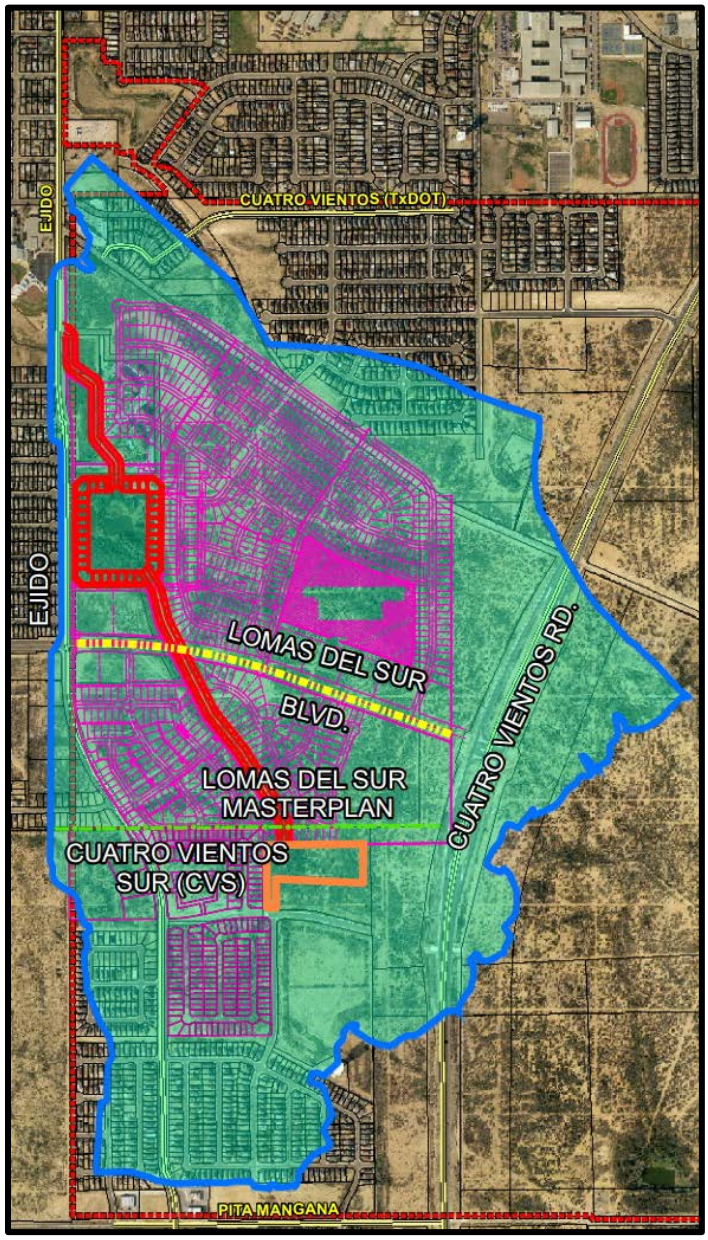
WEBB COUNTY DRAINAGE DISTRICT NO. 1

HYDRAULIC AND HYDROLOGIC STUDY
(LOMAS DEL SUR & CUATRO VIENTOS SUR)



WCDD BOARDMEMBERS

MS. LETI MARTINEZ
PRESIDENT

MR. AMBROSIO GARZA
TREASURER

MS. MARGIE ARCE
BOARDMEMBER

THE STATE OF TEXAS
COUNTY OF WEBB

SUBMITTED BY:

CRANE ENGINEERING
CIVIL • PUBLIC WORKS • PLANNING • HYDROLOGY

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12/3/14

STATE OF TEXAS
EDWARD D. GARZA
75853
LICENSED
PROFESSIONAL ENGINEER

1. PURPOSE

The purpose of this report is to analyze stormwater designs for Lomas Del Sur and Cuatro Vientos Sur Subdivisions. The intent of this analysis is to determine if the proposed channel and detention pond for Lomas Del Sur can accommodate the post development flow from Cuatro Vientos Sur Subdivision.

By conveying post flow through Lomas Del Sur drainage system, a detention pond can be eliminated within Cuatro Vientos Sur thus reducing long term maintenance costs for the Webb County Drainage District. Stormwater designs for each subdivision were provided by the respective consultant engineers representing the developer. Refer to Exhibit 1 for Location Map.

This report does not attempt to confirm that the subdivision designs are in compliance to the City of Laredo Land Development Code as it is understood that the developer and its consultant has addressed all requirements.

2. EXISTING CONDITIONS

Cuatro Vientos Subdivision is located upstream from Lomas Del Sur Subdivision. Its watershed is 169.59 acres or 30.5% of the total watershed while Lomas Del Sur watershed totals 386.44 acres or 69.5% of the total. For the purpose of this analysis, the watershed is being identified as A1.

Watershed A1 is comprised of approximately 556 acres and is bound on the north by Cuatro Vientos Norte Subdivision, the west by Ejido Avenue, the south by Pita Mangana Road, and the east by Cuatro Vientos Rd. Small areas of the watershed exceed the bounding roads. The watershed includes developed and undeveloped land both within the Laredo City limits.

There are two (2) tributaries that convey stormwater and converge at an existing pond adjacent to Ejido Avenue. Pond discharges through a natural creek and leaves the property along Ejido along its natural course. The two tributaries are stream order 1 creeks and the creek at the downstream side of the pond is a 2nd order stream. There are currently no effective special flood hazard areas within the watershed being studied. Exhibit 2 illustrates existing creek system.

The overall watershed is composed of two (2) types of soils that contain hydrologic properties that vary from being in groups B-D as depicted in Exhibit 3 Soils Map according to the NRCS Soil Survey of Webb County, Texas. The project site consists of Verick Fine Sandy Loam (VkC) and Copita (CpB). The descriptions of these soils are as follows:

VkC – Verick Fine Sandy Loam (VkC)-*This soil is well drained. Surface runoff is medium, and permeability is moderate. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation. This soil is poorly suited to most urban and recreation uses. Shallowness to sandstone is the main limitation. This soil is in the Shallow Sandy Loam range site.*

CpB – Copita fine sandy loam- This moderately deep, nearly level to gently sloping soil is on summits and side slopes of low hills and on broad, convex plains. Typically, the surface layer is brown fine sandy loam about 9 inches thick. Water erosion and soil blowing are moderate hazards if this soil is left bare of vegetation. This soil is moderately well suited to most urban uses.

3. PROPOSED MASTERPLANS

Proposed Masterplans were provided by the developers for both Lomas Del Sur and Cuatro Vientos Sur Subdivisions. Refer to Exhibits 4 and 5 for Masterplans. Currently, the extension of Lomas Del Sur Blvd. is ongoing with construction of a culvert crossing to be incorporated into this analysis. Through coordination with TxDOT, design plans and criteria were made available to us for integration into the effective models developed and discussed further in Section 4 – H&H Analysis.

The Lomas Del Sur Masterplan proposes various landuses such as commercial, single-family residential, multi-family residential, and a future school site. Lomas Del Sur's drainage masterplan indicates one major channel system within a proposed 120' Drainage Easement and one detention pond site of approximately 8.67 acres. Preliminary design plans call for an approximate 2,332 LF of earthen channel beginning from the southern boundary of the proposed development to the proposed pond site with 14' bottom width, 6:1 side slopes, 74' top of channel, 5' depth, and a 20' access road within the easement. The detention pond shown on the provided preliminary plat for Lomas Del Sur displays a pond depth of approximately 17' determined from the contours on said plat. This development's drainage masterplan includes watersheds which do incorporate the neighboring Cuatro Vientos Sur, and are consistant with our watershed area.

The TxDOT designed culvert crossing lying intermediately within the proposed Lomas Del Sur drainage channel consists of three (3) 127 LF runs of 48" diameter reinforced concrete pipe accounting for a 256.10 acre drainage area. According to construction plans for this structure, a 10 year design flow of 270.35 cfs was utilized to design this improvement.

Porras-Nance Engineering provided their drainage masterplan for Cuatro Vientos Sur consisting of a short pilot channel and detention pond site roughly 3.58 acres in size. The masterplan indicates proposed landuses include commercial, single-family residential, multi-family residential and a future school site. As stated in the purpose, it is the intent of this analysis to remove the need for detention for this subdivision. The proposed channel design provided is comprised of an 8' wide, 1' deep pilot channel, 14' gross bottom width, 3:1 side slopes, 40' top width, and 4.33' foot depth within a 70' wide drainage easement.

The contributing watersheds as per the masterplan accrue to an approximate 168.81 acres in which sub-watershed A1-A of this analysis is comparable at 169.59 acres.

4. H&H Analysis

A feasibility study for the two cooperating developments described in the previous section consisting of a H&H Analysis was prepared by integrating these proposed developments to determine if individual detention ponds can be replaced with a regional pond.

Exhibit 6 provides watershed delineations used to estimate time of concentration. The SCS Curve Method was utilized to develop design flows. Pre-development and post-development flows take into consideration hydrologic soil types, current and future landuse, proposed drainage designs provided by respective engineering consultants, antecedent moisture conditions, and existing storm drainage structures.

As per the future masterplans provided, channels were analyzed for adequate capacity in conveyance of post development flow. Post and predevelopment flows are indicated for 10-year, 25-year, and 50-year return events. Flows determined within this analysis for Watershed A1 are as follows:

Comparing Watershed A1, totaling 556 acres, flows for the 25-year event (1696.79 cfs) to Sherfey's calculations (1833 cfs for 552 acres) indicates some variance in our approach which can be attributed to our integration of antecedent moisture conditions in determining SCS Curve Numbers and the delineation of various smaller sub-watersheds by Sherfey Engineering. For the purpose of this analysis, a design flow of 1765 cfs for a 25-year event is being utilized.

Sub-watershed A1-A is comprised of Cuatro Vientos Sur's contributing watershed. Porras-Nance Engineering's contributing watershed measures 168.81 acres in comparison to this study sub-watershed A1-A delineated at 169.59 acres. The design flow for the proposed pilot channel for Cuatro Vientos Sur is 520 cfs, while the 25-year post development flow determined for A1-A is 517.52 cfs. This comparison of watershed areas indicate the same area however reviewing Porras-Nance, Sherfey, and our study, the following design flows for a 25-year post development flow are compared:

Porras-Nance	**Sherfey**	**Crane**
806 cfs	630 cfs	518 cfs

Porras-Nance utilizes the rational method for computing this runoff and also provides a separate design flow of 520 cfs for their pilot channel design (Exhibit 7). Sherfey and Crane utilize the SCS curve method with Sherfey's flow higher due to smaller watersheds in their analysis. Based on this information, a design flow of 600 cfs is being utilized for this analysis.

H&H Run Results (Exhibit 8)

HEC-RAS, HY-8, and Pondpack were utilized to model the estimated flows for Cuatro Vientos Sur and Lomas Del Sur. Models were developed utilizing plans received from Lomas consultants on 10/20/14 and 10/17/14, Cuatro Vientos consultants on 10/10/14, and TxDOT. The following observations are made based on these designs as follows:

A1: The first run of channel from Cuatro Vientos Sur Lomas Del Sur common line up to 500 ft south of the recently constructed Lomas Del Sur drainage crossing is able to accommodate the estimated flow of both developments. The only drawback is the velocity in this channel segment exceeds 5 ft/sec. This will require improvements to combat the high velocity.

A2: The channel overtops its banks as flow approaches the drainage crossing at Lomas Del Sur which is undersized and creates a backwater effect that causes this overtopping effect. Flow also overtops Lomas Del Sur Boulevard which is currently under construction. Review of construction plans indicate drainage crossing design is base on a 10 year pre development flow.

A3: The channel downstream of Lomas Del Sur crossing to proposed detention pond accommodates the flow released by the drainage crossing but velocities along channel exceed 5 ft/sec.

B1: The second run of the channel design which provides drop structures produces similar results as the first run. Higher velocities are reduced and are confined to the drop structure section. Runoff overtops Lomas Del Sur Boulevard and velocities within the channel downstream of the Lomas crossing exceed 5 ft/sec.

C1: The maximum flow that the drainage crossing at Lomas Del Sur Boulevard can support and still provide a one (1') freeboard to the top of headwall is 400 cfs.

D1: The Lomas Del Sur pond provides adequate storage (81.33 ac/ft) of post development runoff for both developments maintaining adherence to City ordinance releasing less than predevelopment flow for each storm event.

Return Event	Predevelopment Runoff	Computed Outflow	Freeboard
50 year	1,140.58 cfs	851.31 cfs	2.72 ft
25 year	883.28 cfs	766.78 cfs	4.61 ft
10 year	618.24 cfs	620.49 cfs	7.4 ft

5. CONCLUSIONS & RECOMMENDATIONS

The overall plan developed by Lomas Del Sur consultants is adequate to support Cuatro Vientos Sur post development flow as well as Lomas Del Sur post flow. This plan fails at the Lomas Del Sur Boulevard drainage crossing recently constructed under a joint project by TxDOT and City of Laredo.

As a result, the elimination of a detention pond at Cuatro Vientos Sur is not feasible. It is recommended that Cuatro Vientos construct a detention pond within its development and reevaluate its outlet design flow as the Lomas Del Sur drainage crossing has a maximum estimated capacity of 400 cfs.

Lomas Del Sur must also reevaluate its stormwater masterplan to address the flow restrictions at Lomas Del Sur Boulevard. This limitation will not allow the downstream pond to effectively serve the development and might require Lomas developers to develop an additional detention pond upstream of the Lomas Del Sur Boulevard drainage crossing.

