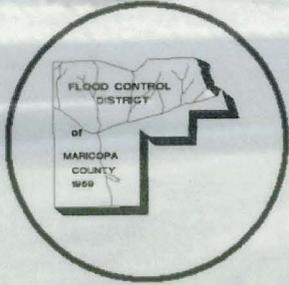


Submitted To:



Flood Control District of Maricopa County

CANDIDATE ASSESSMENT REPORT

New River Channel Improvement Grand Avenue To Skunk Creek

FCD Contract 98-24
Assignment No. 1



Prepared By:



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June, 1999

Final Revision: June 2000

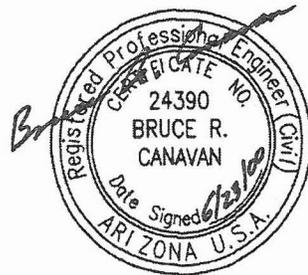
July 1999

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CANDIDATE ASSESSMENT REPORT

**NEW RIVER CHANNEL IMPROVEMENT
GRAND AVENUE TO SKUNK CREEK**

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Revised: January 2000
Amended: June 2000

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CANDIDATE ASSESSMENT REPORT

NEW RIVER CHANNEL IMPROVEMENT GRAND AVENUE TO SKUNK CREEK

I Requested Project

Willdan has prepared this Candidate Assessment Report (CAR) for the purpose of evaluating a capital improvement project originally submitted in 1997 by the City of Peoria to the Flood Control District of Maricopa County (MCFCD). The project limits were defined as along New River from Grand Avenue to the confluence with Skunk Creek. The project ranked second on the City's 1997/98 Capital Improvement Plan. Specific requests by the City included providing protection from a 100-year flood event, riverbank stabilization, the potential to develop recreational facilities or a municipal golf course within the project limits, and control of sediment transport.

This CAR will be used to summarize and verify existing information relating to both land use and hydrology/hydraulics, develop and evaluate additional information, develop alternatives to the initially proposed project, identify costs and potential funding sources, and recommend a final project based on the existing MCFCD evaluation and ranking criteria.

Revisions to the original report were added to include a separate exhibit and land use table for district and other public lands outside the SPF limits that would be available for sale to offset the project cost. The second addressed preferences of the District to have slopes for the soil cement stabilization option at 1:1 and gabions at 1:1.75 maximum, which affected project costs, and also a desire to include a review of the ACDC Design Memorandum for possible velocity applications.

II Project Area Description

The project area is located within and adjacent to the New River drainage channel from Grand Avenue approximately 1.5 miles north to the confluence with Skunk Creek. The stationing, based on distance above the confluence with the Agua Fria River consistent with adjacent projects, is 359+70 to 451+00. The channel is approximately 350 to 400 feet wide. The project is located entirely within the incorporated boundary of the City of Peoria and is more particularly located within the Sections 10, 15 and 16, Township 3 North, Range 1 East, Gila and Salt River Base and Meridian. The northern boundary of the project has been defined as the southern edge of the grade control structure on Skunk Creek at the confluence with New River. The eastern boundary is generally defined by the east bank of New River, north of Thunderbird Road, and the Loop 101 freeway south of Thunderbird Road. The southern boundary has also been defined to approximately 1,200 feet north of Grand Avenue right-of-way at the end of existing bank protection. The western boundary is generally the Sun City Limits and the eastern boundaries of the Plaza del Rio and Desert Harbor Subdivisions. (See attached map, Appendix A, Figure 2)

III. Review of Available Studies and Mapping

The New River has been the subject of numerous hydrologic and hydraulic studies. As development occurred near its confluence with the Agua Fria River, and the potential for flood damage increased, various agencies participated in engineering efforts to eliminate or mitigate damage to future developments and to protect existing development. In addition, zoning and land use ordinances have

been implemented to assist in the legal enforcement of those engineering findings. A summary of the studies, as provided by MCFCD or obtained by Willdan, and the relevant portions associated with the area and its application to this project are provided below:

A. Hydrology and Hydraulic Studies

1. *The Gila River Basin, Phoenix, Arizona & Vicinity (including New River), New River Dam (including New River to Skunk Creek), Design Memorandum No. 3, U.S. Corps of Engineers, 1982.*

a. Purpose of Study

The purpose of this study was to develop the technical design of the structures required to mitigate flooding in the northwest Phoenix metropolitan area. The approved plan involved the construction of Dreamy Draw, Cave Buttes, Adobe Mountain, and New River Dams, as well as the construction of the Arizona Canal Diversion Channel (ACDC) from 40th street to Skunk Creek with improvement and stabilization of the New and Agua Fria Rivers. A cost/benefit analysis was included.

b. Results

The approved plan controls floods on Dreamy Draw, Cave Creek, Skunk Creek, and the New and Agua Fria Rivers through the construction of Cave Buttes, Adobe, and New River Dams, and the ACDC. Flowage easements were identified to be acquired along Skunk Creek and the New and Agua Fria Rivers downstream from the diversion channel. The approved plan provided for recreational development at the dams and along the ACDC, Cave Creek, Skunk Creek, and the New and Agua Fria Rivers.

c. CAR Application

The report provides a base line for anticipated flood control improvements to protect the Phoenix Metropolitan area in the context of the entire Gila River Basin, of which New River is a tributary. Background information for the full project scope and phasing described the New River and Skunk Creek improvements required for flood protection including a combination of channelization, levees, and easements. Additionally, it emphasized the recreational aspect of the flood control projects and delineated this portion of New River as having a riding and hiking trail, with a rest area immediately below Grand Avenue, in the Recommended Plan For Recreation. The controlled release of storm waters was anticipated to have a positive benefit on riparian areas due to the increased duration of flows. The revised design discharges for the Recommended Plan are 41,000 cfs for New River below the confluence with Skunk Creek as shown on Plate 3 of the report contained in Appendix D.

Verify w/
AMM

2. *Glendale-Peoria Area Drainage Master Plan, Camp-Dresser & McKee, Inc. and James M. Montgomery Consulting Engineers, Inc., May 1987.*

a. Purpose of Study:

Prior to 1987, both Glendale and Peoria completed separate storm drainage master plans that were confined to the area within the municipal boundaries of each city. However, because of the area's topography, portions of Glendale would drain to and across Peoria. Therefore, the FCDMC initiated this study to examine the potential benefits of combining the storm drainage systems of the two communities. The study also included some areas within Maricopa County adjacent to Glendale and Peoria that lie within the same watershed.

b. Results

For the purposes of developing the overall master plan, the study area was divided into a number of subareas. The only subarea that benefitted from a combination of facilities was the portion of Glendale south of the ACDC, and the portion of Peoria east of New River and Skunk Creek. Therefore, facilities in this area were determined by choosing the best set of combined facilities. A final preferred alternative was developed with associated costs, funding alternatives, implementation and construction phasing. Equivalent pipe sizes, alignments and outfall locations were determined. All proposed pipes within the project area flowed east to west and discharged on the east side of New River. Thunderbird Road (pipe #667) had a $Q(10)=290$ cfs, Sweetwater Avenue (pipe #670) had a $Q(10)=180$ cfs and Cactus Road (pipe # 659 with a discharge point at Grand Avenue) had a $Q(10)=970$ cfs.

c. CAR Application

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504

New facilities that impact the New River CAR include pipe or box culverts that outfall to New River on the Cactus Road, Sweetwater Avenue, and Thunderbird Road alignments as discussed above. Outfall protection would be required if not included with other projects to prevent scour and flooding due to back flow into the structures. Improvements, if constructed within the channel, would need to anticipate and be developed around frequent low volume flows from collected runoff.

3. New River from Grand Avenue to Greenway Road Study, Wood, Patel & Associates, Inc. February 1994.

a. Purpose of Study

The purpose of this report was to determine the Standard Project Flood (SPF) delineation utilizing 68,000 cfs and to develop construction plans and special provisions for a drop structure and other elements within the New River reach between Grand Avenue and Greenway Road. The report was initiated as a first step to satisfy the formal agreement between the US Army Corps of Engineers (USCOE) and the Flood Control District to contain the SPF.

Verify w/
Amm

b. Results

The report established a SPF profile based on the USCOE peak flood of 68,000 cfs for New River below the confluence with Skunk Creek. Sediment transport analysis was performed and indicated a general tendency toward aggradation above Thunderbird Road and degradation between Grand Avenue and Thunderbird Road. Channel widening parameters, dimensions and slopes were established to reduce destructive velocities and areas of fill placement were identified to contain the SPF. Rights-of-way and temporary construction easement requirements were delineated. Required channel protection with both soil cement and rip-rap, drop structure design elements, and both lined and unlined drainage outlet modifications into the river were identified, discussed and designs prepared.

c. CAR Application

The report provides valuable detailed hydraulic design parameters, detailed sediment analysis, bank stability, and geotechnical information that can be utilized and incorporated into future designs.

4. *HEC 1 Technical Appendix, book 1 of 9, New River Watershed, Hydrology Report, Arizona Canal Diversion Channel, Area Drainage Master Study Phase I, Kaminski-Hubbard Engineering, Inc., May 1995.*

a. Purpose of Study

The purpose of this report was to define the specific hydrologic characteristics of the New River watershed for future hydraulic structure design.

b. Results

The final report produced estimates of surface runoff flows for various storm events including 2-year 6-hour and 24-hour storms, 10-year 6-hour and 24-hour storms and 100-year 6-hour and 24-hour storms. Individual subareas within the overall watershed were studied and routed through the HEC 1 program to produce concentration points of flow and a final flow amount.

c. CAR Application

The technical notebook provided was for the specific subarea of New River above the confluence with Skunk Creek, which is beyond the project limits. Additionally, the ACDC discharges into Skunk Creek above this project. Therefore this report is of little value to this project by itself.

5. *Middle New River Watercourse Master Plan Study, Stantec Consulting, Inc., 1999.*

a. Purpose of Study

The FCDMC, in cooperation with Peoria and Glendale, commissioned a master plan

study of middle New River from the confluence with Skunk Creek to New River Dam. This reach is presently under development pressure. Several residential development projects, which include construction within the flood plain and/or channelization of New River are proposed for completion within the next few years. This project was intended to provide Peoria and Glendale with a comprehensive approach to river management. Further, it resulted from the FCDMC's desire to honor their commitment to the USCOE to maintain a flood water conveyance corridor downstream of New River Dam.

b. Results

Hydraulic models for various alternatives were analyzed and incorporated features including levees, bridges, islands, split flows and grade control structures. Reaches 1 and 2, which extend north of the confluence with Skunk Creek to Pinnacle Peak Road, are proposed to be armored with gabions, using as much of the existing gabion armoring installed with development projects as possible. A non-structural approach, using an erosion setback buffer zone along the 100-year flood plain, is proposed for Reach 3 that extends from Pinnacle Peak Road to the dam. Scour analysis and sediment transport were calculated for all reaches including Reach 1.

c. CAR Application

Below the confluence with Skunk Creek, the future condition peak discharge of 41,000 cfs for New River is the same as the existing condition peak discharge. Scour depths for Reach 1 (Skunk Creek to Beardsley Road) ranged from 9.06' to 13.74' with a value of 9.83' just above the grade control structure at the confluence with Skunk Creek. The computed erosion setback at Skunk Creek is 109.5' with all reaches defined as having an erodible channel. Additionally, affected agency and public inputs have been received and considered in development of possible alternatives and the recommended alternative. These included safety, property security, and access issues relating to paths and trails along the river that were considered during the CAR recommendation formulation. The agencies desired a recreation component but recognized that it would be included in a later project.

6. *Desert Harbor Hydrology Master Plan*, Ellis, Murphy & Holgate, Inc., February 1979.

a. Purpose

The purpose of this study was to provide an assessment of the risks in developing a 477 acre residential development with a 54 acre recreational lake immediately adjacent to the New River channel and provide measures to eliminate, or at the very least, mitigate the dangers of flooding to an acceptable level of risk. The report was also intended to present alternatives to achieve these goals consistent with the developer's needs and the City's responsibilities and regulations. The report also recognized the imminent construction of the New River and Adobe Mountain Dams, ACDC, and other flood control structures either under construction at that time or planned for the future and discussed their impact on the proposed development.

b. Results

The report discussed previous USCOE work which resulted in a 100-year flow of 58,000 cfs below the confluence with Skunk Creek. The project was designed for a flow of 41,000 cfs, due to the imminent flood control structure construction, using a combination of elevating existing ground with excavated lake material, levee construction, and channelization of the New River. Also discussed was the option of the City acquiring the channel right-of-way or the USCOE obtaining flowage easements which would permit future recreational opportunities within the channel and eliminate the possibility of future development. An attached soils report indicated anticipated velocities up to 13 fps and channel excavation up to 15 feet which result in localized scours.

c. CAR Application

The report file contained an approval letter from the City of Peoria, dated 9/13/79, for the channel alignment, cross-sections and grades contained in the final 9/11/79 submittal with stipulations. These included protecting channel side slopes where velocities exceed 10.5 fps and that construction be with full approval and maintenance easements from each land owner.

7. Report on "Annual Erosion Potential for Desert Harbor Along New River", Mathews Kessler Associates, Inc., March 1989.

a. Purpose

This report was prepared, at the request of the City of Peoria, to review a September 1988 Ellis-Murphy report "Desert Harbor Erosion Study" and develop an estimate of the annual costs that the City would incur in maintaining approximately 8,000 LF of unprotected channel bank along New River. The report also presented an estimate of the annual volume of bank material that might be lost to various flood events with the detailed engineering calculations used to derive the conclusions.

b. Results

The report assumed a $D_{50}=2\text{mm}$ from the Ellis Murphy report and concluded erosion is predicted at all flow events because of the extremely low allowable (critical) shear stress for a 2mm particle versus maximum cross-sectional shear stress corresponding to each peak discharge. It assumed that the existing 5:1 (11.3 degree) bank slope would erode to a 30 degree slope. Average annual erosion volume was predicted to be 3,484 c.y., with volumes ranging from 68,569 c.y. for Q_{100} to 300 c.y. for Q_2 based on an erosion potential of 100% of flow depth. A cost of \$2-5.00/c.y. was estimated for the work, the variable being the ability of the City to perform force account work.

c. CAR Application

The report relied upon and referenced data from a "1985 SLA report (Final

Sediment Transport Study for New River and Skunk Creek)” which was not referenced in other documents nor available for review. However, a summary table of flows from this report was included. The report provides clear indication that the existing bank material is subject to erosion and will require some form of stabilization or maintenance. The storm return interval, flows, depths and velocities were utilized to develop a volume of eroded material consistent with the MKA methodology that could be expected for this project and a summary table is presented in Appendix B.

