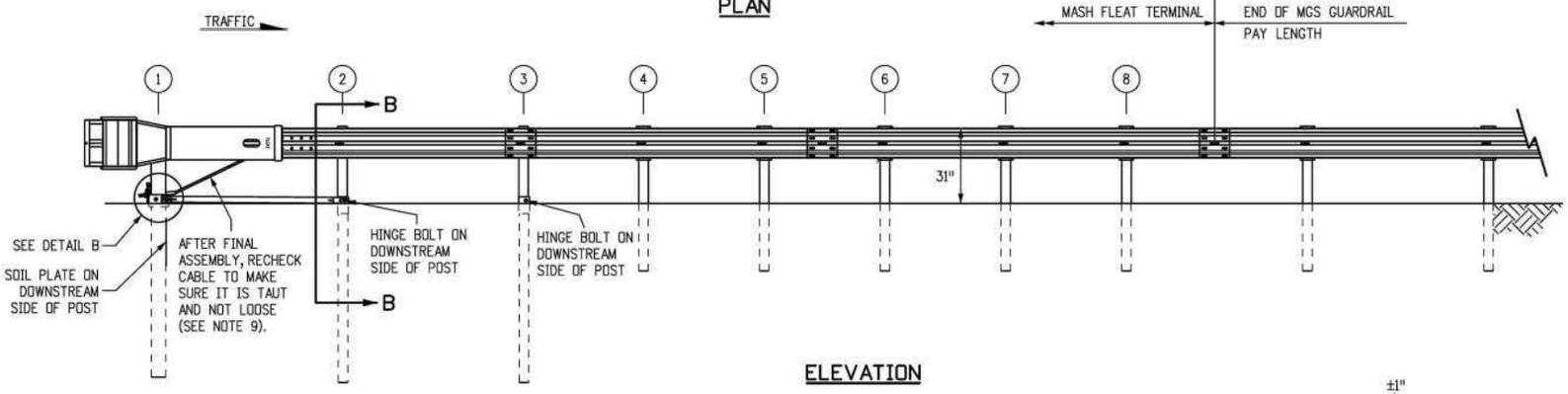
Project Sheet Number:

OFFSET NOTES

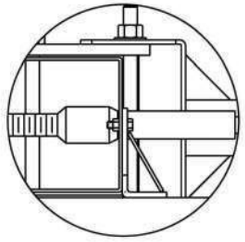
1. POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF POSTS.
2. THE GUARDRAIL BETWEEN POST (1) THRU (8) IS ON A STRAIGHT LINE FLARE.



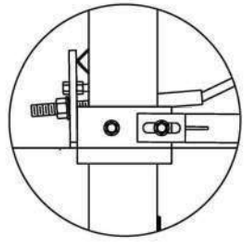
PLAN



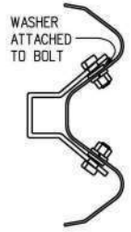
ELEVATION



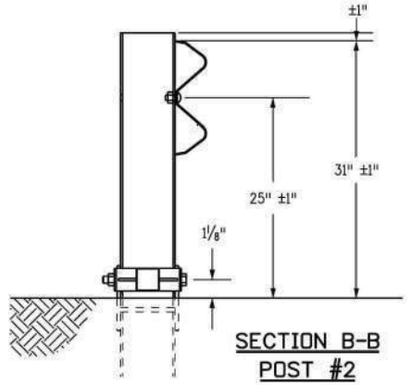
DETAIL A
IMPACT HEAD CONNETION



DETAIL B
POST #1 CONNECTION



SECTION A-A
ANCHOR BRACKET



SECTION B-B
POST #2

NOTES

1. THE END ANCHORAGE (FLARED) SHALL BE THE MFLEAT TERMINAL, AS MANUFACTURED BY ROAD SYSTEMS INC. (TELEPHONE #: 432-263-2435). ONE END ANCHORAGE (FLARED) SHALL INCLUDE ALL POST, RAIL, AND ALL HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (FLARED) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO INSTALLATION OF THE DEVICE.
2. RETROREFLECTOR TABS SHALL NOT BE USED ON END ANCHORAGE POSTS.
3. DELINEATION SHALL BE APPLIED TO THE END PIECE, AND SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
4. AESTHETIC TREATMENT OPTIONS MAY BE AVAILABLE WITH PRIOR APPROVAL OF THE PROJECT ENGINEER. CONTACT THE MANUFACTURER FOR APPROVED AESTHETIC TREATMENT OPTIONS.
5. ALL BOLTS, NUTS, CABLE ASSEMBLIES, CABLE ANCHORS AND BEARING PLATES SHALL BE GALVANIZED.
6. THE LOWER SECTIONS OF THE POSTS 1, 2, AND 3 SHALL NOT PROTRUDE MORE THAN 4 INCHES ABOVE THE GROUND (MEASURED ALONG A 5 FOOT CORD). SITE GRADING MAY BE NECESSARY TO MEET THIS REQUIREMENT.
7. THE LOWER SECTIONS OF THE HINGED POSTS SHOULD NOT BE DRIVEN WITH THE UPPER POST ATTACHED. IF THE POST IS PLACED IN A DRILLED HOLE, THE BACKFILL MATERIAL MUST BE SATISFACTORILY COMPACTED TO PREVENT SETTLEMENT.
8. WHEN COMPETENT ROCK IS ENCOUNTERED, A 12 INCH DIA. POST HOLE, DRILLED 20 INCHES DEEP INTO THE ROCK SURFACE SHALL BE USED IF APPROVED BY THE ENGINEER FOR POSTS 1 AND/OR 2. GRANULAR MATERIAL SHALL BE PLACED IN THE BOTTOM OF THE HOLE, APPROXIMATELY 2.5 INCHES DEEP TO PROVIDE DRAINAGE. THE FIRST AND/OR SECOND POST SHALL BE FIELD CUT TO LENGTH, PLACED IN THE HOLE AND BACKFILLED WITH SUITABLE BACKFILL. THE SOIL PLATE MAY BE TRIMMED IF REQUIRED.
9. THE BREAKAWAY CABLE ASSEMBLY SHALL BE TAUT. A LOCKING DEVICE (VICE GRIPS OR CHANNEL LOCK PLIERS) SHOULD BE USED TO PREVENT THE CABLE FROM TWISTING WHEN TIGHTENING NUTS.

MFLEAT TERMINAL

(MASH CERTIFIED)

END ANCHORAGES (FLARED)

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)	03/05/20	Replaced the SRT-31 and FLEAT 350 flared terminals with the MFLEAT flared terminal to be MASH compliant.
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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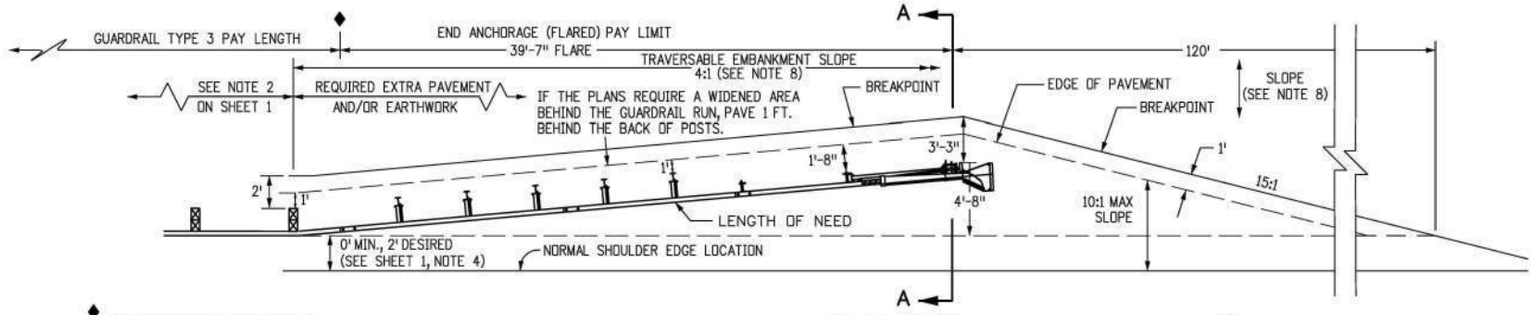
MIDWEST
GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

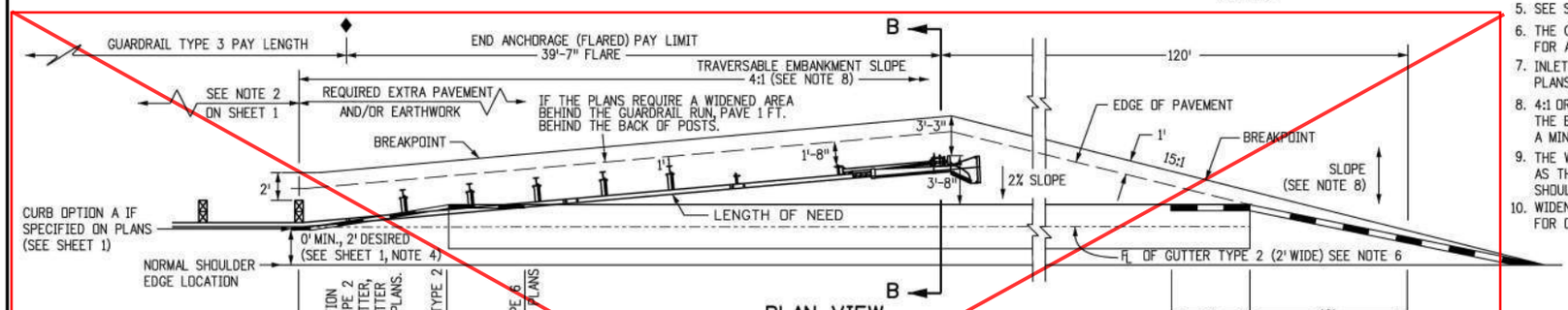
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-606-1
Standard Sheet No. 6 of 19
Project Sheet Number:

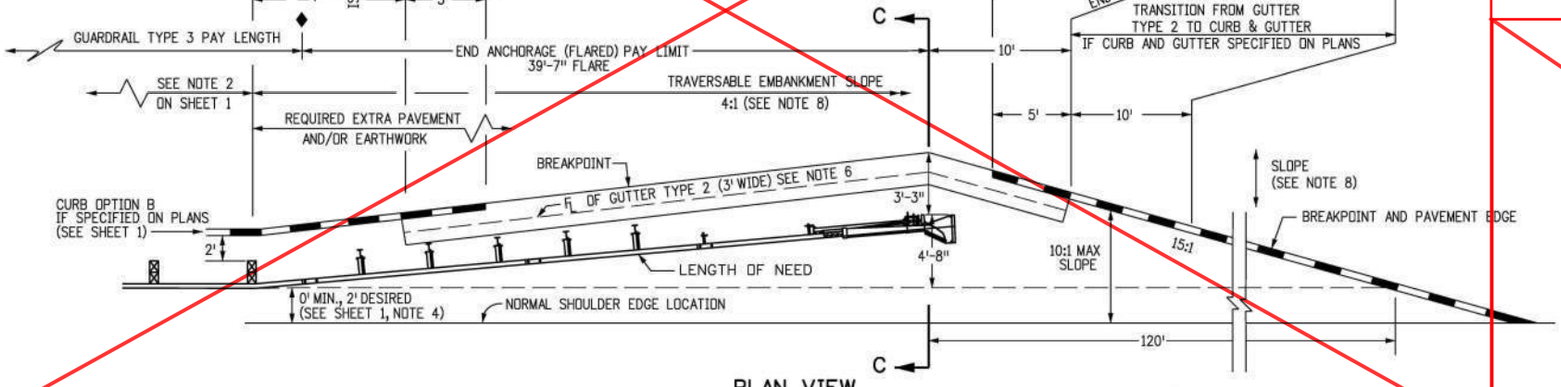


PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) *

* THIS PLAN VIEW SHOWS ONLY THE SRT-31. THE FLEAT-350 USES THE SAME WIDENING DETAILS.



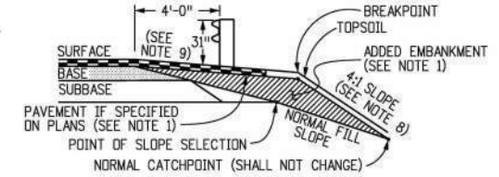
PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED)
WITH CURB OPTION A *



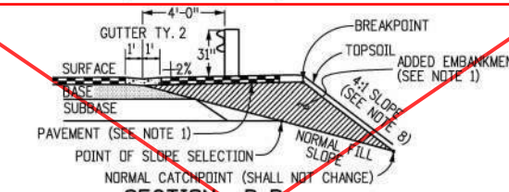
PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION B *

NOTES

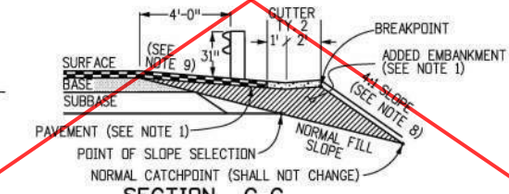
1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 45 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLANS DO NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL BE CONSTRUCTED IN ACCORDANCE WITH SUBSECTION 203.07, AASHTO T 99.
2. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 70 SQ. YDS.) SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 403 OR 412 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 403 OR 412
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 403 OR 412 (SEE SHEET 1, NOTE 2 FOR PAVEMENT TYPES)
3. CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF AS DIRECTED BY THE ENGINEER.
4. WHEN OVERLAY PAVING, THE FINISHED SURFACE AT EACH POST SHALL NOT BE ABOVE THE TOP BREAKAWAY HOLE OR STRUT ASSEMBLY. THE WIDENED AREA AT THE FLARED END ANCHORAGE SHOULD NOT BE OVERLAYED UNLESS PAVEMENT CONDITIONS WARRANT IT BEING OVERLAYED. ANY OVERLAY PAVEMENT ABUTTING THE FLARED END ANCHORAGE SHALL BE TAPERED TO PREVENT A DROP IN THE PAVED SURFACE BELOW THE RAIL.
5. SEE SHEETS 1, 2, 3, AND 5 FOR STANDARD TYPE 3 GUARDRAIL INSTALLATION DETAILS.
6. THE COST OF THE GUTTER WILL BE PAID FOR AS "GUTTER TYPE 2 (2 FT.)" FOR A LENGTH OF 134 FT. OR "GUTTER TY. 2 (3 FT.)" FOR A LENGTH OF 40 FT.
7. INLETS OR RUNDOWNS MAY BE USED INSTEAD OF THE GUTTER IF SPECIFIED ON THE PLANS. NO ADDITIONAL CURB SHALL BE ADDED IN THE VICINITY OF THE END ANCHORAGE.
8. 4:1 OR FLATTER SLOPES IN THE TRAVERSABLE AREA SHALL BE USED BEHIND THE END ANCHORAGE, AND IN ADVANCE OF POST (1) IF THIS IS NOT POSSIBLE, A MINIMUM 3:1 SLOPE MAY BE USED IF APPROVED BY THE ENGINEER.
9. THE WIDENED AREA, EXCEPT FOR CURB OPTION A, SHALL HAVE THE SAME GRADING AS THE ADJACENT GUARDRAIL: 10:1 OR FLATTER IF MORE THAN 2 FT. FROM SHOULDER OR SLOPE EQUAL TO ROADWAY SLOPE IF 2 FT. OR LESS FROM SHOULDER.
10. WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.



SECTION A-A



SECTION B-B



SECTION C-C

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)	03/05/20	Replaced the old end anchorage drawings with the new MELEAT end anchorage drawing.
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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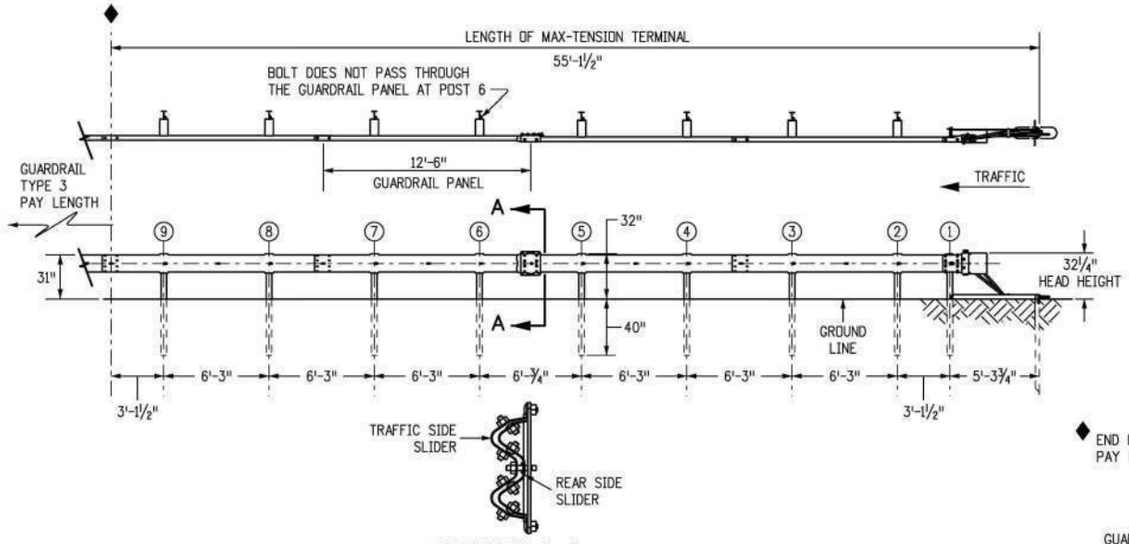
MIDWEST
GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-606-1
Standard Sheet No. 7 of 19
Project Sheet Number:



SECTION A-A

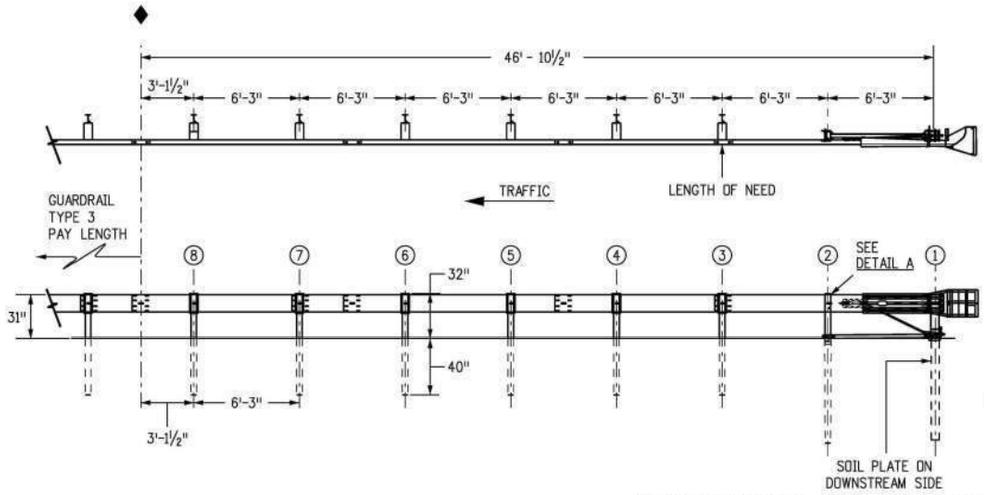
MAX-TENSION TERMINAL END ANCHORAGE (NONFLARED)

(MASH CERTIFIED)

NOTES FOR NONFLARED

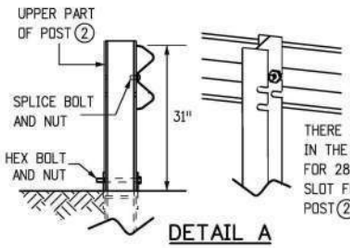
1. THE END ANCHORAGE (NONFLARED) SHALL EITHER BE THE SOFTSTOP AS MANUFACTURED BY TRINITY INDUSTRIES, INC. (TEL. #: 1-888-356-2363), OR THE MAX-TENSION AS MANUFACTURED BY LINDSAY TRANSPORTATION SOLUTIONS (TEL. #: 402-829-6800), OR THE MSKT AS MANUFACTURED BY ROAD SYSTEMS, INC. (TEL. #: 432-263-2435). THE END ANCHORAGE (NONFLARED) SHALL INCLUDE ALL POST, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (NONFLARED) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE DEVICE.
2. DO NOT ATTACH THESE END ANCHORAGES DIRECTLY TO A RIGID BARRIER (EX. CONCRETE BARRIER, STEEL BARRIER, CONCRETE STRUCTURE) WITHOUT A PROPER TRANSITION.
3. CONNECTIONS TO W-BEAMS WHERE THE SPLICE IS NOT AT MID-SPAN BUT AT A POST CAN BE MADE USING A 3'-1½", 9'-4½", OR 15'-7½" W-BEAM PANEL DOWNSTREAM OF TRAFFIC.
4. FOR MSKT END ANCHORAGES (NONFLARED), USE THE MANUFACTURER'S SPECIFIED STEEL FOUNDATION TUBES FOR POSTS (1) AND (2).
5. RETROREFLECTOR TABS SHALL NOT BE USED ON END ANCHORAGE POSTS.
6. DELINEATION SHALL BE APPLIED TO THE END PIECE AND SHALL NOT BE PAID FOR SEPARATELY BUT BE INCLUDED IN THE COST OF THE WORK. SEE STANDARD PLAN S-612-1.

