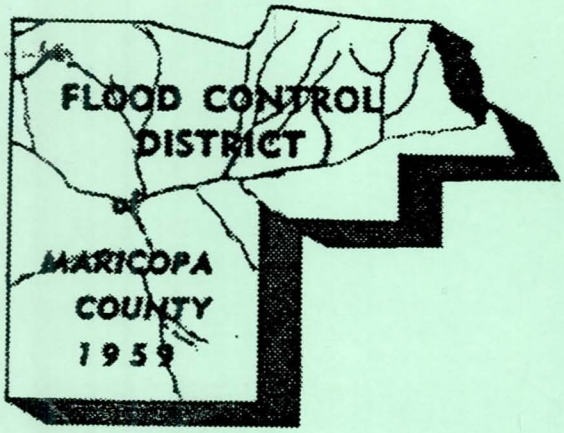


VOLUME 1

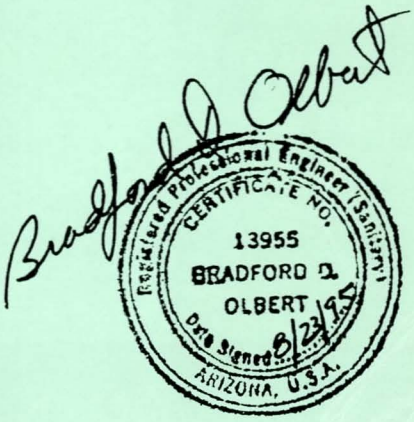
Skunk Creek Master Plan Final Report

Contract FCD 93-24

Skunk Creek
Arizona Canal Diversion Channel to
Adobe Dam Outlet Structure
Maricopa County, Arizona

August 1995

Prepared for:
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85007



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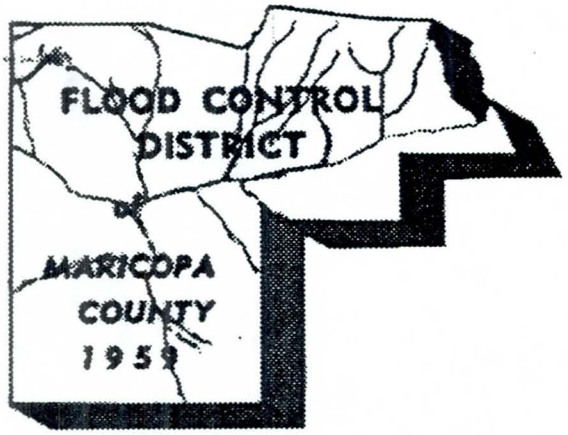

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Section I

INTRODUCTION

PROJECT OVERVIEW

Skunk Creek is a natural, well-defined channel with drainage improvements and roadway crossings interspersed throughout the project limits. The downstream end of the 5.5-mile study segment begins at the Skunk Creek intersection with the Arizona Canal Diversion Channel (ACDC), located south of Bell Road and west of 75th Avenue. The upstream limit of the study is the Adobe Dam outlet structure, located north of the intersection of Beardsley Road and 43rd Avenue (see Figures I-1 and I-2).

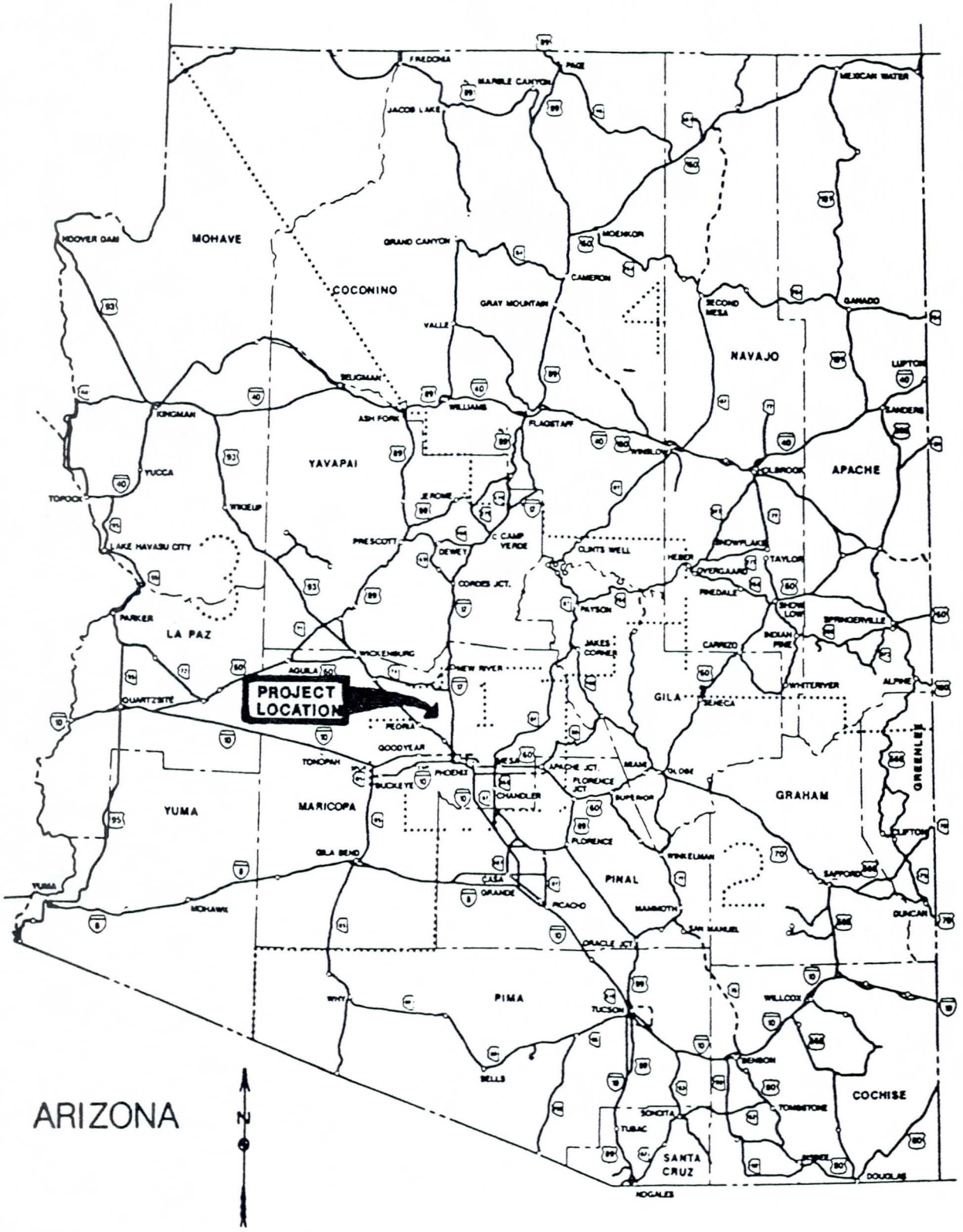
The channel meanders through a developing region within the city limits of Peoria, Glendale, and Phoenix. Land adjacent to the channel is partially developed with commercial, residential, and municipal uses. Undeveloped portions are presently in the master planning phase by land developers.

The purpose of this Master Plan is to examine the Skunk Creek corridor from the confluence with the ACDC (west of 75th Avenue) to the Adobe Dam outlet structure and develop and evaluate alternatives for channel modifications including considerations for aesthetics, bicycle and pedestrian paths, equestrian access, conveyance capacity for the 100-year flood, and recommend a preferred alternative. This Skunk Creek Master Plan—Final Report presents the results of the detailed analyses of the various improvement alternatives. The recommended alternative consists of a mixture of the alternatives identified in the Skunk Creek Master Plan—Initial Report. This Final Report describes the recommended improvements, ties the horizontal and vertical location to known survey reference points, and identifies the specific improvements required for full development of the channel.

DESCRIPTION OF THE EXISTING CHANNEL

Skunk Creek is comprised of natural and man-made channels of varying cross-section and width, and having several channel lining types. The description of the existing channel has been divided into 14 contiguous segments, distinguished mainly by channel lining type and separated by road crossings and/or existing improvements. These segments should not be confused with the 11 study reaches described in Section IV. References in this section have been made to Flood Insurance Rate Maps (FIRM) (see Figures I-3 and I-4) which show areas of adjacent land to be within the 100-year floodplain. Terminology used in the following segment descriptions is defined below.

Location Map



FCD 93-24

FIGURE I-1

Vicinity Map

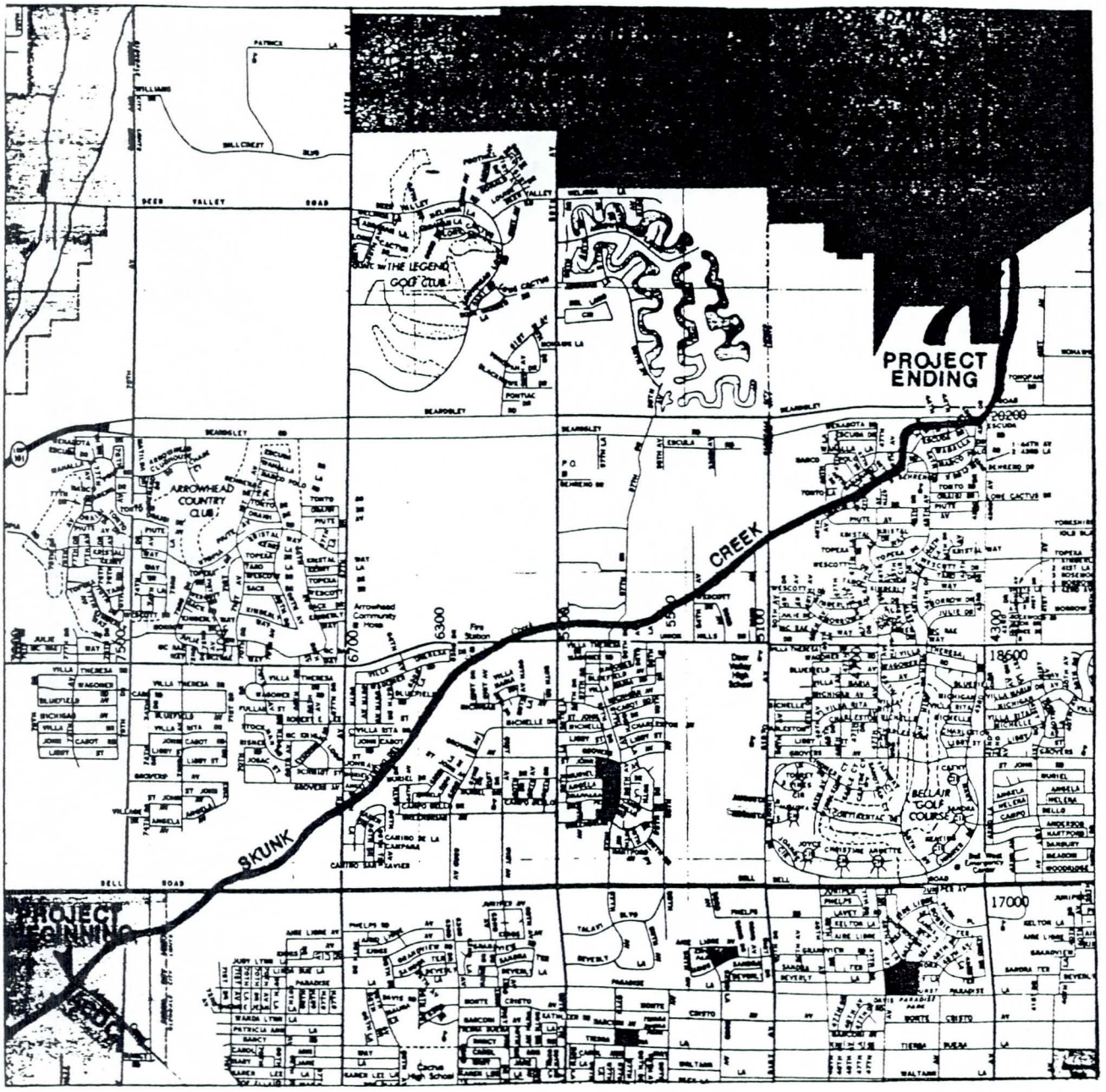
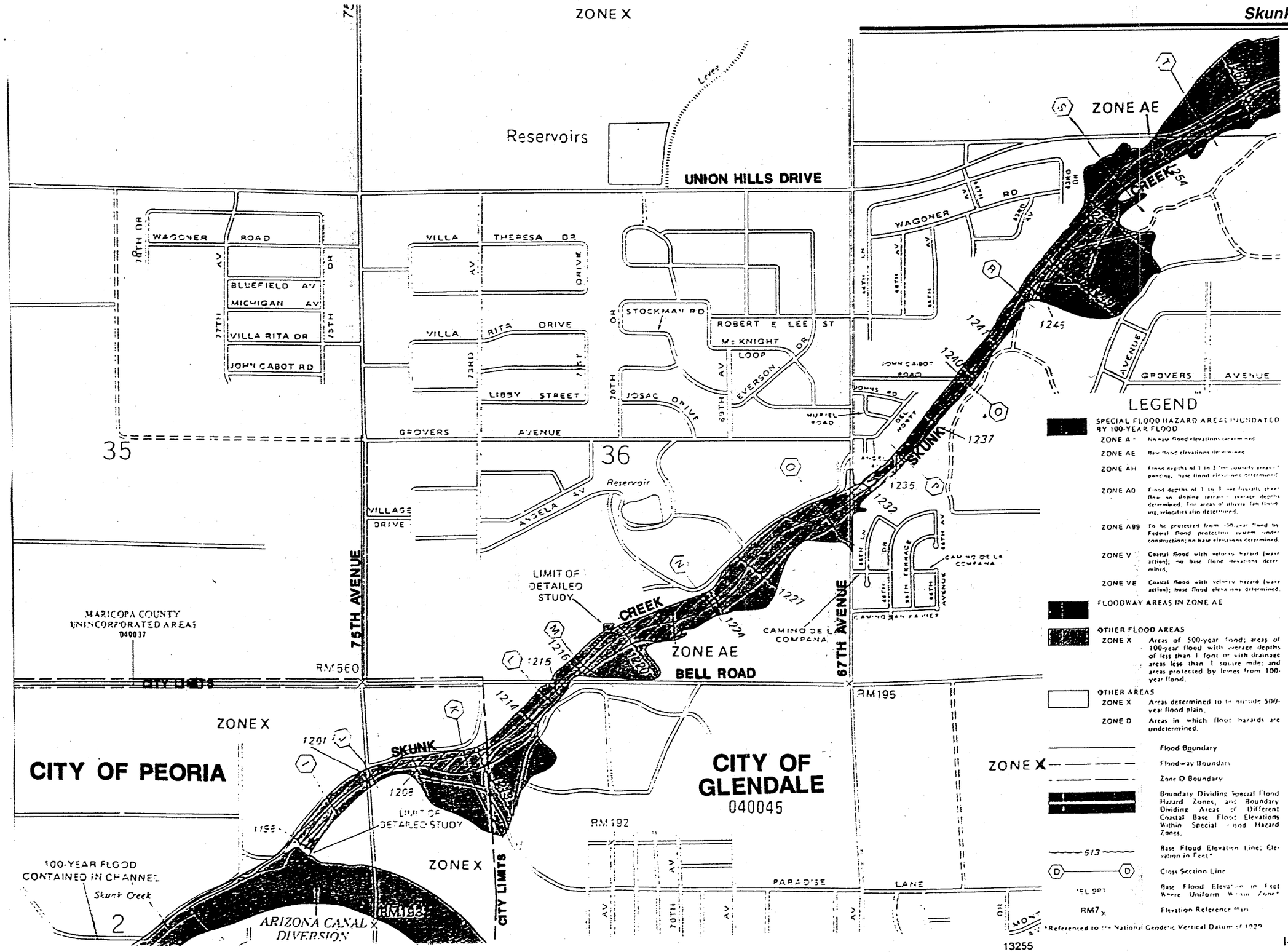


FIGURE I-2



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1190 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
GLENDALE, CITY OF	040045	1190	F
MARICOPA COUNTY UNINCORPORATED AREAS	040037	1190	F
PEORIA, CITY OF	040050	1190	F

MAP NUMBER
04013C1190 F

MAP REVISED:
DECEMBER 3, 1993

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR 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 sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS
- ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS
- ZONE X — Areas determined to be outside 500-year flood plain.
- ZONE D — Areas in which flood hazards are undetermined.

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- D — Cross Section Line
- EL 987 — Base Flood Elevation in Feet Where Uniform Within Zone*
- RM7 X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

APPROXIMATE SCALE IN FEET
1000 0 1000

FIGURE I-3

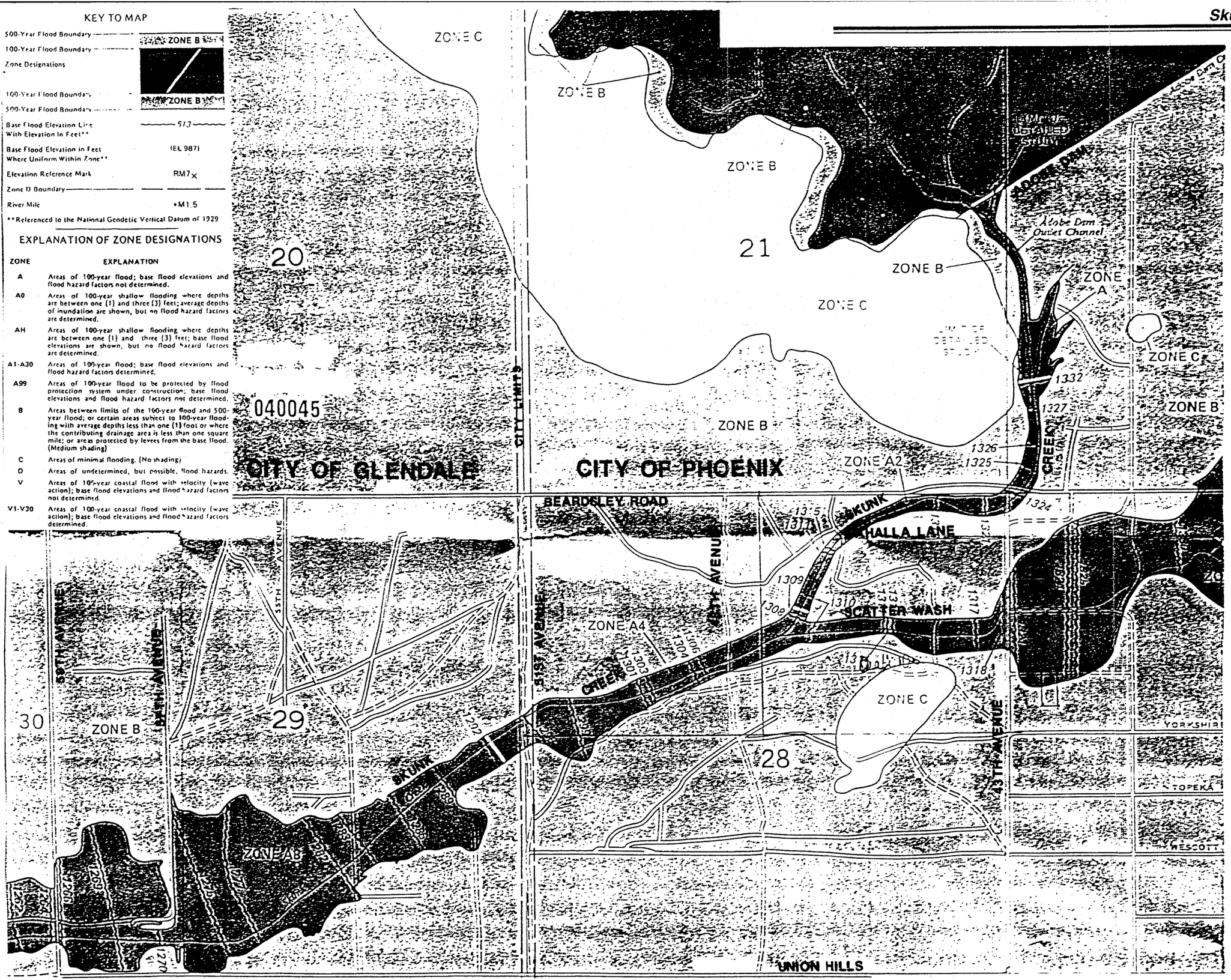
KEY TO MAP

500-Year Flood Boundary	
100-Year Flood Boundary	
Zone Designations	ZONE B / ZONE B
100-Year Flood Boundary	
500-Year Flood Boundary	
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	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 (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.



FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1195 OF 4350

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
GLENDALE, CITY OF	040045	1195	D
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1195	D
PHOENIX, CITY OF	040051	1195	D

MAP NUMBER
04013C1195 D

EFFECTIVE DATE:
APRIL 15, 1988

Federal Emergency Management Agency

APPROXIMATE SCALE IN FEET
1000 0 1000

FIGURE I-4

Vegetation:	Small (bushes 1 to 3 feet in height) Medium (bushes 4 to 8 feet in height) Large (trees 8 feet or higher interspersed with bushes)
Bank Description:	Refers to the area between the top and toe of slope
Sideslope:	Refers to the steepness of slope (horizontal:vertical)
Channel Linings:	Unlined earth, grass, gabions, soil cement, shotcrete, and concrete
Left or Right:	Referenced to an upstream view of the channel
Erosion:	Minor (0 to 2-foot gouges or 2-foot high eroded banks) Moderate (2 to 6-foot high eroded banks) Severe (6 feet high eroded banks or greater)

ACDC to 75th Avenue

The existing ACDC channel is a trapezoidal, grass-lined channel on an east-west alignment. The Skunk Creek channel intersects the ACDC channel at approximately a 45 degree angle 1,300 feet west of 75th Avenue. Grouted riprap bank protection has been used to line the banks of the confluence. Skunk Creek is well defined with a bottom width of 50 to 60 feet, and has some small vegetation in the channel bottom. Minor erosion is evident in the low-flow channel near the ACDC. The Skunk Creek channel banks are unlined earth, show minor or no erosion and have sideslopes ranging from 2:1 to 1:1. The streambed is headcutting west of 75th Avenue. The surrounding land is relatively flat and vacant. The Flood Insurance Rate Map (FIRM) (see Figure I-3) shows none of the adjacent land to be within the 100-year floodplain. Proposed commercial development along this segment of Skunk Creek will replace the unlined channel with a lined channel consisting of grouted riprap sideslopes and a concrete bottom. New bridge crossings of Skunk Creek at Paradise Lane and 75th Avenue are being designed by Dibble and Associates.

75th Avenue to Bell Road

The channel continues in an east by northeast direction for approximately 2,500 feet. As the wash proceeds easterly to Bell Road, the overall channel becomes wider and less defined with numerous low-flow channels. Some small vegetation is present in the channel bottom with denser medium vegetation on the channel sideslopes near Bell Road. Moderate erosion is evident immediately downstream of the Bell Road Bridge. Channel banks are unlined earth, with minor or no erosion and sideslopes ranging from 3:1 to 2:1. The surrounding land is relatively flat and vacant. The FIRM (see Figure I-3) shows an area south of the channel to be within the 100-year floodplain. Armoring is present in several locations where an incised low flow channel has formed.

Bell Road to 67th Avenue

The channel extends northeast for approximately 4,000 feet. Upstream of Bell Road, the cross-section is 200 to 250 feet wide, and is less defined with a single, 40- to 50-foot wide low-flow channel. A storm drainage channel intersects the north side of Skunk Creek at 71st Avenue. This channel conveys storm flow from several subdivisions into the creek. A new subdivision (Coventry Estates) is planned along the north side of Skunk Creek from the 71st Avenue drainage channel to 67th Avenue. A new roadway dip crossing is planned as a portion of the Coventry Estates subdivision at 69th Avenue. In the vicinity of 67th Avenue, the channel takes on a more trapezoidal shape with a bottom width of 150 feet. Some small vegetation is present in the channel bottom with denser medium vegetation on the channel sideslopes near Bell Road. Channel banks are unlined earth with sideslopes ranging from 6:1 to 1:1. Minor erosion is evident on the left bank upstream from the Bell Road bridge. Sand bars are present upstream of the Bell Road bridge, which indicates aggradation in that area. Channel armoring is present in several locations where an incised low flow channel has formed. The surrounding land is relatively flat and vacant. The FIRM (see Figure I-3) shows several areas south of the channel to be within the 100-year floodplain.

67th Avenue to Union Hills Drive

The channel continues in a northeasterly direction for approximately 5,000 feet. Upstream of 67th Avenue, the cross-section is trapezoidal and well defined with a bottom width ranging between 40 and 110 feet. A moderate amount of medium vegetation is present in the channel bottom with some small vegetation present on channel sideslopes. The majority of this reach consists of unlined earthen channel banks with sideslopes ranging from 2:1 to 1:1. Gabion channel bank lining (in good condition with 1.5:1 sideslopes) begins 1,300 feet downstream of Union Hills Drive and continues upstream at Union Hills Drive. An earthen levee, 3 to 4 feet high, has been constructed on the right bank, parallel to the gabions. Bank erosion is present only at St. John Avenue where runoff from the adjacent subdivision washed away the soil bedding around a storm drain pipe. The streambed is headcutting at the downstream end of the gabion section. The surrounding land is relatively flat. There are developing subdivisions on both sides of Skunk Creek (Arrowhead Valley III and Sunset Vista 5 and 6) for this entire segment. A new bridge crossing of Skunk Creek at 67th Avenue is being designed by INCA Engineers. The FIRM (see Figure I-3) indicates an area 2,500 feet downstream of Union Hills Drive and south of the channel to be within the 100-year floodplain.

Union Hills Drive to 59th Avenue

At Union Hills Drive, the channel alignment extends in a more easterly direction for approximately 1,600 feet. The cross-section is trapezoidal and well defined with a bottom width of 112 feet. A moderate amount of medium vegetation is present in the channel bottom with some small vegetation present on the channel sideslopes. Gabion channel bank lining (in good condition with 1.5:1 sideslopes) continues from Union Hills Drive to the 59th Avenue bridge. No erosion or aggradation is evident throughout this reach. The surrounding land is relatively flat and vacant. A new residential development (Copper Crest) is under

construction north of Skunk Creek and west of 59th Avenue. The FIRM (see Figure I-3 and I-4) shows both sides of the channel to be within the 100-year floodplain.

59th Avenue to 57th Avenue

The channel extends east for approximately 1,400 feet. The downstream gabion lined cross-section flares out to a cross-section that is trapezoidal with a bottom width of approximately 200 feet. A moderate amount of medium vegetation is present in the channel bottom with some small vegetation present on the channel sideslopes. Gabion channel bank lining on the left side (6-inch soil cover with 3:1 sideslopes) continues from the 59th Avenue bridge upstream for approximately 1,400 feet to 57th Avenue. The right bank is unlined earth with 6:1 sideslopes. Aggradation is evident upstream from the bridge piers. The surrounding land is relatively flat. A major storm drain outlet structure (10-foot diameter) is present on the right bank just west of 57th Avenue. 57th Avenue is a low-flow dip crossing with three 30-inch x 36-inch Corrugated Metal Pipe Arch (CMPA) culverts. The parking lot and detention basin for a manufacturing facility (Honeywell) is adjacent the left bank east of 59th Avenue. The FIRM (see Figure I-4) shows both sides of the channel to be within the 100-year floodplain.

57th Avenue to 55th Avenue (confluence with side channel)

The Skunk Creek channel extends east for approximately 1,100 feet. The cross-section is mildly irregular with a bottom width of 200 feet. A moderate amount of medium vegetation is present in the channel bottom with some small vegetation present on the channel sideslopes. Gabion channel bank lining on the left side (6″ soil cover with 3:1 sideslopes) continues from the 57th Avenue dip crossing upstream for approximately 200 feet. The right channel bank is unlined earth, varies in height and has sideslopes ranging from 6:1 to 2:1. Grouted riprap has been used to line Skunk Creek at the confluence with the Arrowhead Ranch Drain. The Arrowhead Ranch Drain channel intersects the north side of Skunk Creek at 55th Avenue. This channel conveys storm flow from several subdivisions into the creek. The surrounding land is relatively flat. A park is located north of the left bank and the land on the south side of the channel is vacant. The FIRM (see Figure I-4) shows both sides of the channel to be within the 100-year floodplain.

55th Avenue to 54th Avenue

The channel extends northeast for approximately 900 feet. Just upstream of the confluence with the side channel previously discussed, the trapezoidal channel narrows to a 60- to 90-foot bottom width. A moderate amount of medium vegetation is present in the channel bottom with some small vegetation present on the channel sideslopes. Channel banks are unlined earth and sideslopes range from 2:1 to 1:1. No erosion of the banks is evident throughout the reach. However, armoring of the streambed is present in a 500-foot stretch of the channel west of 54th Avenue. The land adjacent to the north and south banks has been used for gravel operations. Along the north bank of the creek, extensive dumping of construction debris has occurred. Equipment storage, fuel storage, refueling areas, vehicle scales, and offices exist on the south side of the creek. Subsurface investigation in the area of several above-ground storage tanks (AST) showed that petroleum hydrocarbons are

present to depths of 12 feet. For further information regarding the gravel operation near 54th Avenue, see the report entitled, Exploration Trenching for Further Site Characterization at the Skunk Creek Channel Near 54th Avenue and Union Hills Road in Glendale, Arizona, prepared by CEC/WRA dated June 29, 1994. The FIRM (see Figure I-4) shows both sides of the channel to be within the 100-year floodplain.

54th Avenue to 51st Avenue

The channel extends northeast for approximately 2,700 feet. The cross-section is very irregular with a bottom width ranging between 60 and 350 feet. A moderate amount of medium vegetation is present in the channel bottom with some small vegetation present on the channel sideslopes. The majority of this channel has unlined earthen banks that vary in height, and have sideslopes ranging from 6:1 to 2:1. For approximately 400 feet upstream of 54th Avenue, a trapezoidal channel exists with a 60- to 90-foot bottom width. No bank erosion is evident throughout the reach. The land adjacent to the north bank has been used as a landfill. Subsurface investigations of the landfill revealed the presence of construction material (concrete, cinder block, and brick) but no evidence of any hazardous materials. No special handling of the landfill material will be required. For further information regarding the landfill near 54th Avenue see the report prepared by CEC/WRA dated June 29, 1994.

A new subdivision (Chelsea Village I and III) is being developed south of Skunk Creek and west of 51st Avenue. Along the north bank immediately west of 51st Avenue, another new subdivision (Carmel Park) is also being developed. Gabion bank protection has been proposed through these areas on both sides of the creek.

Soil cement lining starts approximately 300 feet downstream of the 51st Avenue bridge and ends 200 feet upstream. Channel improvements through the 51st Avenue bridge consisted of soil cement bank protection with a soil bottom. The channel through this segment consists of a 120-foot wide bottom and 2:1 sideslopes. Armoring of the streambed through the soil cement channel section is evident due to erosion. Downstream of the soil cement section the streambed is aggrading with several sand bars present. The FIRM (see Figure I-4) shows both overbank areas to be within the 100-year floodplain.

51st Avenue to 48th Avenue

The channel extends east by northeast for approximately 1,800 feet. The cross-section is trapezoidal with a bottom width ranging between 150 and 250 feet. No vegetation is present in the channel for 1,300 feet upstream from the 51st Avenue bridge. Dense, large vegetation is present in the channel bottom for the 500-foot section downstream of 48th Avenue. For most of this reach, the channel banks are unlined earth with 2:1 sideslopes. The soil cement lining ends 200 feet upstream of the 51st Avenue bridge. Gabions have recently been installed on both banks, starting 500 feet upstream of the soil cement on the left bank and 200 feet upstream of the soil cement on the right bank. The gabions continue for 700 feet upstream on the left bank and 900 feet on the right bank. The top of the channel banks for 500 feet downstream from 48th Avenue are bounded by cinder-block walls. The surrounding

land on both sides is in various stages of residential development. The FIRM (see Figure I-4) does not show the adjacent areas to be within the 100-year floodplain.

48th Avenue to Confluence with Scatter Wash

The channel extends east by northeast for approximately 1,200 feet. The cross-section is trapezoidal with a bottom width of 220 to 240 feet. Dense large vegetation is present in the channel bottom upstream of 48th Avenue. For this segment, the channel banks are unlined earth with 2:1 sideslopes. The tops of the channel banks along the entire reach are bounded by cinder block walls. The surrounding land on both sides is residentially developed. Drop structures are present on both legs (Skunk Creek and Scatter Wash) of the confluence. The FIRM (see Figure I-4) does not show the adjacent areas to be within the 100-year floodplain.

Confluence with Scatter Wash to Wahalla Drive

The channel extends north by northeast for approximately 800 feet. The cross-section is trapezoidal with a bottom width of 80 to 100 feet. Dense large vegetation is present in the channel. The channel banks are unlined earth with 4:1 sideslopes. The surrounding land on both sides is residentially developed. The FIRM (see Figure I-4) does not show the adjacent areas to be within the 100-year floodplain.

Wahalla Drive to 43rd Avenue/Beardsley Road

The channel curves to the east for approximately 2,000 feet. The cross-section is trapezoidal with a bottom width of 50 to 60 feet. Dense large vegetation is present in the entire channel for 200 feet upstream of Wahalla Drive. A moderate amount of medium vegetation is present in the channel bottom for the remaining 1,800 feet. Upstream from Wahalla Drive, the channel banks are unlined earth with 2:1 sideslopes for 800 feet. The remaining 1,200 feet is improved with gunite channel banks (in good condition). Cinder-block walls are set back 15 feet from the top of the right channel bank for approximately 1,800 feet upstream from Wahalla Drive. The land on left side is flat and planned for an apartment complex. The FIRM (see Figure 4) does not show the adjacent areas to be within the 100-year floodplain.

Beardsley Road to Adobe Mountain Dam

Skunk Creek is contained within a 5 barrel 10-foot wide x 6-foot high x 200-foot long concrete box culvert that crosses under the Beardsley Road/43rd Avenue intersection. From the inlet to the box culvert, the channel extends to the north for approximately 3,000 feet. The channel is trapezoidal with a bottom width range of 10 to 60 feet. Some small vegetation is present in the channel bottom up to the grade control structure located 500 feet upstream from Beardsley Road. Dense large vegetation is present in the entire channel for the remaining 2,500 feet upstream from the grade control structure to the Adobe Dam outlet structure. Channel banks are gunite-lined with 1.5:1 sideslopes for 500 feet upstream of Beardsley Road. The next 600 feet has a very irregular channel with banks of varying height and condition. The remaining 1,900 feet of channel is formed by two levees terminating at the Adobe Dam outlet structure. The land on the west is mountain slope and the land on the

east is presently being converted to a residential development. The FIRM (see Figure I-4) shows the adjacent area east of the channel to be within the 100-year floodplain.

HYDROLOGY FOR THIS PROJECT

The peak flows used for this study were developed by the Corps of Engineers (COE). Below is a list of the design discharges used.

Skunk Creek at ACDC	11,000 cfs
Skunk Creek below confluence with Scatter Wash	8,400 cfs
Skunk Creek above confluence with Scatter Wash	2,600 cfs
Skunk Creek below Adobe Dam	1,730 cfs

The COE study gradually increased the flows in Skunk Creek with each cross section downstream. COE's study was made prior to extensive development in the area. Thus a gradual increase in flows downstream was justified. The COE also developed peak flows for a "future" condition. These flows are higher than the flows shown above. With two major tributaries intersecting Skunk Creek in the vicinity of 55th Avenue, Arrowhead Drain to the north and 10-foot diameter storm drain to the south, it was concluded that this was a logical place for dividing the design flows as 11,000 cfs downstream and 8,400 cfs upstream of the Arrowhead Drain. This approach is more conservative approach than the one used by COE, but is close to what the COE determined the future condition would be. In a similar manner, Beardsley Road was chosen as the dividing point for design flows as 2,600 cfs downstream and 1,730 cfs upstream of the roadway.

DESCRIPTION OF THE DRAINAGE STRUCTURES

Skunk Creek channel passes under four bridges, through two concrete box culverts, and over six grade control structures and four paved dip crossings. Abbreviations used for these structures are CBC (concrete box culvert), RCP (reinforced concrete pipe), CMP (corrugated metal pipe), CMPA (corrugated metal pipe, arched), PCCP (portland cement concrete pavement). "Left" or "right" refers to the upstream view. Flows breaking out of the upstream channel banks were noted but not modeled using split flow analysis. Existing storm drain facilities along the Skunk Creek corridor have been summarized in Table I-1 at the end of this section.

Paradise Lane Bridge

A new 144-foot long two span precast-prestressed concrete girder bridge is proposed over Skunk Creek west of 75th Avenue. The bridge will be skewed right approximately 5 degrees to align with Skunk Creek. The center pier will consist of four, 4-foot diameter, drilled shafts. Skunk Creek will also be improved from the ACDC to approximately 400 feet east of 75th Avenue. Skunk Creek will be lined with grouted riprap on the banks and concrete on the bottom. The proposed bridge and channel work is part of the Paradise Lane Improvement District for the City of Peoria. The proposed bridge opening would convey the 100-year streamflow (11,000 cfs) with a water surface elevation of 1,196.44, allowing for freeboard of 7.3 feet. Flows will be contained by the proposed channel banks on the upstream side.

75th Avenue Crossing

Existing 75th Avenue is a section-line arterial street carrying northbound and southbound traffic. The roadway forms a dip crossing raised approximately 2.5 feet above the streambed. There are five 12-inch diameter RCP, with projecting ends, that can convey up to 24 cfs (combined) before the roadway is overtopped. The sideslopes of the roadway are 2:1 and protected with PCCP. A 72-inch diameter RCP terminates on the downstream side, left bank, with 45-degree wingwalls projecting into the channel causing a moderate obstruction. Minor local erosion was evident downstream from the concrete slope protection.

The RCP culverts are inadequate to convey the 100-year streamflow (11,000 cfs). The water surface elevation (WSEL) for the 100-year event is 1,200.5 with a resultant depth of flow of 8.7 feet over the roadway.

A new 156-foot long, two span, precast-prestressed, concrete girder bridge is proposed over Skunk Creek at 75th Avenue. The bridge will be skewed left approximately 25 degrees to align with Skunk Creek. The center pier will consist of four 4-foot diameter drilled shafts. This bridge work is also a part of the Paradise Lane Improvement District for the City of Peoria. The proposed bridge opening would convey the 100-year streamflow (11,000 cfs) with a water surface elevation of 1,197.33, allowing for freeboard of 7.1 feet. Flows will be contained by the proposed channel banks on the upstream side.

Bell Road Bridge

Bell Road is a section-line arterial street carrying eastbound and westbound traffic. The roadway crosses Skunk Creek via a nine-span concrete bridge. The piers are the solid "wall" type, 1.5 feet wide, with a rounded nose and is skewed to the right 45-degrees. The piers are constructed on spread footings. The bridge top chord is formed by the concrete barriers on both sides of the bridge. The barriers are 2 feet higher than the lowest top of channel bank upstream from the bridge. The bridge low chord is 12 feet above the streambed channel at the low-flow channel. The inlet is relatively clear, however, the outer two bridge openings are almost completely blocked by trees at the outlet. The center opening is clear at the outlet. All of the other openings are moderately obstructed by 6 to 8-foot bushes. A 6-foot high sand bar has formed on the left side of the channel, adding to the blockage of the left two openings. The 15-foot wide low-flow channel is not blocked by the sand bar. There is moderate local erosion at the downstream piers.

The existing bridge opening conveys the 100-year streamflow (11,000 cfs) with a water surface elevation of 1,216.70, allowing for freeboard of 0.6 feet. Flows are marginally contained by the channel banks on the upstream side.

69th Avenue Crossing

A proposed roadway dip crossing is planned as a portion of the Coventry Estates subdivision at 69th Avenue. The roadway will connect to existing 69th Avenue located immediately west of the Home Depot commercial center.

67th Avenue Crossing

67th Avenue is a section-line arterial street carrying northbound and southbound traffic. The roadway forms a dip crossing at the level of the streambed. There are no culverts to carry low flows. No local erosion is evident at the crossing.

The dip crossing is submerged at any flow and is inadequate for the 100-year streamflow (11,000 cfs). The 100-year WSEL is 1,233.2 with the depth of flow 8.6 feet over the roadway.

A new 165-foot long, three span, precast voided slab bridge is proposed over Skunk Creek at 67th Avenue. The bridge will be skewed left approximately 30 degrees to align with Skunk Creek, which will be improved 400 feet upstream and downstream of 67th Avenue. Gabion bank protection will be provided through the improved channel section. The proposed bridge opening would convey the 100-year streamflow (11,000 cfs) with a water surface elevation of 1,232.11, allowing for freeboard of 0.5 feet. Flows will be contained by the proposed channel banks on the upstream side.

Union Hills Drive Bridge

Union Hills Drive is an arterial street carrying eastbound and westbound traffic. The roadway crosses over Skunk Creek via a three-span concrete bridge. Piers consist of seven 3-foot diameter columns oriented parallel to the flow, skewed 60 degrees to the right with the roadway. The bridge low chord is 14 feet above the streambed channel at the low-flow channel. All openings are partially obstructed by 4 to 8-foot bushes. No local erosion or aggradation was evident at the bridge piers.

The existing bridge opening is adequate to convey the 100-year streamflow (11,000 cfs). The 100-year WSEL is 1,257.3, allowing for freeboard of 3.8 feet. Flows are contained by the channel banks on the upstream side.

59th Avenue Bridge

The 59th Avenue roadway is an arterial street carrying northbound and southbound traffic. The roadway crosses Skunk Creek via a three-span concrete bridge. The piers are solid "wall" type, 3-foot wide, have a triangular nose and are oriented parallel to the flow. The bridge low chord is 11 feet above the streambed channel at the low-flow channel. All of the openings are partially obstructed by 4 to 8-foot bushes. Minor local erosion was evident at the downstream pier face.

The existing bridge opening is inadequate to convey the 100-year streamflow (11,000 cfs). The 100-year WSEL is 1,267.25 and the bridge has no freeboard (1.0 feet above the lowest low chord). Flows are contained in the channel banks on the upstream side.

57th Avenue Crossing

The 57th Avenue roadway is a quarter-mile collector street carrying northbound and southbound traffic. The roadway crossing consists of a PCCP dip crossing with a low-flow culvert. Minor flows pass under the roadway via three 30-inch x 36-inch CMPAs with end sections. The sideslopes of the roadway are 0.5:1 and are protected with shotcrete. The culverts were clear of debris and silt. Minor aggradation was evident upstream from the crossing.

The existing crossing is submerged at flows over 70 cfs. For the 100-year streamflow (11,000 cfs) the water surface is 1,269.5 with the depth of flow 5.4 feet over the roadway.

51st Avenue Bridge

The 51st Avenue roadway is an arterial street carrying northbound and southbound traffic. The roadway crosses Skunk Creek via a two-span concrete bridge. The pier consists of five 5-foot diameter columns oriented parallel to the flow. The bridge low chord is 10 feet above the streambed channel at the low-flow channel. All of the openings are clear of debris and vegetation. Moderate erosion of the channel bottom was evident upstream and downstream from the bridge.

The existing bridge opening is adequate to pass the 100-year streamflow (8,400 cfs). The 100-year WSEL is 1,291.8 allowing for freeboard of 3.7 feet. The flows are contained by the upstream channel banks.

48th Avenue Dip Crossing

The 48th Avenue roadway is a quarter-mile collector street carrying northbound and southbound traffic. The roadway crossing consists of a paved dip crossing with a low-flow culvert. Minor flows pass under the roadway via three 18-inch RCPs with a drop structure inlet. The culverts are clear of debris and silt. A sidewalk is located on the upstream side and a level concrete weir (higher than the sidewalk) controls the water surface at high flows. A 20-foot x 2.1-foot rectangular notch in the weir allows medium flows to pass over the road. A concrete plunge basin with a "dragon tooth" energy dissipator is located immediately downstream of the concrete weir. A second weir is located immediately downstream from the plunge basin, and is at the level of the downstream channel bottom.

The existing crossing is submerged at flows greater than 38 cfs. The 100-year streamflow (8,400 cfs) WSEL is 1,307.3 with the depth of flow 6.5 feet over the roadway.

Confluence with Scatter Wash

The streamflow on Skunk Creek is reduced to 2,600 cfs upstream from the confluence with Scatter Wash. Grade control structures have been set upstream from the confluence with both Scatter Wash and Skunk Creek.

Wahalla Lane Concrete Box Culvert

Wahalla Lane is a residential street carrying eastbound and westbound traffic. Flows pass under the roadway via a 5 barrel,10-foot x 6-foot CBC. The culverts were partially clogged with silt. A headwall on the upstream side is set one foot higher than the lowest upstream top of channel bank.

A grade control structure (GCS) is located just upstream from the CBC, and is at the level of the upstream channel bottom. Nuisance flows are directed to a drop inlet and conveyed past the GCS with three 12-inch RCPs.

The existing crossing is marginal for the 100-year streamflow (2,600 cfs). The water surface is 1,314.1 and the freeboard to the top of the headwall is one foot. The flows are marginally contained by the channel banks on the upstream side.

Beardsley Road/43rd Avenue Concrete Box Culvert

Beardsley Road is an arterial street carrying eastbound and westbound traffic. This roadway will be reconstructed as a segment of the Outer Loop Freeway. 43rd Avenue is also an arterial roadway carrying northbound and southbound traffic. Flows are conveyed under both roadways through a 5 barrel, 10-foot x 6-foot CBC. The culvert bends under Beardsley Road and was not visible. All barrels appeared to be free of silt. A headwall on the upstream side is 1.3 feet higher than the lowest upstream top of channel bank.

A grade control structure is located immediately upstream from the CBC and is at the level of the upstream channel bottom.

The existing crossing is marginal for the 100-year streamflow (2,600 cfs). The water surface elevation is 1,324.2 and the freeboard to the top of the headwall is 3.0 feet. The flows are contained by the channel banks on the upstream side.

Grade Control Structure (North of Beardsley Road)

A grade control structure is located 200 feet upstream of the Beardsley CBC. The GCS is set at the level of the upstream channel bottom. Concrete abutments are located on each bank adjacent the GCS. There is no roadway crossing.

PREVIOUS STUDIES

The U.S. Federal Emergency Management Agency prepared a Flood Insurance Study for Maricopa County and Incorporated Areas. The report was last revised September 29, 1989.

The WLB Group prepared a conceptual study in 1987 for the City of Glendale. The study, Skunk Creek Master Plan, developed conceptual plans for bicycle/pedestrian paths, equestrian trails, and typical channel cross sections for Skunk Creek within the city limits of Glendale.

Coe & Van Loo Consulting Engineers, Inc. prepared a Floodplain Delineation Report in December, 1990 for the Flood Control District of Maricopa County. The report covers Skunk Creek in two separate reaches between the Arizona Diversion Channel and the Central Arizona Project. Flood delineations were shown for existing and future conditions.

TABLE I-1
EXISTING STORM DRAIN SUMMARY

NEAR MAJOR CROSS STREET	SKUNK CREEK STATION	BASELINE OFFSET		TYPE OF STORM DRAIN FACILITY	EXISTING END TREATMENT
		DIST (feet)	Lt/Rt		
75TH AVENUE	63+74	27	right	18" RCP	Projecting
75TH AVENUE	64+16	21	left	78" RCP	Wingwalls
75TH AVENUE	69+78	34	right	24" RCP	Projecting
75TH AVENUE	73+62	40	left	18" CMP	Projecting
75TH AVENUE	78+50	80	left	12" PVC	Projecting
BELL ROAD	88+37	90	right	36" RCP	Projecting
71ST AVENUE	96+05	113	left	71st Ave Drainage Channel	N/A
66TH LANE	130+70	77	left	18" CMP	Grouted Riprap
66TH LANE	131+41	62	right	15" PVC	Projecting
GROVERS RD	136+88	35	left	18" CMP	Grouted Riprap
GROVERS RD	138+32	80	right	12" PVC	Projecting
ST. JOHN RD	142+43	80	right	36" RCP	Grouted Riprap
JOHN CABOT RD	145+50	40	left	24" CMP	Grouted Riprap
BLUEFIELD RD	160+54	39	left	18" RCP	Grouted Riprap
63RD DRIVE	163+32	39	left	24" RCP	Grouted Riprap
59TH AVENUE	195+51	85	right	18" RCP	Gabions
59TH AVENUE	197+70	112	left	18" RCP	Gabions
59TH AVENUE	198+15	130	right	24" CMP	Projecting
57TH AVENUE	210+00	44	left	24" RCP	Wingwalls
56TH AVENUE	217+34	164	right	96" RCP	Conc Apron
55TH AVENUE	222+41	Centerline Equation (1)	left	55th Ave. Drainage	Grouted Riprap
52ND AVENUE	244+77	69	right	Future Storm Drain	Gabions

TABLE I-1 (Continued)
EXISTING STORM DRAIN SUMMARY

NEAR MAJOR CROSS STREET	SKUNK CREEK STATION	BASELINE OFFSET		TYPE OF STORM DRAIN FACILITY	EXISTING END TREATMENT
		DIST (feet)	Lt/Rt		
51ST AVENUE	255+41	76	right	30" RCP	Projecting
51ST AVENUE	255+61	44	left	30" RCP	Projecting
50TH AVENUE	260+25	143	left	8" PVC	Riprap Apron
49TH DRIVE	264+54	80	left	18" RCP	Riprap Apron
49TH AVENUE	265+57	118	right	8" PVC	Gabions
48TH LANE	268+25	129	left	8" PVC	Gabions
47TH DRIVE	284+81	130	right	Conc. Spillway	Conc Apron
BEARDSLEY RD	321+70	25	right	36" RCP	in CBC Barrel
BEARDSLEY RD	321+84	27	right	36" RCP	in CBC Wingwall

NOTE: (1) Centerline Equation 222+41.41 (Skunk Cr.) = 0+00 (55th Ave Drain)

Section II

STUDY PROCEDURE

The study procedure consisted of four steps:

1. Define the primary goal(s) and identify the desired results in terms of objectives
2. Collect all relevant information
3. Develop alternatives
4. Evaluate the alternatives against the objective(s)

The first step of defining the primary goal and identifying the desired results was described in the detailed scope of work, discussed during the project kick-off meeting and refined through two public meetings and agency meetings. Specific tasks within the approach to this preliminary report include:

a. Develop a hydraulic model of the existing Skunk Creek channel using the HEC-2 computer program. Aerial topographic mapping provided by the Flood Control District (FCD) was used for cross section information on the channel. Field surveys were performed to verify the aerial mapping. Additional field survey was obtained to update areas that had changed from the date the aerial mapping was flown.

b. Perform a preliminary sediment analysis on the existing Skunk Creek channel.

c. Describe the channel by reach (between roadway crossings and/or grade control structures), assess sections of the channel (streambank overtopping, erosion, sedimentation, inadequate drainage structures) and summarize the results.

d. Describe existing structures (bridges, culverts, dip crossings, and grade control structures).

e. Develop typical cross-sections for channel improvements in unimproved areas.

f. For each alternative, examine the effects on the water surface, breakout of flows, adequacy of existing drainage structures, relative erosion resistance, and channel maintenance.

g. Identify concerns such as channel aesthetics, maintenance access, and recreation opportunities in the design alternatives.

h. Calculate rough earthwork requirements, lining quantities, right-of-way requirements, utility locations, and need for additional grade control structures.

i. Produce 1″=100′ scale plan and profile sheets for the existing case and the alternatives.

The second step, collect all relevant information, included the following tasks:

j. Collect as-built plans for all channel crossings.

k. Contact utility companies (see Table II-1) for location of facilities within the channel corridor.

l. Contact public agencies (see Table II-2) for input to the project.

m. Acquire property data from FCD, including assessor's map and property owner listing, for use in determining right-of-way/easement acquisition.

n. Acquire listing of known landfills and/or potential hazardous waste sites from FCD.

Table II-1
UTILITY CONTACTS

Utility Company	Response
Mr. Chuck Hughes Salt River Project P.O. Box 52025 Phoenix, AZ 85072-2025	No response to FCDMC letter dated April 30, 1993. No response to July 19, 1994, request for updated plans.
Mr. Pete Funk AT&T 211 West Monroe Phoenix, AZ 85003	AT&T responded with no conflicts noted on May 11, 1993. No response to July 19, 1994, request for updated plans.
Mr. Ronald Faucett Insight Communications 21200 North Black Canyon Highway Phoenix, AZ 85027	No response to FCDMC letter dated April 30, 1993. No response to July 19, 1994, request for updated plans.
Mr. Paul Johnson Southwest Gas Corporation P.O. Box 52075 Mail Code 420-583 Phoenix, AZ 85072-2075	No response to FCDMC letter dated April 30, 1993. No response to July 19, 1994, request for updated plans.
Mr. Curt Sayer US West Communications 6350 South Maple Tempe, AZ 85023	FCDMC received plans on May 17, 1993. Sverdrup received plans on August 10, 1994.
Mr. Dan Nissen City of Peoria 8401 West Monroe Street Peoria, AZ 85345	FCDMC received plans on May 12, 1993. Sverdrup received plans on August 12, 1994.
Mr. Bob Maurer Salt River Project P.O. Box 52025 Phoenix, AZ 85072-2025	SRP responded with no conflicts noted on May 10, 1993. No response to July 19, 1994, request for updated plans.

Utility Company	Response
Mr. Grant Anderson City of Glendale 5850 West Glendale Avenue Glendale, AZ 85301	City of Glendale submitted subdivision plats and plans on May 17, 1993, July 26, 1994, and November 22, 1994.
Mr. John Herrera Arizona Public Service Company P.O. Box 53999 Mail Station 3289 Phoenix, AZ 85072-3999	FCDMC received plans on May 12, 1993. No response to July 19, 1994, request for updated plans.
Mr. Carl McKay Dimension Cable Services 115 North 51st Avenue Phoenix, AZ 85043	FCDMC received plans on May 21, 1993. No response to additional request on July 19, 1994.
Mr. Jerry Arakaki City of Phoenix Water and Wastewater Department 455 North 5th Street Phoenix, AZ 85004	FCDMC received plans on May 10, 1993. Sverdrup received plans on August 1, 1994.

Table II-2
AGENCY CONTACTS

Agency	
Mr. Sam F. Spiller Field Supervisor U.S. Fish & Wildlife Service 2321 West Royal Palm Road, Suite 103 Phoenix, AZ 85021	Mr. Robert Coons City of Glendale Planning Department 5850 West Glendale Avenue Glendale, AZ 85301
Ms. Catherine Johnson Arizona State Parks State Historic Preservation Office 1300 West Washington Phoenix, AZ 85007	Mr. Robert Darr, PE City of Peoria Engineering Department 8401 West Monroe Street Peoria, AZ 85345
Ms. Cindy Lester U.S. Army Corps of Engineers Phoenix Area Office 3636 North Central Avenue, Suite 740 Phoenix, AZ 85012-1936	Mr. Ralph Goodall Street Transportation Department City of Phoenix 1034 East Madison Street Phoenix, AZ 85034
Mr. Dan Sherwood, PE City of Glendale Engineering Department 5850 West Glendale Avenue Glendale, AZ 85301	

The development of alternatives consisted of several tasks, the first of which being development of a computer terrain model based upon triplet data provided by FCD with modifications from field surveys.

Next, the existing horizontal alignment was produced consisting of a "best-fit" solution. From that alignment, an input file for the HEC-2, was developed. Analysis utilized the April 1991 version of HEC-2 as implemented by Dodson and Associates, Inc.

Seven basic alternatives were developed (see Section IV, Alternatives Considered) utilizing the study goals, results from the HEC-2 run of existing conditions and the results from the sediment analysis. These alternatives were presented at a public information meeting. Comments and opinions were obtained from questionnaires filled out at the meeting. Meetings were held with the City of Peoria and the City of Glendale to obtain additional information and comments on the alternatives.

Step Four of the study procedure consisted of the evaluation of alternatives relative to constructability; construction cost; new right-of-way requirements; safety; access control; environmental impacts; channel esthetics; and recreational improvements such as continuity of bicycle and pedestrian paths, and equestrian access.

A recommended channel improvement alternative (Alternative 8) was developed on plan and profile sheets, at 1"= 40' scale, for inclusion in this report.

Sediment samples were collected at eighteen locations within the channel. A sediment transport analysis on the existing Skunk Creek channel was then performed. The results were used to determine the channel equilibrium slope, locations for drop structures, cut off walls, and the toedown depth of the channel bank protection.

Quantities for the recommended alternative were calculated and a total estimated construction cost was prepared.

Step five of the study procedure consisted of review and comment on the recommended alternative by the FCDMC and the cities of Peoria, Glendale, and Phoenix. In addition, the recommended alternative was presented at a public information meeting held on July 12, 1995 for public review and comment. The recommended alternative was refined from the review comments and finalized.

At the request of the FCDMC, the project was divided into four segments and cost estimates prepared for programming as future flood control projects.

Section III

MAJOR DESIGN FEATURES

GOALS

The primary goals for the improvements to Skunk Creek channel are to maintain the conveyance capacity stipulated in the Flood Insurance Study, identify improvements to stabilize the channel, review channel improvements for aesthetics, and incorporate provisions for future recreational opportunities. In attaining these goals, the intent was to provide channel improvements that would enhance passive recreational use, channel aesthetics, and minimize project costs. In addition to the stated goals, several other factors were considered in the development and evaluation of alternatives.

Capacity: Channel improvements shall accommodate the following flows:

Skunk Creek downstream of Arrowhead Drain to ACDC	11,000 cfs
Skunk Creek downstream of confluence with Scatter Wash and upstream of Arrowhead Drain	8,400 cfs
Skunk Creek downstream of Beardsley Road and upstream of confluence with Scatter Wash	2,600 cfs
Skunk Creek downstream of Adobe Dam to Beardsley Road	1,730 cfs

The need for a low-flow channel within the main channel will be analyzed.

Recreation/ Aesthetics: Development of passive recreation and enhancing channel aesthetics along the Skunk Creek corridor have been primary goals of the City of Glendale. Provisions for bicycle/pedestrian paths, equestrian trails, access to nearby parks and continuity of the paths/trails will be emphasized. Bank protection options will be reviewed to enhance channel aesthetics.

Access: Access into and out of the channel for maintenance purposes will be provided between hydraulic structures and from subdivision roadways where possible. Access to maintenance roads from arterial streets should be avoided.

Safety: Safety is extremely important in the development of any alternative. It is desirable that channel sideslopes be flat enough to allow people to climb out of the channel in an emergency.

Environment: Minimizing and/or mitigating environmental impacts is an integral part of the development and evaluation of alternatives.

Maintenance: The frequency and scope of maintenance for each alternative will be considered.

Cost: Construction costs will be determined for each alternative.

HORIZONTAL AND VERTICAL ALIGNMENT

The horizontal alignment will follow the existing alignment as nearly as possible to minimize channel disruption, to maximize the use of the existing channel, and minimize right-of-way requirements from sites identified as landfills or having potential hazardous waste problems. A vertical alignment will be developed to provide a stable channel bottom. Grade control structures, if necessary, will be placed downstream of roadway crossing structures to minimize potential head-cutting into structure footings. Grade control structures may be recommended elsewhere if the channel slope must be flattened.

ACCESS CONTROL

Subdivision roads will be used, where possible, for access to ramps that lead to the bottom of the proposed channel because channel maintenance will commence from the bottom of the channel. Bicycle/pedestrian paths adjacent to the channel will be available for channel maintenance, but will not be the primary function of the pathway. Access points from major roadways to the channel will be discouraged in order to preclude use of the paths and channel bottom by motorized vehicles. Access along the channel bottom will be provided at most of the grade control and drop structures to provide continuity of access along the channel for equestrian use.

UTILITIES

Utilities that are present within the Skunk Creek corridor include water, wastewater, electric, gas, storm drain, telephone, and cable television. Contact has been made with all utility companies that have facilities within the project limits (see Table II-1). The following utilities have facilities within the project:

- Arizona Public Service Company
- US West Communications
- City of Phoenix
- City of Glendale
- City of Peoria

During development of the preferred alternative, the extent of utility relocations will be established.

ROADWAY CROSSINGS

Roadway crossings that will be evaluated at section roads include:

- 10-year low flow crossings at Section Line roadway crossings.
- 25-year low flow crossings at Section Line roadway crossings.

Bridge crossings presently exist at Bell Road, Union Hills Drive, 51st Avenue, and 59th Avenue.

RIGHT-OF-WAY

Significant portions of the Skunk Creek corridor have already been purchased by the FCDMC or have been dedicated to the Cities of Peoria, Glendale and Phoenix through the development process. Right-of-way requirements will vary between 80 and 280 feet depending upon the channel alternatives. However, a constant minimum width parallel to the channel will be established to attain the desired use of the corridor.

PERMITS

Channel improvements will be required to obtain nationwide or individual permits, under Section 404 of the Clean Water Act. In addition, National Pollution Discharge Elimination System (NPDES) permits will be required during construction from the U.S. Environmental Protection Agency and/or Arizona Department of Environmental Quality.

Section IV

ALTERNATIVES CONSIDERED

The goal of this study is to develop alternatives capable of conveying the 100-year storm, maximize the utilization of the existing channel for passive recreational use, and enhance channel esthetics. A recommended alternative will be developed into an integrated planned corridor master plan to be used for future development along the Skunk Creek corridor. In addition to a No-Plan Alternative, seven basic design alternatives were investigated during the course of the study. Basic design alternatives involve the removal and management of existing vegetation, reshaping the existing channel, and providing bank protection. The advantages and disadvantages of each of the basic design alternatives were evaluated, and several alternatives considered were discontinued because they did not satisfy the study objectives. Seven basic alternatives were studied. An eighth alternative was also studied that was a mixture the basic alternatives. It was recognized that the recommended alternative would most likely be a combination of two or more of the seven basic alternatives studied. These alternatives include:

Alternative 1: Trapezoidal section with grassed bottom and banks

Alternative 2: Trapezoidal channel with a natural bottom and dumped riprap banks or option using grouted riprap banks

Alternative 3: Trapezoidal channel with a natural bottom and soil cement banks

Alternative 4: Trapezoidal channel with natural bottom and shotcrete banks

Alternative 5: Trapezoidal channel with natural bottom and gabion banks

Alternative 6: Rectangular channel with concrete bottom and sides.

Alternative 7: Existing channel using natural bottom and banks with vegetative management.

Alternative 8: Combination of Alternatives 2, 4, 5, and 7 (Recommended Alternative).

A qualitative and quantitative evaluation of the alternatives was conducted based upon items of primary consideration, followed by secondary items.

Primary Drainage Considerations:

- Convey the 100-year storm within the channel.
- Do not exceed the maximum velocity for a given lining.
- Eliminate existing and preclude future erosion and scour problems.

- Provide controlled access into/out of channel bottom from subdivision roads.
- Provide maintenance access above the 10-year water surface elevation.
- Ensure FEMA's Base Flood Elevation is not increased more than one foot.
- Avoid known landfills or other hazardous material sites if possible.
- Freeboard under bridges must not be reduced.
- Do not disturb, require reconstruction, or provide a grade change at existing drainage structures.

Primary Aesthetic and Recreational Considerations:

- Enhance channel visual appeal.
- Enhance recreational opportunities for bicycle, pedestrian and equestrian use.
- Provide controlled access along corridor from subdivision roads and preclude use by motor vehicles.
- Provide continuity for bicycle, pedestrian and equestrian paths/trails.
- Provide paths/trails above the 10-year water surface elevation.

Secondary Considerations:

- Minimize overall project cost.
- Minimize right-of-way acquisition beyond existing banks.
- Match existing channel linings.
- Minimize channel maintenance costs.