8. “*Desert Harbor Drainage Report*”, Rick Engineering Company, March 1994.

a. Purpose

The purpose of this report was to verify how the criteria specified in the Master Drainage Report and Plan by Ellis, Murphy & Holgate, March 1979, were followed in the present developments and to investigate the present drainage conditions. The report investigated the potential of home flooding in parcel 1, the flows in 91st Avenue pavement for Q₁₀ and Q₁₀₀ storms and the relation between lake inflow and storage capacity with regard to the existing developed sites for Q₁₀₀ routing.

b. Results

The report concluded that the finished floor elevations for Parcel 4, which contained the lowest finished floor elevations (62.16) around the lake were safe from flooding in the 100-year storm event. With the exception of parcels 6a and 10, in an undeveloped pre-graded condition, and parcel 11, fully developed, all development had proceeded according to the Master plan. Regarding pavement flows, the report concluded that while the road interior capacities were over taxed in many locations, there was no danger of home flooding. 91st Avenue was overtaxed during the 10 year event. The primary drainage structure is a double barrel 5'x8' concrete box culvert with a maximum capacity of 695 cfs. The lake system is designed to contain the 100 year storm event with storage of 27 acre-feet before discharge begins.

c. CAR Application

Almost in passing, the report identified the resolution to questions relating to the source of flows in the western side channel at the intersection of 91st Avenue and Thunderbird road. The report stated “...and south of Desert Harbor Drive, a catch basin on 33" pipe, running south toward Thunderbird Road, is discharging the runoff into a channel south of Thunderbird Road together with the storm drain in Thunderbird Road.”. Additionally, any proposed improvements would have to incorporate the discharge flows from the lake to prevent slope erosion.

9. “*Plaza Del Rio On-Site Drainage Report*”, Amwest Engineering Company, Inc., May 1990.

a. Purpose

The report, apparently prepared at the request of the developer, presented the results of field investigation and analysis of existing improvements and proposed modifications to the improvements contained within the original Ellis-Murphy "Hydrologic and Hydraulic Study for Plaza Del Rio" of June 1983.

b. Results

The report concluded that no new retention facilities would be required for any new developments within the Plaza Del Rio campus because the 100 year storm runoff could flow in ditches with direct discharge to New River or in internal, private roadways with inverted crowns. It also provided a schedule for development and improvements required for approval from the City. As is typical, once approved and constructed the inverted crown private streets have since been dedicated to the City. The City of Peoria has since denied the use of any streets as storm water conveyance structures.

c. CAR Application

A reference in the report stated "the SW corner of 91st Avenue and Thunderbird can be graded to drain into the existing ditch running south from the Thunderbird 72" pipe storm drain outlet. The ditch is a direct outlet to New River...".

An assumption described how "The County will require Coe & Van Loo to revise HEC-2 data like Amwest and get similar results" without additional reference or discussion.

The report also referenced "channelization described in the Amwest 'Cost Analysis of Improvements Proposed for New River' dated January 1990.." again without additional reference or discussion beyond the immediate needs of this development.

The schedule for Improvements on parcel 8 recognized the need to provide necessary spillway bank stabilization and channel outlet erosion protection for the existing ditch along the east side of Plaza Del Rio. This work was never performed.

10. *Amendments to Amwest Engineering Co. "Revised May 1990 Plaza Del Rio On-Site Drainage Report", Kirkham, Michael and Associates, March 1996*

a. Purpose

The report, also apparently prepared at the request of the developer, presented the results of an analysis of existing improvements and proposed additional modifications to the modifications proposed by Amwest in May 1990 to the original improvements contained within the Ellis-Murphy "Hydrologic and Hydraulic Study for Plaza Del Rio" of June 1983. The primary driving reasons for the report, as stated in the second paragraph, is that upon completion of the proposed improvements land used as common retention would no longer be necessary, use

of cost effective graded channels to outlet to New River and construction of an east/west roadway functioning as a storm water conveyance would greatly enhance parcel development.

b. Result

The report achieved its stated goals of rationalizing the elimination of retention facilities.

c. CAR Application

None, except serving as an example of the need for critical vigilance during the development review process. The report also ignores the significant impact of backflow up the channels or the inability to discharge to New River during a significant storm event.

11 *Hydraulic Analysis To Support Submittal For A Conditional Letter Of Map Revision For Alzheimer and Hospice Site, Peoria Arizona, CMX Group Inc., November 30, 1998.*

a. Purpose

The purpose of this report was to provide a hydraulic analysis of the New River flood plain adjacent to the care facility on the west bank near the south project limit. Additionally, it set forth bank stabilization criteria to protect the new development from erosion.

b. Results

The project report described placement of the fill within the existing floodway and the resultant effect on the water surface elevations (WSE). As depicted, the WSE would generally increase from 0.4 feet to 1.0 feet with only a singular station No. 358 decreasing by 0.5 feet. Pre- and post-project HEC-2 models were run to provide the supporting analysis. A gabion wire tied rock stabilization blanket was proposed for the length of the project.

c. CAR Application

This report contained significant conflicts with the proposed improvements and conclusion from the 1994 Wood, Patel & Associates report and design prepared for the MCFC D. Of primary concern is the proposal to encroach into the floodway with development, design only to the 100-year event for bank height, and indicating a flow of 39,000 cfs on the CLOMR form. The earlier study was designed for a SPF of 68,000 cfs to size bank improvements which would be encroached upon with this development and all other documents reference a 100-year flow of 41,000 cfs. The proposed development, if allowed to proceed without further analysis and coordination with other improvements, would have a significant impact on the anticipated CAR project final selection and cost. Additionally, it could place the

MCFCD in a position of violating its agreement with the USCOE to contain the SPF.

- 12 *Phase I Environmental Site Assessment at the New River Channel in Maricopa County Arizona, CEC/WRA, September, 1993.*

a. Purpose

The purpose of the report was to present the results of a Phase I environmental assessment for a series of parcels along and within the New River alignment from Greenway Road on the north to a point 1/4 mile south of Thunderbird road.

b. Results

The report concluded that although some wild cat dumping of household and construction debris had occurred, no record or visible evidence of hazardous waste was present at the site.

c. CAR Application

The report confirmed the results of the field observations and conclusions of Willdan personnel during several inspection visits to the project site.

- 13 *Exploration Trenching for Further Site Characterization at the New River Channel Near 88th Avenue and Thunderbird Road in Maricopa County Arizona;CEC/WRA, March, 1994.*

a. Purpose

This report provided the results of the visual analysis of six trenches dug to supplement the original site characterization of the area on the east side of New River discussed in the September 1993 CEC/WRA report.

b. Results

Observations of material excavated from the trenches did not reveal significant evidence to suggest the presence of hazardous substances on the subject property at the time of the excavations. No subsurface foreign materials were encountered during the investigation.

c. CAR Application

The report confirmed the results of the field observations and conclusions of Willdan personnel during several inspection visits to the project site.

- 14 *New River from Grand Avenue to Greenway Road Study, Addendum #1, Wood, Patel & Associates, Inc. April 1994.*

a. Purpose

The addendum presented the results of changes and/or additions to the original report based on Maricopa County Flood Control District comments.

b. Results

The addendum included revisions to the quantity summary table, a revision in the HEC-2 data cards, revisions in the drop structure computation tables and calculations, revisions in the stepped drop structure quantities, and a revision in the soil cement and RCC aggregate gradations.

c. CAR Application

The addendum provides valuable detailed hydraulic design parameters and geotechnical information that can be utilized and incorporated into future designs.

15 *Arizona canal Diversion Channel - 40th Street to Cactus Road (Including Cudia City Wash Sediment Basin, Cave Creek Sediment Basin, and Cave Creek Channel), Final Design Memorandum #12, U.S. Army corps of Engineers, April 1986.*

a. Purpose

The purpose of the report was to provide the technical design of the Arizona Canal Diversion Channel (40th Street to Cactus Road), Cudia City Wash and Cave Creek Sediment Basins and Cave Creek Channel as a basis for preparing the plans and specifications for construction.

b. Results

A combination structural-nonstructural plan was determined to be the best solution to the flood problem in the project area, which would comprise approximately 50,500 acres of flood susceptible area during the SPF. The ACDC and sediment basins were designed to carry the 100-year flood with the channel entrenched over its entire length to allow surface flows to enter over the channel walls and slopes. Confluence structures, deep inlets, vehicle and pedestrian bridges along with recreational amenities were planned in the report.

c. CAR Application

The report covered an area north and east of this project boundaries with the closest point being the discharge into skunk Creek approximately 1 mile north of the confluence with New River. A concern was that the relatively clear water discharging into Skunk Creek might cause some scour if it were to accumulate a sediment load. Both Scour gauges and sediment staffs were installed down stream of the ACDC discharge point to monitor conditions. Prior to design of the New River section, data from these stations should be reviewed for possible applications.

Referenced Reports Unavailable for Review

The following report references were contained in the documents noted above but were unavailable for a detailed review and incorporation into this CAR. It is believed that the information contained in both the 1994 Wood, Patel & Associates study and the 1999 Stantec study provide sufficient data and information to supercede and render any information they may contain insignificant in its impact on the proposed project.

"1985 SLA report (Final Sediment Transport Study for New River and Skunk Creek)
January 1990 Amwest 'Cost Analysis of Improvements Proposed for New River'
June 1983 Ellis-Murphy "Hydrologic and Hydraulic Study for Plaza Del Rio"
Reference in Amwest 1990 Plazo Del Rio study stated "County will require Coe & Van Loo to revise HEC-2 data".
ADOT Loop 101 Drainage report

B Planning, Land Use and Zoning

1. *Peoria Comprehensive Master Plan, City of Peoria, 1998.*

As noted earlier, the project lies within the incorporated boundaries of the City of Peoria which has jurisdiction over issues relating to land use and zoning for development. Originally adopted by the City in May 1987, the Comprehensive Master Plan with its associated land use map provides a broad framework to promote orderly growth. It ensures compatibility and a logical transition between residential, commercial and industrial developments that meet the vision and goals of the citizens and leaders of the community.

General land uses identified within this project area include Business Park/Industrial, Community Commercial, Medium and High Density Residential, and most significantly, Park/Open Space along the New River channel alignment. Principal and major traffic arterials identified are Grand Avenue, Thunderbird Road, and the Loop 101 freeway. Additionally, the project area also falls within the North Peoria Redevelopment Plan boundary which includes development guidelines.

2. *Peoria Zoning Map, City of Peoria, November 1997.*

Specific zoning districts, which are the detailed application of the general land use categories, include General Agricultural (AG), Commercial (C2, C3, C4 & C5), Light Industrial (I-1), Multifamily and Single Family Residential (RM-1 & R1-8). Integrated developments include Planned Neighborhood Commercial (PC-1), Planned Community Commercial (PC-2) and Planned Unit Developments (PUD) involving industrial, commercial and residential elements. Significantly, only one small area of Flood Plain (FP) zoning is applied to the Desert Harbor residential development lake discharge. However, this zoning has not been applied to the New River channel itself.

The current *Federal Emergency Management Agency (FEMA) flood insurance rate maps*

04013C1630F and 10113C1610G, Panels 1610 and 1630 of 4352, both revised December 3, 1993, indicate the project area is zone AE with a designated floodway generally along the New River channel alignment. The overbank area is designated as zone X. Zone AE is defined as a special flood hazard area inundated by the 100-year flood and zone X is an area of 500 year flood; areas of 100 year flood with average depths less than 1 foot or with drainage areas less than 1 mile and areas protected by levees from the 100-year flood. The City of Peoria entered into the National Flood Insurance Program and is charged with implementing and enforcing development regulations to limit damage from flood events. Although the SPF is not shown on these maps, the City and the MCFCD must maintain close cooperation and review to ensure that the District's agreement with the USCOE to contain the SPF is not compromised.

3. *Trails Master Plan, City of Peoria*

The importance and value of open space recreation opportunities combined with the recognized need to preserve and protect the desert mountains, rivers and washes has motivated all agencies within the area to develop long term concepts and master plans to achieve these goals. In particular, the City of Peoria has specifically established a Trails Master Plan designating proposed and existing corridors that are intended to promote and enhance the access to neighborhood parks connected by multi-use trails and paved paths. This plan falls within the project limits and provides for a paved multi-use path along the New River alignment from south of Grand Avenue continuing north to the City limits with branches into the Desert Harbor residential area and another at the confluence with Skunk Creek at the Peoria Sports Complex.

4. *West Valley Corridor, Multi-Modal Linear Open Space, City of Phoenix.*

In 1998 all participants, including MAG, Maricopa County, Avondale, Glendale, Peoria, and Phoenix responded to a call from Mr. John F. Long to cooperate and coordinate the complementary and often overlapping goals in this area. The result of this effort was the compilation of all available agency plans into a single document referred to as the West Valley Corridor - Tres Rios to New River. The concept, as defined in the plan, is to provide a connecting series of trails within a natural desert river setting branching into neighborhood park "nodes" for additional urban recreation and trailhead access. In addition to these initial goals, the corridor is intended to enhance wildlife habitat, mitigate flooding potential and provide storm water retention and recharge areas, along with additional education and tourism opportunities.

5. *New River Area Redevelopment Area, City of Peoria.*

The City of Peoria has established a redevelopment area coincident with the majority of this project boundary. The east side is defined by Grand Avenue on the south, Greenway Road on the north, the west right-of-way of the Loop 101 freeway, and generally following the west bank of the river while encompassing contiguous parcels. The stated purpose of this effort is to promote and foster commercial and residential development consistent with current land use and zoning ordinances and recreation/trails master plans. The City will provide funds, acquire parcels within the designated area, install necessary infrastructure and sell or lease the parcels back to business interests.

