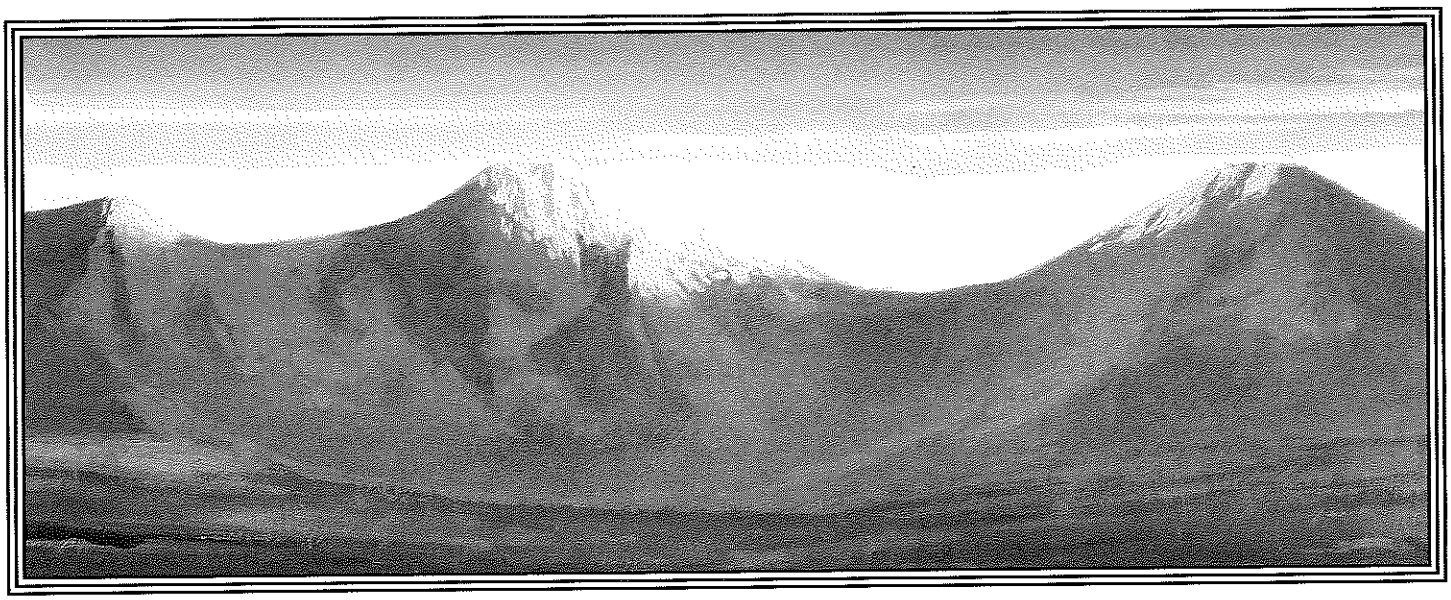

Final Drainage Report
for
PEGASUS AIRPARK
UNIT 2

TOWN OF QUEEN CREEK
MARICOPA COUNTY, ARIZONA

Prepared for: Circle G Pegasus, L.L.C.
2220 S. Country Club Drive, Suite 107
Mesa, AZ 85210
(602) 834-4516

Prepared by: Sunrise Engineering, Inc.
Mesa, Arizona
Sunrise Job No: 00750.001.0003

Date: July 2, 2002

SUNRISE ENGINEERING INC.

Final Drainage Report
for
PEGASUS AIRPARK
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TOWN OF QUEEN CREEK
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TABLE OF CONTENTS

1.0 INTRODUCTION

"PEGASUS AIRPARK, UNIT 2 is the second phase of a proposed single family subdivision in the Town of Queen Creek. It will consist of 46 suburban ranch lots on approximately 65 acres, with each lot comprising a minimum of 43,600 square feet and on-lot retention. The project covers the North ½ of the SW ¼ of Section 35, Township 2 South, Range 7 East, Gila and Salt River Meridian, Maricopa County. See Vicinity Map, Exhibit A.

2.0 OBJECTIVE

The objective of this Drainage Report is to discuss the onsite and offsite drainage flows which will contribute to the proposed subdivision and present calculations for the proposed design. The Final Drainage Report for unit 1 of this subdivision established the basic design criteria for the initial roadway rainfall runoff on-lot retention; and the criteria and guidelines for the individual home site grading improvements, to ensure that the future development, will concur with the requirements of the Town of Queen Creek. The Final Drainage Report for Unit 1 dated October 26, 1999 and revised May 2000 and February 2001 is hereby made apart of this report by reference.

3.0 ONSITE DRAINAGE METHODOLOGY

The site will be developed into large lots (43,600 square foot minimum) for custom homes on custom graded lots. Each will be required to provide on-lot retention for stormwater rainfall runoff from adjacent paved surfaces and the lot itself. Retention will be provided for the storm water runoff generated by a 100-year, 2-hour storm as defined in the "Drainage Design Manual for Maricopa County, Volume 1, Hydrology", or 12,000 cubic feet (minimum required by final plat), whichever is greater. The 100-year, 2-hour precipitation depth for this area is 2.6 inches = 0.22 ft. (See Appendix A).

Each lot will be graded individually (not by this project developer) after the lots are sold. This Report defines the coefficients of runoff and the Total runoff volume to be stored in the retention area of each lot. These values will be compared to the 12,000 cubic feet minimum value required by the Final Plat.

The Grading Plan defines the finished floor elevation, pad elevation, yard elevation (retention area) and perimeter containment berm elevations.

The initial grading and paving of the project roadways require temporary retention graded within each lot until the lot is developed. The front 35 feet of each lot will be graded at the same time as the roadway to provide the necessary temporary retention. The first 35 feet of the containment berms will also be constructed.

The Final Grading Plan includes various cross-sections for establishing finished floor elevations to be 15" above the low curb of each lot. All the finished floor elevations are a minimum of 21" above the overflow point of the lot.

Typical lot layouts for four different types of lots that together are representative of all the lots in the subdivision are shown on the following figures. On the pages that follow, a composite weighted runoff coefficient, total retention requirement, and a minimum area that must be reserved on each lot for retention are calculated for typical lots. As noted previously, a requirement for provided retention per lot has been set forth in the final plat. The minimum requirement is 12,000 cubic feet. This value is compared to the calculated retention requirements and the greater of the two is used for design purposes.

Due to the existing topography of the site and the size of the lots, special care needs to be given to the final design of individual lot grading. Three general situations are analyzed; interior lot with front yard elevated with respect to the back yard, interior lot with back yard elevated with respect to front yard, and an exterior lot backing on the taxiway adjacent to the runway. Conceptual grading plans are included in Appendix C for each of these cases to demonstrate that adequate retention can be provided using the elevations proposed on the grading plans. However the grades given are minimum elevations that satisfy the design criteria. Different grades con be used when individual lots are graded provided that they meet the minimum criteria established in this report and on the grading plans.

Streets that are to be continued in future phases are graded at the property boundary to prevent flow onto the site as well.

The subdivision has ultimate outfall points along the northern and western subdivision boundaries which are lower than any finished floor. The offsite flows will exit along these boundaries, thereby preserving historic flow patterns.

4.0 OFFSITE DRAINAGE

4.1 Flood Zone Designation

The site is located within Zone X on the Flood Insurance Rate Map (FIRM). (See Exhibit B, FIRM Map Panel No. 3080 of 4350).

Zone X is defined as areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

4.2 Existing Drainage Patterns

Drainage in the vicinity of the project site is from the south to the north at approximately 1.0 percent. The area is characterized by agricultural fields in which crops such as cotton, alfalfa, corn, and melons are grown. This area is rural in nature with homes, roads, or buildings. Paved roads are primarily limited to mile and some half mile roads. The site is currently undeveloped farm land and existing improvements associated with Pegasus Unit 1.

Offsite flows from the east are minimal since the ground is predominantly sloping to the north. Irrigation berms on the boundary lots will prevent offsite flows from entering the site. Existing topography will cause runoff to flow north along the east property boundary and along the south property boundary.

Offsite flows from the south will be intercepted by the existing runway and taxiway retaining the runoff generated in areas located between both elements.

4.3 Previous Modeling of Offsite Flows

The offsite areas to the South and those areas at and around Unit 1 were modeled in the Unit 1 Final Drainage Report.

4.4 Offsite Flows South of Empire Road

The offsite storm water from the San Tan Mountain area to the south of Empire Road flows northward but due to the topographical conditions in the area is intercepted by an existing dirt road south of Hunt Highway and by Hunt Highway itself. Hunt Highway acts as a natural barrier to drainage and carries accumulated flows from the south along it's alignment both East and West. Refer to Exhibit C.

This drainage report therefore analyzes flows originating and accumulating north of Hunt Highway up to and including Empire Road. To the south of the project, Empire Road is not normally crowned but slopes entirely to the south forming a large wide "swale" of sorts with the north shoulder of Empire Road acting as the northernmost boundary of the "swale" with the desert forming the southern boundary. Please refer to Section A-A of Exhibit C. Due to the existing topography, flows that accumulate at Empire Road flow both east and west, the dividing line being an existing north and south running dirt road that bisects the north half of section 2 north of Hunt Highway.

Flows were analyzed using the Maricopa Rational Method and it was determined that the peak Flows should not overtop the north shoulder of the swale formed by Empire Road and the desert to the south. See Appendix B.

PEGASUS AIRPARK UNIT TWO

QUEEN CREEK, ARIZONA

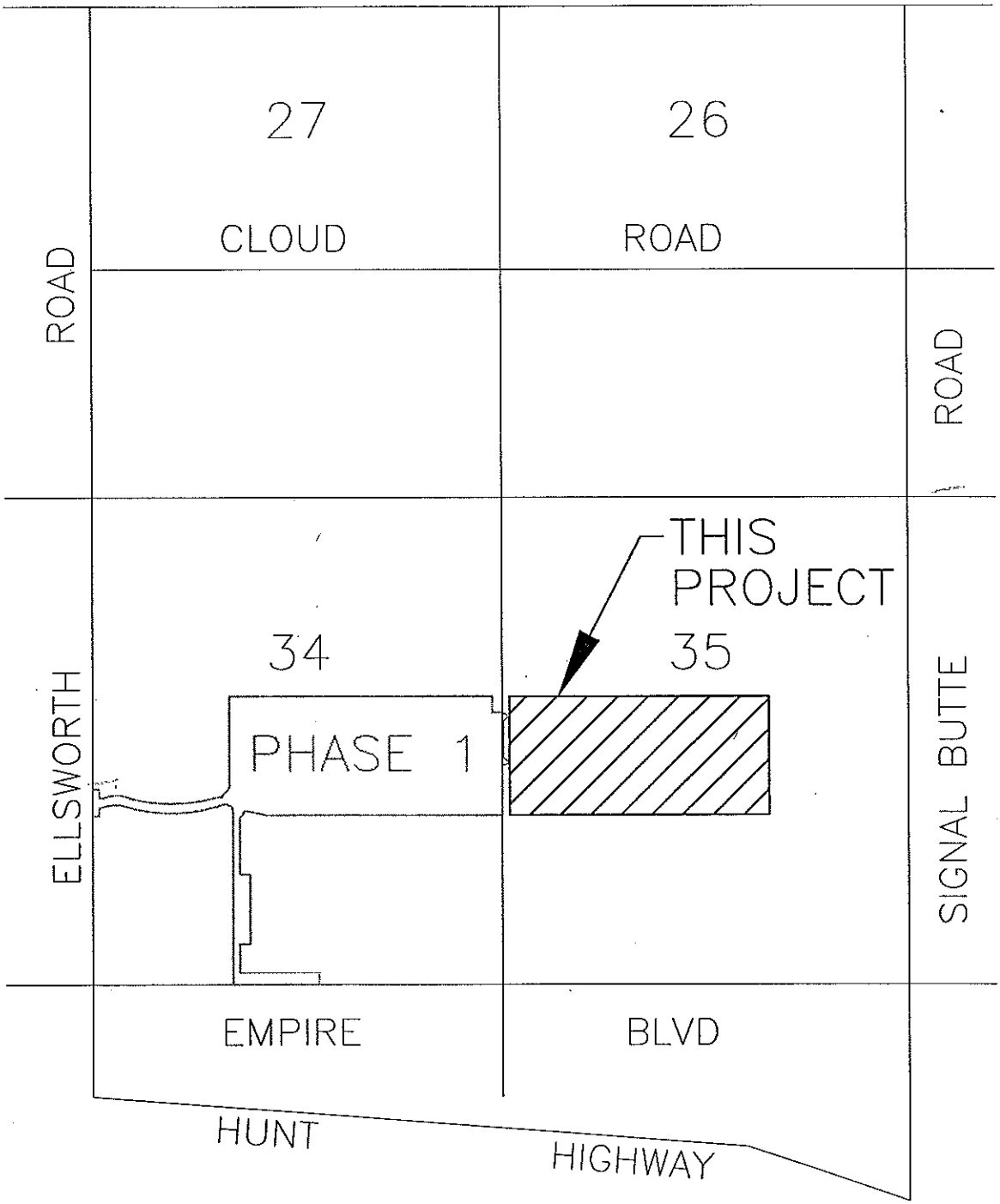


EXHIBIT A – VICINITY MAP

N.T.S.

1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.

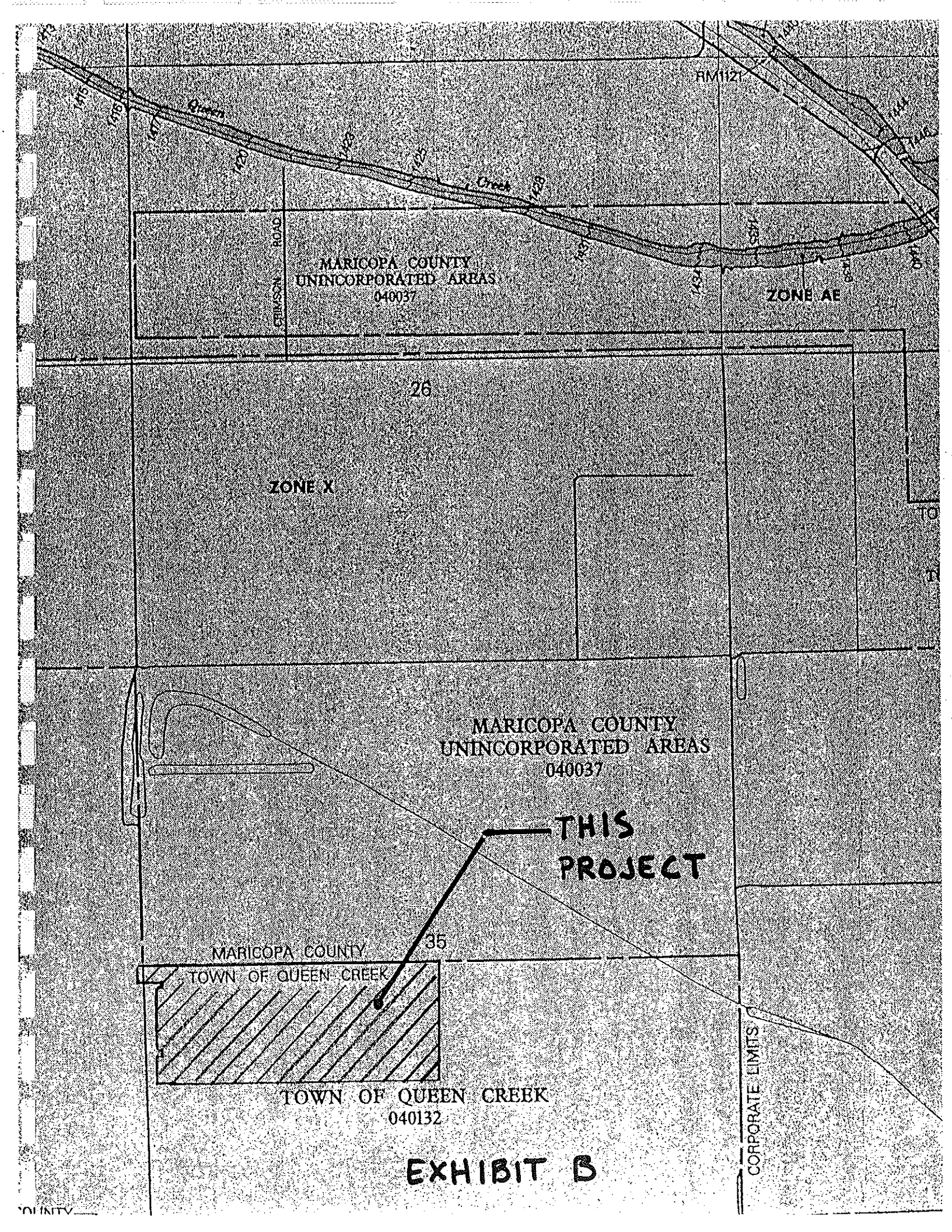

RM112T
Queen Creek
MARICOPA COUNTY
UNINCORPORATED AREAS
040037
ZONE AE
GILBERT ROAD
26
ZONE X
MARICOPA COUNTY
UNINCORPORATED AREAS
040037
THIS PROJECT
35
MARICOPA COUNTY
TOWN OF QUEEN CREEK
TOWN OF QUEEN CREEK
040132
CORPORATE LIMITS

EXHIBIT B

APPENDIX A

Rainfall Data

(source: flood control district of maricopa county, 1992., Drainage design manual of maricopa county, Volume 1, hydrology

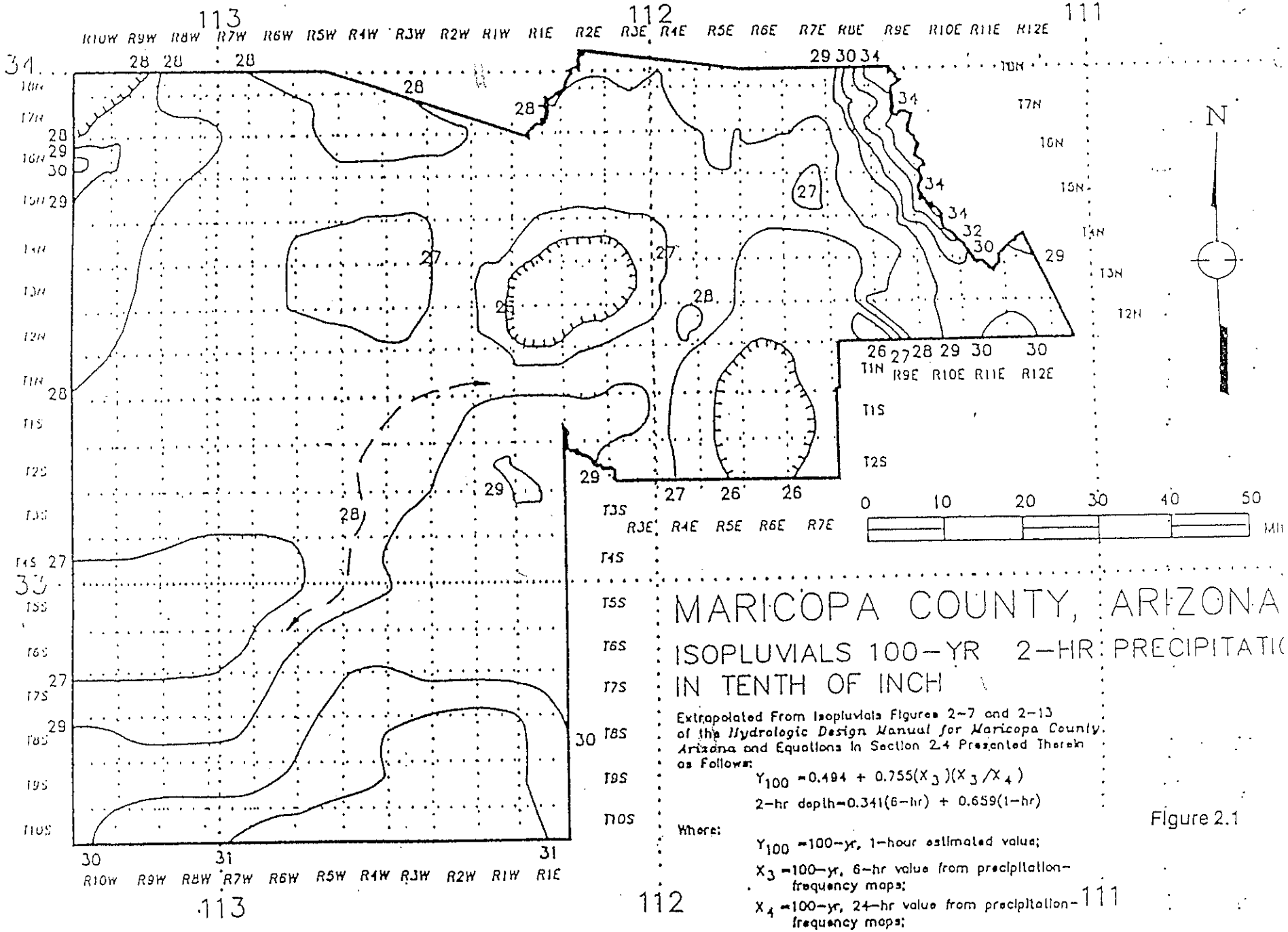

113
112
111
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
T7N
T6N
T5N
T4N
T3N
T2N
T1N
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
T10S
N
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 2-HR PRECIPITATION
IN TENTH OF INCH
Extrapolated From Isopluvials Figures 2-7 and 2-13 of the Hydrologic Design Manual for Maricopa County, Arizona and Equations in Section 2.4 Presented Therein as Follows:
$Y_{100} = 0.484 + 0.755(X_3)(X_3/X_4)$
2-hr depth = 0.341(6-hr) + 0.659(1-hr)
Where:
Y_{100} = 100-yr, 1-hour estimated value;
X_3 = 100-yr, 6-hr value from precipitation-frequency maps;
X_4 = 100-yr, 24-hr value from precipitation-frequency maps;
6-hr isopluvial values from figure 2.7;

Figure 2.1

APPENDIX B

Offsite Runoff Calculations

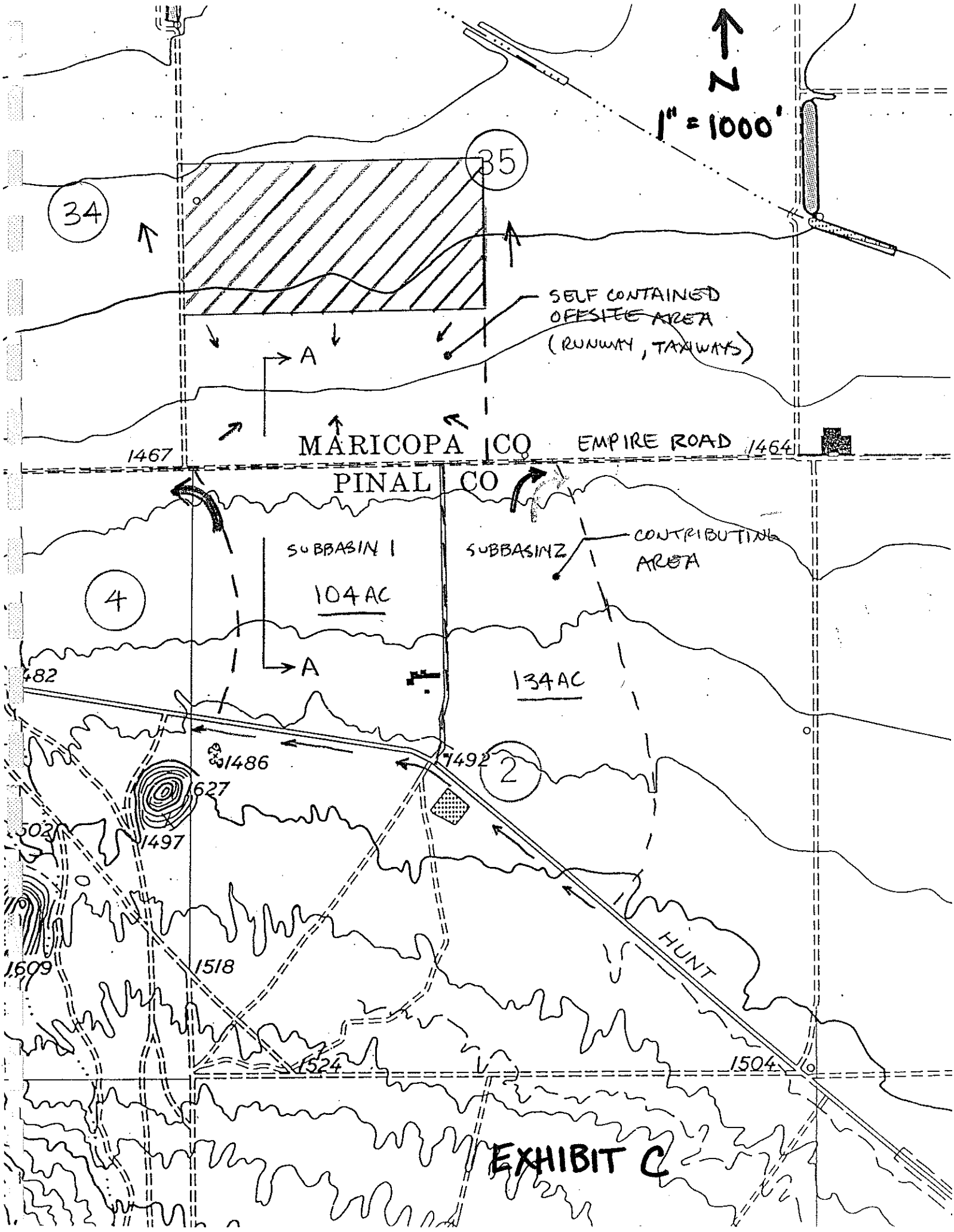
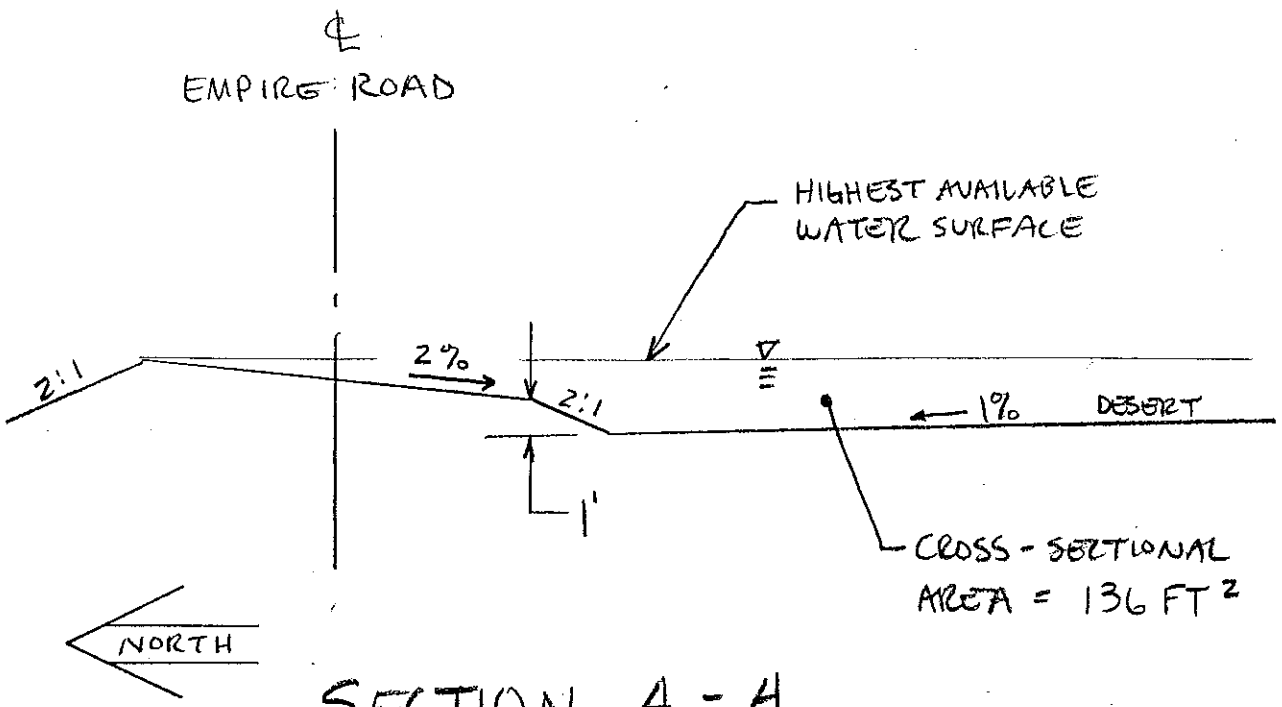

N
1" = 1000'
35
34
SELF CONTAINED
OFFSITE AREA
(RUNWAY, TAXIWAYS)
A
A
MARICOPA CO
PINAL CO
EMPIRE ROAD
1467
1464
SUBBASIN 1
104 AC
SUBBASIN 2
CONTRIBUTING
AREA
134 AC
4
2
482
1486
1492
1627
1497
1502
1609
1518
1524
1504
HUNT

EXHIBIT C

SUNRISE ENGINEERING INC.

BY ..... DATE ..... SUBJECT ..... SHEET NO. ..... OF .....
CHKD. BY ..... DATE .... JOB NO. .....



SECTION A-A

SUBBASIN 1, Q_{max} = 83.5 cfs*, V = 0.61 ft/s

SUBBASIN 2, Q_{max} = 107.6 cfs*, V = 0.79 ft/s

* See Rational calcs included with this report

NOTE: THE ABOVE CALCS SHOW THAT THE MINIMUM VELOCITIES REQUIRED TO PREVENT OVERTOPPING OF EMPIRE ROAD FOR SUBBASINS 1 AND 2 ARE 0.61 ft/s AND 0.79 ft/s RESPECTIVELY. THESE ARE EXTREMELY LOW VELOCITIES, ACTUAL VELOCITIES WOULD CERTAINLY BE HIGHER.

Circle G Pegasus

Maricopa Co. Rational Method

Subbasin 1

Storm · 10 year, 6 hour

BASIC EQUATIONS:

$Q=CiA$

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$

$I=i_p(P^6_{10})/2.07$

LEGEND

input	
calculated	
iterate	

Tc

L =	length of longest flow path in miles	L	0.66	miles
K_b =	watershed resistance coefficent (fig 3.1 or table 3.1)	K_b	0.08	
S =	watercourse slope in feet/mile	S	53	
I =	rainfall intensity in inches/hr.	I	2.6	inches/hr.
Tc =	in hours	Tc	0.5	hours = 30.4 mins.

Iterate

i

i_p =	Phoenix Metro area intensity, see note below	i_p	2.5	inches/hr.
P^6_{10} =	10 yr, 6 hr precip depth, fig 2.4	P^6_{10}	1.90	inches
I =	inches/hr.	I	2.3	inches/hr.

Note: Iterate changing i_p based on fig 3.2 until chosen T_c and calculated T_c (G16) match

Q

C =	Runoff Coefficient from Table 3.2	C	0.35	
i =	from above	i	2.3	inches/hr.
A =	in acres	A	134.00	acres
Q =	cfs	Q	107.6	cfs

Circle G Pegasus

Maricopa Co. Rational Method

Subbasin 2

Storm 10 year, 6 hour

BASIC EQUATIONS:

$Q=CiA$

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$

$I=i_p(P^6_{10})/2.07$

LEGEND

input	
calculated	
iterate	

Tc

L =	length of longest flow path in miles	L	0.66	miles
K_b =	watershed resistance coefficent (fig 3.1 or table 3.1)	K_b	0.08	
S =	watercourse slope in feet/mile	S	53	
I =	rainfall intensity in inches/hr.	*I*	2.6	inches/hr.
Tc =	in hours	Tc	0.5	hours = 30.4 mins.

Iterate

i

i_p =	Phoenix Metro area intensity, see note below	i_p	2.5	inches/hr.
P^6_{10} =	10 yr, 6 hr precip depth, fig 2.4	P^6_{10}	1.90	inches
I =	inches/hr.	*I*	2.3	inches/hr.

Note: Iterate changing i_p based on fig 3.2 until chosen T_c and calculated T_c (G16) match

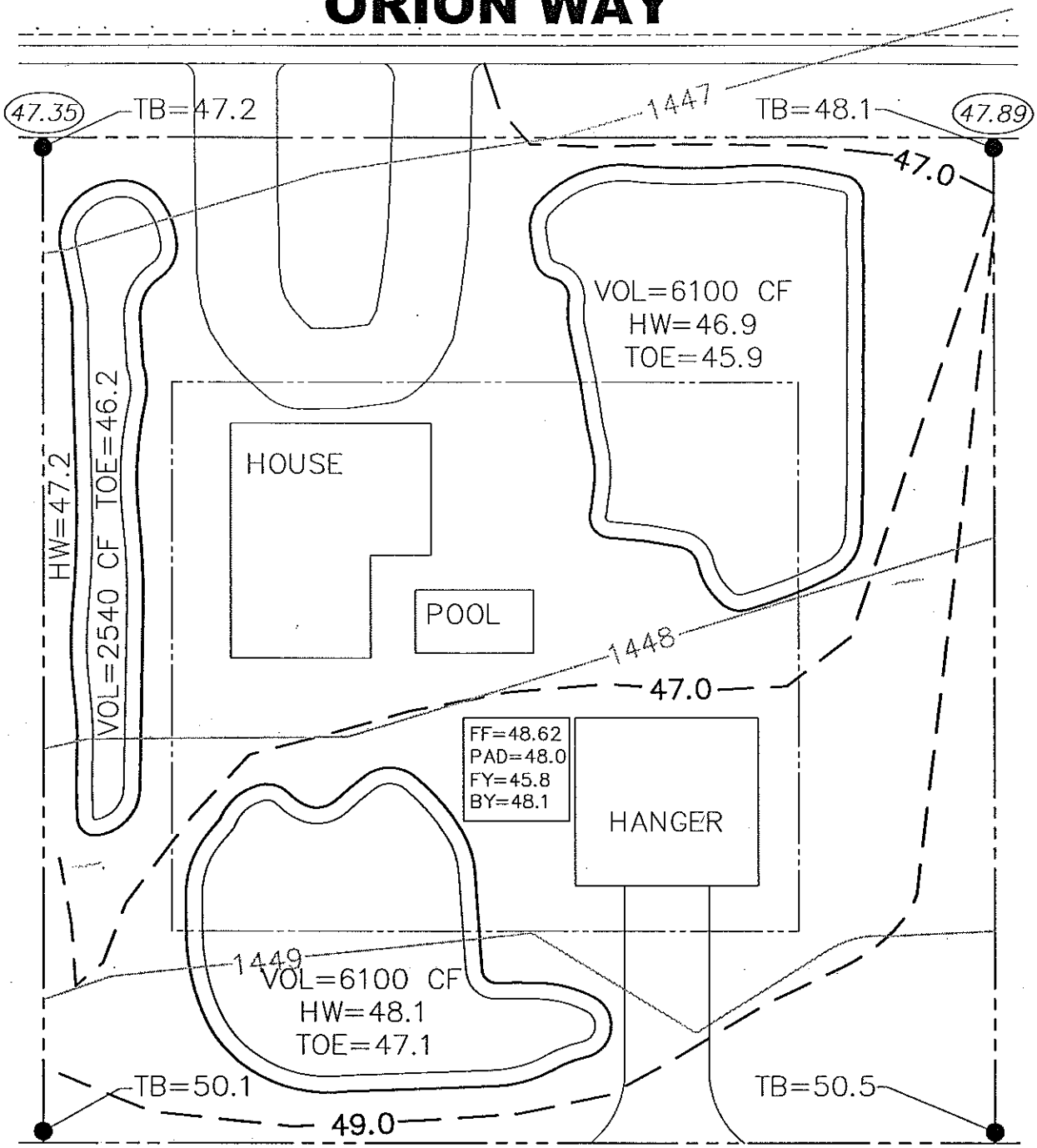
Q

C =	Runoff Coefficient from Table 3.2	C	0.35	
i =	from above	*i*	2.3	inches/hr.
A =	in acres	A	134.00	acres
Q =	cfs	Q	107.6	cfs

APPENDIX C

Lot Grading Examples

ORION WAY



LOT 115

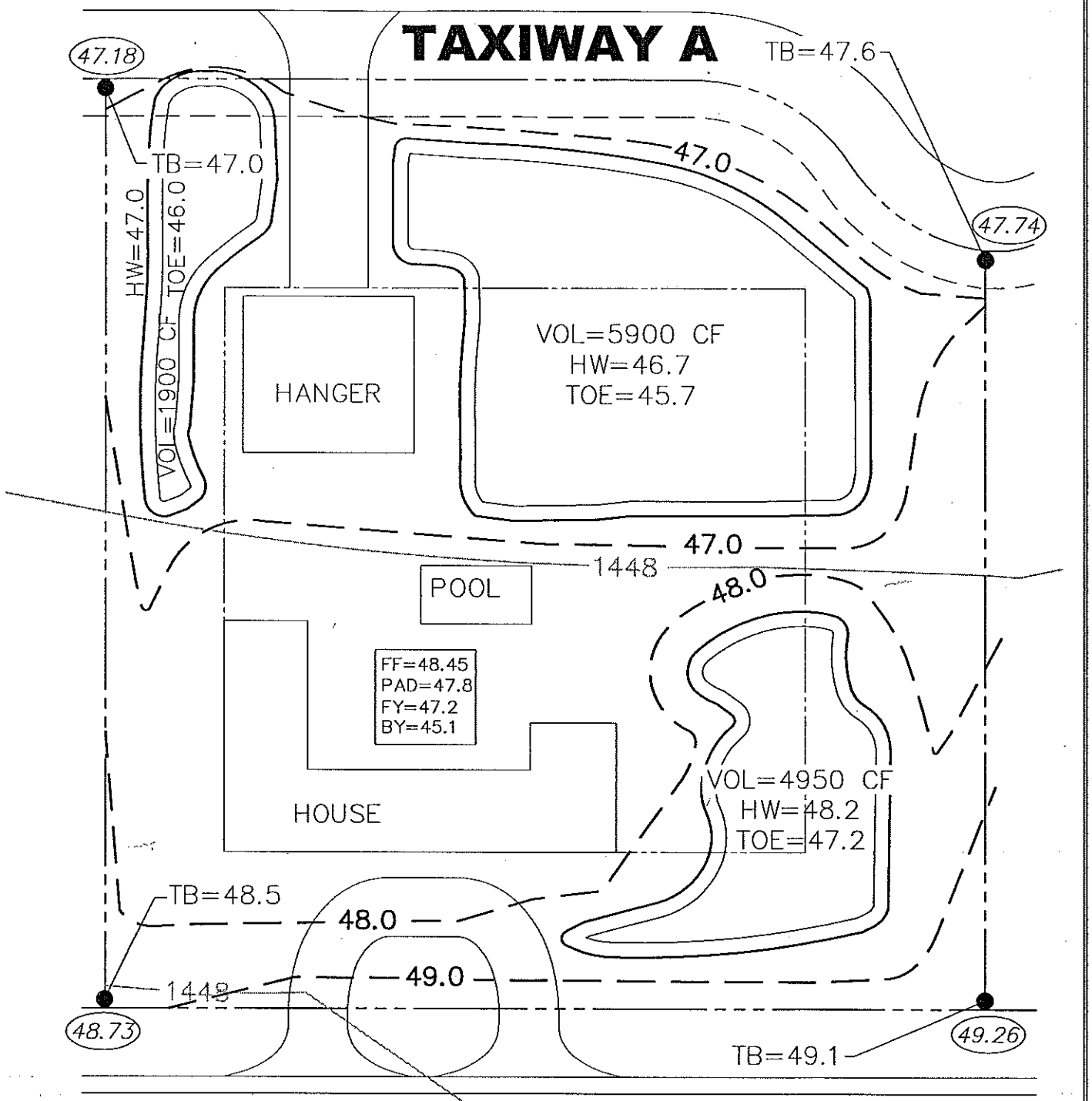
LEGEND

- RIGHT OF WAY
- SET BACK LINE
- 39.0 PROPOSED CONTOURS
- 1439 EXISTING CONTOURS
- RETENTION HW
- RETENTION TOE

EXHIBIT D1

1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.



ORION WAY

LOT 131

LEGEND

- RIGHT OF WAY
- SET BACK LINE
- —39.0— PROPOSED CONTOURS
- 1439 EXISTING CONTOURS
- RETENTION HW
- RETENTION TOE

EXHIBIT D3

1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.

SUNRISE ENGINEERING INC.

BY ..... DATE ..... SUBJECT ..... SHEET NO. ..... OF .....
CHKD. BY ..... DATE .... JOB NO. .....

ONSITE RETENTION - ZEUS WAY

C FACTORS :

PAVED SURFACES = 0.95

LANDSCAPE / RETENTION = 0.70

CONTRIBUTING PAVED AREA :

$12,600\ ft^2$

CONTRIBUTING LANDSCAPE :

$13,500\ ft^2$

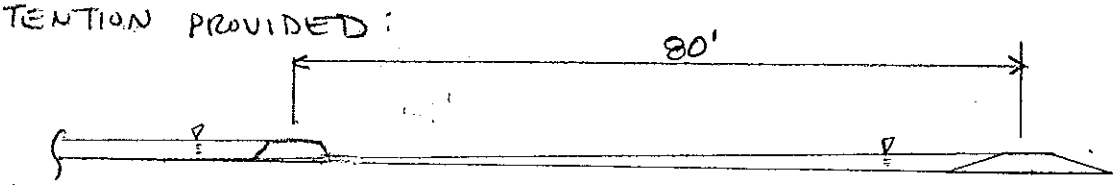
100 YR. STORM = 2.2"

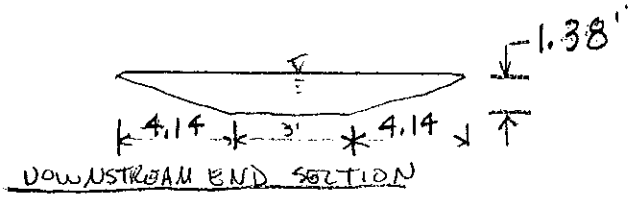
TOTAL RUNOFF :

$$= \left(\frac{2.6"}{12"}\right)\left[(12,600)(.95) + 13,500(.70)\right]$$

$= 4,641\ ft^3$ REQUIRED RETENTION

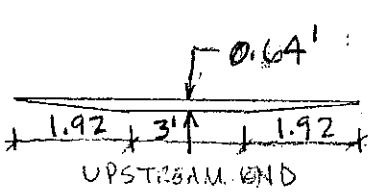
RETENTION PROVIDED :





DOWNSTREAM END SECTION

AREA = $9.85\ ft^2$



UPSTREAM END

AREA = 3.15

$AREA_{avg} = 6.5\ ft^2$, CELL LENGTH = 80'

∴ VOLUME / CELL = $520\ ft^3$, 10.8 CELLS, = $5,616\ ft^3$ TOTAL ✓

SUNRISE ENGINEERING INC.

BY ..... DATE ..... SUBJECT ..... SHEET NO. ..... OF .....
CHKD. BY ..... DATE .... JOB NO. .....

ONSITE RETENTION - ZEUS WAY AND TAXIWAY B-D

C FACTORS:

PAVED SURFACES = 0.95

LANDSCAPE / RETENTION = 0.70

CONTRIBUTING PAVED AREA :

14,700 FT^2

LANDSCAPED :

17,876 FT^2

100 YR. STORM = 2.2"

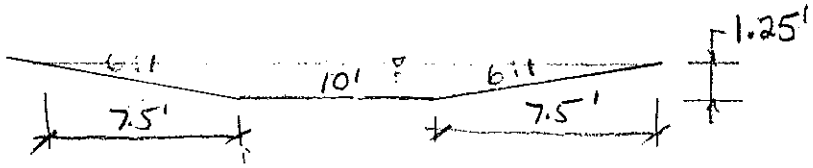
TOTAL RUNOFF.

$$= \left[\frac{2.6''}{12}\right]\left[(14,700)(0.95) + (17,876)(0.70)\right]$$

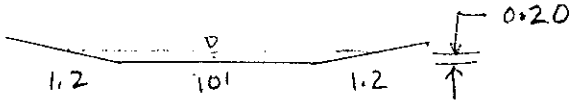
$$= 5,825 \text{ FT}^3$$

RETENTION PROVIDED:

SWALE SECTION



DOWNSTREAM AREA = 21.9 ft^2



UPSTREAM AREA = 2.2 ft^2

SUNRISE ENGINEERING INC.

BY ..... DATE ..... SUBJECT ..... SHEET NO. ..... OF .....
CHKD. BY ..... DATE .... JOB NO. .....

AVERAGE AREA = 12.1 ft^2

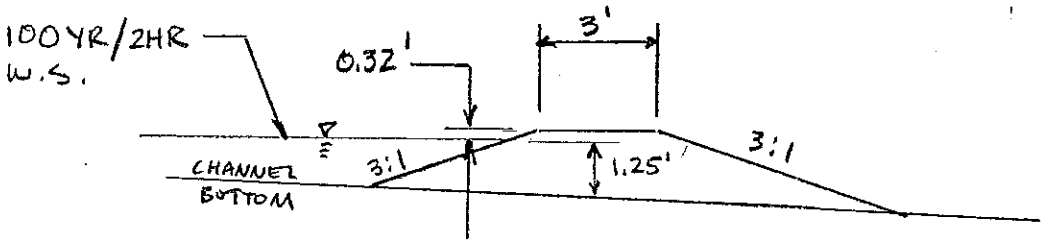
DAMS EVERY 100'

∴ Volume / cell = 1210 ft^3

Length of Basin = 520 ft.

∴ (5.2)(1210) = 6,300 ft^3 ✓

∴ Dams every 100', height ≥ 1.55'



VOLUME/CELL = 1210 FT^3

APPENDIX E

Runoff and Retention Calculations for Individual Lots

INDIVIDUAL LOT RETENTION CALCULATIONS

1 adjacent street (Example: Lot 152)

Surface	Area (sf)	C factor	C x A
Pavement	5,000	0.95	4,750
Roofs	7,600	0.95	7,220
Pool	1,500	0.00*	0
Yard and landscaping	36,700	0.48	17,616
	50,800		29,586
Weighted C = CxA / Total Area =		0.58	

1 adjacent street and adjacent taxiway (Example: Lot 124)

Surface	Area (sf)	C factor	C x A
Pavement	9,600	0.95	9,120
Roofs	7,600	0.95	7,220
Pool	1,500	0.00*	0
Yard and landscaping	50,600	0.48	24,288
	69,300		40,628
Weighted C = CxA / Total Area =		0.59	

2 adjacent streets and adjacent taxiway (Example: Lot 146)

Surface	Area (sf)	C factor	C x A
Pavement	14,400	0.95	13,680
Roofs	7,600	0.95	7,220
Pool	1,500	0.00*	0
Yard and landscaping	52,600	0.48	25,248
	76,100		46,148
Weighted C = CxA / Total Area =		0.61	

1 adjacent street and adjacent landscaped area (Example: Lot 138)

Surface	Area (sf)	C factor	C x A
Pavement	7,200	0.95	6,840
Roofs	7,600	0.95	7,220
Pool	1,500	0.00*	0
Yard and landscaping	50,300	0.48	24,144
	66,600		38,204
Weighted C = CxA / Total Area =		0.57	

* The pool retains the water that falls on it, but does not function as retention for other areas.

Verification of on-lot retention

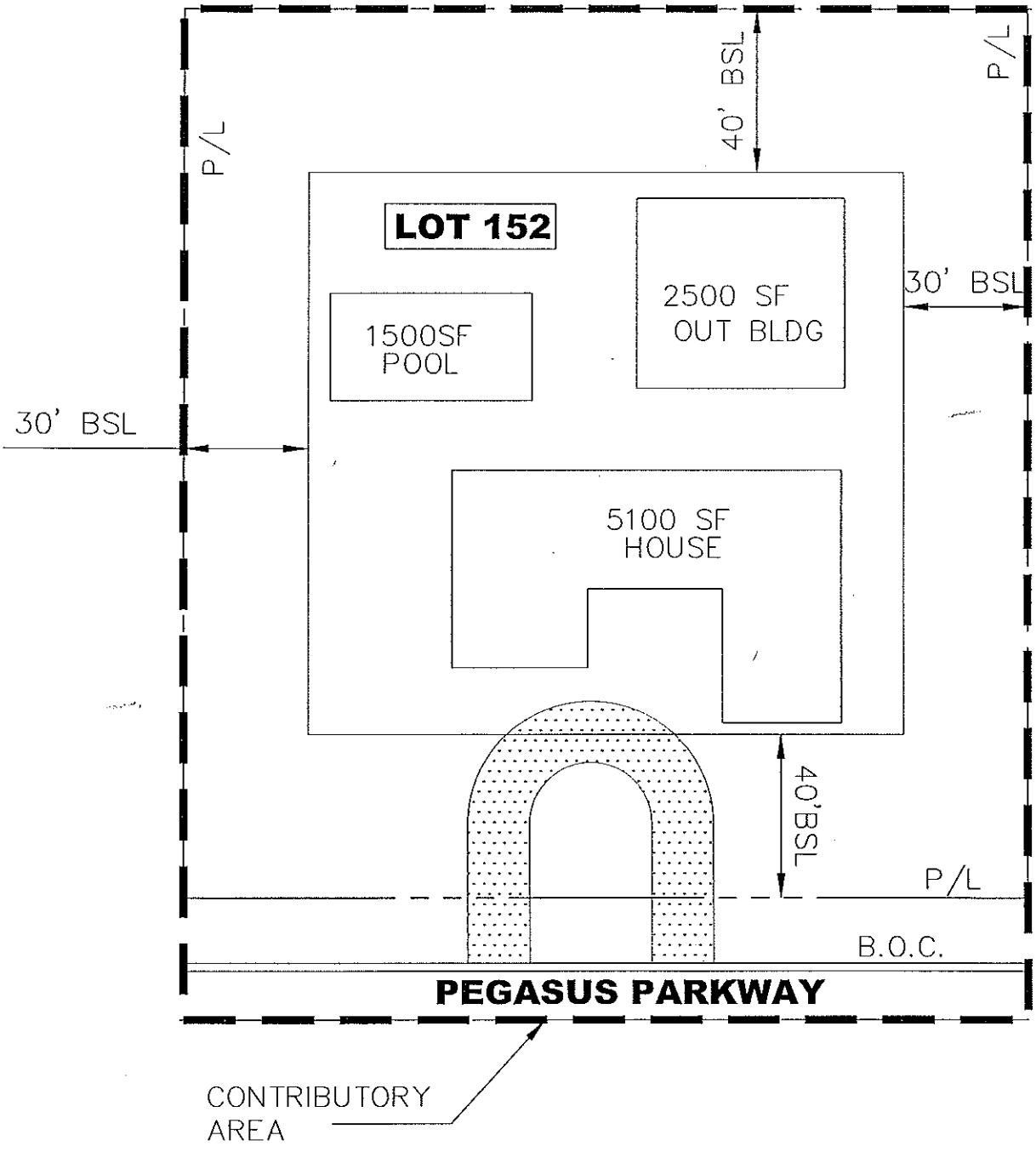
Lot	Wieghted C	D (ft)	Total Area (sf)	V=CDA
152	0.58	0.22	50,800	6,509
124	0.59	0.22	69,300	8,938
146	0.61	0.22	76,100	10,153
138	0.57	0.22	66,600	8,405

The Final Plat's requirement to provide a minimum of 12,000 cubic feet of retention per lot is therefore more than sufficient for any type of lot in this subdivision

EXHIBIT E1

NORTH

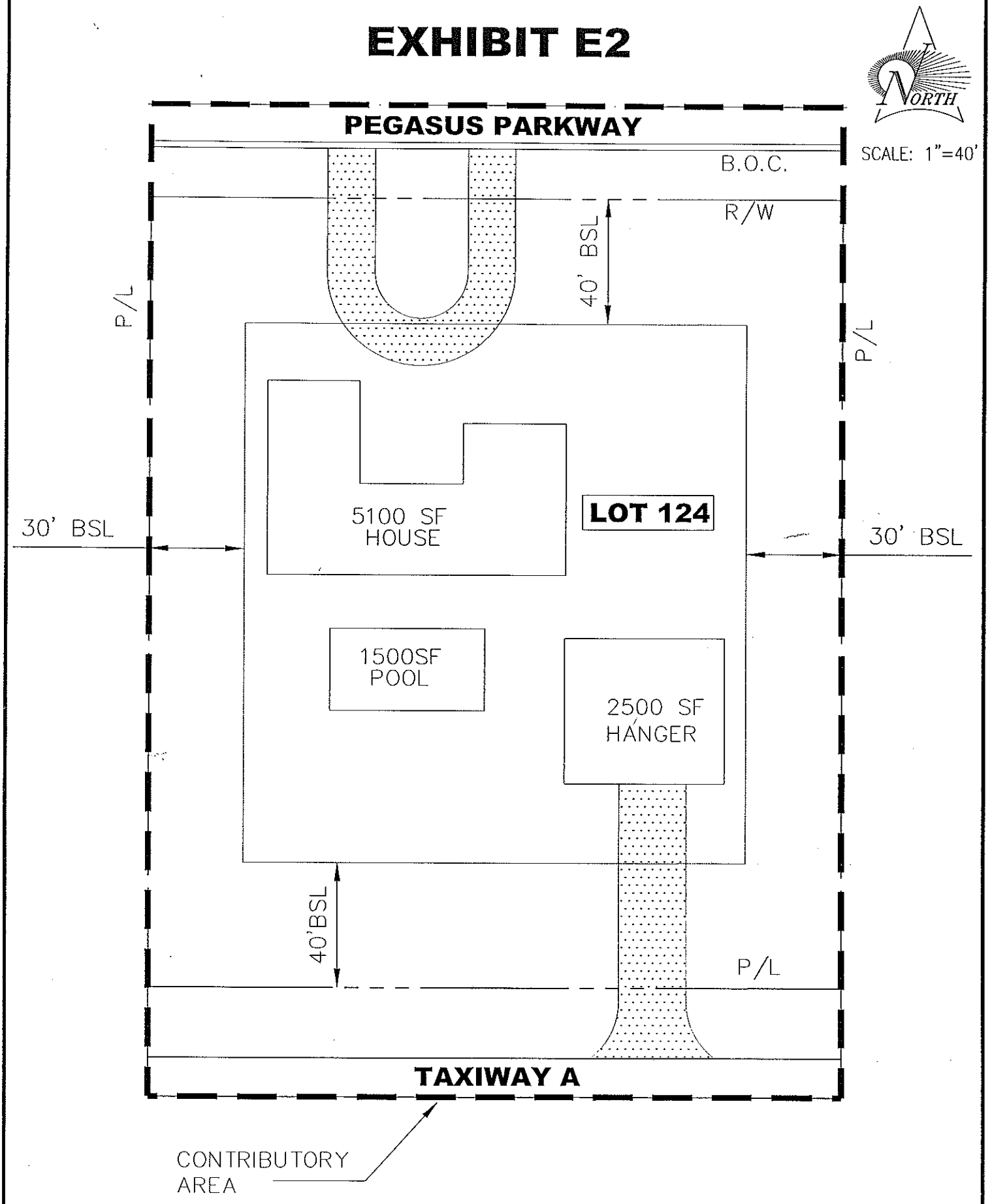
SCALE: 1"=40'



1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.

EXHIBIT E2

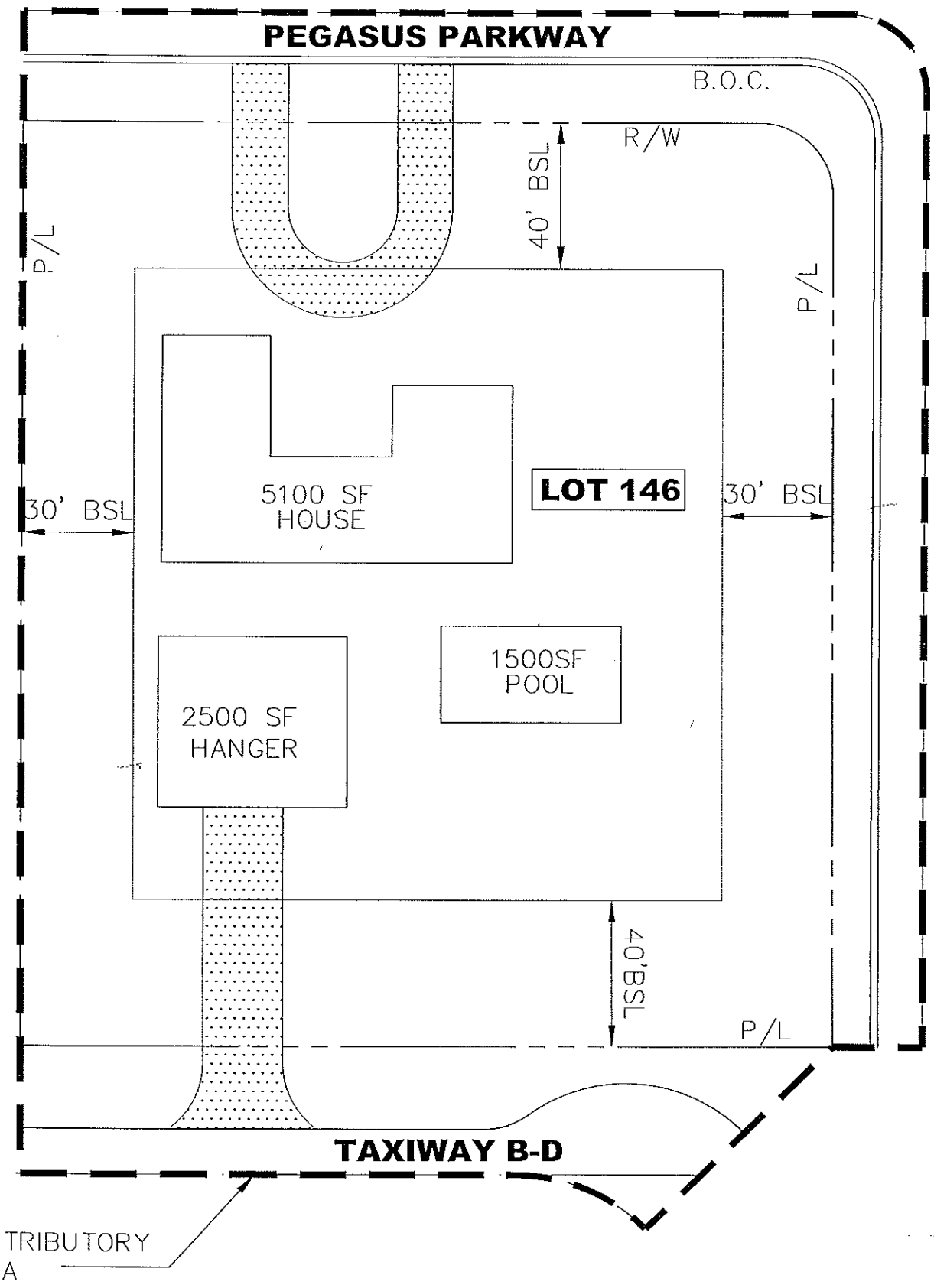


K:\00750PG2\IMPROVEMENTS\EXHIBIT-E.DWG JWATSON 04/05/02 12:20 am

1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.

EXHIBIT E3



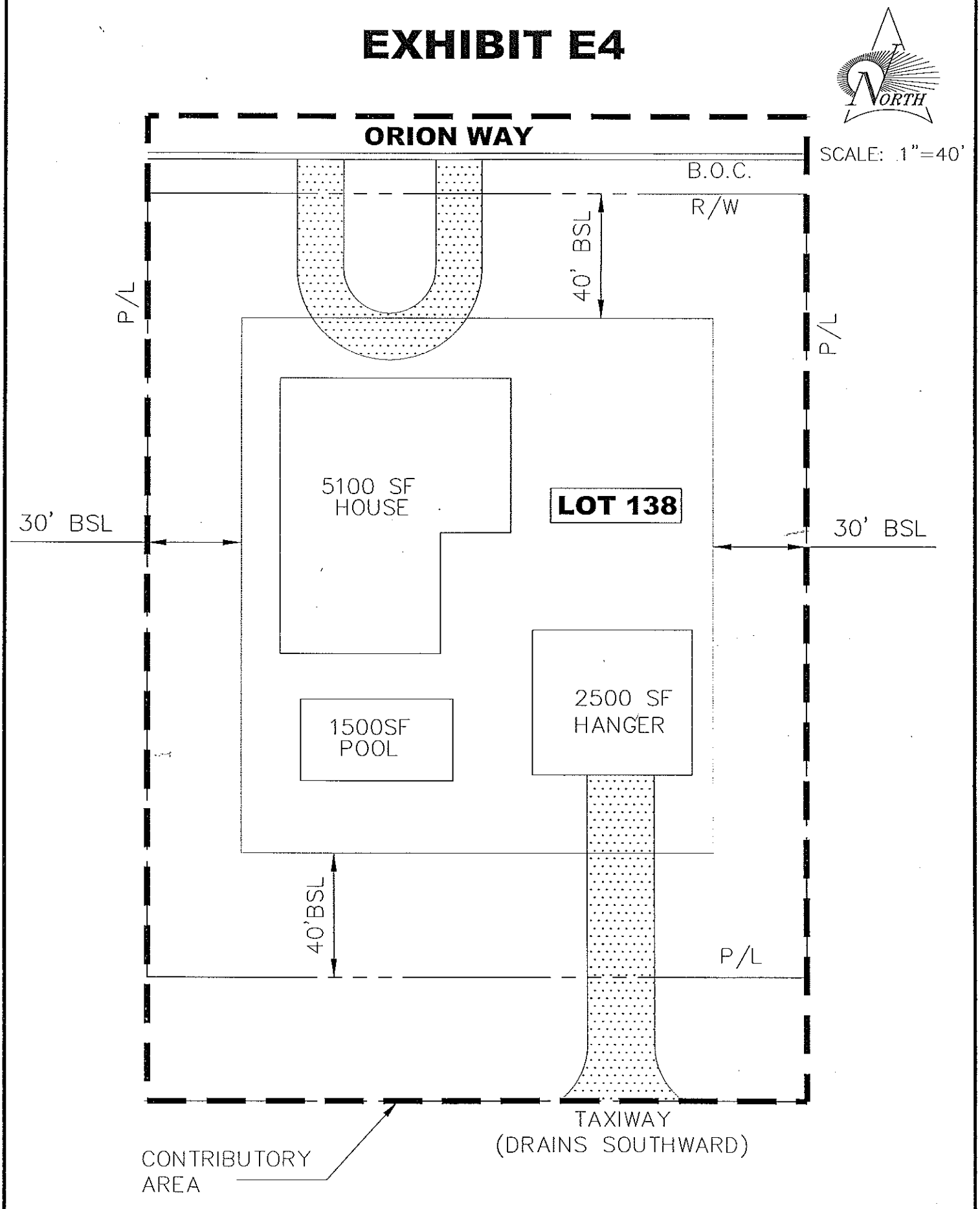
NORTH

SCALE: 1"=40'

1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.

EXHIBIT E4



1930 S. ALMA SCHOOL ROAD SUITE A-114 MESA, ARIZONA 85210

SUNRISE ENGINEERING INC.