

CHEROKEE WASH HYDRAULIC ANALYSIS

Executive Summary

Prepared for:

Town of Paradise Valley



Prepared by:



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**CHEROKEE WASH
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TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	DESIGN CRITERIA	2
3.	METHODOLOGY	2
4.	RESULTS	2
5.	COST/SAVINGS ESTIMATE	4
6.	RECOMMENDATIONS	7

LIST OF TABLES

Table 1 - Existing Channel Capacity vs. Design Discharge (cfs)	3
Table 2 - Existing Channel Bottom Width vs. Improved Channel Bottom Width	3
Table 3 - Proposed Culvert Configurations	4
Table 4 - Cost Estimate for Cherokee Wash Improvements	4
Table 5 - Cost Savings to DTRR Drainage Improvements	5

LIST OF APPENDICES

- Plot of Cross Section and Reach Locations
- Photos of Cross Sections with Plots of Existing and Proposed Cross Sections



1. Introduction:

Purpose:

This study has been performed by Dibble & Associates for the Town of Paradise Valley as part of the Doubletree Ranch Road Drainage Improvement Study. The purpose of this analysis is to evaluate the feasibility and cost of improving the hydraulic capacity of Cherokee Wash between 56th Street and Indian Bend Wash in order to convey the 10-year storm runoff. Improving Cherokee Wash in this area could eliminate the need for the 56th Street Lateral of the Doubletree Ranch Road Storm Drain as shown in the 30% plans, and reduce the size of the proposed storm drain under Doubletree Ranch Road from 56th Street to Indian Bend Wash. This could reduce the overall cost of the Doubletree Ranch Road drainage improvements.

There are 4 dip section road crossings along Cherokee Wash between 56th Street and Indian Bend Wash. These crossings, from upstream to downstream, are at 58th Street, 59th Place, Morning Glory Road and Caballo Lane. These dip crossings were redesigned as culvert crossings with sufficient capacity to pass the 10-year runoff under the roads.

Existing Studies:

Three studies considering flood control in the area have been performed recently. The following is a summary of each of these completed studies.

Erie & Associates - January, 1993

The purpose of the Erie & Associates study was to provide non-structural floodplain management with minimal improvements. The recommended solution of this study was to designate an area of restricted development 50' to 70' wide on either side of the Cherokee Wash centerline. Building permits would be restricted to projects which would not decrease flow capacity of Cherokee Wash. Other items included in the solution recommended by the Erie report are clearing shrubs, trimming trees, installing box culverts at road crossings, wall removals, some wall reconstruction, and lowering the channel elevation near Indian Bend Wash.

Hook Engineering - March, 1997

The purpose of the Hook Engineering study was to increase the level of flood protection through both the Doubletree Ranch Road corridor and the Cherokee Wash corridor. Through a series of coordination meetings with heavy public involvement, Hook Engineering recommended limiting improvements to Cherokee Wash to the existing drainage easement. Items included in the solution recommended by the Hook report include diverting the 10-year discharge from Cherokee Wash at both 52nd Street and 56th Street to a storm drain in the Doubletree Ranch Road corridor. Cherokee Wash would be lined with Gabion mattresses from 52nd Street to Indian Bend Wash.

Dibble & Associates - November, 1998

The purpose of the Dibble & Associates study was to provide flood protection from the 10-year, 24-hour storm to area residents. The main components of the Dibble recommended solution is a 10-year storm drain system in the Doubletree Ranch Road corridor with major laterals in the 52nd Street corridor both north and south of Doubletree Ranch Road, as well as in the 56th Street corridor south of Doubletree Ranch Road. The recommended improvements to Cherokee Wash consist of constructing a box culvert to replace the dip crossing at 56th Street, and diverting a portion of the 10-year discharge from Cherokee Wash down the 56th Street lateral to the Doubletree Ranch Road storm drain.

2. Design Criteria:

The improvements to Cherokee Wash were designed based on an earthen channel, maintaining the same channel slope and channel depth as the existing wash. The hydraulic capacity of the wash was increased by widening the wash bottom, and using 2:1 (horizontal:vertical) bank slopes to match the existing ground.

The culvert crossings were designed so that the full 10-year runoff will pass under the road. No overtopping of the road in the 10-year storm is allowed.

3. Methodology:

Six locations along Cherokee Wash between 56th Street and Indian Bend Wash were identified to be surveyed and used as representative cross sections for this analysis. These cross section locations were selected through a field investigation during which relatively uniform reaches of Cherokee Wash were identified. One cross section for each reach was chosen and used to represent that particular reach of the wash. Each of the 4 road dip crossings of Cherokee Wash were also surveyed.

