



SUNRISE
ENGINEERING

SKY WASH APEX SOLUTION
ALTERNATIVES MEMORANDUM

SEI #03570
February 2011



Date: February 28, 2011

To: Woodrow C. Scoutten, P.E.
W.C. Scoutten, Inc.
1626 N. Litchfield Road, Suite 310
Goodyear, Arizona 85395
Phone (623) 547-4661

Subject: **Sky Wash Regional Drainage Proposal Alternatives**
SEI Project No. 03570

Dear Mr. Scoutten,

It is our understanding that the Town is set to begin work on the Sky Wash Regional Drainage Proposal with the Flood Control District of Maricopa County (District) as part of its Capital Improvement Projects (CIP) program. The District has requested to review the preliminary engineering that Sunrise has been completed to date. The review will help the District decide where to start the project either at the Design Concept or pre-design phase. All preliminary calculations, computer modeling files, exhibits, and cost estimates have been attached for review. A formal report was never required or submitted for any of this data, thus the informality of this letter and attachments.

Project Overview

The apex of Sky Wash alluvial fan is located approximately two miles north of I-10 at Watson Road. The area is bounded by the White Tank Mountains to the north and I-10 to the south. Immediately north of I-10 is the existing Buckeye Flood Retarding Structure (FRS) No. 3. All runoff from Sky Wash ultimately outfalls to the Buckeye FRS No. 3 via sheet flow in the alluvial fan and existing natural cut washes. The alluvial fan area downstream of the Sky Wash apex is within Alluvial Fan Zone A Administrative Floodway and Alluvial Fan Zone A Floodplain, see the attached FIRM.

The Sky Wash Regional Drainage Proposal proposes to control alluvial fan flows by constructing a detention facility and channel to attenuate and channelize alluvial fan flows. Sunrise has worked on several different iterations of the proposal with several years passing between the iterations. The various iterations have been summarized into three alternatives. The latest version, Alternative 3, was submitted to the District as part of the CIP program application for the Town. The design progressed without the benefit of knowing that alternatives would be required. Therefore calculations or cost estimates may not have been completed for some of the Alternatives.

Topographic Survey

A combination of topographic surveys were used for this project. The first was "Valencia, AZ" Topographic Survey by the USGS 1957, revised 1982. And the second was a compilation of 2 foot contour survey's supplied by FCDMC with dates ranging from 1987 to 2002.

Hydrologic Modeling

All hydrologic modeling was completed using the flood hydrograph computer program HEC-1. The base hydrology model for this project is the 1999 FCDMC Floodplain Delineation Study model by DEI that was approved and published by FEMA in 2000. In December 2006 the District and JE Fuller completed the Sun Valley Area Drainage Master Plan. Although new modeling was produced in the ADMP, FCDMC recommended the use of FEMA approved hydrology model. Therefore the HEC-1 files used for the preliminary Alternative engineering were the same files FEMA used for the approved floodplain delineation. The files were used as 'base' files and revised to add the apex detention basin and outflow works for the three alternatives. In all alternatives the peak offsite flow is estimated to be 4,340-cubic feet per second (cfs). See attached overview map.

The alternatives models use storage-discharge for reservoir routing. Input data for the model includes reservoir stage and storage, and outflow rating curves. Stage storage data for the proposed basins was extracted from the topographic surveys based on proposed contours. Several different basin sizes were modeled in an effort to optimize the basin size versus the channel size. All basin sizes are given for reference and may not have been used in an Alternative. See attached Stage-Storage chart. See the **Hydraulics** section for information regarding the outflow rating curves.

Several models were run with different configurations of basin volumes and outlets to solve for peak storage and outflow rates. The first model was run and used for Alternative 1 and 2. This run was with a 36-in diameter low flow pipe and weir. In this configuration the basin would fill without releasing significant amounts of water until the storage level reached the weir crest. Then the excess incoming flow would passed through the weir.

The additional runs were created for Alternative 3 to look at ways to reduce required storage size. Additional model runs were performed with much larger box culverts as the "low flow". The box culvert low flow allows more storm water volume to pass thru the system earlier in the storm event. The result is a smaller basin with a slight increase in peak flows leaving the basin.

The table below summarizes the model runs. It provides model file name, max storage, low level outlet, and peak outflow for each run. Where max storage volume is the maximum storm water volume stored for that model run. The low level outlet dimension describes the outlet pipe or culvert. It should be noted that all model run basins were modeled with a 100-ft wide weir in addition to the described outlet. Peak outflow is the maximum flow that is expected for that model run based on the given basin and pipe configuration.



The following conceptual HEC-1 runs data files can be found attached:

HEC-1 Model .DAT File	Max Storage Volume [ac-ft]	Low Level Outlet Dimension	Peak Outflow [cfs]
APEX1	223	36" Pipe	533
APEX2	200	36" Pipe 10' X 6'	924
APEX2-1	200	Box	759
APEX3	150	36" Pipe 10' X 6'	2042
APEX3-1	150	Box 12' X 5'	904
APEX3-2	150	Box 12' X 6'	926
APEX3-3	150	Box 15' X 4'	1052
APEX3-4	150	Box	943
APEX4	100	36" Pipe	3411
APEX5	50	36" Pipe	4265

Hydraulics

Hydraulic calculations were performed for channel section sizing, culvert flow, weir flow, and orifice flow. Channel sections were preliminarily sized using the Mannings equation as presented in the Flow Master computer program. See attached FlowMaster work sheets.

Culvert rating curves were calculated using the Federal Highway Administration Culvert Program HY-8 computer program. Four different box culvert sizes were modeled. The sizes are 10-ft x 6-ft, 12-ft x 5-ft, 12-ft x 6-ft, and 15-ft x 4-ft. See attached HY-8 output files and Culvert summary for calculations.

Weir flow calculations were calculated from USDA SCS, "Hydraulics of Broad-Crested Spillways". The weir equation was used to calculate the rating curve for the weir. Orifice calculations were made using the orifice equation with discharge coefficients obtained from Driscoll, "Groundwater and wells", figure 16.2. The orifice equation was used to produce a rating curve for the 36-inch low flow output pipe. The spillway and low flow pipe rating curves were combined to produce combined outflows. See the attached Orifice and Weir Flow calculation sheet.

Alternative 1

Alternative 1 consists of a large detention basin with a small low flow outlet into a trapezoidal channel. The detention basin is formed by placing an earthen berm across the apex and excavating upstream to reach the desired volume. The proposed channel will carry outflows south to the Buckeye FRS. The channel alignment is along an existing wash that runs easterly along the eastern edge of the Zone A floodplain delineation. The channel alignment for this Alternative most closely matches the channel alignment proposed in the Sun Valley ADMP. This alignment would require right of way from the State Land Department and the Fisher Property.

Alternative 1 proposes the following:

- 223 ac-ft detention basin at the apex of the alluvial fan
- 10 ft maximum water depth in basin
- 6 ft tall earthen berm across the apex
- 100 ft long weir
- 36 in diameter low flow outlet pipe
- 825 cfs peak outflow
- Channel – Will have to add additional flow for area from north that is tributary to the channel.
 - Trapezoidal
 - 25 ft bottom width
 - 65 ft top width
 - 3 ft water depth
 - 2 ft freeboard
 - 4:1 side slopes
 - riprap lined

Alternative 1 Pro's and Con's

Pros:

- Uses Sun Valley ADMP proposed alignment.
- Natural meandering path along an existing wash alignment in the general direction of the natural flow path.

Cons:

- Potential 404 issues with existing wash alignment.
- R/W from both Fisher Property and Stateland.
- Large basin.
- Longest channel run.
- Potential hard rock excavation for basin and channel.

Alternative 2

Alternative 2 consists of the same detention basin and low flow outlet as Alternative 1. Alternative 2's channel alignment differs from Alternative 1 by routing it south adjacent to Watson Road. Along the proposed alignment another large wash west of Watson Road intersects with Watson about 1 mile south of the apex. The proposed channel joins the two flows and continues south past Roosevelt Street to the proposed Watson Road culvert crossing. The proposed culvert crossing, south of the existing wash, avoids a second existing wash crossing at Roosevelt Street. This alignment requires right of way from the State Land Department. See attached exhibit Sky Wash Regional Drainage Solution conceptual plans.

Alternative 2 proposes the following:

- Estimated Cost \$11,500,000
- 223 ac-ft detention basin at the apex of the alluvial fan
- 10 ft maximum water depth in basin
- 6 ft tall earthen berm across the apex
- 100 ft long weir
- 36 in diameter low flow outlet pipe
- 825 cfs peak outflow
- Channel (Section D) before confluence with existing wash
 - 45 ft bottom width
 - 85 ft top width
 - 167 ft R/W
 - 3.0 ft water depth
 - 2 ft freeboard
 - 4:1 side slopes
 - Riprap lined
 - S=1.5%
 - n=0.069
 - 15 ft Multi-use D.G. trail on both sides
 - 25 ft Landscape setback both sides
- Channel (Section E) after confluence with existing wash
 - 2,117 cfs (1292 cfs per FEMA study + 825 cfs)
 - 75 ft bottom
 - 123 ft top width
 - 200 ft R/W
 - 4 ft water depth
 - 2 ft freeboard
 - 4:1 side slopes
 - Riprap lined
 - S=1.5%
 - n=0.069
 - 15 ft Multi-use D.G. trail on both sides
 - 45 ft Landscape setback one side

Alternative 2 Pro's and Con's

Pros:

- Shorter channel length
- R/W from only Stateland
- Multi-use trail
- Serve as scenic corridor for Watson Road

Cons:

- Culverts will be required for street crossings off of Watson for future development of western parcels.
- Large basin.
- Potential hard rock excavation for basin and channel.

Alternative 3

Alternative 3 consists of a smaller detention basin than Alternatives 1 and 2. A channel will convey flows from the culvert to an existing natural wash channel to the southwest. The existing channel is a natural deep cut rock lined wash that is west of Watson Road. Using this existing natural wash channel will save improvement costs versus constructing a parallel channel. The natural wash crosses Watson Road and Roosevelt Road. This project proposes to realign the wash to cross Watson Road south of the current location with a large box culvert. The realigned wash will avoid a second crossing at Roosevelt Road, which would result in additional large box culverts.

Alternative 3 proposes the following:

- Estimated Cost \$6,900,000
- 150 AC-FT Detention Basin
- 10 ft maximum water depth in basin
- 6 ft tall earthen berm across the apex
- 100 ft long weir (emergency spillway)
- 10 x 6 ft Box Culvert outlet
- 904 cfs peak outflow
- Channel (Section D) before confluence with existing wash
 - 45 ft bottom
 - 85 ft top width
 - 167 ft R/W
 - 3.2 ft water depth
 - 2 ft freeboard
 - 4:1 side slopes
 - Riprap lined
 - S=1.5%
 - n=0.069
 - 15 ft Multi-use D.G. trail on both sides

- 25 ft Landscape setback both sides
- Channel (Section E) after confluence
 - 2,300 cfs (1292cfs FEMA Study + 904cfs+104 cfs safety factor)
 - 75 ft bottom
 - 123 ft top width
 - 200 ft R/W
 - 4.2 ft water depth
 - 2 ft freeboard
 - 4:1 side slopes
 - Riprap lined
 - $S=1.5\%$
 - $n=0.069$
 - 15 ft Multi-use D.G. trail on both sides
 - 45 ft Landscape setback one side

Alternative 3 Pro's and Con's

Pros:

- Shortest improved channel length.
- Smaller basin.
- Uses a natural existing wash alignment.
- R/W from only Stateland.
- Multi-use trail
- Minimizes hard rock excavation risk by using natural channel alignment and smaller basin.

Cons:

- Potential 404 Wash issues with existing wash alignment.
- Existing wash may be under capacity.
- Culverts will be required for street crossings off of Watson for future development of western parcels.

Conclusion

Alternative 3 is the alternative of choice. It minimizes basin size while only slightly increasing channel depths. That makes it the most cost effective of the three alternatives. The smaller basin size saves millions of dollars of soil and/or rock excavation over the larger basin alternatives.

There is enough data presented here to proceed directly to the pre-design phase of the project. During the design concept phase of the project the District will work with the Town and a consultant to brainstorm 3 alternatives. The consultant will then model the alternatives and design the concepts with estimates and present them in an Alternatives Report.

The alternatives have been modeled, designed, and estimated. With minimal work the data presented here can be used to produce an Alternative Report. Or the District and the Town can proceed straight to the predesign phase using an alternative as presented here. Another option would be to expand the design phase to include design revisions that the Town or the District may desire.

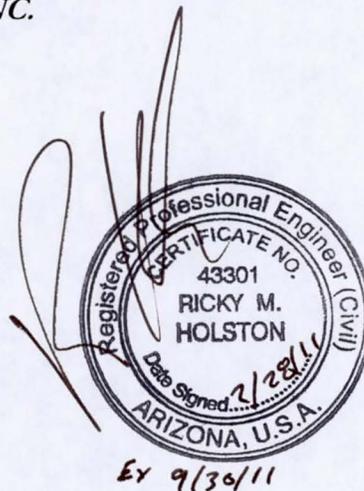
Sunrise would be immensely pleased if the District and the Town would like Sunrise to continue work on the project. This project has presented some great challenges and it would be an honor to see them taken to the end.

Please let us know if you have questions, comments, or require additional information.

Warmest Regards,

SUNRISE ENGINEERING, INC.