END OF GUARDRAIL PAY LENGTH



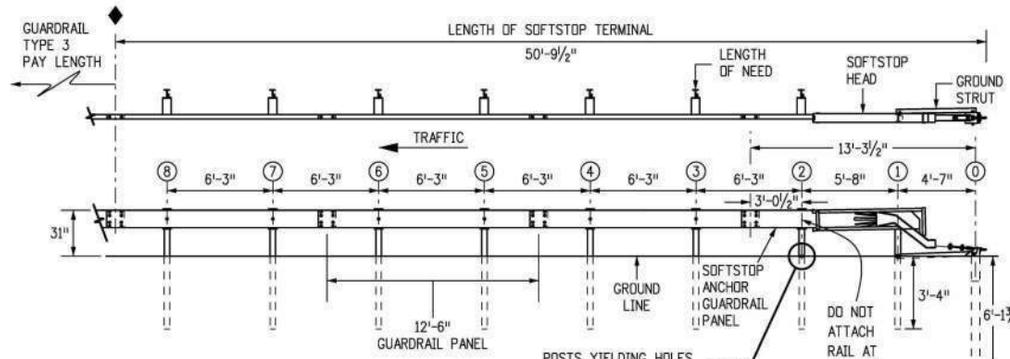
MSKT TERMINAL END ANCHORAGE (NONFLARED)

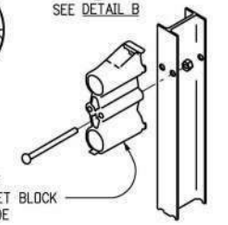
(MASH CERTIFIED)



DETAIL A

THERE ARE TWO SETS OF OPEN-ENDED SLOTS IN THE UPPER PART OF POST (2). THESE ARE FOR 28" AND 31" RAIL HEIGHTS. USE THE TOP SLOT FOR THE 31" MSKT TERMINAL. INSTALL POST (2) WITH THE SLOTS FACING POST (1)





DETAIL B

SOFTSTOP TERMINAL END ANCHORAGE (NONFLARED)

(MASH CERTIFIED)

END ANCHORAGES (NONFLARED)

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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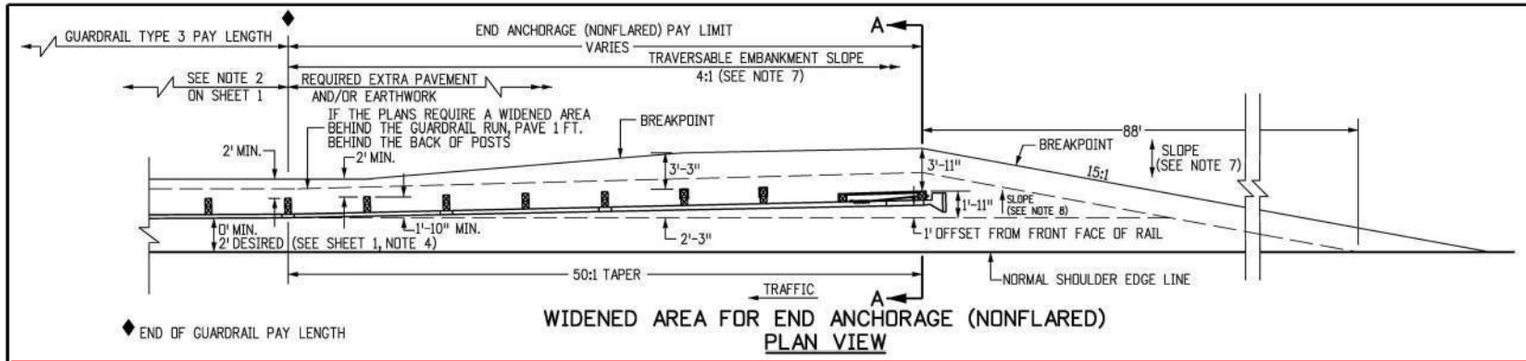
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

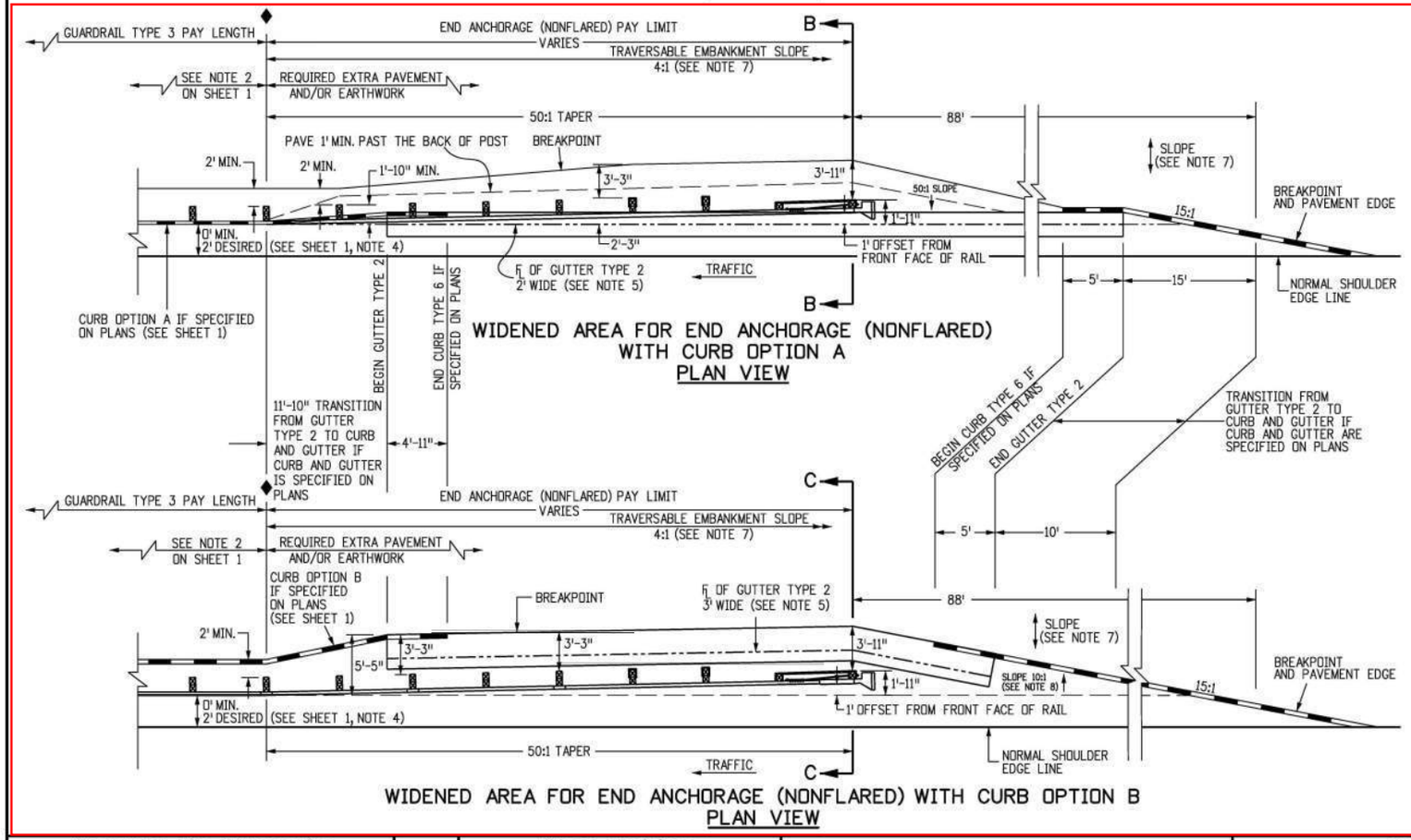
STANDARD PLAN NO. M-606-1

Standard Sheet No. 8 of 19

Project Sheet Number:



WIDENED AREA FOR END ANCHORAGE (NONFLARED)
PLAN VIEW

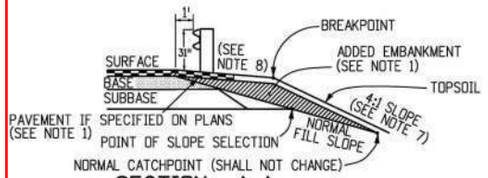


WIDENED AREA FOR END ANCHORAGE (NONFLARED)
WITH CURB OPTION A
PLAN VIEW

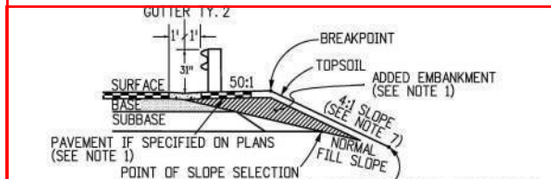
WIDENED AREA FOR END ANCHORAGE (NONFLARED) WITH CURB OPTION B
PLAN VIEW

NOTES

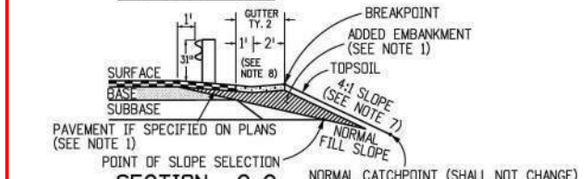
1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 25 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203.
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (NONFLARED) WHEN THE CONTRACT PLANS DOES NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL BE BE CONSTRUCTED IN ACCORDANCE WITH SUBSECTION 203.07, AASHTO T 99.
2. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 39 SQ. YDS.) SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 403 OR 412 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 403 OR 412.
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (NONFLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 403 OR 412, (SEE SHEET 1, NOTE 2 FOR PAYMENT TYPES).
3. WHEN OVERLAY PAVING, THE FINISHED SURFACE AT EACH POST SHALL NOT BE ABOVE THE TOP BREAKWAY HOLE OR STRUT ASSEMBLY. THE WIDENED AREA AT THE END ANCHORAGE (NONFLARED) SHALL NOT BE OVERLAYED UNLESS PAVEMENT CONDITIONS WARRANT IT BEING OVERLAYED. ANY OVERLAY PAVEMENT ABUTTING THE END ANCHORAGE (NONFLARED) SHALL BE TAPERED TO PREVENT A DROP IN THE PAVED SURFACE BELOW THE RAIL.
4. SEE SHEETS 1, 2, 3, AND 5 FOR STANDARD TYPE 3 GUARDRAIL INSTALLATION DETAILS.
5. THE COST OF THE GUTTER WILL BE PAID FOR AS "GUTTER TYPE 2 (2 FT.)" FOR A LENGTH OF 111 FT., OR "GUTTER TY. 2 (3 FT.)" FOR A LENGTH OF 50 FT.
6. INLETS OR RUNDOWNS MAY BE USED INSTEAD OF THE GUTTER IF SPECIFIED ON THE PLANS. NO ADDITIONAL CURB SHALL BE ADDED IN THE VICINITY OF THE END TREATMENT.
7. 4:1 OR FLATTER SLOPES IN THE TRAVERSABLE AREA SHALL BE USED BEHIND THE END ANCHORAGE AREA, AND IN ADVANCE OF POST (1) IF THIS IS NOT POSSIBLE A MINIMUM 3:1 SLOPE MAY BE USED IF APPROVED BY THE ENGINEER.
8. THE WIDENED AREA, EXCEPT FOR CURB OPTION A, SHALL HAVE THE SAME GRADING AS BENEATH THE ADJACENT GUARDRAIL: 10:1 OR FLATTER IF MORE THAN 2 FT. FROM SHOULDER, OR SLOPE EQUAL TO ROADWAY SLOPE IF 2 FT. OR LESS FROM SHOULDER.
9. WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.



SECTION A-A



SECTION B-B



SECTION C-C

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
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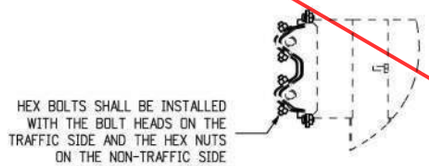
MIDWEST
GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

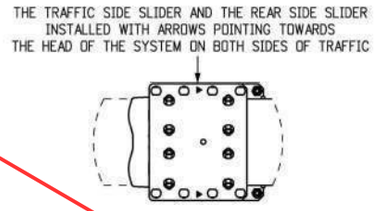
STANDARD PLAN NO.
M-606-1
Standard Sheet No. 9 of 19
Project Sheet Number:

MEDIAN TERMINAL NOTES

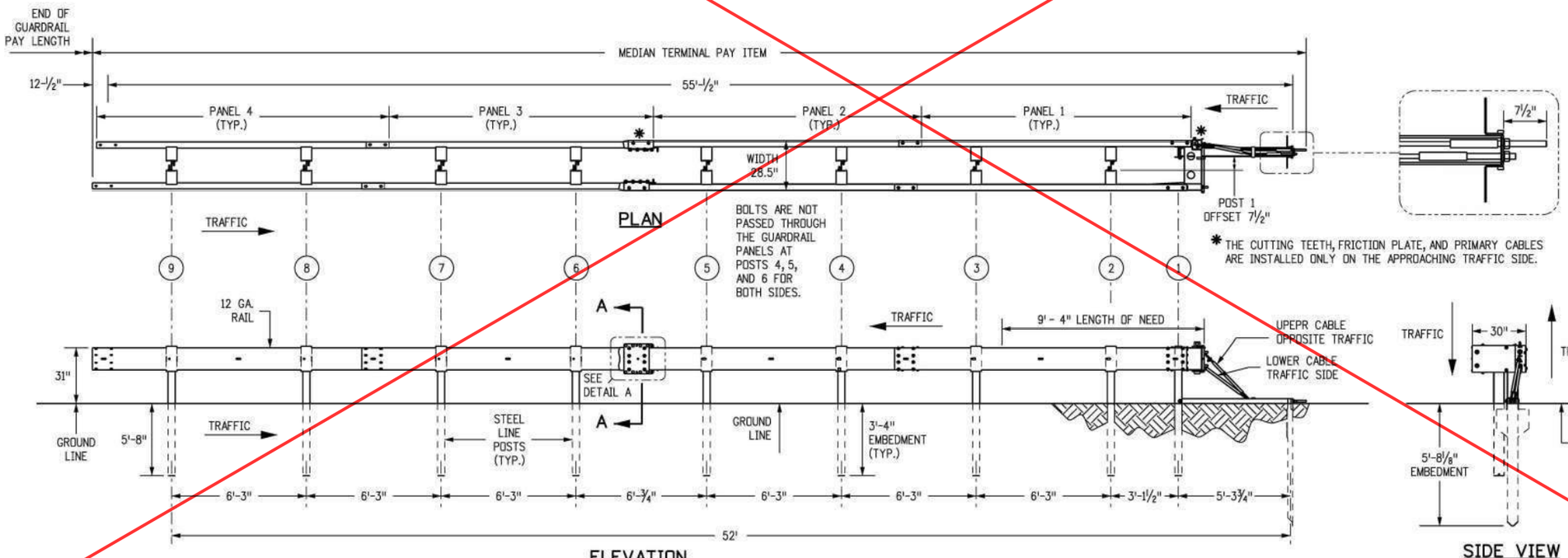
1. THE MEDIAN TERMINAL SHALL BE THE MAX-TENSION MEDIAN AS MANUFACTURED BY BY BARRIER SYSTEM BY LINDSAY (LINDSAY TRANSPORTATION SOLUTIONS) (TEL #: 888 800-3691).
2. THE MAX-TENSION SHALL BE APPLIED DIRECTLY TO W-BEAM GUARDRAIL SYSTEMS AT, OR TRANSITIONED TO, 31 INCH WITH PANELS AND POST SPACING CONFIGURED AT MID-SPAN SPLICE. TRANSITIONS TO STRONG POST W-BEAM GUARDRAIL SYSTEMS OR OTHER BARRIERS WHERE THE SPLICE IS NOT MID-SPAN SHALL BE ACCOMPLISHED USING A 3 FT. 1-1/2 INCH, 9 FT. 4-1/2 INCH OR 15 FT. 7-1/2 INCH PANELS AFTER THE MAX-TENSION SYSTEM (MIN. OF 50 FT. DOWNSTREAM OF THE FIRST POST). TRANSITIONS TO OTHER BARRIER SYSTEMS SHALL ALSO BE AT A MIN. OF 50 FT. DOWNSTREAM FROM THE FIRST POST. SEE SHEET 4.
3. THE MAX-TENSION SHALL NOT BE ATTACHED DIRECTLY TO RIGID BARRIERS SUCH AS CONCRETE BARRIERS, STEEL BARRIERS OR CONCRETE STRUCTURES WITHOUT PROPER TRANSITION. IF ROCK OR STIFF SOIL IS ENCOUNTERED, THE POSTS AND SOIL ANCHOR MAY BE INSTALLED BY AUGURING AND BACKFILLING THE HOLE.
4. EITHER 8 INCH OR 12 INCH COMPOSITE OR TIMBER BLOCKOUTS SHALL BE USED PER MANUFACTURE'S RECOMMENDATIONS.
5. EITHER 12 FT.-6 INCH OR 25 FOOT PANELS SHALL BE USED DEPENDING ON SITE CONDITIONS OR CONNECTED BARRIER SYSTEMS.
6. RAIL PANELS SHALL BE LAPPED PER MANUFACTURER'S INSTALLATION MANUAL, REGARDLESS OF AN UPSTREAM OR DOWNSTREAM END SYSTEM POSITION.
7. ALL STEEL COMPONENTS SHALL BE GALVANIZED PER ASTM A123 OR EQUIVALENT UNLESS OTHERWISE STATED.
8. ONE MEDIAN TERMINAL SHALL INCLUDE ALL POSTS, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE DEVICE SHALL BE INSTALLED IN CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LISTS TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE DEVICE.
9. UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL BE INSTALLED FOR BIDIRECTIONAL TRAFFIC APPLICATION.
10. EACH INSTALLATION SHALL BE SUPERVISED AND CERTIFIED AS CORRECT UPON COMPLETION BY A REPRESENTATIVE OF THE DEVICE MANUFACTURER OR BY AN EMPLOYEE OF THE CONTRACTOR WHO IS A CERTIFIED INSTALLER. THE CERTIFIED INSTALLER SHALL HAVE COMPLETED DEVICE TRAINING AND SHALL BE REGISTERED WITH THE MANUFACTURER AS A CERTIFIED INSTALLER.
11. DELINEATION, IF REQUIRED, SHALL BE APPLIED TO THE END PIECE AND WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. SEE STANDARD PLAN S-612-1.



