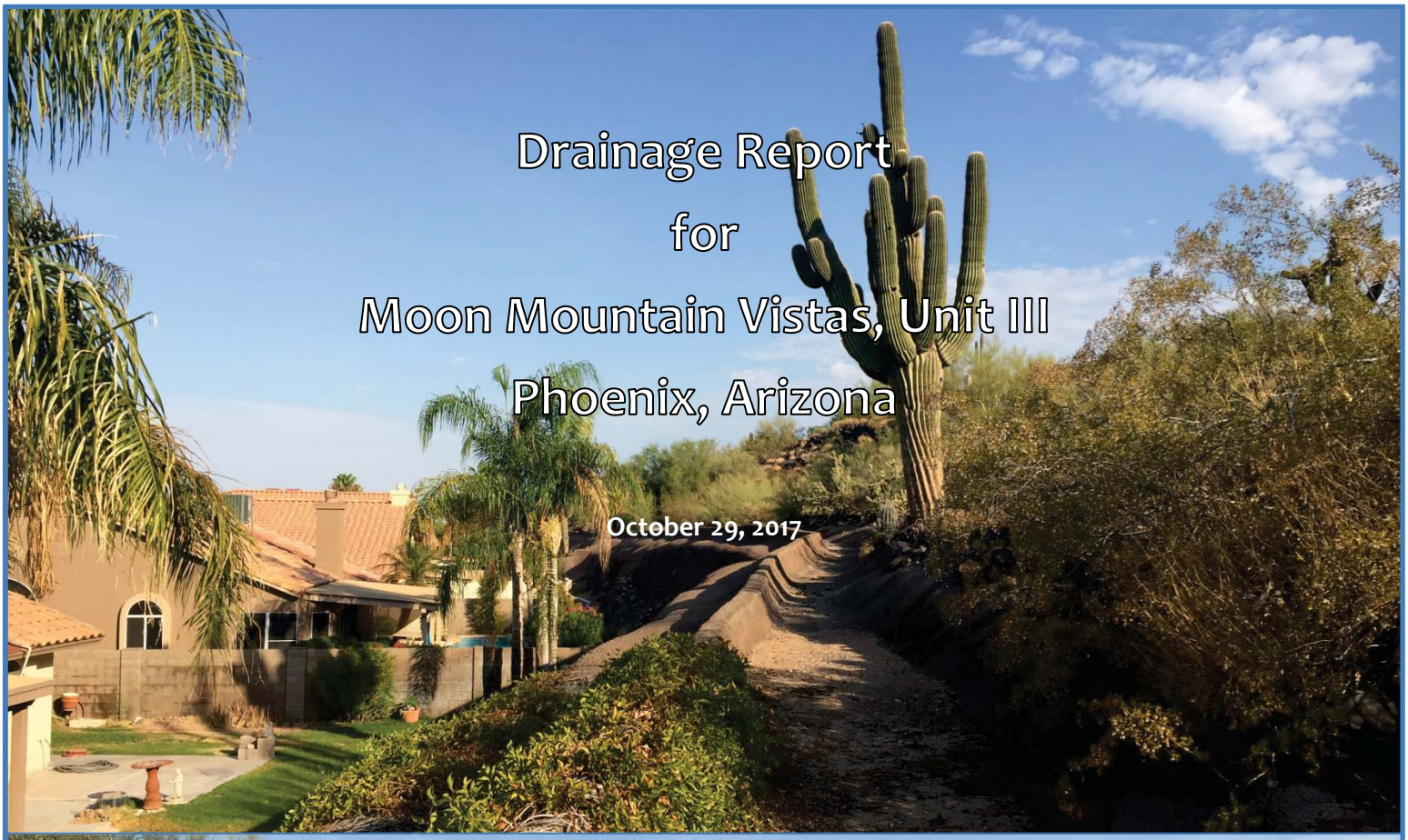
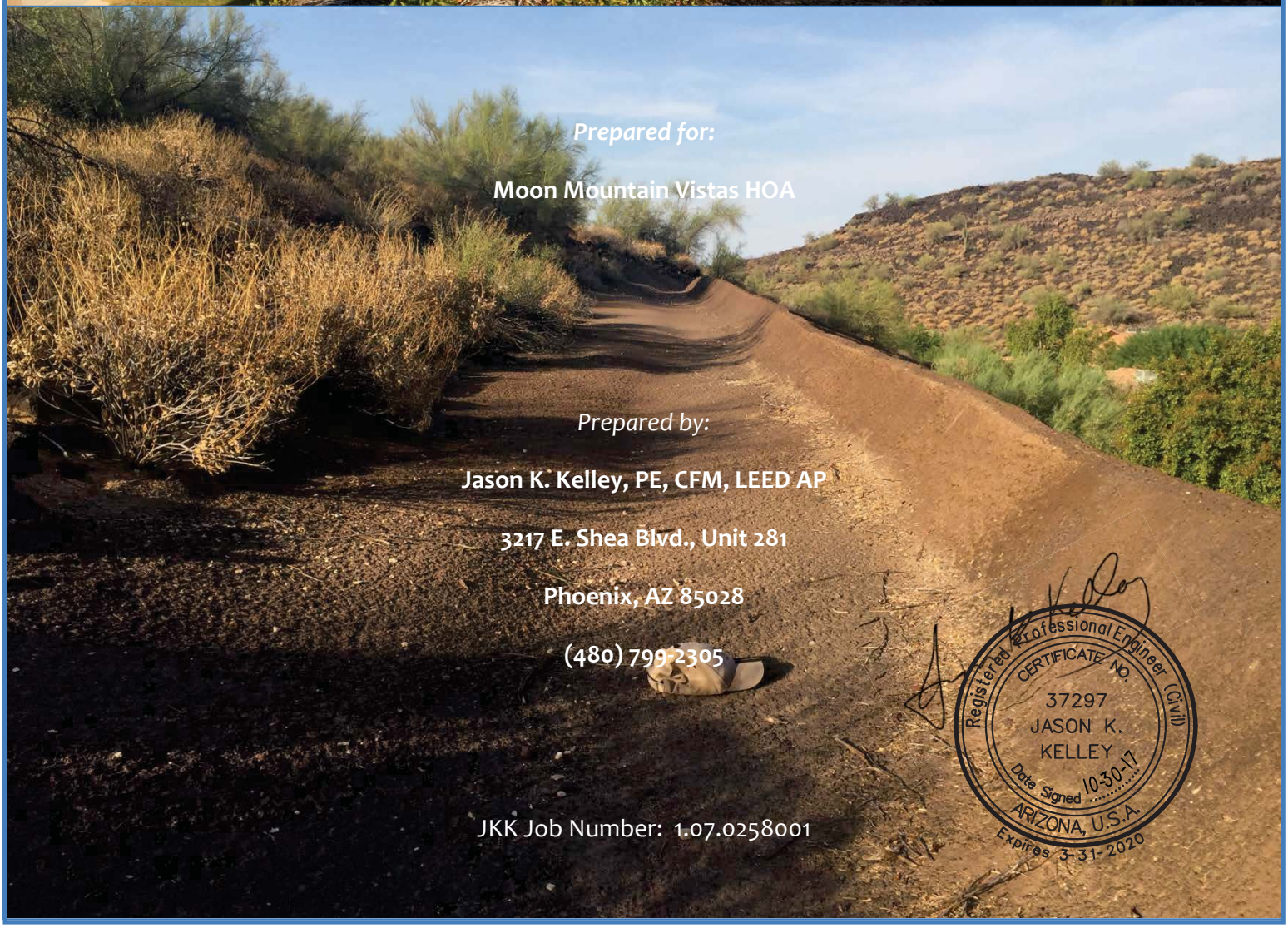