Ricky M. Holston, P.E., CFM
Project Manager



Attachments

- FIRM Map
- Overview Map
- HEC-1 Model Results
- Stage-Storage Charts
- FlowMaster Open Channel Calculations
- Orifice and Weir Flow Calculations
- Culvert Summary
- Cost Estimates
- Alternative 1 Exhibit
- Alternative 2 Conceptual Plans
- Alternative 3 Conceptual Plans

FIRM Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updates or additional flood hazard information.

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or Floodway Data and Summary of Stillwater Elevations Tables contained within the Flood Insurance Study (FIS) report that accompany this FIS. Users should be aware that BFEs shown on the FIS represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIS for purposes of construction and/or floodplain management purposes when they are higher than the elevations shown on this FIS.

Coastal Base Flood Elevations shown on this map apply only to landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIS should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations Table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations Table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIS.

Boundaries of the Floodways were computed at cross sections and interpolated between cross sections. The Floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Arizona State Plane Zone 3176 (Central Azimuth). The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FISs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIS.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NGA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3181

To obtain current elevation, description, and/or location information for beach marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>

Base map information shown on this FIS was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:5000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIS for this jurisdiction. The floodplains and floodways that were transferred from the previous FIS may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contain authoritative hydraulic data) may reflect stream channel changes that differ from what is shown on this map.

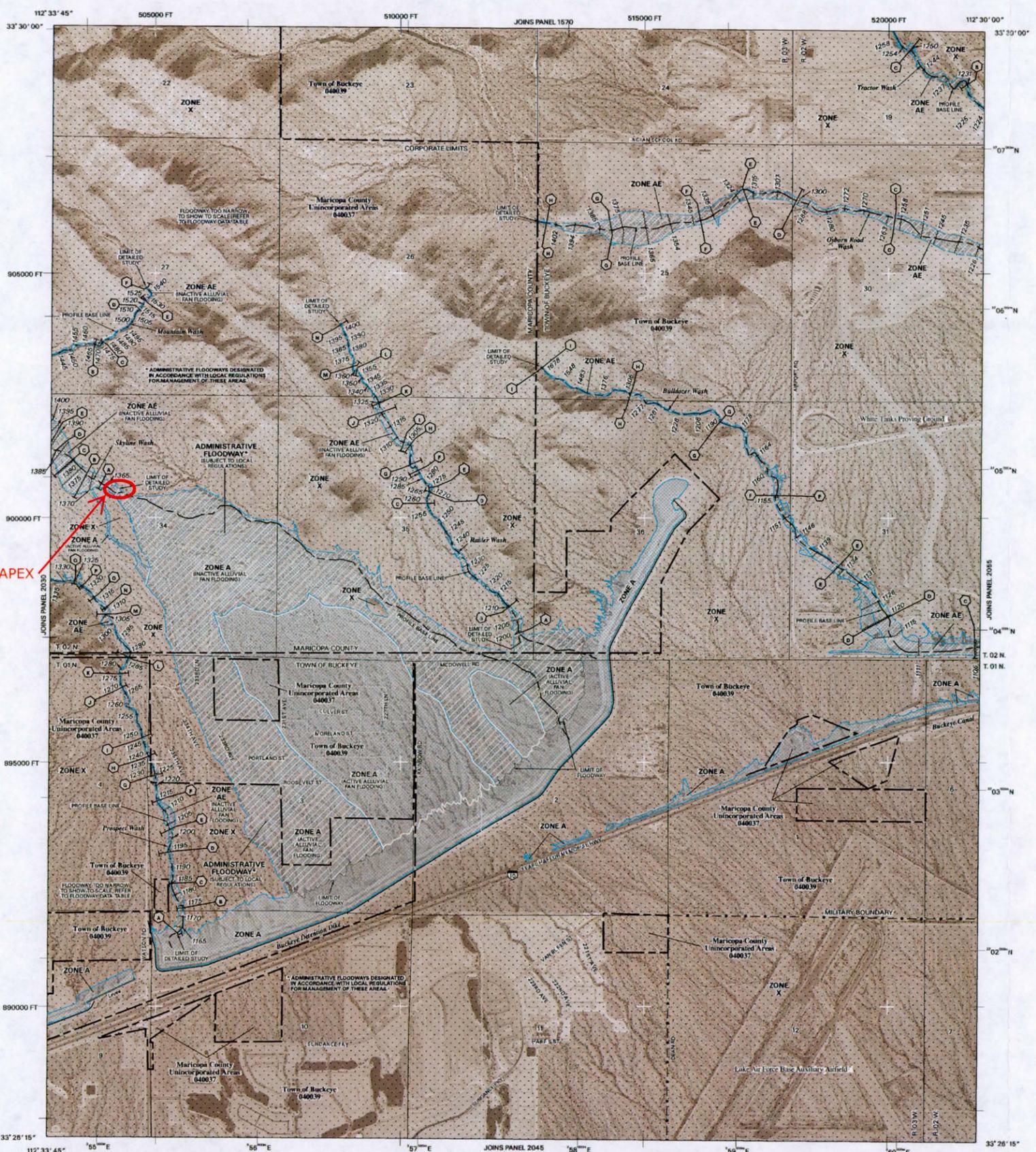
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the ponds on which each community is located.

Contact the FEMA Map Service Center at 1-800-358-9616 for information on available products associated with this FIS. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by fax at 1-800-358-9629 or its website at <http://www.fema.gov>

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMAMAP (1-877-335-2627) or visit the FEMA website at <http://www.fema.gov>

SKY WASH APEX



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), was known as the base flood. In the Flood Insurance Study (FIS) report that accompany this FIS, users should be aware that the Special Flood Hazard Areas are based on the 1% annual chance flood. The Special Flood Hazard Areas of Special Flood Hazard Zones A, AE, AH, AO, AR, AV, and V, the Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually areas of ponding); average flood depths determined. For areas of adverse fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was noncompliant. Zone AR indicates that the former flood control system is being retained to provide protection from the 1% annual chance or greater flood.
- ZONE AV** Areas to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The Floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- ZONE X** Areas of 0.2% annual chance flood: areas of 1% annual chance flood with average depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevation determined, and areas protected by levees from 1% annual chance flood.
- ZONE D** Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE I** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone I boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- Base Flood Elevation line and value, elevation in feet.
- Base Flood Elevation value where uniform within zone, elevation in feet.

* Referenced to the National Geodetic Vertical Datum of 1929

- Cross section line
- Transect line

112° 07' 06", 33° 25' 41" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

1005-meter Universal Transverse Mercator grid tick values zone 12.

875000 FT 500-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)

870V2313 Bench mark (see explanation in Notes to Users section of this FIS panel)

* MSL Mean Sea Level

MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 4, 1991; September 30, 1995; July 19, 2001

September 30, 2005: to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road numbers, to incorporate previously issued Letters of Map Amendment, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for the jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2035H

FIRM FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 2035 OF 4350

DATE MAP INDEX FOR THIS PANEL (LAYOUT)

COMMUNITY	REARER	PANEL	SUFFIX
BUCKEYE, TOWN OF	04000	2035	H
MARICOPA COUNTY	04007	2035	H

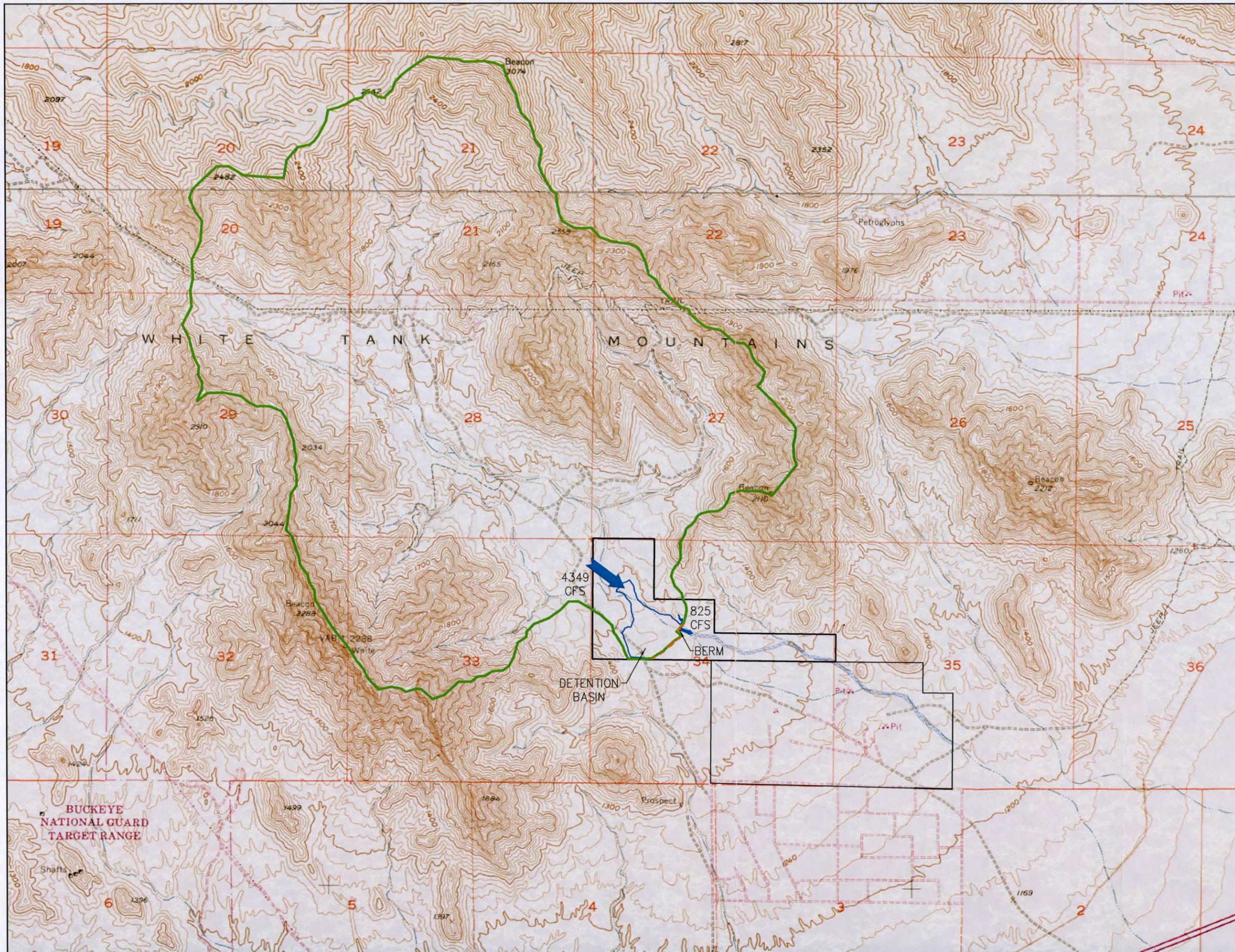
Notes to User: The Map Information below should be used when plotting map orders. Community boundaries shown should be used as map order specifications for the subject community.

MAP NUMBER
04013C2035H

MAP REVISED
SEPTEMBER 30, 2005

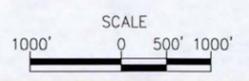
Federal Emergency Management Agency

Overview Map



- LEGEND**
- STATE LAND BOUNDARY
 - FISHER PROPERTY BOUNDARY
 - SUB-WATERSHED BOUNDARY
 - DETENTION BASIN FOOTPRINT
 - CHANNEL
 - ➔ FLOW DIRECTION

NOTE: THE SUB-WATERSHED BOUNDARY AND RUNOFF ARE BASED ON THE SKYLINE WASH AND TRIBUTARIES FLOODPLAIN DELINEATION STUDY COMPLETED IN 1999 FOR THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



REV NO.	COMMENT	DATE
 SUNRISE ENGINEERING 12227 SOUTH BUSINESS PARK DRIVE, SUITE 220 DRAPER, UTAH 84020 TEL 801.523.0100 • FAX 801.523.0990 www.sunrise-eng.com		
FISHER PROPERTY TOWN OF BUCKEYE MARICOPA COUNTY, ARIZONA OVERVIEW MAP		
SEI NO. 02280	DESIGNED DSA	DRAWN DSA
CHECKED LQ	SHEET NO. 01 of 01	FIGURE 1

P:\Fisher Property_AZ\dwg\Fisher Hydrology Exhibits.dwg May 25, 2007 10:11am danderson

HEC-1 Model Results

Sky Wash Apex Solution Conceptual HEC-1 Model Results

Input		HEC-1		Model Output	
Stage	Outflow	Model	Max Storage	Peak Q	Peak Stage
H	Q	Number	V	Q	H
[ft]	[cfs]		[ac-ft]	[cfs]	[ft]
1354.0	0.0	1	223	533	1364.9
1356.0	22.3	2	200	924	1365.4
1357.0	38.6	3	150	2042	1366.3
1358.0	49.8	4	100	3411	1367.3
1359.0	58.9	5	50	4265	1367.8
1360.0	66.8				
1361.0	73.9				
1362.0	80.3				
1363.0	86.3				
1364.0	91.8				
1365.0	557.1				
1366.0	1582.1				
1367.0	2986.8				
1368.0	4641.4				

Stage Storage Charts

Stage-Storage

Spillway= 100' wide
Low flow= 36" Pipe

223 ACRE-FT

Elevation	Depth (ft)	Storage (Acre-ft)	Comments
1354	0	0	Bottom
1355	1	22	
1356	2	44	
1357	3	66	
1358	4	88	
1359	5	110	
1360	6	132	
1361	7	154	
1362	8	176	
1363	9	198	
1364	10	223	Spillway Invert
1365	11	245	
1366	12	267	
1367	13	289	
1368	14	311	Top of Berm