Another option would be for the Cuatro Vientos Sur development to add additional pipes at the Lomas Del Sur crossing to increase flow under the road in order to eliminate need for detention pond. This would be subject to Lomas Del Sur willingness to accept Cuatro Vientos Sur post flow.

1 inch equals 900.00 feet

PARK
EXISTING
DEVELOPMENT

MERIDA

CUATRO VIENTOS (TxDOT)

LOS PRESIDENTES
EXISTING DEVELOPMENT

EJIDO

CUATRO VIENTOS (TxDOT)

Discharge to City R.O.W. System

Discharge Channel

CUATRO VIENTOS EAST
MASTERPLAN

P-1

Lomas Del Sur Pond
(Possible Regional Pond)

LOMAS DEL SUR
BLVD.

CUATRO VIENTOS RD.

Existing Drainage
Pipe Structure

Conveyance Channel

LOMAS DEL SUR
MASTERPLAN

Cuatro Vientos Sur
Inflow to Channel

CUATRO VIENTOS
SUR (CVS)

Cuatro Vientos Sur
Channel and Pond Site
(Possible Elimination of Pond)

PITA MANGANA

Legend

Webb County Drainage District Boundary Line

Webb County
Drainage District

Exhibit # 01
Location Map

CRANE ENGINEERING CORP.
1310 JUNCTION DRIVE SUITE B
LAREDO, TEXAS 78041 956-712-1996
FIRM REGISTRATION NO. F-3353

GEORGE WASHINGTON
CENTURY CITY
INDEPENDENCE H
PECAN ACRES
PINECREST
LOS PRESIDENTES
EASTERN DIVISION
LAS AMERICAS
CUATRO VIENTOS NORTE
SOUTHGATE II THE PLAZA
LOMAS DEL SUR
CUATRO VIENTOS SUR
CUATRO VIENTOS

N
W
E
S

1 inch equals 750 feet

Green Space Ordinance

-Buffer cannot be less than 25ft from the Ordinary High Water Mark on either side. Buffer may not exceed 100ft from the Ordinary High Water Mark on either side.

-First and Second Order Streams are voluntary and allow for disturbance of the immediate buffer if the requirements of section 24.57.7 of the Ordinance are met. Third Order stream buffers are mandatory.

-Existing ponds may be used as stormwater facilities, but shall have 20ft buffer in addition to Maintenance Access Agreement requirements. Refer to Stormwater Management Ordinance Section 24-59.3.2.5 "Retention/Detention Facilities"

Legend

- WCDD Boundary
- Green Space Ordinance Stream Order with Buffer
- 1- 50' Buffer
- 2- 50' Buffer
- 3- 50' Buffer
- 4- 75' Buffer
- 5- 100' Buffer
- Watershed A1

POND DISCHARGE CREEK

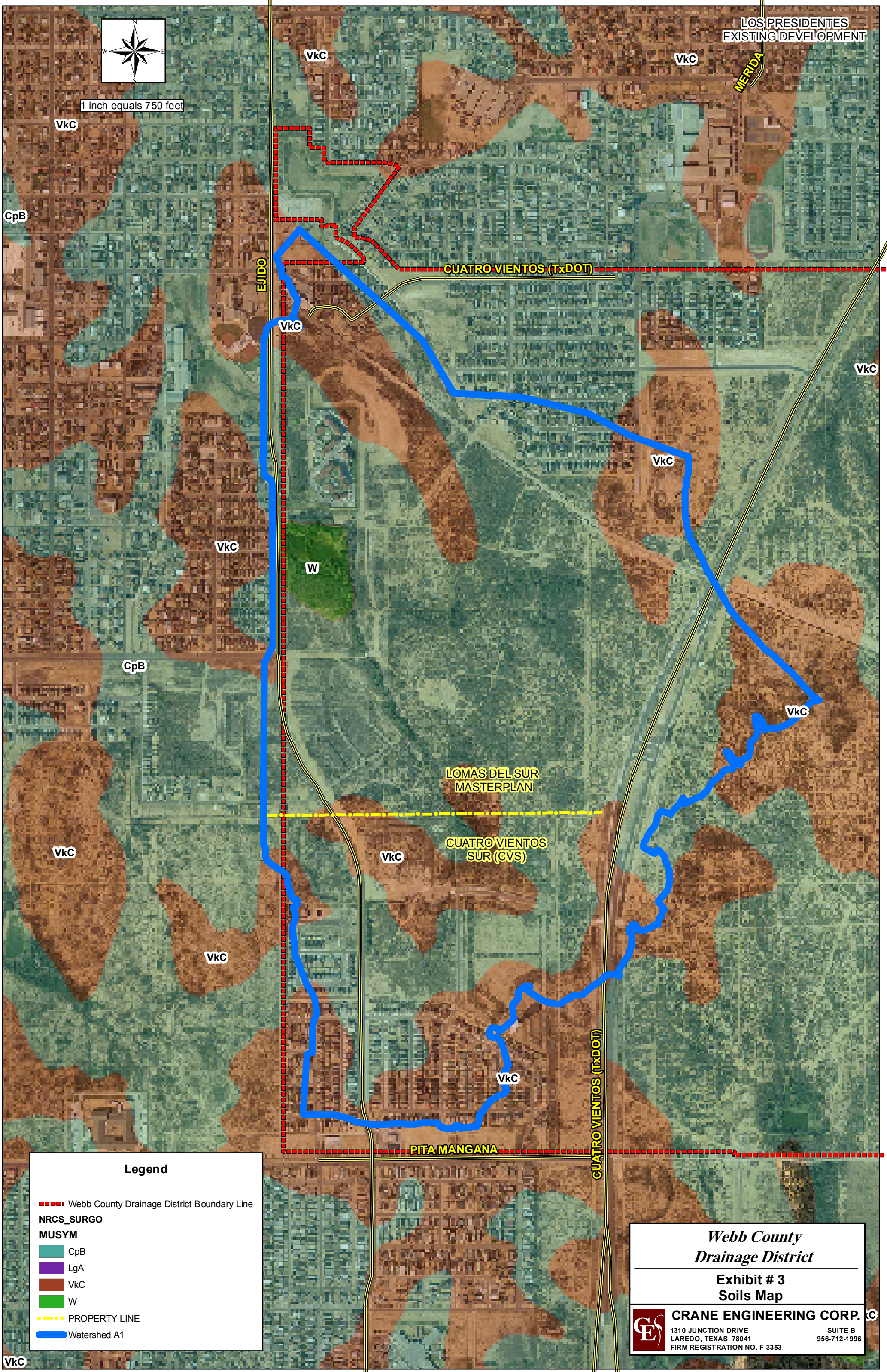
EXISTING POND

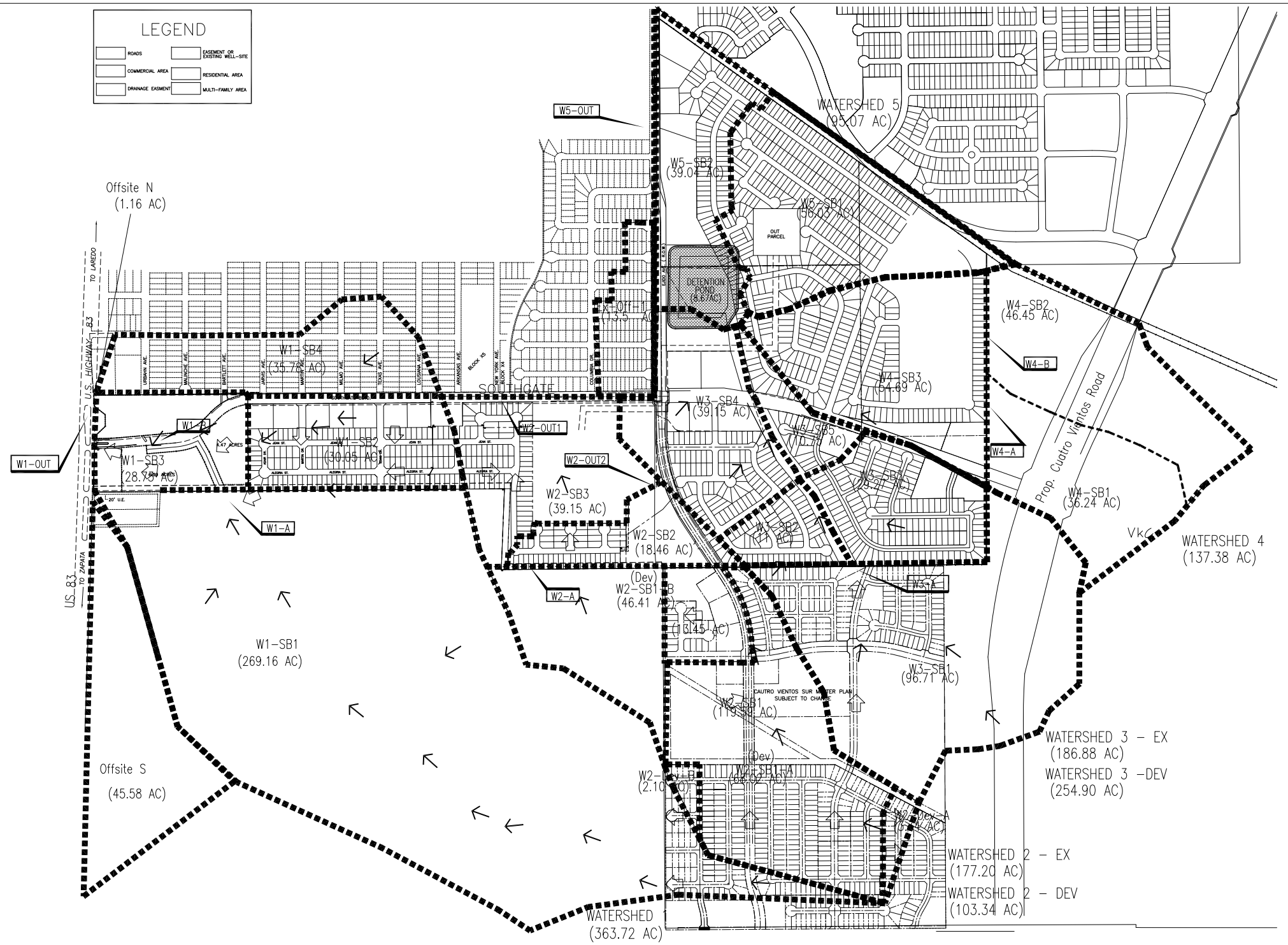
EXISTING TRIBUTARIES

Webb County Drainage District

Exhibit #2
Existing Creek System

CRANE ENGINEERING CORP.
1310 JUNCTION DRIVE SUITE B
LAREDO, TEXAS 78041 956-712-1996
FIRM REGISTRATION NO. F-3353


LOS PRESIDENTES
EXISTING DEVELOPMENT
MERIDA
1 inch equals 750 feet
EJIDO
CUATRO VIENTOS (TxDOT)
LOMAS DEL SUR
MASTERPLAN
CUATRO VIENTOS
SUR (CVS)
PITA MANGANA
CUATRO VIENTOS (TxDOT)
VkC
CpB
W
Legend
Webb County Drainage District Boundary Line
NRCS_SURGO
MUSYM
CpB
LgA
VkC
W
PROPERTY LINE
Watershed A1
Webb County
Drainage District
Exhibit # 3
Soils Map
CRANE ENGINEERING CORP.
1310 JUNCTION DRIVE
LAREDO, TEXAS 78041
SUITE B
956-712-1996
FIRM REGISTRATION NO. F-3353



LEGEND

- PROPOSED FLOW
- EXISTING FLOW
- WATERSHED DELINEATION
- PROPOSED FLOW ON STREETS
- 10 FT CONTOURS
- 50 FT CONTOURS

CpB COPITA B (hydrological soil type)
VkC VERICK C (hydrological soil type)

Developed Conditions

	Sub-Basin	Tc	CN	Area	Return Period (CFS) 10 yr	25 yr	50 yr	100 yr
*	W1-SB1	1.10	71	296.16	382	490	590	713
	W1-SB2	0.26	83	30.05	99	121	140	164
WATERSHED 1	W1-SB3	0.19	93	28.73	133	158	179	206
*	W1-SB4	0.29	80	35.78	122	151	177	208
*	OFFSITE	1.15	66	46.74	54	72	88	108
			Total Area:	410.46				
WATERSHED 2	W2-SB3	0.39	77	39.15	110	138	163	193
			Total Area:	39.15				
	W3-SB1	0.46	90	96.71	334	398	456	524
	W3-SB2	0.42	77	11.0	30	38	45	53
WATERSHED 3	W3-SB3	0.48	77	29.27	76	95	113	134
	W3-SB4	0.62	84	39.15	107	130	151	176
	W3-SB5	0.56	80	10.75	28	35	41	48
	W2-SB1-A	0.52	83	68.02	197	240	280	327
	W2-SB1-B	0.53	76	46.41	113	142	169	200
	W2-SB2	0.32	75	18.46	54	67	80	96
			Total Area	317.79				
*	W4-SB1	0.60	60	36.24	47	65	81	102
WATERSHED 4	* W4-SB2	0.61	59	46.45	57	79	101	127
	W4-SB3	0.31	76	54.69	165	207	245	291
			Total Area	137.38				
WATERSHED 5	W5-SB1	0.49	80	56.03	156	193	225	265
	W5-SB2	0.37	78	39.04	116	144	170	201
			Total Area	95.07				
	Ex-Off1	.35	75	13.50	38	48	57	68
			Total Area	28				

