City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

October 18, 1995

Howard C. Stone, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: REVISED DRAINAGE MASTER PLAN FOR LAS VENTANAS SUBDIVISION (B10/D3), SUBMITTED FOR BULK LAND PLAT APPROVAL, ENGINEER'S STAMP DATED OCTOBER 1995.

Dear Mr. Stone:

Based on the information provided in the resubmittal of October 12, 1995, the revised Drainage Master Plan for Las Ventanas Subdivision is approved for Bulk Land Plat with the following condition.

The report states that a temporary retention pond is to be used for drainage basin 315B. Before any development may occur within this basin, the downstream drainage facilities in Paradise Boulevard must be identified, designed and funded in order for a retention pond to be allowed. All drainage easements required between the proposed pond and any downstream facilities must also be in place prior to development. These issues must be addressed prior to development of Tracts H and J.

If you should have any questions, please do not hesitate to call me at 768-2666.

Sincerely,

Susan Calongne

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Tamara K. Morgan, Bohannan Huston
Cleve Matthews, Owner
File

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N.E. - ALBUQUERQUE, N.M. 87107
TELEPHONE (505) 884-2215

June 8, 1995

Mr. Fred Aguirre, P.E.
City of Albuquerque
PWD Hydrology
P.O. Box 1293
Albuquerque, NM 87103

RE: Las Ventanas Development, Map # B-10

Dear Fred:

We understand that you have received the second draft of the Las Ventanas Drainage Management Plan for review. As you are aware, Sandia Properties is pursuing a cost share arrangement with AMAFCA for the dam and outfall.

Seeing that the Las Ventanas Plan will be all encompassing and based on fully developed conditions, we anticipate that this document will dictate drainage development in this area in the future. I have marked our draft with several revisions and comments that Bohannan-Huston should address. Because this report directly impacts proposed City facilities, your input and comments are also warranted. Items such as interim facilities and interim requirements may need to be discussed further.

We understand that Bohannan-Huston will make a final revision based on City and AMAFCA comments. Once you or your staff have reviewed the document, I suggest we meet with all parties to discuss any concerns or implications, prior to development of the final draft.

Should you have any questions, do not hesitate to call me.

Sincerely,
AMAFCA

Kurt Browning, P.E.
Drainage Engineer

c: Ms. Susan Calongne, City/County Floodplain Administrator
Mr. Howard Stone, Bohannan-Huston
Mr. Cleve Matthews, Sandia Properties

4 1995

Las Ventanas Subdivision
Drainage Master Plan

April 1995
Updated October 1995

LAS VENTANAS SUBDIVISION DRAINAGE MASTER PLAN

Prepared for:

Sandia Properties Ltd.
#10 Tramway Loop NE
Albuquerque, NM 87122

BOHANNAN-HUSTON INC.
ENGINEERS • PLANNERS • PHOTOGRAMMETRISTS • SURVEYORS • LANDSCAPE ARCHITECTS
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ALBUQUERQUE — LAS CRUCES — SANTA FE

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EXECUTIVE SUMMARY

The proposed Las Ventanas Development is located between the extension of Paradise Boulevard and the extension of Irving Boulevard, directly west of the existing Paradise Hills community. This Drainage Master Plan has determined drainage patterns and peak flowrates for the primarily residential development. The analysis resulted in a conceptual plan for on-site drainage infrastructure to protect development and safely accommodate on-site and off-site 100-year flows.

This Drainage Master Plan proposes to implement a major element of the draft "Piedras Marcadas Drainage Management Plan" (PMDMP), 1993, prepared for AMAFCA by Molzen-Corbin & Associates. AMAFCA's purpose in performing the PMDMP was to obtain a hydrologic analysis of the Piedras Marcadas watershed, identify drainage deficiencies, and develop alternative solutions.

The PMDMP concluded, that without additional improvements, new development would cause the Piedras Marcadas Dam to be overwhelmed. Under existing conditions, 65% of the Las Ventanas plan area discharges to the Middle Branch of the Piedras Marcadas watershed via Paradise Hills Boulevard. According to the PMDMP, the Petroglyph National Monument (in the Middle Branch of the Piedras Marcadas Arroyo) is being subjected to severe erosion that could be worsened by developed flows.

The proposed drainage plan for Las Ventanas provides the opportunity to significantly reduce the impact of developed flows on the Monument and Piedras Marcadas Dam. This is accomplished by diverting as much of the flows as possible to the Calabacillas Arroyo at the eastern edge of Las Ventanas. This drainage solution is similar to the highest ranked alternatives proposed in the PMDMP. AMAFCA, in its March 23, 1995 Board meeting, acknowledged the two diversions identified in the PMDMP. The Board acknowledged the diversion at Lyons Boulevard and the Las

Ventanas Diversion as being necessary to address the downstream capacity problems.

The proposed diversion at Las Ventanas is anticipated to be an AMAFCA regional facility. This diversion is a cost efficient regional solution for the Piedras Marcadas watershed since it would significantly reduce the cost of downstream improvements in Paradise Boulevard and in Lyons/Unser Boulevards.

This Drainage Master Plan recommends maximizing the drainage basin area that can drain to the proposed AMAFCA pond, named Las Ventanas Drainage Facility No. 1 (LVDF No. 1), in the eastern portion of the site. This plan diverts basins into this pond that were not diverted in the PMDMP. These include on-site basins in the northern portion of Las Ventanas and off-site basins west of Las Ventanas that historically drain to the West Branch of the Calabacillas Arroyo, and basins in the southern portion of Las Ventanas that historically drain to the Boca Negra Arroyo. The increase over the PMDMP in contributing drainage basin area to LVDF No. 1 is 0.770 sq. mi. for a total of 2.045 sq. miles, and peak 100-year inflow increases from 1808 to 2998 cfs. Diverting flows from the West Branch of the Calabacillas is advantageous to the system since it eliminates the need for another outfall and energy dissipator into the Calabacillas Arroyo and negates the need for future improvements upstream of the Las Ventanas Diversion outfall.

LVDF No. 1 was enlarged beyond the size of the PMDMP pond to accommodate the higher flowrates that resulted from increasing the contributing drainage basin area by 30%. Two main systems provide the diversions to LVDF No. 1. The West Branch Calabacillas Diversion System in the northern portion of Las Ventanas primarily drains the basins that historically flow to the West Branch of the Calabacillas Arroyo. The North Branch Piedras Marcadas System in the central portion of Las Ventanas primarily drains the basins that historically flow to the Middle Branch of the Piedras Marcadas.

Outflow from LVDF No. 1 is 49 cfs and is routed north to the West Branch of the Calabacillas in a 42" outfall pipe. The 42" increases to 60" (utilizing the 60" pipe AMAFCA salvaged from Golf Course Road) where it intercepts flows from a smaller second AMAFCA pond, named Las Ventanas Drainage Facility No. 2 (LVDF No. 2). Total outflow to the Calabacillas is 91 cfs. This outfall scenario (Scenario "A") was first developed in the BHI November 15, 1994 report, "Las Ventanas Subdivision Outfall Scenarios to the West Branch of the Calabacillas," (see Appendix H) and was modified for this Drainage Master Plan.

Outfall Scenario "A" (large detention pond and small outfall pipe) was determined to be the most prudent choice from an economic as well as a drainage perspective. It was shown to be economically preferable in a cost analysis for three different outfall scenarios (see Appendix H), and was determined to be the drainage system most capable of reducing developed flows to near-historic levels.

LVDF No. 1 and No. 2 and their outflow pipes, and the pipes that convey the two ponds' discharge flows to the West Branch of the Calabacillas, are proposed to be AMAFCA facilities. All on-site channels are proposed to be concrete-lined and maintained by AMAFCA. Concrete-lined channels have been proposed due to the highly erodible soils, high velocities resulting from the concentration of developed runoff, and resultantly high maintenance costs associated with softer channel linings under these conditions. Mitigation of the aesthetic impact of concrete-lined channels is proposed to be accomplished through the dedication of channel corridors, varying in width from 100' to 130', which will include extensive trail and landscape improvements on both sides.

1.0 INTRODUCTION

1.1 Purpose and Scope

This report summarizes the findings of a hydrologic analysis of existing and developed drainage conditions for the proposed Las Ventanas Subdivision and formulates a drainage master plan for the development of the property.

This report is intended to:

1) Evaluate drainage in Las Ventanas Subdivision based on the Piedras Marcadas hydrologic model prepared by Molzen-Corbin & Associates in 1993, with modifications.

