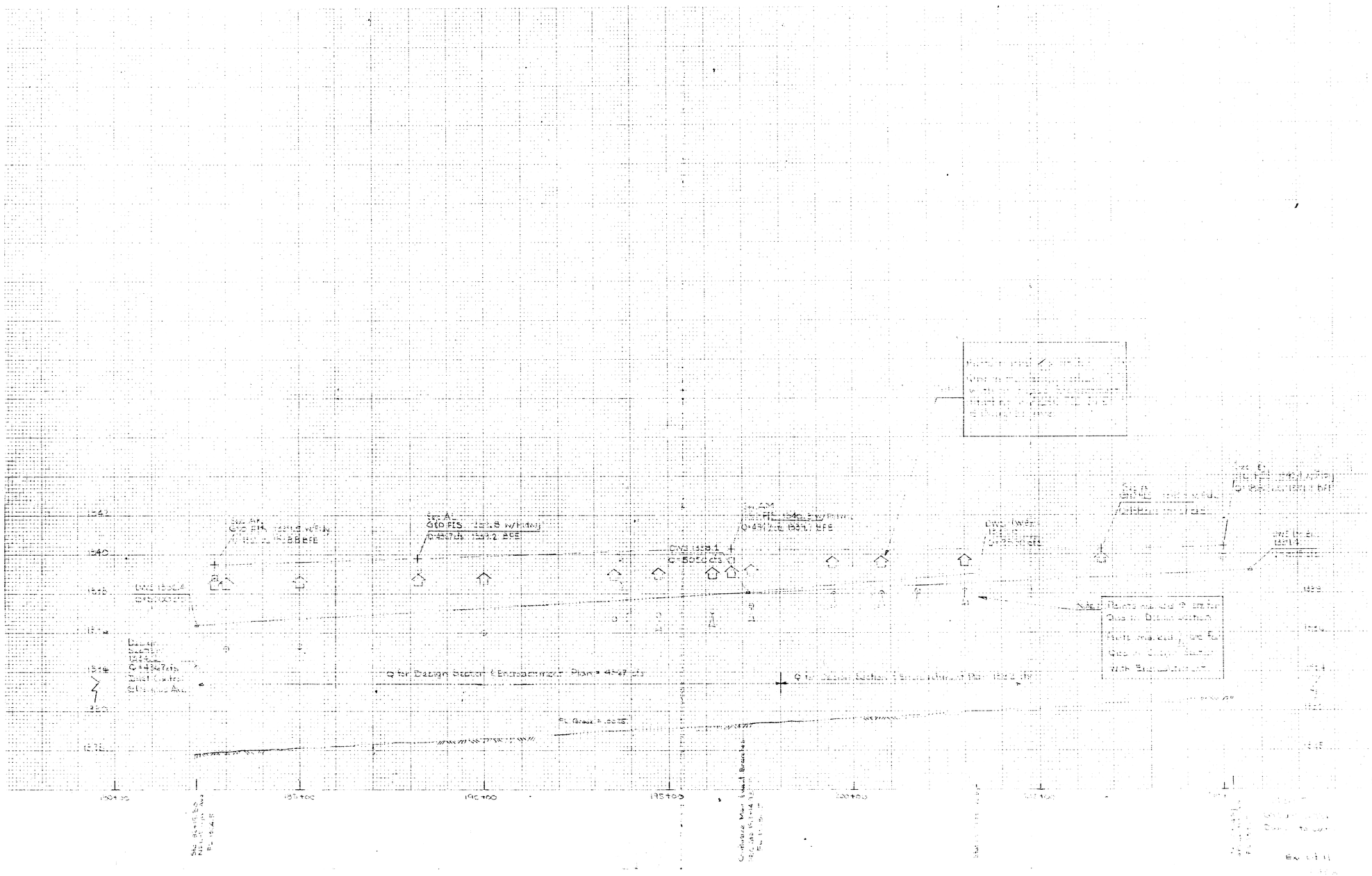
GYPSUM CREEK ENCROACHMENT PLAN
& ROCKBOROUGH OFFICE PARK
(Drainage)

7


Q for Design Section & Encroachment with Plans 4547 cfs
Q for Design Section & Encroachment with Plans 4547 cfs
Pt. Grade Access
Pt. Grade Access
Pt. Grade Access

GYPSUM CREEK ENCROACHMENT PLAN
& ROCKBOROUGH OFFICE PARK
(Drainage)

ROCK ROAD

240

302

RESTAURANT

THEATRE

260

EXPOSED OFFICE BUILDING

250

DRAINAGE EASEMENT

PROPERTY LINE

PROPERTY LINE

SITE PLAN

north

General Notes

1. Gypsum Creek Stationing & flow rates from Flood Control Plan dated Feb 1964.
2. Surveyed x sections by Baughman Co. September 1984.
3. Flood Insurance data from City of Wichita FID by Greenhorne & O'Mara.

Geometric Model
Gypsum Creek Encroachment Plan
Rockborough Addition

CARNEY ENTERPRISES

DAVID A. HAINES architect
HOWARD HELMER PHILLIPS architects p.a.

GYPSUM CREEK ENCROACHMENT PLAN
& ROCKBOROUGH OFFICE PARK
(Drainage)

