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Tres Rios River Management Plan

Flood Control Summary Report

DRAFT

November 1997

Flood Control Technical Committee

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December 4, 1997

MEMO TO: Tres Rios River Management Plan (TRRMP) Steering Committee

FROM: Dick Perreault, Chairman, TRRMP Flood Control Technical Committee

SUBJECT: TRRMP Flood Control Technical Committee Flood Control Summary Report

The Flood Control Technical Committee (FCTC) herein provides the Tres Rios Flood Control Summary Report to the TRRMP Steering Committee. This report is a final draft summary documentation of the FCTC analyses, findings and recommendations. Additional expanded documentation of the analyses is provided in the report appendices.

This report is based on the technical knowledge of the individuals serving on the FCTC. It is important to note that the report does not reflect the policies or regulations of federal, state and local agencies.

TRES RIOS RIVER MANAGEMENT PLAN
FLOOD CONTROL TECHNICAL COMMITTEE

FLOOD CONTROL SUMMARY REPORT

DRAFT

November 1997

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TRES RIOS RIVER MANAGEMENT PLAN
FLOOD CONTROL TECHNICAL COMMITTEE

FLOOD CONTROL SUMMARY REPORT

DRAFT

November 1997

1. FORWARD

This Summary Report prepared by the Tres Rios River Management Plan (TRRMP) Flood Control Technical Committee (FCTC) is based on the technical knowledge of the individuals serving on this committee. It does not reflect the policies or regulations of Federal, State and local agencies. The TRRMP FCTC was formed in December, 1996 by the TRRMP Steering Committee and has met monthly since that date. This report is a summary of the TRRMP FCTC analyses, findings and recommendations. Additional expanded documentation of analyses are provided in the Appendices.

2. INTRODUCTION

The (TRRMP Steering Committee) team is preparing a management plan for the reach of the Salt/Gila River from approximately 75th Avenue to the confluence of the Agua Fria River. The TRRMP team is divided into six Technical Committees. Each committee is composed of technical experts to focus on the specific issues related to that committee's goal. The analyses and alternative developments are to be based only on the technical considerations relative to that specific technical committee. Participants are not to be influenced by the policies of regulatory agencies they represent. The Flood Control Technical Committee's focus is on flood control and flood protection technical issues. The Committee has developed a preferred alternative, an acceptable alternative, and the unacceptable alternative(s).

2.1 Purpose and Goals

The purpose of the TRRMP Flood Control Technical Committee is to develop an acceptable flood control management plan that accomplishes the following goals in the Salt/Gila Rivers between 75th Avenue and the confluence with the Agua Fria River:

- To improve the river flood conveyance capacity
- Provide 100-year flood protection for existing improvements to FEMA standards
- Maintain and enhance existing natural habitat
- Develop an implementable plan

- Develop a public/private partnership
- Not to make the flooding situation worse in any area as a result of a proposed plan

2.2 Committee Participants

The following is a list of the participants who attended TRRMP Flood Control Technical Committee Meetings:

Dick Perreault (Committee Chair)	Flood Control District of Maricopa County (FCDMC)
Barbara Corsette	AZ Division of Emergency Management
Russ Cruff	FCDMC
John Drake	Corps of Engineers
Mike Ellegood	FCDMC
Don Gross	AZ Dept. Water Resources
Paul Kinshella	City of Phoenix
Dan Lawrence	AZ Dept. Water Resources
Terri Miller	AZ Dept. Water Resources
Tim Murphy	FCDMC
Marvin Murray	Bureau of Reclamation
Debbie Radford	City of Phoenix
Adron Reichert	Holly Acres
Fred Ringlero Jr.	Gila River Indian Community
Alfonso Rodriguez	Gila River Indian Community
Mike Ternak	Corps of Engineers
Joe Tram	FCDMC
Frank Turek	Greeley and Hansen
Rene Vermeeren	Corps of Engineers
Roland Wass	City of Phoenix
Bill Werner	AZ Game & Fish Dept.

2.3 Committee Tasks

The TRRMP Flood Control Technical Committee developed the following tasks as the approach to achieve the committee goals:

- Update existing HEC-2 model
- Develop right-of-way/land ownership database

- Develop alternatives
- Identify existing data and constraints
- Identify existing/future improvements
- Identify data gaps (for desirable information)
- Perform analyses
- Evaluate erosion potential (susceptibility)
- Rate alternatives
- Write report

3. STUDY PARAMETERS

The TRRMP Flood Control Technical Committee (FCTC) met several times to establish the parameters to define the limits of the study and the information required for analyses.

3.1 Study Area

Tres Rios study area is generally defined as the area of the Salt River downstream of the 91st Avenue Wastewater Treatment Plant (WWTP) discharge to the confluence with the Gila River and the portion of the Gila River extending from the Salt River downstream past the confluence with the Agua Fria River to the diversion structure of the Buckeye Irrigation Company in the Gila River. The FCTC decided the flood control study reach must extend upstream of the 91st Avenue WWTP to allow HEC-2 modeling to include impacts to the WWTP. The Committee also decided the study area must extend beyond the channels of the riverbed because during flood events the river overflows the channel banks and inundates adjacent bank areas in the floodplain.