SECTION A-A



DETAIL A



MAX-TENSION MEDIAN

(MASH CERTIFIED)

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
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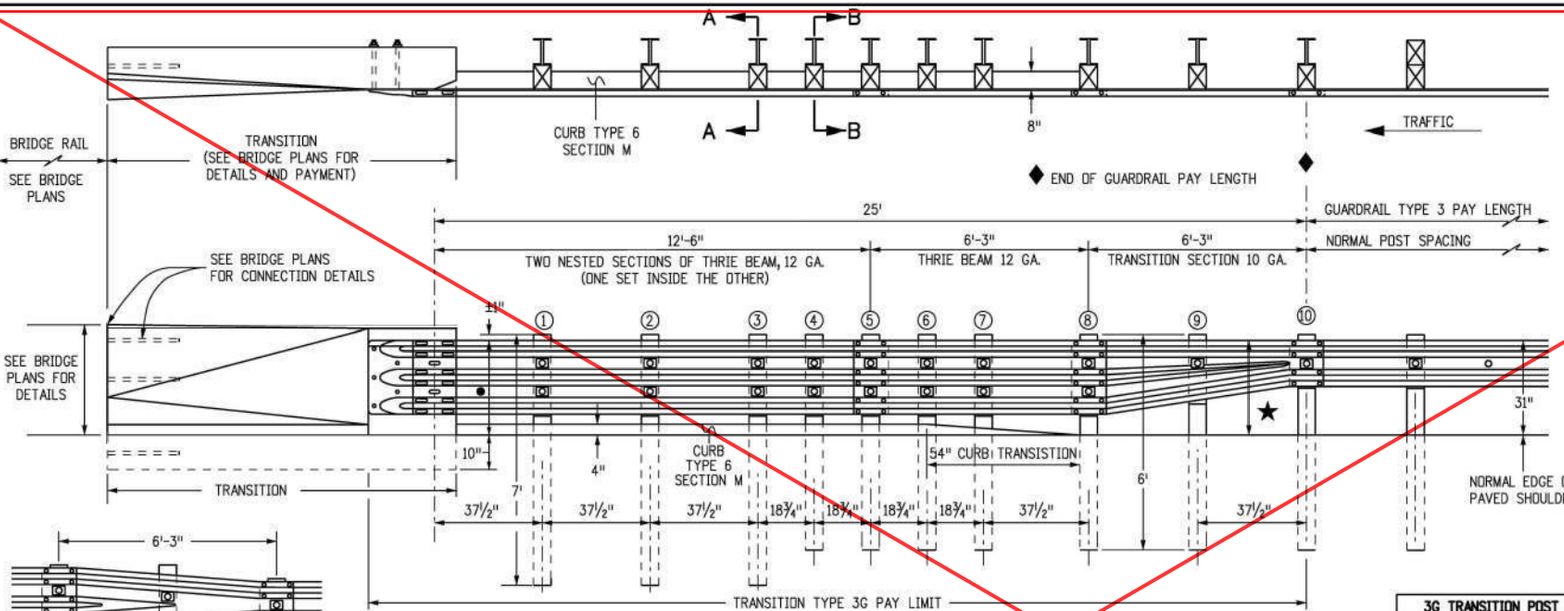
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-606-1

Standard Sheet No. 10 of 19

Project Sheet Number:

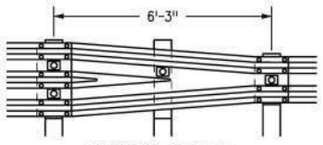


TRANSITION TYPE 3G

ALL POSTS SHALL BE STEEL

★ IF THE HEIGHT OF THE TRANSITION TYPES 3G OR 3H IS MORE THAN 31", THEN A SYMMETRICAL TRANSITION SECTION SHALL BE USED HERE.

● 31" FOR ASPHALT BRIDGE OVERLAY. 33.25" FOR POLYMER CONCRETE BRIDGE OVERLAY.

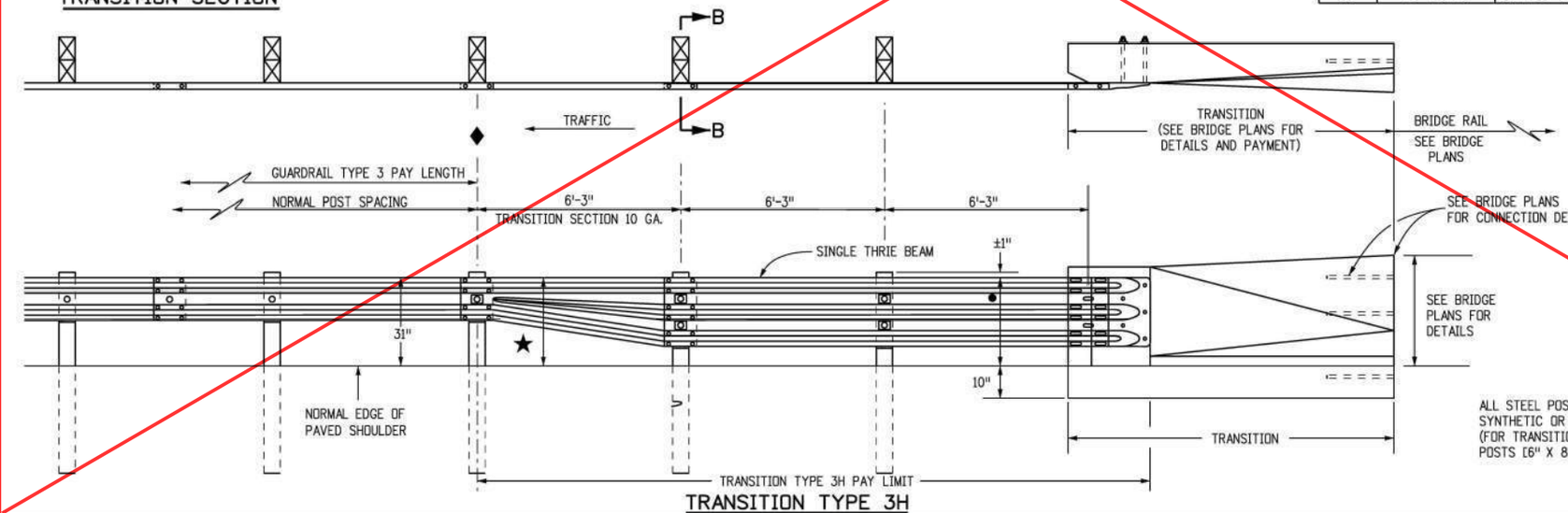


SYMMETRICAL TRANSITION SECTION

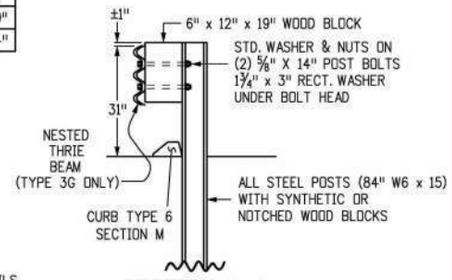
NOTES

1. TRANSITION TYPE 3G IS FOR USE AT BOTH ENDS OF BRIDGES ON TWO-WAY HIGHWAYS AND AT THE APPROACH END OF BRIDGES ON ONE-WAY HIGHWAYS.
2. TRANSITION TYPE 3H IS FOR USE AT THE TRAILING END OF BRIDGES ON ONE-WAY HIGHWAYS.
3. THE THRIE BEAM SECTION IN TRANSITION TYPES 3G AND 3H MAY BE SHOP BENT TO FIT CORRESPONDING RADIUS CURVES. HOWEVER, THE 6 FT.-3 IN. TRANSITION SECTION SHALL NOT BE BENT.
4. A TRANSITION SHALL BE REQUIRED BETWEEN TYPES 3G OR 3H AND THE BRIDGE RAILS. SEE STANDARD PLAN M-606-15 FOR THE TRANSITION TO TYPE 9 GUARDRAIL BARRIER.
5. TRANSITION TYPES 3G AND 3H ARE BOTH MASH COMPLIANT.
6. BACKUP PLATE IS NOT REQUIRED AT POSTS ON TYPE 3G AND 3H.
7. (D) THIS SYMBOL IN THE ELEVATION DRAWINGS SHOWS THE LOCATIONS WHERE A RECTANGULAR WASHER IS REQUIRED UNDER THE POST BOLT HEAD.
8. CURB TYPE 6 SECTION M, MAY BE ASPHALT OR CONCRETE. THE COST OF CURB IS INCLUDED IN THE WORK, UNLESS A SEPARATE PAY ITEM IS INCLUDED IN THE BID SCHEDULE.
9. FOR TYPE 3G, POSTS ① THRU ③ ARE 7 FT. LONG. ALL OTHER POSTS SHALL BE A STANDARD 6 FT. LONG UNLESS OTHERWISE SPECIFIED IN THE CONTRACT.
10. NOTCHED RAIL BLOCKS MANUFACTURED FROM SYNTHETIC MATERIAL WILL BE ACCEPTED AS ALTERNATIVES TO WOOD NOTCHED BLOCKS FOR USE WITH STEEL POSTS PROVIDED THAT THE BLOCKS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL. STEEL BLOCKS ARE NOT ALLOWED.

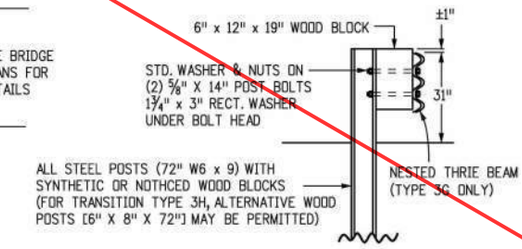
3G TRANSITION POST / BLOCK SIZING		
POST #	STEEL POST SIZE	BLOCKOUT SIZE
1 - 3	84" W6 X 15	6" X 12" X 19"
4 - 9	72" W6 X 9	6" X 12" X 19"
10	72" W6 X 9	6" X 12" X 14"



TRANSITION TYPE 3H



SECTION A-A



SECTION B-B

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)	03/05/20	Revised Gen. Notes 3 & 5. Revised transition sections notes to see the "Bridge Plans" and deleted their x-sections details. Revised the ★ note.
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
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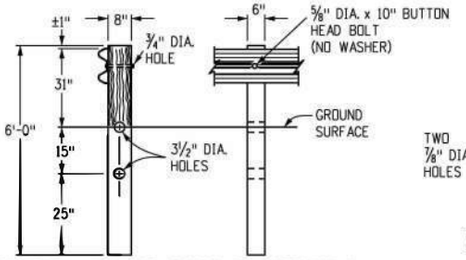
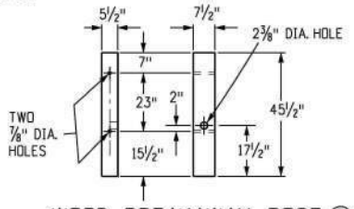
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

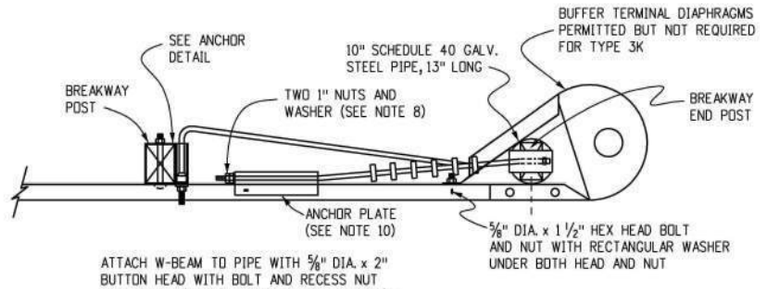
STANDARD PLAN NO.
M-606-1
Standard Sheet No. 11 of 19
Project Sheet Number:



CONTROLLED RELEASING TERMINAL (CRT) POST ①

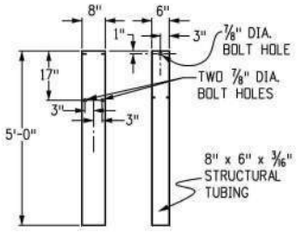


WOOD BREAKAWAY POST ②

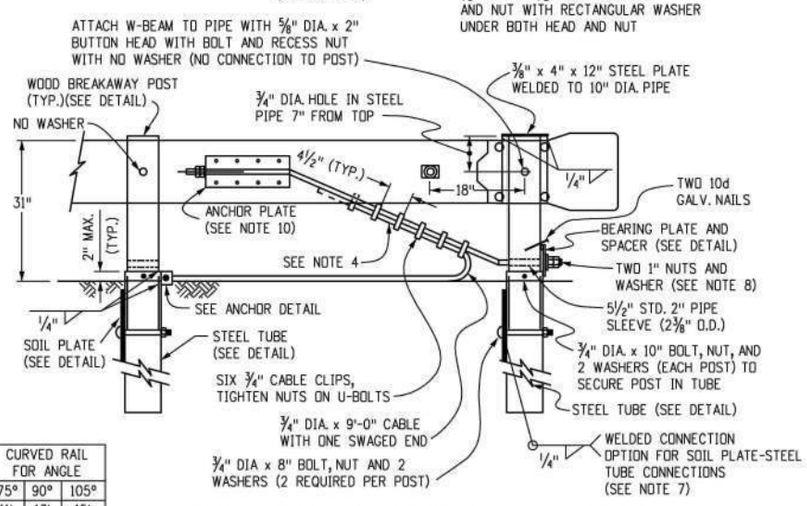


POST	DIMENSIONS	TYPE
①	6" x 8" x 6'	CRT
②	5 1/2" x 7 1/2" x 45 1/2"	BREAKAWAY

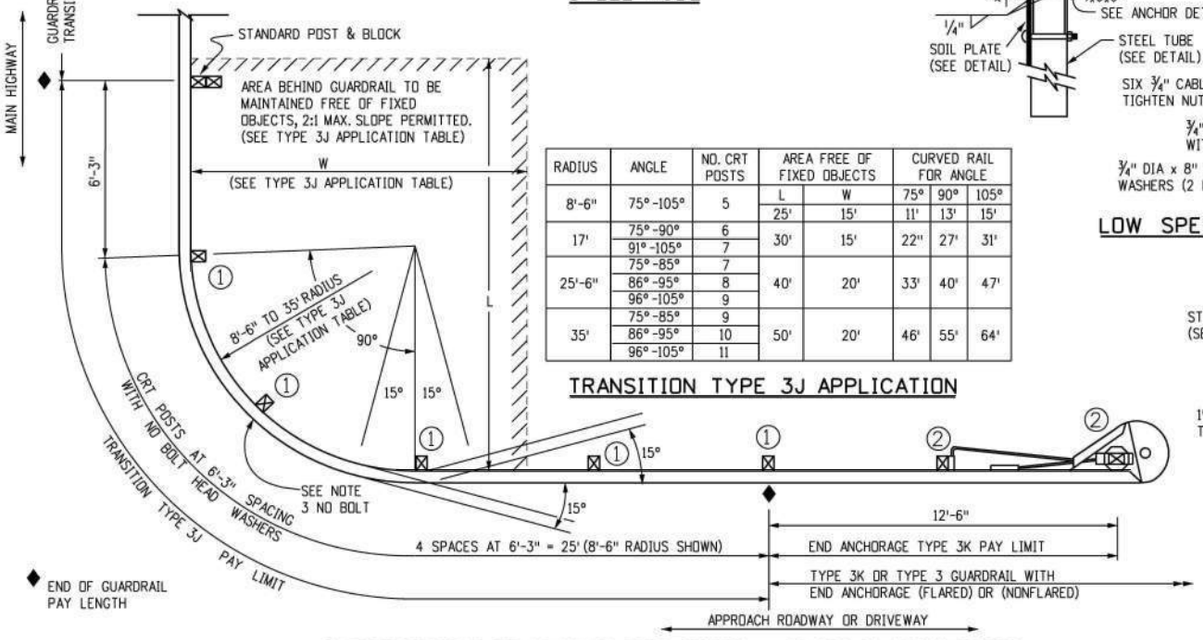
POSTS



STEEL TUBE



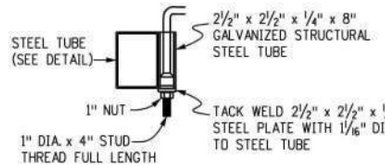
LOW SPEED END ANCHORAGE - TYPE 3K



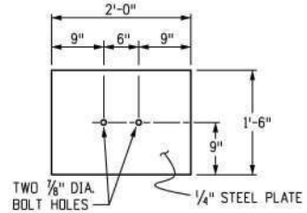
RADIUS	ANGLE	NO. CRT POSTS	AREA FREE OF FIXED OBJECTS		CURVED RAIL FOR ANGLE		
			L	W	75°	90°	105°
8'-6"	75°-105°	5	25'	15'	11'	13'	15'
17'	75°-90°	6	30'	15'	22'	27'	31'
	91°-105°	7					
25'-6"	75°-85°	7	40'	20'	33'	40'	47'
	86°-95°	8					
	96°-105°	9					
35'	75°-85°	9	50'	20'	46'	55'	64'
	86°-95°	10					
	96°-105°	11					

TRANSITION TYPE 3J APPLICATION

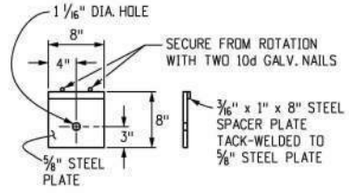
INTERSECTING ROADWAYS TRANSITION - TYPE 3J TRANSITION



ANCHOR DETAIL



SOIL PLATE



BEARING PLATE FOR STEEL TUBE

NOTES

1. APPLICATION: THE TRANSITION TYPE 3J MAY BE USED TO SHIELD HAZARDS AT THE INTERSECTION OF TWO ROADWAYS. TYPICAL APPLICATIONS INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:
   A. CANAL SERVICE ROADS AT BRIDGE ENDS.
   B. INTERRUPTIONS IN GUARDRAIL RUNS BY INTERSECTING ROADWAYS, ETC.

