MASTER DEVELOPMENT DRAINAGE PLAN
FOR
NORTHGATE HIGHLANDS

RETURN WITHIN 2 WEEKS TO:
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MASTER DEVELOPMENT DRAINAGE PLAN
FOR
NORTHGATE HIGHLANDS

December 1998
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Revised May 1999
Revised June 1999
Revised August 1999

Prepared For:

US HOMES CORPORATION
6000 South Greenwood Plaza Boulevard, Suite 200
Englewood, CO 80111
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Job No. 9048.00

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MASTER DEVELOPMENT DRAINAGE PLAN FOR NORTHGATE HIGHLANDS

DRAINAGE REPORT STATEMENT

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 to the criteria established by the City 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.

COLORADO REGISTERED MICHAEL A. BRAMLETT 32314 PROFESSIONAL ENGINEER

Mike A. Bramlett, Colorado P.E. #32314 — Date: 5.21.99
For and On Behalf of JR Engineering, Ltd.

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

Business Name: US Homes Corporation

By: Dean Myerson

Title: V.P.

Address: 6000 South Greenwood Plaza Blvd., Suite 200

Englewood, CO 80111

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

City Engineer — Date: 9/20/99

Conditions:

MASTER DEVELOPMENT DRAINAGE PLAN FOR NORTHGATE HIGHLANDS

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APPENDIX

MASTER DEVELOPMENT DRAINAGE PLAN FOR NORTHGATE HIGHLANDS

PURPOSE

This document is the Master Development Drainage Plan for Northgate Highlands. The purpose of this report is to analyze the phased development and create the foundation for each final drainage report, which will be filed with the subdivision plats. This report will estimate peak rates of storm water runoff, recommend solutions for drainage concerns resulting from development, and identify necessary improvements to safely route storm water runoff to adequate outfall facilities.

GENERAL DESCRIPTION

Northgate Highlands is located in portions of Sections 5, 6, and 7, Township 12 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso. The site is bounded to the north by the Gleneagle Subdivision and Smith Creek, to the west by a future neighborhood commercial site and future park site, to the south by Northgate Road and to the east by unplatted county land. Zoning of this 133 acre site will be R1-6000 DFOZ. Proposed use is single family residential development, containing 347 lots.

Northgate Highlands has an existing ridge splitting the site, which slopes from northeast to southwest at a 7.0% grade and from the southeast to the northwest at a 15% grade to the valley floor. Vegetation is native grass with some pods of grambling oak, scattered pines, and cottonwoods with willow along Smith Creek. This site will be graded to preserve specific areas of vegetation; therefore some portions of this site will remain in its natural state. The soil condition reflects Hydrologic Group "B" (Tomah/Crowfoot, Pring and Payton) soils as determined by the "Soil Survey of El Paso County Area," prepared by S.C.S. (See appendix).

The annexation agreement for Northgate states "a Drainage Basin Planning Study has not been completed for the Smith Creek North Drainage Basin, and Picolan, Inc. agrees to produce a study

for Smith Creek North before submitting any plats within the drainage basin." The current basin study draft does not address issues relating to the Prebles Mouse and its potential habitat within Smith Creek, therefore Picolan, Inc. (present landowner) is in the process of retaining the services of Muller Engineering Company, Inc. to revise and complete the Drainage Basin Planning Study. This M.D.D.P. will recommend drainage solutions, which will allow some development to progress while the Drainage Basin Planning Study is being revised. (Approved City letter is included within the appendix.)

The developer and Picolan both agree that the construction of the first filing within Northgate Highlands should require the construction of the proposed regional detention facility detailed in the D.B.P.S. Due to the unadopted status of the D.B.P.S., and additional mouse habitat issues that relate to the location of channel improvements, this report is proposing the construction of a temporary detention facility to detain developed runoff quantities to historic levels. It has been agreed upon that Picolan, Inc. and the City of Colorado Springs will draft an agreement which will be included in the Drainage Basin Planning Study and states that prior to approval of any additional filing, the D.B.P.S. will be adopted by the City of Colorado Springs.

The final drainage reports will detail the required drainage, bridge, and pond fees required per acre. It has been agreed upon with the City that these fees will be the draft D.B.P.S. fee adjusted for inflation to present day dollars.

In conjunction with Filing No. 1, U.S. Home Corporation will post a letter of credit for the estimated construction costs of the regional detention facility. A signed private maintenance agreement for the temporary facility will be included in the Final Drainage Report.

EXISTING DRAINAGE CONDITIONS

Northgate Highlands is located within the Smith Creek Drainage Basin. In the analysis of this site, JR Engineering used a draft copy of the "Smith Creek Drainage Basin Planning Study," by Muller Engineering Company, Inc., dated March 1996.

PROPOSED DRAINAGE CHARACTERISTICS

After construction of Northgate Highlands, on-site and off-site runoff will be split into several outfall locations (see Drainage Map). The "Drainage Basin Planning Study," prepared by Muller Engineering Company, Inc. detailed a regional detention facility located at the existing stock pond (on channel). This detention requirement was to be obtained by raising the existing embankment to increase the storage capacity. Due to the potential impacts to the habitat of the threatened species know as the Prebles Meadow Jumping Mouse and the potential for a 300 foot buffer/setback restriction, this Master Development Drainage Plan is recommending the construction of a temporary detention pond outside of the mouse habitat to restrict flows to historic levels (see Drainage Plan for pond locations). Picolan, Inc. is currently working on mitigation plans for Smith Creek. Once these plans have been completed and approved by the U.S. Fish and Wildlife, the regional detention pond detailed in the basin study will be constructed. The time table for the mitigation plan approval will range from six (6) months to a year, which would mean the regional facility could be completed with future phases/filings of Northgate Highlands.

Design Point 1 consists of runoff from Off-site Basin OS-1 (Q_5 = 12.7 cfs and Q_{100} = 30.3 cfs), which will sheet flow on-site and be routed via side lot line swales and open space into Basin A. Basin A (Q_5 = 30.6 cfs and Q_{100} = 64.0 cfs) consists of streets and lots (1/4 acre), which will combine with Off-site Basin OS-1 at Design Point 1. A 14' D-10-R sump inlet will be constructed at Design Point 1 to intercept a portion of these flows, the overflow will overtop the crown of the residential street and collect at Design Point 2.

