DRAINAGE REPORT

for

Anasazi Ridge Subdivision

Prepared for

Tiffany Homes SW
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Prepared by

Mark Goodwin & Associates, PA
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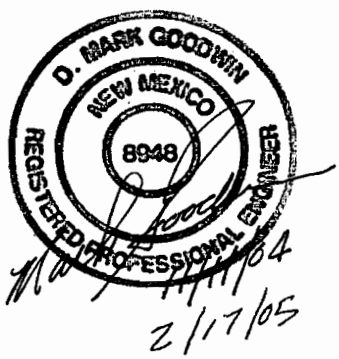
November 2004



11/11/04
2/17/05

I. PROJECT DESCRIPTION

This report has been prepared in support of a proposed 42.16 acre single family residential development to be located on Albuquerque's west side. Specifically, the site is bounded on the north and east by the Calabacillas Arroyo, on the south by the future McMahon Boulevard right-of-way, and on the west by the currently platted Universe Boulevard right-of-way which is currently encumbered by a utility and drainage easement. City officials have indicated that long range street plans call for Universe Boulevard swinging further to the west adjacent to this site upon development of the roadway ***(Plate 1 - Vicinity Map).***

II. DRAINAGE DESIGN CRITERIA AND RELATED STUDIES

The design criteria used in this report was in accordance with Section 22.2 Hydrology of the Development Process Manual, Volume 2, Design Criteria, January 1993 Edition. The 100-year, 6-hour storm event, was analyzed to determine street capacities using P(1hr) = 1.87", P(6hr) = 2.20", and P(24hr) = 2.66". The onsite Land Treatment values used for the developed state were Treatment B = 42 and Treatment D = 58. AHYMO printouts are provided within Appendix A.

III. EXISTING TOPOGRAPHY

North Side of McMahon Blvd.: Portions of this site are currently encumbered by 100-year and 500-year flood plains. This site currently falls from the southwest to the northeast at slopes ranging from 2% to over 25% along the banks of the natural arroyo. Storm flows from this site discharge, at various locations, into the Calabacillas Arroyo.

South Side of McMahon Blvd.: The existing topography on this approximate 6.2 acre site shows the site primarily falling from west to east, with a ridge line splitting the flows, allowing portions to discharge to the northeast, and portions to the southeast. An existing retaining wall along the western edge of the Seville, Unit 7 subdivision intercepts portions of the existing flows generated from this site. Once encountering the wall, flows are routed to the north to the future McMahon Blvd. right-of-way. None of this site is encumbered by a floodplain.

IV. OFFSITE RUNOFF

North Side of McMahon Blvd.: Plate 2 - Off-site Drainage Basin Map shows that the only off-site flows that would impact this site originate from the west. Off-site flows form basins OS-1 = 11.96 cfs and OS-2 =- 38.93 cfs, are currently intercepted by a graded bar-ditch constructed along the western edge of an existing gravel road that provides access to the PNM substation located near the northwest. In addition, flow from off-site basin OS-3 are intercepted and routed through a detention facility built in conjunction with the substation site.

With the existing diversions defined above, all storm runoff from the west of the proposed Anasazi Ridge site is routed to the north and enters the Calabacillas Arroyo upstream of this site. With that, there are no off-site storm waters impacting the Anasazi Ridge site.

South Side of McMahon Blvd.: Given that this site is naturally higher than the neighboring terrain, very little off-site flows impact this site. Minor flows sheet flow onto the site from the west, and immediately exit the site to the south.

V. DEVELOPED DRAINAGE CONDITIONS

North Side of McMahon Blvd. (Developed Units 1 & 2): *As depicted on the proposed Anasazi Ridge Grading & Drainage plan included in Plate 1, in the developed state storm waters will be routed via on-site streets to storm drain collection points located throughout the eastern lower half of the subdivision (please refer to street and storm drain calculations). A low point in both the storm drain system and the street system has been established at the intersection of Ancients Road NW & Kayenta Avenue NW. Any storm waters not previously intercepted by drop inlets will be collected at this location. Calculations show that a total of 148 cfs (100-year, 6-hour storm) will be collected in the on-site storm drain system. The collected developed storm flows will outfall into the adjacent Calabacillas Arroyo within the hard-lined channel section proposed with the McMahon Blvd. Crossing Structure (plans still being finalized by City's design engineer).*