The study area boundaries established by the FCTC are:

- 75th Avenue alignment on the east
- Southern Avenue alignment on the north
- Agua Fria River junction on the west
- Baseline Road alignment on the south

3.2 Hydrology Conditions

Previous HEC-2 modeling was based on the hydrologic conditions in the Salt River and downstream in the Gila River that existed prior to the expansion of storage capacity provided by Roosevelt Dam improvements. The Corps of Engineers provided the Committee with the revised discharge quantities

based on modified Roosevelt Dam improvements and these values were used to update HEC-2 analyses. The hydrology information used for this study is:

Recurrence Interval	*Salt River Upstream of Gila River, cfs*	*Gila River, cfs*
100-year	162,000	227,000
50-year	130,000	185,000
25-year[1]	92,000	115,000
20-year	82,000	92,000
10-year	49,000	57,000
5-year	19,500	23,500

[1] The 25-year recurrence values were interpolated from a plot of the 5, 10, 20, 50 and 100-year recurrence interval values.

3.3 Considerations

The FCTC identified several considerations during initial monthly meetings that needed to be addressed as a part of the analyses. These are existing or planned features that would impact flood conveyance and HEC-2 analyses. They also include impacts to the community. The following are brief descriptions of the considerations incorporated into the analyses:

- ***Holly Acres Levee.*** This is an existing flood protection structure extending from 113th Avenue downstream to El Mirage Road (123rd Avenue) located on the north bank of the Salt River. This levee can accommodate 115,000 cubic feet per second (cfs) of flow with three feet of freeboard. However, at flows of 100,000 cfs (±), the river flows over the north bank near 99th Avenue and can then flow north around the Holly Acres Levee. Flows in excess of 250,000 cfs are projected to overtop the Holly Acres Levee.

- ***91st Avenue Wastewater Treatment Plant (WWTP) Bank Stabilization.*** The 91st Avenue WWTP has a flood protection project scheduled for construction along the north bank of the Salt River. The City of Phoenix provided the design plans for the bank stabilization project. Design flows are for the 100-year flood.

- ***123rd Avenue Landfill in River.*** There is an abandoned municipal landfill in the Gila River channel at 123rd Avenue. The FCTC modeled the flood flow impacts caused

by the landfill and included them in the analyses. Possible water quality impacts and the requirements for removal of the landfill were not addressed by the FCTC.

- ***115th Avenue Bridge and Approach Roads***. Maricopa County Department of Transportation is constructing a new bridge crossing the Gila River at approximately 115th Avenue, north and south roads are also to be constructed. The impacts of the bridge and the approach roads on flood flows and ponding caused by the north approach road were included in the analyses.

- ***Phoenix International Raceway***. The Raceway is located on the south bank of the Gila River and has parking areas in the Gila River channel and adjacent to the south road. The raceway will have no impact on the river hydraulics after construction of the south approach road.

- ***St. Johns Irrigation District Fields and Farming Issues***. There are numerous irrigation canals and laterals throughout the area. These locations were included in the analyses to prevent a proposed alternative from resulting in the interruption of irrigation water to farming areas. The farmers have a minimum size field which can be used for irrigation economically. The alternatives were developed to minimize dividing fields so farming of these fields would no longer be economical. Dividing the fields into small units could increase project costs due to the need to purchase more farmland.

- ***Gila River Indian Community***. The Tres Rios area is in District 7 of the Community. The Gila River Indian Community provided input on future development plans and conditions along the south bank of the Salt River. These data were incorporated into HEC-2 analyses to verify that a proposed alternative would not increase the flooding potential on the south bank of the river.

- ***Break-Out Points***. These are locations of lower elevation along the north bank of the Salt River where flood water could leave the channel and flow north around existing flood protection structures.

- ***School District Tax Base***. This issue was raised to address the transfer of land from private to public ownership. The land would be removed from the tax base when in

public ownership. Alternatives were evaluated to minimize the economic impact to the School District by limiting the land needed for flood protection alternatives.

- ***Holly Acres Area History***. The history of flooding of the Holly Acres Community areas and local knowledge of problems were provided by community representatives. This helped to evaluate the alternatives and to evaluate citizen acceptance of the alternatives.

- ***Interior Drainage***. If a levee alternative is selected, interior drainage must be addressed.

3.4 Nonstructural Flood Control Alternatives

Nonstructural flood control alternatives are methods to mitigate flooding problems without construction of regional flood protection facilities. The FCTC developed a list of non-structural flood control alternatives and conducted an initial assessment of each to determine if they were implementable. Non-structural alternatives determined to be implementable were carried forward for additional assessments. The others were deleted from further consideration to allow the FCTC to focus time and efforts on the implementable alternatives.