4. Results:

This study determined that Cherokee Wash does not have adequate capacity to convey the runoff generated by the 10-year storm, even when Cherokee Wash is cleared of vegetation. Table 1 shows the runoff reaching each cross section during the 10-year storm, and the existing capacity of that cross section. Cross section locations are shown on the "Cherokee Wash Cross Section and Reach Layout" exhibit in the appendix.

Table 1 - Existing Capacity vs. Design Discharge

Cross Section Number	Cross Section Location	10-year Discharge	Existing Capacity
10	East of 56 th St.	789 cfs	568 cfs
9	West of 58 th St.	789 cfs	139 cfs
7	West of 59 th Pl.	835 cfs	206 cfs
5	West of Morning Glory	894 cfs	134 cfs
3	South of Caballo Ln.	894 cfs	318 cfs
1	North of Caballo Ln.	953 cfs	119 cfs

Each of these cross sections was redesigned to convey the 10-year runoff by widening the wash bottom, while maintaining the same channel depth and grading to a uniform earth surface. Table 2 shows the existing width of the wash bottom at each cross section, as well as the bottom width required to convey the design flow.

Table 2 - Existing Bottom Width vs. Improved Bottom Width

Cross Section Number	Existing Bottom Width	Improved Bottom Width
10	10 ft	10 ft
9	7 ft	50 ft
7	10 ft	35 ft
5	9 ft	56 ft
3	5 ft	32 ft
1	6 ft	44 ft

Average Improved Bottom Width = 38 ft

Plots of these cross sections showing both existing conditions and improved conditions can be found in the appendix, along with photos of existing cross sections.

Road crossings at 58th St., 59th Pl., Morning Glory Rd., and Caballo Ln. were redesigned as box culvert crossings. These road crossings correspond to cross sections 8, 6, 4 and 2, respectively, and are also shown on the "Cross Section and Reach Layout" exhibit in the appendix. Table 3 shows the 10-year flow reaching each road crossing, and the configuration of each box culvert designed to pass the runoff under the road.

Table 3 - Proposed Culvert Configurations

Location	10-year Discharge	Culvert Configuration	Culvert Width
58th Street	789 cfs	3- 9' x 4' RCBC X 45'	31 ft
59th Place	835 cfs	3- 10' x 4' RCBC X 35'	34 ft
Morning Glory Road	894 cfs	4- 8' x 4' RCBC X 40'	36 ft
Caballo Lane	894 cfs	4- 8' x 4' RCBC X 40'	36 ft

5. Cost/Savings Estimate

The costs associated with improving Cherokee Wash to convey the 10-year discharge are shown in Table 4. Costs are shown associated with the wash improvements, as well as each box culvert. A contingency factor of 30% is included.

Table 4 - Cost Estimate for Cherokee Wash Improvements

ITEM	DESCRIPTION	QUAN.	UNIT	UNIT COST	COST
	CHEROKEE WASH:				
1	Construction	1	L. Sum	\$940,108.00	\$940,108.00
2	Present Worth of 10 Years Operation and Maintenance	1	L. Sum	\$69,498.00	\$69,498.00
				Sub Total:	\$1,009,606.00
	58TH STREET BOX CULVERT:				
3	3- 9' x 4' RCBC	1	L. Sum	\$69,635.00	\$69,635.00
	59TH PLACE BOX CULVERT:				
4	3- 10' x 4' RCBC	1	L. Sum	\$62,747.00	\$62,747.00
	MORNING GLORY ROAD BOX CULVERT:				
5	4- 8' x 4' RCBC	1	L. Sum	\$69,337.00	\$69,337.00
	CABALLO LANE BOX CULVERT:				
6	4- 8' x 4' RCBC	1	L. Sum	\$67,422.00	\$67,422.00
				TOTAL	\$1,278,747.00

The potential cost savings which could be transferred to the Doubletree Ranch Road Drainage Improvements if the Cherokee Wash improvements are implemented are shown in Table 5. Notice that savings are shown as positive and costs are shown as negative.

Table 5 - Cost Savings to DTRR Drainage Improvements via Cherokee Wash Improvements

Cherokee Wash Improvements	Wash Improvements & Box Culverts:	- \$1,278,747
DTRR Improvements Savings	Elimination of 56 th St. Lateral:	+ \$1,133,119
	Downsizing Trunk Line from 56 th St. to Indian Bend Wash:	+ \$124,290
Total Savings/Loss to DTRR Drainage Improvements		- \$ 21,338

To accurately compare the cost of implementing the Cherokee Wash improvements versus the cost of installing the 56th Street lateral with the DTRR drainage improvements, the annual maintenance costs of each system have been estimated. The construction costs for the 56th Street lateral are slightly higher than those associated with the Cherokee Wash improvements. However, the annual maintenance cost for the 56th Street lateral are practically zero once the system is installed. The annual cost to maintain Cherokee Wash is estimated to be \$2,500 with a \$20,000 cost every 5th year. The importance of maintaining the wash so that it does not become constricted by vegetation growth cannot be overstated. If the improvements to Cherokee Wash are made, and the wash is then allowed to accumulate debris and vegetation, the capacity of the wash will be significantly reduced and will not be able to convey the 10-year discharge.