During the alternative evaluation, the project was divided into 11 reaches based on existing channel conditions relative to bank linings, grade control structures, bridges, culverts, and changes to 100-year peak flows. Table IV-1, provides descriptions of each reach:

Table IV-1
REACH IDENTIFICATION

Reach Number	Limits of Reach
1	ACDC confluence with Skunk Creek to 900 feet east of 75th Avenue Station 54+00 to Station 69+25
2	400 feet east of 75th Avenue to 67th Avenue Station 69+25 to Station 124+73
3	67th Avenue to 1,350 feet south of Union Hills Drive Station 124+73 to Station 164+88
4	1,350 feet south of Union Hills Drive to 59th Avenue Station 164+88 to Station 197+53
5	59th Avenue to Arrowhead Drain (55th Avenue) Station 197+53 to Station 224+78

Reach Number	Limits of Reach
6	Arrowhead Drain (55th Avenue) to 350 feet west of 51th Avenue Station 224+78 to Station 253+73
7	350 feet west of 51th Avenue to 600 feet west of 48th Avenue Station 253+73 to Station 270+22
8	600 feet west of 48th Avenue to Confluence with Scatter Wash Station 270+22 to Station 288+17
9	Confluence with Scatter Wash to Wahalla Lane Station 288+17 to Station 296+40
10	Wahalla Lane to 43rd Avenue/Beardsley Road Station 296+40 to Station 316+87
11	43rd Avenue/Beardsley Road to Adobe Dam Outlet Channel Station 316+87 to Station 336+99

EVALUATION OF THE ADVANTAGES AND DISADVANTAGES OF THE ALTERNATIVES CONSIDERED

The following is a description and evaluation of the advantages and disadvantages of the alternatives considered. Typical sections of the alternatives are provided in Appendix B.

No-Action Alternative

The No-Action Alternative will not involve channel development along the Skunk Creek corridor. This alternative will not provide any logical channel development or continuity between sections of existing developed channel.

Alternative 1

This alternative involves the construction of a grass-lined trapezoidal channel with a bottom width varying from 50 feet to 200 feet and 4:1 sideslopes. Ultimate right-of-way widths will vary depending on the channel bottom width and channel depth, but will be in the range of 170 to 280 feet.

The advantages of the grass-lined channel are:

- Lowest channel construction cost.
- Short construction time.
- Aesthetically pleasing, and providing a park-like atmosphere for adjoining residents.

The disadvantages of the grass-lined channel are:

- Maximum tolerable channel velocity is limited to 8 feet per second.
- Requires maximum right-of-way.
- Requires grass to be maintained.
- Requires irrigation system construction, maintenance and operation cost.

Preliminary HEC-2 analysis showed channel velocities exceed 8 fps in all but three of the reaches (1,2 and 7). Grade control structures would be required on reaches to reduce channel velocities. Construction of these grade control structures would require coordination with adjacent landowners and developments. Another limiting factor with Alternative 1 is the high cost of operation and maintenance.

An option to the grass lined channel would be to use natural desert vegetation. This option would have similar advantages of the grass lined channel and lower maintenance costs. The main disadvantage is that the maximum tolerable channel velocity would decrease to 5 feet per second. Required right-of-way would be 80 percent larger than the grass lined section in order to construct the channel section. Flat channel slopes needed to reduce the channel velocity would require frequent grade control structures and high excavation quantities.

Alternative 2

This alternative involves the construction of a trapezoidal channel with a natural earthen bottom ranging in width from 50 feet to 200 feet. Sideslopes would consist of dumped riprap, 3:1 sideslopes on banks. Ultimate right-of-way widths would vary depending on the channel bottom width, but will range between 150 feet and 270 feet. Grouted riprap would have 1.5:1 sideslopes on banks.

The advantages of the dumped riprap lined channel are:

- Lower construction cost, less labor intensive.
- The 3:1 sideslope requires less right-of-way than Alternative 1 or 4.
- Channel flow velocity more closely matches existing channel velocity.
- Lower maintenance cost than Alternative 1; same maintenance cost as Alternative 5.

The disadvantages of the dumped and grouted riprap lined channel are:

- Maximum tolerable channel velocity is 9 feet per second.
- Dumped riprap requires more right-of-way than Alternative 3, 5, or 6.
- Grouted riprap requires more right-of-way than Alternative 6.
- Bank lining is not as durable as Alternatives 3 through 6, inclusive, for the higher streamflows.
- Vegetation will grow through dumped riprap lining and require maintenance.
- Difficulty for horses to climb channel banks in emergency situations.
- Unnatural looking channel banks will not be aesthetically pleasing.

Alternative 2 would work in all but three of the reaches (1, 2 and 7). Grade control structures would be required on reaches to reduce channel velocities. Construction of these grade control structures would require coordination with adjacent landowners and developments.

Alternative 3

Alternative 3 consists of a trapezoidal channel with a natural earthen bottom ranging in width from 50 feet to 200 feet, and 2:1 sideslopes stabilized with soil cement. Ultimate right-of-way widths will vary between 140 feet and 270 feet, depending on the channel bottom width.

The advantages of the soil cement lined channel are:

- Low construction cost, less labor intensive.
- 2:1 sideslope requires less right-of-way than Alternatives 1 through 5.
- Increased channel flow velocity will reduce aggredation problems. Higher flow velocity will reduce the bottom width requirements in reaches bounded by existing residential lots.
- Lower maintenance cost than Alternatives 1, 2 and 5; same maintenance cost as Alternative 4 (shotcrete lining).
- Soil cement surface at the top of bank could serve as an access road.
- Vegetation will not grow through the bank lining; maintenance will be required only in the channel bottom.

The disadvantages of the soil cement lined channel are:

- Maximum tolerable channel velocity is no higher than riprap or gabions (9 fps). Since the roughness is reduced, the streamflow velocity increases and the existing degrading conditions in the majority of the reaches would be aggravated. This alternative requires the construction of additional grade control structures (in degrading reaches) to flatten streambed slopes (lower velocity).
- Bank lining will not be as durable as the shotcrete or concrete alternatives (4 and 6) for the higher streamflows.
- Access ramps would provide the only means of escape in emergency situations.
- Not aesthetically pleasing, unnatural looking channel banks.

The channel velocities exceed 9 fps in all but four of the proposed improvement reaches. Grade control structures would be required on most reaches to reduce channel velocities. Construction of these grade control structures would require coordination with adjacent landowners and developments.

Alternative 4

Alternative 4 involves the construction of a trapezoidal channel with a natural earthen bottom ranging in width from 50 feet to 200 feet. Bank protection will consist of a 4- to 6-inch thick

shotcrete (concrete) lining at a slope of 4 horizontal to 1 vertical. Ultimate right-of-way widths will vary depending on the channel bottom width but will range from 170 feet to 280 feet.

The advantages of a shotcrete lined channel are:

- A highly durable channel bank surface.
- Increased channel flow velocity would reduce aggradation problems. This higher flow velocity will reduce the bottom width requirements in reaches bounded by existing residential lots.
- Lower maintenance cost than Alternatives 1, 2 and 5; same maintenance cost as Alternative 3 (soil cement lining).

The disadvantages of a shotcrete channel lining are:

- Requires maximum right-of-way.
- Not aesthetically pleasing; banks set at 4:1 sideslope have a maximum visual impact.
- Maximum tolerable channel velocity is no higher than riprap, gabions or soil cement (9 fps).

Since the roughness is reduced, the streamflow velocity increases and the existing degrading conditions in the majority of the reaches will be aggravated. The channel velocities exceed 9 fps in all but four of the proposed improvement reaches. Grade control structures will be required on most reaches to reduce channel velocities. Construction of these grade control structures will require coordination with adjacent landowners and developments.

Alternative 5

This alternative involves the construction of a trapezoidal channel with a natural earthen bottom ranging in width from 50 feet to 200 feet. Bank protection will consist of gabions installed with a 3:1 sideslope. Ultimate right-of-way widths will vary depending on the channel bottom width, and channel depth, but width will range between 130 feet and 260 feet.

The advantages of the gabion-lined channel are:

- 3:1 sideslope requires less right-of-way than Alternative 1, and 4.
- Channel flow velocity more closely matches existing channel velocity.
- Lower maintenance cost than Alternative 1; same maintenance cost as Alternative 2.
- More durable than dumped riprap or grass.
- Gabions with soil covering are aesthetically pleasing, natural looking channel banks. Desert grasses and plants can grow on sideslopes. Uncovered gabions are moderately aesthetic with earth tone rock. Growth of desert plants on sideslopes is possible but limited.

- Matches existing channel bank improvements in the majority of the adjacent reaches.
- Gabions with soil covering minimize potential damage to wire baskets from vandalism and floating debris.

The disadvantages of the gabion-lined channel are:

- Maximum tolerable channel velocity is 9 feet per second.
- Bank lining will not be as durable as Alternative 3, 4, or 6 for higher streamflows.
- Vegetation growth on soil covered bank lining will require maintenance.
- Erosion of the soil covering over the gabion bank lining during large storm flows will require periodic maintenance.

Gabions will work in all reaches. Grade control structures will be required on several reaches. Construction of these grade control structures will require coordination with adjacent landowners and developments.

Alternative 6

Alternative 6 consists of a rectangular, fully lined concrete channel ranging in width from 50 feet to 200 feet. Ultimate right-of-way widths will vary depending on the width of the channel bottom and channel depth, but width will range between 80 feet and 240 feet.

The advantages of a rectangular concrete channel are:

- Minimum right-of-way requirements.
- High channel velocities will be maintained and flush out most debris.
- Streambed erosion completely eliminated.
- Grade control structures are not required.
- Minimum bank height requirements.
- Least prone to aggradation.
- No vegetation management required.

The disadvantages of the rectangular concrete channel are:

- Fencing will be required because trespassers will not be able to escape high storm flows.
- Most expensive alternative.
- Least visually appealing.
- Smooth concrete would be prone to graffiti (even with a fence); vagrants are more likely to occupy concrete channels.
- Passive recreation will be limited to the upper access road.
- All existing dip crossings will require replacement with concrete box culverts or bridges.

Alternative 7

This alternative involves retaining the existing channel, and removing vegetation to improve hydraulic capacity. Right-of-way widths vary depending on the existing channel width, but will range from 170 to 280 feet.

The advantages of the existing channel are:

- No construction cost because the existing channel alignment and cross section are retained.
- Vegetative management will improve channel hydraulic capacity and aesthetics.

The disadvantages of the existing channel with vegetative management are:

- Maximum tolerable channel velocity is limited to 5 feet per second.
- Where channel stream velocity exceed 5 feet per second, the banks are not stable because of the presence of non-cohesive soil lenses in banks. Thus the required right-of-way width is difficult to predict.
- Risk of property damage to subdivisions adjacent to the channel is much higher than other alternatives because of unstable banks during high flow events.

Vegetative management requires periodic trimming of bushes to the level of the streambed. Plant roots will remain and continue to stabilize the streambed. These plants will eventually grow back, but the overall channel roughness will be reduced for the majority of the year. Larger existing mesquite or palo verde trees should be trimmed up to a height of 8 feet. This vegetation management plan would lower the channel roughness (n-value) for the majority of flows.

ALTERNATIVES CONSIDERED AND DISCONTINUED

Alternatives 1 through 7 were investigated and discontinued from consideration through one or more of the reaches for reasons presented in the following paragraphs. A summary of the evaluation is presented in Table IV-2, Alternative Matrix, at the end of this section.

Alternative 1

Although the trapezoidal section with grassed bottom and banks of Alternative 1 have high aesthetic appeal, the high runoff velocities within the channel exceed the maximum allowable velocity for channels of this type for reaches 1 through 7 and reach 10. The wide channel section would be constrained by planned development in reach 2, and not possible because of existing developments in reaches 1, 3, a portion of reach 4, and 7. Reaches 8 and 9 currently have natural bottoms and banks, but only require vegetative management to improve the hydraulic capacity. Reach 11, north of Beardsley Road, will remain a natural channel, improvements are outside this scope of work.

Alternative 2

The trapezoidal section with natural bottom and dumped riprap banks is not aesthetically appealing, and is very difficult for horses to climb in emergency situations. The City of Glendale is committed to an aesthetically pleasing channel, thus alternative 2 is not acceptable to the city (Reaches 2 through 7). Reaches 8 and 9, which currently have natural bottoms and banks, do not require bank protection. Reach 10 has a short channel segment in which dumped riprap will be acceptable. Reach 11, north of Beardsley Road, will remain a natural channel, improvements are outside this scope of work.

Alternative 3

Like Alternative 2, the trapezoidal section with natural bottom and soil cement banks is not aesthetically appealing, and is impossible for horses to climb in emergency situations. The City of Glendale is committed to an aesthetically pleasing channel, thus alternative 3 is not acceptable to the city (Reaches 2 through 7). Reaches 8 and 9, which currently have natural bottoms and banks, do not require bank protection. Reach 10 has a short segment of channel in which soil cement bank protection will be functionally acceptable. Reach 11, north of Beardsley Road, will remain a natural channel, improvements are outside this scope of work.

Alternative 4

The trapezoidal section with natural bottom and shotcrete banks is not aesthetically appealing, and is difficult for horses to climb in emergency situations. The City of Glendale is committed to an aesthetically pleasing channel, thus alternative 4 is not acceptable to the city (Reaches 2 through 7). Reaches 8 and 9, which currently have natural bottoms and banks, do not require bank protection. Reach 10 has shotcrete lining for a majority of the reach and would be acceptable for the remaining portion of the reach that is unlined. Reach 11, north of Beardsley Road, will remain a natural channel, improvements are outside this scope of work.

Alternative 5

The trapezoidal section with natural bottom and gabion banks is not aesthetically appealing with exposed wire and rock, and is very difficult for horses to climb in emergency situations. The City of Glendale is committed to an aesthetically pleasing channel, thus alternative 5 is not acceptable to the city (Reaches 2 through 7). However, the option of having a soil covering over the gabions is acceptable to the City of Glendale. Reaches 8 and 9, which currently have natural bottoms and banks, do not require bank protection. Reach 10 has a short segment of channel that gabion bank protection would be acceptable. Reach 11, north of Beardsley Road, will remain a natural channel, improvements are outside this scope of work.

Alternative 6

The rectangular section with concrete bottom and sides is not aesthetically appealing. The City of Glendale is committed to an aesthetically pleasing channel, thus alternative 6 is not acceptable to the city (Reaches 2 through 7). Reaches 8 and 9, which currently have natural bottoms and banks, do not require bank protection. Reach 10 has a short segment of channel that the concrete channel will be functionally acceptable. Reach 11, north of Beardsley Road, will remain a natural channel, improvements are outside this scope of work.

Alternative 7

Although the natural channel section with desert vegetation of Alternative 7 has high aesthetic appeal, the high runoff velocities within the channel exceed the maximum allowable velocity for channels of this type for reaches 1 through 7, and reach 10. Reaches 8 and 9, which currently have natural bottoms and banks, require vegetative management to maintain conveyance capacity of the existing channel section.

A summary of the above evaluation is presented on the following page in Table IV-2, Alternatives Matrix.

Table IV-2
Alternatives Matrix
Skunk Creek Master Plan

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	"No Action"
Alternatives Description	Trapezoidal channel with grassed bottom and banks.	Trapezoidal channel with with natural bottom and dumped riprap on banks.	Trapezoidal channel with natural bottom and soil cement banks.	Trapezoidal channel with natural bottom and shot-crete on banks.	Trapezoidal channel with natural bottom and soil covered gabions on banks. (See Note 1)	Rectangular channel with concrete bottom and sides.	Existing natural channel with vegetative manage-ment.	Trapezoidal channel with natural bottom and comb-nation shotcrete, natural, gabion, and riprap sides.	No change to existing channel section.
Reach									
1 (See Note 2)	Not Recommended	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Not Recommended	Acceptable See Note 2	Not Recommended
2	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Not Recommended	Not Recommended	Acceptable Selected Alternative 5	Not Recommended
3	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Not Recommended	Not Recommended	Acceptable Selected Alternative 5	Not Recommended
4	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Not Recommended	Not Recommended	Acceptable Selected Alternative 5	Not Recommended
5	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Not Recommended	Not Recommended	Acceptable Selected Alternative 5	Not Recommended
6	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Not Recommended	Not Recommended	Acceptable Selected Alternative 5	Not Recommended
7	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Not Recommended	Not Recommended	Acceptable Selected Alternative 5	Not Recommended
8	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Acceptable Selected Alternative 7	Not Recommended
9	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Acceptable Selected Alternative 7	Not Recommended
10	Not Recommended	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Not Recommended	Acceptable Selected Alternative 4	Not Recommended
11	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Not Recommended	Acceptable	Acceptable Selected Alternative 7	Not Recommended

Notes:
1. Exposed gabions (Alt. 5a) are recommended for a portion of Reach 7 upstream of 51st Avenue bridge and portion of Reach 10.
2. The City of Peoria selected concrete bottom with grouted riprap sideslopes for Reach 1 (Station 54+00 to 69+25) as part of Paradise Lane Improvement District midway through study.

RECOMMENDED ALTERNATIVE 8

This alternative involved selecting one or more alternatives from each reach and combining them to form the recommended alternative. The right-of-way widths vary depending on the existing channel width but will be in the range of 170 to 280 feet. The following alternatives were selected for reaches 1-11:

Reach 1 — Station 54+00 to 69+25

Grouted riprap sideslopes with concrete bottom were selected by the City of Peoria to line the channel through a new commercial area from Station 54+00 to 69+25.

Reach 2 — Station 69+25 to 124+73

Utilize soil covered gabions with natural bottom (Alt. 5b).

Reach 3 — Station 124+73 to 164+88

Utilize soil covered gabions with natural bottom (Alt. 5b).

Reach 4 — Station 164+88 to 197+53

Utilize existing exposed gabions with natural bottom (Alt. 5a).
Replace existing exposed gabions in place on south side of channel from Station 164+88 to 171+20 with soil covered gabions (Alt. 5b).

Reach 5 — Station 197+53 to 224+78

Utilize soil covered gabions with natural bottom (Alt. 5b).
Utilize existing soil covered gabions in place on north side of channel from Station 224+78 to 213+90.

Reach 6 — Station 224+78 to 253+73

Utilize soil covered gabions with natural bottom (Alt. 5b).
Utilize existing exposed gabions in place on south side of channel from Station 239+75 to 253+73.
Replace existing exposed gabions in place on north side of channel from Station 247+36 to 253+00 with new soil covered gabions (Alt. 5b).

Reach 7 — Station 253+73 to 270+22

Utilize existing soil cement in place on both sides of channel from Station 253+73 to 259+46.
Utilize exposed gabions with natural bottom (Alt. 5a) on the south side from Station 259+46 to Station 264+06 (see Other Considerations).
Utilize exposed gabions with natural bottom (Alt. 5a) on the north side from Station 259+46 to Station 260+60 (see Other Considerations).
Utilize existing exposed gabions in place on south side of channel from Station 260+60 to 269+50.

Utilize existing exposed gabions in place on north side of channel from Station 264+06 to 270+22.

Reach 8 — Station 270+22 to 288+17
Utilize existing natural channel with vegetative management (Alt.7).

Reach 9 — Station 288+17 to 296+40
Utilize existing natural channel with vegetative management (Alt.7).

Reach 10 — Station 296+40 to 316+87
Utilize shotcrete sideslopes with natural bottom (Alt. 4) from Station 296+40 to 303+92.
Utilize existing shotcrete in place on both sides of channel from Station 303+92 to 316+87.

Reach 11 — Station 316+87 to 344+34
Utilize existing natural channel with vegetative management (Alt.7).

Soil covered gabions were selected for most of the reaches (1-7). The advantages/disadvantages of the gabion-lined channel are have been outlined under Alternative 5. The major reasons for selecting gabions being:

- Gabions with soil covering are aesthetically pleasing, providing natural looking channel banks. Desert grasses and plants can grow on the sideslopes enhancing their appearance.
- Most of the existing bank protection along Skunk Creek uses gabions. Thus new gabions would tie into a similar channel bank improvement system.

Reaches 8, 9, and 11 are functioning well in their current condition. These reaches require only periodic vegetative management to maintain their channel hydraulic capacity.

Shotcrete channel bank protection was selected to match the existing bank protection used in an upstream portion of reach 10.

The alternatives selected from each reach to form Recommended Alternative 8 has been shown in Table IV-2, Alternative Matrix. Preliminary plan and profile drawings of Alternative 8 are located in Section X of this report.

LOW-FLOW CHANNELS

In conjunction with the alternatives described above, low-flow channels were also investigated. The purpose of a low-flow channel is to provide conveyance of runoff from storms less than 10-years to control meandering low-flow channels. Manmade channels with large width to depth ratios are vulnerable to the formation of low-flow channels. When trapezoidal channels are designed to carry large events, such as the 100-year flood, more frequent flows may cause a shallow sheetflow condition. Rather than conveying these flows

as sheetflow, the channel will develop a low-flow channel that provides a more efficient conveyance.

Low-flow channels will meander across the bottom of the larger channel, thus randomly coming into contact with the channel bank. It is important to acknowledge low-flow incisement when computing total scour depth for the bank-lining design. Field observations along the project limits of Skunk Creek showed existing incised low flow channels were approximately 1.0 to 1.5 feet deep.

For the purpose of this study, low-flow incisement will be controlled by including 1-foot of incisement in the total scour depth for use in the bank-lining toedown depth. The channel will be allowed to form its own low-flow channel. This will provide a more natural appearance.

OTHER CONSIDERATIONS

Development of the channel within Reach 7, starting approximately 200 feet upstream of the 51st Avenue bridge, has left a portion of the channel unlined. Approximately 150 to 200 feet of the south bank and 500 feet the north bank have not been lined. Flow velocities in the unlined section of the channel are between 7 and 8 fps for the 100-year storm. This exceeds the 5 fps allowable velocity for unlined earthen channels.

The 51st Avenue bridge abutments are protected with soil cement bank protection that extends approximately 200 feet on each side of the channel upstream of the bridge. Upstream of the unlined channel banks is a trapezoidal channel consisting of an earthen bottom and gabion lined banks. The gabion lining on the south bank terminates at a 10-inch diameter sewer crossing of Skunk Creek. The sewer line is encased in concrete with sloping cutoff walls upstream and downstream of the sewer. The grade of the sewer is sloping to the south at 0.24 percent. The top of the concrete is set at the bottom of Skunk Creek so that the sewer crossing will act as a grade control structure. It also should be mentioned that because the concrete encased sewer is not level, there is a good chance that a low-flow channel will form adjacent to the south bank of the channel at the sewer crossing. Thus, the unlined section of bank downstream from the sewer crossing will have a higher potential for erosion to occur.

It is recommended that the existing gabion bank protection be extended to the existing soil cement bank protection.

There are several locations where the existing bank is located behind the proposed channel bank. Construction the proposed banks using a 14-foot top of dike width and a 3:1 backslope would cause a low area behind the proposed channel bank to form. These low areas should be filled using excess material excavated from the channel or borrow material. Notes on the plans have been used to identify most of the low areas to be filled. The area left of Station 241+00 to 251+00 is an exception to the above. A dike with a minimum 3-feet of freeboard will be used in lieu of filling the area. A 24-inch culvert with a flap grate is needed to provide a means to drain the area into Skunk Creek.

Section V

RECREATIONAL AND MAINTENANCE CONSIDERATIONS

BICYCLE/PEDESTRIAN PATHWAYS

The bicycle / pedestrian trail system for the Skunk Creek Master Drainage Plan was intended to meet the following needs:

- To provide a continuous bicycle route from the ACDC/Skunk Creek confluence to 51st Avenue.
- To provide a trail system that remains above the 10-year water surface of Skunk Creek.
- To provide a paved trail that is wide enough to allow bicycles and pedestrians to simultaneously occupy the trail. The recommended bike path is 10 feet wide (12 foot would be preferable to bicyclists). Auxiliary trails are 8 feet or wider.
- To provide a buffer zone on each side for safety, and to allow meandering of the trail, as well as landscaping using low maintenance desert plants.
- The trail system would utilize at-grade crossings of arterial streets.
- To provide access ramps at key points along the route that would be handicapped-accessible. The ramps would meet the most current standards regarding access by wheelchair users. The locations of these "special" ramps were specifically noted in the trail descriptions below. The ramps could be used only during periods when Skunk Creek is not flowing ("dry-weather").
- To provide emergency exits out of the channel at regular intervals for all users, including equestrians.

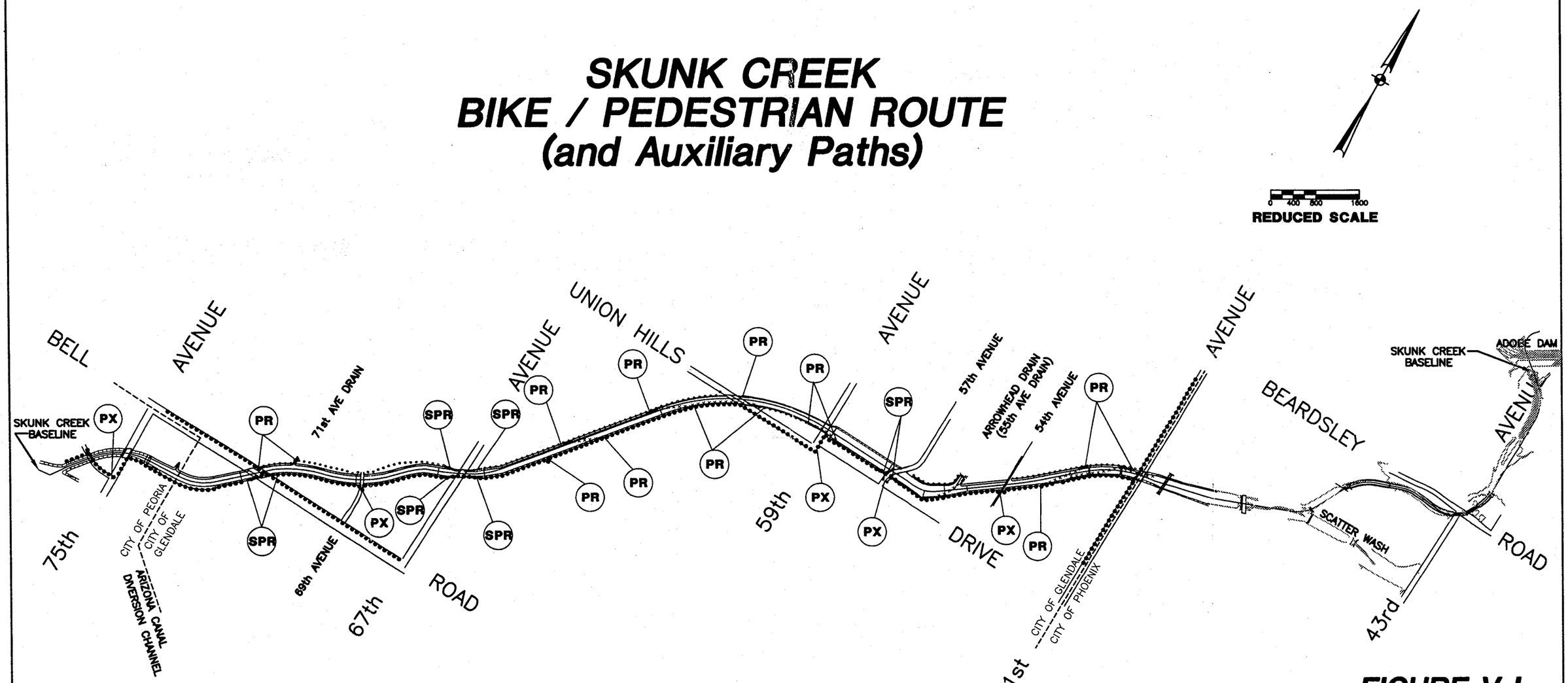
The bicycle/pedestrian trail is hereafter referred to as the "recommended bike route", but implies the combined use by bicyclists and pedestrians. Additional bike trails are called "auxiliary trails." All bike trails are described below on a reach by reach basis, from ACDC to 43rd Avenue. See Figure V-1, Bike/Pedestrian Paths, for a schematic of the path system.

REACH 1 (ACDC to end of concrete channel, east of 75th Avenue)

The recommended bike route begins on the east side of 75th Avenue, turns east and follows the south bank of Skunk Creek.

The City of Peoria has also specified that bicyclists traveling from the west, on Paradise Lane, must cross 75th Avenue to reach the aforementioned bike route.

SKUNK CREEK
BIKE / PEDESTRIAN ROUTE
(and Auxiliary Paths)



LEGEND

- CORPORATE BOUNDARY
- PRIMARY BIKE ROUTE
- AUXILIARY BIKE PATH
- OPTIONAL BIKE PATH (Across Channel)
- SPR — SPECIAL PEDESTRIAN RAMP (Conforms with requirements of the American Disability Act)
- PR — PEDESTRIAN RAMP (auxiliary)
- PX — PEDESTRIAN AT-GRADE CROSSING

FIGURE V-I

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	4/95
DRAWN	D. STOUGH	4/95
CHECKED	B. OLBERT	4/95

Sverdrup CORPORATION

BIKE / PEDESTRIAN PATHS

REACH 2 (End of concrete channel to 67th Avenue)

The recommended bike route is located on the south bank along this reach, and continues to Bell Road.

An auxiliary ramp is recommended at 69+00 on the south bank.

Special ramps are recommended at Bell Road on both the south bank at Station (Sta) 87+00 and 91+00. An additional special ramp is recommended on the north bank at Sta 90+00. Bicyclists could pass under the existing bridge during dry periods.

There is an existing bike path dip-crossing on the north side of the Bell Road bridge. It is recommended that this trail be realigned to match the recommended ramps. Installation of a paved path under the bridge (connecting the two ramps) would be at the discretion of the City of Glendale.

The recommended bike route is located on the south bank. North of Bell Road, an auxiliary bike trail is recommended on the north bank, that ties in with the planned trail at 71st Avenue channel.

On the north bank, bicyclists can cross the 71st Avenue channel using the bicycle path dip crossing (Sta 96+00). The future bicycle path on the north bank crosses 69th Avenue with an at-grade crossing and continues on to 67th Avenue. On the south bank, the bicyclists cross the future 69th Avenue at an at-grade crossing, set back from the channel.

From 69th Avenue to 67th Avenue, the recommended bike route is located on the south bank. During low flows, bicyclists could pass under the future bridge. Special ramps were planned at 67th Avenue on both the south and north banks (Sta 123+78 and 130+94).

During high flows, bicyclists could travel along the trail to Bell Road, turn east and cross Bell and 67th Avenue at the intersection, and then travel north along 67th Avenue to Skunk Creek to rejoin the route.

REACH 3 (67th Avenue to Union Hills Drive)

East of 67th Avenue, the recommended bike route is located on the south bank. An auxiliary trail (8-foot wide) is recommended for the north bank.

REACH 4 (Union Hills Drive to 59th Avenue)

An auxiliary bike trail is recommended for the south bank between Union Hills and 59th Avenue. However, the primary bike route will turn east on the south side of Union Hills Drive. Bicyclists will cross Union Hills Drive and 59th Avenue (at the intersection), and then travel north to intercept the bike route at Skunk Creek.

Although ramps are recommended at 59th Avenue and Union Hills Drive, a bicycle path under the two bridges is not recommended. Installation of a paved path in the channel, under the two bridges, would be at the discretion of the City of Glendale.

REACH 5 (59th Avenue to confluence with 55th Ave Channel)

The recommended bike route along this reach is located on the south bank, then turns southeast to an at-grade crossing at the intersection of 57th Avenue and Union Hills Drive.

During dry weather, bicyclists could use the down-ramp on the south bank (Sta 207+50), cross 57th Avenue using the two recommended equestrian ramps (Sta 210+50), and use the up-ramp to the south bank, east of 57th Avenue (Sta 213+00).

East of 57th Avenue, an auxiliary trail is recommended on the north bank, in the vicinity of the existing park/baseball area.

It is recommended that the grouted riprap channel lining be removed at the confluence with 55th Avenue drainage channel (for hydraulic reasons).

A ramp is recommended on the south bank of Skunk Creek, opposite the 55th Avenue channel (Sta 221+00). A ramp is also recommended on the east bank of the 55th Ave channel (Sta 224+00). Installation of a paved path, across the channel connecting the south and north ramp, would be at the discretion of the City of Glendale. During dry periods, bicyclists could cross the channel, in the confluence area.

REACH 6 (confluence with 55th Ave channel to 51st Ave)

The recommended bike route is located on the south bank, east to 51st Avenue, and will cross 54th Avenue at an at-grade crossing. East of 54th Avenue, an auxiliary bike trail is recommended for the north bank.

REACH 7 (51st Avenue to 48th Lane)

Due to recent construction of channel linings and existing subdivisions, no new bike trails were planned in Reach 7. The recommended bike route ends on the west side of 51st Avenue. From there, bicyclists could travel north or south.

Installation of a paved path on one of the Skunk Creek channel banks (connecting 51st Avenue and 48th Avenue), will need to be addressed by the City of Phoenix.

REACH 8 (48th Lane to confluence with Scatter Wash)

The recommended bike route along this reach is through the adjacent residential areas.

REACH 9 (confluence with Scatter Wash to Wahalla Drive)

The recommended bike route along this reach is through the adjacent residential areas.

REACH 10 (Wahalla Drive to 43rd Avenue)

The recommended bike route is located on the north bank, east to 43rd Avenue.

EQUESTRIAN AND MAINTENANCE ACCESS

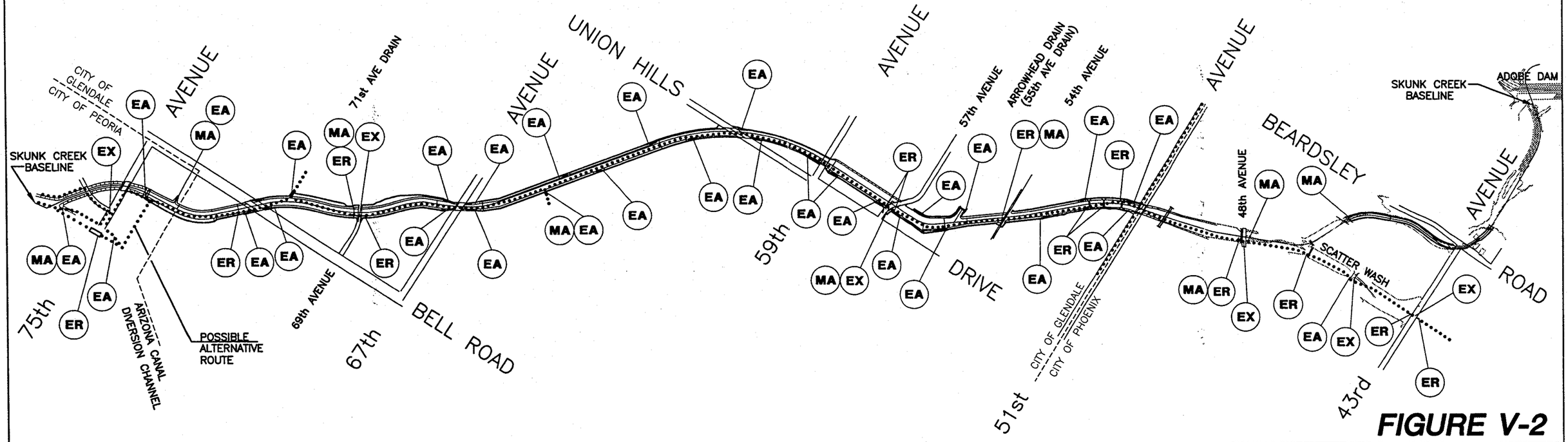
The equestrian trail system included in the Skunk Creek Master Drainage Plan was intended to meet the following needs:

- To provide a continuous equestrian trail from the ACDC/Skunk Creek confluence to the Scatter Wash/Skunk Creek confluence.
- To provide a trail system that remains primarily in the Skunk Creek streambed, minimizing at-grade crossings of arterial streets.
- To keep the trail in a sandy, vegetated setting with earth-covered channel banks.
- To provide alternate paths for periods of high flows in Skunk Creek.
- To provide access ramps that horses can negotiate easily (10 feet wide, 10 percent maximum grade, using asphalt concrete surfacing).
- To provide access ramps at known equestrian egress points, existing equestrian oriented neighborhoods, future equestrian attractors, and existing or future equestrian trail crossings.
- To provide emergency exits for equestrians out of the channel at regular intervals.
- To improve access past barriers at existing or recommended grade control structures.

The trail system is described herein on a reach by reach basis, from ACDC to 43rd Avenue. See Figure V-2, Equestrian & Maintenance Access, for a schematic of the trail system and access point locations.

SKUNK CREEK
EQUESTRIAN ROUTE
(and Maintenance Access)

0 400 800 1600
REDUCED SCALE



LEGEND

- CORPORATE BOUNDARY
- RECOMMENDED EQUESTRIAN ROUTE
- (ER) EQUESTRIAN RAMP (at Grade Control Structure)
- (EA) EQUESTRIAN ACCESS RAMP (Combined Use Ramp)
- (EX) EQUESTRIAN AT-GRADE CROSSING
- (MA) MAINTENANCE ACCESS RAMP

FIGURE V-2

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	4/95
DRAWN	D. STOUGH	4/95
CHECKED	B. OLBERT	4/95

Sverdrup CORPORATION

EQUESTRIAN / MAINTENANCE ACCESS

REACH 1 (ACDC to end of concrete channel, east of 75th Avenue)

The channel in this reach has already been planned by the City of Peoria. The main equestrian trail is not within the channel. Equestrians are neither intended nor expected to negotiate the future grade control structure east of 75th Avenue (Sta 69+25). The equestrian route will begin at the existing ramp out of ACDC, east of 75th Avenue. The City of Peoria has agreed to specify an equestrian corridor along the east side of 75th Avenue, northward to Skunk Creek. From there, equestrians follow a trail on the south bank for approximately 400 feet. At the upstream limit of the concrete lined streambed, a ramp will be provided on the south bank (Sta 69+25). An emergency/maintenance ramp is recommended on the north bank at approximately 73rd Avenue (Sta 74+06).

The City of Peoria has specified that equestrians traveling from the west, on the north bank of Skunk Creek, will cross Paradise Lane at an at-grade crossing. From there, equestrians will travel on the north side of Paradise Lane to 75th Avenue. There will be an at-grade crossing at 75th Avenue to reach the aforementioned equestrian corridor. This will be the only instance of an at-grade, arterial street-equestrian crossing, within this Master Drainage Plan.

A ramp at the ACDC drop structure just west of 75th Avenue would improve continuity of equestrian use of the ACDC and Skunk Creek east and west of the drop structure.

REACH 2 (End of concrete channel to 67th Avenue)

Between 67th Avenue and Bell Road, the dry-weather equestrian route in this reach is a natural sand trail located within the channel. During wet weather, equestrians can follow the bike path on the south bank.

During dry periods, equestrians will be able to pass under the existing bridge at Bell Road.

An equestrian ramp is recommended at the new grade control drop structure (Sta 86+24).

Ramps are recommended at Bell Road on both the south bank at Sta 87+00 and 91+00. An additional ramp is recommended on the north bank at Sta 90+00.

Upstream of Bell Road, the dry-weather equestrian route is a natural sand trail located within the channel. During wet weather, equestrians can follow the bike path on the north or south bank.

Access up the 71st Avenue channel (Sta 97+00) is recommended. Equestrians can either continue north up 71st Avenue channel or climb out using the bicycle path dip crossing.

For the recommended streambed grade, two equestrian ramps are recommended at the 69th Avenue dip crossing (Sta 108+30). However, the equestrian ramps will not be needed for the interim dip crossing.

REACH 3 (67th Avenue to Union Hills Drive)

During dry periods, equestrians will be able to pass under the future bridge at 67th Avenue (planned by City of Glendale). Ramps were planned for both banks, on both sides of 67th Avenue (Sta 123+78 and 130+94). The dry-weather equestrian route in this reach is a natural sand trail located within the channel. During wet weather, equestrians can follow the bike path on the north or south bank.

An equestrian/maintenance ramp is recommended on the south bank at St. John Avenue (Sta 142+70).

Additional ramps are recommended on the north bank (sta 146+00) and on the south bank (Sta 154+00). These ramps will be in the vicinity of future parks or equestrian riding areas. Ramps are recommended on the north bank at Sta 162+00 and the south bank (Sta 171+00) to provide access to Union Hills Drive, south side.

REACH 4 (Union Hills Drive to 59th Avenue)

During dry periods, equestrians will be able to pass under the existing bridge at Union Hills Drive.

The dry-weather equestrian route in this reach is a natural sand trail located within the channel. During wet weather, equestrians can follow the bike path on the south bank.

Ramps are recommended on the south bank, north of Union Hills Drive (Sta 183+50) and on the north bank (Sta 179+90).

During dry periods, equestrians will be able to pass under the existing bridge at 59th Avenue.

A ramp is recommended on the south bank, west of 59th Avenue (Sta 193+00) and east of 59th Avenue (Sta 199+50).

REACH 5 (59th Avenue to confluence with 55th Ave Channel)

The dry-weather equestrian route in this reach is a natural sand trail located within the channel. During wet weather, equestrians can follow the bike path on the south bank. A ramp is recommended on the south bank, west of 57th Avenue (Sta 207+50). Two equestrian ramps are recommended at the 57th Avenue dip crossing (Sta 210+50). A ramp is recommended on the south bank, east of 57th Avenue (Sta 213+00). A ramp providing access to the existing park is recommended on the north bank, east of 57th Avenue (Sta 216+00). It is also recommended that the grouted riprap channel lining be removed from the confluence with the 55th Avenue drainage channel (for hydraulic reasons), and allow the equestrians to remain in the channel in the confluence area.

A ramp is recommended on the south bank of Skunk Creek, opposite the 55th Avenue channel (Sta 221+00). A recommended grade control structure on the 55th Avenue channel

will pose a barrier to northbound equestrians. Therefore, a ramp is recommended on the east bank of the 55th Avenue channel, just north of the confluence (Sta 2+50, 55th Ave. drain).

REACH 6 (confluence with 55th Ave channel to 51st Ave)

The dry-weather equestrian route in this reach is a natural sand trail located within the channel. During wet weather, equestrians can follow the bike path on the south bank. Equestrians will be able to cross the 54th Avenue dip-crossing using the recommended equestrian ramp. Ramps are recommended on the south bank, near the 53rd Avenue alignment (Sta 238+00) and the north bank (Sta 247+00). Equestrian ramps are required at recommended grade control structures, west of 51st Avenue (Sta 247+36, 249+75 and 253+09). Ramps are recommended on the north and south bank, west of 51st Avenue (Sta 255+00).

REACH 7 (51st Avenue to 48th Lane)

Due to recent construction of channel linings and the lack of channel side access, no ramps are recommended in Reach 7.

REACH 8 (48th Lane to confluence with Scatter Wash)

An equestrian/maintenance ramp is recommended for the existing grade control structure at the 48th Avenue dip crossing (Sta 275+66).

SCATTER WASH (east of confluence)

An equestrian ramp is recommended at the existing grade control structure in Scatter Wash, east of its confluence (approximate Sta 287+00) with Skunk Creek.

The City of Phoenix will be responsible for equestrian access across 43rd Avenue via a trail system. As a result, riders will be able to continue farther east, to ultimately cross under the future Outer Loop Freeway.

REACH 9 (confluence with Scatter Wash to Wahalla Drive)

The channel in this reach has already been built by developers. Although some equestrian traffic does occur in this reach, there is no outlet to the north. Therefore, no new ramps are recommended in this reach, and equestrians will not be encouraged to use this portion of the channel.

REACH 10 (Wahalla Drive to 43rd Avenue)

Access for maintenance vehicles is recommended on the north bank, just upstream of the Wahalla Drive grade control structure. Very little equestrian traffic occurs in this reach, and there is no outlet to the north. Therefore, no other ramps are recommended in this reach, and equestrians will not be encouraged to use this portion of the channel.

Section VI

ENVIRONMENTAL CONSIDERATIONS

As part of the alternatives development process, potential impacts were identified and are described in the following sections.

LAND USE

Existing land use along the Skunk Creek corridor is a mixture of undeveloped land and residential and commercial properties. All undeveloped land is privately owned.

Coordination with the Phoenix, Glendale, and Peoria Planning Departments indicated that the privately owned lands are zoned for residential uses, except for two areas. The first area is located in the City of Peoria and is bounded by the ACDC, Skunk Creek, and the Glendale city limits. This area is zoned as a light industrial and general agricultural district. The second area is located in the City of Glendale and is located between 57th Avenue and 53rd Avenue. This area is zoned as Agricultural. Proposed improvements along Skunk Creek should not adversely affect existing or future land uses.

HAZARDOUS MATERIALS

An environmental site assessment of the project area was conducted by Certified Environmental Corporation, Inc./Water Resources Associates, Inc. (CEC/WRA) under a separate contract with the Flood Control District. Results of that assessment were contained in a report entitled "Phase I Environmental Site Assessment at the Skunk Creek Wash between the Intersections of 43rd Avenue and Beardsley Road and approximately 75th Avenue and Bell Road," dated April 27, 1994.

This report identified two sites where further investigation was recommended, those being:

- Rainbow Enterprises Landfill, on the left bank of 54th Avenue.
- Auto Repairs/Salvage Yard on the right bank at 54th Avenue.

There is sporadic surface dumping throughout the entire length of the wash. Other than these locations, there were no observations or evidence to suggest the potential presence of hazardous substances within the project area.

Additional subsurface investigations for the above-listed sites were performed by CEC/WRA and described in a report entitled "Exploration Trenching for Further Site Characterization at the Skunk Creek Channel, near 54th Avenue and Union Hills Road in Glendale, Arizona," dated June 29, 1994. Based on this investigation, CEC/WRA concluded that there was no significant evidence to suggest the presence of subsurface hazardous materials within the Rainbow Enterprises Landfill. No special handling of the landfill material will be required. The landfill contains construction materials such as concrete, cinder block, and brick.

Investigation of the Auto Repairs/Salvage Yard revealed petroleum hydrocarbon contamination. Future construction of channel improvements in this area will require additional subsurface investigations to determine the depth and lateral extent of the plume.

CULTURAL RESOURCES

Archeological investigations were conducted by Scientific Archeological Services (SAS) under two separate contracts with the Flood Control District. Results of those investigations are contained in reports entitled "The Skunk Creek Master Plan Archeological Inventory Project of Northern Glendale, Arizona," dated June 29, 1994, and "The Skunk Creek Master Plan Archeological Addendum Inventory Project at Northern Phoenix, Arizona," dated August 10, 1994.

A thorough literature search and site records check of the entire area surrounding the project was performed. Archival records indicate the former existence of four historic features: two branches of the 1894 Frog Tanks to Phoenix Road; a western portion of the Arizona Canal; and the eastern section of the Extension Arizona Canal. These four historic features have evidently been destroyed by urban development as no physical evidence or observable features remain. These records also revealed a large rock art site (NA15,912 or AZ T:8:3 (ASM)), the largest part of which was later included on the National Register of Historic Places. The southern most portion of the rock art site, is a smaller site known as Locality X, is eligible for the National Register, but was excluded because it was on private property. This site is located approximately 700 feet north of Beardsley Road and 30 feet west of Skunk Creek. No channel improvements are proposed for that reach of Skunk Creek.

SECTION 404 AND FLOODPLAIN CONSIDERATIONS

The Flood Control District completed a delineation of the waters of the United States in May 1994, which was subsequently approved by the Regulatory Branch of the Los Angeles District Corps of Engineers (COE). Results of the delineation indicated the Corps of Engineers has jurisdictional authority over Skunk Creek for the entire project length from the ACDC to Adobe Dam. Any alteration of Skunk Creek between the ordinary high water marks will require Section 404 permits from the Corps of Engineers and must be in compliance with 33 CFR, Part 330, of the Clean Water Act.

Skunk Creek is an intermittent stream located in Zone A, 100-year floodplain as indicated on the Flood Insurance Rate Maps (Panels 1190 and 1195; Map Nos. 04013C1190F and 04013C1195D) prepared by the Federal Emergency Management Agency.

THREATENED AND ENDANGERED SPECIES

In consultation with the U.S. Fish and Wildlife Service (USFWS), it has been determined that there are no listed or proposed threatened or endangered species, or other important resources, which would likely be affected by future channel improvements.

VEGETATION

A vegetation survey was completed by the Flood Control District, Construction and Operations Division, Environmental Branch on June 13, 1994. Sampling and vegetation types were determined along the banks of the wash and the channel bottom.

Paloverde and mesquite are the predominant trees occurring along the drainageway, and burro brush and cheesebush are the dominant shrubs. A summary of the plant densities occurring along the channel is listed in Table VI-1.

Table VI-1
SKUNK CREEK PLANT DENSITIES

Common Name	Scientific Name	Plants per Acre
On Skunk Creek Banks		
Paloverde	*Cercidium floridum*	26
Mesquite	*Prosopis juliflora*	4
Catclaw	*Acacia greggii*	4
Wolfberry	*Lycium andersonii*	10
Skunk Creek Channel		
Burro Brush	*Hymenoclea monogyra*	124
Cheesebush	*Hymenoclea salsola*	132
Canyon Ragweed	*Ambrosia ambrosioides*	67
Desert Broom	*Baccharis sarothroides*	28
Bebbia	*Bebbia juncea*	44

Native species should be utilized for aesthetic treatments and revegetation. The following seed mix (Table VI-2) can be considered for overbank areas disturbed by construction activities.

Table VI-2
REVEGETATION SEED MIX

Common Name	Scientific Name	Seeding Rate (# PLS/Acre)
Catclaw	*Acacia greggii*	3.0
Canyon Ragweed	*Ambrosia ambrosioides*	3.0
Triangle-Leaf Bursage	*Ambrosia deltoidea*	3.0
Globemallow	*Sphaeralcea ambigua*	1.5
Creosote Bush	*Larrea divaricata*	6.0
Purple Threeawn	*Aristida purpurea*	1.0
Sand Dropseed	*Sporobolus cryptandrus*	1.0
Desert Cassia	*Cassis covesii*	2.0
Desert Lupine	*Lupinus sparsiflorus*	2.0
	TOTAL	**22.5**

WATER QUALITY

Improvements within Skunk Creek will have the potential for temporary effects upon the water quality of the wash. The actual extent of these effects will depend upon the time of year in which construction occurs, as the wash is an intermittent stream that is dry for most of the year. The developer or entity responsible for construction of the improvements must obtain a water quality certification from the Arizona Department of Environmental Quality (ADEQ) prior to the COE issuance of a Section 404 permit.

In addition, a National Pollutant Discharge Elimination System (NPDES) permit will be required from the Environmental Protection Agency in order to construct any improvements in or adjacent to existing streams and washes. All potential impacts will be minimized by adhering to FCD's Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control.

Skunk Creek is not designated as a wild and scenic river, and, therefore, does not require special consideration as required by the Wild and Scenic Rivers Act (16 USC 1271-1287).

CONSTRUCTION IMPACTS

Temporary air and noise impacts will occur during construction of the Skunk Creek improvements. The construction contractor will be required to control fugitive dust with water applications and comply with City and County regulations to minimize air and noise impacts. To control erosion, areas disturbed by construction will be either revegetated with indigenous plant species (as listed earlier in this section) or bank protection will be constructed.

Section VII

SCOUR ANALYSIS & SEDIMENT TRANSPORT

This following section presents a technical discussion of the engineering assumptions and methodologies used to develop the channel design recommendations. A sediment transport analysis was conducted in order to investigate the potential for aggradation and long-term scour potential for those sections of the channel with earth bottoms. In addition, single event bed scour analysis was conducted for this project.

In the initial phase of the channel design, the primary concern was for the channel section, the channel capacity, and width constraints at various existing and future structures. This second phase of the design involved calculations of several elements: Sediment Supply, Equilibrium Bed Slopes, Channel Bed Slopes and Drop Structures locations, Bank Lining Toedown Depth, and Placement of Cutoff Walls.

SEDIMENT SUPPLY

The existing Skunk Creek channel geometry and sediment transport characteristics have been modified from its natural state throughout the study reach. The Adobe Dam intercepts water and sediment flows from the watershed above the study reach. Urbanization of both the Scatter Wash basin and the Skunk Creek basin down to the confluence with the Arizona Canal Diversion Channel have reduced sediment inflow into Skunk Creek.

Therefore, the result will be less sediment entering the system than the channel flows are capable of transporting. The tendency of sediment deprived channels is to erode either the channel banks or the channel bed as a source of sediment. Since lateral erosion of the channel banks will be controlled by the application of bank protection, this study will only investigate the potential for long-term vertical movement of the channel bed. This analysis will employ the concept of equilibrium slope to determine the long-term trend for aggradation or degradation of the channel bed.

The equilibrium slope is defined as the slope at which the sediment transport capacity of the channel is equal to the dominant, incoming sediment supply. When the equilibrium slope and channel bed slope are equal, the channel bed will neither aggrade nor degrade.

The first step in the analysis is to determine the existing sediment supply to the channel. For ephemeral channels, the 5 to 10-year event is considered the dominant discharge most responsible for affecting long-term changes to the channel. The 10-year event was selected for use in this study.

Because the sediment supply to Skunk Creek has been altered due to urbanization of the area and construction of the Adobe Dam, the sediment supply was determined by selecting sections of the existing channel that appeared to be in a state of equilibrium. From field reconnaissance, four example locations were selected.

Station 177+63	Downstream from Union Hills Drive Bridge
Station 273+39	Downstream from 48th Avenue Dip Crossing
Station 299+08	Upstream from Wahalla Lane Box Culvert
Station 322+40	Upstream from Beardsley Road Box Culvert

Bed-material data used for this study were taken from 14 sediment samples located along the length of the proposed channel. Sediment samples were taken from existing channel banks at four locations, but were not used in the sediment supply analysis. Based on a review of the gradation curves for these samples, the following D_{50} and gradation coefficients were selected for use in the equilibrium slope analysis for the listed reaches.

Reach	D_{50}	G
1 - 5	6.0 mm	7.08
6 - 8	4.0 mm	5.73
9 - 11	4.0 mm	5.58

These values, which are typical of sand-bed channels, were used for both the sediment supply calculations and the sediment transport rates through the proposed channel improvements. See Appendix C for the sample locations, gradation curves, and laboratory sieve analysis of these samples.

The following equation (Zeller-Fullerton, 1983) was used to compute the sediment supply in the existing channel. The Zeller-Fullerton equation is as follows:

$$q_s = 0.0064 \frac{n^{1.77} V^{4.32} G^{0.45}}{Y_h^{0.30} D_{50}^{0.61}}$$

where q_s = unit transport rate of bed-material load (cfs/ft)
n = Manning's "n" value
V = average channel velocity (fps)
G = gradation coefficient of bed-material
Y_h = hydraulic depth of flow (ft)
D_{50} = median diameter of bed-material particles (mm)

Using the HEC-2 run for existing conditions, the hydraulic parameters for the four locations selected as being in equilibrium, were used to compute the sediment supply for the appropriate reaches. The computed sediment supply rates for both subcritical and

supercritical flow regimes are listed below, and the sediment supply rate computations are provided in Appendix D.

Reach	Q_{10} (cfs)	Subcritical Q_s (cfs)	Supercritical Q_s (cfs)
1 - 5	2,970	3.5	29.3
6 - 8	2,270	0.5	36.6
9 - 10	1,730	1.1	7.0
11	1,730	0.7	4.7

Proceeding downstream along the channel alignment, the sediment supply should increase as more tributaries are intercepted. However, the data indicate that the sediment supply decreases from Reach 9 to Reach 8 in the subcritical regime. The sediment transport rate is reduced in a portion of Reach 8 due to a wide channel cross section and flat grade established by the drop structures at the 48th Avenue dip crossing and the Skunk Creek confluence with Scatter Wash. Field reconnaissance showed that this section of Reach 8 was aggrading. The sediment supply was calculated in a portion of Reach 8 downstream of the 48th Avenue dip crossing that appeared to be in equilibrium. The sediment supply increases again downstream of the Union Hills Drive bridge.

EQUILIBRIUM SLOPES

The second step was to compute the equilibrium slopes using the existing sediment supply rates and the normal depth flow parameters. The sediment supply rates are listed in Table VII-1 under the column titled "Target Q_s." The purpose of Table VII-1 is to calculate the equilibrium slope where: (1) the channel flow capacity matches the design flow at that section and; (2) the sediment transport rate of the channel matches the target sediment supply rate. The Zeller-Fullerton equation was used to calculate q_s and Q_s in each reach.

The equilibrium slopes were adjusted until the computed sediment transport capacities of the channel were approximately equal to the sediment supplies, "Target Q_s." Both the subcritical and supercritical "n" values were used in this analysis in order to examine a broad envelope of equilibrium slope scenarios. All hydraulic calculations in Table VII-1 are based on normal depth assumptions.

CHANNEL BED SLOPES AND DROP STRUCTURES

The third step was to set recommended channel bed slopes equal to the subcritical, 10-year, equilibrium slope (where possible). Grade control drop structures were specified in 6 locations. The HEC-2 channel improvements were changed to show the designed channel bottom and drop structures. The grade control structures were placed within areas of

recommended channel improvements or just downstream from bridges or low-water crossings.

Certain reaches called for a steeper grade than was physically possible (Reach 3, Sta 197+53 to 209+58 of Reach 5, and Sta 296+40 to 303+92 of Reach 10). In these cases, the channel capacity (and freeboard) or channel physical constraints governed the final bed slope. The channel bed slopes, grade breaks and drop structures are shown on Figure VII-1. The HEC-2 outputs for subcritical and supercritical, 10, 50 and 100-year flows are provided in Appendix F.

TABLE VII - 1

By: BDO
Ckd: DES

SKUNK CREEK MASTER PLAN

EQUILIBRIUM SLOPE CALCULATIONS (10-year event)

CHANNEL DIMENSIONS / PARAMETERS										SEDIMENT TRANSPORT CAPACITY						
REACH / STATION	Flow Regime	Depth	Equilibrium Channel Slope	Bottom Width	Side Slope	Mannings n	V (fps)	Calculated Q (cfs)	Target Q(10) (cfs)	Froude Number	Yh	G	D50 (mm)	qs (cfs/ft)	Calculated Qs (cfs)	Target Qs (cfs)
1	Subcritical	4.72	0.0031	60	2	0.023	9.06	2968	2970	0.78	4.16	7.08	6.00	0.0579	3.5	3.5
(61+00)	Supercritical	3.10	0.0128	60	2	0.023	14.45	2966	2970	1.51	2.83	7.08	6.00	0.4890	29.3	29.3
2	Subcritical	3.37	0.0048	130	3	0.035	6.28	2967	2970	0.62	3.14	7.08	6.00	0.0273	3.5	3.5
(75+11)	Supercritical	1.93	0.0161	130	3	0.025	11.34	2972	2970	1.47	1.85	7.08	6.00	0.2259	29.4	29.3
3	Subcritical	4.06	0.0044	100	2	0.035	6.76	2967	2970	0.61	3.78	7.08	6.00	0.0354	3.5	3.5
(125+73)	Supercritical	2.33	0.0146	100	2	0.025	12.18	2971	2970	1.44	2.23	7.08	6.00	0.2913	29.1	29.3
3	Subcritical	4.62	0.0044	80	2	0.035	7.21	2974	2970	0.62	4.19	7.08	6.00	0.0454	3.6	3.5
(128+67)	Supercritical	2.68	0.0141	80	2	0.025	12.96	2965	2970	1.44	2.52	7.08	6.00	0.3667	29.3	29.3
3	Subcritical	3.97	0.0046	100	3	0.035	6.71	2979	2970	0.62	3.59	7.08	6.00	0.0347	3.5	3.5
(130+94)	Supercritical	2.29	0.0152	100	3	0.025	12.16	2977	2970	1.46	2.15	7.08	6.00	0.2925	29.2	29.3
4	Subcritical	3.80	0.0044	112	2	0.035	6.54	2972	2970	0.61	3.57	7.08	6.00	0.0312	3.5	3.5
(170+88)	Supercritical	2.16	0.0150	112	2	0.025	11.81	2967	2970	1.44	2.08	7.08	6.00	0.2598	29.1	29.3
5	Subcritical	2.56	0.0052	200	3	0.035	5.58	2967	2970	0.63	2.47	7.08	6.00	0.0176	3.5	3.5
(211+32)	Supercritical	1.45	0.0180	200	3	0.025	10.06	2981	2970	1.49	1.42	7.08	6.00	0.1459	29.2	29.3
5	Subcritical	2.66	0.0051	190	3	0.035	5.66	2978	2970	0.62	2.56	7.08	6.00	0.0184	3.5	3.5
(222+73)	Supercritical	1.49	0.0179	190	3	0.025	10.20	2956	2970	1.49	1.46	7.08	6.00	0.1539	29.2	29.3
6	Subcritical	4.70	0.0015	100	3	0.035	4.24	2272	2270	0.37	4.18	5.73	4.00	0.0053	0.5	0.5
(224+78)	Supercritical	1.77	0.021	100	3	0.025	12.16	2266	2270	1.65	1.69	5.73	4.00	0.3656	36.6	36.6
6	Subcritical	4.46	0.0015	110	3	0.035	4.13	2274	2270	0.36	4.02	5.73	4.00	0.0048	0.5	0.5
(231+89)	Supercritical	1.66	0.0215	110	3	0.025	11.84	2261	2270	1.65	1.59	5.73	4.00	0.3323	36.6	36.6

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TABLE VII-1; EQUIL SLOPE-Q10, SCOUR.XLS

TABLE VII - 1

By: BDO
Ckd: DES

SKUNK CREEK MASTER PLAN

EQUILIBRIUM SLOPE CALCULATIONS (10-year event)

CHANNEL DIMENSIONS / PARAMETERS										SEDIMENT TRANSPORT CAPACITY						
REACH / STATION	Flow Regime	Depth	Equilibrium Channel Slope	Bottom Width	Side Slope	Mannings n	V (fps)	Calculated Q (cfs)	Target Q(10) (cfs)	Froude Number	Yh	G	D50 (mm)	qs (cfs/ft)	Calculated Qs (cfs)	Target Qs (cfs)
6	Subcritical	3.97	0.0015	135	3	0.035	3.89	2271	2270	0.36	3.67	5.73	4.00	0.0038	0.5	0.5
(239+77)	Supercritical	1.46	0.0225	135	3	0.025	11.22	2283	2270	1.66	1.42	5.73	4.00	0.2720	36.7	36.6
6	Subcritical	4.17	0.0015	125	2.5	0.035	4.03	2274	2270	0.36	3.87	5.73	4.00	0.0044	0.5	0.5
(243+54)	Supercritical	1.54	0.0218	125	2.5	0.025	11.44	2271	2270	1.65	1.50	5.73	4.00	0.2918	36.5	36.6
6	Subcritical	4.26	0.0015	120	2.5	0.035	4.07	2266	2270	0.36	3.94	5.73	4.00	0.0046	0.5	0.5
(245+36)	Supercritical	1.58	0.0217	120	2.5	0.025	11.60	2271	2270	1.65	1.53	5.73	4.00	0.3069	36.8	36.6
7	Subcritical	3.38	0.0015	180	2	0.035	3.60	2271	2270	0.35	3.26	5.73	4.00	0.0028	0.5	0.5
(261+20)	Supercritical	1.20	0.0244	180	2	0.025	10.37	2270	2270	1.68	1.18	5.73	4.00	0.2047	36.8	36.6
8	Subcritical	2.78	0.0016	240	3	0.035	3.28	2263	2270	0.35	2.69	5.73	4.00	0.0020	0.5	0.5
(276+36)	Supercritical	0.98	0.0271	240	3	0.025	9.57	2278	2270	1.71	0.97	5.73	4.00	0.1534	36.8	36.6
9	Subcritical	3.56	0.0033	80	4	0.035	5.15	1728	1730	0.52	3.09	5.73	4.00	0.0135	1.1	1.1
(288+17)	Supercritical	2.21	0.0088	80	4	0.025	8.85	1738	1730	1.10	2.01	5.73	4.00	0.0880	7.0	7.0
9	Subcritical	3.34	0.0033	90	4	0.035	5.00	1727	1730	0.51	2.96	5.73	4.00	0.0121	1.1	1.1
(291+40)	Supercritical	2.06	0.0089	90	4	0.025	8.58	1736	1730	1.10	1.90	5.73	4.00	0.0782	7.0	7.0
10	Subcritical	4.10	0.0029	70	2	0.035	5.40	1732	1730	0.49	3.71	5.73	4.00	0.0157	1.1	1.1
(296+40)	Supercritical	2.51	0.0078	70	2	0.025	9.20	1732	1730	1.06	2.35	5.73	4.00	0.0991	6.9	7.0
10	Subcritical	4.47	0.0029	60	2	0.035	5.62	1732	1730	0.50	3.96	5.73	4.00	0.0183	1.1	1.1
(303+92)	Supercritical	2.75	0.0077	60	2	0.025	9.59	1727	1730	1.06	2.54	5.73	4.00	0.1160	7.0	7.0

NOTE: Yh is hydraulic radius; Yh=A/Wp

Wp is CALCULATED wetted perimeter; Wp=Bot Wid + (2*Depth *(1+SS^2)^0.5)

BANK LINING TOEDOWN DEPTH

The fourth step was to determine the toedown required for the channel bank lining. This scour calculation was not performed for Reach 1, which has a concrete-lined channel bottom. The equation for total scour (ΔZ_{TOT}) was used, along with the HEC-2 results for the recommended channel, 100-year flow. See Table VII-2 for each component of scour, the total scour depth, and the toedown depth.