C Utilities

1. Storm Drainage

Several storm drainage features are within the project boundaries and will have an impact upon the final project. These include both pipe and open channel conveyance structures and detention/retention basins related to commercial and residential developments. Specific features identified, which are shown on Appendix A Figure 5, include the following:

- The Desert Harbor lake detention basin primary emergency outlet consisting of a double 5'x8' RCBC with a grouted rip-rap outlet from a discharge point at the top of the west bank to the toe of the slope. Two items of interest noted were the placement of a 1/2" expanded metal screen over the inlet of the box and 18" of scour at the channel slope toe.
- The intersection of several underground storm drain pipes at the intersection of Thunderbird Road and 91st Avenue. The layout consists of a 33" rcp flowing south from Desert Harbor in 91st Avenue intercepting three catch basins before crossing Thunderbird Road as a 36" rcp. On the south side of Thunderbird Road it intercepts a 60" rcp flowing from the west, then becoming a 72" rcp flowing southeasterly within the right-of-way and intercepting two additional catch basins. The 72" flows southerly an additional 30 feet where it discharges into an unlined channel, referred to as the 91st Avenue channel, which then flows south approximately 1,000 feet to a discharge point on the west bank of the New River opposite the Plaza Del Rio Freedom Care Center. Current ownership of the parcel which contains this channel is Town Development Incorporated.
- The Plaza Del Rio development contains three distinct drainage features which will be referred to as the north, central and south channels and basins. The north structure begins by intercepting runoff at basins on the west side of Plaza Del Rio Boulevard, crossing under this road to the east and flowing southerly in an open channel to the north side of the Freedom Care Center where it enters a detention basin with an 8" outlet metering pipe and a gunite protected wier discharging to the 91st Avenue channel.

The central structure consists of a detention basin and roadside ditch at the intersection of Plaza Del Rio Boulevard and an unnamed east/west road at its midpoint which crosses under the boulevard in CMP's to a cobble lined channel. This flows southeasterly approximately 500 feet to a detention basin and then an additional 100 feet in an unlined channel to the New River after exiting through a 6" metering pipe and cobble rip-rapped wier.

The south structure is similar to the others described beginning as roadside ditches at the southern loop intersection of the Boulevard and 94th Drive and also flowing southeasterly 400 feet to a basin with metering pipe and rip-rapped wier. This discharges immediately north of the western soil cement lined bank.

- Two concrete lined open channels discharge from Sun City into New River within the length of improved channel bank described above. The first is 400 feet south of the southerly Plaza Del Rio discharge and the second is an additional 1,000 feet south, adjacent to the ATSF railroad. Both have outlets consisting of grouted rip-rap.
- On the eastern side of the New River two major concrete lined storm drain channels from the ADOT Loop 101 freeway discharge within the project limits. The first flows from north of Thunderbird Road along the east side of the freeway, collecting runoff from both the freeway and some adjacent residential development to a point approximately 3,400 feet north of Grand Avenue, then discharging westerly into the river through a concrete lined open channel. The second channel collects runoff on the extreme northern project limits and discharges into Skunk Creek.
- Additional flows are carried in all local street sections within developments until discharged into one of the structures described above.

2. Water

A major 12" water line crosses New River on the north side of Thunderbird Road and acts as a transmission line for other local lines. It crosses the river suspended from the Thunderbird Road bridge.

The City of Peoria owns a potable water production well on the east side of New River and plans to tie it into its distribution system with a line crossing beneath New River. A survey party was recently observed performing preliminary field work related to this project south of the Freedom Care Center.

3. Wastewater

The major wastewater feature that must be of concern is a 30" sanitary sewer at the intersection of Thunderbird Road and 91st Avenue which flows to the south on the west bank of the 91st Avenue Channel to the southeast corner of the Freedom Care Center before turning southwest. It continues parallel to the New River western bank to a point just north of the Plaza Del Rio south channel discharge and then turns east flowing beneath the New River channel bed in a steel casing.

4. Electric Transmission

A Salt River Project 69 KV electric transmission line impacts the project boundaries along the 91st Avenue west bank, proceeding due south and crossing the New River. It continues in a southerly direction beyond Grand Avenue. An electric substation is also located on the south side of Thunderbird Road, between 91st Avenue and New River.

5. Communications

A fiber optic telephone cable and a CATV cable are both located within the

Thunderbird Road right-of-way and run in an east/west direction. Both cross New River suspended on the bridge.

6. Gas

Natural gas distribution is provided by Southwest Gas Corporation through a system of 1-1/8" to 2" serving adjacent developments. No distribution lines were shown on the company maps crossing the project boundaries.

D. Environmental

1. Hazardous Wastes and Cultural Concerns:

A field review of the project limits was performed on March 15, 1999 to identify any visual environmental concerns on the project. This survey was performed by Susanna Struble and Bruce Canavan. Visual review indicated that no hazardous waste sites or archeological findings were immediately evident. A meeting on April 6th with Mr. Burton Charron of the City of Peoria confirmed that the City was also not aware of any known hazardous waste sites or cultural findings in the project area. A review of the Peoria New River Redevelopment Area Redevelopment Plan, supplied by the City on June 16th, provided information that some areas on the eastern side on the river have been used as informal and illegal landfills. Phase I Environmental Assessment Reports performed by CEA/WRA in 1993/94 were later located which reported similar conclusions for a large portion of the project limits. A certified archeologist has not reviewed the project site, nor has a hazardous waste search been performed within the scope of this CAR. A certified archeologist will have to review the project site to determine actual cultural affects. The State Historic Preservation Office and the Arizona State Museum will also need to be contacted by the archeologist to provide additional information of known historic properties.

2. U.S. Army Corp of Engineers 404 Permit:

Due to the proposed project being within the water course of New River, the USCOE 404 permit and ADEQ 401 Water Quality Certification will be required for work within areas which are designated as Waters of the United States. Waters of the United States are defined from 33CFR part 328 as "all waters such as ...rivers, streams (including intermittent streams)." and "Wetlands adjacent to waters". Jurisdictional boundaries of these Waters are defined as ordinary high water mark plus wetland boundary. Wetland areas were identified in the channel bottom above Thunderbird Road.

The first step in defining the extent of the requirements for these permits is to obtain a jurisdictional boundary determination from the USCOE. The District may either define the limits themselves and present their findings to the USCOE for concurrence or have the USCOE define them. The jurisdictional boundary coupled with the limits of work to be performed will determine the extent of the necessary 404/401 certifications from no permit to a nationwide permit to an individual permit. Possible Nationwide Permit Numbers and titles which can be obtained will include:

- 7. Outfall structures
- 13. Bank stabilization
- 18. Minor Discharges
- 24. State Administered Section 404 Programs
- 26. Headwaters and Isolated Waters Discharges
- 31. Maintenance of Existing Flood Control Structures

3. US Fish and Wildlife Service(USFWS):

Should a 404/401 permit be required the USFWS will be required to have a determination on threatened or endangered species which may be affected by the project. USFWS was contacted and the following list of threatened and endangered species were identified within Maricopa County:

<u>Common Name</u>	<u>Scientific Name</u>	<u>Status</u>
American peregrine falcon	<i>Falco Perigrinus anatum</i>	Endangered
Arizona agave	<i>Agave arizonica</i>	Endangered
Arizona cliffrose	<i>Purshia subintegra</i>	Endangered
Arizona Hedgehog cactus	<i>Echinocereus triglochidiatus arizonicus</i>	Endangered
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Threatened
Bonytail chub	<i>Gila elegans</i>	Endangered
Cactus ferruginous pygmy owl	<i>Glaucidium brasilianum cactorum (AZ)</i>	Endangered
Desert pupfish	<i>Cyprinodon macularius</i>	Endangered
Gila topminnow	<i>Poeciliopsis occidentalis</i>	Endangered
Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuena</i>	Endangered
Mexican spotted owl	<i>Strix occidentalis lucida</i>	Threatened
Razorback sucker	<i>Xyrauchen texanus</i>	Endangered
Sonoran pronghorn	<i>Antilocapra americana sonoriensis</i>	Endangered
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered
Yuma clapper rail	<i>Rallus longirostris yumanensis</i>	Endangered

A certified biologist will be required to review the list and the project limits for determination of effect of species on this list. Also the regional USFWS works closely with the Arizona State Game and Fish and will require coordination with the state list of threatened and endangered species

4. Loop 101 Freeway:

An environmental document was prepared as a part of the recent Loop 101 freeway construction. This document could not be obtained for review and summary, however it is expected that further environmental information may be gained from this document.

IV Summary of Findings

Based upon a review of studies and reports noted above and field inspections of the project area, the following summarizes our findings:

- The Desert Harbor subdivision has been effectively protected from the 100-year flood event with a combination of channel improvement, pad elevations, and levee construction. The lake also has excess storage capacity beyond that required to contain locally generated runoff from

the 100-year storm event. Field investigation revealed the double box culvert primary outlet structure has had a 1/2" expanded metal screen place over its inlet and the grouted rip-rap outlet structure has had 18" of channel erosion below the toe of slope since its construction.

- The 91st Avenue channel is severely clogged with salt cedar and palo verde trees from Thunderbird Road to the intersection with the gunite outlet from the north Plaza Del Rio detention basin. South of the basin the channel is overgrown for half its length and also begins to severely erode its bed and banks until reaching a confluence with New River. A low point near the north end of the Freedom Care loop road has allowed on-site water to escape and created a secondary side channel cutting back the bank approximately 15 feet. Just above the confluence the channel has eroded the bank to within 14' of an SRP steel transmission tower with a bank over 15 feet high. This bank shows continued signs of surface cracking indicating additional imminent failure.
- Existing structures on the Plaza Del Rio site have been protected from the 100-year storm event by elevating above the predicted water surface elevation. New structures, particularly those on the south end adjacent to New River, must continue to be elevated to provide protection. Additionally, a levee may be needed along this south western bank. The developer of Plaza Del Rio continues to push for elimination of detention basins to maximize developable land at the expense of down stream channel capacity. The central and south basins may be subject to inundation during a flood event due to backwater flows through the metering pipes. No bank stabilization measures have been performed with this development except at the discharge of the north detention basin into the 91st Avenue channel. The proposed encroachment of the Alzheimer and Hospice site into the floodway will significantly impact the anticipated results and proposed improvements of earlier District studies.
- River banks on both north and south project terminus points have been hardened with roller compacted soil cement and provided with a walking surface of cement enriched RCC and welded steel handrails. Side slopes are approximately 1/2:1.
- Existing bridge structures at both Thunderbird Road and Grande Avenue have sufficient clearance to pass the 100-year storm event.
- Existing soils have a $D_{50}=2$ mm to $D_{50}=70$ mm and are subject to erosion. This was confirmed during the field inspection with numerous side channels and meanders observed. Where larger cobbles have aggregated, the resistance to erosion was significantly increased.
- North of Thunderbird Road significant areas of wetland and riparian vegetation were observed. Although most have dried up since the original field inspection in March, two still contained some water. Numerous birds, rabbits, and signs of other animal life were observed in this area. South of Thunderbird Road the character of the vegetation differed significantly, consisting primarily of salt cedar with some palo verde trees. Wild life continued to be observed but to a much lesser degree.
- Drainage structures constructed with developments on the western bank and the Loop 101 freeway on the east side have effectively controlled and diverted locally generated flows to specific discharge points which have been hardened to prevent erosion in most cases. Where this has not been done, or done without energy dissipation, erosion of the banks continues.

- Local and regional agencies have identified the New River corridor as a valuable and highly prized source of open space and recreation opportunities. Significant work involving planning and interagency coordination has occurred to date.
- Anticipated flows in the New River channel vary from a $Q_{100}=41,000$ cfs and $v=12.02$ fps to $Q_2=1995$ cfs and $v=4.44$ fps. A complete summary table is shown in Appendix B. Modifications proposed with the Alzheimer and Hospice near the south end of the Plaza Del Rio development site will encroach into the floodway and increase these velocities up to a maximum of 13.7 fps.

V Project Alternatives

A. No Action

1. Description

The alternative of taking no action to enhance or improve the channel alignment, width, depth, erosion resistance or usage must be explored as a baseline of options available. The river channel and all existing drainage structures would remain as currently constructed. Maintenance would be limited to repair of channel banks where meanders encroached upon or threatened existing development. No efforts would be made to improve or stabilize the main New River channel, the 91st Avenue channel or any of the drainage structures associated with the private developments within the project limits. No enhancements would be made to encourage habitat development, open space or recreational usage.

2. Issues

Significant issues relating to maintaining the status quo include continued development pressure within the identified New River open space corridor, a certainty of damage and erosion to existing bank configuration along with the potential for reduced flow capacity as sedimentation and tree growth continues. The unmanaged and uncontrolled use of the channel for "recreation" can result in vandalism, graffiti and construction of so-called camps and structures within the channel invert. Continued erosion will endanger the SRP overhead power pole and transmission line. No action would also jeopardize the District commitment to the USCOE to contain the SPF.

3. Project Costs

a. Land Acquisition

No funds would be expended for the acquisition of additional property and ownership would remain as currently indicated. Any ownership transfers in the future would be within the development community and as required by jurisdictional agencies as part of the development process. Enforcement of a nominal 120 foot erosion building setback by the City would be required in lieu of other stabilization actions.

b. Construction

It is anticipated that no public funds would be expended for construction of improvements or enhancements. Any construction required would be placed as a condition of new development and enforced by the City of Peoria.

c. Operation and Maintenance

Operation and maintenance costs would be limited to restoration of bank material lost to significant flood events. As shown on the table in Appendix B, this volume could reasonably be expected to be up to 788/cy for a 2-year storm and up to 178,689/cy for a 100-year event. This translates to a cost ranging from \$3,940 up to \$893,445, based on a unit of cost of \$5.00/cy. Additionally, if the lower reaches of the project limits were breached due to high water or suffered from bank loss due to erosion or channel meandering, emergency flood control and cleanup costs associated could be anticipated. The exact amount associated with this effort is indeterminate at this time but could reasonably be expected to be in the range of \$15,000 to \$30,000 for labor, materials and equipment.

B. Bank Stabilization

1. Traditional Hard Surfacing

a. Description

The use of what is referred to as "hard surfacing" contains a range of engineered and constructed improvements ranging from channels lined with concrete, gunite, roller compacted concrete or soil cement, rip-rap contained within mats or gabions, and loose machine or hand placed rip-rap.

b. Issues

As can be anticipated, the level of protection provided with the durability and resistance to erosive forces increases while the amount of maintenance and aesthetic qualities decrease with the increasing "hardness" incorporated into a project. Some corresponding increase on cost is also associated with the increased durability.

