



City of Albuquerque

February 10, 2000

Charles Easterling, PE
Easterling & Associates
2600 American Rd, SE, Ste. 100
Rio Rancho, NM 87124

Re: Black Arroyo Trail Drainage Computations
Engineer Stamp 2-9-00 (A13/D16)

Dear Mr. Easterling,

Based upon your submittal dated 2-10-00, the above referenced site is approved for DRC signoff.

If you have any questions, you can contact me at 924-3986

Sincerely,

Bradley L. Bingham, PE
Hydrology Review Engineer

C: Kevin Broderick, DRC
file

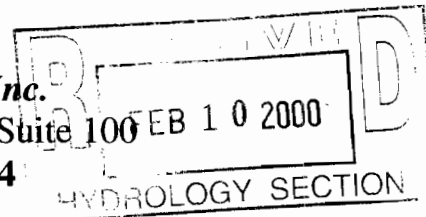
**BLACK ARROYO TRAIL
DRAINAGE COMPUTATIONS**

C.O.A. PROJECT NO. 631491

FEBRUARY 2000

**PREPARED FOR:
City of Albuquerque
Parks & Recreation
P.O. Box 1293
Albuquerque, NM 87102**

**PREPARED BY:
Easterling & Associates, Inc.
2600 The American Road SE, Suite 100
Rio Rancho, NM 87124**



I, Charles M. Easterling, do hereby certify that this report was prepared by me or under my direction and that I am a duly registered Professional Engineer under the laws of the State of New Mexico

Charles M. Easterling, P.E.
NM No. 6411



2-9-00
Date

BLACK ARROYO TRAIL DRAINAGE COMPUTATIONS

At the request of the City of Albuquerque Design Review Committee, the following Drainage Computations are hereby submitted in support of the Black Arroyo Trail, Project No. 631491.

Easterling & Associates, Inc.

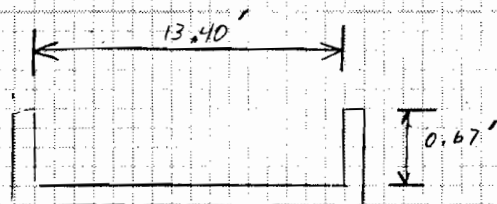
2600 The American Road, Suite 100
Rio Rancho, New Mexico 87124
(505) 898-8021
FAX (505) 898-8501

Project Name _____
Date 5/05/00 Project No. 50
Subject _____
By _____ Sheet 1 of 4
Reviewed by CME Date _____

SIDEWALK BRIDGE AT STA 36+19.52

$Q_{100} = 21.6$ CFS FROM DRAINAGE MANAGEMENT
PLAN FOR SALIDA DEL SOL BASIN CI

OPEN CHANNEL CAPACITY



$$\begin{aligned} n &= 0.017 \\ S &= 0.028 \\ A &= 13.40 \times 0.67 = 8.97 \text{ SF} \\ P &= 13.40 + 0.67 + 0.67 \\ P &= 14.74 \\ R &= \frac{A}{P} = \frac{8.97}{14.74} = 0.61 \end{aligned}$$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{0.017} (8.97) (0.61)^{2/3} (0.028)^{1/2}$$

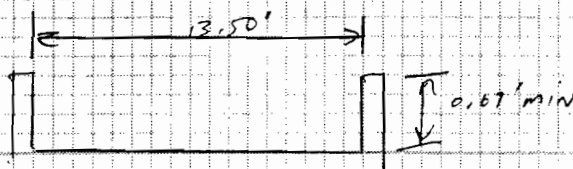
$$Q = 94.46 \text{ CFS} > 21.6 \text{ CFS} \therefore \text{OK}$$

NORMAL DEPTH = 0.27 FT (SEE ATTACHED)

SIDEWALK BRIDGE AT STA 46+0.0

$Q_{100} = 18.0 + 4.8$ CFS FROM DRAINAGE MANAGEMENT
 $Q_{100} = 22.8$ CFS PLAN FOR SALIDA DEL SOL BASIN DI AND

OPEN CHANNEL CAPACITY



HYDROLOGY SECTION

$$\begin{aligned} n &= 0.017 \\ S &= 0.0116 \\ A &= 13.50 \times 0.67 = 9.05 \\ P &= 13.50 + 0.67 + 0.67 \\ P &= 14.84 \text{ SF} \\ R &= \frac{A}{P} = \frac{9.05}{14.84} = 0.61 \end{aligned}$$

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{0.017} 9.05 (0.61)^{2/3} (0.0116)^{1/2}$$

$$Q = 61.345 \text{ CFS} > 22.8 \text{ CFS}$$

NORMAL DEPTH = 0.37 FT (SEE ATTACHED)

Easterling & Associates, Inc.