   THE LOW SPEED (<45 MPH) END ANCHORAGE TYPE 3K SHALL BE USED ONLY ON DRIVEWAYS AND LOW SPEED SERVICE ROADS. ***END ANCHORAGE TYPE 3K IS NOT CRASHWORTHY.*** WHEN AN APPROVED CRASH-TESTED END TREATMENT IS REQUIRED, USE THE END ANCHORAGE (FLARED) OR (NONFLARED) WITH 37 FT.-6 IN. LENGTH.
2. GRADING AND PAVING FOR THE 3J & 3K SHALL MATCH THE GRADING AND PAVING OF THE GUARDRAIL TO WHICH THEY ARE ATTACHED, AND SHALL BE IN ACCORDANCE WITH SHEET ONE OF THIS STANDARD. MAXIMUM FILL SLOPE SHALL BE 2:1.
3. THE RAIL IS NOT BOLTED TO THE CRT POST AT THE CENTER OF THE CURVE FOR THE 8 FT.-6 IN., 17 FT., AND 25 FT.-6 IN. RADII. PLATES SHALL CONFORM TO ASTM A 36, AND THE STRUCTURAL TUBING TO ASTM A 500.
4. THE 3/4IN. GALVANIZED WIRE ROPE (CABLE) SHALL CONFORM TO AASHTO M 30 TYPE II.
5. PLATES SHALL CONFORM TO ASTM A 36, AND STRUCTURAL TUBING TO ASTM A 500. WELDING SHALL MEET ALL REQUIREMENTS OF THE AMERICAN WELDING SOCIETY.
6. ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN CONFORMANCE WITH ASTM A 123. POSTS SHALL NOT BE PUNCHED, DRILLED, CUT, OR WELDED AFTER GALVANIZING.
7. WHEN THE SOIL PLATE WELDED OPTION IS SELECTED, SOIL PLATE CONNECTION BOLT HOLES ARE NOT REQUIRED.
8. OUTSIDE NUT SHALL BE TORQUED AGAINST INSIDE NUT WITH THE CABLE INSTALLED TAUT BETWEEN THE ANCHOR PLATE AND FIRST POST.
9. ALL CURVED GUARDRAIL SHALL BE SHOP BENT.
10. SEE SHEET 5 FOR ANCHOR PLATE AND OTHER DETAILS.
11. THE STEEL TUBE MAY BE DRIVEN WITH WOOD POST INSERTED IF NO DAMAGE OCCURS TO THE POST OR BOLTS.

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
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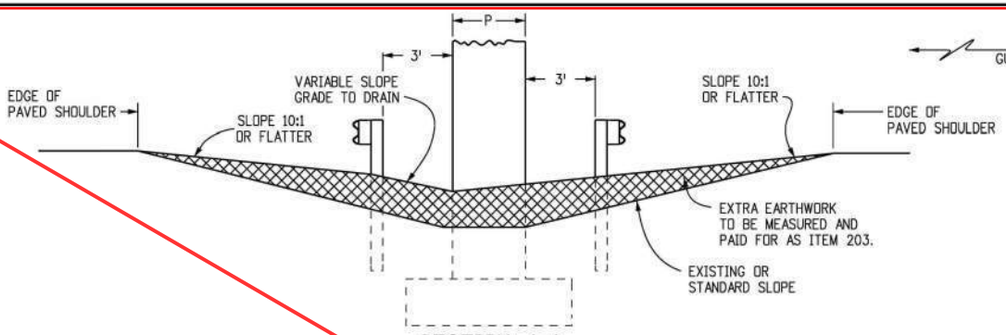
Project Development Branch JBK

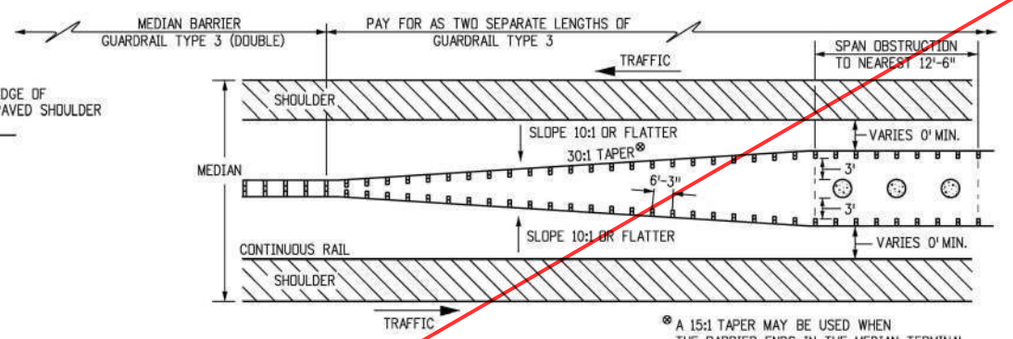
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-606-1
Standard Sheet No. 12 of 19
Project Sheet Number:

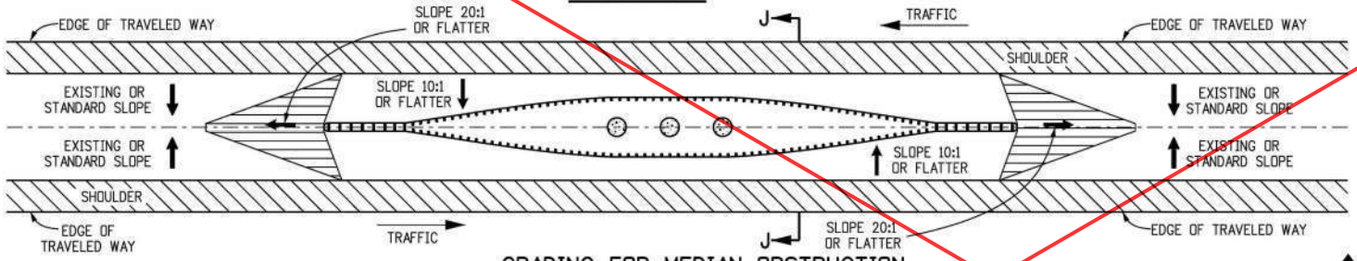


SECTION J-J

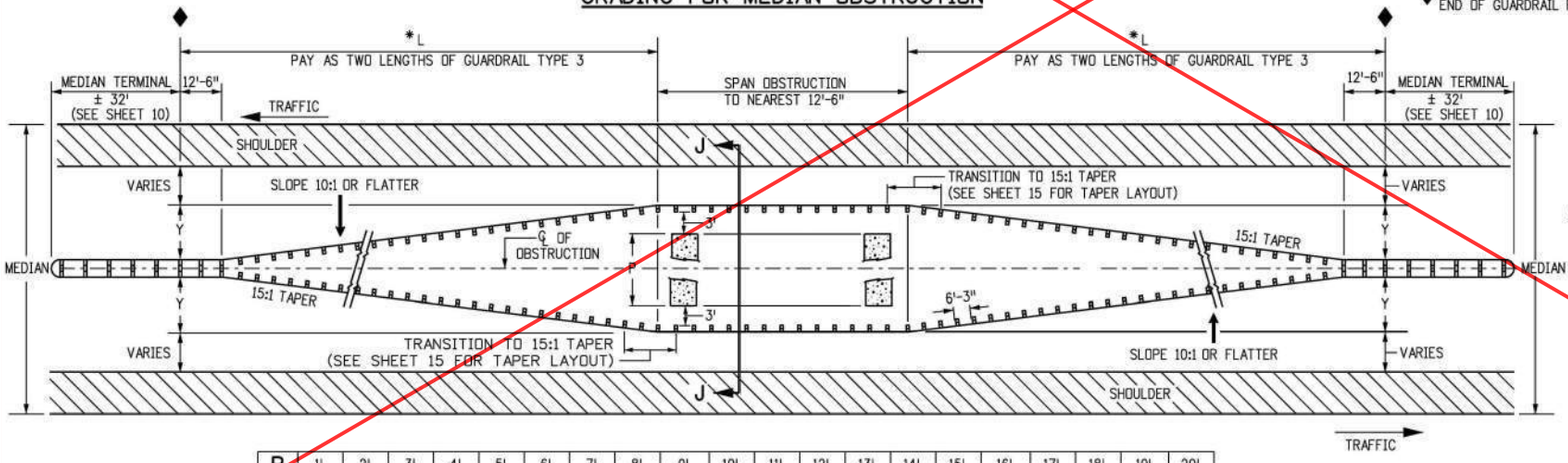


⊗ A 15:1 TAPER MAY BE USED WHEN THE BARRIER ENDS IN THE MEDIAN TERMINAL

OBSTRUCTION IN MEDIAN 30 FT. WIDE OR LESS



GRADING FOR MEDIAN OBSTRUCTION



◆ END OF GUARDRAIL PAY LENGTH

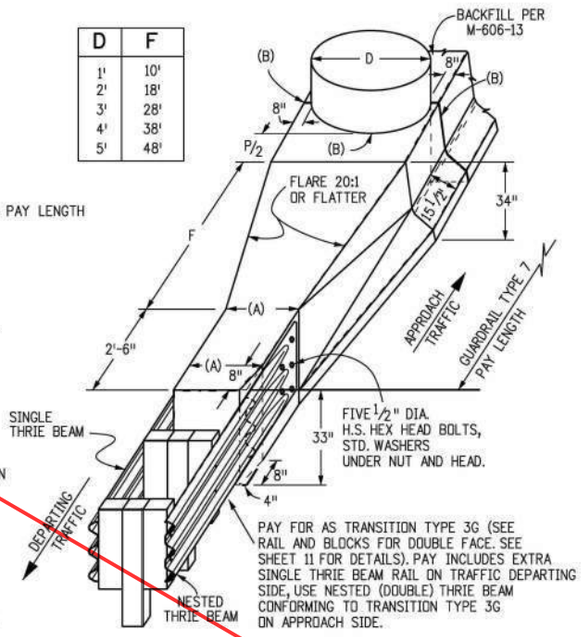
P	1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'
Y	4'-1"	4'-7"	5'-1"	5'-7"	6'-1"	6'-7"	7'-1"	7'-7"	8'-1"	8'-7"	9'-1"	9'-7"	10'-1"	10'-7"	11'-1"	11'-7"	12'-1"	12'-7"	13'-1"	13'-7"
L	75'	87'-6"		100'	112'-6"		125'		137'-6"	150'		162'-6"		175'		187'-6"	200'		212'-6"	225'

*L IS MEASURED ALONG FACE OF GUARDRAIL

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.

NOTE: FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 20 FT. IN MEDIANS USE SHEET 16.

D	F
1'	10'
2'	18'
3'	28'
4'	38'
5'	48'



PAY FOR AS TRANSITION TYPE 3G (SEE RAIL AND BLOCKS FOR DOUBLE FACE. SEE SHEET 11 FOR DETAILS). PAY INCLUDES EXTRA SINGLE THRIE BEAM RAIL ON TRAFFIC DEPARTING SIDE, USE NESTED (DOUBLE) THRIE BEAM CONFORMING TO TRANSITION TYPE 3G ON APPROACH SIDE.

(A). TIMBER POSTS 2 FT., STEEL POSTS 1 FT.-9½IN.

(B). ½ IN. PREFORMED JOINT MATERIAL

NARROW MEDIAN DETAIL

USUALLY LESS THAN 30 FT. WIDE MEDIAN WITH ALL PAVED SURFACE

OBSTRUCTIONS IN MEDIANS

Computer File Information		Sheet Revisions	
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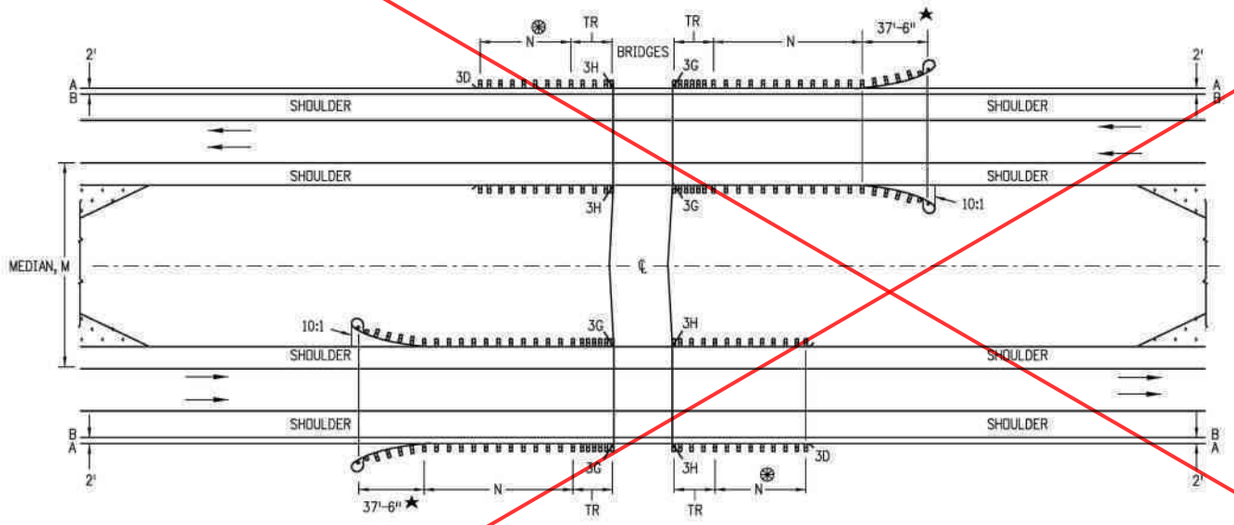
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-606-1

Standard Sheet No. 13 of 19

Project Sheet Number:



MULTILANE DIVIDED HIGHWAYS FOR STEEP EMBANKMENTS IN MEDIAN

NOTES

1. MEDIAN BARRIERS TANGENT TO THE ROADWAY MAY BE USED WHERE THE SHOULDER SLOPES IN THE MEDIAN ARE STEEP.
2. BARRIER LENGTHS SHALL BE INCREASED TO ACCOUNT FOR STEEP EMBANKMENTS OR OTHER HAZARDS WITHIN CLOSE PROXIMITY OF BRIDGES.

⊛ — DO NOT CONSTRUCT THE TR AND GUARDRAIL ON THE TRAILING BRIDGE ENDS IF SITE CONDITIONS DO NOT WARRANT THE USE OF GUARDRAIL.

N — SHOWN ON PLANS. LENGTH TO SHIELD ALL HAZARDS IS BASED ON GUARDRAIL'S LENGTH OF NEED COMPUTATION. SEE AASHTO ROADWAY DESIGN GUIDE. THE MINIMUM SHALL BE 12 FT. - 6 IN., WHERE SITE CONDITIONS ALLOW. THE TOTAL LENGTH OF NEED WILL INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.

TR — 25 FEET FOR TRANSITION TYPES 3G AND 3H.

A — EDGE OF 8 FT. OR 10 FT. SHOULDER.

B — EDGE OF 6 FT. OR LESS SHOULDER.

★ — END ANCHORAGE CAN BE FLARED OR NONFLARED.

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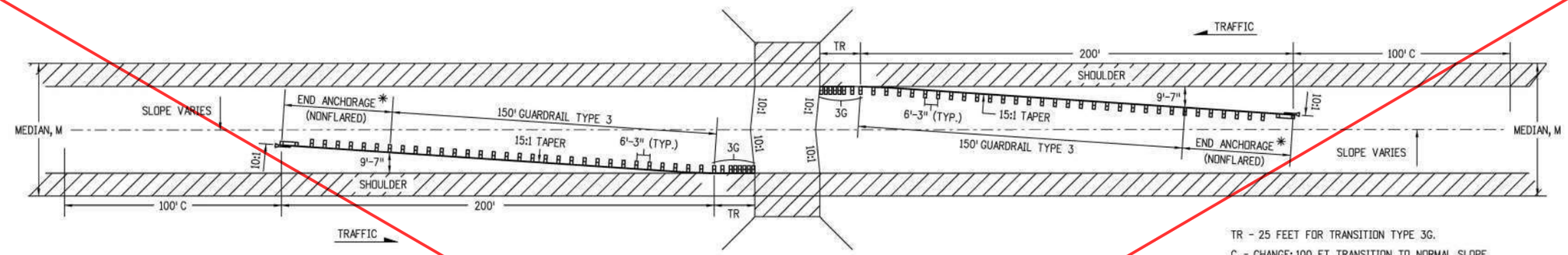
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-606-1

Standard Sheet No. 14 of 19

Project Sheet Number:



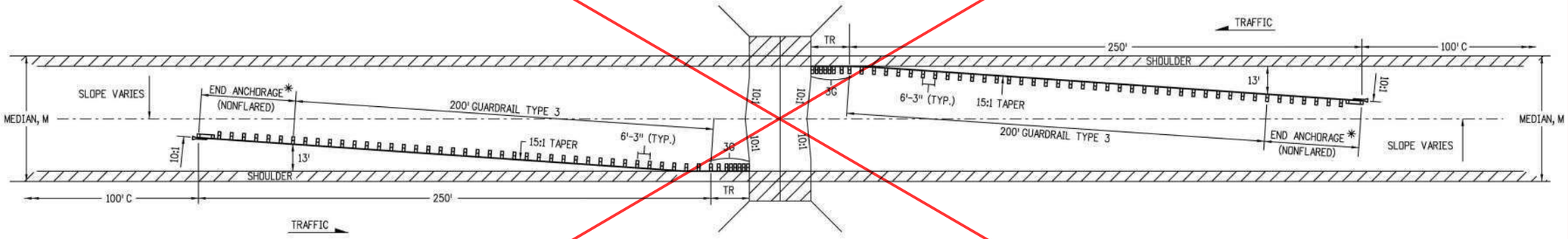
MEDIANS 60 FT. AND OVER WITH 10 FT. OR WIDER SHOULDERS.