200 ACRE-FT

Elevation	Depth (ft)	Storage (Acre-ft)	Comments
1354	0	0	Bottom
1355	1	20	
1356	2	40	
1357	3	60	
1358	4	80	
1359	5	100	
1360	6	120	
1361	7	140	
1362	8	160	
1363	9	180	
1364	10	200	Spillway Invert
1365	11	220	
1366	12	240	
1367	13	260	
1368	14	280	Top of Berm

150 ACRE-FT

Elevation	Depth (ft)	Storage (Acre-ft)	Comments
1354	0	0	Bottom
1355	1	15	
1356	2	30	
1357	3	45	
1358	4	60	
1359	5	75	
1360	6	90	
1361	7	105	
1362	8	120	
1363	9	135	
1364	10	150	Spillway Invert
1365	11	165	
1366	12	180	
1367	13	195	
1368	14	210	Top of Berm

100 ACRE-FT

Elevation	Depth (ft)	Storage (Acre-ft)	Comments
1354	0	0	Bottom
1355	1	10	
1356	2	20	
1357	3	30	
1358	4	40	
1359	5	50	
1360	6	60	
1361	7	70	
1362	8	80	
1363	9	90	
1364	10	100	Spillway Invert
1365	11	110	
1366	12	120	
1367	13	130	
1368	14	140	Top of Berm

50 ACRE-FT

Elevation	Depth (ft)	Storage (Acre-ft)	Comments
1354	0	0	Bottom
1355	1	5	
1356	2	10	
1357	3	15	
1358	4	20	
1359	5	25	
1360	6	30	
1361	7	35	
1362	8	40	
1363	9	45	
1364	10	50	Spillway Invert
1365	11	55	
1366	12	60	
1367	13	65	
1368	14	70	Top of Berm

FlowMaster Open Channel Calculations

Worksheet for Alt 2 Lower Trap Channel

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	75.00	ft
Discharge	2117.00	ft ³ /s

Results

Normal Depth	3.96	ft
Flow Area	359.32	ft ²
Wetted Perimeter	107.62	ft
Hydraulic Radius	3.34	ft
Top Width	106.65	ft
Critical Depth	2.77	ft
Critical Slope	0.05192	ft/ft
Velocity	5.89	ft/s
Velocity Head	0.54	ft
Specific Energy	4.50	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.96	ft
Critical Depth	2.77	ft
Channel Slope	0.01500	ft/ft

Worksheet for Alt 2 Lower Trap Channel

GVF Output Data

Critical Slope 0.05192 ft/ft

Messages

Notes

6" Rip rap liner
Q=1292 cfs (Skyline Report for Culverts) + 825= 2,117 cfs

Worksheet for Alt 2 Upper Trap Channel

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	45.00	ft
Discharge	825.00	ft ³ /s

Results

Normal Depth	3.01	ft
Flow Area	171.68	ft ²
Wetted Perimeter	69.82	ft
Hydraulic Radius	2.46	ft
Top Width	69.08	ft
Critical Depth	2.05	ft
Critical Slope	0.05791	ft/ft
Velocity	4.81	ft/s
Velocity Head	0.36	ft
Specific Energy	3.37	ft
Froude Number	0.54	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.01	ft
Critical Depth	2.05	ft
Channel Slope	0.01500	ft/ft

Worksheet for Alt 2 Upper Trap Channel

GVF Output Data

Critical Slope 0.05791 ft/ft

Messages

Notes

6" Rip rap liner

Worksheet for Alt 3 Lower Trap Channel

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	75.00	ft
Discharge	2300.00	ft ³ /s

Results

Normal Depth	4.15	ft
Flow Area	379.85	ft ²
Wetted Perimeter	109.20	ft
Hydraulic Radius	3.48	ft
Top Width	108.18	ft
Critical Depth	2.92	ft
Critical Slope	0.05113	ft/ft
Velocity	6.06	ft/s
Velocity Head	0.57	ft
Specific Energy	4.72	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.15	ft
Critical Depth	2.92	ft
Channel Slope	0.01500	ft/ft

Worksheet for Alt 3 Lower Trap Channel

GVF Output Data

Critical Slope 0.05113 ft/ft

Messages

Notes

6" Rip rap liner
Q=1292 cfs (Skyline Report for Culverts) + 904+104 safety factor= 2,300 cfs

Worksheet for Alt 3 Upper Trap Channel

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.01500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	45.00	ft
Discharge	904.00	ft ³ /s

Results

Normal Depth	3.17	ft
Flow Area	182.72	ft ²
Wetted Perimeter	71.13	ft
Hydraulic Radius	2.57	ft
Top Width	70.35	ft
Critical Depth	2.17	ft
Critical Slope	0.05697	ft/ft
Velocity	4.95	ft/s
Velocity Head	0.38	ft
Specific Energy	3.55	ft
Froude Number	0.54	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.17	ft
Critical Depth	2.17	ft
Channel Slope	0.01500	ft/ft

Worksheet for Alt 3 Upper Trap Channel

GVF Output Data

Critical Slope 0.05697 ft/ft

Messages

Notes

6" Rip rap liner

Orifice and Weir Flow Calculations

Sky Wash Apex Solution
ORIFICE AND WEIR FLOW

Top of Embankment Width = 14 ft
 Side Slope of Embankment = 6:1

Weir Length = 190 ft
 Weir Width = 14 ft

Discharge Coefficient C = 0.8
 Orifice Diameter d = 2.5 ft
 Orifice Area A = 4.91 ft²
 g g = 32.17 ft/s²
 Pipe Diameter D = 3 ft
 Ratio of d to D d/D = 0.83
 Orifice Flow Q = CA(2gH)^{0.5} cfs

C obtained from Driscoll, "Groundwater and Wells", Figure 16.2

1355.5 Elevation at Centerline of Low Level Outlet Pipe

Weir flow calculated from USDA SCS, "Hydraulics of Broad-Crested Spillways"

Stage H [ft]	Pipe		Weir		Cummulative Q [cfs]	HEC-1 Input Stage Outflow H Q [ft] [cfs]	
	H _p [ft]	Q _p [cfs]	H _w [ft]	Q _w [cfs]		H	Q
						[ft]	[cfs]
1354.0	0	0.0	0	0	0.0	1354.0	0.0
1356.0	0.5	22.3	0	0	22.3	1356.0	22.3
1357.0	1.5	38.6	0	0	38.6	1357.0	38.6
1358.0	2.5	49.8	0	0	49.8	1358.0	49.8
1359.0	3.5	58.9	0	0	58.9	1359.0	58.9
1360.0	4.5	66.8	0	0	66.8	1360.0	66.8
1361.0	5.5	73.9	0	0	73.9	1361.0	73.9
1362.0	6.5	80.3	0	0	80.3	1362.0	80.3
1363.0	7.5	86.3	0	0	86.3	1363.0	86.3
1364.0	8.5	91.8	0	0	91.8	1364.0	91.8
1365.0	9.5	97.1	1	460	557.1	1365.0	557.1
1366.0	10.5	102.1	2	1480	1582.1	1366.0	1582.1
1367.0	11.5	106.8	3	2880	2986.8	1367.0	2986.8
1368.0	12.5	111.4	4	4530	4641.4	1368.0	4641.4

Culvert Summary

Sky Wash Apex Solution

CULVERT SUMMARY

Top of Embankment Width = 12 ft

Side Slope of Embankment = 6:1

Stages at culvert flows 100, 200, ...1000 cfs were calculated using HY8

Concrete Box Culvert 10' X 6'

Concrete Box Culvert 12' X 5'

Concrete Box Culvert 12' X 6'

Concrete Box Culvert 10' X 6'			Concrete Box Culvert 12' X 5'			Concrete Box Culvert 12' X 6'		
Stage	Box Culvert		Stage	Box Culvert		Stage	Box Culvert	
H	H _B	Q _B	H	H _B	Q _B	H	H _B	Q _B
[ft]	[ft]	[cfs]	[ft]	[ft]	[cfs]	[ft]	[ft]	[cfs]
1354.00	0.00	0.0	1354.00	0.00	0.0	1354.00	0.00	0.0
1355.00	1.00	47.8	1355.00	1.00	53.8	1355.00	1.00	54.3
1356.00	2.00	95.7	1355.86	1.86	100.0	1355.84	1.84	100.0
1356.09	2.09	100.0	1356.00	2.00	111.9	1356.00	2.00	113.7
1357.00	3.00	168.4	1357.00	3.00	196.6	1357.00	3.00	199.1
1357.42	3.42	200.0	1357.04	3.04	200.0	1357.01	3.01	200.0
1358.00	4.00	251.8	1358.00	4.00	297.0	1358.00	4.00	300.0
1358.54	4.54	300.0	1358.03	4.03	300.0	1358.89	4.89	400.0
1359.00	5.00	344.7	1358.97	4.97	400.0	1359.00	5.00	412.9
1359.57	5.57	400.0	1359.00	5.00	403.0	1359.74	5.74	500.0
1360.00	6.00	441.0	1359.96	5.96	500.0	1360.00	6.00	529.5
1360.62	6.62	500.0	1360.00	6.00	503.5	1360.62	6.62	600.0
1361.00	7.00	532.8	1361.00	7.00	591.2	1361.00	7.00	639.6
1361.78	7.78	600.0	1361.10	7.10	600.0	1361.58	7.58	700.0
1362.00	8.00	616.4	1362.00	8.00	667.7	1362.00	8.00	739.3
1363.00	9.00	691.0	1362.43	8.43	700.0	1362.65	8.65	800.0
1363.12	9.12	700.0	1363.00	9.00	736.5	1363.00	9.00	828.9
1364.00	10.00	757.1	1363.99	9.99	800.0	1363.86	9.86	900.0
1364.66	10.66	800.0	1364.00	10.00	800.6	1364.00	10.00	910.3
1365.00	11.00	819.3	1365.00	11.00	856.7	1365.00	11.00	983.8
1366.00	12.00	876.1	1365.77	11.77	900.0	1365.22	11.22	1000.0
1366.42	12.42	900.0	1366.00	12.00	911.4	1366.00	12.00	1057.4
1367.00	13.00	929.0	1367.00	13.00	960.9	1367.00	13.00	1130.9
1368.00	14.00	979.0	1367.79	13.79	1000.0	1368.00	14.00	1204.4
1368.42	14.42	1000.0	1368.00	14.00	1010.4			

Concrete Box Culvert 15' X 4'

Stage H [ft]	Box Culvert	
	H _B [ft]	Q _B [cfs]
1354.00	0.00	0.0
1355.00	1.00	62.1
1355.61	1.61	100.0
1356.00	2.00	138.2
1356.63	2.63	200.0
1357.00	3.00	243.0
1357.49	3.49	300.0
1358.00	4.00	360.0
1358.34	4.34	400.0
1359.00	5.00	469.5
1359.29	5.29	500.0
1360.00	6.00	562.8
1360.42	6.42	600.0
1361.00	7.00	643.3
1361.76	7.76	700.0
1362.00	8.00	715.3
1363.00	9.00	779.0
1363.33	9.33	800.0
1364.00	10.00	837.0
1365.00	11.00	892.3
1365.14	11.14	900.0
1366.00	12.00	941.0
1367.00	13.00	988.6
1367.24	13.24	1000.0
1368.00	14.00	1036.2

Cost Estimates



ALTERNATIVE 2 PRELIMINARY

Engineer's Opinion of Probable Cost *

FOR CONCEPTUAL USE ONLY

Project: Sky Wash Apex Improvements 1/22/10
Prepared By: Ricky Holston, P.E.

Item Description	Total	Unit	Unit Price	Total
Land Acquisition				
State Land Acquisition	100	AC	\$5,000	\$500,000
Basin				
Earthwork - Excavation & Placement	650,000	CY	\$10	\$6,500,000
Earthwork - Embankment	4,000	CY	\$15	\$60,000
FCS Outlet Channel				
Earthwork - Excavation	67,500	CY	\$10	\$675,000
Structural Concrete (Weir Structure)	1	LS	\$250,000	\$250,000
Rip Rap (Channel Liner)	12,200	CY	\$50	\$610,000
Access Road (Watson Road End of Pavement to FCS)				
Asphalt Pavement, 5" over 12" (Watson Road)	13,000	SY	\$25	\$325,000
Thickened Edge	8,600	LF	\$4	\$34,400
Ribbon Curb	8,600	LF	\$10	\$86,000
10' x 5' x 4 Box Culvert (Watson Wash Crossing)	300	LF	\$1,800	\$540,000
Head Walls (Box Culverts)	2	EA	\$10,000	\$20,000
Total Land & Construction Cost				\$9,600,400
Contingency (20%)				\$1,920,000
Engineering & Administration (20%)				\$2,300,000
PROJECT TOTAL				\$11,500,000

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.