- ***Corridor Clearing***: A flood flow corridor was cleared in the Salt and Gila Rivers by clearing a 1,000-foot wide corridor of vegetation. The clearing was not a wholesale removal of vegetation, but rather was done to remove salt cedar from within the corridor. This corridor functioned quite well during the flooding of 1993. This non-structural alternative involves re-establishment of a cleared corridor. The FCTC felt this is an implementable alternative.

- ***Regulatory; Controlled Development in Floodplain***: Restricting development within the 100-year flood plain is an effective method to keep future development out of flood risk zones. The regulations are in place and can be used, but this is not an effective method to remedy existing problems. The focus of the FCTC was not just the protection of future developments but also existing structures and facilities. Control of development within the flood plain will be enforced by Maricopa County and municipalities with jurisdiction in the Tres Rios area. The FCTC did not identify regulatory controls as an effective method to solve existing problems and meet the committee's goals.

- ***Flood Proofing Individual Property***: In some cases it is feasible to provide flood protection for individual structures. This can be cost effective if there are few structures within a large area. This non-structural alternative was considered appropriate by the FCTC in specific instances, but would not be implementable for the total area.

- ***Relocation/Buy-Out***: This involves the relocation of residents to a new area in exchange for their existing property or the buy-out of individual residents where they receive cash for the property. Relocation and buy-out alternatives may or may not involve Federal participation and would be a long-term process. The FCTC felt that the buy-out option was an implementable alternative, but not a total solution. The buy-out alternative would be voluntary.

- ***Easements***: This alternative included purchasing flood easements from landowners. The easement purchase is a right to flood the property and restrict some of its uses but does not include the purchase of the property. The residents would still be subject to flooding of farmland and structures. Based on discussions with the Holly Acres representative this was not found to be acceptable or implementable.

- ***"n" Factor Modifications***. The "n" factor is a roughness coefficient applied to channel conditions for HEC-2 modeling. Channel roughness is increased by vegetation because the plants restrict the flow of water. The FCTC included "n" factor reductions in HEC-2 analyses to determine what impacts "n" factor changes could have on flood flows. The modifications could include open space dry, open space wet, growth control to regulate vegetation and vegetation changes. The analyses did not include identification of specific plant species or vegetation communities that could be modified to achieve the reduction in "n" factors. This alternative partially meets some of the committee's goals.

3.5 Structural Flood Control Alternatives

Structural flood control alternatives are facilities constructed to provide flood control and flood protection. These are engineered facilities of a permanent nature. The FCTC identified several structural alternatives and just as with the non-structural alternatives, conducted an assessment to determine which were implementable. Structural alternatives have a greater physical impact on the area than non-structural alternatives and require maintenance during the life of the structure.

- ***Conveyance Corridor Excavation***: The conveyance corridor clearing described as a non-structural alternative can be combined with conveyance corridor excavation to enhance the channel capacity. The FCTC did not consider massive excavation of a corridor but rather included the removal of river bed material to produce a relatively hydraulically uniform corridor. Excavation included removal of high points within the corridor rather than excavation of the entire corridor. This was found to be implementable.

- ***Channelization***: This alternative would involve excavating a defined channel and then lining it with concrete or soil cement. The channelization would increase flood conveyance capacity. The FCTC eliminated this structural alternative from further consideration because construction would result in extensive disturbance of the riparian environment and its significant costs. It would be opposed by the public.

- ***Levees, Setbacks From Bank***: Flood control levees set on or near the river banks are a proven flood control structural alternative. This alternative was found to be implementable.

- ***Deflector Dikes***: In some locations dikes can be constructed in the river channel to deflect the high velocity flow of flood water away from the banks. This can reduce bank erosion and flooding. Construction of deflector dikes would have a major impact on the existing riparian habitat in the river channel but would not achieve the committee's goals. The FCTC did not rate deflector dikes as an implementable solution.

- ***Over Bank Storage***: Construction of structures to provide storage of flood flow on bank areas subject to flooding was the foundation of this structural alternative. This would be more disruptive to the local community than other alternatives and thus FCTC did not consider this as a viable alternative.

- ***On-Line Storage***: Construction of new flood control storage in the Salt/Gila River watershed could help reduce future flood flows. The FCTC did not consider this to be feasible based on the opposition to new flood control dams in the past.

4. FLOOD CONTROL ALTERNATIVES

4.1 Post New Roosevelt Discharges, Future Without Project

The FCTC identified this as the base condition. HEC-2 modeling would project the future 100-year flood flow elevations and inundation areas. This alternative incorporated a projected increase in vegetation encroachment in the river channel, increased vegetation density, and new modified Roosevelt Dam hydrology projections.