Significant effort has been expended by Stantech Consulting, Inc. in producing a reasonable list of viable options and obtaining public and agency input for the MCFCD "Middle New River Watercourse Master Plan" whose limits are the grade control structure at the confluence with Skunk Creek northward to the New River Dam. The use of concrete or gunite was eliminated due to cost or durability factors. Of the remaining options, preferences tended toward use of rock filled gabions with some aesthetic enhancement. The addition of hiking trails was acceptable to the public, if safety and access issues along with reasonable separation from homes could be provided. The final preferred alternative selected ("Alternative 2"), a trapazoidal channel with gabion mattress slope, was based on cost, incorporation

of existing structural features, and safety and aesthetics. An additional alternative available is the use of soil cement with soil and plantings added to the slope to flatten and soften the appearance while providing the required stabilization.

c. Project costs

1. Land Acquisition

Before construction of any hard surfacing project could begin, the controlling agency would be required to obtain clear title to the required channel width selected for construction, flowage, access and maintenance purposes. The project limits, as defined, contain a total of 176 acres in a mixture of public and private ownership of affected parcels with approximately 55% of gross parcel area public or district, and 45% privately held. Appendix D contains a summary table of specific ownership and acreages for both totals held and amount required to be obtained for channel stabilization. As shown, this total acreage is approximately 93 acres, but only approximately 32 acres would be acquired from private holdings. Based on a cost of \$1.25 per square foot within the flood plain, this would amount to a total of \$1,732,600. If the District elects to dispose of excess acreage not needed for the project by sale to the private sector, the sale has the potential to actually generate revenue in excess of the project acquisition costs for the 100-year option. The SPF option would not generate an excess revenue but would greatly reduce the land acquisition cost as shown in the table.

2. Construction

Based on the unit prices contained within the referenced "Middle New River Master Plan", anticipated construction costs for several material types are presented below. An increased amount has been added to account for the required hydraulic analysis, engineering design, construction document preparation, construction management and contingency.

	Channel Length (ft)	Slope (ft/ft)	Surface Area (sy)	Volume (cy)	Unit Cost	Sub-Total	Earth Work	Total with Engineering & Contingency
Soil Cement (9' wide)	8,660	1:1	68,000	204,000	\$35/cy	\$7,140,000	\$1,210,000	\$11,022,000
RCC (4' wide)	8,660	1:1	68,000	91,000	\$50/cy	\$4,530,000	\$1,210,000	\$7,577,000
Gabion	8,660	1.75:1	97,000	48,500	\$70/cy	\$3,395,000	\$1,024,000	\$5,833,000
Rip-Rap	8,660	3:1	152,000	76,000	\$45/cy	\$3,420,000	\$572,000	\$5,269,000
Non-Structural Landscaped	8,660	5:1	246,000	N/A	\$14/sy	\$3,444,000	N/A	\$4,546,000
Top Revegetation & Irrigation (8' wide)	8,660	5:1	15,400	N/A	\$1.50/sf	\$207,900	N/A	\$275,000

3. Operation and Maintenance

Normal yearly operation and maintenance figures should be limited to time and travel required to perform inspections on a specified interval basis and after each significant storm event. These are defined here as twice yearly for normal inspections and after a 25 year (or greater) storm event which would produce a flow of 19,000 cfs and a velocity of 9.98 fps. Additional maintenance activities are limited to "weed wacking" and debris removal. This is estimated to be \$5,300 utilizing inmate labor and MCFCD equipment. Based on a unit rate of \$35/hour for inspection and travel, the total O&M costs should be \$5,900 per year including a probability factor for the major event. Costs associated with repair are not included with this figure because it is anticipated that the structure will be designed to withstand, as a minimum, flows associated with a 100-year event.

2. Aesthetic Treatments

The term aesthetic treatments as used in this report refers to the use of natural shrubs, trees, and aggregates to soften and disguise the use of hard surfacing options employed in channel and bank stabilization. At its extreme, it relies totally on the ability of plants and aggregates to perform all stabilization functions. While generally less obtrusive and "man made" in appearance than structural options discussed above, the use of aesthetic treatments affords great flexibility and options to provide an environment that is less sterile and encourages use by both humans and wildlife. The options range from completely landscaped and maintained areas such as golf courses to native riparian habitat totally dependant upon natural flows.

a. Golf Course

1. Description

Because the City of Peoria has expressed continued interest over the years in developing a public golf course within and adjacent to the New River from Grand Avenue northward to Greenway Road, an evaluation of the impacts and issues related to this option are presented.

2. Issues

Primary issues related to this option involve the high investment of capital for land acquisition, construction and operation and maintenance. Construction would require major permitting efforts. The project would involve significant access and safety related problems associated with continued usage during various size storm/flood events. Acceptance of costs associated with continual repair to flood damaged components of the course, whether actual greens and fairways or paths and amenities, is a significant budget commitment of public funds.

3. Project costs

a. Land Acquisition

The area required for a full 18 hole golf course, club house, parking lot, driving range and access road is estimated to be between 160 and 320 acres without associated housing developments. A conservative figure of 200 acres is assumed for the basis of this report. Because of this expanded requirement compared to other options, the majority of land must come from the purchase of private property. Current land values in the area, based on available TRW data base information, is \$1,306/acre for agricultural land and \$217,800-57,500/acre for commercial-industrial land. Recent acquisitions involving parcels with large percentages within the floodway and river channel have been in the range of \$21,800-43,600/acre. Because of these widely variable values and the anticipation that private holdings would become significantly inflated with the disclosure of immanent purchase, total land acquisition costs could be expected to be approximately \$17,424,000 based on \$87,120/acre. The use of grant funding would be limited to the use of Heritage Funds for right-of-way and all other costs would be born by the agency developing the course.

b. Construction

Construction costs for a municipal golf course are generally accepted to be in the range of \$250,000 to \$500,000 per hole depending on the degree of difficulty encountered due to topography, the desired level of landscape density and maturity, and the amount and sophistication of clubhouse styling, space and amenities. Based on the assumption that the City will not produce a facility that is considered lavish, that the course must remain operational except in the most extreme storm events, and that minimizing separation of portions of the course by New River flood events will involve various bridges and elevated pathways, costs can be expected to be in the range of \$9,000,000.

c. Operation and Maintenance

Yearly operation and maintenance costs for a golf course are estimated to be a minimum of \$50,000/hole which would be \$900,000 per year.

Additional expenses, above and beyond those normally expected from conventionally sited courses would relate to the repair to flood damaged facilities discussed earlier. Although difficult to estimate, particularly on a yearly basis due to the unpredictability of flood related events, the values discussed earlier for erosion damage provide a reasonable starting point for quantifying this item. As noted, the volume of earthwork required to replace eroded channel soil is 8,342 cy and an assumption is made that 50% of ground cover within the channel will be grass and

50% soil/rock mulch. At a unit cost of \$5.00/cy for earthwork and \$1.00/sy for ground cover, the estimated additional yearly flood related O&M costs are \$186,000.

3. Parks & Trails

a. Description

The use of parks and trails within the channel combines both aesthetic treatments and lower cost landscaping than the golf course option with greater opportunity for general public usage. It addresses the desires expressed in both comments made during the "Middle New River Watercourse Master Plan" public hearings and those from agency participants in the "West Valley Corridor, Multi-Modal linear Open Space" document setting as a goal the expansion and connection into the local and regional trail systems. The use of this method is traditionally considered the "low cost" option for construction costs but may have significantly higher O&M costs.

b. Issues

Options available include placing the trail on top of the bank, at some intermediate point or in the channel invert. The channel invert may be developed as a traditional graded, landscaped park, as a low flow channel with hardened sides and improvements on each side, as a natural or enhanced riparian area. Combinations of the locations and choices noted may provide a cost effective, aesthetically pleasing compromise. Depending on the final configuration and funding available, some erosion setback may be required. The possibility of groundwater recharge credits for the City should be explored as noted in the "Middle New River Master Plan". A MCFCD project with Carter-Burgess to coordinate all agency studies and plans for trails and open space within the Agua Fria and New Rivers is currently underway and is anticipated to produce a Design Concept Report in early July. Relevant issues relating to this project include a proposal to incorporate an equestrian trail in the river bottom and utilizing a 10' trail width conforming to AASHTO criteria if Federal enhancement funding is utilized.

c. Project Costs

1. Land Acquisition

Acquisition of land for use under this option could be limited to obtaining flowage and trail easements instead of fee title if no other improvements were to be made. However, this would require the implementation of setbacks from the existing channel to account for potential erosion and would not provide protection to existing development. Therefore it is recommended that this option also include, as a minimum, the acquisition of channel right-of-way similar to that which is described in the traditional hard surfacing option. This cost would also be \$1,732,600. Revenue generation from the sale of excess District property would also apply as discussed previously.

2. Construction

Because the exact level of development with this option is variable and adaptable to community needs, desires and funding, an average construction cost of \$65,000/acre is estimated at this conceptual stage. For a total of 93 acres, this translates to a cost of \$6,045,000.

3. Operation and Maintenance

Operation and maintenance of a park and trail system is anticipated to be performed by the City with budget allocations through the existing Parks and Recreation Department. Values for yearly operation and maintenance are necessarily dependant upon the degree and level of amenities placed within the facilities, the amount of turf and trees requiring irrigation, the probability and severity of vandalism and the amount of litter control and patrolling to be provided. A reasonable level of maintenance with moderate vegetation, once established, could be expected to cost \$5,000 per year per acre. Based on a 93 acre park/trail complex this would equate to \$483,900 per year with an allowance for minimal bank repair.

VI Potential Additional Funding Sources

A. City of Peoria:

In addition to MCFCD funding, other potential sources for joint funding were identified for the project. Discussions with the City of Peoria have indicated that they have budgeted \$2.7 million for matching on the project. Additionally depending on outcome of the redevelopment of the area, they will be willing to financially support aesthetic treatments for trails or recreational facilities.

B. FEMA/ADEM:

These agencies actively support the reduction or removal of hazards within flood plains. On a yearly basis the State of Arizona receives an allotment for Flood Mitigation Assistance. These funds are provided to implement measures to reduce or eliminate the long term risk of flood damage to buildings, manufactured housing and other structures insurable. Two types of grants are available under the National Flood insurance Program (NFIP): Planning grants and Project grants. Typical eligible projects include elevating, dry proofing or relocating insured structures, minor localized structural projects not fundable by state or other federal programs, and grass planting for beach nourishment. Mitigation of repetitively or substantially damaged structures is a high priority for use of these funds. Cost sharing for the project is 75% FEMA and 25% the applicant.

It is doubtful that work on this project will be eligible for these funds unless the bank stabilization efforts can show reducing the long term risk to adjacent properties and structures.

C. Heritage Funds:

On a yearly basis the State of Arizona provides approximately \$7 million in lottery funds for Heritage Fund projects. These funds are administered by two state agencies: State Parks and Arizona Game and Fish. Grants are available to the federal government, the state Indian tribes, counties, cities, school districts or any political subdivision of the state. The following is a list of grants available by each agency, available funds (1999) and application deadlines.

Arizona Game and Fish - Application deadline last working day of November.

- Environmental Education - \$35,600
- Schoolyard Grants - \$60,000
- Identification, Inventory, Acquisition, Protection, and Management of Sensitive Species and Habitats (IIAPAM) - \$400,000
- Urban Wildlife and Urban Wildlife Habitat - \$246,000
- Public Access - \$200,000

Arizona State Parks

- Local, Regional and State Parks - \$3.5 million --application deadline last working day of February.
- Historic Preservation - \$1.7 million -- application deadline first working day of June.
- Trails - \$475,000 -- application deadline last working day of February.

D. Enhancement Grants:

On a yearly basis the Arizona Department of Transportation has approximately \$4 million available for the enhancement of transportation corridors. These funds can be used on landscaping and trail development along transportation corridors. Transportation corridors can include freeways, streets or intermodal connections. The application deadline is typically July of each year and must be submitted through the Maricopa Association of Governments. Projects are designed by the applicant and typically constructed by ADOT.

E. Private Development:

As mentioned previously, this area has been a part of the City of Peoria redevelopment plan which includes a golf course and open spaces area. The City has periodically discussed the possibility of a golf course with interested developers. Critical items for furthering these discussions include access to the property as well as property acquisition. At this time no private developers are interested, therefore all plans are on hold for participating with developers on golf course improvements within the channel and adjacent properties. Despite this, the City wishes to continue to pursue the acquisition of properties within the project limits to maintain the area for recreational purposes.

Additionally, bank stabilization requirements have been included as stipulations of development approval for additional phases of the Plaza Del Rio project.

VII Recommended Alternative

Discussion

- As shown on the following table of alternatives, taking no action has no associated costs with land acquisition and construction and the least for yearly O&M; however, it leaves the community vulnerable to a demonstrated flood hazard, provides no coherent standards and leaves the responsibility for any actions to private development. Private developers have repeatedly demonstrated a propensity to do nothing, or worse, push beyond the established limits to maximize developable area and profits. The City would be solely responsible to enforce the erosion construction setback limits during the development process.
- The proposal to develop a golf course without private development participation has the highest cost in both land acquisition and yearly O&M costs and, although recurring in the City's "wish list", is eliminated as a viable alternative.
- Providing only bank stabilization, while having the highest initial cost, has the major advantage of having the least O&M costs and the assurance of completed flood control with a single project. However it does not address the needs and desires of the communities to maintain and enhance open space recreational opportunities and connecting corridors. Minor revegetation along the top bank provides some aesthetic treatment without adding significant O&M costs, but does not address community input for recreational opportunities.
- At the other end of the spectrum, the use of the channel and associated areas for parks and recreation, while having an attractive, relatively low cost for construction, has significant long term operation and maintenance costs. Inclusion of these costs quickly reveals the true nature of this "low cost" alternative and decreases the initial attraction based solely on a construction cost.
- To meet the requirements of its commitment to the US Army Corps of Engineers to provide flood protection to Standard Project Flood (SPF) levels, the levees could be constructed to the 100-year level with a three foot freeboard which would be used in an extreme case to contain the SPF.
- To provide additional funding for the project costs and reduce future maintenance and cleanup costs, the District could dispose of "excess" property not needed for levee construction and maintenance. The property would be sold or exchanged with adjacent private owners. A summary of the available land is provided in Appendix D, with acquisition/sale adjustments shown on an additional following table.

PROJECT COSTS					
Alternative	Land (2)	Construction	O& M/ Year (1)	Total (2)	Total (3)
No Action	\$0	\$0	\$18,940-\$923,445	\$945,000	\$945,000
Golf Course	\$17,424,000	\$9,000,000	\$1,086,000	\$46,957,000	\$46,957,000
Trails/Parks	\$1,732,600	\$6,045,000	\$483,900	\$31,972,600	\$31,450,400
Soil Cement w/Revegetation	\$1,732,600	\$11,297,000	\$21,900	\$14,124,600	\$13,602,400
RCC w/Revegetation	\$1,732,600	\$7,852,000	\$21,900	\$10,679,600	\$10,157,400
Rip-Rap w/Revegetation	\$1,732,600	\$5,544,000	\$21,900	\$8,371,600	\$7,849,400
Recommended Alternative	Land (2)	Construction	O & M/ Year (1)	Total (2)	Total (3)
Rip-Rap Bank Stabilization w/Trails & revegetation	\$1,732,600	\$5,960,000	\$53,900	\$10,837,600	\$9,865,400

(1) Assumed 50 year project life

(2) Without revenue from excess land sale (3) With revenue from District land sale

Based on the evaluation of factors shown for the alternatives listed above, the recommended alternative is to provide rip-rap slope armoring to the 100-year flood elevation with toe protection to prevent erosion and protect development. The proposed design would take into account the communities desires to incorporate a recreational trail within the channel corridor and to use the existing riparian low flow channels for wildlife habitat. Added aesthetic features to meet citizen desires would include revegetation landscaping. District commitment to the US Corps of Engineers to provide protection to the SPF could be addressed by utilizing the 3 freeboard to contain the difference.

