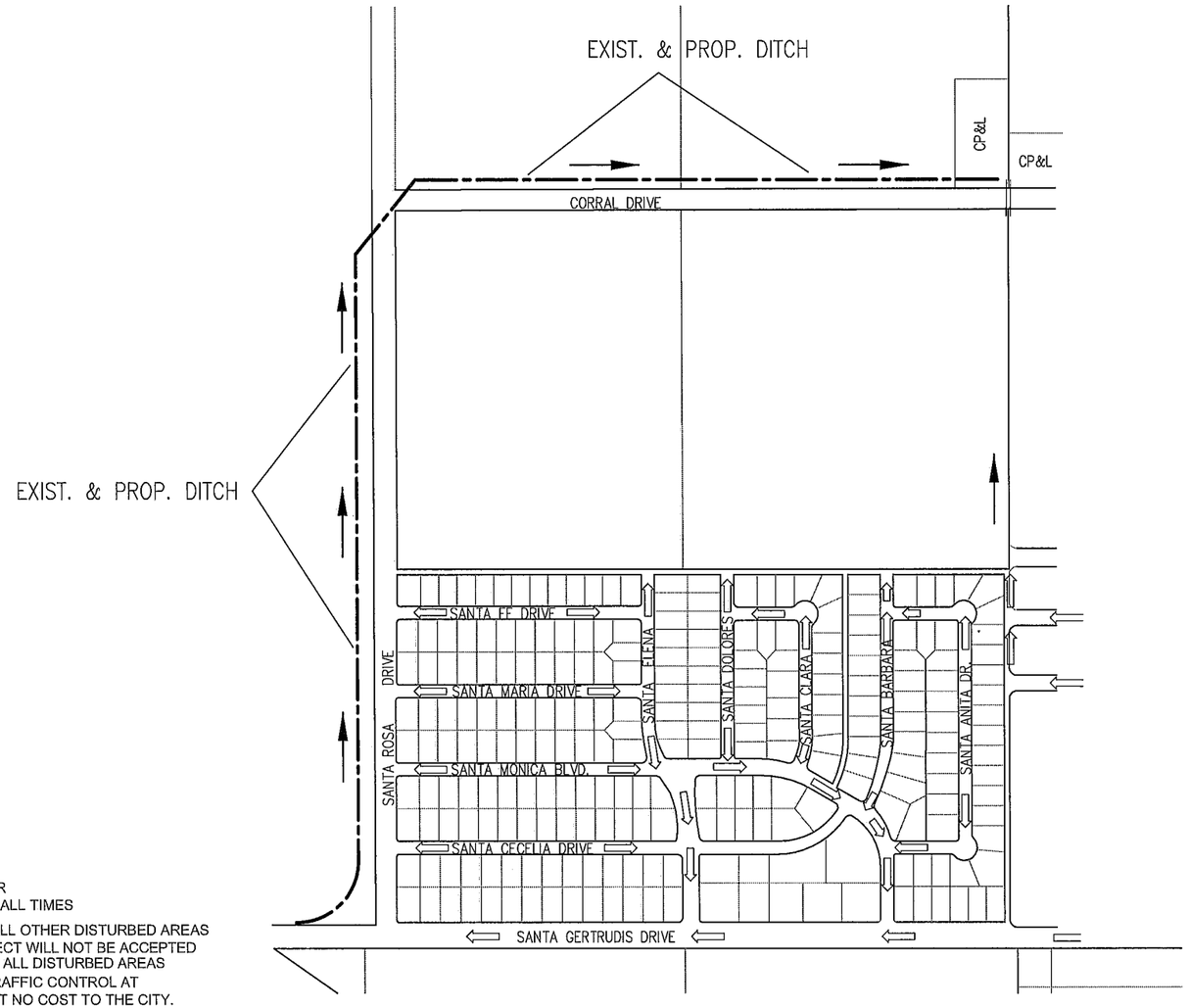
Santa Rosa & Corral Storm Drainage Improvement Project Specifications

CITY OF KINGSVILLE
SANTA ROSA & CORRAL DRAINAGE IMPROVEMENT



LOCATION MAP

N.T.S.

INDEX OF SHEETS

PLAN NOTES:

1) THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING A CLEAN WORK AREA AT ALL TIMES
2) BOTTOM & BANKS OF THE DITCH AND ALL OTHER DISTURBED AREAS MUST BE HYDROMULCHED. THE PROJECT WILL NOT BE ACCEPTED UNTIL 100% GRASS IS ESTABLISHED IN ALL DISTURBED AREAS
3) CONTRACTOR IS RESPONSIBLE FOR TRAFFIC CONTROL AT THE VICINITY OF THE PROJECT AREA AT NO COST TO THE CITY. All TRAFFIC CONTROL DEVISES MUST BE AS PER MUTCD, 2006 OR LATER EDITION
4) CONTRACTOR IS RESPONSIBLE FOR EROSION CONTROL AT NO COST TO THE CITY
5) CONTRACTOR SHALL CONFORM TO APPLICABLE REQUIREMENTS OF TCEQ, EPA, OSHA AND ANY OTHER REGULATORY AUTHORITY HAVING JURISDICTION OVER THE WORK
6) CONTRACTOR SHALL BE RESPONSIBLE FOR COMPACTION TEST AT FILL AREA AT NO COST TO THE CITY. ALL TEST MUST BE DONE BY A REPUTABLE GEOTECHNICAL COMPANY.

5/17/11

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY MD. NAIM UDDIN KHAN, P.E. #87776

STATE OF TEXAS — MD. NAIM UDDIN KHAN — 87776 — REGISTERED PROFESSIONAL ENGINEER

THESE CONSTRUCTION PLANS WERE PREPARED UNDER THE RESPONSIBLE SUPERVISION OF MD. NAIM UDDIN KHAN, REGISTERED PROFESSIONAL ENGINEER NO. 87776.