7

6-13-77

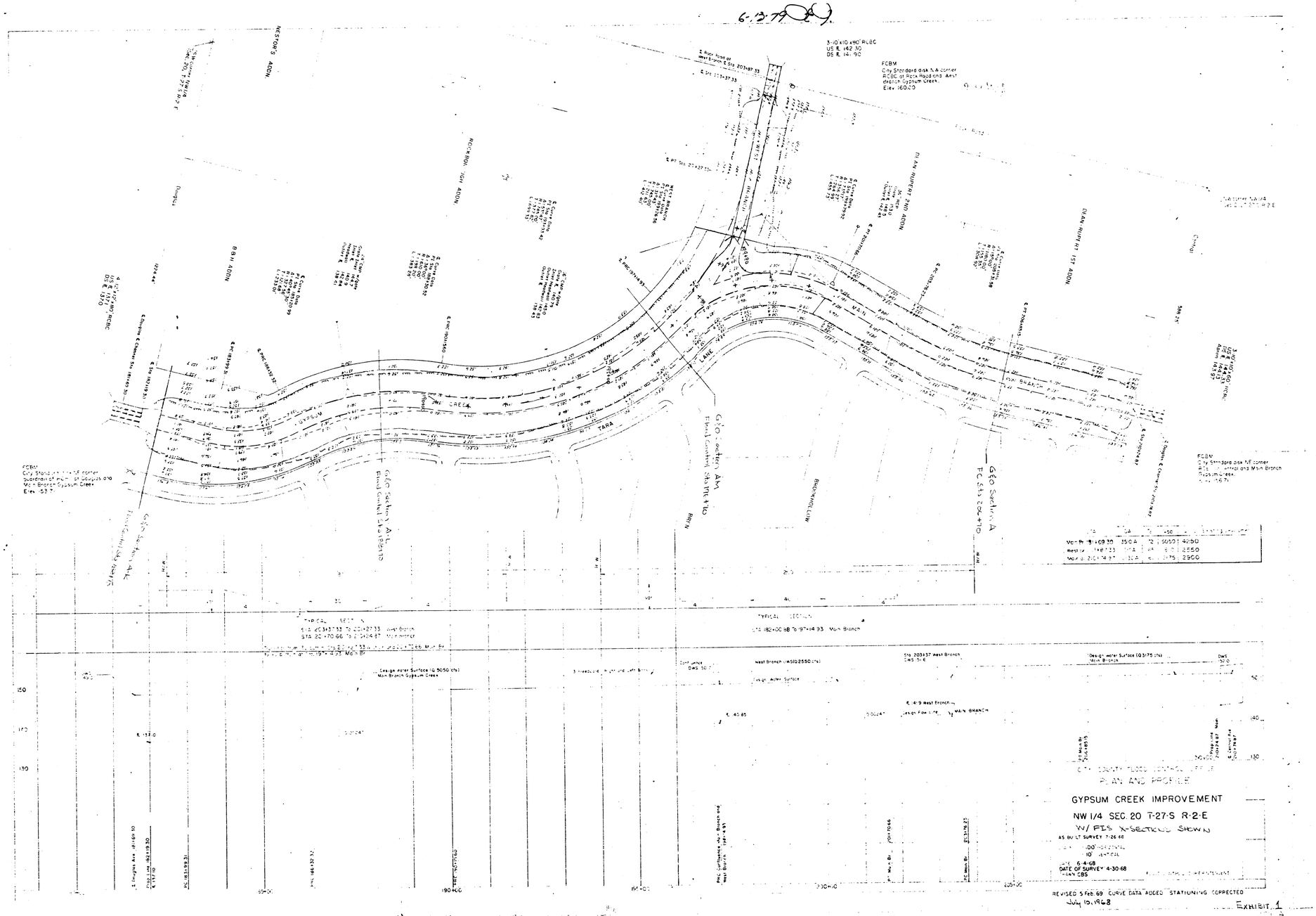


EXHIBIT 1

Exhibit 9 Calculation of section properties for design channel modified by encroachment for Run 2. (3)

Exhibit 10 HEC-2 Water Surface Profile Calculations for Design Channel for surveyed cross-section locations with encroachment beginning w/inlet control @ Douglas Ave. (Run 2)

Exhibit 11 Profiles of Gypsum Creek between Douglas and Central showing relationship of water surface profiles for Q100 with and without encroachment and Design Discharge.

Exhibit 12 Calculation of section properties for design channel modified by encroachment for Run 3. (4)

Exhibit 13 HEC-2 Water Surface Profile Calculations for Design Channel for surveyed and FIS cross-section locations with encroachment beginning @ BFE @ Douglas Ave. (Run 3)

MAIN BRANCH-GYPSUM CREEK
SURVEYED X-SECTIONS

Pg 1 of 2

STA 192+56

1341.7 @ -5 (Left)	1341.7 @ 8	1329.7 @ 27	1329.5 @ 59
1328.1 @ 79	1327.1 @ 92	1326.4 @ 135	1328.1 @ 158
1338.5 @ 166	1338.3 @ 179	1342.3 @ 216	1338.5 @ 238

STA 194+73

1341.8 @ -5 (Left)	1341 @ 7	1340.0 @ 29	1329.2 @ 75
1327.1 @ 79	1327.1 @ 110	1328.2 @ 112	1329.2 @ 120
1330.0 @ 127	1340.0 @ 170	1339.7 @ 187	1341.2 @ 200

STA 197+17

1341.2 @ -5 (Left)	1340.8 @ 26	1329.2 @ 74	1329.6 @ 96
1327.1 @ 81	1327.6 @ 85	1327.1 @ 96 (Right)	1330.5 @ 117
1339.9 @ 125	1340.6 @ 149	1340.6 @ 179	

STA 199+22

1340.8 @ -5 (Left)	1340.8 @ 26	1329.2 @ 74	1329.6 @ 96
1327.1 @ 81	1327.6 @ 85	1327.1 @ 96 (Right)	1330.5 @ 117
1339.9 @ 125	1340.6 @ 149	1340.6 @ 179	

STA [illegible]

[illegible]	[illegible]	[illegible]	[illegible] FS
1332.1 @ 78	[illegible] @ 88	[illegible] @ 92	1329.7 @ 98.5
[illegible] @ 117	[illegible] @ 141	[illegible] @ 144	1332.1 @ 171
[illegible]	[illegible] @ 241		

Exhibit 8

Main (Middle) Branch of Gypsum Creek
Surveyed X-Sections

Pg 2 of 2

Sta 199+43

1342.1 @ -5 (Left)	1342.1 @ 12	1341.1 @ 50	1329.1 @ 99
1328.7 @ 82	1328.4 @ 108	1330.9 @ 116	1331.2 @ 142
1329.6 @ 155 (PI)	1320.8 @ 193	1329.8 @ 201	1328.5 @ 204
1328.4 @ 222	1329.8 @ 232	1331.1 @ 243	1341.6 @ 291
1341.5 @ 295	1341.99 @ 314 (Right)		

Sta 200+79

1341.4 @ -5 (Left)	1342.3 @ 12	1341.2 @ 17	1330.7 @ 74
1328.4 @ 93	1328.0 @ 116	1329.6 @ 107	1332.6 @ 123
1332.1 @ 126	1339.9 @ 156	1341.8 @ 166	1341.6 @ 190