Two possible configurations are provided in Appendix D, with the trail in the river bottom and another with it located on the slope near the 100-year flood elevation. The latter configuration, while slightly higher in initial construction cost due to the requirement to provide benched terraces, offers the advantage of less susceptibility to flood damage and increased distance from, and less disturbance to, the riparian and wildlife habitat located within the channel bottom.

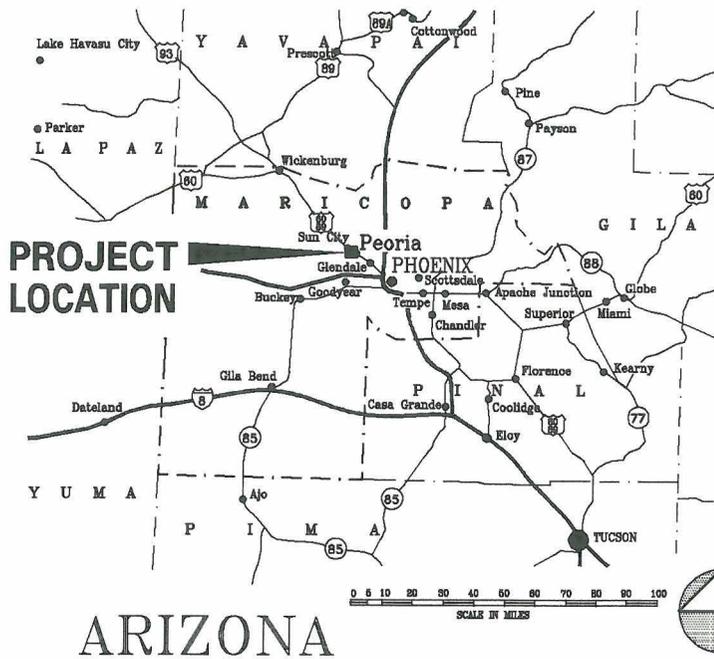
The incorporation of the bank protection with a trail system combination has an additional major advantage. Phases of the project can be constructed as funding becomes available, for either bank stabilization or corridor enhancement.

The next step in the design process should be the further development of the results presented in this study into a Design Concept Report for the purpose of refining the proposed costs to

solicit and secure definite funding sources. Additional coordination with recreational and environmental agencies is warranted if the results, as presented, are accepted. A proposed project milestone time frame to move beyond this project into the Design Concept Report and engineering design is attached.

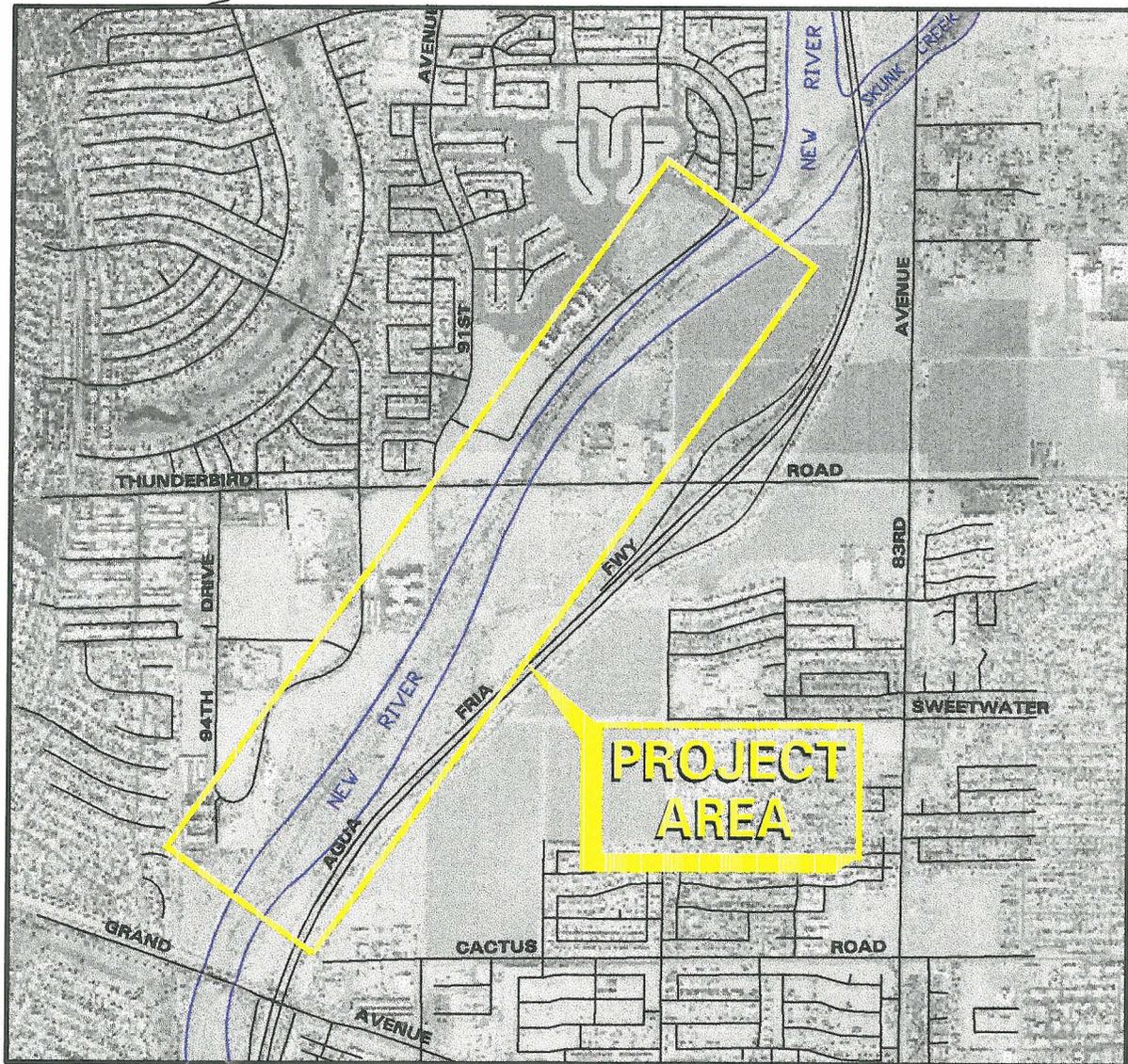
PROPOSED PROJECT MILESTONE TIME FRAMES

Program Project	1 ½ months
Scope of Work and Contract	1 month
Prepare DCR	3 months
MCFCD/City Review	1 month
Public Meetings	1 ½ months
Funding	6 months
Survey	1 month
Design	5 months
Permits	6 months
Bid/Construct	<u>10 months</u>
Total	36 months

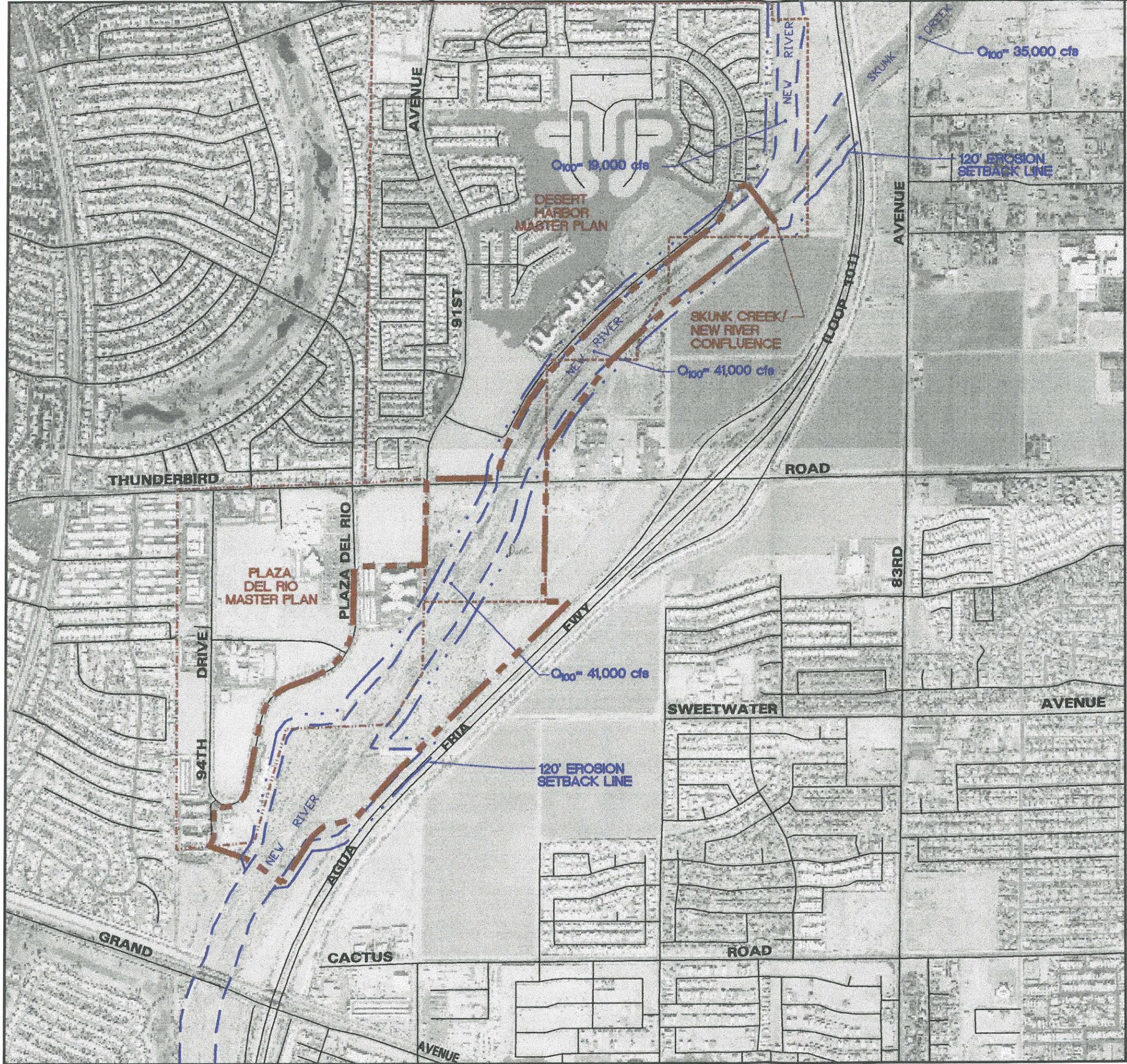


SCALE: 1"=2000'

ARIZONA



PROJECT VICINITY MAP



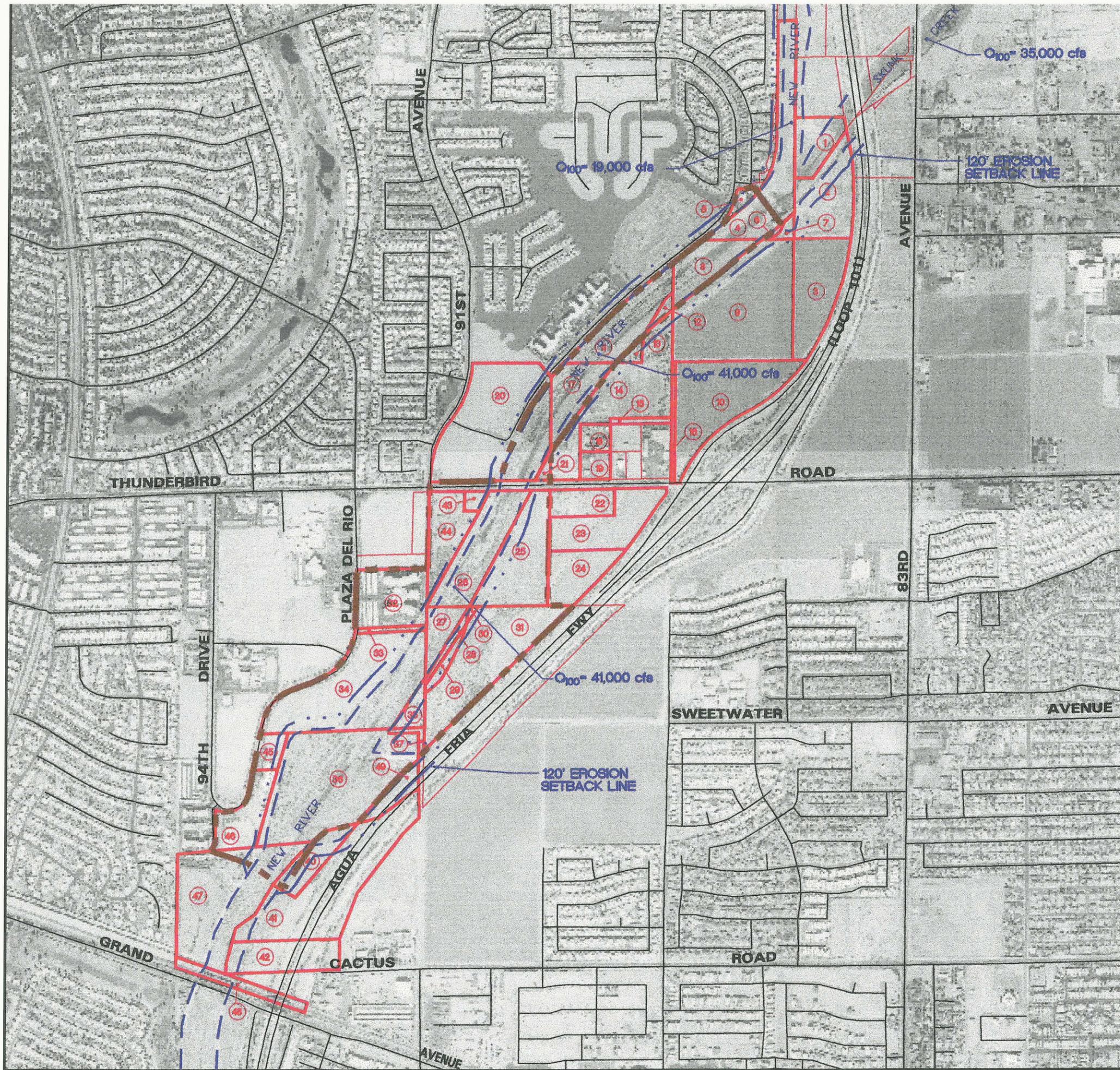
BOUNDARY LEGEND

- 100 Year Floodplain Limits
- Drainage Channel Boundary Limits
- Desert Harbor Master Plan Limits
- Plaza Del Rio Master Plan Limits