# Drainage Report
# for
# Moon Mountain Vistas, Unit III
# Phoenix, Arizona

**October 29, 2017**



*Prepared for:*

**Moon Mountain Vistas HOA**

*Prepared by:*


**Jason K. Kelley, PE, CFM, LEED AP**

**3217 E. Shea Blvd., Unit 281**

**Phoenix, AZ 85028**

**(480) 799-2305**


Registered Professional Engineer (Civil)
CERTIFICATE NO.
37297
JASON K.
KELLEY
Date Signed 10-30-17
ARIZONA, U.S.A.
Expires 3-31-2020

JKK Job Number: 1.07.0258001

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DRAFT

# 1.0 INTRODUCTION

## 1.1. Scope

Jason K. Kelley, PE, has been contracted by Moon Mountain Vistas HOA (HOA) to provide a drainage evaluation for the Moon Mountain Vistas Unit III community (community). The purpose of this report is to present prioritized solutions for mitigating debris and sediment issues.

This report is focused on providing solutions to decrease the frequency of debris and sediment cleanup within the community after rain storms. The procedures used herein are derived from, and performed with, currently accepted engineering methodologies and practices within the City of Phoenix and Maricopa County.

## 1.2. Jurisdiction

The community is located within Section 7, Township 3 North, Range 3 East of the Gila & Salt River Base & Meridian and was constructed to meet City of Phoenix and Maricopa County drainage requirements. Current versions of requirements, substantially similar to the requirements from 1989, are located in the City *Storm Water Policies and Standards* [1] and *Drainage Design Manuals for Maricopa County, Arizona, Volume I, Hydrology* [2] and *Volume II, Hydraulics* [3]. The final plat was recorded on November 14, 1989 (see Appendix A).

# 2.0 GENERAL SITE DESCRIPTION

## 2.1. Community History and Drainage Conditions

Grading and construction on the site began in early 1990 continuing through early 1992. The community is irregular square in shape and is approximately 24.5 acres in size, including the undeveloped hillsides surrounding the residences. The community is comprised of 55 single family homes. The surrounding hillsides slope towards the residences at approximately 30% and the community roads slope westerly at 0.5% to 1.0% towards 19$^{th}$ Avenue. Except Lots 23-25 and 54-55, the site is bordered by a two to four-foot-deep trapezoidal, soil cement channel integrated with a six to 12-foot tall vertical soil cement retaining wall (see Photo 1). The channel is grouted flush with the 30% hillsides and conveys stormwater to each of four concrete outfall channels which drain onto the residential street (see Photo 2). There is a 12”x24” grate inlet draining into a 12” CMP pipe which intercepts a small portion of the hillside flows above Moon Mountain Trail and routes them towards the community (see Photo 3). Moon Mountain Trail incorporates 6” asphalt curbing which contains flows and routes them south away from the

Community (see Photo 4). The access road to the old City water tanks has a cross-slope into the hillside (see Photo 5). Flows coming from above the access road travel down the road and away from the Community.

### 2.2. Hillside Watershed Areas, Channel & Flow Directions

Areas of the hillside drain to specific portions of the perimeter channel. Figure 1 labels the approximate sub-areas contributing stormwater runoff to the channel (SB-1 through SB-6). The channel was constructed with highpoints (grade-breaks – black lines on Figure 1) from which it slopes in opposite directions eventually leading to the outfall channels (green lines). The highpoints and outfall channel locations are identified in Figure 1. There are two portions of the channel that are relatively flat (see Figure 1 and Photo 6). Flow directions (yellow arrows), the grate and pipe culvert locations (blue lines) are shown on Figure 1 as well.

