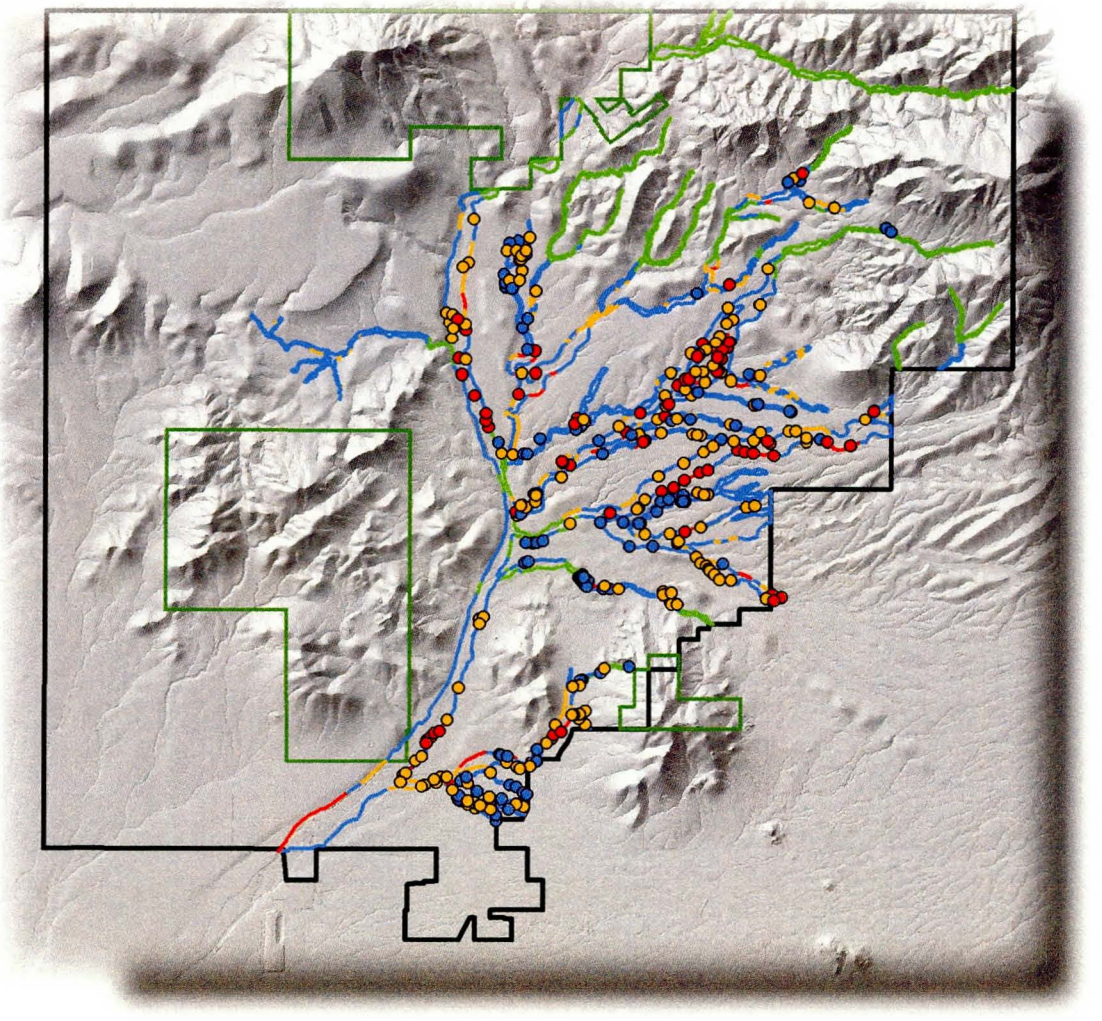
Cave Creek Drainage Master Plan



Geomorphic and Sedimentation Engineering Report

JE FULLER
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Cave Creek Drainage Master Plan

Geomorphic and Sedimentation Engineering Report

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SECTION 1 INTRODUCTION

1.1 Purpose and Objectives

The Cave Creek Drainage Master Plan (CCDMP) is a multidisciplinary project led by HDR Inc. and implemented by the Flood Control District of Maricopa County (District) on behalf of the Town of Cave Creek (TOCC). The purpose of the CCDMP is to identify and quantify existing flooding hazards for selected drainages within the study area to aid in the development of a regulatory drainage and watershed implementation plan for use by local floodplain managers. An important component of the CCDMP is an evaluation of erosion and sedimentation processes within the study area. JE Fuller/Hydrology & Geomorphology, Inc. (JEF) was tasked to perform the geomorphic and sedimentation evaluation.

The primary objectives of the geomorphic and sedimentation engineering analyses for the CCDMP are to provide:

- qualitative analyses to:
  (1) identify washes that convey significant flow and which should be left undisturbed in the watershed and
  (2) delineate erosion hazard zones.

- quantitative analyses to:
  (1) check the bank stability for erosion potential, and
  (2) estimate the equilibrium slope for the major washes identified in geomorphic evaluation.

The identification of major washes was conducted and presented in a separate report by JEF in September 2006 (JEF, 2006). Elements of that report germane to the current report are repeated as necessary.

1.2 Study Area

Figure 1 shows the location of the study area. Figure 2 shows the study area boundary and the washes within the area. The study area is largely similar to the present Town of Cave Creek municipal limits generalized along the western and northern limits to form a simple rectangular area bounded on the north by the Tonto National Forest and the 24th Street alignment on the west. The southern and eastern boundaries coincide with the Town limits.

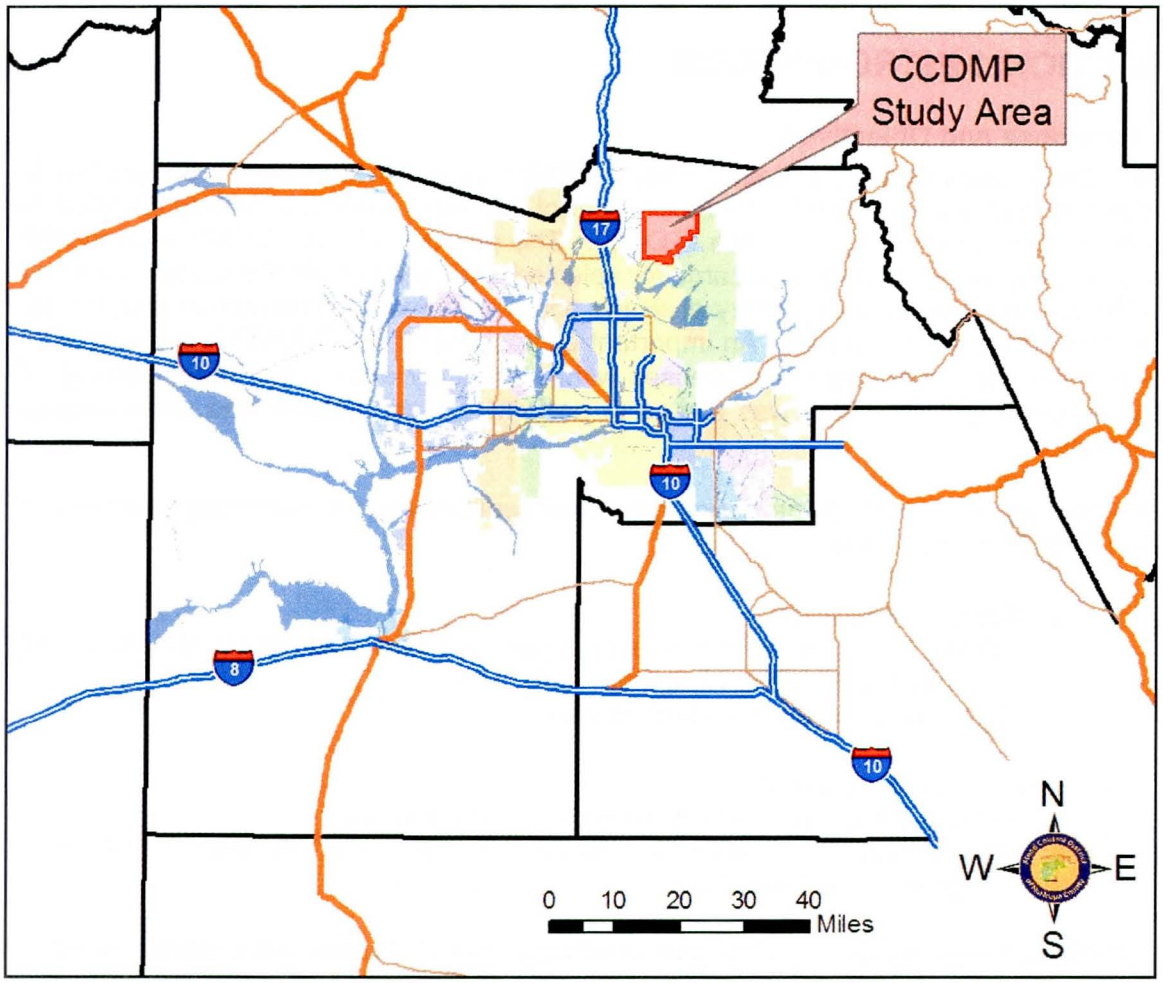

Figure 1 Study Area Location

The western portions of the study area draining to Skunk Creek and Apache Wash were previously investigated as part of the Adobe Dam/Desert Hills Area Drainage Master Plan (ADMP) (JEF, 2004). The results of that study are incorporated into the current CCDMP. In particular, the geomorphic evaluation and erosion hazard delineations performed in the Adobe ADMP are included in this report and identified as such where they are shown.

Figure 2 shows the delineated floodplains, major washes, and other drainages in the study area as identified in the Major Wash Identification report (JEF, 2006). The current evaluations focused on Cave Creek and its tributaries in both the eastern and western portions of the area. In particular, detailed field investigations and erosion hazard delineations were performed for 61 miles of existing and proposed delineated regulatory floodplain reaches and 6 miles of additional washes as discussed in SECTION 4.

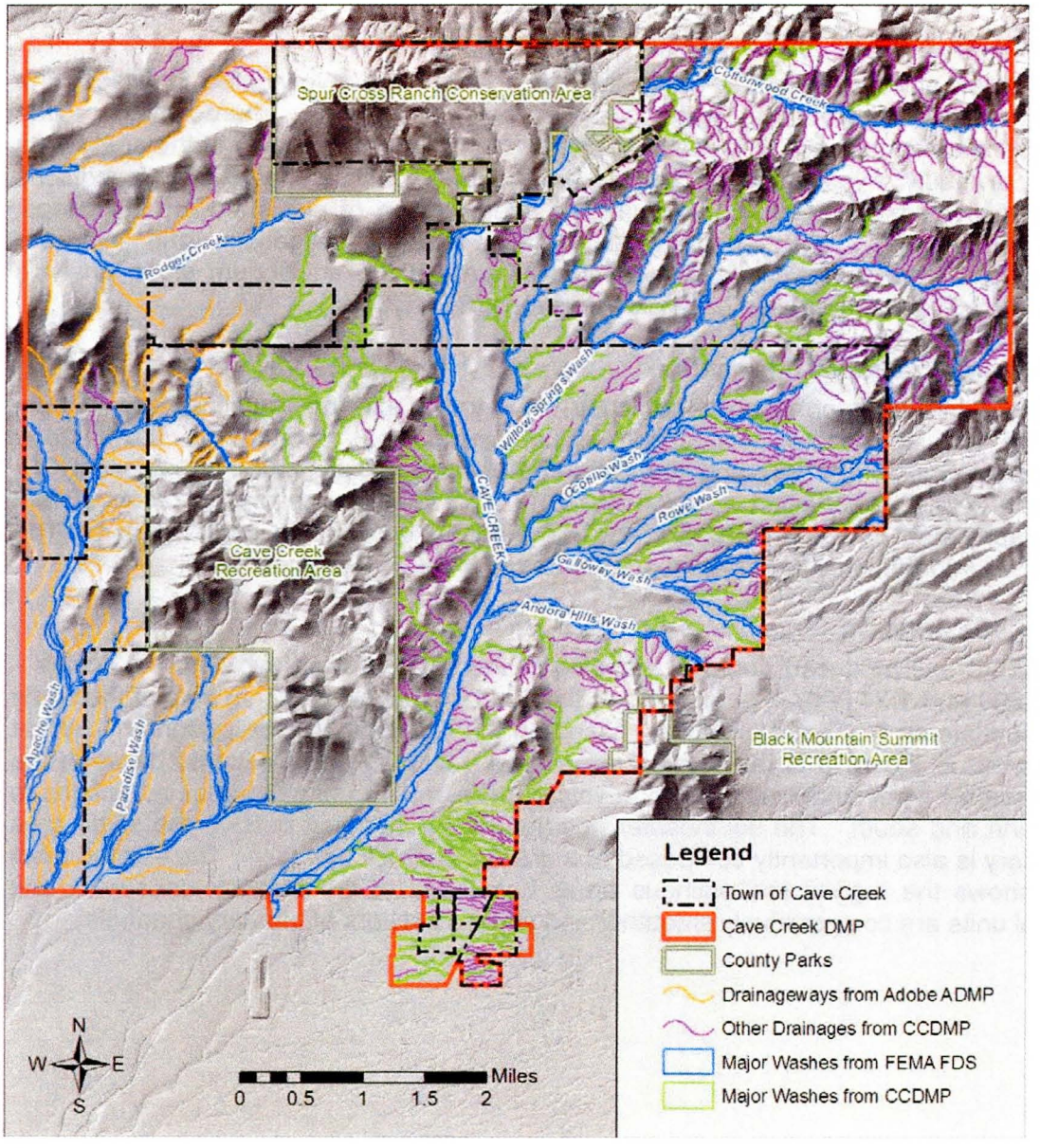

Figure 2 Streams in CCDMP Study Area (from JEF, 2006)

1.3 Report Overview

The geomorphic evaluation and sedimentation engineering report consists of the following sections:

- SECTION 1 Introduction
- SECTION 2 Existing Conditions Assessment
- SECTION 3 Equilibrium Slope Analysis
- SECTION 4 Erosion Hazard Zones
- SECTION 5 Summary and Recommendations
- SECTION 6 References

SECTION 2 EXISTING CONDITIONS ASSESSMENT

Cave Creek and its tributaries within the study area were investigated to assess the existing conditions of the watercourses, their geomorphic characteristics, and sedimentation conditions. The watercourses in the far western portion of the study area were previously investigated as part of the Adobe ADMP. The existing conditions assessment consisted of field observations, interpretation of published reports, maps, aerial photography, and topography. Detailed field investigations and hydraulic calculations were performed and evaluated as part of the equilibrium slope analysis (SECTION 3) and the erosion hazard delineations (SECTION 4).

2.1 Existing Published Information

Existing published information of particular value to the existing conditions assessment and the erosion hazard delineations include maps and reports from the Arizona Geological Survey (AZGS) and the Natural Resource Conservation Service (NRCS; formerly Soil Conservation Service (SCS)). In addition, relatively recent 2-foot topography and color orthophotography were available to aid in interpretation. The published information sources used are discussed in the following sections.

2.1.1 AZGS Mapping

The AZGS has produced geologic mapping of the study area at two different scales – 1:100,000 and 1:24,000. Figure 3 shows the 1:100,000 scale geologic map of the study area overlain on a shaded relief map based on the County's 10-foot topography. What stands out in Figure 3 is the Quaternary alluvial valley (Q and Qo units) between the metamorphic (Xmv and Xms units) and volcanic (Tb and Tv units) bedrock mountains to the north and south. The southeastern portion of the map just outside the study area boundary is also importantly composed of a granitic bedrock unit (Yg). The shaded relief map shows the rugged mountainous areas composed of the bedrock units while the alluvial units are comparatively smoother and show a network of tributary channels.

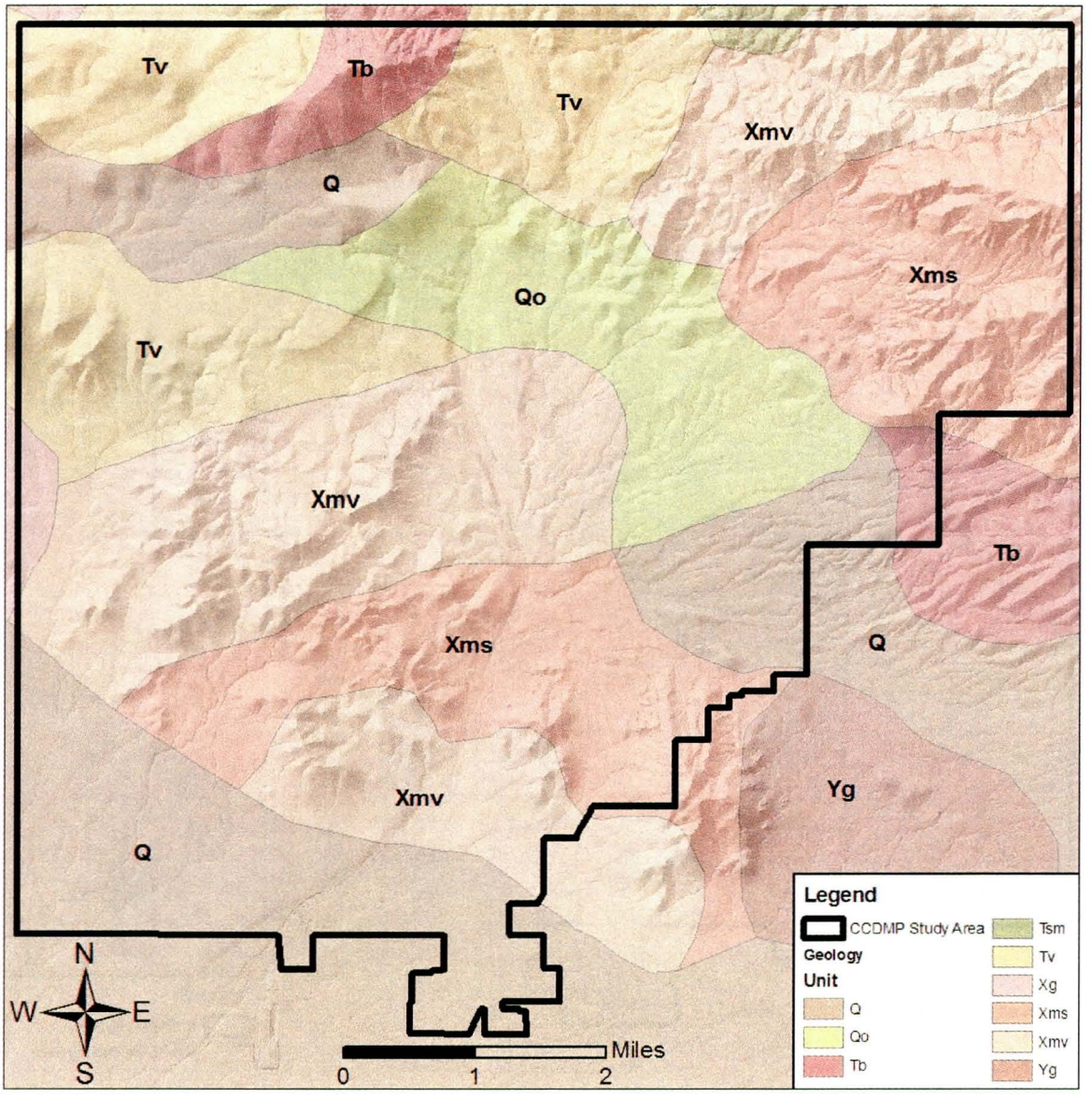

Figure 3 AZGS 100K Geology Map

The 1:24,000 series maps of the Daisy Mountain, New River SE, New River Mesa, and Cave Creek Quadrangles were scanned and semi-rectified using Geographic Information System (GIS) software tools to assist in the existing conditions assessment and erosion hazard delineations. Figure 4 shows the 24,000 series maps overlain by the 100,000 series polygons. The figure is provided to give an idea of the relative level of additional details provided by the 24,000 series maps, rather than to be interpreted at this scale. The scanned maps are provided on electronic media accompanying this report. Again, the more detailed geologic mapping shows the complex bedrock mountainous areas drained by a tributary channel network.

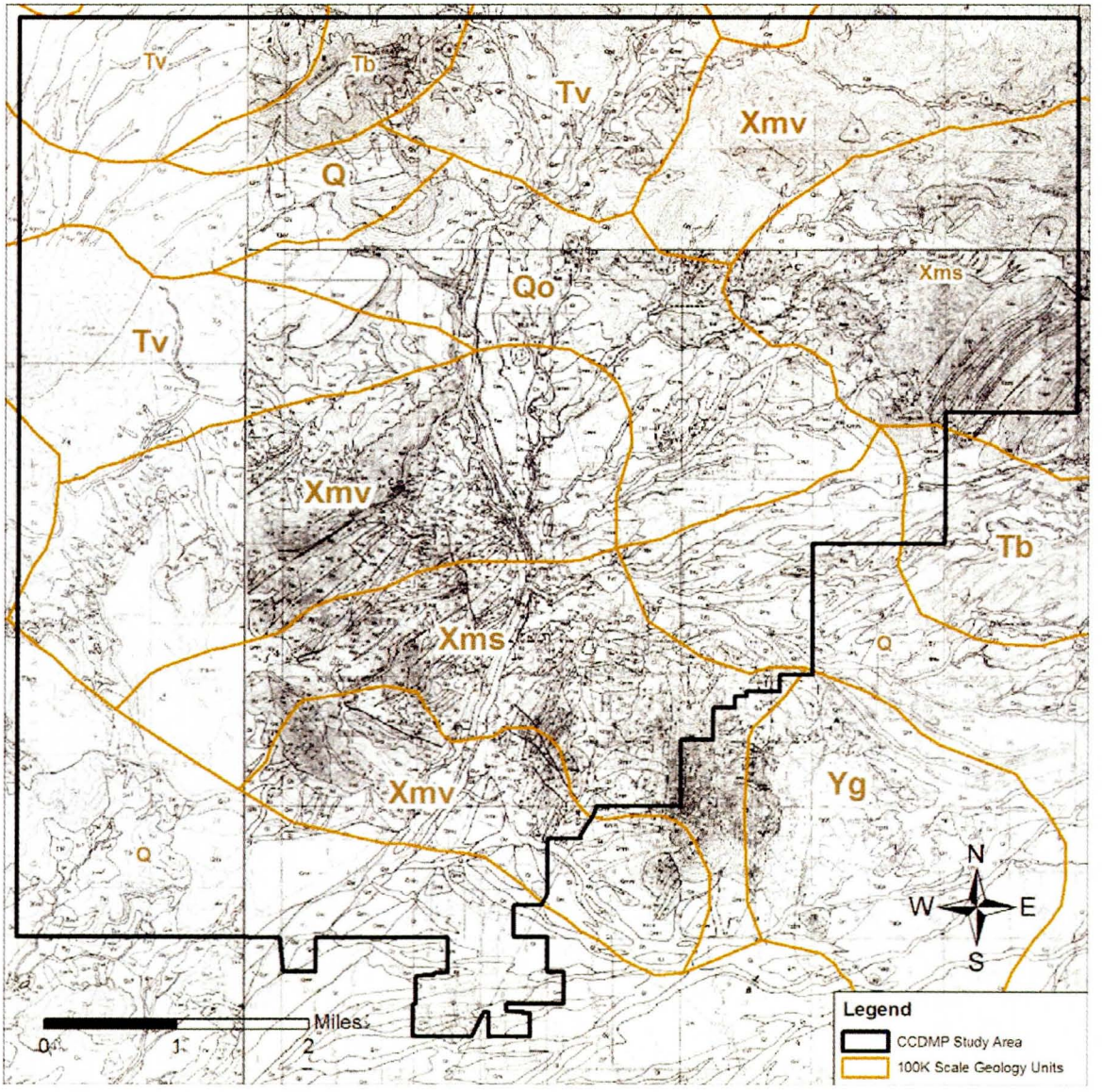

Figure 4 AZGS 24K Geology Map

The AZGS 24,000 series maps are described in the following publications:

- Leighty, R.S., S.J. Skotnicki, and P.A. Pearthree., 1997, Geologic Map of the Cave Creek Quadrangle, Maricopa County, Arizona. AZGS Open-File Report 97-1.
- Pearthree, P.A, and KA. Dempsey, 1996, Surficial Geologic Map of the southern parts of the New River Mesa and Humbolt Mountain Quadrangles, Maricopa County, Arizona. AZGS Open-File Report 96-26.
- Leighty, R.S., Compilation Geologic Map of the Daisy Mountain 7.5' Quadrangle, Maricopa County, Arizona. AZGS Open-File Report 98-22.
- Leighty, R.S., and S.D. Holloway, 1998, Geologic Map of the New River SE 7.5' Quadrangle, Maricopa County, Arizona. AZGS Open-File Report 98-21.

Geomorphic mapping identifies and classifies differences in the physical characteristics of land surfaces. The physical characteristics of a geomorphic surface provide clues as to its depositional history, stability, and flood potential. If a land surface ceases to receive new deposits (i.e., is not flooded), it will begin to age. As it ages, the surface develops distinctive physical and chemical characteristics indicative of its age. As a soil develops, its structure, color, and content change. Soils become redder with increased age due to oxidation of iron, a process called rubification. Clay and carbonate also accumulate as a soil ages, causing the soil to develop layers and internal structure (peds), and become whiter (carbonate) and more cemented (carbonate). Soils with high clay and carbonate content are generally more resistant to erosion.

In the desert soils of the Southwest, the amount of calcium carbonate ($CaCO_3$) in a soil layer can be used to estimate the period of time over which the carbonate accumulated. The degree of carbonate development is assigned a stage, with Stage I representing incipient (youngest) soil formation, and Stage VI representing maximum (oldest) accumulation of carbonate (Birkeland et al., 1991). The accumulation can be compared with other soils of known age and similar environment to estimate the soil age (Birkeland, 1984; Machette, 1985) and the age of the geomorphic surface. The degree of carbonate accumulation is measured by the reaction of the soil to the application of dilute hydrochloric acid (HCl), by the rind thickness which occurs on gravel clasts, or by the interval of maximum carbonate cementation. The gravel content of the soil must be considered when evaluating carbonate development, since carbonate accumulates more quickly in coarse alluvium than in fine alluvium. The most advanced stages of carbonate development often form very cohesive soils that may resemble bedrock in appearance and relative hardness. Advanced stages of $CaCO_3$ (often termed as caliche) can provide resistance to lateral bank erosion. Figure 5 and Figure 6 show varying $CaCO_3$ stage development within the CCDMP study area.

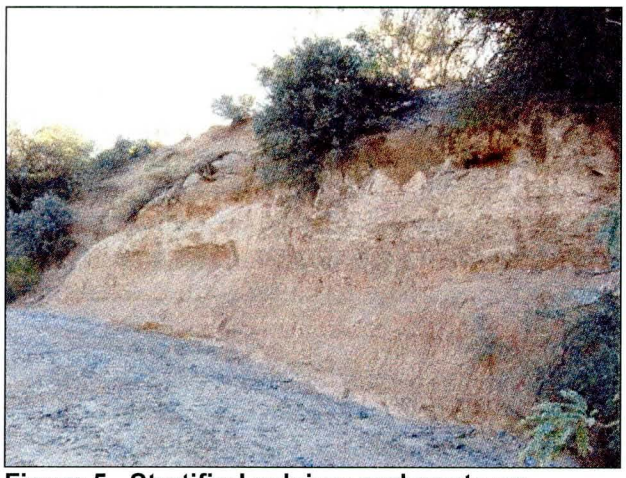

Figure 5. Stratified calcium carbonate on Galloway Wash North Tributary, (11-06-2006-908.jpg). View downstream.

Figure 6. Stage III to IV carbonate development in the bed and banks of Willow Springs Wash Tributary #2. (10-25-2006-480.jpg) View upstream.

As they age, surfaces may also develop gravel lag coverings known as desert pavement. The large clasts on the surface, if they contain sufficient ferromagnesian minerals, will develop a dark black patina called desert varnish on their top and an orange coating underneath. Surfaces free from new deposition will also begin to erode and develop new tributary channel networks, creating a greater degree of relief between the channel bottoms and the ridges which separate them.

Because many of these characteristics take thousands of years to develop, it can be concluded that surfaces that exhibit well-developed soils, red color, significant carbonate development, desert pavements composed of strongly varnished gravels, and tributary drainage networks have been relatively free from flooding and erosion for thousands of years. Therefore, without external disturbance, it can be assumed that their flood and erosion hazard potential in the future will remain low.

The AZGS 24,000 series mapping distinguishes the following geomorphic surfaces within the CCDMP study area:

- Active channel deposits (Q_{yc}). The Q_{yc} unit predominantly consists of silt, sand, gravel and cobble deposits found in active channels. Alluvium in Q_{yc} units is typically well-stratified and lacks any appreciable soil development. For the small tributaries, a Q_{yc} unit is not distinguished from the wider Q_y unit at a 1:24,000 map scale.
- Holocene[1] alluvium (Q_y). The Q_y unit consists of river deposits younger than about 10,000 years, and is generally found in small active channels and on low terraces. The unit is characterized by unconsolidated, stratified, poorly to moderately sorted sand, gravel, cobble and boulder deposits along the drainageways. Alluvial surfaces exhibit bar and swale topography, with the ridges typically being slightly more vegetated. Q_y surfaces typically lack desert varnish or pavement, and often have a sandy loam mantle. Surface colors are usually light brown to yellowish brown, with slight reddening due to iron oxidation. Q_y surfaces are considered subject to flooding and erosion.
- Late Pleistocene[2] alluvium (Q_l). The Q_l unit consists of alluvial fan surfaces and terraces that are 10,000 to 250,000 years old. The unit may be moderately incised by stream channels, but has some constructional, relatively flat interfluvial surfaces with a subdued bar and swale topography. The surfaces have no to moderately developed desert pavement and varnish, with slightly more red color than Q_y surfaces. Soil profiles have weak to moderate argillic horizons and stage II-III carbonate development. Q_l surfaces are generally not flood prone, except where they are immediately adjacent to active washes.
- Middle Pleistocene alluvium (Q_m). The Q_m unit consists of relict alluvial fan and river terraces greater than 250,000 years old. The soil units are characterized by tan, sandy to loamy materials with sand- to boulder-sized clasts. Q_m surfaces have generally been eroded into shallow valleys and ridges due to development of an internal drainage pattern. The surfaces typically have moderate to strongly developed desert pavement and varnish, except where surface erosion has removed them, and are brown to reddish brown. The soils are strongly

[1] The Holocene geologic Epoch spans the past 10,000 years before the present.
[2] The Pleistocene geologic Epoch spanned 1.8 million years before the present to 10,000 years before the present.

developed with reddened argillic horizons and stage II-IV calcic horizons. Q_m surfaces are generally not flood prone.

- Early Pleistocene alluvial fan deposits (Q_o). The Q_o unit consists of relict alluvial fan and river terraces greater than 750,000 years old. The Q_o deposits are moderately consolidated and indurated by carbonate. The surfaces are typically deeply dissected by larger drainages, and have strongly developed reddish brown argillic and stage III-IV calcic horizons. Q_o surfaces are generally not flood prone.

The 24,000 series AZGS mapping were also an important element of the erosion hazard delineation discussed in SECTION 4.

2.1.2 NRCS Mapping

The NRCS detailed *Soil Survey of the Aguila-Carefree Area* (Camp, 1986) includes the CCDMP study area. Figure 7 shows the soil units classified by predominant landform type as indicated in the map unit descriptions in the *Soil Survey*. Table 1 gives the map unit numbers, landform type and soil unit description for the map units present in the study area.

As with the geologic mapping, the soils mapping shows an area of terraces lying between two mountainous areas drained by a tributary floodplain network. The dark brown pediment area in the southeast portion of the study area corresponds to the granitic map unit shown in the 100,000 series geologic map.

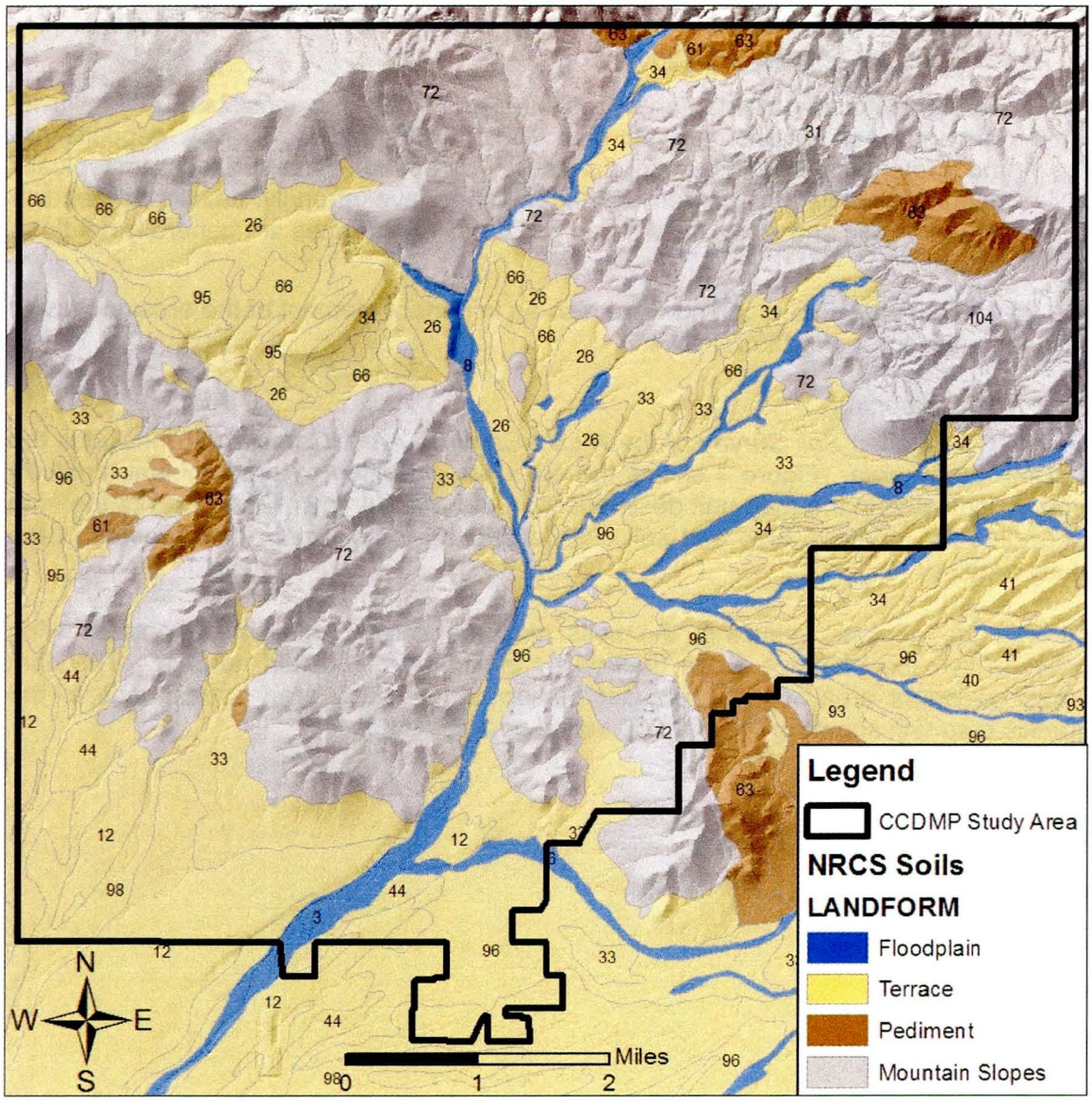

Figure 7 NRCS Soils Map with Landform Interpretation

Table 1 NRCS Map Units and Landform Interpretation in the Cave Creek DMP Area

Map Unit	Landform Type	Soil Unit Description
3	Floodplain	Antho-Carrizo-Maripo complex
6	Floodplain	Anthony-Arizo complex
8	Floodplain	Arizo cobbly sandy loam
12	Terrace	Carefree cobbly clay loam
13	Terrace	Carefree-Beardsley complex
26	Terrace	Continental cobbly clay loam
28	Terrace	Continental-Ohaco complex
31	Mountain Slopes	Dixaleta-Rock outcrop complex
33	Terrace	Eba very gravelly loam
34	Terrace	Eba very gravelly loam
40	Terrace	Eba-Pinaleno complex
41	Terrace	Eba-Pinaleno complex
44	Terrace	Ebon very gravelly loam
61	Pediment	Gran-Wickenburg complex
63	Pediment	Gran-Wickenburg-Rock outcrop
66	Terrace	Greyeagle-Suncity Variant complex
72	Mountain Slopes	Lehmans-Rock Outcrop
93	Terrace	Nickel-Cave complex
95	Terrace	Ohaco gravelly loam
96	Terrace	Pinaleno-Tres Hermanos complex
98	Terrace	Pinamt-Tremant complex
104	Mountain Slopes	Rock Outcrop-Lehmans complex
110	Terrace	Suncity-Cipriano complex
112	Terrace	Tremant gravelly sandy loams
120	Terrace	Tres Hermanos grvly sandy loam
121	Terrace	Tres Hermanos-Anthony complex

2.1.3 Aerial Photos

Fluvial landforms and surficial characteristics in the area were also evaluated based on interpretation of orthorectified aerial photographs. Aerial photographs from December 2004 and 2005 were examined along with a set of lower resolution photos dated 1953. A list of the aerial photographs used is provided in Table 2.

Table 2 Historical Aerial Photographs

Year	Description	Source
1953	Scanned Black & White prints	Army Mapping Service
2005	Digital Orthophotographs (Dec 2004-Jan 2005)	District
2006	Digital Orthophotographs (Dec 2005-Jan 2006)	District

The aerial photos help estimate the age of stream terraces adjacent to the main channels. Their age provides information on past stream bed elevations and positions that can be used to help forecast where the stream may be located in the future. Geomorphic surface characteristics were used to compare terraces within the study

limits to surfaces in the local area previously evaluated by the AZGS and NRCS, as described above. Those characteristics included the following:

- Soil development
- Surface color
- Desert pavement
- Desert varnish
- Topographic relief
- Vegetative characteristics

Individually, any one of these age-indicating characteristics provide a relatively low degree of confidence in age estimates. Considered together, and with information obtained from the AZGS and NRCS mapping, those characteristics provide a high degree of confidence in the interpretation of erosion hazards made as described in SECTION 4.

2.1.4 Topography

Topographic mapping was also examined to aid in understanding and interpreting the geomorphic setting of watercourses in the study area. Data sources included recent 2-foot contour data for most of the study area supplemented with 10-foot contours dated 2001. The shaded relief shown in Figure 7 is based on the 10-foot elevation data. Figure 8 shows the flight dates and contour interval of the topography used in the study.

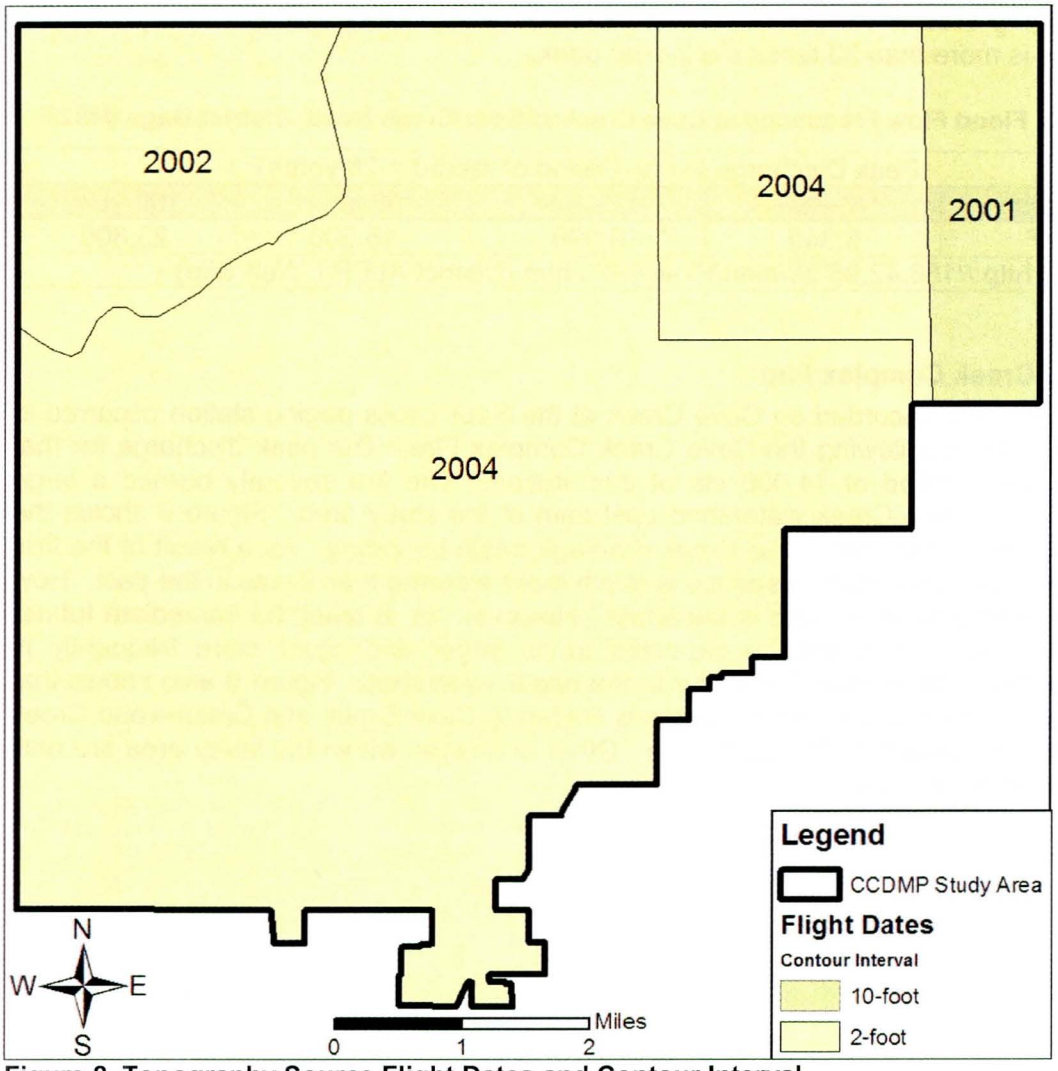

Figure 8 Topography Source Flight Dates and Contour Interval

The contour data help identify the slope of the land, degree of incision, height and slope of channel banks, and location of drainages complementing the aerial photographs. The topography assisted in the equilibrium slope analysis and was also used in the erosion hazard delineations described in SECTION 3 and SECTION 4.

2.2 Hydrology

Previous floodplain delineation studies show that hydrology within the area is predominantly characterized by short-duration, high peak discharges. The unit discharges (cfs/mi^2) for many of the smaller drainages, like Andora Hills Wash, are among the highest in Maricopa County. Cave Creek itself can experience prolonged low level flows, and during wet years may flow continuously for many weeks. However, the high magnitude discharges are typically also of relatively short duration.

Like most semi-arid watersheds, the magnitude of the infrequent flows, like the 100-year flood, are significantly larger than the more frequent events, such as the 2-year flood. Table 3 shows the flood flow frequency data for the District's Cave Creek at Spur Cross

Road gaging station which lies within the study area. Note that the 100-year peak discharge is more than 30 times the 2-year peak.

Table 3 Flood Flow Frequency at Cave Creek at Spur Cross Road, District Gage #4923

Peak Discharge in cfs (Period of record = 26 years)				
2-year	10-year	20-year	50-year	100-year
737	5,340	9,090	16,300	23,800
Source: http://156.42.96.39/alert/Flow/4923.htm (District ALERT Web Site)				

2.3 Cave Creek Complex Fire

The largest flood recorded on Cave Creek at the Spur Cross gaging station occurred in September 2005 following the Cave Creek Complex Fire. The peak discharge for that event was estimated at 14,000 cfs at this station. The fire severely burned a large portion of the Cave Creek watershed upstream of the study area. Figure 9 shows the extent of the fire over the Cave Creek drainage basin boundary. As a result of the fire, the Cave Creek watershed response is much more extreme than it was in the past. How long this condition will remain is uncertain. However, for at least the immediate future, floods on Cave Creek can be expected to be larger and occur more frequently in response to rainfall events that occur in the upper watershed. Figure 9 also shows that the impact of the fire is almost exclusively limited to Cave Creek and Cottonwood Creek watersheds upstream of the study area. Other drainages within the study area are only slightly, if at all, affected.

Road gaging station which lies within the study area. Note that the 100-year peak discharge is more than 30 times the 2-year peak.

Table 3 Flood Flow Frequency at Cave Creek at Spur Cross Road, District Gage #4923

Peak Discharge in cfs (Period of record = 26 years)				
2-year	10-year	20-year	50-year	100-year
737	5,340	9,090	16,300	23,800
Source: http://156.42.96.39/alert/Flow/4923.htm (District ALERT Web Site)				

2.3 Cave Creek Complex Fire

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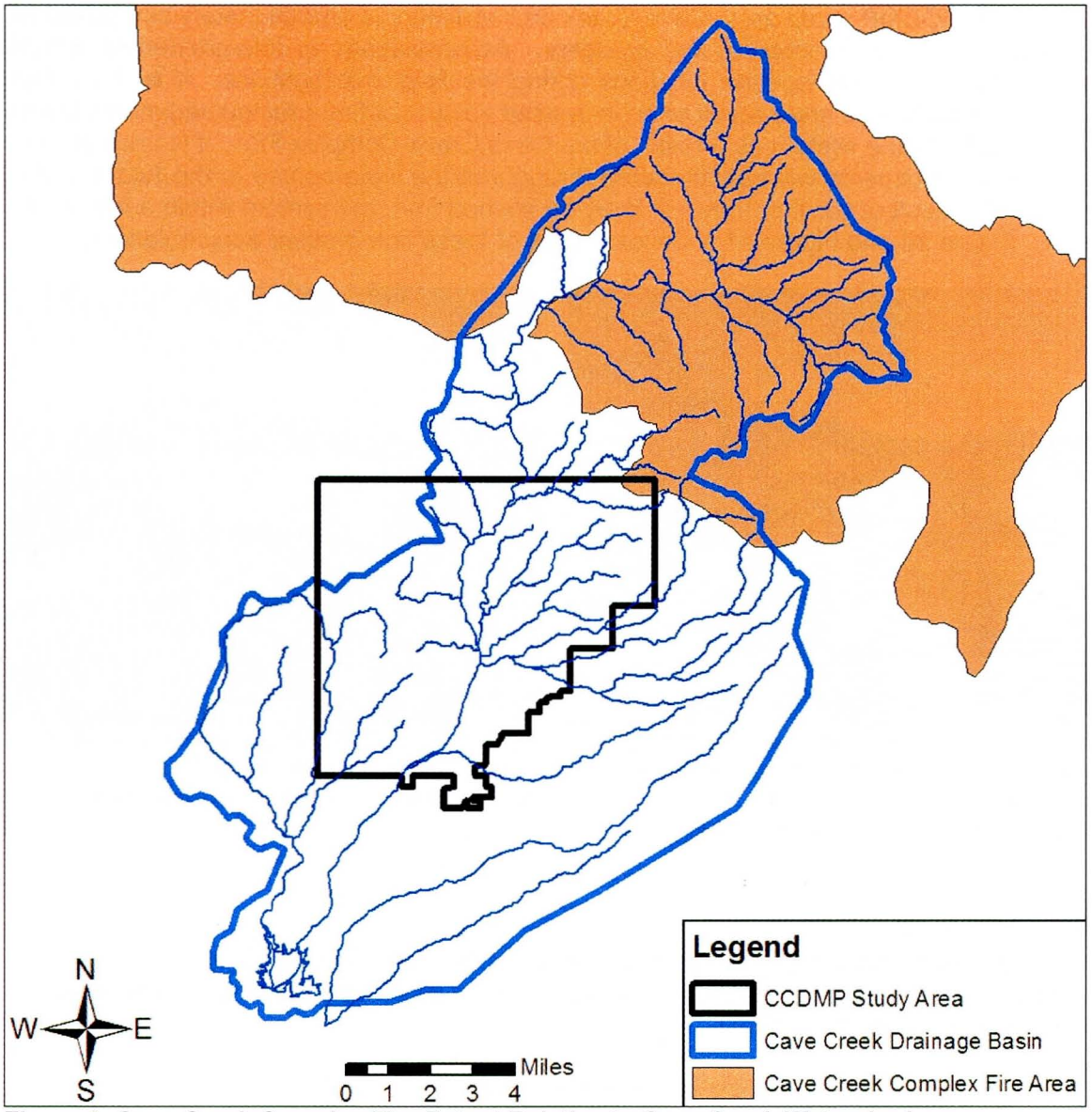

Figure 9 Cave Creek Complex Fire Extent Relative to Cave Creek Watershed

2.4 Watershed Sediment Sources

Sediment can be delivered to the washes in the study area from hill slopes, channel banks, or the channel beds. Field observations indicate that many of the smaller drainages in the steeper headwaters of the various washes show large areas of bedrock outcrops. This means that hillslope erosion is not a predominant source of sediment supply in the area. Rather, channel banks and channel beds provide the source of most of the sediment available for transport and deposition. As mentioned in Section 2.3, the Cave Creek Complex Fire is expected to produce additional sediment to the downstream reaches for some period of time. The exact period of recovery of the watershed is uncertain. Field observations and anecdotal information reveal some short term influx of sediments to the Cave Creek channel since the fire. However, they are generally not well-pronounced and are limited in extent.

Within the CCDMP study area, Cave Creek bed sediment is predominately composed of very coarse gravels, cobbles, and boulders. Accumulations of fine-grained sediment were observed at site-specific locations during the field investigations. It is likely that these accumulations are a result of an increased volume of fine-grained sediments being introduced into the system as a result of the Cave Creek Complex Fire. It is unclear how these finer sediments will be distributed throughout the watercourse in the future, but if they are a result of the fire, they will likely be flushed from the system within a few years time. Figure 10 and Figure 11 show examples of these fine-grained accumulations.

Figure 10. Accumulation of fine-grained sediment along Cave Creek, represented by the grassy areas. (11-08-2006-1258.jpg). View downstream.

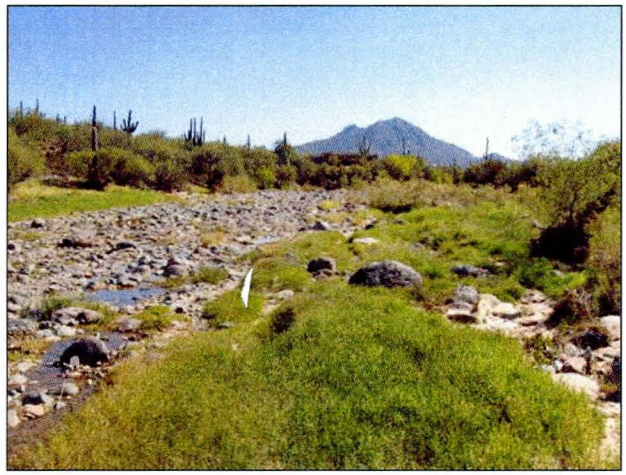

Figure 11. Additional fine-grained sediment accumulation on Cave Creek. (11-08-2006-1307.jpg). View downstream.

2.5 Field Observations

Field reconnaissance and detailed field observations were made of the study area and the delineated floodplain reaches in particular. Field investigations of the Adobe ADMP watershed were also reviewed.

The objectives of the field visits included the following:

- Identify stream reaches with evidence of recent or historical lateral erosion
- Identify reaches with evidence of recent or historical degradation or aggradation
- Identify evidence of lateral erosion within recent geologic time
- Identify evidence of limits to future lateral erosion (bedrock, carbonate, structures)
- Identify stream responses to human impacts or structures
- Identify points of natural grade control
- Characterize channel bank composition

Specific types of field evidence considered included the following:

2.5.1 Bank Conditions

The physical condition of the stream banks provides evidence of whether the stream has been subject to recent lateral erosion and may be subject to future bank erosion. The

following sections describe some of the physical conditions of stream banks that affect bank erosion potential. In addition, examples from the study area are provided showing what these features look like in the field.

2.5.1.1 Bank Height

Higher, steeper banks are typically more erodible than low banks, particularly if bank height was increased by channel degradation. Figure 12 through Figure 15 show examples of tall, vertical cutbanks within the study area. Note how the toes of the slopes are almost entirely void of loose material because it is being actively removed by flood water.

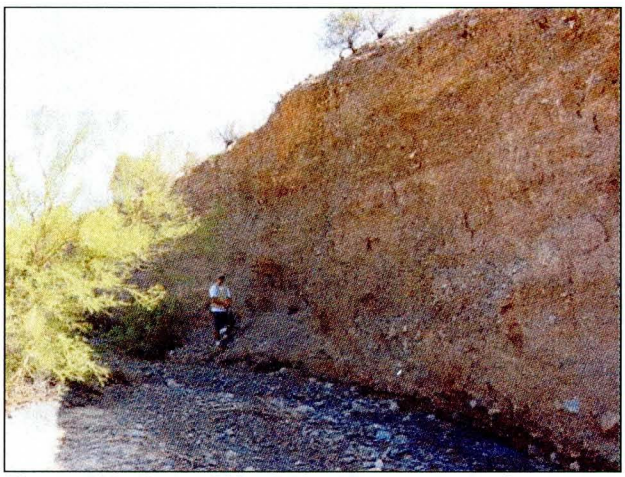

Figure 12 Rowe Wash, just upstream of Ridgeway Drive. Active erosion of vertical bank (left bank). Caliche present in soil matrix. (11-06-2006-1003.jpg). View upstream.

Figure 14 Ocotillo Wash Tributary #1, downstream of Tributary #1A. Vertical bank (left bank) with caliche seen in soil matrix. (10-19-2006-228.jpg). View downstream.

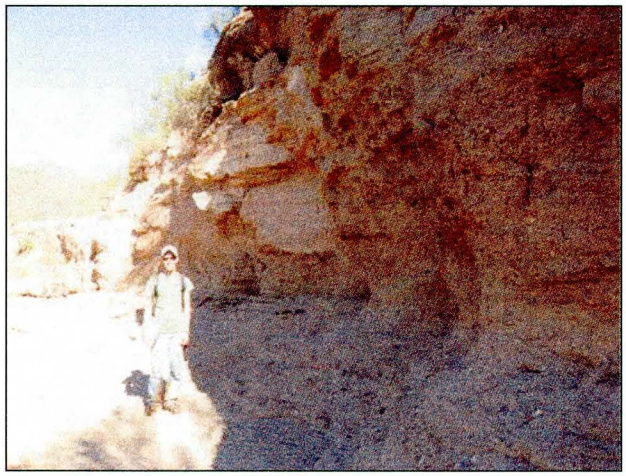

Figure 13. Cave Creek upstream Cave Creek Tributary #1. High, vertical bank showing evidence of active erosion.

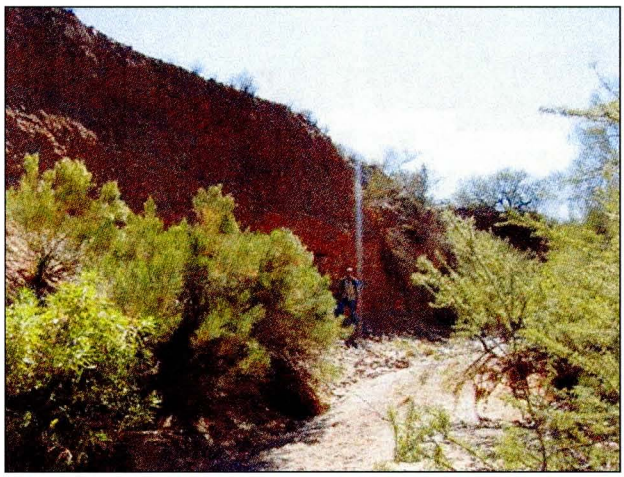

Figure 15. Willow Springs Wash Tributary #1 immediately upstream of Willow Spring Wash confluence.

2.5.1.2 Bank Slope

A cutbank is defined as a vertical or near vertical, unstable, unvegetated stream bank that has been recently eroded or trimmed by lateral erosion. If a stream does not continue to erode the bank to a vertical face, slope processes will work to flatten the bank slope to its angle of repose (typically, about a 2H:1V slope). The rate at which slope processes act on a stream bank is a function of the resistance of the bank slope material, the climate, interference by stream processes, and other hydrologic and geologic factors.

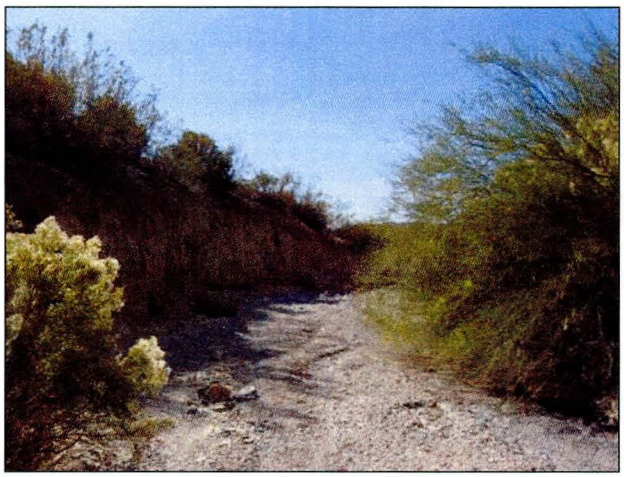

Figure 16 Rowe Wash, just upstream of School House Road. Active erosion at vertical channel bank (left bank). (11-06-2006-997.jpg). View downstream.

Figure 18 Galloway Wash, upstream of North Tributary. Sandy bottom and stable left bank. (10-31-2006-875.jpg). View upstream.

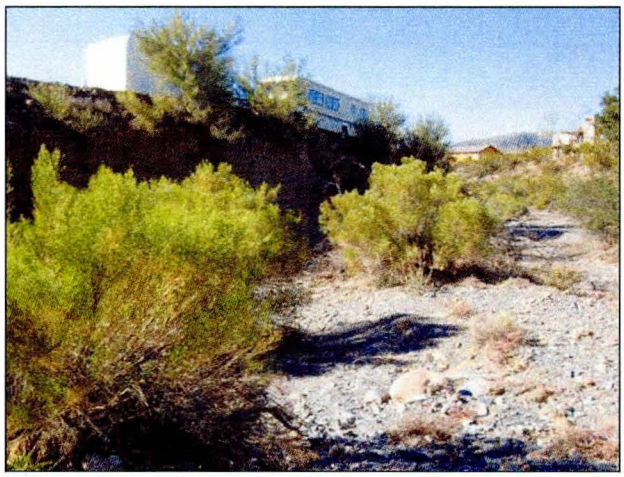

Figure 17. Ocotillo Wash downstream of Spur Cross Road. Note the motorhome parked near the top of the bank. (10-19-2006-316.jpg). View downstream.

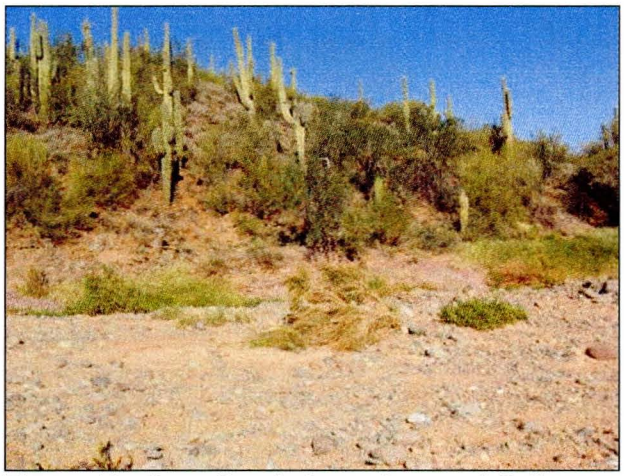

Figure 19. Cave Creek downstream of Galloway Wash confluence. Stable right bank. (11-09-2006-1461.jpg). View upstream.

Figure 16 and Figure 17 show examples of active vertical cutbanks located on Rowe Wash and Ocotillo Wash, respectively. In contrast, Figure 18 and Figure 19 show examples of stable slope banks. Figure 20 shows the location of cutbanks observed along the floodplain study reaches. Notice the strong correlation between the location of

the cutbanks and the soil map units identified as terraces by the NRCS. This relationship demonstrates how the erodible alluvial materials of the terraces are subject to lateral erosion by the watercourses flowing through them. The areas dominated by mountain slope soils and bedrock, on the other hand, do not show many incidences of cutbanks. The few locations where the map shows cutbanks on mountain slopes reflect the relatively small scale of the NRCS mapping in comparison with the detailed field observations.

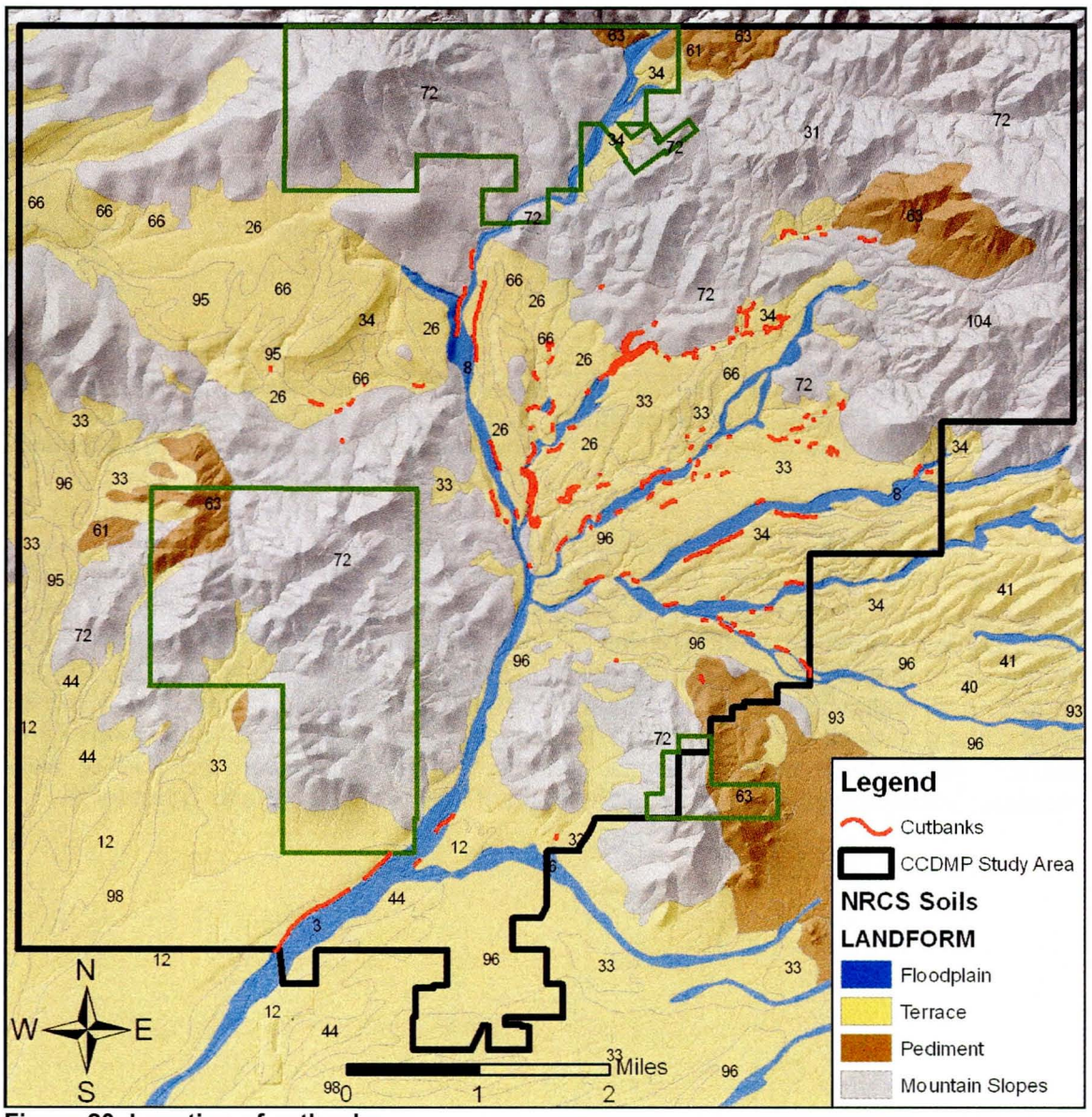

Figure 20 Location of cutbanks

2.5.1.3 Bank Material

Bank materials provide resistance to lateral erosion through a variety of properties such as cohesion, armoring (sediment material size), angle of repose, ability to transmit and store water, susceptibility to piping, stratigraphy, and the ability to promote or prevent root growth. Figure 21 shows a bank along Cave Creek that is composed of very large gravel material. Figure 22 shows a much finer grained bank along Galloway Wash that

is currently experiencing lateral erosion as indicated by its vertical shape. In both instances, the banks provide material to the channel that must be transported. The large particles in the banks of Cave Creek provide material for potential armoring of the channel bed for some level of flow. The bank materials shown on Galloway Wash are comparatively fine-grained and easily transported.

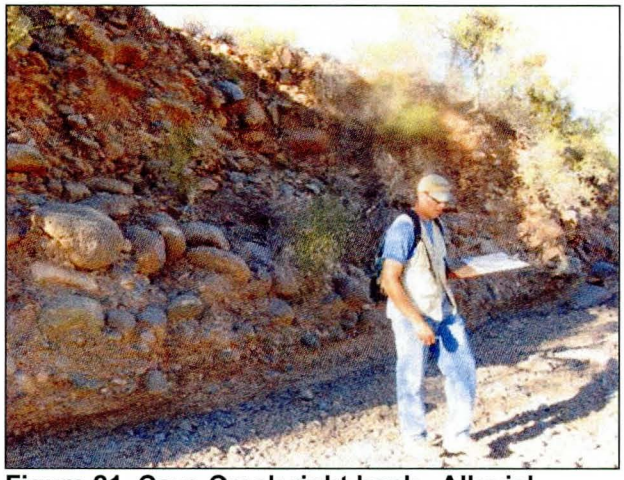

Figure 21 Cave Creek right bank. Alluvial material with caliche (Stage I – II) at toe of bank. (11-08-2006-1375.jpg). View upstream.

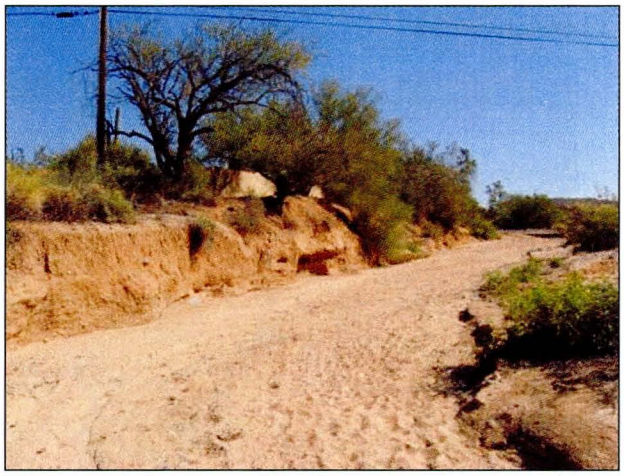

Figure 22 Galloway Wash, upstream limit of study. Sandy bottom, vertical right bank. House adjacent to bank seen in background. (10-31-2006-898.jpg). View upstream.

2.5.1.4 Bank Vegetation Type, Density and Age

Bank vegetation can reduce the rate of lateral erosion by increasing the hydraulic roughness (lower velocity), anchoring soil material, and decreasing the amount of soil to water contact. Different plant species provide different levels of bank stability and resistance to erosion, depending on root density, rooting depth, trunk strength, canopy density, and malleability to flow. Figure 23 shows an example of moderately dense shrubs along a reach of Ocotillo Wash Tributary #2. Note the gradual bank slopes and coarser bed material in the channel. Figure 24 shows another example of well-vegetated channel banks along a straight reach of Willow Springs Wash Tributary #1.

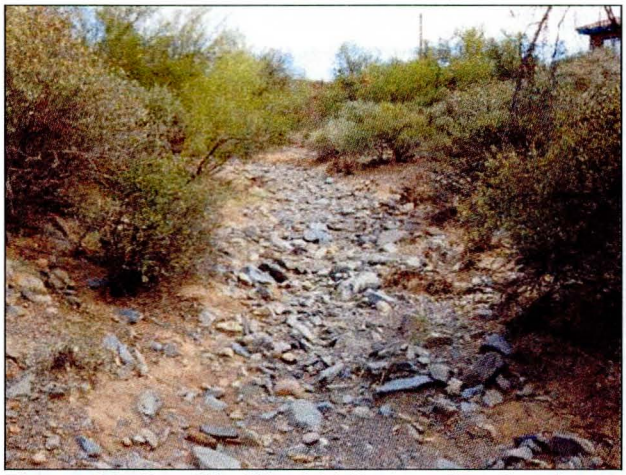

Figure 23 Ocotillo Wash Tributary #2. Sand-gravel-cobble bed. Moderate overbank vegetation.
(10-13-2006-034.jpg). View upstream.

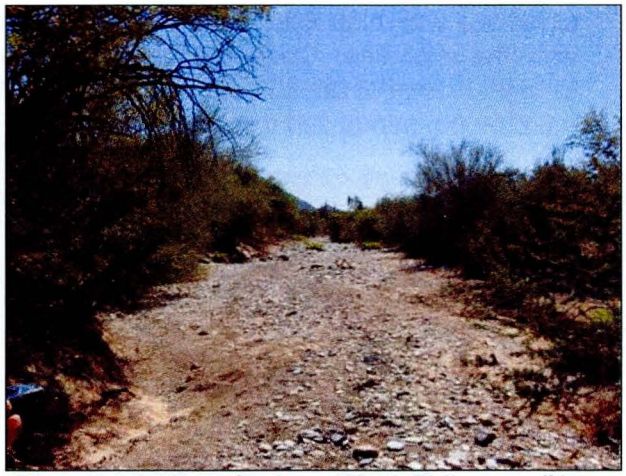

Figure 24 Willow Springs Wash Tributary #1. Just upstream of confluence with Willow Springs Wash.
(10-27-2006-650.jpg). View downstream.

2.5.1.5 Engineered Protection

Properly designed and constructed bank protection is an effective barrier against erosion. Very few instances of engineered bank protection were observed in the study area. Figure 25 shows the installation of engineered riprap bank protection on Andora Hills Wash. Figure 26 shows an example of a bolted, grouted bank slope protection measure installed on Rowe Wash (note the residence located very close to the tall, steep bank).

Figure 25 Andora Hills Wash, downstream of Basin Road. Right bank riprap placement.
(10-31-2006-781.jpg). View downstream.

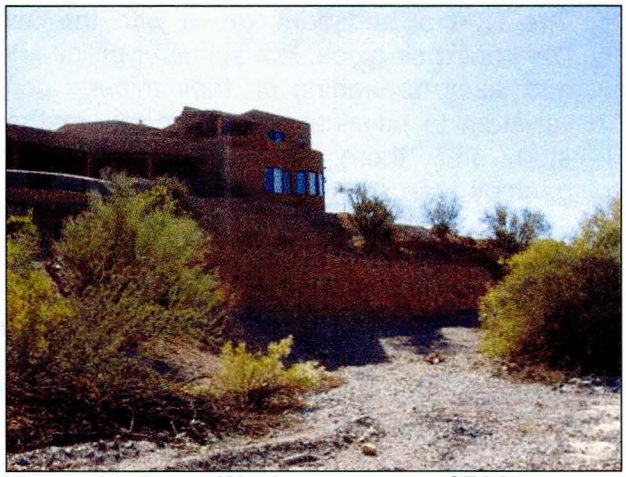

Figure 26 Rowe Wash, upstream of Ridgeway Drive. Left bank bolted, grouted slope protection.
(11-06-2006-984.jpg). View downstream.

2.5.2 Bed Conditions

Bed sediment characteristics such as size, imbrication[3], sorting, or armoring are indicative of channel processes, flow velocities, and rate of sediment movement.

[3] Imbrication is a sedimentary structure characterized by flat pebbles or cobbles all tilted and overlapped in the same orientation indicating flow direction.

Channels with high velocities are subject to higher rates of lateral erosion than channels with low velocities. Channels with high rates of sediment movement are typically subject to higher rates of lateral erosion. Bed armoring may lead to increased lateral erosion as the channel mines sediment from its banks.

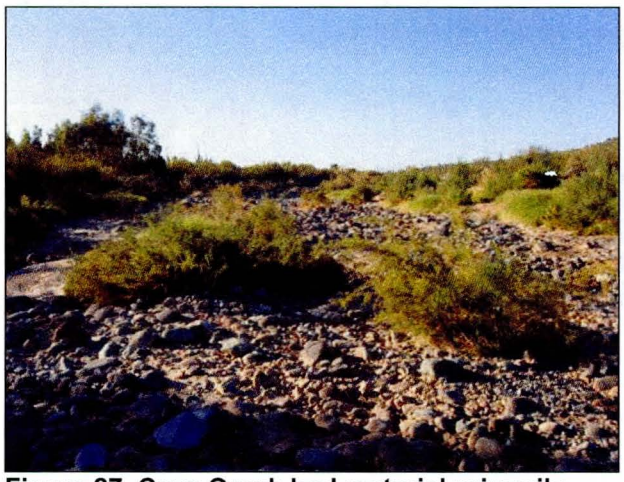

Figure 27 Cave Creek bed material primarily consisting of sands, gravels, cobbles. (11-09-2006-1433.jpg). View downstream.

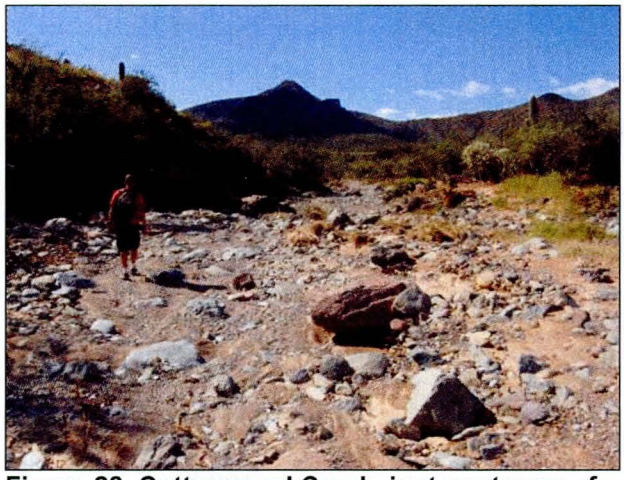

Figure 28 Cottonwood Creek, just upstream of Tonto National Park boundary. Bedrock controlled left bank. (10-18-2006-167.jpg). View downstream.

2.5.2.1 Sediment Type

The type of sediment varies with the available geologic materials in its watershed. Different rock types, like schist or granite, weather and breakdown into different shapes and sizes depending on their mineral composition. Some rock types are also more resistant to physical and chemical weathering than others. In the Cave Creek DMP study area, there are three predominant rock types as shown on the 100,000 scale geology map (Figure 3) – metamorphic rocks, volcanic rocks, and granitic rocks. The variable lithologies are clearly seen in the bed and bank sediments in the study area. Willow Springs, Ocotillo, and Rowe Washes drain predominantly metamorphic schist areas and commonly have black, flat sediment. Galloway Wash drains a predominantly granitic area and has tannish, square gravelly sands in its bed and banks. Cave Creek also contains numerous large basaltic boulders. Figure 29 shows the confluence of Galloway and Rowe Washes. Note the dark grayish color of the bed of Rowe Wash and the light tan color of Galloway Wash.

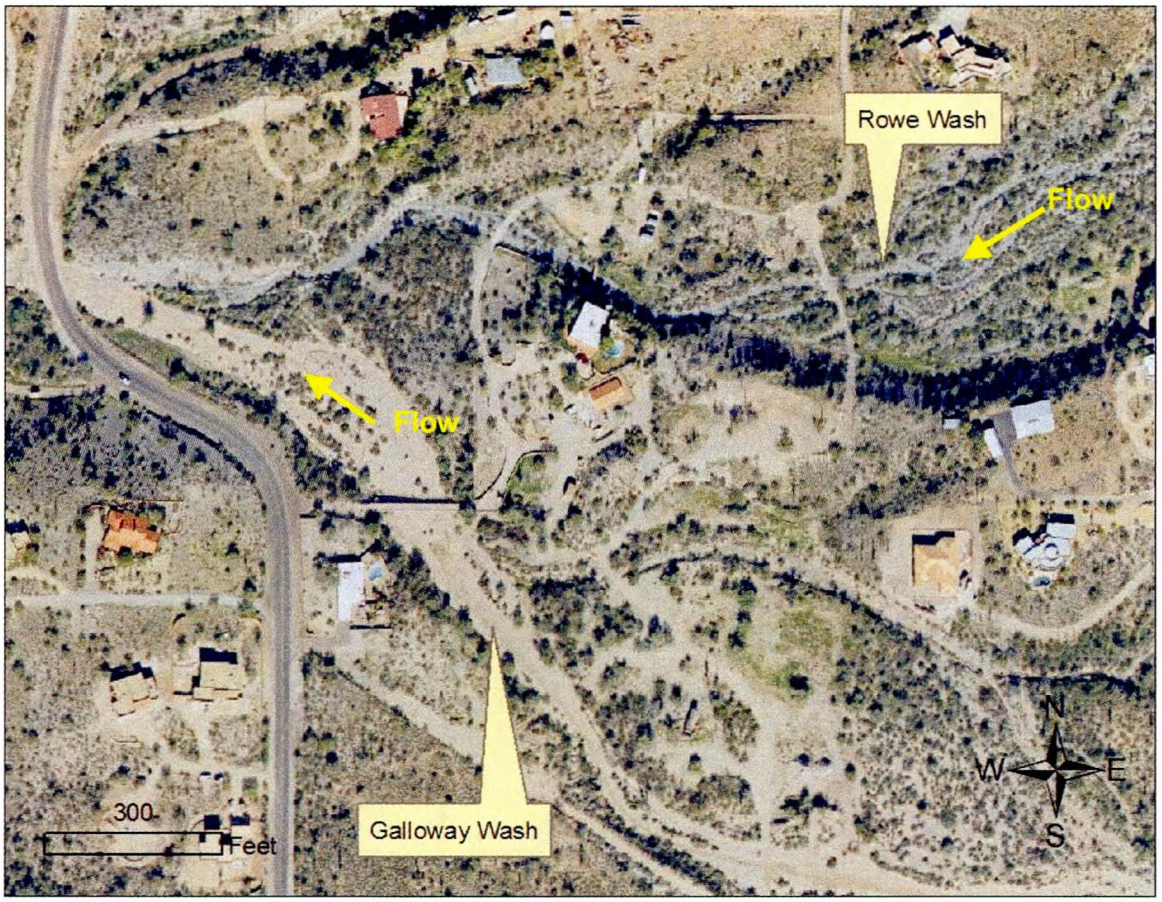

Figure 29 Aerial of Galloway/Rowe Wash Confluence

2.5.2.2 Sediment Size

Sediment size is a function of lithology as well as transport distance and the sediment transport capacity of the reach. The channel cross-section adjusts in a complex, multi-variant manner to respond to the inputs of sediment type, size, and quantity as well as the frequency and magnitude of water. The result is a physical sorting of sediment sizes spatially in direct relation to the distribution of energy in the fluvial system. Sediment sizes are generally larger in the steeper, mountainous reaches of the study area as well as within Cave Creek which experiences the largest flows. Steeper-sloped reaches also tend to have larger sediment sizes than shallow-sloped reaches due to slope's influence on sediment transport capacity. That is, steeper slopes are capable of moving larger materials. Sediment sizes also vary laterally in a cross-section with channel bars having coarser-grained sediment than the lower portion of the channel bed.

Sediment samples were taken at 59 locations along the floodplain study reaches. The locations and median bed sediment diameter are shown in Figure 30. The complete sieve sample and pebble count data are provided in Appendix B. These data were used in the equilibrium slope analysis discussed in SECTION 3.

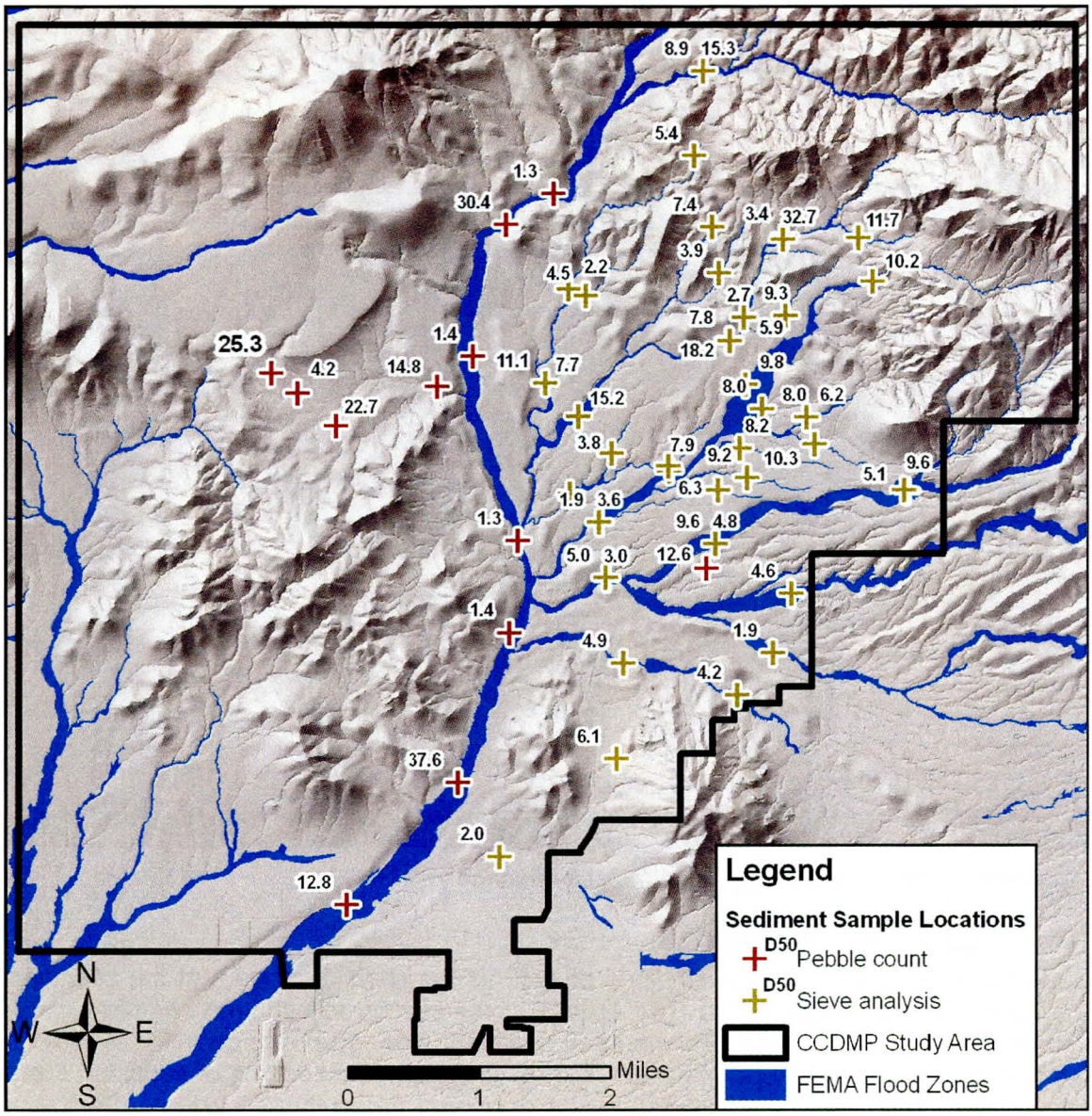

Figure 30 Sediment Sample Locations and D_{50} (in mm)

2.5.2.3 Incision

Channel degradation is closely linked to increased lateral erosion of the incised channel. Conversely, long-term aggradation leads to channel widening and/or avulsive channel change. The vast majority of channel reaches in the CCDMP study area are degradational. Channels are generally incised between older Pleistocene terraces. Bedrock and caliche outcrops are found in many locations (see also Section 2.5.3.3). Figure 31 and Figure 32 show incised reaches of Willow Springs Wash and its Tributary #2. Note how the bed sediments form a thin veneer over the surrounding hard, caliche banks and valley floor.

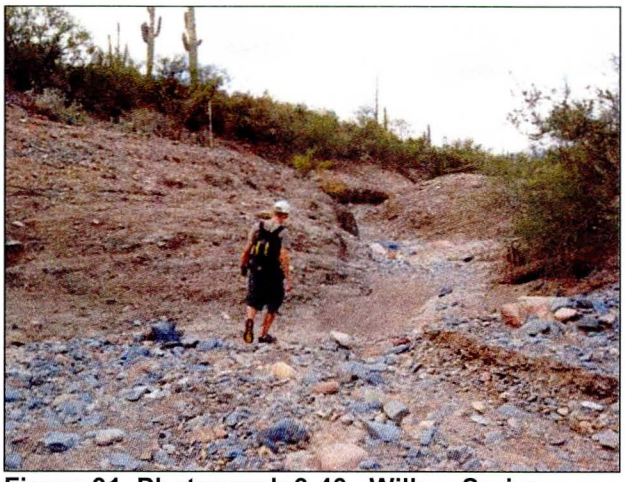

Figure 31 Photograph 3-46. Willow Springs Wash, upstream of Tributary #2. Caliche controlled channel banks. (10-25-2006-455.jpg). View downstream.

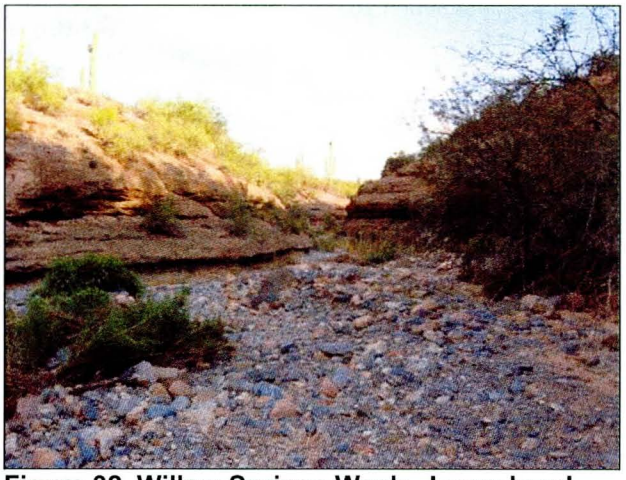

Figure 32 Willow Springs Wash. Large bend downstream of Cahava Ranch Road. Entrenched channel with caliche banks. (10-25-2006-543.jpg). View downstream.

2.5.3 Channel Characteristics

The planimetric and topographic characteristics of the channel also provide information regarding its recent and long-term lateral and vertical stability.

2.5.3.1 Bankfull Width/Depth Ratio.

Streams with high width to depth ratios are subject to higher rates of lateral erosion than streams with low width to depth ratios. The clear contrasting examples of this stream characteristic are seen comparing the relatively narrow and deep channels in the steeper channel reaches with the wider valley bottom areas of portions of lower Rowe Wash (Figure 33) or lower Cave Creek. Also note the tall, nearly vertical bank located on the left bank of this same cross-section.

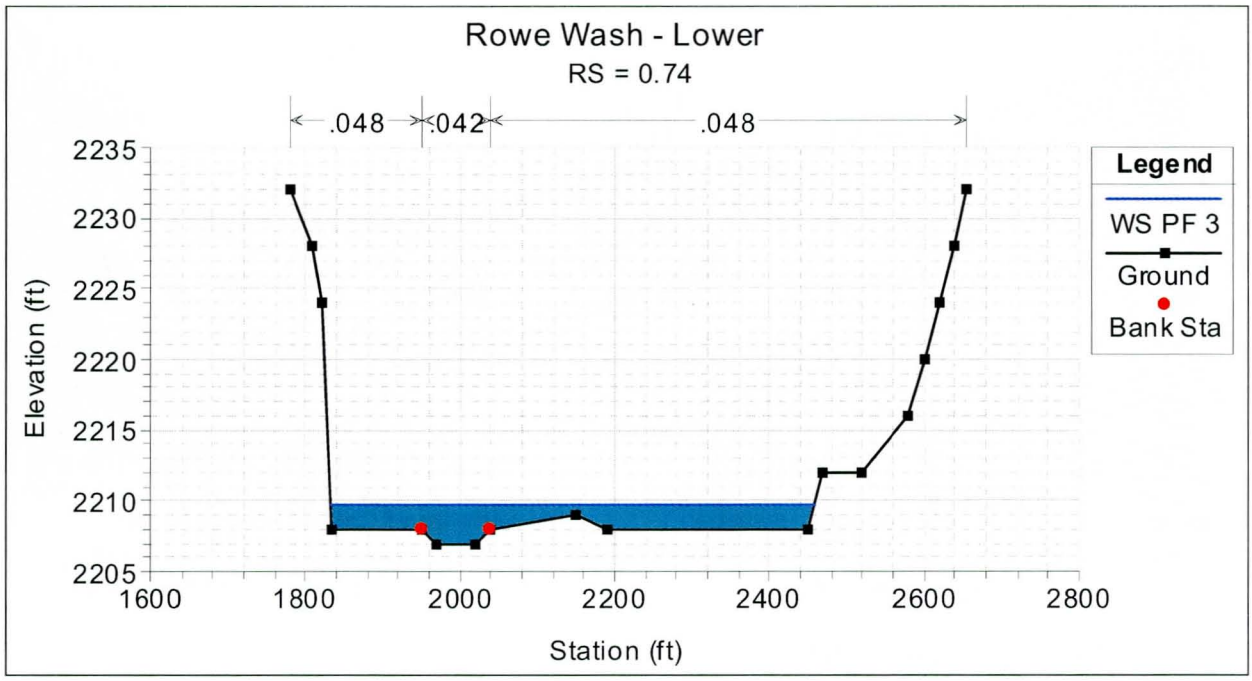

Figure 33 Example of high width to depth ratio reach along lower Rowe Wash

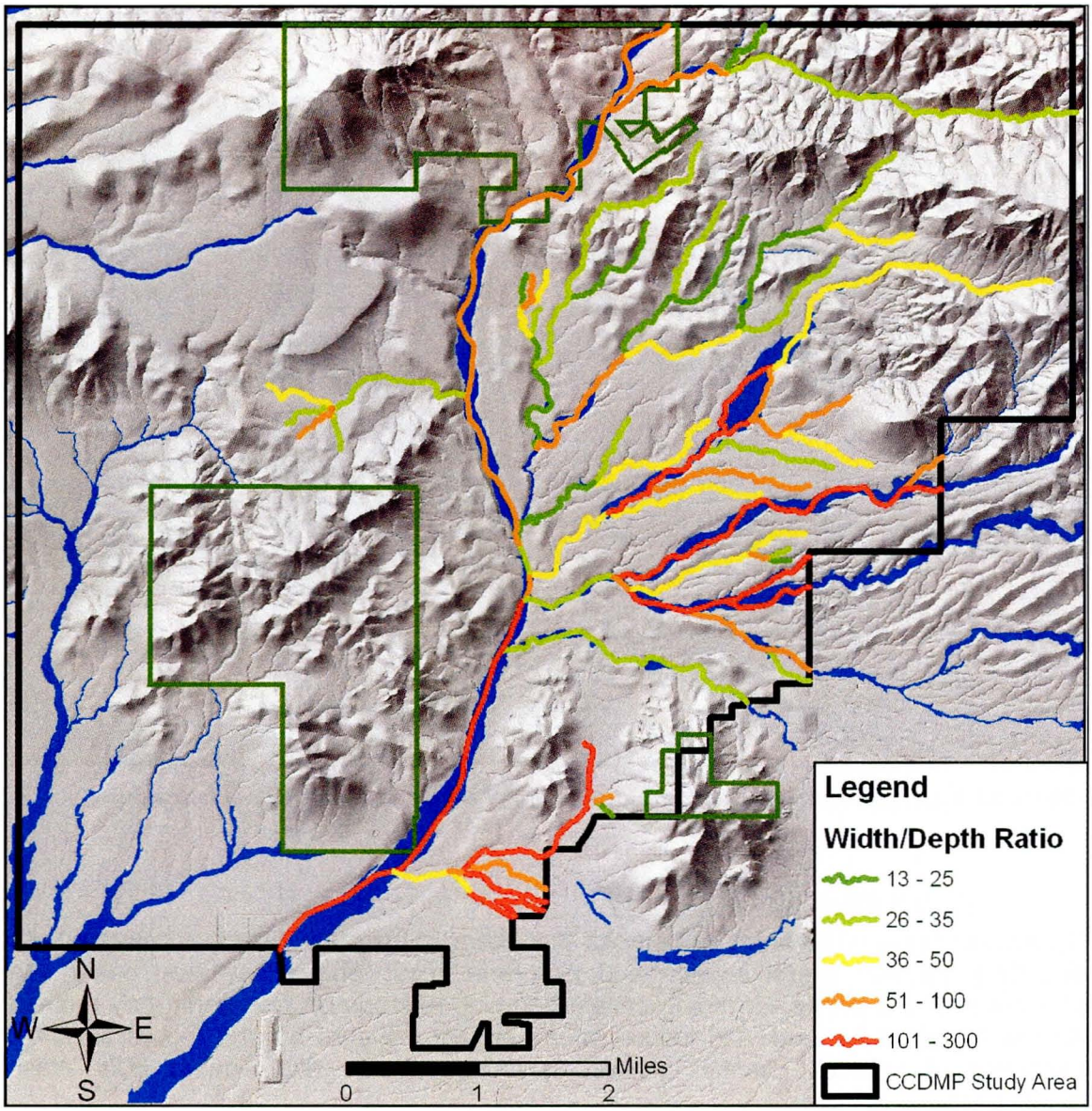

Figure 34 Width/Depth ratio for detailed study reaches

Figure 34 shows the computed width to depth ratio for the detailed study reaches based on the hydraulic calculations for the equilibrium slope analysis. Note the comparatively wide channels on Cave Creek, Rowe Wash, and middle Galloway Wash. These reaches therefore would be expected to exhibit greater potential for lateral erosion than the relatively narrow reaches such as the upper tributaries of Willow Springs Wash or Cottonwood Creek.

2.5.3.2 Channel Bend Angle, Pattern, and Sinuosity.

Sinuous stream reaches and channels with sharp bends are subject to higher rates of lateral erosion and more frequent avulsions than straight channels. Sinuous and meandering streams tend to experience lateral migration by erosion of the banks on the outside of bends. Straight or braided channels tend to erode by widening both banks. Sinuosity for streams in the study area are mostly very low. However, there are a few

reaches of entrenched sinuous channel such as shown in Figure 35 from lower Ocotillo Wash (flow is from right to left).

Figure 35 Example of entrenched sinuous channel reach on lower Ocotillo Wash

2.5.3.3 Natural Grade Control

Bedrock Outcrop. The types of bedrock that occur in the study area are resistant and effectively prevent lateral erosion and long-term scour where they crop out in the channel bed and banks. In some cases, bedrock outcrops on one bank may redirect flow at the opposite bank and induce lateral erosion. Figure 36 and Figure 37 show examples of bedrock channel control on Ocotillo Wash and Andora Hills Wash respectively.

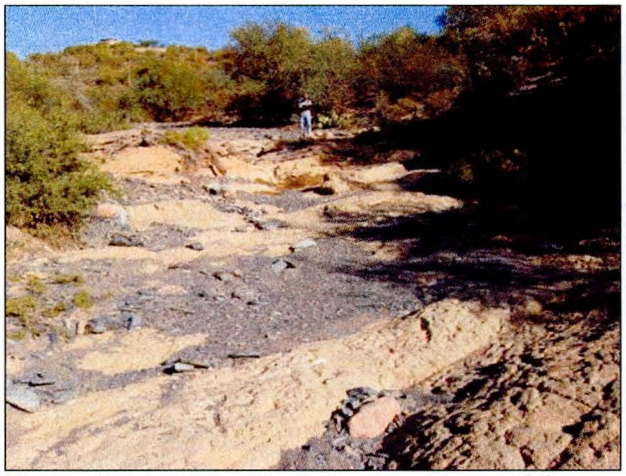

Figure 36 Ocotillo Wash just upstream of Cave Creek. Bedrock bed control. (10-19-2006-333.jpg). View upstream.

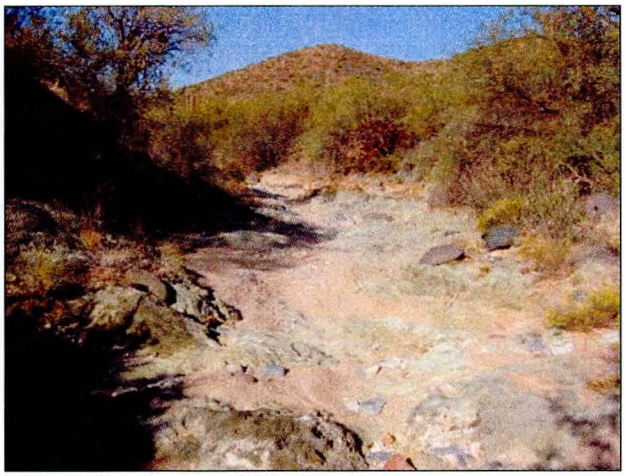

Figure 37 Andora Hills Wash just upstream of Cave Creek. Bedrock control seen in channel bed. (10-31-2006-834.jpg) View downstream.

Caliche Outcrop. Accumulation of calcium carbonate (CaCO3, a.k.a. "caliche") in the bank materials can significantly increase resistance to bank erosion. Field evidence in the Cave Creek study area suggests that banks with caliche have experienced some lateral erosion, particularly where underlying soil layers are less resistant. Figure 38 and Figure 39 show locations on Willow Springs Wash tributaries that have significant caliche outcrops that restrict the horizontal and vertical adjustments of their channels.

Figure 38 Willow Springs Wash Tributary #2, downstream of Tributary #2A. Caliche controlled channel bed and banks. (10-25-2006-485.jpg). View upstream.

Figure 39 Willow Springs Wash Tributary #1. Just downstream of Morning Star Road. Caliche controlled bed. (10-27-2006-624.jpg). View downstream.

Figure 40 shows a map of the observed bedrock and caliche outcrops identified for the detailed study reaches. The map also shows the NRCS soil units classified by landform (see also Figure 7). As with the distribution of cutbanks, the locations of caliche observed in these reaches is almost entirely found within the terrace landform units. Similarly, the locations of bedrock are seen where channels pass through or adjacent to the mountain slope areas. The absence of an observation of caliche or bedrock does not necessarily mean that they are not present in a particular bank or just below the

channel bed. Stable slopes or banks otherwise obscured by vegetation or shallow soils may hide these resistant materials and therefore also limit lateral and vertical instability in those reaches. The presence or absence of resistant bed or bank materials at any specific site could therefore require some type of further subsurface geologic investigation.

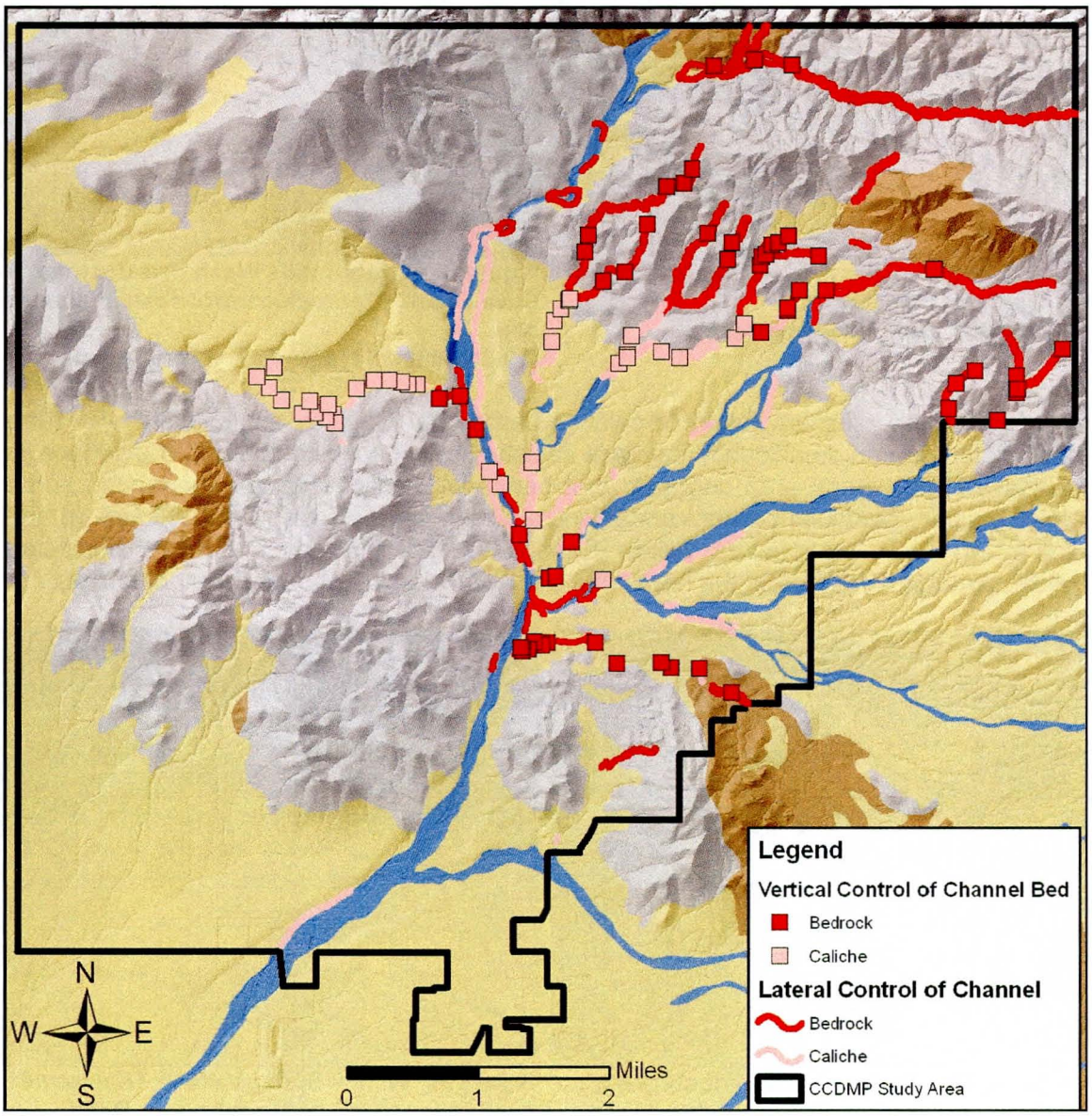

Figure 40 Distribution of observed bedrock and caliche in detailed study reaches

2.5.3.4 Channel Slope

A critical control on hydraulic forces in any channel is the channel slope. The channel slopes of washes in the study area are generally steep. Slopes are highest in the mountainous areas and decrease in the downstream direction and with increasing drainage area. Plots of the longitudinal profiles of each of the detailed study reaches were developed and examined for their shape and to look for distinct changes in slope along those reaches. Plots for all reaches are provided in Appendix D.

In general, the longitudinal profile plots show reaches with nearly constant slopes. Figure 41 shows an example from Cave Creek. Note how the slope is very similar along nearly the entire nine mile reach.

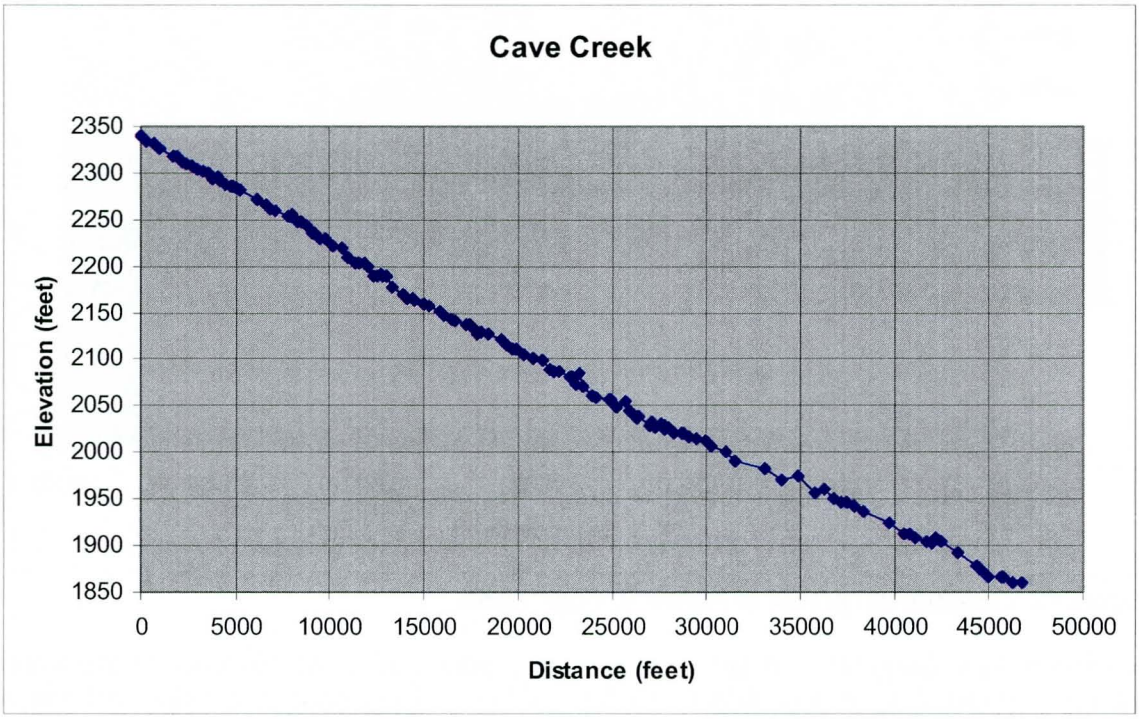

Figure 41 Longitudinal profile of Cave Creek

Another common pattern is a concave shape with dramatically increasing slope as the wash enters the mountainous uplands. Figure 42 shows the profile of Willow Springs Wash from Cave Creek up to its headwaters. Note the rapid increase in slope above about 2550 feet.

A few reaches showed interesting changes in slope along their length. Note in Figure 42 a second change in slope near 2200 feet elevation on Willow Springs Wash. This occurs immediately downstream of an area of channel dominated by caliche in the channel bed. The profile suggests that the channel would like to be flatter but the resistant caliche is preventing the wash from lowering its bed, or at least, it is slowing the rate of incision.

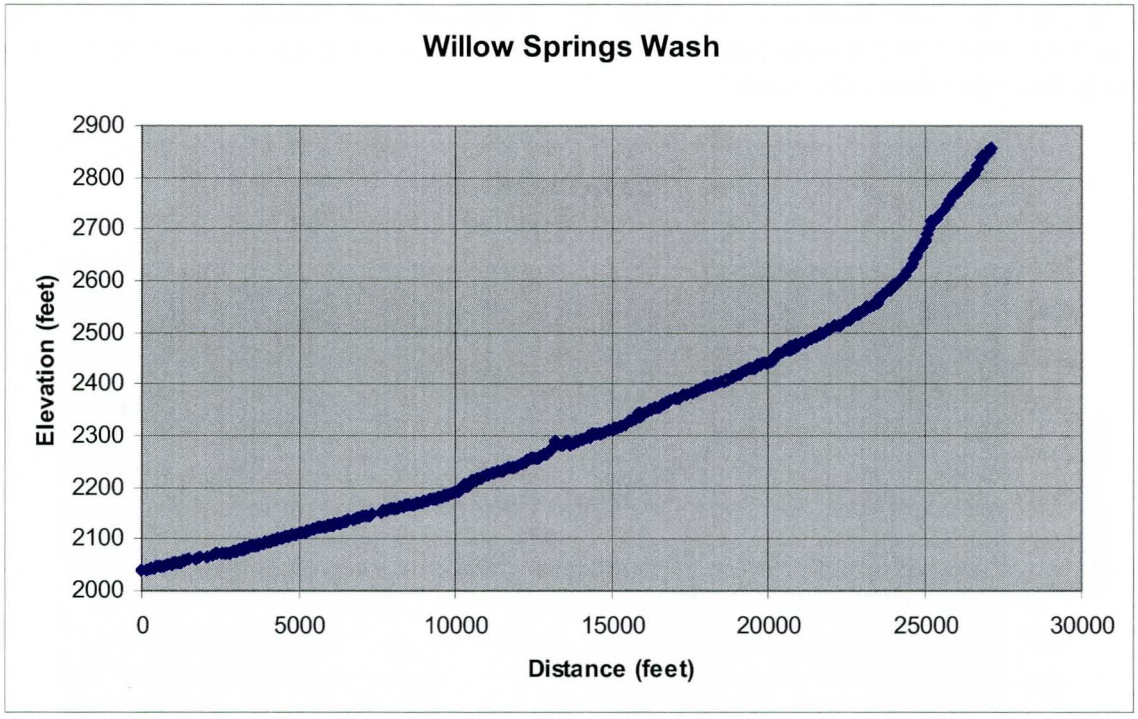

Figure 42 Longitudinal profile of Willow Springs Wash

A second, less dramatic change occurs near elevation 2075. At this location the wash passes a bedrock knob and drops into Cave Creek. The channel is wider and has a flatter slope. Figure 43 shows a view of the caliche controlled reach. Figure 44 shows a view of the flatter sloped reach just upstream of Cave Creek. Note the inset grassy floodplain area contrasted with the almost complete lack of any sediment in the caliche reach upstream.

Figure 43 View of Willow Springs Wash in caliche controlled reach. (10-25-2006-539.jpg). View upstream.

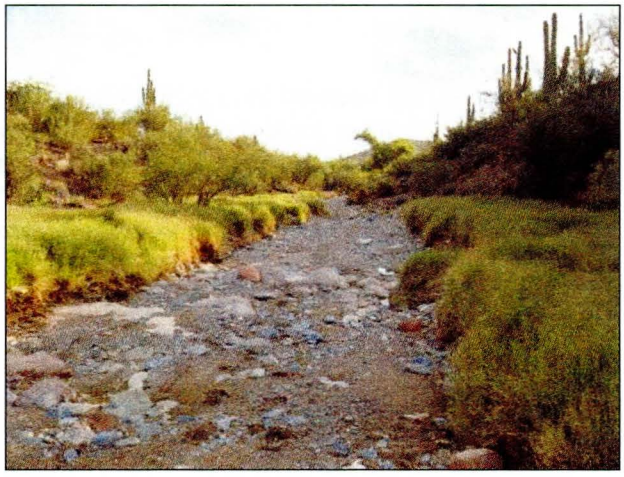

Figure 44 View downstream in Willow Springs Wash in flatter slope reach just upstream of Cave Creek. (10-25-2006-547.jpg). View downstream.

Another example is seen in Figure 45 which shows the longitudinal profile for Ocotillo Wash Tributary 1. Note the change in slope near 2325 feet elevation. The change in slope is probably due to the sudden increase in drainage area resulting from the inflow of Tributary 1A as also shown on the plot.

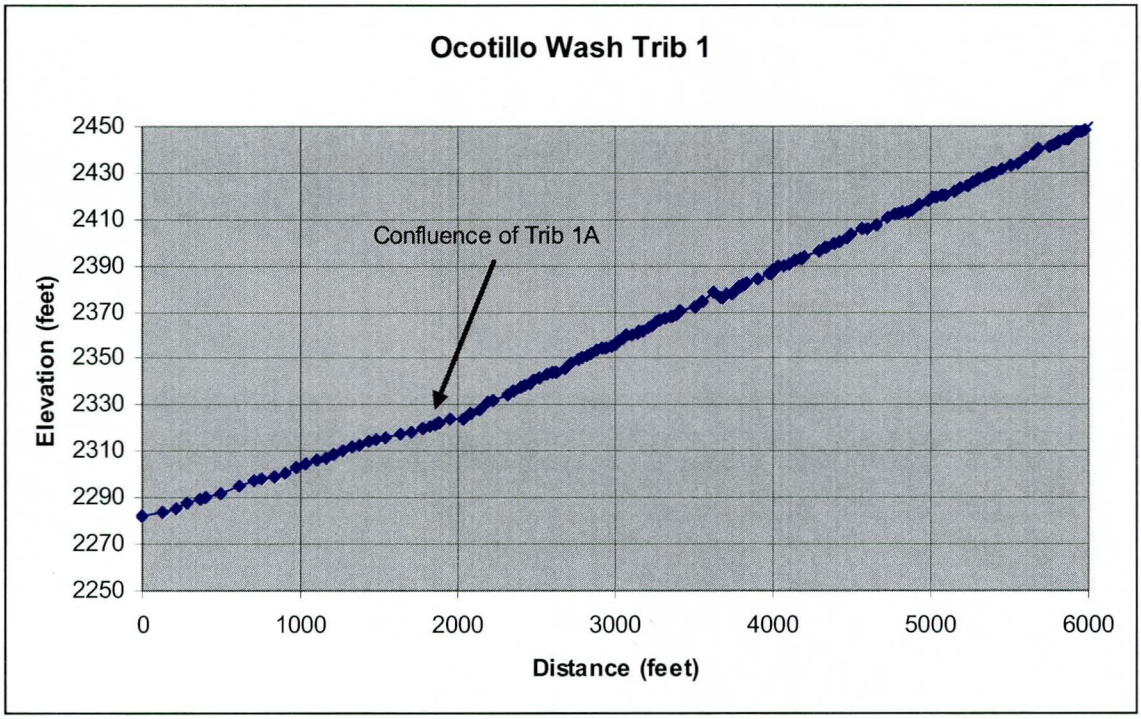

Figure 45 Longitudinal profile of Ocotillo Wash Tributary 1

Figure 46 shows the distribution of existing channel slope for the detailed study reaches from the equilibrium slope analysis. Note that the headwater tributaries have the highest slopes compared to the lower reaches and to Cave Creek.

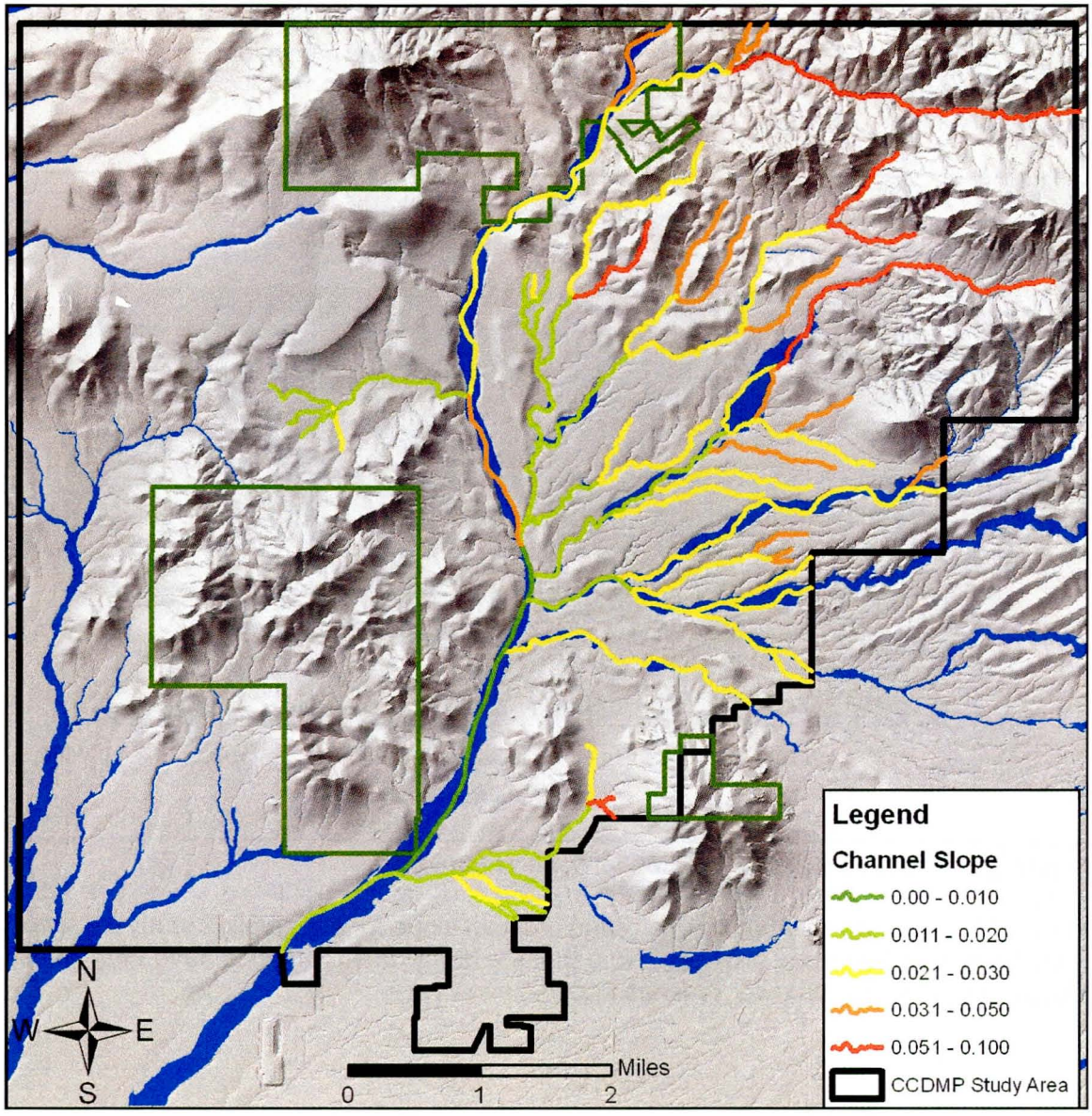

Figure 46 Channel slope for detailed study reaches

2.5.4 Avulsion Potential

Evidence of channel avulsions was observed and noted in the field. Most of the locations of avulsion potential are located within the existing floodway or floodplains. An abrupt change in the location of the low-flow channel may occur within the existing floodplain and not significantly alter the spatial extent or depth of flood flows within the reach. However, if the low-flow channel relocates from one side of the valley floor to the other, a bank that presently has a stable appearance may begin to experience direct lateral erosion as a result of the change in flow distribution across the cross-section. Similarly, the former cutbank may begin to "heal" as flood waters no longer remove eroded hillslope materials and bank failures from its toe.

