

QUEEN CREEK/SANOKAI WASH HYDRAULIC MASTER PLAN

FCD 98-26

November 2000

Property of
Flood Control District of Maricopa County
Please Return to
2801 W. Durango
Phoenix, AZ 85009
2801 W. Durango
Phoenix, AZ 85009

STUDY REPORT Executive Summary

Prepared for
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

by

HUITT-ZOLLARS

In Association with

Aquatic Consulting & Testing/Archaeological Consultant Services
Hoque & Associates/Kenney Aerial Mapping/WEST Consultants



A480.916

QUEEN CREEK & SANOKAI WASH HYDRAULIC MASTER PLAN

EXECUTIVE SUMMARY

Introduction

This Executive Summary generally describes the most significant features of the Queen Creek/Sanokai Wash Hydraulic Master Plan (HMP) Study Report. For more complete and detailed information, please refer to the Study Report.

Study Overview

The purpose of this study is to recommend a conceptual plan that will provide flood control along Queen Creek and Sanokai Wash for the 100-year, 24-hour rainfall event and serve as a guideline to assure that washes maintain adequate conveyance capacity for future land use conditions. In addition, the study is to identify opportunities for multi-use and recreational facilities and other aesthetic features for community enhancement to soften the impact of flood control features. This study was initiated by the Flood Control District of Maricopa County (District) and authorized by a contract (FCD 98-26) between the District and Huitt-Zollars, Inc.

Project Need

Queen Creek and Sanokai Wash are currently inadequate to contain the 100-year flood event. Presently, the impact of the 100-year event is limited to the flooding of adjacent agricultural fields and residential properties along the watercourses. However, as land is rapidly being developed, flooding will have a greater impact on residential properties and a plan is necessary to aid developers and municipalities in planning for future development and flood control. A conceptual plan will also enable the community to take advantage of opportunities to incorporate community enhancement features such as parks, trails, and/or even recharge facilities into necessary flood control features.

Project Involvement

The participation of both public and private parties was an important aspect of this project. Therefore, the communities, developers, municipalities, the counties, and other agencies were encouraged to provide input and assist in collectively developing a plan capable of being implemented. The District and the Towns of Queen Creek and Gilbert were the principal agencies participating in the study and were



instrumental in the development of the plan and the completion of this project. Their contribution and participation are greatly appreciated.

To obtain public input, two Neighborhood Open House Meetings were held during the study effort. The first meeting outlined the purpose and scope of the study and solicited recommendations for consideration in the development of flood mitigating alternatives. The second meeting was held to present several alternatives for flood mitigation and to provide the public an opportunity to evaluate the direction of the study and the alternatives presented.

Study Area

Study Limits

Queen Creek and Sanokai Wash are located in eastern Maricopa and northwestern Pinal County, primarily within the limits of the Town of Queen Creek. The study includes approximately 16 miles of Queen Creek located between the East Maricopa Floodway (EMF) and the Central Arizona Project (CAP) aqueduct in Pinal County and approximately 10 miles of Sanokai Wash located within Maricopa County (Figure 1). The study limits of the Main Branch of Sanokai Wash extends approximately 6 miles from the Queen Creek confluence to the

Maricopa County Line. The study limits of the East Branch of Sanokai Wash extends approximately 4 miles from the Main Branch confluence to the Maricopa County Line.

Existing Watershed Characteristics

The Queen Creek/Sanokai Wash watershed covers approximately 95 square miles (exclusive of the watershed upstream of the Sanokai Detention Dike) and includes portions of the Town of Queen Creek, the Town of Gilbert, eastern Maricopa County, and northwestern Pinal County. Much of the watershed area in Maricopa County was previously used for agricultural purposes, but is now gradually being converted primarily into low-density residential communities. In Pinal County, the watershed area varies from agricultural fields, to natural desert, to mountainous terrain. As in Maricopa County, land is gradually developed into for residential purposes.