## 3.0 DEBRIS ISSUES

When it rains on the site, sediment, gravel and plant debris are washed off the surrounding hillsides. The debris are intercepted by the soil cement channel around the perimeter of the site (perimeter channel) and conveyed to any of four concrete collection channels that discharge onto the street. Ongoing maintenance to cleanup sediment and debris is required after storm events. A summary of drainage issues follows:

### 3.1. Dirt and Plant Debris on the Streets

(1) Sediment, gravel and debris move into the street from the outfall channels and cleaning becomes an ongoing maintenance issue.

(2) Sediment and debris collect in the outfall channels, especially at the energy dissipater blocks and ongoing maintenance is required.

## 4.0 MAINTENANCE ISSUES

There were several issues observed during site visits related to ongoing maintenance but not related to mitigating sediment and debris on the street. These are as follows:

### 4.1. Sediment Accumulation in Perimeter Channel

(1) Deposition (accumulation) of sediment will continue to occur in flatter areas of the perimeter channel and ongoing maintenance will be required to clean sediment build-up after storms (see Figure 1 for location of flat areas).

### 4.2. Minor Cracking of Perimeter Channel

Minor cracking was observed in various locations. Temperature expansion/contraction cracking is normal for soil cement and most cracks are 1-2 mm in width (see Photo 7).

### 4.3. Perimeter Channel Grouted Edge Exposure and Minor Scour

Minor exposure and scour was observed in various locations along the grouted edge against the hillslope. This is attributed to removal of sediment during rain storms and settlement over time (see Photo 8).

### 4.4. Ponding in Perimeter Channel and Soil Loss at Base of Retaining Wall

General comment regarding item (2): Observed exposure at the bottom of the retaining wall is most likely not due to piping, but due to sediment removal and settlement over time (see Photo 9). Repeated ponding in the perimeter channel may eventually lead to seepage through any cracks. If this occurs on a regular basis, the following may result:

(1) Piping of soils at the base of the soil cement retaining wall could occur, possibly compromising the structure (see Photo 9).

(2) Though designed to handle the loadings of wetted soils, hydrostatic pressure build-up behind the retaining wall could lead to expansion cracking requiring maintenance.

### 4.5. Parallel Flaking/Cracking in Perimeter Channel near Lots 38-40

(1) Flaking is occurring near Lots 38-40 (see Photo 10). Flaking is most likely occurring due to contraction/expansion separating a top layer of soil cement from another.

(2) Parallel cracking is occurring in this same location (see Photo 10).

## 5.0 DEBRIS ISSUES - Potential Solutions (refer to Section 3.0)

There are several solutions to minimizing the frequency and quantity of sediment moving into the street. These are as follows:

## 5.1. Deepen Catchment Area

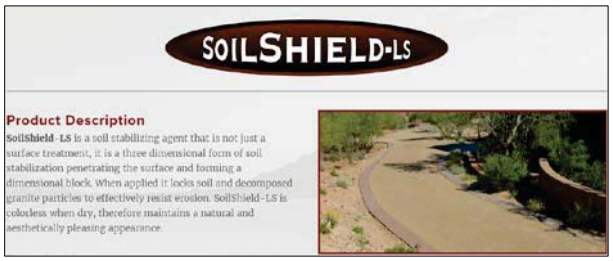
Deepen the catchment area adjacent to the perimeter channel at the outlet of Sub-Area SB-6 (see Photo 11). Advantages: Would provide additional available volume for sediment capture. Would create a weir-flow condition into the concrete outfall channel thus producing cleaner water as sediment is trapped. Disadvantages: Construction would involve removal and replacement of a section of the soil cement channel. An outlet pipe through the depressed area leading to the outfall channel would be required to drain ponded water. Implementation would be relatively costly and care would need to be taken so as not to compromise the retaining wall during construction.

## 5.2. Install Rock Check Berms

Install rock check berms on the hillside along the two primary stormwater accumulation areas (washes) within Sub-Areas SB-2 and SB-6 (see Photo 12 and Rock Berm Concept Detail). Advantages: Would provide additional available volume for sediment capture. Multiple check berms would intermittently reduce flow velocities and reduce the ability of the flows to carry sediment. Check berms can be constructed of rocks from the hillside, thus reducing costs. Disadvantages: Manual labor would be required to construct the berms, including hand selection of stones and placement of a compact matrix of stones). Maintenance and removal of sediment would occur on the hillside requiring hiking up the hillside.

## 5.3. Apply Soil Stabilizer

Apply spray-on soil stabilizer to areas of exposed soil contributing to sediment loading (see Photo 13). Advantages: Quite effective in reducing soil erosion. Relatively low cost. Mobile spray application and re-application by unskilled labor. Storage of extra product for future applications. Disadvantages: Re-application after 2-4 years. Examples of stabilizer products listed below.



### 5.4. Construct Stone Weirs at Outfall Channels

Construct small hand placed stone weirs near the outfall channels in the perimeter channel (see Photo 14). Advantages: Will trap some debris and sediment before flows enter the outfall channels. Low cost. Disadvantages: May lose stones. Will create additional areas to monitor for regular cleanout of sediment. May need to grout and provide small low-flow pipe (e.g. 4" pvc).

## 6.0 MAINTENANCE ISSUES - Potential Solutions (refer to Section 4.0)

### 6.1. Sediment Accumulation in Perimeter Channel

(1) Clean sediment build-up after storms.

(2) Steepen slope in perimeter channel by removal and construction. Advantages: Eliminates ponding and sediment buildup. Disadvantages: Major construction, structural engineering efforts and associated design and construction costs would be required to remove and adjust the perimeter channel and top of the retaining wall. Excavation of the hillside and addition of retaining wall against the hillside would be required.

### 6.2. Minor Cracking of Perimeter Channel

(1) Apply concrete grout to cracks (see Photo 7). Brush any debris and pebbles out of cracks and hand apply grout into crack and on surface along crack. Advantages: Low cost, hand application. Disadvantages: None.