The potential for, and historical observation of, low-flow channel movements between higher, older terraces is an important mechanism of the fluvial system behavior in the CCDMP study area, especially in the wider floodplain reaches along Rowe Wash, lower

Ocotillo Wash, portions of Galloway Wash, and lower Cave Creek. Figure 47 shows an example of a reach of channel on lower Cave Creek that had a noticeably divided low-flow channel in 1953. By 2004 the eastern branch is largely obscured in the overbank of the modern channel. Also note the movement of the western split in 1953 to toward the center of the floodplain area over that same period.

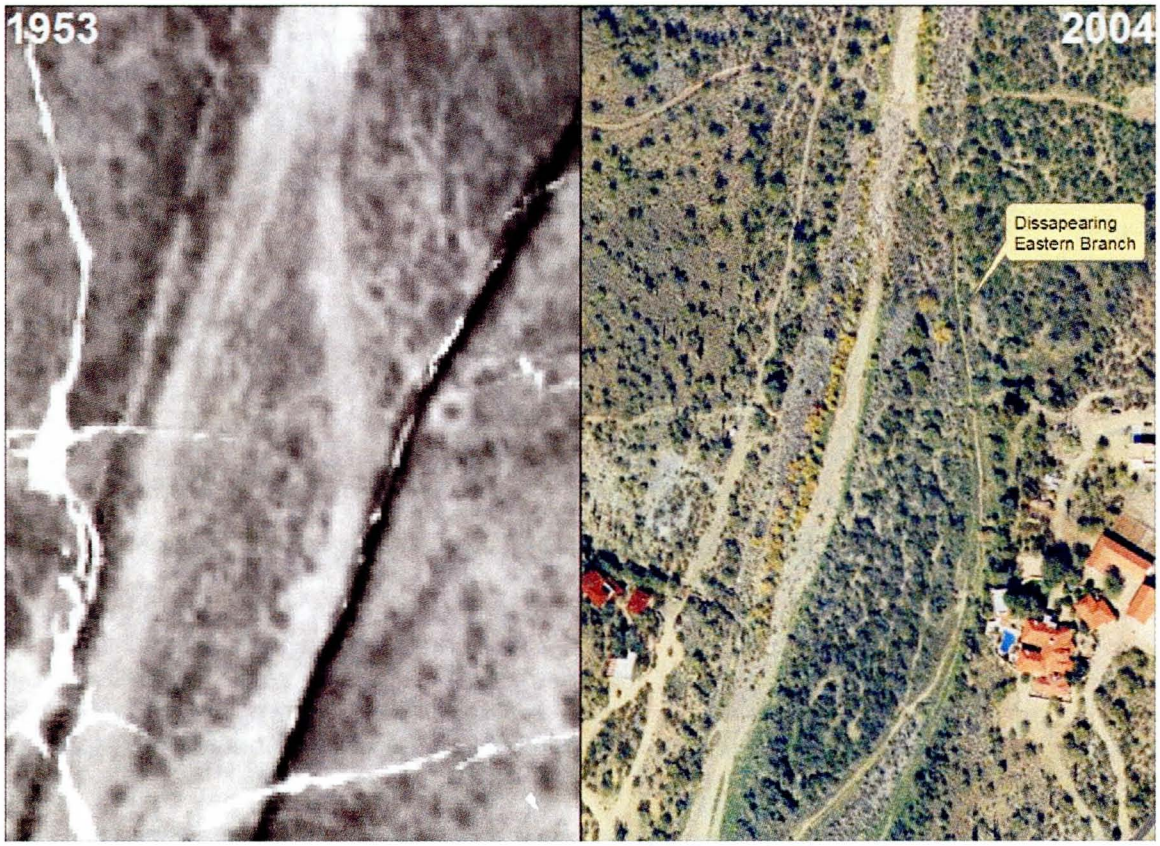

Figure 47 Example of healing avulsion channel on lower Cave Creek

2.6 Historical Lateral Stability

Historical documentation of past channel movement or changes in channel pattern is the best method for establishing the scale and risk of future channel change. As suggested in the discussion above, most of the channel changes observed in the historical photography comparison indicate that channel movements have been limited to areas between the higher, older geologic terraces. While evidence of historic bank erosion is visible in the field, the magnitude of the changes to terrace banks is not large enough to be detected in the aerial photograph comparison. Additional discussion of the historical comparisons and their use in the erosion hazard assessment is found in Section 4.2.3.4

2.7 Sedimentation at Existing Structures

Existing structures in the study area were examined for sedimentation issues and impacts. The primary type of drainage structures within the study area are roadway drainage crossings. The majority of the drainage crossings are at-grade (dip) crossings. Some of these are paved, while many others are gravel. Most of the at-grade crossings were found to have little negative sedimentation impact. At a few locations some minor localized deposition or scour was observed. For example, as shown in Figure 48 and

Figure 49, Galloway Wash exhibits a moderate drop in grade downstream of its paved at-grade crossings at Spur Cross and School House Roads. Though the abrupt drop-offs create an additional hazard to motorists, the disruption of sediment transport appears to be limited to the reach immediately upstream and downstream of the roadway crossings.

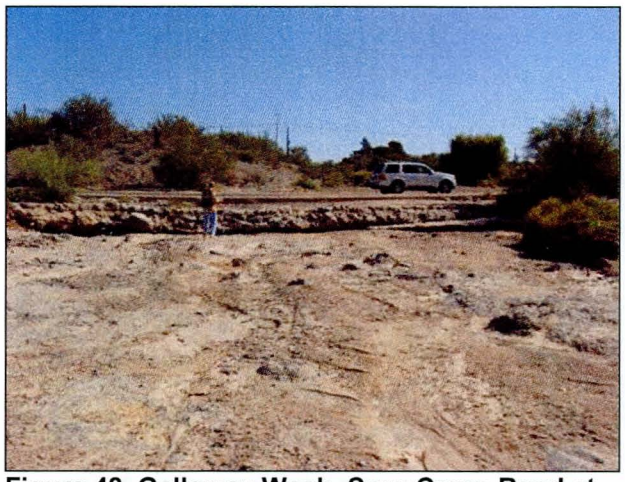

Figure 48 Galloway Wash, Spur Cross Road at-grade crossing.
(10-31-2006-860.jpg). View upstream.

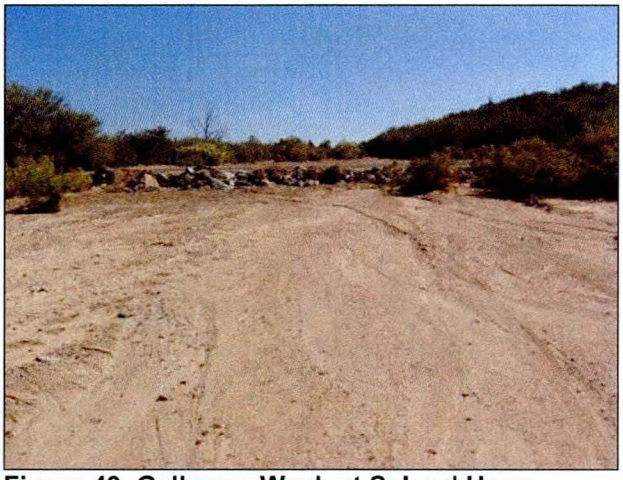

Figure 49 Galloway Wash at School House Road crossing.
(10-31-2006-872.jpg). View upstream.

Figure 50 and Figure 51 show examples of net deposition, also called aggradation, at two different roadway crossings. On Ocotillo Wash, aggradation is occurring at an at-grade crossing as can be seen from the piles of dirt removed from the roadway by maintenance crews. The culverts under Cave Creek Road shown in Figure 51 are nearly completely clogged with granitic sediments from one of the tributaries to Mormon Girl Wash.

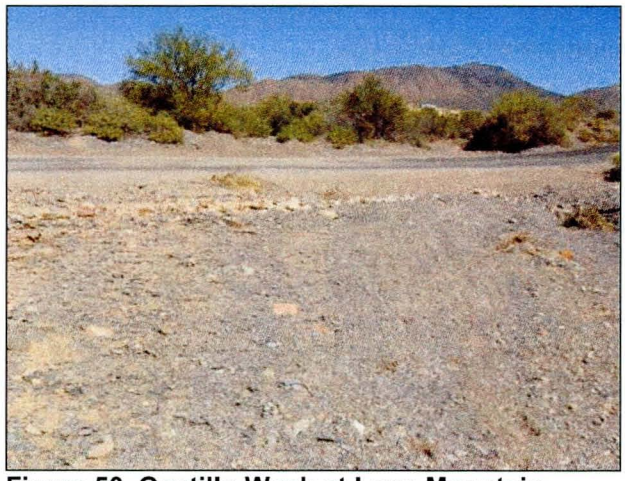

Figure 50 Ocotillo Wash at Lone Mountain Road.
(10-19-2006-273.jpg). View downstream.

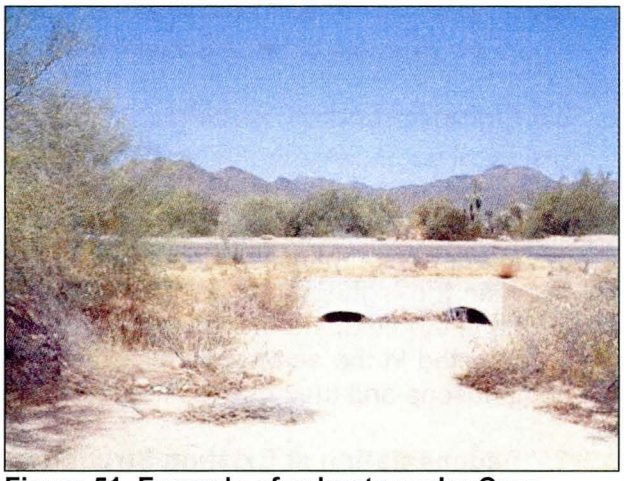

Figure 51 Example of culverts under Cave Creek Road north of Carefree Hwy almost completely clogged with sediment.
(90104-012.jpg) View downstream.

2.8 Stream Responses to Development

Urbanization often causes changes in the natural hydrology of a watershed that result in erosive channel changes such as increased flooding, depletion of sediment supply, and/or long-term degradation. New buildings and roads increase the amount of impervious surfaces which generate runoff more frequently in response to smaller rainfall events that would otherwise infiltrate. During larger rainfall events, the additional impervious area also increases the magnitude of peak discharges and total runoff volume. The result is that more energy is applied to the fluvial system more often.

More energy means more work is performed in the channel increasing the amount of sediment transport. Impervious surfaces also reduce the available sediment supply for delivery to the washes. The combination of reduced sediment supply and more sediment transport potential means an increase in the likelihood and magnitude of erosion within the wash corridors. When the wash is unable to mine sediment from its channel bed, it will attempt to get it from its banks.

The CCDMP area is developing, predominantly with large lot residential style development. Most of the area is being developed without retention. Therefore, the typical urbanization effects on the watershed hydrology and watercourse sediment balance is also expected.

Figure 52 shows the existing land use distribution in the study area. Note that the urbanization to date has been limited to the middle portion of the area and in the adjacent municipalities, with the highest concentration within the Mormon Girl Wash system. Given the spatial distribution of the existing urbanized areas, the potential impacts of urbanization are expected to be limited to the lower reaches of the eastern tributaries to Cave Creek so far. Lower Willow Springs Wash, Ocotillo Wash, Rowe Wash, Galloway Wash, and Andora Hills Wash have the largest areas of existing development. Much of the main stem of Cave Creek lies outside the study area within the Tonto National Forest and is not subject to development.

Much of the undeveloped land shown in light brown in Figure 52 is potentially subject to development in the future. However, much of that area has steep hillslopes (> 15% slope), thus is a highly unlikely candidate for dense development. Additionally, these steep areas are dominated by bedrock presently resulting in minimal infiltration and high runoff rates. Nevertheless, as the area develops, urbanization is expected to increase the magnitude and frequency of flooding and increase erosion potential in the future.

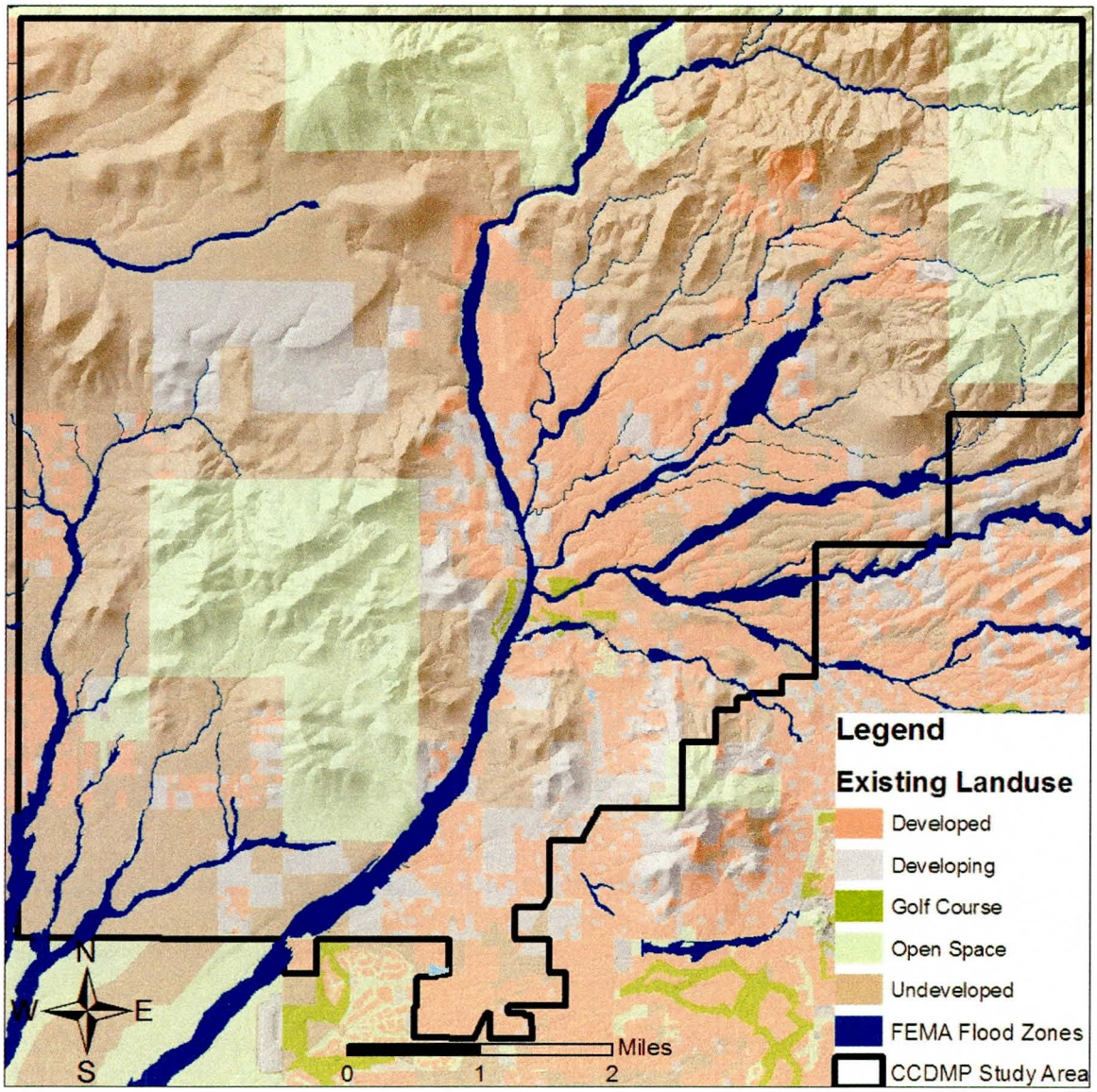

Figure 52 Existing land use in the CCDMP area

2.8.1 Floodplain Encroachments

Floodplain encroachment displaces floodwater into the channel, resulting in higher channel velocities and increased channel bank and bed erosion. Figure 53 shows an example of a channel encroachment by a golf course on lower Galloway Wash. Notice the wide bright area in the left overbank with a large channel bar and overbank channel in the 1953 photo that is now part of the green, bunkers, and fairway of a hole on the Rancho Manana Golf Course. The channel is now a very narrow channel paralleled by large trees as compared to the wide shallow channel seen in the 1953 aerial photo. Figure 54 shows a view from the ground of the tree-lined channel today.

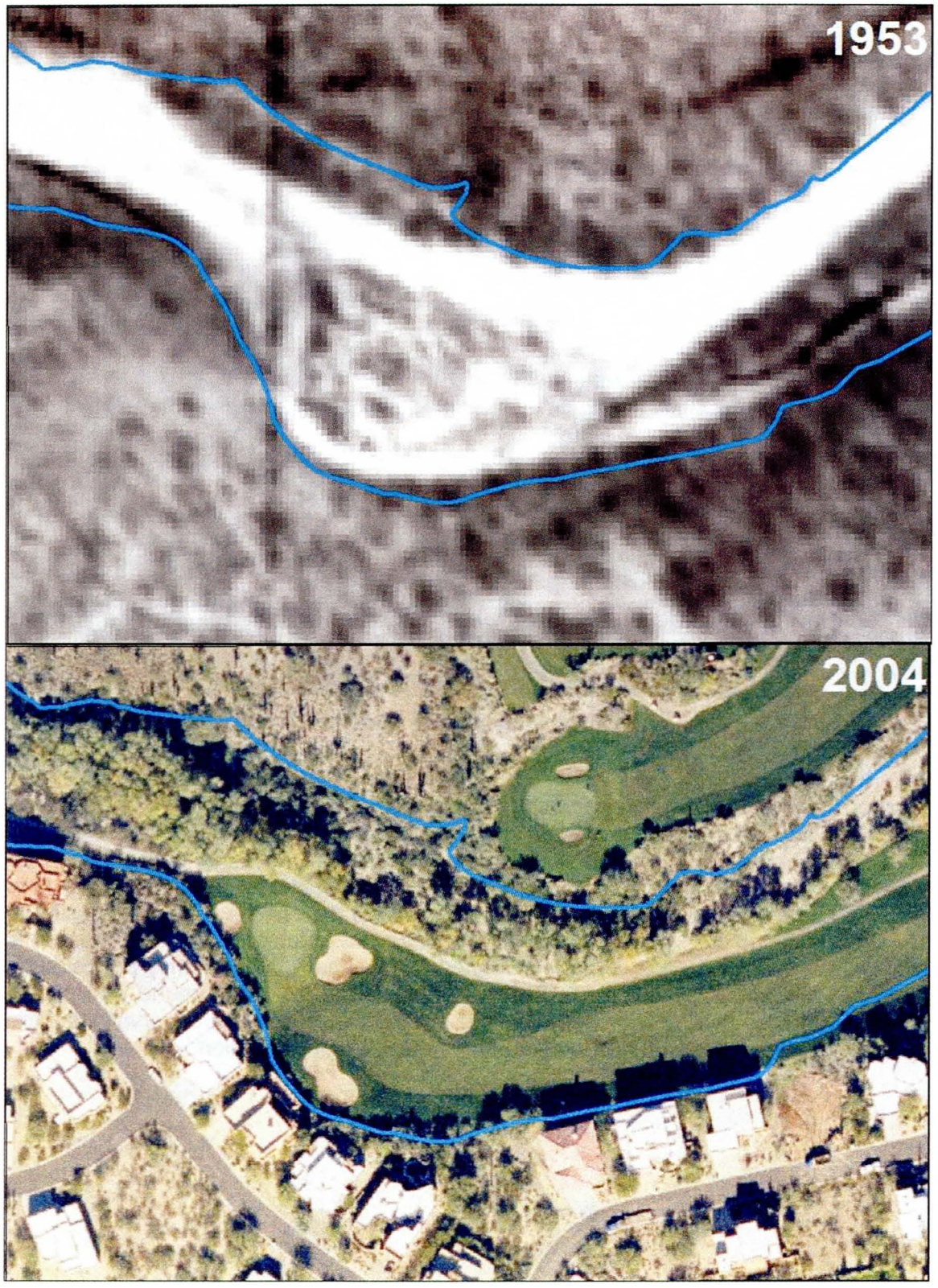

Figure 53 Example of encroachment on channel of lower Galloway Wash. Flow is from left to right.

Figure 54 View upstream of Galloway Wash through Rancho Manana Golf Course.

2.8.2 Roadway Drainage Crossings

Another type of floodplain encroachment and channel impact occurs at roadway crossings. Most of the wash crossings in the study area are at-grade crossings. Section 2.7 presents some examples of sedimentation impacts in the study area. Figure 55 shows a location of a large culvert crossing of Cave Creek Road over Andora Hills Wash. Note the split in the main channel upstream of the current roadway crossing in the 1953 aerial photo. Today that area is covered by structures and the channel is reduced to the northern split. The encroached channel bank is apparently protected by a partially buried gabion mattress. Figure 56 and Figure 57 show ground view of this bank and an area of exposed mattress. It is not clear from the field observations if the mattress has been exposed due to channel or hillslope-related erosion.

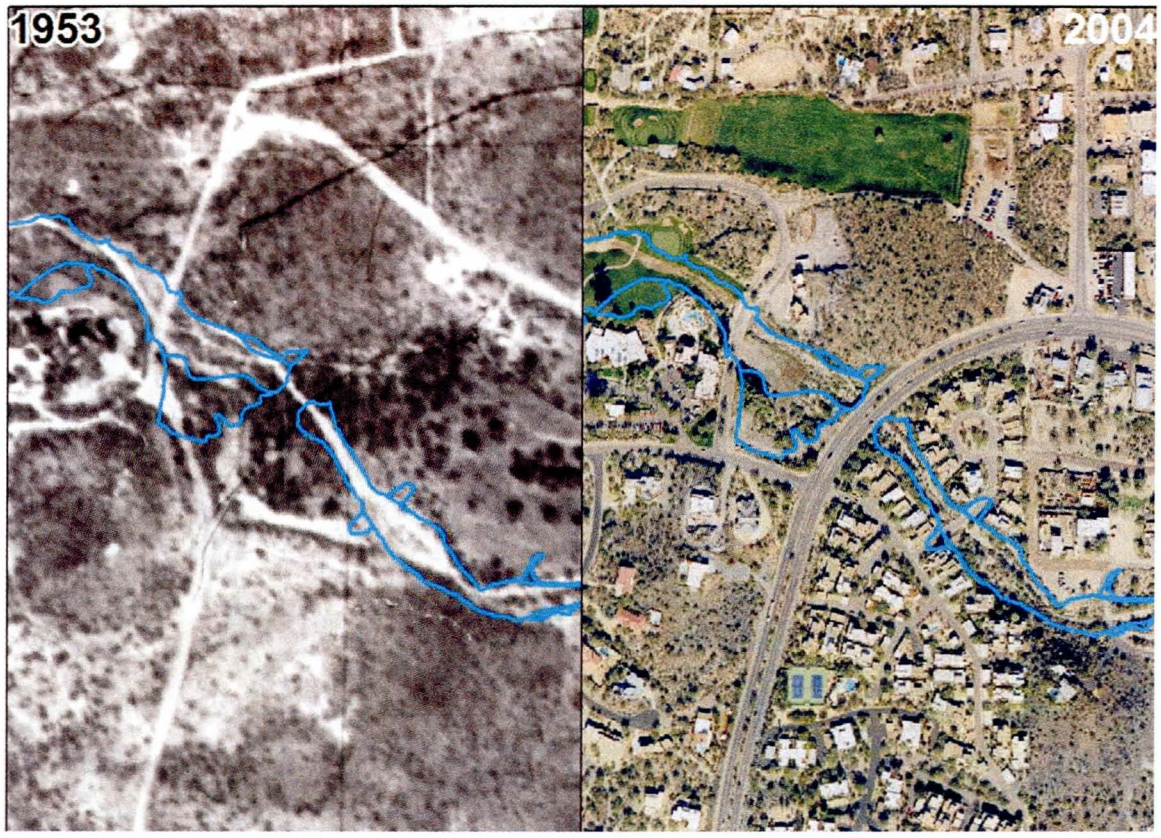

Figure 55 Channel split encroachment on Andora Hills Wash.

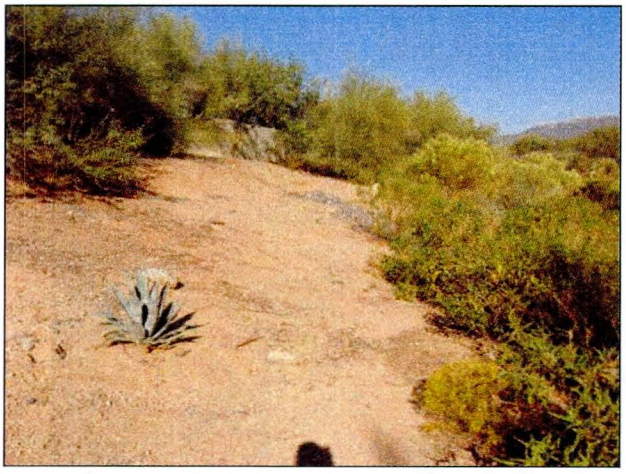

Figure 56 Andora Hills Wash upstream of Cave Creek Road.
(10-31-2006-801.jpg) View downstream.

Figure 57 Close up of exposed gabion mattress on left bank of Andora Hills Wash upstream of Cave Creek Road.
(10-31-2006-802.jpg) View upstream.

2.8.3 Manmade Channel Disturbance

In addition to channel encroachments and roadway drainage crossings, another type of manmade disturbance of the natural channels observed in the study area is the redirection or obscuring of those channels. Channel redirection can lead not only to

changes in the areas flooded during runoff events, but also the changes in channel slope can cause localized deposition and/or scour of the adjacent reaches. When channels are obscured by development, new construction may fail to identify the hazards associated with flooding and sedimentation in the area. The Mormon Girl Wash Tributary system contains several examples where development has re-directed flow and structures have been build across previous drainages. Figure 58 and Figure 59 show examples where development in the study area has obscured and/or redirected the original drainage patterns.

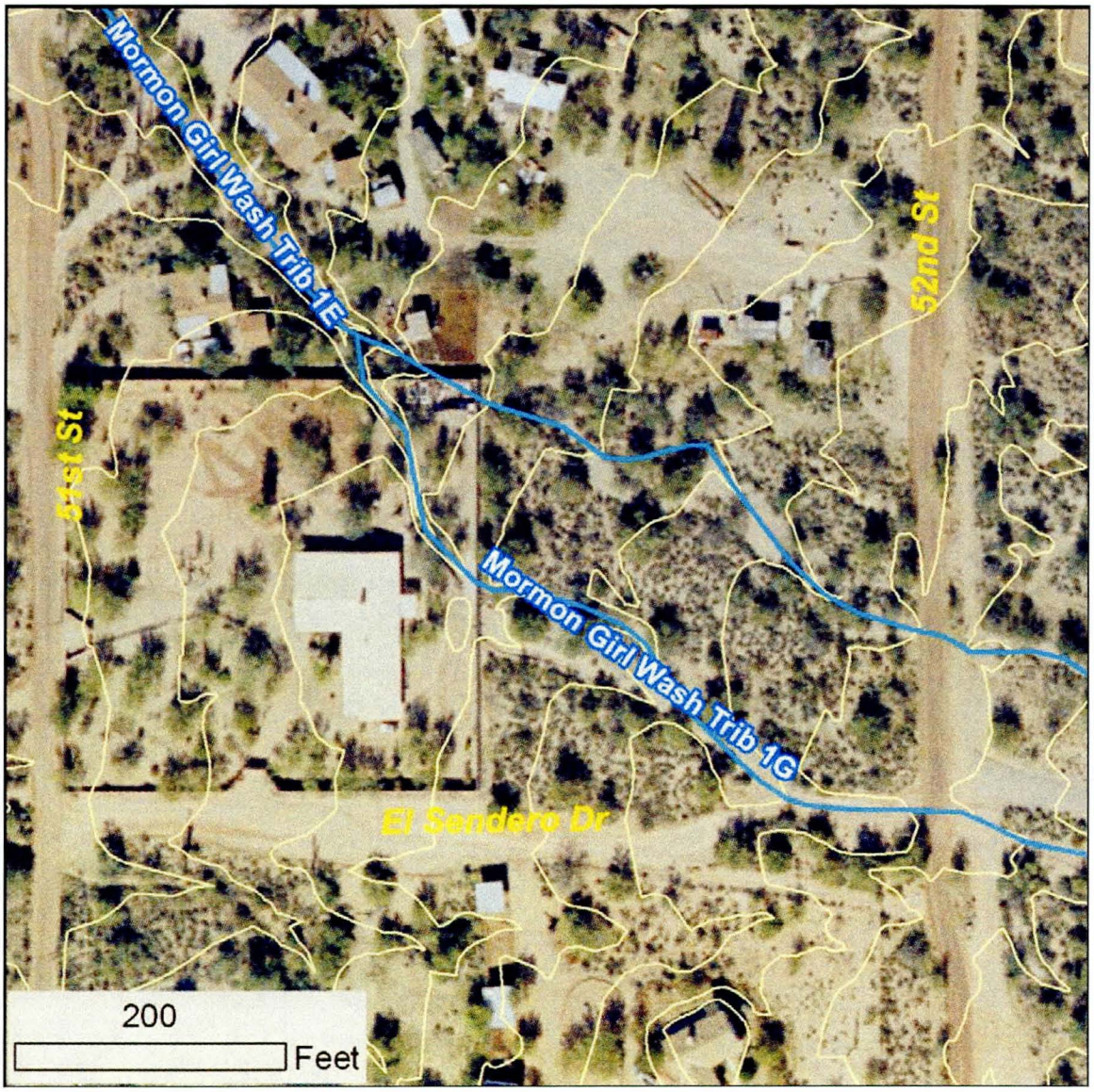

Figure 58 Example of human-caused flow re-direction. Note the block wall that impacts the flow paths.

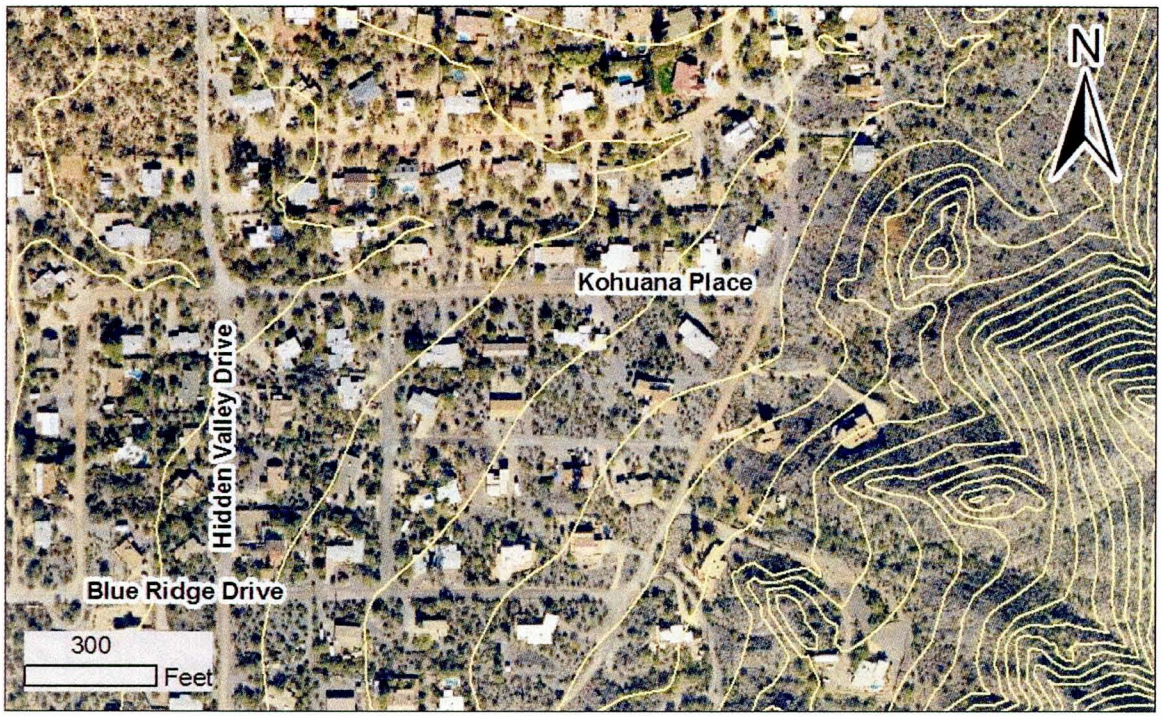

Figure 59 Obscured drainage from Black Mountain hillslopes

2.9 Evidence of Long-Term Aggradation or Degradation

The drainages in the CCDMP study area are all predominantly degradational systems. The presence of well-developed Quaternary terraces along the alluvial reaches attest to the downcutting of these channels throughout the Holocene epoch. Bedrock and/or caliche outcrops are common in many channels throughout the study area indicative of the history of channel incision.

The south-eastern portion of the study area is drained by Mormon Girl Wash. The main channel divides into numerous distributary channels beginning near Terra Vita Way about one mile east of Cave Creek Road. This area represents an old alluvial fan which has been aggrading onto the piedmont south of Black Mountain. The more recent geomorphic history of the area suggests an area of relatively stable distributary channels in near equilibrium with their sediment supply (Hjalmarson & Kemna, 1991; Hjalmarson, 1994).

Localized aggradational reaches are found in areas with very wide geologic floodplains and where human activity has raised the reach base level locally or abruptly widened the channel. Roadway crossings are a typical setting where base level has been fixed causing localized deposition upstream. At-grade crossings often result in some local channel widening due to the grading of the roadway approaches. Some examples of local aggradation at structures were presented in Section 2.7.

In addition, aggradation has occurred upstream of several stock tanks located in the study area. The majority of the stock tanks in the area are located on the Tributary 2 system of Galloway Wash. A few others are located in the Adobe ADMP portion of the study area. Figure 60 shows the locations of the stock tanks.

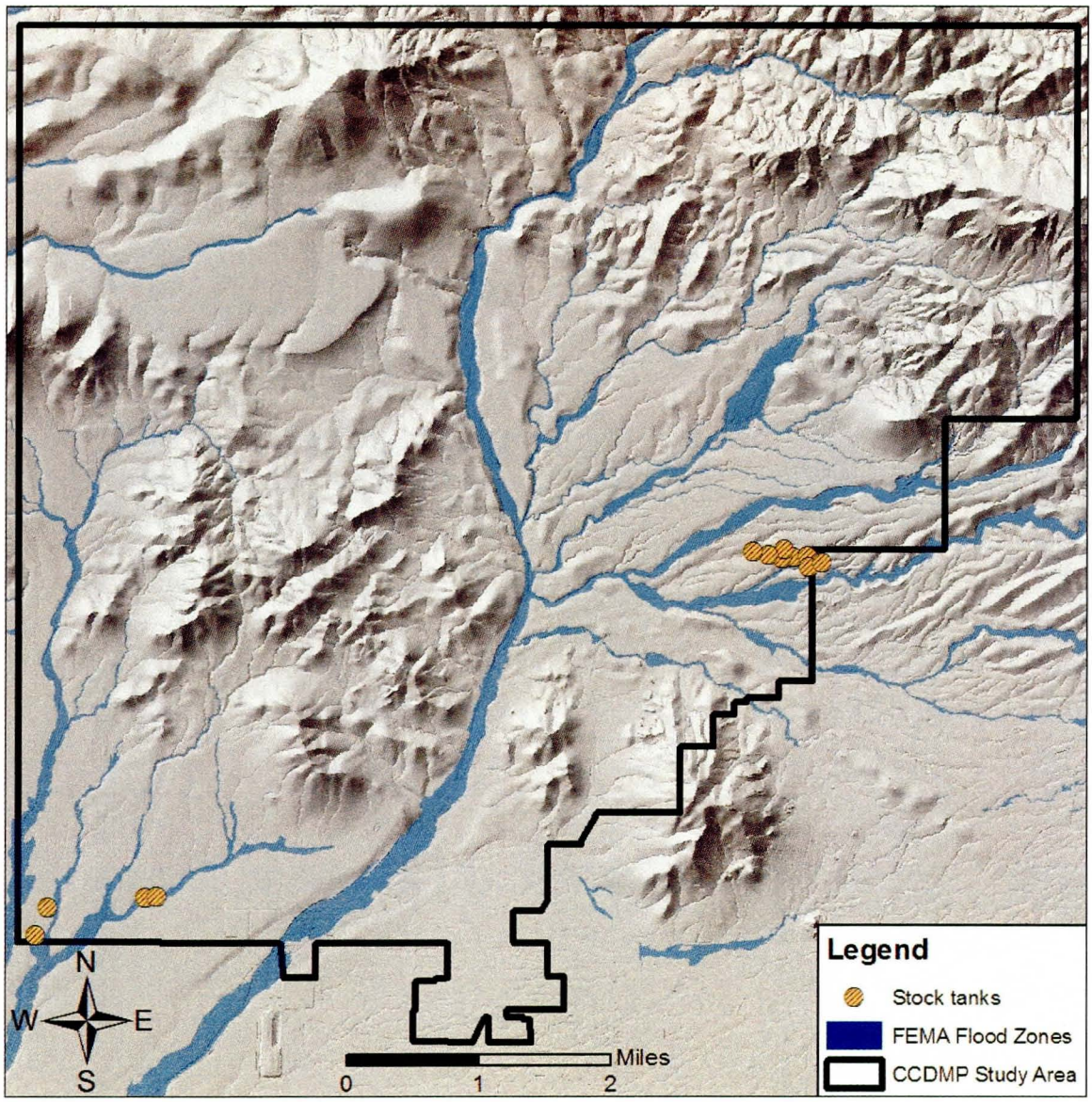

Figure 60 Stock tanks in the CCDMP area

More recent human caused degradation was also observed in the study area. The lower reach of Cave Creek appears to have experienced recent channel bed lowering probably due to sand and gravel mining activity in the channel upstream and downstream of Carefree Highway (JEF, 2000). Figure 61 and Figure 62 show ground photos of an old gravel mining area in the left overbank of Cave Creek just upstream of Carefree Highway. Water and fine sediments are currently being captured from tributaries entering from the east.

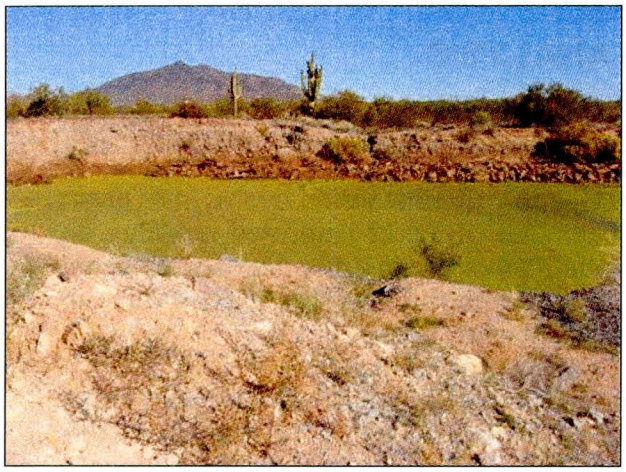

Figure 61 View of old gravel pit in left overbank of Cave Creek.
(11-08-2006-1350.jpg) View upstream.

Figure 62 View across old gravel mining area in lower Cave Creek.
(11-08-2006-1352.jpg) View downstream.

2.10 Summary

Existing published data and field observations were evaluated to assess the existing conditions of the watercourses in the CCDMP study area. The evaluation reveals a predominantly degrading fluvial system where the washes are confined between steep bedrock slopes or old alluvial terraces. Flooding and erosion are generally limited to the geologic floodplain between these more resistant surfaces. Urbanization has had some adverse affects on sediment transport continuity due to channel encroachments and roadway drainage crossings. In addition, drainage patterns have been locally obscured or redirected. Long-term effects of urbanization are expected to increase the magnitude and frequency of storm water runoff and decrease sediment delivery to the watercourses. However, current sediment supply is predominantly coming from the channel bed and banks. Therefore, the long-term result is an increased potential for lateral and vertical erosion of channels in the study area and some increase in stream instability. On the other hand, many reaches have channel beds and banks that are composed of relatively resistant bedrock and/or caliche that will limit the rate and extent of lateral and vertical erosion in the future.

Areas at risk from lateral erosion are specifically identified and discussed in SECTION 4.

SECTION 3 EQUILIBRIUM SLOPE ANALYSIS

3.1 Introduction

Equilibrium slope is defined as the slope at which the channel bed is neither aggrading nor degrading. It could be interpreted as the slope the channel would evolve into, given continuous flows and sediment input for an extended period of time, and provides an idea as to what the long-term channel slope could become. In other words, over time, the natural trend is for the channel to transform its slope from the existing towards the equilibrium slope as a response to flow and sediment influx events.

The equilibrium slope calculations were performed using the procedures outlined in the Arizona Department of Water Resources (ADWR) manual (1985). According to this approach, the equilibrium slope is defined as the slope which causes the channel's sediment transport capacity to equal the incoming sediment supply. If the slope is too steep, flow velocities will be high and net erosion will occur. If the slope is too flat, flow velocities will be low and net deposition will occur. The equilibrium slope is the slope that the undisturbed, natural channel will tend towards over the long term. While there are philosophical and practical problems with applying equilibrium slope concepts to ephemeral streams with variable channel geometry and high flash flood potential, or streams where the natural hydrology has been altered by urbanization, equilibrium slope equations provide a useful guideline on the expected trend of sedimentation or scour. The method could also be used to provide order-of-magnitude assessment of the likelihood of vertical channel adjustments.

Reach-averaged data required for application of the equilibrium slope equations to the study area were derived from the following sources:

- Topographic data – 2-foot contour data DTM
- Hydrologic data – ratio of 100-year FDS discharge
- Hydraulic data – normal-depth computations

3.2 Hydrology

Most equilibrium slope equations are based on the mean annual flood, the "channel-forming" or "bankfull" discharge. On many perennial alluvial streams, particularly in humid climates, the mean annual flood and the channel-forming and bankfull discharges are nearly equivalent. However, on ephemeral streams where flow events are rare, the channel-forming discharge is often difficult to determine. The ADWR Manual suggests use of the 5- to 10-year flow rate to predict expected slope adjustments in ephemeral watercourses like those in the DMP study area. Based on ratios of the 100-year flow rate in the District's Hydrology Manual (2003), a value of 35% of the 100-year flow was used to compute equilibrium slopes. The 100-year flow rates were taken from the effective FDS for each reach.

3.3 Hydraulics

The hydraulic calculations for all the washes were performed using the normal depth approach. Channel cross-sections were obtained at various locations along the study reaches at approximately 1,000 foot intervals. A triangular irregular network (TIN) surface was generated within ArcGIS using 2-foot contour-interval topographic mapping, with the exception of small, upstream portions of Cottonwood Creek and Ocotillo Wash

where 2-foot topography was not available. Ten-foot contour-interval mapping was used to obtain cross-sections within these reaches (see also Figure 8).

The normal depth calculations were performed at these cross-sections to obtain hydraulic parameters such as velocity and flow depth. Reach-averaged values of these parameters were then obtained for each of the reaches to be used to estimate the sediment transport capacity for the equilibrium analysis.

3.4 Sediment Transport Capacity

The Zeller-Fullerton equation from the ADWR Manual was used to compute sediment transport capacity for all channel reaches. The Zeller-Fullerton Equation is a total bed-material discharge equation, and is formulated as follows:

$$Q_s = 0.0064\, n^{1.77} V^{4.32} G^{0.45} Y_h^{-0.30} D_{50}^{-0.61}$$

Where:
Q_s = sediment discharge rate (cfs)
n = Manning's roughness coefficient, channel
V = mean channel velocity (ft/s)
G = gradation coefficient
Y_h = hydraulic depth, channel (ft)
D_{50} = median bed sediment size (mm)

Hydraulic data required to apply the Zeller-Fullerton equation were obtained from the normal depth hydraulic calculations for each reach. The gradation coefficient and D_{50} were based on the sieve sample and pebble count data collected in the field (Appendix B).

3.5 Equilibrium Slope Analysis

Sediment transport capacity values were used to compute the equilibrium slope for live bed reaches based on the sediment transport continuity approach outlined in the ADWR Manual. Sediment transport capacity was computed for each watercourse having a delineated floodplain.

The equilibrium slope analysis computes the slope at which the sediment transport in the reach of concern matches the sediment inflows into that reach. The equilibrium slope analysis assumes that the there is infinite sediment supply available to be eroded and does not take into account the presence of pivotal hard points (such as grade control structures, roadway crossings, or natural hard points like bedrock outcrops and caliche). However, the equilibrium slope results are used between pivot points to estimate the depth of aggradation or degradation between two points. The long-term slope can be expected to be the same as the equilibrium slope when there is infinite sediment supply. However, in reality, slope adjustments will be influenced by limiting sediment input conditions, such as extensive bedrock outcrops in a watershed. As an example, consider Andora Hills Wash where slope adjustments would be minimal due to the presence of bedrock at several locations. As part of the study, the equilibrium slope calculations were performed for this wash to predict the trend of sedimentation (erosion and deposition) rather than to determine the long-term slope. Lack of sediment supply and the presence of bedrock will control the sedimentation characteristics in such reaches with the tendency of the flow leaning towards erosion.

Pivot points were digitized in GIS and used as starting points from which slope adjustments (based on equilibrium slope computations) were used to compute the depth of aggradation and degradation. Figure 63 shows the locations of bedrock, caliche, and roadway pivot points, most of which were used in the equilibrium slope analysis.

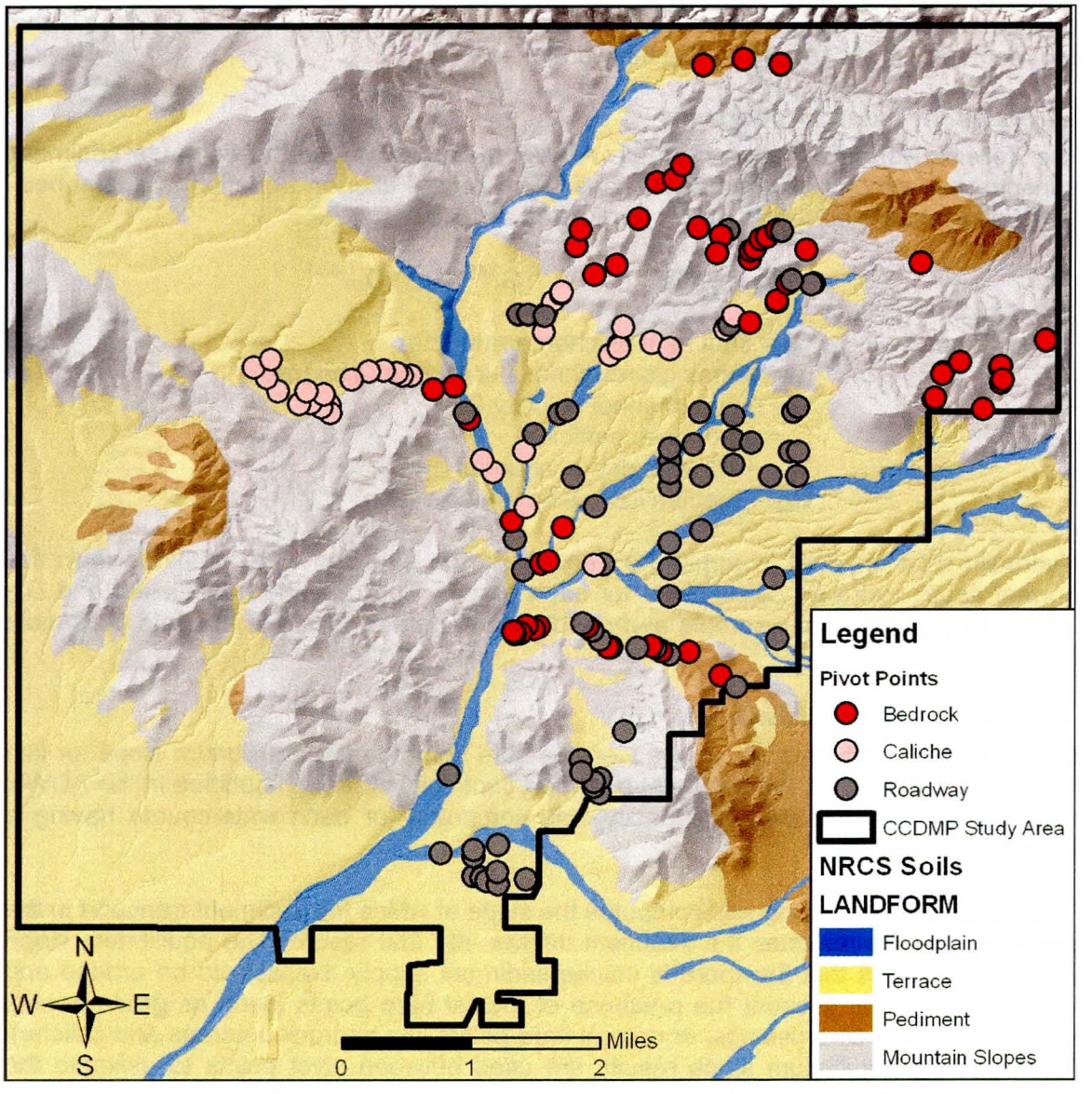

Figure 63 Location of pivot points

The study reaches were subdivided into smaller segments using the pivot points and other factors such flow confluences as guidelines. The equilibrium slope analysis was then performed for each of these subdivided segments. The procedure adopted is briefly outlined as follows:

1. The Zeller-Fullerton equation was used at the upstream-most cross-section of each reach to calculate the sediment transport capacity. Therefore, sediment inflows into each reach were estimated based on the sediment outflow from upstream reaches. The Zeller-Fullerton equation was also utilized to calculate

sediment transport capacity for reaches truncated at the study area boundary. In this instance, a reach cross-section was taken at the boundary, and used as the upper-most cross-section. No hillslope processes or inputs were considered as part of this study.

2. An initial estimate of the equilibrium slope was made. The existing slope was typically used to provide a starting condition.

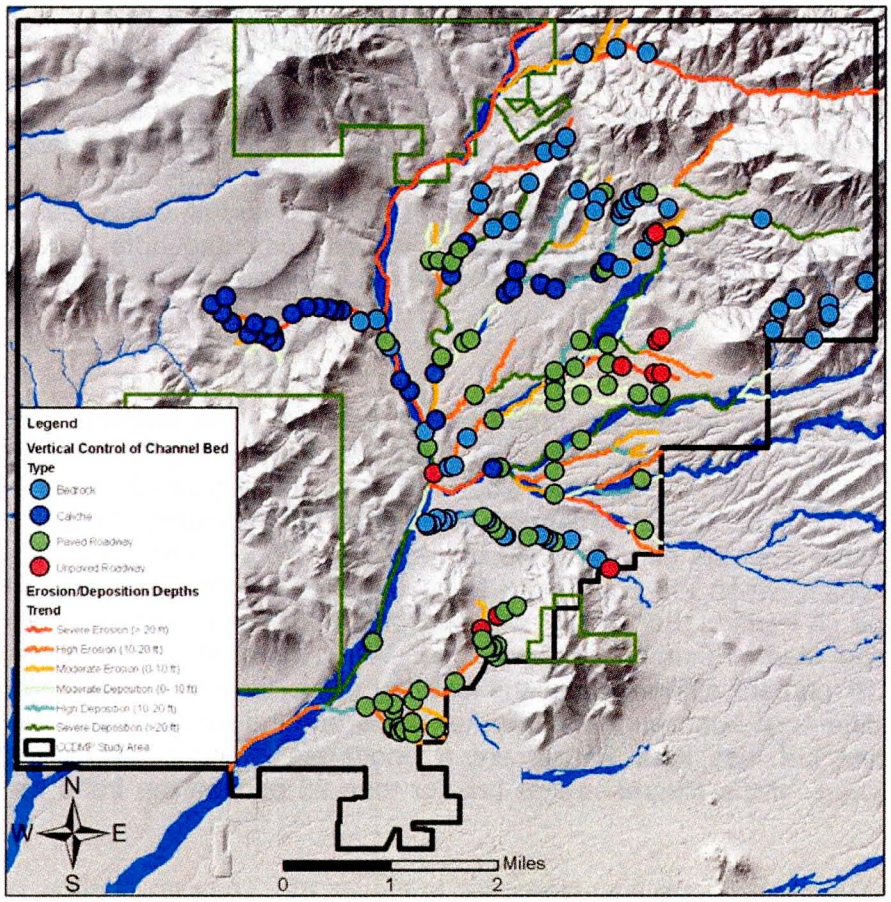

Figure 64 Depth of aggradation and degradation

3. Using the equilibrium slope estimate (which is the initial slope for first iteration), the long-term sediment transport capacity was obtained. The estimated equilibrium slope was applied to all cross-sections in the reach segment and hydraulics were estimated using normal depth calculations for each cross-section. Reach average values of velocity and flow depth were obtained from the hydraulics calculations. The reach average values were then used to estimate the sediment transport capacity for the entire reach using the Zeller-Fullerton equation.
4. The ADWR approach requires the matching of the long-term sediment transport to the total sediment inflows into the study reach. At this step, a comparison of the computed sediment inflows is made to the sediment transport computed in step 3.
5. Using the comparison as guidance, the equilibrium slope was adjusted. Steps 3 and 4 were repeated in an iteratively until adequate convergence of the

equilibrium slope value was obtained. The equilibrium slope adjustment at each step was performed using a bisection algorithm.

6. The procedure was repeated for all reaches starting upstream and working downstream.

The location of the pivot points are shown in Figure 63. Using these pivot point locations to identify reaches, the depth of aggradation and degradation was computed for all reaches (see Appendix C for results). The depth of aggradation or degradation at a pivot point is based on the difference between exiting and equilibrium slopes bound between an upstream and downstream pivot point, with the difference equal to zero at the downstream pivot point (existing and equilibrium slopes are equal at this location) and at it maximum at the upstream pivot point. Using these estimates, the aggradation and degradation potential was determined and is shown in Figure 64. Aggradation and degradation 0 to 10 ft are labeled "moderate", 10 to 20 ft as "high" and all values above 20 ft as "severe". The aggradation and degradation values computed here provide indications of the long-term sedimentation trends and are not intended for the purpose of design or construction.

3.6 Results

The equilibrium slope analysis results are presented in Table 4. The sedimentation trend was indicated as one of five categories for the purposes of evaluating the direction and relative magnitude of expected change in slope. First the trend was identified as either "erosion", "deposition", or "stable" depending on whether the estimated equilibrium slope is steeper or flatter than the existing slope by more than 10 percent. The trend was identified as "erosion" when the equilibrium slope is more than 10 percent flatter than the existing slope. A trend of "deposition" was assigned when the equilibrium slope is more than 10 percent steeper than the existing slope. When the predicted slope was between less than 10 percent different than the existing slope the trend was called "stable". When the difference between the equilibrium slope and the existing slope was more than 10 percent but less than 25 percent a "moderate" trend of erosion or deposition was assigned. If the difference was greater than 25 percent the trend was identified as "high".

Equilibrium slope analysis results are also presented in Figure 65. The results show no clear geographic pattern. However, many of the observed bedrock reaches are predicted with a trend of erosion, which would support the numerical prediction (sediment transport capacity is greater than long-term sediment supply), but does not reflect the reality that bedrock is limiting erosion in these reaches. For example, some channels have a predicted trend of erosion with widespread observed bedrock outcrops along its entire reach. Elsewhere, long-term predictions of deposition are not well supported by the geologic setting of entrenched channels between higher, older geologic terraces.

The results along with the hydraulic analyses are also presented in Appendix C.

Table 4 Estimated Equilibrium Slopes

XLID	Reach ID	Initial Slope	Equil Slope	Diff	Trend
MGW_TRIB_1C	1	0.0200	0.0160	0.0039	Moderate Erosion
MGW_TRIB_1A	2	0.0566	0.0566	0.0000	Stable
MGW_TRIB_1B_1	3	0.0599	0.0599	0.0000	Stable
MGW_TRIB_1B_2	4	0.0543	0.0812	-0.0269	High Deposition
MGW_TRIB_1	5	0.0201	0.0194	0.0007	Stable
MORMONGIRL1	6	0.0179	0.0108	0.0071	High Erosion
MORMONGIRL2	7	0.0142	0.0137	0.0005	Stable
MGW_TRIB_1D	8	0.0221	0.0163	0.0058	High Erosion
MORMONGIRL3	9	0.0149	0.0118	0.0031	Moderate Erosion
MGW_TRIB_1F	10	0.0184	0.0184	0.0000	Stable
MGW_TRIB_1E_1	11	0.0185	0.0164	0.0022	Moderate Erosion
MGW_TRIB_1E_2	12	0.0232	0.0217	0.0015	Stable
MGW_TRIB_1G	13	0.0200	0.0156	0.0044	Moderate Erosion
MGW_TRIB_1E_3	14	0.0217	0.0125	0.0092	High Erosion
MORMONGIRL4	15	0.0167	0.0219	-0.0051	High Deposition
GALLOWAY_TRIB_2B	16	0.0387	0.0387	0.0000	Stable
GALLOWAY_TRIB_2A_1	17	0.0485	0.0485	0.0000	Stable
GALLOWAY_TRIB_2A_2	18	0.0297	0.0483	-0.0186	High Deposition
GALLOWAY_TRIB_3	19	0.0354	0.0343	0.0011	Stable
GALLOWAY_TRIB_2	20	0.0225	0.0168	0.0058	High Erosion
NGALLOWAY_TRIB_1	21	0.0252	0.0207	0.0046	Moderate Erosion
NTG1	22	0.0251	0.0311	-0.0059	Moderate Deposition
NTG2	23	0.0219	0.0263	-0.0044	Moderate Deposition
GALLOWAY1	24	0.0203	0.0233	-0.0030	Moderate Deposition
GALLOWAY_TRIB_1	25	0.0211	0.0128	0.0082	High Erosion
GALLOWAY2	26	0.0221	0.0149	0.0072	High Erosion
GALLOWAY3	27	0.0230	0.0188	0.0042	Moderate Erosion
GALLOWAY4	28	0.0168	0.0512	-0.0344	High Deposition
GRAPEVINE	29	0.0298	0.0312	-0.0014	Stable
ROWE1	30	0.0329	0.0372	-0.0042	Moderate Deposition
ROWE2	31	0.0255	0.0324	-0.0069	High Deposition
GALLOWAY5	32	0.0200	0.0114	0.0086	High Erosion
CAVCRK_TRIB_1_2	33	0.0122	0.0074	0.0048	High Erosion
CVCRK_TRIB1B	34	0.0186	0.0186	0.0000	Stable
CAVCRK_TRIB_1_4	35	0.0298	0.0156	0.0142	High Erosion
CVCRK_TRIB1C	36	0.0145	0.0154	-0.0009	Stable
CAVCRK_TRIB_1_3	37	0.0010	0.0260	-0.0250	High Deposition
CVCRK_TRIB1D	38	0.0296	0.0348	-0.0052	Moderate Deposition
CAVCRK_TRIB_1_1	39	0.0161	0.0037	0.0124	High Erosion
CTNCRK_TRIB_2	40	0.0462	0.0454	0.0008	Stable
CTNCRK_TRIB_1	41	0.0357	0.0322	0.0035	Stable

XLID	Reach ID	Initial Slope	Equil Slope	Diff	Trend
CTNCRK_TRIB_3	42	0.0371	0.0335	0.0036	Stable
CTNCRK1	43	0.0514	0.0292	0.0221	High Erosion
CTNCRK2	44	0.0263	0.0252	0.0010	Stable
CAVECRK1	45	0.0375	0.0117	0.0258	High Erosion
CAVECRK2	46	0.0245	0.0120	0.0125	High Erosion
CAVECRK3	47	0.0368	0.0181	0.0187	High Erosion
WSW_TRIB5A	48	0.0250	0.0199	0.0051	Moderate Erosion
WSW_TRIB5_1	49	0.0210	0.0281	-0.0071	High Deposition
WSW_TRIB5_2	50	0.0152	0.0110	0.0042	High Erosion
WSW1	51	0.0711	0.0681	0.0030	Stable
FLMSPRNGS	52	0.0717	0.1311	-0.0594	High Deposition
WSW2	53	0.0279	0.0319	-0.0040	Moderate Deposition
WSW_TRIB4	54	0.0403	0.0369	0.0034	Stable
WSW3	55	0.0237	0.0264	-0.0026	Moderate Deposition
WSW_TRIB2_1	56	0.0362	0.0399	-0.0037	Moderate Deposition
WSW_TRIB2A	57	0.0339	0.0327	0.0012	Stable
WSW_TRIB2_2	58	0.0210	0.0288	-0.0078	High Deposition
WSW4	59	0.0170	0.0201	-0.0031	Moderate Deposition
WSW_TRIB1_1	60	0.0289	0.0104	0.0185	High Erosion
WSW_TRIB1A	61	0.0520	0.0881	-0.0360	High Deposition
WSW_TRIB1_2_1	62	0.0171	0.0421	-0.0250	High Deposition
WSW_TRIB_6A	63	0.0220	0.0171	0.0048	Moderate Erosion
WSW_TRIB_6_1	64	0.0129	0.0147	-0.0018	Moderate Deposition
WSW_TRIB_6_2	65	0.0142	0.0146	-0.0004	Stable
WSW_TRIB_6B	66	0.0197	0.0233	-0.0036	Moderate Deposition
WSW_TRIB_6_4	67	0.0101	0.0122	-0.0021	Moderate Deposition
WSW_TRIB_6C	68	0.0200	0.0221	-0.0022	Moderate Deposition
WSW_TRIB_6_3	69	0.0151	0.0060	0.0091	High Erosion
WSW_TRIB1_2_2	70	0.0103	0.0245	-0.0142	High Deposition
WSW5	71	0.0141	0.0136	0.0005	Stable
WSW6	72	0.0124	0.0032	0.0092	High Erosion
CAVECRK4	73	0.0024	0.0274	-0.0250	High Deposition
OCTLO_TRIB1_1	74	0.0293	0.0269	0.0025	Stable
OCTLO_TRIB1A	75	0.0401	0.0455	-0.0054	Moderate Deposition
OCTLO_TRIB1_2	76	0.0218	0.0435	-0.0218	High Deposition
OCOTILLO1	77	0.0660	0.1009	-0.0349	High Deposition
OCOTILLO2B1	78	0.0314	0.0333	-0.0019	Stable
OCOTILLO2B2	79	0.0228	0.0330	-0.0102	High Deposition
OCOTILLO2A	80	0.0286	0.0528	-0.0242	High Deposition

XLID	Reach ID	Initial Slope	Equil Slope	Diff	Trend
OCOTILLO3	81	0.0187	0.0260	-0.0073	High Deposition
OCTLO_TRIB2	82	0.0374	0.0286	0.0088	Moderate Erosion
OCOTILLO4	83	0.0196	0.0153	0.0043	Moderate Erosion
OCTLO_TRIB3	84	0.0278	0.0294	-0.0017	Stable
OCOTILLO5	85	0.0197	0.0192	0.0005	Stable
OCTLO_TRIB4	86	0.0274	0.0301	-0.0027	Stable
OCOTILLO6	87	0.0185	0.0119	0.0066	High Erosion
CAVECRK5	88	0.0084	0.0048	0.0036	High Erosion
CAVECRK6	89	0.0088	0.0106	-0.0018	Moderate Deposition
ANDORA	90	0.0206	0.0264	-0.0058	High Deposition
CAVECRK7	91	0.0089	0.0316	-0.0227	High Deposition
CAVECRK8	92	0.0119	0.0087	0.0032	High Erosion

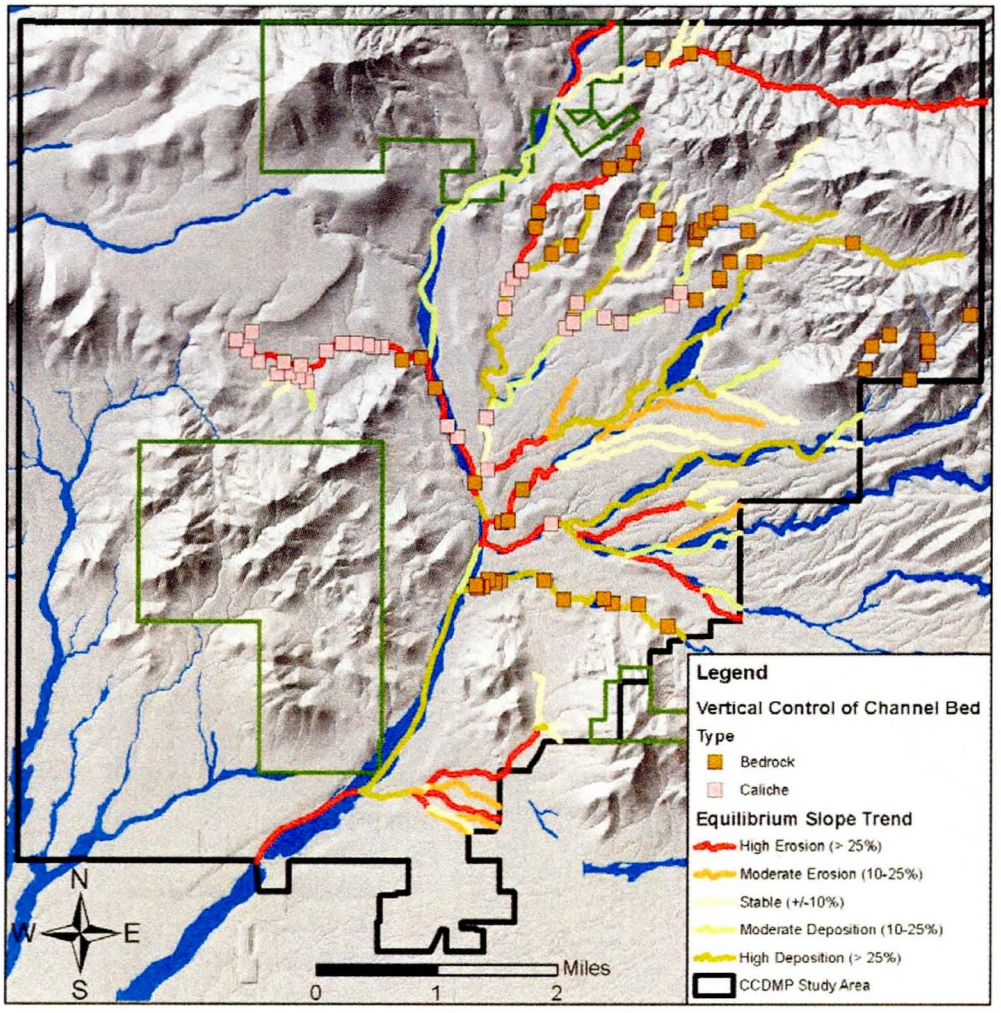

Figure 65 Equilibrium slope trend predictions by reach

SECTION 4 EROSION HAZARD ZONES

4.1 Introduction

A watercourse may erode laterally over an extended period of time, or as a result of a single flood event. In order to assess the potential for, and possible magnitude of, channel lateral migration, JEF documented hydrologic, hydraulic and geologic existing and historic conditions for watercourses within the CCDMP study area that have detailed or approximate floodplain delineations. The study area and assessed watercourses are shown on Figure 66. The reaches in dark blue are reaches with existing FEMA floodplains. The reaches shown in orange are part of the Phase 2 delineations. The reaches shown in purple are additional washes that were evaluated for the DMP. The floodplain reaches for Apache Wash and the other western washes were conducted in previous studies (JEF, 2004; 2001).

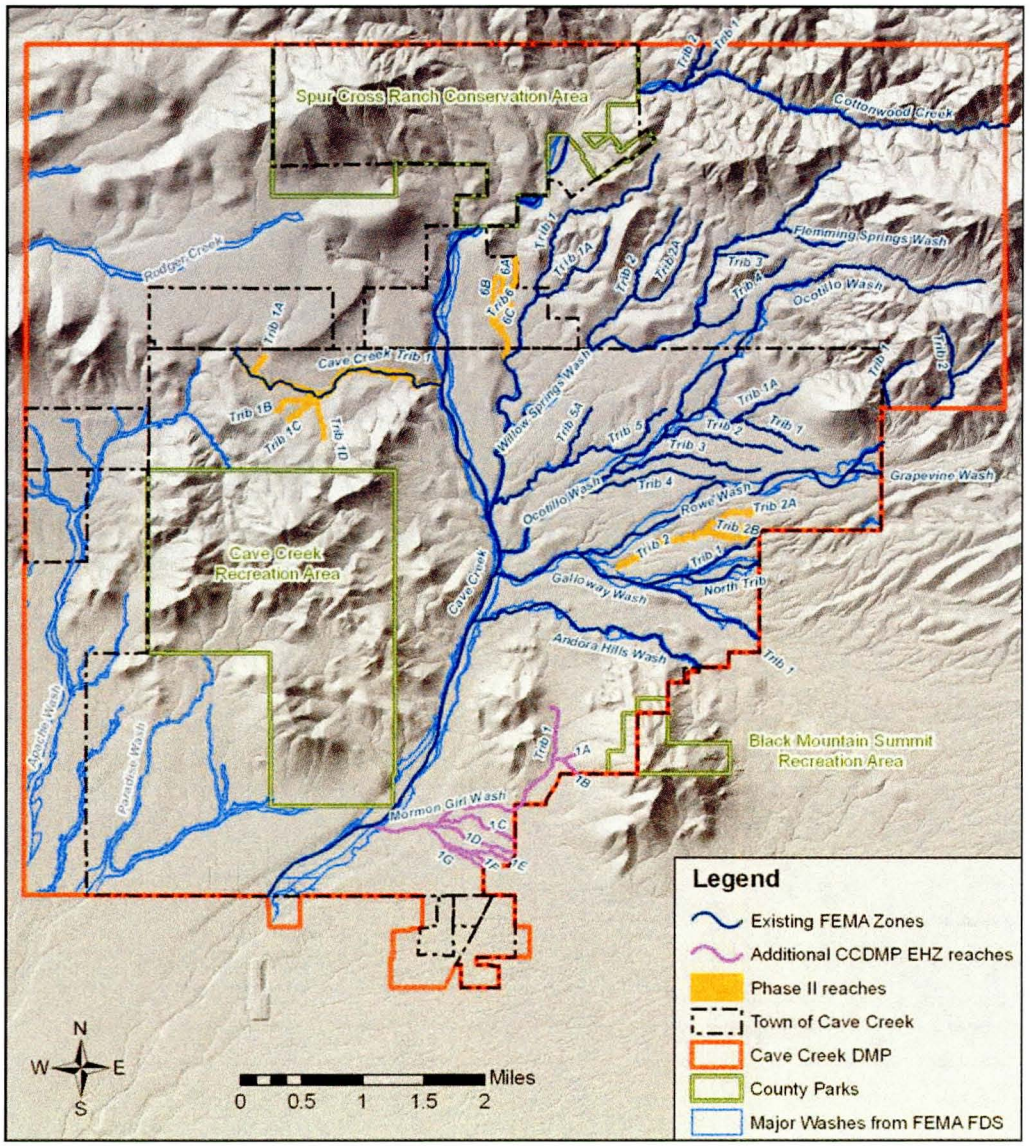

Figure 66 Erosion hazard delineation reaches

The purpose of an erosion hazard zone (EHZ) is to provide the floodplain manager a tool to identify areas that have the potential to be adversely impacted by channel migration and/or changes in channel geometry. The erosion hazard zones delineated for the CCDMP were based on field observations, comparison of historical and recent aerials, SS 5-96 Level 1 and Level 2 calculations, and the equilibrium slope analyses. It is possible that with more detailed, site-specific analysis, the EHZ delineations could be refined in some locations. It should be noted that more detailed, site-specific investigations may still reveal the need for engineered erosion protection measures in order for construction of proposed facilities to be approved by the Town of Cave Creek within a delineated erosion hazard zone.

Approximately 67 miles of watercourse were assessed in order to delineate new erosion hazard zones. The assessed watercourses and associated geomorphic field reconnaissance methodologies are listed in Table 5.

Table 5 Assessed Watercourses and Geomorphic Field Reconnaissance Method

Watercourse Reach	Upstream Limit	Downstream Limit	Length (miles)	Field Recon. Method
Existing FEMA Floodplain Reaches				
Andora Hills Wash	Study Limit	Cave Creek	2.3	Walk
Cave Creek	Tonto NF	Carefree Highway	7.2	Walk
Cottonwood Creek	Study Limit	Cave Creek	3.4	Walk
Cottonwood Creek Tributary 1	Study Limit	Cottonwood Creek	0.6	Walk
Cottonwood Creek Tributary 2	Study Limit	Cottonwood Creek	0.3	Walk
Flemming Springs Wash	FDS Limit	Willow Springs Wash	0.8	Walk
Galloway Wash	Study Limit	Cave Creek	2.5	Walk
North Tributary Galloway Wash	Study Limit	Galloway Wash	1.0	Walk
Ocotillo Wash	FDS Limit	Cave Creek	6.8	Walk/Car
Ocotillo Wash Tributary 1	FDS Limit	Ocotillo Wash	1.1	Walk
Ocotillo Wash Tributary 1A	FDS Limit	Ocotillo Wash Tributary 1	0.6	Walk
Ocotillo Wash Tributary 2	FDS Limit	Ocotillo Wash	1.1	Walk/Car
Ocotillo Wash Tributary 3	FDS Limit	Ocotillo Wash	1.4	Walk/Car
Ocotillo Wash Tributary 4	FDS Limit	Ocotillo Wash	1.3	Walk/Car
Rowe Wash	FDS Limit	Galloway Wash	3.5	Walk
Rowe Wash Tributary 1	FDS Limit	Rowe Wash	1.1	Walk
Rowe Wash Tributary 2	FDS Limit	Rowe Wash	0.5	Walk

Watercourse Reach	Upstream Limit	Downstream Limit	Length (miles)	Field Recon. Method
Willow Springs Wash	FDS Limit	Cave Creek	5.1	Walk
Willow Springs Wash Tributary 1	FDS Limit	Willow Springs Wash	3.6	Walk
Willow Springs Wash Tributary 1A	FDS Limit	Willow Springs Wash Tributary 1	1.0	Walk
Willow Springs Wash Tributary 2	FDS Limit	Willow Springs Wash	1.7	Walk
Willow Springs Wash Tributary 2A	FDS Limit	Willow Springs Wash Tributary 2	1.0	Walk
Willow Springs Wash Tributary 3	FDS Limit	Willow Springs Wash	0.5	Walk
Willow Springs Wash Tributary 4	FDS Limit	Willow Springs Wash	1.1	Walk
Willow Springs Wash Tributary 5	FDS Limit	Willow Springs Wash	2.1	Walk
Willow Springs Wash Tributary 5A	FDS Limit	Willow Springs Wash Tributary 5	0.6	Walk
Phase 2 Reaches				
Cave Creek Tributary 1	Study Limit	Cave Creek	2.2	Walk
Cave Creek Tributary 1A	Study Limit	Cave Creek Tributary 1	0.2	Walk
Cave Creek Tributary 1B	Study Limit	Cave Creek Tributary 1	0.4	Walk
Cave Creek Tributary 1C	Study Limit	Cave Creek Tributary 1	0.4	Walk
Cave Creek Tributary 1D	Study Limit	Cave Creek Tributary 1	0.3	Walk
Galloway Wash Tributary 2	Study Limit	Galloway Wash	1.6	Walk
Galloway Wash Tributary 2A	Study Limit	Galloway Wash Tributary 2	0.3	Walk
Galloway Wash Tributary 2B	Study Limit	Galloway Wash Tributary 2	0.2	Walk
Grapevine	Study Limit	North Galloway Wash	0.3	Walk
North Galloway Wash Tributary 1	Study Limit	Galloway Wash	0.8	Walk
Willow Springs Tributary 6	Study Limit	Willow Springs Wash	1.1	Walk
Willow Springs Tributary 6A	Study Limit	Willow Springs Wash Tributary 6	0.2	Walk
Willow Springs Tributary 6B	Study Limit	Willow Springs Wash Tributary 6	0.3	Walk
Willow Springs Tributary 6C	Study Limit	Willow Springs Wash Tributary 6	0.3	Walk
Additional Reaches				
Mormon Girl Wash	Study Limit	Cave Creek	2.4	Walk
Mormon Girl Wash Tributary 1	Study Limit	Mormon Girl Wash	0.4	Walk/Car
Mormon Girl Wash Tributary 1A	Study Limit	Mormon Girl Wash Tributary 1	0.1	Car

Watercourse Reach	Upstream Limit	Downstream Limit	Length (miles)	Field Recon. Method
Mormon Girl Wash Tributary 1B	Study Limit	Mormon Girl Wash Tributary 1	0.3	Car
Mormon Girl Wash Tributary 1C	Study Limit	Mormon Girl Wash Tributary 1	0.7	Car
Mormon Girl Wash Tributary 1D	Study Limit	Mormon Girl Wash Tributary 1	0.7	Car
Mormon Girl Wash Tributary 1E	Study Limit	Mormon Girl Wash Tributary 1	0.8	Car
Mormon Girl Wash Tributary 1F	Study Limit	Mormon Girl Wash Tributary 1	0.2	Car
Mormon Girl Wash Tributary 1G	Study Limit	Mormon Girl Wash Tributary 1	0.4	Car

4.2 Methodology and Results

The erosion hazard zones were established using a combination of data sources and analytic approaches. The methods included field investigation, interpretation of current and historical aerial photographs, topographic map data, Arizona Geological Survey (AZGS) geologic map data, Natural Resources Conservation Service (NRCS) Soil Survey data, data from previous studies in the area, the hydraulic modeling results from the floodplain delineation studies, consideration of the State Standards Level 1 setbacks and Level 2 allowable velocity results, and the equilibrium slope analysis. The specific methods and use of data sources in support of the erosion hazard zone determination are described in the following sections.

4.2.1 State Standard 5-96, Level I Calculation of Erosion Setback Distance

The ADWR State Standard (SS 5-96) Level I erosion setback distance calculation was performed for each study reach. The setback distance provides an estimate of a safe setback allowance using minimal hydrologic and channel geometry information. Required information includes drainage area, 100-year peak discharge, and channel planform. For watercourses having a contributing area less than 30 square miles, the Level I erosion setback allowances are calculated as follows:

- Setback = $1.0(Q_{100})^{0.5}$ (for reaches with minor curvature); or
- Setback = $2.5(Q_{100})^{0.5}$ (for channels with obvious curvature or channel bend).

However, in all cases, the minimum Level I setback is equal to 20 feet for a channel reach with minor curvature and 50 feet for a channel reach with obvious curvature. Obvious curvature is defined as a channel centerline having a radius of curvature less than five times the channel top width. The calculated setback distance is measured from the 100-year floodway or the channel top-of-bank, whichever is greater.

As seen in the setback equations above, the Level I setback distance is based on the 100-year peak discharge. Typically the 100-year peak discharges used for calculating the Level I erosion setback limits were taken from HEC-2 or HEC-RAS models developed as part of previous floodplain delineation studies. The models were provided to JEF from the District for use in the DMP. For the majority of washes located within the project area, the 100-year floodplain/floodway limits were delineated as part of the Cave Creek/Carefree FIS (March 1990, for the District, by CH2M Hill, Inc.). Table 6 gives a complete list of the floodplain studies used in the current analysis.

The top-of-bank locations used for determination of the Level I erosion setback limits were identified through the use of the 2- and 10-foot contour interval topography, aerial photographs (dated Dec. 2004/ Jan. 2005), field reconnaissance and engineering judgment. Typically the top-of-bank was recognized at the top of the predominant change in channel side slope adjacent to or within the 100-year floodplain. Where no predominant channel side slope was apparent, erosion setback limit offsets were taken from the floodplain or floodway boundary.

Based on the number of assumptions and degree of uncertainty associated with hydrologic calculations/computations, the calculated Level I erosion setback limits were rounded up to the nearest 5 feet prior to application of the Level 1 setback distance from the top-of-bank or 100-year floodplain/floodway. For example, a calculated erosion setback distance of 112 feet would be offset a distance of 115 feet. The Level I erosion setback limits were evaluated as part of the overall assessment when determining the final erosion hazard zone boundaries.

The Level I analysis is limited to watercourses under 30 square miles drainage area. For this reason, Level I erosion hazard setback limits were not calculated for Cave Creek since the drainage area upstream of the project limits is over 60 square miles. Additionally, Level I is not applicable for areas where massive shifting of the river channel has been observed in the past. Thus, Level 1 analysis for the distributary/split flow reach of Ocotillo Wash upstream of the Ocotillo Wash Tributary #2 confluence was not performed.

Level I erosion setback guidelines and calculations are provided in Appendix A. A map showing the Level I erosion setback limits is also provided in Appendix A. An ArcGIS shapefile is also provided on the disc accompanying this report.

Table 6 Assessed Watercourses and Associated Hydrologic/Hydraulic Studies

Assessed Watercourse	Study Used to Obtain Discharge Estimates
Cave Creek (Between Carefree Highway and Morning Star Road)	Cave Creek Floodplain Delineation (GVSCE, April, 1997)
Cave Creek (Above Morning Star Road)	Cave Creek Floodplain Delineation Revision (WEST Consultants, June, 2001)
Cottonwood Wash (Including Tributaries 1 and 2)	Cave Creek/Carefree Flood Insurance Study (CH2M Hill, March, 1990)
Ocotillo Wash Above RS 2.03 (Including Tributaries 1, 2, 3, and 4)	Cave Creek/Carefree Flood Insurance Study (CH2M Hill, March, 1990)
Ocotillo Wash Below RS 2.03	Cave Creek Drainage Master Plan (Harris-Toups, 1979)
Flemming Springs Wash	Cave Creek/Carefree Flood Insurance Study (CH2M Hill, March, 1990)
Rowe Wash	Cave Creek/Carefree Flood Insurance Study (CH2M Hill, March, 1990)
Willow Springs Wash Above RS 1.78 (Including Tributaries 1, 1A, 2, 2A, 3, 4, 5, and 5A)	Cave Creek/Carefree Flood Insurance Study (CH2M Hill, March, 1990)
Willow Springs Wash Below RS 1.78	Cave Creek Drainage Master Plan (Harris-Toups, 1979)
Andora Hills Wash	Floodplain Delineation Study of Andora Hills & Galloway Washes (JEF, April, 2002)
Galloway Wash	Floodplain Delineation Study of Andora Hills & Galloway Washes (JEF, April, 2002)
Phase 2 Washes - Willow Springs Wash Tributaries 6, 6A - 6C - Cave Creek Tributaries 1, 1A - 1D - Galloway Wash Tributaries 2, 2A, 2B	CCDMP, Phase 2, (HDR, 2007) • Hydrology • Floodplain Delineation
Additional Washes - Mormon Girl Wash - Mormon Girl Wash Tributaries 1, 1A-1G	CCDMP, FLO-2D Model (HDR, 2007)

4.2.2 State Standard 5-96 Level II Material Stability Analyses

A Level II material stability analysis estimates the potential for channel lateral migration, under 100-year flood conditions, given the bed and bank configuration and material composition. However, a Level II analysis does not calculate a lateral migration setback distance or allowance. Per the scope of work, the Level 2 Allowable Velocity approach presented in SS 5-96 was used for this study and is discussed below.

In order to perform the Allowable Velocity Analysis, some knowledge of bank material is required. Given the level of detail associated with a regional study, it was decided that unless apparent site conditions dictated otherwise, bed and bank material were assumed to have similar material compositions. After field assessment of each watercourse, and review of the Level II calculations, this assumption proved applicable.

Material samples were taken at locations distributed throughout the project area. Size distributions were determined through sieve analysis or pebble count. Material sampling locations are shown in Figure 67 as well as the mean diameter of the bed material for each location. The complete sieve analyses and pebble count results are provided in Appendix B. An ArcGIS shapefile of the locations is also provided on the disc accompanying this report.

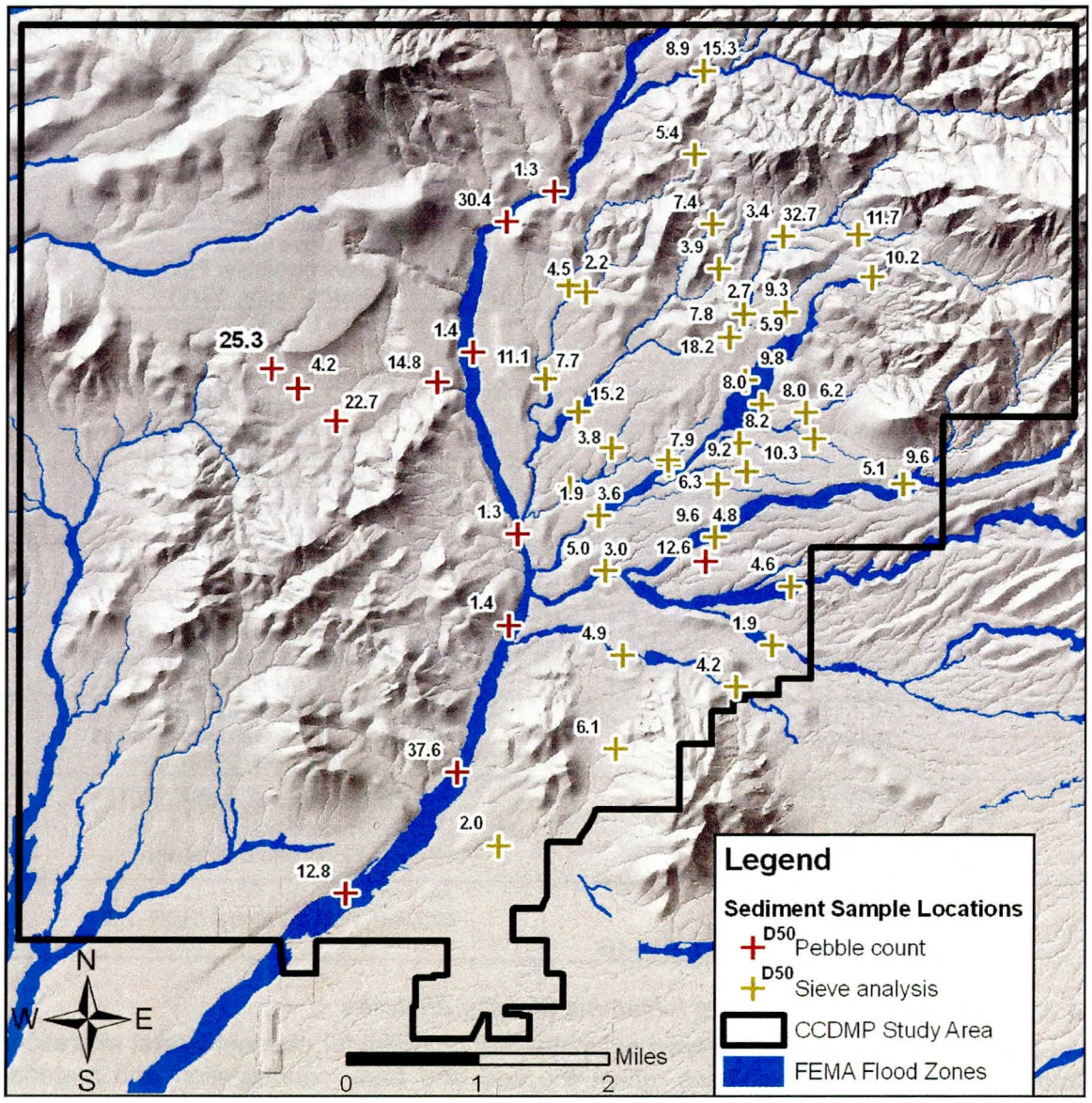

Figure 67 Sediment Sampling Locations and Bed Material D_{50}

Hydraulic parameters required for the Level II analyses were obtained from models prepared for previous floodplain delineation studies. Most of these models were provided to JEF in a HEC-2 format; however, Andora Hills Wash and Galloway Wash had been recently modeled using HEC-RAS. The previous hydraulic models utilized the subcritical flow regime option for determining inundated areas. JEF imported the HEC-2 models into HEC-RAS and re-ran the models with the mixed flow regime option. The mixed flow regime option allows for computation of supercritical flow velocities which

provide a more conservative value for assessing actual versus allowable flow velocities. Other than selecting a mixed flow regime option, no other modifications were made to the imported models. A list of previous studies associated with each assessed watercourse is provided in Table 6. The hydraulics for the Mormon Girl Wash and the North Galloway Tributary were obtained using normal depth calculations (see SECTION 3). In these cases, the hydraulic parameters were obtained at several cross-section locations and an average was computed for the Level II analysis.

4.2.2.1 Allowable Velocity Analysis

The allowable velocity analysis compares the 100-year peak flow velocity within the watercourse to a calculated maximum allowable velocity. The maximum allowable velocity is the threshold flow velocity at which erosion is not anticipated, and is calculated as follows:

$$V_a = V_b C_a C_b C_d$$

where V_a = Maximum allowable flow velocity (ft/s);
V_b = Basic maximum allowable flow velocity (ft/s); and
C_a, C_b and C_d = Correction factors for alignment, bank slope and flow depth, respectively.

Values of V_b, C_a, C_b and C_d were determined from State Standard 5-96, Figures 1 through 4. Given the linear miles of wash requiring Level II material stability analysis for this project, it was decided that trend line equations would be used to accurately and efficiently calculate these values. For SS 5-96 Figures 1 through 4, trend lines were drawn through the data points, and associated trend line equations were then used in an Excel spreadsheet for calculation of V_b, C_a, C_b and C_d. However, the value of C_b for bank slopes equal to or flatter than 3H:1V is approximately 0.84 (see SS 5-96, Figure 3). Therefore, for the purpose of calculating V_a, the flattest allowable bank slope was 3H:1V. It is understood that in some instances the calculated values of V_b, C_a, C_b and C_d may not fall within the range shown in the figures, but for each case, the calculated value was assessed for reasonableness. The allowable velocity calculations and the SS5-96 Figure 1 through 4 trend lines are provided in Appendix A.

The results show overwhelmingly that the banks of the study reaches are potentially erodible based on the allowable velocity analysis. Therefore, only reaches with bedrock or engineered bank protection are considered not potentially erodible for the purpose of the erosion hazard zone determination.

4.2.3 Supporting Evidence for Delineation of EHZ

The ADWR SS 5-96 Level I and II analyses supplemented the detailed field investigations and other additional evidence supporting channel lateral stability (or instability) discussed as part of the existing conditions assessment in SECTION 2. The manner in which supporting evidence was used during the EHZ delineation process to provide a reasonable estimate of the erosion setback for the DMP is discussed below.

4.2.3.1 AZGS Geomorphic Mapping

The AZGS geologic mapping for the study area was outlined in Section 2.1.1. For the purposes of this study the Q_{yc} and Q_y (Holocene) surfaces mapped by the AZGS were

considered to be within the erosion hazard zone. In addition, portions of some Q_l (Late Pleistocene) surfaces and the margins of Q_m surfaces were delineated in the erosion hazard zone because of their proximity to actively eroding cutbanks or position on channel bends. However, it should be noted that site reconnaissance and the project 2-foot contour topography supplemented the 1:24,000 scale AZGS geologic mapping thereby increasing the spatial accuracy of the EHZ boundaries.

4.2.3.2 NRCS Soil Mapping

The NRCS soil survey for the area (Camp, 1986) was also used to support determination of lateral channel stability or instability. Nearly all of the soil units near the new erosion hazard delineation reaches in the study area were designated by the NRCS as fan terraces. A few soil units along the major watercourses were mapped as drainageway or floodplain soils. Designation of the soils in the study area as fan terraces appears to indicate that the erosion hazard outside the main channel and active floodplain is slight. However, the designation as fan terrace for these surfaces is probably more a reflection of the scale of the NRCS mapping and unit descriptions than a precise interpretation of the existing surficial processes. Field evidence and the District's 100-year floodplain mapping clearly indicate potential inundation and erosion of broader areas than indicated by the NRCS map units. The degree of soil development recorded by the NRCS does indicate that erosion of the areas outside the main channel and floodplain corridor has been relatively rare during the past 10,000 years, and has generally been confined within the floodplain for the past 250,000 years.

4.2.3.3 Interpretation of Aerial Photographs

Erosion hazards were also evaluated by interpreting fluvial landforms and surficial characteristics visible on aerial photographs. A list of the aerial photographs used is provided in Table 2 in Section 2.1.3. Visible characteristics of geomorphic surfaces, such as color and vegetation, provide valuable clues as to the age and relative stability as discussed in Section 2.1.3. Considered together with information obtained from AZGS and NRCS mapping, the visible characteristics seen in aerial photographs provide a high degree of confidence in interpretation of erosion hazards.

4.2.3.4 Existing and Historical Channel Position

Changes in planform of the major watercourses in the study area were also compared using the historical aerial photographs. In general, channel positions within the study area have not significantly changed during the 53 year period of record between the earliest and most recent aerial photos.

Of significant interest is the Cave Creek channel position as seen in the 2005 and 2006 aerial photographs. The Cave Creek reach within the study area experienced its largest recorded flood event on September 3, 2005 (14,000 cfs and 11,400 cfs at FCDMC gauges 4923 and 4889, respectively). However, significant changes between the 2005 and 2006 channel planform are not evident in the aerial photographs, suggesting a high degree of lateral stability for this reach of Cave Creek. The channel changes observed were predominantly limited within the existing active main channel area. Figure 68 and Figure 69 show example comparisons of the pre- and post-flood Cave Creek channel at two locations. Note that the active main channel is somewhat reworked in each reach. In addition, the primary low-flow portion of the channel has also altered its position somewhat. However, none of the outer banks or overall larger channel planimetric form

have changed noticeably. This was found to be the case along all of Cave Creek through the study area.

Figure 68 Comparison of active Cave Creek channel before and after flood of Sept. 5, 2005

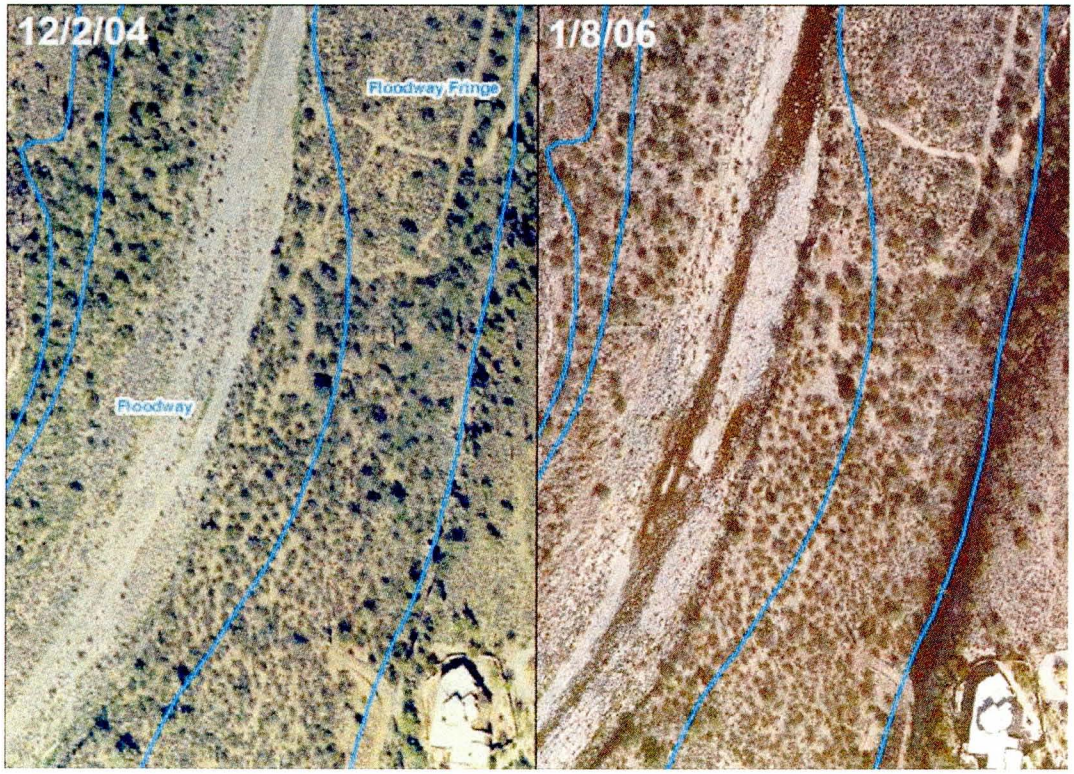

Figure 69 Another comparison of Cave Creek channel before and after Sept. 5, 2005 flood

4.2.3.5 Field Observations

Field visits were conducted to each of the stream reaches identified in Table 5 to assist in the determination of the erosion hazard zone. The characteristics discussed in Section 2.5 were observed and documented for each reach.

Photographs of typical channel conditions of each of the individual watercourses assessed for this study are provided on the disc accompanying this report. Figure 70 shows the locations of field photos taken of the EHZ delineation reaches. In addition, an ArcGIS shapefile is also provided on the disc which gives the photograph location and additional description.

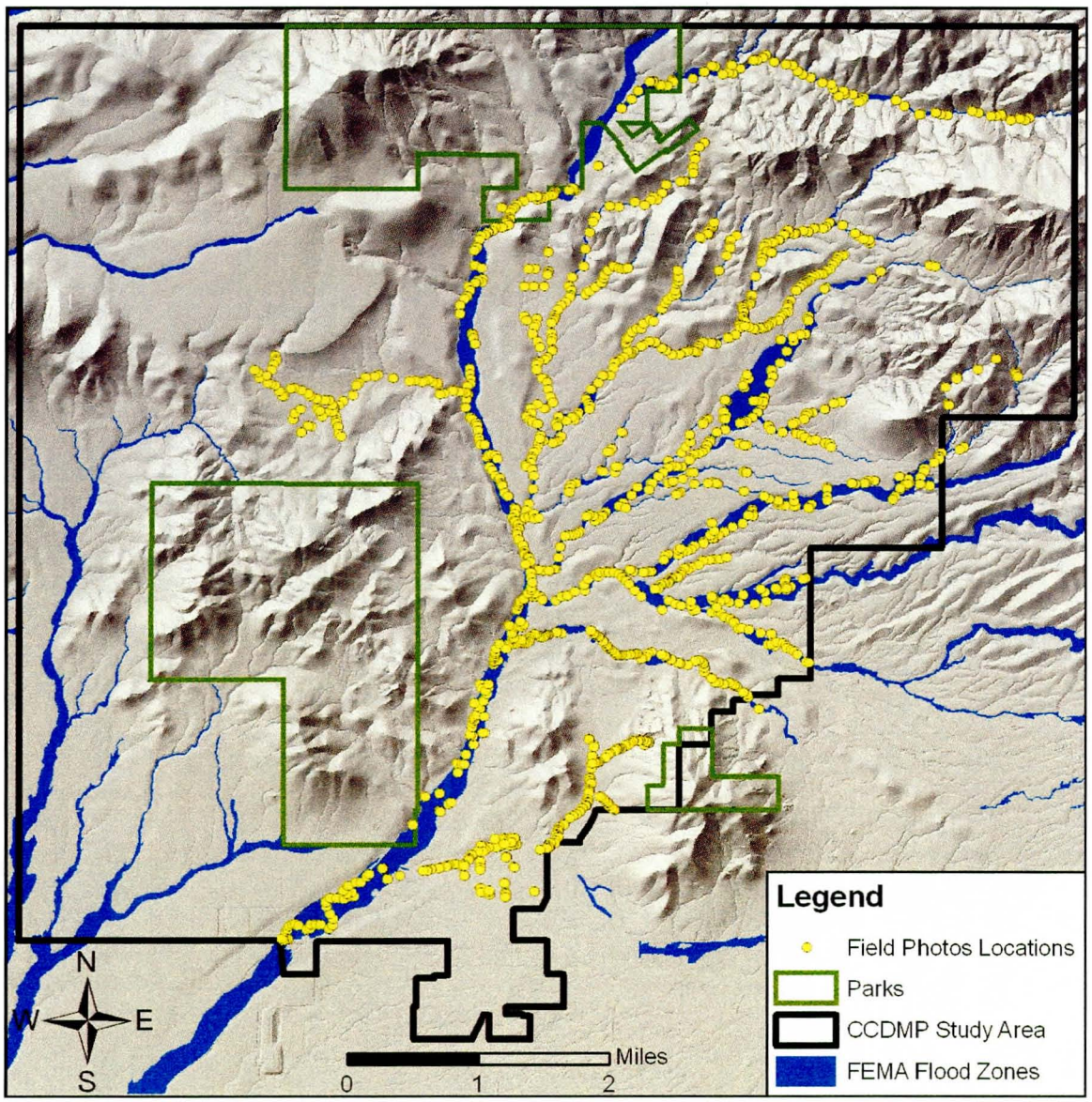

Figure 70 Location of Field Photos for Detailed Study Reaches

The field evidence provided critical information regarding site specific channel and bank characteristics that affect the erosion potential of the reach. These data were incorporated into the final erosion hazard boundary along with the other elements discussed in this section.

4.2.3.6 Pleistocene/Holocene Lateral Erosion Rate

As part of the EHZ delineation assessment, the entire Holocene floodplain was considered to have high erosion potential. Where the main channel is actively eroding a Pleistocene surface, the rate of lateral erosion of the Pleistocene surface must be estimated to delineate the EHZ. For the CCDMP erosion hazard zone delineations, the Pleistocene surface erosion rate was established by comparison of historical aerial photographs, use of results of previous detailed lateral migration studies (JEF, 2000; 2001a, 2001b, 2004), and by observation of specific field evidence of historic erosion. Measurements from past studies in the area indicate that erosion of the Pleistocene surface on the largest streams in the study area is less than one foot per year, except at sharp channel bends with active cutbanks. Previous watercourse master plans conducted for the District have used a 60-year planning period (i.e., 60 feet of erosion at 1ft/yr) for erosion hazard delineation.

Figure 71 shows an example of a large tree along a Pleistocene terrace on Ocotillo Wash. This shows that the terraces are subject to erosion, but that the rate is relatively slow to allow for such a large, old tree to still be growing along the bank. This distance from the main tree trunk to the toe of the existing slope is about 10 feet. If the tree is between 50 to 100 years old, the rate of erosion at the outside of this bend is estimated at between 0.1 to 0.2 feet per year. Therefore, where an active channel in the CCDMP study area abutted a Pleistocene (or older) surface, the erosion hazard zone was delineated by considering the width of the Holocene floodplain, assessing rates of lateral migration through comparison of historical and modern aerial photographs, and the application of regional rate of corridor widening established from other studies.

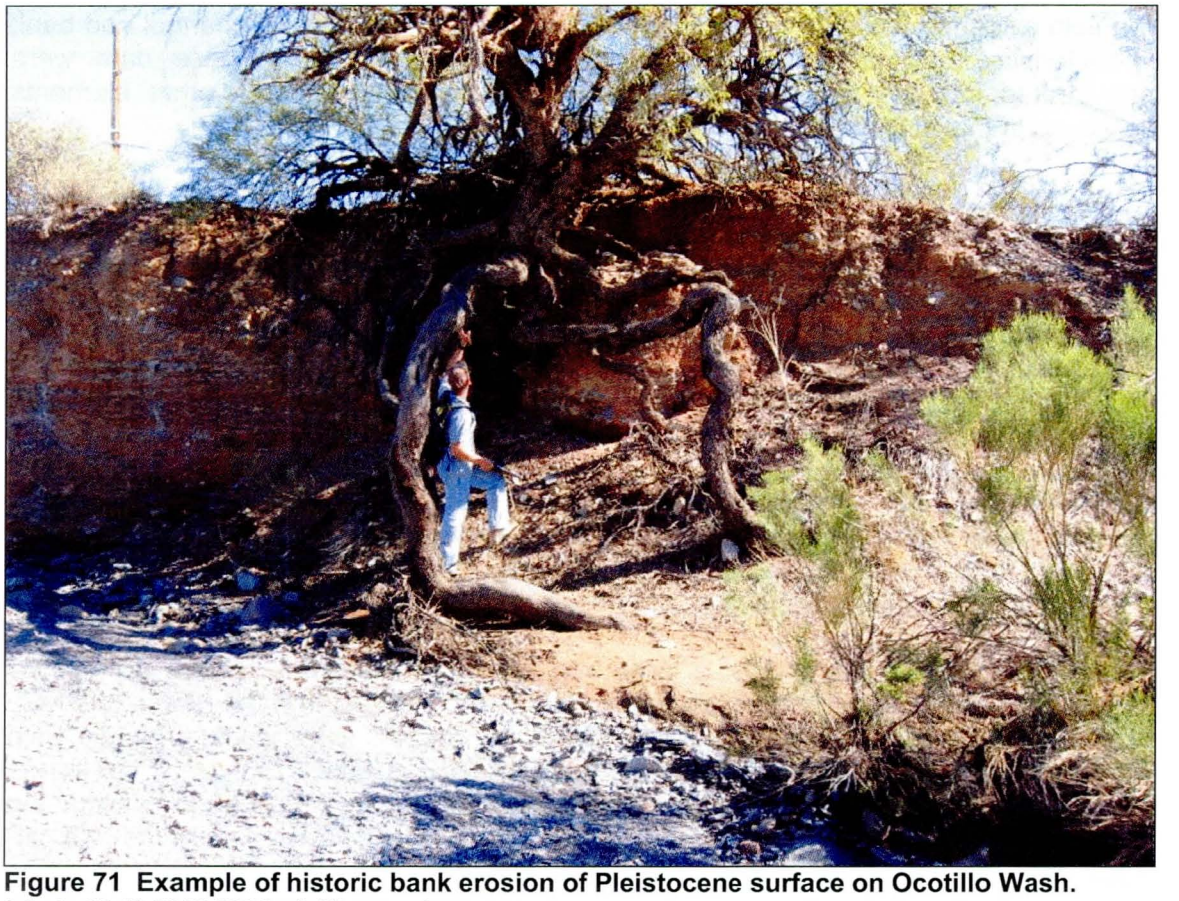

Figure 71 Example of historic bank erosion of Pleistocene surface on Ocotillo Wash. (photo 10-19-2006-308.jpg) View upstream.

4.2.3.7 Floodplain/Floodway Mapping

The existing regulatory floodplain and floodway delineations were considered for delineation of erosion hazard zones. Detailed floodplain and floodway delineations were available for the majority of stream reaches considered for this study. However, as part of the CCDMP scope of work, HDR Engineering modeled the Ocotillo Wash flow split area, located immediately downstream of HEC-RAS River Station 3.17, with additional, higher-resolution HEC-RAS modeling to better understand the complex hydraulics taking place at this location and downstream through the east and west splits. In addition, new floodplain delineations were performed for Phase 2 as listed in Table 6 and shown in Figure 66.

Previous studies that delineated regulatory floodplains and floodways within the study area include the following:

- Cave Creek Drainage Master Plan, 1978, Harris-Toups
- Cave Creek/Carefree Flood Insurance Study, March 1990, CH2M Hill
- Cave Creek Above Carefree Highway Floodplain Delineation Study, April 1997, George V. Sabol Consulting
- Cave Creek Floodplain Delineation Revision, June 2001, WEST Consultants, Inc.
- Floodplain Delineation Study of Andora Hills and Galloway Washes, April 2002, JE Fuller/Hydrology & Geomorphology, Inc.

The following floodplain and floodway characteristics were considered for the erosion hazard zone delineations:

- 100-Year Discharge. In general, the larger the 100-year peak discharge, the greater the risk of lateral erosion and scour. Streams with large regulatory discharges tend to have wider erosion hazard zones.
- Floodplain Flow Depth. The depth of flow on the floodplain is an important characteristic for identifying potential channel avulsions, as described below. The greater the depth of flow on the floodplain, the greater the potential for a channel avulsion.
- Floodplain Limits. Common sense dictates that erosion hazards are greatest in areas that are flooded. Any area within the regulatory floodplain was considered for possible inclusion in the erosion hazard zone.
- Floodway Limits. Floodways include the areas of most frequent flow, as well as the portions of the channel subject to the greatest flow depths and velocities, and therefore have the greatest erosion potential. In general, the erosion hazard zones include the regulatory floodway.

4.2.3.8 Identification of Avulsion Areas

Channel avulsions are responsible for some of the largest magnitudes of known lateral channel movement in Arizona. An avulsion occurs when a new channel forms in an area that was formerly part of the floodplain, leaving an island of relatively high ground between the former and current channel locations. The potential for avulsive channel change increases as the frequency of inundation, depth of inundation, and duration of inundation increases. In order for an avulsion to occur, the floodplain must be subject to inundation for a long enough duration for erosion of a new channel to occur. Therefore, to be avulsive, a floodplain must be flooded at great enough depth, velocity and frequency to cause channel formation. No instances of channel avulsion potential outside the delineated floodplain/floodway were noted in the DMP study reaches.

4.2.4 Recommended Erosion Hazard Zone

Erosion hazards were delineated using the information summarized above. In addition, the following principles were applied when delineating the EHZ:

- Corridor width. The EHZ encompasses a width defined by the width of the main channel, including the width of the short braided reaches and small confined avulsive reaches that occur within the single channel reaches. That is, the EHZ allows a sufficient width for future braiding and small confined avulsions along the main channel.
- Bank vegetation. The EHZ was delineated along the outside of the canopy of the vegetation lining the main channel banks. *If bank vegetation is removed, the EHZ should be widened to account for increased bank erosion potential.*
- Channel bends. The EHZ is typically wider on the outside of channel bends than in straight reaches.
- Road crossings. The EHZ is wider at road crossing where undersized culverts increase the potential for erosion outside the main channel.
- Fences. The EHZ is widened to reflect the likely effect of fences that block or divert the main channel.

- Field judgment. The EHZ reflects the judgment of the project engineer/geomorphologist's interpretation of the field conditions with respect to future erosion potential.
- Park areas. Zones were not delineated within the parks as development is not expected within those areas.

The recommended erosion hazard zones shown on Figure 72 and Plate 1 are intended to identify the areas likely impacted by future lateral erosion, or the areas for which more detailed analysis is warranted prior to future development. The erosion hazard zones from the Adobe ADMP (JEF, 2004) and Rodger Creek EHZ (JEF, 2001b) studies are also included on the maps. All of the recommended erosion hazard zones are based on the engineering judgment and experience of the project engineer/geomorphologist, and therefore cannot be reduced to a single formula or series of equations. In general, the recommended erosion hazard zones are conservative. Both Figure 72 and Plate 1 are intended for illustrative purposes only. The erosion hazard zone boundaries are also provided in digital format for incorporation into the District's and Town's GIS systems. It is anticipated that the GIS data will be used by Town staff in the evaluation of future building permits.

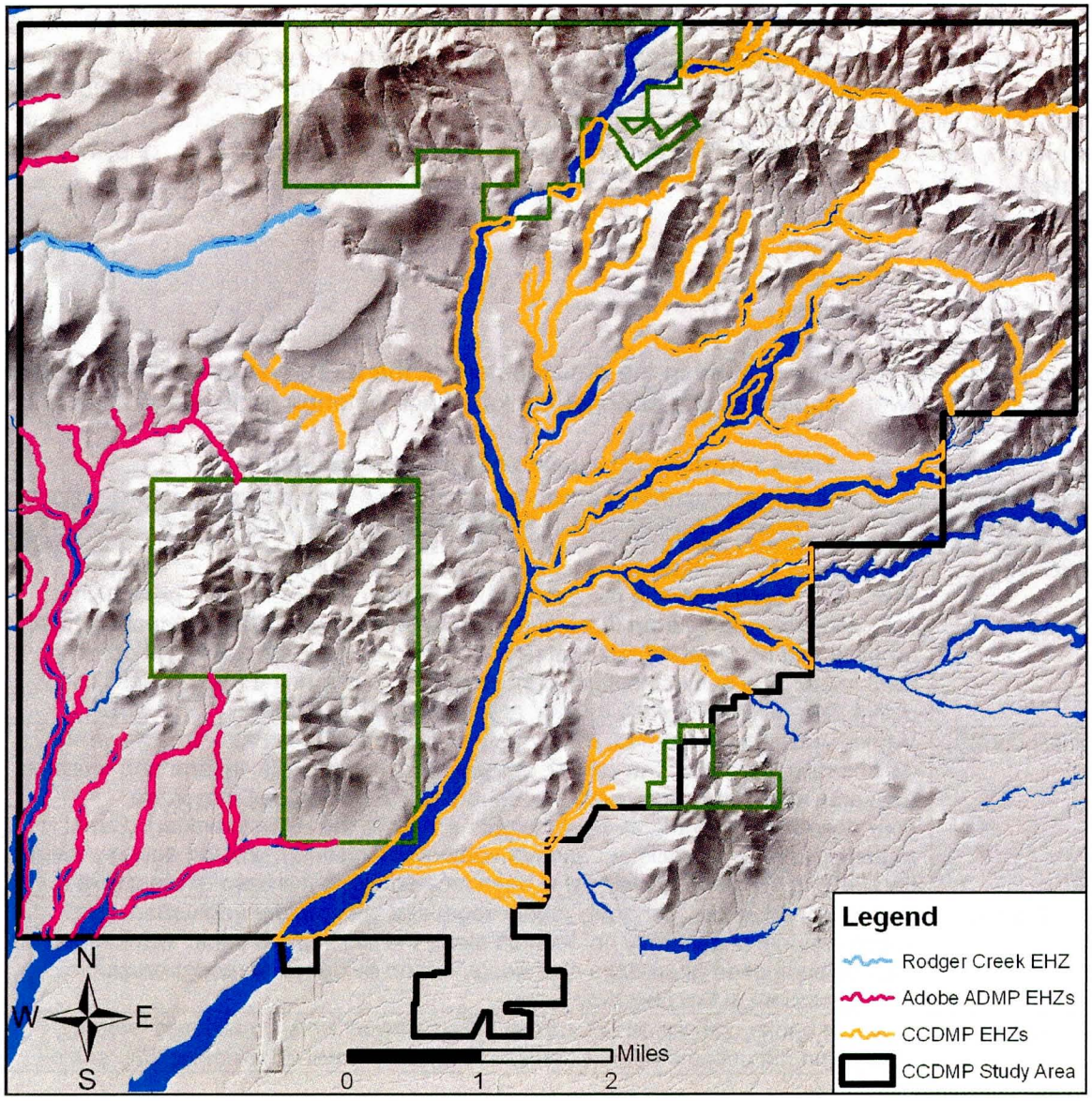

Figure 72 Erosion Hazard Zones in the CCDMP area

It should be noted that the final erosion hazard zones are based on the best available information at the time. A significant change in channel geometry, planform and/or profile could affect these documented erosion setback limits and lateral migration potential should be reassessed. In addition, substantial change within a contributing area, or changes made to channel bank conditions (i.e. vegetation/bedrock/caliche removal, slope modifications, etc…), may have an impact on channel stability, requiring reassessment of potential lateral migration.

4.3 Comparative Erosion Hazards and Existing Structures at Risk

In order to assist with the DMP alternatives analysis, a comparative ranking system was developed for the erosion hazard zones in each study reach. In addition, structures within the erosion hazard areas were identified and relative rankings also determined and assigned. The following sections describe the ranking development and results.

4.3.1 Erosion Hazard Ranking – Erosion Hazard Zones

The erosion hazard zone delineations were classified with an erosion hazard ranking value for the purpose of identifying and prioritizing the areas that presently exhibit the highest potential for erosion. Plate 2 illustrates the erosion hazard zone rankings. Four rankings were used in the analysis and designated by numeric values zero, one, two, or three:

0. Stable
1. Severe
2. Moderate
3. Minimal

Several criteria were considered in the development of the three hazard ranking values, most of which were applied to the channel banks. Each criterion is discussed below in Table 7.

