Released Material

Memorandum

City of Las Vegas
Department of Public Works
Engineering Planning

To: Richard Danielson, A.I.A
Architectural Services

From: John Bettencourt, P.E.
Flood Control

Date: January 19, 2005

Re: Deer Springs Park and Deer Springs Way

We reviewed the improvement plans and drainage study for Deer Springs Park, by Stantec received on May 29, 2002, and found the study acceptable.

Cc:
Guy Ruddy – Stantec Fax: 258-4956
Wayne Dowdey – CLV Land Development
Greg McDermott – CLV Flood Control

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Other elements of the HEC-1s have also been changed. The original submission included a 96-inch rcp, which drained Pond 1. That pipe has been removed and replaced with an open channel. The one advantage of the 96-inch pipe in the original HEC-1 was the headwater required to generate the model flow. An open channel simply draining the Pond, requires no headwater. Hence, the Pond drained so fast that no storage was achieved. This submission, and the enclosed plans include a culvert of 3, 48-inch HDPE pipes draining the Pond into the open channel.

The revised HEC-1s, Enclosure 7B, and form 6 are included.

Comment 2.

In previous meetings with the consultant it was agreed that all future 10-year flows at "Pond 1" would be routed south to "Pond 2." Neither the HEC-1 nor exhibit 7B reflects this routing. The HEC-1 model should be revised at "Pond 1" and "FS Pond" to reflect the 10-year flow in the basin. By doing so the entire future 10-year flow will be routed south along Deer Springs Way as agreed. The engineer should also revise all the down stream concentration points that were affected by this change.

Response 2.

All HEC-1s have been revised to rout all future 10-year flows south to Pond 2. The revised HEC-1s and Enclosure 7B are included.

Comment 3.

(PP-1 & PP-2) No hydraulic calculations were included for the 96-inch RCP that drains the detention basin. The next submittal must include hydraulic calculations for this pipe if this system is to be constructed with Phase I of the park. The 100-year flow, 10-year flow, and hydraulic grade lines must be identified on the plan and profile sheets. A headwall and trash-rack must be provided at the outlet of the basin into the 96-inch pipe. The discharge of the pipe should also occur further west of Buffalo Drive to allow the storm flows to surface drain prior to reaching Buffalo Drive. Proper erosion protection should be provided at the outlet of the pipe.

Response 3.

As noted above in response 1, the 96-inch RCP has been replaced with an open channel. The channel is designated as the North Channel and is to be constructed in two phases. The first phase is to be constructed with the current phase of the park, the north 20 plus acres. The second phase is to be constructed along with the construction of Deer Springs Way. In the first phase the proposed channel extends from the eastern terminus at Buffalo at Wittig, westerly to the southeast corner of the Clark County Middle School site. This channel is designed to convey 550 cfs. A smaller open channel to be constructed on the park site, along the southern boundary of the Middle School, drains into the main North Channel. The smaller channel is to convey storm flow from the cul-de-sac in Conough Lane to the main North Channel.

As a part of the Middle School project, a drop inlet to capture nuisance flow is to be constructed at the low point of the Conough cul-de-sac. As a part of the park project, an 18-inch HDPE will drain the Conough cul-de-sac drop inlet. The plans and calculations supporting the design various design elements are included.

Comment 4.

(C-2) The drop inlets at STA 1+05 and STA 1+11 on Deer Springs Way should be modified to 6-foot Neenah drop inlets. Contact the Flood Control Section to obtain a digital copy of the Neenah drop inlet detail. Calculations for the proposed 24-inch pipe must be included with the next submittal to ensure that this pipe can adequately convey stormwater from the existing pipe in Deer Springs Way. Also Detail A on this sheet must be revised to show a 1/2 inch curb face rather than a zero curb face. The channel construction and proposed culverts along the north side of Deer Springs must be included as part of these roadway improvements.

Response 4.

The following revisions appear on sheet C-2 and others as noted below. Neenah, CM2 Drop Inlets, are now shown on the plans. The construction details provided by the City of Las Vegas has been modified and are included in the plans.

Given an existing Q100 flow in Deer Spring at the west side of the site, the drop inlets would accept approximately 17 cfs each. The existing 24 inch RCP in Deer Springs Rd. is dry; there are no inlets to the pipe and each end is capped. The approved constructions drawing, CLV dwg No. 107-V3108 by VTN, delineates an HGL at the top of the pipe. This response assumes, based on the approved HGL, that the existing 24 inch pipe flows full at 35 cfs. The Q calculations and the VTN drawing are included. Based on the inlet capacities and the capacity of the 24 inch pipe, the drain pipes have been calculated to be 42 inches. The storm drain hydraulic calculation is included.

Detail A has been modified to indicate a 1/2 inch curb face.

Deer Springs Way drainage channel with associated culverts and nuisance pipes are shown in plan and profile on sheets C8 and C9. All appropriate calculations are included.

Comment 5.

(C-3) Detail A must be revised for all of Deer Springs Way to show regular "L" Type curb and gutter along the south side of the roadway to collect nuisance water.

Response 5.

The plans have been revised. An offset crown and an "L-curb" are called for along the entire length of the south side of Deer Spring Way. The revised plans are included.

In the future condition, none of these culvert flows will occur. In the future the runoff generated in the historical tributary basins located west of Hwy 95 will not impact the site.

The tributary basins located east of Hwy 95 are rapidly developing. While some parcels are undeveloped, this study considers entire area developed.

As mentioned above off-site flows impact the site at 3 locations. First are the flows reaching the site in Elkhorn Road. Second are the flows reaching the site in Deer Springs Way. Third are flows reaching the site in Buffalo Road, at the south end of the site. These basins, their sub-basin, the collection points etc. are shown Drainage Basin Maps, Enclosure 7A and 7B.

Runoff in the existing condition, which includes the culvert flows at Hwy 95, arriving at the site in Elkhorn, splits at the intersection with Buffalo. One third of the existing 100 and 10 year flows in Elkhorn turns south in Buffalo. In the future condition, the 100 year flow will split, one third south in Buffalo, as in the existing condition. But in the future 10 year storm, no split occurs.