The cost/savings estimate shown above includes acquisition of new right-of-way in order to allow Cherokee Wash to be widened, but does not include any severance damage costs that may be incurred. The following is a reach-by-reach discussion of the required acquisitions.

REACH 1 - 56th St. to approximately 860' east of 56th St.

This reach begins at 56th Street and extends approximately 860 ft to the east. The existing wash in this reach is adequate in size and shape. The only required action in order for this reach to convey the 10-year discharge is to trim trees and clear the wash of shrubs and weeds. No right-of-way acquisitions are required.

REACH 2 - Approximately 860' east of 56th St. to 58th Pl.

This reach begins approximately 860 ft east of 56th Street and continues east to 58th Street. The wash improvements along this reach require a 16 ft. strip of new right-of-way along the north side of the wash, and a 7 ft. strip along the south side of the wash. Three properties on the north side and 4 properties on the south side of Cherokee Wash are impacted by the required acquisitions. Fences bordering each of these properties will need to be moved to the boundary of the new right-of-way. Any existing landscaping and irrigation systems destroyed by the improvements to the wash will need to be reconstructed. The number of impacted properties

could be minimized by shifting the wash to the north so that all of the new right-of-way is on the north side of the wash, however the new right-of-way would then encroach on an existing swimming pool on one of the properties. In this case a 23 ft. strip along the north would be required and the total amount of new right-of-way remains the same.

REACH 3 - 58th St.. to 59th Pl.

This reach extends from 58th Street to 59th Place. A strip of new right-of-way 15 ft. wide along the north side of the wash is required to make the required improvements to the wash. Three properties are impacted by the required acquisitions. Two of these 3 properties are bordered by a fence which would need to be removed and replaced at the new right-of-way boundary. Existing landscaping and irrigation systems destroyed by the improvements to the wash will need to be reconstructed.

REACH 4 - 59th Pl. to Morning Glory Rd.

This reach extends from 59th Place to Morning Glory Road. The proposed wash improvements require a new strip of right-of-way 21 ft. wide along the north side of the wash, and a new strip of right of way 2 ft. wide along the south side. There are 2 impacted properties on the north side of the wash and 2 impacted properties on the south side of the wash. Again, the number of impacted properties could be minimized by shifting the wash to the north, and once again an existing swimming pool would be impacted by the shift. In either case, the fences of the impacted properties will need to be removed and relocated at the new right-of-way boundary and any destroyed landscaping and irrigation systems will need to be reconstructed. The same amount of new right-of-way would be required regardless of whether the wash is shifted to the north or not.

REACH 5 - Morning Glory Rd. to Caballo Ln.

This reach extends from Morning Glory Road on the west to Caballo Lane on the east. A strip of new right-of-way 7 ft. wide is required along the north side of the wash in order to make the Cherokee Wash improvements. There are 3 total impacted properties in this reach. The existing wash near the east end of this reach has been modified from its natural state to a concrete valley gutter with desert landscaping and turf on the banks (see photo of cross section #3 in appendix). The wash in this area runs directly through 2 residential properties, both of which have swimming pools immediately adjacent to Cherokee Wash. One of the homes is situated very near the wash (valley gutter). Any modifications to the wash in this reach will be difficult to make without impacting the appearance and landscaping of the residential properties which the wash dissects. Any existing landscaping and irrigation systems destroyed by the improvements will need to be reconstructed. In addition, the wash is very close to Caballo Lane at this point. Any improvements to the north side of the wash will be difficult to construct without impacting the road.

REACH 6 - Caballo Ln. to Indian Bend Wash

This reach begins at Caballo lane on the west, and extends to Indian Bend Wash on the east. The proposed improvements to Cherokee Wash require a strip of new right-of-way 15 ft. wide on the north side of the wash. There is 1 impacted property on the north side of the wash, and no impacted properties on the south side. The new right-of-way will require the removal and relocation of the fence along the new property line, as well as the reconstruction of any existing landscaping and irrigation systems impacted by the improvements.