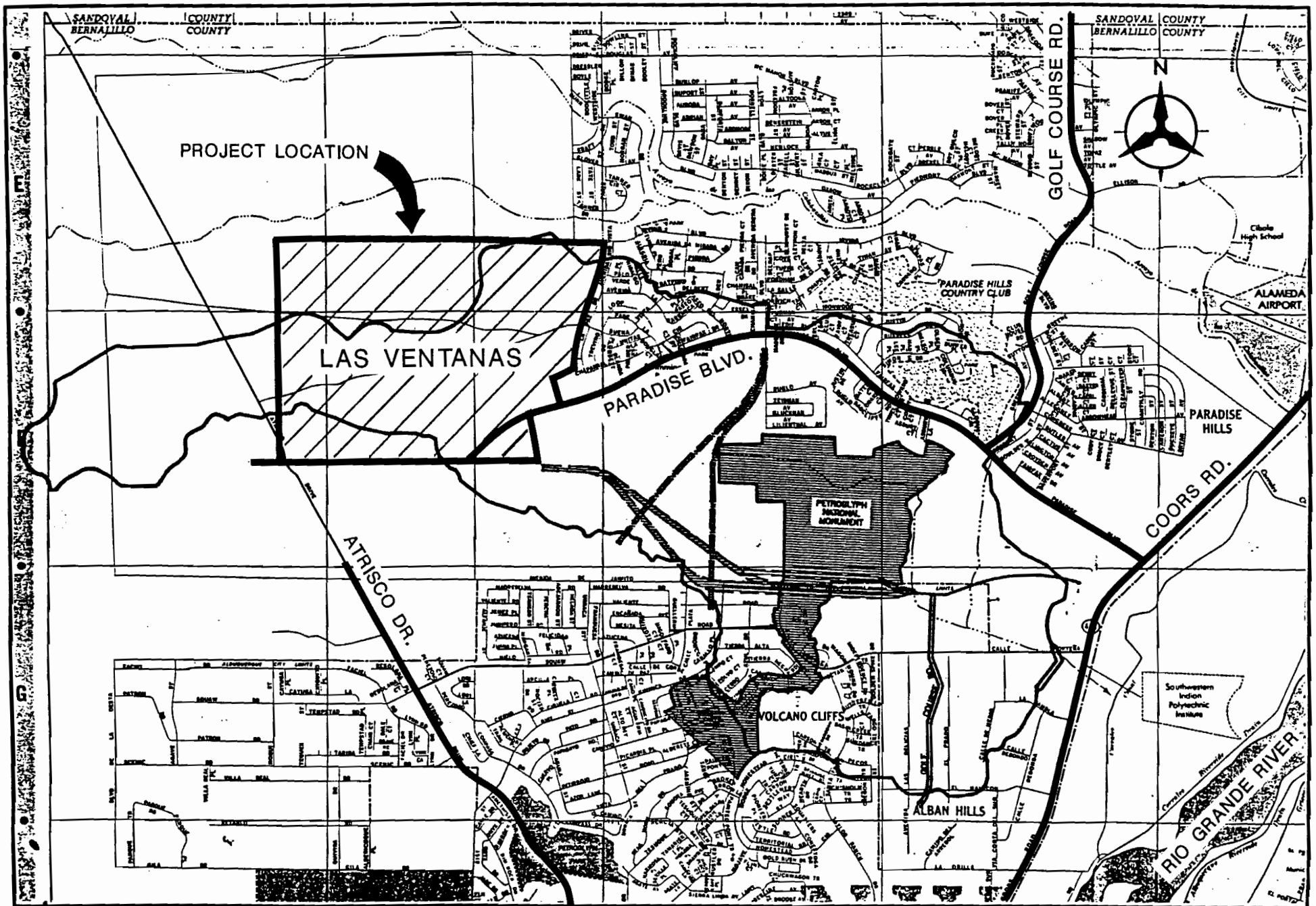
2) Provide a conceptual plan for drainage in order to determine drainage facilities sizes and total costs.

3) Provide drainage outfall alternatives.

The phasing of the construction of the drainage facilities described in this report are addressed in a separate report entitled "Las Ventanas Subdivision Interim Drainage Facilities Plan."

1.2 Property Description and Proposed Development Concepts

Las Ventanas Subdivision is located within the Albuquerque City limits in Bernalillo County and lies directly west of the existing Paradise Hills Subdivision (see Vicinity Map, Figure 1).



VICINITY MAP
FIGURE 1

LAS VENTANAS DRAINAGE MASTER PLAN

DEC. 1994 JOB. NO. 94118.20

Las Ventanas occupies an area of 940 acres, or approximately 1.5 square miles. The parcel has approximate dimensions of 1 mile (north-south) by 1.5 miles (east-west).

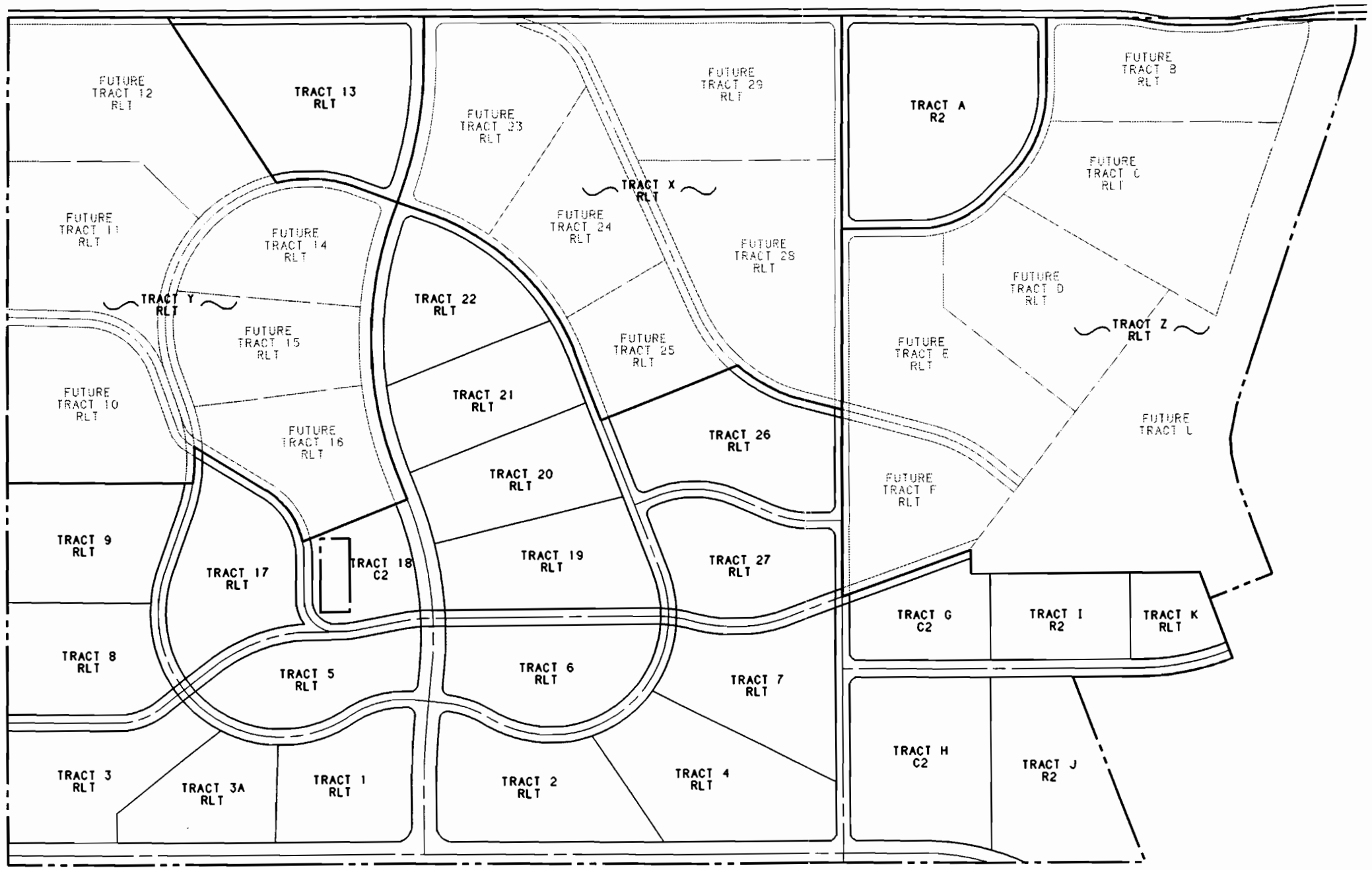
The boundaries of Las Ventanas are: Paradise Hills Subdivision to the east, future Irving Boulevard along the north, future Paseo del Norte Boulevard along the south, and undeveloped land along the west boundary. Access to the property will be along the south via the existing Paradise Boulevard extension and proposed westward extension of Paseo del Norte, and along the north via the proposed westward extension of Irving Boulevard.