The total scour is defined by:

$$\Delta Z_{TOT} = \Delta Z_{DEGR} + \Delta Z_{LS} + \Delta Z_{GS} + \Delta Z_{BS} + \Delta Z_{I} + \Delta Z_{AD}$$

where
ΔZ_{TOT} = total vertical adjustment in bed elevation
ΔZ_{DEGR} = vertical change due to long-term degradation
ΔZ_{LS} = vertical change due to local scour
ΔZ_{GS} = vertical change due to general scour
ΔZ_{BS} = vertical change due to bend scour
ΔZ_{I} = vertical change due to low-flow incisement
ΔZ_{AD} = vertical change due to antidune troughs

Long-Term Degradation—This process occurs over a long period of time in response to an imbalance between the sediment transport capacity of the channel and the dominant sediment supply to the channel. An equilibrium slope analysis has been conducted to establish an approximate envelope of long-term aggradation/degradation for the proposed flood control channel.

Local Scour—Local scour will occur in response to objects being placed in the path of flowing water. The most common form of local scour is that occurring at bridge piers, and protruding bridge abutments and drop structures. Computation of local scour at bridges and drop structures is not a part of the scope of work, and is the only component of scour not computed in this analysis.

General Scour (Contraction Scour)—This scour process occurs in response to changes in channel geometry from one reach of a channel to the next. General scour will occur when a channel contracts and causes an increase in velocity through the contracted section. There are four locations where changes in the channel geometry form a contraction. They are located at:

- The city boundary between Glendale and Peoria where the channel contracts from 130-feet wide to 100-feet wide.
- The 67th Avenue bridge where the main channel contracts from 100-feet wide to a combination section having a 83-feet wide low-flow channel under the bridge.
- The 59th Avenue bridge where the channel contracts from 200-feet wide to 142-feet wide upstream of the bridge.

- The city boundary between Glendale and Phoenix (51st Avenue bridge) where the channel contracts from 240-feet wide to 110-feet wide upstream of the bridge.

General scour was analyzed using the Federal Highway Administration HEC-18 procedure. The computer program HY-9, "Contraction Scour" routine was used with the HEC-2 output.

Bend Scour—This scour process only occurs in the vicinity of channel curvature on the outside of the curve. The centerline radius was used in the formula.

Low-Flow Incisement—Manmade channels with large width to depth ratios are very vulnerable to the formation of low-flow channels as mentioned in Section IV. For the purpose of this study, a 1-foot incisement is included in the total scour depth for use in the bank-lining toedown dimension.

Antidune Troughs—Sand bed channels are prone to the development of transitory bedforms, such as dunes and antidunes. Such bedforms create troughs, or depressions, below the natural bed of the channel during the flow event.

Table VII-2 presents a summary of the total scour depths and the recommended toedown depths that should be applied to the bank-lining. Calculations are based on 100-year peak flows and hydraulic information taken from the HEC-2 run for the proposed conditions.

Toedown depth is the Total Scour Depth multiplied by a safety factor of 1.5. For ease of design and construction staking, the toedown depth was generally rounded up to the nearest foot. Toe down depths have also been shown on Figure VII-1, Recommended Channel Invert, at the end of this section.

By: DES
Ckd: BDO

TABLE VII-2

SKUNK CREEK MASTER PLAN
CHANNEL SCOUR ANALYSIS

SUBCRITICAL CASE (PROPOSED CONDITIONS - Q100)

REACH	STATION	Max Chl Depth (ft) Ymax	Avg Upstm Channel Velocity (fps) Vavg	Channel Topwidth (ft) Tw	Channel Area (sq ft) A	Energy Gradeline Slope (ft / ft) Segl	Mannings Rough-ness n	Centerline Radius of Curvature (ft) rc	Hydraulic Depth (ft) Yh	General Scour (ft) Zgs	Anti-dune Trough Depth (ft) Za	Bend Scour (ft) Zbs	Thalweg Depth (ft) Zlft	(ft) Subtotal	Scour Safety Factor (ft) SF	Total Scour Depth (ft) Ztot	Toe Down Depth (ft) Use
1	69+25	7.42	12.90	129.7	853	0.0078	0.035	99999	6.6	1.0	2.2	0.0	1.0	4.2	1.5	6.4	6.5
	74+06	8.84	7.95	183.1	1384	0.0024	0.035	99999	7.6	1.0	0.9	0.0	1.0	2.9	1.5	4.3	5.0
	78+88	7.80	9.19	176.8	1197	0.0037	0.035	850	6.8	0.0	1.1	1.3	1.0	3.4	1.5	5.1	5.0
	81+49	7.53	9.57	175.2	1149	0.0042	0.035	850	6.6	0.0	1.2	1.2	1.0	3.5	1.5	5.2	5.0
	86+24	6.18	11.97	167.1	919	0.0083	0.035	99999	5.5	0.0	1.9	0.0	1.0	2.9	1.5	4.4	5.0
	88+62	7.19	10.91	151.0	1008	0.0056	0.035	99999	6.7	0.0	1.6	0.0	1.0	2.6	1.5	3.9	4.0
	89+81	8.01	8.92	178.1	1234	0.0035	0.035	99999	6.9	0.0	1.1	0.0	1.0	2.1	1.5	3.1	4.0
2	91+59	7.72	9.30	176.3	1183	0.0039	0.035	99999	6.7	0.0	1.2	0.0	1.0	2.2	1.5	3.3	4.0
	97+68	7.27	9.97	173.6	1103	0.0048	0.035	2292	6.4	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	102+67	7.26	9.99	173.5	1101	0.0048	0.035	2292	6.3	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	108+16	7.26	9.99	173.5	1101	0.0048	0.035	1910	6.3	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	114+53	7.71	9.32	176.2	1180	0.0039	0.035	1910	6.7	0.0	1.2	0.0	1.0	2.2	1.5	3.3	4.0
	120+14	7.28	9.94	173.7	1106	0.0047	0.035	99999	6.4	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	123+73	7.25	9.99	173.2	1101	0.0048	0.035	99999	6.4	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	125+73	7.67	13.68	138.7	804	0.0102	0.035	1700	5.8	1.0	2.5	0.0	1.0	4.5	1.5	6.8	7.0
	128+67	8.57	13.08	127.0	841	0.0079	0.035	99999	6.6	1.0	2.3	0.0	1.0	4.3	1.5	6.5	7.0
	130+94	10.35	8.10	168.1	1359	0.0022	0.035	1500	8.1	1.0	0.9	0.3	1.0	3.2	1.5	4.7	5.0
	134+16	9.70	8.78	158.2	1253	0.0028	0.035	1500	7.9	0.0	1.0	0.1	1.0	2.2	1.5	3.3	4.0
3	144+63	8.79	9.90	152.8	1111	0.0040	0.035	99999	7.3	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	149+68	8.73	9.99	152.4	1101	0.0041	0.035	99999	7.2	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	156+03	8.71	10.02	152.2	1098	0.0041	0.035	99999	7.2	0.0	1.4	0.0	1.0	2.4	1.5	3.5	4.0
	160+62	8.70	10.03	152.2	1097	0.0041	0.035	99999	7.2	0.0	1.4	0.0	1.0	2.4	1.5	3.5	4.0
	164+88	8.68	10.80	134.7	1018	0.0045	0.035	3290	7.6	1.0	1.6	0.0	1.0	3.6	1.5	5.4	6.0
	170+88	7.21	12.64	137.3	871	0.0078	0.035	3290	6.3	1.0	2.2	0.0	1.0	4.2	1.5	6.2	6.0
	175+61	7.34	12.13	135.0	907	0.0067	0.035	3290	6.7	0.0	2.0	0.0	1.0	3.0	1.5	4.5	5.0
4	181+90	7.43	12.27	133.8	896	0.0069	0.035	3290	6.7	0.0	2.0	0.0	1.0	3.0	1.5	4.5	5.0
	188+02	9.28	9.90	139.5	1111	0.0036	0.035	3290	8.0	0.0	1.3	0.0	1.0	2.3	1.5	3.5	4.0
	193+78	9.84	9.28	148.5	1186	0.0031	0.035	3290	8.0	0.0	1.2	0.0	1.0	2.2	1.5	3.2	4.0
	197+53	10.95	4.31	265.7	2551	0.0005	0.035	99999	9.6	5.0	0.3	0.0	1.0	6.3	1.5	9.4	9.0
	203+49	8.81	5.51	252.9	1996	0.0011	0.035	99999	7.9	0.0	0.4	0.0	1.0	1.4	1.5	2.1	4.0
	207+60	7.56	6.53	245.4	1685	0.0018	0.035	99999	6.9	0.0	0.6	0.0	1.0	1.6	1.5	2.4	4.0
5	209+58	7.02	7.09	242.1	1552	0.0024	0.035	99999	6.4	0.0	0.7	0.0	1.0	1.7	1.5	2.5	4.0
	213+46	8.65	5.63	251.9	1954	0.0012	0.035	99999	7.8	0.0	0.4	0.0	1.0	1.4	1.5	2.1	6.0
	216+76	7.33	5.95	274.0	1848	0.0016	0.035	550	6.7	0.0	0.5	2.6	1.0	4.1	1.5	6.1	6.0
	220+73	5.94	9.14	220.6	1204	0.0049	0.035	550	5.5	0.0	1.1	1.9	1.0	4.1	1.5	6.1	6.0
	222+73	6.37	9.02	204.1	1220	0.0043	0.035	99999	6.0	0.0	1.1	0.0	1.0	2.1	1.5	3.1	6.0

By: DES
Ckd: BDO

TABLE VII-2
SKUNK CREEK MASTER PLAN
CHANNEL SCOUR ANALYSIS
SUBCRITICAL CASE (PROPOSED CONDITIONS - Q100)

REACH	STATION	Max Chl Depth (ft) Ymax	Avg Upstm Channel Velocity (fps) Vavg	Channel Topwidth (ft) Tw	Channel Area (sq ft) A	Energy Gradeline Slope (ft / ft) Segl	Mannings Rough-ness n	Centerline Radius of Curvature (ft) rc	Hydraulic Depth (ft) Yh	General Scour (ft) Zgs	Anti-dune Trough Depth (ft) Za	Bend Scour (ft) Zbs	Thalweg Depth (ft) Zlft	(ft) Subtotal	Scour Safety Factor (ft) SF	Total Scour Depth (ft) Ztot	Toe Down Depth (ft) Use
	224+78	5.66	12.69	134.0	662	0.0108	0.035	99999	4.9	0.0	2.2	0.0	1.0	3.2	1.5	4.8	5.0
	229+28	8.54	7.83	151.3	1073	0.0026	0.035	99999	7.1	0.0	0.8	0.0	1.0	1.8	1.5	2.7	4.0
	231+88	8.29	8.12	149.7	1035	0.0006	0.035	99999	6.9	0.0	0.9	0.0	1.0	1.9	1.5	2.8	4.0
6	233+95	8.22	8.21	156.1	1023	0.0031	0.035	4500	6.6	1.0	0.9	0.0	1.0	2.9	1.5	4.4	4.3*
	239+77	8.27	6.52	176.4	1288	0.0017	0.035	99999	7.3	1.0	0.6	0.0	1.0	2.6	1.5	3.9	4.3*
	243+54	8.13	7.11	165.6	1181	0.0021	0.035	99999	7.1	0.0	0.7	0.0	1.0	1.7	1.5	2.5	4.3*
	247+35	8.36	7.13	161.8	1178	0.0034	0.045	2040	7.3	0.0	0.7	0.0	1.0	1.7	1.5	2.5	4.3*
	249+74	7.88	7.64	159.4	1100	0.0042	0.045	2040	6.9	0.0	0.8	0.0	1.0	1.8	1.5	2.7	4.3*
	252+89	8.90	6.64	164.5	1264	0.0027	0.045	2040	7.7	0.0	0.6	0.0	1.0	1.6	1.5	2.4	4.3*
	255+38	6.58	10.07	149.4	834	0.0061	0.036	2040	5.6	0.0	1.4	0.0	1.0	2.4	1.5	3.6	4.3*
	257+73	6.72	8.69	168.8	967	0.0044	0.036	2040	5.7	0.0	1.0	0.0	1.0	2.0	1.5	3.0	4.3*
7	261+20	4.72	9.37	198.9	896	0.0066	0.035	99999	4.5	0.0	1.2	0.0	1.0	2.2	1.5	3.3	6.4*
	263+93	5.89	7.11	231.8	1181	0.0032	0.035	99999	5.1	1.0	0.7	0.0	1.0	2.7	1.5	4.0	6.4*
	268+80	3.24	9.98	274.7	841	0.0125	0.035	99999	3.1	1.0	1.3	0.0	1.0	3.3	1.5	5.0	6.4*
	273+39	5.90	5.45	279.7	1540	0.0035	0.050	99999	5.5	0.0	0.4	0.0	1.0	1.4	1.5	N/A	N/A
8	276+36	9.20	3.53	309.9	2377	0.0009	0.050	99999	7.7	0.0	0.2	0.0	1.0	1.2	1.5	N/A	N/A
	278+50	8.40	3.78	297.9	2225	0.0011	0.050	99999	7.5	0.0	0.2	0.0	1.0	1.2	1.5	N/A	N/A
	286+21	9.35	1.56	690.3	5397	0.0002	0.050	650	7.8	0.0	0.0	3.2	1.0	4.2	1.5	N/A	N/A
	288+17	8.46	3.91	80.0	665	0.0011	0.045	99999	8.3	0.0	0.2	0.0	1.0	1.2	1.5	N/A	N/A
9	291+40	6.30	4.97	122.6	523	0.0041	0.050	99999	4.3	0.0	0.3	0.0	1.0	1.3	1.5	N/A	N/A
	293+71	6.54	4.97	121.2	523	0.0040	0.050	99999	4.3	0.0	0.3	0.0	1.0	1.3	1.5	N/A	N/A
	296+40	3.23	9.66	93.1	269	0.0082	0.028	99999	2.9	0.0	1.3	0.0	1.0	2.3	1.5	3.4	4.0
	297+53	4.12	8.05	86.5	323	0.0041	0.028	800	3.7	0.0	0.9	0.1	1.0	2.0	1.5	3.0	4.0
10	299+08	4.57	7.19	88.3	361	0.0029	0.028	800	4.1	0.0	0.7	0.1	1.0	1.8	1.5	2.7	4.0
	301+36	4.80	6.80	89.2	382	0.0024	0.028	800	4.3	0.0	0.6	0.1	1.0	1.8	1.5	2.6	4.0
	303+92	4.85	8.84	85.0	294	0.0054	0.028	99999	3.5	0.0	1.1	0.0	1.0	2.1	1.5	3.1	4.0

NOTES:

1) Proposed channel bed slope is set at equilibrium slope (subcritical case); Long Term Scour = 0
2) Hydraulic Depth Yh = Area / Topwidth
3) General Scour (Contraction Scour) per HEC-18
4) Anti-dune Scour Za = 0.0135*Vavg^2
5) Bend Scour Zbs = 0.0685*Ymax*Vavg^0.8/(Yh^0.4*Segl^0.3)*(2.1*(Tw/(4*rc))^0.2-1)
6) Low Flow Thalweg Scour Zlft is assumed based on observations of existing conditions. Use 1.0 ft.
7) Total Scour Depth Ztot = (Zgs + Za + Zbs + Zlft) * Safety Factor (1.5)

N/A Not appropriate - No bank protection required for this area

* Toe Down Depth selected matches existing bank protection.

PLACEMENT OF CUTOFF WALLS

Additional grade control was required in certain key areas where grade breaks were required. A one-foot margin was allowed above the lining toedown (i.e. the long term scour could not go below that height). Additional cutoff walls were located where the equilibrium slope intersected the one-foot margin line.

The locations for grade control and cutoff wall structures have been shown on Figure VII-1. The design of these structures is not a part of this study and is left for the final channel design. Final design may include modifications to the bank protection at these locations.

DISCUSSION OF ANALYSIS AND DESIGN

Table VII-3 provides a more meaningful summary of the equilibrium slope analysis by cross referencing discharge, sediment supply, channel bottom width, design slope, equilibrium slope envelope, and predicted long-term trend to specific channel cross-sections. The equilibrium slope information is plotted on Figure VII-1 in order to provide a visual representation of the impact that the equilibrium slopes have on the channel profile.

The results of the equilibrium slope analysis indicates that in most locations the existing channel slope is very close to the subcritical equilibrium slope. Since the channel appears to operate in the subcritical regime, the channel should be relatively stable. Under supercritical conditions, the channel could experience a potential for aggradation. Should substantial aggradation occur, the channel should be excavated.

Two previously designed channel sections should be monitored for aggradation. The first section is located between the confluence of Skunk Creek with Scatter Wash and the 48th Avenue dip crossing. The second channel section is the lined section of channel located 500 feet east of 75th Avenue to the ACDC.

Long-term degradation of the channel is directly related to the number and magnitude of flow events that the channel experiences. Because of the lack of flow in Skunk Creek, it is logical to conclude that long-term degradation will take many years to develop. Accordingly, there will be ample time to monitor the progression of such a phenomenon and take corrective action before the channel would sustain any damage. Should the reduction in sediment supply be more severe than anticipated, an obvious corrective action would be to install additional grade control structures to stabilize the channel profile.

At the confluence of Skunk Creek with ACDC, the depth of flows and velocities for the two channels are similar for the 100-year storm event. However, if little flow is present within the ACDC and a 100-year flow is present in Skunk Creek the water surface in Skunk Creek will be drawn down to a lower water surface elevation in the ACDC. This event would cause an acceleration of the flow in Skunk Creek upstream of the confluence. Since Skunk Creek is lined upstream of the confluence, erosion would not be a problem. However, formation of a scour hole downstream of the cutoff wall (Sta 54+00) would result. This could

jeopardize bank protection at this location. Dumped riprap placed between stations 52+00 and 54+00 and sized for the event would control the development of the scour hole.

Table VII-3
Skunk Creek Master Plan
Summary of Equilibrium Slope Analysis

Reach	HEC-2 X-SEC	Q10 (cfs)	Sediment Supply (cfs)	Channel Bottom Width (ft)	Slope (ft/ft) Design	Slope (ft/ft) Equilibrium	Predicted Long-Term Trend
	54+00	2,970	3.5 to 29.3	60	0.0017 *	0.0031 to 0.0128	Aggredation
1	61+00	2,970	3.5 to 29.3	60	0.0017 *	0.0031 to 0.0128	Aggredation
	66+01	2,970	3.5 to 29.3	60	0.0017 *	0.0031 to 0.0128	Aggredation
	69+25	2,970	3.5 to 29.3	100	0.0047	0.0031 to 0.0128	Degredation to Stable to Aggredation
	74+06	2,970	3.5 to 29.3	130	0.0047	0.0031 to 0.0128	Degredation to Stable to Aggredation
	78+88	2,970	3.5 to 29.3	130	0.0047	0.0048 to 0.0161	Stable to Aggredation
	81+49	2,970	3.5 to 29.3	130	0.0047	0.0048 to 0.0161	Stable to Aggredation
	86+24	2,970	3.5 to 29.3	130	0.0047	0.0048 to 0.0161	Stable to Aggredation
	88+62	2,970	3.5 to 29.3	130	0.0047	0.0048 to 0.0161	Stable to Aggredation
	89+81	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
2	91+59	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	97+68	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	102+67	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	108+16	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	114+53	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	120+14	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	123+73	2,970	3.5 to 29.3	130	0.0048	0.0048 to 0.0161	Stable to Aggredation
	125+73	2,970	3.5 to 29.3	100	0.0063 *	0.0044 to 0.0146	Degredation to Stable to Aggredation
	128+67	2,970	3.5 to 29.3	80	0.0039 *	0.0048 to 0.0141	Aggredation
	130+94	2,970	3.5 to 29.3	100	0.0041	0.0046 to 0.0152	Aggredation
	134+16	2,970	3.5 to 29.3	100	0.0041	0.0046 to 0.0152	Aggredation
3	144+63	2,970	3.5 to 29.3	100	0.0041	0.0046 to 0.0152	Aggredation
	149+68	2,970	3.5 to 29.3	100	0.0041	0.0046 to 0.0152	Aggredation
	156+03	2,970	3.5 to 29.3	100	0.0041	0.0046 to 0.0152	Aggredation
	160+62	2,970	3.5 to 29.3	100	0.0041	0.0046 to 0.0152	Aggredation
	164+88	2,970	3.5 to 29.3	122	0.0074 *	0.0044 to 0.0150	Degredation to Stable to Aggredation
	170+88	2,970	3.5 to 29.3	112	0.0074 *	0.0044 to 0.0150	Degredation to Stable to Aggredation
	175+61	2,970	3.5 to 29.3	112	0.0015 *	0.0044 to 0.0150	Aggredation
4	181+90	2,970	3.5 to 29.3	112	0.0033 *	0.0044 to 0.0150	Aggredation
	188+02	2,970	3.5 to 29.3	112	0.0051 *	0.0044 to 0.0150	Degredation to Stable to Aggredation
	193+78	2,970	3.5 to 29.3	112	0.0031 *	0.0044 to 0.0150	Aggredation
	197+53	2,970	3.5 to 29.3	200	0.0041	0.0052 to 0.0180	Aggredation
	203+49	2,970	3.5 to 29.3	200	0.0041	0.0052 to 0.0180	Aggredation
	207+60	2,970	3.5 to 29.3	200	0.0041	0.0052 to 0.0180	Aggredation
5	209+58	2,970	3.5 to 29.3	200	0.0052 *	0.0052 to 0.0180	Stable to Aggredation
	213+46	2,970	3.5 to 29.3	200	0.0052 *	0.0052 to 0.0180	Stable to Aggredation
	216+76	2,970	3.5 to 29.3	200	0.0052 *	0.0052 to 0.0180	Stable to Aggredation
	220+73	2,970	3.5 to 29.3	185	0.0052	0.0052 to 0.0180	Stable to Aggredation
	222+73	2,970	3.5 to 29.3	190	0.0052	0.0052 to 0.0180	Stable to Aggredation
	224+78	2,270	0.5 to 36.6	100	0.0020	0.0015 to 0.0210	Degredation to Stable to Aggredation
	229+28	2,270	0.5 to 36.6	100	0.0020	0.0015 to 0.0210	Degredation to Stable to Aggredation
	231+89	2,270	0.5 to 36.6	110	0.0020	0.0015 to 0.0215	Degredation to Stable to Aggredation
6	233+95	2,270	0.5 to 36.6	110	0.0020	0.0015 to 0.0215	Degredation to Stable to Aggredation
	239+77	2,270	0.5 to 36.6	135	0.0020	0.0015 to 0.0225	Degredation to Stable to Aggredation
	243+54	2,270	0.5 to 36.6	125	0.0020	0.0015 to 0.0218	Degredation to Stable to Aggredation
	247+36	2,270	0.5 to 36.6	120	0.0020	0.0015 to 0.0217	Degredation to Stable to Aggredation

7/14/95
SCOUR2.XLS

Table VII-3
Skunk Creek Master Plan
Summary of Equilibrium Slope Analysis

Reach	HEC-2 X-SEC	Q10 (cfs)	Sediment Supply (cfs)	Channel Bottom Width (ft)	Slope (ft/ft) Design	Slope (ft/ft) Equilibrium	Predicted Long-Term Trend
	252+89	2,270	0.5 to 36.6	120	0.0020	0.0015 to 0.0217	Degredation to Stable to Aggredation
	255+38	2,270	0.5 to 36.6	110	0.0100 *	0.0015 to 0.0215	Degredation to Stable to Aggredation
7	257+73	2,270	0.5 to 36.6	120	0.0061 *	0.0015 to 0.0217	Degredation to Stable to Aggredation
	261+20	2,270	0.5 to 36.6	180	0.0022 *	0.0015 to 0.0244	Degredation to Stable to Aggredation
	263+93	2,270	0.5 to 36.6	190	0.0104 *	0.0015 to 0.0251	Degredation to Stable to Aggredation
	268+80	2,270	0.5 to 36.6	240	0.0137 *	0.0016 to 0.0271	Degredation to Stable to Aggredation
	273+39	2,270	0.5 to 36.6	240	0.0009 *	0.0016 to 0.0271	Aggredation
8	276+36	2,270	0.5 to 36.6	240	0.0051 *	0.0016 to 0.0271	Degredation to Stable to Aggredation
	278+50	2,270	0.5 to 36.6	240	0.0000 *	0.0016 to 0.0271	Aggredation
	286+21	2,270	0.5 to 36.6	240	0.0046 *	0.0016 to 0.0271	Degredation to Stable to Aggredation
	288+37	1,730	1.1 to 7.0	80	0.0030 *	0.0033 to 0.0088	Stable to Aggredation
9	291+40	1,730	1.1 to 7.0	90	0.0030 *	0.0033 to 0.0089	Stable to Aggredation
	293+71	1,730	1.1 to 7.0	90	0.0017 *	0.0033 to 0.0089	Aggredation
	296+40	1,730	1.1 to 7.0	70	0.0020	0.0029 to 0.0078	Aggredation
	297+53	1,730	1.1 to 7.0	70	0.0020	0.0029 to 0.0078	Aggredation
10	299+08	1,730	1.1 to 7.0	70	0.0020	0.0029 to 0.0078	Aggredation
	301+36	1,730	1.1 to 7.0	70	0.0020	0.0029 to 0.0078	Aggredation
	303+92	1,730	1.1 to 7.0	60	0.0025 *	0.0029 to 0.0077	Stable to Aggredation
	315+82	1,730	1.1 to 7.0	60	0.0029 *	0.0029 to 0.0077	Stable to Aggredation

* Existing channel slope for previously designed section of Skunk Creek.

RECOMMENDED CHANNEL INVERT

(Bank Lining, Toedown, and Equilibrium Slopes)

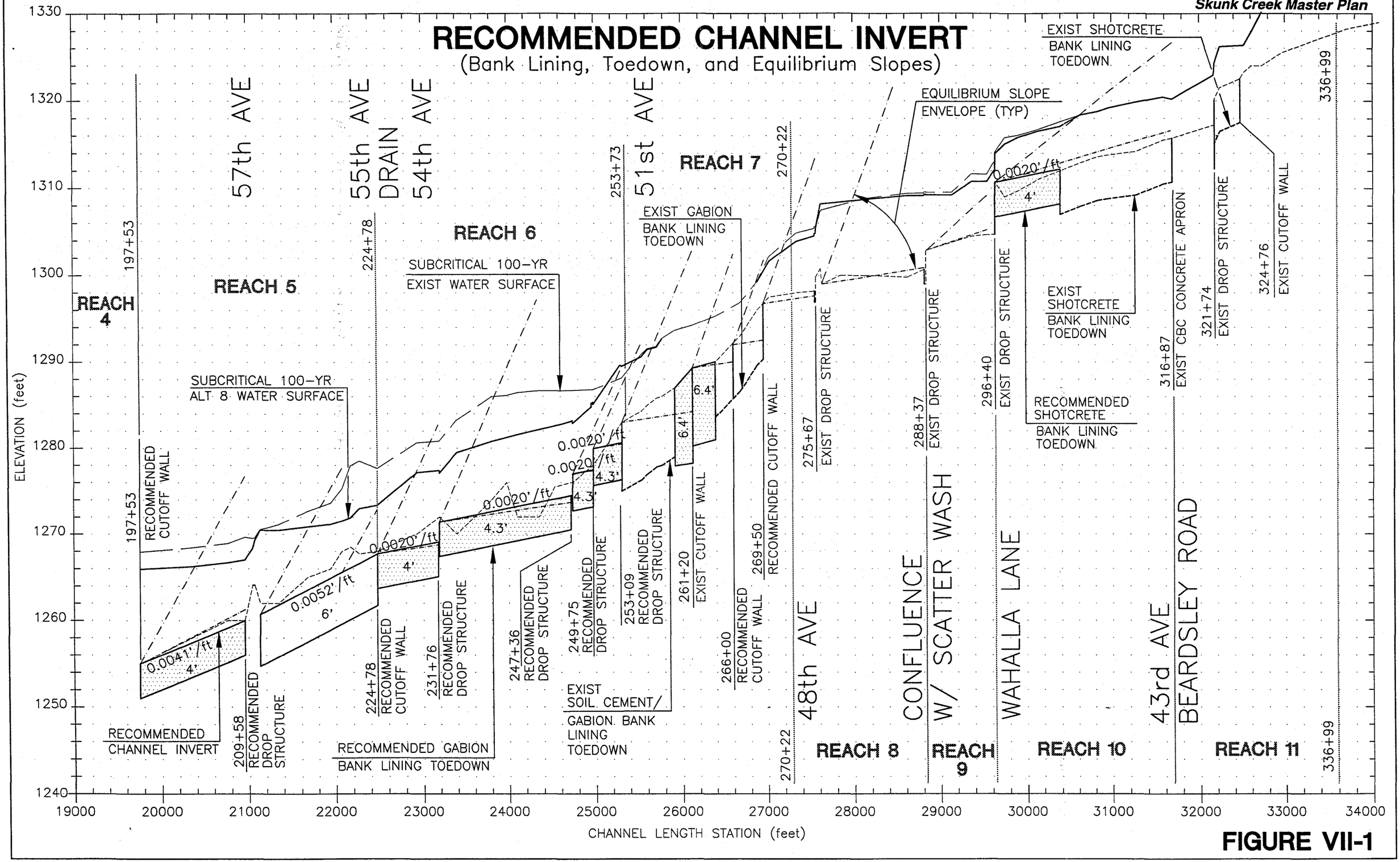

FIGURE VII-1

FILE: N:\013255\DWG\C\SCDUR1.DWG DATE: 04-21-95

RECOMMENDED CHANNEL INVERT

(Bank Lining, Toedown, and Equilibrium Slopes)

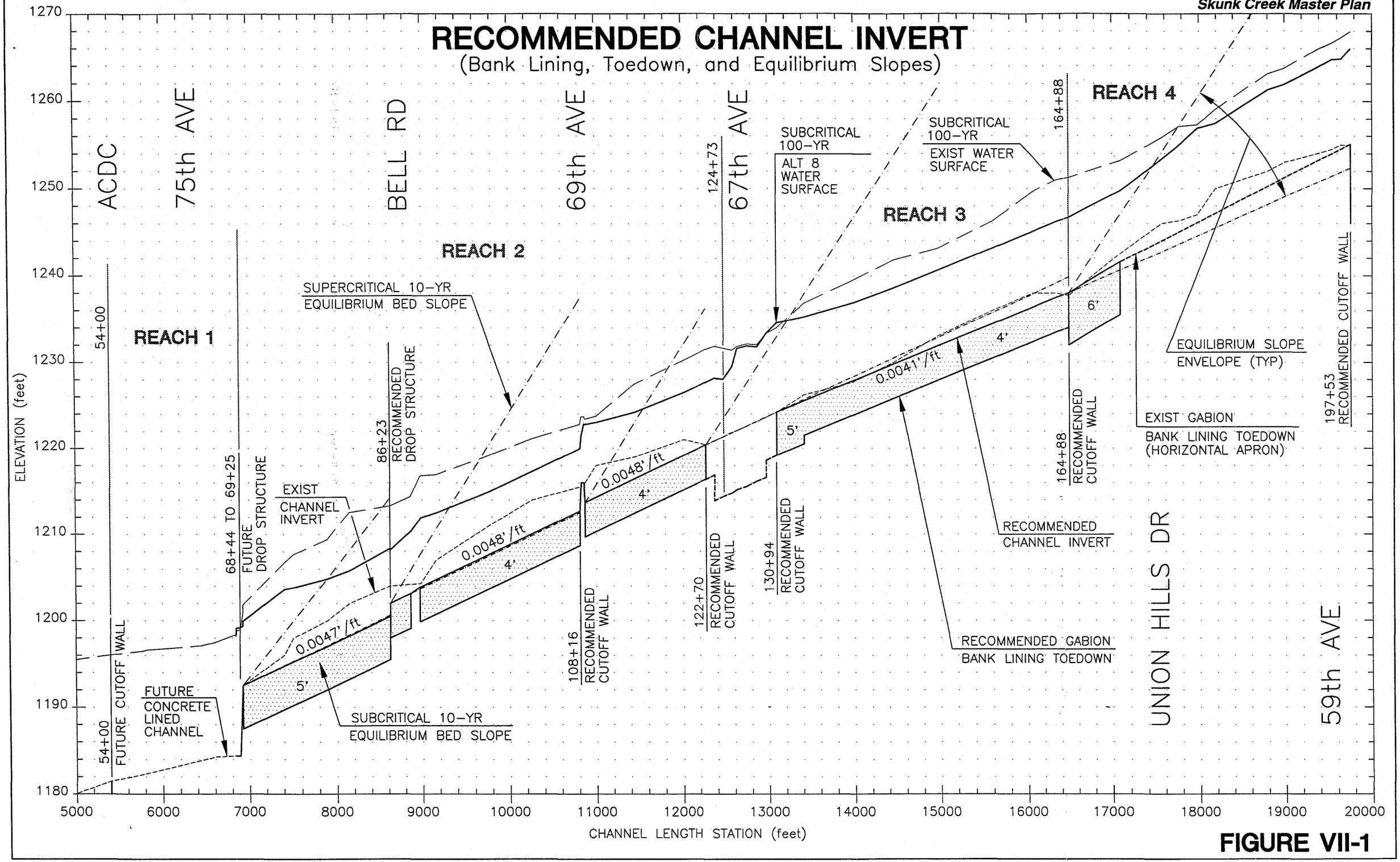

FIGURE VII-1

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Section VIII

COST ESTIMATES

Cost estimates were prepared for all channel alternatives. Unit prices were based on recent Flood Control District and Arizona Department of Transportation bid results with adjustments made to reflect the difficulty of the work anticipated.

The basis of the quantity estimates and unit prices is as follows:

- Clearing and Grubbing—Construction area quantities were computed based on AutoCAD computer output during alternatives development.
- Channel Excavation per Cubic Yard—Quantities were provided as part of the HEC-2 computer output using the existing typical sections and the proposed channel section.
- Channel Embankment per Cubic Yard—Quantities were provided as part of the AutoCAD computer output using the appropriate typical section and 3-D topo files.
- Grass Lining per Acre—Quantities were based on the total area of the channel to receive a grass lining. The unit price includes the fine grading of the channel, installation of an irrigation system, and establishment of turf.
- Dumped Riprap per Cubic Yard—Quantities were based on a 24-inch thick riprap blanket with a 6-foot toe down. The unit price includes the riprap, 6-inch thick bedding material, and a non-woven filter fabric.
- Soil Cement per Cubic Yard—Quantities were based on the soil cement being placed in 9-inch lifts being 9 feet wide with an 6-foot toe down. Unit price was based on the soil and cement being mixed onsite.
- Shotcrete per Square Yard—Quantities were based on a 6-inch thickness and a toe-down of 6 feet. Unit price includes fine grading, wire mesh, and placement of shotcrete.
- Gabions per Cubic Yard—Quantities were based on baskets measuring 3 feet wide x 12 feet long x 1 1/2 feet thick, placed parallel to the sloped bank, not stepped, with a toe down depth as shown on Figure VII-1. Unit price includes fine grading, filter fabric, wire baskets, and rock.
- Concrete per Cubic Yard—Quantities were based on a 150-foot wide channel with 12-inch thick walls and bottom. Unit price includes concrete and reinforcing steel.
- Asphalt Concrete (AC) per Ton—Quantities were based on providing AC for the bicycle/pedestrian trail located on the channel bank(s). The trail was assumed to be 10-foot wide and 4 inches in depth.

- Channel Access per Each—Access into the channel is anticipated at various locations down into the channel bottom (see Figure V-2), using AC ramps.
- Fencing per Linear Foot—Quantities were based on parallel 6-foot high chain link fending each side of the channel. Fencing was used for Alternative 6 only.
- Environmental Impact Mitigation—Costs for this work include erosion control, protection against water/soil contamination, revegetation of channel where necessary, and removal of construction waste. Costs for this item are estimated as 2 percent of the construction cost.
- Right-of-Way—R/W cost was based on a cost per acre for the various types of zoning. Cost per acre was established by the FCDMC.

A summary of the costs associated with each alternative is presented in Table VIII-1 below. A detailed cost estimate for recommended Alternative 8 is presented following Table VIII-1. Detailed cost estimates for the other seven alternatives can be found in Appendix A. The parcels affected by Alternative 8 are listed in Table VIII-2, along with an approximate amount of land needed for acquisition. Figure VIII-1 shows the locations of the parcels listed in Table VIII-2.

Table VIII-1
COST ESTIMATE SUMMARY

Alternative	Construction ($)	Design ($)	Right-of-Way ($)	Total ($)
1	$7,271,200	$327,200	$2,338,300	$9,936,700
2	$23,366,800	$1,058,800	$1,442,500	$25,868,100
3	$12,736,800	$575,600	$2,039,700	$15,352,100
4	$21,353,000	$967,300	$2,338,300	$24,658,600
5	$18,667,200	$845,200	$1,890,400	$21,402,800
6	$34,130,400	$1,548,100	$2,189,000	$37,867,500
7	$0	$0	$0	$0
8	$9,849,500	$444,000	$897,000	$11,190,500

Alternative 8 was later subdivided into four smaller segments for programming purposes. Detailed cost estimates for each of the segments have been provided at the end of this section. The four segments are:

City of Peoria - ACDC to 73rd Avenue
City of Glendale - 73rd Avenue to Union Hills Drive
City of Glendale - Union Hills Drive to 51st Avenue
City of Phoenix - 51st Avenue to Adobe Dam

SKUNK CREEK; ACDC to Beardsley Road
DETAILED COST ESTIMATE FOR ALTERNATIVE 8

ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
Clearing and Grubbing	Acre	52	$1,000	$52,000
Initial Vegetation Management	Acre	22	$1,000	$22,000
Removal of Structures & Obstructions	L.Sum	1	$76,850	$76,850
Removal of Asphaltic Concrete Pavement	Sq.Yd.	676	$1	$676
Removal of Construction Debris	Cu.Yd.	16,400	$5	$82,000
Channel Excavation; Not Including Toedown	Cu.Yd.	198,700	$5	$993,500
Overexcavation for Toedown and Lining (all linings)	Cu.Yd.	112,000	$5	$560,000
Borrow	Cu.Yd.	19,100	$5	$95,500
Soil Overlay; 6" thick (soil covered gabions only)	Cu.Yd.	16,200	$5	$81,000
Gabions; Slope Blanket, 18" Thick	Cu.Yd.	72,100	$60	$4,326,000
Shotcrete; 6" Thick, Rough Finish	Sq.Yd.	3,900	$50	$195,000
Grade Control Drop Structures	L.Sum	1	$220,000	$220,000
Grade Control, Cutoff Wall	L.Sum	1	$138,000	$138,000
Asphaltic Concrete Ramps; Side Banks; 150'x10'x4" thick	Ea	22	$5,800	$127,600
Asphaltic Concrete Ramps; at Grd Cntl Str; 50'x10'x4" thick	Ea	11	$3,900	$42,900
Asphaltic Concrete Bicycle Path, 10' Wide, 4" thick	L.F.	21,636	$7.20	$155,779
Asphaltic Concrete Bicycle Path, 8' Wide, 4" thick	L.F.	3,400	$5.70	$19,380
Pipe Culvert (24" CMP)	L.F.	55	$35	$1,900
Pipe Culvert (18" CMP)	L.F.	42	$25	$1,100
Pipe Culvert (36" RCP)	L.F.	83	$60	$5,000
Pipe Culvert (24" RCP)	L.F.	98	$50	$4,900
Pipe Culvert (18" RCP)	L.F.	19	$45	$900
Pipe Culvert (15" PVC)	L.F.	14	$20	$280
Pipe Culvert (12" PVC)	L.F.	16	$15	$240
Pipe Culvert (8" PVC)	L.F.	42	$12	$504
Cast Iron Flap Gate / headwall (24" dia.)	Ea	1	$5,000	$5,000
Outlet Protection; Dumped Riprap, 12" D50	Cu.Yd.	988	$55	$54,340
Reseeding ($0.15/sf) (1750 LF x 33')	Sq Ft	869,800	$0.15	$130,470
Signing at Ramps; Channel Depth Markers	Ea	32	$100	$3,200
CONSTRUCTION SUBTOTAL				**$7,400,000**
Erosion Control (2%)				$148,000
Utility Relocation (see Appendix E)				$81,500
Contingencies (30%)				$2,220,000
EXTRAS SUBTOTAL				**$2,449,500**
DESIGN ENGINEERING (6% of Construction Subtotal)				$444,000
Right-of-Way & Drainage Easements				$897,000
TOTAL PROJECT COST				**$11,190,500**

TABLE VIII-2
RIGHT-OF-WAY REQUIRED FOR ALTERNATIVE 8
(BY REACH AND LAND USE)

REACH	Figure Reference Number *	Parcel Number	Land Owner	LAND USE DESCRIPTION	TAKE AREA (ACRES)
1	1	200-53-021A	DMB Circle Rd.	PLANNED AREA DEVELOPMENT (PAD)	0.149
	2	200-53-008A	Senseman Properties	PLANNED LIGHT INDUSTRIAL DISTRICT (PL-1)	1.243
	3	200-53-021A	DMB Circle Rd.	PLANNED AREA DEVELOPMENT (PAD)	0.176
	4	200-53-022	Dillon R/E Co.	PLANNED AREA DEVELOPMENT (PAD)	2.011
	5	200-52-004	Senseman Properties	PLANNED LIGHT INDUSTRIAL DISTRICT (PL-1)	4.433
2a	6	200-52-016C	Finkelstein / Bell	PLANNED UNIT DEVELOPMENT (PUD)	0.052
	7	200-52-016A	Bell-Monroe Ptrshp	PLANNED UNIT DEVELOPMENT (PUD)	0.027
2b	8	200-52-019H	Bedford, Trustee	PLANNED RESIDENTIAL DEVELOPMENT (PRD) (use same cost/acre as PUD)	3.226
	9	200-44-001T	Snodgrass	PLANNED AREA DEVELOPMENT (PAD)	0.009
	10	200-44-001S	Lyon Realty / Westcor	PLANNED AREA DEVELOPMENT (PAD)	0.060
	11	200-44-003J	Schweim	PLANNED AREA DEVELOPMENT (PAD)	0.670
	12	200-44-003K	Kendall	PLANNED AREA DEVELOPMENT (PAD)	1.099
	13	200-44-003P	TGK Properties	PLANNED AREA DEVELOPMENT (PAD)	2.642
3	14	200-45-184F	Money Saver Insurance	SINGLE RESIDENCE MOBILE HOME (R1-6 MH)	1.508
	15	200-46-001L	Lennar Communities	SUBURBAN RESIDENCE (SR-17)	0.467
4	16	200-47-002C	Cohen	AGRICULTURAL (A-1)	1.842
	17	200-47-002L	Coady	AGRICULTURAL (A-1)	0.184
	18	200-47-002H	Coady	AGRICULTURAL (A-1)	0.228
6	19	200-25-015	Burditt	AGRICULTURAL (A-1)	0.412
	20	200-25-004K	Walter Lorimor	AGRICULTURAL (A-1)	1.559
	21	200-25-001T	Walter Lorimor	AGRICULTURAL (A-1)	1.980
	22	200-25-001M	Ellis Lorimor	AGRICULTURAL (A-1)	1.008
	23	200-25-001N	Lawrence	AGRICULTURAL (A-1)	0.781
	24	200-25-001Y	Cribb	AGRICULTURAL (A-1)	0.177
	25	200-25-001Z	Kirkpatrick	AGRICULTURAL (A-1)	0.061
	26	200-25-001U	Newcomb	AGRICULTURAL (A-1)	0.333
	27	200-25-001H	B E H Mtg Enterprise	AGRICULTURAL (A-1)	2.086
	28	200-25-002W	Weiting	SINGLE RESIDENCE (R1-6)	0.909
	29	200-25-002X	Weiting	SINGLE RESIDENCE (R1-6)	0.055
10	30	206-31-001F	Skunk Creek Apts	MULTIPLE RESIDENCE (R-3)	2.596
11	31	206-18-0015A	Phillps	RE-43	3.030
	32	206-18-015B	Reisen	RE-43	1.990

* See Figure VIII-1

TOTAL RIGHT-OF-WAY TAKE (ACRES) 37.00

SKUNK CREEK; ACDC to 73rd AVENUE
COST ESTIMATE - PROJECT 1
ALTERNATIVE 8

ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
Clearing and Grubbing (875 LF x 150' / 43560)	Acre	3	$1,000	$3,013
Initial Vegetation Management	Acre	0	$1,000	$0
Removal of Structures & Obstructions	L.Sum	0	$5,000	$0
Removal of Asphaltic Concrete Pavement	Sq.Yd.	0	$1	$0
Removal of Construction Debris	Cu.Yd.	0	$5	$0
Channel Excavation; Not Including Toedown	Cu.Yd.	39,600	$5	$198,000
Overexcavation for Toedown and Lining (all linings)	Cu.Yd.	8,200	$5	$41,000
Borrow	Cu.Yd.	0	$5	$0
Soil Overlay; 6" thick (soil covered gabions only)	Cu.Yd.	1,200	$5	$6,000
Gabions; Slope Blanket, 18" Thick	Cu.Yd.	5,000	$60	$300,000
Shotcrete; 6" Thick, Rough Finish	Sq.Yd.	0	$50	$0
Grade Control Drop Structures	L.Sum	1	$0	$0
Grade Control, Cutoff Wall	L.Sum	1	$0	$0
Asphaltic Concrete Ramps; Side Banks; 150'x10'x4" thick	Ea	2	$5,800	$11,600
Asphaltic Concrete Ramps; at Grd Cntl Str; 50'x10'x4" thick	Ea	0	$3,900	$0
Asphaltic Concrete Bicycle Path, 10' Wide, 4" thick	L.F.	1,500	$7.20	$10,800
Asphaltic Concrete Bicycle Path, 8' Wide, 4" thick	L.F.	0	$5.70	$0
Pipe Culvert (24" CMP)	L.F.	0	$35	$0
Pipe Culvert (18" CMP)	L.F.	0	$25	$0
Pipe Culvert (36" RCP)	L.F.	0	$60	$0
Pipe Culvert (24" RCP)	L.F.	0	$50	$0
Pipe Culvert (18" RCP)	L.F.	0	$45	$0
Pipe Culvert (15" PVC)	L.F.	0	$20	$0
Pipe Culvert (12" PVC)	L.F.	0	$15	$0
Pipe Culvert (8" PVC)	L.F.	0	$12	$0
Outlet Protection; Dumped Riprap, 12" D50	Cu.Yd.	900	$55	$49,500
Reseeding ($0.15/sf) (1750 LF x 33')	Sq Ft	58,000	$0.15	$8,700
Signing at Ramps; Channel Depth Markers	Ea	2	$100	$200
CONSTRUCTION SUBTOTAL				**$630,000**
Erosion Control (2%)				$12,600
Utility Relocation (see Appendix E)				$0
Contingencies (30%)				$189,000
EXTRAS SUBTOTAL				**$201,600**
DESIGN ENGINEERING (6% of Construction Subtotal)				$37,800
Right-of-Way & Drainage Easements				$352,000
TOTAL PROJECT COST				**$1,221,400**

SKUNK CREEK; 73rd AVENUE to UNION HILLS DRIVE
COST ESTIMATE - PROJECT 2
ALTERNATIVE 8

ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
Clearing and Grubbing (8540 LF x 150' / 43560)	Acre	29	$1,000	$29,408
Initial Vegetation Management	Acre	0	$1,000	$0
Removal of Structures & Obstructions	L.Sum	0	$5,000	$0
Removal of Asphaltic Concrete Pavement (69th Ave)	Sq.Yd.	676	$1	$676
Removal of Construction Debris	Cu.Yd.	0	$5	$0
Channel Excavation; Not Including Toedown	Cu.Yd.	94,500	$5	$472,500
Overexcavation for Toedown and Lining (all linings)	Cu.Yd.	65,000	$5	$325,000
Borrow	Cu.Yd.	0	$5	$0
Soil Overlay; 6" thick (soil covered gabions only)	Cu.Yd.	10,200	$5	$51,000
Gabions; Slope Blanket, 18" Thick	Cu.Yd.	43,600	$60	$2,616,000
Shotcrete; 6" Thick, Rough Finish	Sq.Yd.	0	$50	$0
Grade Control Drop Structures	L.Sum	1	$40,000	$40,000
Grade Control, Cutoff Wall	L.Sum	1	$52,000	$52,000
Asphaltic Concrete Ramps; Side Banks; 150'x10'x4" thick	Ea	8	$5,800	$46,400
Asphaltic Concrete Ramps; at Grd Cntl Str; 50'x10'x4" thick	Ea	3	$3,900	$11,700
Asphaltic Concrete Bicycle Path, 10' Wide, 4" thick	L.F.	9,836	$7.20	$70,819
Asphaltic Concrete Bicycle Path, 8' Wide, 4" thick	L.F.	3,400	$5.70	$19,380
Pipe Culvert (24" CMP)	L.F.	20	$35	$700
Pipe Culvert (18" CMP)	L.F.	42	$25	$1,100
Pipe Culvert (36" RCP)	L.F.	83	$60	$5,000
Pipe Culvert (24" RCP)	L.F.	18	$50	$900
Pipe Culvert (18" RCP)	L.F.	19	$45	$900
Pipe Culvert (15" PVC)	L.F.	14	$20	$280
Pipe Culvert (12" PVC)	L.F.	16	$15	$240
Pipe Culvert (8" PVC)	L.F.	0	$12	$0
Outlet Protection; Dumped Riprap, 12" D50, 2' thick	Cu.Yd.	65	$55	$3,553
Reseeding ($0.15/sf) (16500 LF x 33')	Sq Ft	544,500	$0.15	$81,675
Signing at Ramps; Channel Depth Markers	Ea	11	$100	$1,100
CONSTRUCTION SUBTOTAL				**$3,830,000**
Erosion Control (2%)				$76,600
Utility Relocation (see Appendix E)				$48,000
Contingencies (30%)				$1,149,000
EXTRAS SUBTOTAL				**$1,273,600**
DESIGN ENGINEERING (6% of Construction Subtotal)				$229,800
Right-of-Way & Drainage Easements				$358,000
TOTAL PROJECT COST				**$5,691,400**

SKUNK CREEK; UNION HILLS DRIVE to 51st AVENUE
COST ESTIMATE - PROJECT 3
ALTERNATIVE 8

ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
Clearing and Grubbing (2853 LF x 150' + 2659 LF x 75')	Acre	15	$1,000	$15,000
Initial Vegetation Management	Acre	8	$1,000	$8,000
Removal of Structures & Obstructions (55th Ave channel lining)	Sq. Ft.	66,850	$1	$66,850
Removal of Asphaltic Concrete Pavement	Sq.Yd.	0	$1	$0
Removal of Construction Debris (Rainbow Enterprises Landfill)	Cu.Yd.	16,400	$5	$82,000
Channel Excavation; Not Including Toedown	Cu.Yd.	64,600	$5	$323,000
Overexcavation for Toedown and Lining (all linings)	Cu.Yd.	34,200	$5	$171,000
Borrow	Cu.Yd.	14,000	$5	$70,000
Soil Overlay; 6" thick (soil covered gabions only)	Cu.Yd.	4,800	$5	$24,000
Gabions; Slope Blanket, 18" Thick	Cu.Yd.	22,300	$60	$1,338,000
Shotcrete; 6" Thick, Rough Finish	Sq.Yd.	0	$50	$0
Grade Control Drop Structures	L. Sum	1	$180,000	$180,000
Grade Control, Cutoff Wall	L. Sum	1	$54,000	$54,000
Asphaltic Concrete Ramps; Side Banks; 150'x10'x4" thick	Ea	11	$5,800	$63,800
Asphaltic Concrete Ramps; at Grd Cntl Str; 50'x10'x4" thick	Ea	6	$3,900	$23,400
Asphaltic Concrete Bicycle Path, 10' Wide, 4" thick	L.F.	8,200	$7.20	$59,040
Asphaltic Concrete Bicycle Path, 8' Wide, 4" thick	L.F.	0	$5.70	$0
Pipe Culvert (24" CMP)	L.F.	35	$35	$1,200
Pipe Culvert (18" CMP)	L.F.	0	$25	$0
Pipe Culvert (36" RCP)	L.F.	0	$60	$0
Pipe Culvert (24" RCP)	L.F.	80	$50	$4,000
Pipe Culvert (18" RCP)	L.F.	0	$45	$0
Pipe Culvert (15" PVC)	L.F.	0	$20	$0
Pipe Culvert (12" PVC)	L.F.	0	$15	$0
Pipe Culvert (8" PVC)	L.F.	0	$12	$0
Cast Iron Flap Gate / headwall (24" dia.)	Ea	1	$5,000	$5,000
Outlet Protection; Dumped Riprap, 12" D50 (200sf x 2' / 27)	Cu.Yd.	15	$55	$815
Reseeding ($0.15/sf) (8100 LF x 33')	Sq Ft	267,300	$0.15	$40,095
Signing at Ramps; Channel Depth Markers	Ea	16	$100	$1,600
CONSTRUCTION SUBTOTAL				**$2,530,000**
Erosion Control (2%)				$50,600
Utility Relocation (see Appendix E)				$33,500
Contingencies (30%)				$759,000
EXTRAS SUBTOTAL				**$843,100**
DESIGN ENGINEERING (6% of Construction Subtotal)				$151,800
Right-of-Way & Drainage Easements				$30,000
TOTAL PROJECT COST				**$3,554,900**

SKUNK CREEK; 51st AVENUE to ADOBE DAM
COST ESTIMATE - PROJECT 4
ALTERNATIVE 8

ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
Clearing and Grubbing (485+758) LF x 150' / 43560	Acre	5	$1,000	$5,000
Initial Vegetation Management	Acre	14	$1,000	$14,000
Removal of Structures & Obstructions	Sq. Ft.	0	$1	$0
Removal of Asphaltic Concrete Pavement	Sq.Yd.	0	$1	$0
Removal of Construction Debris (Rainbow Enterprises Landfill)	Cu.Yd.	0	$5	$0
Channel Excavation; Not Including Toedown	Cu.Yd.	0	$5	$0
Overexcavation for Toedown and Lining (all linings)	Cu.Yd.	4,600	$5	$23,000
Borrow	Cu.Yd.	5,100	$5	$25,500
Soil Overlay; 6" thick (soil covered gabions only)	Cu.Yd.	0	$5	$0
Gabions; Slope Blanket, 18" Thick	Cu.Yd.	1,200	$60	$72,000
Shotcrete; 6" Thick, Rough Finish	Sq.Yd.	3,900	$50	$195,000
Grade Control Drop Structures	L. Sum	1	$0	$0
Grade Control, Cutoff Wall	L. Sum	1	$44,000	$44,000
Asphaltic Concrete Ramps; Side Banks; 150'x10'x4" thick	Ea	1	$5,800	$5,800
Asphaltic Concrete Ramps; at Grd Cntl Str; 50'x10'x4" thick	Ea	2	$3,900	$7,800
Asphaltic Concrete Bicycle Path, 10' Wide, 4" thick	L.F.	2,100	$7.20	$15,120
Asphaltic Concrete Bicycle Path, 8' Wide, 4" thick	L.F.	0	$5.70	$0
Pipe Culvert (24" CMP)	L.F.	0	$35	$0
Pipe Culvert (18" CMP)	L.F.	0	$25	$0
Pipe Culvert (36" RCP)	L.F.	0	$60	$0
Pipe Culvert (24" RCP)	L.F.	0	$50	$0
Pipe Culvert (18" RCP)	L.F.	0	$45	$0
Pipe Culvert (15" PVC)	L.F.	0	$20	$0
Pipe Culvert (12" PVC)	L.F.	0	$15	$0
Pipe Culvert (8" PVC)	L.F.	42	$12	$504
Outlet Protection; Dumped Riprap, 12" D50, 100 sf x 2' / 27	Cu.Yd.	8	$55	$440
Reseeding ($0.15/sf)	Sq Ft	0	$0.15	$0
Signing at Ramps; Channel Depth Markers	Ea	3	$100	$300
CONSTRUCTION SUBTOTAL				**$410,000**
Erosion Control (2%)				$8,200
Utility Relocation (see Appendix E)				$0
Contingencies (30%)				$123,000
EXTRAS SUBTOTAL				**$131,200**
DESIGN ENGINEERING (6% of Construction Subtotal)				$24,600
Right-of-Way & Drainage Easements				$157,000
TOTAL PROJECT COST				**$722,800**

Section IX

PUBLIC INVOLVEMENT AND PROJECT COORDINATION

The following agencies were contacted during project development and invited to participate in a project scoping session:

- City of Phoenix
- City of Glendale
- City of Peoria

A public information meeting was conducted on July 6, 1994, at the Arrowhead Towne Center Mall at Peoria, Arizona. The purpose of the meeting was to inform the public of the purpose of this project, and to seek input regarding their concerns and requests. The following comments and concerns were expressed at this meeting which was attended by approximately 35 property owners and interested parties.

- Several equestrian trails have been blocked by current owners, and former users cannot utilize those facilities in Skunk Creek.
- Several questions were asked as to whether or not this project will design specific improvements, and when they would occur.
- Concern was expressed as to whom would pay for the identified improvements; private sector (i.e., the taxpayer) versus the federal/state government.
- Concern was expressed about land being developed adjacent to Skunk Creek, and whether or not developers would be responsible for channel improvements.
- Complaints were expressed regarding poor channel maintenance.

A second public information meeting was conducted on November 2, 1994, at the Arrowhead Towne Center Mall at Peoria, Arizona. The purpose of the meeting was to provide information to the public regarding the several alternatives presently under consideration for Skunk Creek and to seek input regarding their comments and concerns. The following comments and concerns were expressed at this meeting which was attended by approximately 45 property owners and interested parties.

- Concern was expressed about maintaining route continuity for existing equestrian trails. They prefer to travel in the stream bed, but would be willing to ride on unpaved trails on the banks.

- Most expressed their preference for a natural channel bed with soil banks and vegetation in lieu of linings with rock, gabions, and soil cement. Soil banks provide unlimited access and is a natural setting. Dumped rock, gabions, and grouted riprap are barriers to horses in most situations.

- Ramps should be provided at grade control structures. Ramps should be provided at roadway crossings for joint use for equestrians, pedestrians, bicyclists, and maintenance.

- Several developments adjacent to the channel have blocked previous paths around grade control structures and box culvert/bridges from use by pedestrians and equestrians.

- The equestrians preferred natural earth or gravel covered access ramps. However, textured concrete ramps set at a 10 percent grade would be acceptable. Grouted riprap would be too uneven for horses to negotiate.

- The clearance under bridges and box culverts should be 12 feet to provide adequate clearance for mounted equestrians.

- Several were concerned about channel bank overtopping due to the heavy debris and vegetative growth in the channel, and who is responsible for maintaining the channel.

- Several attendees expressed a desire to see some form of desert landscaping along the banks to replace what was removed by the developers. Most were acceptable to trimming of established trees in the stream bed.

- Several property owners wanted to maximize the use of their property and wanted the narrowest channel width as possible.

Additional meetings were held with the Cities of Peoria and Glendale.

The City of Peoria was overseeing a commercial improvement district to develop the area east and west of 75th Avenue and north of Skunk Creek. Improvements included two bridges over Skunk Creek with lining of the Creek to the ACDC.

The City of Glendale expressed their concern that a strong emphasis be placed on the aesthetic treatment and recreational use of Skunk Creek within their jurisdiction. Continuity of equestrian, pedestrian, and bicycle trails/paths should be provided. Destination points were identified for the passive recreational users.

A third public information meeting was held on July 12, 1995, at the Arrowhead Towne Center Mall at Peoria, Arizona. The purpose of the meeting was to provide information to the public regarding the recommended alternative for Skunk Creek and to obtain their comments and any concerns they may have. The following comments and concerns were

expressed at this meeting which was attended by approximately 20 property owners and interested parties.

- Some of the attendees felt that the recommended equestrian, pedestrian/bicycle routes were reasonable. One of the attendees felt that a more direct path from Skunk Creek to the ACDC could be placed on the FCDMC property located east of 75th Avenue. An easement could be established on the property along the west property line. This would help shift some of the users away from busy 75th Avenue. A ramp at the ACDC grade control structure near 75th Avenue would help continuity for equestrians along the ACDC.

- Several attendees liked the aesthetic treatment of the banks and the use of vegetative management to promote the growth of desirable plants and trees while controlling growth of the less desirable plants.

- The City of Glendale requested an additional equestrian ramp on the south side of Skunk Creek just west of 51st Avenue. The additional ramp would give equestrians the option to cross Skunk Creek using the river bed instead of the 51st Avenue bridge.

- One attendee pointed out that the property east of the 55th Avenue Drain along the north bank used to be the location of a deep gravel pit that was later filled with construction debris. The attendee had witnessed water from the creek flowing into a hole at the base of the north bank. Possibly some piping was occurring within the landfill construction material.

Some of the questions from the meeting attendees were focused on:

- Who would build the recommended improvements?

- How would the improvements be funded?

- How soon would the work begin?