Runoff in the existing condition, which includes the culvert flows at Hwy 95, arriving at the site in Deer Springs joins with minor runoff from adjacent subdivisions. The undeveloped site conveys these flows directly east across the property into residential areas along Deer Springs east of Buffalo. The developed site will divert the runoff arriving in Deer Springs into a pond with two outlets. One outlet conveys the main 100 and 10 year existing flow northeasterly to Buffalo at Wittig. The second outlet conveys the rest of the flow southeasterly to Buffalo at John Herbert. Some of the southeasterly flow will split east, drain through the proposed parking areas, and drain into Deer Springs. In the future condition, the 100 year flow will fill the pond and drain from the two outlets as in the existing condition. But in the future 10 year condition, the entire runoff will flow southeast, none will flow to the northeast.

Runoff in the existing condition, which includes the culvert flows at Hwy 95, arriving at the site in Buffalo joins with runoff from adjacent subdivisions. In all conditions, existing and future, 100 and 10 year storms, these flows drain east in Buffalo to John Herbert, the south away from the site.

Overflow into

Pond-1

DEERSPRINGS WAY TOP
Worksheet for Irregular Channel

10yr Interim
236 cfs
- Just before Proposed St.

Project Description	
Worksheet	DEER SPRINGS W
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.027000	ft/ft
Discharge	236.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.88	ft
Elevation Range	0.00 to 0.83	
Flow Area	30.6	ft²
Wetted Perimeter	85.47	ft
Top Width	84.00	ft
Actual Depth	0.88	ft
Critical Elevation	1.14	ft
Critical Slope	0.004466	ft/ft
Velocity	7.72	ft/s
Velocity Head	0.93	ft
Specific Energy	1.80	ft
Froude Number	2.26	
Flow Type	Supercritical	

* Assumed all flows below the South side Crown remain, while all other flow above the sidewalk on the north side weir/flow over.

Calculation Messages:
Water elevation exceeds lowest end station by 0.27698231 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19
73+.50	0.02

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DEERSPRINGS WAY TOP
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
73+.50	0.57
74+.00	0.57
78+.00	0.65
84+.00	0.77

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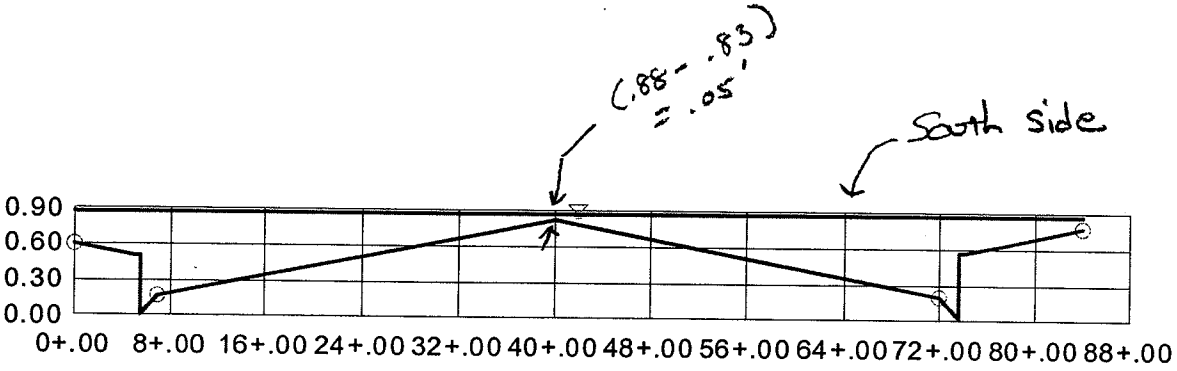
DEERSPRINGS WAY TOP
Cross Section for Irregular Channel

Project Description	
Worksheet	DEER SPRINGS W
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.027000	ft/ft
Water Surface Elevation	0.88	ft
Elevation Range	0.00 to 0.83	
Discharge	236.00	cfs



V:10.0
H:1
NTS

South side only

Area = (44 x .05)

V = 2.72

Q above crown = AV

= (44 x .05) 2.72

= 17 cfs

Q remain = Q total south side − 17 cfs

= 118 − 17

= 101 cfs + Q north = 13 cfs

= 114 cfs

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Check 10 yr

Weir check for South Side

$L = 300'$ (STA 200 → 5+00)

$C = 2.6$

$H = 0.05'$ elevation above the crown.

$Q = CLH^{1.5}$

$= 2.6(300)(.05)^{1.5}$

$= 9$ cfs ← we slowed 17 cfs but this doesn't account for MOMENTUM.

Weir check for North Side

$L = 300'$

$C = 2.6'$

$H = (0.88' - 0.6) = 0.28'$ over the back of walk on the North Side

$Q = 2.6(300)(.28)^{1.5}$

$= 116$ cfs overtopping

$Q_{remain} = 236 - 116 = 120$ cfs

∴ close to the 114 cfs calculated

→ thus 114 cfs in STREET

122 into the Pond

DEERSPRINGS WAY TOP
Worksheet for Irregular Channel

694 cfs

-Just before proposed ST.

Project Description	
Worksheet	DEER SPRINGS W
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.027000	ft/ft
Discharge	694.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	1.21	ft
Elevation Range	0.00 to 0.83	
Flow Area	58.6	ft²
Wetted Perimeter	86.14	ft
Top Width	84.00	ft
Actual Depth	1.21	ft
Critical Elevation	1.80	ft
Critical Slope	0.003597	ft/ft
Velocity	11.83	ft/s
Velocity Head	2.18	ft
Specific Energy	3.39	ft
Froude Number	2.50	
Flow Type	Supercritical	

* Assumed all flows below the South side Crown remain. Meanwhile, all other flows overtop the sidewalk on the north side.