4.2 Flood Control Levees

A series of four levee alignments on the North Bank were developed for HEC-2 analyses. These are:

- Levees following the river bank from the break out point near 99th Avenue west to Dysart Road
- Levees following an alignment located 500 feet south of Southern Avenue to Dysart Road
- Levees following an alignment located 1,300 feet south of Southern Avenue to Dysart Road
- Levees following the alignment of Southern Avenue to Dysart Road

4.3 Conveyance Corridor Clearing

This alternative was based on the conditions that would result if the 1,000 foot wide corridor was restored and cleared of vegetation. The FCTC recognized that if the corridor was cleared in the future, the alignment of the corridor and width would have to be coordinated with environmental resource agencies.

4.4 Conveyance Corridor Excavation

Conveyance corridor excavation was limited to excavating the depth of the cleared conveyance corridor to the average depth of the low points in the river cross-sections. This alternative did not project major excavation to deepen the entire corridor to a new depth but rather was developed to regrade the corridor to remove high spots.

4.5 "n" Factor Modification.

The "n" factor modifications developed for HEC-2 analyses varied depending on the alternative. In the Future Without Project alternative the "n" factor was increased to simulate increased vegetation

impacts. In corridor clearing and excavation alternatives the "n" factor was decreased to represent cleaner, less resistive flow paths.

4.6 Flood Proofing

Flood proofing (as discussed in Section 3.4), can provide flood protection for individual structures. The FCTC reviewed information concerning projected 100-year flood water depths, number of structures, and type of construction used in the structure. The purpose of the flood proofing evaluation was to calculate the associated costs to determine if this is a cost effective alternative. Flood water depths were obtained from the Future Without Project HEC-2 modeling.

4.7 Relocation/Buy-Out

The FCTC found this to be a complex issue. Previous relocation proposals were strongly opposed by the Holly Acres residents. Assessment of the relocation alternative required a review of the potential funding sources, the requirements of the program, and willingness of the residents to voluntarily participate in the program.

5. HEC-2 ANALYSES

The FCTC had many HEC-2 simulation models run as a part of the analyses. The data is attached as an appendix to this Summary Report. The following descriptions are summaries of the HEC-2 modeling efforts.

5.1 Simulation Options.

5.1.1 Changing "n" Factors.

This alternative involved increasing the "n" factor to simulate continued vegetation growth in the Salt and Gila River channels.

5.1.2 North Bank Levee Options.

The initial HEC-2 models only included the four levee alignments described in Section 4.2.

5.1.3 Corridor Clearing.

Channel cross-sections were adjusted to reflect reduced "n" factors due to vegetation clearing. Corridor clearing was initially studied as a stand alone alternative but was later incorporated into other alternatives.

5.1.4 Corridor Excavation.

The excavation could not occur without first clearing the corridor. It included developing cross-sections by removal of high spots of riverbed material in the cleared corridor.

5.1.5 North Bank Levee, Corridor Clearing, and Corridor Excavation.

This alternative was developed after reviewing the results of the HEC-2 simulations for the other alternatives. The corridor clearing increased the conveyance capacity, corridor excavation provided additional open cross-section area, and a levee on the north bank would provide flood protection.

5.2 Results

5.2.1 Changing "n" Factors.

The HEC-2 model projected that a future 20-year flood with the increased "n" factors will inundate an area equal to about 50 percent of the total current 100-year flood plain. The 50-year flood covers about the same area as the current 100-year flood. Additional flooding would occur on the south side of the river and the GRIC could have additional problems. The projected 100-year flood stays in the river at 91st Avenue but just barely. If the high velocity waters impact the stability of the 91st Avenue WWTP dikes, the WWTP could be flooded. Downstream the PIR buildings will be impacted.

5.2.2 North Bank Levee Options.

All of the levee options could provide 100-year flood protection for areas of the north bank but they increased flood impacts on the south bank. There were major differences in the degree flood protection with the four alignments.

5.2.3 Corridor Clearing.

The HEC-2 models projected a lowering of the water surface elevation but the result was not sufficient to provide 100-year flood protection. The FCTC determined it would be an important component of alternatives.

5.2.4 Corridor Excavation.

When combined with corridor clearing the corridor excavation provided for additional 100-year flood water surface elevation lowering but it did not meet the goal of 100-year flood protection. There are areas between 99th Avenue and 115th Avenue on the north bank that are topographic low areas. The flood flows could breakout of the channel and innundate areas of the north bank.

5.2.5 North Bank Levee, Corridor Clearing and Corridor Excavation.

The HEC-2 run data showed this alternative provided 100-year flood protection for the north bank and did not result in additional flooding of the southbank.

5.3 Analyses

The HEC-2 analyses demonstrated.

- The 123rd Avenue Landfill results in localized water surface elevation increases but does not present a regional water surface change issue.

- The Indian Springs Road embankment west of PIR does not have a significant impact on flood elevations.

- The new 116th Avenue bridge does not seem to have a significant effect on the water surface elevation.