TR - 25 FEET FOR TRANSITION TYPE 3G.

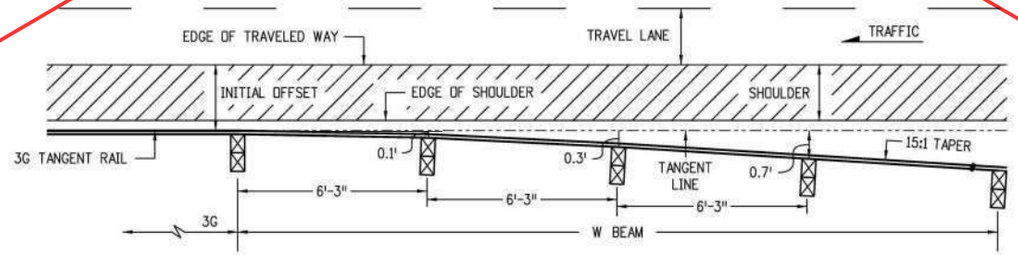
C - CHANGE: 100 FT. TRANSITION TO NORMAL SLOPE.

M - WIDTH OF MEDIAN.

* END ANCHORAGE LENGTH AND FLARE RATES VARY BY DEVICE. SEE MANUFACTUERER/SUPPLIER FOR INSTALLATION REQUIREMENTS.



MEDIANS 60 FT. AND OVER WITH 4 to 8 FT. SHOULDERS.



TRANSITION TO TYPICAL 15:1 TAPER

NOTES

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 25 FEET BASED ON POST OFFSET DIMENSIONS SHOWN.
2. SEE SHEET 14 FOR THE RIGHT SHOULDER GUARDRAIL LAYOUT.

MULTILANE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 60 FT. AND OVER WITH OPEN HAZARDS OR OBSTRUCTIONS)

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MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

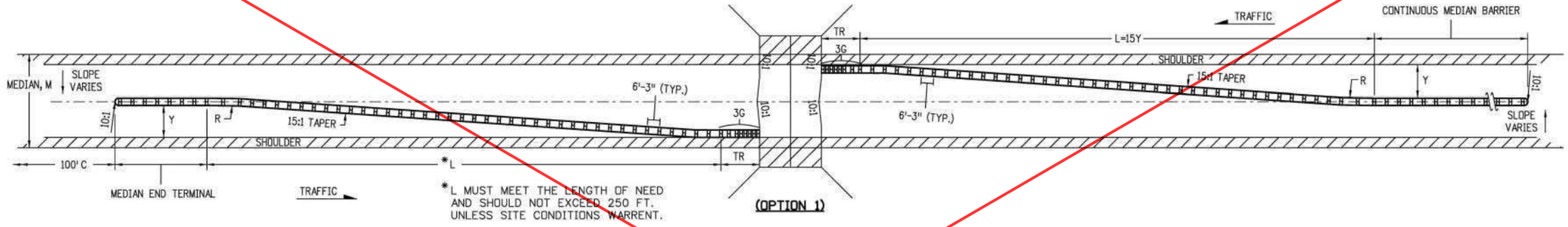
STANDARD PLAN NO. M-606-1

Standard Sheet No. 15 of 19

Project Sheet Number:

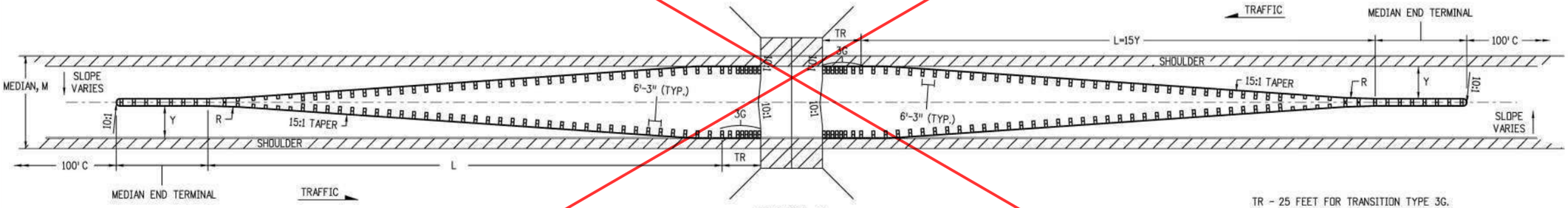
NOTES

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 25 FEET BASED ON POST OFFSET DIMENSIONS SHOWN.
2. THE OPTION 1 LAYOUT SHALL BE USED WHEN "Y" EXCEEDS 16 FEET OR WHEN MEDIAN BARRIER IS CONTINUOUS.
3. THE OPTION 2 LAYOUT SHALL BE USED WHEN "Y" IS 16 FEET OR LESS.
4. SEE SHEET 14 FOR RIGHT SHOULDER GUARDRAIL LAYOUT.



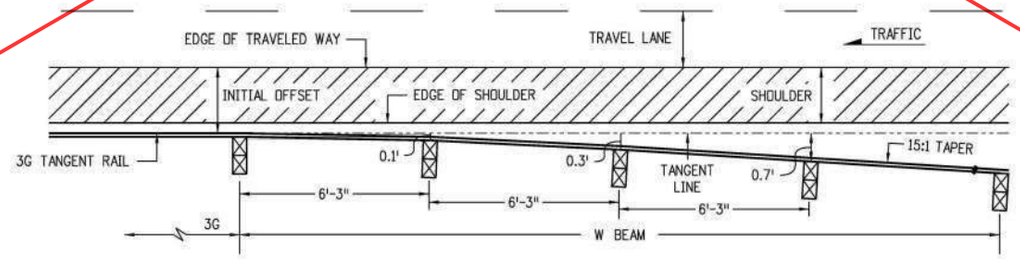
*L MUST MEET THE LENGTH OF NEED AND SHOULD NOT EXCEED 250 FT. UNLESS SITE CONDITIONS WARRENT.

(OPTION 1)



(OPTION 2)

TR - 25 FEET FOR TRANSITION TYPE 3G.
C - CHANGE: 100 FT. TRANSITION TO NORMAL SLOPE.
M - WIDTH OF MEDIAN.
L - TOTAL LENGTH PAID AS GUARDRAIL TYPE 3.
Y - FINAL OFFSET AT END.



TRANSITION TO TYPICAL 15:1 TAPER

MULTILANE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 21 - 59 FT. WITH OPEN HAZARDS OR OBSTRUCTIONS)

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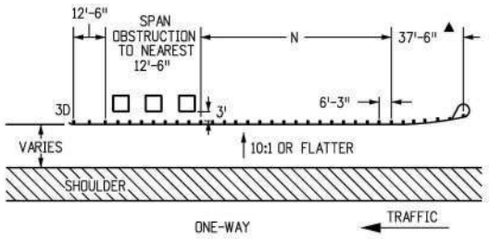
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

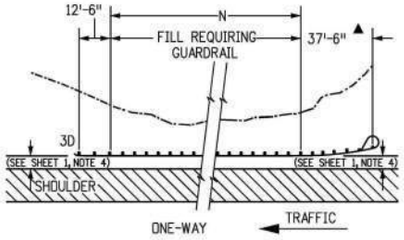
Issued by the Project Development Branch: July 31, 2019

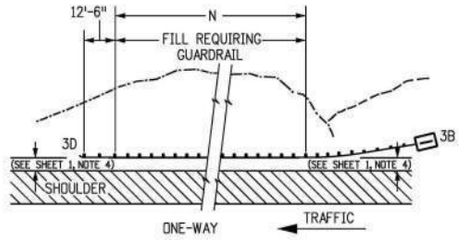
STANDARD PLAN NO. M-606-1

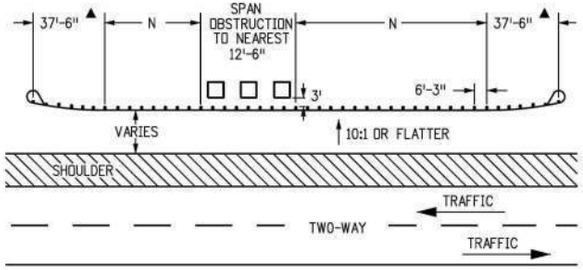
Standard Sheet No. 16 of 19

Project Sheet Number:

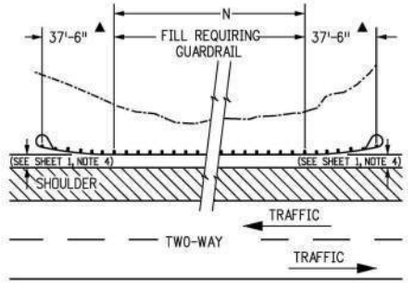




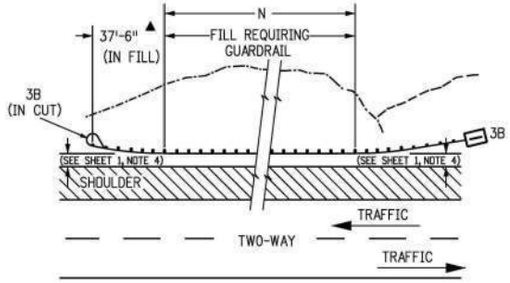




GUARDRAIL FOR ROADSIDE OBSTRUCTIONS



GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION

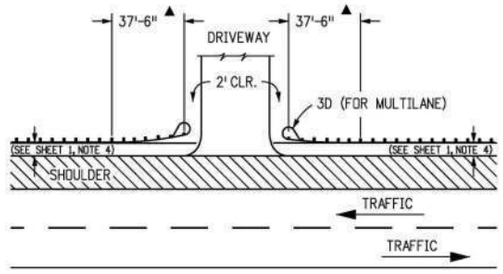


GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION

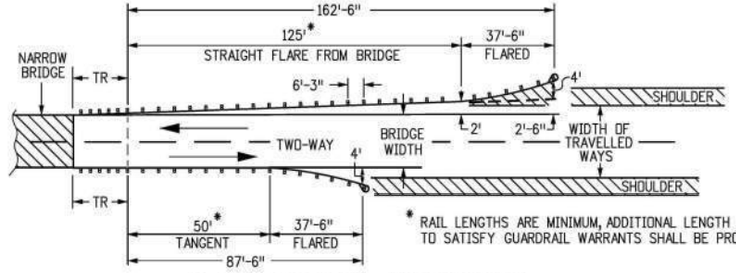
NOTES

1. A TYPE 3G OR 3H TRANSITION (SEE SHEET 11) SHALL BE USED TO CONNECT THE TYPE 3 W-BEAM TO A TYPE 9 CONCRETE BARRIER (SEE M-606-15) OR TO A TYPE 8 OR 10 BRIDGE RAIL.
2. "TR" SHALL BE 25 FEET FOR THE TRANSITION TYPES 3G AND 3H.
3. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT. A TRAVERSABLE SLOPE SHALL BE PROVIDED BEHIND THE TERMINAL TO DIMENSION "N" PRIOR TO THE OBSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER.

▲ END ANCHORAGE CAN BE FLARED OR NONFLARED

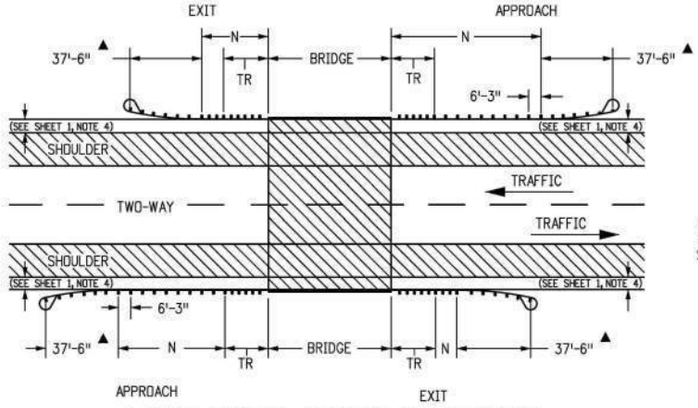


LAYOUT FOR DRIVEWAY APPROACH

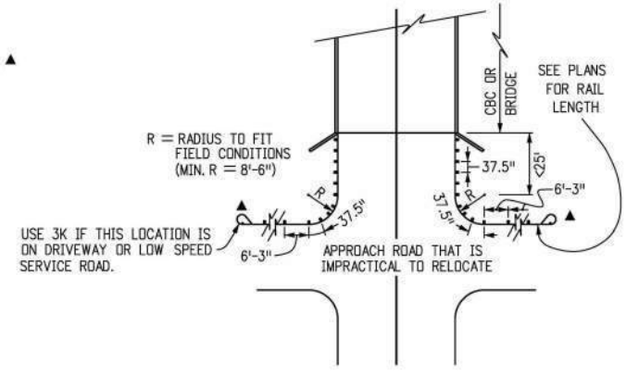


* RAIL LENGTHS ARE MINIMUM, ADDITIONAL LENGTH TO SATISFY GUARDRAIL WARRANTS SHALL BE PROVIDED

2-WAY NARROW APPLICATION



2-WAY NORMAL BRIDGE APPLICATION



GUARDRAIL TYPE 3 WITH BLOCKED OUT POSTS SPACED AT 3'-1½" FROM STRUCTURE AROUND CURVE.

INTERRUPTED STRUCTURE APPROACH

(USE TYPE 3J ON SHEET 12 WHEN PRACTICAL)

Computer File Information		Sheet Revisions	
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Issued by the Project Development Branch: July 31, 2019

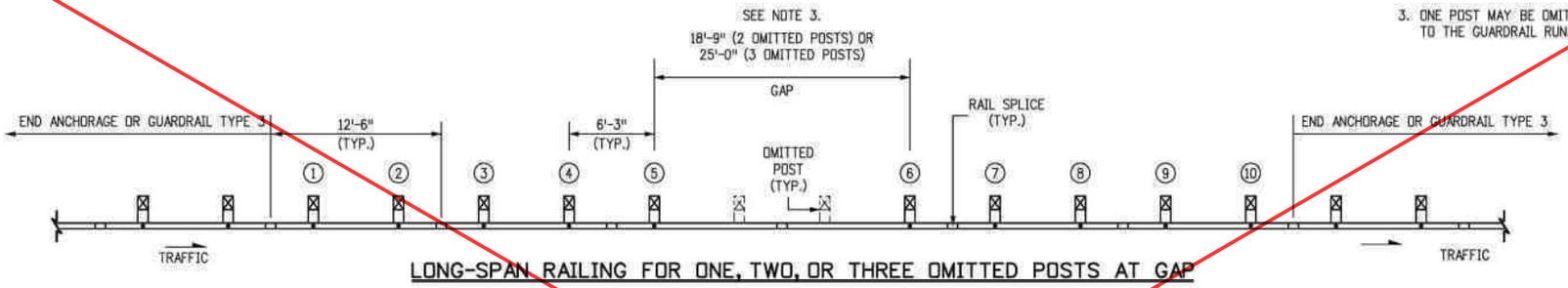
STANDARD PLAN NO. M-606-1

Standard Sheet No. 17 of 19

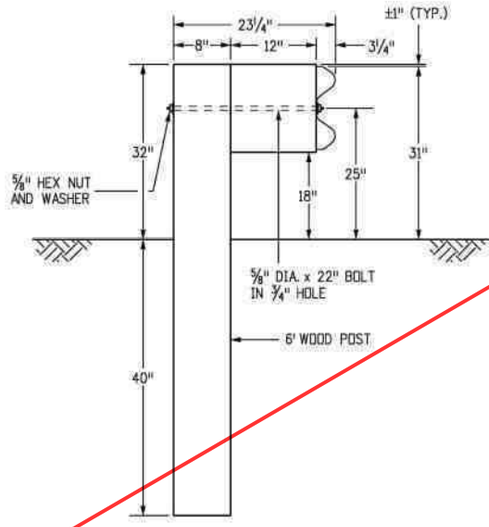
Project Sheet Number:

NOTES

1. POSTS ①, ②, ⑨, and ⑩ MAY BE TIMBER OR STEEL.
2. THE NUMBER OF OMITTED POSTS IS DEPENDENT ON THE LENGTH OF THE GAP.
3. ONE POST MAY BE OMITTED WITHOUT ANY MODIFICATION TO THE GUARDRAIL RUN.