South Side of McMahon Blvd. (Developed Unit 3): *The enclosed Unit 3 Grading & Drainage plan shows developed flows surface discharging to two separate exit points. The estimated 9.05 cfs of developed flows generated from developed sub-basin DB-1 is intercepted by Calle Vizcaya NW, and routed to the east. Existing Type 'A' drop inlets within the Seville, Unit 7 subdivision were designed to accept these off-site flows from further west in Calle Vizcaya. Included street capacity calculations show that there is sufficient capacity in the existing section of Calle Vizcaya to convey these additional flows to the drop inlets.*

Flows from developed sub-basin DB-2 (Q = 9.82 cfs) are shown surface discharging to Sipapu Drive. The flows will be carried south in the street to a proposed 10' concrete rundown, which will deliver the flows to the McMahon Boulevard right-of-way via an opening in the proposed new curb. Once in McMahon, the flows will be routed to the east to the new crossing structure, proposed by the City of Albuquerque, over the Calibicillas Arroyo. Included within the project infrastructure list will be a section of temporary asphalt, with temporary asphalt curb, along the north side of McMahon Blvd., between this site, and the proposed permanent section further to the east.

VI. PROJECT PHASING

Upon receiving approval of the Grading & Drainage submittal, and upon approval of the arroyo narrowing studies, plans call for the grading of the entire Anasazi Ridge site. Infrastructure improvements will be constructed in two separate phases. Unit 1, totaling 91 lots, includes the southwestern portion of the site. All of Unit 1 is outside the flood plain encumbered areas. The 24 lots comprising Unit 3, south of McMahon Blvd., will likely also be fully developed within the first phase, given that it too is outside the floodplain encumbered area. Further development within the area defined as Unit 2 will not occur until a CLOMR is approved by FEMA.

As seen on the Grading & Drainage Plan, there are no storm drain improvements required within the Unit 1 designated area. Interim, adequately sized, detention basins will be constructed at the bottom of all streets to collect developed storm flows from Unit 1. Rip-rap lined emergency spillways are proposed within each temporary basin. Any storm flows discharging from the ponds will be routed within the downstream graded streets to the aforementioned low point. With the eventual development of Unit 2, the remaining infrastructure will be completed, which includes the necessary storm drain improvements identified on the Grading & Drainage Plan.

VII. CONCLUSION

With the significant analysis being done, and with the sequencing of construction as presented, the development of the Anasazi Ridge Subdivision will have no adverse impacts upstream or downstream of the site.

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PROJECT Anasazi Ridge
SUBJECT Developed Basins
BY JSD DATE 11-11-04
CHECKED _____ DATE _____
SHEET ____ OF ____

STORM FLOWS FROM DEVELOPED SUB-BASINS

FROM EARLIER CALCS:
'D'/LOT = 3200 SF = 0.0735 AC
ROADS = 20% 'B' & 80% 'D'

DB-1:
AREA = 10.00 AC. #LOTS = 63 ROW = 1.43 AC.
TREATMENT TOTALS:
D: (63 LOTS x 0.0735 AC) + (0.80 x 1.43 AC ROADS) = 5.77 AC = 57.8%
B: 10.00 - 5.77 = 4.23 AC = 42.3%
FROM AHYMO, Q = 34.96 cfs

DB-2:
AREA = 9.11 AC #LOTS = 59 ROW = 2.00 AC
TREATMENT TOTALS:
D: (59 x 0.0735 AC) + (0.80 x 2.00 AC) = 5.94 AC = 65%
B: 9.11 - 5.94 = 3.17 AC = 35%
FROM AHYMO, Q = 32.25 cfs

DB-3:
AREA = 8.36 AC #LOTS = 43 ROW = 1.80 AC.
TREATMENT TOTALS:
D: (43 x 0.0735 AC) + (0.80 x 1.80 AC) = 4.60 AC = 55%
B: 8.36 - 4.60 = 3.76 AC = 45%
FROM AHYMO, Q = 27.78 cfs

DB-4:
AREA = 8.00 AC #LOTS = 46 ROW = 1.83 AC
TREATMENT TOTALS:
D: (46 x 0.0735 AC) + (0.80 x 1.83 AC) = 4.85 AC = 61%
B: 8.00 - 4.85 = 3.15 AC = 39%
FROM AHYMO, Q = 27.64 cfs

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PROJECT _____
SUBJECT _____
BY _____ DATE _____
CHECKED _____ DATE _____
SHEET ____ OF ____