Design Point 2 consists of runoff from Basin B (Q_5 = 2.8 cfs and Q_{100} = 5.7 cfs) and the overflow from Design Point 1. The combined flow of Design Point 1 and Design Point 2 is Q_5 = 42.6 cfs and Q_{100} = 92.5 cfs. Therefore, a 14' D-10-R sump inlet will be constructed at Design Point 2. These intercepted flows will be routed west in the residential street to Design Points 3 and 4 (see Drainage Plan) via a 36" R.C.P. at a minimum slope of 2%.

Design Point 3 consists of surface runoff from Basin C (Q_5 = 24.8 cfs and Q_{100} = 59.6 cfs) and Basin D (Q_5 = 8.6 cfs and Q_{100} = 17.6 cfs), with a combined flow at Design Point 3 of Q_5 = 29.9 cfs and Q_{100} = 70.1 cfs. A 14' D-10-R sump inlet will be constructed at Design Point 3 to intercept a portion

of these flows, the overflow will overtop the crown of the residential street and collect at Design Point 4.

Design Point 4 consists of runoff from Basin E (Q_5 = 5.0 cfs and Q_{100} = 10.2 cfs) and the overflow from Design Point 3. The combined flow of Design Points 3 and 4 is Q_5 = 33.8 cfs and Q_{100} = 78.3 cfs. Therefore, a 14' D-10-R sump inlet will be constructed at Design Point 4. This intercepted flow from Design Points 3 and 4 will combine with piped flows from Design Points 1 and 2, and will be routed west via a 42" R.C.P. at 3% west towards Design Point 5.

Design Point 5 consists of runoff from Basin F (Q_5 = 3.5 cfs and Q_{100} = 7.4 cfs). This runoff collects at a sump location (with overflow provision) in a cul-de-sac along the site's west boundary line. A 4' D-10-R sump inlet will intercept these flows and route them via an 18" R.C.P. at 2% into the temporary detention facility (see Drainage Plan).

Design Point 6 consists of runoff from Basin G (Q_5 = 15.8 cfs and Q_{100} = 33.3 cfs) and Basin K (Q_5 = 0.7 cfs and Q_{100} = 1.8 cfs) and Basin J (Q_5 = 0.6 cfs and Q_{100} = 1.4 cfs). Basins K and J consist of open space, which will be routed through lot line swales in Basin G and be routed through the subdivision streets to Design Point 6. This runoff will collect at a 10' D-10-R sump inlet (with overflow provision) located at the low point in the cul-de-sac. A 24" R.C.P. storm lateral at 2% will convey this flow into the temporary detention facility.

The temporary detention facility has a combined developed flow of Q_5 = 87 cfs and Q_{100} = 192 cfs. The historic flow from these basins is Q_5 = 43 cfs and Q_{100} = 106 cfs. Therefore, a 3.6 ac-ft. detention facility will be required at this point to detain flows to historic levels (both 5-year and 100-year release rates). Basin I (Q_5 = 10.3 cfs and Q_{100} = 21.1 cfs) was included in the detained flow calculation, therefore the detention facility will be oversized to allow this developed runoff to discharge directly into the road side ditch along Northgate Road.

Basin H (Q_5 = 2.7 cfs and Q_{100} = 6.4 cfs) consists of residential lots (rear yards) and a portion of the entrance road, which will release flows into the road side ditch along Northgate Road. At this time traffic volume does not warrant expanding Northgate Road to four lanes. The developer is proposing

acceleration and deceleration lanes without curb and gutter.

The second temporary pond (Pond 2) may not be required since the regional facility is required with the second filing. When the regional facility is approved, this facility will become a sediment control structure. Pond 2 begins with an off-site Basin OS-2 (Q_5 = 39.9 cfs and Q_{100} = 97.7 cfs) and collects at Design Point 7 along the east boundary of the site (see on-site and off-site drainage maps for historic channel section). This off-site runoff will be routed via a trapezoidal grass lined swale into the cul-de-sac along the east boundary line. At this location there are two (2) options, the first would be to install a storm sewer system to intercept the entire off-site flows, or a portion of the flows with the street conveying the major storm event. The second would be to install a chase section and split these flows into both curb lines of the cul-de-sac to ensure street capacity is not exceeded (34 cfs per side in the initial storm). At this time the developer is proposing to construct the first alternative, the final configuration and system design will be detailed in the Final Drainage Report.

Design Point 8 consists of runoff from the previously mentioned off-site Basin OS-2 and OS-3 in combination with on-site Basins M (Q_5 = 32.1 cfs and Q_{100} = 66.6 cfs), N (Q_5 = 3.4 cfs and Q_{100} = 8.0 cfs), O (Q_5 = 0.9 cfs and Q_{100} = 2.1 cfs), P (Q_5 = 1.7 cfs and Q_{100} = 4.1 cfs), Q (Q_5 = 6.0 cfs and Q_{100} = 12.4 cfs), R (Q_5 = 26.4 cfs and Q_{100} = 55.9 cfs), S (Q_5 = 2.1 cfs and Q_{100} = 5.0 cfs), and T (Q_5 = 5.5 cfs and Q_{100} = 11.5 cfs). The combined runoff from these basins is Q_5 = 101.4 cfs and Q_{100} = 221.5 cfs. This flow exceeds street capacity. An inlet system will need to intercept a portion of these flows (see Drainage Plan for approximate location and sizes). Once again the final configuration of the system will be detailed in the final drainage report to ensure conformance with the regional system.

Basin U (Q_5 = 0.7 cfs and Q_{100} = 1.7 cfs) consists of open space, which will remain unaltered from historic levels or drainage patterns. Basin V (Q_5 = 5.9 cfs and Q_{100} = 12.2 cfs) consists of rear yards, which will drain off-site and sheet flow into Smith Creek at historic levels.