Sta 201+71

1342.5 @ -5 (Left)	1342.7 @ 15	1332.1 @ 65	1330.1 @ 71
1327.9 @ 81	1327.2 @ 84	1328.4 @ 96	1329.6 @ 110
1330.1 @ 116	1331.2 @ 115	1327.9 @ 141	1341.9 @ 166
1341.5 @ 190			

GYPSUM CREEK ENCROACHMENT PLAN
& ROCKBOROUGH OFFICE PARK
(Drainage)

2-1 2-4

Design Channel - Main Branch Gypsum Creek, Properties

S to 197+17.2 FL = 1327.10 = 1327.5
+ .00247% 2.75 ÷ 1493.62 = +.0025071%

PRC Sta 197+14.93 FL = 1326.95 = 1327.25

X-Sec Sta 192+56 ΔD = 259 x .0025 = .90 FL = 1327.25 / 1327.25 Top 1340.71

X-Sec Sta 194+73 ΔD = 342 x .0025 = 1.60 FL = 1327.65 Top 1340.71

X-Sec Sta 196+17 ΔD = 202 x .0025 = 1.24 FL = 1327.01 Top 1340.71

X-Sec Sta 197+22 ΔD = 48 x .0025 = .02 FL = 1327.27 Top 1340.71

Main channel bottom width = 39.8

X-Sec Sta 197+55 ΔD = 140 x .0025 = .35 FL = 1327.60 Top 1340.71

Main channel bottom width = 32.692

X-Sec Sta 199+43 ΔD = 227 x .0025 = .57 FL = 1327.92 Top 1340.71

Main channel bottom width = 32 Bluff = 95 Top 1340.71

X-Sec Sta 200+77 ΔD = 134 x .0025 = .34 FL = 1328.26 Top 1340.71

Main channel bottom width = 32.1 Bluff = 92 Top 1340.71

X-Sec Sta 2T 201+71 ΔD = 250 x .0025 = .63 FL = 1328.89 Top 1340.71

Main channel bottom width = 30' Top 1340.71

ΔD = 2.89 ΔL = 1156.0 Top 1340.71

EWS = 197+14.93 = 1493.62 ΔL = 1157 Top 1340.71

DWS = 197+14.93 = 1493.62 ΔL = 1156.0 Top 1340.71

[illegible] ΔL = [illegible] = [illegible] Top [illegible]

X-Section @ Sta 204+70 ΔD = 322 x .0025 = 2.39 Top [illegible]

FL = 1328.89 + 2.39 = 1331.28 Top [illegible]

Exhibit 6

West Branch Gypsum Creek Design Channel
Transition from 40' bottom @ Main Branch
PRC Station 197+15 to 30' bottom @
West Branch PT Station 201+27

Length of Transition = 201+27 − 197+15 = 412'
Rate of Transition = 10/412 = .02427 ft/ft.

Distance, ΔD, from PT Station 201+27 to Surveyed
X-Section 199+45 = 182'
Incremental width, Δw = ΔD x rate = 182 x .02427 = 4.42'
Width, w, @ X-Section 199+45 = 34.4

Flowline elevation for West Branch

FL Elevation @ PRC Station 197+15 = 140.97 (Sta 197+17) = 1327.25
FL Elevation @ D.S. end 3-10x10 RCBC @ 0.0% Gb = 141.90 = 1328.18
Fall between Sta 201+27 and Sta 197+15 = 1.05
Distance, D = 201+27 − 197+15 = 612
Gradient = 1.05/612 = .001686

Incremental total distance, ΔD, from E.o of RCBC @ Sta 201+27
to the surveyed X-Section 199+45 = 2.71'
Incremental fall, ΔΔ, from 201+27 to 199+45 =
.001686 x 312 = 0.66'
FL @ X-Sec 199+45 = 328.2 − 0.66 = 1327.64

Exhibit 5A

Pg 1

Section Properties Run 1
Main Branch of Gypsum Creek - Design Channel

Sta 183+00 TWS 1335.2
FL 1329.7 d1 = 10.5 A = [40+(10.5x4)]10.5 = 861
WP = 40 + 10.5(8.25) = 127
w = 40 R = 6.79 R^2/3 = 3.61

Sta 185+00 TWS 1335.7
FL 1325.2 d1 = 10.5 A = 861
w.P = 127
w = 40 R = 6.79 R^2/3 = 3.61

Sta 190+00 TWS 1336.0
FL 1324.45 d1 = 9.55 A = [40+(9.55x4)]9.55 = 797
WP = 40 + 9.55(8.25) = 119
w = 40 R = 6.69 R^2/3 = 3.48

Sta 192+56 TWS 1336.7
FL 1323.55 d1 = 9.35 A = [40+(9.35x4)]9.35 = 722
WP = 40 + 9.35(8.25) = 117
w = 40 R = 6.18 R^2/3 = 3.29

Sta 194+73 TWS 1336.9
FL 1323.05 d1 = 9.15 A = [40+(9.15x4)]9.15 = 699
WP = 40 + 9.15(8.25) = 116
w = 40 R = 6.12 R^2/3 = 3.27

Pg 2

Section Properties Run 1
Main Branch of Gypsum Creek Design Channel

Sta 196+17 TWS 1337.1
FL = 1328.0 d1 = 9.1 A = [40+(9.1x4)]9.1 = 695
WP = 40 + 9.1(8.25) = 115
w = 40 R = 6.04 R^2/3 = 3.24

Sta 197+23 TWS 1337.4
FL = 1328.25 d1 = 9.15 A = [39.8+(9.15x4)]9.15 = 699
WP = 39.8 + 9.15(8.25) = 115
w = 39.8 R = 6.06 R^2/3 = 3.25

Sta 199+43 TWS 1338.1
FL 1328.8 d1 = 9.3 A = [35+(9.3x4)]9.3 = 671
WP = 35 + 9.3(8.25) = 112
w = 35 R = 6.01 R^2/3 = 3.22

Sta 200+77 TWS 1338.1
FL 1328.2 d1 = 8.9 A = [32.1+(8.9x4)]8.9 = 602
WP = 32.1 + 8.9(8.25) = 106
w = 32.1 R = 5.70 R^2/3 = 3.11