Calculation Messages:
Water elevation exceeds lowest end station by 0.61106999 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19
73+.50	0.02

- 2% Cross Slope both sides

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DEERSPRINGS WAY TOP
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
73+.50	0.57
74+.00	0.57
78+.00	0.65
84+.00	0.77

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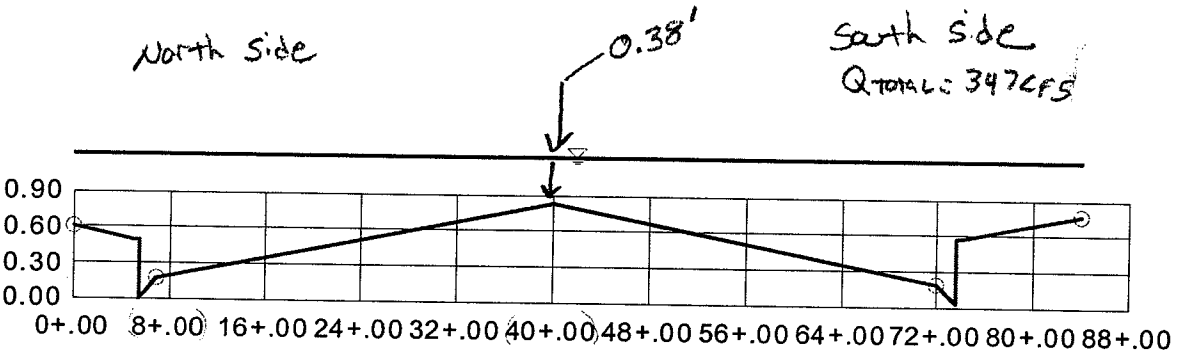
DEERSPRINGS WAY TOP
Cross Section for Irregular Channel

Project Description	
Worksheet	DEER SPRINGS W
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.027000	ft/ft
Water Surface Elevation	1.21	ft
Elevation Range	0.00 to 0.83	
Discharge	694.00	cfs



South Side Only

V:10.0
H:1
NTS

$Q_{total} = 347_{CFS}$

$Area = (0.38 \times 44)$

$V = 11.8$

$Q_{above\ crown} = A \times V$

$= (.38 \times 44)\,11.8$

$= 197_{CFS}$

$Q_{remain} = Q_{total} - Q_{above}$

$= 347 - 197$

$= 150_{CFS}$

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Check assumptions 100yr

Weir check for South side

$L = 300'$ (sta 200 → 5+00)

$C = 2.6$

$H = 0.38'$ elevation above crown.

$Q = CLH^{1.5}$

$= 2.6(300)(0.38)^{1.5}$

$= 183$ cfs approximately 197 calculated.

Weir check for North side

$Q_{total\ overflow} = 694 - 163$

$= 531$ cfs

$Q = CLH^{1.5}$

$Q = 531$ needed

$C = 2.6$

$L = 300$

$\therefore H = 0.77'$

back of walk $= 0.6'$

total depth needed $= 0.77 + 0.6$

$= 1.37'$

AT first we only have 1.21' depth but then it rises as the slope goes down. (at 1.8% slope d = 1.30', when Q = 694) thus, this is close. Also, we are ignoring Momentum, which will have some effect, especially around the bend.

NORTH SIDE, 100-YR
Worksheet for Irregular Channel

100yr, Interim
- flow on the north side below sidewalk after the weir.

Project Description	
Worksheet	DEER SPRINGS WAY OUT, NOR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.008300	ft/ft
Water Surface Elevation	0.60	ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.016	
Elevation Range	0.00 to 0.87	
Discharge	13.35	cfs
Flow Area	4.9	ft²
Wetted Perimeter	27.09	ft
Top Width	26.50	ft
Actual Depth	0.60	ft
Critical Elevation	0.62	ft
Critical Slope	0.006572	ft/ft
Velocity	2.72	ft/s
Velocity Head	0.12	ft
Specific Energy	0.72	ft
Froude Number	1.12	
Flow Type	Supercritical	

← 13 cfs remains in the street on the north side of the road, after all other flows weir over.

* assumes all flow above the sidewalk on the north side overtops, along with flows above the crown on the south side.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	40+.00	0.017

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.13
7+.00	0.21
40+.00	0.87

– 2% cross slope after weir

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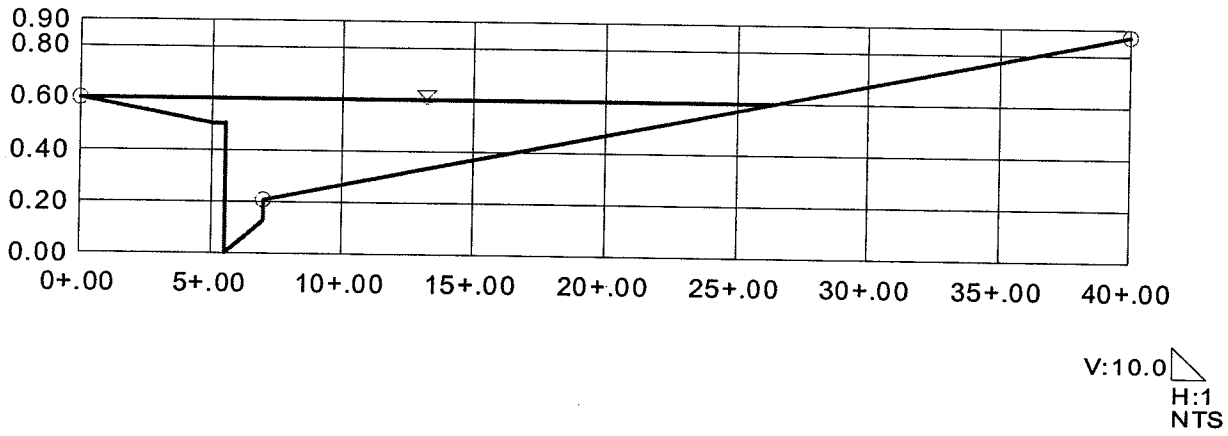
NORTH SIDE, 100-YR
Cross Section for Irregular Channel

Project Description	
Worksheet	DEER SPRINGS WAY OUT, NOR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.008300	ft/ft
Water Surface Elevation	0.60	ft
Elevation Range	0.00 to 0.87	
Discharge	13.35	cfs



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Street X sections

X-SECTION A
Worksheet for Irregular Channel

FUTURE 10yr

Project Description	
Worksheet	X-SECTION A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	33.00	cfs

=(47-14)

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.50	ft
Elevation Range	0.00 to 0.83	
Flow Area	6.3	ft²
Wetted Perimeter	35.77	ft
Top Width	34.77	ft
Actual Depth	0.50	ft
Critical Elevation	0.63	ft
Critical Slope	0.005722	ft/ft
Velocity	5.27	ft/s
Velocity Head	0.43	ft
Specific Energy	0.93	ft
Froude Number	2.19	
Flow Type	Supercritical	

D x V

0.5 x 5.27 = 2.6 < 6 ✓

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19
73+.50	0.02

X-SECTION A
Worksheet for Irregular Channel

Future 100yr

Project Description	
Worksheet	X-SECTION A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	81.00	cfs