HYDROLOGIC/HYDRAULIC CRITERIA

This report has been prepared in accordance with the 1991 City/County Drainage Criteria Manual. The Rational Method was used to estimate storm water runoff anticipated from design storms with a 5-year and 100-year recurrence interval. (Current Criteria dated October 12, 1994). The inlets for this site were sized based on a 5-year ponding depth not exceeding the crown of the street (6" max depth at flowline) and a 100-year ponding depth not to exceed the right-of-way assuming a 2% grade from top back of curb to the right-of-way (12" max depth at flowline). Street capacity is based on 5-year flows not exceeding the crown (6" max depth at flowline), 20 cfs max flow (34 cfs max flow collector streets) and the 100-year flows not exceeding a 12" depth at flowline with no adjacent flooding. (Current criteria dated October 12, 1994).

FLOODPLAIN STATEMENT

No portion of this site is located within the floodplain as determined by the Flood Insurance Rate Map (F. I .R .M.) Community Panel Number 0841C0290F, dated March 17, 1997.

SUMMARY

Construction of this subdivision will not adversely affect the surrounding developments. All drainage facilities were sized using the 1991 City of Colorado Springs Drainage Criteria and will safely discharge storm water runoff to adequate outfalls.

PREPARED BY:

JR Engineering

Aaron B. Egbert, E.I.
Project Engineer

/cw/904800/mddp-feb99.doc

REFERENCES

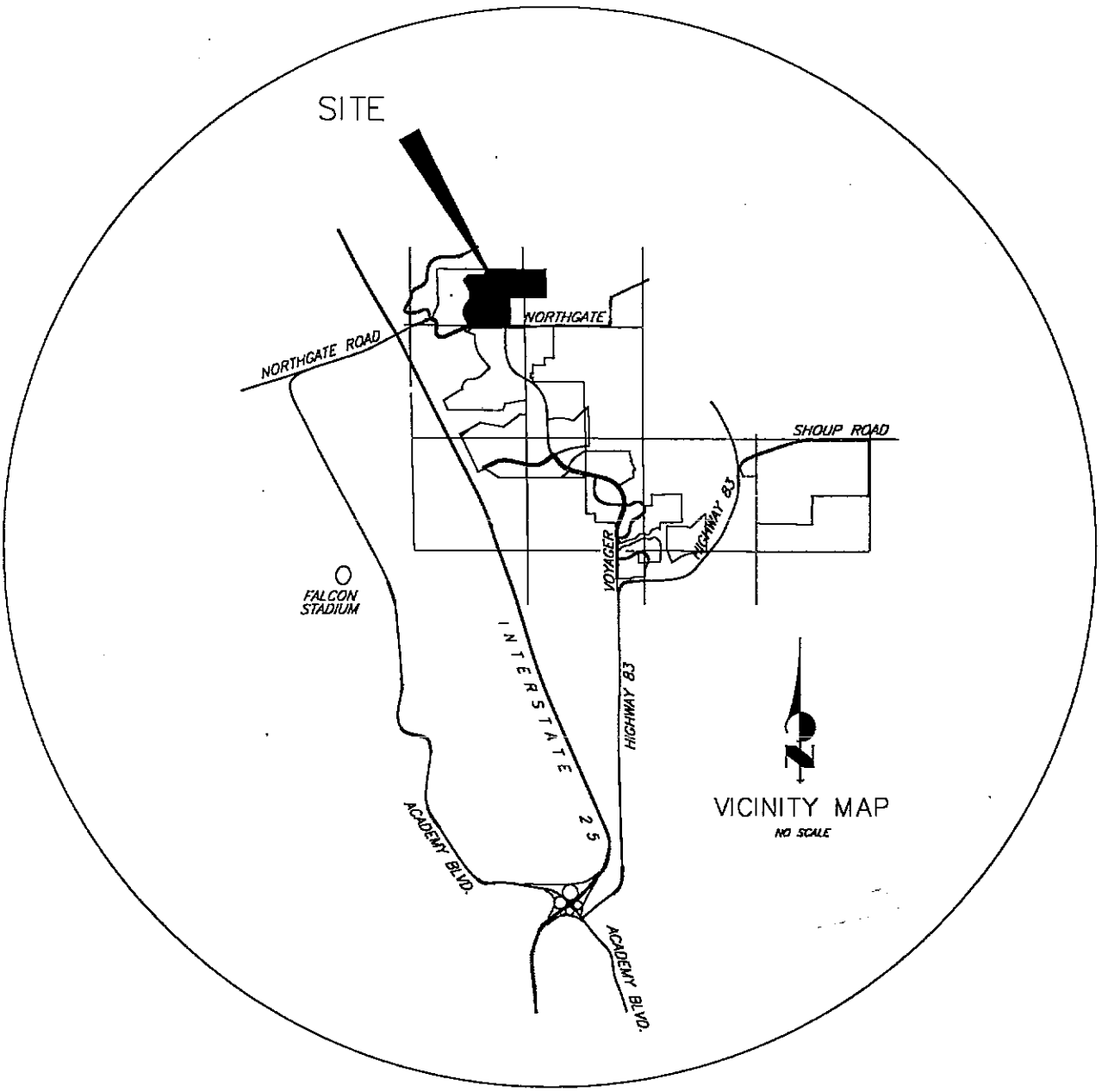
1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated October, 1991.

2. "Smith Creek Drainage Basin Planning Study," Muller Engineering Company, Inc., dated March 1996.