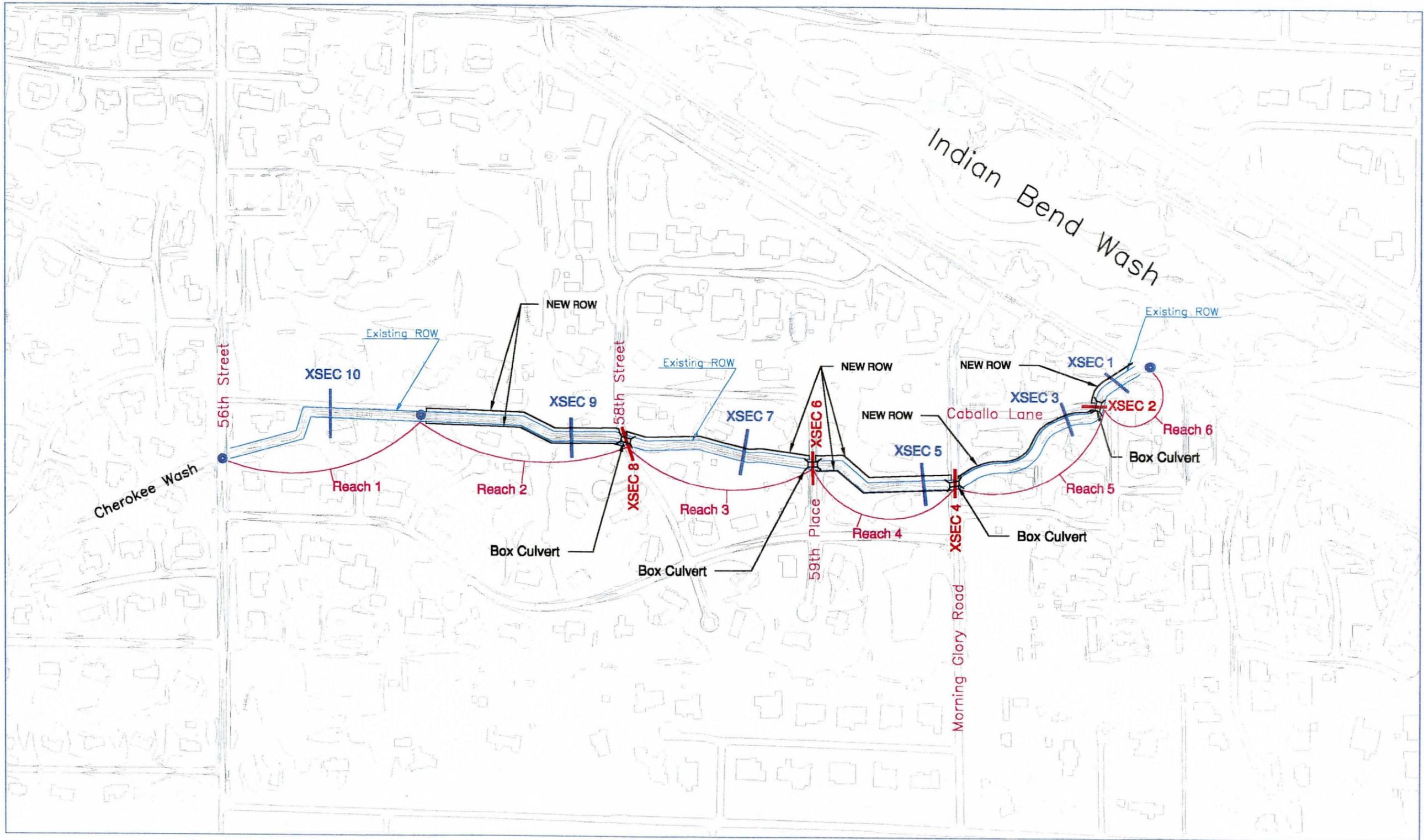
6. Recommendations:

The cost of constructing the Cherokee Wash improvements from 56th Street to Indian Bend Wash is slightly less than building the 56th Street lateral and trunk line as shown in the 30% plans of the Doubletree Ranch Road Drainage Improvements. However, this minimal apparent financial benefit disappears when the annual maintenance costs of each system are considered. As discussed above, the Cherokee Wash improvements have an associated annual maintenance cost of \$2,500 with a \$20,000 cost every 5th year, or an average annual cost of \$6,300. The 56th Street lateral has little to no annual maintenance costs.

Cherokee Wash meanders throughout a well-populated residential area whose residents seem to enjoy the existing condition of Cherokee Wash, its vegetation and its wildlife. Although attempts were made through the design criteria to minimize the impacts to the overall characteristics of Cherokee Wash, the required improvements will drastically alter the size and appearance of the wash. Much of the improvements will occur at wash locations very near to residential properties. As noted above, some of this private property will need to be purchased to implement these improvements. Certainly, some residents will feel that the wash and the landscape has been irreversibly scarred by these drainage improvements, and the right-of-way acquisitions will be very difficult considering the severance damage to the neighboring residential parcels. Additionally, the right-of-way acquisitions may cause some parcels to become less than 1 acre in size, forcing them out of conformance with zoning regulations.