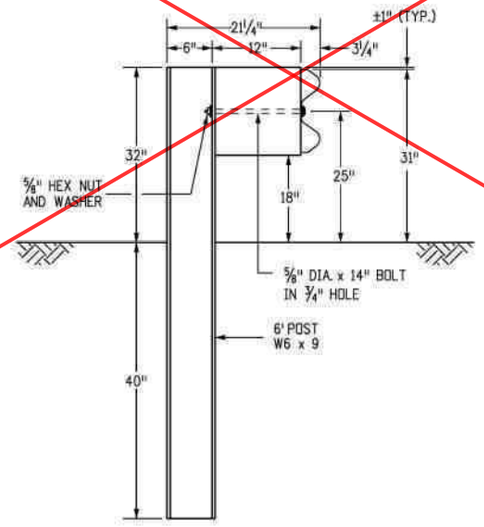


LONG-SPAN RAILING FOR ONE, TWO, OR THREE OMITTED POSTS AT GAP



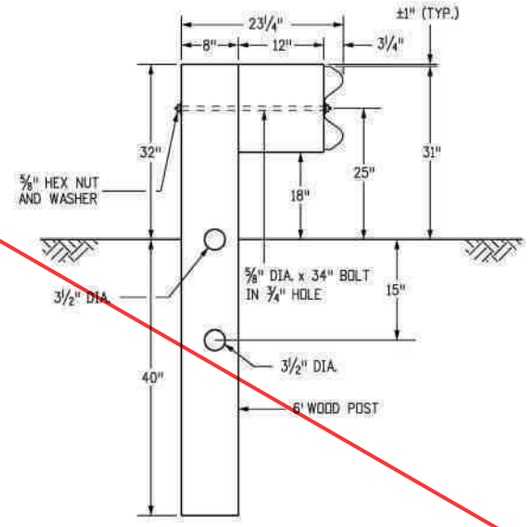
TIMBER POST

POSTS ①-② AND ⑨-⑩ (SEE NOTE 1)



STEEL POST

POSTS ①-② AND ⑨-⑩ (SEE NOTE 1)



BREAKWAY TIMBER POST

POSTS ③ - ⑧

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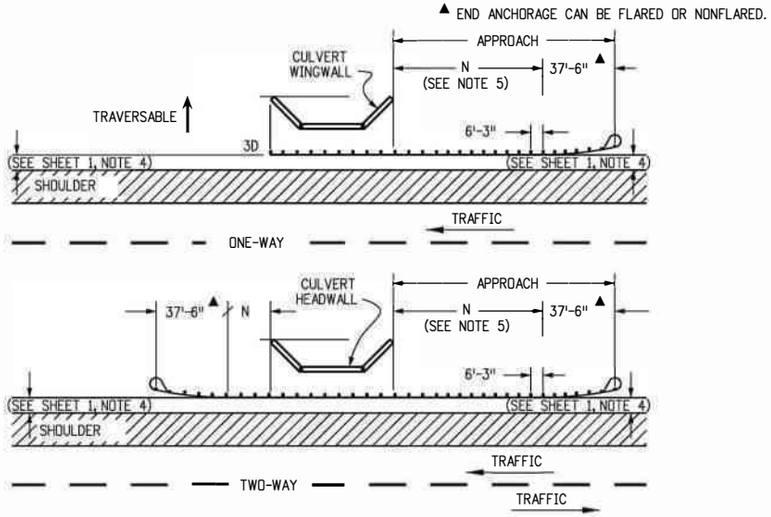
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued by the Project Development Branch: July 31, 2019

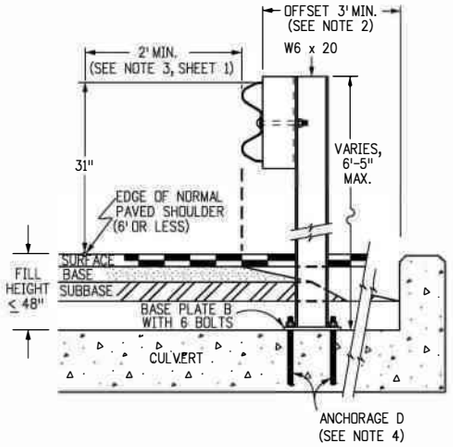
STANDARD PLAN NO. M-606-1

Standard Sheet No. 18 of 19

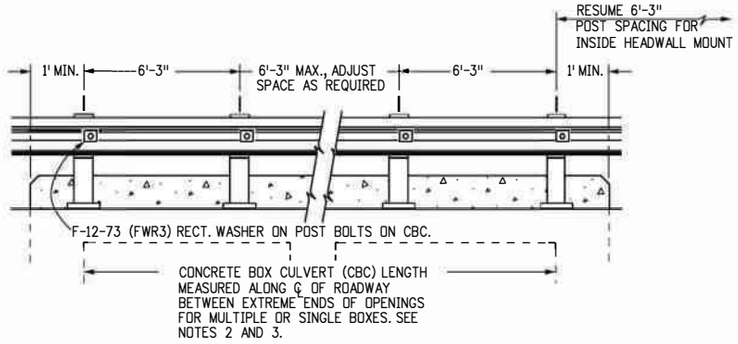
Project Sheet Number:



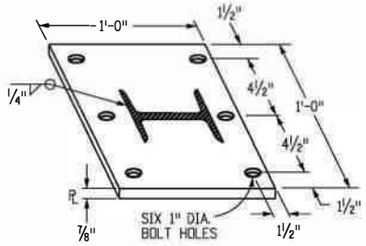
GUARDRAIL FOR CULVERTS



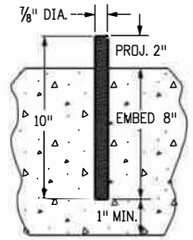
INSIDE MOUNT ON CBC



RAIL PLACEMENT FOR INSIDE MOUNT



BASE PLATE B
(FOR INSIDE MOUNT)



ANCHORAGE D
(FOR INSIDE MOUNT)

NOTES

1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND WINGWALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 15. THE GUARDRAIL TYPE 3 SHALL CONTINUE ACROSS THE CULVERT AS SHOWN ON THIS SHEET.
2. RIGHT SHOULDER BOX CULVERT TREATMENT IS SHOWN ON THIS SHEET FOR CULVERTS 20 FT. OR LESS IN LENGTH.
3. CONSTRUCTION AND PAYMENT FOR FILL HEIGHTS SHALL BE INCLUDED IN THE COST OF THE GUARDRAIL TYPE 3.
4. ANCHORAGE D: SIX BOLTS FOR BASE PLATE "B" WITH INSIDE MOUNT. THE BOLTS SHALL BE 7/8 IN. DIA X 10 IN. HIGH STRENGTH RODS THREADED FULL LENGTH AND ALL GALVANIZED. RODS SHALL BE CAST-IN-PLACE FOR NEW STRUCTURES. FOR EXISTING STRUCTURES, THE RODS SHALL BE INSTALLED IN 1-1/4 IN. DIA HOLES WITH NON-SHRINK GROUT OR EPOXY CONFORMING TO ASTM C 881. IF THE THICKNESS OF A CULVERT'S TOP PANEL REQUIRES BOLTS TO BE LESS THAN 10 IN. HIGH, THE BOLTS SHALL BE APPROVED BY THE ENGINEER.
5. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.
6. ALL POSTS, BASE PLATES, AND ANCHOR BOLTS SHALL BE FABRICATED FROM ASTM A 36 STEEL. THE ABOVE MATERIAL, W-BEAM, AND ALL ANCHOR BOLTS AND MISCELLANEOUS BOLTS, NUTS,AND WASHERS SHALL BE GALVANIZED AFTER FABRICATION INACCORDANCE WITH SECTION 509. CONCRETE, REINFORCING STEEL, AND STRUCTURAL STEEL ELEMENTS SHALL BE IN ACCORDANCE WITH SECTIONS 601, 602, AND 509, RESPECTIVELY.
7. POST ANCHORS, ENCASED IN CONCRETE, SHALL BE ASTM A 36 STEEL, AND NEED NOT BE GALVANIZED.
8. PRIOR TO INSTALLATION OF GUARDRAIL ON CULVERTS, THREE SETS OF WORKING DRAWINGS WHICH COMPLY WITH THE REQUIREMENTS OF SECTION 105 SHALL BE SUBMITTED TO THE ENGINEER FOR INFORMATION ONLY.

Computer File Information		Sheet Revisions	
Creation Date: 07/31/19		Date:	Comments
Designer Initials: JBK	(R-X)		
Last Modification Date: 03/05/20	(R-X)		
Detailer Initials: LTA	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

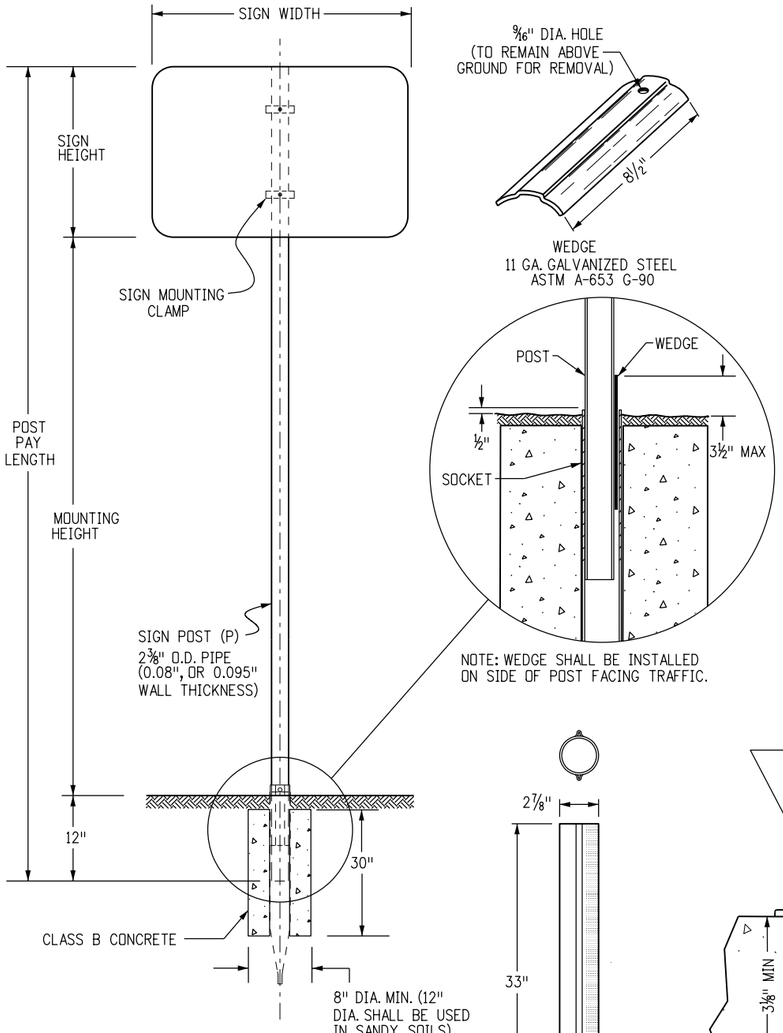
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-606-1

Standard Sheet No. 19 of 19

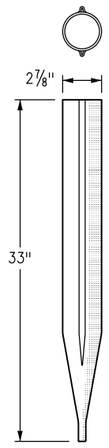
Project Sheet Number:

TUBULAR STEEL POSTS
(SOCKET SYSTEM) (FOR USE WITH ALL P-POST INSTALLATIONS)
(SEE SHEET 2 FOR P1 AND P2 POST INSTALLATIONS)



WEDGE
11 GA. GALVANIZED STEEL
ASTM A-653 G-90

NOTE: WEDGE SHALL BE INSTALLED ON SIDE OF POST FACING TRAFFIC.

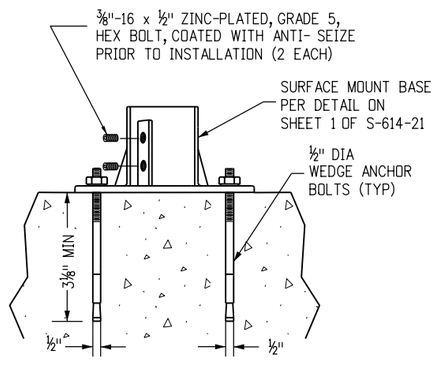


TUBULAR CONCRETE FOOTING
12 GA. GALVANIZED
STEEL ASTM - 787

POST NOTES

THE POST MAY BE PRE-PUNCHED WITH ⅜" DIA. HOLES AND THE SIGN MOUNTED DIRECTLY TO THE POST, OR AN APPROVED MOUNTING CLAMP MAY BE USED TO MOUNT THE SIGN TO THE POST. IF THE POST IS PRE-PUNCHED, THE HOLES SHALL BE SPACED THE FOLLOWING DISTANCES FROM THE TOP:

1", 3", 10", 16", 21", 23", 24", 27", 33", 37", 39", AND 45"



SIDE VIEW

SURFACE MOUNT DETAIL (P POST ONLY)

THE POST MAY BE SURFACE MOUNTED WHEN APPROVED BY THE ENGINEER

SIGNPOST SELECTION GUIDE (90 MPH WIND LOAD DESIGN)
(FOR SOCKET SYSTEM AND SLIPBASE INSTALLATIONS USING P, P1 OR P2 POSTS)

SIGN HEIGHT (FT) \ 7' MOUNTING HEIGHT, SIGN WIDTH (FT)	1	2	2.5	3	4	5	6	7	8	9	10	11	12+
1	P	P	P	P	P	P1	SIZES NOT USED						
2	P	P	P	P	P	P1							
2.5	P	P	P	P	P1	P1							
3	P	P	P	P1	P1	P1							
4	P	P1	P1	P1	P1	P1	TWO P1'S						TWO P2'S
5	SIZES NOT USED		P1	P1	P1	P1							
6			P1	P1	P1	P2▼					TWO P2'S	THREE P2'S	
7			P1	P1	P2▼						TWO P2'S	SEE CHART NOTE 5.	

▼SEE CHART NOTE 4.

SIGN HEIGHT (FT) \ 8' MOUNTING HEIGHT, SIGN WIDTH (FT)	1	2	2.5	3	4	5	6	7	8	9
1	P	P	P	P	P	P1	SIZES NOT USED			
2	P	P	P	P	P1	P1				
2.5	P	P	P	P1	P1	P1				
3	P	P	P1	P1	P1	P1	TWO P1'S			
4	P	P1	P1	P1	P1	P1				
5	SIZES NOT USED		P1	P1	P1	P2▼				
6			P1	P1	P1	P2▼				TWO P2'S
7			P1	P1	TWO P1'S	TWO P1'S		TWO P2'S	SIZES NOT USED	

SIGN HEIGHT (FT) \ 9' MOUNTING HEIGHT, SIGN WIDTH (FT)	1	2	2.5	3	4	5	6	7	8	9
1	P	P	P	P	P	P1	SIZES NOT USED			
2	P	P	P	P	P1	P1				
2.5	P	P	P	P1	P1	P1				
3	P	P	P1	P1	P1	P1	TWO P1'S			
4	P	P1	P1	P1	P1	P1				
5	SIZES NOT USED		P1	P1	P1	P2▼				TWO P2'S
6			P1	P1	P2▼	TWO P1'S			TWO P2'S	
7			P1	P2	TWO P1'S	TWO P1'S		TWO P2'S	SIZES NOT USED	

CHART NOTES

1. TYPICAL POST MOUNTING HEIGHTS FROM GROUND TO BOTTOM OF SIGN PANEL ARE 7, 8 OR 9 FEET. OTHER HEIGHTS MAY BE REQUIRED WHEN SIGNS ARE MOUNTED ON STEEPER FILL OR CUT SLOPES.
2. FOR SIGNS MOUNTED ON TWO POSTS, THE MINIMUM DISTANCE BETWEEN POSTS SHALL BE 2 FEET AND THE MAXIMUM DISTANCE SHALL BE 8 FEET. DISTANCE FROM POST TO EDGE OF SIGN PANEL(S) SHALL BE 0 TO 4 INCHES. WHEN BACKING ZEES ARE USED, POSTS SHALL BE INSTALLED WITH A MINIMUM OF 2 INCHES TO THE EDGE OF THE BACKING ZEE.
3. ALL SIGN PANELS GREATER THAN 60 INCHES IN WIDTH MUST BE MOUNTED ON TWO POSTS TO PREVENT TURNING.
4. THE POST SIZES SHOWN ARE THE MINIMUM SIZES REQUIRED. TWO P1 POSTS MAY BE SUBSTITUTED WHERE ONE P2 POST IS INDICATED. P2 POSTS MAY SUBSTITUTED FOR P1 POSTS WHEN DIRECTED BY THE ENGINEER. W-SHAPE BEAM MAY BE SUBSTITUTED FOR P2 POSTS WHEN DIRECTED BY THE ENGINEER.
5. USE W-SHAPE BEAMS ONLY FOR SIGN POSTS.

GENERAL NOTES

1. SIGN PANELS LESS THAN 60 INCHES IN WIDTH MAY BE ATTACHED DIRECTLY TO T BRACKETS WITHOUT ZEES AND SIGN PANELS LESS THAN 48 INCHES IN WIDTH MAY BE ATTACHED DIRECTLY TO U BRACKETS WITHOUT ZEES. WIDTH OF A DIAMOND CONFIGURED SIGN PANEL IS MEASURED ACROSS OPPOSITE CORNERS.
2. U-BRACKETS MAY BE USED FOR MULTIPLE SIGN INSTALLATIONS.
3. FOR BACKING ZEE REQUIREMENTS AND DETAILS, SEE STANDARD PLANS S-614-3 AND S-614-4.
4. THE CONTRACTOR SHALL INSTALL THE POSTS PER THE MANUFACTURER'S RECOMMENDATIONS WITHOUT ADDITIONAL COMPENSATION.

POST SPECIFICATIONS

POST SIZE	OUTSIDE DIAMETER	WALL THICKNESS	MATERIAL	**COATING	MAX ALLOW MOMENT	PAID FOR AS:
P	2.375"	.080"	ASTM-513	ASTM A-653 G-210 WITH 3.0 MIL	1.47 KIP FT	STEEL SIGN SUPPORT (2 INCH ROUND)
P1	2.875"	.160"	ASTM-513	POLYMER COATING PER ASTM A123 CLEAR COATING	4.02 KIP FT	STEEL SIGN SUPPORT (2½ INCH ROUND NP-40)
P2	2.875"	.276"	ASTM-500	GC HOT DIPPED PER ASTM-123	5.13 KIP FT	STEEL SIGN SUPPORT (2½ INCH ROUND SCH 80)

** COLOR POWDER COATING MAY BE ADDED ACCORDING TO MANUFACTURER SPECIFICATIONS FOR SPECIAL LOCATIONS WHEN SHOWN ON THE PLANS.

Computer File Information
Creation Date: 07/04/12
Created By: KEN
Last Modification Date: 03/01/24
Last Modified By: YSaucedo
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

Sheet Revisions		
	Date:	Comments
R-1	03/01/24	Update general note 1, updated ASTM reference for galvanized steel, added surface mount detail and updated charts.