Table 7 Criteria for erosion hazard zone ranking

Hazard Ranking	Explanation
1 (Severe)	Vertical and oversteepened, unstable, channel banks with low to no calcium carbonate development in the stratigraphic matrix. Highly variable bank height but generally ranging from three feet to more than 20 feet. Bank material is highly erodible and no resistant material (e.g. bedrock, stage III-IV caliche) is present. Bank material is subject to significant erosion during a single flood event. The active channel is frequently located at the base of the cutbank.
2 (Moderate)	Vertical and oversteepened, moderately stable to stable banks with stage III-IV caliche development. The caliche development is generally uniform and massive, but some stratified caliche banks were ranked as moderate if they were competent. Highly variable bank heights similar to the severe ranking. Bank material is relatively resistant and not subject to significant erosion during a single flood event. The active channel is often located along the base of the cutbank.
3 (Minimal)	Stable sloped banks, generally highly vegetated with mature vegetation. The active channel is generally not located along the base of the bank. Bank material may be composed of erodible sediments, but no evidence of recent erosion activity present in the historical record.
0 (Stable)	Channel banks composed of bedrock. These areas were considered laterally stable and not subject to lateral erosion within a normal engineering time scale.

4.3.2 Erosion Hazard Ranking – Structures

Structures identified within, or in a many instances, directly adjacent to the erosion hazard zone were also classified with an erosion hazard ranking. The structures were identified using the 2005 and 2006 orthorectified aerial photography in addition to information collected from field investigations. The same ranking system used for the erosion hazard zones was applied to the structures:

1. Severe
2. Moderate
3. Minimal

The structure hazard rankings were not meant to be an exhaustive, quantitative assessment, but rather an overall, general assessment. The primary purpose was to identify the structures that were of the highest hazard with respect to erosion. It should be noted that relative importance of the structures was not considered in the ranking.

For example, a house located at the top of the vertical, unstable cutbank was not given a higher ranking than a shed, corral, pool, or other non-dwelling structure located at the top of a vertical, unstable bank. All structures were considered equally. Road crossings were also included in the structure hazard ranking dataset. Although no roads were found to have an imminent threat from erosion, they were included in the structure assessment. Table 8 provides a brief explanation of the structure rankings and Plate 2 shows the location of the structures and their associated hazard ranking.

Table 8 Criteria for structure hazard ranking

Structure Ranking	Explanation
1 (Severe)	Structures near the top of vertical, unstable, alluvial cutbanks. Structures near the present low-flow channel. Structures that have the potential of being impacted by a single-flood event. Structures adjacent to an erosion hazard zone with a severe hazard ranking. A few roadway crossings were identified with a hazard ranking of 1.
2 (Moderate)	Structures near the top of vertical, more stable, caliche banks. Structures adequately set back from vertical, unstable, alluvial cutbanks. Structures that are unlikely to be impacted from a single-flood event. Structures located inside the erosion hazard zone or adjacent to an erosion hazard zone with a moderate hazard ranking. Most roadway crossings were identified with a hazarding ranking of 2.
3 (Minimal)	Structures located at the top of stable-sloped, vegetated banks. Structures protected from erosion by bedrock. Structures that are adequately set back from more stable, caliche banks. Structures that are adequately setback from the present low-flow channel. Structures adjacent to an erosion hazard zone with a minimal hazard ranking.

4.3.3 Results & Recommendations

Figure 73 shows the location of the buildings identified. The disc accompanying this report contains a GIS shapefile of their locations. Also shown are homes identified in the EHZ area during the Adobe ADMP.

Erosion hazard zones and structures classified with a severe hazard ranking should be considered the highest priority in the CCDMP Recommended Alternatives analysis. While the structures were not specifically identified by type, such an assignment would be necessary to identify high-value (houses) vs. low-value (sheds) structures. It is unlikely that a universal solution could be applied to all the severe hazard structures. Therefore, it is recommended that each structure be analyzed and assessed individually or in clusters of structures affected by the same eroding bank.

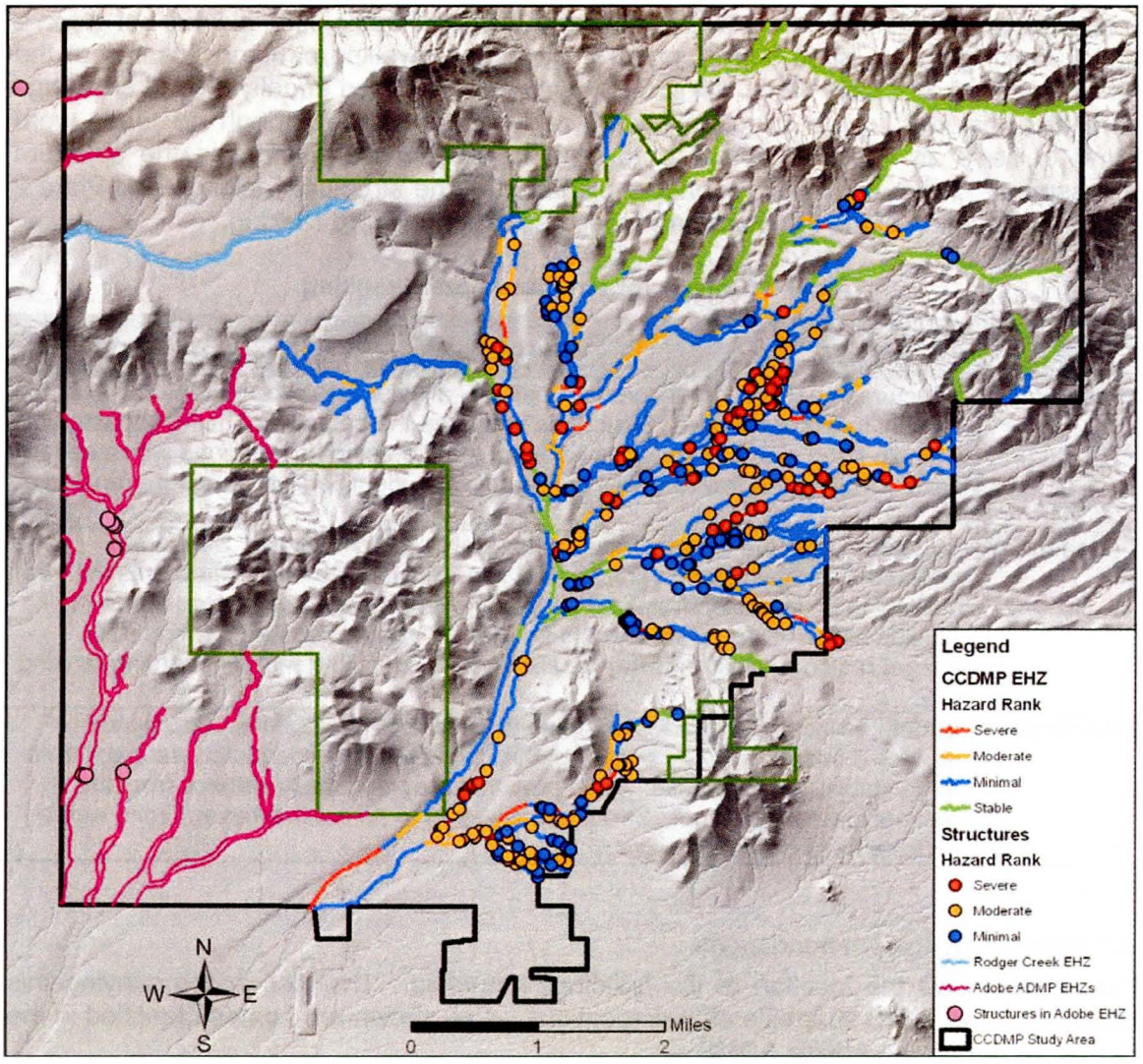

Figure 73 Location and ranking of buildings in erosion hazard zones

4.4 Conclusions

Based on the methodologies described above used to evaluate the erosion hazards, the following general conclusions can be drawn for the streams in the CCDMP study area:

- Cutbanks, which are evidence of recent and ongoing bank erosion, occur throughout the study area, especially on channel bends, where the channels have experienced some degree of long-term degradation, and where bank vegetation has been removed.
- Lateral erosion should be expected within the Holocene floodplain.
- Lateral erosion will occur in response to two types of flooding:
    - Single floods – floods that fill the main channel and flow onto the floodplain will cause significant amounts of lateral erosion at specific locations. Floods greater than about the 5-year peak discharge will typically cause this type of erosion.
    - Series of floods – lateral erosion will occur in response to series of smaller floods that combine to produce significant amounts of cumulative

erosion over time periods equivalent to the design life of the structures proposed in or near the streams in the study area.

- Holocene floodplain soils appear to be composed of highly erosive materials that lack resistance to lateral erosion or avulsive movement of the low-flow channels.
- The streams in the study area have been subject to local scour and channel migration.
- The streams in the study area have a high sediment transport capacity, and could increase lateral erosion if sediment supply is decreased.
- Caliche or clay-rich soils do not prevent lateral erosion, though they may significantly slow the rate of lateral erosion.
- Bedrock prevents lateral erosion.
- Significant long-term changes in channel profile (degradation and aggradation) have not occurred in the study area, except locally where the channel has been disturbed by human impacts such as encroachment or construction of road crossings.
- Erosion hazards are most significant at locations in which building structures are immediately adjacent to actively eroding cutbanks. A number of these have been identified and should be considered for remedial action as part of the alternatives analysis of the DMP.

4.5 Limitations and Assumptions

Any technical analysis is limited by the data available, the contracted scope of services, and the assumptions of the methodologies used. For the CCDMP erosion hazard assessments, the following general limitations apply:

- Hydrology. Discharge estimates for the majority of streams were obtained from previous studies (see Table 6 above). These studies may be outdated due to changes in watershed and/or modeling approaches. Although streamflow gauging data is available for Cave Creek, it is not available for any Cave Creek tributaries. The longest period of record of streamflow gauges located within the project limits is 24 years.
- Hydraulics. Similar to the discharge estimates discussed above, typical hydraulic models were prepared by others for the purpose of delineating the 100-year floodplain and floodway (see Table 6 above). As described in Section 4.2.1, the location of the floodway limits affects the SS 5-96 Level 1 methodology. Modification of the HEC-2 input code, which may have improved floodway delineations, was not part of the scope of services for this study. The hydraulic parameters were obtained using normal depth approach for the Mormon Girl Wash and North Galloway Tributaries.
- Geotechnical Data. Beyond the sediment sampling performed for the equilibrium slope analysis (see SECTION 3) and the AZGS and NRCS mapping, no detailed geotechnical data were available for the study area. More accurate predictions of existing lateral erosion hazards could be made if extensive geotechnical investigations were completed along the stream corridors.
- Level of Detail/Scale of Analysis. The erosion hazard zones determined for this evaluation are based on the SS 5-96 Level 1 and 2 methodologies, observations made in the field, interpretation of historical aerial photographs, and consideration of previously published reports. It is possible that the recommended erosion hazard zones could be refined by applying more detailed methodologies, such as those discussed in SECTION 5. In addition, the

evaluation described in this report considered approximately 62 miles of river corridors. It is possible that more detailed evaluation of shorter reaches or specific sites could improve the accuracy of the predictions of future channel behavior in those reaches.

- Additional Erosion Hazards. Riverine erosion and flood hazards exist along all of the watercourses in the study area, regardless of their size. In addition, erosion from slope processes will occur on steep slopes within the study area. This study is limited to evaluation of riverine erosion hazards on the watercourses shown on Plate 1 and listed in Table 6.

SECTION 5 SUMMARY & RECOMMENDATIONS

5.1 Introduction

This study examined the geomorphic and sedimentation conditions in the CCDMP study area. In particular, erosion hazard zones were delineated for reaches with existing and proposed FEMA floodplains. Those results along with the results from two previous FCDMC studies (JEF 2004; JEF, 2001b) are included in this report for use in the management of development by the Town of Cave Creek of new buildings in these areas. In addition, it should be recognized that erosion hazards exist to some degree on all watercourses in the CCDMP study area. New development should be set back a safe distance from any watercourse, not just those with erosion hazard zone delineations. The major wash identification and other drainage delineation performed as part of a separate task (JEF, 2006) can be used to locate areas of other potential concern. Persons wishing to build in or near any of these areas should be required to perform some level of engineering analyses in support of their development plan.

Additional specifics associated with the management and use of the erosion hazard zones is provided in the following section.

5.2 Erosion Hazard Zones

The recommended best management practice for the erosion hazard zones is to prohibit construction of permanent or habitable structures within any delineated erosion hazard zone. If development is to occur within established erosion hazard zones, a detailed analysis is recommended as part of the design process.

5.2.1 Detailed Analysis

In some cases, the erosion hazard zones delineated for the CCDMP sedimentation engineering and geomorphic analysis may be refined by a more detailed analysis. A detailed analysis should be completed by a registered professional engineer and qualified fluvial geomorphologist, and may consist of any or all of the following elements:

1. Historical Analyses
    a. Historical analysis of horizontal channel change
        i. Quantify maximum long-term channel movement by comparing channel position on rectified historical (oldest available) and modern (most recent) aerial photographs and/or historical survey data.
        ii. Quantify maximum single event channel movement by comparing channel position on a sequence of rectified historical and modern aerial photographs and/or historical survey data.
        iii. Identify trends of channel movement (direction, scale, and type) related to the current or historical channel pattern that may affect future channel movement.
        iv. Identify changes in channel pattern during the period of historical record. Determine whether channel pattern changes are cyclical or evolutionary, and relate pattern changes to the potential future channel movement.
        v. For streams with limited historical data, expand the study reach to adjacent stream reaches or adjacent watercourses (spatial data substitutes for temporal data) to identify regional rates of historical

channel movement. Where regional rates of channel movement are significantly different from historical channel movement in the project reach, the regional rates should be used to estimate future erosion potential, or a physical reason for the differences is required.

vi. Identify land use changes and human impacts to watercourse, as well as the historical channel response to those changes. Relate the potential for future land use changes and human impacts to future channel changes.

vii. Catalogue the record of past floods by magnitude and relate the observed historical channel changes to the flood series. Where no flood records exist, examine rainfall records or flood series from adjacent watercourses to identify periods of likely flooding or drought.

viii. Relate the observed historical scale of channel change to the magnitude and frequency of historical floods, as well as to a potential future flood series that might occur during the design life of the proposed development.

b. Historical analysis of vertical channel change

i. Quantify past bed elevation changes by comparing historical and modern topographic mapping, field observations, and channel elevations shown on structure as-built plans.

ii. Identify long-term degradation or aggradation trends in the project reach indicated by the historical record.

iii. Relate observed changes in elevation to historical watershed changes, natural riverine processes, and manmade changes to the river system.

iv. Predict future channel elevation changes and the anticipated channel response given past trends and likely future watercourse and watershed changes.

2. Geomorphic and Geologic Mapping & Analyses

a. Delineate Holocene and Pleistocene surfaces and landforms. Surficial geologic mapping for many parts of Arizona is available from the Arizona Geological Survey. Detailed soils mapping may be available in published soil surveys by the NRCS or U.S. Forest Service.

b. Subdivide Holocene surfaces by age, topography, and surficial characteristics to constrain long-term rate of lateral movement in modern geologic time. Map the extent and describe the physical characteristics of each Holocene surface.

c. Conduct subsurface investigations using test pits or borings to quantify physical differences between Holocene surfaces such as resistance to erosion, clay content, degree of carbonate cementation, induration, sediment size, bedding, degree of soil development, color, provenance, or other characteristics.

d. Use geomorphic mapping to calibrate the minimum long-term rate of lateral movement within the stream corridor, and maximum magnitude of channel movement within different time periods represented by the Holocene surfaces.

e. Identify and map the extent and lithology of bedrock outcrops. Identify physical barriers to lateral channel movement.

f. Describe modern geomorphic setting relative to local historical geology and channel evolution to determine trends of expected future channel change.

g. Examine a longitudinal profile of the stream to identify knickpoints, convexities, or other slope irregularities relative to the position of the proposed development. Predict changes in channel profile and discuss the implications of profile changes on potential lateral and vertical erosion.

3. Field Investigation

a. Describe and document channel and bank conditions in reach.

b. Identify and document stream characteristics indicative of active or recent lateral erosion. Provide photographs of diagnostic features.

c. Identify and document stream characteristics indicative of resistance to lateral erosion. Provide photographs of diagnostic features.

d. Identify and document stream and floodplain characteristics indicative of potential, historical, or active channel avulsions. Provide photographs of diagnostic features.

e. Conduct stream classification analysis to identify the scale of erosion potential by analogy to similar stream types.

f. Apply bank stability indexes based on field parameters. A variety of bank stability indexes have been published.

g. Identify local bank failure mechanisms. Relate observed bank failure mechanisms to flow hydraulics & sediment transport analysis results.

h. Identify evidence of long-term degradation or aggradation near the proposed development site or in adjacent stream reaches.

i. Identify evidence of bed sediment movement, armoring, imbrication, and scour for use in verifying the results of sediment transport and scour analyses.

j. Identify archaeological evidence to help identify the age of geomorphic surfaces.

4. Hydraulic Modeling

a. Perform inundation mapping using HEC-RAS or other hydraulic models to determine the relative magnitude and frequency (recurrence interval) of floodplain inundation and inundation of Holocene geomorphic surfaces. Relate the inundation frequency to avulsion potential and definition of channel bank stations.

b. Determine channel and floodplain hydraulic data, such as velocity, depth, and stream power, for a range of flood frequencies to determine thresholds of channel and floodplain erosion, and for use in sediment transport analyses. Plot changes in channel velocity and other hydraulic variables versus stream distance to identify trends and discontinuities, and to identify channel choke points and flow expansion areas that may impact the lateral erosion potential.

c. Map overbank flow patterns at various flow frequencies, and identify overbank flow concentration areas to identify possible avulsive flow paths.

d. Determine bankfull discharge for use in applying regime and hydraulic geometry equations.

5. Sediment Transport & Engineering Analysis

a. Estimate sediment transport competence and size range of transported material at various flow frequencies. Relate transport competence to bed material gradations observed in the streambed and banks.

b. Estimate local scour at a range of flow frequencies and rates and predict the impact of such scour on bank stability and lateral erosion.

c. Estimate armoring potential to whether vertical scour limit exists in channel at a range of flow frequencies. If armoring is likely, revise scour estimates

accordingly and estimate the potential impacts of armoring on the potential for lateral erosion.

d. Apply equilibrium and stable slope equations to estimate long-term degradation or aggradation potential. Relate equilibrium slope predictions to the observed longitudinal profile and potential armoring. Predict long-term scour by comparing the estimated equilibrium slope and the existing channel slope, considering natural or man-made grade control features that may serve as hinge points for channel slope adjustments.

e. Apply bank resistance methodologies such as allowable velocity, tractive force, and tractive shear to determine susceptibility of banks and surfaces to lateral erosion or avulsion.

f. Apply regime and hydraulic geometry equations to determine direction or potential for future channel adjustments in the main channel width and depth.

g. Perform sediment continuity analysis to identify localize sediment deficits or surplus and relate to areas of expected erosion and deposition. Consider potential changes in predicted sediment deficit and surplus due to channel pattern migration and lateral erosion.

h. Consolidate results of engineering and sediment transport analyses to identify stable and unstable stream reaches and the expected direction and magnitude of future channel changes.

6. Computer Modeling of Lateral Erosion

   a. Computer models have not advanced to the point of being able to accurately predict single event or long-term lateral channel movement. Therefore, computer modeling shall not be included in the scope of analysis for a detailed erosion hazard analysis without prior approval by the floodplain manager. Sediment transport computer models have some utility for identifying reaches of sediment deficit or sediment surplus, comparing relative differences between management alternatives, or predicting the expected direction of vertical channel changes.

7. Delineate Erosion Hazard Zone

   a. An erosion hazard zone shall be delineated that is based on the results of the methodologies and analyses outlined above.

8. Report

   a. An engineering report shall be prepared summarizing the methodologies used to support the erosion hazard delineation, the assumptions and limitations of those methodologies, the results of the analysis, and the applicable time frame for the erosion hazard zone delineation. The report shall include photographic and other documentation supporting the analyses and conclusions. An engineer's certification form shall be provided with the erosion hazard analysis report.

The erosion hazard zones delineated for the CCDMP should not be modified unless a site specific detailed analysis is performed as described above.

5.3 Conclusion

The primary objectives of the geomorphic evaluation and sedimentation engineering report for the CCDMP were to provide qualitative and quantitative analyses of the geomorphic conditions and erosion potential in the study area. Erosion hazards zones for use in management of the delineated floodplain reaches were identified.

Other major washes and smaller drainages with potential management needs were presented in another separate report (JEF, 2006).

The study found a predominantly degrading fluvial system where flooding and erosion are generally limited to the geologic floodplain between higher, more resistant surfaces. Urbanization has had some adverse affects on sediment transport continuity due to channel encroachments and roadway drainage crossings. In addition, drainage patterns have been locally obscured or redirected. Long-term effects of urbanization are expected to increase the magnitude and frequency of storm water runoff and decrease sediment delivery to the watercourses.

Areas at risk from lateral erosion were specifically identified and relative risks ranked. Mitigation of some of the existing hazards identified should be considered as part of the DMP alternatives analyses.

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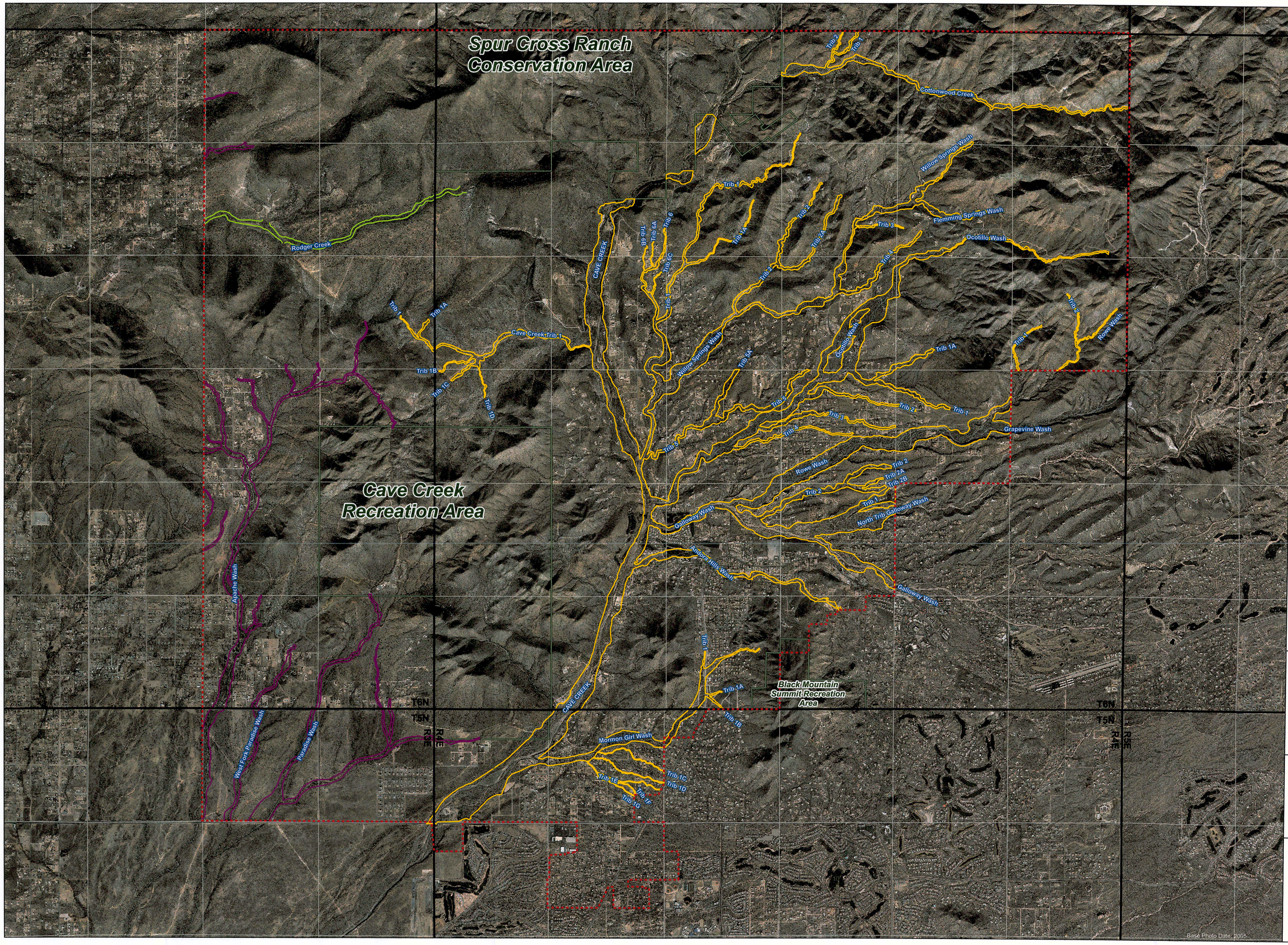


EROSION HAZARD ZONES

- Cave Creek DMP Study Area
- Rodger Creek EHZ (JEF, 2001)
- Adobe ADMP EHZ (JEF, 2003)
- CCDMP Erosion Hazard Zones
- County Parks

N
W E
S

LOCATION MAP

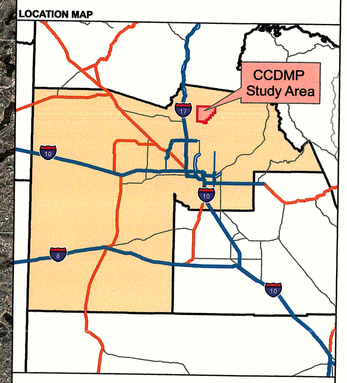


PLATE 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK DRAINAGE MASTER PLAN

RECOMMENDED EROSION HAZARD ZONES

FCD 2004C072
NOVEMBER 2007

Registered Professional Engineer (Civil) CERTIFICATE NO. 41014 BRIAN NICHOLAS SCHALK Date Signed 11-23-07 ARIZONA, U.S.A.

REGISTERED GEOLOGIST CERTIFICATE NO. 43618 MICHAEL J. KELLOGG Date Signed 11-23-07 ARIZONA, U.S.A.

Feet
0 750 1,500 3,000 4,500 6,000

0 0.25 0.5 1
Miles

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
www.jefuller.com

Base Photo Date: 2005

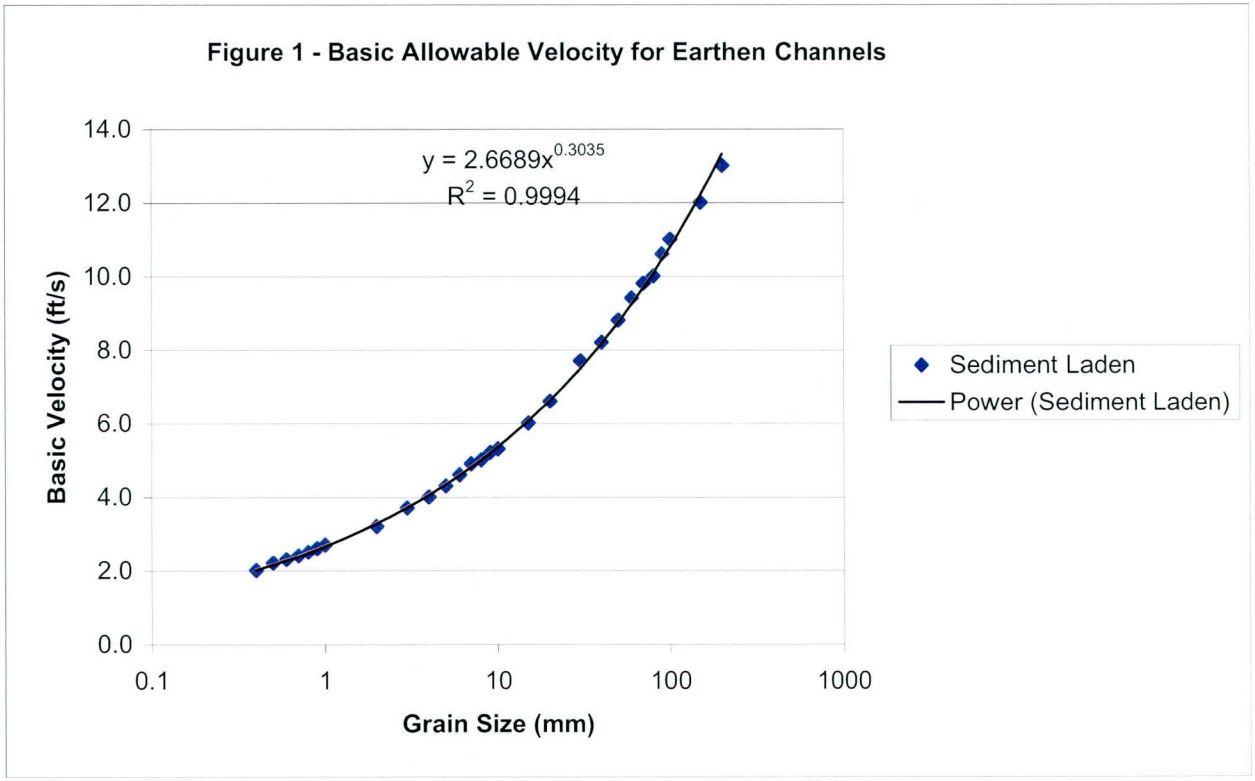
Appendix A

ADWR State Standard SS 5-96

Level 1 Setback
&
Level 2 Allowable Velocity Analysis

Arizona Department of Water Resources
Watercourse System Sediment Balance, State Standard 5-96
Guideline 1 - Lateral Migration Setback Allowance for Riverine Floodplains in Arizona
Figure 1 - Basic Allowable Velocity for Earthen Channels
Sediment Laden Curve Based on D_{75} Paricle Size

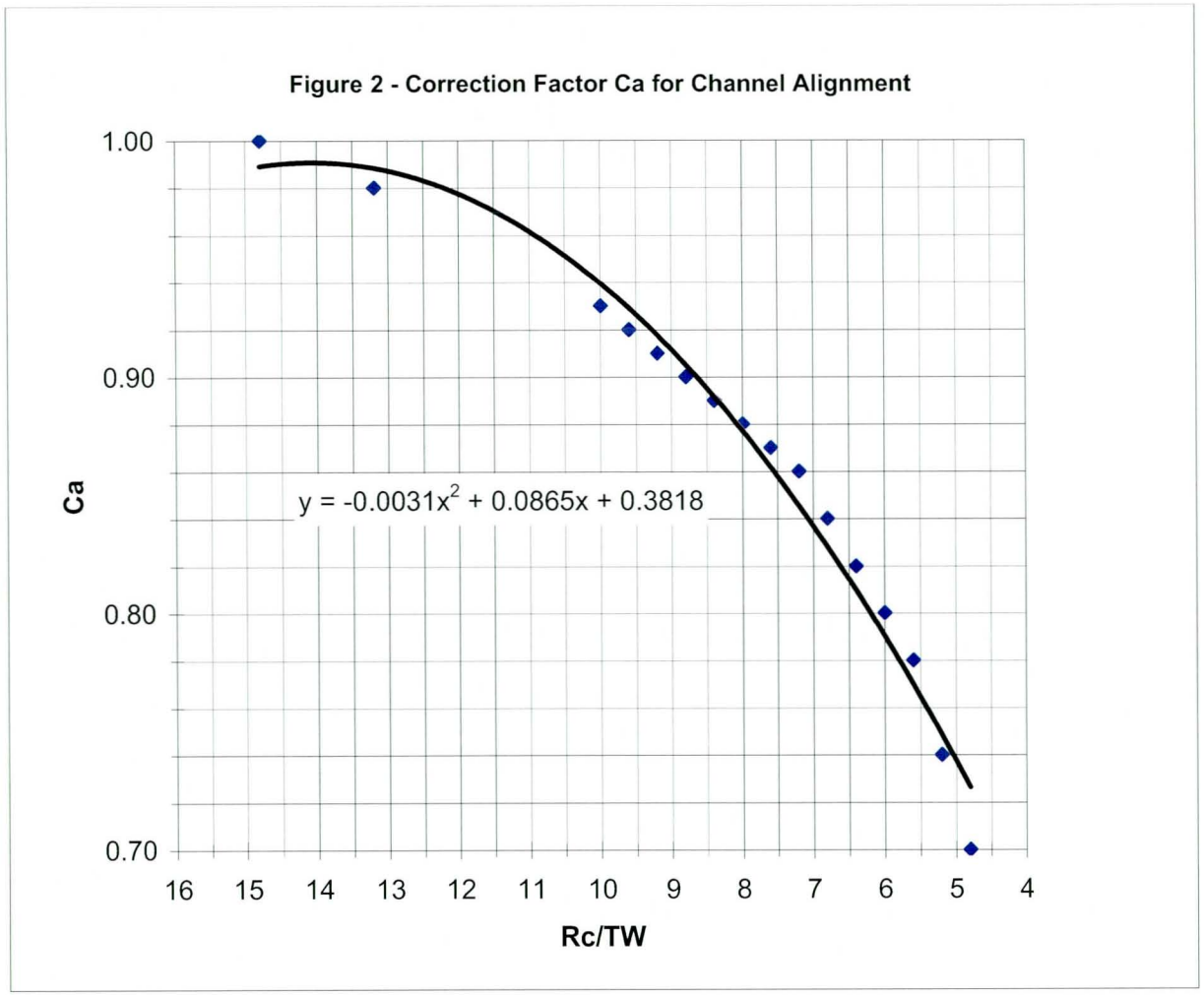
Grain Size (mm)	Basic Velocity (ft/s)	Trendline
0.4	2.0	2.0
0.5	2.2	2.2
0.6	2.3	2.3
0.7	2.4	2.4
0.8	2.5	2.5
0.9	2.6	2.6
1	2.7	2.7
2	3.2	3.3
3	3.7	3.7
4	4.0	4.1
5	4.3	4.3
6	4.6	4.6
7	4.9	4.8
8	5.0	5.0
9	5.2	5.2
10	5.3	5.4
15	6.0	6.1
20	6.6	6.6
30	7.7	7.5
40	8.2	8.2
50	8.8	8.7
60	9.4	9.2
70	9.8	9.7
80	10.0	10.1
90	10.6	10.5
100	11.0	10.8
150	12.0	12.2
200	13.0	13.3



Arizona Department of Water Resources
Watercourse System Sediment Balance, State Standard 5-96
Guideline 1 - Lateral Migration Setback Allowance for Riverine Floodplains in Arizona
Figure 2 - Correction Factor C_a for Channel Alignment

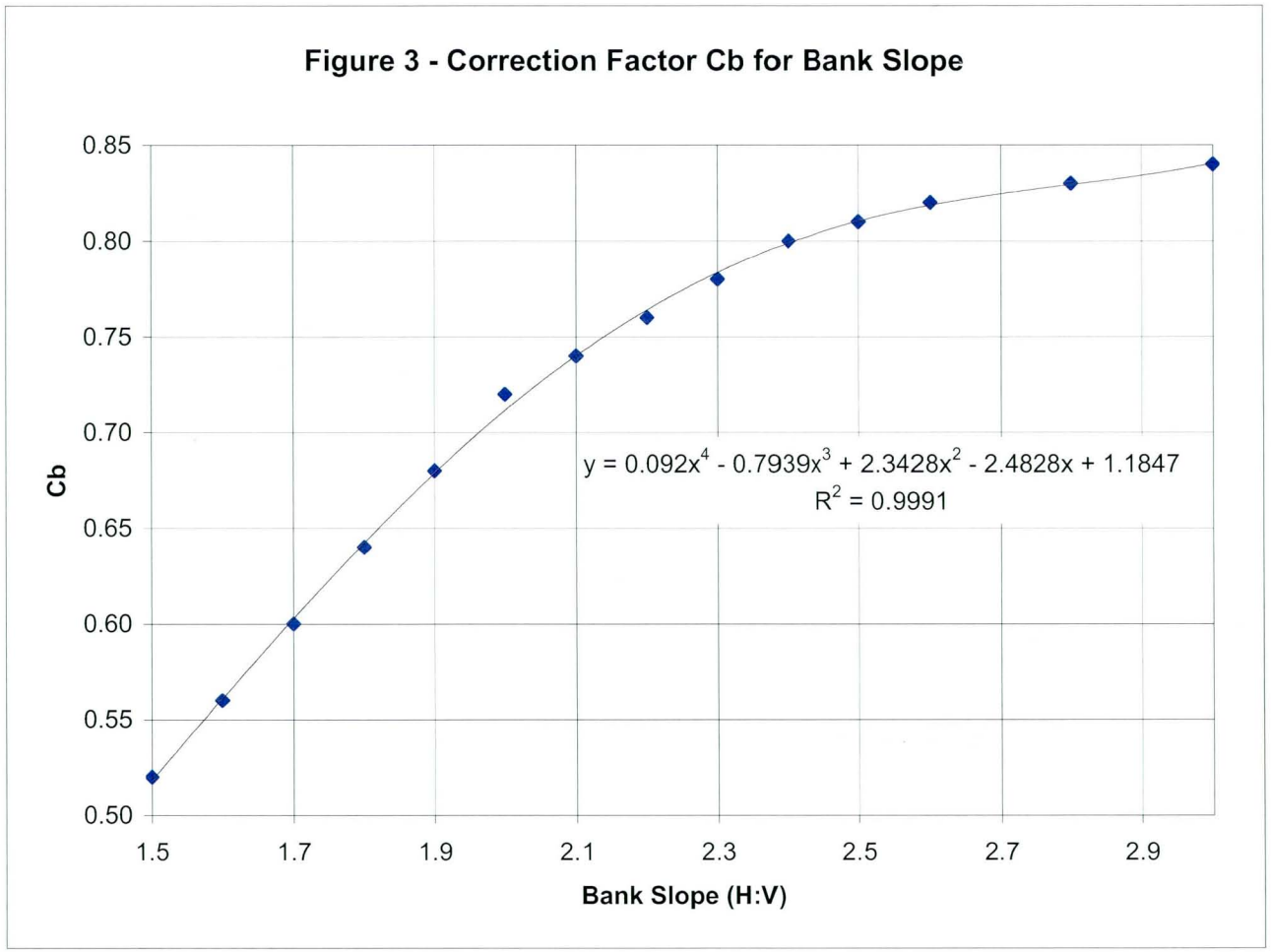
Rc/TW	C_a	Trendline
4.8	0.70	0.73
5.2	0.74	0.75
5.6	0.78	0.77
6	0.80	0.79
6.4	0.82	0.81
6.8	0.84	0.83
7.2	0.86	0.84
7.6	0.87	0.86
8	0.88	0.88
8.4	0.89	0.89
8.8	0.90	0.90
9.2	0.91	0.92
9.6	0.92	0.93
10	0.93	0.94
13.2	0.98	0.98
14.8	1.00	0.98

Notes:
1. Rc = radius of curvature (ft).
2. TW = water surface width (ft).



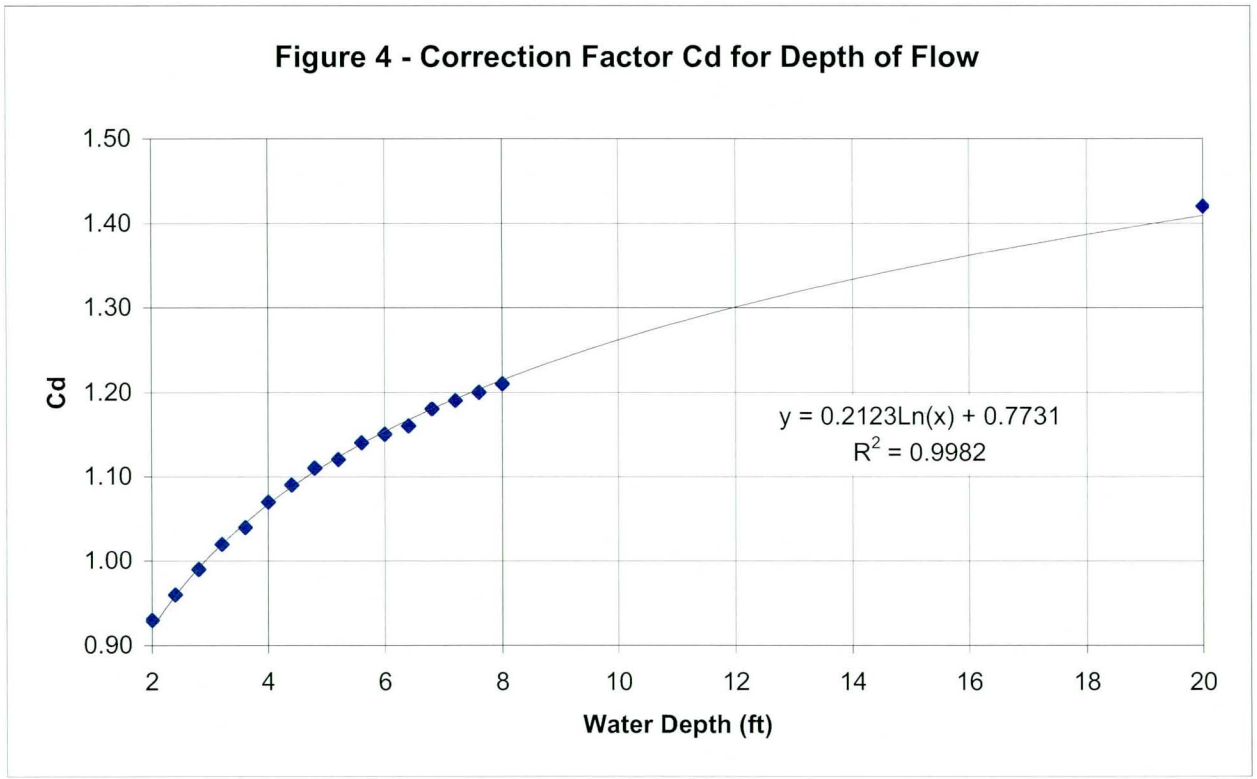
Arizona Department of Water Resources
Watercourse System Sediment Balance, State Standard 5-96
Guideline 1 - Lateral Migration Setback Allowance for Riverine Floodplains in Arizona
Figure 3 - Correction Factor C_b for Bank Slope

Bank Slope, Z (H:V)	C_b	Trendline
1.5	0.52	0.52
1.6	0.56	0.56
1.7	0.60	0.60
1.8	0.64	0.64
1.9	0.68	0.68
2	0.72	0.71
2.1	0.74	0.74
2.2	0.76	0.76
2.3	0.78	0.78
2.4	0.80	0.80
2.5	0.81	0.81
2.6	0.82	0.82
2.8	0.83	0.83
3	0.84	0.84



Arizona Department of Water Resources
Watercourse System Sediment Balance, State Standard 5-96
Guideline 1 - Lateral Migration Setback Allowance for Riverine Floodplains in Arizona
Figure 4 - Correction Factor C_d for Depth of Flow

Water Depth (ft)	C_d	Trendline
2	0.93	0.92
2.4	0.96	0.96
2.8	0.99	0.99
3.2	1.02	1.02
3.6	1.04	1.05
4	1.07	1.07
4.4	1.09	1.09
4.8	1.11	1.11
5.2	1.12	1.12
5.6	1.14	1.14
6	1.15	1.15
6.4	1.16	1.17
6.8	1.18	1.18
7.2	1.19	1.19
7.6	1.20	1.20
8	1.21	1.21
20	1.42	1.41



Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

ANDORA HILLS WASH
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Floodplain Delineation Study of Andora Hills & Galloway Washes, FCD 99-14
Flood Control District of Maricopa County, October 2000
JE Fuller Hydrology & Geomorphology, Inc., Tempe, AZ

HEC-RAS: Project: AndoraErsnHzd.prj
HEC-RAS Plan: AndoraErsnHzd.p03
HEC-RAS Geometry: AndoraErsnhazd.g02
HEC-RAS Flow: AndoraErsnHzd.f01

Resources: Arizona Deptarment of Water Resources
Watercourse System Sediment Balance, State Standard 5-96

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Rc (ft) — Radius of curve
- Lc (ft) — Length of curve
- b (ft) — Difference between Lft and Rt bank stations
- Z — Bank slope (horizontal:vertical)
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Andora Hills	Reach 5	Profile 1	2.324	2260	2253.38	5.84	6.59	0.007604	213.24	0.065	9964.83	10023.41	58.6	0	0	3	0.6	48	119	5.94	N/A	1.00	0.84	1.17	5.84	Stable
Andora Hills	Reach 5	Profile 1	2.28	2260	2248.72	12.17	7.24	0.027355	68.96	0.065	9987.69	10011.81	24.1	0	0	3	0.6	48	119	5.94	N/A	1.00	0.84	1.19	5.94	Unstable
Andora Hills	Reach 5	Profile 1	2.219	2260	2241.07	5.47	6.64	0.00553	177.03	0.065	9990.59	10035	44.4	0	0	3	0.6	48	119	5.94	N/A	1.00	0.84	1.18	5.85	Stable
Andora Hills	Reach 5	Profile 1	2.174	2260	2236.83	10.75	4.96	0.034857	72.47	0.065	9962.85	10013	50.1	0	0	3	0.6	48	119	5.94	N/A	1.00	0.84	1.11	5.54	Unstable
Andora Hills	Reach 5	Profile 1	2.153	2260	2234.7	8.65	6.3	0.015484	133.24	0.065	9993	10021.04	28.0	110	60	3	0.6	48	119	5.94	2.14	0.70	0.84	1.16	4.06	Unstable
Andora Hills	Reach 5	Profile 1	2.124	2260	2231.35	11.81	7.59	0.025834	127.25	0.065	9988.36	10003.99	15.6	150	70	3	0.6	48	119	5.94	4.48	0.70	0.84	1.20	4.20	Unstable
Andora Hills	Reach 5	Profile 1	2.09	2260	2223.89	15.42	7.99	0.053571	66.79	0.065	9990	10005	15.0	0	0	3	0.6	48	119	5.94	N/A	1.00	0.84	1.21	6.05	Unstable
Andora Hills	Reach 5	Profile 1	2.056	2260	2207.24	17.3	4.81	0.137189	43.01	0.065	9977.47	10026.85	49.4	0	0	3	0.6	48	119	5.94	N/A	1.00	0.84	1.11	5.51	Unstable
Andora Hills	Reach 5	Profile 1	2.019	2500	2205.36	10.46	6.46	0.022612	80.71	0.065	9973.98	10008.66	34.7	0	0	2	0.6	50	125	5.94	N/A	1.00	0.71	1.17	4.94	Unstable
Andora Hills	Reach 5	Profile 1	1.976	2500	2200.53	10.73	7.35	0.019231	69.82	0.065	9980.78	10010.91	30.1	0	0	2	0.6	50	125	5.94	N/A	1.00	0.71	1.20	5.06	Unstable
Andora Hills	Reach 5	Profile 1	1.935	2500	2196.53	10.72	6.83	0.01873	99.24	0.06	9983.6	10013.2	29.6	0	0	3	0.6	50	125	5.94	N/A	1.00	0.84	1.18	5.88	Unstable
Andora Hills	Reach 5	Profile 1	1.888	2500	2193.27	9.02	6.91	0.012573	172.46	0.06	9983.41	10009	25.6	0	0	3	0.6	50	125	5.94	N/A	1.00	0.84	1.18	5.89	Unstable
Andora Hills	Reach 5	Profile 1	1.831	2500	2190.43	7.44	7.09	0.007933	116.21	0.06	9976.85	10018.72	41.9	230	135	3	0.6	50	125	5.94	3.22	0.70	0.84	1.19	4.14	Unstable
Andora Hills	Reach 5	Profile 1	1.786	2500	2186.95	10.42	6.18	0.018739	90.72	0.06	9984.92	10016	31.1	0	0	3	0.6	50	125	5.94	N/A	1.00	0.84	1.16	5.78	Unstable
Andora Hills	Reach 5	Profile 1	1.731	2500	2181.64	9.51	5.57	0.018378	122.61	0.06	9976.94	10021	44.1	0	0	3	0.6	50	125	5.94	N/A	1.00	0.84	1.14	5.67	Unstable
Andora Hills	Reach 5	Profile 1	1.668	2620	2177.69	8.13	7.08	0.009592	160.08	0.06	9983.36	10015.98	32.6	0	0	3	0.4	51	128	5.51	N/A	1.00	0.84	1.19	5.49	Unstable
Andora Hills	Reach 5	Profile 1	1.609	2620	2172.59	9.94	5.14	0.022074	89.49	0.06	9962.62	10017.29	54.7	0	0	3	0.4	51	128	5.51	N/A	1.00	0.84	1.12	5.18	Unstable
Andora Hills	Reach 5	Profile 1	1.566	2620	2168.82	8.88	5.59	0.015496	187.76	0.06	9973.86	10014.11	40.3	0	0	3	0.4	51	128	5.51	N/A	1.00	0.84	1.14	5.26	Unstable
Andora Hills	Reach 4	Profile 1	1.555	2395	2167.48	10.29	5.26	0.023547	92.81	0.06	9988.7	10013	24.3	0	0	3	0.4	49	122	5.51	N/A	1.00	0.84	1.13	5.20	Unstable
Andora Hills	Reach 4	Profile 1	1.539	2395	2165.1	10.62	4.2	0.030281	120.29	0.06	9978.41	10009.25	30.8	0	0	3	0.4	49	122	5.51	N/A	1.00	0.84	1.08	4.98	Unstable
Andora Hills	Reach 3	Profile 1	1.496	2700	2161.99	6.54	5.64	0.008589	245.09	0.06	9961.04	10024.54	63.5	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.14	5.27	Unstable
Andora Hills	Reach 3	Profile 1	1.466	2700	2160.11	8.97	8.71	0.011704	304.35	0.06	9983.42	10013	29.6	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.23	5.70	Unstable
Andora Hills	Reach 3	Profile 1	1.438	2700	2153.53	16.61	6.53	0.04801	53.71	0.06	9989.74	10015.74	26.0	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.17	5.41	Unstable
Andora Hills	Reach 3	Profile 1	1.394	2700	2149.88	11.68	6.36	0.023007	112.08	0.06	9987.66	10011	23.3	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.17	5.39	Unstable
Andora Hills	Reach 3	Profile 1	1.353	2700	2147.49	4.98	6.69	0.004073	188.86	0.06	9964.13	10033.74	69.6	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.18	5.44	Stable
Andora Hills	Reach 3	Profile 1	1.298	2700	2143.74	12.57	8.19	0.0179	104.95	0.06	9987.19	10006	18.8	220	110	3	0.4	52	130	5.51	5.85	0.78	0.84	1.22	4.41	Unstable
Andora Hills	Reach 3	Profile 1	1.266	2700	2139.09	12.97	6.62	0.028004	46.74	0.06	9983.8	10018.65	34.9	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.17	5.43	Unstable
Andora Hills	Reach 3	Profile 1	1.222	2700	2133.95	9.93	7	0.016105	69.05	0.06	9974.42	10018.22	43.8	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.19	5.48	Unstable
Andora Hills	Reach 3	Profile 1	1.17	2700	2130.96	8.81	8.21	0.008904	68.6	0.06	9976	10011.76	35.8	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.22	5.64	Unstable
Andora Hills	Reach 3	Profile 1	1.133	2700	2127.83	11.1	7.81	0.01713	60.41	0.06	9983.58	10017.43	33.9	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.21	5.59	Unstable
Andora Hills	Reach 3	Profile 1	1.085	2700	2123.3	10.63	7.56	0.02052	125.55	0.06	9977.4	10015.2	37.8	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.20	5.56	Unstable
Andora Hills	Reach 3	Profile 1	1.039	2700	2114.49	16.45	6.6	0.046399	78.84	0.06	9989.37	10007.89	18.5	0	0	3	0.4	52	130	5.51	N/A	1.00	0.84	1.17	5.42	Unstable
Andora Hills	Reach 3	Profile 1	0.992	2750	2112.5	7.46	7.58	0.007356	119.73	0.06	9985.88	10016.55	30.7	0	0	3	0.4	52	131	5.51	N/A	1.00	0.84	1.20	5.56	Unstable
Andora Hills	Reach 3	Profile 1	0.954	2750	2108.29	13.12	7.48	0.022996	62.5	0.06	9983.96	10009	25.0	0	0	3	0.4	52	131	5.51	N/A	1.00	0.84	1.20	5.55	Unstable
Andora Hills	Reach 3	Profile 1	0.911	2900	2102.75	8.88	4.77	0.023705	96.01	0.06	9939	10030	91.0	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.10	5.11	Unstable
Andora Hills	Reach 3	Profile 1	0.902	2900	2102.44	7.03	7.94	0.007258	52	0.06	9957	10009	52.0	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.21	5.61	Unstable
Andora Hills	Reach 3		0.893	Culvert																						
Andora Hills	Reach 3	Profile 1	0.884	2900	2101.63	7.14	8.13	0.007401	50	0.06	9957	10007	50.0	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.22	5.63	Unstable
Andora Hills	Reach 3	Profile 1	0.854	2900	2101.13	5.41	8.13	0.003372	363.42	0.06	9985.23	10010	24.8	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.22	5.63	Stable
Andora Hills	Reach 3	Profile 1	0.83	2900	2098.76	11.64	8.26	0.016395	304.22	0.06	9981.18	10008.48	27.3	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.22	5.64	Unstable
Andora Hills	Reach 3	Profile 1	0.816	2900	2092.92	19.68	6.04	0.091453	160.67	0.06	9988.94	10014.21	25.3	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.15	5.34	Unstable
Andora Hills	Reach 3	Profile 1	0.805	2900	2086.21	20.18	4.61	0.110271	77.37	0.06	9992	10018	26.0	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.10	5.07	Unstable
Andora Hills	Reach 3		0.797	Culvert																						
Andora Hills	Reach 3	Profile 1	0.789	2900	2087.22	10.79	6.92	0.020194	146.93	0.06	9992	10019	27.0	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.18	5.47	Unstable
Andora Hills	Reach 3	Profile 1	0.761	2900	2080.48	16.3	3.78	0.028525	75.01	0.035	9973.79	10019.26	45.5	0	0	3	0.4	54	135	5.51	N/A	1.00	0.84	1.06	4.88	Unstable
Andora Hills	Reach 3	Profile 1	0.729	3000	2079.97	9.61	5.59	0.006529	191.17	0.035	9961.17	10021.42	60.3	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.14	5.26	Unstable
Andora Hills	Reach 3	Profile 1	0.687	3000	2080.19	5.5	8.11	0.001177	231.89	0.035	9981	10009.28	28.3	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.22	5.63	Stable
Andora Hills	Reach 3	Profile 1	0.679	3000	2080.19	4.34	8.92	0.000788	258.34	0.035	9963	10004	41.0	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.24	5.72	Stable
Andora Hills	Reach 3		0.673	Culvert																						
Andora Hills	Reach 3	Profile 1	0.667	3000	2076.64	8.56	6.08	0.005026	255.57	0.035	9962	10002	40.0	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.16	5.34	Unstable
Andora Hills	Reach 3	Profile 1	0.628	3000	2071.21	15.22	2.89	0.043785	128.38	0.035	9973	10027	54.0	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.00	4.61	Unstable
Andora Hills	Reach 3	Profile 1	0.592	3000	2067.07	12.97	4.5	0.01815	214.02	0.035	9984	10018.62	34.6	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.09	5.05	Unstable
Andora Hills	Reach 3	Profile 1	0.563	3000	2062.32	16.72	3.65	0.040636	232.36	0.035	9993.27	10013.52	20.3	0	0	3	0.4	55	137	5.51	N/A	1.00	0.84	1.05	4.84	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

ANDORA HILLS WASH
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Floodplain Delineation Study of Andora Hills & Galloway Washes, FCD 99-14
Flood Control District of Maricopa County, October 2000
JE Fuller Hydrology & Geomorphology, Inc., Tempe, AZ

HEC-RAS: Project: AndoraErsnHzd.prj
HEC-RAS Plan: AndoraErsnHzd.p03
HEC-RAS Geometry: AndoraErsnhazd.g02
HEC-RAS Flow: AndoraErsnHzd.f01

Resources: Arizona Deptarment of Water Resources
Watercourse System Sediment Balance, State Standard 5-96

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Rc (ft) — Radius of curve
- Lc (ft) — Length of curve
- b (ft) — Difference between Lft and Rt bank stations
- Z — Bank slope (horizontal:vertical)
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level II Bank Stability Estimate						
																		Level I Erosion Setback		Allowable Velocity Analysis					
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Andora Hills	Reach 3	Profile 1	0.522	3100	2058.68	14.46	7.48	0.010162	127.07	0.035	9990	10010.72	20.7	0	0	3	0.4	56	139	5.51	N/A	1.00	0.84	1.20	5.55	Unstable
Andora Hills	Reach 3	Profile 1	0.48	3100	2051.71	20.7	5.14	0.033907	143.07	0.035	9993.57	10019	25.4	0	0	3	0.4	56	139	5.51	N/A	1.00	0.84	1.12	5.18	Unstable
Andora Hills	Reach 3	Profile 1	0.447	3100	2050.23	11.54	7.05	0.023604	111.3	0.06	9975	10019.91	44.9	0	0	3	0.4	56	139	5.51	N/A	1.00	0.84	1.19	5.49	Unstable
Andora Hills	Reach 3	Profile 1	0.432	3100	2048.04	9.46	9.51	0.014425	274.45	0.06	9999	10026	27.0	0	0	3	0.4	56	139	5.51	N/A	1.00	0.84	1.25	5.78	Unstable
Andora Hills	Reach 3		0.429	Culvert																						
Andora Hills	Reach 3	Profile 1	0.426	3100	2047.65	9.25	9.72	0.013498	249.01	0.06	9988	10015	27.0	0	0	3	0.4	56	139	5.51	N/A	1.00	0.84	1.26	5.80	Unstable
Andora Hills	Reach 3	Profile 1	0.393	3100	2042.65	7.48	9.23	0.010443	165.99	0.06	9972.76	9999.76	27.0	0	0	3	0.4	56	139	5.51	N/A	1.00	0.84	1.24	5.75	Unstable
Andora Hills	Reach 3	Profile 1	0.317	3100	2035.31	10.2	6.08	0.025773	136.19	0.06	9966.1	10031.45	65.4	220	90	3	0.4	56	139	5.51	1.38	0.70	0.84	1.16	3.74	Unstable
Andora Hills	Reach 2	Profile 1	0.271	1913	2027.84	10.61	5	0.039059	69.06	0.06	9970.95	10026	55.0	0	0	3	0.4	44	109	5.51	N/A	1.00	0.84	1.11	5.15	Unstable
Andora Hills	Reach 2	Profile 1	0.236	1913	2022.87	9.74	6.38	0.021516	53.77	0.06	9983.94	10026.6	42.7	280	115	2	0.4	44	109	5.51	2.70	0.70	0.71	1.17	3.20	Unstable
Andora Hills	Reach 2	Profile 1	0.185	1913	2015.84	11.28	5.97	0.026701	41.7	0.06	9985	10019.23	34.2	0	0	2	0.4	44	109	5.51	N/A	1.00	0.71	1.15	4.52	Unstable
Andora Hills	Reach 1	Profile 1	0.162	3200	2013.29	9.97	5.99	0.022246	75.62	0.06	9970.09	10041	70.9	0	0	3	0.4	57	141	5.51	N/A	1.00	0.84	1.15	5.33	Unstable
Andora Hills	Reach 1	Profile 1	0.14	3200	2012.16	7.76	7.82	0.009603	81.7	0.06	9944	10013.27	69.3	0	0	2	0.4	57	141	5.51	N/A	1.00	0.71	1.21	4.74	Unstable
Andora Hills	Reach 1	Profile 1	0.129	3200	2010.02	11.91	6.12	0.024334	62.05	0.06	9964.28	10011.27	47.0	0	0	2	0.4	57	141	5.51	N/A	1.00	0.71	1.16	4.54	Unstable
Andora Hills	Split 1	Profile 1	0.244	305	2168.53	3.64	2.16	0.011624	61.01	0.06	9961.45	10011.97	50.5	0	0	2	0.4	17	44	5.51	N/A	1.00	0.71	0.94	3.67	Stable
Andora Hills	Split 1	Profile 1	0.232	305	2166.83	5.83	1.63	0.051666	54.11	0.06	9966.08	10015.13	49.0	0	0	2	0.4	17	44	5.51	N/A	1.00	0.71	0.93	3.65	Unstable
Andora Hills	Split 2	Profile 1	0.093	1287	2028.37	8.75	4.87	0.039989	63.91	0.06	9986.2	10047.52	61.3	0	0	2	0.4	36	90	5.51	N/A	1.00	0.71	1.11	4.35	Unstable
Andora Hills	Split 2	Profile 1	0.083	1287	2022.02	10.04	5.51	0.044031	48.16	0.06	9966.35	10014.13	47.8	0	0	3	0.4	36	90	5.51	N/A	1.00	0.84	1.14	5.25	Unstable
Andora Hills	Split 2	Profile 1	0.042	1287	2016.78	7.37	6.35	0.015632	50.41	0.06	9982.63	10028.21	45.6	0	0	3	0.4	36	90	5.51	N/A	1.00	0.84	1.17	5.39	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

COTTONWOOD CREEK
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study:	Cave Creek/Carefree Flood Insurance Study
Prepared For:	Flood Control District of Maricopa County, March 1990
Prepared By:	CH2M Hill, Inc.
Imported HEC-2 File:	CW.DAT
HEC-RAS Project:	CW.prj
HEC-RAS Plan:	CW.p02
HEC-RAS Geometry:	CW.g01
HEC-RAS Steady Flow:	CW.f02

Variables:

V_b (ft/s)	Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
C_a	Correction factor for channel alignment, SSA 5-96, Figure 2
C_b	Correction factor for bank slope, SSA 5-96, Figure 3
C_d	Correction factor for depth of flow, SSA 5-96, Figure 4
V_a (ft/s)	Calculated allowable velocity for earthen channels considering correction factors
Z	Bank slope (horizontal:vertical)
Lc (ft)	Length of curve
Rc (ft)	Radius of curve
b (ft)	Difference between Lft and Rt bank stations
D_{75}	The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cottonwood	Reach-1	PF 3	4.52	1366	3320.61	18.22	3.81	0.098068	37.97	0.05	9984.2	10010.6	26.4	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.06	5.9	Unstable
Cottonwood	Reach-1	PF 3	4.45	1366	3287.79	16.95	6.29	0.08135	27.68	0.05	9985.8	10011.8	26	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.16	6.5	Unstable
Cottonwood	Reach-1	PF 3	4.34	1366	3228.1	20.64	4.4	0.122627	28.95	0.045	9981.4	10013.8	32.4	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.09	6.1	Unstable
Cottonwood	Reach-1	PF 3	4.26	1366	3198.77	14.48	4.67	0.051854	49.27	0.05	9983.6	10007.2	23.6	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.10	6.1	Unstable
Cottonwood	Reach-1	PF 3	4.17	1366	3156.61	17.51	5.81	0.089566	23.43	0.06	9993	10013.7	20.7	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.15	6.4	Unstable
Cottonwood	Reach-1	PF 3	4.08	1366	3115.71	19.57	6.11	0.07574	23.39	0.045	9985.8	10008.3	22.5	370	110	3	0.8	37	92	6.7	4.89	0.70	0.84	1.16	4.5	Unstable
Cottonwood	Reach-1	PF 3	4.01	1366	3090	16.2	3.8	0.072457	69.67	0.05	9995.2	10015.5	20.3	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.06	5.9	Unstable
Cottonwood	Reach-1	PF 3	3.92	1366	3057.52	17.73	5.32	0.060582	33.65	0.05	9999.5	10013.7	14.2	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.13	6.3	Unstable
Cottonwood	Reach-1	PF 3	3.79	1366	3015.43	17.2	5.42	0.059401	31.17	0.045	9990.8	10013.5	22.7	260	120	1	0.8	37	92	6.7	5.29	0.75	0.50	1.13	2.8	Unstable
Cottonwood	Reach-1	PF 3	3.71	1366	2992.84	14.62	4.44	0.054499	51.35	0.05	9990.2	10012	21.8	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.09	6.1	Unstable
Cottonwood	Reach-1	PF 3	3.61	1366	2961.37	18.27	4.97	0.057681	41.71	0.05	9991.1	10005.6	14.5	170	70	1	0.8	37	92	6.7	4.83	0.70	0.50	1.11	2.6	Unstable
Cottonwood	Reach-1	PF 3	3.53	1366	2936.81	14.22	4.01	0.064439	62.85	0.05	9985	10017.3	32.3	180	70	1	0.8	37	92	6.7	2.17	0.70	0.50	1.07	2.5	Unstable
Cottonwood	Reach-1	PF 3	3.48	1366	2914.7	20.01	4.5	0.085501	38.79	0.045	9993.9	10015.1	21.2	0	0	0.5	0.8	37	92	6.7	N/A	1.00	0.50	1.09	3.6	Unstable
Cottonwood	Reach-1	PF 3	3.41	1366	2895.68	13.89	4.68	0.039566	61.76	0.045	9989.8	10022.2	32.4	0	0	2	0.8	37	92	6.7	N/A	1.00	0.71	1.10	5.2	Unstable
Cottonwood	Reach-1	PF 3	3.32	1366	2872.96	16.07	3.66	0.077378	34.64	0.045	9975.2	10014.2	39	0	0	2	0.8	37	92	6.7	N/A	1.00	0.71	1.05	5.0	Unstable
Cottonwood	Reach-1	PF 3	3.21	1366	2841.39	11.46	3.79	0.044242	58.59	0.06	9994.8	10021	26.2	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.06	5.9	Unstable
Cottonwood	Reach-1	PF 3	3.15	1366	2823.86	14.41	5.26	0.056726	50.38	0.05	9980.3	10009.6	29.3	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.13	6.3	Unstable
Cottonwood	Reach-1	PF 3	3.08	1366	2800.93	12.98	3.93	0.07075	65.76	0.05	9976.1	10020.5	44.4	260	120	3	0.8	37	92	6.7	2.70	0.70	0.84	1.06	4.2	Unstable
Cottonwood	Reach-1	PF 3	3.01	1366	2781.29	9.92	3.39	0.043512	75.2	0.05	9970.9	10036	65.1	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.03	5.8	Unstable
Cottonwood	Reach-1	PF 3	2.91	1366	2749.85	13.71	4.35	0.076534	68.56	0.05	9984.7	10031.3	46.6	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.09	6.1	Unstable
Cottonwood	Reach-1	PF 3	2.85	1366	2733.65	13.24	4.75	0.030117	42.19	0.05	9987.5	10009.3	21.8	140	50	2	0.8	37	92	6.7	2.29	0.70	0.71	1.10	3.7	Unstable
Cottonwood	Reach-1	PF 3	2.79	1366	2717.2	15.14	2.7	0.099478	88.78	0.045	9980.8	10022.7	41.9	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	0.98	5.5	Unstable
Cottonwood	Reach-1	PF 3	2.71	1366	2698.69	8.56	3.29	0.027542	86.4	0.045	9967.9	10054.1	86.2	0	0	3	0.8	37	92	6.7	N/A	1.00	0.84	1.03	5.7	Unstable
Cottonwood	Reach-1	PF 3	2.58	9424	2671.4	19.6	5.9	0.036619	140.31	0.045	9988.8	10032	43.2	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.15	6.4	Unstable
Cottonwood	Reach-1	PF 3	2.47	9424	2648.62	18.68	6.92	0.039493	145.08	0.05	9955.2	10027	71.8	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.18	6.6	Unstable
Cottonwood	Reach-1	PF 3	2.40	9424	2635.21	20.61	7.31	0.031317	105.55	0.045	9976.2	10021.6	45.4	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.20	6.7	Unstable
Cottonwood	Reach-1	PF 3	2.30	9424	2619.5	19.96	6.8	0.032352	87.93	0.045	9946.2	10019.9	73.7	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.18	6.6	Unstable
Cottonwood	Reach-1	PF 3	2.19	9424	2598.2	20.93	6.2	0.044314	138.11	0.045	9975.8	10032.2	56.4	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.16	6.5	Unstable
Cottonwood	Reach-1	PF 3	2.12	9424	2586.83	20.66	7.73	0.026771	81.94	0.045	9964.9	10020.1	55.2	210	75	1	0.8	97	243	6.7	1.36	0.70	0.50	1.21	2.8	Unstable
Cottonwood	Reach-1	PF 3	2.07	9424	2574.66	25.52	9.46	0.03254	71.41	0.045	9984.3	10018.2	33.9	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.25	7.0	Unstable
Cottonwood	Reach-1	PF 3	1.97	9424	2545.45	28.51	5.75	0.097549	116.58	0.045	9974.5	10020.5	46	260	75	1	0.8	97	243	6.7	1.63	0.70	0.50	1.14	2.7	Unstable
Cottonwood	Reach-1	PF 3	1.85	9424	2527.74	18.65	12.24	0.016506	69.96	0.05	9993.6	10034.4	40.8	0	0	3	0.8	97	243	6.7	N/A	1.00	0.84	1.30	7.3	Unstable
Cottonwood	Reach-1	PF 3	1.74	10925	2496.94	33.41	6.84	0.089042	119.76	0.035	9958.6	10022.4	63.8	0	0	3	0.8	105	261	6.7	N/A	1.00	0.84	1.18	6.6	Unstable
Cottonwood	Reach-1	PF 3	1.63	10925	2488.63	20.71	12.63	0.011778	80.2	0.04	9975.9	10013.3	37.4	0	0	3	0.8	105	261	6.7	N/A	1.00	0.84	1.31	7.3	Unstable
Cottonwood	Reach-1	PF 3	1.54	10925	2475.97	27.21	9.77	0.03194	92.64	0.04	9989	10025.5	36.5	0	0	3	0.8	105	261	6.7	N/A	1.00	0.84	1.26	7.0	Unstable
Cottonwood	Reach-1	PF 3	1.40	10925	2460.59	19.95	10.69	0.021278	146.31	0.045	9984.8	10016.9	32.1	220	75	3	0.8	105	261	6.7	2.34	0.70	0.84	1.28	5.0	Unstable
Cottonwood	Reach-1	PF 3	1.34	10925	2455.53	17.54	15.43	0.013339	99.98	0.05	9993.6	10030.5	36.9	0	0	1	0.8	105	261	6.7	N/A	1.00	0.50	1.35	4.5	Unstable
Cottonwood	Reach-1	PF 3	1.23	10925	2427.79	36.53	9.69	0.053547	75.12	0.035	9980.6	10011.2	30.6	0	0	1	0.8	105	261	6.7	N/A	1.00	0.50	1.26	4.2	Unstable
Cottonwood	Reach-1	PF 3	1.14	10925	2415.56	22.47	9.56	0.02426	108.75	0.04	9974.5	10031.1	56.6	0	0	3	0.8	105	261	6.7	N/A	1.00	0.84	1.25	7.0	Unstable
Cottonwood	Reach-1	PF 3	1.03	10956	2401.53	25.61	8.83	0.02344	141.75	0.035	9989.2	10026.4	37.2	500	250	3	0.8	105	262	6.7	6.72	0.82	0.84	1.24	5.7	Unstable
Cottonwood	Reach-1	PF 3	0.94	10956	2391.33	20.37	8.93	0.027094	343.96	0.035	9952.3	10017.3	65	350	200	3	0.8	105	262	6.7	3.08	0.70	0.84	1.24	4.8	Unstable
Cottonwood	Reach-1	PF 3	0.87	10956	2382.83	19.25	7.03	0.023121	248.3	0.035	9973.2	10018.7	45.5	0	0	3	0.8	105	262	6.7	N/A	1.00	0.84	1.19	6.6	Unstable
Cottonwood	Reach-1	PF 3	0.79	10956	2374.65	17.61	7.55	0.020399	375.73	0.035	9681.2	9769.8	88.6	0	0	3	0.8	105	262	6.7	N/A	1.00	0.84	1.20	6.7	Unstable
Cottonwood	Reach-1	PF 3	0.69	10956	2364.01	18.69	10.21	0.013567	92.86	0.035	9948.4	10026	77.6	0	0	3	0.8	105	262	6.7	N/A	1.00	0.84	1.27	7.1	Unstable
Cottonwood	Reach-1	PF 3	0.66	10956	2358.09	22.98	6.89	0.032445	138.35	0.035	9966	10052.6	86.6	0	0	3	0.8	105	262	6.7	N/A	1.00	0.84	1.18	6.6	Unstable
Cottonwood	Reach-1	PF 3	0.57	10956	2351.23	17.08	10.92	0.013997	118.05	0.04	9986.1	10036.9	50.8	225	60	2	0.8	105	262	6.7	1.18	0.70	0.71	1.28	4.2	Unstable
Cottonwood	Reach-1	PF 3	0.51	10956	2343.58	21.13	11.38	0.014025	75.09	0.04	9979.9	10013.9	34	0	0	2	0.8	105	262	6.7	N/A	1.00	0.71	1.29	6.1	Unstable
Cottonwood	Reach-1	PF 3	0.45	10956	2333.04	25.31	6.34	0.029369	127.19	0.03	9948.5	10027.5	79	0	0	1	0.8	105	262	6.7	N/A	1.00	0.50	1.17	3.9	Unstable
Cottonwood	Reach-1	PF 3	0.32	10956	2322.74	20.23	8.74	0.014953	258.88	0.03	9972.3	10024.3	52	0	0	1	0.8	105	262	6.7	N/A	1.00	0.50	1.23	4.1	Unstable
Cottonwood	Reach-1	PF 3	0.22	10956	2311.5	14.48	6.79	0.037098	221.7	0.045	9875.9	10095.2	219.3	0	0	2	0.8	105	262	6.7	N/A	1.00	0.71	1.18	5.6	Unstable
Cottonwood	Reach-1	PF 3	0.13	10956	2305.01	16.63	7.91	0.008319	154.94	0.03	9985.9	10038.5	52.6	0	0	1	0.8	105	262	6.7	N/A	1.00	0.50	1.21	4.0	Unstable
Cottonwood	Reach-1	PF 3	3.78	10956	2286.01	20.77	3.31	0.050457	220.91	0.03	9917.1	10138.7	221.6	0	0	3	0.8	105	262	6.7	N/A	1.00	0.84	1.03	5.7	Unstable

COTTONWOOD CREEK TRIB 1

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: CWT1.DAT
HEC-RAS Project: CWT1.prj
HEC-RAS Plan: CWT1.p03
HEC-RAS Geometry: CWT1.g01
HEC-RAS Steady Flow: CWT1.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis					
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cottonwood Trib 1	Reach-1	PF 3	0.70	1269	2543.74	14.95	5.63	0.034018	38.63	0.05	9995.7	10010.1	14.4	0	0	3	0.8	36	89	6.7	N/A	1.00	0.84	1.14	6.4	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.56	1269	2517.7	13.34	5.3	0.037301	52.45	0.045	9990.5	10015.5	25	140	63	3	0.8	36	89	6.7	2.52	0.70	0.84	1.13	4.4	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.44	1269	2495.29	15.51	6.19	0.02578	29.9	0.045	9987.6	10000	12.4	80	25	3	0.8	36	89	6.7	2.02	0.70	0.84	1.16	4.5	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.32	1269	2469.89	17.02	4.59	0.061865	26.75	0.045	9988.6	10011.6	23	0	0	2	0.8	36	89	6.7	N/A	1.00	0.71	1.10	5.2	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.24	1269	2455.42	14.29	4.92	0.025168	35.18	0.045	9992.6	10007.9	15.3	190	80	3	0.8	36	89	6.7	5.23	0.75	0.84	1.11	4.6	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.18	1410	2440.69	17.91	6.09	0.073629	39.08	0.05	9998	10013.5	15.5	0	0	3	0.8	38	94	6.7	N/A	1.00	0.84	1.16	6.5	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.15	1410	2430.55	15.8	5.15	0.05696	25.65	0.05	9986.7	10010.8	24.1	150	50	3	0.8	38	94	6.7	2.07	0.70	0.84	1.12	4.4	Unstable
Cottonwood Trib 1	Reach-1	PF 3	0.06	1410	2416.16	12.17	6.16	0.02128	38.21	0.05	9989.4	10009.4	20	0	0	3	0.8	38	94	6.7	N/A	1.00	0.84	1.16	6.5	Unstable
Cottonwood Trib 1	Reach-1	PF 3	1.03	1410	2396.32	13.53	3.62	0.05668	61.91	0.05	9989.2	10026.4	37.2	500	250	3	0.8	38	94	6.7	6.72	0.82	0.84	1.05	4.8	Unstable

COTTONWOOK CREEK TRIB 2

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: CWT2.DAT
HEC-RAS Project: CWT2.prj
HEC-RAS Plan: CWT2.p02
HEC-RAS Geometry: CWT2.g01
HEC-RAS Steady Flow: CWT2.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cottonwood Trib 2	Reach-1	PF 3	0.22	141	2506.96	6.65	1.56	0.031665	20.47	0.05	10000	10013	13	0	0	3	0.8	12	30	6.7	N/A	1.00	0.84	0.93	5.2	Unstable
Cottonwood Trib 2	Reach-1	PF 3	0.15	141	2492.09	8.32	2.99	0.049489	22.13	0.05	9996.1	10013	16.9	140	50	3	0.8	12	30	6.7	2.96	0.70	0.84	1.01	3.9	Unstable
Cottonwood Trib 2	Reach-1	PF 3	0.10	141	2478.37	7.38	2.77	0.042996	13.47	0.05	9985.9	10010.9	25	110	50	3	0.8	12	30	6.7	2.00	0.70	0.84	0.99	3.9	Unstable
Cottonwood Trib 2	Reach-1	PF 3	0.02	141	2452.61	9.95	2.21	0.087807	10.73	0.05	9992.8	10007.6	14.8	80	30	3	0.8	12	30	6.7	2.03	0.70	0.84	0.94	3.7	Unstable
Cottonwood Trib 2	Reach-1	PF 3	0.18	141	2438.03	6.49	3.43	0.030014	12.68	0.05	9998	10013.5	15.5	0	0	3	0.8	12	30	6.7	N/A	1.00	0.84	1.03	5.8	Unstable

FLEMMING SPRINGS WASH

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: FS.DAT
HEC-RAS Project: FS.prj
HEC-RAS Plan: FS.p02
HEC-RAS Geometry: FS.g01
HEC-RAS Steady Flow: FS.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Flemming Springs	Reach 1	PF 3	0.76	610	2822.39	12.64	2.89	0.130185	34.89	0.06	9983.1	10000	16.9	0	0	3.0	1.3	25	62	7.7	N/A	1.00	0.84	1.00	6.5	Unstable
Flemming Springs	Reach 1	PF 3	0.67	610	2759.83	12.93	2.53	0.132586	36.25	0.06	9983	10000	17	150	50	3.0	1.3	25	62	7.7	2.94	0.70	0.84	0.97	4.4	Unstable
Flemming Springs	Reach 1	PF 3	0.57	610	2713.12	13.59	3.32	0.063519	50.83	0.06	9996	10000	4	0	0	3.0	1.3	25	62	7.7	N/A	1.00	0.84	1.03	6.6	Unstable
Flemming Springs	Reach 1	PF 3	0.47	610	2670.87	13.87	3.27	0.096798	58.36	0.045	9997.6	10018.5	20.9	180	75	3.0	1.3	25	62	7.7	3.59	0.70	0.84	1.02	4.6	Unstable
Flemming Springs	Reach 1	PF 3	0.41	610	2644.77	15.15	2.37	0.068414	32.75	0.045	10000	10012.3	12.3	180	80	3.0	1.3	25	62	7.7	6.50	0.81	0.84	0.96	5.0	Unstable
Flemming Springs	Reach 1	PF 3	0.33	610	2626.57	7.67	1.87	0.033772	96.69	0.045	10000	10027.6	27.6	0	0	3.0	1.3	25	62	7.7	N/A	1.00	0.84	0.93	6.0	Unstable
Flemming Springs	Reach 1	PF 3	0.21	610	2582.52	16.48	2.42	0.178103	50.93	0.045	9998.3	10013.6	15.3	140	75	3.0	1.3	25	62	7.7	4.90	0.73	0.84	0.96	4.5	Unstable
Flemming Springs	Reach 1	PF 3	0.07	610	2544.7	12.95	3.5	0.066929	27.03	0.045	9998.3	10026.2	27.9	250	100	3.0	1.3	25	62	7.7	3.58	0.70	0.84	1.04	4.7	Unstable
Flemming Springs	Reach 1	PF 3	0.04	610	2537.05	10.8	2.35	0.042591	69.5	0.038	10000	10020.8	20.8	0	0	3.0	1.3	25	62	7.7	N/A	1.00	0.84	0.95	6.2	Unstable
Flemming Springs	Reach 1	PF 3	0.01	610	2531.04	7.1	3.04	0.019026	68.3	0.038	9960	10000	40	0	0	3.0	1.3	25	62	7.7	N/A	1.00	0.84	1.01	6.5	Unstable

GALLOWAY WASH

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Floodplain Delineation Study of Andora Hills & Galloway Washes, FCD 99-14
Flood Control District of Maricopa County, October 2000
JE Fuller Hydrology & Geomorphology, Inc., Tempe, AZ

HEC-RAS Project: GW_Ersn_Hazd.prj
HEC-RAS Plan: GW_Ersn_Hazd.p02
HEC-RAS Geometry: GW_Ersn_Hazd.g01
HEC-RAS Flow: GW_Ersn_Hazd.f02

Variables:

V_b (ft/s)	Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
C_a	Correction factor for channel alignment, SSA 5-96, Figure 2
C_b	Correction factor for bank slope, SSA 5-96, Figure 3
C_d	Correction factor for depth of flow, SSA 5-96, Figure 4
V_a (ft/s)	Calculated allowable velocity for earthen channels considering correction factors
Z	Bank slope (horizontal:vertical)
Lc (ft)	Length of curve
Rc (ft)	Radius of curve
b (ft)	Difference between Lft and Rt bank stations
D_{75}	The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway	Reach 4	Profile 1	2.458	3440	2305.77	12.87	3.93	0.032854	148.11	0.04	9918.5	10020	101.5	0	0	3	0.14	59	147	3.9	N/A	1.00	0.84	1.06	3.5	Unstable
Galloway	Reach 4	Profile 1	2.420	3440	2301.03	11.95	4.78	0.020063	104.02	0.04	9989.92	10070	80.08	0	0	3	0.14	59	147	3.9	N/A	1.00	0.84	1.11	3.6	Unstable
Galloway	Reach 4	Profile 1	2.382	3440	2297.05	11.17	4.4	0.023152	143.6	0.045	9987.37	10065.53	78.16	0	0	3	0.14	59	147	3.9	N/A	1.00	0.84	1.09	3.6	Unstable
Galloway	Reach 4	Profile 1	2.344	3440	2291.77	12.64	3.3	0.021119	92.05	0.035	9993	10085	92	0	0	3	0.14	59	147	3.9	N/A	1.00	0.84	1.03	3.4	Unstable
Galloway	Reach 4	Profile 1	2.299	4410	2289.66	10.64	4.78	0.008671	218.25	0.035	9941.65	10025.07	83.42	0	0	3	0.14	66	166	3.9	N/A	1.00	0.84	1.11	3.6	Unstable
Galloway	Reach 4	Profile 1	2.281	4410	2289.52	6.18	7.21	0.00228	218.73	0.04	9920	10016.1	96.1	0	0	3	0.14	66	166	3.9	N/A	1.00	0.84	1.19	3.9	Unstable
Galloway	Reach 4		2.275	Culvert																						
Galloway	Reach 4	Profile 1	2.268	4410	2285.45	11.39	4.26	0.015347	108.21	0.04	9940	10034	94	0	0	3	0.14	66	166	3.9	N/A	1.00	0.84	1.08	3.6	Unstable
Galloway	Reach 4	Profile 1	2.240	4410	2279.48	15.71	3.26	0.062122	130.92	0.04	9958.29	10084.44	126.15	0	0	3	0.14	66	166	3.9	N/A	1.00	0.84	1.02	3.4	Unstable
Galloway	Reach 4	Profile 1	2.193	4410	2275.85	9.43	3.87	0.01639	185.86	0.04	9895.73	10060	164.27	0	0	3	0.14	66	166	3.9	N/A	1.00	0.84	1.06	3.5	Unstable
Galloway	Reach 4	Profile 1	2.162	4410	2272	10.5	5	0.029124	410.85	0.045	9863.71	10026.6	162.89	0	0	3	0.14	66	166	3.9	N/A	1.00	0.84	1.11	3.7	Unstable
Galloway	Reach 4	Profile 1	2.098	5490	2264.27	10.14	3.67	0.02089	376.8	0.04	9871.46	10010.28	138.82	0	0	3	0.14	74	185	3.9	N/A	1.00	0.84	1.05	3.4	Unstable
Galloway	Reach 4	Profile 1	2.041	5490	2257.12	11.01	3.56	0.026948	423.95	0.04	9935	10058.43	123.43	0	0	3	0.14	74	185	3.9	N/A	1.00	0.84	1.04	3.4	Unstable
Galloway	Reach 4	Profile 1	2.004	6060	2252.66	11.37	3.67	0.021842	511.52	0.04	9963.65	10059.24	95.59	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.05	3.4	Unstable
Galloway	Reach 4	Profile 1	1.966	6060	2247.96	11.88	3.68	0.020378	315.19	0.04	9969.25	10086.22	116.97	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.05	3.5	Unstable
Galloway	Reach 4	Profile 1	1.928	6060	2243.81	12.22	4.07	0.018591	315.76	0.04	9975.64	10087.88	112.24	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.07	3.5	Unstable
Galloway	Reach 4	Profile 1	1.917	6060	2242.33	13.48	4.27	0.023771	281	0.04	9982.04	10073.21	91.17	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.08	3.6	Unstable
Galloway	Reach 4	Profile 1	1.890	6060	2240.95	8.52	6.29	0.005603	175.99	0.04	9975.86	10082.93	107.07	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.16	3.8	Unstable
Galloway	Reach 4	Profile 1	1.846	6060	2236.84	13.88	7.27	0.012943	79.05	0.04	9970	10040	70	0	0	1	0.14	78	195	3.9	N/A	1.00	0.50	1.19	2.3	Unstable
Galloway	Reach 4	Profile 1	1.815	6060	2230.06	19.51	5.03	0.04215	76.13	0.04	9991	10065	74	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.12	3.7	Unstable
Galloway	Reach 4	Profile 1	1.790	6060	2227.57	16.47	5.97	0.021504	226.4	0.04	9990	10056.52	66.52	0	0	3	0.14	78	195	3.9	N/A	1.00	0.84	1.15	3.8	Unstable
Galloway	Reach 4	Profile 1	1.761	6060	2223.35	16.28	4.85	0.037053	128.88	0.045	9979.29	10065.27	85.98	150	50	3	0.14	78	195	3.9	0.58	0.70	0.84	1.11	2.6	Unstable
Galloway	Reach 4	Profile 1	1.739	6060	2220.88	15.07	5.28	0.016441	91.36	0.035	9946.54	10032.11	85.57	0	0	2	0.14	78	195	3.9	N/A	1.00	0.71	1.13	3.1	Unstable
Galloway	Reach 4	Profile 1	1.701	6060	2214.76	17.81	3.93	0.034383	117.27	0.035	9980	10077.22	97.22	0	0	1	0.14	78	195	3.9	N/A	1.00	0.50	1.06	2.1	Unstable
Galloway	Reach 4	Profile 1	1.663	6060	2211.84	14.06	5.35	0.014198	101.77	0.035	9972	10063.13	91.13	0	0	2	0.23	78	195	4.6	N/A	1.00	0.71	1.13	3.7	Unstable
Galloway	Reach 4	Profile 1	1.625	6060	2206.24	16.97	4.31	0.030132	103.33	0.035	9931.76	10032.3	100.54	0	0	2	0.23	78	195	4.6	N/A	1.00	0.71	1.08	3.5	Unstable
Galloway	Reach 4	Profile 1	1.587	6060	2204.07	13.32	6.52	0.010719	97.09	0.035	9926.04	10010	83.96	0	0	2	0.23	78	195	4.6	N/A	1.00	0.71	1.17	3.8	Unstable
Galloway	Reach 4	Profile 1	1.549	6060	2199.04	17.21	5.02	0.023217	88.17	0.035	9934.98	10014.61	79.63	0	0	3	0.23	78	195	4.6	N/A	1.00	0.84	1.12	4.3	Unstable
Galloway	Reach 4	Profile 1	1.511	6060	2194.14	17.02	4.46	0.026408	90.67	0.035	9925	10015.13	90.13	0	0	3	0.23	78	195	4.6	N/A	1.00	0.84	1.09	4.2	Unstable
Galloway	Reach 3	Profile 1	1.474	10800	2190.51	17.59	5.42	0.020556	569.91	0.035	9945	10024.48	79.48	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.13	4.3	Unstable
Galloway	Reach 3	Profile 1	1.435	10800	2185.61	17.17	4.76	0.025256	333.4	0.035	9929.76	10042.14	112.38	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.10	4.2	Unstable
Galloway	Reach 3	Profile 1	1.397	10800	2181.57	15.67	4.68	0.018691	287.73	0.035	9966.77	10086.43	119.66	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.10	4.2	Unstable
Galloway	Reach 3	Profile 1	1.360	10800	2176.74	17.1	4.11	0.025912	303.55	0.035	9976.83	10091.53	114.7	0	0	2	0.23	104	260	4.6	N/A	1.00	0.71	1.07	3.5	Unstable
Galloway	Reach 3	Profile 1	1.331	10800	2173.37	16.43	4.31	0.022049	321.24	0.035	9979.12	10081.71	102.59	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.08	4.1	Unstable
Galloway	Reach 3	Profile 1	1.284	10800	2165.07	18.9	4.93	0.028628	212.5	0.035	9949.31	10068.13	118.82	0	0	2	0.23	104	260	4.6	N/A	1.00	0.71	1.11	3.6	Unstable
Galloway	Reach 3	Profile 1	1.246	10800	2164.41	10.5	8.45	0.002821	376.73	0.03	9998.27	10092.5	94.23	0	0	2	0.23	104	260	4.6	N/A	1.00	0.71	1.23	4.0	Unstable
Galloway	Reach 3	Profile 1	1.209	10800	2158.9	19.99	6.4	0.015638	399.33	0.03	9992.08	10070.2	78.12	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.17	4.5	Unstable
Galloway	Reach 3	Profile 1	1.171	10800	2153.54	21.28	5.29	0.02578	342.55	0.03	9986.09	10092.95	106.86	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.13	4.3	Unstable
Galloway	Reach 3	Profile 1	1.133	10800	2148.21	21.08	6.03	0.03551	281.35	0.04	9956.72	10035.32	78.6	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.15	4.4	Unstable
Galloway	Reach 3	Profile 1	1.110	10800	2145.94	18.46	7.56	0.025132	464.53	0.04	9950.23	10018.85	68.62	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.20	4.6	Unstable
Galloway	Reach 3	Profile 1	1.095	10800	2144.24	18.25	6.44	0.031553	350.14	0.04	9942.07	10018.22	76.15	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.17	4.5	Unstable
Galloway	Reach 2	Profile 1	1.056	6693	2140.62	12.22	5.47	0.016833	135.14	0.045	9904.72	10014.5	109.78	0	0	3	0.23	82	205	4.6	N/A	1.00	0.84	1.13	4.3	Unstable
Galloway	Reach 2	Profile 1	1.019	6693	2136.81	13.52	6.27	0.017119	110	0.045	9972.08	10053.09	81.01	0	0	3	0.23	82	205	4.6	N/A	1.00	0.84	1.16	4.4	Unstable
Galloway	Reach 2	Profile 1	0.974	6693	2133.17	14.82	10.17	0.01198	103.39	0.045	9983.52	10028.75	45.23	0	0	3	0.23	82	205	4.6	N/A	1.00	0.84	1.27	4.8	Unstable
Galloway	Reach 2	Profile 1	0.941	6693	2124.1	22.57	5.04	0.061524	83.61	0.045	9974.33	10036.11	61.78	0	0	3	0.23	82	205	4.6	N/A	1.00	0.84	1.12	4.3	Unstable
Galloway	Reach 1	Profile 1	0.905	10800	2124.4	11.25	9.06	0.007148	224.9	0.045	9986.04	10092.18	106.14	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.24	4.7	Unstable
Galloway	Reach 1	Profile 1	0.896	10800	2124.62	9.21	9.76	0.004016	266.64	0.045	9987.02	10094.3	107.28	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.26	4.8	Unstable
Galloway	Reach 1	Profile 1	0.868	10800	2124.59	6.92	11.76	0.00183	347.92	0.045	9974.5	10099.49	124.99	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.30	5.0	Unstable
Galloway	Reach 1		0.866	Bridge													0.23									
Galloway	Reach 1	Profile 1	0.864	10800	2118.95	13.35	6.92	0.016077	168.05	0.045	9969.62	10109.61	139.99	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.18	4.5	Unstable
Galloway	Reach 1	Profile 1	0.845	10800	2113.48	18.36	3.92	0.055224	168.65	0.045	9946.74	10107.03	160.29	0	0	3	0.23	104	260	4.6	N/A	1.00	0.84	1.06	4.1	Unstable
Galloway	Reach 1	Profile 1	0.792	13700	2110.53	14.86	7.2	0.015903	189.41	0.045	9957.28	10056.73	99.45	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.19	4.6	Unstable
Galloway	Reach 1	Profile 1	0.754	13700	2108.49	14.52	8.91	0.006976	247.72	0.035	9930.88	10027.4	96.52	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.24	4.7	Unstable

GALLOWAY WASH

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Floodplain Delineation Study of Andora Hills & Galloway Washes, FCD 99-14
Flood Control District of Maricopa County, October 2000
JE Fuller Hydrology & Geomorphology, Inc., Tempe, AZ

HEC-RAS Project: GW_Ersn_Hazd.prj
HEC-RAS Plan: GW_Ersn_Hazd.p02
HEC-RAS Geometry: GW_Ersn_Hazd.g01
HEC-RAS Flow: GW_Ersn_Hazd.f02

Variables:

V_b (ft/s)	Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
C_a	Correction factor for channel alignment, SSA 5-96, Figure 2
C_b	Correction factor for bank slope, SSA 5-96, Figure 3
C_d	Correction factor for depth of flow, SSA 5-96, Figure 4
V_a (ft/s)	Calculated allowable velocity for earthen channels considering correction factors
Z	Bank slope (horizontal:vertical)
Lc (ft)	Length of curve
Rc (ft)	Radius of curve
b (ft)	Difference between Lft and Rt bank stations
D_{75}	The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway	Reach 1	Profile 1	0.711	13700	2101.09	22.21	8.45	0.020037	194.12	0.035	9970.6	10051.6	81	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.23	4.7	Unstable
Galloway	Reach 1	Profile 1	0.678	13700	2098.88	21.57	10.06	0.013842	206.62	0.035	9965	10025	60	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.26	4.1	Unstable
Galloway	Reach 1	Profile 1	0.641	13700	2092.72	23.61	6.83	0.047162	193.4	0.045	9939.11	10023.59	84.48	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.18	3.8	Unstable
Galloway	Reach 1	Profile 1	0.603	13700	2091.55	16.51	9.57	0.013705	173.6	0.045	9955.03	10016	60.97	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.25	4.1	Unstable
Galloway	Reach 1	Profile 1	0.565	13700	2085.86	19.73	7.96	0.028442	240.48	0.045	9989.39	10066.85	77.46	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.21	3.9	Unstable
Galloway	Reach 1	Profile 1	0.527	13700	2082.43	16.68	9.2	0.014942	268.82	0.045	9966.98	10055	88.02	0	0	1	0.23	117	293	4.6	N/A	1.00	0.50	1.24	2.8	Unstable
Galloway	Reach 1	Profile 1	0.489	13700	2077.71	18.42	8.78	0.021865	281.61	0.045	9959.74	10053	93.26	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.23	4.0	Unstable
Galloway	Reach 1	Profile 1	0.451	13700	2075.68	16.5	10.96	0.01193	262.52	0.045	9949.12	10015.02	65.9	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.28	4.9	Unstable
Galloway	Reach 1	Profile 1	0.413	13700	2070.88	19.46	9.38	0.019337	149.56	0.045	9967.49	10022.28	54.79	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.25	4.8	Unstable
Galloway	Reach 1	Profile 1	0.376	13700	2068.98	16.91	10.77	0.013388	224.82	0.045	9982.3	10038.91	56.61	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.28	4.9	Unstable
Galloway	Reach 1	Profile 1	0.338	13700	2063.53	19.86	8.14	0.025615	156.33	0.045	9969.81	10039.1	69.29	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.22	4.7	Unstable
Galloway	Reach 1	Profile 1	0.300	13700	2060.95	12.35	10.55	0.017743	202.37	0.07	9961.09	10039.67	78.58	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.27	4.1	Unstable
Galloway	Reach 1	Profile 1	0.262	13700	2057.32	13.27	11.76	0.017279	198.97	0.07	9966.02	10027	60.98	0	0	1	0.23	117	293	4.6	N/A	1.00	0.50	1.30	3.0	Unstable
Galloway	Reach 1	Profile 1	0.224	13700	2053.3	13.86	13.82	0.018927	221.4	0.07	9972.04	10022.15	50.11	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.33	5.1	Unstable
Galloway	Reach 1	Profile 1	0.186	13700	2045.5	18.05	10.02	0.046132	238.02	0.07	9966.91	10017.32	50.41	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.26	4.8	Unstable
Galloway	Reach 1	Profile 1	0.149	13700	2041.91	10.38	12.73	0.013478	266.7	0.07	9976.03	10026.02	49.99	0	0	1	0.23	117	293	4.6	N/A	1.00	0.50	1.31	3.0	Unstable
Galloway	Reach 1	Profile 1	0.111	13700	2039.8	12.32	14.23	0.012111	170.78	0.07	9977.87	10019.81	41.94	0	0	3	0.23	117	293	4.6	N/A	1.00	0.84	1.34	5.1	Unstable
Galloway	Reach 1	Profile 1	0.073	13700	2035.07	16.25	12.87	0.024903	154.17	0.07	9986.33	10014.22	27.89	0	0	2	0.23	117	293	4.6	N/A	1.00	0.71	1.32	4.3	Unstable
Galloway	Reach 1	Profile 1	0.035	13700	2032.49	11.49	12.27	0.014006	259.77	0.07	9954.52	10010.8	56.28	0	0	1	0.23	117	293	4.6	N/A	1.00	0.50	1.31	3.0	Unstable
Galloway	Split 3	Profile 1	0.148	4107	2141.68	10.7	10.09	0.006549	341.27	0.045	9980.04	10010	29.96	0	0	1	0.23	64	160	4.6	N/A	1.00	0.50	1.26	2.9	Unstable
Galloway	Split 3	Profile 1	0.115	4107	2134.22	19.21	6.42	0.051987	53.32	0.045	9982.56	10032.56	50	0	0	2	0.23	64	160	4.6	N/A	1.00	0.71	1.17	3.8	Unstable
Galloway	Split 3	Profile 1	0.072	4107	2132.49	12.53	8.02	0.01296	355.85	0.045	9987	10009.49	22.49	0	0	1	0.23	64	160	4.6	N/A	1.00	0.50	1.22	2.8	Unstable
Galloway	Split 3	Profile 1	0.035	4107	2126.24	17.54	6.34	0.036277	110.39	0.045	9982	10011	29	0	0	1	0.23	64	160	4.6	N/A	1.00	0.50	1.17	2.7	Unstable
Grapevine	Reach 1	Profile 1	0.210	5720	2216.58	10.81	4.98	0.026019	390.11	0.045	9982.9	10023.1	40.2	0	0	1	0.23	76	189	4.6	N/A	1.00	0.50	1.11	2.5	Unstable
Grapevine	Reach 1	Profile 1	0.166	5720	2211.48	11.25	5.01	0.020645	423.21	0.045	9986.15	10014.79	28.64	0	0	1	0.23	76	189	4.6	N/A	1.00	0.50	1.12	2.5	Unstable
Grapevine	Reach 1	Profile 1	0.119	5720	2205.18	12.91	5.26	0.024685	330.58	0.045	9953	10009.55	56.55	0	0	1	0.23	76	189	4.6	N/A	1.00	0.50	1.13	2.6	Unstable
Grapevine	Reach 1	Profile 1	0.075	5720	2199.91	13.01	6.29	0.021475	465.62	0.045	9972.28	10021.99	49.71	0	0	1	0.23	76	189	4.6	N/A	1.00	0.50	1.16	2.7	Unstable
Grapevine	Reach 1	Profile 1	0.031	5720	2194.84	13.2	5.61	0.023532	479.96	0.045	9978.75	10024.25	45.5	0	0	1	0.23	76	189	4.6	N/A	1.00	0.50	1.14	2.6	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

GALLOWAY WASH TRIBUTARIES 2, 2A AND 2B
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level II Bank Stability Estimate						
																		Level I Erosion Setback		Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway Wash Tribs	Trib2B	PF 1	1399.79 XS	69	2325.44	0.43	4.33	0.000071	57.53	0.056	42.76	101.61	58.85	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.08	4.0	Stable
Galloway Wash Tribs	Trib2B	PF 1	1347.03 XS	69	2325.44	0.33	6.16	0.000026	52.49	0.058	53.4	107.32	53.92	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.16	4.2	Stable
Galloway Wash Tribs	Trib2B	PF 1	1300.17 XS	69	2325.44	0.19	7.17	0.000007	73.08	0.059	37.88	113.04	75.16	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.19	4.4	Stable
Galloway Wash Tribs	Trib2B	PF 1	1267.35 XS	69	2325.44	0.16	9.01	0.000006	83.47	0.071	32.26	120.04	87.78	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.24	4.5	Stable
Galloway Wash Tribs	Trib2B	PF 1	1250.90 XS	69	2325.44	0.16	9.49	0.000008	85.52	0.072	31.15	118.35	87.2	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.25	4.6	Stable
Galloway Wash Tribs	Trib2B	PF 1	1199.48 XS	69	2325.44	0.12	11.02	0.000004	95.61	0.071	24.33	123.43	99.1	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.28	4.7	Stable
Galloway Wash Tribs	Trib2B	PF 1	1148.76 XS	69	2325.44	0.09	12.09	0.000001	104.2	0.07	32.3	137.14	104.84	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.30	4.8	Stable
Galloway Wash Tribs	Trib2B	PF 1	1099.22 XS	69	2325.44	0.07	12.94	0.000001	115.35	0.066	33.87	150.84	116.97	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.32	4.8	Stable
Galloway Wash Tribs	Trib2B	PF 1	1048.29 XS	69	2325.44	0.05	14.45	0	128.26	0.061	32.38	162.12	129.74	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.34	4.9	Stable
Galloway Wash Tribs	Trib2B	PF 1	1011.78 XS	69	2325.44	0.07	8.58	0.000001	141.82	0.057	24.63	167.67	143.04	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.23	4.5	Stable
Galloway Wash Tribs	Trib2B	PF 1	999.86	69	2325.44	0.14	4.02	0.000007	150.8	0.059	44.62	196.7	152.08	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.07	3.9	Stable
Galloway Wash Tribs	Trib2B		981.91	Culvert									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2B	PF 1	899.75 XS	69	2306.08	2.92	0.79	0.018368	46.44	0.044	90.91	146.73	55.82	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2B	PF 1	849.90 XS	69	2305.18	3.47	1.16	0.015448	26.4	0.044	94.06	121.25	27.19	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2B	PF 1	799.64 XS	69	2303.63	5.22	1.56	0.049889	15.69	0.056	79.36	95.34	15.98	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2B	PF 1	751.53 XS	69	2302.47	2.01	2.14	0.004876	36.77	0.049	82.66	121.42	38.76	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2B	PF 1	701.05 XS	69	2302.5	0.29	3.85	0.000033	87.35	0.059	55.43	143.81	88.38	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.06	3.9	Stable
Galloway Wash Tribs	Trib2B	PF 1	599.31 XS	69	2302.5	0.11	10.8	0.000002	87.26	0.062	33.33	121.89	88.56	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.28	4.7	Stable
Galloway Wash Tribs	Trib2B	PF 1	548.90 XS	69	2302.5	0.09	11.67	0.000001	106.14	0.063	21.33	128.21	106.88	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.29	4.7	Stable
Galloway Wash Tribs	Trib2B	PF 1	516.28 XS	69	2302.5	0.2	3.84	0.000011	114.82	0.05	28.66	144.24	115.58	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.06	3.9	Stable
Galloway Wash Tribs	Trib2B	PF 1	486.62	69	2302.4	2.41	1.68	0.004855	27.29	0.044	29.24	58.42	29.18	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2B		479.33	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2B	PF 1	470.42	69	2302.27	3.6	8.52	0.011672	19.07	0.044	29.45	50.04	20.59	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.23	4.5	Stable
Galloway Wash Tribs	Trib2B	PF 1	399.08 XS	69	2300.73	5.1	17.29	0.032984	17.17	0.044	22.23	39.98	17.75	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.38	5.1	Unstable
Galloway Wash Tribs	Trib2B	PF 1	349.98 XS	69	2282.88	5	1.24	0.033915	18.13	0.045	64.36	82.62	18.26	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2B	PF 1	299.03 XS	69	2280.23	4.77	0.95	0.036033	20.85	0.048	47.01	68.67	21.66	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2B	PF 1	248.98 XS	69	2278.35	5.17	1.32	0.031255	16.26	0.044	52.78	69.54	16.76	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2B	PF 1	199.05 XS	69	2277.26	1.53	2.74	0.001713	32.27	0.05	38.6	71.57	32.97	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.99	3.6	Stable
Galloway Wash Tribs	Trib2B	PF 1	148.35 XS	69	2277.25	0.66	4.54	0.00021	39.64	0.061	36.91	77.53	40.62	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.09	4.0	Stable
Galloway Wash Tribs	Trib2B	PF 1	99.47 XS	69	2277.25	0.37	5.82	0.00004	58.72	0.055	26.07	85.97	59.9	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.15	4.2	Stable
Galloway Wash Tribs	Trib2B	PF 1	39.61 XS	69	2277.25	0.14	8.31	0.000004	84.47	0.062	20.51	105.21	84.7	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.22	4.5	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	699.72 XS	146	2277.25	0.13	9.56	0.000003	155.98	0.066	26.24	182.67	156.43	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.25	4.6	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	649.97 XS	146	2277.25	0.15	8.1	0.000003	145.1	0.059	26.56	171.87	145.31	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.22	4.5	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	624.67	146	2277.25	0.5	3.07	0.000125	163.03	0.049	60.45	223.74	163.29	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.01	3.7	Stable
Galloway Wash Tribs	Trib2A.2		611.95	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	599.06	146	2275.1	3.66	1.44	0.04915	97.3	0.051	70.01	227.71	157.7	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.2	PF 1	356.94 XS	146	2256.67	5.44	1.93	0.034315	29.85	0.048	68.91	104.09	35.18	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.2	PF 1	299.47 XS	146	2254.39	5.41	1.65	0.027612	30.33	0.044	65.39	99.61	34.22	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.2	PF 1	248.87 XS	146	2253.76	1.97	2.43	0.002969	63.63	0.045	56.1	120.52	64.42	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.96	3.5	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	199.27 XS	146	2253.77	0.87	3.62	0.000219	75.81	0.044	40.18	117.26	77.08	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.05	3.8	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	148.43 XS	146	2253.77	0.45	5.63	0.000038	82.71	0.05	31.48	117.32	85.84	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.14	4.2	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	98.37 XS	146	2253.77	0.29	7.49	0.000006	103.99	0.037	26.38	121.12	94.74	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.20	4.4	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	49.52 XS	146	2253.77	0.19	8.54	0.000004	126.11	0.048	21.14	144.8	123.66	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.23	4.5	Stable
Galloway Wash Tribs	Trib2A.2	PF 1	32.15 XS	146	2253.77	0.19	8.81	0.000002	111.85	0.043	18.91	132.04	113.13	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.24	4.5	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	1249.07 XS	81	2349.63	5.49	1.8	0.034239	16.09	0.047	28.85	45.04	16.19	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	1199.68 XS	81	2343.82	5.57	1.85	0.0288	15.37	0.043	35.38	50.92	15.54	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	1149.58 XS	81	2339.16	5.88	2.11	0.027419	13.03	0.042	33.62	46.79	13.17	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	1098.25 XS	81	2334.54	5.93	2.15	0.0257	12.72	0.041	31.93	44.82	12.89	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.94	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	1049.91 XS	81	2329.29	5.91	1.93	0.02954	12.71	0.044	42.77	55.81	13.04	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	1000.70 XS	81	2326.31	6.1	2.23	0.029575	11.87	0.043	48.92	60.93	12.01	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.94	3.5	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	949.37 XS	81	2322.57	5.28	1.56	0.025808	18.11	0.04	51.26	69.64	18.38	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	900.14 XS	81	2319.72	5.51	1.79	0.024135	15.98	0.039	65.89	82.14	16.25	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	847.48 XS	81	2314.98	6.9	2.89	0.026061	7.95	0.039	68.36	76.42	8.06	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.00	3.7	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	799.87 XS	81	2315.2	0.35	6.43	0.000027	55.78	0.056	37.88	94.11	56.23	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.17	4.3	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	749.78 XS	81	2315.2	0.25	7.91	0.000011	63.45	0.057	33.2	97.04	63.84	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.21	4.4	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	700.45 XS	81	2315.2	0.16	8.82	0.000003	81.46	0.054	32.88	114.76	81.88	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.24	4.5	Stable

GALLOWAY WASH TRIBUTARIES 2, 2A AND 2B
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate – Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway Wash Tribs	Trib2A.1	PF 1	650.58 XS	81	2315.2	0.1	9.82	0.000001	102	0.056	36.6	139.02	102.42	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.26	4.6	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	635.5	81	2315.2	0.12	7.52	0.000002	115.76	0.064	45.38	161.52	116.14	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.20	4.4	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	616.68	81	2315.2	0.31	4.3	0.000059	116.23	0.064	41.65	158.32	116.67	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.08	4.0	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	613.42	81	2315.19	0.6	2.54	0.000418	112.38	0.058	59.85	172.51	112.66	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.97	3.6	Stable
Galloway Wash Tribs	Trib2A.1		604.11	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	597.02	81	2314.01	3.71	0.8	0.051253	52.66	0.052	69.48	164.85	95.37	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	399.72 XS	81	2290.77	5.32	1.8	0.051547	17.74	0.056	51.48	69.73	18.25	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	349.82 XS	81	2287.85	5.81	2.01	0.030145	13.54	0.044	49.35	63.11	13.76	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.92	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	300.43 XS	81	2285.58	5.77	1.94	0.038212	13.66	0.05	41.7	55.5	13.8	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	249.30 XS	81	2282.87	5.73	1.72	0.030692	14.04	0.045	44.26	58.79	14.53	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	200.06 XS	81	2280	5.1	1.59	0.040821	15.82	0.058	42.31	58.19	15.88	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	148.26 XS	81	2277.82	4.86	1.45	0.044218	23.16	0.051	49.6	73.62	24.02	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2A.1	PF 1	100.05 XS	81	2277.24	1.37	2.94	0.001482	40.09	0.057	23.77	64.51	40.74	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.00	3.7	Stable
Galloway Wash Tribs	Trib2A.1	PF 1	49.46 XS	81	2277.25	0.19	6.59	0.000006	93.35	0.053	0	93.5	93.5	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.17	4.3	Stable
Galloway Wash Tribs	Trib2.2	PF 1	4799.61 XS	579	2253.77	0.6	9.07	0.000037	149.77	0.052	23.25	173.69	150.44	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.24	4.6	Stable
Galloway Wash Tribs	Trib2.2	PF 1	4777.8	579	2253.76	0.87	5.84	0.000082	160.17	0.041	15.68	176.23	160.55	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.15	4.2	Stable
Galloway Wash Tribs	Trib2.2	PF 1	4762.7	579	2253.72	1.74	4.35	0.001131	159.19	0.048	9.71	169.1	159.39	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.09	4.0	Stable
Galloway Wash Tribs	Trib2.2		4747.720	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2.2	PF 1	4732.870	579	2251.81	5.71	2.78	0.036639	103.63	0.052	14.03	161.37	147.34	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.99	3.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4650.25 XS	579	2242.23	7.91	2.62	0.01895	52.19	0.044	82.84	108.07	25.23	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.98	3.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4599.88 XS	579	2240.7	8.15	2.88	0.016376	52.52	0.044	71.79	92.86	21.07	175	140	1	1.1	24	60	7.3	6.64	0.82	0.50	1.00	3.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4549.50 XS	579	2239.94	5.55	2.79	0.013488	91.51	0.052	46.32	78.8	32.48	175	140	1	1.1	24	60	7.3	4.31	0.70	0.50	0.99	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4499.73 XS	579	2238.8	7.68	2.51	0.018909	76.86	0.044	63.88	89.49	25.61	175	140	1	1.1	24	60	7.3	5.47	0.76	0.50	0.97	2.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4447.51 XS	579	2237.08	7.36	2.67	0.021117	64.37	0.044	66.13	95.65	29.52	175	140	1	1.1	24	60	7.3	4.74	0.70	0.50	0.98	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4399.58 XS	579	2235.77	7.18	2.29	0.018875	80.95	0.044	118.68	147.6	28.92	175	140	1	1.1	24	60	7.3	4.84	0.70	0.50	0.95	2.4	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4350.09 XS	579	2235.14	6.21	3.01	0.013489	83.46	0.044	117.25	149.71	32.46	175	140	1	1.1	24	60	7.3	4.31	0.70	0.50	1.01	2.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4302.30 XS	579	2233.99	7.93	2.82	0.01858	57.98	0.044	70.61	94.52	23.91	215	160	1	1.1	24	60	7.3	6.69	0.82	0.50	0.99	3.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4249.63 XS	579	2232.63	7.88	2.17	0.021604	57.59	0.044	51.24	77.01	25.77	215	160	1	1.1	24	60	7.3	6.21	0.80	0.50	0.94	2.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4198.92 XS	579	2231.07	7.4	2.89	0.020687	59.22	0.044	69.35	97.93	28.58	215	160	1	1.1	24	60	7.3	5.60	0.77	0.50	1.00	2.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4149.84 XS	579	2229.07	7.67	2.83	0.015992	55.75	0.044	65.16	89.12	23.96	215	160	1	1.1	24	60	7.3	6.68	0.82	0.50	0.99	3.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4100.09 XS	579	2228.11	7.29	2.76	0.019897	68.98	0.044	70.94	100.88	29.94	215	160	1	1.1	24	60	7.3	5.34	0.76	0.50	0.99	2.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	4050.06 XS	579	2226.87	7.61	3	0.016593	65.29	0.044	66.81	91.15	24.34	215	160	1	1.1	24	60	7.3	6.57	0.82	0.50	1.01	3.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3999.05 XS	579	2225.6	8.2	2.94	0.018073	48.18	0.044	74.09	95.7	21.61	215	160	1	1.1	24	60	7.3	7.40	0.85	0.50	1.00	3.1	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3949.48 XS	579	2224.12	7.38	2.51	0.022206	62.76	0.044	78.91	108.95	30.04	215	160	1	1.1	24	60	7.3	5.33	0.75	0.50	0.97	2.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3897.87 XS	579	2222.18	5.91	1.8	0.02695	86.53	0.045	82.41	129.81	47.4	215	160	1	1.1	24	60	7.3	3.38	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3849.68 XS	579	2220.91	6.39	2.1	0.023233	103.26	0.044	101.84	142.26	40.42	215	160	1	1.1	24	60	7.3	3.96	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3799.20 XS	579	2219.61	7.59	2.17	0.01999	57.51	0.044	119.44	151.7	32.26	215	160	1	1.1	24	60	7.3	4.96	0.73	0.50	0.94	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3750.49 XS	579	2218.29	7.31	2.39	0.021038	78.16	0.046	89.45	118.12	28.67	215	160	1	1.1	24	60	7.3	5.58	0.77	0.50	0.96	2.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3699.41 XS	579	2217.5	5.88	2.44	0.01791	86.45	0.056	62.03	95.13	33.1	215	160	1	1.1	24	60	7.3	4.83	0.70	0.50	0.96	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3649.93 XS	579	2216.03	7.2	2.62	0.035178	84.32	0.055	63.12	95.37	32.25	215	160	1	1.1	24	60	7.3	4.96	0.73	0.50	0.98	2.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3599.58 XS	579	2214.66	5.67	2.72	0.009226	75.39	0.044	43.91	77.27	33.36	215	160	1	1.1	24	60	7.3	4.80	0.70	0.50	0.99	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3549.97 XS	579	2213.34	8.8	3.57	0.016656	51.71	0.044	68.21	88.14	19.93	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3499.86 XS	579	2212.25	8.29	3.51	0.015661	57.15	0.043	74.63	99.21	24.58	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3449.68 XS	579	2211.16	8.72	3.56	0.014679	59.98	0.039	73.69	93.38	19.69	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3400.58 XS	579	2210.09	6.69	3.32	0.010192	56.06	0.042	66.98	93.54	26.56	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.03	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3349.93 XS	579	2209.12	8.68	3.49	0.013444	50.13	0.04	56.38	74.24	17.86	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3300.27 XS	579	2208.24	8.85	3.31	0.014239	51.41	0.039	41.93	60.58	18.65	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.03	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3249.78 XS	579	2207.12	8.76	2.97	0.01846	51.71	0.042	43.16	63.57	20.41	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.00	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3199.35 XS	579	2206.21	7.73	3.19	0.017973	61.47	0.047	45.32	69.23	23.91	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.02	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3150.83 XS	579	2205.39	7.82	3.01	0.018117	63.18	0.046	41.92	65.57	23.65	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.01	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3099.58 XS	579	2204.35	7.83	3.06	0.017762	73.08	0.043	40.57	65.5	24.93	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.01	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	3048.61 XS	579	2203.66	4.38	3.18	0.010111	76.79	0.057	40.52	101.17	60.65	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.02	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2999.06 XS	579	2203.3	4.02	2.94	0.006329	76.44	0.046	46.17	122.54	76.37	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.00	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2971.59 XS	579	2203.26	2.98	3.01	0.003287	111.38	0.046	62.2	173.22	111.02	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.01	3.7	Stable
Galloway Wash Tribs	Trib2.2		2955.8	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2.2	PF 1	2935.93	579	2200.78	7.09	2	0.020639	83.83	0.044	75.23	107.02	31.79	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.92	3.4	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