ALTERNATIVE 3 PRELIMINARY

Engineer's Opinion of Probable Cost *

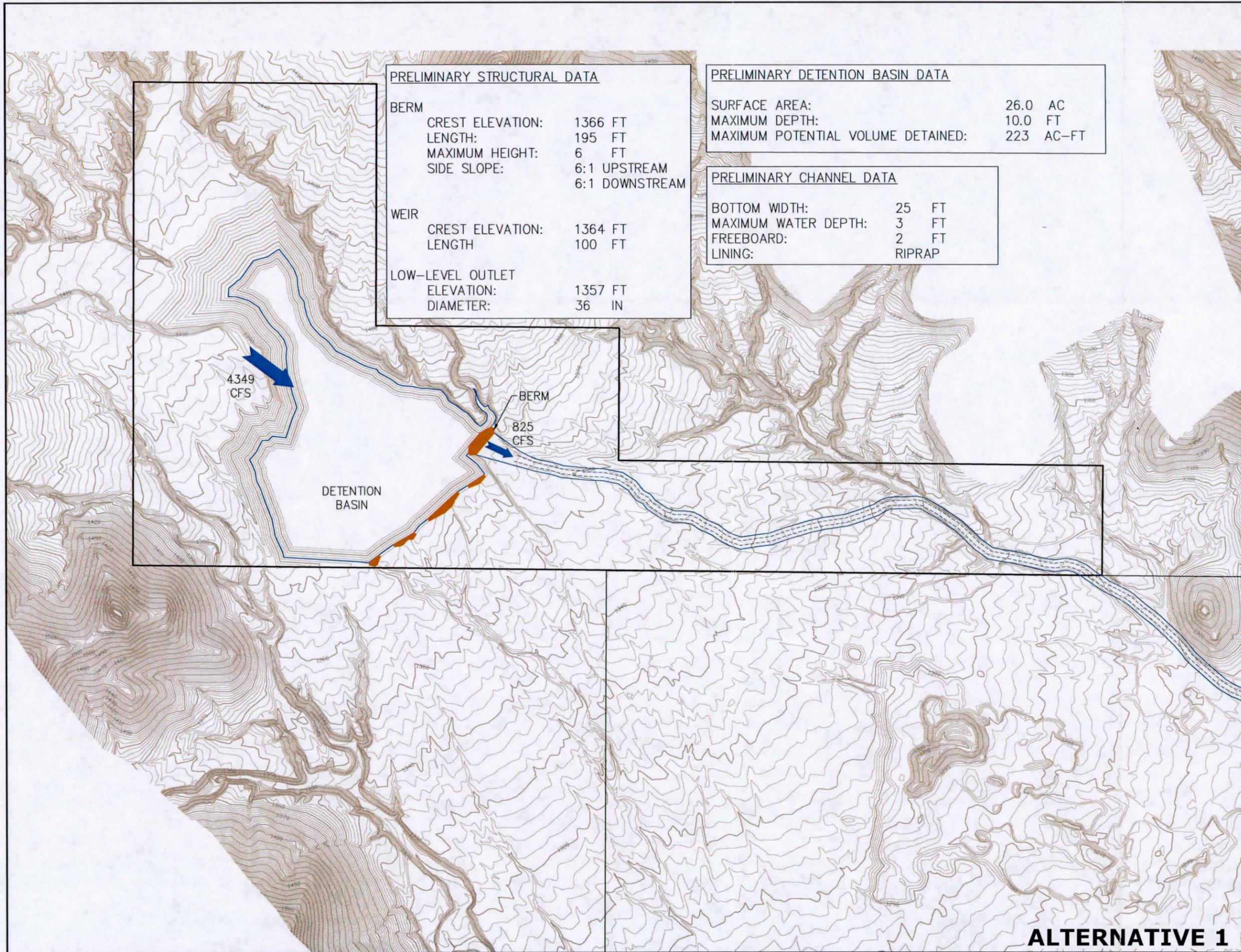
FOR CONCEPTUAL USE ONLY

Project: Sky Wash Apex Improvements 6/23/10
Prepared By: Ricky Holston, P.E.

Item Description	Total	Unit	Unit Price	Total
Land Acquisition				
State Land Acquisition (Basin, Channel & Watson Rd.)	91	AC	\$5,000	\$455,000
Sky Wash Detention Basin				
Earthwork - Excavation & Export	530,000	CY	\$7.00	\$3,710,000
Earthwork - Excavation & Embankment	10,000	CY	\$15.00	\$150,000
Detention Basin Outlet Channel				
Concrete Basin Outlet Structure	1	LS	\$250,000	\$250,000
Earthwork - Excavation	3,500	LF	\$75.00	\$262,500
Rip Rap (Channel Liner)	3,500	LF	\$70.00	\$245,000
Access Road (Watson Road End of Pavement to FCS)				
Asphalt Pavement, 5" over 12" (Watson Road)	9,000	LF	\$36.00	\$324,000
Thickened Edge	18,000	LF	\$4.00	\$72,000
10' x 5' x 4 Box Culvert (Watson Wash Crossing)	300	LF	\$1,800	\$540,000
Head Walls (Box Culverts)	2	EA	\$10,000	\$20,000
Total Land & Construction Cost				\$6,028,500
Contingency (15%)				\$900,000
Engineering & Administration (15%)				\$1,040,000
PROJECT TOTAL				\$6,900,000

*In providing opinions of probable construction cost the Client understands that the Engineer has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinion of probable construction cost provided herein is made on the basis of the Engineer's qualifications and experience. The Engineer makes no warranty, expressed or implied, as the accuracy if such opinions compared to bid or actual costs.

ALTERNATIVE 1 Exhibit



PRELIMINARY STRUCTURAL DATA

BERM	
CREST ELEVATION:	1366 FT
LENGTH:	195 FT
MAXIMUM HEIGHT:	6 FT
SIDE SLOPE:	6:1 UPSTREAM 6:1 DOWNSTREAM
WEIR	
CREST ELEVATION:	1364 FT
LENGTH:	100 FT
LOW-LEVEL OUTLET	
ELEVATION:	1357 FT
DIAMETER:	36 IN

PRELIMINARY DETENTION BASIN DATA

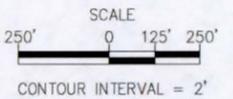
SURFACE AREA:	26.0 AC
MAXIMUM DEPTH:	10.0 FT
MAXIMUM POTENTIAL VOLUME DETAINED:	223 AC-FT

PRELIMINARY CHANNEL DATA

BOTTOM WIDTH:	25 FT
MAXIMUM WATER DEPTH:	3 FT
FREEBOARD:	2 FT
LINING:	RIPRAP

LEGEND

	STATE LAND BOUNDARY
	FISHER PROPERTY BOUNDARY
	DETENTION BASIN FOOTPRINT
	CHANNEL
	FLOW DIRECTION



REV NO.	COMMENT	DATE

PRELIMINARY
NOT
FOR
CONSTRUCTION
DATE

**SUNRISE
ENGINEERING**

12227 SOUTH BUSINESS PARK DRIVE, SUITE 220
DRAPER, UTAH 84020
TEL 801.523.0100 • FAX 801.523.0990
www.sunrise-eng.com

FISHER PROPERTY

**TOWN OF BUCKEYE
MARICOPA COUNTY, ARIZONA**

CONCEPTUAL APEX DETENTION BASIN DESIGN

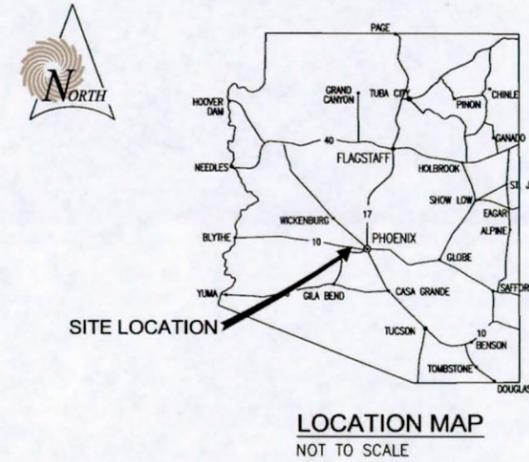
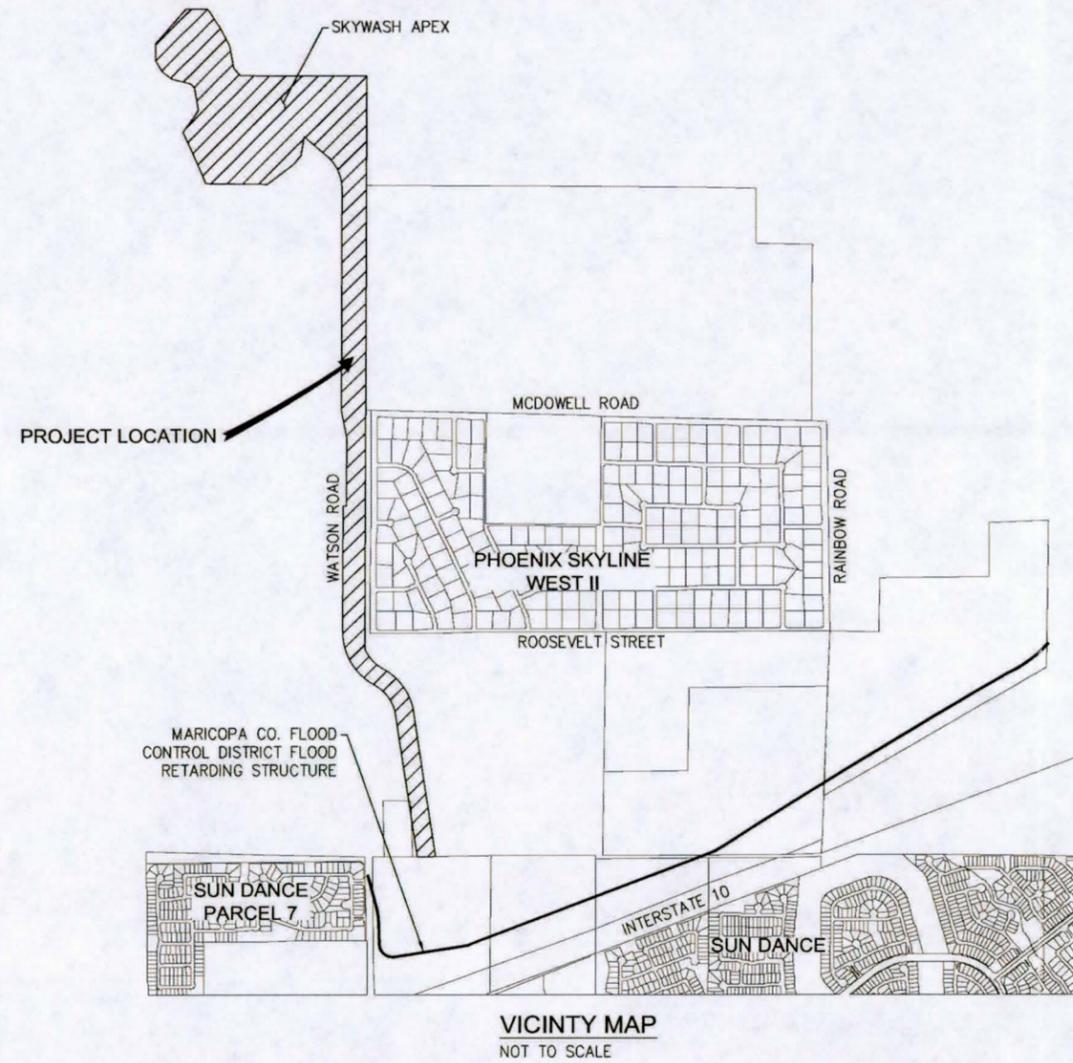
SET NO. 02280	DESIGNED DSA	DRAWN DSA	CHECKED LQ	SHEET NO. 01 of 01	FIGURE 2
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ALTERNATIVE 1

P:\Fisher Property\dwg\03\line Wash Apex Solution.dwg Sep 28, 2007 3:43pm danderson

