HYDROLOGY L9/D5 6 PLANS 1 of 2

L9/D5

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Le Plans

# McKELLAR DEVELOPMENT CORPORATION

January,29,1982

Mr. Chuck Easterling
City of Albuquerque,Hydrology Dept.

L9-D5

RE: S. MESA PATIO HOMES

Mr. Easterling,

Per your request,at such time as we begin development of S. MESA PATIO HOMES,we will employ a qualified engineer to certify that on site drainage improvements are completed per approved plans.

SIGNED

TRU HAWKINS
ALB.,N.M. OPERATIONS

McKELLAR & ASSOCIATES
2200 Sand Hill Road, Suite 105
Menlo Park, CA 94025

OLD TOWN
University Avenue
Los Gatos, CA 95030

LAS VEGAS, NV 89104
311 Almond Tree Lane
Phone 702/732 1052

McKELLAR PLAZA, LA JOLLA, CA 92037
1250 Prospect Street, Suite C 14
Phone 714/459 3891

## PROPOSED DEVELOPMENT

The proposed development will consist of 96 duplex units and related street and storm drainage improvements. Typical lot sizes will average 30' wide by 111' deep. Typical structure sizes will average 900 ft.$^2$, or 25' wide by 35' deep. Building front setbacks will be staggered between 20 and 25' back of the street right-of-way.

## TOPOGRAPHIC MAP

The topographic map used as a basis for the grading plan is the result of a field survey conducted by Walker Surveying Company in March, 1981. This plan represents the site topography as it now exists.

## SOILS REPORT

The soil-type from ground surface to the 9 to 12' depth for the site consists of deposits of light brown to tan, silty to clayey fine sands (SM-SC) which are generally very loose at the surface and become medium dense or firm with depth. Specific drainage requires positive surface water drainage around and away from any building for the foundation design covered in the report. (See soils report in back of this report)

## DRAINAGE/GRADING EXHIBIT

The drainage/grading plan located in the back of this report shows the location of the proposed drainage improvements and the proposed final grades for the site.

## PRE-DESIGN CRITERIA

1. Offsite drainage impacts the site primarily at Sage Road on the south side of the site. The south tier of lots adjacent to Sage Road will be withheld from proposed construction until flows within Sage Road are reduced by AMAFCA storm drainage facilities upstream of the site.

2. Other offsite flows from the west will be intercepted without entering the site and routed to Sage Road to the south, or San Ignacio Road to the north.
3. Onsite drainage would be controlled in part by the use of rear yard pond areas, only where feasible where adequate pond capacity can be achieved without exceeding the 0.5' depth requirement set by the City and FHA.
4. All other onsite flows would drain to the adjacent internal streets for discharge into a 10' wide dedicated concrete lined channel situated along the east boundary of the site. This channel will drain to the south for ultimate discharge onto Sage Road, or a future storm drain system within Sage Road.
5. The developer will set aside several lots at the SE corner of the site to act as a temporary detention pond to receive flows from the onsite channel. This pond will have a controlled outlet onto Sage Road, will be landscaped with native shrubs and have a gravel, cobble bottom. The developer will provide a perimeter safety fence for pond depths greater than 18". The City Engineer will not commit to City maintenance of the pond at this time, but will accept a request by the developer at the time of submittal of final plans.
6. In a meeting with the City Traffic Engineer, it was determined that the best course of action would be to escrow the construction funds for Sage and Ignacio Road adjacent to the site because the ultimate design has not been established for either street.

## EXISTING DRAINAGE

At first glance, the area topo seems to indicate that the site lies in the pathway of substantial offsite flows affecting its north and west boundaries. However, a closer site/area inspection determined that relatively minor sheet flow intercepts these two boundaries. The area of the site which can experience substantial offsite flooding is the south side, or along Sage Road. A more detailed offsite analysis follows:

Sage Road/South Boundary Area

This report used the approved storm drainage analysis for Sunset West Unit 2 as the starting point for determining the offsite flow conditions. (See copy of Herkenhoff study in back of this report)

Individual Rear Yard Ponds

Each lot with rear yard ponds have the same lot depth, 111', for two lot widths, 29' and 31'. Areas draining to pond include the roof area, side yard area, and rear yard area.

| Data | 29' Lot Width | 31' Lot Width |
|---|---|---|
| Area to Pond | 2639 ft.$^2$ | 2821 ft.$^2$ |
| C = 0.9 Area | 800 ft.$^2$ | 1000 ft.$^2$ |
| C = 0.4 Area | 1839 ft.$^2$ | 1821 ft.$^2$ |
| Composite C | 0.55 | 0.58 |
| Pond Vol.$_{100}$ | 266 ft.$^3$ | 300 ft.$^3$ |
| Top Pond Dimensions | 25' wide x 25'long | 27' wide x 25' long |
| w/2:1 S.S. | x 0.5' deep | x 0.5' deep |

## RECOMMENDATIONS TO DEVELOPER

1. Grade around each townhouse to provide a positive slope away from the foundation to carry drainage to discharge/pond points.

2. Grade Lots 85-90 as shown on grading plan to act as a temporary detention pond.

   a) Install 3-7" pipes at flowline invert of 5089.94' to act as the controlled release point of the pond.

   b) Construct an overflow spillway in concrete block wall around east and south pond perimeter at SE corner of pond. Construct wier 0.2' deep by 72' long, with flowline at 5090.50' to act as the emergency overflow point of the pond.

   c) Landscape pond area with native shrubs/large cobble for Southwest style without plastic liner.

3. Construct 10' wide concrete lined channel per City standards along the east side of the site within 10' drainage right-of-way.

4. Grade shallow swale within south half of San Ignacio as shown on grading plan.

5. Escrow funds for:

   a) Maintenance of common pond area in the event the City does not

accept maintenance, and in the event the area pond is damaged by flood flows following Sage Road.

b) Curb and gutter and equivalent residential street pavement for one half of Sage Road and San Ignacio Road adjacent to the site on the south and north sides, respectively.

6. File a temporary drainage easement for records allowing the use of Lots 85-90 as a ponding area, to revert to owner of record at the time the City releases said pond requirements.

## C O N C L U S I O N

The proposed drainage plan sets forth requirements to be followed by the developer, McKellar Development Company, in order to meet City drainage requirements for the area, the effect of the impact of the offsite area flows on the site, and steps to be taken to insure minimal effect on the site in the event of a 100 yr. storm.

The following pages contain the Planning Department's recommendations and approvals, a copy of the pertinent part of the Sunset West Unit 2 report and the soils report.

1) Does the City want the easements provided by the Drainage Report, including the Backyard easement? Recommend private easement

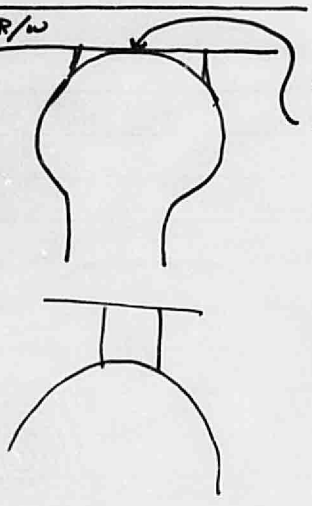
Item 4 from the Subdivision Review Board Comments?

2) Point contact along property lines and cul-de-sac not acceptable.

5) All double frontage lots will require the installation of curb & gutter, sidewalk, and paving of both streets abutting the properties. What about Soff Rd and San Tomaso S.W.?

6) Triangular pieces of land at each cul-de-sac. Who owns?

7) Drainage




I understand that this is not acceptable

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

November 12, 1981

Chris Weiss, P.E.
Consultants Terra Sol Inc.
P. O. Box 142
Sandia Park, N. M. 87047

RE: South Mesa Patio Townhouses
(File No. L-9-D5)

Dear Chris:

The following are my comments regarding the referenced Drainage Report:

1.) Per the S.R.B. comments dated April 21, 1981, City approved street grades will be required for Sage Road, 86th Street and San Ygnacio S.W.

2.) Indicate on the proposed plat all private and public easements.

3.) Point contact along property lines and cul-de-sac is not acceptable; recommend a buffer zone dedicated as a drainage easement separating the two lines.

4.) Any construction within public right-of-way will require the approval of the Assistant City Engineer/Design. This includes the proposed ditch within San Ygnacio to divert offsite flows away from the proposed development.

5.) Drainage covenants required for the proposed Drainage facilities on Private Property.

If you have any questions or would like to make an appointment to discuss my comments, please feel free to call me at 766-7644.

Sincerely,

Fred J. Aguirre, P.E.
Civil Engineer/Hydrology

FJA/el

cc: Drainage File
Reading File

Brian

# City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

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Civil Engineer/Hydrology

FJA/el

cc: Drainage File
Reading File

Consultants torrajol inc.
P.O. Box 142 Sandia Park, New Mexico 87047 (505) 281-1991

January 26, 1982

RECEIVED
JAN 26 1982

Mr. Fred J. Aguirre, P.E.
City of Albuquerque/Hydrology Department
P.O. Box 1293
Albuquerque, New Mexico 87103

RE: South Mesa Patio Townhouses
(File No. L-9-D5)

Dear Fred:

We have completed the additions/changes to the above referenced plans, per your letter of November 12, 1981. Our delay in replying was due to some marketing problems that the client was working out, but he is now ready to proceed with construction of the site. We are submitting the plans to the City for approval signatures.

The following items correspond to the numbers outlined in your letter:

1. We have added the design of both Sage Road and San Ignacio to the set. The design for 86th St. had already been completed in the original submittal, per the requirements established by the Traffic Engineer.

The street improvements adjacent to the site for San Ignacio will be constructed with the project. However, the Sage Road improvements will be completed with the overall Sage Road project in the future, at the request of the Traffic Engineer.

2. All easements shown on the plat will be designated either public or private.

3. Point contact at the head of each cul-de-sac has been removed by the dedication of a 10' wide drainage R/W, as shown on the plat, with respective lot dimensions changed to reflect the change.

4. Special Order #19 documents will be prepared and submitted to the Assistant City Engineer/Design for the outlet pipe design. The proposed ditch within San Ignacio is no longer necessary due to the planned construction of street improvements for the area.

5. Drainage covenants have been supplied to the client for submittal to the City.

We will be happy to go over these changes with you.

We will be ready to route the plat through the respective departments this week for signatures, and if these changes meet with your requirements, we would appreciate a letter from your department approving the drainage.

Thank you.

Respectfully,

Christopher L. Weiss, P.E.
President

CLW/vw

# City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

November 12, 1981

Chris Weiss, P.E.
Consultants Terra Sol Inc.
P. O. Box 142
Sandia Park, N. M. 87047

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Civil Engineer/Hydrology

FJA/el

cc: Drainage File
Reading File

CHRISTOPH L. WEISS
BOX 143
SANDIA PARK, N.M.
87047

Mr. Fred J. Aguirre, P.E.
City of Albuquerque/Hydrology Department
P.O. Box 1293
Albuquerque, New Mexico 87103

# DRAINAGE REPORT & GRADING PLAN

South Mesa Patio Townhouses

on

86th St. SW

Albuquerque, New Mexico

August 1981

RECEIVED

Consultants terraSol inc.

DRAINAGE REPORT & GRADING PLAN

South Mesa Patio Townhouses

on

86th St. SW

Albuquerque, New Mexico

August 1981

RECEIVED

SEP 0 2 1981

ENGINEERING

Consultants terra Sol inc.
P.O. Box 142 Sandia Park, New Mexico 87047 (505) 281-6991

August 24, 1981

Mr. Chuck Easterling
Principal Assistant City Engineer/Hydrology
City of Albuquerque
400 Marquette NW
Albuquerque, New Mexico 87102

RE: South Mesa Patio Townhouses

Dear Mr. Easterling:

We are submitting the attached report, prepared by Consultants/Terra-Sol, Inc., together with a soils report for the subject property prepared by ATL, for your review and comments necessary to obtain City approval.

Thank you.

Respectfully,

Christopher L. Weiss, P.E.
President

CLW/vw

Enclosures

DRAINAGE REPORT & GRADING PLAN
SOUTH MESA PATIO TOWNHOUSES

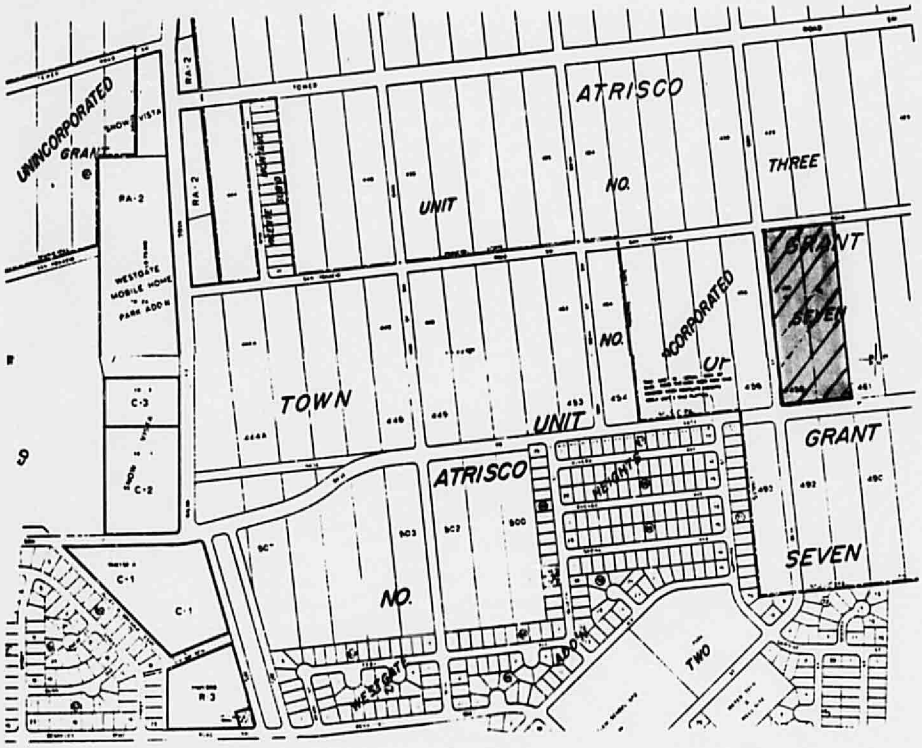
AUGUST 1981

## INTRODUCTION

At the request of McKellar Development Company, Consultants/Terra-Sol, Inc. has investigated the storm drainage for the proposed townhouse complex, known as South Mesa Patio Townhouses. This investigation follows the criteria set forth in a pre-design conference with the City Engineers Department, and sets forth recommendations for the developer to follow in order for the site to meet City criteria.

## SITE LOCATION

The proposed townhouse site (10 Acres) is located in the SW quadrant of the City. It lies east of and adjacent to 86th St. SW, between Sage Road and San Ignacio Road SW, and is bordered on the east by undeveloped land.



SOUTH MESA PATIO TOWNHOUSES AUGUST 1981

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6. In a meeting with the City Traffic Engineer, it was determined that the best course of action would be to escrow the construction funds for Sage and Ignacio Road adjacent to the site because the ultimate design has not been established for either street.

? DRAINAGE COVENANT

Proposed street grades needed for design

## EXISTING DRAINAGE

At first glance, the area topo seems to indicate that the site lies in the pathway of substantial offsite flows affecting its north and west boundaries. However, a closer site/area inspection determined that relatively minor sheet flow intercepts these two boundaries. The area of the site which can experience substantial offsite flooding is the south side, or along Sage Road. A more detailed offsite analysis follows:

### Sage Road/South Boundary Area

This report used the approved storm drainage analysis for Sunset West Unit 2 as the starting point for determining the offsite flow conditions. (See copy of Herkenhoff study in back of this report)

SOUTH MESA PATIO TOWNHOUSES AUGUST 1981

Offsite flows from Areas 1-4, referenced in Sunset West 2 report, cross 98th Street and continue to the east, converging at 90th Street and Sage Road. From there, the flows continue east down Sage Road past the south boundary of the South Mesa Patio Townhouses. Sunset West 2, which interupts this flow pattern, has details in the report for routing the offsite flows to the 90th and Sage intersection to continue this natural outfall pattern. Although the Sunset West 2 site has not been completed as of this date, present small storm flow patterns have been established which follow the proposed developed plan, whereby 90th Street will be used to carry off-site flows to Sage Road. In the event of a larger storm, not all flows would presently follow 90th Street, but continue to the east to be intercepted by 86th Street, which lies adjacent to the South Mesa Patio site.