*Note: A portion of these areas were analyzed as pre-developed condition

PROPOSED POND AND OUTLET STRUCTURES

Elevation (ft)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
455.50	5.02	0.00	0.00	.000
458.00	5.45	15.70	13.08	13.08
460.00	5.90	17.02	11.34	24.43
464.00	6.83	19.07	25.43	49.86
466.00	7.32	21.22	14.14	64.01
470.00	8.35	23.48	31.31	95.33
471.00	8.67	25.52	8.50	103.84

Structure Type = Culvert-Box

No. Barrels	=	3
Barrel Height	=	4.00 ft
Barrel Width	=	4.00 ft
Upstream Invert	=	455.55 ft
Dnstream Invert	=	455.22 ft
Horiz. Length	=	100.00 ft
Barrel Length	=	100.00 ft
Barrel Slope	=	.00328 ft/ft

POINT OF ANALYSIS

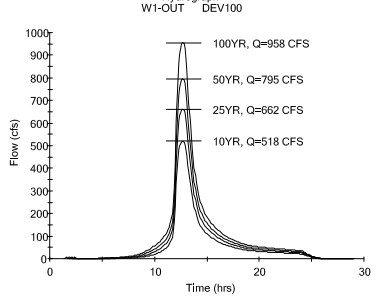
	Point of Analysis	Develop Conditions Return Period (CFS) 10 yr	25 yr	50 yr	100 yr
*	W1-A	382	490	590	713
	W1-B	424	541	651	784
	W1-OUT	518	662	795	958
	W2-OUT1	110	138	163	193
	W2-OUT2	156	196	231	263
	W2-A	113	142	169	200
	W3-A	529	635	732	847
*	W4-A	47	65	81	102
*	W4-B	57	79	101	127
	W5-OUT	658	764	850	943

* Pre-developed conditions

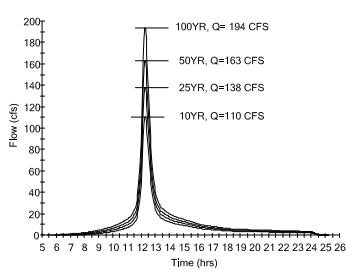
HYDROLOGY INFO: WIN-TR55 WAS USED AS AND AID TO COMPUTE THE AVERAGE CURVE NUMBERS AND TIME OF CONCENTRATION FOR EACH WATERSHED. PONDPACK VERSION 9.0 WAS USED TO ANALYZED THE ENTIRE WATERSHEDS BY SCS METHOD. FOR REACH ROUTINGS, MODIFIED PULS WAS USED AS A HYDROLOGY ROUTING ALGORITHM.

BASE MAP IS TAKEN FROM UNITED STATES DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY, LAREDO SOUTH QUADRANGLE, DATED 1979.
7.5 MINUTE SERIES (TOPOGRAPHIC)

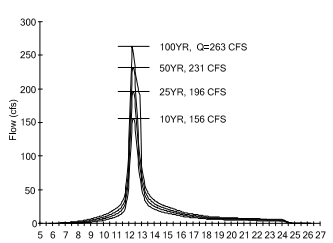
Hydrograph
W1-OUT DEV100



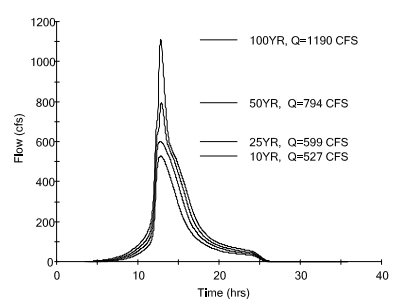
Hydrograph
W2-OUT1 DEV100



Hydrograph
W2-OUT2 DEV100



Hydrograph
W3-5-OUT DEV100



Designed By: D.G.			Sherfey Engineering Company, L.L.C.	104 Del Court Suite 400 Laredo, Texas 78041 956-791-3511
Drawn By: D.G.				
Checked By: JPS				
Approved By: JPS				
File 8036.03-DP-8036\20051114	Revision	Date	Description	

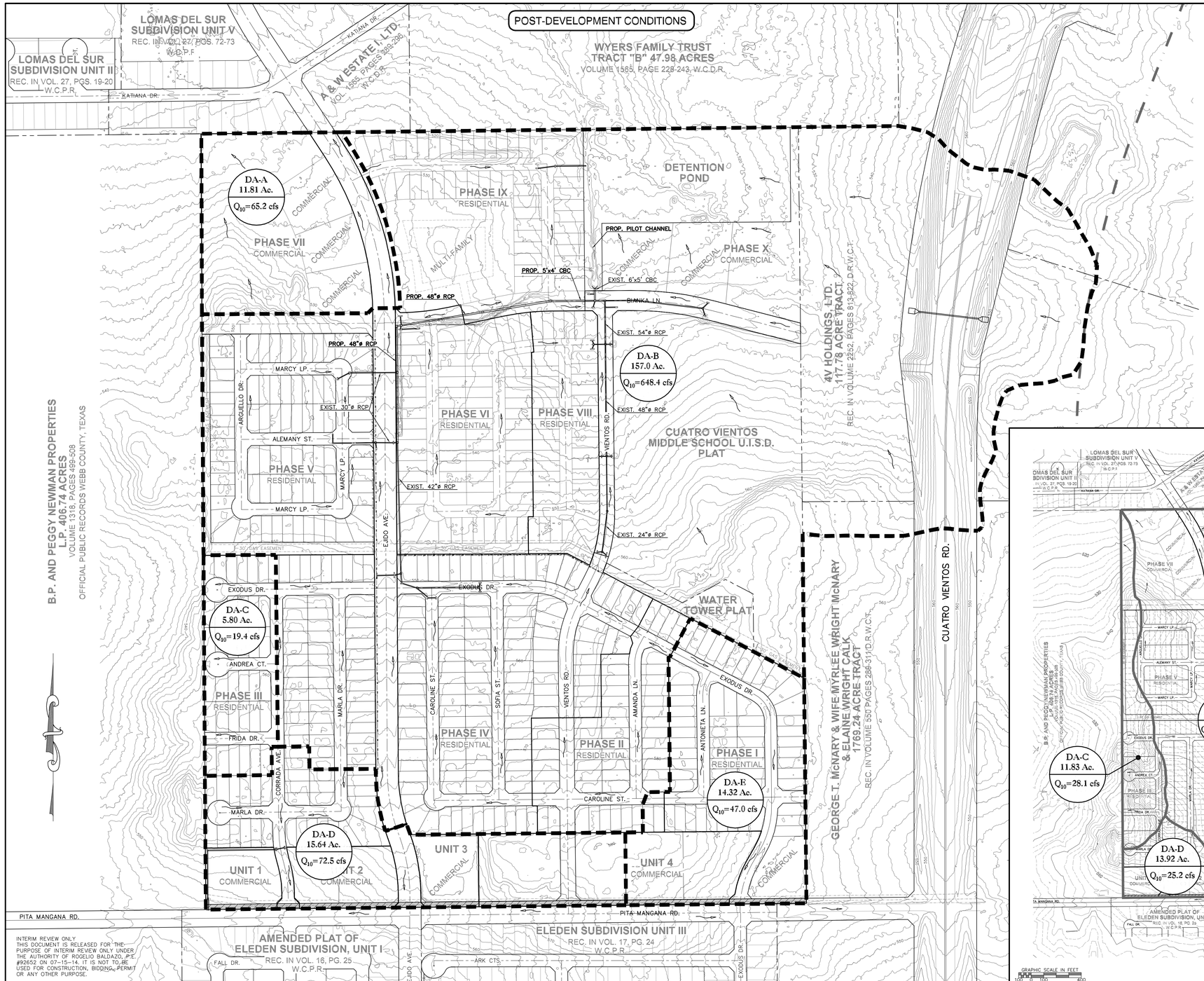
LOMAS DEL SUR
DETENTION POND

FOR INTERIM REVIEW ONLY
Not for construction, Bidding, or Permit purposes
Name: JoEmma P. Sherfey, P.E.
Registration No.: TX - 68028
Date: Feb. 2007

LOMAS DEL SUR
MASTER DRAINAGE PLAN
DEVELOPED CONDITIONS
Scale: 1"=500'
Date: 2/20/2006

PROJ. NO. 8036.03
2
SHEET 2 OF 2

POST-DEVELOPMENT CONDITIONS



D.A. = Drainage Area
Q_{10} = Runoff for a 10-yr Storm Event
A = Area

C = Runoff Coeficient for Rational Method
I = Intensity Value for Rational Method
Q = CIA (Rational Method Formula)

Pre-Development Runoff Calculations

D.A.	C	I_{10}	A (ac.)	Q_{10} (cfs)	Proposed Use
A	0.35	4.01	73.92	103.75	Commercial
B	0.35	4.73	86.48	143.17	Residential/Commercial/Institutional
C	0.35	6.79	11.83	28.11	Residential
D	0.35	5.17	13.92	25.19	Residential / Commercial
E	0.35	5.03	14.54	25.60	Residential / Commercial
F	0.35	5.12	3.27	5.86	Institutional

Post-Development Runoff Calculations

D.A.	C	I_{10}	A (ac.)	Q_{10} (cfs)	Proposed Use
A	0.95	5.81	11.81	65.19	Commercial
B	0.70	5.90	157.00	648.41	Residential/Commercial/Institutional
C	0.52	6.42	5.80	19.36	Residential
D	0.81	5.72	15.64	72.46	Residential / Commercial
E	0.66	4.97	14.32	46.97	Residential / Commercial
F	N/A	N/A	N/A	N/A	

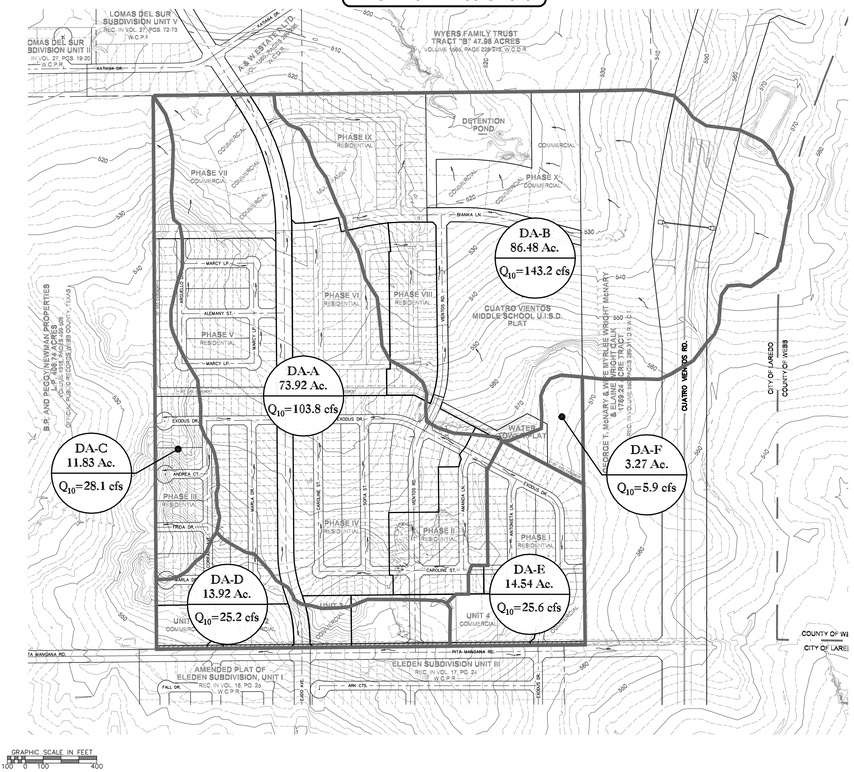
25-yr Post Development Runoff

D.A.	C	I_{25}	A (ac.)	Q_{25} (cfs)	Proposed Use
A	0.95	6.57	11.81	73.71	Commercial
B	0.70	6.67	157.00	733.03	Residential/Commercial/Institutional
C	0.52	7.24	5.80	21.84	Residential
D	0.81	6.47	15.64	81.96	Residential / Commercial
E	0.66	5.64	14.32	53.30	Residential / Commercial

50-yr Post Development Runoff

D.A.	C	I_{50}	A (ac.)	Q_{50} (cfs)
A	0.95	7.29	11.81	81.79
B	0.70	7.41	157.00	814.36
C	0.52	8.03	5.80	24.22
D	0.81	7.18	15.64	90.96
E	0.66	6.27	14.32	59.26

PRE-DEVELOPMENT CONDITIONS



INTERIM REVIEW ONLY
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GRAPHIC SCALE IN FEET
50 0 100 200 400

DATE : 07-15-2014
REVISIONS :

VERICAL SCALE	: ----
HORIZONTAL SCALE	: 1"=200'
DRAWN	: D.M.
CHECKED	: T.P.N./W.N.
APPROVED	: R.B./W.N.
FIELD BOOK	: ----

LEGEND:

R.O.W.	RIGHT OF WAY
P.O.B.	POINT OF BEGINNING
W.C.P.R.	WEBB COUNTY PLAT RECORDS
W.C.D.R.	WEBB COUNTY DEED RECORDS
B.S.	BUILDING SETBACK
U.E.	UTILITY EASEMENT
W.L.	WATER LINE
S.S.L.	SANITARY SEWER LINE
●	1/2" IRON ROD

PORRAS NANCE ENGINEERING
P.O. BOX 1670
LAREDO, TEXAS 78044
TEXAS REGISTERED
ENGINEERING FIRM F-6205
OFFICE (956) 724-3097
FAX (956) 724-9208

OWNER:
LAREDO FOUR WINDS, LTD
P.O. BOX 440127
LAREDO, TEXAS 78044
(956) 718-2892 OFF.