In summary, no financial benefit will be realized by making the Cherokee Wash improvements. In fact, the maintenance of the wash will become an annual financial obligation to the Town. The improvements will significantly alter Cherokee Wash in size, width and appearance from its present condition. Right-of way acquisitions required to make the improvements will be difficult and expensive. It does not seem feasible to make these improvements to Cherokee Wash. Dibble & Associates recommends moving forward with the Doubletree Ranch Road Drainage Improvements as Approved by the Town Council, including the 56th Street Lateral.

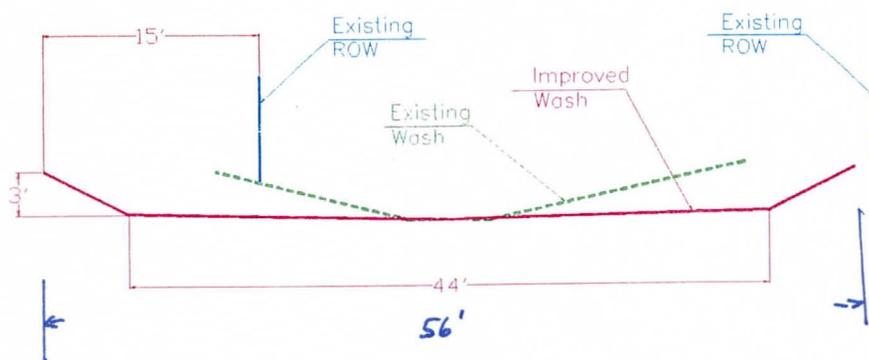
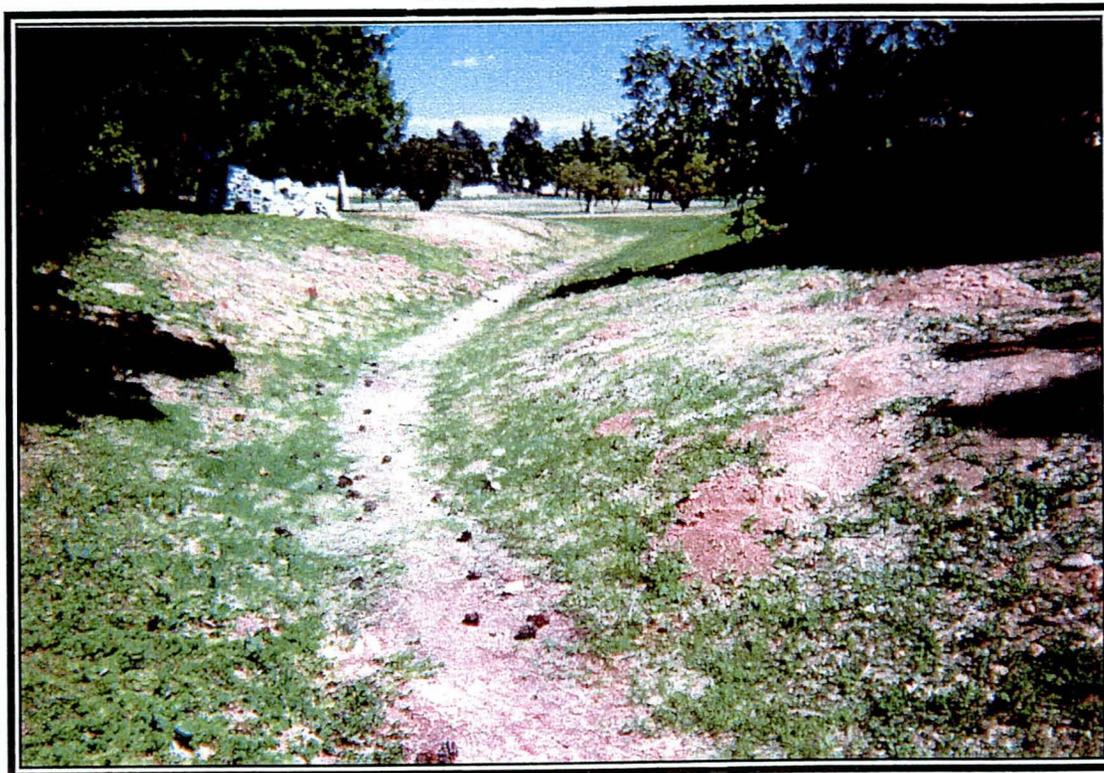
Cross Section and Reach Location Plot