= (103-22)

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.66	ft
Elevation Range	0.00 to 0.83	
Flow Area	13.8	ft²
Wetted Perimeter	62.02	ft
Top Width	60.88	ft
Actual Depth	0.66	ft
Critical Elevation	0.82	ft
Critical Slope	0.005693	ft/ft
Velocity	5.85	ft/s
Velocity Head	0.53	ft
Specific Energy	1.19	ft
Froude Number	2.16	
Flow Type	Supercritical	

D x V

0.66 x 5.85 = 3.9 < 8 ✓

Calculation Messages:
Water elevation exceeds lowest end station by 0.55888576e-1 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

X-SECTION A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
73+.50	0.02
73+.50	0.57
74+.00	0.57
78+.00	0.65
84+.00	0.77

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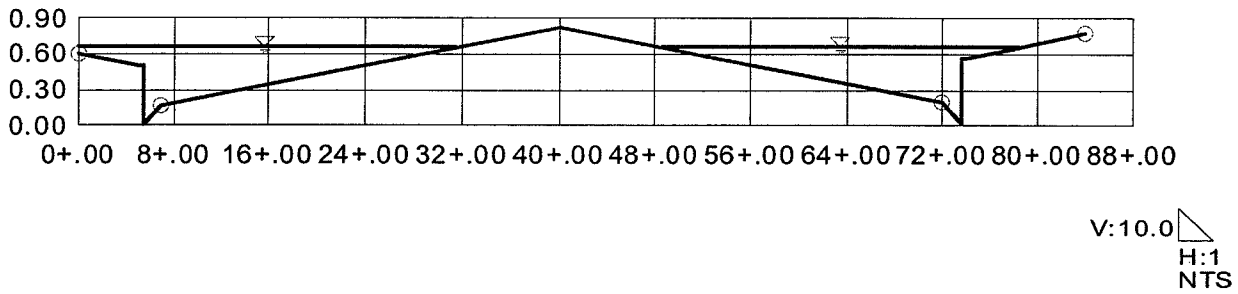
X-SECTION A
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.029600	ft/ft
Water Surface Elevation	0.66	ft
Elevation Range	0.00 to 0.83	
Discharge	81.00	cfs



X-SECTION A
Worksheet for Irregular Channel

Existing 10 yr (proposed flows in street)

Project Description	
Worksheet	X-SECTION A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	114.00	cfs

Storm drain capacities were NOT used for existing flows.

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.72	ft
Elevation Range	0.00 to 0.83	
Flow Area	17.9	ft²
Wetted Perimeter	71.34	ft
Top Width	70.14	ft
Actual Depth	0.72	ft
Critical Elevation	0.90	ft
Critical Slope	0.005219	ft/ft
Velocity	6.37	ft/s
Velocity Head	0.63	ft
Specific Energy	1.35	ft
Froude Number	2.22	
Flow Type	Supercritical	

$D \times V$

$0.72 \times 6.37 = 4.6 < 6$ ✓

Calculation Messages:
Water elevation exceeds lowest end station by 0.11760574 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

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X-SECTION A
Worksheet for Irregular Channel

EXISTING (PR) 100 yr

Project Description	
Worksheet	X-SECTION A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	163.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.79	ft
Elevation Range	0.00 to 0.83	
Flow Area	23.3	ft²
Wetted Perimeter	81.23	ft
Top Width	79.93	ft
Actual Depth	0.79	ft
Critical Elevation	1.00	ft
Critical Slope	0.004798	ft/ft
Velocity	7.00	ft/s
Velocity Head	0.76	ft
Specific Energy	1.55	ft
Froude Number	2.28	
Flow Type	Supercritical	

D x V

0.79 x 7.00 = 5.5 < 8 ✓

Calculation Messages:
Water elevation exceeds lowest end station by 0.18934842 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

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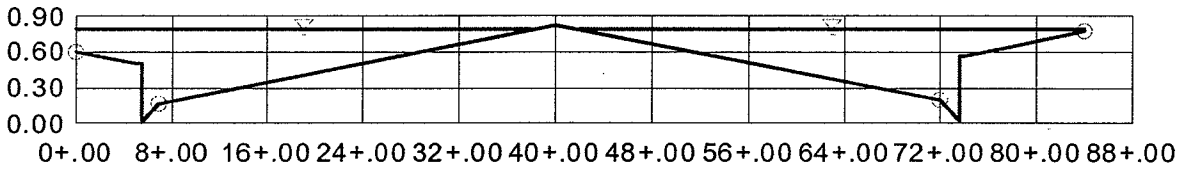
X-SECTION A
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
73+.50	0.02
73+.50	0.57
74+.00	0.57
78+.00	0.65
84+.00	0.77

X-SECTION A
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.029600	ft/ft
Water Surface Elevation	0.79	ft
Elevation Range	0.00 to 0.83	
Discharge	163.00	cfs



V:10.0
H:1
NTS

DEER SPRINGS, 100-YR AFTER OVERFLOW
Worksheet for Irregular Channel

100 yr
Interim/Proposed
X Section B

Project Description	
Worksheet	DEER SPRINGS WAY
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.008300	ft/ft
Discharge	163.00	cfs

← total flow from both N. + S. sides after the overflow. Approximate station is 5+00.

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.95	ft
Elevation Range	0.00 to 0.87	
Flow Area	34.8	ft²
Wetted Perimeter	85.78	ft
Top Width	84.00	ft
Actual Depth	0.95	ft
Critical Elevation	1.03	ft
Critical Slope	0.004763	ft/ft
Velocity	4.69	ft/s
Velocity Head	0.34	ft
Specific Energy	1.29	ft
Froude Number	1.29	
Flow Type	Supercritical	

$D \times V = 0.95 \times 4.69$

$= 4.4 < 6$ o.k.

Calculation Messages:
Water elevation exceeds lowest end station by 0.35065747 ft.