The point of study for the 100 yr. flow rate at Sage and 86th Street concerns the following areas: Areas 1-4, the mobile home park (421.4 Acres), developed contributing areas of Sunset West Unit 1 (12.5 Acres) and Unit 2 (8.4 Acres) plus the additional area "A" west of Unit 1 up to 98th Street ( 34.4 Acres), area "B", north of San Ignacio from 98th Street to the east limit of Sunset West 2 (35.4 Acres), and area "C", east of Sunset West 2 up to 86th Street (27.1 Acres).

Assuming the ultimate development of Sunset West 2, with its offsite drainage diversions in place, the flows traveling within Sage at 86th Street would be:

$Q100 = (0.44)(2.18)(539.20) = 518$ cfs, concentrated flow.

Summary Table

| Basin | Area | "C" | Tc |
|---|---|---|---|
| 1-4 Mobile | 421.4 | 0.44 | 49.7 - Base time |
| S.W. 1 | 12.5 | 0.69 | 16.0 |
| S.W. 2 | 8.4 | 0.66 | 10.0 |
| A | 34.4 | 0.40 | 10.0 |
| B | 35.4 | 0.40 | 14.0 |
| C | 27.1 | 0.40 | 10.0 |
| Total | 539.20 | 0.44 | 61.6 min. |

86th Street/West Boundary Area

The only contributing area to affect the west side is from Area "C". Sheet flow from this area will have to pass through a low-density residential strip adjacent to 86th Street before being routed to Sage Road. There presently is no evidence of erosion through this residential area, but the improvements to Sunset West 2 need to be completed to keep its diverted flow patterns from impacting 86th Street.

Area "C" - Q100 = (0.40)(5.4)(27.1) = 59 cfs, sheet flow.

The capacity of 86th Street, with a width of 60' FF with a 5" crown at a minimum slope of 0.5% = 101 cfs. However, only the east half of 86th Street will be completed with this project, so this capacity won't be realized at this time.

San Ignacio Road/North Boundary Area

Examination of the U.S.G.S. Quad sheet shows a major offsite area north of Area 4. The map shows a defined arroyo crossing Tower Road at the 5150 contour. However, a field inspection revealed that this arroyo crossing no longer exists. Grading operations of Tower Road have substantially lowered the roadway with a net effect of 1) a 4-5' berm on the south side of the road, and 2) a redefined, regraded arroyo exists leading the arroyo flows directly onto Tower Road. The net result was to cut off this offsite flow and re-route it directly east. The remaining area "D" contributes sheet flow over a 4000' reach with a Tc of 23 minutes.

Area "D" - Q100 = (0.4)(3.94)(29.3 Acres) = 46 cfs, sheet flow.

## DEVELOPED DRAINAGE

Offsite Flows

Offsite flows within Sage Road will spread out over a portion of the south side of the site. If these lots were developed at this time, the burden of these displaced flows would be pushed to the south side of Sage. Either upstream diversions need to be completed or the full designed section of Sage Road with storm drain fecilities needs to be completed before these lots can be developed. The extent of the spread of these flows is shown on the drainage/grading plan under the design assumption that the internal street system of the site was in place. The control line is the south curb line of the internal cul-de-sac.

Section 1 - Design Q = 518 cfs - Existing Channel Properties

| j | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| xj | 0 | 10 | 60 | 120 | 130 | 145 | 200 | 300 | 320 |
| yj | 94.4 | 91.8 | 91.6 | 92.0 | 92.1 | 92.0 | 91.8 | 91.8 | 92.2 |

W.S. at 92.2 Bank Sta. 0+00 to 320

A = 112.25
P = 320.01
AR2/3 = 55.83
T = 320

Dn = 0.35
n = 0.020
S = 0.015
$Q_{92.2}$ = 508 ≅ 518
V = 4.5'/sec.

Section 2 - Design Q = 518 cfs - Existing Channel Properties

| j | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| xj | 0 | 10 | 60 | 125 | 160 | 180 | 220 | 300 |
| yj | 93.2 | 90.8 | 90.7 | 91.0 | 91.2 | 91.0 | 90.8 | 91.4 |

W.S. at 91.35 Bank Sta. at 0+00 to 300

A = 119.00
P = 300.02
AR2/3 = 64.24
T = 300.0

Dn = 0.40
n = 0.020
S = 0.015
$Q_{91.35}$ = 585 > 518 cfs design
V = 4.9'/sec.

Section 3 - Design Q = 518 cfs - Existing Channel Properties

| j | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| xj | 0 | 10 | 100 | 160 | 200 | 280 |
| yj | 92.0 | 90.5 | 90.3 | 90.4 | 90.3 | 90.9 |

W.S. at 90.85 Bank Sta. at 0+00 to 300

A = 114.25
P = 280.1
AR2/3 = 62.85
T = 280.00

Dn = 0.41
n = 0.020
S = 0.015
$Q_{90.85}$ = 572 > 518 cfs design
V = 5'/sec.

The net effect of the flood plain with reference to the south tier of lots is a shallow spread of water along each side of Sage Road adjacent to the site. However, the proposed elevation of the south internal cul-de-sac is above the 100 yr. flood level of Sage Road.

Offsite flows intercepted by 86th Street will be in the form of sheet flow. These flows will pass through a strip of low-density residential units on the west side of 86th Street and follow the existing drainage pattern south to Sage within 86th Street. Only the east half of 86th Street will be constructed with this project. The flattest street grade will occur just prior to the intersection of Sage Road. The hydraulic capacity of the half street system and existing west half of the right-of-way is as follows. Sta.0+00 is at the east curb line.

Section 4 - Design Q = 59 cfs - Existing/Proposed Channel Properties

| j | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| xj | 0 | 1 | 30 | 32 | 40 | 60 | 80 | 100 |
| yj | 93.9 | 93.2 | 93.6 | 93.5 | 93.0 | 92.6 | 93.0 | 93.9 |

W.S. at T.C. Bank Sta. at 0+00 to 100 →

A = 73.78
P = 100.27
AR2/3 = 60.09
T = 100

Dn = 0.74
n = 0.020
S = 0.005
$Q_{TC}$ = 316 cfs > 59 cfs
V = 4.3'/sec.

The net effect of the proposed construction of the east half of 86th Street, combined with the existing west half road section, will be a section capable of handling an excess of the estimated 100 yr. flows from Area "C".

Offsite flows intercepted by the north boundary of the site will be in part deflected by the site perimeter wall required by FHA. However, flows shouldn't be allowed to erode against this wall, so a shallow graded swale will have to be completed within the south half right-of-way of San Ignacio Road. For the estimated flow rate of 46 cfs, the channel section would have the following properties:

S.S. = 5:1
W = 10'
n = 0.030
S = 0.015 Avg.

Q design = 46 cfs
D = 0.8'
Vel. = 4.3'/sec.

Refer to grading plan for location details.

Onsite Flows

Each of the four cul-de-sacs drains to the east for discharge into the 10' concrete channel located on the west side of the site. This channel slopes to the south for ultimate discharge into Sage Road. However, because of the downstream burden already placed on Sage, these onsite flows will be discharged into a temporary pond located within lots 85 through 90. This pond will in turn release the peak discharge from the site into the Sage right-of-way over a prolonged period of time after the peak flow in Sage Road has passed. A spillway overflow for the pond will be provided above the same location as the outflow pipe. In addition to the use of a common detention pond for the entire site, internal discharge within the site will be restricted to a certain degree by the use of rear yard ponds for a majority of the lots. The first eight lots on each side of each cul-de-sac will be ponded, with the remaining lots around each cul-de-sac bulb draining to a rear yard swale for discharge into the concrete channel.

Discharge of each cul-de-sac area to the drainage channel with an effective drainage area = 58,400 ft.2.
Overland flow time = 6 minutes
Street flow/32' FF at 1.5% + slope = 6'/sec. = 1 minute
Use Tc = 10 min. for study pt. at end of each cul-de-sac.
Q100 = (0.65)(5.4)(1.34 Acres) = 5 cfs

SOUTH MESA PATIO TOWNHOUSES

AUGUST 1981

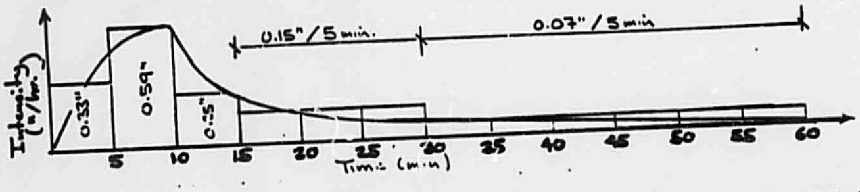
| Cul-de-Sac | Q100 at St. Exit/Pt. | Channel Vel./Depth | Channel Slope/ Routing Time | Q100 in Channel Between Streets |
|---|---|---|---|---|
| Harmon Lane | 5 cfs/Pt.1 | 2.2/0.23 | 0.37%/2 min. | 4.5 cfs/Pt.2 |
| Stromson Lane | 5 cfs/Pt.2 | 2.9/0.33 | 0.43%/1.5 min. | 8.6 cfs/Pt.3 |
| Randy Lane | 5 cfs/Pt.3 | 3.1/0.45 | 0.32%/1.4 min. | 12.4 cfs/Pt.4 |
| Tru Lane | 5 cfs/Pt.4 | 4.7/0.39 | 0.87%/0.2 min. | 16.4 cfs/Pt.5 |
| Pond | Pt.5 | | | |

## D R A I N A G E  P O N D  C A L C S

Area Pond

The inflow-outflow hydrograph method used for this report is based on data supplied by the City Engineer's office for new development, using the Rational Method as the model for the rainfall-runoff process.

In particular, the 6 hr.-100 yr. storm of 2.4" was used to form a precipitation profile for a one hour period of the 6 hr.-100 yr. average storm of total "P" for the one hour of 2.05". (This storm was adjusted for the site area of 2.2").

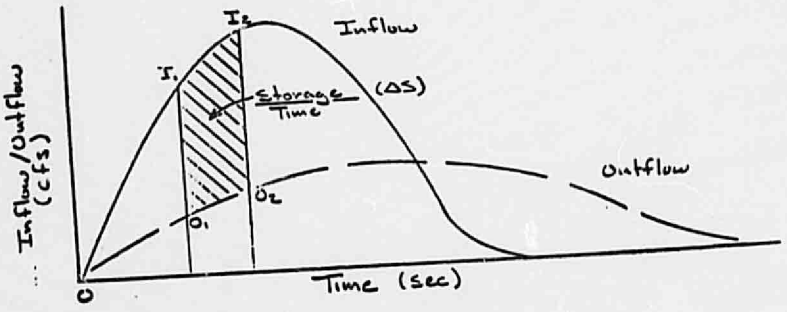



The rationale is that every conceivable storm which results in a total precipitation of 2.05" in one hour is by definition a 100 yr. storm event. This is a sound procedure for designing detention basins capable of intercepting the entire 100 yrs. developed runoff volume, with a Q5 release rate, irregardless of whether the peak intensity occurs at the beginning or toward the end of the storm period. The net result is a more effective detention basin design and use of the affected land.

SOUTH MESA PATIO TOWNHOUSES

AUGUST 1981

General Data




Typical Inflow/Outflow Hydrograph

Equations Used

$$\Delta S = \frac{I_1+I_2}{2}\Delta t - \frac{O_1+O_2}{2}\Delta t = S_2 - S_1$$

$$\Delta S = S_2\Delta t - S_1\Delta t$$

$$I_1+I_2+A_1 = R_2; \quad \text{where } A_1 = \frac{2S_1}{\Delta t} - O_1$$

$$R_2 = \frac{2S_2}{\Delta t} + O_2$$

$$I = S/\Delta t = \frac{[C_1 \times P \times A_r \times 43{,}560/12]}{\Delta t}$$

Where $C_1$ = Runoff Coefficient

P = Local Area Precipitation (Inches) = (SE/2.40) Po

Ar = Drainage Basin (Acres)

SE = Local 6 hr.-100 yr. storm event

Po = 1 hr. (hr.-100 yr. average storm) precipitation (Inches)

SOUTH MESA PATIO TOWNHOUSES AUGUST 1981

Runoff to Pond - Applicable areas from 4 cul-de-sacs

Base Data

Onsite Area = 5.36 Acres

Runoff Coeficient before development = 0.40

Runoff Coeficient after development = 0.65

Q100 Runoff = (0.65)(4.71)(5.36) = 16 cfs (Spillway Design)

$Q_5$ Runoff = (0.40)(2.43)(5.36) = 5 cfs (Outlet Pipe Design)

Local Area Precipitation = 2.2"

Total Onsite Developed Vol. to be routed through pond

= (2.2/12)(0.65)(5.36) = 27,820 $ft.^3$

Spillway Data

Available Head = 0.2';Min. flow capacity required = 16 cfs

Spillway Breadth = 72' (Eq. Q = CLH3/2)

Pipe Data

Available Head = 0.56', maximum Q discharge for head available

= 3.77 cfs.

These results obtained by using a submerged 12" diameter pipe.

Equivalent Area = 113 $in.^2$ (Eq. $Q = CA\sqrt{2gh}$)

Results (See Data Sheets in back of report)

Peak Volume stored while outflowing less than $Q_5$ of 3.8 cfs (maximum achieved for pipe size and head available = 7765 $ft.^3$ at time interval of 35 minutes at a depth in pond at 0.56 ft.

Outlet Facilities

The pond outlet facilities will be defined by a concrete wall as shown on the grading plan. The outlet will consist of 1) 3-7" diameter pipes with flowlines at elevation 5089.94 to release the entire ponded volume from the site at a peak controlled rate of 3.77 cfs, and 2) a 72' long spillway with its lip at elevation 5090.50. The capacity of the spillway is based on the peak onsite developed runoff of 16 cfs.

If the pipe remains open for the entire storm cycle, the maximum volume to be stored temporarily in the pond would equal 7765 $ft.^3$ at a high water elevation of 5090.50 ft.

If the pipe should become plugged, ponded waters would have the potential to rise briefly to elevation 5090.70 to discharge peak flows over the spillway.

Individual Rear Yard Ponds

Each lot with rear yard ponds have the same lot depth, 111', for two lot widths, 29' and 31'. Areas draining to pond include the roof area, side yard area, and rear yard area.

| Data | 29' Lot Width | 31' Lot Width |
|---|---|---|
| Area to Pond | 2639 ft.$^2$ | 2821 ft.$^2$ |
| C = 0.9 Area | 800 ft.$^2$ | 1000 ft.$^2$ |
| C = 0.4 Area | 1839 ft.$^2$ | 1821 ft.$^2$ |
| Composite C | 0.55 | 0.58 |
| Pond Vol.100 | 266 ft.$^3$ | 300 ft.$^3$ |
| Top Pond Dimensions | 25' wide x 25'long | 27' wide x 25' long |
| w/2:1 S.S. | x 0.5' deep | x 0.5' deep |

RECOMMENDATIONS TO DEVELOPER

1. Grade around each townhouse to provide a positive slope away from the foundation to carry drainage to discharge/pond points.

2. Grade Lots 85-90 as shown on grading plan to act as a temporary detention pond.

a) Install 3-7" pipes at flowline invert of 5089.94' to act as the controlled release point of the pond.

b) Construct an overflow spillway in concrete block wall around east and south pond perimeter at SE corner of pond. Construct wier 0.2' deep by 72' long, with flowline at 5090.50' to act as the emergency overflow point of the pond.

c) Landscape pond area with native shrubs/large cobble for Southwest style without plastic liner.

3. Construct 10' wide concrete lined channel per City standards along the east side of the site within 10' drainage right-of-way.

