



**MASTER DEVELOPMENT
DRAINAGE REPORT
FOR
NICHOLS BUSINESS CENTER**

JUNE 16, 2006
Revised December 6, 2006

Prepared for:

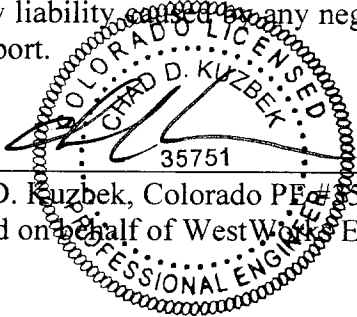
FF Investments, LLC
3710 Sinton Road, Suite 200
Colorado Springs, CO 80907
(719) 473-7763

WestWorks Job #90526

**MASTER DEVELOPMENT DRAINAGE REPORT FOR
NICHOLS BUSINESS CENTER**

Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according the criteria established by the City/County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.



Chad D. Kuzbek, Colorado PE # 35751
For and on behalf of WestWood Engineering

12/6/06
Date

Developer's Statement:

I, the developer have read and will comply with all of the requirements specified in this drainage report and plan.

FF Investments, LLC
Business Name

By: [Signature]

Title: Manager

Address: 3710 Sinton Road, Suite 200
Colorado Springs, CO 80907

City of Colorado Springs Only:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

For the City Engineer

12/13/06
Date

Conditions: /

MASTER DEVELOPMENT DRAINAGE REPORT FOR NICHOLS BUSINESS CENTER

PURPOSE

The purpose of this drainage report is to identify general guidelines and solutions to problems on site and off-site resulting from future re-development of this subdivision to be replatted.

GENERAL LOCATION AND DESCRIPTION

Nichols Business Center is an 7.3-acre subdivision within a portion of Section 32, Township 13 south, Range 66 west of the 6th P.M. in Colorado Springs, Colorado. The site is located north of the intersection of Nichols Blvd and N. Arcadia Street (see Vicinity Map in Appendix). The site is located in the Templeton Gap Drainage Basin.

The site is currently zoned as an industrial site and has been operating as a greenhouse and nursery. The site consists of flat grades, is covered mostly with existing buildings, parking lot pavement, and landscape areas. The site slopes generally from northeast to southwest. The majority of the site consists of Hydrologic Soil Group 'B'.

This site is already platted as Lot 1, Block 1 Haley's Second Filing (Plat Book D-3, Page 83). This proposed replat seeks to subdivide the site into 5 lots.

Future re-development of each individual lot created by this subdivision may require a site specific Final Drainage Report and will need to address applicable current stormwater quality standards.

DRAINAGE BASIN CHARACTERISTICS

Existing Conditions:

The existing site is developed with large greenhouse buildings, other buildings, paved parking lots, and landscape area. The existing site is surrounded by alleys that generally intercept off-site drainage and route it around the site.

Basin EX-A represents the entire existing site. Runoff of $Q_5 = 20$ cfs and $Q_{100} = 41$ cfs runs off into Nichols Blvd at DPexA. There is an existing City of Colorado Springs standard D-9 inlet in Nichols Blvd near the southwest corner of the site (DP0s1). The capacity of this inlet with 1-ft ponding is estimated at approximately 35 cfs. Runoff not intercepted by this inlet will continue west in Nichols Blvd.

Developed Conditions:

Proposed re-development of the site will be industrial. Most or all of the existing greenhouses will be demolished and some of the existing buildings will be preserved. A proposed private drive will be constructed through the middle of the site to access the lots. Future development on each lot is not fully known at this time. For this reason,

Future re-development of each individual lot created by this subdivision may require a site specific Final Drainage Report and will need to address applicable current stormwater quality standards.

Basin A includes 4.0 acres generating runoff of $Q_5 = 13$ cfs and $Q_{100} = 25$ cfs. The majority of this flow will drain south in the proposed private drive and into Nichols Blvd at DP-A.

Basin B includes 2.3 acres generating runoff of $Q_5 = 7$ cfs and $Q_{100} = 15$ cfs. The majority of this flow will drain south into Nichols Blvd at DP-B.

Basin C includes 1.2 acres generating runoff of $Q_5 = 5$ cfs and $Q_{100} = 9$ cfs. The majority of this flow will drain south into an existing water quality Pond C. Pond C was installed with the installation of a parking lot associated with the redevelopment of an existing building on the site. The WQ Pond C outfall structure is modeled in this MDDP. Discharge from Pond C will flow south from DP-C into Nichols Blvd.

The total combined developed flow from the site is $Q_5 = 20$ cfs and $Q_{100} = 40$ cfs (DP-DEV). This is the total developed flow discharging into Nichols Blvd. This is essentially equal to the existing flow discharging into Nichols Blvd (DPexA - $Q_5 = 20$ cfs and $Q_{100} = 41$ cfs); therefore re-development of this site will not adversely impact existing drainage conditions.

The existing street capacity of Nichols Boulevard is estimated at approximately 100 cfs. Discharge from this site does not exceed the capacity of Nichols Blvd.