Sta 201+71 TWS 1338.1
FL 1329.4 d1 = 8.7 A = [30+(8.7x4)]8.7 = 564
WP = 30 + 8.7(8.25) = 102
w = 30 R = 5.52 R^2/3 = 3.05

Sta 204+70 TWS 1338.1
FL 1329.7 d1 = 8.4 A = [30+(8.4x4)]8.4 = 554
WP = 30 + 8.4(8.25) = 99
w = 30 R = 5.59 R^2/3 = 3.09

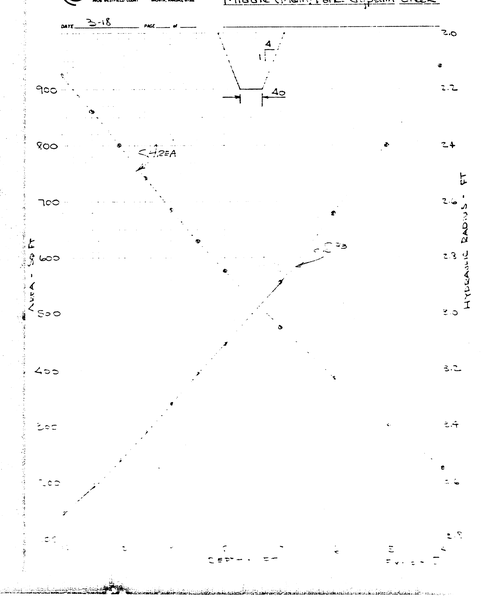
Pg 3

Section Properties - Run 1
West Branch of Gypsum Creek - Design Channel

Sta 199+45 TWS 1338.0
FL = 1328.6 d1 = 9.4 A = [34.4+(9.4x4)]9.4 = 677
WP = 34.4 + 9.4(8.25) = 112
w = 34.4 R = 6.04 R^2/3 = 3.34

Middle (Main Fork) Gypsum Creek

FLORY ENGINEERING AND CONSTRUCTION, INC.
HIGH MEADOWS COURT MONTE VERDE, STATE
DATE 3-18 PAGE of



2-18

MIDDLE (MAIN) BRANCH GYPSUM CREEK
Design Channel from Sta 182 to 197+15
b = 40' bottom; 2:1 & 4:1 Side Slopes n = .035

Area = bd + 2d^2 Wetted Perimeter = b + d(2√2^2+1)

Depth	Area	WP	R	R^2/3
1	44	42.3	1.02	.94
2	96	86.5	1.70	1.43
3	156	128	2.41	1.80
4	224	173	3.07	2.12
5	300	217.3	3.69	2.40
6	384	261	4.27	2.64
7	476	304.8	4.91	2.89
8	576	348	5.43	3.11
8.5	629	369.8	5.71	3.21
9	684	391.6	5.99	3.32
9.5	741	413.3	6.26	3.42
10	800	435.0	6.53	3.52
10.5	861	456.6	6.80	3.61
11	924	478.3	7.07	3.71

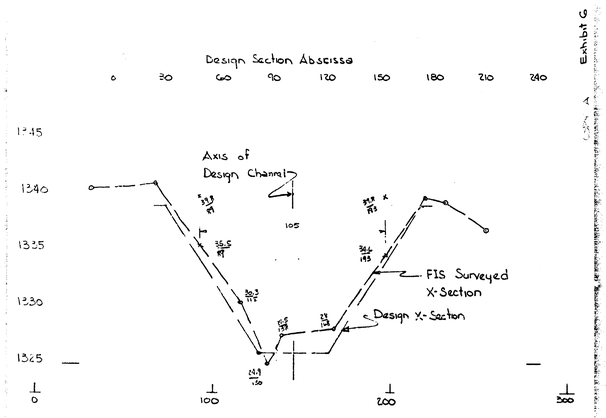
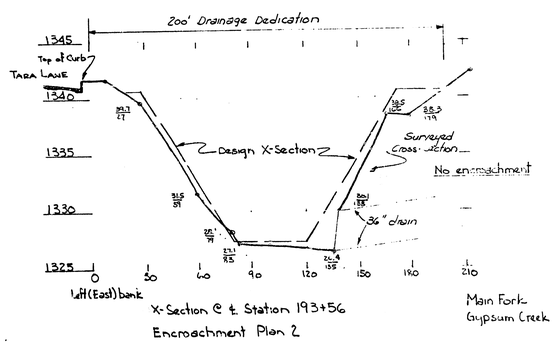
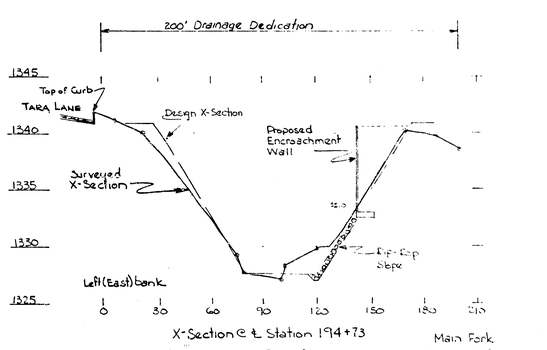
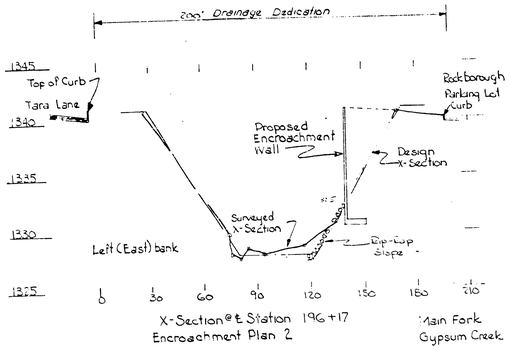