Note: no dry Lane exists during the interim condition.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.13
7+.00	0.21
40+.00	0.87
72+.00	0.23

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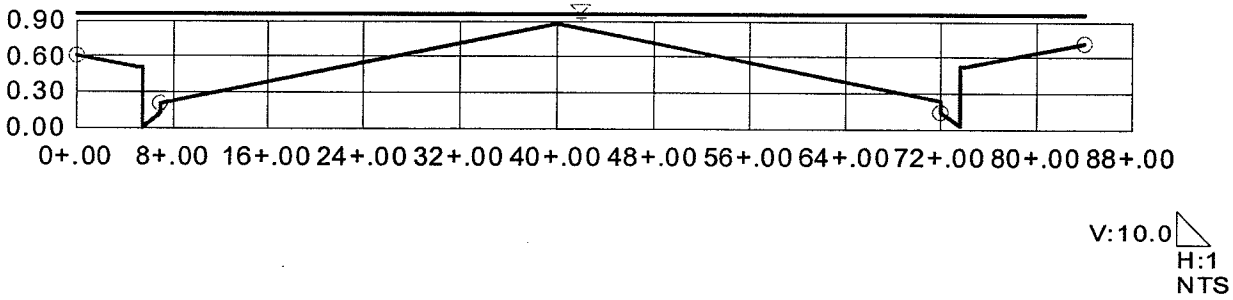
DEER SPRINGS, 100-YR AFTER OVERFLOW
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
72+.00	0.14
73+.50	0.02
73+.50	0.52
74+.00	0.52
78+.00	0.60
84+.00	0.72

Cross Section for Irregular Channel

Project Description	
Worksheet	DEER SPRINGS WAY
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.008300	ft/ft
Water Surface Elevation	0.95	ft
Elevation Range	0.00 to 0.87	
Discharge	163.00	cfs



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X-SECTION B
Worksheet for Irregular Channel

Future 10 yr

Project Description	
Worksheet	X-SECTION B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.008300	ft/ft
Discharge	33.00	cfs

= (47 − 14)

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 0.83	
Flow Area	11.3	ft²
Wetted Perimeter	55.44	ft
Top Width	54.35	ft
Actual Depth	0.61	ft
Critical Elevation	0.63	ft
Critical Slope	0.006481	ft/ft
Velocity	2.91	ft/s
Velocity Head	0.13	ft
Specific Energy	0.74	ft
Froude Number	1.12	
Flow Type	Supercritical	

D x V

0.61 x 2.91 = 1.8 < 6

Calculation Messages:
Water elevation exceeds lowest end station by 0.12303191e-1 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

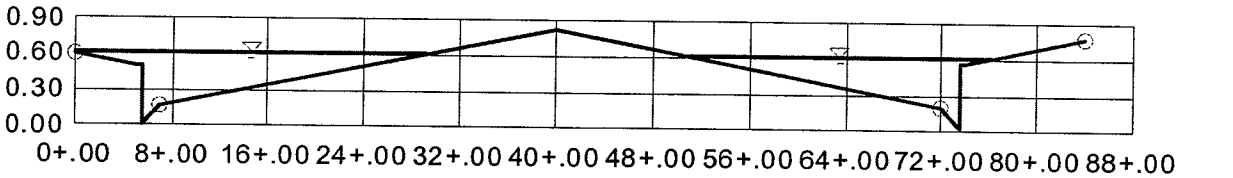
Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

X-SECTION B
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.008300	ft/ft
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 0.83	
Discharge	33.00	cfs

10' dry lane does not exist.
However, the storm drain is maxed.



V:10.0
H:1
NTS

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X-SECTION B
Worksheet for Irregular Channel

Future 100yr

Project Description	
Worksheet	X-SECTION B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.008300	ft/ft
Discharge	81.00	cfs

= (103 - 22)

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.78	ft
Elevation Range	0.00 to 0.83	
Flow Area	22.3	ft²
Wetted Perimeter	79.90	ft
Top Width	78.63	ft
Actual Depth	0.78	ft
Critical Elevation	0.82	ft
Critical Slope	0.005544	ft/ft
Velocity	3.64	ft/s
Velocity Head	0.21	ft
Specific Energy	0.98	ft
Froude Number	1.21	
Flow Type	Supercritical	

D x V

0.78 x 3.64 = 2.8 < 8 ✓

Calculation Messages:
Water elevation exceeds lowest end station by 0.17631261 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

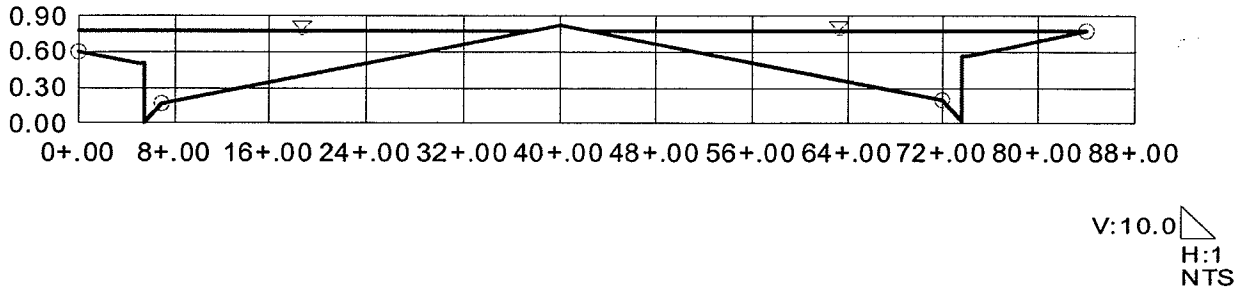
X-SECTION B
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
73+.50	0.02
73+.50	0.57
74+.00	0.57
78+.00	0.65
84+.00	0.77

X-SECTION B
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.008300	ft/ft
Water Surface Elevation	0.78	ft
Elevation Range	0.00 to 0.83	
Discharge	81.00	cfs



X-SECTION C
Worksheet for Irregular Channel

Existing 100yr
(or proposed existing flow in the street)

Project Description	
Worksheet	X-SECTION C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	163.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.79	ft
Elevation Range	0.00 to 0.83	
Flow Area	23.3	ft²
Wetted Perimeter	81.23	ft
Top Width	79.93	ft
Actual Depth	0.79	ft
Critical Elevation	1.00	ft
Critical Slope	0.004798	ft/ft
Velocity	7.00	ft/s
Velocity Head	0.76	ft
Specific Energy	1.55	ft
Froude Number	2.28	
Flow Type	Supercritical	

DxV
$(0.79)(7.00) = 5.5 < 8$ o.k.

Note: less than 6 thus, 10yr O.K.