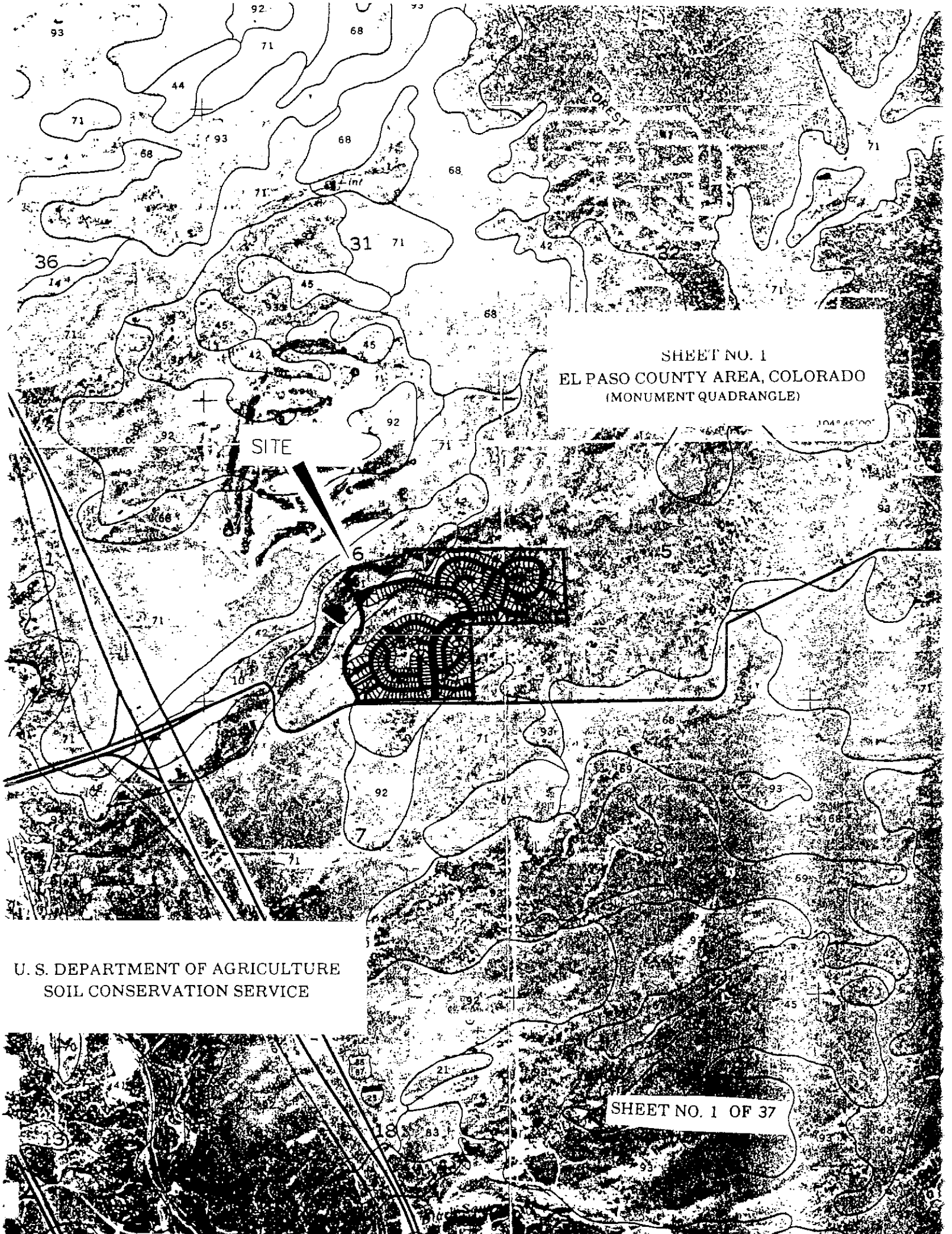
3. "Northgate M.D.D.P. Monument Branch and Middle Tributary Basins," by URS Consultants, dated December 1987.

APPENDIX

VICINITY MAP


SITE
NORTHGATE
NORTHGATE ROAD
SHOUP ROAD
HIGHWAY 83
VOYAGER
FALCON STADIUM
INTERSTATE 25
HIGHWAY 83
ACADEMY BLVD.
ACADEMY BLVD.
N
VICINITY MAP
NO SCALE