The development concept (see Conceptual Development Master Plan, Figure 2) consists primarily of low to medium density residential land uses with a small area of high density residential land use. Also included are some institutional (probable elementary school) and commercial land uses. Current zoning for the property will permit up to 4500 dwelling units. The density of development will vary from approximately 3 dwelling units per acre (du/ac) to 5 du/ac in the single family residential areas, and a maximum of 24 du/ac in the multi-family residential areas.

2.0 SITE CHARACTERISTICS

2.1 Topographic Features

The terrain of Las Ventanas slopes downward from west to east, with a maximum elevation difference of approximately 150 feet, with an average slope of about 2%.



NORTH

100 500
0 200 1000
SCALE : 1" = 800'

CONCEPTUAL DEVELOPMENT MASTER PLAN FIGURE 2

LAS VENTANAS
DRAINAGE MASTER PLAN

OCTOBER 1995 JOB NO. 94118.20

In its current undeveloped state, the site vegetation consists of mainly native brush, with a few cedar trees in the eastern portion. A water well and storage reservoir owned by New Mexico Utilities occupy a 2-acre site in the western portion of the parcel, and an existing underground gas pipeline cuts diagonally across the southwest corner of the subdivision. An overhead power line runs north-south midway through the eastern half of the property.

2.2 Soil and Subsurface Basalt

According to Soil Conservation Service maps, the soil types over the site vary and are classified as Bluepoint loamy fine sand, Madurez loamy fine sand and Madurez-Wink, and Alameda sandy loam. These correspond to hydrologic soil group classifications of A, B, and C, respectively.

The subsurface condition of underlying basalt bedrock significantly affects the planning of Las Ventanas. For the site, the shallowness of the basalt layer ranges from surface level in the east down to soil cover depths greater than 20 feet in the western portion of the property.

Basalt depths were provided by two separate studies: SHB AGRA dated November 12, 1993, and Geo-Test dated October 13, 1994. Both studies give basalt depths based on data obtained from soil borings.

The SHB report gives basalt depths over the entire site based on borings made in a grid pattern every 300 feet. The Geo-Test report provides a more detailed study of the south portion of the site and gives basalt depths along the waterline easement from the well site eastward to the large playa in the east.

According to the data, the depth to basalt is 0 to 4' for the eastern half of the site. The western half of the site has a minimum depth of 20' to the underlying basalt

layer. The surface of the basalt is irregular and quite weathered. The top 0 to 3' is most likely rippable by conventional equipment, but areas of hard dense rock can be expected. Rock profile is being developed for the proposed outfalls from LVDF No. 1 and No. 2.

2.3 Site Grading

The issue of shallow rock is to be resolved through significant grading of the property, moving large volumes of deep soils from the west side of the site towards the east side of the site to be used as fill. It is anticipated that cut depths in the westerly one-third of the site will average 15-20' in order to provide adequate soil cover by filling the easterly two-thirds of the site by an average of 5-10'. A Conceptual Master Grading Plan is provided for reference in Appendix G. The Conceptual Grading Plan will be developed in phases as the subdivision is developed with appropriate drainage facilities and erosion protection facilities.

3.0 HYDROLOGIC ANALYSIS

3.1 Previous Hydrologic Analysis

The basis for Las Ventanas' hydrology is the AHYMO model in the Piedras Marcadas Drainage Management Plan (PMDMP) prepared by Molzen-Corbin & Associates for AMAFCA (May 1993).

3.2 Base Information

The aerial map with contours from the PMDMP report as well as the existing FEMA aerial map with contours were used to determine elevations and slopes. A

digital topographic database for the property was prepared by BHI for detailed grading analysis and evaluation of soil cover and earthwork volumetrics.

3.3 Assumptions and Procedures Used in this Analysis

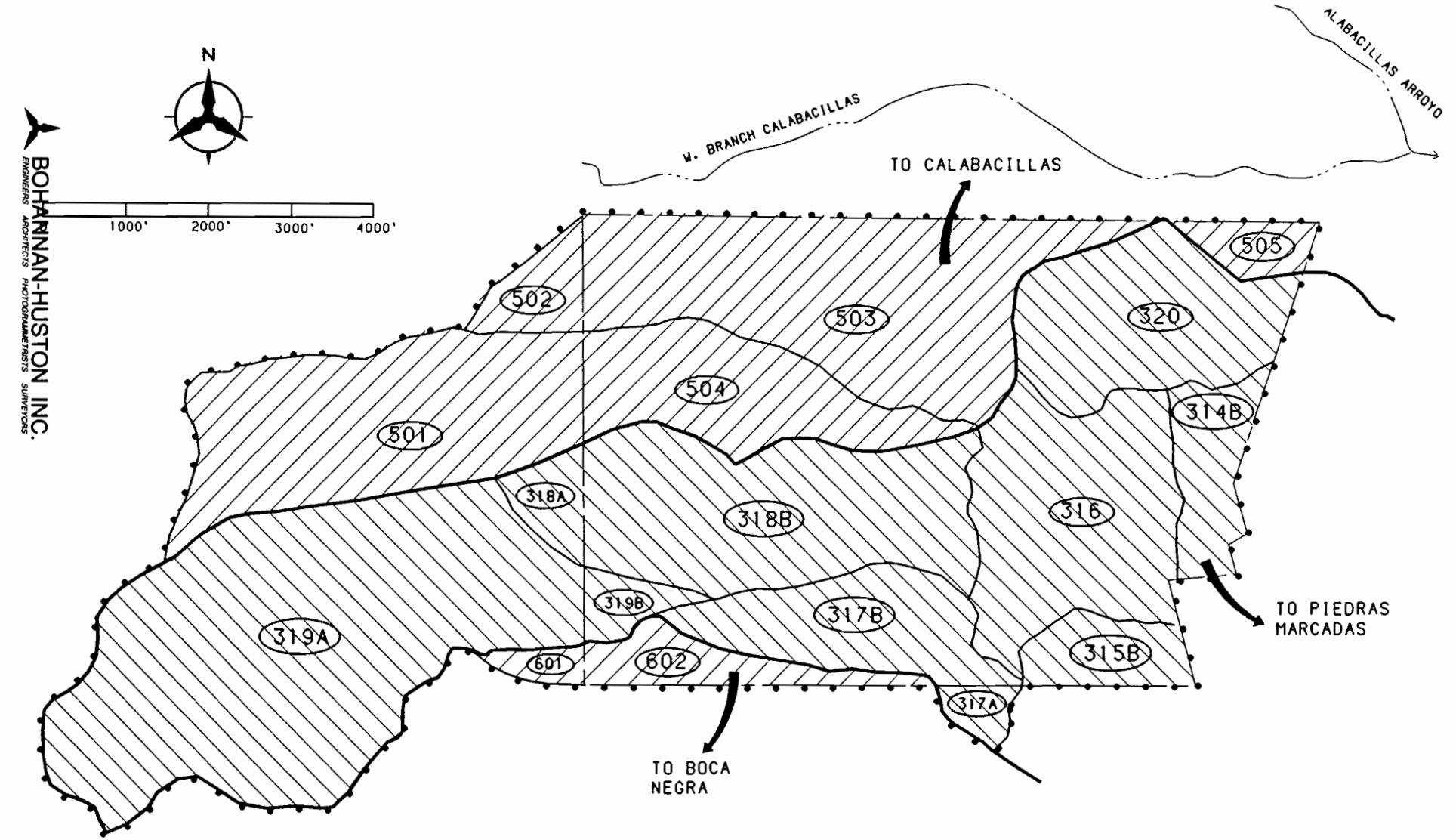
For the hydrologic analysis, the City of Albuquerque's Development Process Manual (DPM), Chapter 22, Section 22.2 was followed. The systems for retaining and routing the flows were analyzed using the AMAFCA PC version of the AHYMO program (updated January 1994). Following are the assumptions and procedures that were used to produce the analysis.

3.3.1 Basin Identification

1) Contributing hydrologic basins for the analysis with existing overall basin flow patterns are shown in the Overall Basin Map, Figure 3. For greater detail, see the Master Drainage Basin Maps in the Appendix.

2) Basins with "300" ID numbers historically discharge to the Piedras Marcadas Middle Branch watershed. The same basin ID numbers from the PMDMP were used in this analysis. These include Basins 314, 315, 316, 317, 318, 319, and 320.

3) Basins 314, 315, 317, 318, and 319 are crossed by the boundary of Las Ventanas. These basins have been subdivided at the boundary so that inflow and outflow data for Las Ventanas could be compared for existing and developed conditions. The subdivided basins are noted by the "A" and "B" suffixes in the basin ID numbers. Basins with the suffix "B" are inside the Las Ventanas boundary.