Section X

ALTERNATIVE 8

(Recommended Alternative)

SKUNK CREEK
RIGHT-OF-WAY AQUISITION REQUIREMENTS

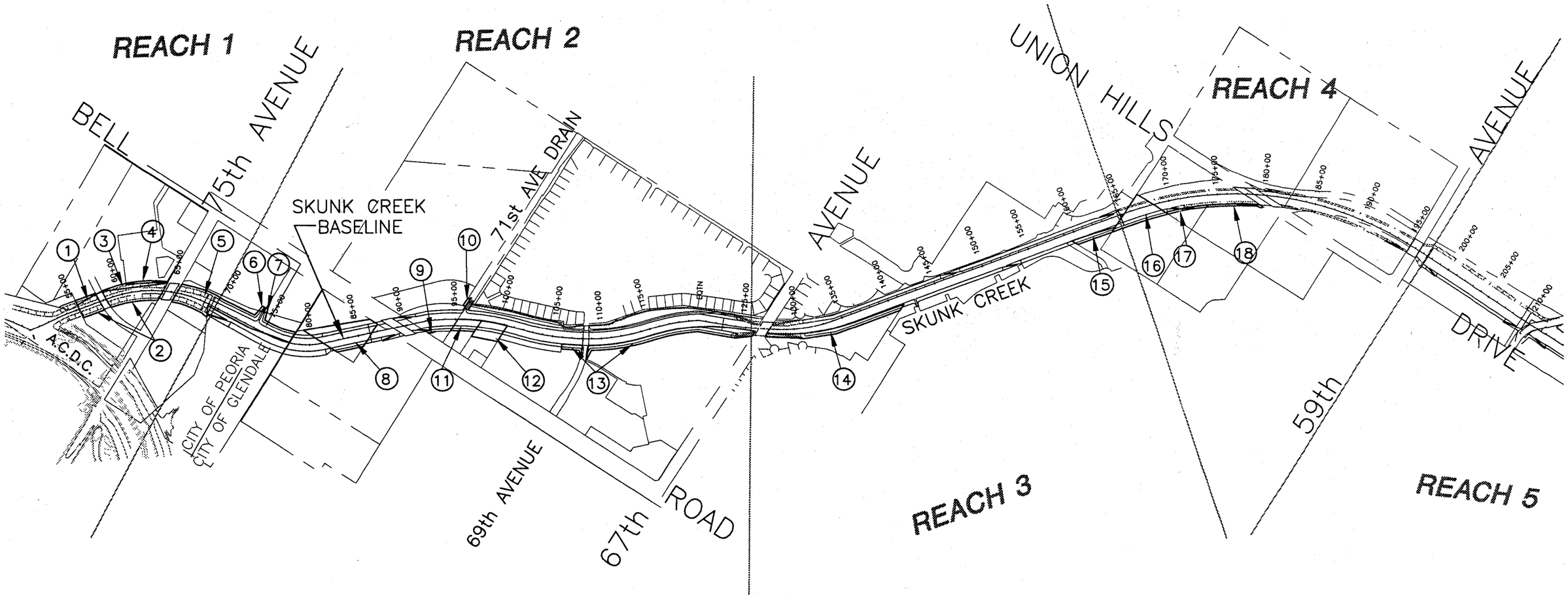


FIGURE VIII-1

250 750
0 500 1000 2000
SCALE: 1"=1000'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION		BY	DATE
	DESIGNED	D. STOUGH	04-95
	DRAWN	D. STOUGH	04-95
	CHECKED	B. OLBERT	04-95

Sverdrup CORPORATION

R/W AQUISITION REQUIREMENTS — SHEET 1 OF 2

SKUNK CREEK
RIGHT-OF-WAY AQUISITION REQUIREMENTS

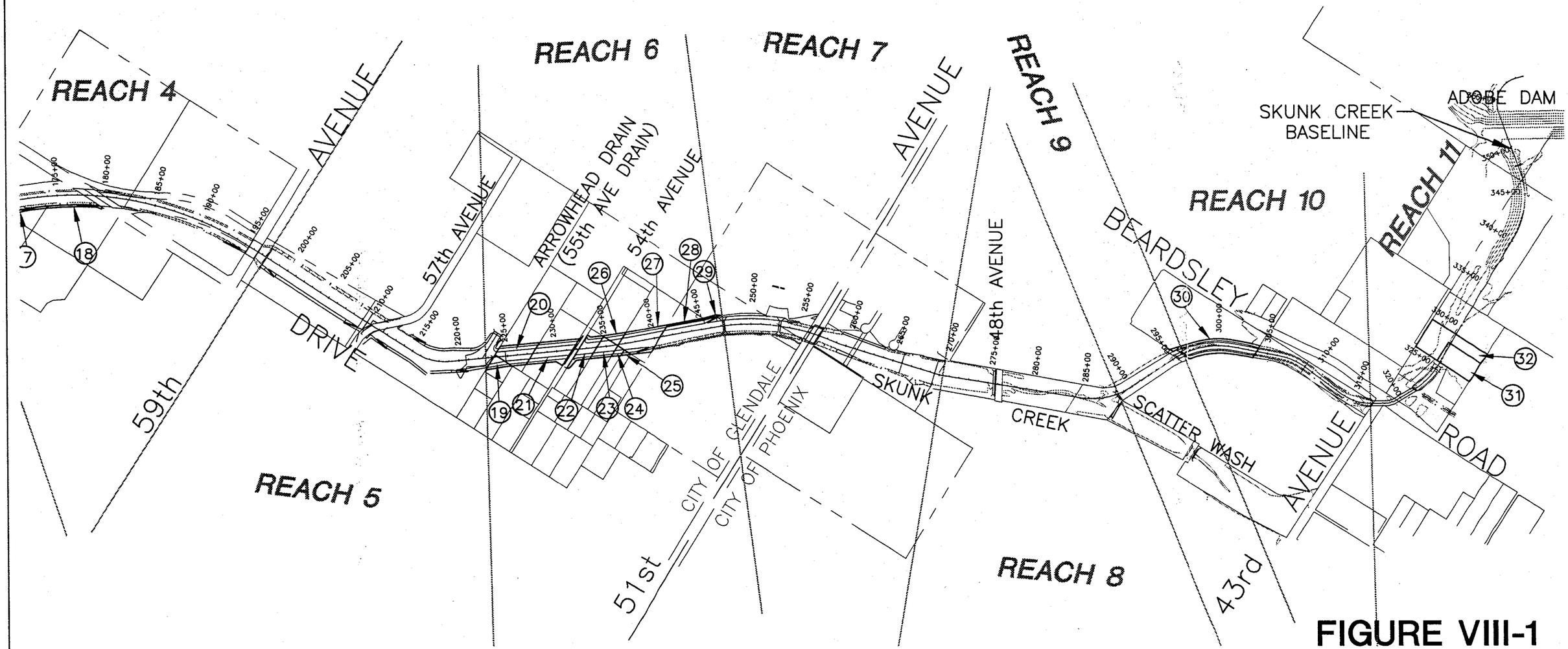


FIGURE VIII-1

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

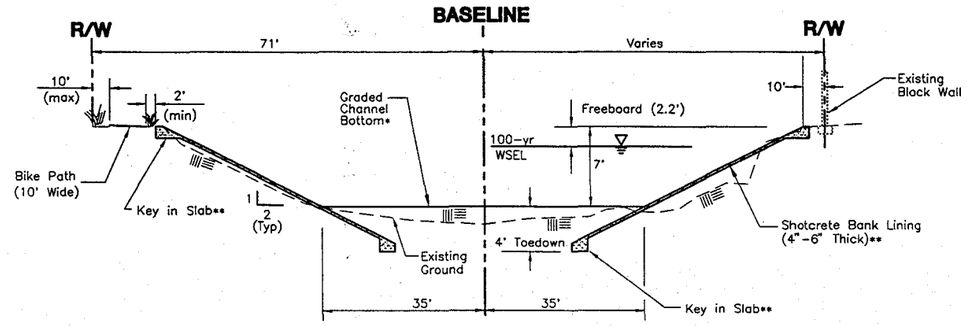
SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

R/W AQUISITION REQUIREMENTS — SHEET 2 OF 2



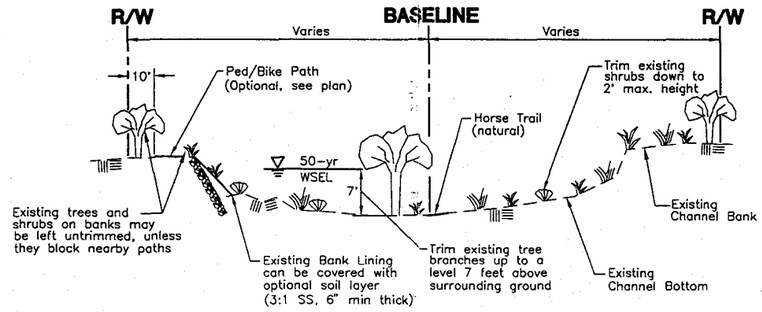
* Recurring vegetation in channel bottom will require Vegetation Management.

** Key-in and weep holes to be installed per FCDMC or City of Phoenix standards, as required.

TRAPEZOIDAL CHANNEL SHOTCRETE BANK LINING

N.T.S.

Sta 296+40 to Sta 303+92



VEGETATION MANAGEMENT

N.T.S.

See Plan for Locations

Channel bottom and banks are not to be regraded in Vegetation Management areas unless localized erosion warrants remedial measures.

Excess vegetation in channel bottom can be transplanted to erosion prone areas or can be used to revegetate channel banks of graded reaches.

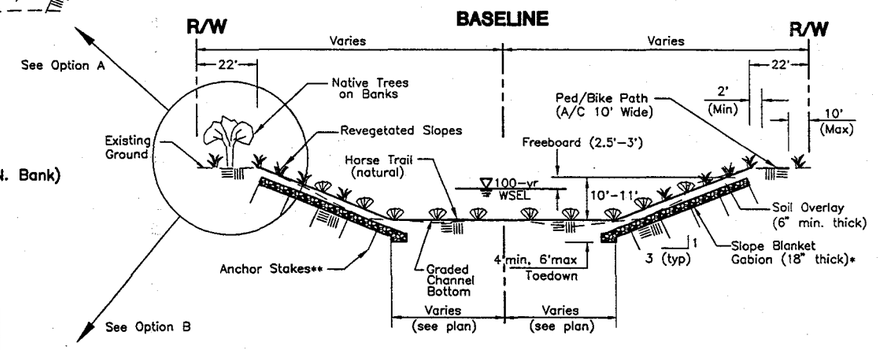
ALL reaches with an unlined channel bottom will require Vegetation Management on a bi-yearly basis (every 2-years).

Bank Option A
(Bank Lining on Dike)

Sta 241+50 to Sta 250+50, (N. Bank)

Bank Option B
(Backfill Behind Bank Lining)

Sta 89+80 to Sta 108+00 (Both Banks)
Sta 109+00 to Sta 119+96 (N. Bank)
Sta 197+53 to Sta 205+00 (S. Bank)
Sta 259+50 to Sta 264+00 (N. Bank)



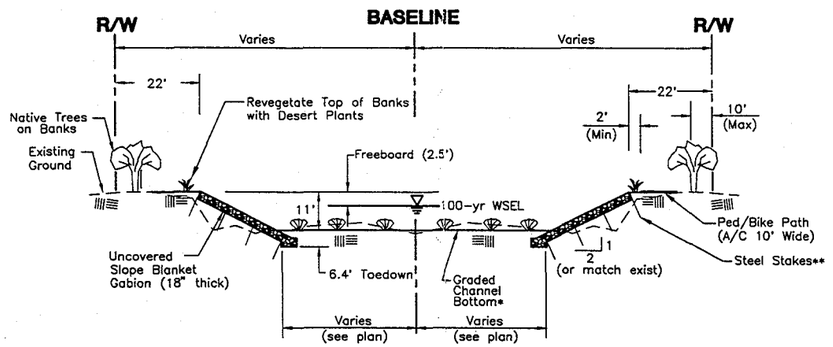
TRAPEZOIDAL CHANNEL SLOPE BLANKET GABIONS
(Soil Covered)

N.T.S.

Sta 69+25 to Sta 124+15
Sta 130+94 to Sta 171+20
Sta 197+53 to Sta 253+73
(See Option B for S. Bank in This Area)

* Recurring vegetation on banks and channel bottom will require Vegetation Management.

** Anchor stakes and counterforts to be placed as per FCDMC or City of Glendale standards, as required.



TRAPEZOIDAL CHANNEL SLOPE BLANKET GABIONS
(Uncovered)

N.T.S.

Sta 259+46 to Sta 264+06

* Recurring vegetation in channel bottom will require Vegetation Management.

** Anchor stakes and counterforts to be placed as per FCDMC, or City of Glendale or City of Phoenix standards, as required.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	07/95
DRAWN	B. EDGAR	07/95
CHECKED	B. OLBERT	07/95

PRELIMINARY NOT FOR CONSTRUCTION

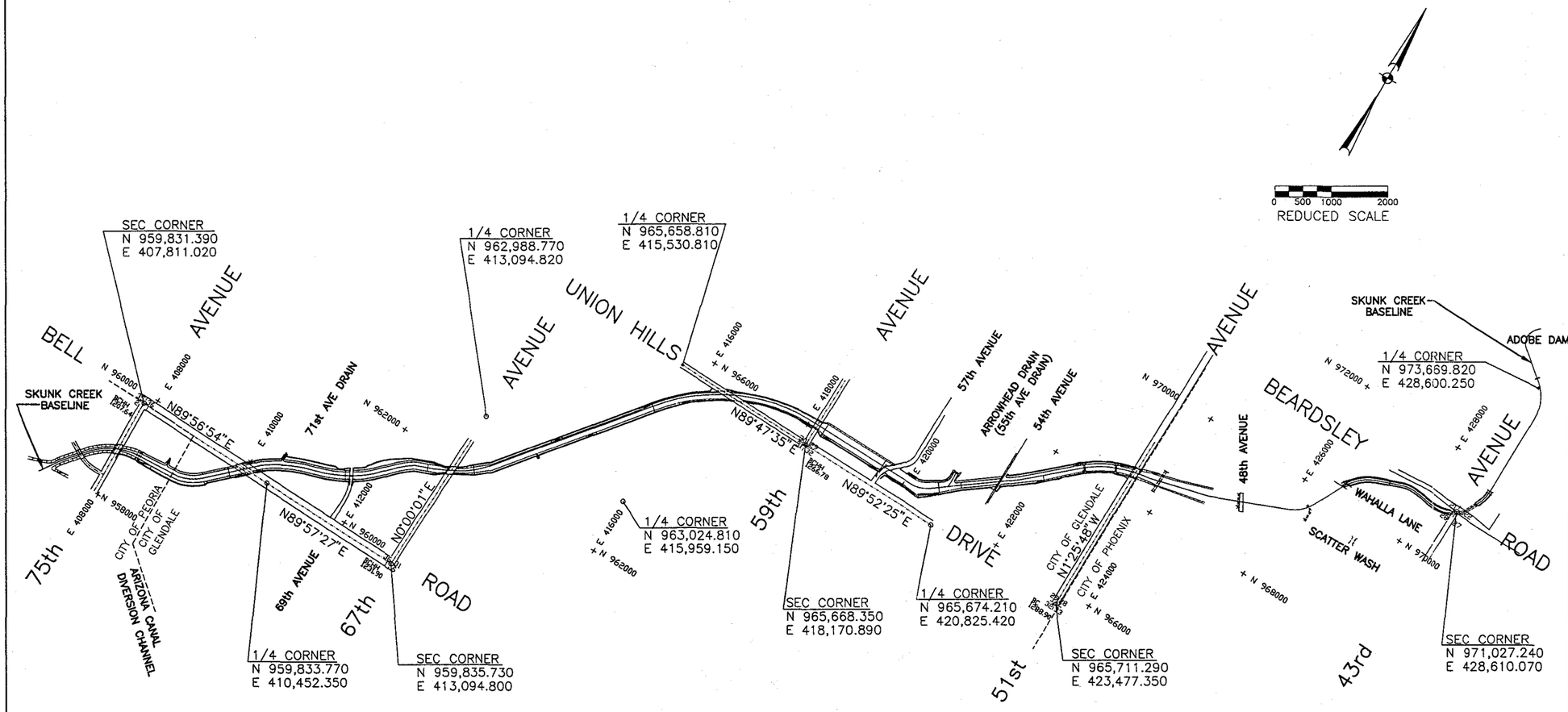
Sverdrup CORPORATION

DETAIL SHEET

SHEET OF 1A 30

FILE: N:\013255\DWG\C\C255DR01.DWG DATE: 7/10/95

SKUNK CREEK
SURVEY CONTROL



HORIZONTAL AND VERTICAL DATUM

Found Brass Cap in Handhole; City of Phoenix
43rd Avenue and Union Hills Drive
N=965,730.4802 E=428,628.2823 Elev=1307.867 (Feet AMSL)
See Survey Book 1 of 4, page 3

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

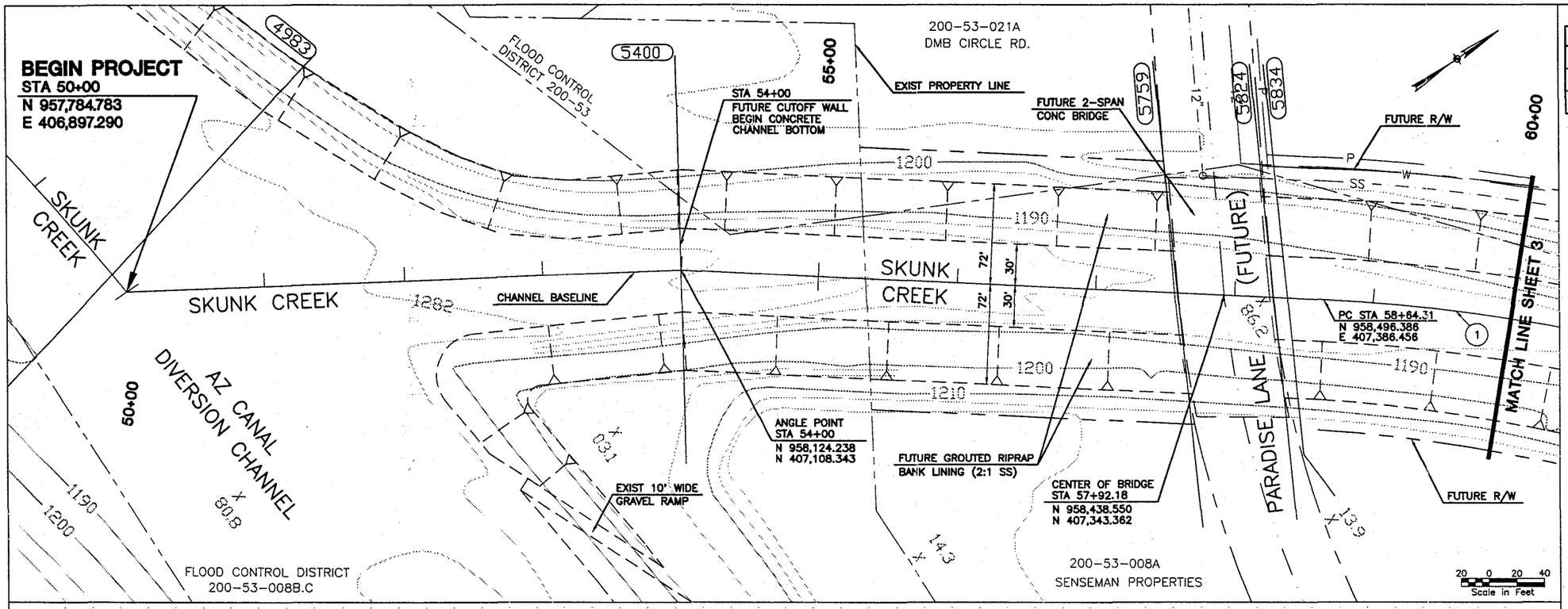
		BY	DATE
PRELIMINARY NOT FOR CONSTRUCTION	DESIGNED	D.STOUGH	04/95
	DRAWN	D.STOUGH	04/95
	CHECKED	B.OLBERT	04/95

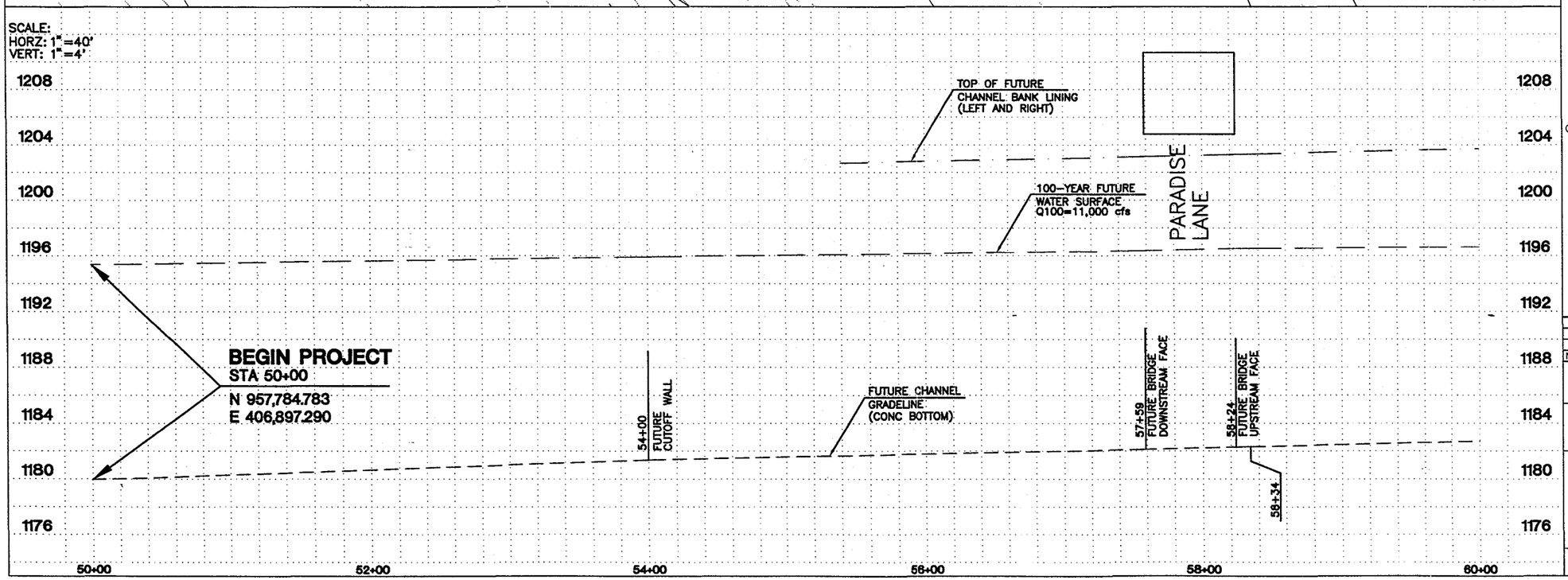
Sverdrup CORPORATION

SURVEY CONTROL SHEET

SHEET OF 01B 30

FILE: N:\013255\DWG\C\C255A701.DWG DATE:7/10/95





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
①	1245.00'	48°28'20"	560.47'	1053.27'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING — TOP OF SLOPE / TOE OF SLOPE
- (RECOMMENDED) BANK LINING — TOP OF SLOPE / TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC — BURIED CABLE TV
  - NG — BURIED NATURAL GAS
  - P — BURIED POWER LINE
  - OHP — OVERHEAD POWER w/ POLE
  - SS — SANITARY SEWER w/ MANHOLE
  - SD — STORM DRAIN
  - T — BURIED TELEPHONE CABLE
  - W — WATER MAIN w/ VALVE
  - SD — (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY
NOT FOR
CONSTRUCTION

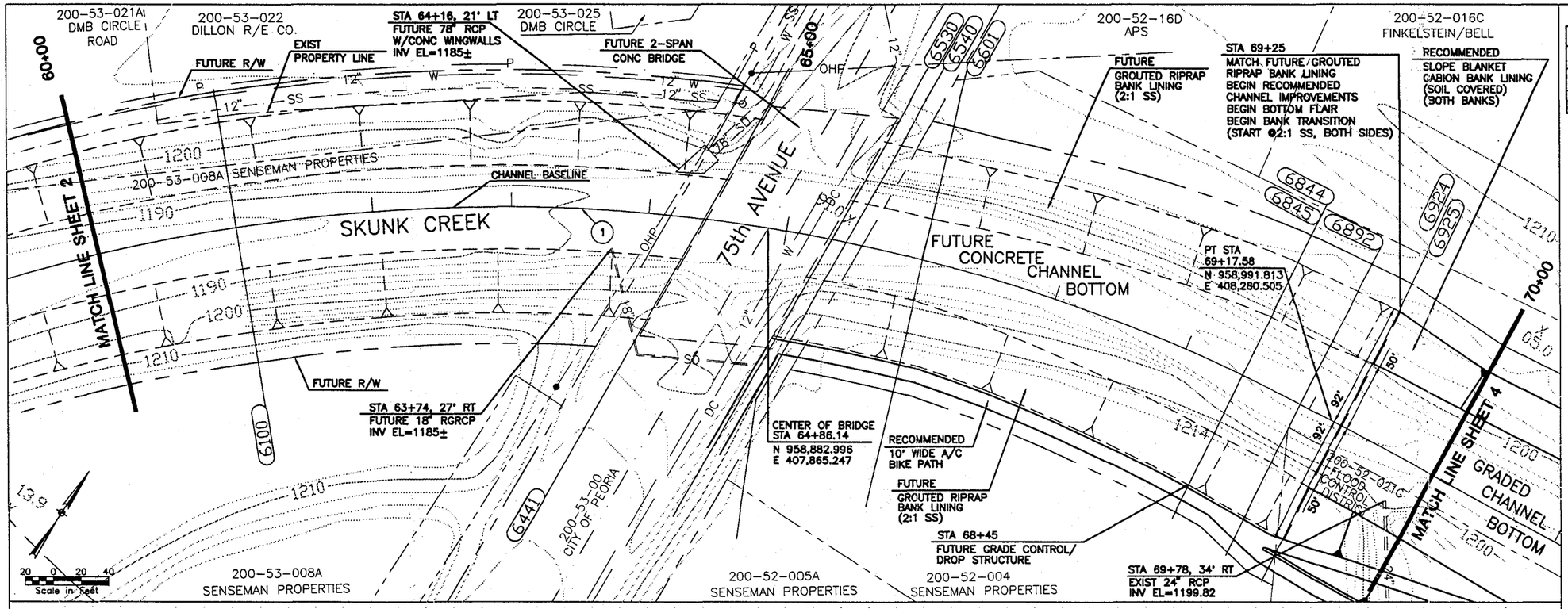
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 02 30

FILE: N:\013255\DWG\C\C255A702.DWG DATE: 04/26/95

MCDOT PLAN VIEW RA-304 11/93



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
①	1245.00'	48°28'20"	560.47'	1053.27'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
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- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY
NOT FOR
CONSTRUCTION

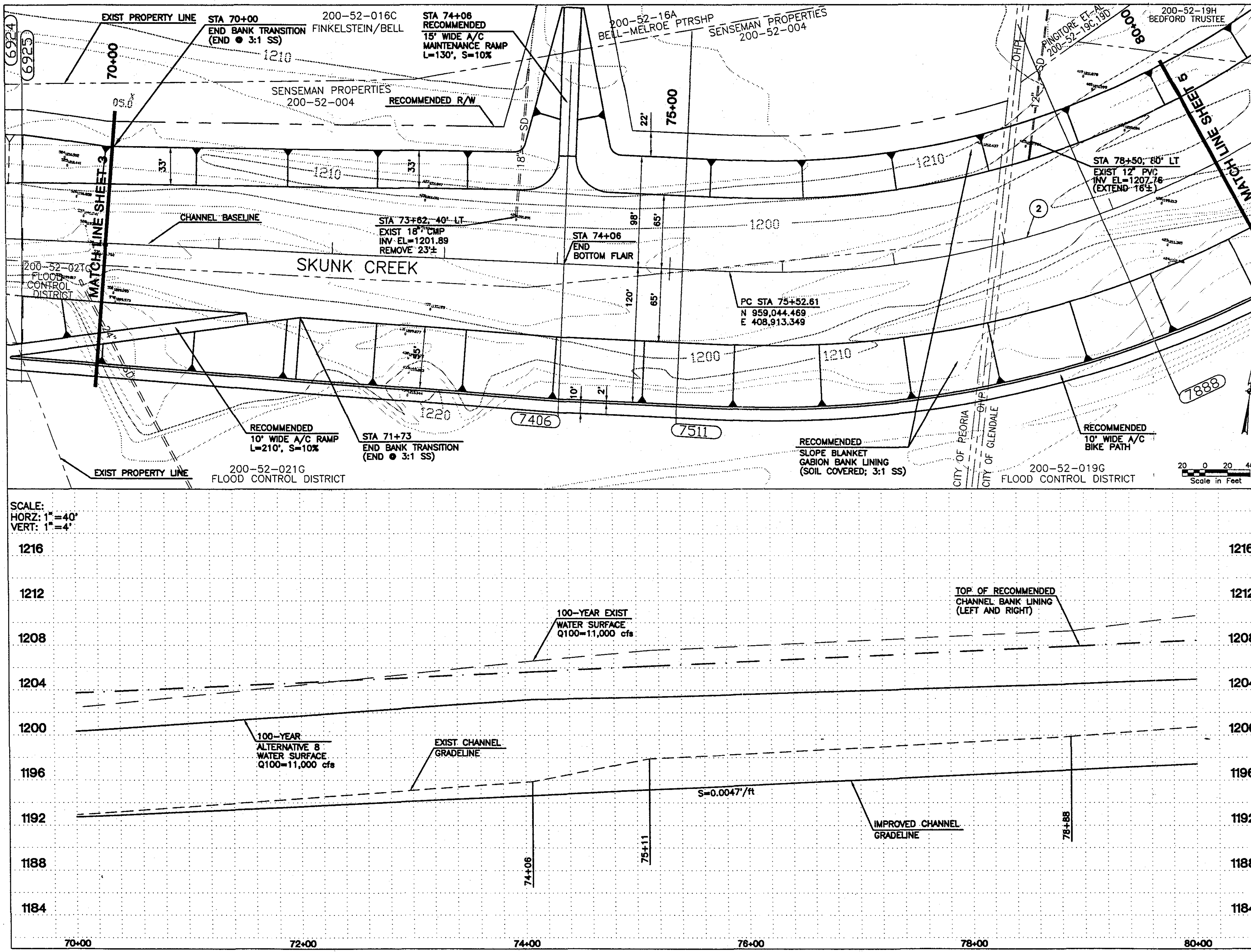
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF
03 30

\013255\DWG\C\C255A703.DWG DATE: 02/21/95

MSPACE PLAN VIEW RA: 120, 46.50"



CHANNEL BASELINE CURVE DATA

CURVE#	RADIUS	DELTA	TANGENT	ARC LENGTH
②	850.00'	40°17'26"	311.82'	597.72'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- CROSS SECTION / STATION
- (EXIST) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
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  - SD — STORM DRAIN
  - T — BURIED TELEPHONE CABLE
  - W — WATER MAIN w/ VALVE
  - SD — (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

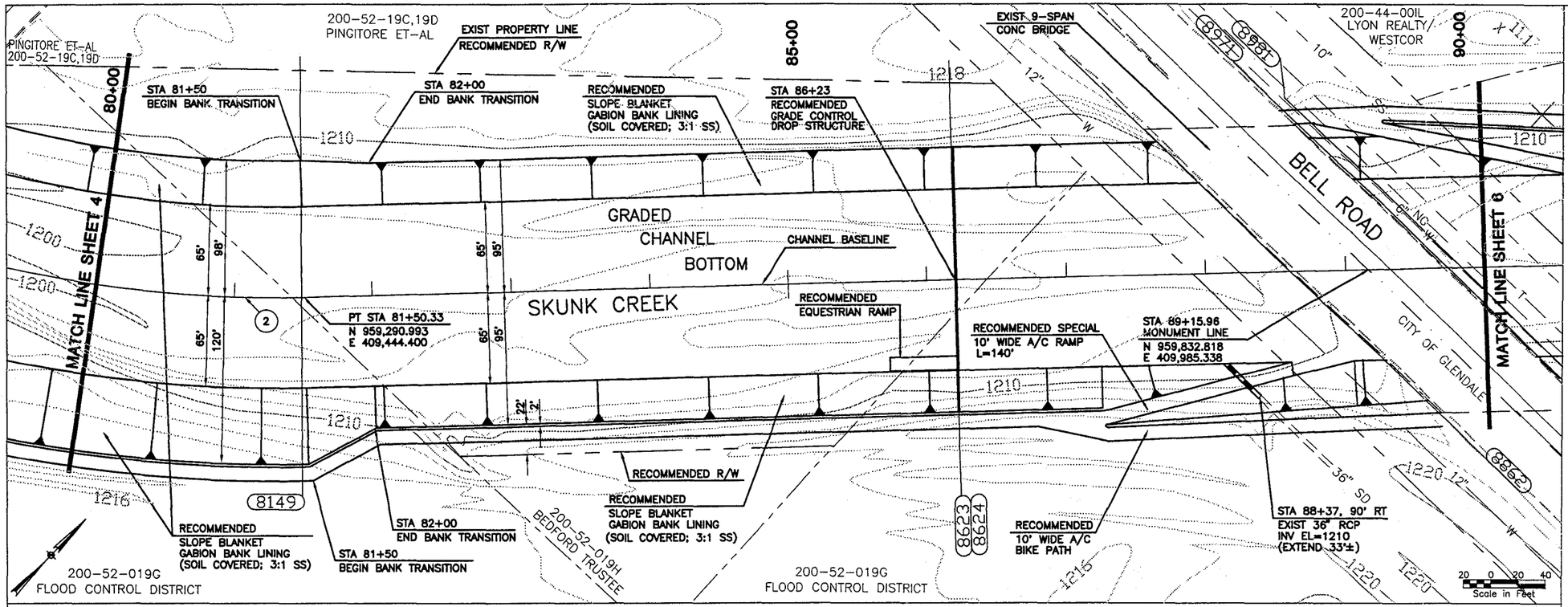
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE — SHEET 04 OF 30

FILE: N:\013255\DWG\C\C255A704.DWG DATE: 04/27/95



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(2)	850.00'	40°17'26"	311.82'	597.72'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
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- (RECOMMENDED) BIKE PATH
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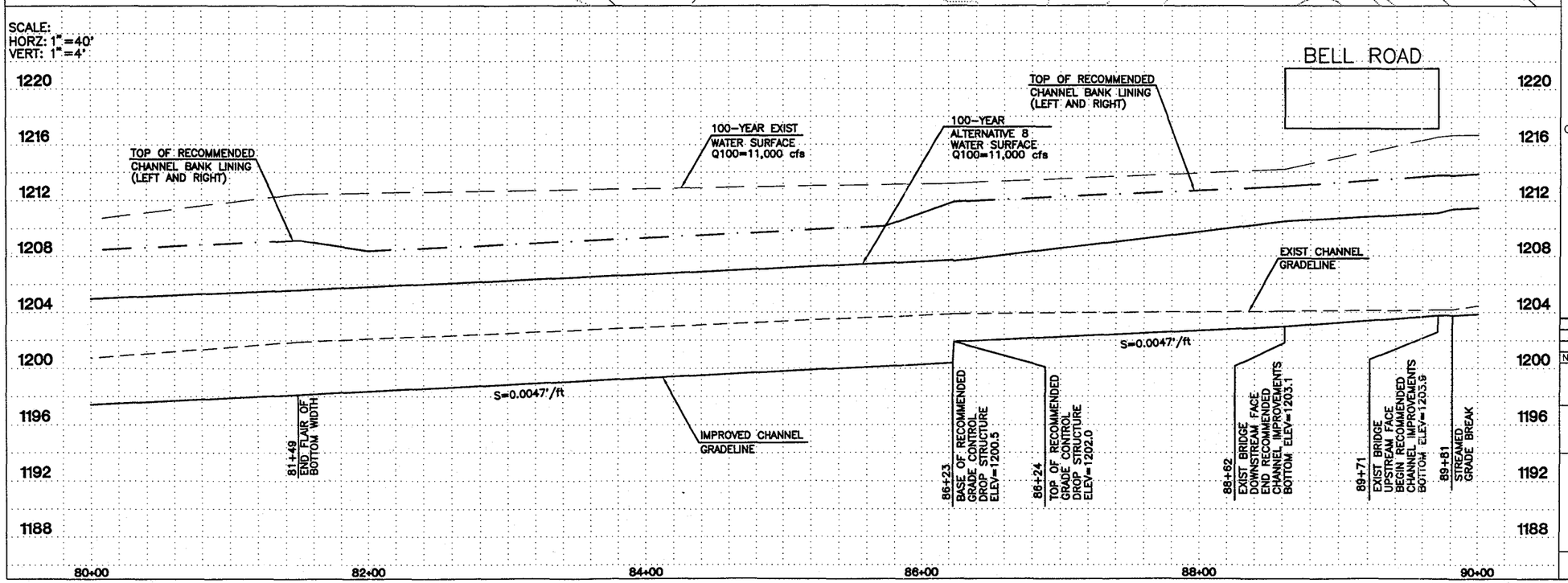


LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY
NOT FOR
CONSTRUCTION

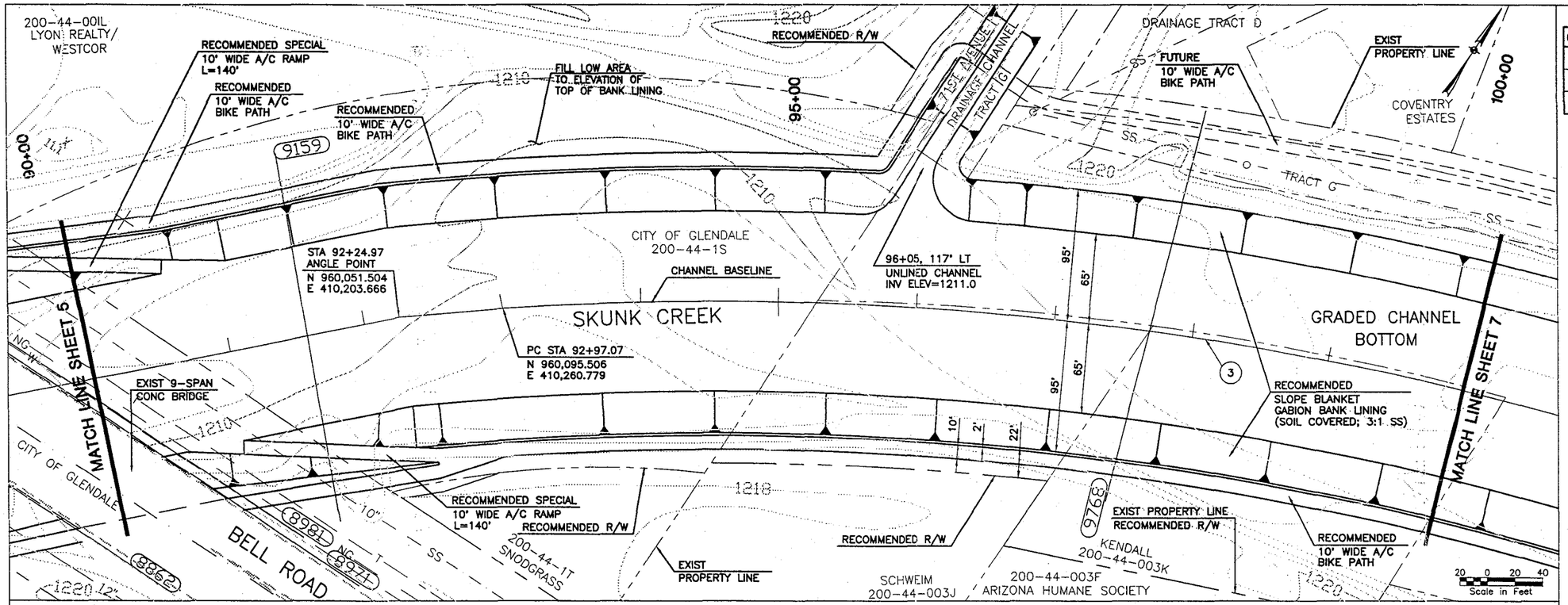
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF
05 30

FILE: N:\013255\DWG\C\C255A705.DWG DATE: 04/26/95

MSPACE PLAN VIEW RA-316 4567*



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
3	2291.83'	21°19'31"	431.50'	853.01'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
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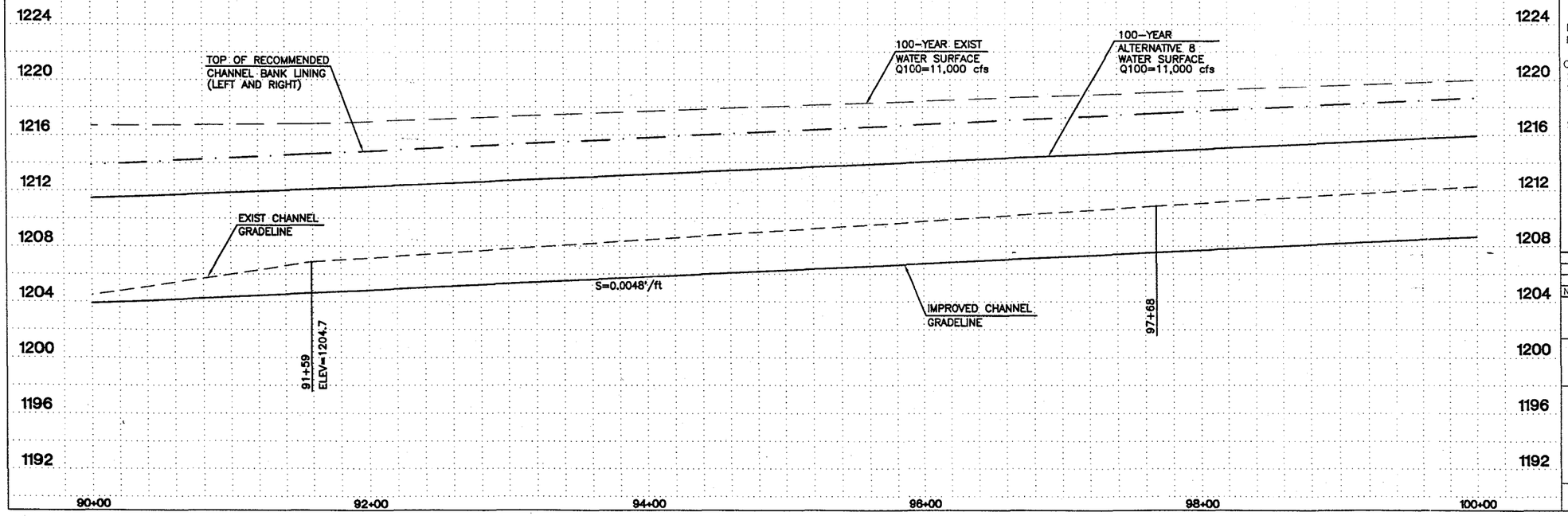
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

SCALE:
HORZ: 1"=40'
VERT: 1"=4'



LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY
NOT FOR
CONSTRUCTION

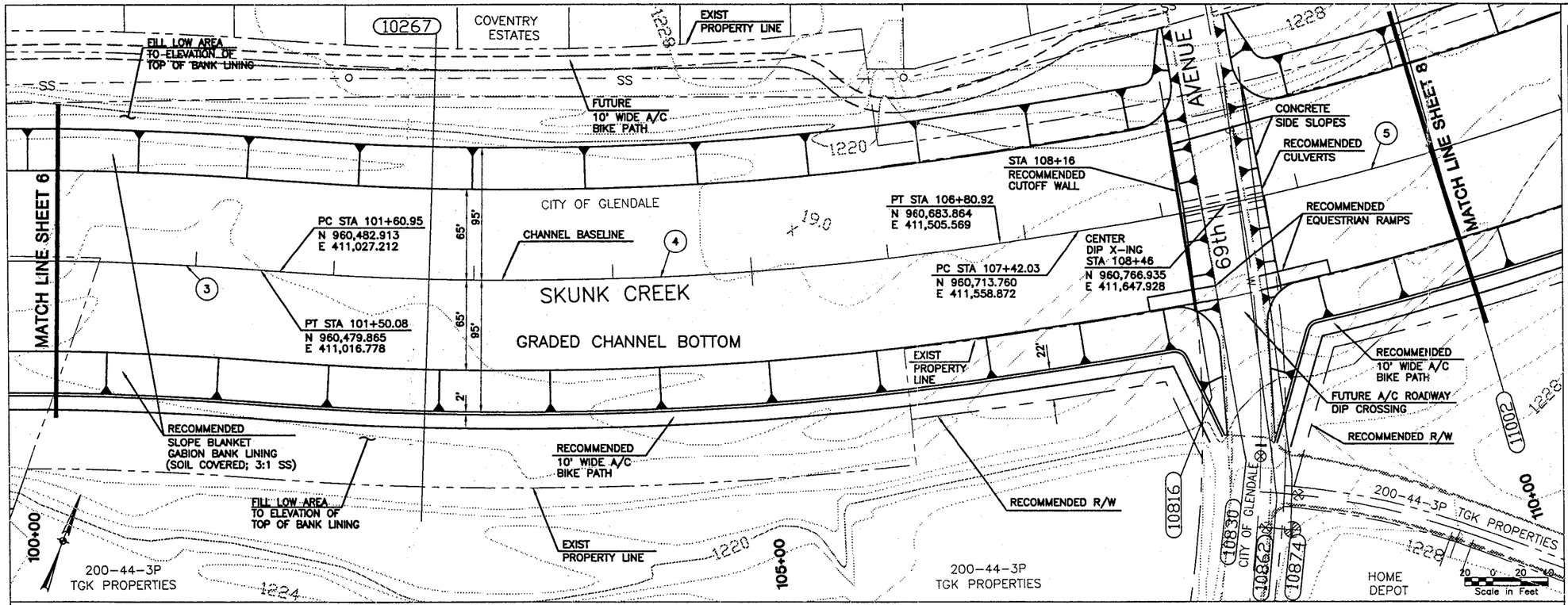
Sverdrup CORPORATION

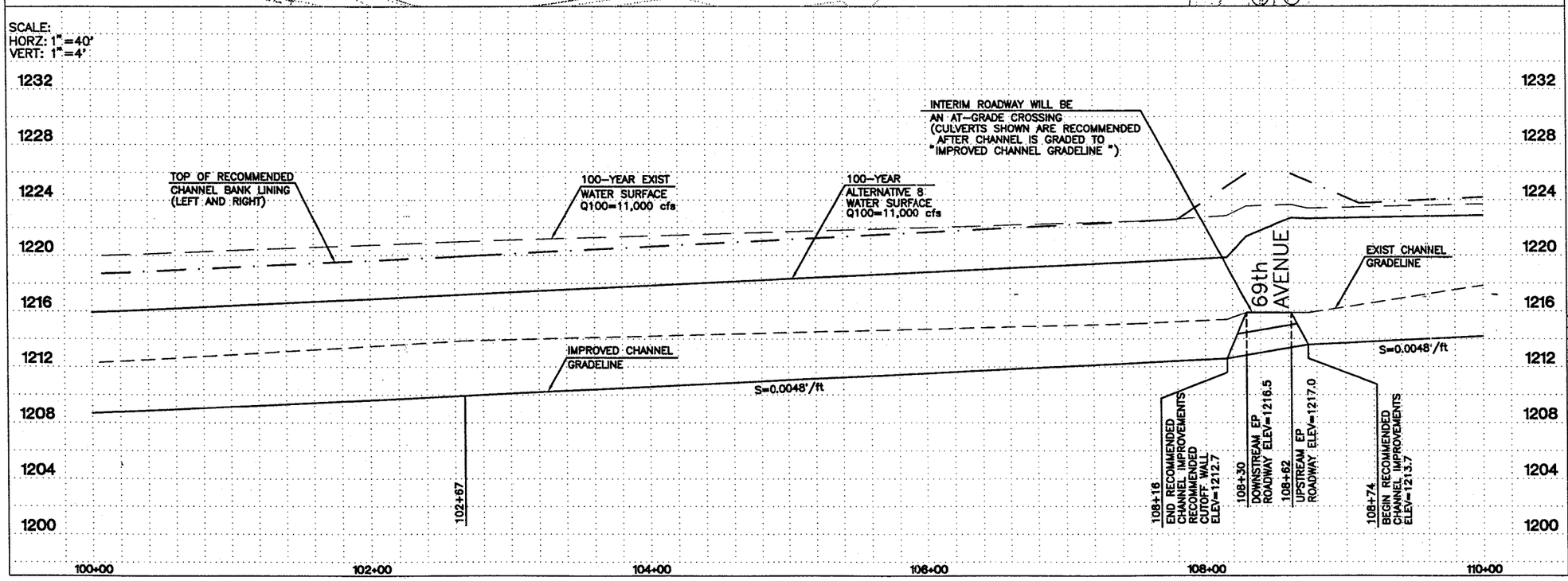
RECOMMENDED ALTERNATIVE

SHEET OF 06 30

FILE: N:\013255\DWG\C\C255A706.DWG DATE: 04/26/95

MCPAFF PLAN VIEW RA-126 4119*





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
③	2291.83'	21°19'31"	431.50'	853.01'
④	2291.83'	12°59'57"	261.10'	519.57'
⑤	1909.86'	20°20'28"	342.77'	678.32'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE / TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE / TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

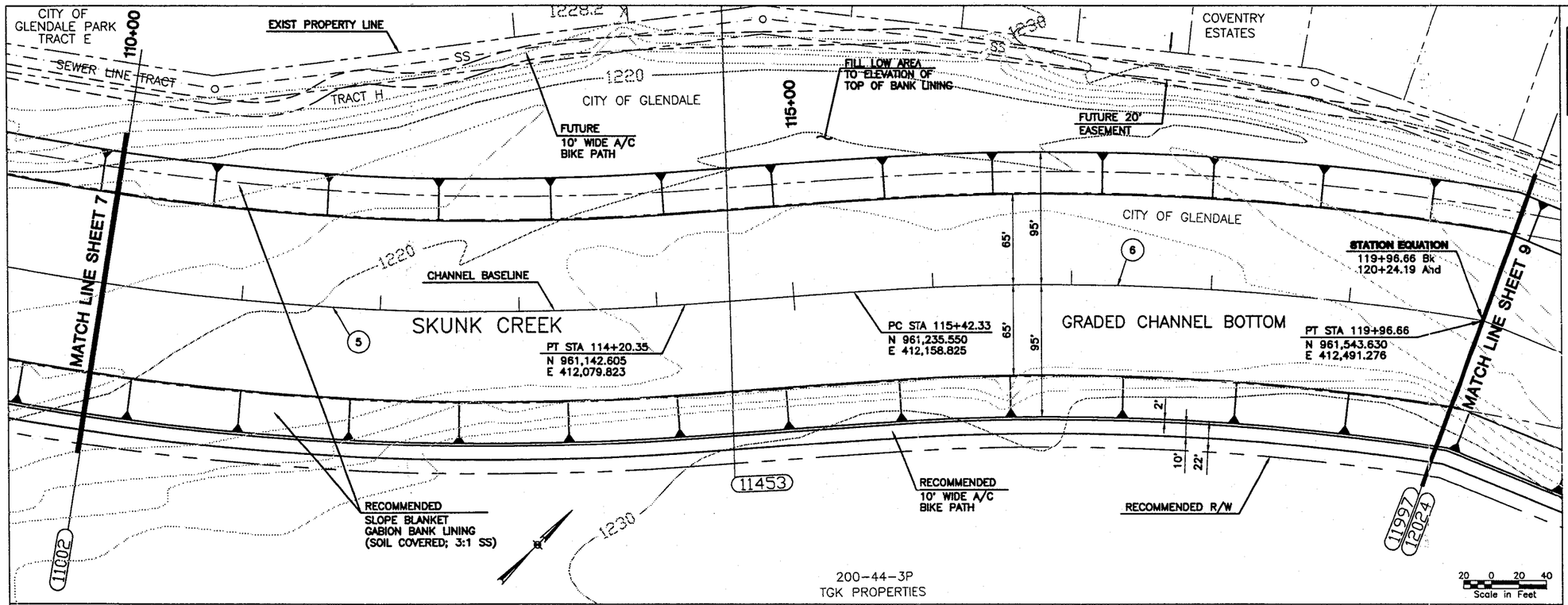
Sverdrup CORPORATION

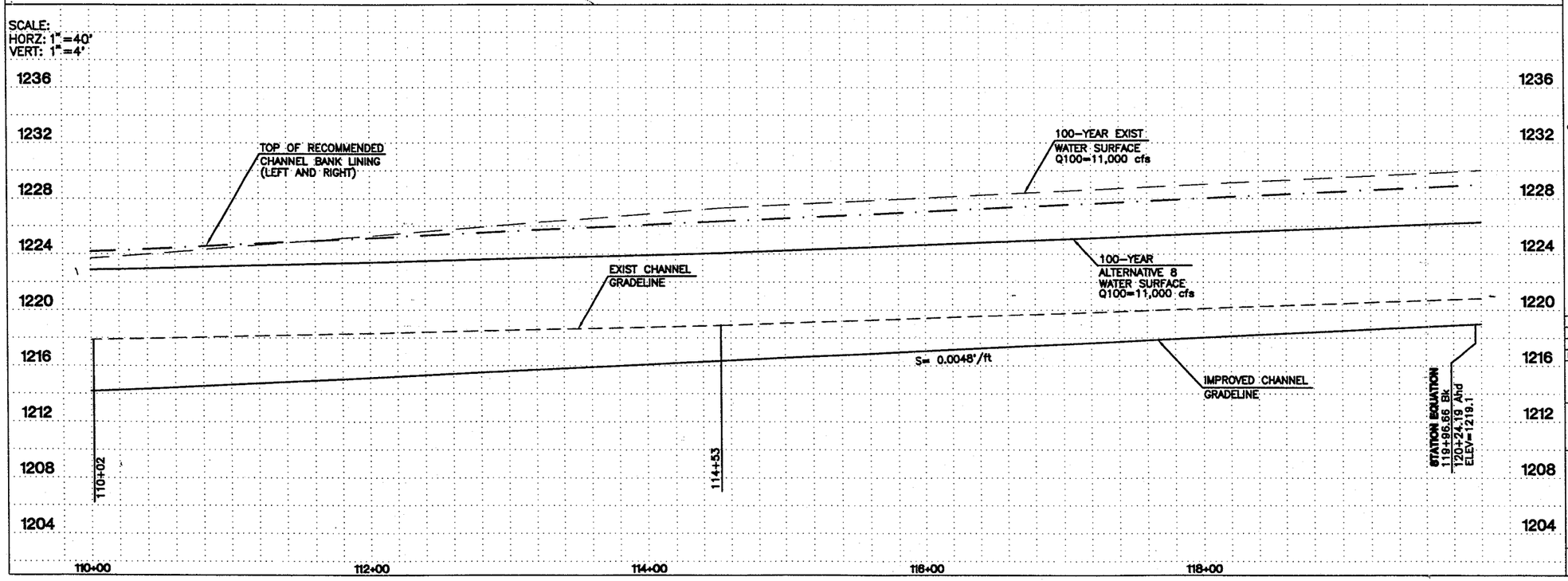
RECOMMENDED ALTERNATIVE

SHEET OF 07 30

FILE: N:\013255\DWG\C\C255A707.DWG DATE: 04/22/95

PLAN VIEW RA-339 4"=1'-0"





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(5)	1909.86'	20°20'58"	342.77'	678.32'
(6)	1909.86'	13°37'47"	228.24'	454.32'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC — BURIED CABLE TV
  - NG — BURIED NATURAL GAS
  - P — BURIED POWER LINE
  - OHP — OVERHEAD POWER w/ POLE
  - SS — SANITARY SEWER w/ MANHOLE
  - SD — STORM DRAIN
  - T — BURIED TELEPHONE CABLE
  - W — WATER MAIN w/ VALVE
  - SD — (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

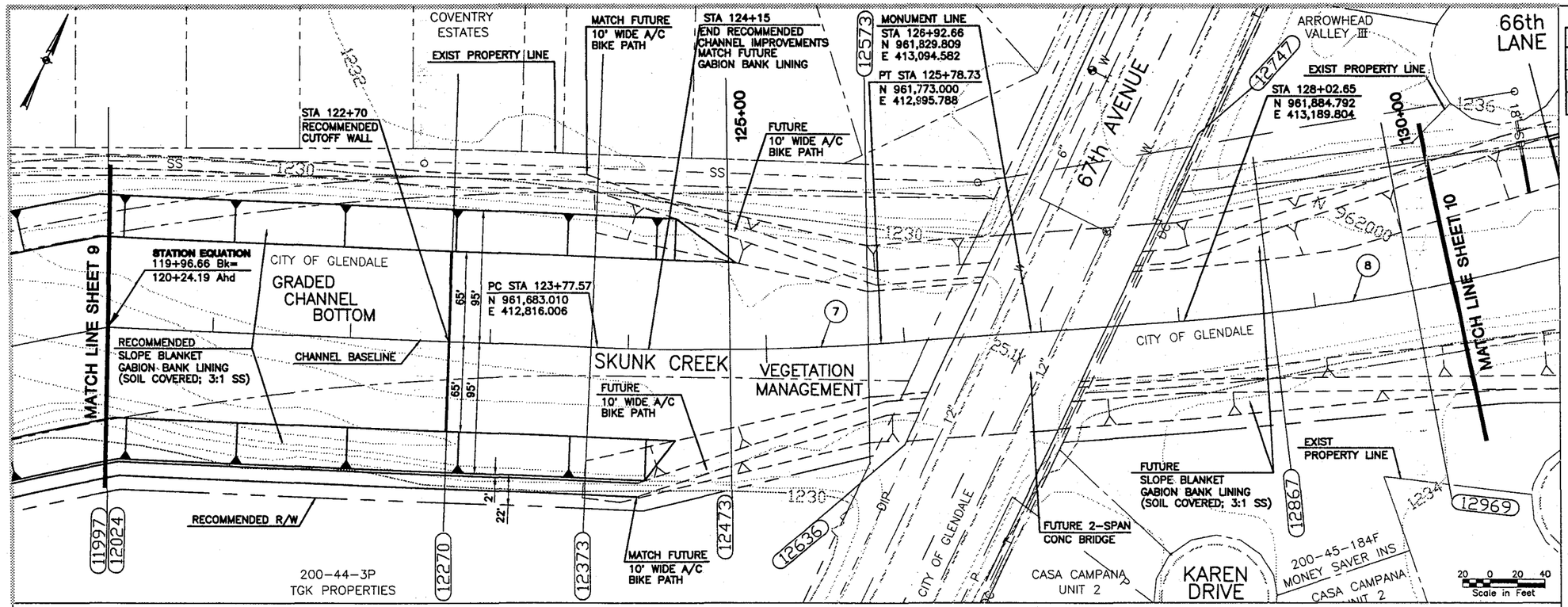
Sverdrup CORPORATION

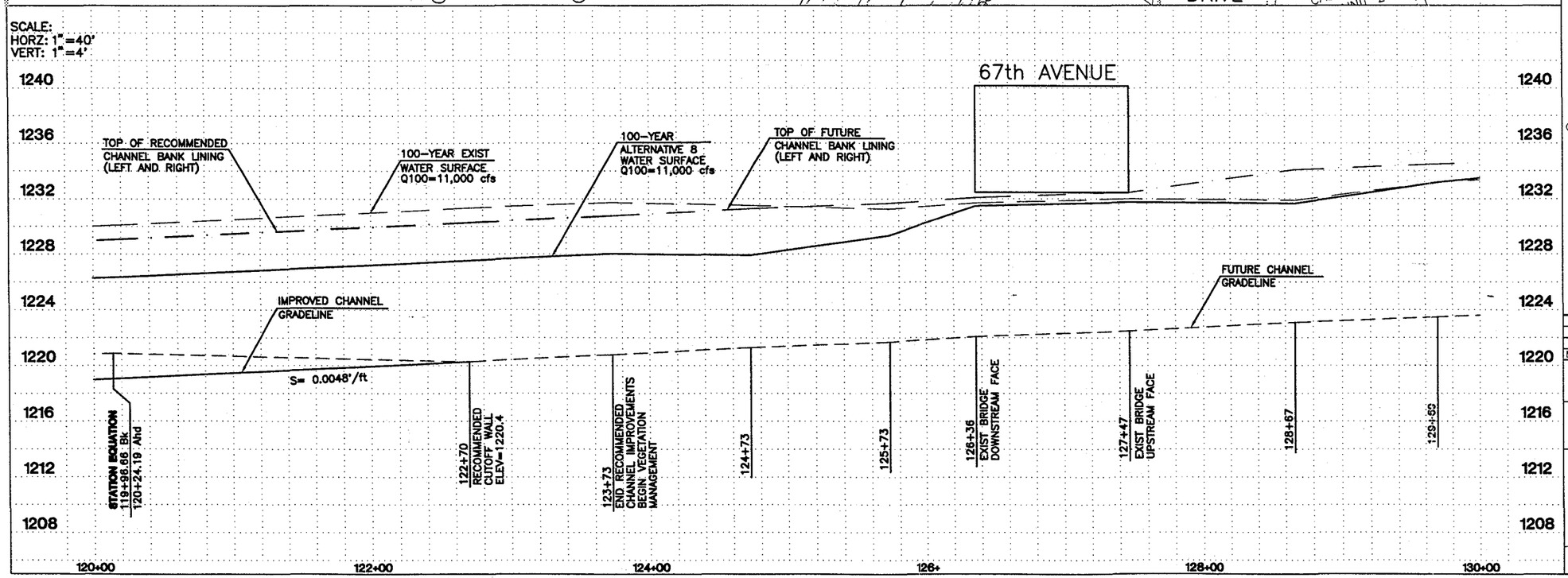
RECOMMENDED ALTERNATIVE

SHEET OF 08 30

FILE: N:\013255\DWG\C\C255A708.DWG DATE: 04/22/95

PLAN VIEW RA-314 5/95





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
⑦	1700.00'	6°46'47"	100.70'	201.76'
⑧	1500.00'	22°59'10"	304.99'	601.78'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

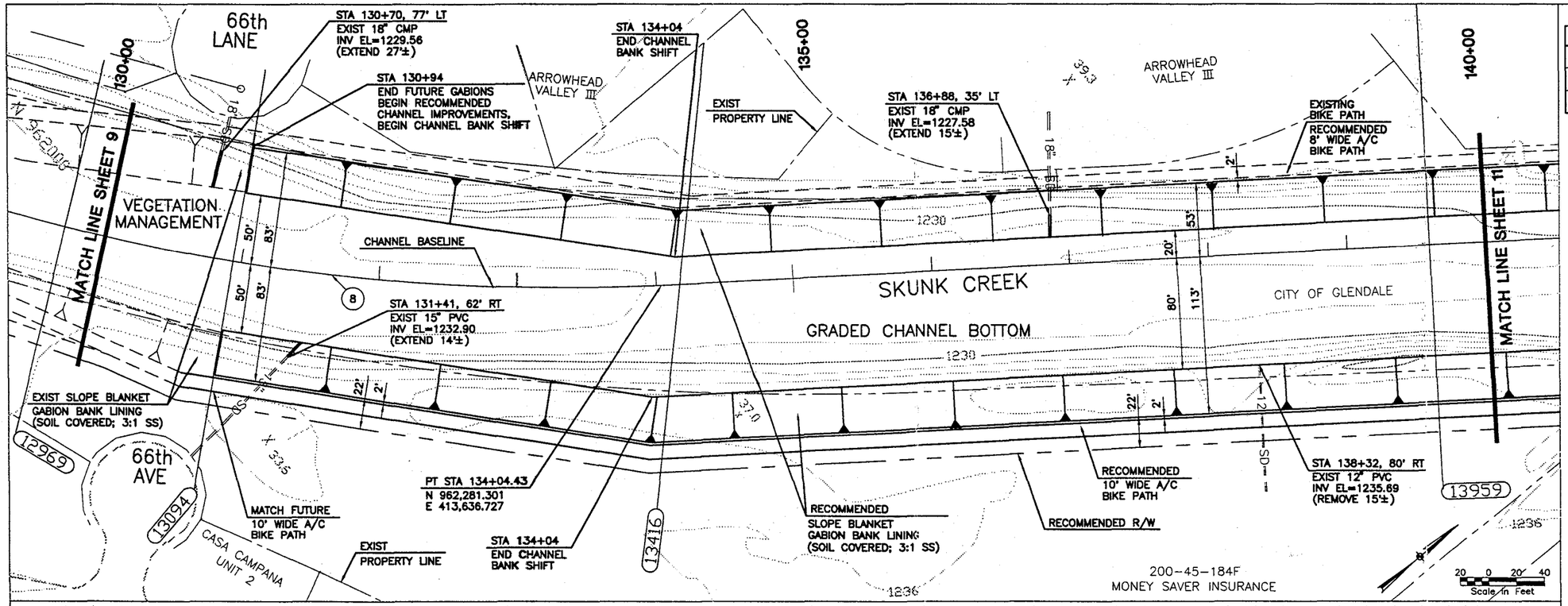
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