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Project Name EL PASO ARROYO TRAIL

Date 01/05/00 Project No. 5110

Subject HYDRAULIC COMPUTATIONS

By DSH Sheet 2 of 4

Reviewed by CME Date _____

2 - 24" CULVERTS STA 31+18.91 AND STA 31+27.16

$Q_{100} = 32.3 \text{ CFS}$ FROM DRAINAGE MANAGEMENT PLAN FOR
SALIDA DEL SOL

CONDUIT CAPACITY

24" COMP UTRA-FLOW TYPE 2 ALUMINIZED STEEL OR GALVANIZED STEEL

$A = 3.14 \text{ SF}$

$n = 0.012$

$S = 0.005 \text{ FT/FT}$

$R/O = 0.25 \Rightarrow R = 0.5$

$$Q_{\text{FULL}} = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{0.012} (3.14)(0.50)^{2/3} (0.005)^{1/2}$$

$Q_{\text{FULL}} = 17.32 \text{ CFS}$

$Q_{\text{TOTAL}} = 2 \times Q_{\text{FULL}} = 2 \times 17.32 = 34.65 \text{ CFS}$

$Q_{\text{TOTAL}} = 34.65 \text{ CFS} > 32.3 \text{ CFS} \therefore \text{OK}$

ORIFICE CHECK

TOP OF PIPE 5114.0

PIPE INV = 5111.0

$h = 5114.0 - 5111.0$

$h = 3.0 \text{ FT}$

$D/A = 2.0 \text{ FT}$

$A = 3.14 \text{ SF}$

$C = 0.67$

$$Q_1 = CA \sqrt{2gh}$$

$$Q_1 = 0.67 (3.14) \sqrt{2(32.2)(3.0)}$$

$Q_1 = 23.87 \text{ CFS}$

$$Q_T = 2Q_1 = 2(23.87) = 47.75 \text{ CFS}$$

$Q_T = 47.75 \text{ CFS} > 32.3 \text{ CFS} \therefore \text{OK}$

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Project Name BACK ARROYO TRAIL

Date 01/05/00 Project No. 5110

Subject HYDRAULIC COMPUTATION

By DSM Sheet 3 of 4

Reviewed by CME Date _____

1-24" CONDUIT STA 22+50

BASIN A

$$Q_{110} = 2.8 \text{ CFS}$$

CONDUIT CAPACITY

24" CMP ULTRA - FLOW TYPE 2 ALUMINIZED STEEL OR GALVANIZED STEEL

$$A = 3.14 \text{ SF}$$

$$n = 0.012$$

$$S = 0.005 \text{ FT/FT}$$

$$R/D = 0.25 \Rightarrow R = 0.5$$

$$Q_{\text{Full}} = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{0.012} (3.14) (0.50)^{2/3} (0.005)^{1/2}$$

$$Q_{\text{Full}} = 17.32 \text{ CFS} > 2.8 \text{ CFS} \quad \therefore \text{OK}$$

1-12" CONDUIT STA 10+43.59

BASIN B

$$Q_{110} = 0.6 \text{ CFS}$$

CONDUIT CAPACITY

12" CMP ULTRA - FLOW TYPE 2 ALUMINIZED STEEL OR GALVANIZED STEEL

$$A = 0.785 \text{ SF}$$

$$n = 0.012$$

$$S = 0.005 \text{ FT/FT}$$

$$R/D = 0.25 \Rightarrow R = 0.25$$

$$Q_{\text{Full}} = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{0.012} (0.785) (0.25)^{2/3} (0.005)^{1/2}$$

$$Q_{\text{Full}} = 2.72 \text{ CFS} > 0.6 \text{ CFS} \quad \therefore \text{OK}$$

Easterling & Associates, Inc.

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Project Name BLACK ANCHO TAIL

Date 01/05/2000 Project No. 5110

Subject HYDRAULIC COMPUTATIONS

By DSM Sheet 4 of 4

Reviewed by CME Date _____

1 - 12 INCH DIA STA 47+03.39

BASIN C

$$Q_{100} = 0.4 \text{ CFS}$$

CONDUIT CAPACITY

12" CMP - ULTRA-FLOW TYPE 2 ALUMINIZED STEEL OR GALVANIZED STEEL

$$A = 0.785 \text{ SF}$$

$$n = 0.012$$

$$S = 0.005 \text{ FT/FT}$$

$$R/D = 0.25 \Rightarrow R = 0.25$$

$$Q_{FULL} = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{0.012} (0.785) (0.25)^{2/3} (0.005)^{1/2}$$