601 BASIN ID.

• • • STUDY AREA LIMITS

BOUNDARY OF LAS VENTANAS

BOUNDARY OF PIEDRAS MARCADAS WATERSHED FROM MOLZEN-CORBIN 1993 PIEDRAS MARCADAS DRAINAGE MANAGEMENT PLAN (PMDMP)

BASIN FROM PMDMP

BASINS OUTSIDE OF PIEDRAS MARCADAS (PMDMP) WATERSHED

EXISTING FLOW PATTERN

OVERALL BASIN BOUNDARY MAP FIGURE 3

LAS VENTANAS
DRAINAGE MASTER PLAN

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4) Basins with "500" and "600" numerical ID's are in this analysis, but were not in the PMDMP. This is because these basins do not historically flow to the Piedras Marcadas watershed. Basins 501, 502, 503, 504, and 505 historically flow north to the Calabacillas, and Basins 601 and 602 flow south to Boca Negra Arroyo. The development of Las Ventanas is proposed to consolidate flows generated within the project site and those entering Las Ventanas from off site; therefore, the 500 and 600 basins are included. These internal diversions were accomplished in order to consolidate detention facilities and outfall structures reducing maintenance costs and impacts upon downstream properties.

5) The north and south boundary lines of Basin 318B, and the south boundary of 319B are not the same in the existing and developed conditions. For existing conditions, the PMDMP's boundaries for these basins were used in order to arrive at the same flows for existing conditions. For developed conditions, the PMDMP boundary lines of Basins 318B and 319B were adjusted slightly so that they would fall squarely on the ridges that define those basins.

3.3.2 Treatment Types and Time of Concentration Values

1) The basis of this study is the PMDMP. Therefore, for existing conditions, the treatment types and time-of-concentration are exactly the same as the PMDMP for the "300" basins that are featured in both this report and the PMDMP. This was done so that the resultant runoff rates for existing conditions would be equivalent to those in the PMDMP. Treatment types are given in Appendix A, Treatment Types for Existing and Developed Conditions.

2) For developed conditions, treatment types A through D were determined according to the proposed dwelling density and land usage for each basin in the subdivision. The Las Ventanas Conceptual Development Master Plan, Figure 2, was used for determination of type D percentages. Outside of Las Ventanas, land treatments were the same as in the PMDMP, i.e., fully developed conditions were assumed for upstream off-site flows.

3) For the "500" and "600" basins in existing conditions, and for all basins in developed conditions, time-of-concentration values were determined according to procedures given in DPM Section 22.2, Part B. These calculations are provided in Appendix B, Basin Time of Concentration Calculations.

3.3.3 Rainfall

The 100-year 24-hour storm was used in the analysis. For the existing and developed conditions, the same rainfall values were used as input for AHYMO as in the PMDMP. These values are:

Rain One (1 hour - 100 year)	1.84	inches
Rain Six (6 hour - 100 year)	2.20	inches
Rain Day (24 hour - 100 year)	2.66	inches

The AHYMO default values for initial abstraction and infiltration were used.

3.3.4 Sediment Bulking

For the overall analysis of existing conditions, 10% sediment bulking was applied to the flows as recommended in the PMDMP. The analysis of developed conditions

applied a sediment bulking of 2.5%, a slightly more conservative value than the 2% used in the PMDMP.

The analysis of development phasing (see Section 7.4, Development and Infrastructure Phasing) involved a combination of existing and developed regions. For this analysis, 10% sediment bulking for existing conditions was used (same as the PMDMP), and 2.5% for developed regions was applied (slightly more conservative than the PMDMP). LVDF No. 1 and No. 2 were analyzed for fully developed conditions using 2.5% sediment bulking resulting in total volumes of sediment yield in the two ponds of 204,000 cf and 18,000 cf, respectively for one 100-year, 24-hour storm. LVDF No. 1 and No. 2 will be sized for 5-year sediment accumulation.

4.0 EXISTING CONDITIONS

Under existing conditions, the runoff from all the basins with "300"-numbered ID's is discharged to the Middle Branch Piedras Marcadas Arroyo. The runoff from the "500"-numbered basins is conveyed north to the Calabacillas, and the "600"-numbered basins discharge south to the Boca Negra. These existing flow patterns are shown with arrows in Figure 3, Overall Basin Map.

4.1 Middle Branch Piedras Marcadas Flows

Flows that historically discharge to the Middle Branch of the Piedras Marcadas originate at the top of Basin 319A, west of Las Ventanas. The majority of this runoff enters Las Ventanas and is conveyed in series to two main storage areas. The first area is the playa (Loop Road Playa, see Figure 4 or Figure 6) situated east of the well site in Basin 318B. The second is the playa in Basin 316 (Main Playa, see Figure 4 or Figure 6), which is the only FEMA floodplain in the Las Ventanas Drainage Master

Plan area. According to the 1983 FEMA mapping, this floodplain covers an area of approximately 5 acres.

Flows exiting the playa in Basin 316 (Main Playa) are conveyed east out of Las Ventanas to Paradise Hills Subdivision. These flows combine with flows from Basin 314B and Basin 315B and eventually discharge to the Middle Branch Piedras Marcadas Arroyo. Basin 320 flows through a playa in the east of that basin, exits Las Ventanas to the east, flows through Paradise Hills Subdivision, and outfalls to the Middle Branch Piedras Marcadas.

4.2 West Branch Calabacillas Flows

Flows that historically discharge to the Calabacillas originate at the top of Basins 501 and 502, west of Las Ventanas. These basins flow east, enter Las Ventanas, combine with Basins 503 and 504, are conveyed northward by the arroyo in the east of Basin 503, and are discharged to the West Branch of the Calabacillas. Basin 505 in the northeast corner of the subdivision also discharges to the West Branch of the Calabacillas.

5.0 METHODOLOGY

5.1 Modifications to the PMDMP

The PMDMP only analyzed the basins contributing to the Piedras Marcadas system. The northern one-third of the property was not modeled by the PMDMP. The areas not contributing to the Piedras Marcadas system (500s and 600s) were added to the AHYMO model (see Overall Basin Map, Figure 3). All off-site contributing basins, similar to the PMDMP, were modeled assuming fully developed conditions. A density of 6 dwelling units per acre was used for fully developed conditions.

The model for Las Ventanas updates the PMDMP by diverting more basins to the existing playa/proposed dam area in Basin 316 on the east side of the subdivision.

The most significant modifications that were made to the PMDMP model include the following:

- The flows in the northern part of the project site that historically drain northward to the Calabacillas Arroyo ("500" basins) were incorporated into this new analysis and diverted to the proposed LVDF No. 1 under developed conditions in order to consolidate detention ponding and outfall infrastructures.

- The flows in the southwestern portion of the site that historically drain southward to the Boca Negra ("600" basins) were also incorporated into this new analysis and diverted to the proposed LVDF No. 1 under developed conditions in order to reduce the impact upon downstream properties, including the Petroglyph Monument, for stormwater discharges.

- The hydrologic parameters were refined so that they would more accurately reflect the proposed development planned for Las Ventanas.

- Storage volumes for the two largest playas in existing conditions were changed from the PMDMP. The two largest playas are Loop Road Playa in east Basin 318 and Main Playa in Basin 316 (see Figure 4 or Figure 6). The volumes were recalculated using the new BHI mapping by first digitizing the areas of the playas' contours, then converting areas to volume using the formula for a truncated cone volume.

5.2 Existing and Developed Flows in Las Ventanas

Drainage area sizes and peak flowrates for the 100-year storm under existing and developed conditions are outlined in Table 1. Figure 4 depicts the existing drainage basins and the flows entering and leaving the Las Ventanas Subdivision under existing conditions. Figure 5 shows the developed drainage basins along with the flows entering and leaving the subdivision. Names for basins and analysis points correspond to hydrograph ID numbers in the AHYMO Summary Tables for Existing and Developed Conditions, Appendices E and F.