SCALE: 1"=1000'

PROJECT BOUNDARY MAP

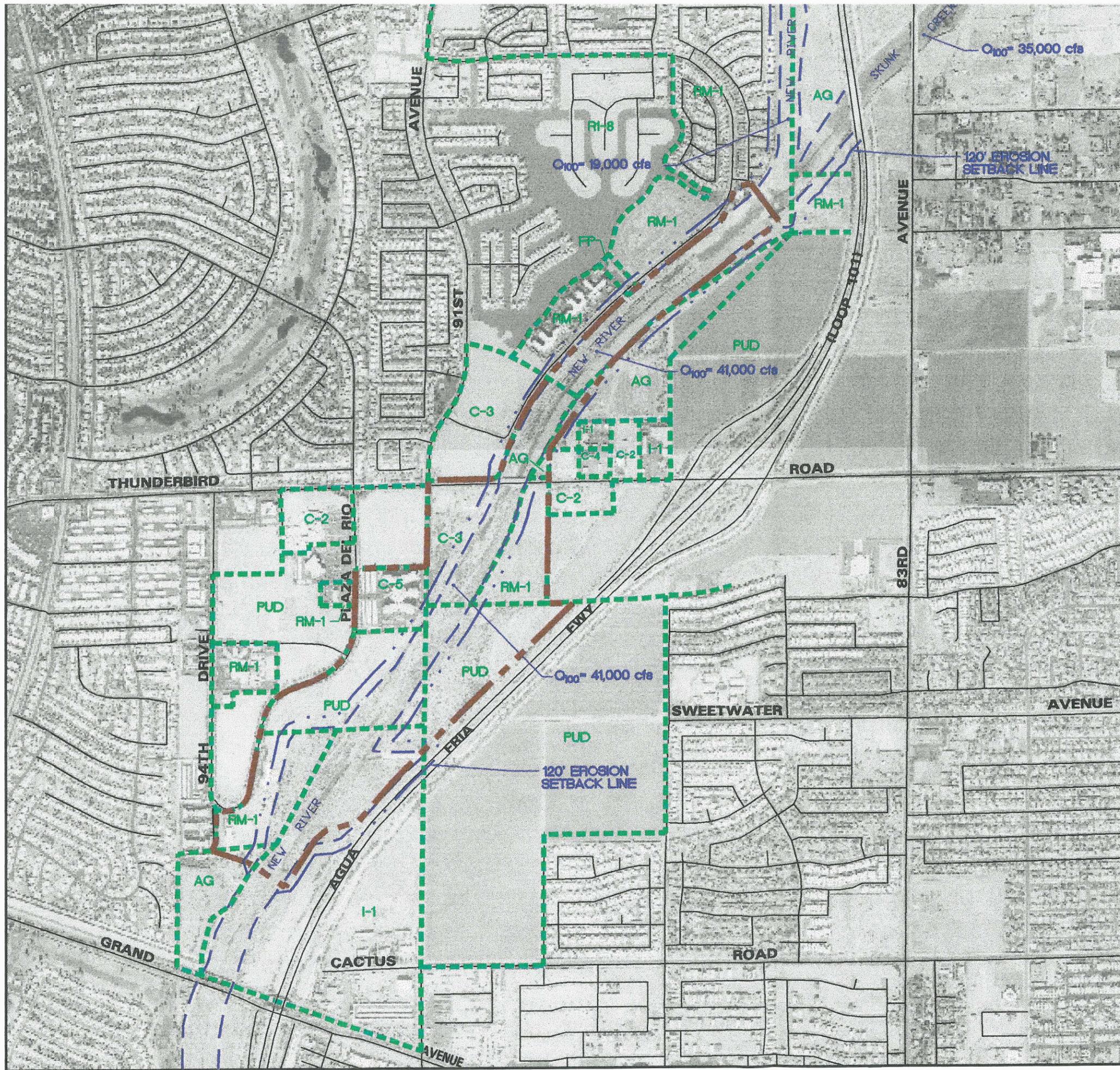


PARCEL I.D.	OWNER	ACREAGE (APPROX.)
1.	Maricopa County Flood Control District	6.05
2.	Maricopa County Flood Control District	12.63
3.	Lydic, Howard M. and Ruth	13.20
4.	Zilber, LTD	8.56
5.	Zilber, LTD	1.18
6.	Maricopa County Flood Control District	0.17
7.	Lydic, Howard M. and Ruth	0.95
8.	Maricopa County Flood Control District	7.51
9.	Lydic, Howard M. and Ruth	31.64
10.	Lydic, Howard M. and Ruth	19.86
11.	Zilber, LTD	10.96
12.	Maricopa County Flood Control District	0.20
13.	Cardilla Giulio and Leonarda Etal	2.22
14.	Cardilla Giulio and Leonarda Etal	19.62
15.	Lydic, Howard M. and Ruth	0.87
16.	Salt River Project	1.25
17.	Maricopa County Flood Control District	6.11
18.	SOL RIO Development	2.50
19.	Campbell Juanity Jo / 1st Interstate Bank	2.08
20.	Zilber, LTD	25.28
21.	Maricopa County Flood Control District	0.64
22.	ECPG - Thunderbird LTD	4.40
23.	Triple B Farms	12.34
24.	Baskett Farms Inc.	10.28
25.	Town Development Inc.	15.15
26.	City of Peoria	13.18
27.	Maricopa County Flood Control District	3.99
28.	Maricopa County Flood Control District	1.22
29.	Arizona Department Of Transportation	0.82
30.	Maricopa County flood Control District	0.12
31.	Arizona Department Of Transportation	21.33
32.	Plaza II Limited Partnership Freedom PLaza LTD Partnership Lease	10.94
33.	Plaza II Limited Partnership Freedom PLaza LTD Partnership Lease	1.02
34.	Sun Health Properties Inc.	25.68
35.	Plaza II Limited Partnership	2.25
36.	Maricopa County Flood Control District	34.99
37.	Maricopa County Flood Control District	0.69
38.	Sun Health Properties Inc.	0.61
39.	Maricopa County Flood Control District	22.17
40.	Maricopa County Flood Control District	5.01
41.	Arizona Department Of Transportation	23.87
42.	Arizona Department Of Transportation	7.51
43.	Arizona Public Service	1.35
44.	Towne Development Co.	8.44
45.	Sun Health Corporation/CR	2.63
46.	Sun Health Corporation/CR	7.67
47.	Maricopa County Flood Control District	26.05
48.	Atchison Topeka and Santa Fe Railway Co.	1.45
49.	Arizona Department Of Transportation	3.65



SCALE: 1"=1000'

PARCEL MAP



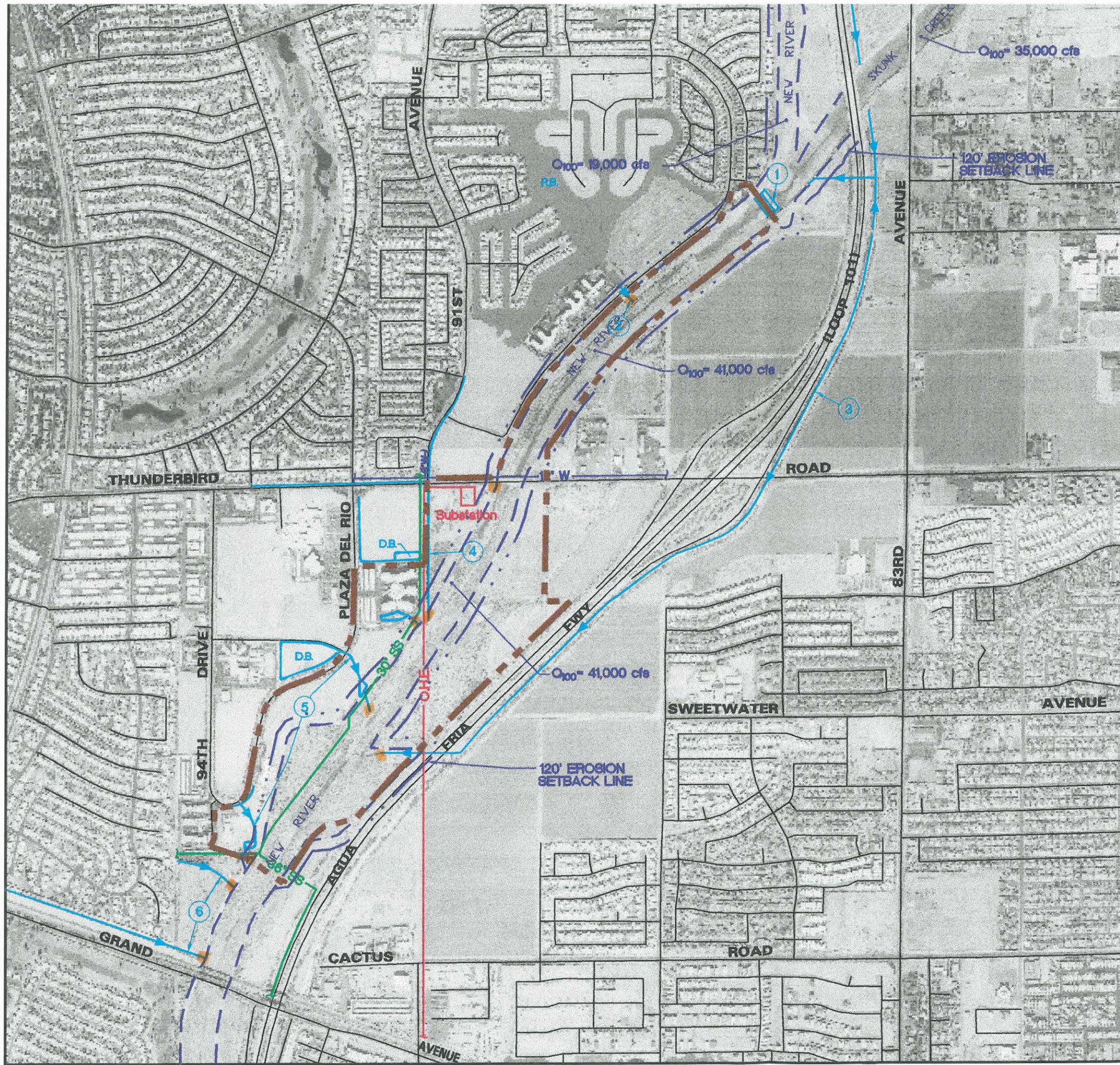
ZONING LEGEND

- ■ ■ ■ ■ Zoning District Boundary
- AG General Agricultural District
- RM-1 Multi Family Residential District
- I-1 Light Industrial District
- FP Flood Plain District
- C-1 Convenience Commercial District
- C-2 Intermediate Commercial District
- C-3 Central Commercial District
- C-4 General Commercial District
- C-5 Major Arterial District
- PUD Planned Unit Development



SCALE: 1"=1000'

ZONING MAP

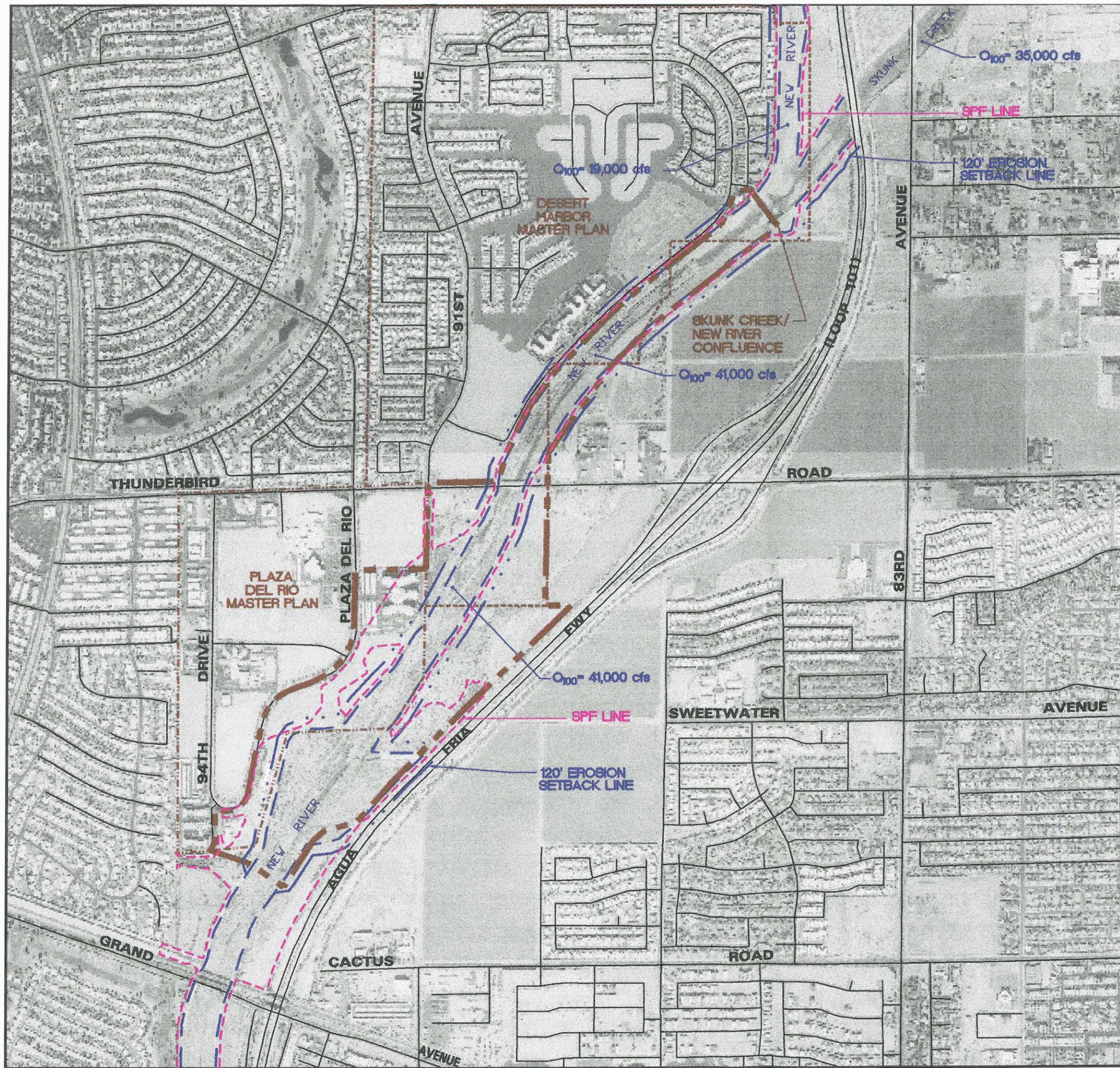


- ① Grade Control Structure
- ② RCB And Rip-Rap
- ③ Concrete Lined Channel
- ④ 91st Avenue Unlined Channel
- ⑤ Rip-Rap Lined Ditch And Basins (Typ.)
- ⑥ Concrete Lined Channels