OB-5:
AREA = 5.75 AC #LOTS = 31 ROW = 1.89 AC
TREATMENT TOTALS:
D: (31 X .0735 AC) + (.80 X 1.89 AC) = 3.79 AC = 66%
B: 5.75 - 3.79 = 1.96 AC = 34%
FROM AHYMO, Q = 20.58 cfs

OB-6:
AREA = 1.40 AC #LOTS = 0 ROW = 1.40 AC
TREATMENT TOTALS:
D: (0 X .0735 AC) + (.80 X 1.40 AC) = 1.12 AC = 80%
B: 20%
FROM AHYMO, Q = 5.51 cfs

∴ Total developed Q = 148.08 cfs

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PROJECT Anasazi Ridge
SUBJECT Street Calcs.
BY JSD DATE 11-11-04
CHECKED ____ DATE ____
SHEET 1 OF 4

BASKETWEAVER AVE

1. West of Atlatl Dr.

Q in st. = 291 lots x .55 cfs/lot = 15.95 cfs
28' F-F, S = 2.07%

Roll Curb

Try d = 0.28', A = 4.48 SF R = .157, n = .017
$V = 1.49 (.157)^{.67} (.02)^{.5} / .017 = 3.59$ fps
Q = VA = (3.59)(4.48) = 16.06 cfs
$d + V^2/2g = .28 + (3.59)^2/64.4 = .48'$
.48' < .53' OK

∴ Roll curb on Basketweaver west of Atlatl.

2. East of Tacol St.

Q in st. = 63 lots x .55 cfs/lot = 34.65 cfs
28' F-F, S = 2.54%

8" V.C.

+ Try d = .50', A = 10.08, R = .348, n = .017
V = 6.89 fps $d + V^2/2g$ = 1.24 7.85 NO
Q = 69.42

+ Try d = .44, A = 8.45 F, R = .291
V = 6.11 fps, Q = 51.31 fps, $d + V^2/2g$ = 1.02 7.85 No

+ Try d = .38, A = 6.725 F, R = .234
V = 5.28, Q = 35.47, $d + V^2/2g$ = .81 < .85 OK

∴ w/ design Q = 34.65, vert. curb from Atlatl east to end will work.

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PROJECT Anasazi Ridge
SUBJECT Street Hydraulics
BY JSD DATE 11-11-04
CHECKED ____ DATE ____
SHEET 2 OF 4

DESERT SPIRIT ROAD

1. West of Atlatl Dr.

Q in St. = 32 lots × .55 cfs/lot = 17.5 cfs
32' F-F, S = 3.01%

Roll Curb

- Try d = .33', A = 5.445f, R = .167, n = .017
  V = 4.58 fps Q = 24.9 cfs $d + V^2/2g$ = .66 ≥ .53 NO

- Try d = .28', A = 3.925f, R = .137, n = .017
  V = 4.01fps Q = 15.74cfs, $d + V^2/2g$ = .53 ≥ .53 yes

∴ Roll Curb to Atlatl & Vert remainder east.

2. Check east end of Desert Spirit

Q in St = 59 lots × .55cfs/lot = 32.45 cfs
32' F-F, S = 1.25%

Vertical Curb

d = .45', A = 9.285f, R = .282
V = 4.20 fps, Q = 38.94 cfs $d + V^2/2g$ = .72 < .85 OK

∴ Vert. Curb works to drop inlets at Anasazi Ridge returns.

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PROJECT Anasazi Ridge
SUBJECT Street Calcs.
BY JSD DATE 11-11-04
CHECKED ____ DATE ____
SHEET 3 OF 4

ANCIENTS ROAD

1. West of Atlatl Dr.

Q in St = 16 cfs, 32'F-F, S = 3.12%, n = .017

Roll Curb

Try d = .28', A = 3.925f, R = .137.
V = 4.09 fps, Q = 16 cfs, $d + V^2/2g$ = .53 ≤ .53 OK

∴ Roll curb west of Atlatl works.