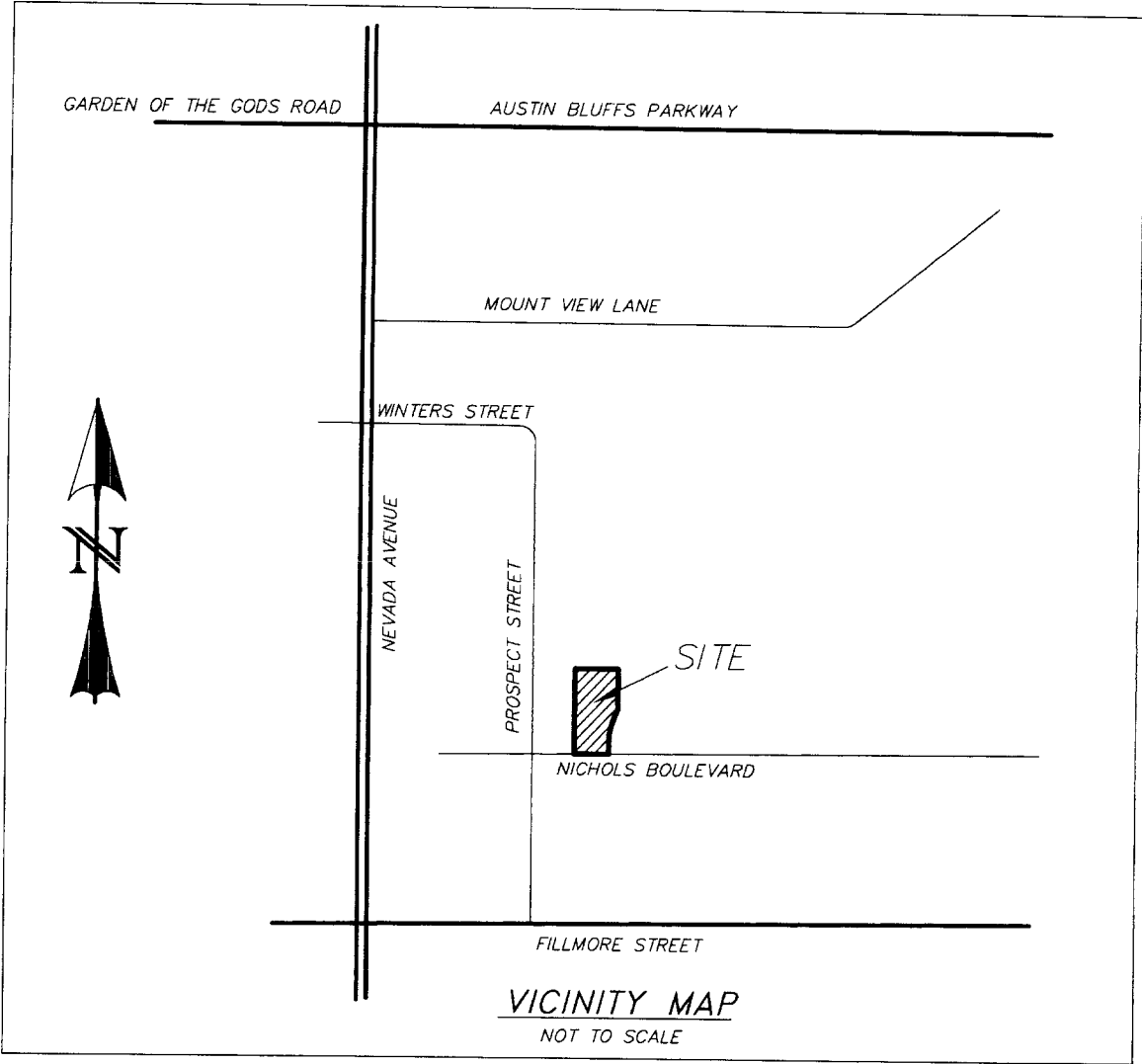
FLOODPLAIN STATEMENT

To the best of WestWorks Engineering's knowledge and belief, no portion of Nichols Business Center is within a F.E.M.A. designated floodplain per Flood Insurance Rate Map Community Panel Nos. 08041C0518 F, effective March 17th, 1997.

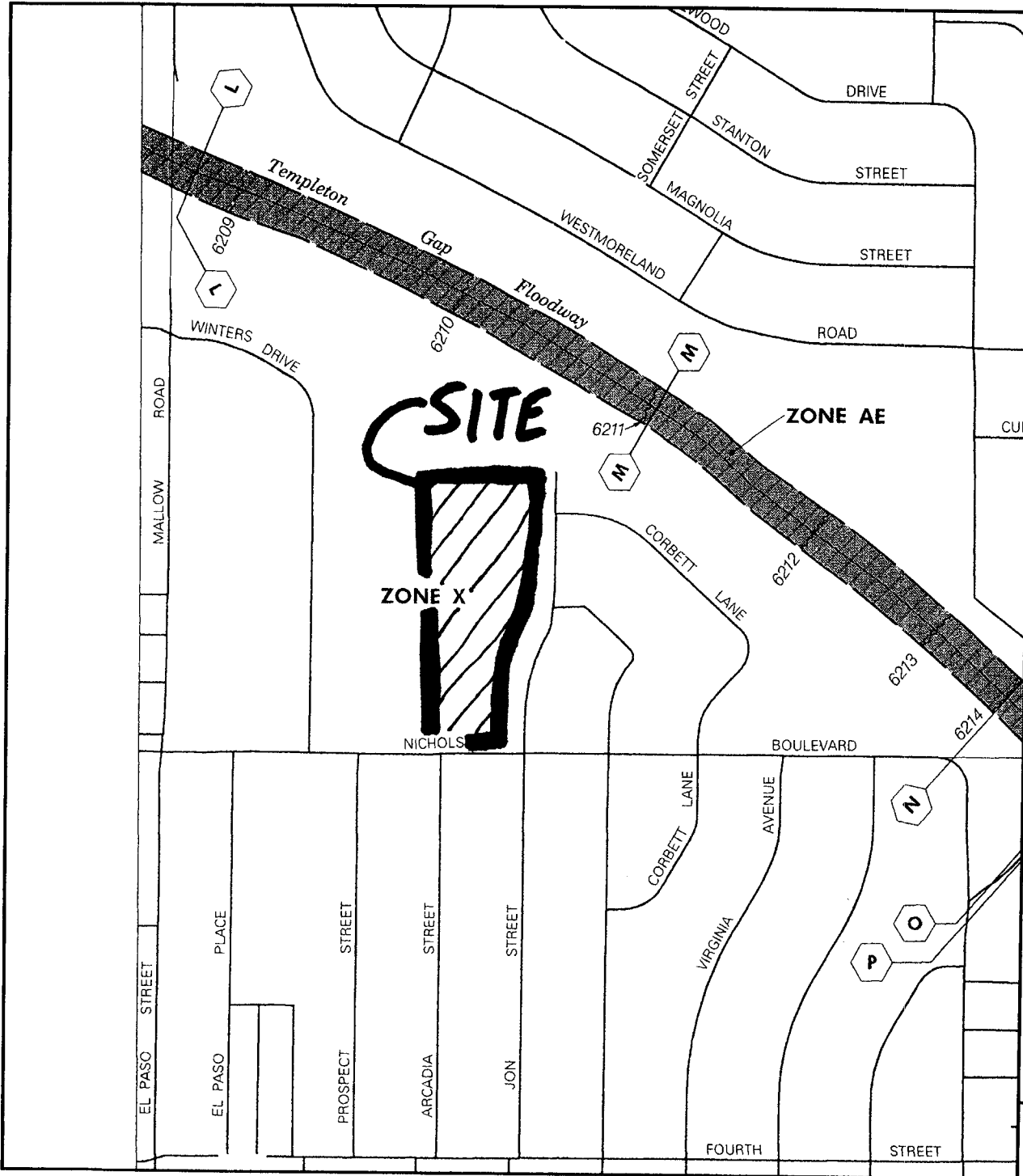
DRAINAGE FEES

The study area is in the Templeton Gap Drainage Basin. This site is already platted as Lot 1, Block 1 Haley's Second Filing (Plat Book D-3, Page 83); therefore no drainage fees are due.

APPENDIX



VICINITY MAP
NOT TO SCALE



APPROXIMATE SCALE IN FEET
 500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

**FIRM
 FLOOD INSURANCE RATE MAP**

EL PASO COUNTY,
 COLORADO AND
 INCORPORATED AREAS

PANEL 518 OF 1300
 (SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	000060	0518	F