Cherokee Wash
Cross Section & Reach Layout

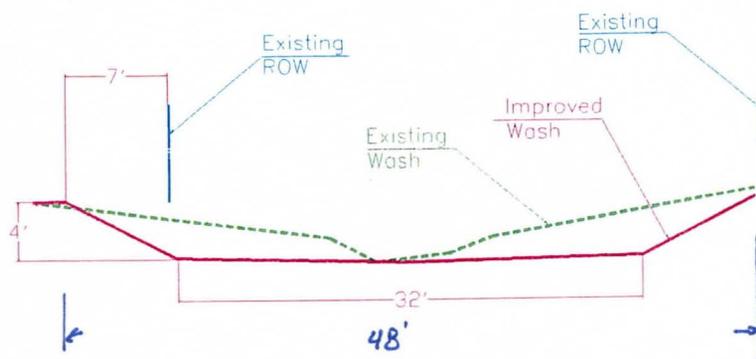
**Cross Section Photos
with
Plots of Existing and Proposed Cross Sections**

CROSS SECTION #1



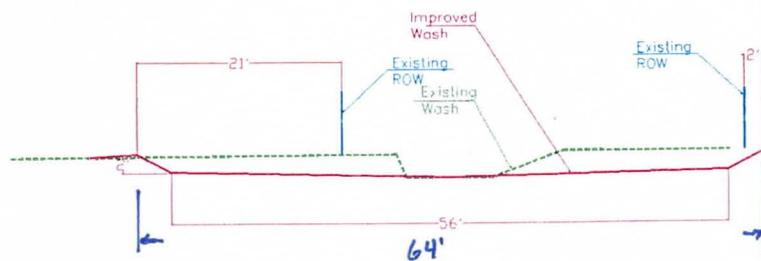
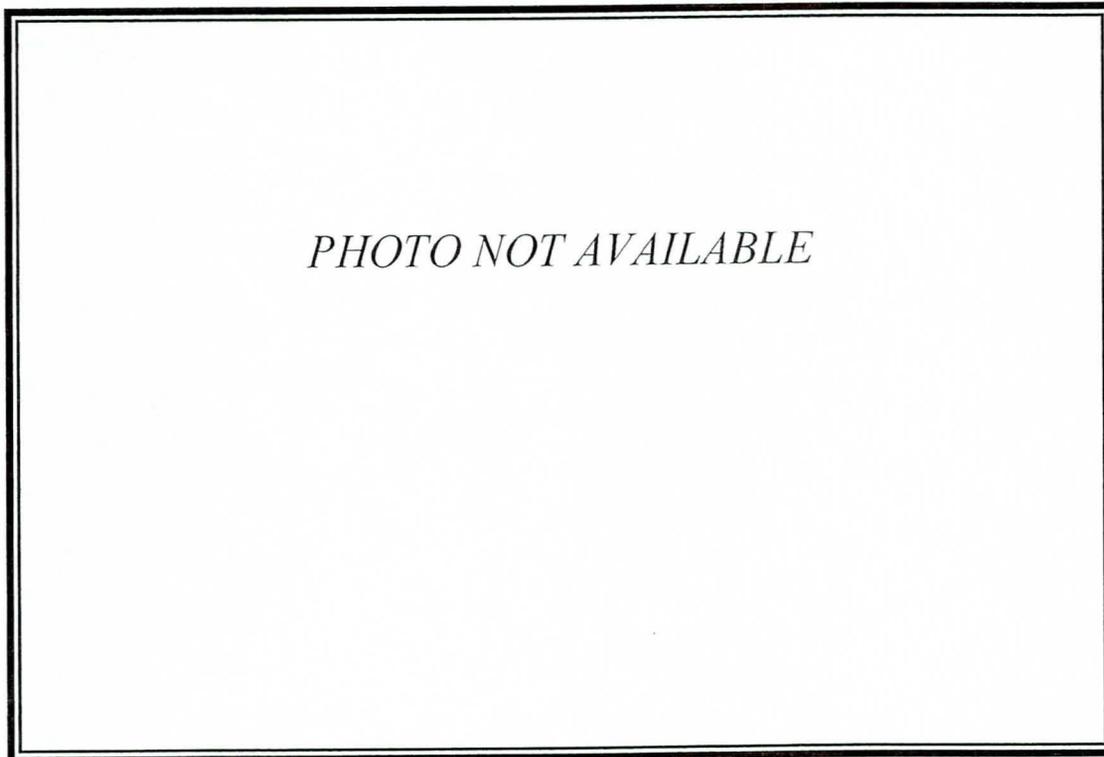
$Q_{10} = 953$ cfs