- The levee alignments studied in the HEC-2 analysis as described in Section 5.3 provided successively less flood protection the further north the levee was located. Correspondingly the further north the levee was located, the less impact it had on the water surface elevation in the river. The levee alignment along Southern Avenue and the alignment located 500 feet south of Southern Avenue did not provide sufficient flood protection to meet project goals. The FCTC decided to use a combination of the levee alignment along the north bank with a levee alignment 1,300 feet south of Southern Avenue in future levee scenarios to minimize impacts to land within the Holly Acres area. This would help to maintain farm field continuity and minimize land ownership transfer from public to private and thus reduce tax impacts to the school district. Due to the topography of the north bank area, the levee by itself could not provide total protection without negatively impacting the south bank. Changes in the river channel over time could raise the water surface elevation and could result in flood waters over topping the levee.

- Corridor Clearing. The FCTC did not find this to be a suitable alternative unless it should be combined with other alternatives.

5.3.1 Corridor Excavation

This alternative did not meet the goal of 100-year flood protection. The FCTC did determine that it should be combined with other alternatives.

5.3.2 North Bank Levee, Corridor Clearing and Corridor Excavation.

This alternative met the goals of the FCTC. Increased channel capacity obtained by corridor clearing and increase cross-section area provided by corridor excavation lowered the 100-year flood water surface elevation. The north bank levee provided additional protection to prevent breakouts of flood flows.

During initial FCTC meetings an alternative was discussed to include constructed wetlands on the north bank. These wetlands would be placed on a bench excavated into the north bank and the levee would be built north of the wetlands. An advantage discussed was that excavation for the constructed wetlands would increase the cross-section thereby reducing or eliminating the required channel excavation at that location. Other issues to be considered and studied for such constructed wetlands are; hydraulic efficiency of cross section, bank destabilization effects of excavation, environmental impacts of the excavation and economic feasibility. The FCTC did not prepare HEC-2 simulation for this option. This option was not evaluated because it would require; calculation of new cross-sections with the wetlands, determination of all excavation impacts and relocation studies for the levee, which exceeded the available resources of the FCTC.

6. FLOOD PROOFING ANALYSES

The FCTC prepared an initial assessment of the flood proofing alternative and did not recommend it as a high priority alternative. The analyses estimated the costs for flood proofing including construction of flood walls and levees around structures and also raising or elevating the structure above the 100-year water surface level. The FCTC developed the following conclusions:

- The estimated flood proofing costs associated with the projected 100-year water surface elevation were projected to range from $ 21,000 to $74,000 per house. The range was due to the type of structure involved and the method of flood proofing. The dominant structure type in the Holly Acres area with an appropriate method of flood proofing had a projected cost of $25,000 per structure.

- The typical depth of water associated with the 100-year water surface averaged four to five feet. Flood proofing is usually cost effective where the projected water depths are two feet or less.

- Most of the structures in the area consist of slab on grade masonry construction. These types of structures can not be easily moved or raised and there are documented examples of the problems associated with relocating masonry structures. There are also examples of problems associated with relocating wood frame structures. Flood proofing by elevating the structures was not found to be viable.

- Flood proofing could be viable if the water surface elevation was lowered or if a lesser degree of protection (less than 100-year flood) was considered.

FCTC recognized that the conclusions are not definitive in determining future participation by any local or Federal agency in a cost shared non-structural flood control project. If the flood elevation projections change as a result of a flood control project, flood proofing will need to be reevaluated as a part of future studies based on the new conditions.

7. RELOCATION ANALYSES

The FCTC compiled a land ownership map delineating the layout of the parcels and the owner of the parcel. The land ownership map was prepared in one mile segments from the east to the west and included the river channel and lands north of the river to Southern Avenue. This map was used as the foundation to determine the landowners who could be involved in relocation.

The initial step in the analysis was a presentation by the Holly Acres representative about the previous relocation proposal. The residents had opposed that previous relocation proposal. They like their community and did not want it to be broken up.

The FCTC was told by the Arizona Division of Emergency Management that when considering relocation or buy-out, relocation is the more expensive option based on their data from Winkelman, Arizona. Relocation involves new homes and infrastructure whereas buy-out is a purchase of property. The FCTC also determined the relocation has specific conditions that will require more to evaluate.

- ***Participation***. Residents need to volunteer to join the relocation program. Due to the opposition to relocation in the past the residents must be surveyed to determine how many would participate. If the residents' involvement is limited then flood protection will still be needed. This will impact the feasibility of the relocation program. The FCTC recommended that the residents be surveyed on an informal level to solicit input on interest in the relocation or individual buy-out programs. This should be done as a continuing study.

- ***Qualification***. The relocation program has criteria that must be met to qualify for participation in the relocation program. Guidelines for acquisition or relocation projects are summarized in **Appendix E**.

- ***Funding***. The FCTC analysis showed Federal moneys can be made available but there is no local sponsor presently identified to provide matching funds. Funding is a 50-50 split and without a local sponsor there is no program. Local sponsors will not commit funding until there is evidence that the residents are interested in the program. This is another reason the residents' survey is needed. Potential local sponsors included the State of Arizona, the Flood Control District and the City of Phoenix.