Calculation Messages:
Water elevation exceeds lowest end station by 0.18934842 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

X-SECTION C
Worksheet for Irregular Channel

Future 10yr

Project Description	
Worksheet	X-SECTION C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	22.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.015	
Water Surface Elevation	0.44	ft
Elevation Range	0.00 to 0.83	
Flow Area	4.5	ft²
Wetted Perimeter	30.17	ft
Top Width	29.28	ft
Actual Depth	0.44	ft
Critical Elevation	0.56	ft
Critical Slope	0.005603	ft/ft
Velocity	4.89	ft/s
Velocity Head	0.37	ft
Specific Energy	0.81	ft
Froude Number	2.20	
Flow Type	Supercritical	

DxV

$(0.44)(4.89) = 2.2 < 6$ ✓

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

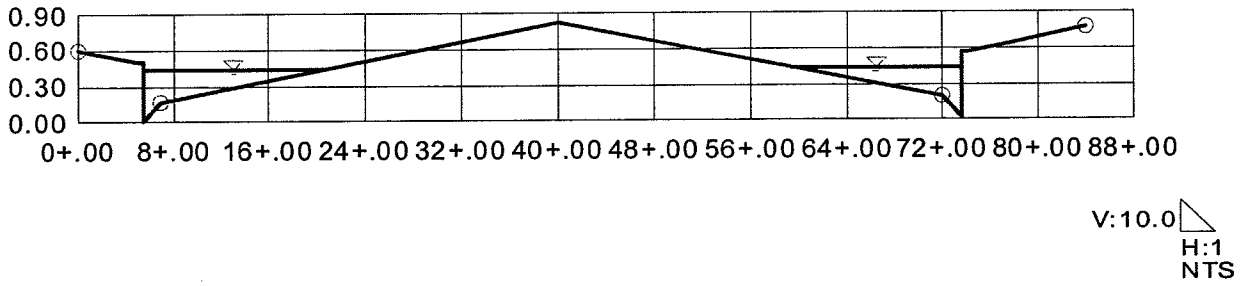
Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19
73+.50	0.02

X-SECTION C
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.015	
Channel Slope	0.029600	ft/ft
Water Surface Elevation	0.44	ft
Elevation Range	0.00 to 0.83	
Discharge	22.00	cfs

* 12' dry lane in each direction



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X-SECTION C
Worksheet for Irregular Channel

FUTURE 100 yr

Project Description	
Worksheet	X-SECTION C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.029600	ft/ft
Discharge	62.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.61	ft
Elevation Range	0.00 to 0.83	
Flow Area	11.3	ft²
Wetted Perimeter	55.31	ft
Top Width	54.22	ft
Actual Depth	0.61	ft
Critical Elevation	0.76	ft
Critical Slope	0.005958	ft/ft
Velocity	5.49	ft/s
Velocity Head	0.47	ft
Specific Energy	1.08	ft
Froude Number	2.12	
Flow Type	Supercritical	

D x V =

- (0.61)(5.49) = 3.3 < 8

- depth is less than 1 FT

Calculation Messages:
Water elevation exceeds lowest end station by 0.11469366e-1 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

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X-SECTION D
Worksheet for Irregular Channel

Existing 100 yr

Project Description	
Worksheet	X-SECTION D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.013800	ft/ft
Discharge	195.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.91	ft
Elevation Range	0.00 to 0.83	
Flow Area	33.4	ft²
Wetted Perimeter	85.54	ft
Top Width	84.00	ft
Actual Depth	0.91	ft
Critical Elevation	1.06	ft
Critical Slope	0.004653	ft/ft
Velocity	5.84	ft/s
Velocity Head	0.53	ft
Specific Energy	1.44	ft
Froude Number	1.63	
Flow Type	Supercritical	

D x V

(0.91)(5.84) = 5.3 < 8 ✓

Note: less than 6 thus 10yr O.K.

Calculation Messages:
Water elevation exceeds lowest end station by 0.31024719 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19
73+.50	0.02

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X-SECTION D
Worksheet for Irregular Channel

Future 10 yr

Project Description	
Worksheet	X-SECTION D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.013800	ft/ft
Discharge	30.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 0.83	
Flow Area	8.3	ft²
Wetted Perimeter	43.92	ft
Top Width	42.87	ft
Actual Depth	0.55	ft
Critical Elevation	0.62	ft
Critical Slope	0.006271	ft/ft
Velocity	3.63	ft/s
Velocity Head	0.20	ft
Specific Energy	0.75	ft
Froude Number	1.46	
Flow Type	Supercritical	

D x V

0.55 x 3.63 = 2.0 < 6 ✓

12' dry lane exists both ways

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19
73+.50	0.02

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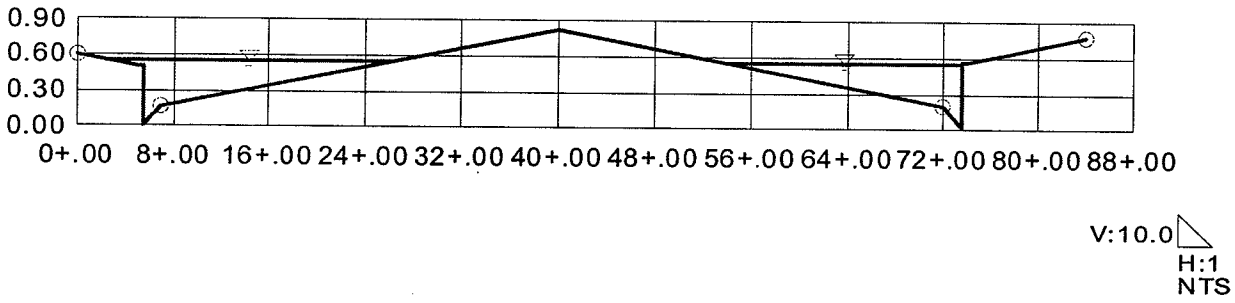
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.013800	ft/ft
Water Surface Elevation	0.55	ft
Elevation Range	0.00 to 0.83	
Discharge	30.00	cfs

12' dry lane each wall



V:10.0
H:1
NTS

Worksheet for Irregular Channel

Future 100 yr

Project Description	
Worksheet	X-SECTION D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.013800	ft/ft
Discharge	78.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	0.72	ft
Elevation Range	0.00 to 0.83	
Flow Area	17.9	ft²
Wetted Perimeter	71.40	ft
Top Width	70.20	ft
Actual Depth	0.72	ft
Critical Elevation	0.81	ft
Critical Slope	0.005632	ft/ft
Velocity	4.35	ft/s
Velocity Head	0.29	ft
Specific Energy	1.01	ft
Froude Number	1.52	
Flow Type	Supercritical	

D x V

(0.72)(4.35) = 3.1 < 6 O.K.