CROSS SECTION #3



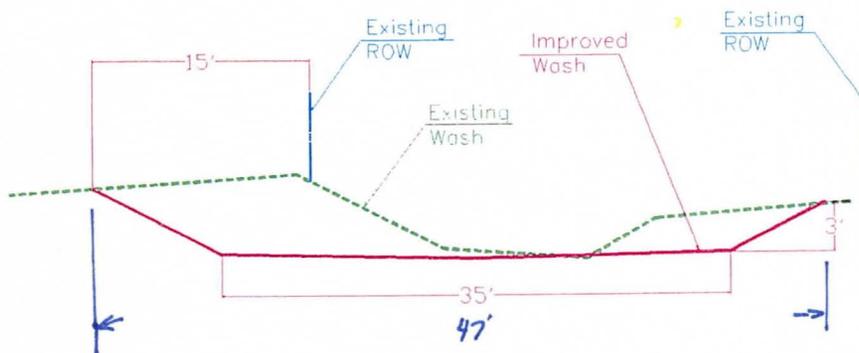
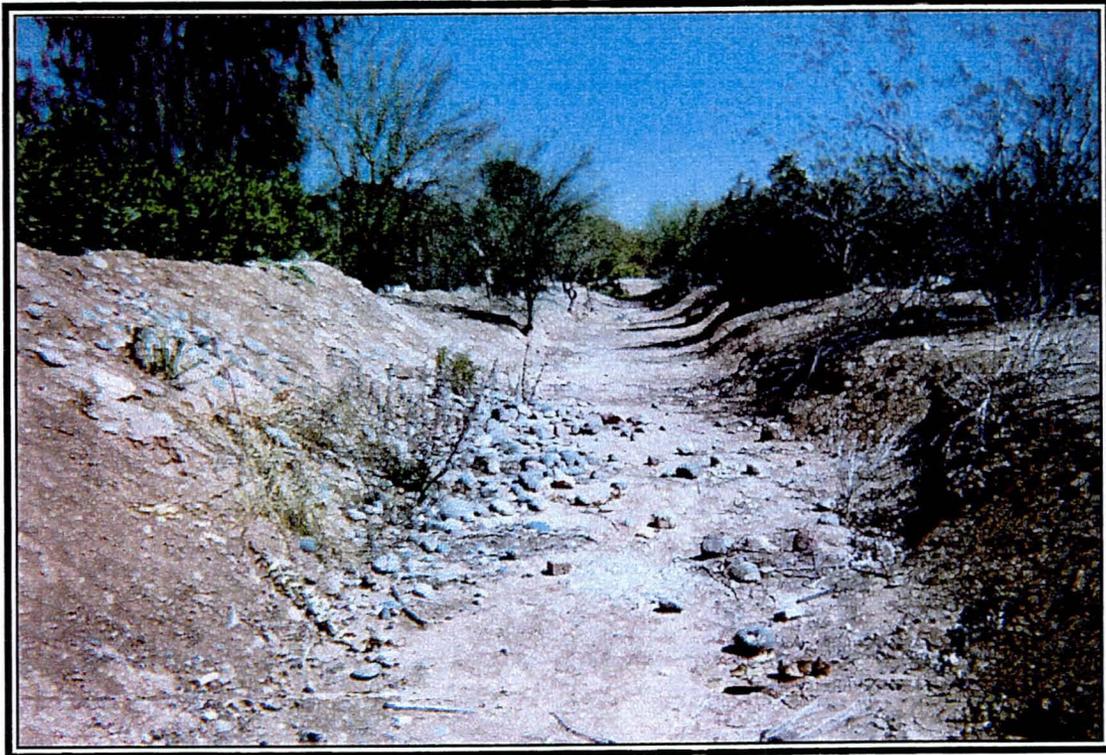
$$Q_{10} = 894 \text{ cfs}$$