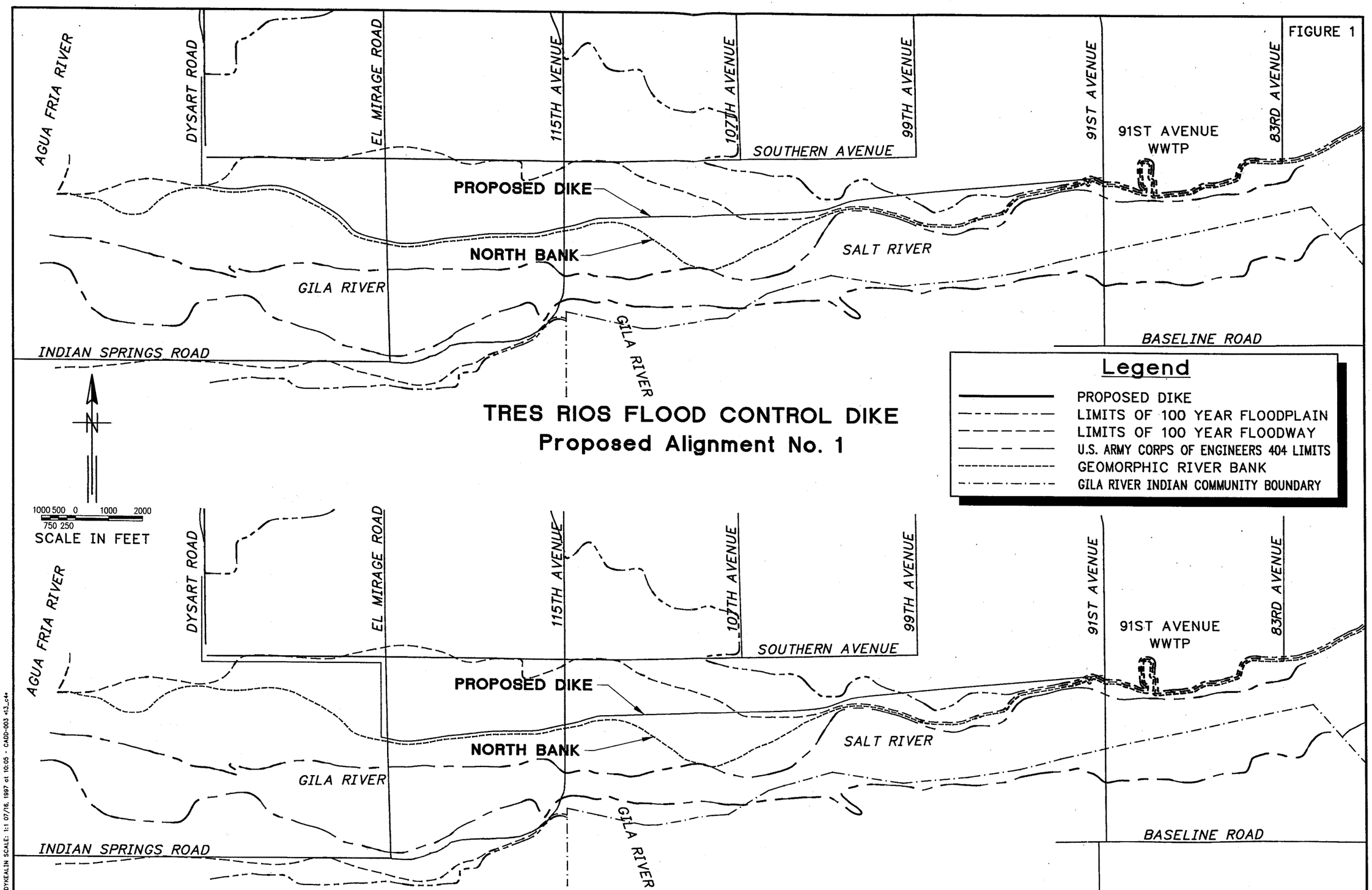
The FCTC found that the relocation program can be a feasible alternative but there is a data gap that prevents completion of a full evaluation and this is the knowledge of the number of residents interested in the program and identification and funding by a local sponsor(s). General information pertaining to relocation programs is included in the appendices.

8. NORTH BANK LEVEE COSTS

The FCTC developed two levee alignments as shown on **Figure 1**. These levee alignments used combined portions of the north bank and 1,300 feet south of Southern Avenue alignment.

- ***Alignment 1***. Alignment 1 follows north of the river bank from 91st Avenue to the existing Holly Acres Levee at 113th Avenue. It then follows the existing levee alignment (existing levee proposed to the raised) from 113th Avenue to El Mirage Road. From El Mirage Road the levee continues along the north bank to Dysart Road. The levee then follows Dysart Road north for 3500 feet.