Exhibit 4

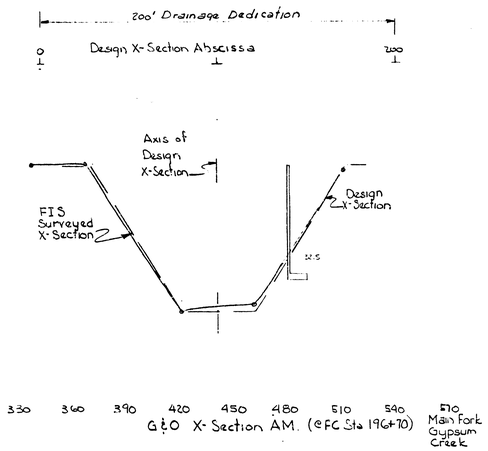






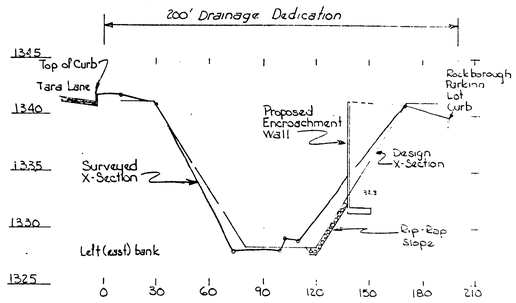
X-Section @ ℄ Station 196+17
Encroachment Plan 2

Main Fork Gypsum Creek



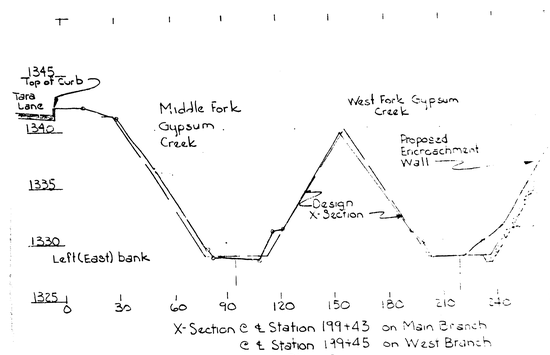
G℄O X-Section AM. (@FC Sta 196+70)

Main Fork Gypsum Creek

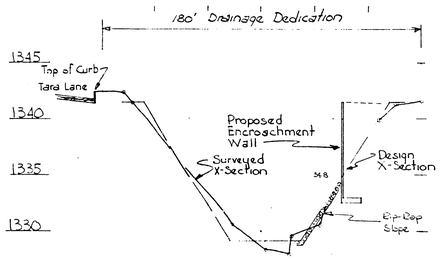


X-Section @ ℄ Station 197+23
Encroachment Plan 2

Main Fork Gypsum Creek

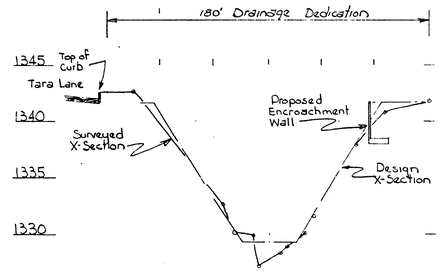


X-Section @ ℄ Station 199+43 on Main Branch
@ ℄ Station 199+45 on West Branch
Encroachment Plan 2



X-Section @ ℄ Station 200+77
Encroachment Plan 2

Middle Fork Gypsum Creek



X-Section @ ℄ Station 201+71
Encroachment Plan 2

Middle Fork Gypsum Creek

3-18

Main Branch Gypsum Creek
Culvert @ Douglas w/Inlet Control
4-12x12 RCBC Q_{25} 4367 cfs

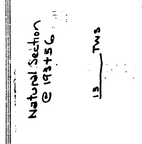
$\frac{4367}{4}$ = 1092 cfs/cell ÷ 12 = 91 cfs/ft of width

From Chart 1058 HW_{25}/D = .81 ; D = 12x.81 = 9.7 feet

FL 1137.1 +11.74 = 1324.5 +9.7 = 1334.2
Starting water surface elevation @ Sta 182+20 (Douglas Ave)

Pg 1

Section Properties Run 2
Main Branch of Gypsum Creek - Encroachment Plan 2
Natural Sec @ Sta 193+56 TWS 1330.7



Encroachment @ Sta 194+73 TWS 1334.3
FL=1327.65 d_1 = 9.15 $A = [40 - (3.15 \times 4)]9.15 - \frac{(3.8)^2}{2} \times 2 = 612$
Wall @ 1335.0 d_2 = 3.8 $WP = 40 + 7.15(2.25) - 3.8(2.12) = 104$
W = 40 R = 6.48 $R^{2/3} = 3.50$

Encroachment @ Sta 196+17 662 TWS 1337
FL=1328.0 d_1 = 9.0 $A = [40 + (\frac{9.0}{2} \times 4)]9 - \frac{(4.5)^2}{2} \times 2 = 644$
Wall @ 1334.5 d_2 = 4.5 $WP = 40 + 9.0(2.25) - 4.5(2.12) = 100$
W = 40 R = 6.42 $R^{2/3} = 3.48$

Encroachment @ Sta 197+23 648 TWS 1337.2
FL 1328.25 d_1 = 9.05 $A = [39.8 + (\frac{9.05}{2} \times 4)]9.05 - \frac{(4.5)^2}{2} \times 2 = 647$
Wall @ 1332.8 d_2 = 4.5 $WP = 39.8 + 9.05(2.25) - 4.5(2.12) = 100$
W = 39.8 R = 6.41 $R^{2/3} = 3.47$

Exhibit 7

Pg 2

Section Properties Run 2
Main Branch Gypsum Creek - Encroachment Plan 2

No Encroachment @ Sta 199+43 TWS 1328.1
FL 1328.8 d_1 = 9.3 $A = [35 + (9.3 \times 4)]9.3 = 671$
No Wall W = 35' WP = 35 + 9.3(2.25) = 112
R = 6.01 $R^{2/3} = 3.32$

Encroachment @ Sta 200+77 602 TWS 1328.1
FL 1329.2 d_1 = 8.9 $A = [32.1 + (\frac{8.9}{100} \times 4)]8.9 - (3.3)^2 \times 2 = 581$
Wall @ 1334.7 d_2 = 3.3 $WP = 32.1 + 8.9(2.25) - 3.3(2.12) = 95$
W = 32.1 R = 6.10 $R^{2/3} = 3.36$

No Encroachment @ Sta 201+71 TWS 1333.1
FL 1329.4 d_1 = 8.7 $A = [30 + (8.7 \times 4)]8.7 = 564$
Wall @ 1334.9 d_2 = 0 $WP = 30 + 8.7(2.25) = 102$
W = 30 R = 5.53 $R^{2/3} = 3.15$