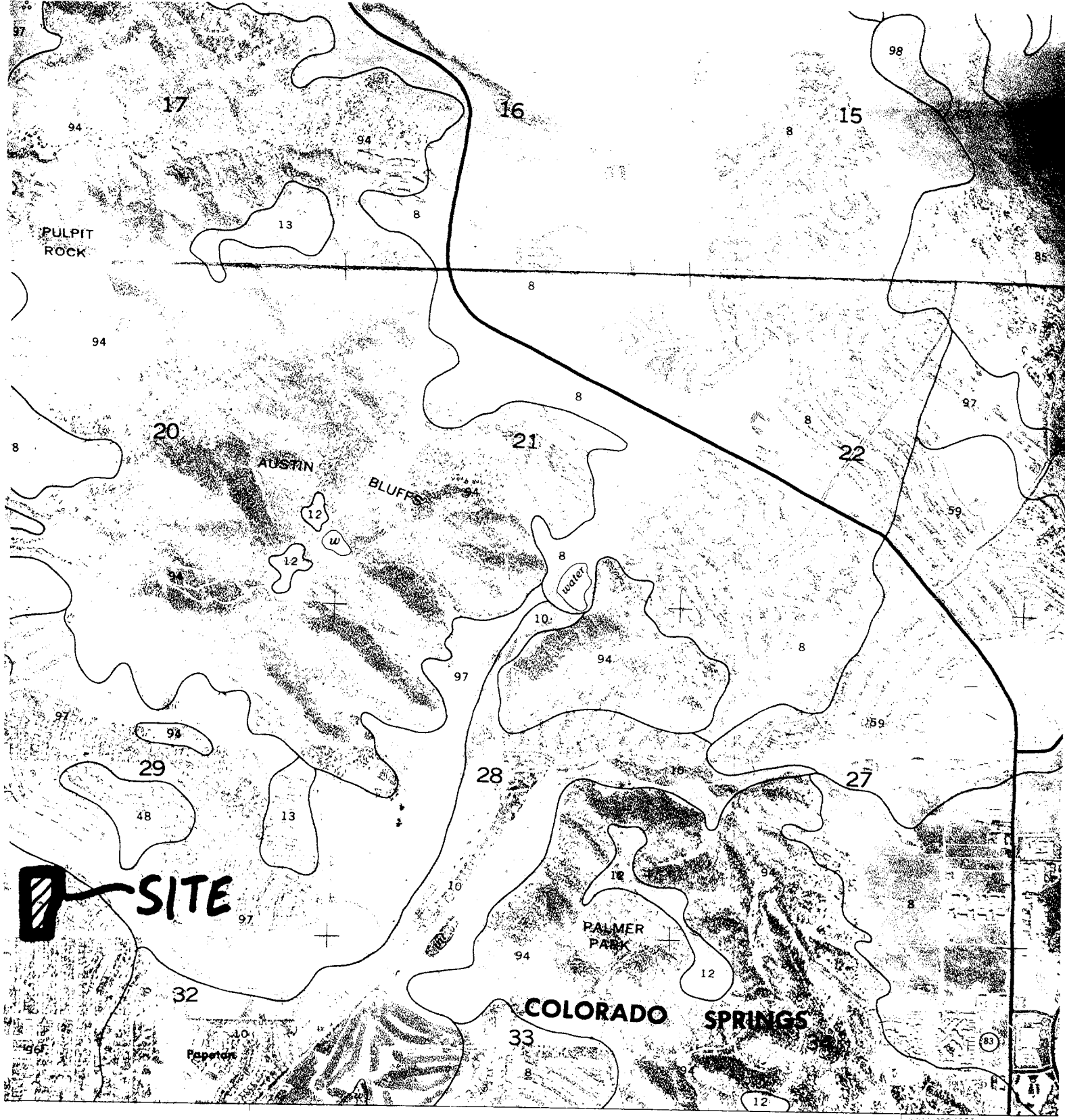
**MAP NUMBER
 08041C0518 F**

**EFFECTIVE DATE:
 MARCH 17, 1997**



Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



Time of Concentration Calculations

Sub-Basin Area [ac]	Time of Concentration, Tc [min.]					Sub-Basin Area [ac]	Time of Concentration, Tc [min.]					Sub-Basin Area [ac]	Time of Concentration, Tc [min.]				
	Flowline	L [ft.]	S [%]	v [ft/s]	Tc [min.]		Flowline	L [ft.]	S [%]	v [ft/s]	Tc [min.]		Flowline	L [ft.]	S [%]	v [ft/s]	Tc [min.]
EX-A 4.6	overland	50	1.0		11.2	A 4.1	overland	30	2.0		6.9						
	channel	300	1.0	3.50	1.4		channel	840	1.0	3.50	4.0						
Total Tc =					12.7	Total Tc =					10.9						
						B 3.3	overland	30	2.0		6.9						
							channel	780	1.0	3.50	3.7						
Total Tc =						Total Tc =					10.6						
						C 1.2	overland	16	2.0		5.0						
							channel	240	1.5	4.29	0.9						
Total Tc =						Total Tc =					6.0						



Project: Nichols Business Center - MDDP

Job No.: 90526

Engineer: Chad Kuzbek, PE

Date: June 16, 2006

Capacity of Grate Inlets in Sag Location

Weir Condition (depth of flow < 0.4 ft)				Orifice Condition (depth of flow > 1.4 ft)			
Design Point	Perimeter, P [ft]	Depth of Flow, d [ft] (<0.4ft)	Flow Intercepted, Qi [cfs]	Design Point	Open Area, A [ft]	Depth of Flow, d [ft] (>1.4ft)	Flow Intercepted, Qi [cfs]
os1	25	1.0	37.5	os1	12.45	1.00	33.4

$$*Qi = (3.0 * P * d^{1.5}) / F$$

Where:

- Qi = flow intercepted in grate opening [cfs]
- P = perimeter of grate, disregarding bars [ft]
- d = depth of water at grate [ft]
- F = clogging factor (= 2)

$$*Qi = 0.67 * A / F (2 * g * d)^{0.5}$$

Where:

- A = open area of grate [ft]
- g = acceleration of gravity (32.2 ft/s²)

*equations from City of Colo Spgs & El Paso County
Drainage Criteria Manual - Section 7.5.2



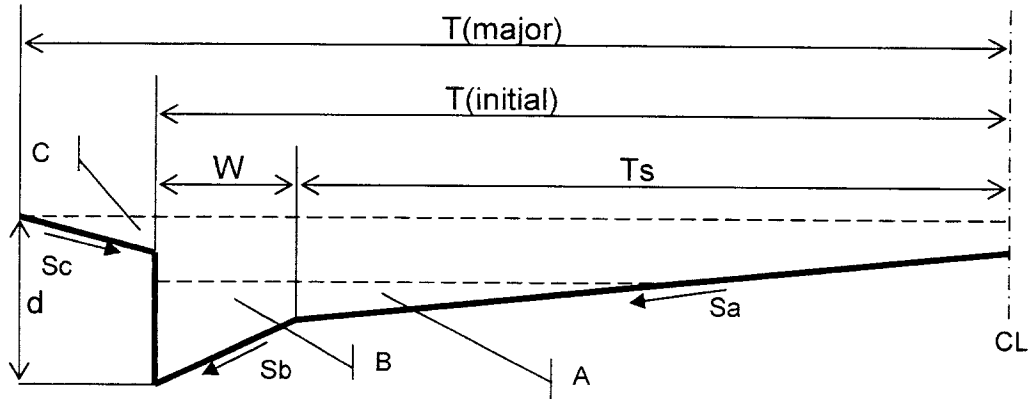
Project: Nichols Business Center - MDDP

Job No.: 90526

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Date: June 16, 2006

Street Capacity



$$* Q = 0.56 / (n * S_x) * S^{0.5} * (T * S_x)^{2.67}$$

*equation taken from City of Colorado Springs and El Paso County Drainage Criteria Manual Chapter 7.3

where:

Q = flow rate [cfs]
 T = width of flow (spread) [ft]
 S_x = cross slope [ft/ft]
 S = longitudinal slope [ft/ft]
 n = Manning's n coeff.