FIGURE 1



TRES RIOS FLOOD CONTROL DIKE
Proposed Alignment No. 1

TRES RIOS FLOOD CONTROL DIKE
Proposed Alignment No. 2

DRAFT

GREELEY AND HANSEN

NOVEMBER 1997

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- *Alignment 2*. Alignment 2 follows north of the river bank from 91st Avenue to the existing Holly Acres Levee at 113th Avenue. It then follows the existing Levee alignment (existing levee proposed to be raised) from 113th Avenue to El Mirage Road. The levee then turns north along El Mirage Road to Southern Avenue and follows Southern Avenue west to Dysart Road. It then follows Dysart Road north for 3000 feet.

The projected costs developed for each levee alignment include corridor clearing and excavation, levee construction and rights-of-way. The costs for each levee alignment was calculated using both rip-rap and soil cement protection. **Table 8-1** summarizes the costs. These range from $18,320,000 to $20,740,000.

9. DATA GAPS

As a part of the analyses of the available flood control information, the FCTC identified data deficiencies. These deficiencies did not have a significant impact on the ability of the FCTC to develop alternatives because the information that was available was sufficient for the level of detail required for the TRRMP process. The data gaps are deficiencies that need to be addressed in future studies that will be conducted in much greater detail.

9.1 Gila River Hydrology

FCTC recognized the significant impact Gila River flood flows could have on the Tres Rios area. TRRMP HEC-2 modeling of the Gila River upstream of Tres Rios was not attempted as a part of the TRRMP due to a lack of available detailed data and also staff time constraints. HEC-2 modeling of the Gila River upstream of the Tres Rios area is a data gap and should be addressed in the Corps of Engineers Feasibility Study.

9.2 South Bank Conditions

Previous studies focused on the north banks of the Salt and Gila Rivers. There is limited information available on the south bank within the jurisdiction of the Gila River Indian Community. Tres Rios HEC-2 analyses conducted by the FCTC addressed the potential impacts flood control alternatives could have on the south bank area but without updated topographic data comparable to that available for the north bank, the impacts could not be quantified upstream of the confluence.

Representatives from the Gila River Indian Community reported that there is a rise in elevation near the Salt River but the land decreases in elevation to the south . If the water surface elevation is

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Table 8-1
Summary of Estimated Costs for North Bank Levee Alternatives

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1.	***Alternative 1: Alignment No. 1 with Soil Cement Protection***	
	Soil Cement Protection	$5,980,000
	R/W - Levee	3,920,000
	R/W - Corridor	1,500,000
	1000' Corridor (Exc.)	8,410,000
		$19,810,000
2.	***Alternative 2: Alignment No. 1 with Rip Rap Protection***	
	Rip Rap Protection	$4,490,000
	R/W - Levee	3,920,000
	R/W - Corridor	1,500,000
	1000' Corridor (Exc.)	8,410,000
		$18,320,000
3.	***Alternative 3: Alignment No. 2 with Soil Cement Protection***	
	Soil Cement Protection	$5,010,000
	R/W - Levee	5,820,000
	R/W - Corridor	1,500,000
	1000' Corridor (Exc.)	8,410,000
		$20,740,000
4.	***Alternative 4: Alignment No. 2 with Rip Rap Protection***	
	Rip Rap Protection	$3,720,000
	R/W - Levee	5,820,000
	R/W - Corridor	1,500,000
	1000' Corridor (Exc.)	8,410,000
		$19,450,000

increased by a proposed alternative on the north bank it could result in wide spread inundation of the Gila River Indian Community if the water over tops the rise and flows into the topographic low area (Gila River Floodplain).

Detailed topographic survey data of this south bank area is needed and currently is identified as a data gap. This south bank area should be surveyed to develop the additional data required for future HEC-2 analyses of flood impacts.

9.3 Landfill Removal Costs

FCTC analyses found the landfill results in local increases in the water surface elevation during flooding but does not cause a regional flooding impact. The local impacts could be mitigated if the landfill is removed but plans and costs for removal were not developed. The FCTC felt there were many issues associated with removal of the landfill that were complex and involved more than flood control. These issues exceeded the scope of the flood control committee's mission. Landfill removal should be addressed in future studies.

9.4 New FEMA Flood Plain Delineation

Revised projections of flood flows based on the improvements to Roosevelt Dam were provided to the FCTC by the Corps of Engineers. The FEMA flood plain delineations that correspond with the new flow data have not been completed. This is currently a data gap because it is needed to define areas subject to inundation. The lands will be included into potential relocation programs and flood insurance programs. When the updated FEMA is available in 1998 it should be incorporated into future Tres Rios analyses.

9.5 Topographic Surveys

The available topographic survey data for the Tres Rios area consists of 4-foot contours. This was sufficient for the HEC-2 analyses conducted by the FCTC. Future flood control studies and structure design will require more detailed and better survey control will be needed. It is recommended that a topographic survey using 2-foot contour control be completed to mitigate this data gap.