No Encroachment @ Sta 202+00 TWS 1329.2
FL 329.7 d_1 = 9.5 $A = [30 + (\frac{9.5}{100} \times 4)]9.5 = 542$
$WP = 30 + 9.5(2.25) = 100$
W = 30 R = 5.4 $R^{2/3} = 3.11$

West Fork Gypsum Creek - Encroachment Plan 2

Encroachment @ Sta 197+42 696 TWS 1328.0
FL = 1329.6 d_1 = 9.4 $A = [34.4 + (9.4 \times \frac{4}{100})]9.4 - (3.0)^2 \times 2 = 459$
W @ 1330 d_2 = 3.0 $WP = 34.4 + 9.4(2.25) - 3.0(2.12) = 103$
W = 34.4 R = 6.40 $R^{2/3} = 3.46$

Pg 3

HEC-2 WATER SURFACE PROFILE CALCULATIONS

PROJECT: Middle (Main) Branch Gypsum Creek - Douglas to Central Run 1
DISCHARGE Sta 182+00 To Sta 198+00 = 4367 cfs
Sta 198+00 to Sta 201+00 = 1382 cfs

Design X-Sections 4-14-84

Sta/ED Info/Cross Section	1 Reach Length	2 Flow and Elev	Trial W.S. Elev	4 Area A	5 $R^{2/3}$	6 n	7 $K \times 10^{-3}$	8 $S_f \times 10^{-3}$	9 S_f	10 h_f	11 K_1/K_2	12 α	13 $\alpha V_2^2/2g$	14 $V_2^2/2g$	15 $(V_2^2/2g)_{corr}$	16 αh_f	17 h_o	18	19 Top Width	20 Remarks
182+20			1324.5	1324.5	46.4	2.41	.015	111.3	Inlet	elevation @ 4-12x12 RCBC		1	9.87	1.36	1.24				1324.5	Dave WS Data
183+00	80	1324.7	1335.2	84.1	3.61	.035	132.0	121.6	.0013	.10	N/A	1	5.01	.40	.40	.96	.10	1.16	1335.36	Dave WS Data
185+00	200	1335.1	1335.1	84.1	3.61	.035	132.0	132.0	.0011	.22	"	1	5.01	.40	.40	0	0	.22	1335.33	Dave WS Data
190+00	500	1334.45	1334.0	727	3.43	.035	108.8	120.3	.0013	.65	"	1	5.55	.53	.53	1.13	.04	.56	1334.46	Dave WS Data
194+56	356	1327.35	1334.7	723	3.39	.035	104.1	106.4	.0017	.60	"	1	6.04	.57	.57	1.04	.01	.57	1334.7	Dave WS Data
194+73	117	1327.65	1334.9	712	3.37	.035	101.8	103.0	.0018	.21	"	1	6.13	.58	.58	1.01	0	.20	1334.9	Dave WS Data
196+17	144	1328.0	1337.1	695	3.34	.035	98.5	100.2	.0019	.27	"	1	6.33	.61	.6	1.04	.01	.14	1337.1	Dave WS Data
197+22	106	1329.12	1337.4	699	3.35	.035	99.3	98.9	.0019	.21	"	1	6.25	.61	.61	0	0	.21	1337.6	Dave WS Data
199+43	Confluence		with West		Branch			Plotted												
	650	1328.8	1338.1	671	3.32	.035	96.8	97.1	.000938	.08	"	1	2.80	.12	.12	.89	.05	.62	337.93	Dave WS Data
200+77	134	1329.1	1338.1	602	3.21	.035	82.2	88.5	.00045	.06	"	1	3.12	.15	.15	.03	.01	.04	1338.02	Dave WS Data
201+71	94	1329.4	1338.1	564	3.15	.035	75.4	78.8	.00057	.05	"	1	3.34	.17	.17	.02	.01	.04	1338.06	Dave WS Data
202+00	129	1329.7	1338.1	534	3.09	.035	70.0	72.7	.00067	.09	"	1	3.52	.19	.19	.02	.01	.08	1338.14	Dave WS Data
197+42				West	Entrance	Gypsum	Creek	From	Confluence	with	Middle	Branch	to	Rock	Road					
			1337.4	699	3.35	.035	99.3	98.0	.00093	.21	"	1	4.17	.59	.59	.02	0	.21	1337.61	Dave WS Data
197+42	332	1328.2	1338.0	677	3.34	.035	96.0	97.6	.00077	.15	"	1	3.78	.22	.22	.37	.04	.56	1337.93	Dave WS Data

H = Col 10± Col 16 + Col 17

Exhibit 7

MIDDLE BRANCH GYPSUM CREEK
Douglas to Central - Rockborough Office Park Encroachment Plan 2

4-14-84

STATION	2 Flowline Elevation	3 Max WS Elevation	4 Depth (feet)	5 Bank Station (left)	6 Bank Station (right)	7 Bank n/n/n	8 Bottom width(ft)	9 Bottom n	10 Bottom $R^{2/3}$	11 Area(ft²)	12 Top Width(ft)	13 Wetted Perimeter(ft)	14 Hydraulic Radius(ft)	15 Energy Slope	16 Conveyance	17 Q Ratio	18 Velocity(fps)	19 Velocity Head	20
195+56	1327.10	1336.7	9.6	46.04	.035	1.61	12	.025	1.6	84.7	.015	.06	6.6	24.87	.035	1.57	132.43	4.92	.036
194+73	1327.65	1334.9	9.25	28.55	.035	4.55	40	.035	1.40	77.2	.015	.06	6.55	22.05	.045	2.33	54.60	3.20	.036
196+17		1336.8	9.15	37.72	.035	4.32	40	.035	1.40	77.2	.015	.06	6.35	23.04	.045	2.33	100.76	3.40	.036
197+23	1328.25	1337.3	9.05	37.31	.035	4.31	40	.035	1.40	77.2	.015	.07	6.5	22.55	.045	2.32	100.36	3.40	.036
201+71	1329.4	1338.0	8.6	36.28	.035	4.27	32	.035	1.12	3.42	.015	.05	5.6	23.09	.045	.03	24.87	3.42	.037
				West	Branch	Gypsum	Creek	-	Confluence	with	Middle	Branch	to	Rock	Road				
199+45	1332.6	1338.0	9.4	38.76	.035	1.36	34	.025	1.19	3.0	.015	.05	6.4	24.19	.035	.92	102.15	4.01	.036