S. C. S. SOIL MAP

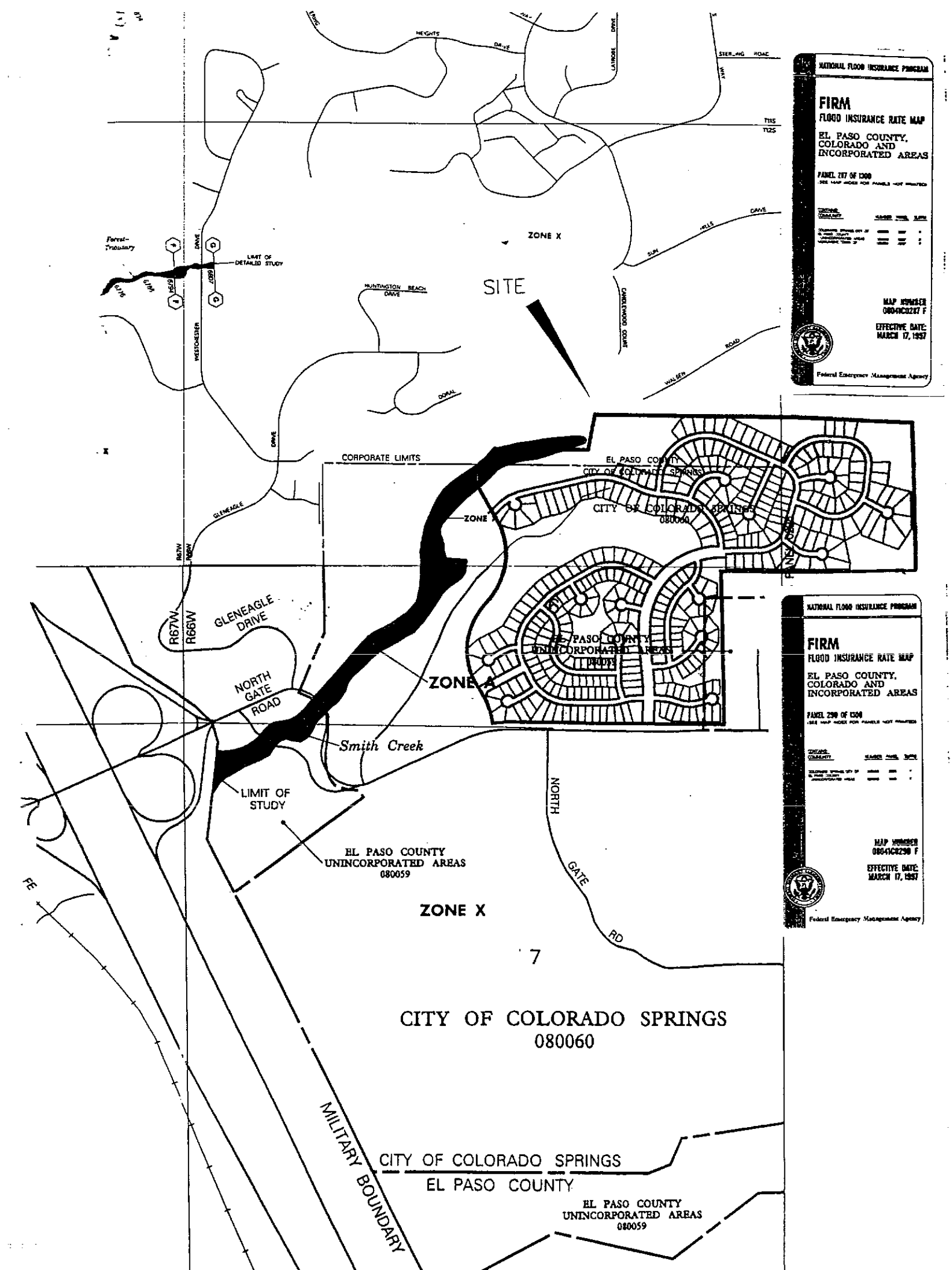


SHEET NO. 1
EL PASO COUNTY AREA, COLORADO
(MONUMENT QUADRANGLE)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 1 OF 37

F. E. M. A. FLOODPLAIN MAP


NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 287 OF 1300
MAP NUMBER
080041C0287 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency
ZONE X
SITE
CORPORATE LIMITS
EL PASO COUNTY
CITY OF COLORADO SPRINGS
CITY OF COLORADO SPRINGS
080060
ZONE A
EL PASO COUNTY
UNINCORPORATED AREAS
080059
GLENEAGLE DRIVE
R67W
R66W
NORTH GATE ROAD
Smith Creek
LIMIT OF STUDY
LIMIT OF DETAILED STUDY
NORTH GATE RD
MILITARY BOUNDARY
CITY OF COLORADO SPRINGS
EL PASO COUNTY
EL PASO COUNTY
UNINCORPORATED AREAS
080059
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 290 OF 1300
MAP NUMBER
080041C0290 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency

7

HYDROLOGIC CALCULATIONS

BASIN A

150' OVERLAND @ 4%

2200' STREET FLOW @ 4% ⇒ 7 fps

$$T_c = 1.87(1.1-.25)(150)^{1/2}(4)^{-.33} + \frac{2200}{60(7)}$$

$$T_c = 12.32 + 5.2$$

$$T_c = 17.6 \text{ MIN}$$

$$I_5 = 3.1 \text{ IN/HR}$$

$$I_{100} = 5.4 \text{ IN/HR}$$

BASIN B

50' OVERLAND @ 2%

450' STREET @ 4% ⇒ 7 fps

$$T_c = 1.87(1.1-.25)(50)^{1/2}(2)^{-.33} + \frac{450}{60(7)}$$

$$T_c = 8.9 + 1.1$$

$$T_c = 10.0 \text{ MIN}$$

$$I_5 = 4.1 \text{ IN/HR}$$

$$I_{100} = 7.0 \text{ IN/HR}$$

BASIN C

200' OVERLAND @ 8 %

400' SWALE @ 4 fps

900' STREET @ 1 % ⇒ 3.5 fps

$T_c = 1.87(1.1-.25)(200)^{1/2}(8)^{-.33} + \frac{400}{60(4)} + \frac{900}{(60)(3.5)}$

$= 11.3 + 1.7 + 4.3$

$T_c = 7.3$ MIN

$I_5 = 3.2$ IN/HR

$I_{100} = 5.6$ IN/HR

BASIN D

115' OVERLAND @ 2%

1000' STREETS @ 3% ⇒ 6.1 fps

$T_c = 1.87(1.1-.25)(115)^{1/2}(2)^{-.33} + \frac{1000}{60(6.1)}$

$= 13.6 + 2.7$

$T_c = 16.3$ MIN

$I_5 = 3.3$ IN/HR

$I_{100} = 5.7$ IN/HR

BASIN E

100' OVERLAND @ 2%

$T_c = 1.87(1.1-.25)(100)^{1/2}(2)^{-.33} = 12.7$ MIN.

$I_5 = 3.7$ IN/HR

$I_{100} = 6.3$ IN/HR

BASIN F

100' OVERLAND @ 2%

300' STREET @ 3% ⇒ 6.1 fps

$T_c = 12.7 + \frac{300}{60(6.1)} = 13.5$ MIN

$I_5 = 3.5$ IN/HR

$I_{100} = 6.1$ IN/HR

BASIN G

120' OVERLAND @ 2%

1900' STREET @ 2.5% ⇒ 5.5 fps

$T_c = 1.87(1.1-.25)(120)^{1/2}(2)^{-.33} + \frac{1900}{60(5.5)} = 19.6$ MIN

$I_5 = 2.9$ IN/HR

$I_{100} = 5.1$ IN/HR

BASIN H

180' OVERLAND @ 7%

$T_L = 1.87(1.1-.25)(180)^{1/2}(7)^{-.33} = 11.2$ MIN.

$I_5 = 4.0$ IN/HR

$I_{100} = 6.8$ IN/HR

BASIN I

120' OVERLAND @ 5%

$T_L = 1.87(1.1-.25)(120)^{1/2}(5)^{-.33} = 10.2$ MIN

$I_5 = 4.1$ IN/HR

$I_{100} = 7.0$ IN/HR

BASIN J

200' OVERLAND @ 4%

$T_L = 1.87(1.1-.25)(200)^{1/2}(4)^{-.33} = 14.23$ MIN

$I_5 = 3.5$ IN/HR

$I_{100} = 6.1$ IN/HR

BASIN K

100' OVERLAND @ 8%

$T_L = 1.87(1.1-.25)(100)^{1/2}(8)^{-.33} = 8.0$ MIN

$I_5 = 4.5$ IN/HR

$I_{100} = 7.8$ IN/HR

BASIN L

300' OVERLAND @ 15%

$T_c = 1.87(1.1-.25)(300)^{1/2}(15)^{-.33} = 11.3$ MIN

$I_5 = 4.0$ IN/HR

$I_{100} = 6.8$ IN/HR

BASIN M

100' OVERLAND @ 2%

$T_c = 1.87(1.1-.25)(100)^{1/2}(2)^{-.33} = 12.7$ MIN

1200' STREETS @ 3.5% ⇒ 6.6 fps

$T_c = 12.7 + \frac{1200}{60(6.6)} = 15.7$ MIN

$I_5 = 3.3$ IN/HR

$I_{100} = 5.7$ IN/HR

BASIN N

270' OVERLAND @ 13%

$T_c = 1.87(1.1-.25)(270)^{1/2}(13)^{-.33} = 11.2$ MIN.