### 6.3. Perimeter Channel Grouted Edge Exposure and Minor Scour

(1) Apply concrete grout at edges of perimeter channel against hillslope. Advantages: Will limit seepage under edges of perimeter channel. Low material cost, hand application (see Photo 8). Disadvantages: Application of larger amounts of grout, access of equipment to perimeter channel. Higher labor costs than crack grouting.

### 6.4. Ponding in Perimeter Channel and Soil Loss at Base of Retaining Wall

(1) Apply concrete grout to any cracks in flat areas. Advantages: Will promote evaporation and limit seepage. Low cost, hand application. Disadvantages: None.

(2) Pressure grout Soil Loss areas at Base of Retaining Wall. Advantages: Address important maintenance item. Limit continued removal/sluffing of soil. Disadvantages: Mobilizing pressure grouting equipment. Cost of hiring pressure grouting specialist.

## 7.0 RECOMMENDED SOLUTIONS TO DEBRIS ISSUES

Rock Check Berms

(1) Rock check berms to be approximately 42" high at the lowest point, extending perpendicular across the wash approximately 50 feet.
(2) Top width of berm 24", bottom width of berms will be defined by extending slopes at 1:1
(3) A well graded selection of loose rocks from the hillslopes should be used to extent possible
(4) Rocks need to be taken from areas where removal will not disturb or expose soil
(5) Rocks from higher up on the hillside preferable
(6) Rocks ranging in diameter from 4" to 16" used to create berms to form a well-grade, interlocking matrix

Notes

(1) Recommendations based on site visits and engineering judgement
(2) Sketches and details are conceptual only
(3) Engineering based on topographic survey recommended for final design, estimation of quantities and location of rock check berms

## 8.0 REFERENCES

[1] City of Phoenix (COP), "Storm Water Policies and Standards Manual," April 2011.

[2] Flood Control District of Maricopa County, "Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology," Revised August 2013.

[3] Flood Control District of Maricopa County, Arizona, "Drainage Design Manual for Maricopa County, Volume II, Hydraulics," Revised August 2013.

# FIGURES

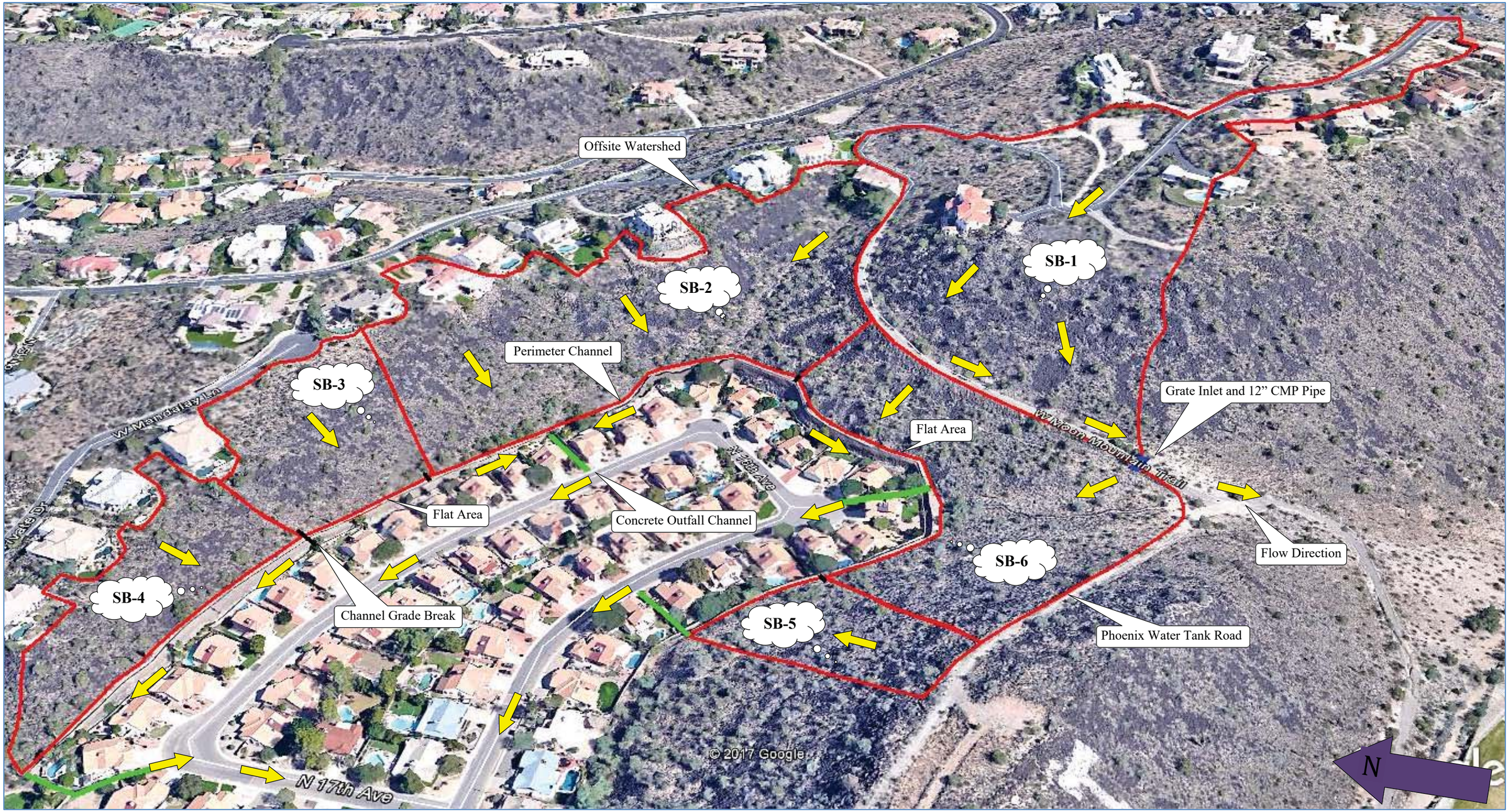



**Figure 1 – Drainage Map**

# APPENDIX A - Plat

# MOON MOUNTAIN VISTAS UNIT III

## A PLANNED RESIDENTIAL DEVELOPMENT

## A PORTION OF LOTS 2, 3 AND THE WEST HALF OF SECTION 7, T. 3 N., R. 3 E., G. & S. R. B. & M., MARICOPA COUNTY, ARIZONA

UNOFFICIAL DOCUMENT

## CERTIFICATION

This to certify that the plat is correct and accurate, and that the monuments described have been located or set as indicated on said plat, and that the survey of the premises described hereon was made under my direction during the Month of OCTOBER, 1989.