Table 1

Flowrates for Existing and Developed Conditions

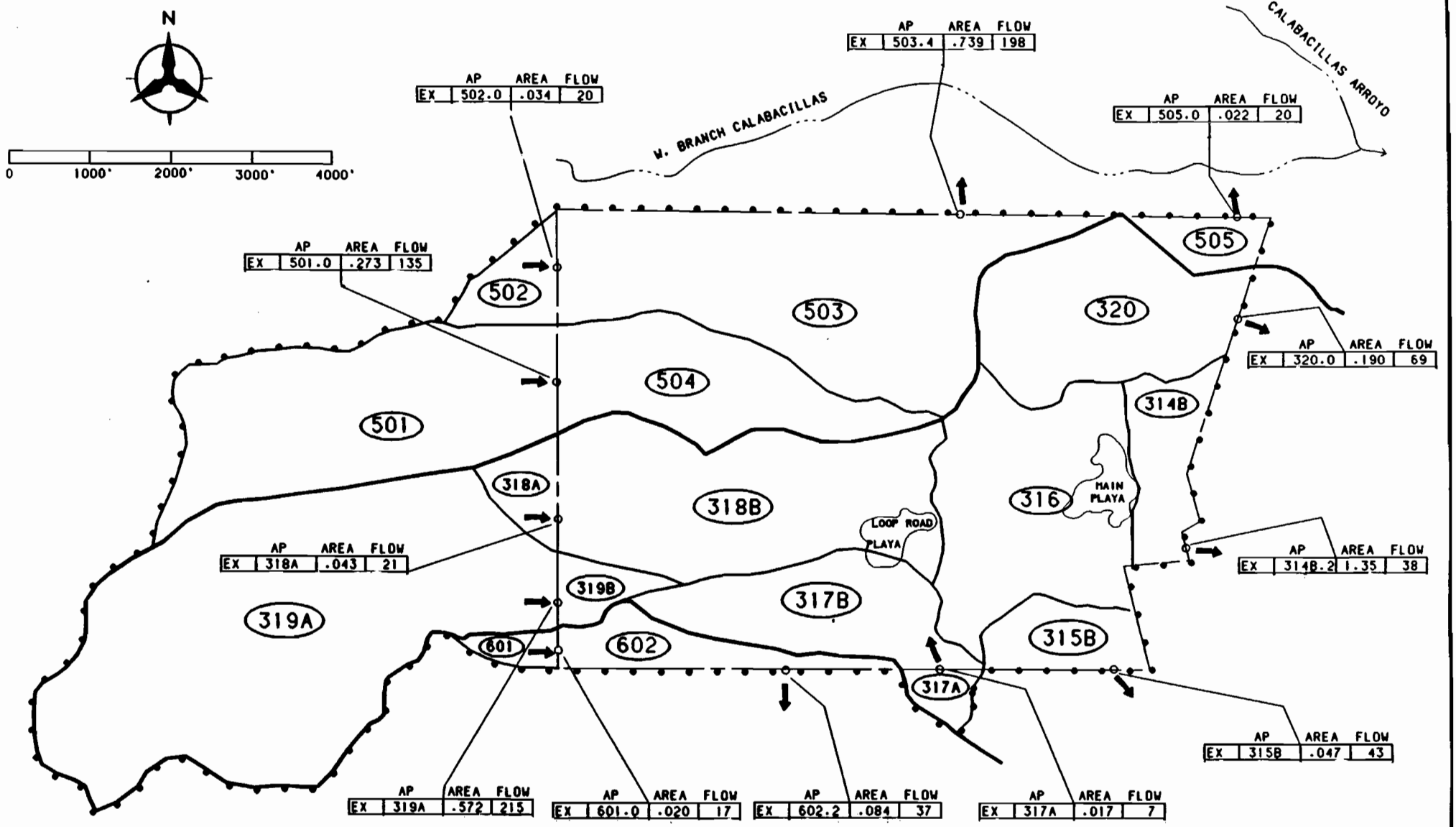
Flow Into Las Ventanas Subdivision

EXISTING			DEVELOPED		
Analysis ID	Drainage Area (sq mi)	Flow (cfs)	Analysis ID	Drainage Area (sq mi)	Flow (cfs)
501	.273	135	501.0	.273	432
502.0	.034	20	502.0	.034	76
318A	.043	21	318A	.043	96
319A	.572	215	319A	.572	959
601.0	.020	17	601.0	.020	45
317A	.017	7	317A	.017	38

Flow Out of Las Ventanas Subdivision

EXISTING			DEVELOPED		
Analysis ID	Drainage Area (sq mi)	Flow (cfs)	Analysis ID	Drainage Area (sq mi)	Flow (cfs)
503.4	.739	198	503E.1	.080	115
505.0	.022	20	505.2	2.28	92
320.0	.190	69	320.0	.190	0
314B.2	1.35	38	314BS	.023	34
315B	.047	43	315B.1	.047	39*
602.2	.084	37	602.2	.084	0

*Developed flow = 0 cfs if a retention pond is used in Basin 315B.
Developed flow = 39 cfs if a detention pond is used.



ANALYSIS PT. I.D. — AP
CONTRIBUTING DRAINAGE AREA (SQ. MILE) — AREA
PEAK FLOW (cfs) — FLOW

EXISTING CONDITION → EX | 501.0 | .273 | 179

➡ EXISTING FLOW DIRECTION

EXISTING FLOWS IN LAS VENTANAS
FIGURE 4

LAS VENTANAS
DRAINAGE MASTER PLAN

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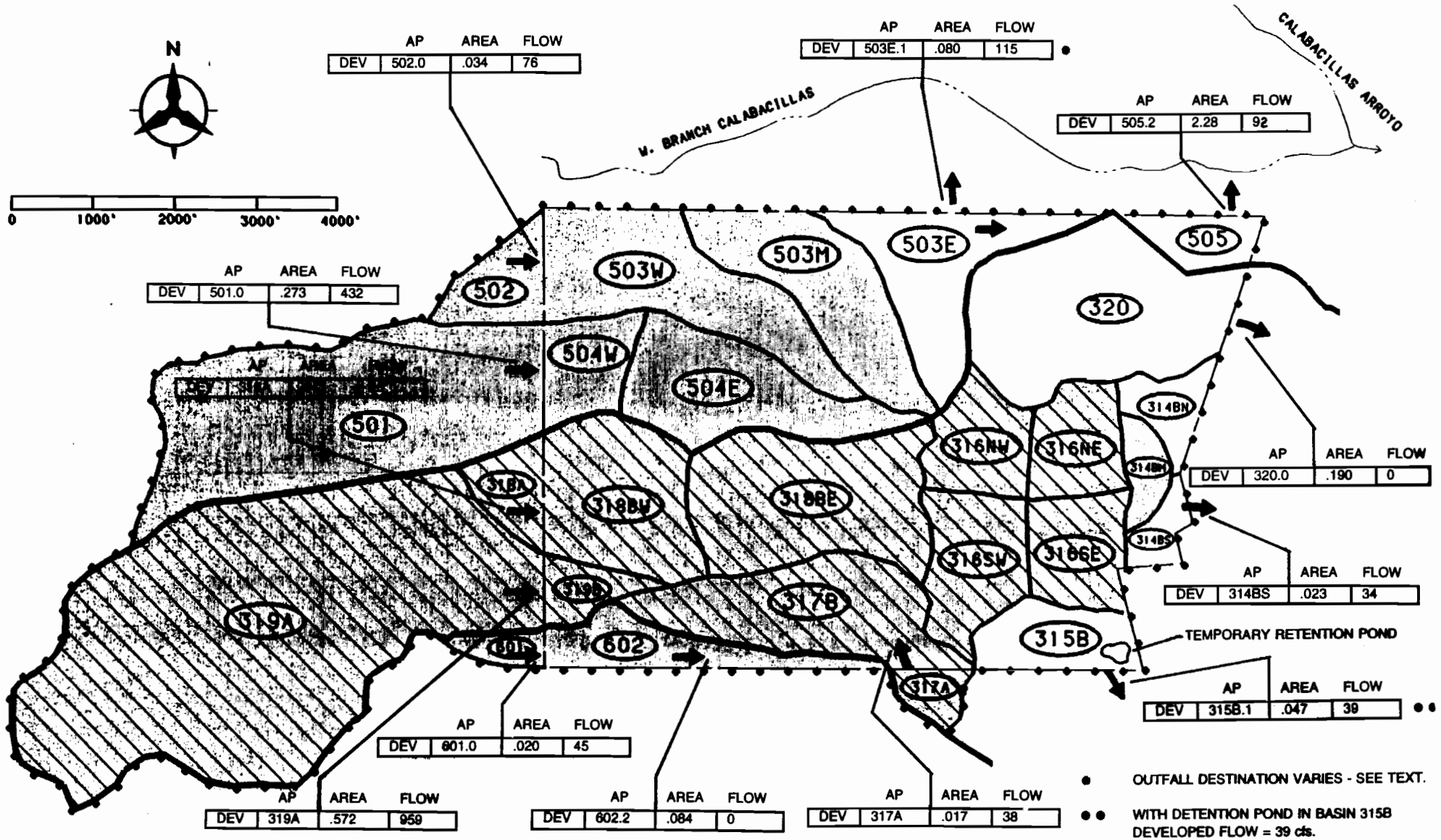

NOTE: FOR PROPOSED DEVELOPED CONDITIONS FLOW PATHS & DIVERSIONS, SEE FIGURE 6.