$I_5 = 4.0$ IN/HR

$I_{100} = 6.8$ IN/HR

BASIN O

200' OVERLAND @ 15%

$T_c = 1.87(1.1-.25)(200)^{1/2}(15)^{-.33} = 9.2$ MIN.

$I_5 = 4.3$ IN/HR

$I_{100} = 7.4$ IN/HR

BASIN P

220' OVERLAND @ 15%

$T_c = 1.87(1.1-.25)(220)^{1/2}(15)^{-.33} = 9.7$ MIN.

$I_5 = 4.1$ IN/HR

$I_{100} = 7.0$ IN/HR

BASIN Q

100' OVERLAND @ 2%

1400' STREET @ 4% $\Rightarrow$ 7.2 fps

$T_c = 1.87(1.1-.25)(100)^{1/2}(2)^{-.33} + \frac{1400}{60(7.2)}$

$T_c = 15.9$ MIN.

$I_5 = 3.3$ IN/HR

$I_{100} = 5.7$ IN/HR

BASIN R

100' OVERLAND @ 2%

1950' STREET @ 2.4% = 5.4 fps

$T_c = 12.7 + \frac{1950}{60(5.4)} = 18.7$ MIN.

$I_5 = 3.0$ IN/HR

$I_{100} = 5.3$ IN/HR

BASIN S

200' OVERLAND @ 14%

$T_c = 1.87(1.1-.25)(200)^{1/2}(14)^{-.33} = 9.4$ MIN

$I_5 = 4.2$ IN/HR

$I_{100} = 7.2$ IN/HR

BASIN T

100' OVERLAND @ 2%

1850' STREET @ 5% ⇒ 7.8 fps

$T_c = 12.7 + \frac{850}{60(7.8)} = 14.5$ MIN.

$I_5 = 3.4$ IN/HR

$I_{100} = 5.9$ IN/HR

BASIN U

150' OVERLAND @ 20 %

$T_c = 1.87(1.1-.25)(150)^{1/2}(20)^{-.33}$

$T_c = 7.2$ MIN

$I_5 = 4.8$ IN/HR

$I_{100} = 8.2$ IN/HR

BASIN V

100' OVERLAND @ 10 %

$T_c = 1.87(1.1-.25)(100)^{1/2}(10)^{-.33}$

$T_c = 7.4$ MIN

$I_5 = 4.8$ IN/HR

$I_{100} = 8.2$ IN/HR

OS-1, OS-2 AND OS-3

SEE OFFSITE DRAINAGE PLAN FOR BASIN PARAMETERS AND HYDROLOGIC CALCULATIONS

RATIONAL METHOD: Q = CIA

BASIN	AREA (acres)	L (ft)	H (ft)	S (%)	V (fps)	Tc (min)	I_5	I_{100}	SOIL GROUP	LAND USE	C_5	C_{100}	FLOW Q_5	FLOW Q_{100}
A	19.74	SEE	BASIN	PARAMETERS		17.6	3.1	5.4	B	RES	0.50	0.60	30.6	64.0
													9.87	11.84
B	1.36					10.0	4.1	7.0	B	RES	0.50	0.60	2.8	5.7
													0.68	0.82
C	19.36					17.3	3.2	5.6	B	RES	0.40	0.55	24.8	59.6
													7.74	10.65
D	5.15					16.3	3.3	5.7	B	RES	0.50	0.60	8.6	17.6
													2.58	3.09
E	2.69					12.7	3.7	6.3	B	RES	0.50	0.60	5.0	10.2
													1.35	1.61
F	2.02					13.5	3.5	6.1	B	RES	0.50	0.60	3.5	7.4
													1.01	1.21
G	10.87					19.6	2.9	5.1	B	RES	0.50	0.60	15.8	33.3
													5.44	6.52
H	1.70					11.2	4.0	6.8	B	RES	0.40	0.55	2.7	6.4
													0.68	0.94

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PROJECT: NORTHGATE HIGHLANDS

ENGINEER: ABE DATE: 12-22-98

JOB NO.: 9048.00 PAGE: 1

RATIONAL METHOD: Q = CIA

BASIN	AREA (acres)	L (ft)	H (ft)	S (%)	V (fps)	Tc (min)	I_5	I_{100}	SOIL GROUP	LAND USE	C_5	C_{100}	FLOW Q_5	FLOW Q_{100}
I	5.03	SEE	BASIN	PARAMETERS		10.2	4.1	7.0	B	RES	0.50	0.60	10.3	21.1
													2.52	3.02
J	0.66					14.2	3.5	6.1	B	OPEN SPACE	0.25	0.35	0.6	1.4
													0.17	0.23
K	0.65					8.0	4.5	7.8	B	OPEN SPACE	0.25	0.35	0.7	1.8
													0.16	0.23
L	7.06					11.3	4.0	6.8	B	OPEN SPACE	0.25	0.35	7.1	16.8
													1.77	2.47
M	19.47					15.7	3.3	5.7	B	RES	0.50	0.60	32.1	66.6
													9.74	11.68
N	3.37					11.2	4.0	6.8	B	OPEN SPACE	0.25	0.35	3.4	8.0
													0.84	1.18
O	0.82					9.2	4.3	7.4	B	OPEN SPACE	0.25	0.35	0.9	2.1
													0.21	0.29
P	1.67		↓			9.7	4.1	7.0	B	OPEN SPACE	0.25	0.35	1.7	4.1
													0.42	0.59