| Registered Land Surveyor | Reg. No. | Date |
|---|---|---|
| | 10846 | 10/20/89 |

## APPROVALS

Approved by the City Council of the City of Phoenix, Arizona, this day of November 8, 1989.

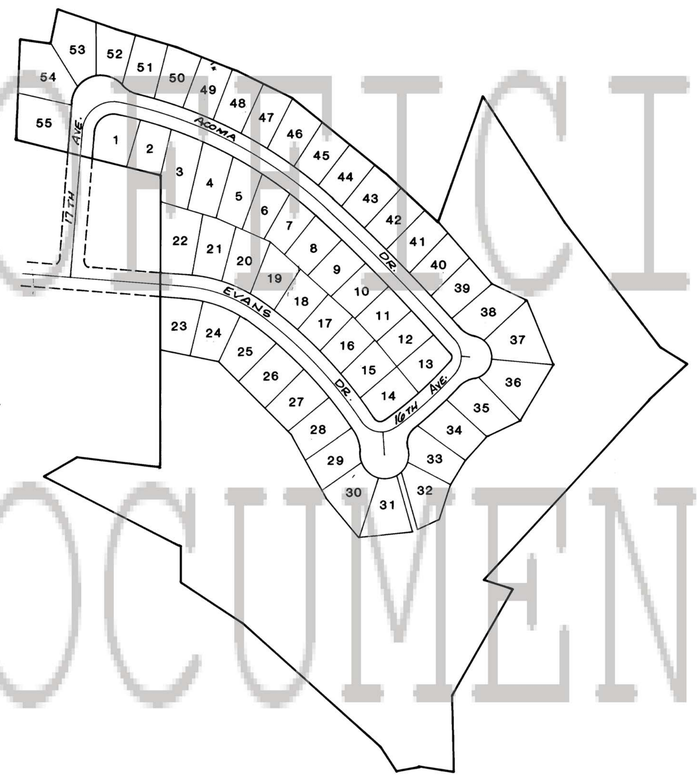
| For City of Engineer | Reg. No. | Date |
|---|---|---|
| | | 11-14-89 |

Attested by:

| City Clerk | Date |
|---|---|
| | 11-08-89 |

## NOTES

1. THE MAXIMUM BUILDING ENVELOPE FOR EACH LOT SHALL NOT EXCEED 3500 SQUARE FEET.
2. THERE SHALL BE AN 18' SETBACK FROM BACK OF SIDEWALK TO THE FACE OF VERTICALLY LIFTING GARAGE DOORS, 20' SETBACK FOR ALL OTHERS.
3. MONUMENTS TO BE INSTALLED ARE TO BE IN ACCORDANCE WITH M.A.G. STANDARD DETAIL 120-1




## KEY MAP

## OWNER/DEVELOPER

MOON MOUNTAIN SHADOWS LTD. PARTNERSHIP
2198 EAST CAMELBACK ROAD
SUITE 205
PHOENIX, ARIZONA 85016
(602)945-0962

## DEDICATION

State of Arizona )
SS
County of Arizona )

KNOW ALL MEN BY THESE PRESENTS; That MOON MOUNTAIN SHADOWS LIMITED PARTNERSHIP, an Arizona Limited Partnership, as Owner, has subdivided under the name of MOON MOUNTAIN VISTAS UNIT III that portion of Lots 2 & 3 and the W.1/2 of Section 7, Township 3 North, Range 3 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona, as shown and platted hereon and hereby publishes this as and for the plat of said MOON MOUNTAIN VISTAS UNIT III, a subdivision and hereby declares that said plat sets forth the location and gives the dimensions of the lots, streets and easements constituting the same and that each lot and street shall be known by the number and name that is given to each respectively on said plat. And that MOON MOUNTAIN SHADOWS LIMITED PARTNERSHIP, as Owner, hereby dedicates to the public the streets and easements for use as such as shown hereon.

INWITNESS WHEREOF: MOON MOUNTAIN SHADOWS LIMITED PARTNERSHIP, as an Arizona Limited Partnership, as Owner, has caused its name to be signed by the undersigned General Partner thereunto duly authorized.

MOON MOUNTAIN SHADOWS LIMITED PARTNERSHIP
An Arizona Limited Partnership, as Owner
By SKP Investments, an Arizona general partnership
Its General Partner
By Francis J. Slavin
A General Partner

STATE OF ARIZONA
County of Maricopa } SS
I hereby certify that the with in instrument was filed and re-corded at request of
City of Phoenix
NOV 14 '89-4 25
in Book 335
of Page 27
Witnes my hand and offic-ial seal the day and year above-said
Helen Purcell County Recorder
By Nancy Nolline
Deputy Recorder

## ACKNOWLEDGEMENTS

STATE OF ARIZONA )
SS
COUNTY OF MARICOPA )

On this day 1st day of November, 1989, before me, the undersigned officer, personally appeared Francis J. Slavin, who acknowledged himself to be General Partner of MOON MOUNTAIN SHADOWS LIMITED PARTNERSHIP, as Arizona Limited Partnership, as Owner, and as such, being duly authorized so to do, executed the foregoing instrument for the purposes therein contained.