HEC-2 WATER SURFACE PROFILE CALCULATIONS

PROJECT: Main & Middle Branch of Gypsum Creek — Run 2
DISCHARGE 436 cfs Below West Branch; 1882 cfs Above West Branch; 2318 cfs Below Confluence

Rockborough Encroachment Plan 2

1 Sta	2 Reach Length	3 Channel Flow	4 Total WS Elev	5 Area A	6 Q^2/A^2	7 n	8 K	9 Sf	10 Sf_avg	11 α	12 V^2/2g	13 hv	14 EGL	15 h	16 H	17 Invert Elev	18 Remarks
G&O AK (182+70)			1324.63	1388.8	1370	4.27	.035	248,989					3.14	.15	.15		1338.8	From ESS Table 5.1c
183+00	30	1324.70	1338.8	1359	4.26	.035	245,784	247,387	.000051	.01			3.21	.16	.16	-.01	0	0	1339.50
185+00	200	1325.20	1338.9	1299	4.19	.035	231,075	238,430	.000336	.07			3.36	.18	.18	-.02	.01	.06	1339.84
G&O AL (188+70)	370	1326.12	1339.2	1208	4.08	.035	209,529	220,302	.000239	.15			3.62	.20	.20	-.02	.01	.14	1339.66
190+90	130	1326.45	1339.2	1160	4.02	.035	198,271	203,900	.000146	.06			3.76	.22	.22	-.02	.01	.06	1339.92
193+56	356	1327.35	1339.3	1049	3.88	.035	172,916	185,594	.000355	.20			4.16	.27	.27	-.05	.02	.17	1339.73
194+73	117	1327.65	1339.3	930	4.02	.036	154,321	163,619	.000171	.08			4.70	.34	.34	-.07	.02	.03	1339.26
196+17	144	1328.0	1339.3	870	3.95	.035	141,896	148,109	.000187	.13			5.02	.39	.39	-.05	.02	.10	1339.30
G&O AM (196+70)	53	1328.13	1339.4	864	3.94	.035	144,469	143,183	.000193	.05			5.06	.40	.40	-.01	0	.04	1339.20
197+23	53	1328.25	1339.4	854	3.92	.035	142,088	143,278	.000193	.05			5.11	.41	.41	-.01	0	.04	1339.66
Confluence with West Branch																			
199+93	220	1328.8	1339.8	869	3.45	.035	154,324	138,406	.000118	.04			2.17	.07	.07	.34	.10	.48	1339.92
200+77	134	1329.2	1340.0	759	3.14	.036	98,685	116,604	.000226	.03			2.48	.10	.10	.03	.01	.01	1339.92
201+71	94	1329.4	1340.0	767	3.52	.035	114,597	104,541	.000131	.03			2.45	.10	.10	0	0	.03	1339.92
203+00	129	1329.7	1340.0	733	3.46	.035	107,752	111,175	.000129	.04			2.57	.10	.10	0	0	.04	1340.00
G&O A (204+70)	170	1330.6	1340.2	657	3.33	.035	92,742	100,247	.000135	.13			2.87	.13	.13	-.03	.01	.11	1340.11
West Branch Gypsum Creek From Confluence with Middle Branch to Rock Road Q = 2560 cfs																			
197+23 M.B.			1339.4	854	3.92	.035	142,088		.000193	.05			5.11	.41	.41	-.01	0	.04	1339.66
199+45 W.B.	222	1329.6	1339.8	841	3.86	.036	133,992	138,040	.000134	.08			5.04	.42	.42	-.27	.03	.28	1339.39

Exhibit 12

Section Properties Run 3 — Pg 1
Main Branch Gypsum Creek Design Channel

G&O AK @ Sta 182+70 (50' u.s. Douglas Ave) FIS WS 1338.8
FL=1324.63
d = 14.17 A = [40 + (14.17x4)]14.1 = 1370
WP = 40 + 14.17(8.25) = 157
w=40 R = 8.73 R^2/3 = 4.27

Sta 183+00 TWS 1338.8
FL=1324.7
d = 14.1 A = [40 + (14.1x4)]14.1 = 1359
WP 40 + 14.1(8.25) = 156
w=40 R = 8.69 R^2/3 = 4.26

Sta 185+00 TWS 1338.9
FL=1325.2
d = 13.7 A = [40 + (13.7x4)]13.7 = 1299
WP 40 + 13.7(8.25) = 153
w=40 R = 8.49 R^2/3 = 4.19

G&O AL Sta 188+70 FIS WS 1339.2
FL=1326.12
d = 13.08 A = [40 + (13.08x4)]13.08 = 1208
WP = 40 + 1308(8.25) = 148
w=40 R = 8.16 R^2/3 = 4.08

Sta 190+00 TWS 1339.2
FL=1326.45
d = 12.75 A = [40 + (12.75x4)]12.75 = 1160
WP 40 + 12.75(8.25) = 145
w=40 R = 7.99 R^2/3 = 4.02

Section Properties Run 3 — Pg 2
Main Branch Gypsum Creek Design Channel

Sta 193+56 TWS = 1339.3
FL = 1327.35
d = 11.95 A = [40 + (11.95x4)]11.95 = 1049
WP = 40 + 11.95(8.25) = 138
w=40 R = 7.57 R^2/3 = 3.88

Encroachment Sta 194+73 TWS 1339.3
FL = 1327.65
Wall @ 1338.0
d1 = 11.65 A = [40 + (1009/11.65 x4)]11.65 - (6.3)^2 x2 = 930
d2 = 6.3 WP = 40 + 11.65(8.25) + 6.3(3.12) = 146
w=40 R = 7.98 R^2/3 = 4.02

Encroachment Sta 196+17 TWS 1339.3
FL = 1328.0
Wall @ 1332.5
d1 = 11.3 A = [40 + (11.3x4)]11.3 - (6.8)^2 x2 = 870
d2 = 6.8 WP = 40 + 11.3(8.25) + 6.8(3.12) = 112
w=40 R = 7.70 R^2/3 = 3.95