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PROJECT: NORTHGATE HIGHLAND

ENGINEER: ABE DATE: 12-22-98

JOB NO.: 9048.00 PAGE: 2

RATIONAL METHOD: Q = CIA

BASIN	AREA (acres)	L (ft)	H (ft)	S (%)	V (fps)	Tc (min)	I_5	I_{100}	SOIL GROUP	LAND USE	C_5	C_{100}	FLOW Q_5	FLOW Q_{100}
Q	3.61	SEE	BASIN	PARAMETERS		15.9	3.3	5.7	B	RES	0.50	0.60	6.0	12.4
													1.81	2.17
R	17.59					18.7	3.0	5.3	B	RES	0.50	0.60	26.4	55.9
													8.80	10.55
S	1.97					9.4	4.2	7.2	B	OPEN SPACE	0.25	0.35	2.1	5.0
													0.49	0.69
T	3.25					14.5	3.4	5.9	B	RES	0.50	0.60	5.5	11.5
													1.63	1.95
U	0.60					7.2	4.8	8.2	B	OPEN SPACE	0.25	0.35	0.7	1.7
													0.15	0.21
V	2.47		↓			7.4	4.8	8.2	B	RES	0.50	0.60	5.9	12.2
													1.24	1.48
HISTORIC	81.9		1000'	@ 6%		36	2.1	3.7	B	HIST.	0.25	0.35	43	106
POND 1			2000	@ 4										

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PROJECT: NORTHGATE HIGHLANDS

ENGINEER: ABE DATE: 12-22-98

JOB NO.: 9048.00 PAGE: 3

RATIONAL METHOD: Q = CIA

BASIN	AREA (acres)	L (ft)	H (ft)	S (%)	V (fps)	Tc (min)	I_5	I_{100}	SOIL GROUP	LAND USE	C_5	C_{100}	FLOW Q_5	FLOW Q_{100}
DP-1	A										9.87	11.84		
	OS-1									+	3.19	4.46		
						17.6	3.1	5.4			13.06	16.30	40.5	88.0
DP-2	B												2.8	5.7
DP-3	C	17.3	+ 500' STREET @			1%					7.74	10.65		
	D									+	2.58	3.09		
						19.7	2.9	5.1			10.32	13.74	29.9	70.1
DP-4	E												5.0	10.2
DP-5	F												3.5	7.4
DP-6	G										5.44	6.52		
	K&J										0.33	0.46		
						19.6	2.9	5.1			5.77	6.98	16.7	35.6

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PROJECT: NORTHGATE HIGHLANDS

ENGINEER: ABE DATE: 12-22-98

JOB NO.: 9048.00 PAGE: 1

RATIONAL METHOD: Q = CIA

BASIN	AREA (acres)	L (ft)	H (ft)	S (%)	V (fps)	Tc (min)	I_5	I_{100}	SOIL GROUP	LAND USE	C_5	C_{100}	FLOW Q_5	FLOW Q_{100}
DP-7	OS-2												39.9	97.7
DP-8	OS-2		17.1	+ 2700' @		3.5%					12.46	17.44		
	M										9.74	11.68		
	N										0.84	1.18		
	O										0.21	0.29		
	P										0.42	0.59		
	Q										1.81	2.17		
	R										8.80	10.55		
	S										0.49	0.69		
	T										1.63	1.95		
	OS-3										1.16	1.62		
						23.9	2.7	4.6			37.56	48.16	101.4	221.5

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PROJECT: NORTHGATE HIGHLANDS

ENGINEER: ABE DATE: 12-22-98

JOB NO.: 9048.00 PAGE: 2

RATIONAL METHOD: Q = CIA

BASIN	AREA (acres)	L (ft)	H (ft)	S (%)	V (fps)	Tc (min)	I_5	I_{100}	SOIL GROUP	LAND USE	C_5	C_{100}	FLOW Q_5	FLOW Q_{100}
POND 1	DP-1										13.06	16.30		
	DP-2										0.68	0.82		
	DP-3										10.32	13.74		
	DP-4										1.35	1.61		
	DP-5										1.01	1.21		
	DP-6										5.77	6.98		
	I										2.52	3.02		
						26	2.5	4.4			34.71	43.68	87	192
POND 2	DP-8												101.4	221.5

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JOB NO.: 9048.00 PAGE: 3

HYDRAULIC CALCULATIONS

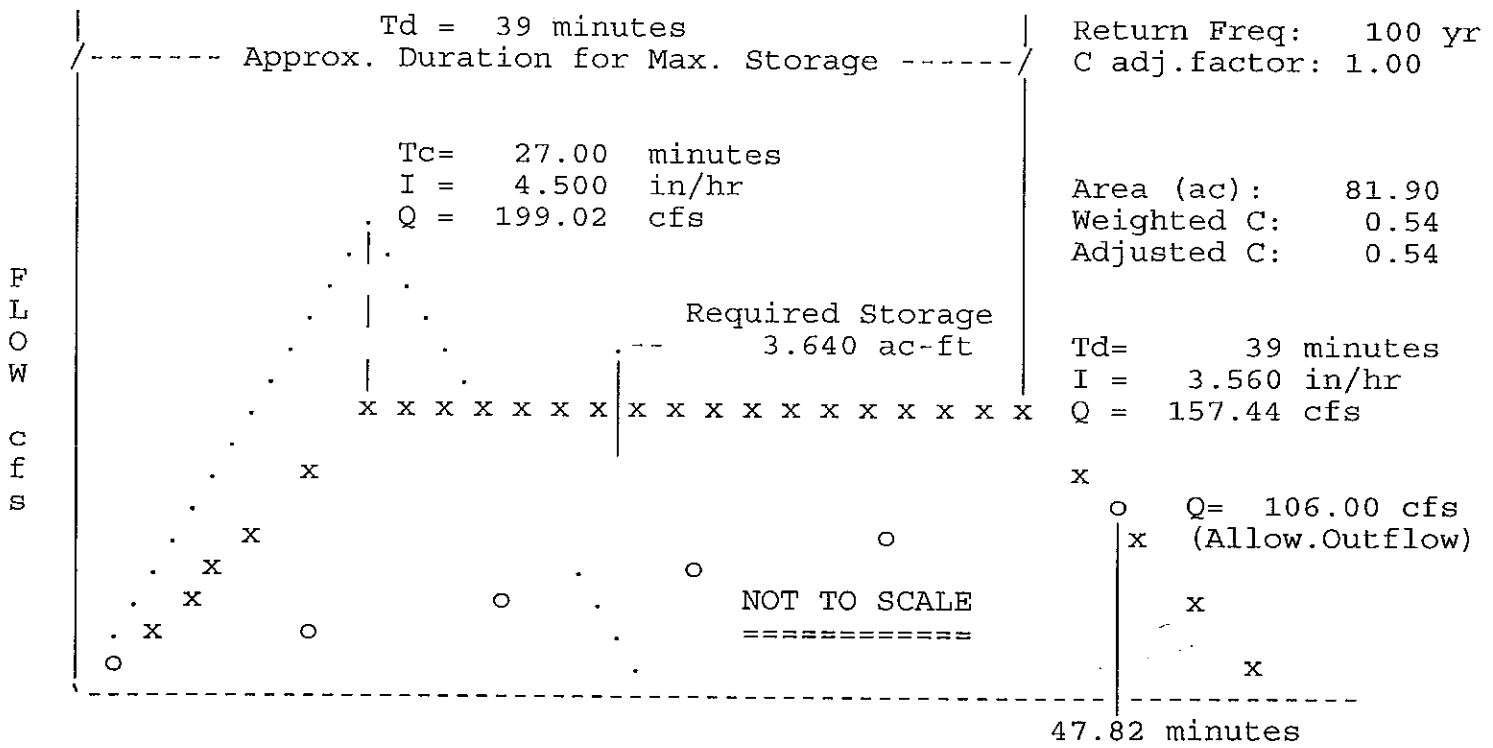
Quick TR-55 Ver.5.46 S/N:
Executed: 09:46:42 12-23-1998