IN WITNESS WHEREOF: I hereunto set my hand and official seal.

My commission Expires: May 29, 1992

Shirley E Dilang
Notary Public

QS 33-25 & 34-25
P-87164 S
5-24-88

**MOON MOUNTAIN VISTAS UNIT III**

Keogh Engineering, Inc.
7250 NORTH 16TH STREET • SUITE 414 • PHOENIX, ARIZONA 85020
PHONE (602) 395-0999

JOB NO. 17015 MAP NO. E-17015

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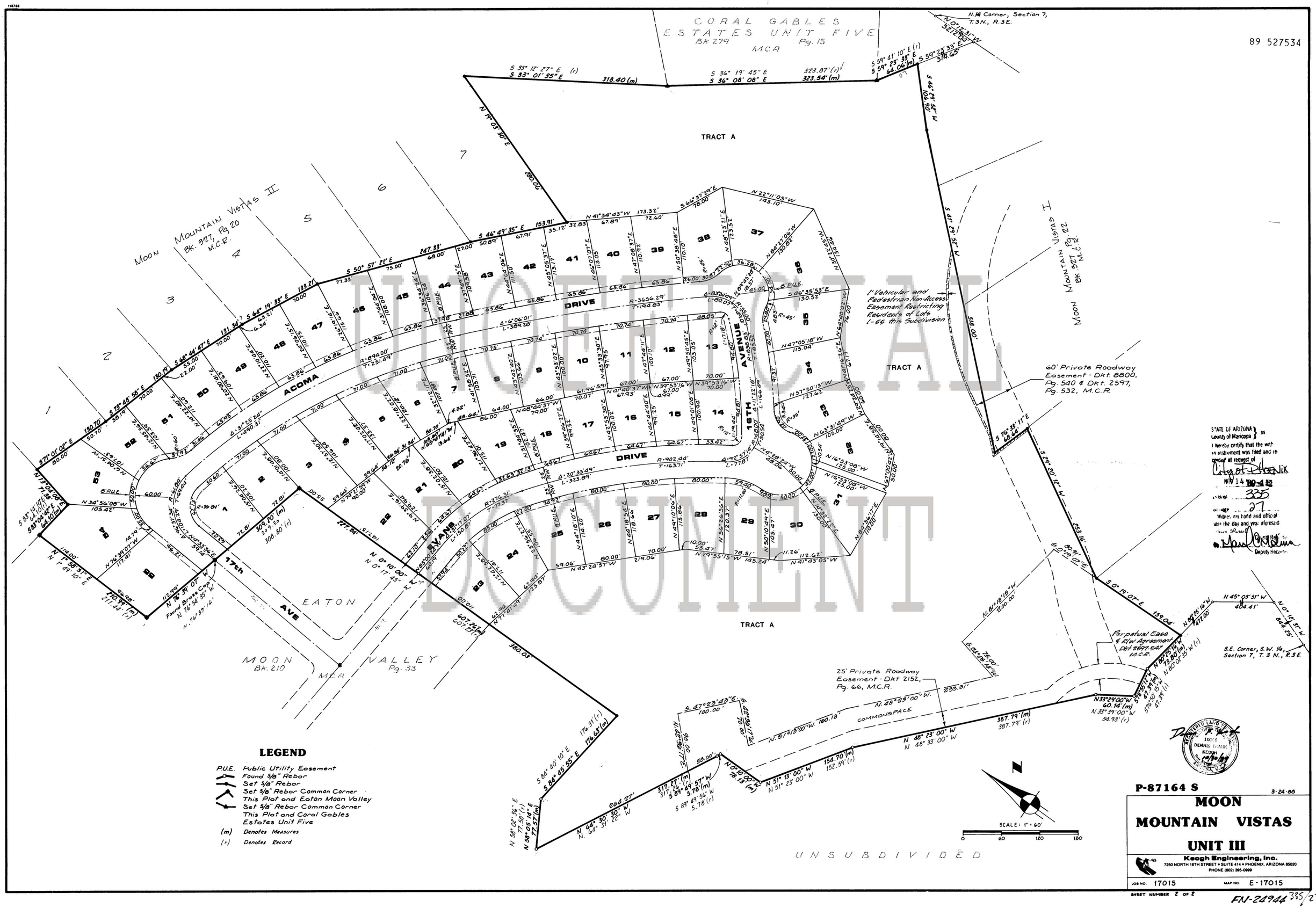