G&O AM Encroachment Sta 196+70 TWS 1339.4
FL = 1328.13
Wall @ 1332.5
d1 = 11.27 A = [40 + (11.27x4)]11.57 - (6.9)^2 x2 = 864
d2 = 6.9 WP = 40 + 11.27(8.25) + 6.9(3.12) = 111
w=40 R = 7.75 R^2/3 = 3.94

Encroachment Sta 197+23 TWS 1339.4
FL = 1328.25
Wall @ 1332.9
d1 = 11.15 A = [39.8 + (11.15x4)]11.15 - (6.6)^2 x2 = 854
d2 = 6.6 WP = 39.8 + 11.15(8.25) - 6.6(3.12) = 111
w = 39.8 R = 7.68 R^2/3 = 3.92

Section Properties Run 3 — Pg 3
Main Branch Gypsum Creek Design Channel

No Encroachment Sta 199+93 TWS 1339.8
FL = 1328.8
d1 = 11.0 A = [35 + (11. x4)]11. = 869
WP = 35 + 11. (8.25) = 126
w = 35 R = 6.91 R^2/3 = 3.65

Encroachment Sta 200+77 TWS 1340.0
FL = 1329.2
Wall @ 1334.9
d1 = 10.8 A = [32.1 + (10.8/123 x4)]10.8 - (6.2)^2(2) = 759
d2 = 5.2 WP 32.1 + (10.8)(8.25) - 5.2(3.12) = 137
w = 32.1 R = 5.52 R^2/3 = 3.14

Encroachment Sta 201+71 TWS 1340.0
(Wall intercept above TWS)
FL = 1329.4
d1 = 10.6 A = [30 + (10. x4)]10.3 = 767
d2 = 0 WP = 30 + (10. X8.25) = 117
w = 30 R = 6.53 R^2/3 = 3.52

Sta 203+00 TWS 1340.0
FL = 1329.7
d = 10.3 A = [20 + (10.3x4)]10.3 = 733
V.P = 30 + 10.3(3.12) = 115
w = 30 R = 6.37 R^2/3 = 3.46

Sta 206+70 TWS 1340.2
FL = 1330.6
d = 9.6 A = 30 + (9.6x4)9. = 657
WP = 30 + 9.6(8.25) = 109
R = 6.01 R^2/3 = 3.33

Section Properties Run 3 — Pg 4
West Branch Gypsum Creek

Encroachment X-Section 199+45 TWS 1339.8
FL = 1328.6
Wall = 1335
d1 = 11.2 A = [34.4 + (88/11.2 x4)]11.2 - (4.8)^2 x2 = 841
d2 = 4.8 WP = 34.4 + 11.2(8.25) - 4.8(3.12) = 112
w = 34.4 R = 7.52 R^2/3 = 3.86

This profile begins w/ G&O FIS BFE @ X-Section 50' u.s. Douglas Ave

HEC-2 WATER SURFACE PROFILE CALCULATIONS

PROJECT: Main & Middle Branch of Gypsum Creek — Run 3
DISCHARGE 436 cfs Below West Branch; 1882 cfs Above West Branch

Rockborough Office Park & Cobblestone Alley Encroachment Plan 2

1 Sta	2 Reach Length	3 Channel Flow	4 Total WS Elev	5 Area A	6 Q^2/A^2	7 n	8 K	9 Sf	10 Sf_avg	11 α	12 V^2/2g	13 hv	14 EGL	15 h	16 H	17 Invert Elev	18 Remarks
G&O AK (182+70)			1324.63	1388.8	1370	4.27	.035	248,989					3.14	.15	.15		1338.8	From ESS Table 5.1c
183+00	30	1324.70	1338.8	1359	4.26	.035	245,784	247,387	.000051	.01			3.21	.16	.16	-.01	0	0	1339.50
185+00	200	1325.20	1338.9	1299	4.19	.035	231,075	238,430	.000336	.07			3.36	.18	.18	-.02	.01	.06	1339.84
G&O AL (188+70)	370	1326.12	1339.2	1208	4.08	.035	209,529	220,302	.000239	.15			3.62	.20	.20	-.02	.01	.14	1339.66
190+90	130	1326.45	1339.2	1160	4.02	.035	198,271	203,900	.000146	.06			3.76	.22	.22	-.02	.01	.06	1339.92
193+56	356	1327.35	1339.3	1049	3.88	.035	172,916	185,594	.000355	.20			4.16	.27	.27	-.05	.02	.17	1339.73
194+73	117	1327.65	1339.3	930	4.02	.036	154,321	163,619	.000171	.08			4.70	.34	.34	-.07	.02	.03	1339.26
196+17	144	1328.0	1339.3	870	3.95	.035	141,896	148,109	.000187	.13			5.02	.39	.39	-.05	.02	.10	1339.30
G&O AM (196+70)	53	1328.13	1339.4	864	3.94	.035	144,469	143,183	.000193	.05			5.06	.40	.40	-.01	0	.04	1339.20
197+23	53	1328.25	1339.4	854	3.92	.035	142,088	143,278	.000193	.05			5.11	.41	.41	-.01	0	.04	1339.66
Confluence with West Branch																			
199+93	220	1328.8	1339.8	869	3.45	.035	154,324	138,406	.000118	.04			2.17	.07	.07	.34	.10	.48	1339.92
200+77	134	1329.2	1340.0	759	3.14	.036	98,685	116,604	.000226	.03			2.48	.10	.10	.03	.01	.01	1339.92
201+71	94	1329.4	1340.0	767	3.52	.035	114,597	104,541	.000131	.03			2.45	.10	.10	0	0	.03	1339.92
203+00	129	1329.7	1340.0	733	3.46	.035	107,752	111,175	.000129	.04			2.57	.10	.10	0	0	.04	1340.00
G&O A (204+70)	170	1330.6	1340.2	657	3.33	.035	92,742	100,247	.000135	.13			2.87	.13	.13	-.03	.01	.11	1340.11
West Branch Gypsum Creek From Confluence with Middle Branch to Rock Road Q = 2560 cfs																			
197+23 M.B.			1339.4	854	3.92	.035	142,088		.000193	.05			5.11	.41	.41	-.01	0	.04	1339.66
199+45 W.B.	222	1329.6	1339.8	841	3.86	.036	133,992	138,040	.000134	.08			5.04	.42	.42	-.27	.03	.28	1339.39

Exhibit 12