9.6 Holly Acres Right-of-Way Offer

Residents of the Holly Acres have offered to make land available for flood protection structures. If flood protection levees are selected as a part of Tres Rios then this offer should be pursued to quantify the amount of land that will be donated. This will impact the overall project cost. At this time

the alignment of flood protection levees has not been finalized and the right-of way quantification is a data gap.

9.7 Relocation Survey

The willingness of the Holly Acres residents to participate in a relocation or buy-out program is not known. A survey of residents to verify interest is needed and should be conducted as a part of continuing investigations.

9.8 Constructed Wetlands Alternative.

As discussed in Section 5.3.2, the cross section area of the channel can be increased by excavation within the corridor or excavation of the bank to inset constructed wetlands. This option should be modeled in future studies to include:

- Placement of constructed wetlands inset into the north bank
- Calculation of new cross-sections
- Relocation of the North bank levee relative to constructed wetlands placement
- Recalculation of HEC-2 100-year flood impacts
- Stabilization of disturbed bank
- Environmental impacts of bank excavation
- Cost analyses of this alternative

10. CONCLUSIONS

The FCTC analyses and conclusions are summarized as follows:

- Relocation may be a viable alternative but a survey of residents is needed to verify the number of participants who may be interested in the voluntary program.

- Flood proofing does not appear to be a viable alternative due to 100-year flood water depths and the construction method used for the structures.

- The 123rd Avenue Landfill does result in local 100-year flood water surface elevation impacts but does not produce regional impacts.

- Future Without Project conditions will result in increased 100-year flood water surface elevations due to increased vegetation density in the river channel. The 91st

Avenue WWTP, PIR, and residents on both the north and south sides of the Salt and Gila Rivers will be subjected to more severe flooding.

- The North Bank Levee Alternative, Corridor Clearing Alternative and Corridor Excavation Alternative, when evaluated separately do not provide 100-year flood protection.

- A combination of a North Bank levee, corridor clearing, and corridor excavation does provide 100-year flood protection.

- The estimated cost for the North Bank levee, corridor clearing and corridor excavation ranges from $18,320,000 to $20,740,000 depending on the method of levee protection and alignment selected.

11. RECOMMENDATION

The FCTC developed the following recommendations:

- Future studies should be scoped to develop information to address the data gaps.

- The survey of residents in the Holly Acres should be completed to verify if there is a local interest to volunteer to participate in the relocation and buy-out program.

- A joint State, County, and municipal effort should be organized to secure State and possible Federal funding to study the removal of the 123rd Avenue Landfill in the Gila River, and to fund the removal of the landfill.

11.1 Unacceptable Alternatives.

The FCTC identified three alternatives as unacceptable.

- Future Without Project Alternative. This is unacceptable because it does not provide 100-year flood protection and over time flooding impacts will increase. The future flooding could inundate the Holly Acres residents and the 91st Avenue Wastewater Treatment Plant.

- Levee on the North Bank of the Salt and Gila Rivers. This alternative would protect lands north of the rivers but was found to be unacceptable because it would increase flooding south of the rivers due to raising the water surface elevation.

- Cleared Corridor. Vegetation control to provide a cleared corridor would not result in sufficient water surface elevation reductions to provide protection from 100-year flood events.

11.2 Acceptable Alternative

The FCTC identified the Corridor Clearing and Corridor Excavation as the acceptable alternative. This alternative by itself does not provide 100-year flood protection but it does lower the water surface elevation of the 100-year flood. The FCTC felt lowering of the water surface elevation would reduce the number of structures within the 100-year flood plain and lower the depth of water impacting the remaining structures in the 100-year flood plain. Individual structure flood proofing and buy-out alternative feasibility would increase and could provide the additional protection needed to meet the 100-year flooding protection goal.

The FCTC recognized there are some constraints associated with this alternative. Long-term maintenance of the excavated corridor is a major issue. Flooding will redistribute river bed materials and regrading and/or removal may be needed to restore conveyance capacity. Excavation may be performed by gravel companies thus developing a public/private partnership and providing a revenue source from materials sales. The FCTC had a concern about the time it would take to excavate the materials and how the time would impact the flood protection completion schedule. Land ownership and the related materials ownership will need to be resolved because at the present time the GRIC feels the entire river bottom to the north bank is GRIC property.

11.3 Preferred Alternative

The FCTC identified a combination of a levee on the north bank, the cleared corridor, and excavation as the preferred alternative. The FCTC considered the issues related to excavation in the cleared corridor described in Section 10.2 and recommended that excavation options include cleared corridor excavation, bank excavation for placement of constructed wetlands or a combination of both depending on the final project design parameters and specific river conditions.

As stated in Section 5.1, the excavation in the cleared corridor was simulated to increase the open area in the river cross-sections. Cutting the bank for constructed wetlands was not studied but may

feasibly provide open area cross-sections. Placement of constructed wetlands will require further study as indicated in Section 9.8 and, if utilized, will require relocating the north bank levees modeled in Section 5.2.