4. Grade shallow swale within south half of San Ignacio as shown on grading plan.

5. Escrow funds for:

a) Maintenance of common pond area in the event the City does not

accept maintenance, and in the event the area pond is damaged by flood flows following Sage Road.

b) Curb and gutter and equivalent residential street pavement for one half of Sage Road and San Ignacio Road adjacent to the site on the south and north sides, respectively.

6. File a temporary drainage easement for records allowing the use of Lots 85-90 as a ponding area, to revert to owner of record at the time the City releases said pond requirements.

## CONCLUSION

The proposed drainage plan sets forth requirements to be followed by the developer, McKellar Development Company, in order to meet City drainage requirements for the area, the effect of the impact of the offsite area flows on the site, and steps to be taken to insure minimal effect on the site in the event of a 100 yr. storm.

The following pages contain the Planning Department's recommendations and approvals, a copy of the pertinent part of the Sunset West Unit 2 report and the soils report.

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## C O N C L U S I O N

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The following pages contain the Planning Department's recommendations and approvals, a copy of the pertinent part of the Sunset West Unit 2 report and the soils report.

**********
*
* STORMWATER DETENTION POND DESIGN *
* SMALL DRAINAGE AREA *
*
**********

PROGRAM PARAMETERS

| | | |
|---|---|---|
| A2 | = DRAINAGE BASIN SIZE(ACRES) | 5.36 |
| C1 | = RUNOFF COEFFICIENT | .466 |
| C2 | = FIRST GEOMETRIC VOLUME COEFFICIENT | 13374 |
| C3 | = SECOND GEOMETRIC VOLUME COEFFICIENT | 879 |
| C4 | = HEAD LOSS COEFFICIENT | .8 |
| C5 | = PRECIPITATION COEFFICIENT | .92 |
| D | = DISCHARGE PIPE DIAMETER~~(FT)~~ (IN) | 12 |
| J | = INCREMENTAL DEPTH SIZE(FT) | .05 |
| K | = NUMBER OF ROUTING TIME PERIODS | 15 |
| T | = ROUTING TIME(SECS) | 300 |
| X | = DEPTH OF DETENTION POND(FT) | .8 |
| Z | = DRAIN PIPE ELEVATION-EXIT TO ENTRANCE(FT) | 0 |

PART ONE

ROUTING ELEMENT VS DISCHARGE RATE
FOR A KNOWN STORAGE VOLUME

| DEPTH TO INVERT (FEET) | STORAGE VOLUME (CUBIC FEET) | DISCHARGE RATE (CU. FT/SEC) | ROUTING ELEMENT (CU. FT/SEC) |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| .05 | 670 | 1.12 | 5 |
| .1 | 1346 | 1.59 | 10 |
| .15 | 2025 | 1.95 | 15 |
| .2 | 2709 | 2.25 | 20 |
| .25 | 3398 | 2.52 | 25 |
| .3 | 4091 | 2.76 | 30 |
| .35 | 4788 | 2.98 | 34 |
| .4 | 5490 | 3.18 | 39 |
| .45 | 6196 | 3.38 | 44 |
| .5 | 6906 | 3.56 | 49 |
| .55 | 7621 | 3.73 | 54 |
| .6 | 8340 | 3.9 | 59 |
| .65 | 9064 | 4.06 | 64 |
| .7 | 9792 | 4.21 | 69 |
| .75 | 10524 | 4.36 | 74 |
| .8 | 11261 | 4.5 | 79 |

PART TWO

CALCULATE ROUTING EQUATION ELEMENTS

| T (MIN) | I2 (CFS) | SV (CF) | A1 (CFS) | R2 (CFS) | Q2 (CFS) | WL (FT) |
|---|---|---|---|---|---|---|
| 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 9.17 | 1346 | 5 | 9 | 1.59 | .1 |
| 15 | 16.4 | 4230 | 25 | 31 | 2.8 | .31 |
| 20 | 6.95 | 6906 | 42 | 49 | 3.56 | .5 |
| 25 | 4.17 | 7478 | 45 | 53 | 3.7 | .54 |
| 30 | 4.17 | 7621 | 46 | 54 | 3.73 | .55 |
| 35 | 4.17 | 7765 | 47 | 55 | 3.77 | .56 |
| 40 | 2.22 | 7478 | 46 | 53 | 3.7 | .54 |
| 45 | 1.94 | 7049 | 43 | 50 | 3.6 | .51 |
| 50 | 1.94 | 6622 | 40 | 47 | 3.49 | .48 |
| 55 | 1.94 | 6196 | 37 | 44 | 3.38 | .45 |
| 60 | 1.94 | 5772 | 34 | 41 | 3.26 | .42 |
| 65 | 1.94 | 5349 | 32 | 38 | 3.14 | .39 |
| 70 | 0 | 4788 | 28 | 34 | 2.98 | .35 |
| 75 | 0 | 3813 | 23 | 28 | 2.66 | .28 |

PEAK INFLOW = 16.4 cfs
MAX OUTFLOW ≤ 5.0 cfs
MAX PONDING ≤ 0.8 ft
DRAINAGE AREA = 5.36 Ac.
RUNOFF COEFF = 0.65
100 YR STORM = 2.2 IN / 6 HRS
AVG 100 YR STORM = 2.4 IN / 6 HRS.
DISCHARGE PIPE COEFF. = 0.8
5 MIN TIME PERIODS

---

BECAUSE ONLY PEAK INFLOW GIVEN HAVE TO ESTABLISH ARTIFICIAL RUNOFF COEFFICIENT.

$$I = C_R \cdot P \cdot A_c \cdot \left(\frac{43560}{3600}\right)$$

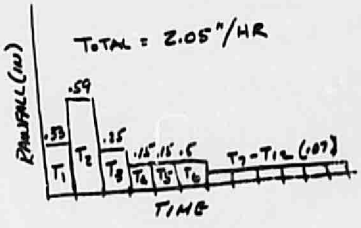
WHERE $P = (2.2/2.4)(T_2)$

$$\therefore C_R = \frac{I(T_2)}{P \cdot A_c \cdot \left(\frac{43560}{3600}\right)}$$

$$= \frac{16.4}{\left(\frac{2.2}{2.4}\right)(.59)(5.36)(12.1)}$$

$$\cong 0.466.$$

$\therefore$ USE $C_R = C_1$(PROGRAM) $= 0.466$ ← THIS IS ARTIFICIAL TO CORRESPOND TO ACTUAL INFLOW

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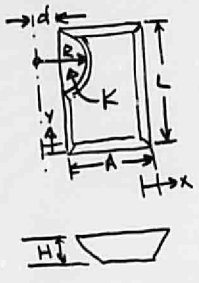
GEOMETRIC VOLUME COEFFICIENTS:




FROM MEASUREMENT
R = 50
d = 25
A = 105
L = 200
H = 1.0
SIDE SLOPE = 3:1

$$V(H) = (A-6)(L-6)H + \tfrac{1}{2}(2) \times \overset{(L-6)}{L} H + \tfrac{1}{2}(2) Y \overset{(A-6)}{A} H - K$$

BUT $X = 3H$ & $Y = 3H$

$$\therefore V = (99)(194)H + (3)(99)H^2 + (3)(99)H^2 - K$$

$$= 19206H + 879H^2 - K \quad \text{BUT}$$

$$K = \pi(R+1.5)^2 H - 2dRH$$

$$= \pi(51.5)^2 H - 2500H \cong 5832H \therefore$$

$$V = (19206 - 5832)H + 879H^2$$

$$= 13374H + 879H^2 \therefore$$

$C_2 = 13374$ & $C_3 = 879$

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

MAYOR
*David P. Rusk*

July 23, 1981

LETTER OF ADVICE

Mr. Christopher Weiss
P.O. Box 142
Sandia Park, New Mexico 87047

RE: S-81-13

Dear Mr. Weiss:

At the meeting of the Subdivision Review Board on July 23, 1981 the following decision was made:

BE IT RESOLVED that S-81-13 be given preliminary approval subject to the sign-off by the City Hydrologist.

The appeal deadline for this decision is August 7, 1981. Appeal may be made at the offices of the Planning Division, Room 601, City Hall, 400 Marquette, NW, Albuquerque, N.M, 87103. No permits or other such action may be taken until this date has passed.

If you have any questions concerning these decisions, do not hesitate to contact me at 766-7422.

Sincerely,

Robert J. Casias, Chairman
Subdivision Review Board

RJC/mes/7835A

CC: McKellan Development Corporation, P.O. Box 2066; 87103
Fred Hawkins, 820 86th Street, SW; 87105

AGENDA ITEM NO. 2
SUBDIVISION REVIEW BOARD
July 23, 1981

S-81-13 Christopher Weiss, agent for McKellar Development Corp., requests subdivision approval for Tracts 459 and 460, Unit 7, Town of Atrisco Grant (as Filed Dec. 5, 1944) located on the east side of 86th Street between San Ygnacio Road and Sage Road, SW, containing 10 acres. (L & M9)
DEFERRED 5-28-81

ACTION BY SRB 5-28-81:
Christopher Weiss, agent, requested indefinite deferral, pending the outcome of annexation of this land.

Fred Hawkins, 820 86th Street SW; 87105, asked to be notified concerning this case, as an interested citizen.

BE IT RESOLVED that S-81-13 be indefinitely deferred.

MOVED by Bob Kielich
SECONDED by Bob Casias

Motion Carried Unanimously

Bob Casias, Chairman

ADDITIONAL COMMENTS TO THE SRB 7-23-81:
Requested is preliminary subdivision plat approval for Tracts 459 and 460, Unit 7, Town of Atrisco Grant located on 86th Street, S.W. between San Ygnacio and Sage Roads.

The Subdivision Review Board indefinitely deferred S-81-13 on May 28, 1981 pending annexation and zoning of the applicant's property. On June 15, 1981 City Council approved annexation and gave R-D zoning to the applicant's property.

The applicant has submitted a revised preliminary plat satisfying the need for additional right-of-way along 86th Street, SW and Sage Road, SW. A detailed drainage report and grading plan is required but has not yet been submitted. The drainage study should incorporate the drainage conditions from the subdivisions on the west.

FINDING: A detailed drainage report and grading plan must be approved by the City Engineer.

RECOMMENDATION: PRELIMINARY PLAT APPROVAL OF S-81-13 IS RECOMMENDED, CONTINGENT ON THE SATISFACTION OF THE ABOVE FINDING.

Cynthia Bruce
Planner

CB/mas

cc: Christopher Weiss, P.O. Box 142, Sandia Park, NM; 87047
McKellan Development Corporation, P.O. Box 2066; 87103
Fred Hawkins, 820 86th Street, SW; 87105

IT IS REQUESTED THAT THE APPLICANT/AGENT BE PRESENT AT THE MEETING

SUBDIVISION REVIEW BOARD
PRIOR MATERIALS FROM THE
MEETING OF APRIL 21, 1981
S-81-13

S-81-13 Christopher L. Weiss, agent for McKellar Development Corp., requests approval of the South Mesa Patio Homes Subdivision encompassing Lots 459 and 460, Unit 7, Town of Atrisco Grant, located east of 86th Street between Sage Road and San Ygnacio Road S.W., containing approximately 10 acres (L & M-9).

COMMENTS FROM OTHER DEPARTMENTS TO THE SRB 4/21/81:

Transportation:
Traffic: "See the Traffic Engineer's comments on street widths and paving."
"Sage Road is a minor arterial requiring an 86' right-of-way; 43' from center must be dedicated. 86th Street is a logical replacement. Recommend 86th Street right-of-way be 80' (68' collector plus 12' for bike lanes), if not, then 68'. Curbs, gutters, sidewalks and pavement should be required on abutting streets (Sage, 86th, San Ygnacio) as well as internal streets. Triangular 'no man's land' parcels at cul-de-sacs should be added to adjoining lots."

Gas Company: "Approves the plat."
Parks and Recreation: "Under Ordinance 7-1976, as amended, the developer is required to pay a development fee at building permit time, plus dedicate land or cash-in-lieu of land."

City Engineer: "(1) A drainage study is required for approval prior to approval of plat. (2) Study should incorporate the drainage conditions from the subdivisions from the west. (3) Who will own the triangular pieces of land at each cul-de-sac? Do not dedicate to City. (4) Point contact along property lines and cul-de-sac is not acceptable. (5) All double frontage lots will require the installation of curb & gutter, sidewalk, and paving of both streets abutting the properties."

Refuse: "No adverse comments."
Police Department: "No adverse comments."
MRGCG: "Sage Road is designed as a Minor Arterial and 86th Street is designated as a Collector on the Long Range Major Street Plan. As such, Sage should have a right-of-way of no less than 86 feet, and 86th Street should have a right-of-way of no less than 68 feet. Dedications shown on this plat do not insure the required right-of-way for Sage or 86th Street. Arrangements should be made to dedicate the required right-of-way among all property owners whose lands abut the above-mentioned streets associated with this preliminary plat."

AMAFCA: "Defer to City Engineer's comments."
APS: "No adverse comments."
Mountain Bell: "No comment."
Fire Department: "Provide required fire flow and fire hydrant distribution."

PLANNING DIVISION COMMENTS TO THE SRB 4/21/81:

Requested is subdivision approval for South Mesa Patio Homes located along the east side of 86th Street between Sage and San Ygnacio Roads, SW, containing 10.0 acres (L & M-9).

The submitted plat is one of rather curious design with the interior street pattern consisting of 4 curved cul-de-sacs which terminate at the easterly boundary line of the site. The agent for the proposal has indicated to Planning Staff that this street pattern is currently being amended to a more conventional design which will be available at the time the Subdivision Review Board meets on the matter.

Otherwise, the proposal is quite conventional. There is, however, a major point which must be stressed. As noted by the City Traffic Engineer and Middle Rio Grande Council of Governments, Sage Road is a minor arterial, therefore it must have an 86' wide right-of-way (43 feet from center must be dedicated by the developer). Also 86th Street requires a 68' wide right-of-way minimum (80' if bicycle lanes are provided).

It is hoped that the forthcoming corrected plat will also address the remaining comments of Other Departments. If not, these comments will need to be addressed in a satisfactory manner. And, as usual, all components of Section 21 of the City of Albuquerque Subdivision Ordinance must be addressed and a detailed drainage report and grading plan must be approved prior to final plat approval.

FINDINGS: 1. Right-of-way widths of Sage Road and 86th Street must be amended to those requirements outlined above.
2. All components of Section 21 of the City of Albuquerque Subdivision Ordinance must be addressed.
3. A detailed drainage report and grading plan is required.

RECOMMENDATION: A 10-day deferral of S-81-13 is recommended in order to allow the applicant time to address the Findings.

Robert J. Casias, Planner

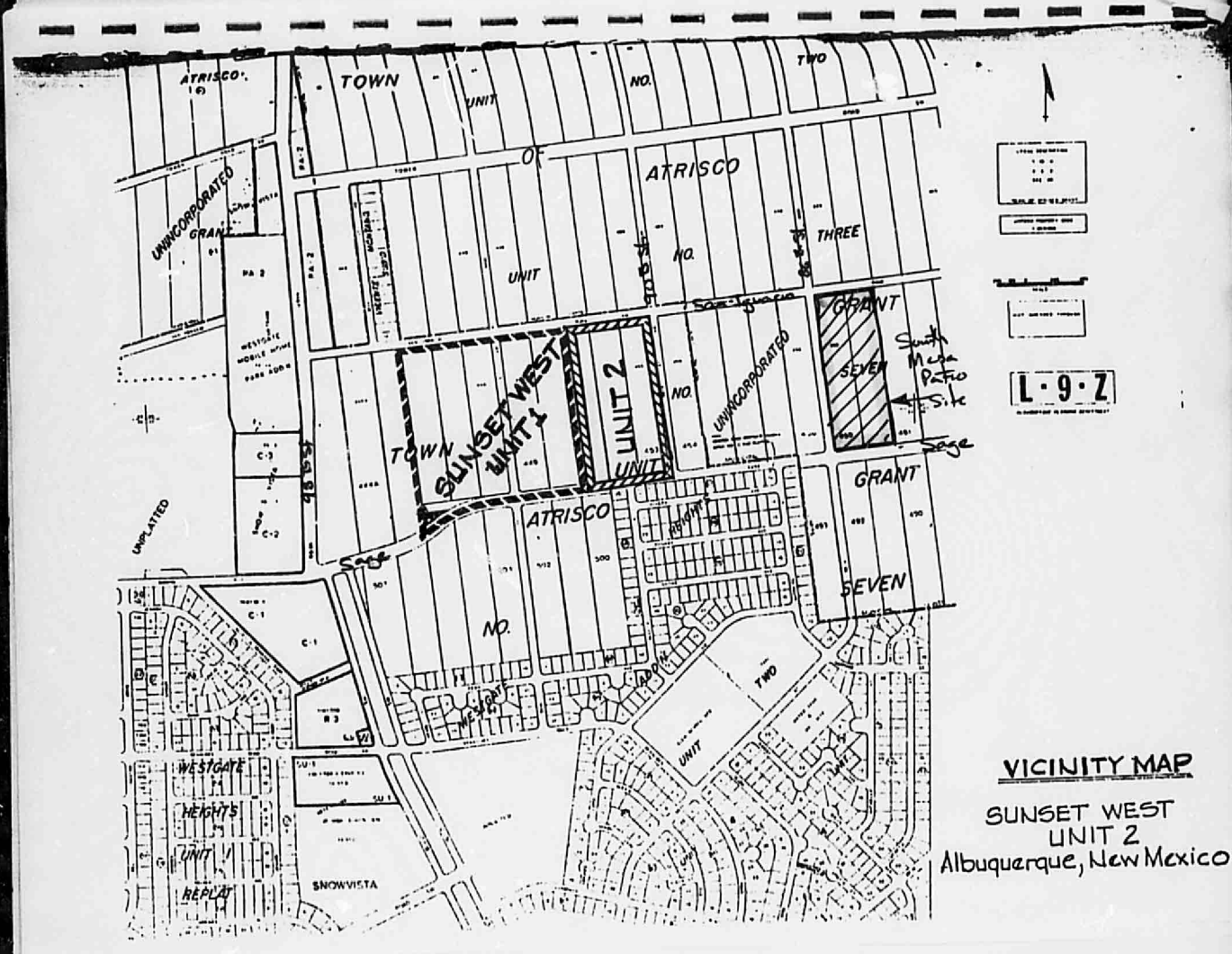
cc: Christopher Weiss, P.O. Box 142, Sandia Park, NM 87047
McKellan Development Corporation, P.O. Box 2066; 87103

IT IS REQUESTED THAT THE APPLICANT/AGENT BE PRESENT AT THE MEETING

ENGINEER'S REPORT
STORM DRAINAGE
FOR SUNSET WEST
SUBDIVISION UNIT 2

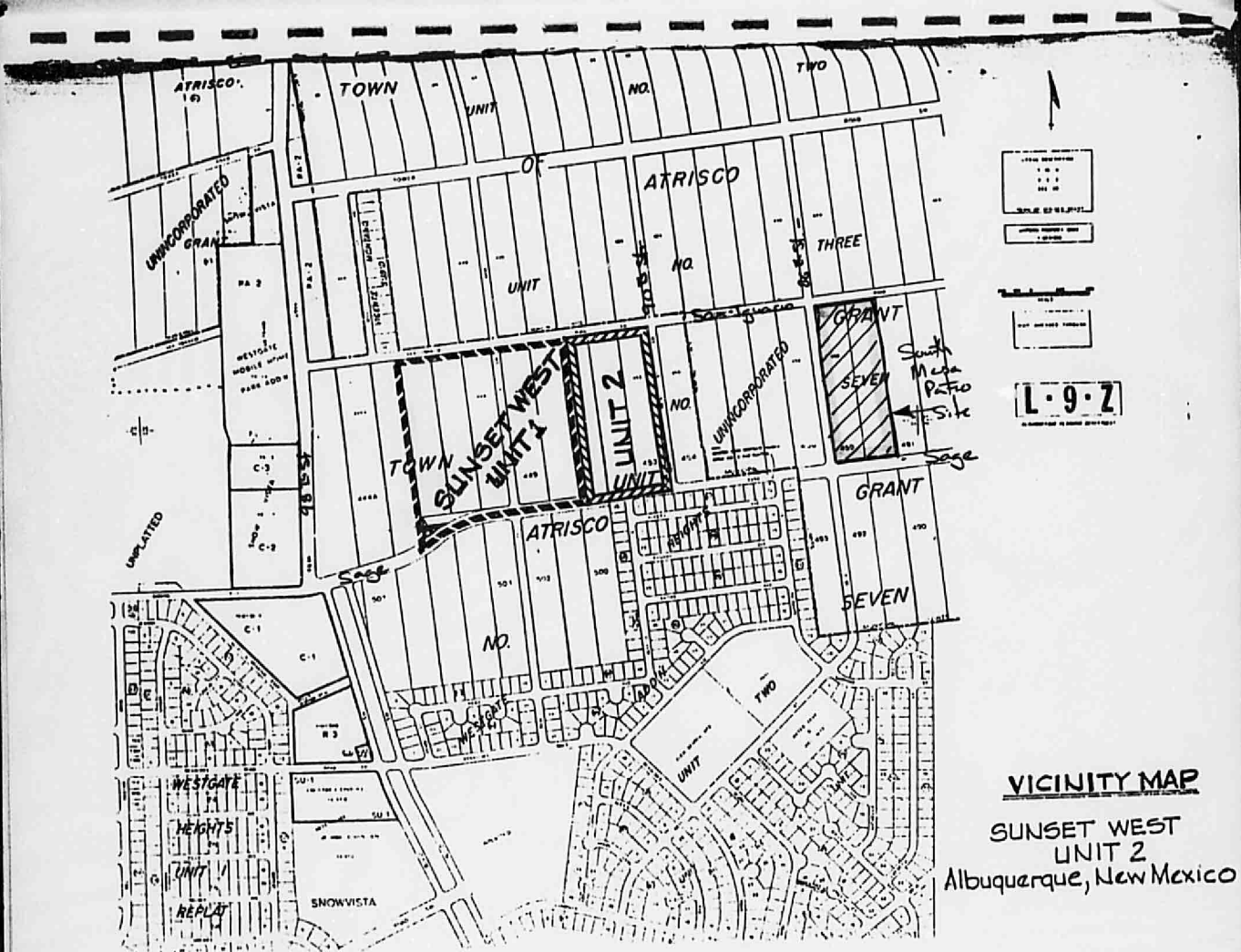
INTRODUCTION: Sunset West Subdivision Unit 2 is located east (down stream) of Sunset West Subdivision Unit 1 (see vicinity map), which is under construction at the present time. The Engineer's Report on Storm Drainage for Sunset West dated July 1979 and approved August 30, 1979; (see appendix A) addressed the natural drainage in the area and established a means of providing protection from possible offsite flows to the subdivision with temporary and permanent facilities. These facilities will be extended on the north, east and south of Unit 2 of the subdivision.

There are several areas upstream from the site which must be evaluated in considering this tract. Some information for this area has been developed in the Albuquerque Metropolitan Arroyo Flood Control Authority's (A.M.A.F.C.A.) Drainage Management Plan Western Albuquerque Metropolitan Area and the Corps of Engineers Flood Plain Information, Albuquerque Arroyos Part III, Albuquerque, New Mexico. The Master Plan of Drainage, City of Albuquerque, New Mexico and Environs 1963 and the Flood Hazard Boundary Maps for the City of Albuquerque, N.M. were also consulted. The subdivision area appears to be outside any flood hazard area, although none of the aforementioned reports clearly exclude the site from possible floodwater encroachment. After careful study, it was concluded that the site could be protected from possible offsite flows with temporary and permanent facilities.




## VICINITY MAP

SUNSET WEST
UNIT 2
Albuquerque, New Mexico




## VICINITY MAP

SUNSET WEST
UNIT 2
Albuquerque, New Mexico

PURPOSE: The purpose of this report is to provide information regarding the hydrology and natural drainage facilities relating to Unit 2 of the subdivision and design criteria for areas to be graded and for facilities to be constructed.

DESCRIPTION OF THIS SITE AND PROJECT: The site consists of a 16.299 acre tract which is situated between Sage Road S.W. (Gibson Boulevard) and San Ygnacio Road S.W. and west of 90th Street S.W. to the east line of Unit 1 of the subdivision (see vicinity map).

The site will be subdivided into 76 lots for single family homes. The design size of the lots was 61 feet by 100 feet, although the average lot is larger. Homes to be constructed within the project are anticipated to approximate 1,300 square feet of living area plus a double car garage.

Existing development in the immediate area consists of single family subdivisions to the immediate west, Unit 1 of this subdivision and across the street on the south side of Sage Road S.W.

HYDROLOGY AND HYDRAULICS: As discussed in the introduction of this report, several hydrologic studies have been conducted relative to this area, but none of these reports either clearly eliminated from or situated the subdivision area within a flood hazard area. The current F.I.A. maps now eliminate the subdivision area from the flood hazard area, the aforementioned Corps of Engineers Report indicates a possibility that the arroyo intercepted by Tower Road S.W. at the 5150 contour (See Appendix B for 1:12,000 scale topographic map) could produce some shallow sheetflow north of the subdivision, although the limit of the study's extent was considerably north of the site. The A.M.A.F.C.A. study is no more

home park on 98th Street, drainage area 4 (See Appendix B) contributed approximately 71 C.F.S. (cubic feet per second) to the arroyo. Present facilities include a 24 inch C.M.P. (corrugated metal pipe) underground through the mobile home park, and a small area north of the mobile home park will contribute by overland flow. These two flows (approximately 30 C.F.S. from the 24 inch C.M.P. and 27 C.F.S. from the overland flow) will combine to flow through the three 36 inch R.C.P. (reinforced concrete pipe) structure under 98th Street into the arroyo channel. In order to ensure capacity in case of any failure of constructed facilities upstream, the ditch section of the ditch-dike on the north side of San Ygnacio Rd. running parallel with both Units 1 & 2, is designed to accommodate 161 C.F.S. with the two foot high dike section above grade serving an additional protection. The ditch-dike will be extended east to 90th Street where it will be turned in a southerly direction to outfall into its original southeasterly course. A dike will also be placed on the easterly side of the 90th Street right of way to protect against overflow to the east. This ditch-dike section is designed to accomodate 167 C.F.S.

With the construction of Unit 1, which abuts to the west side of Unit 2, of the subdivision already underway, the only runoff entering Unit 2 from the west will be that portion of the onsite runoff from Unit 1 that will be carried in Sunbow and Sunridge Ave.

The most critical offsite flow to be considered is that which would utilize the southerly boundary of the subdivision (Sage Road) for outfall. Accumulated flows from Areas 1, 2, and 3 (See Appendix B) and the overflow not accomodated by the aforementioned 24 inch C.M.P. serving Area 4 would ultimately reach the inter-

definite. A.M.A.F.C.A. is planning, in the immediate future, to act upon a study relative to diversion facilities planned to provide permanent protection from storm runoff for this immediate area downstream from approximately the 5170 contour. The exact location of the major facility has not been determined at this time. If the major facility is constructed upstream from the 5170 contour, the problem of local drainage within drainage areas 1, 2, 3 & 4, and downstream of the facility and west of 98th Street will have to be handled by the developers of that area. At this time no funds have been allocated for construction of this facility; however A.M.A.F.C.A.'s Executive Engineer has assigned a high priority for this work when funds become available. A.M.A.F.C.A. has had working drawings developed for extending the channel-dike system already partially constructed along the power line west of Westgate Subdivision (See Appendix B), and construction will be effected in the near future using their own maintenance forces. This will remove some area from a drainage basin contributing upstream (Area 4-Appendix B).

An extensive study was made of all available information and mapping together with several field inspections relative to the extent of offsite storm runoff that might encroach upon the subdivision site. It is believed that the aforementioned arroyo intercepted by Tower Road S.W. at the 5150 contour would not contribute to any flood hazard for the subdivision, since the depth of the Tower Road excavation is such that the large part of any flow would be diverted in an easterly direction on the road alignment. However, this is not a provable theory, therefore a combination ditch-dike will be placed within the San Ygnacio Road S.W. right of way (See Hydrologic & Hydraulic Computations-Appendix H) to provide protection from the possibility of this overflow. This facility will also serve to intercept and conduct flows accumulated in the arroyo crossing the north boundary of the subdivision. Prior to the construction of the mobile

section of Sage Road and 98th Street. Flows from the mobile home park development would also reach this point through the concrete flume discharge to 98th Street near the alignment of San Ygnacio and the 24 inch C.M.P. draining a 36 inch square catch basin at the southeast corner of the mobile home park. It is believed that any structural failures or other occurences which might reroute flows would still deliver and distribute flows in much the same manner as can presently be expected, although a somewhat greater flow might be anticipated in the channel north of Sage Road. A topographic map (Appendix F) indicates existing conditions in this vicintiy. The maximum flow anticipated to reach the intersection is 469 C.F.S. including that contriubted by all of Areas 1, 2, 3 and 4 and the mobile home park. Even the small scale topographic map in Appendix F clearly indicates the absolute certainty that there would be overflow creating sheetflow conditions in the intersection. While there is a defined channel on the north side of and adjacent to Sage Road, it is narrow and shallow, and the natural tendency for outfall is in a southeasterly direction. It is speculated that at the outset of the flow only a small quantity would utilize the Sage Road channel, and, as the channel was scoured, a somewhat larger flow could be expected. It is estimated that one-fourth of the total flow with a maximum of 150 C.F.S. would be expected to follow this channel under the most adverse conditions. In order to ensure safe capacity of the designed section, the paved street will be constructed with a 12 inch high straight curb producing a hydraulic capacity of 224 C.F.S. (See Appendix H). The entire area between the north back of curb and the right-of-way line along the south line of Unit 2, will be paved with sidewalk to protect from overflow scouring. This treatment is identical to that used in Unit 1 along the north right-of-way line of Sage Road S.W.

The intersection of Sage Road S.W. with Blazick Street S.W., and with 90th Street S.W. will be constructed with a temporary design as shown in Appendix H to accomodate anticipated flows, until permanent protection is afforded by construction of the A.M.A.F.C.A. Diversion Channel upstream. A retaining wall will be constructed on the street boundaries of the lot at the northeast corner of the intersection of Sage Road and Blazick Street to the elevation of the rough pad grade to ensure that meandering flows at the intersection remain channelized, and a two foot high dike fifty feet long will be constructed between the edges of new pavement and existing pavement in lieu of the 8 inch extruded asphalt curb at the southeast corner of the intersection for the same purpose. A four (4) foot concrete cutoff wall will be constructed at the east in extremity of 90th Street to protect the pavement from downstream outfall.

It is believed that the aforementioned facilities will provide adequate protection from offsite storm runoff.

Onsite construction will provide for compliance with Drainage Resolution 1972-2 (See Appendix H for computations). The gross developed area in Unit 2, including San Ygnacio, Sage Road, and 90th St. is 17.866 acres. Prior to development this area would generate 100 year frequency storm runoff at a rate of 43.16 C.F.S. and a volume of 57,063.6 cubic feet (C.F.). The developed runoff from Unit 2, will be generated from street areas, driveways, sidewalks, and front yards, and eight (8) lots which have a 100% drainage. The remaining 68 lots will have interior drainage with no outfall to the streets (see Drainage layout). The developed area generating runoff that will enter the street system for conduct offsite is 8.36 acres, and a rate of 29.80 C.F.S. and a volume of 44,431.20 C.F. Both the rate and volume are well below the natural runoff from

THIS MICROIMAGE IS THE BEST POSSIBLE
REPRODUCTION DUE TO THE POOR QUALITY
OF THE ORIGINAL DOCUMENT

d [illegible]d 98th Street. Flows from the mobile home park develop
this point through the concrete flume discharge to 98th Street
[illegible]t of San Ygnacio and the 24 inch C.M.P. draining a 36 inch
si[illegible]at the southeast corner of the mobile home park. It is
any structural failures or other occurences which might reroute
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and 4 and the mobile home park. Even the small scale topographic map in
end[illegible] F clearly indicates the absolute certainty that there would be overflow
[illegible]eating sheetflow conditions in the intersection. While there is a defined
[illegible]el on the north side of and adjacent to Sage Road, it is narrow and shallow,
and the natural tendency for outfall is in a southeasterly direction. It is
speculated that at the outset of the flow only a small quantity would utilize
the Sage Road channel, and, as the channel was scoured, a somewhat larger flow
could be expected. It is estimated that one-fourth of the total flow with a
maximum of 150 C.F.S. would be expected to follow this channel under the most
adverse conditions. In order to ensure safe capacity of the designed section,
the paved street will be constructed with a 12 inch high straight curb pro-
ducing a hydraulic capacity of 224 C.F.S. (See Appendix H). The entire area
between the north back of curb and the right-of-way line along the south line
of Unit 2, will be paved with sidewalk to protect from overflow scouring. This
treatment is identical to that used in Unit 1 along the north right-of-way line
of Sage Road S.W.

the site hereinbefore mentioned. The maximum interior street flow will occur on Sunbow Ave. The maximum internal runoff from Unit 1, 23 C.F.S., will be carried down Sunbow Ave. Between Unit 1 and Blazick Street, on which some of the flow will be carried to Sage Road, there are ten (10) lots that will contribute approximately 2.85 C.F.S. to the flow in Sunbow Ave. The total anticipated flow in Sunbow Ave. of 25.85 C.F.S. is well under the curb full minimum street capacity of 32 C.F.S.

The typical design lot cross section and plan is indicated on the Drainage Layout. The anticipated volume of runoff on the undrained portion of a design lot is 527.9 C.F. The average depth of lot ponds will be:

Upper Lots = 9 1/4"

Lower Lots = 11 1/4"

RECOMMENDATIONS: It is recommended that the City of Albuquerque approve this report, in that it provides for adequate site protection together with accomodating the requirements set forth in drainage regulations.

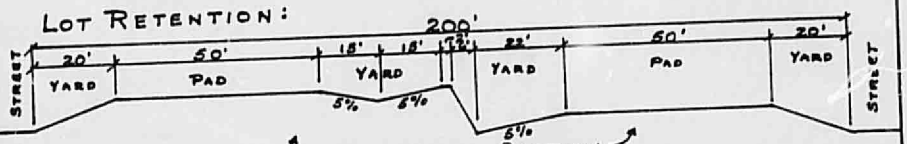
| GORDON HERKENHOFF & ASSOCIATES<br>SANTA FE NEW MEXICO<br>ENGINEERING CONSULTANTS | NAME OF PROJECT SUNSET WEST UNIT 1<br>HYDROLOGY & HYDRAULIC COMPUTATION | | | SHEET NUMBER<br>2 OF 4 |
|---|---|---|---|---|
| | COMPUTED BY<br>JP | CHECKED BY | JOB NUMBER | DATE<br>7/9/79 |

HYDROLOGY (CONT'D):
SUBDIVISION TRACT (CONT'D)-
DEVELOPED RUNOFF (CONT'D)-
RATE (CONT'D).-
AREA = 302,499 + 212,506 = 515,005 SF = 515,005 SF
= ENTIRE LOTS DRAINING TO STREET: 6*65*80 = 31,200 SF
TOTAL = 546,205 SF
= 12.54 Ac

COMP. C = [(302,499*0.9) + (212,506*0.4)]/515,005 = 0.69
TRAVEL = 2400 L.F., AVER. VEL = 2.5 F.P.S.
Tc = 2,400/(2.5*60) = 16.00 MIN.
I = 189/(25+16.00) = 4.61 IN./HR
Q = 12.54 * 4.61 * 0.69 = 39.89 C.F.S.

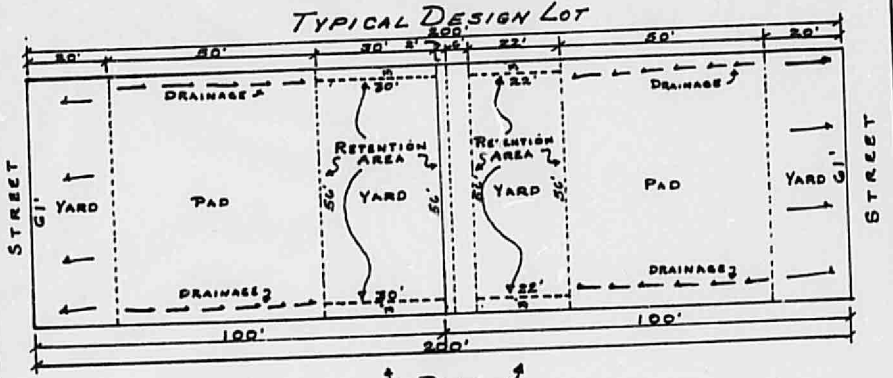
VOLUME -
V = 12.54 * (2.2/12) * 0.69 = 1.59 AC. FT. = 69,099.66 C.F.

LOT RETENTION:




LONGITUDINAL SECTION

TYPICAL DESIGN LOT




PLAN

ANTICIPATED VOLUME -
AREAS - 1,800 SQ. FT. HOUSE & GARAGE
3,080 SQ. FT. LANDSCAPED
} 80*61 = 4,880 SQ. FT.
COMP. C = [(1800*0.9) + (3,080*0.4)]/4,080 = 0.70
V = 4,080 * (2.2/12) * 0.70 = 524 C.F.

VOLUME AVAILABLE -
56*30*0.75/2 = 630 C.F.
56*22*1.10/2 = 677 C.F.

| GORDON HERKENHOFF & ASSOCIATES ALBUQUERQUE SANTA FE ENGINEERING COMPUTATIONS | NAME OF PROJECT Sunset West Unit 2 Hydrology & Hydraulic Computations | | | SHEET NUMBER 1 OF 4 |
|---|---|---|---|---|
| | COMPUTED BY RBG | CHECKED BY | JOB NUMBER | DATE 1-30-80 |

Hydrology:

Drainage Area ① (Appendix B) C = 0.40

Area = 45.91 Ac.; $T_c$ = 23.99 min.; $I = 189/(23.99+25) = 3.86$ In/HR.

$Q = 0.40 \times 3.86 \times 45.91 = 70.89$ C.F.S.

Drainage Areas 1, 2, 3, 4 & the Mobile Home Park

Area = 421.37 Ac.; $T_c$ = 49.70 min.; $I = 189/(49.70+25) = 2.53$ In/HR.

Composite $C = [(\text{Developed } 49.82 \times 0.7) + (\text{Undeveloped } 371.55 \times 0.4)]/421.37 =$

$C = 0.44$

$Q = 421.37 \times 2.53 \times 0.44 = 469.07$ C.F.S.

Subdivision Tract: - Unit 2

Gross Area = 17.866 acres

Natural Runoff:

Rate:- Area = 17.866 Ac.; C = 0.40

$$T_c = \left[\frac{(98.0/5280)^3 \times 11.9}{28-6}\right]^{0.385} = 0.105 \text{ HR.} = 6.3 \text{ min.}$$

$I = 189/(25+6.3) = 6.04$ In/HR.

$Q = 17.866 \times 6.04 \times 0.40 = 43.16$ C.F.S.

Volume:-

100 yr. - 6 HR. Precipitation = 2.2 inches

$V = 17.866 \times (2.2/12) \times 0.4 = 1.31$ Ac. Ft. = 57,063.6 C.F.

Developed Runoff:

Rate:-

Area to Runoff = Street Area Plus Front Yard Area Plus Eight (8) Back Yard Area.

| Hard Surface - | | |
|---|---|---|
| 2,787.76 L.F. street | × 41.25 Ft. = | 114,995.10 S.F. |
| 958.36 L.F. street | × 29.62 Ft. = | 28,386.62 S.F. |
| 645.03 L.F. street | × 31.62 Ft. = | 20,395.85 S.F. |
| 76 Driveways | × 15 Ft. × 20 Ft. = | 22,800 S.F. |
| | Total | 186,577.57 S.F. |

Appendix H

GORDON HERKENHOFF & ASSOCIATES
ALBUQUERQUE SANTA FE
ENGINEERING COMPUTATIONS

NAME OF PROJECT Sunset West Unit 2 Hydrology & Hydraulic Computations | SHEET NUMBER 2 OF 4

COMPUTED BY RBG | CHECKED BY | JOB NUMBER | DATE 1-30-80

## Hydrology (Cont'd):

Unpaved Surface -

| | | |
|---|---|---|
| 2,787.76 L.F. street | x 8.75 Ft. = | 24,392.90 S.F. |
| 958.36 L.F. street | x 4.38 Ft. = | 4,197.62 S.F. |
| 645.03 L.F. street | x 3.38 Ft = | 2,180.20 S.F. |
| 2,787.76 L.F. Front Yards | x 40 Ft = | 111,510.40 S.F. |
| 616.32 L.F. Front Yards | x 20 Ft. = | 12,326.40 S.F. |
| Less Driveways | = | - 22,800 S.F. |
| Entire Lots 565 L.F. | x 81 Ft. = | 45,765. S.F. |
| Total | = | 177,572.52 S.F. |

Area = 186,577.57 + 177,572.52 = 364,150 S.F.
= 8.36 Ac.

Comp. C = [(186,577.57 x 0.9) + (177,572.52 x 0.4)] / 364,150 = 0.66

Travel = 1500 L.F., Average Vel = 2.5 F.P.S.

$T_c$ = 1,500/(2.5x60) = 10.0 min.

I = 189/(25+10) = 5.4 In/HR.

Q = 8.36 x 5.4 x 0.66 = 29.80 C.F.S.

Volume -

V = 8.36 x (2.2/12) x 0.66 = 1.02 Ac. Ft. = 44,431.20 C.F.

## Lot Retention:

Anticipated Volume -

Areas - 1,800 S.F. House & Garage, 3,080 S.F. Landscaped } 80x61 = 4,880 S.F.

Comp. C = [(1,800x0.9) + (3,080x0.4)] / 4,880 = .59

Volume = 4,880 x (2.2/12) x 0.59 = 527.9 C.F.

Pond Depth Required:-

Upper Lots = 527.9/(55x12.5) = .768' = 9¼" in depth

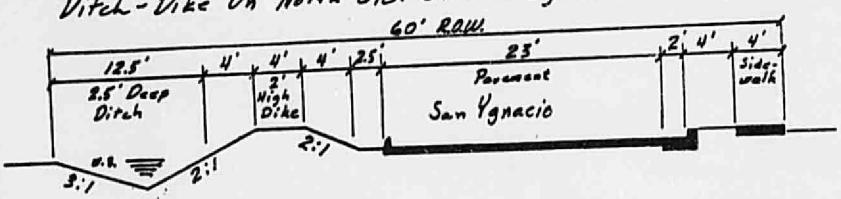
Lower Lots = 527.9/(55x10.25) = .936' = 11¼" in depth

Appendix H

| GORDON HERKENHOFF & ASSOCIATES ALBUQUERQUE SANTA FE ENGINEERING COMPUTATIONS | NAME OF PROJECT Sunset West Unit 2 Hydrology & Hydraulic Computations | | | SHEET NUMBER 3 OF 4 |
|---|---|---|---|---|
| | COMPUTED BY R.B.G. | CHECKED BY | JOB NUMBER | DATE 1-30-80 |

## Hydraulics:

Ditch - Dike On North Side of San Ygnacio Rd. S.W. in Unit #2



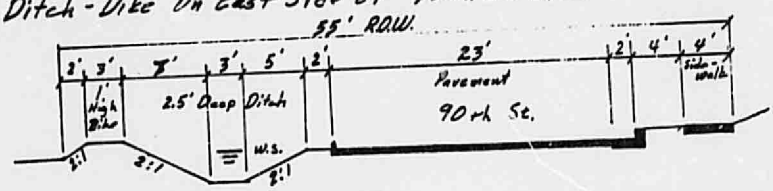

$S = 0.01925$ ; $n = 0.022$

Area $= 12.5 \times 2.5/2 = 15.63$ S.F. ; WP $= 5.59 + 7.91 = 13.5$ L.F.

$V = (1.486/0.022)(15.63/13.5)^{2/3}(0.01925)^{1/2} = 10.33$ F.P.S.

$Q = 15.63 \times 10.33 = 161.51$ C.F.S.

Ditch - Dike On East Side of 90rd. St. S.W. Unit 2



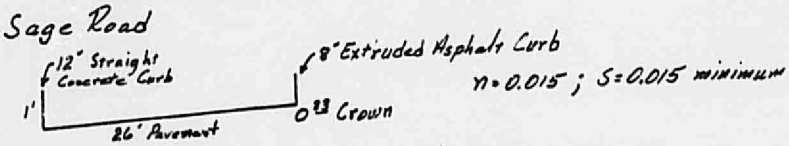

$S = 0.0097$ $n = 0.022$

Area $= (3 \times 2.5) + [(10 \times 2.5)]/2 = 20$ S.F. ; WP $= 5.59 + 5.59 + 3 = 14.18$ L.F.

$V = (1.486/0.022)(20/14.18)^{2/3}(0.0097)^{1/2} = 8.37$ F.P.S.

$Q = 8.37 \times 20 = 167.4$ C.F.S.

Sage Road




$n = 0.015$ ; $S = 0.015$ minimum

Area $= (1 + 0.67)/2 \times 26 = 21.71$ S.F. ; WP $= 27.67$ L.F.

$V = (1.486/0.015)(21.71/27.67)^{2/3}(0.015)^{1/2} = 10.32$ F.P.S.

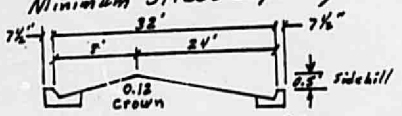
$Q = 21.71 \times 10.32 = 224.08$ C.F.S.

Appendix H

| GORDON HERKENHOFF & ASSOCIATES: ALBUQUERQUE SANTA FE ENGINEERING COMPUTATIONS | NAME OF PROJECT: Sage at West Unit 2 Hydrology & Hydraulic Computations | | | SHEET NUMBER 4 OF 4 |
|---|---|---|---|---|
| | COMPUTED BY: RBG | CHECKED BY | JOB NUMBER | DATE: 1-30-80 |

## Hydraulics (Cont'd):

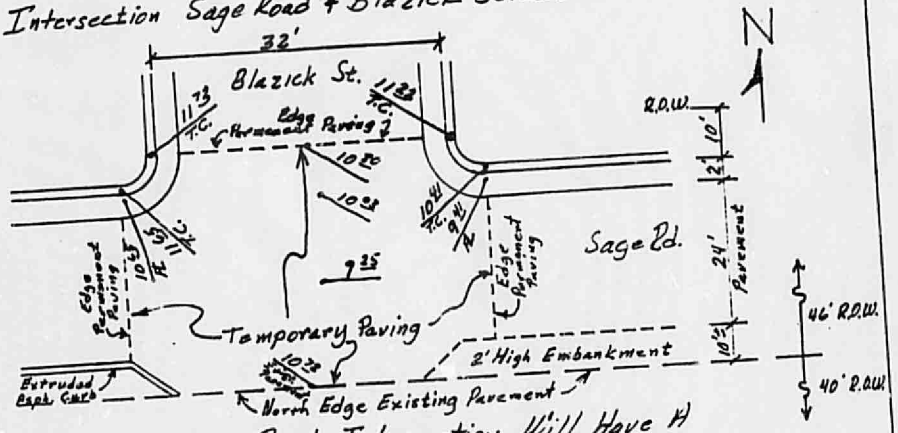
### Minimum Street Capacity:




n = 0.015; S = 0.006 minimum

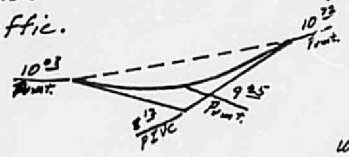
$A_{rea} = [(0.17+0.05)/2 \times 8] + [(0.67+0.05)/2 \times 24]$
$= 0.88 + 8.64 = 9.52$ S.F.
$W.P. = 32.84$ L.F.
$R = 9.52/32.84 = 0.29$
$V = (1.486/0.015)(0.29)^{2/3}(0.006)^{1/2} = 3.36$ F.P.S.
$Q = 9.52 \times 3.36 = 32.00$ C.F.S.