The most significant new development is the Trilogy at Power Ranch located along Queen Creek between Recker Road and Power Road. Through this reach, the wash has been modified to pass through a new golf course and a new bridge has been constructed across the wash (Figure 2).

QUEEN CREEK & SANOKAI WASH HYDRAULIC MASTER PLAN



Figure 2. CON-ARCH bridge across Queen Creek at the entrance to the Trilogy at Power Ranch development.

Future Land Use and Development

This study is based upon the expected ultimate development of the watershed. Information regarding land development and land use was obtained for the City of Mesa, the Town of Gilbert, the Town of Queen Creek, Pinal County, and Maricopa County. The General Plan maps for these municipalities have been combined into a Future Land Use Map to show the planned ultimate development of the study area based upon the municipalities general growth plans. The future Land Use Map was used to create hydrology to account for expected future development of the entire study area and contributing watershed.

Queen Creek

Queen Creek exhibits ephemeral flow characteristics and is dry except after significant rainfall events. Initially a natural watercourse, Queen Creek has been significantly altered through the study area. Active and abandoned aggregate mining pits between the CAP aqueduct and Rittenhouse Road significantly affect Queen Creek and continue to alter its alignment through Pinal County. West of Rittenhouse Road, embankments have been built up along Queen Creek to prevent flooding of adjacent farmland to the extent that as the creek continues westerly, it becomes perched above the surrounding farmland and is contained between unengineered levees (Figure 3). Recently, however, the levees between Power and Recker Roads have been removed and a new golf course has been constructed within the channel as part of the

Trilogy at Power Ranch development. For Queen Creek, the existing channel width varies from 100 feet to greater than 300 feet in parts of Pinal County.

The Arizona Game & Fish (AG&F), the U.S. Fish and Wildlife Service (USFWS) have identified Queen Creek between Higley and Vineyard Roads as an area with biological and botanical resources of significant value. This area is characterized by dense growths of cottonwood, willow, sycamores and salt cedars (Figure 3). The AG&F and the USFWS have indicated that these areas are possible habitats for of pigmy owls, southwest willow flycatchers, and Sonoran desert tortoises.



Figure 3. Cottonwoods and dense vegetation along Queen Creek.

Sanokai Wash

Like Queen Creek, Sanokai Wash exhibits ephemeral flow characteristics and is dry except after significant rainfall events. Sanokai Wash originates in northwestern Pinal County in the foothills of the San Tan and Goldmine Mountains. Sanokai Wash consists of an East Branch and a Main Branch which join in the proximity of the Queen Creek landfill about $\frac{1}{4}$ mile east of the intersection of Hawes Road and Riggs Road.

The Main Branch of Sanokai Wash downstream of the East Branch/Main Branch confluence consists of a natural channel from Riggs Road to Via del Jardin although it has been altered and realigned

in some locations due to development. From Via del Jardin to the Higley Road, Sanokai Wash is mainly contained between unengineered levees. From Higley Road to the confluence of Queen Creek, Sanokai Wash is undefined and sheet flows into Queen Creek. The Main Branch of Sanokai Wash upstream of the East Branch/Main Branch confluence is a small channel with raised embankments. From San Tan Boulevard to the confluence with the East Branch, the Main Branch channel is non-existent and consists of overland flow. Where a channel exists, channel width of the Main Branch varies from y 50 feet to 200 feet.

The East Branch of Sanokai Wash is poorly defined or nonexistent in areas and consists mainly of small drainage channels, tailing ponds and overland flow across agricultural fields. The apparent alignment of the East Branch extends northwesterly from the Maricopa/Pinal county line to Signal Butte Road and then turns west along the Riggs Road alignment until it joins the Main Branch of Sanokai. Where a channel exists, the existing channel width varies from 50 feet to 100 feet.