ENGINEER/SURVEYOR:
PORRAS NANCE ENGINEERING
304 E. CALTON RD.
P.O. BOX 1670
LAREDO, TEXAS 78044
(956) 724-3097 PH
(956) 724-9208 FX

PROJECT DATA:

ACRES	:	170.13 Ac.
LOTS	:	629 LOTS
R.O.W.	:	R.O.W.
B/B	:	B/B

PLAT OF:

CUATRO VIENTOS SUR SUBDIVISION

MASTER DRAINAGE PLAN

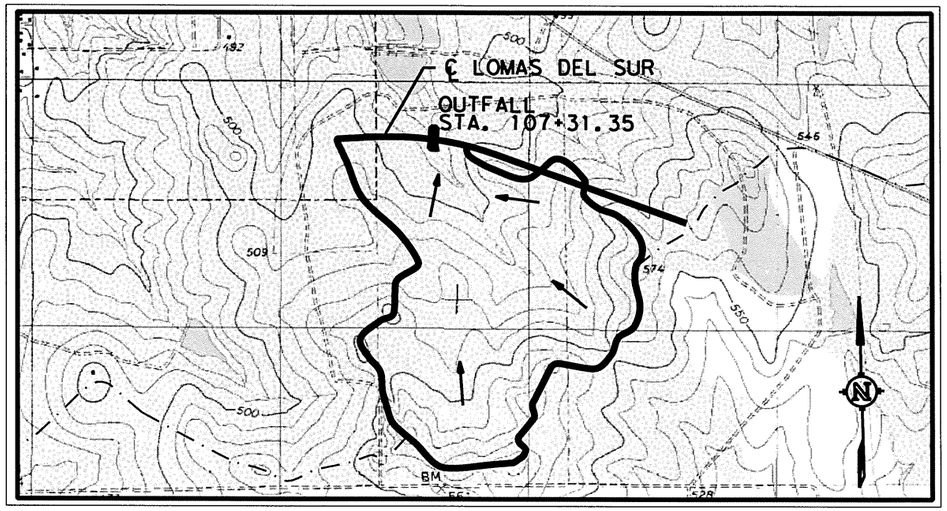
SHEET:
1 OF 1

HYDROLOGIC CALCULATIONS

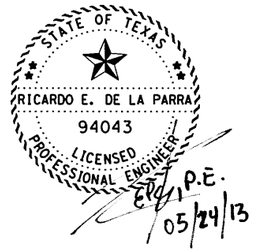
OUTFALL LOCATION (STA.)	DRAINAGE AREA ID	DRAINAGE AREA (ACRES)	T (HR)	RAINFALL DEPTH (IN) (10 YR)	Q, CFS (10YR)	RAINFALL DEPTH (IN) (100YR)	Q, CFS (100 YR)
LOMAS DEL SUR							
107+35.31	A2	256.10	0.95	6.50	270.35	10.0	612.17

- A 10 YEAR DESIGN CRITERIA WAS USED FOR THIS FACILITY.

DRAINAGE AREA



HYDROLOGY: NRCS RUNOFF HYDROGRAPH WinTR-55 TYPE III DISTRIBUTION			PROPOSED STRUCTURE		
TIME OF CONCENTRATION		SLOPE	RUNOFF COEFF.	CURVE NUMBER	DRAINAGE AREA
	HR	FT/FT		CN	AC
TOTAL	0.949			60	256.10
T SHEET	0.233	0.0050	0.13		
T SHALLOW	0.655	0.0180	0.05		
T CHANNEL	0.061	0.0045	0.12		



NOT TO SCALE

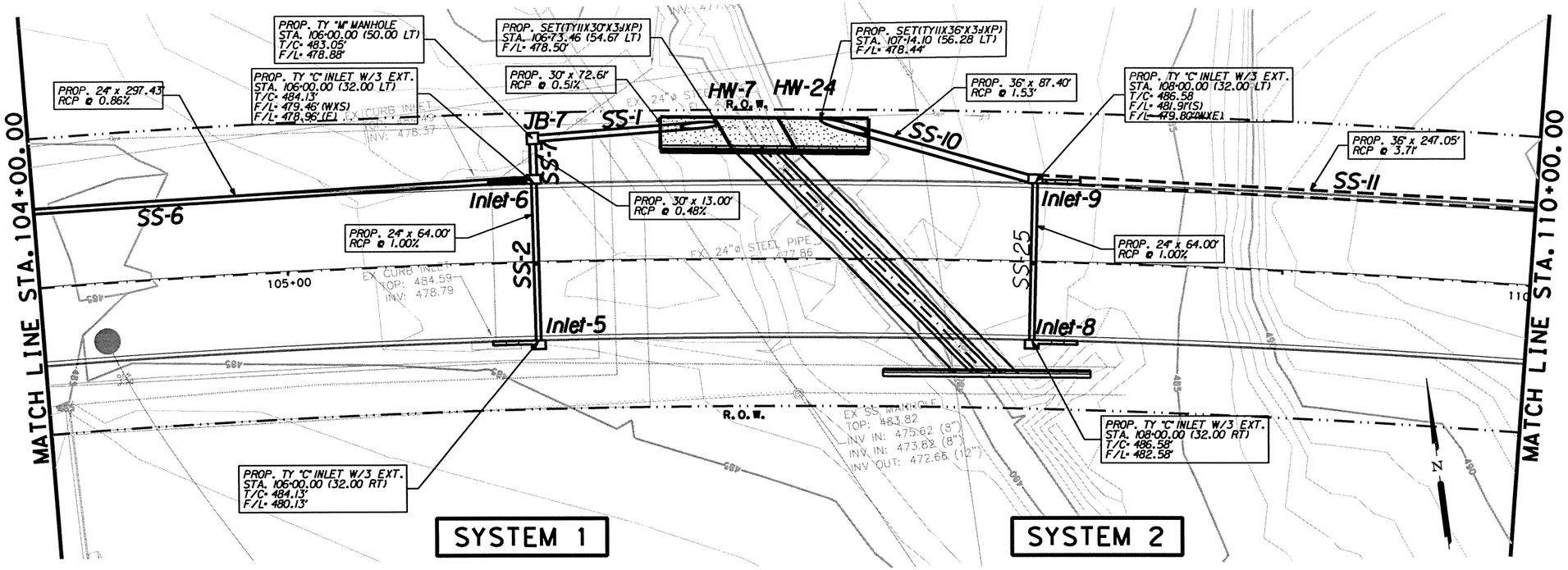
LOMAS DEL SUR
DRAINAGE AREA MAP AND
HYDROLOGIC CALCULATIONS

DN: DLC	DW: DLC
CK: RED	CK: RED

FED.RD. DIV.NO.	FEDERAL PROJECT NO.	SHEET NUMBER	SHEET NO.
6	CBI 2012(590), ETC.	SHEET 1 OF 1	85

STATE	STATE DIST.NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
TEXAS	22	WEBB	0922	33	135, ETC.	VARIOUS

5/24/2013 MTORRE1 t:\projects\240\0922331135\Design\Drainage\LDSdrgmap.dgn

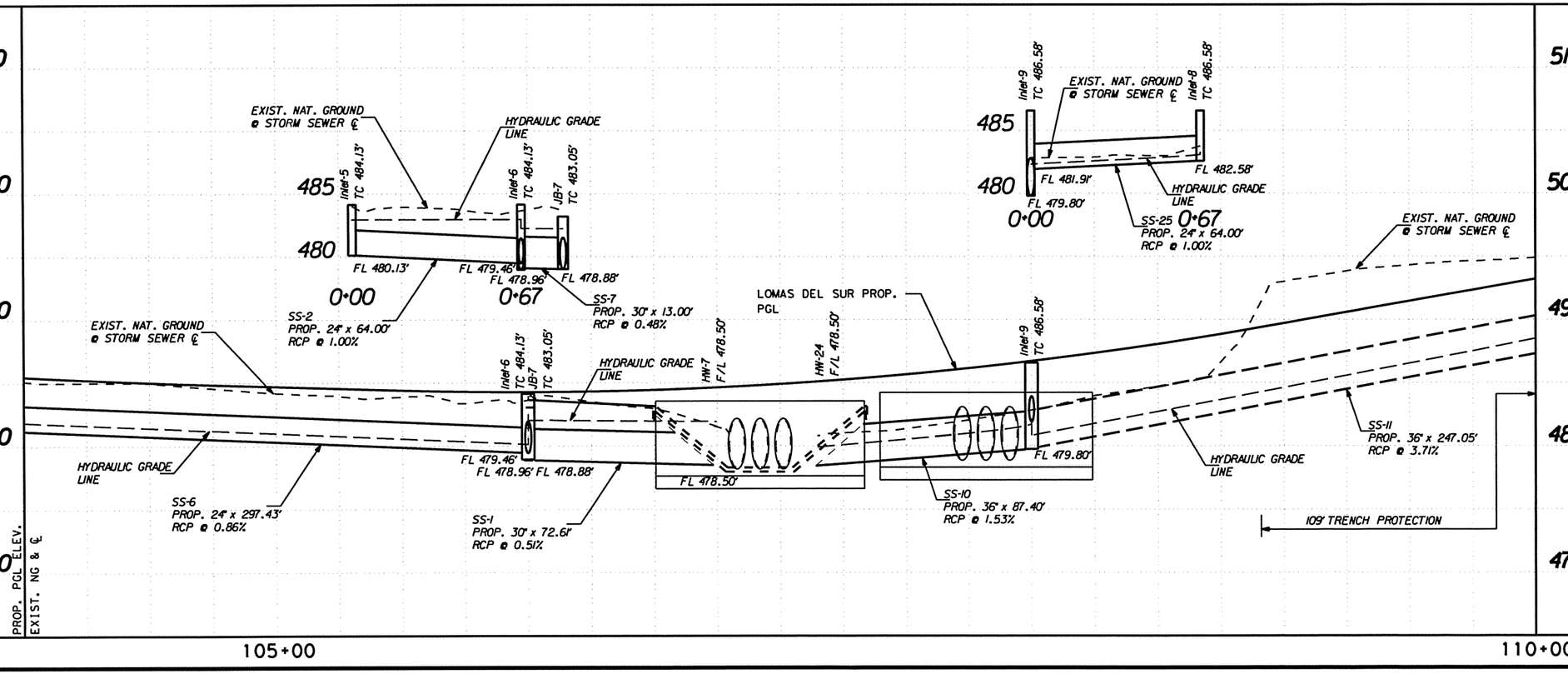


LEGEND

- PROP STORM SEWER
- PROP STORM SEWER TO BE PLACE ON A FUTURE PROJECT
- F/L- FLOW LINE
- T/C- TOP OF CURB
- PROP FLUME

GENERAL NOTES

1. SEE HYDRAULIC DATA SHEET FOR ADDITIONAL INFORMATION
2. ALL RCP WILL BE CLASS III UNLESS OTHERWISE NOTED.
3. TOP OF STRUCTURE ELEVATIONS FOR INLETS TYPE "C" IS TO TOP OF CURB UNLESS OTHERWISE SHOWN ON PLANS.
4. SEE "PROJECT CONTROL DATA SHEET" FOR ALIGNMENT AND BENCHMARK DATA.
5. ALL UTILITIES SHOWN WERE PROVIDED BY OTHERS; AND WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL HORIZONTAL & VERTICAL INFORMATION IN THE FIELD.
6. SEE CROSS SECTION SHEETS FOR FLOWLINE ELEVATIONS TO CORRECTLY PLACE FLUMES ALONG DITCHS.
7. INLETS WITHOUT TRUNK CONECTION WILL REMAIN CLOSE.
8. STATION AND OFFSET FOR DRAINAGE STRUCTURE ARE AS FOLLOWS:
   - MANHOLE TO CENTROID OF COVER.
   - TYPE "C" TO BACK OF CURB AT CENTER OF COVER.
   - CURB FLUME TO LIP OF CURB AT CENTER.