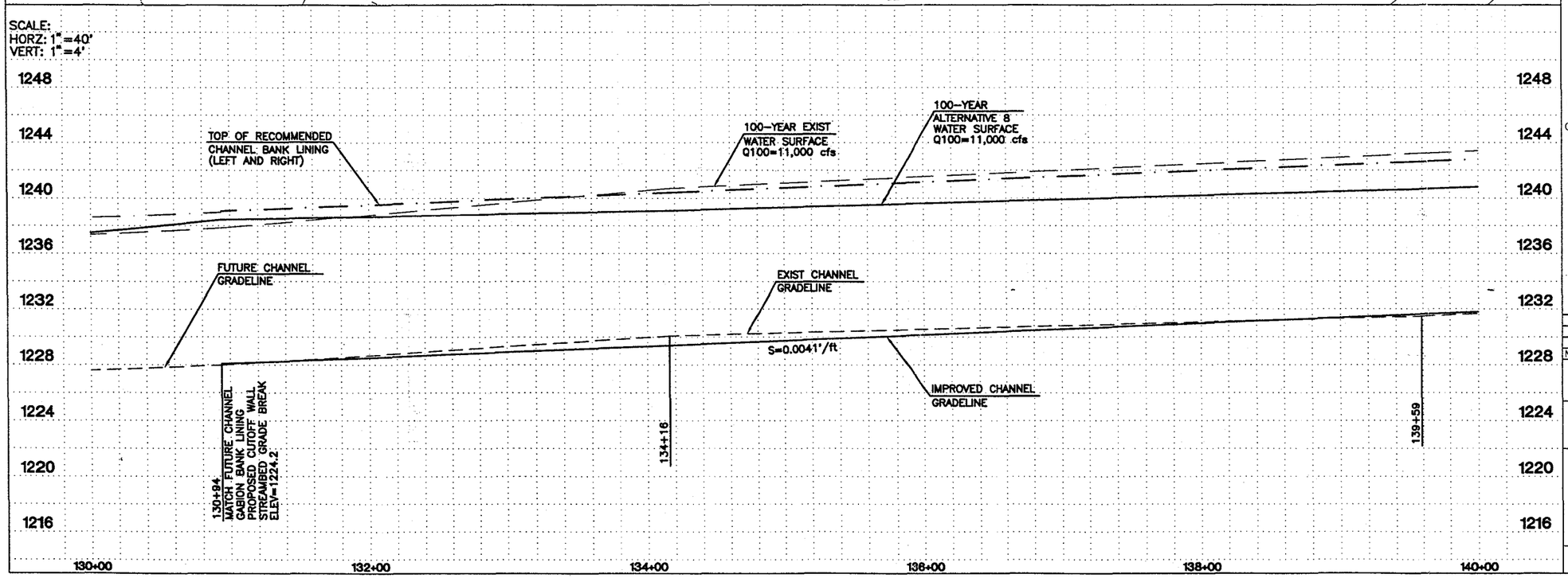
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE — SHEET OF 09 30

FILE: N:\013255\DWG\C255AZ09.DWG DATE: 03/26/95



SCALE:
HORZ: 1"=40'
VERT: 1"=4'



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(8)	1500.00'	22°59'10"	304.99'	601.78'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE / TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

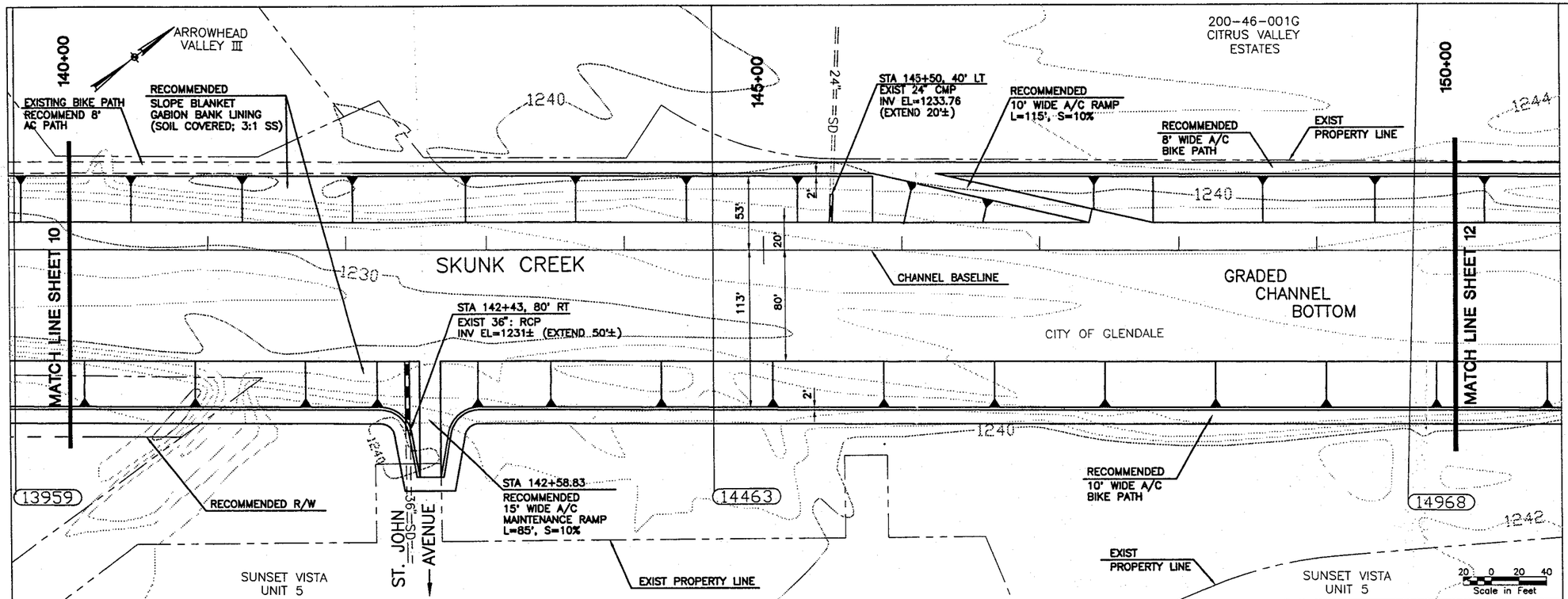
	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

Sverdrup CORPORATION

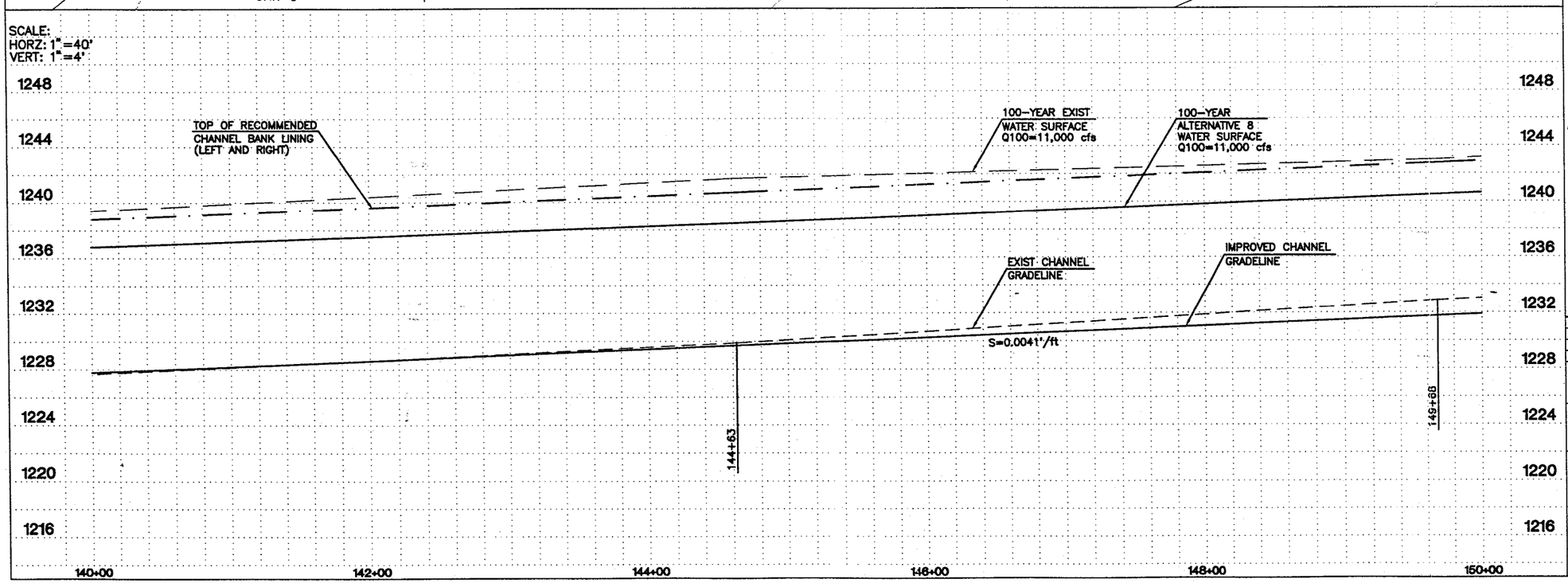
RECOMMENDED ALTERNATIVE

SHEET OF 10 30

PACE PLAN VIEW RA1309.7(18)



SCALE:
HORZ: 1"=40'
VERT: 1"=4'



NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE
  1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING
  TOP OF SLOPE
  TOE OF SLOPE
- (RECOMMENDED) BANK LINING
  TOP OF SLOPE
  TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
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  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
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  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY
NOT FOR
CONSTRUCTION

Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 11 30

PLOT PLAN VIEW RA-306.6003

200-46-001G
CITRUS VALLEY
ESTATES

150+00

155+00

160+00

MATCH LINE SHEET 11

MATCH LINE SHEET 13

RECOMMENDED
SLOPE BLANKET
GABION BANK LINING
(SOIL COVERED; 3:1 SS)

EXIST
PROPERTY LINE

RECOMMENDED
8' WIDE A/C
BIKE PATH

CHANNEL BASELINE

SKUNK CREEK

CITY OF GLENDALE

GRADED CHANNEL BOTTOM

RECOMMENDED
10' WIDE A/C RAMP
L=115', S=10%

EXISTING
PROPERTY LINE

RECOMMENDED
10' WIDE A/C
BIKE PATH

TRACT "B"

14968

15603

16062

SUNSET VISTA
UNIT 6

Scale in Feet
20 0 20 40

NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE
  1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED)
  RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING
  TOP OF SLOPE
  TOE OF SLOPE
- (RECOMMENDED) BANK LINING
  TOP OF SLOPE
  TOE OF SLOPE
- (EXIST)
  CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL
  STRUCTURE &
  EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

SCALE:
HORZ: 1"=40'
VERT: 1"=4'

TOP OF RECOMMENDED
CHANNEL BANK LINING
(LEFT AND RIGHT)

100-YEAR
ALTERNATIVE 8
WATER SURFACE
Q100=11,000 cfs

100-YEAR EXIST
WATER SURFACE
Q100=11,000 cfs

EXIST CHANNEL
GRADELINE

IMPROVED CHANNEL
GRADELINE

S=0.0041'/ft

158+03

1256
1252
1248
1244
1240
1236
1232
1228
1224

150+00 152+00 154+00 156+00 158+00 160+00

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

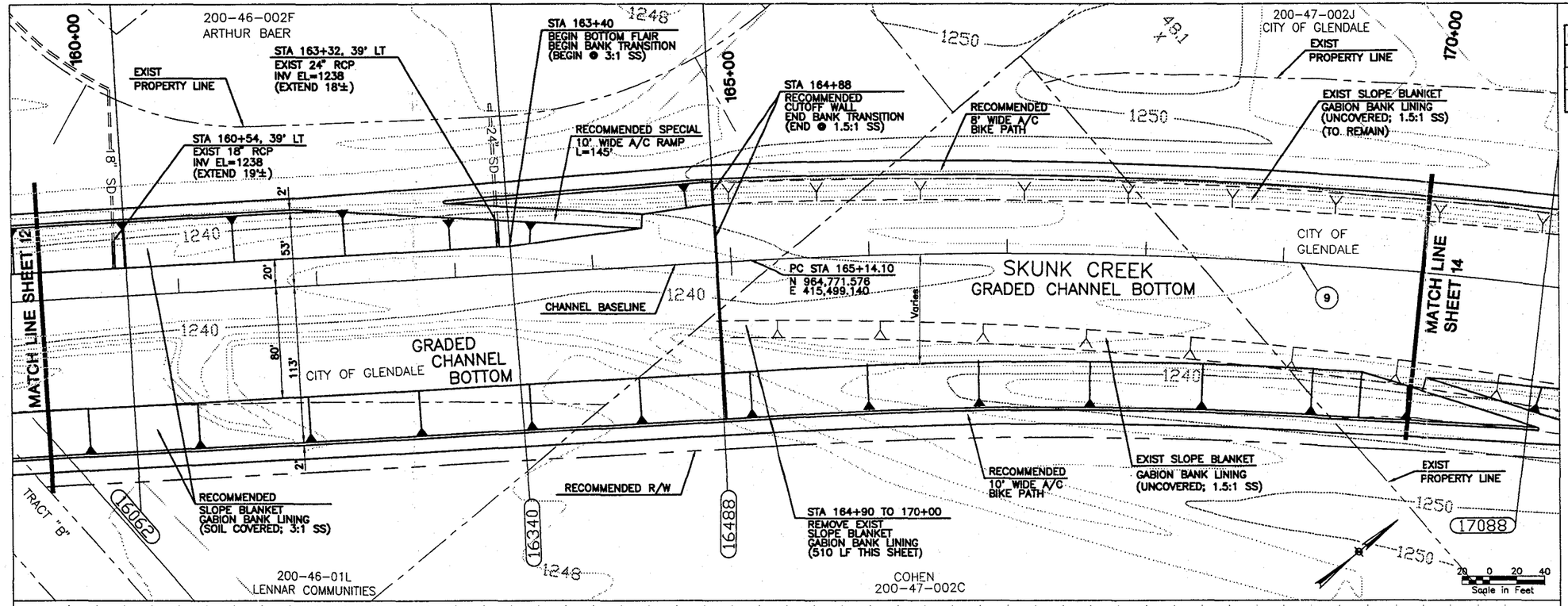
PRELIMINARY
NOT FOR
CONSTRUCTION

Sverdrup
CORPORATION

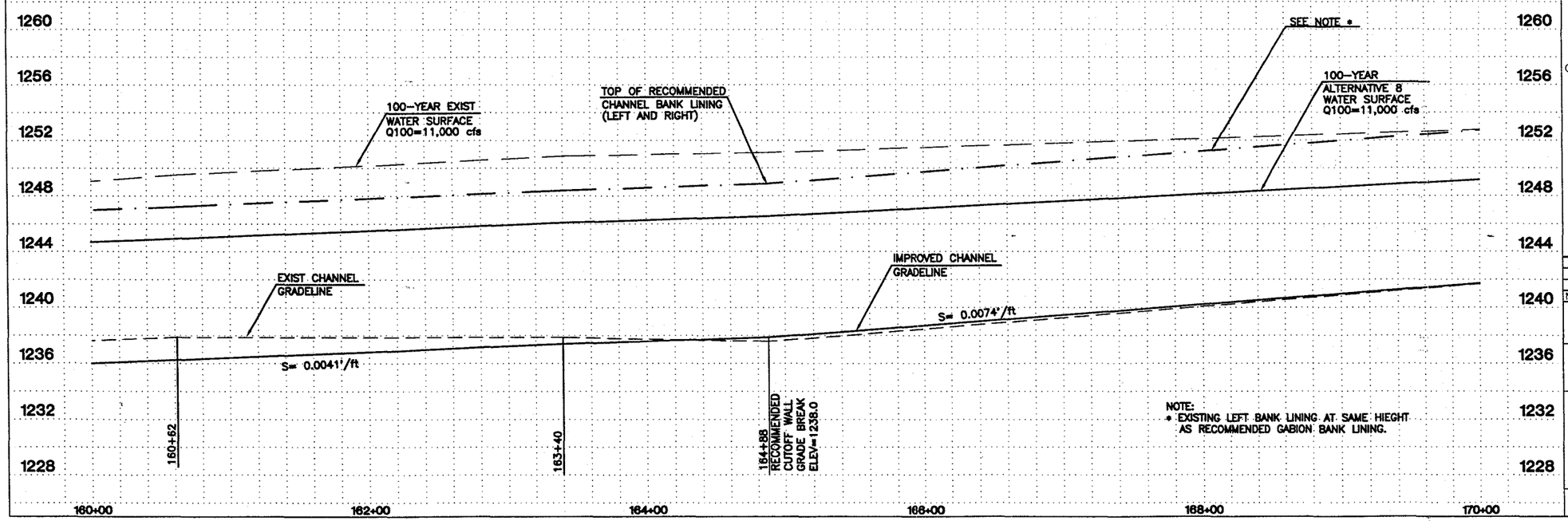
RECOMMENDED ALTERNATIVE

SHEET OF
12 30

SURFACE PLAN VIEW RA-305 1954



SCALE:
HORZ: 1"=40'
VERT: 1"=4'



NOTE:
* EXISTING LEFT BANK LINING AT SAME HIEGHT AS RECOMMENDED GABION BANK LINING.

CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(9)	3290.00'	53°16'06"	1649.96'	3052.74'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

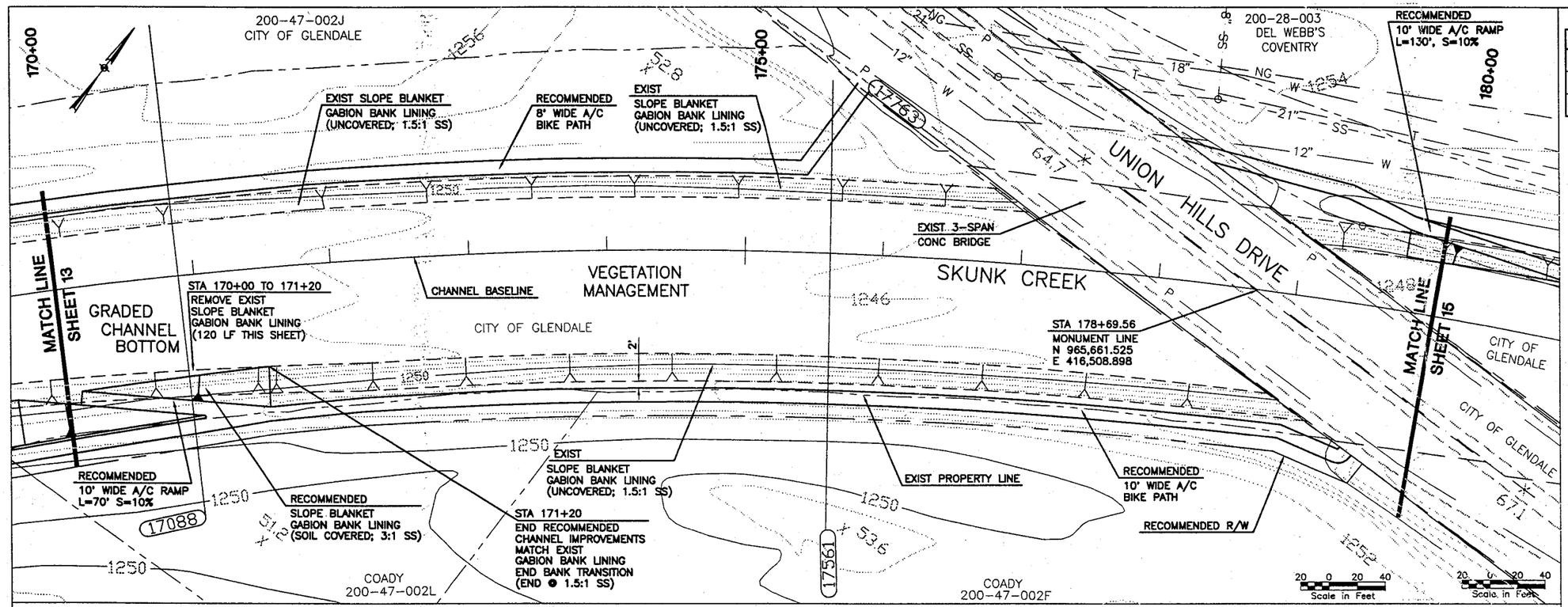
PRELIMINARY NOT FOR CONSTRUCTION

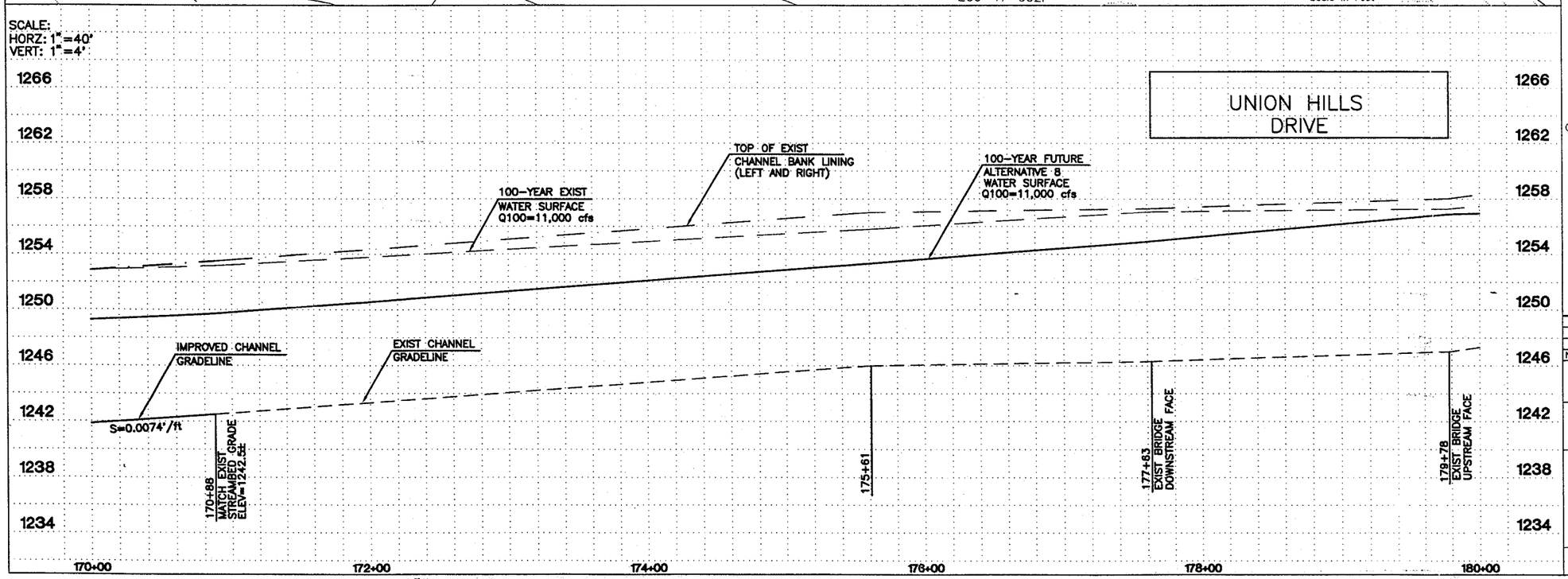
	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 13 30





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
⑨	3290.00'	53°16'06"	1649.96'	3058.74'

LEGEND (PLAN)

- SECTION LINE
  1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING
  TOP OF SLOPE
  TOE OF SLOPE
- (RECOMMENDED) BANK LINING
  TOP OF SLOPE
  TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY
NOT FOR
CONSTRUCTION

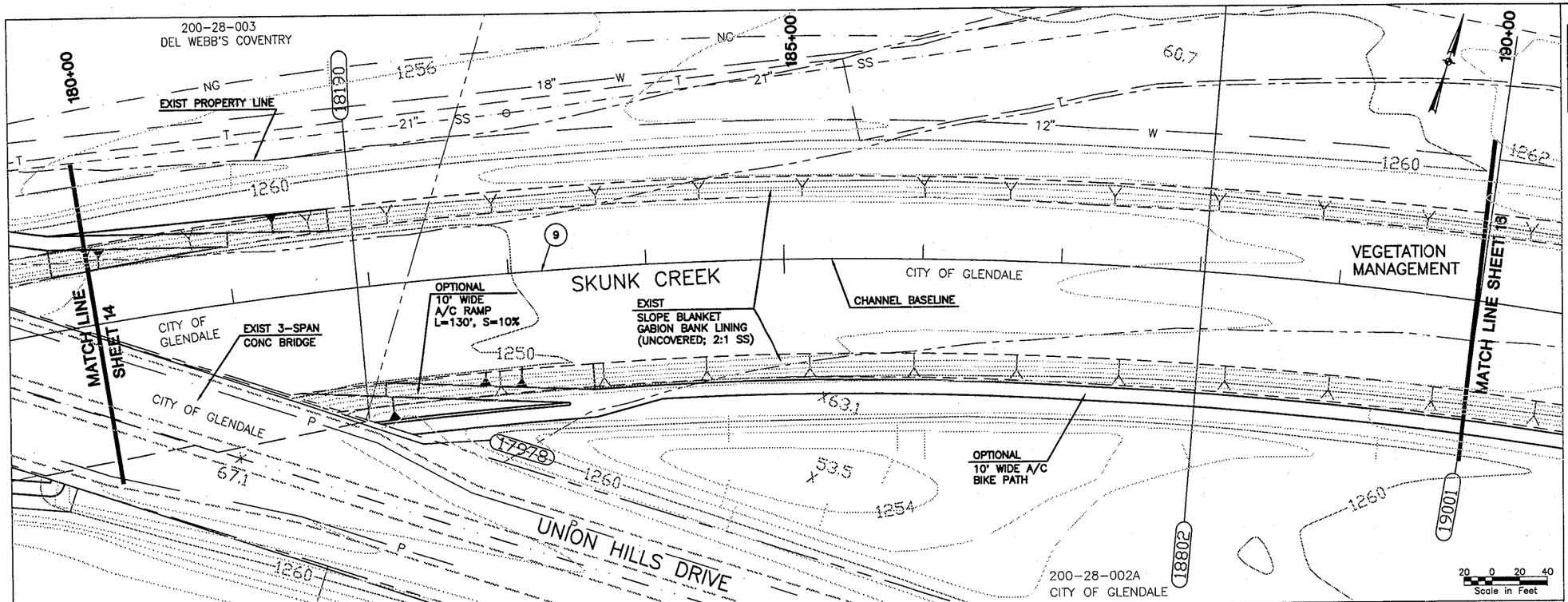
	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

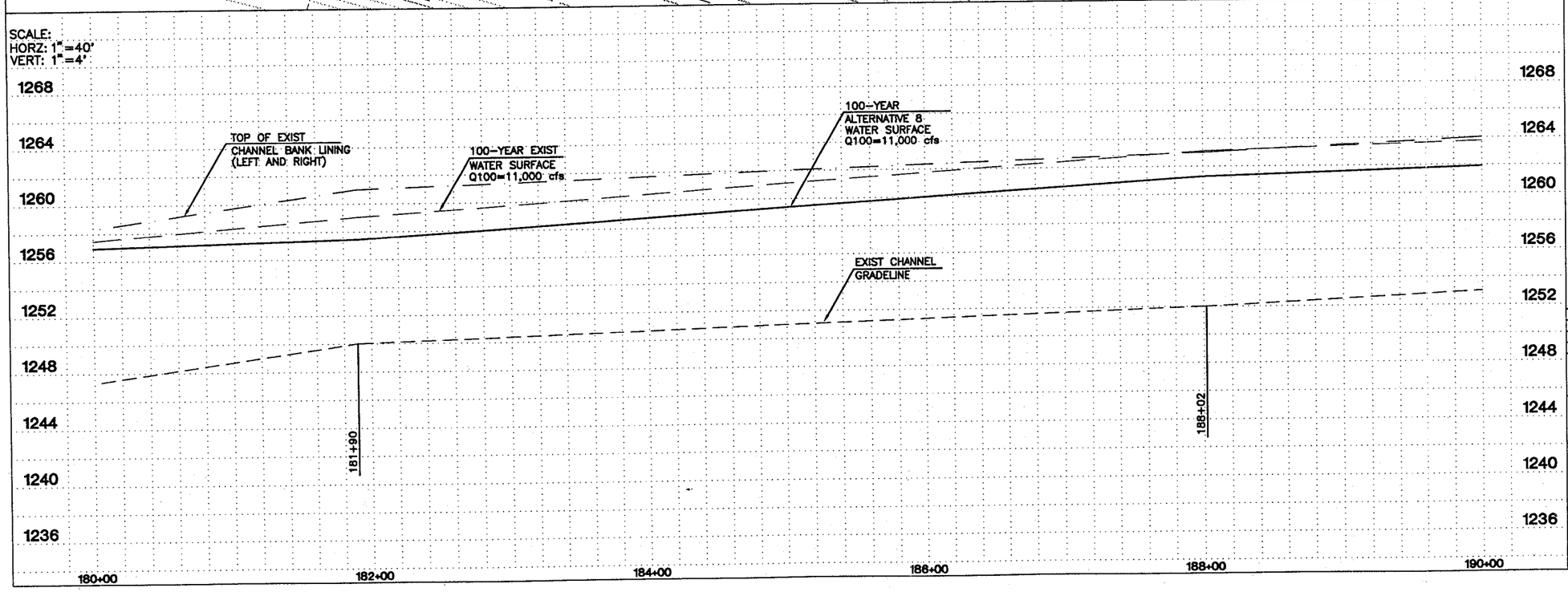
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 14 30

SPACE PLAN VIEW PA:322 9171*





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(9)	3290.00'	53°16'06"	1649.96'	3058.74'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE / TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE / TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY NOT FOR CONSTRUCTION

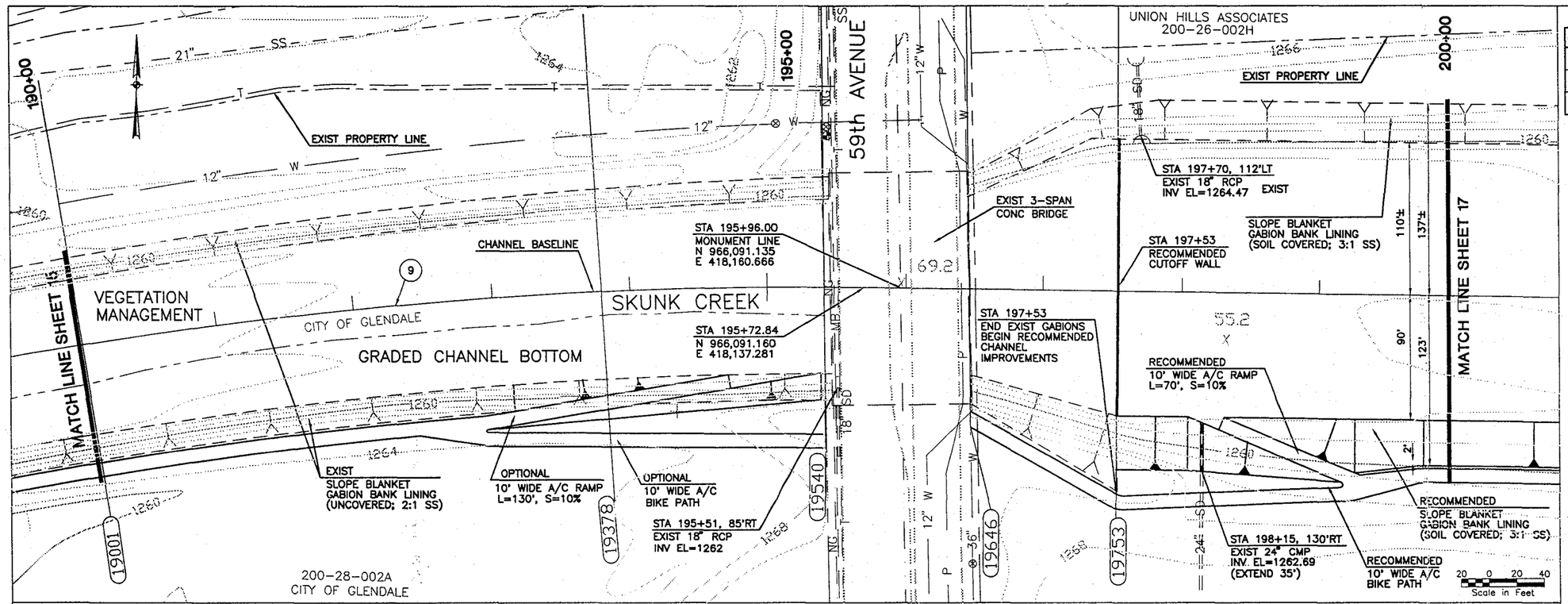
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 15 30

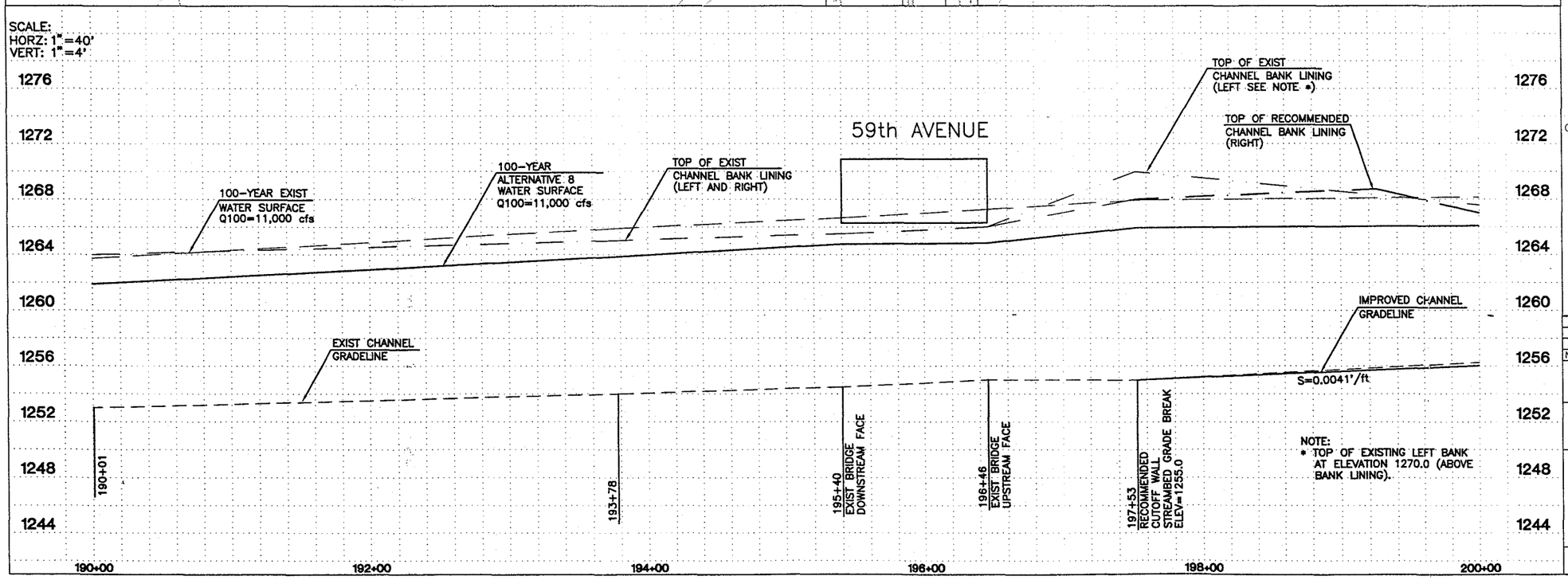
FILE: N:\013255\DWG\C\C255A715.DWG DATE: 03/30/95

MSPACE PLAN VIEW RA: 341 7496"



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(9)	3290.00'	53°16'06"	1649.96'	3058.74'



LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH

(EXIST) UTILITIES

- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

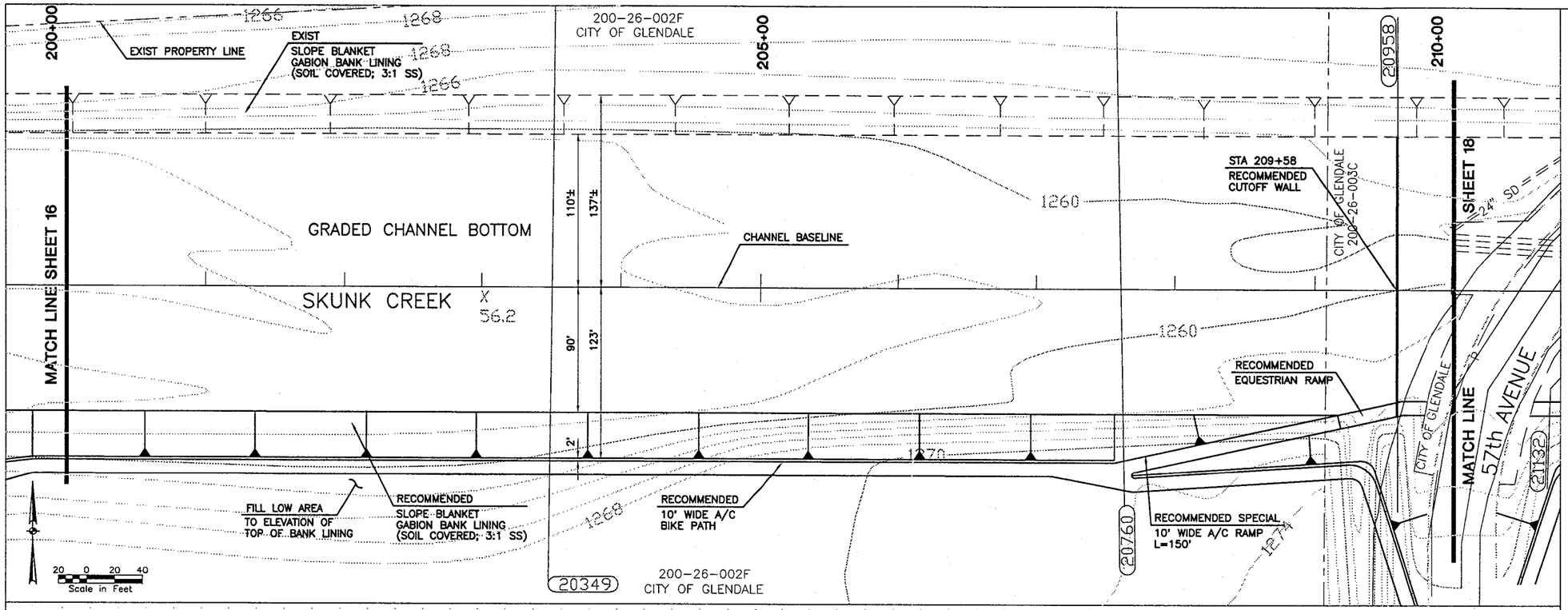
	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

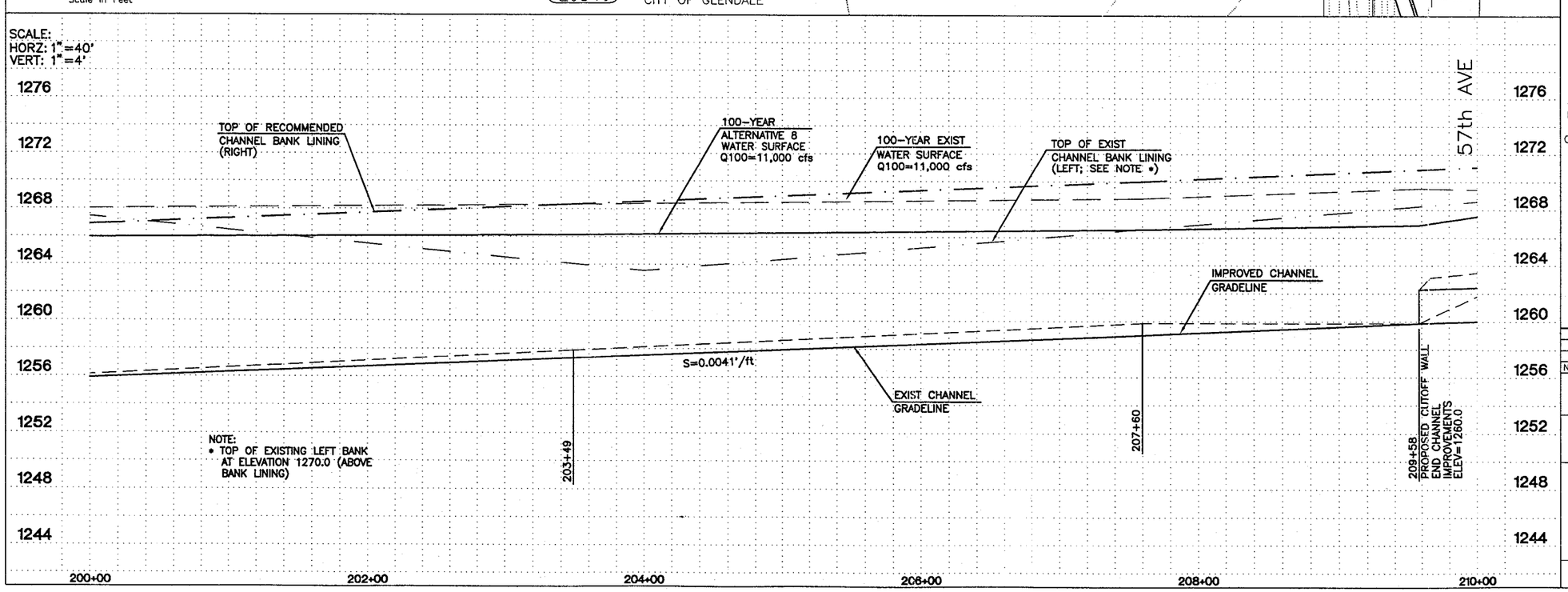
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 16 30

FILE: N:\013255\DWG\C\C255A716.DWG DATE: 04/28/95





NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

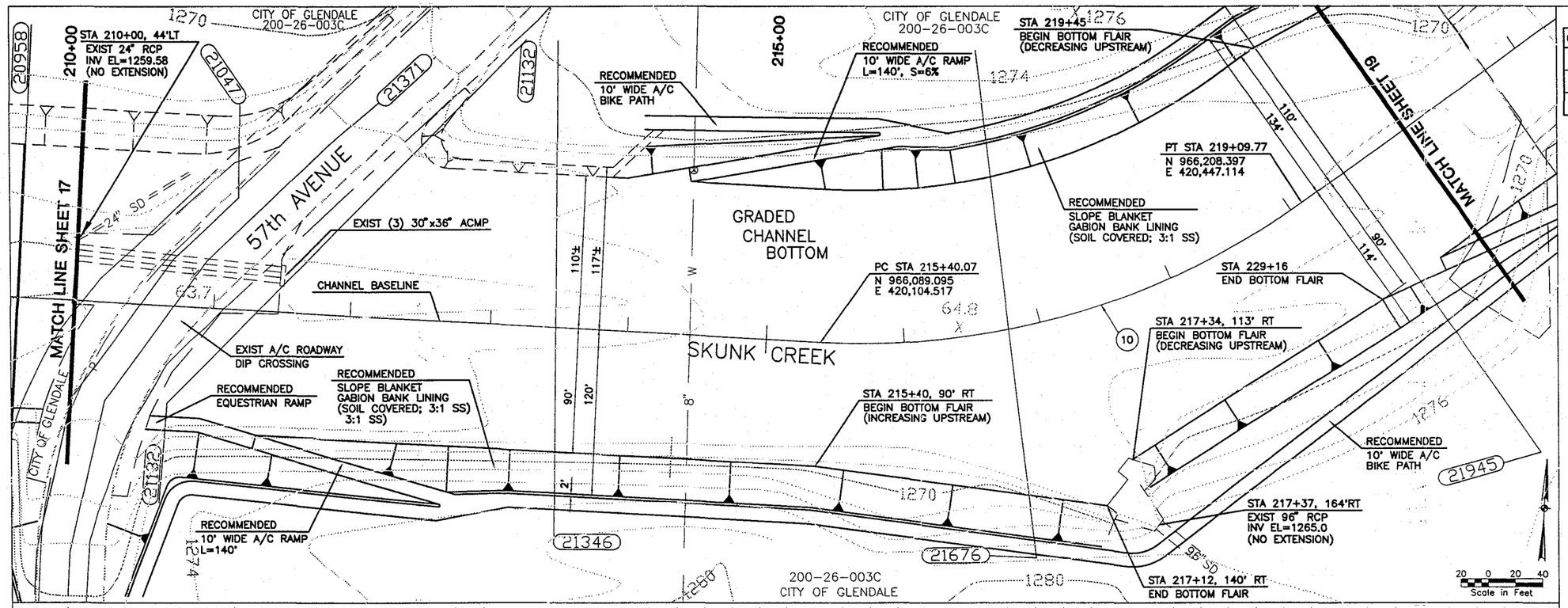
Sverdrup CORPORATION

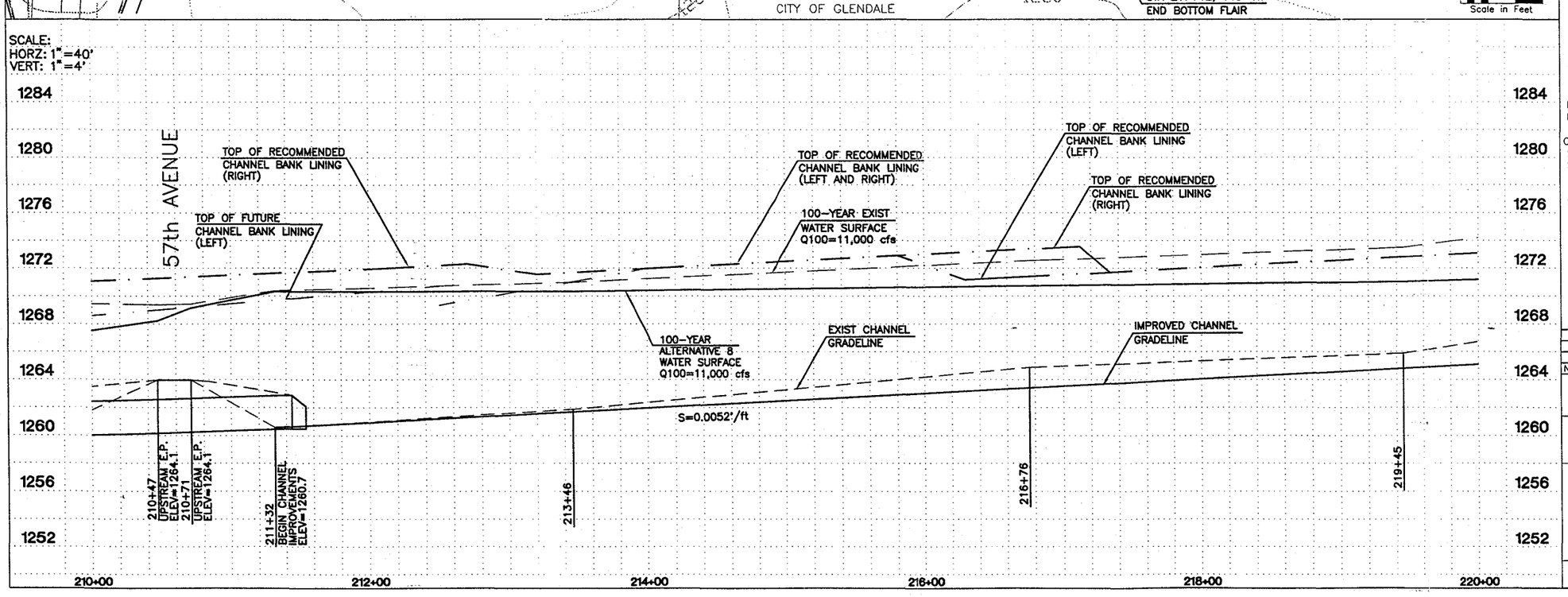
RECOMMENDED ALTERNATIVE

SHEET OF 17 30

FILE: N:\013255\DWG\C\C255A717.DWG DATE: 03/30/95

MSPACE PLAN VIEW RA-1*





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(10)	550.00'	38°30'49"	192.14'	369.70'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

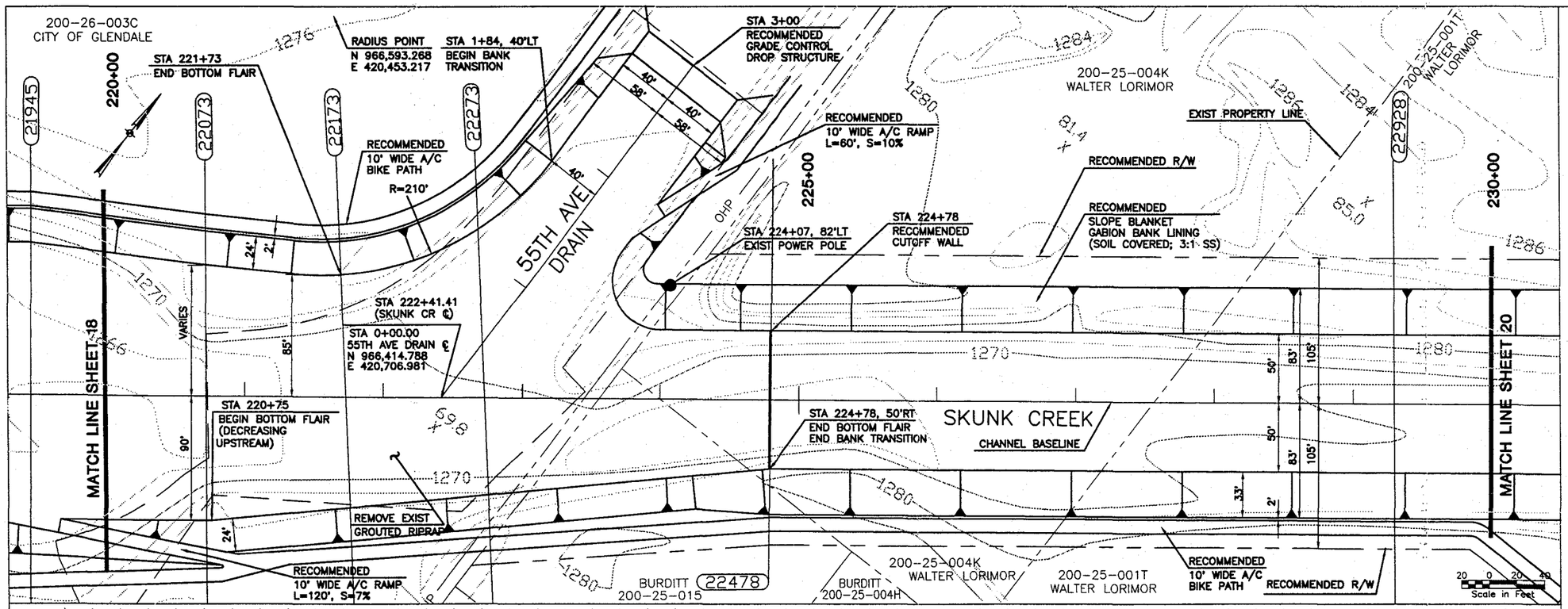
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 18 30

FILE: N:\013255\DWG\C\C255A718.DWG DATE: 04/28/95

MSPACE PLAN VIEW (PA 36, P55%)

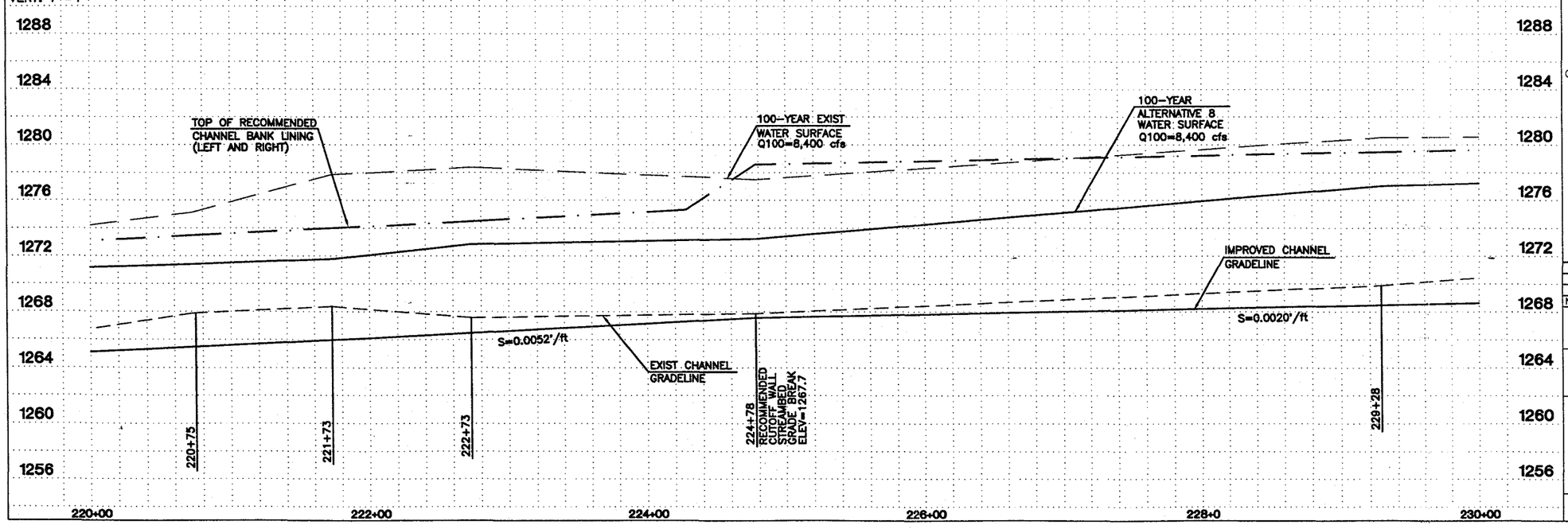


NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

SCALE:
HORZ: 1"=40'
VERT: 1"=4'



LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

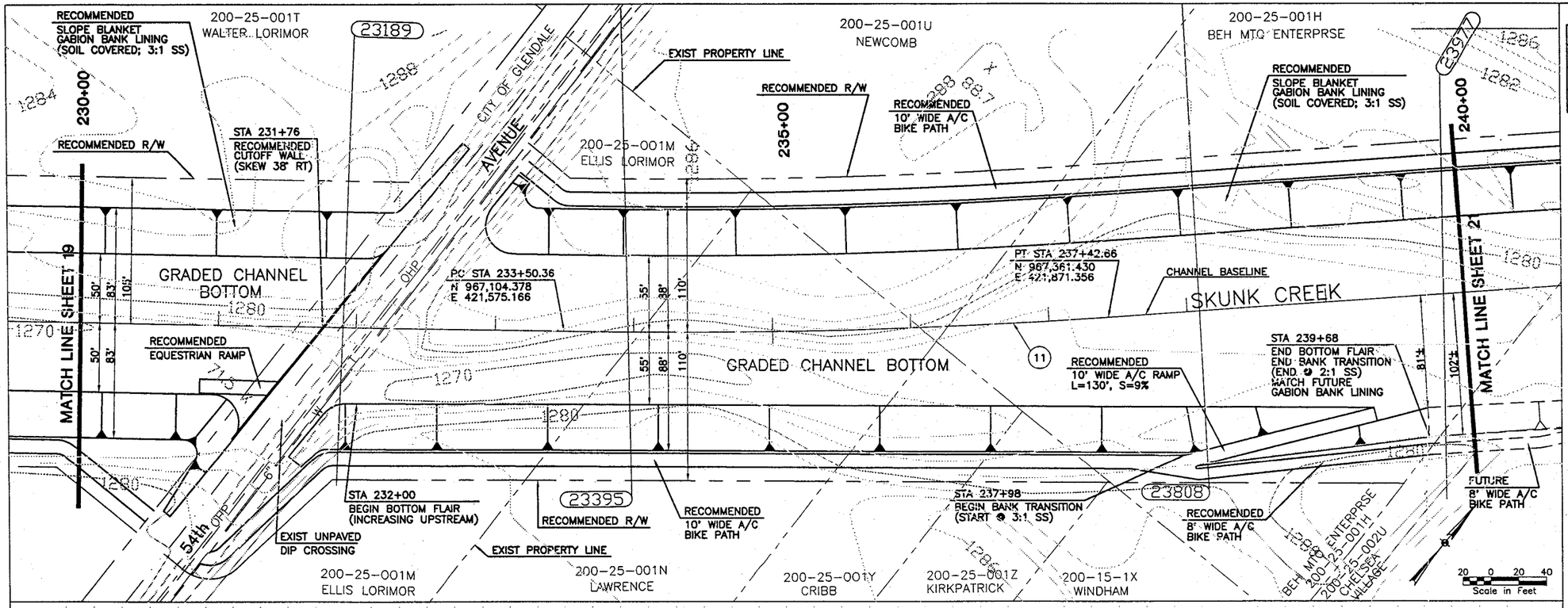
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 19 30

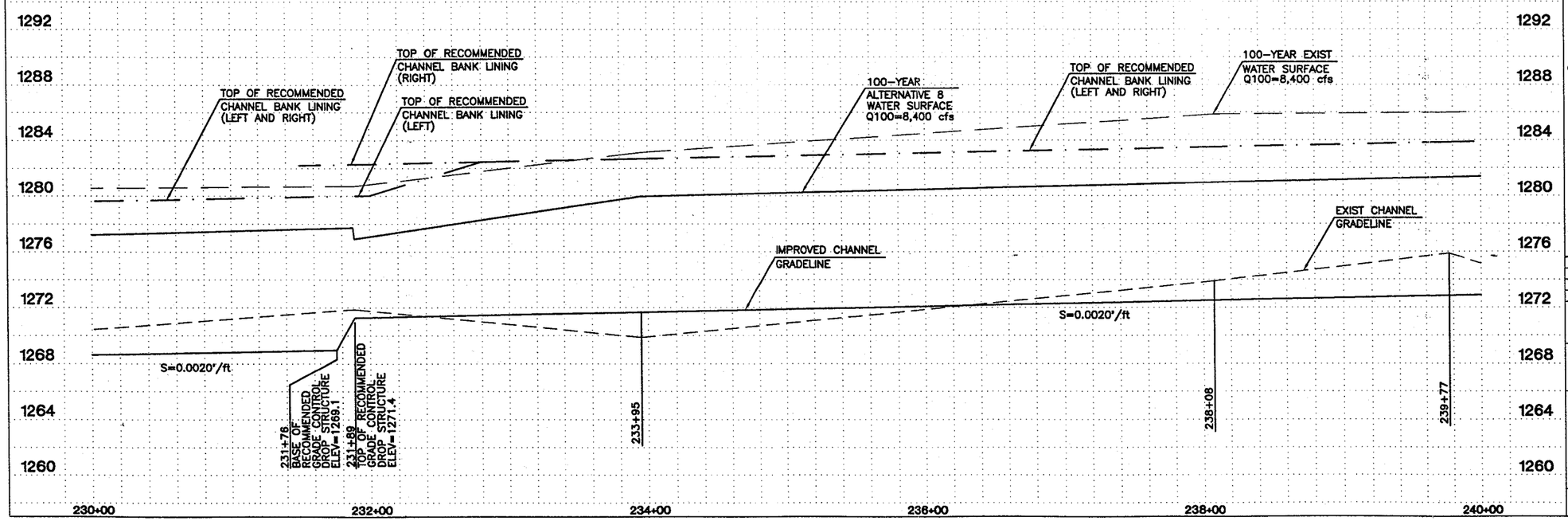
FILE: N:\013255\DWG\C\C255A719.DWG DATE: 04/04/95

MSPAFE PLAN VIEW RA:121 16:13:



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(11)	4500.00'	4°59'42	196.28'	392.30'



LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE. TOE OF SLOPE.
- (RECOMMENDED) BANK LINING TOP OF SLOPE. TOE OF SLOPE.
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY NOT FOR CONSTRUCTION