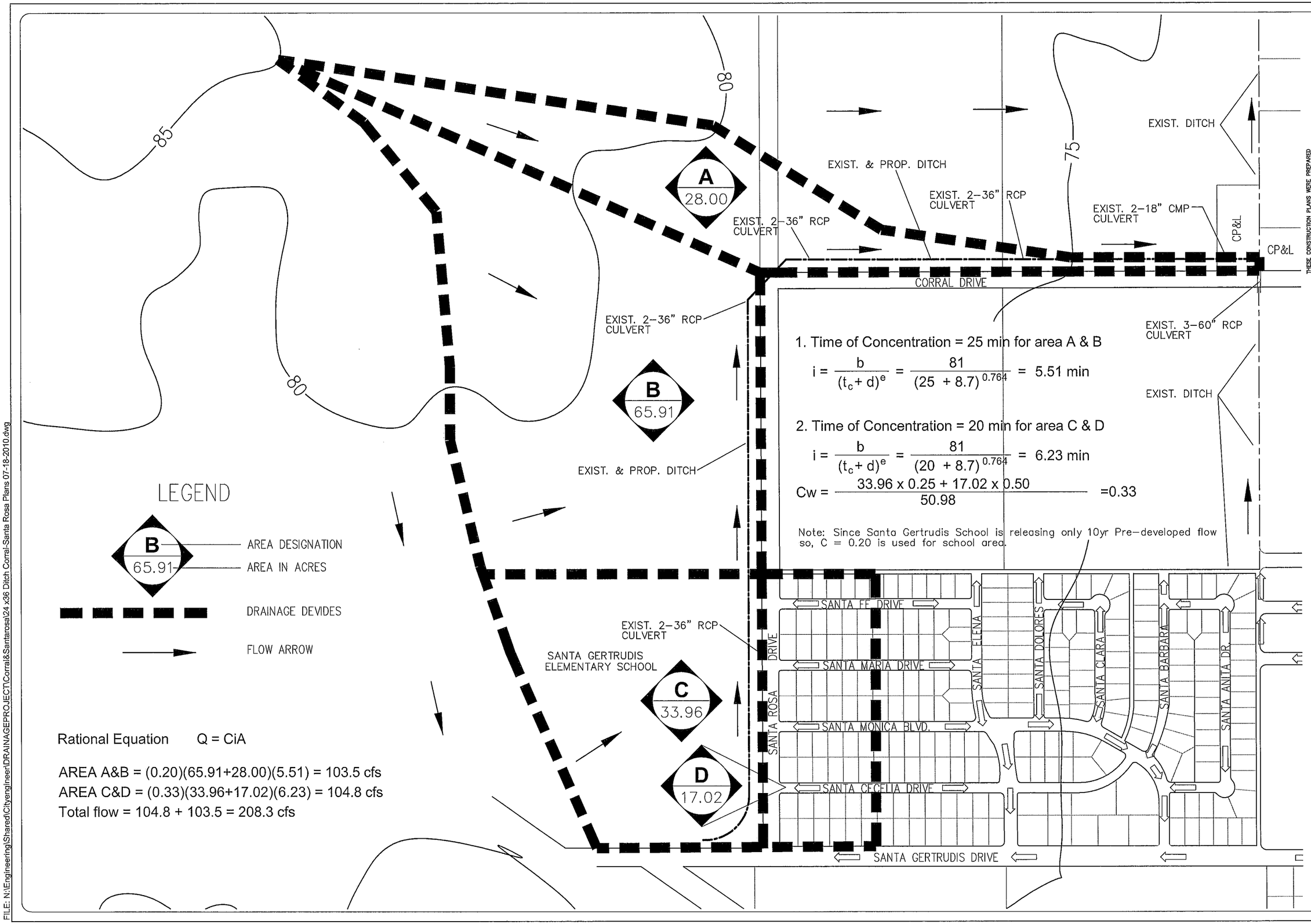
CAUTION ! ! !
UNDERGROUND UTILITIES

EXISTING UTILITIES AND UNDERGROUND FACILITIES INDICATED ON THESE PLANS HAVE BEEN LOCATED FROM REFERENCE INFORMATION SUPPLIED BY VARIOUS OWNERS OF THE FACILITIES. CITY OF KINGSVILLE DOES NOT ACCEPT THE RESPONSIBILITY FOR THE UTILITY LOCATIONS SHOWN. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY BOTH HORIZONTALLY AND VERTICALLY THE LOCATION OF ALL EXISTING UTILITIES AND UNDERGROUND FACILITIES PRIOR TO CONSTRUCTION, TO TAKE NECESSARY PRECAUTIONS IN ORDER TO PROTECT ALL FACILITIES ENCOUNTERED, AND TO NOTIFY THE ENGINEER PROMPTLY OF ALL CONFLICTS OF THE WORK WITH EXISTING FACILITIES. THE CONTRACTOR SHALL PRESERVE AND PROTECT ALL EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION. ANY DAMAGE BY THE CONTRACTOR TO EXISTING UTILITIES SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OR HER EXPENSE. CONTACT ALL POSSIBLE UTILITY AND UNDERGROUND FACILITY OWNERS.

CALL 1-800-DIG-TESS AT LEAST 72 HOURS PRIOR TO COMMENCING CONSTRUCTION IN VICINITY.

KLEBERG COUNTY, TEXAS

May, 2011



LEGEND

B — AREA DESIGNATION
65.91 — AREA IN ACRES

DRAINAGE DEVIDES

FLOW ARROW

1. Time of Concentration = 25 min for area A & B

$$i = \frac{b}{(t_c + d)^e} = \frac{81}{(25 + 8.7)^{0.764}} = 5.51 \text{ min}$$

2. Time of Concentration = 20 min for area C & D

$$i = \frac{b}{(t_c + d)^e} = \frac{81}{(20 + 8.7)^{0.764}} = 6.23 \text{ min}$$

$$Cw = \frac{33.96 \times 0.25 + 17.02 \times 0.50}{50.98} = 0.33$$

Note: Since Santa Gertrudis School is releasing only 10yr Pre-developed flow so, C = 0.20 is used for school area.

Rational Equation Q = CiA

AREA A&B = (0.20)(65.91+28.00)(5.51) = 103.5 cfs
AREA C&D = (0.33)(33.96+17.02)(6.23) = 104.8 cfs
Total flow = 104.8 + 103.5 = 208.3 cfs

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CITY OF KINGSVILLE
ENGINEERING DEPARTMENT
200 East Kleberg
Kingsville, Texas 78363
Office 361.595.8005
Fax 361.595.8035

STATE OF TEXAS — MD. NAIM UDDIN KHAN — 87776 — REGISTERED PROFESSIONAL ENGINEER

Revision: | Date: | Drawn by: A. Vigstol | Date: June 17, 2010 | Note: | H. Scale: 1" = 200' | V. Scale: N/A

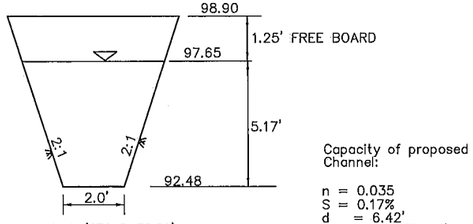
SANTA ROSA & CORRAL DITCH
DRAINAGE AREA MAP & CALCULATIONS

FILE: N:\Engineering\Shared\Cityengineer\DRAINAGEPROJECT\Corral&Santarosa\24 x36 Ditch Corral-Santa Rosa Plans 07-18-2010.dwg

TRIAL CULVERT									HEADWATER CALCULATION																		
		DEPTH RANGE D.R.			POSSIBLE CULVERT SIZES				INLET CONTROL					OUTLET CONTROL													
															CASE III HW = H + TW − L X S_o (feet)				CASE IV HW = H + h_o − L X S_o (feet)								
Trial Area of Opening $T.A_c = \frac{Q}{V_{max}}$ (sq. ft.)	Channel Width "W" (feet)	$\frac{T.A_c}{W}$ (feet)	AHW (feet)	Try Depth "D" (ft)	No. Openings	Width of Box "D" (ft.)	Total Culvert Area "A_c" (sf)	"Q" Each Opening (c.f.s.)	Entrance Type	Case No.	Q/B (c.f.s.)	$\frac{HW}{D}$	HW (feet)	Entrance Coeff. K_e	"H" (feet)	"TW" (feet)	L X S_o (feet)	"HW" (feet)	"H" (figure 27) (feet)	$h_o = \frac{d_c + D}{2}$ or h_o = TW (use larger) d_c (figure 30) (feet)	$\frac{d_c + D}{2}$ (feet)	"TW" (feet)	h_o (feet)	L X S_o (feet)	"HW" (feet)	The Greater Controlling Head Water (Inlet or Outlet) (feet)	SELECTED CONDUIT SIZE
1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
17.36	2	8.67	6.29	5	1	5	25	208.30	3A	I	41.66	1.25	6.25	0.70	2.05	5.17	0.22	7.0	2.05	3.7	4.35	5.17	5.17	0.22	7.0	7.0' (OUTLET)	1–5'x5' RCB

BM 1
STA. 1+28.27
OFF. 82.81 (LT.)
ELE. 100.00
BOX CUT ON TOP OF A CONC. BASE FOR A PVC CONDUIT NEXT TO A PP. APPROX. 47.5' SOUTH OF THE CL OF CORRAL AND 40' WEST OF THE CL OF A THE EXISTING DITCH.

NOTE: ALTERNATE OF HEADWALLS (TO BE FIELD DETERMINED):
1. AT STA. 12+25.0 AND 12+78.0 FLARED WINGWALLS MIGHT BE REPLACED WITH TxDOT SETP–PD AT STA. 12+22.79 & STA. 12+80.67 FOR 2–36" RCP CULVERT W/CONC. RIP–RAP ON BOTH SIDES.
2. CONCRETE RIP–RAP TO BE 6"–3000 PSI WITH #3 REBARS @ 18" O.C.E.W. AND TO BE INSTALLED FROM THE BOTTOM TO THE TOP OF SAFETY END TREATMENT ON BOTH SIDES.



SEC A–A (STA 2+52.69)
N.T.S.

Capacity of proposed Channel:
n = 0.035
S = 0.17%
d = 6.42'
$V_{average}$ = 3.72 ft/sec
Q_{CAP} = 354.75 c.f.s.

CULVERT DESIGN CALCULATIONS

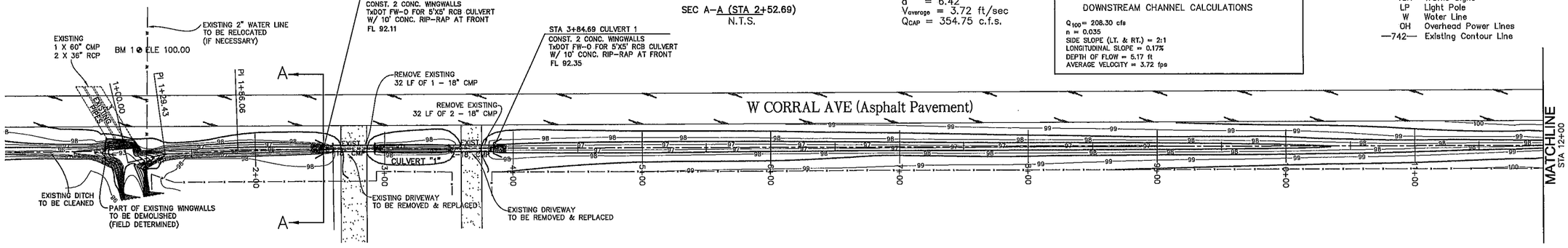
CULVERT LOCATION: KINGSVILLE, TEXAS
LENGTH, L 132.0 FT. DESIGN STORM FREQ. 10–YR
ROUGHNESS COEFF., n 0.012 MAX. VEL. 12.0 ft/sec
TAILWATER 6.42' D.S. CHANNEL WIDTH 2'
ENTRANCE DESCRIPTION 3A DESIGN DISCHARGE 208.30 cfs