0 25 50
SCALE: 1"=50' H
1"=10' V

STATE OF TEXAS
RICARDO E. DE LA PARRA
94043
LICENSED PROFESSIONAL ENGINEER
P.E.
05/24/13

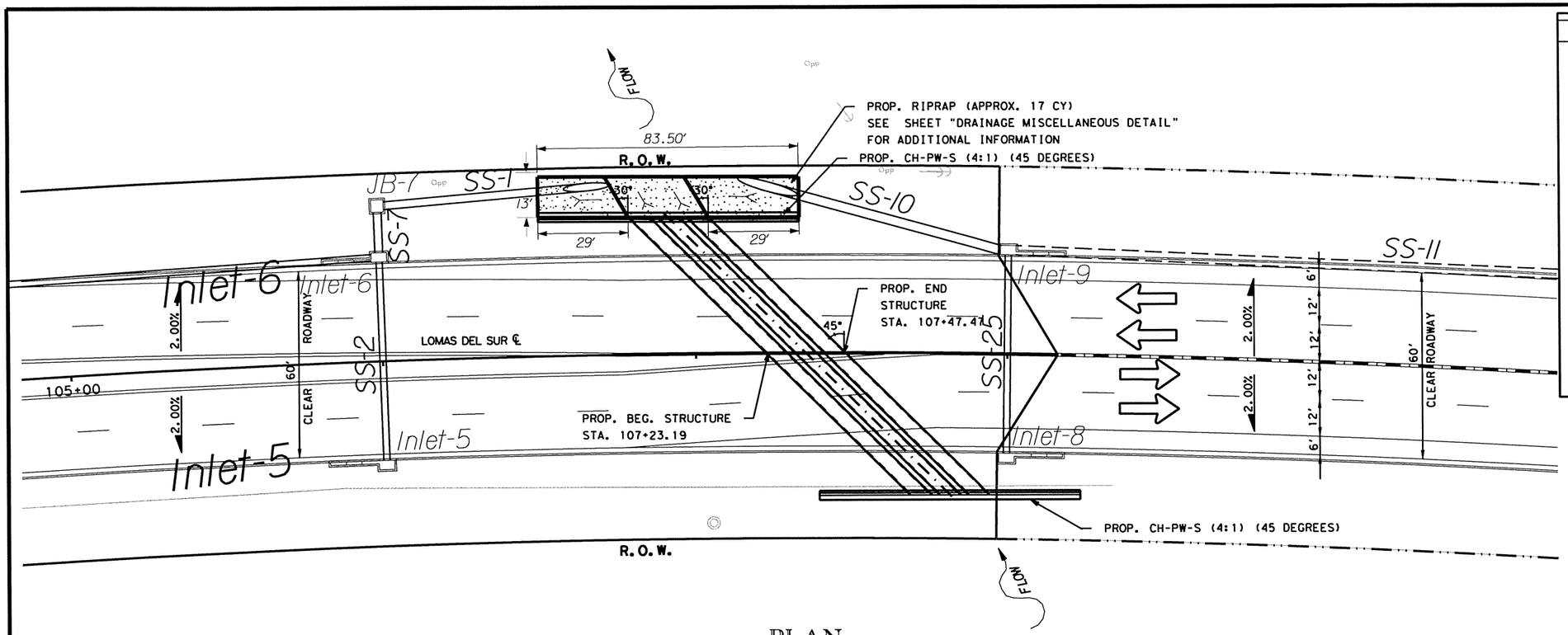
LOMAS DEL SUR DRAINAGE LAYOUT

DN: MT	DW: MT
CK: RED	CK: RED

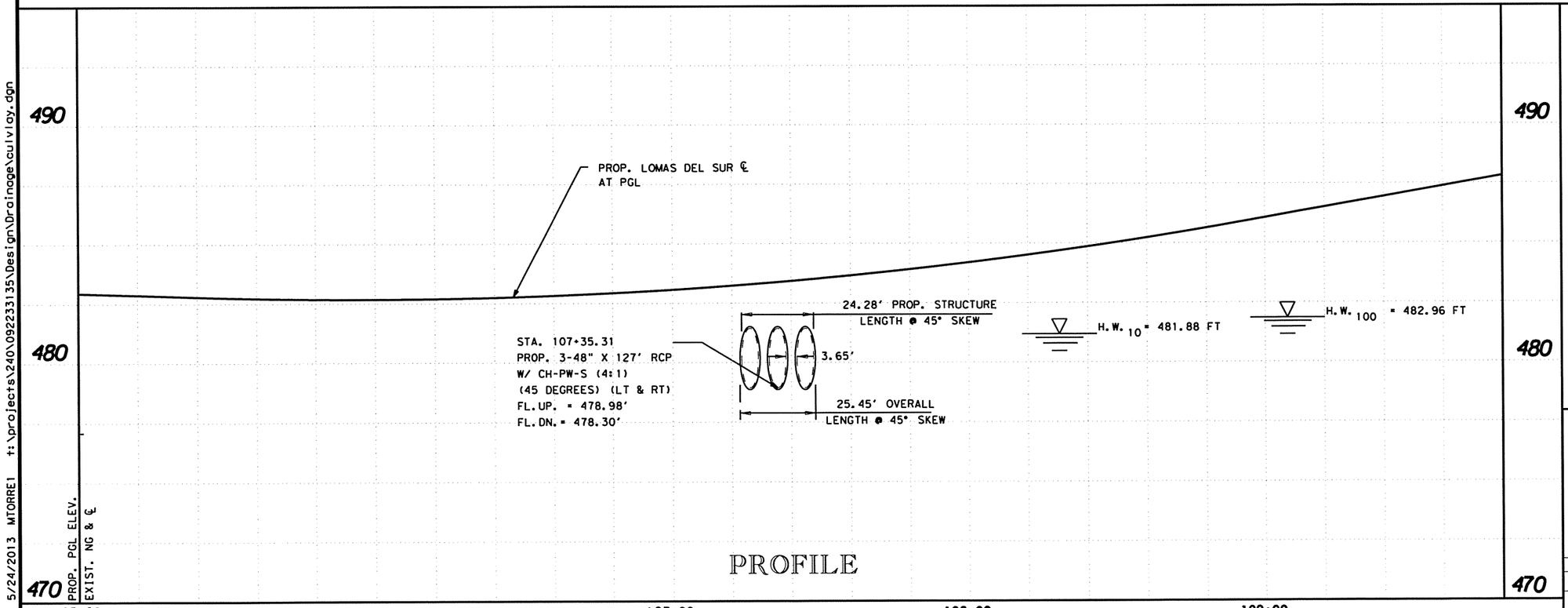
FED.RD. DIV.NO.	FEDERAL PROJECT NO.	SHEET NUMBER	SHEET NO.
6	CBI 2012(590), ETC.	SHEET 2 OF 6	103

STATE	STATE DIST. NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
TEXAS	22	WEBB	0922	33	135, ETC.	VARIOUS

5/24/2013 MTORREI t:\projects\240\092233135\Design\Drainage\P&P\LDSsspp02.dgn



PLAN



PROFILE

HYDRAULIC DATA

DRAIN DITCH BRIDGE-HYDRAULIC SUMMARY 10-YR (DESIGN) FLOW

PROPOSED BRIDGE

Q_{10} (cfs)	n Channel	Slope	H.W.$_{10}$ (ft.)	T.W.$_{10}$ (ft.)	V_{OUTLET} (ft./s)	$V_{TAILWATER}$ (ft./s)
270.36	0.12	0.0045	4.735	3.186	10.04	2.907

DRAIN DITCH BRIDGE-HYDRAULIC SUMMARY 100-YR FLOW

PROPOSED BRIDGE

Q_{100} (cfs)	n Channel	Slope	H.W.$_{100}$ (ft.)	T.W.$_{100}$ (ft.)	V_{OUTLET} (ft./s)	$V_{TAILWATER}$ (ft./s)
612.17	0.12	0.0045	6.631	4.267	10.023	3.264

DRAINAGE AREA WAS DETERMINED FROM THE USGS QUAD MAP FOR LAREDO, TEXAS. THE WinTR-55 SMALL WATERSHED HYDROLOGY METHOD WAS UTILIZED FOR COMPUTING PEAK DISCHARGES. REFERENCES: 1.) WEBB COUNTY SOIL SURVEY 2.) USGS LAREDO, TEX QUAD MAP

DESIGN SPEED: 30 MPH
PROPOSED ADT: 1,400 (2013)
2,400 (2033)
RDWY FUNCT CLS: LOCAL STREET

NOTES:

REFER TO STANDARD SHEET(S): "CH-PW-S" FOR ADDITIONAL INFORMATION

REFER TO "LOMAS DEL SUR DRAINAGE AREA MAP AND HYDROLOGIC CALCULATIONS" SHEET FOR MORE INFORMATION

STATE OF TEXAS
RICARDO E. DE LA PARRA
94043
LICENSED PROFESSIONAL ENGINEER
P.E.
05/24/13

HORZ: 1"=40'
20 10 0 20 40
2 1 0 2 4
VERT: 1"=4'
IN ENGLISH

TEXAS DEPARTMENT OF TRANSPORTATION ®

LOMAS DEL SUR CULVERT LAYOUT STA. 107+35.31

DN: DLC	DW: DLC
CK: RED	CK: RED

FED.RD. DIV.NO.	FEDERAL PROJECT NO.	SHEET NUMBER	SHEET NO.
6	CBI 2012(590), ETC.	SHEET 1 OF 1	87

STATE	STATE DIST.NO.	COUNTY	CONTROL	SECTION	JOB	HIGHWAY NO.
TEXAS	22	WEBB	0922	33	135, ETC.	VARIOUS

5/24/2013 MTORRE1 f:\projects\240\09223135\Design\Drainage\culvlay.dgn

1 inch equals 650 feet

Pre Development				
Watershed	Area (Acres)	Composite SCS CN	Time of Concentration (Tc) min	Flow Rate
A1	556.03	56	25.26	Q10 = 618.24 Q25 = 883.28 Q50 = 1140.58

Post Development				
Watershed	Area (Acres)	Composite SCS CN	Time of Concentration (Tc) min	Flow Rate
A1	556.03	72	32.28	Q10 = 1328.56 Q25 = 1696.79 Q50 = 2037.69

Sub-Watershed	Area (Acres)	Post Dev. Flow Rate
A1-A	169.59	Q10 = 406.19 Q25 = 517.52 Q50 = 621.5
A1-B	97.49	Q10 = 232.94 Q25 = 297.50 Q50 = 357.27
A1-C	138.89	Q10 = 331.86 Q25 = 423.84 Q50 = 508.99
A1-D	150.06	Q10 = 358.55 Q25 = 457.93 Q50 = 549.93

EJIDO

A1-D

POND

LOMAS DEL SUR MASTERPLAN

J-2

A1-C

LOMAS DEL SUR CULVERT CROSSING

J-1

A1-B

A1-A

CUATRO VIENTOS SUR MASTERPLAN

PITA MANGANA

Junction	Contributing Watershed	Combined Flow Rates
J-1	A1-A + A1-B	Q10 = 639.13 Q25 = 815.02 Q50 = 978.77
J-2	A1-A + A1-B+A1-C	Q10 = 970.99 Q25 = 1238.86 Q50 = 1487.76
Pond	A1-A + A1-B+A1-C+A1-D	Q10 = 1328.56 Q25 = 1696.79 Q50 = 2037.69

Legend

- Webb County Drainage District Boundary Line
- Watershed A1

Watershed Contributing to Channel

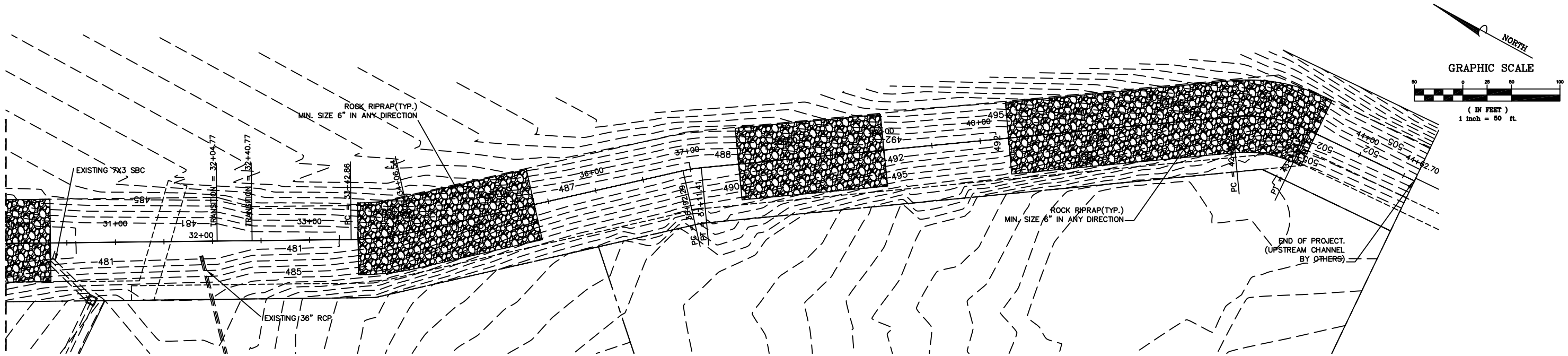
Sub-Watershed

- A1-A
- A1-B
- A1-C
- A1-D

Webb County Drainage District

Exhibit # 7
Watershed Map

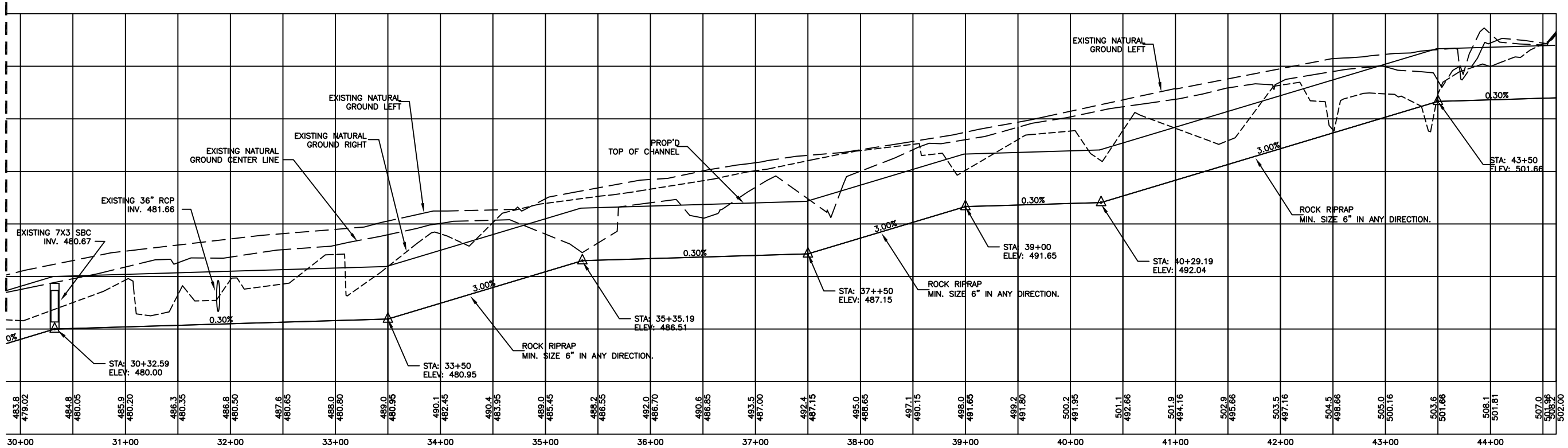
CRANE ENGINEERING CORP.
1310 JUNCTION DRIVE SUITE B
LAREDO, TEXAS 78041 956-712-1996
FIRM REGISTRATION NO. F-3353