Height of Curb = 0.67 ft

-- Initial Storm -- d(max) @ flowline = 0.50 ft

Known:

T(initial) = 27.00 ft S_a = 0.02 ft/ft S_b = 0.06 ft/ft n (road) = 0.016
 W = 0.83 ft S = 0.02 ft/ft

Solution:

Q(A) = 25.4 cfs Q(B) = 2.7 cfs

Initial Storm Street Capacity, Q_{cap} = Q(A) + Q(B) = 28 cfs/side

-- Major Storm -- d(max) @ flowline = 0.67 ft

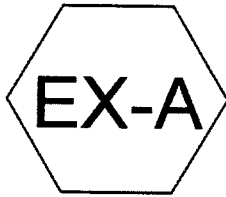
Known:

T(major) = 50.00 ft S_a = 0.02 ft/ft S_b = 0.06 ft/ft n (road) = 0.016
 W = 2.00 ft S = 0.02 ft/ft S_c = 0.02 ft/ft n (grass) = 0.030

Solution:

Q(A) = 42.4 cfs Q(B) = 10.0 cfs Q(C) = 0.0 cfs

Major Storm St. Capacity, Q_{cap} = Q(A) + Q(B) + Q(C) = 52 cfs/side



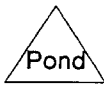
BASIN EX-A



DPexA



TO DPos1



5YR-EXISTING

El Paso County 5-Year Duration=13 min, Inten=3.69 in/hr

Prepared by WestWorks Engineering

HydroCAD® 7.00 s/n 002053 © 1986-2003 Applied Microcomputer Systems

Page 2

12/6/2006

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-A: BASIN EX-A

Runoff Area=7.300 ac Runoff Depth=0.60"
Tc=12.7 min C=0.75 Runoff=20.28 cfs 0.365 af

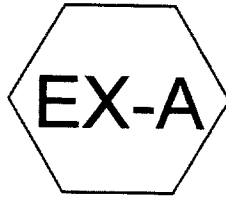
Link DPexA: DPexA

Inflow=20.28 cfs 0.365 af
Primary=20.28 cfs 0.365 af

Link DPos1: TO DPos1

Inflow=20.28 cfs 0.365 af
Primary=20.28 cfs 0.365 af

Total Runoff Area = 7.300 ac Runoff Volume = 0.365 af Average Runoff Depth = 0.60"



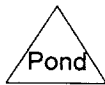
BASIN EX-A



DPexA



TO DPos1



100YR-EXISTING

El Paso County 100-Year Duration=13 min, Inten=6.57 in/hr

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Page 2

12/6/2006

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-A: BASIN EX-A

Runoff Area=7.300 ac Runoff Depth=1.21"
Tc=12.7 min C=0.85 Runoff=40.93 cfs 0.736 af

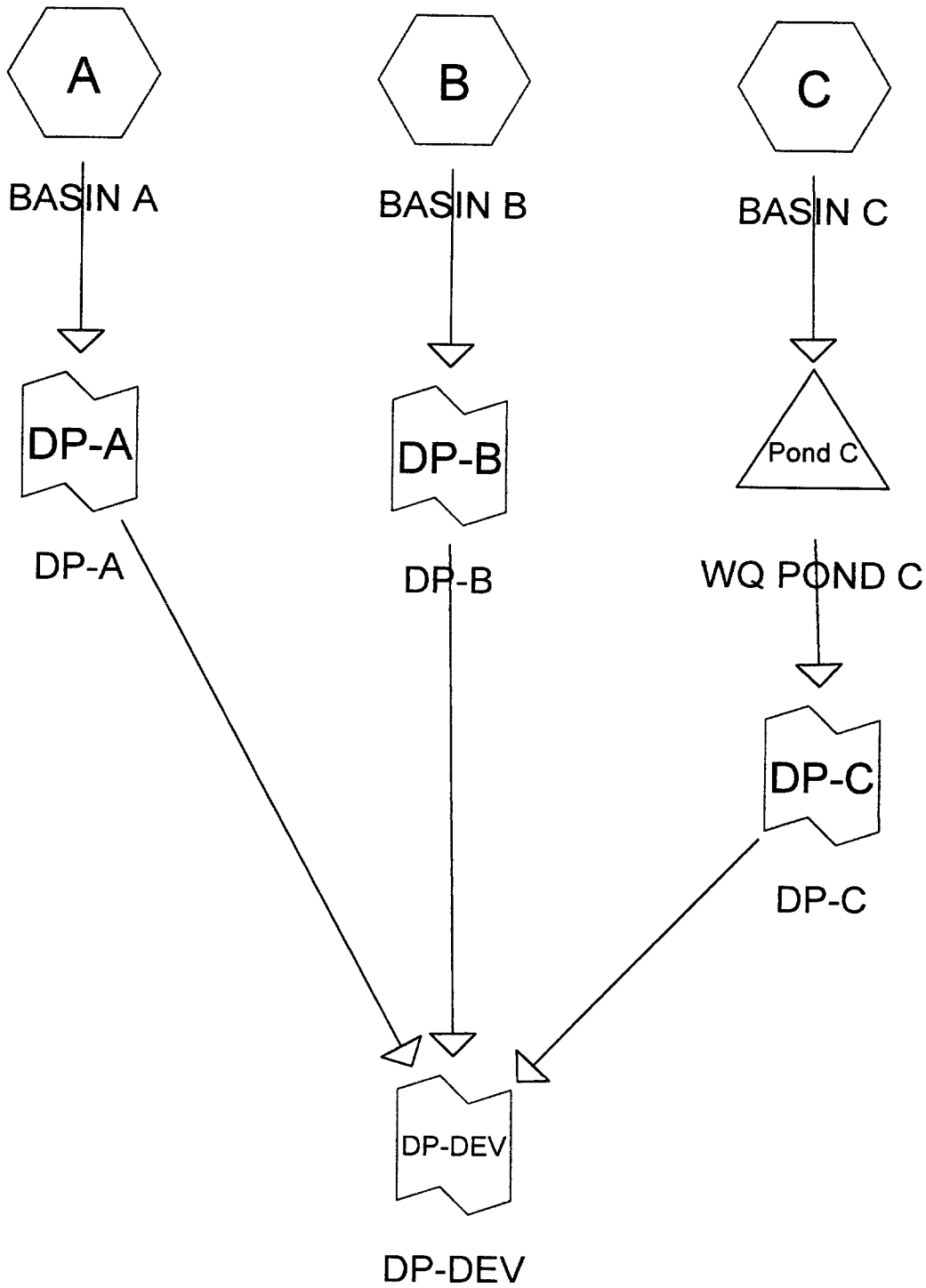
Link DPexA: DPexA

Inflow=40.93 cfs 0.736 af
Primary=40.93 cfs 0.736 af

Link DPos1: TO DPos1

Inflow=40.93 cfs 0.736 af
Primary=40.93 cfs 0.736 af

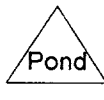
Total Runoff Area = 7.300 ac Runoff Volume = 0.736 af Average Runoff Depth = 1.21"



Subcat



Reach



Pond



Link

Drainage Diagram for 5YR-DEVELOPED
 Prepared by WestWorks Engineering 12/6/2006
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5YR-DEVELOPED

El Paso County 5-Year Duration=11 min, Inten=3.95 in/hr

Prepared by WestWorks Engineering

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Page 1

12/6/2006

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: BASIN A

Runoff Area=4.000 ac Runoff Depth=0.58"
Tc=10.9 min C=0.80 Runoff=12.64 cfs 0.193 af

Subcatchment B: BASIN B

Runoff Area=2.300 ac Runoff Depth=0.58"
Tc=10.6 min C=0.80 Runoff=7.33 cfs 0.111 af

Link DP-A: DP-A

Inflow=12.64 cfs 0.193 af
Primary=12.64 cfs 0.193 af

Link DP-B: DP-B

Inflow=7.33 cfs 0.111 af
Primary=7.33 cfs 0.111 af

Link DP-DEV: DP-DEV

Inflow=20.01 cfs 0.318 af
Primary=20.01 cfs 0.318 af

Total Runoff Area = 6.300 ac Runoff Volume = 0.304 af Average Runoff Depth = 0.58"