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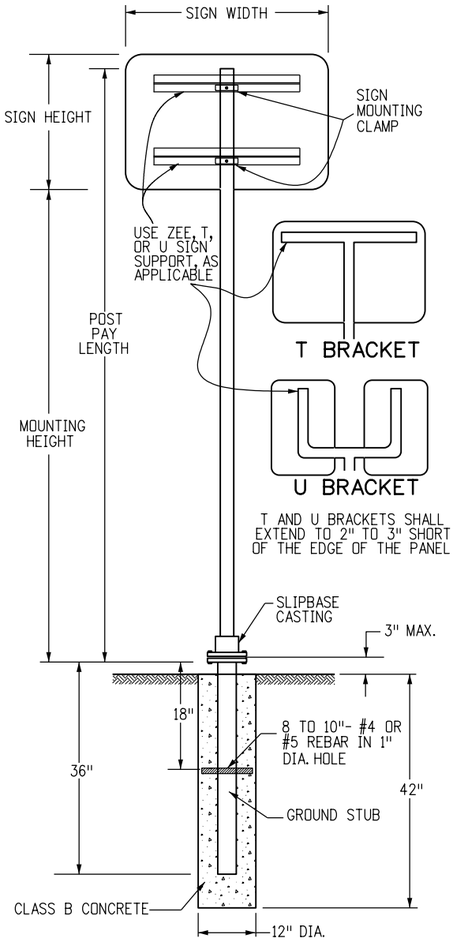
TUBULAR STEEL SIGN SUPPORT DETAILS

Issued By: Traffic & Safety Engineering Branch July 31, 2019

STANDARD PLAN NO.
S-614-8
Standard Sheet No. 1 of 7
Project Sheet Number:

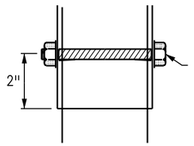


TUBULAR STEEL POST
(WITH SLIPBASE)
(FOR USE WITH ALL P1 AND P2 POST INSTALLATIONS)
(SEE SHEET 1 FOR P-POST INSTALLATIONS)

DIMENSIONS FOR MOUNTING CLAMP (ALL DIMENSION ARE IN INCHES)

STANDARD PIPE SIZE	A	B	C	D	E	F	G	K	L	R_1	R_2
2	3¾	2¾	1½	1⅛	½	3/16	1	2 11/16	1 7/32	1¼	1 3/16
2½	4¼	3¼	2	1¼	½	¼	1	3 3/16	1 15/32	1½	1 7/16

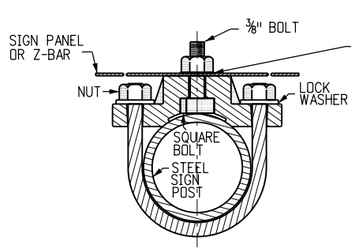
T AND U BRACKET ATTACHMENT



½" x 4½" INCH LONG ZINC-PLATED OR GALVANIZED, GRADE 5 HEX BOLT. 2 FLAT AND 1 LOCK WASHER REQUIRED.

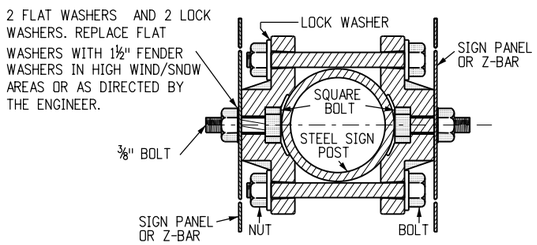
REPLACE FLAT WASHERS WITH 1½" FENDER WASHER IN HIGH WIND/SNOW AREAS OR AS DIRECTED BY THE ENGINEER.

TYPICAL SINGLE BRACKET



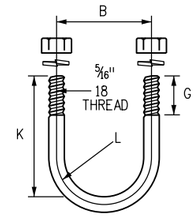
FLAT WASHER. REPLACE FLAT WASHER WITH 1½" FENDER WASHER IN HIGH WIND/SNOW AREAS OR AS DIRECTED BY THE ENGINEER.

TYPICAL BACK TO BACK

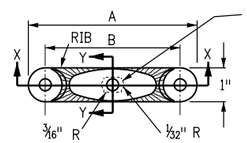


PIPE CLAMP CASTING

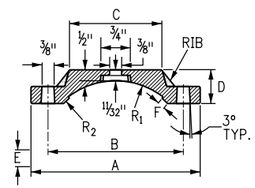
PIPE CLAMP CASTING SHALL BE ASTM B26 OR B108 ALUMINUM ALLOY A444.0-T4 OR 356.0-F. ALL SIGN MOUNTING CLAMP PARTS NOT MADE FROM ALUMINUM SHALL BE GALVANIZED STEEL IN CONFORMANCE WITH ASTM A153 OR STAINLESS STEEL.



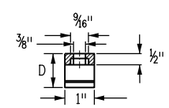
U-BOLT TO BE MADE IN ACCORDANCE WITH STANDARD MANUFACTURING PROCEDURE. ¼" OR 5/18" DIAMETER STOCK IS PERMISSIBLE. AMERICAN STANDARD REGULAR SEMI-FINISHED HEX NUTS AND SPRING LOCKWASHERS.



SLOT TO HOLD HEAD OF ⅜" HEX HEAD BOLT. THE BOLT SHALL BE 1¼" LONG, WITH FULL THREADS, A MEDIUM WASHER, AND GALVANIZED STEEL OR ALUMINUM SELF-LOCKING HEX HEAD NUT. THE BOLT HEAD MUST NOT TURN IN THE SLOT.



SECTION X-X



SECTION Y-Y

DETAILS FOR SIGN PANEL ATTACHMENT

MOUNTING CLAMP FOR SOCKET OR SLIPBASE

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12		Date:	Comments
Created By: SCL	R-1	12/29/20	BOLT LENGTH IN 'T AND U BRACKET ATTACHMENT' WASHER REQUIREMENTS IN SIGN PANEL ATTACHMENT
Last Modification Date: 12/29/20			
Last Modified By:DiNardo			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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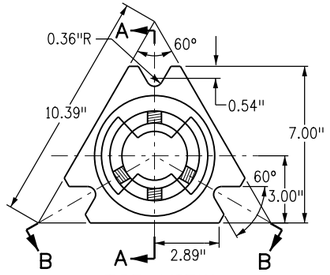
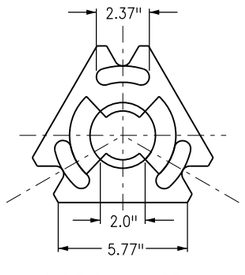
TUBULAR STEEL SIGN SUPPORT DETAILS

Issued By: Traffic & Safety Engineering Branch July 31, 2019

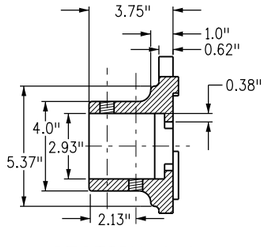
STANDARD PLAN NO.
S-614-8
Standard Sheet No. 2 of 7
Project Sheet Number:



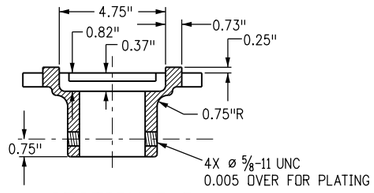
TOP VIEW



BOTTOM VIEW



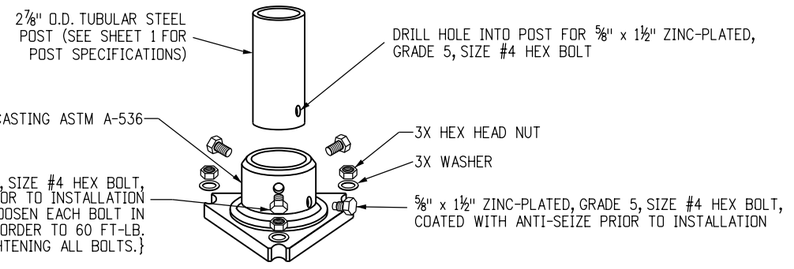
SECTION A-A



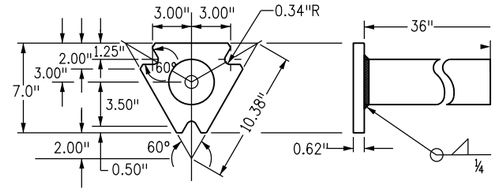
SECTION B-B

SLIPBASE CASTING 1

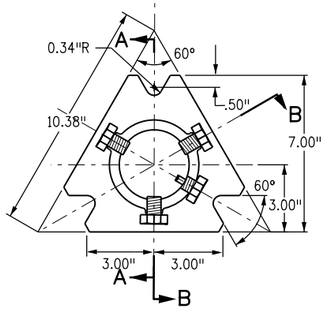
DIRECTION OF TRAVEL



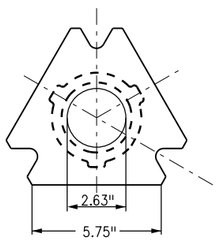
TYPICAL ASSEMBLY



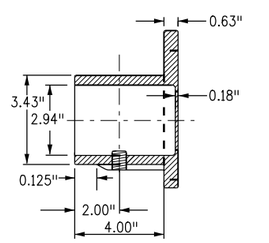
SLIPBASE STUB BASE



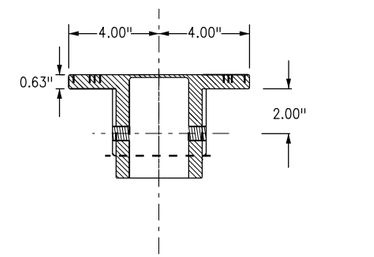
TOP VIEW



BOTTOM VIEW



SECTION A-A



SECTION B-B

SLIPBASE CASTING 2

DIRECTION OF TRAVEL

SLIPBASE CASTING REQUIREMENTS

FOR 2-7/8 INCH POSTS (P1 OR P2 POSTS)
GALVANIZED STEEL SLIPBASE CASTING ASTM-536

MOUNTING HARDWARE

- 3 - EACH 5/8 x 2 1/2 INCH LONG HEX BOLT
- 3 - EACH 5/8 x 1 INCH LONG ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT
- 1 - EACH 5/8 x 1 1/2 INCH LONG ZINC-PLATED, GRADE 5 SIZE #4 HEX BOLT
- 1 - EACH 30 GAUGE STEEL BOLT RETAINING PLATE ASTM A-563, G-90 COATING

ALL HARDWARE WILL BE GALVANIZED OR ZINC PLATED.

INSTALLATION REQUIREMENTS

ALL HEX BOLTS SHALL BE COATED WITH ANTI-SEIZE PRIOR TO INSTALLATION

TUBULAR STEEL SIGN SUPPORT SLIPBASE NOTES

1. REFER TO SIGNING PLANS FOR SIGN LOCATIONS AND HEIGHT
2. MINUMUM ALLOWABLE TENSION CAPACITY FOR WEDGE ANCHORS = 3000 LBS.
3. MAXIMUM ALLOWABLE MOMENT FOR SIGN BASE = 5.13 kip-ft.
4. PAY ITEM "STEEL SIGN SUPPORT(X-INCH ROUND)(SLIPBASE)" SHALL INCLUDE STUB BASE, CASTING AND NECESSARY HARDWARE (SLIPBASE CASTING MOUNTING HARDWARE AS SHOWN ON THIS SHEET)
5. PAY ITEM "STEEL SIGN SUPPORT CASTING" SHALL INCLUDE CASTING AND NECESSARY MOUNTING HARDWARE (SLIPBASE CASTING MOUNTING HARDWARE AS SHOWN ON THIS SHEET)
6. PAY ITEM "STEEL SIGN GROUND STUB BASE (36 INCH)" SHALL INCLUDE SLIPBASE STUB BASE

CAST-IN-PLACE SLIPBASE FOR NEW INSTALLATIONS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12		Date:	Comments
Created By: KEN	R-2	03/01/24	Updated typical assembly to include a drilled hole into the post for the Hex Bolt and added an optional third washer between retaining plate and slipbase.
Last Modification Date: 03/01/24			
Last Modified By: YSaucedo	R-1	12/29/20	5/8" x 2 1/2" HEX BOLTS FROM GRADE 5, SIZE #4 TO GRADE A325 IN 'TYPICAL ASSEMBLY'
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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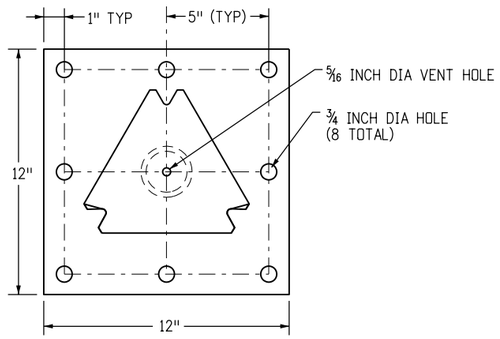
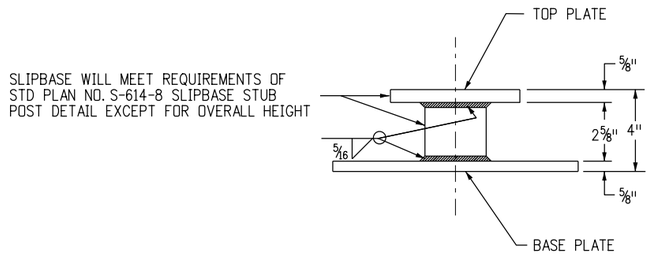
TUBULAR STEEL SIGN SUPPORT DETAILS

Issued By: Traffic & Safety Engineering Branch July 31, 2019

STANDARD PLAN NO.
S-614-8
Standard Sheet No. 3 of 7
Project Sheet Number:





SURFACE MOUNT SLIPBASE BASE PLATE

SURFACE MOUNT SLIPBASE BASE PLATE FABRICATION REQUIREMENTS

BASE PLATE - 3/4 INCH ASTM A 36 PLATE STEEL
PIPE STUB - 3 INCH NOMINAL SCHEDULE 80, ASTM A-500 GRADE B
TOP PLATE - MEET REQUIREMENTS OF SHEET 3

MEET ASTM A-123 GALVANIZING AFTER FABRICATION IS COMPLETE

SURFACE MOUNT SLIPBASE TUBULAR STEEL SIGN BASE REQUIREMENTS

FOR 2-7/8 INCH POSTS (P1 OR P2 POSTS)
FOR CONCRETE SURFACES GREATER THAN 7 INCHES THICK
FOR CONCRETE SURFACES GREATER THAN 12 INCHES IN WIDTH

MOUNTING HARDWARE

- 8 - EACH 5/8 x 5 1/2 INCH LONG "HILTI KWIK HUS-EZ SCREW ANCHORS
- 16 - EACH 5/8 INCH FLAT WASHERS
- 8 - EACH 5/8 INCH LOCK WASHERS
- 8 - EACH 5/8 INCH NUTS

ALL HARDWARE WILL BE GALVANIZED OR ZINC PLATED.

INSTALLATION REQUIREMENTS:

DRILL: (8) - 5/8 INCH HOLES 6 INCH DEEP, CLEAN HOLE PRIOR TO INSTALLING ANCHORS

USE ADDITIONAL WASHERS FOR SHIMMING TO LEVEL BASE PLATE.

TUBULAR STEEL SIGN SUPPORT SURFACE MOUNT SLIPBASE NOTES

1. REFER TO SIGNING PLANS FOR SIGN LOCATIONS AND HEIGHT
2. REFER TO SHEET 3 FOR SLIPBASE CASTING INFORMATION
3. MINUMUM ALLOWABLE TENSION CAPACITY FOR WEDGE ANCHORS = 3000 LBS.
4. MAXIMUM ALLOWABLE MOMENT FOR SIGN BASE = 5.13 kip-ft.
5. PAY ITEM "STEEL SIGN SURFACE MOUNT BASE PLATE (SLIPBASE)" SHALL INCLUDE BASE PLATE, CASTING AND ALL NECESSARY HARDWARE (SLIPBASE CASTING MOUNTING HARDWARE AS SHOWN ON SHEET 3 AND SURFACE MOUNT SLIPBASE MOUNTING HARDWARE AS SHOWN ON THIS SHEET)
6. PAY ITEM "STEEL SIGN SURFACE MOUNT BASE PLATE" SHALL INCLUDE BASE PLATE AND NECESSARY HARDWARE (SURFACE MOUNT SLIPBASE MOUNTING HARDWARE AS SHOWN ON THIS SHEET)

SURFACE MOUNT SLIPBASE FOR RETROFIT INSTALLATIONS

Computer File Information		Sheet Revisions	
Creation Date: 04/12/18		Date:	Comments
Created By: DiNardo	R-1	03/01/24	Revised note 2, 5 and 6.
Last Modification Date: 03/01/24			
Last Modified By: YSaucedo			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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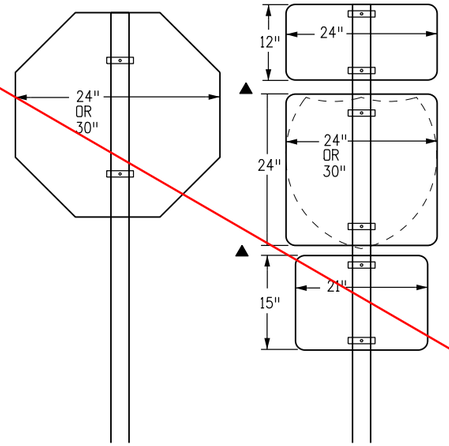
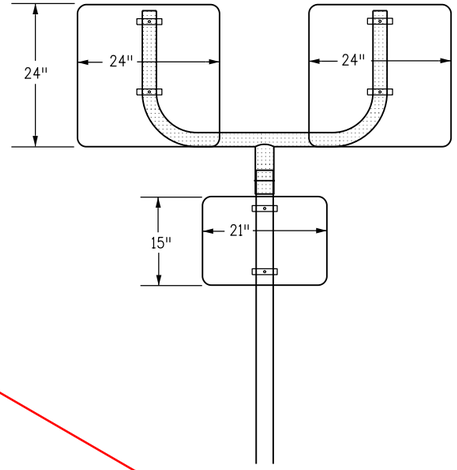
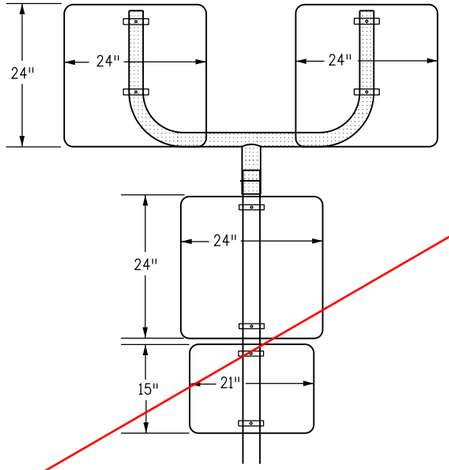
TUBULAR STEEL SIGN SUPPORT DETAILS

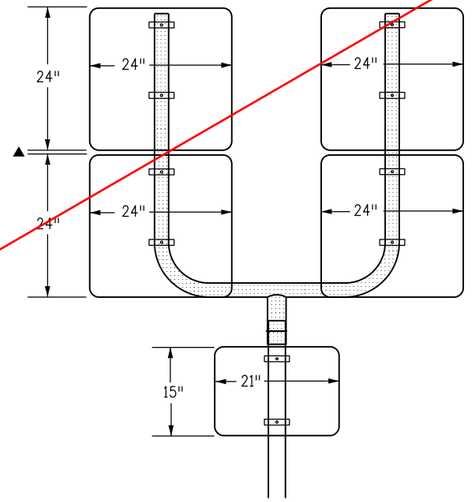
Issued By: Traffic & Safety Engineering Branch July 31, 2019