UNOFFICIAL DOCUMENT

FN-24944 335/27

# APPENDIX B - Photos

**Photo 1 – Perimeter Channel and Retaining Wall**

**Photo 2 – Concrete Outfall Channels**

**Photo 3 – Grate Inlet and Pipe at east end of Moon Mountain Trail**

**Photo 4 – Asphalt Curbing along Moon Mountain Trail**

**Photo 5 – Phoenix Water Tank Road**

**Photo 6 – Sediment Accumulation in Flat Portions of the Perimeter Channel**

**Photo 7 – Minor Cracking of Perimeter Channel**

**Photo 8 – Grouted Edge Exposure**

**Photo 9 – Soil settlement and erosion; Potential Piping at Base of Retaining Wall**

**Photo 10 – Flaking and Parallel Cracking**

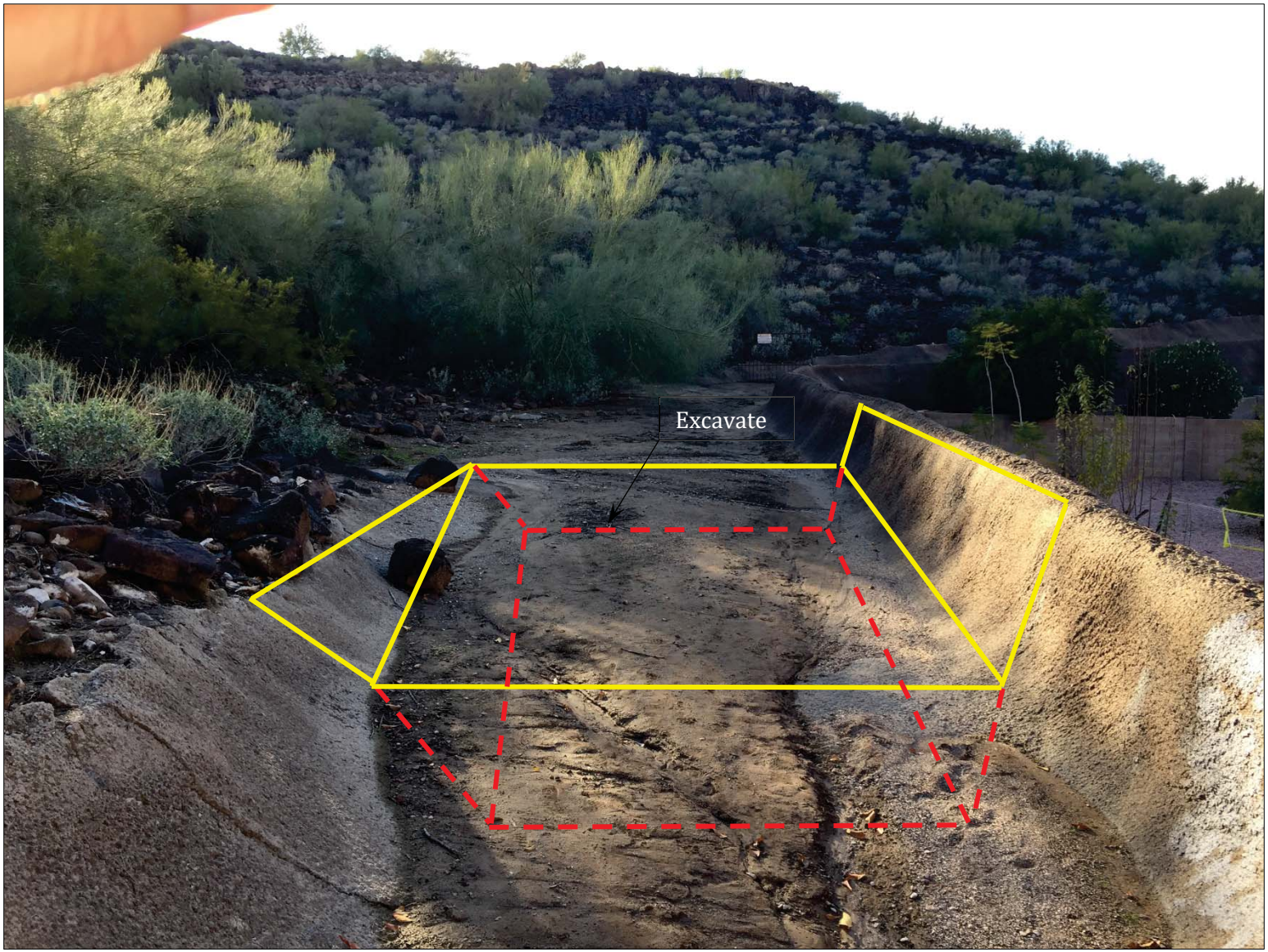
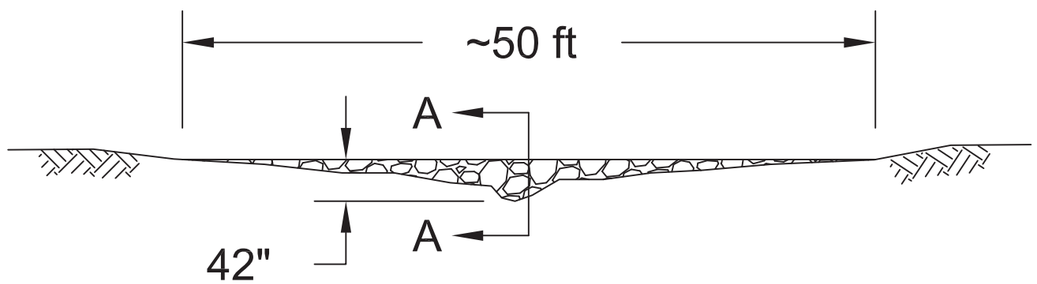
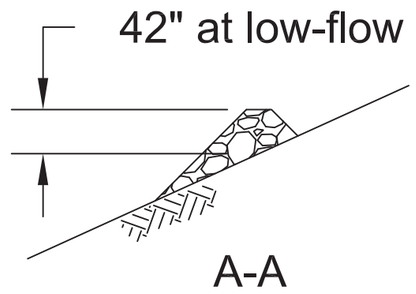
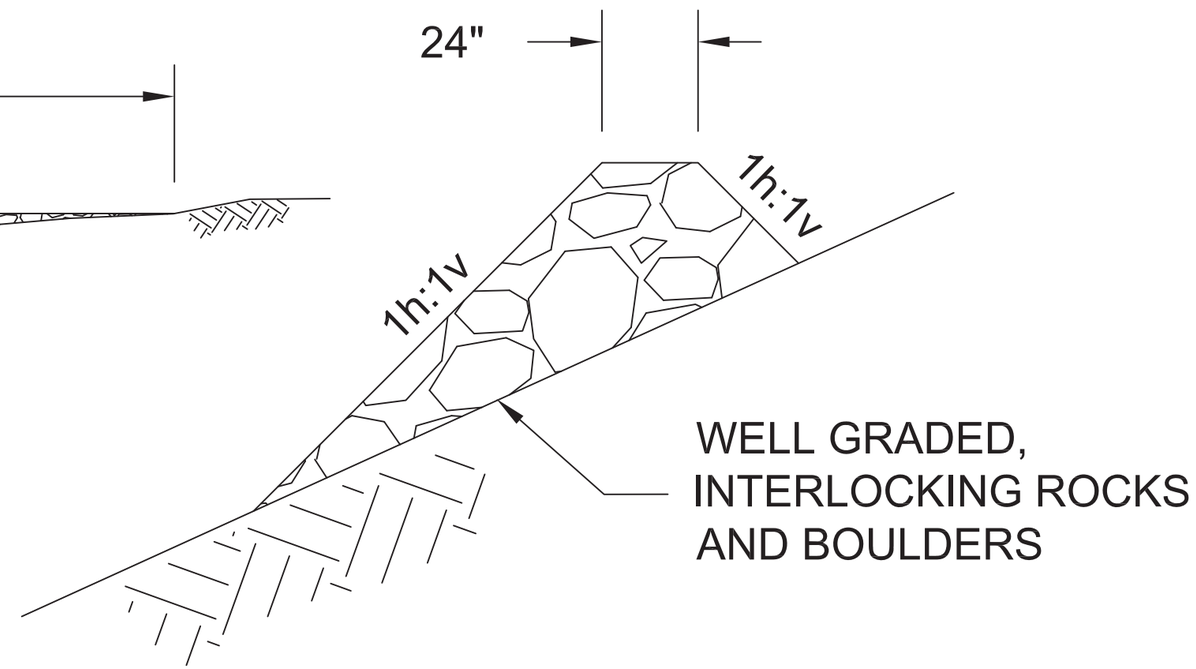