5YR-DEVELOPED

El Paso County 5-Year Duration=6 min, Inten=4.86 in/hr

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Page 1

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12/6/2006

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment C: BASIN C

Runoff Area=1.200 ac Runoff Depth=0.39"
Tc=6.0 min C=0.80 Runoff=4.70 cfs 0.039 af

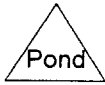
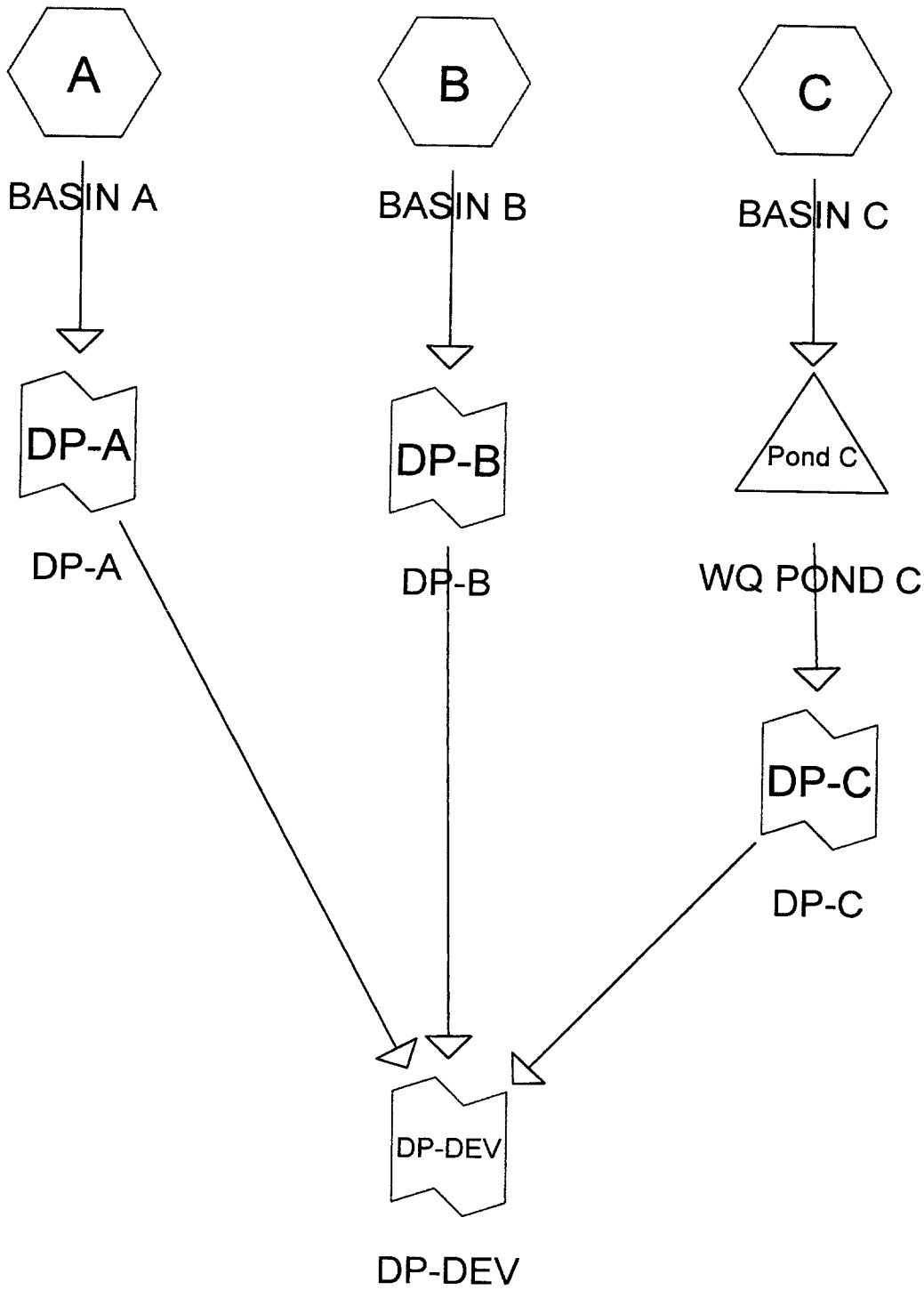
Pond Pond C: WQ POND C

Peak Elev=78.51' Storage=0.039 af Inflow=4.70 cfs 0.039 af
Outflow=0.04 cfs 0.008 af

Link DP-C: DP-C

Inflow=0.04 cfs 0.008 af
Primary=0.04 cfs 0.008 af

Total Runoff Area = 1.200 ac Runoff Volume = 0.039 af Average Runoff Depth = 0.39"



Drainage Diagram for 100YR-DEVELOPED
 Prepared by WestWorks Engineering 12/6/2006
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100YR-DEVELOPED

El Paso County 100-Year Duration=11 min, Inten=7.04 in/hr

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Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: BASIN A

Runoff Area=4.000 ac Runoff Depth=1.16"
Tc=10.9 min C=0.90 Runoff=25.35 cfs 0.387 af

Subcatchment B: BASIN B

Runoff Area=2.300 ac Runoff Depth=1.16"
Tc=10.6 min C=0.90 Runoff=14.69 cfs 0.222 af

Link DP-A: DP-A

Inflow=25.35 cfs 0.387 af
Primary=25.35 cfs 0.387 af

Link DP-B: DP-B

Inflow=14.69 cfs 0.222 af
Primary=14.69 cfs 0.222 af

Link DP-DEV: DP-DEV

Inflow=40.43 cfs 0.663 af
Primary=40.43 cfs 0.663 af

Total Runoff Area = 6.300 ac Runoff Volume = 0.610 af Average Runoff Depth = 1.16"

100YR-DEVELOPED

El Paso County 100-Year Duration=6 min, Inten=8.65 in/hr

Prepared by WestWorks Engineering

Page 1

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12/6/2006

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment C: BASIN C

Runoff Area=1.200 ac Runoff Depth=0.78"
Tc=6.0 min C=0.90 Runoff=9.42 cfs 0.078 af