2. East of Cliff Dwellers Road Intersection. Four inlets upstream will intercept 40 cfs, leaving only 15.42 cfs in St.

Q = 15.42 cfs, 32'F-F, S = 0.60%, n = .017

Vert. Curb

Try d = .40', A = 7.685f, R = .234
V = 2.57 fps, Q = 19.70 cfs, $d + V^2/2g$ = .50 < .85 OK

∴ Vert. curb. from Atlatl east to Anasazi

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PROJECT Anasazi Ridge
SUBJECT Street Calcs
BY JSD DATE 11-11-04
CHECKED _____ DATE _____
SHEET 4 OF 4

CLIFF DWELLERS ROAD

1. Look at lower portion, east of Cliff House Dr.
   $Q = 27.64$ cfs (worst case), 28' F-F, $S = 0.72\%$

   - Vert. Curb
     Try $d = .50'$, $A = 10.08$ SF, $R = .348$, $n = .017$
     $V = 3.67$ fps, $Q = 37$ cfs, $d + V^2/2g = .71 < .85$ OK

   ∴ Vertical curb from Cliff House east to drop inlets at Anaients Rd. intersection will work.

ANASAZI RIDGE AVE

1. Since road borders arroyo, and is main entrance into subdivision, Vert. curb will be used throughout.

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PROJECT Anasazi Ridge
SUBJECT Drainage Calcs
BY JSO DATE
CHECKED DATE
SHEET OF

Verify that there is sufficient capacity in Calle Vizcoya (Seville, Unit 7) to carry additional storm flow from Anasazi, Unit 3

Section: 28' F-F, vertical curb
S = 0.61% (worst case),

1) Try flow depth = .50'

$A = (.22' \cdot .28') + 2(\frac{1}{2}(.28) \cdot .14) = 10.085F$

$R_h = A/WP = 10.08/(28+1) = 0.35$

$V = 1.49(R)^{2/3}(S)^{1/2}/n = 1.49(.35)^{.67}(.0061)^{.5}/.017 = 3.39 fps$

$Q = VA = 3.39(10.08) = 34.17 cfs$

* Seville, Unit 7 design show 14 cfs in Calle Vizcoya (included offsite flows from west).

∴ Conservative $Q = 14 + 9 = 23 cfs$

$23 cfs < 34.17 cfs \rightarrow OK$

$d + V^2/2g = .50 + (3.39)^2/64.4 = .68' \rightarrow OK$

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PROJECT Anasazi Ridge
SUBJECT Drop Inlet Capacity
BY JSD DATE 11-11-04
CHECKED ____ DATE ____
SHEET 1 OF 1

Determine inlet requirement at east end of Basket Weaver Ave.

- Inlet(s) will be located in a sump at end of cul de sac.
- Q total to inlet(s) = 35 cfs

$Q = CA(2gh)^{1/2}$
where $C = .67$, $h = .67'$

Double Albuquerque Grate Cross Area = 13.88 sf
minus bearing and cross bar areas − 5.02 sf
8.86 sf

w/ 1/2 clog factor, A = 4.43 sf
use curb opening area = .5' x 5' = 2.5 sf

∴ Q grate = $.67(4.43)(64.4 \cdot .67)^{1/2}$ = 19.50 cfs
Q curb opening = $.67(2.5)(64.4 \cdot .67)^{1/2}$ = 11.00 cfs
30.50 cfs

30.50 cfs < 35 cfs
no good

Plans will call for a triple 'C' inlet to ensure adequate capacity.

Sizing of storm drain pipes was performed using Manning's Eqtn - Flowing Full.

Anasasi Ridge McMahon

(s16.66H
AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02d RUN DATE (MON/DAY/YR) =04/15/2006
INPUT FILE = C:\DOCUME~1\Doug\Desktop\MCMAHON.txt USER NO.= AHYMO-I-9702dGoodwinM-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 NOTATION
START										TIME= .00
RAINFALL TYPE= 2				10 YR						RAIN24= 1.770
COMPUTE NM HYD	1A	-	1	.01440	2.23	.063	.08231	1.550	.242	PER IMP= .00
COMPUTE NM HYD	1B	-	1	.00340	.53	.015	.08231	1.550	.243	PER IMP= .00
COMPUTE NM HYD	1C	-	1	.01590	21.66	.890	1.04941	1.500	2.129	PER IMP= 60.00
RAINFALL TYPE= 2				100 YR						RAIN24= 2.660
COMPUTE NM HYD	1A	-	1	.01440	11.88	.337	.43936	1.500	1.289	PER IMP= .00
COMPUTE NM HYD	1B	-	1	.00340	2.81	.080	.43936	1.500	1.291	PER IMP= .00
COMPUTE NM HYD	1C	-	1	.01590	36.19	1.512	1.78251	1.500	3.556	PER IMP= 60.00
FINISH										