1 PLANVIEW: DRAINAGE CHANNEL STA: 30+00 TO 44+62.70

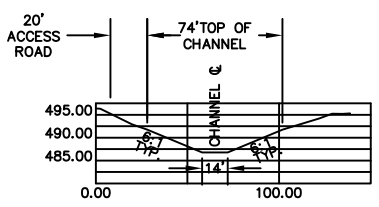
SCALE: HOR. 1"=50'
VERT. 1"=5'

MATCHLINE: SEE SHEET # 5



2 PROFILE: DRAINAGE CHANNEL STA: 30+00 TO 44+62.70

SCALE: HOR. 1"=50'
VERT. 1"=5'



3 EARTHEN CHANNEL TYPICAL SECTION

FROM STA: 32+40.77 TO STA: 44+62.70 NTS

NOTE:

1. FOR GRADING GENERAL NOTES SEE SHEET # 3

TRENCH EXCAVATION PROTECTION

CONTRACTOR AND/OR CONTRACTOR'S INDEPENDENTLY RETAINED EMPLOYEE OR STRUCTURAL DESIGN/GEOTECHNICAL/SAFETY/EQUIPMENT CONSULTANT, IF ANY SHALL REVIEW THESE PLANS AND ANY AVAILABLE GEOTECHNICAL INFORMATION AND THE ANTICIPATED INSTALLATION SITE(S) WITHIN THE PROJECT WORK AREA IN ORDER TO DEVELOP THE CONTRACTOR'S PLANS TO IMPLEMENT THE PROJECT DESCRIBED IN THE CONTRACT DOCUMENTS. THE CONTRACTOR'S PLAN SHALL PROVIDE FOR ADEQUATE TRENCH SAFETY SYSTEMS THAT COMPLY WITH AS MINIMUM, OSHA STANDARDS FOR TRENCH EXCAVATIONS. SPECIFICALLY, CONTRACTOR OF CONTRACTOR'S INDEPENDENTLY RETAINED EMPLOYEE OR SAFETY CONSULTANT SHALL DEVELOP AND IMPLEMENT A TRENCH SAFETY PROGRAM IN ACCORDANCE WITH OSHA STANDARDS GOVERNING THE PRESENCE AND ACTIVITIES OF INDIVIDUALS WORKING IN AND AROUND TRENCH EXCAVATION.

DRAWINGS ARE BEING ISSUED FOR APPROVAL AND BIDDING ONLY, UNDER THE AUTHORITY OF JOEMMA P. SHERFEY, P.E. TEXAS No. 68028 _____

Designed By: VG
Drawn By: VG
Checked By: JPS
Approved By: JPS
File: 8036.03DP-06 CHNELPP

Revision	Date	Description

Sherfey Engineering Company, L.L.C.
104 Del Court
Suite 400
Laredo, Texas 78041
956-791-3511

LOMAS DEL SUR DETENTION POND
AND DRAINAGE CHANNEL

STATE OF TEXAS
JOEMMA P. SHERFEY
68028
REGISTERED
PROFESSIONAL ENGINEER

DRAINAGE CHANNEL
STA: 30+00 TO 44+62.70

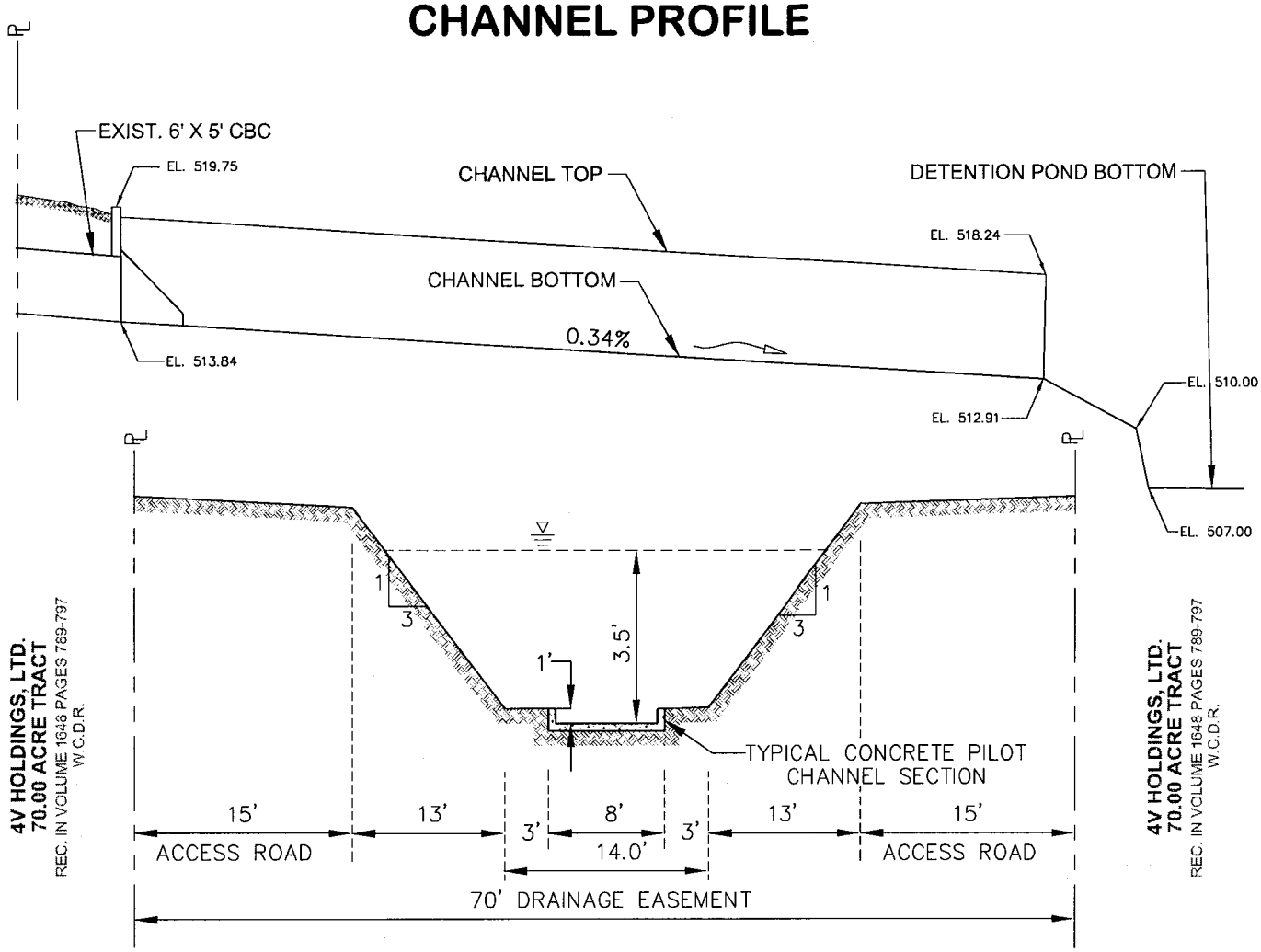
Scale: 1"=50' Date: 10/12/2007

PROJ. NO.8036.03

6

SHEET 6 OF 12

CHANNEL PROFILE



SECTION "A" - "A"
TYPICAL

CHANNEL CALCULATIONS

Post-Development 25-year

Bottom Width = 14 ft.

Left & Right Side Slopes = 3:1

Mannings n = 0.016

Channel Slope = 0.0034 ft/ft

Depth = 3.5 ft.

Discharge Capacity = ~520 cfs.

NOT TO SCALE

PORRAS NANCE ENGINEERING P.O. BOX 1670 LAREDO, TEXAS TEXAS REGISTERED ENGINEERING FIRM F-4205 OFFICE (956) 724-3097 FAX (956) 724-9208	**DETENTION POND CHANNEL DRAINAGE PROFILE, CROSS SECTION AND CALCULATIONS**	**CUATRO VIENTOS SUR DETENTION POND**

PONDPACK

MASTER SUMMARY

Webb County Drainage District
Hydrologic and Hydraulic Analysis
for Lomas Del Sur and Cuatro Vientos Sur
PondPack V8i Results

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
Watershed A1	Pre-Development 10 year	10	87.324	12.400	618.24
Watershed A1	Post-Development 10 year	10	157.085	12.300	1,328.56
Watershed A1	Pre-Development 25 year	25	120.373	12.400	883.28
Watershed A1	Post-Development 25 year	25	200.398	12.300	1,696.79
Watershed A1	Pre-Development 50 year	50	152.688	12.400	1,140.58
Watershed A1	Post-Development 50 year	50	240.995	12.300	2,037.69

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
J-3	Pre-Development 10 year	10	87.324	12.400	618.24
J-3	Post-Development 10 year	10	157.085	12.300	1,328.56
J-3	Pre-Development 25 year	25	120.373	12.400	883.28
J-3	Post-Development 25 year	25	200.398	12.300	1,696.79
J-3	Pre-Development 50 year	50	152.688	12.400	1,140.58
J-3	Post-Development 50 year	50	240.995	12.300	2,037.69
O-1	Pre-Development 10 year	10	83.060	12.950	301.48
O-1	Post-Development 10 year	10	151.938	12.750	620.49
O-1	Pre-Development 25 year	25	115.363	12.900	453.77
O-1	Post-Development 25 year	25	201.547	12.750	766.78
O-1	Pre-Development 50 year	50	147.100	12.900	570.70
O-1	Post-Development 50 year	50	241.866	12.800	851.31

Webb County Drainage District
Hydrologic and Hydraulic Analysis
for Lomas Del Sur and Cuatro Vientos Sur
PondPack V8i Results

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-3 (IN)	Pre-Development 10 year	10	87.282	12.450	617.55	(N/A)	(N/A)
PO-3 (OUT)	Pre-Development 10 year	10	83.060	12.950	301.48	464.86	23.591
PO-3 (IN)	Post-Development 10 year	10	157.029	12.350	1,317.52	(N/A)	(N/A)
PO-3 (OUT)	Post-Development 10 year	10	151.938	12.750	620.49	468.60	47.174
PO-3 (IN)	Pre-Development 25 year	25	120.320	12.450	878.78	(N/A)	(N/A)
PO-3 (OUT)	Pre-Development 25 year	25	115.363	12.900	453.77	466.32	32.413
PO-3 (IN)	Post-Development 25 year	25	207.260	12.250	2,692.91	(N/A)	(N/A)
PO-3 (OUT)	Post-Development 25 year	25	201.547	12.750	766.78	471.39	66.920
PO-3 (IN)	Pre-Development 50 year	50	152.624	12.450	1,132.04	(N/A)	(N/A)
PO-3 (OUT)	Pre-Development 50 year	50	147.100	12.900	570.70	467.81	41.932
PO-3 (IN)	Post-Development 50 year	50	248.141	12.150	2,692.91	(N/A)	(N/A)
PO-3 (OUT)	Post-Development 50 year	50	241.866	12.800	851.31	473.28	81.330

Subsection: Time of Concentration Calculations
Return Event: Post Development
Label: LDS

Time of Concentration Results

Segment #1: TR-55 Shallow Concentrated Flow	
Hydraulic Length	2,692.00 ft
Is Paved?	True
Slope	0.020 ft/ft
Average Velocity	2.87 ft/s
Segment Time of Concentration	0.260 hours

Segment #2: TR-55 Channel Flow		
Flow Area	24.5	ft²
Hydraulic Length	495.00	ft
Manning's n	0.016	
Slope	0.003	ft/ft
Wetted Perimeter	24.67	ft
Average Velocity	5.41	ft/s
Segment Time of Concentration	0.025	hours

Segment #3: TR-55 Channel Flow		
Flow Area	267.0	ft²
Hydraulic Length	2,803.00	ft
Manning's n	0.035	
Slope	0.005	ft/ft
Wetted Perimeter	90.00	ft
Average Velocity	5.90	ft/s
Segment Time of Concentration	0.132	hours

Segment #4: Length and Velocity		
Hydraulic Length	105.00	ft
Velocity	10.00	ft/s
Segment Time of Concentration	0.003	hours

Time of Concentration (Composite)		
Time of Concentration (Composite)	0.421	hours