Pond Pond C: WQ POND C

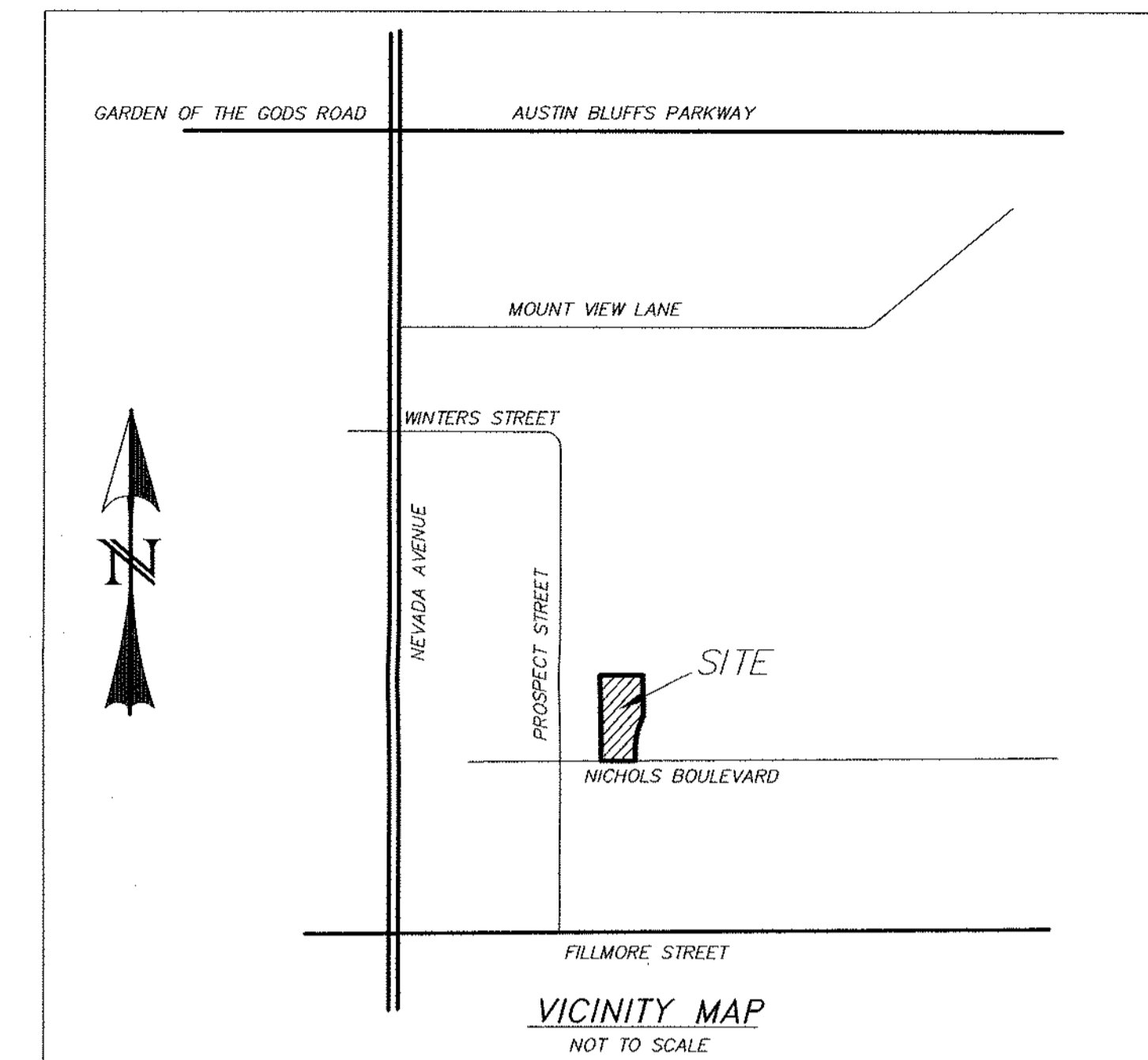
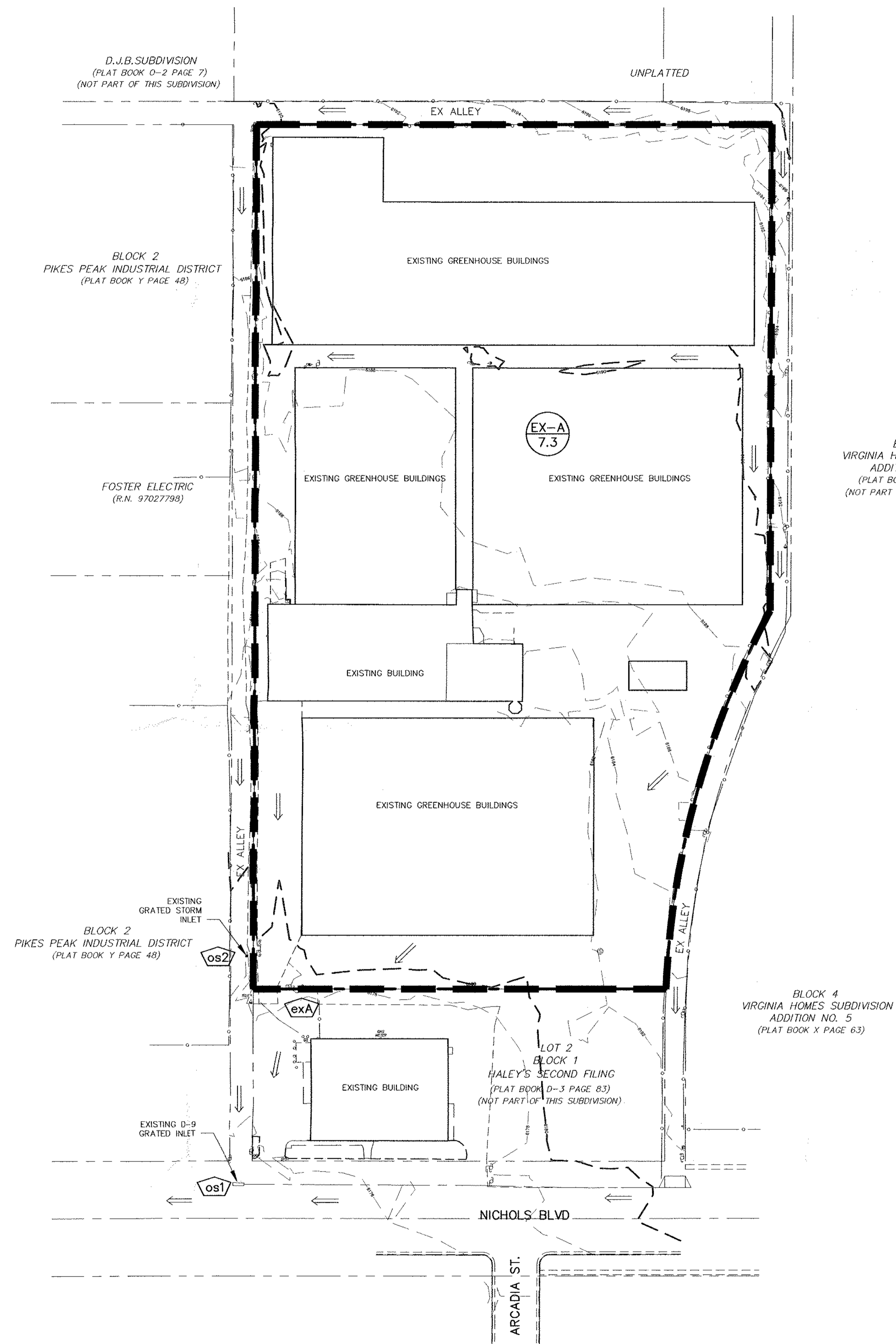
Peak Elev=79.02' Storage=0.077 af Inflow=9.42 cfs 0.078 af
Outflow=0.12 cfs 0.019 af

Link DP-C: DP-C

Inflow=0.12 cfs 0.019 af
Primary=0.12 cfs 0.019 af

Total Runoff Area = 1.200 ac Runoff Volume = 0.078 af Average Runoff Depth = 0.78"

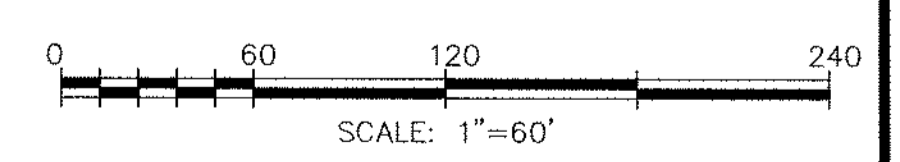
**DRAINAGE MAPS
(EXISTING & PROPOSED CONDITIONS)**