Few cultural resource investigations have occurred in the watershed area and the few recent surveys that have been conducted did not located any other significant cultural resources except along the CAP corridor. The Sonoqui Pueblo and Pozos de Sonoqui prehistoric sites located along the East Branch of Sanokai Wash, are known from extensive surveys conducted in the 1930s and 1940s; however, agricultural and other development has obscured and/or disturbed these resources. With the exception of the Desert Wells Stage Stop, located near Sanokai Wash and Sossaman Road, ranches, roads, houses, and other structures that show up on historic maps have been disturbed or destroyed by agriculture.

Hydrology

Because flood control features will need to provide adequate protection for changes in the watershed upon future development, the District established the 100-yr, 24-hr fully developed watershed conditions (with detention) as the design hydrology for the Queen Creek/Sanokai Wash HMP. The fully developed conditions hydrology (a.k.a. future land use conditions) was created from the existing conditions hydrology that was constructed from previous studies and updated as part of this study. The fully developed conditions hydrology was then revised to reflect proposed detention basins and changes in flow routing for the project alternatives and the recommended plan.

For Queen Creek, peak flows for the existing land use conditions ranged from approximately 3150 to 5900 cfs (Figure 4). Peak flows for

QUEEN CREEK & SANOKAI WASH HYDRAULIC MASTER PLAN

the preferred alternative (using fully developed land use conditions) range from approximately 2300 cfs to 3350 cfs.

For the Main Branch of Sanokai Wash, peak flows for the existing land use conditions range from approximately 2000 cfs to 4600 cfs. Peak flows for the preferred alternative (using future land use conditions) range from approximately 2250 cfs to 4440 cfs.

For the East Branch of Sanokai Wash, peak flows for the existing land use conditions range from approximately 2050 cfs to 2350 cfs (Figure 4). Peak flows for the preferred alternative (using fully developed land use conditions) range from approximately 3200 cfs to 4260 cfs.

Hydraulics

The District provided existing conditions hydraulic models developed from previous studies for both Queen Creek and the Main Branch of Sanokai Wash. These models were used to develop hydraulic alternatives during the course of this study. The results of the hydraulic analysis may be found in the Technical Report.

Development of the Preferred Alternative

The alternative development and selection process consisted of three levels of analysis. Level I was the initial stage of formulation in which

feasible alternatives are identified and the most favorable, based upon non-quantitative preliminary analyses, considered for further development in Level II. In Level II, the three most favorable alternatives were further developed and the alternatives analyzed and evaluated in more detail with the most favorable alternatives being selected as the preferred alternatives for development in Level III. In Level III, the alternatives were developed in sufficient detail to create conceptual plans for use in guiding local development.

Evaluation Criteria

To compare and evaluate alternatives, an evaluation matrix was prepared as a means of selecting from among the alternatives for the two watercourses. The evaluation matrix consisted of the following eight independent criteria: Aesthetics/Landscaping/Multi-Use; Biology; Cost; Culture; Environment; Implementability; Planning; and Public Acceptance.

Each evaluator assigned each criterion a relative weight based upon their judgement of its importance. The rating for each alternative was then totaled and the alternatives ranked based upon evaluator's ratings. The results were then compiled and the preferred alternatives identified.

Recommended Plan

The Queen Creek/Sanokai Wash Hydraulic Master Plan is comprised of a preferred alternative that includes recommendations for sedimentation, erosion and lateral migration control and recommendations for multi-use and community enhancement features to incorporate into proposed flood control facilities.

Sedimentation Transport/Lateral Migration Analysis

A limited, preliminary sediment transport and lateral migration analyses was conducted on the preferred alternative and recommendations were made for drop structures, channel lining and sedimentation basins. These recommendations, though preliminary, were incorporated into the hydraulic and hydrologic models for the preferred alternative. The preferred alternative, however, was not reevaluated for sedimentation and erosion control. Future studies necessary for the design of channel improvements will need to conduct a more detailed analysis for design.