Calculation Messages:
Water elevation exceeds lowest end station by 0.11799938 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	72+.00	0.017
72+.00	84+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	0.60
5+.00	0.50
5+.50	0.50
5+.50	0.00
7+.00	0.17
40+.00	0.83
72+.00	0.19

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X-SECTION E
Worksheet for Irregular Channel

Project Description	
Worksheet	X-SECTION E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Proposed
existing flow 100yr

Input Data		
Channel Slope	0.004000	ft/ft
Discharge	180.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	99.04	ft
Elevation Range	97.97 to 99.36	
Flow Area	44.8	ft²
Wetted Perimeter	78.53	ft
Top Width	76.00	ft
Actual Depth	1.07	ft
Critical Elevation	97.97	ft
Critical Slope	0.000000	ft/ft
Velocity	4.02	ft/s
Velocity Head	0.25	ft
Specific Energy	99.29	ft
Froude Number	0.92	
Flow Type	Subcritical	

DxV
1.07(4.02)=4.3 < 6

⇒ will work for 10yr 9150
- less than 2-foot depth

Calculation Messages:
Water elevation exceeds lowest end station by 0.46931551 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	73+.00	0.017
73+.00	80+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	98.57
5+.00	98.47
5+.50	98.47
5+.50	97.97
7+.00	98.14
43+.00	98.86
43+.00	99.36

X-SECTION E
Worksheet for Irregular Channel

Project Description	
Worksheet	X-SECTION E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Future 10yr

Input Data		
Channel Slope	0.004000	ft/ft
Discharge	30.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	98.61	ft
Elevation Range	97.97 to 99.36	
Flow Area	13.9	ft²
Wetted Perimeter	62.41	ft
Top Width	61.29	ft
Actual Depth	0.64	ft
Critical Elevation	98.58	ft
Critical Slope	0.006541	ft/ft
Velocity	2.15	ft/s
Velocity Head	0.07	ft
Specific Energy	98.69	ft
Froude Number	0.80	
Flow Type	Subcritical	

DxV

$(0.64)(2.15) = 1.4 < 6$

Calculation Messages:
Water elevation exceeds lowest end station by 0.42892623e-1 ft.
Flow is divided.

Note: 12' dry lane does NOT happen. However, this is due to offsite flows. our storm drain is maxed. Also, D = .64 2xD = 1.3, FF should be 18" above highest tc or 2 feet, thus, FF are protected.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	73+.00	0.017
73+.00	80+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	98.57
5+.00	98.47
5+.50	98.47
5+.50	97.97
7+.00	98.14
43+.00	98.86
43+.00	99.36

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Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
47+.00	99.16
47+.00	98.66
73+.00	98.14
74+.50	97.97
74+.50	98.47
75+.00	98.47
80+.00	98.57

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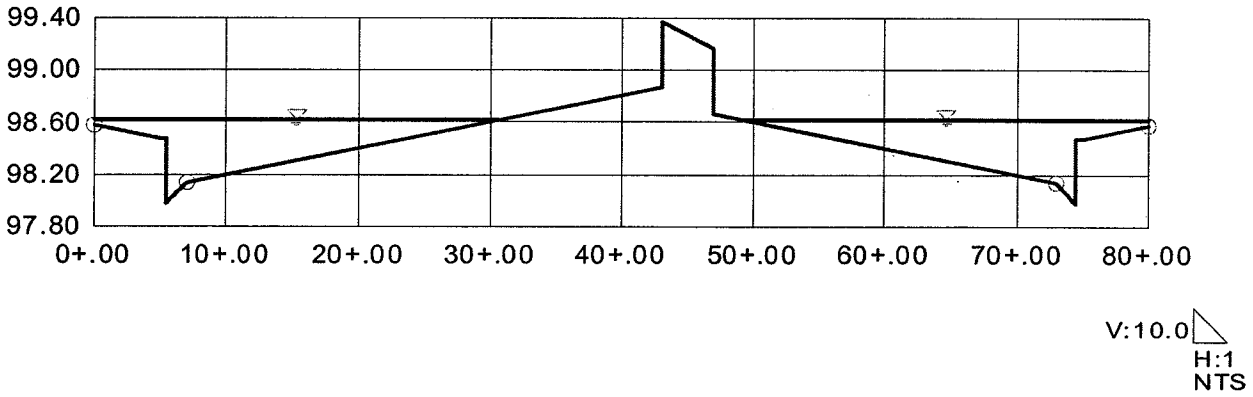
Cross Section for Irregular Channel

Project Description	
Worksheet	X-SECTION E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	0.004000	ft/ft
Water Surface Elevation	98.61	ft
Elevation Range	97.97 to 99.36	
Discharge	30.00	cfs



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Worksheet for Irregular Channel

Future 100 yr

Project Description	
Worksheet	X-SECTION E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.004000	ft/ft
Discharge	93.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	98.84	ft
Elevation Range	97.97 to 99.36	
Flow Area	29.8	ft²
Wetted Perimeter	76.90	ft
Top Width	75.13	ft
Actual Depth	0.87	ft
Critical Elevation	97.97	ft
Critical Slope	0.000000	ft/ft
Velocity	3.12	ft/s
Velocity Head	0.15	ft
Specific Energy	98.99	ft
Froude Number	0.87	
Flow Type	Subcritical	