GALLOWAY WASH TRIBUTARIES 2, 2A AND 2B
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway Wash Tribs	Trib2.2	PF 1	2901.88 XS	579	2199.47	8.13	2.68	0.01824	69.74	0.044	75.13	101.03	25.9	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.98	3.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2849.49 XS	579	2198.05	8.73	3.12	0.015817	69.99	0.044	84.78	101.98	17.2	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.01	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2800.47 XS	579	2196.86	8.04	3.1	0.013446	99.78	0.041	81.69	102.41	20.72	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.01	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2748.93 XS	579	2195.86	7.57	3.09	0.012827	102.05	0.041	77.26	99.76	22.5	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.01	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2700.26 XS	579	2194.64	7.61	2.96	0.010871	112.69	0.038	60.02	80.69	20.67	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.00	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2648.64 XS	579	2192.99	6.23	3.13	0.009115	82.79	0.036	90.94	125.84	34.9	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.02	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2599.75 XS	579	2191.92	7.74	2.78	0.024072	61.43	0.049	113.64	145.25	31.61	185	125	1	1.1	24	60	7.3	3.95	0.70	0.50	0.99	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2549.84 XS	579	2190.32	5.88	1.83	0.042058	91.00	0.063	121.74	181.16	59.42	185	125	1	1.1	24	60	7.3	2.10	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2500.04 XS	579	2189.17	3.64	2.47	0.017412	105.81	0.073	123.21	188.92	65.71	185	125	1	1.1	24	60	7.3	1.90	0.70	0.50	0.97	2.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2449.58 XS	579	2188.35	4.17	2.87	0.01088	117.38	0.057	149.46	209.52	60.06	185	125	1	1.1	24	60	7.3	2.08	0.70	0.50	1.00	2.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2398.77 XS	579	2186.99	7.53	2.3	0.027425	74.48	0.053	133.96	164.99	31.03	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.95	3.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2350.01 XS	579	2185.96	6.96	3.36	0.014461	61.14	0.052	110.75	136.76	26.01	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.03	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2300.64 XS	579	2185.45	5.39	4.37	0.015121	94.07	0.069	103.22	127.77	24.55	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.09	4.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2251.35 XS	579	2184.05	8.02	3.65	0.023765	83.61	0.055	89.26	110.21	20.95	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.05	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2198.42 XS	579	2183.24	6.75	4.21	0.016147	85.49	0.053	77.12	101.86	24.74	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.08	4.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2149.23 XS	579	2182.84	4.67	4.15	0.017129	95.74	0.072	77.62	112.27	34.65	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.08	3.9	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2100.01 XS	579	2180.94	6.91	2.96	0.042329	91.86	0.07	99.91	125.36	25.45	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.00	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	2049.56 XS	579	2179.89	3.52	2.71	0.013889	129.29	0.069	110.09	172.5	62.41	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.98	3.6	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1998.81 XS	579	2178.56	4.08	2.92	0.022895	129.59	0.062	132.78	193.09	60.31	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.00	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1949.31 XS	579	2177.66	4.35	3.23	0.026648	130.44	0.063	114.95	180.24	65.29	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.02	3.7	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1900.23 XS	579	2176.2	3.54	3.96	0.016929	139.70	0.057	115.85	191.42	75.57	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.07	3.9	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1850.51 XS	579	2175.6	2.05	3.95	0.013213	145.79	0.08	75.04	166.65	91.61	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.06	3.9	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1799.36 XS	579	2175.05	2.76	3.5	0.018668	141.50	0.08	40.94	136.24	95.3	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1700.68 XS	579	2173.86	4.43	4.04	0.008624	80.08	0.061	73.39	119.35	45.96	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.07	3.9	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1651.43 XS	579	2173.01	5.44	4.27	0.028411	73.57	0.075	73.16	120.45	47.29	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.08	4.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1599.18 XS	579	2171.94	6.88	3.64	0.010231	80.78	0.039	71.62	120.51	48.89	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.05	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1548.81 XS	579	2171.2	5.18	3.72	0.024461	91.36	0.069	93	144.07	51.07	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.05	3.9	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1498.71 XS	579	2170.5	5.54	3.54	0.008207	96.40	0.042	94.84	143.15	48.31	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1449.27 XS	579	2170.04	5.03	3.59	0.016829	87.44	0.068	110.83	149.76	38.93	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	1.04	3.8	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1400.52 XS	579	2168.64	7.45	2.6	0.021614	69.09	0.048	99.35	132.91	33.56	0	0	1	1.1	24	60	7.3	N/A	1.00	0.50	0.98	3.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1350.06 XS	579	2167.7	7.33	2.16	0.018454	83.68	0.039	120.1	156.59	36.49	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.94	4.9	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1304.43 XS	579	2167.17	5.16	2.29	0.010489	87.64	0.042	56.35	99.18	42.83	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.95	4.9	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1250.10 XS	579	2166.93	3.76	2.69	0.005528	104.19	0.041	66.98	170.02	103.04	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.98	5.1	Stable
Galloway Wash Tribs	Trib2.2		1222.37	Inl Struct									0	0	0	2	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.71	0.93	4.8	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1199.79 XS	579	2164.99	6.77	2.45	0.011721	98.36	0.036	128.85	165.34	36.49	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.96	5.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1148.77 XS	579	2165.19	2.65	4.02	0.000935	128.22	0.037	96.37	147.55	51.18	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.07	5.6	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1100.11 XS	579	2165.11	2.94	3.93	0.002415	104.51	0.054	59.24	98.4	39.16	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.06	5.5	Stable
Galloway Wash Tribs	Trib2.2	PF 1	1049.33 XS	579	2164	7.8	3.42	0.027834	56.56	0.058	63.43	90.22	26.79	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.03	5.4	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	999.47 XS	579	2162.89	8.06	3.03	0.018189	59.23	0.046	56.01	79.67	23.66	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.01	5.3	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	950.14 XS	579	2162.12	4.99	2.59	0.013321	66.26	0.057	50.56	102.66	52.1	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.98	5.1	Stable
Galloway Wash Tribs	Trib2.2	PF 1	898.04 XS	579	2161.81	3.94	3.88	0.005098	75.70	0.051	75.9	133.53	57.63	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.06	5.5	Stable
Galloway Wash Tribs	Trib2.2	PF 1	848.99 XS	579	2161.55	3.71	4.35	0.006558	87.84	0.053	77.34	170.47	93.13	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.09	5.7	Stable
Galloway Wash Tribs	Trib2.2	PF 1	826.23	579	2161.33	3.64	2.77	0.016375	109.18	0.067	118.83	234.94	116.11	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.99	5.2	Stable
Galloway Wash Tribs	Trib2.2		805.12	Culvert									0	0	0	2	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.71	0.93	4.8	Stable
Galloway Wash Tribs	Trib2.2	PF 1	743.18	579	2158.54	2.25	2.75	0.00114	161.42	0.035	130.23	258.85	128.62	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.99	5.2	Stable
Galloway Wash Tribs	Trib2.2	PF 1	731.57	579	2158.55	1.89	2.35	0.000994	204.68	0.036	175.5	305.68	130.18	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.95	5.0	Stable
Galloway Wash Tribs	Trib2.2		721.95	Culvert									0	0	0	2	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.71	0.93	4.8	Stable
Galloway Wash Tribs	Trib2.2	PF 1	699.26	579	2156.73	3.39	3.19	0.007022	166.42	0.048	209.27	320.35	111.08	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.02	5.3	Stable
Galloway Wash Tribs	Trib2.2	PF 1	678.38	579	2156.41	4.51	3.45	0.009944	122.05	0.048	84.33	178.89	94.56	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.04	5.4	Stable
Galloway Wash Tribs	Trib2.2	PF 1	652.61 XS	579	2156.03	5.03	4.03	0.012654	101.69	0.049	72.77	166.92	94.15	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.07	5.6	Stable
Galloway Wash Tribs	Trib2.2	PF 1	600.23 XS	579	2155.29	4.94	4.16	0.018618	123.22	0.051	77.76	148.42	70.66	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.08	5.6	Stable
Galloway Wash Tribs	Trib2.2	PF 1	549.80 XS	579	2154.61	4.03	4.25	0.011799	129.22	0.046	100.56	190.04	89.48	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.08	5.6	Stable
Galloway Wash Tribs	Trib2.2	PF 1	502.28 XS	579	2153.95	4.5	4.91	0.015011	118.06	0.045	28.73	126.56	97.83	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.11	5.8	Stable
Galloway Wash Tribs	Trib2.2	PF 1	450.71 XS	579	2153.18	5.6	3.84	0.010234	79.76	0.047	62.63	103.55	40.92	60	35	2	1.1	24	60	7.3	0.86	0.70	0.71	1.06	3.9	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	400.73 XS	579	2152.26	6.97	4.31	0.017206	56.25	0.059	71.83	96	24.17	60	35	2	1.1	24	60	7.3	1.45	0.70	0.71	1.08	4.0	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	349.19 XS	579	2151.35	7.74	4.2	0.014354	84.04	0.052	79.6	97.65	18.05	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.08	5.6	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

GALLOWAY WASH TRIBUTARIES 2, 2A AND 2B
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate – Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway Wash Tribs	Trib2.2	PF 1	301.42 XS	579	2150.76	5.67	3.89	0.007969	73.03	0.047	86.26	113.33	27.07	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.06	5.5	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	249.17 XS	579	2149.52	7.93	2.93	0.025324	54.54	0.044	115.69	150.82	35.13	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.00	5.2	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	198.80 XS	579	2148.68	6.58	2.62	0.016788	86.48	0.044	116.25	156.98	40.73	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	0.98	5.1	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	149.40 XS	579	2147.99	6.26	4.17	0.014764	96.29	0.044	110.78	151.11	40.33	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.08	5.6	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	97.12 XS	579	2147.64	4.46	5.3	0.007168	119.61	0.062	80.42	114.49	34.07	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.13	5.9	Stable
Galloway Wash Tribs	Trib2.2	PF 1	48.99 XS	579	2146.76	6.76	5.23	0.011206	43.40	0.055	37.53	59.02	21.49	60	30	2	1.1	24	60	7.3	1.40	0.70	0.71	1.12	4.1	Unstable
Galloway Wash Tribs	Trib2.2	PF 1	1.65 XS	579	2146.37	6.42	6.46	0.007112	34.20	0.044	61.99	85.94	23.95	0	0	2	1.1	24	60	7.3	N/A	1.00	0.71	1.17	6.1	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	2649.51 XS	150	2343.46	1.38	4.13	0.001308	46.37	0.068	34.21	80.9	46.69	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.07	3.9	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2599.70 XS	150	2343.44	0.86	5.95	0.000347	55.65	0.068	38.49	94.64	56.15	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.15	4.2	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2550.01 XS	150	2343.44	0.51	7.1	0.000088	75.76	0.067	39.66	115.66	76	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.19	4.4	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2500.27 XS	150	2343.44	0.31	8.43	0.00002	101.37	0.06	34.26	135.87	101.61	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.23	4.5	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2448.75 XS	150	2343.44	0.17	9.95	0.000003	127.39	0.056	32.12	160.04	127.92	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.26	4.6	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2399.52 XS	150	2343.44	0.11	10.23	0.000001	177.91	0.054	9.79	187.91	178.12	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.27	4.6	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2367.96 XS	150	2343.44	0.12	8.99	0.000002	188.97	0.055	7.15	196.26	189.11	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.24	4.5	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2346.04 XS	150	2343.43	0.34	3.33	0.000039	186.13	0.05	16.93	203.27	186.34	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.03	3.8	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2334.18	150	2343.07	4.65	3.19	0.010725	19.98	0.044	199.36	219.5	20.14	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.02	3.7	Unstable
Galloway Wash Tribs	Trib2.1		2330.42	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2.1	PF 1	2325.23	150	2342.14	6.87	2.83	0.028495	15.36	0.044	203.09	218.56	15.47	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.99	3.6	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	2199.30 XS	150	2326.99	4.53	1.42	0.02975	54.66	0.045	42.48	97.66	55.18	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	2150.08 XS	150	2324.58	5.06	1.43	0.032141	36.75	0.047	69.57	106.61	37.04	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	2098.99 XS	150	2322.98	5.45	1.63	0.028344	30.12	0.044	65.54	95.94	30.4	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	2049.22 XS	150	2321.54	5.24	1.28	0.030848	34.20	0.044	60.69	95.23	34.54	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1999.51 XS	150	2319.82	5.25	1.17	0.030736	34.06	0.044	40.18	74.73	34.55	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1949.36 XS	150	2317.74	5.21	1.49	0.031539	35.26	0.044	42.81	78.46	35.65	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1898.05 XS	150	2317.46	1.6	4.08	0.001464	44.98	0.057	49.32	94.43	45.11	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.07	3.9	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1850.25 XS	150	2317.45	0.86	4.97	0.000332	63.20	0.061	53.47	116.72	63.25	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.11	4.1	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1799.29 XS	150	2317.45	0.39	7.03	0.000023	80.01	0.05	55.42	135.65	80.23	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.19	4.4	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1748.98 XS	150	2317.45	0.24	8.66	0.000005	102.02	0.044	48.78	151.39	102.61	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.23	4.5	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1721.45	150	2317.45	0.2	9.46	0.000004	121.00	0.047	39.43	160.77	121.34	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.25	4.6	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1695.02 XS	150	2317.45	0.3	5.61	0.000016	125.92	0.048	28.58	154.74	126.16	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.14	4.2	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1678.78	150	2317.42	1.35	1.8	0.001384	110.06	0.042	30	163.73	133.73	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2.1		1668.4	Inl Struct									0	0	0	1	1.1	#VALUE!	#VALUE!	7.3	N/A	1.00	0.50	0.93	3.4	Stable
Galloway Wash Tribs	Trib2.1	PF 1	1658.06	150	2316.23	3.93	1.38	0.044924	85.07	0.049	47.57	161.85	114.28	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1524.43	150	2299.85	5.03	1.3	0.041278	38.23	0.051	52.48	92.31	39.83	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1499.97 XS	150	2298.28	4.87	1.31	0.040557	42.99	0.049	46.66	91.82	45.16	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1449.01 XS	150	2295.28	5.62	1.72	0.043099	27.62	0.053	60.95	91.99	31.04	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1398.57 XS	150	2293.19	4.78	1.54	0.042571	46.57	0.049	30.39	79.98	49.59	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1349.34 XS	150	2289.83	5.55	1.44	0.036787	28.78	0.049	56.11	86.6	30.49	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1299.50 XS	150	2287.89	3.78	1.9	0.015685	35.85	0.052	55.11	91.07	35.96	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1249.67 XS	150	2286.43	5.95	1.58	0.03306	22.08	0.049	49.77	73.77	24	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1200.13 XS	150	2285.1	4.19	1.82	0.028939	48.47	0.049	60.95	117.89	56.94	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1149.14 XS	150	2283.44	4.8	1.62	0.032383	37.70	0.049	73.35	113.91	40.56	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1098.06 XS	150	2281.97	4.02	1.9	0.02863	50.35	0.051	79.29	132.4	53.11	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	1040.95 XS	150	2279.85	4.71	1.62	0.044411	48.75	0.05	81.47	132.48	51.01	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	999.06 XS	150	2277.85	4.67	1.89	0.028727	34.29	0.051	78.5	119.97	41.47	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	950.21 XS	150	2276.16	5.18	1.97	0.038348	35.32	0.049	54.93	94.64	39.71	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	901.12 XS	150	2274.01	5.4	1.59	0.032992	31.07	0.049	40.28	73.43	33.15	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	849.60 XS	150	2272.15	5.91	1.82	0.032809	23.61	0.049	56.09	81.93	25.84	125	80	1	1.1	20	50	7.3	3.10	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	798.58 XS	150	2270.65	4.82	1.95	0.031287	36.45	0.049	51.58	94.96	43.38	125	80	1	1.1	20	50	7.3	1.84	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	749.36 XS	150	2269.79	3.54	2.51	0.013463	37.58	0.052	44.44	95.43	50.99	125	80	1	1.1	20	50	7.3	1.57	0.70	0.50	0.97	2.5	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	700.00 XS	150	2268.46	5.43	1.63	0.037563	30.76	0.049	38.3	73.28	34.98	125	80	1	1.1	20	50	7.3	2.29	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	648.71 XS	150	2266.52	4.37	1.37	0.028921	39.67	0.052	36.63	86.56	49.93	125	80	1	1.1	20	50	7.3	1.60	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	599.63 XS	150	2264.78	5.03	1.42	0.03948	38.93	0.049	56.37	99.22	42.85	125	80	1	1.1	20	50	7.3	1.87	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	549.45 XS	150	2262.83	3.89	1.53	0.018878	44.16	0.049	67.53	119	51.47	125	80	1	1.1	20	50	7.3	1.55	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	519.57 XS	150	2261.83	5.22	1.86	0.039442	35.59	0.05	74.16	116.81	42.65	125	80	1	1.1	20	50	7.3	1.88	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	479.46 XS	150	2260.14	4.73	1.4	0.038611	47.08	0.049	83.72	145.75	62.03	125	80	1	1.1	20	50	7.3	1.29	0.70	0.50	0.93	2.4	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

GALLOWAY WASH TRIBUTARIES 2, 2A AND 2B
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																				Level II Bank Stability Estimate						
																			Level I Erosion Setback		Allowable Velocity Analysis					
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Galloway Wash Tribs	Trib2.1	PF 1	446.17 XS	150	2258.73	5.14	1.44	0.035378	36.47	0.049	81.72	125.57	43.85	125	80	1	1.1	20	50	7.3	1.82	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	396.87 XS	150	2256.63	4.88	1.75	0.039413	41.69	0.049	73.5	127.73	54.23	125	80	1	1.1	20	50	7.3	1.48	0.70	0.50	0.93	2.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	348.88 XS	150	2255.4	3.76	2.09	0.012559	31.60	0.051	60.46	94.22	33.76	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	299.42 XS	150	2254	5.54	1.71	0.051228	29.03	0.058	53.34	100.05	46.71	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	0.93	3.4	Unstable
Galloway Wash Tribs	Trib2.1	PF 1	249.04 XS	150	2253.8	1.51	3.24	0.001793	50.23	0.065	40	100.81	60.81	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.02	3.7	Stable
Galloway Wash Tribs	Trib2.1	PF 1	199.93 XS	150	2253.78	0.88	4.74	0.000394	62.25	0.065	41.87	109.32	67.45	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.10	4.0	Stable
Galloway Wash Tribs	Trib2.1	PF 1	148.99 XS	150	2253.77	0.56	5.78	0.0001	75.80	0.062	35.05	113.6	78.55	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.15	4.2	Stable
Galloway Wash Tribs	Trib2.1	PF 1	99.49 XS	150	2253.77	0.39	6.58	0.000041	91.17	0.062	16.9	112.4	95.5	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.17	4.3	Stable
Galloway Wash Tribs	Trib2.1	PF 1	51.84 XS	150	2253.77	0.26	7.88	0.000005	102.47	0.038	0	104.08	104.08	0	0	1	1.1	20	50	7.3	N/A	1.00	0.50	1.21	4.4	Stable

NORTH GALLOWAY WASH TRIBUTARY 1
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: See Note 3.
HEC-RAS Project: See Note 3.
HEC-RAS Plan: See Note 3.
HEC-RAS Geometry: See Note 3.
HEC-RAS Steady Flow: See Note 3.

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic parameters based on normal depth sections used for equilibrium slope calculations.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

											Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
XLID	XSID	Q Total (cfs)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	Channel n-Value	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
NGALLOWAY_TRIB_1	1	165	1.61	1.54	0.045	91.1	0	0	3	0.3	20	50	5.1	N/A	1.00	0.84	0.86	3.7	Stable
NGALLOWAY_TRIB_1	2	165	1.44	1.22	0.045	63.6	225	160	3	0.3	20	50	5.1	2.5	0.58	0.84	0.82	2.0	Stable
NGALLOWAY_TRIB_1	3	165	1.24	0.51	0.045	26.4	0	0	3	0.3	20	50	5.1	N/A	1.00	0.84	0.63	2.7	Stable

OCOTILLO WASH - LOWER (STA 0.05-2.03)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Maricopa County - Cave Creek Area
Prepared For: Flood Control District of Maricopa County, 1978
Prepared By: Harris-Toups
Imported HEC-2 File: OCOTILLO.DAT
HEC-RAS Project: OCOTILLO.prj
HEC-RAS Plan: OCOTILLO.p02
HEC-RAS Geometry: OCOTILLO.g01
HEC-RAS Steady Flow: OCOTILLO.f02

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo Wash - Lower	Reach-1	PF 3	2.03	4630	2243.18	13.14	4.18	0.022006	169.33	0.042	1960	2030	70	0	0	3	0.71	68	170	6.4	N/A	1.00	0.84	1.08	5.8	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	1.83	4820	2220.11	14.54	5.11	0.019977	174.13	0.042	1980	2020	40	0	0	3	0.71	69	174	6.4	N/A	1.00	0.84	1.12	6.0	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	1.71	4820	2206.89	10.15	2.89	0.020594	186.16	0.042	1900	2065	165	0	0	3	0.71	69	174	6.4	N/A	1.00	0.84	1.00	5.4	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	1.56	4820	2188.79	11.11	2.79	0.02707	388.21	0.042	1945	2050	105	0	0	3	0.71	69	174	6.4	N/A	1.00	0.84	0.99	5.3	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	1.47	4820	2177.77	10.85	3.77	0.017348	283.82	0.042	1960	2040	80	0	0	3	0.71	69	174	6.4	N/A	1.00	0.84	1.05	5.7	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	1.36	5020	2165.24	10.41	3.24	0.031529	385.78	0.042	1950	2020	70	0	0	3	0.71	71	177	6.4	N/A	1.00	0.84	1.02	5.5	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	1.14	5020	2142.71	9.71	2.71	0.021086	293.78	0.042	1950	2050	100	0	0	3	0.33	71	177	5.1	N/A	1.00	0.84	0.98	4.2	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.97	5020	2123.22	7.07	3.22	0.016046	454.43	0.042	1860	2050	190	0	0	3	0.33	71	177	5.1	N/A	1.00	0.84	1.02	4.4	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.92	5220	2117.06	9.05	3.06	0.017231	277.26	0.042	1940	2120	180	0	0	3	0.33	72	181	5.1	N/A	1.00	0.84	1.01	4.3	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.89	5220	2113.99	10.61	2.99	0.022095	185.37	0.042	1895	2065	170	0	0	3	0.33	72	181	5.1	N/A	1.00	0.84	1.01	4.3	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.78	5220	2105.59	10.9	5.59	0.008143	161.92	0.037	1980	2040	60	0	0	3	0.33	72	181	5.1	N/A	1.00	0.84	1.14	4.9	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.7	5220	2099.7	13.77	6.7	0.009555	87.98	0.037	1970	2020	50	0	0	3	0.33	72	181	5.1	N/A	1.00	0.84	1.18	5.0	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.55	5220	2085.29	18.05	4.29	0.030223	96.89	0.037	1970	2030	60	0	0	3	0.33	72	181	5.1	N/A	1.00	0.84	1.08	4.6	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.46	5420	2080.12	16.03	7.12	0.011633	86.42	0.037	1980	2010	30	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	1.19	5.1	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.39	5420	2072.96	17.58	5.96	0.018367	106.1	0.037	1980	2020	40	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	1.15	4.9	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.31	5420	2063.84	13.96	3.84	0.024821	180.4	0.037	1960	2050	90	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	1.06	4.5	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.23	5420	2053.21	11.86	2.21	0.03037	301.79	0.037	1980	2020	40	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	0.94	4.0	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.18	5420	2049.1	12.03	5.1	0.012276	104.12	0.037	1940	2040	100	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	1.12	4.8	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.13	5420	2045	15.19	6	0.013469	84.36	0.037	1970	2025	55	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	1.15	4.9	Unstable
Ocotillo Wash - Lower	Reach-1	PF 3	0.05	5420	2038.51	14.86	5.51	0.016002	91.98	0.037	1965	2035	70	0	0	3	0.33	74	184	5.1	N/A	1.00	0.84	1.14	4.8	Unstable

OCOTILLO WASH - UPPER (STA 2.03-5.61)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: OCEAST.DAT
HEC-RAS Project: OCEAST.prj
HEC-RAS Plan: OCEAST.p02
HEC-RAS Geometry: OCEAST.g01
HEC-RAS Steady Flow: OCEAST.F02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis					
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo (East Braid)		Profile 3	5.61	1714	3328.89	19.26	4.09	0.100064	58.42	0.05	9981.9	10000	18.1	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.07	6.2	Unstable
Ocotillo (East Braid)		Profile 3	5.51	1714	3273.53	19.62	3.43	0.103957	38.88	0.05	9997	10023.2	26.2	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.03	6.0	Unstable
Ocotillo (East Braid)		Profile 3	5.35	1714	3164.68	14.71	3.38	0.171285	76.59	0.055	9907.8	10016.6	108.8	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.03	6.0	Unstable
Ocotillo (East Braid)		Profile 3	5.17	1714	3048.16	23.45	5.46	0.085562	23.42	0.05	9994.5	10008.8	14.3	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.13	6.6	Unstable
Ocotillo (East Braid)		Profile 3	4.99	1714	2956.47	26.49	6.17	0.104067	21.3	0.05	10000	10011.4	11.4	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.16	6.7	Unstable
Ocotillo (East Braid)		Profile 3	4.81	1714	2893.76	16.67	5.06	0.051031	52.77	0.05	9952.3	9972.6	20.3	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.12	6.5	Unstable
Ocotillo (East Braid)		Profile 3	4.61	1714	2838.08	16.13	4.68	0.053599	48.48	0.05	9985.7	10012.4	26.7	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.10	6.4	Unstable
Ocotillo (East Braid)		Profile 3	4.46	1714	2787.6	18.33	4.5	0.072981	30.11	0.055	9988.3	10010.5	22.2	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.09	6.3	Unstable
Ocotillo (East Braid)		Profile 3	4.42	1714	2774.88	15.22	5.38	0.058763	32.04	0.055	9981.7	10011	29.3	140	70	3	0.90	41	104	6.9	2.39	0.70	0.84	1.13	4.6	Unstable
Ocotillo (East Braid)		Profile 3	4.38	1714	2759.67	16.77	5.57	0.081076	36.42	0.055	9984.2	10013.8	29.6	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.14	6.6	Unstable
Ocotillo (East Braid)		Profile 3	4.28	1714	2732.19	14.84	4.69	0.037659	43.74	0.045	9983.7	10014	30.3	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.10	6.4	Unstable
Ocotillo (East Braid)		Profile 3	4.19	1714	2699.66	22.12	4.56	0.100365	24.88	0.045	9988.7	10013	24.3	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.10	6.3	Unstable
Ocotillo (East Braid)		Profile 3	4.07	1714	2657.23	16.92	8.83	0.052573	23.35	0.045	9985.9	10013	27.1	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.24	7.1	Unstable
Ocotillo (East Braid)		Profile 3	3.99	1714	2627.94	19.44	5.04	0.089139	35.05	0.045	10000	10026.7	26.7	200	80	3	0.90	41	104	6.9	3.00	0.70	0.84	1.12	4.5	Unstable
Ocotillo (East Braid)		Profile 3	3.93	1714	2613.39	7.09	3.89	0.038546	169.52	0.05	9904.7	10075.4	170.7	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.06	6.1	Unstable
Ocotillo (East Braid)		Profile 3	3.83	1714	2585.46	11.01	4.06	0.069538	94.03	0.05	9933.1	10046.4	113.3	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.07	6.2	Unstable
Ocotillo (East Braid)		Profile 3	3.74	1714	2564.41	7.1	2.31	0.04831	219.89	0.05	9833.3	10035.6	202.3	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	0.95	5.5	Unstable
Ocotillo (East Braid)		Profile 3	3.65	1714	2537.22	13.76	2.82	0.055432	78.97	0.035	9955.6	10039.8	84.2	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	0.99	5.7	Unstable
Ocotillo (East Braid)		Profile 3	3.57	1714	2518.77	13.74	3.87	0.035669	54.75	0.035	9968.3	10034.5	66.2	300	120	3	0.90	41	104	6.9	1.81	0.70	0.84	1.06	4.3	Unstable
Ocotillo (East Braid)		Profile 3	3.49	1714	2500.19	14.33	3.49	0.054391	55.47	0.04	9933.5	10015.6	82.1	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.04	6.0	Unstable
Ocotillo (East Braid)		Profile 3	3.39	1714	2480.51	8.78	5.31	0.030322	102.68	0.045	9815.5	10032.6	217.1	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.13	6.5	Unstable
Ocotillo (East Braid)		Profile 3	3.29	1714	2457.06	9.03	4.96	0.06592	144.31	0.045	9829.6	10000	170.4	0	0	3	0.90	41	104	6.9	N/A	1.00	0.84	1.11	6.4	Unstable
Ocotillo (East Braid)		Profile 3	3.17	2992	2430.66	12.87	4.66	0.032067	104.86	0.035	9962	10080	118	300	150	3	0.59	55	137	6.1	1.27	0.70	0.84	1.10	3.9	Unstable
Ocotillo (East Braid)		Profile 3	3.09	2992	2413.21	17.78	3.91	0.04526	278.1	0.03	9908.3	10049.5	141.2	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.06	5.4	Unstable
Ocotillo (East Braid)		Profile 3	2.97	2992	2386.85	5.72	4.35	0.035953	238.83	0.035	9700	10025.9	325.9	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.09	5.5	Unstable
Ocotillo (East Braid)		Profile 3	2.85	2992	2365.04	15	4.64	0.029164	273.06	0.03	9946.7	10024.3	77.6	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.10	5.6	Unstable
Ocotillo (East Braid)		Profile 3	2.78	2992	2354.46	8.96	3.66	0.036937	238.84	0.035	9960.7	10073.7	113	300	150	3	0.59	55	137	6.1	1.33	0.70	0.84	1.05	3.7	Unstable
Ocotillo (East Braid)		Profile 3	2.72	2992	2344.37	7.4	2.56	0.036338	344.32	0.044	9982	10315	333	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	0.97	4.9	Unstable
Ocotillo (East Braid)		Profile 3	2.65	2992	2330.19	8.35	4.19	0.031703	245.98	0.04	9903.4	10196.5	293.1	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.08	5.5	Unstable
Ocotillo (East Braid)		Profile 3	2.58	2992	2317.55	10.25	3.84	0.033825	189.87	0.04	9985.2	10162.9	177.7	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.06	5.4	Unstable
Ocotillo (East Braid)		Profile 3	2.47	2992	2300.74	10.69	3.74	0.02453	165.04	0.035	9916.2	10057.1	140.9	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.05	5.4	Unstable
Ocotillo (East Braid)		Profile 3	2.40	2992	2289.4	11.49	4	0.052814	177.5	0.041	9778.6	10014.9	236.3	0	0	3	0.59	55	137	6.1	N/A	1.00	0.84	1.07	5.4	Unstable
Ocotillo (East Braid)		Profile 3	2.31	4047	2276.65	10.69	3.45	0.018278	168.07	0.035	9963.4	10110.1	146.7	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	1.04	5.3	Unstable
Ocotillo (East Braid)		Profile 3	2.26	4047	2271.28	13.65	4.47	0.021639	174.39	0.035	9928.2	10010.6	82.4	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	1.09	5.6	Unstable
Ocotillo (East Braid)		Profile 3	2.17	4047	2258.96	8.16	3.65	0.037913	392.88	0.042	9986.5	10355.2	368.7	300	100	3	0.59	64	159	6.1	0.27	0.70	0.84	1.05	3.7	Unstable
Ocotillo (East Braid)		Profile 3	2.07	4047	2249.8	9.93	4.3	0.012119	145.94	0.035	9943.5	10069.5	126	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	1.08	5.5	Unstable
Ocotillo (East Braid)		Profile 3	2.03	4047	2241.59	15.66	2.58	0.112945	195.36	0.04	9874.2	10067.5	193.3	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	0.97	5.0	Unstable
Ocotillo (West Braid)		PF 3	2.85	2132	2366.83	7.22	3.03	0.023999	194.46	0.045	9946.7	10024.3	77.6	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	1.01	5.1	Unstable
Ocotillo (West Braid)		PF 3	2.78	2132	2354.39	9.36	3.59	0.044792	130.32	0.055	9960.7	10073.7	113	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	1.04	5.3	Unstable
Ocotillo (West Braid)		PF 3	2.72	2132	2342.49	8.73	2.49	0.041201	190.26	0.041	9982	10315	333	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	0.97	4.9	Unstable
Ocotillo (West Braid)		PF 3	2.65	2132	2330.7	7.37	4.1	0.021945	254.94	0.042	9903.4	10196.5	293.1	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	1.07	5.5	Unstable
Ocotillo (West Braid)		PF 3	2.58	2132	2314.64	14.38	2.74	0.071619	147.19	0.03	9985.2	10162.9	177.7	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	0.99	5.0	Unstable
Ocotillo (West Braid)		PF 3	2.47	2132	2302.08	7.6	2.98	0.012198	202.03	0.03	9916.2	10057.1	140.9	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	1.00	5.1	Unstable
Ocotillo (West Braid)		PF 3	2.40	2132	2288.85	15.8	2.45	0.101454	119.85	0.04	9778.6	10014.9	236.3	300	180	3	0.59	46	115	6.1	0.76	0.70	0.84	0.96	3.4	Unstable
Ocotillo (West Braid)		PF 3	2.34	2132	2277.75	6.53	3.45	0.01148	158.61	0.04	9963.4	10110.1	146.7	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	1.04	5.3	Unstable
Ocotillo (West Braid)		PF 3	2.26	2132	2272.3	7.18	3	0.018339	186.11	0.04	9928.2	10010.6	82.4	0	0	3	0.59	46	115	6.1	N/A	1.00	0.84	1.01	5.1	Unstable
Ocotillo (West Braid)		PF 3	2.17	2132	2259.14	11.24	2.44	0.035207	121.13	0.035	9986.5	10355.2	368.7	300	100	3	0.59	46	115	6.1	0.27	0.70	0.84	0.96	3.4	Unstable
Ocotillo (West Braid)		PF 3	2.07	4047	2249.64	10.14	4.14	0.014564	144.71	0.035	9943.5	10069.5	126	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	1.07	5.5	Unstable
Ocotillo (West Braid)		PF 3	2.03	4047	2243.77	13.4	2.77	0.078051	204.87	0.04	9874.2	10067.5	193.3	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	0.99	5.0	Unstable
Ocotillo (West Braid)		PF 3	1.83	4047	2221.07	9.45	5.77	0.011877	155.49	0.035	9988.5	10118.4	129.9	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	1.15	5.8	Unstable
Ocotillo (West Braid)		PF 3	1.71	4047	2206.85	11.89	4.95	0.03128	166.16	0.036	9989.7	10135.5	145.8	0	0	3	0.59	64	159	6.1	N/A	1.00	0.84	1.11	5.7	Unstable

OCOTILLO WASH TRIB 1

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: OCT1.DAT
HEC-RAS Project: OCT1.prj
HEC-RAS Plan: OCT1.p03
HEC-RAS Geometry: OCT1.g02
HEC-RAS Steady Flow: OCT1.f03

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo Wash Trib 1		Profile 3	1.10	223	2450.03	7.11	3.03	0.038007	31.02	0.04	9982	10025.1	43.1	130	50	3.0	0.98	20	37	7.1	1.16	0.70	0.84	1.01	4.2	Unstable
Ocotillo Wash Trib 1		Profile 3	1.00	223	2429.64	7.94	2.33	0.038157	24.05	0.04	9981	10018.7	37.7	200	60	2.0	0.98	20	37	7.1	1.59	0.70	0.71	0.95	3.4	Unstable
Ocotillo Wash Trib 1		Profile 3	0.91	223	2416.87	8.34	2.57	0.019858	27.95	0.04	9990.6	10000	9.4	0	0	3.0	0.98	20	37	7.1	N/A	1.00	0.84	0.97	5.8	Unstable
Ocotillo Wash Trib 1		Profile 3	0.81	223	2400.95	8.69	1.85	0.048513	27.13	0.04	10000	10019.5	19.5	0	0	3.0	0.98	20	37	7.1	N/A	1.00	0.84	0.93	5.5	Unstable
Ocotillo Wash Trib 1		Profile 3	0.73	223	2383.1	8.22	2.5	0.037628	21.68	0.04	9973.5	10016.9	43.4	120	30	1.0	0.98	20	37	7.1	0.69	0.70	0.50	0.97	2.4	Unstable
Ocotillo Wash Trib 1		Profile 3	0.63	223	2367	9.87	2.9	0.025053	20.52	0.04	9995	10000	5	150	60	3.0	0.98	20	37	7.1	12.00	0.97	0.84	1.00	5.8	Unstable
Ocotillo Wash Trib 1		Profile 3	0.51	223	2343.89	9.12	1.79	0.057525	27.92	0.04	9978.7	10000	21.3	200	80	1.0	0.98	20	37	7.1	3.76	0.70	0.50	0.93	2.3	Unstable
Ocotillo Wash Trib 1		Profile 3	0.42	223	2329.73	6.39	1.93	0.022305	29.09	0.04	9990.8	10038.4	47.6	180	60	3.0	0.98	20	37	7.1	1.26	0.70	0.84	0.93	3.9	Unstable
Ocotillo Wash Trib 1		Profile 3	0.37	223	2321.7	9.89	2.2	0.039393	23.62	0.04	9995.5	10004.8	9.3	0	0	3.0	0.98	20	37	7.1	N/A	1.00	0.84	0.94	5.6	Unstable
Ocotillo Wash Trib 1		Profile 3	0.30	223	2316.45	6.82	2.45	0.020294	26.24	0.04	9986.7	10008.6	21.9	0	0	3.0	0.98	20	37	7.1	N/A	1.00	0.84	0.96	5.7	Unstable
Ocotillo Wash Trib 1		Profile 3	0.24	1397	2310.51	7.59	2.41	0.018559	160.95	0.04	9941.6	10000	58.4	250	150	3.0	0.98	37	93	7.1	2.57	0.70	0.84	0.96	4.0	Unstable
Ocotillo Wash Trib 1		Profile 3	0.16	1397	2300.72	12.73	3.81	0.023689	74.4	0.04	9992.8	10009.7	16.9	0	0	3.0	0.98	37	93	7.1	N/A	1.00	0.84	1.06	6.3	Unstable
Ocotillo Wash Trib 1		Profile 3	0.09	1397	2290.68	7.92	2.98	0.031326	132.06	0.04	9879.4	10015	135.6	180	100	3.0	0.98	37	93	7.1	0.74	0.70	0.84	1.00	4.2	Unstable

OCOTILLO WASH TRIB 1A

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: OCT1A.DAT
HEC-RAS Project: OCT1A.prj
HEC-RAS Plan: OCT1A.p02
HEC-RAS Geometry: OCT1A.g01
HEC-RAS Steady Flow: OCT1A.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																				Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo Wash Trib 1A		Profile 3	0.69	1206	2451.84	12.25	2.84	0.032019	56.35	0.035	9961.2	10007.2	46	130	50	2.0	0.47	35	87	5.7	1.09	0.70	0.71	0.99	2.8	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.62	1206	2439.92	13.05	2.52	0.03161	56.3	0.035	9976.7	10012.1	35.4	160	60	1.5	0.47	35	87	5.7	1.69	0.70	0.52	0.97	2.0	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.54	1206	2426.35	14.99	4.15	0.031254	71.49	0.035	9977	10000	23	100	40	2.0	0.47	35	87	5.7	1.74	0.70	0.71	1.08	3.0	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.47	1206	2408.74	19.41	2.64	0.073876	92.21	0.035	10060	10074.3	14.3	0	0	3.0	0.47	35	87	5.7	N/A	1.00	0.84	0.98	4.6	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.42	1206	2397.92	11.06	2.42	0.026804	112.79	0.035	9980.6	10017.5	36.9	0	0	2.0	0.47	35	87	5.7	N/A	1.00	0.71	0.96	3.9	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.35	1206	2381.04	17.54	2.64	0.054731	68.95	0.032	9984.7	10014.3	29.6	0	0	2.0	0.47	35	87	5.7	N/A	1.00	0.71	0.98	3.9	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.27	1206	2366.61	12.33	2.41	0.027837	82.33	0.032	9978.1	10021.5	43.4	350	140	1.0	0.47	35	87	5.7	3.23	0.70	0.50	0.96	1.9	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.18	1206	2349.1	14.76	3	0.04175	52.64	0.032	9983	10024.2	41.2	181	70	2.0	0.47	35	87	5.7	1.70	0.70	0.71	1.01	2.8	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.12	1206	2337.36	13.99	3.66	0.03538	98	0.032	9975.2	10009.6	34.4	0	0	2.0	0.47	35	87	5.7	N/A	1.00	0.71	1.05	4.2	Unstable
Ocotillo Wash Trib 1A		Profile 3	0.02	1206	2321.02	13.19	3.22	0.03952	287.16	0.032	9985	10007.2	22.2	0	0	3.0	0.47	35	87	5.7	N/A	1.00	0.84	1.02	4.8	Unstable

OCOTILLO WASH TRIB 2

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: OCT2.DAT
HEC-RAS Project: OCT2.prj
HEC-RAS Plan: OCT2.p02
HEC-RAS Geometry: OCT2.g01
HEC-RAS Steady Flow: OCT2.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo Wash Trib 2		Profile 3	1.07	260	2401.32	7.65	1.02	0.042016	55.17	0.035	9984.9	10022.8	37.9	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.93	6.1	Unstable
Ocotillo Wash Trib 2		Profile 3	0.99	260	2384.59	8.54	1.79	0.03658	30.18	0.035	9975	10009.6	34.6	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.93	6.1	Unstable
Ocotillo Wash Trib 2		Profile 3	0.88	260	2364.4	8.81	2.4	0.032809	23.48	0.035	9971.7	10022	50.3	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.96	6.3	Unstable
Ocotillo Wash Trib 2		Profile 3	0.78	260	2349.72	7.03	2.02	0.024595	33.81	0.035	9973.8	10023.2	49.4	140	80	3.0	1.38	20	40	7.9	1.62	0.70	0.84	0.92	4.3	Unstable
Ocotillo Wash Trib 2		Profile 3	0.67	260	2328.18	10.44	2.18	0.055223	22.84	0.035	9975.7	10027.1	51.4	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.94	6.2	Unstable
Ocotillo Wash Trib 2		Profile 3	0.57	260	2310.78	6.71	2.08	0.030196	36.46	0.04	9987	10023.8	36.8	200	90	3.0	1.38	20	40	7.9	2.45	0.70	0.84	0.93	4.3	Unstable
Ocotillo Wash Trib 2		Profile 3	0.48	260	2298.26	5.51	3.36	0.023101	47.44	0.04	9997.6	10024.7	27.1	90	30	3.0	1.38	20	40	7.9	1.11	0.70	0.84	1.03	4.7	Unstable
Ocotillo Wash Trib 2		Profile 3	0.42	260	2286.32	7.74	1.82	0.042727	35.28	0.045	10000	10024.2	24.2	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.93	6.1	Unstable
Ocotillo Wash Trib 2		Profile 3	0.31	260	2269.23	6.54	2.93	0.024792	34.03	0.045	9981	10008.1	27.1	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	1.00	6.6	Stable
Ocotillo Wash Trib 2		Profile 3	0.23	260	2255.81	7.93	2.61	0.040082	24.32	0.045	9978.9	10014	35.1	250	160	3.0	1.38	20	40	7.9	4.56	0.70	0.84	0.98	4.5	Unstable
Ocotillo Wash Trib 2		Profile 3	0.15	260	2244.29	4.6	2.39	0.021313	164.86	0.04	9852.2	9923.6	71.4	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.96	6.3	Stable
Ocotillo Wash Trib 2		Profile 3	0.07	260	2233.94	6.58	2.24	0.026823	55.4	0.04	9963.7	10000	36.3	0	0	3.0	1.38	20	40	7.9	N/A	1.00	0.84	0.94	6.2	Unstable

OCOTILLO WASH TRIB 3

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: OCT3.DAT
HEC-RAS Project: OCT3.prj
HEC-RAS Plan: OCT3.p02
HEC-RAS Geometry: OCT3.g01
HEC-RAS Steady Flow: OCT3.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo Wash Trib 3		Profile 3	1.75	296	2428.04	7.42	1.44	0.036004	49.67	0.045	10000	10024.5	24.5	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.93	5.2	Unstable
Ocotillo Wash Trib 3		Profile 3	1.70	296	2418.93	6.97	1.73	0.034046	45.66	0.045	10000	10029.4	29.4	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.93	5.2	Unstable
Ocotillo Wash Trib 3		Profile 3	1.61	296	2403.46	7.64	1.96	0.030178	39.41	0.045	10000	10017.7	17.7	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.93	5.2	Unstable
Ocotillo Wash Trib 3		Profile 3	1.51	296	2387.25	6.46	2.35	0.031544	40.95	0.045	10000	10052.7	52.7	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.95	5.4	Unstable
Ocotillo Wash Trib 3		Profile 3	1.43	296	2374.29	6.84	3.29	0.027195	29.83	0.045	9984.9	10020.2	35.3	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	1.03	5.8	Unstable
Ocotillo Wash Trib 3		Profile 3	1.30	296	2352.55	7.13	2.15	0.03862	48.99	0.045	10000	10027	27	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.94	5.3	Unstable
Ocotillo Wash Trib 3		Profile 3	1.19	296	2336.24	6.42	2.74	0.02284	47.97	0.045	9992.6	10027.6	35	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.99	5.6	Unstable
Ocotillo Wash Trib 3		Profile 3	1.12	296	2321.58	6.44	2.78	0.056216	59.82	0.045	9996.5	10037.5	41	200	90	3.0	0.83	20	43	6.7	2.20	0.70	0.84	0.99	3.9	Unstable
Ocotillo Wash Trib 3		Profile 3	1.07	296	2313.18	6.44	2.38	0.025634	33.77	0.045	9974.8	10031	56.2	220	80	3.0	0.83	20	43	6.7	1.42	0.70	0.84	0.96	3.8	Unstable
Ocotillo Wash Trib 3		Profile 3	0.96	296	2298.27	8.09	4.17	0.024425	21.65	0.045	9981.4	10000	18.6	150	60	3.0	0.83	20	43	6.7	3.23	0.70	0.84	1.08	4.3	Unstable
Ocotillo Wash Trib 3		Profile 3	0.86	296	2283.13	8.45	1.93	0.034137	45.52	0.045	10000	10011.1	11.1	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.93	5.2	Unstable
Ocotillo Wash Trib 3		Profile 3	0.75	296	2263.05	7.73	2.35	0.034479	29.83	0.045	9975.6	10007.4	31.8	150	60	2.0	0.83	20	43	6.7	1.89	0.70	0.71	0.95	3.2	Unstable
Ocotillo Wash Trib 3		Profile 3	0.65	296	2247.41	6.48	2.61	0.030572	39.4	0.055	10000	10027.7	27.7	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.98	5.5	Unstable
Ocotillo Wash Trib 3		Profile 3	0.57	296	2234.13	7.27	2.63	0.03228	33.24	0.055	10000	10018.4	18.4	200	110	3.0	0.83	20	43	6.7	5.98	0.79	0.84	0.98	4.4	Unstable
Ocotillo Wash Trib 3		Profile 3	0.48	296	2226.66	1.51	4.46	0.000545	85.59	0.055	10000	10027.5	27.5	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	1.09	6.2	Stable
Ocotillo Wash Trib 3		Profile 3	0.46	296	2226.67	0.37	7.17	0.000016	156.98	0.055	9986.7	10000	13.3	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	1.19	6.7	Stable
Ocotillo Wash Trib 3		Profile 3	0.45	296	2220.89	3.41	1.39	0.026103	117.63	0.055	9986.7	10000	13.3	160	70	3.0	0.83	20	43	6.7	5.26	0.75	0.84	0.93	3.9	Stable
Ocotillo Wash Trib 3		Profile 3	0.41	296	2213.87	6.19	2.37	0.03454	44.57	0.055	10000	10033.2	33.2	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.96	5.4	Unstable
Ocotillo Wash Trib 3		Profile 3	0.29	296	2209.23	0.39	9.63	0.000011	127.69	0.055	9966.1	10000	33.9	180	80	2.0	0.83	20	43	6.7	2.36	0.70	0.71	1.25	4.2	Stable
Ocotillo Wash Trib 3		Profile 3	0.28	296	2209.23	0.27	12.73	0.000003	214.47	0.055	9870	10065.7	195.7	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	1.31	7.4	Stable
Ocotillo Wash Trib 3		Profile 3	0.26	296	2195.82	8.17	1.92	0.038293	54.36	0.055	9971	10026	55	300	130	3.0	0.83	20	43	6.7	2.36	0.70	0.84	0.93	3.7	Unstable
Ocotillo Wash Trib 3		Profile 3	0.24	296	2188.41	8.74	1.01	0.139235	49.65	0.055	10000	10039.5	39.5	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.93	5.2	Unstable
Ocotillo Wash Trib 3		Profile 3	0.16	296	2183.18	4.61	2.98	0.014256	50.08	0.055	9974.1	10014.9	40.8	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	1.00	5.7	Stable
Ocotillo Wash Trib 3		Profile 3	0.07	296	2173.94	4.04	1.44	0.027694	90.19	0.055	9945.2	10024.4	79.2	0	0	3.0	0.83	20	43	6.7	N/A	1.00	0.84	0.93	5.2	Stable

OCOTILLO WASH TRIB 4

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: OCT4.DAT
HEC-RAS Project: OCT4.prj
HEC-RAS Plan: OCT4.p02
HEC-RAS Geometry: OCT4.g01
HEC-RAS Steady Flow: OCT4.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Ocotillo Wash Trib 4		Profile 3	1.25	83	2314.32	4.69	1.32	0.035425	26.84	0.045	9977.6	10025.5	47.9	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Stable
Ocotillo Wash Trib 4		Profile 3	1.16	83	2297.18	5.73	0.88	0.035908	37.23	0.045	9993	10000	7	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable
Ocotillo Wash Trib 4		Profile 3	1.06	83	2280.65	6.62	1.35	0.02697	21.21	0.045	9996.1	10000	3.9	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable
Ocotillo Wash Trib 4		Profile 3	0.97	83	2265.58	6.84	1.18	0.036506	21.99	0.045	10000	10005.6	5.6	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable
Ocotillo Wash Trib 4		Profile 3	0.86	83	2247.96	6.88	1.26	0.025049	19.15	0.025	9983	10032	49	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable
Ocotillo Wash Trib 4		Profile 3	0.77	83	2234.33	5.28	1.73	0.033564	18.83	0.045	9973.9	10019.8	45.9	200	110	3.0	0.59	20	23	6.1	2.40	0.70	0.84	0.93	3.3	Unstable
Ocotillo Wash Trib 4		Profile 3	0.68	83	2217.04	6.06	0.94	0.040153	24.25	0.04	9984.7	10000	15.3	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable
Ocotillo Wash Trib 4		Profile 3	0.61	83	2215.41	0.19	10.11	0.000001	99.6	0.04	9982.7	10021.7	39	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	1.26	6.4	Stable
Ocotillo Wash Trib 4		Profile 3	0.60	83	2215.18	3.4	10.18	0.000379	152.72	0.04	9997.6	10000	2.4	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	1.27	6.4	Stable
Ocotillo Wash Trib 4		Profile 3	0.58	83	2204.15	10.33	3.35	0.015468	35.05	0.04	9997.6	10000	2.4	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	1.03	5.2	Unstable
Ocotillo Wash Trib 4		Profile 3	0.57	83	2197.06	19.33	1.05	0.646232	8.65	0.04	9986.7	10000	13.3	150	60	3.0	0.59	20	23	6.1	4.51	0.70	0.84	0.93	3.3	Unstable
Ocotillo Wash Trib 4		Profile 3	0.48	83	2186.63	4.58	1.63	0.020311	22.31	0.04	9984	10023.7	39.7	120	60	2.0	0.59	20	23	6.1	1.51	0.70	0.71	0.93	2.8	Unstable
Ocotillo Wash Trib 4		Profile 3	0.38	83	2173.56	5.98	1.86	0.029259	16.33	0.04	10000	10051.9	51.9	160	100	3.0	0.59	20	23	6.1	1.93	0.70	0.84	0.93	3.3	Unstable
Ocotillo Wash Trib 4		Profile 3	0.28	83	2159.9	4.76	1	0.023461	29.02	0.035	9964	10013.7	49.7	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable
Ocotillo Wash Trib 4		Profile 3	0.17	83	2145.37	5.99	1.67	0.025968	16.55	0.035	9944.5	10013.3	68.8	0	0	3.0	0.59	20	23	6.1	N/A	1.00	0.84	0.93	4.7	Unstable

ROWE WASH - LOWER (STA 0.06-1.52)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Maricopa County - Cave Creek Area
Prepared For: Flood Control District of Maricopa County, 1978
Prepared By: Harris-Toups
Imported HEC-2 File: ROWEWASH.DAT
HEC-RAS Project: ROWEWASH.prj
HEC-RAS Plan: ROWEWASH.p02
HEC-RAS Geometry: ROWEWASH.g01
HEC-RAS Steady Flow: ROWEWASH.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Rowe Wash	Reach-1	PF 3	1.52	6645	2314.36	11.75	3.35	0.025022	321	0.042	1970	2050	80	0	0	3	0.39	82	204	5.4	N/A	1.00	0.84	1.03	4.6	Unstable
Rowe Wash	Reach-1	PF 3	1.44	6645	2303.58	12.78	3.58	0.025704	273	0.042	1950	2050	100	0	0	3	0.39	82	204	5.4	N/A	1.00	0.84	1.04	4.7	Unstable
Rowe Wash	Reach-1	PF 3	1.34	6740	2291.27	11.08	3.27	0.021062	464	0.042	1885	2060	175	0	0	3	0.39	82	205	5.4	N/A	1.00	0.84	1.02	4.6	Unstable
Rowe Wash	Reach-1	PF 3	1.25	6740	2277.28	10.22	2.28	0.062489	554	0.042	1970	2035	65	0	0	3	0.39	82	205	5.4	N/A	1.00	0.84	0.95	4.3	Unstable
Rowe Wash	Reach-1	PF 3	1.15	6740	2265.65	7.66	2.65	0.027635	587	0.042	1950	2040	90	0	0	3	0.39	82	205	5.4	N/A	1.00	0.84	0.98	4.4	Unstable
Rowe Wash	Reach-1	PF 3	1.03	6740	2249.43	10.22	3.43	0.029832	655	0.042	1940	2070	130	0	0	3	0.39	82	205	5.4	N/A	1.00	0.84	1.03	4.6	Unstable
Rowe Wash	Reach-1	PF 3	0.95	6840	2237.72	11.58	3.72	0.020715	418	0.042	1950	2090	140	0	0	3	0.39	83	207	5.4	N/A	1.00	0.84	1.05	4.7	Unstable
Rowe Wash	Reach-1	PF 3	0.87	6840	2227.04	13.32	3.04	0.035095	281	0.042	1945	2070	125	0	0	3	0.39	83	207	5.4	N/A	1.00	0.84	1.01	4.5	Unstable
Rowe Wash	Reach-1	PF 3	0.74	6840	2209.63	9.57	2.63	0.022662	625	0.042	1950	2040	90	0	0	3	0.39	83	207	5.4	N/A	1.00	0.84	0.98	4.4	Unstable
Rowe Wash	Reach-1	PF 3	0.63	6840	2193.56	12.72	3.56	0.028526	480	0.042	1970	2060	90	0	0	3	0.39	83	207	5.4	N/A	1.00	0.84	1.04	4.7	Unstable
Rowe Wash	Reach-1	PF 3	0.48	6840	2169.5	13.78	3.5	0.030736	331	0.042	1960	2040	80	0	0	3	0.39	83	207	5.4	N/A	1.00	0.84	1.04	4.7	Unstable
Rowe Wash	Reach-1	PF 3	0.39	6940	2156.19	11.15	3.19	0.024891	319	0.042	1940	2020	80	0	0	3	0.39	83	208	5.4	N/A	1.00	0.84	1.02	4.6	Unstable
Rowe Wash	Reach-1	PF 3	0.3	6940	2144.9	10.91	3.9	0.020211	345	0.042	1940	2040	100	0	0	3	0.39	83	208	5.4	N/A	1.00	0.84	1.06	4.8	Unstable
Rowe Wash	Reach-1	PF 3	0.23	6940	2132.75	11.81	4.75	0.033694	207	0.042	1930	2050	120	0	0	3	0.39	83	208	5.4	N/A	1.00	0.84	1.10	5.0	Unstable
Rowe Wash	Reach-1	PF 3	0.1	6940	2120.67	12.75	5.67	0.015972	183	0.042	1970	2050	80	0	0	3	0.39	83	208	5.4	N/A	1.00	0.84	1.14	5.1	Unstable
Rowe Wash	Reach-1	PF 3	0.06	6940	2112.63	17.33	6.63	0.021517	193	0.042	1980	2015	35	0	0	3	0.39	83	208	5.4	N/A	1.00	0.84	1.17	5.3	Unstable

ROWE WASH - UPPER (STA 1.52-4.53)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: RO.DAT
HEC-RAS Project: RO.prj
HEC-RAS Plan: RO.p02
HEC-RAS Geometry: RO.g01
HEC-RAS Steady Flow: RO.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Rowe Wash (Main Channel)		PF 3	4.53	352	3244.8	20.11	3.2	0.230115	12.05	0.045	9991	10000	9	0	0	3	0.75	19	47	6.5	N/A	1.00	0.84	1.02	5.6	Unstable
Rowe Wash (Main Channel)		PF 3	4.44	352	3135.58	18.53	2.78	0.225131	13.68	0.045	9988.3	10013	24.7	0	0	3	0.75	19	47	6.5	N/A	1.00	0.84	0.99	5.4	Unstable
Rowe Wash (Main Channel)		PF 3	4.35	352	3042.11	18.78	3.31	0.171027	12.53	0.045	9990.8	10000	9.2	0	0	3	0.75	19	47	6.5	N/A	1.00	0.84	1.03	5.6	Unstable
Rowe Wash (Main Channel)		PF 3	4.25	352	2967.68	13.58	2.48	0.125099	21.46	0.045	9985.1	10007.4	22.3	0	0	3	0.75	19	47	6.5	N/A	1.00	0.84	0.97	5.3	Unstable
Rowe Wash (Main Channel)		PF 3	4.16	352	2925.08	9.07	2.58	0.069042	38.12	0.045	9968.8	10000	31.2	0	0	3	0.75	19	47	6.5	N/A	1.00	0.84	0.97	5.3	Unstable
Rowe Wash (Main Channel)		PF 3	4.05	352	2862.63	16.78	1.83	0.165873	19.57	0.045	9985.8	10000	14.2	0	0	3	0.75	19	47	6.5	N/A	1.00	0.84	0.93	5.1	Unstable
Rowe Wash (Main Channel)		PF 3	3.98	1334	2839.93	15.32	6.03	0.051407	31.3	0.045	9984.3	10011.5	27.2	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.15	6.3	Unstable
Rowe Wash (Main Channel)		PF 3	3.94	1334	2820.95	21.94	5.15	0.073052	27.71	0.045	9987.4	10000	12.6	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.12	6.1	Unstable
Rowe Wash (Main Channel)		PF 3	3.88	1334	2807.4	15.53	5.3	0.043641	34.05	0.045	9987.9	10011.4	23.5	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.13	6.2	Unstable
Rowe Wash (Main Channel)		PF 3	3.78	1334	2755.89	31.16	4.29	0.175449	19.35	0.045	9998.9	10009.1	10.2	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.08	5.9	Unstable
Rowe Wash (Main Channel)		PF 3	3.68	1334	2721.91	21.38	5.71	0.041065	24.02	0.045	9993.1	10000	6.9	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.14	6.3	Unstable
Rowe Wash (Main Channel)		PF 3	3.59	1334	2686.77	24.92	4.97	0.111259	19.31	0.045	9986.5	10000	13.5	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.11	6.1	Unstable
Rowe Wash (Main Channel)		PF 3	3.52	1334	2664.72	18.41	4.42	0.048837	44.39	0.045	10008.9	10017.4	8.5	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.09	6.0	Unstable
Rowe Wash (Main Channel)		PF 3	3.47	1334	2646.82	22.18	6.82	0.062404	20.24	0.045	9990.8	10000	9.2	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.18	6.5	Unstable
Rowe Wash (Main Channel)		PF 3	3.41	1334	2627.39	18.51	5.19	0.066078	26.21	0.045	9990.1	10009.4	19.3	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.12	6.1	Unstable
Rowe Wash (Main Channel)		PF 3	3.32	1334	2604.01	15.45	4.01	0.040692	32.53	0.045	9987.9	10009.7	21.8	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.07	5.8	Unstable
Rowe Wash (Main Channel)		PF 3	3.25	1334	2591.89	11.92	3.99	0.03062	47.07	0.045	9973.2	10009.8	36.6	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.07	5.8	Unstable
Rowe Wash (Main Channel)		PF 3	3.16	1334	2565.73	21.56	4.93	0.069776	23.93	0.045	9991	10004.8	13.8	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.11	6.1	Unstable
Rowe Wash (Main Channel)		PF 3	3.09	1334	2548.06	14.46	4.36	0.043469	41.05	0.045	9984.3	10013.1	28.8	0	0	3	0.75	37	91	6.5	N/A	1.00	0.84	1.09	5.9	Unstable
Rowe Wash (Main Channel)		PF 3	3.01	2048	2534.98	16.94	4.58	0.026015	119.63	0.035	9991.2	10009.3	18.1	0	0	1	0.75	45	113	6.5	N/A	1.00	0.50	1.10	3.6	Unstable
Rowe Wash (Main Channel)		PF 3	2.90	2048	2516.74	18.65	5.14	0.029553	98.37	0.035	9988.6	10012.9	24.3	0	0	1	0.75	45	113	6.5	N/A	1.00	0.50	1.12	3.7	Unstable
Rowe Wash (Main Channel)		PF 3	2.84	2048	2508.65	12.26	5.74	0.035846	146.39	0.048	9986.4	10017.7	31.3	0	0	1	0.75	45	113	6.5	N/A	1.00	0.50	1.14	3.7	Unstable
Rowe Wash (Main Channel)		PF 3	2.76	2048	2494.93	7.52	2.83	0.031755	201.7	0.048	9919.8	9981.2	61.4	0	0	2	0.75	45	113	6.5	N/A	1.00	0.71	0.99	4.6	Unstable
Rowe Wash (Main Channel)		PF 3	2.69	5307	2480.28	15.3	4.98	0.031069	158.53	0.035	9611.9	10020.2	408.3	0	0	3	0.75	73	182	6.5	N/A	1.00	0.84	1.11	6.1	Unstable
Rowe Wash (Main Channel)		PF 3	2.62	5307	2470.43	12.33	5.03	0.027277	257	0.036	9633.9	10050.2	416.3	0	0	2	0.75	73	182	6.5	N/A	1.00	0.71	1.12	5.2	Unstable
Rowe Wash (Main Channel)		PF 3	2.57	5307	2463.26	8.56	3.76	0.03467	344.11	0.048	9685	10025	340	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.05	3.4	Unstable
Rowe Wash (Main Channel)		PF 3	2.51	5307	2453.01	5.23	6.21	0.027672	297.13	0.048	9935.4	10144.5	209.1	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.16	3.8	Unstable
Rowe Wash (Main Channel)		PF 3	2.45	5307	2445.9	6.34	4.2	0.017292	424.67	0.048	9988.6	10396.5	407.9	350	400	1	0.75	73	182	6.5	0.98	0.70	0.50	1.08	2.5	Unstable
Rowe Wash (Main Channel)		PF 3	2.37	5307	2436.51	8.69	5.71	0.025908	266.38	0.048	9983.4	10427.1	443.7	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.14	3.7	Unstable
Rowe Wash (Main Channel)		PF 3	2.25	5307	2417.88	7.13	3.88	0.01656	311.06	0.048	9753.9	10083.1	329.2	550	300	1	0.75	73	182	6.5	0.91	0.70	0.50	1.06	2.4	Unstable
Rowe Wash (Main Channel)		PF 3	2.14	5307	2405.99	9.61	4.89	0.022965	206.2	0.048	9829.1	10045.3	216.2	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.11	3.6	Unstable
Rowe Wash (Main Channel)		PF 3	2.05	5307	2392.54	8.36	3.14	0.036571	388.51	0.048	9668.3	10019.1	350.8	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.02	3.3	Unstable
Rowe Wash (Main Channel)		PF 3	1.94	5307	2376.82	7.12	6.72	0.022702	344.24	0.048	9732.1	10028.9	296.8	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.18	3.8	Unstable
Rowe Wash (Main Channel)		PF 3	1.83	5307	2361.76	7.4	5.86	0.030314	616.09	0.048	9672.8	10103.7	430.9	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.15	3.7	Unstable
Rowe Wash (Main Channel)		PF 3	1.74	5307	2346.32	6.35	2.82	0.022126	520.18	0.048	9580	10116.8	536.8	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	0.99	3.2	Unstable
Rowe Wash (Main Channel)		PF 3	1.60	5307	2327.48	7.35	3.48	0.028795	440.92	0.048	9982.7	10407.2	424.5	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.04	3.4	Unstable
Rowe Wash (Main Channel)		PF 3	1.52	5307	2314.5	8.85	3.5	0.013361	328.13	0.042	9970	10050	80	0	0	1	0.75	73	182	6.5	N/A	1.00	0.50	1.04	3.4	Unstable

WILLOW SPRINGS WASH - LOWER (STA 0.13-1.78)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Maricopa County - Cave Creek Area
Prepared For: Flood Control District of Maricopa County, 1978
Prepared By: Harris-Toups
Imported HEC-2 File: WILLOWWA.DAT
HEC-RAS Project: WILLOWWA.prj
HEC-RAS Plan: WILLOWWA.p02
HEC-RAS Geometry: WILLOWWA.g01
HEC-RAS Steady Flow: WILLOWWA.f02

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs - Lower	Reach-1	PF 3	1.78	4800	2187.82	15.97	7.82	0.018009	52.0	0.045	1975	2015	40	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.21	6.6	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.7	4800	2178.07	16.42	5.07	0.035557	65.8	0.045	1960	2025	65	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.12	6.1	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.57	4800	2169.51	11.02	5.51	0.013641	162.7	0.045	1970	2050	80	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.14	6.2	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.48	4800	2161.97	11.61	2.97	0.031013	397.8	0.045	1965	2020	55	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.00	5.5	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.4	4800	2154.54	9	4.54	0.011214	432.6	0.045	1960	2035	75	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.09	6.0	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.34	4800	2147.12	13.19	3.12	0.037751	321.2	0.045	1955	2030	75	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.01	5.6	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.27	4800	2142.33	9.98	4.33	0.014674	300.1	0.045	1970	2040	70	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.08	5.9	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.19	4800	2134.76	11.34	3.76	0.020677	308.0	0.045	1960	2030	70	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.05	5.8	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.09	4800	2126.41	10.75	3.41	0.014809	278.5	0.037	1960	2030	70	350	180	3	0.75	69	173	6.5	2.6	0.70	0.84	1.03	4.0	Unstable
Willow Springs - Lower	Reach-1	PF 3	1.02	4800	2120.39	13.1	5.39	0.011633	173.8	0.037	1975	2020	45	680	305	3	0.75	69	173	6.5	6.8	0.83	0.84	1.13	5.1	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.89	4800	2109.64	16.69	4.64	0.025526	282.0	0.037	1985	2015	30	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.10	6.0	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.84	4800	2102.8	12.64	3.8	0.017335	127.0	0.037	1950	2050	100	0	0	3	0.75	69	173	6.5	N/A	1.00	0.84	1.06	5.8	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.79	6340	2100.85	10.34	5.85	0.006421	182.6	0.037	1960	2045	85	0	0	3	0.75	80	199	6.5	N/A	1.00	0.84	1.15	6.3	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.7	6290	2095.35	14.24	8.35	0.008158	109.5	0.037	1975	2025	50	0	0	3	0.75	79	198	6.5	N/A	1.00	0.84	1.22	6.7	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.6	6290	2085.92	18.63	5.92	0.023065	70.0	0.037	1970	2030	60	0	0	3	0.75	79	198	6.5	N/A	1.00	0.84	1.15	6.3	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.54	6290	2082.24	15.39	8.23	0.011273	58.9	0.037	1970	2025	55	0	0	3	0.75	79	198	6.5	N/A	1.00	0.84	1.22	6.7	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.47	6290	2077.76	16.79	7.76	0.01314	62.5	0.037	1975	2025	50	0	0	3	0.75	79	198	6.5	N/A	1.00	0.84	1.21	6.6	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.39	6240	2073.95	15.3	7.95	0.011451	59.9	0.037	1975	2030	55	0	0	3	0.75	79	197	6.5	N/A	1.00	0.84	1.21	6.6	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.32	6240	2071.58	11.6	9.58	0.005033	77.9	0.037	1970	2030	60	0	0	3	0.75	79	197	6.5	N/A	1.00	0.84	1.25	6.9	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.25	6240	2067.4	15.8	9.4	0.008374	82.6	0.037	1985	2020	35	0	0	3	0.75	79	197	6.5	N/A	1.00	0.84	1.25	6.8	Unstable
Willow Springs - Lower	Reach-1	PF 3	0.13	6240	2058.56	18.22	7.56	0.015465	67.8	0.037	1975	2020	45	0	0	3	0.75	79	197	6.5	N/A	1.00	0.84	1.20	6.6	Unstable

WILLOW SPRINGS WASH - UPPER (STA 1.78-5.31)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WS.DAT
HEC-RAS Project: WS.prj
HEC-RAS Plan: WS.Pp02
HEC-RAS Geometry: WS.g01
HEC-RAS Steady Flow: WS.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																		Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs		PF 3	5.31	362	3004.94	22.93	2.94	0.17023	12.22	0.05	10000	10004.4	4.4	0	0	3.0	0.35	19	48	5.2	N/A	1.00	0.84	1.00	4.4	Unstable
Willow Springs		PF 3	5.24	362	2940.63	16.55	3.23	0.184911	12.75	0.05	9998.7	10011.1	12.4	0	0	3.0	0.35	19	48	5.2	N/A	1.00	0.84	1.02	4.4	Unstable
Willow Springs		PF 3	5.18	362	2890.24	19.22	3.44	0.136624	14.58	0.06	9996.2	10000	3.8	0	0	3.0	0.35	19	48	5.2	N/A	1.00	0.84	1.04	4.5	Unstable
Willow Springs		PF 3	5.10	362	2851.48	11.76	2.68	0.070596	16.65	0.06	9986	9997.7	11.7	0	0	3.0	0.35	19	48	5.2	N/A	1.00	0.84	0.98	4.3	Unstable
Willow Springs		PF 3	5.02	362	2817.87	9.05	2.47	0.094906	31.55	0.06	9992.8	10023.6	30.8	0	0	3.0	0.35	19	48	5.2	N/A	1.00	0.84	0.97	4.2	Unstable
Willow Springs		PF 3	4.95	362	2790.28	10.13	2.78	0.058829	22.08	0.05	9998.3	10018	19.7	0	0	3.0	0.35	19	48	5.2	N/A	1.00	0.84	0.99	4.3	Unstable
Willow Springs		PF 3	4.85	724	2753.83	17.73	4.33	0.064216	21.25	0.04	9993	10006.8	13.8	0	0	3.0	0.35	27	67	5.2	N/A	1.00	0.84	1.08	4.7	Unstable
Willow Springs		PF 3	4.77	724	2718.83	21.76	2.83	0.102463	24.6	0.04	9989.8	10000	10.2	0	0	3.0	0.35	27	67	5.2	N/A	1.00	0.84	0.99	4.3	Unstable
Willow Springs		PF 3	4.69	724	2671.57	18.29	3.07	0.120988	24.73	0.04	9985.1	10008	22.9	0	0	3.0	0.35	27	67	5.2	N/A	1.00	0.84	1.01	4.4	Unstable
Willow Springs		PF 3	4.60	724	2614.72	19.36	3.42	0.120464	25.12	0.06	9993	10000	7	0	0	3.0	0.35	27	67	5.2	N/A	1.00	0.84	1.03	4.5	Unstable
Willow Springs		PF 3	4.49	724	2580.96	10.1	3.46	0.03859	57.66	0.06	10015.8	10026.2	10.4	170	60	3.0	0.35	27	67	5.2	5.77	0.78	0.84	1.04	3.5	Unstable
Willow Springs		PF 3	4.38	724	2553.33	10.35	3.83	0.058167	35.83	0.06	9978.1	10006.8	28.7	170	60	3.0	0.35	27	67	5.2	2.09	0.70	0.84	1.06	3.2	Unstable
Willow Springs		PF 3	4.31	724	2543.35	7.9	3.45	0.021099	86.78	0.05	9993.9	10019.7	25.8	280	150	3.0	0.35	27	67	5.2	5.81	0.78	0.84	1.04	3.5	Unstable
Willow Springs		PF 3	4.24	2027	2533.6	8.28	2.5	0.028175	192.88	0.04	10019.1	10118	98.9	230	140	3.0	0.35	45	113	5.2	1.42	0.70	0.84	0.97	2.9	Unstable
Willow Springs		PF 3	4.16	2027	2515.57	18.03	5.27	0.037466	50.51	0.04	9981	10007.5	26.5	0	0	3.0	0.35	45	113	5.2	N/A	1.00	0.84	1.13	4.9	Unstable
Willow Springs		PF 3	4.04	2027	2500.43	14.61	7.03	0.018997	52.75	0.04	9990.6	10016	25.4	0	0	3.0	0.35	45	113	5.2	N/A	1.00	0.84	1.19	5.2	Unstable
Willow Springs		PF 3	3.94	2027	2481.71	16.51	2.81	0.075473	94.75	0.04	9980.9	10035.2	54.3	0	0	3.0	0.35	45	113	5.2	N/A	1.00	0.84	0.99	4.3	Unstable
Willow Springs		PF 3	3.81	2027	2463.02	11.11	4.62	0.0155	95.96	0.04	9975	10016.4	41.4	0	0	3.0	0.35	45	113	5.2	N/A	1.00	0.84	1.10	4.8	Unstable
Willow Springs		PF 3	3.68	2932	2439.72	23.75	6.92	0.035434	43.36	0.04	9989.2	10005.9	16.7	320	160	3.0	0.71	54	135	6.4	9.58	0.93	0.84	1.18	5.9	Unstable
Willow Springs		PF 3	3.59	2932	2428.27	21.85	7.97	0.019638	39.45	0.035	9990.9	10006.2	15.3	0	0	3.0	0.71	54	135	6.4	N/A	1.00	0.84	1.21	6.5	Unstable
Willow Springs		PF 3	3.49	2932	2412.23	22.5	5.73	0.042839	46.68	0.035	9988	10017	29	0	0	3.0	0.71	54	135	6.4	N/A	1.00	0.84	1.14	6.2	Unstable
Willow Springs		PF 3	3.39	2932	2401.73	15.2	7.73	0.016524	49.96	0.04	9982.5	10012.8	30.3	0	0	3.0	0.71	54	135	6.4	N/A	1.00	0.84	1.21	6.5	Unstable
Willow Springs		PF 3	3.31	2932	2390.53	17.91	5.43	0.034714	53.84	0.04	9970.9	10007.2	36.3	0	0	3.0	0.71	54	135	6.4	N/A	1.00	0.84	1.13	6.1	Unstable
Willow Springs		PF 3	3.23	2932	2379.3	15.51	5.5	0.026444	149.76	0.04	9984.3	10014.3	30	600	300	3.0	0.71	54	135	6.4	10.00	0.94	0.84	1.14	5.7	Unstable
Willow Springs		PF 3	3.14	2932	2369.22	14.34	5.62	0.018885	124.46	0.04	9997.7	10018	20.3	180	60	0.0	0.71	54	135	6.4	2.96	0.70	0.50	1.14	2.6	Unstable
Willow Springs		PF 3	3.05	2932	2357.1	15.66	5.9	0.02647	71.48	0.045	9994.4	10025.3	30.9	0	0	3.0	0.71	54	135	6.4	N/A	1.00	0.84	1.15	6.2	Unstable
Willow Springs		PF 3	2.99	2932	2344.53	20.15	6.33	0.039005	54.29	0.04	9989.2	10015.6	26.4	190	60	3.0	0.71	54	135	6.4	2.27	0.70	0.84	1.16	4.4	Unstable
Willow Springs		PF 3	2.93	2932	2333.22	15.58	4.22	0.039591	66.49	0.04	9980.8	10041.6	60.8	0	0	3.0	0.71	54	135	6.4	N/A	1.00	0.84	1.08	5.8	Unstable
Willow Springs		PF 3	2.85	3193	2319.9	17.76	5.7	0.02267	47.92	0.035	9973.1	10010.3	37.2	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.14	6.0	Unstable
Willow Springs		PF 3	2.78	3193	2312	15.35	6.8	0.02432	92.03	0.035	9975.9	10036.3	60.4	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.18	6.2	Unstable
Willow Springs		PF 3	2.68	3193	2301.77	13.53	5.67	0.019753	171.88	0.035	9980.3	10012.9	32.6	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.14	6.0	Unstable
Willow Springs		PF 3	2.57	3193	2285.85	15.74	6.35	0.027895	85.22	0.035	9969.5	10024.6	55.1	250	100	3.0	0.67	57	141	6.3	1.81	0.70	0.84	1.17	4.3	Unstable
Willow Springs		PF 3	2.51	3193	2278.48	18.31	7.08	0.017318	52.21	0.035	9986.8	10008.4	21.6	230	70	3.0	0.67	57	141	6.3	3.24	0.70	0.84	1.19	4.4	Unstable
Willow Springs		PF 3	2.45	3193	2272.48	16.41	5.48	0.024707	127.97	0.03	9962.5	10011	48.5	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.13	6.0	Unstable
Willow Springs		PF 3	2.36	3193	2260.59	12.28	4.09	0.028716	109.05	0.04	9976.7	10072.6	95.9	380	230	2.0	0.67	57	141	6.3	2.40	0.70	0.71	1.07	3.4	Unstable
Willow Springs		PF 3	2.27	3193	2252.34	13.01	5.04	0.011009	71.85	0.03	9956.3	10016.2	59.9	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.12	5.9	Unstable
Willow Springs		PF 3	2.17	3193	2238.77	22.88	6.37	0.02506	51.56	0.03	9987.2	10011.2	24	390	190	1.0	0.67	57	141	6.3	7.92	0.87	0.50	1.17	3.2	Unstable
Willow Springs		PF 3	2.10	3193	2232.08	17	4.18	0.021757	53.73	0.03	9980.1	10030.9	50.8	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.08	5.7	Unstable
Willow Springs		PF 3	1.97	3193	2218.54	12.81	5.44	0.02143	88.64	0.035	9941.6	10024.3	82.7	0	0	3.0	0.67	57	141	6.3	N/A	1.00	0.84	1.13	6.0	Unstable
Willow Springs		PF 3	1.91	4682	2207.16	22.1	8.16	0.018168	65.56	0.025	9976.6	10018.5	41.9	0	0	3.0	0.67	68	171	6.3	N/A	1.00	0.84	1.22	6.4	Unstable
Willow Springs		PF 3	1.78	4682	2184.92	28.44	5.62	0.035397	63.1	0.025	9981.4	10019.1	37.7	0	0	3.0	0.67	68	171	6.3	N/A	1.00	0.84	1.14	6.0	Unstable

WILLOW SPRINGS WASH TRIB 1
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST1.DAT
HEC-RAS Project: WST1.prj
HEC-RAS Plan: WST1.p02
HEC-RAS Geometry: WST1.g01
HEC-RAS Steady Flow: WST1.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 1		PF 3	3.56	286	2518.88	9.81	2.78	0.037046	25.31	0.04	10000	10013.8	13.8	0	0	3.0	0.75	20	42	6.5	N/A	1.00	0.84	0.99	5.4	Unstable
Willow Springs Trib 1		PF 3	3.52	286	2510.69	8.9	2.29	0.043646	32.8	0.04	9987.4	10000	12.6	0	0	3.0	0.75	20	42	6.5	N/A	1.00	0.84	0.95	5.2	Unstable
Willow Springs Trib 1		PF 3	3.46	286	2501.43	8.82	2.73	0.018912	26.5	0.04	10000	10008.2	8.2	0	0	3.0	0.75	20	42	6.5	N/A	1.00	0.84	0.99	5.4	Unstable
Willow Springs Trib 1		PF 3	3.41	286	2496.6	8.47	3.2	0.018062	25.6	0.04	9989.6	10000	10.4	0	0	3.0	0.75	20	42	6.5	N/A	1.00	0.84	1.02	5.6	Unstable
Willow Springs Trib 1		PF 3	3.31	286	2477.89	17.01	3.49	0.05429	10.66	0.04	10000	10005	5	0	0	3.0	0.75	20	42	6.5	N/A	1.00	0.84	1.04	5.7	Unstable
Willow Springs Trib 1		PF 3	3.22	286	2453.52	11.2	3.32	0.053504	19.83	0.04	9999.9	10016.8	16.9	150	50	3.0	0.75	20	42	6.5	2.96	0.70	0.84	1.03	3.9	Unstable
Willow Springs Trib 1		PF 3	3.16	286	2440.95	7.28	2.35	0.031724	43.65	0.04	10000	10012.2	12.2	160	60	3.0	0.75	20	42	6.5	4.92	0.73	0.84	0.95	3.8	Unstable
Willow Springs Trib 1		PF 3	3.07	286	2423.27	9.35	3.07	0.040701	22.39	0.04	9999.6	10018.9	19.3	0	0	3.0	0.75	20	42	6.5	N/A	1.00	0.84	1.01	5.5	Unstable
Willow Springs Trib 1		PF 3	2.98	286	2405.74	9.5	2.54	0.027679	25.02	0.04	9989	10000.4	11.4	130	50	3.0	0.75	20	42	6.5	4.39	0.70	0.84	0.97	3.7	Unstable
Willow Springs Trib 1		PF 3	2.89	286	2394.6	7.07	2.7	0.026937	37.87	0.04	9997.2	10033.1	35.9	230	60	1.0	0.75	20	42	6.5	1.67	0.70	0.50	0.98	2.2	Unstable
Willow Springs Trib 1		PF 3	2.82	286	2382.23	12.35	2.53	0.033917	20.26	0.04	9993.7	10000	6.3	160	60	1.0	0.75	20	42	6.5	9.52	0.92	0.50	0.97	2.9	Unstable
Willow Springs Trib 1		PF 3	2.77	629	2376.14	10	3.04	0.021473	41.84	0.04	9981.1	10000	18.9	130	50	1.0	0.75	25	63	6.5	2.65	0.70	0.50	1.01	2.3	Unstable
Willow Springs Trib 1		PF 3	2.71	629	2367.68	15.19	4.48	0.031227	43.23	0.04	9996.4	10000	3.6	0	0	3.0	0.75	25	63	6.5	N/A	1.00	0.84	1.09	6.0	Unstable
Willow Springs Trib 1		PF 3	2.63	629	2355.01	12.32	3.91	0.028489	37.96	0.04	9994	10001.7	7.7	140	70	1.0	0.75	25	63	6.5	9.09	0.91	0.50	1.06	3.2	Unstable
Willow Springs Trib 1		PF 3	2.57	629	2345.87	15.24	4.07	0.02916	40.75	0.04	9998.9	10000.3	1.4	0	0	3.0	0.75	25	63	6.5	N/A	1.00	0.84	1.07	5.9	Unstable
Willow Springs Trib 1		PF 3	2.48	629	2335.19	9.48	2.29	0.02443	84.32	0.04	10000	10012.3	12.3	130	40	3.0	0.75	25	63	6.5	3.25	0.70	0.84	0.95	3.6	Unstable
Willow Springs Trib 1		PF 3	2.42	629	2327.44	13.57	3.84	0.022199	38.24	0.04	9999.3	10002	2.7	180	50	2.0	0.75	25	63	6.5	18.52	1.00	0.71	1.06	4.9	Unstable
Willow Springs Trib 1		PF 3	2.37	629	2316.8	15.12	2.3	0.056119	34.6	0.04	9987.6	10000.6	13	230	80	3.0	0.25	25	63	4.7	6.15	0.80	0.84	0.95	3.0	Unstable
Willow Springs Trib 1		PF 3	2.33	629	2311.84	11.2	3.54	0.017877	45.53	0.04	9993.3	10000.1	6.8	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	1.04	4.1	Unstable
Willow Springs Trib 1		PF 3	2.24	629	2296.84	12.14	1.64	0.057828	41.48	0.04	10000	10019.1	19.1	0	0	2.0	0.25	25	63	4.7	N/A	1.00	0.71	0.93	3.1	Unstable
Willow Springs Trib 1		PF 3	2.16	629	2287.36	9.49	2.96	0.016186	40.22	0.04	9992.1	10010.8	18.7	150	80	2.0	0.25	25	63	4.7	4.28	0.70	0.71	1.00	2.3	Unstable
Willow Springs Trib 1		PF 3	2.10	629	2280.34	10.35	2.44	0.032004	46.06	0.04	9985.7	10000.1	14.4	180	60	1.0	0.25	25	63	4.7	4.17	0.70	0.50	0.96	1.6	Unstable
Willow Springs Trib 1		PF 3	2.04	629	2271.47	12.18	3.27	0.023219	39.93	0.04	9995.1	10000.5	5.4	280	90	2.0	0.25	25	63	4.7	16.67	1.00	0.71	1.02	3.4	Unstable
Willow Springs Trib 1		PF 3	1.96	629	2258.99	12.96	2.49	0.037045	41.35	0.04	9991.2	10000	8.8	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	0.97	3.8	Unstable
Willow Springs Trib 1		PF 3	1.88	629	2252.58	11.48	3.58	0.01895	41.68	0.04	9995.3	10000.1	4.8	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	1.04	4.1	Unstable
Willow Springs Trib 1		PF 3	1.82	629	2243.22	13.41	3.22	0.03329	26.64	0.04	9994.3	10007.5	13.2	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	1.02	4.0	Unstable
Willow Springs Trib 1		PF 3	1.78	629	2233.5	15.28	2.6	0.057654	31.59	0.04	9985.5	10000	14.5	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	0.98	3.8	Unstable
Willow Springs Trib 1		PF 3	1.73	629	2229.65	9.07	2.55	0.01761	63.31	0.04	10000	10012.5	12.5	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	0.97	3.8	Unstable
Willow Springs Trib 1		PF 3	1.65	629	2221.95	8.97	2.45	0.016766	41.95	0.03	9969.9	10029.4	59.5	0	0	3.0	0.25	25	63	4.7	N/A	1.00	0.84	0.96	3.8	Unstable
Willow Springs Trib 1		PF 3	1.58	629	2212.62	11.85	2.42	0.031573	33.28	0.03	9978.8	10048	69.2	160	60	3.0	0.25	25	63	4.7	0.87	0.70	0.84	0.96	2.6	Unstable
Willow Springs Trib 1		PF 3	1.52	1065	2209.03	9.29	4.13	0.008943	62.09	0.03	9986.9	10026.2	39.3	0	0	3.0	0.25	33	82	4.7	N/A	1.00	0.84	1.07	4.2	Unstable
Willow Springs Trib 1		PF 3	1.45	1065	2203.01	9.4	2.01	0.03724	92.06	0.035	9946.8	10069.3	122.5	0	0	3.0	0.25	33	82	4.7	N/A	1.00	0.84	0.92	3.6	Unstable
Willow Springs Trib 1		PF 3	1.38	1065	2196.36	7.72	3.66	0.014808	75	0.035	9926.5	10032.2	105.7	0	0	3.0	0.25	33	82	4.7	N/A	1.00	0.84	1.05	4.1	Unstable
Willow Springs Trib 1		PF 3	1.30	1065	2184.76	13.76	3.06	0.037832	50.76	0.03	9974.9	10022.8	47.9	450	170	1.0	0.98	33	82	7.1	3.55	0.70	0.50	1.01	2.5	Unstable
Willow Springs Trib 1		PF 3	1.19	1065	2175.19	9.6	3.59	0.010779	48.52	0.03	9980.2	10022.3	42.1	0	0	3.0	0.98	33	82	7.1	N/A	1.00	0.84	1.04	6.2	Unstable
Willow Springs Trib 1		PF 3	1.07	1065	2161.27	15.17	3.07	0.037829	37.02	0.03	9978	10013	35	0	0	2.0	0.98	33	82	7.1	N/A	1.00	0.71	1.01	5.1	Unstable
Willow Springs Trib 1		PF 3	0.98	1065	2157.04	8.5	4.64	0.010633	57.4	0.03	9977.8	10041	63.2	0	0	3.0	0.98	33	82	7.1	N/A	1.00	0.84	1.10	6.5	Unstable
Willow Springs Trib 1		PF 3	0.88	1438	2149.89	11.75	4.59	0.012076	47.96	0.03	9984.5	10021.4	36.9	500	240	2.0	0.98	38	95	7.1	6.50	0.81	0.71	1.10	4.5	Unstable
Willow Springs Trib 1		PF 3	0.78	1438	2145.79	9.51	4.39	0.009418	82.83	0.035	9978.4	10014.1	35.7	0	0	2.0	0.98	38	95	7.1	N/A	1.00	0.71	1.09	5.5	Unstable
Willow Springs Trib 1		PF 3	0.70	1438	2140.97	7.62	4.57	0.009646	79.33	0.035	9959	10034.9	75.9	0	0	2.0	0.98	38	95	7.1	N/A	1.00	0.71	1.10	5.5	Unstable
Willow Springs Trib 1		PF 3	0.63	1438	2137.63	7.86	3.63	0.009443	211.64	0.03	9968.6	10021.3	52.7	0	0	2.0	0.98	38	95	7.1	N/A	1.00	0.71	1.05	5.3	Unstable
Willow Springs Trib 1		PF 3	0.52	1438	2131.19	9.88	2.99	0.013588	176.59	0.03	9980.8	10026	45.2	650	230	1.0	0.98	38	95	7.1	5.09	0.74	0.50	1.01	2.6	Unstable
Willow Springs Trib 1		PF 3	0.42	1438	2124.44	10.59	3.64	0.010293	76.87	0.03	9986.1	10026.9	40.8	400	220	1.0	0.98	38	95	7.1	5.39	0.76	0.50	1.05	2.8	Unstable
Willow Springs Trib 1		PF 3	0.35	1438	2121.69	8.41	3.99	0.007387	122.52	0.03	9963.2	10023.7	60.5	0	0	1.0	0.98	38	95	7.1	N/A	1.00	0.50	1.07	3.8	Unstable
Willow Springs Trib 1		PF 3	0.27	1438	2117.27	10.92	3.77	0.011483	149.61	0.03	9976.2	10014	37.8	500	250	2.0	0.98	38	95	7.1	6.61	0.82	0.71	1.05	4.3	Unstable
Willow Springs Trib 1		PF 3	0.22	1438	2112.81	11.85	3.21	0.019425	56.53	0.03	9970.1	10026.1	56	380	200	3.0	0.98	38	95	7.1	3.57	0.70	0.84	1.02	4.2	Unstable
Willow Springs Trib 1		PF 3	0.17	1438	2111.61	9.33	4.41	0.00643	78.2	0.03	9961.8	10012.3	50.5	0	0	3.0	0.98	38	95	7.1	N/A	1.00	0.84	1.09	6.5	Unstable
Willow Springs Trib 1		PF 3	0.09	1438	2107.65	7.85	2.25	0.01934	198.13	0.03	9931.1	10026.1	95	0	0	3.0	0.98	38	95	7.1	N/A	1.00	0.84	0.95	5.6	Unstable

WILLOW SPRINGS WASH TRIB 1A

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST1A.DAT
HEC-RAS Project: WST1A.prj
HEC-RAS Plan: WST1A.p02
HEC-RAS Geometry: WST1A.g01
HEC-RAS Steady Flow: WST1A.f02

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 1A		PF 3	0.97	341	2488.67	19.76	3.37	0.140059	19	0.05	10000	10002.3	2.3	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.03	4.6	Unstable
Willow Springs Trib 1A		PF 3	0.91	341	2441.21	18.69	2.21	0.150653	16.38	0.05	10007.1	10013.3	6.2	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	0.94	4.2	Unstable
Willow Springs Trib 1A		PF 3	0.84	341	2409.68	12.62	3.68	0.05893	16.11	0.05	10000	10009	9	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.05	4.6	Unstable
Willow Springs Trib 1A		PF 3	0.76	341	2374.28	13.63	2.98	0.12819	19.57	0.05	9986.4	10000	13.6	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.00	4.4	Unstable
Willow Springs Trib 1A		PF 3	0.68	341	2341.93	9.7	2.93	0.053745	27.43	0.05	10000	10015.7	15.7	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.00	4.4	Unstable
Willow Springs Trib 1A		PF 3	0.59	341	2308.41	11.33	2.91	0.090482	22.14	0.05	10000	10021.8	21.8	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.00	4.4	Unstable
Willow Springs Trib 1A		PF 3	0.52	341	2290.64	7.94	3.44	0.035694	26.99	0.05	9983.4	10000	16.6	120	70	3.0	0.37	20	46	5.3	4.22	0.70	0.84	1.04	3.2	Unstable
Willow Springs Trib 1A		PF 3	0.44	341	2272.95	9.47	2.45	0.048553	48.83	0.045	10000	10016.4	16.4	250	100	3.0	0.37	20	46	5.3	6.10	0.79	0.84	0.96	3.4	Unstable
Willow Springs Trib 1A		PF 3	0.39	341	2264.01	8.28	3.61	0.030317	24.96	0.045	9999.8	10016.7	16.9	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.05	4.6	Unstable
Willow Springs Trib 1A		PF 3	0.33	341	2250.13	13.59	2.43	0.048901	18.59	0.04	9990.3	10000.2	9.9	0	0	2.0	0.37	20	46	5.3	N/A	1.00	0.71	0.96	3.6	Unstable
Willow Springs Trib 1A		PF 3	0.26	341	2239.18	9.71	2.68	0.022404	25.93	0.04	9989.1	10001.9	12.8	220	100	1.0	0.37	20	46	5.3	7.81	0.87	0.50	0.98	2.2	Unstable
Willow Springs Trib 1A		PF 3	0.20	341	2231.27	10.59	1.77	0.02498	29.27	0.028	9979.3	10000	20.7	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	0.93	4.1	Unstable
Willow Springs Trib 1A		PF 3	0.15	341	2224.04	13.14	2.34	0.029769	33.2	0.028	10000	10008.4	8.4	200	120	2.0	0.37	20	46	5.3	14.29	0.98	0.71	0.95	3.5	Unstable
Willow Springs Trib 1A		PF 3	0.08	341	2215.62	9.42	3.22	0.020883	28.95	0.03	10000	10008.1	8.1	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	1.02	4.5	Unstable
Willow Springs Trib 1A		PF 3	1.52	341	2207.31	7.24	2.4	0.012552	31.06	0.03	9986.9	10026.2	39.3	0	0	3.0	0.37	20	46	5.3	N/A	1.00	0.84	0.96	4.2	Unstable

WILLOW SPRINGS WASH TRIB 2

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST2.DAT
HEC-RAS Project: WST2.prj
HEC-RAS Plan: WST2.p02
HEC-RAS Geometry: WST2.g01
HEC-RAS Steady Flow: WST2.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 2		PF 3	1.61	445	2466.82	10.47	2.62	0.067019	26.36	0.055	9981.6	10005.6	24	0	0	3.0	0.63	21	53	6.2	N/A	1.00	0.84	0.98	5.1	Unstable
Willow Springs Trib 2		PF 3	1.49	445	2426.92	14.61	4.72	0.056766	15.49	0.055	9999.3	10005.4	6.1	150	80	3.0	0.63	21	53	6.2	13.11	0.98	0.84	1.10	5.6	Unstable
Willow Springs Trib 2		PF 3	1.38	445	2395.1	11.01	3.1	0.055287	24.31	0.055	9994.3	10009.1	14.8	0	0	3.0	0.63	21	53	6.2	N/A	1.00	0.84	1.01	5.3	Unstable
Willow Springs Trib 2		PF 3	1.31	445	2376.68	10.52	3.38	0.045336	25.3	0.055	9988.1	10003.5	15.4	140	70	3.0	0.63	21	53	6.2	4.55	0.70	0.84	1.03	3.7	Unstable
Willow Springs Trib 2		PF 3	1.20	891	2353.61	12.77	4.31	0.035198	26.97	0.045	9988.1	10011.3	23.2	0	0	3.0	0.63	30	75	6.2	N/A	1.00	0.84	1.08	5.6	Unstable
Willow Springs Trib 2		PF 3	1.12	891	2340.11	11.38	4.51	0.031492	44.52	0.05	9990.1	10011.3	21.2	160	60	3.0	0.63	30	75	6.2	2.83	0.70	0.84	1.09	4.0	Unstable
Willow Springs Trib 2		PF 3	0.98	891	2321.33	8.91	4.13	0.018214	45.78	0.045	9985.9	10019.4	33.5	180	70	3.0	0.63	30	75	6.2	2.09	0.70	0.84	1.07	3.9	Unstable
Willow Springs Trib 2		PF 3	0.91	891	2314.45	7.09	2.55	0.021768	92.27	0.05	9993.7	10010	16.3	300	80	3.0	0.63	30	75	6.2	4.91	0.73	0.84	0.97	3.7	Unstable
Willow Springs Trib 2		PF 3	0.82	891	2303.27	9.17	4.87	0.021831	43.3	0.045	9968.4	10004.5	36.1	250	100	1.0	0.63	30	75	6.2	2.77	0.70	0.50	1.11	2.4	Unstable
Willow Springs Trib 2		PF 3	0.74	891	2291.85	9.58	5.15	0.024822	49.94	0.05	9995.9	10022.9	27	120	40	1.0	0.63	30	75	6.2	1.48	0.70	0.50	1.12	2.4	Unstable
Willow Springs Trib 2		PF 3	0.66	1492	2279.8	13.29	4.6	0.026759	62.87	0.045	9976.9	10000	23.1	150	50	1.0	0.63	39	97	6.2	2.16	0.70	0.50	1.10	2.4	Unstable
Willow Springs Trib 2		PF 3	0.54	1492	2266.68	10.62	6.38	0.018214	48.61	0.045	9984.4	10020.2	35.8	0	0	3.0	0.63	39	97	6.2	N/A	1.00	0.84	1.17	6.1	Unstable
Willow Springs Trib 2		PF 3	0.40	1492	2253.01	11.19	4.61	0.018768	91.55	0.04	9989.5	10023.2	33.7	330	130	1.0	0.63	39	97	6.2	3.86	0.70	0.50	1.10	2.4	Unstable
Willow Springs Trib 2		PF 3	0.30	1492	2242.72	8.21	2.62	0.021981	105.5	0.04	9992.8	10091.7	98.9	180	70	1.0	0.63	39	97	6.2	0.71	0.70	0.50	0.98	2.1	Unstable
Willow Springs Trib 2		PF 3	0.20	1492	2231.18	13.24	4.88	0.016179	43.48	0.035	9987.3	10013.5	26.2	0	0	1.0	0.63	39	97	6.2	N/A	1.00	0.50	1.11	3.4	Unstable
Willow Springs Trib 2		PF 3	0.10	1492	2218.75	18.45	4.55	0.021736	31.68	0.03	9989	10007	18	0	0	1.0	0.63	39	97	6.2	N/A	1.00	0.50	1.09	3.4	Unstable
Willow Springs Trib 2		PF 3	0.04	1492	2213.12	13.62	3.42	0.021998	44.65	0.03	9966.5	10009.3	42.8	0	0	1.0	0.63	39	97	6.2	N/A	1.00	0.50	1.03	3.2	Unstable
Willow Springs Trib 2		PF 3	1.91	1492	2204.39	16.88	5.39	0.03395	35.06	0.03	9976.6	10018.5	41.9	320	120	1.0	0.63	39	97	6.2	2.86	0.70	0.50	1.13	2.5	Unstable

WILLOW SPRINGS WASH TRIB 2A

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST2A.DAT
HEC-RAS Project: WST2A.prj
HEC-RAS Plan: WST2A.p02
HEC-RAS Geometry: WST2A.g01
HEC-RAS Steady Flow: WST2A.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 2A		PF 3	1.00	402	2461.95	8.5	2.85	0.037006	35.01	0.05	9984.7	10009.9	25.2	0	0	3.0	0.49	20	50	5.7	N/A	1.00	0.84	1.00	4.8	Unstable
Willow Springs Trib 2A		PF 3	0.90	402	2443.21	8.45	3.61	0.033812	37.4	0.05	9991.5	10014.9	23.4	0	0	3.0	0.49	20	50	5.7	N/A	1.00	0.84	1.05	5.0	Unstable
Willow Springs Trib 2A		PF 3	0.81	402	2418.87	13.13	3.37	0.070472	14.71	0.05	9990.7	10003.2	12.5	170	80	3.0	0.49	20	50	5.7	6.40	0.81	0.84	1.03	4.0	Unstable
Willow Springs Trib 2A		PF 3	0.72	402	2401.7	9.02	3.4	0.023558	22.41	0.045	9988	10006.6	18.6	0	0	3.0	0.49	20	50	5.7	N/A	1.00	0.84	1.03	5.0	Unstable
Willow Springs Trib 2A		PF 3	0.62	402	2384.61	10.78	2.91	0.042646	21.49	0.04	9989.9	10018	28.1	0	0	3.0	0.49	20	50	5.7	N/A	1.00	0.84	1.00	4.8	Unstable
Willow Springs Trib 2A		PF 3	0.52	402	2368.62	8.47	3.02	0.023772	44.9	0.04	9989.3	10016.4	27.1	0	0	3.0	0.49	20	50	5.7	N/A	1.00	0.84	1.01	4.8	Unstable
Willow Springs Trib 2A		PF 3	0.40	601	2340.34	13.74	3.14	0.067727	24.76	0.04	9986.4	10016.4	30	0	0	3.0	0.49	25	61	5.7	N/A	1.00	0.84	1.02	4.9	Unstable
Willow Springs Trib 2A		PF 3	0.29	601	2323.37	8.32	3.07	0.021012	39.64	0.045	9978.4	10008	29.6	0	0	3.0	0.49	25	61	5.7	N/A	1.00	0.84	1.01	4.9	Unstable
Willow Springs Trib 2A		PF 3	0.22	601	2312.34	10.94	3.24	0.037552	36.79	0.045	9991.4	10014.3	22.9	0	0	3.0	0.49	25	61	5.7	N/A	1.00	0.84	1.02	4.9	Unstable
Willow Springs Trib 2A		PF 3	0.10	601	2296.82	7.69	3.42	0.021924	48.84	0.045	9952.9	9990.6	37.7	160	50	1.0	0.49	25	61	5.7	1.33	0.70	0.50	1.03	2.1	Unstable
Willow Springs Trib 2A		PF 3	0.66	601	2278.03	11.55	2.83	0.044334	34.18	0.045	9976.9	10000	23.1	150	50	1.0	0.49	25	61	5.7	2.16	0.70	0.50	0.99	2.0	Unstable

WILLOW SPRINGS WASH TRIB 4

LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST4.DAT
HEC-RAS Project: WST4.prj
HEC-RAS Plan: WST4.p02
HEC-RAS Geometry: WST4.g01
HEC-RAS Steady Flow: WST4.f02

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 4		PF 3	1.09	133	2561.68	6.24	1.58	0.037042	27.64	0.04	9983	10010.7	27.7	0	0	3.0	0.75	20	29	6.5	N/A	1.00	0.84	0.93	5.1	Unstable
Willow Springs Trib 4		PF 3	0.98	133	2539.91	8.91	1.41	0.03637	17.66	0.04	10000	10008.3	8.3	150	70	3.0	0.75	20	29	6.5	8.43	0.89	0.84	0.93	4.5	Unstable
Willow Springs Trib 4		PF 3	0.89	219	2514.19	9.09	1.99	0.069209	26.44	0.04	9984	10010.4	26.4	0	0	3.0	0.75	20	37	6.5	N/A	1.00	0.84	0.93	5.1	Unstable
Willow Springs Trib 4		PF 3	0.80	219	2492.7	7.57	2.1	0.031986	23.37	0.04	9989.3	10017.7	28.4	150	70	3.0	0.75	20	37	6.5	2.46	0.70	0.84	0.93	3.6	Unstable
Willow Springs Trib 4		PF 3	0.69	219	2469.93	9.82	2.73	0.046272	18.68	0.04	9991.4	10006.8	15.4	100	50	3.0	0.75	20	37	6.5	3.25	0.70	0.84	0.99	3.8	Unstable
Willow Springs Trib 4		PF 3	0.58	219	2442.21	10.43	1.91	0.048853	18.51	0.04	9993.8	10007.7	13.9	0	0	3.0	0.75	20	37	6.5	N/A	1.00	0.84	0.93	5.1	Unstable
Willow Springs Trib 4		PF 3	0.52	219	2432.74	6.62	2.34	0.022314	26.78	0.04	9990.4	10015.6	25.2	0	0	3.0	0.75	20	37	6.5	N/A	1.00	0.84	0.95	5.2	Unstable
Willow Springs Trib 4		PF 3	0.45	318	2415.71	12.21	2.11	0.073562	26.39	0.04	9991.3	10009.7	18.4	180	70	3.0	0.75	20	45	6.5	3.80	0.70	0.84	0.93	3.6	Unstable
Willow Springs Trib 4		PF 3	0.38	318	2404.35	8.36	2.85	0.018661	27.65	0.04	10000	10015.9	15.9	0	0	3.0	0.75	20	45	6.5	N/A	1.00	0.84	1.00	5.4	Unstable
Willow Springs Trib 4		PF 3	0.31	318	2392.26	7.2	1.46	0.075361	55.39	0.05	9993.8	10046.2	52.4	210	100	3.0	0.75	20	45	6.5	1.91	0.70	0.84	0.93	3.6	Unstable
Willow Springs Trib 4		PF 3	0.21	318	2373.44	8.26	3.54	0.020106	20.42	0.04	9990.9	10009.6	18.7	150	50	3.0	0.75	20	45	6.5	2.67	0.70	0.84	1.04	4.0	Unstable
Willow Springs Trib 4		PF 3	0.12	318	2354.09	13.71	2.19	0.083154	18.28	0.04	9994.2	10009.7	15.5	0	0	3.0	0.75	20	45	6.5	N/A	1.00	0.84	0.94	5.1	Unstable
Willow Springs Trib 5		PF 3	2.93	318	2331.01	5.31	2.01	0.01501	47.29	0.04	9980.8	10041.6	60.8	0	0	3.0	0.75	20	45	6.5	N/A	1.00	0.84	0.92	5.0	Unstable

WILLOW SPRINGS WASH TRIB 5
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST5.DAT
HEC-RAS Project: WST5.prj
HEC-RAS Plan: WST5.p02
HEC-RAS Geometry: WST5.g01
HEC-RAS Steady Flow: WST5.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level II Bank Stability Estimate						
																		Level I Erosion Setback		Allowable Velocity Analysis					
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 5		PF 3	2.04	296	2250.98	8.31	4.28	0.021229	16.66	0.04	9956.1	9995.6	39.5	0	0	3.0	1.57	20	43	8.2	N/A	1.00	0.84	1.08	7.4	Unstable
Willow Springs Trib 5		PF 3	1.92	296	2237.73	6.43	1.83	0.027604	48.48	0.04	9975	10012.2	37.2	180	50	1.0	1.57	20	43	8.2	1.34	0.70	0.50	0.93	2.7	Unstable
Willow Springs Trib 5		PF 3	1.83	296	2223.85	6.54	1.85	0.029978	46.09	0.04	9974.9	10022.8	47.9	180	75	2.0	1.57	20	43	8.2	1.57	0.70	0.71	0.93	3.8	Unstable
Willow Springs Trib 5		PF 3	1.75	296	2215.96	5.46	2.96	0.014319	42.46	0.04	9984.2	10019.2	35	160	50	2.0	1.57	20	43	8.2	1.43	0.70	0.71	1.00	4.1	Unstable
Willow Springs Trib 5		PF 3	1.66	296	2207.45	6.82	2.65	0.020707	33.15	0.04	9992.9	10035.2	42.3	0	0	3.0	1.57	20	43	8.2	N/A	1.00	0.84	0.98	6.7	Unstable
Willow Springs Trib 5		PF 3	1.57	296	2197.11	6.77	1.91	0.029424	41.01	0.04	9994.5	10045.1	50.6	130	60	3.0	1.57	20	43	8.2	1.19	0.70	0.84	0.93	4.5	Unstable
Willow Springs Trib 5		PF 3	1.46	296	2182.86	5.07	1.66	0.020176	87.42	0.04	9980	10016.2	36.2	0	0	3.0	1.57	20	43	8.2	N/A	1.00	0.84	0.93	6.4	Stable
Willow Springs Trib 5		PF 3	1.36	296	2171.74	5.87	2.14	0.020613	54.5	0.04	9978.7	10021.4	42.7	0	0	3.0	1.57	20	43	8.2	N/A	1.00	0.84	0.93	6.4	Stable
Willow Springs Trib 5		PF 3	1.28	296	2162.15	6.68	2.15	0.024292	44.04	0.04	9984.7	10025.7	41	120	120	3.0	1.57	20	43	8.2	2.93	0.70	0.84	0.94	4.5	Unstable
Willow Springs Trib 5		PF 3	1.17	296	2152.45	6.15	3.65	0.015851	27.49	0.045	9977	10000	23	380	220	3.0	1.57	20	43	8.2	9.57	0.93	0.84	1.05	6.6	Stable
Willow Springs Trib 5		PF 3	1.07	296	2144.05	6.14	2.45	0.015594	38.67	0.035	9976.2	10016.2	40	0	0	3.0	1.57	20	43	8.2	N/A	1.00	0.84	0.96	6.6	Stable
Willow Springs Trib 5		PF 3	0.99	296	2136.65	6.82	2.35	0.019101	35.11	0.04	9983.2	10011	27.8	140	40	1.0	1.57	20	43	8.2	1.44	0.70	0.50	0.95	2.7	Unstable
Willow Springs Trib 5		PF 3	0.92	296	2126.55	5.65	1.75	0.02736	62.5	0.04	9982.1	10039.7	57.6	200	75	3.0	1.57	20	43	8.2	1.30	0.70	0.84	0.93	4.5	Unstable
Willow Springs Trib 5		PF 3	0.80	631	2115.99	3.7	5.89	0.001987	98.19	0.045	9982.4	10010.8	28.4	0	0	3.0	0.98	25	63	7.1	N/A	1.00	0.84	1.15	6.8	Stable
Willow Springs Trib 5		PF 3	0.71	631	2116.05	0.66	10.75	0.000018	217.2	0.045	9989.8	10016.5	26.7	180	75	3.0	0.98	25	63	7.1	2.81	0.70	0.84	1.28	5.3	Stable
Willow Springs Trib 5		PF 3	0.70	631	2116.04	0.96	13.64	0.00003	250.84	0.045	10000	10020.1	20.1	0	0	3.0	0.98	25	63	7.1	N/A	1.00	0.84	1.33	7.9	Stable
Willow Springs Trib 5		PF 3	0.69	631	2105.92	9.52	3.51	0.021759	29.6	0.045	10000	10020.1	20.1	0	0	3.0	0.98	25	63	7.1	N/A	1.00	0.84	1.04	6.2	Unstable
Willow Springs Trib 5		PF 3	0.65	631	2102.85	6.79	5.14	0.013019	38.81	0.045	9978.6	10010	31.4	0	0	3.0	0.98	25	63	7.1	N/A	1.00	0.84	1.12	6.7	Unstable
Willow Springs Trib 5		PF 3	0.58	631	2098.38	7.61	3.78	0.011131	44.49	0.045	9991.3	10007.2	15.9	300	130	1.0	0.98	25	63	7.1	8.18	0.88	0.50	1.06	3.3	Unstable
Willow Springs Trib 5		PF 3	0.51	631	2093.2	9.32	3.6	0.015107	44.32	0.04	9990	10006.9	16.9	150	60	1.5	0.98	25	63	7.1	3.55	0.70	0.52	1.05	2.7	Unstable
Willow Springs Trib 5		PF 3	0.41	631	2086.5	9.14	3.1	0.013574	43.32	0.035	9984.9	10007.3	22.4	170	80	1.0	0.98	25	63	7.1	3.57	0.70	0.50	1.01	2.5	Unstable
Willow Springs Trib 5		PF 3	0.30	631	2078.11	10.46	4.01	0.013594	27.49	0.035	9990.2	10008.2	18	0	0	3.0	0.98	25	63	7.1	N/A	1.00	0.84	1.07	6.3	Unstable
Willow Springs Trib 5		PF 3	0.20	631	2069.86	7.33	3.36	0.008857	36.6	0.04	9989.2	10015.7	26.5	160	75	2.0	0.98	25	63	7.1	2.83	0.70	0.71	1.03	3.6	Unstable
Willow Springs Trib 5		PF 3	0.11	631	2064.31	9.86	4.01	0.016495	29.5	0.04	9985.7	10003.8	18.1	260	80	2.0	0.98	25	63	7.1	4.42	0.70	0.71	1.07	3.8	Unstable
Willow Springs Trib 5		PF 3	0.05	631	2056.51	9.68	3.11	0.038787	35.77	0.05	9991	10020	29	0	0	2.0	0.98	25	63	7.1	N/A	1.00	0.71	1.01	5.1	Unstable

WILLOW SPRINGS WASH TRIB 5A
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek/Carefree Flood Insurance Study
Prepared For: Flood Control District of Maricopa County, March 1990
Prepared By: CH2M Hill, Inc.
Imported HEC-2 File: WST5A.DAT
HEC-RAS Project: WST5A.prj
HEC-RAS Plan: WST5A.p02
HEC-RAS Geometry: WST5A.g01
HEC-RAS Steady Flow: WST5A.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Trib 5A		PF 3	0.60	145	2193.81	5.73	1.71	0.021999	31.12	0.04	9985.1	10014.3	29.2	0	0	3.0	1.38	20	30	7.9	N/A	1.00	0.84	0.93	6.1	Stable
Willow Springs Trib 5A		PF 3	0.53	145	2185.09	4.53	1.19	0.024848	49.83	0.04	9976.2	10018.4	42.2	0	0	3.0	1.38	20	30	7.9	N/A	1.00	0.84	0.93	6.1	Stable
Willow Springs Trib 5A		PF 3	0.44	145	2173.89	5.18	1.69	0.021482	30.72	0.04	9981.6	10021.8	40.2	180	70	3.0	1.38	20	30	7.9	1.74	0.70	0.84	0.93	4.3	Unstable
Willow Springs Trib 5A		PF 3	0.36	145	2164.11	6.32	2.41	0.024174	19.08	0.04	9996.6	10019.2	22.6	330	130	2.0	1.38	20	30	7.9	5.75	0.78	0.71	0.96	4.2	Unstable
Willow Springs Trib 5A		PF 3	0.27	145	2152.59	6.79	2.59	0.023902	22.6	0.04	9975.8	10000	24.2	130	70	3.0	1.38	20	30	7.9	2.89	0.70	0.84	0.98	4.5	Unstable
Willow Springs Trib 5A		PF 3	0.19	145	2141.66	6.8	1.86	0.027937	20.83	0.04	9976	10000	24	0	0	1.5	1.38	20	30	7.9	N/A	1.00	0.52	0.93	3.8	Unstable
Willow Springs Trib 5A		PF 3	0.13	145	2133.1	6.56	1.6	0.026047	40.96	0.04	9995.4	10012.1	16.7	0	0	3.0	1.38	20	30	7.9	N/A	1.00	0.84	0.93	6.1	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