BASIN	Q5 [CFS]	Q100 [CFS]
EX-A	20	41

DESIGN POINT	Q5 [CFS]	Q100 [CFS]	DESCRIPTION
exA	20	41	DISCHARGE INTO NICHOLS BLVD

- LEGEND**
- BASIN IDENTIFIER: BASIN AREA [AC]
 - DESIGN POINT IDENTIFIER:
 - DRAINAGE BASIN BOUNDARY:
 - SURFACE FLOW DIRECTION:
 - EXISTING MAJOR CONTOUR (10'):
 - EXISTING MINOR CONTOUR (2'):
 - PROPOSED MAJOR CONTOUR (10'):
 - PROPOSED MINOR CONTOUR (2'):



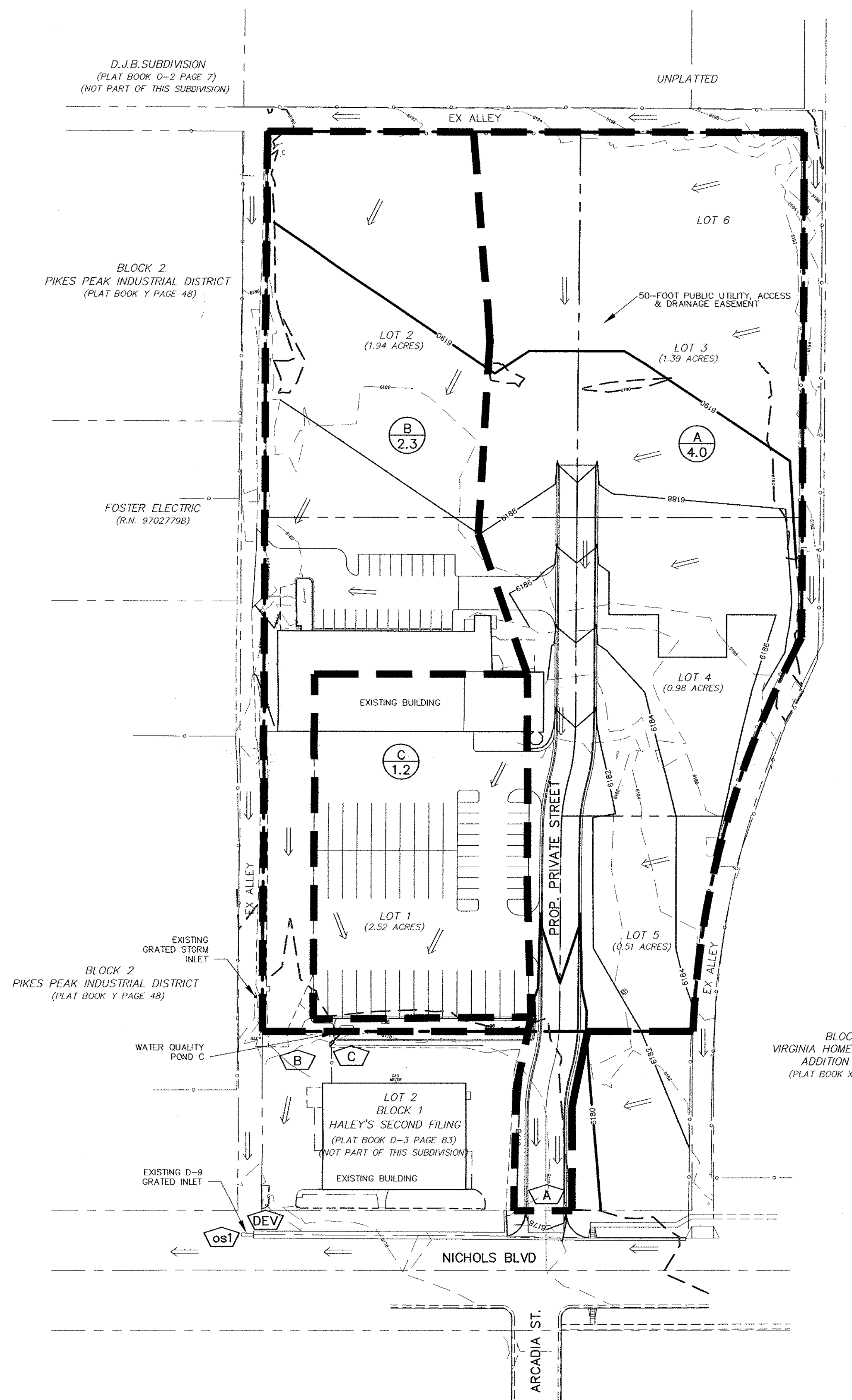
REV.	DESCRIPTION	BY	DATE
1.	PER CITY ENGINEERING COMMENTS	CDK	12/6/06

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
 CALL 1-800-922-1987
 UTILITY NOTIFICATION CENTER OF COLORADO
 IT'S THE LAW