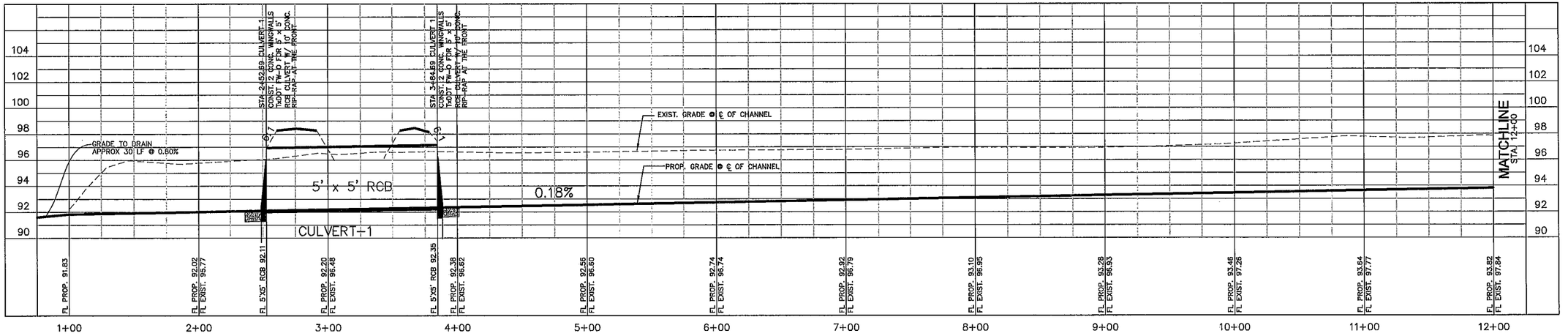
RDWY. ELEV. 99.00	U.S. CULV. F.L. 92.71
U.S. CULV. F.L. 92.71	D.S. CULV. F.L. 92.48
DIFFERENCE 5.17'	DIFFERENCE 0.23
REQ'D. FREEBOARD 0 FT.	CULV. SLOPE, S_o = DIFF. FT. / LENGTH FT.
ALLOW. HEADWATER 6.29 FT.	S_o = 0.23 FT. / 132.0 = 0.17%

DOWNSTREAM CHANNEL CALCULATIONS

Q_{100} = 208.30 cfs
n = 0.035
SIDE SLOPE (LT. & RT.) = 2:1
LONGITUDINAL SLOPE = 0.17%
DEPTH OF FLOW = 5.17 ft
AVERAGE VELOCITY = 3.72 fps

LEGEND
PP Power Pole
WV Water Valve
SN Sign
TSN Traffic Signs
LP Light Pole
W Water Line
OH Overhead Power Lines
—742— Existing Contour Line





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CITY OF KINGSVILLE
ENGINEERING DEPARTMENT
200 East Kleberg
Kingsville, Texas 78363
Office 361.595.8005
Fax 361.595.8035

Date:
Drawn by: A. Vigstol
Date: February 14, 2010
Note:
H. Scale: 1" = 40'
V. Scale: 1" = 4'
Revision:

SANTA ROSA & CORRAL DITCH
DITCH & CULVERT
PLAN, PROFILE & CALCULATIONS

FILE: N:\Engineering\Shared\Cityengineer\DRAINAGEPROJECT\Corral&Santarosa\24 x36 Ditch Corral-Santa Rosa Plans 07-18-2010.dwg

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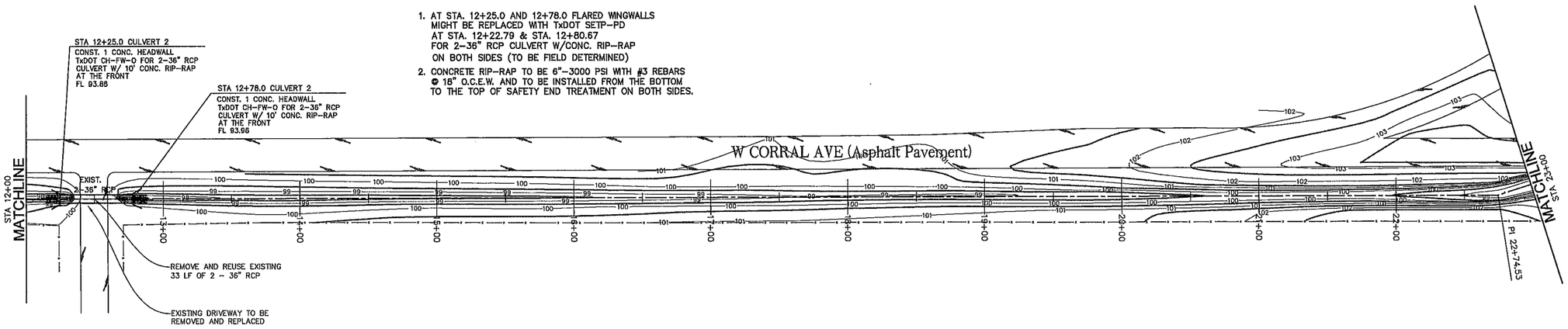

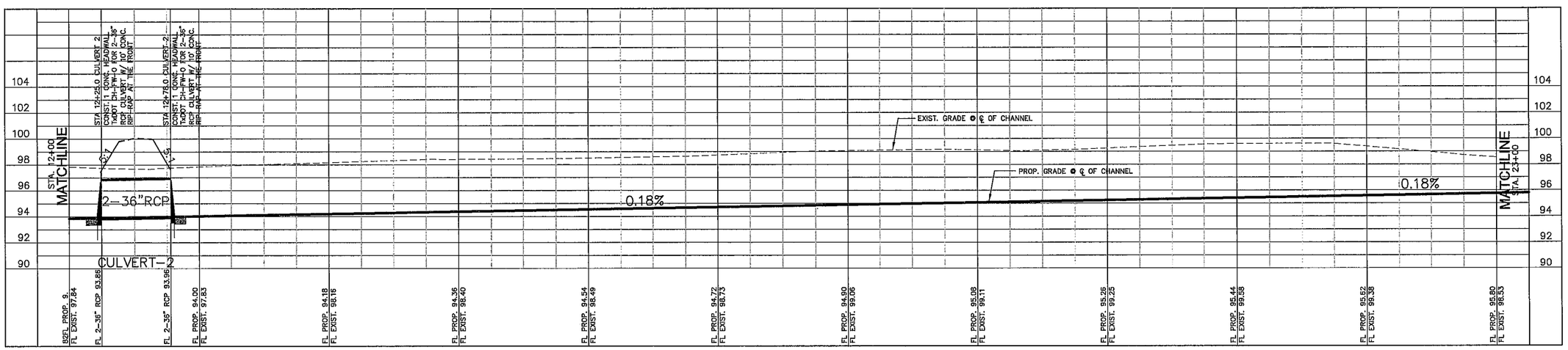

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Fax 361.595.8035

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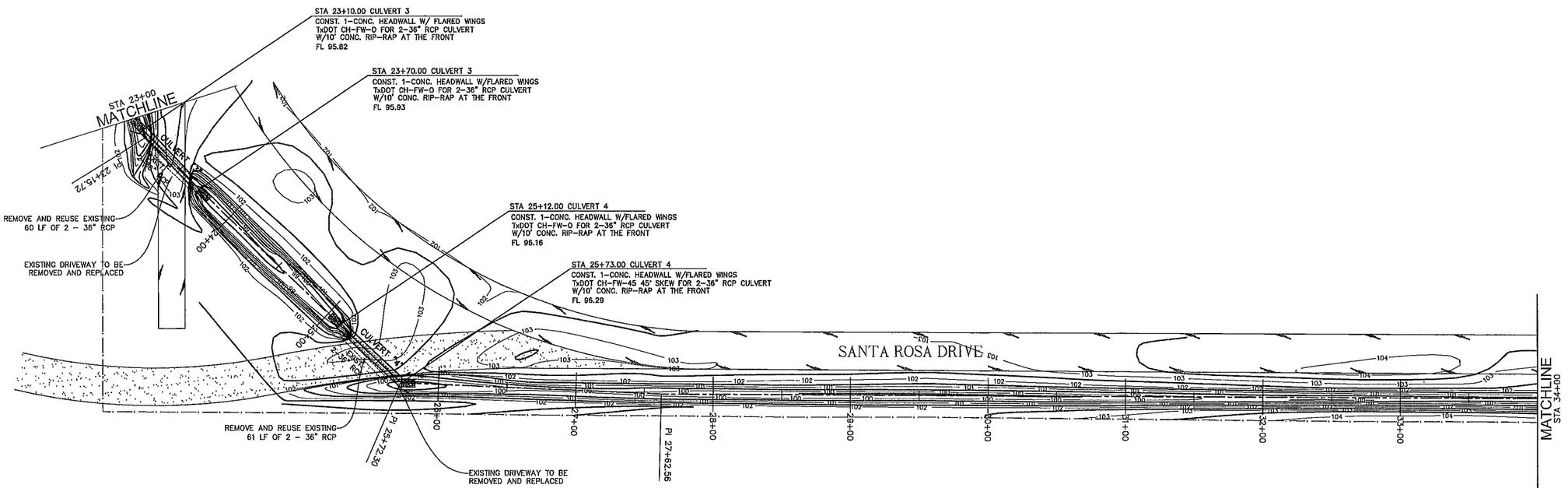