ALTERNATIVE 2 Conceptual Plans

SKYWASH REGIONAL DRAINAGE SOLUTION



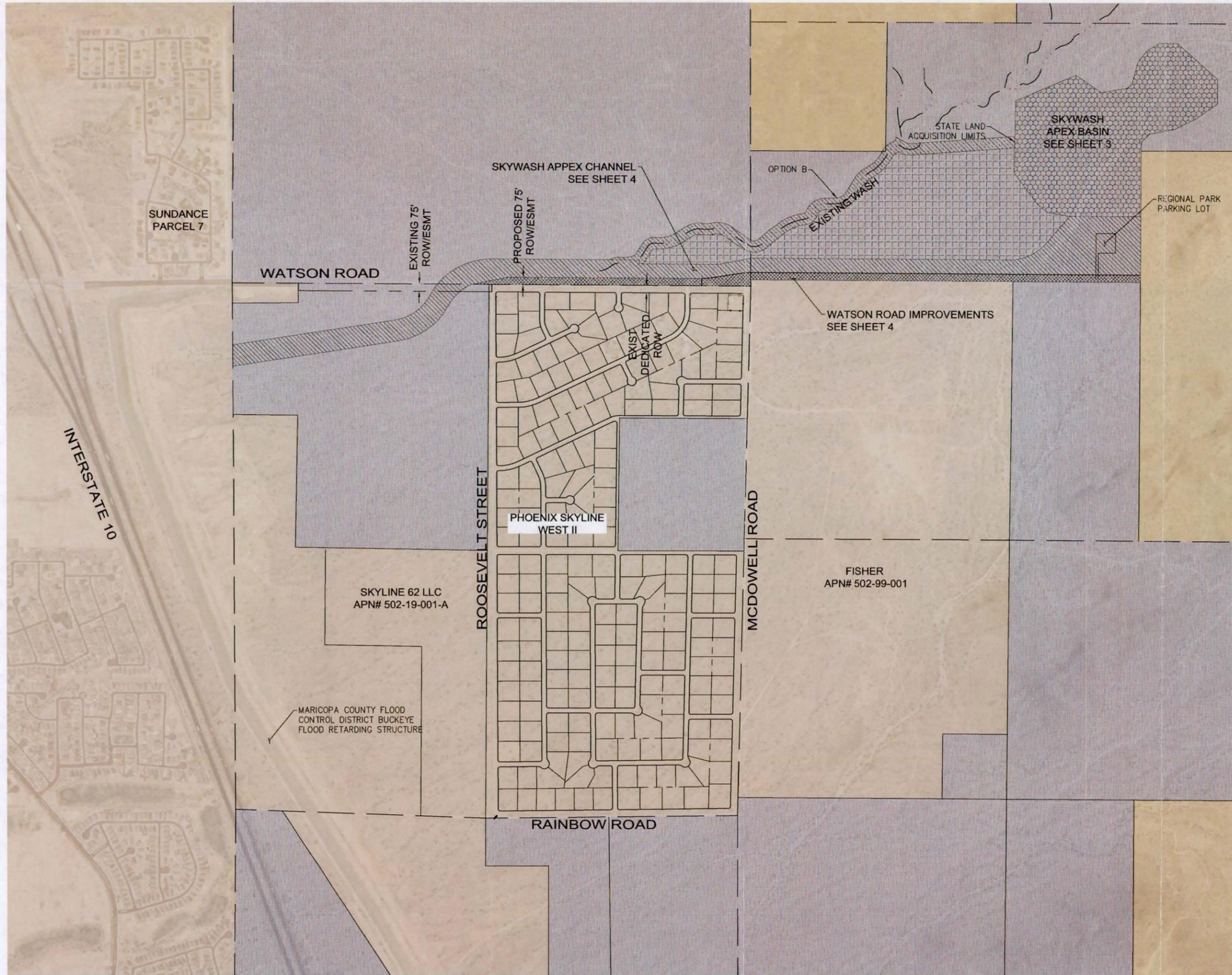
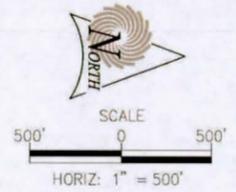
SHEET INDEX

SHEET #	DESCRIPTION
1	COVER
2	OVERALL LAND USE
3	SKYWASH APEX BASIN
4	WATSON ROAD & SKYWASH CHANNEL PLAN
5	WATSON ROAD & SKYWASH CHANNEL SECTIONS

ALTERNATIVE 2

REV NO.	COMMENT	DATE
 SUNRISE ENGINEERING 2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 · FAX 480.768.8609 www.sunrise-eng.com		
SKYLINE 62 LLC REGIONAL DRAINAGE SOLUTION COVER		
SEI NO. 03557	DESIGNED CM	DRAWN SLF
CHECKED RMH	SHEET NO. 1 of 5	COVER

SKYWASH APEX SOLUTION



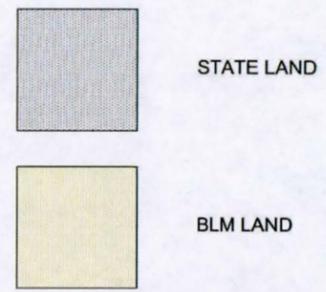
STATE LAND ACQUISITION	
BASIN	66.842 AC
WATSON ROAD CHANNEL	35.094 AC
TOTAL DRAINAGE SOLUTION	101.936 AC
RIGHT OF WAY	11.493
OPT B NATURAL CHANNEL	12.116 AC
OPT B EXCESS LAND	57.770 AC

APEX BASIN QUANTITIES	
Vr	223 ACRE - FEET
Vp	230 ACRE - FEET
CUT	1,002,375 CUBIC YARDS
FILL	9,311 CUBIC YARDS
EXPORT	993,064 CUBIC YARDS

SKYWASH CHANNEL QUANTITIES	
CUT	139,915 CUBIC YARDS
FILL	22,827 CUBIC YARDS
EXPORT	117,088 CUBIC YARDS
6" RIP-RAP	21,463 CUBIC YARDS

WATSON ROAD QUANTITIES	
2" A-12.5MM/3" A-19MM/12" ABC	30,596 SQUARE YARDS
RIBBON CURB	8,077 LINEAR FEET
THICKENED EDGE	9,133 LINEAR FEET
8 BARRELS X 10' X 5' CONCRETE BOX CULVERT	192 LINEAR FEET

LEGEND



SECTION LINE
ALTERNATIVE 2

REV. NO.	COMMENT	DATE

FOR REVIEW ONLY
NOT FOR CONSTRUCTION
DATE

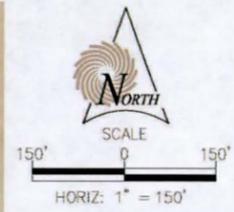
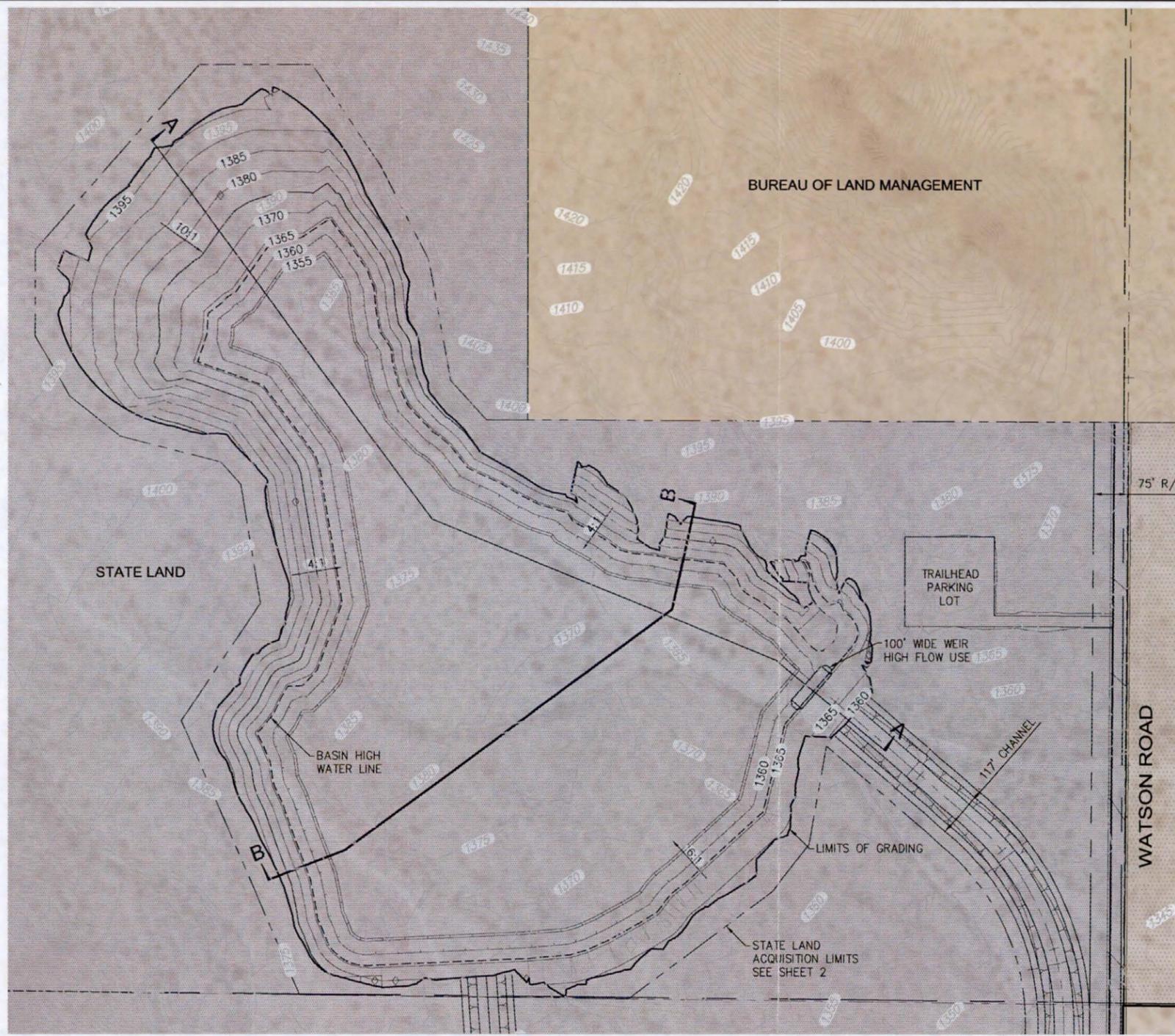
SUNRISE ENGINEERING
2152 SOUTH VINEYARD, SUITE 123
MESA, ARIZONA 85210
TEL 480.768.8600 • FAX 480.768.8609
www.sunrise-eng.com

SKYLINE 62 LLC
REGIONAL DRAINAGE SOLUTION

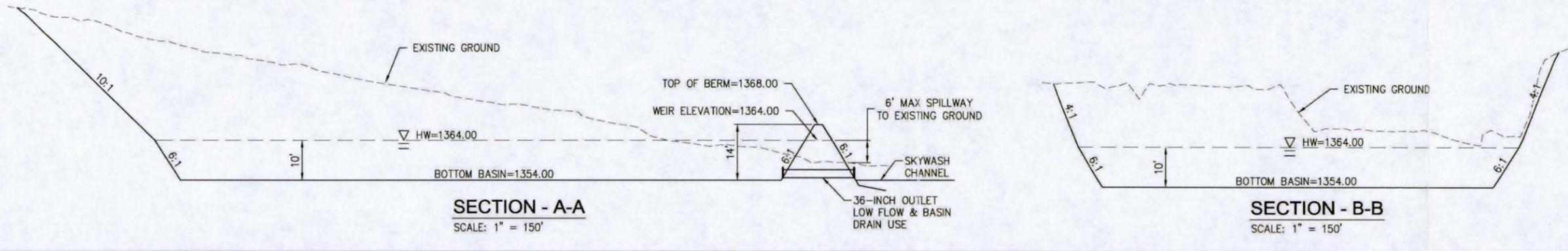
OVERALL LAND USE

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
0.3557	CM	SLF	RMH	2 of 5	OVR

P:\Work\03570_SkyWash\Apex Solution\Sheets\SWAS-LAND.dwg Apr 15, 2010 4:22pm stuller



SKYWASH APEX BASIN



SECTION - A-A
SCALE: 1" = 150'

SECTION - B-B
SCALE: 1" = 150'

ALTERNATIVE 2

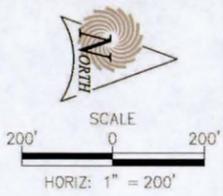
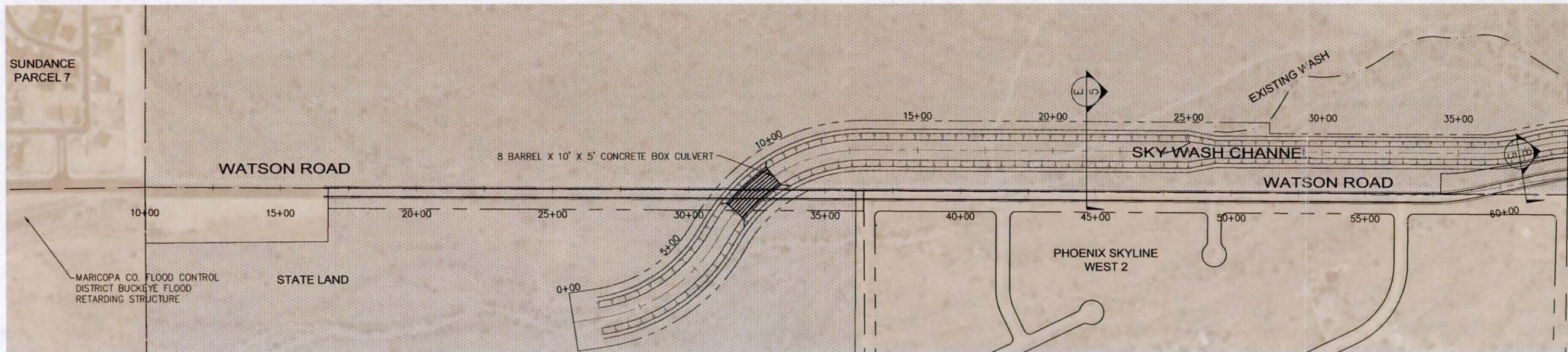
REV NO.	COMMENT	DATE

FOR REVIEW ONLY
NOT
FOR CONSTRUCTION
DATE

**SUNRISE
ENGINEERING**
2152 SOUTH VINEYARD, SUITE 123
MESA, ARIZONA 85210
TEL 480.768.8600 • FAX 480.768.8609
www.sunrise-eng.com