WILLOW SPRINGS WASH TRIBUTARIES 6, 6A, 6B AND 6C
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level II Bank Stability Estimate						
																	Level I Erosion Setback		Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Wash Tribs	Trib6A	PF 1	1298.93 XS	60	2232.67	4.07	1.02	0.03	29.09	0.048	34.44	65.09	30.65	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	1251.56 XS	60	2229.01	4.39	1.21	0.03	23.09	0.048	34.01	57.97	23.96	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	1202.61 XS	60	2225.49	4.61	1.17	0.03	20.26	0.046	36.53	57.18	20.65	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	1148.99 XS	60	2222.83	4.34	1.17	0.03	24.37	0.047	29.15	54.81	25.66	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	1099.83 XS	60	2220.77	4.59	1.25	0.03	20.2	0.046	69.91	90.76	20.85	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	1049.00 XS	60	2218.69	4.47	1.29	0.01	21.96	0.033	43	65.92	22.92	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	999.82 XS	60	2217.3	4.33	1.14	0.02	24.24	0.036	59.55	85.21	25.66	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	949.67 XS	60	2215.28	4.18	1.22	0.02	26.99	0.037	88.31	116.52	28.21	60	35	3	1.0	20	50	7.1	1.24	0.70	0.84	0.93	3.9	Unstable
Willow Springs Wash Tribs	Trib6A	PF 1	877.35 XS	60	2213.15	3.81	1.53	0.03	20.53	0.056	39.56	60.78	21.22	60	35	3	1.0	20	50	7.1	1.65	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	840.59 XS	60	2212.46	2.74	1.73	0.02	25.3	0.06	60.55	86.1	25.55	60	35	3	1.0	20	50	7.1	1.37	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	799.07 XS	60	2211.16	4.89	1.4	0.05	16.79	0.052	76.25	93.58	17.33	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	751.32 XS	60	2210.18	3.74	1.52	0.01	21.18	0.035	74.74	96.68	21.94	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	699.17 XS	60	2209.13	4.68	1.36	0.05	19.18	0.052	56.56	76.71	20.15	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	649.54 XS	60	2207.73	4.55	1.27	0.02	20.76	0.035	35.65	56.91	21.26	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	599.60 XS	60	2207.69	1.39	2.24	0.00	49.17	0.038	35.16	66.33	31.17	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.94	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	580.2	60	2207.69	0.87	2.75	0.00	64.23	0.04	24.62	88.61	63.99	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.99	5.9	Stable
Willow Springs Wash Tribs	Trib6A		570.53	Inl Struct									0	0	0	3	1.0									
Willow Springs Wash Tribs	Trib6A	PF 1	560.39	60	2206.54	3.98	1.42	0.02	31.93	0.034	35.47	68.35	32.88	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	550.27 XS	60	2205.56	4.63	1.33	0.02	20.09	0.04	42.75	63.05	20.3	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	530.05	60	2205	3.91	1.36	0.02	22.57	0.04	29.13	52.99	23.86	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	512.65	60	2204.56	4.55	1.32	0.02	21.02	0.04	32.29	54.04	21.75	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	488.74 XS	60	2203.8	4.68	1.34	0.03	19.14	0.045	34.02	54.21	20.19	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	450.17 XS	60	2203	3.79	1.07	0.01	35.15	0.039	43.82	60.92	17.1	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	399.69 XS	60	2201.87	4.84	1.39	0.02	17.41	0.04	48.24	65.84	17.6	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	350.24 XS	60	2201.2	3.23	1.57	0.01	23.57	0.046	78.81	104	25.19	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	300.54 XS	60	2200.41	4.32	1.5	0.02	26.99	0.043	91.59	107.04	15.45	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	249.44 XS	60	2199.11	3.6	0.79	0.05	67.44	0.056	80.92	105	24.08	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	199.40 XS	60	2198.31	1.75	1.49	0.00	79.07	0.045	76.94	113.44	36.5	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	161.57 XS	60	2197.96	3.29	1.41	0.01	48.83	0.041	70.67	96.77	26.1	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	135.24 XS	60	2197.51	2.71	1.34	0.03	52.27	0.063	56.73	93.35	36.62	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	102.08 XS	60	2197.35	1.87	2.28	0.00	48.98	0.049	55.99	77.17	21.18	50	30	3	1.0	20	50	7.1	1.42	0.70	0.84	0.95	4.0	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	76.00 XS	60	2197.31	1.65	2.53	0.00	41.14	0.043	47.33	70.58	23.25	50	30	3	1.0	20	50	7.1	1.29	0.70	0.84	0.97	4.1	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	41.40 XS	60	2197.25	1.74	2.34	0.00	42.77	0.051	51.24	74.37	23.13	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.95	5.7	Stable
Willow Springs Wash Tribs	Trib6A	PF 1	16.67 XS	60	2197.25	1.02	2.59	0.00	67.26	0.045	37.22	66.05	28.83	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.98	5.8	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1499.93 XS	50	2217.8	3.97	1.58	0.02	15.68	0.05	53.89	70.1	16.21	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1449.80 XS	50	2216.84	3.61	1.8	0.02	15.07	0.048	32.47	48.57	16.1	50	35	3	1.0	20	50	7.1	2.17	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1399.87 XS	50	2215.4	4.89	1.44	0.05	14.16	0.052	39.1	53.74	14.64	50	35	3	1.0	20	50	7.1	2.39	0.70	0.84	0.93	3.9	Unstable
Willow Springs Wash Tribs	Trib6B	PF 1	1349.93 XS	50	2213.93	4.63	1.26	0.02	16.53	0.037	16.31	33.35	17.04	60	35	3	1.0	20	50	7.1	2.05	0.70	0.84	0.93	3.9	Unstable
Willow Springs Wash Tribs	Trib6B	PF 1	1300.37 XS	50	2212.84	2.86	1.78	0.01	21.35	0.054	47.05	68.69	21.64	60	35	3	1.0	20	50	7.1	1.62	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1250.70 XS	50	2211.78	4.04	1.76	0.02	13.6	0.052	51.52	65.92	14.4	60	25	3	1.0	20	50	7.1	1.74	0.70	0.84	0.93	3.9	Unstable
Willow Springs Wash Tribs	Trib6B	PF 1	1199.55 XS	50	2210.71	3.63	1.77	0.02	17.02	0.05	81.84	99.5	17.66	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1150.07 XS	50	2209.17	5.02	1.52	0.04	13.07	0.047	48.34	62.47	14.13	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1103.60 XS	50	2208.1	3.32	1.06	0.01	24.18	0.04	54.45	78.86	24.41	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1067.50 XS	50	2207.34	3.65	1.37	0.04	23.64	0.054	56.95	80.77	23.82	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	1031.02 XS	50	2206.69	3.61	1.41	0.01	19.84	0.038	52.1	72.1	20	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	999.73 XS	50	2206.29	3.04	1.59	0.02	21.93	0.056	53.81	76.75	22.94	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	973.61	50	2205.92	2.52	1.52	0.01	28	0.053	68.71	95.97	27.26	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	948.18 XS	50	2205.32	3.98	0.92	0.02	26.51	0.039	67.48	94.33	26.85	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	926.02	50	2204.97	3.22	1.11	0.01	26.1	0.04	58.06	85.34	27.28	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	900.04 XS	50	2204.44	4.11	1.03	0.02	23.75	0.037	62.6	87.03	24.43	55	35	3	1.0	20	50	7.1	1.43	0.70	0.84	0.93	3.9	Unstable
Willow Springs Wash Tribs	Trib6B	PF 1	879.37	50	2204.32	2.74	2.42	0.00	9.11	0.034	79.53	88.7	9.17	55	35	3	1.0	20	50	7.1	3.82	0.70	0.84	0.96	4.0	Stable
Willow Springs Wash Tribs	Trib6B	869.58	HONDA BOW	Culvert									0	0	0	3	1.0									
Willow Springs Wash Tribs	Trib6B	PF 1	845.79 XS	50	2203.17	3.05	1.47	0.01	17.33	0.051	51.25	68.72	17.47	55	35	3	1.0	20	50	7.1	2.00	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	822.64	50	2202.48	4.43	1.28	0.05	18.82	0.054	54.71	75.51	20.8	50	35	3	1.0	20	50	7.1	1.68	0.70	0.84	0.93	3.9	Unstable
Willow Springs Wash Tribs	Trib6B	PF 1	800.62 XS	50	2201.93	3.58	1.53	0.01	40.49	0.036	60.59	104.49	43.9	50	35	3	1.0	20	50	7.1	0.80	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	764.68	50	2201.73	1.76	1.75	0.01	31.14	0.058	50.41	81.77	31.36	50	35	3	1.0	20	50	7.1	1.12	0.70	0.84	0.93	3.9	Stable

WILLOW SPRINGS WASH TRIBUTARIES 6, 6A, 6B AND 6C
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study:	Cave Creek DMP
Prepared For:	Flood Control District of Maricopa County, October 2007
Prepared By:	JE Fuller Hydrology and Geomorphology
Imported HEC-2 File:	N/A
HEC-RAS Project:	GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan:	Method 4 Encroachment
HEC-RAS Geometry:	Method 4 Encroachment
HEC-RAS Steady Flow:	Method 4 Encroachment

Variables:

V_b (ft/s)	Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
C_a	Correction factor for channel alignment, SSA 5-96, Figure 2
C_b	Correction factor for bank slope, SSA 5-96, Figure 3
C_d	Correction factor for depth of flow, SSA 5-96, Figure 4
V_a (ft/s)	Calculated allowable velocity for earthen channels considering correction factors
Z	Bank slope (horizontal:vertical)
Lc (ft)	Length of curve
Rc (ft)	Radius of curve
b (ft)	Difference between Lft and Rt bank stations
D_{75}	The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
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4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Wash Tribs	Trib6B	PF 1	739.34 XS	50	2201.5	2.5	2.12	0.01	18.93	0.056	61.98	81.4	19.42	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	698.61 XS	50	2200.51	4.83	1.43	0.05	14.68	0.053	42.95	58.96	16.01	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	649.80 XS	50	2199.52	2.7	1.62	0.01	20.76	0.059	42.1	63.29	21.19	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	599.99 XS	50	2198.73	3.81	1.42	0.01	18.29	0.037	27.43	46.66	19.23	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	548.45 XS	50	2197.98	3.71	2.03	0.02	13.45	0.05	36.18	50.01	13.83	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.92	5.5	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	499.90 XS	50	2197.08	3.59	1.64	0.02	17.08	0.052	57.39	74.73	17.34	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	448.82 XS	50	2196.21	3.51	1.94	0.01	18.11	0.049	46.63	61.07	14.44	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	399.65 XS	50	2195.58	2.86	1.84	0.01	19.14	0.057	59.07	78.98	19.91	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	349.74 XS	50	2194.94	2.94	1.88	0.01	21.19	0.054	65.51	82.02	16.51	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	300.13 XS	50	2193.96	3.44	1.67	0.04	39.83	0.057	65.88	90	24.12	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	250.28 XS	50	2192.68	3.45	1.46	0.02	31.06	0.052	64.62	79.57	14.95	35	25	3	1.0	20	50	7.1	1.67	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	214.31 XS	50	2192.37	2.21	1.58	0.01	21.93	0.055	44.14	66.16	22.02	25	10	3	1.0	20	50	7.1	0.45	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	179.23 XS	50	2192.09	2.51	1.92	0.01	26.25	0.054	48.5	68.69	20.19	40	25	3	1.0	20	50	7.1	1.24	0.70	0.84	0.93	3.9	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	149.93 XS	50	2192.08	1.3	2.55	0.00	41.27	0.051	45.04	63.31	18.27	40	25	3	1.0	20	50	7.1	1.37	0.70	0.84	0.97	4.1	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	112.94 XS	50	2192.07	0.89	2.82	0.00	55.85	0.057	20.28	43.58	23.3	55	25	3	1.0	20	50	7.1	1.07	0.70	0.84	0.99	4.2	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	83.75	50	2192.06	0.63	3.65	0.00	56.93	0.051	0	28.39	28.39	55	25	3	1.0	20	50	7.1	0.88	0.70	0.84	1.05	4.4	Stable
Willow Springs Wash Tribs	Trib6B	PF 1	51.85 XS	50	2192.06	0.66	4.2	0.00	38.73	0.061	0	21.6	21.6	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	1.08	6.4	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1454.68 XS	77	2201.2	5.11	1.48	0.01	20.48	0.037	42.38	52.66	10.28	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1399.34 XS	77	2200.16	6.61	1.85	0.02	17.85	0.038	51.19	58.1	6.91	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	1349.43 XS	77	2199.11	6.43	1.78	0.01	16.55	0.033	42.04	50.21	8.17	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	1300.25 XS	77	2198.26	5.31	1.45	0.02	30.3	0.04	34.81	44.31	9.5	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1257.15 XS	77	2197.44	2.17	1.94	0.00	56.01	0.039	37.9	54.81	16.91	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1228.74	77	2197.24	3.3	1.93	0.01	28.35	0.039	53.33	72.05	18.72	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1208.3	77	2197.1	3.46	2.2	0.01	106.54	0.037	51.37	83.39	32.02	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.94	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1201.09 XS	77	2196.78	5.2	2.02	0.01	62.21	0.035	50.93	68.41	17.48	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.92	5.5	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1159.65	77	2195.71	5.08	1.5	0.02	39.43	0.04	67.74	84.15	16.41	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1113.82	77	2195.12	4.41	2.43	0.01	34.54	0.048	71.56	81.59	10.03	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.96	5.7	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1101.05 XS	77	2194.68	5.67	1.99	0.03	14.53	0.051	62.96	73.75	10.79	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	1082.25 XS	77	2194.2	5.53	2.05	0.02	15.74	0.052	62.94	71.79	8.85	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.5	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	1039.68	77	2193.21	5.14	2.08	0.02	40.18	0.053	52.93	63.14	10.21	210	120	3	1.0	20	50	7.1	11.75	0.97	0.84	0.93	5.4	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	1000.85 XS	77	2191.98	5.74	2.11	0.04	13.23	0.056	44.22	54.52	10.3	210	120	3	1.0	20	50	7.1	11.65	0.97	0.84	0.93	5.4	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	951.53 XS	77	2190.96	4.44	1.65	0.02	32.73	0.05	50.36	62.42	12.06	210	120	3	1.0	20	50	7.1	9.95	0.94	0.84	0.93	5.2	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	900.27 XS	77	2189.56	6.68	2.22	0.02	12.38	0.045	58.12	64.4	6.28	210	120	3	1.0	20	50	7.1	19.11	1.00	0.84	0.94	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	850.52 XS	77	2188.55	6.15	1.77	0.02	17.51	0.044	49.58	57.21	7.63	210	120	3	1.0	20	50	7.1	15.73	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	800.16 XS	77	2187.09	6.16	1.73	0.02	15.97	0.044	63.5	71.47	7.97	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	750.74 XS	77	2186.42	4.35	1.61	0.01	19.79	0.033	68.64	83.61	14.97	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	713.03 XS	77	2186.28	3.28	1.61	0.00	26.62	0.033	72.06	95.13	23.07	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	707.15 XS	77	2186.3	2.57	1.52	0.00	35.7	0.034	75.44	111.17	35.73	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C		693.52	Inl Struct									0	0	0	3	1.0									
Willow Springs Wash Tribs	Trib6C	PF 1	677.13 XS	77	2185.16	5.37	1.3	0.01	20.12	0.032	74.91	85.76	10.85	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	648.37 XS	77	2183.68	3.14	1.45	0.01	24.61	0.051	24.83	37.66	12.83	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	606.15 XS	77	2182.76	5.64	1.59	0.02	18.83	0.039	27.1	37.93	10.83	160	115	3	1.0	20	50	7.1	10.62	0.95	0.84	0.93	5.3	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	552.89 XS	77	2181.63	5.15	1.34	0.02	35.27	0.039	42.26	51.15	8.89	160	115	3	1.0	20	50	7.1	12.94	0.98	0.84	0.93	5.5	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	500.13 XS	77	2180.57	5.32	1.48	0.02	21.4	0.043	55.01	67.41	12.4	160	115	3	1.0	20	50	7.1	9.27	0.92	0.84	0.93	5.1	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	448.03 XS	77	2179.64	5.13	1.88	0.01	19.23	0.039	55.87	64.38	8.51	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	400.97 XS	77	2179.08	5.28	1.78	0.01	18.81	0.039	48.77	56.76	7.99	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	349.49 XS	77	2178.2	5.87	1.56	0.02	18.1	0.039	45.52	54.97	9.45	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	300.54 XS	77	2177.32	5.05	1.53	0.01	19.2	0.039	63.73	72.24	8.51	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	249.98 XS	77	2176.41	5.55	1.59	0.02	18.09	0.039	59.31	69.88	10.57	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	215.00 XS	77	2175.72	5.53	1.34	0.02	17.72	0.039	52.2	64.75	12.55	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	181.57 XS	77	2174.96	5.82	1.31	0.02	16.36	0.039	55.22	64.45	9.23	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	157.74 XS	77	2174.47	5.65	1.26	0.02	16.63	0.039	48.89	59.61	10.72	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.93	5.6	Unstable
Willow Springs Wash Tribs	Trib6C	PF 1	99.91 XS	77	2174.65	1.72	2.52	0.00	34.43	0.039	77.07	91.78	14.71	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	0.97	5.8	Stable
Willow Springs Wash Tribs	Trib6C	PF 1	57.06 XS	77	2174.64	1.21	3.07	0.00	30.1	0.039	89.51	105.95	16.44	0	0	3	1.0	20	50	7.1	N/A	1.00	0.84	1.01	6.0	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	1249.72 XS	1182	2173.7	6.67	3.94	0.01	77.81	0.04	113.29	162.45	49.16	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.06	5.4	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	1200.11 XS	1182	2173.51	6.33	5.01	0.00	83.9	0.039	106.77	144.65	37.88	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.12	5.6	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

WILLOW SPRINGS WASH TRIBUTARIES 6, 6A, 6B AND 6C
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																		Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Wash Tribs	Trib6.4	PF 1	1151.14 XS	1182	2172.37	9.59	3.87	0.01	54.62	0.032	111.32	143.72	32.4	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.06	5.4	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	1099.31 XS	1182	2171.8	9.58	3.59	0.01	55.99	0.032	104.54	139.5	34.96	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.04	5.3	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	1048.17 XS	1182	2171.18	8.45	4.52	0.01	64.48	0.032	98.78	132.88	34.1	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.09	5.5	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	994.62 XS	1182	2170.4	9.82	4.15	0.01	59.98	0.032	112.39	141.9	29.51	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.08	5.4	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	951.78 XS	1182	2169.79	9.51	3.77	0.01	62.16	0.032	111.46	145.47	34.01	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.05	5.3	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	901.24 XS	1182	2168.5	8.98	4.51	0.01	60.54	0.032	76.72	120.34	43.62	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.09	5.5	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	851.84 XS	1182	2167.93	9.5	6.35	0.01	54.53	0.032	64.57	95.1	30.53	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.17	5.9	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	800.56 XS	1182	2166.49	9.45	4.81	0.01	63.71	0.032	60.94	84.56	23.62	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.11	5.6	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	746.48 XS	1182	2165.06	8.88	4.82	0.01	65.82	0.032	66.27	105.73	39.46	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.11	5.6	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	715.78	1182	2163.99	7.27	6.38	0.01	57.82	0.047	70.25	107.65	37.4	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.17	5.9	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	700.84 XS	1182	2164.14	5.56	6.33	0.00	68.09	0.045	70.72	113.42	42.7	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.16	5.9	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	650.05 XS	1182	2163.72	6.16	6.14	0.02	65.34	0.078	44.94	83.18	38.24	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.16	5.9	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	600.77 XS	1182	2162.91	6.42	6.21	0.02	65.86	0.076	52.37	88.11	35.74	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.16	5.9	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	550.40 XS	1182	2162.64	4.48	6.54	0.01	91.45	0.078	64.66	104.67	40.01	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.17	5.9	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	504.71 XS	1182	2162.36	4.66	6.8	0.01	81.42	0.067	56.61	96.3	39.69	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.18	6.0	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	451.96 XS	1182	2162.18	3.94	7.52	0.00	79.89	0.078	53.55	95.84	42.29	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.20	6.1	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	428.32 XS	1182	2161.88	5.01	7.22	0.01	71.35	0.078	47.24	90.86	43.62	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.19	6.0	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	382.34 XS	1182	2161.17	6.14	6.87	0.01	58.14	0.076	38.88	77.51	38.63	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.18	6.0	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	348.80 XS	1182	2160.81	5.74	7.24	0.01	61.46	0.075	32.79	74.39	41.6	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.19	6.0	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	301.79 XS	1182	2160.11	6.25	6.92	0.01	59.75	0.074	19.79	61.63	41.84	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.18	6.0	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	254.00 XS	1182	2159.01	7.15	6.1	0.03	60.02	0.077	24.94	66.57	41.63	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.16	5.9	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	200.32 XS	1182	2158.75	4.1	6.29	0.01	94.38	0.076	44.18	99.15	54.97	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.16	5.9	Stable
Willow Springs Wash Tribs	Trib6.4	PF 1	149.37 XS	1182	2158	6.26	5.54	0.01	73.78	0.062	45.37	85.13	39.76	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.14	5.8	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	99.15 XS	1182	2156.9	8.25	4.81	0.02	58.78	0.064	53.11	83.58	30.47	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.11	5.6	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	54.32 XS	1182	2156.27	8	5.64	0.01	54.5	0.053	62.92	92.45	29.53	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.14	5.8	Unstable
Willow Springs Wash Tribs	Trib6.4	PF 1	28.80 XS	1182	2156.11	7.05	5.75	0.01	59.99	0.06	31.74	67.92	36.18	0	0	2	1.0	34	86	7.1	N/A	1.00	0.71	1.14	5.8	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	1642.19 XS	1017	2190.88	7.38	4.42	0.02	123.56	0.051	156.02	197.27	41.25	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.09	6.5	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	1598.41 XS	1017	2190.45	6.26	4.48	0.01	128.44	0.053	158.38	204.61	46.23	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.09	6.5	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1552.26 XS	1017	2189.65	7.04	4.41	0.02	100.57	0.049	156.38	208.2	51.82	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.09	6.5	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	1506.59 XS	1017	2189.05	6.62	4.24	0.01	99.76	0.051	128.5	181.34	52.84	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.08	6.4	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	1455.49 XS	1017	2188.67	5.4	4.25	0.01	134.42	0.052	67.66	127.16	59.5	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.08	6.5	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1400.05 XS	1017	2188.29	4	4.67	0.01	100.98	0.065	87.15	161.76	74.61	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.10	6.6	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1349.91 XS	1017	2187.84	4.54	5	0.01	113.78	0.057	102.42	176.72	74.3	140	75	3	1.0	32	80	7.1	1.01	0.70	0.84	1.11	4.7	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1301.62 XS	1017	2187.68	3.97	5.12	0.00	137.05	0.046	50.82	122.71	71.89	140	75	3	1.0	32	80	7.1	1.04	0.70	0.84	1.12	4.7	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1255.73	1017	2187.25	5.33	4.97	0.01	101.02	0.063	43.45	99.29	55.84	140	75	3	1.0	32	80	7.1	1.34	0.70	0.84	1.11	4.7	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	1191.11 XS	1017	2186.41	5.76	5.26	0.01	90.03	0.064	43.53	91.56	48.03	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.13	6.7	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1149.01 XS	1017	2185.92	5.23	5.05	0.01	128.68	0.065	72.14	129.95	57.81	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.12	6.7	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1099.74 XS	1017	2185.46	4.65	4.74	0.01	136.29	0.064	68.84	126.46	57.62	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.10	6.6	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	1023.98 XS	1017	2184.95	4.18	4.72	0.01	129.58	0.062	70.83	132.87	62.04	0	0	3	1.0	32	80	7.1	N/A	1.00	0.84	1.10	6.6	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	989.50 XS	1017	2184.68	4.2	4.93	0.01	129.94	0.052	66.12	205.77	139.65	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.11	7.2	Stable
Willow Springs Wash Tribs	Trib6.3		976.01	Inl Struct									0	0	0	3	1.3									
Willow Springs Wash Tribs	Trib6.3	PF 1	962.45 XS	1017	2184.41	5.82	4.67	0.01	127.04	0.059	77.7	124.09	46.39	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.10	7.1	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	947.58 XS	1017	2184.19	5.92	5	0.01	117.37	0.061	54.58	107.23	52.65	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.11	7.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	903.90 XS	1017	2183.53	6.08	4.9	0.02	144.74	0.06	49.81	98.87	49.06	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.11	7.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	865.92 XS	1017	2183.37	4.46	5.03	0.00	167.47	0.049	44.45	101.98	57.53	45	35	3	1.3	32	80	7.7	0.61	0.70	0.84	1.12	5.1	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	823.09	1017	2183.11	4.51	5.61	0.01	138.49	0.064	17.29	69	51.71	45	35	3	1.3	32	80	7.7	0.68	0.70	0.84	1.14	5.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	771.87 XS	1017	2182.4	6.51	5.18	0.01	96.5	0.051	29.9	67.98	38.08	80	55	3	1.3	32	80	7.7	1.44	0.70	0.84	1.12	5.1	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	729.75	1017	2182.25	4.68	5.88	0.01	82.19	0.062	46.89	100.13	53.24	80	55	3	1.3	32	80	7.7	1.03	0.70	0.84	1.15	5.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	700.59 XS	1017	2182.18	3.76	5.91	0.00	101.2	0.063	57.31	115.02	57.71	80	55	3	1.3	32	80	7.7	0.95	0.70	0.84	1.15	5.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	651.56 XS	1017	2181.42	6.35	5.61	0.02	85.25	0.065	62.33	110.27	47.94	80	55	3	1.3	32	80	7.7	1.15	0.70	0.84	1.14	5.2	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	599.32 XS	1017	2180.79	6.4	5.54	0.01	77.14	0.057	64.3	101.66	37.36	80	55	3	1.3	32	80	7.7	1.47	0.70	0.84	1.14	5.1	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	551.23 XS	1017	2180.1	6.79	4.85	0.02	62.59	0.06	47.73	86.43	38.7	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.11	7.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	499.93 XS	1017	2179.62	5.58	5.38	0.01	67.97	0.062	52.5	95.28	42.78	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.13	7.3	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	448.50 XS	1017	2179.11	5.92	5.19	0.01	72.69	0.053	46.87	87.34	40.47	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.12	7.3	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	398.51 XS	1017	2178.69	6.3	5.12	0.01	62.25	0.049	40.56	76.68	36.12	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.12	7.2	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	351.00 XS	1017	2177.89	8.18	4.61	0.01	57.07	0.043	65.4	96.04	30.64	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.10	7.1	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

WILLOW SPRINGS WASH TRIBUTARIES 6, 6A, 6B AND 6C
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Wash Tribs	Trib6.3	PF 1	300.22 XS	1017	2176.85	9.73	4.12	0.01	49.05	0.042	75.82	102.94	27.12	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.07	6.9	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	250.04 XS	1017	2176.45	8.41	3.45	0.01	55.71	0.039	77.02	109.88	32.86	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.04	6.7	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	199.81 XS	1017	2175.9	8.1	3.54	0.01	64.16	0.043	49.34	83.89	34.55	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.04	6.7	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	150.20 XS	1017	2175.49	7.03	3.34	0.01	70.1	0.043	102.38	141.35	38.97	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.03	6.7	Unstable
Willow Springs Wash Tribs	Trib6.3	PF 1	122.08 XS	1017	2175.31	6.47	3.44	0.01	73	0.041	82.3	125.77	43.47	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.04	6.7	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	95.43 XS	1017	2175.22	5.54	3.63	0.01	78.86	0.042	25.59	71.47	45.88	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	1.05	6.8	Stable
Willow Springs Wash Tribs	Trib6.3	PF 1	55.31 XS	1017	2174.12	8.53	2.74	0.02	59.58	0.042	0	40.1	40.1	0	0	3	1.3	32	80	7.7	N/A	1.00	0.84	0.99	6.4	Unstable
Willow Springs Wash Tribs	Trib6.2	PF 1	498.92 XS	606	2196.98	3.98	3.17	0.01	205.96	0.052	192.31	251.25	58.94	0	0	3	1.0	25	62	7.1	N/A	1.00	0.84	1.02	6.1	Stable
Willow Springs Wash Tribs	Trib6.2	PF 1	450.33 XS	606	2196.32	5.2	3.41	0.01	103.46	0.051	97.44	138.8	41.36	0	0	3	1.0	25	62	7.1	N/A	1.00	0.84	1.03	6.2	Stable
Willow Springs Wash Tribs	Trib6.2	PF 1	399.34 XS	606	2195.8	4.67	3.2	0.01	107.08	0.053	83	132.59	49.59	0	0	3	1.0	25	62	7.1	N/A	1.00	0.84	1.02	6.1	Stable
Willow Springs Wash Tribs	Trib6.2	PF 1	306.53 XS	606	2194.92	3.86	3.64	0.01	116.65	0.064	75.76	132.59	56.83	110	95	3	1.0	25	62	7.1	1.67	0.70	0.84	1.05	4.4	Stable
Willow Springs Wash Tribs	Trib6.2	PF 1	249.64 XS	606	2193.89	6	3.08	0.02	100.76	0.055	101.14	139.87	38.73	110	95	3	1.0	25	62	7.1	2.45	0.70	0.84	1.01	4.2	Unstable
Willow Springs Wash Tribs	Trib6.2	PF 1	206.00 XS	606	2193.03	6.51	2.87	0.02	96.59	0.049	105.87	139.29	33.42	75	50	3	1.0	25	62	7.1	1.50	0.70	0.84	1.00	4.2	Unstable
Willow Springs Wash Tribs	Trib6.2	PF 1	129.88 XS	606	2192.25	6.03	4.07	0.01	106.39	0.045	66.06	94.88	28.82	75	50	3	1.0	25	62	7.1	1.73	0.70	0.84	1.07	4.5	Unstable
Willow Springs Wash Tribs	Trib6.2	PF 1	82.26	606	2192.09	4.28	4.75	0.01	107.72	0.052	58.88	92	33.12	0	0	3	1.0	25	62	7.1	N/A	1.00	0.84	1.10	6.6	Stable
Willow Springs Wash Tribs	Trib6.2	PF 1	48.03 XS	606	2191.94	3.8	4.47	0.01	108.19	0.057	71.47	110.29	38.82	0	0	3	1.0	25	62	7.1	N/A	1.00	0.84	1.09	6.5	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	2150.19 XS	548	2239.08	6.18	4.84	0.03	35.88	0.07	28.74	65.11	36.37	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.11	5.6	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	2099.70 XS	548	2236.69	8.26	3.79	0.05	31.28	0.067	33.44	66.81	33.37	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.06	5.3	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	2049.58 XS	548	2233.65	6.31	3.19	0.05	53.02	0.069	33.78	88.23	54.45	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.02	5.2	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1999.91 XS	548	2231.78	5.71	3.39	0.03	52.13	0.071	40.02	96.06	56.04	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.03	5.2	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1950.55 XS	548	2230.69	4.01	3.96	0.02	81.82	0.073	37.23	123.41	86.18	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.07	5.4	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1849.32 XS	548	2229.42	3.77	5.79	0.01	51.61	0.072	45.77	99.48	53.71	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.15	5.8	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1795.80 XS	548	2228.11	6.64	6.01	0.03	32.44	0.069	44.72	80.23	35.51	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.15	5.8	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1749.23 XS	548	2225.83	8.39	4.82	0.05	27.28	0.069	39.76	71.18	31.42	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.11	5.6	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1702.62 XS	548	2224.75	5.71	4.92	0.02	36.86	0.071	23.9	63.84	39.94	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.11	5.6	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1649.18 XS	548	2223.65	5.41	4.42	0.02	50.67	0.071	42.85	84.58	41.73	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.09	5.5	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1600.01 XS	548	2222.62	6.27	3.46	0.01	44.47	0.052	46.24	82.59	36.35	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.04	5.3	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1549.82 XS	548	2221.84	6.55	3.49	0.01	45.31	0.051	55.63	87.97	32.34	0	0	2	1.0	23	59	7.1	N/A	1.00	0.71	1.04	5.3	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1497.15 XS	548	2221.46	4.81	3.41	0.01	56.16	0.057	45.16	86.78	41.62	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.03	6.2	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1450.19 XS	548	2220.36	6.76	2.31	0.03	51.5	0.057	42.1	86.9	44.8	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	0.95	5.7	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1400.87 XS	548	2219.89	4.38	2.72	0.01	80.69	0.056	26.89	72.73	45.84	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	0.99	5.9	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1350.42 XS	548	2218.6	7.42	2.28	0.02	59.12	0.043	28.25	66.52	38.27	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	0.95	5.7	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	1314.76	548	2217.88	5.16	1.93	0.02	90.33	0.054	52.74	87.03	34.29	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	0.93	5.6	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1311.47	548	2217.78	4.56	4.75	0.01	91.64	0.066	51.1	86.05	34.95	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.10	6.6	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1299.88 XS	548	2217.52	5.35	4.83	0.02	93.12	0.068	50.53	80.4	29.87	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.11	6.6	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1248.76 XS	548	2216.85	4.67	4.54	0.01	74.06	0.069	46.61	81.11	34.5	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.09	6.5	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1199.65 XS	548	2216.01	5.29	4.16	0.02	63.74	0.068	58.9	95.43	36.53	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.08	6.4	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1153.74 XS	548	2214.79	5.99	3.53	0.03	57.48	0.067	53.68	94.08	40.4	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.04	6.2	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1088.19 XS	548	2214.2	3.45	3.52	0.01	85.14	0.06	123.59	188.08	64.49	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.04	6.2	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	1034.46 XS	548	2213.88	3.19	3.7	0.01	81.67	0.063	94.6	162	67.4	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.05	6.3	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	960.37 XS	548	2213.18	4.02	3.85	0.01	57.14	0.072	76.43	134.59	58.16	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.06	6.3	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	912.45 XS	548	2212.27	5.13	3.21	0.02	61.57	0.061	66.14	132.65	66.51	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.02	6.1	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	892.66	548	2212.06	4.2	2.6	0.01	83.89	0.059	70.37	136.68	66.31	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	0.98	5.8	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	873.68	548	2211.57	5.42	2.47	0.02	82.22	0.056	77.65	143.18	65.53	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	0.97	5.8	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	852.96	548	2210.56	6.88	3.41	0.06	67.39	0.067	91.33	147.3	55.97	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.03	6.2	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	839.52 XS	548	2210.65	3.7	4.2	0.01	85.26	0.058	35.73	95.39	59.66	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.08	6.4	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	803.20 XS	548	2210.33	4.24	4.29	0.01	71.39	0.059	58.2	116.15	57.95	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.08	6.5	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	761.86 XS	548	2210.2	2.96	5.17	0.00	105.02	0.057	72.21	151.92	79.71	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.12	6.7	Stable
Willow Springs Wash Tribs	Trib6.1		748.12	Culvert									0	0	0	3	1.0									
Willow Springs Wash Tribs	Trib6.1	PF 1	721.14	548	2208.61	4.21	4.41	0.02	88.55	0.07	95.32	158.03	62.71	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.09	6.5	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	699.33 XS	548	2208.41	3.86	4.61	0.01	95.54	0.067	128.63	174.63	46	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.10	6.6	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	649.64 XS	548	2207.54	5.62	4.47	0.02	61.01	0.069	69.12	104.1	34.98	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.09	6.5	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	599.55 XS	548	2206.08	7.24	3.39	0.02	53.94	0.053	35.59	69.13	33.54	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.03	6.2	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	550.49 XS	548	2205.44	6.12	3.47	0.01	64.13	0.047	32.55	66.96	34.41	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.04	6.2	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	499.35 XS	548	2204.87	5.78	3.42	0.01	72.54	0.047	39.75	84.48	44.73	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.03	6.2	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	449.73 XS	548	2204.2	5.79	3.75	0.02	77.05	0.055	44.38	83.56	39.18	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.05	6.3	Stable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

WILLOW SPRINGS WASH TRIBUTARIES 6, 6A, 6B AND 6C
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Willow Springs Wash Tribs	Trib6.1	PF 1	400.48 XS	548	2203.34	5.61	3.61	0.02	86.31	0.056	61.19	105.99	44.8	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.05	6.2	Stable
Willow Springs Wash Tribs	Trib6.1	PF 1	349.58 XS	548	2202.25	6.49	3.08	0.02	113.1	0.043	79.04	124.52	45.48	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.01	6.0	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	299.63 XS	548	2201.81	4.51	3.55	0.01	161.97	0.051	102.71	148.75	46.04	130	70	3	1.0	23	59	7.1	1.52	0.70	0.84	1.04	4.4	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	247.92 XS	548	2201.14	5.52	3.18	0.01	146.81	0.045	78.64	110.11	31.47	130	70	3	1.0	23	59	7.1	2.22	0.70	0.84	1.02	4.3	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	192.58 XS	548	2200.12	7.66	3.58	0.02	93.4	0.044	96.93	122.31	25.38	130	70	3	1.0	23	59	7.1	2.76	0.70	0.84	1.04	4.4	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	149.94 XS	548	2199.66	6.34	3.68	0.01	99.61	0.05	147.91	177	29.09	0	0	3	1.0	23	59	7.1	N/A	1.00	0.84	1.05	6.3	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	99.74 XS	548	2198.79	5.86	3.66	0.02	143.06	0.061	145.28	182.3	37.02	45	35	3	1.0	23	59	7.1	0.95	0.70	0.84	1.05	4.4	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	74.47	548	2198.27	6.18	3.42	0.02	151.37	0.049	155.32	186.81	31.49	45	35	3	1.0	23	59	7.1	1.11	0.70	0.84	1.03	4.3	Unstable
Willow Springs Wash Tribs	Trib6.1	PF 1	51.24 XS	548	2197.84	6.01	3.27	0.02	180.82	0.045	156.29	193.53	37.24	45	35	3	1.0	23	59	7.1	0.94	0.70	0.84	1.02	4.3	Unstable

CAVE CREEK - LOWER (STA 30.20-35.54)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek Above Carefree Hgwy FDS
Prepared For: Flood Control District of Maricopa County, April 1997
Prepared By: George Sabol
Imported HEC-2 File: CAVEFW1.DAT
HEC-RAS Project: CAVEFW1.prj
HEC-RAS Plan: CAVEFW1.p02
HEC-RAS Geometry: CAVEFW1.g01
HEC-RAS Steady Flow: CAVEFW1.f02

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Watercourse drainage area is greater than 30 square miles; therefore, Level I calculations are not applicable.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek - Lower	Reach-1	PF 1	36400	28271	2202.41	11.15	13.64	0.009456	324.55	0.065	9876.4	10085.3	209	870	570	3	4.7	N/A	N/A	11.4	2.7	0.59	0.84	1.33	7.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	36310	28319	2194.73	19.91	15.36	0.011369	233.61	0.045	9965	10027.1	62	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.35	12.9	Unstable
Cave Creek - Lower	Reach-1	PF 1	36230	28319	2188.73	12.98	13.86	0.01232	329.77	0.06	9969	10130.4	161	870	570	3	4.7	N/A	N/A	11.4	3.5	0.65	0.84	1.33	8.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	36180	28319	2182.65	16.1	12.68	0.023217	247.15	0.06	9957.1	10144	187	870	570	3	4.7	N/A	N/A	11.4	3.0	0.62	0.84	1.31	7.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	36060	28319	2177.62	15.4	16.75	0.003988	548.49	0.035	9957.6	10048.3	91	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.37	13.1	Unstable
Cave Creek - Lower	Reach-1	PF 1	35960	28319	2174.57	15.5	14.8	0.004919	492.67	0.035	9929.7	10054.2	125	870	570	3	4.7	N/A	N/A	11.4	4.6	0.71	0.84	1.35	9.2	Unstable
Cave Creek - Lower	Reach-1	PF 1	35870	28319	2166.77	21.1	9.2	0.02987	415.71	0.045	9968	10120.8	153	870	570	3	1.4	N/A	N/A	7.9	3.7	0.66	0.84	1.24	5.5	Unstable
Cave Creek - Lower	Reach-1	PF 1	35770	28319	2163.39	14.54	10.12	0.011487	544.86	0.045	9931.1	10092.1	161	870	570	3	1.4	N/A	N/A	7.9	3.5	0.65	0.84	1.26	5.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	35690	28338	2158.92	12.87	12.75	0.006411	577.41	0.045	9937	10050	113	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.31	8.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	35590	28338	2154.83	14.89	15.26	0.007406	659.12	0.045	9932.1	10031.4	99	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.35	9.0	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.54	23200	2151.67	13.68	13.57	0.009964	529.86	0.06	9966.5	10015.7	49	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.33	8.8	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.47	23200	2145.72	15.07	10.22	0.018234	538.64	0.06	9961.2	10042.6	81	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.27	8.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.37	23200	2142.8	8.85	16.6	0.004005	596.78	0.06	9984.4	10095.1	111	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.37	9.1	Stable
Cave Creek - Lower	Reach-1	PF 1	35.28	23200	2139.72	11.77	16.02	0.006369	756.31	0.06	9930.4	10014.3	84	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.36	9.0	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.24	23200	2135	17.31	11.6	0.022246	369.51	0.06	9911.5	10017.5	106	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.29	8.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.18	23200	2131.67	11.08	12.07	0.009342	544.34	0.06	9883.6	10011.7	128	870	570	3	1.4	N/A	N/A	7.9	4.4	0.71	0.84	1.30	6.1	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.15	23200	2129.38	12.62	12.08	0.012358	531.66	0.06	9908.7	10009.1	100	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.30	8.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.09	23200	2126.55	11.32	12.15	0.009452	651.34	0.06	9884.3	10013.2	129	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.30	8.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	35.01	23200	2122	11.19	12.1	0.010152	569.29	0.06	9972	10098.3	126	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.30	8.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.92	23400	2117.72	10.04	9.82	0.008491	477.75	0.06	9921.9	10056.2	134	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.26	8.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.88	23400	2114.41	14.39	11.61	0.014648	393.7	0.06	9968.4	10046.3	78	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.29	8.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.83	23400	2112.66	10.72	12.46	0.006868	493.62	0.06	9959	10028.2	69	0	0	3	1.4	N/A	N/A	7.9	N/A	1.00	0.84	1.31	8.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.73	23400	2105.94	14.77	10.64	0.017383	411.37	0.06	9952.8	10047.6	95	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.28	7.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.63	23400	2100.34	9.1	11.04	0.009874	420.48	0.07	9977.7	10017.2	40	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.28	7.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.54	23400	2095.97	9.05	11.87	0.008827	500.94	0.07	10000	10032.2	32	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.30	7.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.45	23400	2089.46	10.77	9.26	0.01668	534.39	0.07	10000	10026.4	26	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.25	7.1	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.36	23400	2085.99	10.39	16.29	0.005095	525.07	0.055	9949.2	10016.7	68	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.37	7.8	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.27	23400	2080.05	16.67	14.15	0.018505	262.75	0.055	9904.2	9949.7	46	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.34	7.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.19	23400	2075.54	14.38	19.04	0.008066	415.11	0.055	9976	10015.9	40	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.40	8.0	Unstable
Cave Creek - Lower	Reach-1	PF 1	34.08	23400	2069	15.09	11	0.013439	479.02	0.055	9963.2	10043.9	81	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.28	7.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.98	23400	2064.68	11.4	13.78	0.00663	518.81	0.055	9975.9	10073.1	97	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.33	7.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.89	23400	2060.34	12.97	12.84	0.009042	281.48	0.055	9912.5	10015	103	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.32	7.5	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.77	24000	2057.33	10.87	18.03	0.004082	249.62	0.055	9974.8	10042.4	68	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.39	7.9	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.67	24000	2049.08	19.34	13.38	0.017543	155.4	0.055	9976.8	10058.6	82	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.32	7.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.56	24400	2042.67	17.08	17.77	0.009392	245.71	0.055	9962.7	10013.1	50	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.38	7.9	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.46	24700	2038.25	14.62	14.15	0.009748	484.94	0.055	9948.9	10033.9	85	0	0	3	0.9	N/A	N/A	6.8	N/A	1.00	0.84	1.34	7.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.36	24700	2034.97	12.23	14.47	0.006198	295.08	0.055	9946.7	10021.8	75	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.34	8.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.26	30900	2030.45	13.74	12.75	0.009329	325.14	0.055	9988	10044.9	57	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.31	8.2	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.17	30900	2025.31	15.6	14.01	0.009946	392.79	0.055	9983.4	10038.7	55	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.33	8.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	33.08	30900	2020.34	12.43	8.44	0.012739	495.79	0.055	9939.8	10071.1	131	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.23	7.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.99	30900	2016.29	10.69	10.79	0.007169	489.52	0.055	9937.1	10041.7	105	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.28	8.0	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.9	30900	2012	13.84	16.7	0.009276	414.9	0.055	9972.7	10044.5	72	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.37	8.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.8	31200	2008.14	12.79	15.94	0.005996	464.88	0.055	9951	10021.8	71	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.36	8.5	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.7	31200	2002.74	17.91	16.24	0.0076	448.25	0.045	9933.5	10000	67	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.36	8.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.62	31200	1997.82	16.01	12.32	0.008678	546.5	0.045	9956.3	10058.4	102	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.31	8.2	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.52	31200	1993.72	14.7	11.62	0.008051	670.18	0.045	9917.6	10045.1	128	0	0	3	1.2	N/A	N/A	7.5	N/A	1.00	0.84	1.29	8.1	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.49	31300	1991.78	17.05	11.28	0.010942	595.85	0.045	9929.9	10012.2	82	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.29	12.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.44	31300	1990.38	14.74	12.88	0.006709	650.27	0.045	9973.7	10018.9	45	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.32	12.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.33	31300	1985.96	14.01	13.46	0.006011	542.64	0.045	9947.9	10055.1	107	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.33	12.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.24	31300	1981.59	18.03	13.19	0.010361	543.81	0.045	9962.1	10025.7	64	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.32	12.6	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.15	31300	1974.03	37.87	10.33	0.060799	576.59	0.045	9967.5	10009.8	42	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.27	12.1	Unstable
Cave Creek - Lower	Reach-1	PF 1	32.07	31300	1974.48	17.16	14.68	0.00805	543.57	0.045	9968.3	10028.3	60	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.34	12.9	Unstable

CAVE CREEK - LOWER (STA 30.20-35.54)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek Above Carefree Hgwy FDS
Prepared For: Flood Control District of Maricopa County, April 1997
Prepared By: George Sabol
Imported HEC-2 File: CAVEFW1.DAT
HEC-RAS Project: CAVEFW1.prj
HEC-RAS Plan: CAVEFW1.p02
HEC-RAS Geometry: CAVEFW1.g01
HEC-RAS Steady Flow: CAVEFW1.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Watercourse drainage area is greater than 30 square miles; therefore, Level I calculations are not applicable.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek - Lower	Reach-1	PF 1	31.98	31300	1969.92	17.89	13.42	0.009355	463.34	0.045	9958.4	10013.9	56	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.32	12.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.91	31400	1967.14	15.87	13.83	0.007228	509.18	0.045	9968	10025.9	58	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.33	12.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.87	31400	1965.69	12.63	12.09	0.007947	514.67	0.055	9938.9	10007.4	69	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.30	12.5	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.82	31400	1962.71	13.79	10.01	0.012879	668.01	0.055	9861.7	10000	138	900	600	3	4.7	N/A	N/A	11.4	4.3	0.70	0.84	1.26	8.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.75	31400	1958.35	14	11.85	0.012717	841.04	0.055	9936	10016	80	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.30	12.4	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.63	31400	1952.5	11.83	12	0.007388	869.93	0.055	9972.7	10037	64	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.30	12.4	Stable
Cave Creek - Lower	Reach-1	PF 1	31.54	31400	1948.55	10.99	8.45	0.010171	934.98	0.055	9928.9	10073.6	145	900	600	3	4.7	N/A	N/A	11.4	4.1	0.69	0.84	1.23	8.1	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.45	31400	1944.92	9.64	11.82	0.006713	972.12	0.055	9927.1	10009.4	82	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.30	12.4	Stable
Cave Creek - Lower	Reach-1	PF 1	31.34	31400	1940.16	9.7	8.66	0.008375	778.57	0.055	9949.9	10027.2	77	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.23	11.8	Stable
Cave Creek - Lower	Reach-1	PF 1	31.25	31400	1935.23	12.06	9.83	0.012733	1055.26	0.05	9881.1	10031.4	150	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.26	12.0	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.17	31400	1931.55	11.24	10.75	0.00749	1012.14	0.05	9965.1	10054.8	90	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.28	12.2	Stable
Cave Creek - Lower	Reach-1	PF 1	31.14	31400	1929.76	14.74	11.96	0.010328	1042.69	0.05	9965.8	10026.5	61	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.30	10.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	31.05	31400	1925.57	11.66	8.67	0.009751	1023.71	0.05	9934.2	10000	66	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.23	9.8	Unstable
Cave Creek - Lower	Reach-1	PF 1	30.96	31400	1922.35	9.86	10.35	0.005585	937.71	0.05	9973.8	10048.6	75	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.27	10.1	Stable
Cave Creek - Lower	Reach-1	PF 1	30.85	33800	1917.43	12.62	12.13	0.009777	802.87	0.05	9912.4	10018.4	106	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.30	10.3	Unstable
Cave Creek - Lower	Reach-1	PF 1	30.75	33800	1914.26	9.86	13.26	0.004383	683.67	0.05	9963.4	10050.3	87	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.32	10.5	Stable
Cave Creek - Lower	Reach-1	PF 1	30.65	33800	1910.16	15.48	12.96	0.010061	794.19	0.05	9943.8	10019.6	76	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.32	10.5	Unstable
Cave Creek - Lower	Reach-1	PF 1	30.52	33800	1902.38	14.55	8.88	0.013821	1103.57	0.05	9983.4	10061.8	78	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.24	9.8	Unstable
Cave Creek - Lower	Reach-1	PF 1	30.42	33800	1897.4	9.59	11.6	0.006275	952.28	0.05	9970.3	10052.9	83	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.29	10.3	Stable
Cave Creek - Lower	Reach-1	PF 1	30.28	33800	1891.96	13.98	14.86	0.007502	875.25	0.05	9908.6	10014.5	106	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.35	10.7	Unstable
Cave Creek - Lower	Reach-1	PF 1	30.2	33800	1884.72	17.37	9.52	0.022969	1017.11	0.05	9927.7	10093.2	166	0	0	3	2.6	N/A	N/A	9.5	N/A	1.00	0.84	1.25	9.9	Unstable

CAVE CREEK - UPPER (STA 35.49-38.79)
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek FDS (FCD 1999C048)
Prepared For: Flood Control District of Maricopa County, June 2001
Prepared By: George Sabol
Imported HEC-2 File: CAVEFW1.DAT
HEC-RAS Project: CAVEFW1.prj
HEC-RAS Plan: CAVEFW1.p02
HEC-RAS Geometry: CAVEFW1.g01
HEC-RAS Steady Flow: CAVEFW1.f02

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Watercourse drainage area is greater than 30 square miles; therefore, Level I calculations are not applicable.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek - Upper	Reach-1	38790	PF 1	20679	2345.34	21.19	7.74	0.027009	230.43	0.04	9948.5	10093.4	144.9	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.21	7.7	Unstable
Cave Creek - Upper	Reach-1	38710	PF 1	20679	2341.86	15.94	15.56	0.008465	289.17	0.045	9971.2	10046.3	75.1	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.36	8.7	Unstable
Cave Creek - Upper	Reach-1	38610	PF 1	20679	2335.78	16.44	12.08	0.017932	265.19	0.06	9997.1	10056	58.9	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.30	8.3	Unstable
Cave Creek - Upper	Reach-1	38500	PF 1	20679	2329.3	16.51	14.4	0.008192	426.44	0.04	9949.5	10019.4	69.9	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.34	8.6	Unstable
Cave Creek - Upper	Reach-1	38430	PF 1	20679	2324.16	11.17	9.86	0.007732	584.18	0.04	9936.8	10050.1	113.3	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.26	8.1	Unstable
Cave Creek - Upper	Reach-1	38320	PF 1	20679	2317.69	15.48	11.58	0.010394	358.81	0.04	9963.2	10064.8	101.6	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.29	8.3	Unstable
Cave Creek - Upper	Reach-1	38250	PF 1	20679	2313.83	12.38	9.93	0.009	411.13	0.045	9929.9	10111.7	181.8	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.26	8.1	Unstable
Cave Creek - Upper	Reach-1	38140	PF 1	20679	2309.97	11.43	15.47	0.007452	459.24	0.06	9953.8	10027.7	73.9	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.35	8.7	Unstable
Cave Creek - Upper	Reach-1	38030	PF 1	20679	2303.18	14.65	10.38	0.009419	329.68	0.04	9954.5	10115.4	160.9	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.27	8.1	Unstable
Cave Creek - Upper	Reach-1	37930	PF 1	20679	2293.84	19.55	10.14	0.017755	304.37	0.04	9928.9	10053.2	124.3	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.26	8.1	Unstable
Cave Creek - Upper	Reach-1	37800	PF 1	23260	2290.58	14.12	7.88	0.008412	386.89	0.035	9917.1	10138.7	221.6	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.21	7.8	Unstable
Cave Creek - Upper	Reach-1	37750	PF 1	23260	2285.15	17.62	8.65	0.033355	410.01	0.045	9959.6	10186.4	226.8	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.23	7.9	Unstable
Cave Creek - Upper	Reach-1	37660	PF 1	23260	2278.95	13.39	8.95	0.01364	485.21	0.045	9923.4	10128.4	205	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.24	7.9	Unstable
Cave Creek - Upper	Reach-1	37570	PF 1	23260	2273.93	15.79	14.53	0.006647	704.08	0.035	9963.9	10065.5	101.6	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.34	8.6	Unstable
Cave Creek - Upper	Reach-1	37470	PF 1	23260	2270.81	14.14	13.11	0.004646	587.26	0.035	9969.8	10062	92.2	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.32	8.5	Unstable
Cave Creek - Upper	Reach-1	37370	PF 1	23260	2266.34	15.49	12.64	0.007002	349.73	0.035	9945.7	10095.8	150.1	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.31	8.4	Unstable
Cave Creek - Upper	Reach-1	37310	PF 1	23260	2263.23	12.02	13.63	0.011487	386.46	0.06	9885.7	10031.9	146.2	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.33	8.5	Unstable
Cave Creek - Upper	Reach-1	37270	PF 1	23260	2261.71	10.1	15.01	0.008218	397.76	0.065	9937	10027.7	90.7	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.35	8.6	Unstable
Cave Creek - Upper	Reach-1	37200	PF 1	23260	2257.53	12.84	14.43	0.0126	266.32	0.065	9978.7	10095.8	117.1	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.34	8.6	Unstable
Cave Creek - Upper	Reach-1	37120	PF 1	23260	2250.17	16.08	16.47	0.023748	228.2	0.065	9969	10060.6	91.6	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.37	8.8	Unstable
Cave Creek - Upper	Reach-1	37080	PF 1	23260	2248.65	10.79	12.85	0.008763	267.16	0.065	9947.8	10081.6	133.8	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.32	8.4	Unstable
Cave Creek - Upper	Reach-1	37010	PF 1	23260	2245.94	10.25	16.94	0.006968	426.46	0.065	9935.4	10061.1	125.7	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.37	8.8	Unstable
Cave Creek - Upper	Reach-1	36960	PF 1	23260	2244.49	9.31	18.49	0.004111	286.48	0.065	9943.8	10059.8	116	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.39	8.9	Unstable
Cave Creek - Upper	Reach-1	36880	PF 1	23260	2236.74	19.52	15.24	0.023599	135.86	0.065	9954.8	10023.3	68.5	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.35	8.7	Unstable
Cave Creek - Upper	Reach-1	36780	PF 1	23260	2226.66	12.83	16.76	0.010396	183.49	0.065	9976.3	10093.2	116.9	0	0	3	1.3	N/A	N/A	7.6	N/A	1.00	0.84	1.37	8.8	Unstable
Cave Creek - Upper	Reach-1	36690	PF 1	23235	2220.88	14.56	16.98	0.01197	196.49	0.065	9957	10037.3	80.3	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.37	13.1	Unstable
Cave Creek - Upper	Reach-1	36610	PF 1	23235	2217.99	12.1	17.39	0.007239	196.61	0.065	9955.2	10031.1	75.9	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.38	13.2	Stable
Cave Creek - Upper	Reach-1	36520	PF 1	23235	2209.85	17.72	15.35	0.024387	187.36	0.065	9928	10011.7	83.7	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.35	12.9	Unstable
Cave Creek - Upper	Reach-1	36490	PF 1	23235	2205.34	15.47	11.44	0.025016	225.83	0.065	9971.6	10114.1	142.5	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.29	12.3	Unstable
Cave Creek - Upper	Reach-1	36400	PF 1	23235	2200.73	10.45	12.43	0.009655	301.64	0.065	9876.4	10085.3	208.9	0	0	3	4.7	N/A	N/A	11.4	N/A	1.00	0.84	1.31	12.5	Stable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib 1.1	PF 1	1560.12 XS	451	2304.95	8.11	3.68	0.026589	46.01	0.049	40.34	59.68	19.34	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.05	5.4	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1519.91 XS	451	2303.6	8.19	3.63	0.028709	41.13	0.052	40.72	60.58	19.86	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.05	5.4	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1469.82 XS	451	2302.19	5.95	3.76	0.016426	50.61	0.054	47.23	75.52	28.29	50	45	1	3.3	21	53	10.2	1.59	0.70	0.50	1.05	3.8	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1442.17 XS	451	2301.26	7.73	3.43	0.031711	44.83	0.053	53.47	77.82	24.35	50	45	1	3.3	21	53	10.2	1.85	0.70	0.50	1.03	3.7	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1418.59 XS	451	2300.74	6.02	3.23	0.013161	44.79	0.049	49.01	78.08	29.07	50	45	1	3.3	21	53	10.2	1.55	0.70	0.50	1.02	3.7	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1369.00 XS	451	2299.47	7.8	2.79	0.027436	47.07	0.05	33.17	55.5	22.33	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.99	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1320.16 XS	451	2298.23	7.67	3.25	0.021327	50.9	0.049	31.06	52.43	21.37	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.02	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1268.10 XS	451	2296.97	6.56	3.22	0.022668	46.97	0.053	40.83	78.56	37.73	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.02	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1218.92 XS	451	2295.44	8	4.08	0.024383	39.29	0.052	56.32	77.71	21.39	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.07	5.5	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1170.11 XS	451	2293.76	6.62	3.02	0.01773	57.19	0.049	73.86	102.75	28.89	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.01	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1120.03 XS	451	2292.57	7.69	3	0.021708	50.39	0.049	69.98	91.09	21.11	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.01	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1068.23 XS	451	2291.07	6.99	2.23	0.029908	49.58	0.049	62.05	101.28	39.23	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.94	4.8	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	1020.10 XS	451	2289.9	5.78	2.29	0.016054	61.62	0.049	47.86	83.59	35.73	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.95	4.9	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	967.24 XS	451	2288.82	6.95	2.79	0.025	62.6	0.049	38.5	68.92	30.42	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.99	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	919.85 XS	451	2287.74	4.58	2.95	0.008536	92.29	0.052	58.05	92.36	34.31	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.00	5.1	Stable
Cave Creek Tribs	Trib 1.1	PF 1	869.49 XS	451	2286.56	7.36	3.14	0.021175	61.23	0.051	67.5	89.18	21.68	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.02	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	820.01 XS	451	2285.22	7.17	3.1	0.025997	39.97	0.05	48.47	89.13	40.66	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.01	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	770.28 XS	451	2283.29	6.63	2.44	0.023814	56.39	0.051	48	83.13	35.13	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.96	4.9	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	719.91 XS	451	2282.44	5.94	3.03	0.013986	58.02	0.051	47.64	78.15	30.51	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.01	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	670.23 XS	451	2281.34	7.28	2.84	0.026522	64.82	0.049	47.36	72.5	25.14	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.99	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	635.60 XS	451	2280.22	6.73	2.38	0.027262	104.82	0.052	53.21	74.63	21.42	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.96	4.9	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	596.99 XS	451	2279.4	6.57	2.75	0.021992	96.27	0.05	57.49	87.11	29.62	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.99	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	560.25 XS	451	2278.67	6.91	2.5	0.020963	80.9	0.049	65.79	89.74	23.95	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.97	5.0	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	519.61 XS	451	2277.72	6.45	2.11	0.025512	79.66	0.054	61.3	92.59	31.29	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.93	4.8	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	468.21 XS	451	2276.63	6.33	2.95	0.01866	114.65	0.053	86.84	113.33	26.49	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.00	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	419.46 XS	451	2275.41	7.08	2.98	0.019548	85.46	0.049	74.35	96.35	22	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.00	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	367.43 XS	451	2274.02	6.98	2.9	0.011656	81.84	0.037	88.23	116.31	28.08	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.00	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	319.29 XS	451	2273.03	6.84	3.19	0.008538	112.07	0.034	75.58	95.98	20.4	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.02	5.2	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	269.26 XS	451	2271.59	5.61	2.62	0.008041	98.86	0.036	83.93	112.26	28.33	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.98	5.0	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	220.21 XS	451	2270.68	6.71	2.97	0.025094	69.5	0.048	85.17	121.47	36.3	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.00	5.1	Unstable
Cave Creek Tribs	Trib 1.1	PF 1	170.85 XS	451	2269.75	4.39	2.78	0.019928	95.06	0.055	97.48	145.28	47.8	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.99	5.1	Stable
Cave Creek Tribs	Trib 1.1	PF 1	119.55 XS	451	2268.99	4.1	2.41	0.018115	86.78	0.054	83.52	131.59	48.07	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.96	4.9	Stable
Cave Creek Tribs	Trib 1.1	PF 1	69.51 XS	451	2268.45	3.73	2.65	0.010142	81.94	0.049	77.76	130.65	52.89	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	0.98	5.0	Stable
Cave Creek Tribs	Trib 1.1	PF 1	19.38 XS	451	2268.29	3.13	3.62	0.002727	77.18	0.046	77.19	127.71	50.52	0	0	1	3.3	21	53	10.2	N/A	1.00	0.50	1.05	5.4	Stable
Cave Creek Tribs	Trib1A	PF 1	1100.44 XS	918	2302.91	5.16	3.88	0.01565	77.91	0.064	27.46	108.52	81.06	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.06	5.4	Stable
Cave Creek Tribs	Trib1A	PF 1	1049.90 XS	918	2300.99	7.49	5.42	0.056611	82.1	0.075	58.62	121.63	63.01	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.13	5.8	Unstable
Cave Creek Tribs	Trib1A	PF 1	1000.81 XS	918	2297.7	7.06	4.32	0.059396	96.19	0.076	48.94	119.5	70.56	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.08	5.5	Unstable
Cave Creek Tribs	Trib1A	PF 1	950.92 XS	918	2295.97	5.61	3.93	0.02041	95.76	0.068	66.56	142.94	76.38	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.06	5.4	Unstable
Cave Creek Tribs	Trib1A	PF 1	900.01 XS	918	2293.55	8.55	3.96	0.049006	47.79	0.065	41.49	92.16	50.67	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.07	5.5	Unstable
Cave Creek Tribs	Trib1A	PF 1	850.35 XS	918	2291.48	7.36	4.1	0.029571	108.67	0.06	71.14	117.18	46.04	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.07	5.5	Unstable
Cave Creek Tribs	Trib1A	PF 1	800.20 XS	918	2289.76	6	4.02	0.015629	110.72	0.058	76.27	131.63	55.36	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.07	5.5	Unstable
Cave Creek Tribs	Trib1A	PF 1	749.66 XS	918	2289.25	5.36	5.22	0.00912	100.45	0.059	73.74	118.28	44.54	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.12	5.8	Stable
Cave Creek Tribs	Trib1A	PF 1	700.49 XS	918	2287.9	8.14	5.1	0.027413	80.72	0.065	68.47	98.93	30.46	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.12	5.7	Unstable
Cave Creek Tribs	Trib1A	PF 1	649.73 XS	918	2286.15	8.04	3.72	0.025539	73.95	0.059	51.49	79.95	28.46	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.05	5.4	Unstable
Cave Creek Tribs	Trib1A	PF 1	600.05 XS	918	2284.9	6.93	3.34	0.026089	71.77	0.061	54.13	110.56	56.43	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.03	5.3	Unstable
Cave Creek Tribs	Trib1A	PF 1	551.16 XS	918	2284.29	4.7	4.05	0.011484	76.72	0.069	44.71	110.08	65.37	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.07	5.5	Stable
Cave Creek Tribs	Trib1A	PF 1	498.23 XS	918	2283.6	4.9	4.68	0.014131	75.82	0.071	23.64	90.3	66.66	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.10	5.6	Stable
Cave Creek Tribs	Trib1A	PF 1	450.61 XS	918	2281.94	8.45	3.48	0.024245	62.9	0.058	41.93	70.65	28.72	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.04	5.3	Unstable
Cave Creek Tribs	Trib1A	PF 1	400.22 XS	918	2280.64	8.24	3.95	0.036077	74.21	0.058	47.03	82.03	35	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.06	5.4	Unstable
Cave Creek Tribs	Trib1A	PF 1	351.72 XS	918	2278.91	8.54	3.5	0.033312	66.94	0.058	42.77	78.31	35.54	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.04	5.3	Unstable
Cave Creek Tribs	Trib1A	PF 1	301.02 XS	918	2277.5	6.75	4.28	0.019012	87.96	0.065	44.73	85.69	40.96	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.08	5.5	Unstable
Cave Creek Tribs	Trib1A	PF 1	249.82 XS	918	2276.1	8.58	3.86	0.020011	70.8	0.054	27.23	54.76	27.53	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.06	5.4	Unstable
Cave Creek Tribs	Trib1A	PF 1	200.96 XS	918	2274.99	8.53	3.59	0.02632	87.61	0.055	43.46	72.59	29.13	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.04	5.3	Unstable
Cave Creek Tribs	Trib1A	PF 1	128.96 XS	918	2272.140	7.72	2.4	0.049746	92.2	0.063	45.03	107.54	62.51	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	0.96	4.9	Unstable
Cave Creek Tribs	Trib1A	PF 1	81.70 XS	918	2270.480	6.11	3.21	0.025482	91.58	0.064	50.58	126.77	76.19	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	1.02	5.2	Unstable
Cave Creek Tribs	Trib1A	PF 1	49.14 XS	918	2269.140	7.18	2.79	0.047607	97.92	0.07	2.99	71.79	68.8	0	0	1	3.3	30	76	10.2	N/A	1.00	0.50	0.99	5.1	Unstable

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib1.2	PF 1	3276.91 XS	1584	2267.19	7.41	4.61	0.030772	102.99	0.069	57.29	135.9	78.61	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.10	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	3225.50 XS	1584	2266.56	5.54	6.76	0.008588	87	0.069	63.23	131.69	68.46	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	3176.64 XS	1584	2265.79	6.94	6.27	0.015124	84.22	0.066	86.93	137.75	50.82	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	3126.26 XS	1584	2264.57	7.96	5.61	0.022899	82.61	0.066	90.67	144.43	53.76	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	3076.09 XS	1584	2263.4	7.89	5.21	0.023972	76.97	0.069	88.41	132.7	44.29	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	3026.25 XS	1584	2262.85	6.6	6	0.008225	85.3	0.051	70.08	128.32	58.24	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2976.89 XS	1584	2262.65	5.55	5.82	0.00578	143.04	0.051	61.72	120.06	58.34	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2926.50 XS	1584	2262.28	6.07	6.45	0.004903	96.48	0.044	53.06	110.37	57.31	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2874.41 XS	1584	2261.11	8.77	5.16	0.017961	97.91	0.048	54.47	110.9	56.43	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2825.71 XS	1584	2260.24	8.85	5.43	0.014069	95.76	0.042	60.41	113.97	53.56	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2776.16 XS	1584	2259.32	7.41	4.58	0.005479	100.18	0.035	58.48	125.36	66.88	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.10	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2726.60 XS	1584	2259.05	7.06	4.76	0.00608	85.12	0.037	59.44	133.72	74.28	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.10	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2677.04 XS	1584	2257.76	9.28	4.54	0.026895	65.51	0.049	64.72	130.58	65.86	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.09	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2626.98 XS	1584	2257.06	6.89	4.75	0.006197	89.61	0.038	84.43	161.25	76.82	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.10	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2577.17 XS	1584	2256.06	8.84	4.53	0.009627	94.35	0.035	117.38	185.46	68.08	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.09	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2527.13 XS	1584	2255.12	9.14	5.35	0.033648	55.29	0.063	141.71	211.25	69.54	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2484.05 XS	1584	2254.39	6.47	5.93	0.018574	81.65	0.069	178.34	252.43	74.09	150	45	1	1.1	40	99	7.3	0.61	0.70	0.50	1.15	3.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2448.51 XS	1584	2253.87	6.24	6.69	0.013606	123.43	0.067	200.35	262.06	61.71	150	45	1	1.1	40	99	7.3	0.73	0.70	0.50	1.18	3.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2392.89 XS	1584	2253.61	3.93	7.56	0.005295	142.27	0.071	188.86	279.23	90.37	150	45	1	1.1	40	99	7.3	0.50	0.70	0.50	1.20	3.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2307.26 XS	1584	2252.91	5.01	7.13	0.006875	87.01	0.068	175.52	251.49	75.97	150	45	1	1.1	40	99	7.3	0.59	0.70	0.50	1.19	3.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2275.58 XS	1584	2252.25	6.5	6.68	0.014407	60.87	0.068	160.11	233.78	73.67	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2226.36 XS	1584	2251.32	7.08	6.38	0.017058	58.46	0.066	122.44	200.06	77.62	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2176.55 XS	1584	2250.05	7.95	5.53	0.024213	60.32	0.063	94.75	172.29	77.54	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2126.56 XS	1584	2249.04	8.36	5.14	0.014918	64.58	0.058	71.03	112.37	41.34	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2076.05 XS	1584	2248.51	7.79	5.41	0.010413	73.27	0.054	83.35	121.57	38.22	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	2026.23 XS	1584	2247.98	7.49	6.27	0.011519	73.25	0.057	80.65	123.79	43.14	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1975.87 XS	1584	2247.48	7.07	6.01	0.010916	85.42	0.057	79.02	126.58	47.56	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1926.02 XS	1584	2247.08	6.67	5.89	0.00894	110.77	0.057	62.06	102.73	40.67	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1875.82 XS	1584	2246.13	8.1	5.87	0.014792	89.27	0.061	68.52	104.19	35.67	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1826.28 XS	1584	2245.95	5.4	5.77	0.005835	119.13	0.06	68.84	119.85	51.01	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1775.85 XS	1584	2245.23	7.28	5.43	0.00887	87.05	0.055	75.96	110.13	34.17	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1727.16 XS	1584	2244.75	7.9	6.14	0.009371	84.5	0.054	83.2	109.19	25.99	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1676.33 XS	1584	2244.4	7.1	6.03	0.007099	90.24	0.054	84.31	113.12	28.81	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1626.37 XS	1584	2243.92	7.68	5.69	0.00572	90.67	0.039	88.74	122.42	33.68	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1576.20 XS	1584	2243.68	7.52	5.4	0.005729	89.26	0.039	103.17	140.23	37.06	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1526.67 XS	1584	2242.37	9.97	4.03	0.013065	83.1	0.039	106.1	146.66	40.56	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.07	3.9	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1476.67 XS	1584	2241.88	6.54	4.86	0.008235	88.81	0.049	138.32	160.71	22.39	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.11	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1426.68 XS	1584	2241.35	6.38	4.73	0.009311	93.63	0.049	146.25	177.79	31.54	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.10	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1376.88 XS	1584	2240.55	6.91	4.25	0.012481	98.34	0.05	142.7	175.21	32.51	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.08	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1326.19 XS	1584	2240.41	5.62	5.59	0.003499	112.3	0.043	146.66	177	30.34	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1276.26 XS	1584	2238.81	10.51	4.57	0.015176	82.75	0.042	132.9	164.97	32.07	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.10	4.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1227.05 XS	1584	2238.53	8.2	5.43	0.009625	104.66	0.048	115.69	150.6	34.91	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1176.55 XS	1584	2237.37	9.67	5.25	0.015932	90.62	0.049	102.06	136.69	34.63	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1126.52 XS	1584	2236.94	7.89	5.71	0.010568	108.35	0.051	95.23	134.28	39.05	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1076.84 XS	1584	2236.55	6.76	5.55	0.011397	140.45	0.052	142.6	202.99	60.39	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	1025.89 XS	1584	2236.16	6.07	6.17	0.007841	138.81	0.055	138.94	196.12	57.18	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	977.03 XS	1584	2235.7	6.2	5.97	0.009522	142.6	0.059	133.32	193.51	60.19	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	926.59 XS	1584	2235.24	6.11	5.68	0.009335	131.05	0.059	125.76	194.97	69.21	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	876.05 XS	1584	2234.81	6.05	5.79	0.007802	177.88	0.055	150.21	216.33	66.12	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	827.18 XS	1584	2233.34	9.05	5.63	0.021395	94.76	0.055	83.76	141.16	57.4	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	777.10 XS	1584	2233.31	5.98	6.08	0.003818	132.36	0.043	92.74	140.82	48.08	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	726.51 XS	1584	2232.6	8.06	6.22	0.008793	87.96	0.046	114.04	153.44	39.4	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	676.99 XS	1584	2232.17	7.87	6.45	0.009933	102.52	0.05	112.89	149.03	36.14	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.2	PF 1	626.69 XS	1584	2231.22	8.76	5.11	0.018912	77.95	0.053	114.43	158.52	44.09	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	579.37 XS	1584	2230.9	6.77	5	0.006437	159.55	0.046	157.26	193.15	35.89	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.11	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	527.08 XS	1584	2230.55	6.16	5.49	0.008555	157.43	0.054	134.7	187.5	52.8	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.13	4.2	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																		Level I Erosion Setback		Level II Bank Stability Estimate – Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib1.2	PF 1	476.86 XS	1584	2230.07	6.48	5.22	0.009537	151.42	0.055	100.27	145.84	45.57	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	426.19 XS	1584	2229.02	8.47	5.7	0.011358	118.3	0.049	105.96	139.13	33.17	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	377.26 XS	1584	2228.7	7.41	6.12	0.00895	130.74	0.049	108.17	142.76	34.59	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.16	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	327.03 XS	1584	2228.24	7.14	6.1	0.008442	138.36	0.053	105.61	143.25	37.64	130	85	1	1.1	40	99	7.3	2.26	0.70	0.50	1.16	3.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	276.70 XS	1584	2227.92	6.59	5.92	0.005953	165.8	0.047	96.08	138.35	42.27	130	85	1	1.1	40	99	7.3	2.01	0.70	0.50	1.15	3.0	Unstable
Cave Creek Tribs	Trib1.2	PF 1	226.29 XS	1584	2227.5	6.42	5.64	0.00976	146.62	0.057	84.82	138.82	54	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	175.97 XS	1584	2226.44	8.46	5.1	0.012716	161.73	0.047	85.74	128.45	42.71	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.2	PF 1	126.15 XS	1584	2225.77	7.2	5.55	0.005303	182.91	0.041	101.27	140.63	39.36	0	0	1	1.1	40	99	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.2	PF 1	55.460	1584	2225.57	6.33	6.05	0.003653	160.28	0.041	165.37	200.45	35.08	180	100	1	1.1	40	99	7.3	2.85	0.70	0.50	1.16	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	2350.46 XS	243	2262.740	6.53	2.23	0.023956	40.52	0.049	42.11	61.39	19.28	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	2299.81 XS	243	2261.510	4.75	1.96	0.014707	69.05	0.049	57.24	87.52	30.28	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	2247.07 XS	243	2260.480	5.84	1.96	0.021671	62.64	0.049	50.64	71.13	20.49	185	100	1	2.4	20	39	9.3	4.88	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	2199.70 XS	243	2259.330	5.25	1.93	0.020767	105.35	0.049	66.72	88.15	21.43	185	100	1	2.4	20	39	9.3	4.67	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	2149.47 XS	243	2257.910	5.82	1.27	0.029018	62.46	0.049	49.42	74.14	24.72	185	100	1	2.4	20	39	9.3	4.05	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	2100.35 XS	243	2257.370	3.62	2.11	0.00668	60.02	0.049	54.44	82.06	27.62	185	100	1	2.4	20	39	9.3	3.62	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	2050.03 XS	243	2256.760	4.23	1.8	0.016411	67.7	0.055	50.69	87.97	37.28	185	100	1	2.4	20	39	9.3	2.68	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	1999.48 XS	243	2255.720	4.81	1.97	0.021285	80.06	0.052	68.4	107.25	38.85	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	1949.68 XS	243	2254.170	5.96	1.56	0.032614	40.77	0.049	73.6	114.36	40.76	140	75	1	2.4	20	39	9.3	1.84	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	1899.50 XS	243	2253.450	3.9	2.22	0.007239	63.55	0.049	32.38	49.94	17.56	140	75	1	2.4	20	39	9.3	4.27	0.70	0.50	0.94	3.1	Unstable
Cave Creek Tribs	Trib1B	PF 1	1849.57 XS	243	2253.130	3.81	2.83	0.006314	57.06	0.049	43.04	68.99	25.95	140	75	1	2.4	20	39	9.3	2.89	0.70	0.50	0.99	3.2	Unstable
Cave Creek Tribs	Trib1B	PF 1	1798.07 XS	243	2252.840	3.58	2.9	0.00572	53.94	0.052	53.96	82.86	28.9	140	75	1	2.4	20	39	9.3	2.60	0.70	0.50	1.00	3.2	Unstable
Cave Creek Tribs	Trib1B	PF 1	1750.07 XS	243	2251.780	6.31	2.2	0.029323	39.23	0.05	61.01	87.72	26.71	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	1698.95 XS	243	2250.590	4.59	1.45	0.023174	78.01	0.056	47.67	81.86	34.19	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	1650.15 XS	243	2249.910	4.01	2	0.00988	50.69	0.054	41.11	73.23	32.12	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.92	4.3	Stable
Cave Creek Tribs	Trib1B	PF 1	1600.12 XS	243	2248.710	6.47	1.87	0.030081	44.06	0.051	36.91	57.72	20.81	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	1550.11 XS	243	2247.650	4.57	2.18	0.01291	54.6	0.055	36.64	59.68	23.04	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	1499.90 XS	243	2247.160	4.35	2.98	0.007324	45.93	0.05	61.55	84.4	22.85	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	1.00	4.7	Stable
Cave Creek Tribs	Trib1B	PF 1	1449.78 XS	243	2246.300	6.02	2.38	0.029077	51.93	0.053	66.53	88.65	22.12	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.96	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	1400.14 XS	243	2245.470	5	2.05	0.01547	67.2	0.049	77.39	97.05	19.66	145	80	1	2.4	20	39	9.3	4.07	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	1349.34 XS	243	2244.310	5.98	2.35	0.021278	59.48	0.049	37.16	58.35	21.19	145	80	1	2.4	20	39	9.3	3.78	0.70	0.50	0.95	3.1	Unstable
Cave Creek Tribs	Trib1B	PF 1	1299.45 XS	243	2243.590	5.28	2.16	0.016189	59.2	0.05	50.12	69.14	19.02	145	80	1	2.4	20	39	9.3	4.21	0.70	0.50	0.94	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	1250.90 XS	243	2242.860	4.63	2.42	0.016263	72.6	0.054	43.32	72.61	29.29	145	80	1	2.4	20	39	9.3	2.73	0.70	0.50	0.96	3.1	Unstable
Cave Creek Tribs	Trib1B	PF 1	1200.58 XS	243	2241.520	6.21	2.43	0.024818	47.81	0.051	63.56	87.17	23.61	145	90	1	2.4	20	39	9.3	3.81	0.70	0.50	0.96	3.1	Unstable
Cave Creek Tribs	Trib1B	PF 1	1150.26 XS	243	2241.160	3.66	2.89	0.006047	79.33	0.051	70.82	95.05	24.23	145	90	1	2.4	20	39	9.3	3.71	0.70	0.50	1.00	3.2	Unstable
Cave Creek Tribs	Trib1B	PF 1	1099.46 XS	243	2240.860	3.45	2.82	0.007346	63.55	0.053	64.03	95.67	31.64	145	90	1	2.4	20	39	9.3	2.84	0.70	0.50	0.99	3.2	Unstable
Cave Creek Tribs	Trib1B	PF 1	1050.89 XS	243	2239.910	5.3	2.71	0.025293	66.72	0.055	42.62	75.76	33.14	145	90	1	2.4	20	39	9.3	2.72	0.70	0.50	0.98	3.2	Unstable
Cave Creek Tribs	Trib1B	PF 1	999.76 XS	243	2238.820	5.65	2.66	0.017025	62.07	0.049	44.66	68.21	23.55	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.98	4.6	Unstable
Cave Creek Tribs	Trib1B	PF 1	950.75 XS	243	2237.920	5.6	2.03	0.021477	85.22	0.05	50.81	72.7	21.89	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.92	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	899.79 XS	243	2237.550	3.3	2.5	0.004864	94.41	0.049	43.62	60.83	17.21	70	50	1	2.4	20	39	9.3	2.91	0.70	0.50	0.97	3.1	Unstable
Cave Creek Tribs	Trib1B	PF 1	850.83 XS	243	2237.060	5.27	1.28	0.034639	78.1	0.049	42.35	60.15	17.8	70	50	1	2.4	20	39	9.3	2.81	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1B	PF 1	799.92 XS	243	2235.990	5.07	1.71	0.021829	94.47	0.052	52.08	79.96	27.88	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	750.06 XS	243	2235.200	4.74	2.53	0.014541	88.23	0.049	79.55	107.6	28.05	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.97	4.5	Unstable
Cave Creek Tribs	Trib1B	PF 1	702.29 XS	243	2234.350	5.7	2.77	0.020554	71.52	0.051	113.82	133.81	19.99	100	45	1	2.4	20	39	9.3	2.25	0.70	0.50	0.99	3.2	Unstable
Cave Creek Tribs	Trib1B	PF 1	649.60 XS	243	2233.590	5.55	2.39	0.018452	88.68	0.049	117.98	132.83	14.85	100	45	1	2.4	20	39	9.3	3.03	0.70	0.50	0.96	3.1	Unstable
Cave Creek Tribs	Trib1B	PF 1	591.49 XS	243	2233.060	4.23	2.48	0.007862	70.37	0.049	61.1	78.63	17.53	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.97	4.5	Stable
Cave Creek Tribs	Trib1B	PF 1	550.21 XS	243	2232.540	4.47	2.22	0.012175	64.52	0.049	42.4	75.74	33.34	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	499.90 XS	243	2231.640	5.46	2.24	0.020594	73.29	0.05	36.42	62.87	26.45	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	449.12 XS	243	2230.830	4.76	2.55	0.014323	54.04	0.051	28.33	60.23	31.9	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.97	4.5	Unstable
Cave Creek Tribs	Trib1B	PF 1	398.78 XS	243	2229.880	6.08	2.7	0.01814	51.71	0.049	33.71	49.1	15.39	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.98	4.6	Unstable
Cave Creek Tribs	Trib1B	PF 1	349.34 XS	243	2229.100	5.49	2.56	0.014497	56.93	0.049	36.42	54.7	18.28	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.97	4.5	Unstable
Cave Creek Tribs	Trib1B	PF 1	300.24 XS	243	2228.170	6.24	2.18	0.020993	71.11	0.049	41.97	57.3	15.33	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	250.01 XS	243	2227.120	5.81	1.96	0.022417	90.17	0.049	54.37	71.57	17.2	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1B	PF 1	199.20 XS	243	2225.980	5.02	2.17	0.02187	102.6	0.051	44.58	80.84	36.26	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1B	PF 1	63.090	243	2225.850	1.71	5.54	0.000367	78.36	0.042	0	31.91	31.91	0	0	1	2.4	20	39	9.3	N/A	1.00	0.50	1.14	5.3	Stable
Cave Creek Tribs	Trib1.3	PF 1	56.87 XS	1827	2225.38	4.55	7.45	0.001997	289.94	0.046	227.25	259.61	32.36	180	100	1	1.1	43	107	7.3	3.09	0.70	0.50	1.20	3.1	Unstable
Cave Creek Tribs	Trib1.3	PF 1	28.32 XS	1827	2225.39	3.38	7.53	0.001417	324.59	0.051	244.2	280.9	36.7	180	100	1	1.1	43	107	7.3	2.72	0.70	0.50	1.20	3.1	Unstable

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib1C.1	PF 1	1881.60 XS	531	2250.91	7.37	3.18	0.011949	74.63	0.038	51.92	79.28	27.36	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.02	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1832.84 XS	531	2249.44	7.25	3.24	0.01306	78.57	0.04	29.29	59.85	30.56	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.02	4.8	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1780.69 XS	531	2248.65	7.17	3.27	0.018528	84.84	0.045	30.58	58.37	27.79	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.02	4.8	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1732.08 XS	531	2247.73	7.51	2.95	0.014358	70.61	0.039	49.73	76.82	27.09	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.00	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1667.12 XS	531	2246.73	6.77	2.73	0.013089	79.1	0.038	74.94	111.46	36.52	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.99	4.6	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1630.77 XS	531	2245.98	5.02	2.67	0.011825	95.6	0.049	91.24	118.07	26.83	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.98	4.6	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1604.30 XS	531	2245.78	3.75	2.68	0.007115	115.99	0.051	124.48	156.39	31.91	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.98	4.6	Stable
Cave Creek Tribs	Trib1C.1	PF 1	1581.06 XS	531	2245.15	5.83	2.79	0.023696	101.11	0.054	116.75	145.16	28.41	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.99	4.6	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1556.15 XS	531	2244.68	4.07	2.76	0.011382	113.42	0.05	133.53	166.03	32.5	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.99	4.6	Stable
Cave Creek Tribs	Trib1C.1	PF 1	1530.78 XS	531	2243.72	5.46	2.36	0.027955	128.31	0.049	143.64	175.63	31.99	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.96	4.4	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1481.05 XS	531	2242.5	4.35	2.37	0.01925	165.7	0.049	158.81	188.21	29.4	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.96	4.4	Stable
Cave Creek Tribs	Trib1C.1	PF 1	1422.32 XS	531	2241.88	3.89	2.43	0.01168	148.93	0.05	120.88	160.76	39.88	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	0.96	4.5	Stable
Cave Creek Tribs	Trib1C.1	PF 1	1381.36 XS	531	2241.2	4.65	2.97	0.014056	120.63	0.05	105.35	145.91	40.56	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.00	4.7	Stable
Cave Creek Tribs	Trib1C.1	PF 1	1331.71 XS	531	2240.75	4.79	3.03	0.010623	116.59	0.049	89.93	109.27	19.34	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.01	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1281.34 XS	531	2240.21	5.34	3.13	0.010582	99.4	0.05	58.56	86.8	28.24	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.02	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1231.01 XS	531	2239.65	5.36	2.95	0.010965	62.99	0.052	64.99	84.66	19.67	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.00	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1181.67 XS	531	2238.75	7.18	3.15	0.019534	77.56	0.05	50.64	75.13	24.49	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.02	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1130.69 XS	531	2237.81	4.16	3.43	0.005385	96.48	0.051	55.25	83.35	28.1	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.03	4.8	Stable
Cave Creek Tribs	Trib1C.1	PF 1	1081.94 XS	531	2237.4	5.42	4	0.007341	95.93	0.049	58	73.09	15.09	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.07	5.0	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	1031.90 XS	531	2236.65	6.78	5.13	0.010751	73.92	0.049	51.41	67.01	15.6	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.12	5.2	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	980.80 XS	531	2235.9	7.17	3.3	0.017294	85.6	0.049	61.32	82.29	20.97	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.03	4.8	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	930.87 XS	531	2235.09	7.01	3.67	0.016042	98.87	0.049	66.05	86.47	20.42	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.05	4.9	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	880.63 XS	531	2234.35	6.45	3.13	0.015723	110.59	0.05	107.71	131.54	23.83	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.02	4.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	830.89 XS	531	2233.71	7.13	2.79	0.011956	126.31	0.032	115.66	150.26	34.6	130	60	1	2.4	23	58	9.3	1.73	0.70	0.50	0.99	3.2	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	781.52 XS	531	2233.36	3.81	3.36	0.005526	138.48	0.045	117.97	151.61	33.64	130	60	1	2.4	23	58	9.3	1.78	0.70	0.50	1.03	3.4	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	712.75 XS	531	2232.17	6.77	2.91	0.017915	90.37	0.045	80.57	118.19	37.62	130	55	1	2.4	23	58	9.3	1.46	0.70	0.50	1.00	3.3	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	681.58 XS	531	2231.85	4.84	3.17	0.003859	118.02	0.034	70.24	106.42	36.18	130	55	1	2.4	23	58	9.3	1.52	0.70	0.50	1.02	3.3	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	654.88 XS	531	2231.86	3.94	4.19	0.001807	126.95	0.034	59.42	80.47	21.05	130	55	1	2.4	23	58	9.3	2.61	0.70	0.50	1.08	3.5	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	608.01 XS	531	2231.44	5.31	4.08	0.004052	80.67	0.034	45.02	78.08	33.06	130	55	1	2.4	23	58	9.3	1.66	0.70	0.50	1.07	3.5	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	579.05 XS	531	2230.83	7.47	3.84	0.013637	71.61	0.041	55.59	76.78	21.19	130	55	1	2.4	23	58	9.3	2.60	0.70	0.50	1.06	3.4	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	531.04 XS	531	2230.42	4.88	4.2	0.00288	82.9	0.034	51.57	69.6	18.03	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.08	5.0	Stable
Cave Creek Tribs	Trib1C.1	PF 1	481.63 XS	531	2229.31	7.93	4.27	0.016186	55.18	0.044	31.48	55.52	24.04	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.08	5.0	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	431.58 XS	531	2228.61	6.44	3.54	0.013609	88.97	0.045	60.29	93	32.71	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.04	4.8	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	381.15 XS	531	2227.87	7.15	3.18	0.015783	131.39	0.044	91.78	113.95	22.17	230	80	1	2.4	23	58	9.3	3.61	0.70	0.50	1.02	3.3	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	333.36 XS	531	2227.29	6.51	3.35	0.013399	147.22	0.045	132.74	153.4	20.66	230	80	1	2.4	23	58	9.3	3.87	0.70	0.50	1.03	3.3	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	281.03 XS	531	2226.75	6.16	3.04	0.010412	142.87	0.039	166.64	179.99	13.35	230	80	1	2.4	23	58	9.3	5.99	0.79	0.50	1.01	3.7	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	228.67 XS	531	2226.17	6.91	2.77	0.014906	129.25	0.039	163.09	183.41	20.32	230	80	1	2.4	23	58	9.3	3.94	0.70	0.50	0.99	3.2	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	181.19 XS	531	2225.74	5.45	3.35	0.007203	124.9	0.039	152.04	170.6	18.56	230	80	1	2.4	23	58	9.3	4.31	0.70	0.50	1.03	3.3	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	140.24 XS	531	2225.55	4.94	3.45	0.00538	126.94	0.039	137.75	156.52	18.77	230	80	1	2.4	23	58	9.3	4.26	0.70	0.50	1.04	3.4	Unstable
Cave Creek Tribs	Trib1C.1	PF 1	86.23 XS	531	2225.5	3.01	3.95	0.001348	112.95	0.04	99.08	122.39	23.31	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.06	4.9	Stable
Cave Creek Tribs	Trib1C.1	PF 1	59.11 XS	531	2225.48	2.48	4.48	0.000683	113.68	0.039	89.37	116.08	26.71	0	0	1	2.4	23	58	9.3	N/A	1.00	0.50	1.09	5.1	Stable
Cave Creek Tribs	Trib1C.2	PF 1	45.20 XS	764	2225.45	1.72	6.43	0.000821	177.38	0.062	108.96	175.33	66.37	0	0	1	2.4	28	69	9.3	N/A	1.00	0.50	1.17	5.4	Stable
Cave Creek Tribs	Trib1C.2	PF 1	23.91 XS	764	2225.44	1.45	6.72	0.000411	201.07	0.058	108.44	184.82	76.38	0	0	1	2.4	28	69	9.3	N/A	1.00	0.50	1.18	5.5	Stable
Cave Creek Tribs	Trib1D	PF 1	2000.81 XS	233	2279.23	6.46	2.07	0.027262	28.57	0.044	33.92	68.42	34.5	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1951.50 XS	233	2277.67	6.67	2.48	0.015695	28.5	0.034	32.47	58.06	25.59	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.97	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	1900.27 XS	233	2275.97	6.37	2.59	0.02185	28.93	0.044	38.89	63.65	24.76	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.98	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	1849.65 XS	233	2275.13	5.99	2.22	0.01508	44.6	0.039	54.17	81.21	27.04	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1D	PF 1	1799.45 XS	233	2273.77	5.66	2.46	0.014553	73.06	0.04	72	92.25	20.25	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.96	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	1749.39 XS	233	2271.83	6.18	2.16	0.018753	54.61	0.039	68.77	89.52	20.75	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1D	PF 1	1700.46 XS	233	2270.2	7.31	3.22	0.019693	21.04	0.039	46.72	66.19	19.47	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.02	4.7	Unstable
Cave Creek Tribs	Trib1D	PF 1	1650.94 XS	233	2268.69	6.7	2.77	0.014459	36.03	0.039	38.57	55.8	17.23	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.99	4.6	Unstable
Cave Creek Tribs	Trib1D	PF 1	1624.07 XS	233	2267.8	6.34	1.89	0.016671	41.72	0.039	37.39	59.93	22.54	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1593.76 XS	233	2266.95	6	1.83	0.02114	39.7	0.04	44.73	77.51	32.78	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1550.15 XS	233	2265.7	6.01	1.82	0.017878	46.03	0.04	51.25	78.86	27.61	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1500.84 XS	233	2264.53	4.79	1.97	0.017226	49.7	0.045	42.89	88.23	45.34	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1450.16 XS	233	2264.27	3.55	3.77	0.003616	49.01	0.041	37.54	73.1	35.56	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.05	4.9	Stable

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate – Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib1D	PF 1	1406.24 XS	233	2263.37	6.52	2.18	0.020963	43.21	0.04	55.68	84.08	28.4	100	60	1	2.4	20	38	9.3	2.11	0.70	0.50	0.94	3.1	Unstable
Cave Creek Tribs	Trib1D	PF 1	1371.69 XS	233	2262.26	4.86	2.11	0.012318	39.06	0.041	35.07	80	44.93	100	60	1	2.4	20	38	9.3	1.34	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1D	PF 1	1324.46 XS	233	2261.1	6.67	2.76	0.0205	25.32	0.041	19.74	56.02	36.28	100	60	1	2.4	20	38	9.3	1.65	0.70	0.50	0.99	3.2	Unstable
Cave Creek Tribs	Trib1D	PF 1	1292.59 XS	233	2259.87	6.8	2.27	0.016513	31.97	0.039	37.04	56.3	19.26	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.95	4.4	Unstable
Cave Creek Tribs	Trib1D	PF 1	1250.15 XS	233	2258.59	6.86	2.46	0.016861	31.45	0.039	38.22	56.96	18.74	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.96	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	1200.37 XS	233	2256.49	6.78	2.38	0.016028	36.06	0.039	47.22	65.98	18.76	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.96	4.4	Unstable
Cave Creek Tribs	Trib1D	PF 1	1148.38 XS	233	2255.31	4.9	1.81	0.013774	46.61	0.047	42.13	70.56	28.43	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1099.76 XS	233	2254.24	5.94	1.86	0.022933	46.59	0.045	67.37	104.99	37.62	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	1049.95 XS	233	2252.85	6.26	2.45	0.016956	41.51	0.039	69.02	102.28	33.26	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.96	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	999.92 XS	233	2251.13	5.77	1.82	0.020525	42.08	0.04	41.31	78.84	37.53	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	948.74 XS	233	2249.85	6.12	2.28	0.015424	55.64	0.039	47.71	65.69	17.98	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.95	4.4	Unstable
Cave Creek Tribs	Trib1D	PF 1	900.17 XS	233	2248.53	5.86	1.71	0.017662	49.75	0.039	55.41	83.84	28.43	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	849.27 XS	233	2246.73	6.07	2.15	0.016735	49.73	0.04	62.41	87.2	24.79	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.94	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	798.77 XS	233	2245.52	5.94	2.6	0.014435	54.89	0.039	63.32	84.28	20.96	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.98	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	764.86 XS	233	2244.83	5.89	2.57	0.014059	60.34	0.039	54.4	75.85	21.45	70	50	1	2.4	20	38	9.3	2.33	0.70	0.50	0.97	3.2	Unstable
Cave Creek Tribs	Trib1D	PF 1	732.60 XS	233	2243.58	6.09	2.09	0.016109	45.3	0.039	44.33	69.99	25.66	70	50	1	2.4	20	38	9.3	1.95	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1D	PF 1	694.11 XS	233	2242.5	5.88	1.31	0.020816	47.06	0.039	43.36	64.18	20.82	70	50	1	2.4	20	38	9.3	2.40	0.70	0.50	0.93	3.0	Unstable
Cave Creek Tribs	Trib1D	PF 1	650.95 XS	233	2241.3	5.78	2.06	0.018596	48.46	0.04	57.82	97.62	39.8	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	589.80 XS	233	2239.54	6.48	2.47	0.017699	35.17	0.039	29.46	54.66	25.2	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.97	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	549.57 XS	233	2238.14	7.02	2.98	0.020913	22.29	0.039	37.83	65.71	27.88	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.00	4.7	Unstable
Cave Creek Tribs	Trib1D	PF 1	498.24 XS	233	2237	6.86	2.93	0.020463	23.26	0.039	29.99	61.27	31.28	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.00	4.7	Unstable
Cave Creek Tribs	Trib1D	PF 1	449.41 XS	233	2236.03	6.66	3.28	0.0156	37.87	0.039	39.29	61.65	22.36	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.03	4.8	Unstable
Cave Creek Tribs	Trib1D	PF 1	421.98 XS	233	2235.53	5.98	3.3	0.011015	62.8	0.039	39.12	57.43	18.31	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.03	4.8	Unstable
Cave Creek Tribs	Trib1D	PF 1	394.91 XS	233	2234.45	7.2	3.09	0.012098	35.44	0.039	52.1	62.04	9.94	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.01	4.7	Unstable
Cave Creek Tribs	Trib1D	PF 1	353.10 XS	233	2233.44	6.78	2.41	0.015964	34.01	0.039	50.99	67.29	16.3	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.96	4.5	Unstable
Cave Creek Tribs	Trib1D	PF 1	328.87 XS	233	2232.4	6.15	1.89	0.027011	34.42	0.043	49.63	83.13	33.5	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.93	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	284.89 XS	233	2230.6	5.83	2.18	0.020382	47.48	0.039	30.66	59.14	28.48	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.94	4.4	Unstable
Cave Creek Tribs	Trib1D	PF 1	249.31 XS	233	2229.72	5.94	2.02	0.018913	45.81	0.039	27.52	60.41	32.89	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	0.92	4.3	Unstable
Cave Creek Tribs	Trib1D	PF 1	200.44 XS	233	2227.41	4.12	3.07	0.005976	43.64	0.04	20.2	53.13	32.93	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.01	4.7	Stable
Cave Creek Tribs	Trib1D	PF 1	150.37 XS	233	2226.31	6.88	2.85	0.019026	28.2	0.039	13.74	35.65	21.91	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.00	4.6	Unstable
Cave Creek Tribs	Trib1D	PF 1	99.35 XS	233	2225.51	2.97	3.25	0.003686	57.18	0.043	0	47.32	47.32	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.02	4.8	Stable
Cave Creek Tribs	Trib1D	PF 1	39.60 XS	233	2225.48	1.65	4.87	0.000626	63.52	0.045	0	42.17	42.17	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.11	5.2	Stable
Cave Creek Tribs	Trib1D	PF 1	20.37 XS	233	2225.48	1.35	5.45	0.000345	67.33	0.045	0	48.85	48.85	0	0	1	2.4	20	38	9.3	N/A	1.00	0.50	1.13	5.3	Stable
Cave Creek Tribs	Trib1.4	PF 1	6649.15 XS	2909	2224.73	7.17	6.35	0.006232	246.41	0.054	252.74	294.19	41.45	180	100	0.5	1.1	54	135	7.3	2.41	0.70	0.50	1.17	3.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6599.99 XS	2909	2223.12	10.67	6.45	0.01785	170.47	0.052	246.35	289.75	43.4	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6562.48 XS	2909	2222.85	9.56	7.21	0.01032	181.81	0.053	268.67	291.94	23.27	100	75	0.5	1.1	54	135	7.3	3.22	0.70	0.50	1.19	3.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6510.02 XS	2909	2222.54	7.89	6.91	0.007034	202.7	0.051	272.99	307.89	34.9	100	75	0.5	1.1	54	135	7.3	2.15	0.70	0.50	1.18	3.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6447.86 XS	2909	2222.07	6.87	7.73	0.008809	158.79	0.062	236.5	300.06	63.56	100	75	0.5	1.1	54	135	7.3	1.18	0.70	0.50	1.21	3.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6401.71 XS	2909	2220.97	9.24	6.24	0.010518	115.48	0.05	210.42	259.1	48.68	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6350.21 XS	2909	2220.7	7.97	5.39	0.008221	148.19	0.05	150.88	199.73	48.85	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.13	4.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6299.56 XS	2909	2220.4	7.37	6.74	0.005856	159.7	0.05	142.83	186.13	43.3	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6250.09 XS	2909	2220.08	7.76	7.31	0.005425	163.02	0.049	118.96	153.56	34.6	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.20	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6199.90 XS	2909	2219.9	6.45	8.11	0.005242	155.67	0.058	60.72	108.07	47.35	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.22	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6149.61 XS	2909	2218.95	8.75	6.62	0.009913	130.84	0.054	82.44	125.9	43.46	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6100.00 XS	2909	2218.55	7.73	6.33	0.008148	114.9	0.056	78.44	138.66	60.22	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	6052.53 XS	2909	2218.23	7.58	6.88	0.006605	116.68	0.053	74.86	131.51	56.65	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5954.73 XS	2909	2217.16	9.23	7.76	0.007251	82.22	0.049	82.1	119.11	37.01	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5900.01 XS	2909	2215.79	11.33	7.75	0.016437	68.96	0.055	74.79	108.43	33.64	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5850.09 XS	2909	2215.58	8.61	8.06	0.008269	87.54	0.057	69.78	114.1	44.32	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.22	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5798.99 XS	2909	2214.97	8.95	8.07	0.012475	104.34	0.062	77.82	124.13	46.31	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.22	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5736.39 XS	2909	2214.28	8.71	8.45	0.011977	108.82	0.062	86.83	134.57	47.74	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.23	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5694.94 XS	2909	2213.02	10.31	7.18	0.021381	86.87	0.061	72.26	132.82	60.56	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.19	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5649.37 XS	2909	2211.65	11.87	5.87	0.017046	76.15	0.049	58.42	98.61	40.19	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5606.87 XS	2909	2211.31	10.01	5.04	0.013786	100.03	0.049	57.97	108.13	50.16	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.12	4.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5549.53 XS	2909	2210.61	9.17	4.81	0.012494	121.62	0.049	75.67	123.78	48.11	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.11	4.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5498.99 XS	2909	2209.97	8.95	4.73	0.012021	120.32	0.049	70.25	108.41	38.16	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.10	4.0	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																				Level II Bank Stability Estimate						
																		Level I Erosion Setback		Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib1.4	PF 1	5449.72 XS	2909	2209.5	8.24	5.35	0.009201	123.2	0.049	77.88	114.29	36.41	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.13	4.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5399.50 XS	2909	2208.68	8.84	6.83	0.010263	109.83	0.049	60.87	109.19	48.32	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5346.56 XS	2909	2208.21	8.29	6.17	0.01073	106.57	0.054	56.6	110.83	54.23	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5300.11 XS	2909	2207.98	6.87	8.16	0.00617	99	0.054	48.24	105.38	57.14	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.22	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5250.57 XS	2909	2207.46	7.26	7.96	0.009572	87.99	0.066	40.38	99.81	59.43	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5199.10 XS	2909	2206.38	8.35	7.41	0.021183	120.69	0.072	60.34	134.91	74.57	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.20	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5150.50 XS	2909	2206.02	6.77	8.48	0.007799	140.16	0.067	103.08	158.38	55.3	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.23	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5086.65 XS	2909	2205.75	5.61	7.93	0.004844	179.1	0.065	104.11	154.13	50.02	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	5049.33 XS	2909	2205.5	5.59	7.89	0.005085	173.7	0.069	97.08	154.02	56.94	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4999.60 XS	2909	2203.48	12.13	7.46	0.013087	127.31	0.05	121.76	146.19	24.43	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.20	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4948.90 XS	2909	2203.44	8.11	8.21	0.008052	158.21	0.059	122.13	155.88	33.75	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.22	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4900.48 XS	2909	2203.15	7.54	8.21	0.006075	160.08	0.056	131.01	162.48	31.47	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.22	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4866.43 XS	2909	2203.1	5.81	8.42	0.004759	172.62	0.064	126.7	169.56	42.86	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.23	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4798.38 XS	2909	2201.89	8.53	6.81	0.010038	182.72	0.058	74.64	122.12	47.48	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4750.23 XS	2909	2201.73	6.27	6.64	0.006343	179.91	0.061	45.92	112.65	66.73	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4699.86 XS	2909	2201.31	6.81	6.78	0.008993	159.33	0.063	34.58	94.83	60.25	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4649.75 XS	2909	2200.29	9.03	5.92	0.009442	157.62	0.049	50.44	97.62	47.18	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4600.58 XS	2909	2200.27	6.18	6.12	0.00395	192.52	0.049	60.59	119.1	58.51	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.16	4.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4549.73 XS	2909	2199.42	8.12	6.39	0.008681	130.18	0.053	42.7	100.26	57.56	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4499.39 XS	2909	2199.11	7.21	6.21	0.006518	107.62	0.053	49.43	116.86	67.43	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.16	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4449.14 XS	2909	2198.74	7.31	6.01	0.007122	110.73	0.054	62.65	129.71	67.06	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.15	4.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4399.43 XS	2909	2198.18	7.96	5.75	0.009339	125.35	0.054	90.03	154.39	64.36	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.14	4.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4349.25 XS	2909	2197.88	7.55	6.52	0.006524	126.55	0.053	97.55	141.12	43.57	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.17	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4299.58 XS	2909	2197.15	8.41	6.7	0.009445	119.04	0.055	93.32	145.55	52.23	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4249.02 XS	2909	2196.35	9.1	6.82	0.013949	105.07	0.058	96.52	154.22	57.7	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.18	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4205.69 XS	2909	2195.91	8.52	7.03	0.010178	131.29	0.056	102.04	154.2	52.16	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.19	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4149.22 XS	2909	2195.6	7.89	7.88	0.006368	149.3	0.053	113.94	150.35	36.41	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4099.75 XS	2909	2195.43	6.83	7.77	0.004498	176.28	0.053	151.15	189.45	38.3	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	4049.30 XS	2909	2195.13	6.5	7.92	0.007055	162.53	0.06	138.67	200.67	62	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.21	4.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3999.67 XS	2909	2194.82	6.44	8.89	0.00566	178.49	0.059	96.69	150.92	54.23	0	0	0.5	1.1	54	135	7.3	N/A	1.00	0.50	1.24	4.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3949.46 XS	2909	2194.22	7.42	8.36	0.008533	167.24	0.062	48.18	98.45	50.27	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.22	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3900.01 XS	2909	2193.79	7.51	8.33	0.008462	165.43	0.063	37.24	85.51	48.27	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.22	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3875.49 XS	2909	2193.79	6.27	8.51	0.004776	179.23	0.059	28.56	72.32	43.76	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.23	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3850.32 XS	2909	2192.74	9.84	7.46	0.010573	156.49	0.053	27.18	60.12	32.94	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.20	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3799.78 XS	2909	2191.47	11.01	6.03	0.015845	87.39	0.051	22.89	64.34	41.45	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.15	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3750.26 XS	2909	2191.19	8.72	5.62	0.008635	116.26	0.048	23.64	77.36	53.72	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.14	5.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3700.07 XS	2909	2190.82	8.14	5.54	0.007876	107.23	0.047	15.31	77.57	62.26	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.14	5.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3664.96 XS	2909	2190.42	8.52	5.96	0.009705	107.36	0.051	14.7	72.68	57.98	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.15	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3600.86 XS	2909	2190.43	5.35	6.3	0.00289	190.98	0.047	114.99	174.65	59.66	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.16	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3549.58 XS	2909	2190.16	5.92	6.38	0.003483	153.78	0.048	109.54	167.63	58.09	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.17	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3499.14 XS	2909	2190	6.43	7.03	0.003055	152.86	0.045	120.57	156.11	35.54	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.19	5.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3449.16 XS	2909	2189.25	8.55	7.26	0.007338	172.98	0.049	101.62	141.11	39.49	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.19	5.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3399.41 XS	2909	2187.33	11.73	5.34	0.010453	99.12	0.038	90.23	134.75	44.52	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.13	5.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3349.04 XS	2909	2186.38	12.01	4.99	0.017223	88.99	0.044	97.96	141.37	43.41	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.11	4.9	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3300.97 XS	2909	2185.62	11.66	4.79	0.009569	93.39	0.032	88.85	141.02	52.17	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.11	4.9	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3249.95 XS	2909	2184.65	10.48	4.2	0.007329	109.66	0.03	75.46	131.8	56.34	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.08	4.7	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3199.53 XS	2909	2184.32	10.21	5.32	0.006759	124.74	0.033	120.8	166.33	45.53	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.13	5.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3149.34 XS	2909	2184.11	8.13	5.3	0.004729	136.44	0.034	141.09	195.25	54.16	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.13	5.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3099.01 XS	2909	2183.92	8.04	5.85	0.004139	122.98	0.034	125.99	176.13	50.14	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.15	5.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	3049.55 XS	2909	2183.47	8.47	5.97	0.007456	130.33	0.044	126.98	184.89	57.91	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.15	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2999.47 XS	2909	2183.08	8.7	5.87	0.007282	116.18	0.044	155.07	201.51	46.44	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.15	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2950.09 XS	2909	2182.86	7.97	5.95	0.005972	190.65	0.044	174.92	223.83	48.91	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.15	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2900.65 XS	2909	2182.71	6.85	6.1	0.004331	213	0.044	170.86	233.26	62.4	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.16	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2848.09 XS	2909	2181.9	9	6.17	0.007655	183.74	0.044	158	204.22	46.22	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.16	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2800.15 XS	2909	2180.9	10.21	6.38	0.009946	150.15	0.044	133.74	181.4	47.66	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.17	5.1	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2749.27 XS	2909	2180.88	7.14	6.66	0.00568	141.09	0.049	106.4	171.61	65.21	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.18	5.2	Unstable

Project Name: Cave Creek Drainage Master Plan
Source: Flood Control District of Maricopa County, FCD 2004C072

CAVE CREEK TRIBUTARIES 1, 1A, 1B, 1C AND 1D
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: N/A
HEC-RAS Project: GWTribFPDSP (Prepared by HDR Engineering - Final Draft Model Dated Sept 26, 2007)
HEC-RAS Plan: Method 4 Encroachment
HEC-RAS Geometry: Method 4 Encroachment
HEC-RAS Steady Flow: Method 4 Encroachment

Variables:
- V_b (ft/s) — Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a — Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b — Correction factor for bank slope, SSA 5-96, Figure 3
- C_d — Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) — Calculated allowable velocity for earthen channels considering correction factors
- Z — Bank slope (horizontal:vertical)
- Lc (ft) — Length of curve
- Rc (ft) — Radius of curve
- b (ft) — Difference between Lft and Rt bank stations
- D_{75} — The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic and channel parameters taken from HEC-RAS model.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

																			Level I Erosion Setback		Level II Bank Stability Estimate: Allowable Velocity Analysis						
River	Reach	Profile	River Sta	Q Total (cfs)	W.S. Elev (ft)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	E.G. Slope (ft/ft)	Top Width, TW (ft)	Channel n-Value	Lft Bank Station (ft)	Rt Bank Station (ft)	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
Cave Creek Tribs	Trib1.4	PF 1	2699.13 XS	2909	2180.65	6.58	6.73	0.005698	167.65	0.053	111.9	180.06	68.16	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.18	5.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2599.14 XS	2909	2180.32	6.4	7.9	0.002687	232.29	0.042	117.49	169.63	52.14	0	0	0.5	2.0	54	135	8.8	N/A	1.00	0.50	1.21	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2549.70 XS	3699	2179.2	9.51	7.35	0.008363	147.56	0.043	107.57	168.2	60.63	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.20	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2500.04 XS	3699	2178.41	10.69	7.26	0.009436	131.46	0.04	100.3	152.11	51.81	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.19	5.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2450.02 XS	3699	2178.3	8.97	8.62	0.005801	156.14	0.042	105.12	153.58	48.46	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.23	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2399.34 XS	3699	2178.07	8.95	8.93	0.005188	180.5	0.041	138.04	178.59	40.55	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.24	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2350.05 XS	3699	2176.69	12.51	8.2	0.010185	146.75	0.038	131.84	161.47	29.63	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.22	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2299.67 XS	3699	2175.99	11.54	7.57	0.007488	153.01	0.035	118.22	154.1	35.88	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.20	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2250.59 XS	3699	2175.86	10.02	8.22	0.004945	151.32	0.033	98.74	144.44	45.7	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.22	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2199.80 XS	3699	2176.01	7.57	8.51	0.002439	170.18	0.035	103.12	128.36	25.24	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.23	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2149.54 XS	3699	2175.9	6.29	8.56	0.002053	170.71	0.037	66.04	129.12	63.08	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.23	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2099.27 XS	3699	2174.28	10.75	7.53	0.007568	134.34	0.036	37.96	103.07	65.11	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.20	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	2049.17 XS	3699	2174.13	9.27	7.68	0.006284	131.81	0.038	33.13	108.36	75.23	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.21	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1999.30 XS	3699	2173.94	8.92	7.19	0.004454	134.43	0.035	30.6	99.01	68.41	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.19	5.2	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1949.95 XS	3699	2173.82	8.51	7.37	0.00367	131.45	0.035	30.68	92.86	62.18	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.20	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1899.40 XS	3699	2173.66	8.65	7.45	0.003959	139.71	0.037	24.72	73.97	49.25	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.20	5.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1849.84 XS	3699	2173.56	7.99	8.24	0.003999	148.46	0.041	27.51	69.71	42.2	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.22	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1799.89 XS	3699	2173.46	6.55	9.4	0.005516	158.34	0.061	30.24	79.23	48.99	240	160	0.5	2.0	61	152	8.8	3.27	0.70	0.50	1.25	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1749.76 XS	3699	2173.26	6.03	9.5	0.003734	167.41	0.058	25.16	80.89	55.73	240	160	0.5	2.0	61	152	8.8	2.87	0.70	0.50	1.25	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1699.68 XS	3699	2172.92	7.24	9.46	0.004538	170.6	0.056	47.61	86.02	38.41	240	160	0.5	2.0	61	152	8.8	4.17	0.70	0.50	1.25	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1649.72 XS	3699	2172.68	7.3	9.05	0.005072	171.85	0.057	43.41	83.61	40.2	240	160	0.5	2.0	61	152	8.8	3.98	0.70	0.50	1.24	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1598.80 XS	3699	2172.45	6.58	9.59	0.00477	166.75	0.059	40.02	98.38	58.36	240	160	0.5	2.0	61	152	8.8	2.74	0.70	0.50	1.25	3.9	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1549.38 XS	3699	2171.39	9.76	8.83	0.008644	136.63	0.054	36.08	71.44	35.36	155	145	0.5	2.0	61	152	8.8	4.10	0.70	0.50	1.24	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1499.84 XS	3699	2168.97	13.38	8.5	0.025025	93.92	0.062	28.95	64.69	35.74	155	145	0.5	2.0	61	152	8.8	4.06	0.70	0.50	1.23	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1450.07 XS	3699	2168.11	11.82	8.58	0.019965	85.25	0.063	49.93	88.76	38.83	155	145	0.5	2.0	61	152	8.8	3.73	0.70	0.50	1.23	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1400.02 XS	3699	2167.64	11.53	10.53	0.009582	81.44	0.054	51.51	77.35	25.84	155	145	0.5	2.0	61	152	8.8	5.61	0.77	0.50	1.27	4.3	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1349.78 XS	3699	2165.56	14.41	9.35	0.019752	70.39	0.054	38.11	66.03	27.92	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.25	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1300.10 XS	3699	2163.47	13.66	8.78	0.027714	66.26	0.062	35.95	71.59	35.64	190	110	0.5	2.0	61	152	8.8	3.09	0.70	0.50	1.23	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1250.76 XS	3699	2161.82	13.95	9.72	0.023768	63.36	0.058	49.55	82.65	33.1	190	110	0.5	2.0	61	152	8.8	3.32	0.70	0.50	1.26	3.9	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1198.87 XS	3699	2161.4	8.43	12.28	0.004842	80.89	0.056	58.44	83.14	24.7	190	110	0.5	2.0	61	152	8.8	4.45	0.70	0.50	1.31	4.0	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1149.76 XS	3699	2158.17	14.24	9.36	0.026942	55.29	0.064	51.01	83.32	32.31	190	110	0.5	2.0	61	152	8.8	3.40	0.70	0.50	1.25	3.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1099.52 XS	3699	2157.63	11.79	10.15	0.011761	60.35	0.055	42.88	73.97	31.09	190	110	0.5	2.0	61	152	8.8	3.54	0.70	0.50	1.27	3.9	Unstable
Cave Creek Tribs	Trib1.4	PF 1	1048.85 XS	3699	2157.42	9.35	11.85	0.009254	73.57	0.065	39.1	78.76	39.66	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.30	5.7	Unstable
Cave Creek Tribs	Trib1.4	PF 1	999.54 XS	3699	2154.4	15.49	10.22	0.018367	52.53	0.054	36.46	57.36	20.9	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.27	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	949.51 XS	3699	2151.29	17.2	11.86	0.020474	38.93	0.054	39.27	50.96	11.69	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.30	5.7	Unstable
Cave Creek Tribs	Trib1.4	PF 1	899.77 XS	3699	2149.58	16.19	10.62	0.020033	40.65	0.054	41.9	64.09	22.19	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.27	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	849.15 XS	3699	2147.14	14.63	8.79	0.025275	52.54	0.061	41.69	56.97	15.28	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.23	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	799.63 XS	3699	2146.21	14.83	9.05	0.019385	56.41	0.054	52.36	73.06	20.7	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.24	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	749.58 XS	3699	2144.59	15.12	9.75	0.020114	53.18	0.054	56.06	74.5	18.44	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.26	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	700.56 XS	3699	2142.29	13.36	10.78	0.015533	54.8	0.054	54.21	72.06	17.85	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.28	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	649.50 XS	3699	2142	11.12	11.11	0.008234	51.95	0.054	49.57	80.15	30.58	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.28	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	599.90 XS	3699	2141.82	9.65	12.49	0.007579	57.01	0.062	40.38	73.72	33.34	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.31	5.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	549.03 XS	3699	2137.83	16.37	10.17	0.022036	36.66	0.057	46.64	70.83	24.19	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.27	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	499.39 XS	3699	2136.77	12.86	9.77	0.014676	54.44	0.055	48.68	81.44	32.76	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.26	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	448.71 XS	3699	2136.36	11.83	9.96	0.01047	49.48	0.054	44.82	75.56	30.74	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.26	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	400.11 XS	3699	2133.17	16.46	12.45	0.022727	39.31	0.054	45.22	66.15	20.93	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.31	5.8	Unstable
Cave Creek Tribs	Trib1.4	PF 1	356.15 XS	3699	2126.06	14.61	8.93	0.020631	55.06	0.054	55.47	80.86	25.39	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.24	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	310.51 XS	3699	2124.46	14.9	9.42	0.020108	49.2	0.054	35.58	64.31	28.73	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.25	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	259.90 XS	3699	2122.81	14.29	8.41	0.028314	48.87	0.062	34.2	71.3	37.1	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.23	5.4	Unstable
Cave Creek Tribs	Trib1.4	PF 1	200.99 XS	3699	2122.46	9.5	9.75	0.009629	75.65	0.061	37.8	81.37	43.57	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.26	5.5	Unstable
Cave Creek Tribs	Trib1.4	PF 1	165.99 XS	3699	2122.32	8.48	10.27	0.007261	91.09	0.062	42.48	88.03	45.55	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.27	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	110.68 XS	3699	2121.97	7.84	10.81	0.008577	112.42	0.07	42.59	89.78	47.19	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.28	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	72.13 XS	3699	2121.71	7.12	10.55	0.009469	161.08	0.073	50.69	108.05	57.36	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.27	5.6	Unstable
Cave Creek Tribs	Trib1.4	PF 1	39.15 XS	3699	2121.57	6.4	10.71	0.006467	267.12	0.069	162.28	210.03	47.75	0	0	0.5	2.0	61	152	8.8	N/A	1.00	0.50	1.28	5.6	Unstable

MORMON GIRL WASH AND TRIBUTARIES
LEVELS I AND II LATERAL EROSION SETBACK CALCULATIONS

Originating Study: Cave Creek DMP
Prepared For: Flood Control District of Maricopa County, October 2007
Prepared By: JE Fuller Hydrology and Geomorphology
Imported HEC-2 File: See Note 3.
HEC-RAS Project: See Note 3.
HEC-RAS Plan: See Note 3.
HEC-RAS Geometry: See Note 3.
HEC-RAS Steady Flow: See Note 3.