CONTRIBUTING BASINS FOR LAS VENTANAS DRAINAGE & RECREATION FACILITY NO. 1 DEVELOPED CONDITIONS

FIGURE 5

LAS VENTANAS
DRAINAGE MASTER PLAN
APR. 1995

JOB NO. 94118.20

Developed flows exiting Las Ventanas are larger than existing flows at one location--AP 505.2, which is the outfall to the West Branch of the Calabacillas.

The balance of flows to the Calabacillas, Piedras Marcadas, and Boca Negra is as follows:

Sum of flows to Calabacillas:

Existing	218 cfs
Developed	207 cfs
Change	-11 cfs

Sum of flows to Piedras Marcadas via Paradise Boulevard (with proposed temporary retention pond vs. temporary detention pond):

Temporary retention pond: in Basin 315B		Temporary detention pond in Basin 315B	
Existing	150 cfs	Existing	150 cfs
Developed	0 cfs	Developed	39 cfs
Change	-150 cfs	Change	-111 cfs

Note that these ponds are not two separate facilities, but one facility only, to be located in Basin 315B in the southeast corner of Las Ventanas. This facility is proposed to be a temporary retention pond that will be converted into detention when downstream drainage facilities in Paradise Boulevard can be constructed.

Sum of flows to Boca Negra:

Existing	37 cfs
Developed	0 cfs
Change	-37 cfs

6.0 DEVELOPED CONDITIONS

Development will increase peak discharge and runoff volume throughout the Las Ventanas drainage area. This plan proposes diverting basins to the existing playa/proposed dam area in Basin 316 on the east side of the subdivision. This consolidates within the project site the flow that historically is conveyed through and out of Las Ventanas.

AMAFCA is currently implementing Alternative 7 of the PMDMP which includes two diversions from the Piedras Marcadas Watershed to the Calabacillas Watershed. Similar to PMDMP Alternative 7, this Drainage Master Plan effectively concentrates drainage facilities within Las Ventanas and reduces the number of discharge points and uncontrolled flows that outfall to the Piedras Marcadas and the Calabacillas Arroyo. Proposed diversions and conveyance structures are pictured in the Conceptual Drainage Plan, Figure 6, and have been identified within the report titled "Las Ventanas Subdivision Outfall Scenarios to the West Branch of the Calabacillas," which is included in Appendix H. Appendix G contains a Conceptual Grading Plan for Las Ventanas.

The outfall to the Calabacillas includes LVDF No. 1 and No. 2, their outflow pipes, and the pipes that convey the two ponds' discharge flows to the West Branch of the Calabacillas. The structures of the outfall are AMAFCA facilities. All other ponds in Las Ventanas are city-maintained facilities. All on-site concrete-lined, open channels in Las Ventanas will be maintained by AMAFCA. All underground storm sewer, excluding

the outfall for LVDF No. 1 and 2 (which will be maintained by AMAFCA), will be maintained by the City of Albuquerque.

6.1 Developed Conditions Flow Scenario

There are two main systems for conveying flows. The northern system is the West Branch Calabacillas Diversion System which primarily drains the basins that historically flow to the Calabacillas. The southern system is the North Branch Piedras Marcadas System and primarily drains the basins that historically discharge through the existing playa in Basin 316.

6.1.1 West Branch Calabacillas Diversion System

A pipe (Reach 1) collects the flows that enter the site from just south of the northwest corner of Las Ventanas. These flows are attenuated by routing through a proposed city-maintained pond/park in Basin 503W. This concept has been coordinated with representatives of the City of Albuquerque Parks and General Services Department. The pond outflows to a pipe (Reach 2) that collects additional flows from the surrounding basins. This pipe extends east in the Loop Road to the intersection of Rainbow Boulevard and joins Reach 3.

Basin 503E is too low in elevation to be drained to LVDF No. 1. This can either drain to the north to the West Calabacillas Arroyo or east to LVDF No. 2. If it is drained to the north, it will be carried in a storm drain within the right-of-way for the proposed future extension of Universe Boulevard. This decision of which way to drain this area will occur at the time Basin 503E is developed.

In Rainbow Boulevard, north of the Loop Road, a pipe (Reach 4) collects local flows and outfalls south to the Loop Road, where it is intercepted by Reach 3. This pipe and the West Branch Calabacillas Diversion Channel collect the flows that

historically drain to the West Branch of the Calabacillas from the northwest region of Las Ventanas. The pipe flow is added to the West Branch Calabacillas Diversion Channel, which is routed past a neighborhood park site. Downstream of the park site, the channel outfalls into LVDF No. 1 (the large pond in Basin 316) from the northwest.

6.1.2 North Branch Piedras Marcadas System

This system has the largest upstream flow contribution, mostly due to the large surface area of contributing basins. Included are the large basins west of Las Ventanas, Basins 501 and 319A.

Tributary A Channel, Tributary B Channel, and a pipe (Reach 5) collect the flows entering Las Ventanas from Basins 501, 319A, and 318A, respectively. At the well site/park in the middle of Basin 318B, Tributary A and Tributary B converge to the North Branch Piedras Marcadas Channel. This channel continues east and intercepts flows from Basin 317B.

Basins 601 and 602 historically flow to the Boca Negra, and Basin 317A is outside of the limits of Las Ventanas, but all three basins are diverted as street flows and remain within the Las Ventanas system. These flows are added to the North Branch Piedras Marcadas Channel at its intersection with Universe Boulevard. The channel then outfalls to LVDF No. 1 from the west.

Basin 314BS is the basin that will remain undeveloped east of the LVDF No. 1 (between the pond and Paradise Hills). The runoff from this basin will be directed to the streets that end at the existing Paradise Hills Subdivision. This is where runoff currently goes now.

6.2 Outfall to the Calabacillas

Three scenarios for this outfall system were evaluated in a separate report (see Appendix H) entitled "Las Ventanas Subdivision Outfall Scenarios to the West Branch

of Calabacillas," dated November 15, 1994. Scenario "A" (large pond, small pipe) from the report was chosen for the outfall system, with modifications in pipe sizes and costs.

Two ponds operating in parallel are used in the outfall system. LVDF No. 1, the larger of the two, outfalls to a pipe (Reach 6) which extends north. The other pond, LVDF No. 2, collects flows from Basin 320 and outfalls to a pipe (Reach 7), which flows east. Reach 7 is intercepted by Reach 6, and the combined flows are routed through a pipe (Reach 8) north. Basin 505 is added to Reach 8 at the northwest corner of Las Ventanas, and the combined flows are conveyed north to the West Branch of the Calabacillas Arroyo.

LVDF Nos. 1 and 2, and the pipes in Reaches 6, 7, and 8, are to be AMAFCA facilities. The infrastructure channels proposed for the West Branch Calabacillas Diversion and the North Branch Piedras Marcadas systems (includes Tributaries A and B) are proposed to be AMAFCA-maintained facilities.

6.3 Paseo del Norte

Paseo del Norte presently is constructed as a two-lane rural section on the southern border of the Las Ventanas Subdivision. As shown on Figure 5, Paseo del Norte is the southern divide for Basins 601 and 602. For the ultimate roadway section a total of 9 cfs will be collected in the north-half of the street from the high point near Basin 602 east to the low point in the road at the intersection of Rainbow Boulevard. The total flow of 12 cfs at this point will be collected by inlets and carried under Paseo del Norte into the existing arroyo, which is part of the Boca Negra system.

public
No - into ROW

From Rainbow Boulevard to Universe Boulevard a total of 11 cfs will be generated on the north-half of the street. This flow will be directed from Paseo del Norte north on to the west side of Universe Boulevard. The runoff will then be collected into inlets just south of the intersection at Paradise Boulevard and from there will be directed in a storm drain to the North Branch of the Piedras Marcadas Channel. Additionally, 38 cfs from Basin 317A will either be taken directly north through the

subdivision into the North Branch Piedras Marcadas Channel or the storm drain extended from Universe Boulevard to accommodate this flow.

6.4 Proposed Detention Ponds

Three of the four detention ponds in the developed model are less than 10 feet deep with storage volumes less than 10 acre-feet. Two of the four ponds, LVDF No. 1 and No. 2, are proposed AMAFCA ponds. The other two ponds are city ponds.

The largest pond, LVDF No. 1, is proposed to occupy over 34 acres and will be sized for 5-year sediment accumulation. LVDF No. 2 is in a depression area in the east of Basin 320 and intercepts flows from Basin 320. This pond operates in parallel with Facility No. 1 and is proposed to be less than 10 acre-feet in storage volume and 7 feet in depth. Flowrates are reduced from 293 cfs to 32 cfs.