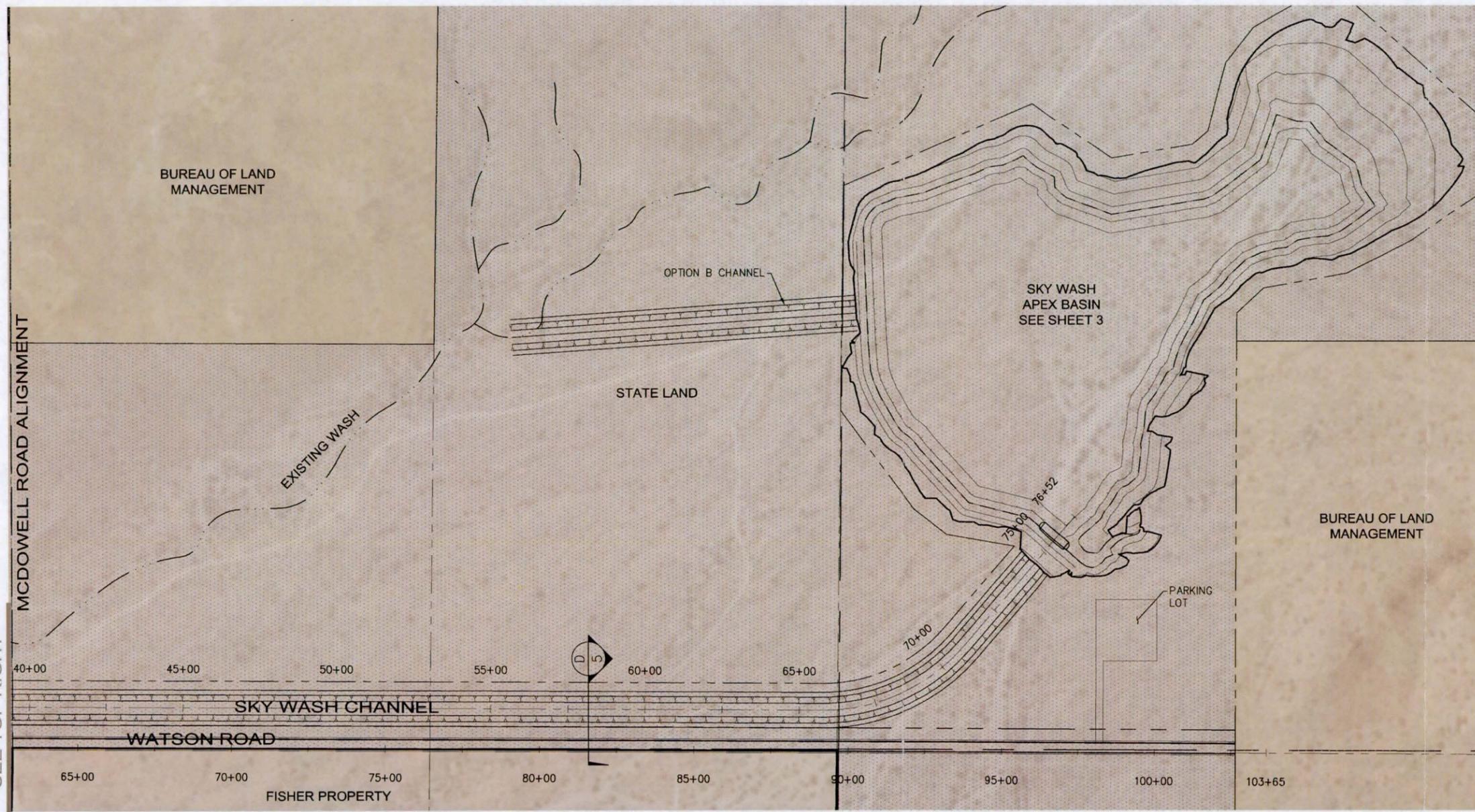
SKYLINE 62 LLC
REGIONAL DRAINAGE SOLUTION
SKYWASH APEX BASIN

REV NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	GD1
0.3557	CM	SLF	RMH	3 of 5	



SEE BELOW LEFT

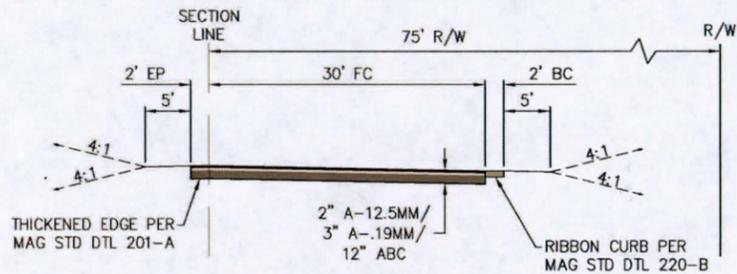
MCDOWELL ROAD



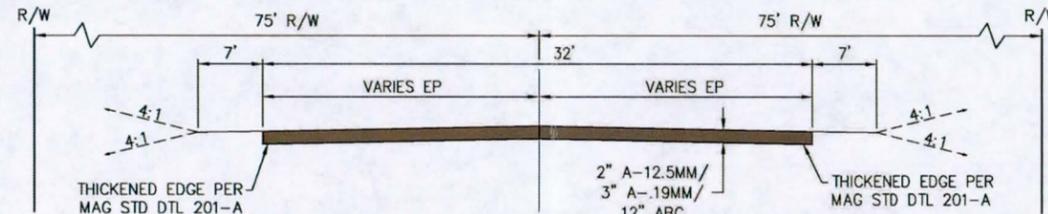
SEE TOP RIGHT

ALTERNATIVE 2

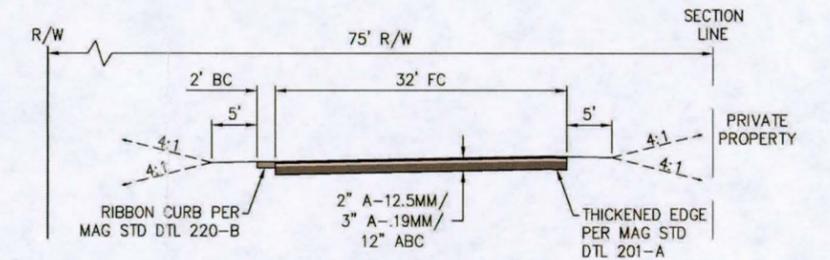
REV NO.	COMMENT	DATE
 SUNRISE ENGINEERING 2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 · FAX 480.768.8609 www.sunrise-eng.com		
SKYLINE 62 LLC REGIONAL DRAINAGE SOLUTION WATSON ROAD & SKYWASH CHANNEL		
SEI NO. 03557	DESIGNED CM	DRAWN SLF
CHECKED RMH	SHEET NO. 4 of 5	GD2



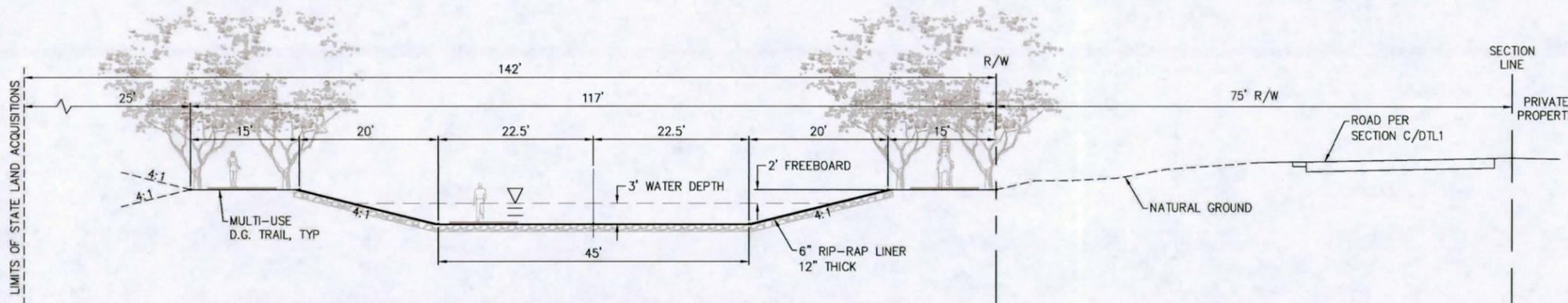
A SECTION - WATSON ROAD
SCALE: 1" = 10'
STA 16+60 TO 57+58



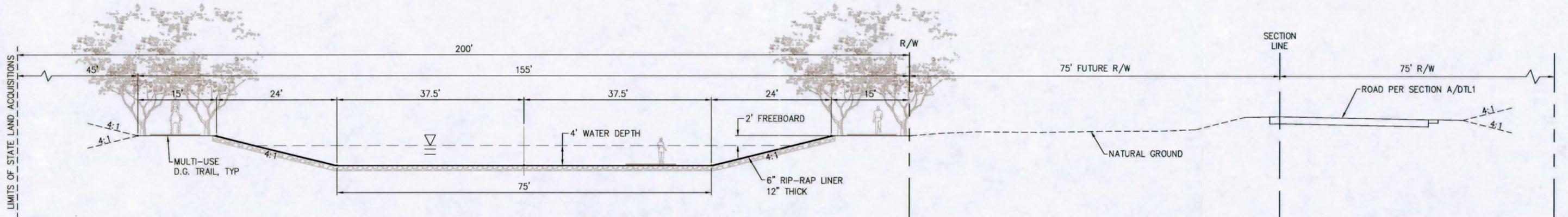
B SECTION - WATSON ROAD TRANSITION
SCALE: 1" = 10'
STA 57+58 TO 62+86



C SECTION - WATSON ROAD
SCALE: 1" = 10'
STA 62+86 TO 102+65



D SECTION - SKYWASH CHANNEL 45' WIDE BOTTOM
SCALE: 1" = 10'
STA 25+00 TO 74+50



E SECTION - SKYWASH CHANNEL 75' WIDE BOTTOM
SCALE: 1" = 10'
STA 1+00 TO 25+00

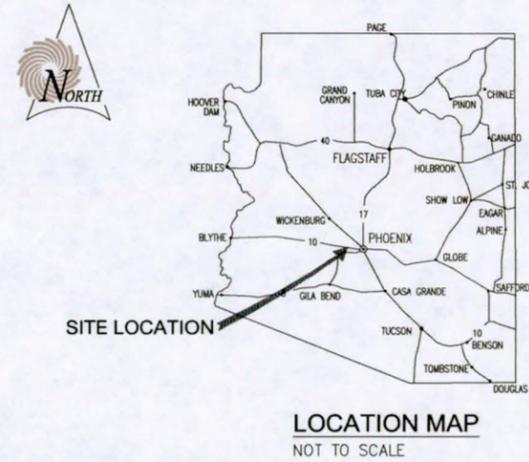
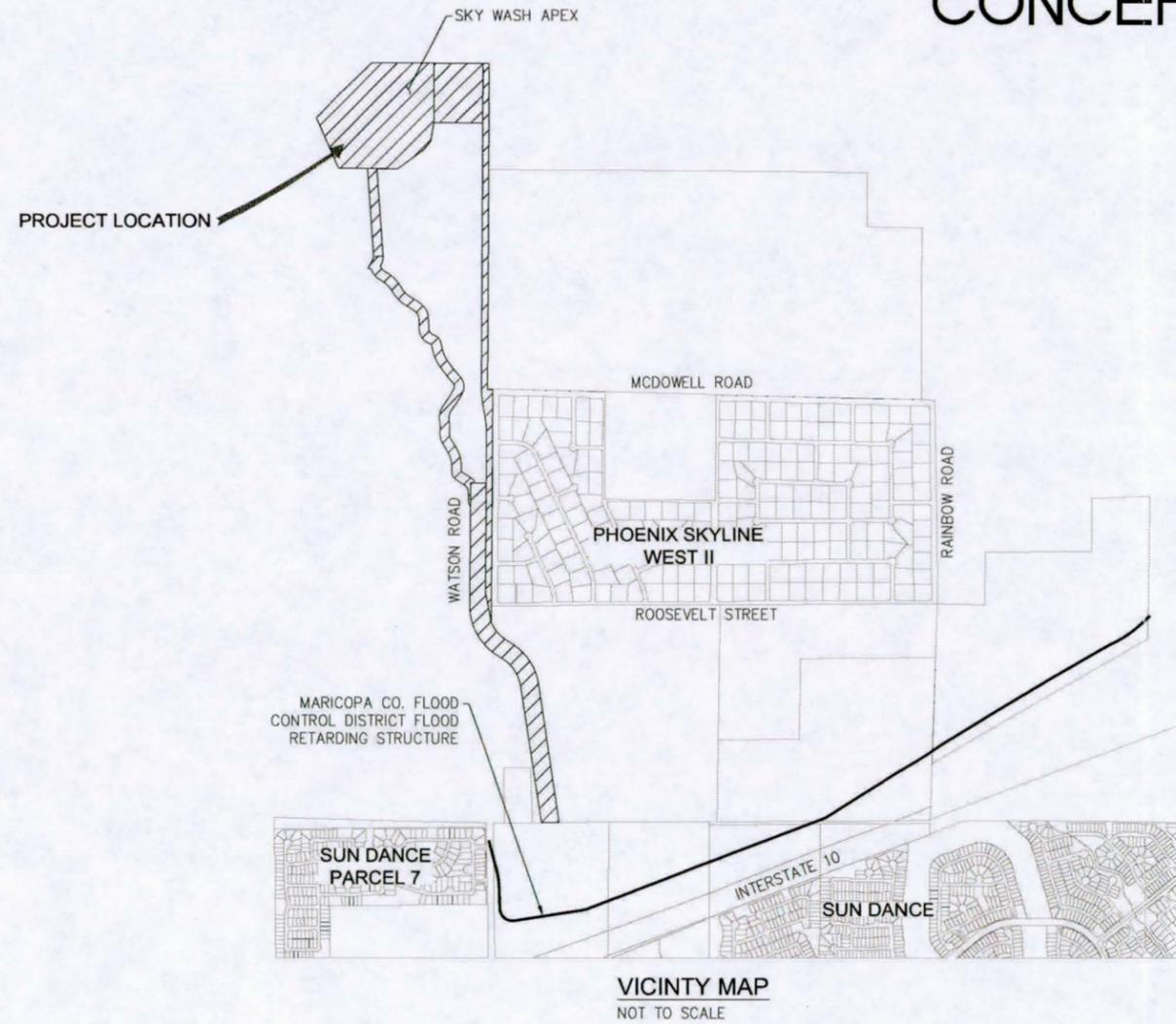
ALTERNATIVE 2