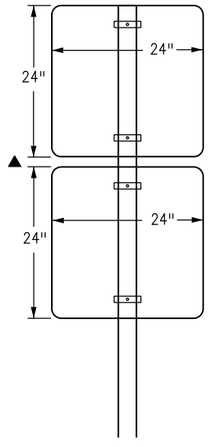
STANDARD PLAN NO.
S-614-8
Standard Sheet No. 4 of 7
Project Sheet Number:

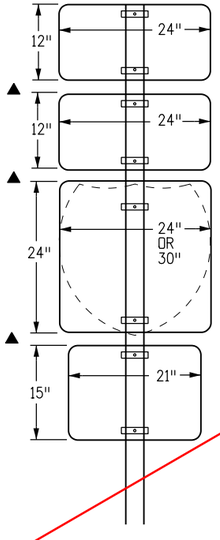


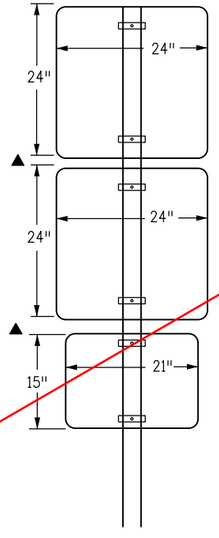




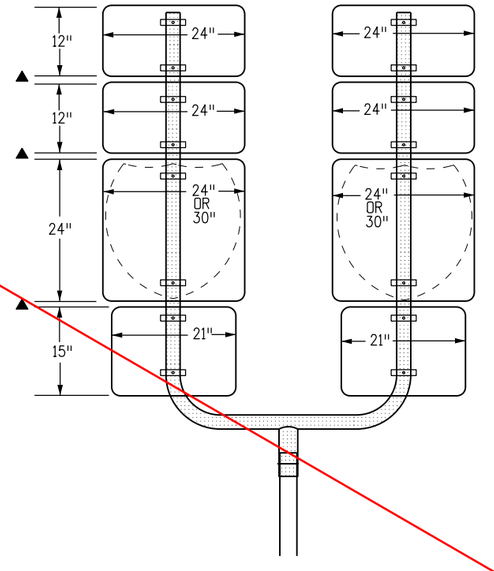








CLASS I SIGN COMBINATIONS (DIRECT ATTACHMENT)



CLASS I SIGN COMBINATIONS USING U-BRACKETS

▲ SEE NOTE 6 ON SHEET 6

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12		Date:	Comments
Created By: KEN	R-1	03/01/24	Revised reference note for vertical spacing.
Last Modification Date: 03/01/24			
Last Modified By: YSaucedo			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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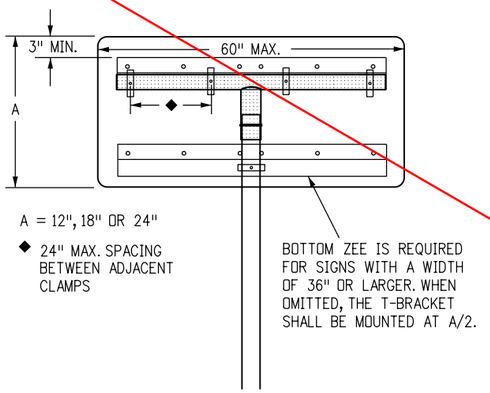
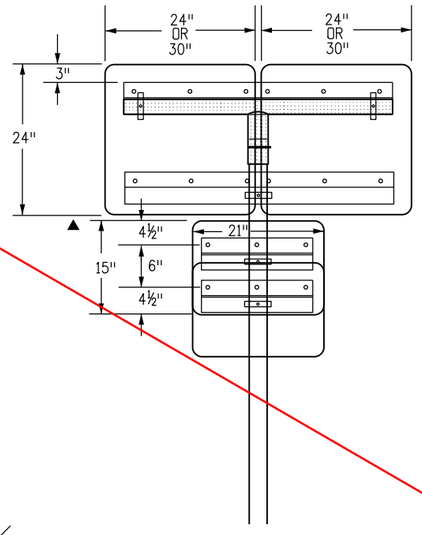
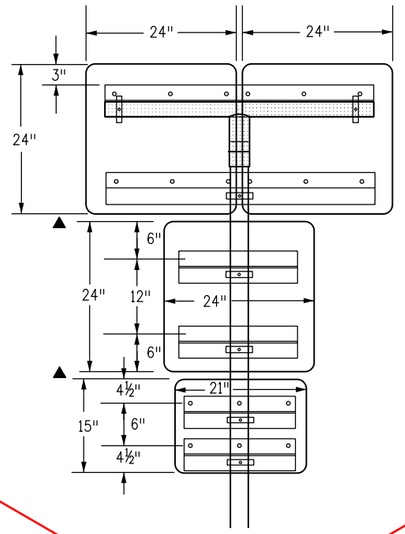
STANDARD PLAN NO.
S-614-8
Standard Sheet No. 5 of 7
Project Sheet Number:



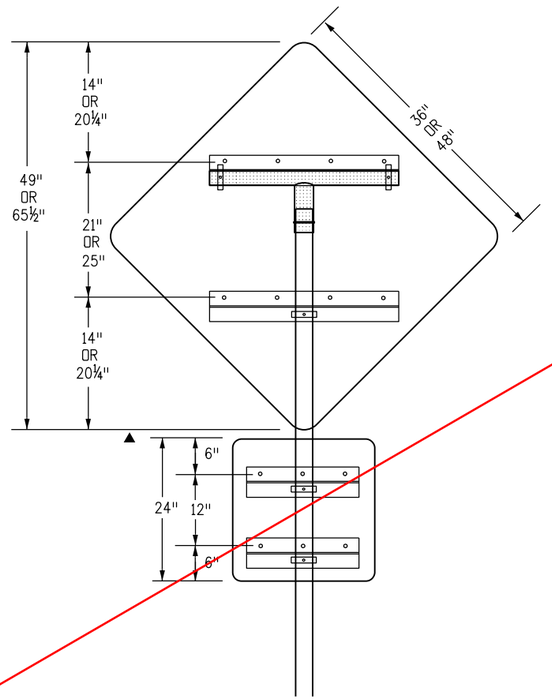


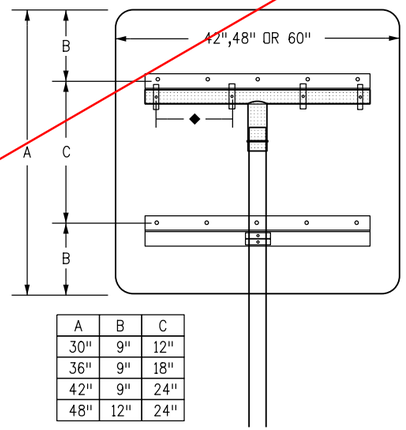


PANEL WIDTHS	ZEE LENGTH
21"	15"
24"	18"
30"	24"
36"	30"
42"	36"
45"	39"
48"	42"
54"	48"
60"	54"
36" DIAMOND	22"
48" DIAMOND	36"
24" & 24"	43"
24" & 30"	49"
30" & 30"	55"
36" & 36"	67"
45" & 36"	76"
24" & 24" & 24"	68"
24" & 24" & 30"	74"
24" & 30" & 24"	74"
30" & 24" & 30"	80"
24" & 30" & 30"	80"
30" & 30" & 30"	86"

NOTES

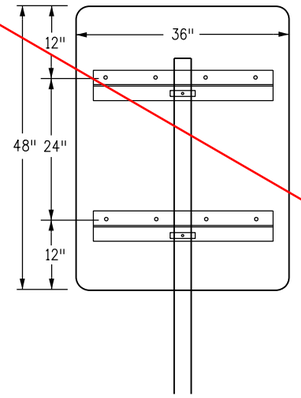
1. Z-BAR LENGTH SHALL BE 3 INCH (± ½ INCH) SHORT OF THE EDGE OF THE SIGN OR ROW OF SIGNS ON BOTH SIDES. THE ACCOMPANYING TABLE GIVES THE Z-BAR LENGTH FOR MOST TYPICAL PANEL COMBINATIONS.
2. FIRST AND LAST HOLES SHALL BE 2 INCH FROM EDGE OF Z-BAR. THE HOLES IN BETWEEN SHALL BE 6 INCH TO 8 INCH APART.
3. T AND U BRACKETS SHALL TERMINATE 2 INCHES TO 3 INCHES FROM EDGE OF SIGN PANEL. WHEN A ZEE IS CONNECTED TO A T-BRACKET, THEY SHALL BE THE SAME LENGTH EXCEPT WHEN THE ZEE MUST EXTEND BEYOND THE MAXIMUM LENGTH OF A T-BRACKET.
4. TWO MOUNTING CLAMPS ARE REQUIRED ON ZEES WHERE THERE IS ONLY ONE ZEE FOR THE PANEL AND THE ZEE IS ATTACHED TO ONLY ONE POST.
5. ZEES SHALL BE ATTACHED TO T-BRACKETS AND U-BRACKETS WITH U-BOLTS OR MOUNTING CLAMPS.
6. ▲ VERTICAL SPACING BETWEEN SIGN PANELS SHALL BE 1 INCH TO 1½ INCH TYPICAL.
7. IN SPECIAL CASES U-BRACKETS MAY BE USED TO MOUNT SIGNS THAT FACE DIFFERENT DIRECTIONS. THE ENGINEER SHALL DETERMINE THE ORIENTATION OF THE SIGN PANELS AND VERIFY THAT THE MAXIMUM ALLOWABLE WIND LOADS FOR THE POST ARE NOT EXCEEDED.

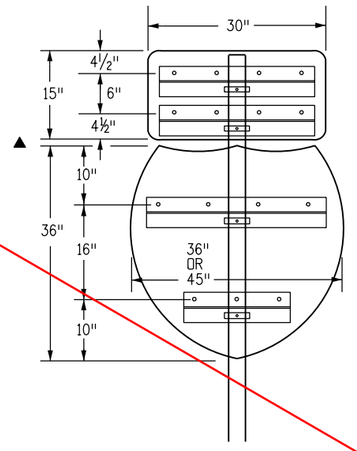




A	B	C
30"	9"	12"
36"	9"	18"
42"	9"	24"
48"	12"	24"

◆ 24" MAX. SPACING BETWEEN ADJACENT CLAMPS





CLASS II SIGN COMBINATIONS USING T-BRACKETS WITH Z-BAR

SINGLE POST CLASS II SIGNS USING Z-BAR

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12		Date:	Comments
Created By: KEN	R-1	03/01/24	Revised note 6.
Last Modification Date: 03/01/24			
Last Modified By: YSaucedo			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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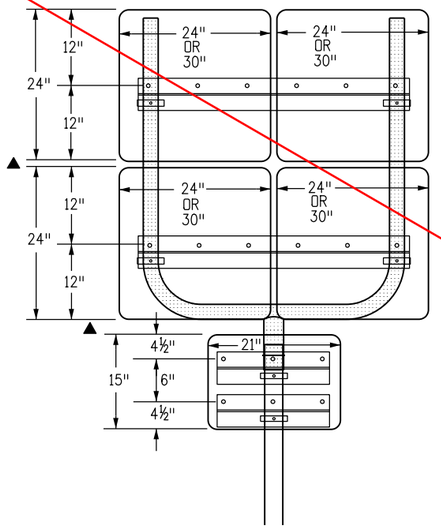
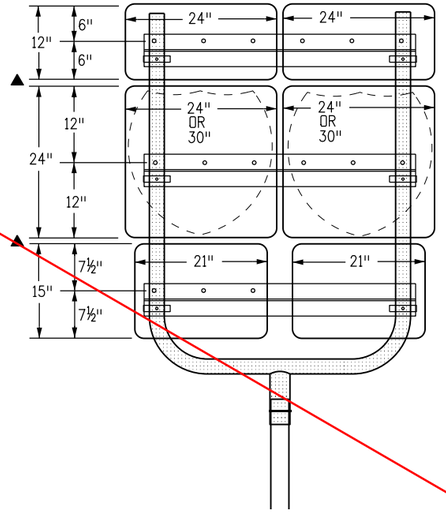
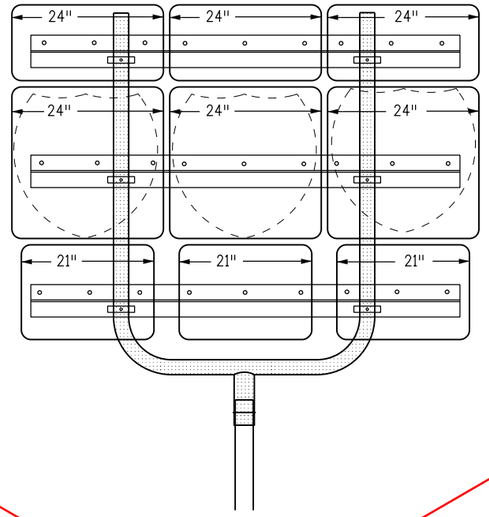
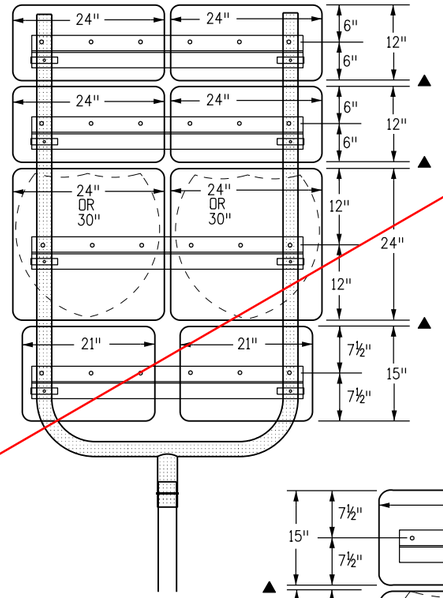
STANDARD PLAN NO.
S-614-8
Standard Sheet No. 6 of 7
Project Sheet Number:

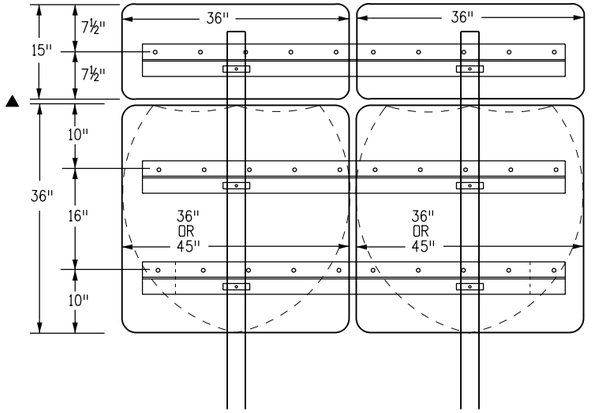






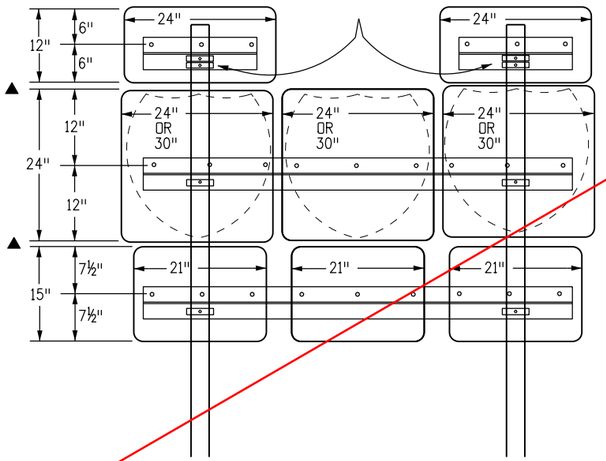


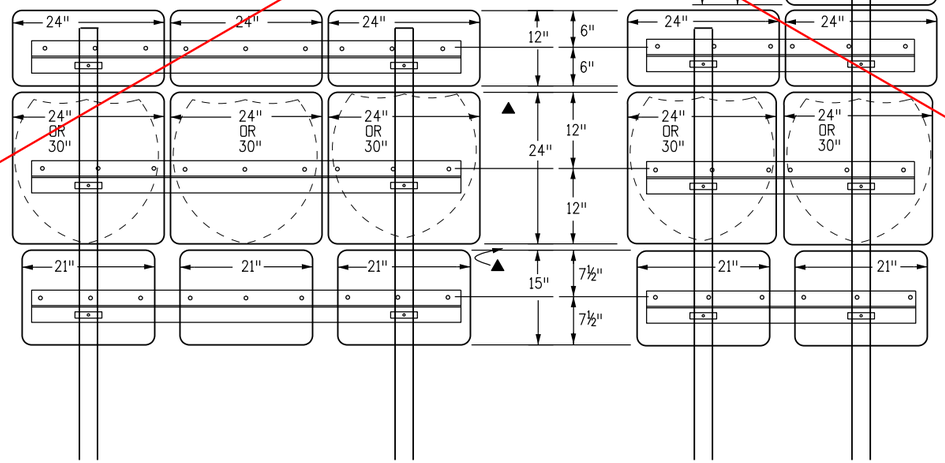
CLASS II SIGN COMBINATIONS USING U-BRACKETS

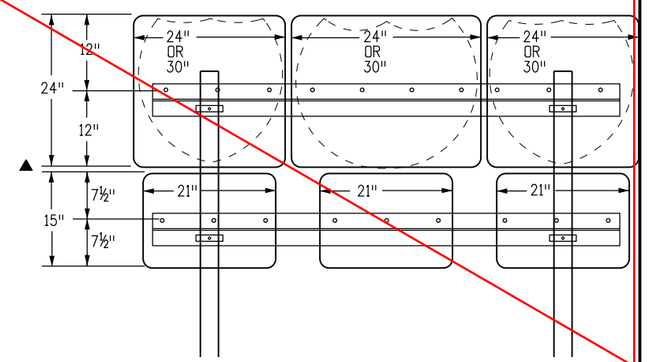


NOTE: THIS CONFIGURATION IS PREFERABLE TO USING TWO SEPARATE SIGNS.

SEE NOTE 4 ON SHEET 6







▲ SEE NOTE 6 ON SHEET 6

CLASS II SIGN COMBINATIONS USING TWO POSTS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12		Date:	Comments
Created By: KEN	R-1	03/01/24	Revised reference note for vertical spacing.
Last Modification Date: 03/01/24			
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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Issued By: Traffic & Safety Engineering Branch July 31, 2019

STANDARD PLAN NO.
S-614-8
Standard Sheet No. 7 of 7
Project Sheet Number: