DRAINAGE REPORT

FOR

SUNSET WEST UNIT 2
ALBUQUERQUE, NEW MEXICO

Prepared for

Tom Neilson
Albuquerque, New Mexico

April 1994

LH 94005.11

LEEDSHILL-HERKENHOFF, INC.
Copper Square, 500 Copper Avenue, NW
P.O. Box 1217 - Phone (505) 247-0294
Albuquerque, New Mexico 87103

ENGINEERS ARCHITECTS

4-18-94

I, Susan M. Alvarez, Registered Professional Engineer No. 11511, hereby certify that these documents were prepared by me, or under my direct supervision, and are true and correct to the best of my knowledge and belief.

Registered Professional Engineer
No. 11521

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I. INTRODUCTION

A. GENERAL

The Sunset West Subdivision is located on Albuquerque's westside near the intersection of Sage Road and Unser Boulevard. This subdivision was originally designed by Gordon Herkenhoff and Associates in the early 1980's. Unit 1 was approved and constructed in or around 1980. Unit 2 was designed and the construction plans were approved by the City in 1981, however, this section of the subdivision was never constructed. Recently, Mr. Tom Neilson contracted Leedshill-Herkenhoff, Inc. (LH) to proceed with a redesign in order to update the project to current City of Albuquerque - Development Process Manual (DPM) standards.

An initial meeting was held with Mr. Fred Aguirre (City of Albuquerque - Hydrology) and Lee Lunsford (City of Albuquerque - Special Assessment Districts (SAD)) in order to assess the City's requirements for project drainage improvements. At that meeting, LH was directed to regrade the lots to remove proposed rear lot retention facilities, and to analyze the project drainage for existing and proposed site development conditions. A hydraulic analysis of Sage and 90th Streets to assess the need for underground storm drainage was also requested. Because of ongoing planning and design for storm improvements for the adjacent SAD #222, City decisions regarding requirements for storm sewerage and on-site detention were deferred until receipt and review of this report.

This report presents the results of the Drainage Analysis completed for the project using Section 22.2 of the DPM. This analysis basically includes development of peak runoff rates occurring from the 10-year and 100-year frequency rainfall events, and analysis of the resulting hydraulic characteristics under site conditions with and without the construction of the Sunset West Unit 2 project. We have included a description of the methodologies and assumptions used for this analysis, as well as the results and conclusions reached through this study.

B. PROJECT DESCRIPTION

As shown on Figure 1, Unit 2 of the Sunset West Subdivision is located between San Ygnacio Road to the north, Sage Road to the south, and 90th Street to the east; Unit 1 is located directly west of Unit 2. The project is located adjacent to the Special Assessment District #222 and is affected by construction of SAD storm and water utility construction. The project is included on City of Albuquerque Zone Atlas Maps L-9 and M-9. The original plat for this project was filed on October 31, 1980. This plat incorporates 76 single family residential lots on approximately 16.3 acres of land.

L · 9 · Z

M · 9 · Z

SUNSET WEST UNIT 2

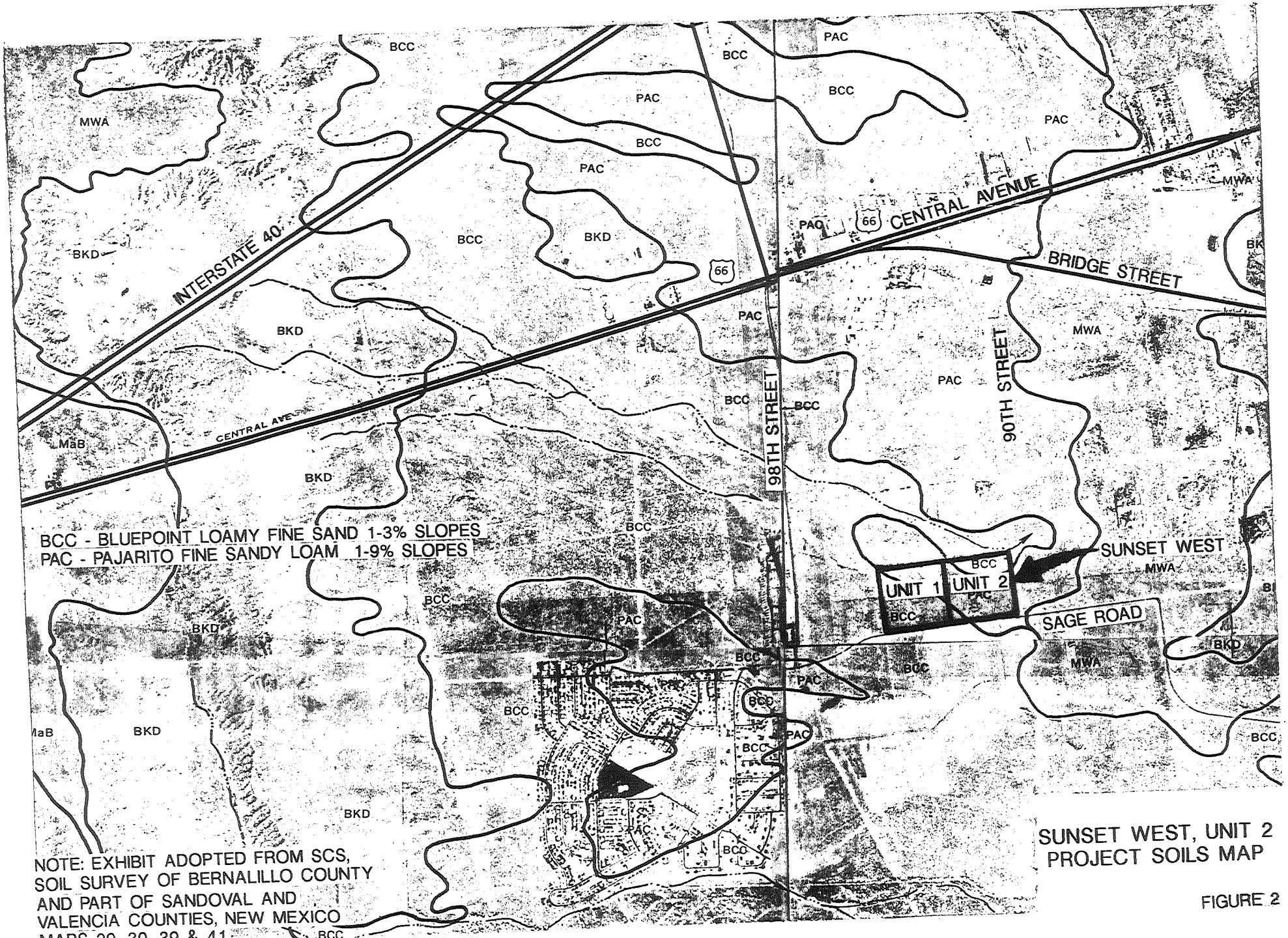
PROJECT LOCATION MAP

The entire area gently slopes from northwest to southeast at an approximate 1.5 per cent slope. The soils are generally very permeable, fine loamy sands as indicated by the "Soil Conservation Service (SCS) - Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico (1977)". Present surface cover consists of approximately 75 percent native grasses with bare earth. Figure 2 indicates an overlay of the site onto the SCS base mapping.

The entire drainage area currently drains toward Sage Road. The runoff is then conveyed eastward along Sage Road, partially by the roadway and partially by adjacent roadside ditches. There is one channel north of Sage from 90th Street to 86th Street. From 86th Street eastward to Unser Boulevard, there are currently roadside ditches on both sides of the road. The drainage currently crosses Unser Boulevard and discharges to a large playa located east of Unser Boulevard. The Sage Road Improvements, Drainage Report, prepared for the City of Albuquerque by Andrews, Asbury and Robert in 1990, and a DRC Review Comment Sheet by Carlos Montoya of the City of Albuquerque, Public Works Department, Hydrology Division, dated January 17, 1990, both cite the need for storm improvements in Sage Road. To date, these improvements have not been constructed. ↳ WHO IS RESPONSIBLE FOR THESE?

The project area is contained within Community Panel No. 350020033C, dated October 14, 1983 of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps. Sage Road and the existing playa lake are both indicated within the 100-year flood plain; however, the site itself is not within the 100-year flood plain as indicated on Figure 3, adopted from the FEMA mapping of the area.

↳ CURRENTLY NO EASEMENT



BCC - BLUEPOINT LOAMY FINE SAND 1-3% SLOPES
PAC - PAJARITO FINE SANDY LOAM 1-9% SLOPES

NOTE: EXHIBIT ADOPTED FROM SCS, SOIL SURVEY OF BERNALILLO COUNTY AND PART OF SANDOVAL AND VALENCIA COUNTIES, NEW MEXICO MAPS 29, 30, 39 & 41

SUNSET WEST, UNIT 2
PROJECT SOILS MAP

FIGURE 2

ZONE AO (DEPTH 1)

CORPORATE LIMITS

ZONE AO (DEPTH 1)

ZONE C

94TH STREET

86TH STREET

UNSER BLVD.

ZONE AO (DEPTH 1)

TOWER ROAD

ZONE AO (DEPTH 1)

CORPORATE LIMITS

ZONE C

TOWER ROAD

ZONE C

EBBETS

CORPORATE LIMITS

SUNSET WEST UNIT 1

SUNSET WEST UNIT 2

86TH STREET

ZONE AO (DEPTH 1)

ZONE C

ZONE AO (DEPTH 1)

ROAD

SAGE

ZONE AO (DEPTH 1)

LIMIT OF DETAILED STUDY

CORPORATE LIMITS

SUNSET WEST, UNIT 2
PROJECT FLOOD PLAIN MAP

NOTE: EXHIBIT ADOPTED FROM FEMA FIRM COMMUNITY PANEL NO. 350002 0033 C DATED OCTOBER 14, 1983

FIGURE 3

II. HYDROLOGY

A. METHODOLOGY

The hydrologic analysis was performed using the Albuquerque Metropolitan Arroyo Flood Control Authority's (AMAFCA) version of the USDA Agricultural Research Service HYMO Computer Program known as AHYMO; version 9.93 was utilized for this analysis. Because the timing of the SAD construction is unknown at this time, the analysis was performed for four different development scenarios in order to provide quantification of localized impacts, and impacts to the receiving waters (the plaza east of Unser). The analyses incorporated the area generally bounded by Tower on the north, Unser on the east, Sage on the south and 98th Street on the west. The area west of 98th Street is assumed to be diverted southward to Snow Vista Channel by SAD construction in all four scenarios. These scenarios are indicated in Figures 4A - 4D and are generally described as follows:

- Existing Conditions (Figure 4A) - SAD #222 improvements have not been construction; the drainage areas north of San Ygnacio are undeveloped and follow the existing paths. Sunset West Unit 2 is undeveloped. All other areas are modelled to reflect current level of development. (The retention pond for Westview Town homes remains in place.)

- Interim Conditions (Figure 4B) - The SAD #222 improvements have not been constructed, the drainage areas north of San Ygnacio are undeveloped and follow the existing paths. Sunset West Unit 2 is developed. All other areas are modelled to reflect current level of development. This presents a "worse case" for drainage conditions for 90th Street and the Sage Road system.

- Interim II Conditions (Figure 4C) - The SAD #222 improvements have been constructed. These consist of a storm drain located in San Ygnacio and a proposed detention facility to be located near 86th and the San Ygnacio. While it is assumed that those areas are to be developed as part of the SAD #222 it is also assumed that the outflow from the detention facility should approximate existing conditions. Because the detailed information on these facilities necessary to properly route the flows through the system is not available at this time, it was modelled as existing conditions flow rates. Therefore, because the expected lag resulting from the detention facility will not occur, the peak flow values arriving at the Unser Plaza may not be totally correct, the volume of runoff at this location should be. Sunset West is undeveloped; the remaining areas are modelled to reflect current development. This presents an "existing condition" for Sunset West with the SAD in place.

- Developed Conditions (Figure 4D) - The SAD #222 improvements have been constructed. Sunset West is developed; the remaining areas are modelled to reflect current development. This presents a "developed conditions" for Sunset West with the SAD in place.

Table 1 provides a brief summary of these four analysis scenarios.

TABLE 1
Summary of Analysis Conditions

Scenario	Area West of 98th	Area North of San Ygnacio	SAD Improvements	Sunset West Unit 2	Remaining Areas
Existing Conditions	Diverted south	Undeveloped	Not in place	Undeveloped	As current
Interim I Conditions	Diverted south	Undeveloped	Not in place	Developed	As current
Interim II Conditions	Diverted south	Developed*	Constructed	Undeveloped	As current
Developed Conditions	Diverted south	Developed*	Constructed	Developed	As current
* Modelled as existing to account for detention facility.					

B. BASIN PARAMETERS

The AHYMO computer model requires the input of several variables, or basin parameters, which define the characteristics of each sub-basin in the analysis. Table 2 includes a summary of the basin parameters utilized for the existing basin conditions analysis; Table 3 shows the same parameters but for the developed condition. A brief description of these parameters, and the methods and assumptions used in their determination follows.

1. Drainage Areas

The drainage areas were determined from an orthophotographic map of the area developed for the City of Albuquerque in 1980, by Bohannan-Huston. The areas, so determined, were then field verified. Figures 4A - 4D indicate the basins used for these analyses. It should be noted that runoff from the area west of 98th Street was assumed to be diverted southward to the Snow Vista Channel. Coordination with on-going work for Special Assessment District #222 (SAD) indicates that runoff from the drainage areas north of San Ygnacio will be diverted eastward along San Ygnacio by a storm drain to a proposed detention facility to be located on the northeast corner of San

– Is IT?

SUNSET WEST UNIT 2

AHYMO BASIN PARAMETER WORKSHEET

MARCH 21, 1994
LEEDSHILL – HERKENHOFF, INC.

TABLE 2

UNDEVELOPED BASIN CONDITIONS

BASIN	AREA (AC)	LENGTH (FT)	ELEV DIFF (FT)	SLOPE (FT/FT)	K	VELOCITY (FT/S)	T(C) (HRS)	T(P) (HRS)	SURFACE TREATMENT %			
									A	B	C	D
A1–U	57.97	400	10	0.025	0.7	1.11	0.10	0.07	100	0	0	0
		550	12	0.022	1.0	1.48	0.10	0.07	100	0	0	0
		900	16	0.018	3.0	4.00	0.06	0.04	100	0	0	0
		1550	20	0.013	2.0	2.27	0.19	0.13	100	0	0	0
	TOTAL =	3400	58	0.017			0.46	0.30				
A2–U	25.3	400	9	0.023	0.7	1.05	0.11	0.07	100	0	0	0
		1050	13	0.012	1.0	1.11	0.26	0.17	100	0	0	0
	TOTAL =	1450	22	0.015			0.37	0.25				
A3–U	59.26	2600	56	0.022	3.0	4.40	0.16	0.11	100	0	0	0
		1100	28	0.025	1.0	1.60	0.19	0.13	100	0	0	0
	TOTAL =	3700	84	0.023			0.36	0.24				
A4–U	39.6	400	8	0.020	0.7	0.99	0.11	0.07	100	0	0	0
		1230	16	0.013	1.0	1.14	0.30	0.20	100	0	0	0
	TOTAL =	1630	24	0.015			0.41	0.27				
A5–U	57.77	400	6	0.015	0.7	0.86	0.13	0.09	100	0	0	0
		2230	24	0.011	1.0	1.04	0.60	0.40	100	0	0	0
	TOTAL =	2630	30	0.011			0.73	0.48				

TABLE 2 (Cont'd.)

UNDEVELOPED BASIN CONDITIONS

BASIN	AREA (AC)	LENGTH (FT)	ELEV DIFF (FT)	SLOPE (FT/FT)	K	VELOCITY (FT/S)	T(C) (HRS)	T(P) (HRS)	SURFACE TREATMENT %			
									A	B	C	D
B1-U	4.3	400	8	0.020	0.7	0.99	0.11	0.07	75	0	0	25
		150	2	0.013	0.7	0.81	0.05	0.03	75	0	0	25
	TOTAL =	550	10	0.018			0.16	0.11				
B2-U	10.3	150	1	0.007	0.7	0.57	0.07	0.05				
		100	3	0.030	3.0	5.20	0.01	0.00				
		800	9	0.011	3.0	3.18	0.07	0.05				
		450	8	0.018	3.0	4.00	0.03	0.02				
		125	1	0.008	3.0	2.68	0.01	0.01				
	TOTAL =	1625	22	0.014			0.19	0.13	20	50	0	30
B3-U	27.0	150	1	0.007	0.7	0.57	0.07	0.05				
		50	2	0.040	3.0	6.00	0.00	0.00				
		1550	24	0.015	3.0	3.73	0.12	0.08				
		700	12	0.017	1.0	1.31	0.15	0.10				
	TOTAL =	2450	39	0.016			0.34	0.23	50	25	0	25
B4-U	10.4	400	4	0.010	0.7	0.70	0.16	0.11	100	0	0	0
		800	12	0.015	1.0	1.22	0.18	0.12	100	0	0	0
	TOTAL =	1200	16	0.013			0.34	0.23				
C1-U	11.5	2200	14	0.006	3.0	2.39	0.26	0.17	50	0	0	50

SUNSET WEST UNIT 2

AHYMO BASIN PARAMETER WORKSHEET

TABLE 3

MARCH 21, 1994
LEEDSHILL–HERKENHOFF, INC.

DEVELOPED BASIN CONDITIONS

BASIN	AREA (AC)	LENGTH (FT)	ELEV DIFF (FT)	SLOPE (FT/FT)	K	VELOCITY (FT/S)	T(C) (HRS)	T(P) (HRS)	SURFACE TREATMENT % A	B	C	D
A1–D*	57.97	400	10	0.025	0.7	1.11	0.10	0.07	100	0	0	0
		550	12	0.022	1.0	1.48	0.10	0.07	100	0	0	0
		900	16	0.018	3.0	4.00	0.06	0.04	100	0	0	0
		1550	20	0.013	2.0	2.27	0.19	0.13	100	0	0	0
	TOTAL =	3400	58	0.017			0.46	0.30				
A2–D	25.3	400	9	0.023	0.7	1.05	0.11	0.07	100	0	0	0
		1050	13	0.012	1.0	1.11	0.26	0.17	100	0	0	0
	TOTAL =	1450	22	0.015			0.37	0.25				
A3–D*	59.26	2600	56	0.022	3.0	4.40	0.16	0.11	100	0	0	0
		1100	28	0.025	1.0	1.60	0.19	0.13	100	0	0	0
	TOTAL =	3700	84	0.023			0.36	0.24				
A4–D*	39.6	400	8	0.020	0.7	0.99	0.11	0.07	100	0	0	0
		1230	16	0.013	1.0	1.14	0.30	0.20	100	0	0	0
	TOTAL =	1630	24	0.015			0.41	0.27				
A5–D*	57.77	400	6	0.015	0.7	0.86	0.13	0.09	100	0	0	0
		2230	24	0.011	1.0	1.04	0.60	0.40	100	0	0	0
	TOTAL =	2630	30	0.011			0.73	0.48				

*BASIN ACTUALLY DEVELOPED; HOWEVER, MODELLED AS EXISTING TO REFLECT DETENTION FACILITY

TABLE 3 (Cont'd.)

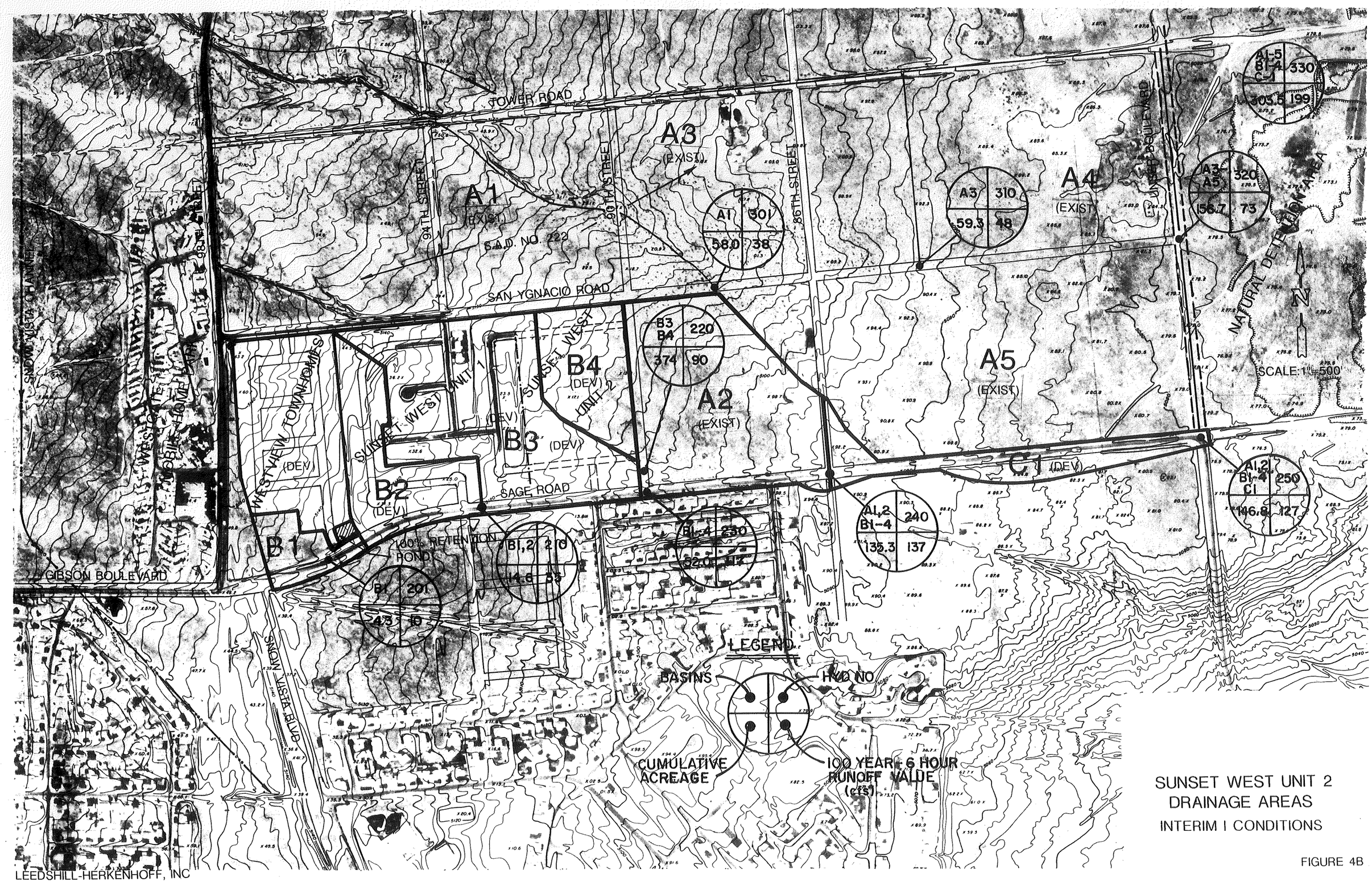
DEVELOPED BASIN CONDITIONS

BASIN	AREA (AC)	LENGTH (FT)	ELEV DIFF (FT)	SLOPE (FT/FT)	K	VELOCITY (FT/S)	T(C) (HRS)	T(P) (HRS)	SURFACE TREATMENT % A	B	C	D
B1–D	4.3	400	8	0.020	0.7	0.99	0.11	0.07	75	0	0	25
		150	2	0.013	1.0	1.15	0.04	0.02	75	0	0	25
	TOTAL =	550	10	0.018			0.15	0.10				
B2–D	10.3	150	1	0.007	0.7	0.57	0.07	0.05				
		100	3	0.030	3.0	5.20	0.01	0.00				
		800	9	0.011	3.0	3.18	0.07	0.05				
		450	8	0.018	3.0	4.00	0.03	0.02				
		125	1	0.008	3.0	2.68	0.01	0.01				
	TOTAL =	1625	22	0.014			0.19	0.13	20	50	0	30
B3–D	27.0	150	1	0.007	0.7	0.57	0.07	0.05				
		50	2	0.040	3.0	6.00	0.00	0.00				
		1550	24	0.015	3.0	3.73	0.12	0.08				
		700	12	0.017	3.0	3.93	0.05	0.03				
	TOTAL =	2450	39	0.016			0.24	0.16	20	50	0	30
B4–D	10.4	150	2	0.013	0.7	0.81	0.05	0.03				
		1450	16	0.011	3.0	3.15	0.13	0.09				
	TOTAL =						0.18	0.12	20	50	0	30
C1–D	11.5	2200	14	0.006	3.0	2.39	0.26	0.17	50	0	0	50

SUNSET WEST UNIT 2
DRAINAGE AREAS
EXISTING CONDITIONS

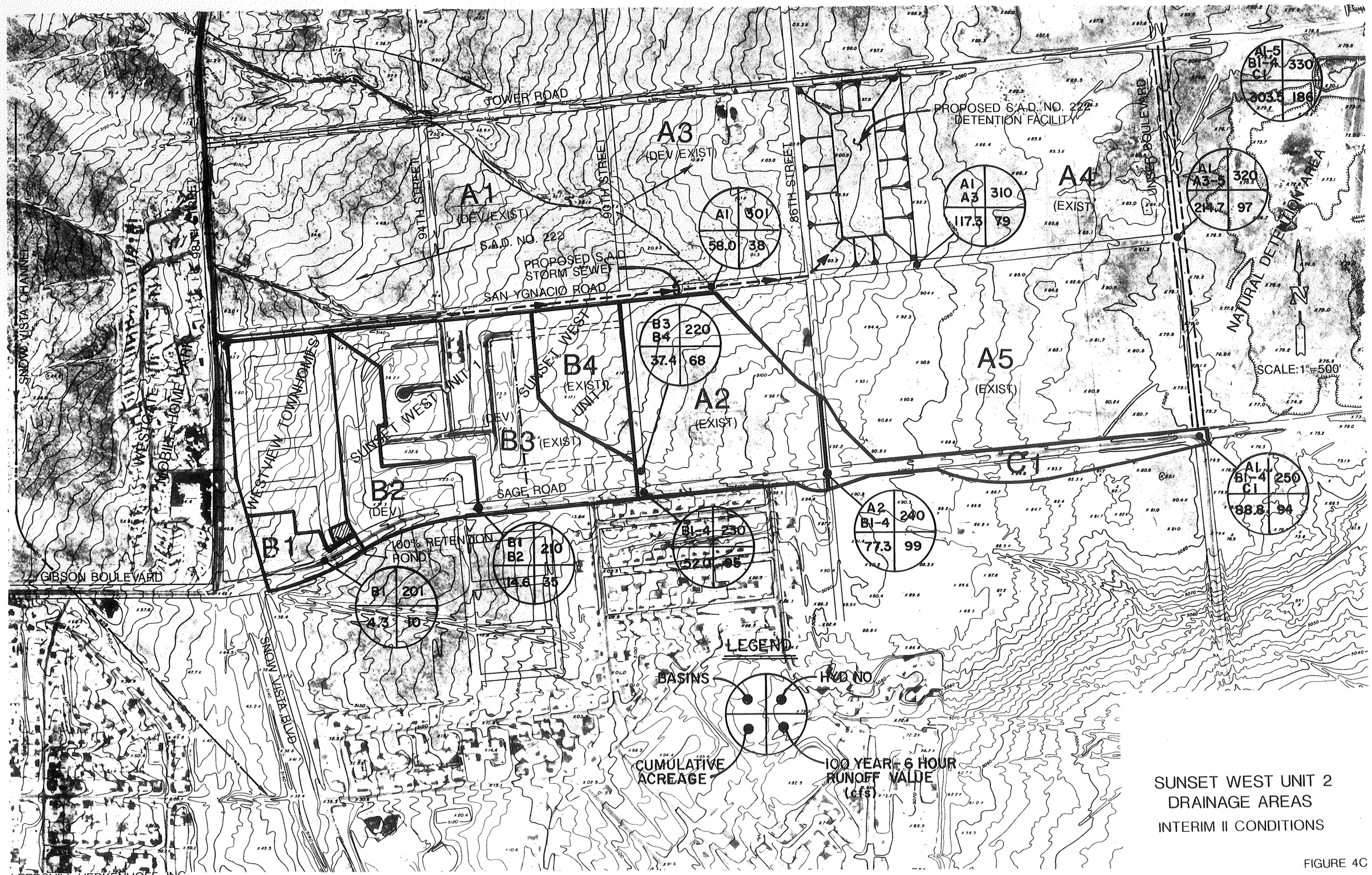
FIGURE 4A

LEEDSHILL-HERKENHOFF, INC



SUNSET WEST UNIT 2
DRAINAGE AREAS
INTERIM I CONDITIONS

FIGURE 4B



SUNSET WEST UNIT 2
DRAINAGE AREAS
INTERIM II CONDITIONS

FIGURE 4C

LEEDSHILL-HERKENHOFF, INC

TOWER ROAD
SAN YGNACIO ROAD
SAGE ROAD
GIBSON BOULEVARD
SNOW VISTA CHANNEL
SNOW VISTA BLVD
94TH STREET
98TH STREET
86TH STREET
UNSER BOULEVARD
SUNSET WEST UNIT 1
SUNSET WEST UNIT 2
WESTVIEW TOWNHOMES
MOBILE HOME PARK
S.A.D. NO. 222
PROPOSED S.A.D. NO. 222 DETENTION FACILITY
PROPOSED S.A.D. STORM SEWER
100% RETENTION POND
NATURAL DETENTION AREA
A1 (DEV./EXIST)
A2 (EXIST)
A3 (DEV./EXIST)
A4 (EXIST)
A5 (EXIST)
B1 (DEV.)
B2 (DEV.)
B3 (DEV.)
B4 (DEV.)
C1
A1 301 58.0 38
A1 A3 310 117.3 79
A1 A3-5 320 214.7 97
A1-5 B1-4 C1 330 303.5 199
B3 B4 220 37.4 90
B1 B2 210 14.6 55
B1 201 42.3 10
B1-4 230 52.0 H1
A2 B1-4 240 77.3 120
A2 B1-4 C1 250 88.8 H10
SCALE: 1" = 500'
LEGEND
BASINS
HYD NO
CUMULATIVE ACREAGE
100 YEAR - 6 HOUR RUNOFF VALUE (cfs)

SUNSET WEST UNIT 2 DRAINAGE AREAS
DEVELOPED CONDITIONS

FIGURE 4D

LEEDSHILL-HERKENHOFF, INC

Ygnacio and 86th Street. In addition, it was assumed that the runoff from the Westview Townhomes Addition, located at West Sky Street between San Ygnacio Road and Sage Road, is directed to an existing retention pond located at the southeast corner of this subdivision. ↳ They may want to reclaim

2. Surface Treatment

The surface treatment consists of four groups as defined in the DPM. These groups are defined by surface cover, amount of impervious area, general soil type, and land uses. The surface treatments for this study were selected based upon field reconnaissance, the orthophotographic mapping, and engineering judgement based upon knowledge of the construction of the previous section of Sunset West. In general, a 30-percent impervious assumption was made for the existing Sunset West Unit 1 subdivision and for the proposed Sunset West Unit 2 subdivision. This assumption was made to maintain consistency with the assumptions utilized in the Sage Road Drainage Report.

3. Hydraulic Length

The hydraulic length is a parameter which defines the longest path for runoff to follow as it travels through the sub-basin. The hydraulic lengths were determined from the orthophotographic mapping of the area.

4. Basin Slopes

The orthophotographic mapping was also used to determine the overall elevation difference across a basin, and to calculate the slope of the basin. In addition, slopes were also calculated for each reach used to route the hydrographs through the Sage Road system.

5. Conveyance, k

The conveyance factor, k, is a measure of how well a basin conveys runoff along its hydraulic length. The values of k used for this analysis were based upon review of aerial photography, the orthophotographic mapping, and field reconnaissance. The conveyance factors used were obtained from Table B-1 of the DPM Section 22.2, and ranged from 0.7 for turf areas, to 3.0 for street sections.

6. Velocity, v

As the hydraulic lengths for the basins in this study were all under 400 feet in length, the velocities were calculated as a function of the conveyance times the square root of the slope as recommended in the DPM Section 22.2.

7. Time of Concentration, T_c

The time of concentration, T_c is the time for runoff to travel from the hydraulically most distant part of the sub-basin to the point of analysis. This parameter was calculated by the Soils Conservation Service Upland method, which is a function of the hydraulic length divided by the velocity. A minimum T_c of 0.2 was utilized.

8. Time to Peak, T_p

The time to peak, T_p is the time from the beginning of the unit rainfall excess to the time of the peak flow of the unit runoff hydrograph. From empirical studies and as defined in the DPM 22.2, it is generally accepted to be 2/3 of the time of concentration, T_c.

C. HYDROGRAPH ROUTING

The basin hydrographs were calculated and routed along Sage Road using AHYMO. The streets were treated as channels and three different roadway cross-sections were utilized to reflect actual conditions found for Sage Road. A full four-lane street section with curb and gutter on both sides and a median was used from 98th Street to 90th Street. From 90th Street eastward to 86th Street, a two lane roadway cross-section with curb and gutter on the south side and a small ditch on the north side was used. From 86th Street to Unser Boulevard, a two lane roadway with borrow ditches located on both sides of the roadway was utilized. Copies of the AHYMO models utilized for this analysis are contained in Appendix A. Sketches of the road sections utilized for the hydraulic calculations are contained in Appendix B.

D. RESULTS

Using the AHYMO model, the peak run-off rates were calculated for the 10-year, 6-hour and the 100-year, 6-hour frequency rainfall events under existing interim, and developed watershed conditions. A summary of the resulting peak runoff rates at various key locations within the watershed under the 10-year event is presented in Table 4. The 100-year event values are contained in Table 5.

TABLE 4
Comparison of Peak Runoff Values for 10-year 6-hour Storm

Location	Existing	Interim I	Interim II	Developed
West Sky at Sage	4	4	4	4
94th and Sage	16	16	16	16
90th, north of Sage	27	45	27	45
90th and Sage	34	56	39	50
86th and Sage	36	52	35	50
Unser and Sage	38	51	38	48
San Ygnacio and Unser	12	12	14	15
Unser playa lake	50	62	51	62
Volume to Unser playa (acre-feet)	4.0	4.6	4.0	4.6

TABLE 5
Comparison of Peak Runoff Values for 100-year 6-hour Storm

Location	Existing	Interim I	Interim II	Developed
West Sky at Sage	10	10	10	10
94th and Sage	35	35	35	35
90th, north of Sage	52	90	68	90
90th and Sage	81	117	95	117
86th and Sage	112	137	99	120
Unser and Sage	106	127	93	110
San Ygnacio and Unser	73	73	97	97
Unser playa lake	179	198	186	198
Volume to Unser playa (acre-feet)	13.8	14.6	13.8	1.6

As indicated in these tables, there is a localized increase in runoff resulting from the development of Sunset West Unit 2. However, there is also a slight reduction of the

peak runoff values which results from the implementation of the SAD #222 improvements north of the project. For the 10-year event the runoff from drainage areas B3 and B4 (Sunset West Units 1 and 2) increases from 27 to 45 cfs. The runoff from the 100-year event at this location increases from 52 to 90 cfs. However, because of hydrograph timing and attenuation of these peaks, the impacts on Sage Road are not as pronounced. At Sage and 90th there is an increase from 34 to 56 cfs, further east on Sage and 86th the increase from 36 to 52 cfs under the 10-year storm event. These increases would be 81 to 117 cfs and 112 to 137 cfs, respectively for the 100-year event. This attenuation is due in part to the roadside channels located along Sage which convey runoff more slowly than a street section would.

An investigation into the overall effects on the existing receiving water course was also made. This water course is presently a large 12± acre natural playa located east of Unser Boulevard and north of Sage. The peak inflow from the entire area east of Unser, between Tower and Sage, for the 100-year event increases from 179 to 198 cfs without the SAD improvements in place (approximately 10 percent), and from 186 to 198 cfs with the SAD improvements. There is an overall 5.8 percent increase in the 100-year runoff volume to this playa, however, because of its size, this results in an approximate 0.06 foot increase in ponding in this playa.

III. HYDRAULICS

A. METHODOLOGY

In order to assess the adequacy of the roadways to convey the peak runoff resulting from the 10-year and the 100-year frequency storm events, hydraulic analyses were performed for the following existing street sections:

- 90th Street between San Ygnacio Road and Sage Road - a two lane (32 foot wide) roadway with curb and gutter;
- Sage Road between 86th and 90th Streets - a two-lane (30-foot wide) roadway cross-section with curb and gutter on the south side and a small ditch on the north side; and
- Sage Road between 86th and Unser Boulevard - a two-lane (30-foot wide) roadway with borrow ditches located on both sides of the roadway;

Sketches of these road sections are contained within Appendix B. Manning's formula for open channel flow was utilized to analyze the maximum allowable capacity of these streets under two scenarios:

- 10-year frequency storm with one 12-foot wide lane open to traffic (per DPM criteria);
- 100-year frequency storm with a maximum water level of 0.2 feet above the top of curb or 0.2 feet above the crown of the road where no curb and gutter is present (Sage Road between 86th Street and Unser Boulevard)(also per DPM criteria).

This allowable street capacity was then compared with the peak runoff rates calculated under existing interim and developed conditions in order to assess the adequacy of the streets to convey these flows. The hydraulic calculations for the maximum allowable street capacities are contained in Appendix B.

B. RESULTS

Table 6 provides a comparison of the calculated maximum allowable street capacity versus the peak runoff rates for the 10-year frequency rainfall event under existing, interim and developed watershed conditions. The flow rates for the 10-year storm show an increase on 90th Street between the existing and developed condition. The street

TABLE 6
Comparison of Street Capacity Versus Calculated Peak Runoff Values for 10-year Storm

Location	Street Capacity (cfs)	Peak Runoff (cfs)			
		Existing	Interim I	Interim II	Developed
90th Street between San Ygnacio and Sage	4	27	45	27	45
Sage Road between 86th and 90th	26	34	56	39	50
Sage Road between 86th and 90th	78	36	52	35	50

capacity is exceeded for all conditions. It may be possible to install an interim channel within the right-of-way of 90th Street to convey this runoff as contained in the original plans for this subdivision.

Sage Road between 90th Street and 86th Street does not have adequate capacity to convey the 10-year runoff event from existing, interim or developed conditions; however, it may be possible to increase the capacity of the adjacent roadside channel to mitigate this problem. → Ditch only on north side Q86 on south

These results are consistent with the previous analyses performed for the Sage Road Improvements, Drainage Report, performed for the City of Albuquerque in 1990, and with the previous Review Comments to DRC from Carlos Montoya of the City of Albuquerque, Public Works Department, Hydrology Division. Both of these previous sources advocate the need for storm improvements to be included with the construction of Sage Road. Due to funding constraints, these improvements were not provided at the time of the original Sage Road construction.

Sage Road between 86th Street and Unser Boulevard, with ditches along both the north and southbound lanes, is capable of handling both existing and future flows during a 10-year frequency.

Table 7 provides a comparison of the calculated maximum allowable street capacity versus the peak runoff rates and velocities for the 100-year frequency rainfall event under both existing and developed watershed conditions. This table indicates that all three roadway sections analyzed are capable of handling both existing and developed peak runoff.

TABLE 7
Comparison of Street Capacity Versus Calculated Peak Runoff Values for 100-year Storm

Location	Street Capacity (cfs)	Peak Runoff (cfs)			
		Existing	Interim I	Interim II	Developed
90th Street between San Ygnacio and Sage	122	52	90	58	90
Sage Road between 86th and 90th	233	81	117	95	117
Sage Road between 86th and 90th	207	112	137	99	120

IV. CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the hydrologic and hydraulic analysis performed for this study, it is possible to draw the following conclusions and recommendations.

1. As would be expected, there will be a slight increase in the 10 and 100-year peak runoff rates due to the development of the Sunset West Unit 2 subdivision.

2. The construction of the SAD improvements results in a slight reduction of peak runoff along Sage Road.

3. There are negligible impacts to the offsite playa resulting from the construction of Sunset West Unit 2.

4. The street capacities of 90th Street and Sage Road between 90th Street and 86th Street are inadequate to convey the runoff resulting from the 10-year 6-hour frequency storm event under existing watershed conditions.

5. Because of the increase in runoff between existing and developed conditions, the street capacities of 90th Street, and Sage Road between 90th Street and 86th Street are inadequate to convey the runoff resulting from the 10-year, 6-hour frequency storm event under developed watershed conditions for conditions with and without the SAD improvements in place.

6. The street capacity of all three roadway segments analyzed is adequate for conveyance of the 100-year frequency storm runoff.

7. Under DPM guidelines, street capacity less than the 10-year rainfall event would normally require installation of storm sewerage; however, lack of a downstream outfall renders storm sewer construction at this time impractical.

8. The lack of storm sewer infrastructure in Sage Road is an existing problem. Therefore, it may not be wholly equitable to require the private sector to remedy this situation.

9. Channel improvements along the east side of 90th Street and along the westbound lanes of Sage Road between 86th and 90th Streets, are recommended as an interim system to mitigate the nuisance flooding occurring under the 10-year frequency rainfall events.

10. If storm sewers are required to be constructed in 90th Street, it may be possible to install them at this time, and plug them until an outfall can be constructed in Sage Boulevard. This would alleviate the need to re-construct the paving in this area at a later date.

DRAINAGE REPORT

FOR

SUNSET WEST UNIT II

MARK GOODWIN & ASSOCIATES
CONSULTING ENGINEERS

DRAINAGE REPORT

FOR

SUNSET WEST UNIT II

Prepared for

FAIR PLAZA ASSOCIATES

August 1989

D. Mark Goodwin & Associates, P.A.
Consulting Engineers
P.O. BOX 21307, ALBUQUERQUE, NM 87154
(505) 265-0905

August 22, 1989

Public Works Department
Hydrology Section
CITY OF ALBUQUERQUE
PO Box 1293
Albuquerque, NM 87103

Re: Proposed Residential Subdivision: Sunset West Unit II, Phase I and Phase II

Gentlemen:

Please find enclosed the Drainage Report for the referenced project.

We wish to point out that this project will be developed in two phases. In addition to the detailed grading plan for Phase I, the conceptual plan for Phase II is included. Runoff and Capacity Calculations for both phases have been performed and are included.

If you should have questions, please call me.

Sincerely,

D. MARK GOODWIN AND ASSOCIATES, P.A.

Mark Goodwin

Mark Goodwin, P.E.

DMG/mbs

Enclosures

PROJECT LOCATION AND DESCRIPTION

The proposed Sunset West Unit II subdivision is planned for a 16 acre site located in southwest Albuquerque. The site is bounded by Sage Road on the south, San Ygnacio Road on the north, 90th Street on the east, and by the developed Sunset West Unit I on the west. The project was platted in 1980, therefore no platting action will be necessary to complete the project.

A drainage report entitled "Engineers Report on Storm Drainage for Sunset West Unit 2" was presented in February 1980 by Gordon Herkenhoff and Associates, (City File L9/D4). Due to the age of this report and changes in City policies and ordinances, a new report is deemed necessary.

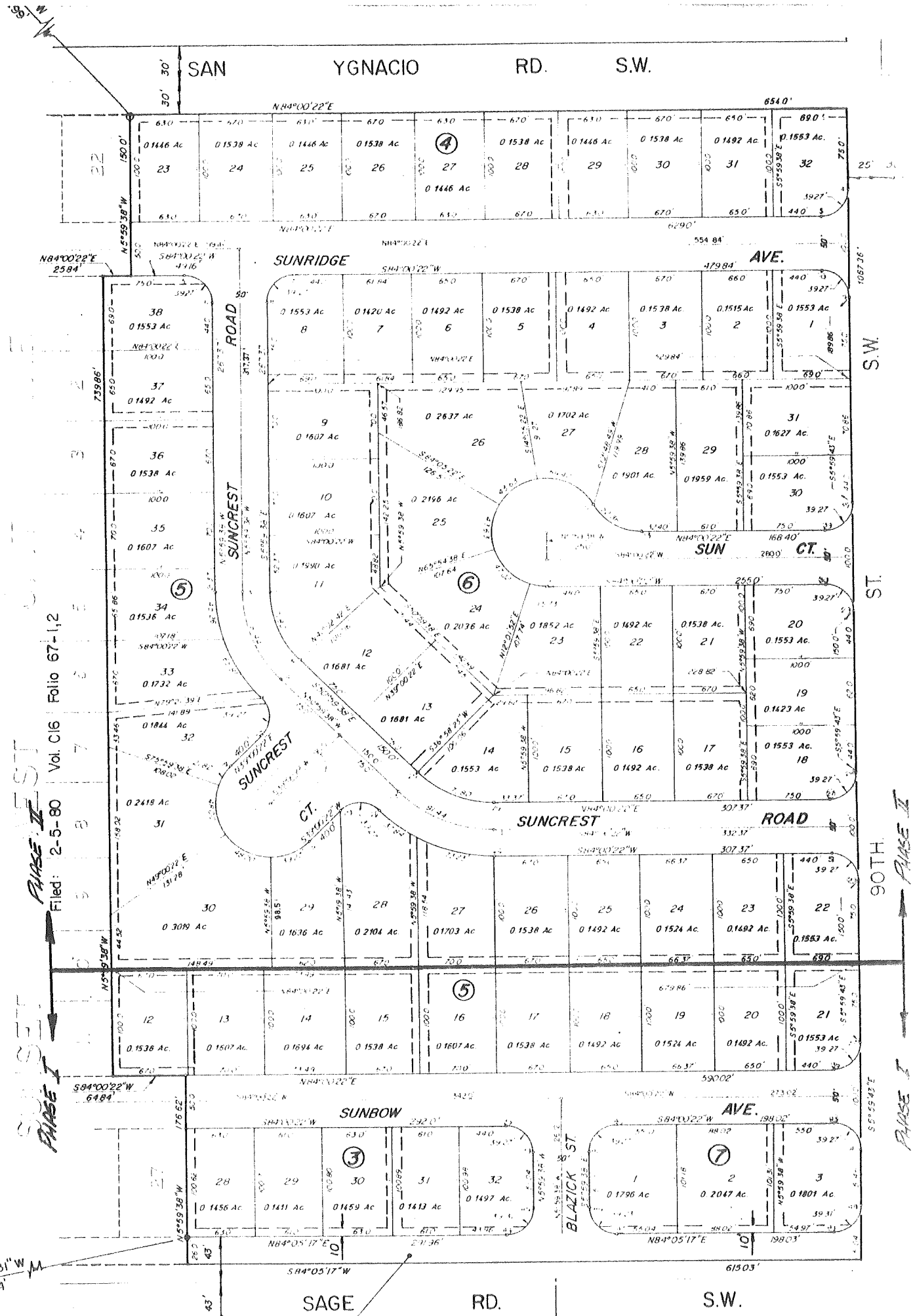
The proposed site is relatively mild in slope, has medium cover, and is comprised of Bluepoint Soils (BCC). The difference in elevation from the northwest corner to the southeast corner is approximately 10 feet in 1300 feet. There is a small arroyo running through the project which was blocked off by construction of Unit I and no longer has any significance. Offsite flows currently enter this site at three locations. A 12.5 acre portion of Unit I discharges into Unit II from the west near the south boundary by means of a residential street, Sunbow Avenue. A one acre portion of Unit I discharges into Unit II from the west near the north boundary by way of a residential street, Sunridge Avenue. A 65 acre drainage area north and west of the site sheet flows to San Ygnacio Road where it is intercepted and conveyed to the road's terminus at the northwest corner of Unit II. Released runoff then sheet flows across Unit II. All offsite flows ultimately reach Sage Road for conveyance in a ditch section to the east.

Development in the immediate area is typically residential and of an age such that tract and/or rear year ponding was specified and constructed under old Resolution 1972-2. FEMA panels 32 and 33 indicate that runoff from Unit II will contribute to a flood plain, however we will show in subsequent sections of this report that conditions have changed which would allow for free discharge of this particular site.

dmg D. MARK GOODWIN & ASSOC.
CONSULTING ENGINEERS

JOB Sunset West - Unit II
SUBJECT
JOB NO. SHEET OF
BY DATE
CHECKED DATE

VICINITY MAP


SAN YGNACIO RD. S.W.
SUNRIDGE AVE.
SUNCREST ROAD
SUNCREST CT.
SUN CT.
SUNBOW AVE.
BLAZICK ST
90TH. ST. S.W.
SAGE RD. S.W.
PHASE II
PHASE I
Filed: 2-5-80 Vol. C16 Folio 67-1,2

PROPOSED DRAINAGE PROVISIONS

The intent of this plan is threefold:

1. To adequately intercept and/or convey offsite runoff to Sage Road. Sage is the natural collection point for these flows;
2. To collect onsite runoff by way of the interior streets and discharge directly to Sage Road; and
3. To provide a workable phasing scheme.

Offsite Flows

The offsite runoff generated by the 65 acres north of San Ygnacio Road would be intercepted by the extension of the existing half street section across the northern boundary of this project to the intersection with 90th street on the east boundary. An appropriate erosion control pad would be placed at the end of the pavement and stormwaters would be released at this point. Use of San Ygnacio for interception, and the ultimate release of stormwaters at the boundary of the project is just a continuation of the practice currently employed by the existing Unit to the west. Per the attached calculations, the peak rate of runoff from the 100 year - 6 hour event would be 76 cfs. Our calculations indicate that continuation of the existing street section will intercept this flow, and that there is adequate capacity to do so.

w/ i = 2.97"/hr

The offsite runoff generated by the 12.5 acres of the existing Unit I discharging at the end of Sunbow Avenue would be routed through Unit II with the extension of Sunbow to the east boundary at 90th Street. These flows would be collected by the proposed construction of one half of 90th and conveyed to Sage Road to the south for release. Calculations show this peak rate of runoff to be 34 cfs. Attached calculations show that Sunbow has adequate capacity for these flows.

The offsite runoff generated by the one acre of the existing Unit I carried by Sunridge Avenue would also be routed through Unit II by the extension of Sunridge to the east boundary at 90th Street. Again, 90th Street would be utilized to convey flows to Sage. The peak rate of runoff

from this area is anticipated to be 5 cfs. This is a negligible flow rate and can be easily accommodated.

The reader will note that all offsite flows have been determined and evaluated. Extensions of existing streets are all that will be necessary to convey this runoff through Unit II.

Onsite Flows

The primary purpose of this report is to show justification for direct discharge of onsite generated stormwaters. To accomplish this justification, we will show that direct discharge will not have an adverse impact on downstream systems.

As previously mentioned, FEMA panels 32 and 33 show that this site contributes runoff to a large flood zone. Per these maps, a large portion of the flood zone is due to contributory flows originating west of 98th Street, and from Westgate Heights via Gibson Blvd. This runoff ultimately reaches a large playa east of Sunset West at approximately Stinson Road.

In 1986/1987, the Albuquerque Metropolitan Flood Control Authority had constructed Phase III of the Snow Vista Channel approximately 1,000 feet west of 98th Street (see enclosed Drainage Map). The design analysis for this channel reach as prepared by Gordon Herkenhoff and Associates indicates interception and diversion away from the referenced flood zone of a peak 100 year flow rate of 844 cfs. and a volume of 2,800,00 cubic feet. In addition, the peak rate of runoff in Sage Road appears to have been reduced form 469 cfs. to 115 cfs. due to construction of a water block in Gibson at the Snow Vista crossing. Runoff from approximately 650 acres has been intercepted which gives us confidence in the cited figures.

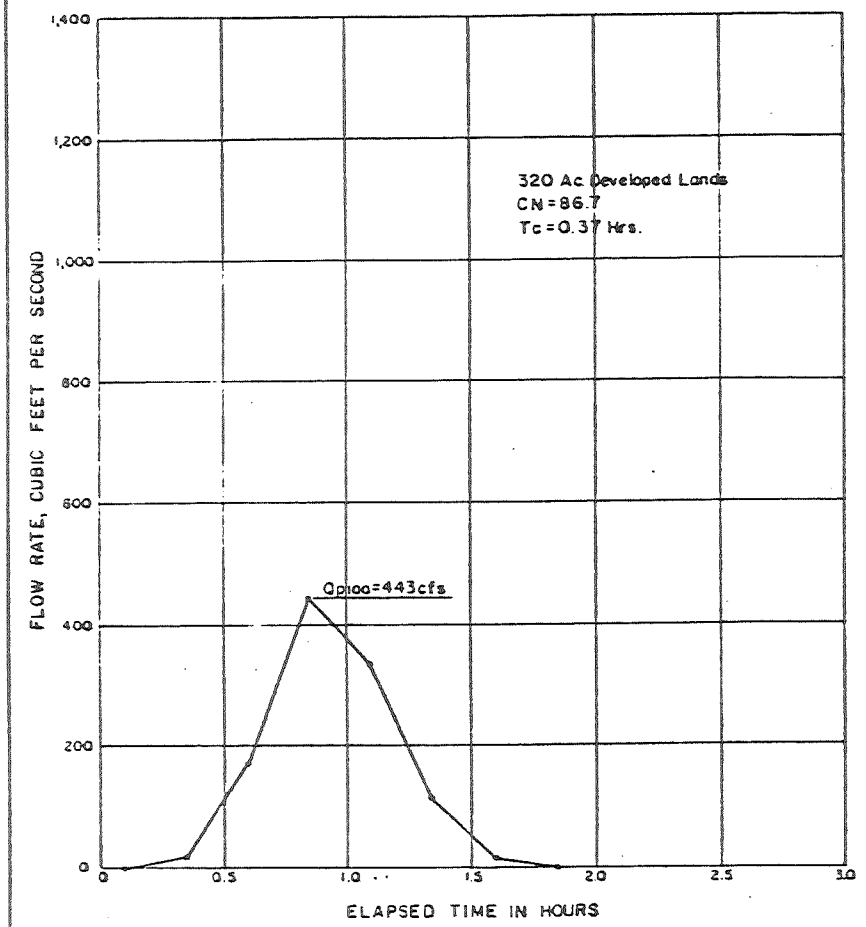
As with any natural depression or playa, the flood zone cannot be completely eliminated unless direct measures are taken to drain it. It is our understanding that the City ultimately intends to do this with the Amole storm drain. However, by removing 2,800,000 cubic feet of stormwater volume by construction of the Snow Vista Channel, a substantial portion of the flood zone has been removed.

Attached calculations indicate that direct discharge from Sunset West Unit II will increase the volume from a current level of 49,929 cubic feet to 87,375 cubic feet. This is an increase of 37,446 cubic feet. The increase would amount to 1.34% of the level removed by the Snow Vista Channel. In addition, taking into account the area of the flood zone, this increased volume would add approximately 0.02 feet to the water surface elevation. Those values are negligible, and should not prevent direct discharge for this project.

The other downstream system to consider is Sage Road and its ability to carry the proposed stormwaters. The peak rate of runoff in Sage just prior to 90th Street is 115 cfs., with a time of concentration of 29 minutes. The peak rate from Sunset West Unit II would be 45 cfs., at a time of concentration of 14 minutes. At worst case, the flows in Sage would be 160 cfs. Our calculations show the capacity of Sage to be 225 cfs. This is more than adequate, and would be increased when Sage is completed to its full section.

In conclusion, we have shown that in light of the Snow Vista Channel improvements, the FEMA maps are no longer valid. While the flood zone undoubtedly still exists, it cannot be near the size as shown, nor will the additional volume generated from Sunset West Unit II cause any measurable change. We feel that by demonstrating no adverse impact, that this site should be allowed free discharge. Furthermore, we have shown that Sage Road can accommodate the additional runoff without detriment.

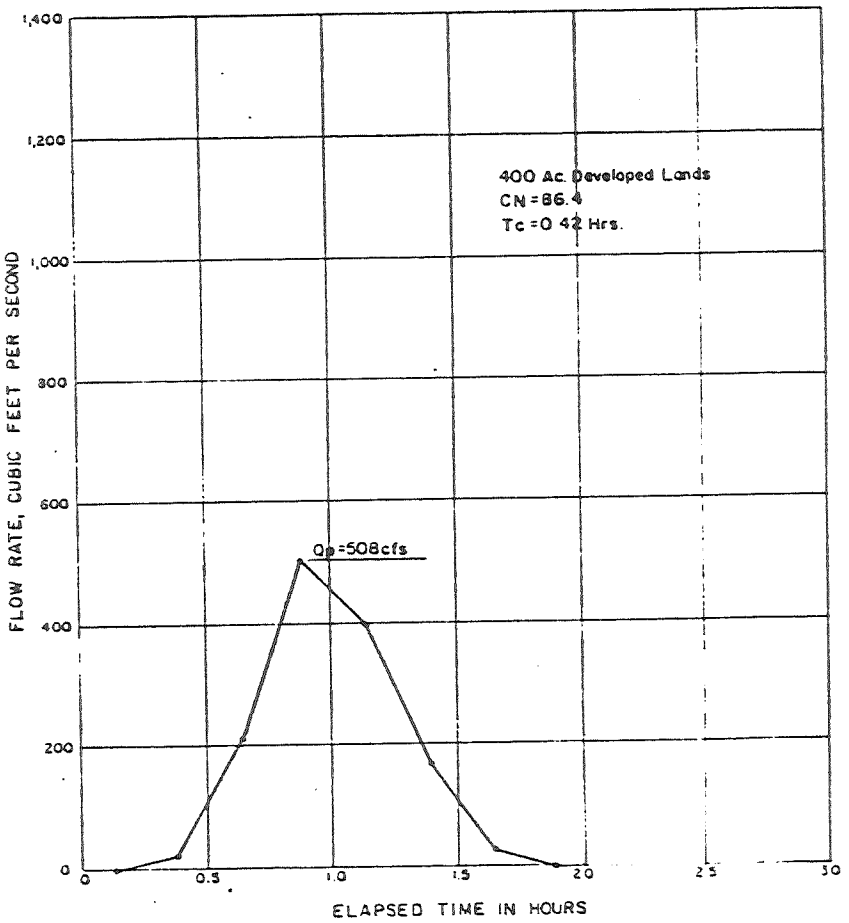
The developers propose to phase construction with Phase I being the south 18 lots fronting on Sunbow Avenue, and Phase II being the remaining 58 lots. Phase I would involve the construction of Sunbow and Blazick only. Sunbow would be barricaded at 90th Street while Blazick would connect with Sage for all weather access. Temporary erosion control would be provided at the end of Sunbow. Phase II would complete the subdivision including the extension of San Ygnacio to 90th Street, and the construction of the west half of 90th Street to Sage. This report provides detailed information for Phase I and enough conceptual information for Phase II to indicate the workability of this phasing scheme.



GORDON HERKENHOFF & ASSOCIATES, INC.
302 Eighth Street, N.W.
Albuquerque, New Mexico 87102
(505) 247-0294

Description: SNOW VISTA CHANNEL
FLOW INTO EUCARIZ AVE.

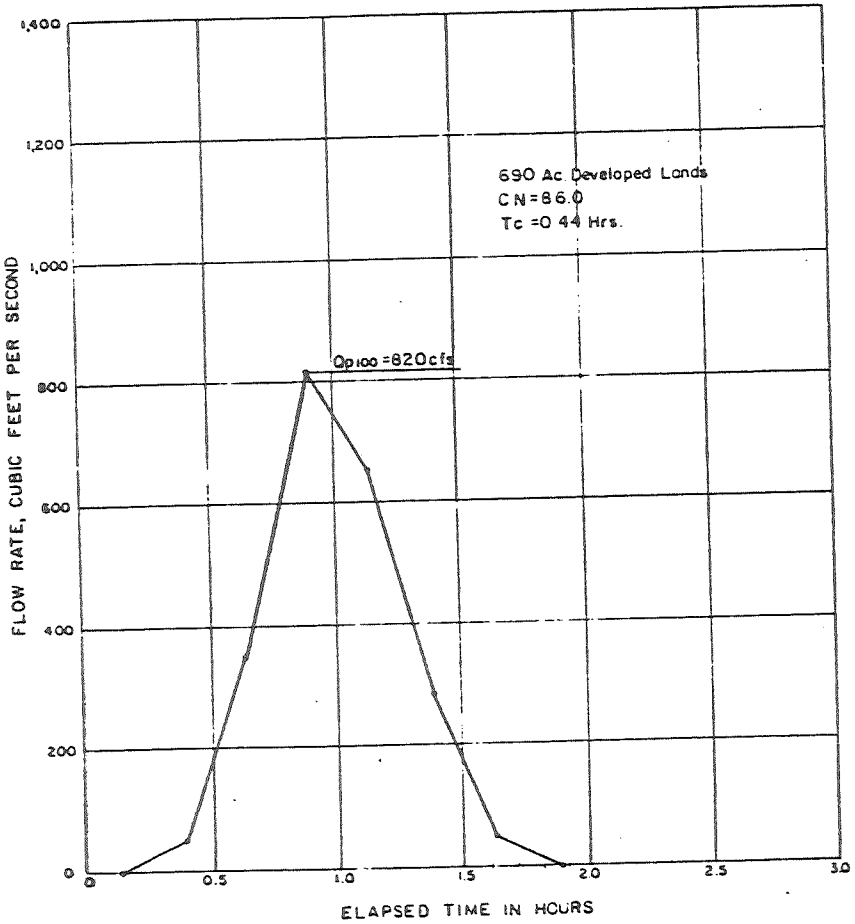
Date: DEC. 1980 | Drawing No. 1 | Page



GORDON HERKENHOFF & ASSOCIATES, INC.
302 Eighth Street, N.W.
Albuquerque, New Mexico 87102
(505) 247-0294

Description: SNOW VISTA CHANNEL
FLOW AT SAN YGNACIO ROAD

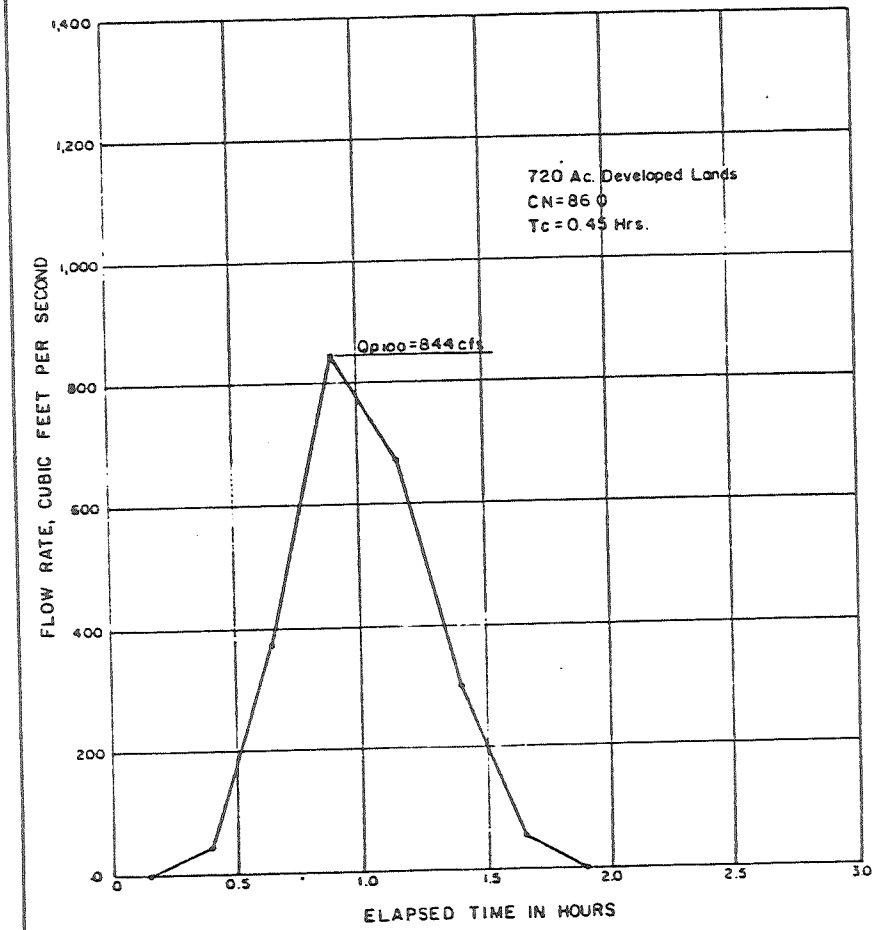
Date: DEC. 1980 | Drawing No. 2 | Page



GORDON HERKENHOFF & ASSOCIATES, INC.
302 Eighth Street, N.W.
Albuquerque, New Mexico 87102
(505) 247-0294

Description: SNOW VISTA CHANNEL
FLOW ACROSS GIBSON BLVD.

Date: DEC. 1980 | Drawing No. 3 | Page



GORDON HERKENHOFF & ASSOCIATES, INC.
302 Eighth Street, N.W.
Albuquerque, New Mexico 87102
(505) 247-0294

Description: SNOW VISTA CHANNEL
FLOW INTO ENERGY DISSIPATOR

Date: DEC 1980 | Drawing No. 4 | Page

Runoff Calculations

Off-site Runoff to San Ysidro:

D.A. (from Orthophoto) = 65 Ac.

P(100 yr - 6 hr) = 2.2 in.

Soil Type = A → C = 0.42

10 % developed (Mobile Home Park)

Predominately Sheet Flow

Length = 5100'

ΔH = 5192 - 5109 = 83' → S = 0.016

$$T_c = \frac{0.0078 (5100)^{.77}}{(.016)^{.385}} = 27 \text{ min.}$$

$$I = (2.2)(6.84)(27)^{-.51} = 2.80 \text{ in./hr.}$$

$$Q = CIA = 76 \text{ cfs}$$

Off-Site Runoff to Sunbow:

D.A. = 12.5 Ac.
P = 2.2 in.
C = 0.66 from Herkenhoff report
Length = 1525'
Slope (AVG. for streets) = 1%

$T_c = \frac{0.0078 (1525)^{.77}}{(.01)^{.385}} = 13$ min.

$I = 2.2 (6.84)(13)^{-.51} = 4.07$ in/hr.

Q = 34 cfs

Vol. = 65,885 cu. Ft.

Off-Site Runoff to Sunridge:

D.A. = 1 Ac.
P = 2.2 in.
C = 0.66
Length = 300'
Slope = 0.75 %

$T_c = 4$ min. $I = 7.42$ in/hr

Q = 5 cfs

On-Site Runoff - Phase I :

Existing :

D.A. = 3.3 Ac

P = 2.2

C = 0.40

Length = 715'

ΔH = 6' $\longrightarrow$ S = 0.008 ft/ft

$$T_c = 0.0078 \frac{(715)^{.77}}{(.008)^{.385}} = 8 \text{ min.}$$

$$I = 2.2(6.84)(8)^{-.51} = 5.21 \text{ in./hr.}$$

Q (undeveloped) = 6.9 cfs

Vol. = CDA = 10,542 cu. ft

Developed :

C = 0.70 all other parameters are same

Q (developed) = 12 cfs

Vol. = 18,448 cu. ft.

On-site Runoff – Phase II :

Existing :

D.A. = 12.33 Ac.

P = 2.2 in.

C = 0.40

Length = 1300'

ΔH = 8' $\rightarrow$ S = 0.0062 ft/ft

$$T_c = \frac{0.0078\,(1300)^{.77}}{(.0062)^{.385}} = 14 \text{ min.}$$

$$I = 2.2(6.84)(14)^{-.51} = 3.92 \text{ in/hr.}$$

Q (undeveloped) = 19 cfs

Vol = 39,327 cu. ft.

Developed :

C = 0.70

S = 0.75 %

L = 1539'

$$T_c = \frac{0.0078\,(1539)^{.77}}{(.0075)^{.385}} = 15 \text{ min.}$$

$$I = 2.2(6.84)(15)^{-.51} = 3.78 \text{ in/hr}$$

Q = 33 cfs

Vol = 68,927 cu. ft.

Runoff to SAGE:

D.A. = 58 Ac.

P = 2.2 in

C = 0.55

Since street flow is involved we will break T_c calculations into 2 components:

for overland $T_c = 0.0078 \frac{L^{.77}}{S^{.385}}$

for street flow $T_c = \frac{L}{60V}$

Overland Flow:

L = 2200'

$\Delta H = 5192 - 5156 = 36'$ → S = 0.016 ft/ft

$T_{c_1} = 0.0078 \frac{(2200)^{.77}}{(.016)^{.385}} = 14$ min.

Street Flow:

L = 3000'

→ S = 0.016 ft/ft

$\Delta H = 5156 - 5108 = 48'$

V = 3.4 fps

$T_{c_2} = \frac{3000}{3.4(60)} = 15$ min.

$T_c = 29$ min.

$I = (2.2)6.84(29)^{-.51} = 2.70$ in/hr.

$Q = 86$ cfs

Vol. = 254,753 cu. Ft.

Runoff from Unit I to Sage:

D.A. = 12 Ac.

P = 2.2 in

C = 0.66

$L = 2004'$ $S = 1\%$ AVG.

$T_c = 0.0078 \frac{(2004)^{.77}}{(.01)^{.385}} = 16$ min.

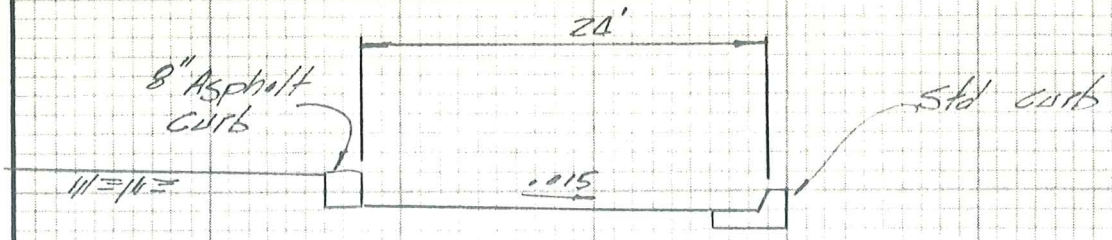
$I = (2.2)(6.84)(16)^{-.51} = 3.66$ in/hr.

$Q = 29$ cfs

Vol. = 63,249 cu. Ft.

STREET CAPACITIES

San Ygnacio : S = 2.25%



S = 2.25% (field measurements)

n = 0.017

Area = 11.76 Sq. Ft WP = 24.98 L.F.

$$V = \frac{1.486}{.017}\left(\frac{11.76}{24.98}\right)^{2/3}(.0225)^{1/2} = 7.93 \text{ fps}$$

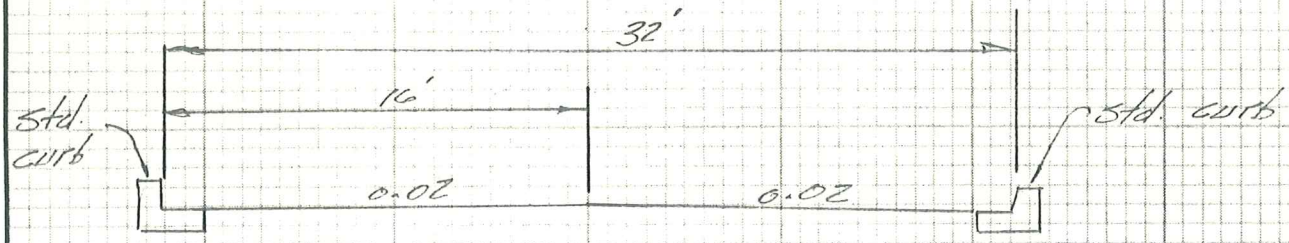
Q = 93 cfs ✓

Q reaching San Ygnacio = 76 cfs O.K.

D. MARK GOODWIN & ASSOC.
CONSULTING ENGINEERS

JOB Sunset West
SUBJECT Drainage
JOB NO. _____ SHEET 8 OF 10
BY MG DATE 8/18/89
CHECKED _____ DATE _____

Sunbow : S= 0.015



S = 1.50%

n = 0.017

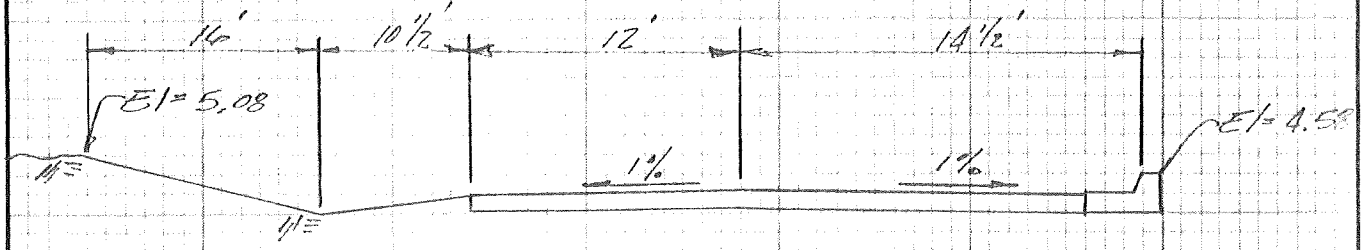
Area = 16.32 SQ. FT. WP = 33.34'

$$V = \frac{1.486}{.017}\left(\frac{16.32}{33.34}\right)^{2/3}(.015)^{1/2} = 6.65 \text{ fps}$$

Q = 109 cfs

Q in Sunbow = 34 cfs O.K.

SAGE



From attached rating curve:

n (ditch) = 0.03
n (street) = 0.017
Q (ditch) = 147 cfs
Q (street) = 303 cfs

→ Q_T = 450 cfs

flow in Sage = 100 cfs

SECTION 2 - MAIN CHANNEL - CHANNEL - STA 1 + 0 - Q = 450

	FLOW RATE	AREA	VEL	CONVEY	n-VAL	RCH	WET PR
CHANNEL	146.5	34.7	4.2	.0031	0.030	100	27
OVERBNK	303.5	38.5	7.9	.0209	0.017	100	28

WSEL =	106.79	VEL HD =	0.741	JUMP ELEV =	0.00
CRWSEL =	106.79	EN LOSS =	1.500	STA JUMP =	0.00
TOP WID =	54	EN GD LN =	107.53	JMP LOSS =	0.000
CHNL SLP =	1.5000 %	DEPTH =	1.05	RAPID FLOW	

SECTION DATA

POINT	STATION	ELEVATION	POINT	STATION	ELEVATION
1	0.00	106.58	2	16.00	104.94
3	23.00	105.32	4	39.00	105.44
5	53.00	105.22	6	54.00	106.08

STA OF LEFT OVERBANK = 0 STA OF RIGHT OVERBANK = 27

V. BIBLIOGRAPHY

1. Herkenhoff, Gordon, and Associates. Engineer's Report on Storm Drainage for Sunset West Unit 2. February 1980.

2. Andrews, Asbury, and Robert, Inc. Sage Road Improvements Drainage Report. December 1990.

3. Andrews, John. Telephone Conversations. February & March 1994.

4. Albuquerque Metropolitan Arroyo Flood Control Authority. AHYMO Computer Program and User's Manual. September 1993.

5. City of Albuquerque, et al. Development Process Manual. Volume 2, Design Criteria, Section 22.2 - Hydrology. January 1993.

6. Soil Conservation Service - Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico (1977)", United State Department of Agriculture.

7. Montoya, Carlos. Memorandum to Development Review Committee (DRC) concerning Sage Road Drainage Improvements, dated January 17, 1990.