REV. NO.	COMMENT	DATE
<p>SUNRISE ENGINEERING 2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 · FAX 480.768.8609 www.sunrise-eng.com</p>		
<p>SKYLINE 62 LLC REGIONAL DRAINAGE SOLUTION</p>		
<p>WATSON ROAD & SKYWASH CHANNEL SECTIONS</p>		
DESIGNED CM	DRAWN SLF	CHECKED RMH
SEI NO. 03557	SHEET NO. 5 of 5	DTL1

ALTERNATIVE 3

Conceptual Plans

SKY WASH REGIONAL DRAINAGE PROPOSAL CONCEPT PLAN



SHEET INDEX

SHEET #	DESCRIPTION
1	COVER
2	OVERALL LAND USE
3	SKY WASH APEX BASIN
4	WATSON ROAD & SKYWASH CHANNEL PLAN
5	WATSON ROAD & SKYWASH CHANNEL SECTIONS

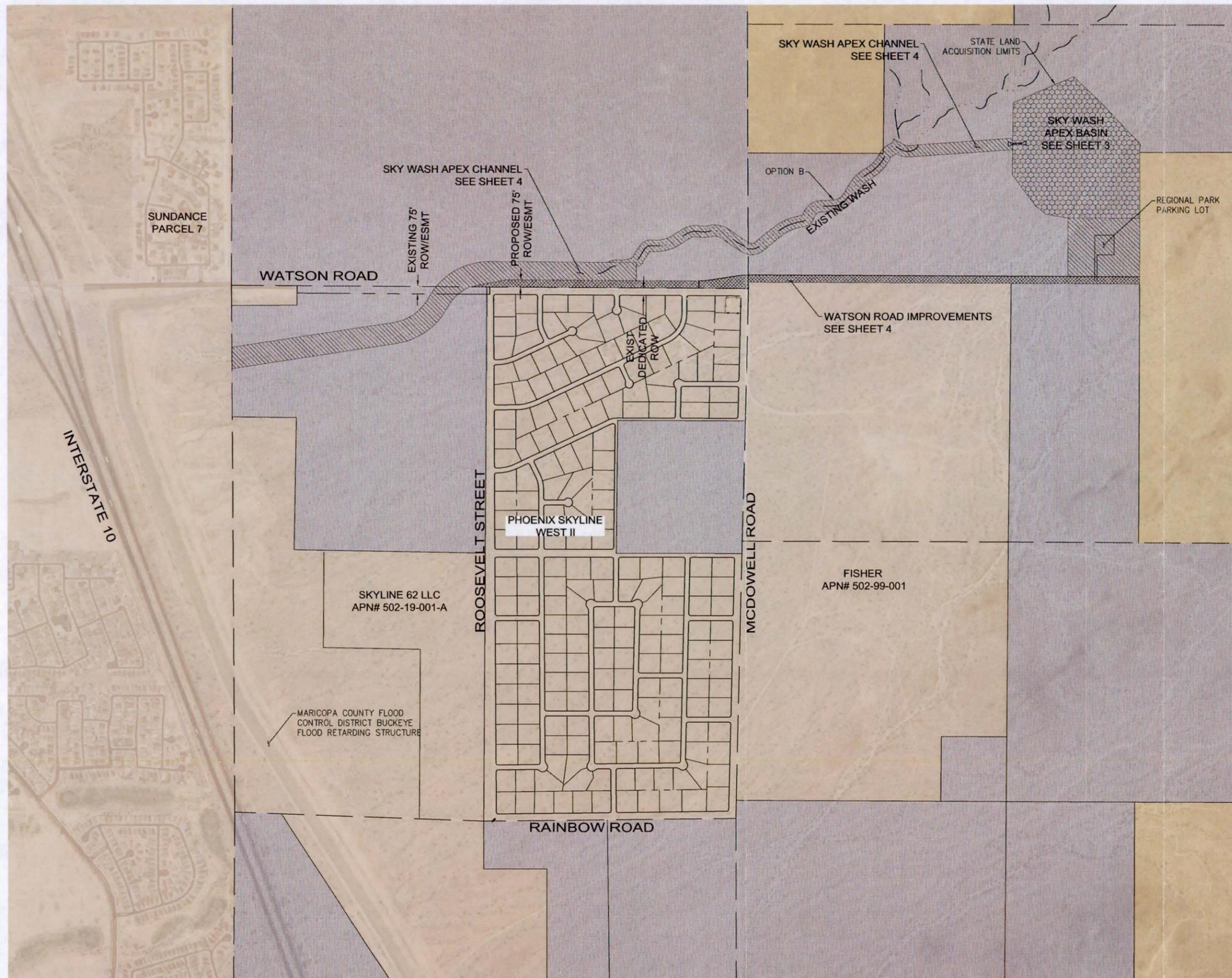
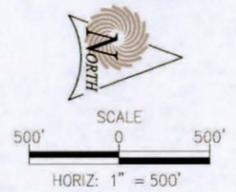
ALTERNATIVE 3

REV NO.	COMMENT	DATE			
 SUNRISE ENGINEERING 2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 • FAX 480.768.8609 www.sunrise-eng.com					
TOWN OF BUCKEYE REGIONAL DRAINAGE PROPOSAL CONCEPT PLAN COVER					
SET NO. 03557	DESIGNED CM	DRAWN SLF	CHECKED RMH	SHEET NO. 1 of 5	COV

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 DATE

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SKY WASH APEX SOLUTION



STATE LAND ACQUISITION

BASIN	33.727 AC	
SKY WASH CHANNEL	33.688 AC	
RIGHT OF WAY	11.493 AC	
NATURAL CHANNEL	12.116 AC	
TOTAL DRAINAGE SOLUTION	91.024 AC	

APEX BASIN QUANTITIES

Vr	150	ACRE - FEET
Vp	153	ACRE - FEET
CUT	535,863	CUBIC YARDS
FILL	9,427	CUBIC YARDS
EXPORT	526,436	CUBIC YARDS

SKYWASH CHANNEL QUANTITIES

CUT	66,148	CUBIC YARDS
FILL	17,604	CUBIC YARDS
EXPORT	48,544	CUBIC YARDS
6" RIP-RAP	14,567	CUBIC YARDS

WATSON ROAD QUANTITIES

2" A-12.5MM/3" A-19MM/12" ABC	30,596	SQUARE YARDS
RIBBON CURB	8,077	LINEAR FEET
THICKENED EDGE	9,133	LINEAR FEET
8 BARRELS X 10' X 5' CONCRETE BOX CULVERT	192	LINEAR FEET

LEGEND



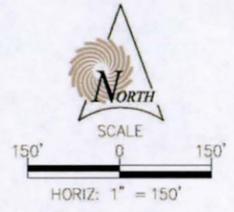
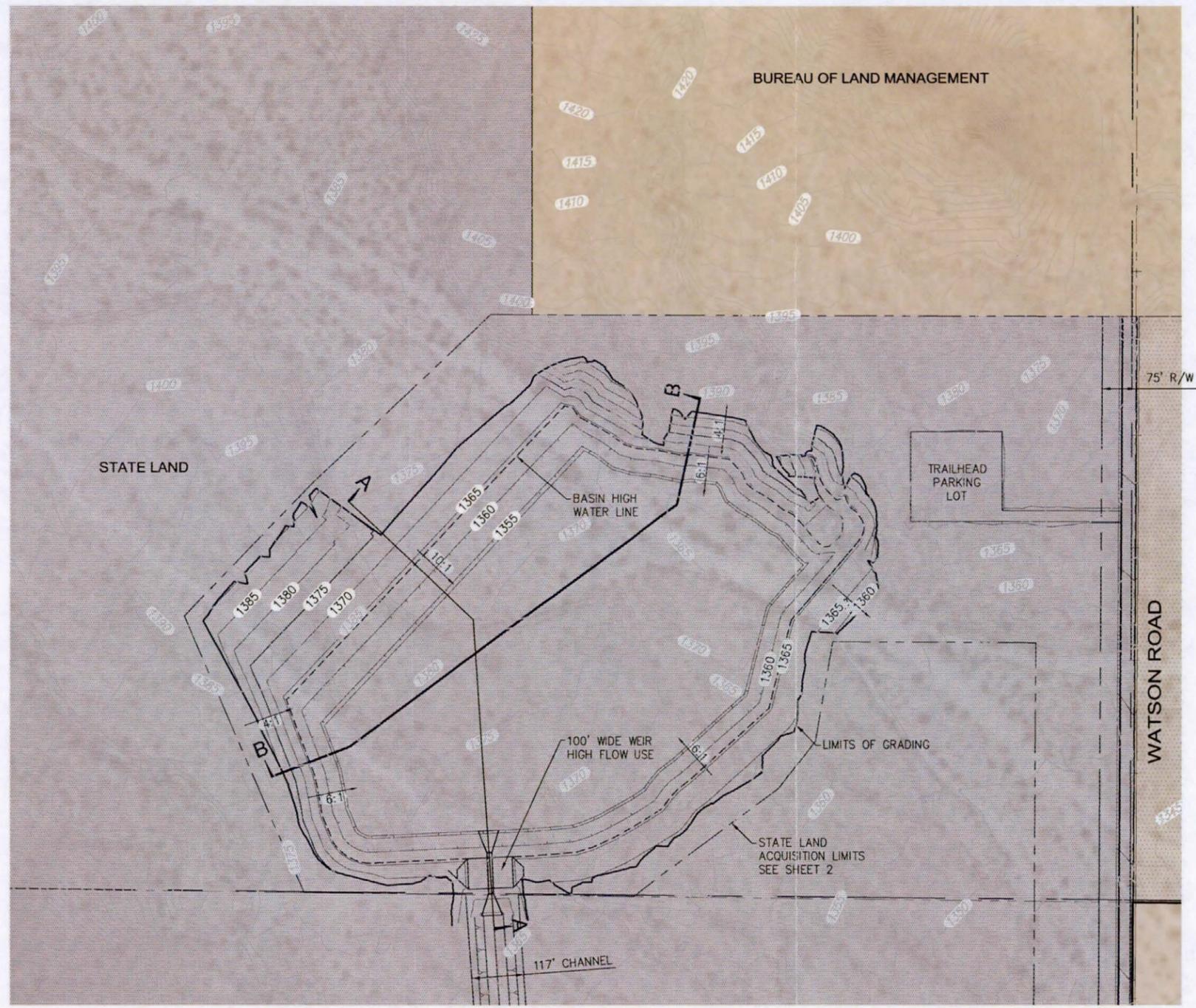
SECTION LINE ALTERNATIVE 3

REV NO.	COMMENT	DATE
2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 - FAX 480.768.8609 www.sunrise-eng.com		

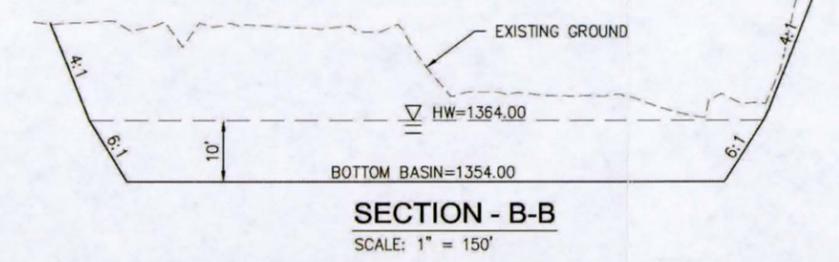
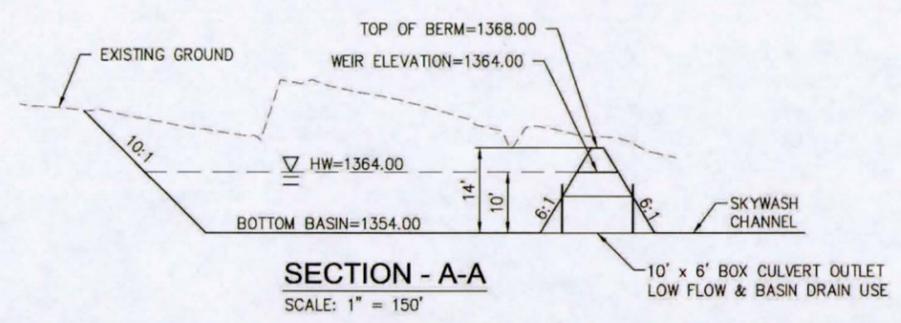
TOWN OF BUCKEYE
 REGIONAL DRAINAGE PROPOSAL
 CONCEPT PLAN
 OVERALL LAND USE