SCALE: 1"=100'

UTILITIES / DRAINAGE MAP



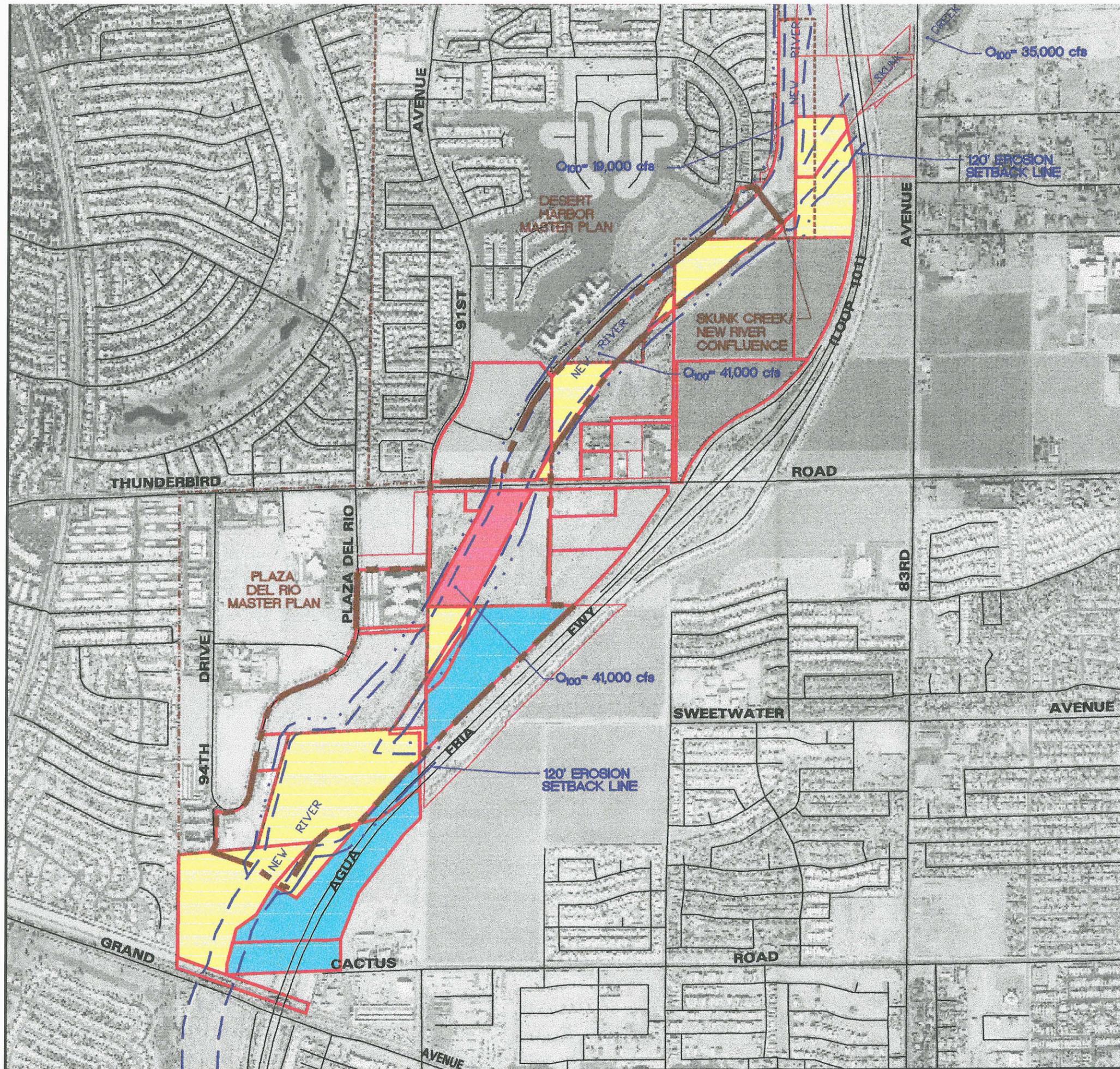
BOUNDARY LEGEND

- — — — — 100 Year Floodplain Limits
- — — — — Drainage Channel Boundary Limits
- - - - - Desert Harbor Master Plan Limits
- - - - - Plaza Del Rio Master Plan Limits
- - - - - Standard Project Flood (SPF) Limits
- . . . - 120' Erosion Setback Line



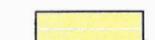
SCALE: 1"=1000'

FLOODPLAIN AND EROSION LIMITS MAP



BOUNDARY LEGEND

-  100 Year Floodplain Limits
-  Drainage Channel Boundary Limits
-  Desert Harbor Master Plan Limits
-  Plaza Del Rio Master Plan Limits
-  Parcel Boundary

-  Maricopa County Flood Control District Land
-  Arizona Department of Transportation Land
-  City of Peoria Land
-  Private Land



SCALE: 1"=1000'

PUBLIC vs. PRIVATE OWNERSHIP MAP

Appendix B

Summary of Flows and Velocities

New River Below Confluence with Skunk Creek

Return Interval	Q (cfs)	Depth (ft)	Velocity (fps)
100	41,000	15.12	12.02
50	29,000	12.57	10.84
25	19,000	9.98	9.53
10	10,500	7.16	7.89
5	6,000	5.21	6.55
2	1,995	2.74	4.44

Summary of Estimated Erosion Volume

Percent of Flow Depth to Use for Erosion Height:100%

New River Below Confluence with Skunk Creek to South Outlet Structure at Plaza Del Rio

Return Interval (years)	Annual Probability of Occurrence (1 year)	Assumed Percent of Bankline Eroded (L.F.)	Length of Eroded Bankline (L.F.)	Flow Depth (ft)	Assumed Erosion Height (ft)	Erosion Volume (cu.ft.) per L.F. of Bankline	Total Erosion Volume for This Event (cu.yd.)
100	0.01	75	12,900	15.12	15.12	374.0	178,689
50	0.02	50	8,660	12.57	12.57	258.5	82,911
25	0.04	40	6,930	9.98	9.98	162.9	41,811
10	0.10	30	5,200	7.16	7.16	83.9	16,158
5	0.20	20	3,460	5.21	5.21	44.4	5,690
2	0.50	10	1,730	2.74	2.74	12.3	788

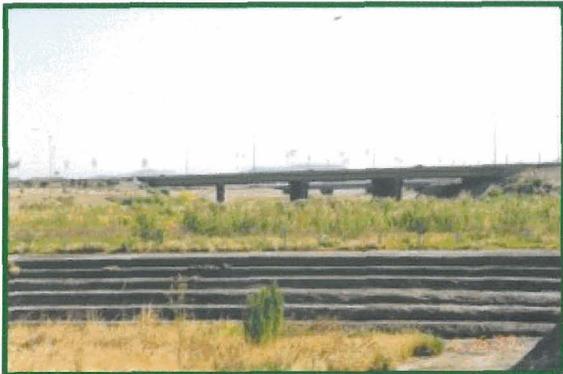
Average Annual Erosion Volume = **8,342 cu. yd.**

(Derived from report on "Annual Erosion Potential for Desert Harbor Along New River", Mathews Kessler Assoc., Inc., March 1989)

Confluence with Skunk Creek:



**Drop Control Structure:
Looking North from
New River Channel
East Bank.**

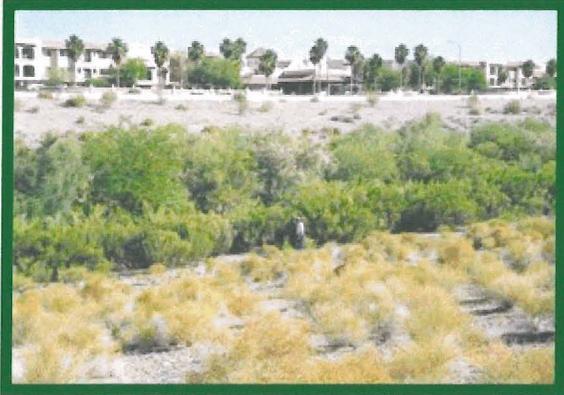


**101 Freeway Bridge:
Looking North from
East top of bank of
drop control structure.**

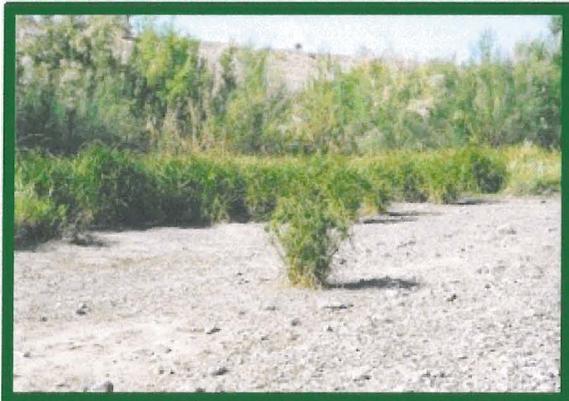


**Drop Control Structure:
Looking West from
Top of East Bank.**

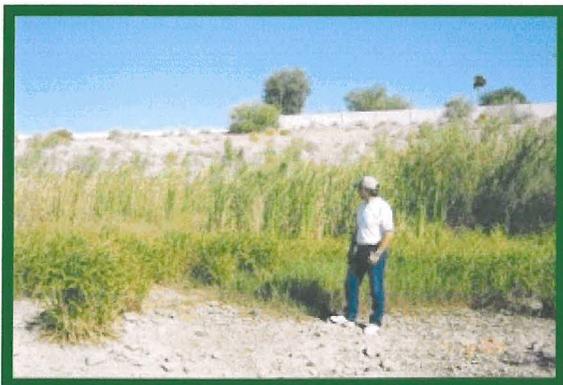
Riparian/Wetland Areas:



Salt Cedar:
Looking West from
East Bank.
200' North of
Thunderbird.



Grasses:
Looking South from
Channel bottom across
from Desert Harbor



Bull Rushes/Grasses:
Looking South from
Channel Bottom
200 feet downstream of
Skunk Creek Confluence

Desert Harbor Outlet:



**Inlet Structure:
Looking East from
West side of Desert
Harbour Boulevard.**



**Outlet:
Looking West from
New River Channel.**

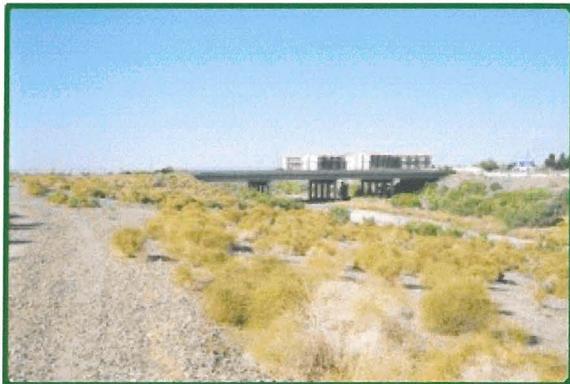


**Outlet:
Looking South from New
River Channel at base
of Outlet.**

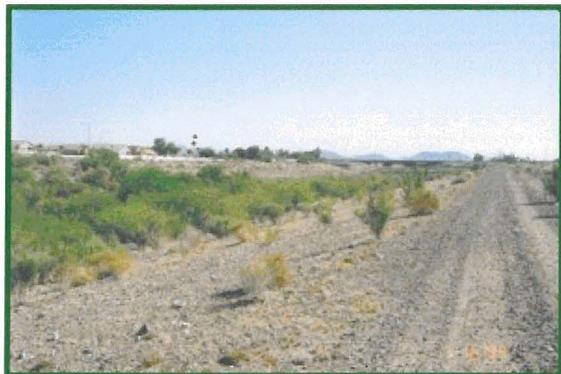
New River North of Thunderbird:



**West bank:
Looking North from
Desert Harbor
Boulevard.**



**East Bank:
Looking South to
Thunderbird.**



**East Bank and Access
Road:
Looking North from
Top East bank.**

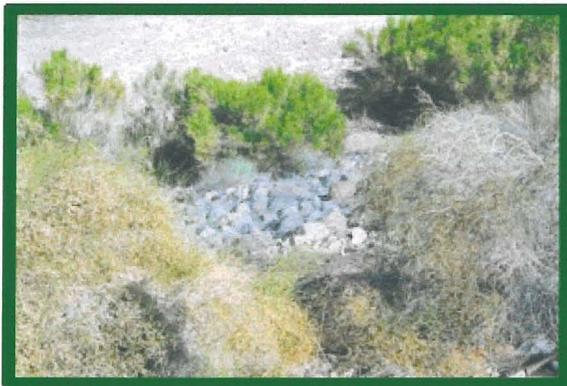
Thunderbird Bridge:



**Bridge:
Looking South from
East Bank**



**Bridge Abutment:
Looking South from
East Bank**



**Gabion Basket Scour
Protection:
Looking South from
East Bank**

91st Ave. Storm Drain Outlet:



**72 Inch Outlet:
Looking North from
West Abutment.**



**91st Avenue Channel:
Looking North from
Outlet Pipe.**



**Channel Outlet:
Looking South from Top
West bank.**

91st Avenue Drainage Channel:

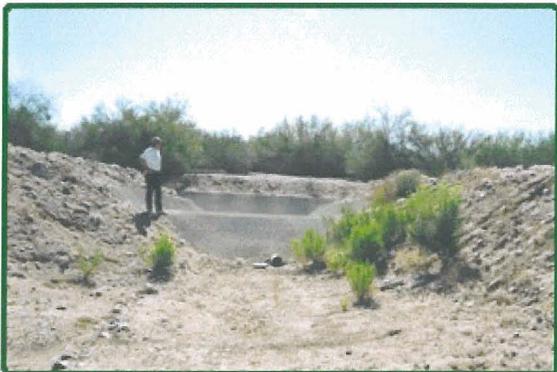


**Cofluence with New
River:
Looking North from
Channel bottom.**

Plaza Del Rio North Detention Basin:



**Detention Basin:
Looking west from
west channel bank**



**Outlet:
Looking east from
Bottom of
Detention Basin**



**91st Avenue Channel:
Looking South from
Detention Basin Outlet.**

Plaza Del Rio North Detention Basin:



**91st Avenue Channel:
Looking North from
Detention Basin Outlet.**

Plaza Del Rio Middle Detention Basin:



**Outlet of Middle Basin
at Plaza del Rio Drive:
Looking West from
East side of Road,
North bank.**



**Drainage Channel:
Looking East from
South bank of Outlet.**

Plaza Del Rio Southern Detention Basin:



**Outlet of Southern Basin
at Plaza del Rio Drive:
Looking West from
East side of Road,
South bank.**



**Rip-rap Lined Drainage
Channel:
Looking West from
South bank.**

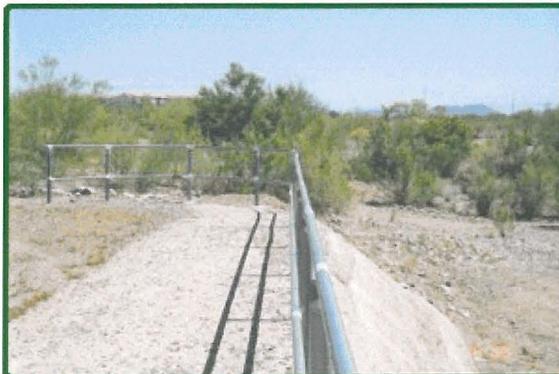


**Detention Basin:
Looking South from
West bank.**

Southern Project Limits:



**West Bank:
Looking South to
Grand Avenue along
West bank.**



**End Treatment:
Looking North from
Top of West bank.**



**End Treatment:
Looking East upstream
of West bank at Plaza
del Rio Southern
Channel.**

Grand Avenue:



**Grand Avenue and
Railroad Bridge:
Looking South from
Channel confluence
with Sun City Drain.**

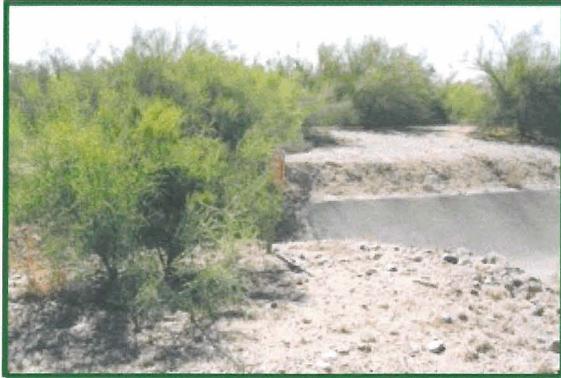


**Channel Bottom:
Looking North from
Sun City Drain
Confluence.**

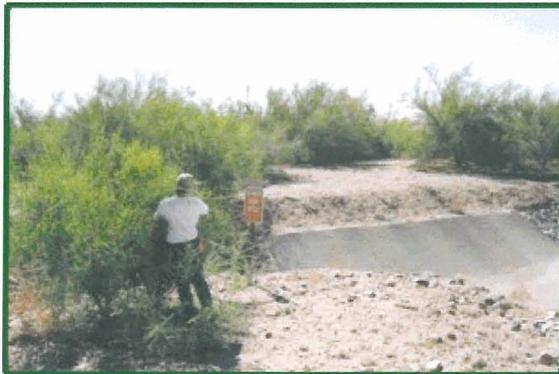


**West Bank:
Looking North from
Sun City Drain
Confluence.**

Peoria 30" Sanitary Sewer Line:



**Manhole:
Looking East from South
Bank of Plaza Del Rio
North Detention Basin**



**Manhole:
Looking East from South
Bank of Plaza Del Rio
North Detention Basin**



**Manhole:
Looking North from
West Bank below
Plaza del Rio Senior
Care Facility**

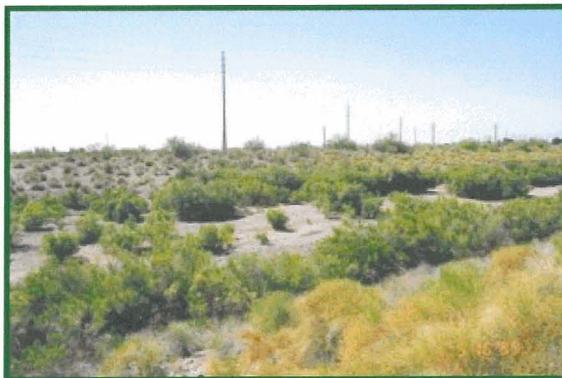
SRP Overhead 115kV Power Line:



**Pole Line:
Looking North from
Plaza Del Rio North
Detention Basin**



**South Pole at West bank
of New River:
Looking South from
Plaza del Rio.
Pole typical 15 feet
from New River Bank
on west bank.**



**Pole Line Crossing New
River:
Looking South from
Plaza Del Rio**

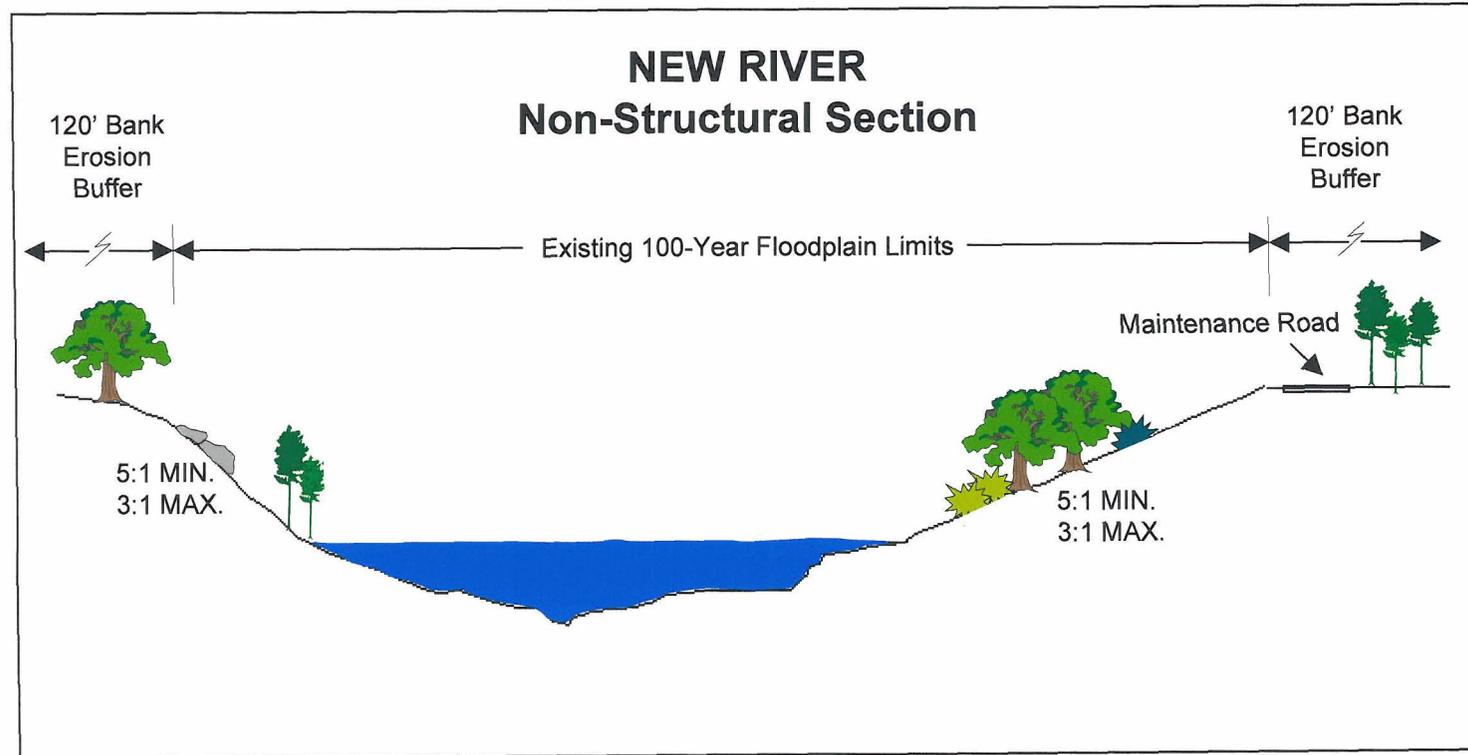
NEW RIVER CAR
PROPERTY OWNERSHIP & VALUE
Acquisition For 100Yr & SPF

Parcel ID	Owner	Total Parcel Acreage	100YEAR Acreage Req'd	SPF Acreage Req'd	100Yr Excess Acreage	SPF Excess Acreage	Est. Unit Value/Ac	100Yr total cost/savings	SPF Total cost/savings
4	Ziber, Ltd	8.56	6.14	8.56	2.42	0	\$54,450.00	\$334,323.00	\$466,092.00
11	Ziber, Ltd	10.96	10.96	10.96	0	0	\$54,450.00	\$596,772.00	\$596,772.00
13	Candilla, et al	2.22	1.19	1.93	1.03	0.29	\$54,450.00	\$64,795.50	\$105,088.50
20	Ziber, Ltd	25.28	6.56	8.07	18.72	17.18	\$54,450.00	\$357,192.00	\$439,411.50
44	Towne Dev. Co.	8.44	0.66	1.06	7.78	7.38	\$54,450.00	\$35,937.00	\$57,717.00
34	Sun Health Prop.	25.68	6.31	8.31	19.37	17.37	\$54,450.00	\$343,579.50	\$452,479.50
35	Plaza II Limited	2.25	0	0.71	2.25	1.54	\$54,450.00	\$0.00	\$38,659.50
36	MCFCFCD	34.99	14.82	17.39	-20.17	-17.6	\$54,450.00	(\$1,098,256.50)	(\$958,320.00)
47	MCFCFCD	26.05	9.84	11.03	-16.21	-15.02	\$54,450.00	(\$882,634.50)	(\$817,839.00)
40	MCFCFCD	5.01	0.06	0.84	-4.95	-4.17	\$54,450.00	(\$269,527.50)	(\$227,056.50)
41	ADOT	23.87	1.61	2.16	N/A	N/A	\$54,450.00	\$0.00	\$0.00
42	ADOT	7.51	2.68	2.96	N/A	N/A	\$54,450.00	\$0.00	\$0.00
30	MCFCFCD	0.12	0.04	0.12	-0.08	0	\$54,450.00	(\$4,356.00)	\$0.00
29	ADOT	0.82	0	0	N/A	N/A	\$54,450.00	\$0.00	\$0.00
31	ADOT	21.33	0	0	N/A	N/A	\$54,450.00	\$0.00	\$0.00
Total								(\$522,175.50)	\$153,004.50

Assumes Sale of
MCFCFCD Excess
to Private Sector

RECOMMENDED ALTERNATIVE PROPERTY ACQUISITION			
PARCEL I.D.	PUBLIC/PRIVATE	GROSS ACREAGE	ACQUISITION ACREAGE
4	Private	6.19	5.05
6	MCFC	0.17	0
8	MCFC	7.33	0
11	Private	10.27	10.27
12	MCFC	0.20	0
17	MCFC	5.93	0
20	Private	25.28	7.16
21	MCFC	0.65	0
25	Town Development Co.	14.92	1.66
26	City of Peoria	11.37	0
27	MCFC	4.09	0
28	MCFC	1.30	0
30	MCFC	0.09	0
34	Private	14.57	9.18
36	MCFC	33.18	0
40	MCFC	5.98	0
44	Town Development Co.	8.73	0.58
47	MCFC	26.05	0
TOTAL		176.30	33.9

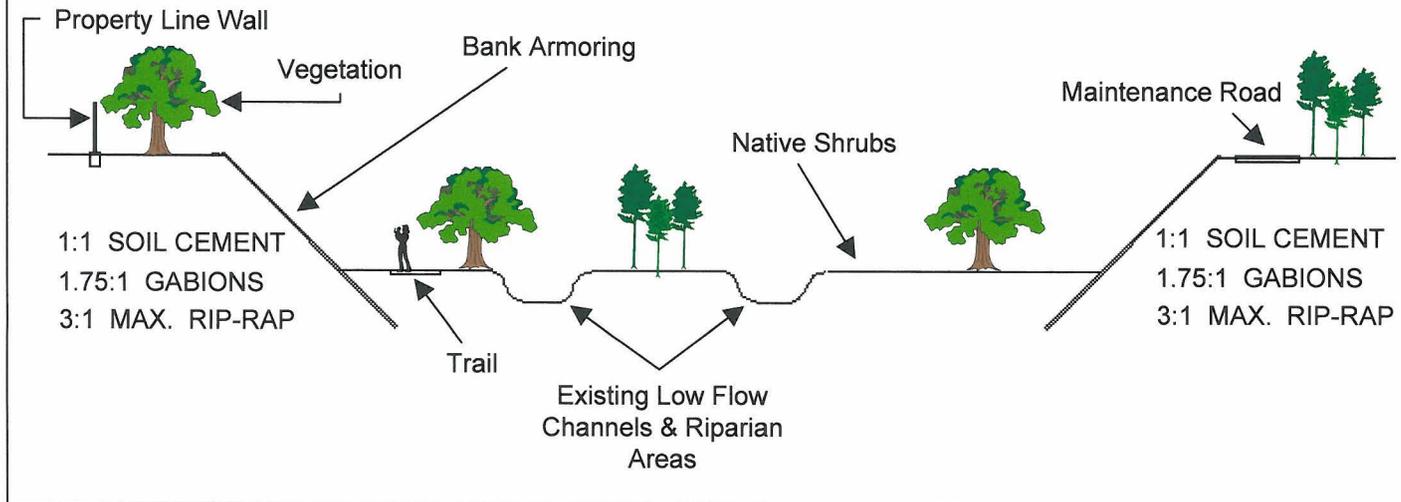
NEW RIVER Non-Structural Section



NEW RIVER GRAND AVENUE TO SKUNK CREEK

Structural Type Trapezoidal Section

Trail In Channel Bottom



NEW RIVER Structural Type Trapezoidal Section with Trail Bench