D x V

$(0.87)(3.12) = 2.7 < 6$ ✓

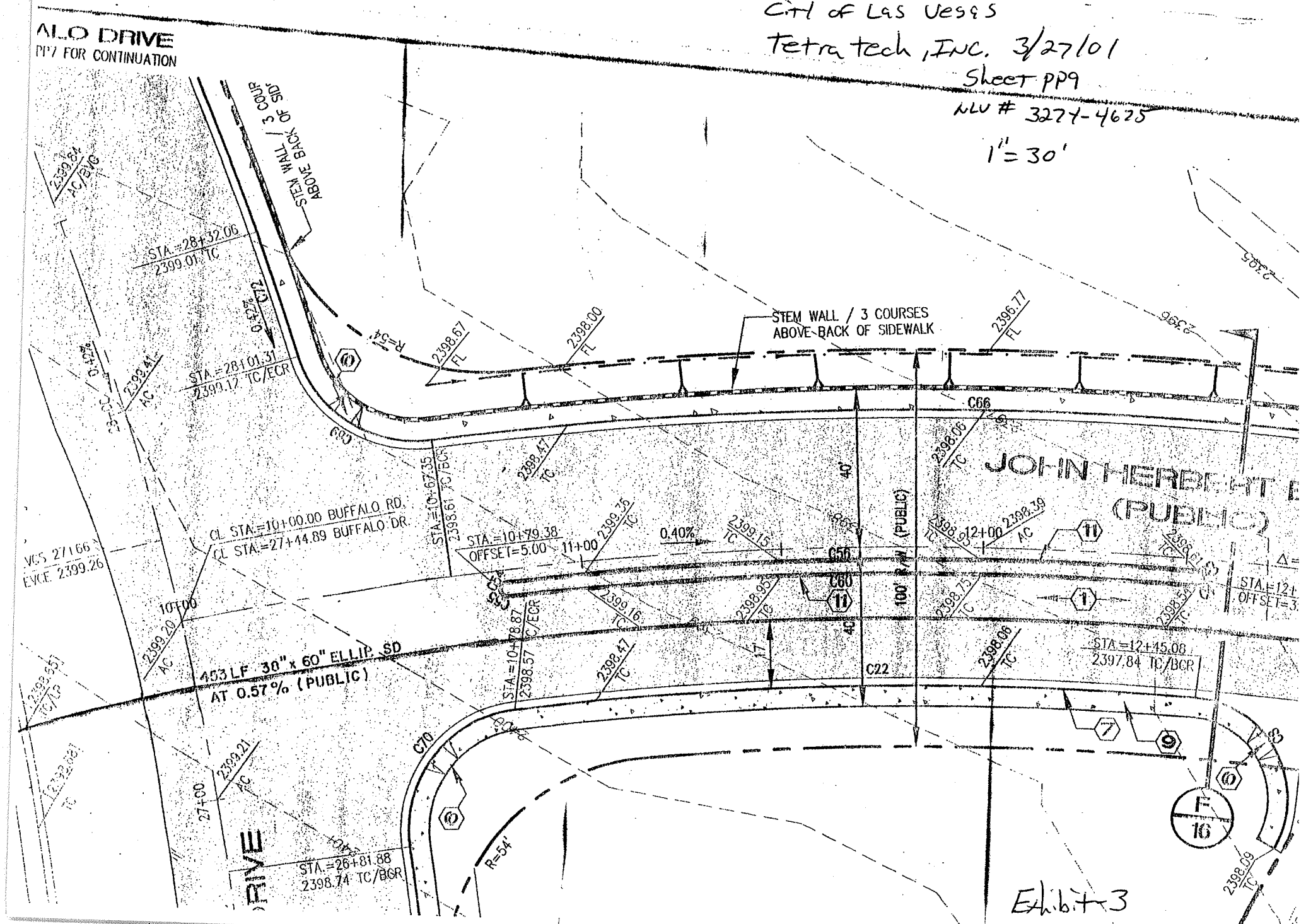
– less than 1' depth.

Calculation Messages:
Water elevation exceeds lowest end station by 0.2726904 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	73+.00	0.017
73+.00	80+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	98.57
5+.00	98.47
5+.50	98.47
5+.50	97.97
7+.00	98.14
43+.00	98.86
43+.00	99.36

Buffalo/95 - Resency
City of Las Vegas
Tetra tech, INC. 3/27/01
Sheet PP9
NLV # 3274-4625
1" = 30'



X-SECTION F
Worksheet for Irregular Channel

Project Description	
Worksheet	X-SECTION F
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Proposed existing 100yr

Input Data		
Channel Slope	0.024000	ft/ft
Discharge	91.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	98.96	ft
Elevation Range	98.39 to 99.05	
Flow Area	20.2	ft²
Wetted Perimeter	109.05	ft
Top Width	108.03	ft
Actual Depth	0.57	ft
Critical Elevation	99.05	ft
Critical Slope	0.006254	ft/ft
Velocity	4.51	ft/s
Velocity Head	0.32	ft
Specific Energy	99.27	ft
Froude Number	1.84	
Flow Type	Supercritical	

D x V

$(0.57)(4.51) = 2.6 < 6$

Will work for 10yr also

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	108+.00	0.017
108+.00	115+.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+.00	98.99
5+.00	98.89
5+.50	98.89
5+.50	98.39
7+.00	98.56
65+.00	98.96
108+.00	98.62
109+.50	98.45

Buffalo, 100-yr flow split to north
Worksheet for Irregular Channel

Future 10yr

note: Flows will be contained west side below crown.

Project Description	
Worksheet	Buffalo, flow to north
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	0.024000	ft/ft
Discharge	38.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.017	
Water Surface Elevation	98.90	ft
Elevation Range	98.39 to 98.99	
Flow Area	8.8	ft²
Wetted Perimeter	51.59	ft
Top Width	51.08	ft
Actual Depth	0.51	ft
Critical Elevation	98.99	ft
Critical Slope	0.006636	ft/ft
Velocity	4.30	ft/s
Velocity Head	0.29	ft
Specific Energy	99.18	ft
Froude Number	1.82	
Flow Type	Supercritical	

$D \times V$

$(0.51)(4.30) = 2.2 < 6$

Dry Lanes exist since the entire East side is open.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+.00	7+.00	0.013
7+.00	65+.00	0.017

Natural Channel Points

Station (ft)	Elevation (ft)
0+.00	98.99
5+.00	98.89
5+.50	98.89
5+.50	98.39
7+.00	98.56
65+.00	98.96

Stantec Consulting Inc
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X-SECTION F

Cross Section for Irregular Channel

Project Description	
Worksheet	Buffalo, flow to north
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.017
Channel Slope	0.024000 ft/ft
Water Surface Elevation	98.90 ft
Elevation Range	98.39 to 98.99
Discharge	38.00 cfs

Whole East side open 9150.