### Intersection Sage Road & Blazick Street:




The Temporary Paved Intersection Will Have A Parabolic Cross-Section To Provide For Accomodating The Anticipated Flow And To Permit Opening The Intersection To Vehicular Traffic.

Cross Section




$S = 1.56/41 = 0.03805$
Width = 36'
n = 0.015
Depth = 1.13'
Water depth = 0.78'

$A_{rea} = 27.141$ S.F.
$V = 15.98$ F.P.S.; $Q = 433.7$ C.F.S. @ full depth (1.13')

# GEOTECHNICAL INVESTIGATION FOR THE PROPOSED SOUTH MESA PATIO HOMES SUBDIVISION 86th STREET AND SAGE ROAD, S.W. ALBUQUERQUE, NEW MEXICO

ATL ENGINEERING SERVICES NO. 2232

MARCH 20, 1981

ATL ENGINEERING SERVICES

March 20, 1981

Consultants Terra Sol, Inc.
P. O. Box 142
Sandia Park, New Mexico 87047

Re: ATL Engineering Services No. 2232. Geotechnical Investigation for the Proposed South Mesa Patio Homes Subdivision at 86th Street and Sage Road, S.W., Albuquerque, New Mexico

Attention: Mr. Chris Weiss

Gentlemen:

Transmitted herewith is our GEOTECHNICAL INVESTIGATION REPORT for the above referenced project.

INTRODUCTION:

The test borings were drilled on March 12 and 13, 1981 using a Mobile B-61 "Pacemaker" Rotary Drill mounted on a 1979 Ford truck, the drill itself being powered by a Ford Industrial Engine. The test holes were advanced "dry" using 6-3/8" O.D. by 3-1/4" I.D., continuous flight, 5-foot sectional hollow stem augers. Standard penetration tests were made at 2½ to 5 foot vertical intervals in the holes and through the hollow stems of the augers at the time of drilling. The purpose of the standard penetration test is to obtain a measure of the relative density or consistency of the subsurface soils encountered and to obtain samples of the soils for visual inspection and laboratory testing.

TEST DATA AND RESULTS:

A sketch showing the locations of the six (6) test holes is shown on Page 3 and was made from a print of the site plan furnished to our office. "Boring Log Graphs" of the Test Holes are shown on Pages 4, 5 and 6 and depict the subsurface soils encountered in

the holes along with the results of the standard penetration tests, natural or existing moisture content, dry densities where obtainable, grain size classifications and Atterberg Limit Tests made on typical recovered samples. Notes and Definitions pertaining to the "Log Graphs" are shown on Page 7. Conclusions and Recommendations follow.

If any questions should arise concerning this report, please contact our office.

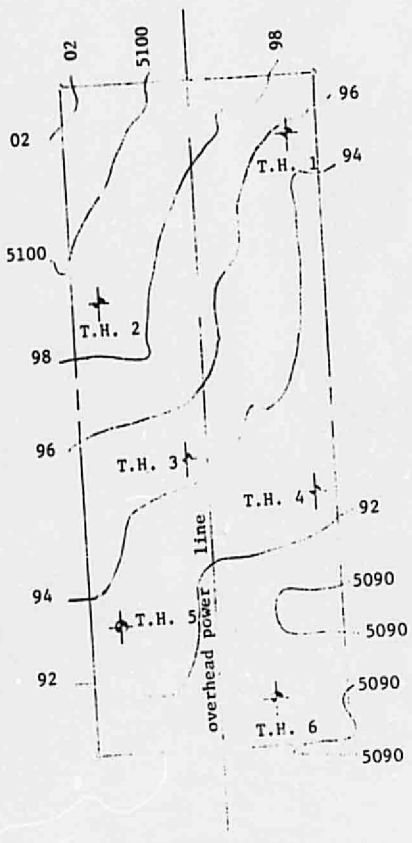
Respectfully submitted,

ATL ENGINEERING SERVICES

James H. Clary, Geologist
Reviewed by:

Robert K. Lloyd, P.E.

JHC/ksc




TEST LOCATIONS

Scale: 1"=200'
Existing Contours Shown
Contour Interval = 2'

# ALBUQUERQUE TESTING LABORATORY



PROJECT: South Mesa Patio Homes Subdivision

Lab No. 2232

Date: March 20, 1981

BORING LOG GRAPH - TEST HOLE NO. 1 & 2

| Depth | VISUAL DESCRIPTION | PENETRATION RESISTANCE Per Foot N | Per 6" or as Noted | Per Foot C | SAMPLER TYPE | MOISTURE CONTENT % M | DRY DENSITY P.C.F. D | PARTICLE SIZE DISTRIBUTION % GRAVEL | SAND | SILT & CLAY | ATTERBERG LIMITS % LIQUID LIMIT | PLASTIC LIMIT | P.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Test Hole No. 1 Approx. Elev. 5095' | | | | | | | | | | | | |
| | Light brown to tan, silty fine sand (SM - SC) | 4 | 1<br>2 | | S | 5.9 | | 1 | 81 | 18 | | | |
| | | | 4 | | | 4.9 | 88 | | | | | | |
| | | 18 | 8<br>10 | | C | 6.4 | 89 | 0 | 60 | 40 | 29 | 14 | 15 |
| | slightly clayey; calcareous Very Loose at the surface becoming Medium Dense with depth. | | 6 | | | | | | | | | | |
| | | 12 | 6<br>6 | | S | 3.1 | | 0 | 81 | 19 | | | |
| | | | 6 | | | | | | | | | | |
| | | 18 | 7<br>11 | | S | 4.6 | | 0 | 76 | 24 | | | |
| | | | 4 | | | | | | | | | | |
| | | 16 | 6<br>10 | | S | 2.3 | | 2 | 82 | 16 | | | |
| | 12' | | | | | | | | | | | | |
| | Light gray, clean sand (SW-SP) Medium Dense | | 6 | | | | | | | | | | |
| | | 22 | 10<br>12 | | S | 0.9 | | 1 | 97 | 2 | | | |
| | Test Hole No. 2 Approx. Elev. 5099' | | | | | | | | | | | | |
| | | 4 | 1<br>2 | | S | 6.2 | | | | | | | |
| | Light brown to tan, silty fine sand (SM) slightly clayey; calcareous | | 7 | | | 5.0 | 108 | | | | | | |
| | | 25 | 10<br>15 | | C | 2.5<br>2.5 | 104<br>107 | | | | | | |
| | Very Loose at the surface becoming Medium Dense at depth; slightly cemented at 2½' depth | | 4 | | | | | | | | | | |
| | | 11 | 5<br>6 | | S | 4.7 | | | | | | | |
| | | | 5 | | | | | | | | | | |
| | | 12 | 6<br>6 | | S | 3.4 | | | | | | | |
| | | | 5 | | | | | | | | | | |
| | | 17 | 8<br>9 | | S | 4.0 | | | | | | | |
| | 12' | | | | | | | | | | | | |
| | Light gray, clean, fine to medium sand (SP) Medium Dense | | 5 | | | | | | | | | | |
| | | 22 | 10<br>12 | | S | 1.3 | | | | | | | |

# ALBUQUERQUE TESTING LABORATORY

PROJECT: South Mesa Patio Homes Subdivision

Lab No. 2232

Date: March 20, 1981

BORING LOG GRAPH - TEST HOLE NO. 3 & 4

| Depth - Ft. | VISUAL DESCRIPTION | PENETRATION RESISTANCE Per Foot N | Per 6" or as Noted | Per Foot C | SAMPLER TYPE | MOISTURE CONTENT % M | DRY DENSITY P.C.F. D | PARTICLE SIZE DISTRIBUTION % GRAVEL | SAND | SILT & CLAY | ATTERBERG LIMITS % LIQUID LIMIT | PLASTIC LIMIT | P.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Test Hole No. 3 Approx. Elev. 5095 | | | | | | | | | | | | |
| | Light brown to tan, silty fine sand (SM) calcareous | 4 | 1<br>2<br>2 | | S | 6.2 | | 0 | 82 | 18 | | | |
| | | 17 | 5<br>6 | | S | 5.0 | | 0 | 69 | 31 | | | |
| 5 | Very Loose at the surface becoming Medium Dense with depth 9' | 25 | 6<br>10<br>15 | | C | 3.5<br>3.8<br>4.0 | 93<br>97<br>108 | 1 | 78 | 21 | | | |
| | | 24 | 7<br>10<br>14 | | S | 4.2 | | 0 | 77 | 23 | | | |
| 0 | Light gray, silty to clean fine sand (SM-SP) Medium Dense | 17 | 4<br>5<br>12 | | S | 1.4 | | 4 | 91 | 5 | | | |
| 15 | | 24 | 7<br>9<br>15 | | S | 2.2 | | 0 | 86 | 14 | | | |
| | Test Hole No. 4 Approx. Elev. 5093' | | | | | | | | | | | | |
| 0 | Light brown to tan, silty fine sand (SM) slightly clayey; calcareous | 2 | 1<br>1 | | S | 5.5 | | | | | | | |
| | | 44 | 10<br>18<br>26 | | C | 5.2<br>2.9<br>2.8 | 109<br>109<br>111 | | | | | | |
| 5 | Very Loose at the surface becoming Medium Dense with depth; slightly cemented at the 2½ depth | 12 | 4<br>5<br>7 | | S | 3.2 | | | | | | | |
| | | 9 | 5<br>5<br>4 | | S | 3.5 | | | | | | | |
| 0 | 12' Light gray, clean, fine to medium sand (SP) Medium Dense | 14 | 4<br>6<br>8 | | S | 1.7 | | | | | | | |
| 15 | | 28 | 8<br>11<br>17 | | S | 1.2 | | | | | | | |

# ALBUQUERQUE TESTING LABORATORY



PROJECT: South Mesa Patio Homes Subdivision

Lab No. 2232

Date: March 20, 1981

BORING LOG GRAPH - TEST HOLE NO. 5 & 6

| Depth - Ft. | VISUAL DESCRIPTION | Penetration Resistance: Per Foot N | Per 6" or as Noted | Per Foot C | Sampler Type | Moisture Content % M | Dry Density P.C.F. D | Particle Size Distribution %: Gravel | Sand | Silt & Clay | Atterberg Limits %: Liquid Limit | Plastic Limit | P.I. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Test Hole No. 5<br>Approx. Elev. 5093' | | | | | | | | | | | | |
| | Light brown to tan, silty, clayey sand (SM-SC) calcareous; Loose at the surface becoming Medium Dense to Dense or Firm to Very Firm. | 5 | 2<br>3 | | S | 4.7 | | | | | | | |
| | | | 3 | | | 6.7 | 84 | | | | | | |
| | | | 8 | | C | 6.9 | -- | | | | | | |
| | | 25 | 11 | | | 5.4 | 108 | | | | | | |
| | | | 14 | | | | | | | | | | |
| 5 | | | 5 | | S | 3.8 | | | | | | | |
| | | 16 | 8 | | | | | | | | | | |
| | | | 8 | | | | | | | | | | |
| | | | 10 | | S | 5.8 | | | | | | | |
| | | 35 | 17 | | | | | | | | | | |
| | with depth 9½' | | 18 | | | | | | | | | | |
| | | | 3 | | S | 2.7 | | | | | | | |
| 0 | | 7 | 3 | | | | | | | | | | |
| | Light gray, clean sand (SW-SP) Loose to Medium Dense | | 4 | | | | | | | | | | |
| | | | 5 | | S | 1.6 | | | 1 | 98 | 1 | | |
| 5 | | 20 | 10 | | | | | | | | | | |
| | | | 10 | | | | | | | | | | |
| | Test Hole No. 6<br>Approx. Elev. 5091' | | | | | | | | | | | | |
| | | | 1 | | | | | | | | | | |
| 0 | | 4 | 2 | | S | 8.1 | | | 0 | 77 | 23 | | |
| | Light brown to tan, silty fine sand (SM) slightly clayey; calcareous | | 2 | | | | | | | | | | |
| | | | 3 | | | | | | | | | | |
| | | 9 | 4 | | S | 7.2 | | | 8 | 61 | 31 | 18 | 14 4 |
| | | | 5 | | | | | | | | | | |
| | | | 5 | | | 5.3 | 104 | | | | | | |
| 5 | Very Loose to Loose and Medium Dense with depth | 9 | 5 | | C | 5.1 | 106 | | 1 | 77 | 22 | | |
| | | | 4 | | | | | | | | | | |
| | | | 3 | | | | | | | | | | |
| | | 13 | 4 | | S | 2.5 | | | 3 | 87 | 10 | | |
| | 9' | | 9 | | | | | | | | | | |
| | | | 4 | | | | | | | | | | |
| 0 | Light gray, clean sand (SP) Medium Dense | 24 | 9 | | S | 1.3 | | | 0 | 97 | 3 | | |
| | | | 15 | | | | | | | | | | |
| | 13' | | | | | | | | | | | | |
| | Brown, silty, sandy clay (CL) Very Firm | | | 15 | | | | | | | | | |
| 15 | | 39 | 17 | | S | 9.2 | | | 1 | 17 | 82 | | |
| | | | 22 | | | | | | | | | | |

## NOTES AND DEFINITIONS

1. **Penetration Resistance** - Blows per foot using "A" rod, 140 lb. hammer with 30-inch guided free fall unless otherwise noted.
   - N - Standard Penetration Resistance (ASTM: D-1586), 2" O.D. split barrel sampler
   - C - Continuous Penetration Resistance, 2½" O.D., conical, steel drive point
   - R - Penetration Resistance, 3" O.D. Modified Dames & Moore Split Ring Sampler

2. **Sample Type**
   - S - Standard Split barrel; 2" O.D. x 1-3/8" I.D.
   - C - California Sampler; 2-3/8" O.D. equipped with 2" I.D. x 4" high brass liners
   - R - Modified Dames & Moore Sampler; 3" O.D. equipped with 2.42" I.D. x 1" high brass liners
   - T - Shelby Tube

3. **Soil Index Properties**
   - M - Moisture Content, % of dry soil weight
   - D - Density, lbs per cubic foot computed either by volumetric or displacement methods. Soils Classifications are visual unless accompanied by grain size analysis and Atterberg Limits.

4. **Water Table** - If encountered is noted on Log Graphs as ⏚.

## UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM: D2487

### COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

| Symbol | Letter | Description | Major Divisions |
|---|---|---|---|
| | GW | Well-graded gravels or gravel-sand mixtures, less than 5% - 200 fines | GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. |
| | GP | Poorly-graded gravels or gravel-sand mixtures, less than 5% - 200 fines | |
| | GM | Silty gravels, gravel-sand-silt mixtures, more than 12% - 200 fines | |
| | GC | Clayey gravels, gravel-sand-clay mixtures, more than 12% - 200 fines | |
| | SW | Well-graded sands or gravelly sands, less than 5% - 200 fines | SANDS More than half of coarse fraction is smaller than No. 4 sieve size. |
| | SP | Poorly-graded sands or gravelly sands, less than 5% - 200 fines | |
| | SM | Silty sands, sand-silt mixtures more than 12% - 200 fines | |
| | SC | Clayey sands, sand-clay mixtures more than 12% - 200 fines | |

NOTE – Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols.