$$Q_{FULL} = 2.72 \text{ CFS} > 0.4 \text{ CFS} \quad \text{OK}$$

HYDROLOGY SUMMARY

PROJECT NAME:		Black Arroyo Trail		AREA (acres)	LAND TREATMENTS				2 YEAR			10 YEAR			100 YEAR		
JOB NUMBER:		4800							Q (cfs)	VOLUME (ac.ft.)		Q (cfs)	VOLUME (ac.ft.)		Q (cfs)	VOLUME (ac.ft.)	
BASIN	COND.	DESCRIPTION		A	B	C	D		6 HR	24 HR		6 HR	24 HR		6 HR	24 HR	
A	DEV	PARK		1.40	0.0%	100.0%	0.0%	0.0%	0.0	0.0012	0.0012	1.1	0.0257	0.0257	2.8	0.0782	0.0782
B	DEV	ROW		0.36	40.0%	60.0%	0.0%	0.0%	0.0	0.0002	0.0002	0.2	0.0049	0.0049	0.6	0.0173	0.0173
C	DEV	ROW		0.22	40.0%	60.0%	0.0%	0.0%	0.0	0.0001	0.0001	0.1	0.0030	0.0030	0.4	0.0106	0.0106

COPY

DRAINAGE MANAGEMENT PLAN

FOR

SALIDA DEL SOL

PREPARED FOR
AMERICAN SERVICE CORPORATION

BY:
COMMUNITY SCIENCES CORPORATION

AUGUST, 1983

KENT M. WHITMAN, P.E.

SURVEYING
LAND PLANNING
CIVIL ENGINEERING
DEVELOPMENT CONSULTANTS

AREA/POINT DESIGNATION = A3(O)

AREA= 6E-03 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 5 MINUTES
FRAC IMPERV= .38
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
235	7.9

VOL = 12161.4 CF

AREA/POINT DESIGNATION = B1
AREA= .039 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 19 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
245	32.8

VOL = 72015.9 CF

AREA/POINT DESIGNATION = B2
AREA= .022 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 18 MINUTES
FRAC IMPERV= .26
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
244	17.4

VOL = 34370 CF

AREA/POINT DESIGNATION = B2
AREA= .022 SQ MI
1 HR RAIN= 1.25 INCHES
6 HR RAIN= 1.45 INCHES
TC= 18 MINUTES
FRAC IMPERV= .26
CN (PERVIOUS)= 70
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
244	7.7

VOL = 15573.4 CF

AREA/POINT DESIGNATION = B3
AREA= .013 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 5 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
234	15.6

VOL = 24005.3 CF

AREA/POINT DESIGNATION = B3
AREA= .013 SQ MI
1 HR RAIN= 1.25 INCHES
6 HR RAIN= 1.45 INCHES
TC= 5 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
233	7.2

VOL = 11379.1 CF

AREA/POINT DESIGNATION = C1
AREA= .018 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 7 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	21.6

VOL = 33238.1 CF

AREA/POINT DESIGNATION = C1
AREA= .018 SQ MI
1 HR RAIN= 1.25 INCHES
6 HR RAIN= 1.45 INCHES
TC= 7 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
------	--------

240 . 10.0

VOL = 15755.6 CF

AREA/POINT DESIGNATION = D1
AREA= .015 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 8 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	18.0

VOL = 27698.4 CF

AREA/POINT DESIGNATION = D1
AREA= .015 SQ MI
1 HR RAIN= 1.25 INCHES
6 HR RAIN= 1.45 INCHES
TC= 8 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
240	8.3

VOL = 13129.7 CF

AREA/POINT DESIGNATION = D2
AREA= .01 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 6 MINUTES

FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
------	--------

AREA/POINT DESIGNATION = E1
AREA= 4E-03 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 5 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
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236	4.8
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VOL = 7386.24 CF

AREA/POINT DESIGNATION = D2
AREA= .01 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 6 MINUTES
FRAC IMPERV= .32
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
------	--------

236	12.0
-----	------

VOL = 18465.6 CF

AREA/POINT DESIGNATION = F1
AREA= .03 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 6 MINUTES
FRAC IMPERV= .53
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
238	48.0

VOL = 74331.8 CF

AREA/POINT DESIGNATION = F1
AREA= .03 SQ MI
1 HR RAIN= 1.25 INCHES
6 HR RAIN= 1.45 INCHES
TC= 6 MINUTES
FRAC IMPERV= .53
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

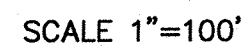
TIME	Q(CFS)
240	25.4

VOL = 38960.7 CF

AREA/POINT DESIGNATION = G2
AREA= .078 SQ MI
1 HR RAIN= 1.9 INCHES
6 HR RAIN= 2.2 INCHES
TC= 14 MINUTES
FRAC IMPERV= .37
CN (PERVIOUS)= 72
CN (IMPERVIOUS)= 95

PEAK ONLY OUTPUTTED

TIME	Q(CFS)
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CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

BLACK ARROYO TRAIL
BASIN MAP

CITY REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	Mo./DAY/YR.	Mo./DAY/YR.
CITY PROJECT No.	ZONE MAP NO.	SHEET	OF	
631491	A-13	1	1	

D 24
C 20
B 16
A 12

CITY OF ALBUQUERQUE