(s10H

Flow in the North ½ of McMahon is basins 1A plus 1B plus ½ of 1C — 10yr 13.59 cfs — 100yr 32.78
Flow in the South ½ of McMahon is just half of basin 1C — 10.83 — 18.10
50.88 Total

The west approach to the brige has a slope of 1.22%
So the flow depth in the north ½ of Mcmahon is — 0.48' — 0.65'
and " " " " " south ½ " " " — 0.45' — 0.54'

The allowable 10YR Spread/Depth is: 2' gutterpan 0.13' Deep
6' bike lane @2% 0.12'
12' lane @ 2% 0.24'
20' at 0.49' depth
leaving one 12' lane open in each direction.

After crossing the bridge the slope is 2.51%
So the flow depth in the north Half of McMahon is: — 0.45 — 0.61'
and the " " " " south Half " " " — 0.47 — 0.53
at the higher flows at the low point.

(over)

Flows approaching low spot from West

The Mc Mahon Basin is increased by about 950' LF from the west side of the bridge to the low spot which is 3.4 acres or 33% increase in both area and flow.

10YR increase = 3.57cfs in each half
100YR increase = ~~11.94cfs~~ in each half = 5.97

Flows approaching low spot from east.

The Mc Mahon Basin is increased by 1500 LF from low point East to high point which is 5.37 ac or 53% increase in flow.

10 yr. increase = 11.48 cfs
100 yr. increase = 19.18 cfs for a total flow at the sump of 10yr =
100yr = 82.00 cfs

10 YR capacity on the west approach to the low point is exceeded at beginning of the vertical curve where the slope decreases Sta 1058+60 ±

10 YR capacity on the east approach to the low point is exceeded where the slope decreased to about 0.22% or 24' east of the low spot where the elevation is only 0.03' higher than the low spot.

The single grate inlets on grade to the west will each intercept about 9 or 10 cfs 100 YR, leaving about 62 cfs at the sump. Use 2 double grate inlets on each side to provide about double the required 100yr capacity.

OS-3
TO PNM SITE
20 Ac.

PNM

Q=25.98 cfs

2' DEEP, 40' WIDE
BAR-DITCH W/IN 40'
DRAINAGE EASEMENT

40' DRAINAGE
EASEMENT

Q=38.93 cfs

OS-2
30 Ac.

50' REA UTILITY
EASEMENT

ANASAZI
RIDGE

11.96 cfs

OS-1A
9.22 Ac.

OS-1B
2.2ac

Mc MAHON BLVD

OS-1C 10.2ac Mc Mahon Blvd.

2' DEEP, 40' WIDE
BAR-DITCH W/IN 40'
DRAINAGE EASEMENT

UNIVERSE

N

300' 150' 0 300' 600'

SCALE: 1" = 300'

A4063Anasazi Ridge\EXHIBITS\Offsite-Basin (11/10/04) SPS NHE DER

PLATE 2

ANASAZI RIDGE SUBDIVISION

OFFSITE DRAINAGE BASINS

dmg MARK GOODWIN & ASSOCIATES, P.A.
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Designed: JSD	Drawn: SPS	Checked: DMG	Sheet 1 of 1
Scale: 1" = 300'	Date: 11-10-04	Job: A04063	

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PROJECT Anasazi, Unit 3
SUBJECT Drainage
BY AHD DATE 2-16-05
CHECKED ____ DATE ____
SHEET ____ OF ____

Area of Subdivision = 6.17 AC.

1. Find Q per lot:

Pads = 40'x70' = 2800 sf
Drives = 20x20 = 400 sf
3200 sf

∴ 25 • 3200 = 80,000 sf = 1.84 ac of 'D'

2. Find Q in ROW:

Use 20% B & 80% D
ROW area = 1.13 ac

∴ 'B' = .23 ac , 'D' = .90 ac

3. Total Treatment Types

'D' = 1.84 ac + 0.90 ac = 2.74 ac.
'B' = 6.17 ac - 2.74 ac = 3.43 ac.

4. Rainfall

P_1 = 1.87 in , P_{10} = 2.2 in

5. From AHYMO Output:

DB 1 (2.96 ac), Q = 9.05 CFS
DB2 (3.21 ac.), Q = 9.82 CFS
Site, Existing Q = 8.01 cfs