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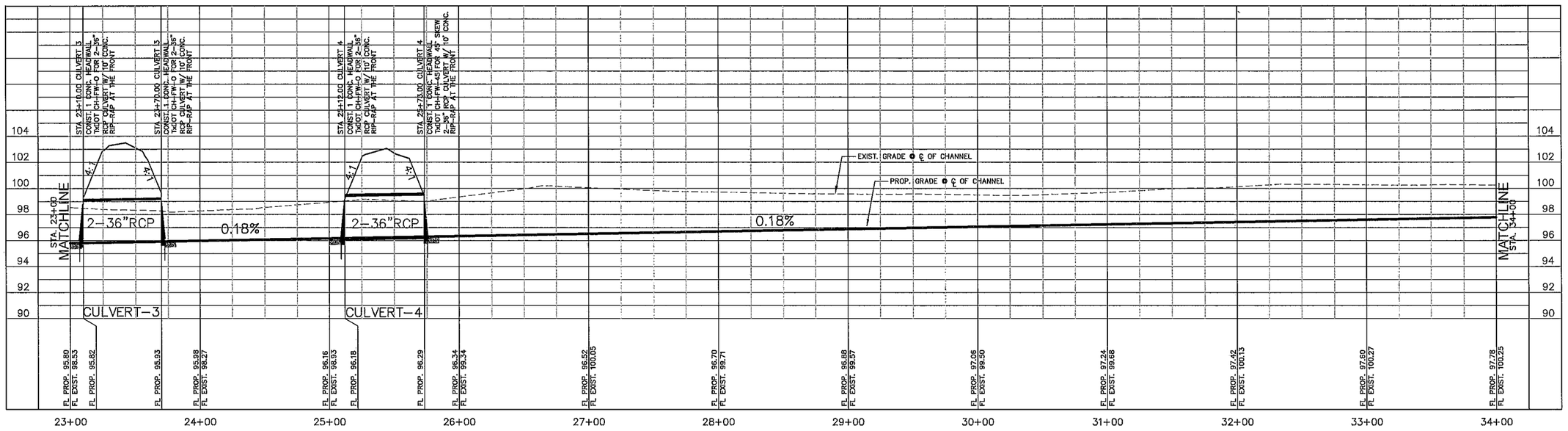

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Fax 361.595.8035

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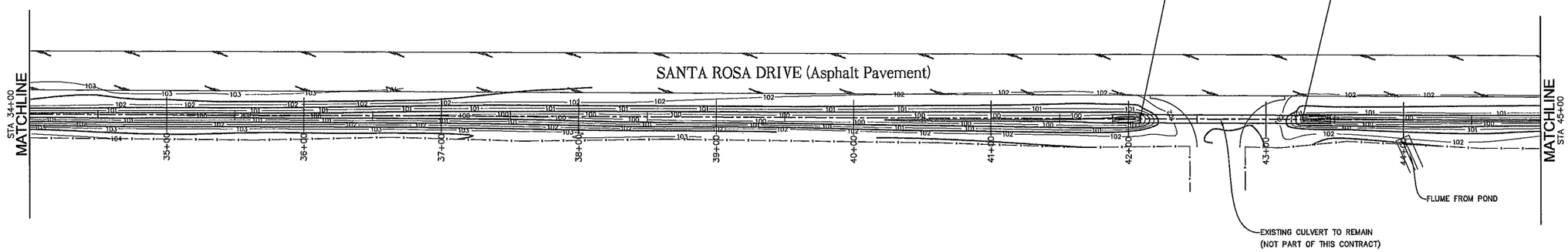

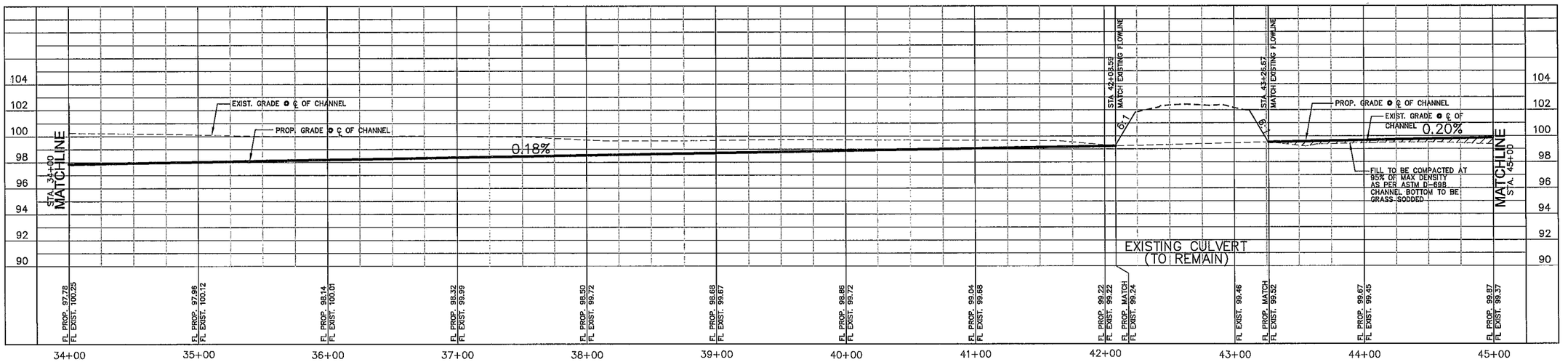

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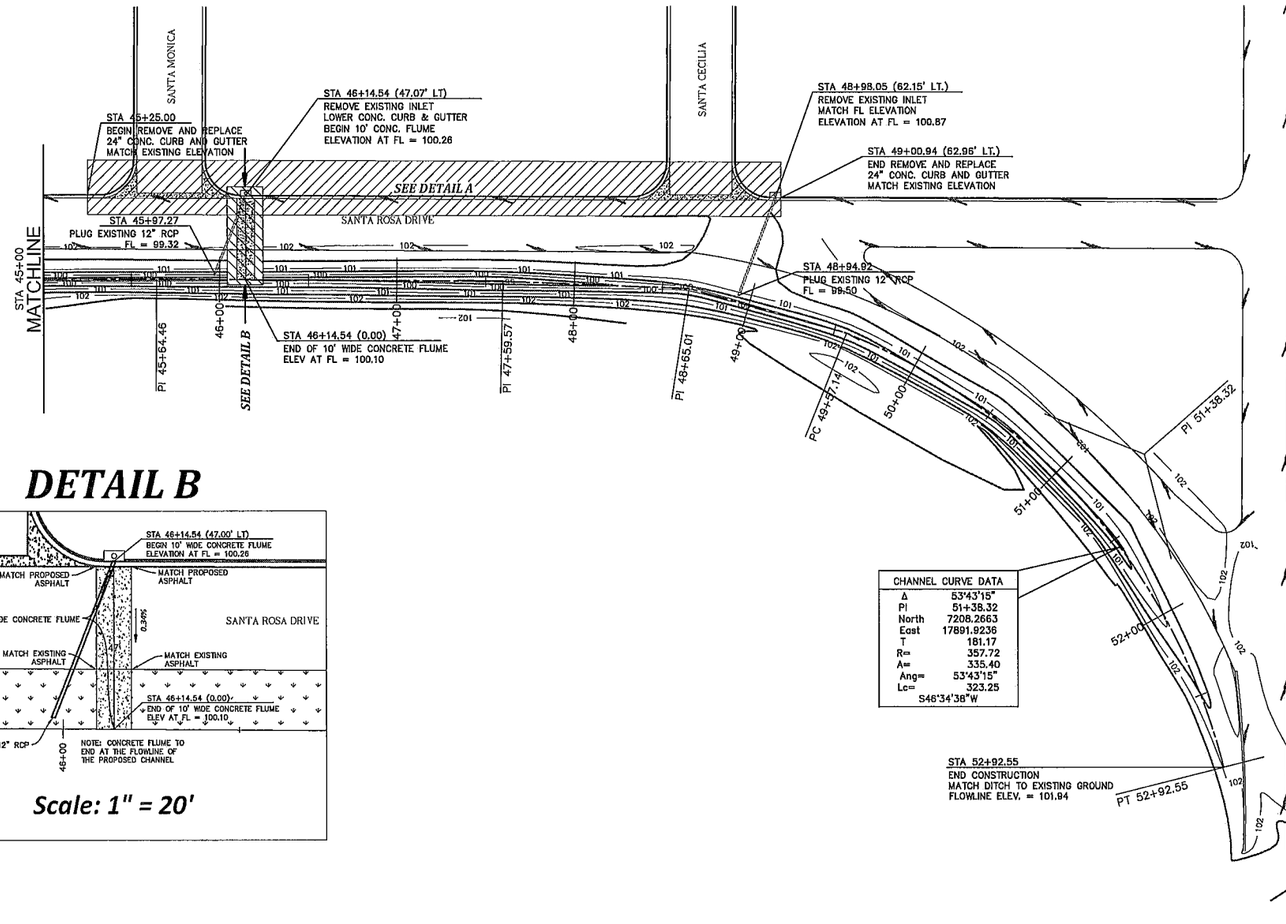
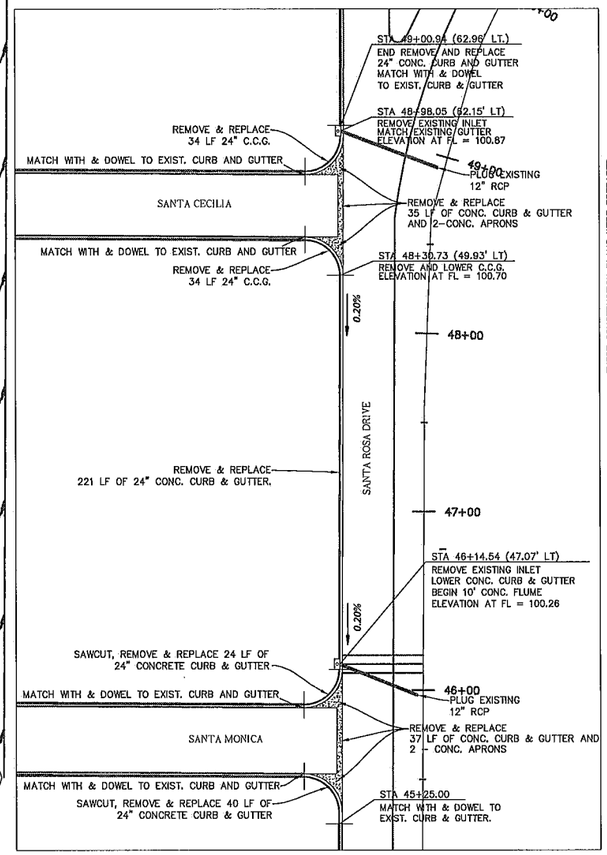
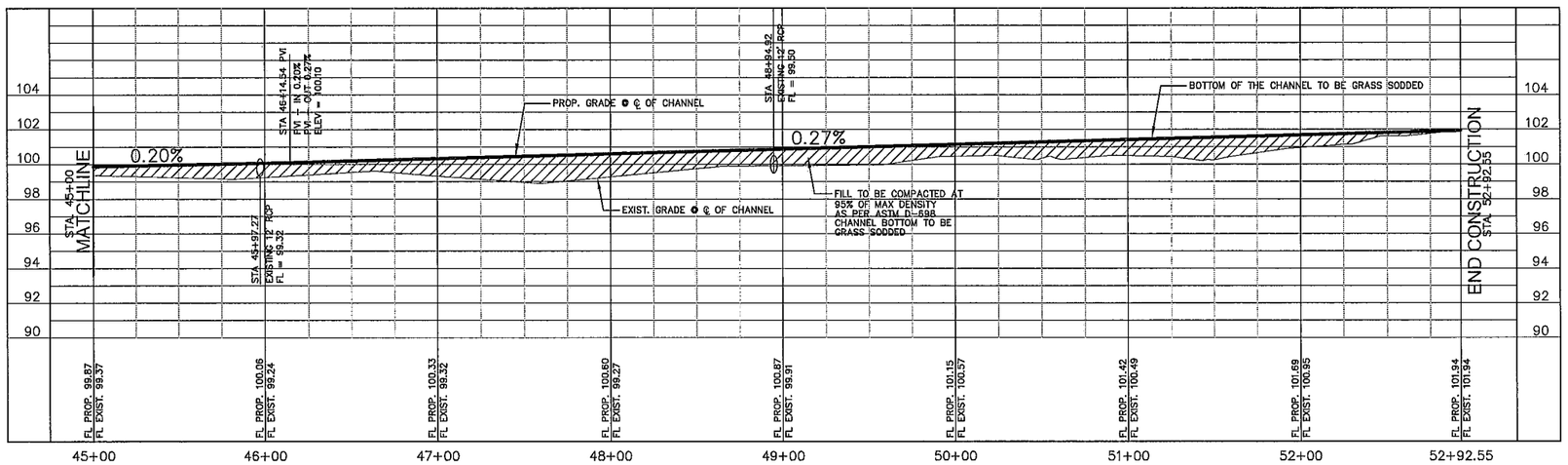


DETAIL B

Scale: 1" = 20'

DETAIL A





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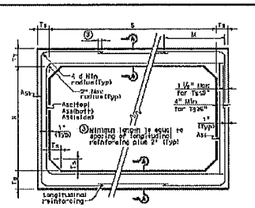
BOX DATA

SECTION DIMENSIONS					FILL Height	W mats	REINFORCING (in/ft) ②							Unit Weight (tons)
S (ft)	H (ft)	T_1 (in)	T_2 (in)	T_3 (in)	(ft)	(in)	A_{s1}	A_{s2}	A_{s3}	A_{s4}	A_{s5}	A_{s6}	A_{s7}	
5	3	8	7	6	CF	-	0.19	0.31	0.21	0.14	0.19	0.19	0.19	0.17
5	4	8	8	6	0-3	4S	0.19	0.31	0.19	0.14	-	-	-	-
5	5	8	8	6	3-5	5S	0.19	0.34	0.19	0.14	-	-	-	-
5	5	8	8	6	5-10	5S	0.19	0.34	0.19	0.14	-	-	-	-
5	5	8	8	6	10	5S	0.19	0.34	0.19	0.17	-	-	-	-
5	5	8	8	6	15	5S	0.19	0.15	0.21	0.28	-	-	-	-
5	5	8	8	6	20	5S	0.19	0.31	0.27	0.28	-	-	-	-
5	5	8	8	6	25	5S	0.19	0.34	0.34	0.28	-	-	-	-
5	5	8	8	6	30	5S	0.19	0.34	0.41	0.28	-	-	-	-
6	3	8	7	6	CF	-	0.19	0.23	0.24	0.14	0.19	0.19	0.19	0.17
6	4	8	8	6	0-3	4S	0.19	0.27	0.22	0.14	-	-	-	-
6	4	8	8	6	3-5	4S	0.19	0.27	0.19	0.14	-	-	-	-
6	4	8	8	6	5-10	5S	0.19	0.34	0.19	0.14	-	-	-	-
6	4	8	8	6	15	5S	0.19	0.34	0.23	0.24	0.14	-	-	-
6	4	8	8	6	20	5S	0.19	0.34	0.27	0.28	0.14	-	-	-
6	4	8	8	6	25	5S	0.19	0.34	0.34	0.28	0.14	-	-	-
6	4	8	8	6	30	5S	0.19	0.34	0.41	0.28	0.14	-	-	-
6	5	8	8	6	CF	-	0.19	0.31	0.26	0.14	0.19	0.19	0.19	0.17
6	5	8	8	6	0-3	4S	0.19	0.29	0.24	0.14	-	-	-	-
6	5	8	8	6	3-5	4S	0.19	0.31	0.19	0.14	-	-	-	-
6	5	8	8	6	5-10	4S	0.19	0.34	0.19	0.14	-	-	-	-
6	5	8	8	6	15	5S	0.19	0.34	0.24	0.28	0.14	-	-	-
6	5	8	8	6	20	5S	0.19	0.34	0.29	0.28	0.14	-	-	-
6	5	8	8	6	25	5S	0.19	0.34	0.34	0.28	0.14	-	-	-
6	5	8	8	6	30	5S	0.19	0.34	0.41	0.28	0.14	-	-	-
6	6	8	8	6	CF	-	0.20	0.31	0.28	0.14	0.22	0.19	0.19	0.17
6	6	8	8	6	30	6S	0.23	0.33	0.34	0.14	-	-	-	-

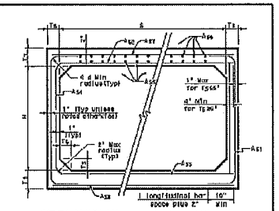
① Per box length = 6'-0"

② Min Bars Ast/ft and Asx are minimum required areas of reinforcement per linear foot of box length. Asx and Ass are minimum required areas of reinforcement per linear foot of box width.

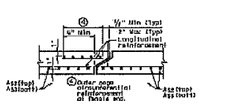
④ These designs were designed by TxDOT and are not shown to the ASTM specifications.



FILL HEIGHT 2 FT AND GREATER



FILL HEIGHT LESS THAN 2 FT



SECTION A-A

(TOP AND BOTTOM SLAB JOINT REINFORCEMENT)

GENERAL NOTES:
Designs shown conform to ASTM C1612, Standard Specification for Concrete Pipe.

All concrete shall be Class "A" Concrete with a minimum compressive strength of 3,000 psi.

See SCP-18 standard sheet for alternate barrels and apron not shown.

Slab and wall thickness designs shown on this sheet are for non-skew angles. Alternate slab thickness may be used in lieu of the thickness shown for the design fill height in the table. Shop plans for alternate designs shall be submitted in accordance with Item "Precast Concrete Structures".

H-20 LOADING

Texas Department of Transportation — Bridge Division

SINGLE BOX CULVERTS PRECAST 5'-0" SPAN

SCP-5

FILE: pcp18x05x00.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	JOB:
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ELEVATION

Showing dimensions

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL ③

SLOPE (H:V)	Values for one Pipe				Reinforcing (Lbs) ①	Concrete (CY) ①	Reinforcing (Lbs) ①	Concrete (CY) ①
	W	X	Y	L	X and W		Y	
18"	1'-7 7/8"	2'-4"	2'-10"	3'-2 1/2"	84	0.4	79	0.3
24"	2'-2 5/8"	2'-8 1/2"	3'-4 1/2"	3'-9 1/2"	93	0.5	84	0.3
30"	2'-9 1/2"	3'-1"	3'-10"	4'-3 1/2"	125	0.6	93	0.3
36"	3'-4 1/4"	3'-5 1/2"	4'-4 1/2"	4'-9 1/2"	155	0.8	125	0.4
42"	3'-11"	3'-10"	4'-10"	5'-3 1/2"	155	0.9	155	0.5
48"	4'-5 3/4"	4'-2 1/2"	5'-4 1/2"	5'-9 1/2"	155	1.0	155	0.6
54"	5'-0 1/2"	4'-7"	5'-10"	6'-3 1/2"	173	1.2	155	0.6
60"	5'-7 3/8"	4'-11 1/2"	6'-4"	6'-9 1/2"	173	1.3	155	0.7
66"	6'-2 1/8"	5'-4"	6'-10"	7'-3 1/2"	173	1.4	155	0.8
72"	6'-9"	5'-8 1/2"	7'-4"	7'-9 1/2"	173	1.5	155	0.8
78"	7'-3 3/4"	6'-1"	7'-10"	8'-3 1/2"	173	1.6	155	0.9
84"	7'-10 5/8"	6'-5 1/2"	8'-4"	8'-9 1/2"	173	1.7	155	0.9
90"	8'-5 1/2"	6'-10"	8'-10"	9'-3 1/2"	173	1.8	155	1.0
96"	9'-0 3/8"	7'-2 1/2"	9'-4"	9'-9 1/2"	173	1.9	155	1.0
102"	9'-7 1/4"	7'-7"	9'-10"	10'-3 1/2"	173	2.0	155	1.1
108"	10'-2"	7'-11 1/2"	10'-4"	10'-9 1/2"	173	2.1	155	1.1
114"	10'-8 7/8"	8'-4"	10'-10"	11'-3 1/2"	173	2.2	155	1.2
120"	11'-3 3/4"	8'-8 1/2"	11'-4"	11'-9 1/2"	173	2.3	155	1.2
126"	11'-10 5/8"	9'-1"	11'-10"	12'-3 1/2"	173	2.4	155	1.3
132"	12'-5 1/2"	9'-5 1/2"	12'-4"	12'-9 1/2"	173	2.5	155	1.3
138"	13'-0 3/8"	9'-10"	12'-10"	13'-3 1/2"	173	2.6	155	1.4
144"	13'-7 1/4"	10'-2 1/2"	13'-4"	13'-9 1/2"	173	2.7	155	1.4

SLOPE (H:V)	Values for one Pipe				Reinforcing (Lbs) ①	Concrete (CY) ①	Reinforcing (Lbs) ①	Concrete (CY) ①
	W	X	Y	L	X and W		Y	
18"	1'-7 7/8"	2'-4"	3'-10"	3'-2 1/2"	84	0.4	79	0.3
24"	2'-2 5/8"	2'-8 1/2"	4'-4 1/2"	3'-9 1/2"	93	0.5	84	0.3
30"	2'-9 1/2"	3'-1"	4'-10"	4'-3 1/2"	125	0.6	93	0.3
36"	3'-4 1/4"	3'-5 1/2"	5'-4 1/2"	4'-9 1/2"	155	0.8	125	0.4
42"	3'-11"	3'-10"	5'-10"	5'-3 1/2"	155	0.9	155	0.5
48"	4'-5 3/4"	4'-2 1/2"	6'-4 1/2"	5'-9 1/2"	155	1.0	155	0.6
54"	5'-0 1/2"	4'-7"	6'-10"	6'-3 1/2"	173	1.2	155	0.6
60"	5'-7 3/8"	4'-11 1/2"	7'-4"	6'-9 1/2"	173	1.3	155	0.7
66"	6'-2 1/8"	5'-4"	7'-10"	7'-3 1/2"	173	1.4	155	0.8
72"	6'-9"	5'-8 1/2"	8'-4"	7'-9 1/2"	173	1.5	155	0.8
78"	7'-3 3/4"	6'-1"	8'-10"	8'-3 1/2"	173	1.6	155	0.9
84"	7'-10 5/8"	6'-5 1/2"	9'-4"	8'-9 1/2"	173	1.7	155	0.9
90"	8'-5 1/2"	6'-10"	9'-10"	9'-3 1/2"	173	1.8	155	1.0
96"	9'-0 3/8"	7'-2 1/2"	10'-4"	9'-9 1/2"	173	1.9	155	1.0
102"	9'-7 1/4"	7'-7"	10'-10"	10'-3 1/2"	173	2.0	155	1.1
108"	10'-2"	7'-11 1/2"	11'-4"	10'-9 1/2"	173	2.1	155	1.1
114"	10'-8 7/8"	8'-4"	11'-10"	11'-3 1/2"	173	2.2	155	1.2
120"	11'-3 3/4"	8'-8 1/2"	12'-4"	11'-9 1/2"	173	2.3	155	1.2
126"	11'-10 5/8"	9'-1"	12'-10"	12'-3 1/2"	173	2.4	155	1.3
132"	12'-5 1/2"	9'-5 1/2"	13'-4"	12'-9 1/2"	173	2.5	155	1.3
138"	13'-0 3/8"	9'-10"	13'-10"	13'-3 1/2"	173	2.6	155	1.4
144"	13'-7 1/4"	10'-2 1/2"	14'-4"	13'-9 1/2"	173	2.7	155	1.4

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

② For multiple barrels, burrs shall project in more than 2 planes (radial planes). Bevel heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities due to additional compensation will be allowed for this work.

③ Provide a 1'-0" flashing as shown where required to maintain 4" min cover for 24 gauge.

④ Quantities shown are for one structure and only one headwall.

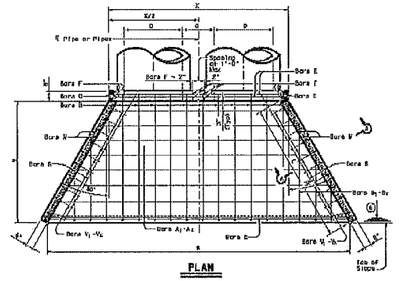
⑤ Min Length = $6' + 2' \times \left(\frac{12' \times H - 3'}{12' \times L}\right)$

Max Length = $12' \times R - 3' \times \left(\frac{12' \times H - 2'}{12' \times L}\right) - 1'$

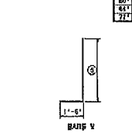
⑥ Lengths of wings based on 6:1 slope along side flow.

TABLE OF REINFORCING STEEL			
Bar	Size	Spa	No.
A	# 4	1'-0"	-
B	# 3	1'-0"	-
C	# 4	1'-0"	-
D	# 3	1'-0"	-
E	# 5	-	4
F	# 5	-	4
G	# 3	-	2
H	# 4	-	2
J	# 4	1'-0"	-
K	# 3	-	2
L	# 4	1'-0"	-
M	# 3	-	2
N	# 3	-	1
P	# 5	-	1
R	# 5	-	1
W	# 3	-	4

TABLE OF CONSTANT DIMENSIONS			
D (in)	D	E	H
12"	1'-0"	2'-0"	2'-0"
18"	1'-6"	2'-0"	2'-3"
24"	2'-0"	2'-0"	2'-6"
30"	2'-6"	2'-0"	2'-9"
36"	3'-0"	2'-0"	3'-0"
42"	3'-6"	2'-0"	3'-3"
48"	4'-0"	2'-0"	3'-6"
54"	4'-6"	2'-0"	3'-9"
60"	5'-0"	2'-0"	4'-0"
66"	5'-6"	2'-0"	4'-3"
72"	6'-0"	2'-0"	4'-6"



PLAN



GENERAL NOTES:
Designs according to AASHTO LRFD specifications.

Reinforcing steel shall be placed with a minimum concrete cover of 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

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

The pipe radii of any type may be rounded directly to these culvert headwalls.

Texas Department of Transportation — Bridge Division

CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW PIPE CULVERTS

CH-FW-0

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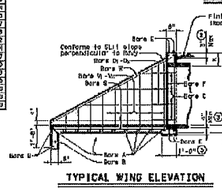

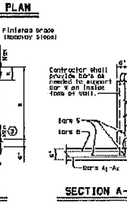

CORNER DETAILS

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

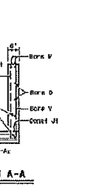

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL ①

SLOPE (H:V)	Values for one Pipe				Reinforcing (Lbs) ②	Concrete (CY) ②	Reinforcing (Lbs) ②	Concrete (CY) ②
	W	X	Y	L	X and W		Y	
18"	1'-7 7/8"	2'-4"	2'-10"	3'-2 1/2"	84	0.4	79	0.3
24"	2'-2 5/8"	2'-8 1/2"	3'-4 1/2"	3'-9 1/2"	93	0.5	84	0.3
30"	2'-9 1/2"	3'-1"	3'-10"	4'-3 1/2"	125	0.6	93	0.3
36"	3'-4 1/4"	3'-5 1/2"	4'-4 1/2"	4'-9 1/2"	155	0.8	125	0.4
42"	3'-11"	3'-10"	4'-10"	5'-3 1/2"	155	0.9	155	0.5
48"	4'-5 3/4"	4'-2 1/2"	5'-4 1/2"	5'-9 1/2"	155	1.0	155	0.6
54"	5'-0 1/2"	4'-7"	5'-10"	6'-3 1/2"	173	1.2	155	0.6
60"	5'-7 3/8"	4'-11 1/2"	6'-4"	6'-9 1/2"	173	1.3	155	0.7
66"	6'-2 1/8"	5'-4"	6'-10"	7'-3 1/2"	173	1.4	155	0.8
72"	6'-9"	5'-8 1/2"	7'-4"	7'-9 1/2"	173	1.5	155	0.8
78"	7'-3 3/4"	6'-1"	7'-10"	8'-3 1/2"	173	1.6	155	0.9
84"	7'-10 5/8"	6'-5 1/2"	8'-4"	8'-9 1/2"	173	1.7	155	0.9
90"	8'-5 1/2"	6'-10"	8'-10"	9'-3 1/2"	173	1.8	155	1.0
96"	9'-0 3/8"	7'-2 1/2"	9'-4"	9'-9 1/2"	173	1.9	155	1.0
102"	9'-7 1/4"	7'-7"	9'-10"	10'-3 1/2"	173	2.0	155	1.1
108"	10'-2"	7'-11 1/2"	10'-4"	10'-9 1/2"	173	2.1	155	1.1
114"	10'-8 7/8"	8'-4"	10'-10"	11'-3 1/2"	173	2.2	155	1.2
120"	11'-3 3/4"	8'-8 1/2"	11'-4"	11'-9 1/2"	173	2.3	155	1.2
126"	11'-10 5/8"	9'-1"	11'-10"	12'-3 1/2"	173	2.4	155	1.3
132"	12'-5 1/2"	9'-5 1/2"	12'-4"	12'-9 1/2"	173	2.5	155	1.3
138"	13'-0 3/8"	9'-10"	12'-10"	13'-3 1/2"	173	2.6	155	1.4
144"	13'-7 1/4"	10'-2 1/2"	13'-4"	13'-9 1/2"	173	2.7	155	1.4