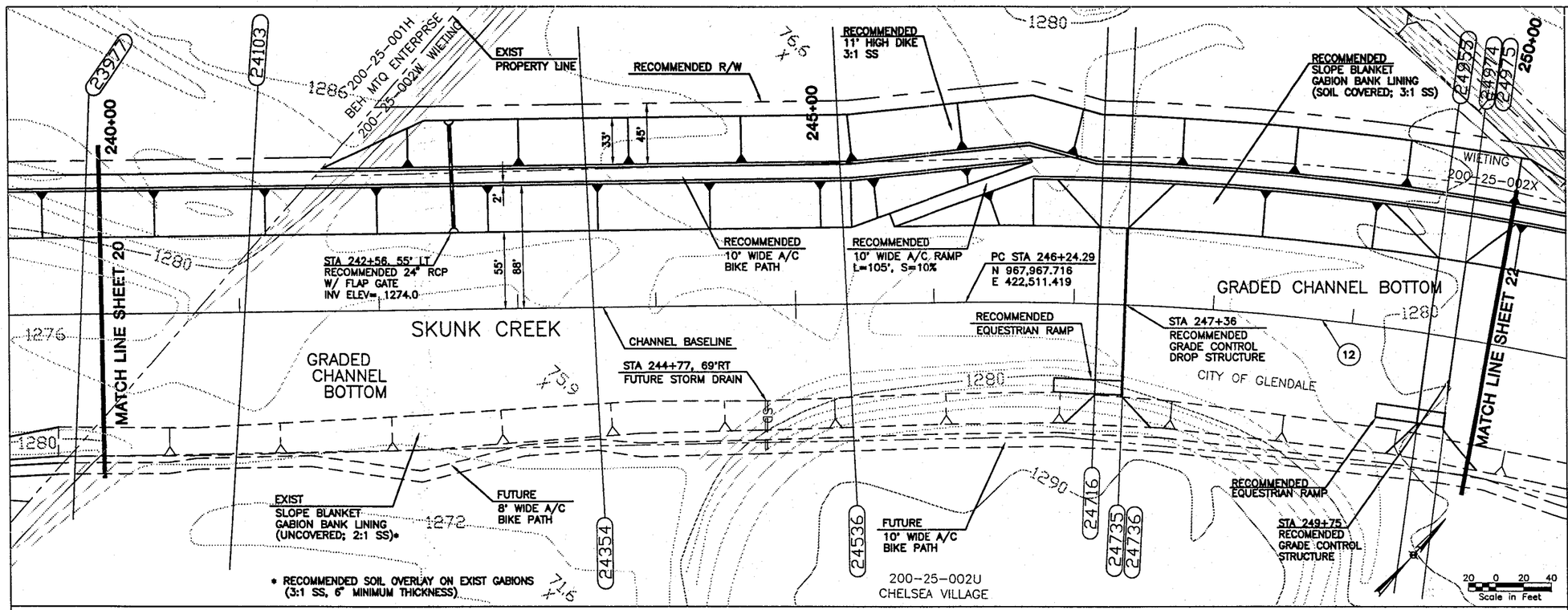
Sverdrup CORPORATION

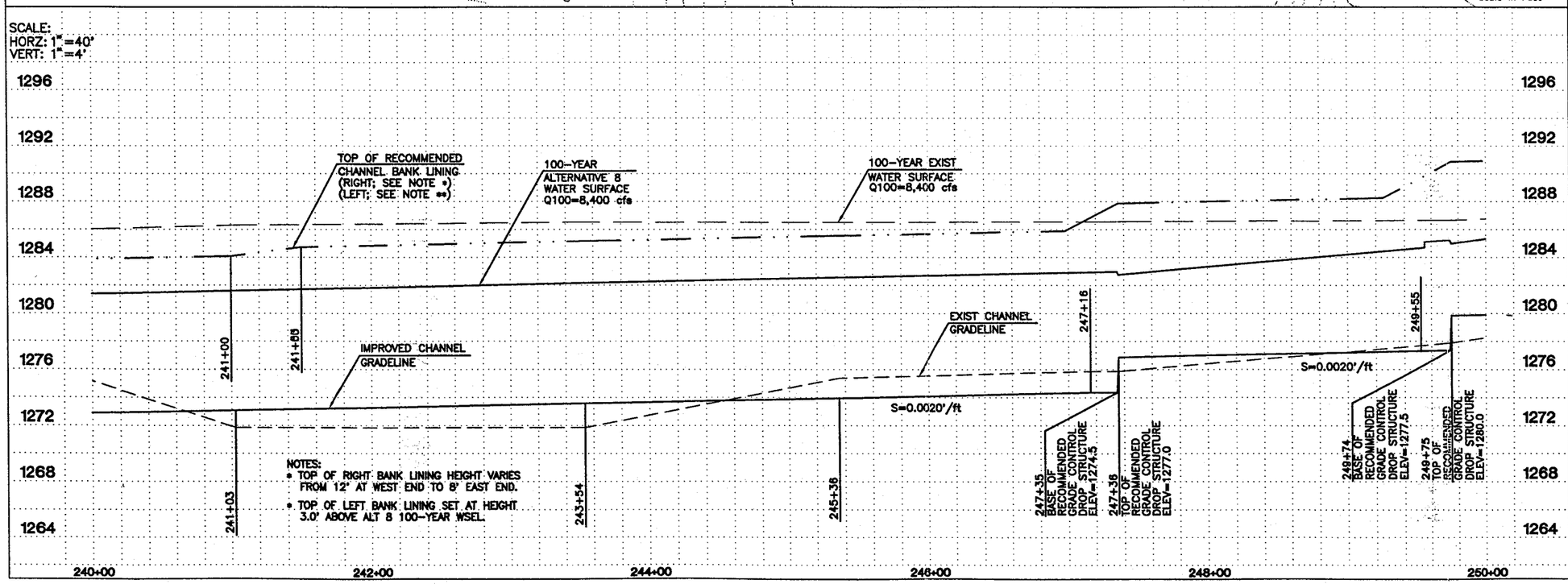
RECOMMENDED ALTERNATIVE

SHEET OF 20 30

FILE: N:\013255\DWG\C\C255A720.DWG DATE: 04/28/95

HSPACT PLAN VIEW PA-120 4702*





CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(12)	2040.00'	32°57'10"	603.36'	1173.27'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

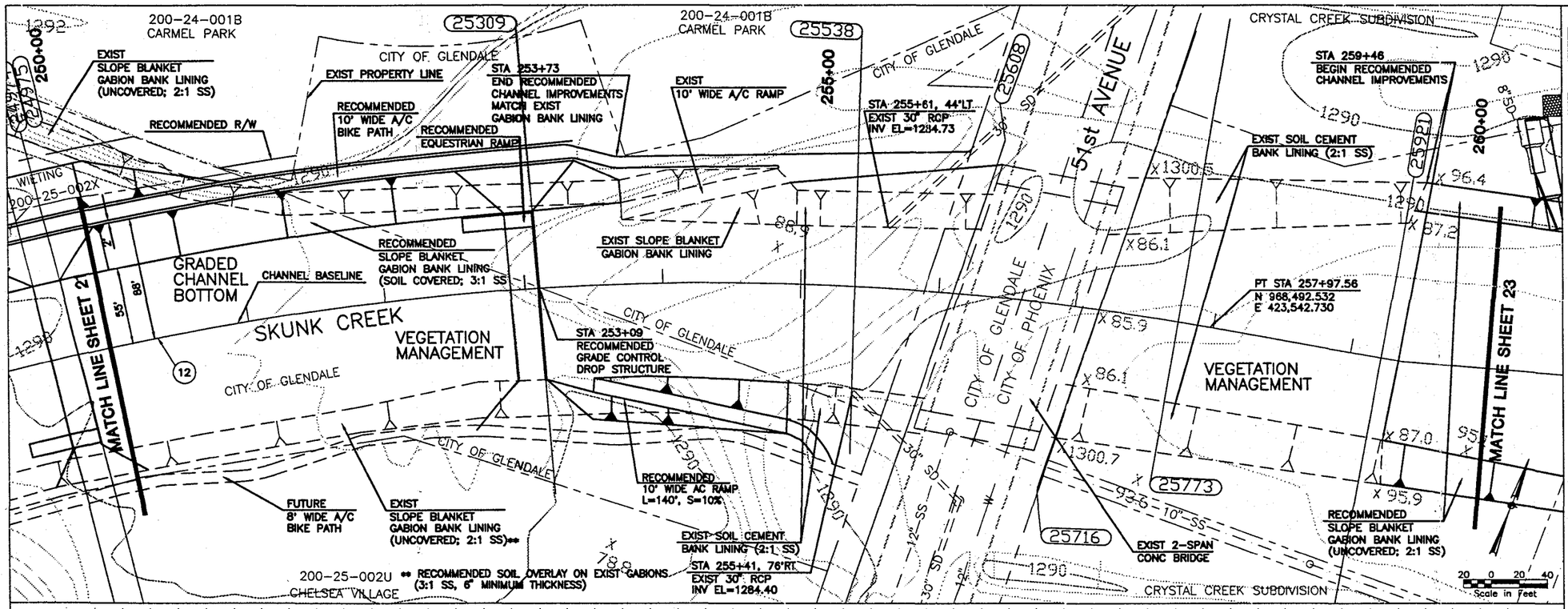
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 21 30

FILE: N:\013255\DWG\C\C255A721.DWG DATE: 04/28/95

MSPACE PLAN VIEW RA1317.3273*



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(12)	2040.00'	32°57'10"	603.36'	1173.27'

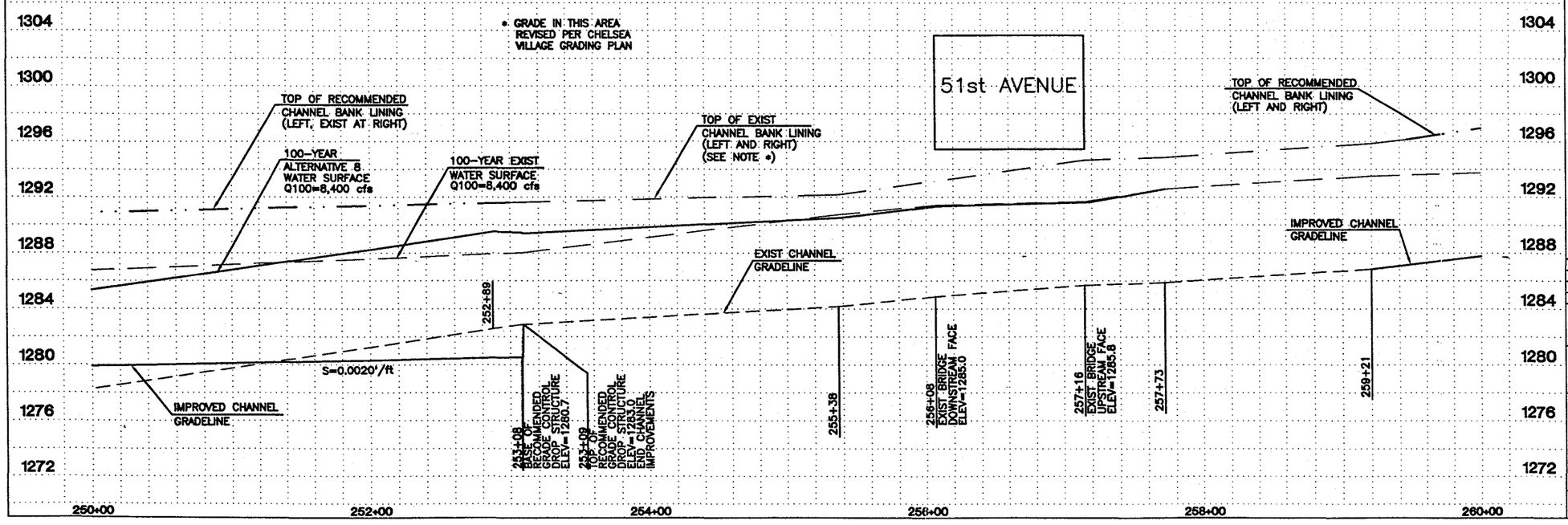
LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH

(EXIST) UTILITIES

- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

SCALE:
HORZ: 1"=40'
VERT: 1"=4'



LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN		04/95
CHECKED	B. OLBERT	04/95

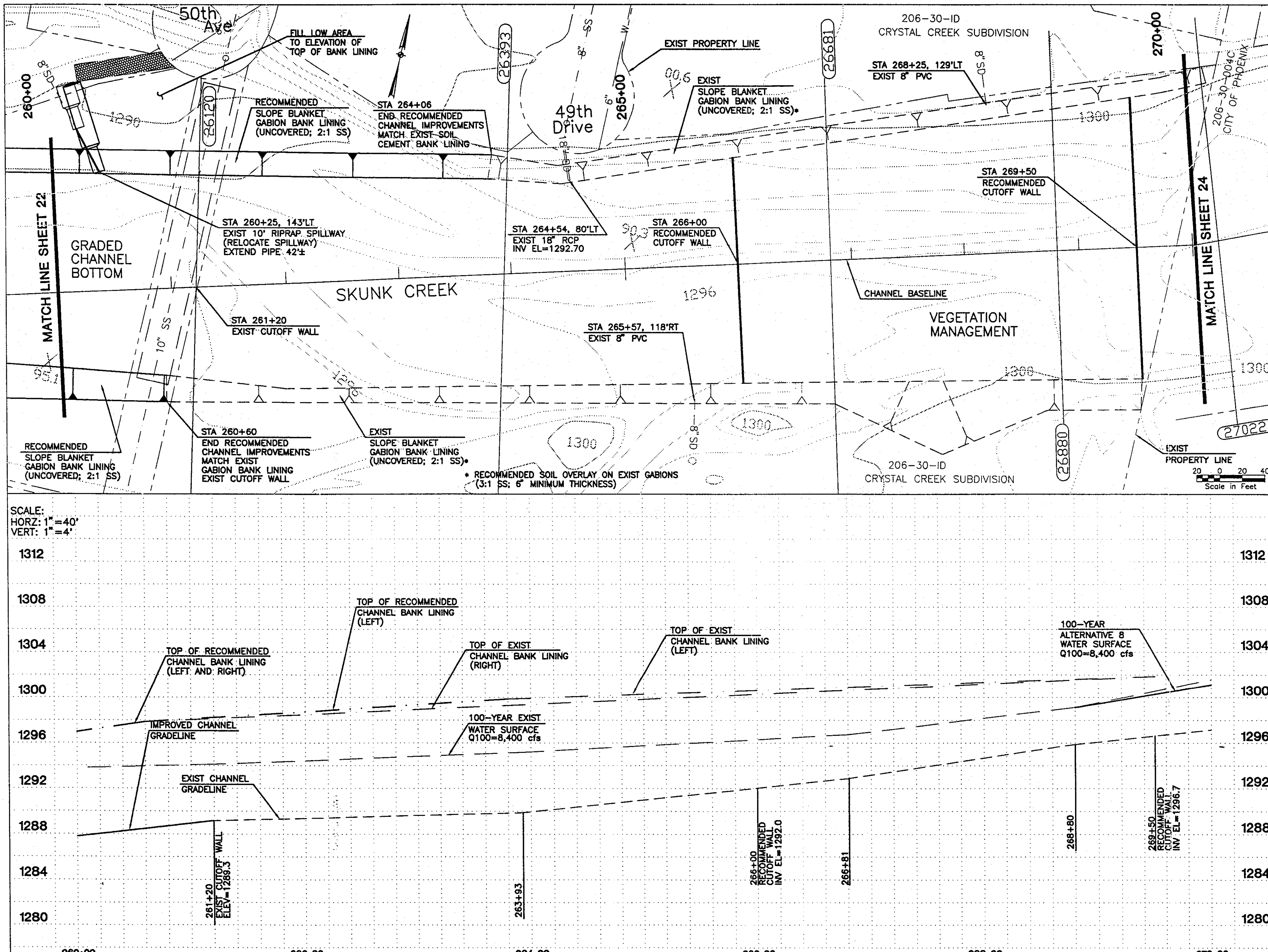
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 22 30

FILE: N:\013255\DWG\C\C255A722.DWG DATE: 04/28/95

MSPACE PLAN VIEW RA: 339.3675'



NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC BURIED CABLE TV
  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

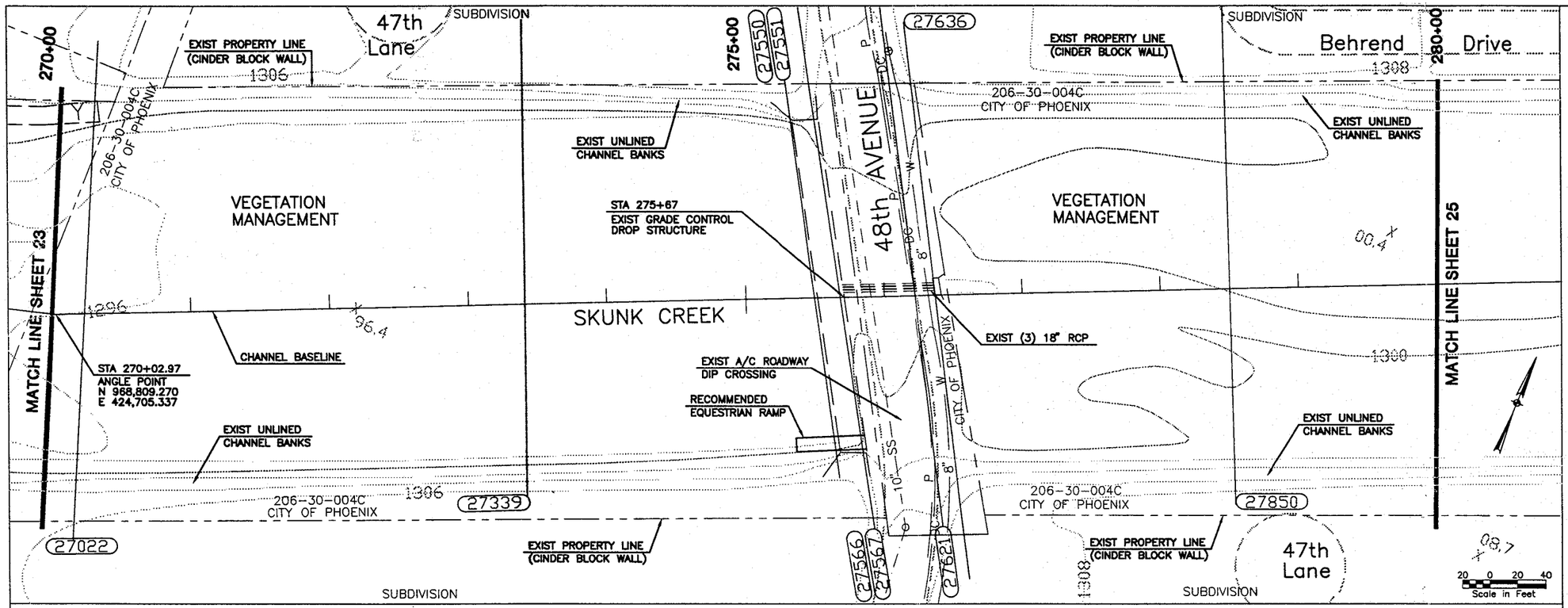
	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN		04/95
CHECKED	B. OLBERT	04/95

Sverdrup CORPORATION

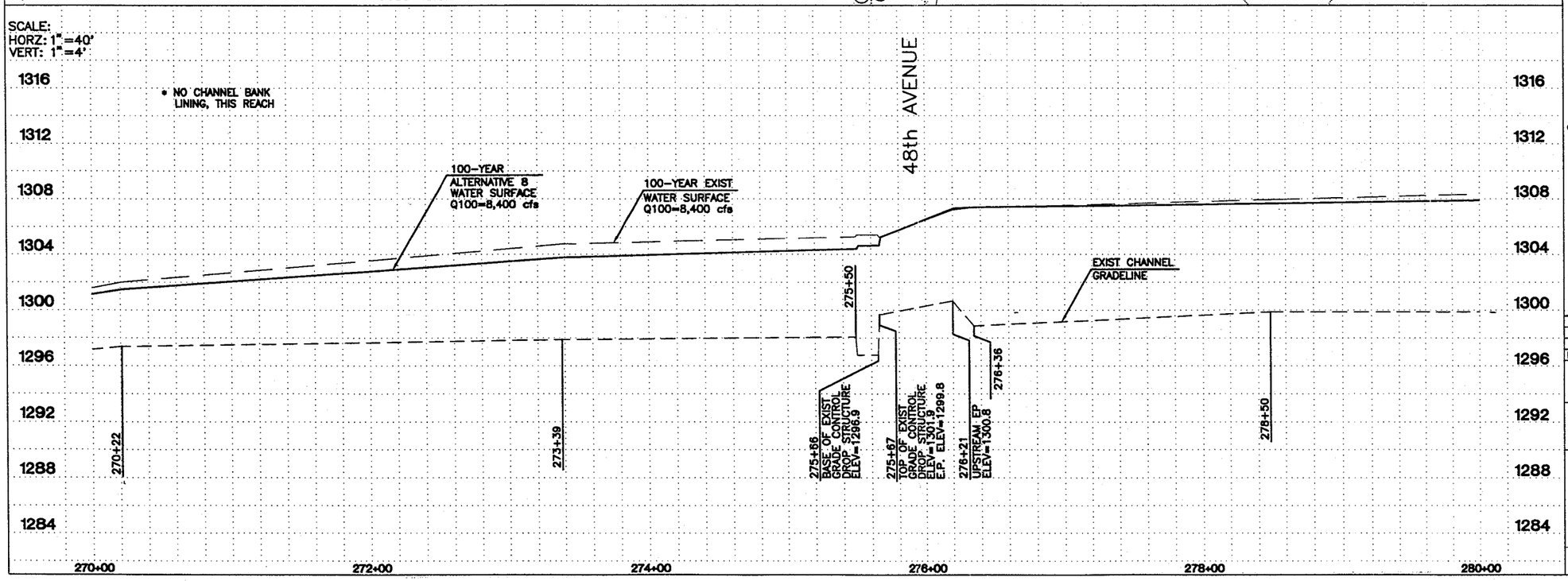
RECOMMENDED ALTERNATIVE

SHEET 23 OF 30

FILE: N:\013255\DWG\C\C255A723.DWG DATE: 04/28/95



SCALE:
HORZ: 1"=40'
VERT: 1"=4'



NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
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  - NG BURIED NATURAL GAS
  - P BURIED POWER LINE
  - OHP OVERHEAD POWER w/ POLE
  - SS SANITARY SEWER w/ MANHOLE
  - SD STORM DRAIN
  - T BURIED TELEPHONE CABLE
  - W WATER MAIN w/ VALVE
  - SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN		04/95
CHECKED	B. OLBERT	04/95

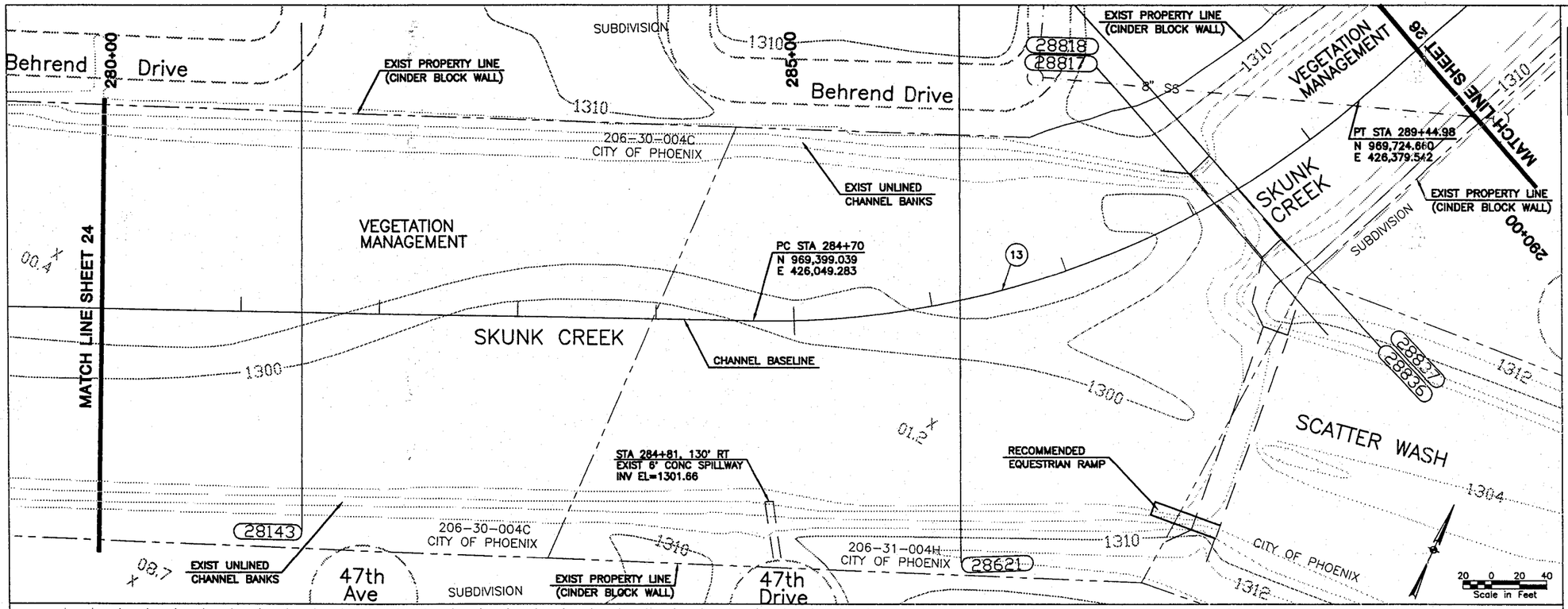
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

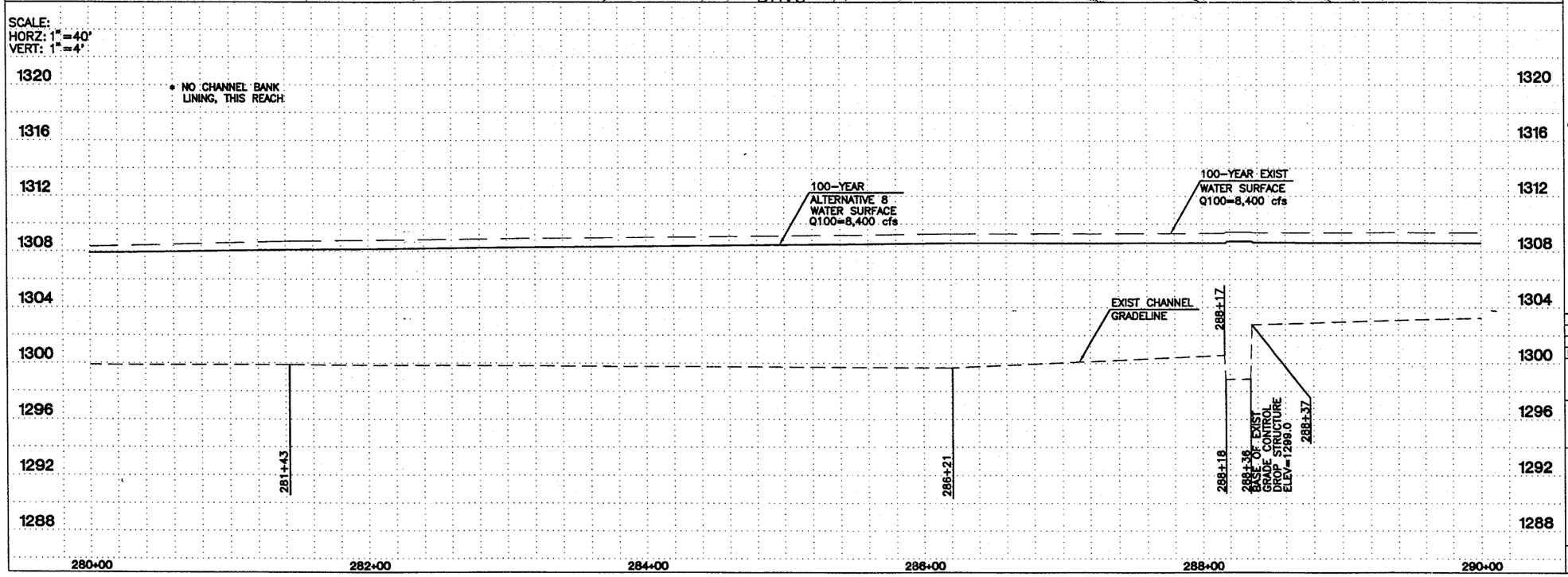
SHEET OF 24 30

FILE: N:\013255\DWG\C\C255A724.DWG DATE: 02/16/95

MSPACE PLAN VIEW (RA:937 5475')



SCALE:
HORZ: 1"=40'
VERT: 1"=4'



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
13	650.00'	41°48'10"	248.23'	474.24'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

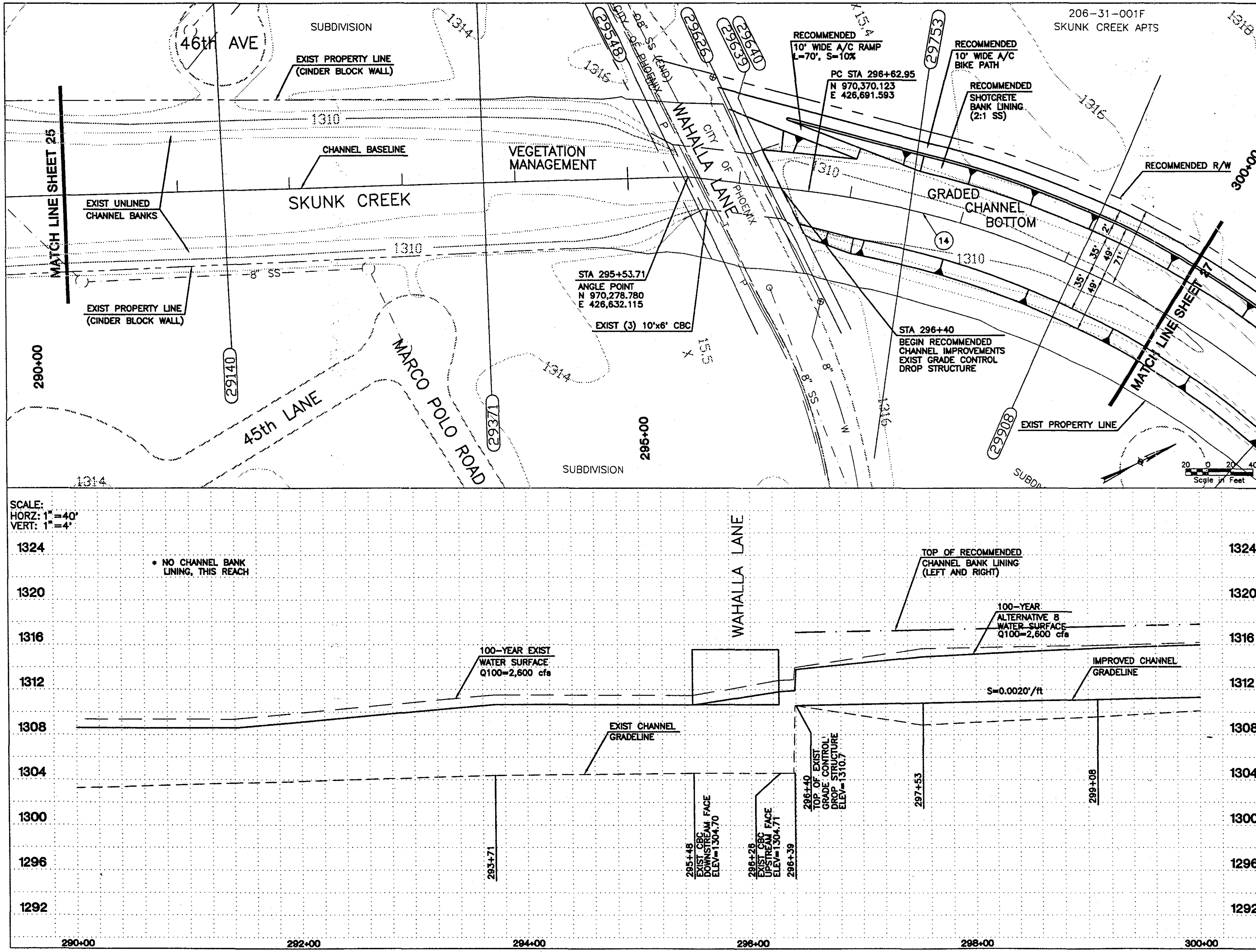
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 25 30

FILE: N:\013255\DWG\C\C255A725.DWG DATE: 04/26/95

MCPAFC PLAN VIEW RA1325 2702



SUBDIVISION
46th AVE
EXIST PROPERTY LINE (CINDER BLOCK WALL)
1314
1316
1310
MATCH LINE SHEET 25
CHANNEL BASELINE
VEGETATION MANAGEMENT
SKUNK CREEK
EXIST UNLINED CHANNEL BANKS
8" SS
EXIST PROPERTY LINE (CINDER BLOCK WALL)
290+00
29140
29371
45th LANE
MARCO POLO ROAD
SUBDIVISION
295+00
29548
29626
29639
29640
29753
29908
CITY OF PHOENIX
WAHALLA LANE
STA 295+53.71
ANGLE POINT
N 970,278.780
E 426,632.115
EXIST (3) 10'x6' CBC
15.5
15.4
RECOMMENDED 10' WIDE A/C RAMP L=70', S=10%
PC STA 296+62.95
N 970,370.123
E 426,691.593
RECOMMENDED 10' WIDE A/C BIKE PATH
RECOMMENDED SHOTCRETE BANK LINING (2:1 SS)
206-31-001F
SKUNK CREEK APTS
1318
RECOMMENDED R/W
300+00
GRADED CHANNEL BOTTOM
14
STA 296+40
BEGIN RECOMMENDED CHANNEL IMPROVEMENTS
EXIST GRADE CONTROL DROP STRUCTURE
MATCH LINE SHEET 27
EXIST PROPERTY LINE
35'
49'
71'
2'
Scale in Feet
SCALE:
HORZ: 1"=40'
VERT: 1"=4'
NO CHANNEL BANK LINING, THIS REACH
WAHALLA LANE
TOP OF RECOMMENDED CHANNEL BANK LINING (LEFT AND RIGHT)
100-YEAR ALTERNATIVE 8 WATER SURFACE Q100=2,600 cfs
100-YEAR EXIST WATER SURFACE Q100=2,600 cfs
IMPROVED CHANNEL GRADELINE
S=0.0020'/ft
EXIST CHANNEL GRADELINE
293+71
295+48 EXIST CBC DOWNSTREAM FACE ELEV=1304.70
296+28 EXIST CBC UPSTREAM FACE ELEV=1304.71
296+39
296+40 TOP OF EXIST. GRADE CONTROL DROP STRUCTURE ELEV=1310.7
297+53
299+08
1324
1320
1316
1312
1308
1304
1300
1296
1292
290+00
292+00
294+00
296+00
298+00
300+00

CHANNEL BASELINE CURVE DATA

CURVE#	RADIUS	DELTA	TANGENT	ARC LENGTH
(14)	800.00'	34°52'18"	251.26'	486.90'

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING — TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING — TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC — BURIED CABLE TV
  - NG — BURIED NATURAL GAS
  - P — BURIED POWER LINE
  - OHP — OVERHEAD POWER w/ POLE
  - SS — SANITARY SEWER w/ MANHOLE
  - SD — STORM DRAIN
  - T — BURIED TELEPHONE CABLE
  - W — WATER MAIN w/ VALVE
  - SD — (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

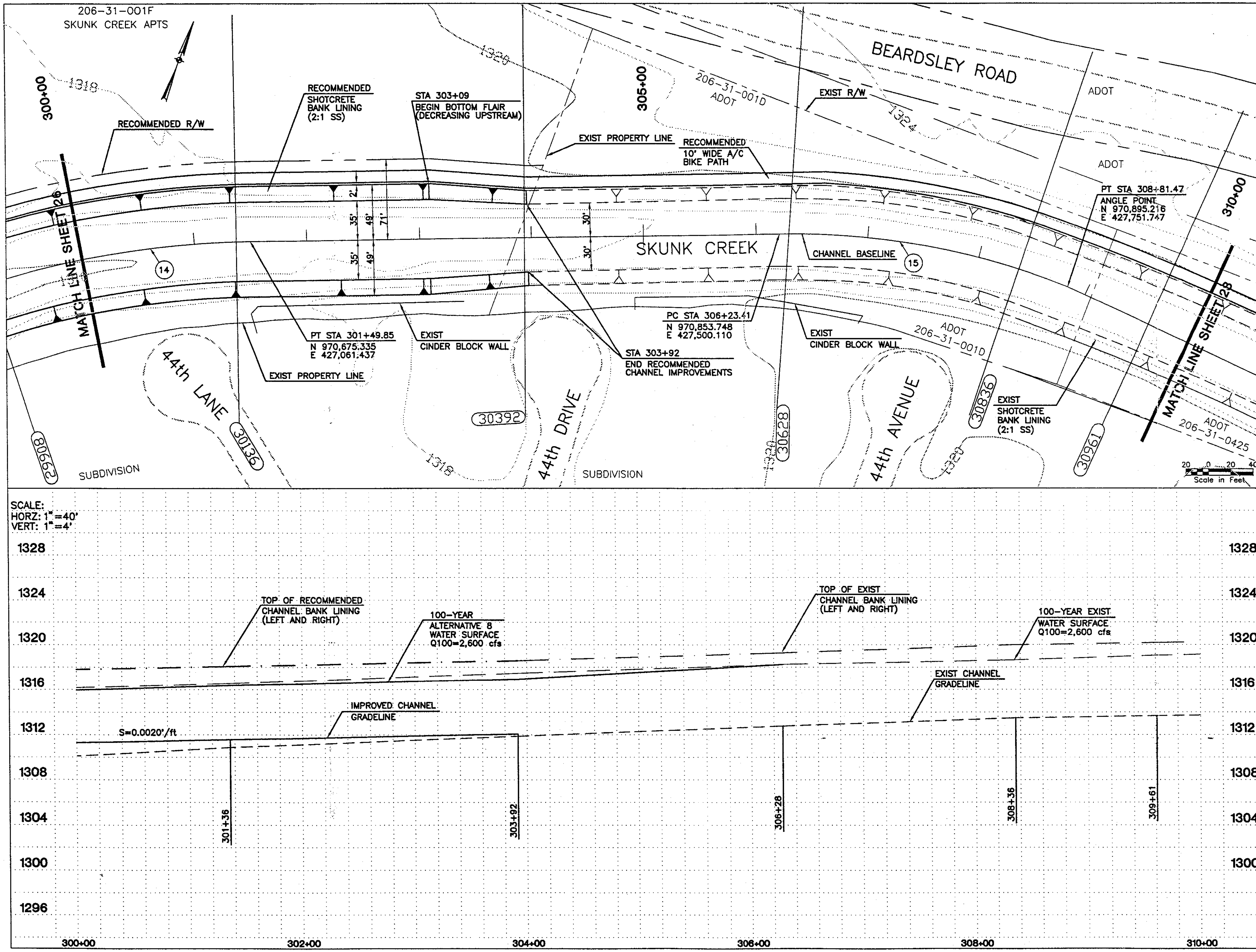
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE — SHEET 26 OF 30

FILE: N:\013255\DWG\C\C255A726.DWG DATE: 02/17/95



CHANNEL BASELINE CURVE DATA

CURVE#	RADIUS	DELTA	TANGENT	ARC LENGTH
14	800.00'	34°52'18"	251.26'	486.90'
15	650.00'	22°44'50"	130.75'	258.06'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- CROSS SECTION / STATION
- (EXIST) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (RECOMMENDED) BANK LINING TOP OF SLOPE TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

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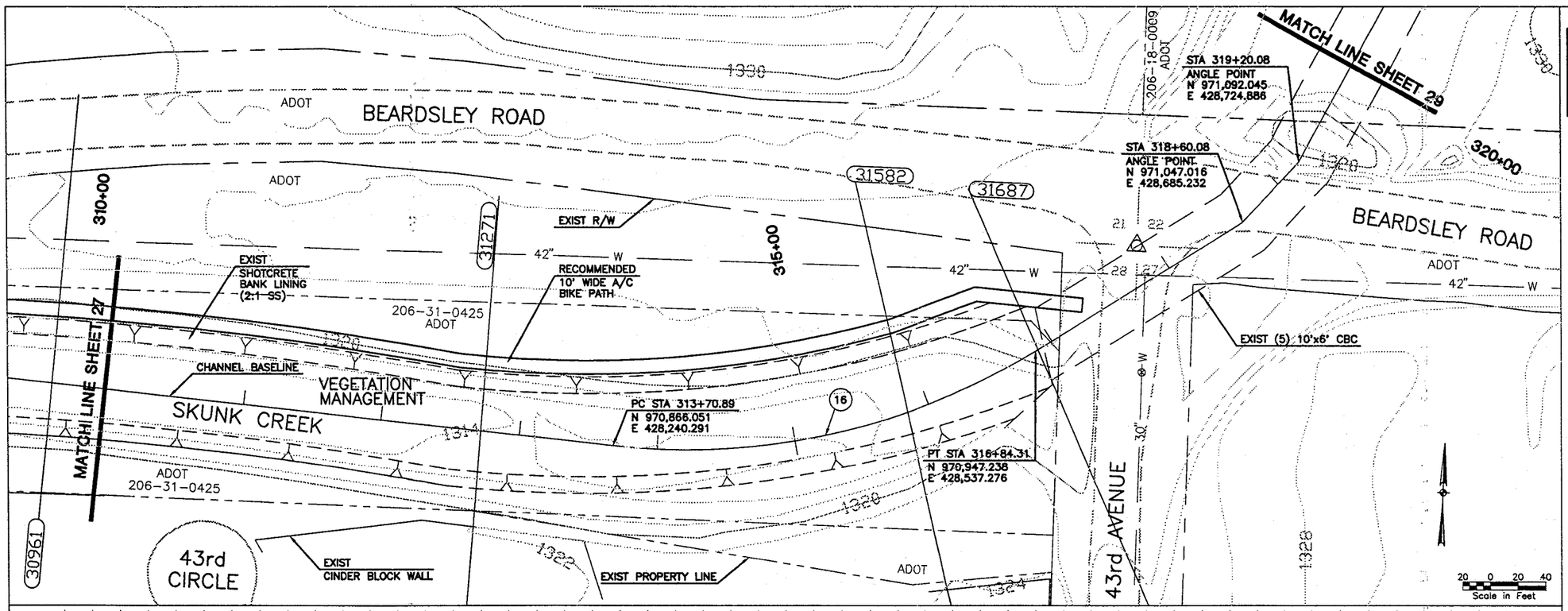
	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET 27 OF 30

FILE: N:\013255\DWG\C\C255A727.DWG DATE: 01/21/95



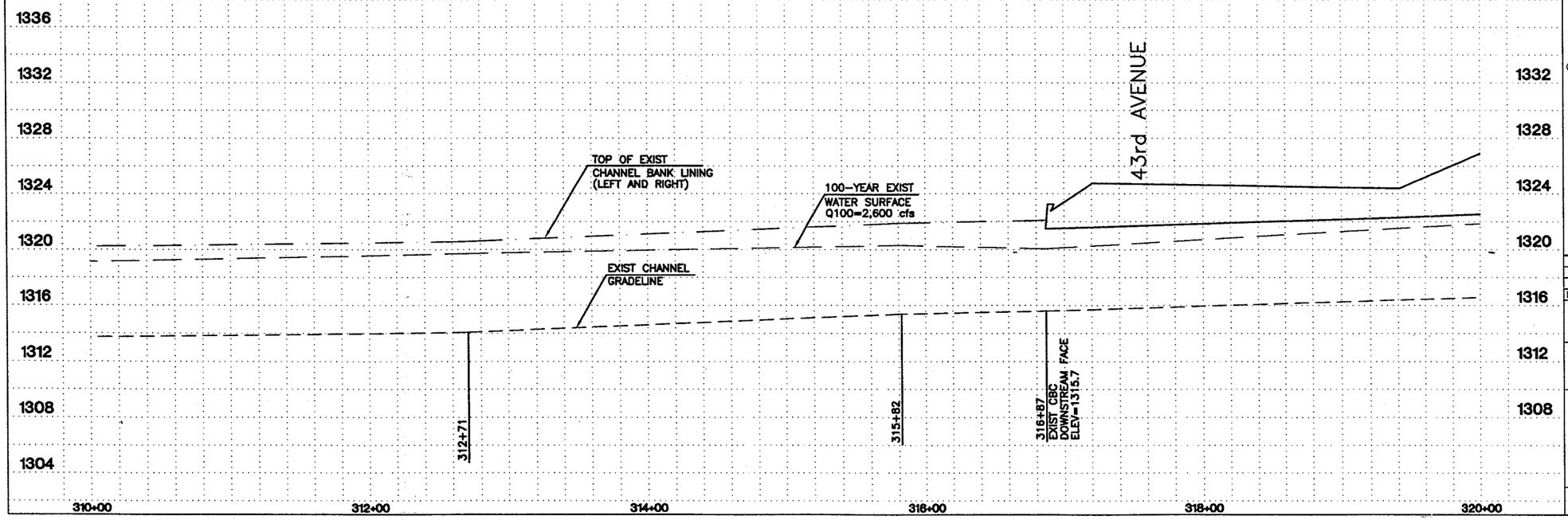
CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(16)	480.00'	37°24'42"	162.53'	313.42'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING — TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING — TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC — BURIED CABLE TV
  - NG — BURIED NATURAL GAS
  - P — BURIED POWER LINE
  - OHP — OVERHEAD POWER w/ POLE
  - SS — SANITARY SEWER w/ MANHOLE
  - SD — STORM DRAIN
  - T — BURIED TELEPHONE CABLE
  - W — WATER MAIN w/ VALVE
  - SD — (RECOMMENDED) STORM DRAIN

SCALE:
HORZ: 1"=40'
VERT: 1"=4'



LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	01/95

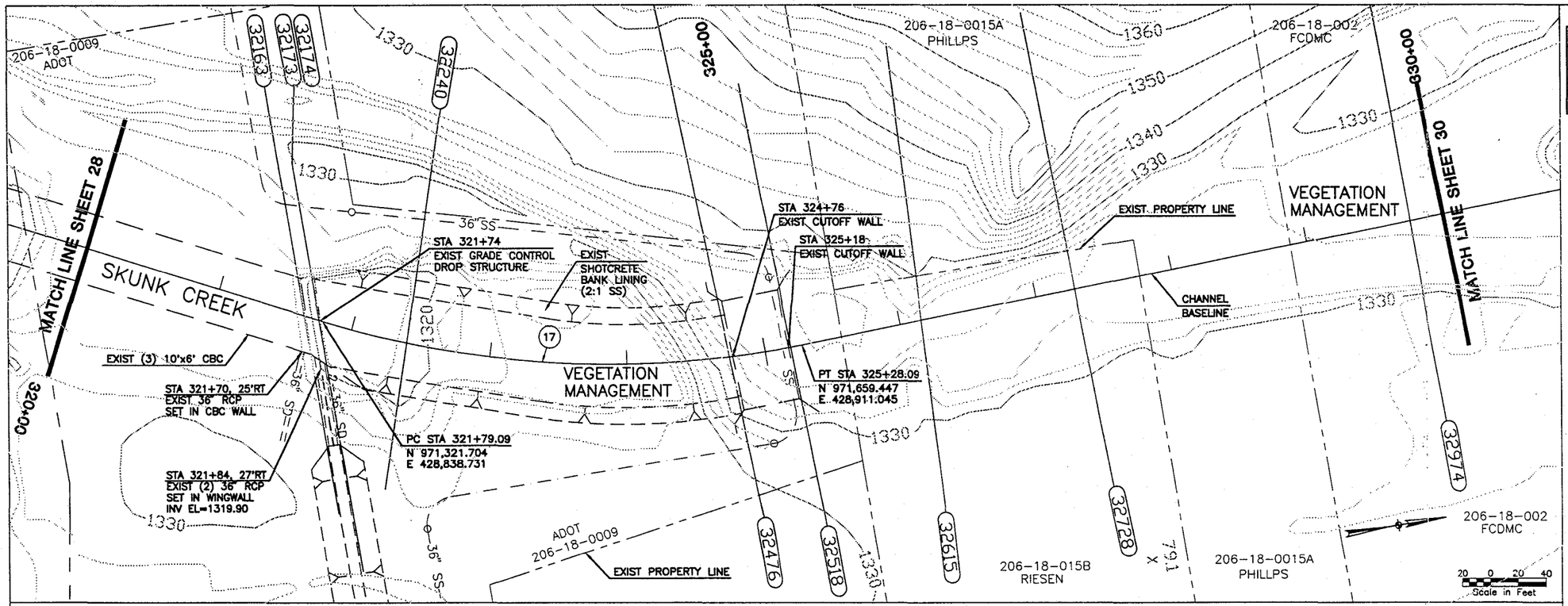
Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

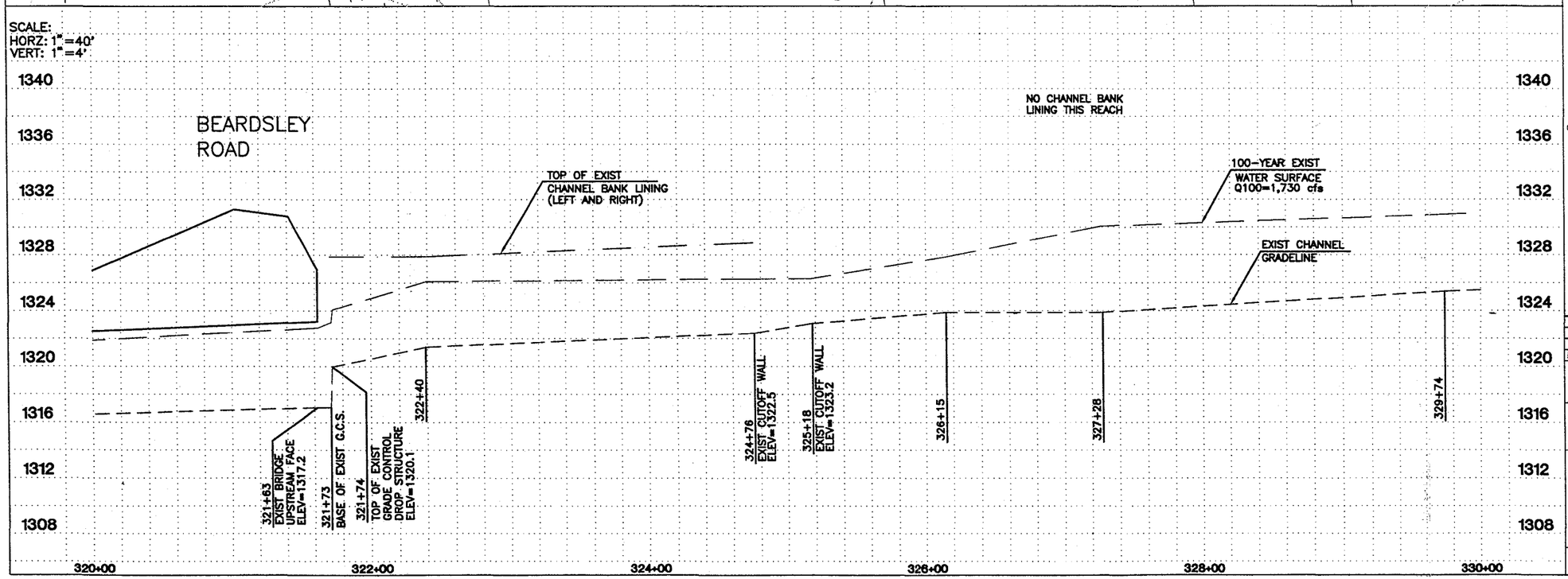
SHEET OF 28 30

FILE: N:\013255\DWG\C\C255A728.DWG DATE: 04/28/95

MSPACE PLAN VIEW (RA: 957.6241')



SCALE:
HORZ: 1"=40'
VERT: 1"=4'



CHANNEL BASELINE CURVE DATA

CURVE #	RADIUS	DELTA	TANGENT	ARC LENGTH
(17)	700.00'	28°33'58"	178.21'	349.00'

LEGEND (PLAN)

- SECTION LINE / 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- (5044) CROSS SECTION / STATION
- (EXIST) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (RECOMMENDED) BANK LINING: TOP OF SLOPE, TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
  - DC — BURIED CABLE TV
  - NG — BURIED NATURAL GAS
  - P — BURIED POWER LINE
  - OHP — OVERHEAD POWER w/ POLE
  - SS — SANITARY SEWER w/ MANHOLE
  - SD — STORM DRAIN
  - T — BURIED TELEPHONE CABLE
  - W — WATER MAIN w/ VALVE
  - SD — (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY
NOT FOR
CONSTRUCTION

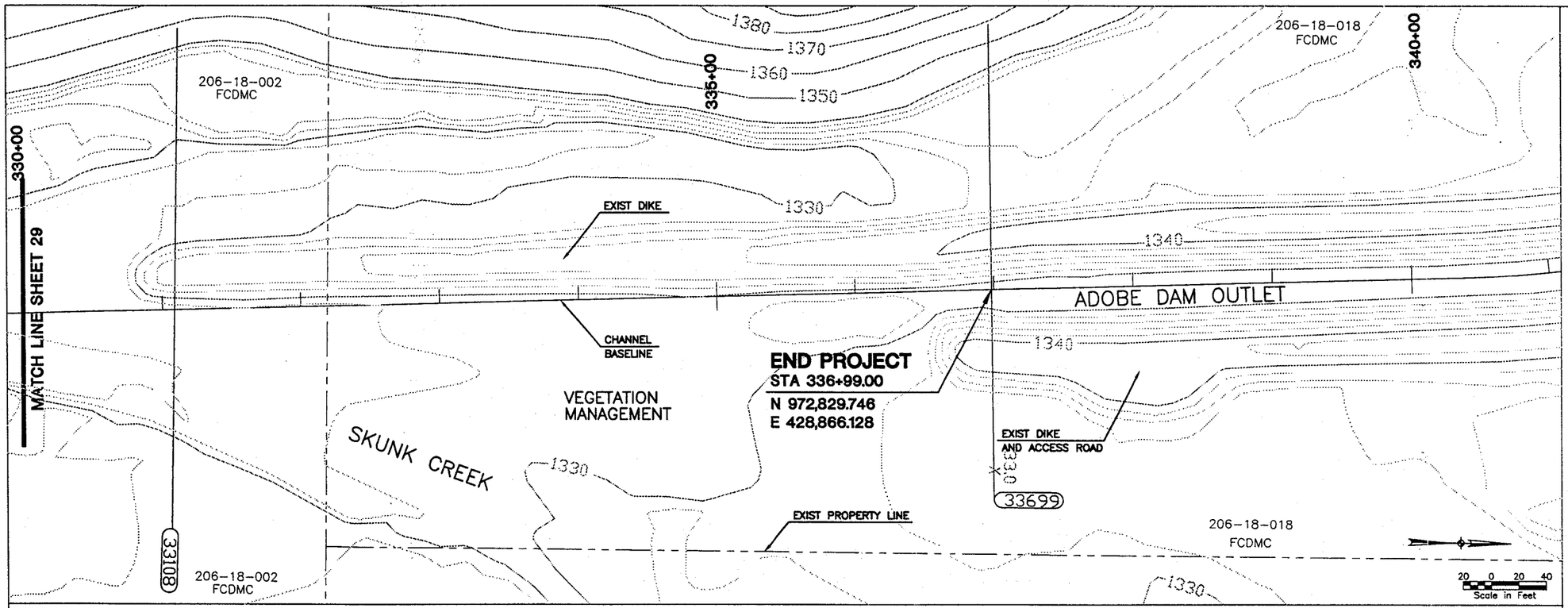
Sverdrup CORPORATION

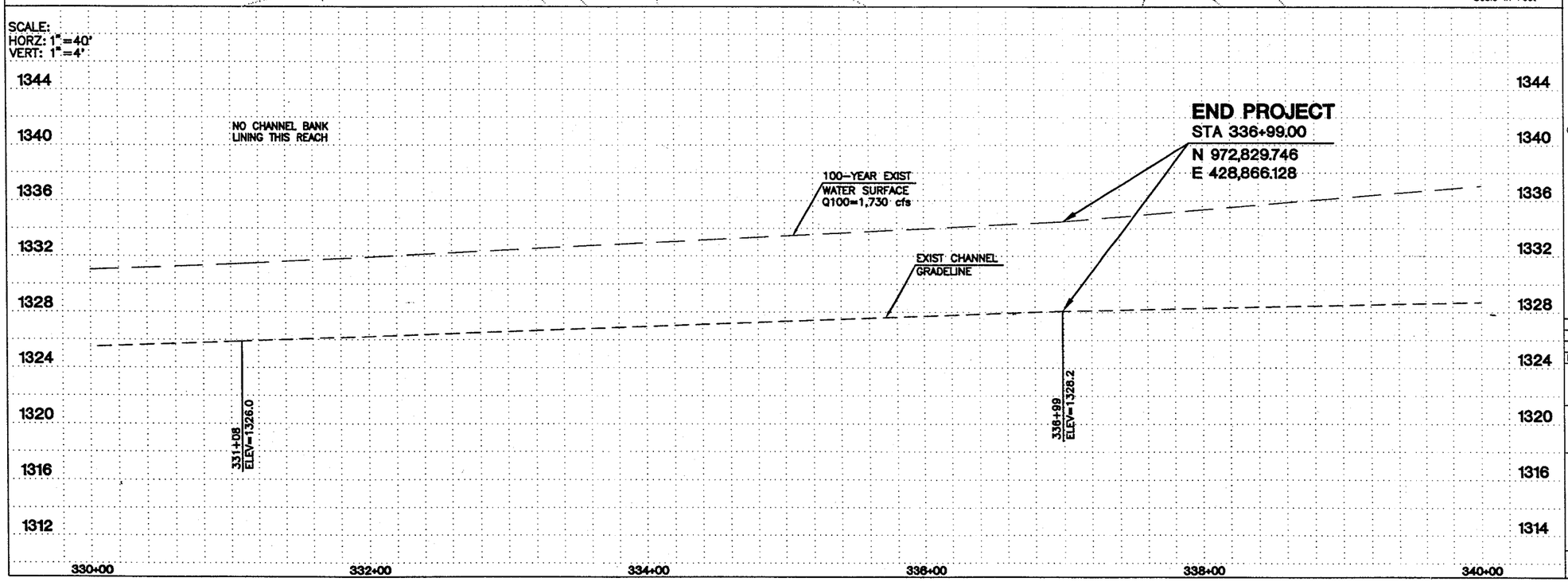
RECOMMENDED ALTERNATIVE

SHEET OF 29 30

FILE: N:\013255\DWG\C\C255A729.DWG DATE: 04/28/95

MSPACE PLAN VIEW RA:279.2629'





NO CURVES THIS SHEET

LEGEND (PLAN)

- SECTION LINE
- 1/4 SECTION LINE
- (EXIST) RIGHT OF WAY
- (RECOMMENDED) RIGHT OF WAY
- (EXIST) PROPERTY LINE
- 5044 CROSS SECTION / STATION
- (EXIST) BANK LINING
- TOP OF SLOPE
- TOE OF SLOPE
- (RECOMMENDED) BANK LINING
- TOP OF SLOPE
- TOE OF SLOPE
- (EXIST) CONCRETE STRUCTURE
- (RECOMMENDED) GRADE CONTROL STRUCTURE & EQUESTRIAN RAMP
- (RECOMMENDED) CUTOFF WALL
- (RECOMMENDED) BIKE PATH
- (EXIST) UTILITIES
- DC BURIED CABLE TV
- NG BURIED NATURAL GAS
- P BURIED POWER LINE
- OHP OVERHEAD POWER w/ POLE
- SS SANITARY SEWER w/ MANHOLE
- SD STORM DRAIN
- T BURIED TELEPHONE CABLE
- W WATER MAIN w/ VALVE
- SD (RECOMMENDED) STORM DRAIN

LEGEND (PROFILE)

- (EXIST) WATER SURFACE (100-YR)
- ALTERNATIVE 8 WATER SURFACE (100-YR)
- (EXIST) CHANNEL INVERT PROFILE
- (RECOMMENDED) CHANNEL INVERT PROFILE
- (RECOMMENDED) TOE OF BANK LINING

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04/95
DRAWN	L. WESTFALL	04/95
CHECKED	B. OLBERT	04/95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

RECOMMENDED ALTERNATIVE

SHEET OF 30 30

FILE: N:\013255\DWG\C\C255A730.DWG DATE: 04/28/95

HCPAFF PLAN VIEW (PA-PC) 24x36.*

APPENDIX

Appendix A

COST ESTIMATES

(ALTERNATIVES 1-7)

Cost Estimate

ALTERNATIVE 1

Contract FCD 93-24
Skunk Creek Master Plan

Construct a Grass-Lined Trapezoidal Channel (150′ bottom width).

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	107	$1,000	$107,000
Excavation and Grading	Cu Yd	230,000	5	1,150,000
Construction (seeding)	Lin Ft	19,400	31	601,400
Grade Control Structure	Each	14	240,000	3,360,000
Access Roadway	Tons	5,700	30	171,000
Channel Access Roadway	Each	11	5,800	63,800
Embankment Backfill	Cu Yd	0	5	0
Fencing	Lin Ft	0	7	0
SUBTOTAL				$5,453,200
Erosion Control	Percent	2		109,064
Utility Relocation	Lump Sum	1	73,000	73,000
Contingencies	Percent	30		1,635,960
CONSTR. TOTAL				$7,271,224
Design Engineering	Percent	6		327,192
Right-of-Way Acquisition	Lump Sum	1	2,338,300	2,338,300
TOTAL				**$9,936,716**

Cost Estimate

ALTERNATIVE 2

Contract FCD 93-24
Skunk Creek Master Plan

Construct a Trapezoidal Channel with a Natural Earthen Bottom and Dumped Riprap Sideslopes.

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	103	$1,000	$103,000
Excavation and Grading	Cu Yd	326,000	5	1,630,000
Construction	Lin Ft	19,400	635	12,319,000
Grade Control Structure	Each	14	240,000	3,360,000
Access Roadway	Tons	5,700	30	171,000
Channel Access Roadway	Each	11	5,800	63,800
Embankment Backfill	Cu Yd	0	5	0
Fencing	Lin Ft	0	7	0
SUBTOTAL				$17,646,800
Erosion Control	Percent	2		352,936
Utility Relocation	Lump Sum	1	73,000	73,000
Contingencies	Percent	30		5,294,040
CONSTR. TOTAL				$23,366,776
Design Engineering	Percent	6		1,058,808
Right-of-Way Acquisition	Lump Sum	1	1,442,500	1,442,500
TOTAL				**$25,868,084**

Cost Estimate

ALTERNATIVE 3

Contract FCD 93-24
Skunk Creek Master Plan

Construct a Trapezoidal Channel with a Natural Earthen Bottom and Soil Cement Sideslopes.

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	98	$1,000	$98,000
Excavation and Grading	Cu Yd	249,000	5	1,245,000
Construction	Lin Ft	19,400	240	4,656,000
Grade Control Structure	Each	14	240,000	3,360,000
Access Roadway	Tons	5,700	30	171,000
Channel Access Roadway	Each	11	5,800	63,800
Embankment Backfill	Cu Yd	0	5	0
Fencing	Lin Ft	0	7	0
SUBTOTAL				$9,593,800
Erosion Control	Percent	2		191,876
Utility Relocation	Lump Sum	1	73,000	73,000
Contingencies	Percent	30		2,878,140
CONSTR. TOTAL				$12,736,816
Design Engineering	Percent	6		575,628
Right-of-Way Acquisition	Lump Sum	1	2,039,700	2,039,700
TOTAL				**$15,352,144**

Cost Estimate

ALTERNATIVE 4

Contract FCD 93-24
Skunk Creek Master Plan

Construct a Trapezoidal Channel with a Natural Earthen Bottom and Shotcrete Sideslopes.

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	107	$1,000	$107,000
Excavation and Grading	Cu Yd	254,000	5	1,270,000
Construction	Lin Ft	19,400	451	8,749,400
Grade Control Structure	Each	24	240,000	5,760,000
Access Roadway	Tons	5,700	30	171,000
Channel Access Roadway	Each	11	5,800	63,800
Embankment Backfill	Cu Yd	0	5	0
Fencing	Lin Ft	0	7	0
SUBTOTAL				$16,121,200
Erosion Control	Percent	2		322,424
Utility Relocation	Lump Sum	1	73,000	73,000
Contingencies	Percent	30		4,836,360
CONSTR. TOTAL				$21,352,984
Design Engineering	Percent	6		967,272
Right-of-Way Acquisition	Lump Sum	1	2,338,300	2,338,300
TOTAL				**$24,658,556**

Cost Estimate

ALTERNATIVE 5b

Contract FCD 93-24
Skunk Creek Master Plan

Construct a Trapezoidal Channel with a Natural Earthen Bottom and Gabion Sideslopes (Slope Blanket).

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	94	$1,000	$94,000
Excavation and Grading	Cu Yd	210,500	5	1,052,500
Construction	Lin Ft	19,400	358	6,945,200
Grade Control Structure	Each	24	240,000	5,760,000
Access Roadway	Tons	5,700	30	171,000
Channel Access Roadway	Each	11	5,800	63,800
Embankment Backfill	Cu Yd	0	5	0
Fencing	Lin Ft	0	7	0
SUBTOTAL				$14,086,500
Erosion Control	Percent	2		281,730
Utility Relocation	Lump Sum	1	73,000	73,000
Contingencies	Percent	30		4,225,950
CONSTR. TOTAL				$18,667,180
Design Engineering	Percent	6		845,190
Right-of-Way Acquisition	Lump Sum	1	1,890,400	1,890,400
TOTAL				**$21,402,770**

Cost Estimate

ALTERNATIVE 6

Contract FCD 93-24
Skunk Creek Master Plan

Construct a Fully Lined Concrete Rectangular Channel.