Preferred Alternative

The principal features for the preferred alternative are shown in Figure 4 and include:

Queen Creek:

- Relocate the EMF/Queen Creek confluence to just south of Queen Creek Road.
- A~45,000 c.y. (sediment capacity) sedimentation basin prior to the EMF.
- Incise Queen Creek from the EMF to Recker Road and matching the established channel invert at Recker Road.
- Incise Queen Creek from Power Road to Hawes Road.
- Approximately 4.5 ft. of grade control is proposed between Recker Road the CON-ARCH bridge entrance to the Trilogy at Power Ranch.
- Approximately 5 ft. of grade control is proposed between the CON-ARCH bridge and Power Road.
- Approximately 3.6 ft. of grade control is proposed between Power Road and Sossaman Road
- Bank protection along the entire wash where channel improvements are proposed.

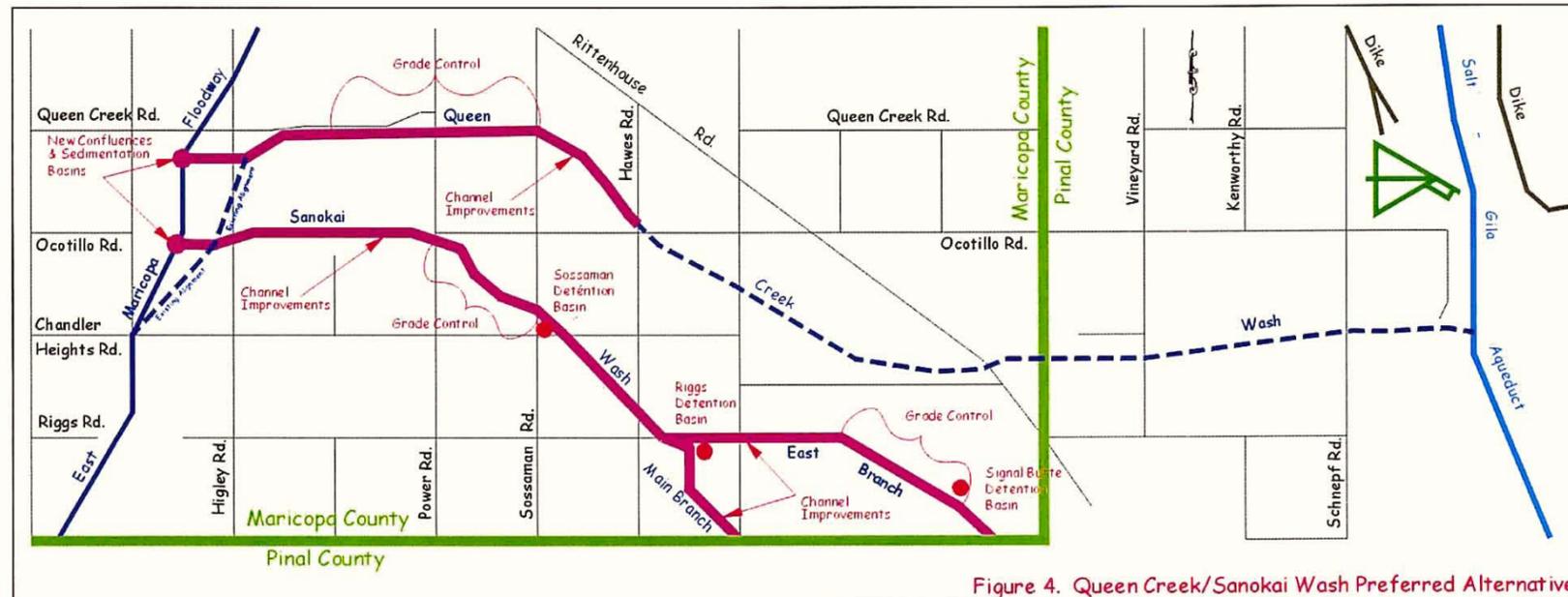


Figure 4. Queen Creek/Sanokai Wash Preferred Alternative

QUEEN CREEK & SANOKAI WASH HYDRAULIC MASTER PLAN

Sanokai Wash:

- Relocate the EMF/Sanokai Wash outfall to approximately the Ocotillo Road alignment.
- A 26,000 c.y. (sediment capacity) sedimentation basin prior to discharging into the EMF.
- A 58 acre-ft offline detention basin (min. storage capacity) to the East Branch of Sanokai Wash near Signal Butte Road.
- A 79 acre-ft offline detention basin (min. storage capacity) to the East Branch of Sanokai Wash located south of Riggs Road and ~0.5 miles east of Hawes Road.
- A 53 acre-ft offline detention basin (min. storage capacity) to the Main Branch of Sanokai Wash near Sossaman Road.
- Provide channel bank protection along the entire length of both branches of Sanokai Wash
- Channelize Sanokai Wash from the EMF to Riggs Road with the channel realigned downstream of Via del Jardin.
- Approximately 7.0 ft. of grade control is required between Power Road and Sossaman Road.
- Realign the Main Branch of Sanokai Wash downstream of San Tan Boulevard and relocate the East Branch/Main Branch confluence ~0.5 miles to the east.
- Incise and line the Main Branch of Sanokai Wash from the East/Main confluence to Hunt Highway.
- Incise the East Branch of Sanokai Wash along the south side of Riggs Road from the East/Main confluence to Crismon Road.
- Channelize the East Branch of Sanokai Wash from Crismon Road to Hunt Highway (County Line).
- Approximately 3.8 ft. of grade control is required between the East/Main Branch confluence and Signal Butte Road.

Recommendations for Multi-Use and Community Enhancement Features

As part of the Queen Creek/Sanokai Wash HMP, it was desired to minimize the visual impact of proposed flood control features and investigate opportunities to incorporate aesthetics, landscaping and multi-use features into the design of proposed flood control facilities. To develop these concepts, field visits, project team meetings, and Neighborhood Open House meetings were held to present concepts and collect input from the District, Town of Queen Creek, and members of the community.

Several concepts were considered for the proposed channels and detention basins. The concepts for detention basins and channel design ranged from more natural channels/basins with trail systems to more

urban, turf-lined channels/basins with baseball or soccer fields. Consideration was also given to water based facilities such as ponds or lakes and continuously flowing streams which could also be incorporated into recharge facilities. While most of these concepts are not proposed as part of the recommended plan, they are features the community might want to consider in the future.

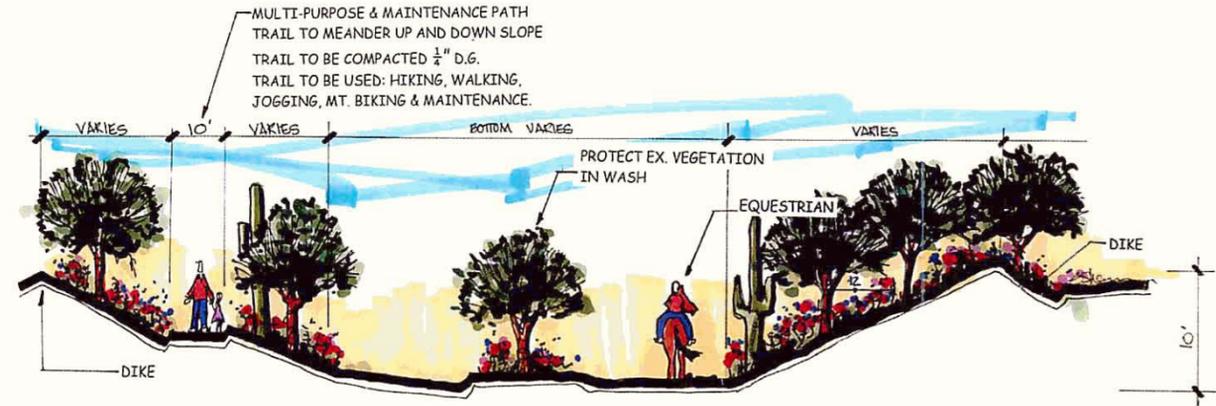
Multi-Use Schemes for Queen Creek and Sanokai Wash

Presently, the community of Queen Creek is primarily rural and agricultural. Input from the community indicates that there is a desire to try and preserve that identity even as the area continues to develop. Sanokai Wash was identified as the wash that the community wishes to maintain in a more natural or rural state. Active recreational features such as baseball fields, turf-lined channels and water-based facilities were not seriously considered through this corridor but a more passive multi-purpose trail system was favored.