PREPARED FOR:
FF INVESTMENTS, LLC
 3710 SINTON ROAD, SUITE 200
 COLORADO SPRINGS, CO 80907
 (719) 473-7763

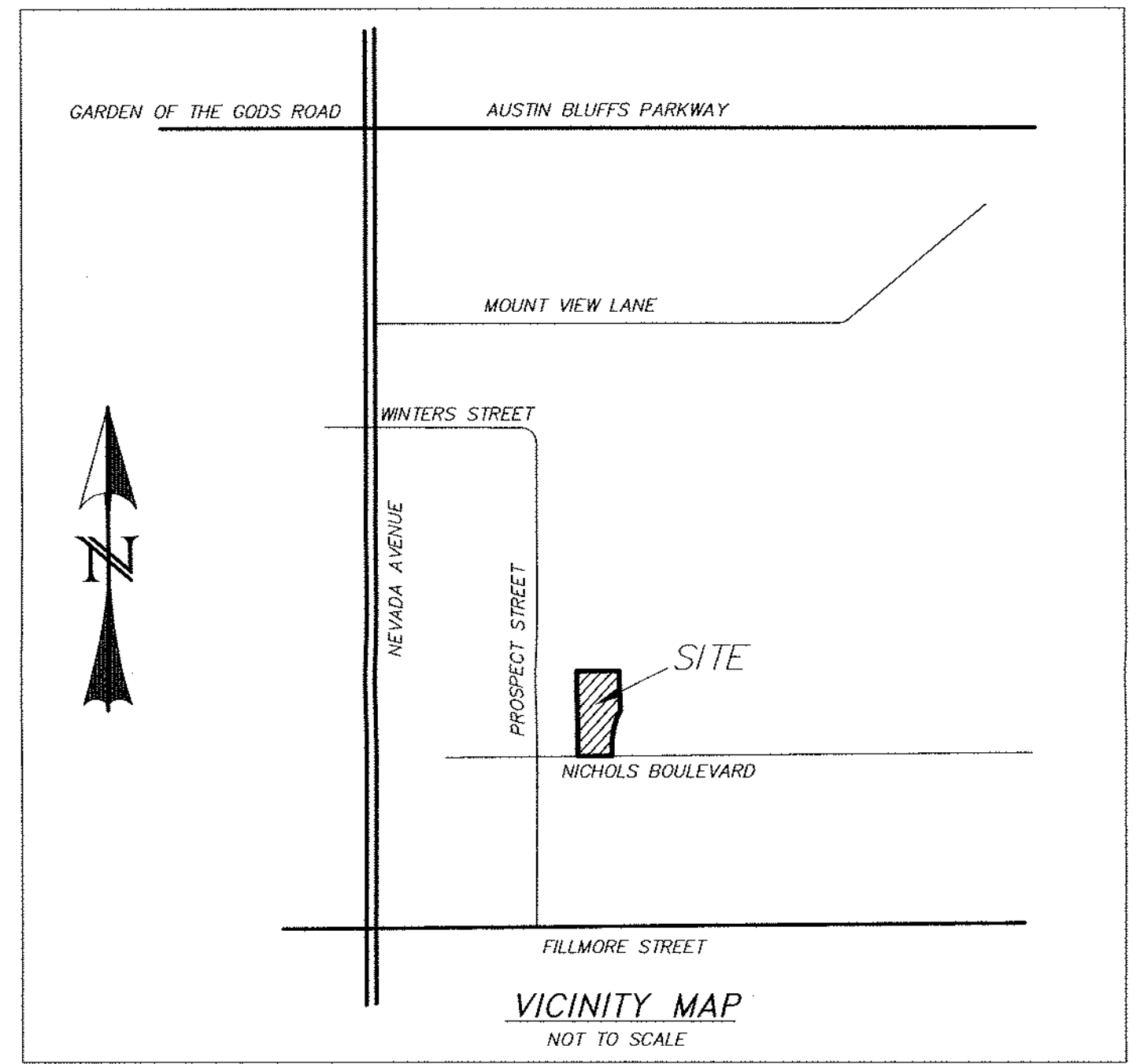


NICHOLS BUSINESS CENTER MDDP		DRAWN BY: CDK	DATE: 12/6/06
		SCALE: 1"=60'	JOB NUMBER: 90526
EXISTING CONDITIONS DRAINAGE MAP		SHEET: 1 OF 2	



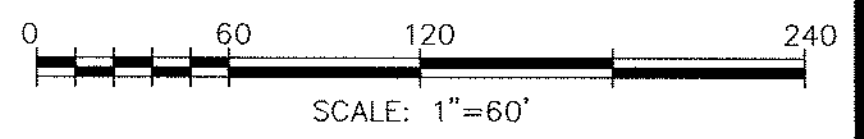
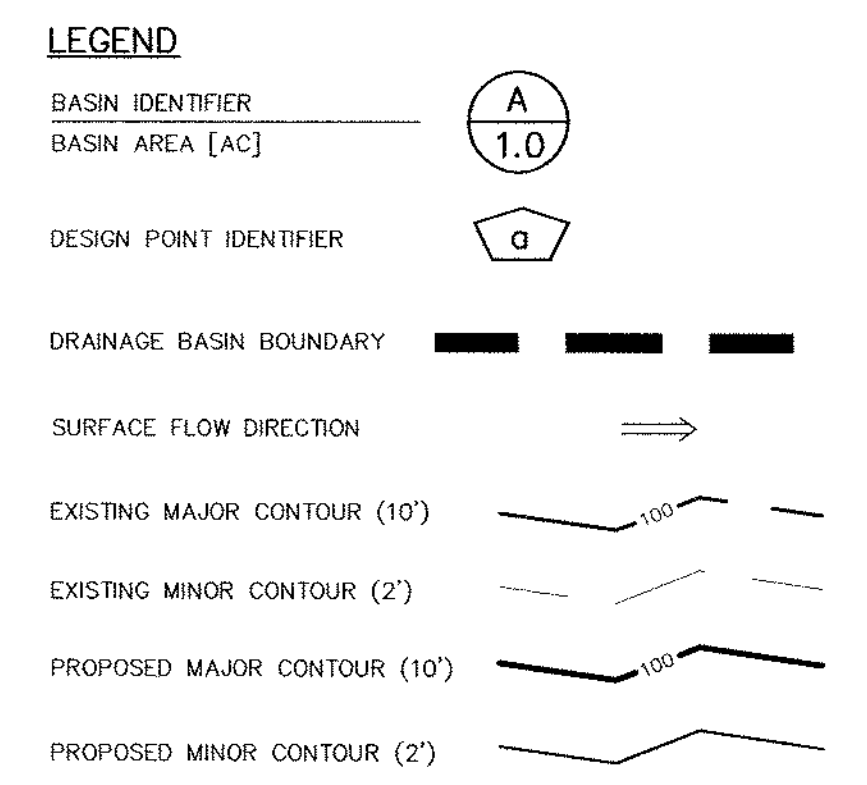
BLOCK 4
VIRGINIA HOMES SUBDIVISION
ADDITION NO. 5
(PLAT BOOK X PAGE 63)
(NOT PART OF THIS SUBDIVISION)

BLOCK 4
VIRGINIA HOMES SUBDIVISION
ADDITION NO. 5
(PLAT BOOK X PAGE 63)

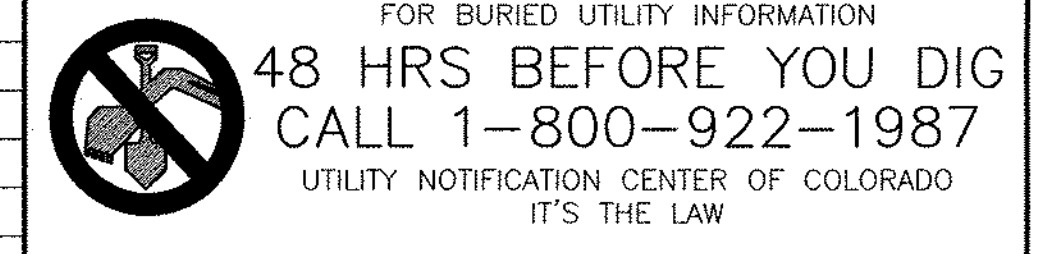


BASIN	Q5 [CFS]	Q100 [CFS]
A	13	25
B	7	15
C	5	9

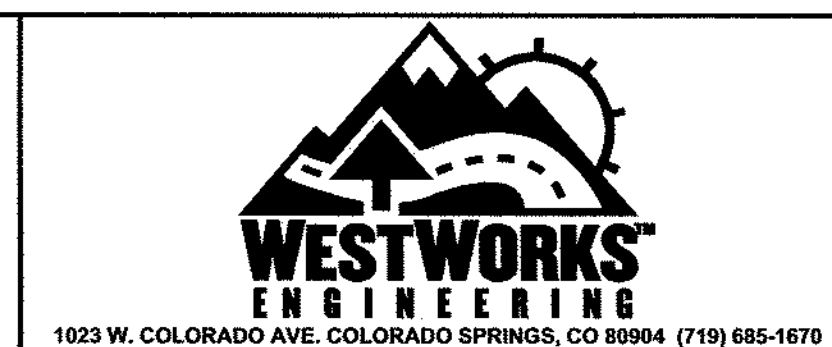
DESIGN POINT	Q5 [CFS]	Q100 [CFS]	DESCRIPTION
A	13	25	PRIVATE DRIVE FLOW TO NICHOLS
B	7	15	FLOW TO NICHOLS
C	1	1	WQ POND C DISCHARGE
DEV	20	40	TOTAL DEV FLOW TO NICHOLS



REV.	DESCRIPTION	BY	DATE
1.	PER CITY ENGINEERING COMMENTS	CDK	12/6/06



PREPARED FOR:
FF INVESTMENTS, LLC
3710 SINTON ROAD, SUITE 200
COLORADO SPRINGS, CO 80907
(719) 473-7763



NICHOLS BUSINESS CENTER MDDP		DRAWN BY: CDK	DATE: 12/6/06
		SCALE: 1"=60'	JOB NUMBER: 90526
DEVELOPED CONDITIONS DRAINAGE MAP		SHEET: 2 OF 2	