SLOPE (H:V)	Values for one Pipe				Reinforcing (Lbs) ②	Concrete (CY) ②	Reinforcing (Lbs) ②	Concrete (CY) ②
	W	X	Y	L	X and W		Y	
18"	1'-7 7/8"	2'-4"	3'-10"	3'-2 1/2"	84	0.4	79	0.3
24"	2'-2 5/8"	2'-8 1/2"	4'-4 1/2"	3'-9 1/2"	93	0.5	84	0.3
30"	2'-9 1/2"	3'-1"	4'-10"	4'-3 1/2"	125	0.6	93	0.3
36"	3'-4 1/4"	3'-5 1/2"	5'-4 1/2"	4'-9 1/2"	155	0.8	125	0.4
42"	3'-11"	3'-10"	5'-10"	5'-3 1/2"	155	0.9	155	0.5
48"	4'-5 3/4"	4'-2 1/2"	6'-4 1/2"	5'-9 1/2"	155	1.0	155	0.6
54"	5'-0 1/2"	4'-7"	6'-10"	6'-3 1/2"	173	1.2	155	0.6
60"	5'-7 3/8"	4'-11 1/2"	7'-4"	6'-9 1/2"	173	1.3	155	0.7
66"	6'-2 1/8"	5'-4"	7'-10"	7'-3 1/2"	173	1.4	155	0.8
72"	6'-9"	5'-8 1/2"	8'-4"	7'-9 1/2"	173	1.5	155	0.8
78"	7'-3 3/4"	6'-1"	8'-10"	8'-3 1/2"	173	1.6	155	0.9
84"	7'-10 5/8"	6'-5 1/2"	9'-4"	8'-9 1/2"	173	1.7	155	0.9
90"	8'-5 1/2"	6'-10"	9'-10"	9'-3 1/2"	173	1.8	155	1.0
96"	9'-0 3/8"	7'-2 1/2"	10'-4"	9'-9 1/2"	173	1.9	155	1.0
102"	9'-7 1/4"	7'-7"	10'-10"	10'-3 1/2"	173	2.0	155	1.1
108"	10'-2"	7'-11 1/2"	11'-4"	10'-9 1/2"	173	2.1	155	1.1
114"	10'-8 7/8"	8'-4"	11'-10"	11'-3 1/2"	173	2.2	155	1.2
120"	11'-3 3/4"	8'-8 1/2"	12'-4"	11'-9 1/2"	173	2.3	155	1.2
126"	11'-10 5/8"	9'-1"	12'-10"	12'-3 1/2"	173	2.4	155	1.3
132"	12'-5 1/2"	9'-5 1/2"	13'-4"	12'-9 1/2"	173	2.5	155	1.3
138"	13'-0 3/8"	9'-10"	13'-10"	13'-3 1/2"	173	2.6	155	1.4
144"	13'-7 1/4"	10'-2 1/2"	14'-4"	13'-9 1/2"	173	2.7	155	1.4

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

② Provide a 1'-0" flashing as shown where required to maintain 4" min cover for 24 gauge.

③ Min Length = $6' + 2' \times \left(\frac{12' \times H - 3'}{12' \times L}\right)$

Max Length = $12' \times R - 3' \times \left(\frac{12' \times H - 2'}{12' \times L}\right) - 1'$

④ Lengths of wings based on 6:1 slope along side flow.

TABLE OF REINFORCING STEEL			
Bar	Size	Spa	No.
A	# 4	1'-0"	-
B	# 3	1'-0"	-
C	# 4	1'-0"	-
D	# 3	1'-0"	-
E	# 5	-	4
F	# 5	-	4
G	# 3	-	2
H	# 4	-	2
J	# 4	1'-0"	-
K	# 3	-	2
L	# 4	1'-0"	-
M	# 3	-	2
N	# 3	-	1
P	# 5	-	1
R	# 5	-	1
W	# 3	-	4

TABLE OF CONSTANT DIMENSIONS			
D (in)	D	E	H
12"	1'-0"	2'-0"	2'-0"
18"	1'-6"	2'-0"	2'-3"
24"	2'-0"	2'-0"	2'-6"
30"	2'-6"	2'-0"	2'-9"
36"	3'-0"	2'-0"	3'-0"
42"	3'-6"	2'-0"	3'-3"
48"	4'-0"	2'-0"	3'-6"
54"	4'-6"	2'-0"	3'-9"
60"	5'-0"	2'-0"	4'-0"
66"	5'-6"	2'-0"	4'-3"
72"	6'-0"	2'-0"	4'-6"

PLAN

GENERAL NOTES:
Designs according to AASHTO LRFD specifications.

Reinforcing steel shall be placed with a minimum concrete cover of 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

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

The pipe radii of any type may be rounded directly to these culvert headwalls.

Texas Department of Transportation — Bridge Division

CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW PIPE CULVERTS

CH-FW-0

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REVISIONS					

CORNER DETAILS

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

THESE CONSTRUCTION PLANS WERE PREPARED UNDER THE SUPERVISION OF MD. NAIM-UDDIN KHAN, REGISTERED PROFESSIONAL ENGINEER NO. 87776.

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY MD. NAIM UDDIN KHAN, P.E. #87776

5/17/11

CITY OF KINGSVILLE
ENGINEERING DEPARTMENT

200 East Kleberg
Kingsville, Texas 78363
Office 361.595.8005
Fax 361.595.8035

STATE OF TEXAS — MD. NAIM UDDIN KHAN — 87776 — REGISTERED PROFESSIONAL ENGINEER

Revision:

Date:

Drawn by: A. Vigstol

Date: February 14, 2010

Note:

H. Scale: 1" = 40'

V. Scale: 1" = 4'

SANTA ROSA & CORRAL DITCH

DETAILS

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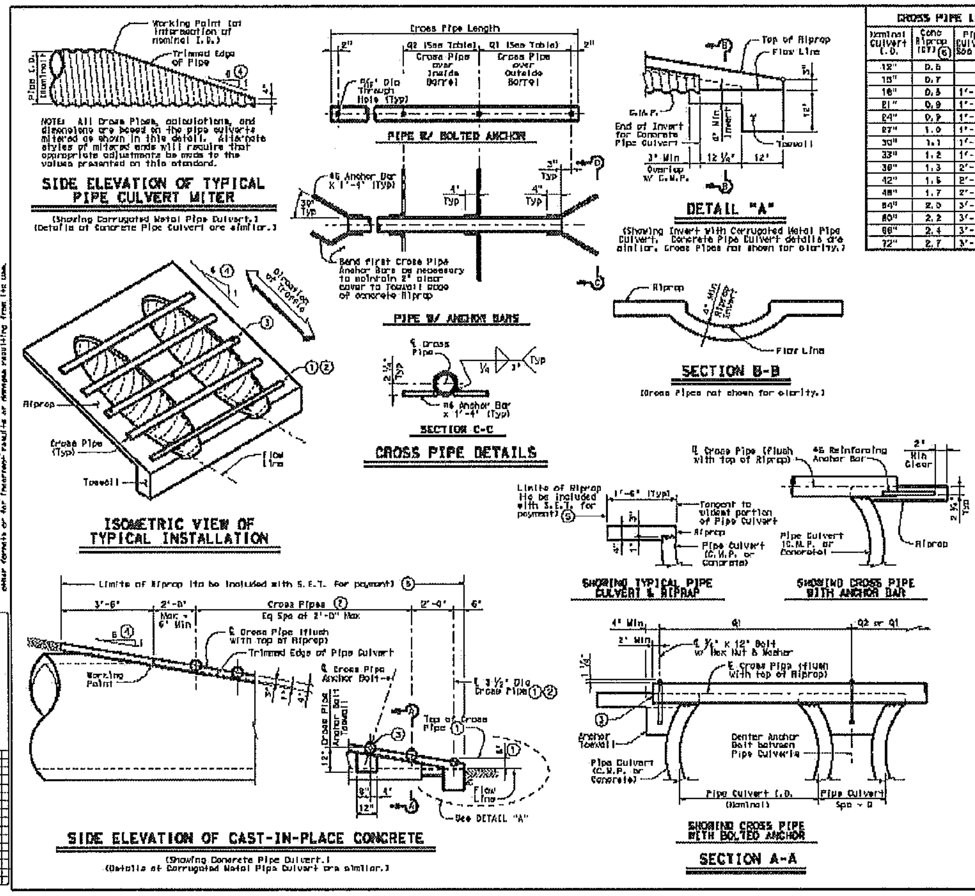