### FINE-GRAINED SOIL

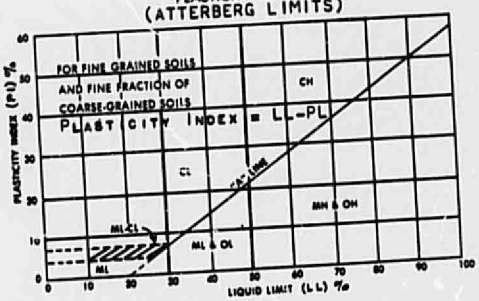
MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

| Symbol | Letter | Description | Major Divisions |
|---|---|---|---|
| | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity | SILTS AND CLAYS Liquid limit less than 50 |
| | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays | |
| | OL | Organic silts and organic silt-clays of low plasticity | |
| | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts | SILTS AND CLAYS Liquid limit greater than 50 |
| | CH | Inorganic clays of high plasticity, fat clays | |
| | OH | Organic clays of medium to high plasticity, organic silts | |
| | PT | Peat and other highly organic soils | |

### SOIL FRACTIONS

| Component | | Size Range |
|---|---|---|
| Boulders | | Above 12 in. |
| Cobbles | | 3 in. to 12 in. |
| Gravel | | 3 in. to No. 4 sieve |
| Coarse Gravel | G | 3 in. to ¾ in. |
| Fine gravel | | ¾ in. to No. 4 sieve |
| Sand | | No. 4 to No. 200 |
| Coarse | CS | No. 4 to No. 10 |
| Medium | MS | No. 10 to No. 40 |
| Fine | FS | No. 40 to No. 200 |
| Fines (silt or clay) | S/C | Below No. 200 sieve |

### PLASTICITY CHART (ATTERBERG LIMITS)



HYDROLOGY L9/D5 6 PLANS 2 of 2

## CONCLUSIONS AND RECOMMENDATIONS

Based on the conditions of the surface and subsurface soils existing at the site as revealed by the six (6), fifteen foot depth test borings; standard field penetration tests (A.S.T.M. D-1586) made at the time of drilling; laboratory tests made on representative soil samples; and a visual inspection of the site; we submit the following opinions and recommendations concerning the design of the foundations of the proposed residences and other pertinent geotechnical considerations:

### A. SITE CONDITIONS

The area is moderately vegetated with grasses and weeds, and surface fill and rubbish occurs as scattered small piles over much of the area. The ground surface slopes relatively evenly to the southeast with a difference in elevation of approximately 12 feet between the high northwest corner and low southeast corner.

From the existing ground surface to the 9 to 12 foot depths at all test locations, the soils consist of light brown to tan, silty to clayey fine sands (SM-SC) which are generally Very Loose at the surface and become Medium Dense or Firm with depth. These overlying soil deposits are calcareous and of aeolian origin.

Beneath the windblown sands and extending below the 9 to 12 foot depth to the full 16½ foot tested depth, are light gray, clean, river deposited sands (SP-SW) which are in a Loose to Medium Dense state of relative density and brown, silty, sandy clays (CL) which are in a Very Firm state of relative firmness.

No water table or water bearing strata was encountered at any of the test locations.

### B. PROPOSED CONSTRUCTION

It is our understanding that the proposed development will consist of single story, residential duplexes; having either continuous, reinforced concrete foundations or turned-down slab edges; "on-grade" concrete floor slabs; and without basements.

C. SITE PREPARATION

Prior to construction, the entire site should be completely stripped of vegetation and rubbish and these materials wasted. Recommended "Guideline Specifications for Earth Filling and/or Cutting Operations" are given in the Appendix.

D. FOUNDATIONS

All foundations should be based entirely on naturally deposited, undisturbed soils at a minimum depth of 1½ feet beneath the existing ground surface and 2 feet beneath the adjacent, exterior finished grade. For foundations based at this depth and entirely on naturally deposited, undisturbed soils, an allowable soil bearing pressure of 1,500 lbs./sq. ft. may be used. This value may be increased by one-third for the total combination of dead load plus full live load, plus seismic forces. Minimum width of continuous footings, if used, should be 1'-4". If a turned down slab foundation is used, then the haunch should be adequately reinforced to help distribute the loads over a portion of the slab.

E. ON-GRADE FLOOR SLABS

All on-grade concrete floor slabs should be based on a minimum 6 inch compacted thickness of approved on-site soils or imported fill soils consisting of a pit-run sand and gravel or similar material having a Plasticity Index not exceeding 6. Slab fill soils should be properly processed, spread and compacted to a minimum of 90 percent of Modified Proctor Density as described in the "Guideline Specifications for Earth Filling and/or Cutting Operations" given in the Appendix.

F. PAVEMENTS

Support for asphaltic concrete pavement (parking areas and drives) may be provided by a minimum 4 inch and preferably 6 inch compacted thickness of imported aggregate base course and fines, placed and compacted as described in the Guideline Specifications. The following minimum pavement sections are suggested for varying traffic conditions:

Lab. No. 2232

| Traffic Condition | Minimum Pavement Thickness (inches) | Recommended Aggregate Base Course Thickness (inches) |
|---|---|---|
| Light - passenger cars and general parking areas | 2 | 6 |
| Medium - light to medium trucks, driveways | 3 | 6 |

Specifications for asphaltic concrete pavement and select base course may be taken from the "New Mexico Standard Specifications for Public Works Construction", 1979 Edition, Section 115 and 302 respectfully. In addition, the following specifications are recommended for the pavements:

Marshall Stability (Modified Method) - 1500 minimum
Marshall Flow - 10 to 16
% Aggregate voids filled with asphalt cement - 70 to 80
% Voids in compacted mix - 3 to 5
Density of compacted pavement - minimum of 96% of laboratory compacted specimen.

G. DRAINAGE AND PROTECTION OF FOUNDATION SOILS

It will be of primary importance at this site to keep the soils beneath floor slabs and foundations protected from moisture intrusions. Foundation soils in their present, relatively dry state, can easily support the anticipated, light structural loads. However, as indicated by the Consolidation Tests in the Appendix, the foundation soils are susceptible to additional settlements with increased or saturated moisture conditions. To help prevent moisture intrusions into foundation soils, we advise that the following minimum precautions be taken:

1. Provide and maintain positive surface water drainage around and away from all foundations and exterior walls.

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2. Keep all opened excavations dry, with concreting, and backfilling operations to follow as soon as is practical.
3. Properly compact all backfill soils in utility trenches and around foundations to a minimum of 90 percent of Modified Proctor Density.
4. Discourage the planting of vegetation adjacent to foundations unless underdrains are placed beneath planted areas to lead irrigation waters away from foundations.

The recommendations given in this report are based on the actual subsurface soil conditions existing at the test locations, a visual inspection of the site, and our understanding of the proposed construction.

Any changes or deviations from the recommendations given in this report, in structure loads, foundation depths or any other factors which could affect or alter the recommendations covered herein, should be brought to our attention before finalization of plans and prior to construction.

Your attention is directed to the fact that only very small, fractional parts of the proposed site area were "opened" and the subsurface soils exposed and tested from the test borings depict soils and soil conditions only at these locations. Subsurface soils and their in-situ properties which can materially affect design considerations may change in areas not covered by test borings. Therefore, if during construction and when excavations for footings are opened, soil foundation conditions differ from those encountered by the test borings of this report, our laboratory should be notified immediately for possible revision to our recommendations.

Professional opinions and recommendations presented in this report are based on our evaluations of the subsurface soil conditions at the site, our understanding of the proposed construction and our experience in the geotechnical field. Our only guarantee concerning the project is that our engineering and geological work and judgments given herein meet the standards of our profession at this time.

Respectfully submitted,

ATL ENGINEERING SERVICES

James H. Clary, Geologist

Reviewed by:

Robert K. Lloyd, P.E.

**APPENDIX**

## GUIDELINE SPECIFICATIONS FOR EARTH FILLING AND/OR CUTTING OPERATIONS

(1) Prior to fill placement and grading operations, all areas to receive compacted fill for support of floor slabs or pavement at the site shall be thoroughly cleared of any trash, any loose fill soils and excessive vegetation that may exist. An inspection or inspections as required will be made by the Soils Engineer and his approval will be given to commence grading and filling operations when the site has been properly cleared.

(2) All building pads where residences are planned shall be composed either entirely of natural ground or of compacted, controlled fill. In the building areas where both fill and cut are encountered, the natural ground shall be overcut for a vertical distance of at least 1 foot below finished pad grade. Both the fill and overcut natural ground sections shall be compacted as hereinafter specified.

(3) Prior to placement of compacted fill soils the existing surface of natural ground in filled areas or overcut natural ground sections shall be leveled, scarified and properly moistened and compacted to a minimum of 90% of Modified Proctor Density by A.S.T.M. Method D-1557, and for a vertical depth of at least 8 inches. This may require processing of as much as 12 inches to 14 inches of the existing ground and/or cut ground soils.

(4) Approved fill soils with a Plasticity Index not exceeding 6 shall be those soils available at the site or from a source approved by the Soils Engineer. These soils shall be processed and thoroughly mixed with water outside of areas to be filled until they are within 2% of optimum moisture. They shall then be spread in horizontal layers not to exceed 8 inches in loose thickness and compacted, using suitable equipment, to a minimum of 90% of Modified Proctor Density as determined by A.S.T.M. D-1557.

(5) During construction, low areas shall be protected from excessive water intrusions and the contractor shall have adequate equipment on the project site to promptly remove surface water that might accumulate in areas due to any cause.

(6) The Soils Engineer will provide adequate trained personnel during the construction period to continuously supervise and test all fills as they are placed. This will include "Densities of Soil in Place by the Sand Cone Method or by Nuclear Methods (A.S.T.M. D-2922)". A sufficient number of tests will be made during each day's operation on each lift of fill to insure the Soils Engineer that specification requirements are being adhered to. At least one (1) field density test should be made in each compacted "pad" or controlled fill area beneath "on-grade" floor slab construction. In addition, tests of fill soils should be made at the following rates:

(a) one field density test per each 2000 square yards of subgrade prior to fill placement.

(b) one field density test for each 350 cubic yards of fill placed or each layer of fill for each work area, whichever is greater.

When tests indicate that the density of any layer of fill or portion thereof is below the required density, the particular layer or portion shall be reworked until the required density is obtained.

(7) No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable weather conditions. If the work is interrupted by surface water intrusions, fill operations shall not be resumed until the Soils Engineer accepts the moisture content and density of the natural ground or previously placed filled soils.

(8) The owner shall employ the services of a registered, licensed Soils Engineer to supervise all controlled earthwork. The Soils Engineer shall provide continuous on-site inspection by experienced personnel during construction of controlled earthwork. The Contractor shall notify Housing and Urban Development at least two (2) working days in advance of any field operations on the controlled earthwork, or of any resumption of operations after stoppages. Costs of all tests and inspection(s) shall be the responsibility of the Contractor.

## CONSOLIDATION TESTS

**TEST DATA:** Two relatively "undisturbed" silty sand samples from T.H.-1 at the 2½ foot depth and T.H.-6 at the 5 foot depth were tested for their consolidation characteristics using the Soiltest Model C-252 consolidometer. The samples were placed in the apparatus at existing "in-situ" moisture content, then loaded in increments to 1 ton/sq. ft. After consolidation under the 1 ton/sq. ft. load and "in-situ" moisture conditions was complete, the samples were flooded with water. After consolidation under the 1 ton/sq. ft. load and saturated conditions was complete, the samples were loaded to a final 2 tons/sq. ft.

**TEST RESULTS:** Results of the consolidation tests are tabulated below and shown graphically on the following pages.

| Sample Designation | Percent Consolidation (Cumulative) 1 t.s.f., in-situ moisture | 1 t.s.f., saturated | 2 t.s.f., saturated |
|---|---|---|---|
| T.H.-1, 2½' | 1.28 | 8.49 | 12.65 |
| T.H.-6, 5' | 0.99 | 4.14 | 5.66 |

# CONSOLIDATION TEST DATA

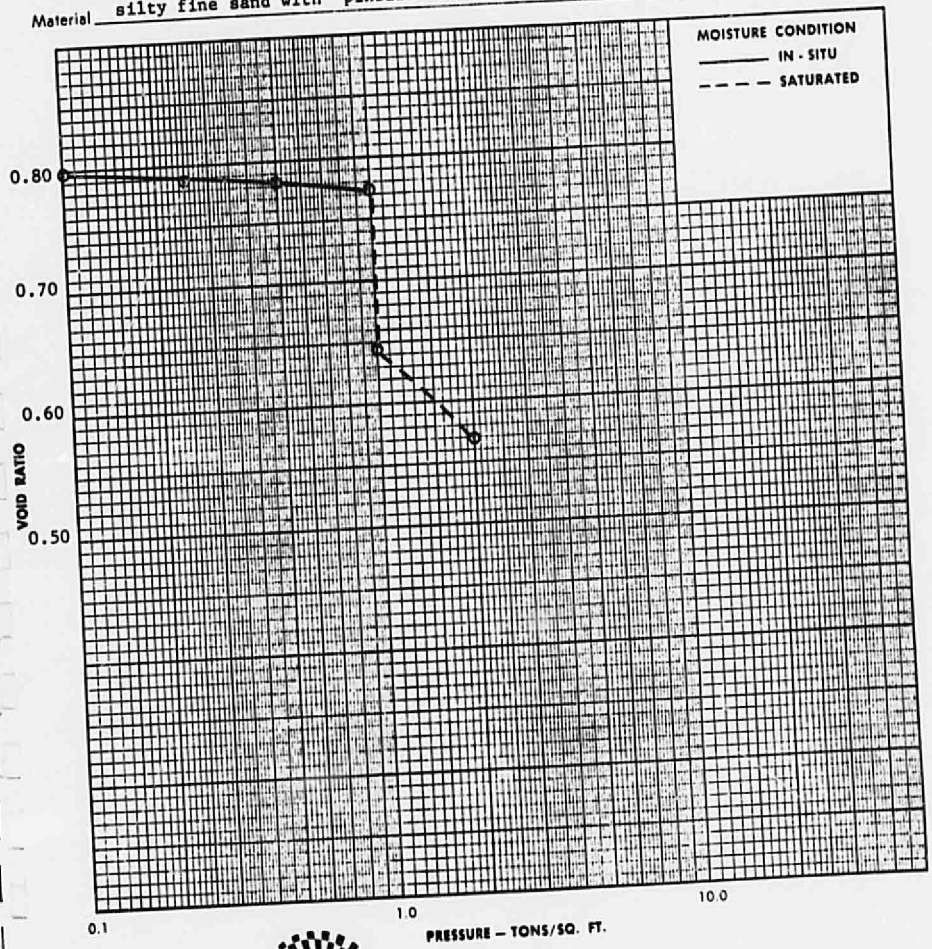


Lab. No. 2232

Project South Mesa Patio Homes Subdivision Location Albuquerque, New Mexico

Source of Sample Test Hole No. 1 at 2½' depth

Material silty fine sand with "pinsize" holes




ATL ENGINEERING SERVICES

Lab. No. 2232

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Project South Mesa Patio Homes Subdivision

Location Albuquerque, New Mexico

Sample Source Test Hole 1, Depth 2½ feet

Material tan fine silty sand, pinholes

Undisturbed [X] 'C' Remolded [ ]

**ATL ENGINEERING SERVICES**

CONSOLIDATION TEST

| Date | Time | Load T/sf | Elasped Time(min) | Dial Reading |
|---|---|---|---|---|
| 3/16/81 | 2:40 | 1/4 | 0 | 0.0000 |
| | | | 1/4 | 0.0023 |
| | | | 1/2 | 0.0024 |
| | | | 1 | 0.0024 |
| | | | 2 | 0.0025 |
| | | | 4 | 0.0026 |
| | 4:10 | | | 0.0035 |
| 3/17/81 | 7:43 | | | 0.0053 |
| | 8:18 | 1/2 | 0 | 0.0054 |
| | | | 1/4 | 0.0068 |
| | | | 1/2 | 0.0069 |
| | | | 1 | 0.0069 |
| | | | 2 | 0.0070 |
| | | | 4 | 0.0070 |
| | 9:27 | | | 0.0075 |
| | 10:38 | | | 0.0078 |
| | 11:39 | 1 | 0 | 0.0080 |
| | | | 1/4 | 0.0105 |
| | | | 1/2 | 0.0106 |
| | | | 1 | 0.0107 |
| | | | 2 | 0.0108 |
| | | | 4 | 0.0110 |
| | 12:58 | | | 0.0119 |
| | 2:18 | | | 0.0123 |
| | 3:40 | | | 0.0127 |
| | 4:22 | 1* | 0 | 0.0128 |
| | | | 1/4 | 0.0165 |
| | | | 1/2 | 0.0255 |
| | | | 1 | 0.0410 |
| | | | 2 | 0.0635 |
| | | | 4 | 0.0790 |
| 3/18/81 | 7:45 | | | 0.0849 |
| | 8:32 | 2* | 0 | 0.0849 |
| | | | 1/4 | 0.1095 |
| | | | 1/2 | 0.1125 |
| | | | 1 | 0.1146 |
| | | | 2 | 0.1167 |
| | | | 4 | 0.1186 |
| | 9:50 | | | 0.1250 |
| | 11:02 | | | 0.1260 |
| | 12:05 | | | 0.1263 |
| | 1:13 | | (end) | 0.1265 |

Wet Wt. Soil + Ring 106.8 gm.
Ring Wt. 33.4 gm.
Wet Soil 73.4 gm.
Dry Soil 69.7 gm.