==== User Defined Length & Velocity

Tc = (Lf / V) / 3600

Where:
Tc= Time of concentration, hours
Lf= Flow length, feet
V= Velocity, ft/sec

==== SCS TR-55 Shallow Concentration Flow

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Tc =

Paved Surface:
V = 20.3282 * (Sf**0.5)

(Lf / V) / 3600

Where:
V= Velocity, ft/sec
Sf= Slope, ft/ft
Tc= Time of concentration, hours
Lf= Flow length, feet

==== SCS TR-55 Sheet Flow

Tc = (0.007 * ((n * Lf)**0.8)) / ((P**0.5) * (Sf**0.4))

Where:
Tc= Time of concentration, hours
n= Manning's n
Lf= Flow length, feet
P= 2yr, 24hr Rain depth, inches
Sf= Slope, %

Webb County Drainage District
Hydrologic and Hydraulic Analysis
for Lomas Del Sur and Cuatro Vientos Sur
PondPack V8i Results

Return Event: Pre-Development

Label: LDS

Time of Concentration Results

Segment #1: TR-55 Shallow Concentrated Flow		
Hydraulic Length	1,872.00	ft
Is Paved?	True	
Slope	0.020	ft/ft
Average Velocity	2.87	ft/s
Segment Time of Concentration	0.181	hours

Segment #2: Length and Velocity		
Hydraulic Length	105.00	ft
Velocity	10.00	ft/s
Segment Time of Concentration	0.003	hours

Segment #3: TR-55 Channel Flow		
Flow Area	24.5	ft²
Hydraulic Length	3,623.00	ft
Manning's n	0.035	
Slope	0.005	ft/ft
Wetted Perimeter	24.67	ft
Average Velocity	2.84	ft/s
Segment Time of Concentration	0.354	hours

Time of Concentration (Composite)		
Time of Concentration (Composite)	0.538	hours

==== User Defined Length & Velocity

Tc = (Lf / V) / 3600

Where:
Tc= Time of concentration, hours
Lf= Flow length, feet
V= Velocity, ft/sec

==== SCS TR-55 Shallow Concentration Flow

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Tc =

Paved Surface:
V = 20.3282 * (Sf**0.5)

(Lf / V) / 3600

Where:
V= Velocity, ft/sec
Sf= Slope, ft/ft
Tc= Time of concentration, hours
Lf= Flow length, feet

==== SCS TR-55 Sheet Flow

Tc = (0.007 * ((n * Lf)**0.8)) / ((P**0.5) * (Sf**0.4))

Where:
Tc= Time of concentration, hours
n= Manning's n
Lf= Flow length, feet
P= 2yr, 24hr Rain depth, inches
Sf= Slope, %

Subsection: Runoff CN-Area
Return Event: Post Development
Label: LDS

Runoff Curve Number Data

Soil/Surface Description	CN	Area (acres)	C (%)	UC (%)	Adjusted CN
Impervious Areas - Paved; curbs and storm sewers - Soil B	95.000	9.560	0.0	0.0	95.000
Impervious Areas - Paved; curbs and storm sewers - Soil C	95.000	23.450	0.0	0.0	95.000
Residential Districts - 1 acre - Soil C	70.000	194.840	0.0	0.0	70.000
Residential Districts - 1 acre - Soil B	60.000	75.130	0.0	0.0	60.000
Urban Districts - Commercial & Business - Soil B	87.000	7.250	0.0	0.0	87.000
Urban Districts - Commercial & Business - Soil C	90.000	52.900	0.0	0.0	90.000
Residential Districts - 1/8 acre (town houses) - Soil B	78.000	9.070	0.0	0.0	78.000
Residential Districts - 1/8 acre (town houses) - Soil C	85.000	16.760	0.0	0.0	85.000
Residential- Soil B	60.000	32.770	0.0	0.0	60.000
Residential- Soil C	70.000	96.660	0.0	0.0	70.000
School Site- Soil B	60.000	10.490	0.0	0.0	60.000
School Site - Soil C	70.000	27.150	0.0	0.0	70.000
COMPOSITE AREA & WEIGHTED CN --->	(N/A)	556.030	(N/A)	(N/A)	72.062

Subsection: Runoff CN-Area
Return Event: Pre Development
Label: LDS

Runoff Curve Number Data

Soil/Surface Description	CN	Area (acres)	C (%)	UC (%)	Adjusted CN
Open space (Lawns,parks etc.) - Good condition; grass cover > 75% - Soil B	52.000	400.150	0.0	0.0	52.000
Open space (Lawns,parks etc.) - Good condition; grass cover > 75% - Soil C	65.000	155.880	0.0	0.0	65.000
COMPOSITE AREA & WEIGHTED CN --->	(N/A)	556.030	(N/A)	(N/A)	55.644

Index

HEC-RAS

HEC-RAS Plan: Drop Structures River: LDS Reach: 1

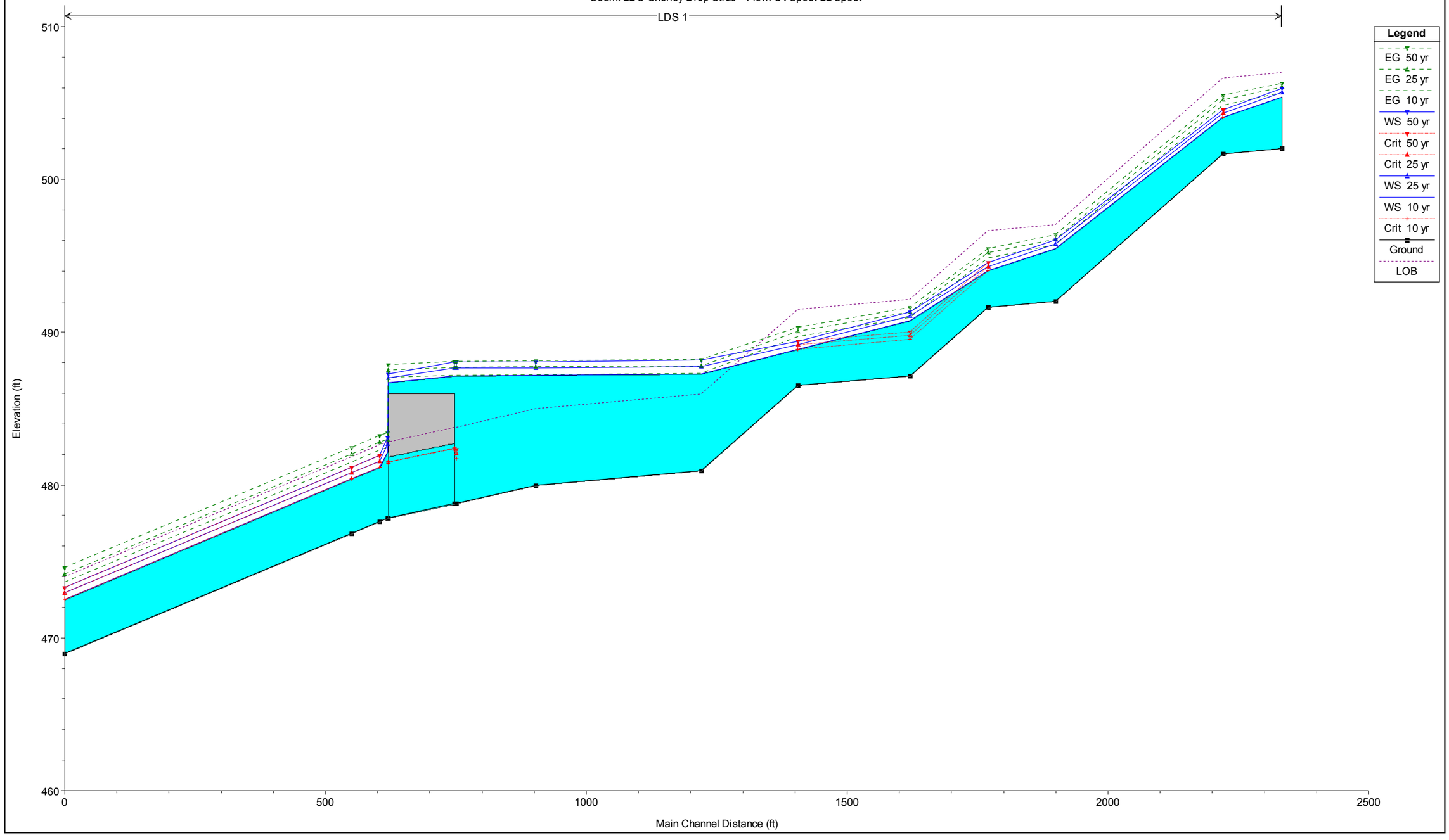
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	2332.54	10 yr	489.00	502.00	505.39		505.66	0.003642	4.21	116.20	54.63	0.51
1	2332.54	25 yr	600.00	502.00	505.70		506.01	0.003725	4.48	134.04	58.42	0.52
1	2332.54	50 yr	704.00	502.00	505.96		506.31	0.003802	4.70	149.75	61.56	0.53
1	2219.84	10 yr	489.00	501.66	504.05	504.05	504.86	0.015742	7.21	67.85	42.71	1.01
1	2219.84	25 yr	600.00	501.66	504.32	504.32	505.20	0.015298	7.53	79.64	45.91	1.01
1	2219.84	50 yr	704.00	501.66	504.54	504.54	505.49	0.014956	7.80	90.31	48.62	1.01
1	1899.03	10 yr	489.00	492.04	495.47		495.73	0.003455	4.13	118.48	55.13	0.50
1	1899.03	25 yr	600.00	492.04	495.78		496.08	0.003547	4.40	136.50	58.92	0.51
1	1899.03	50 yr	704.00	492.04	496.05		496.38	0.003617	4.62	152.54	62.10	0.52
1	1769.84	10 yr	489.00	491.65	494.04	494.04	494.85	0.015743	7.21	67.85	42.71	1.01
1	1769.84	25 yr	600.00	491.65	494.31	494.31	495.19	0.015300	7.53	79.64	45.91	1.01
1	1769.84	50 yr	704.00	491.65	494.53	494.53	495.48	0.014953	7.79	90.32	48.62	1.01
1	1619.84	10 yr	489.00	487.15	490.74	489.54	490.97	0.002830	3.83	127.55	57.07	0.45
1	1619.84	25 yr	600.00	487.15	491.07	489.81	491.33	0.002910	4.09	146.87	61.00	0.46
1	1619.84	50 yr	704.00	487.15	491.34	490.03	491.63	0.002976	4.29	163.98	64.28	0.47
1	1405.03	10 yr	489.00	486.51	488.90	488.90	489.71	0.015742	7.21	67.85	42.71	1.01
1	1405.03	25 yr	600.00	486.51	489.17	489.17	490.05	0.015315	7.54	79.61	45.90	1.01
1	1405.03	50 yr	704.00	486.51	489.40	489.40	490.34	0.014919	7.79	90.40	48.64	1.01
1	1219.84	10 yr	489.00	480.95	487.26		487.30	0.000202	1.54	316.95	74.00	0.13
1	1219.84	25 yr	600.00	480.95	487.77		487.81	0.000213	1.69	354.49	74.00	0.14
1	1219.84	50 yr	704.00	480.95	488.18		488.23	0.000225	1.83	385.13	74.00	0.14
1	902.43	10 yr	722.00	480.00	487.17		487.22	0.000247	1.90	380.38	74.00	0.15
1	902.43	25 yr	898.00	480.00	487.66		487.73	0.000286	2.16	416.60	74.00	0.16
1	902.43	50 yr	1062.00	480.00	488.05		488.14	0.000323	2.38	445.97	74.00	0.17

HEC-RAS Plan: Drop Structures River: LDS Reach: 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	750	10 yr	722.00	478.80	487.15	481.72	487.19	0.000128	1.54	468.21	74.00	0.11
1	750	25 yr	898.00	478.80	487.64	482.07	487.69	0.000157	1.78	504.25	74.00	0.12
1	750	50 yr	1062.00	478.80	488.04	482.36	488.10	0.000185	1.99	533.43	74.00	0.13
1	683.16		Culvert									
1	619	10 yr	722.00	477.84	482.18		482.45	0.002665	4.15	174.05	66.13	0.45
1	619	25 yr	898.00	477.84	482.70		482.98	0.002496	4.28	209.72	72.31	0.44
1	619	50 yr	1062.00	477.84	483.12		483.42	0.002306	4.42	240.43	74.00	0.43
1	604	10 yr	1054.00	477.63	481.18	481.18	482.28	0.013859	8.43	125.08	56.55	1.00
1	604	25 yr	1322.00	477.63	481.57	481.57	482.80	0.013715	8.90	148.49	61.32	1.01
1	604	50 yr	1571.00	477.63	481.93	481.93	483.24	0.013160	9.17	171.36	65.64	1.00
1	550	10 yr	1054.00	476.86	480.40	480.40	481.51	0.013880	8.43	125.01	56.54	1.00
1	550	25 yr	1322.00	476.86	480.80	480.80	482.03	0.013704	8.90	148.53	61.33	1.01
1	550	50 yr	1571.00	476.86	481.16	481.16	482.47	0.013173	9.17	171.30	65.63	1.00
1	0	10 yr	1054.00	469.00	472.54	472.54	473.65	0.013910	8.44	124.91	56.51	1.00
1	0	25 yr	1322.00	469.00	472.94	472.94	474.17	0.013734	8.91	148.41	61.30	1.01
1	0	50 yr	1571.00	469.00	473.30	473.30	474.61	0.013193	9.18	171.21	65.61	1.00