Variables:
- V_b (ft/s) Basic allowable velocity for earthen channels, SSA 5-96, Figure 1
- C_a Correction factor for channel alignment, SSA 5-96, Figure 2
- C_b Correction factor for bank slope, SSA 5-96, Figure 3
- C_d Correction factor for depth of flow, SSA 5-96, Figure 4
- V_a (ft/s) Calculated allowable velocity for earthen channels considering correction factors
- Z Bank slope (horizontal:vertical)
- Lc (ft) Length of curve
- Rc (ft) Radius of curve
- b (ft) Difference between Lft and Rt bank stations
- D_{75} The diameter, for which 75% of the particles are finer.

Notes:
1. The D_{75} data was obtained from the closest sample available to the given cross-section. If at a location where only a bed material sample was available, it was assumed that bed and bank material were similar.
2. Lc, Rc and Z values were estimated from aerial photographs and 2-foot contour topography.
3. Hydraulic parameters based on normal depth sections used for equilibrium slope calculations.
4. Minimum Level I erosion setback distance for straight reach is equal to 20 feet.
5. Minimum Level I erosion setback distance for reach with bend is equal to 50 feet.

											Level I Erosion Setback		Level II Bank Stability Estimate – Allowable Velocity Analysis						
XLID	XSID	Q Total (cfs)	Vel Chnl (ft/s)	Max Chnl Dpth, Y (ft)	Channel n-Value	b (ft)	Lc (ft)	Rc (ft)	Z (H:V)	D_{75} (in)	Straight Reach (ft)	Bend (ft)	V_b (ft/s)	Rc/b (ft/ft)	C_a	C_b	C_d	V_a (ft/s)	Stability
MGW_TRIB_1	1	1166	2.31	3.92	0.045	108.9	0	0	3	0.8	34	85	6.6	N/A	1.00	0.84	1.06	5.9	Stable
MGW_TRIB_1	2	1166	1.94	4.83	0.045	119.7	0	0	3	0.8	34	85	6.6	N/A	1.00	0.84	1.11	6.2	Stable
MGW_TRIB_1	3	1166	1.94	1.85	0.045	213.7	0	0	3	0.8	34	85	6.6	N/A	1.00	0.84	0.90	5.0	Stable
MGW_TRIB_1A	1	637	3.27	2.14	0.045	52.5	0	0	3	0.8	25	63	6.6	N/A	1.00	0.84	0.93	5.2	Stable
MGW_TRIB_1B_1	1	254	3.34	2.64	0.045	20.2	0	0	3	0.8	20	50	6.6	N/A	1.00	0.84	0.98	5.4	Stable
MGW_TRIB_1B_2	1	891	2.18	2.67	0.045	196.0	0	0	3	0.8	30	75	6.6	N/A	1.00	0.84	0.98	5.5	Stable
MGW_TRIB_1C	1	217	1.24	2.30	0.045	77.5	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.95	3.4	Stable
MGW_TRIB_1C	2	217	1.49	2.19	0.045	66.0	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.94	3.4	Stable
MGW_TRIB_1C	3	217	0.89	2.12	0.045	202.4	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.93	3.3	Stable
MGW_TRIB_1C	4	217	1.18	1.50	0.045	102.2	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.86	3.1	Stable
MGW_TRIB_1D	1	314	1.51	2.73	0.045	86.3	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.99	3.5	Stable
MGW_TRIB_1D	2	314	1.70	1.74	0.045	68.9	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.89	3.2	Stable
MGW_TRIB_1D	3	314	1.40	1.36	0.045	114.4	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.84	3.0	Stable
MGW_TRIB_1D	4	314	1.14	1.32	0.045	153.7	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.83	3.0	Stable
MGW_TRIB_1E_1	1	159	0.97	1.87	0.045	128.1	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.91	3.2	Stable
MGW_TRIB_1E_1	2	159	1.25	1.53	0.045	55.8	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.86	3.1	Stable
MGW_TRIB_1E_2	1	289	1.20	1.51	0.045	149.5	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.86	3.1	Stable
MGW_TRIB_1E_3	1	537	2.19	2.31	0.045	58.6	0	0	3	0.2	23	58	4.3	N/A	1.00	0.84	0.95	3.4	Stable
MGW_TRIB_1F	1	159	0.97	1.07	0.045	117.0	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.79	2.8	Stable
MGW_TRIB_1G	1	249	1.27	1.61	0.045	103.3	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.87	3.1	Stable
MGW_TRIB_1G	2	249	0.97	1.27	0.045	187.2	0	0	3	0.2	20	50	4.3	N/A	1.00	0.84	0.82	2.9	Stable
MORMONGIRL1	1	5220	2.64	5.13	0.045	215.8	0	0	3	0.2	72	181	4.3	N/A	1.00	0.84	1.12	4.0	Stable
MORMONGIRL1	2	5220	2.30	4.83	0.045	352.1	0	0	3	0.2	72	181	4.3	N/A	1.00	0.84	1.11	4.0	Stable
MORMONGIRL1	3	5220	2.43	4.55	0.045	340.8	0	0	3	0.2	72	181	4.3	N/A	1.00	0.84	1.09	3.9	Stable
MORMONGIRL1	4	5220	3.17	4.96	0.045	215.2	585	350	3	0.2	72	181	4.3	1.6	0.51	0.84	1.11	2.0	Unstable
MORMONGIRL1	5	1931	2.28	4.67	0.045	146.8	0	0	3	0.2	44	110	4.3	N/A	1.00	0.84	1.10	3.9	Stable
MORMONGIRL1	6	1931	3.54	3.99	0.045	70.2	0	0	3	0.2	44	110	4.3	N/A	1.00	0.84	1.07	3.8	Stable
MORMONGIRL1	7	1931	2.87	4.33	0.045	107.7	0	0	3	0.2	44	110	4.3	N/A	1.00	0.84	1.08	3.9	Stable
MORMONGIRL2	1	5751	2.49	4.58	0.045	329.8	0	0	3	0.2	76	190	4.3	N/A	1.00	0.84	1.10	3.9	Stable
MORMONGIRL3	1	5874	2.72	6.97	0.045	279.8	190	125	3	0.2	77	192	4.3	0.4	0.42	0.84	1.19	1.8	Unstable
MORMONGIRL4	1	7351	4.06	11.03	0.045	139.1	0	0	3	3.4	86	214	10.3	N/A	1.00	0.84	1.28	11.1	Stable
MORMONGIRL4	2	7351	3.61	6.12	0.045	181.2	0	0	3	0.2	86	214	4.3	N/A	1.00	0.84	1.16	4.1	Stable
MORMONGIRL4	3	7351	4.07	6.26	0.045	136.5	0	0	3	0.2	86	214	4.3	N/A	1.00	0.84	1.16	4.1	Stable

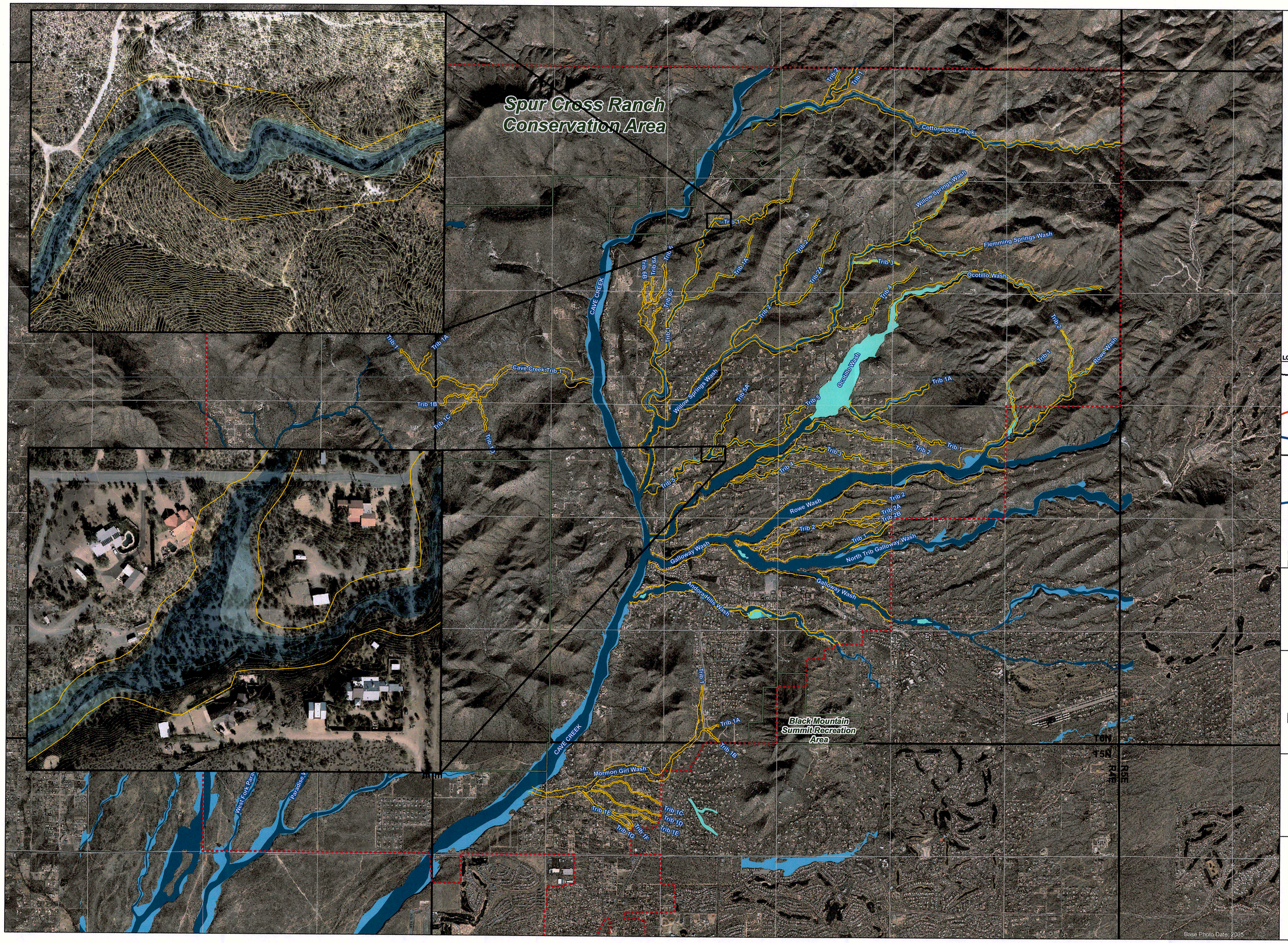
ADWR State Standard 5-96
Watercourse System Sediment Balance
Guideline 1 - Lateral Migration Seback Allowance for Riverine Floodplains in Arizona

(HEC-RAS modeling for the watercourses listed below was not available. However, the 100-year discharges were obtained (or derived) from information shown on the floodplain workmap exhibits.)

Level I Analysis: Setback = $1.0(Q_{100})^{0.5}$ for straight channel reaches or reaches with minor curvature
Setback = $2.5(Q_{100})^{0.5}$ for channels with obvious curvature or channel bend

Watercourse	Q_{100} (cfs)	Straight Channel Setback (ft)	Channel w/ Curvature Setback (ft)	Note
Rowe Wash Trib 1	714	27	67	100-yr discharge taken from workmap
Rowe Wash Trib 2	397	20	50	100-yr discharge taken from workmap
Rowe Wash Above Trib 2	352	20	50	100-yr discharge taken from workmap
Willow Springs Wash Trib 3	-	20	50	100-yr discharge not shown on workmap, but comparison of hydrologically similar contributing areas indicates a maximum discharge less than 320 cfs

Assumptions/Notes:
1. Watercourse drainage area is less than 30 square miles.
2. Minimum setback shall be 20' for straight channel and 50' for channel with curvature.
3. Setback is measured outward from the 100-year floodway or the top of the channel bank, whichever is greater.
4. Originating study - Cave Creek FIS, March 1990.



LEGEND

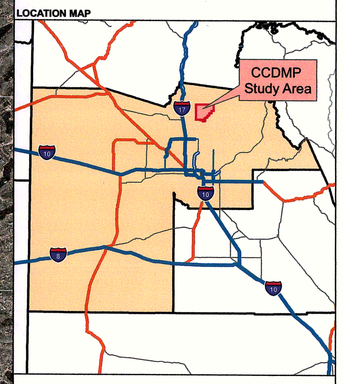
- Level I Erosion Hazard Zone
- Cave Creek DMP Study Area
- County Parks

FEMA Flood Hazard Zones

- A
- AE
- FW

N
W E
S

LOCATION MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK DRAINAGE MASTER PLAN

SS 5-96 LEVEL I EROSION HAZARD ZONES

FCD 2004C072
NOVEMBER 2007

Registered Professional Engineer (Civil) CERTIFICATE NO. 41014 BRIAN NICHOLAS SCHALK Date Signed 11-29-07 ARIZONA, U.S.A.

REGISTERED GEOLOGIST CERTIFICATE NO. 43618 MICHAEL J. KELLOGG Date Signed 11-29-07 ARIZONA, U.S.A.

Feet
0 750 1,500 3,000 4,500 6,000

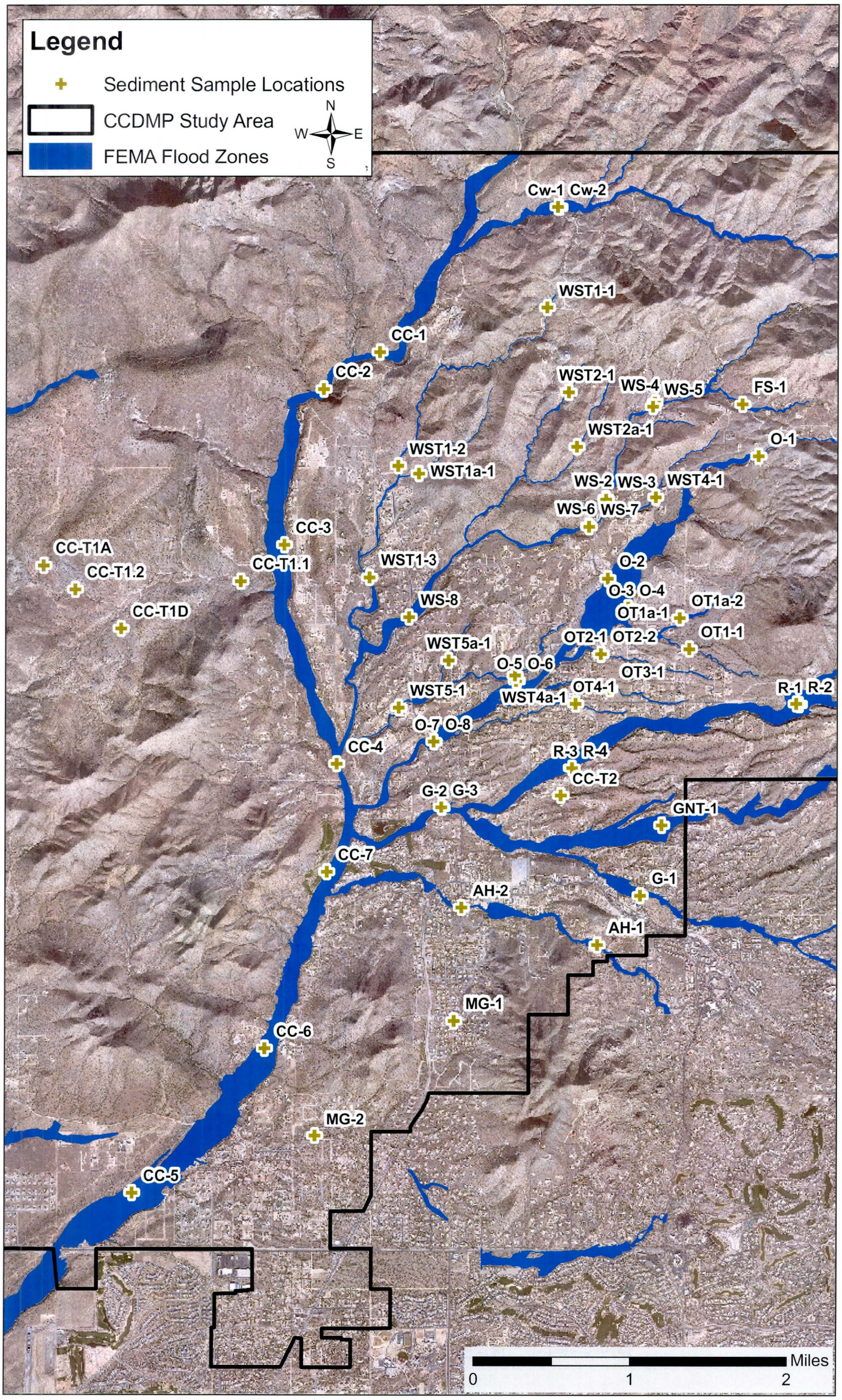
0 0.25 0.5 1
Miles

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
www.jefuller.com

Base Photo Date: 2005

Appendix B

Sediment Data


Legend
Sediment Sample Locations
CCDMP Study Area
FEMA Flood Zones
N
W
E
S
Cw-1
Cw-2
WST1-1
CC-1
CC-2
WST2-1
WS-4
WS-5
FS-1
WST2a-1
O-1
WST1-2
WST1a-1
WS-2
WS-3
WST4-1
WS-6
WS-7
CC-3
CC-T1A
CC-T1.2
CC-T1.1
WST1-3
O-2
O-3
O-4
OT1a-2
WS-8
OT1a-1
CC-T1D
OT2-1
OT2-2
OT1-1
WST5a-1
O-5
O-6
OT3-1
WST5-1
OT4-1
R-1
R-2
WST4a-1
O-7
O-8
CC-4
R-3
R-4
CC-T2
G-2
G-3
GNT-1
CC-7
G-1
AH-2
AH-1
MG-1
CC-6
MG-2
CC-5
Miles
0
1
2

Project Name Cave Creek DMP
Company JE Fuller Hydrology and Geomorphology Inc.
Project Location Cave Creek, Arizona
Date 24-Jan-07

Sieve Analysis Data

Lab Sample No.	236773	236774	236775	236776	236794	236795	236803	236804	236820	236779	236780	236777	236778	236806	236805	236781
Field Sample No.	Ocotillo-1	Ocotillo-2	Ocotillo-3	Ocotillo-4	Ocotillo-5	Ocotillo--6	Ocotillo-7	Ocotillo-8	Ocotillo Trib	Ocotillo Trib	Ocotillo Trib	Ocotillo Trib	Ocotillo Trib	Ocotillo Trib	Ocotillo Trib	Willow Spring
Link ID for GIS	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	OT1-1	OT1a-1	OT1a-2	OT2-1	OT2-2	OT3-1	OT4-1	WS-2
0.074	3	3	3	5	2	24	2	12	3	3	11	2	17	2	3	2
0.149	4	4	4	6	3	26	3	17	4	4	14	3	20	3	5	2
0.297	4	6	6	8	6	29	5	25	5	6	18	4	24	4	7	4
0.42	5	7	8	9	8	31	8	29	6	8	19	5	25	6	10	5
0.59	6	8	9	10	11	32	11	34	8	11	21	7	27	8	13	8
1.19	11	14	14	15	17	36	22	43	12	17	25	13	31	13	22	17
2	18	21	20	20	24	41	34	51	18	24	30	20	34	19	30	27
2.38	20	24	22	22	26	43	39	55	22	28	32	22	36	21	33	30
4.76	33	36	34	34	39	55	61	69	32	41	41	32	43	32	44	45
6.35	38	41	42	39	44	59	68	69	38	51	45	38	47	39	50	52
9.525	48	49	57	47	56	65	80	77	48	68	54	49	52	51	61	61
12.7	56	56	69	54	65	71	86	82	56	77	60	54	56	60	70	67
19.05	70	69	84	63	79	81	92	89	68	89	69	62	61	71	81	76
25.4	79	77	90	70	86	87	94	92	74	93	74	68	66	78	86	81
31.75	89	87	95	78	92	95	98	95	79	97	82	76	76	87	92	87
38.1	96	93	96	83	100	99	99	95	89	100	88	80	83	95	99	90
50.8	98	96	97	89	100	100	100	98	100	100	95	87	89	100	100	90
76.2	100	100	100	92	100	100	100	100	100	100	100	97	100	100	100	97
152.4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Diameter (mm)	O-1	O-2	O-3	O-4	O-5	O-6	O-7	O-8	OT1-1	OT1a-1	OT1a-2	OT2-1	OT2-2	OT3-1	OT4-1	WS-2
16	1.8	1.4	1.5	1.4	1.1	0.1	0.9	0.1	1.7	1.1	0.2	1.5	0.1	1.6	0.8	1.1
50	10.2	9.8	8.0	10.8	7.9	3.8	3.6	1.9	10.3	6.2	8.0	10.3	8.2	9.2	6.3	5.9
65	16.7	16.9	11.7	20.8	12.8	9.3	5.6	4.1	17.6	8.9	16.3	22.1	24.2	15.5	10.9	11.7
84	28.5	29.8	19.4	40.6	23.5	22.3	11.6	14.7	34.7	16.4	33.7	45.2	39.3	29.9	22.4	28.7
90	32.3	34.8	25.2	57.5	29.5	28.0	17.1	21.3	38.9	20.8	42.4	58.8	53.7	34.2	29.2	37.7
G	4.26	4.97	3.96	5.79	5.04	28.5	3.67	10.7	4.76	4.22	19.67	5.51	57.75	4.44	5.77	5.01

Project Name
Company
Project Location
Date

Sieve Analysis Data

Lab Sample No.	236782	236783	236784	236785	236786	236800	236787	236797	236799	236798	236788	236789	236790	236796	236802	236801
Field Sample No.	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring	Willow Spring
Link ID for GIS	WS-3	WS-4	WS-5	WS-6	WS-7	WS-8	WST1-1	WST1-2	WST1-3	WST1a-1	WST2-1	WST2a-1	WST4-1	WST4a-1	WST5-1	WST5a-1
0.074	13	3	6	2	7	2	2	2	3	3	2	4	4	2	2	4
0.149	16	4	8	2	8	3	3	3	3	3	2	5	5	3	3	4
0.297	20	7	10	4	10	5	5	5	4	5	3	7	6	3	4	5
0.42	22	9	11	5	11	6	8	8	6	8	4	10	8	4	4	6
0.59	25	14	12	7	12	8	11	13	8	11	5	13	11	4	5	7
1.19	34	26	15	14	14	15	20	30	14	15	12	23	18	5	9	10
2	45	40	18	22	17	23	29	47	21	19	21	34	24	9	15	15
2.38	47	44	19	25	18	27	32	52	23	30	24	39	27	16	18	17
4.76	70	59	23	36	23	39	48	71	31	52	38	56	37	26	29	25
6.35	76	67	26	44	27	45	53	76	37	61	46	62	41	31	36	30
9.525	83	76	30	57	35	56	62	83	46	75	58	70	51	40	49	39
12.7	87	81	33	66	41	64	68	87	54	83	67	75	60	45	58	45
19.05	91	88	38	78	51	75	75	92	67	91	79	81	74	54	69	57
25.4	93	92	42	83	57	83	80	95	75	96	86	84	82	60	76	65
31.75	94	96	49	90	67	92	87	98	86	99	94	88	89	72	82	77
38.1	95	100	55	95	76	99	95	99	90	99	96	92	94	86	86	86
50.8	95	100	66	96	87	100	97	100	94	100	99	96	96	97	94	100
76.2	100	100	76	96	96	100	100	100	96	100	100	100	100	100	95	100
152.4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Diameter (mm)	WS-3	WS-4	WS-5	WS-6	WS-7	WS-8	WST1-1	WST1-2	WST1-3	WST1a-1	WST2-1	WST2a-1	WST4-1	WST4a-1	WST5-1	WST5a-1
16	0.2	0.7	1.5	1.4	1.7	1.3	1.0	0.7	1.4	1.4	1.6	0.8	1.0	2.4	2.1	2.2
50	2.7	3.4	32.7	7.8	18.2	7.7	5.4	2.2	11.1	4.5	7.4	3.9	9.3	16.3	9.9	15.2
65	4.2	6.0	49.6	12.3	30.5	13.5	11.2	4.0	18.1	7.4	12.1	7.5	15.1	28.0	16.6	25.4
84	10.3	15.1	102.4	26.1	47.8	26.2	29.0	10.3	30.7	13.7	23.3	25.1	27.1	37.0	34.9	36.8
90	18.2	22.4	121.1	32.3	60.1	30.6	34.1	16.8	38.4	18.4	28.6	34.9	32.8	42.3	44.6	41.9
G	10.18	4.68	12.43	4.44	6.81	4.62	5.52	3.94	5.32	3.1	3.94	5.73	5.95	4.59	4.13	4.72

Project Name
Company
Project Location
Date

Sieve Analysis Data

Lab Sample No.	236791	236792	236793	236807	236808	236809	236810	236811	236812	236815	236817	236813	236814	236818	236819
Field Sample No.	Flemming Sp	Cottonwood-	Cottonwood-	Rowe-1	Rowe-2	Rowe-3	Rowe-4	Galloway N T	Galloway-1	Galloway-2	Galloway-3	Andora Hills-	Andora Hills-	Mormon Girl-	Mormon Girl-2
Link ID for GIS	FS-1	Cw-1	Cw-2	R-1	R-2	R-3	R-4	GNT-1	G-1	G-2	G-3	AH-1	AH-2	MG-1	MG-2
0.074	3	10	3	2	3	3	5	2	4	3	5	2	1	3	8
0.149	4	12	4	3	4	5	6	3	6	3	7	3	2	4	10
0.297	5	14	7	6	7	7	8	5	11	5	10	6	4	7	14
0.42	7	15	9	7	10	9	9	6	14	7	13	9	7	9	16
0.59	9	17	12	10	14	12	10	9	18	10	15	12	10	13	20
1.19	15	21	18	15	25	20	13	17	31	22	21	22	18	21	35
2	23	28	23	20	34	29	18	27	53	37	29	32	26	31	50
2.38	27	28	25	21	37	32	20	31	58	43	33	37	29	32	53
4.76	37	38	32	31	49	50	31	51	86	68	49	54	49	45	76
6.35	41	43	36	38	54	58	38	65	92	78	57	62	58	51	83
9.525	47	52	42	50	62	73	50	82	97	86	68	70	71	60	89
12.7	51	59	47	66	67	81	60	88	98	90	76	74	78	66	92
19.05	59	73	55	75	73	90	75	95	100	93	87	79	86	74	94
25.4	65	81	60	85	77	93	83	97	100	95	92	83	91	80	95
31.75	80	92	73	94	82	98	95	98	100	97	97	88	94	84	98
38.1	87	99	83	98	85	99	100	98	100	98	98	92	94	87	98
50.8	97	100	90	100	94	100	100	100	100	100	100	94	97	91	98
76.2	97	100	95	100	97	100	100	100	100	100	100	100	97	95	100
152.4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Diameter (mm)	FS-1	Cw-1	Cw-2	R-1	R-2	R-3	R-4	GNT-1	G-1	G-2	G-3	AH-1	AH-2	MG-1	MG-2
16	1.3	0.5	1.0	1.4	0.7	0.9	1.6	1.1	0.5	0.9	0.7	0.8	1.0	0.8	0.4
50	11.7	8.9	15.3	9.6	5.1	4.8	9.6	4.6	1.9	3.0	5.0	4.2	4.9	6.1	2.0
65	25.3	15.4	27.9	12.6	11.4	7.8	14.9	6.3	3.0	4.5	8.6	7.5	8.1	12.1	3.6
84	35.1	27.3	39.4	24.9	36.1	14.9	26.0	10.7	4.6	8.7	17.1	27.1	17.1	32.2	7.0
90	41.7	30.6	51.2	28.9	45.6	19.6	29.2	14.7	5.8	13.1	22.4	34.9	24.3	48.3	10.7
G	5.98	10.86	8.9	4.71	7.3	4.18	4.28	3.25	3.02	3.13	5.21	5.85	4.13	6.35	4.16

BED MATERIAL ANALYSIS FORM

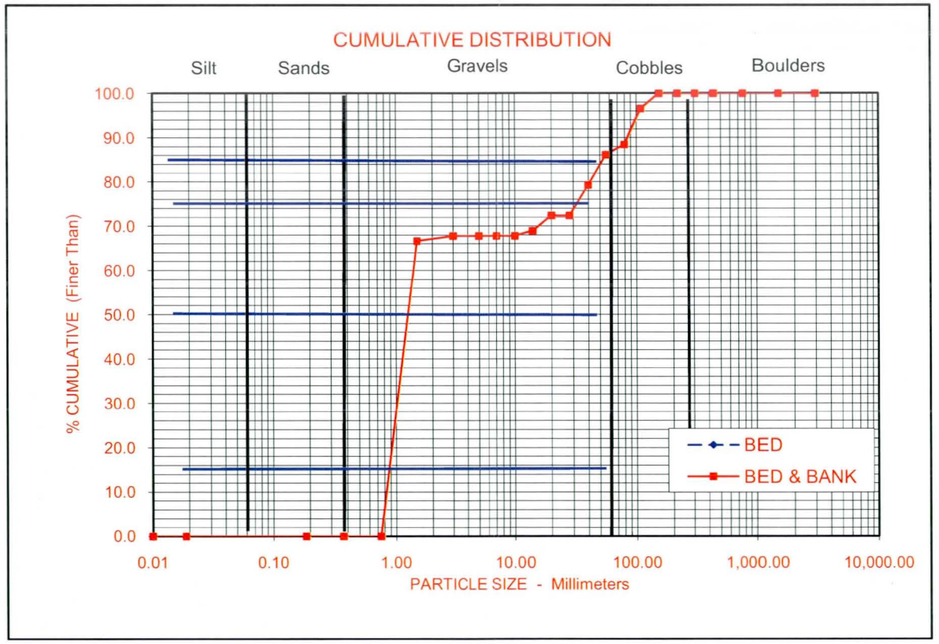
Printed: 10/16/2007

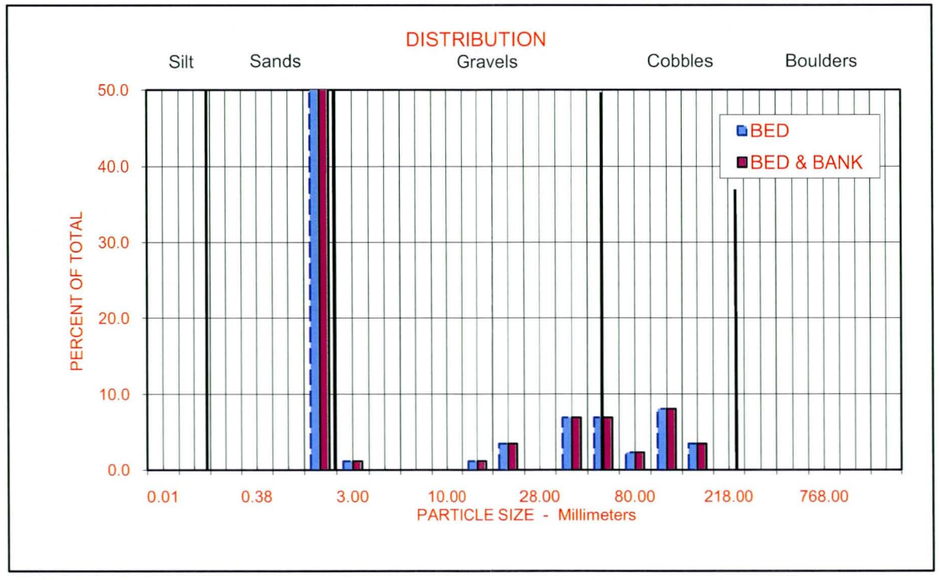
Watercourse Name: Cave Creek
Reach Name/Location: Reach 1/
Date of Sampling: 8-Nov-06

Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.9	mm
d50:	N/A	mm	1.3	mm
d75:	N/A	mm	32.5	mm
d85:	N/A	mm	85.4	mm
			G: 20.09	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		58		58	66.7	66.7	66.7	66.7
Very Fine	3.00	2 - 4		1		1	1.1	67.8	1.1	67.8
Fine	5.00	4 - 5.7	G			0	0.0	67.8	0.0	67.8
Fine	7.00	5.7 - 8	R			0	0.0	67.8	0.0	67.8
Medium	10.00	8 - 11.3	A			0	0.0	67.8	0.0	67.8
Medium	14.00	11.3 - 16	V	1		1	1.1	69.0	1.1	69.0
Coarse	20.00	16 - 22.6	E	3		3	3.4	72.4	3.4	72.4
Coarse	28.00	22.6 - 32	L			0	0.0	72.4	0.0	72.4
Very Coarse	40.00	32 - 45	S	6		6	6.9	79.3	6.9	79.3
Very Coarse	56.00	45 - 64		6		6	6.9	86.2	6.9	86.2
Small	80.00	64 - 90	C	2		2	2.3	88.5	2.3	88.5
Small	109.00	90 - 128	O	7		7	8.0	96.6	8.0	96.6
Large	154.00	128 - 180	B	3		3	3.4	100.0	3.4	100.0
Large	218.00	180 - 256	L			0	0.0	100.0	0.0	100.0
Small	309.00	256 - 362	B			0	0.0	100.0	0.0	100.0
Small	438.00	362 - 512	L			0	0.0	100.0	0.0	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	87		87	100.0		100.0	





Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.

BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

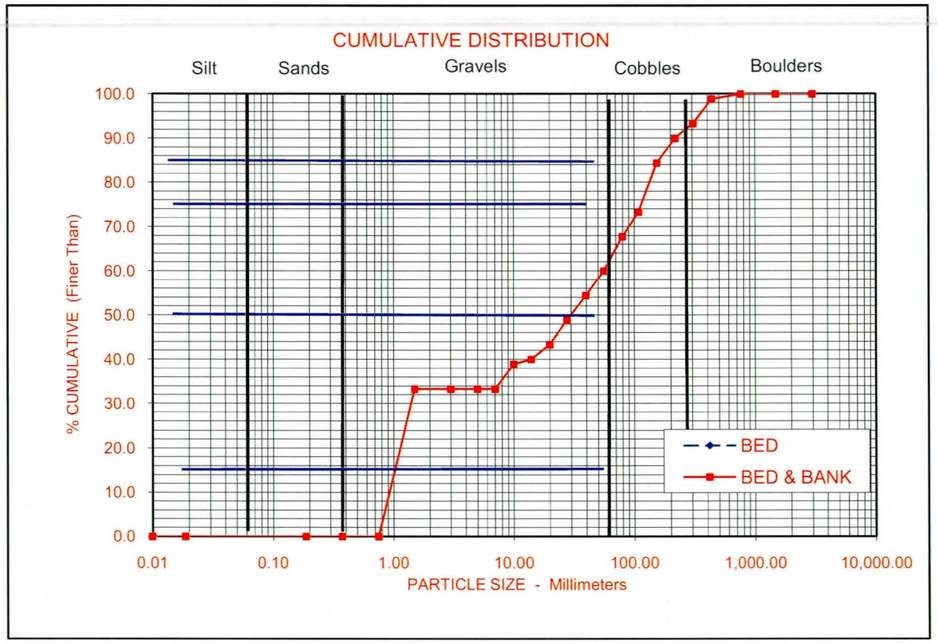
Watercourse Name: Cave Creek
Reach Name/Location: Reach 2
Date of Sampling: 8-Nov-06

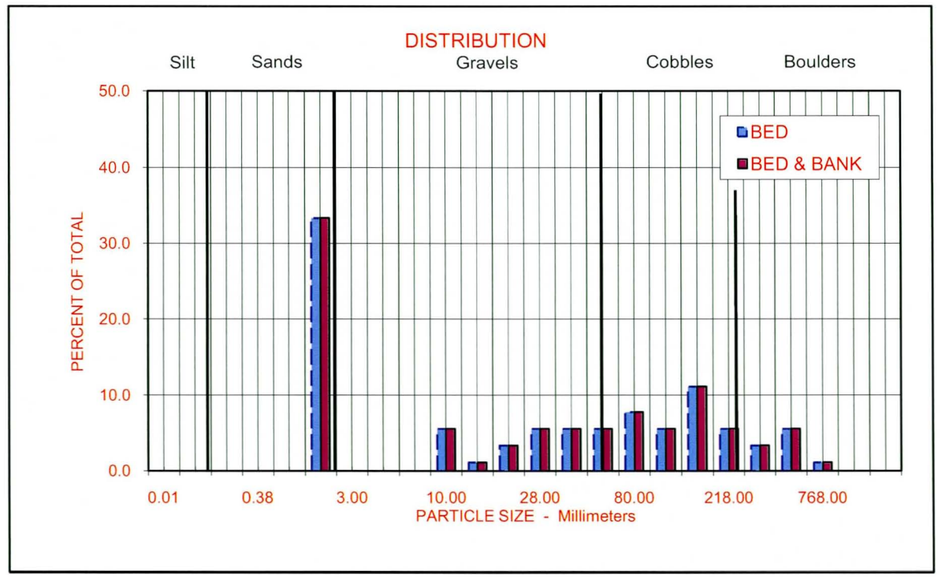
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	1.1	mm
d50:	N/A	mm	30.4	mm
d75:	N/A	mm	115.8	mm
d85:	N/A	mm	218.0	mm
			d90: 218.0	mm
			G: 16.2	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		30		30	33.3	33.3	33.3	33.3
Very Fine	3.00	2 - 4				0	0.0	33.3	0.0	33.3
Fine	5.00	4 - 5.7	G			0	0.0	33.3	0.0	33.3
Fine	7.00	5.7 - 8	R			0	0.0	33.3	0.0	33.3
Medium	10.00	8 - 11.3	A	5		5	5.6	38.9	5.6	38.9
Medium	14.00	11.3 - 16	V	1		1	1.1	40.0	1.1	40.0
Coarse	20.00	16 - 22.6	E	3		3	3.3	43.3	3.3	43.3
Coarse	28.00	22.6 - 32	L	5		5	5.6	48.9	5.6	48.9
Very Coarse	40.00	32 - 45	S	5		5	5.6	54.4	5.6	54.4
Very Coarse	56.00	45 - 64		5		5	5.6	60.0	5.6	60.0
Small	80.00	64 - 90	C	7		7	7.8	67.8	7.8	67.8
Small	109.00	90 - 128	O	5		5	5.6	73.3	5.6	73.3
Large	154.00	128 - 180	B	10		10	11.1	84.4	11.1	84.4
Large	218.00	180 - 256	L	5		5	5.6	90.0	5.6	90.0
Small	309.00	256 - 362	B	3		3	3.3	93.3	3.3	93.3
Small	438.00	362 - 512	L	5		5	5.6	98.9	5.6	98.9
Medium	768.00	512 - 1024	D	1		1	1.1	100.0	1.1	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	90		90	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

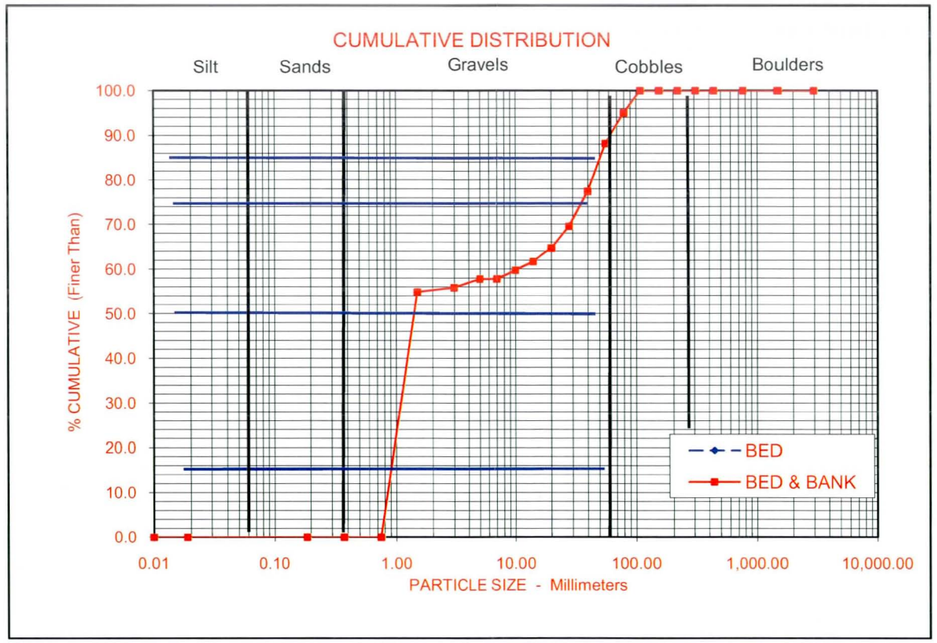
Watercourse Name: Cave Creek
Reach Name/Location: Reach 3
Date of Sampling: 8-Nov-06

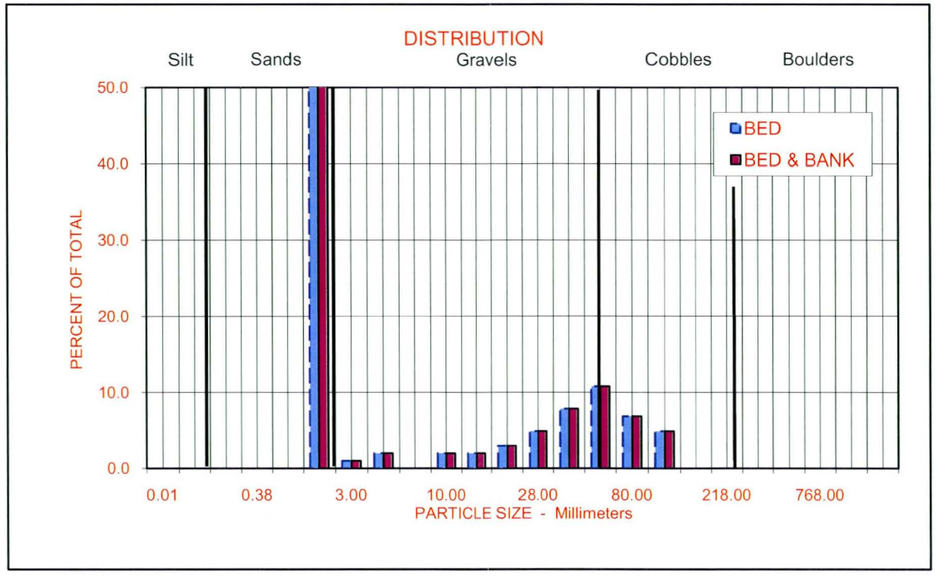
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	1.0	mm
d50:	N/A	mm	1.4	mm
d75:	N/A	mm	36.3	mm
d85:	N/A	mm	62.2	mm
G:			18.09	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		56		56	54.9	54.9	54.9	54.9
Very Fine	3.00	2 - 4		1		1	1.0	55.9	1.0	55.9
Fine	5.00	4 - 5.7	G	2		2	2.0	57.8	2.0	57.8
Fine	7.00	5.7 - 8	R			0	0.0	57.8	0.0	57.8
Medium	10.00	8 - 11.3	A	2		2	2.0	59.8	2.0	59.8
Medium	14.00	11.3 - 16	V	2		2	2.0	61.8	2.0	61.8
Coarse	20.00	16 - 22.6	E	3		3	2.9	64.7	2.9	64.7
Coarse	28.00	22.6 - 32	L	5		5	4.9	69.6	4.9	69.6
Very Coarse	40.00	32 - 45	S	8		8	7.8	77.5	7.8	77.5
Very Coarse	56.00	45 - 64		11		11	10.8	88.2	10.8	88.2
Small	80.00	64 - 90	C	7		7	6.9	95.1	6.9	95.1
Small	109.00	90 - 128	O	5		5	4.9	100.0	4.9	100.0
Large	154.00	128 - 180	B			0	0.0	100.0	0.0	100.0
Large	218.00	180 - 256	L			0	0.0	100.0	0.0	100.0
Small	309.00	256 - 362	B			0	0.0	100.0	0.0	100.0
Small	438.00	362 - 512	L			0	0.0	100.0	0.0	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	102		102	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

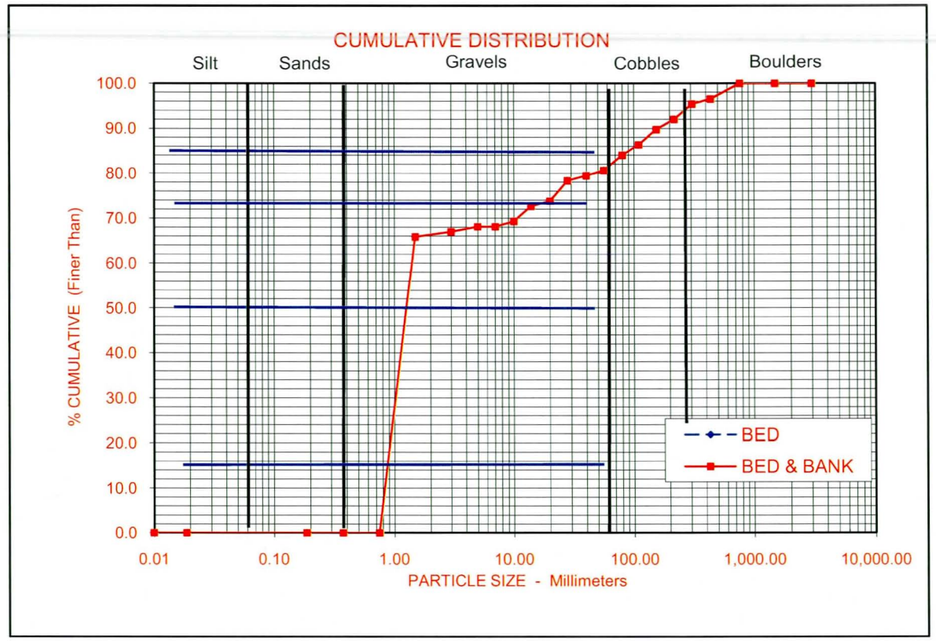
Watercourse Name: Cave Creek
Reach Name/Location: Reach 4
Date of Sampling: 8-Nov-06

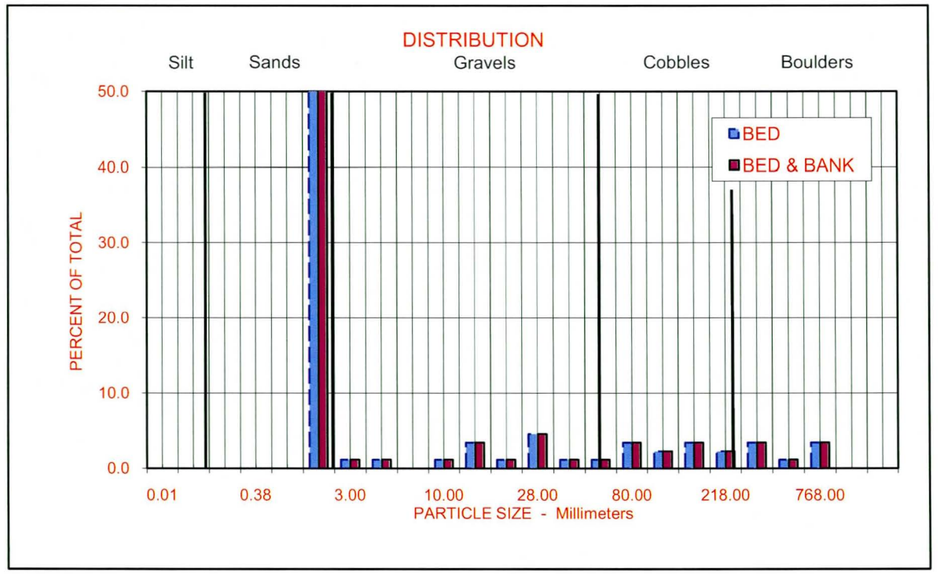
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.9	mm
d50:	N/A	mm	1.3	mm
d75:	N/A	mm	22.0	mm
d85:	N/A	mm	160.4	mm
G:			30.79	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		58		58	65.9	65.9	65.9	65.9
Very Fine	3.00	2 - 4		1		1	1.1	67.0	1.1	67.0
Fine	5.00	4 - 5.7	G	1		1	1.1	68.2	1.1	68.2
Fine	7.00	5.7 - 8	R			0	0.0	68.2	0.0	68.2
Medium	10.00	8 - 11.3	A	1		1	1.1	69.3	1.1	69.3
Medium	14.00	11.3 - 16	V	3		3	3.4	72.7	3.4	72.7
Coarse	20.00	16 - 22.6	E	1		1	1.1	73.9	1.1	73.9
Coarse	28.00	22.6 - 32	L	4		4	4.5	78.4	4.5	78.4
Very Coarse	40.00	32 - 45	S	1		1	1.1	79.5	1.1	79.5
Very Coarse	56.00	45 - 64		1		1	1.1	80.7	1.1	80.7
Small	80.00	64 - 90	C	3		3	3.4	84.1	3.4	84.1
Small	109.00	90 - 128	O	2		2	2.3	86.4	2.3	86.4
Large	154.00	128 - 180	B	3		3	3.4	89.8	3.4	89.8
Large	218.00	180 - 256	L	2		2	2.3	92.0	2.3	92.0
Small	309.00	256 - 362	B	3		3	3.4	95.5	3.4	95.5
Small	438.00	362 - 512	L	1		1	1.1	96.6	1.1	96.6
Medium	768.00	512 - 1024	D	3		3	3.4	100.0	3.4	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	88		88	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

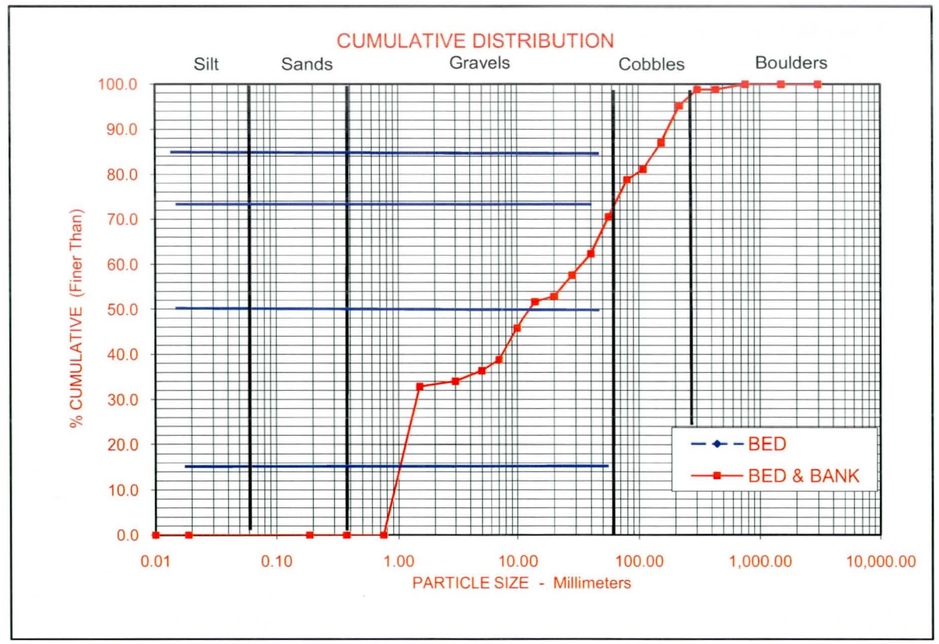
Watercourse Name: Cave Creek
Reach Name/Location: Reach 5
Date of Sampling: 8-Nov-06

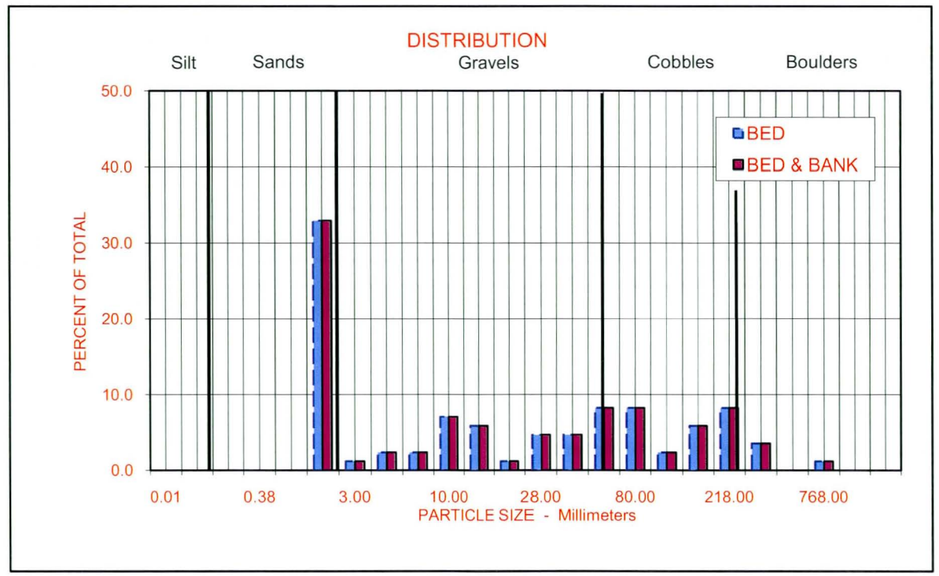
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	1.1	mm
d50:	N/A	mm	12.8	mm
d75:	N/A	mm	68.9	mm
d85:	N/A	mm	176.9	mm
			G: 10.85	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		28		28	32.9	32.9	32.9	32.9
Very Fine	3.00	2 - 4		1		1	1.2	34.1	1.2	34.1
Fine	5.00	4 - 5.7	G	2		2	2.4	36.5	2.4	36.5
Fine	7.00	5.7 - 8	R	2		2	2.4	38.8	2.4	38.8
Medium	10.00	8 - 11.3	A	6		6	7.1	45.9	7.1	45.9
Medium	14.00	11.3 - 16	V	5		5	5.9	51.8	5.9	51.8
Coarse	20.00	16 - 22.6	E	1		1	1.2	52.9	1.2	52.9
Coarse	28.00	22.6 - 32	L	4		4	4.7	57.6	4.7	57.6
Very Coarse	40.00	32 - 45	S	4		4	4.7	62.4	4.7	62.4
Very Coarse	56.00	45 - 64		7		7	8.2	70.6	8.2	70.6
Small	80.00	64 - 90	C	7		7	8.2	78.8	8.2	78.8
Small	109.00	90 - 128	O	2		2	2.4	81.2	2.4	81.2
Large	154.00	128 - 180	B	5		5	5.9	87.1	5.9	87.1
Large	218.00	180 - 256	L	7		7	8.2	95.3	8.2	95.3
Small	309.00	256 - 362	B	3		3	3.5	98.8	3.5	98.8
Small	438.00	362 - 512	L			0	0.0	98.8	0.0	98.8
Medium	768.00	512 - 1024	D	1		1	1.2	100.0	1.2	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	85		85	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

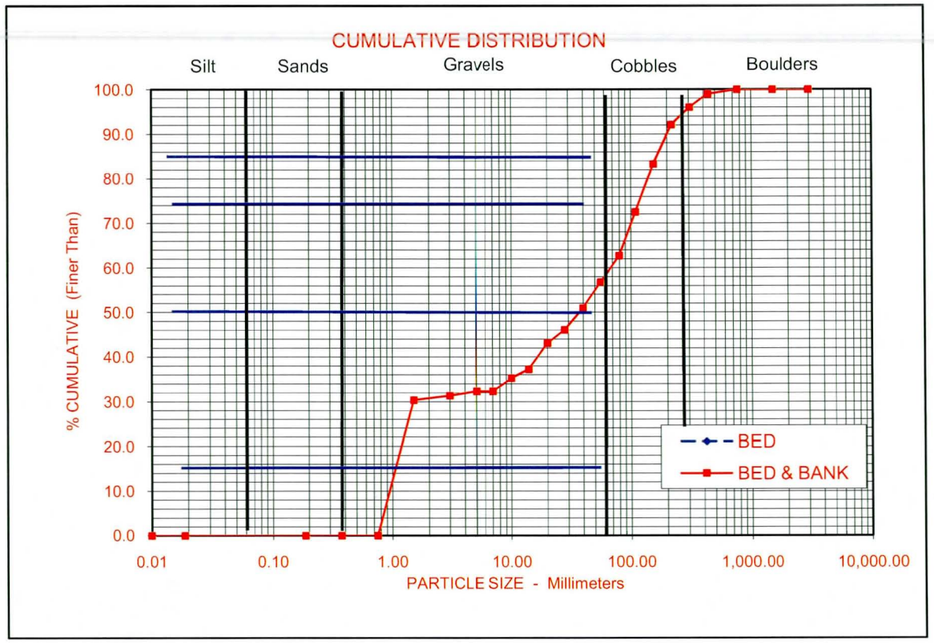
Watercourse Name: Cave Creek
Reach Name/Location: Reach 6
Date of Sampling: 9-Nov-06

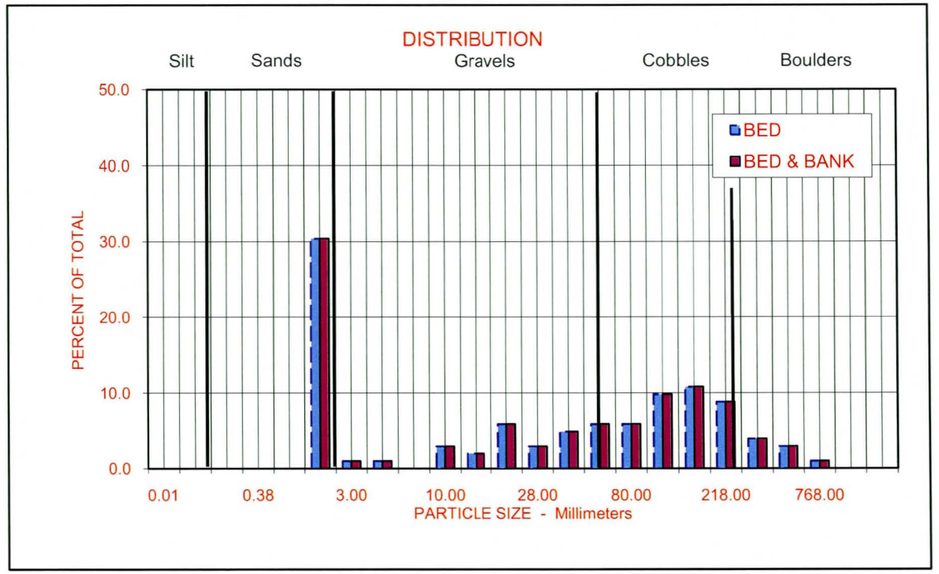
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	1.1	mm
d50:	N/A	mm	37.6	mm
d75:	N/A	mm	119.2	mm
d85:	N/A	mm	202.4	mm
d90:			202.4	mm
G:			18.53	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		31		31	30.4	30.4	30.4	30.4
Very Fine	3.00	2 - 4		1		1	1.0	31.4	1.0	31.4
Fine	5.00	4 - 5.7	G	1		1	1.0	32.4	1.0	32.4
Fine	7.00	5.7 - 8	R	0		0	0.0	32.4	0.0	32.4
Medium	10.00	8 - 11.3	A	3		3	2.9	35.3	2.9	35.3
Medium	14.00	11.3 - 16	V	2		2	2.0	37.3	2.0	37.3
Coarse	20.00	16 - 22.6	E	6		6	5.9	43.1	5.9	43.1
Coarse	28.00	22.6 - 32	L	3		3	2.9	46.1	2.9	46.1
Very Coarse	40.00	32 - 45	S	5		5	4.9	51.0	4.9	51.0
Very Coarse	56.00	45 - 64		6		6	5.9	56.9	5.9	56.9
Small	80.00	64 - 90	C	6		6	5.9	62.7	5.9	62.7
Small	109.00	90 - 128	O	10		10	9.8	72.5	9.8	72.5
Large	154.00	128 - 180	B	11		11	10.8	83.3	10.8	83.3
Large	218.00	180 - 256	L	9		9	8.8	92.2	8.8	92.2
Small	309.00	256 - 362	B	4		4	3.9	96.1	3.9	96.1
Small	438.00	362 - 512	L	3		3	2.9	99.0	2.9	99.0
Medium	768.00	512 - 1024	D	1		1	1.0	100.0	1.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R	0		0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	102		102	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

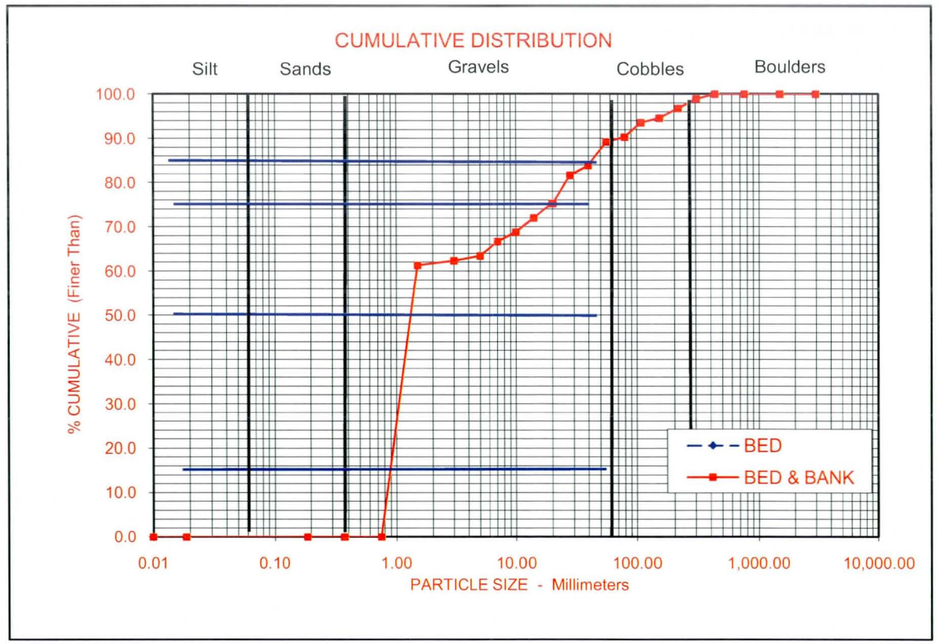
Printed: 10/16/2007

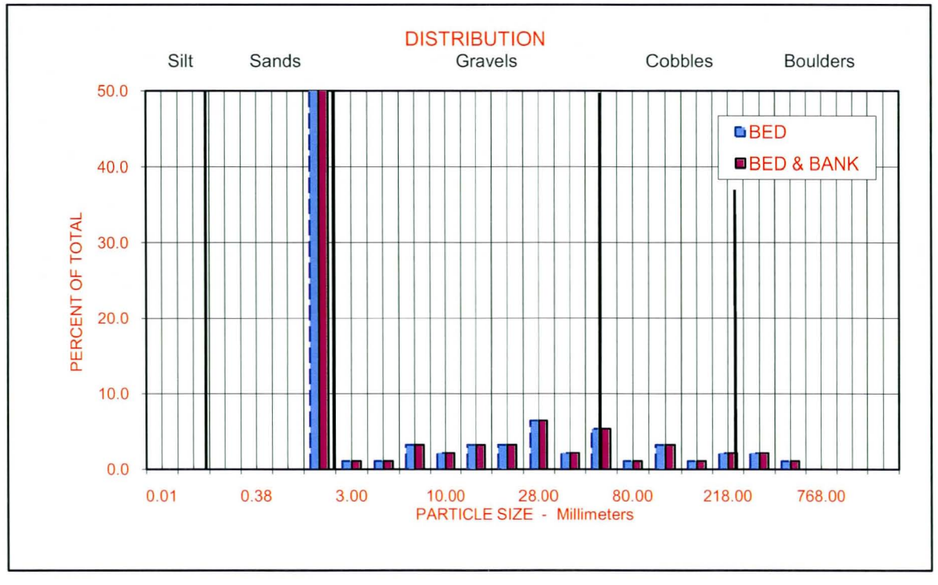
Watercourse Name: Cave Creek
Reach Name/Location: Reach 7
Date of Sampling: 9-Nov-06

Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.9	mm
d50:	N/A	mm	1.4	mm
d75:	N/A	mm	19.5	mm
d85:	N/A	mm	72.8	mm
			G: 15.55	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A			0	0.0	0.0	0.0	0.0
Medium	0.38	.25 - .50	N			0	0.0	0.0	0.0	0.0
Coarse	0.75	.50 - 1.0	D			0	0.0	0.0	0.0	0.0
Very Coarse	1.50	1.0 - 2		57		57	61.3	61.3	61.3	61.3
Very Fine	3.00	2 - 4		1		1	1.1	62.4	1.1	62.4
Fine	5.00	4 - 5.7	G	1		1	1.1	63.4	1.1	63.4
Fine	7.00	5.7 - 8	R	3		3	3.2	66.7	3.2	66.7
Medium	10.00	8 - 11.3	A	2		2	2.2	68.8	2.2	68.8
Medium	14.00	11.3 - 16	V	3		3	3.2	72.0	3.2	72.0
Coarse	20.00	16 - 22.6	E	3		3	3.2	75.3	3.2	75.3
Coarse	28.00	22.6 - 32	L	6		6	6.5	81.7	6.5	81.7
Very Coarse	40.00	32 - 45	S	2		2	2.2	83.9	2.2	83.9
Very Coarse	56.00	45 - 64		5		5	5.4	89.2	5.4	89.2
Small	80.00	64 - 90	C	1		1	1.1	90.3	1.1	90.3
Small	109.00	90 - 128	O	3		3	3.2	93.5	3.2	93.5
Large	154.00	128 - 180	B	1		1	1.1	94.6	1.1	94.6
Large	218.00	180 - 256	L	2		2	2.2	96.8	2.2	96.8
Small	309.00	256 - 362	B	2		2	2.2	98.9	2.2	98.9
Small	438.00	362 - 512	L	1		1	1.1	100.0	1.1	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	93		93	100.0		100.0	





Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.

BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

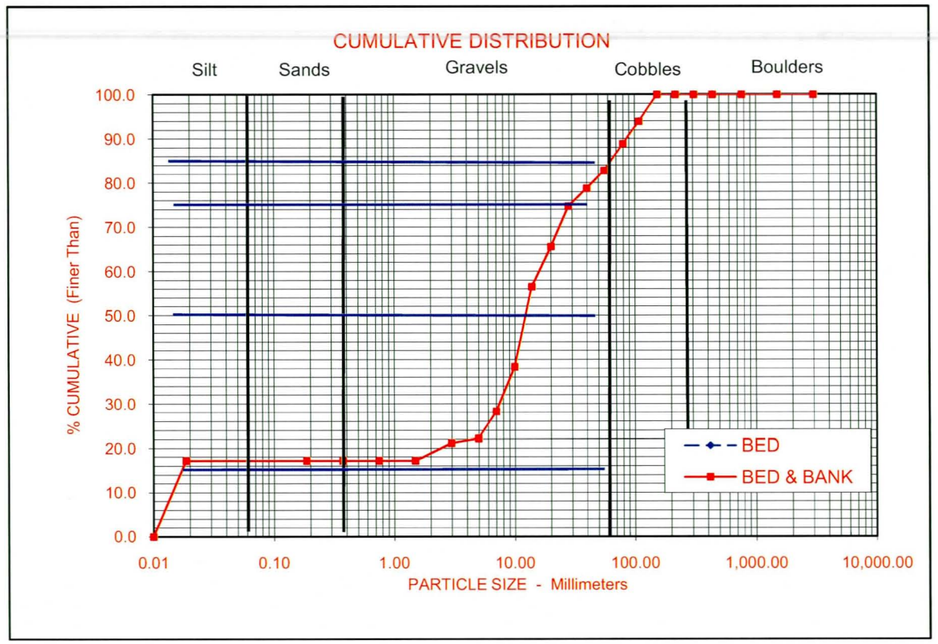
Watercourse Name: Galloway Wash
Reach Name/Location: Trib 2
Date of Sampling: 29-May-07

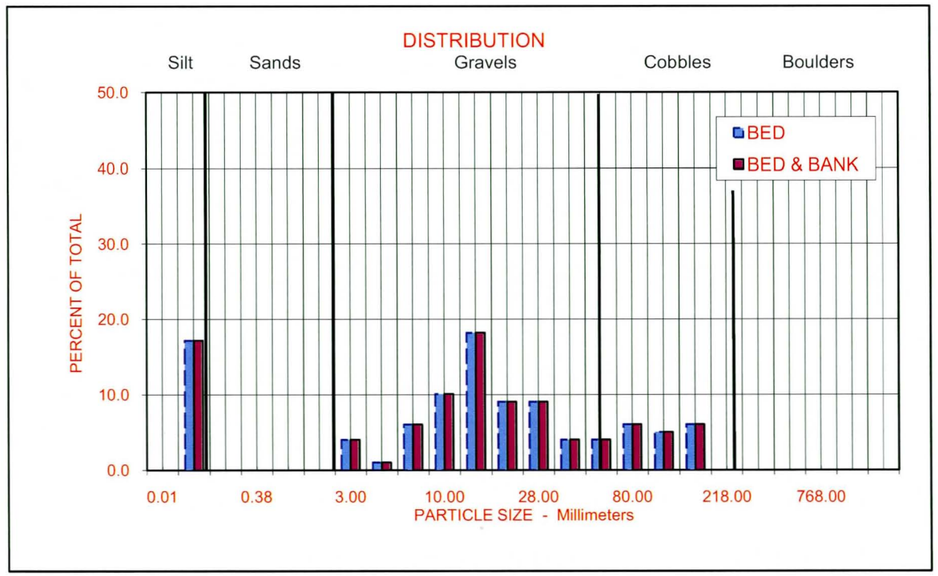
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.02	mm
d50:	N/A	mm	12.6	mm
d75:	N/A	mm	28.8	mm
d85:	N/A	mm	86.4	mm
			G: 358.23	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S	17		17	17.2	17.2	17.2	17.2
Fine	0.19	.125 - .25	A			0	0.0	17.2	0.0	17.2
Medium	0.38	.25 - .50	N			0	0.0	17.2	0.0	17.2
Coarse	0.75	.50 - 1.0	D			0	0.0	17.2	0.0	17.2
Very Coarse	1.50	1.0 - 2				0	0.0	17.2	0.0	17.2
Very Fine	3.00	2 - 4		4		4	4.0	21.2	4.0	21.2
Fine	5.00	4 - 5.7	G	1		1	1.0	22.2	1.0	22.2
Fine	7.00	5.7 - 8	R	6		6	6.1	28.3	6.1	28.3
Medium	10.00	8 - 11.3	A	10		10	10.1	38.4	10.1	38.4
Medium	14.00	11.3 - 16	V	18		18	18.2	56.6	18.2	56.6
Coarse	20.00	16 - 22.6	E	9		9	9.1	65.7	9.1	65.7
Coarse	28.00	22.6 - 32	L	9		9	9.1	74.7	9.1	74.7
Very Coarse	40.00	32 - 45	S	4		4	4.0	78.8	4.0	78.8
Very Coarse	56.00	45 - 64		4		4	4.0	82.8	4.0	82.8
Small	80.00	64 - 90	C	6		6	6.1	88.9	6.1	88.9
Small	109.00	90 - 128	O	5		5	5.1	93.9	5.1	93.9
Large	154.00	128 - 180	B	6		6	6.1	100.0	6.1	100.0
Large	218.00	180 - 256	L			0	0.0	100.0	0.0	100.0
Small	309.00	256 - 362	B			0	0.0	100.0	0.0	100.0
Small	438.00	362 - 512	L			0	0.0	100.0	0.0	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	99		99	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

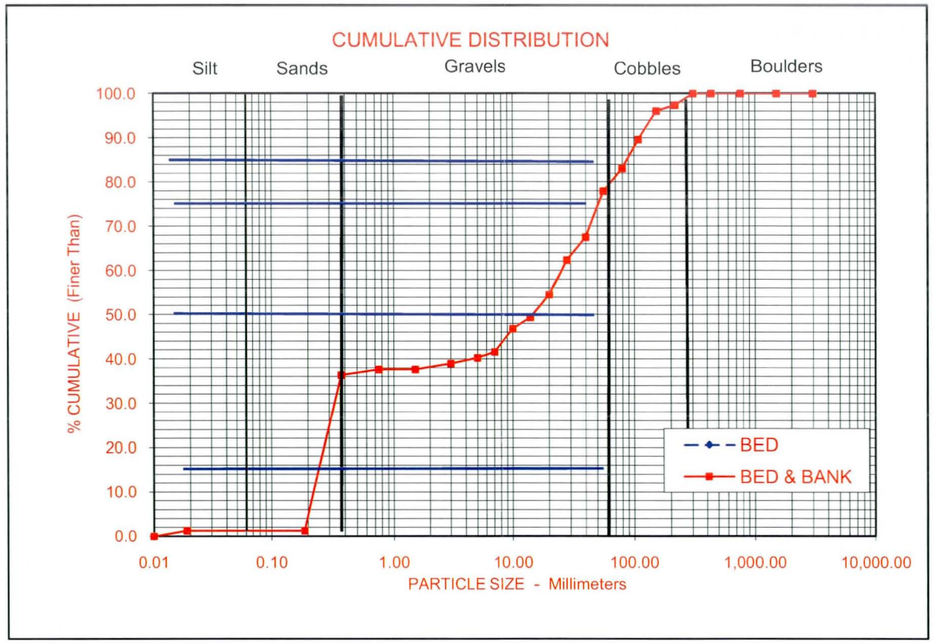
Printed: 10/16/2007

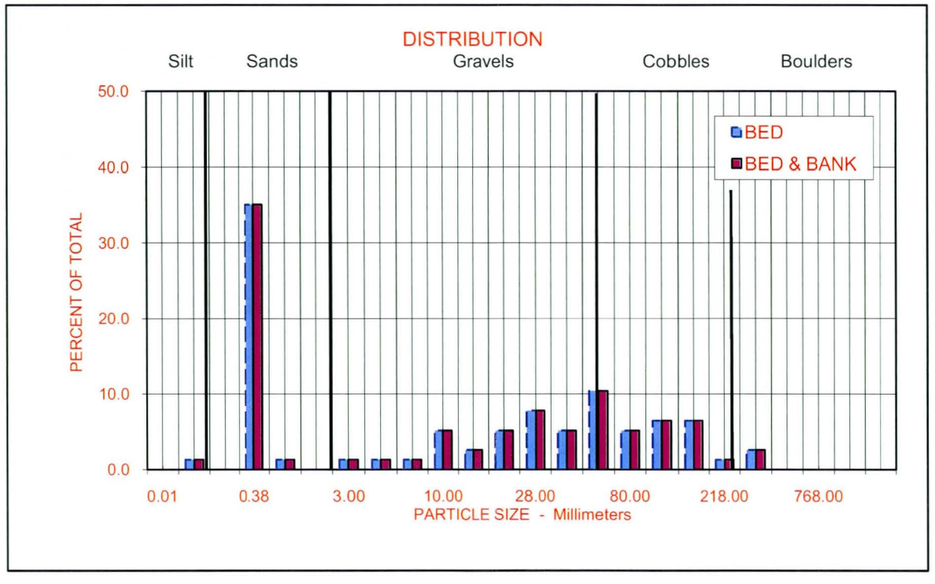
Watercourse Name: Cave Creek
Reach Name/Location: Trib 1 Sheet #1 (CC-t1.1)
Date of Sampling: 28-May-07

Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.3	mm
d50:	N/A	mm	14.8	mm
d75:	N/A	mm	51.5	mm
d85:	N/A	mm	111.7	mm
			G: 31.13	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S	1		1	1.3	1.3	1.3	1.3
Fine	0.19	.125 - .25	A			0	0.0	1.3	0.0	1.3
Medium	0.38	.25 - .50	N	27		27	35.1	36.4	35.1	36.4
Coarse	0.75	.50 - 1.0	D	1		1	1.3	37.7	1.3	37.7
Very Coarse	1.50	1.0 - 2				0	0.0	37.7	0.0	37.7
Very Fine	3.00	2 - 4		1		1	1.3	39.0	1.3	39.0
Fine	5.00	4 - 5.7	G	1		1	1.3	40.3	1.3	40.3
Fine	7.00	5.7 - 8	R	1		1	1.3	41.6	1.3	41.6
Medium	10.00	8 - 11.3	A	4		4	5.2	46.8	5.2	46.8
Medium	14.00	11.3 - 16	V	2		2	2.6	49.4	2.6	49.4
Coarse	20.00	16 - 22.6	E	4		4	5.2	54.5	5.2	54.5
Coarse	28.00	22.6 - 32	L	6		6	7.8	62.3	7.8	62.3
Very Coarse	40.00	32 - 45	S	4		4	5.2	67.5	5.2	67.5
Very Coarse	56.00	45 - 64		8		8	10.4	77.9	10.4	77.9
Small	80.00	64 - 90	C	4		4	5.2	83.1	5.2	83.1
Small	109.00	90 - 128	O	5		5	6.5	89.6	6.5	89.6
Large	154.00	128 - 180	B	5		5	6.5	96.1	6.5	96.1
Large	218.00	180 - 256	L	1		1	1.3	97.4	1.3	97.4
Small	309.00	256 - 362	B	2		2	2.6	100.0	2.6	100.0
Small	438.00	362 - 512	L			0	0.0	100.0	0.0	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	77		77	100.0		100.0	





Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.
4. Caliche samples = 25

BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

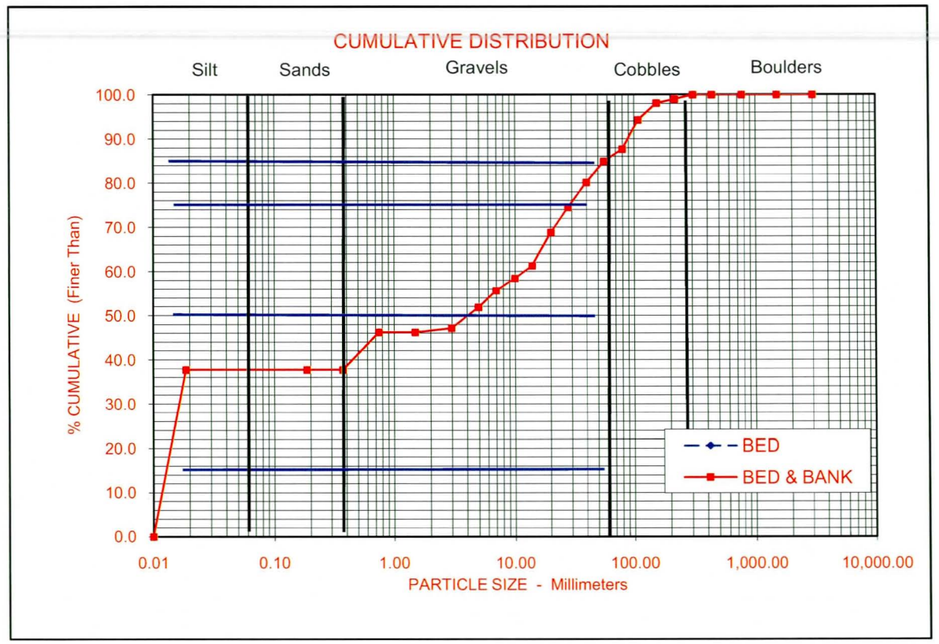
Watercourse Name: Cave Creek
Reach Name/Location: Trib #1 Sheet #2 (CC-T1.2)
Date of Sampling: 28-May-07

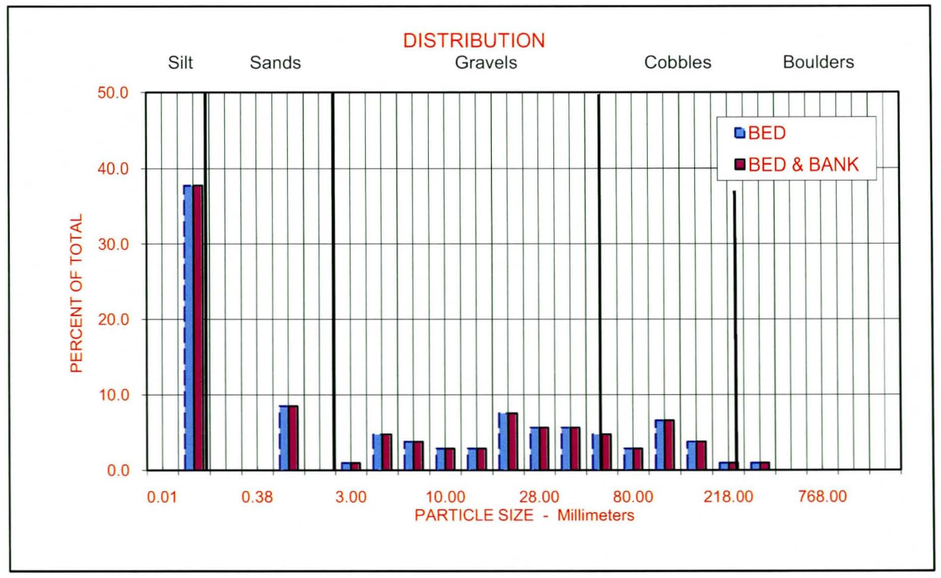
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.0	mm
d50:	N/A	mm	4.2	mm
d75:	N/A	mm	29.0	mm
d85:	N/A	mm	89.9	mm
			G: 162.11	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S	40		40	37.7	37.7	37.7	37.7
Fine	0.19	.125 - .25	A			0	0.0	37.7	0.0	37.7
Medium	0.38	.25 - .50	N			0	0.0	37.7	0.0	37.7
Coarse	0.75	.50 - 1.0	D	9		9	8.5	46.2	8.5	46.2
Very Coarse	1.50	1.0 - 2				0	0.0	46.2	0.0	46.2
Very Fine	3.00	2 - 4		1		1	0.9	47.2	0.9	47.2
Fine	5.00	4 - 5.7	G	5		5	4.7	51.9	4.7	51.9
Fine	7.00	5.7 - 8	R	4		4	3.8	55.7	3.8	55.7
Medium	10.00	8 - 11.3	A	3		3	2.8	58.5	2.8	58.5
Medium	14.00	11.3 - 16	V	3		3	2.8	61.3	2.8	61.3
Coarse	20.00	16 - 22.6	E	8		8	7.5	68.9	7.5	68.9
Coarse	28.00	22.6 - 32	L	6		6	5.7	74.5	5.7	74.5
Very Coarse	40.00	32 - 45	S	6		6	5.7	80.2	5.7	80.2
Very Coarse	56.00	45 - 64		5		5	4.7	84.9	4.7	84.9
Small	80.00	64 - 90	C	3		3	2.8	87.7	2.8	87.7
Small	109.00	90 - 128	O	7		7	6.6	94.3	6.6	94.3
Large	154.00	128 - 180	B	4		4	3.8	98.1	3.8	98.1
Large	218.00	180 - 256	L	1		1	0.9	99.1	0.9	99.1
Small	309.00	256 - 362	B	1		1	0.9	100.0	0.9	100.0
Small	438.00	362 - 512	L			0	0.0	100.0	0.0	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	106		106	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.





BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

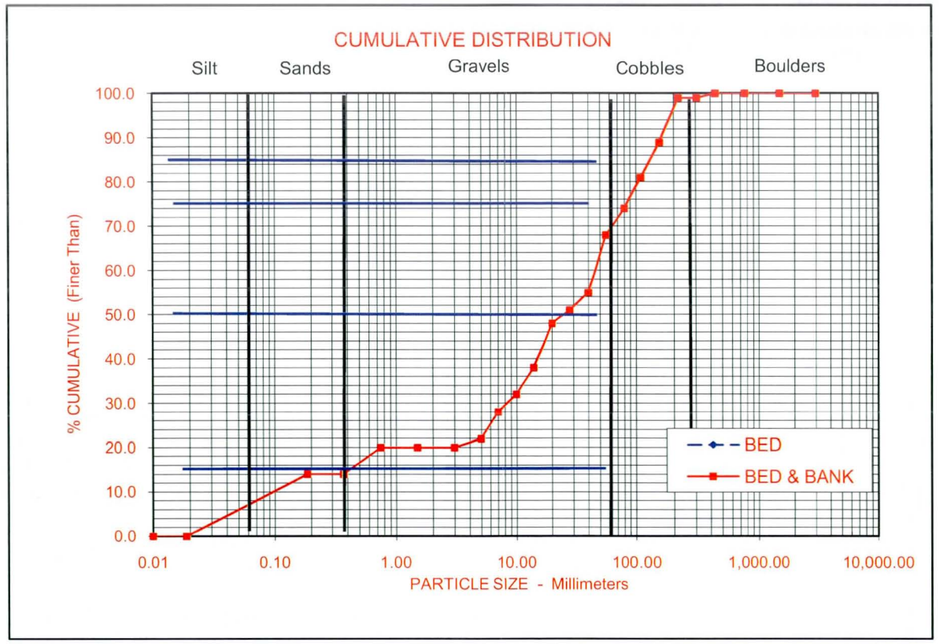
Watercourse Name: Cave Creek
Reach Name/Location: Trib #1A
Date of Sampling: 28-May-07

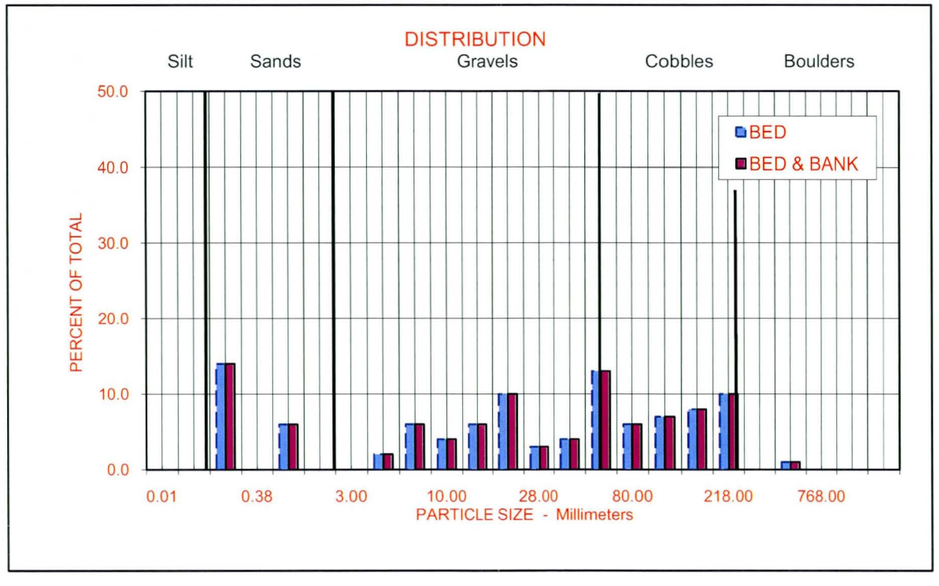
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.4	mm
d50:	N/A	mm	25.3	mm
d75:	N/A	mm	84.1	mm
d85:	N/A	mm	160.4	mm
			G: 31.44	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S			0	0.0	0.0	0.0	0.0
Fine	0.19	.125 - .25	A	14		14	14.0	14.0	14.0	14.0
Medium	0.38	.25 - .50	N			0	0.0	14.0	0.0	14.0
Coarse	0.75	.50 - 1.0	D	6		6	6.0	20.0	6.0	20.0
Very Coarse	1.50	1.0 - 2				0	0.0	20.0	0.0	20.0
Very Fine	3.00	2 - 4				0	0.0	20.0	0.0	20.0
Fine	5.00	4 - 5.7	G	2		2	2.0	22.0	2.0	22.0
Fine	7.00	5.7 - 8	R	6		6	6.0	28.0	6.0	28.0
Medium	10.00	8 - 11.3	A	4		4	4.0	32.0	4.0	32.0
Medium	14.00	11.3 - 16	V	6		6	6.0	38.0	6.0	38.0
Coarse	20.00	16 - 22.6	E	10		10	10.0	48.0	10.0	48.0
Coarse	28.00	22.6 - 32	L	3		3	3.0	51.0	3.0	51.0
Very Coarse	40.00	32 - 45	S	4		4	4.0	55.0	4.0	55.0
Very Coarse	56.00	45 - 64		13		13	13.0	68.0	13.0	68.0
Small	80.00	64 - 90	C	6		6	6.0	74.0	6.0	74.0
Small	109.00	90 - 128	O	7		7	7.0	81.0	7.0	81.0
Large	154.00	128 - 180	B	8		8	8.0	89.0	8.0	89.0
Large	218.00	180 - 256	L	10		10	10.0	99.0	10.0	99.0
Small	309.00	256 - 362	B			0	0.0	99.0	0.0	99.0
Small	438.00	362 - 512	L	1		1	1.0	100.0	1.0	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	100		100	100.0		100.0	

Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.
4. Caliche samples = 1





BED MATERIAL ANALYSIS FORM

Printed: 10/16/2007

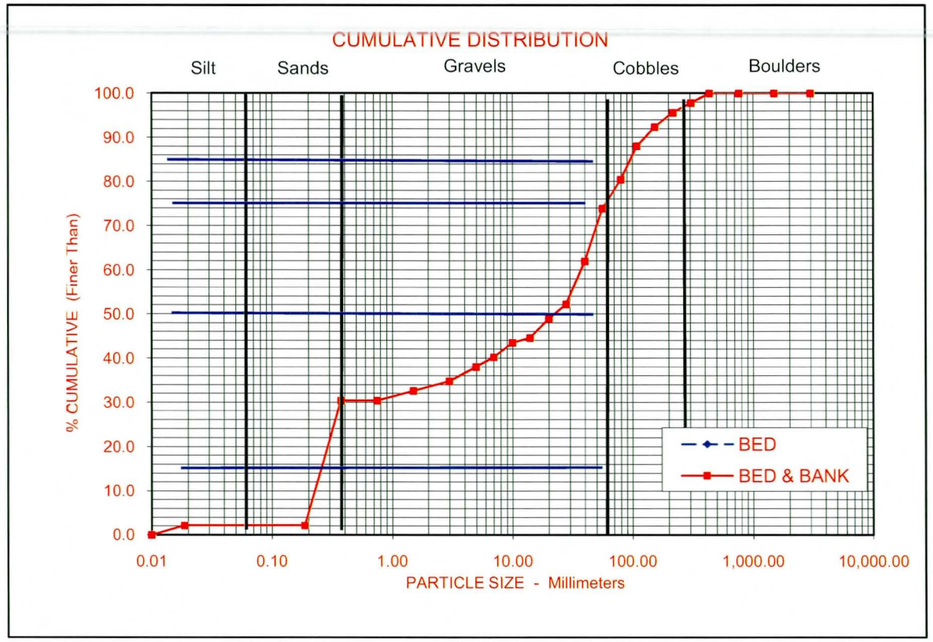
Watercourse Name: Cave Creek
Reach Name/Location: Trib #1D
Date of Sampling: 28-May-07

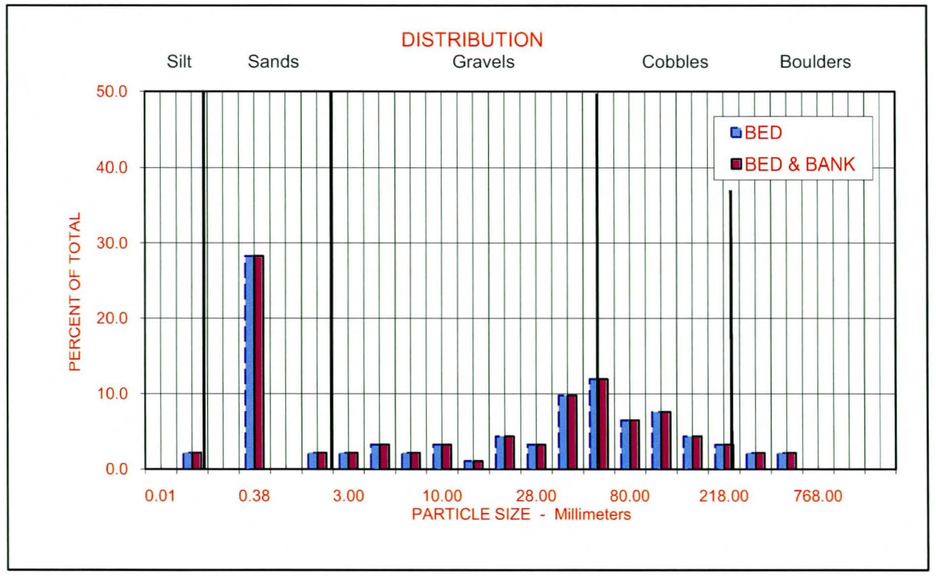
Data type: Sampled
(estimated / sampled)

	BED		BED & BANK	
d15:	N/A	mm	0.3	mm
d50:	N/A	mm	22.7	mm
d75:	N/A	mm	60.0	mm
d85:	N/A	mm	129.3	mm
			G: 43.64	

	Median	Range (mm)		BED	BANK	TOTAL #	BED ITEM %	BED % CUM	BED & BANK ITEM %	BED & BANK % CUM
Silt/Clay	0.01	<.062	S/C			0	0.0	0.0	0.0	0.0
Very Fine	0.02	.062 - .125	S	2		2	2.2	2.2	2.2	2.2
Fine	0.19	.125 - .25	A			0	0.0	2.2	0.0	2.2
Medium	0.38	.25 - .50	N	26		26	28.3	30.4	28.3	30.4
Coarse	0.75	.50 - 1.0	D			0	0.0	30.4	0.0	30.4
Very Coarse	1.50	1.0 - 2		2		2	2.2	32.6	2.2	32.6
Very Fine	3.00	2 - 4		2		2	2.2	34.8	2.2	34.8
Fine	5.00	4 - 5.7	G	3		3	3.3	38.0	3.3	38.0
Fine	7.00	5.7 - 8	R	2		2	2.2	40.2	2.2	40.2
Medium	10.00	8 - 11.3	A	3		3	3.3	43.5	3.3	43.5
Medium	14.00	11.3 - 16	V	1		1	1.1	44.6	1.1	44.6
Coarse	20.00	16 - 22.6	E	4		4	4.3	48.9	4.3	48.9
Coarse	28.00	22.6 - 32	L	3		3	3.3	52.2	3.3	52.2
Very Coarse	40.00	32 - 45	S	9		9	9.8	62.0	9.8	62.0
Very Coarse	56.00	45 - 64		11		11	12.0	73.9	12.0	73.9
Small	80.00	64 - 90	C	6		6	6.5	80.4	6.5	80.4
Small	109.00	90 - 128	O	7		7	7.6	88.0	7.6	88.0
Large	154.00	128 - 180	B	4		4	4.3	92.4	4.3	92.4
Large	218.00	180 - 256	L	3		3	3.3	95.7	3.3	95.7
Small	309.00	256 - 362	B	2		2	2.2	97.8	2.2	97.8
Small	438.00	362 - 512	L	2		2	2.2	100.0	2.2	100.0
Medium	768.00	512 - 1024	D			0	0.0	100.0	0.0	100.0
Lrg-Vry Lrg.	1500.00	1024 - 2048	R			0	0.0	100.0	0.0	100.0
BEDROCK	3000.00					0	0.0	100.0	0.0	100.0
			TOTALS	92		92	100.0		100.0	

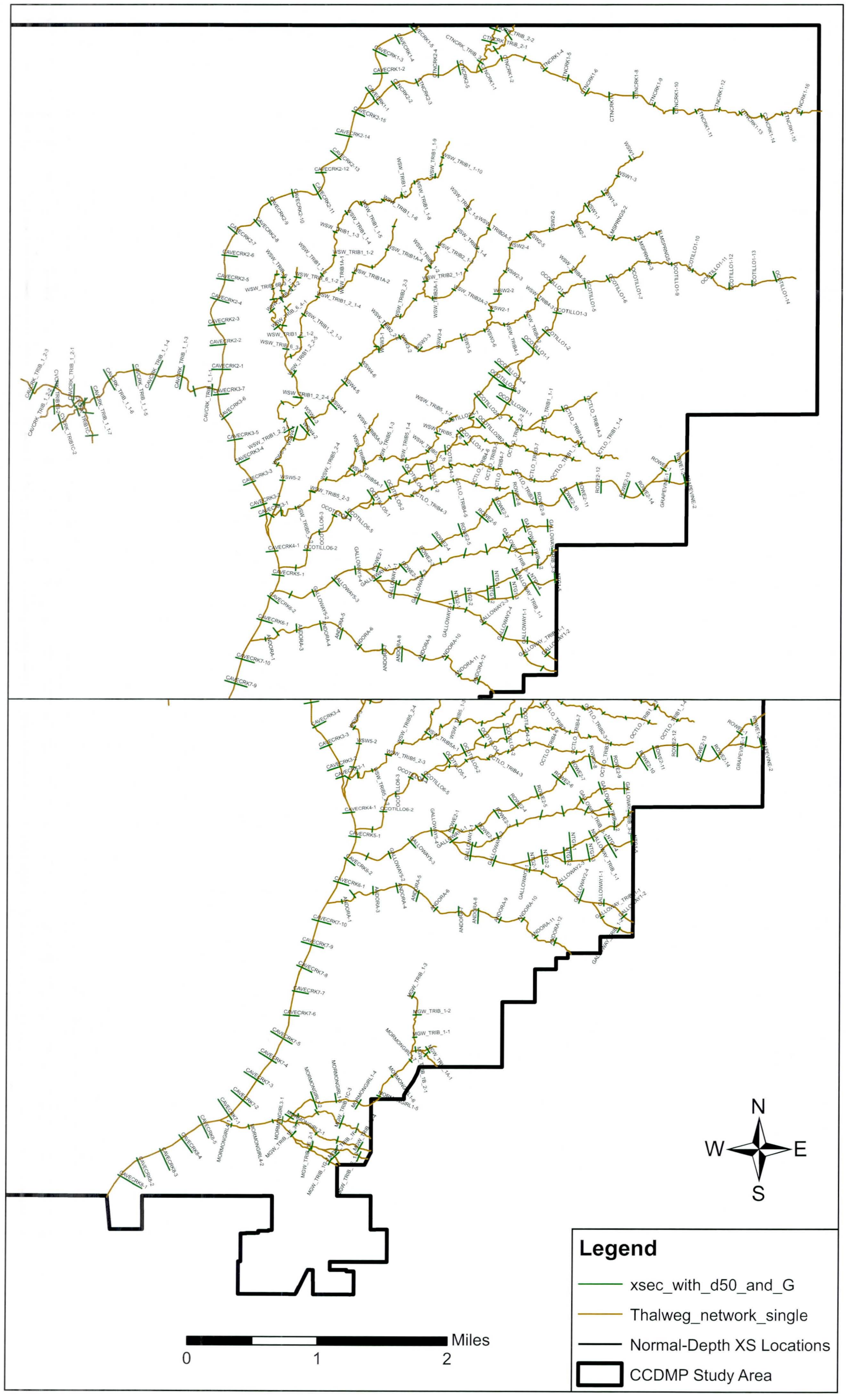
Notes:
1. Samples collected with Wolman Pebble Count technique.
2. Samples collected by Dave M., Brian S. and Mike K.
3. Samples include both bed and bank material.
4. Caliche samples = 9





Appendix C

Equilibrium Slope Analysis


N
W
E
S
Legend
xsec_with_d50_and_G
Thalweg_network_single
Normal-Depth XS Locations
CCDMP Study Area
0
1
2
Miles

Reach	River	Cutline ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D_{50} (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Wetted Perimeter (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	Erosion Trend
U/S Limit	MGW_TRIB_1C	4	76	0.045	0.0198	1100.4	63.8	28.3	64.8	2.7	0.4	2.7	0.4	63.8	2	4.16	0.2				69.9	31.3	71.0	2.4	0.4								
	MGW_TRIB_1C	3	76	0.045	0.0186	995.5	35.4	23.0	36.9	3.3	0.7				2	4.16					36.1	24.3	37.6	3.1	0.7								
	MGW_TRIB_1C	2	76	0.045	0.0237	1059.8	28.2	19.3	28.5	3.9	0.7				2	4.16					38.8	24.7	39.1	3.1	0.6								
1	MGW_TRIB_1C	1	76	0.045	0.0162	642.4	30.2	22.6	31.6	3.4	0.7	3.3	0.6	39.4	2	4.16	0.3	0.2		0.2	30.3	22.7	31.7	3.4	0.7	3.0	0.6	43.8	0.1903098	0.01602445	0.01996	0.003935547	Moderate Erosion
2	MGW_TRIB_1A	1	223	0.045	0.0566	697.9	41.5	33.0	41.7	6.7	0.8	6.7	0.8	41.5	6.1	6.35	3.4	3.4		3.4	41.5	33.0	41.7	6.7	0.8	6.7	0.8	41.5	3.4222606	0.05660977	0.0566	-9.76562E-06	Stable
3	MGW_TRIB_1B_1	1	89	0.045	0.0599	950.0	13.7	12.2	14.2	7.3	0.9	7.3	0.9	13.7	6.1	6.35	1.6	1.6		1.6	13.7	12.2	14.2	7.3	0.9	7.3	0.9	13.7	1.5541642	0.05990977	0.0599	-9.76562E-06	Stable
4	MGW_TRIB_1B_2	1	312	0.045	0.0543	399.5	149.2	68.2	149.6	4.6	0.5	4.6	0.5	149.2	6.1	6.35	2.7	1.6	3.4	5.0	135.5	58.2	135.9	5.4	0.4	5.4	0.4	135.5	4.9748039	0.08118477	0.0543	-0.026884766	High Deposition
U/S Limit	MGW_TRIB_1	3	408	0.045	0.0285	605.5	179.0	104.5	179.2	3.9	0.6	3.9	0.6	179.0	6.1	6.35	1.5				184.5	118.7	184.6	3.4	0.6								
	MGW_TRIB_1	2	408	0.045	0.0134	936.7	77.0	94.0	78.0	4.3	1.2				6.1	6.35					73.4	82.5	74.4	4.9	1.1								
5	MGW_TRIB_1	1	408	0.045	0.0211	1153.1	56.3	72.2	56.6	5.7	1.3	4.6	1.0	104.1	6.1	6.35	1.6	1.5		1.5	61.2	76.5	61.5	5.3	1.2	4.6	1.0	106.4	1.5222034	0.01941617	0.02009	0.000673828	Stable
	MORMONGIRL1	7	676	0.045	0.0217	872.3	79.4	111.2	79.8	6.1	1.4				2	4.16					81.8	138.6	82.4	4.9	1.7								
	MORMONGIRL1	6	676	0.045	0.025	1000.0	57.2	93.5	57.7	7.2	1.6				2	4.16					61.6	123.9	62.1	5.5	2.0								
	MORMONGIRL1	5	676	0.045	0.0155	1008.1	115.6	143.3	117.2	4.7	1.2				2	4.16					123.0	163.7	124.7	4.1	1.3								
	MORMONGIRL1	4	1827	0.045	0.0206	1000.0	208.8	302.1	210.5	6.0	1.4				2	4.16					210.2	367.6	212.3	5.0	1.7								
	MORMONGIRL1	3	1827	0.045	0.0156	949.5	259.0	357.7	260.6	5.1	1.4				2	4.16					266.8	403.9	268.5	4.5	1.5								
	MORMONGIRL1	2	1827	0.045	0.0134	1000.5	337.7	415.8	338.8	4.4	1.2				2	4.16					339.4	444.1	340.5	4.1	1.3								
6	MORMONGIRL1	1	1827	0.045	0.0114	587.8	215.8	366.6	219.0	5.0	1.7	5.5	1.4	181.9	2	4.16	8.5	1.6	2.7	4.3	215.8	372.3	219.0	4.9	1.7	4.7	1.6	185.5	4.274981	0.01083039	0.01793	0.007099609	High Erosion
7	MORMONGIRL2	1	2012.85	0.045	0.0142	316.4	247.3	382.9	248.9	5.3	1.5	5.3	1.5	247.3	2	4.16	9.3	8.5	0.3	8.8	248.6	387.8	250.2	5.2	1.6	5.2	1.6	248.6	8.8042149	0.01370195	0.0142	0.000498047	Stable
U/S Limit	MGW_TRIB_1D	4	110	0.045	0.0183	976.0	113.2	45.4	114.3	2.4	0.4	2.4	0.4	113.2	2	4.16	0.2				115.7	47.5	116.8	2.3	0.4								
	MGW_TRIB_1D	3	110	0.045	0.0241	970.5	98.0	39.4	98.2	2.8	0.4				2	4.16					101.6	44.9	101.9	2.4	0.4								
	MGW_TRIB_1D	2	110	0.045	0.0243	1000.4	68.8	34.3	70.2	3.2	0.5				2	4.16					68.8	38.8	70.4	2.8	0.6								
8	MGW_TRIB_1D	1	110	0.045	0.0215	919.5	64.0	34.4	64.4	3.2	0.5	2.9	0.5	86.0	2	4.16	0.4	0.2		0.2	77.9	40.5	78.4	2.7	0.5	2.6	0.5	91.0	0.2236805	0.01627898	0.02207	0.005791016	High Erosion
9	MORMONGIRL3	1	2056	0.045	0.0149	529.9	130.1	296.2	131.6	6.9	2.3	6.9	2.3	130.1	2	4.16	14.4	0.4	9.3	9.6	150.5	336.8	152.0	6.1	2.2	6.1	2.2	150.5	9.635031	0.01176523	0.0149	0.003134766	Moderate Erosion
10	MGW_TRIB_1F	1	55.5	0.045	0.0184	972.8	54.5	22.4	54.8	2.5	0.4	2.5	0.4	54.5	2	4.16	0.1	0.1		0.1	54.6	22.4	54.8	2.5	0.4	2.5	0.4	54.6	0.1175271	0.01839023	0.0184	9.76562E-06	Stable
U/S Limit	MGW_TRIB_1E_1	2	55.5	0.045	0.0157	885.8	43.7	21.5	43.9	2.6	0.5	2.6	0.5	43.7	2	4.16	0.1				43.6	21.2	43.7	2.6	0.5								
11	MGW_TRIB_1E_1	1	55.5	0.045	0.0208	1111.5	55.0	21.7	55.3	2.6	0.4	2.6	0.4	49.4	2	4.16	0.1	0.1		0.1	57.6	23.7	57.8	2.3	0.4	2.5	0.4	50.6	0.1067077	0.0163818	0.01854	0.002158203	Moderate Erosion
12	MGW_TRIB_1E_2	1	101	0.045	0.0232	1215.1	116.9	40.7	118.2	2.5	0.3	2.5	0.3	116.9	2	4.16	0.3	0.1	0.1	0.2	120.1	42.0	121.4	2.4	0.3	2.4	0.3	120.1	0.2399846	0.02172539	0.0232	0.001474609	Stable
U/S Limit	MGW_TRIB_1G	2	87	0.045	0.019	823.6	125.5	40.5	125.7	2.1	0.3	2.1	0.3	125.5	2	4.16	0.2				131.6	43.9	131.9	2.0	0.3								
13	MGW_TRIB_1G	1	87	0.045	0.0206	1313.5	59.9	29.4	60.0	3.0	0.5	2.6	0.4	92.7	2	4.16	0.2	0.2		0.2	63.5	32.8	63.7	2.7	0.5	2.3	0.4	97.6	0.1568983	0.01555617	0.01998	0.004423828	Moderate Erosion
14	MGW_TRIB_1E_3	1	188	0.045	0.0217	1099.8	43.2	40.4	43.4	4.7	0.9	4.7	0.9	43.2	2	4.16	1.1	0.2	0.3	0.5	46.3	49.1	46.6	3.8	1.1	3.8	1.1	46.3	0.4948084	0.01245195	0.0217	0.009248047	High Erosion
	MORMONGIRL4	3	2573	0.045	0.0166	607.8	117.1	313.6	117.6	8.2	2.7				2	4.16					113.7	285.4	114.2	9.0	2.5								
	MORMONGIRL4	2	2573	0.045	0.0165	866.1	178.1	373.8	181.5	6.9	2.1				2	4.16					174.6	340.7	177.9	7.6	2.0								
15	MORMONGIRL4	1	2573	0.045	0.017	875.6	53.0	230.4	55.4	11.2	4.3	8.8	3.0	116.1	37.6	18.53	10.5	1.1	14.4	15.6	51.2	210.5	53.4	12.2	4.1	9.6	2.9	113.2	15.552801	0.02185648	0.01671	-0.005146484	High Deposition
16	GALLOWAY_TRIB_2B	1	35	0.045	0.0387	932.8	12.9	7.7	13.2	4.6	0.6	4.6	0.6	12.9	12.6	358.23	0.8	0.8		0.8	12.9	7.7	13.2	4.6	0.6	4.6	0.6	12.9	0.8389022	0.03869023	0.0387	9.76562E-06	Stable
17	GALLOWAY_TRIB_2A_1	1	43	0.045	0.0485	919.9	17.9	9.2	18.0	4.7	0.5	4.7	0.5	17.9	12.6	358.23	1.3	1.3		1.3	17.9	9.2	18.0	4.7	0.5	4.7	0.5	17.9	1.3435665	0.04849023	0.0485	9.76562E-06	Stable
18	GALLOWAY_TRIB_2A_2	1	76	0.045	0.0297	749.6	39.0	20.5	39.1	3.7	0.5	3.7	0.5	39.0	12.6	358.23	1.1	1.3	0.8	2.2	37.1	17.4	37.2	4.4	0.5	4.4	0.5	37.1	2.1830815	0.04826445	0.0297	-0.018564453	High Deposition
U/S Limit	GALLOWAY_TRIB_3	3	91	0.045	0.0316	658.8	20.2	17.3	20.5	5.3	0.9	5.3	0.9	20.2	12.6	358.23	2.2				19.9	16.8	20.2	5.4	0.8								
	GALLOWAY_TRIB_3	2	91	0.045	0.042	1002.3	28.2	18.1	28.4	5.0	0.6				12.6	358.23					28.8	19.4	29.0	4.7	0.7								
19	GALLOWAY_TRIB_3	1	91	0.045	0.0311	958.3	43.5	23.5	43.7	3.9	0.5	4.7	0.7	30.6	12.6	358.23	2.2	2.2		2.2	42.5	22.6	42.6	4.0	0.5	4.7	0.7	30.4	2.1972604	0.03433555	0.0354	0.001064453	Stable
	GALLOWAY_TRIB_2	5	266	0.045	0.027	1060.9	52.7	50.6	53.3	5.3	1.0				12.6	358.23					53.8	58.9	54.4	4.5	1.1								
	GALLOWAY_TRIB_2	4	266	0.045	0.0251	1002.4	46.2	49.0	46.5	5.4	1.1				12.6	358.23					48.4	56.3	48.8	4.7	1.2								
	GALLOWAY_TRIB_2	3	266	0.045	0.0186	1006.2	68.1	62.6	68.5	4.3	0.9				12.6	358.23					70.0	65.2	70.3	4.1	0.9								
	GALLOWAY_TRIB_2	2	266	0.045	0.0199	1031.1	46.8	52.8	47.1	5.0	1.1				12.6	358.23					47.6	55.9	47.9	4.8	1.2								
20	GALLOWAY_TRIB_2	1	266	0.045	0.0221	1473.5	22.7	39.3	24.4	6.8	1.7	5.3	1.2	47.3	12.6	358.23	5.0	2.2	1.1	3.3	23.0	43.1	24.9	6.2	1.9	4.9	1.2	48.6	3.315153	0.01677805	0.02253	0.005751953	High Erosion
U/S Limit	NGALLOWAY_TRIB_1	3	57.75	0.045	0.0292	645.9	91.1	24.5	91.2	2.4	0.3	2.4	0.3	91.1	4.6	3.25	0.1				91.3	27.2	91.4	2.1	0.3								
	NGALLOWAY_TRIB_1	2	57.75	0.045	0.0305	949.2	63.7	21.0	63.8	2.8	0.3				4.6	3.25					64.1	23.6	64.2	2.4	0.4								
21	NGALLOWAY_TRIB_1	1	57.75	0.045	0.0221	2399.1	26.4	16.3	26.7	3.5	0.6	2.9	0.4	60.4	4.6	3.25	0.1	0.1		0.1	26.7	16.7	27.0	3.5	0.6	2.7	0.4	60.7	0.0970475	0.02067945	0.02524	0.004560547	Moderate Erosion
U/S Limit	NTG1	5	2614.5	0.045	0.027	575.3	173.3	320.1	174.0	8.2	1.8	8.2	1.8	173.3	4.6	3.25	22.3				171.5	305.6	172.2	8.6	1.8								
	NTG1	4	2614.5	0.045	0.0304	1000.0	293.2	380.9	293.7	6.9	1.3				4.6	3.25					291.9	377.8	292.5	6.9	1.3								
	NTG1	3	2614.5	0.045	0.0245	1000.0	266.9	391.7	268.1	6.7	1.5				4.6	3.25					254.4	357.8	255.5	7.3	1.4								
	NTG1	2	2614.5	0.045	0.0215	832.9	399.7	478.5	400.8	5.5	1.2				4.6	3.25					320.2	392.2	321.3	6.7	1.2								
22	NTG1	1	2614.5	0.045	0.0171	332.9	453.0	539.4	455.5	4.8	1.2	6.4	1.4	317.2	4.6	3.25	15.5	22.3		22.3	348.3	406.0	350.3	6.4	1.2	7.2	1.4	277.2	22.269909	0.03106773	0.02514	-0.005927734	Moderate Deposition
	NTG2	2	2614.5	0.045	0.0381	605.1	292.9	356.3	294.6	7.3	1.2				4.6	3.25					316.3	410.6	318.0	6.4	1.3								
23	NTG2	1	2614.5	0.045	0.0125	1048.0	349.0	533.9	351.0	4.9	1.5	6.1	1.4	321.0	4.6	3.25	12.9	15.5	0.1	15.6	300.3	402.3	302.1	6.5	1.3	6.4	1.3	308.3	15.615843	0.02629383	0.02187	-0.004423828	Moderate Deposition
U/S Limit	GALLOWAY1	2	1204	0.045	0.022	940.2	69.3	149.0	70.6	8.1	2.1	8.1	2.1	69.3	1.9	3.02	13.5				68.8	145.9	70.0	8.3	2.1								
24	GALLOWAY1	1	1204	0.045	0.0187	980.8	146.0	209.6	146.7	5.7	1.4	6.9	1.8	107.7	1.9	3.02	11.3	13.5		13.5	145.2	195.7	145.8	6.2	1.3	7.2	1.7	107.0	13.495695	0.02331805	0.02032	-0.002998047	Moderate Deposition
U/S Limit	GALLOWAY_TRIB_1	2	645.75	0.045	0.0159	1024.7	75.3	116.7	76.5	5.5	1.5	5.5	1.5	75.3	1.9	3.02	3.1				76.5	125.2	77.7	5.2	1.6								
25	GALLOWAY_TRIB_1	1	645.75	0.045	0.0255	1186.8	29.8	70.8	31.2	9.1	2.4	7.3	2.0	52.5	1.9	3.02	6.9	3.1		3.1	34.5	92.3	36.2	7.0	2.7	6.1	2.2	55.5	3.1470996	0.01283711	0.02105	0.008212891	High Erosion
	GALLOWAY2	4	1921.5	0.045	0.0278	1019.2	368.2	356.2	368.7	5.4	1.0				1.9	3.02					390.6	439.6	391.1	4.4	1.1								
	GALLOWAY2	3	1921.5	0.045	0.0204	1000.0	69.0	201.7	70.5	9.5	2.9				1.9	3.02					71.0	224.3	72.7	8.6	3.2								
	GALLOWAY2	2	1921.5	0.045	0.023	759.9	97.2	223.2	99.4	8.6	2.3				1.9	3.02					98.2	255.4	100.6	7.5	2.6								
26	GALLOWAY2	1	1921.5	0.045	0.0176	1058.9	73.4	216.1	75.1	8.9	2.9	8.1	2.3	152.0	1.9	3.02	29.4	6.9	11.3	18.2	74.0	228.0	75.8	8.4	3.1	7.2	2.5	158.5	18.15012	0.01491273	0.02211	0.007197266	High Erosion
	GALLOWAY3	2	2121	0.045	0.0241	1182.8	179.0	296.0	179.9	7.2	1.7				3	3.13					170.8	241.3	171.5	8.8	1.4								
27	GALLOWAY3	1	2121	0.045	0.0221	1453.6	173.4	301.0	175.7	7.0	1.7	7.1	1.7	176.2	3	3.13	16.2	29.4	12.9	42.3	156.6	234.0	158.7	9.1	1.5	8.9	1.5	163.7	42.342555	0.04468945	0.023	-0.021689453	High Deposition
28	GALLOWAY4	1	2121	0.045	0.0168	712.9	124.4	285.1	124.9	7.4	2.3	7.4	2.3	124.4	3	3.13	12.8	16.2	5.0	21.3	121.7	253.7	122.2	8.4	2.1	8.4	2.1	121.7	21.265832	0.02405586	0.0168	-0.007255859	High Deposition
U/S Limit	GRAPEVINE	2	1751.4	0.045	0.0304	443.4	214.9	264.7	215.7	6.6	1.2	6.6	1.2	214.9	9.6	4.71	9.5				214.2	262.3	215.1	6.7	1.2								
29	GRAPEVINE	1	1751.4	0.045	0.0295	1074.7	250.5	284.0	251.6	6.2	1.1	6.4	1.2	232.7	9.6	4.71	8.9	9.5		9.5	249.6	278.9	250.7	6.3	1.1	6.5	1.2	231.9	9.4661532	0.03119555	0.02976	-0.001435547	Stable
U/S Limit	ROWE1	2	701.4	0.045	0.0379	1031.0	29.4	65.8	30.9	10.7	2.2	10.7	2.2	29.4	9.6	4.71	8.5				32.5	68.7	34.0	10.2	2.1								
30	ROWE1	1	701.4	0.045	0.0281	1057.7	172.7	143.4	173.2	4.9	0.8	7.8	1.5	101.1	9.6	4.71	8.4	8.5		8.5	167.5	130.2	168.0	5.4	0.8	7.8	1.4	100.0	8.5381481	0.03718805	0.03294	-0.004248047	Moderate Deposition
	ROWE2	14	1857.45	0.045	0.0252	965.8	145.2	248.2	146.0	7.5	1.7				4.8	4.18					132.8	222.1	133.5	8.4	1.7								
	ROWE2	13	1857.45	0.045	0.0277	1011.7	224.8	287.0	225.6	6.5	1.3				4.8	4.18					215.4	269.2	216.1	6.9	1.2								
	ROWE2	12	1857.45	0.045	0.0248	1131.7	131.2	239.9	132.6	7.7	1.8				4.8	4.18					104.2	202.0	105.4	9.2	1.9								
	ROWE2	11	1857.45	0.045	0.0252	839.7	306.0	333.9	306.6	5.6	1.1				4.8	4.18					303.7	308.7	304.4	6.0	1.0								
	ROWE2	10	1857.45	0.045	0.028	1000.0	328.7	333.6	331.1	5.6	1.0				4.8	4.18					292.1	304.7	294.5	6.1	1.0								
	ROWE2	9	1857.45	0.045	0.0245	1220.7	355.9	357.9	357.1	5.2	1.0				4.8	4.18					326.5	318.0	327.6	5.8	1.0								
	ROWE2	8	2002	0.045	0.0217	1000.0	434.5	420.6	436.4	4.8	1.0				4.8	4.18					339.6	338.1	341.3	5.9	1.0								
	ROWE2	7	2002	0.045	0.0281	866.0	452.5	396.3	456.4	5.1	0.9				4.8	4.18					428.6	371.7	432.5	5.4	0.9								
	ROWE2	6	2002	0.045	0.0264	1000.0	343.5	361.2	345.4	5.5	1.1				4.8	4.18					322.8	331.4	324.6	6.0	1.0								
	ROWE2	5	2002	0.045	0.0279	1073.7	318.4	344.4	319.6	5.8	1.1				4.8	4.18					315.8	328.2	317.0	6.1	1.0								
	ROWE2	4	2002	0.045	0.0257	1000.0	286.1	338.1	287.0	5.9	1.2				4.8	4.18					282.3	313.7	283.1	6.4	1.1								
	ROWE2	3	2002	0.045	0.0272	1000.0	320.3	348.0	321.8	5.8	1.1				4.8	4.18					316.1	328.5	317.6	6.1	1.0								
	ROWE2	2	2002	0.045	0.0232	1000.0	249.4	330.9	251.9	6.0	1.3				4.8	4.18					243.2	296.4	245.6	6.8	1.2								
31	ROWE2	1	2002	0.045	0.022	1166.5	260.9	341.6	262.1	5.9	1.3	5.9	1.2	297.0	4.8	4.18	11.7	8.4	8.9	17.3	220.0	284.2	221.1	7.0	1.3	6.6	1.2	274.5	17.328169	0.03239383	0.02547	-0.006923828	High Deposition
	GALLOWAY5	4	3780	0.045	0.0252	839.3	78.7	300.8	81.4	12.6	3.8				3	3.13					87.8	399.2	91.0	9.5	4.5								
	GALLOWAY5	3	4725	0.045	0.0191	1000.0	103.0	415.7	106.2	11.4	4.0				3	3.13					107.2	494.0	110.9	9.6	4.6								
	GALLOWAY5	2	4725	0.045	0.0195	1000.0	146.0	472.1	148.2	10.0	3.2				3	3.13					151.8	563.6	154.2	8.4	3.7								
32	GALLOWAY5	1	4725	0.045	0.0174	1181.3	109.4	434.4	110.5	10.9	4.0	11.2	3.8	109.3	3	3.13	56.7	11.7	12.8	24.5	118.3	508.9	119.5	9.3	4.3	9.2	4.3	116.3	24.462072	0.01138602	0.01997	0.008583984	High Erosion
U/S Limit	CAVCRK_TRIB_1_2	3	780	0.045	0.007	1255.8	62.5	155.3	63.7	5.0	2.5	5.0	2.5	62.5	4.2	162.11	5.5				61.9	152.2	63.0	5.1	2.5								
	CAVCRK_TRIB_1_2	2	780	0.045	0.0205	983.7	67.7	115.8	68.4	6.7	1.7				4.2	162.11					72.1	161.4	73.0	4.8	2.2								
33	CAVCRK_TRIB_1_2	1	780	0.045	0.0104	935.9	111.7	173.9	113.5	4.5	1.6	5.4	1.9	80.6	4.2	162.11	10.6	5.5		5.5	117.6	196.6	119.5	4.0	1.7	4.6	2.1	83.9	5.5188449	0.00739094	0.01218	0.004789063	High Erosion
U/S Limit	CVCRK_TRIB1B	2	161	0.045	0.0187	1295.4	31.8	34.1	32.1	4.7	1.1	4.7	1.1	31.8	4.2	162.11	2.7				31.8	34.2	32.2	4.7	1.1								
34	CVCRK_TRIB1B	1	161	0.045	0.0185	902.0	30.9	33.8	31.1	4.8	1.1	4.7	1.1	31.3	4.2	162.11	2.8	2.7		2.7	30.8	33.8	31.1	4.8	1.1	4.7	1.1	31.3	2.7484012	0.01857117	0.01862	4.88281E-05	Stable
35	CAVCRK_TRIB_1_4	1	941	0.045	0.0298	51.2	115.6	143.7	117.1	6.5	1.2	6.5	1.2	115.6	4.2	162.11	39.6	2.8	10.6	13.4	164.6	200.6	166.1	4.7	1.2	4.7	1.2	164.6	13.398569	0.01561055	0.0298	0.014189453	High Erosion
U/S Limit	CVCRK_TRIB1C	2	340	0.045	0.0173	986.8	99.0	86.1	99.6	4.0	0.9	4.0	0.9	99.0	22.7	43.64	0.8				101.2	89.8	101.8	3.8	0.9								
36	CVCRK_TRIB1C	1	340	0.045	0.0119	1058.1	66.5	82.3	67.3	4.1	1.2	4.0	1.1	82.8	22.7	43.64	0.7	0.8		0.8	62.8	74.4	63.6	4.6	1.2	4.2	1.0	82.0	0.8408072	0.01544384	0.01451	-0.000933838	Stable
37	CAVCRK_TRIB_1_3	1	1281	0.045	0.001	22.4	276.0	678.1	279.8	1.9	2.5	1.9	2.5	276.0	4.2	162.11	0.4	0.7	39.6	40.3	189.1	219.3	191.4	5.8	1.2	5.8	1.2	189.1	40.307949	0.02596069	0.001	-0.024960693	High Deposition