Table 2 compares existing and developed data for this facility and lists data for LVDF No. 2.

Table 2
Proposed AMAFCA Ponds

	Contributing Area (sq mi)	Inflow (cfs)	Outflow (cfs)	Storage (ac-ft)
LVDF No. 1				
Existing	1.28	139	0	33
PMDMP Developed	1.28	1808	251	73
BHI Developed	2.045	2998	49	143
LVDF No. 2	0.190	293	32	9.99

The main reasons for the difference in LVDF No. 1 developed flows from the PMDMP are:

- The Las Ventanas drainage scheme maximizes the drainage area into the pond by diversions of "500" and "600" basins. This has increased the contributing basin area to over 2 square miles from the PMDMP's 1.3 square miles. This correspondingly has reduced the flows going to the Calabacillas and the Middle Branch Piedras Marcadas.

- The Las Ventanas development scenario is different from that assumed by the PMDMP.

The differences in the contributing drainage areas are pictured in Figure 5, Contributing Basins for Las Ventanas Drainage Facility No. 1.

The two city ponds in Basin 503W and Basin 315B are summarized in Table 3. Following Table 3 are brief descriptions of flow scenarios for the ponds.

Table 3

City Ponds

Name	Drainage Area (sq mi)	Flowrate (cfs) In	Flowrate (cfs) Out	Storage (ac-ft)	Total Depth (ft)
503W Pond	.034	73	13	1.7	3.5
315B Pond	.047	107	0	4.5	7

The city pond in Basin 503W intercepts flows from Basin 502 entering Las Ventanas just south of the northwest corner of the subdivision. This pond reduces flows from 73 cfs to 13 cfs.

The city pond proposed for Basin 315B is a temporary retention pond because there is no existing storm drain into which these flows can be discharged. As long as it is a temporary retention pond, maintenance will be the responsibility of the property owner. The pond may be reconstructed into detention or eliminated when downstream improvements or capacity become available. As a detention pond, flows are reduced from 107 cfs to 39 cfs, which approximates the existing condition flowrates.

6.5 Synopsis of Developed Flow

The following is a synopsis of the flow patterns for Las Ventanas:

- West Branch Calabacillas Diversion System: Basins 502, 503W, 503M, 504E, and 316NW are routed to LVDF No. 1 via the West Branch Calabacillas Diversion Channel, 316NE is added to these flows, and the sum is discharged into LVDF No. 1 from the northwest.

- North Branch Piedras Marcadas System: Basins 501, 504W, 319A, 319B, 318A, 318B, 317A, and 316SW are routed via Tributary A, Tributary B, and the North Branch Piedras Marcadas Channel. Basins 601, 602, and 317A are routed as street flows to the North Branch Piedras Marcadas Channel and summed. The combined flows are summed with 316SE and discharged from the channel into LVDF No. 1 from the west.

- Basin 320 discharges to LVDF No. 2 in the east of Basin 320. Facility No. 2's discharges are added to the same pipe that outfalls from LVDF No. 1. Basin 505 is also added to this pipe as it exits Las Ventanas at the northeast corner of the property. The sum of the flows are conveyed to the West Branch of the Calabacillas.

- Basins 503E, 314BS, and 315B discharge in directions away from the routes to Facilities No. 1 and 2. 503E and 314BS exit Las Ventanas without attenuation although the total discharge from these two basins is less than the existing, undeveloped discharge from these areas. 315B in the southeast corner of Las Ventanas is proposed to have a temporary retention pond until downstream facilities are constructed east of Las Ventanas.

7.0 RECOMMENDATIONS AND PHASING OF PROPOSED DRAINAGE PLAN

7.1 Introduction

This Drainage Master Plan updates an upstream portion of the PMDMP that was requested by AMAFCA in 1993 and implements many of the conceptual improvements proposed in the PMDMP. It provides a plan for accommodating the off-site and on-site drainage flows in a series of channels, storm drains, and detention ponds.

By implementing components of the PMDMP and diverting additional basins to LVDF No. 1, drainage is effectively concentrated within Las Ventanas. The proposed drainage system lessens the peak flows that would impact the Calabacillas Arroyo and the Middle Branch of the Piedras Marcadas Arroyo.

A large portion of land will be required to provide locations for drainage structures that will accommodate increased flows due to full development. It is anticipated that the largest detention and outfall facilities will be located on the east edge of Las Ventanas. This area is approximately 80 acres and borders almost the entire length of the east boundary of the project.

In addition to the drainage area, other areas within Las Ventanas have been designated as sites for "neighborhood" parks. There will be at least four of these 3- to 6-acre sites strategically located throughout the subdivision. These parks have the potential of acting as detention ponds in the 100-year flood but have not been modeled as such for this analysis, except for the pond in Basin 503W (near the northwest corner of the subdivision). This concept has been coordinated with the City of Albuquerque Parks and General Services Department.

7.2 Benefits for Maximizing Diversions to Las Ventanas Drainage Facility No. 1 (LVDF No. 1)

The proposed drainage system for the Las Ventanas Development will significantly decrease the peak flows that drain to the Calabacillas Arroyo and the Middle Branch of the Piedras Marcadas Arroyo by maximizing the drainage area that is collected by the proposed LVDF No. 1. The following outlines the benefits incurred by diverting as much flow as possible from the Middle Branch of the Piedras Marcadas Watershed and the West Branch of the Calabacillas Arroyo.

7.2.1 The West Branch Calabacillas Diversion Reduces the Number of Major Detention Facilities from Two to One. The West Branch Calabacillas Diversion System directs developed flows away from the historical outfall to the Calabacillas located at the midpoint of the north boundary of Las Ventanas. This eliminates the need for a major facility (detention pond with small outfall or large outfall) that would be needed at this location to carry developed flows of over 400 cfs. Instead, flows are routed to LVDF No. 1. Operating one major detention facility is more efficient than operating two.

7.2.2 The North Branch Piedras Marcadas System Reduces the Size of Drainage Improvements in Paradise Boulevard Downstream from Las Ventanas. The North Branch Piedras Marcadas System routes developed flows to LVDF No. 1, generally using the same route as historical flows. Unlike historical, however, LVDF No. 1

discharges north through Las Ventanas to the Calabacillas instead of east through Paradise Hills Boulevard. This lessens the impact of developed flows on the Paradise Hills community and reduces infrastructure requirements to convey developed flows from Las Ventanas and Paradise Hills to the Calabacillas via Paradise and Lyons Boulevards.

7.2.3 Developed Flows from Las Ventanas to the Paradise Hills Community are Reduced as Much as Possible. Historical flows out of Las Ventanas to the east total approximately 150 cfs. The North Branch Piedras Marcadas System and the Outfall System to the Calabacillas reduce this to 34 cfs, a reduction of over 75%. The remaining 34 cfs flowrate is generated downstream of the proposed facilities and could be captured, however, by a temporary retention pond with a storage of 1.5 ac-ft directly south and east of the proposed LVDF No. 1.

7.3 Summary of Recommended Improvements

The major proposed drainage improvements are:

1) West Branch Calabacillas Diversion Channel
2) North Branch Piedras Marcadas Channel (includes Tributaries A and B)
3) AMAFCA regional drainage facility outfall to the Calabacillas, which includes LVDF No. 1 and LVDF No. 2.

All of the channels in the proposed system will use tinted concrete and have 10-ft bottom widths. Concrete-lined channels have been proposed due to the high velocities resulting from the concentration of developed, highly erodible soils, and resultantly high maintenance costs associated with softer channel linings under these conditions. Mitigation of the aesthetic impact of concrete-lined channels is proposed to be accomplished through the dedication of channel corridors, varying in width from 100' to 130', which will include improvements on both sides. The proposed drainage

infrastructures are shown graphically in Figure 6, Conceptual Drainage Plan Developed Conditions.

The following summarizes the recommended improvements of the Las Ventanas Master Drainage Plan.

7.3.1 West Branch Calabacillas Diversion System Summary

- Beginning in northwest Las Ventanas, off-site flows enter from south of the northwest corner and are routed east through 2000 feet of 36" storm drain (Reach 1) located between lots and is to be maintained by the City.

- The 36" pipe discharges to a detention pond in Basin 503W with a storage capacity of 1.7 ac-ft. and the pond is to be maintained by the City Parks Department if it is a joint use facility.

- The pond reduces flows and discharges east through 500 feet of 36" pipe (Reach 2) located in the Loop Road. Reach 2 is to be maintained by the City.

- At the intersection of the Loop Road and Rainbow Boulevard, the 36" pipe increases to a 54" (Reach 3) after receiving local flows gathered by the 600-foot 42" storm drain (Reach 4) in Rainbow Boulevard. Reach 3 is to be maintained by the City.