Lomas Del Sur Drainage Channel

Geom: LDS-Sherfey Drop Struc Flow: CVSpost-LDSpost

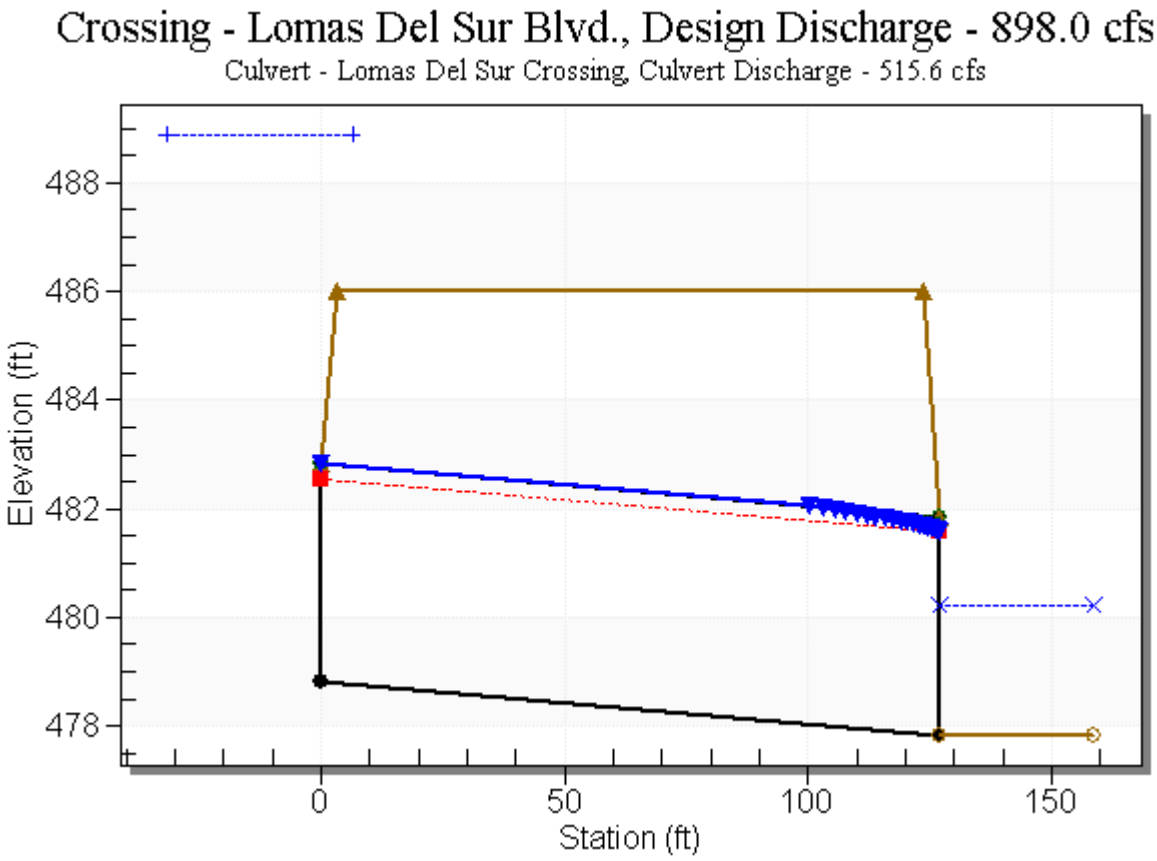


HY – 8
CULVERT ANALYSIS

Table 2 - Culvert Summary Table: Lomas Del Sur Crossing

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)
TxDOT 10 yr Pre	280.00	280.00	483.69	4.875	0.238	5-S2n	2.425	2.925	2.497	1.218	11.328
Max with Freeboard	400.00	400.00	485.92	7.103	6.292	5-S2n	3.207	3.445	3.219	1.497	12.337
LDS/CVS 25 yr Post	898.00	515.55	488.90	10.079	8.799	7-M2c	4.000	3.735	3.735	2.372	14.075

Water Surface Profile Plot for Culvert: Lomas Del Sur Crossing



Site Data - Lomas Del Sur Crossing

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 478.82 ft

Outlet Station: 127.00 ft

Outlet Elevation: 477.84 ft

Number of Barrels: 3

Culvert Data Summary - Lomas Del Sur Crossing

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

PONDPACK

PONDMAKER WORKSHEET REPORT

PondMaker Worksheet Detailed Report: Worksheet (PO-3) - 1

Element Details

ID	104
Label	Worksheet (PO-3) - 1
Select Pond to Design	PO-3
Flow Allowed Below Target	25.0
Flow Allowed Above Target	0.0
Flow Allowed Below Target	30.0
Flow Allowed Above Target	0.0
Volume Allowed Below Target	25.0
Volume Allowed Above Target	50.0
Tolerance Display	Display PASS for values within specified tolerance

Notes

Volume

Pond Type	Elevation-Area	Use Void Space?	False

Elevation-Area

Pond Elevation (ft)	Pond Area (acres)
460.50	5.020
463.00	5.450
465.00	5.900
469.00	6.830
471.00	7.320
475.00	8.350
476.00	8.670

Infiltration

Infiltration Method	No Infiltration

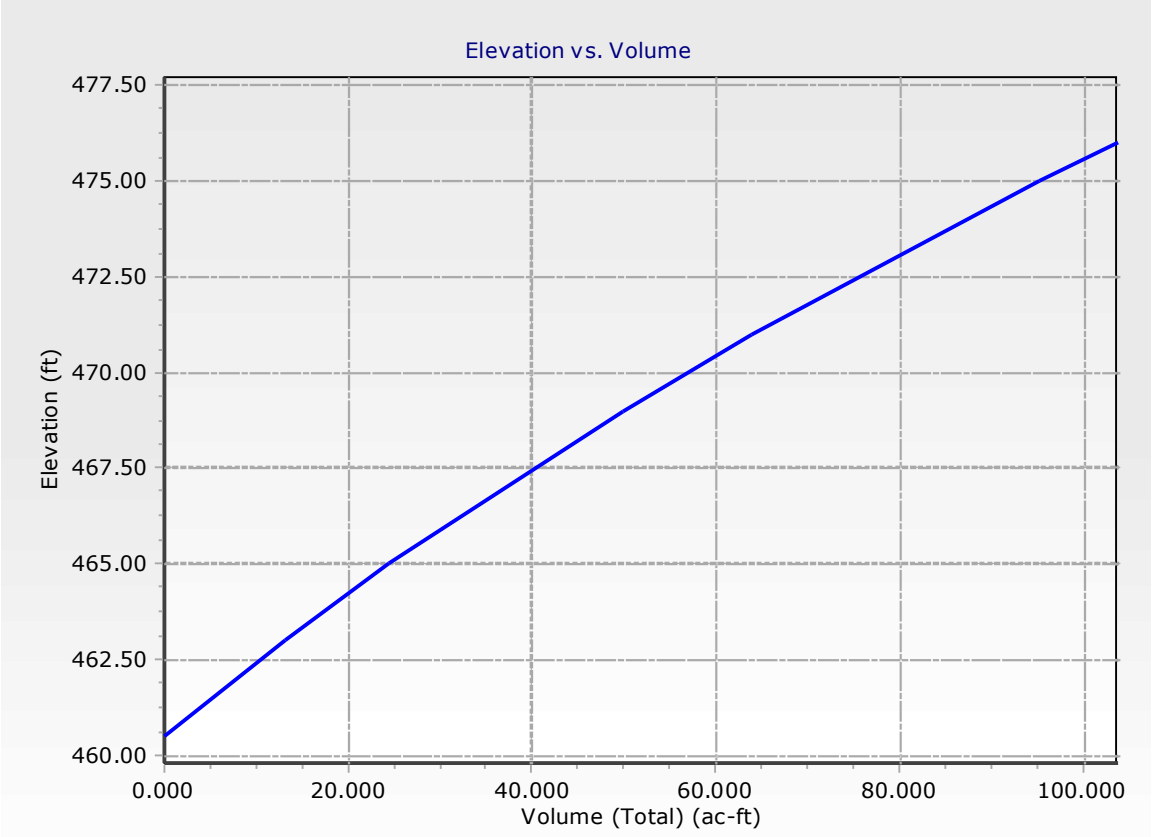
Output

Detention Time	Compute All Methods

Initial Conditions

Is Outflow Averaging On?	False	Define Starting Water Surface Elevation	Pond Invert

PondMaker Worksheet Detailed Report: Worksheet (PO-3) - 1

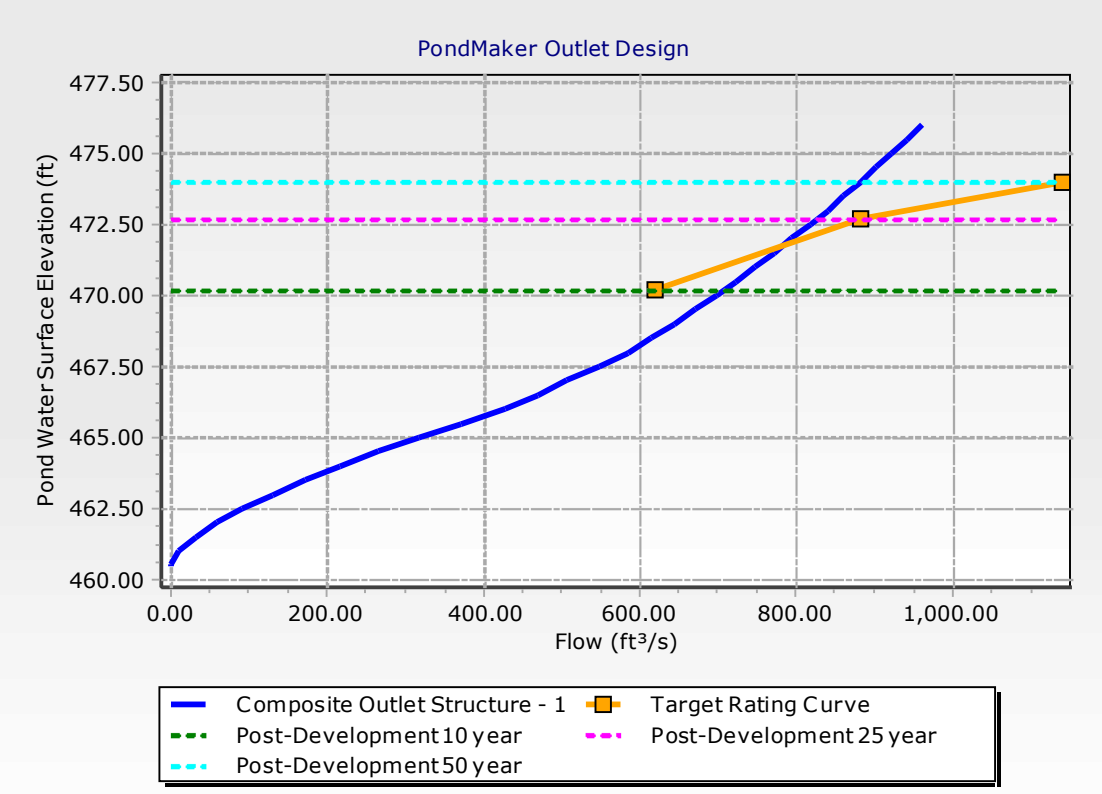


PondMaker Worksheet Detailed Report: Worksheet (PO-3) - 1

PondMaker Worksheet (Outlet Design)

Design Scenario	Design Return Event	Target Peak Outflow (ft³/s)	Target Outflow Volume (ac-ft)	Peak Pond Inflow (ft³/s)	Total Inflow Volume (ac-ft)
Post-Development 50 year	50	1,140.58	152.688	2,692.91	248.141
Post-Development 25 year	25	883.28	120.373	2,692.91	207.260
Post-Development 10 year	10	618.24	87.324	1,317.52	157.029

Estimated Storage (ac-ft)	Estimated Max Water Surface Elevation (ft)	Estimated Freeboard Depth	Design Outlet Structure	Estimated Peak Outflow (ft³/s)	Estimated Peak Outflow vs. Target
87.471	474.00	Pass	Composite Outlet Structure - 1	881.59	Pass
77.403	472.71	Pass	Composite Outlet Structure - 1	826.76	Pass
58.549	470.23	Pass	Composite Outlet Structure - 1	709.29	Fail



PondMaker Worksheet Detailed Report: Worksheet (PO-3) - 1

PondMaker Worksheet (Routing Design)

Design Scenario	Design Return Event	Target Peak Outflow (ft³/s)	Computed Peak Outflow (ft³/s)	Computed Peak Outflow vs. Target	Target Outflow Volume (ac-ft)
Post-Development 50 year	50	1,140.58	851.31	Pass	152.688
Post-Development 25 year	25	883.28	766.78	Pass	120.373
Post-Development 10 year	10	618.24	620.49	Fail	87.324

Computed Volume Outflow (ac-ft)	Computed Outflow Volume vs. Target	Routing Outlet Structure	Computed Max Water Elevation (ft)	Freeboard Depth	Maximum Storage (ac-ft)
241.866	Fail	Composite Outlet Structure - 1	473.28	Pass	81.330
201.547	Fail	Composite Outlet Structure - 1	471.39	Pass	66.920
151.938	Fail	Composite Outlet Structure - 1	468.60	Pass	47.174