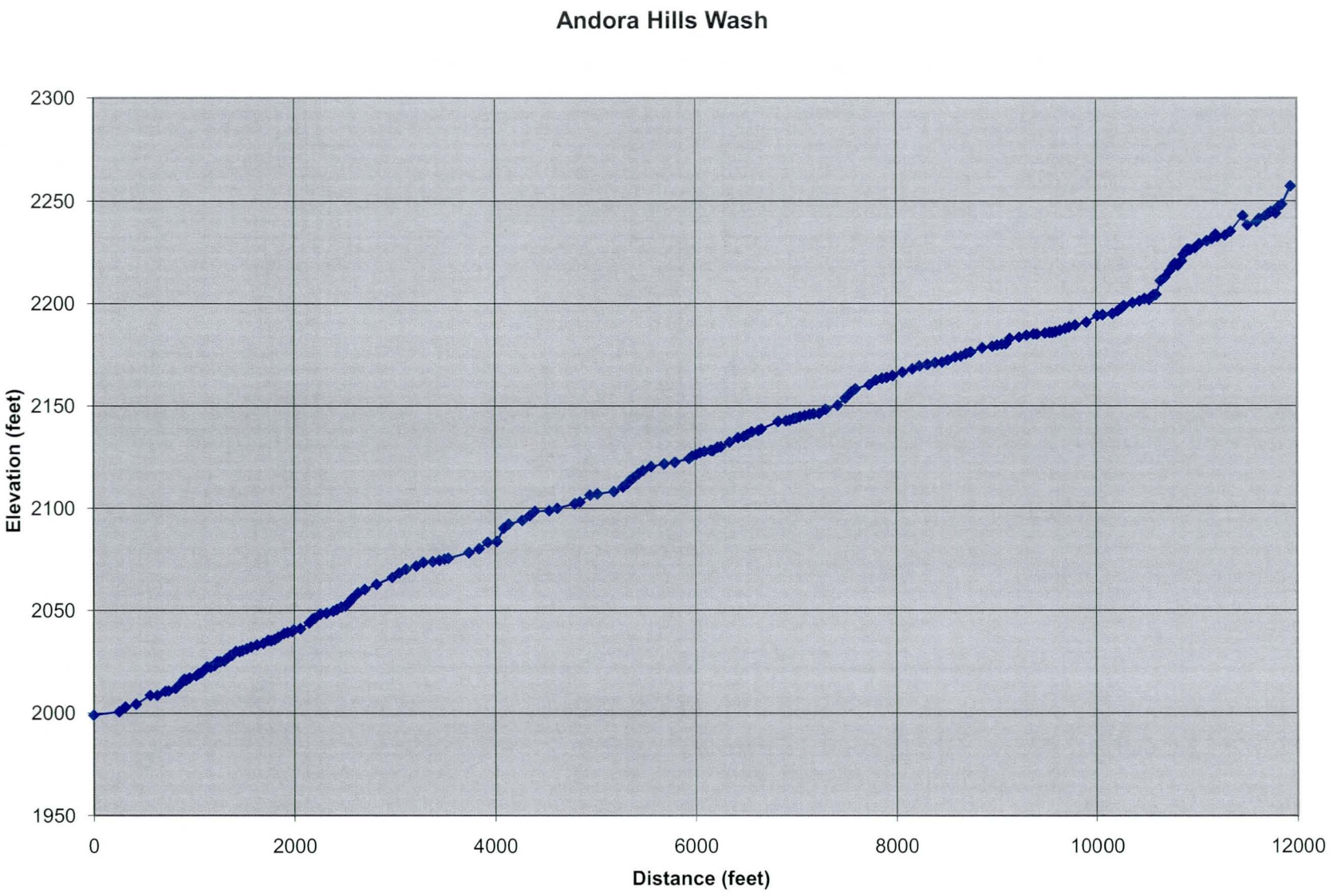
Reach	River	Cutline ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D_{50} (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Wetted Perimeter (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	Erosion Trend
U/S Limit	CVCRK_TRIB1D	2	158	0.045	0.0342	798.9	26.5	26.2	26.8	6.0	1.0	6.0	1.0	26.5	22.7	43.64	1.3				26.4	26.0	26.7	6.1	1.0								
38	CVCRK_TRIB1D	1	158	0.045	0.0257	951.1	30.3	30.2	30.8	5.2	1.0	5.6	1.0	28.4	22.7	43.64	1.1	1.3		1.3	28.7	27.0	29.2	5.9	0.9	6.0	1.0	27.6	1.3448764	0.03478508	0.02958	-0.005205076	Moderate Deposition
	CAVCRK_TRIB_1_1	7	1732	0.045	0.0125	989.3	99.6	253.2	100.8	6.8	2.5				14.8	31.13					119.9	391.7	121.4	4.4	3.3								
	CAVCRK_TRIB_1_1	6	1732	0.045	0.0123	1074.9	72.0	223.8	73.2	7.7	3.1				14.8	31.13					133.0	408.1	134.5	4.2	3.1								
	CAVCRK_TRIB_1_1	5	1732	0.045	0.0101	1051.2	111.3	282.5	113.0	6.1	2.5				14.8	31.13					135.8	411.8	137.6	4.2	3.0								
	CAVCRK_TRIB_1_1	4	1732	0.045	0.0109	1030.9	98.8	263.1	100.1	6.6	2.7				14.8	31.13					127.9	401.8	129.4	4.3	3.1								
	CAVCRK_TRIB_1_1	3	1732	0.045	0.0088	1018.1	117.6	300.3	118.7	5.8	2.6				14.8	31.13					121.8	394.0	123.2	4.4	3.2								
	CAVCRK_TRIB_1_1	2	1732	0.045	0.031	854.3	46.0	143.0	47.8	12.1	3.1				14.8	31.13					62.8	306.5	65.8	5.7	4.9								
39	CAVCRK_TRIB_1_1	1	1732	0.045	0.0387	632.2	43.1	130.1	44.5	13.3	3.0	8.4	2.8	84.1	14.8	31.13	14.3	1.1	0.4	1.4	59.9	300.6	62.6	5.8	5.0	4.7	3.7	108.7	1.4334104	0.00374156	0.01614	0.012398438	High Erosion
U/S Limit	CTNCRK_TRIB_2	2	20.3	0.045	0.0461	550.8	7.7	4.3	8.1	4.7	0.6	4.7	0.6	7.7	8.9	10.86	0.1				7.7	4.3	8.1	4.7	0.6								
40	CTNCRK_TRIB_2	1	20.3	0.045	0.0462	905.4	6.3	4.1	6.9	5.0	0.6	4.8	0.6	7.0	8.9	10.86	0.2	0.1		0.1	6.3	4.1	6.9	5.0	0.6	4.8	0.6	7.0	0.1478679	0.04540805	0.04616	0.000751953	Stable
U/S Limit	CTNCRK_TRIB_1	2	114.1	0.045	0.0334	1075.9	18.3	19.0	19.1	6.0	1.0	6.0	1.0	18.3	8.9	10.86	0.9				18.4	19.2	19.2	5.9	1.0								
41	CTNCRK_TRIB_1	1	114.1	0.045	0.0381	1002.9	14.3	16.6	15.2	6.9	1.2	6.4	1.1	16.3	8.9	10.86	1.0	0.9		0.9	14.7	17.7	15.6	6.5	1.2	6.2	1.1	16.5	0.8600635	0.03218367	0.03567	0.003486328	Stable
42	CTNCRK_TRIB_3	1	137.55	0.045	0.0371	1153.0	18.8	20.6	19.3	6.7	1.1	6.7	1.1	18.8	8.9	10.86	1.3	1.0	0.2	1.2	19.2	21.4	19.7	6.4	1.1	6.4	1.1	19.2	1.1592441	0.03353555	0.0371	0.003564453	Stable
U/S Limit	CTNCRK1	16	478.1	0.045	0.0799	1375.0	22.6	37.5	23.6	12.8	1.7	12.8	1.7	22.6	8.9	10.86	23.7				25.2	53.1	26.5	9.0	2.1								
	CTNCRK1	15	478.1	0.045	0.0782	1000.0	15.2	33.2	17.1	14.4	2.2				8.9	10.86					18.0	47.9	20.4	10.0	2.7								
	CTNCRK1	14	478.1	0.045	0.0497	1000.0	14.9	38.9	18.2	12.3	2.6				8.9	10.86					16.5	47.5	20.1	10.1	2.9								
	CTNCRK1	13	478.1	0.045	0.0822	1000.0	38.4	45.5	39.1	10.5	1.2				8.9	10.86					39.8	63.2	40.9	7.6	1.6								
	CTNCRK1	12	478.1	0.045	0.06	1000.0	15.7	37.0	18.4	12.9	2.4				8.9	10.86					18.0	48.5	21.2	9.8	2.7								
	CTNCRK1	11	478.1	0.045	0.0654	1000.0	59.1	57.6	59.3	8.3	1.0				8.9	10.86					63.0	75.2	63.3	6.4	1.2								
	CTNCRK1	10	478.1	0.045	0.0532	1000.0	72.8	67.0	74.1	7.1	0.9				8.9	10.86					79.8	83.2	81.3	5.7	1.0								
	CTNCRK1	9	478.1	0.045	0.0491	1000.0	42.4	55.1	42.8	8.7	1.3				8.9	10.86					45.0	65.9	45.5	7.3	1.5								
	CTNCRK1	8	3298.4	0.045	0.0498	1000.0	139.7	281.1	140.5	11.7	2.0				8.9	10.86					141.3	331.5	142.3	10.0	2.3								
	CTNCRK1	7	3298.4	0.045	0.0411	1000.0	126.6	286.4	127.4	11.5	2.3				8.9	10.86					128.7	319.3	129.5	10.3	2.5								
	CTNCRK1	6	3298.4	0.045	0.0512	1000.0	54.4	194.8	57.3	16.9	3.6				8.9	10.86					57.3	235.7	60.6	14.0	4.1								
	CTNCRK1	5	3298.4	0.045	0.037	1000.0	102.2	273.4	104.8	12.1	2.7				8.9	10.86					103.0	294.4	105.8	11.2	2.9								
	CTNCRK1	4	3823.75	0.045	0.0136	1000.0	79.2	368.4	83.6	10.4	4.7				8.9	10.86					71.6	280.7	75.2	13.6	3.9								
	CTNCRK1	3	3823.75	0.045	0.0291	1000.0	74.1	281.9	75.8	13.6	3.8				8.9	10.86					74.0	281.4	75.7	13.6	3.8								
	CTNCRK1	2	3823.75	0.045	0.0427	1000.0	59.7	232.5	62.4	16.4	3.9				8.9	10.86					62.4	265.1	65.2	14.4	4.2								
43	CTNCRK1	1	3823.75	0.045	0.0193	699.9	99.0	359.0	101.9	10.7	3.6	11.9	2.5	63.5	8.9	10.86	43.5	23.7		23.7	90.5	305.9	93.3	12.5	3.4	10.3	2.7	64.6	23.678887	0.02924086	0.05136	0.022119141	High Erosion
	CTNCRK2	5	3823.75	0.045	0.0215	1336.9	181.3	440.6	184.3	8.7	2.4				8.9	10.86					179.3	418.0	182.2	9.1	2.3								
	CTNCRK2	4	3832.85	0.045	0.0314	963.2	362.9	517.9	365.5	7.4	1.4				8.9	10.86					363.9	553.6	366.5	6.9	1.5								
	CTNCRK2	3	3832.85	0.045	0.0139	1000.0	120.8	426.7	122.3	9.0	3.5				8.9	10.86					111.2	345.1	112.5	11.1	3.1								
	CTNCRK2	2	3832.85	0.045	0.0535	1000.0	155.3	316.4	159.1	12.1	2.0				8.9	10.86					170.4	411.4	174.6	9.3	2.4								
44	CTNCRK2	1	3832.85	0.045	0.0157	1262.9	180.8	482.8	182.4	7.9	2.7	9.0	2.4	200.2	8.9	10.86	42.0	43.5	1.3	44.9	178.9	416.8	180.3	9.2	2.3	9.1	2.3	200.7	44.868605	0.02523508	0.02628	0.001044922	Stable
U/S Limit	CAVECRK1	5	7237.65	0.045	0.012	660.4	247.8	873.0	252.6	8.3	3.5	8.3	3.5	247.8	1.3	20.09	137.2				273.3	915.2	278.2	7.9	3.3								
	CAVECRK1	4	7237.65	0.045	0.071	909.0	135.0	401.0	137.0	18.1	3.0				1.3	20.09					205.2	816.2	209.0	8.9	4.0								
	CAVECRK1	3	7237.65	0.045	0.0865	1000.0	143.2	388.9	147.2	18.6	2.7				1.3	20.09					449.2	1115.0	455.8	6.5	2.5								
	CAVECRK1	2	7237.65	0.045	0.0126	982.0	225.4	823.5	229.2	8.8	3.7				1.3	20.09					227.6	850.2	231.4	8.5	3.7								
45	CAVECRK1	1	7237.65	0.045	0.0071	1262.9	254.8	1030.6	258.1	7.0	4.0	12.2	3.4	201.2	1.3	20.09	588.7	137.2		137.2	219.5	837.0	222.5	8.6	3.8	8.1	3.5	274.9	137.24683	0.01165992	0.03749	0.025830078	High Erosion
	CAVECRK2	15	8141	0.045	0.0237	739.9	270.7	786.2	271.6	10.4	2.9				1.3	20.09					266.4	744.4	267.2	10.9	2.8								
	CAVECRK2	14	8141	0.045	0.0225	1000.1	299.8	835.1	303.7	9.7	2.8				1.3	20.09					294.5	777.8	298.2	10.5	2.6								
	CAVECRK2	13	8141	0.045	0.0619	1007.3	199.4	523.1	201.5	15.6	2.6				1.3	20.09					251.7	729.6	254.2	11.2	2.9								
	CAVECRK2	12	8141	0.045	0.1157	959.2	107.7	339.9	109.6	24.0	3.2				1.3	20.09					146.0	589.8	149.3	13.8	4.0								
	CAVECRK2	11	8141	0.045	0.0088	992.7	209.1	961.6	213.7	8.5	4.6				1.3	20.09					195.7	662.8	199.9	12.3	3.4								
	CAVECRK2	10	8132.25	0.045	0.018	1040.8	174.1	718.6	176.7	11.3	4.1				1.3	20.09					171.0	625.7	173.3	13.0	3.7								
	CAVECRK2	9	8132.25	0.045	0.0095	1000.0	138.5	794.6	140.7	10.2	5.7				1.3	20.09					124.1	550.4	125.8	14.8	4.4								
	CAVECRK2	8	8132.25	0.045	0.0122	1000.0	229.2	902.5	233.4	9.0	3.9				1.3	20.09					224.2	698.2	228.0	11.6	3.1								
	CAVECRK2	7	8132.25	0.045	0.0102	1000.0	207.7	914.9	211.1	8.9	4.4				1.3	20.09					143.6	584.3	146.1	13.9	4.1								
	CAVECRK2	6	8132.25	0.045	0.0414	1000.0	94.5	441.4	97.6	18.4	4.7				1.4	18.09					96.6	502.4	100.1	16.2	5.2								
	CAVECRK2	5	8132.25	0.045	0.0045	947.0	475.4	1620.5	477.2	5.0	3.4				1.4	18.09					147.0	587.6	148.2	13.8	4.0								
	CAVECRK2	4	8132.25	0.045	0.004	1033.2	449.6	1645.6	453.9	4.9	3.7				1.4	18.09					235.4	709.9	237.7	11.5	3.0								
	CAVECRK2	3	8132.25	0.045	0.0295	1053.0	243.1	706.3	245.2	11.5	2.9				1.4	18.09					246.0	722.1	248.1	11.3	2.9								
	CAVECRK2	2	8132.25	0.045	0.003	966.8	371.1	1670.3	379.7	4.9	4.5				1.4	18.09					109.0	526.7	112.7	15.4	4.8								
46	CAVECRK2	1	8132.25	0.045	0.01	1327.5	233.5	964.7	237.5	8.4	4.1	10.7	3.8	246.9	1.4	18.09	368.2	588.7	42.0	630.7	168.1	622.6	171.2	13.1	3.7	12.9	3.6	188.0	630.43272	0.02783102	0.02454	-0.003291016	Moderate Deposition
	CAVECRK3	7	8132.25	0.045	0.0122	672.5	448.2	1173.9	450.3	6.9	2.6				1.3	30.79					444.2	1039.1	446.0	7.8	2.3								
	CAVECRK3	6	8190	0.045	0.023	1000.0	330.5	865.3	334.4	9.5	2.6				1.3	30.79					349.9	951.3	353.9	8.6	2.7								
	CAVECRK3	5	8190	0.045	0.0673	1021.8	274.8	583.2	279.0	14.0	2.1				1.3	30.79					354.6	957.8	360.0	8.6	2.7								
	CAVECRK3	4	8190	0.045	0.1004	1000.0	123.4	374.8	124.7	21.9	3.0				1.3	30.79					248.0	829.0	250.9	9.9	3.3								
	CAVECRK3	3	8190	0.045	0.0069	978.2	332.8	1247.1	338.0	6.6	3.7				1.3	30.79					152.1	684.5	155.4	12.0	4.5								
	CAVECRK3	2	8190	0.045	0.0325	709.2	132.0	543.3	135.4	15.1	4.1				1.3	30.79					182.5	736.3	186.5	11.1	4.0								
47	CAVECRK3	1	8190	0.045	0.0088	1140.0	241.9	1018.4	244.5	8.0	4.2	11.7	3.2	269.1	1.3	30.79	825.7	368.2	14.3	382.4	234.9	810.6	237.2	10.1	3.5	9.7	3.3	280.9	382.73314	0.01808977	0.03683	0.018740234	High Erosion
U/S Limit	WSW_TRIB5A	3	50.75	0.045	0.0225	1455.4	27.0	15.1	27.1	3.4	0.6	3.4	0.6	27.0	15.2	4.72	0.1				27.6	15.8	27.7	3.2	0.6								
	WSW_TRIB5A	2	50.75	0.045	0.0279	942.3	18.6	12.2	18.8	4.2	0.7				15.2	4.72					19.7	13.8	19.9	3.7	0.7								
48	WSW_TRIB5A	1	50.75	0.045	0.026	802.3	15.5	11.7	15.9	4.4	0.8	4.0	0.7	20.4	15.2	4.72	0.1	0.1		0.1	16.3	12.9	16.6	3.9	0.8	3.6	0.7	21.2	0.0610208	0.01990164	0.02497	0.005068359	Moderate Erosion
U/S Limit	WSW_TRIB5_1	7	103.6	0.045	0.026	812.5	16.2	18.3	16.8	5.7	1.1	5.7	1.1	16.2	16.3	4.59	0.3				16.0	17.8	16.6	5.8	1.1								
	WSW_TRIB5_1	6	103.6	0.045	0.0198	1000.0	27.0	24.1	27.3	4.3	0.9				16.3	4.59					24.0	20.7	24.3	5.0	0.9								
	WSW_TRIB5_1	5	103.6	0.045	0.0225	1000.0	14.1	19.4	17.4	5.3	1.4				16.3	4.59					13.5	17.8	16.6	5.8	1.3								
	WSW_TRIB5_1	4	103.6	0.045	0.0227	1000.0	71.6	34.1	71.9	3.0	0.5				16.3	4.59					70.4	31.8	70.6	3.3	0.5								
	WSW_TRIB5_1	3	103.6	0.045	0.0177	979.6	38.2	28.7	38.6	3.6	0.8				16.3	4.59					29.8	22.6	30.1	4.6	0.8								
	WSW_TRIB5_1	2	103.6	0.045	0.0165	906.5	33.0	27.7	33.6	3.7	0.8				16.3	4.59					27.4	21.9	27.9	4.7	0.8								
49	WSW_TRIB5_1	1	103.6	0.045	0.0227	858.6	39.3	27.0	39.9	3.8	0.7	4.2	0.9	34.2	16.3	4.59	0.2	0.3		0.3	37.5	24.8	38.1	4.2	0.7	4.8	0.9	31.2	0.2668049	0.02809055	0.02103	-0.007060547	High Deposition
	WSW_TRIB5_2	4	220.85	0.045	0.0146	1354.5	44.4	50.9	45.0	4.3	1.1				9.9	4.13					48.3	57.3	48.9	3.9	1.2								
	WSW_TRIB5_2	3	220.85	0.045	0.0144	1000.2	24.4	40.6	25.3	5.4	1.7				9.9	4.13					25.3	44.7	26.3	4.9	1.8								
	WSW_TRIB5_2	2	220.85	0.045	0.0119	1000.0	26.8	44.7	27.9	4.9	1.7				9.9	4.13					27.3	46.1	28.4	4.8	1.7								
50	WSW_TRIB5_2	1	220.85	0.045	0.0202	956.9	21.4	34.8	22.2	6.3	1.6	5.3	1.5	29.3	9.9	4.13	0.4	0.2	0.1	0.3	23.3	43.2	24.2	5.1	1.9	4.7	1.6	31.0	0.2597066	0.01100008	0.01517	0.004169922	High Erosion
U/S Limit	WSW1	4	253.4	0.045	0.0752	1126.7	19.2	24.6	20.3	10.3	1.3	10.3	1.3	19.2	11.7	5.98	5.6				20.0	25.7	21.0	9.9	1.3								
	WSW1	3	253.4	0.045	0.0911	963.6	14.5	20.9	15.6	12.1	1.4				11.7	5.98					15.3	23.3	16.4	10.9	1.5								
	WSW1	2	253.4	0.045	0.088	951.8	19.2	23.2	19.8	10.9	1.2				11.7	5.98					19.6	25.3	20.3	10.0	1.3								
51	WSW1	1	253.4	0.045	0.0452	1542.4	68.1	46.5	68.4	5.4	0.7	9.7	1.2	30.2	11.7	5.98	7.0	5.6		5.6	64.2	40.2	64.5	6.3	0.6	9.3	1.2	29.8	5.6254241	0.06809242	0.07111	0.003017578	Stable
U/S Limit	FLMSPRNGS	4	213.5	0.045	0.1213	659.5	16.7	18.1	17.4	11.8	1.1	11.8	1.1	16.7	11.7	5.98	9.3				16.5	17.5	17.1	12.2	1.1								
	FLMSPRNGS	3	213.5	0.045	0.0882	1000.0	39.6	27.7	40.0	7.7	0.7				11.7	5.98					36.0	23.7	36.3	9.0	0.7								
	FLMSPRNGS	2	213.5	0.045	0.0586	1000.0	40.6	31.6	40.7	6.8	0.8				11.7	5.98					35.1	23.4	35.2	9.1	0.7								
52	FLMSPRNGS	1	213.5	0.045	0.0472	1477.5	44.8	35.2	45.4	6.1	0.8	8.1	0.8	35.4	11.7	5.98	4.1	9.3		9.3	20.7	19.0	21.1	11.2	0.9	10.4	0.8	27.1	9.2889352	0.13110383	0.07168	-0.059423828	High Deposition
	WSW2	7	709.45	0.045	0.0333	522.8	89.4	105.6	90.1	6.7	1.2				3.4	4.68					89.6	107.1	90.3	6.6	1.2								
	WSW2	6	709.45	0.045	0.0267	1000.0	28.6	73.8	31.2	9.6	2.6				3.4	4.68					27.3	68.8	29.8	10.3	2.5								
	WSW2	5	709.45	0.045	0.0321	1000.0	40.1	78.4	41.6	9.0	2.0				3.4	4.68					40.2	78.7	41.8	9.0	2.0								
	WSW2	4	709.45	0.045	0.0306	1000.0	33.0	73.7	34.4	9.6	2.2				3.4	4.68					32.4	72.3	33.8	9.8	2.2								
	WSW2	3	1026.2	0.045	0.018	1000.0	38.0	114.4	39.9	9.0	3.0				3.4	4.68					35.9	94.0	37.4	10.9	2.6								
	WSW2	2	1026.2	0.045	0.0158	1000.0	99.6	172.0	100.2	6.0	1.7				5.9	5.01					70.1	121.1	70.6	8.5	1.7								
53	WSW2	1	1026.2	0.045	0.0382	1278.0	39.6	92.2	40.8	11.1	2.3	8.7	2.1	52.6	5.9	5.01	9.0	4.1	7.0	11.2	43.3	100.8	44.6	10.2	2.3	9.3	2.1	48.4	11.145774	0.03186367	0.02785	-0.004013672	Moderate Deposition
U/S Limit	WSW_TRIB4	5	76.65	0.045	0.0459	1412.8	19.8	13.9	20.1	5.5	0.7	5.5	0.7	19.8	9.3	5.95	0.5				20.4	15.0	20.7	5.1	0.7								
	WSW_TRIB4	4	76.65	0.045	0.0475	1000.0	27.4	15.6	27.6	4.9	0.6				9.3	5.95					29.2	17.2	29.4	4.4	0.6								
	WSW_TRIB4	3	111.3	0.045	0.038	1000.0	23.0	19.4	23.2	5.7	0.8				9.3	5.95					23.1	19.6	23.3	5.7	0.8								
	WSW_TRIB4	2	111.3	0.045	0.0337	1000.0	32.9	23.2	33.3	4.8	0.7				9.3	5.95					32.5	22.5	32.9	4.9	0.7								
54	WSW_TRIB4	1	111.3	0.045	0.0355	1278.0	17.0	17.7	17.5	6.3	1.0	5.5	0.8	24.0	9.3	5.95	0.6	0.5		0.5	16.9	17.5	17.4	6.4	1.0	5.3	0.8	24.4	0.5411105	0.03688227	0.04031	0.003427734	Stable

Reach	River	Cutline ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D_{50} (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Wetted Perimeter (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	Erosion Trend
	WSW3	6	1117.55	0.045	0.0212	728.1	63.1	139.1	64.7	8.0	2.2				7.8	4.44					61.5	128.9	63.0	8.7	2.1								
	WSW3	5	1117.55	0.045	0.0261	1016.5	205.1	208.3	207.3	5.4	1.0				7.8	4.44					204.6	207.4	206.7	5.4	1.0								
	WSW3	4	1117.55	0.045	0.025	1000.0	58.2	128.0	59.4	8.7	2.2				7.8	4.44					57.7	125.5	58.9	8.9	2.2								
	WSW3	3	1117.55	0.045	0.0187	983.5	96.3	171.0	98.6	6.5	1.8				7.8	4.44					93.5	152.3	95.6	7.3	1.6								
	WSW3	2	1117.55	0.045	0.0232	1000.0	43.9	117.6	45.5	9.5	2.7				7.8	4.44					43.5	112.7	45.0	9.9	2.6								
55	WSW3	1	1117.55	0.045	0.0298	607.9	43.1	109.5	45.9	10.2	2.5	8.1	2.1	85.0	7.8	4.44	8.3	0.6	9.0	9.6	43.4	113.9	46.2	9.8	2.6	8.3	2.0	84.0	9.5673788	0.02636695	0.02374	-0.002626953	Moderate Deposition
U/S Limit	WSW_TRIB2_1	5	155.75	0.045	0.0595	1054.3	13.3	17.1	14.3	9.1	1.3	9.1	1.3	13.3	7.4	3.94	2.5				14.5	19.9	15.5	7.8	1.4								
	WSW_TRIB2_1	4	155.75	0.045	0.0377	1000.0	14.7	20.4	15.8	7.6	1.4				7.4	3.94					14.6	20.0	15.6	7.8	1.4								
	WSW_TRIB2_1	3	311.85	0.045	0.0166	1000.0	41.0	58.3	41.6	5.3	1.4				7.4	3.94					33.7	41.4	34.2	7.5	1.2								
	WSW_TRIB2_1	2	311.85	0.045	0.042	999.9	72.2	55.2	72.6	5.7	0.8				7.4	3.94					72.3	56.0	72.7	5.6	0.8								
56	WSW_TRIB2_1	1	311.85	0.045	0.0244	1027.7	26.5	44.7	28.5	7.0	1.7	6.9	1.3	33.6	7.4	3.94	1.9	2.5		2.5	23.4	36.7	25.2	8.5	1.6	7.4	1.3	31.7	2.4874486	0.03991164	0.03623	-0.003681641	Moderate Deposition
U/S Limit	WSW_TRIB2A	5	140.7	0.045	0.038	1169.2	12.7	18.3	14.1	7.7	1.4	7.7	1.4	12.7	3.9	5.73	1.9				13.1	19.4	14.5	7.3	1.5								
	WSW_TRIB2A	4	140.7	0.045	0.0384	1000.0	11.4	17.7	13.1	7.9	1.6				3.9	5.73					11.9	18.9	13.7	7.4	1.6								
	WSW_TRIB2A	3	140.7	0.045	0.0316	1000.0	18.4	21.8	18.9	6.5	1.2				3.9	5.73					18.3	21.5	18.8	6.5	1.2								
	WSW_TRIB2A	2	212.45	0.045	0.0293	1000.0	40.8	39.0	41.3	5.5	1.0				3.9	5.73					40.5	37.6	41.0	5.7	0.9								
57	WSW_TRIB2A	1	212.45	0.045	0.0313	1027.6	26.8	32.4	27.3	6.6	1.2	6.8	1.3	22.0	3.9	5.73	2.1	1.9		1.9	26.7	31.9	27.2	6.7	1.2	6.7	1.3	22.1	1.9383791	0.03268789	0.03385	0.001162109	Stable
	WSW_TRIB2_2	4	522.2	0.045	0.0199	1030.8	35.4	71.6	36.6	7.3	2.0				7.8	4.44					34.2	63.1	35.3	8.3	1.8								
	WSW_TRIB2_2	3	522.2	0.045	0.012	1000.0	60.6	102.5	61.5	5.1	1.7				7.8	4.44					35.9	64.0	36.6	8.2	1.8								
	WSW_TRIB2_2	2	522.2	0.045	0.0294	1000.0	39.8	66.8	41.3	7.8	1.7				7.8	4.44					40.0	67.4	41.6	7.8	1.7								
58	WSW_TRIB2_2	1	522.2	0.045	0.024	607.9	26.7	61.2	28.6	8.5	2.3	7.2	1.9	40.6	7.8	4.44	2.5	2.1	1.9	4.0	24.0	55.6	25.7	9.4	2.3	8.4	1.9	33.5	4.0062886	0.02878367	0.02102	-0.007763672	High Deposition
	WSW4	6	1638.7	0.045	0.0218	1452.0	22.1	129.8	31.3	12.6	5.9				7.7	4.62					22.2	133.6	31.6	12.3	6.0								
	WSW4	5	1638.7	0.045	0.0139	1000.0	110.3	246.9	111.4	6.6	2.2				7.7	4.62					108.4	219.5	109.4	7.5	2.0								
	WSW4	4	1638.7	0.045	0.0175	1098.9	287.9	337.8	289.8	4.9	1.2				7.7	4.62					269.4	315.6	271.3	5.2	1.2								
	WSW4	3	1638.7	0.045	0.0147	961.1	270.2	347.5	273.0	4.7	1.3				7.7	4.62					258.1	310.7	260.8	5.3	1.2								
	WSW4	2	1638.7	0.045	0.0175	715.3	186.9	284.8	189.2	5.8	1.5				7.7	4.62					177.1	267.5	179.4	6.1	1.5								
59	WSW4	1	1638.7	0.045	0.014	810.6	249.8	341.8	252.5	4.8	1.4	6.6	2.2	187.9	7.7	4.62	7.6	2.5	8.3	10.8	67.8	183.4	69.8	8.9	2.7	7.5	2.4	150.5	10.79365	0.02009617	0.01702	-0.003076172	Moderate Deposition
U/S Limit	WSW_TRIB1_1	10	100.1	0.045	0.0229	920.5	22.3	21.1	22.9	4.7	0.9	4.7	0.9	22.3	5.4	5.52	0.4				25.0	28.0	25.7	3.6	1.1								
	WSW_TRIB1_1	9	100.1	0.045	0.0465	1000.0	14.8	14.6	15.4	6.9	1.0				5.4	5.52					19.7	25.6	20.5	3.9	1.3								
	WSW_TRIB1_1	8	100.1	0.045	0.0355	1321.9	13.7	15.4	14.5	6.5	1.1				5.4	5.52					17.4	24.5	18.4	4.1	1.4								
	WSW_TRIB1_1	7	220.15	0.045	0.0282	1000.0	28.1	34.8	28.8	6.3	1.2				5.4	5.52					37.3	52.6	38.0	4.2	1.4								
	WSW_TRIB1_1	6	220.15	0.045	0.0301	1035.8	28.2	34.1	28.7	6.4	1.2				5.4	5.52					33.7	50.5	34.4	4.4	1.5								
	WSW_TRIB1_1	5	220.15	0.045	0.0285	1000.0	28.5	35.0	29.3	6.3	1.2				5.4	5.52					56.3	61.9	57.3	3.6	1.1								
	WSW_TRIB1_1	4	220.15	0.045	0.0259	965.2	71.8	51.7	72.4	4.3	0.7				2.2	3.94					84.0	72.4	84.7	3.0	0.9								
	WSW_TRIB1_1	3	220.15	0.045	0.0268	1000.0	30.7	37.0	32.2	5.9	1.2				2.2	3.94					41.0	55.1	42.8	4.0	1.3								
	WSW_TRIB1_1	2	220.15	0.045	0.0235	1000.0	49.2	45.9	49.9	4.8	0.9	51.3			2.2	3.94					51.3	59.6	52.1	3.7	1.2								
60	WSW_TRIB1_1	1	220.15	0.045	0.0213	1352.1	39.7	43.4	40.4	5.1	1.1	5.7	1.1	32.7	2.2	3.94	1.8	0.4		0.4	44.0	56.2	44.9	3.9	1.3	3.8	1.2	41.0	0.3849825	0.01038508	0.02893	0.018544922	High Erosion
U/S Limit	WSW_TRIB1A	5	119.35	0.045	0.0868	817.1	10.2	11.8	11.3	10.1	1.2	10.1	1.2	10.2	4.5	3.1	3.7				10.2	11.8	11.2	10.1	1.2								
	WSW_TRIB1A	4	119.35	0.045	0.1006	1000.0	14.8	12.8	15.2	9.3	0.9				4.5	3.1					15.2	13.4	15.7	8.9	0.9								
	WSW_TRIB1A	3	119.35	0.045	0.0355	1000.0	17.0	18.5	17.5	6.5	1.1				4.5	3.1					15.2	13.4	15.6	8.9	0.9								
	WSW_TRIB1A	2	119.35	0.045	0.0172	1000.0	13.2	21.4	14.7	5.6	1.6				4.5	3.1					9.9	11.6	10.8	10.3	1.2								
61	WSW_TRIB1A	1	119.35	0.045	0.033	1352.1	24.0	21.6	24.4	5.5	0.9	7.4	1.1	15.9	4.5	3.1	1.5	3.7		3.7	22.0	15.5	22.3	7.7	0.7	9.2	1.0	14.5	3.7178942	0.08805492	0.05201	-0.036044922	High Deposition
	WSW_TRIB1_2_1	4	372.75	0.045	0.0063	647.9	56.0	98.0	56.3	3.8	1.8				2.2	3.94					44.0	50.3	44.2	7.4	1.1								
	WSW_TRIB1_2_1	3	372.75	0.045	0.0191	1000.0	51.3	67.9	51.6	5.5	1.3				11.1	5.32					48.3	52.2	48.5	7.1	1.1								
	WSW_TRIB1_2_1	2	372.75	0.045	0.0262	1000.0	43.2	57.9	43.9	6.4	1.3				11.1	5.32					41.2	49.2	41.8	7.6	1.2								
62	WSW_TRIB1_2_1	1	372.75	0.045	0.0118	752.9	34.6	67.5	35.4	5.5	1.9	5.3	1.6	46.3	11.1	5.32	0.7	1.5	1.8	3.4	28.5	42.6	29.1	8.8	1.5	7.7	1.2	40.5	3.3556251	0.04208117	0.01713	-0.024951172	High Deposition
U/S Limit	WSW_TRIB_6A	2	33	0.045	0.0278	536.6	57.4	14.8	57.5	2.2	0.3	2.2	0.3	57.4	11.1	5.32	0.0				60.0	17.4	60.1	1.9	0.3								
63	WSW_TRIB_6A	1	33	0.045	0.0164	564.9	15.7	10.4	15.9	3.2	0.7	2.7	0.5	36.5	11.1	5.32	0.0	0.0		0.0	15.6	10.2	15.8	3.2	0.7	2.6	0.5	37.8	0.0357391	0.01711602	0.02195	0.004833984	Moderate Erosion
U/S Limit	WSW_TRIB_6_1	2	304	0.045	0.0148	650.1	54.9	66.9	55.7	4.5	1.2	4.5	1.2	54.9	11.1	5.32	0.5				55.0	67.0	55.8	4.5	1.2								
64	WSW_TRIB_6_1	1	304	0.045	0.0113	818.3	56.1	72.9	56.5	4.2	1.3	4.4	1.3	55.5	11.1	5.32	0.4	0.5		0.5	54.0	66.4	54.4	4.6	1.2	4.6	1.2	54.5	0.4645293	0.01467495	0.01285	-0.001824951	Moderate Deposition
65	WSW_TRIB_6_2	1	335	0.045	0.0142	521.6	83.4	84.4	83.7	4.0	1.0	4.0	1.0	83.4	11.1	5.32	0.4	0.4	0.0	0.4	83.1	83.6	83.5	4.0	1.0	4.0	1.0	83.1	0.4312577	0.01462114	0.0142	-0.000421143	Stable
U/S Limit	WSW_TRIB_6B	3	20	0.045	0.0243	530.8	13.0	6.3	13.2	3.2	0.5	3.2	0.5	13.0	11.1	5.32	0.0				13.1	6.4	13.3	3.1	0.5								
	WSW_TRIB_6B	2	20	0.045	0.003	232.1	14.9	12.6	15.3	1.6	0.8				11.1	5.32					10.3	5.9	10.6	3.4	0.6								
66	WSW_TRIB_6B	1	20	0.045	0.0216	760.8	12.3	6.4	12.4	3.1	0.5	2.6	0.6	13.4	11.1	5.32	0.0	0.0		0.0	12.1	6.2	12.3	3.2	0.5	3.2	0.5	11.8	0.0300465	0.02333305	0.01971	-0.003623047	Moderate Deposition
	WSW_TRIB_6_4	2	331	0.045	0.0102	917.6	57.6	80.1	58.2	4.1	1.4				11.1	5.32					55.6	74.8	56.2	4.4	1.3								
67	WSW_TRIB_6_4	1	331	0.045	0.01	685.9	48.0	74.8	48.4	4.4	1.6	4.3	1.5	52.8	11.1	5.32	0.3	0.0	0.4	0.4	47.3	70.1	47.7	4.7	1.5	4.6	1.4	51.5	0.4263635	0.01217909	0.01011	-0.002069092	Moderate Deposition
U/S Limit	WSW_TRIB_6C	2	45	0.045	0.024	664.1	24.7	13.4	25.2	3.4	0.5	3.4	0.5	24.7	11.1	5.32	0.1				25.1	13.8	25.6	3.3	0.5								
68	WSW_TRIB_6C	1	45	0.045	0.0154	587.9	18.6	13.6	18.8	3.3	0.7	3.3	0.6	21.7	11.1	5.32	0.1	0.1		0.1	17.9	12.0	18.1	3.7	0.7	3.5	0.6	21.5	0.0726266	0.02213773	0.01996	-0.002177734	Moderate Deposition
69	WSW_TRIB_6_3	1	618	0.045	0.0151	1339.0	46.7	95.6	47.8	6.5	2.0	6.5	2.0	46.7	11.1	5.32	1.5	0.1	0.3	0.4	56.2	136.2	57.5	4.5	2.4	4.5	2.4	56.2	0.3832719	0.00595156	0.0151	0.009148438	High Erosion
	WSW_TRIB1_2_2	5	503.3	0.045	0.0087	1239.3	137.4	152.7	138.6	3.3	1.1				11.1	5.32					74.9	87.9	75.8	5.7	1.2								
	WSW_TRIB1_2_2	4	503.3	0.045	0.0108	1000.0	77.1	114.3	78.9	4.4	1.5				11.1	5.32					55.2	78.2	56.6	6.4	1.4								
	WSW_TRIB1_2_2	3	503.3	0.045	0.0119	1550.7	100.4	123.3	102.7	4.1	1.2				11.1	5.32					32.9	64.3	34.6	7.8	2.0								
	WSW_TRIB1_2_2	2	503.3	0.045	0.0085	719.7	7.2	84.0	30.5	6.0	11.6				11.1	5.32					7.2	53.7	22.1	9.4	7.4								
70	WSW_TRIB1_2_2	1	503.3	0.045	0.011	323.2	37.4	85.3	38.5	5.9	2.3	4.7	3.5	71.9	11.1	5.32	0.5	1.5	0.7	2.3	34.1	64.5	35.0	7.8	1.9	7.4	2.8	40.9	2.2520546	0.0245295	0.01029	-0.014239502	High Deposition
	WSW5	3	2184	0.045	0.0165	1618.7	36.3	186.9	41.1	11.7	5.1				9.9	4.13					36.9	199.8	42.0	10.9	5.4								
	WSW5	2	2184	0.045	0.0106	878.8	58.4	251.8	62.0	8.7	4.3				9.9	4.13					57.8	232.1	61.1	9.4	4.0								
71	WSW5	1	2184	0.045	0.0134	956.9	66.5	244.1	68.4	8.9	3.7	9.8	4.4	53.7	9.9	4.13	8.1	0.5	7.6	8.1	66.4	242.7	68.3	9.0	3.7	9.8	4.4	53.7	8.0957781	0.01362242	0.01414	0.000517578	Stable
72	WSW6	1	2404.85	0.045	0.0124	905.9	70.8	270.8	72.5	8.9	3.8	8.9	3.8	70.8	9.9	4.13	7.3	8.1	0.4	8.5	70.0	261.5	71.6	9.2	3.7	9.2	3.7	70.0	8.4807486	0.01371226	0.0124	-0.001312256	Moderate Deposition
73	CAVECRK4	1	8400	0.045	0.0024	1360.5	226.1	1493.7	231.4	5.6	6.6	5.6	6.6	226.1	1.3	30.79	23.5	7.3	825.7	833.0	145.8	609.8	148.4	13.8	4.2	13.8	4.2	145.8	833.18087	0.02629966	0.0024	-0.023899658	High Deposition
U/S Limit	OCTLO_TRIB1_1	4	78.05	0.045	0.0304	1394.7	19.4	15.7	19.6	5.0	0.8	5.0	0.8	19.4	10.3	4.76	0.3				19.7	16.4	20.0	4.8	0.8								
	OCTLO_TRIB1_1	3	78.05	0.045	0.0225	1000.0	71.6	28.8	71.7	2.7	0.4				10.3	4.76					71.5	27.3	71.5	2.9	0.4								
	OCTLO_TRIB1_1	2	78.05	0.045	0.0391	897.0	13.6	12.8	14.3	6.1	0.9				10.3	4.76					14.6	14.7	15.3	5.3	1.0								
74	OCTLO_TRIB1_1	1	78.05	0.045	0.0266	1246.1	18.9	16.2	19.1	4.8	0.9	4.6	0.8	30.9	10.3	4.76	0.3	0.3		0.3	18.8	16.1	19.1	4.8	0.9	4.4	0.8	31.2	0.2715208	0.02688883	0.02934	0.002451172	Stable
U/S Limit	OCTLO_TRIB1A	3	422.1	0.045	0.0454	1074.1	52.5	57.2	53.5	7.4	1.1	7.4	1.1	52.5	6.2	4.22	4.8				52.5	57.2	53.5	7.4	1.1								
	OCTLO_TRIB1A	2	422.1	0.045	0.0405	1000.0	79.9	69.8	80.6	6.0	0.9				6.2	4.22					78.9	67.0	79.6	6.3	0.9								
75	OCTLO_TRIB1A	1	422.1	0.045	0.0349	1200.1	47.5	59.5	48.4	7.1	1.3	6.8	1.1	60.0	6.2	4.22	4.0	4.8		4.8	46.2	54.3	47.0	7.8	1.2	7.1	1.0	59.2	4.7644644	0.04545039	0.04005	-0.005400391	Moderate Deposition
	OCTLO_TRIB1_2	2	488.95	0.045	0.0238	629.5	57.7	78.5	58.3	6.2	1.4				8	3.96					55.9	64.6	56.4	7.6	1.2								
76	OCTLO_TRIB1_2	1	488.95	0.045	0.0203	857.1	95.5	100.7	96.5	4.9	1.1	5.5	1.2	76.6	8	3.96	1.6	4.0	0.3	4.3	82.8	75.6	83.6	6.5	0.9	7.0	1.0	69.3	4.2851714	0.04354758	0.02178	-0.021767578	High Deposition
U/S Limit	OCOTILLO1	14	599.9	0.045	0.1197	1334.1	40.3	47.4	40.8	12.7	1.2	12.7	1.2	40.3	10.2	4.26	27.4				41.6	50.5	42.1	11.9	1.2								
	OCOTILLO1	13	599.9	0.045	0.1067	1033.9	29.5	43.4	30.0	13.8	1.5				10.2	4.26					29.7	44.2	30.2	13.6	1.5								
	OCOTILLO1	12	599.9	0.045	0.0893	1007.7	36.6	50.0	37.5	12.0	1.4				10.2	4.26					36.4	48.1	37.3	12.5	1.3								
	OCOTILLO1	11	599.9	0.045	0.0681	961.5	32.9	52.0	33.6	11.5	1.6				10.2	4.26					31.6	45.4	32.3	13.2	1.4								
	OCOTILLO1	10	599.9	0.045	0.0546	981.9	28.9	53.3	30.4	11.2	1.8				10.2	4.26					25.8	42.4	27.1	14.2	1.6								
	OCOTILLO1	9	599.9	0.045	0.0697	1000.0	17.9	42.1	20.3	14.2	2.4				10.2	4.26					17.0	36.8	19.1	16.3	2.2								
	OCOTILLO1	8	599.9	0.045	0.0515	1000.0	36.6	59.2	37.8	10.1	1.6				10.2	4.26					28.3	43.7	29.4	13.7	1.5								
	OCOTILLO1	7	599.9	0.045	0.0774	1000.0	20.9	42.4	22.3	14.2	2.0				10.2	4.26					20.3	38.7	21.6	15.5	1.9								
	OCOTILLO1	6	599.9	0.045	0.0593	1000.0	46.7	61.9	47.0	9.7	1.3				10.2	4.26					43.4	51.2	43.6	11.7	1.2								
	OCOTILLO1	5	599.9	0.045	0.0494	1076.7	98.7	88.2	99.4	6.8	0.9				10.2	4.26					95.3	70.2	95.9	8.5	0.7								
	OCOTILLO1	4	599.9	0.045	0.0442	1000.0	67.6	78.4	68.0	7.7	1.2				10.2	4.26					65.9	60.5	66.2	9.9	0.9								
	OCOTILLO1	3	599.9	0.045	0.0463	923.3	48.8	68.0	49.3	8.8	1.4				10.2	4.26					45.9	52.5	46.4	11.4	1.1								
	OCOTILLO1	2	599.9	0.045	0.0368	937.4	189.2	124.8	189.5	4.8	0.7				10.2	4.26					142.1	82.2	142.4	7.3	0.6								
77	OCOTILLO1	1	599.9	0.045	0.0328	1101.3	137.8	114.4	139.9	5.2	0.8	10.2	1.4	59.5	10.2	4.26	15.0	27.4		27.4	113.8	75.6	115.5	7.9	0.7	12.0	1.3	52.7	27.360906	0.10092211	0.06601	-0.034912109	High Deposition
	OCOTILLO2B1	2	1047.2	0.045	0.0336	1633.2	152.0	164.4	152.9	6.4	1.1				8	3.96					152.1	164.9	153.0	6.4	1.1								
78	OCOTILLO2B1	1	1047.2	0.045	0.0273	871.5	100.1	148.2	100.9	7.1	1.5	6.7	1.3	126.1	8	3.96	6.1	7.5		7.5	85.5	131.1	86.2	8.0	1.5	7.2	1.3	118.8	7.5255316	0.0333143	0.03141	-0.001904297	Stable
79	OCOTILLO2B2	1	1416.45	0.045	0.0228	1330.9	236.3	264.0	237.5	5.4	1.1	5.4	1.1	236.3	8	3.96	4.5	6.1	1.6	7.7	223.7	231.2	224.9	6.1	1.0	6.1	1.0	223.7	7.6980953	0.03298555	0.0228	-0.010185547	High Deposition
	OCOTILLO2A	4	746.2	0.045	0.0352	1177.5	203.3	148.8	205.1	5.0	0.7				9.8	4.97					175.4	124.2	177.1	6.0	0.7								
	OCOTILLO2A	3	746.2	0.045	0.0282	781.2	101.6	120.7	103.0	6.2	1.2				9.8	4.97					87.1	94.1	88.3	7.9	1.1								

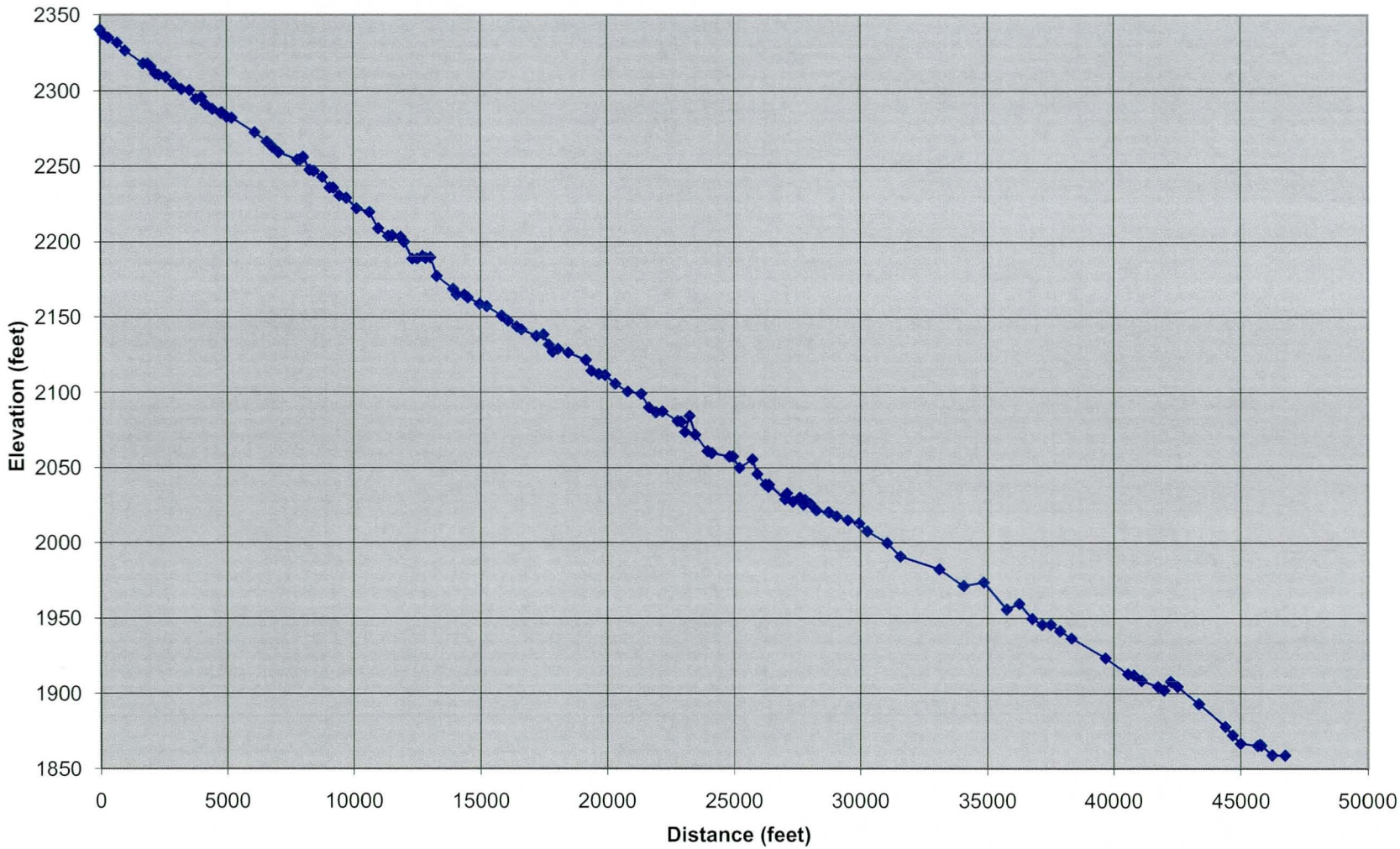
Reach	River	Cutline ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D_{50} (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Wetted Perimeter (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	Erosion Trend
	OCOTILLO2A	2	746.2	0.045	0.0211	1015.7	173.2	162.4	173.9	4.6	0.9				9.8	4.97					134.4	111.4	135.0	6.7	0.8								
80	OCOTILLO2A	1	746.2	0.045	0.0286	957.4	155.1	142.0	156.2	5.3	0.9	5.3	0.9	158.3	9.8	4.97	2.8	7.5		7.5	140.4	113.5	141.4	6.6	0.8	6.8	0.9	134.3	7.5226201	0.05278852	0.02856	-0.024228516	High Deposition
81	OCOTILLO3	1	1416.45	0.045	0.0187	1186.4	186.9	254.9	187.5	5.6	1.4	5.6	1.4	186.9	7.9	5.04	4.4	2.8	4.5	7.3	167.3	220.9	167.8	6.4	1.3	6.4	1.3	167.3	7.3165687	0.02599492	0.0187	-0.007294922	High Deposition
U/S Limit	OCTLO_TRIB2	6	91	0.045	0.0295	3650.9	10.1	14.9	13.3	6.1	1.5	6.1	1.5	10.1	10.3	5.51	0.3				10.1	15.0	13.4	6.1	1.5								
	OCTLO_TRIB2	5	91	0.045	0.001	-1817.7	60.8	75.5	61.1	1.2	1.2				10.3	5.51					34.7	22.0	34.8	4.1	0.6								
	OCTLO_TRIB2	4	91	0.045	0.0298	1000.0	19.0	17.3	19.6	5.3	0.9				10.3	5.51					19.1	17.6	19.7	5.2	0.9								
	OCTLO_TRIB2	3	91	0.045	0.0344	1000.0	28.0	19.2	28.2	4.7	0.7				10.3	5.51					28.6	20.4	28.8	4.5	0.7								
	OCTLO_TRIB2	2	91	0.045	0.0286	1000.0	26.5	19.9	26.9	4.6	0.8				10.3	5.51					26.5	19.9	26.9	4.6	0.8								
82	OCTLO_TRIB2	1	91	0.045	0.0217	1135.4	34.0	23.9	34.5	3.8	0.7	4.3	1.0	29.7	10.3	5.51	0.2	0.3		0.3	32.3	21.5	32.7	4.2	0.7	4.8	0.9	25.2	0.3095591	0.02858211	0.03742	0.008837891	Moderate Erosion
	OCOTILLO4	3	1620.5	0.045	0.017	881.6	108.4	229.5	109.7	7.1	2.1				7.9	5.04					108.7	237.1	110.1	6.8	2.2								
	OCOTILLO4	2	1620.5	0.045	0.0208	1000.0	312.1	328.3	312.4	4.9	1.1				7.9	5.04					314.0	360.7	314.3	4.5	1.1								
83	OCOTILLO4	1	1620.5	0.045	0.0208	939.8	189.2	269.7	191.0	6.0	1.4	6.0	1.5	203.2	7.9	5.04	6.4	0.2	4.4	4.6	212.5	309.6	214.5	5.2	1.5	5.5	1.6	211.7	4.5844877	0.01532289	0.01961	0.004287109	Moderate Erosion
U/S Limit	OCTLO_TRIB3	7	103.6	0.045	0.0302	1449.2	33.5	23.1	33.6	4.5	0.7	4.5	0.7	33.5	9.2	4.44	0.3				33.6	23.3	33.7	4.4	0.7								
	OCTLO_TRIB3	6	103.6	0.045	0.03	1000.0	21.8	19.6	22.1	5.3	0.9				9.2	4.44					21.9	19.7	22.2	5.3	0.9								
	OCTLO_TRIB3	5	103.6	0.045	0.0299	1000.0	32.6	23.0	32.9	4.5	0.7				9.2	4.44					32.6	23.1	32.9	4.5	0.7								
	OCTLO_TRIB3	4	103.6	0.045	0.0334	981.2	24.5	19.9	24.8	5.2	0.8				9.2	4.44					24.7	20.7	25.1	5.0	0.8								
	OCTLO_TRIB3	3	103.6	0.045	0.0241	1000.0	49.5	28.9	49.6	3.6	0.6				9.2	4.44					48.4	27.0	48.5	3.8	0.6								
	OCTLO_TRIB3	2	103.6	0.045	0.0229	1018.8	45.4	28.4	45.8	3.6	0.6				9.2	4.44					43.2	25.8	43.5	4.0	0.6								
84	OCTLO_TRIB3	1	103.6	0.045	0.0226	939.8	49.3	29.5	49.8	3.5	0.6	4.3	0.7	36.6	9.2	4.44	0.3	0.3		0.3	48.2	27.0	48.7	3.8	0.6	4.4	0.7	36.1	0.3268049	0.02941039	0.02776	-0.001650391	Stable
	OCOTILLO5	2	1683.5	0.045	0.021	1043.1	232.9	298.2	233.6	5.6	1.3				3.6	3.67					235.4	307.7	236.2	5.5	1.3								
85	OCOTILLO5	1	1683.5	0.045	0.0184	1102.1	372.9	374.6	374.3	4.5	1.0	5.1	1.1	302.9	3.6	3.67	7.0	0.3	6.4	6.7	371.7	369.5	373.0	4.6	1.0	5.0	1.2	303.5	6.6946173	0.01918148	0.01966	0.000478516	Stable
U/S Limit	OCTLO_TRIB4	7	29.05	0.045	0.0307	889.8	16.7	8.1	16.8	3.6	0.5	3.6	0.5	16.7	6.3	5.77	0.1				16.8	8.2	16.9	3.5	0.5								
	OCTLO_TRIB4	6	29.05	0.045	0.0315	1000.0	11.5	7.0	11.8	4.2	0.6				6.3	5.77					11.6	7.1	11.9	4.1	0.6								
	OCTLO_TRIB4	5	29.05	0.045	0.0296	1000.0	19.1	8.7	19.2	3.4	0.5				6.3	5.77					19.0	8.6	19.1	3.4	0.5								
	OCTLO_TRIB4	4	29.05	0.045	0.0278	1000.0	26.5	10.1	26.7	2.9	0.4				6.3	5.77					26.1	9.8	26.3	3.0	0.4								
	OCTLO_TRIB4	3	29.05	0.045	0.0277	1000.0	13.4	7.7	13.6	3.8	0.6				6.3	5.77					13.2	7.5	13.4	3.9	0.6								
	OCTLO_TRIB4	2	29.05	0.045	0.0235	885.8	23.9	10.1	24.0	2.9	0.4				6.3	5.77					23.2	9.3	23.3	3.1	0.4								
86	OCTLO_TRIB4	1	29.05	0.045	0.0217	1100.0	17.4	9.2	17.5	3.2	0.5	3.4	0.5	18.3	6.3	5.77	0.1	0.1		0.1	16.3	8.1	16.4	3.6	0.5	3.5	0.5	18.0	0.0962377	0.03011555	0.02743	-0.002685547	Stable
	OCOTILLO6	5	1757	0.045	0.0151	1044.9	134.3	271.2	135.0	6.5	2.0				3.6	3.67					135.5	292.7	136.3	6.0	2.2								
	OCOTILLO6	4	1827	0.045	0.0215	977.1	75.3	200.0	77.5	9.1	2.7				3.6	3.67					80.0	245.2	82.5	7.5	3.1								
	OCOTILLO6	3	1827	0.045	0.0177	1000.0	104.6	241.1	106.8	7.6	2.3				3.6	3.67					105.4	273.0	107.9	6.7	2.6								
	OCOTILLO6	2	1827	0.045	0.016	1000.0	177.9	305.5	179.0	6.0	1.7				3.6	3.67					180.0	335.7	181.1	5.4	1.9								
87	OCOTILLO6	1	1827	0.045	0.0217	1208.8	57.9	179.0	59.1	10.2	3.1	7.9	2.4	110.0	3.6	3.67	13.8	0.1	7.0	7.1	61.6	220.0	63.0	8.3	3.6	6.8	2.7	112.5	7.1057069	0.01185914	0.01849	0.006630859	High Erosion
88	CAVECRK5	1	8645	0.045	0.0054	975.3	305.9	1168.6	307.0	7.4	3.8	7.4	3.8	305.9	1.4	15.55	86.1	13.8	23.5	37.3	335.4	1437.2	336.7	6.0	4.3	6.0	4.3	335.4	37.312852	0.00476719	0.0084	0.003632813	High Erosion
	CAVECRK6	2	10815	0.045	0.0097	819.6	377.4	1397.3	382.1	7.7	3.7				1.4	15.55					377.1	1359.9	381.8	8.0	3.6								
89	CAVECRK6	1	10815	0.045	0.0083	1474.2	463.0	1583.8	465.0	6.8	3.4	7.3	3.6	420.2	1.4	15.55	113.0	86.1	56.7	142.8	448.1	1452.4	450.1	7.4	3.2	7.7	3.4	412.6	142.6193	0.01060469	0.0088	-0.001804688	Moderate Deposition
U/S Limit	ANDORA	12	724.5	0.045	0.0337	1332.0	78.3	101.1	78.9	7.2	1.3	7.2	1.3	78.3	4.2	5.85	8.8				90.9	115.4	91.5	6.3	1.3								
	ANDORA	11	724.5	0.045	0.0162	1000.0	40.7	97.7	41.9	7.4	2.4				4.2	5.85					38.5	82.5	39.6	8.8	2.1								
	ANDORA	10	724.5	0.045	0.0137	1000.0	58.9	118.4	59.7	6.1	2.0				4.2	5.85					51.0	91.8	51.7	7.9	1.8								
	ANDORA	9	724.5	0.045	0.0134	990.4	61.9	121.3	62.4	6.0	2.0				4.2	5.85					57.2	95.9	57.7	7.6	1.7								
	ANDORA	8	791	0.045	0.0232	996.7	41.7	93.0	42.5	8.5	2.2				4.9	4.13					41.1	88.9	41.8	8.9	2.2								
	ANDORA	7	791	0.045	0.0181	1009.6	36.7	95.8	38.0	8.3	2.6				4.9	4.13					35.7	84.5	36.8	9.4	2.4								
	ANDORA	6	875	0.045	0.0201	1003.3	36.5	98.6	38.0	8.9	2.7				4.9	4.13					34.9	89.2	36.3	9.8	2.6								
	ANDORA	5	945	0.045	0.0109	1000.0	160.2	221.5	161.5	4.3	1.4				4.9	4.13					127.2	155.0	128.4	6.1	1.2								
	ANDORA	4	1120	0.045	0.0307	1000.0	100.8	149.4	101.7	7.5	1.5				4.9	4.13					102.9	157.6	103.8	7.1	1.5								
	ANDORA	3	1120	0.045	0.0229	968.5	41.0	115.1	42.5	9.7	2.8				4.9	4.13					39.6	108.8	41.1	10.3	2.7								
	ANDORA	2	1120	0.045	0.0294	789.1	78.8	137.9	80.6	8.1	1.8				4.9	4.13					80.4	143.6	82.3	7.8	1.8								
90	ANDORA	1	1120	0.045	0.0124	940.8	67.6	167.9	69.0	6.7	2.5	7.4	2.1	66.9	4.9	4.13	5.7	8.8		8.8	64.6	131.4	65.8	8.5	2.0	8.2	1.9	63.7	8.7790012	0.02639195	0.02064	-0.005751953	High Deposition
	CAVECRK7	10	10920	0.045	0.0087	1307.4	277.3	1279.9	278.7	8.5	4.6				1.4	15.55					181.0	733.3	182.1	14.9	4.1								
	CAVECRK7	9	10955	0.045	0.001	1000.0	815.5	3776.2	818.8	2.9	4.6				1.4	15.55					257.3	845.7	258.9	13.0	3.3								
	CAVECRK7	8	10955	0.045	0.0082	1000.0	480.0	1627.6	483.9	6.7	3.4				37.6	18.53					215.7	789.4	218.0	13.9	3.7								
	CAVECRK7	7	10955	0.045	0.0156	1000.0	443.5	1300.1	447.0	8.4	2.9				37.6	18.53					352.2	959.7	355.2	11.4	2.7								
	CAVECRK7	6	10955	0.045	0.0067	1000.0	437.9	1671.3	444.4	6.6	3.8				37.6	18.53					349.7	960.3	355.8	11.4	2.7								
	CAVECRK7	5	10990	0.045	0.0058	1000.0	665.3	2058.8	668.4	5.3	3.1				37.6	18.53					295.6	895.8	297.6	12.3	3.0								
	CAVECRK7	4	10990	0.045	0.0197	1000.0	468.1	1240.1	471.0	8.9	2.6				37.6	18.53					437.3	1047.5	440.0	10.5	2.4								
	CAVECRK7	3	10990	0.045	0.0032	1000.0	751.8	2584.5	755.5	4.3	3.4				37.6	18.53					616.3	1201.1	619.4	9.2	1.9								
	CAVECRK7	2	10990	0.045	0.0084	918.4	822.7	2007.4	828.4	5.5	2.4				37.6	18.53					563.9	1160.1	567.9	9.5	2.1								
91	CAVECRK7	1	10990	0.045	0.0125	823.3	609.5	1582.2	615.6	6.9	2.6	6.4	3.4	577.2	37.6	18.53	13.1	5.7	113.0	118.7	453.9	1065.7	459.3	10.3	2.3	11.6	2.8	372.3	117.48745	0.03158261	0.00891	-0.022672607	High Deposition
	CAVECRK8	5	10990	0.045	0.0002	1263.9	832.1	6203.9	843.1	1.8	7.5				12.8	10.85					462.1	1575.5	465.5	7.0	3.4								
	CAVECRK8	4	10990	0.045	0.0261	999.5	519.1	1187.8	522.2	9.3	2.3				12.8	10.85					788.1	1948.3	791.7	5.6	2.5								
	CAVECRK8	3	10990	0.045	0.0112	999.8	579.3	1603.6	586.3	6.9	2.8				12.8	10.85					608.0	1761.6	615.4	6.2	2.9								
	CAVECRK8	2	11830	0.045	0.0055	992.8	438.4	1864.8	449.1	6.3	4.3				12.8	10.85					415.4	1587.6	424.9	7.5	3.8								
92	CAVECRK8	1	11830	0.045	0.0171	1506.3	386.1	1261.3	395.6	9.4	3.3	6.7	4.0	551.0	12.8	10.85	22.3	13.1	10.5	23.7	398.1	1563.7	409.1	7.6	3.9	6.8	3.3	534.3	23.675316	0.00873469	0.01193	0.003195313	High Erosion

Appendix D

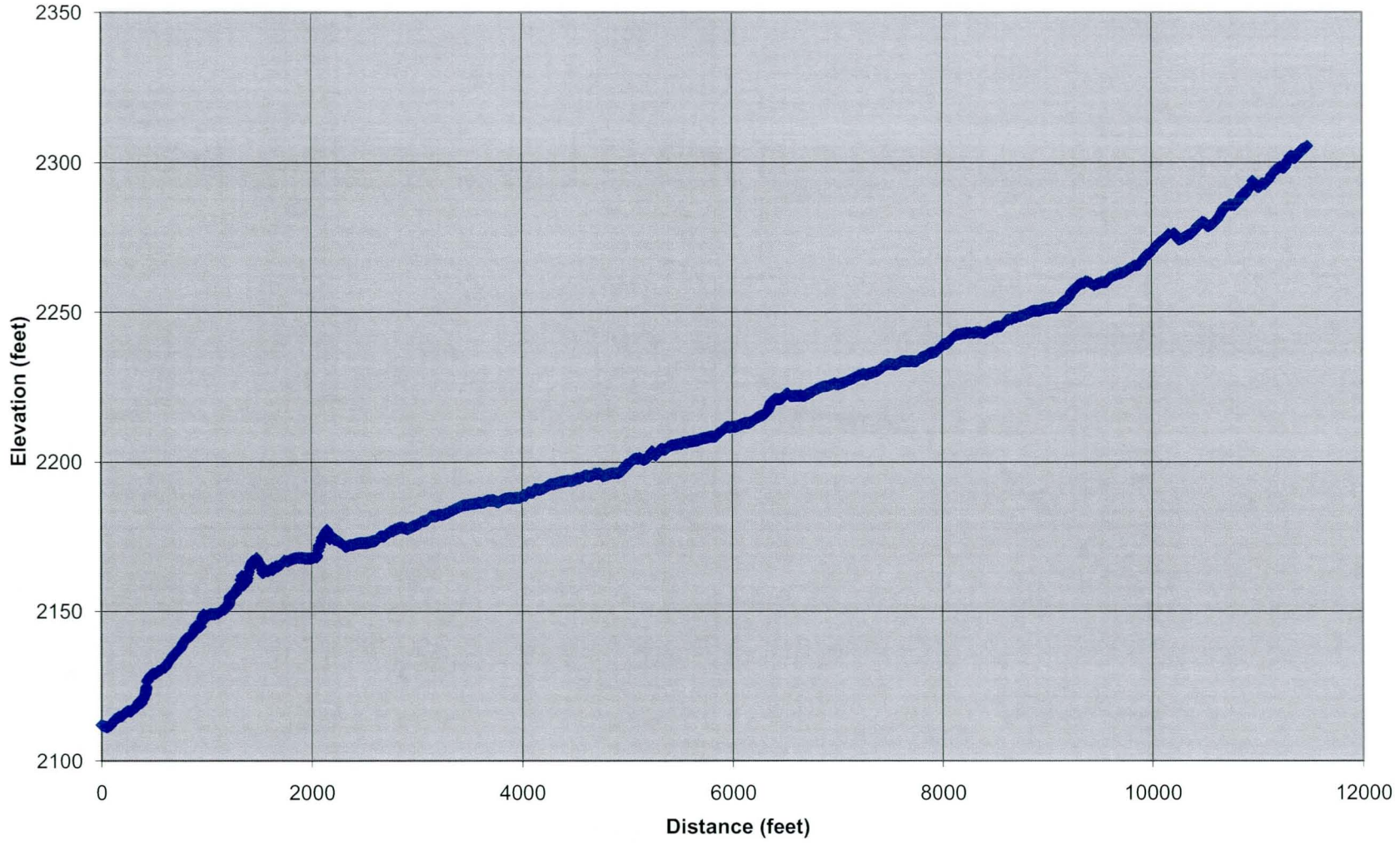
Longitudinal Profile Plots


Andora Hills Wash
Elevation (feet)
2300
2250
2200
2150
2100
2050
2000
1950
0
2000
4000
6000
8000
10000
12000
Distance (feet)

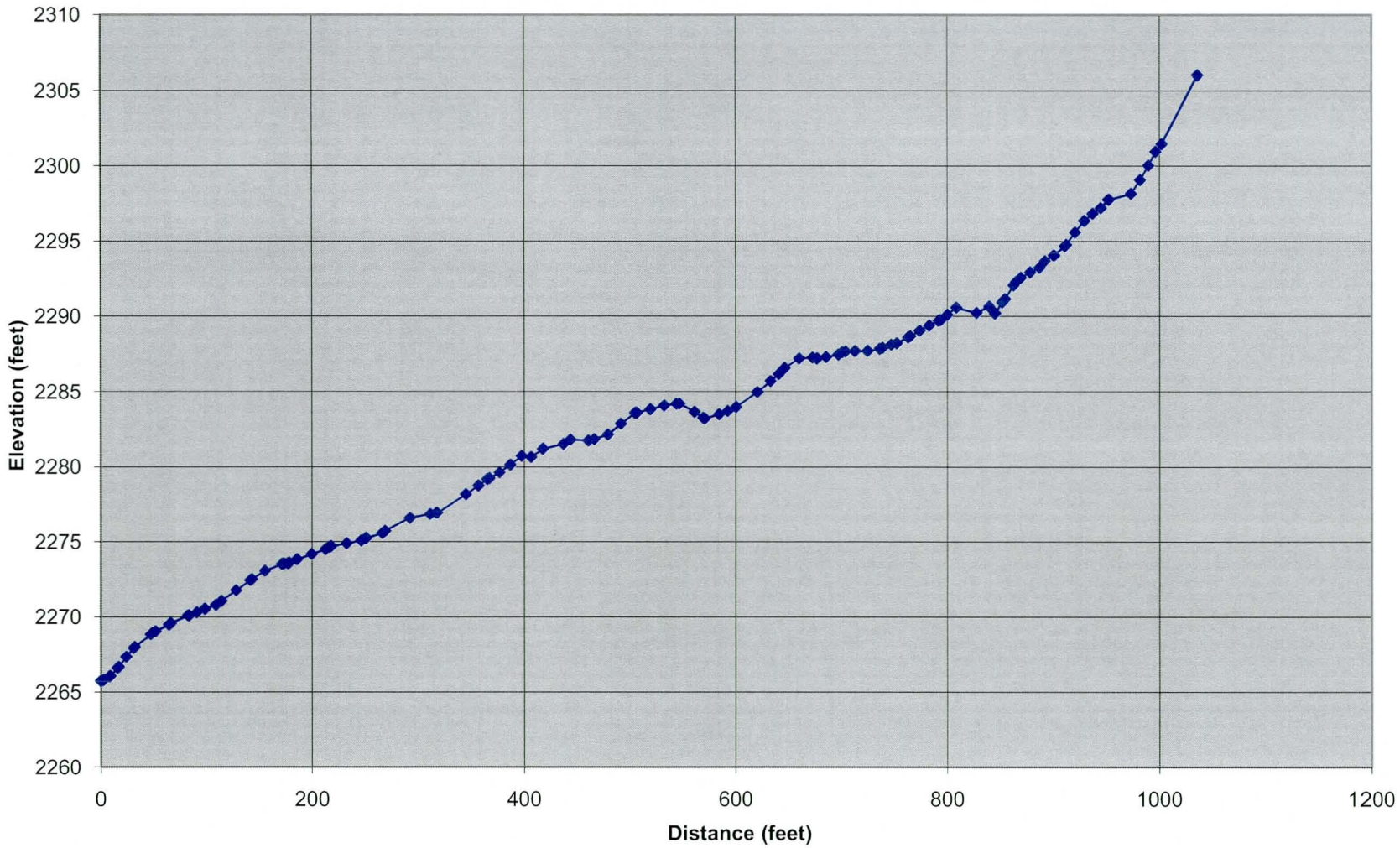
Cave Creek


2350
2300
2250
2200
2150
2100
2050
2000
1950
1900
1850
Elevation (feet)
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
Distance (feet)

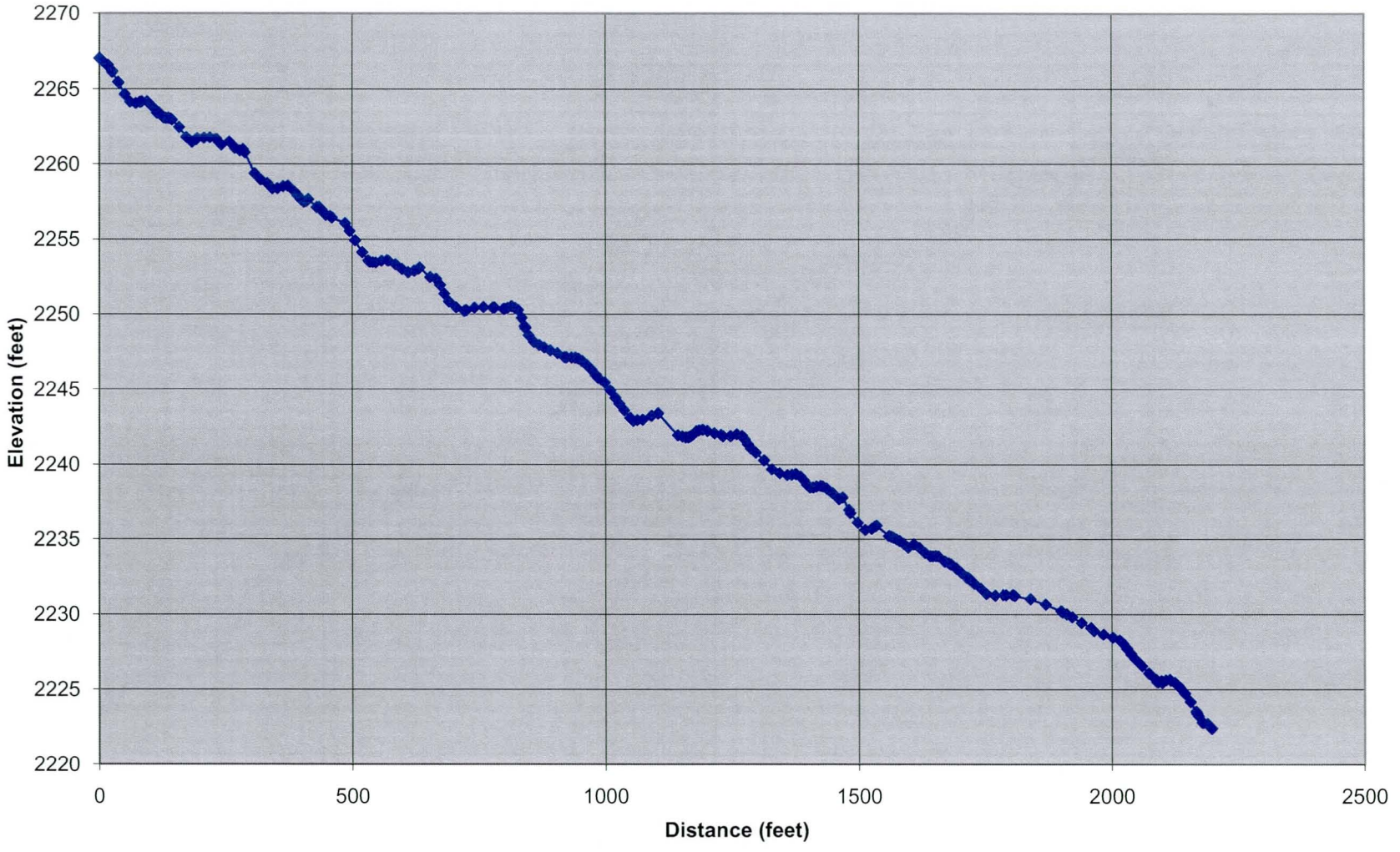
Cave Creek Trib 1



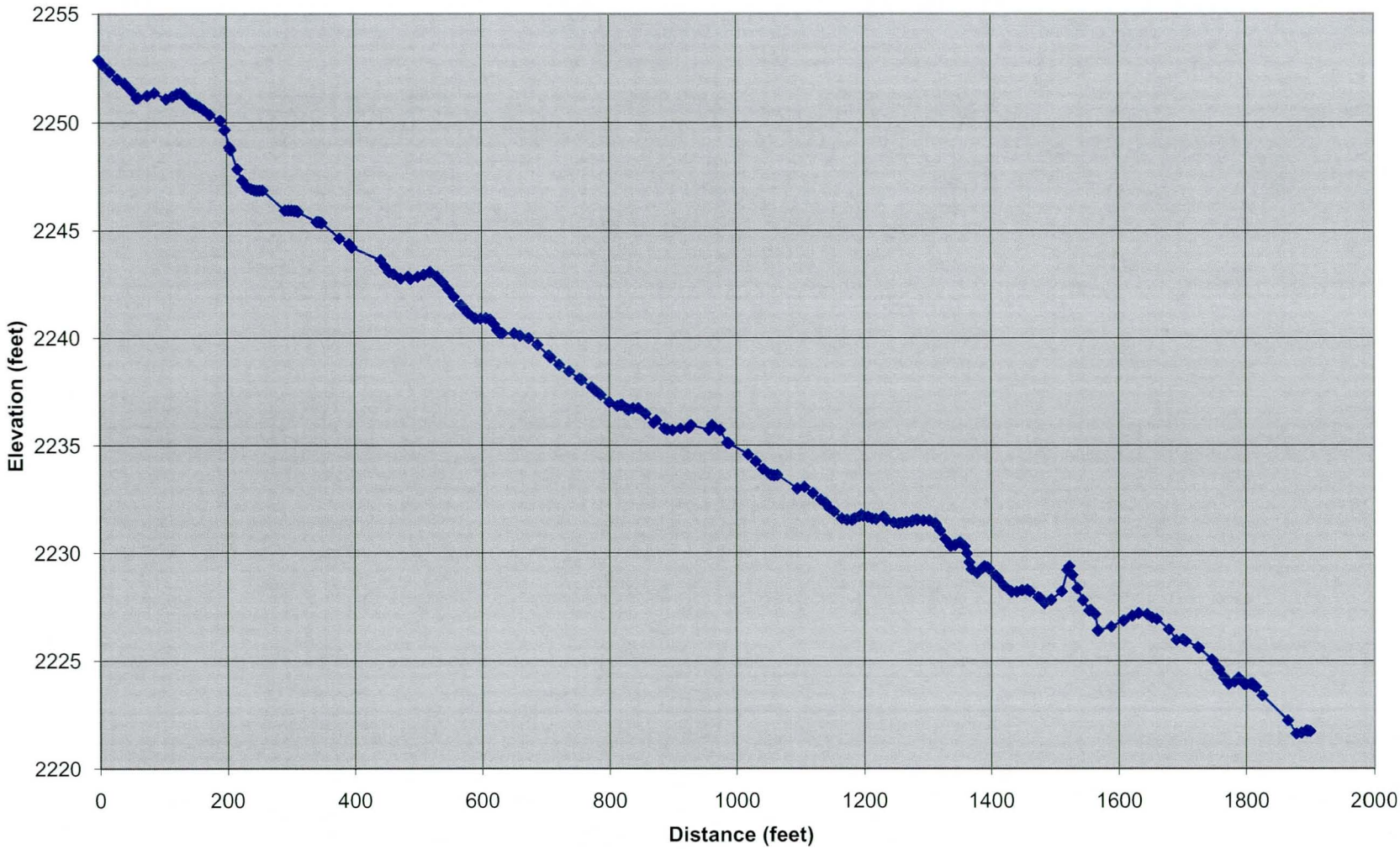
Cave Creek Trib 1A



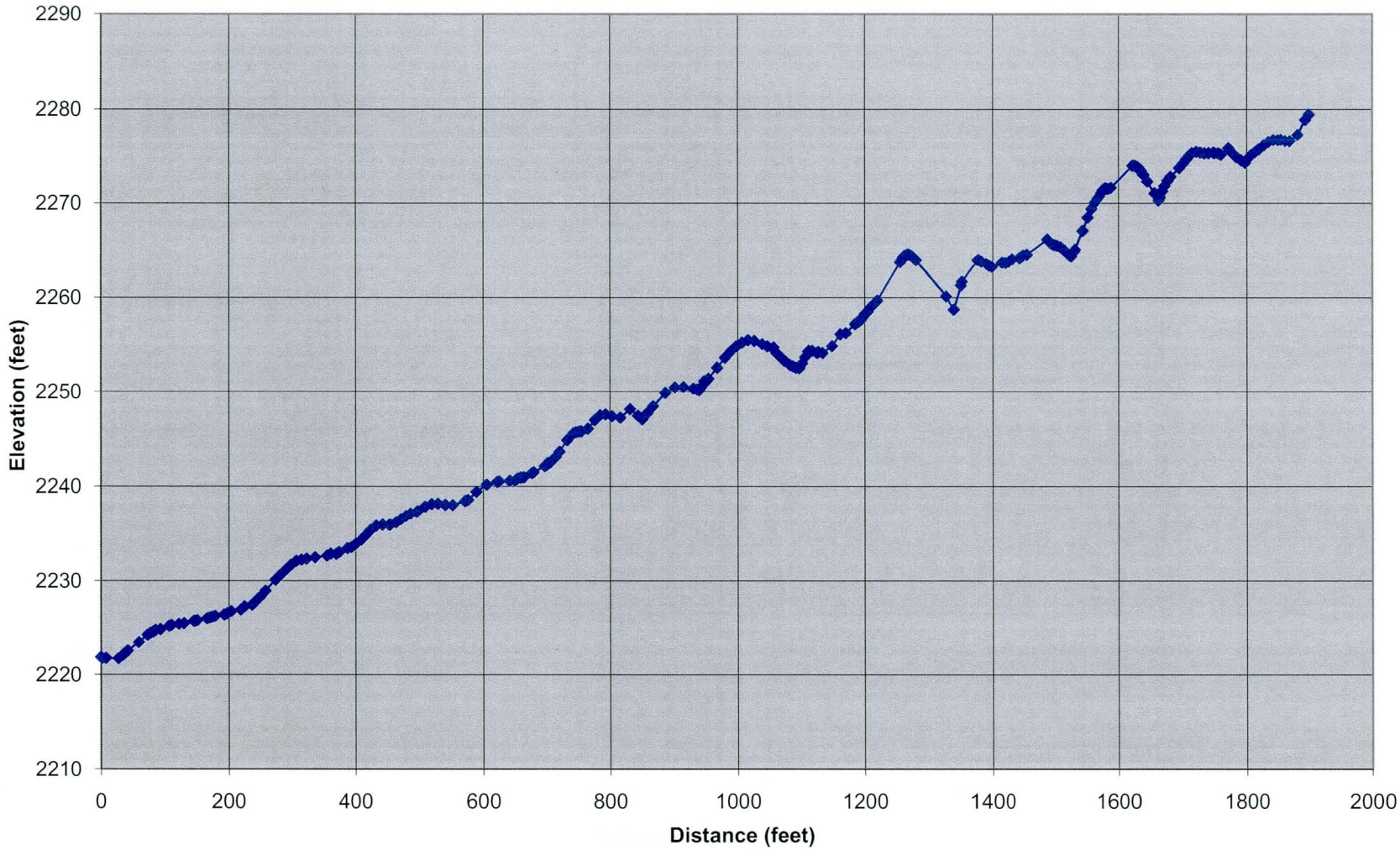
Cave Creek Trib 1B

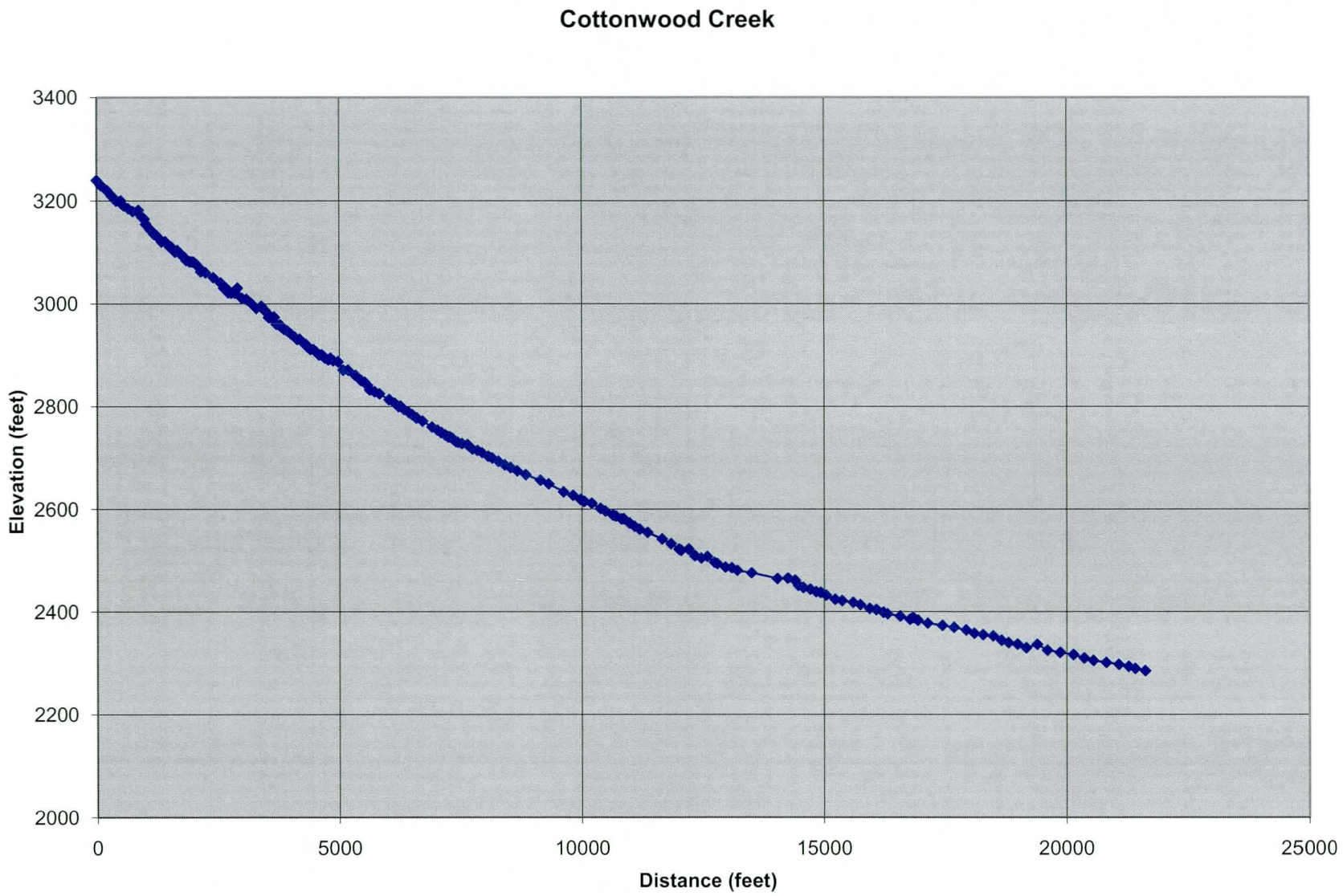


Cave Creek Trib 1C

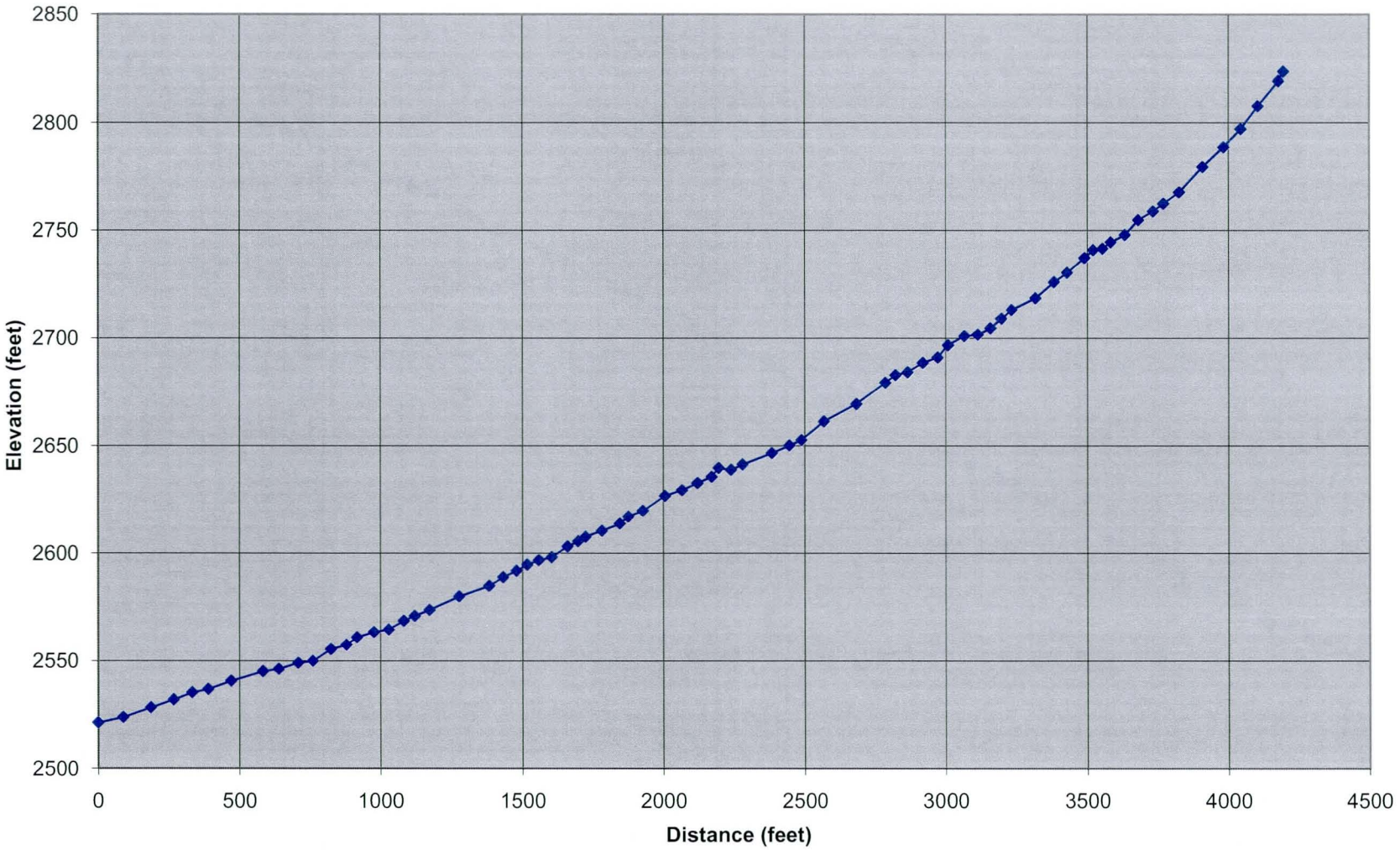


Cave Creek Trib 1D

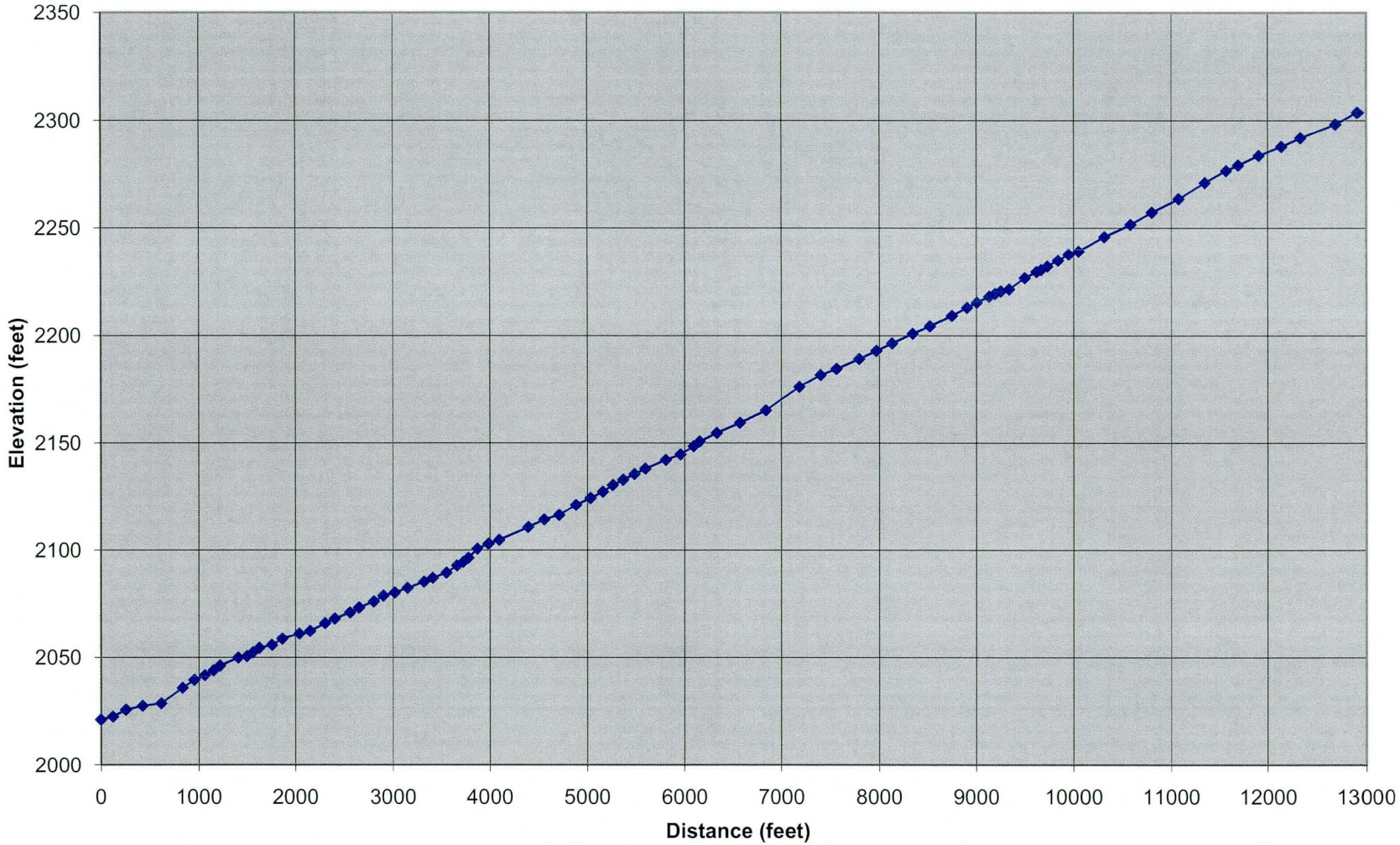



Cottonwood Creek
3400
3200
3000
2800
2600
2400
2200
2000
Elevation (feet)
0
5000
10000
15000
20000
25000
Distance (feet)