**Photo 11 – Increase Sediment Capture from Catchment Area SB-6**

**Photo 12 – Rock Check Berms along Washes**




ROCK BERM CONCEPT DETAIL

**Photo 13 – Apply Soil Stabilizer to Exposed Areas**

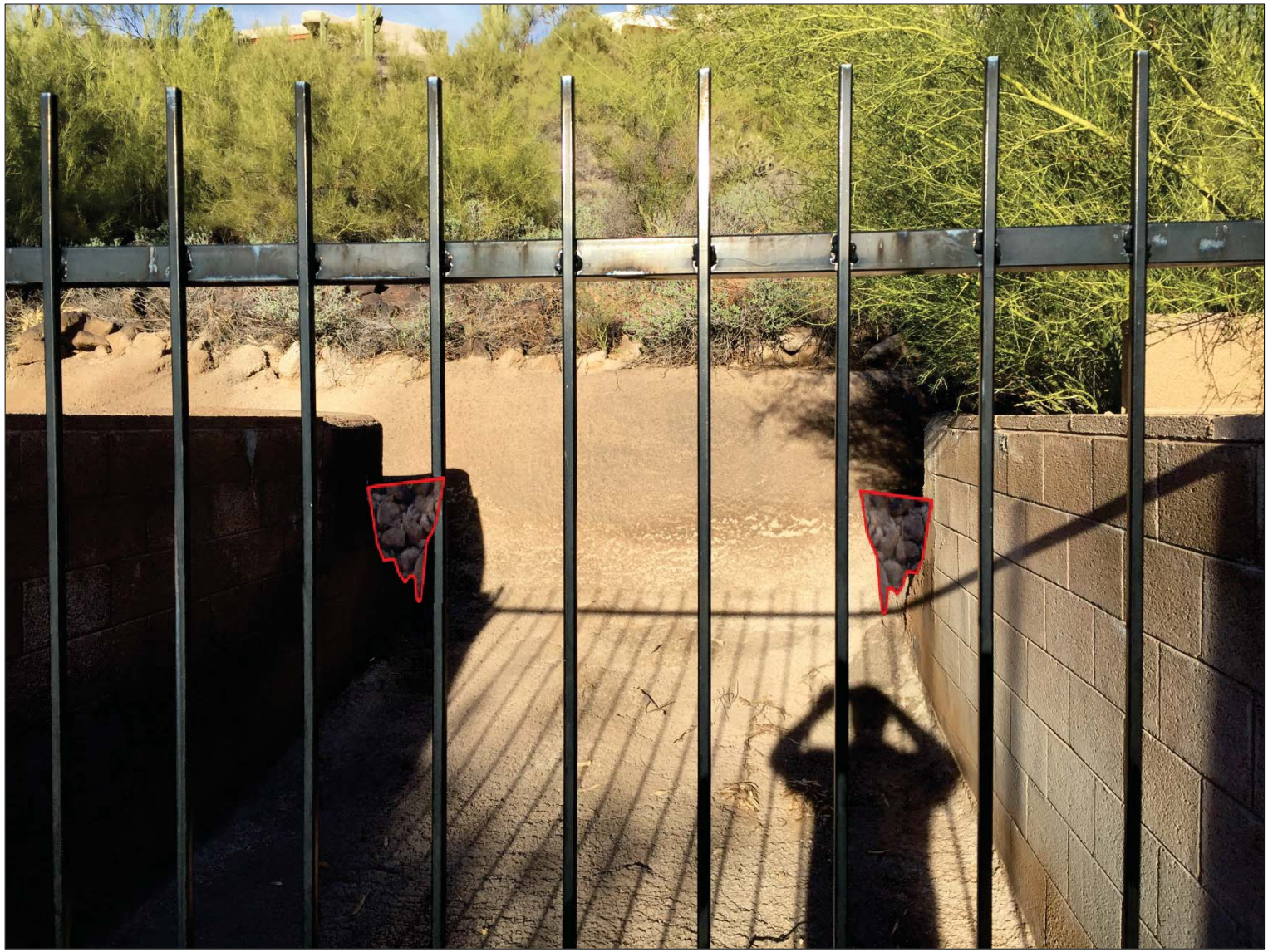


**Photo 14 – Construct Stone Weirs at Outfall Channels**