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, & RIPRAP QUANTITIES (6)

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ D	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for Use of Cross Pipes	Cross Pipe Size
12"	0.6	9"	N/A	2'- 1"	1'- 9"	3 or more Pipe Culverts	3" Std (3.500" O.D.)
15"	0.7	11"	N/A	2'- 5"	2'- 2"		
18"	0.8	1'- 2"	N/A	2'-10"	2'- 8"		
21"	0.9	1'- 4"	N/A	3'- 2"	3'- 1"		
24"	0.9	1'- 7"	N/A	3'- 6"	3'- 7"		
27"	1.0	1'- 8"	N/A	3'-10"	3'-11"	3 or more Pipe Culverts	3 ½" Std (4.000" O.D.)
30"	1.1	1'-10"	N/A	4'- 2"	4'- 4"	2 or more Pipe Culverts	
33"	1.2	1'-11"	4'- 2"	4'- 6"	4'- 8"	All Pipe Culverts	
36"	1.3	2'- 1"	4'- 6"	4'- 9"	5'- 1"	All Pipe Culverts	4" Std (4.500" O.D.)
42"	1.5	2'- 4"	4'-11"	5'- 6"	5'-10"		
48"	1.7	2'- 7"	5'- 6"	6'- 0"	6'- 7"	All Pipe Culverts	5" Std (5.563" O.D.)
54"	2.0	3'- 0"	6'-11"	6'- 9"	7'- 6"		
60"	2.2	3'- 3"	6'- 5"	7'- 4"	8'- 3"		
66"	2.4	3'- 3"	6'-11"	7'-10"	8'- 9"		
72"	2.7	3'- 4"	7'- 5"	8'- 5"	9'- 4"		

(1) The proper installation of the first Cross Pipe is critical for vehicle safety. The top of the first Cross Pipe must be placed at no more than 5" above the flow line.

(2) Size of Cross Pipes, except the first bottom pipe, shall be as shown in the PIPE SIZE table. The first bottom pipe shall be 3 ½" Standard Pipe (4" O.D.).

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

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

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

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

GENERAL NOTES:

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

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

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

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

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

Bolts and nuts shall conform to ASTM A307.

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

Texas Department of Transportation
Bridge Division

SAFETY END TREATMENT
FOR 12" DIA TO 72" DIA
PIPE CULVERTS
TYPE II ~ PARALLEL DRAINAGE

SETP-PD

ALTERNATE OF CONC. HEADWALL TxDOT CH-FW-0 FOR 2-36" RCP

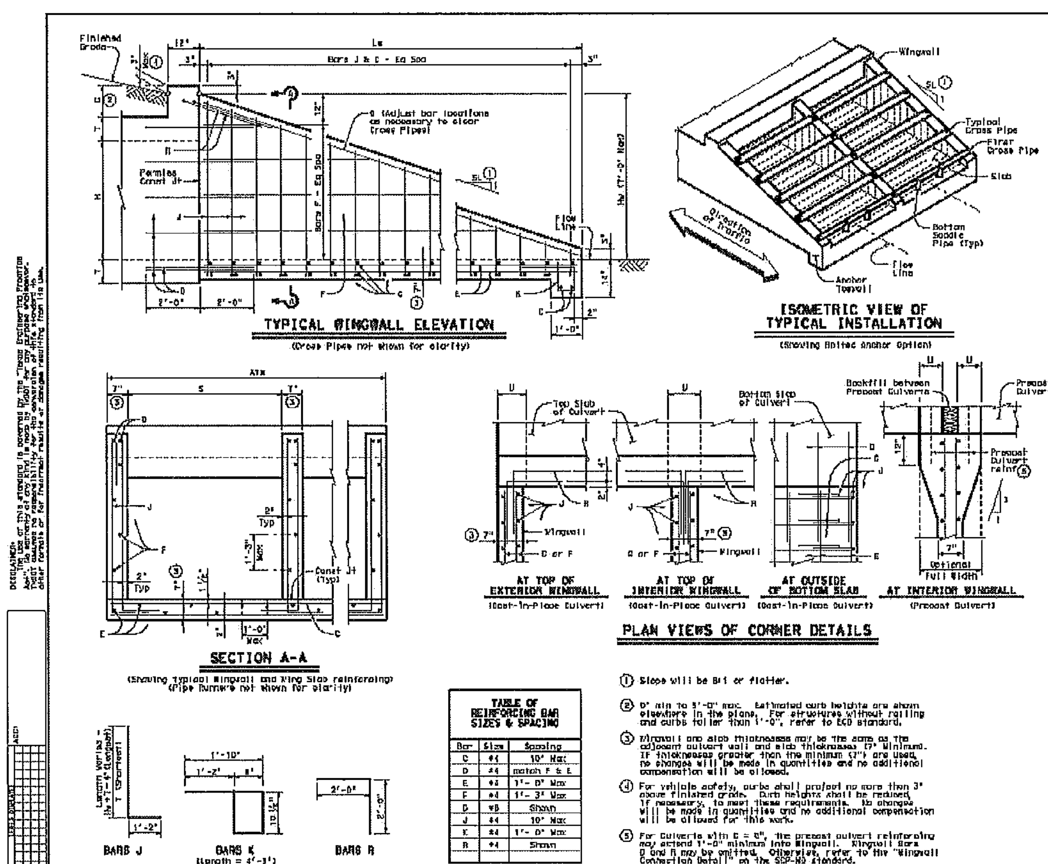

TABLE OF REINFORCING BAR SIZES & SPACING

Bar	Size	Spacing
C	#4	10" Max
D	#4	match F & E
E	#4	1'- 0" Max
F	#4	1'- 3" Max
G	#8	Shown
J	#4	10" Max
K	#4	1'- 0" Max
R	#4	Shown

(1) Slope will be 6:1 or flatter.

(2) 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to ECD standard.

(3) Wingwall and slab thicknesses may be the same as the adjacent culvert wall and slab thicknesses (7" Minimum). If thicknesses greater than the minimum (7") are used, no changes will be made in quantities and no additional compensation will be allowed.

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

(5) For Culverts with C = 0", the precast culvert reinforcing may extend 1'-0" minimum into Wingwall. Wingwall Bars D and R may be omitted. Otherwise, refer to the "Wingwall Connection Detail" on the SCP-MD standard.

Formulas: (All values are in Feet)
HW = H + T + C - 0.250'
LW = (HW - 0.250') (SL)

For Cast-in-place culverts:
ATW = (N) (S) + (N+1) (U)
For Precast culverts:
ATW = (N) (2U + S) + (N-1) (0.500')

Total Wingwall Area (S.F.)
= (0.5) (HW + 0.250') (LW) (N+1)
Total Concrete Volume (C.Y.)
= [(Wingwall Area) (0.583') + (LW) (ATW) (0.583') + (ATW) (1.000') (1.167' - 0.583')] ÷ (27)
Total Reinforcing (Lbs)
= (1.55) (LW) (ATW) + (1.13) (ATW) + (K) (HW) (N+1) (LW)

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

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

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

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

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

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

All reinforcing steel shall be Grade 60. All reinforcing shall be adjusted as necessary to provide a minimum clear cover of 1 ½".

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

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

Bolts and nuts shall conform to ASTM A307.

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

See BCS standard sheet for additional dimensions and information.

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

SHEET 1 OF 2

Texas Department of Transportation
Bridge Division

SAFETY END TREATMENT
FOR BOX CULVERTS
(MAXIMUM Hw = 7'-0")
TYPE I ~ PARALLEL DRAINAGE

SETB-PD

ALTERNATE OF CONC. WINGWALLS TxDOT FW-0 FOR 5'X5' RCB

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY MD. NAIM UDDIN KHAN, P.E. #87776

THESE CONSTRUCTION PLANS WERE PREPARED UNDER THE RESPONSIBLE SUPERVISION OF MD. NAIM UDDIN KHAN, REGISTERED PROFESSIONAL ENGINEER NO. 87776.

5/17/11

CITY OF KINGSVILLE
ENGINEERING DEPARTMENT
200 East Kleberg
Kingsville, Texas 78363
Office 361.595.8005
Fax 361.595.8035

STATE OF TEXAS — MD. NAIM UDDIN KHAN — 87776 — REGISTERED PROFESSIONAL ENGINEER

Revision:	Date:	Drawn by: A. Vigstol
		Date: February 14, 2010
		Note:
		H. Scale: 1" = 40'
		V. Scale: 1" = 4'

SANTA ROSA & CORRAL DITCH
DETAILS

FILE: N:\Engineering\Shared\Cityengineer\DRAINAGEPROJECT\Corral&Santarosa\24 x36 Ditch Corral-Santa Rosa Plans 07-18-2010.dwg