Queen Creek because it had already been significantly altered from its natural state, was considered a more likely candidate for active recreational features. In addition, Queen Creek offered the best opportunity to incorporate water based facilities with potential recharge projects. However, as alternatives that included detention facilities were rejected in favor of strict channel improvements, a more natural channel retaining the existing mature trees and landscaped with native vegetation was considered more appropriate and a multi-purpose trail system was more feasible.

Multi-Purpose Trail System

Both Queen Creek and Sanokai Wash provide excellent opportunities to include a multi-purpose trail system for equestrians, pedestrians, and bicyclists. Currently, the Town of Queen Creek has an adopted trail master plan that includes both washes. The use of the washes for recreational purposes would involve preserving and maintaining the natural character of the washes and providing access to the trails by



RECREATION USE WITH NATIVE MATERIAL PROTECTED

the public. Once the trails are in place, the public will have access to other trails throughout the region.

The conceptual plans show typical channel cross sections that might be considered when incorporating a multi-purpose trail system into necessary improvements to the washes for flood control (see Figure 5). The channel cross sections could vary from 12:1 in areas where land is readily available to 4:1 where channel widening is limited by existing structures or residential properties.

The equestrian trail will access several points along the washes along a 12-foot wide compacted decomposed granite path. The bottom of the washes will be used as the designated trail for the equestrian riders, while the multipurpose trail system will be part of the side slopes of the wash. The multipurpose trail will be 10 foot wide and more of a hard surface material will be used. This multipurpose trail could also be set up as an interpretive trail system, identifying with signage the types of flora and fauna that exist in the area. This path may also be used for maintenance and emergency vehicles. Detention basins along Sanokai Wash can be used for accessing the trail systems for both the equestrian users and the multipurpose users with a designated parking areas, areas for picnicking, and open space.

QUEEN CREEK & SANOKAI WASH HYDRAULIC MASTER PLAN

Opportunities for Other Multi-Use and Community Enhancement Features

While the proposed recommendations for the Queen Creek/Sanokai Wash Hydraulic Master Plan focuses on trail systems, the Towns of Queen Creek and Gilbert or developers may wish to consider other multi-use and community enhancing features.

The Towns of Queen Creek and Gilbert or local developers might wish to consider a well groomed, turf-lined wash, particularly along Queen Creek. A turf-lined wash would work well with more active recreational facilities such as athletic fields or even water-based facilities such as ponds or lakes. It would also work well with possible desires of developers to build new golf courses and developments similar to the Trilogy at Power Ranch Golf Course along Queen Creek.

The proposed Sanokai Wash detention basins could be used for more urban community parks and provide the community with active recreational activities, such as athletic fields, game courts, playgrounds, picnicking areas, and open space. Water-based facilities could also be incorporated into the channels and detention basins. Ponds, lakes and/or continuously flowing streams could be additional

Table 2. Queen Creek/Sanokai Wash Cost Estimate

Description	Land Acquisition Cost	Construction Cost	Landscape Cost	Contingency (15%)	Design & CM (15%)	Total
Queen Creek						
Channel	\$0	\$4,064,000	\$1,263,550	\$799,133	\$919,002	\$7,045,685
Sedimentation Basin	\$0	\$579,300	\$70,000	\$97,395	\$112,004	\$858,699
Total (Queen Creek)	\$0	\$4,643,300	\$1,333,550	\$896,528	\$1,031,006	\$7,904,384
Sanokai Wash						
Channel (Main Branch)	\$150,000	\$6,773,000	\$2,341,250	\$1,367,138	\$1,572,209	\$12,203,597
Channel (East Branch)	\$0	\$2,980,500	\$1,236,375	\$632,531	\$727,411	\$5,576,817
Sedimentation Basins	\$0	\$202,600	\$28,000	\$34,590	\$39,779	\$304,969
Detention Basins						
Sossaman Basin	\$570,000	\$928,300	\$266,000	\$179,145	\$206,017	\$2,149,462
Riggs Basin	\$600,000	\$968,250	\$280,000	\$187,238	\$215,323	\$2,250,811
Signal Butte Basin	\$450,000	\$758,200	\$210,000	\$145,230	\$167,015	\$1,730,445
Subtotal Detention Basins	\$1,620,000	\$2,654,750	\$756,000	\$511,613	\$588,355	\$6,130,718
Total (Sanokai Wash)	\$1,770,000	\$12,610,850	\$4,361,625	\$2,545,871	\$2,927,754	\$24,216,100
PROJECT TOTAL	\$1,770,000	\$17,254,150	\$5,695,175	\$3,442,399	\$3,958,760	\$32,120,484

amenities that would add to the community. Fishing, non-motorized boating and even riparian habitats could be established within the flood control facilities. These amenities, however, would require suitable sources of water to maintain the facilities.

In addition, the Town of Queen Creek may wish to consider extending the trail system through the reaches of Queen Creek were channel improvements are not proposed, particularly east of Hawes Road. A nature trail restricted to pedestrian use would help preserve the habitat along the wash while providing a continuous trail system for hikers, bird-watchers and other pedestrian users.

Conservation

Proposed channel improvements and detention basins can also be incorporated into conservation efforts to recharge ground water or to provide habitat for birds and other species. The City of Mesa and other public agencies are considering efforts to utilize property within the study area for ground water recharge including sites in the Ocotillo/Higley area and in an area east of the SPRR. The basins could also be utilized in a manner similar to a recharge project by the Town of Gilbert in the vicinity of Greenfield Road and Guadalupe Road. The

Town of Gilbert has constructed a recharge facility/riparian preserve that would incorporate ground water recharge, habitats for migratory birds and other species, and even recreational and educational facilities for the public. The channels themselves could be used for recharge and to provide riparian habitats.

Cost Estimates

Estimated Project Cost

A summary of the preliminary cost estimate for the construction of the recommended plan is shown in Table 2. The estimate is based upon the conceptual

plans and available information. It includes estimates for the major construction items including: basin and channel excavation, grade control, hydraulic structures (basin inlets/outlets), utility relocation, trails, landscaping, bridge modifications/construction (Queen Creek only) and land acquisition.

Maintenance Cost

Maintenance costs are broken into regular maintenance and periodic maintenance. Regular maintenance would cover the general upkeep of the facilities including the removal of trash and debris from the public areas, pruning/removal of vegetation to maintain channel conveyance and minor channel maintenance for erosion/sedimentation. More intense sediment removal and channel maintenance/repair efforts would be required on a periodic basis and would be dependent upon the frequency and severity of significant rainfall events. Estimated yearly maintenance costs for the recommended plan are shown in Table 3.

Table 3. Yearly Maintenance Costs

Description	Yearly Cost
Regular Maintenance	
Full-Time Employee (incl. overhead)	\$60,000
Periodic Maintenance	
Sediment Removal/Channel Repair (annualized/year)	\$17,750
Total Estimated Yearly Maintenance Costs	\$77,750

Implementation

Most improvements for Queen Creek and Sanokai Wash are to be implemented by landowners as property is developed along the two watercourses. The Towns of Queen Creek and Gilbert have the authority, through the development review/approval process, to establish guidelines to control new development within their jurisdictions. This study will provide a basis for the local jurisdictions to establish guidelines to require the construction and development of facilities that will be consistent with flood control efforts and the Town General Plans.

To aid in the construction of the facilities and/or to incorporate multi-use and community enhancement features, funding from various public programs may be available provide specific conditions are met. Improvement Districts or other funding programs could also be considered to provide some funds for construction.