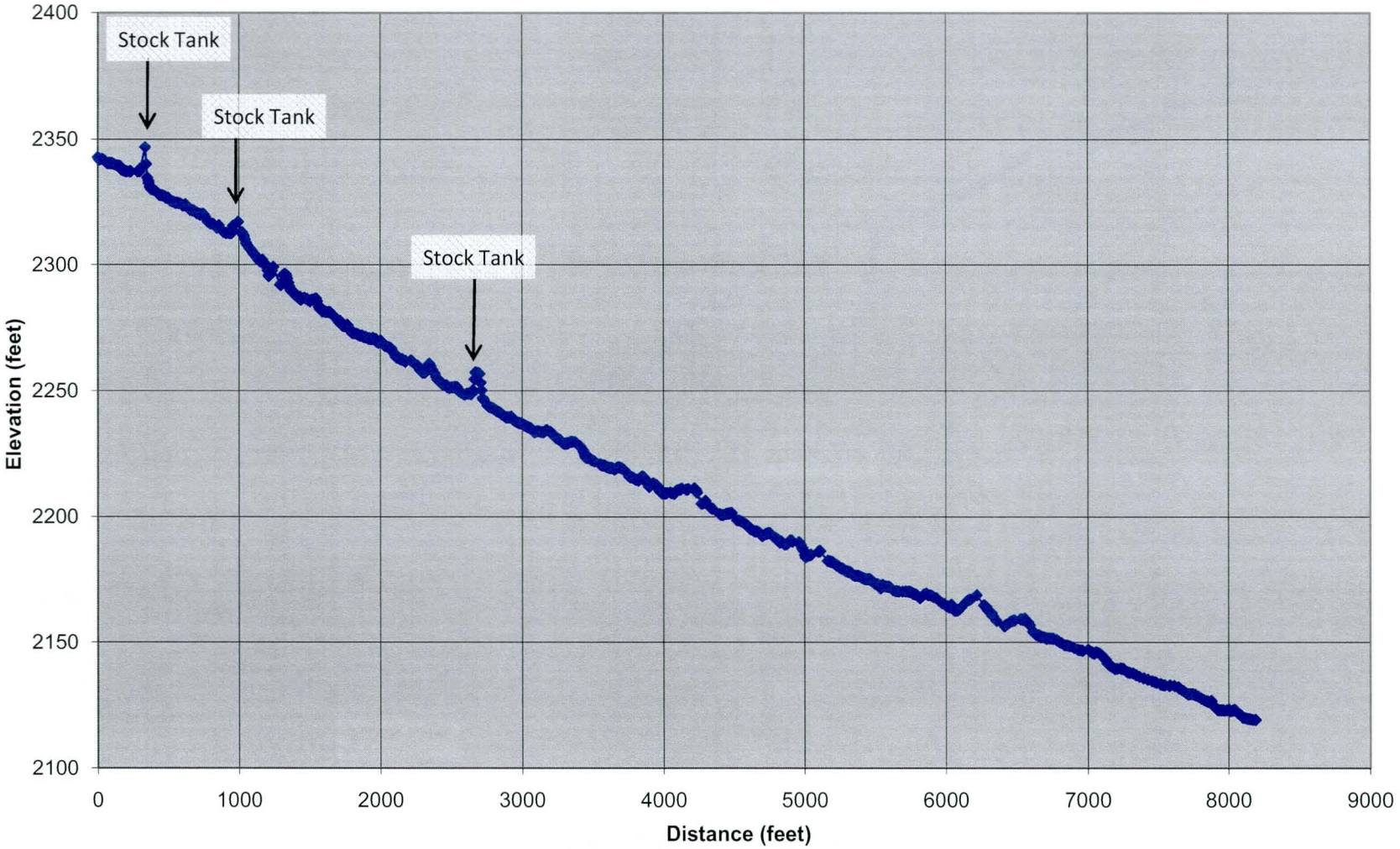
Flemming Springs Wash



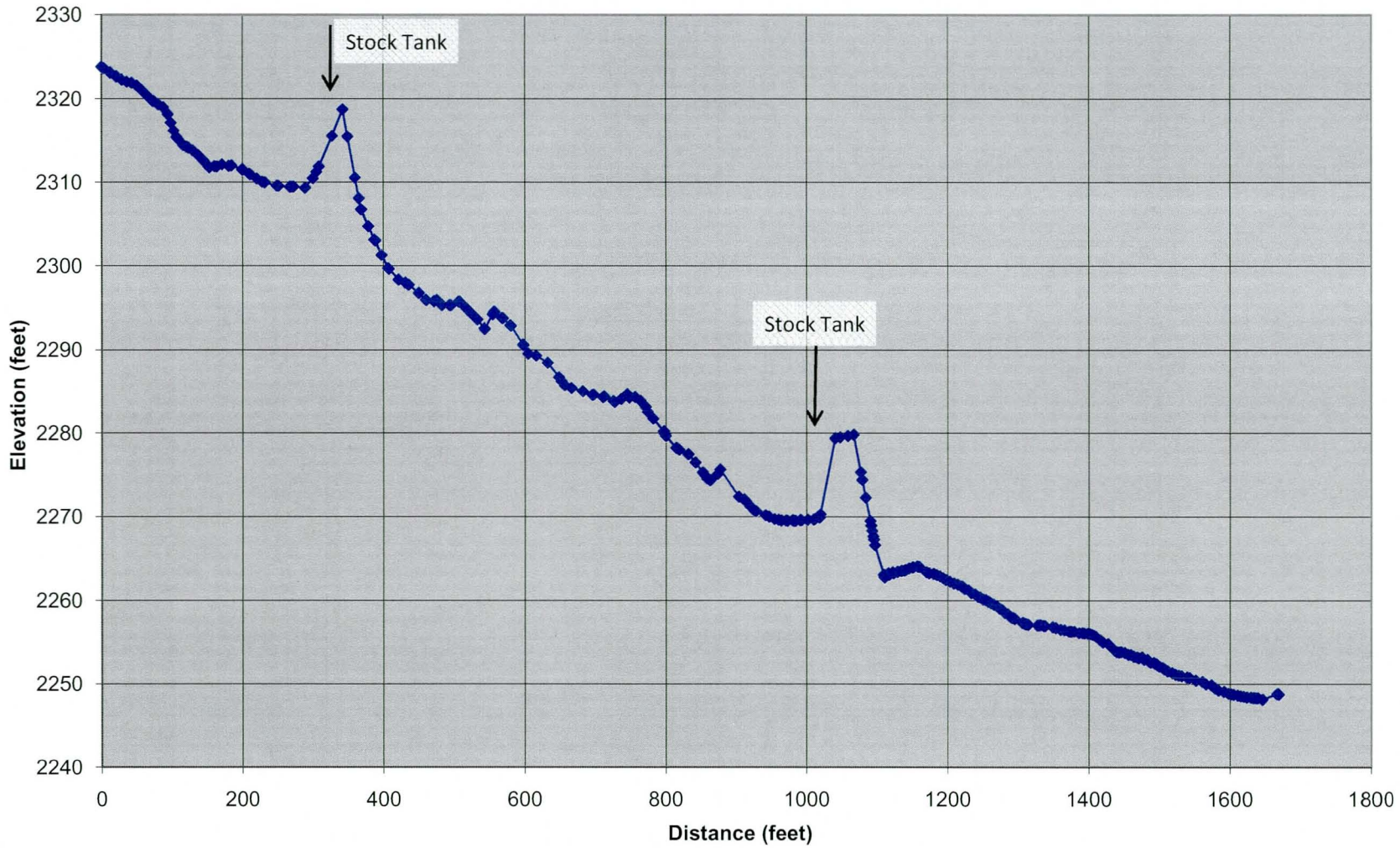
Galloway Wash



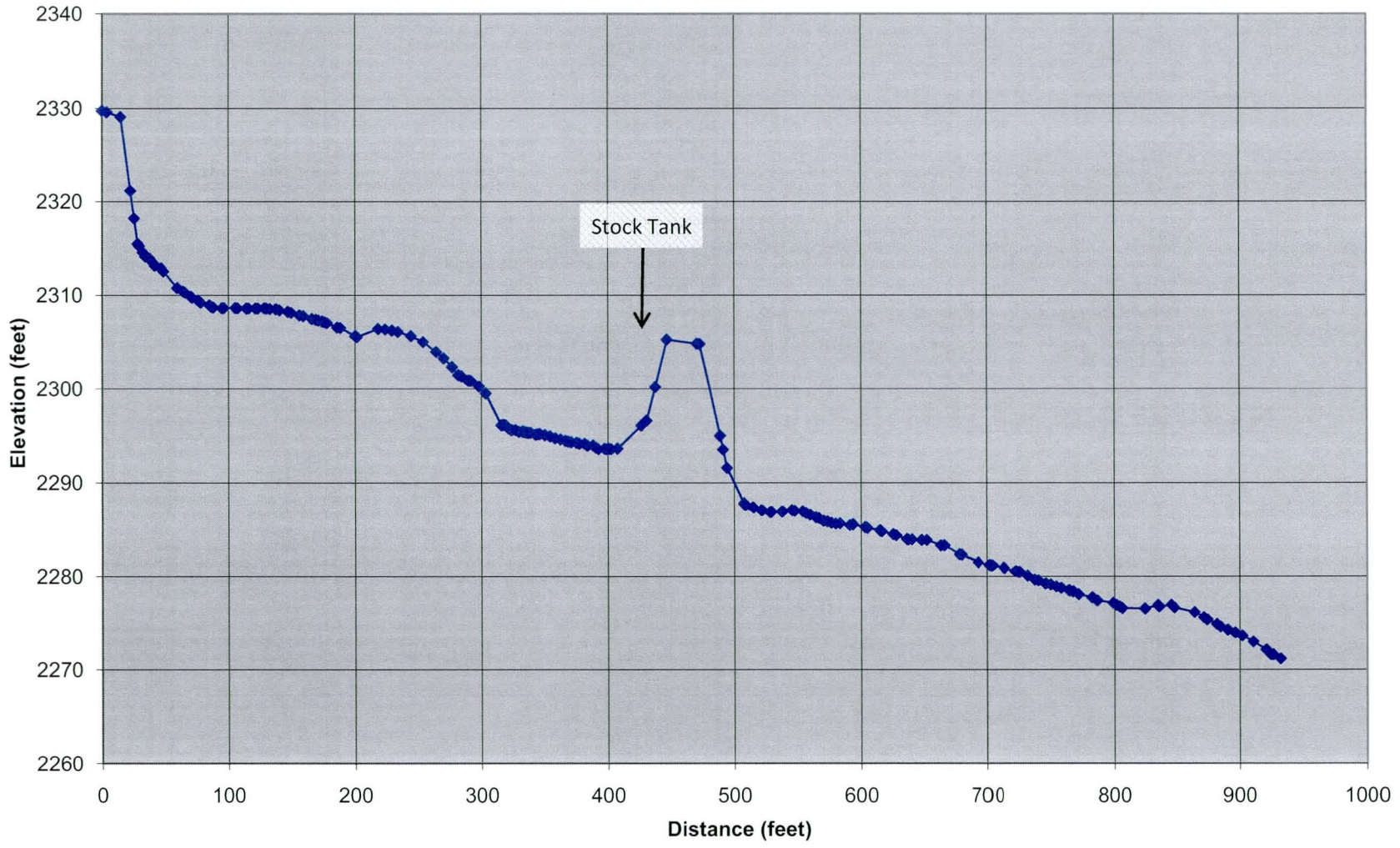
Galloway Wash Trib 2



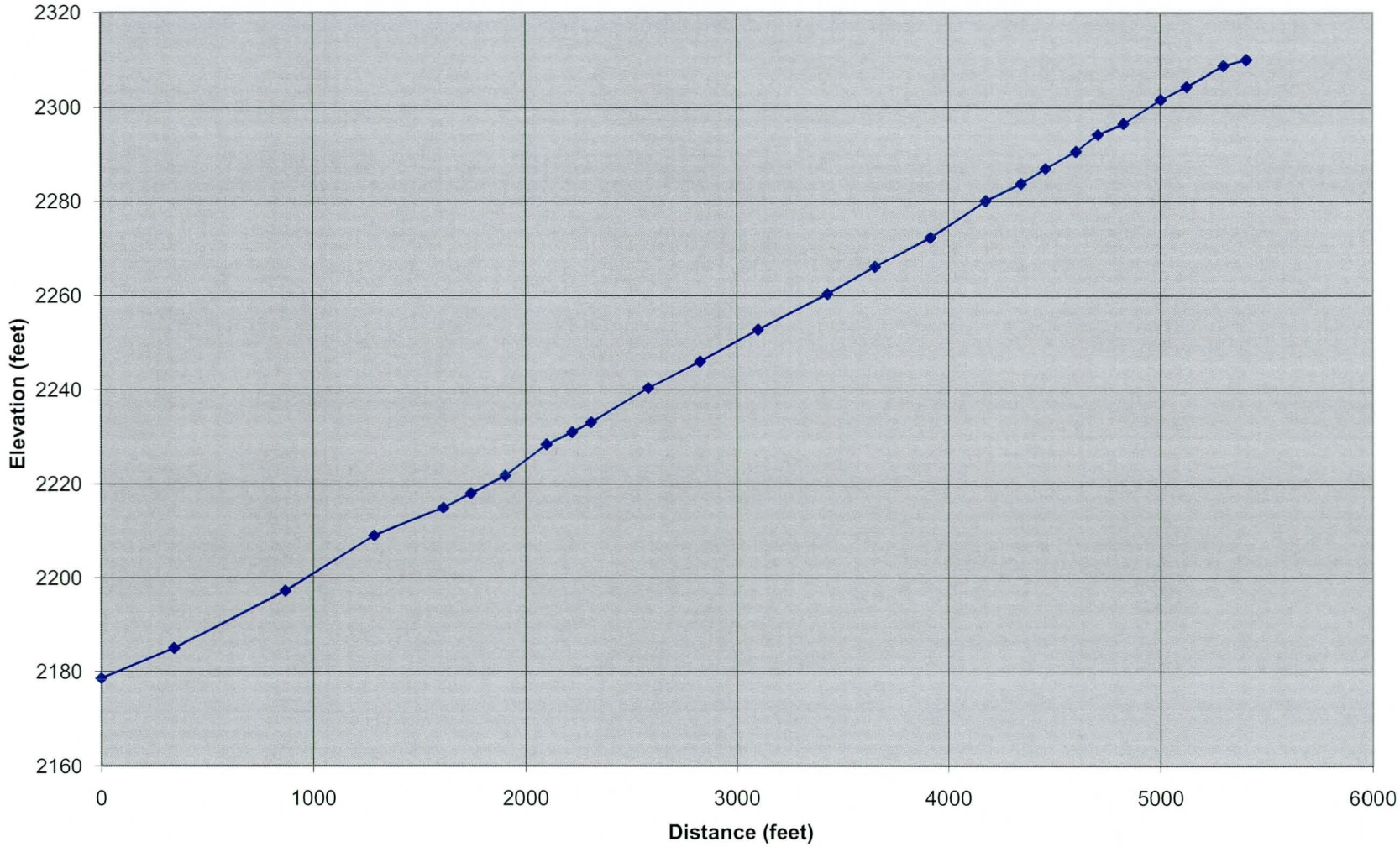
Galloway Wash Trib 2A



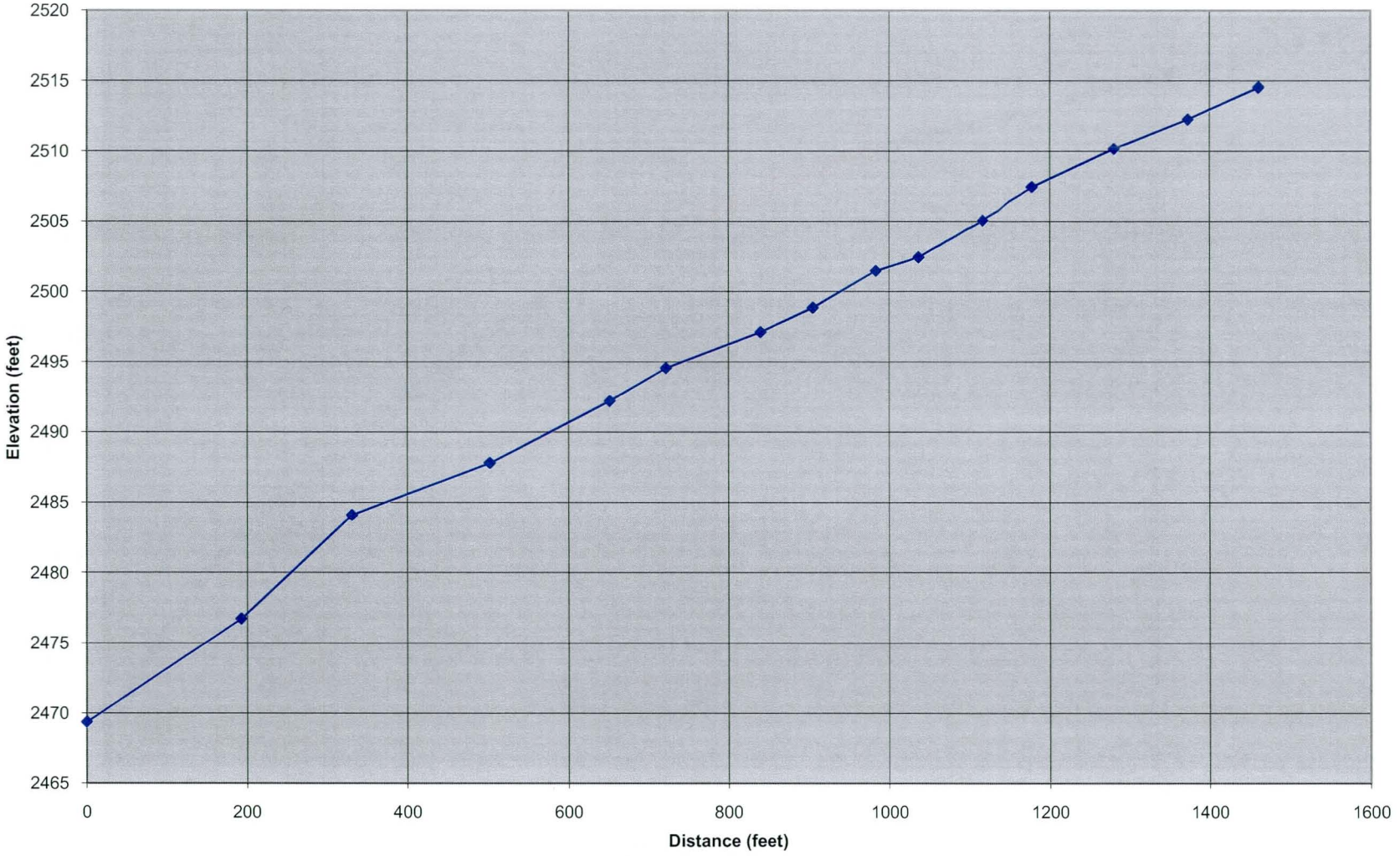
Galloway Wash Trib 2B



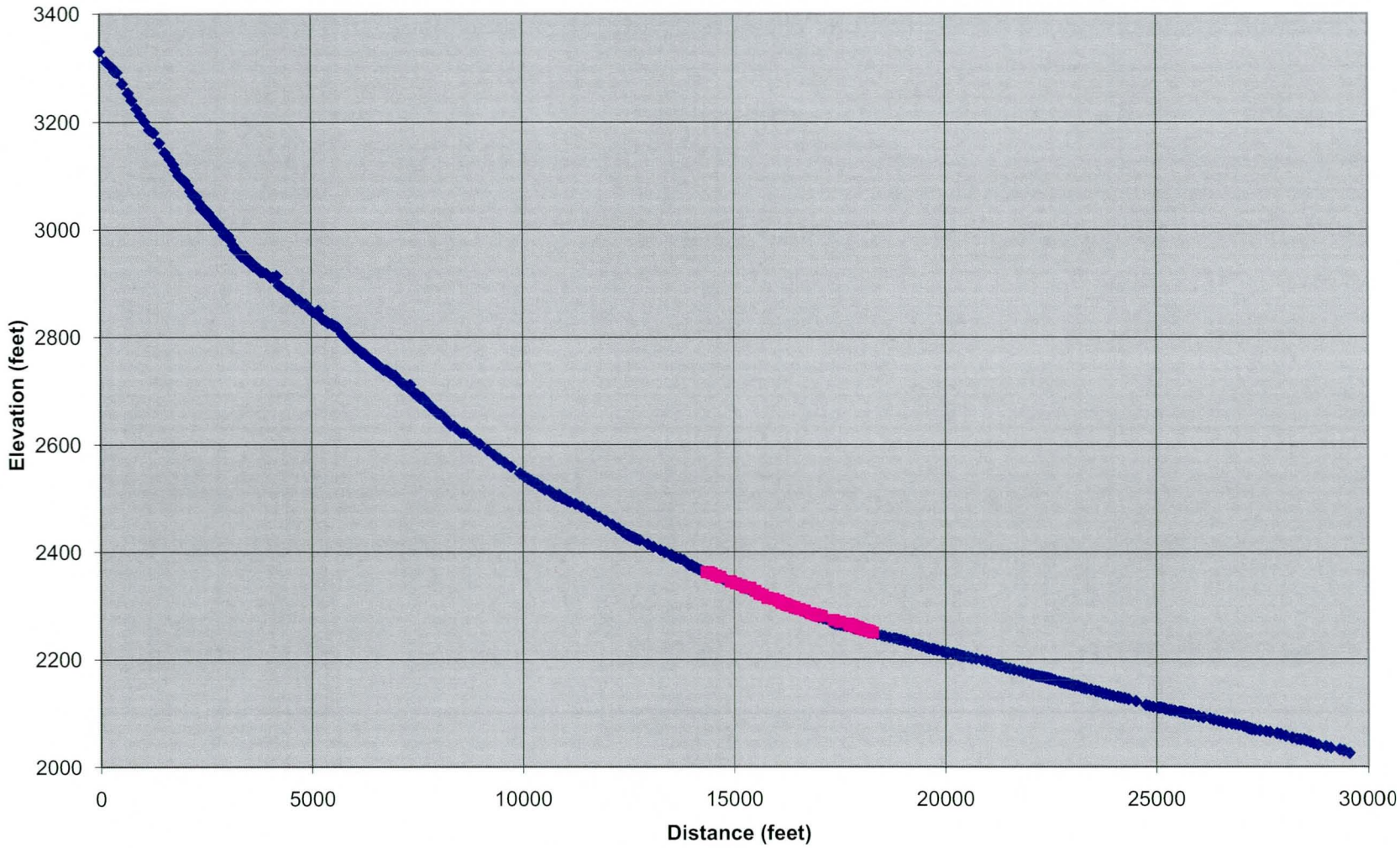
North Tributary Galloway Wash



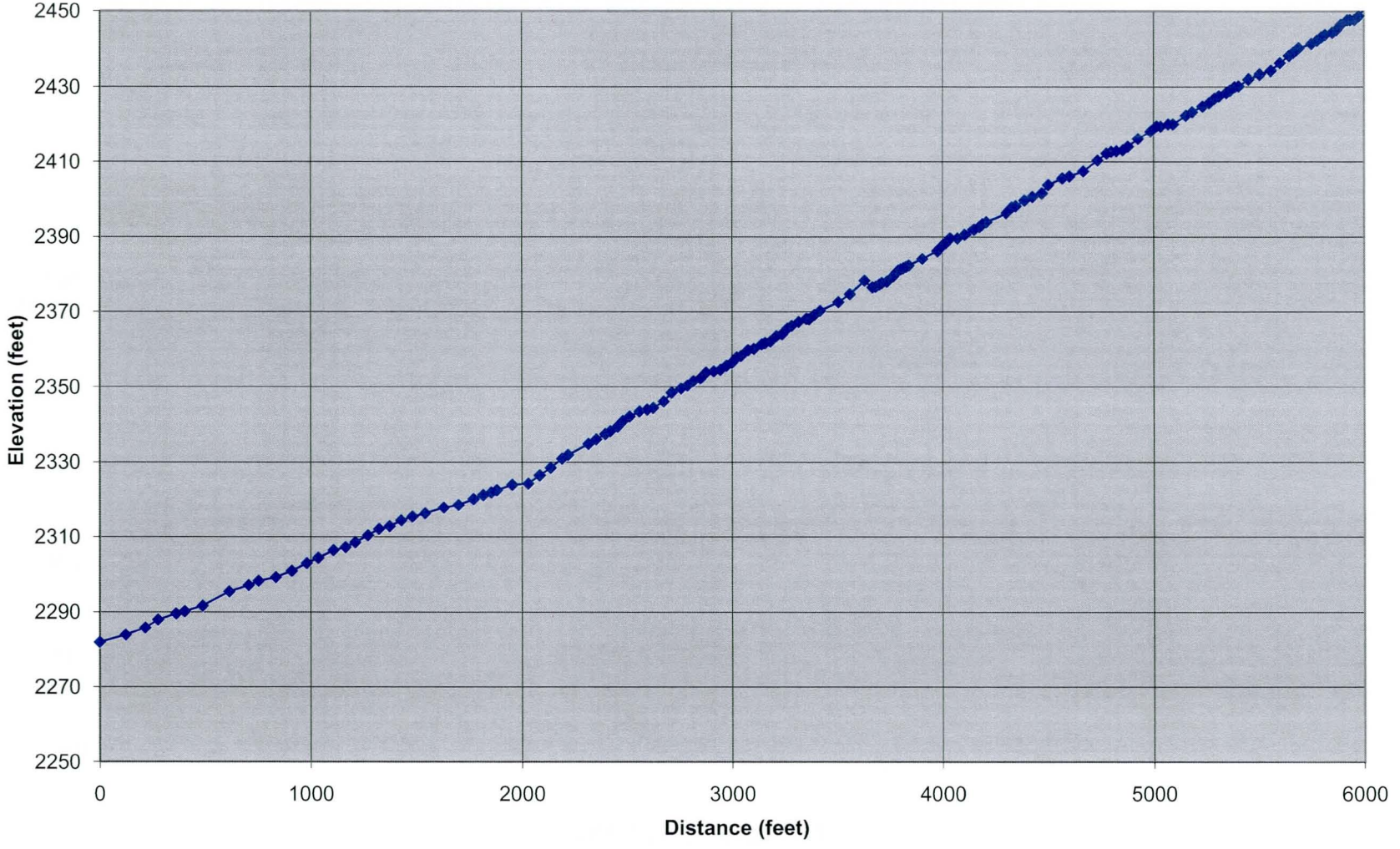
Grapevine Wash



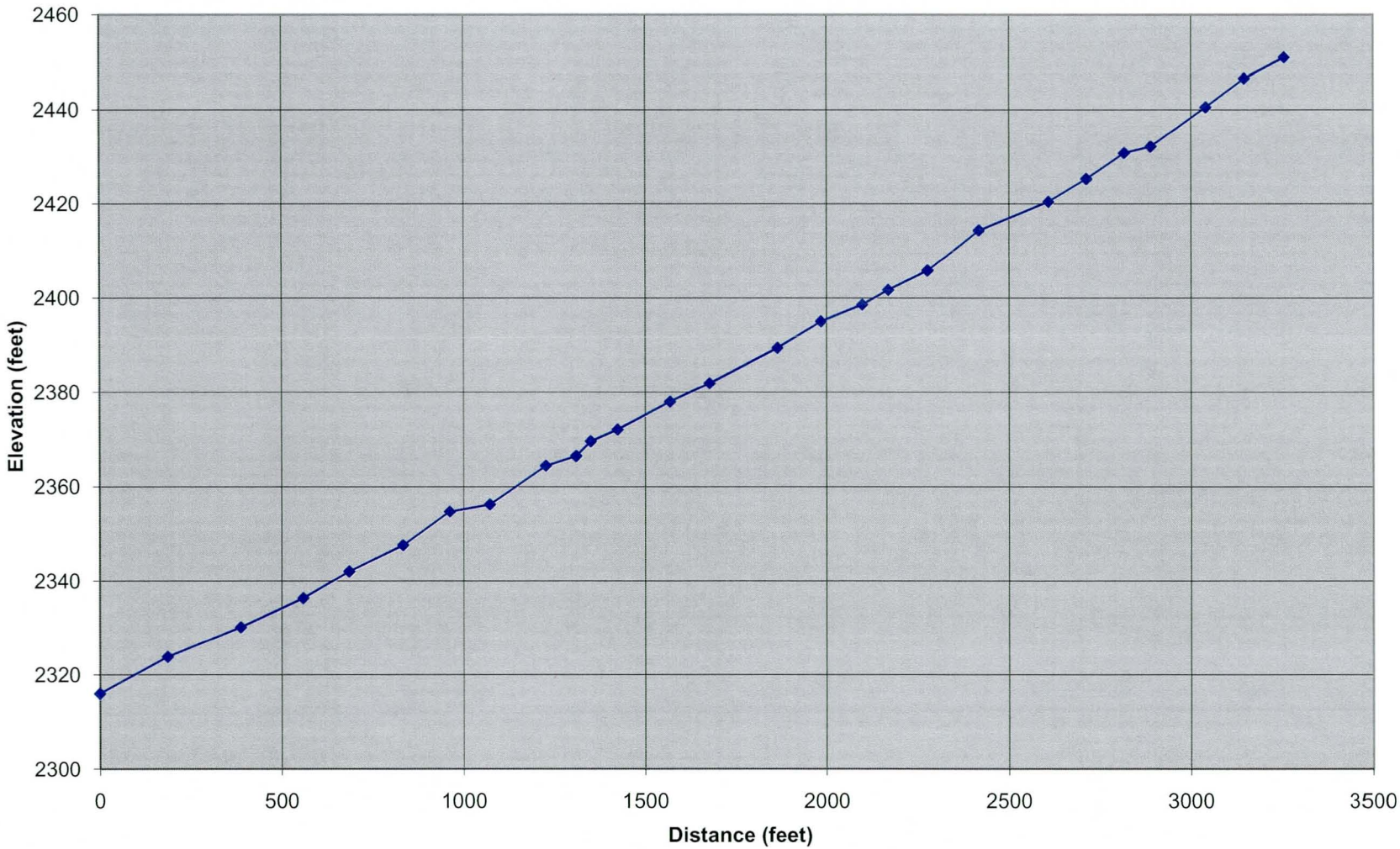
Ocotillo Wash

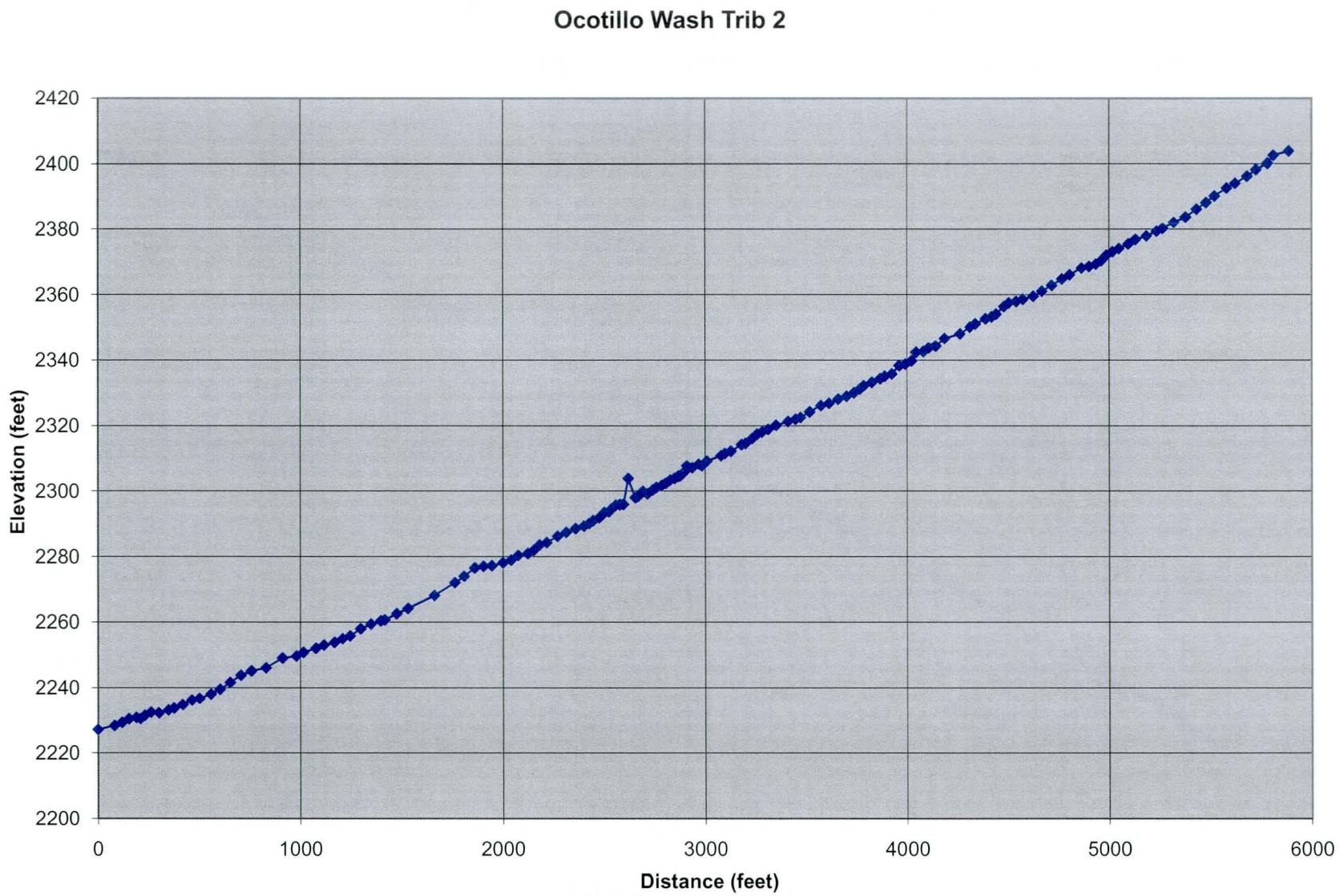


Ocotillo Wash Trib 1

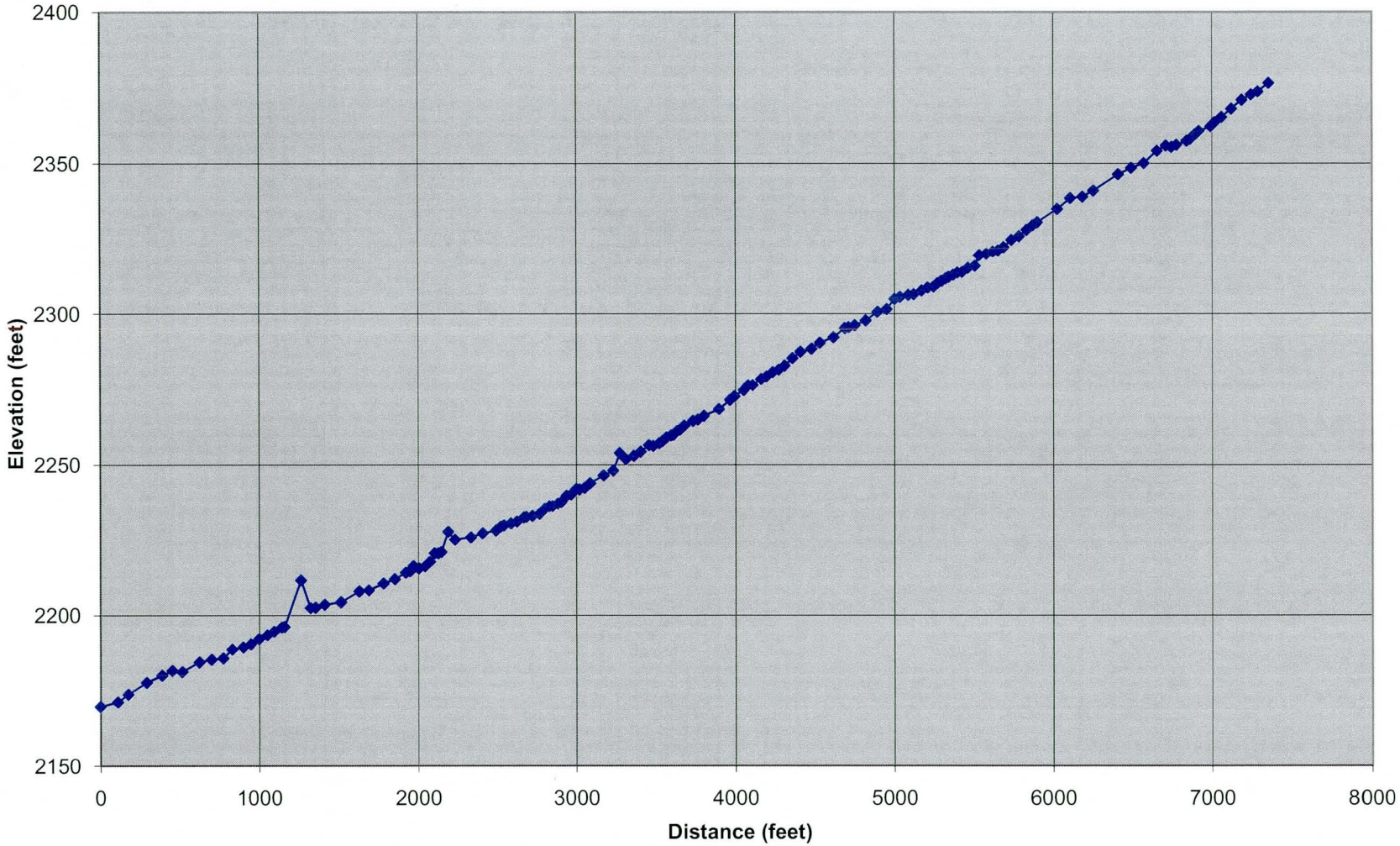


Ocotillo Wash Trib 1A

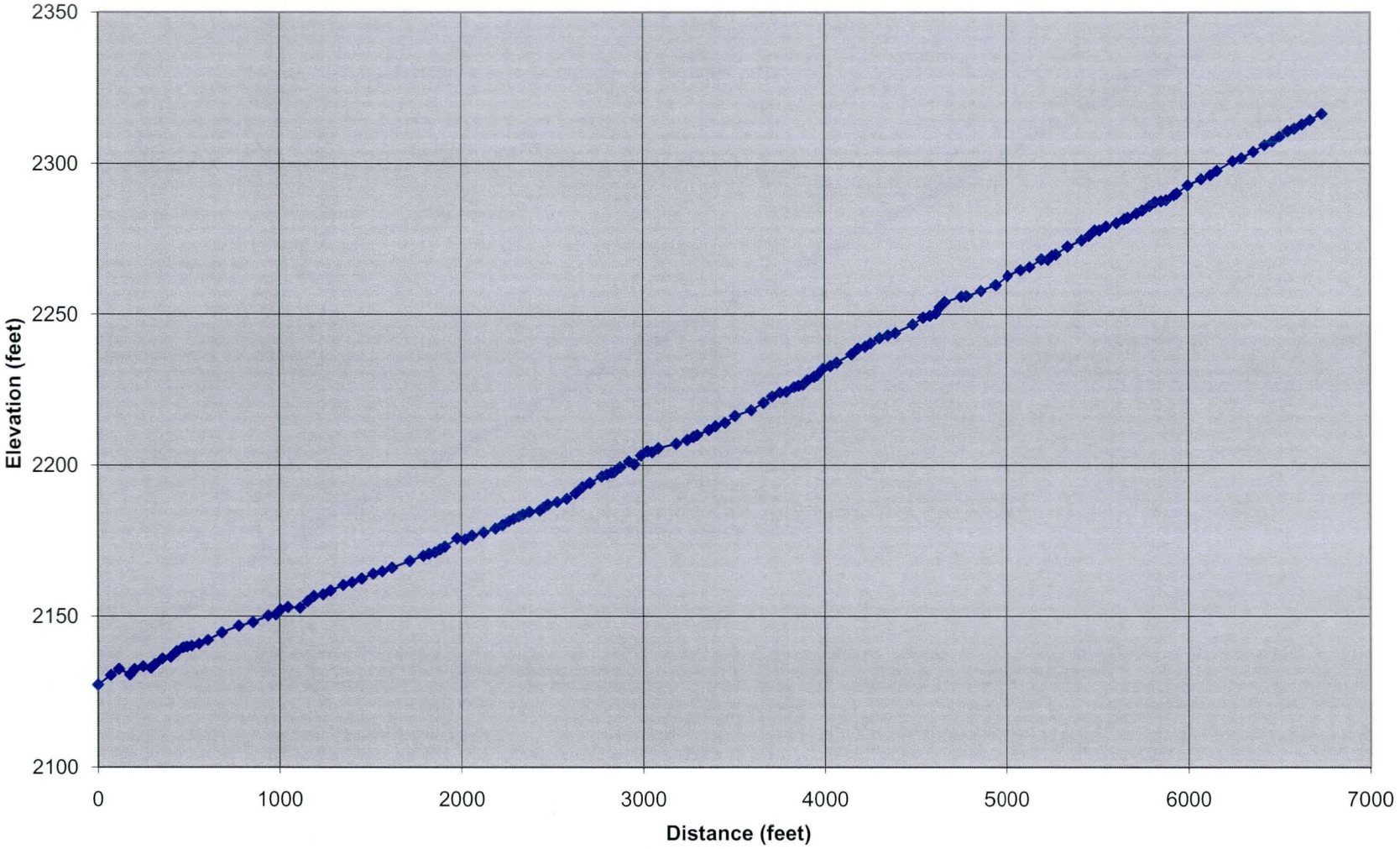



Ocotillo Wash Trib 2
Elevation (feet)
2420
2400
2380
2360
2340
2320
2300
2280
2260
2240
2220
2200
0
1000
2000
3000
4000
5000
6000
Distance (feet)

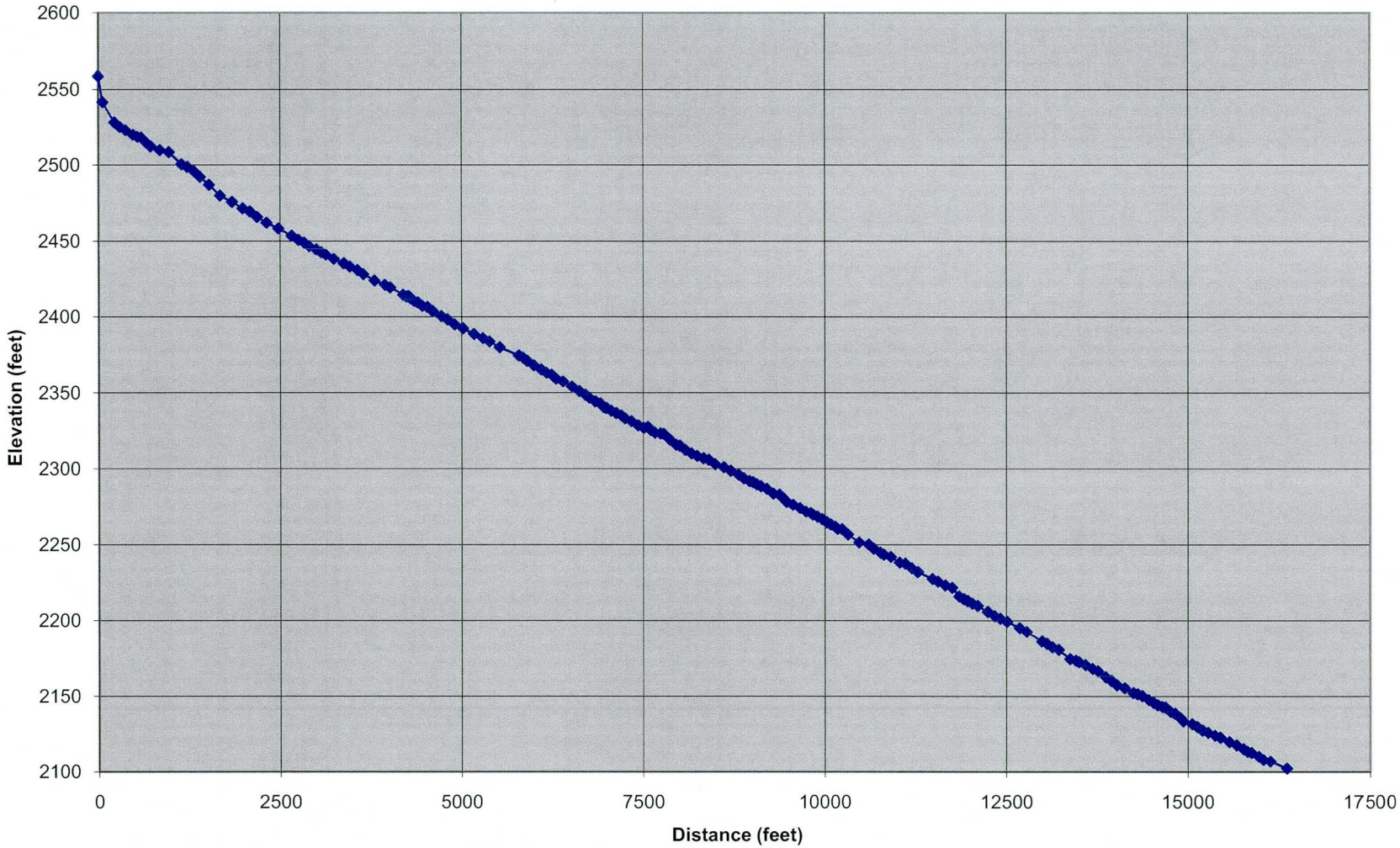
Ocotillo Wash Trib 3

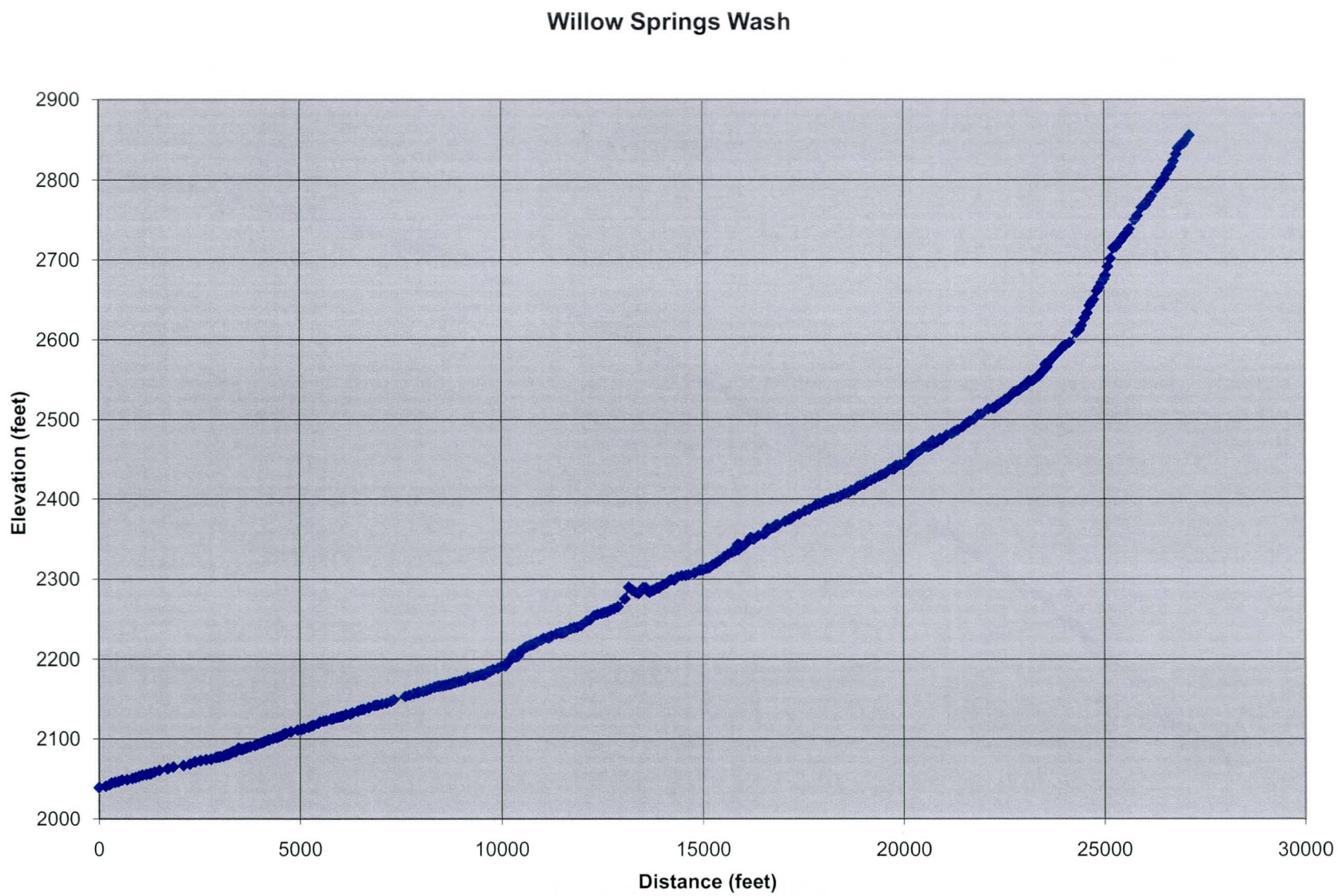


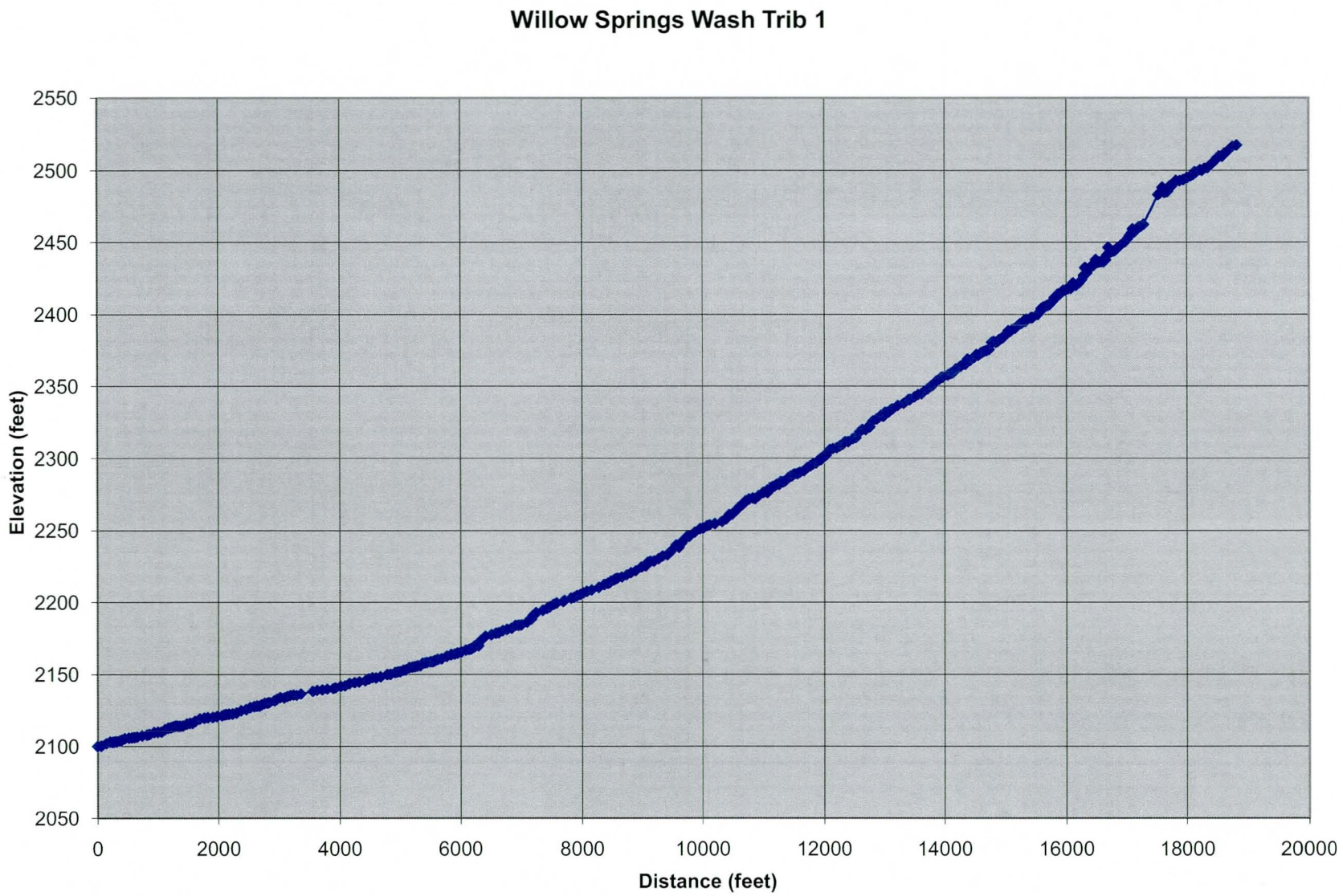
Ocotillo Wash Trib 4

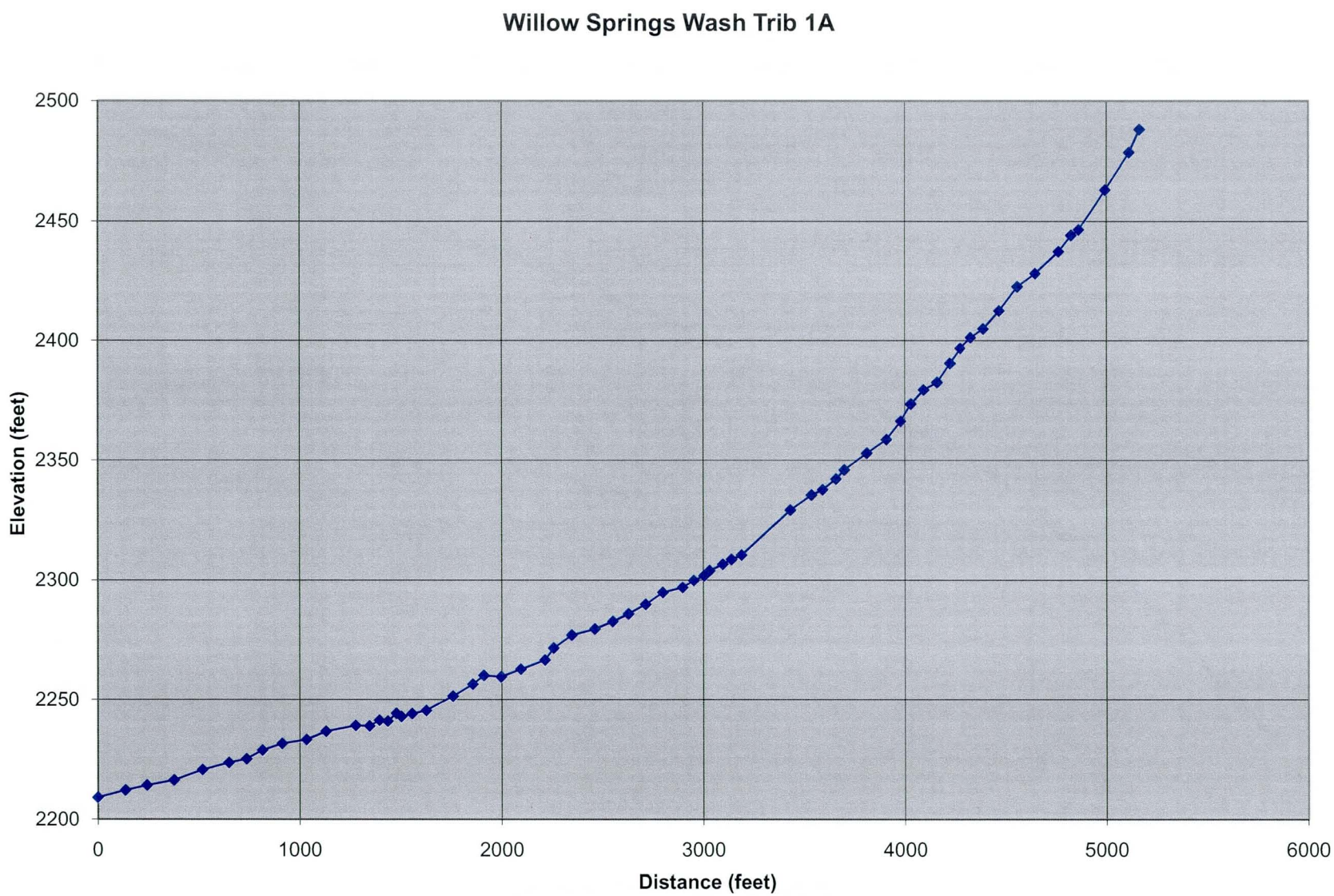


Rowe Wash

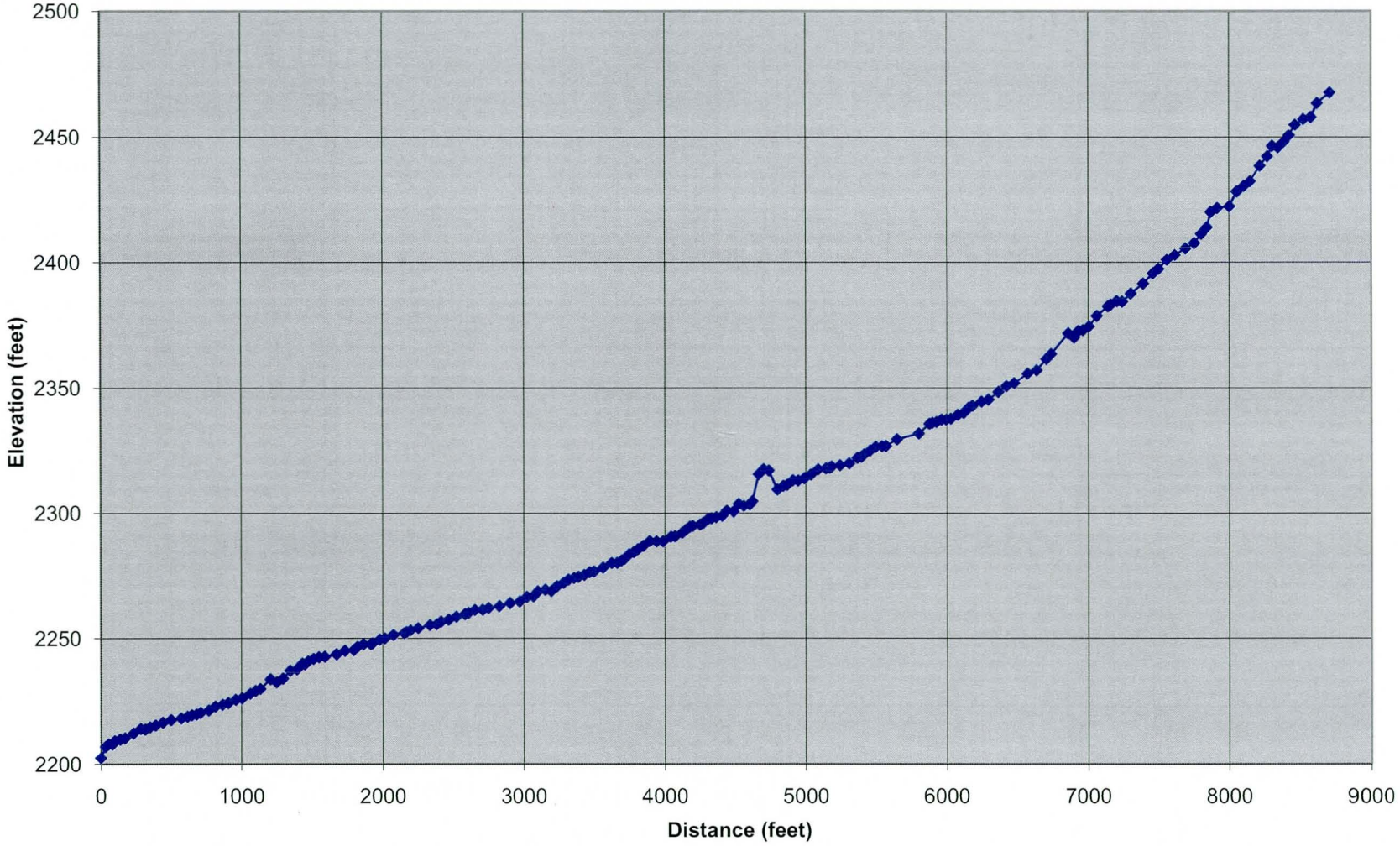

2600
2550
2500
2450
2400
2350
2300
2250
2200
2150
2100
Elevation (feet)
0
2500
5000
7500
10000
12500
15000
17500
Distance (feet)


Willow Springs Wash
Elevation (feet)
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
0
5000
10000
15000
20000
25000
30000
Distance (feet)

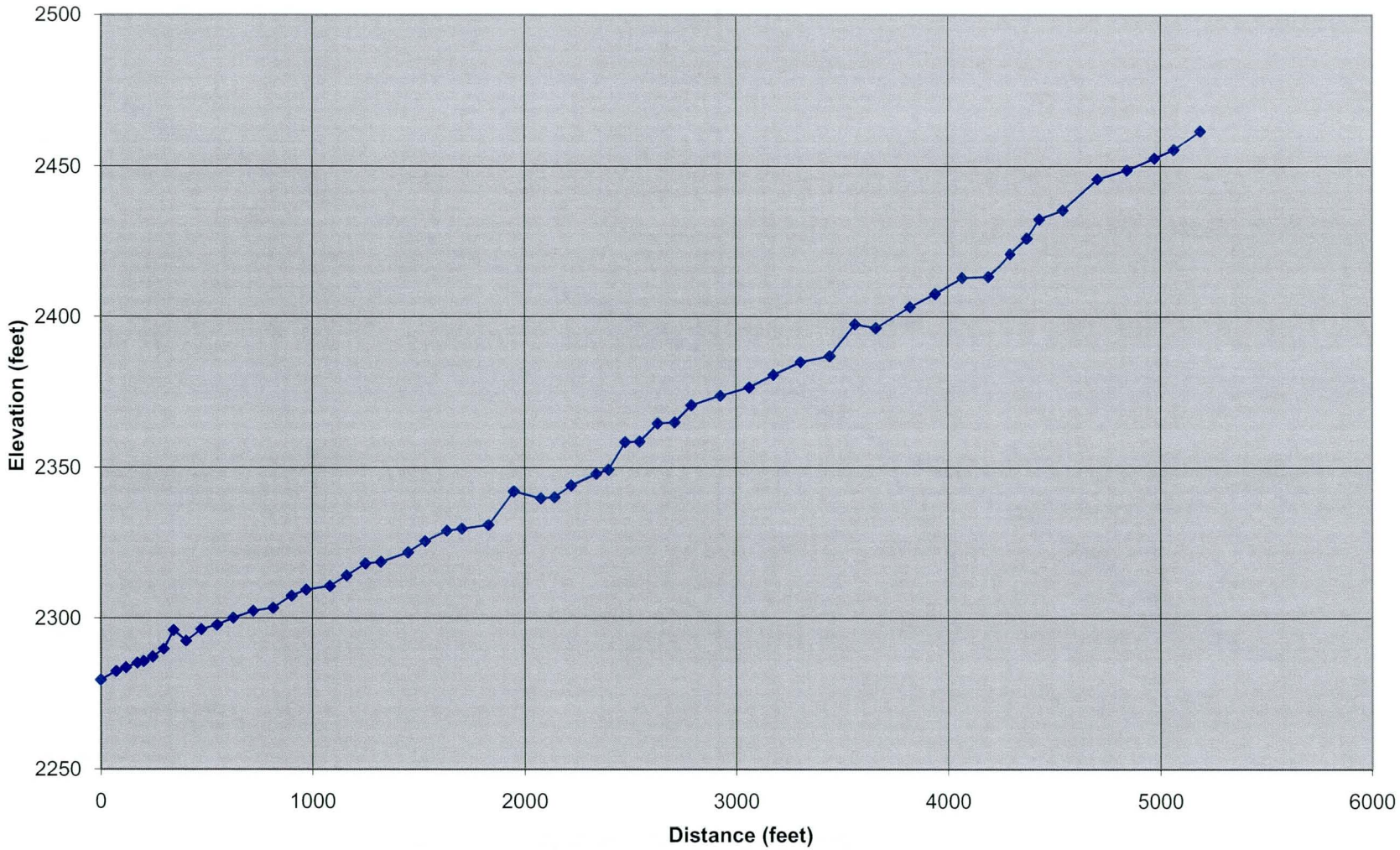

Willow Springs Wash Trib 1
Elevation (feet)
2550
2500
2450
2400
2350
2300
2250
2200
2150
2100
2050
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Distance (feet)


Willow Springs Wash Trib 1A
Elevation (feet)
2500
2450
2400
2350
2300
2250
2200
0
1000
2000
3000
4000
5000
6000
Distance (feet)

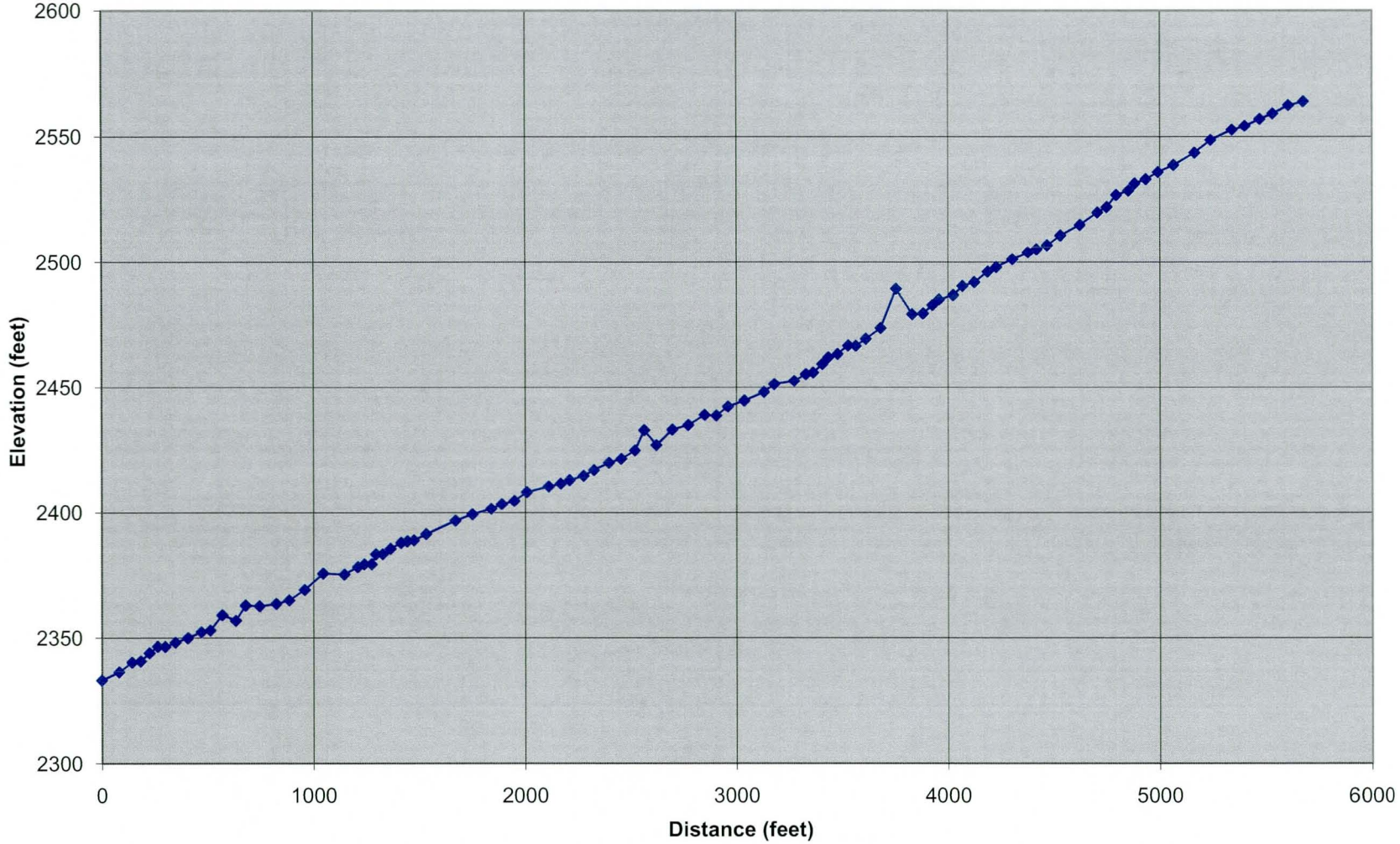
Willow Springs Wash Trib 2



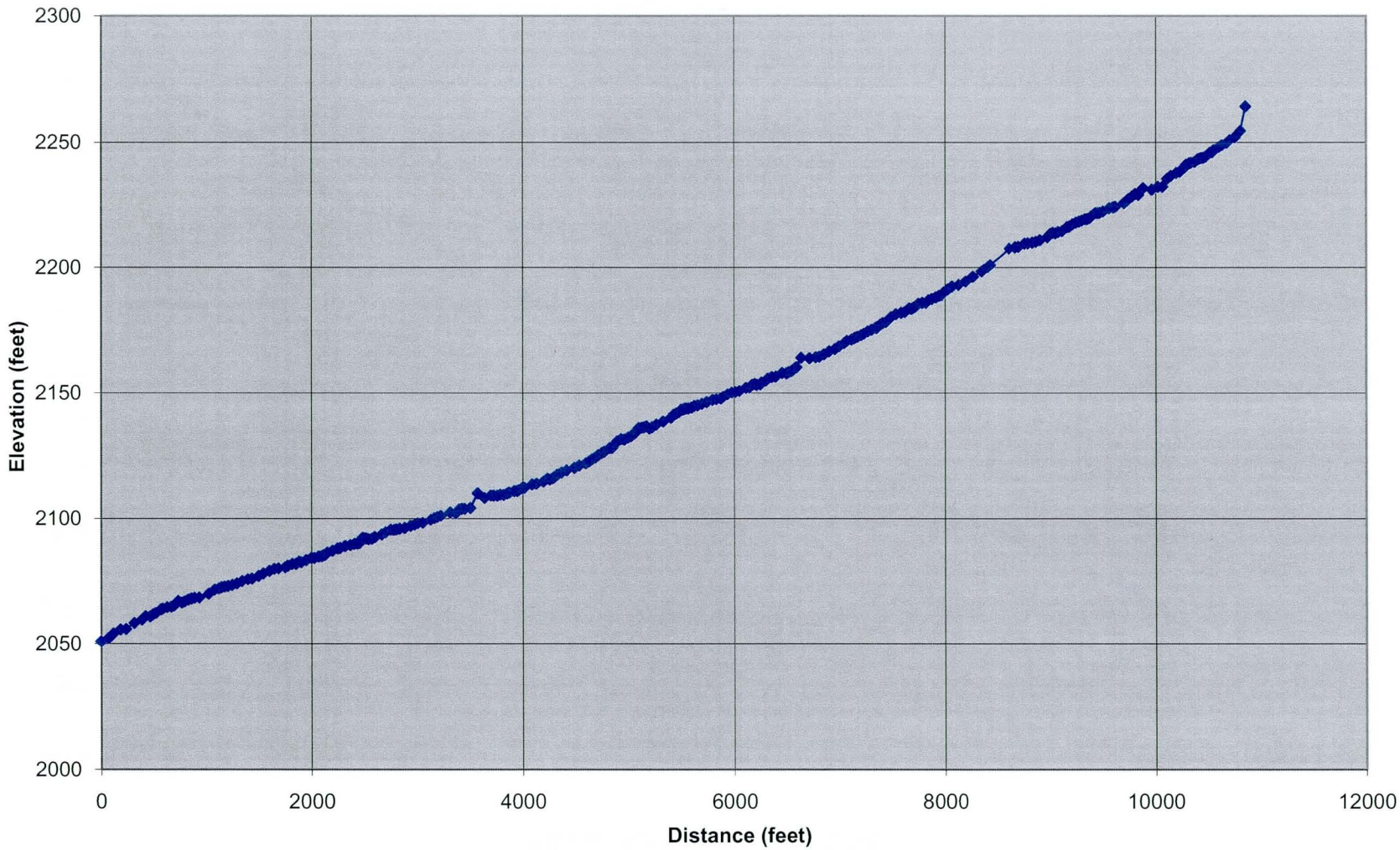
Willow Springs Wash Trib 2A



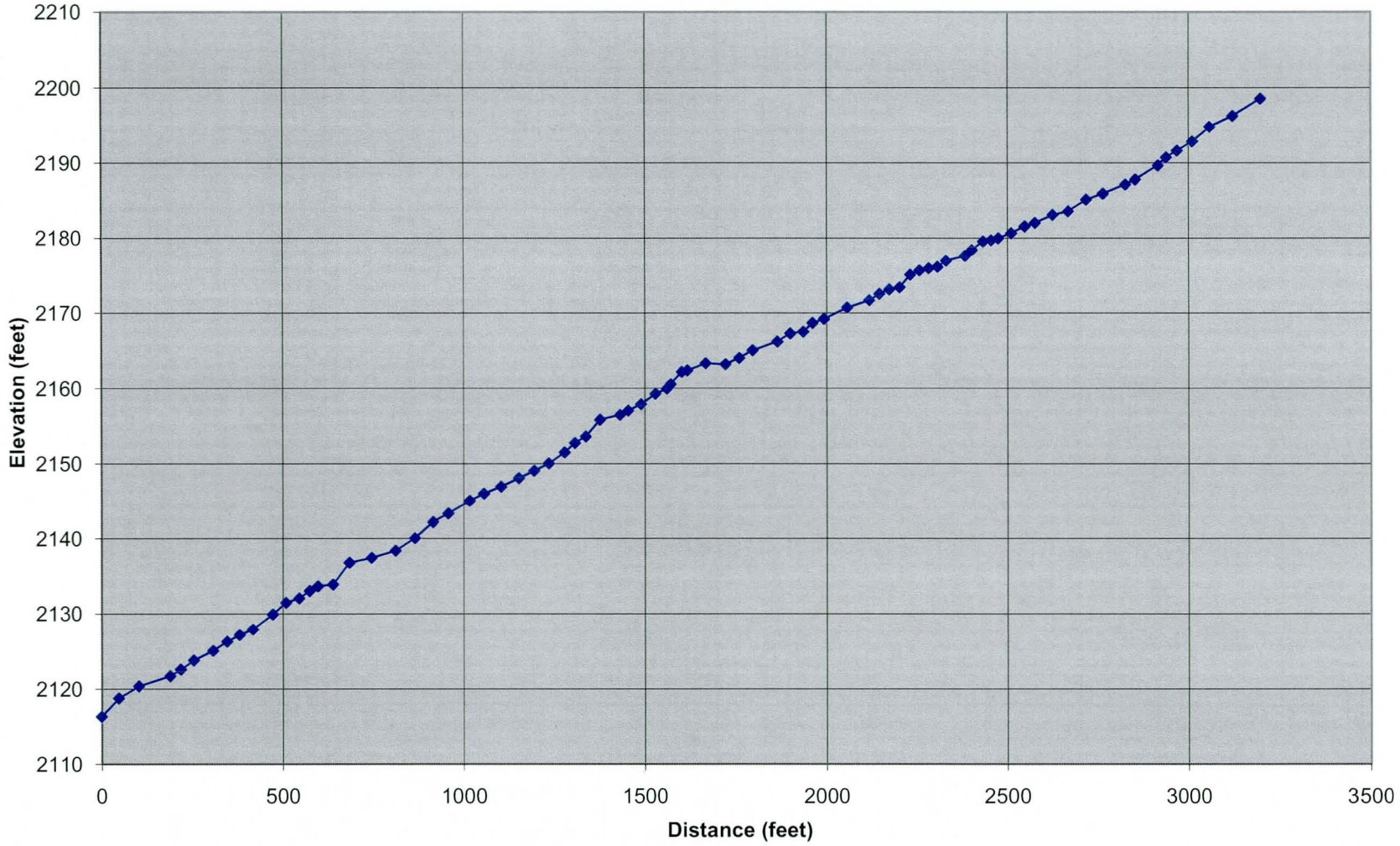
Willow Springs Wash Trib 4



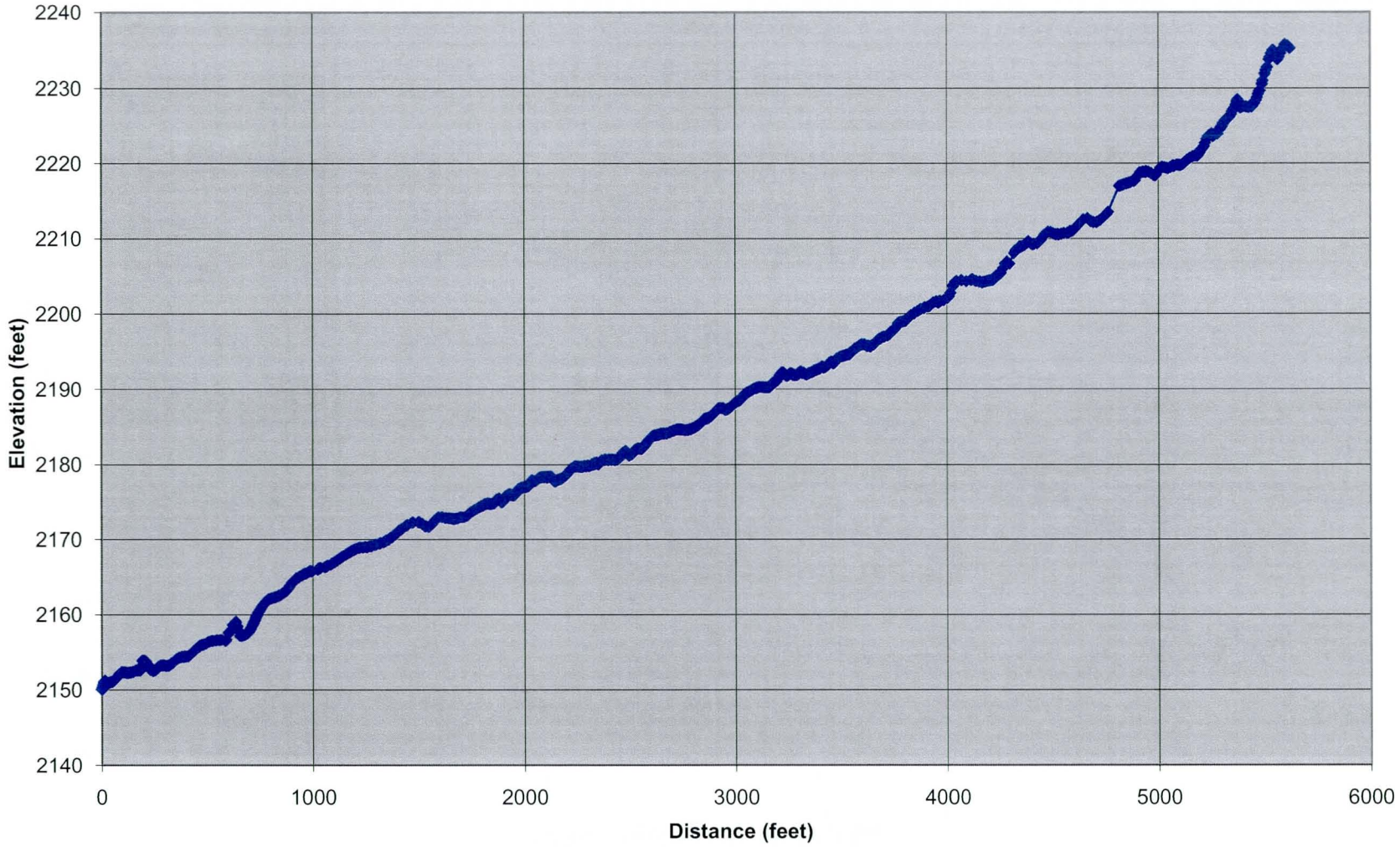
Willow Springs Wash Trib 5



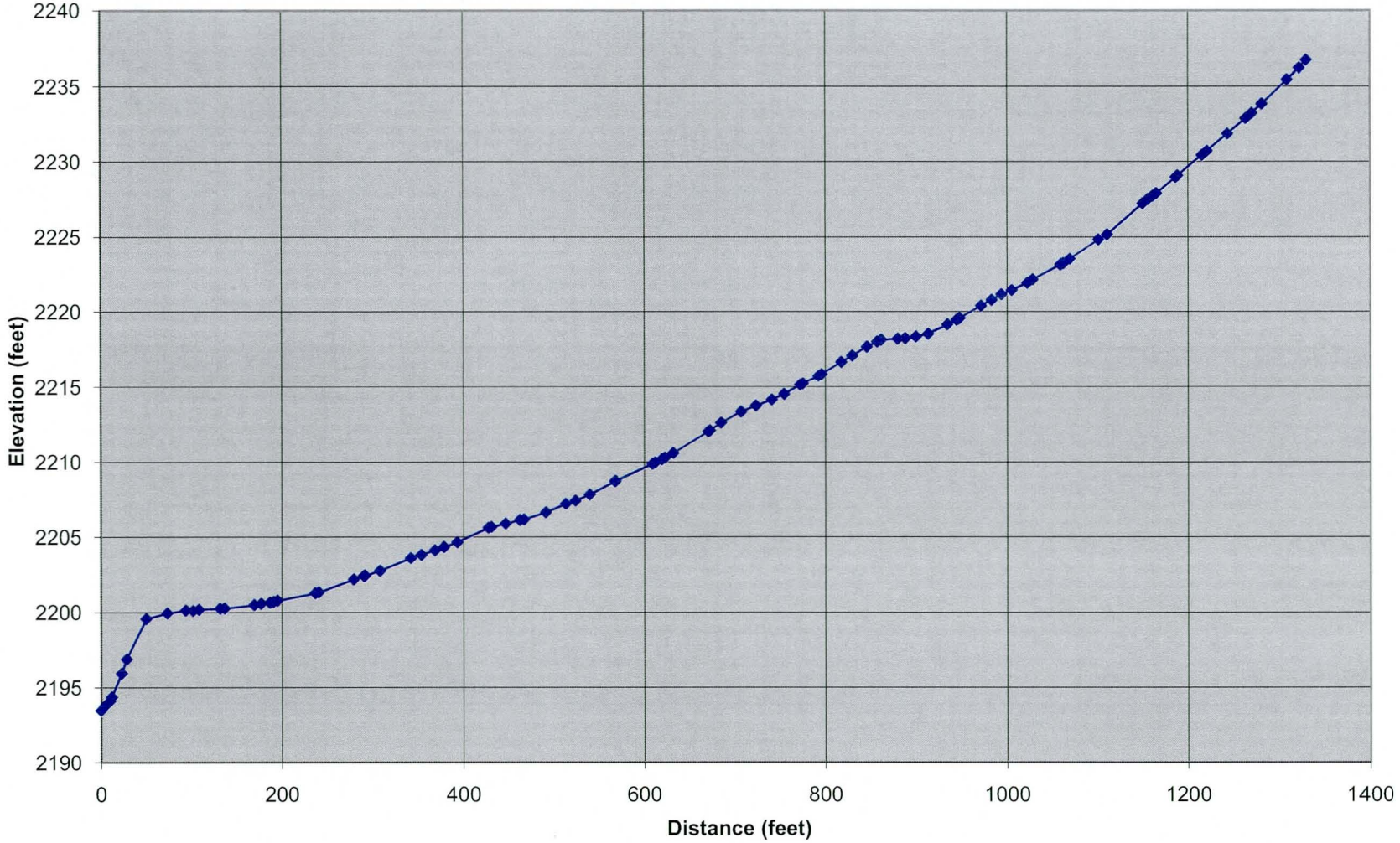
Willow Springs Wash Trib 5A



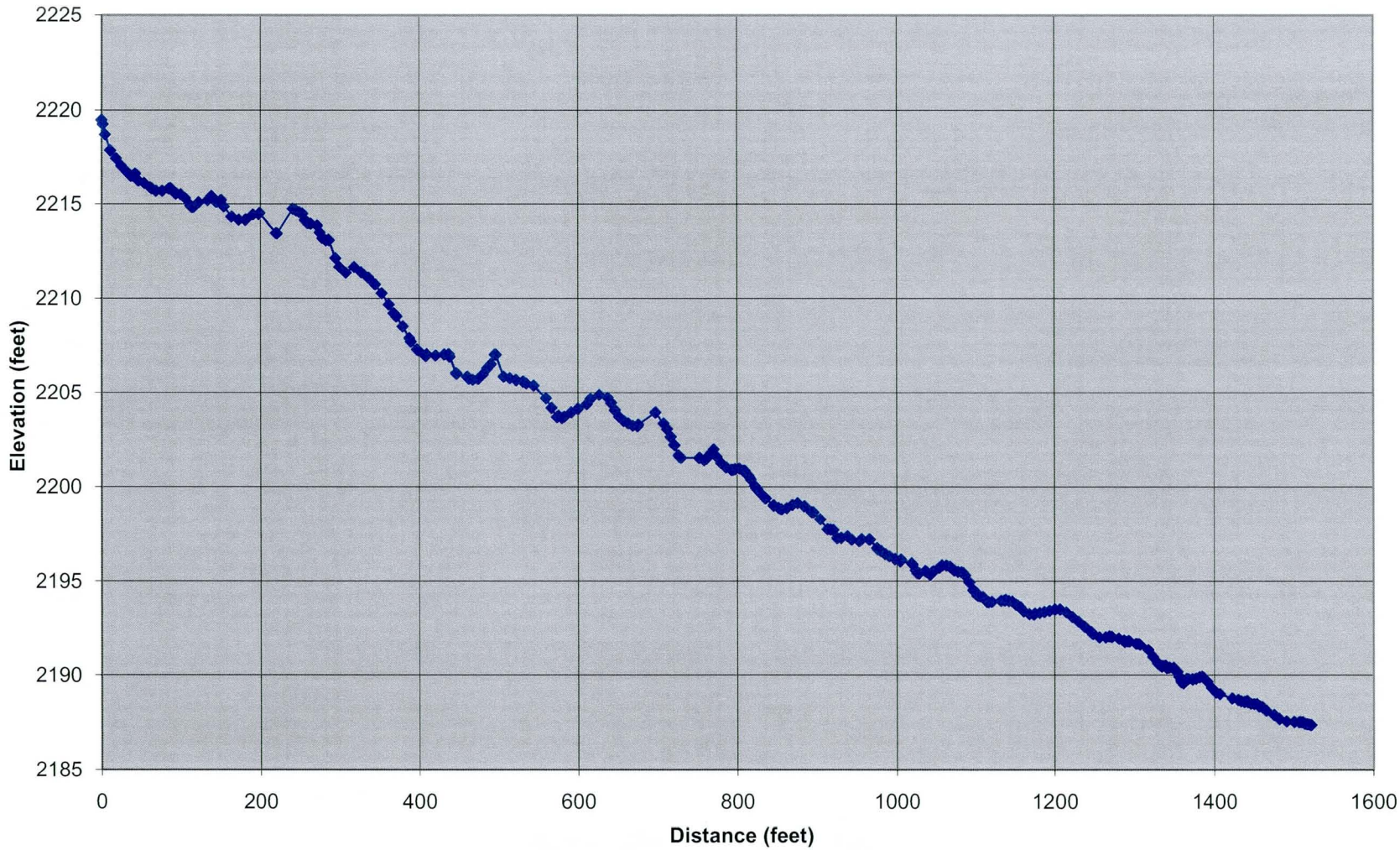
Willow Springs Wash Trib 6



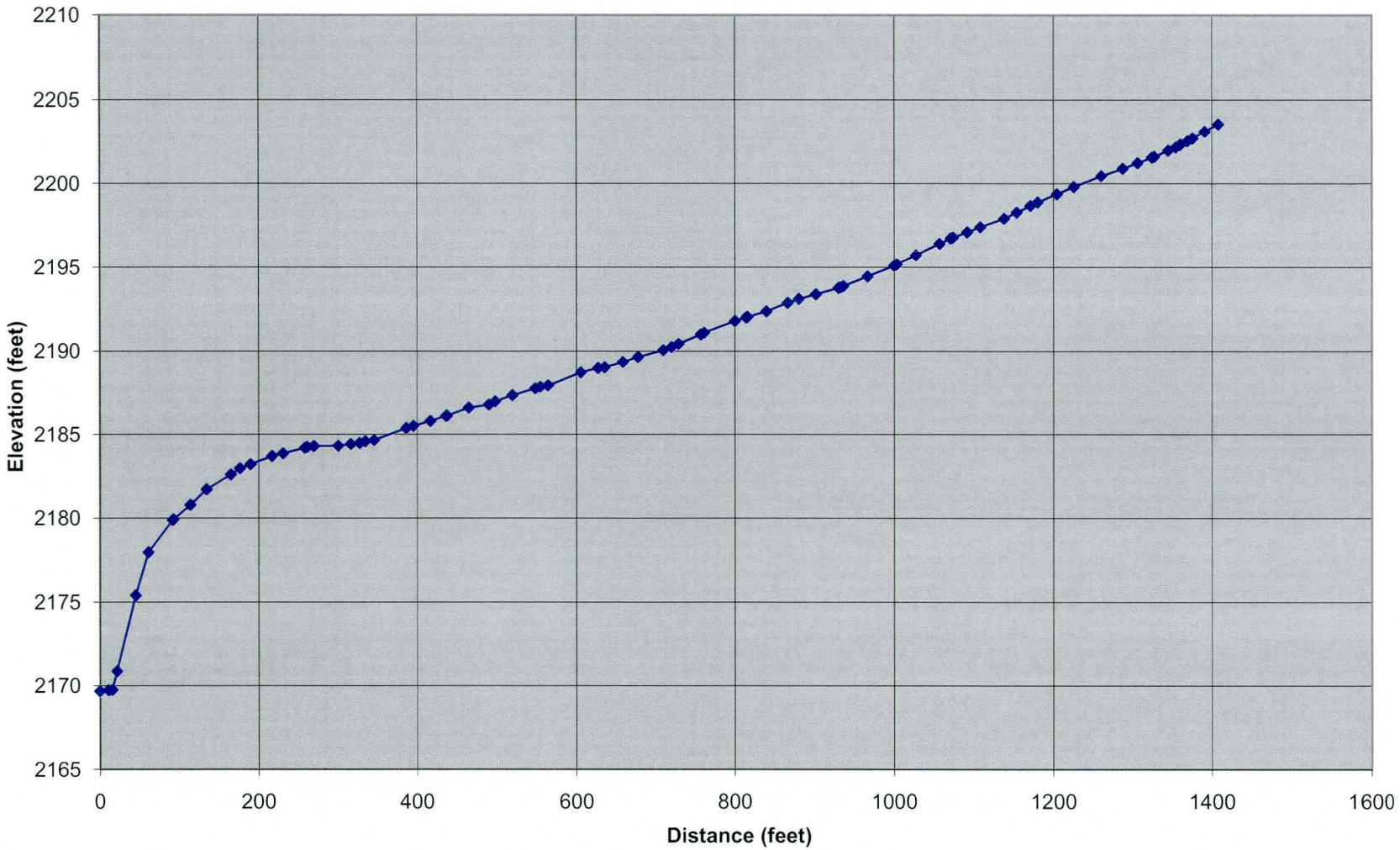
Willow Springs Wash Trib 6A



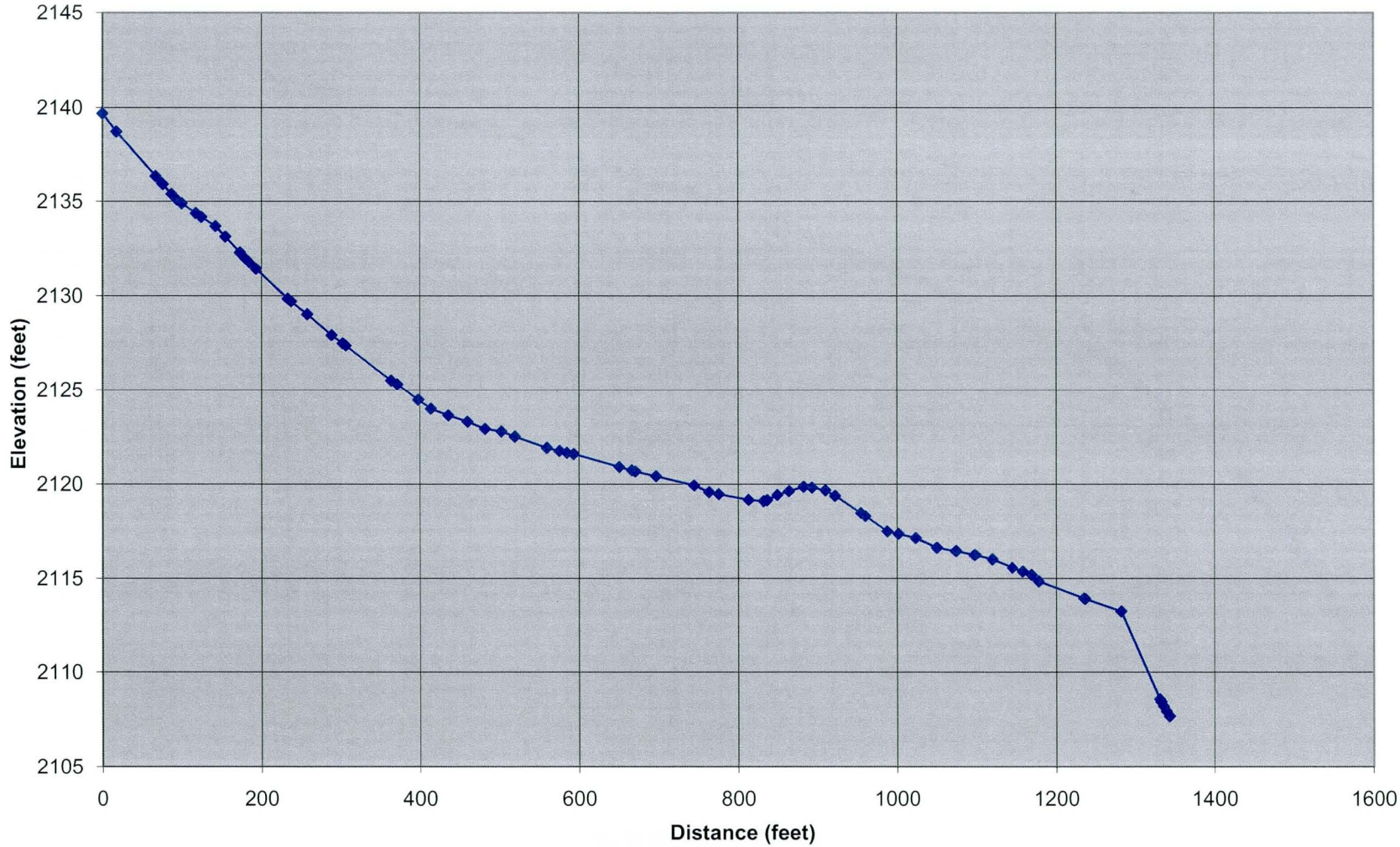
Willow Springs Wash Trib 6B

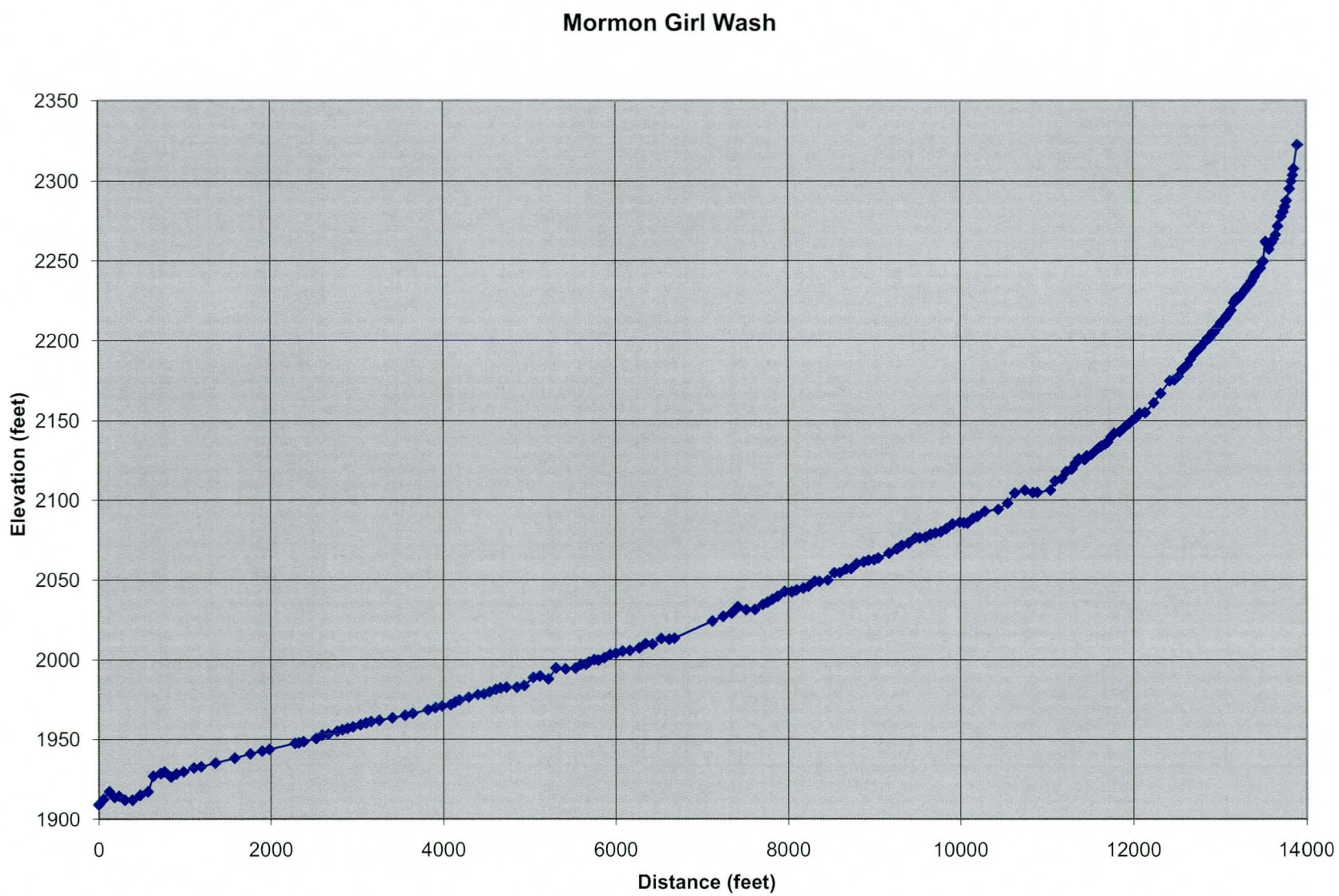


Willow Springs Wash Trib 6C

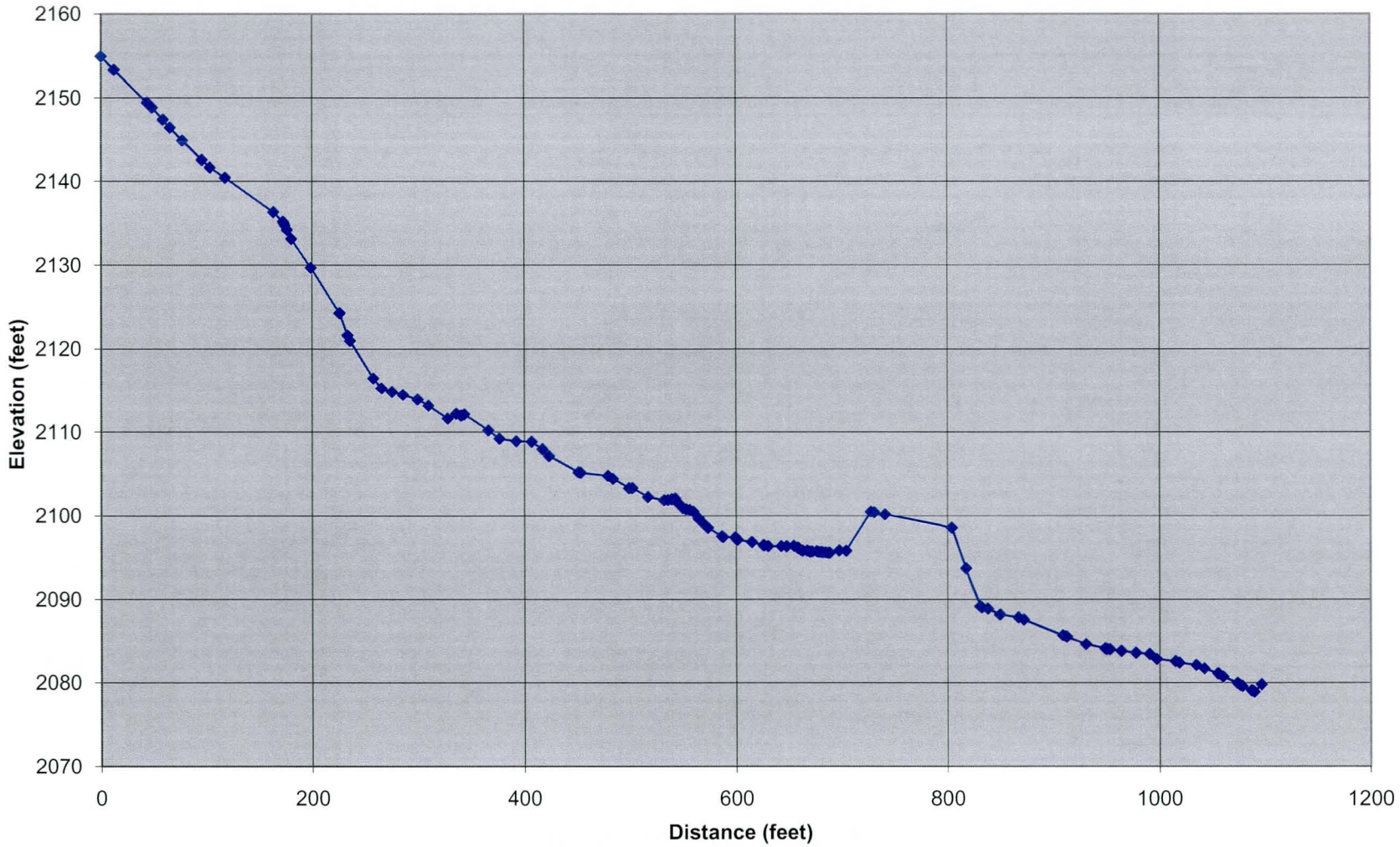


Mormon Girl Wash Trib 1

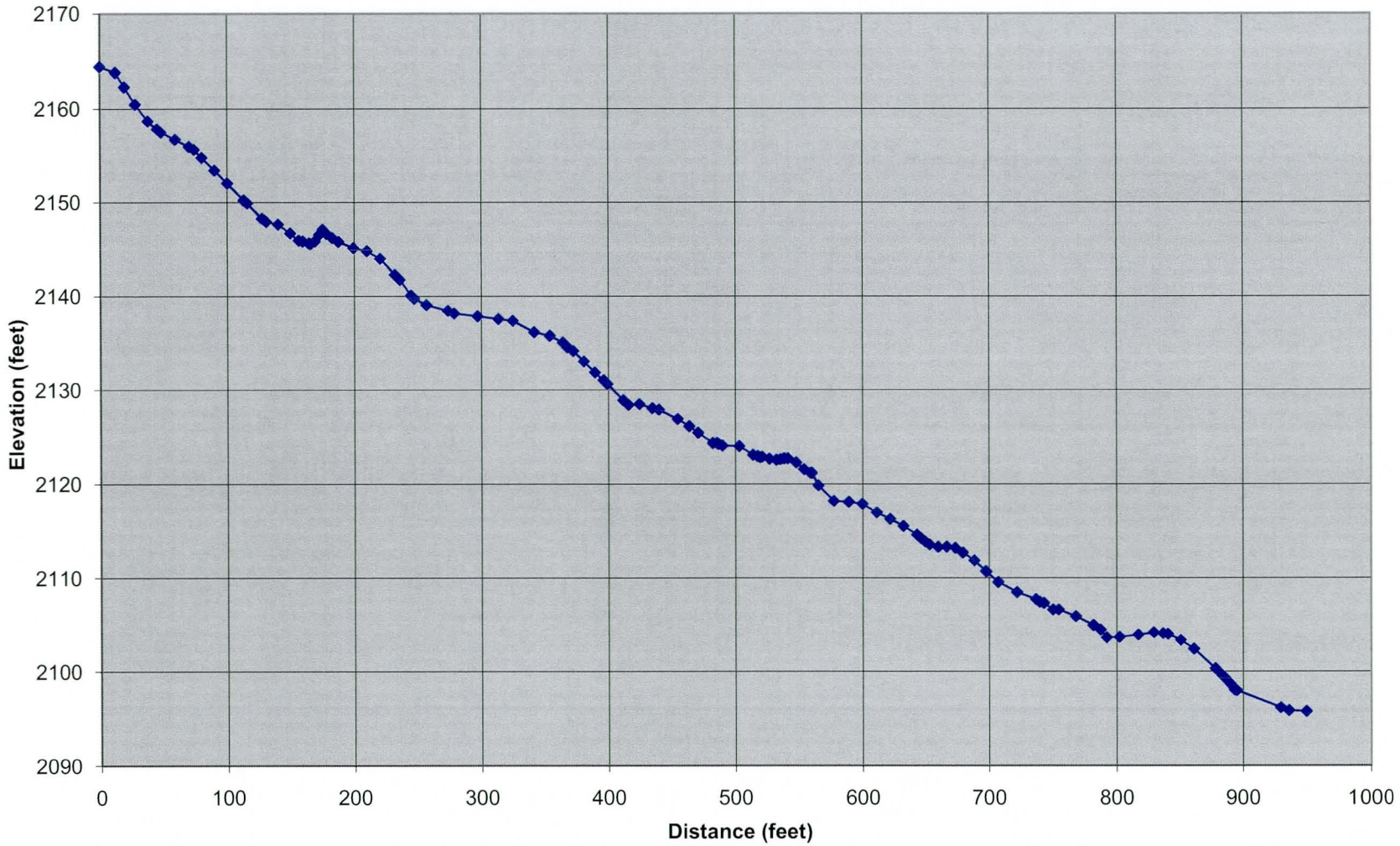


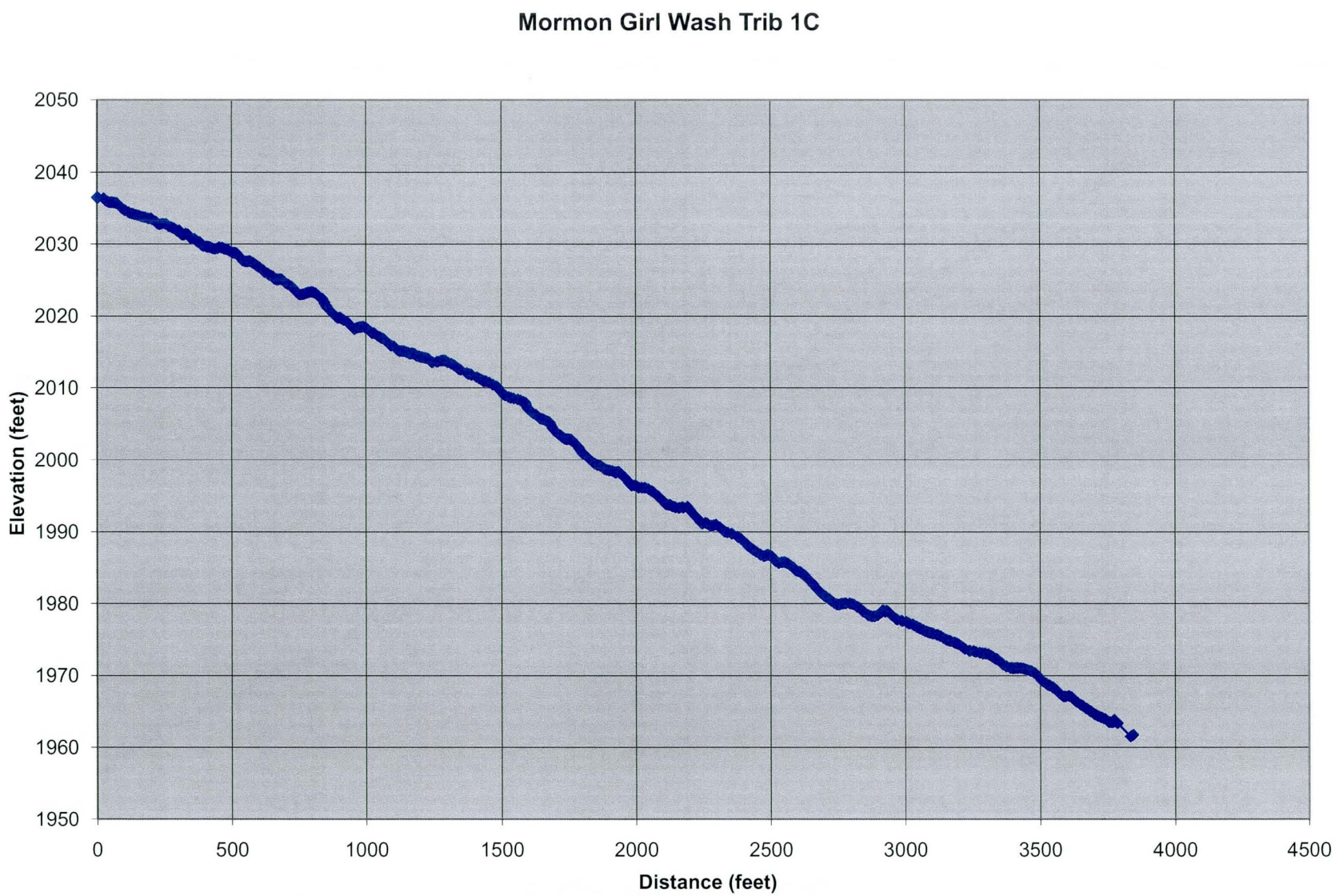

Mormon Girl Wash
Elevation (feet)
2350
2300
2250
2200
2150
2100
2050
2000
1950
1900
0
2000
4000
6000
8000
10000
12000
14000
Distance (feet)

Mormon Girl Wash Trib 1A

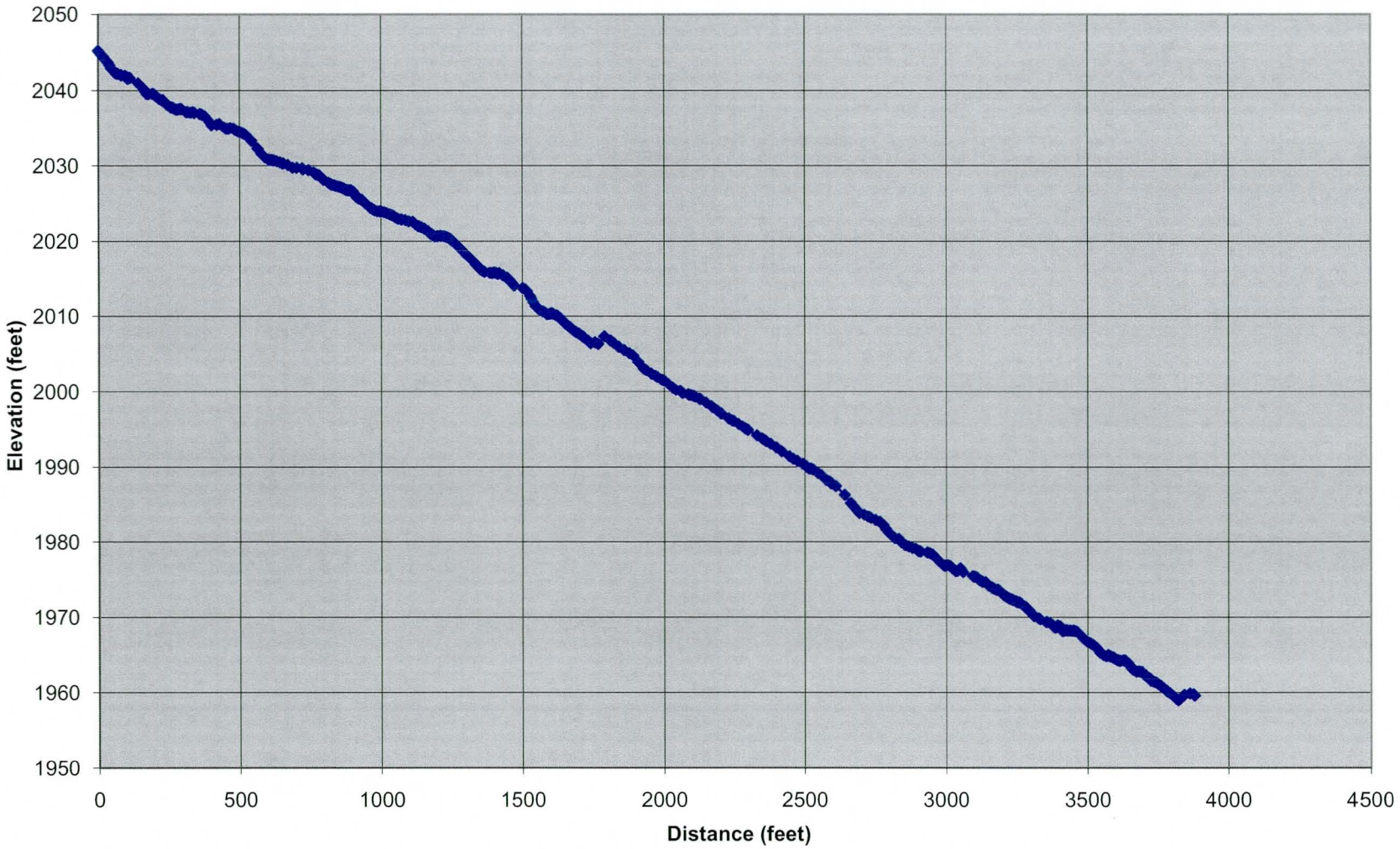


Mormon Girl Wash Trib 1B

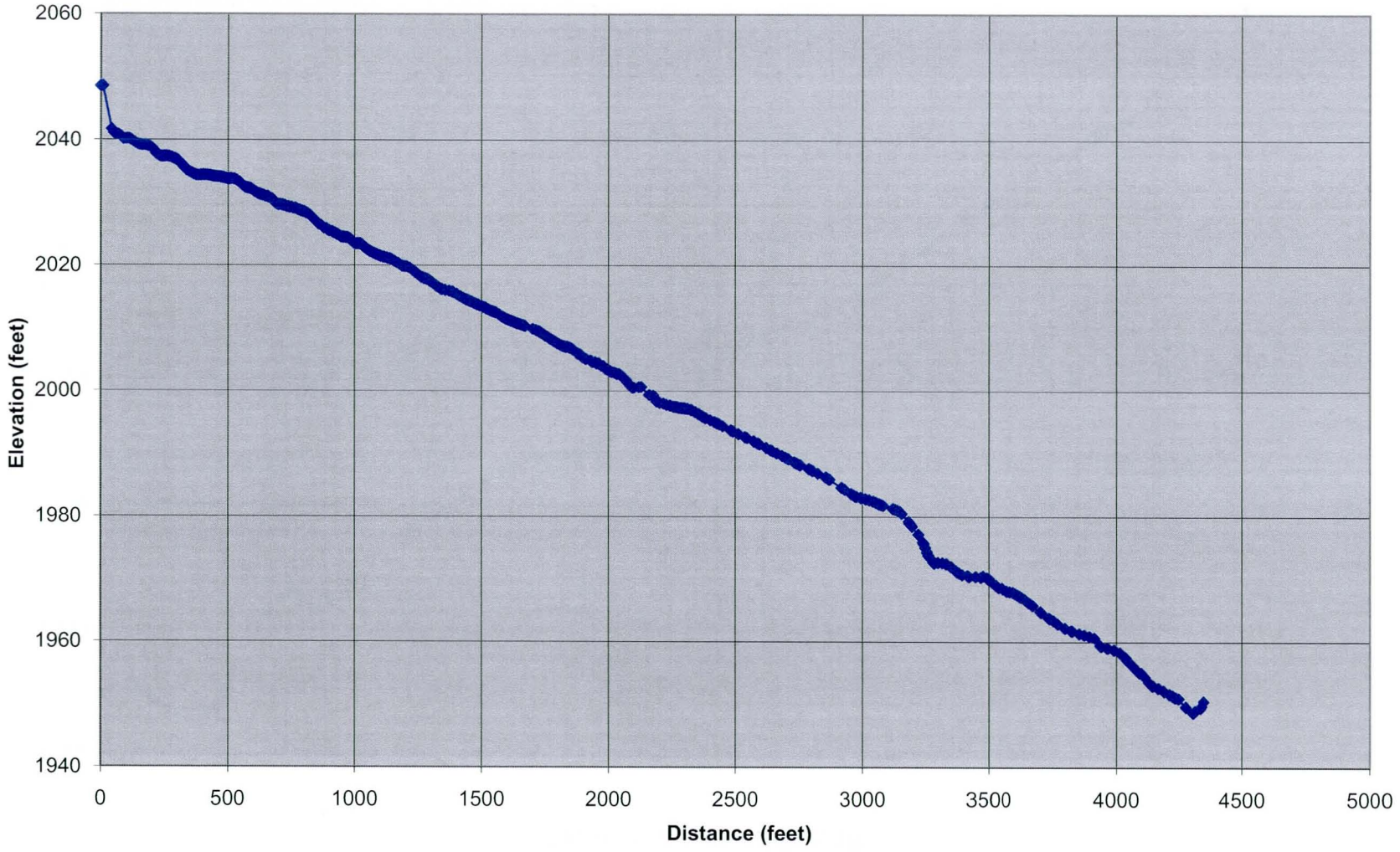



Mormon Girl Wash Trib 1C
Elevation (feet)
2050
2040
2030
2020
2010
2000
1990
1980
1970
1960
1950
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Distance (feet)

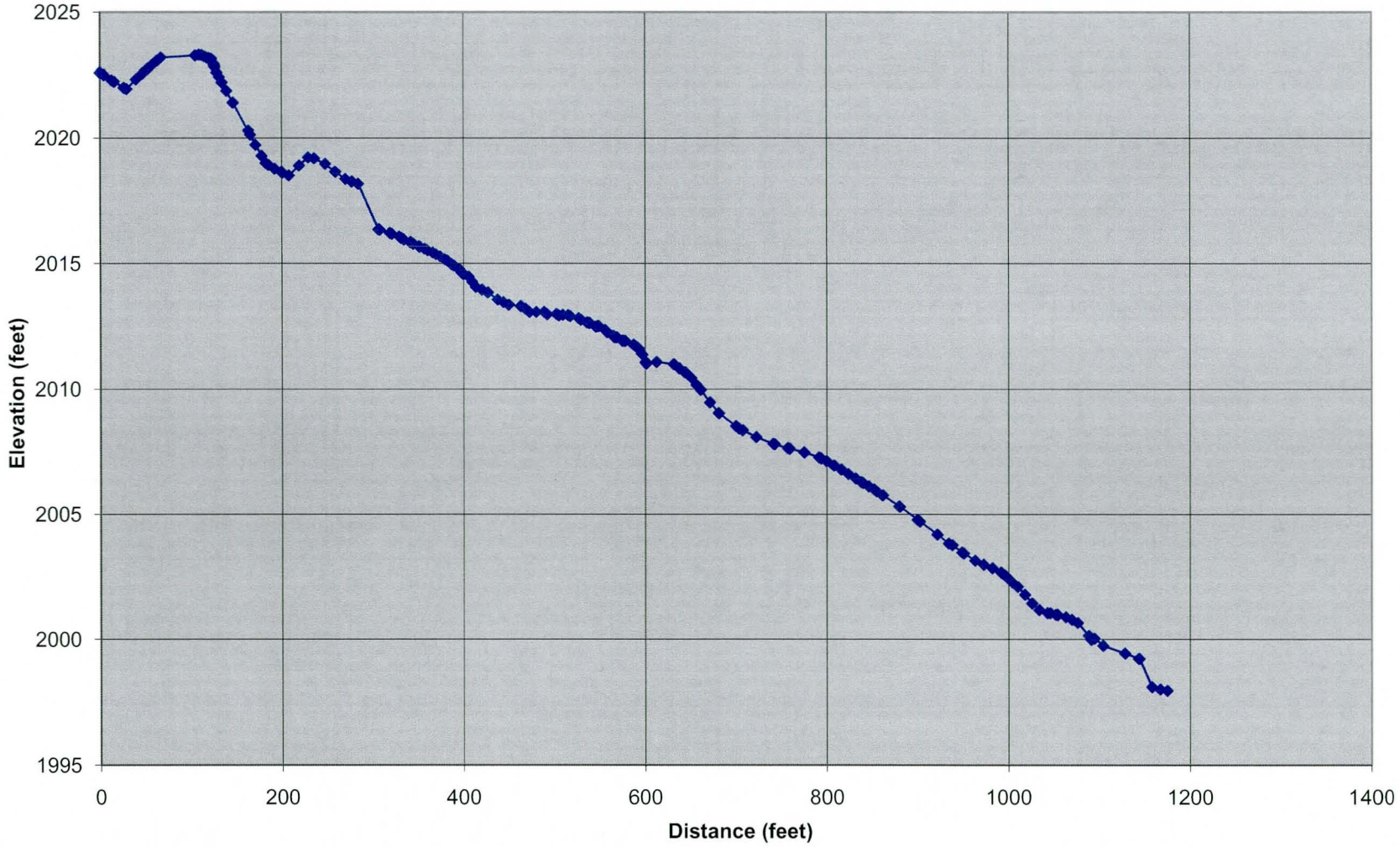
Mormon Girl Wash Trib 1D



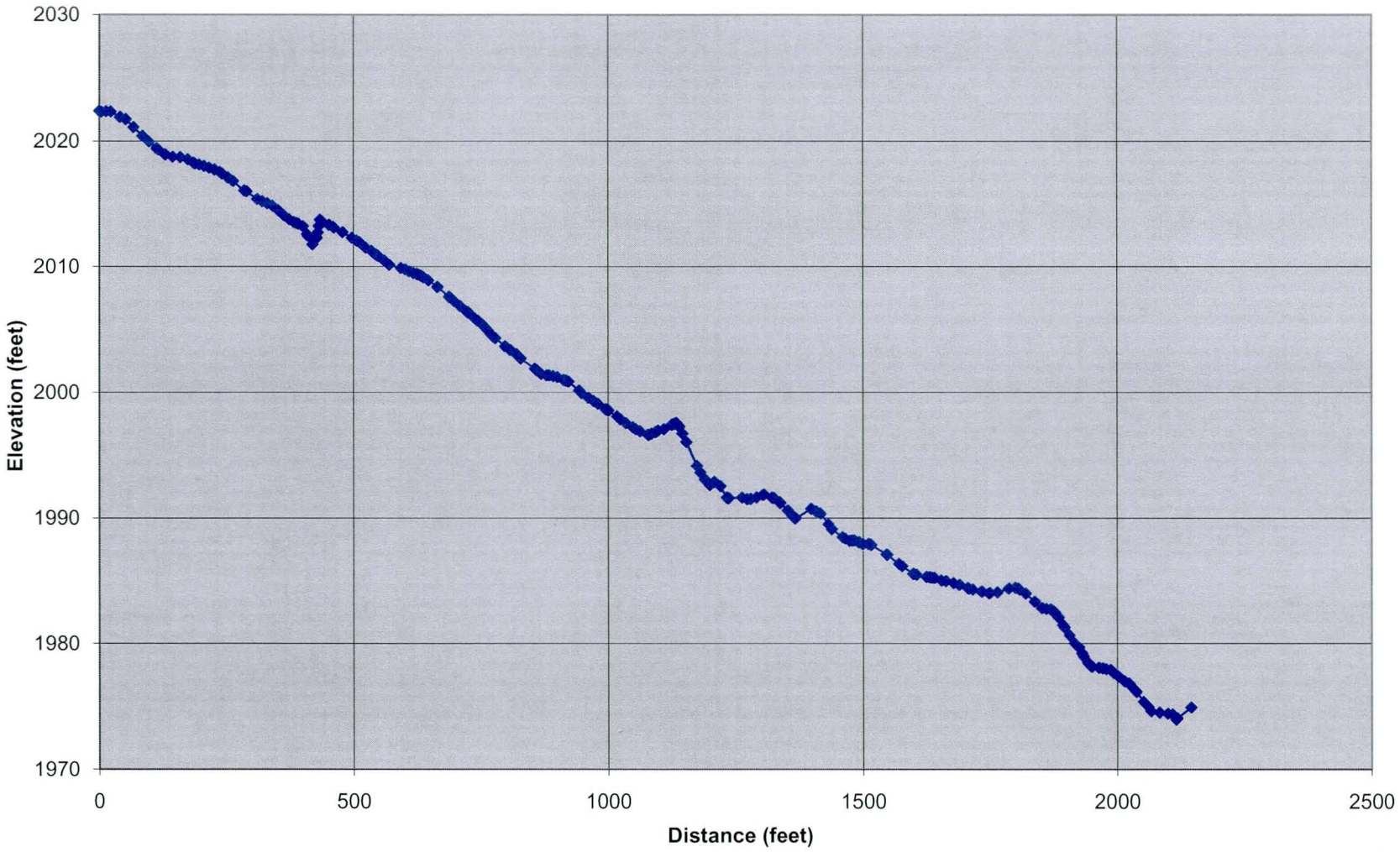
Mormon Girl Wash Trib 1E



Mormon Girl Wash Trib 1F



Mormon Girl Wash Trib 1G



Appendix E

Electronic Data