Assumed Sp. Gr. 2.65

CONSOLIDATION RING

Dia. 1.9140 in. Area 2.8772 sq.in.

Ht. 1.000 in. Vol. 0.00167 cu.ft.

Percent Moisture 5.3 Dry Density 92.0 pcf

$V_s = \frac{\text{Dry Density}}{(62.4)\text{Sp.Gr.}} = 0.5564$

$V_v = 1 - V_s = 0.4436$

Init.Void Ratio(e) $= \frac{V_v}{V_s} = 0.7973$

$e = \frac{\triangle - V_s}{V_s}$

| Load T/sf | Dial Reading | 1-Dial Reading (△) | e | Percent Consolidation |
|---|---|---|---|---|
| 0 | 0.0000 | 1.0000 | 0.7973 | 0 |
| ¼ | 0.0054 | 0.9946 | 0.7876 | 0.54 |
| ½ | 0.0080 | 0.9920 | 0.7829 | 0.80 |
| 1 | 0.0128 | 0.9872 | 0.7743 | 1.28 |
| 1* | 0.0849 | 0.9151 | 0.6447 | 8.49 |
| 2* | 0.1265 | 0.8735 | 0.5699 | 12.65 |
| 4* | | | | |
| 8* | | | | |
| 12* | | | | |
| 16* | | | | |

*Saturated

## CONSOLIDATION TEST DATA

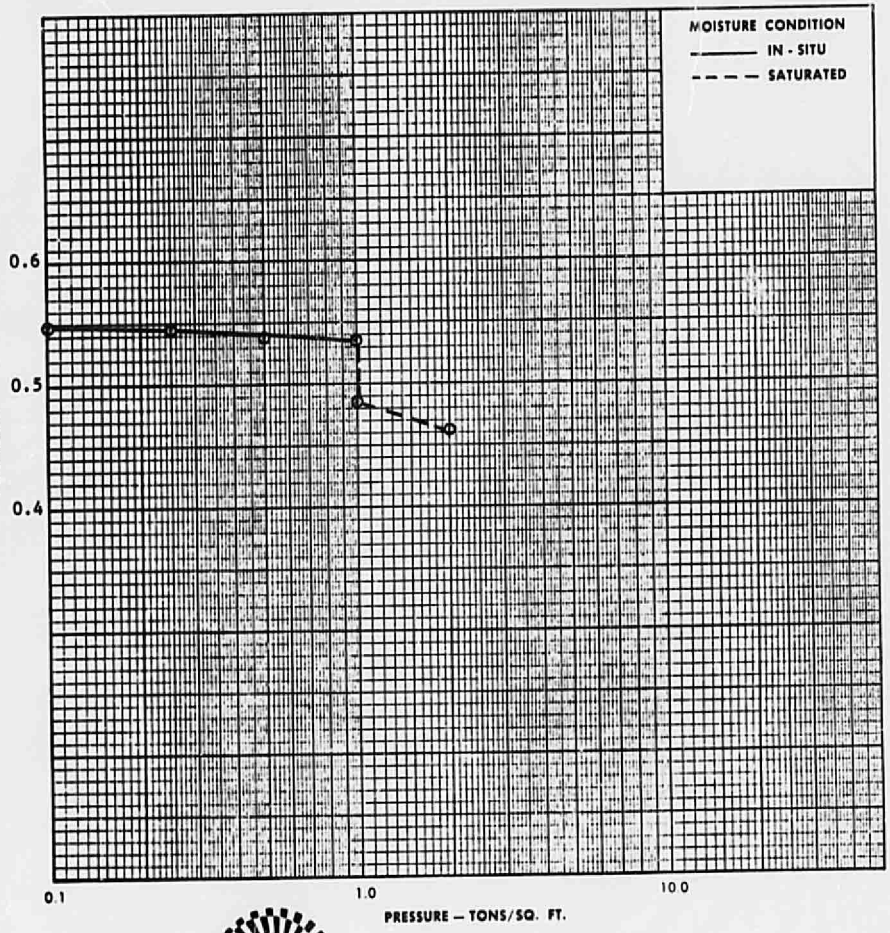
Lab. No. 2232



Project South Mesa Patio Homes Subdivision Location Albuquerque, New Mexico

Source of Sample Test Hole No. 6 at 5' depth

Material tan, fine to medium sand

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Lab. No. 2232

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Project South Mesa Patio Homes Subdivision

Location Albuquerque, New Mexico

Sample Source Test Hole 6, Depth 5' feet

Material tan, fine to medium sand

Undisturbed [X] 'C' Remolded [ ]

**ATL ENGINEERING SERVICES**

CONSOLIDATION TEST

| Date | Time | Load T/sf | Elasped Time (min) | Dial Reading | Date | Time | Load T/sf | Elasped Time (min) | Dial Reading |
|---|---|---|---|---|---|---|---|---|---|
| 3/17/81 | 2:28 | 1/4 | 0 | 0.0000 | | | | 1 | 0.0387 |
| | | | 1/4 | 0.0019 | | | | 2 | 0.0393 |
| | | | 1/2 | 0.0019 | | | | 4 | 0.0397 |
| | | | 1 | 0.0020 | | 12:05 | | | 0.0412 |
| | | | 2 | 0.0021 | | 1:16 | 2* | 0 | 0.0414 |
| | | | 4 | 0.0021 | | | | 1/4 | 0.0519 |
| | 3:40 | | | 0.0028 | | | | 1/2 | 0.0525 |
| | 4:20 | 1/2 | 0 | 0.0029 | | | | 1 | 0.0531 |
| | | | 1/4 | 0.0050 | | | | 2 | 0.0535 |
| | | | 1/2 | 0.0051 | | | | 4 | 0.0540 |
| | | | 1 | 0.0052 | | 2:20 | | | 0.0555 |
| | | | 2 | 0.0053 | | 3:40 | | | 0.0559 |
| | | | 4 | 0.0054 | | 3:35 | | | 0.0562 |
| 3/18/81 | 7:45 | | | 0.0065 | | 5:07 | | | 0.0563 |
| | 8:33 | 1 | 0 | 0.0065 | | 7:56 | | (end) | 0.0566 |
| | | | 1/4 | 0.0085 | | | | | |
| | | | 1/2 | 0.0086 | | | | | |
| | | | 1 | 0.0087 | | | | | |
| | | | 2 | 0.0088 | | | | | |
| | | | 4 | 0.0090 | | | | | |
| | 9:50 | | | 0.0097 | | | | | |
| | 11:02 | 1* | 0 | 0.0099 | | | | | |
| | | | 1/4 | 0.0360 | | | | | |
| | | | 1/2 | 0.0380 | | | | | |

Wet Wt. Soil + Ring 118.2 gm.
Ring Wt. 35.7 gm.
Wet Soil 82.5 gm.
Dry Soil 79.4 gm.

Assumed Sp. Gr. 2.65

CONSOLIDATION RING

Dia. 1.8990 in. Area 2.8323 sq.in.

Ht. 1.000 in. Vol. 0.00164 cu.ft.

Percent Moisture 3.9 Dry Density 106.7 pcf

$V_s = \frac{\text{Dry Density}}{(62.4)Sp.Gr.} = 0.6453$

$V_v = 1 - V_s = 0.3547$

Init.Void Ratio(e) $= \frac{V_v}{V_s} = 0.5497$

$e = \frac{\triangle - V_s}{V_s}$

| Load T/sf | Dial Reading | 1-Dial Reading (△) | e | Percent Consolidation |
|---|---|---|---|---|
| 0 | 0.0000 | 1.0000 | 0.5497 | 0 |
| ¼ | 0.0029 | 0.9971 | 0.5452 | 0.29 |
| ½ | 0.0065 | 0.9935 | 0.5396 | 0.65 |
| 1 | 0.0099 | 0.9901 | 0.5343 | 0.99 |
| 1* | 0.0414 | 0.9586 | 0.4855 | 4.14 |
| 2* | 0.0566 | 0.9434 | 0.4620 | 5.66 |
| 4* | | | | |
| 8* | | | | |
| 12* | | | | |
| 16* | | | | |

*Saturated

Lab. No. 2232



Project South Mesa Patio Homes Subdivision

Location Albuquerque, New Mexico

Sample Source Test Hole 6, Depth 5' feet

Material tan, fine to medium sand

Undisturbed [X] 'C' Remolded [ ]

**ATL ENGINEERING SERVICES**

CONSOLIDATION TEST

| Date | Time | Load T/sf | Elasped Time(min) | Dial Reading | Date | Time | Load T/sf | Elasped Time(min) | Dial Reading |
|---|---|---|---|---|---|---|---|---|---|
| 3/17/81 | 2:28 | 1/4 | 0 | 0.0000 | | | | 1 | 0.0387 |
| | | | 1/4 | 0.0019 | | | | 2 | 0.0393 |
| | | | 1/2 | 0.0019 | | | | 4 | 0.0397 |
| | | | 1 | 0.0020 | | 12:05 | | | 0.0412 |
| | | | 2 | 0.0021 | | 1:16 | 2* | 0 | 0.0414 |
| | | | 4 | 0.0021 | | | | 1/4 | 0.0519 |
| | 3:40 | | | 0.0028 | | | | 1/2 | 0.0525 |
| | 4:20 | 1/2 | 0 | 0.0029 | | | | 1 | 0.0531 |
| | | | 1/4 | 0.0050 | | | | 2 | 0.0535 |
| | | | 1/2 | 0.0051 | | | | 4 | 0.0540 |
| | | | 1 | 0.0052 | | 2:20 | | | 0.0555 |
| | | | 2 | 0.0053 | | 3:40 | | | 0.0559 |
| | | | 4 | 0.0054 | | 3:35 | | | 0.0562 |
| 3/18/81 | 7:45 | | | 0.0065 | | 5:07 | | | 0.0563 |
| | 8:33 | 1 | 0 | 0.0065 | | 7:56 | | (end) | 0.0566 |
| | | | 1/4 | 0.0085 | | | | | |
| | | | 1/2 | 0.0086 | | | | | |
| | | | 1 | 0.0087 | | | | | |
| | | | 2 | 0.0088 | | | | | |
| | | | 4 | 0.0090 | | | | | |
| | 9:50 | | | 0.0097 | | | | | |
| | 11:02 | 1* | 0 | 0.0099 | | | | | |
| | | | 1/4 | 0.0360 | | | | | |
| | | | 1/2 | 0.0380 | | | | | |

Wet Wt. Soil + Ring 118.2 gm.
Ring Wt. 35.7 gm.
Wet Soil 82.5 gm.
Dry Soil 79.4 gm.

Assumed Sp. Gr. 2.65

CONSOLIDATION RING

Dia. 1.8990 in. Area 2.8323 sq.in.

Ht. 1.000 in. Vol. 0.00164 cu.ft.

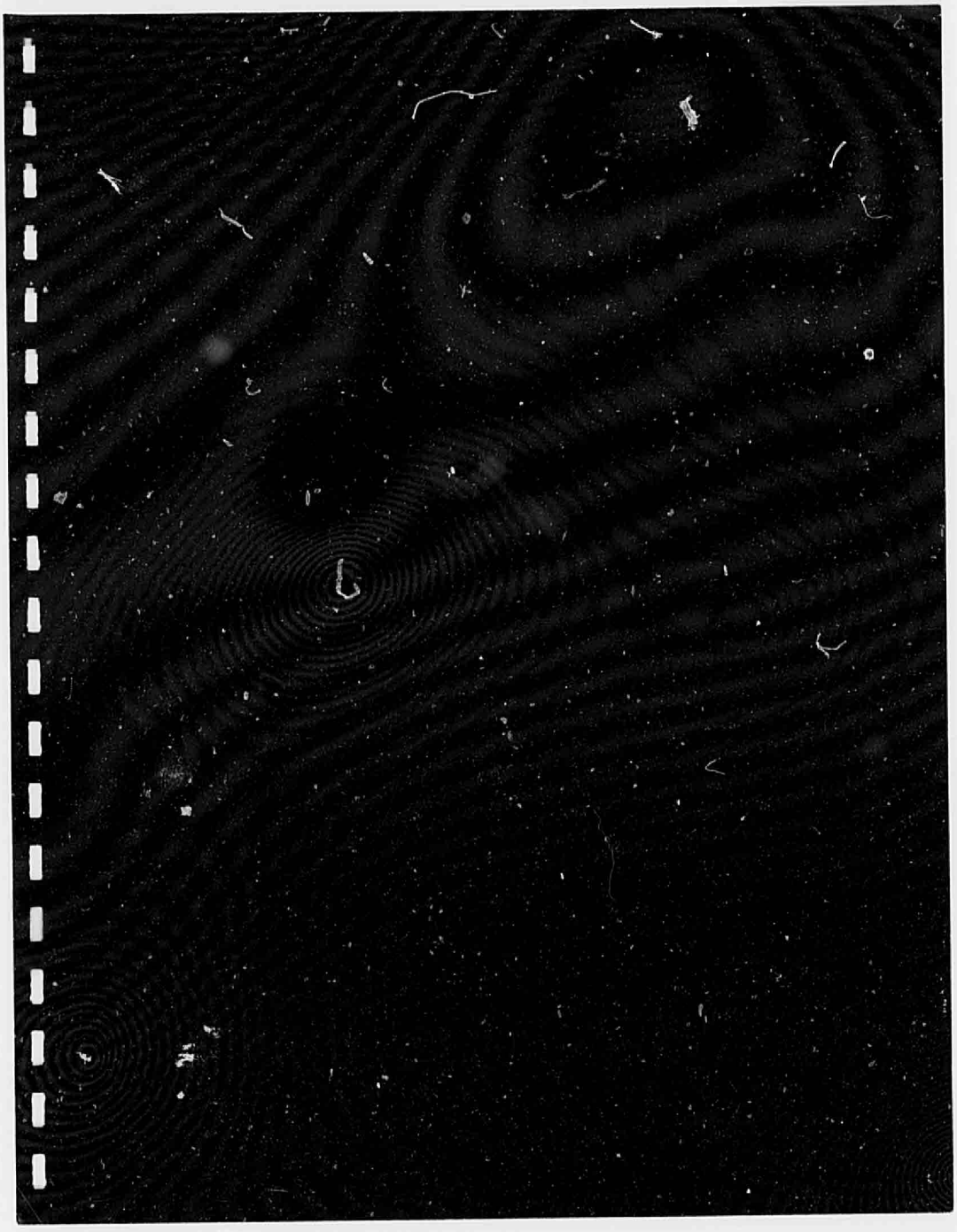
Percent Moisture 3.9 Dry Density 106.7 pcf

$V_s = \frac{\text{Dry Density}}{(62.4)\text{Sp.Gr.}} = 0.6453$

$V_v = 1 - V_s = 0.3547$

Init.Void Ratio(e) $= \frac{V_v}{V_s} = 0.5497$

$e = \frac{\Delta - V_s}{V_s}$

| Load T/sf | Dial Reading | 1-Dial Reading (Δ) | e | Percent Consolidation |
|---|---|---|---|---|
| 0 | 0.0000 | 1.0000 | 0.5497 | 0 |
| ¼ | 0.0029 | 0.9971 | 0.5452 | 0.29 |
| ½ | 0.0065 | 0.9935 | 0.5396 | 0.65 |
| 1 | 0.0099 | 0.9901 | 0.5343 | 0.99 |
| 1* | 0.0414 | 0.9586 | 0.4855 | 4.14 |
| 2* | 0.0566 | 0.9434 | 0.4620 | 5.66 |
| 4* | | | | |
| 8* | | | | |
| 12* | | | | |
| 16* | | | | |

*Saturated