SEI NO.	DESIGNED	DRAWN	CHECKED	SHEET NO.	
03557	CM	SLF	RMH	2 of 5	OVR

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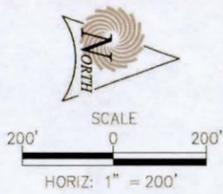
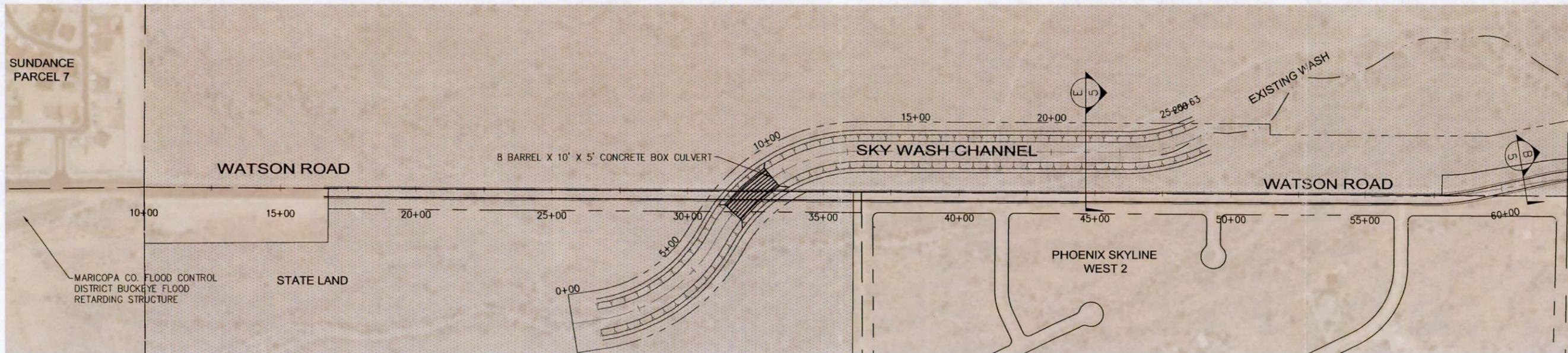
SKYWASH APEX BASIN



ALTERNATIVE 3

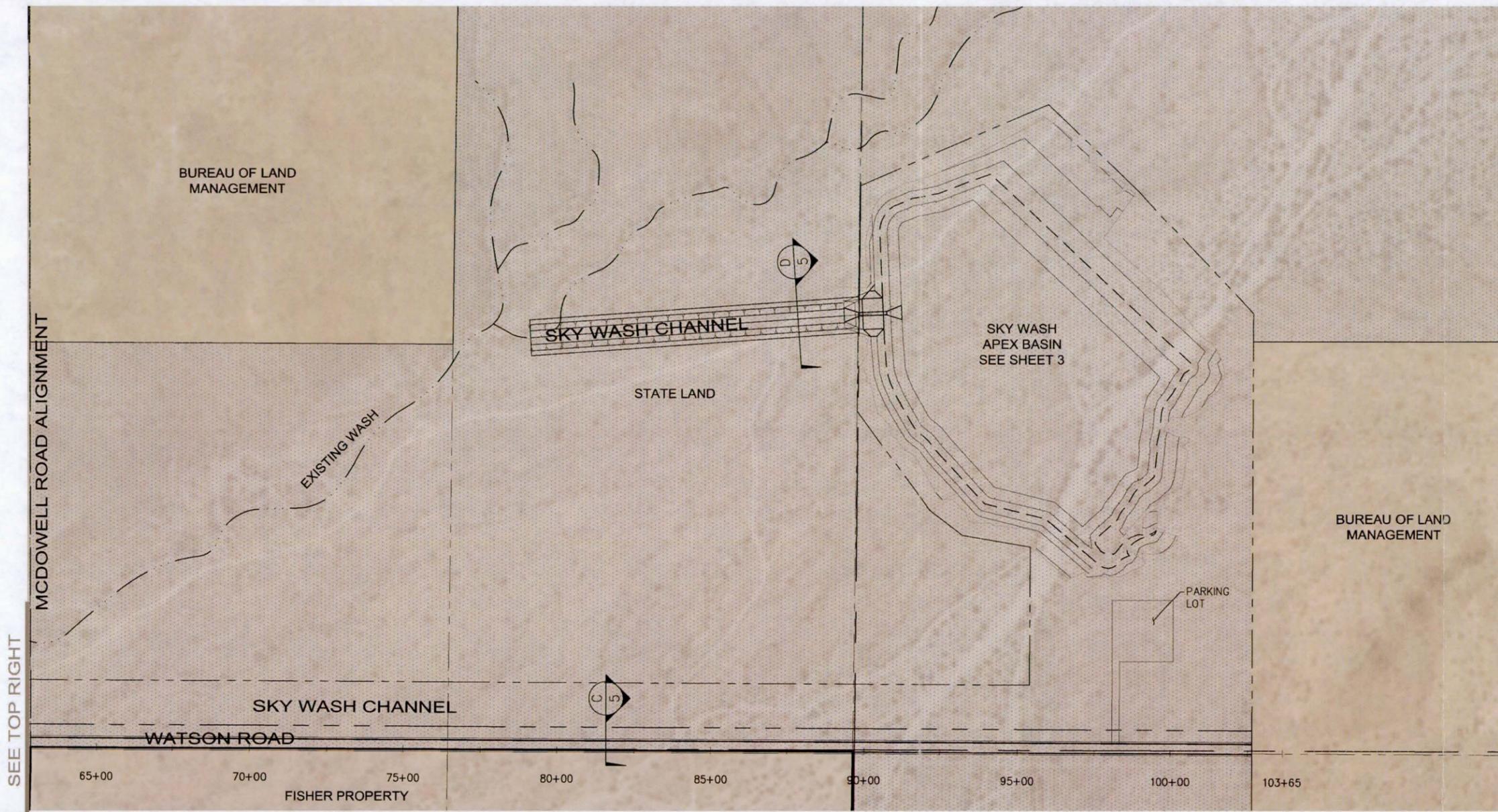
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<div style="border: 1px solid black; padding: 5px; display: inline-block;"> FOR REVIEW ONLY NOT FOR CONSTRUCTION DATE </div>		
SUNRISE ENGINEERING 2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 • FAX 480.768.8609 www.sunrise-eng.com		
TOWN OF BUCKEYE REGIONAL DRAINAGE PROPOSAL CONCEPT PLAN SKYWASH APEX BASIN		
SEI NO. 03557	DESIGNED CM	DRAWN SLF
CHECKED RMH	SHEET NO. 3 of 5	GD1

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SEE BELOW LEFT

MCDOWELL ROAD



MCDOWELL ROAD ALIGNMENT

SEE TOP RIGHT

ALTERNATIVE 3

REV NO.	COMMENT	DATE

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 MESA, ARIZONA 85210
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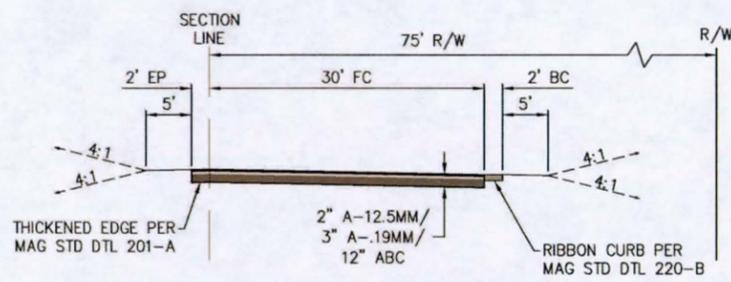
TOWN OF BUCKEYE

REGIONAL DRAINAGE PROPOSAL

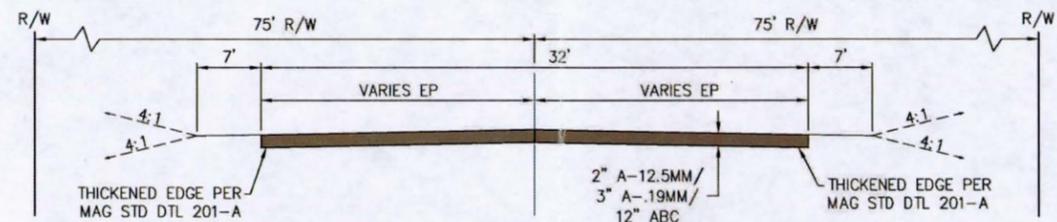
CONCEPT PLAN

WATSON ROAD & SKYWASH CHANNEL

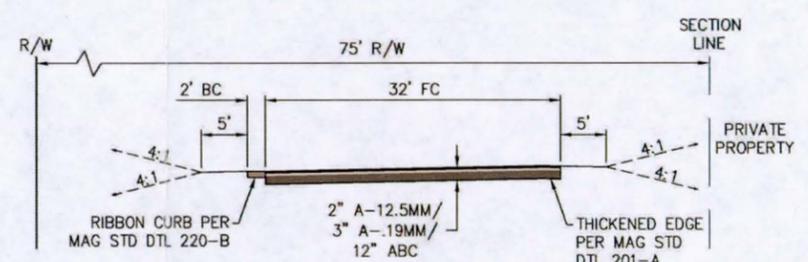
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03557	CM	SLF	RMH	4 of 5	



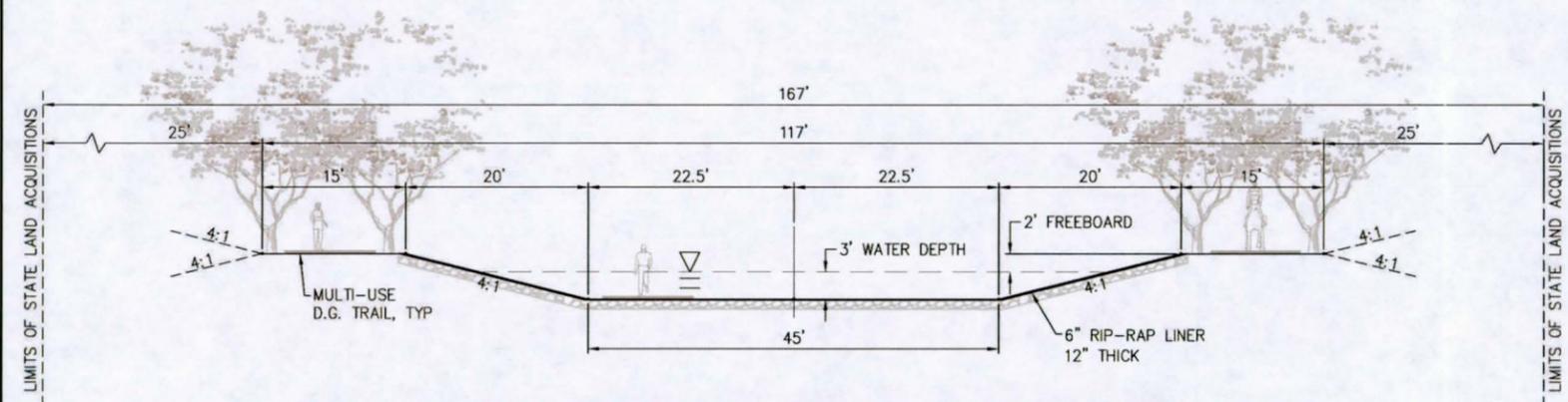
A SECTION - WATSON ROAD
 SCALE: 1" = 10'
 STA 16+60 TO 57+58



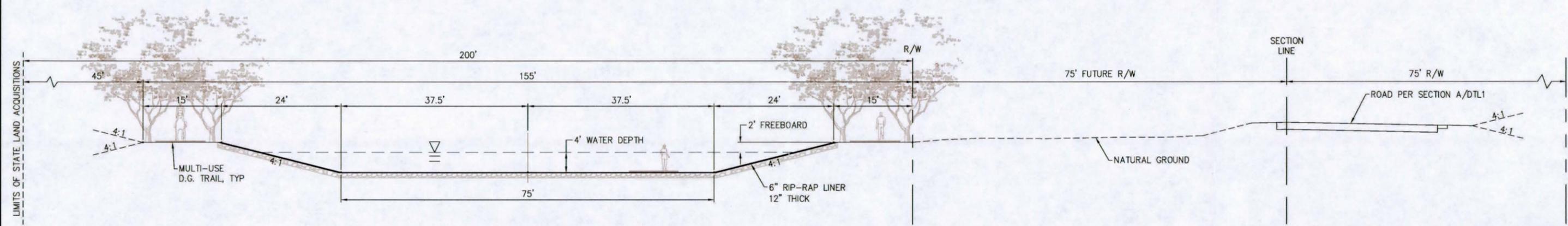
B SECTION - WATSON ROAD TRANSITION
 SCALE: 1" = 10'
 STA 57+58 TO 62+86



C SECTION - WATSON ROAD
 SCALE: 1" = 10'
 STA 62+86 TO 102+65



D SECTION - SKYWASH CHANNEL 45' WIDE BOTTOM
 SCALE: 1" = 10'
 STA 10+00 TO 21+15



E SECTION - SKYWASH CHANNEL 75' WIDE BOTTOM
 SCALE: 1" = 10'
 STA 1+00 TO 24+63

ALTERNATIVE 3

REV NO.	COMMENT	DATE
<p>SUNRISE ENGINEERING 2152 SOUTH VINEYARD, SUITE 123 MESA, ARIZONA 85210 TEL 480.768.8600 - FAX 480.768.8609 www.sunrise-eng.com</p>		
<p>TOWN OF BUCKEYE REGIONAL DRAINAGE PROPOSAL CONCEPT PLAN WATSON ROAD & SKYWASH CHANNEL SECTIONS</p>		
SEI NO. 03557	DESIGNED CM	DRAWN SLF
CHECKED RMH	SHEET NO. 5 of 5	DTL1

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