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

Pond 1

RETURN FREQUENCY: 100 yr	Allowable Outflow: 106.00 cfs
'C' Adjustment: 1.000	Required Storage: 3.640 ac-ft
Peak Inflow: 157.44 cfs	Inflow .HYD stored: NONE STORED



Quick TR-55 Ver.5.46 S/N:
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Pond 1

**** Modified Rational Hydrograph *****

Weighted C = 0.540 Area= 81.900 acres Tc = 27.00 minutes

Adjusted C = 0.540 Td= 39.00 min. I= 3.56 in/hr Qp= 157.44 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: NONE STORED

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.000	0.00	5.83	11.66	17.49	23.33	29.16	34.99
0.117	40.82	46.65	52.48	58.31	64.14	69.98	75.81
0.233	81.64	87.47	93.30	99.13	104.96	110.79	116.63
0.350	122.46	128.29	134.12	139.95	145.78	151.61	157.44
0.467	157.44	157.44	157.44	157.44	157.44	157.44	157.44
0.583	157.44	157.44	157.44	157.44	157.44	151.61	145.78
0.700	139.95	134.12	128.29	122.46	116.63	110.79	104.96
0.817	99.13	93.30	87.47	81.64	75.81	69.98	64.14
0.933	58.31	52.48	46.65	40.82	34.99	29.16	23.33
1.050	17.49	11.66	5.83	0.00			

Quick TR-55 Ver.5.46 S/N:
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Pond 1

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
1	0.540	81.90						
			27.00	0.540	0.540	4.500	81.90	199.02

Quick TR-55 Ver.5.46 S/N:
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****
****
*
*
*
* MODIFIED RATIONAL METHOD
* ---- Grand Summary For All Storm Frequencies ----
*
*
*
****
****

First peak outflow point assumed to occur at inflow recession leg.

Pond 1

Area = 81.90 acres Tc = 27.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
100	0.540	39	3.560	157.44	106.00	8.458	3.640

Quick TR-55 Ver.5.46 S/N:
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MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

Pond 1

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.000 Allowable Q = 106.00 cfs

Hydrograph file: NONE STORED Tc = 27.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.540	0.540	27	4.500	81.90	199.02	7.401	3.459
0.540	0.540	30	4.200	81.90	185.75	7.676	3.514
0.540	0.540	39	3.560	81.90	157.44	8.458	3.640
0.540	0.540	40	3.500	81.90	154.79	8.528	3.637
0.540	0.540	50	3.000	81.90	132.68	9.138	3.516
0.540	0.540	60	2.700	81.90	119.41	9.869	3.517

********** Storage Maximum

CITY LETTER

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www.jreng.com

— Fax Copy to J.R. 3/8/99 JR
— ORIG. To Sub. Files

February 15, 1999

City of Colorado Springs
Subdivision Engineering Review Team
101 W. Costilla Street, Room 113
Colorado Springs, CO 80903

Approved: Robin Kidder

ATTN: Mr. Robin Kidder

RE: Northgate Highlands M.D.D.P.

Dear Robin:

This letter is intended to summarize the issues and proposed solutions discussed in the February 9th meeting attended by yourself, Dave Lethbridge, Steve Sharkey, Dean Myerson, Mike Bramlett, and myself. The following items were discussed:

- US Home and Picolan both agree that construction of the first filing within Northgate Highland will require the construction of a regional detention facility (due to noise issues, a temporary pond will be constructed). Therefore, to ensure that the drainage fees for Filing No. 1 will be used to construct this facility in the future, US Home has agreed to post a letter of credit for the entire cost of the facility (as the plats are recorded, the drainage fee will be subtracted from this letter of credit).
- The drainage fee for Filing No. 1 will be the fee detailed in the current D.B.P.S. adjusted to 1999 dollars.
- Picolan and the City of Colorado Springs will draft an agreement stating that any additional filings will require the D.B.P.S. to be adopted by the city.
- A private maintenance agreement for the temporary ponds will be included in the M.D.D.P.

If you have any comments or concerns, please do not hesitate to give me a call.

Sincerely,

JR Engineering

Aaron B. Egbert, E.I.
Project Engineer

cc: James Mayerl (via fax)
Perry Thomas (via fax)
Steve Sharkey (via fax)
Dean Myerson (via fax)

RECEIVED
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Drainage/Stormwater

6020 Greenwood Plaza Blvd.
Englewood, Colorado 80111
(303) 740-9393 • FAX (303) 721-9019

2620 East Prospect Rd. Suite 190
Fort Collins, Colorado 80525
(970) 491-9888 • FAX (970) 491-9984

704 Portino Blvd. West
Pueblo, Colorado 81008
(719) 583-2575 • FAX (719) 583-8119

MAR 08 '99 12:47 P01 986 CITY ENGINEER INSPEC 719-578-6161

ON-SITE DRAINAGE MAP

OFF-SITE DRAINAGE MAP