CROSS SECTION #5



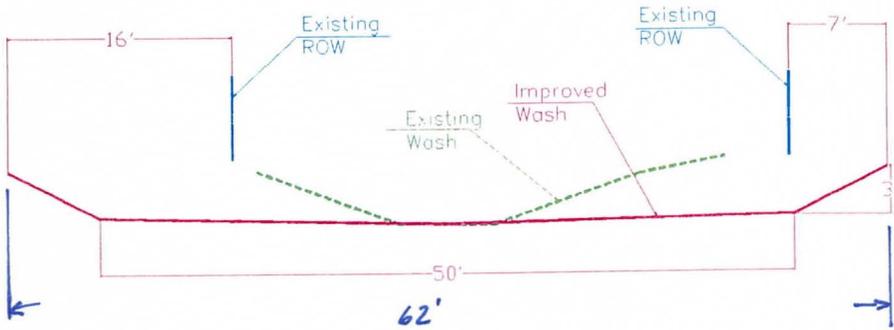
$Q_{10} = 894 \text{ cfs}$

CROSS SECTION #7



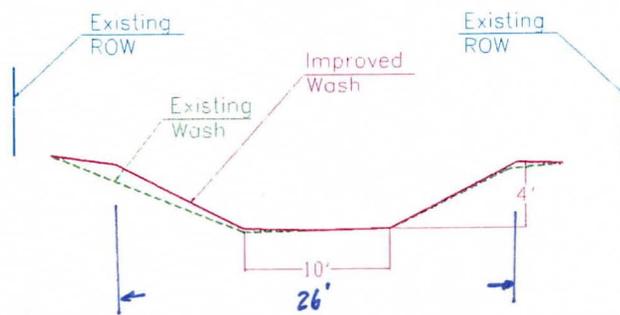
$Q_{10} = 835 \text{ cfs}$

CROSS SECTION #9



$Q_{10} = 789 \text{ cfs}$

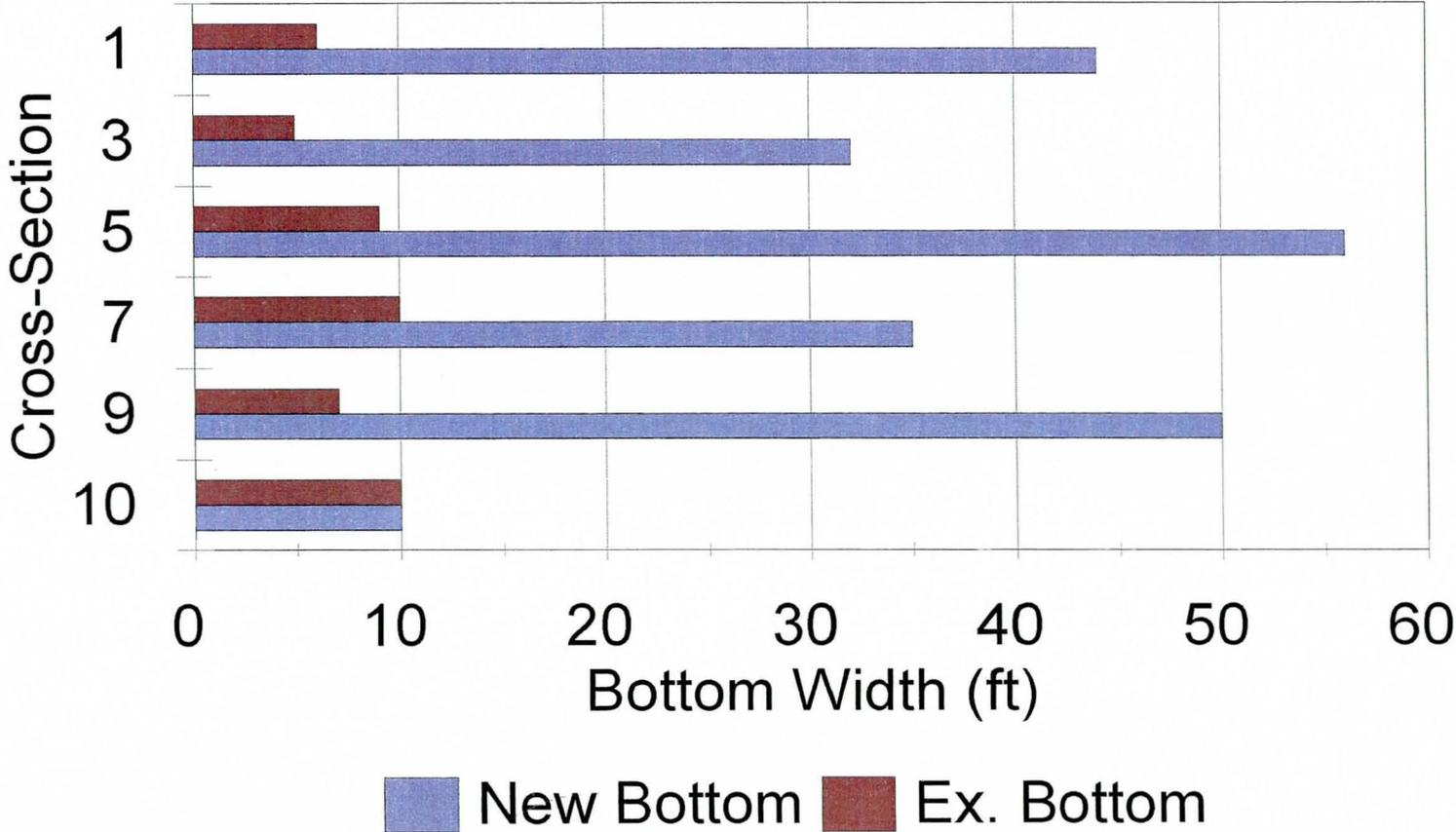
CROSS SECTION #10



$Q_{10} = 789$ cfs

Cherokee Wash

Hydraulic Analysis



Cherokee Wash

Hydraulic Analysis