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	80	$1,000	$80,000
Excavation and Grading	Cu Yd	132,000	5	660,000
Construction	Lin Ft	19,400	1,240	24,056,000
Grade Control Structure	Each	0	240,000	0
Access Roadway	Tons	5,700	30	171,000
Channel Access Roadway	Each	11	5,800	63,800
Embankment Backfill	Cu Yd	101,000	5	505,000
Fencing	Lin Ft	37,900	7	265,300
SUBTOTAL				$25,801,100
Erosion Control	Percent	2		516,022
Utility Relocation	Lump Sum	1	73,000	73,000
Contingencies	Percent	30		7,740,330
CONSTR. TOTAL				$34,130,452
Design Engineering	Percent	6		1,548,066
Right-of-Way Acquisition	Lump Sum	1	2,189,000	2,189,000
TOTAL				**$37,867,518**

Cost Estimate

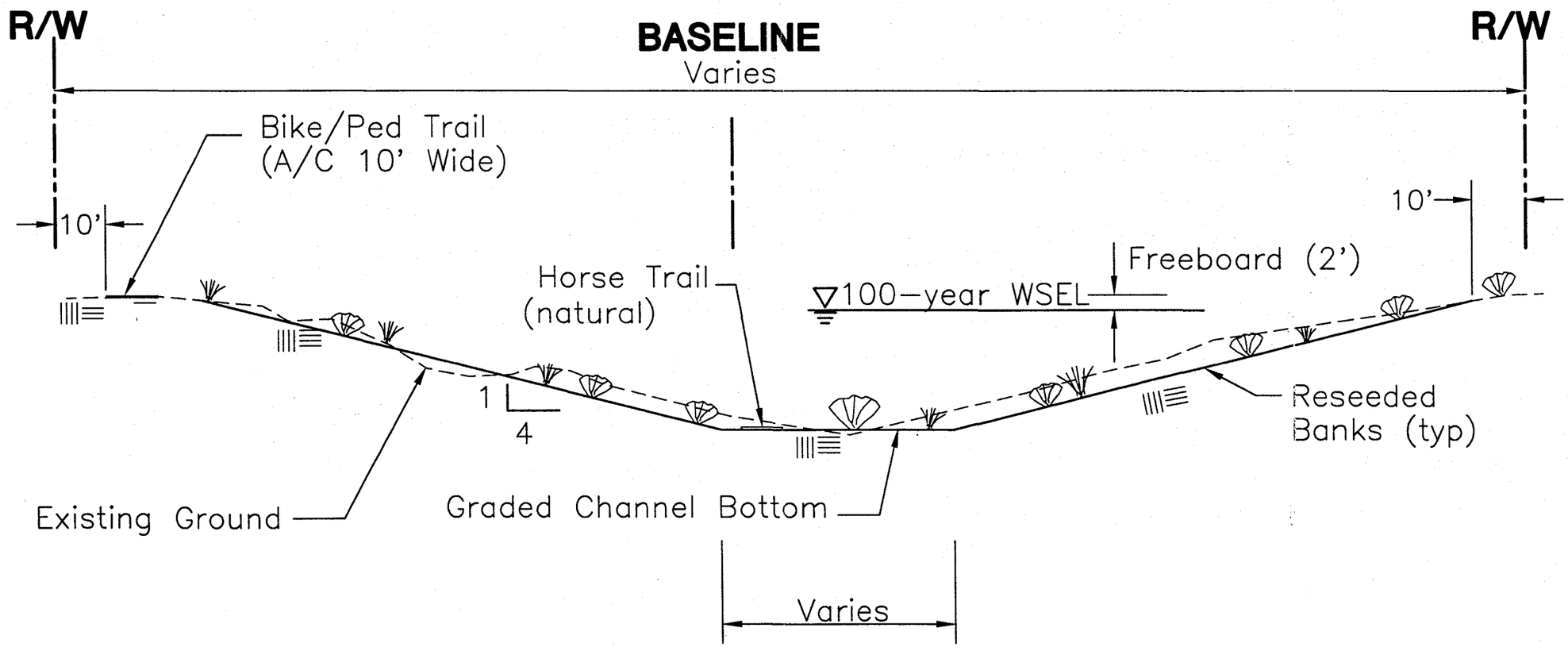
ALTERNATIVE 7

Contract FCD 93-24
Skunk Creek Master Plan

Vegetative Management.

Item	Unit	Quantity	Unit Price	Amount
Clearing and Grubbing	Acre	0	$1,000	$0
Excavation and Grading	Cu Yd	0	5	0
Construction	Lin Ft	0	1,240	0
Grade Control Structure	Each	0	0	0
Access Roadway	Tons	0	30	0
Channel Access Roadway	Each	0	5,800	0
Embankment Backfill	Cu Yd	0	5	0
Fencing	Lin Ft	0	7	0
SUBTOTAL				$0
Erosion Control	Percent	0	0	0
Utility Relocation	Lump Sum	1	0	0
Contingencies	Percent	30	0	0
CONSTR. TOTAL				$0
Design Engineering	Percent	6	0	0
Right-of-Way Acquisition	Lump Sum	1	0	0
TOTAL				**$0**

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 1
GRASS-LINED TRAPEZOIDAL

N.T.S.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

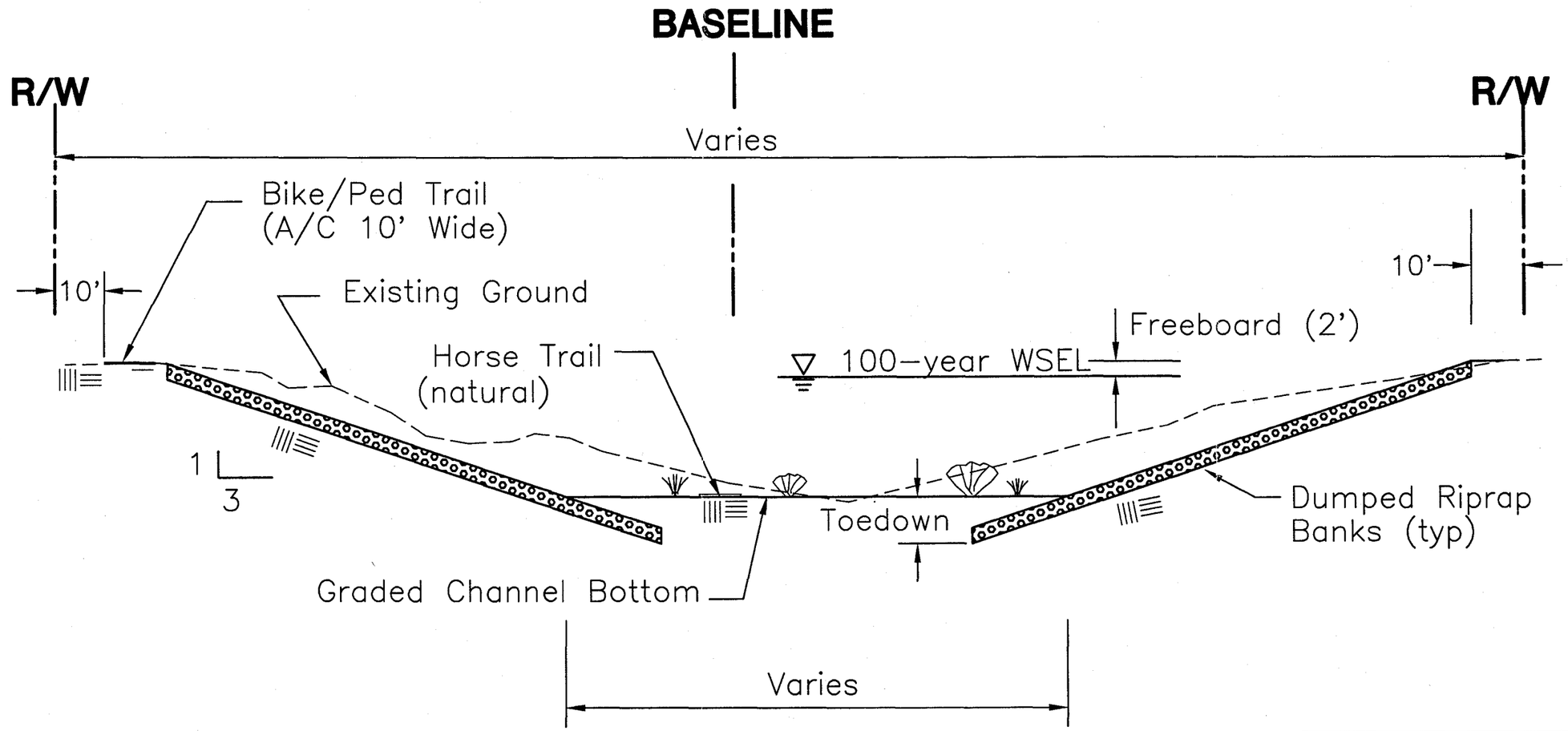
	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

ALTERNATIVE 1

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 2
DUMPED RIPRAP
TRAPEZOIDAL

N.T.S.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

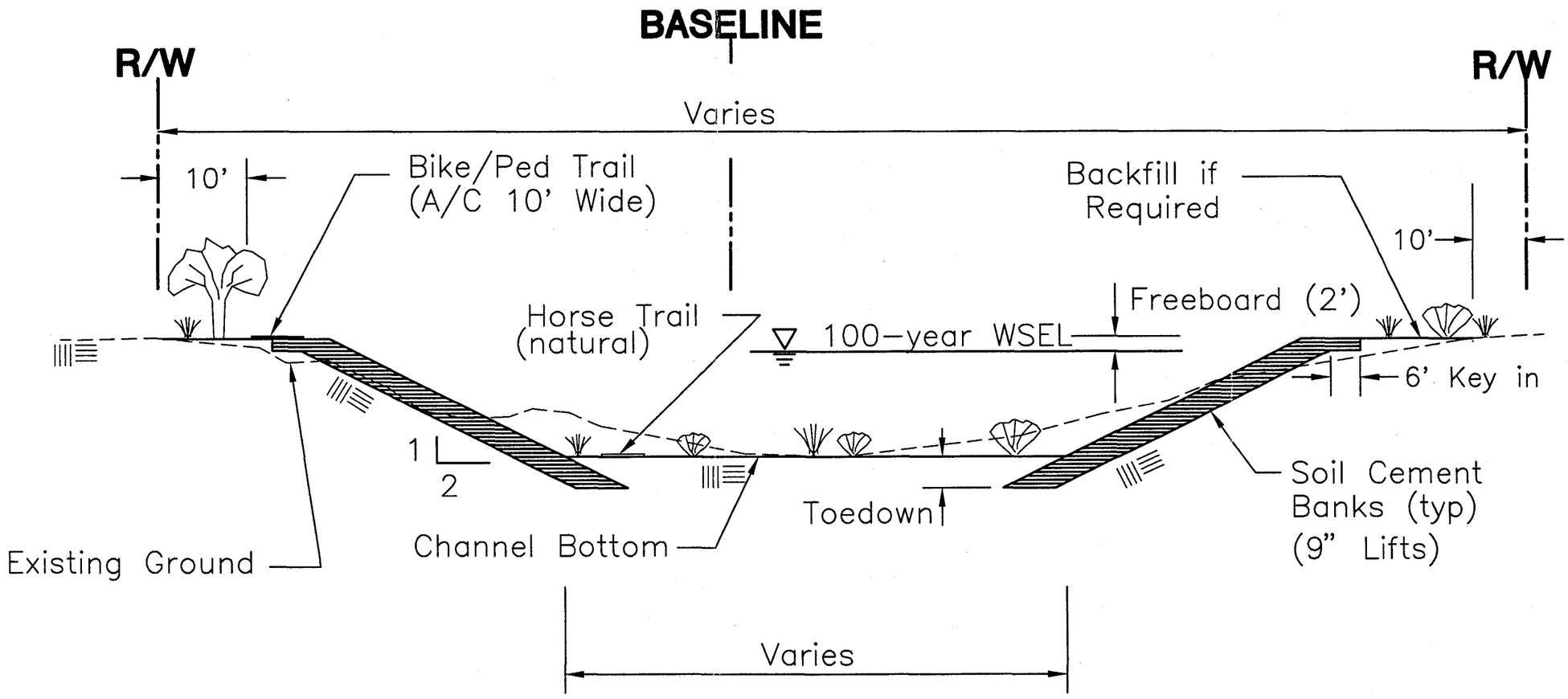
	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

ALTERNATIVE 2

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 3
SOIL CEMENT
TRAPEZOIDAL

N.T.S.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

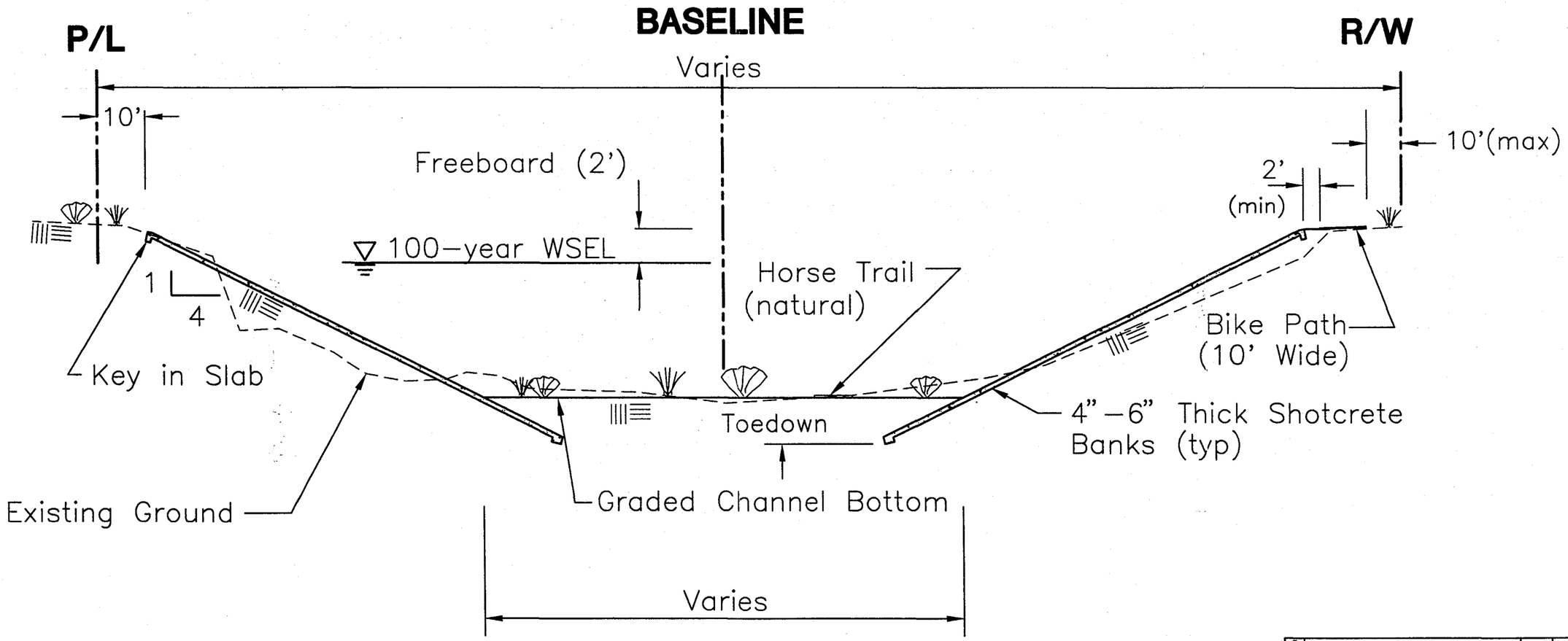
	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

ALTERNATIVE 3

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 4
SHOTCRETE LINED (CONCRETE) TRAPEZOIDAL

N.T.S.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

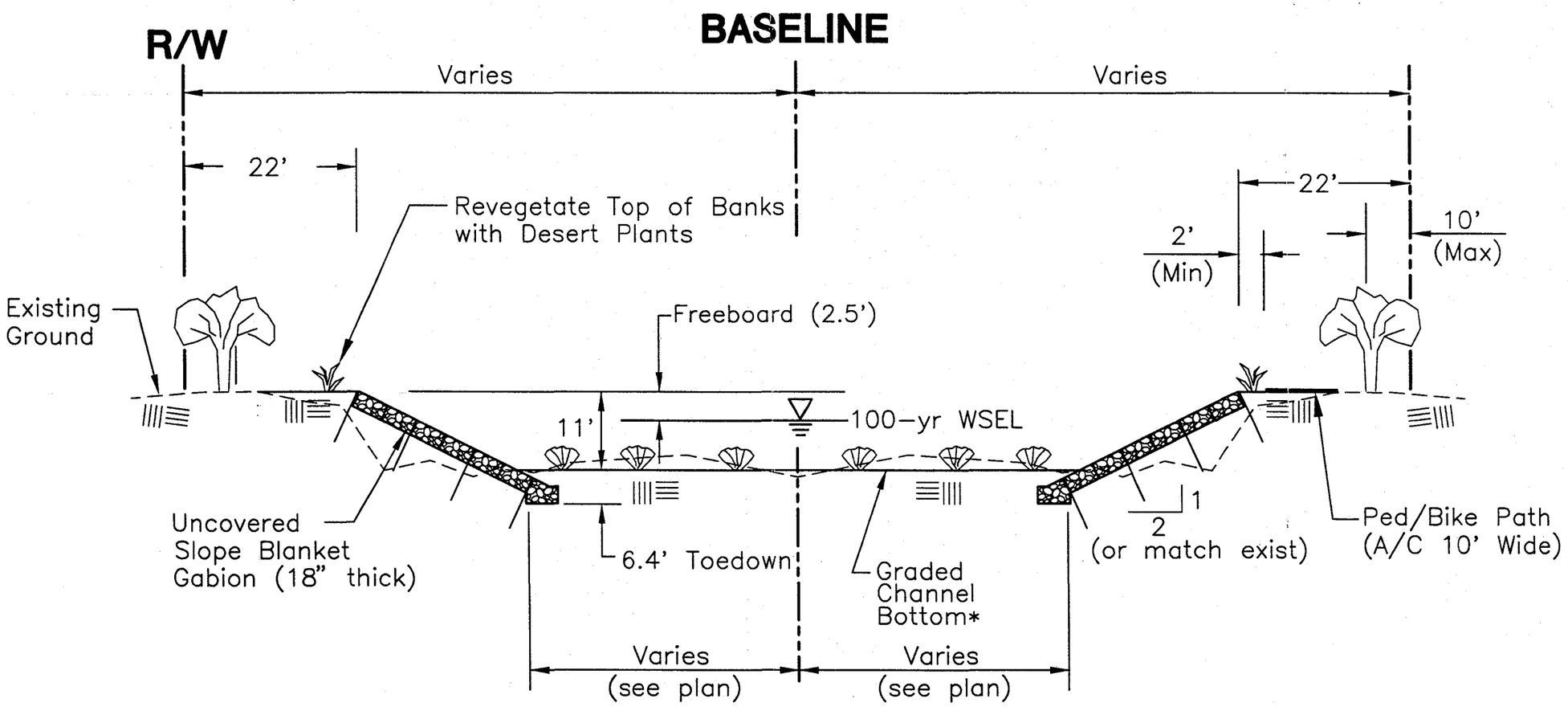
	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

ALTERNATIVE 4

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 5
TRAPEZOIDAL CHANNEL
UNCOVERED SLOPE BLANKET GABIONS

N.T.S.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

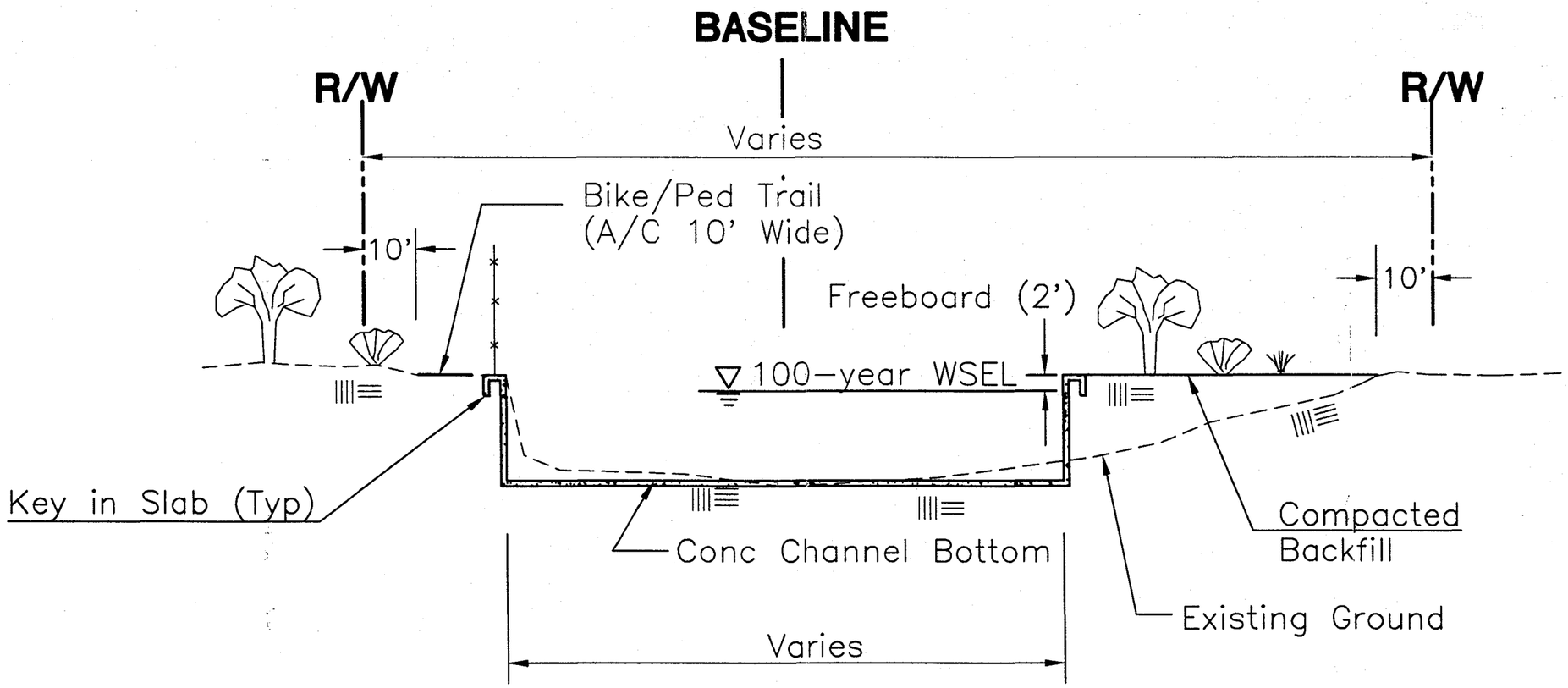
	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY
NOT FOR
CONSTRUCTION

Sverdrup
CORPORATION

ALTERNATIVE 5

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 6
FULLY LINED (CONCRETE) RECTANGULAR

N.T.S.

Horse trail not feasible with this alternative.

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

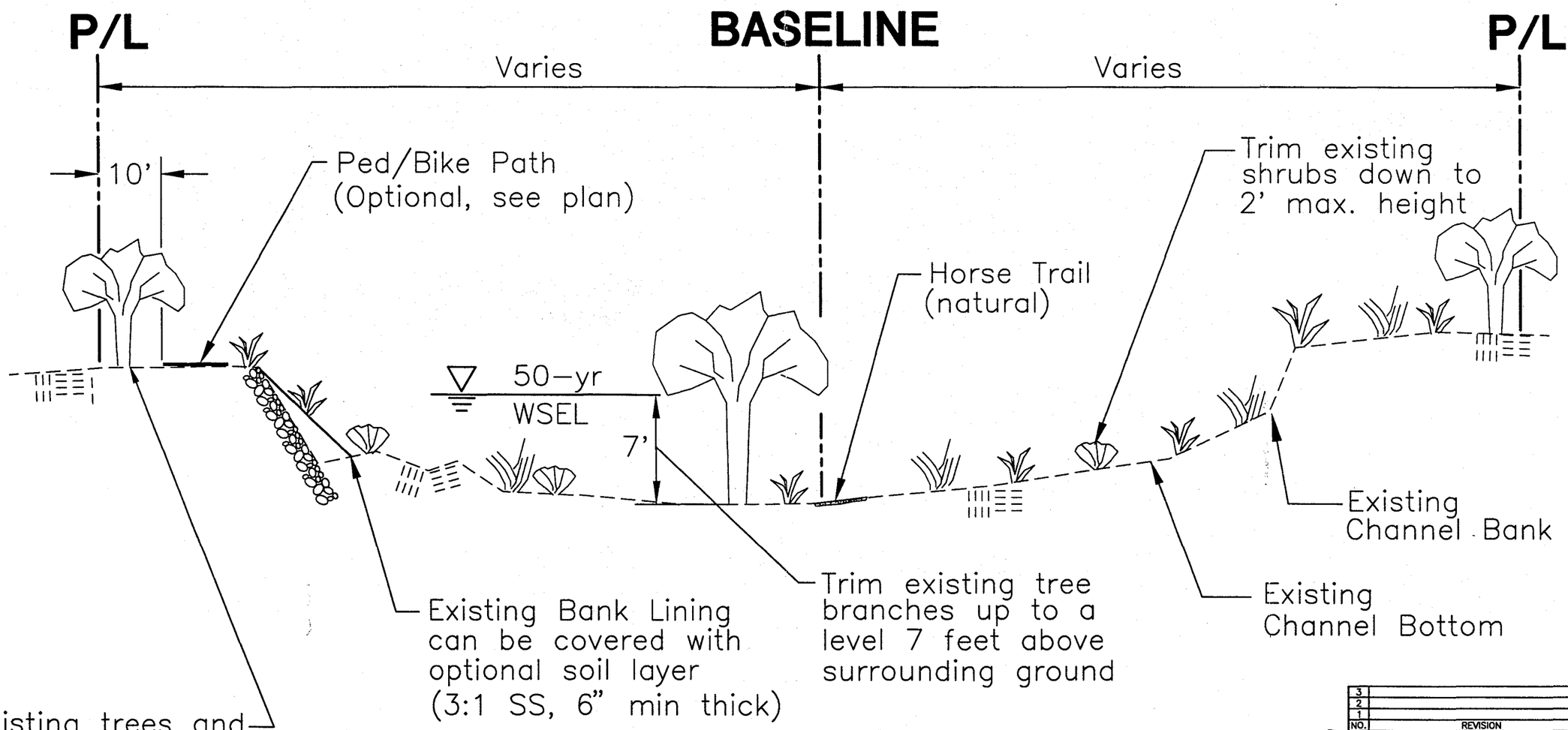
	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

ALTERNATIVE 6

SKUNK CREEK
TYPICAL CROSS-SECTION



ALTERNATIVE 7
VEGETATION MANAGEMENT

N.T.S.

See Plan for Locations

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93-24

	BY	DATE
DESIGNED	D. STOUGH	04-95
DRAWN	D. STOUGH	04-95
CHECKED	B. OLBERT	04-95

PRELIMINARY NOT FOR CONSTRUCTION

Sverdrup CORPORATION

ALTERNATIVE 7

Appendix B

TYPICAL CROSS-SECTIONS

(ALTERNATIVES 1-7)

SVERDRUP

JOB 013255 Skunk Creek

COMPUTATIONS FOR Sediment Transport

SHEET NO. 1 OF 1

DATE 4/19/95

BY BDO CHKD DES

Calculate Soil Gradation Coefficient (G)

from Eq. 3.2.9, Highways in the River Environment, US DOT, Federal Highway Administration January 1987

$$G = \frac{1}{2}\left[\frac{D_{50}}{D_{15.9}} + \frac{D_{84}}{D_{50}}\right]$$

where G = Gradation Coefficient

D_x = the sediment diameter particle of which x percent of sample is finer.

From soil samples through reaches 1-5 the following D_x sizes were selected.

$D_{15.9} = 0.6$ mm

$D_{50} = 6.0$ mm

$D_{84} = 25.0$ mm

$$G = \frac{1}{2}\left[\frac{6.0}{0.6} + \frac{25.0}{6.0}\right] = 7.08$$

From soil samples through reaches 6-8 the following D_x sizes were selected.

$D_{15.9} = 0.7$ mm

$D_{50} = 4.0$ mm

$D_{84} = 23.0$ mm

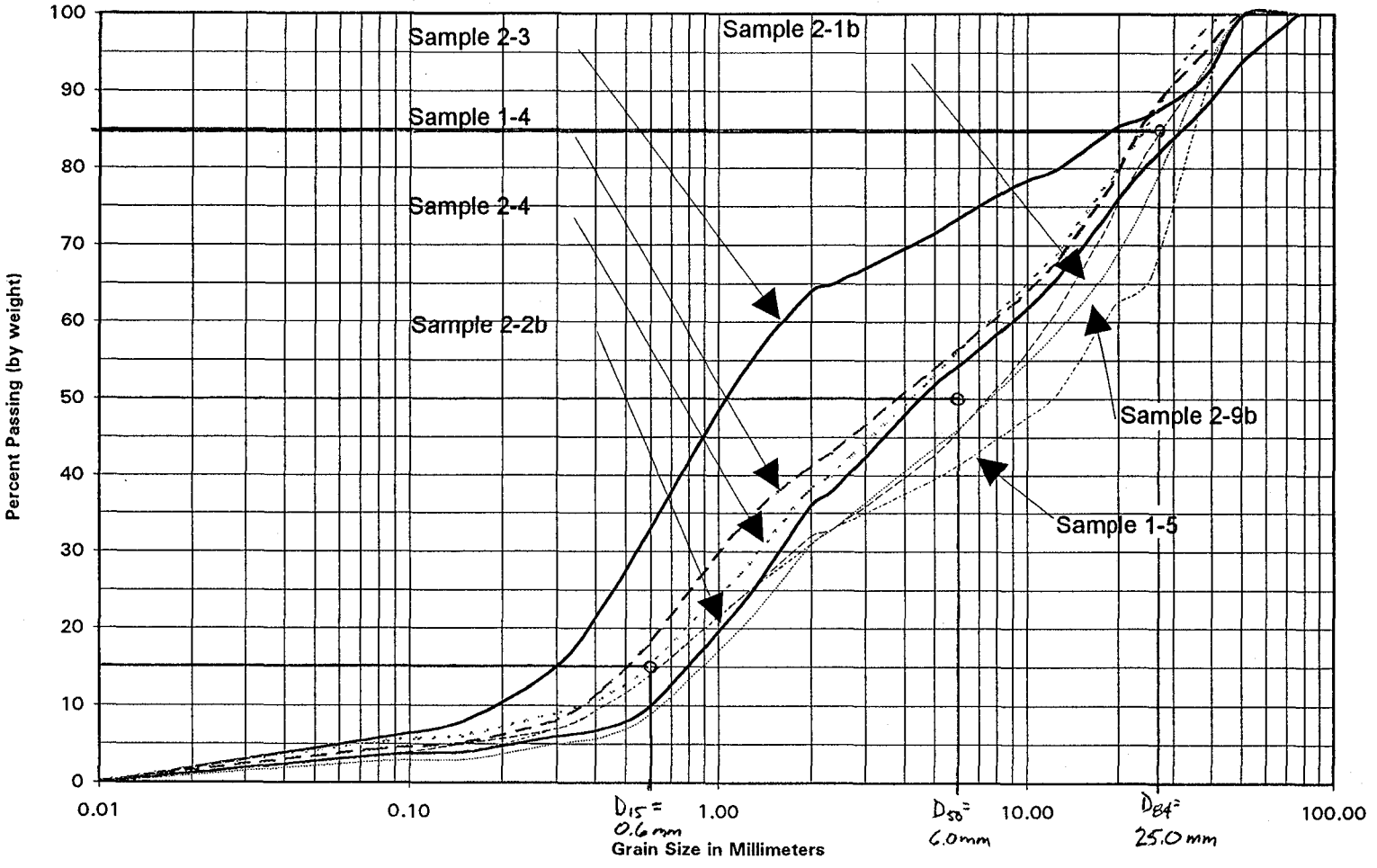
$$G = \frac{1}{2}\left[\frac{4.0}{0.7} + \frac{23.0}{4.0}\right] = 5.73$$

By: DES
Ckd: BDO

PROJECT: SKUNK CREEK MASTER PLAN
SAMPLE DATE: 1/16/95
LOCATION: Channel bottom
STREAMFLOW : 11000 cfs

SAMPLE #:		2-1b	2-2b	2-3	2-4	2-9b	1-4	1-5
Sieve Size (in) or #	Sieve Size (mm)	% passing	% passing	% passing	% passing	% passing	% passing	% passing
3	76.20	100	100	100	100	100	100	100
2	50.80	100	94	100	100	100	100	100
1.5	38.10	93	88	92	98	93	95	90
1	25.40	83	81	87	86	77	87	66
0.75	19.05	74	75	85	79	68	78	62
0.5	12.70	62	66	80	69	59	68	51
0.375	9.53	55	61	78	64	54	63	47
0.25	6.35	47	55	74	57	47	57	42
#4	4.75	42	51	71	52	43	53	39
#8	2.36	33	38	65	40	33	43	33
#10	2.00	32	36	64	38	31	41	31
#16	1.18	24	23	53	27	20	33	24
#30	0.60	14	10	33	15	9	18	14
#40	0.43	10	7	23	11	6	12	10
#50	0.30	7	6	15	9	5	8	7
#100	0.15	5	4	8	6	3	5	4
#200	0.08	3.6	3.5	5.8	5.1	2.8	4.2	3.4
	0.01	0	0	0	0	0	0	0

SKUNK CREEK
Sieve Analysis
11000 cfs Reach

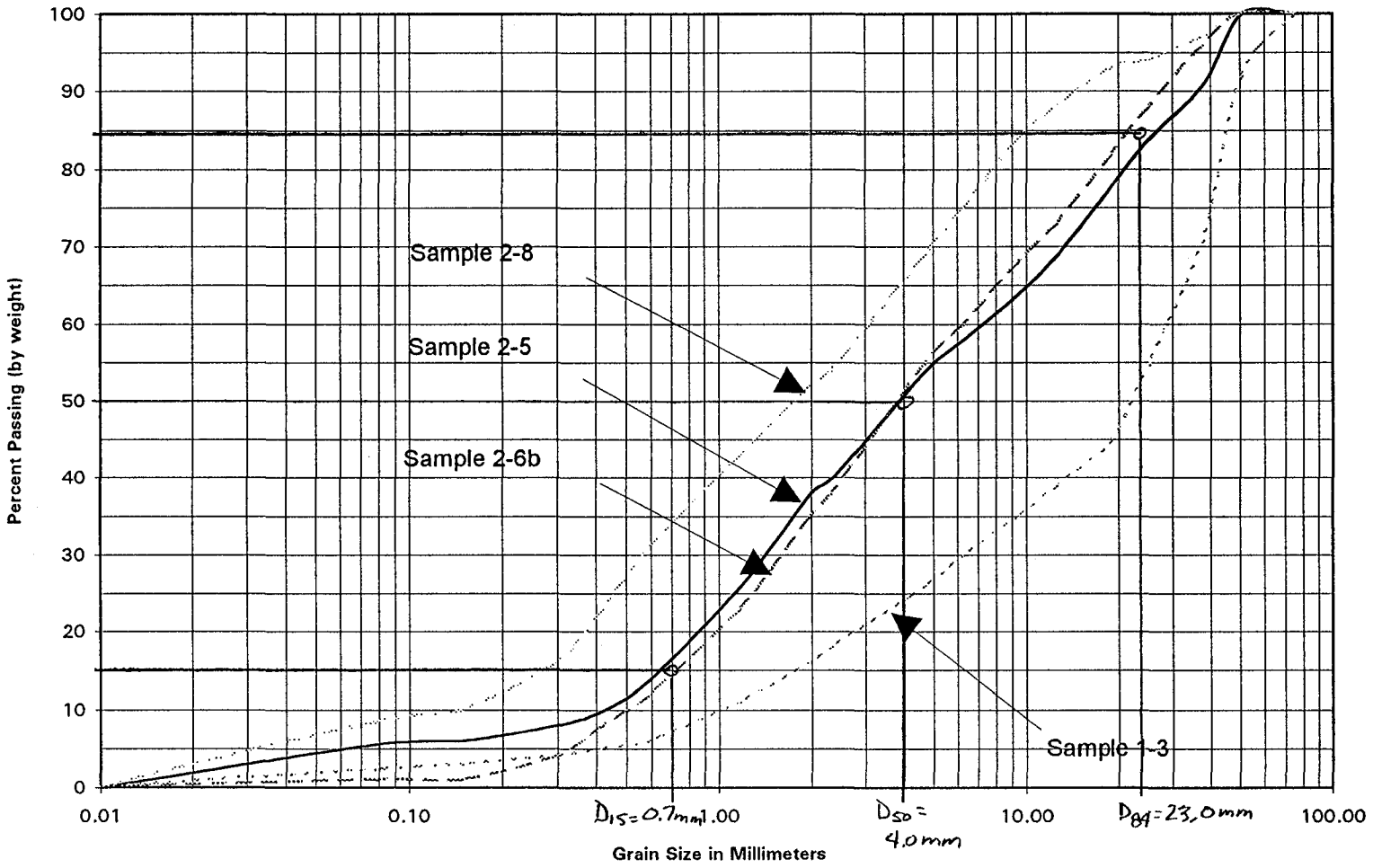


By: DES
Ckd: BDO

PROJECT: SKUNK CREEK MASTER PLAN
SAMPLE DATE: 1/16/95
LOCATION: Channel bottom
STREAMFLOW : 8400 cfs

SAMPLE #:		2-5	2-6b	2-8	1-3
Sieve Size (in) or #	Sieve Size (mm)	% passing	% passing	% passing	% passing
3	76.20	100	100	100	100
2	50.80	100	100	100	92
1.5	38.10	91	96	97	71
1	25.40	84	88	94	55
0.75	19.05	78	82	93	45
0.5	12.70	69	73	88	39
0.375	9.53	64	68	84	35
0.25	6.35	58	60	75	30
#4	4.75	54	55	69	26
#8	2.36	40	38	54	18
#10	2.00	38	35	52	16
#16	1.18	26	23	43	11
#30	0.60	14	12	31	6
#40	0.43	10	8	23	5
#50	0.30	8	4	16	4
#100	0.15	6	1	10	3
#200	0.08	5.6	1	8.5	2.3
	0.01	0	0	0	0

SKUNK CREEK
Sieve Analysis
8400 cfs Reach



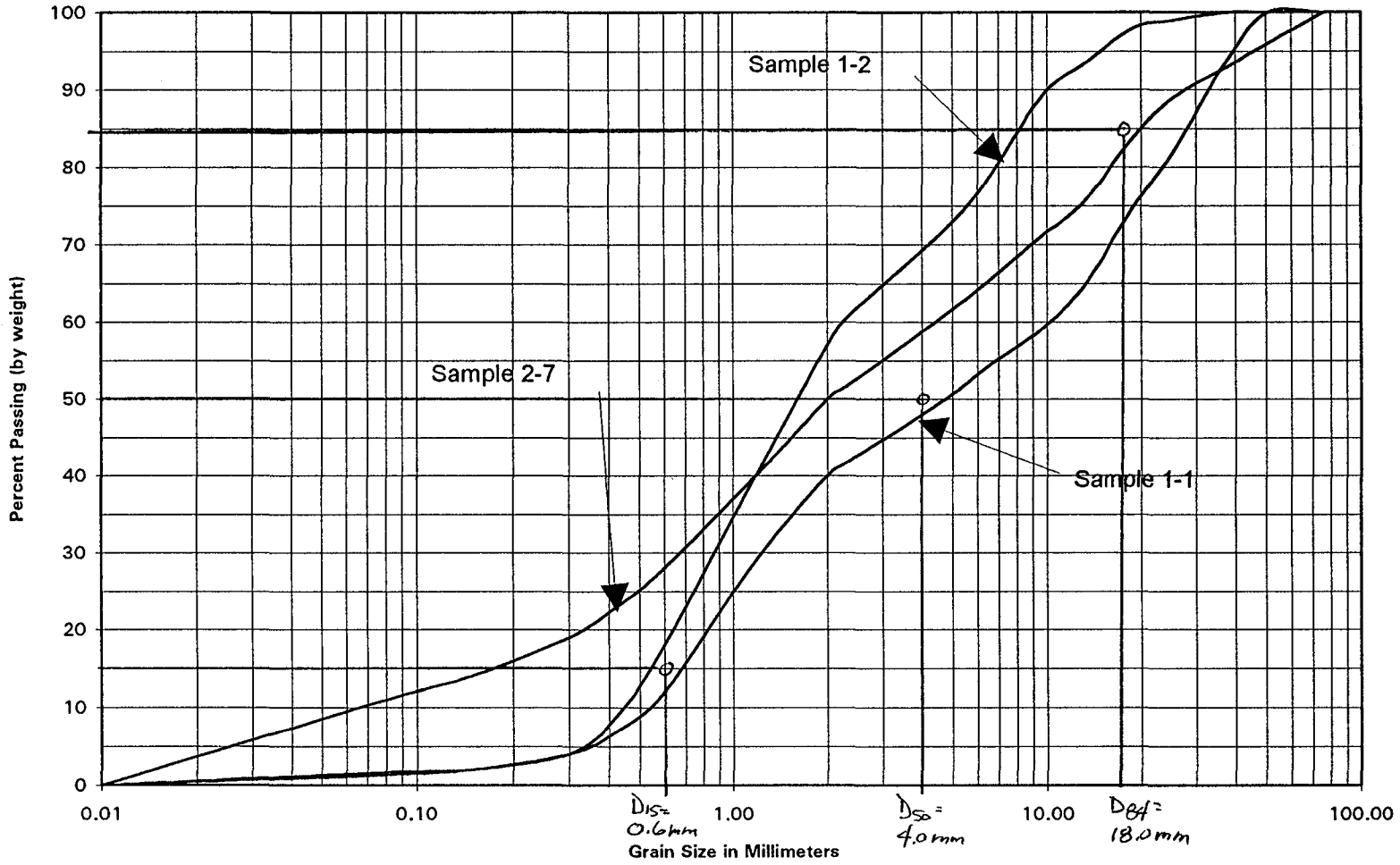
By: DES
Ckd: BDO

PROJECT: SKUNK CREEK MASTER PLAN
SAMPLE DATE: 1/16/95
LOCATION: Channel bottom
STREAMFLOW : 2600 cfs

SAMPLE #:		2-7	1-1	1-2
Sieve Size (in) or #	Sieve Size (mm)	% passing	% passing	% passing
3	76.20	100	100	100
2	50.80	96	100	100
1.5	38.10	93	94	100
1	25.40	89	82	99
0.75	19.05	84	75	98
0.5	12.70	75	64	93
0.375	9.53	71	59	89
0.25	6.35	65	54	78
#4	4.75	61	50	72
#8	2.36	52	42	61
#10	2.00	50	40	57
#16	1.18	40	29	40
#30	0.60	28	12	18
#40	0.43	23	7	9
#50	0.30	19	4	4
#100	0.15	14	2	2
#200	0.08	11	1.3	1.7
	0.01	0	0	0

GRADATION 2900 Chart 3

SKUNK CREEK
Sieve Analysis
2,600 cfs Reach



Sample 1-1

AGRA
Earth & Environmental, Inc.

PROJECT	SVERDRUP #9999	**PROJECT NO**	LT94-3310
LOCATION	US OF BEARDSLEY RD.	**W.O. NO**	1
		LAB NO	1
		DATE	09/01/94

MECHANICAL SIEVE ANALYSIS (ASTM C136)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	94
1 IN	82
3/4 IN	75
1/2 IN	64
3/8 IN	59
1/4 IN	54
#4	50
#8	42
#10	40
#16	29
#30	12
#40	7
#50	4
#100	2
#200	1.3

Sample 1-2

AGRA
Earth & Environmental, Inc.

PROJECT	SVERDRUP #9999	**PROJECT NO**	LT94-3310
LOCATION	CONFLUENCE OF SCOTTER & SKUNK DR.	**W.O. NO**	1
		LAB NO	2
		DATE	09/01/94

MECHANICAL SIEVE ANALYSIS (ASTM C136)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	100
1 IN	99
3/4 IN	98
1/2 IN	93
3/8 IN	89
1/4 IN	78
#4	72
#8	61
#10	57
#16	40
#30	18
#40	9
#50	4
#100	2
#200	1.7

Sample 1-3

AGRA
Earth & Environmental, Inc.

PROJECT	SVERDRUP #9999	**PROJECT NO**	LT94-3310
LOCATION	54TH AVENUE	**W.O. NO**	1
		LAB NO	3
		DATE	09/01/94

MECHANICAL SIEVE ANALYSIS (ASTM C136)

SIEVE SIZE	% PASSING
3 IN	100
2 IN	92
1 1/2 IN	71
1 IN	55
3/4 IN	45
1/2 IN	39
3/8 IN	35
1/4 IN	30
#4	26
#8	18
#10	16
#16	11
#30	6
#40	5
#50	4
#100	3
#200	2.3

Customer Note: 2"+ not sampled-apparent surface armour.

Sample 1-4

AGRA
Earth & Environmental, Inc.

PROJECT	SVERDRUP #9999	**PROJECT NO**	LT94-3310
LOCATION	67TH AVE (LOW WATER CROSSING)	**W.O. NO**	1
		LAB NO	4
		DATE	09/01/94

MECHANICAL SIEVE ANALYSIS (ASTM C136)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	95
1 IN	87
3/4 IN	78
1/2 IN	68
3/8 IN	63
1/4 IN	57
#4	53
#8	43
#10	41
#16	33
#30	18
#40	12
#50	8
#100	5
#200	4.2

Customer Note: 2"+ wasted.

AGRA
Earth & Environmental

Sample 1-5

AGRA
Earth & Environmental, Inc.

PROJECT	SVERDRUP #9999	**PROJECT NO**	LT94-3310
LOCATION	SKUNK CREEK JUST UPSTREAM OF ACDC CONFLUENCE	**W.O. NO**	1
		LAB NO	5
		DATE	09/01/94

MECHANICAL SIEVE ANALYSIS (ASTM C136)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	90
1 IN	66
3/4 IN	62
1/2 IN	51
3/8 IN	47
1/4 IN	42
#4	39
#8	33
#10	31
#16	24
#30	14
#40	10
#50	7
#100	4
#200	3.4

Sample 2-1a

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	1A	LAB NO:	1
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	100
1 IN	100
3/4 IN	99
1/2 IN	98
3/8 IN	97
1/4 IN	96
#4	95
#8	92
#10	91
#16	85
#30	78
#40	73
#50	66
#100	50
#200	37

Sample 2-16

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	1B	LAB NO:	2
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	93
1 IN	83
3/4 IN	74
1/2 IN	62
3/8 IN	55
1/4 IN	47
#4	42
#8	33
#10	32
#16	24
#30	14
#40	10
#50	7
#100	5
#200	3.6

Sample 2-2a

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	2A	LAB NO:	3
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	100
1 IN	96
3/4 IN	94
1/2 IN	89
3/8 IN	86
1/4 IN	80
#4	76
#8	65
#10	61
#16	45
#30	28
#40	24
#50	20
#100	15
#200	11

Sample 2-26

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	2B	LAB NO:	4
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
3 IN	100
2 IN	94
1 1/2 IN	88
1 IN	81
3/4 IN	75
1/2 IN	66
3/8 IN	61
1/4 IN	55
#4	51
#8	38
#10	36
#16	23
#30	10
#40	7
#50	6
#100	4
#200	3.5

Sample 2-3

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	3	LAB NO:	5
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	92
1 IN	87
3/4 IN	85
1/2 IN	80
3/8 IN	78
1/4 IN	74
#4	71
#8	65
#10	64
#16	53
#30	33
#40	23
#50	15
#100	8
#200	5.8

Sample 2-4

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	4	LAB NO:	6
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	98
1 IN	86
3/4 IN	79
1/2 IN	69
3/8 IN	64
1/4 IN	57
#4	52
#8	40
#10	38
#16	27
#30	15
#40	11
#50	9
#100	6
#200	5.1

Sample 2-5

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	5	LAB NO:	7
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	91
1 IN	84
3/4 IN	78
1/2 IN	69
3/8 IN	64
1/4 IN	58
#4	54
#8	40
#10	38
#16	26
#30	14
#40	10
#50	8
#100	6
#200	5.6

AGRA
Earth & Environmental

Sample 2-6a

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	6A	LAB NO:	8
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	96
1 IN	96
3/4 IN	94
1/2 IN	91
3/8 IN	89
1/4 IN	86
#4	84
#8	79
#10	78
#16	71
#30	61
#40	56
#50	49
#100	37
#200	28

Sample 2-66

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	**JOB NO:**	LT95-3389
LOCATION:	CITY OF GLENDALE	**WORK ORDER NO:**	1
MATERIAL:	6B	**LAB NO:**	9
SAMPLE SOURCE:	SKUNK CREEK	**DATE SAMPLED:**	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	96
1 IN	88
3/4 IN	82
1/2 IN	73
3/8 IN	68
1/4 IN	60
#4	55
#8	38
#10	35
#16	23
#30	12
#40	8
#50	4
#100	1
#200	1.0

AGRA
Earth & Environmental

Sample 2-7

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	7	LAB NO:	10
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
3 IN	100
2 IN	96
1 1/2 IN	93
1 IN	89
3/4 IN	84
1/2 IN	75
3/8 IN	71
1/4 IN	65
#4	61
#8	52
#10	50
#16	40
#30	28
#40	23
#50	19
#100	14
#200	11

Sample 2-8

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	**JOB NO:**	LT95-3389
LOCATION:	CITY OF GLENDALE	**WORK ORDER NO:**	1
MATERIAL:	8	**LAB NO:**	11
SAMPLE SOURCE:	SKUNK CREEK	**DATE SAMPLED:**	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	97
1 IN	94
3/4 IN	93
1/2 IN	88
3/8 IN	84
1/4 IN	75
#4	69
#8	54
#10	52
#16	43
#30	31
#40	23
#50	16
#100	10
#200	8.5

Sample 2-9a

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	JOB NO:	LT95-3389
LOCATION:	CITY OF GLENDALE	WORK ORDER NO:	1
MATERIAL:	9A	LAB NO:	12
SAMPLE SOURCE:	SKUNK CREEK	DATE SAMPLED:	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
3IN	100
2 IN	95
1 1/2 IN	93
1 IN	92
3/4 IN	91
1/2 IN	90
3/8 IN	89
1/4 IN	88
#4	86
#8	82
#10	81
#16	71
#30	55
#40	49
#50	42
#100	29
#200	19

Sample 2-96

AGRA Earth & Environmental

PROJECT:	SKUNK CREEK MASTER PLAN	**JOB NO:**	LT95-3389
LOCATION:	CITY OF GLENDALE	**WORK ORDER NO:**	1
MATERIAL:	9B	**LAB NO:**	13
SAMPLE SOURCE:	SKUNK CREEK	**DATE SAMPLED:**	01-16-95

MECHANICAL SIEVE ANALYSIS (ASTM C136 & C117)

SIEVE SIZE	% PASSING
2 IN	100
1 1/2 IN	93
1 IN	77
3/4 IN	68
1/2 IN	59
3/8 IN	54
1/4 IN	47
#4	43
#8	33
#10	31
#16	20
#30	9
#40	6
#50	5
#100	3
#200	2.8

AGRA
Earth & Environmental

Appendix D

SEDIMENT TRANSPORT CALCULATIONS

COMPUTED SEDIMENT SUPPLY RATE (Q10 and Q100)
SKUNK CREEK (below Adobe Dam)

Calculate the Gradation Coefficient

Reach	1 - 5		6 - 8		9 - 11
D50	6.0		4.0		4.0
D15.9	0.6		0.7		0.6
D84.1	25.0		23.0		18.0
G	7.08		5.73		5.58

REACH # 4 (for use with Reaches 1 through 5)

Existing Conditions		Subcritical				Supercritical			
Cross-Section		177+63		177+63		179+78		179+78	
Bed Slope (ft/ft)		0.0043		0.0043		0.0043		0.0043	
Yh (ft.)		4.43		8.68		2.53		5.68	
Area (sq. ft.)	(HEC-2 data)	550		1269		325		806	
Topwidth (ft.)	(HEC-2 data)	124.2		146.2		128.5		141.8	
Q100 (cfs)				11,000				11,000	
Q10 (cfs)		2,970				2,970			

TO DETERMINE SEDIMENT SUPPLY (Qs)

n		0.055		0.055		0.045		0.045
V (fps)	(HEC-2 data)	5.40		8.68		9.13		13.65
G		7.08		7.08		7.08		7.08
D50 (mm)		6.0		6.0		6.0		6.0
Yh (ft.)		4.43		8.68		2.53		5.68
qs (cfs/ft)		0.028		0.181		0.228		1.018
Qs (cfs)		3.5		26.4		29.3		144.3

REACH # 8 (for use with Reaches 6 through 8)

Existing Conditions		Subcritical				Supercritical			
Cross-Section		273+39		273+39		273+39		273+39	
Bed Slope (ft/ft)		0.0018		0.0018		0.0018		0.0018	
Yh (ft.)		3.44		6.34		1.35		3.16	
Area (sq. ft.)	(HEC-2 data)	911		1812		340		831	
Topwidth (ft.)	(HEC-2 data)	265.1		285.7		251		263.1	
Q100 (cfs)				8,400				8,400	
Q10 (cfs)		2,270				2,270			

SEDIMENT SUPPLY (Qs)

n		0.072		0.072		0.062		0.062
V (fps)	(HEC-2 data)	2.49		4.64		6.67		10.11
G		5.73		5.73		5.73		5.73
D50 (mm)		4.0		4.0		4.0		4.0
Yh (ft.)		3.44		6.34		1.35		3.16
qs (cfs/ft)		0.002		0.025		0.146		0.681
Qs (cfs)		0.5		7.1		36.6		179.3

COMPUTED SEDIMENT SUPPLY RATE (Q10 and Q100)
SKUNK CREEK (below Adobe Dam)

REACH # 10 (for use with Reaches 9 and 10)

Existing Conditions		Subcritical				Supercritical			
Cross-Section		299+08		299+08		299+08		299+08	
Bed Slope (ft/ft)		0.0054		0.0054		0.0054		0.0054	
Yh (ft.)		3.66		4.05		2.43		3.02	
Area (sq. ft.)	(HEC-2 data)	338		447		192		261	
Topwidth (ft.)	(HEC-2 data)	92.4		110.5		79		86.4	
Q100 (cfs)				2,600				2,600	
Q10 (cfs)		1,730				1,730			

TO DETERMINE SEDIMENT SUPPLY (Qs)

n		0.035		0.035		0.025		0.025
V (fps)	(HEC-2 data)	5.12		5.82		9.00		9.95
G		5.58		5.58		5.58		5.58
D50 (mm)		4.0		4.0		4.0		4.0
Yh (ft.)		3.66		4.05		2.43		3.02
qs (cfs/ft)		0.012		0.021		0.088		0.128
Qs (cfs)		1.1		2.3		7.0		11.0

REACH # 11

Existing Conditions		Subcritical				Supercritical			
Cross-Section		322+40		322+40		322+40		322+40	
Bed Slope (ft/ft)		0.0027		0.0027		0.0027		0.0027	
Yh (ft.)		4.16		4.16		2.54		2.54	
Area (sq. ft.)	(HEC-2 data)	325		325		179		179	
Topwidth (ft.)	(HEC-2 data)	78.1		78.1		70.5		70.5	
Q100 (cfs)				1,730				1,730	
Q10 (cfs)		1,730				1,730			

TO DETERMINE SEDIMENT SUPPLY (Qs)

n		0.028		0.028		0.018		0.018
V (fps)	(HEC-2 data)	5.33		5.33		9.67		9.67
G		5.58		5.58		5.58		5.58
D50 (mm)		4.0		4.0		4.0		4.0
Yh (ft.)		4.16		4.16		2.54		2.54
qs (cfs/ft)		0.010		0.010		0.066		0.066
Qs (cfs)		0.7		0.7		4.7		4.7

SVERDRUP

JOB 013255 Skunk Creek SHEET NO. 1 OF 1

COMPUTATIONS FOR Sediment Transport DATE 4/19/95 BY BDO CHKD DES

Calculate Sediment Supply Rate

Use Zeller and Fullerton Equation

Eqn 5.86 from Design Manual For Engineering Analysis of Fluvial Systems, Simons, Li & Associates March 1985

$$q_s = 0.0064 \frac{n^{1.77} V^{4.32} G^{0.45}}{Y_h^{0.30} D_{50}^{0.61}}$$

where n = Mannings roughness coefficient
V = mean velocity (fps) (HEC-2, Volume 2)
G = Gradation coefficient (Sieve Analysis - Appdx B)
Y_h = hydraulic depth (ft) (A, TW; HEC-2, Vol. 2)
D_{50} = Median diameter (mm) (Sieve Analysis - Appdx B)

$Q_s = q_s \times$ Channel Topwidth

Compute Sediment Supply from Section 177+63

from HEC-2 run w/ Q_{10} = 2,970 cfs (Subcritical Run)

$V = 5.40$ fps
$n = 0.055$
$Y_h = \frac{\text{Area}}{TW} = \frac{550 \text{ SF}}{124.2 \text{ ft}} = 4.43$ ft
$G = 7.08$
$D_{50} = 6.0$ mm

$$q_s = 0.0064 \times \frac{(0.055)^{1.77} (5.40)^{4.32} (7.08)^{0.45}}{(4.43)^{0.30} (6.0)^{0.61}} = 0.0285 \text{ cfs/ft}$$

(0.055)^1.77 → 0.0059; (5.40)^4.32 → 1,458.6; (7.08)^0.45 → 2.413
(4.43)^0.30 → 1.5163; (6.0)^0.61 → 2.983

$Q_s = 0.0285 \times 124.2 = \underline{3.5 \text{ cfs}}$

TABLE VII - 1

By: BDO
Ckd: DES

SKUNK CREEK MASTER PLAN

EQUILIBRIUM SLOPE CALCULATIONS (10-year event)

CHANNEL DIMENSIONS / PARAMETERS										SEDIMENT TRANSPORT CAPACITY						
REACH / STATION	Flow Regime	Depth	Equilibrium Channel Slope	Bottom Width	Side Slope	Mannings n	V (fps)	Calculated Q (cfs)	Target Q(10) (cfs)	Froude Number	Yh	G	D50 (mm)	qs (cfs/ft)	Calculated Qs (cfs)	Target Qs (cfs)
1	Subcritical	4.72	0.0031	60	2	0.023	9.06	2968	2970	0.78	4.16	7.08	6.00	0.0579	3.5	3.5
(61+00)	Supercritical	3.10	0.0128	60	2	0.023	14.45	2966	2970	1.51	2.83	7.08	6.00	0.4890	29.3	29.3
2	Subcritical	3.37	0.0048	130	3	0.035	6.28	2967	2970	0.62	3.14	7.08	6.00	0.0273	3.5	3.5
(75+11)	Supercritical	1.93	0.0161	130	3	0.025	11.34	2972	2970	1.47	1.85	7.08	6.00	0.2259	29.4	29.3
3	Subcritical	4.06	0.0044	100	2	0.035	6.76	2967	2970	0.61	3.78	7.08	6.00	0.0354	3.5	3.5
(125+73)	Supercritical	2.33	0.0146	100	2	0.025	12.18	2971	2970	1.44	2.23	7.08	6.00	0.2913	29.1	29.3
3	Subcritical	4.62	0.0044	80	2	0.035	7.21	2974	2970	0.62	4.19	7.08	6.00	0.0454	3.6	3.5
(128+67)	Supercritical	2.68	0.0141	80	2	0.025	12.96	2965	2970	1.44	2.52	7.08	6.00	0.3667	29.3	29.3
3	Subcritical	3.97	0.0046	100	3	0.035	6.71	2979	2970	0.62	3.59	7.08	6.00	0.0347	3.5	3.5
(130+94)	Supercritical	2.29	0.0152	100	3	0.025	12.16	2977	2970	1.46	2.15	7.08	6.00	0.2925	29.2	29.3
4	Subcritical	3.80	0.0044	112	2	0.035	6.54	2972	2970	0.61	3.57	7.08	6.00	0.0312	3.5	3.5
(170+88)	Supercritical	2.16	0.0150	112	2	0.025	11.81	2967	2970	1.44	2.08	7.08	6.00	0.2598	29.1	29.3
5	Subcritical	2.56	0.0052	200	3	0.035	5.58	2967	2970	0.63	2.47	7.08	6.00	0.0176	3.5	3.5
(211+32)	Supercritical	1.45	0.0180	200	3	0.025	10.06	2981	2970	1.49	1.42	7.08	6.00	0.1459	29.2	29.3
5	Subcritical	2.66	0.0051	190	3	0.035	5.66	2978	2970	0.62	2.56	7.08	6.00	0.0184	3.5	3.5
(222+73)	Supercritical	1.49	0.0179	190	3	0.025	10.20	2956	2970	1.49	1.46	7.08	6.00	0.1539	29.2	29.3
6	Subcritical	4.70	0.0015	100	3	0.035	4.24	2272	2270	0.37	4.18	5.73	4.00	0.0053	0.5	0.5
(224+78)	Supercritical	1.77	0.021	100	3	0.025	12.16	2266	2270	1.65	1.69	5.73	4.00	0.3656	36.6	36.6
6	Subcritical	4.46	0.0015	110	3	0.035	4.13	2274	2270	0.36	4.02	5.73	4.00	0.0048	0.5	0.5
(231+89)	Supercritical	1.66	0.0215	110	3	0.025	11.84	2261	2270	1.65	1.59	5.73	4.00	0.3323	36.6	36.6

TABLE VII - 1

By: BDO
Ckd: DES

SKUNK CREEK MASTER PLAN

EQUILIBRIUM SLOPE CALCULATIONS (10-year event)

CHANNEL DIMENSIONS / PARAMETERS										SEDIMENT TRANSPORT CAPACITY						
REACH / STATION	Flow Regime	Depth	Equilibrium Channel Slope	Bottom Width	Side Slope	Mannings n	V (fps)	Calculated Q (cfs)	Target Q(10) (cfs)	Froude Number	Yh	G	D50 (mm)	qs (cfs/ft)	Calculated Qs (cfs)	Target Qs (cfs)
6	Subcritical	3.97	0.0015	135	3	0.035	3.89	2271	2270	0.36	3.67	5.73	4.00	0.0038	0.5	0.5
(239+77)	Supercritical	1.46	0.0225	135	3	0.025	11.22	2283	2270	1.66	1.42	5.73	4.00	0.2720	36.7	36.6
6	Subcritical	4.17	0.0015	125	2.5	0.035	4.03	2274	2270	0.36	3.87	5.73	4.00	0.0044	0.5	0.5
(243+54)	Supercritical	1.54	0.0218	125	2.5	0.025	11.44	2271	2270	1.65	1.50	5.73	4.00	0.2918	36.5	36.6
6	Subcritical	4.26	0.0015	120	2.5	0.035	4.07	2266	2270	0.36	3.94	5.73	4.00	0.0046	0.5	0.5
(245+36)	Supercritical	1.58	0.0217	120	2.5	0.025	11.60	2271	2270	1.65	1.53	5.73	4.00	0.3069	36.8	36.6
7	Subcritical	3.38	0.0015	180	2	0.035	3.60	2271	2270	0.35	3.26	5.73	4.00	0.0028	0.5	0.5
(261+20)	Supercritical	1.20	0.0244	180	2	0.025	10.37	2270	2270	1.68	1.18	5.73	4.00	0.2047	36.8	36.6
8	Subcritical	2.78	0.0016	240	3	0.035	3.28	2263	2270	0.35	2.69	5.73	4.00	0.0020	0.5	0.5
(276+36)	Supercritical	0.98	0.0271	240	3	0.025	9.57	2278	2270	1.71	0.97	5.73	4.00	0.1534	36.8	36.6
9	Subcritical	3.56	0.0033	80	4	0.035	5.15	1728	1730	0.52	3.09	5.73	4.00	0.0135	1.1	1.1
(288+17)	Supercritical	2.21	0.0088	80	4	0.025	8.85	1738	1730	1.10	2.01	5.73	4.00	0.0880	7.0	7.0
9	Subcritical	3.34	0.0033	90	4	0.035	5.00	1727	1730	0.51	2.96	5.73	4.00	0.0121	1.1	1.1
(291+40)	Supercritical	2.06	0.0089	90	4	0.025	8.58	1736	1730	1.10	1.90	5.73	4.00	0.0782	7.0	7.0
10	Subcritical	4.10	0.0029	70	2	0.035	5.40	1732	1730	0.49	3.71	5.73	4.00	0.0157	1.1	1.1
(296+40)	Supercritical	2.51	0.0078	70	2	0.025	9.20	1732	1730	1.06	2.35	5.73	4.00	0.0991	6.9	7.0
10	Subcritical	4.47	0.0029	60	2	0.035	5.62	1732	1730	0.50	3.96	5.73	4.00	0.0183	1.1	1.1
(303+92)	Supercritical	2.75	0.0077	60	2	0.025	9.59	1727	1730	1.06	2.54	5.73	4.00	0.1160	7.0	7.0