- The 54" storm drain (Reach 3) extends 800 feet east down the Loop Road, turns northeast from the Loop Road and flows 400 feet down a local road, passes between subdivision lots for a distance of 600 feet, then discharges into the West Branch Calabacillas Diversion Channel.

IRVING BOULEVARD

REACH 1

POND

REACH 2

REACH 3

REACH 4

WEST BRANCH CALABACILLAS DIVERSION CHANNEL

UNIVERSE BOULEVARD

LAS VENTANAS DRAINAGE FACILITY NO. 2

REACH 8

REACH 7

REACH 6

N

SCALE: 1" - 600'

RAINBOW BOULEVARD

TRIBUTARY "A"

REACH 5

CHANNEL

LAS VENTANAS DRAINAGE FACILITY NO. 1

- - - FUTURE UNIT BOUNDARY

NORTH BRANCH PIEDRAS MARCADAS CHANNEL

CHANNEL

PARADISE BOULEVARD

TRIBUTARY "B"

POND

PASEO DEL NORTE

LAS VENTANAS
CONCEPTUAL DRAINAGE PLAN
DEVELOPED CONDITIONS
FIGURE 6

BOHANNAN-HUSTON, INC.
ALBUQUERQUE, NEW MEXICO
ENGINEERS PLANNERS PHOTOGRAMMETRISTS

- The starting point of the West Branch Calabacillas Diversion Channel is about 500 feet south of the approximate midpoint of the northern border of Las Ventanas. The 3' deep channel flows southeast for a distance of 200 feet, and then becomes 4' deep after it intercepts the flows from Reach 3. The 4' deep channel extends 1800 feet before reaching the park in north-central Las Ventanas.

- At the park in north-central Las Ventanas, the channel becomes 5' deep, flows southeast for a distance of 1600 feet, and discharges to the northwest side of LVDF No. 1.

7.3.2 North Branch Piedras Marcadas Channel System Summary

- Beginning north of the midpoint of the west boundary, a channel inlet gathers off-site flows and routes them eastward between lots in a 1000-foot-long, 4'-deep channel described as Tributary "A" Channel.

- Tributary "A" turns south, runs alongside and then crosses the Loop Road, gathering additional flows. The channel becomes 6' deep and travels 2100 ft between lots to the park at the well site.

- South of the beginning of Tributary "A," off-site flows are gathered by an inlet and routed east between lots through 1100 feet of 36" storm drain (Reach 5). The 36" storm drain discharges to Tributary "A."

- South of Reach 5, a channel inlet gathers off-site flows and routes them east between lots through Tributary "B." Tributary "B" is a 2000-foot long, 5-foot deep channel which gathers additional local flows and crosses the Loop Road before reaching the park at the well site.

- Tributary "A" and Tributary "B" Channels join at a confluence located in the park at the well site. This confluence will need to be analyzed and modeled in the future during design. From here, the channel becomes the North Branch Piedras Marcadas Channel, a 7-foot deep channel.

- The North Branch Piedras Marcadas Channel flows east across Las Ventanas paralleling an existing water line easement, crossing Rainbow Boulevard and the Loop Road. It travels 3200 feet, gathering local flows and off-site flows from the southwest corner of Las Ventanas before reaching Universe Boulevard.

- At the intersection of Universe Boulevard and North Branch Piedras Marcadas Channel, the channel increases to 8' deep and flows east 800 feet before discharging to the west side of LVDF No. 1.

7.3.3 Outfall to the Calabacillas Summary (Includes Las Ventanas Drainage Facilities No. 1 and No. 2 and Reaches 6, 7, and 8)

- LVDF No. 1 is a detention pond with 143 ac-ft of storage that occupies over 34 acres of land. This pond accommodates all of the flows discharged to it from the West Branch Calabacillas Diversion Channel and the North Branch Piedras Marcadas Channel, and will be sized for 5-year sediment accumulation. Total peak inflow in the 100-year storm is 2998 cfs, which is attenuated to a peak outflow of 49 cfs.

- The outfall from Facility No. 1 is a 42" storm drain (Reach 6) that flows north 2250 feet to where it intercepts the outfall of LVDF No. 2.

- LVDF No. 2 is a detention pond with a storage of less than 10 ac-ft and accommodates local flows from the region north of LVDF No. 1. Total

peak inflow in the 100-year storm is 293 cfs, which is attenuated to a peak outflow of 32 cfs. This pond outfalls to a 36" pipe (Reach 7) that flows eastward a distance of 150 feet.

- At the confluence of the outfall from LVDF No. 2, the 42" outfall pipe from LVDF No. 1 increases to a 60" pipe (utilizing the 60" pipe that was salvaged from Golf Course Road) (Reach 8).

- Over a distance of 1500 feet, the 60" pipe gathers local flows from the northeast region of Las Ventanas, crosses Irving Boulevard, and outfalls to the West Branch of the Calabacillas Arroyo.

- The outfall discharges through a drainage easement to the West Branch of the Calabacillas, directly north of the northeast corner of Las Ventanas. This is to be a joint trench with a waterline being installed by New Mexico Utilities, Inc. (NMUI). In addition to the original 25' drainage easement, NMUI has acquired a 20' easement, and Sandia is obtaining an additional 15' easement for AMAFCA, for a total easement width of 60 feet.

- A USBR Type IV baffle-wall energy dissipator is proposed to reduce the velocity of the 92 cfs flows where it exits to the natural arroyo.

7.4 Development and Infrastructure Phasing

This section describes the anticipated project phasing with respect to the permanent and interior construction of the AMAFCA outfall facilities. The interior drainage facilities are described in a separate report entitled "Las Ventanas Subdivision Interim Drainage Facilities." Dedication of temporary and permanent easements will occur at platting.

Sandia Properties intends to develop the Las Ventanas Subdivision from the south to the north. The southern one-third of the property will be constructed first. Due to the shallow depth to rock on the eastern portion of the site, earth from the western portion will be placed on the eastern portion to provide enough soil cover for utility services. This will minimize the amount of rock excavation.

The anticipated yearly build-out for Las Ventanas will be 190 to 250 lots. Table 4, Development and Drainage Outfall Phasing, describes the proposed build-out through the year 1999.

Table 4

Development and Drainage Infrastructure Phasing

Year	Cumulative No. of Lots Built	AMAFCA Outfall Activity
1995	-	-
1996	250	Sandia to design outfall diversion and dam
1997	450	AMAFCA build outfall diversion
1998	640	AMAFCA start dam construction September 1998
1999	890	AMAFCA construction of dam complete by May 1999

The increased runoff from the development of lots will be accommodated in the two existing playas through construction of the first two phases. The two playas have enough volume to store upstream existing flows and flows from individual developments totaling 450 residential units. Before any more than 450 lots can be developed the outfall diversion to the Calabacillas will need to be constructed. With the outfall diversion constructed and the Loop Road Playa removed, a total of 640 residential units can be constructed. Any lot development beyond 640 lots will require

LVDF No. 1 to be under construction. While LVDF No. 1 is under construction an additional 250 lots can be developed. LVDF No. 2 will be built when the basin that drains to it (Basin 320 in northeast Las Ventanas) is developed. Sandia Properties will maintain the two playas prior to the construction of LVDF No. 1 by AMAFCA.

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Las Ventanas Land Treatment Types

Existing Conditions

	Percentage Treatment Type			
Basin ID	A	B	C	D
314B	96	0	2	2
315B	98	0	2	0
316	98	0	2	0
317A	98	0	2	0
317B	98	0	2	0
318A	96	0	2	2
318B	96	0	2	2
319A	98	0	2	0
319B	98	0	2	0
320	98	0	2	0
501	98	0	2	0
502	98	0	2	0
503	98	0	2	0
504	98	0	2	0
505	96	0	4	0
601	98	0	2	0
602	98	0	2	0

Developed Conditions

	Percentage Treatment Type			
Basin ID	A	B	C	D
314BN	10	70	10	10
314BS	10	70	10	10
315B	2	18	20	60
316NW	2	33	15	50
316NE	5	33	15	47
316SW	2	20	18	60
316SE	2	23	10	65
317B	4	20	22	54
317A	7	14	20	59
318A	7	14	20	59
318BE	4	20	25	51
318BW	7	14	20	59
319A	7	14	20	59
319B	5	20	25	50
320	7	22	22	49
501	7	14	20	59
502	7	14	20	59
503E	4	20	30	46
503M	4	20	30	46
503W	4	20	30	46
504E	4	20	30	46
504W	4	20	30	46
505	7	53	20	20
601	7	14	20	59
602	5	18	20	57