NOTE: Yh is hydraulic radius; Yh=A/Wp

Wp is CALCULATED wetted perimeter; Wp=Bot Wid + (2*Depth *(1+SS^2)^0.5)

SVERDRUP

JOB 013255 Skunk Creek

COMPUTATIONS FOR Sediment Transport

SHEET NO. 1 OF 2

DATE 4/19/95

BY BDO CHKD DES

Determine Equilibrium Channel Slope, Table VII-1

Check Equilibrium Envelop for Subcritical & Supercritical for Dominant Flow (Q10)

Use HEC-2 Section 130+84

Subcritical Flow + Super Critical Flow

Recommended Channel

(W) Bottom Width = 100 feet
Sideslope = 3:1
Mannings roughness n = 0.035 (Subcritical), 0.025 (super critical)
Design Q10 = 2,970 cfs
G = 7.08
D_{50} = 6.00 mm
Target Q_s = 3.5 cfs (subcritical) } Reach 1 Sediment Supply Rates
Target Q_s = 29.3 cfs (supercritical) }

Iterate slope & channel until the hydraulic capacity and sediment transport match design values Q10 = 2,970 cfs, Q_s = 3.5 cfs / 29.3 cfs

Try Slope = 0.0046 ft/ft, depth = 3.97', n = 0.035
Top Width = 100 + 2(3) 3.97 = 123.82'
Area = $3.97(100) + 3.97^2(3)$ = 444.3 SF
WP = $100 + 2\sqrt{(3.97)^2 + (3 \times 3.97)^2}$ = 125.11 FT
R = Area / WP = 444.3 / 125.11 = 3.5513'
Y_h = Area / TW = 444.3 / 123.82 = 3.59'

$$Q = \frac{1.486}{n} \times A \times R^{0.67} \times S^{0.5} = \frac{1.486}{0.035}(444.3)(3.5513)^{0.67}(0.0046)^{0.5}$$

= 2,979 cfs ≈ 2,970 cfs OK

$V = Q/A = 2979/444.3 = 6.70$ fps

$$Q_s = W \times 0.0064 \frac{n^{1.77} \; V^{4.32} \; G^{0.45}}{Y_h^{0.30} \; D_{50}^{0.61}}$$

$$Q_s = 100 \times 0.0064 \frac{(0.035)^{1.77} \; (6.70)^{4.32} \; (7.08)^{0.45}}{(3.59)^{0.30} \; (6.0)^{0.61}}$$

(0.0026, 1.77, 3703.7, 4.32, 2.413, 0.45; 1.467, 0.30, 2.983, 0.61)

$= 3.47$ cfs $\sim$ 3.5 cfs (OK)

∴ Equilibrium Slope for Subcritical Flow is 0.0046 ft/ft

Check equilibrium slope for supercritical flow

Try Slope 0.0152 ft/ft, depth = 2.29', n = 0.025

Top Width = $100 + 2(3)\,2.29 = 113.74'$

Area = $100(2.29) + (2.29)^2 3 = 244.73$ SF

WP = $100 + 2\sqrt{(2.29)^2 + (3 \times 2.29)^2} = 114.48$ ft

R = Area/WP = 244.7 / 114.48 = 2.1375'

Y_h = Area/TW = 244.7 / 113.74 = 2.15'

$$Q = \frac{1.486}{0.025}(244.7)(2.1375)^{0.67}(0.0152)^{0.5}$$

$= 2,976$ cfs $\sim$ 2,970 cfs (OK)

$V = Q/A = 2,976 / 244.7 = 12.16$ fps

$$Q_s = 100 \times 0.0064 \frac{(0.025)^{1.77} \; (12.16)^{4.32} \; (7.08)^{0.45}}{(2.15)^{0.30} \; (6.0)^{0.61}}$$

(0.0015, 1.77, 48.631, 4.32, 2.413, 0.45; 1.2581, 0.30, 2.983, 0.61)

$= 29.2$ cfs $\sim$ 29.3 cfs (OK)

SVERDRUP

JOB 013255 Skunk Creek

COMPUTATIONS FOR Scour Depths

SHEET NO. 1 OF 3

DATE 4/19/95

BY BDO CHKD DES

Calculate Channel Scour Depths (for Q100), Table VII-1

HEC-2, Section 130+94 Hydraulic Parameters

Max Depth - 10.35 ft
Mean Velocity - 8.10 fps
Top Width - 168.1 fps
Channel Area - 1,359 SF
Energy Gradeline - 0.0022 ft/ft
Mannings - 0.035
Centerline Radius - 1,500 ft
Hydraulic Depth = $\frac{\text{Area}}{TW} = \frac{1359}{168.1} = 8.1$ ft

Anti-dune Trough Depth

Eqn 11.24 from Engineering Analysis of Fluvial Systems Simons, Li & Assoc., 1982

$$Z_a = 0.0137 (V_m)^2$$

where V_m = Mean Velocity (fps)

$$Z_a = 0.0137 (8.10)^2 = 0.90 \text{ ft.}$$

Bend Scour

Eqns 6.6 & 6.7 from Standards Manual for Drainage Design and Floodplain Management in Tucson, Az, Simons, Li & Assoc., December, 1989.

$$Z_{bs} = 0.0685 \frac{Y_{max} V_m^{0.8}}{Y_h^{0.4} S_e^{0.3}} \left[2.1 \left(\frac{T}{4 r_c} \right)^{0.2} - 1 \right]$$

where

V_m = Average Velocity flow (fps)

Y_{max} = Maximum Depth of Flow (ft)

Y_h = Hydraulic Depth (ft)

S_e = Energy Slope (ft/ft)

r_c = radius of curvature (C/L of channel) (ft)

T = Channel Top Width (ft)

$$Z_{bs} = 0.0685 \frac{(10.35)(8.10)^{0.8}}{(8.1)^{0.4}(0.0022)^{0.3}} \left[2.1 \left(\frac{168.1}{4(1,500)} \right)^{0.2} - 1 \right]$$

$= 0.28'$, Use 0.3'

Thalweg Depth Z_{tpf}

From field Observation, Use 1.0 ft

General Scour (Contraction Scour)

See Attached Contraction Scour Calculations

Z_{gs} = 1.0 ft

SVERDRUP

JOB 013255 Skunk Creek

SHEET NO. 3 OF 3

DATE 4/19/95

COMPUTATIONS FOR Scour Depths

BY BDO CHKD DES

Subtotal of Scour Depths

Antidune	Z_a =	0.9'
Bend Scour	Z_{bs} =	0.3'
Thalweg Scour	Z_{lft} =	1.0'
General Scour	Z_{gs} =	1.0'
Subtotal		3.2'

Total Scour Depth Z_{tot} = Scour Depth x Safety Factor

= 3.2 ft x 1.5

= 4.7 feet, Use 5.0 ft

SVERDRUP

JOB SKUNK CREEK

SHEET NO. 1 OF 2

DATE 3-15-95

COMPUTATIONS FOR CONTRACTION SCOUR DATA FOR HY-9 INPUT (HEC-18)

BY DES CHKD BDD

GEOGRAPHIC LOCATION: UPSTM FROM 67th AVE

APPROACH SECTION # : 130+94 (1)

CONTRACTION SECTION # : 127+47 (2)

$y_2 \equiv$ FLOW DEPTH @ CONSTRICTION = W_2 83 (9b' * 0.8660) n_2 .035

$y_1 \equiv$ FLOW DEPTH @ APPROACH (& AVG DEPTH) Q_2 11000 y_2 9.28'

$W_1 \equiv$ BOTTOM WIDTH @ APPROACH

$W_2 \equiv$ " " @ CONTRACTION

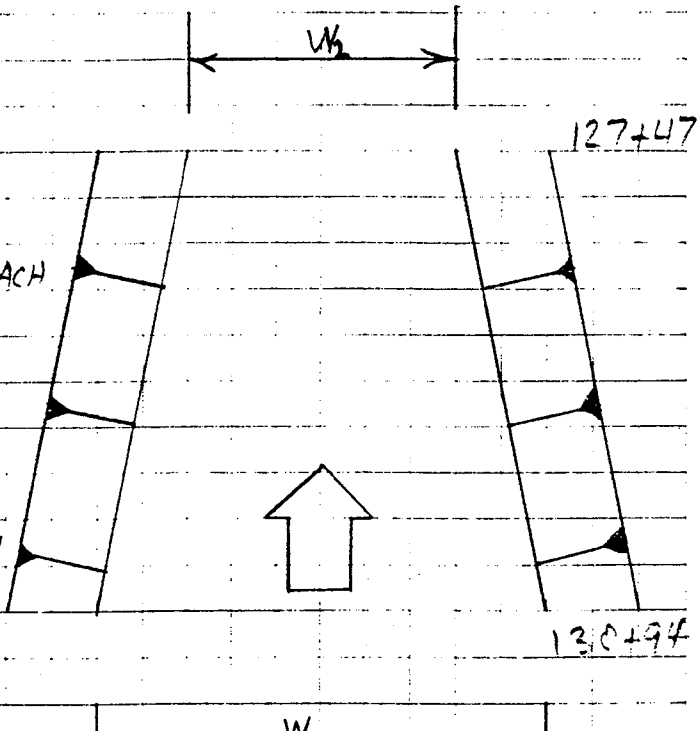
$Q_2 \equiv$ CONTRACTED FLOW

$Q_1 \equiv$ MAIN CHANNEL FLOW @ APPROACH

$S_1 \equiv$ EGL SLOPE @ APPROACH

$n_1 \equiv$ MANNING's n @ APPROACH

$n_2 \equiv$ MANNING's n @ CONTRACTION



Q_1 = 11000 W_1 100' n_1 .035

$V_0 = (g y_1 S_1)^{1/2} = (32.2 * 10.35' * 0.002201)^{1/2}$ S_1 0.002201 ft/ft $(D_{50})_1$ 6.00 mm

V = 0.86 fps V_0 0.86 fps y_1 10.35'

ω_1 1.80 psf V_0/ω_1 0.48

ω FROM FIG.3, P.34, HEC-18 2nd Ed.

HEC-2 INFO FROM SKALT 8.0H2 3/4/95 (SUBCRITICAL)

****

SK 13094

CONTRACTION SCOUR
ASE 2 The normal river channel width becoming narrower either because of the bridge itself or by the bridge site being on a narrower reach.

BRIDGE NUMBER1 Q-

1	flow depth @ approach	y1	ft	=	10.35
2	width @ approach	w1	ft	=	100
3	width @ constriction	w2	ft	=	83
4	contracted flow	Qt	cfs	=	11000
5	main channel flow @ approach	Qc	cfs	=	11000
6	Vratio ShearV/FallV			=	.48
7	Manning nRatio contracted/approach			=	1

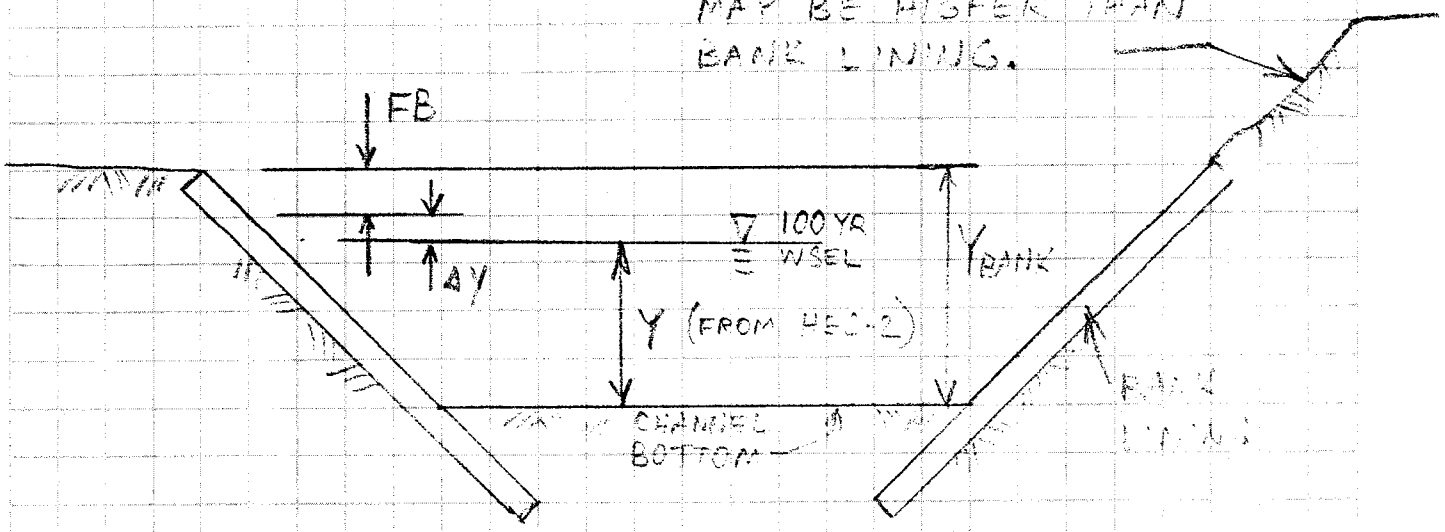
CONTRACTION SCOUR EQUATION 1 = 1 Ft

SVERDRUP

JOB SKUNK CREEK CHANNEL DESIGN SHEET NO. 1 OF 6

DATE 04-28-95

COMPUTATIONS FOR CHANNEL BANK HEIGHT & FREEBOARD EQUATIONS BY DLS CHKD SDD



SUPERELEVATION OF BANK ON CURVE

USE EQUATION 5.9 DRAINAGE DESIGN MANUAL FOR MARICOPA COUNTY, AZ VOL. II HYDRAULICS, NOV. 1991

$\Delta y = V^2 * T / (g \cdot r_c)$

V = CHANNEL VELOCITY
T = " TOPWIDTH
g = 32.2 FT/S²
r_c = RADIUS OF CURVATURE (FT) OF CHL. CENTERLINE

BASIC FREEBOARD

FB = 2.0' OR

* FB = 0.25 * [Y + V²/2g] } WHICHEVER IS GREATER

* EQUATION 5.10 DRAINAGE DESIGN MANUAL, ET AL.

SVERDRUP

JOB SKUNK CREEK CHANNEL DESIGN SHEET NO. 2 OF 5

DATE 2-12-95

COMPUTATIONS FOR CHANNEL SUPERELEVATION REACHES 2 & 3 BY DES CHKD BRD

SUPERELEVATION REQUIRED

@ REACH 2 & 3 USE STA 81+49 (REGULAR SECTION HIGHEST VELOCITY)

$Y = 7.5'$

$V = 9.6$ FPS

$T = 175'$

$r_c = 850'$

$\Delta y = V^2 \cdot T / (g \cdot r_c) = 9.6^2 \cdot 175 / (32.2 \cdot 850)$

$\Delta y = 0.59'$

FREEBOARD ON STRAIGHTS

$FB = 0.25 (Y + V^2/2g) = 0.25 (7.5 + 9.6^2/(2 \cdot 32.2))$

$= 2.23'$

TOTAL FREEBOARD ON CURVES

$TFB = FB + \Delta y = 2.23' + 0.59' = 2.82'$

USE 3' AS STANDARD FREEBOARD

SPECIFY TOTAL DEPTH: STRAIGHTS $8.8' + 2.2' \rightarrow$ USE 11'

CURVES $7.5' + 2.8' \rightarrow$ USE 11'

$Y_{BANK} = 11.0'$

SVERDRUP

JOB SKUNK CREEK MDP

SHEET NO. 3 OF 5

DATE 2-12-95

COMPUTATIONS FOR FREEBOARD, REACH 4

BY DES CHKD

SUPERELEVATION REQUIRED
@ REACH 4

$Y = 8.7'$ USE SECTION 164+88

$V = 10.8$ FPS

$T = 135$

$r_c = 3290'$

$\Delta y = V^2 \cdot T / (g \cdot r_c) = 10.8^2 \cdot 135' / (32.2 \cdot 3290')$

$\Delta y = 0.15'$

FREEBOARD

$FB = 0.25(Y + V^2/2g) = 0.25(8.7' + 10.8^2/2 \cdot 32.2)$

$FB = 2.63'$

TOTAL FREEBOARD ON CURVES

$TFB = FB + \Delta y = 2.63' + 0.15'$

$= 2.78'$ (USE 3.0' → CURVES)

EXISTING GABION CHANNEL DEPTH IS 11.0'

$Y_{BANK} = Y + \Delta Y + FB = 8.7' + 0.15' + 2.78' = 11.63' \geq 11.0'$

USE $Y_{BANK} = 11.0'$

ALL NEW CONSTRUCTION SHALL MATCH EXIST TOP OF CHANNEL BANK & GABIONS

SVERDRUP

JOB SKUNK CREEK CHANNEL DESIGN

COMPUTATIONS FOR CHANNEL FREEBOARD REACH 5

SHEET NO. 4 OF 5

DATE 2-12-95

BY DES CHKD SDO

SUPERELEVATION

$Y = 7.3'$

$V = 6.0$ FPS

$T = 275$

$V_c = 550'$

USE SECTION 21+76

$\Delta y = V^2 * T/(g r_c) = (6.0)^2 * 275/(32.2 * 550)$

$\Delta y = 0.56'$

FREEBOARD

$FB = 0.25 * (Y + V^2/(c\ g)) = 0.25 * (7.3' + (6.0)^2/(3 * 32.2))$

$FB = 2.09'$

TOTAL FREEBOARD $= FB + \Delta y = 2.09' + 0.56' = 2.65'$

TOTAL DEPTH; AT 57th AVE DIP X-ING

$Y_{BANK} = 7.3' + 2.65' = 9.95'$

ON ALL SECTIONS, REACH 5 **USE $Y_{BANK} = 10.0'$**

SVERDRUP

JOB SKUNK CREEK MDP SHEET NO. 5 OF 6

COMPUTATIONS FOR FREEBOARD, REACH 6 & 7 DATE 2-12-95

BY DES CHKD BDD

SUPERELEV. RQD. @ REACH 6 & 7

$Y = 7.5'$ USE SECTION 249+74

$V = 7.9$ FPS

$T = 163'$

$r_c = 2040'$

SUPERELEV

$$\Delta y = V^2 \cdot T / (g \cdot r_c) = 7.9^2 \cdot 160 / (32.2 \cdot 2040)$$

$$\Delta y = 0.15'$$

FREEBOARD ON STRAIGHTS (USE $Y = 8.5'$ $V = 7.8$ FPS SHEET 27+28)

$$FB = 0.25(Y + V^2/2g) = 0.25(8.5' + 7.8^2/(2 \times 32.2))$$

$$FB = 2.36'$$

TOTAL FREEBOARD ON CURVES

$$TFB = FB + \Delta y = 2.36' + 0.15'$$

$$TFB = 2.51' \quad \text{USE } TFB = 2.5'$$

TOTAL DEPTH $Y_{BANK} = 8.5' + 2.5 = 11'$

CURVES & STRAIGHTS, USE $Y_{BANK} = 11'$

SVERDRUP

JOB SKUNK CREEK MDP

SHEET NO. 5 OF 6

DATE 2-12-95

COMPUTATIONS FOR FREE BOARD, REACH 10

BY DES CHKD BDD

SUPERELEV RQD. ON REACH 10

USE SECTION 301+36 (MAX DEPTH)

$Y = 4.83'$

$V = 6.76$ FPS

$T = 90'$

$r_c = 800'$

SUPERELEV

$$\Delta y = V^2 \cdot T / (g \cdot r_c) = 6.76^2 \cdot 90 / (32.2 * 800)$$

$$\Delta y = 0.16'$$

FREEBOARD

$$FB = 0.25(Y + V^2/2g) = 0.25(4.83' + 6.76^2/(2*32.2))$$

$$FB = 1.38'$$

TOTAL FREEBOARD

$$TFB = FB + \Delta y = 1.38' + 0.16'$$

$$TFB = 1.54'$$

TOTAL CHANNEL DEPTH OF $4.8 + 1.6 = 6.4'$

CURVES & STRAIGHTS, USE $\boxed{Y_{BANK} = 6.5'}$

SVERDRUP

JOB SKUNK QUANTITIES

SHEET NO. 1 OF 1

DATE 2-24-95

COMPUTATIONS FOR BANK LINING, DEPTH TAKEN STATION TO STATION, & SIDE

BY DES CHKD SD

REACH	BEGIN STA	END STA	BANK HEIGHT	TOEDOWN	SIDE(S) (LOOKING UPSTM CONSTRUCTION ORIENTATION)	
	69+25	86+23	11'	5'	BOTH	
2	86+23	119+97	11'	4'	BOTH	EXCLUDE 109' BELL ER (WIDTH OF 3922 AVE TO ACCOUNT FOR WRAPARC
	120+24	124+50	11'	4'	BOTH	EQTN 119+97 = 120+24
	130+94	134+16	11'	5'	BOTH	
3	134+16	164+88	11'	4'	BOTH	
	164+88	171+52	11'	6'	RT	COVERED
4	179+75	181+75	11'	6'	LT	RAMPS UNCOVERD
	181+40	183+56	11'	6'	RT	↓
	193+10	195+38	11'	6'	RT	
5	197+53	210+00	10'	4'	RT	
	210+90	224+78	10'	6'	RT	
	213+83	224+78	10'	6'	LT	
6	224+78	232+10	11'	4'	LT	
	224+78	231+11	11'	4'	RT	
	232+92	253+75	11'	4.3'	LT	
	231+89	239+77	11'	4.3'	RT	
7	259+33	263+86	11'	6.4'	LT	UNC. GABIONS
	259+33	260+92	11'	6.4	RT	UNC. GABIONS
10	296+34	303+92	6.5'	4'	LT	SHOTCRETE
	296+71	303+92	6.5'	4'	RT	SHOTCRETE

Appendix E

Quantities

By: DES
Ckd: BDO

SKUNK CREEK
BANK LINING AND EARTHWORK QUANTITIES
PROJECT 1
ALTERNATIVE EIGHT

REACH NUMBER	HEC-2 Cumul. Earthwk (k cu yd)	Incremental Earthwork FILL (cu yd)	Incremental Earthwork CUT (cu yd)	Init. Veg.Mgmt. Chl Width (ft) / Length (ft) / Area (acres)	Chl Bank Side	Height> / Toedown>	SHOTCRETE	GABIONS: Soil-Covered (SCG)								Soil Cov Gab Dike		Uncovered (UCG)		Comments
							6.5	8	8	10	10	10	11	11	11	8	11	9	11	
							4	4.3	6	4	5	6	4	4.3	5	6	4.3	4.3	6.4	6	
1 Sta 54+00 to 69+25	0.0	0	0																	Existing Bank Linings on Both Banks No earthwork, No Vegetation Management
2A Sta 69+25 to 78+00	39.6	0	39.6		Lt										875					
					Rt										875					
		FILL	CUT	(acres)			(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	
Cumulative Totals *(K.Cu.Yd.)		0.0	39.6	na			0	0	0	0	0	0	0	0	1,750	0	0	0	0	0	
						Sideslope (h:1)>	2	3	3	3	3	3	3	3	3	3	3	3	2	1.5	
						Thickness	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Bank Lining Volumes																					
						Subtotal (Cu Yd)	0	0	0	0	0	0	0	0	4,919	0	0	0	0	0	
						Total Area of Shotcrete	0	(Square Yards)													
																				Total Volume of Gabion Lining Material	4,919 Cubic Yards
Overexcavation for Toedown and Lining																					
						Subtotal (Cu Yd)	0	0	0	0	0	0	0	0	8,160	0	0	0	0	0	
																				Total Overexcavation Volume for All Linings	8,160 Cubic Yards
Soil Overlay Volume																					
						Subtotal (Cu Yd)	NA	0	0	0	0	0	0	0	1,127	0	0	0	0	0	
																				Total Soil Overlay Volume on Gabions	1,127 Cubic Yards

Cumulative Earthwork is taken from HEC-2 intermediate output and is shown in thousands of cubic yards.
Earthwork includes excavation of channel and backfill required up to the elevation of the lowest channel bank.

Bank Lining Vol= Length*Thickness*[(Toedown+Height)*(1+Sideslope^2)^0.5]/27

Toedown Overexcav = [Length*Toedown^2*(1+Sideslope)/(2*27)]+Bank Lining Vol

Lining Thickness = Gabion (1.5'), Shotcrete (0.5)

Soil Overlay= Length*Soil Thickness*[Height*(1+Sideslope^2)^0.5]/27

* The Total Volumes (outlined and shaded) are used in "Construction Materials Quantity & Cost Estimate" spreadsheet.

By: DES
Ckd: BDO

SKUNK CREEK
BANK LINING AND EARTHWORK QUANTITIES
PROJECT 2
ALTERNATIVE EIGHT

REACH NUMBER	HEC-2 Cumul. Earthwk (k cu yd)	Incremental Earthwork FILL (cu yd)	Incremental Earthwork CUT (cu yd)	Init. Veg.Mgmt. Chl Width (ft) Length (ft) Area (acres)	Chl Bank Side	Height> Toedown>	SHOTCRETE 6.5 4	GABIONS Soil-Covered (SCG) 8 4.3	8 6	10 4	10 5	10 6	11 4	11 4.3	11 5	11 6	Soil Cov Gab Dike 8 4.3	11 4.3	Uncovered (UCG) 9 6.4	11 6	Comments
2B Sta 78+00 to 124+73	*(39.6)* 99.4	0	59.8		Lt					3694	423				400						Subtract 113' on both banks for bridge at Bell Road (10' high, 4' toedown SCG)
					Rt					3694	423				400						
3 Sta 124+73 to 164+88	134.1	0	34.7		Lt								3072		322						No initial vegetation management required in this area
					Rt								3072		322						
4A Sta 164+88 to 171+20	134.1	0	0.0		Lt											632					
					Rt																
		FILL	CUT	(acres)			(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	
Cumulative Totals *(K.Cu.Yd.)		0.0	94.5	0.00			0	0	0	7,388	846	0	6,144	0	1,444	632	0	0	0	0	
						Sideslope (h:1)>	2	3	3	3	3	3	3	3	3	3	3	3	2	1.5	
						Thickness	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Bank Lining Volumes																					
						Subtotal (Cu Yd)	0	0	0	18,171	2,229	0	16,191	0	4,059	1,888	0	0	0	0	
						Total Area of Shotcrete	0	(Square Yards)												Total Volume of Gabion Lining Material	42,538	Cubic Yards
Overexcavation for Toedown and Lining																					
						Subtotal (Cu Yd)	0	0	0	26,927	3,796	0	23,473	0	6,733	3,573	0	0	0	0	
																				Total Overexcavation Volume for All Linings	64,502	Cubic Yards
Soil Overlay Volume																					
						Subtotal (Cu Yd)	NA	0	0	4,326	495	0	3,958	0	930	407	0	0	0	0	
																				Total Soil Overlay Volume on Gabions	10,117	Cubic Yards

Cumulative Earthwork is taken from HEC-2 intermediate output and is shown in thousands of cubic yards.
Earthwork includes excavation of channel and backfill required up to the elevation of the lowest channel bank.

Bank Lining Vol= Length*Thickness*[(Toedown+Height)*(1+Sideslope^2)^0.5]/27
Toedown Overexcav = (Length*Toedown^2*(1+Sideslope)/(2*27))+Bank Lining Vol
Lining Thickness = Gabion (1.5'), Shotcrete (0.5)
Soil Overlay= Length*Soil Thickness*[Height*(1+Sideslope^2)^0.5]/27

* The Total Volumes (outlined and shaded) are used in "Construction Materials Quantity & Cost Estimate" spreadsheet.

By: DES
Ckd: BDO

SKUNK CREEK
BANK LINING AND EARTHWORK QUANTITIES
PROJECT 3
ALTERNATIVE EIGHT

REACH NUMBER	HEC-2 Cumul. Earthwk (k cu yd)	Incremental Earthwork FILL (cu yd)	Incremental Earthwork CUT (cu yd)	Init. Veg.Mgmt. Chl Width (ft) / Length (ft) / Area (acres)	Chl Bank Side	Height> / Toedown>	SHOTCRETE 6.5 / 4	GABIONS Soil-Covered (SCG) 8 / 4.3	8 / 6	10 / 4	10 / 5	10 / 6	11 / 4	11 / 4.3	11 / 5	11 / 6	Soil Cov Gab Dike 8 / 4.3	11 / 4.3	Uncovered (UCG) 9 / 6.4	11 / 6	Comments
4B Sta 171+20 to 197+53	*(134.1)* 134.8	0	0.7	*150* *2312* 7.96	Lt Rt															200 444	Vegetation Management Only; Unlined gabions used at optional ramps
5 Sta 197+53 to 224+78	161.9	0	27.1		Lt Rt				908 778			320 320	 1205			248					130' added to left bank to account for 55th Ave Drainage Channel lining
6A Sta 224+78 to 241+03	198.7	0	36.8		Lt Rt									1625 1490							Break at 54th Ave
6B Sta 241+03 to 249+75	162.5	(4.1)	0.0		Lt Rt												239	633			Dike on Lt bank (32,100 cu.yd.subtracted from FILL to account for low area behind dike.)
6C Sta 249+75 to 253+09	152.6	9.9	0.0		Lt Rt			334													
		FILL	CUT	(acres)			(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	
Cumulative Totals *(K.Cu.Yd.)		14.0	64.6	7.96			0	334	1,686	0	0	640	1,205	3,115	0	248	239	633	0	644	
						Sideslope (h:1)>	2	3	3	3	3	3	3	3	3	3	3	3	2	1.5	
						Thickness	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Bank Lining Volumes																					
						Subtotal (Cu Yd)	0	722	4,147	0	0	1,799	3,175	8,373	0	741	516	1,701	0	1,096	
						Total Area of Shotcrete	0	(Square Yards)											Total Volume of Gabion Lining Material	22,271	Cubic Yards
Overexcavation for Toedown and Lining																					
						Subtotal (Cu Yd)	0	1,179	8,643	0	0	3,506	4,604	12,639	0	1,402	0	0	0	2,170	
																			Total Overexcavation Volume for All Linings	34,142	Cubic Yards
Soil Overlay Volume																					
						Subtotal (Cu Yd)	NA	156	790	0	0	375	776	2,007	0	160	112	408	0	0	
																			Total Soil Overlay Volume on Gabions	4,783	Cubic Yards

Cumulative Earthwork is taken from HEC-2 intermediate output and is shown in thousands of cubic yards.
Earthwork includes excavation of channel and backfill required up to the elevation of the lowest channel bank.

Bank Lining Vol= Length*Thickness*[(Toedown+Height)*(1+Sideslope^2)^0.5]/27
Toedown Overexcav = (Length*Toedown^2*(1+Sideslope)/(2*27)]+Bank Lining Vol
Lining Thickness = Gabion (1.5'), Shotcrete (0.5)
Soil Overlay= Length*Soil Thickness*[Height*(1+Sideslope^2)^0.5]/27 (DOES NOT INCLUDE "SOIL OVERLAY WEDGE" FOR EXISITING GABIONS)

* The Total Volumes (outlined and shaded) are used in "Construction Materials Quantity & Cost Estimate" spreadsheet.

By: DES
Ckd: BDO

SKUNK CREEK
BANK LINING AND EARTHWORK QUANTITIES
PROJECT 4
ALTERNATIVE EIGHT

REACH NUMBER	HEC-2 Cumul. Earthwk (k cu yd)	Incremental Earthwork FILL (cu yd)	Incremental Earthwork CUT (cu yd)	Init. Veg.Mgmt. Chl Width (ft) / Length (ft) / Area (acres)	Chl Bank Side	Height> / Toedown>	SHOTCRETE	GABIONS: Soil-Covered (SCG)										GABIONS: Soil Cov Gab Dike		GABIONS: Uncovered (UCG)		Comments
						Height>	6.5	8	8	10	10	10	11	11	11	11	8	11	9	11	
						Toedown>	4	4.3	6	4	5	6	4	4.3	5	6	4.3	4.3	6.4	6	
	(152.6)				Lt														485		
7 Sta 253+09 to 270+22	148.4	4.2	0.0		Rt														139		No initial vegetation management required in this area
				240	Lt																
8 Sta 270+22 to 288+37	148.4	0	0.0	*1815* 10.00	Rt																Vegetation Management Only No earthwork
				80	Lt																
9 Sta 288+37 to 296+40	148.4	0	0.0	*711* 1.31	Rt																Vegetation Management Only No earthwork
				60	Lt		758														
10 Sta 296+40 to 316+87	147.5	0.9	0.0	*1295* 1.78	Rt		721														
				60	Lt																
11 Sta 316+87 to 336+99	147.5	0	0.0	*302* 0.42	Rt																Vegetation Management Only No earthwork
		FILL	CUT	(acres)			(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	(Lin.Ft)	
Cumulative Totals *(K.Cu.Yd.)		5.1	0.0	13.51			1,479	0	0	0	0	0	0	0	0	0	0	0	624	0	
						Sideslope (h:1)>	2	3	3	3	3	3	3	3	3	3	3	3	2	1.5	
						Thickness	0.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
Bank Lining Volumes																					
						Subtotal (Cu Yd)		0	0	0	0	0	0	0	0	0	0	0	1,194	0	
						Total Area of Shotcrete	3,858	(Square Yards)											Total Volume of Gabion Lining Material	1,194	Cubic Yards
Overexcavation for Toedown and Lining																					
						Subtotal (Cu Yd)	5,173	0	0	0	0	0	0	0	0	0	0	0	2,614	0	
																			Total Overexcavation Volume for All Linings	7,787	Cubic Yards
Soil Overlay Volume																					
						Subtotal (Cu Yd)	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	
																			Total Soil Overlay Volume on Gabions	0	Cubic Yards

Cumulative Earthwork is taken from HEC-2 intermediate output and is shown in thousands of cubic yards.
Earthwork includes excavation of channel and backfill required up to the elevation of the lowest channel bank.

Bank Lining Vol= Length*Thickness*[(Toedown+Height)*(1+Sideslope^2)^0.5]/27
Bank Lining Area= Length*[(Toedown+Height)*(1+Sideslope^2)^0.5]/9
Toedown Overexcav = [Length*Toedown^2*(1+Sideslope)/(2*27)]+Bank Lining Vol
Lining Thickness = Gabion (1.5'), Shotcrete (0.5)
Soil Overlay= Length*Soil Thickness*[Height*(1+Sideslope^2)^0.5]/27

* The Total Volumes (outlined and shaded) are used in "Construction Materials Quantity & Cost Estimate" spreadsheet.

By: DES
Ckd: BDO

SKUNK CREEK

EXISTING STORM DRAIN SUMMARY WORKSHEET

(Including Pipe Extensions and New Pipe)

NEAR MAJOR CROSS STREET	SKUNK CREEK STATION	BASELINE OFFSET DIST (feet)	Lt/Rt	INVERT ELEV (feet)	SURVEY POINT NUMBER	END TREATMENT	CMP Diam (in)		RCP Diam (in)							PVC Diam (in)			Replace Riprap (sq ft)	Comments
							18	24	15	18	24	30	36	78	96	8	12	15		
75TH AVENUE	63+74	27	right		(10)	Projecting				0									0	NA
75TH AVENUE	64+16	21	left		(10)	Wingwalls								0					0	NA
75TH AVENUE	69+78	34	right	1199.82	533	Projecting					0								0	Remove 20'
75TH AVENUE	73+62	40	left	1201.89	426	Projecting	0												100	Remove 23'
75TH AVENUE	78+50	80	left	1207.76	425	Projecting											16		36	Extend
BELL ROAD	88+37	90	right	1210	(1)	Projecting							33						100	Extend
71ST AVENUE	96+05	117	left	1211															0	NA
66TH LANE	130+70	77	left	1229.56	370	Grouted Riprap	27												100	Extend
66TH LANE	131+41	62	right	1232.90	369	Projecting												14	100	Extend
GROVERS RD	136+88	35	left	1227.58	361 & 54	Grouted Riprap	15												100	Extend
GROVERS RD	138+32	80	right	1235.69	360	Projecting											0		36	Remove 15'
ST. JOHN RD	142+43	80	right	1231.00		Grouted Riprap							50						100	Extend
JOHN CABOT RD	145+50	40	left	1233.76	352 & 53	Grouted Riprap		20											100	Extend
BLUEFIELD RD	160+54	39	left	1238	(2)	Grouted Riprap				19									100	Extend
63RD DRIVE	163+32	39	left	1238	(2)	Grouted Riprap					18								100	Extend
59TH AVENUE	195+51	85	right	1262	(3)	Gabions				0									0	NA
59TH AVENUE	197+70	112	left	1264.47	307	Gabions				0									0	NA
59TH AVENUE	198+15	130	right	1262.69	301	Projecting		35											100	Extend
57TH AVENUE	210+00	44	left	1259.58	284	Wingwalls					0								0	NA
56TH AVENUE	217+34	164	right	1265	(4)	Conc Apron									0				0	NA

7/14/95 10:20 AM
SKCST_A8.XLS Exist Stm Drn Summary Worksht

SKUNK CREEK

EXISTING STORM DRAIN SUMMARY WORKSHEET

(Including Pipe Extensions and New Pipe)

NEAR MAJOR CROSS STREET	SKUNK CREEK STATION	BASELINE OFFSET DIST (feet)	Lt/Rt	INVERT ELEV (feet)	SURVEY POINT NUMBER	END TREATMENT	CMP Diam (in)		RCP Diam (in)							PVC Diam (in)			Replace Riprap (sq ft)	Comments
							18	24	15	18	24	30	36	78	96	8	12	15		
55TH AVENUE	222+41	CL EQTN (5)		1271.75	265	Grouted Riprap													0	NA
52ND AVENUE	242+56	55	left	1274.0	NEW	New Flap Gate					80								0	NA
52ND AVENUE	244+77	69	right		(6)	Gabions													0	NA
51ST AVENUE	255+41	76	right	1284.40	207	Projecting						0							100	NA
51ST AVENUE	255+61	44	left	1284.73	208	Projecting						0							100	NA
50TH AVENUE	260+25	143	left		(7)	Conc. Spillway													420	Replace
						Riprap Apron										42				Extend
49TH DRIVE	264+54	80	left	1292.70	(7)	Gabions				0									0	NA
49TH AVENUE	265+57	118	right		(7)	Gabions										0			0	NA
48TH LANE	268+25	129	left		(7)	Gabions										0			0	NA
47TH DRIVE	284+81	130	right	1301.66	534-37	Conc Apron													0	NA
BEARDSLEY RD	321+70	25	right		(8)	in CBC Barrel							0						0	NA
BEARDSLEY RD	321+84	27	right	1319.90	(8)	in CBC Wingwall							0						0	NA
							(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(LF)	(Cu Yd)	
						TOTAL:	42	55	0	19	98	0	83	0	0	42	16	14	125	

NOTES:

(1) Bell Road Bridge Plans
(2) Arrowhead Valley Unit III Subdivision Grading and Drainage Plans
(3) 59th Avenue Bridge Plans
(4) FCDMC Topographic Map
(5) Centerline Equation 222+41.41 (Skunk Cr.) = 0+00 (55th Ave Drain)
(6) Chelsea Village Subdivision Grading & Drainage Plans
(7) Crystal Creek Subdivision Grading Plans
(8) Outer Loop Highway Plans at Beardsley Road + Pictures
(9) Left/Right Bank References Made Looking Upstream

By: DES
Ckd: BDO

SKUNK CREEK
Project No. 013255

Utility Quantity & Cost Estimate - Alternative 8

Station	Item Description	Size	Unit Cost ($)	Quantity	Project Number	Estimated Amount
	Arizona Public Service					
224+07 ±	Relocate Steel Power Pole Foundation	69 kV	$14,000	1	3	14,000
					Subtotal	14,000
	US West					
90+10 ±	Relocate UG Telephone Cable		$15	300	2	4,500
232+13 ±	Relocate UG Telephone Cable		$15	300	3	4,500
					Subtotal	9,000
	Southwest Gas					
89+90 ±	Relocate Gas Line		$20	300	2	6,000
					Subtotal	6,000
	MCI Communications Corp.					
	No Relocations			0		0
					Subtotal	0
	City of Glendale, Water Department					
88+30 ±	Relocate Water Line	12"	$40	300	2	12,000
89+80 ±	Relocate Water Line	6"	$20	300	2	6,000
108+58 ±	Relocate Water Line	6"	$20	300	2	6,000
214+45 ±	Relocate Water Line	8"	$30	300	3	9,000
232+19 ±	Relocate Water Line	6"	$20	300	3	6,000
					Subtotal	39,000
	City of Glendale, Wastewater Department					
90+40 ±	Replace San Swr w/ Coated	12" DIP	$45	300	2	13,500
						13,500
					Total	$81,500

SVERDRUP

JOB 013255 Skunk Creek SHEET NO. 1 OF 2

COMPUTATIONS FOR Drop Structures DATE 7/6/95

BY BDO CHKD DES

Design Vertical Drop w/ Riprap Basin for Drop Structure @ 253+09 (Use procedure outlined pgs 6-33 to 3[illegible] Drainage Design Manual for Maricopa [illegible]

Δ Elev. 1283.0 − 1280.7 = 2.3′ = Z

Note: See design example pgs 6-71 to 6-73

bed width is B_o = 120 ft
side slopes are = 3 : 1
design discharge = 2,268 cfs (Q10)
the depth of flow is = 2.2′
average velocity is = 8.2 fps (HEC-2 Output)

$$E_o = y_o + V_o^2/2g = 2.2 + 8.2^2/2(32.2)$$

$$= 2.2 + 1.04 = 3.2'$$

The head on the weir required to pass the design flow is a follows:

$$H = [Q/(5.67\,B)]^{0.67}$$

$$H = [2,268/(5.67 \times 120)]^{0.67} = 2.24' \text{ Use } 2.2'$$

The height of the weir crest is

$$P = E_o - H$$

$$P = 3.2' - 2.2' = 1.0'$$

y_2 = 4.4′ (HEC-2 Output)

SVERDRUP

JOB 013255 Skunk Creek SHEET NO. 2 OF 2

COMPUTATIONS FOR Drop Structure DATE 7/6/95

BY BDO CHKD DES

Check for Q100 Storm Flows

Q = 8,400 cfs @ Drop Structure Sta 253+09

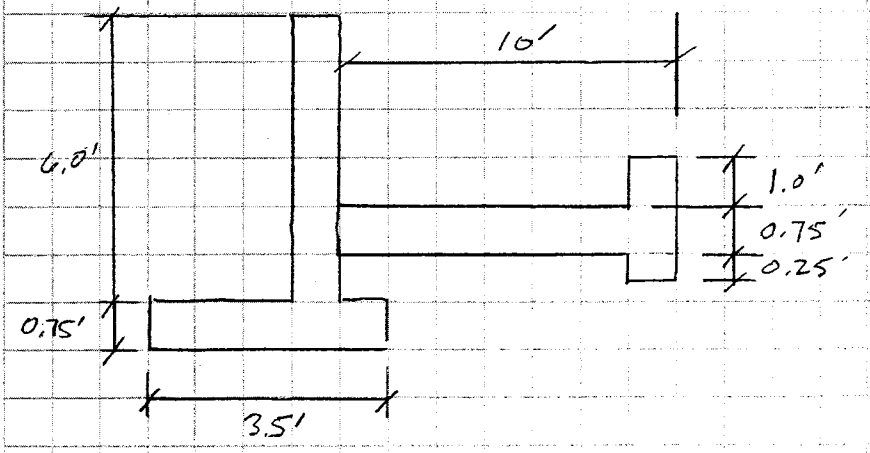
$H = [Q / (5.67\ B)]^{0.67}$

$H = [8,400 / (5.67 \times 120)]^{0.67} = 5.39$ ft, use 5.4'

$Y_2 = 8.9$ ft $Y_{upstream} = 6.5$ ft.

Note: Drop Structure is submerged at 100-year Peak Flow

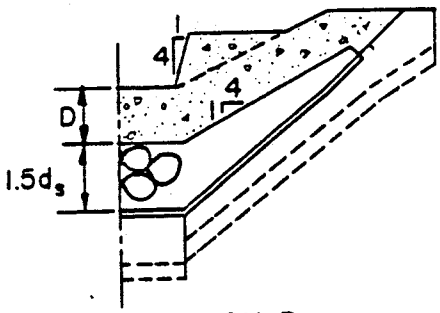
Assume: Drop Structure is designed with hard bottom in lieu of riprap basin.



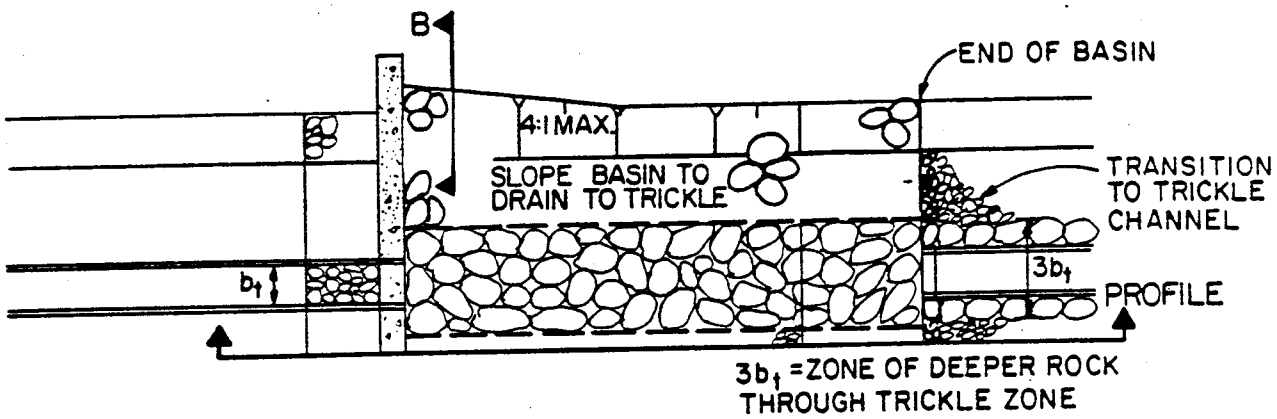
Area = 15.6 SF

Assume: Cut off Wall use above structure mining hard pan

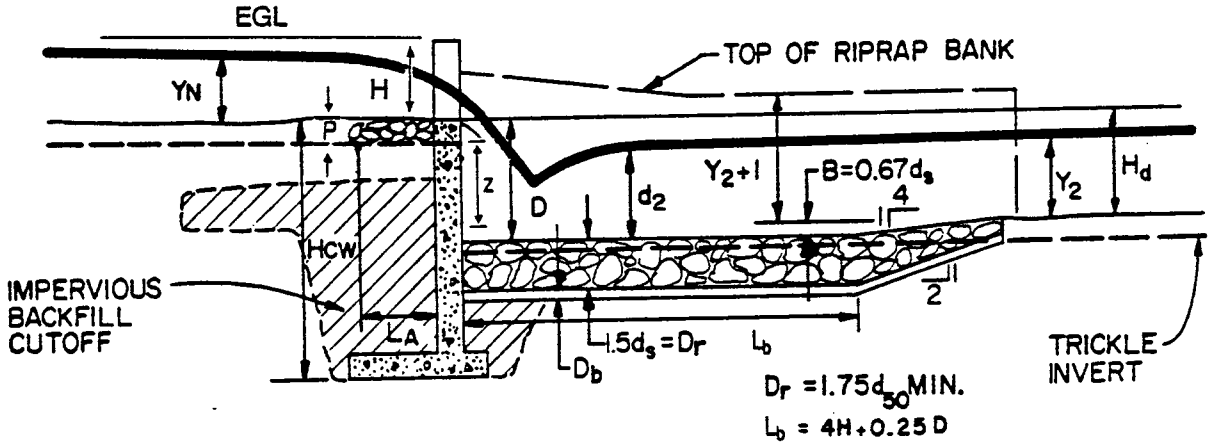
Area = 7.125 SF



SECTION B

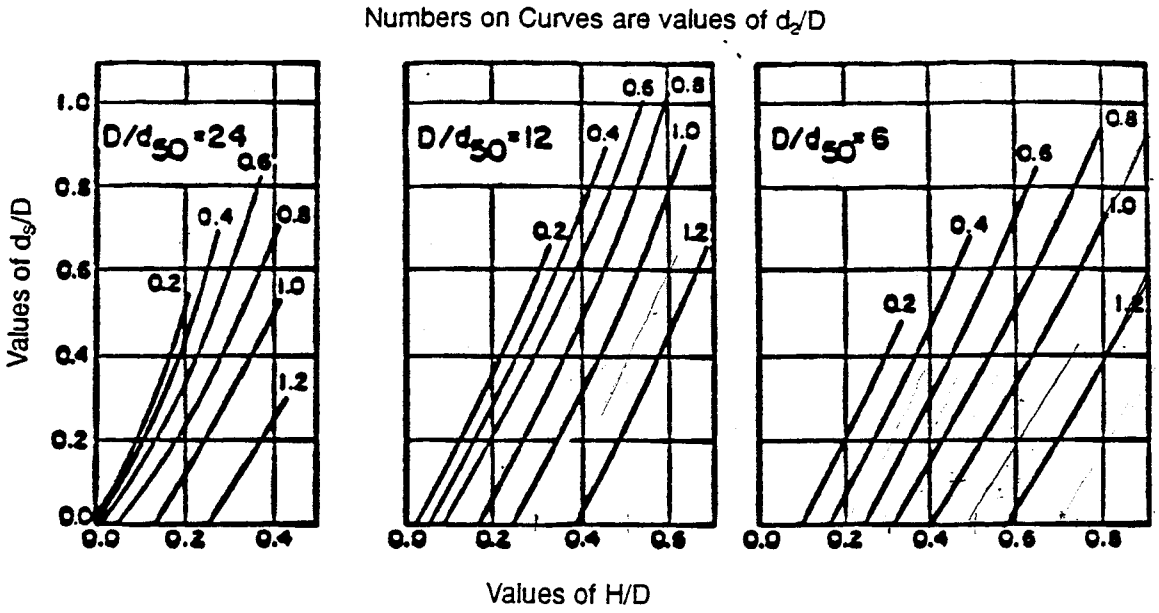


PARTIAL PLAN



PROFILE

Figure 6.12
Vertical Riprap Basin Drop
(Stevens 1981)



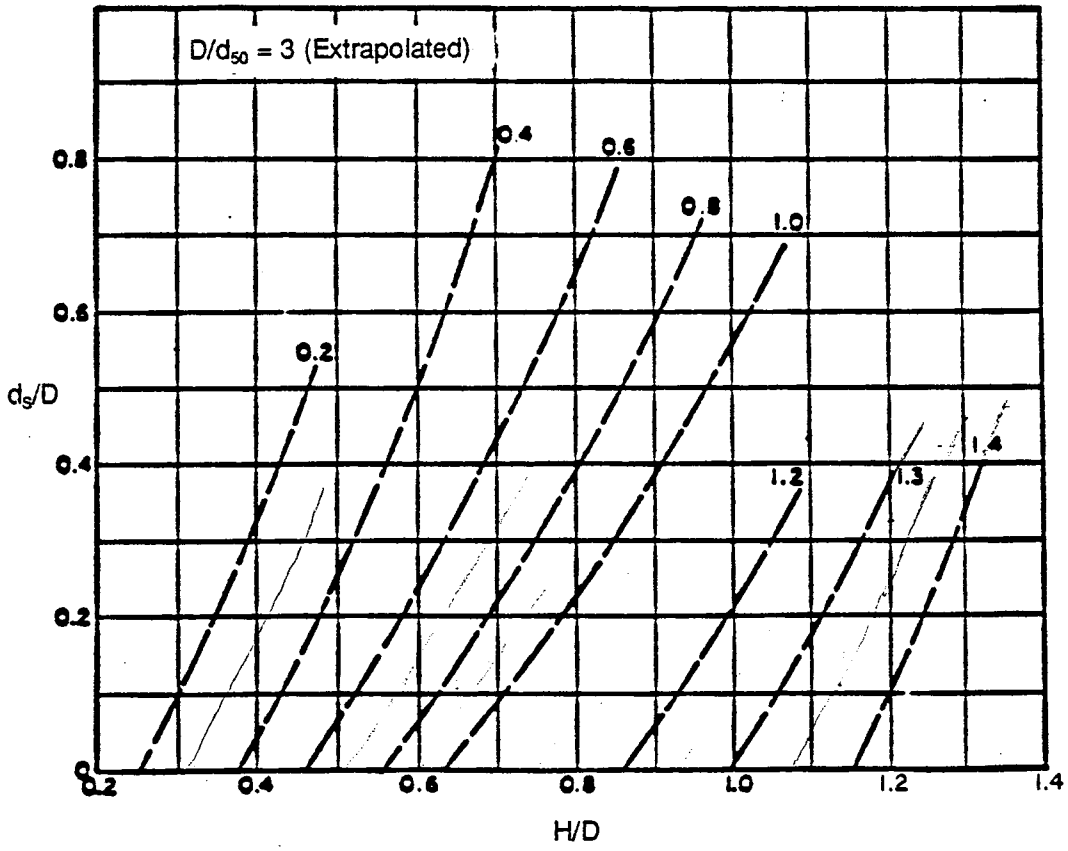


Figure 6.13
Curves for Scour Depth at Vertical Drop
(Stevens 1981)

SKUNK CREEK MASTER DRAINAGE PLAN

Open Channel Drop Structure Design
Vertical Drop with Riprap Basin
Ten - Year Storm

Z = 2.3 feet
H = 2.2 feet
y2 = 4.4 feet

	D (ft)	d50 (ft)	H/D	Trial d2 (ft)	d2/D	ds/D	ds (ft)	0.67 ds (ft)	Resulting d2 (ft)	
D/d50 = 12	6.0	0.5	0.37	4.0	0.67	0.52	3.12	2.09	6.49	NG
				5.0	0.83	0.39	2.34	1.57	5.97	NG
				5.2	0.87	0.35	2.10	1.41	5.81	OK
		Z = 2.3	4.1	NG						
D/d50 = 12	5.0	0.4	0.44	5.0	1.00	0.4	2.00	1.34	5.74	NG
				5.1	1.02	0.38	1.90	1.27	5.67	OK
		Z = 2.3	3.3	NG						
D/d50 = 12	4.5	0.4	0.49	5.0	1.11	0.39	1.76	1.18	5.58	OK
				5.1	1.13	0.34	1.53	1.03	5.43	NG
		Z = 2.3	2.9	NG						
D/d50 = 12	4.0	0.3	0.55	4.5	1.13	0.46	1.84	1.23	5.63	NG
				4.8	1.20	0.35	1.40	0.94	5.34	OK
		Z = 2.3	2.4	OK						

Lb = 4H + 0.25 D
Lb = 9.9 feet, Use 10 feet

SKUNK CREEK

GRADE CONTROL STRUCTURE QUANTITY WORKSHEET

PRICE OF EXAMPLE CONCRETE STRUCTURE (ADOT Conc. Box Culv)	$1,725,750
PRICE OF EXAMPLE STEEL REINFORCEMENT	$483,750
Cubic Yards of Structural Concrete	7670
DERIVED UNIT COST PER CUBIC YARD OF CONCRETE (including concrete, and steel)	$288.07
COST USED PER CUBIC YARD (including any unusual forming, riprap, modify existing gabions)	**$375.00**

DROP STRUCTURES

STA	LENGTH	AREA/L.F. (sq ft/L.F.)	Drop Str Volume (cu yd)	Wingwall Volume (cu yd)	Subtotal Conc Vol (cu yd)	Total Conc Vol (cu yd)	Quantity Used for Cost Est
8623	130	15.6	75.1	40	115.1	115.1	115
3+00	80	15.6	46.2	40	86.2	Arrowhead Drain	
231+76	170	15.6	98.2	0	98.2		
247+36	120	15.6	69.3	40	109.3		
249+75	120	15.6	69.3	40	109.3		
253+08	120	15.6	69.3	40	109.3	512.4	510
				TOTAL	627.6	(cu yd)	

CUTOFF WALLS

STA	LENGTH	AREA/L.F. (sq ft/L.F.)	Subtotal Conc Vol (cu yd)		
10816	145	7.125	38.3		
12270	130	7.125	34.3		
13094	100	7.125	26.4		
16488	120	7.125	31.7	130.6	130
19753	200	7.125	52.8		
20958	200	7.125	52.8		
22478	100	7.125	26.4	131.9	130
26600	200	7.125	52.8		
26950	200	7.125	52.8	105.6	105
		TOTAL	368.1	(cu yd)	365

TOTAL CONCRETE VOLUME (cu yd)	**995.7**	**(cu yd)**	**990**
TOTAL STRUCTURES COST		$373,380	**$370,000**

Appendix C

CHANNEL BED DATA

APPENDIX C

CHANNEL BED DATA

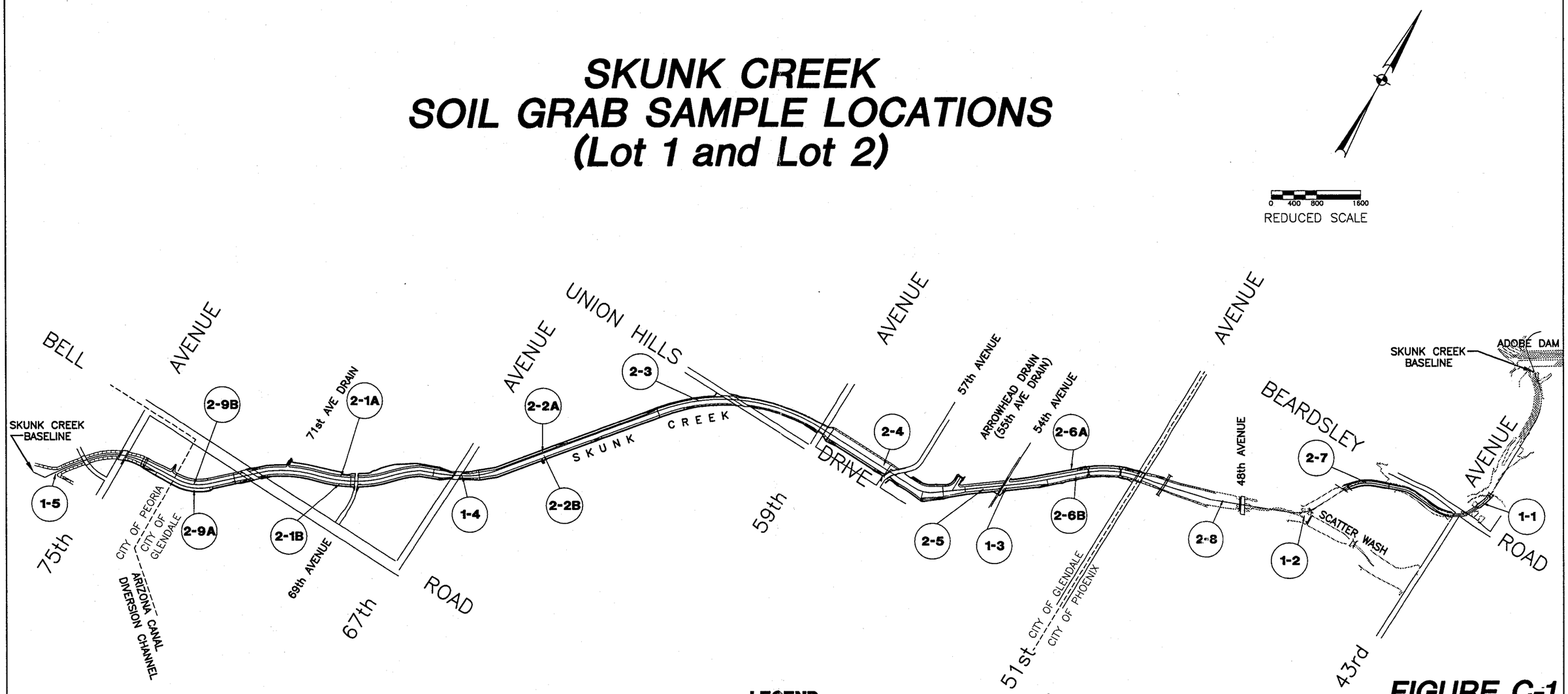
Bed-material data used for this study were taken from 14 bed samples located in the proposed channel. The bed samples were taken at approximately 1/2 mile increments. In addition, soil samples were taken from existing channel banks at four locations. The bank samples were for comparison information purposes only. Laboratory analysis of the samples consisted of mechanical sieve analysis and are included in this appendix. See Figure C-1 for the sample locations.

The bed-material samples were divided into three groups based upon the design flows. The first group contains samples from reaches 1-5 where the 100-year design flow is 11,000 cfs. The second group contains samples from reaches 6-8 where the 100-year design flow is 8,400 cfs. The third group contains samples from reaches 9-11 where the 100-year design flow varies from 2,600 to 1,730 cfs. Based on a review of the gradation curves for these samples, the following D_{15}, D_{50}, and D_{84} were selected for the listed reaches. Gradation Coefficients were calculated from the soil data and are shown below. See this Appendix for Gradation Coefficient calculations.

Reach	D_{15}	D_{50}	D_{84}	G
1 - 5	0.6 mm	6.0 mm	25.0 mm	7.08
6 - 8	0.7 mm	4.0 mm	23.0 mm	5.73
9 - 11	0.6 mm	4.0 mm	18.0 mm	5.58

These values, which are typical of sand-bed channels, were used for both the sediment supply calculations and the sediment transport rates through the proposed channel improvements.

SKUNK CREEK
SOIL GRAB SAMPLE LOCATIONS
(Lot 1 and Lot 2)



NOTES

1) Only bottom samples were used in the Sediment Transport Analysis.
2) Bank samples were taken at 2–1A, 2–2A, 2–6A and 2–9A.
3) "Lot 1" samples were taken 8–94 and sieve analysis was performed 9–94.
4) "Lot 2" samples were taken 1–95 and sieve analysis was performed 1–95.

LEGEND

- 1-1 LOT 1, BOTTOM SAMPLE
- 2-1A LOT 2, BANK SAMPLE
- 2-1B LOT 2, BOTTOM SAMPLE
- 2-3 LOT 2, BOTTOM SAMPLE
- EXISTING CHANNEL IMPROVEMENTS
- RECOMMENDED CHANNEL IMPROVEMENTS
- --- CITY CORPORATE BOUNDARY
- STREET R/W

FIGURE C-1

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

SKUNK CREEK MASTER PLAN
ACDC TO ADOBE DAM
CONTRACT FCD 93–24

PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	D. STOUGH	3/95
DRAWN	D. STOUGH	3/95
CHECKED	B. OLBERT	4/95

Sverdrup CORPORATION

SOIL GRAB SAMPLE LOCATIONS

File name: N:\013255\DWG\C\SKSOILS.DWG Plot Date: 04/21/95 @ 1:30 Plot Scale: fit